DOUGLAS COUNTY
COLORADO

Hazard Mitigation Plan

Volume I— Base Plan




March 2026

TETRA TECH

Douglas County Hazard Mitigation Plan

March 2026

PREPARED FOR

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EXECUTIVE SUMMARY

Hazard Mitigation Overview

Hazard mitigation is the use of long-term and short-term policies, programs, projects, and other activities to minimize the loss of life, injury, and property damage that can result from a disaster. Communities, residents, and businesses across the United States have been faced with continually increasing costs associated with natural and human-caused hazards. Hazard mitigation is the first step in reducing risk and is the most effective way to reduce costs associated with hazards.

Douglas County has developed a hazard mitigation plan (HMP) to reduce risks from disasters to the people, property, economy, and environment within the County. Developed by the County and 10 other participating jurisdictions (the Planning Partners), this HMP updates the 2021 Douglas County HMP. It includes countywide assessment of hazards, risk, and capabilities. The HMP complies with federal and state hazard mitigation planning requirements to establish the Planning Partners' eligibility for funding under Federal Emergency Management Agency (FEMA) grant programs.

The following are the jurisdictions that participated as Planning Partners:

- Douglas County
- City of Castle Pines
- Town of Castle Rock
- Town of Larkspur
- City of Lone Tree
- Town of Parker
- Denver Water District
- Dominion Water and Sanitation District
- Highlands Ranch Water District
- Parker Water Sanitation District

The Planning Process

Overall Approach

To support the planning process, the Planning Partners accomplished the following:

- Developed a Core Planning Team consisting of key stakeholders and a countywide Local Planning Committee made up of the Core Planning Team members, the Planning Partners, and other regional stakeholders
- Reviewed the 2021 Douglas County Hazard Mitigation Plan
- Identified hazards of concern to the County to be included in the update
- Profiled the hazards of concern

- Estimated the inventory at risk and potential losses associated with these hazards
- Reviewed and updated the mitigation goals and objectives
- Reviewed mitigation strategy and actions outlined in the 2021 HMP to indicate progress
- Developed new mitigation actions to reduce the vulnerability of assets from hazards of concern
- Involved a wide range of stakeholders and the public in the HMP update process
- Developed mitigation plan maintenance procedures to be executed after obtaining approval of the HMP from the Colorado Division of Homeland Security and Emergency Management (DHSEM) and FEMA

Multiple Agency Support for Hazard Mitigation

Primary responsibility for hazard mitigation lies with local governments. Partners at the regional, state, and federal levels are available to assist local communities with their mitigation strategies. FEMA provides grants, tools, guidance, and training to support mitigation planning. In Colorado, the DHSEM is the lead agency providing hazard mitigation planning assistance to local jurisdictions.

The participating jurisdictions provided significant input into the preparation of this HMP, in particular the preparation of jurisdiction-specific annexes included in Volume II. They fully coordinated with and solicited participation from county and local governments, relevant organizations and groups, state and federal agencies, and the general public. This coordination ensured that stakeholders had established communication channels and relationships to support mitigation planning and mitigation actions included in the HMP.

The Douglas County Hazard Mitigation Core Planning Team provided oversight for the preparation of this plan. The Core Planning Team includes representatives from the following:

- Douglas County Facilities, Fleet and Emergency Support Services
- Douglas County Sheriff's Office
- Douglas County Public Relations and Communication
- Douglas County Administration
- Douglas County Building Division
- Douglas County Planning Department
- Douglas County Health Department
- Douglas County Open Space & Natural Resources Department
- Douglas County Public Works Department
- Douglas County Information Technology GIS

Risk Assessment for Local Hazards of Concern

The Planning Partners evaluated each jurisdiction's risk and vulnerability due to each of the hazards of concern, based on past events, past and predicted future losses, and the expected probability of future occurrence. From these evaluations, hazards were ranked as high, medium, or low risk to each jurisdiction. The hazard rankings were used to focus and prioritize individual jurisdictional mitigation strategies. Summary overall hazard rankings for all of Douglas County are as follows:

- Dam Failure—Low
- Drought—Medium
- Earthquake—Low
- Flood— Medium
- Geologic Hazards— Medium
- Hazardous Materials Release— Medium
- Pandemic— Medium
- Severe Weather—High
- Wildfire—High

Capability Assessment and Plan Integration into Other Local Mechanisms

Effective mitigation is achieved when hazard awareness and risk management become integral parts of public activities and decision-making. Douglas County has many plans and programs that support hazard risk management. This HMP integrates, complements, and references those plans and programs to the extent practical in order for it to be a comprehensive resource for hazard mitigation.

The HMP includes a capability assessment to review relevant local mechanisms for each participating jurisdiction. This assessment identifies where each jurisdiction is currently able to implement hazard mitigation measures and where each would benefit from improved capabilities for such measures. The capability assessment also provides a summary and description of the existing plans, programs, and regulatory mechanisms at all levels of government (federal, state, county and local) that support hazard mitigation in the County. In the jurisdictional annexes, each participating jurisdiction identifies how it has integrated hazard risk management into its existing planning, regulatory and operational/administrative framework, and how it intends to continue to promote this integration.

Mitigation Strategy

Hazard Mitigation Plan Goals and Objectives

The HMP includes mitigation goals for reducing or avoiding long-term vulnerabilities to the identified hazards of concern. The planning process included a review and update of previous mitigation goals and objectives developed to guide the selection of mitigation actions. The goals and objectives were updated based on the updated risk assessment, discussions, research, and input from plan participants and stakeholders. The goal development process considered the goals expressed in the Colorado Enhanced State Hazard Mitigation Plan, as well as other relevant county and local planning documents. The following are the selected 2026 Pikes Peak Regional HMP goals:

- Goal 1—Enhance predictive measures, including the expansion and protection of warning systems and supporting technologies.
- Goal 2—Enhance the quality of assessments, analysis, and planning through the development and collection of data.
- Goal 3—Increase public awareness of hazards and their mitigation.
- Goal 4—Reduce impacts, costs, and damage from hazard events to people, property, local government and private assets, economy, and natural and cultural resources.
- Goal 5—Coordinate and integrate hazard mitigation activities with local land development planning activities and emergency operations planning to consider resiliency.
- Goal 6—Strengthen communication and coordination among public entities, non-governmental organizations, businesses and private citizens.

- Goal 7—Support continuity of operations before, during, and after hazard events, including the support of community lifelines.
- Goal 8—Address long-term vulnerabilities from hazardous dams.

Implementation of the 2021 Plan

The status of the mitigation projects identified in the 2021 HMP was reviewed for this HMP. Numerous projects and programs have been implemented that have reduced the hazard vulnerability of assets in the planning area. Uncompleted projects have been evaluated, modified as necessary, and incorporated into this updated HMP. The Planning Partners' annexes describe these mitigation activities in more detail, and plan maintenance procedures have been developed to encourage thorough integration with local decisions and processes and regular review of implementation progress.

2026 Mitigation Strategy

Jurisdictional actions included in the mitigation strategy had a focus on the update and/or development of emergency plans; working with outside agencies to strengthen education and response to the wildfire risk; ensuring continuity of operations for critical facilities through the installation of emergency backup generators; the reduction of flood risk through the increase in capacity of stormwater infrastructure, including culverts, drainage systems, and catch basins; and working to identify safety measures and procedures of dams within the various jurisdictions.

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1. INTRODUCTION

Douglas County has developed a hazard mitigation plan (HMP) to reduce risks from disasters to the people, property, economy, and environment within the County. Developed by the County and 10 other participating local jurisdictions (the Planning Partners), this HMP updates the 2021 Douglas County HMP. The updated 2026 HMP includes countywide analysis and assessment of hazards, risk, and capabilities.

1.1 OVERVIEW TO HAZARD MITIGATION PLANNING

1.1.1 What Is Hazard Mitigation?

Hazard mitigation is any sustained action taken to reduce or eliminate the long-term risk and effects that can result from hazards. The Federal Emergency Management Agency (FEMA) defines a hazard mitigation plan as the documentation of a state or local government's evaluation of natural hazards and strategies to mitigate them.

Effective mitigation planning helps people, organizations, and government agencies to better prepare for and respond when disasters occur. It also allows local governments to remain eligible for FEMA grant funding for mitigation projects that will reduce the impact of future disaster events. The long-term benefits of mitigation planning and implementation include the following:

- An increased understanding of hazards faced by local communities
- A more sustainable and disaster-resistant community
- Financial savings through partnerships that support planning and mitigation efforts
- Focused use of limited resources on hazards that have the biggest impact on the community
- Reduced long-term impacts and damage to human health and structures
- Reduced costs associated with response and recovery efforts, including repairs

FEMA estimates that for every dollar spent on damage prevention (mitigation), twice that amount is saved by not having to perform post-disaster repairs.

1.1.2 Regulatory Framework

Federal policy regarding disasters encourages communities to assess their vulnerability to hazards before disaster strikes and then take actions to reduce potential risks. A disaster-resistant community can rebound more quickly and cost-effectively from a natural disaster, with less human injury or loss of property. This minimizes other losses associated with disasters, such as the time lost from productive activity by businesses and industries.

The federal Disaster Mitigation Act of 2000 (DMA) encourages hazard mitigation planning by states, tribes, and local governments. Under the DMA, communities seeking certain hazard-related federal funding must identify potential natural hazards to the community's health, safety, and well-being, and identify and prioritize actions that can be taken by the community to mitigate those hazards before disaster strikes.

Regulations implementing the DMA are included in Title 44 of the Code of Federal Regulations, Section 201 (44 CFR 201). To be eligible for hazard mitigation assistance from the federal government, communities must have an HMP to prepare for and reduce the potential impacts of natural hazards. The federal regulations require

that governments update their HMPs on a 5-year basis. Table 1-1 summarizes the 44 CFR 201 requirements and where each is addressed in this updated Douglas County HMP.

Table 1-1. FEMA Local Mitigation Plan Review Crosswalk

Plan Criteria	Primary Location in Plan
Prerequisites	
Adoption by the Local Governing Body: §201.6(c)(5)	Section 2.7; Appendix A
Planning Process	
Documentation of the Planning Process: §201.6(b) and §201.6(c)(1)	Chapter 2
Risk Assessment	
Identifying Hazards: §201.6(c)(2)(i)	Chapter 5
Profiling Hazards: §201.6(c)(2)(i)	Chapters 6 – 14
Assessing Vulnerability: Overview: §201.6(c)(2)(ii)	Chapter 4
Assessing Vulnerability: Identifying Structures: §201.6(c)(2)(ii)(A)	Section 3.9, Section 4.2.2, Section 4.2.3
Assessing Vulnerability: Estimating Potential Losses: §201.6(c)(2)(ii)(B)	Section 4.3, Chapters 6 – 14 subsections X.2
Assessing Vulnerability: Analyzing Development Trends: §201.6(c)(2)(ii)(C)	Section 3.9.2, Section 4.2.5
Mitigation Strategy	
Capabilities	Chapter 16
Local Hazard Mitigation Goals: §201.6(c)(3)(i)	Section 17.2
Identification and Analysis of Mitigation Actions: §201.6(c)(3)(ii)	Section 17.3; Volume II
Implementation of Mitigation Actions: §201.6(c)(3)(iii)	Section 17.3; Volume II
Multi-Jurisdictional Mitigation Actions: §201.6(c)(3)(iv)	Section 17.3; Volume II
Plan Maintenance Process	
Monitoring, Evaluating, and Updating the HMP: §201.6(c)(4)(i)	Section 18.2
Incorporation into Existing Planning Mechanisms: §201.6(c)(4)(ii)	Section 18.2; Volume II Annexes
Continued Public Involvement: §201.6(c)(4)(iii)	Section 2.8; Section 18.2

1.1.3 Specialized Terms and Concepts

Over the years, the field of hazard mitigation has developed its own set of terms and concepts with particular meanings within the field. A glossary and list of acronyms is provided at the end of this document. The list below provides a quick reference for specialized terms whose use is especially prominent in this hazard mitigation plan:

- **Adaptive capacity—**the ability of a system to adjust to change by moderating potential damage, taking advantage of opportunities, or coping with the consequences (EPA 2023)
- **Asset—**anything that is important to the character and function of a community (e.g., people, structures, community lifelines, the economy, and natural, historic, and cultural resources) (FEMA 2023)
- **Capability assessment—**an evaluation of which authorities, policies, programs, funding and resources a participant has to accomplish hazard mitigation (FEMA 2023)
- **Cascading hazards—**a primary event, such as heavy rainfall, seismic activity, or rapid snowmelt, followed by a chain of consequences that may range from modest (lesser than the original event) to substantial (National Academies of Sciences, Engineering, and Medicine 2022)

- **Community lifelines—**the fundamental services in a community that, when stabilized, enable all other aspects of society to function (FEMA 2023)
- **Extent—**the range of anticipated intensities of a hazard within a community, commonly expressed using a scientific scale (FEMA 2022)
- **Hazard profile—**a description of a hazard's location, extent, previous occurrences and probability of future events within a community (FEMA 2023)
- **Hazard ranking—**the process of identifying the hazards that pose the greatest risk to a community, based on how likely the hazard is to occur, the potential consequences if the hazard does occur, and other relevant local factors
- **Impact—**the consequences of a hazard on a community's assets (FEMA 2023)
- **Integration—**the inclusion of hazard mitigation principles, vulnerability information, and mitigation actions into other existing community planning to reduce risk and increase resilience (FEMA 2022)
- **Mitigation action—**measures, projects, plans or activities to reduce identified hazard vulnerabilities (FEMA 2023)
- **Mitigation strategy—**a long-term blueprint for reducing potential hazard-related losses; the strategy consists of mitigation goals, mitigation actions, and a plan for implementing the actions (FEMA 2023)
- **Natural hazard—**a source of harm or difficulty created by a meteorological, environmental, or geological event (FEMA 2023)
- **Plan maintenance—**monitoring and updating a hazard mitigation plan as warranted by changing conditions, availability of new information, and progress on the proposed mitigation actions (FEMA 2023)
- **Planning process—**the procedures used to develop a hazard mitigation plan with broad acceptance across the community
- **Risk—**the potential for damage or loss when natural hazards interact with people or assets (FEMA 2023)
- **Risk assessment—**a data-driven analysis to find how and where a local jurisdiction is vulnerable to hazards (FEMA 2023)
- **Stakeholder—**individuals or groups that a mitigation action or policy affects, including businesses, private organizations and residents (FEMA 2023)
- **Vulnerability—**a description of which assets within locations identified to be hazard prone are at risk from the effects of the hazard (FEMA 2023)

1.2 HISTORY OF HAZARD MITIGATION PLANNING IN DOUGLAS COUNTY

1.2.1 Previous Douglas County HMPs

Douglas County adopted its first HMP in 2010 and has updated, and adopted the plan regularly since then, with updates adopted in 2015 and 2021.

1.2.2 Key Changes in the Current Update

The following are the most significant changes made between the previous County HMP (2021) and the current (2026) update:

- The 2021 Douglas County HMP identified extreme temperature, severe weather (hail and lightning), severe weather (tornadoes), severe weather (thunderstorms and windstorms), and severe winter weather as individual hazards of concern. Members of the Core Planning Team and Local Planning Committee chose to group these hazards as a single "severe weather" hazard of concern for the 2026 HMP update.
- The 2021 Douglas County HMP identified soil hazards (erosion and deposition), soil hazards (expansive soils and heaving bedrock), soil hazards (land subsidence), and soil hazards (slope failure) as individual hazards of concern. Members of the Core Planning Team and Local Planning Committee chose to group these hazards in a single "geologic hazards" hazard of concern for the 2026 HMP update.
- The Core Planning Team re-evaluated the 2021 HMP's inclusion of animal disease, infestation, and plant disease as stand-alone hazards. Based on recommendations provided by FEMA during its review of the 2021 HMP and the lack of proposed actions in the 2021 Douglas County HMP to mitigate these hazards, it was determined to not include these hazards in the 2026 HMP update.
- In the 2021 HMP, the capability assessment section was presented in Chapter 6 as part of the mitigation strategy. For the 2026 HMP update, the capability assessment was expanded and is presented as a stand-alone chapter. The discussion capabilities in each jurisdictional annex has been expanded (Volume II).

1.3 PLAN ORGANIZATION

The Douglas County HMP is organized into two volumes: Volume I includes all information that applies to the entire planning area (Douglas County); and Volume II includes specific information for each participating jurisdiction.

Volume I includes the following chapters:

- Part 1, The Planning Process and Planning Area
  - Chapter 1, Introduction
  - Chapter 2, Planning Process—A description of the plan methodology and development process, committee and stakeholder roles and activities, and how the HMP will be incorporated into existing programs; information regarding the adoption of the HMP by participating jurisdictions
  - Chapter 3, County Profile—An overview of Douglas County, including general information and physical conditions, land use patterns and trends, population and demographics, economy, general building stock inventory, community lifelines, and natural, historic, and cultural resources
- Part 2, Risk Assessment
  - Chapter 4, Methodology—Description of the methodology used to assess hazard risk and the status of local data
  - Chapter 5, Hazards of Concern Identification—Documentation of the process of identifying the natural hazards of concern for further profiling and evaluation
  - Chapters 6 – 14—Hazard profiles and findings of the risk assessment (estimates of the impact of hazard events on life, safety, and health; general building stock; critical facilities; the economy, and natural, historic, and cultural resources)
  - Chapter 15, Hazard Ranking—Description and summary of the hazard ranking process

- Part 3, Capability Assessment
  - Chapter 16, Capability Assessment—A summary and description of the existing plans, programs, and regulatory mechanisms at all levels of government (federal, state, county, local) that support hazard mitigation within the County
- Part 4, Mitigation Strategy
  - Chapter 17, Mitigation Strategy—Information regarding the mitigation goals and objectives identified by the Core Planning Team in response to priority hazards of concern, and the process by which County and local mitigation strategies have been developed or updated
- Part 5, Plan Maintenance
  - Chapter 18, Plan Maintenance Procedures—A system to continue to monitor, evaluate, maintain, and update the HMP

Volume II consists of annexes for each participating jurisdiction. Each annex summarizes the jurisdiction's planning, regulatory, and fiscal capabilities; evaluates vulnerabilities to hazards; describes the status of past mitigation actions; and provides a specific mitigation strategy. The annexes provide each jurisdiction with a resource for implementing mitigation projects and maximizing future grant opportunities.

Appendices include the following:

- Appendix A, Plan Adoption—Documentation of plan approval by each Planning Partner, and a sample plan adoption resolution
- Appendix B, Meeting Documentation—Agendas, attendance sheets, minutes, and other documentation of planning meetings convened during the development of the HMP
- Appendix C, Public and Stakeholder Outreach Documentation—Documentation of the public and stakeholder outreach effort including webpages, informational materials, public and stakeholder meetings and presentations, surveys, and other methods used to receive and incorporate public and stakeholder comment and input to the HMP update process
- Appendix D, Participation Matrix
- Appendix E, Action Worksheet Template and Instructions
- Appendix F, Plan Maintenance Tools—Examples of plan review templates available to support annual plan review and example FEMA Guidance Worksheets (FEMA 386-4).
- Appendix G, Critical Facility Inventory
- Appendix H, Linkage Procedures

2. PLANNING PROCESS

This chapter describes the planning process used to update the Douglas County HMP, including how it was prepared, who was involved in the process, and how the public was involved. The planning approach aimed to achieve the following results:

- The HMP will be multi-jurisdictional. Douglas County invited all jurisdictions in the County to join in the planning process. The County and all five municipal governments in the County participated in the HMP update process, in addition to five special districts:
  - Douglas County
  - City of Castle Pines
  - Town of Castle Rock
  - Town of Larkspur
  - City of Lone Tree
  - Town of Parker
  - Denver Water District
  - Dominion Water and Sanitation District
  - Highlands Ranch Water District
  - Parker Water Sanitation District
- The format of this plan will be such that other entities can easily join at a later date as part of the regulatory 5-year plan update process.
- The HMP will consider all natural hazards that pose a risk to the area, as required by 44 CFR 201.
- The HMP will be developed following FEMA regulations and prevailing FEMA and state guidance. In addition, this plan will meet criteria for FEMA's National Flood Insurance Program (NFIP), Community Rating System, and Flood Mitigation Assistance programs.

2.1 GENERAL MITIGATION PLANNING APPROACH

FEMA provides hazard mitigation planning support to local communities through guidance, resources, and plan reviews. This hazard mitigation plan was prepared in accordance with the following regulations and guidance:

- FEMA Local Mitigation Planning Policy Guide, April 11, 2025
- FEMA Local Mitigation Planning Handbook, June 2025
- DMA 2000 (Public Law 106-390, October 30, 2000)
- 44 CFR 201 and 206
- Colorado Enhanced State Hazard Mitigation Plan. 2023

2.2 ORGANIZATION OF PLANNING PROCESS

2.2.1 Planning Process Participants

The various jurisdictions in Douglas County have differing levels of capabilities and resources available to apply to the HMP update process, as well as differing levels of vulnerability to and impacts from the natural hazards being considered in this plan. It was Douglas County's intent to encourage participation by all jurisdictions, and to accommodate their specific needs and limitations while still meeting the intent and purpose of plan update participation. Such accommodations included establishing a Core Planning Team, engaging a contract consultant

to assume certain elements of the HMP update process on behalf of the jurisdictions, and providing alternative mechanisms for planning participation.

Ultimately, jurisdictional participation is evidenced by a completed annex of the HMP, wherein jurisdictions individually evaluate their risk from the hazards of concern, identify their capabilities to effect mitigation in their community, identify and prioritize a suite of actions to mitigate their hazard risk, and adopt the updated plan via resolution. Annexes are included in Volume II of this HMP.

Project Management and Planning Consultant

Project management was the responsibility of several agencies within Douglas County. A contract planning consultant (Tetra Tech) was tasked with the following:

- Assistance with the organization of a Core Planning Team and the Local Planning Committee
- Assistance with the development and implementation of a public and stakeholder outreach program
- Data collection
- Facilitation and attendance at meetings (Core Planning Team, municipal, stakeholder, public and other)
- Review and update of the hazards of concern, and hazard profiling and risk assessment
- Assistance with the review and update of mitigation planning goals and objectives
- Assistance with the review of past mitigation strategy progress
- Assistance with the screening of mitigation actions and the identification of appropriate actions
- Assistance with the prioritization of mitigation actions
- Authoring of the draft and final plan documents

Local Planning Committee

In April 2025, Douglas County invited all jurisdictions in the County to participate of the HMP planning process. Jurisdictions were asked to formally notify the County of their intent to participate via a letter of intent and to identify points of contact to represent the interests of their communities. All participating jurisdictions, including the County, are recognized as Planning Partners and belong to the Local Planning Committee for this HMP. Table 2-1 shows the primary and alternate points of contact of the Local Planning Committee as of the time of publication of this plan update. For full membership and participation, refer to Appendix D (Participation Matrix). Representatives serving on the Local Planning Committee were charged with the following:

- Representing their jurisdiction throughout the planning process
- Ensuring participation of all departments and functions within their jurisdiction that have a stake in mitigation (e.g., planning, engineering, code enforcement, police and emergency services, public works)
- Assisting in gathering information for inclusion in the HMP update, including the use of previously developed reports and data
- Supporting and promoting the public involvement process
- Reporting on progress of mitigation actions identified in prior or existing HMPs, as applicable
- Identifying, developing, and prioritizing appropriate mitigation actions
- Reporting on progress of integration of prior or existing HMPs into other planning processes and municipal operations

- Supporting and developing a jurisdictional annex
- Reviewing, amending, and approving all sections of the HMP update
- Adopting, implementing, and maintaining the HMP update

All municipalities in the County except the City of Castle Pines actively participate in the National Flood Insurance Program and have a designated NFIP floodplain administrator. All floodplain administrators were informed of the planning process, reviewed the plan documents, and provided direct input to the HMP update. Local floodplain administrators are identified as part of each jurisdiction's hazard mitigation planning team, as presented in the jurisdictional annexes in Volume II, as well as in Appendix D (Participation Matrix).

After completion of the HMP, implementation and ongoing maintenance will become a function of the Local Planning Committee as described in Chapter 18 (Plan Maintenance). The Local Planning Committee will be responsible for reviewing the draft plan and soliciting public comment as part of an annual review and as part of the five-year mitigation plan updates.

Table 2-1. Douglas County Hazard Mitigation Local Planning Committee Members

Jurisdiction	Primary Point of Contact Name	Title	Alternate Point of Contact Name	Title
County of Douglas	Mike Alexander	Emergency Management Director	Lisa Goudy	Safety and Security Administrator
City of Castle Pines	Larry Nimmo	Public Works Director	Donna Ferguson	Director of Community Development
Town of Castle Rock	Norris Croom	Fire Chief and Emergency Manager	Oren Bersagel-Briese	Deputy Chief
Town of Larkspur	Chris Rogowski	Town Manager	Eric Usher	Public Works Director
City of Lone Tree	Arielle Cronin	Senior Management Analyst, Emergency and Risk Manager, City Manager's Office	Jacob James	Deputy Director of Public Works
Town of Parker	Greg Epp	Emergency Manager	Andrew Coleman	Commander / Police
Denver Water District	Olivia Crimaldi	Emergency Management Coordinator	Nick Sporer	Senior Emergency Management Specialist
Dominion Water and Sanitation District	Andrea Cole	General Manager	Britta Strother Chou	Director of Planning
Highlands Ranch Water District	Ryan Edwards	Director of Engineering and Public Works	Sam Calkins	General Manager
Parker Water Sanitation District	Brad Johnson	Safety Coordinator	James Roche	Director of Operations

Core Planning Team

Douglas County developed a Core Planning Team to provide guidance and direction to the HMP update effort, and to ensure that the resulting document will be embraced by local government leaders as well as all who live and work within the planning area. Core Planning Team members were charged with the following:

- Providing guidance and oversight of the planning process on behalf of the general Local Planning Committee

- Attending and participating in Core Planning Team meetings
- Assisting with the development and completion of certain planning elements, including:
  - Reviewing and updating the hazards of concern
  - Developing a public and stakeholder outreach program
  - Ensuring that the data and information used in the HMP update process is the best available
  - Reviewing and updating the hazard mitigation goals
  - Identifying and screening appropriate mitigation strategies and activities
- Reviewing and commenting on plan documents prior to submission to the Colorado Division of Homeland Security and Emergency Management (DHSEM) and FEMA.

The Core Planning Team provided guidance, leadership, and oversight of the planning process and acted as the point of contact for all participating jurisdictions and various interest groups in the planning area. Table 2-2 lists the members of the Core Planning Team.

Table 2-2. Douglas County Hazard Mitigation Core Planning Team Members

Affiliation	Name	Title
County of Douglas Facilities, Fleet, and Emergency Support Services	Lisa Goudy	Safety and Security Administrator
County of Douglas Facilities, Fleet, and Emergency Support Services	Jason Petalas	Safety and Security Manager
County of Douglas Facilities, Fleet, and Emergency Support Services	Tim Hallmark	Director
County of Douglas Emergency Management	Mike Alexander	Director
County of Douglas Emergency Management	Brandon Lenderink	Deputy Director
County of Douglas Public Relations and Communication	Caroline Frizell	Director
County of Douglas Public Relations and Communication	Sarah Packard	Communication Specialist
County of Douglas Administration	Douglas J. DeBord	County Manager
County of Douglas Administration	Holly Carrell	County Manager - Designee
County of Douglas Administration	Troy Dunning	Risk Management and Projects Coordinator
County of Douglas Building Division	Matthew Dziubanski	Chief Building Official
County of Douglas Building Division	Tim Pendleton	Deputy Chief Building Official
County of Douglas Planning Services	Steve Koster	Assistant Director
County of Douglas Health Department	Michael Hill	Director
County of Douglas Health Department	Jon Surbeck	Emergency Preparedness and Disease Surveillance Manager
County of Douglas Open Space and Natural Resources	Dan Dertz	Director
County of Douglas Engineering and Public Works	Janet Herman	Director
County of Douglas Engineering and Public Works	Daniel Roberts	Assistant Director
County of Douglas Information Technology	Tim Jones	Lead Senior Systems Analyst
County of Douglas Information Technology	Michael Butterfield	Systems Analyst
County of Douglas Information Technology	Randy Thompson	Solution Architect

2.2.2 Planning Activities

Members of the Local Planning Committee (individually and as a whole), as well as key stakeholders, met and communicated as needed to share information. This included workshops to identify hazards, assess risks, update inventories of critical facilities, and assist in updating mitigation goals and strategies. All members of the Local Planning Committee had the opportunity to review the draft plan, supported interaction with other stakeholders, and assisted with public involvement efforts. These activities provided continuity through the process to ensure that natural hazard vulnerability information and appropriate mitigation strategies were incorporated.

Table 2-3 summarizes meetings and other planning activities conducted during the development of the HMP. It also identifies which 44 CFR 201 requirements each activity satisfies. Documentation of meetings (agendas, sign-in sheets, minutes, etc.) may be found in Appendix C (Public and Stakeholder Outreach). In addition to the activities listed in the table, there was a great deal of communication between Local Planning Committee members and the consultant through individual local meetings, phone, and email.

Table 2-3. Summary of Mitigation Planning Activities

Date	44 CFR 201 Requirement[a]	Description of Activity	Participants
March 4, 2025	2	Project Startup Meeting: Discuss proposed planning process and scope of work including documenting participation, schedule, and public and stakeholder outreach and involvement.	Douglas County, Tetra Tech
April 17, 2025	2, 3c	GIS data collection meeting	Douglas County, Tetra Tech
April 25, 2025	2	All jurisdictions were invited to participate in the planning process.	-
Monthly	-	Monthly project status meeting to discuss action items in support of the planning process	Douglas County, Tetra Tech
May 22, 2025	2	Core Planning Team Kick-Off Meeting: Welcome and Introductions, Plan Timing and Administration, Data Collection and Sharing, Hazards of Concern, Public and Stakeholder Outreach, Goals, Next Steps, and Schedule	See Appendix D
May 22, 2025	2, 3c, 4a	Local Planning Committee Kick-Off Meeting: Welcome and Introductions, Overview of Hazard Mitigation, Project Scope Review, Project Schedule Review, Next Steps, and Schedule	See Appendix D
August 2025	1b, 2	Public project website developed: https://www.douglas.co.us/douglas-countys-hazard-mitigation-plan/	Douglas County, Tetra Tech
August 2025	1b, 2	Public project StoryMap developed: http://bit.ly/4pVLmcU	Douglas County, Tetra Tech
August 2025	1b, 2	Online Public Hazard Preparedness and Mitigation survey developed and deployed	Douglas County, Tetra Tech
August 2025	1b, 2	Online Stakeholder Hazard Mitigation surveys developed and deployed	Douglas County, Tetra Tech
August 2025	1b, 2	Online Neighboring County Mitigation survey developed and deployed	Douglas County, Tetra Tech
August 29, 2025	2, 3e, 4d, 4e	All originally assigned worksheets due: • Hazard Event History • Capabilities Assessment	Core Planning Team, Local Planning Committee

Date	44 CFR 201 Requirement[a]	Description of Activity	Participants
		• NFIP Administration • Permitting and New Development • Mitigation Action Review	
October 15, 2025	2, 3b, 3c, 3d, 3e, 4a, 4b	Risk Assessment and Mitigation Strategy Meeting: Welcome and Introductions, Project Report and Status Review, Risk Assessment Overview, Risk Assessment Results, Hazard Rankings, Identifying and Developing Mitigation Strategies, Finalized Goals, Developing New Potential Actions, Workshop, Next Steps	See Appendix D
March 5, 2026	1b, 2	Draft Plan Review Meeting: Overview of entire plan and sections; confirmed plan maintenance schedule; public invited to attend.	See Appendix D
March 5, 2026	1b, 2	Draft Plan posted to public project website	Public and Stakeholders
March 5, 2026	1b, 2	Draft Plan posted to StoryMap	Public and Stakeholders
TBD	1b, 2	Public and stakeholder comments to Draft Plan received and incorporated into Final Plan.	Public and Stakeholders
TBD	All requirements	Final plan submitted to DHSEM	Planning Team, Contract Planner, DHSEM
TBD	All requirements	Review comments from DHSEM addressed	Planning Team, Contract Planner, DHSEM
TBD	All requirements	Final plan submitted to FEMA Region 8	Planning Team, Contract Planner, FEMA Region 8
TBD	All requirements	Review comments from FEMA Region 8 addressed	Planning Team, Contract Planner, FEMA Region 8
Upon plan approval by FEMA	1a	Plan adoption by resolution by the governing bodies of all participating municipalities	All plan participants

Note: TBD = to be determined.

a. Numbers in column 2 identify specific requirements of 44 CFR 201.6, as follows:

1a—Prerequisite – Adoption by the Local Governing Body (201.6.a.1)
1b—Public Participation (201.6.b)
2—Planning Process – Documentation of the Planning Process (201.6.c.1)
3a—Risk Assessment – Identifying Hazards (201.6.c.2.i)
3b—Risk Assessment – Profiling Hazard Events (201.6.c.2.i)
3c—Risk Assessment – Assessing Vulnerability: Identifying Assets (201.6.c.2.ii.A)
3d—Risk Assessment – Assessing Vulnerability: Estimating Potential Losses (201.6.c.2.ii.B)
3e—Risk Assessment – Assessing Vulnerability: Analyzing Development Trends (201.6.c.2.ii.C)
4a—Mitigation Strategy – Local Hazard Mitigation Goals (201.6.c.3.i)
4b—Mitigation Strategy – Identification and Analysis of Mitigation Measures (201.6.c.3.ii)
4c—Mitigation Strategy – Implementation of Mitigation Measures (201.6.c.3.iii)
5a—Plan Maintenance Procedures – Monitoring, Evaluating, and Updating the Plan (201.6.c.4.i)
5b—Plan Maintenance Procedures – Implementation through Existing Programs (201.6.c.4.ii)
5c—Plan Maintenance Procedures – Continued Public Involvement (201.6.c.4.iii)

2.3 STAKEHOLDER OUTREACH AND INVOLVEMENT

The Douglas County HMP update was written using the best available information from municipal and regional agencies and staff as well as federal and state agencies and County residents. The Core Planning Team solicited information from local agencies and individuals with specific knowledge of local natural hazards and historical events. This section details the outreach to, and involvement of, entities that have a stake in managing hazard risk and mitigation, commonly referred to as stakeholders.

Efforts were made to ensure broad representation in the planning process. A comprehensive list of stakeholders was developed with the support of the Core Planning Team and Local Planning Committee. Stakeholder outreach was performed early and throughout the planning process, including mass media notification efforts. Identified stakeholders were invited to attend the Local Planning Committee risk assessment meeting, and key stakeholders were requested to participate on the Core Planning Team and/or Local Planning Committee. Information and input provided by these stakeholders has been included throughout this plan. Beyond those described in the sections that follow, many stakeholders were aware of and/or contributed to this plan through formal and informal outreach efforts by the Planning Partners involved in the HMP update.

2.3.1 Federal and State Agencies

The federal and state agencies listed in Table 2-4 were contacted during the planning process and participated as noted.

Table 2-4. Participation of Federal and State Agencies

Agency	Participation
FEMA Region 8	Provided updated planning guidance; provided summary and detailed NFIP data for planning area; presented preliminary regulatory flood products to municipalities and the public; attended meetings; participated in a Mitigation Strategy Workshop; conducted plan review
• **National Centers for Environmental Information (NCEI)** • **National Oceanic and Atmospheric Administration (NOAA)** • **National Weather Service (NWS)** • **Storm Prediction Center (SPC)** • **U.S. Army Corps of Engineers (USACE)** • **U.S. Census Bureau** • **U.S. Geological Survey (USGS)**	Information regarding hazard identification and the risk assessment for this HMP update was received or incorporated by reference
Colorado Division of Homeland Security and Emergency Management	Administered planning grant and facilitated FEMA review; provided updated planning guidance; attended meetings; participated in the Mitigation Strategy Workshop, provided review of draft and final plan
Colorado Department of Natural Resources	Provided data and information on the number and locations of dams.

2.3.2 County and Regional Agencies

The county and regional agencies listed in Table 2-5 were contacted during the planning process and participated as noted.

Table 2-5. County and Regional Agencies

Agency		Participation
• County of Douglas Facilities, Fleet, and Emergency Support Services • County of Douglas Emergency Management • County of Douglas Planning Services • County of Douglas Health Department	• County of Douglas Engineering and Public Works • County of Douglas Information Technology • County of Douglas Building Division	Served on Core Planning Team, attended meetings, completed worksheets, provided input, and reviewed draft plan.
• County of Douglas Public Relations and Communication • County of Douglas Administration	• County of Douglas Open Space and Natural Resources	Served on the Core Planning Team, provided input, and reviewed draft plan.
• City of Castle Pines • Town of Castle Rock • Town of Larkspur • City of Lone Tree • Town of Parker • Denver Water District • Highlands Ranch Water District • Parker Water Sanitation District • County of Douglas Assessor • County of Douglas Clerk and Recorder	• County of Douglas Sheriff's Office • County of Douglas Community Services Department • Larkspur Fire Protection District • South Metro Fire Rescue • Conifer Fire Protection District • Arapahoe Community College Campus Police • AdventHealth Castle Rock • AdventHealth Parker • HCA HealthONE Sky Ridge Medical Center	Attended meetings, provided input, and reviewed draft plan.
• Dominion Water and Sanitation District • Mile High Flood Control District • County of Douglas Commissioner • County of Douglas Coroner • County of Douglas Surveyor • County of Douglas Treasurer • County of Douglas Community Development Department • Parker Police Department • Franktown Fire Protection District • Jackson 105 Fire Protection District • Mountain Communities Volunteer Fire Protection District • North Fork Fire Protection District • West Douglas Fire Protection District	• Castle Rock Police Department • Lone Tree Police Department • Sky Ridge Medical Center • Children's Hospital Colorado - South Campus, Highlands Ranch • UC Health Highlands Ranch • Xcel Energy • CORE Electric Cooperative • Colorado Department of Transportation • Parker Department of Engineering/Public Works • Regional Transportation District • Centennial Airport • Roxborough Water & Sanitation	Provided input and reviewed draft plan.

2.3.3 **Stakeholders by Community Lifeline Category**

FEMA defines community lifelines as fundamental services in a community that, when stabilized, enable all other aspects of society. Following a disaster, intervention is required to stabilize community lifelines. All participating jurisdictions were asked to invite their internal agencies associated with community lifeline categories to complete a stakeholder survey. Many jurisdictions also directly involved representatives of these agencies in the planning process, as identified in the jurisdictional annexes in Volume II. This section describes outreach to and participation by other stakeholders in the planning process associated with FEMA's eight designated community lifeline categories. More detailed information about community lifelines in the planning area is provided in Section 3.10.

Safety and Security

Law Enforcement

Many municipalities directly involved police and other law enforcement representatives in the planning process. Municipalities were asked to invite their law enforcement agencies to complete a stakeholder survey. Further, the following police departments and law enforcement agencies were invited to complete a stakeholder survey and review the draft plan:

- Parker Police Department
- Castle Rock Police Department
- Lone Tree Police Department
- Arapahoe Community College Campus Police
- Colorado State Patrol

Fire Districts and Fire Departments

Many jurisdictions directly involved fire district/department, haz-mat teams, and rescue team representatives in the planning process. Jurisdictions were asked to invite their fire departments to complete a stakeholder survey. The following fire districts or departments, hazardous materials response teams, and rescue teams were invited to complete a stakeholder survey and review the draft plan:

- Franktown Fire Protection District
- Larkspur Fire Protection District
- Jackson 105 Fire Protection District
- Mountain Communities Volunteer Fire Protection District
- North Fork Fire Protection District
- West Douglas Fire Protection District
- Castle Rock Fire and Rescue
- South Metro Fire Rescue
- Conifer Fire Protection District

Dams

In order to address High Hazard Potential Dams, outreach was conducted to the following dam stakeholders:

- Denver Water
- Arapahoe County Water and Wastewater Authority
- U.S. Army Corps of Engineers
- Colorado Department of Natural Resources

The following information was requested:

- Information, data, or resources regarding the risk to dam failure as a result of deficiencies or exposure to hazards such as flooding, geologic impacts, and severe storms
- Concerns with dam safety due to changing climate conditions

- Concerns with emergency action plan deficiencies including warning time, evacuation needs, etc.
- Completed or in progress repairs/improvements to dams
- Potential new mitigation actions that should be considered for inclusion in the HMP mitigation strategy

Food, Hydration, Shelter

Jurisdictions were asked to invite their emergency management related agencies to provide information on shelters and sheltering procedures. The following stakeholders that provide food, hydration, shelter, and agricultural activities in the County were invited to complete a stakeholder survey and review the draft plan:

- American Red Cross Mile High Area

Health and Medical

Hospitals and Health-Care Facilities

The following hospitals and health-care stakeholders were invited to complete a stakeholder survey and review the draft plan:

- Sky Ridge Medical Center
- Children's Hospital Colorado - South Campus, Highlands Ranch
- AdventHealth Castle Rock
- AdventHealth Parker
- UC Health Highlands Ranch
- HCA HealthONE Sky Ridge Medical Center

Energy

In addition to municipal utilities, the following electrical, natural gas, and fuel stakeholders were invited to complete a stakeholder survey and review the draft plan:

- Xcel Energy
- CORE Electric Cooperative

Communications

Each jurisdiction was asked to provide information on emergency communication and warning systems. In addition, the following communications stakeholders were invited to complete a stakeholder survey and review the draft plan:

- Lone Tree Communications Department
- Comcast Cable
- Amateur Radio Emergency Service - Douglas & Elbert Counties

Transportation

The following transportation stakeholders were invited to complete a stakeholder survey and review the draft plan:

- Colorado Department of Transportation (CDOT)
- Castle Pines Public Works Department
- Lone Tree Public Works Department
- Regional Transportation District
- Centennial Airport

Hazardous Materials

The following hazardous material stakeholders were invited to complete a stakeholder survey and review the draft plan:

- Douglas County Health Department
- Douglas County Sheriff's Office - Hazardous Materials Response Team

Water Systems

In addition to municipal utilities, the following water system stakeholders were invited to complete a stakeholder survey and review the draft plan:

- Centennial Water and Sanitation District
- Denver Water District
- Dominion Water and Sanitation District
- Highlands Ranch Water District
- Mile High Flood Control District
- Parker Water Sanitation District
- Roxborough Water & Sanitation

2.3.4 Additional Stakeholder Groups

Additional stakeholder outreach was made to academia and organizations that support underserved populations, as listed in the sections below.

School Districts and Other Academic Institutions

Jurisdictions were asked to invite representatives of their local schools to complete a stakeholder survey. Additionally, the following school districts, colleges, and academic organizations were invited to complete a stakeholder survey and review the draft plan:

- Arapahoe Community College
- Arapahoe Community College
- Rocky Vista University
- Douglas County School District
- Colorado Early Colleges

2.3.5 **Adjacent Jurisdictions**

Neighboring county and municipal governments that border Douglas County were contacted due to their proximity to the county and because the effects of hazard events that impact Douglas County would be similar to that of their neighbors. The County kept these jurisdictions apprised of the project, invited them to complete a neighboring community survey, and requested their review of the draft plan. The following adjoining county and jurisdictional representatives were contacted in August 2025 to inform them about the availability of the project website, draft plan documents, and surveys and to invite them to provide input to the planning process:

- Jefferson County
  - Office of Emergency Management
  - Planning Department
- Teller County
  - Office of Emergency Management
  - Planning Department
- El Paso County
  - Office of Emergency Management
  - Planning Department
- Elbert County
  - Office of Emergency Management
  - Planning Department
- Arapahoe County
  - Office of Emergency Management
  - Planning Department
- City of Aurora (Arapahoe County)
  - Office of Emergency Management
- City of Centennial (Arapahoe County)
  - Office of Emergency Management
- City of Littleton (Arapahoe County)
  - Office of Emergency Management
- Town of Elizabeth (Elbert County)
  - Office of Emergency Management

2.3.6 **Stakeholder and Neighboring Community Survey Summaries**

This section summarizes the results and feedback received by those who completed stakeholder and neighboring community surveys. Feedback was reviewed by the Core Planning Team and integrated where appropriate in the HMP. Full survey results are provided in Appendix C of this plan, along with examples of the surveys.

Stakeholder Survey

The stakeholder survey was designed to identify general needs for hazard mitigation and resiliency within Douglas County from the perspective of stakeholders, as well as to identify specific projects that may be included in the mitigation plan. It was distributed to identified stakeholders, including county and municipal departments and agencies.

Overview of Respondents

As of January 2, 2026, 14 stakeholders completed the survey, with respondents coming from the academic/research sector, business/commerce sector, community services, emergency services, government services, transportation sector, and utilities. Participating respondents provide the following services:

- Community college providing higher education for students, nursing, etc. including high schools and community education programs.
- Community services in partnership with community organizations to provide at-risk residents with resources and services needed to maintain independence and self-sufficiency.
- Provides public transportation in eight Colorado counties. Services include bus, rail, shuttles, ADA paratransit services, demand responsive services like FlexRide, special event services, vanpools, and many more.
- Fire and rescue services for special fire district of 100 square miles.
- Electricity provider to most of Douglas County.
- Provides timely, relevant forestry information and education to the residents of Colorado to achieve resilient forests and communities.
- Provision of clean drinking water to 1.5 million people, operating in 8 counties including Douglas.
- Supports the vitality, resilience, and long-term sustainability of the local business community. The program's primary goals are to retain and expand existing businesses, attract compatible new businesses, support small business success, and strengthen the overall economic base in alignment with community values and adopted plans.
- Offers single family homes, has roughly 110,000+ members, four recreation centers, 8,400 acres of Back Country Wilderness area, and hosts over 100 special and community events.

Respondents were primarily located in Unincorporated Douglas County and the Town of Castle Rock.

Hazard and Damage Identification

Respondents identified wildfire as their highest rated hazard of concern. Many noting infrastructure, new and planned developments, and persons are located in WUI areas.

Four respondents stated they have fixed or mobile assets in a floodplain; three respondents noted they do have flood insurance.

Community Preparedness

Respondents noted the most effective ways to communicate with their community include media sources, trusted non-profit organizations and churches, web based alert notifications (texts/calls), mobile road signs, in-person events, and door-to-door initiatives.

Respondents were asked to identify economic assets and drivers whose losses and inability to operate would severely impact the community and its ability to recover from a disaster. Responses included:

- Significant damages to the electric grid would take days to weeks to repair and restore power
- Closure of campus facilities
- Inability to provide on-site access for education and community programs
- Internet and other methods of communication.
- Obstructions in roads

Noted challenges or barriers to reducing vulnerability in Douglas County, as indicated by the respondents include:

- Establishing communication and adequate access to services
- Lack of available funding streams
- Education on hazard risk, response, and preparedness
- The water distribution system is not designed to fight urban conflagration fires
- A primary barrier is the fragmented nature of preparedness and recovery responsibilities. While emergency response systems are well established, economic and business recovery functions are often dispersed across jurisdictions, departments, and external partners, making coordination and consistent messaging difficult during and after hazard events.
- Capacity constraints, especially among small businesses. Many businesses lack the time, staffing, or financial resources to engage in advance preparedness planning or sustain prolonged disruptions, increasing the risk of permanent closures following disasters.
- The absence of standardized, business-focused recovery tools at the local level. Recovery guidance is often reactive, event-specific, or sourced from multiple agencies, which can create confusion and delay action during critical recovery periods.
- Rapid growth and development patterns increase exposure to hazards and strain infrastructure and service delivery systems, making it more difficult to implement uniform mitigation and recovery strategies across communities.

Project Identification

Respondents identified the following projects or programs that could reduce their organization's vulnerability to damages, including:

- Work on improving the damage resistance of utilities (electricity, communications, water / wastewater facilities, etc.).
- Provide better information about hazard risk and high-hazard areas.
- Inform property owners of ways they can mitigate damage to their properties.
- Assist property owners with securing funding to mitigate impacts to their property(s).
- Improve access to information about hazard risk and high-hazard areas

Respondents identified programs or projects recently implemented that will reduce their vulnerability, damage, and losses. Their responses included:

- Updates to hazard assessments and emergency operations plans.

- Provided an online resource guide and improved services for older adults through Older Adult Initiative.
- Implemented remote functioning activities.
- Adopted a Community Wildfire Protection Plan in 2022.

Neighboring Community Survey

The neighboring community survey was sent to the county and municipal governments that border Douglas County. As of January 2, 2026, two neighboring municipalities (City of Centennial – Arapahoe County; Town of Elizabeth – Elbert County) and one neighboring county submitted the survey (Teller County).

The Neighboring County Survey was broken down into four sections: Emergency Operations and Continuity of Operations Planning, Information Sharing, Projects, Grants, Education and Outreach, and Evacuation and Sheltering, each detailed below.

Emergency Operations and Continuity of Operations Planning

Respondents answered survey questions regarding whether any shared service or mutual aid agreements are in place between their jurisdiction and Douglas County. Respondents noted there is mutual aid in place for all hazards assistance, including emergency staff for disaster response, such as fire suppression.

Each respondent noted that they are unsure whether Douglas County or any of its municipalities participate in their jurisdiction's comprehensive emergency operations planning. The Town of Elizabeth noted they participate in Douglas County's comprehensive emergency operations planning via planning for an emergency operations center incident management team. In regard to Continuity of Operations Planning, one respondent noted they were unsure if Douglas County or any of its municipalities participate in their jurisdiction's planning efforts; a second respondent noted Douglas County nor its municipalities participate in their jurisdiction's planning efforts. All respondents stated they do not participate in Douglas County or any Douglas County municipality's Continuity of Operations planning initiatives. Activations of EOCs or COOP are primarily communicated via email or phone.

Information Sharing

Respondents noted they have access to Douglas County's emergency operations centers at the county and local levels, and information regarding hazard mitigation is shared between the entities during planning and implementation phases of projects. However, all respondents noted it is unknown whether their jurisdiction shares risk and vulnerability assessments (e.g., flood mapping, GIS, Hazus, etc.) with Douglas County.

Participants noted there are hazards shared between their jurisdiction and Douglas County:

- City of Centennial noted shared risks of downstream flooding and wildfire
- Teller County stated there is a shared risk of wildfire
- The Town of Elizabeth identified both jurisdictions share the need to protect critical infrastructure, including major highway corridors.

Information sharing between all jurisdictions is typically performed via email, phone, or in-person communications. A suggested opportunity to optimize information sharing include a common messaging software.

Projects, Grants, Education, and Outreach

The Town of Elizabeth noted there are connect roadway improvements planned which may require cross-collaboration between jurisdictional boundaries, including access road management and planning for future development and egress.

Respondents were unsure if their jurisdiction and Douglas County or any Douglas County municipalities have collaborated on grant applications. Respondents were not aware of any organizations that carry out education and outreach regarding hazards in their jurisdiction and Douglas County. Respondents did note there are opportunities to optimize cooperation with Douglas County on emergency management operations and hazard mitigation efforts, including coordinated training efforts and exercises.

Evacuation and Sheltering

None of the respondents indicated if there is collaboration with Douglas County on establishing evacuation routes or alternative evacuation routes. However, Teller County noted they would consult with Douglas County before making evacuation decisions if the need arose. Teller County also stated that evacuation routes are maintained to the same level of protection across county lines.

The Town of Elizabeth indicated they collaborate with Douglas County or any Douglas County municipalities on establishing shelters – in particular, animal shelters are usually established during an emergency. All respondents noted they were unsure whether their jurisdiction and Douglas County share any spaces suitable for temporary housing.

2.4 PUBLIC OUTREACH

2.4.1 Outreach Activities

In order to facilitate better coordination and communication between the Local Planning Committee and all community members and to involve the public in the planning process, the Local Planning Committee made the following efforts toward public participation in the development and review of the HMP update:

- The public was informed of the hazard mitigation planning effort commencement at the kickoff meeting and through press releases, news articles, and public service announcements released throughout the planning process. Copies of these announcements may be found in Appendix C.
- A public survey was posted on the County website and Story Map in August 2025 and was available for public input through December 2025. All participating jurisdictions were requested to advertise the availability of the survey via local homepage links, and other available public announcement methods (social media, email blasts, etc.).
- Stakeholder and neighboring community surveys were distributed to those listed in Sections 2.3.3 through 2.3.5.
- A public website (https://www.douglas.co.us/douglas-countys-hazard-mitigation-plan/) and Story Map (http://bit.ly/4pVLmcU) were set up to facilitate communication between the Core Planning Team, the Local Planning Committee, the public, and stakeholders. The websites contain a project overview, County and local contact information, access to the public survey and stakeholder surveys, and sections of the HMP for public review and comment.

- All participating jurisdictions were encouraged to distribute press releases on the project, including links to the project webpage and surveys.
- The Draft Plan was posted to the public website as of March 5, 2026, for public review and comment. All public comments were directed to Douglas County for collection and review by the Core Planning Team. All public comments received were forwarded to the appropriate jurisdiction and/or agency and incorporated into the final plan as appropriate.
- Once submitted to DHSEM/FEMA, the Final Plan will be available for public review and comment in the same manner and format as the Draft Plan, as well as in hard-copy format as described in Chapter 18. A printed version of the HMP will be maintained by Douglas County.

Examples of virtual outreach via websites and social media completed by the Planning Partners are provided in Figure 2-1 and Figure 2-2.

2.4.2 **Public Survey Summary**

The online hazards preparedness public survey was developed to gauge household preparedness that may impact Douglas County and to assess the level of knowledge of tools and techniques to assist in reducing risk and loss from hazards. The survey asked quantifiable questions about respondents' perception of risk, knowledge of mitigation, and support of community programs.

The County advertised the survey on their website and social media accounts. As of January 2, 2026, the survey received 150 responses.

Demographically, survey respondents were from all municipalities within Douglas County, and also included individuals who work, but do not live, in the County. Of those who do live in the County, 52 respondents have been residents for 20 years or more. Respondents were primarily aged between 45 and 74 years of age. The age groups (45-54, 55-64, and 65-74) all had 37 recorded responses each. The majority (142 responses) of residents live in a single-family detached residence and own (144 responses) their property.

Most (108 responses) residents receive information concerning hazards before an event through mass notification systems, followed by receiving information from tv news (87 responses) and (80 responses) rely on county or municipal social media. Similarly, the majority (95 responses) of residents receive information concerning hazards during and after an event through mass notification systems, followed by receiving information from tv news (90 responses) and (82 responses) rely on online news sources.

Survey respondents identified the following as the top five most frequently experienced hazard events within Douglas County in the past five years:

- Hail
- High Winds
- Thunderstorm
- Heavy Snow
- Lightning

Survey respondents identified the wildfire hazard as the most concerning hazard within Douglas County. When asked to describe the risks and/or impacts that were concerning, respondents noted:

- There is excess vegetation growth on public and private properties which can fuel wildfire

- Development keeps increasing in wildfire-prone areas, especially in locations where egress is an existing issue
- Evacuation routes are lined with trees and vegetation which can fuel wildfires
- The capacity of evacuation routes is not enough to support the number of residents
- Fireworks are used in the dry months and have been known to start fires, which spread widely

Respondents identified the following as priorities regarding planning for hazards:

- Protecting critical facilities and community lifelines (86.5 percent)
- Protecting and reducing damages to utilities (75.5 percent)
- Strengthening emergency services (e.g., police, fire, EMS) (73.6 percent)
- Protecting private property (69.2 percent)
- Preventing development in hazard areas (66.9 percent)

Respondents identified the following projects which would reduce the damage and disruption of hazards in Douglas County:

- Inform property owners of ways they can mitigate damage to their properties (94 responses)
- Replace inadequate or vulnerable bridges and causeways (93 responses)
- Work on improving the damage resistance of utilities (92 responses)
- Retrofit and strengthen essential facilities (86 responses)
- Improve access to information about hazard risk and high-hazard areas (82 responses)

52 respondents noted their home has been damaged by a hazard event. While most respondents did not report the damages to their local police, fire department, or emergency management agency, many respondents communicated the damages to insurance companies. Identified damages included, but were not limited to:

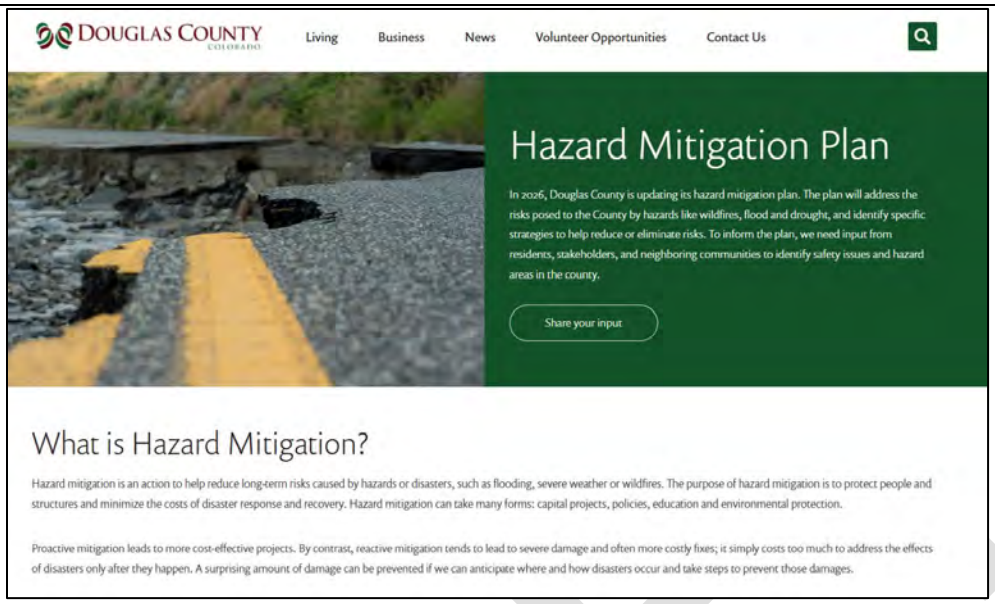
- Roof and siding damage from hail, high winds, and tornadoes
- Water damage to house foundation
- Smoke and fire damage from wildfire

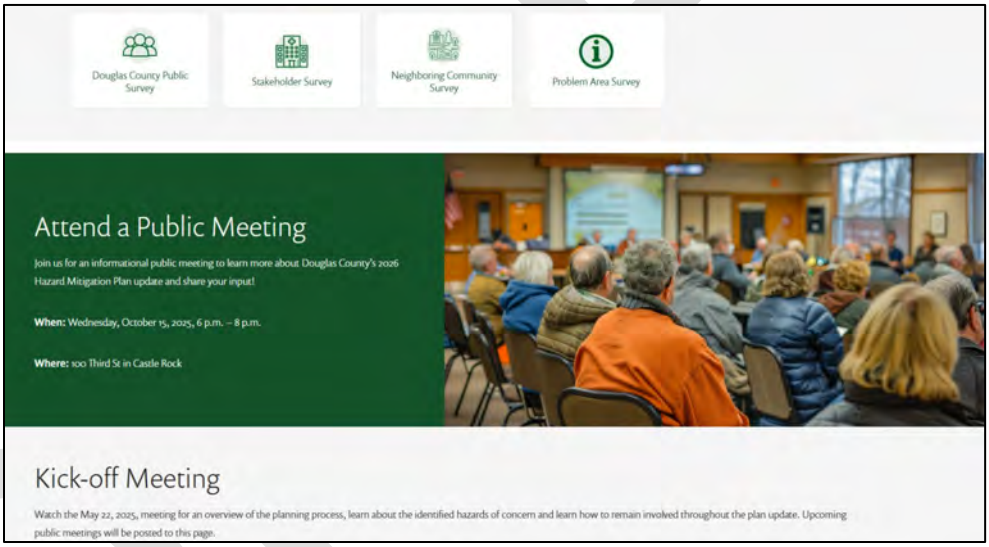
Respondents were also asked about their property's location within the floodplain, and if they have flood insurance. Ten of the respondents who answered this question indicated that their property is located in a designated floodplain; 24 respondents indicated that their home is covered by flood insurance.

The most self-selected jurisdictions respondents indicated that they live in, include Unincorporated Douglas County (100 respondents), the Town of Castle Rock (23 respondents), and the Town of Parker (11 respondents).

Jurisdiction-specific responses can be found in Volume II. Refer to Appendix C (Public and Stakeholder Outreach) for the full list of survey questions and responses.

Figure 2-1. Douglas County HMP Webpage and Local Online Outreach





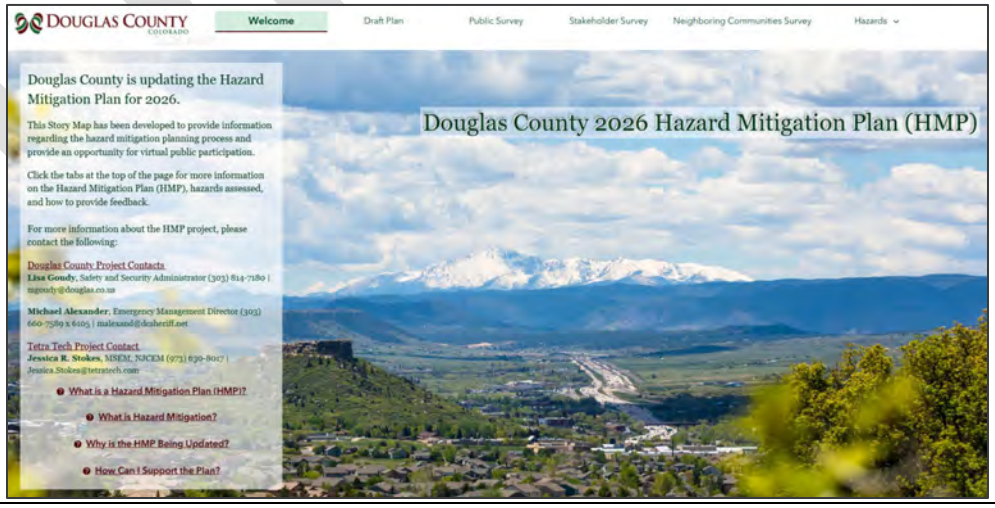


Figure 2-2. Douglas County HMP Webpage and Local Online Outreach

2.5 INCORPORATION OF EXISTING PLANS, STUDIES, REPORTS AND TECHNICAL INFORMATION

The Douglas County HMP uses the best available information to support hazard profiling, risk assessment, review and evaluation of mitigation capabilities, and the development and prioritization of Planning Partner mitigation strategies. Plans, reports, and other technical information were identified and accessed through independent research by the planning consultant or provided directly by the County, participating jurisdictions, and stakeholders involved in the planning effort. Detailed sources of technical data and information used are listed in the References section.

The County and participating jurisdictions provided jurisdiction-specific planning and regulatory documents, which were reviewed to identify the following:

- Existing jurisdictional capabilities
- Needs and opportunities to develop or enhance capabilities, which may be identified in the County or local mitigation strategies
- Mitigation-related goals or objectives, considered in the review and update of the overall HMP goals and objectives
- Proposed, in-progress, or potential mitigation actions to be incorporated into the updated County and local mitigation strategies

The following regulations, codes, ordinances, and plans were reviewed to develop mitigation planning goals and objectives and mitigation strategies that are consistent across local and regional planning and regulatory mechanisms:

- Comprehensive/master plans
- Building codes
- Zoning and subdivision ordinances
- Flood insurance studies
- Flood insurance rate maps
- NFIP flood damage prevention ordinances
- Site plan requirements
- Local waterfront revitalization plans
- Stormwater management plans
- Emergency management and response plans
- Land use and open space plans
- Capital plans
- Community Rating System
- Colorado Enhanced State Hazard Mitigation Plan, 2023

The County and participating jurisdictions assessed their planning and regulatory capabilities (see capability assessment section of each jurisdictional annex in Volume II). They reviewed relevant plans contributing to their capabilities to integrate mitigation efforts into their daily activities. The Planning Partners' annexes list plan types, names, and dates, as well as a summary of how each plan supports mitigation and resilience.

2.6 INTEGRATION WITH EXISTING PLANNING MECHANISMS AND PROGRAMS

Effective mitigation is achieved when hazard awareness and risk management strategies become an integral part of public activities and decision-making. Many existing plans and programs support hazard mitigation in the County. This HMP integrates, coordinates with, and complements those existing plans and programs.

The capability assessment in Chapter 16 describes plans, programs, and regulatory mechanisms at all levels of government (federal, state, county, and local) that support hazard mitigation in Douglas County. In the jurisdictional annexes in Volume II, each participating jurisdiction identifies how it has already integrated hazard mitigation into its planning, regulatory and administrative framework ("integration capabilities") and how it intends to promote this integration ("integration actions").

2.7 PLAN ADOPTION

Adoption by the governing bodies of all participating jurisdictions demonstrates the commitment of the Planning Partners to fulfill the mitigation goals and strategies outlined in this HMP. Adoption via a municipal resolution legitimizes the HMP and authorizes responsible agencies to execute their responsibilities. Adoption of the HMP is required by the DMA and offers the following benefits:

- It lends authority to the plan to serve as a guiding document for government officials.
- It gives legal status to the plan in the event it is challenged in court.
- It certifies to program and grant administrators that the plan's recommendations have been properly considered and approved by the jurisdictions' governing body and citizens.
- It helps to ensure the continuity of mitigation programs and policies over time because elected officials, staff, and other community decision-makers can refer to the official document when making decisions about the future.

All participating jurisdictions will proceed with formal adoption proceedings. Each jurisdiction will submit a copy of its formal adoption resolution or other legal instrument to the Douglas County HMP Coordinator, who will forward the resolutions to the Colorado DHSEM, after which they will be forwarded to FEMA for the record. FEMA allows two options for submitting adoption resolutions:

- **Submittal of adoption resolutions with plan**—All participating jurisdictions provide documentation of plan adoption when the HMP is initially submitted to the state for review. After receiving the draft plan from the state, FEMA conducts its review and will approve the HMP if it meets all requirements.
- **Approvable pending adoption**—A draft HMP is submitted to the state and FEMA for approval prior to adoption by the jurisdictions. When FEMA determines that the HMP as a whole and each participating jurisdiction have met all the requirements except adoption, FEMA will inform the state that the HMP is "approvable pending adoption" (APA). After that, once FEMA receives documentation of adoption resolutions from at least one jurisdiction, the status is changed from APA to approved for the entire plan and for that jurisdiction. Other jurisdictions that participated in the planning process then receive approval once they pass their own adoption resolutions. A jurisdiction with a plan in APA status does not meet the requirement for an approved mitigation plan to apply for and receive funding assistance.

FEMA will transmit acknowledgement of verification of formal plan adoption and the official approval of the HMP to the Douglas County HMP Coordinator. The HMP approval date begins the five-year approval period and sets the expiration date for the HMP. All participating jurisdictions will have the same expiration date regardless of their own jurisdiction's adoption date. The date indicated on FEMA's approval letter is the official approval date.

The resolutions issued by each jurisdiction to support adoption of this HMP are included in Appendix A, along with a sample generic adoption resolution.

2.8 CONTINUED PUBLIC INVOLVEMENT

After completion of this plan, implementation and ongoing maintenance will continue to be a function of the Local Planning Committee. The Local Planning Committee will review the HMP and accept public comment as part of an annual review and as part of five-year mitigation plan updates. The Planning Partners are committed to the continued involvement of the public in the hazard mitigation process. Implementation and maintenance measures are detailed in Chapter 18.

3. COUNTY PROFILE

The planning area for this HMP consists of the entirety of Douglas County. This chapter presents general information about the land, people, and assets of Douglas County. This information provides a baseline for understanding the economic, structural, and population assets at risk from the hazards addressed in this HMP.

3.1 LOCATION

Douglas County is in the central region of Colorado along the I-25 Corridor, as shown in Figure 3-1. The County lies between the major urban activity centers of Denver and Colorado Springs. Its 540,000 acres (840 square miles) feature mountain vistas, ridgelines, hills, and grass-covered plains. Elevations vary from 5,300 feet in the northeastern to almost 10,000 feet at Devil's Head in Pike National Forest (Douglas County 2019).

3.2 JURISDICTIONS WITHIN THE COUNTY

Douglas County includes the City of Castle Pines, the City of Lone Tree, the Town of Castle Rock, the Town of Larkspur, and the Town of Parker; all County area outside these municipalities is unincorporated. Castle Rock, named after a castle tower-shaped butte north of the town, is the county seat (Douglas County 2019).

In addition to the municipalities, a number of public special districts operate within the boundaries of the County. These include Denver Water District, Dominion Water and Sanitation District, Highlands Ranch Water District, and Parker Water Sanitation District.

3.3 HISTORY

Douglas County was created by the Colorado Territorial Legislature on November 1, 1861, along with 16 other original counties in the Colorado Territory. Douglas County was named for U.S. Senator Stephen A. Douglas from Illinois, who had died five months prior to the creation of the County. The county seat was originally in Franktown. It moved to California Ranch in 1863 before its final establishment in Castle Rock in 1874. Douglas County originally extended eastward to the Kansas border, but the eastern-most portion was annexed by Elbert County in 1874.

3.4 MAJOR PAST HAZARD EVENTS

Since 1953, presidential disaster declarations have been issued for hazard events that cause more damage than state and local governments can handle without assistance from the federal government. A presidential disaster declaration operationalizes federal recovery programs to assist residents, businesses, and public entities affected by the disaster. Review of presidential disaster declarations helps establish the probability of reoccurrence for each hazard and identify targets for risk reduction.

Table 3-1 shows FEMA disaster declarations that have included Douglas County through 2025. Douglas County has been the subject of declarations for three flooding events, three fires, one drought, one tornado, and two snow events. Additionally, the County was subject to a disaster declaration pertaining to the COVID-19 pandemic.

Figure 3-1. Douglas County Hazard Mitigation Plan Area

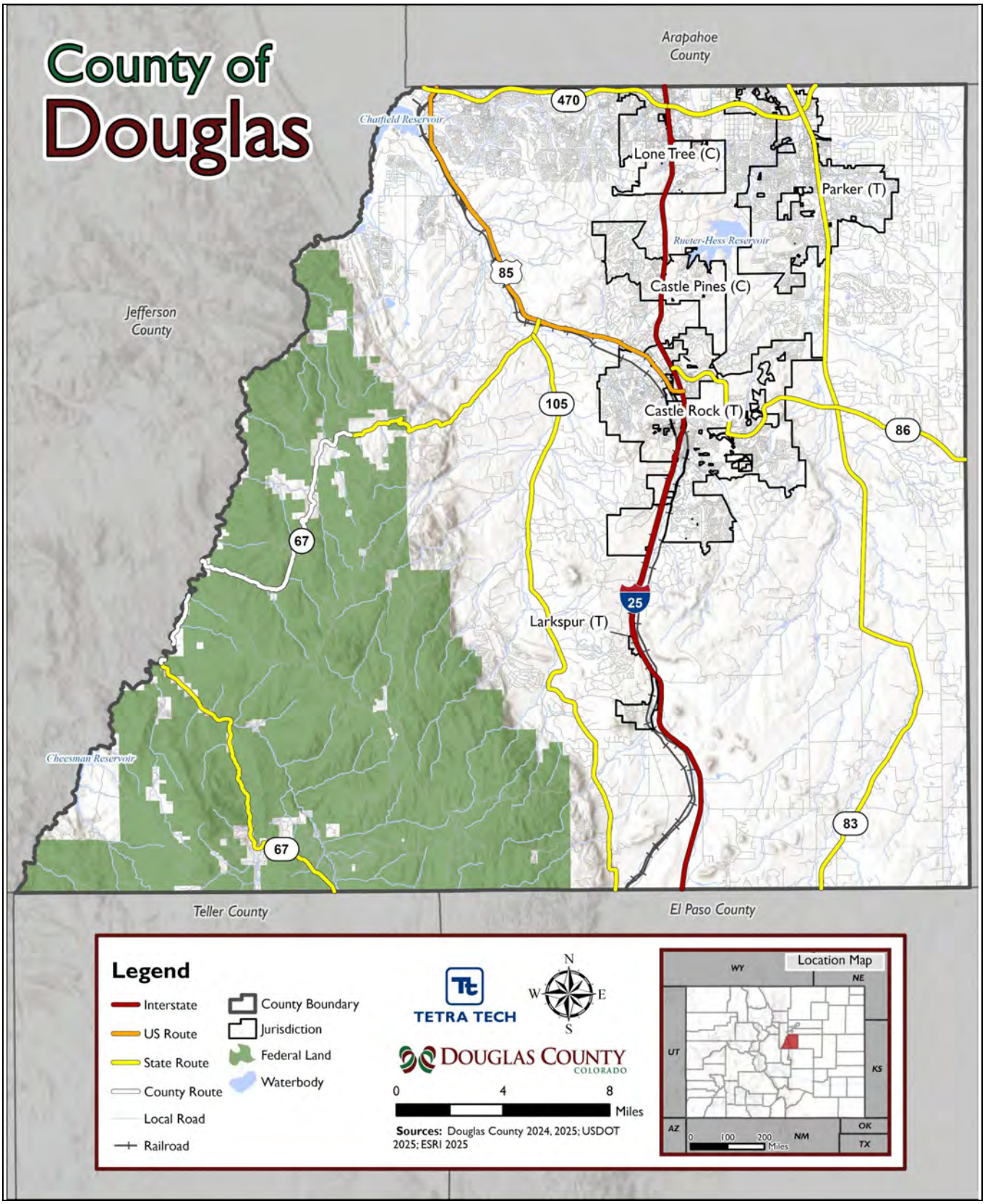


Table 3-1. History of Federally Declared Hazard Events in Douglas County

Disaster Number	Declaration Date	Event Date	Incident Type	Title
DR-200	June 19, 1965	June 19, 1965	Tornado	Tornadoes, Severe Storms, and Flooding
DR-261	May 19, 1969	May 19, 1969	Flood	Severe Storms and Flooding
DR-385	May 23, 1973	May 23, 1973	Flood	Heavy Rains, Snowmelt, and Flooding
EM-3025	January 29, 1977	January 29, 1977	Drought	Drought
FM-2407	May 23, 2002	May 21-May 29, 2002	Fire	Schoonover Fire
DR-1421	June 19, 2002	April 23-August 6, 2002	Fire	Wildfires
EM-3185	April 9, 2003	March 17-20, 2003	Snow	Snow
FM-2510	October 29, 2003	October 29-31, 2003	Fire	Cherokee Ranch Fire
EM-3224	September 5, 2005	August 29-October 1, 2005	Coastal Storm	Hurricane Katrina Evacuation
EM-3270	January 7, 2007	December 18-22, 2006	Snow	Snow
EM-3436	March 13, 2020	January 20, 2020- May 11, 2023	Biological	COVID-19
DR-4498	March 28, 2020	January 20, 2020- May 11, 2023	Biological	COVID-19 Pandemic
DR-4731	August 25, 2023	June 8-23, 2023	Flood	Severe Storms, Flooding, and Tornadoes

Source: (FEMA 2025)

3.5 PHYSICAL SETTING

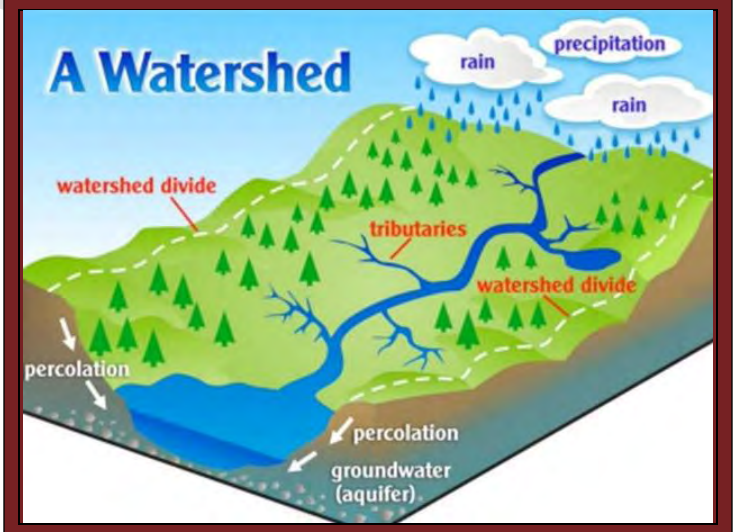
3.5.1 Water Resources

Douglas County is located in the Denver Basin, primarily within the Middle South Platte and Upper South Platte Watersheds. A small portion of the County southeast of Spruce Mountain is located within the Fountain Watershed.

The South Platte River forms Douglas County's western boundary, flowing north from Park County. The river is impounded at Chessman Lake in the southwest portion of the County and at Chatfield Reservoir in the northwestern portion of the County. Tributaries extend east into Pike National Forest.

Chatfield Reservoir also impounds Plum Creek, which branches south of Sedalia near the intersection of Routes 67 and 105. From there, East Plum Creek parallels Interstate 25, passing near Larkspur to its headwaters near the border with El Paso County. West Plum Creek parallels Route 105 to Larkspur, and then to its headwaters up Stark Creek in Pike National Forest.

A **watershed** is the area of land that drains into a body of water such as a river, lake, stream, or bay. It is separated from other systems by high points such as hills or slopes. It includes the waterway and all land area that drains to it. Drainage basins generally refer to large areas that encompass the watersheds of many smaller rivers and streams. Watersheds can cross municipal and county boundaries.



Source: (RCRCD n.d.)

Cherry Creek is the third major surface water system in Douglas County. Its headwaters are also located in El Paso County and the creek is followed by Route 83 northward into Arapahoe County. Both Plum Creek and Cherry Creek are tributaries of the South Platte River.

3.5.2 Topography and Geology

Douglas County topography ranges from grassy plains and gently rolling hills to steep slopes and sharply rising scenic buttes. Several regions of the County are defined by undulating terrain and deep arroyos. Elevations vary from around 5,400 feet to over 9,700 feet (Douglas County 2019).

3.5.3 Climate

Douglas County is characterized by a sunny, moderate climate, unlike the Rocky Mountains region to the west, which has extreme temperatures. The County averages over 300 days of sunshine a year. During the winter, Douglas County typically has a short period of cold and snowy weather. The average high temperature is 87 ºF in July and 46 ºF in January. January's low temperatures can fall to the teens. The average annual precipitation is 18.6 inches, and average annual snowfall is 71.3 inches. Winter days are generally sunny with temperatures in the 40s and low humidity.

3.5.4 Land Cover

Douglas County's land cover predominantly consists of forest and rangelands, which together cover about 80 percent of the County's land area. Urbanized land cover is increasing in the County and taking the place of agriculture and rangeland. Table 3-2 and Figure 3-2 show the land cover distribution in Douglas County.

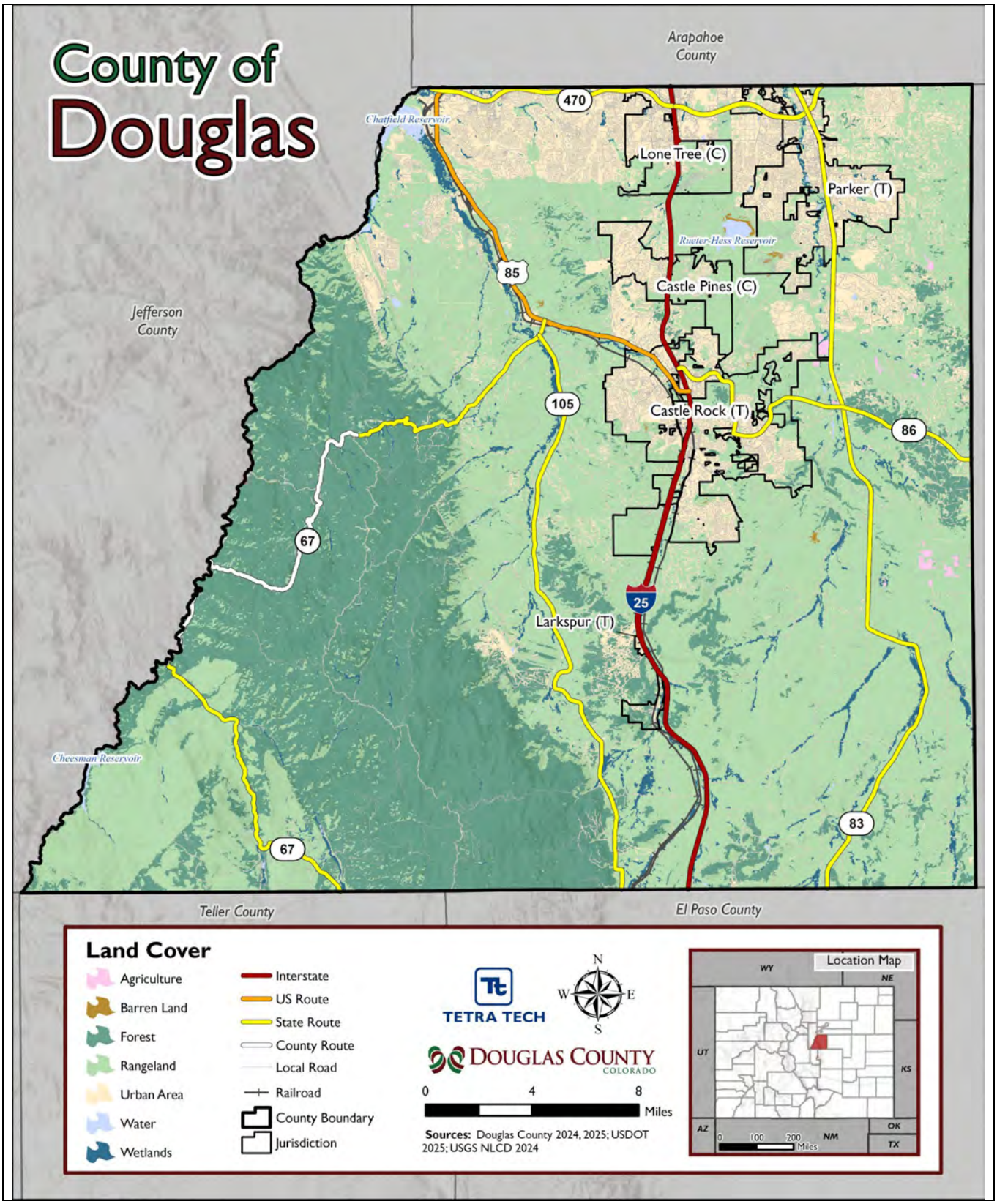
Table 3-2. Douglas County 2020 Land Use Classification

Category Description	Total Area in Category	
	Acres	% of Total
Agriculture	862	0.2%
Barren Land	363	0.1%
Forest	147,723	27.4%
Rangeland	282,396	52.4%
Urban Area	94,510	17.5%
Water	2,183	0.4%
Wetlands	11,325	2.1%
Douglas County	**539,361**	**100.0%**

Source: USGS NLCD 2024

Douglas County's vegetation is as varied as its topography. Pine, spruce, and fir trees cover the mountains of the Pike National Forest. The foothills are home to Gambel oak, mountain mahogany, and choke cherry. Riparian routes throughout the County feature cottonwood trees, willows, and lush grasses. The mid-grass prairies prevalent in the county are populated with blue gramma, switch grass, and winter wheat grasses (Douglas County 2019).

Figure 3-2. Douglas County Land Cover



3.6 LAND USE

This HMP provides a general overview of land use and types of development occurring within the study area. An understanding of these development trends can assist in planning for further development and ensuring that appropriate mitigation, planning, and preparedness measures are in place to protect human health and community infrastructure.

3.6.1 Current Land Use and Land Use Trends

The Colorado Constitution allows cities and towns to have greater authority to regulate at the municipal level through home rule charters. The Local Government Land Use Control Enabling Act allows home rule communities to plan for land use, protect the environment, and regulate activities that impact a community and the surrounding area. All cities and towns in Douglas County are home rule municipalities. The Douglas County government controls land use for unincorporated portions of the County (Douglas County 2025).

Urban Development

Douglas County was initially rural in nature but has grown to become more suburban, particularly in the northern and central portions of the County. New neighborhoods and communities are developing on former ranch and farmlands, and the County is seeing an increased amount of higher-density development in town centers (Douglas County 2019).

Major land use patterns have become more distinct as cities and towns have established projected growth boundaries, and major urban and non-urban areas under County jurisdiction have been designated. As the County, its communities, and jurisdictions continue to recognize broad and progressively more detailed development patterns and boundaries, opportunities are presented for coordinated, strategic decision-making to support effective land use planning (Douglas County 2012).

Agriculture

The U.S. Department of Agriculture's Census of Agriculture tracks agricultural data at the County level. In Douglas County, the number of farms has decreased by 8 percent since 2017, though the acreage of farms has increased 18 percent in the same time. About 70 percent of the County's farm acreage is pastureland.

Douglas County's agriculture products generate almost $15 million in sales each year (a decrease of 21 percent from 2017), with nursery products; cattle and calves livestock and products; and horses, ponies, mules, burros, and donkeys livestock and products generating the vast majority of farm sales. Overall, livestock and poultry account for 53 percent of sales and crops account for 47 percent (USDA 2024, USDA 2019).

3.7 POPULATION AND DEMOGRAPHICS

3.7.1 Current Population

According to the 2020 U.S. Census, Douglas County has a population of 357,978, a significant increase from the 2010 U.S. Census population of 285,465 (Colorado State Demography Office 2025). The Census Bureau's 2023 American Community Survey (ACS) 5-Year Estimates indicate a County population of 368,283. Table 3-3 highlights

population statistics for Douglas County and each local jurisdiction from the 2020 U.S. Census and the 2023 ACS. Figure 3-3 shows the 2020 distribution of population density (persons per square mile) by census block.

Table 3-3. Population Statistics in Douglas County

Jurisdiction	U.S. Census Bureau 2020 Decennial		2023 ACS 5-Year Estimates	
	Total Population	% of County Total	Total Population	% of County Total
Castle Pines	11,036	3.1%	12,573	3.4%
Castle Rock	73,158	20.4%	76,614	20.8%
Larkspur	206	0.1%	171	<0.1%
Lone Tree	14,253	4.0%	14,136	3.8%
Parker	58,512	16.3%	60,115	16.3%
Unincorporated County	200,813	56.1%	204,674	55.6%
Douglas County	**357,978**	**100.0%**	**368,283**	**100.0%**

Source: U.S. Census Bureau 2020 Decennial Census; U.S. Census Bureau 2023 ACS
Note: Unincorporated County population was determined by subtracting the population of cities and towns from the Douglas County total.

3.7.2 Population Trends

Population trend information identifies potential future shifts that could significantly change the character of the area. Population trends can provide a basis for making decisions on the type of mitigation approaches to consider and the locations in which these approaches should be applied. This information can also be used to support planning decisions regarding future development in hazard areas.

According to the Douglas County 2040 Comprehensive Master Plan, the County was one of the fastest growing in the United States during the 1990s. The County population continues to grow, albeit at a slower rate. The County is growing alongside both the state and the Denver Metro region in both population and employment (Douglas County 2019). As seen in Table 3-4, Douglas County's population has increased each decade since 1960.

Table 3-4. Historical and Projected Population Change in Douglas County

Historical Douglas County Population							Projected Douglas County Population		
1960	1970	1980	1990	2000	2010	2020	2030	2040	2050
4,816	8,407	25,153	60,391	175,766	285,465	357,978	420,361	453,635	466,l825

Source: (Colorado State Demography Office 2025); (Colorado State Demography Office 2025)

The Colorado State Demography Office estimates future population using a demographic model that incorporates survival rates, fertility rates, migration, and other factors (Colorado State Demography Office 2025). The model for Douglas County is consistent with the methodology used by the Denver Regional Council of Governments because Douglas County is considered part of the Denver metro area. The state population projections anticipate a continued growth in population through 2050. Figure 3-4 shows the population trend line.

Figure 3-3. Population Distribution in Douglas County

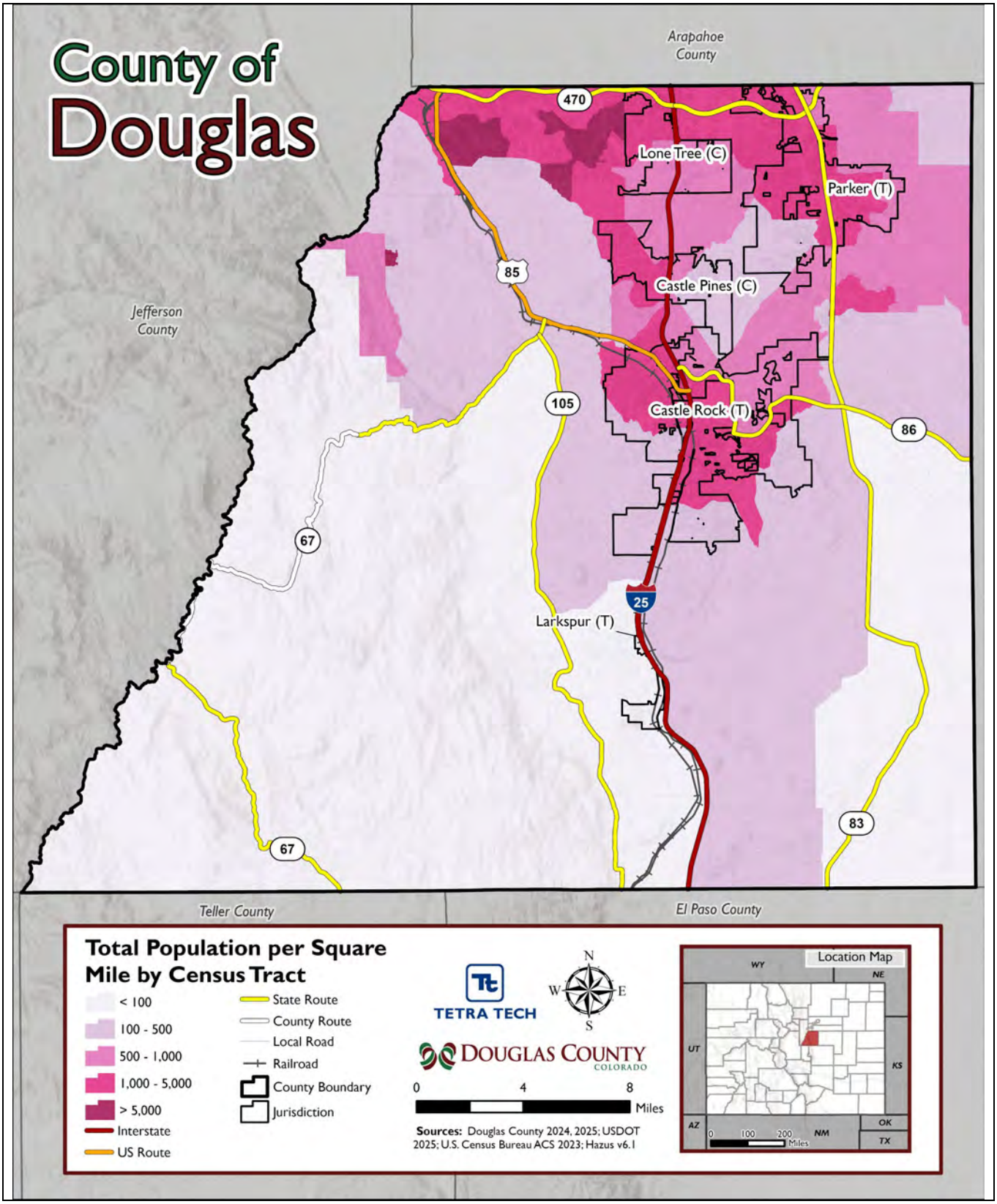
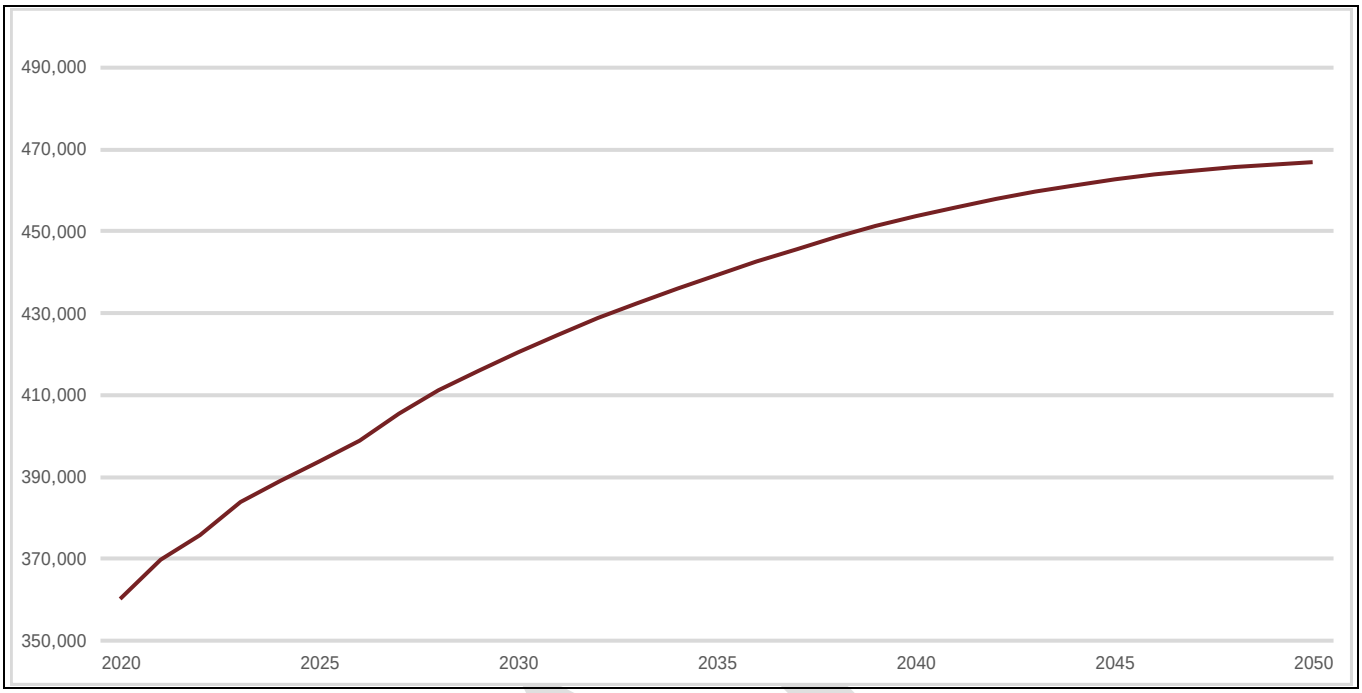


Figure 3-4. Douglas County Population Estimates and Projection, 2015 to 2050



Source: (Colorado State Demography Office 2025)

3.8 ECONOMY

3.8.1 Major Industries

Douglas County is home to premier business parks and LEED-certified buildings, and it actively plans for and pursues new commercial development. Key industries include aerospace, communications/telecom, financial services and insurance, health care/bioscience, and professional services (Metro Denver EDC 2025).

The 2023 County Business Patterns data identified 10,563 business establishments in Douglas County. The professional, scientific, and technical services industry has the greatest number of establishments in the County, with 2,026. This is followed by the health care and social assistance industry with 1,184 establishments, and the construction industry with 1,038 establishments (U.S. Census 2023).

3.8.2 Employment

For the first quarter of 2025, the U.S. Bureau of Labor Statistics estimated that Douglas County had 146,500 people employed by 15,800 establishments. This represented a 1 percent increase in employment from the same quarter of 2024 (BLS 2025).

The largest employment sector in the County in terms of the number of employees is the retail trade, which employs 20,748 workers. The health care and social assistance industry generates the largest payroll of any sector ($1.41 million). This industry represents 11.9 percent of the County's total payroll and employs 13.4 percent of the County's workforce. By contrast, retail trade accounts for 9.3 percent of the County's total payroll yet employs more than 15 percent of the workforce (U.S. Census 2023). Refer to Table 3-5 for additional information.

Table 3-5. County Business Patterns for Douglas County

Sector	# of Establishments	# of Employees	Annual payroll ($1,000)
Accommodation and food services	677	14,964	423,460
Administrative and support and waste management and remediation services	497	9,689	528,605
Agriculture, forestry, fishing and hunting	25	69	3070
Arts, entertainment, and recreation	209	3,085	91,972
Construction	,1038	13,769	1,135,203
Educational services	233	3,693	149,625
Finance and insurance	793	6,148	822,339
Health care and social assistance	1,184	17,821	1,141,038
Industries not classified	5	2	86
Information	245	5,863	749,772
Management of companies and enterprises	67	1,373	305,687
Manufacturing	159	8,826	1,129,211
Mining, quarrying, and oil and gas extraction	37	205	100,061
Other services (except public administration)	950	6,381	278,032
Professional, scientific, and technical services	2,026	10,153	1,050,688
Real estate and rental and leasing	933	2,192	161,523
Retail trade	958	20,748	891,142
Transportation and warehousing	147	2,346	123,094
Utilities	10	291	34,691
Wholesale trade	370	4,881	441,881
Total for all sectors	**10,563**	**132,499**	**9,561,180**

Source: (U.S. Census 2023)

3.8.3 Income

The first-quarter 2025 average weekly wage in Douglas County was $1,826 (BLS 2025). According to the 2023 American Community Survey 5-Year Estimates, the median household income in Douglas County was $14,5737, which is higher than the State median household income of $92,470. The 2020 American Community Survey also shows that 3.7 percent of the population had incomes below the poverty level (U.S. Census 2023).

3.8.4 Economic Trends

Job growth in Douglas County increased 7.5 percent between 2020 and 2022. Establishments or businesses increased by 15.9 percent in the same period. A total of 15,584 businesses employed at least one person with an annual wage for jobs at $72,507. The civilian labor force for Douglas County has continually grown since 2012, as shown in Table 3-6 (Douglas County 2023).

Table 3-6. Douglas County Civilian Labor Force

Year	Civilian Labor Force
2012	160,408
2013	164,423
2014	169,151
2015	172,204
2016	177,570
2017	183,237
2018	190,120
2019	196,099
2020	196,251
2021	202,593
2022	207,841

Source: (Douglas County 2023)

3.9 GENERAL BUILDING STOCK

3.9.1 Existing Development

For this HMP, a general building stock inventory of 139,706 structures was identified from tax data and spatial data. These structures account for a total replacement cost value of $207 billion. Content value per structure was estimated as 50 percent of the replacement cost value for residential buildings and 100 percent of the replacement cost value for all others. Using this methodology, the inventory includes $80 billion in content value. Residential buildings account for 91.7 percent of the total buildings in the County and 72.9 percent of the total building stock value. Table 3-7 presents building stock statistics by occupancy class for Douglas County.

According to 2023 American Community Survey 5-Year Estimates, 136,130 households are located in Douglas County. A household includes all the people who occupy a housing unit as their usual residence. The Census data identified 140,542 housing units in the county. A housing unit is a house, apartment, mobile home or trailer, a group of rooms, or a single room occupied as separate living quarters (or if vacant, intended for occupancy as separate living quarters). There are 4,412 vacant housing units in the County (U.S. Census 2023).

Figure 3-5 through Figure 3-8 show the distribution and value density of residential, commercial, industrial, and other buildings in Douglas County. Value density is the dollar value of structures per unit area, including building content value. The densities are shown in units of $1,000 per square mile. Value density maps can assist communities in visualizing areas of high loss potential and in evaluating aspects of the study area in relation to specific hazard risks.

Table 3-7. Building Stock Count and Replacement Cost Value by Occupancy Class

Jurisdiction	Residential		Commercial		Industrial		Other	
	Building Count	Total Replacement Cost Value	Building Count	Total Replacement Cost Value	Building Count	Total Replacement Cost Value	Building Count	Total Replacement Cost Value
Castle Pines	3,896	$5,555,890,799	62	$145,512,863	2	$1,493,721	40	$266,450,006
Castle Rock	23,693	$25,627,609,558	1,102	$4,156,673,149	76	$392,368,212	328	$2,182,235,181
Larkspur	337	$78,612,910	52	$37,371,450	3	$8,478,312	29	$39,718,842
Lone Tree	3,870	$10,524,777,973	347	$13,310,686,517	3	$50,190,204	65	$393,559,818
Parker	17,048	$20,143,037,127	849	$4,588,584,922	77	$229,984,009	301	$1,880,394,488
Unincorporated County	79,323	$89,290,473,807	3,965	$19,750,020,052	268	$1,454,598,336	3,970	$7,280,886,734
Douglas County	**128,167**	**$151,220,402,175**	**6,377**	**$41,988,848,952**	**429**	**$2,137,112,794**	**4,733**	**$12,043,245,070**

Source: Douglas County 2025; FEMA/ESRI 2025; Microsoft 2020; RSMeans 2024
Note: Other = Government, Religion, Agricultural, and Education

Figure 3-5. Distribution of Residential Building Stock and Value Density in Douglas County

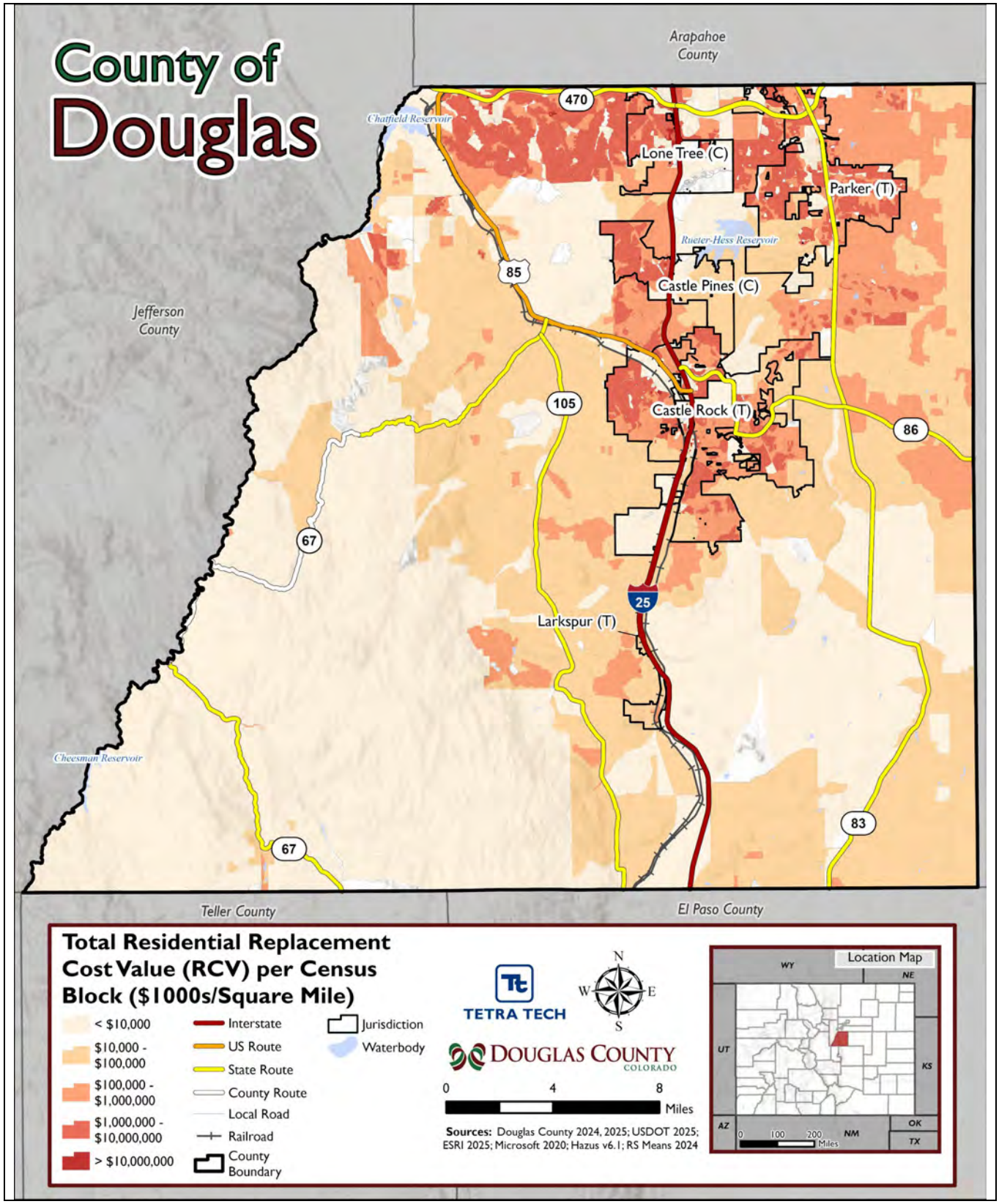


Figure 3-6. Distribution of Commercial Building Stock and Value Density in Douglas County

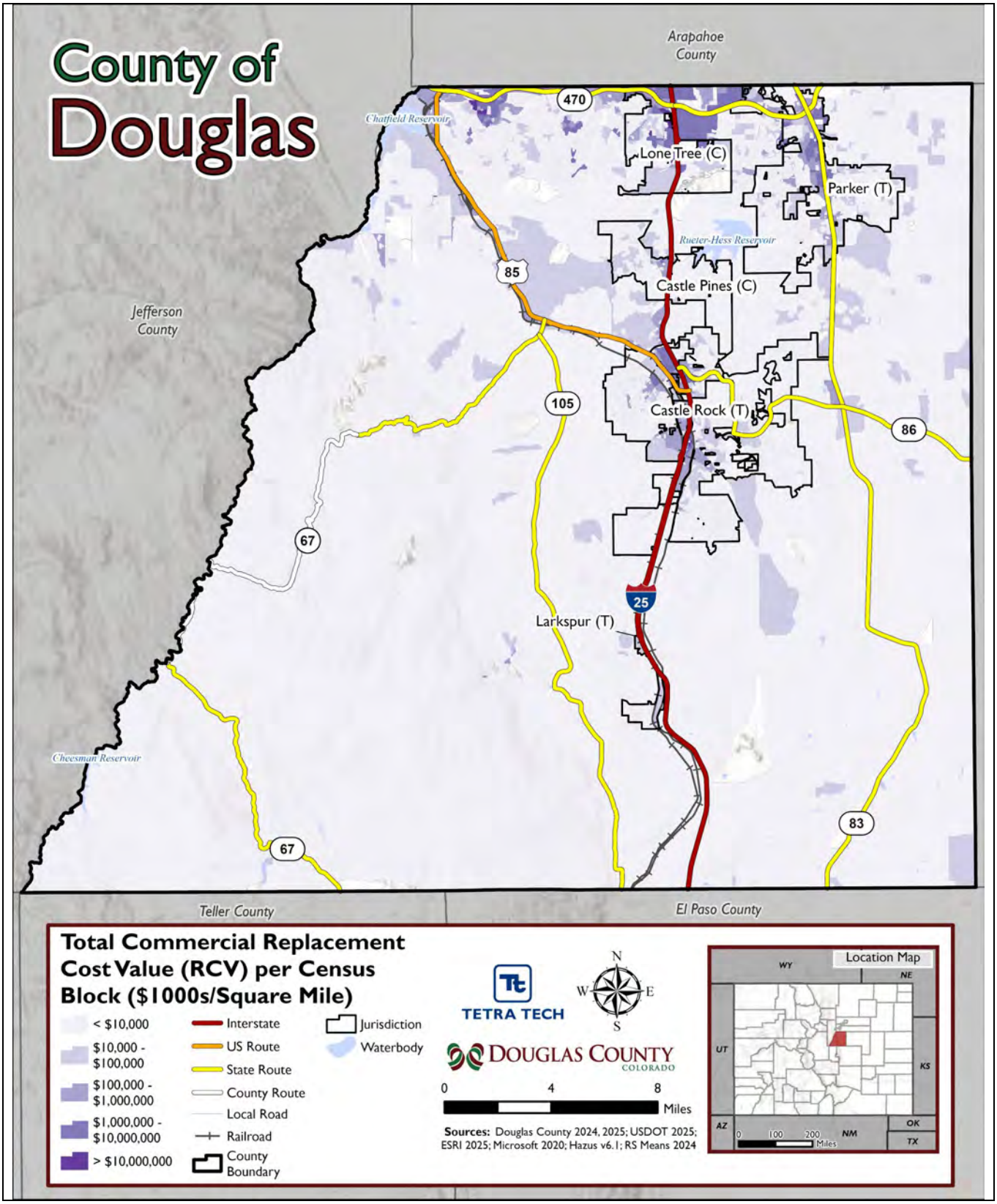


Figure 3-7. Distribution of Industrial Building Stock and Value Density in Douglas County

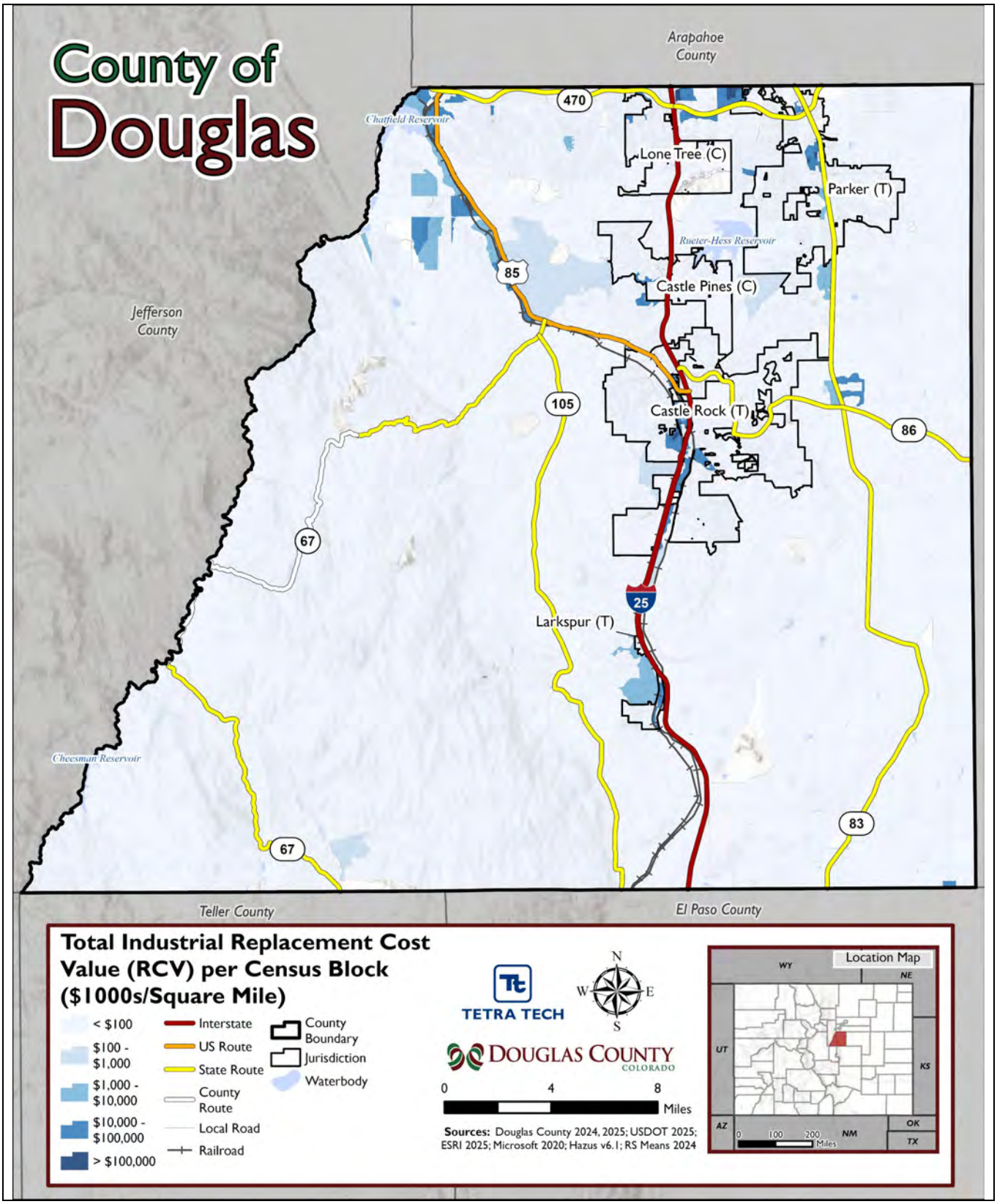
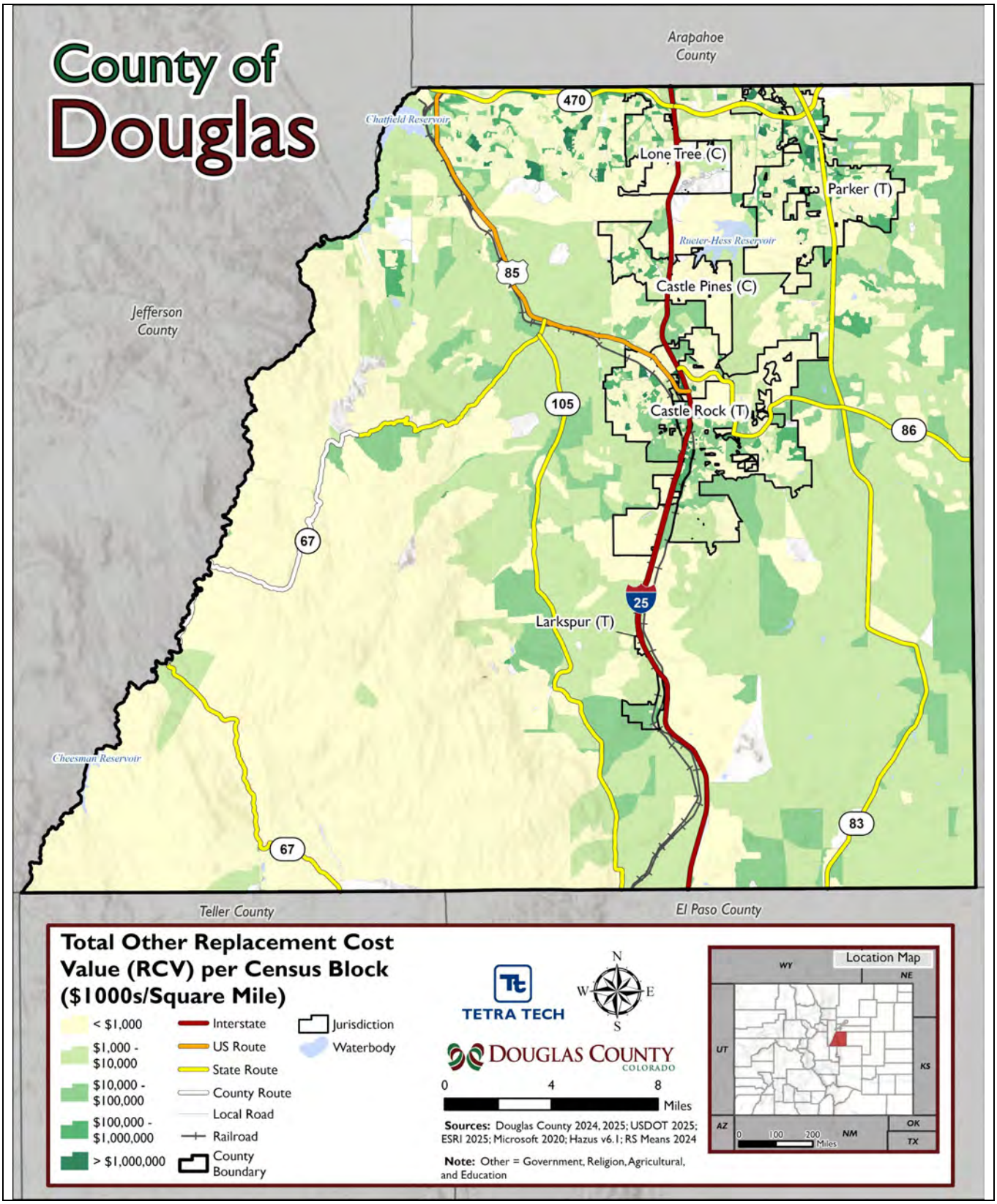


Figure 3-8. Distribution of Other Building Stock and Value Density in Douglas County



3.9.2 New Development

Permits issued for new housing in Douglas County in 2021 increased 35.8 percent from 2020, with a total of 4,967. The increase was largely for single-family and townhome housing units, particularly in Castle Rock, Castle Pines, Parker, the Pinery Separated Urban Area, and the Chatfield Urban Area. In 2021, 3,546 new housing units were completed in Douglas County, which was a 2.6 percent increase in the total housing stock. Multi-family and condominium housing unit permits accounted for 18 percent of the total permits issued in 2021. Over 700,000 square feet of commercial space was permitted in 2021 (Douglas County 2022).

Participating jurisdictions submitted information on 79 new and anticipated developments. The City of Lone Tree indicated 45 of these. Table 3-8 lists this collected data. Individual development projects are detailed in Volume II in each jurisdictional annex.

Table 3-8. New and Anticipated Development Douglas County

Jurisdiction	New Development Count	Anticipated Development Count
Castle Pines	3	0
Castle Rock	0	4
Larkspur	0	0
Lone Tree	15	30
Parker	5	8
Unincorporated County	3	11
Douglas County	**26**	**53**

Source: Douglas County 2025
Note: New Development = constructed within the past five years (2019-2024)
Anticipated Development = to be constructed within the next five years (2024-2029)

Douglas County uses best available data to avoid potential exposure of new development to hazard events where possible. The County discourages development in vulnerable areas and areas with high population density and encourages higher regulatory standards at the local level.

3.10 COMMUNITY LIFELINES

Facilities that are essential to the health and welfare of the population and that maintain essential and emergency functions are designated as critical facilities. These typically include police and fire stations, schools, emergency operations centers, and infrastructure such as roads, bridges and utilities that provide water, electricity, and communications. Facilities that use or store hazardous materials are designated as critical facilities as well. All these facilities are especially important after any hazard event (FEMA 1997).

FEMA defines some types of critical facilities, as well as public services or activities, as “community lifelines.” Community lifelines provide the fundamental services in a community that, when stabilized, enable all other aspects of society. Following an emergency event, intervention is required to stabilize lifelines. FEMA defines eight categories of community lifelines:

- Safety and security
- Food, hydration, shelter
- Health and medical
- Energy
- Communications
- Transportation
- Hazardous materials
- Water systems

A comprehensive inventory of community lifelines in Douglas County was developed from various sources, including input from the Core Planning Team and Local Planning Committee. The following sections describe the inventory. Although many lifeline facilities could fall within numerous categories, each lifeline facility identified for this planning effort was categorized only according to its primary function.

3.10.1 **Safety and Security**

Figure 3-9 shows the location of safety and security facilities included in the lifelines inventory. Key facilities and services considered for the inventory under this category are as follows:

- Emergency facilities include police, fire, and emergency operations centers (EOC). There are 43 identified lifeline emergency facilities in Douglas County.
- Douglas County has 107 school facilities identified as lifelines. The County's students attend the Douglas County School District, which is Colorado's third largest in enrollment.
- There are 48 identified government facility lifelines in Douglas County, which include post offices, town halls, civic centers, administrative buildings, and similar structures.
- According to the Colorado Division of Water Resources, there are 51 active jurisdictional and 19 active non-jurisdictional dams in Douglas County. Jurisdictional dams are those for which state law requires plan review and approval by the state engineer. Only the jurisdictional dams are categorized based on hazard potential (high, significant, or low). Four of the jurisdictional dams in the County are rated high hazard dams, eight are significant hazard, and 39 are low hazard.

3.10.2 **Food, Hydration, Shelter**

Figure 3-10 shows the location of food, hydration, and shelter facilities included in the lifelines inventory. County-wide sheltering policies are documented in the following plans:

- Douglas County Comprehensive Emergency Management Plan
- Douglas County Emergency Operations Plan
  - ESF 6—Mass Care
  - ESF 6a—Animal Sheltering and Issues
  - ESF 7a—Resources and Logistics
  - ESF 7b—Donations Management
  - ESF 7c—Volunteer Coordination
  - ESF 8—Public Health

The American Red Cross and Colorado Disaster Relief may provide support services, in conjunction with Douglas County agencies, during and after an emergency or disaster. Key facilities and services considered for the inventory under this category are as follows:

- There are 23 food distribution facilities identified for Douglas County.

- There are 26 identified shelter lifelines in Douglas County, inclusive of educational facilities, County buildings, and religious buildings.
- There are four identified shelter locations for animals in the County, one of which allows for the co-location of humans and animals.

Figure 3-9. Safety and Security Facilities In Douglas County

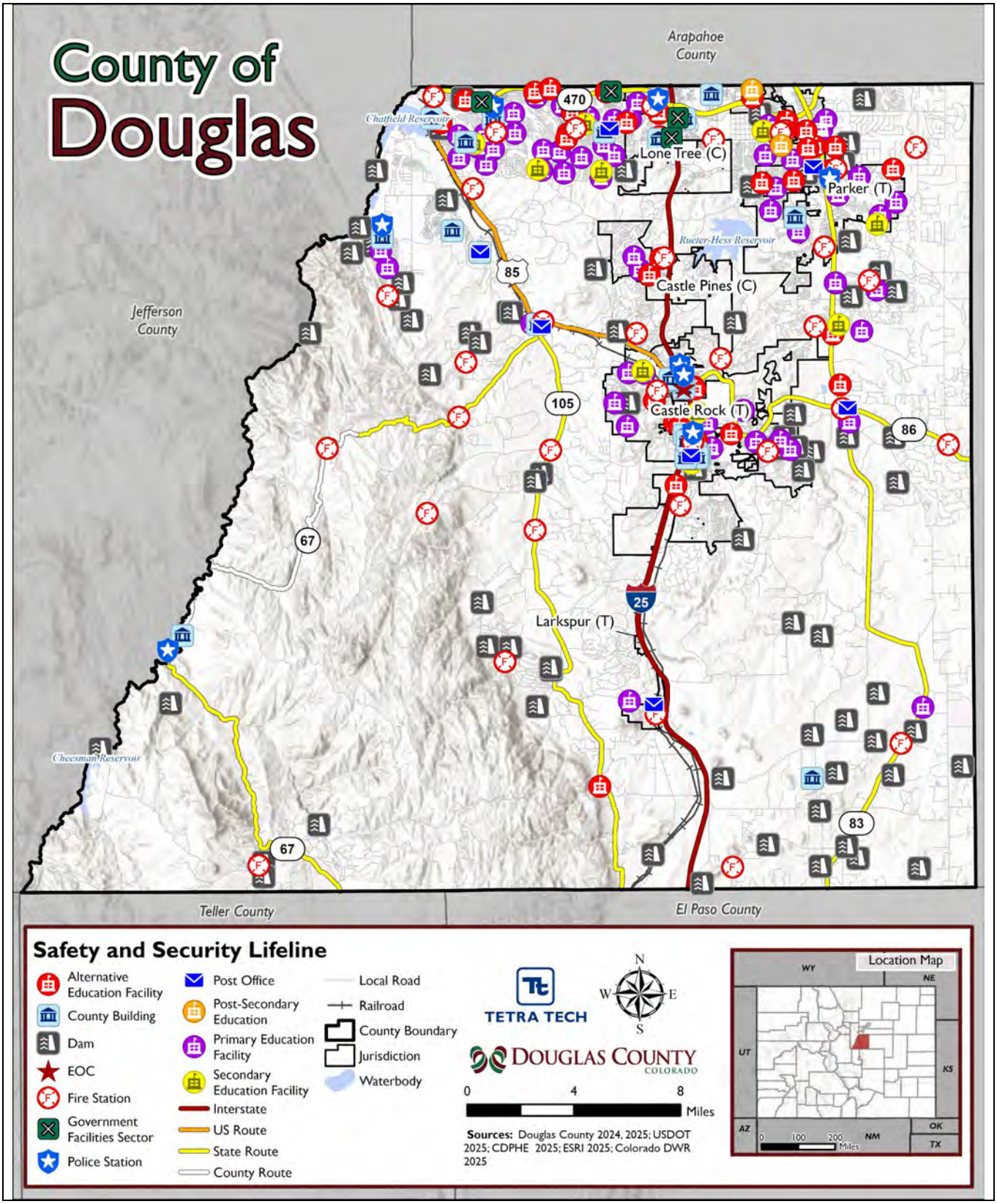
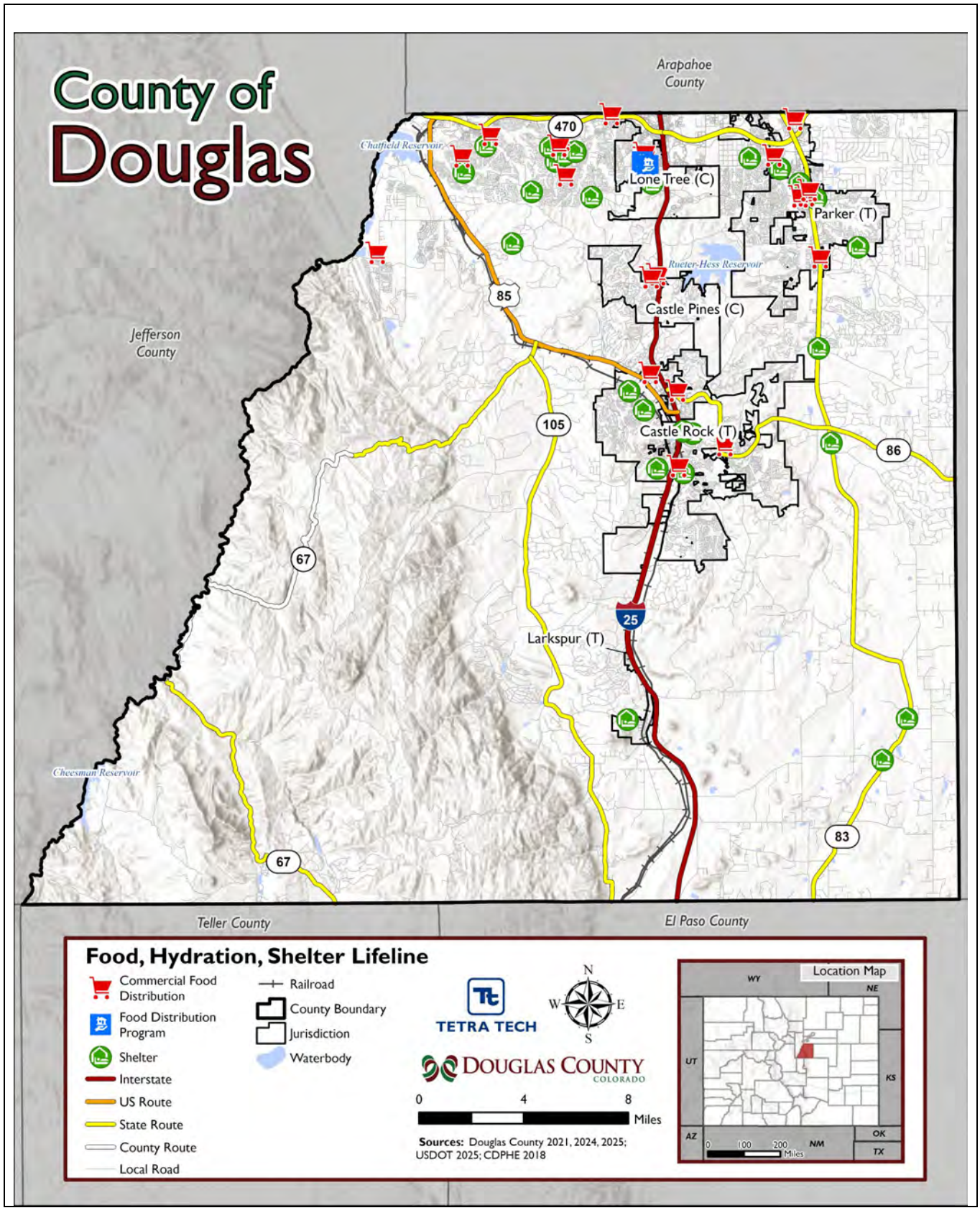


Figure 3-10. Food, Hydration, and Shelter Facilities in Douglas County



3.10.3 **Health and Medical**

Figure 3-11 shows the location of health and medical facilities included in the lifelines inventory. Key facilities and services considered for the inventory under this category are as follows:

- There are 169 health and medical facility lifelines identified in Douglas County. These lifelines are inclusive of assisted living facilities, medical care facilities, hospitals, pharmacies, urgent care facilities, and EMS facilities.

3.10.4 **Energy**

Figure 3-12 shows the location of energy facilities included in the lifelines inventory. Utility providers were not required to provide locations of their key facilities for this plan update. Key facilities and services which were identified for this plan update, and considered for the inventory under this category, are as follows:

- There are three electricity providers for Douglas County:
  - The largest is the Intermountain Rural Electric Association, which is a non-profit electric cooperative that serves the vast majority of the County. Power from the IREA is generated outside Douglas County.
  - Xcel Energy (Public Service Corporation of Colorado) provides electric services to Highlands Ranch.
  - The Mountain View Electric Association, an electric cooperative, provides electric utility service along Colorado Route 83 between Castlewood Canyon State Park and El Paso County.
- Much of Douglas County receives natural gas service from utilities. The northern portion of the County, including Highlands Ranch, Lone Tree, and Parker, has natural gas service available through Xcel Energy. Black Hills Energy provides natural gas service south of the area served by Xcel Energy to the El Paso County line, inclusive of Castle Rock and Larkspur.
- Two hydroelectric plants were identified as critical facilities in the energy lifeline.

3.10.5 **Communications**

Figure 3-13 shows the location of communications facilities included in the lifelines inventory. Communication providers were not required to provide locations of their key facilities for this plan update. Key facilities and services which were identified for this plan update, and considered for the inventory under this category, are as follows:

- Various cell phone companies provide cell phone service throughout the County, though gaps in coverage exist in Pike National Forest. Certain portions of the County also have fiber optic connectivity.
- 639 towers (cell and radio) were identified as critical facilities in the communications lifeline.

Figure 3-11. Health and Medical Facilities in Douglas County

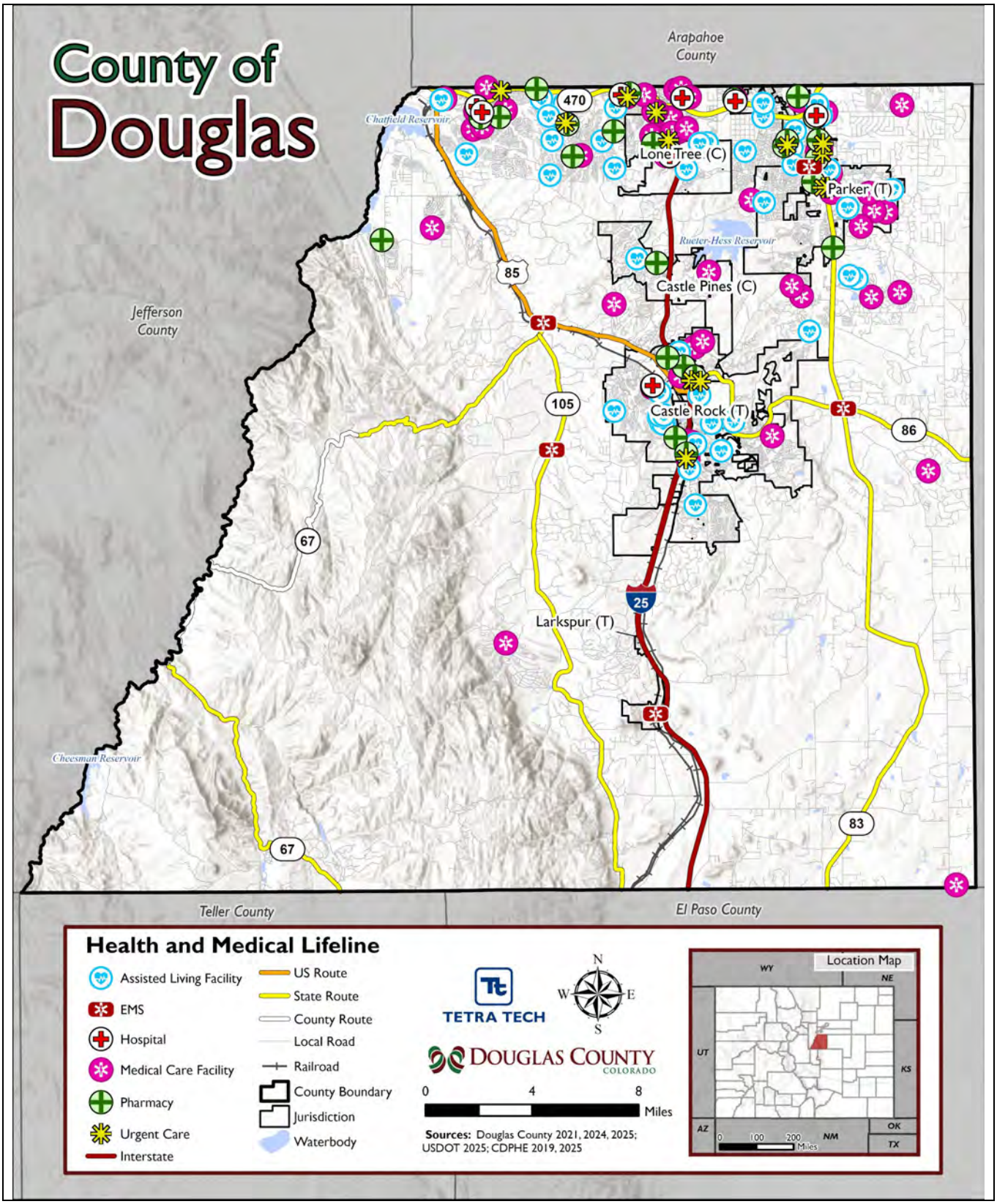


Figure 3-12. Energy Facilities in Douglas County

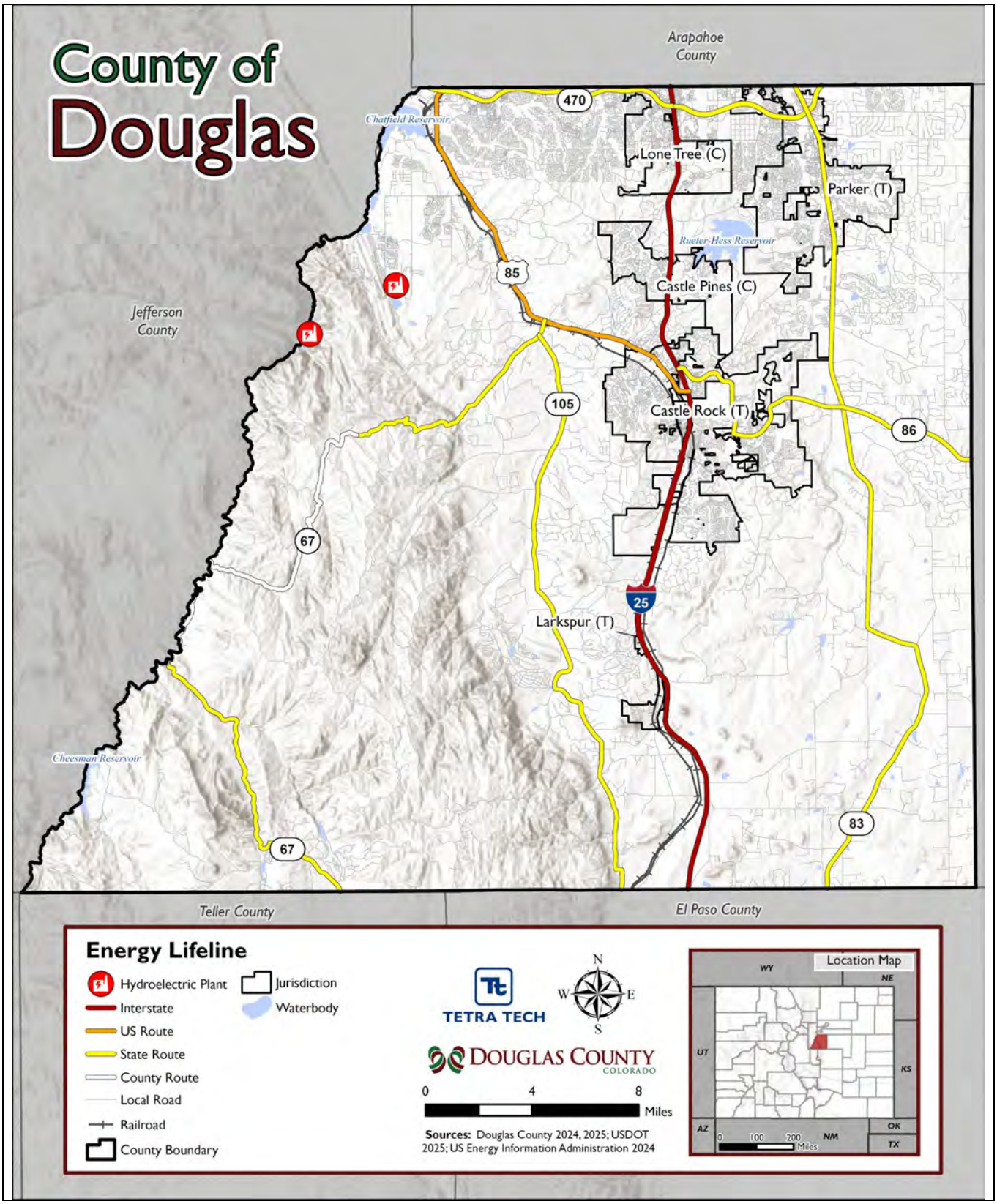
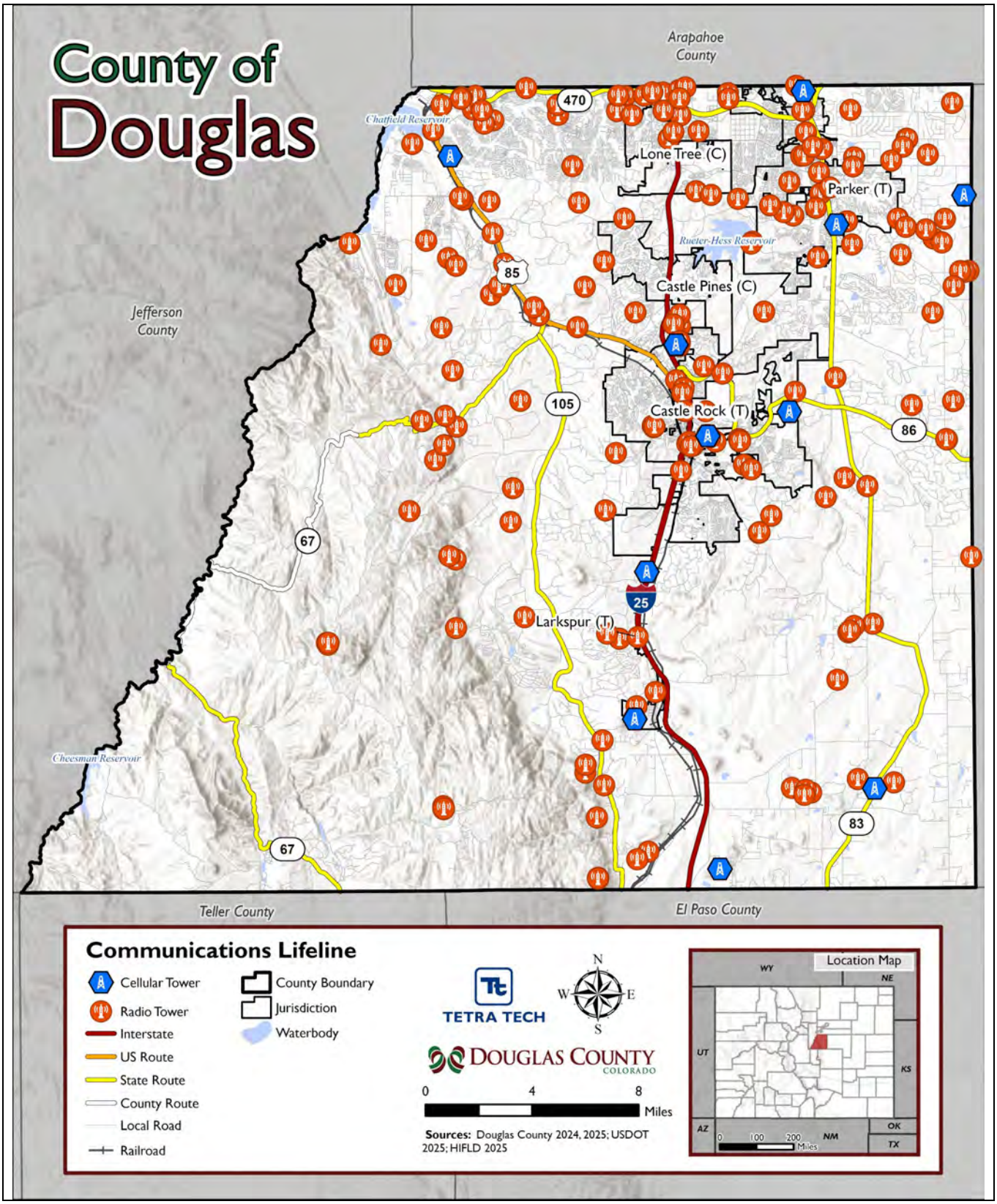


Figure 3-13. Communications Facilities in Douglas County



3.10.6 **Transportation**

Douglas County is located in the greater Denver metropolitan area and functions as suburban and exurban area of Denver. The County is centrally located between Colorado's most populous communities—Denver and Colorado Springs—along the Interstate 25 corridor. From Castle Rock near the center of the County, downtown Denver is just 35 minutes by car and Colorado Springs is just 42 minutes by car.

Douglas County has strong connectivity to the surrounding counties of Teller, El Paso, Elbert, Arapahoe, and Jefferson via Interstate 25 as well as major highways such as US-85, Highway 67, Highway 105, Highway 83, Highway 86, Highway 121, and C-470.

Douglas County continues to make major improvements in transportation projects to serve its businesses and residents. The SE corridor light rail provides access to major employment centers and links the County to downtown Denver. E-470 toll road provides easy access to Denver International Airport as well as access to Parker Adventist Hospital, Rocky Vista University, Sky Ridge Medical Center, and several medical device and research companies. Centennial Airport, one of the nation's busiest general aviation airports, is partly in Douglas County and partly in Arapahoe County (Metro Denver EDC 2025).

Figure 3-14 shows the location of transportation facilities included in the lifelines inventory. Key facilities and services considered for the inventory under this category are as follows:

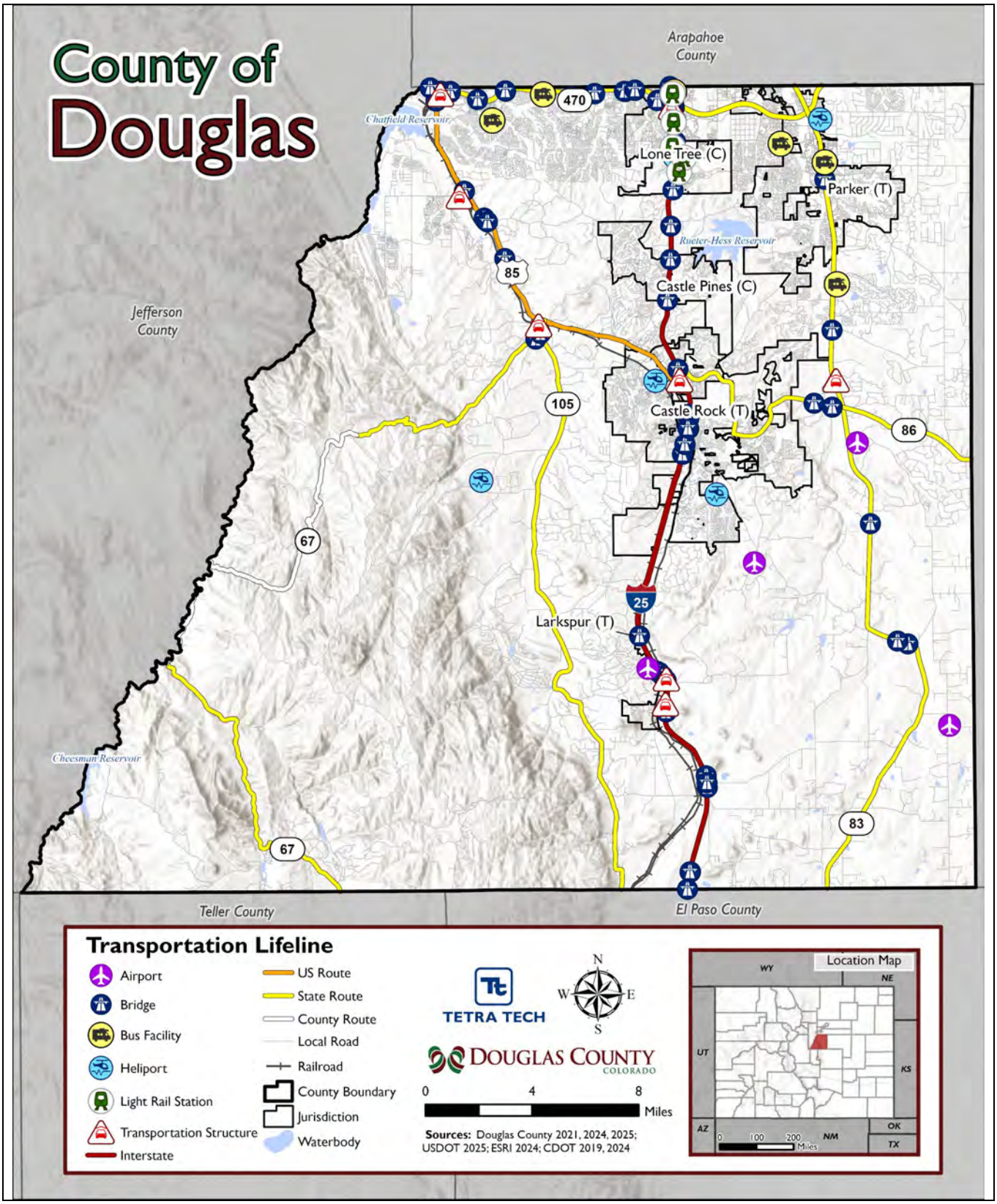
- There are four identified airport facilities and five heliports in Douglas County. Though many of the facilities for Centennial Airport are located in Arapahoe County, a portion of the runways for the Airport are located in northern Douglas County between Parker and Highlands Ranch.
- There are 78 bridges identified as lifelines in Douglas County, of which, 56 bridges are under County jurisdiction.
- Douglas County has 12 identified transportation lifelines related to mass transit in Douglas County, including bus facilities and light rail stations.
- Douglas County identified 48 transportation storage structures, including storage sheds, tanks, offices, and other structures.

3.10.7 **Hazardous Materials**

Due to security concerns, local hazardous materials lifeline data was only partially obtained. Tier II facility information and the location map of Hazardous Materials Facilities has been removed from this public-facing document for confidentiality. Key facilities and services considered for the inventory under this category are as follows:

- The U.S. Environmental Protection Agency (EPA) Comprehensive Environmental Response, Compensation and Liability Information System (Superfund) Public Access Database reports that there are currently no Superfund sites in Douglas County (EPA 2025).
- Abandoned hazardous waste sites placed on the federal National Priorities List (NPL) include those that the EPA has determined present "a significant risk to human health or the environment," with the sites being eligible for remediation under the Superfund Trust Fund Program. As of 2025, Douglas County has zero proposed, new, active, or inactive hazardous sites in the federal Superfund Program that are listed on the NPL (EPA 2025).

Figure 3-14. Transportation Facilities in Douglas County



3.10.8 **Water Systems**

Douglas County water providers include the following organizations:

- Arapahoe County Water and Wastewater Authority
- Aurora Water
- Bell Mountain Ranch Metro District
- Beverly Hills Mutual Water Company
- Castle Pines Metropolitan District
- Castle Pines North Metro District
- Castleton Water and Sanitation
- Centennial Water and Sanitation District
- Chatfield South Water District
- City of Littleton
- Cottonwood Water and Sanitation District
- Dominion Water & Sanitation District
- Inverness Water and Sanitation District
- Louviers Water and Sanitation District
- Meridian Metropolitan District
- Parker Water and Sanitation District
- Perry Park Water and Sanitation District
- Pinery - Denver SE Suburban
- Ravenna Metro District
- Roxborough Park Metropolitan District
- Sedalia Water and Sanitation District
- Sierra Vista Douglas Mutual Water Company
- Silver Heights Water and Sanitation
- Soliltude Metro District
- Southgate Water District
- Southwest Metro WSD
- Stonegate Village Metro
- Thunderbird Water and Sanitation District
- Titan Road Industrial Park Water Association Inc.
- Town of Castle Rock
- Town of Larkspur
- View Ridge Mutual Water Company
- Westcreek Lakes Water District

Douglas County water and sanitation districts include the following organizations:

- Airport Vista Metro District 1
- Airport Vista Metro District 2
- Arapahoe County Water & Wastewater PID
- Bell Mountain Ranch Metropolitan District
- Castle Pines Metro District
- Castle Pines North Metro District
- Castle Pines Town Center Metro District 1,2,3
- Castleton Center Water & San District
- Chatfield South Water District
- Dominion Water & Sanitation District
- E-470 Potomac Metro District
- Hidden Pointe Metro District
- Highlands Ranch Metro District
- Highlands Ranch Metro District 5
- Inverness Water & Sanitation District
- Lincoln Park Metro District
- Louviers Water & Sanitation District
- Roxborough Water & Sanitation District
- Sedalia Water & Sanitation District
- Silver Heights Water & San District
- Soliltude Metro District
- South Meridian Metro District
- South Meridian Metro District Debt Service
- South Park Metro District
- South Santa Fe Metro District 1, 2

- City of Aurora
- Compark Business Campus Metro District
- Concord Metro District
- Consolidated Bell Mountain Ranch Metro District
- Cottonwood Water & Sanitation District
- Crowfoot Valley Ranch Metro District 1, 2
- Denver SE Suburban Water & San District
- Meridian Metro District
- Meridian Village Metro District 2
- North Meridian Metro District
- Northern Douglas County Water & San District
- Parker Water & Sanitation District
- Perry Park Water & Sanitation District
- Ravenna Metro District
- Remuda Ranch Metro District
- Southgate Sanitation District
- Southgate Water District
- Southwest Metro Water & San District
- Stonegate Village Metro District
- Thunderbird Water & Sanitation District
- Town of Castle Rock
- Town of Larkspur
- Westcreek Lakes Water District

Figure 3-15 shows the location of water system facilities included in the lifelines inventory. Due to security concerns, water system lifeline data was only partially obtained. Key facilities and services considered for the inventory under this category are as follows:

- There are 375 potable water facilities in Douglas County, the vast majority of which are potable wells. Additional facilities include lift stations, tanks, and treatment facilities. Much of Douglas County's water supply consists of groundwater derived from the Denver Basin aquifers.
- There are six identified wastewater treatment lifelines in the County inclusive of treatment facilities and pump stations.

3.11 OTHER CRITICAL FACILITIES

Some facilities that are identified as critical for hazard mitigation in Douglas County do not fit in any of FEMA's community lifeline categories. These include daycare facilities (164), historic locations (294), libraries (7), and polling sites (116). Figure 3-16 shows the location in Douglas County of these other critical facilities.

Figure 3-15. Water Systems Lifelines in Douglas County

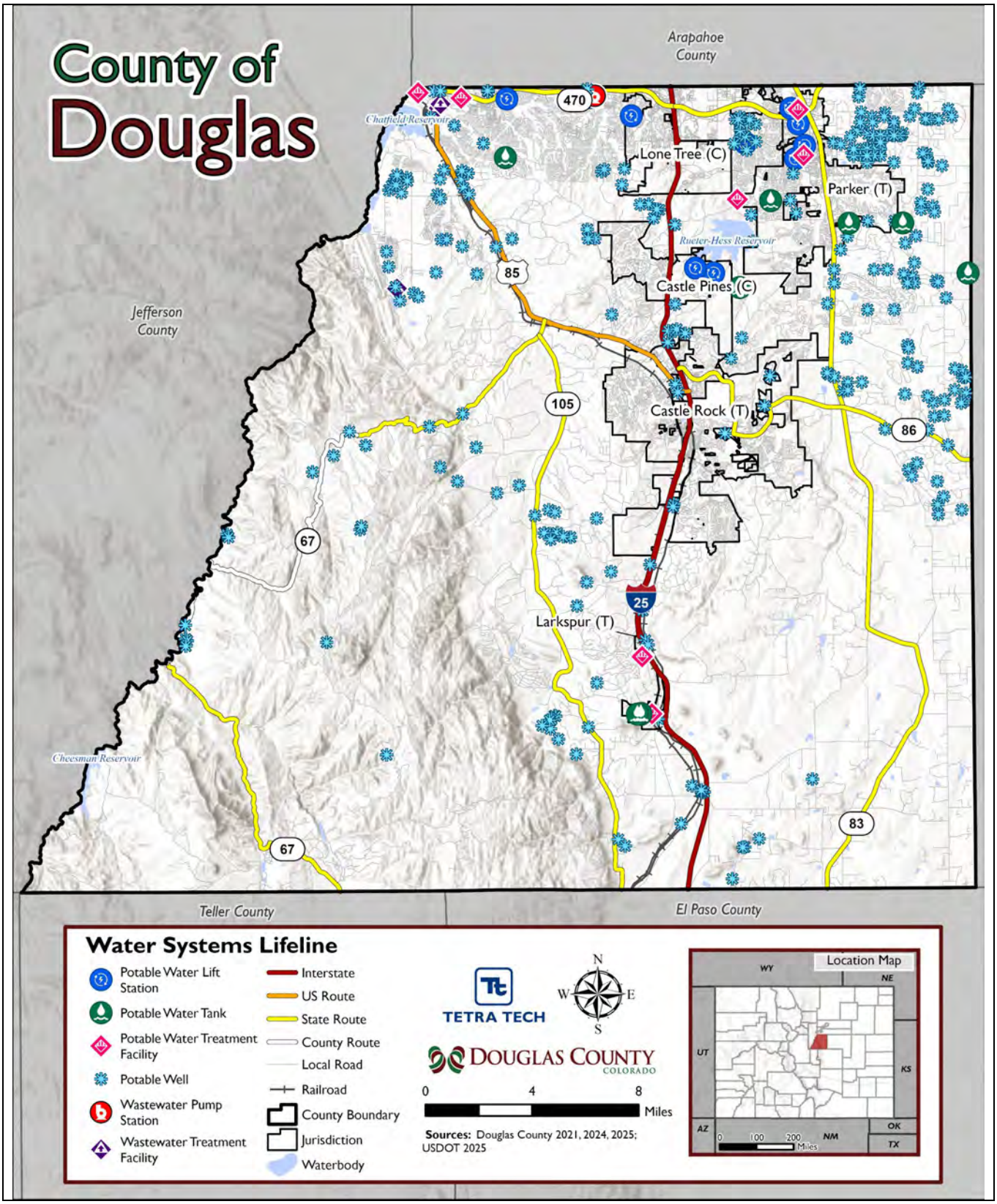
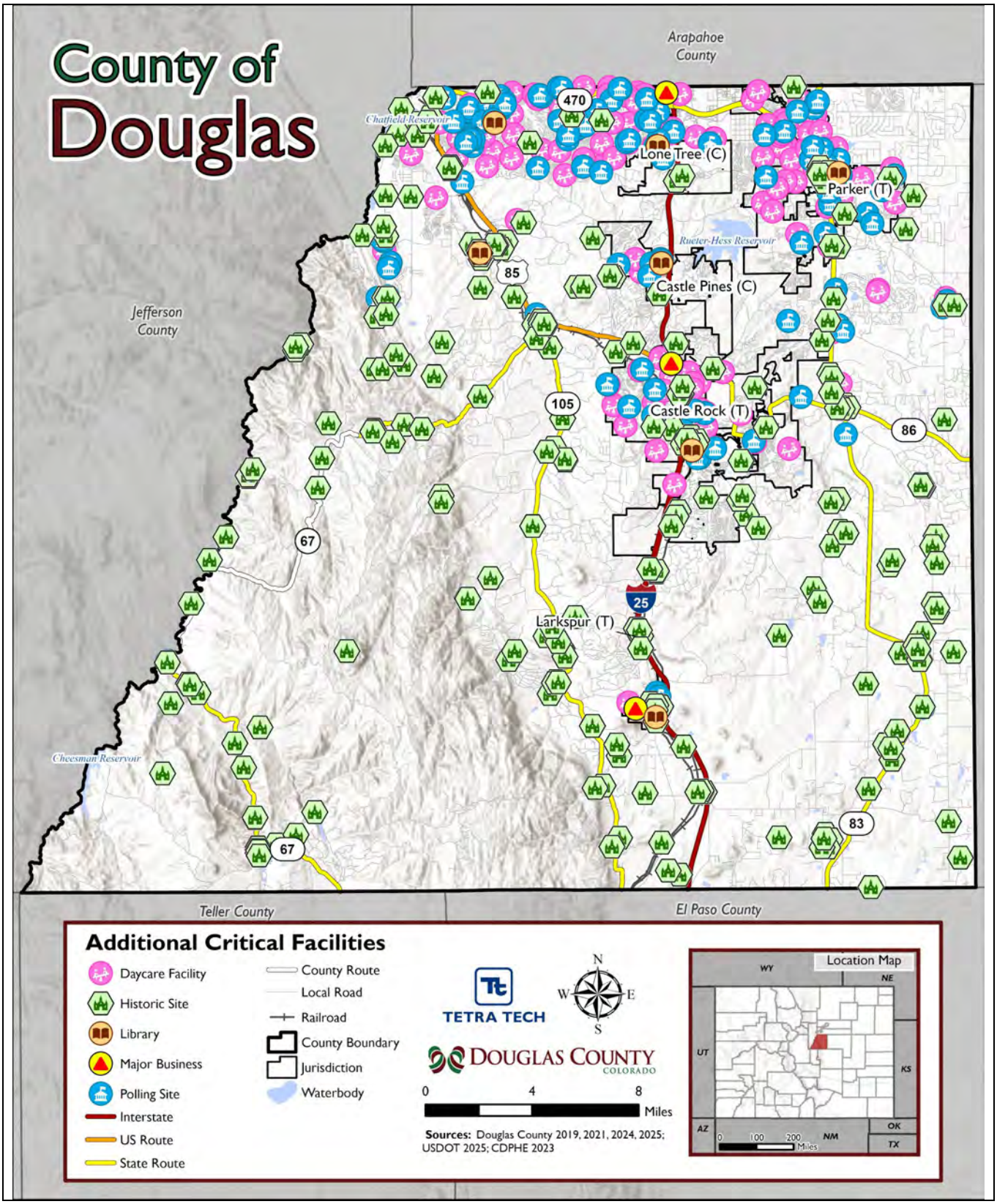


Figure 3-16. Other Critical Facilities in Douglas County



PART 2: RISK ASSESSMENT

4. RISK ASSESSMENT METHODOLOGY AND TOOLS

A risk assessment is the process of evaluating the potential loss of life, personal injury, and economic and property damage that could result from identified hazards. Identifying potential hazards and vulnerable assets allows planning personnel to address and reduce hazard impacts and allows emergency management personnel to establish early response priorities. Results of the risk assessment are used in subsequent mitigation planning processes, including determining and prioritizing mitigation actions that reduce each jurisdiction's risk from each hazard. Past, present, and future conditions must be evaluated to assess risk most accurately for the county and participating jurisdictions. The process focuses on the following elements:

- **Identify Hazards of Concern**—Use all available information to determine what types of hazards may affect a jurisdiction.
- **Profile Each Hazard**—Understand each hazard in terms of:
  - Extent—The potential severity of each hazard
  - Location—Geographic area most likely to be affected by the hazard
  - Previous occurrences and losses
  - Probability of future hazard events
- **Assess Vulnerability and Impacts**—Use all available information to estimate to what extent populations and assets may be adversely affected by a hazard now and in the future:
  - Determine vulnerability—Estimate the total number of assets in the jurisdiction that are likely to experience a hazard event if it occurs by overlaying hazard maps with the asset inventories.
  - Estimate potential impacts/losses—Assess the impact of hazard events on the people, property, economy, and lands of the region, including estimates of the losses associated with potential damage or cost that can be avoided by mitigation.
  - Evaluate future changes that may affect vulnerability and impacts—Analyze how demographic changes, projected development, and other changes can alter current vulnerability and potential impacts.

The Douglas County risk assessment was updated using the following best-available information:

- A new building stock inventory was generated using 2025 FEMA building footprints (obtained through ESRI), 2020 building footprints from Microsoft, parcel data provided by Douglas County, and 2024 RSMeans cost adjustment values.
- 2020 Decennial Census population data and 2019-2023 American Community Survey 5-year Population Estimates were utilized.
- Critical facilities were updated and reviewed by the Local Planning Committee and local jurisdictions.
- Lifelines were identified in the critical facility inventory to align with FEMA's community lifeline definition.
- FEMA's Hazus program was used to estimate potential impacts from the flood, dam failure, and seismic hazards.
- Best-available hazard data were used, as described in this chapter.

4.1 PREVIOUS EVENTS AND PROBABILITY OF OCCURRENCE

Based on records of previous hazard events and consideration of potential future changes that could affect the frequency of future events, the risk assessment for each hazard assigns a rating for the probability of occurrence of that hazard in the future. The following were the primary sources for identifying previous occurrences:

- **FEMA disaster declarations**—FEMA records hazard events that have been declared by the president to be disasters, as described in Section 3.4.
- **U.S. Department of Agriculture disaster declarations**—The U.S. Secretary of Agriculture is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in contiguous counties.
- **Hazard-specific databases**—Sources that provide records of specific types of hazard events include the National Centers for Environmental Information's Storm Events Database, the National Integrated Drought Information System's U.S. Drought Monitor, and the U.S. Geological Survey's Earthquake Catalog.
- **News reports and previously published planning documents** such as the 2023 Colorado Enhanced State Hazard Mitigation Plan and the 2021 Douglas County HMP.

The probability of occurrence ratings were assigned as follows:

- Unlikely—less than 1 percent annual probability
- Possible—between 1 and 49.9 percent annual probability
- Likely—between 50 and 90 percent annual probability
- Highly Likely—greater than 90 percent annual probability

4.2 ASSET INVENTORIES

Douglas County assets were identified to assess potential vulnerability and impacts associated with the hazards of concern. The HMP update assesses vulnerability and potential hazard impacts for the following types of assets: population, buildings, critical facilities, community lifelines, the environment, and new development. Each asset type is described below. To protect individual privacy and the security of critical facilities, information on properties assessed is presented in aggregate, without details about specific individual properties.

The risk assessment included the collection and use of an expanded and enhanced asset inventory to estimate hazard vulnerability and impacts.

4.2.1 Population

Statistics from the 2020 Decennial Census Population estimate and 2019-2023 American Community Survey (ACS) 5-year estimate were used to estimate the vulnerability of and potential impacts on the County's population. Population counts at the jurisdictional level were averaged among the residential structures in the county to estimate the population at the structure level. This estimate provides a more precise distribution of population across the county compared to only using the census block or census tract boundaries.

Population data from FEMA's Hazus program was used to estimate potential impacts on people from flood and seismic hazards (shelter requirements and potential deaths and injuries).

4.2.2 Buildings

The general building stock was updated countywide with a custom inventory using 2025 FEMA building footprints obtained through ESRI, 2020 building footprints from Microsoft, and the latest parcel data provided by Douglas County. Attributes provided in the associated files included year built, number of stories, basement type, occupancy class, and square footage. The centroid of each building footprint defined as the building location.

Structural and content replacement cost values (RCV) were calculated for each building using the available assessor data, the building footprint, and RSMeans 2024 values. RCV is the current cost of returning a destroyed asset to its pre-damaged condition using present-day cost of labor and materials. Total RCV consists of both the structural cost to replace a building and the value of contents inside the building. Content value was estimated as 50 percent of the structure value for residential buildings, and 100 percent of the structure value for non-residential buildings. A regional location factor for building values was applied based on the first three digits of the zip code, as shown in Table 4-1.

Table 4-1. Regional Location Factor for Douglas County

Zip Code Area	Residential	Non-Residential
800-802 Denver	0.90	0.92
804 Golden	0.85	0.86
808-809 Colorado Springs	0.85	0.88

One of the occupancy classes available in Hazus was assigned to each structure: residential, commercial, industrial, agricultural, religious, governmental, or educational. The residential occupancy class includes both multi-family and single-family dwellings.

4.2.3 Critical Facilities and Community Lifelines

A critical facility inventory, which includes essential facilities, utilities, transportation features and user-defined facilities, was created using data from Douglas County (2021, 2025); Colorado Department of Transportation (2019, 2024); Colorado Department of Public Health and Environment (2018, 2019, 2023, 2025); ESRI (2024, 2025); Homeland Infrastructure Foundation-Level Data (HIFLD) (2025); and the U.S. Energy Information Administration (2024).

Development of the inventory involved a review for accuracy, additions, or deletions of new or moved critical assets, identification of backup power for each asset (if known), and determination of whether the critical facility is a lifeline in accordance with FEMA's definition (refer to Appendix G, Critical Facilities).

4.2.4 Environment and Land Cover

National land cover data created by the U.S. Geological Survey (USGS) in 2024 was converted from a raster to a vector polygon, which informed spatial areas of built and natural land cover areas. The built land cover areas were defined as urban areas and include developed open space, low, medium, and high intensity locations. Non-urban areas were extracted into agricultural, barren land, forest, rangeland, water, and wetlands categories.

4.2.5 New Development

New development in the planning area was defined as development that occurred over the last 5 years and development that is expected to occur over the next 5 years. Each jurisdiction was asked to provide a list by address of major development that has taken place within these timeframes. The location of new development projects was submitted via ArcGIS Survey123. The new development is summarized in Chapter 3, and hazard vulnerability analysis results are presented as a table in each annex in Volume II.

A geographic information system (GIS) analysis was conducted to determine hazard exposure of these development sites. Projects built on multiple parcels were assessed as one unit. If one parcel identified within the project boundary intersected a spatial hazard layer, the entire project was considered "exposed" to the hazard area of concern.

4.3 VULNERABILITY AND IMPACT ASSESSMENT METHODOLOGY

Douglas County used standardized tools, combined with local, state, and federal data and expertise to assess potential vulnerability and losses associated with hazards of concern. Three levels of analysis were used, depending upon the data available for each hazard:

- **Qualitative Review—**This analysis includes an examination of historical impacts to understand potential impacts of future events of similar size. Potential impacts and losses are discussed qualitatively using best-available data and professional judgment.
- **Vulnerability Analysis—**This analysis involves overlaying available spatial hazard layers, for hazards with defined locations, on asset mapping in GIS to determine which assets are located in the hazard area.
- **Loss Estimation**—The FEMA Hazus modeling software was used to estimate impact in terms of potential losses for the following hazards: flood, earthquake, and dam failure.

Table 4-2 summarizes the type of analysis conducted by hazard of concern.

Table 4-2. Summary of Risk Assessment Analyses

Hazard	Population	General Building Stock	Critical Facilities	New Development
Dam Failure	L, V	L, V	L, V	V
Drought	Q	Q	Q	Q
Earthquake	L	L	L	Q
Flood	L, V	L, V	L, V	V
Geological Hazards	V	V	V	V
Hazardous Materials	V	V	V	V
Pandemic and Disease Outbreak	Q	Q	Q	Q
Severe Weather	Q	Q	Q	Q
Wildfire	V	V	V	V

Note: V = vulnerability analysis; L = loss estimation; Q = qualitative review

4.3.1 **Hazus**

Hazus is a GIS-based software tool developed by FEMA that uses engineering and scientific risk calculations to estimate damage and loss. Its use is accepted by FEMA and provides a consistent framework for assessing risk across a variety of hazards. Hazus uses GIS technology to produce detailed maps and analytical reports that estimate direct physical damage to building stock, critical facilities, transportation systems and utility systems. To generate this information, Hazus uses default data for inventory, vulnerability, and hazards; this default data can be supplemented with local data to provide a more refined analysis. Analyses that use the default Hazus data are called basic analyses, and those that update the Hazus default with current local data are called advanced analyses.

Hazus damage reports can include induced damage (inundation, fire, threats posed by hazardous materials and debris) and direct economic and social losses (casualties, shelter requirements, and economic impact) depending on the hazard and available local data. Hazus' open data architecture can be used to manage community GIS data in a central location. The use of this software also promotes consistency of data output now and in the future and standardization of data collection and storage.

For this HMP, losses were estimated in Hazus using depth grids for the flood and dam failure analyses and a probabilistic (mean return period) analysis for the seismic hazard. The probabilistic model generates estimated damage and losses for specified return periods (e.g., 500-year).

Critical facility and building inventories were formatted to be compatible with the Hazus Comprehensive Data Management System. The Hazus version used was v6.1.

4.3.2 **Hazard-Specific Methodologies**

Dam Failure

Locations downstream of a dam are considered at risk to the dam failure hazard. For this public-facing document, a qualitative analysis was conducted to assess the County's vulnerability to this hazard of concern.

Drought

All of Douglas County is at risk from the impacts of drought events. A qualitative analysis was conducted to assess the County's vulnerability to this hazard of concern.

Earthquake

A probabilistic assessment was conducted for the 500-year mean return period earthquake event through an advanced analysis in Hazus. The probabilistic method uses information from historical earthquakes and inferred faults, locations, and magnitudes to compute probable ground shaking levels, by census tract, for a seismic event of a selected recurrence period.

The default assumption is a magnitude 7.0 earthquake for all return periods. Although damage is estimated at the census tract level, results were presented at the municipal level. Because there are multiple census tracts that contain more than one jurisdiction, an area analysis was used to extract the percent of each tract that falls within individual jurisdictions. The percentage was multiplied against the results calculated for each tract and summed for each jurisdiction.

Hazus calculated damage to buildings (structural and non-structural) and contents. Structural building losses include load carrying components of the building. Non-structural losses include those to architectural, mechanical, and electrical components of the building, such as nonbearing walls, veneer and finishes, heating and ventilation systems, boilers, etc.

Flood

The 1 percent and 0.2 percent annual chance flood events were examined to evaluate the County's risk from the flood hazard. These flood events are generally those considered by planners and evaluated under federal programs such as NFIP. The following data were used to evaluate vulnerability and determine potential future losses for this plan update:

- The County's FEMA Effective Digital Flood Insurance Rate Map (DFIRM) dated December 12, 2021 with the latest revision date of April 11, 2025.
- The depth grid created from the 2021 effective FEMA Digital Flood Insurance Rate Map (DFIRM) and the 1-meter digital elevation model obtained from the U.S. Geological Survey (2020).

Vulnerability Analysis

The DFIRM flood boundaries were overlaid on the centroids of updated assets (population, building stock, critical facilities, and new development) to assess vulnerability. Centroids that intersected the flood boundaries were totaled to estimate the building RCV and population vulnerable to the flood inundation areas.

Loss Estimation

The Hazus riverine flood model was run to estimate potential losses in Douglas County for the 1 percent annual chance flood event. An advanced analysis was performed for the building stock. Buildings located within the floodplain were imported as user-defined facilities to estimate potential losses at the structural level. Hazus calculated the estimated potential losses to the population (default 2020 U.S. Census data), potential damage to the general building stock, and potential damage to critical facilities based on the depth grids generated and the default Hazus damage functions in the flood model.

Geologic Hazards

A vulnerability analysis was conducted to determine the county's exposure to the geologic hazards using data obtained from Colorado Geological Survey and USGS. The analysis was represented by three soil hazards:

- Slope failure risk was based on debris flow and slope failure hazard areas from the Colorado Geological Survey.
- Erosion risk was based on low and moderate erosion susceptibility zones from the Colorado Geological Survey.
- Subsidence risk was based on carbonate rock and karst topography hazard areas from USGS.

The county's assets (population, buildings, critical facilities, new development) were examined to determine if they are in any of the geologic hazard areas. Assets with their centroid located in these areas were totaled to estimate the totals and values at risk from the impacts of geologic hazards.

Hazardous Materials

A vulnerability analysis was conducted to determine assets' exposure to hazardous materials using major roadway data obtained from Douglas County (2021, 2025), rail line data obtained from the U.S. Department of Transportation (2025), and natural gas pipeline information from HIFLD (2025). A 1-mile buffer was mapped around each of these potential hazardous material sources and used to conduct the vulnerability analysis. The county's assets (population, buildings, critical facilities, new development) were examined to determine if they are built in any of the buffered hazard areas. Assets with their centroid located in these areas were totaled to estimate the totals and values at risk from the impacts of hazardous materials.

Pandemic and Disease Outbreak

All of Douglas County is at risk from the impacts of pandemic and disease outbreak events. A qualitative analysis was conducted to assess the County's vulnerability to this hazard of concern.

Severe Weather

All of Douglas County is at risk from the impacts of severe weather events. A qualitative analysis was conducted to assess the County's vulnerability to this hazard of concern.

Wildfire

A vulnerability analysis was conducted to determine the county's exposure to the wildfire hazard using the latest wildfire data obtained from Colorado State Forest Service (2023). The lowest, low, moderate, high, and highest risk zones were used for the analysis. The county's assets (population, buildings, critical facilities, new development) were examined to determine if they are built in any of the fire hazard severity zones. Assets with their centroid in the hazard area were totaled to estimate the number and value at risk from wildfire.

4.4 DATA SOURCE SUMMARY

Table 4-3 summarizes the data sources used for the risk assessment for this plan.

Table 4-3. Risk Assessment Data Documentation

Data	Source	Date	Format
Population data	U.S. Census Bureau Decennial; American Community Survey 5-Year Estimates	2020; 2023	Digital (GIS)
Building Inventory	Douglas County; FEMA/ESRI; Microsoft; RSMeans	2025; 2025; 2020; 2024	Digital (GIS)
Critical Facilities and Lifelines	Douglas County; CDOT; CDPHE; ESRI; HIFLD; U.S. Energy Information Administration	2021, 2025; 2019, 2024; 2018, 2019, 2023, 2025; 2024, 2025; 2025; 2024	Digital (GIS)
Land Cover	USGS NLCD	2024	Digital (GIS)
Digitized effective FIRM maps	FEMA	2021	Digital (GIS)
1-Meter Digital Elevation Model	USGS	2020	TIFF

Data	Source	Date	Format
Dam Inundation	Douglas County; USACE NID	2025; 2025	Digital (GIS)
Geologic Hazard—Debris Flow	Colorado Geological Survey	n.d.	Digital (GIS)
Geologic Hazard—Slope Failure	Colorado Geological Survey	n.d.	Digital (GIS)
Geologic Hazard—Erosion Susceptibility	Colorado Geological Survey	n.d.	Digital (GIS)
Geologic Hazard—Subsidence	USGS (Carbonate Rock); USGS (Karst)	1984; n.d.	Digital (GIS)
Natural Gas Pipeline	HIFLD	2025	Digital (GIS)
New Development Data	Douglas County Local Planning Committee and County Jurisdictions	2025	Digital (GIS)
Rail Network	USDOT	2025	Digital (GIS)
Road Network	Douglas County	2025	Digital (GIS)
Wildfire Risk	Colorado State Forest Service	2023	Digital (GIS)

Note: CDOT = Colorado Department of Transportation; CDPHE = Colorado Department of Public Health and Environment; HIFLD = Homeland Infrastructure Foundation-Level Data; NLCD = National Land Cover Dataset; USDA = U.S. Department of Agriculture; USDOT = U.S. Department of Transportation; USGS = U.S. Geological Survey

4.5 LIMITATIONS

Loss estimates, vulnerability analyses, and hazard-specific impact evaluations rely on the best-available data and methodologies. Uncertainties are inherent in any loss estimation methodology and arise in part from incomplete scientific knowledge concerning natural hazards and their effects on the built environment. Uncertainties also result from the following:

- Approximations and simplifications necessary to conduct such a study
- Incomplete or dated inventory, demographic, or economic parameter data
- The unique nature, geographic extent, and severity of each hazard
- Mitigation measures already employed by the participating jurisdictions
- The amount of advance notice residents have to prepare for a specific hazard event

These factors can result in a range of uncertainty in loss estimates, possibly by a factor of two or more. Therefore, potential vulnerability and loss estimates are approximate. These results do not predict precise results and should be used to understand relative risk. Over the long term, Douglas County will collect additional data and update and refine existing inventories to assist in estimating potential losses.

Potential economic loss is based on the present value of the general building stock using best-available data. The county acknowledges significant impacts may occur to critical facilities and infrastructure as a result of these hazard events causing great economic loss. However, monetized damage estimates to critical facilities and infrastructure, and economic impacts were not quantified and require more detailed loss analyses. In addition, economic impacts to industry such as tourism and the real-estate market were not analyzed.

4.6 CONSIDERATIONS FOR MITIGATION AND NEXT STEPS

The following items are to be discussed for considerations for the next plan update to enhance the risk assessment:

- All Hazards
  - Create an updated user-defined general building stock dataset using up-to-date parcels, footprints, and RSMeans values.
  - Utilize updated and current demographic data.
- Dam Failure
  - Obtain the most current dam inundation hazard areas in order to support vulnerability and loss estimation analyses.
- Earthquake
  - Identify unreinforced masonry in critical facilities and privately-owned buildings (i.e., residences) by accessing local knowledge, tax assessor information, and/or pictometry/orthophotos. These buildings may not withstand earthquakes of certain magnitudes and plans to provide emergency response or recovery efforts at these properties can be developed.
- Flood
  - The general building stock inventory can be updated to include attributes regarding first floor elevation and foundation type (basement, slab on grade, etc.) to enhance loss estimates.
  - Conduct a Hazus loss analysis for more frequent flood events (e.g., 10- and 50-year flood events).
  - Conduct a repetitive loss area analysis.
  - Continue to expand and update urban flood areas to further inform mitigation.
  - As more current FEMA floodplain data become available (i.e., DFIRMs), update the vulnerability analysis and generate a more detailed flood depth grid that can be integrated into the current Hazus version.
- Geologic Hazards
  - Consider additional soil hazards and/or obtain the latest information for existing soil hazards to perform updated vulnerability analyses.
- Hazardous Materials
  - Further determine appropriate buffer distances to apply to roadways, railways, pipelines for hazardous materials incidents.
- Severe Storm
  - The general building stock inventory can be updated to include attributes regarding protection against strong winds to enhance loss estimates.
  - Integrate evacuation route data that is currently being developed.
  - Track extreme temperature data for injuries, deaths, shelter needs, pipe freezing, agricultural losses, and other impacts to determine distributions of most at-risk areas.
- Wildfire
  - General building stock inventory can be updated to include attributes such as roofing material, fire detection equipment, or distance to fuels as another measure of vulnerability.

5. IDENTIFICATION OF HAZARDS OF CONCERN

5.1 REVIEW OF POTENTIAL HAZARDS

To provide a strong foundation for mitigation actions in this plan, Douglas County considered a full range of hazards that could impact the area and then identified and ranked those that present the greatest concern. These hazards of concern were identified based on the following:

> ***Hazards of Concern*** are hazards that are most likely to impact a community. These are identified using available data and local knowledge.
>
> ***Natural Hazards*** are hazards that are created by a meteorological, environmental, or geological event.

- Input from all Planning Partners.
- Review of the 2023 Colorado Enhanced State Hazard Mitigation Plan (E-SHMP).
- Review of the 2021 Douglas County HMP.
- Research on the frequency, magnitude, and costs associated with hazards that have previously or could feasibly impact the region.
- Qualitative information regarding natural hazards and the perceived vulnerability of the study area's assets to them.

Table 5-1 documents the process of identifying the hazards of concern for further profiling and evaluation.

Based on the review of potential hazards of concern, 9 hazards of concern were identified as significant hazards affecting the entire County, to be addressed at the County level in this plan (shown here in alphabetical order):

- Dam failure
- Drought
- Earthquake
- Flood
- Geologic hazards
- Hazardous materials
- Pandemic and disease outbreak
- Severe weather
- Wildfire

Other natural and human-caused hazards of concern have occurred within Douglas County, but have a low potential to occur, are addressed by other planning mechanisms, and/or do not result in significant impacts within the County. Therefore, these hazards are not addressed in this update. If deemed necessary by the County, these hazards may be considered in future plan updates.

Table 5-1. Identification of Hazards of Concern for Douglas County

Hazard	May Occur in the County?	Significant Threat to the County?	Why was this determination made?	Sources
Animal Disease	Yes	No	The 2023 Colorado E-SHMP identifies animal disease as a hazard of concern. Animal disease, infestation, and plant disease was a hazard of concern in the 2021 Douglas County HMP; however, there were no direct actions proposed to mitigate the hazard. Animal disease, infestation, and plant disease was not identified as a hazard by the Core Planning Team and Local Planning Committee for this update, due to recommendations received by FEMA during its review of the 2021 Douglas County HMP.	2023 Colorado E-SHMP 2021 Douglas County HMP FEMA Input from Core Planning Team and Local Planning Committee
Avalanche	Yes	No	The 2023 Colorado E-SHMP identifies avalanche as a hazard of concern. Avalanche was not a hazard of concern in the 2021 Douglas County HMP. Portions of the topography and climate of Douglas County support the occurrence of an avalanche. Douglas County has a very low avalanche hazard area (0.1 to 2 percent of total land) based on information from the 2023 Colorado E-SHMP. Avalanche was not identified as a hazard by the Core Planning Team and Local Planning Committee, as it is not considered a significant concern.	2023 Colorado E-SHMP 2021 Douglas County HMP Input from Core Planning Team and Local Planning Committee
Dam and Levee Incidents	Yes	No	The 2023 Colorado E-SHMP identifies dam and levee incident as a hazard of concern. Dam failure, instead of dam and levee incidents, was a hazard of concern in the 2021 Douglas County HMP. According to the Colorado Division of Water Resources, there are 51 active jurisdictional and 19 active non-jurisdictional dams in Douglas County. Of these dams, only the jurisdictional dams are categorized as high, significant, or low hazard potential dams; 4 are high hazard dams, 8 are significant hazard, and 39 are low hazard (State of Colorado 2025). The Core Planning Team and Local Planning Committee identified dam failure as a hazard of concern. Levees are not included in this hazard profile, as there are no levees in Douglas County.	2023 Colorado E-SHMP 2021 Douglas County HMP Colorado DWR Input from Core Planning Team and Local Planning Committee

Hazard	May Occur in the County?	Significant Threat to the County?	Why was this determination made?	Sources
Drought	Yes	Yes	The 2023 Colorado E-SHMP identifies drought as a hazard of concern. Drought was a hazard of concern in the 2021 Douglas County HMP. Agriculture is an industry in Douglas County. Drought conditions would impact the County's economy. Douglas County was included in one FEMA drought-related emergency declaration (EM-3025-CO) on January 29, 1977. Douglas County was included in seven recent drought-related U.S. Department of Agriculture (USDA) disaster declarations: 2020: S4703, S4798, S4848 2021: S5147 2022: S5372 2024: S5765, S5817 The Core Planning Team and Local Planning Committee identified drought as a hazard of concern for Douglas County.	2023 Colorado E-SHMP 2021 Douglas County HMP FEMA USDA NOAA-NCEI Input from Core Planning Team and Local Planning Committee
Earthquake	Yes	Yes	The 2023 Colorado E-SHMP identifies earthquake as a hazard of concern. Earthquake was a hazard of concern in the 2021 Douglas County HMP. On September 9, 1965, an M 4.8 earthquake was recorded with an epicenter located between Wildcat Mountain and Coyote Ridge Park in Castle Pines. On December 25, 1994, an earthquake occurred 6 miles northeast of Larkspur and was recorded at a magnitude of M 4.0. In Douglas County, the Rampart fault and the Ute fault are of concern. Based on input from the Core Planning Team and Local Planning Committee, earthquake has been identified as a hazard of concern for Douglas County.	2023 Colorado E-SHMP 2021 Douglas County HMP USGS Input from Core Planning Team and Local Planning Committee
Erosion and Deposition	Yes	Yes	Refer to Geologic Hazards	
Expansive Soils	Yes	Yes	Refer to Geologic Hazards	
Extreme Heat	Yes	Yes	Refer to Severe Weather	

Hazard	May Occur in the County?	Significant Threat to the County?	Why was this determination made?	Sources
Flood (riverine, urban flooding, and flash flooding)	Yes	Yes	The 2023 Colorado E-SHMP identifies flood as a hazard of concern. Flood was a hazard of concern in the 2021 Douglas County HMP. Douglas County was included in three FEMA flood-related declarations: DR-261-CO; May 19, 1969 DR-385-CO; May 23, 1973 DR-4731-CO; August 25, 2023 Douglas County was included in one flood-related USDA disaster declarations: 2023 - S4731 Based on the history of flooding and its impacts on Douglas County and input from the Core Planning Team and Local Planning Committee, flood has been identified as a hazard of concern for the County.	2023 Colorado E-SHMP 2021 Douglas County HMP FEMA NOAA-NCEI USDA Input from Core Planning Team and Local Planning Committee
Geologic Hazards (Erosion, Expansive Soils, Land Subsidence, Slope Failure)			The 2023 Colorado E-SHMP identifies erosion and deposition, expansive soils, ground subsidence, and landslide, debris, rockfall as hazards of concern. Erosion and deposition, expansive soils and heaving bedrock, land subsidence, and slope failure were hazards of concern in the 2021 Douglas County HMP. Geological events have occurred across Douglas County, including erosion following flooding and flash flooding events; isolated incidents in Castle Meadows associated with abandoned clay mines; and two occurrences of landslides in 2004 and 2007 in the Hayman burn area. Based on previous occurrences and input from the Core Planning Team and Local Planning Committee, geologic hazards was identified as a hazard of concern for Douglas County. For this hazard profile, erosion, expansive soils, land subsidence, slope failure are combined into one hazard profile.	2023 Colorado E-SHMP 2021 Douglas County HMP Input from Core Planning Team and Local Planning Committee
Ground Subsidence	Yes	Yes	Refer to Geologic Hazards	
Hail	Yes	Yes	Refer to Severe Weather	
Landslide, Debris Flow, Rockfall	Yes	Yes	Refer to Geologic Hazards	

Hazard	May Occur in the County?	Significant Threat to the County?	Why was this determination made?	Sources
Pandemic	Yes	Yes	The 2023 Colorado E-SHMP identifies pandemic as a hazard of concern. Pandemic and disease outbreak was a hazard of concern in the 2021 Douglas County HMP. The County has been impacted by various diseases (influenza, COVID-19, West Nile virus). Douglas County was included in two FEMA pandemic-related declarations. DR-4498-CO; March 20, 2020 EM-3436-CO; March 13, 2020 The Core Planning Team and Local Planning Committee identified pandemic and disease outbreak as a hazard of concern for Douglas County.	2023 Colorado E-SHMP 2021 Douglas County HMP FEMA Input from Core Planning Team and Local Planning Committee
Pest Infestation	Yes	No	The 2023 Colorado E-SHMP identifies pest infestation as a hazard of concern. Animal disease, infestation, and plant disease was a hazard of concern in the 2021 Douglas County HMP; however, there were no direct actions proposed to mitigate the hazard. Animal disease was not identified as a hazard by the Core Planning Team and Local Planning Committee, due to recommendations received by FEMA during its review of the 2021 Douglas County HMP.	2023 Colorado E-SHMP 2021 Douglas County HMP FEMA Input from Core Planning Team and Local Planning Committee
Severe Wind	Yes	Yes	Refer to Severe Weather	
Severe Weather (Summer: Extreme Heat, Hail, Lightning, Severe Wind, Thunderstorm, Tornado Winter: Blizzard, Heavy Snow, Ice Storm, Extreme Cold)	Yes	Yes	The 2023 Colorado E-SHMP identifies extreme heat, hail, severe wind, thunderstorm, lightning, tornado, and severe winter weather as hazards of concern. Extreme temperatures, hail, lightning, thunderstorms, windstorms, and severe winter storms were hazards of concern in the 2021 Douglas County HMP. Douglas County was included in six FEMA severe weather-related declarations. DR-200-CO; June 19, 1965 DR-261-CO; May 19, 1969 DR-385-CO; May 23, 1973 EM-3185-CO; April 9, 2003 EM-3270-CO; January 7, 2007 DR-4731-CO; August 25, 2023 Based on previous occurrences and input from the Core Planning Team and Local Planning Committee, severe weather was identified as a hazard of concern for Douglas County. For this hazard profile, severe summer and winter weather are combined into one hazard profile.	2023 Colorado E-SHMP 2021 Douglas County HMP FEMA NOAA-NCEI Input from Core Planning Team and Local Planning Committee
Severe Winter Weather	Yes	Yes	Refer to Severe Weather	

Hazard	May Occur in the County?	Significant Threat to the County?	Why was this determination made?	Sources
Thunderstorm, Lightning	Yes	Yes	Refer to Severe Weather	
Tornado	Yes	Yes	Refer to Severe Weather	
Wildfire	Yes	Yes	The 2023 Colorado E-SHMP identifies wildfire as a hazard of concern. Wildfire was a hazard of concern in the 2021 Douglas County HMP. Douglas County was included in three FEMA wildfire-related disaster declarations: FM-2407-CO; May 23, 2002 DR-1421-CO; June 19, 2002 FM-2510-CO; October 29, 2003 Wildfires have occurred within Douglas County. The County's agriculture industry could be severely impacted by a large wildfire. Based on available data and the nature of the county, the Core Planning Team and Local Planning Committee identified wildfire as a hazard of concern.	2023 Colorado E-SHMP 2021 Douglas County HMP FEMA Input from Core Planning Team and Local Planning Committee
Wildlife-Vehicle Collision	Yes	No	The 2023 Colorado E-SHMP identifies wildlife-vehicle collision as a hazard of concern. Wildlife-vehicle collision was a hazard of concern in the 2021 Douglas County HMP. The 2023 Colorado E-SHMP identifies stretches of roadway in Douglas County in which vehicle operators should be cautious while traversing, including Interstate 25. Wildlife-vehicle collision was not identified as a hazard by the Core Planning Team and Local Planning Committee, although it may be discussed in emergency and response plans.	2023 Colorado E-SHMP 2021 Douglas County HMP Input from Core Planning Team and Local Planning Committee

DR = Presidential Disaster Declaration Number; DWR = Division of Water Resources; EM = Presidential Disaster Emergency Number; E-HMP = Enhanced State Hazard Mitigation Plan; HMP = Hazard Mitigation Plan; FEMA = Federal Emergency Management Agency; FM = Fire Management; NCEI = National Centers for Environmental Information; NOAA = National Oceanic and Atmospheric Administration; USDA = U.S. Department of Agriculture; USGS = U.S. Geologic Survey

5.2 HAZARD DEFINITIONS AND GROUPINGS

The Core Planning Team approved use of the following hazard event definitions and groupings:

- Dam failures are any instances when a dam is damaged, destroyed or otherwise overtopped, releasing water or other liquid stored behind the dam.
- A drought is a period characterized by long durations of below normal precipitation.

- An earthquake is the sudden movement of the earth's surface caused by the release of stress accumulated within or along the edge of the earth's tectonic plates, a volcanic eruption, or a man-made activities that cause geologic stresses.
- The flood hazard includes riverine flooding, flash flooding, and urban drainage flooding.
- Geologic hazards include erosion, expansive soils, land subsidence, and slope failure. Erosion entails the transportation and removal of earth materials from one location to another by moving ice, water, waves, or wind. Expansive soils and heaving bedrock entail movement of underlying soil and rock resulting in surface damage. Subsidence occurs when groundwater is withdrawn from an area characterized predominantly by fine-grained sediment rocks. Slope failure refers to the downslope movement of earthen materials such as falls, topples, slides, spreads, or flows.
- The hazardous materials profile includes materials and wastes that are considered severely harmful to human health and the environment, as defined by the U.S. Environmental Protection Agency (EPA) Comprehensive Environmental Response, Compensation, and Liability Act (also known as Superfund).
- The pandemic hazard exists when there are more cases of a particular disease than expected in a given area, or among a specific group of people, over a particular period of time. An aggregation of cases in a given area over a particular period, regardless of the number of cases, is called a cluster. In an outbreak or epidemic, it is presumed that the cases are related to one another or that they have a common cause.
- The severe weather hazard includes both summer and winter severe weather. For this HMP update, severe summer weather includes thunderstorms, hail, lightning, tornadoes, high winds and extreme heat; severe winter weather includes blizzards, ice storms, heavy snow, and extreme cold.
- Wildfire is any non-structural fire that occurs in the wildland. Wildfires result in the disturbance of forest and brush and destruction of real estate and personal property and have secondary impacts on other hazards, such as flooding, by removing vegetation and disturbing watersheds.

These groupings are consistent with FEMA guidance and take into consideration the hazard groupings in the 2023 Colorado Enhanced State Hazard Mitigation Plan.

6. DAM FAILURE

6.1 HAZARD PROFILE

6.1.1 Hazard Description

A dam is an artificial barrier allowing storage of water, wastewater, or liquid-borne materials for many reasons (flood control, human water supply, irrigation, livestock water supply, energy generation, containment of mine tailings, recreation, or pollution control) (Association of State Dam Safety Officials n.d.). Dam failure is any malfunction or abnormality outside of the dam's design that adversely affects a dam's function and leads to a sudden, rapid, and uncontrolled release of water (USSD 2023).

Dam Failure Causes

Dam failures can result from one or more of the following (Association of State Dam Safety Officials n.d.):

- Overtopping caused by floods that exceed the capacity of the dam
- Deliberate acts of sabotage
- Structural failure of materials used in dam construction
- Movement or failure of the foundation supporting the dam
- Settling and cracking of concrete or embankment dams
- Piping and internal erosion of soil in embankment dams
- Inadequate maintenance and upkeep

Dams typically fail when spillway capacity is inadequate so that excess flow overtops the dam, or when internal erosion (piping) through the dam or foundation occurs. If the overtopping or internal erosion results in a complete structural breach, the dam releases a high-velocity wall of debris-filled water that rushes downstream, damaging or destroying anything in its path (FEMA 2016). Figure 6-1 shows the primary causes of dam failures nationally.

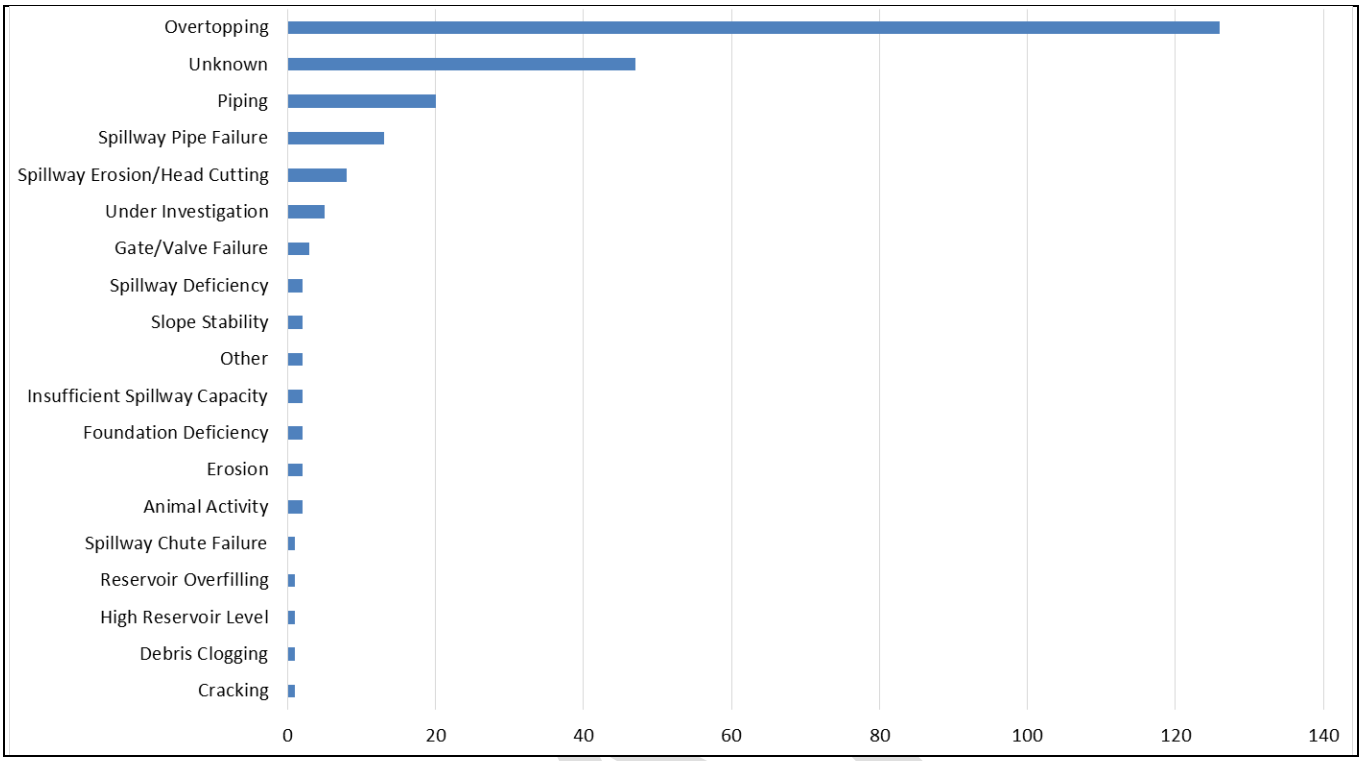
More than a third of the dams in the United States are 50 or more years old. Approximately 15,000 of those dams pose a significant hazard to life and property if failure occurs.

Regulatory Oversight of Dams

Colorado Dam Safety Program

The Colorado Department of Natural Resources' Division of Water Resources monitors and regulates dams. Dams that have a height of 10 feet or greater to the spillway crest, that create a reservoir with more than 100 acre-feet of water, or that cover more than 20 acres at the high-water line are considered jurisdictional dams. Jurisdictional dams require plan review and approvals by the State Engineer. Non-jurisdictional dams are smaller, and plans and specifications are not required for their construction; however, filing of a Notice of Intent to Construct a Non-Jurisdictional Water Impoundment Structure is required.

Figure 6-1. Dam Failure Causes, 2010 – 2019



Source: (Association of State Dam Safety Officials n.d.)

The state's monitoring and regulating of dams is governed by the Code of Colorado Regulations (2 CCR 402-1, Rules and Regulations for Dam Safety and Dam Construction) (Colorado Division of Water Resources 2025). The following structures are exempt (State of Colorado 2020):

- Highways, road-fills and railroad embankments with an ungated outlet conduit
- Structures that only store water below the lowest point of the natural ground unless an outlet works is constructed to develop water

National Dam Safety Act

The National Dam Safety Program is a partnership among states, federal agencies, and other stakeholders that encourages individual and community responsibility for dam safety. The goal of this program is to identify and mitigate the risk of dam failure. It requires a periodic engineering analysis of many dams in the country; exceptions include the following:

- Dams under jurisdiction of the Bureau of Reclamation, Tennessee Valley Authority, or International Boundary and Water Commission
- Dams constructed pursuant to licenses issued under the Federal Power Act
- Dams that the Secretary of the Army determines do not pose any threat to human life or property

Federal funding through the program allows participating states to improve their own dam safety programs through increased inspections, emergency action planning, and purchases of equipment. Grant assistance provides support for improvement of dam safety programs that regulate most of the dams in the United States. The funding also provides for new or expanded dam safety training programs (FEMA 2025).

U.S. Army Corps of Engineers Dam Safety Program

The U.S. Army Corps of Engineers (USACE) operates and maintains approximately 700 dams nationwide. It is also responsible for safety inspections of dams in the United States that meet size and storage limitations specified in the National Dam Safety Act. USACE has inventoried dams; surveyed each state and federal agency's capabilities, practices and regulations regarding design, construction, operation and maintenance of the dams; and developed guidelines for inspection and evaluation of dam safety. The USACE National Inventory of Dams contains information about a dam's location, size, purpose, type, last inspection and regulatory status (USACE 2025).

Federal Energy Regulatory Commission Dam Safety Program

The Federal Energy Regulatory Commission (FERC) cooperates with federal and state agencies to promote dam safety. FERC staff inspect hydroelectric projects on an unscheduled basis to investigate the following (FERC 2025):

- Potential dam safety problems
- Complaints about constructing and operating a project
- Safety concerns related to natural disasters
- Issues concerning compliance with terms and conditions of a license

FERC monitors seismic research and applies its findings to analyze structures of hydroelectric projects where seismic activity is a concern. FERC staff members evaluate the effects of potential and actual large floods on the safety of dams. They visit dams and licensed projects during and after floods, assess the extent of damage, and direct any measures the licensee must undertake. FERC's *Engineering Guidelines for the Evaluation of Hydropower Projects* guides FERC staff and licensees in evaluations of dam safety (FERC 2025).

FERC requires licensees to prepare emergency action plans and conducts training sessions on developing and testing these plans. The plans outline an early warning system in the event of an actual or potential sudden release of water from a dam failure. They include operational procedures that may be implemented during regulatory measures, such as reducing reservoir levels and downstream flows, as well as procedures for notifying affected residents and agencies responsible for emergency management. These plans are frequently updated and tested to ensure that all applicable parties are informed of the proper procedures in emergencies (FERC 2025).

6.1.2 **Location**

According to the Colorado Division of Water Resources, there are 51 active jurisdictional and 19 active non-jurisdictional dams in Douglas County, as listed in Table 6-1. Figure 6-2 shows the location of all active dams in Douglas County.

The jurisdictional dams are categorized as high, significant, or low hazard potential dams—four are rated as high hazard dams, eight are rated as significant hazard, and the rest are rated as low hazard (State of Colorado 2025).

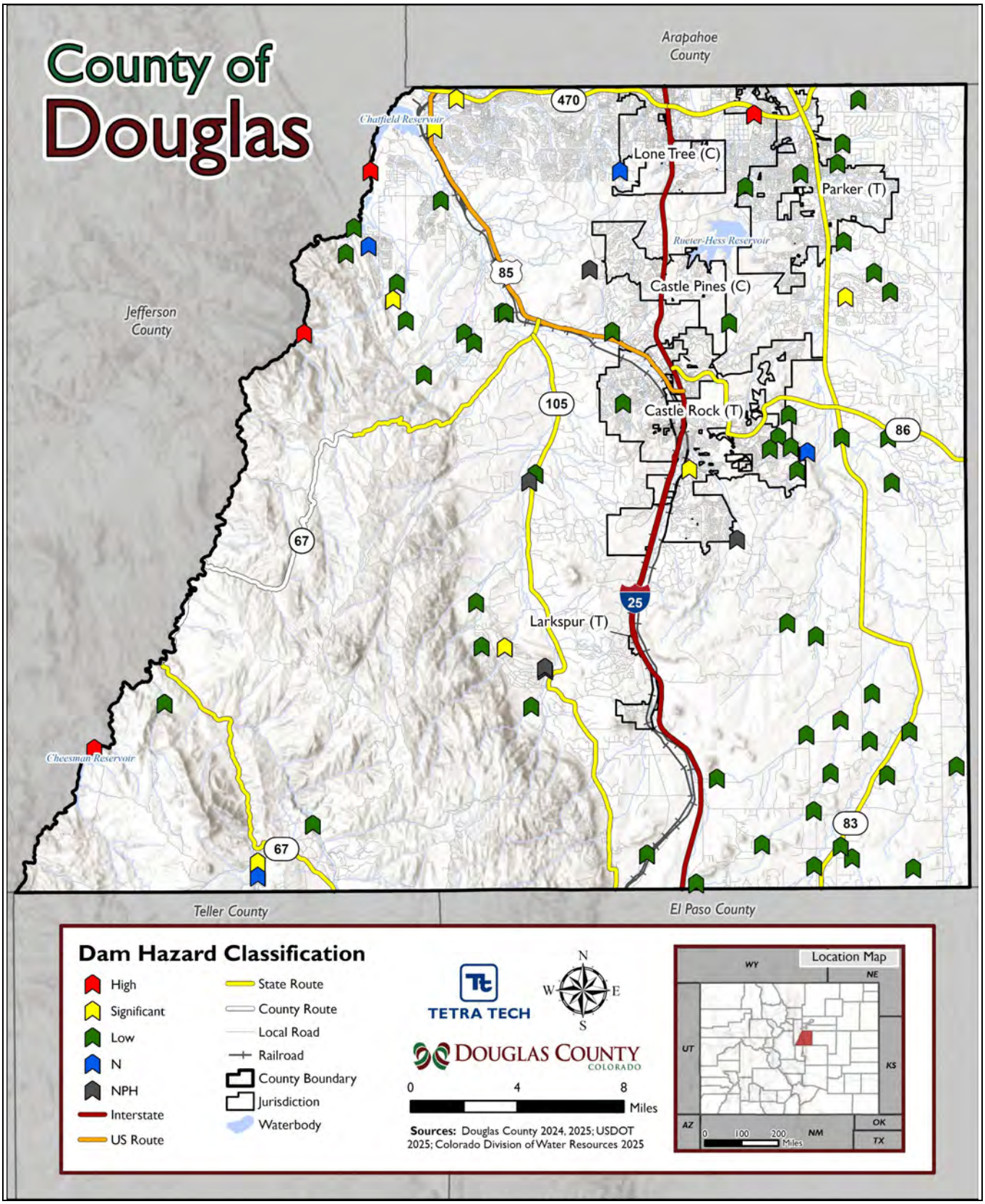
Table 6-1. Dams in Douglas County

Facility Name	Stream	Downstream Town	Last Inspected	Condition	Dam Hazard Class
Jurisdictional Dams					
Strontia Springs	South Platte River	Kassler	5/29/2024	Satisfactory	High
Chatfield	South Platte River	Littleton	Inspected Annually	Satisfactory	High
Cheesman	South Platte River	Deckers	5/14/2025	Satisfactory	High
Chambers Reservoir	Happy Canyon Creek	Parker	2/26/2025	Satisfactory	High
Rueter Hess	Newlin Gulch	Parker	3/12/2025	Satisfactory	Significant
Aurora-Rampart	Willow Creek	Kassler	4/24/2025	Satisfactory	Significant
J. O. Hill	West Creek	Deckers	8/31/2023	Satisfactory	Significant
Joe Blake Water Treatment Plant Forebay	Dad Clark Gulch	Littleton	2/29/2024	Satisfactory	Significant
Million Dollar	E. Plum Creek	Castle Rock	10/23/2024	Conditionally Satisfactory	Significant
Pinery	Cherry Creek	Parker	5/23/2024	Satisfactory	Significant
Spring Gulch	Spring Gulch	Littleton	-	-	Significant
Wauconda	Bear Creek	Sedalia	4/11/2024	Conditionally Satisfactory	Significant
Allis	Carpenter Creek	Castle Rock	10/18/2022	Unsatisfactory	Low
Baird #1	Russellville Gulch	Franktown	9/24/2013	Unsatisfactory	Low
Castle Rock Reservoir #1	Plum Creek	Louviers	-	-	Low
Castlewood Ranch Pond B	Willow Creek	Franktown	12/18/2003	-	Low
Circle 2 Ranch Det. #1	Kinney Creek	Parker	3/15/2007	Satisfactory	Low
Foothills Holding Pond	Willow Creek	Littleton	8/26/2020	Satisfactory	Low
Franktown Parker FPA-1	Antelope Creek	Elizabeth	4/3/2019	Conditionally Satisfactory	Low
Franktown Parker FPA-2	Antelope Creek	Franktown	4/3/2019	Satisfactory	Low
Franktown Parker FPA-4	Antelope Creek	Franktown	4/3/2019	Satisfactory	Low
Franktown Parker FPA-5	Antelope Creek	Franktown	4/3/2019	Satisfactory	Low
Franktown Parker FPA-6	Haskel Creek	Franktown	4/3/2019	Satisfactory	Low
Franktown Parker FPE-7	Iron Gulch	Franktown	4/4/2019	Conditionally Satisfactory	Low
Franktown Parker FPE-8	E. Cherry Creek	Franktown	9/15/2022	Conditionally Satisfactory	Low
Franktown Parker FPLG-1	Lake Gulch	Franktown	3/4/2024	Conditionally Satisfactory	Low
Franktown Parker FPLG-2	Upper Lake Gulch	Franktown	3/4/2024	Conditionally Satisfactory	Low
Franktown Parker FPM-1	Mitchell Gulch	Franktown	4/4/2019	Conditionally Satisfactory	Low
Franktown Parker FPR-1	Wildcat Canyon	Franktown	4/5/2019	Conditionally Satisfactory	Low
Franktown Parker FPR-2	Reed Hollow	Franktown	4/4/2019	Satisfactory	Low
Franktown Parker FPW-1	Willow Creek	Franktown	9/15/2022	Conditionally Satisfactory	Low
Greenland L&C Stockwater	Carpenter Creek	Larkspur	10/18/2022	Conditionally Satisfactory	Low
Kiwanis	Fourmile Creek	Deckers	6/14/2023	Conditionally Satisfactory	Low
Mitchell Gulch	Mitchell Gulch	Parker	-	-	Low
Mann	Dochan Gulch	Littleton	5/10/2023	Conditionally Satisfactory	Low
Paintbrush Park	Trib. 6400 East	Castle Rock	-	-	Low

Facility Name	Stream	Downstream Town	Last Inspected	Condition	Dam Hazard Class
Nelson	Rainbow Creek	Louviers	11/19/2024	Conditionally Satisfactory	Low
Lambert #3	Indian Creek	Louviers	7/10/2007	Conditionally Satisfactory	Low
Castle Rock Reservoir #2	Plum Creek	Louviers	-	-	Low
Parker Bar CCC	Sulpher Gulch	Aurora	3/5/2020	Conditionally Satisfactory	Low
Pinery #11 Detention Pond	Cherry Creek	Parker	6/28/2007	Conditionally Satisfactory	Low
Platte Canyon	Little Willow Creek	Littleton	8/26/2020	Satisfactory	Low
Pond 14	W. Slocum Gulch	Littleton	2/15/2019	Satisfactory	Low
Rainbow Falls #5	Trout Creek	Deckers	9/27/2013	Unsatisfactory	Low
Sanctuary Pond No. 14	Plum Creek	Louviers	10/24/2003	Satisfactory	Low
Spruce Mountain	Carpenter Creek	Larkspur	10/18/2022	Conditionally Satisfactory	Low
Stillwater	Antelope Creek	Franktown	11/15/2023	Conditionally Satisfactory	Low
W. Cherry Creek Det. #10	W. Cherry Creek	Franktown	6/29/2023	Conditionally Satisfactory	Low
W. Cherry Creek Det. #11	W. Cherry Creek	Franktown	9/28/2020	Conditionally Satisfactory	Low
W. Cherry Creek Det. #8	Elk Creek	Franktown	4/4/2019	Conditionally Satisfactory	Low
W. Cherry Creek Det. #9	Elk Creek	Franktown	3/4/2024	Conditionally Satisfactory	Low
Non-Jurisdictional Dams					
10345 Little Moon Trail	Crowfoot Creek	-	-	-	-
Converse Pond No. 1	-	-	-	-	-
Franktown Parker FPB-1	Cherry Creek	-	-	-	-
Franktown Parker FPP-1	Baldwin Gulch	-	-	-	-
Franktown Parker FPS-1	Cherry Creek	-	-	-	-
Haystack	W. Plum Creek	-	-	-	-
Illegal Dam	Hog John Gulch	-	-	-	-
Lambert	Indian Creek	-	-	-	-
Lemon Gulch	-	-	-	-	-
Living Water	-	-	-	-	-
Meridian Village WW Reuse	Newlin Gulch	-	-	-	-
Mitchell Creek	Mitchell Gulch	-	-	-	-
Paradise Pond Dam	E. Plum Creek	-	-	-	-
Remington Flood Control	Antelope Creek	-	-	-	-
Rocking horse Detention Pond 2A	Antelope Creek	-	-	-	-
Stevens #4	W. Plum Creek	-	-	-	-
W. Cherry Creek Det. #7	W. Cherry Creek	-	-	-	-
Wakeman	Willow Creek	-	-	-	-
William-Dale	Antelope Creek	-	-	-	-

Source: (State of Colorado 2025)
Note: " – " = data unavailable

Figure 6-2. Dams in Douglas County



6.1.3 Extent

When assessing the magnitude of a dam failure incident, it is important to consider the severity of an event, the location of the dam, and its proximity to urban centers. Some events may lead to shallow flooding or a slow release while others may completely overwhelm the spillway, resulting in a rush of large volumes of water. Complete failure of a dam has the potential to severely damage property, shutdown facilities and services for more than 30 days, and result in fatalities or leave residents stranded (State of Colorado 2023).

For the dams with the potential to affect Douglas County, extent is established by the hazard classes listed in Table 6-1, which are defined as follows (State of Colorado 2020):

- A Class I (high hazard) dam is a dam for which loss of human life is expected in the event of failure of the dam.
- A Class II (significant hazard) dam is a dam for which significant damage is expected to occur, but no loss of human life is expected in the event of failure of the dam. Significant damage is defined as damage to structures where people generally live, work, or recreate, or public or private facilities exclusive of unpaved roads and picnic areas. Damage means rendering the structures uninhabitable or inoperable.
- A Class III (low hazard) dam is a dam for which loss of human life is not expected, and damage to structures and public facilities as defined for a Class II dam is not expected in the event of failure of the dam.
- A Class IV (no public hazard) dam is a dam for which no loss of human life is expected, and damage is expected only to the dam owner's property in the event of failure of the dam.

6.1.4 Previous Occurrences

FEMA Disaster Declarations

There have been no drought-related declarations for a major disaster (DR) or emergency (EM) that included Douglas County (FEMA 2025).

USDA Declarations

Between 2019 and 2024, Douglas County was not included in any USDA disaster declarations related to dam failure (USDA 2025).

All Recent Events

According to available records from the Douglas County 2021 HMP, the State of Colorado 2023 HMP, the USACE National Inventory of Dams, the Association of State Dam Officials, and the National Performance of Dams Program, there have been several dam incidents in Douglas County and one structural collapse, as listed in Table 6-2. The only structural failure of a dam in Douglas County's history occurred in 1933 at Castlewood Canyon. The failure resulted in the deaths of two residents and the evacuation of 5,000 people. Since 1933, there have been no dam failures, though some dams have experienced structural issues.

Loss estimate records for dam failure are limited. There is no single location that records such data, and figures may be withheld for a variety of reasons, including confidentiality concerns. If an incident impacts multiple jurisdictions there may be different reporting standards or no reporting at all.

Table 6-2. Dam Incidents in Douglas County

Date	Dam Name	Description
August 3, 1933	Castlewood Canyon	The Castlewood Canyon dam failed as a result of a heavy rainfall and poor construction. The dam caused significant damage in Parker, which was an agricultural area at the time, and is considered one of the worst floods in Colorado history. Two people died and nearly 5,000 people evacuated. The dam was not rebuilt and the surrounding area is now a state park.
June 1, 1965	Franktown Parker FPM-1	An inflow flood event resulted in an uncontrollable release from the reservoir.
September 1, 1995	Strontia Springs Dam and Reservoir	A seepage/piping event was reported. No uncontrollable release occurred.
Unknown	J.O. Hill Dam	The dam experienced a 100-year rainfall event over 15 percent of its drainage basin. This generated a 100-year runoff event for the 56 square-mile basin.
Unknown	Stillwater Dam	Stillwater Dam experienced a crack in the spillway.
November 28, 2012	Gaynor	The Gaynor Dam experienced a seepage issue beneath the outlet structure. The dam was temporarily sealed and placed under surveillance until repairs could be made.
August 8, 2013	Two Buttes	Following a period of heavy rainfall, the reservoir level rose significantly. This raised concern that the spillway could flow and overtop the dam. The facility's emergency action plan was activated in response. The Two Buttes Dam does not comply with the state's Dam Safety Rules.
September 18, 2013	Gaynor	The owner of the Gaynor Dam reported seepage at the piping around the outlet. The seepage was associated with statewide flooding experienced during that month.
April 30, 2015	Two Buttes	Sand boils developed during construction at the downstream toe of the dam.
June 17, 2015	Cheesman	The Cheesman Reservoir featured a high reservoir level, resulting in the activation of the facility's emergency action plan.

Source: (Association of State Dam Safety Officials n.d.); (Douglas County 2021); (Colorado n.d.); (USACE 2025); (National Performance of Dams Program 2023); (State of Colorado 2023)

6.1.5 Probability of Future Occurrences

Information on previous dam failure occurrences in the County was used to calculate the probability of future occurrence of such events. Table 6-3 lists the number of events from various sources including all recorded dam incidents and structural failures over the 91-year period from 1933 to 2024, which is the most complete period of record for all sources reviewed. Based on these records and input from the Core Planning Team, the probability of occurrence for dam failure in the County is considered "unlikely."

Table 6-3. Probability of Future Dam Failure Hazard Events in Douglas County

Hazard Type	Number of Occurrences Between 1933 and 2024	% Chance of Occurring in Any Given Year
Dam Failure	1	1.10%
Dam Incidents	9	9.89%

Source: (Association of State Dam Safety Officials n.d.); (Douglas County 2021); (Colorado n.d.); (USACE 2025); (National Performance of Dams Program 2023); (State of Colorado 2023)

The risk of a dam failure increases with the dam's age or as frequency of maintenance decreases. It is also reasonable to assume that future risk may change with any change in general rainfall patterns, given the correlation between overtopping and excessive rainfall.

6.1.6 **Cascading Hazards**

Potential secondary hazards of a dam failure include landslides around the reservoir perimeter, bank erosion on downstream rivers, and destruction of downstream habitat. Dam failure can occur because of structural failures, such as progressive erosion of an embankment or overtopping and breaching by a severe flood. Environmental incidents may ensue due to hazardous materials released when floodwaters infiltrate facilities that store these types of materials.

6.2 **VULNERABILITY AND IMPACT ASSESSMENT**

Dam failures are severe threats to life and property in Douglas County. Dam failure events are frequently associated with other natural hazard events such as earthquakes, landslides, or severe storms, which limits their predictability and compounds the hazard. For this public facing document, a qualitative analysis was performed to assess risk.

6.2.1 **Life, Health, and Safety**

Areas downstream of a dam failure are the most vulnerable to losses associated with such failures. The dam failure hazard also poses risk to people traveling in flooded areas and those whose access to emergency services would be compromised by the event.

Dam failure impacts depend on the severity of the event and whether adequate warning time is provided to residents. Floods created from dam failure and their aftermath present numerous threats to public health and safety including exposure to unsafe food, contaminated drinking and washing water, mosquitoes, animals, mold and mildew. Current loss estimation models such as Hazus are not equipped to measure public health impacts such as these. The best preparation for these effects includes awareness that they can occur, education of the public on prevention, and planning to deal with them during responses to dam failure events.

6.2.2 **General Building Stock**

Buildings located downstream of a dam are at risk to damages should there be a failure. Downstream inundation areas were not available to quantify any potential losses to structures for the dam failure hazard. Properties located closest to the dam inundation areas have the greatest potential to experience the largest, most destructive surge of water. The overall impact of flooding damages caused by dam failure will vary depending on the depth of flooding and velocity of the surge.

Dam failures can cause severe downstream flooding and may transport large volumes of sediment and debris, depending on the magnitude of the event. Widespread damage to buildings and infrastructure affected by an event would result in large costs to repair these locations. In addition to physical damage costs, businesses can be closed while flood waters retreat, and utilities are returned to a functioning state.

6.2.3 Community Lifelines and Other Critical Facilities

Transportation routes are vulnerable to dam inundation and have the potential to be wiped out, creating isolation issues. This includes all roads, railroads and bridges in the path of the dam inundation. Utilities such as overhead power lines, cable and phone lines could also be vulnerable.

Loss of utilities could create isolation issues for the areas of inundation. If phone lines were lost, significant communication issues may occur in the planning area due to limited cell phone reception in many areas. In addition, emergency response would be hindered due to the loss of transportation routes as well as some protective-function facilities located in the inundation zone.

Recovery time to restore many critical functions after an event may be lengthy, as wastewater, potable water, and other community facilities are located in the dam inundation zone. Those that are most vulnerable are those that are already in poor condition and would not be able to withstand a large water surge.

6.2.4 Economy

Dam failure events can significantly impact the local and regional economy. Similar to flooding, losses include, but are not limited to, damages to buildings and infrastructure, agricultural losses, business interruption and impacts on tax base. Flooding as a result of dam failure can cause extensive damage to public utilities and disruptions in delivery of services. Loss of power and communications may occur and drinking water and wastewater treatment facilities may be temporarily out of operation. Debris management may also be a large expense after a flood event, caused by a dam failure.

6.2.5 Natural Resources

The environment is vulnerable to a number of risks in the event of a dam failure. The rush of water downstream can rapidly increase flow rate and turbidity of streams and rivers and may overwhelm terrestrial habitat with floodwaters in severe dam failure events, resulting in destruction of downstream habitat.

The inundation may introduce foreign elements into local waterways, impacting animal and plant species, especially endangered species. Dam failures can result in the release of hazardous materials swept up in floodwaters or in sediment that is contained behind the dam as is often the case in areas that have had mining activities upstream. After the floodwaters subside, contaminated and flood damaged building materials and contents must be properly disposed of. Floodwaters can back up sanitary sewer systems and inundate wastewater treatment plants, causing raw sewage to contaminate the flooding waterway.

6.2.6 Historic and Cultural Resources

Historic and cultural buildings and structures, sites, monuments, districts, and historic documents may be damaged or destroyed in the floodwaters following a dam failure. Cultural resources include “moveable heritage,” such as collections of artifacts, statuary, artwork, and important documents or repositories, that are housed in libraries, museums, archives, historical repositories, or historic properties. Floodwaters following a dam failure pose risks to these resources.

6.3 FUTURE CHANGES THAT MAY AFFECT RISK

6.3.1 Potential or Planned Development

Any areas of growth downstream of a dam are vulnerable to losses associated with a dam failure; therefore, any development downstream from dams will be more susceptible to dam failure impacts.

6.3.2 Projected Changes in Population

The County experienced an increase in population between the 2020 Census (357,978) and the 2023 American Community Survey estimated population of 368,283. The population is expected to continue to increase over the next few years. This may expose more people to the hazard of dam failure.

6.3.3 Other Identified Conditions

Important issues associated with dam failures in Douglas County include the following:

- Dam failures can occur from periods of heavy rain, flooding, earthquakes, and landslides.
- Dam infrastructure may require repair and improvement to withstand any future changes in the timing and intensity of rain events.

7. DROUGHT

7.1 HAZARD PROFILE

7.1.1 Hazard Description

Drought is the consequence of a reduction in the amount of precipitation over an extended period of time, usually over a period of multiple years (State of Colorado 2023). Drought characteristics are relative to the normal precipitation in a region, varying significantly from one region to another. Drought can increase wildfire/brush fire risk and can affect agriculture, water supply, aquatic ecology, wildlife, and plant life. Droughts can be classified in any of the following ways (NDMC 2023):

- **Meteorological** drought is a departure of precipitation from normal. It is defined solely by the relative amount of precipitation (including snowfall). Due to climatic differences, what might be considered a drought in one location of the country may not be a drought in another location.
- **Hydrological** drought is when surface or subsurface water supply is below normal because precipitation shortfalls have lowered stream flows and reservoir, lake, and groundwater levels.
- **Ecological** drought is a prolonged and widespread deficit in naturally available water supplies that creates multiple stresses across ecosystems.
- **Agricultural** drought is when there is not enough water available for a particular crop to grow at a particular time due to precipitation shortages, soil water deficits, reduced groundwater or reservoir levels, and other parameters. Agricultural drought is defined in terms of soil moisture deficiencies relative to water demands of plant life.
- **Socioeconomic** drought occurs when the demand for an economic good exceeds the supply as a result of a weather-related shortfall in the water supply. The supply of many economic goods depends on the weather (for example, water, forage, food grains, fish, and hydroelectric power).

Across the Intermountain West region (Wyoming, Colorado, Utah, Arizona, and western New Mexico), drought onset may occur quickly and last a season or begin gradually and last decades. Droughts can occur at any time and have the potential to directly or indirectly impact every person in the County, as well as the local economy (NIDIS n.d.).

Scales for Assessing Drought

U.S. Drought Monitor

The U.S. Drought Monitor (USDM) is a map that is updated weekly to show current location and intensity of drought across the United States. The following USDM drought categories show experts' assessments of drought conditions, including observations of how much water is available in streams, lakes, and soils compared to usual for the same time of year (NIDIS n.d.):

- Abnormally Dry (D0) (a precursor to drought, not actually drought)
- Moderate (D1)
- Severe (D2)
- Extreme (D3)

- Exceptional (D4)

Palmer Drought Severity Index

The Palmer Drought Severity Index (PDSI) is based on soil conditions. Soil with decreased moisture content is the first indicator of an overall moisture deficit. PDSI values range from negative 5 to positive 5, where 0 represents normal, positive values indicate wetter conditions, and negative values represent drier conditions (National Drought Mitigation Center n.d.). Table 7-1 correlates PDSI values to the categories assigned under the USDM.

Table 7-1. USDM Drought Category and PDSI Descriptions

USDM Category	Possible Impacts	PDSI
D0—Abnormally Dry	• Producers begin supplemental feeding for livestock • Planting is postponed; forage germination is stunted; hay cutting is reduced • Grass fires increase • Surface water levels decline	-1.0 to -1.99
D1—Moderate drought	• Dryland crops are stunted • Early cattle sales begin • Wildfire frequency increases • Stock tanks, creeks, streams are low; voluntary water restrictions are requested	-2.0 to -2.99
D2—Severe drought	• Pasture conditions are very poor • Soil is hard, hindering planting; crop yields decrease • Wildfire danger is severe; burn bans are implemented • Wildlife moves into populated areas • Hydroelectric power is compromised; well water use increases; mandatory water restrictions are implemented	-3.0 to -3.99
D3—Extreme drought	• Soil has large cracks; soil moisture is very low; dust and sandstorms occur • Row and forage crops fail to germinate; decreased yields for irrigated crops and very large yield reduction for dryland crops are reported • Need for supplemental feed, nutrients, protein, and water for livestock increases; herds are sold • Increased risk of large wildfires is noted • Many sectors experience financial burden • Severe fish, plant, and wildlife loss reported • Water sanitation is a concern; reservoir levels drop significantly; surface water is nearly dry; river flow is very low; salinity increases in bays and estuaries	-4.0 to -4.99
D4—Exceptional drought	• Exceptional and widespread crop loss is reported; rangeland is dead; producers are not planting fields • Culling continues; producers wean calves early and liquidate herds due to importation of hay and water expenses • Seafood, forestry, tourism, and agriculture sectors report significant financial loss • Extreme sensitivity to fire danger; firework restrictions are implemented • Widespread tree mortality is reported; most wildlife species' health and population are suffering • Devastating algae blooms occur; water quality is very poor • Exceptional water shortages are noted across surface water sources; water table is declining • Boat ramps are closed; obstacles are exposed in water bodies; water levels are at or near historic lows	-5.0 or less

Source: (National Drought Mitigation Center n.d.)

Keetch-Byram Drought Index

The Keetch-Byram Drought Index (KBDI) is used in determining forest fire potential. The index is based on a daily water balance, as shown in Table 7-2, where a drought factor is balanced with precipitation and soil moisture (assumed to have a maximum storage capacity of 8 inches) and is expressed in hundredths of an inch of soil moisture depletion. The index ranges from 0 to 800, where a drought index of 0 represents no moisture depletion, while an index of 800 represents absolutely dry conditions (Wildland Fire Assessment System 2025). This index is derived from weather station latitude, maximum dry bulb temperature, mean annual precipitation, and the previous 24 hours of rainfall.

Table 7-2. Keetch-Byram Drought Index

KBDI Value	Description
0 to 200	Soil moisture and large class fuel moistures are high and do not contribute much to fire intensity. Typical of spring dormant season following winter precipitation
200 to 400	Typical of late spring, early growing season. Lower litter and duff layers are drying and beginning to contribute to fire intensity
400 to 600	Typical of late summer, early fall. Lower litter and duff layers actively contribute to fire intensity and burn actively.
600 to 800	Often associated with more severe drought with increased wildfire occurrence. Intense, deep burning fires with significant downwind spotting can be expected. Live fuels can also be expected to burn actively at these levels.

Source: (Wildland Fire Assessment System 2025)

7.1.2 **Location**

Drought is a regional phenomenon, so all of Douglas County is equally vulnerable to drought.

7.1.3 **Extent**

The severity of a drought depends on the degree of moisture deficiency, the duration of the event, and the size and location of the affected area. The longer the duration of the drought and the larger the area impacted, the more severe the potential impacts. Douglas County has the potential to experience the entire range of effects, from extreme drought to extremely moist conditions. Winter snowpack in the Colorado Rockies usually determines drought conditions from year to year (NIDIS n.d.).

According to the FEMA National Risk Index, Douglas County has a very low drought risk, with expected annual losses of $3,519 from drought events. All surrounding counties for which sufficient data is available also are rated as very low drought risk (FEMA 2025).

7.1.4 **Previous Occurrences**

FEMA Disaster Declarations

There has been one drought-related declaration for a major disaster (DR) or emergency (EM) that included Douglas County, as described in Table 7-3.

Table 7-3. FEMA Disaster Declarations for Drought Events in Douglas County

Event Date	Declaration Date	Declaration Number	Description
January 29, 1977	January 29, 1977	EM-3025-CO	Drought

Source: (FEMA 2025)

USDA Declarations

Between 2019 and 2024, Douglas County was included in seven USDA disaster declarations related to drought, as listed in Table 7-4.

Table 7-4. USDA Declarations for Drought Events in Douglas County Since Previous HMP

Event Date	USDA Declaration Number	Description
June 16, 2020	S4703	Drought
July 21, 2020	S4798	Drought
August 25, 2020	S4848	Drought
November 1, 2021	S5147	Drought
November 1, 2022	S5372	Drought
July 16, 2024	S5765	Drought
August 20, 2024	S5817	Drought

Source: (USDA 2025)

All Recent Events

Historical drought information shows drought activity across the County. Table 7-5 lists known drought events in Douglas County between 2019 and 2024, as reported by NCEI, USDA, and USDM. For earlier events, refer to the previous HMP.

Table 7-5. Drought Events in Douglas County (2019 to 2024)

Event Dates	Declarations	Location Impacted	Event Details
January 1 – March 5, 2019	N/A	Countywide	Moderate drought conditions
October 1 – November 5, 2019	N/A	Countywide	Moderate drought conditions
May 19, 2020 – May 25, 2021	S4703, S4798, S4848	Countywide	Abnormally dry conditions. October 20, 2020, through February 16, 2021, intensified to exceptional drought in portions of the County.
November 1 – 30, 2021	S5147	Countywide	Much of the Front Range Foothills, South Park, urban corridor and northeast plains were classified to be in severe to extreme drought (D2/D3).
December 1 – 31, 2021	N/A	Countywide	Much of the Front Range Foothills, South Park, Urban Corridor, and northeast CO plains were classified as being severe to extreme drought (D2/D3). These conditions contributed significantly to the Marshall Wildfire, the costliest fire in Colorado history.
July 5 – December 20, 2022	S5372	Countywide	Moderate drought conditions
April 11 – May 9, 2023	N/A	Countywide	Moderate drought conditions
July 30 – November 5, 2024	S5765, S5817	Countywide	Moderate to severe drought conditions

Source: (USDA 2025); (U.S. Drought Monitor 2025); (NOAA NCEI 2025)

7.1.5 Probability of Future Occurrences

Table 7-6 presents the probability of future occurrence of drought events in Douglas County. Information from NOAA-NCEI storm events database, the 2023 State of Colorado HMP, the 2021 Douglas County HMP, and the USDM were used to identify the number of drought events in Douglas County between 2000 and 2024. Based on these records and input from the Core Planning Team, the probability of occurrence for drought in the County is considered "possible."

Table 7-6. Probability of Future Drought Hazard Events in Douglas County

Hazard Type	Number of Occurrences Between 2000 and 2024	% Chance of Occurring in Any Given Year
Drought	15	62.50%

Source: (NOAA NCEI 2025); (State of Colorado 2023); (Douglas County 2021); (U.S. Drought Monitor 2025); (USDA 2025)
Note: Occurrences include all calendar years for which a portion of the County was designated D2 (Moderate Drought).

7.1.6 Cascading Hazards

Drought can create a range of cascading impacts that affect water availability, ecosystems, agriculture, infrastructure, and public health. The following are some of the potential cascading impacts of drought:

- **Water Shortages and Restrictions**—Prolonged droughts reduce water availability in reservoirs, rivers, and aquifers, leading to restrictions on water use for households, businesses, and agriculture. This can affect daily life, reduce agricultural output, and hinder industrial processes that rely on large water supplies.
- **Increased Wildfire Risk—**Dry conditions increase the likelihood of wildfires, especially in forested or rural areas. Prolonged lack of precipitation dries out vegetation, which becomes increasingly susceptible to ignition as the duration of the drought extends.
- **Agricultural Losses and Food Price Increases—**Drought stresses crops and livestock, reducing yields and increasing the risk of crop failure. This can lead to financial losses for farmers, disruptions in food supply, and higher prices for consumers.
- **Ecosystem Disruption and Loss of Biodiversity—**Reduced water flow in rivers, streams, and wetlands can harm fish and wildlife, disrupt migration patterns, and damage habitats. Aquatic species may experience population declines due to low water levels and poor water quality.
- **Soil Degradation and Reduced Land Productivity—**Drought depletes soil moisture, making it more susceptible to erosion and reducing its fertility. Over time, this can lead to lower land productivity, especially for crops requiring high moisture. Soil degradation may also contribute to dust storms, which can further reduce air quality.
- **Public Health Concerns—**Drought can reduce the availability of clean drinking water, leading to reliance on alternative sources that may be less safe. Additionally, poor air quality from wildfires or dust storms can exacerbate respiratory conditions. Lower water availability can also reduce sanitation and hygiene standards, increasing the risk of disease.
- **Pressure on Municipal Water Systems—**Lower water levels can concentrate pollutants in drinking water supplies, increasing treatment costs and putting pressure on municipal water systems. Aging infrastructure may be strained as cities and towns attempt to meet water demand, which can further reduce water quality or increase the risk of water shortages.

- **Long-Term Forest and Vegetation Loss—**Drought can cause long-term damage to forests and green spaces, weakening trees and vegetation and making them more susceptible to disease and pests. This can affect biodiversity, reduce carbon sequestration, and change the landscape over time.

7.2 VULNERABILITY AND IMPACT ASSESSMENT

All of Douglas County is exposed to the drought hazard; therefore, all assets within the County (population, structures, critical facilities, and lifelines) are potentially vulnerable to a drought event. The following sections describe potential impacts of the drought hazard in the County.

7.2.1 Life, Health, and Safety

Drought can affect public health and safety, including reduced local firefighting capabilities, health problems related to low water flows and poor water quality, and health problems related to dust. If droughts are severe enough, these health problems can lead to loss of human life.

Other possible impacts include recreational risks; effects on air quality; diminished living conditions related to energy, air quality, and sanitation and hygiene; compromised food and nutrition; and increased incidence of illness and disease. Due to their health conditions and limited ability to mobilize to shelters, cooling, or medical resources, the infirm, young, and elderly are particularly susceptible to drought and the extreme temperatures sometimes associated with drought conditions. Some drought-related health effects are short term, while others can be long term (CDC 2012).

7.2.2 General Building Stock

A drought event is not expected to directly affect any structures; however, a secondary hazard associated with drought is wildfire. Chapter 14 of the HMP assesses the wildfire hazard in Douglas County.

7.2.3 Community Lifelines and Other Critical Facilities

Droughts have the potential to impact agriculture-related facilities and critical facilities that are associated with water supplies such as potable water used with fire-fighting services.

Reduced precipitation during a drought means that groundwater supplies are not replenished at a normal rate. This can lead to a reduction in groundwater levels and problems such as reduced pumping capacity or wells going dry. Shallow wells are more susceptible than deep wells. Reduced replenishment of groundwater also affects streams. Much of the flow in streams comes from groundwater, especially during the summer when there is less precipitation and after snowmelt ends. Reduced groundwater levels mean that even less water will enter streams when steam flows are lowest.

7.2.4 Economy

Drought causes the most significant economic impacts on industries that use water or depend on water for their business, most notably agriculture and related sectors (forestry, fisheries, and waterborne activities), power plants, and oil refineries. In addition to losses in yields in crop and livestock production, drought is associated with increased insect infestations, plant diseases, and wind erosion.

Drought causes many economic impacts on agriculture. In addition to reduced yields in crops and livestock, drought contributes to increased insect infestations, plant diseases, and wind erosion. Based on the 2022 Census of Agriculture, 1,127 farms were present in Douglas County, encompassing 218,374 acres of farmland. The average farm size was 194 acres. Douglas County farms had a total market value of products sold of $14,866,000 (USDA 2024).

The recreation and tourism industries may undergo a loss of income because of increased costs of food, energy, and other products as supplies decrease. Reduced water supply affects the use of rivers and other water bodies.

Drought can lead to losses in sectors affected by reduced income for farmers, such as reduced business for retailers and others who provide goods and services to farmers. This leads to unemployment, increased credit risk for financial institutions, capital shortfalls, and loss of tax revenue. Prices for food, energy, and other products may also increase as supplies decrease. Local shortages of certain goods trigger the need to import goods from outside the affected region.

7.2.5 Natural Resources

Drought can trigger wildfires, increase insect infestations, and exacerbate the spread of disease (NOAA 2000). Droughts also impact water resources that are relied upon by aquatic and terrestrial species. Ecologically sensitive areas, such as wetlands, can be particularly vulnerable to drought periods because they are dependent on steady water levels and soil moisture availability to sustain growth. As a result, these types of habitats can be negatively impacted after long periods of dryness.

7.2.6 Historic and Cultural Resources

The primary impacts on historic and cultural resources from drought are an increased risk of wildfires, which could threaten these assets, and impacts on structure foundations from the shrink-swell cycle of expansive soils.

Droughts may impact the traditional and customary practices of Indigenous persons, who rely on healthy terrestrial ecosystems. These practices may include the collection of plants, animals, minerals and other practices. Drought and its secondary impacts on watersheds and nearshore waters may impair, diminish, or impede the exercise of traditional and customary practices.

7.3 FUTURE CHANGES THAT MAY AFFECT RISK

7.3.1 Potential or Planned Development

Any areas of growth could be impacted by the drought hazard because the entire County is exposed and vulnerable to droughts. Future growth and development could impact the amount of potable water available due to a drain on available water resources. An increased drain on water resources would not only impact the county's population, but also exacerbate impacts on agriculture and recreational facilities.

7.3.2 Projected Changes in Population

The County experienced an increase in population between the 2020 Census (357,978) and the 2023 American Community Survey estimated population of 368,283. The population is expected to continue to increase over the

next few years. With an increase in population, the demand for water supply will increase. During a drought, the amount of water needed might not be available. This might require reallocation of water resources to meet demand during a drought. If needed, the County can pass special ordinances regulating the amount of water consumed and used during periods of drought to conserve water.

7.3.3 **Other Identified Concerns**

The following have been identified as drought-related issues:

- The County's agricultural economy may face continued losses due to drought.
- The promotion of active water conservation even during non-drought periods should be encouraged.
- Drought may become a larger issue in the event of any future warming trends or fluctuations in precipitation patterns that reduce snowpack.

8. EARTHQUAKE

8.1 HAZARD PROFILE

8.1.1 Hazard Description

An earthquake is the sudden movement of the earth's surface caused by the release of stress within the earth's tectonic plates or a volcanic eruption (FEMA 2013). Most earthquakes occur at the boundaries where tectonic plates meet (faults). However, as plates move and their boundaries change over time, weakened boundary regions become part of the interiors of the plates, and these interior zones of weakness can cause earthquakes in response to stresses that originate at the edges (Shedlock and Pakiser 1997).

The location of an earthquake is commonly described by its focal depth and its epicenter. Focal depth is depth from earth's surface to the region where an earthquake's energy originates (the focus or hypocenter). The epicenter is the point on the earth's surface directly above the hypocenter (Shedlock and Pakiser 1997). Earthquakes can impact areas a great distance from the epicenter (FEMA 2013).

An earthquake hazard is any disruption associated with an earthquake that may affect residents' normal activities. This includes the following (USGS 2012):

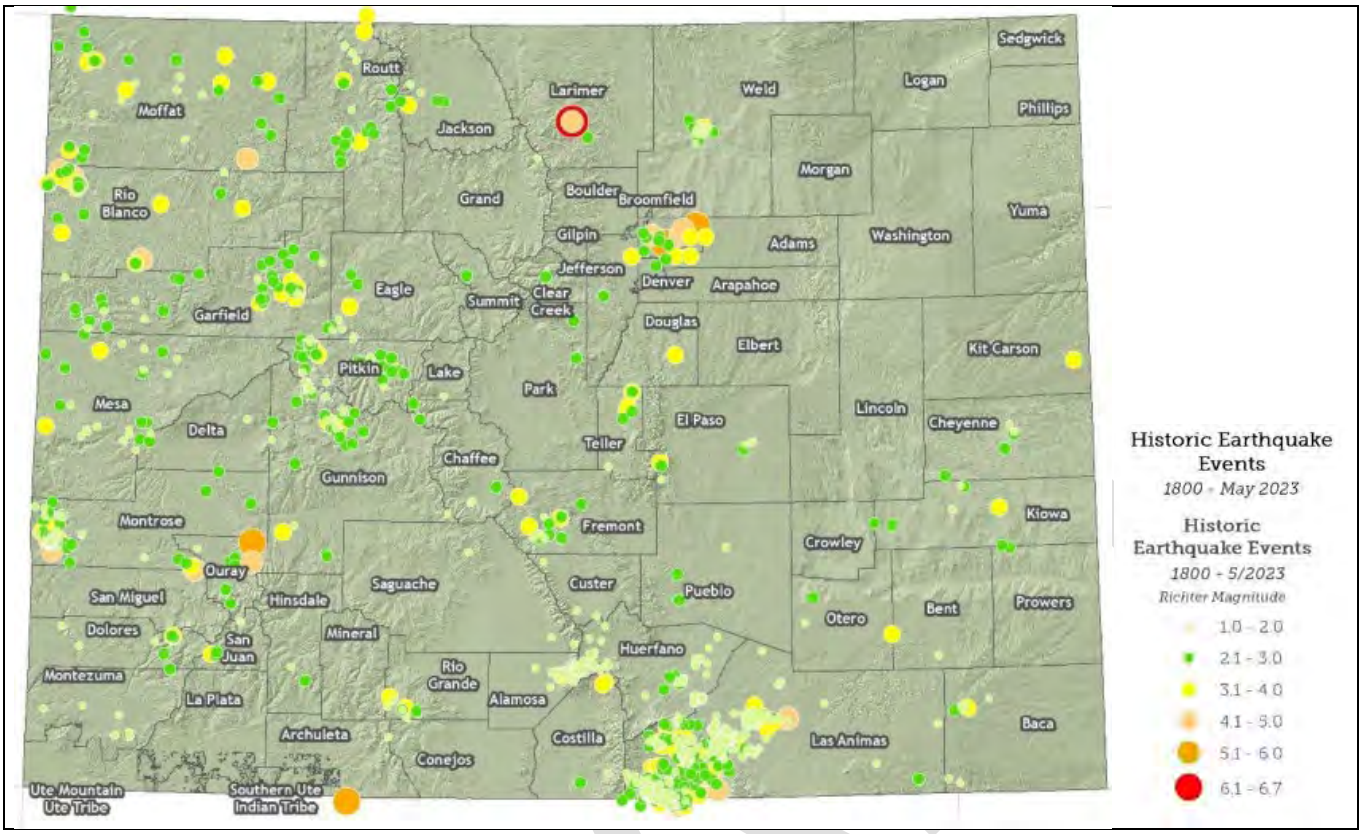
- **Surface faulting**—Displacement that reaches the earth's surface. Commonly occurs with shallow earthquakes (those with a focal depth of less than 12 miles).
- **Ground motion**—Shaking of the earth's surface produced by waves that are generated by a sudden slip on a fault and travel through the earth and along its surface.
- **Landslide**—A movement down a slope of surface material shaken loose by an earthquake.
- **Liquefaction**—A process by which shaking causes water-saturated sediment (like the wet sand near the water at the beach) to temporarily lose its strength and act as a fluid.
- **Tectonic deformation**—Alteration of earth's crust due to tectonic forces, resulting in structures like folds, faults, and mountain ranges.
- **Seiche**—The sloshing of a closed body of water, such as a lake or bay.

8.1.2 Location

In Colorado, the regions at greatest risk from earthquakes are in the western section of the state, as shown in Figure 8-1. Some earthquake clusters are induced by human activities, such as fossil fuel extractions or underground injections.

Douglas County is in central Colorado, where there has been relatively less earthquake activity. In Douglas County, the Rampart fault and the Ute fault are of concern. The Rampart Range fault forms the east flank of the Rampart Range between Larkspur and Colorado Springs (Morgan 2003).

Figure 8-1. Earthquake History in Colorado



Source: (State of Colorado 2023)

8.1.3 **Extent**

An earthquake's magnitude and intensity are used to describe the size and severity of the event. Magnitude describes the energy released at the focus of an earthquake and intensity describes the severity of shaking throughout surrounding areas.

Earthquake Magnitude

An earthquake's magnitude is a measure of the energy released at the source of the earthquake. Magnitude is typically expressed using the moment magnitude (Mw) scale, which is based on the total moment release of the earthquake (the product of the distance a fault moved and the force required to move it). The scale is as follows:

- Great—Mw >8
- Major—Mw = 7.0–7.9
- Strong—Mw = 6.0–6.9
- Moderate—Mw = 5.0–5.9
- Light—Mw = 4.0–4.9
- Minor—Mw = 3.0–3.9
- Micro—Mw = 3.0–3.9

Earthquake Intensity

An earthquake has only one magnitude and one epicenter, but it produces a range of ground shaking at sites throughout the region, which determines intensity at any given location. This shaking depends on the distance

from the earthquake, the rock and soil conditions at sites, and variations in the propagation of seismic waves from the earthquake due to complexities in the structure of the earth's crust.

Mercalli Intensity Scale

The most used intensity scale is the modified Mercalli intensity scale. Ratings of the scale, as well as the perceived shaking and damage potential for structures, are shown in Table 8-1. The modified Mercalli intensity scale is generally represented visually using maps that show the expected ground shaking at any given location produced by an earthquake with a specified magnitude and epicenter.

Table 8-1. Modified Mercalli Intensity Scale

Mercalli Intensity	Shaking	Description
I	Not Felt	Not felt except by a very few under especially favorable conditions.
II	Weak	Felt only by a few persons at rest, especially on upper floors of buildings.
III	Weak	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
IV	Light	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Moderate	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Strong	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	Very Strong	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII	Severe	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX	Violent	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X	Extreme	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.

Source: (USGS n.d.)

Peak Ground Acceleration

The ground experiences acceleration as it shakes during an earthquake. The peak ground acceleration (PGA) is a measure of how hard the earth shakes in a given geographic area. It is expressed as a percentage of the acceleration due to gravity (percent g). Horizontal and vertical PGA varies with soil or rock type. Earthquake hazard assessment involves estimating the annual probability that certain ground accelerations will be exceeded and then summing the annual probabilities over a period of interest (USGS 2019). Damage levels experienced in an earthquake vary with the intensity of ground shaking and with the seismic capacity of structures, as noted in Table 8-2.

Table 8-2. Damage Levels Experienced in Earthquakes

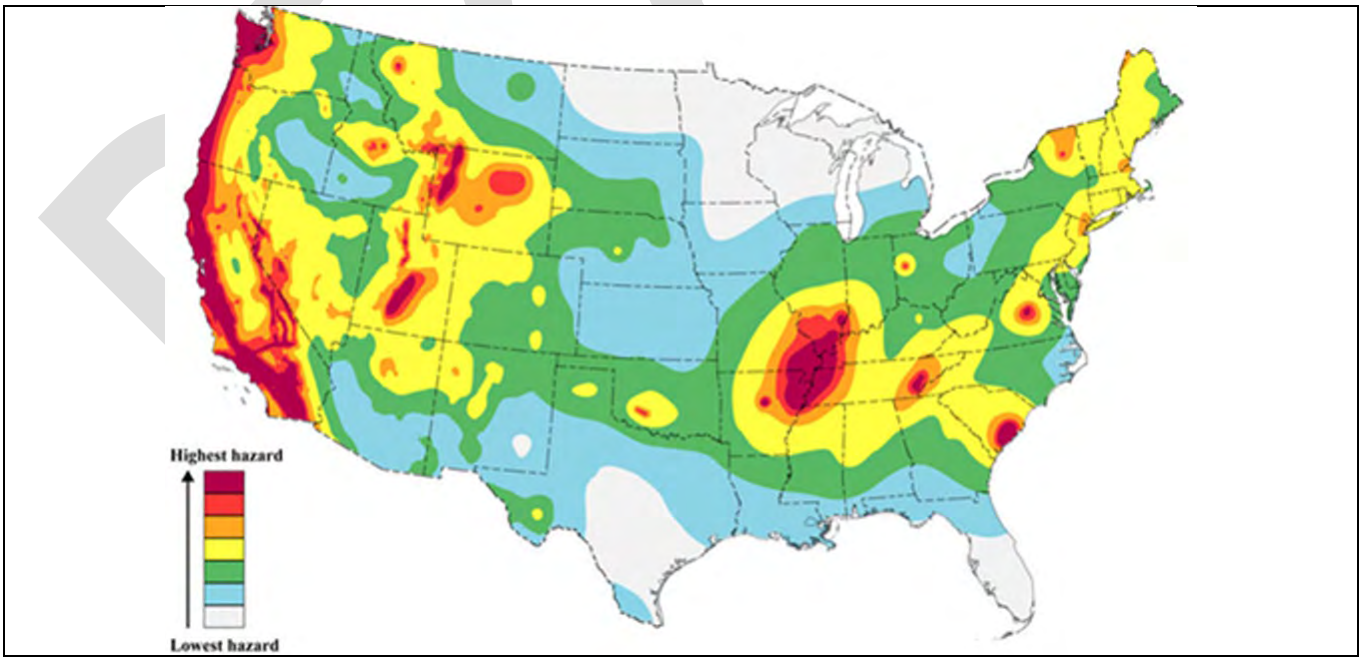
Ground Motion Percentage	Explanation of Damages
1-2%g	Motions are widely felt by people; hanging plants and lamps swing strongly, but damage levels, if any, are usually very low.
Below 10%g	Usually causes only slight damage, except in unusually vulnerable facilities.
10 - 20%g	May cause minor-to-moderate damage in well-designed buildings, with higher levels of damage in poorly designed buildings. At this level of ground shaking, only unusually poor buildings would be subject to potential collapse.
20 - 50%g	May cause significant damage in some modern buildings and very high levels of damage (including collapse) in poorly designed buildings.
≥50%g	May causes higher levels of damage in many buildings, even those designed to resist seismic forces.

Source: (USGS 2019)
Note: %gPeak Ground Acceleration

Earthquake Mapping

National maps of earthquake shaking provide information for creating and updating seismic design requirements for building codes, insurance rate structures, earthquake loss studies, retrofit priorities, and land use planning. After thorough review of the studies, professional organizations of engineers update the seismic-risk maps and seismic design requirements contained in building codes (Brown 2001). The USGS updated the National Seismic Hazard Maps in 2023. New seismic, geologic, and geodetic information on earthquake rates and associated ground shaking were incorporated into these revised maps. The 2023 map is shown in Figure 8-2. It indicates that Douglas County has a moderate earthquake hazard (USGS 2024).

Figure 8-2. 2023 Long-Term National Seismic Hazard Map



Source: (USGS 2024)

When earthquakes occur, the Advanced National Seismic System (ANSS), run by USGS, delivers real-time information, including a map showing the distribution of potentially damaging ground shaking, information used to target post-earthquake response efforts. ANSS stations are situated in two locations in Colorado, one of which is just northwest of Douglas County in Idaho Springs (USGS 2025).

Intensity in Douglas County for a 500-Year Mean Return Period Earthquake

The Hazus earthquake model was run for the 500-year mean return period (MRP) event in Douglas County. A 500-year MRP event is an earthquake with a 0.2 percent chance that mapped PGA levels will be exceeded in any given year. Figure 8-3 illustrates geographic distributions of the Modified Mercalli Scale based on PGAs (*g*) across Douglas County at the census-tract level for the 500-year MRP. Douglas County is estimated to experience light to moderate shaking during a 500-year event. Damages associated with this event would be some dishes and windows broken, unstable objects overturned, walls may make a cracking sound, felt by nearly everyone, many awakened if the event occurs as night (USGS n.d.).

8.1.4 Previous Occurrences

FEMA Disaster Declarations

There have been no earthquake-related declarations for a major disaster (DR) or emergency (EM) that included Douglas County (FEMA 2025).

USDA Declarations

Between 2019 and 2024, Douglas County was not included in any USDA disaster declarations related to earthquake (USDA 2025).

All Recent Events

Between 2020 and 2024, there were no known earthquake events that impacted Douglas County.

Older Events

Douglas County has experienced two earthquakes since 1900 (see Figure 8-4):

- On September 9, 1965, a magnitude-4.8 earthquake was recorded with an epicenter between Wildcat Mountain and Coyote Ridge Park in Castle Pines (Colorado Geological Survey n.d.). It has been hypothesized that this earthquake—along with a number of earthquakes in the Denver area at the same time—was caused by injection of chemical-waste fluids into an underground reservoir at the Rocky Mountain Arsenal 23 miles to the northeast (Healy, et al. 1968). No damage records for the 1965 earthquake were found as part of this HMP update.
- On Christmas Day in 1994, an earthquake was recorded at a magnitude of 4.0. The earthquake's epicenter was 6 miles northeast of Larkspur in a sparsely populated portion of unincorporated Douglas County. This earthquake did not result in major damage (USGS 2025).

Across the state, more than 500 earthquake tremors of magnitude 2.5 or higher have been recorded in Colorado since 1867 as shown in Figure 8-1. It is likely that more earthquakes of magnitude 2.5 to 3 occurred during that time but were not recorded due to the sparse population distribution and limited instrumental coverage in much of the state.

Figure 8-3. Peak Ground Acceleration 500-Year Mean Return Period for Douglas County

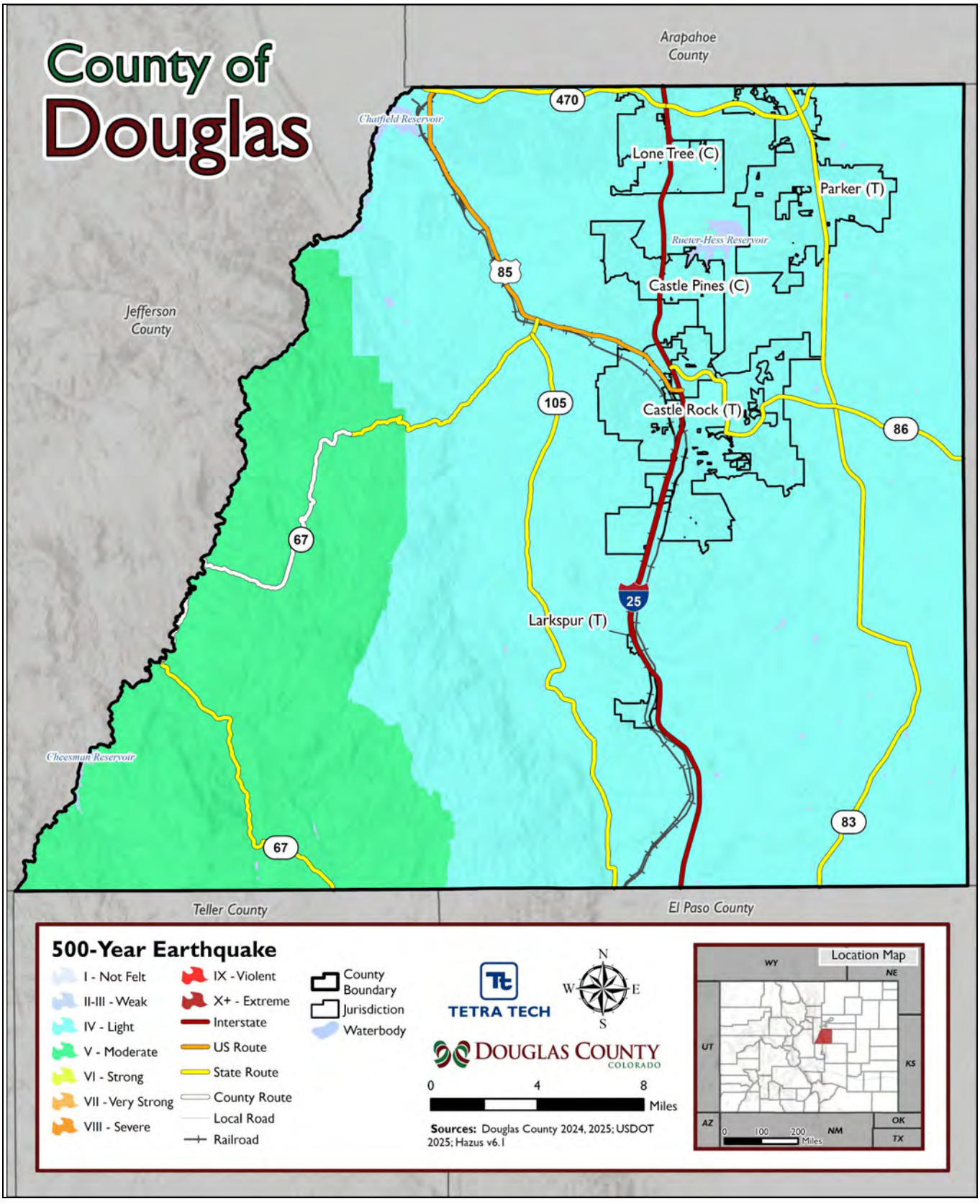
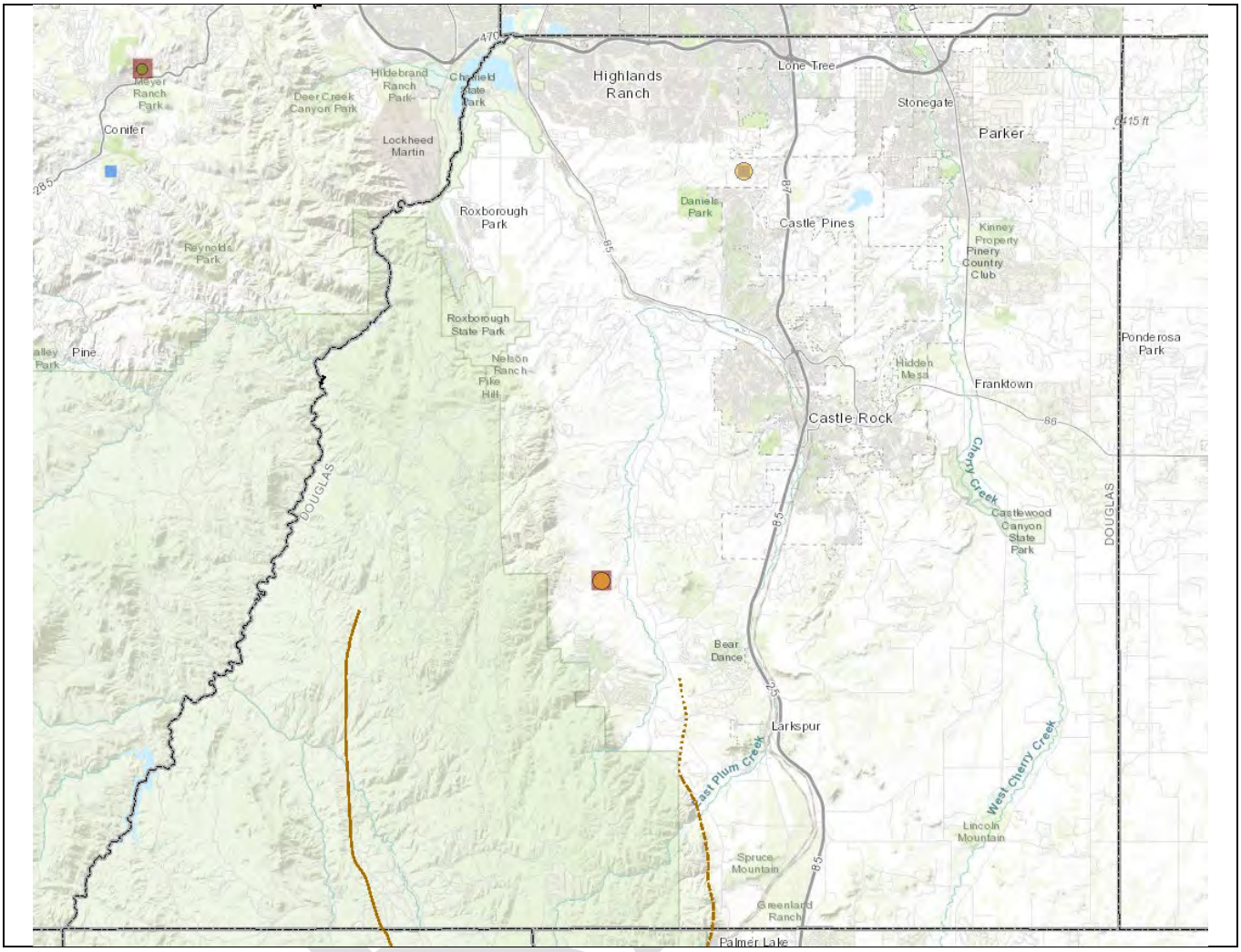


Figure 8-4. Earthquakes in Douglas County



Source: (Colorado Geological Survey n.d.)

8.1.5 **Probability of Future Occurrences**

Information on previous earthquake occurrences in Douglas County was used to calculate the probability of future occurrence of such events. Table 8-3 lists the number of events from various sources over the 70-year period from 1954 to 2024, which is the most complete period of record for all sources reviewed. Based on these records and input from the Core Planning Team, the probability of occurrence for earthquakes in the County is considered "unlikely."

Table 8-3. Probability of Future Earthquake Hazard Events in Douglas County

Hazard Type	Number of Occurrences Between 1954 and 2024	% Chance of Occurring in Any Given Year
Earthquake	2	2.86%

Source: (FEMA 2025); (USGS 2025); (Colorado 2023); (Douglas County Colorado 2021)
Note: The time period presented in this table is the most complete period of record for the various data sources reviewed.

8.1.6 Cascading Hazards

The USGS Global Geoengineering Research Group has investigated the relationship earthquakes have with ground deformation and ground failure. Ground failure can become exacerbated due to earthquake events, causing landslides and erosion. Soft and loose soils are more susceptible to earthquakes. Areas of steep slopes are at greater risk of ground failure and potential erosion during earthquakes (USGS 2021).

Residual impacts from earthquakes could alter the floodplain extent for the County if ground failure and erosion occur. Infrastructure that controls floodwaters or water body sources may become breached as a result of an earthquake event, which could create flooding in the impacted areas.

8.2 VULNERABILITY AND IMPACT ASSESSMENT

Although all of Douglas County may experience an earthquake, the degree of impact is dependent on many factors. A Hazus assessment was conducted to provide a range of loss estimates for the 500-year MRP earthquake. Figure 8-3 illustrates the geographic distribution of intensity across the County for this event. Refer to Section 4.3.2 for additional details on the methodology used.

8.2.1 Life, Health, and Safety

The impact of an earthquake on people depends on the age and type of construction they live in, the soil types their homes are located on, and the intensity of the earthquake. Soft soils can amplify ground shaking to damaging levels even during a moderate earthquake and thus increase risk to the population. Factors such as building material type, geographic location, climate zone, and available resources could impact the ability to rescue and provide medical treatment (USGS 2012).

Hazus provides estimates of the number of persons who will be displaced from their homes or require short-term shelter as the result of an earthquake. The number of people requiring shelter is generally less than the number displaced as some displaced persons use hotels or stay with family or friends following a disaster event. According to the analysis for this HMP update, there would be no persons displaced or seeking short-term shelter as a result of the 500-year MRP event.

Hazus also estimates the number of deaths and injuries an earthquake may cause at three different times of day. Hazus considers residential occupancy at its peak at 2:00 a.m., educational, commercial, and industrial sectors at their maximum peak at 2:00 p.m., and commute time at its peak at 5:00 p.m. Table 8-4 summarizes the County-wide injuries and fatalities estimated for the 500-year MRP earthquake events.

Table 8-4. Number of Injuries and Fatalities from the 500-Year MRP Earthquake Event

Level of Severity	Time of Day - 500-Year Mean Return Period		
	2:00 a.m.	2:00 p.m.	5:00 p.m.
Non-hospitalized injuries	1	1	1
Hospitalizations	0	0	0
Fatalities	0	0	0

Source: Hazus v6.1

Whether directly or indirectly impacted, residents could be faced with business closures, road closures that could isolate populations, and loss of function of critical facilities and utilities. There is a higher risk to public safety for those inside buildings due to structural damage or people walking below building ornamentations and chimneys that may be shaken loose and fall because of an earthquake.

8.2.2 General Building Stock

A building's construction determines how well it can withstand the force of an earthquake (Colorado 2023). A 2009 FEMA report indicates that unreinforced masonry buildings are most at risk during an earthquake because the walls are prone to collapse outward, whereas steel and wood buildings absorb more of the earthquake's energy (FEMA 2009). Attributes that affect a building's ability to withstand an earthquake include its age, number of stories, and quality of construction.

The entire County's general building stock is considered at risk from the earthquake hazard. The Hazus probabilistic earthquake model was applied to analyze impacts of the earthquake hazard on the general building stock. Hazus considers building construction and age of building as part of the analysis. Because a custom general building stock was used for this Hazus analysis, the building ages and building types from the inventory were incorporated into the Hazus model. Potential building damage was categorized as none, slight, moderate, extensive, or complete, as defined for a light wood-framed building in Table 8-5; definitions of the categories of damage for other building types are included in Hazus technical manual documentation. Damage loss estimates include structural and non-structural damage to the building and loss of contents.

Table 8-5. Example of Structural Damage State Definitions for a Light Wood-Framed Building

Damage Category	Description
Slight	Small plaster or gypsum-board cracks at corners of door and window openings and wall-ceiling intersections; small cracks in masonry chimneys and masonry veneer.
Moderate	Large plaster or gypsum-board cracks at corners of door and window openings; small diagonal cracks across shear wall panels exhibited by small cracks in stucco and gypsum wall panels; large cracks in brick chimneys; toppling of tall masonry chimneys.
Extensive	Large diagonal cracks across shear wall panels or large cracks at plywood joints; permanent lateral movement of floors and roof; toppling of most brick chimneys; cracks in foundations; splitting of wood sill plates and/or slippage of structure over foundations; partial collapse of room-over-garage or other soft-story configurations.
Complete	Structure may have large permanent lateral displacement, may collapse, or be in imminent danger of collapse due to cripple wall failure or the failure of the lateral load resisting system; some structures may slip and fall off the foundations; large foundation cracks.

Source: Hazus Technical Manual

Table 8-6 summarizes the estimated level of damage for the 500-year MRP earthquake event. This analysis found that only 0.4 percent of residential buildings will experience any damage; 0.7 percent of commercial buildings; 0.9 percent of industrial buildings; and 0.3 percent of other buildings.

Table 8-7 summarizes the estimated value of damage by general occupancy class for each jurisdiction. Hazus estimated $19,890,678 in total damage as a result of the 500-year MRP earthquake, representing less than 0.1 percent of the total replacement value for general building stock in Douglas County. Residential buildings account for majority of the building replacement cost damages.

Table 8-6. Building Damage Severity by General Occupancy Class for the 500-year MRP Earthquake Event

Occupancy Class	Total Number of Buildings in Occupancy	Severity of Expected Damage	Earthquake 500-Year Mean Return Period	
			Building Count	Percent Buildings in Occupancy Class
Residential Buildings (Single and Multi-Family Dwellings)	128,167	None	127,668	99.6%
		Minor	428	0.3%
		Moderate	65	0.1%
		Severe	6	<0.1%
		Destruction	0	0.0%
Commercial Buildings	6,377	None	6,335	99.3%
		Minor	30	0.5%
		Moderate	11	0.2%
		Severe	1	<0.1%
		Destruction	0	0.0%
Industrial Buildings	429	None	425	99.1%
		Minor	3	0.6%
		Moderate	1	0.3%
		Severe	0	0.0%
		Destruction	0	0.0%
Government, Religion, Agricultural, and Education Buildings	4,733	None	4,718	99.7%
		Minor	14	0.3%
		Moderate	1	<0.1%
		Severe	0	0.0%
		Destruction	0	0.0%

Source: Hazus v6.1; Douglas County 2025; FEMA/ESRI 2025; Microsoft 2020
Note: The number of damaged buildings may be over or underestimated.

Table 8-7. Building Damage for 500-year MRP Earthquake Event

Jurisdiction	Total Replacement Cost Value (RCV)	500-Year MRP Estimated Losses				
		Total Damage	Total Damage as % of Total RCV	Residential Damage	Commercial Damage	All Other Occupancies
Castle Pines	$5,969,347,390	$650,344	<0.1%	$576,998	$60,631	$220
Castle Rock	$32,358,886,100	$2,115,398	<0.1%	$1,666,985	$283,310	$27,100
Larkspur	$164,181,514	$39,161	<0.1%	$33,912	$2,303	$255
Lone Tree	$24,279,214,512	$2,134,623	<0.1%	$1,395,147	$716,880	$1,016
Parker	$26,842,000,546	$1,604,697	<0.1%	$1,097,650	$356,743	$62,525
Unincorporated County	$117,775,978,929	$13,346,454	<0.1%	$9,808,284	$2,671,801	$259,892
Douglas County	**$207,389,608,991**	**$19,890,678**	**<0.1%**	**$14,578,975**	**$4,091,669**	**$351,008**

Source: Hazus v6.1; Douglas County 2025; FEMA/ESRI 2025; Microsoft 2020; RSMeans 2024
Note: Other = Government, Religion, Agricultural, and Education

8.2.3 Community Lifelines and Other Critical Facilities

All critical facilities in Douglas County are vulnerable to the earthquake hazard. The Hazus earthquake model was used to assign a probability of each damage state category to every critical facility in the planning area for the 500-year MRP event. Probabilities were then averaged across the lifeline category, as shown in Table 8-8. The average risk for extensive or complete damage is predicted to be less than 0.1 percent for all lifeline categories.

Table 8-8. Damage State for Critical Facilities During a 500-Year MRP Earthquake Event

	Average Percent Probability of Sustaining Damage from a 500-Year MRP Earthquake					Average Probability of Full Functionality After Earthquake			
Lifeline Category	None	Slight	Moderate	Extensive	Complete	Day 1	Day 7	Day 30	Day 90
Communications	98.7%	1.0%	0.2%	<0.1%	0.0%	98.7%	99.7%	99.9%	99.9%
Energy	98.6%	1.1%	0.3%	<0.1%	0.0%	98.6%	99.6%	99.9%	99.9%
Food, Hydration, Shelter	98.8%	1.0%	0.2%	<0.1%	0.0%	98.7%	99.7%	99.9%	99.9%
Hazardous Materials	98.5%	1.1%	0.3%	<0.1%	0.0%	98.5%	99.6%	99.9%	99.9%
Health and Medical	99.7%	0.2%	0.0%	0.0%	0.0%	99.7%	99.9%	99.9%	99.9%
Safety and Security	99.1%	0.7%	0.2%	<0.1%	0.0%	99.0%	99.7%	99.9%	99.9%
Transportation	98.7%	1.0%	0.3%	<0.1%	0.0%	98.7%	99.6%	99.9%	99.9%
Water Systems	98.7%	1.0%	0.2%	<0.1%	0.0%	98.7%	99.7%	99.9%	99.9%

Source: Hazus v6.1; Douglas County 2021, 2025; CDOT 2019, 2024; CDPHE 2018, 2019, 2023, 2025; ESRI 2024; 2025; HIFLD 2025; USGS 2020; FEMA 2021

Hazus also estimated the average probability of critical facilities being restored to fully functional use within 1, 7, 30, and 90 days after the 500-year MRP earthquake. For example, Hazus might estimate that a facility has a 5 percent chance of being fully functional at Day 3, and a 95 percent chance of being fully functional at Day 90. For Douglas County, Hazus estimates that critical facilities on average will be nearly 100 percent functional within one day of a 500-year MRP event, as shown on Table 8-8.

Although the Hazus analysis did not compute damage estimates for individual roadway segments and railroad tracks, it is assumed that these features would undergo damage due to ground failure resulting in interruptions of regional transportation and of distribution of materials. Losses to the community that would result from damage to lifelines could exceed costs of repair. Earthquake events can significantly affect road bridges, many of which provide the only access to certain neighborhoods. Because softer soils generally follow floodplain boundaries, bridges that cross watercourses should be considered vulnerable. Another key factor in degree of vulnerability is age of facilities and infrastructure, which correlates with standards in place at time of construction.

8.2.4 Economy

Earthquake impacts on the economy include loss of business function, damage to inventory, relocation costs, wage loss, and rental loss due to the repair/replacement of buildings. Damage to roadway segments and railroad tracks due to ground failure would interrupt regional transportation and distribution of materials.

Hazus estimates volume of debris that may be generated as a result of an earthquake event to facilitate planning for debris removal and disposal. Debris estimates are divided into two categories:

- Reinforced concrete and steel that require special equipment to break up before transport can occur
- Brick, wood, and other debris that can be loaded directly onto trucks by use of bulldozers

Table 8-9 lists estimated debris generated by the 500-year MRP event. Hazus estimated 5,892 tons of total debris. Unincorporated Douglas County has the largest amount of debris generated with 3,928 tons of debris.

Table 8-9. Debris Generated by the 500-year MRP Earthquake Event

Jurisdiction	Debris Generated by the 500-Year MRP Earthquake Event (tons)		
	Brick/Wood	Concrete/Steel	Total
Castle Pines	254	38	291
Castle Rock	534	117	651
Larkspur	17	3	20
Lone Tree	532	129	661
Parker	223	117	340
Unincorporated County	3,078	850	3,928
Douglas County	**4,639**	**1,253**	**5,892**

Source: Hazus v6.1; Douglas County 2025; FEMA/ESRI 2025; Microsoft 2020

8.2.5 Natural Resources

Earthquakes can cause damage to the surface of the earth in various forms. Surface faulting that creates wide ruptures in the ground can harm the natural environment by tearing apart plant roots or disconnecting habitats for miles, isolating animal species (USGS n.d.).

Ground failure because of soil liquefaction can have an impact on soil pores and the retention of water resources. The greater the seismic activity and liquefaction properties of the soil, the more likely it is that drainage of groundwater will occur, which depletes water resources. In areas where there is higher pressure of groundwater retention, the pores can build up more pressure and make soil behave like a fluid rather than a solid, increasing the risk of localized flooding and deposition or accumulation of silt (USGS n.d.).

Earthquakes can cause large and sometimes disastrous landslides and mudslides. Any steep slope is vulnerable to slope failure, often as a result of loss of cohesion in clay-rich soils. Landslides that fall into streams may significantly impact fish and wildlife habitat, as well as affecting water quality. Hillsides that provide wildlife habitat can be lost for prolonged periods of time due to landslides.

8.2.6 Historic and Cultural Resources

Earthquake events in Douglas County could bring devastating losses to historical and cultural landmarks. Many historical buildings and homes are not built to withstand earthquakes and are more vulnerable than other structures.

8.3 FUTURE CHANGES THAT MAY AFFECT RISK

8.3.1 Potential or Planned Development

Development in areas with softer soil classes, liquefaction potential, and landslide-susceptibility may experience shifting or cracking in the foundation during earthquakes because of the characteristics of these soil classes. However, current building codes require seismic provisions that should render new construction less vulnerable to seismic impacts than older, existing construction that may have been built to lower construction standards.

8.3.2 Projected Changes in Population

The County experienced an increase in population between the 2020 Census (357,978) and the 2023 American Community Survey estimated population of 368,283. The population is expected to continue to increase over the next few years. A growing population will expose more people to the earthquake hazard. Persons who move into older structures in the County are at greater risk of being impacted by earthquake events because older structures are more vulnerable to ground shaking. However, for new construction, current building codes require seismic provisions that should render new construction less vulnerable to seismic impacts.

8.3.3 Other Identified Concerns

Important issues associated with an earthquake in Douglas County include the following:

- Critical facility/lifeline owners should be encouraged to create or enhance a continuity of operations plan using the information on risk and vulnerability contained in this plan update.
- Identifying assets built prior to the uniform application of seismic provisions in the state will provide a basis to better understand the vulnerability of building stock in the County.
- Earthquakes could trigger other natural hazard events, such as dam failures and slope failures which could impact Douglas County, its municipalities, and districts.

9. FLOOD

9.1 HAZARD PROFILE

9.1.1 Hazard Description

Flooding is the temporary condition of partial or complete inundation of typically dry areas. This is caused by rising water when flow is greater than the capacity of a waterway or in areas that are not considered waterways (State of Colorado 2023). Floods can develop slowly over a period of days or quickly in a matter of hours. Their impacts can be local (impacting a neighborhood or community) or regional (affecting entire river basins and multiple counties or states). Flooding is the most common natural hazard in the United States (DHS 2025).

For this HMP update, as deemed appropriate by Core Planning Team, the following are the flood types of concern in Douglas County:

- **Riverine Flooding—**Riverine flooding occurs when rivers overflow their banks in response to excessive precipitation and water runoff in the watershed.
- **Flash Flooding—**Most flash flooding is caused by slow-moving thunderstorms over a small area, accelerated snow melt due to heavy rains, a dam failure (addressed in Chapter 6), or a sudden release of water held by an ice jam. Flash flooding occurs often along mountain streams and is common in urbanized areas where much of the ground is covered by impervious surfaces. Flash floodwaters move at very high speeds, uprooting trees, destroying buildings, and obliterating bridges and roads.
- **Urban Flooding—**Urban flooding occurs when development has obstructed the natural flow of water and decreases the ability of natural groundcover to absorb and retain surface water runoff.

Flood Causes and Factors

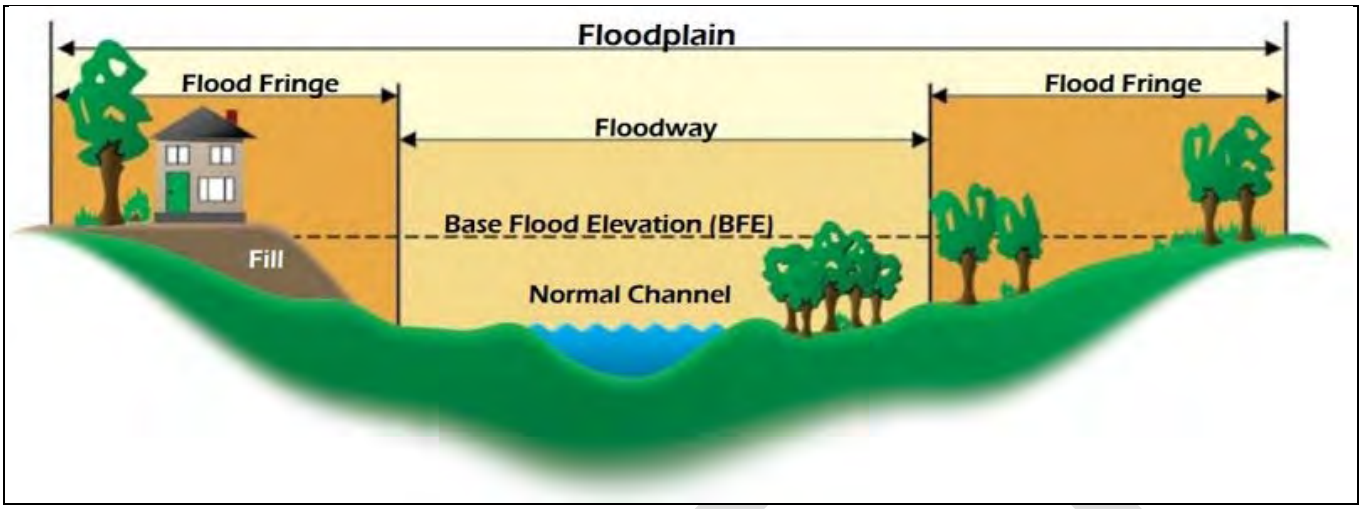
Flooding occurs from runoff resulting from excessive precipitation, snowmelt, dam failure, or the release of debris or ice jams. Excessive runoff results from specific conditions of climate and physiography. Relevant climate factors include precipitation, evaporation, transpiration and interception. Physiographic factors include the size, shape, and slope of the waterway's drainage basin as well as land use within the basin. Runoff from snowmelt yields a high chance of flooding in the river networks that span most of Colorado (State of Colorado 2023).

Floodplains

A floodplain is the land adjoining the channel of a river, stream, lake, or other watercourse or water body that becomes inundated with water during a flood. Riverine floodplains may be broad, as when a river crosses an extensive flat landscape, or narrow, as when a river is confined in a canyon. A floodplain is made up of the following components, as shown in Figure 9-1 (FEMA n.d.):

- **Floodway** is the channel of a river or other waterway and the adjacent land areas that are under water or reserved to carry and discharge the overflow of water caused by flooding.
- **Flood fringe** is the area within the floodplain but outside the floodway. This area extends from the outer banks of a floodway to the edges of river valley where the elevation begins to rise.

Figure 9-1. Characteristics of a Floodplain



Source: (FEMA n.d.)

Flood Mapping

Floodplains along major waterways are often delineated in flood maps made by FEMA called Flood Insurance Rate Maps (FIRMs). FIRMs identify areas known as Special Flood Hazard Areas (SFHAs). The SFHA is the area that will be inundated by a flood of a magnitude that has a 1 percent chance of being equaled or exceeded in any given year—referred to as the 1 percent annual chance flood, the base flood, or the 100-year flood. The SFHA is the area that has flood insurance and floodplain management requirements (FEMA 2020). Flood maps also often show the moderate flood hazard area, which is the area inundated by a flood with a magnitude that has a 0.2 percent chance of being equaled or exceeded in any given year (sometimes called the 500-year floodplain). Additional definitions relating to flood maps can be seen in Table 9-1.

Table 9-1. Flood Map Terms

Map Designation	Description
Zone A, Zone AO, Zone AH, Zones A1-A30, Zone AE, Zone A99, Zone AR, Zone AR/AE, Zone AR/AO, Zone AR/A1-A30, Zone AR/A, Zone V, Zone VE, Zones V1-V30	Special Flood Hazard Area
Zone B or Zone X (shaded)	Moderate flood hazard areas, between the limits of the SFHA and the 0.2 percent annual chance flood
Zone C or Zone X (unshaded)	Areas of minimal flood hazard, outside the SFHA and higher than the elevation of the 0.2 percent annual chance flood

Source: (FEMA 2022)

The boundaries of floodplains on these maps are updated over time to account for changes in land use, the amount of impervious surface, the placement of obstructing structures in floodways, changes in precipitation and runoff patterns, improvements in technology for measuring topographic features, and utilization of different hydrologic modeling techniques.

9.1.2 Location

Floods can happen almost anywhere in Douglas County, although they are most likely adjacent to rivers and streams. The County is located in three watersheds that are subject to flooding: Upper South Platte, Middle South Platte, and Fountain. The South Fork of the South Platte is the major river in the County.

If the local drainage basin is relatively flat, then shallow, slow-moving floodwater can last for days. In drainage areas with substantial slope, or where the channel is narrow and confined, rapidly moving and extreme high water can result in flash flood conditions (State of Colorado 2023). Upland areas are characterized by steep stream slopes. Rapid rises, high peak flows, short durations, and comparatively low volumes of total runoff characterize floods in those areas (FEMA 2021).

Riverine Flooding

Figure 9-2 shows flood zones in Douglas County as depicted on the FEMA preliminary Digital Flood Insurance Rate Map (DFIRM). The land area in the mapped flood hazard areas, exclusive of water bodies, is listed in Table 9-2.

Table 9-2. Number of Acres in Douglas County Exposed to the 1 and 0.2 Percent Annual Chance Flood

Jurisdiction	Total Land Area (Excluding Water Bodies) (acres)	Land Area (Excluding Water Bodies) in the 1% Annual Chance Flood Hazard Area		Land Area (Excluding Water Bodies) in the 0.2% Annual Chance Flood Hazard Area	
		Total Area (acres)	Percent of Total	Total Area (acres)	Percent of Total
Castle Pines	6,137	54	0.9%	54	0.9%
Castle Rock	23,382	704	3.0%	945	4.0%
Larkspur	1,017	117	11.6%	135	13.3%
Lone Tree	6,314	140	2.2%	163	2.6%
Parker	14,446	1,237	8.6%	2,034	14.1%
Unincorporated County	485,066	10,774	2.2%	11,751	2.4%
Douglas County	**536,361**	**13,025**	**2.4%**	**15,082**	**2.8%**

Roadways that cross streams and obstruct flood flows are the most significant factor affecting local flooding. Other constructed objects, such as buildings, cars, and fences, as well as the natural vegetation of the floodplains, can also cause flow obstruction (FEMA 2021).

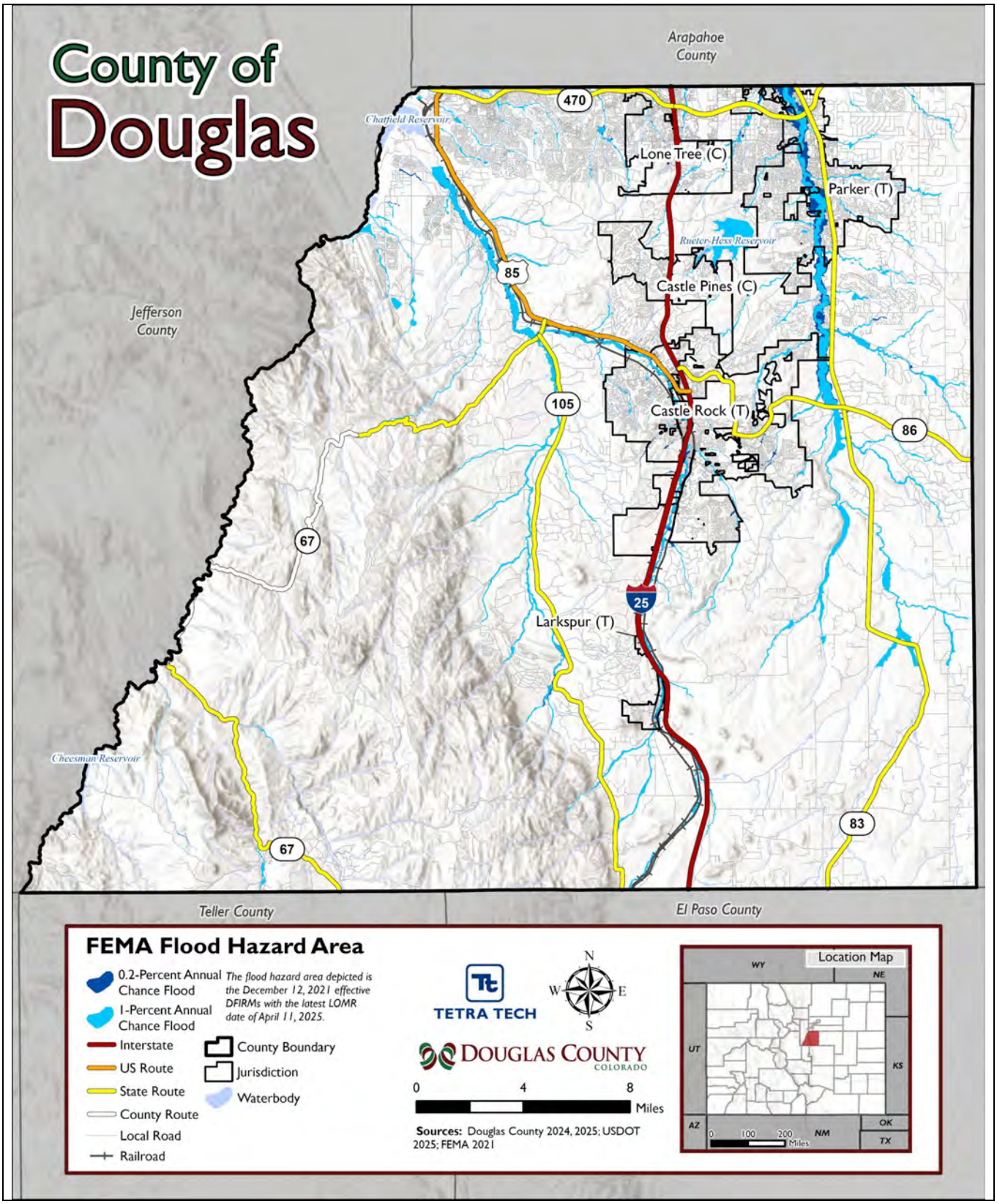
Flash Flooding

The distinctive flash flood event characterized by fast moving water and damaging impacts requires a steep topography. While Douglas County could undergo flash floods (and has, in the past), the County is at a lower risk than other parts of the state for this type of flood event.

Stormwater/Urban Flooding

Stormwater/urban flooding is not mapped by the state or FEMA but is most likely in highly developed areas with high percentages of impervious coverage that contribute to high rates of runoff. Locations that have stormwater components that are undersized or prone to becoming clogged or failing often experience stormwater flooding.

Figure 9-2. FEMA Flood Hazard Areas in Douglas County



9.1.3 Extent

The severity of a flood is determined by a combination of factors. Colorado is vulnerable to flooding resulting from snow runoff and precipitation. Snowmelt in the Front Range is carried by the South Platte River to Douglas County and beyond. Douglas County is located in an area that is prone to intense rainfall, sometimes of cloudburst magnitude. Flooding in Douglas County is often the direct result of thunderstorms and heavy rains. Floods have resulted from storms covering large areas with heavy general rainfall as well as from storms covering small areas with extremely intense rainfall. Floods generally occur from May through August.

Riverine and Flash Flooding

The severity of riverine and flash flooding is determined by stream or river basin physiography; precipitation patterns; soil moisture conditions; degree of vegetative clearing; and impervious surface. The severity of a flood depends not only on the amount of water that accumulates in a period of time, but also on the land's ability to manage this water. One element is the size of rivers and streams in an area; but an equally important factor is the land's absorbency. When it rains, the soil acts like a sponge. When the land is saturated or frozen, infiltration rates decrease and any more water that accumulates must flow as runoff (Harris 2008).

Discharge Probability

The extent of riverine flooding is measured using a discharge probability, which is the probability that a certain river discharge (flow) level will be equaled or exceeded in a given year. Flood studies use historical records to determine the probability of occurrence for the different discharge levels.

Stream Gages

USGS uses stream gages to determine the severity of flood at different points along a body of water. There are eight gages in Douglas County that actively monitor water levels and have determined flood stages, as shown in Table 9-3. The County relies on the gages to determine the height of the river during heavy rain events and to determine whether residents need to evacuate. The USGS website provides details about each of the gages (https://waterwatch.usgs.gov/index.php) and the gage heights of flooding events. The NWS provides the different flood stages for the gages (https://water.weather.gov/ahps/).

Flood Categories

Once a river reaches flood stage, the NWS flood categorizes extent or severity as follows based on property damage and public threat (NOAA NSSL n.d.):

- Minor Flooding—Minimal or no property damage, but possibly some public threat or inconvenience.
- Moderate Flooding—Some inundation of structures and roads near streams. Some evacuations of people and/or transfer of property to higher elevations are necessary.
- Major Flooding—Extensive inundation of structures and roads. Significant evacuations of people and/or transfer of property to higher elevations.

Stormwater/Urban Flooding

Currently, there is no measurement used to define the frequency and severity of stormwater/urban flooding.

Table 9-3. Stream Gages in Douglas County

Gage Site Number	Site Name	Flood Stage Height (feett)
393109104464500	Cherry Creek Near Parker, CO	8.5
06712000	Cherry Creek Near Franktown, CO.	9.5
06708800	East Plum Creek Above Haskins Gulch Near Castle Rock, CO	10
06709000	Plum Creek Near Sedalia, CO.	8
06709530	Plum Creek at Titan Road Near Louviers, CO	-
06708600	West Plum Creek Near Perry Park, CO	-
06701900	South Platte River Below Brush Creek Near Trumbell, CO	-
06700000	SOUTH PLATTE RIVER Above Cheesman Lake, CO	-

Source: (USGS 2025); (NOAA 2025)
Note: " – " = data unavailable

9.1.4 Previous Occurrences

FEMA Disaster Declarations

There have been three flood-related declarations for a major disaster (DR) or emergency (EM) that included Douglas County, as described in Table 9-4.

Table 9-4. FEMA Disaster Declarations for flood Events in Douglas County

Event Date	Declaration Date	Declaration Number	Description
May 19, 1969	May 19, 1969	DR-261-CO	Severe Storms, Flooding
May 23, 1973	May 23, 1973	DR-385-CO	Heavy Rains, Snowmelt, and Flooding
June 8-23, 2023	August 25, 2023	DR-4731-CO	Severe Storms, Flooding, and Tornadoes

Source: (FEMA 2025)

USDA Declarations

Between 2019 and 2024, Douglas County was included in one USDA disaster declaration related to flooding, as listed in Table 9-5.

Table 9-5. USDA Declarations for Flood Events in Douglas County Since Previous HMP

Event Date	USDA Declaration Number	Description
June 8, 2023	S4731	Severe Storms, Flooding, and Tornadoes

Source: (USDA 2025)

All Recent Events

Table 9-6 lists major recorded flood-related events that impacted Douglas County since 2019. For earlier events, refer to the previous HMP.

Table 9-6. Flood Events in Douglas County (2019 to 2025)

Event Date	Declaration Number	Location Impacted	Description
May 12, 2023	N/A	Castlewood Canyon State Park	A slow moving storm system produced flooding and flash flooding across the urban corridor and northeast plains, with heavy snowfall in the higher mountains of the Front Range.
June 9, 2024	N/A	Parker	Flash Flood. Slow moving thunderstorms produced hail and heavy rainfall as they drifted south across the east/southeast part of the Denver Metro area.

Source: (NOAA NCEI n.d.)

9.1.5 Probability of Future Occurrences

Information on previous floods in the County was used to calculate the probability of future occurrence of such events. Table 9-7 lists the number of events from various sources over the 56-year period from 1969 to 2025, which is the most complete period of record for all sources reviewed. Based on these records and input from the Core Planning Team, the probability of occurrence for flood in the County is considered "possible."

Table 9-7. Probability of Future Flood Hazard Events in Douglas County

Hazard Type	Number of Occurrences Between 1969 and 2025	% Chance of Occurring in Any Given Year
Flood	5	8.93%

Source: (FEMA 2023); (NOAA NCEI n.d.)

9.1.6 Cascading Hazards

Riverine flooding often results in bank erosion. This is especially true in the upper courses of rivers with steep gradients, where floodwaters may pass quickly and without much property damage, but scour the banks, edging properties closer to the floodplain or causing them to fall in. Flooding is also responsible for hazards such as landslides when high flows over-saturate soils on steep slopes, causing them to fail. Public health risks associated with floods include the following (FEMA 2022):

- The growth of mold in buildings due to excess moisture and standing water
- Contamination of drinking and washing water with pollutants such as sewage, human and animal feces, pesticides, fertilizers, oil, asbestos, and rusting building materials
- Unsafe food
- Mosquitos and animals
- Carbon monoxide poisoning
- Hazards associated with re-entering and cleaning flooded structures
- Mental stress and fatigue

9.2 VULNERABILITY AND IMPACT ASSESSMENT

The 1- and 0.2 percent annual chance flood events were examined to evaluate the County's risk from the flood hazard, using the methodologies described in Section 4.3.2. These flood events are generally considered by planners and evaluated under federal programs such as NFIP.

9.2.1 Life, Health, and Safety

Table 9-8 summarizes the population exposed to the flood hazard by jurisdiction. An estimated 502 residents live in the 1 percent annual chance floodplain, or 0.1 percent of the County's total population. An estimated 4,473 residents live in the 0.2 percent annual chance floodplain, or 1.2 percent of the County's total population. Unincorporated Douglas County has the greatest number of residents living in the 1 percent annual floodplain, with 443 residents, or 0.2 percent of the jurisdiction's population. Parker has the greatest number of residents living in the 0.2 percent annual floodplain, with 3,088 residents, or 5.1 percent of the jurisdiction's population.

Table 9-8. Population Exposed to the 1 and 0.2 Percent Annual Chance Flood Event Hazard Area

Jurisdiction	Total Population (2023 ACS)	Population in the 1% Annual Chance Flood Hazard Area		Population in the 0.2% Annual Chance Flood Hazard Area	
		Number of Persons	Percent of Total	Number of Persons	Percent of Total
Castle Pines	12,573	0	0.0%	0	0.0%
Castle Rock	76,614	0	0.0%	29	<0.1%
Larkspur	171	7	4.1%	12	7.0%
Lone Tree	14,136	0	0.0%	0	0.0%
Parker	60,115	52	0.1%	3,088	5.1%
Unincorporated County	204,674	443	0.2%	1,344	0.7%
Douglas County	**368,283**	**502**	**0.1%**	**4,473**	**1.2%**

Source: U.S. Census Bureau 2023 ACS; Douglas County 2025; FEMA/ESRI 2025; Microsoft 2020; FEMA 2021

Given the availability of advance weather forecasting, blockades, and warning systems, injuries and deaths due to flooding generally are not anticipated. Ongoing mitigation efforts should help to avoid the most likely cause of injury, which is persons trying to cross flooded roadways or channels during a flood.

More likely impacts involve persons being displaced from their homes or requiring short-term shelter. For the 1 percent annual chance flood event in Douglas County, Hazus estimates that 703 individuals will be displaced and 250 people will seek short-term shelter. These statistics, by jurisdiction, are presented in Table 9-9.

Table 9-9. Estimated Population Displaced or Seeking Short-Term Shelter from the 1 Percent Annual Chance Flood Event Hazard Area

Jurisdiction	Total Population (2023 ACS)	1% Annual Chance Flood Impacts on People	
		Displaced Population	Persons Seeking Short-Term Shelter
Castle Pines	12,573	0	0
Castle Rock	76,614	143	86
Larkspur	171	5	0
Lone Tree	14,136	7	3
Parker	60,115	242	76
Unincorporated County	204,674	306	85
Douglas County	**368,283**	**703**	**250**

Source: Hazus v6.1, U.S. Census Bureau 2023 ACS Vulnerable Population; USGS 2020; FEMA 2021

9.2.2 General Building Stock

Table 9-10 and Table 9-11 summarize the analysis of buildings in the 1 percent and 0.2 percent annual chance flood hazard areas by jurisdiction. There are an estimated 393 buildings in the 1 percent annual chance flood hazard area in Douglas County. These buildings account for $182.5 million in replacement cost value, which is 0.3 percent of the County total. There are an estimated 1,854 buildings in the 0.2 percent annual chance flood event hazard area, accounting for $2.1 billion in replacement cost value, or 1.3 percent of the County total.

Table 9-12 and Table 9-13 show the distribution of buildings in the flood hazard areas by occupancy class. The residential occupancy class accounts for the greatest number of vulnerable buildings in each of the hazard areas.

Hazus estimated the loss to building structures and content that could occur to the exposed inventory from the 1 percent annual chance flood event. Results are summarized in Table 9-14.

Table 9-10. General Building Stock Exposure to the 1 Percent Annual Chance Flood Event

	Jurisdiction Total Buildings		Buildings in the 1% Annual Chance Flood Hazard Area			
			Number of Buildings		Replacement Cost Value	
Jurisdiction	Count	Replacement Cost Value	Count	Percent of Total	Value	Percent of Total
Castle Pines	4,000	$5,969,347,390	0	0.0%	$0	0.0%
Castle Rock	25,199	$32,358,886,100	2	<0.1%	$695,578	<0.1%
Larkspur	421	$164,181,514	21	5.0%	$8,610,268	5.2%
Lone Tree	4,285	$24,279,214,512	0	0.0%	$0	0.0%
Parker	18,275	$26,842,000,546	40	0.2%	$12,966,774	<0.1%
Unincorporated County	87,526	$117,775,978,929	330	0.4%	$160,237,200	0.1%
Douglas County	**139,706**	**$207,389,608,991**	**393**	**0.3%**	**$182,509,820**	**0.1%**

Source: Douglas County 2025; FEMA/ESRI 2025; Microsoft 2020; RSMeans 2024; FEMA 2021

Table 9-11. General Building Stock Exposure to the 0.2 Percent Annual Chance Flood Event

	Jurisdiction Total Buildings		Buildings in the 0.2% Annual Chance Flood Hazard Area			
			Number of Buildings		Replacement Cost Value	
Jurisdiction	Count	Replacement Cost Value	Count	Percent of Total	Value	Percent of Total
Castle Pines	4,000	$5,969,347,390	0	0.0%	$0	0.0%
Castle Rock	25,199	$32,358,886,100	21	0.1%	$37,994,569	0.1%
Larkspur	421	$164,181,514	36	8.6%	$29,445,973	17.9%
Lone Tree	4,285	$24,279,214,512	0	0.0%	$0	0.0%
Parker	18,275	$26,842,000,546	1,047	5.7%	$1,509,063,226	5.6%
Unincorporated County	87,526	$117,775,978,929	750	0.9%	$546,299,088	0.5%
Douglas County	**139,706**	**$207,389,608,991**	**1,854**	**1.3%**	**$2,122,802,856**	**1.0%**

Source: Douglas County 2025; FEMA/ESRI 2025; Microsoft 2020; RSMeans 2024; FEMA 2021

Table 9-12. Buildings in the 1 Percent Annual Chance Flood Hazard Area by General Occupancy Class

Jurisdiction	Residential Buildings in the Hazard Area	Commercial Buildings in the Hazard Area	Industrial Buildings in the Hazard Area	Other Buildings in the Hazard Area
Castle Pines	0	0	0	0
Castle Rock	0	0	0	2
Larkspur	15	3	1	2
Lone Tree	0	0	0	0
Parker	15	12	0	13
Unincorporated County	172	52	2	104
Douglas County	**202**	**67**	**3**	**121**

Source: Douglas County 2025; FEMA/ESRI 2025; Microsoft 2020; FEMA 2021
Note: Other = Government, Religion, Agricultural, and Education

Table 9-13. Buildings in the 0.2 Percent Annual Chance Flood Hazard Area by General Occupancy Class

Jurisdiction	Residential Buildings in the Hazard Area	Commercial Buildings in the Hazard Area	Industrial Buildings in the Hazard Area	Other Buildings in the Hazard Area
Castle Pines	0	0	0	0
Castle Rock	9	10	0	2
Larkspur	25	6	1	4
Lone Tree	0	0	0	0
Parker	876	105	1	65
Unincorporated County	521	86	4	139
Douglas County	**1,431**	**207**	**6**	**210**

Source: Douglas County 2025; FEMA/ESRI 2025; Microsoft 2020; FEMA 2021
Note: Other = Government, Religion, Agricultural, and Education

Table 9-14. Estimated Building Stock Potential Loss by Occupancy to the 1 Percent Annual Chance Flood Event

Jurisdiction	Total Replacement Cost Value	1% Annual Chance Flood Impacts on Buildings					
		Estimated Loss for All Occupancies	% of Total	Estimated Loss for Residential Properties	Estimated Loss for Commercial Properties	Estimated Loss for Industrial Occupancies	Estimated Loss for All Other Occupancies
Castle Pines	$5,969,347,390	$0	0.0%	$0	$0	$0	$0
Castle Rock	$32,358,886,100	$81,178	<0.1%	$0	$0	$0	$81,178
Larkspur	$164,181,514	$663,456	0.4%	$590,907	$45,197	$0	$27,353
Lone Tree	$24,279,214,512	$0	0.0%	$0	$0	$0	$0
Parker	$26,842,000,546	$3,558,323	<0.1%	$1,052,560	$591,148	$0	$1,914,615
Unincorporated County	$117,775,978,929	$27,949,420	<0.1%	$16,797,884	$2,197,366	$610	$8,953,560
Douglas County	**$207,389,608,991**	**$32,252,376**	**<0.1%**	**$18,441,351**	**$2,833,711**	**$610**	**$10,976,705**

Source: Hazus v6.1, Douglas County 2025; FEMA/ESRI 2025; Microsoft 2020; RSMeans 2024; USGS 2020; FEMA 2021
Note: Other = Government, Religion, Agricultural, and Education

NFIP Statistics

For this risk assessment, FEMA Region 8 provided a list of residential properties with NFIP policies, past claims, and multiple claims. A property is considered a repetitive loss property when there are two or more losses reported since January 1, 1978, that were paid more than $1,000 for each loss. The two losses must be within 10 years of each other and be at least 10 days apart. A residential property covered under an NFIP flood insurance policy is considered a severe repetitive loss property if it satisfies either of conditions 1 and 2, as well as condition 3:

1. At least four NFIP claim payments for the property (including building and contents) over $5,000 each have occurred, and the cumulative amount of such claims payments exceeded $20,000.
2. At least two separate claims payments for the property (building payments only) have occurred, and the cumulative amount of the building portion of such claims exceeded the market value of the building.
3. For either of the above, at least two of the referenced claims must have occurred within any 10-year period and must have occurred more than 10 days apart.

Table 9-15 summarizes NFIP policies, claims, and repetitive loss statistics for the County as of April 2025.

Table 9-15. NFIP Statistics in Douglas County

Jurisdiction	Policies in Force	Paid Claims	Number of Repetitive Loss Properties	Number of Severe Repetitive Loss Properties
Castle Pines	0	0	0	0
Castle Rock	66	6	0	0
Larkspur	2	0	0	0
Lone Tree	22	4	0	0
Parker	38	3	0	0
Unincorporated County	231	52	0	0
Douglas County	**359**	**65**	**0**	**0**

Source: FEMA 2025
Note: The City of Castle Pines does not participate in the NFIP.

9.2.3 Community Lifelines and Other Critical Facilities

Table 9-16 summarizes the number of critical facilities in the 1 percent annual chance flood hazard area. Of the 2,333 critical facilities in the County, 70 are located in the 1 percent annual chance flood hazard area. "Other Critical Facilities" account for the highest amount of facilities in the hazard area (21). Table 9-17 shows the number of lifeline facilities by category in the 0.2 percent annual chance flood hazard area. This area includes 113 facilities, with "Other Critical Facilities" again accounting for the greatest number (28).

Hazus estimates the expected amount of damage, as a percent of total value, that critical facilities may sustain as a result of the 1 percent annual chance flood event, as seen in Table 9-18. The results show that facilities in the Water Systems lifeline are most likely to experience damage due to the 1 percent annual chance flood.

Table 9-16. Number of Critical Facilities Located in the 1 Percent Annual Chance Flood Hazard Area

Jurisdiction	Number of Facilities in 1% Annual Chance Flood Hazard Area, by Lifeline Category									Total Facilities in Hazard Area	
	Communications	Energy	Food, Hydration, Shelter	Hazardous Materials	Health & Medical	Safety & Security	Transportation	Water Systems	Other Critical Facilities	Count	Percent of Total
Castle Pines	0	0	0	0	0	0	0	1	0	1	4.0%
Castle Rock	0	0	0	0	0	1	0	0	0	1	0.3%
Larkspur	0	0	0	0	0	0	0	0	0	0	0.0%
Lone Tree	0	0	0	0	0	0	0	0	0	0	0.0%
Parker	0	0	0	0	0	1	0	0	2	3	1.3%
Unincorporated County	0	0	0	3	0	16	9	18	19	65	3.9%
Douglas County	**0**	**0**	**0**	**3**	**0**	**18**	**9**	**19**	**21**	**70**	**3.0%**

Source: Douglas County 2021, 2025; CDOT 2019, 2024; CDPHE 2018, 2019, 2023, 2025; ESRI 2024, 2025; HIFLD2025; U.S. Energy Information Administration 2024; FEMA 2021

Table 9-17. Number of Critical Facilities Located in the 0.2 Percent Annual Chance Flood Hazard Area

Jurisdiction	Number of Facilities in 0.2% Annual Chance Flood Hazard Area, by Lifeline Category									Total Facilities in Hazard Area	
	Communications	Energy	Food, Hydration, Shelter	Hazardous Materials	Health & Medical	Safety & Security	Transportation	Water Systems	Other Critical Facilities	Count	Percent of Total
Castle Pines	0	0	0	0	0	0	0	1	0	1	4.0%
Castle Rock	0	0	1	0	3	1	0	0	0	5	1.7%
Larkspur	0	0	0	0	1	1	0	0	4	6	18.2%
Lone Tree	0	0	0	0	0	0	0	0	0	0	0.0%
Parker	14	0	1	0	1	2	1	4	4	27	11.7%
Unincorporated County	1	0	0	4	0	18	10	21	20	74	4.4%
Douglas County	**15**	**0**	**2**	**4**	**5**	**22**	**11**	**26**	**28**	**113**	**4.8%**

Source: Douglas County 2021, 2025; CDOT 2019, 2024; CDPHE 2018, 2019, 2023, 2025; ESRI 2024, 2025; HIFLD2025; U.S. Energy Information Administration 2024; FEMA 2021

Table 9-18. Critical Facilities Damage Due from the 1 Percent Annual Chance Flood

Lifeline	Number of Facilities Expected to Experience Defined Levels of Damage				
	Damage >0% and <5%	5 - 19% Damage	20 - 39% Damage	40 - 49% Damage	50% or Greater Damage
Communications	0	0	0	0	0
Energy	0	0	0	0	0
Food, Hydration, Shelter	0	0	0	0	0
Hazardous Materials	0	3	0	0	0
Health and Medical	0	0	0	0	0
Safety and Security	0	4	3	0	0
Transportation	0	0	0	0	0
Water Systems	7	3	3	1	2

Source: Hazus v6.1, Douglas County 2021, 2025' CDOT 2019, 2024; CDPHE 2018, 2019, 2023, 2025; ESRI 2024, 2025; HIFLD 2025; USGS 2020; FEMA 2021

Note: Facilities that are not expected to experience any damage are not included in this table.

Critical services during and after a flood may not be available if critical facilities are damaged or transportation routes to access them are impacted. Significant potential impacts on critical services include the following:

- **Transportation**—Roads and bridges that are blocked or damaged can isolate residents and prevent access by service providers needing to get to vulnerable populations or to make repairs.
- **Power and Communications**—Utilities such as overhead power, cable, and phone lines could also be vulnerable due to utility poles damaged by standing water. Loss of these utilities could create additional isolation issues. Flooded buildings may have the utilities disrupted if the service panel, generator, meter, etc. are not elevated above the flood protection level. Oversaturated soils from periods of heavy rain and flooding may cause utility poles to tip over or fall completely, interrupting the power grid for a potentially large area, especially if a transformer is impacted.
- **Water Quality**—Floodwater can contaminate private drinking water sources, such as wells and springs. Floodwater picks up debris, increasing the number of bacteria, sewage, and other industrial waste and chemicals into the water source. Excess water makes it more difficult for water treatment plants to treat water effectively. Consumers without access to clean water are unable to cook or clean in their home and may need to rely on bottled water. In impoverished communities, those affected may not have the economic means to stock up on bottled water. Moreover, in a flood, retail locations are often inaccessible and/or low on water supply.

In cases where short-term functionality is impacted by a flood, facilities of neighboring municipalities may need to increase support response functions during a disaster event. Mitigation planning should consider means to reduce impact on critical facilities and ensure enough emergency and school services remain when a significant event occurs.

9.2.4 Economy

Flood impacts on the local and regional economy include general building stock damage and associated tax loss, business interruption, and impacts on tourism. Renovations of commercial and industrial buildings may be necessary, disrupting associated services.

Debris management may be a large expense after a flood event. Hazus estimates the amount of structural debris generated during a flood event in three categories: finishes (dry wall, insulation, etc.); structural (wood, brick, etc.); and foundations (concrete slab and block, rebar, etc.). These distinctions account for the different types of equipment needed to handle debris. As shown in Table 9-19, Hazus estimates that there will be 296 tons of debris generated during the 1 percent annual chance flood in Douglas County. This estimate includes only structural debris generated by flooding. It does not account for non-structural debris (such as tree limbs) or additional debris generated by wind that may be associated with a storm that causes flooding.

Table 9-19. Debris Generated from the 1 Percent Annual Chance Flood Event

Jurisdiction	1 Percent Annual Chance Flood Event			
	Total (tons)	Finish (tons)	Structure (tons)	Foundation (tons)
Castle Pines	0	0	0	0
Castle Rock	168	168	0	0
Larkspur	4	3	1	1
Lone Tree	0	0	0	0
Parker	28	26	1	1
Unincorporated County	96	70	12	13
Douglas County	**296**	**267**	**14**	**15**

Source: Hazus v6.1, Douglas County 2025; FEMA/ESRI 2025; Microsoft 2020; USGS 2020; FEMA 2021

9.2.5 Natural Resources

Floodwaters can back up sanitary sewer systems and inundate wastewater treatment plants, causing raw sewage to contaminate the flooded waterway. The contents of unsecured containers of oil, fertilizers, pesticides, and other chemicals get added to floodwaters. Hazardous materials may be released and distributed widely across the floodplain. In addition, severe erosion is likely, which can negatively impact local ecosystems.

9.2.6 Historic and Cultural Resources

Historic and cultural resources, such as historic places, community facilities, parks and open spaces, and religious institutions, are all vulnerable to impacts from flooding. Venues such as museums and historic buildings face structural damage during flood events, with additional risk of damage to important cultural artifacts housed within that are not easily replaceable. Historic structures often are not built to modern building code requirements, including design flood elevation and construction standards. Historic resources and structures were often built closely to waterways, increasing their flood risk. Floods can bring devastating loss of property to the area in and around historical landmarks.

Parks, recreation, and community space closures due to flood events can disrupt residents' lives and hinder access to critical community services. Parks and recreational areas are often located near waterways. Although these facilities often experience flooding, they are positioned with flooding in mind, as many parks are considered as open space to disallow development.

9.3 FUTURE CHANGES THAT MAY AFFECT RISK

9.3.1 Potential or Planned Development

As Douglas County evolves with changes in density, flood events may increase in frequency and/or severity due to land use changes, more structures built, and expanded impervious surface area. Any areas of growth located in the special flood hazard area could be impacted by flooding. Areas outside of the special flood hazard can also be impacted by urban flooding and less frequent and more severe flooding events.

9.3.2 Projected Changes in Population

Any changes in the density of population can create issues for residents during evacuation from a natural flood event. Historically, flooding and debris have severely impacted transportation corridors as well as infrastructure. As areas continue to be cleared for new development and runoff persists, the population in the County will remain exposed to this hazard.

9.3.3 Other Identified Conditions

The following issues were identified in Douglas County with regard to flooding:

- Flash floods and debris flows in wildfire burn areas remain a concern due to the extent of burn areas (particularly in the southwestern section of the County) and isolated, vulnerable infrastructure.
- Flood extents for the 1 percent annual chance flood will continue to evolve with any future changes in the overall pattern of storm events.

10. GEOLOGIC HAZARDS

10.1 HAZARD PROFILE

10.1.1 Hazard Description

For this HMP update, geologic hazards include erosion, expansive soils, land subsidence, and slope failure. The following sections provide general information on each of these hazards.

Erosion

Erosion is the removal of earth materials from one location by moving ice, water, waves, or wind. All material that is eroded is later deposited in another location. Deposition is the placing of the eroded material in a new location. Erosion can be a slow process that continues relatively unnoticed or can occur very rapidly. The rate is dependent on the type of soil, the local landscape, and weather conditions (USDA 2020).

In Colorado, erosion typically occurs due to water and winds, though it can also occur due to landslides, debris flows, excessive runoff, or wildfire (State of Colorado 2023). Erosion caused by water is the primary concern for Douglas County. There are three types of water erosion that can occur: sheet, rill, and gully. Sheet erosion is the most difficult to see as it is a uniform soil layer being removed from an area over the surface. Rill erosion starts as water flowing over the soil surface but then concentrates into small streams, creating channels of water flow. Gully erosion is when rill erosion is not kept under control and creates gullies (deeper and wider cuts) (USDA 2005).

Erosion occurs naturally but can be exacerbated by human activity that modifies the environment. It can be most severe where urbanization, development, recreational activities, logging and agricultural practices take place. Extreme rainfall events, lack of vegetative cover, fragile soils and steep slopes combine to accelerate erosion (NRDC 2021).

Expansive Soils

Expansive soils and heaving bedrock entail movement of underlying soil and rock resulting in changes to the earth's surface that result in damage to property and infrastructure. The deformation is localized, resulting in highly variable damage.

Expansion can occur in soils that contain minerals, such as clays, that are capable of absorbing water. Fissures in the soil can facilitate the deep penetration of water when moist conditions occur. When the soils absorb water, they increase in volume, which can exert enough force to damage a building or structure. Expansive soils shrink when they dry out, which can cause damage by removing support from structures. The cycle of swelling and shrinking soils places repetitive stress on structures so that damage can worsen over time. The shrink-swell potential of soils is determined by their linear extensibility, which is the change in length of an unconfined clod of earth or clay as moisture content changes (State of Colorado 2023).

Heaving bedrock occurs where steeply dipping sedimentary bedrock containing claystone is encountered at the ground surface. Heaving of this bedrock can be caused by differential rebound movements or swelling within the bedrock (State of Colorado 2023).

Land Subsidence

Land subsidence is the settlement of low-density soils or the sinking of land over underground voids that could be natural or manmade. It can be caused by natural sediment compaction, sinkholes, settling of mines, or the melting of permafrost. Subsidence can occur slowly or suddenly.

In Colorado, the type of subsidence of greatest concern is the settling of the ground over undermined areas such as coal or clay mines. Subsidence can also occur due to withdrawal of water from underground soils, or, in areas of collapsible soils, with the addition of water. Collapsible soils are relatively low-density materials that shrink in volume when they become wet or are subjected to great weight such as from a building or road fill. The process of collapse with the addition of water is also known as hydro-compaction (State of Colorado 2023).

Areas underlain by carbonate rock (such as limestone), salt beds, or other rocks that can be naturally dissolved by groundwater are more prone to land subsidence and sinkholes. As the rock dissolves, spaces and caverns develop underground, leading to sinkholes (USGS 2013). Areas underlain by such dissolving bedrock and where sinkholes, caves, sinking springs and similar features are present are referred to as having karst topography.

Land subsidence can occur as broad regional lowering of land surfaces or smaller local collapses. Regional lowering may aggravate flood potential or permanently inundate an area, particularly in riverine settings. Local collapse may damage or destroy buildings, roads, and utilities. Other impacts of subsidence include changes in elevation and slope of streams, canals, and drains; damage to bridges, roads, railroads, storm drains, sanitary sewers, canals, and levees; damage to private and public buildings; and failure of well casings (USGS 2019).

Slope Failure

Slope failures are any type of soil hazard that results in abrupt movements of rock, soil, or artificial fill by sliding, spreading, flowing, toppling, or falling. Common types of slope failures include the following:

- **Rock Falls—**blocks of rock that fall away from a bedrock unit without a rotational component
- **Rock Topples—**blocks of rock that fall away from a bedrock unit with a rotational component
- **Rotational Slump—**blocks of fine-grained sediment that rotate and move down slope
- **Transitional Slide—**sediments that move along a flat surface without a rotational component
- **Earth Flows—**fine-grained sediments that flow downhill and typically form a fan structure
- **Creep—**a slow-moving landslide often only noticed through crooked trees and disturbed structures
- **Block Slides—**blocks of rock that slide along a slip plane as a unit down a slope
- **Debris Avalanche—**predominately gravel, cobble, boulder, and sediment portions, and trees that move quickly down slope
- **Debris Flows—**coarse sediments that flow downhill and spread out over relatively flat areas

In Douglas County, the most common slope failures are landslides, mud/debris flows, and rockfalls. Nationwide, landslides are estimated to cause between 25 and 50 deaths and result in more than $1 billion in damage annually.

10.1.2 **Location**

Erosion

Figure 10-1 shows mapped areas of erosion risk in Douglas County. Erosion-susceptible areas are most commonly found along the County's streams and waterways. Erosion issues are exacerbated in wildfire burn areas.

Expansive Soils

Figure 10-2 shows areas of expansive soils in Colorado. In the Front Range region, which includes Douglas County, there are small and relatively isolated areas of soils with high shrink-swell potential. Rocks containing swelling clay are generally softer and less resistant to weathering and erosion than other rocks and therefore, more often occur along the sides of mountain valleys and on the plains than in the mountains. The Colorado Geological Survey classifies some lands in the northern and central part of the County as having soils of high shrink-swell potential. Heaving/dipping bedrock is common along the base of Colorado's Front Range where zones of expansive claystone are encountered near the ground surface.

Land Subsidence

Portions of Douglas County are underlain by carbonate rock or feature karst topography, as shown in Figure 10-3. A large area extends from the County's northwest boundary southeast across Highway 67 to Garber Creek and east to Roxborough State Park. Other narrow bands of carbonate rock stretch northwest from Larkspur toward Garber Creek, along the foothills near Starr Canyon, and along Trout Creek. Other karst topography is found at the confluence of West Plum Creek and Gove Creek, and in the Rainbow Falls Riding Area in Pike National Forest.

The Colorado Geological Survey identifies a few small areas of subsidence risk due to coal mines in the northwestern part of Douglas County, as well as collapsible soils throughout the northeastern half of the county,, as shown in Figure 10-4 (State of Colorado 2023). The Class 3 Hazards map in the County's 2040 Comprehensive Master Plan additionally notes subsidence areas in the vicinity of Castle Rock, including Douglas County High School, the vicinity of the Reserve at Castle Highlands Apartments, and near the intersection of 5th Street and 5th Place (Douglas County 2019).

Slope Failure

Slope failures typically occur in mountainous regions, but can also occur in low-relief areas in the form of river buff failures, lateral landslides, collapse of mine-waste piles, and cut-and-fill failures. Douglas County landslides have generally been limited to the vicinity of Larkspur in the southwestern section of the County. One cluster of landslides has been reported at Dawson Butte and the area to the southeast of Castle Rock. Another cluster was recorded in the vicinity of the Perry Park Country Club, along Dry Gulch, and along Jackson Creek near Devil's Head in the Rampart Range (Colorado Geological Survey 2022). The Hayman Creek burn area stretches from Trout Creek to the County line and may be the location of future landslides or previous unrecorded landslides since the fire (Douglas County 2021).

The Colorado Geological Survey has mapped landslide susceptibility in Douglas County using factors such as relief, slope classes, and geologic rock unit. Figure 10-5 shows the hazard area in Douglas County for slope failures and for debris flow. Susceptible areas are found along the County's buttes and mountain ridges, particularly along the Pike National Forest boundary. The Geological Survey also identified landslide deposits from LIDAR and published geologic maps. Landslide deposits were found in scattered locations across the County, such as between Lone Tree and Castle Pines North, Castlewood Canyon State Park, and Roxborough State Park.

Figure 10-1. Erosion Susceptibility in Douglas County

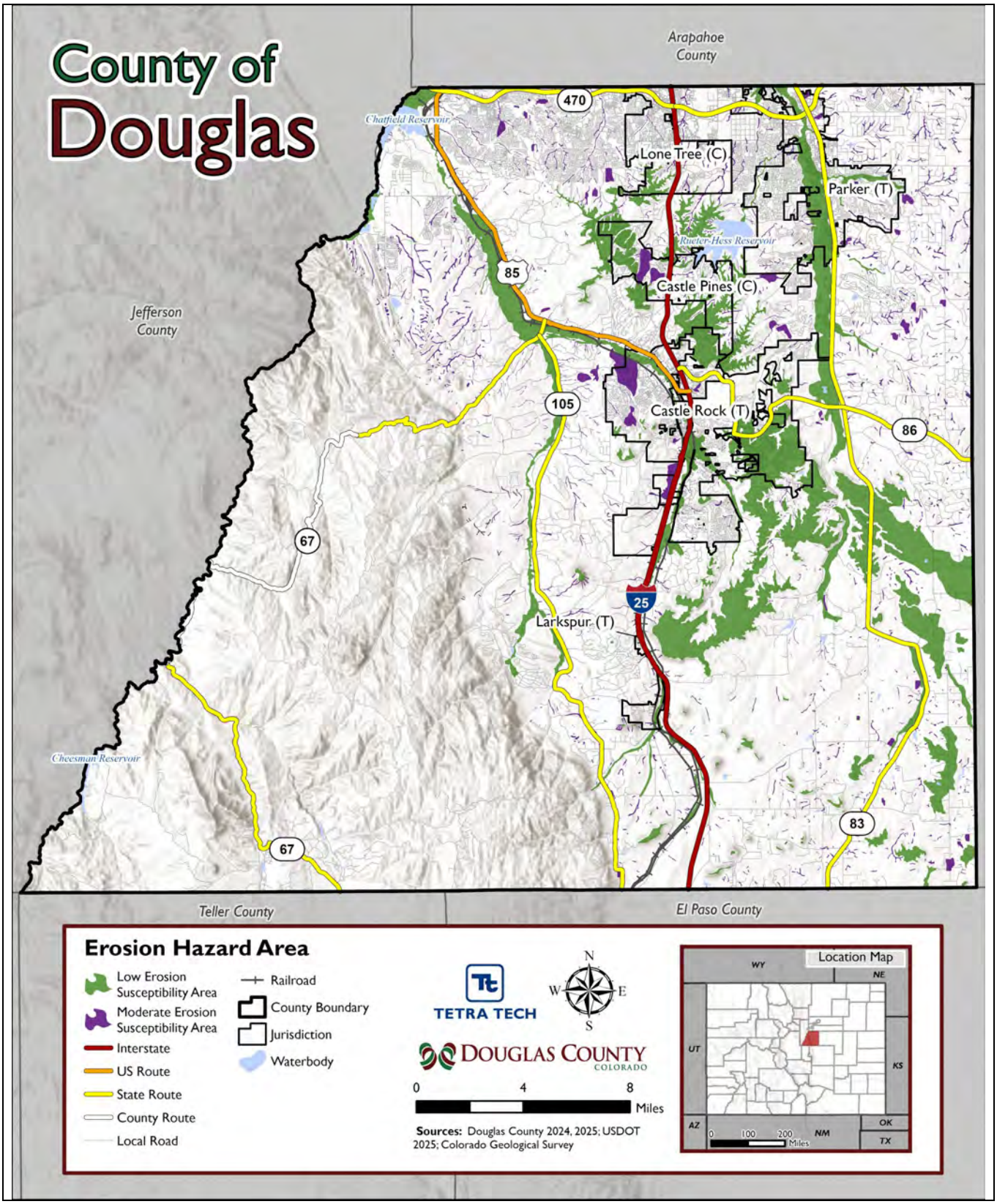
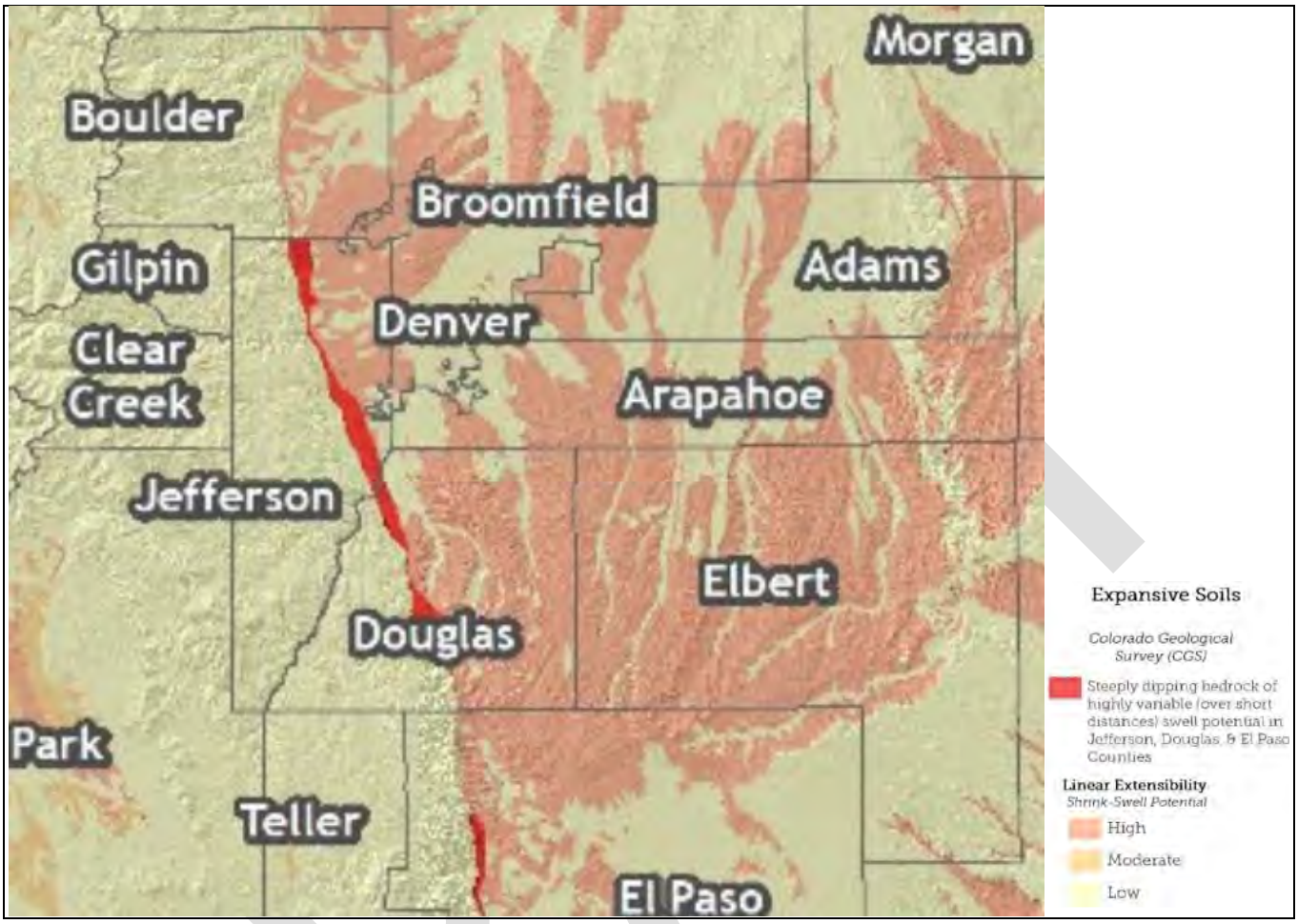


Figure 10-2. Expansive Soils in Douglas and Surrounding Counties



Source: (State of Colorado 2023)

Figure 10-3. Carbonate Rock and Karst Topography Hazard Areas

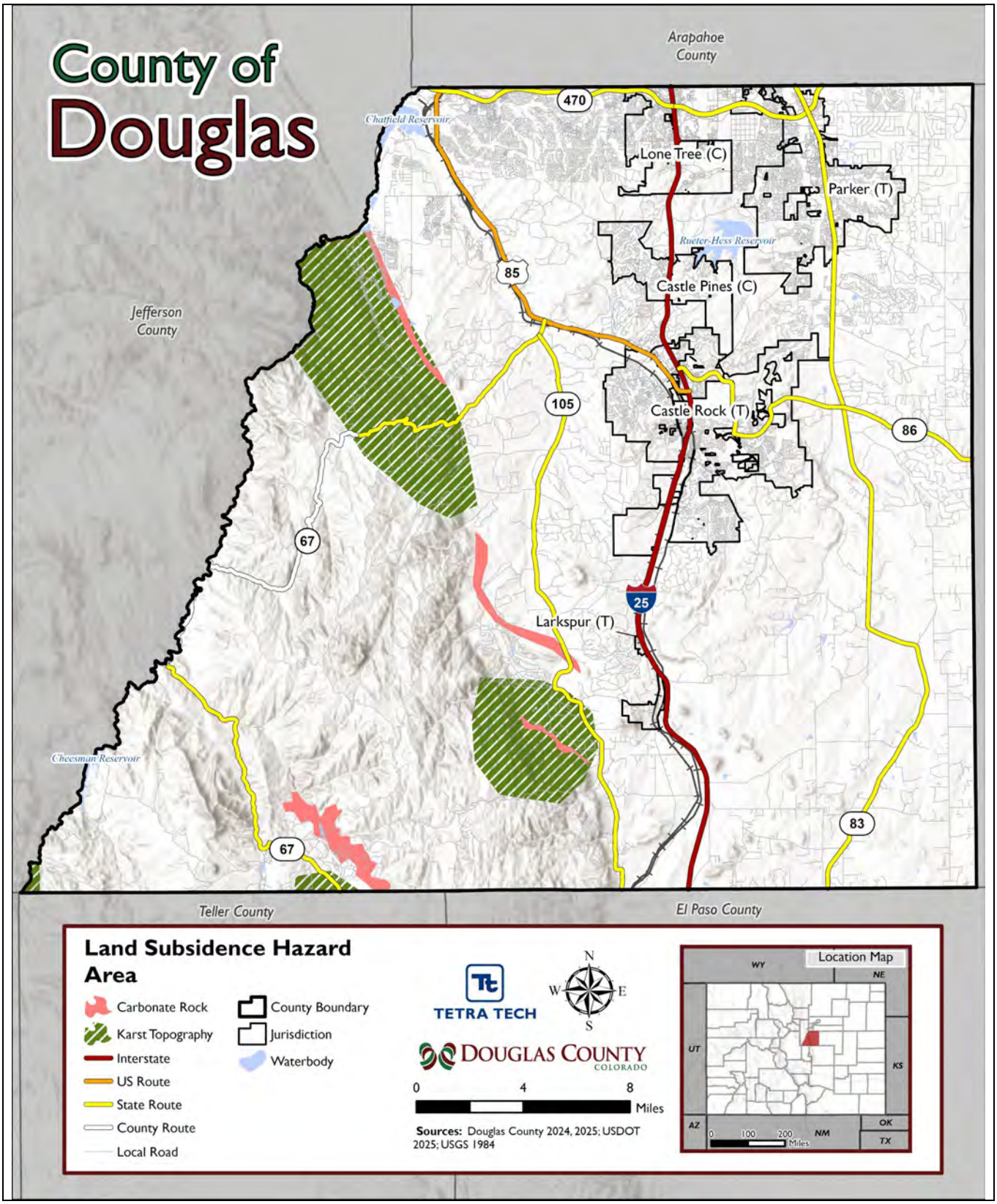
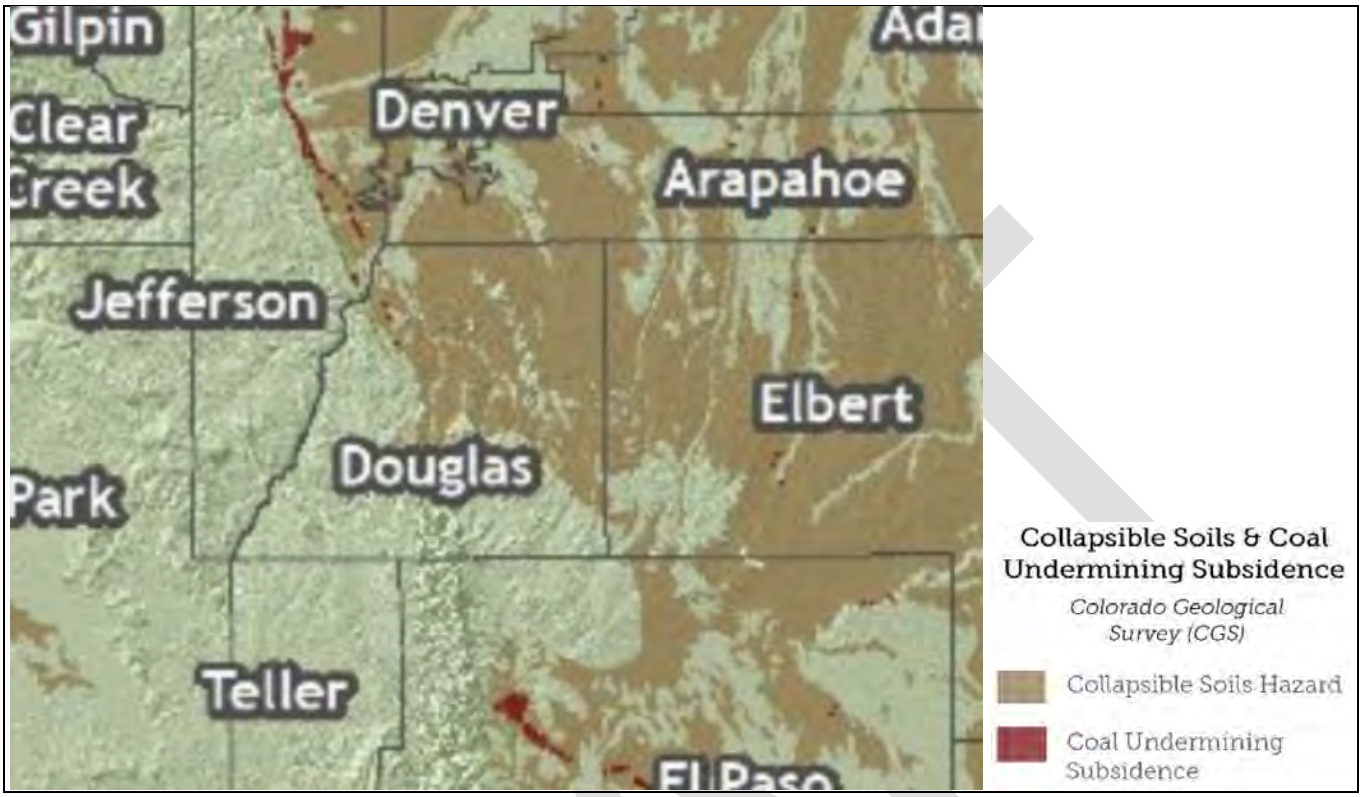
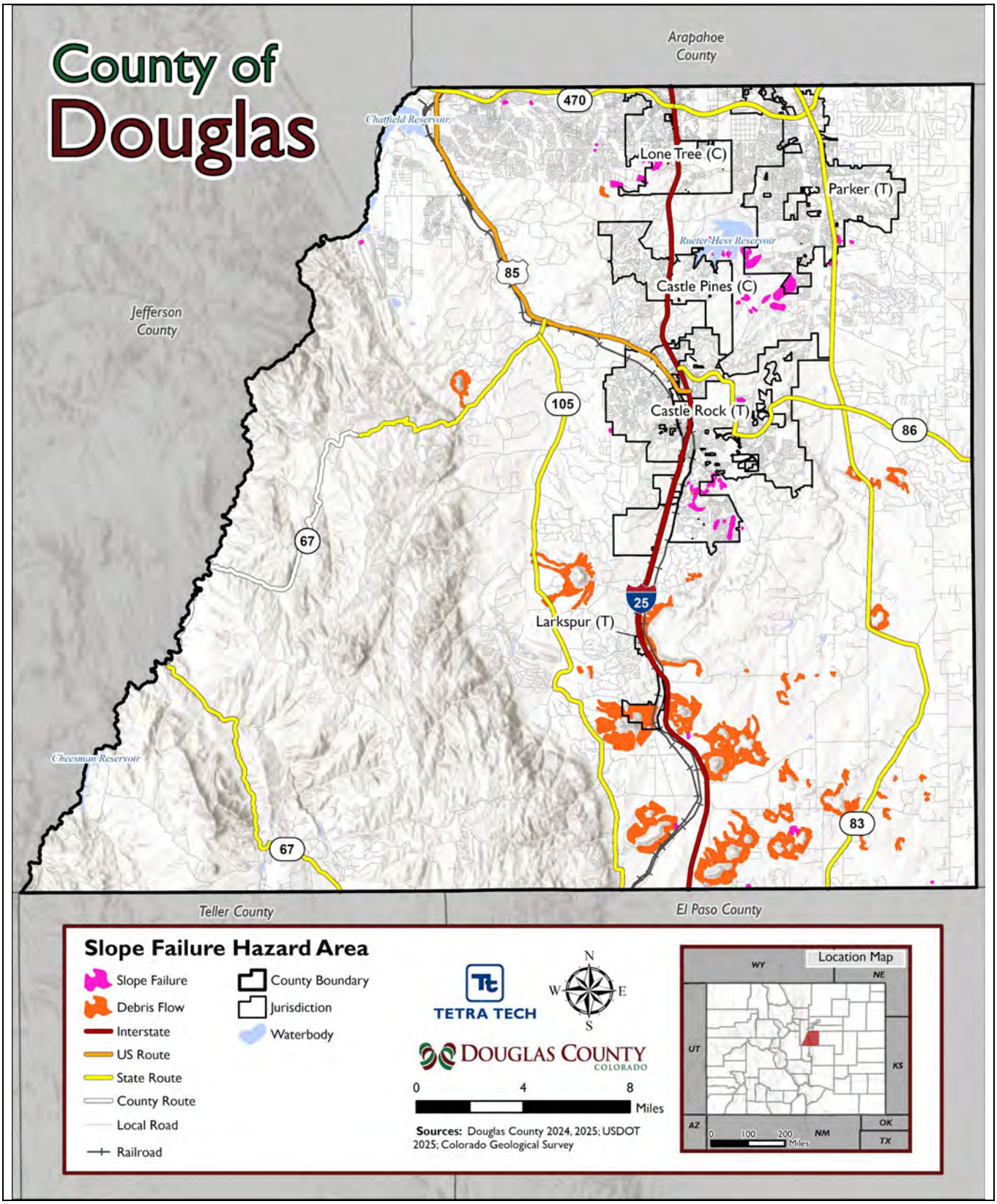


Figure 10-4. Collapsible Soils and Coal Undermining Subsidence in Douglas and Surrounding Counties



Source: (State of Colorado 2023)

Figure 10-5. Slope Failure and Debris Flow Hazard Areas in Douglas County



10.1.3 **Extent**

Erosion

Erosion and deposition occur continually at varying rates, posing threats for property, infrastructure, the natural environment, and agriculture. Sedimentation resulting from erosion can pollute surface waterways, obstruct the flow of water, and cause flooding. The extent of erosion can be generally assessed based on soil surface stability, aggregate stability, infiltration, compaction, and content of organic matter. Measuring these properties—through visual observations along with quantitative measurements—can help provide an understanding of the susceptibility of erosion at a specific location (USDA 2020). As seen in Figure 10-1, the majority of the mapped erosion hazard area in Douglas County is designated as low erosion susceptibility, though areas of moderate susceptibility have also been identified.

Expansive Soils

The extent of expansive soils is based on the presence of underlying rocks that contain swelling clay. This type of rock generally occurs in mountain valleys and plains rather than in mountainous regions. Linear extensibility determines the extent of potential damage. Expansive soils with a linear extensibility of less than 3 percent are considered to have a low shrink-swell potential; those with linear extensibility between 3 and 6 percent are considered moderate; and soils with linear extensibility greater than 6 percent are considered high (State of Colorado 2023). As shown in Figure 10-2 mapped expansive soils in Douglas County generally have a high linear extensibility.

Expansive soils are one of the nation's most prevalent causes of damage to buildings and construction. The American Society of Civil Engineers estimated annual losses of about $2.3 billion, greater than those of tornadoes, floods, earthquakes, and hurricanes combined (State of Colorado 2023). A 1999 study by the Colorado Geological Survey noted that heaving-bedrock hazards had resulted in millions of dollars in damage to suburban-style development beginning in the 1980s (State of Colorado 2023, Douglas County 2021).

Land Subsidence

Subsidence can occur abruptly or slowly and continuously over time. Sinkholes can range from steep-walled holes, to bowl, or cone-shaped depressions. When sinkholes occur in developed areas they can cause severe property damage, disruption of utilities, damage to roadways, injury, and loss of life. There are several methods used to measure land subsidence:

- Global Positioning System (GPS) is used to monitor subsidence on a regional scale.
- USGS uses radar images from earth-orbiting satellites to monitor subsidence by mapping land-surface deformation.
- Interferometric Synthetic Aperture Radar (InSAR) uses radar signals to track deformation in the earth's crust. USGS is using InSAR to map and monitor subsidence caused by compaction of aquifer systems (USDOI, USGS 2000). InSAR data can be assessed to improve understanding of subsidence processes (USGS 2019).

Natural variables that contribute to the overall extent of potential subsidence activity in any particular area include soil properties and underlaying geologic features. Much of Douglas County has both clay and sandy soils, which are susceptible to land subsidence.

Slope Failure

The extent of a landslide can be measured by the characteristics of the affected area (susceptibility) and the history of landslides (incidence). Landslide susceptibility is defined as the likely response of a geologic formation to natural or artificial cutting, to loading of slopes, or to unusually high precipitation. Unusually high precipitation or changes in existing conditions can initiate landslide movement in areas where rocks and soils have experienced numerous landslides in the past. Landslide susceptibility depends on slope angle and the geologic material underlying the slope. Much of Douglas County has both clay-rich and sandy soils, which are susceptible to landslides.

The "Landslide Overview Map of the Conterminous United States" classifies areas as having high, medium, or low landslide incidence and high, medium, or low susceptibility to landsliding (Radbruch-Hall, et al. 1982):

- Incidence:
  - High—More than 15 percent of a location's area has been involved in landsliding
  - Medium—1.5 to 15 percent of a location's area has been involved in landsliding
  - Low—Less than 1.5 percent of a location's area has been involved in landsliding
- Susceptibility:
  - High—More than 15 percent of a location's area would move in response to cutting or heavy rainfall
  - Medium—1.5 to 15 percent of a location's area would move in response to cutting or heavy rainfall
  - Low—Less than 1.5 percent of a location's area would move in response to cutting or heavy rainfall

A landslide also can be measured using the volume of material moved during the event. This is affected by the velocity of the landslide. The rate at which materials move ranges from inches per year to tens of miles per hour (mph) (USGS n.d.-c). A debris flow—a fast-moving slurry of water, rock, soil, vegetation, boulders, and trees—is triggered by short, intense periods of rainfall or rapid snowmelt, and can cause serious property damage and loss of life. A debris flow typically travels at about 10 mph but can exceed 35 mph in extreme cases (USGS 2022).

10.1.4 Previous Occurrences

FEMA Disaster Declarations

There have been no geologic hazard-related declarations for a major disaster (DR) or emergency (EM) that included Douglas County (FEMA 2025).

USDA Declarations

Between 2019 and 2024, Douglas County was not included in any USDA disaster declarations related to geologic hazards (USDA 2025).

All Recent Events

The following information regarding geologic hazards in Douglas County was obtained from local sources, the prior hazard mitigation plan update, and geological reports related to erosion events (Douglas County 2021):

- During road construction at an airport near Larkspur, improper drainage and heavy water runoff caused significant erosion (unknown year).

- In the wake of the 1996 Buffalo Creek wildfire, flash flooding in the burn area washed 160,000 cubic yards of eroded, decomposed granite into Strontia Springs at the County boundary. Erosion occurred again in the wake of the Hayman fire, impacting the Cheesman Reservoir.
- In August 2003, flash flooding occurred in the wake of heavy rains at the confluence of West Creek and Trail Creek in the Hayman Fire burn area. Drainage along Trail Creek was notably eroded, resulting in flattened vegetation.
- In August 2004, flash flooding in the Hayman Fire burn area caused mudslides that closed U.S. Highway 67 for several hours. The vicinity of the Shady Brook YMCA camp experienced erosion of culverts and roads.
- The 2021 County HMP reported occurrences of landslides in July 2007 resulting from localized flash flooding in the Hayman Fire burn area. The rock and mudslide event occurred near Trout Ranch Road.
- Ongoing erosion along Plum Creek, a tributary to the Chatfield Reservoir, has occurred due to urban runoff. In Chatfield State Park at the County's boundary, a project is being undertaken to arrest erosion.

Specific instances of occurrences of heaving bedrock and expansive soils in Douglas County were not found or reported in the 2021 Hazard Mitigation Plan Update or in the 2023 Enhanced State Hazard Mitigation Plan.

The State Hazard Mitigation Plan and the County Comprehensive Master Plan do not reference the subsidence hazard in Douglas County, but the 2015 and 2021 Douglas County Hazard Mitigation Plans reported instances of subsidence in the Castle Meadows area resulting from abandoned clay mines.

10.1.5 **Probability of Future Occurrences**

It is anticipated that erosion will continue to occur annually in Douglas County. Despite the lack of recent reported damage owing to expansive soil and heaving bedrock events in Douglas County, portions of the County remain vulnerable to damage from these soil hazards. Incidences may increase as the development continues in areas susceptible to the hazards.

Land subsidence may continue to develop from below-ground withdrawals or from other natural or man-made forces. The State of Colorado identifies abandoned mines and collapsible soils as the likely sources of future subsidence events. Land subsidence related to abandoned mines and collapsible soils result, in part, from increasing population and development trends leading to varying groundwater withdrawals, and this can lead to more incidences of land subsidence/sinkholes (State of Colorado 2023).

The underlying geologic causes of slope failures will remain in Douglas County. Though slope failures are relatively rare, the potential for future events remains and may increase due to human activity or changing weather patterns.

Based on historical records and input from the Core Planning Team, the probability of occurrence for geological hazard events in the County is considered "possible."

10.1.6 Cascading Hazards

Erosion can be exacerbated by intense flooding. Flash flooding that is common after wildfires can occur quickly in areas that were not previously prone to flood risk, causing increased erosion (Colorado DHSEM n.d.). Some of the largest debris-flow events happen during the first post-fire storm season. It takes less rainfall to trigger debris flows in areas that were burned than in areas that were not affected by fires. Fires reduce the rate in which water can permeate the soil, triggering debris flows, surface erosion, and landsliding on steep slopes. Sediment transported by erosive forces can build up in stream channels, lowering flow capacity. This leads to more frequent flooding in areas that rarely flooded in the past.

10.2 VULNERABILITY AND IMPACT ASSESSMENT

A vulnerability analysis was conducted to determine exposure of the County's assets (population, buildings, critical facilities) to three geologic hazards, using the methodology described in Section 4.3.2:

- Erosion risk was assessed for low and moderate erosion susceptibility zones mapped by the Colorado Geological Surve.
- Subsidence risk was assessed for carbonate rock and karst topography hazard areas mapped by USGS.
- Slope failure risk was assessed for debris flow and slope failure hazard areas mapped by the Colorado Geological Survey.

10.2.1 Life, Health, and Safety

Overall, an event related to geologic hazards would be an isolated incident and impact the population within the immediate area of the incident.

Erosion

As shown in Table 10-1, the Town of Castle Rock has the largest number of people living in the low and moderate erosion susceptibility hazard areas, with 19,666 with 6,680 individuals, respectively. Erosion can cause damage to residential buildings and displace residents. It can also block off or damage major roadways, inhibiting travel for emergency responders or populations trying to evacuate the area.

Table 10-1. Population Living in the Low and Moderate Erosion Susceptibility Hazard Areas

Jurisdiction	Total Population	Population in the Low Erosion Susceptibility Hazard Area		Population in the Moderate Erosion Susceptibility Hazard Area	
		Number of People	Percent of Total	Number of People	Percent of Total
Castle Pines	12,573	6,118	48.7%	2,352	18.7%
Castle Rock	76,614	19,666	25.7%	6,680	8.7%
Larkspur	171	42	24.6%	2	1.2%
Lone Tree	14,136	7	<0.1%	47	0.3%
Parker	60,115	8,205	13.6%	1,029	1.7%
Unincorporated County	204,674	6,233	3.0%	4,634	2.3%
Douglas County	**368,283**	**40,271**	**10.9%**	**14,744**	**4.0%**

Source: U.S. Census Bureau 2023 ACS; Douglas County 2025; FEMA/ESRI 2025; Microsoft 2020; Colorado Geologic Survey

Expansive Soils

The impacts of expansive soils on life, health and safety are minimal. Since the County has only a concentrated area of dipping bedrock, mainly located in undeveloped areas, the number of persons living on lands that contain expansive soils is low.

Land Subsidence

Table 10-2 summarizes the population living in the carbonate rock and karst topography hazard areas. None of this vulnerable population is in the incorporated cities. In the unincorporated county, 3.4 percent of the population lives on lands that contain karst topography and 1.0 percent lives in the carbonate rock hazard area. Overall, 8,958 persons are exposed to the land subsidence hazard areas.

Table 10-2. Population Living in the Carbonate Rock and Karst Topography Hazard Areas

Jurisdiction	Total Population	Population in the Carbonate Rock Hazard Area		Population in the Karst Topography Hazard Area	
		Number of People	Percent of Total	Number of People	Percent of Total
Castle Pines	12,573	0	0.0%	0	0.0%
Castle Rock	76,614	0	0.0%	0	0.0%
Larkspur	171	0	0.0%	0	0.0%
Lone Tree	14,136	0	0.0%	0	0.0%
Parker	60,115	0	0.0%	0	0.0%
Unincorporated County	204,674	2,064	1.0%	6,894	3.4%
Douglas County	**368,283**	**2,064**	**0.6%**	**6,894**	**1.9%**

Source: U.S. Census Bureau 2023 ACS; Douglas County 2025; FEMA/ESRI 2025; Microsoft 2020; USGS

Slope Failure

Table 10-3 shows the estimated population living in the debris-flow and slope failure hazard areas. The Town of Larkspur has the highest percentage of persons exposed to the debris flow hazard area, with 51.5 percent (88 persons). The City of Lone Tree has the highest percentage of persons exposed to the slope failure hazard area, with 1.1 percent (149 persons).

Table 10-3. Population Living in the Debris Flow and Slope Failure Hazard Areas

Jurisdiction	Total Population	Population in the Debris Flow Hazard Area		Population in the Slope Failure Hazard Area	
		Number of People	Percent of Total	Number of People	Percent of Total
Castle Pines	12,573	0	0.0%	0	0.0%
Castle Rock	76,614	22	<0.1%	633	0.8%
Larkspur	171	88	51.5%	0	0.0%
Lone Tree	14,136	0	0.0%	149	1.1%
Parker	60,115	0	0.0%	84	0.1%
Unincorporated County	204,674	735	0.4%	203	0.1%
Douglas County	**368,283**	**845**	**0.2%**	**1,069**	**0.3%**

Source: U.S. Census Bureau 2023 ACS; Douglas County 2025; FEMA/ESRI 2025; Microsoft 2020; Colorado Geological Survey

Generally, a slope failure would be an isolated incident and impact only the population within the immediate area. In addition to causing damage to residential buildings and displacing residents, landslide events can block off or damage major roadways and inhibit travel for emergency responders or populations trying to evacuate the area. Based on previous occurrences and severity in Douglas County, impacts of slope failures on life, health and safety are minimal.

10.2.2 General Building Stock

Erosion

Erosion can impact structures located along the banks of waterways, having the potential to destabilize the foundation of structures. The number and replacement cost value of structures in the moderate and low erosion hazard areas were estimated as shown in Table 10-4. In the low erosion hazard area, 14,748 buildings, with a replacement cost value of $17.9 billion, are exposed. In the moderate erosion hazard area, 5,081 buildings, with a replacement cost value of $7.7 billion, are exposed.

Table 10-4. Building Stock in the Low and Moderate Erosion Susceptibility Hazard Areas

	Buildings in the Low Erosion Susceptibility Hazard Area				Buildings in the Moderate Erosion Susceptibility Hazard Area			
	Number of Buildings		Replacement Cost Value		Number of Buildings		Replacement Cost Value	
Jurisdiction	Count	% of Total	Value	% of Total	Count	% of Total	Value	% of Total
Castle Pines	1,935	48.4%	$2,685,134,403	45.0%	748	18.7%	$889,687,641	14.9%
Castle Rock	6,512	25.8%	$7,963,062,645	24.6%	2,104	8.3%	$2,258,884,397	7.0%
Larkspur	102	24.2%	$47,602,503	29.0%	10	2.4%	$4,249,721	2.6%
Lone Tree	3	0.1%	$2,634,160	<0.1%	18	0.4%	$85,254,889	0.4%
Parker	2,620	14.3%	$3,846,994,388	14.3%	301	1.6%	$1,782,691,888	6.6%
Unincorporated County	3,576	4.1%	$3,338,934,711	2.8%	1,900	2.2%	$2,720,566,632	2.3%
Douglas County	**14,748**	**10.6%**	**$17,884,362,809**	**8.6%**	**5,081**	**3.6%**	**$7,741,335,169**	**3.7%**

Source: Douglas County 2025; FEMA/ESRI 2025; Microsoft 2020; Colorado Geological Survey; RSMeans 2024

Table 10-5 and Table 10-6 list the buildings within the low and moderate erosion hazard areas by general occupancy. Residential buildings represent the greatest number of structures in both the low erosion susceptibility hazard area and moderate erosion susceptibility hazard area, with 12,806 and 4,900 vulnerable buildings, respectively.

Expansive Soils

Residential structures and one-story commercial structures are more susceptible to damage by expansive soils than multi-story buildings because of differences in building construction. Multi-story buildings are heavier and can generally counter the swelling pressures. The exception is when multi-story buildings are built on wet clay where damage can be caused by shrinkage of the clay if moisture levels are substantially reduced by evapotranspiration or by evaporation under heated buildings.

Table 10-5. Buildings in the Low Erosion Susceptibility Hazard Area by General Occupancy Class

Jurisdiction	Buildings in the Low Erosion Susceptibility Hazard Area Hazard Area			
	Residential	Commercial	Industrial	Other
Castle Pines	1,896	36	0	3
Castle Rock	6,082	319	10	101
Larkspur	83	11	1	7
Lone Tree	2	0	0	1
Parker	2,327	209	8	76
Unincorporated County	2,416	465	62	633
Douglas County	**12,806**	**1,040**	**81**	**821**

Source: Douglas County 2025; FEMA/ESRI 2025; Microsoft 2020; Colorado Geological Survey
Note: Other = Government, Religion, Agricultural, and Education

Table 10-6. Buildings in the Moderate Erosion Susceptibility Hazard Area by General Occupancy Class

Jurisdiction	Buildings in the Moderate Erosion Susceptibility Hazard Area			
	Residential	Commercial	Industrial	Other
Castle Pines	729	3	0	16
Castle Rock	2,066	21	1	16
Larkspur	4	3	0	3
Lone Tree	13	5	0	0
Parker	292	6	0	3
Unincorporated County	1,796	54	1	49
Douglas County	**4,900**	**92**	**2**	**87**

Source: Douglas County 2025; FEMA/ESRI 2025; Microsoft 2020; Colorado Geological Survey
Note: Other = Government, Religion, Agricultural, and Education

Land Subsidence

Table 10-7 summarizes the exposed building stock in the carbonate rock and karst topography hazard areas by jurisdiction. There are 2,972 buildings, with a replacement cost value of approximately $2.5 billion, located in the karst topography hazard area countywide and 834 buildings, with a replacement cost value of approximately $719 million, in the carbonate rock hazard area.

Table 10-8 and Table 10-9 list the buildings within these hazard areas by general occupancy. Residential buildings represent the greatest number of structures in both the carbonate rock hazard area and the karst topography hazard area, with 800 and 2,672 residential buildings respectively.

Table 10-7. Building Stock in the Carbonate Rock and Karst Topography Hazard Area

Jurisdiction	Buildings in the Carbonate Rock Hazard Area				Buildings in the Karst Topography Hazard Area			
	Number of Buildings		Replacement Cost Value		Number of Buildings		Replacement Cost Value	
	Count	% of Total	Value	% of Total	Count	% of Total	Value	% of Total
Castle Pines	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Castle Rock	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Larkspur	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Lone Tree	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Parker	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Unincorporated County	834	1.0%	$719,330,913	0.6%	2,972	3.4%	$2,523,814,662	2.1%
Douglas County	**834**	**0.6%**	**$719,330,913**	**0.3%**	**2,972**	**2.1%**	**$2,523,814,662**	**1.2%**

Source: Douglas County 2025; FEMA/ESRI 2025; Microsoft 2020; USGS; RSMeans 2024

Table 10-8. Buildings in the Carbonate Rock Hazard Area by General Occupancy Class

Jurisdiction	Buildings in the Carbonate Rock Hazard Area			
	Residential	Commercial	Industrial	Other
Castle Pines	0	0	0	0
Castle Rock	0	0	0	0
Larkspur	0	0	0	0
Lone Tree	0	0	0	0
Parker	0	0	0	0
Unincorporated County	800	7	1	26
Douglas County	**800**	**7**	**1**	**26**

Source: Douglas County 2025; FEMA/ESRI 2025; Microsoft 2020; USGS
Note: Other = Government, Religion, Agricultural, and Education

Table 10-9. Buildings in the Karst Topography Hazard Area by General Occupancy Class

Jurisdiction	Buildings in the Karst Topography Hazard Area			
	Residential	Commercial	Industrial	Other
Castle Pines	0	0	0	0
Castle Rock	0	0	0	0
Larkspur	0	0	0	0
Lone Tree	0	0	0	0
Parker	0	0	0	0
Unincorporated County	2,672	143	1	156
Douglas County	**2,672**	**143**	**1**	**156**

Source: Douglas County 2025; FEMA/ESRI 2025; Microsoft 2020; USGS
Note: Other = Government, Religion, Agricultural, and Education

Slope Failure

Table 10-10 summarizes the estimated number of buildings in the slope failure and debris flow hazard areas. The Town of Castle Rock has the largest number of buildings (196) in the slope failure hazard area with an estimated replacement cost value of $213 million. Unincorporated Douglas County has the largest number of buildings in the debris flow hazard area (383), with an estimated replacement cost value of $272 million.

Table 10-10. Building Stock in the Debris Flow and Slope Failure Hazard Areas

	Buildings in the Debris Flow Hazard Area				Buildings in the Slope Failure Hazard Area			
	Number of Buildings		Replacement Cost Value		Number of Buildings		Replacement Cost Value	
Jurisdiction	Count	% of Total	Value	% of Total	Count	% of Total	Value	% of Total
Castle Pines	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Castle Rock	7	<0.1%	$8,965,541	<0.1%	196	0.8%	$213,669,010	0.7%
Larkspur	193	45.8%	$58,206,788	35.5%	0	0.0%	$0	0.0%
Lone Tree	0	0.0%	$0	0.0%	41	1.0%	$57,430,794	0.2%
Parker	0	0.0%	$0	0.0%	25	0.1%	$27,845,628	0.1%
Unincorporated County	383	0.4%	$272,286,432	0.2%	90	0.1%	$117,523,990	0.1%
Douglas County	**583**	**0.4%**	**$339,458,761**	**0.2%**	**352**	**0.3%**	**$416,469,422**	**0.2%**

Source: Douglas County 2025; FEMA/ESRI 2025; Microsoft 2020; Colorado Geological Survey; RSMeans 2024

Table 10-11 and Table 10-12 list the buildings in the debris flow and slope failure hazard areas by general occupancy. Residential buildings represent the greatest number of structures in both hazard areas, with 466 in the debris flow hazard area and 340 in the slope failure hazard area.

Table 10-11. Buildings in the Debris Flow Hazard Area by General Occupancy Class

	Buildings in the Debris Flow Hazard Area			
Jurisdiction	Residential	Commercial	Industrial	Other
Castle Pines	0	0	0	0
Castle Rock	7	0	0	0
Larkspur	174	11	1	7
Lone Tree	0	0	0	0
Parker	0	0	0	0
Unincorporated County	285	18	0	80
Douglas County	**466**	**29**	**1**	**87**

Source: Douglas County 2025; FEMA/ESRI 2025; Microsoft 2020; Colorado Geological Survey
Note: Other = Government, Religion, Agricultural, and Education

Table 10-12. Buildings in the Slope Failure Hazard Area by General Occupancy Class

	Buildings in the Slope Failure Hazard Area			
	Residential	Commercial	Industrial	Other
Castle Pines	0	0	0	0
Castle Rock	196	0	0	0
Larkspur	0	0	0	0
Lone Tree	41	0	0	0
Parker	24	0	0	1
Unincorporated County	79	6	0	5
Douglas County	**340**	**6**	**0**	**6**

Source: Douglas County 2025; FEMA/ESRI 2025; Microsoft 2020; Colorado Geological Survey
Note: Other = Government, Religion, Agricultural, and Education

10.2.3 Community Lifelines and Other Critical Facilities

Erosion

Table 10-13 summarizes the number of critical facilities in the low erosion susceptibility hazard area. Of the 2,364 critical facilities in the County, 431 are located in this hazard area. The greatest number of these (176) are in the communications lifeline category.

Table 10-14 summarizes the number of facilities in the moderate erosion susceptibility hazard area. Of the 2,364 critical facilities in the County, 36 are located in this hazard area, The water systems lifeline category and other critical facilities lifeline category having the greatest number of these (10 each).

Critical facilities exposed to the erosion hazard include potable water facilities, bridges, recreation sites, shelters, and assisted living facilities. Erosion can also impact infrastructure such as dams, roads, and other developed land.

Expansive Soils

Several critical facilities in Douglas County are located in the dipping bedrock hazard area. Soil expansion at these facilities could prevent government agencies from providing aid during emergencies, restrict residents' access to food distribution sites, or cause utility failures. Pipelines, sewer lines, and water lines that are buried in areas of expansive soils are also at risk.

Damage from expansive soils is most prevalent when periods of moderate to high rainfall are followed by drought conditions and then by additional periods of heavy rain.

Table 10-13. Number of Critical Facilities in the Low Erosion Susceptibility Hazard Area

Jurisdiction	Number of Facilities in the Low Erosion Susceptibility Hazard Area, by Lifeline Category									Total Facilities in Hazard Area	
	Communications	Energy	Food, Hydration, Shelter	Hazardous Materials	Health & Medical	Safety & Security	Transportation	Water Systems	Other Critical Facilities	Count	Percent of Total
Castle Pines	0	0	0	0	0	1	0	0	3	4	16.0%
Castle Rock	46	0	3	6	11	28	1	0	33	128	44.6%
Larkspur	0	0	0	0	1	1	0	0	5	7	21.2%
Lone Tree	2	0	0	0	0	0	0	0	0	2	1.7%
Parker	10	0	4	2	6	5	1	3	16	47	20.3%
Unincorporated County	118	0	2	10	1	10	26	23	53	243	14.6%
Douglas County	**176**	**0**	**9**	**18**	**19**	**45**	**28**	**26**	**110**	**431**	**18.2%**

Source: Douglas County 2021, 2025; CDOT 2019, 2024; CDPHE 2018, 2019, 2023, 2025; ESRI 2024, 2025; HIFLD 2025; U.S. Energy Information Administration 2024; Colorado Geological Survey

Table 10-14. Number of Critical Facilities in the Moderate Erosion Susceptibility Hazard Area

Jurisdiction	Number of Facilities in the Moderate Erosion Susceptibility Hazard Area, by Lifeline Category									Total Facilities in Hazard Area	
	Communications	Energy	Food, Hydration, Shelter	Hazardous Materials	Health & Medical	Safety & Security	Transportation	Water Systems	Other Critical Facilities	Count	Percent of Total
Castle Pines	0	0	0	0	0	1	0	0	1	2	8.0%
Castle Rock	0	0	0	0	1	2	0	0	1	4	1.4%
Larkspur	0	0	0	0	0	0	0	0	2	2	6.1%
Lone Tree	0	0	0	0	0	0	0	0	0	0	0.0%
Parker	0	0	0	0	3	0	0	0	0	3	1.3%
Unincorporated County	0	0	1	2	2	4	0	10	6	25	1.5%
Douglas County	**0**	**0**	**1**	**2**	**6**	**7**	**0**	**10**	**10**	**36**	**1.5%**

Source: Douglas County 2021, 2025; CDOT 2019, 2024; CDPHE 2018, 2019, 2023, 2025; ESRI 2024, 2025; HIFLD 2025; U.S. Energy Information Administration 2024; Colorado Geological Survey

Land Subsidence

Most of the critical facilities in the karst topography and carbonate rock hazard areas are potable water facilities, recreation sites and dams. Subsidence at the site of these facilities could cause utility failure or flood control issues if there are any breaches to dams.

Table 10-15 summarizes the number of critical facilities in the carbonate rock hazard area. Of 2,364 critical facilities in the County, 10 are in this hazard area. Five of the 10 are in the other critical facilities lifeline category.

Table 10-16 summarizes the number of critical facilities in the karst topography hazard area. Of 2,364 critical facilities in the County, 88 are in this hazard area. Almost half of those (41) are in the communications lifeline category.

Slope Failure

Critical facilities in the slope failure or debris flow hazard area include potable water facilities dams, assisted living, and medical facilities. Slope failure at the site of these facilities could impact the ability to evacuate.

Table 10-17 summarizes the number of critical facilities in the debris flow hazard area. Of the 2,364 critical facilities in the County, 19 are in this hazard area. This includes five each in the water systems and other critical facilities lifeline categories.

Table 10-18 summarizes the number of critical facilities in the slope failure hazard area. Of the 2,364 critical facilities in the County, 5 are in this hazard area. Two of these are in the water systems lifeline category.

10.2.4 Economy

Infrastructure damage is costly and can impact the local and regional economy. Geologic hazards can have the following impacts on the local economy:

- Direct costs associated with erosion include the damage sustained by buildings, property and infrastructure. Indirect costs include clean-up, business interruption, loss of tax revenues, reduced property values, and loss of productivity (USGS 2003). Taxpayers often bear the cost of removing sediment from public roads, road ditches, culverts or streams.
- The greatest damage from expansive soils is to highways and roads. For pavement, differential movement of 0.4 inches with a horizontal distance of 20 feet can pose an engineering problem for fast travel (FEMA 1997).
- Land subsidence impacts include damage sustained by buildings, property and infrastructure, along with indirect costs such as clean-up, business interruption, loss of tax revenues, reduced property values, and loss of productivity (USGS 2013).
- The slope failure and debris flow areas mapped for this hazard occur in predominantly lightly developed or undeveloped portions of Douglas County. Damage from slope failure and debris flows can impact infrastructure that supports economic activity in these areas.

Table 10-15. Number of Critical Facilities Located in the Carbonate Rock Hazard Area

Jurisdiction	Number of Facilities in the Carbonate Rock Hazard Area, by Lifeline Category									Total Facilities in Hazard Area	
	Communications	Energy	Food, Hydration, Shelter	Hazardous Materials	Health & Medical	Safety & Security	Transportation	Water Systems	Other Critical Facilities	Count	Percent of Total
Castle Pines	0	0	0	0	0	0	0	0	0	0	0.0%
Castle Rock	0	0	0	0	0	0	0	0	0	0	0.0%
Larkspur	0	0	0	0	0	0	0	0	0	0	0.0%
Lone Tree	0	0	0	0	0	0	0	0	0	0	0.0%
Parker	0	0	0	0	0	0	0	0	0	0	0.0%
Unincorporated County	0	0	0	0	0	3	0	2	5	10	0.6%
Douglas County	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**2**	**5**	**10**	**0.4%**

Source: Douglas County 2021, 2025; CDOT 2019, 2024; CDPHE 2018, 2019, 2023, 2025; ESRI 2024, 2025; HIFLD 2025; U.S. Energy Information Administration 2024; USGS 1984

Table 10-16. Number of Critical Facilities Located in the Karst Topography Hazard Area

Jurisdiction	Number of Facilities in the Karst Topography Hazard Area, by Lifeline Category									Total Facilities in Hazard Area	
	Communications	Energy	Food, Hydration, Shelter	Hazardous Materials	Health & Medical	Safety & Security	Transportation	Water Systems	Other Critical Facilities	Count	Percent of Total
Castle Pines	0	0	0	0	0	0	0	0	0	0	0.0%
Castle Rock	0	0	0	0	0	0	0	0	0	0	0.0%
Larkspur	0	0	0	0	0	0	0	0	0	0	0.0%
Lone Tree	0	0	0	0	0	0	0	0	0	0	0.0%
Parker	0	0	0	0	0	0	0	0	0	0	0.0%
Unincorporated County	41	0	0	2	0	6	0	15	24	88	5.3%
Douglas County	**41**	**0**	**0**	**2**	**0**	**6**	**0**	**15**	**24**	**88**	**3.7%**

Source: Douglas County 2021, 2025; CDOT 2019, 2024; CDPHE 2018, 2019, 2023, 2025; ESRI 2024, 2025; HIFLD 2025; U.S. Energy Information Administration 2024; USGS 1984

Table 10-17. Number of Critical Facilities Located in the Debris Flow Hazard Area

Jurisdiction	Number of Facilities in the Debris Flow Hazard Area, by Lifeline Category									Total Facilities in Hazard Area	
	Communications	Energy	Food, Hydration, Shelter	Hazardous Materials	Health & Medical	Safety & Security	Transportation	Water Systems	Other Critical Facilities	Count	Percent of Total
Castle Pines	0	0	0	0	0	0	0	0	0	0	0.0%
Castle Rock	0	0	0	0	0	0	0	0	0	0	0.0%
Larkspur	2	0	0	0	0	0	0	1	2	5	15.2%
Lone Tree	0	0	0	0	0	0	0	0	0	0	0.0%
Parker	0	0	0	0	0	0	0	0	0	0	0.0%
Unincorporated County	2	0	0	0	0	4	1	4	3	14	0.8%
Douglas County	**4**	**0**	**0**	**0**	**0**	**4**	**1**	**5**	**5**	**19**	**0.8%**

Source: Douglas County 2021, 2025; CDOT 2019, 2024; CDPHE 2018, 2019, 2023, 2025; ESRI 2024, 2025; HIFLD 2025; U.S. Energy Information Administration 2024; USGS 1984

Table 10-18. Number of Critical Facilities Located in the Slope Failure Hazard Area

Jurisdiction	Number of Facilities in the Slope Failure Hazard Area, by Lifeline Category									Total Facilities in Hazard Area	
	Communications	Energy	Food, Hydration, Shelter	Hazardous Materials	Health & Medical	Safety & Security	Transportation	Water Systems	Other Critical Facilities	Count	Percent of Total
Castle Pines	0	0	0	0	0	0	0	0	0	0	0.0%
Castle Rock	0	0	0	0	0	0	0	0	0	0	0.0%
Larkspur	0	0	0	0	0	0	0	0	0	0	0.0%
Lone Tree	0	0	0	0	0	0	0	0	0	0	0.0%
Parker	0	0	0	0	1	0	0	0	0	1	0.4%
Unincorporated County	0	0	0	0	0	1	0	2	1	4	0.2%
Douglas County	**0**	**0**	**0**	**0**	**1**	**1**	**0**	**2**	**1**	**5**	**0.2%**

Source: Douglas County 2021, 2025; CDOT 2019, 2024; CDPHE 2018, 2019, 2023, 2025; ESRI 2024, 2025; HIFLD 2025; U.S. Energy Information Administration 2024; USGS 1984

10.2.5 Natural Resources

Geologic hazards can have the following impacts on natural resources:

- The impacts of eroded landscape can travel for miles downstream into adjacent waterways and create issues for surrounding watersheds. Erosion disrupts the normal distribution of sediment in water bodies, with potential impacts on ecosystem health, including fish, invertebrates, and aquatic vegetation. Water quality of impacted water bodies can be adversely impacted (EPA 2025). According to the USDA, this includes (USDA 2005):
  - Excess nutrients cause eutrophication, a process in which excess nitrogen and phosphorus cause unwanted biological growth in water bodies.
  - Sediment makes the water cloudy. This turbidity prevents sunlight from penetrating the water and reduces photosynthesis and underwater vegetation. Oxygen levels are reduced in turbid waters, further degrading habitat for fish and other aquatic organisms.
- Expansive soils shrink and swell based on available water content. Absorbing available water could reduce water availability for surrounding ecosystems. Shrinking soils from a lack of water could create cracks in the ground, impacting rooted plants.
- A landslide or sinkhole/subsidence event will alter the landscape. Vegetation and wildlife habitats may be damaged or destroyed, and soil and sediment runoff may accumulate downslope, potentially blocking waterways and roadways and impacting quality of streams and other water bodies.
- Slides can disconnect habitats for miles, isolating animal species or tearing apart plant roots (USGS n.d.). They can have an impact on soil pores and retention of water resources. Mudflows that erode into downstream waterways can threaten the life of freshwater species. Additional environmental impacts include loss of forest productivity.

10.2.6 Historic and Cultural Resources

Geologic events affecting the County could cause loss of life and property in the areas in and around historical and cultural landmarks.

10.3 FUTURE CHANGES THAT MAY AFFECT RISK

10.3.1 Potential or Planned Development

New development can be affected by geologic hazards if it occurs in identified hazard areas. New infrastructure (e.g. highways and streets) could be impacted in areas of expansive soils or debris flow and slope failure. Proper grading and building regulations, including proper slab design and emplacement procedures, can mitigate structural damage to new development in these hazard areas. In most cases, structural damage due to expansive soils is not covered by insurance (FEMA 1997).

Due the lack of exposure and impacts from land subsidence, future development in the County is not likely to be impacted by this hazard in the short term. Future updates to this plan will have to assess any changes in the land subsidence risk.

10.3.2 **Projected Changes in Population**

The County experienced an increase in population between the 2020 Census (357,978) and the 2023 American Community Survey estimated population of 368,283. The population is expected to continue to increase over the next few years. Increasing population will lead to increasing groundwater withdrawals from surface aquifers, and this can lead to more incidences of land subsidence/sinkholes. New homes to accommodate additional people could be built in areas of slope failure or debris flow hazard areas.

Dipping bedrock is located only in Douglas County's unincorporated areas where population densities are lower. Therefore, it is not likely that as development increases there is a larger risk to expansive soils.

10.3.3 **Other Identified Conditions**

Identified issues pertaining to geologic hazards include the following:

- Erosion can cause negative environmental consequences, including water quality degradation.
- Wildfire burn areas will continue to pose erosive threats for Douglas County waterways and water supplies.
- Slope failures in Douglas County can disrupt roadways and infrastructure, creating challenges for emergency response in the event that a slope failure occurs.
- Subsidence is most likely in portions of the County that are sparsely populated. However, subsidence poses a threat to infrastructure, people, and property in these areas.
- The Douglas County 2040 Comprehensive Master Plan shows small areas of subsidence on its Class 3 hazards map. However, the Comprehensive Master Plan itself and the State Hazard Mitigation Plan do not mention collapsible soil or subsidence areas in the County.

11. HAZARDOUS MATERIALS

11.1 HAZARD PROFILE

11.1.1 Hazard Description

Hazardous material incidents involve the accidental release of substances that can pose significant risks when uncontrolled. Hazardous substances are substances that are considered severely harmful to human health and the environment, as defined by the U.S. Environmental Protection Agency (EPA) Comprehensive Environmental Response, Compensation, and Liability Act (Superfund Law). Superfund is a program administered by the U.S. EPA to locate, investigate, and clean up the worst hazardous waste sites throughout the United States. The Superfund law designates more than 800 substances as hazardous and identifies many more as potentially hazardous depending on the circumstances of their release.

Hazardous Substances as Defined in Federal Law

The Comprehensive Environmental Response, Compensation, and Liability Act defines "hazardous substance" by reference to the following authorities:

- Clean Water Act section 311 (“Hazardous Substances”)
- Clean Water Act section 307(a) (“Toxic Pollutants”)
- Clean Air Act section 112 (“Hazardous Air Pollutants”)
- Resource Conservation and Recovery Act section 3001 (“Hazardous Wastes”)
- Toxic Substance Control Act section 7 (currently no substances are designated under this authority)

Section 102(a) of the Comprehensive Environmental Response, Compensation, and Liability Act gives the EPA authority to designate additional hazardous substances not listed under the statutes cited above.

(EPA 2025)

Hazardous materials can include toxic chemicals, radioactive substances, infectious substances, and hazardous waste. Many are commonly used substances which are harmless in their normal uses but dangerous if released.

If released or misused, hazardous substances can cause death, serious injury, long-lasting health effects, and damage to structures and other properties, as well as the environment. While often accidental, releases can occur because of human carelessness, intentional acts, or natural hazards. When caused by natural hazards, these incidents are considered to be secondary events.

11.1.2 Location

Hazardous material incidents are linked to human activities such as industrial production, storage, logistics, and transport. The following information pertains to the locations of hazardous materials incidents.

Hazardous Materials Fixed Site

A fixed-site hazardous materials incident is the uncontrolled release of materials from a fixed site, capable of posing a risk to health, safety, and property Act. It is possible to identify and prepare for a fixed-site incident because federal and state laws require those facilities to notify state and local authorities about the materials being used or produced at the site. Hazardous materials at fixed sites are regulated by the EPA, which designates substances as follows:

- **Hazardous substances** are materials that, if released into the environment, tend to persist for long periods and pose long-term health hazards for living organisms.
- **Extremely hazardous substances** represent acute health hazards that, when released, are immediately dangerous to the lives of humans and animals and seriously damage the environment.

Facilities that contain these materials in quantities at or above a threshold planning quantity must submit "Tier II" information to state and/or local agencies to facilitate emergency planning. Tier II facilities in Douglas County are identified as community lifelines for this HMP update but have been redacted for this public-facing document.

Data from the Comprehensive Environmental Response, Compensation, and Liability Information System database indicates there are not any Superfund sites in Douglas County. The National Priorities List (NPL) is the list of sites of national priority among the known releases or threatened releases of hazardous substances, pollutants, or contaminants throughout the United States and its territories. Sites can be deleted from the NPL once all response actions are complete, and cleanup goals have been achieved (U.S. EPA 2022).

Hazardous Materials In-Transit

As defined in regulations by the U.S. Department of Transportation (DOT), a hazardous materials transportation incident is any event resulting in an uncontrolled release of materials during transport that can pose a risk to health, safety, and property. Transportation incidents are difficult to prepare for because there is little, if any, notice about the types of materials involved should an accident happen. The transportation of hazardous substances is regulated by DOT to prevent incidents, but accidents can still occur. Many products containing hazardous substances are used and stored in homes and these products are shipped daily on highways, railroads, waterways, and pipelines. The Federal Motor Carrier Safety Administration defines nine classes of in-transit hazardous materials incidents (FMCSA 2013):

- Class 1: Explosives
- Class 2: Gases
- Class 3: Flammable Liquid and Combustible Liquid
- Class 4: Flammable Solid, Spontaneously Combustible, and Dangerous When Wet
- Class 5: Oxidizer and Organic Peroxide
- Class 6: Poison (Toxic) and Poison Inhalation Hazard
- Class 7: Radioactive
- Class 8: Corrosive
- Class 9: Miscellaneous

Hazardous materials transportation incidents are likely to occur along corridors where high volumes of hazardous materials are transported. Transportation of hazardous materials on highways involves tanker trucks or trailers, and these are responsible for the greatest number of hazardous substance release incidents. Potential also exists for hazardous substance releases to occur along rail lines, as collisions and derailments of train cars can result in large spills.

Incidents involving hazardous materials in transit can occur anywhere in Douglas County. Recent hazardous material incidents in the County have occurred along roadways in transit and in docking areas during loading and unloading. Transportation corridors in the County that carry hazardous materials include highways, railroads, air/flight paths, pipelines, and navigable waterways. Major highways are more likely to be settings for this type

of hazard because of interstate and local commercial transport of hazardous materials. Transport vehicles do not typically travel through residential areas unless enroute to destinations such as a gasoline service station or storage facility. The following are the main areas of concern in Douglas County for in-transit hazardous materials:

- Major roadways include Interstate 25, US-85, and Colorado State Routes 83, 86, 67, and 105.
- BNSF Railway and the Union Pacific Railroad carry freight through Douglas County.
- The Magellan Pipeline Company's Rocky Mountain pipeline for refined oil enters from the southeast corner of the County and runs along State Route 83 into Centennial. The Phillips 66 Pipeline that carries refined crude oil between Borger and Denver crosses through a small portion of the County in Ponderosa East.
- The Colorado Interstate Gas Company's Pueblo-Watkins Mainline natural gas enters the County in the southeast corner and travels north. East of Castlewood Canyons and the Pinery, the Palmer Divide Mainline joins with the Pueblo-Watkins Mainline which runs north to the City of Aurora. South of the pinery, a natural gas loop owned by Black Hills Energy runs west to Castle Rock. A natural gas pipeline operated by the Public Service Company of Colorado divides in the Town of Parker, with one line running west to Highlands Ranch and one running north to Cottonwood.

Hazard Areas for Risk Assessment

To assess risk associated with hazardous materials for this HMP updates, hazard areas were defined as buffer areas surrounding four types of hazardous materials sites: major roadways, rail lines, and pipelines. These infrastructure datasets were provided by Douglas County, and a 1-mile buffer was mapped around each of them. Figure 11-1 shows these hazardous materials hazard areas.

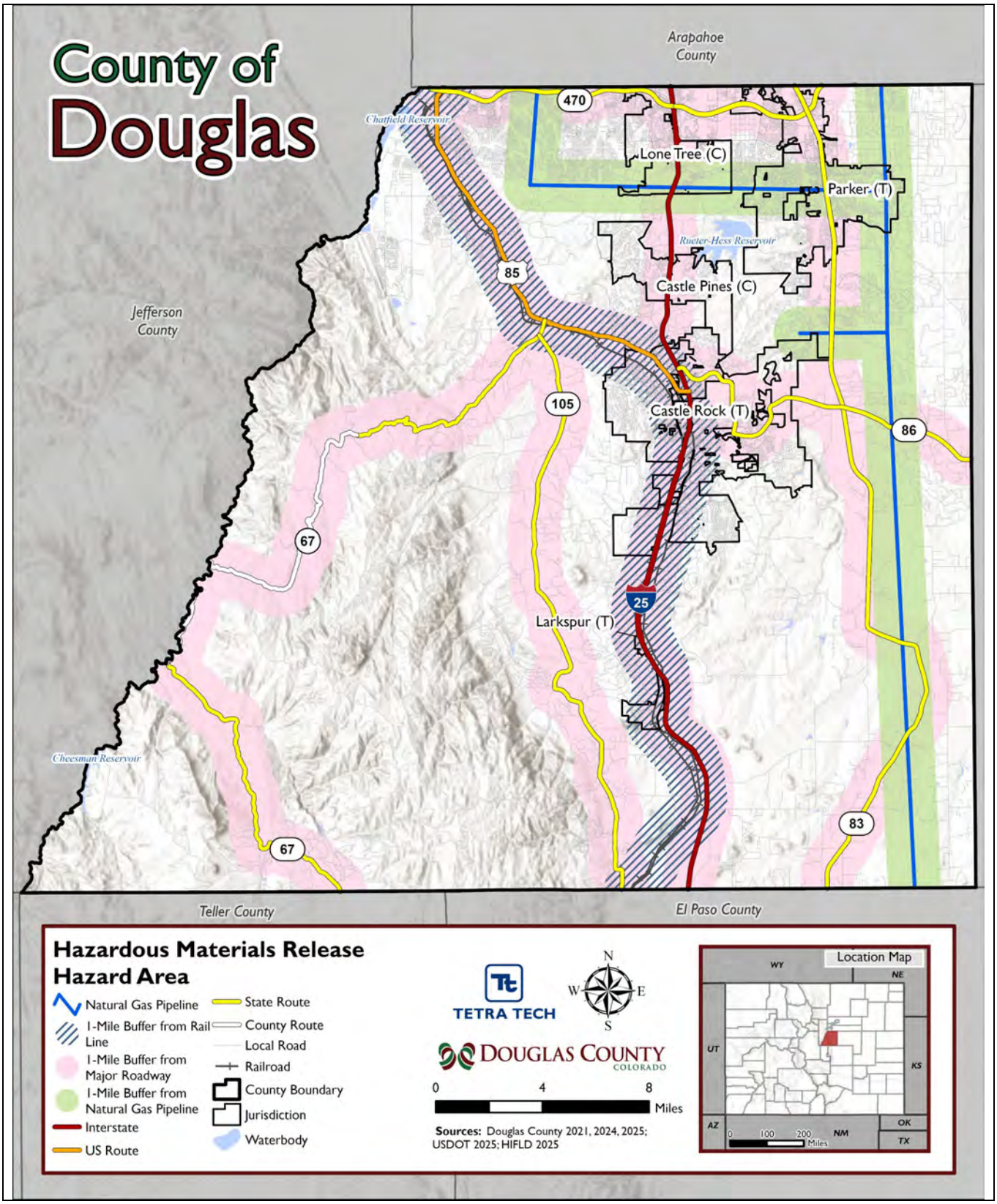
11.1.3 Extent

The extent of a hazardous substance release depends on the toxicity and properties of the substance released, the duration of the release, environmental conditions (for example, wind and precipitation, terrain, etc.), and any mitigating or exacerbating circumstances. Mitigation involves precautionary measures taken in advance to reduce the impact of a release on the surrounding environment. For example, primary and secondary containment or shielding by implementation of sheltering-in-place protects people and property from the harmful effects of a hazardous substance release. Exacerbating conditions—characteristics that can magnify the effects of a hazardous substance release—include the following:

- Weather conditions, which affect how the hazard occurs and develops; dispersion can occur rapidly when the hazardous substance is transported by water and wind
- Micro-meteorological effects of buildings and terrain, which alter dispersion of hazardous materials in compliance with applicable codes (such as building or fire codes)
- Maintenance failures (such as fire protection and containment features), which can substantially increase damage to a facility and to surrounding buildings

The severity of an incident also depends on distance from the release and the response time of emergency response teams. Areas closest to a release are generally at greatest risk; however, depending on the substance, a release can travel great distances or remain present in the environment for months or years.

Figure 11-1. Hazardous Materials Hazard Area in Douglas County



A hazardous materials incident can be sudden and occur without any warning, such as an explosion, or may develop slowly, such as a leaking container. Facilities that store extremely hazardous substances are required to notify local officials when an incident occurs. Local emergency responders and emergency management officials would determine whether they need to evacuate the public or advise the public to shelter in place. The warning time for in-transit hazardous substance incidents varies with the nature of the incident. If an explosion did not occur immediately following an accident, officials may have time to warn adjacent neighborhoods and facilitate appropriate protective actions.

11.1.4 Previous Occurrences

FEMA Disaster Declarations

There have been no hazardous-materials-related declarations for a major disaster (DR) or emergency (EM) that included Douglas County (FEMA 2025).

USDA Declarations

Between 2019 and 2024, Douglas County was not included in any USDA disaster declarations related to hazardous materials (USDA 2025).

All Recent Events

Table 11-1 lists major recorded hazardous materials-related events reported from the U.S. DOT Pipeline and Hazardous Materials Safety Administration (PHMSA) that impacted Douglas County since 2019. For earlier events, refer to the previous HMP.

Table 11-1. PHMSA Reported Hazardous Materials Events in Douglas County, 2019 to 2025

Event Date	Event Type	Report Number	Declaration Number	Location Impacted	Description
July 24, 2019	Corrosive Liquid Spill	E-2019080036	N/A	Lone Tree	During loading, freight was struck with equipment, causing damage that resulted in a release of product. Dock personnel recovered released product with absorbents and placed into a container for proper disposal.
March 30, 2020	Fuel Oil Spill	E-2020040516	N/A	Parker	Driver walking off hose and spilled 1 gallon of diesel. Driver cleaned up with absorbent pads.
May 5, 2020	Elevated Temperature Liquid Spill	E-2020100479	N/A	Castle Rock	During unloading, the consignee had the pump running backward, causing the trailer to overfill and spill 20-25 gallons of product. The driver stated the consignee was cleaning.
July 16, 2020	Elevated Temperature Liquid Spill	E-2021010657	N/A	Castle Rock	Driver stated the customer said they could take 3 loads, but they could only take 2 3/4 and their tank overfilled, spilling about 300 gallons of asphalt. Driver came back and finished the unloading. Customer had most of the spill cleaned up. It spilled upon sand and aggregate material.

Event Date	Event Type	Report Number	Declaration Number	Location Impacted	Description
August 20, 2020	Elevated Temperature Liquid Spill	E-2021020106	N/A	Castle Rock	Driver stated that during offloading at customer they could not hold all of the product. They knew this up front and the customer is the one that shut off the tank when it overfilled in containment. About 20 to 30 gallons of asphalt spilled into the containment area, and customer acknowledged that it was their error.
June 15, 2021	Elevated Temperature Liquid Spill	E-2021100436	N/A	Castle Rock	Customer stated they could handle the amount ordered, but when it was unloaded the tank overfilled causing the spill of 30 to 40 gallons of asphalt that spilled onto the dirt.
June 30, 2021	Elevated Temperature Liquid Spill	E-2021110606	N/A	Castle Rock	During unloading at the consignee, the operator left a valve open that caused product to flow into another tank of asphalt creating an overfill of 300 gallons of asphalt which the consignee cleaned up and took responsibility for.
July 6, 2021	Elevated Temperature Liquid Spill	E-2021120728	N/A	Castle Rock	Tank overfilled spilling about 50 gallons of asphalt. Customer directed driver to the tank to unload to. Customer handled the cleanup.
April 8, 2022	Battery Acid Spill	I-2022050237	N/A	Parker	A battery fell off the lift gate during delivery and was damaged. The release was properly managed. The damaged battery was secured and held pending disposition from the shipper.
July 11, 2022	Battery Acid Spill	I-2022090279	N/A	Parker	Battery leaked in transit.
September 20, 2022	Gasoline Spill	E-2022090834	N/A	Castle Rock	Driver unloading heard a "pop" and shut down the trailer. Hose had cracked, spilling approximately 5 to 10 gallons of gas. Driver cleaned up.
April 7, 2023	Gasohol Spill	E-2023050131	N/A	Parker	While delivering unleaded gasoline, driver switched compartments and resumed delivery. Internal overfill flap in tank closed causing drop fitting to detach from tank spilling about 5 gallons of gasoline onto the cement.
December 7, 2023	Gasoline Spill	E-2024010114	N/A	Castle Rock	Driver did not have a secure connection on hose, spilling 1/2 gallon of gas. Cleaned up with absorbent pads.

Source: (PHMSA 2025)

11.1.5 **Probability of Future Occurrences**

Information on previous hazardous materials incidents in the County was used to calculate the probability of future occurrence of such events. Table 11-2 lists the number of events from various sources over the 38-year

period from 1987 to 2025, which is the most complete period of record for all sources reviewed. Based on these records and input from the Core Planning Team, the probability of occurrence for hazardous materials incidents in the County is considered "possible."

Table 11-2. Probability of Future Hazardous Materials Spill Events in Douglas County

Hazard Type	Number of Occurrences Between 1987 and 2025	% Chance of Occurring in Any Given Year
Hazardous Materials Spill	40	100%

Source: (PHMSA 2025)

Note: 100% probability indicates that it is statistically likely for an event to occur every year. It does not indicate that the occurrence of an event is a certainty in any given year.

11.1.6 Cascading Hazards

Hazardous materials releases can result in fires, leading to structural impacts on nearby buildings. Flammable gases, combustible materials, and electrical hazards are examples of hazardous materials that can result in a fire. Mixed-use areas within the County may be more at risk of a fire caused by a hazardous materials release.

Hazardous materials can be stored in a variety of locations, including at industrial facilities, hospitals, gas stations, and even residential properties. The improper storage of these materials can result in an incident that can cause substantial structural damage. Structural damage to any building has the potential to lead to a collapse of the site, which can cause additional harm to surrounding structures, infrastructure, and nearby persons.

11.2 VULNERABILITY AND IMPACT ASSESSMENT

Hazardous materials were quantitatively analyzed using the mapping of buffer areas around hazardous materials sites as shown on Figure 11-1. To determine what assets are exposed to hazardous materials, the buffered infrastructure datasets were overlaid with the asset inventories (population, general building stock, critical facilities), as described in Section 4.3.2.

11.2.1 Life, Health, and Safety

The general population may be exposed to a hazardous materials release through inhalation, ingestion, or dermal exposure. Exposure may be either acute or chronic, depending upon the nature of the substance and the extent of release and contamination. Populations particularly vulnerable to the effects of hazardous materials incidents are those living near hazardous materials sites and along major transportation routes where significant quantities of chemicals are transported.

Table 11-3 and Table 11-4 summarize population vulnerability to hazardous materials incidents by jurisdiction. According to this analysis, there are 155,859 persons, 50,720 persons, and 106,835 persons living within 1 mile of all roadways, railways, and pipelines, respectively. Unincorporated Douglas County has the highest number of residents living within 1 mile of all roadways (79,807 persons) and within 1 mile of all pipelines (61,007 persons). Castle Rock has the greatest number of people living within 1 mile of all railways (31,401 persons).

Table 11-3. Population in the Hazardous Materials Roadway and Railway Buffer Hazard Areas

Jurisdiction	Total Population (2023 ACS)	Population Vulnerable to Hazardous Material Incidents			
		Within 1 Mile of Hazardous Materials Roadways		Within 1 Mile of Hazardous Materials Railways	
		Number of People	Percent of Total	Number of People	Percent of Total
Castle Pines	12,573	2,607	20.7%	0	0.0%
Castle Rock	76,614	39,201	51.2%	31,401	41.0%
Larkspur	171	111	64.9%	171	100.0%
Lone Tree	14,136	8,032	56.8%	0	0.0%
Parker	60,115	26,101	43.4%	0	0.0%
Unincorporated County	204,674	79,807	39.0%	19,148	9.4%
Douglas County	**368,283**	**155,859**	**42.3%**	**50,720**	**13.8%**

Source: U.S. Census Bureau 2023; Douglas County 2025; FEMA/ESRI 2025; Microsoft 2020; USDOT 2025

Table 11-4. Population in the Hazardous Materials Pipeline Buffer Hazard Areas

	Total Population (2023 ACS)	Population Vulnerable to Hazardous Material Incidents	
		Within 1 Mile of Hazardous Materials Pipeline	
		Number of People	Percent of Total
Castle Pines	12,573	0	0.0%
Castle Rock	76,614	3,055	4.0%
Larkspur	171	0	0.0%
Lone Tree	14,136	829	5.9%
Parker	60,115	41,944	69.8%
Unincorporated County	204,674	61,007	29.8%
Douglas County	**368,283**	**106,835**	**29.0%**

Source: U.S. Census Bureau 2023; Douglas County 2025; FEMA/ESRI 2025; Microsoft 2020; USDOT 2025; HIFLD 2025

Hazardous materials incidents can lead to injury, illness, and/or death of and those living or working within the impacted areas. Specific impacts vary according to the type of material released, the area affected, and the population within the affected area. A chemical incident may also include an explosion, with additional injuries and deaths being caused by the pressure wave. Biological agents may cause disease from which some individuals will recover while others will not. Large chemical incidents can contaminate sources of potable water, crops, and livestock, leading to a reduced local food supply.

11.2.2 General Building Stock

The number and value of general building stock structures in the mapped hazardous materials buffer areas are listed in Table 11-5 through Table 11-7.

Table 11-5. Structures in the 1-Mile Hazardous Materials Roadway Buffer Hazard Area

Jurisdiction	Jurisdiction Total Buildings		Number of Buildings		Replacement Cost Value	
	Count	Replacement Cost Value	Count	% of Total	Value	% of Total
Castle Pines	4,000	$5,969,347,390	862	21.6%	$1,541,534,375	25.8%
Castle Rock	25,199	$32,358,886,100	13,486	53.5%	$19,890,601,737	61.5%
Larkspur	421	$164,181,514	292	69.4%	$131,744,019	80.2%
Lone Tree	4,285	$24,279,214,512	2,560	59.7%	$21,355,696,322	88.0%
Parker	18,275	$26,842,000,546	8,463	46.3%	$15,529,451,507	57.9%
Unincorporated County	87,526	$117,775,978,929	35,492	40.6%	$60,345,012,408	51.2%
Douglas County	**139,706**	**$207,389,608,991**	**61,155**	**43.8%**	**$118,794,040,368**	**57.3%**

Source: Douglas County 2025, FEMA; Microsoft 2020; RSMeans 2024

Table 11-6. Structures in the 1-Mile Hazardous Materials Railway Buffer Hazard Area

Jurisdiction	Jurisdiction Total Buildings		Number of Buildings		Replacement Cost Value	
	Count	Replacement Cost Value	Count	% of Total	Value	% of Total
Castle Pines	4,000	$5,969,347,390	0	0.0%	$0	0.0%
Castle Rock	25,199	$32,358,886,100	11,040	43.8%	$17,054,610,352	52.7%
Larkspur	421	$164,181,514	421	100.0%	$164,181,514	100.0%
Lone Tree	4,285	$24,279,214,512	0	0.0%	$0	0.0%
Parker	18,275	$26,842,000,546	0	0.0%	$0	0.0%
Unincorporated County	87,526	$117,775,978,929	8,945	10.2%	$12,760,294,497	10.8%
Douglas County	**139,706**	**$207,389,608,991**	**20,406**	**14.6%**	**$29,979,086,363**	**14.5%**

Source: Douglas County 2025; FEMA/ESRI 2025, Microsoft 2020; USDOT 2025; RSMeans 2024

Table 11-7. Structures in the 1-Mile Hazardous Materials Pipeline Buffer Hazard Area

Jurisdiction	Jurisdiction Total Buildings		Number of Buildings		Replacement Cost Value	
	Count	Replacement Cost Value	Count	% of Total	Value	% of Total
Castle Pines	4,000	$5,969,347,390	0	0.0%	$0	0.0%
Castle Rock	25,199	$32,358,886,100	950	3.8%	$993,000,961	3.1%
Larkspur	421	$164,181,514	0	0.0%	$0	0.0%
Lone Tree	4,285	$24,279,214,512	241	5.6%	$680,317,455	2.8%
Parker	18,275	$26,842,000,546	12,354	67.6%	$15,955,721,466	59.4%
Unincorporated County	87,526	$117,775,978,929	24,594	28.1%	$31,242,968,505	26.5%
Douglas County	**139,706**	**$207,389,608,991**	**38,139**	**27.3%**	**$48,872,008,387**	**23.6%**

Source: Douglas County 2025; FEMA/ESRI 2025, Microsoft 2020; HIFLD2025; RSMeans 2024

The vulnerability analysis indicates approximately 61,000 buildings with an estimated value of $119 billion within 1 mile of all roadways; 20,000 buildings with an estimated value of $30 billion within 1 mile of all railways; and

38,000 buildings with an estimated value of $49 billion within 1 mile of all pipelines. Unincorporated Douglas County has the greatest number of buildings within 1 mile of all roadways (35,492) and pipelines (24,594), while Castle Rock has the greatest number of buildings within 1 mile of all railways (11,040).

Table 11-8 through Table 11-10 list the buildings within the hazardous materials hazard areas by general occupancy class. Residential buildings account for the greatest number of structures within 1 mile of roadways (53,681), 1 mile of railways (17,469), and 1 mile of pipelines (36,711).

Hazardous materials can pose a long-term threat to property, particularly to the fixed-site facilities where hazardous materials are stored. Potential damage to property caused by a hazardous materials release may include inaccessibility, loss of service, contamination, and/or damage to the structure or contents. Local building stock characteristics and the type of substance released during a spill will greatly affect the extent of property damage. For example, a very small chemical spill in a less populated area would be much less costly and possibly limited to remediation of soil. The impact of a fixed-facility incident will often be localized to the property where it occurs.

Table 11-8. Buildings in the 1-Mile Hazardous Materials Roadway Buffer Hazard Area by Occupancy Class

Jurisdiction	Buildings in the 1-Mile Hazardous Materials Roadway Buffer Hazard Area			
	Residential	Commercial	Industrial	Other
Castle Pines	808	31	0	23
Castle Rock	12,123	1,032	76	255
Larkspur	219	44	3	26
Lone Tree	2,199	310	3	48
Parker	7,402	777	77	207
Unincorporated County	30,930	2,484	256	1,822
Douglas County	**53,681**	**4,678**	**415**	**2,381**

Source: Douglas County 2025, FEMA/EMA/ESRI 2025; Microsoft 2020
Note: Other = Government, Religion, Agricultural, and Education

Table 11-9. Buildings in the 1-Mile Hazardous Materials Railway Buffer Hazard Area by Occupancy Class

Jurisdiction	Buildings in the 1-Mile Hazardous Materials Railway Buffer Hazard Area			
	Residential	Commercial	Industrial	Other
Castle Pines	0	0	0	0
Castle Rock	9,711	1,026	76	227
Larkspur	337	52	3	29
Lone Tree	0	0	0	0
Parker	0	0	0	0
Unincorporated County	7,421	863	210	451
Douglas County	**17,469**	**1,941**	**289**	**707**

Source: Douglas County 2025, FEMA/ESRI 2025, Microsoft 2020; USDOT 2025
Note: Other = Government, Religion, Agricultural, and Education

Table 11-10. Buildings in the 1 Mile Hazardous Materials Pipeline Buffer Hazard Area by Occupancy Class

Jurisdiction	Buildings in the 1 Mile Hazardous Materials Pipeline Buffer Hazard Area			
	Residential	Commercial	Industrial	Other
Castle Pines	0	0	0	0
Castle Rock	945	1	0	4
Larkspur	0	0	0	0
Lone Tree	227	10	0	4
Parker	11,895	305	11	143
Unincorporated County	23,644	450	1	499
Douglas County	**36,711**	**766**	**12**	**650**

Source: Douglas County 2025; FEMA/ESRI 2025; Microsoft 2020; HIFLD 2025
Note: Other = Government, Religion, Agricultural, and Education

11.2.3 Community Lifelines and Other Critical Facilities

Potential impacts on critical facilities due to a hazardous materials incident may include inaccessibility, loss of service, contamination, or damage to structures and contents if an explosion occurs. If the operators at a critical piece of infrastructure such as a power plant are unavailable, there could be physical damage to the infrastructure itself. Hazardous materials incidents can lead to major transportation route closures in the County.

Table 11-11 summarizes the number of critical facilities in the 1-mile hazardous materials roadway buffer hazard area. Of the 2,363 critical facilities in the County, 1,496 are located in this hazard area. This includes 403 facilities in the other critical facilities category and 382 facilities in the communication category.

Table 11-12 shows the number of lifeline facilities by category in the 1-mile hazardous materials railway buffer hazard area. Of the 2,363 critical facilities in the County, 543 are located in this hazard area. This includes 143 facilities in the other critical facilities category and 113 facilities in the communication category.

Table 11-13 shows the number of lifeline facilities by category in the 1-mile hazardous materials pipeline buffer hazard area. Of the 2,363 critical facilities in the County, 415 are located in this hazard area. This includes 109 facilities in the water systems category and 106 facilities in the other critical facilities category.

11.2.4 Economy

A significant hazardous materials incident in a developed area may force businesses to close for an extended period because of contamination or direct damage. Costs associated with product loss, property damage, and decontamination can add up to millions of dollars. It may also prevent workers from commuting or consumers from traveling to businesses. As businesses close and tourists are prohibited from entering the affected area, tourism may decline, and public perception of the area may be permanently affected.

In-transit hazardous materials incidents can impact the companies transporting the materials as well as facilities surrounding the location of the incident. A hazardous materials incident can quickly become costly due to the cost of responders, response equipment, and clean-up. The closure of railroads, airports, and highways as a result of a hazardous materials incident has the potential to impact the ability to deliver goods and services

efficiently. Potential impacts may be local, regional, or statewide, depending on the magnitude of the event and level of service disruptions.

11.2.5 Natural Resources

Hazardous materials incidents can have obvious, immediate environmental impact as well as long-term, hidden impacts. Spilled hazardous substances can contaminate wells, kill wildlife, and harm ecosystems. Water pollution is an immediate concern for fish and wildlife. Some pollutants can bio-accumulate, affecting animals high on the food chain long after a spill. Hazardous waste can leach into soils and travel with wind, so that impacts extend beyond the localized habitat to surrounding communities. Strict disposal regulations have been defined by the EPA to ensure that the environment is protected from such events (EPA 2023). Hazardous materials incidents could significantly impact soils, requiring expensive remediation.

11.2.6 Historic and Cultural Resources

Hazardous material releases can pose a serious long-term threat to nearby historic or cultural resources. Historic sites are typically not built to modern building codes, making them susceptible to damage. These sites often cannot be easily moved or upgraded without getting special permits. Cultural events and/or festivals often take place in outdoor areas. A hazardous materials incident could impact the participants or visitors at these events or result in the event or festival becoming postponed or cancelled.

Table 11-11. Critical Facilities in the 1-Mile Hazardous Materials Roadway Buffer Hazard Area

Jurisdiction	Number of Facilities in 1-Mile Hazardous Materials Roadway Buffer Hazard Area, by Lifeline Category									Total Facilities in Hazard Area	
	Communications	Energy	Food, Hydration, Shelter	Hazardous Materials	Health & Medical	Safety & Security	Transportation	Water Systems	Other Critical Facilities	Count	Percent of Total
Castle Pines	0	0	2	0	1	2	0	1	10	16	64.0%
Castle Rock	74	0	9	15	31	47	18	1	59	254	88.5%
Larkspur	2	0	0	0	1	2	0	3	14	22	66.7%
Lone Tree	20	0	5	12	22	6	22	1	23	111	92.5%
Parker	37	0	9	9	31	17	4	5	60	172	74.5%
Unincorporated County	249	0	9	58	42	94	99	133	237	921	55.2%
Douglas County	**382**	**0**	**34**	**94**	**128**	**168**	**143**	**144**	**403**	**1496**	**63.3%**

Source: Douglas County 2021, 2025; CDOT 2019, 2024; CDPHE 2018, 2019, 2023, 2025; ESRI 2024, 2025; HIFLD 2025; U.S. Energy Information Administration 2024

Table 11-12. Critical Facilities in the 1-Mile Hazardous Materials Railway Buffer Hazard Area

Jurisdiction	Number of Facilities in 1-Mile Hazardous Materials Railway Buffer Hazard Area, by Lifeline Category									Total Facilities in Hazard Area	
	Communications	Energy	Food, Hydration, Shelter	Hazardous Materials	Health & Medical	Safety & Security	Transportation	Water Systems	Other Critical Facilities	Count	Percent of Total
Castle Pines	0	0	0	0	0	0	0	0	0	0	0.0%
Castle Rock	58	0	8	12	29	40	18	1	57	223	77.7%
Larkspur	11	0	0	0	1	2	0	4	15	33	100.0%
Lone Tree	0	0	0	0	0	0	0	0	0	0	0.0%
Parker	0	0	0	0	0	0	0	0	0	0	0.0%
Unincorporated County	44	0	2	29	5	32	56	48	71	287	17.2%
Douglas County	**113**	**0**	**10**	**41**	**35**	**74**	**74**	**53**	**143**	**543**	**23.0%**

Source: Douglas County 2021, 2025; CDOT 2019, 2024; CDPHE 2018, 2019, 2023, 2025; ESRI 2024, 2025; HIFLD 2025; U.S. Energy Information Administration 2024; USDOT 2025

Table 11-13. Critical Facilities in the 1 Mile Hazardous Materials Pipeline Buffer Hazard Area

Jurisdiction	Number of Facilities in 1 Mile Hazardous Materials Pipeline Buffer Hazard Area, by Lifeline Category									Total Facilities in Hazard Area	
	Communications	Energy	Food, Hydration, Shelter	Hazardous Materials	Health & Medical	Safety & Security	Transportation	Water Systems	Other Critical Facilities	Count	Percent of Total
Castle Pines	0	0	0	0	0	0	0	0	0	0	0.0%
Castle Rock	0	0	0	0	0	0	0	0	0	0	0.0%
Larkspur	0	0	0	0	0	0	0	0	0	0	0.0%
Lone Tree	2	0	0	0	1	0	3	0	2	8	6.7%
Parker	24	0	5	5	19	14	1	4	45	117	50.6%
Unincorporated County	58	0	7	10	12	32	7	105	59	290	17.4%
Douglas County	**84**	**0**	**12**	**15**	**32**	**46**	**11**	**109**	**106**	**415**	**17.6%**

Source: Douglas County 2021, 2025; CDOT 2019, 2024; CDPHE 2018, 2019, 2023, 2025; ESRI 2024, 2025; HIFLD 2025; U.S. Energy Information Administration 2024

11.3 FUTURE CHANGES THAT MAY AFFECT RISK

11.3.1 Potential or Planned Development

Any new development near a fixed facility site or transportation corridor would be exposed to hazardous materials incidents. The number and types of hazardous chemicals stored in and transported through the County may increase as available land is developed. Development near the transit routes for hazardous materials and facilities will increase the County's overall risk.

The County should take precautions in the siting of new development near hazardous materials facilities and transit routes. The County may want to consider implementing designs into new development that enable improved evacuation or protection from residual impacts of hazardous materials.

11.3.2 Projected Changes in Population

Any changes in the density of population can impact the number of persons living near hazardous materials facilities, transit routes, and pipelines.

11.3.3 Other Identified Conditions

Important issues associated with hazardous materials incidents in Douglas County include the following:

- Warning time for hazardous material spills is minimal to none; it is uncertain when they will occur.
- Secondary hazards can lead to fire, air quality issues, and impacts on public health.

12. PANDEMIC AND DISEASE OUTBREAK

12.1 HAZARD PROFILE

12.1.1 Hazard Description

The Centers for Disease Control and Prevention (CDC) defines an epidemic as a disease with rates that are clearly above the expected occurrence in a community or region. An epidemic disease does not necessarily have to be contagious, an example being the West Nile virus. A once-declared epidemic can progress into pandemic status. In a pandemic the disease affects several populations, countries, and potentially continents, as opposed to regional epidemics. This wide geographical reach is what makes pandemics lead to large-scale social disruption, economic loss, and general hardship (State of Colorado 2023).

The pandemic/disease outbreak hazard profile for this HMP update addresses West Nile virus, influenza, and COVID-19.

West Nile Virus

West Nile virus is a mosquito-transmitted disease that has been present globally for decades but has spread across the continental United States relatively recently. West Nile virus first appeared in the United States in 1999. Mild infection symptoms include fever, body aches, headaches, and skin rashes. Severe cases are rare (comprising less than 1 percent of people infected) but can cause brain inflammation (encephalitis) and inflammation of the brain's lining (meningitis).

West Nile virus is transmitted through the bites of mosquitoes that become infected when feeding on infected birds. The virus can also be spread by blood transfusion, organ transplants, and breast milk or from a mother to an unborn child. There is not a specific treatment for West Nile virus. Prevention entails steps to prevent habitat for mosquitos, wearing insect repellent, and avoiding mosquito bites more generally.

Influenza

Influenza (the flu) is a contagious virus that can quickly spread from one person to another, causing mild to severe illness or death. Symptoms include fever, cough, sore throat, runny or stuffy nose, muscle or body aches, headache, and tiredness. While flu symptoms are typically mild, older adults, younger children, pregnant persons, and people with pre-existing conditions are more likely to experience complications. Seasonal flu epidemics occur yearly, typically in the fall and winter.

Pandemic influenza differs from seasonal influenza outbreaks, which are caused by viruses already living among people. Pandemic influenza is a global outbreak of a new influenza A virus, which can infect people easily and spread from person to person in an efficient and sustained manner (CDC 2020). The risk of a global influenza pandemic has increased over the last several years. This disease can claim thousands of lives and adversely affect critical infrastructure and key resources. An influenza pandemic can reduce the health, safety, and welfare of the essential services workforce; immobilize core infrastructure; and induce fiscal instability.

The World Health Organization (WHO) has identified six phases of influenza-caused global pandemic and three post-pandemic phases, as summarized in Table 12-1 (WHO 2009).

Table 12-1. WHO Global Influenza-Caused Pandemic Phases

Phase	Description
Preparedness and Response- Global, Regional, National, Sub-National Level	
Phase 1	No animal influenza virus circulating among animals has been reported to cause infection in humans.
Phase 2	An animal influenza virus circulating in domesticated or wild animals is known to have caused infection in humans and is therefore considered a potential pandemic threat.
Phase 3	An animal or human-animal influenza reassortant virus has caused sporadic cases or small clusters of disease in people but has not resulted in human-to-human transmission sufficient to sustain community-level outbreaks.
Containment	
Phase 4	Human-to-human transmission (H2H) of an animal or human-animal influenza reassortant virus able to sustain community-level outbreaks has been verified.
Response—Global Level	
Phase 5	The same identified virus has caused sustained community-level outbreaks in two or more countries in one WHO region.
Phase 6	In addition to the criteria defined in Phase 5, the same virus has caused sustained community-level outbreaks in at least one other country in another WHO region.
Post-Pandemic	
Post-Peak Period	Levels of pandemic influenza in most countries with adequate surveillance have dropped below peak levels.
Possible New Wave	Level of pandemic influenza activity in most countries with adequate surveillance rising again.
Post-Pandemic Period	Levels of influenza activity have returned to the levels seen for seasonal influenza in most countries with adequate surveillance

Source: (WHO 2009)

COVID-19

The COVID-19 novel coronavirus is an infectious disease first identified in 2019 that spread into a global pandemic by spring of 2020. It is caused by the SARS-CoV-2 virus, which can spread from an infected person's mouth or nose in small liquid particles through coughing, sneezing, speaking, singing, or breathing (WHO 2022).

Most people with COVID-19 have mild symptoms, but some people become severely ill or die. Symptoms include shortness of breath, fever or chills, cough, fatigue, muscle or body aches, loss of smell or taste, sore throat, congestion, and nausea or vomiting. Emergency symptoms that require immediate medical attention include trouble breathing, persistent pain or pressure in the chest, confusion, inability to wake or stay awake, and bluish lips or face. Symptoms may appear 2 to 14 days after exposure to the virus (CDC 2021).

12.1.2 Location

Diseases that can infect humans are variable in their nature and methods of transmission. The transmission rates of respiratory disease are often higher in more densely populated areas while the transmission rates of insect-borne disease are often higher in less densely populated areas that provide more habitat for insects. Ultimately, residents need to be vigilant about diseases altogether to better understand and respond to disease outbreaks.

Factors such as population density, visitation, and the length of time the public spends in a location all contribute to the spread of infectious diseases. Indoor areas where people are in close contact with each other appear to

be significant locations for diseases that are spread through respiratory droplets, such as coronavirus and influenza.

Infectious diseases spread by insects may be subject to other types of location hazards. For example, the prevalence of standing water can provide breeding grounds for mosquitoes. Douglas County has large areas with the potential to breed mosquitoes. The presence of disease-carrying mosquitoes has been reported throughout most of the County. These areas include farmland, private yards, stormwater facilities, and sewer plants. These areas need to be addressed as best as possible to control mosquitoes and the viruses they can spread.

12.1.3 Extent

The magnitude of a pandemic ranges from nuisance to widespread. The exact size and extent of an infected population depends on how easily the illness is spread, the mode of transmission, and the amount of contact between infected and uninfected individuals. The transmission rates of pandemic illnesses are often higher in more densely populated areas.

West Nile Virus

Since it was discovered in the western hemisphere, West Nile virus has spread rapidly across North America, affecting thousands of birds, horses and humans. As of August, Colorado had reported 58 West Nile virus human infections in 2025 (CDC 2025). The mosquito season in Colorado begins in the spring and ends in mid-September. Transmission of mosquito-borne illnesses in Douglas County can generally be limited to this period of time unless a resident travels to another region and is bitten by a mosquito.

The CDC has a surveillance program for West Nile virus. Data is collected weekly and reported for five categories: wild birds, sentinel chicken flocks, human cases, veterinary cases and mosquito surveillance (CDC 2024).

Influenza and Coronavirus

The severity and length of the next pandemic cannot be predicted; however, experts anticipate that its effect on the United States could be severe. The CDC and public health officials use the Pandemic Severity Assessment Framework (PSAF) to determine the impact of the pandemic based on two main factors. The first is clinical severity, or how serious the illness is. The second factor is transmissibility, or how easily the pandemic virus spreads from person-to-person. These two factors are used to guide decisions about which actions CDC recommends at a given time during the pandemic. The results help public health officials and health care professionals make timely and informed decisions, and to take appropriate actions (CDC 2016).

12.1.4 Previous Occurrences

FEMA Disaster Declarations

There have been two pandemic-related declarations for a major disaster (DR) or emergency (EM) that included Douglas County, as described in Table 12-2.

USDA Declarations

Between 2019 and 2024, Douglas County was not included in any USDA disaster declarations related to pandemic (USDA 2025).

Table 12-2. FEMA Disaster Declarations for Pandemic Events in Douglas County

Event Date	Declaration Date	Declaration Number	Description
January 20, 2020 - May 11, 2023	March 20, 2020	DR-4498-CO	COVID-19 Pandemic
January 20, 2020 - May 11, 2023	March 13, 2020	EM-3436-CO	COVID-19 Pandemic

Source: (FEMA 2025)

All Recent Events

Table 12-3 lists major recorded pandemic and disease outbreak-related events that impacted Douglas County since 2019. For earlier events, refer to the previous HMP.

Table 12-3. Pandemic and Disease Outbreak Events in Douglas County (2019 to 2024)

Event Date	Declaration Number	Location Impacted	Description
2019	N/A	Countywide	971 West Nile virus human disease cases reported.
2020	N/A	Countywide	731 West Nile virus human disease cases reported.
January 20, 2020 - May 11, 2023	DR-4498-CO, EM-3436-CO	Countywide	Douglas County, between January 2020 and October 2024, had a reported 108,401 positive cases of COVID-19 and 616 deaths associated with COVID-19.
2021	N/A	Countywide	2,911 West Nile virus human disease cases reported.
2022	N/A	Countywide	1,132 West Nile virus human disease cases reported.
2023	N/A	Countywide	2,628 West Nile virus human disease cases reported.
2024	N/A	Countywide	1,791 West Nile virus human disease cases reported.

Source: (FEMA 2025); (Colorado DPHE 2024); (CDC 2025)

12.1.5 Probability of Future Occurrences

Information on previous pandemic occurrences in the County was used to calculate the probability of future occurrence of such events. Table 12-4 lists the number of events from various sources from 1999 to 2024, which is the most complete period of record for all sources reviewed. Based on these records and input from the Core Planning Team, the probability of occurrence for pandemic in the County is considered "possible."

Table 12-4. Probability of Future Pandemic Events in Douglas County

Hazard Type	Number of Occurrences Between 1999 and 2024	% Chance of Occurring in Any Given Year
West Nile Virus	24	96%
Influenza	25	100%
COVID-19	5	20%

Source: (FEMA 2025); (Colorado DPHE 2024); (CDC 2025)
Note: The number of occurrences is not based on cases, but how many years an outbreak or pandemic has occurred.

12.1.6 Cascading Hazards

Pandemics can cause compounding challenges to response and recovery for other hazards. Social distancing can cause hurdles for sheltering and evacuation. Health care systems and responders can become strained due to high volume and limited resources.

12.2 VULNERABILITY AND IMPACT ASSESSMENT

The following sections provide a qualitative discussion of Douglas County's vulnerability to and potential impacts from pandemic and disease outbreak.

12.2.1 Life, Health, and Safety

The entire population of Douglas County is vulnerable to the pandemic and disease outbreak hazard. Areas with a higher population density have an increased risk of exposure or transmission of disease due to the proximity of the population to potentially infected people.

Health care providers and first responders have an increased risk of exposure due to their frequent contact with infected populations. Underlying medical conditions heighten the severity of transmitted illnesses, making those with chronic health issues more vulnerable. Individuals without access to affordable health care are more likely to experience severe outcomes (CDC 2025).

12.2.2 General Building Stock

No structures are anticipated to be directly affected by pandemic and disease outbreak.

12.2.3 Community Lifelines and Other Critical Facilities

No critical facilities are anticipated to be affected by pandemic and disease outbreak. Hospitals and medical facilities will likely see an increase in patients, which may cause an interruption of services, but it is unlikely that there will be damage to the facilities. Large rates of infection may increase the rate of hospitalization, which may overwhelm hospitals and medical facilities and lead to decreased services for those seeking medical attention.

Maintaining certain key functions is important to preserve life and decrease societal disruption during disease outbreaks. Heat, clean water, waste disposal, and corpse management all contribute to public health. Ensuring functional transportation systems also protects health by making it possible for people to access medical care and by transporting food and other essential goods. Critical infrastructure groups have a responsibility to maintain public health, provide public safety, transport medical supplies and food, implement a pandemic response, and maintain societal functions. If workers for these facilities are absent due to pandemic and disease outbreak, these systems can fail (Cybersecurity and Infrastructure Security Agency n.d.).

12.2.4 Economy

Economic costs are associated with the activities and programs implemented to conduct surveillance and address pandemics. Smaller-scale pandemic and disease outbreaks can also cause negative economic impacts, for example by reducing tourism and the use of parks and water bodies.

12.2.5 Natural Resources

Pandemic and disease outbreaks may have an impact on the environment if the outbreaks are caused by invasive species. Invasive species tend to be competitive with native species and their habitat and can be the major transmitters of diseases such as Zika, dengue, and yellow fever (Placer Mosquito and Vector Control District 2019). Secondary impacts from mitigating pandemics could also have an impact on the environment. Pesticides used to control disease carrying insects such as mosquitos have been reviewed by the EPA. If these sprays are applied in large concentrations, they could leach into waterways and harm nearby terrestrial species.

12.2.6 Historic and Cultural Resources

Pandemic and disease outbreaks may limit access to historic and cultural resources. As seen during the COVID-19 pandemic, historic monuments, facilities, and sites imposed restricted access to minimize the spread of the disease.

12.3 FUTURE CHANGES THAT MAY AFFECT RISK

12.3.1 Potential or Planned Development

Any areas of growth could be impacted by the pandemic hazard because the entire planning area is exposed and vulnerable. Additional development of structures in areas with high population density are at an increased risk.

12.3.2 Projected Changes in Population

Changes in the density of population can impact the number of persons exposed to the pandemic hazard.

12.3.3 Other Identified Conditions

Issues associated with pandemics in Douglas County include the following:

- The COVID-19 pandemic revealed that social distancing and quarantine had unprecedented impacts on public gatherings, shopping and activities. This caused significant, unanticipated impacts on economic and social activity, as well as government. The need to adjust operations to account for social distancing has been identified.
- Animal bites and Hepatitis C incidence in the County have grown significantly in the last several years.
- Wild animals and the environment can be a source of human infection.

13. SEVERE WEATHER

13.1 HAZARD PROFILE

13.1.1 Hazard Description

Severe weather events occur year-round in Douglas County, damaging property and infrastructure, downing trees and power lines, and causing injuries and fatalities. The following sections describe the severe weather types that impact the County, separated into severe summer weather and severe winter weather.

Severe Summer Weather

Thunderstorms

A thunderstorm is a local storm produced by a cumulonimbus cloud and accompanied by lightning and thunder (NOAA-NSSL n.d.). A thunderstorm forms from a combination of moisture and rapidly rising warm air, which may be lifted by a warm and cold front, a sea breeze, or a mountain. Although thunderstorms generally affect a small area, they have the potential to become dangerous due to their ability to generate tornadoes, hailstorms, strong winds, flash flooding, and lightning.

Typical thunderstorms are 15 miles in diameter and last an average of 30 minutes. The National Weather Service (NWS) considers a thunderstorm severe if it produces wind gusts of 58 mph or higher, hailstones 1 inch or more in diameter, or tornadoes (NWS n.d.). An estimated 100,000 thunderstorms occur each year in the U.S., with approximately 10 percent of them classified as severe (U.S. Department of Commerce; NOAA; NWS 1994). During the warm season, thunderstorms are responsible for most of the rainfall.

Lightning

Lightning is a bright flash of electrical energy produced by a thunderstorm. The resulting clap of thunder is the result of a shock wave created by the rapid heating and cooling of the air in the lightning channel. All thunderstorms produce lightning, which is one of the top weather killers in the nation. Each year, lightning kills about 20 people and injures hundreds (NWS n.d.).

Hailstorms

Hail forms inside a thunderstorm where there are strong updrafts of warm air and downdrafts of cold water. A water droplet picked up by the updrafts can be carried above the freezing level and turn to ice before falling back down. The frozen droplet thaws as it falls into lower warmer air. It may then be picked up by another updraft and carried back into the cold air to re-freeze. With each trip above and below the freezing level, the frozen droplet adds another layer of ice. The longer a hailstone spends in the clouds, the larger it becomes as more droplets continue to freeze. Hail falls when it becomes heavy enough to overcome the strength of the thunderstorm updraft and is pulled to the earth by gravity (NSSL 2021).

High Winds

Wind is rough horizontal movement of air caused by uneven heating of the earth's surface. It ranges from local breezes lasting a few minutes to global winds resulting from solar heating of the earth. High winds are often

associated with other severe weather events such as thunderstorms (NWS 2012). The following are common types of damaging straight-line winds (distinguished from rotating winds such as tornadoes) (NOAA n.d.):

- **Down draft**—A small-scale column of air that sinks toward the ground
- **Macroburst**—An outward burst of strong winds that are more than 2.5 miles in diameter
- **Microburst**—A small, concentrated downburst which produces an outward burst of relatively strong winds near the surface
- **Downburst—**General term to describe macro and microbursts
- **Gust front—**Leading edge of rain-cooled air which clashes with a warm thunderstorm inflow
- **Derecho—**Long lived windstorm associated with rapidly moving precipitation or thunderstorms. If wind damage swatch is more than 240 miles and includes gusts of wind that reach 58 mph or greater, then the event can be classified as a derecho

Tornadoes

A tornado is a narrow, violently rotating column of air that extends from the base of a thunderstorm to the ground (NOAA 2011). A tornado becomes visible when it forms a condensation funnel made up of water droplets, dust, and debris. Tornadoes are the most violent of all atmospheric storms and the most hazardous when they occur in populated areas. Tornadoes can topple mobile homes, lift cars, snap trees, and turn objects into destructive missiles. Among the most unpredictable weather phenomena, tornadoes can occur at any time of day, in any state in the union, and in any season. While most tornadoes cause little or no damage, some are capable of tremendous destruction, reaching wind speeds of 200 mph or more (NOAA 2023).

Extreme Heat

Extreme heat is defined as temperatures that hover 10 ºF or more above the average high temperature for a region (CDC 2012). A heat wave is a period of abnormally hot and unusually humid weather. Humid conditions occur when a dome of high atmospheric pressure traps hazy, damp air near the ground. A heat wave will typically last two or more days (NOAA 2009). Extreme heat is the number one weather-related cause of death in the U.S. On average, nearly 150 people die each year in the United States from excessive heat (NWS 2022).

Severe Winter Weather

Blizzards

A blizzard is a winter snowstorm lasting 3 hours or more with sustained or frequent wind gusts of 35 mph or more, accompanied by falling or blowing snow reducing visibility to 0.25 mile or less. A blizzard is categorized as severe if it has temperatures below 10°F, winds exceeding 45 mph, and visibility reduced to near zero. Storm systems powerful enough to cause blizzards usually form when the jet stream dips south, allowing cold air from the north to clash with warm, moister air from the south (Lam 2019).

Heavy Snow

Snow is precipitation in the form of ice crystals. It originates in clouds when temperatures are below the freezing point (32°F) and water vapor condenses directly into ice without going through a liquid stage. Snow falls as snowflakes or snow pellets. Snowflakes are clusters of ice crystals that form from a cloud (NOAA 2024). Snow pellets are opaque ice particles that form as ice crystals fall through super-cooled cloud droplets, which are below freezing but remain a liquid. The cloud droplets then freeze to the crystals.

Ice Storms

An ice storm is the damaging accumulation of ice caused by freezing rain, which is rain that falls as liquid but freezes upon contact with cold surfaces. Significant ice accumulations are usually 0.25 inches or greater (FEMA n.d.). Heavy accumulations of ice can bring down trees, power lines, utility poles, and communication towers. Ice can disrupt communications and power for days. Even small accumulations of ice can be extremely dangerous to motorists and pedestrians (Dolce 2012).

Extreme Cold

Extreme cold is defined as temperatures that drop well below normal for an area. In regions unaccustomed to winter storms, near-freezing temperatures may be considered "extreme cold." In regions that experience temperatures below freezing more often, "extreme cold" might be used to describe temperatures below 0° F (NWS n.d.). For this HMP, extreme cold temperatures are defined as ambient air temperature of 0°F or below. Several health hazards are related to extreme cold temperatures (CDC 2023):

- Frostbite is damage to body tissue caused by extreme cold. A wind chill (combined measurement of temperature and wind speed) of -20°F will cause frostbite in 30 minutes. Frostbite can cause a loss of feeling and a white or pale appearance in extremities.
- Hypothermia is a condition brought on when the body temperature drops to less than 95°F, and it can be deadly. Warning signs of hypothermia include uncontrollable shivering, memory loss, disorientation, incoherence, slurred speech, drowsiness, and apparent exhaustion.

Extreme cold can cause emergencies for people without shelter, those who are stranded, or those who live in a home that is poorly insulated or without heat (such as mobile homes). Infants and the elderly are most susceptible to the effects of extreme changes in temperatures (CDC 2012).

13.1.2 **Location**

Severe Summer Weather

Thunderstorms

Thunderstorms affect relatively small, localized areas. They are most common in the central and southern United States (NOAA 2023).

Lightning

Most lightning flashes start within a cloud, and a channel may develop downward toward the surface. When the channel gets less than a hundred yards off the ground, objects like trees, bushes, and buildings send up sparks to meet it. When one of the sparks connects to the downward developing channel, an electric current surges down the channel to the object that produced the spark. Tall objects such as trees, mountains and skyscrapers are more likely than the surrounding ground to produce one of the connecting sparks and are more likely to be struck by lightning (NOAA n.d.).

Hailstorms

Hailstorms are more likely in areas that have the most thunderstorms. Smaller hailstones may be blown away by horizontal winds from the updraft that creates them; larger hail typically falls closer to the updraft (NOAA n.d.).

High Winds and Tornadoes

All of Douglas County is subject to high winds from thunderstorms, tornadoes, and other severe weather events.

Extreme Heat

Extreme heat can occur throughout Colorado for most of the summer, except for areas with high altitudes. Occurrences of excessive heat are generally widespread in Douglas County. However, there can be spot locations that are somewhat cooler (e.g., a shady park near a stream) or hotter (e.g., urban areas because of their built environment holds the heat). The EPA reports that daytime temperatures can be up to 7 ºF higher in urban areas, and nighttime temperatures 2 to 5 °F higher (EPA 2025).

Severe Winter Weather

Blizzards

A blizzard's trajectory largely determines which portion of the County receives the heaviest amount of snow. Severe winter weather events tend to have the heaviest snowfall within a 150-mile-wide swath to the northwest of what are generally southwest to northeast moving storms.

Heavy Snow

All of Douglas County may be subject to heavy snow. The trajectory of a snow storm's center determines the intensity and the duration of snowfall.

Ice Storms

All of Douglas County may be subject to ice storms. The distribution of ice storms often coincides with general distribution of snow. A locality's distance from the passing storm center is often the crucial factor in determining the temperature and type of precipitation during severe winter weather (Changnon and Karl 2003).

Extreme Cold

Extreme cold temperatures can occur anywhere in Douglas County.

13.1.3 Extent

The extent (severity or magnitude) of severe weather is largely dependent upon the most damaging aspects of each type. This section describes the extent of the severe weather hazard in Douglas County.

Severe Summer Weather

Thunderstorms

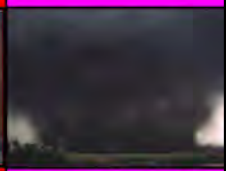
The local NWS office and the NOAA Storm Prediction Center (SPC) issue statements, watches, and warnings for thunderstorms as follows (NWS 2020):

- **Special Weather Statement**—Issued for strong storms that are below severe levels but may have impacts. Usually reserved for the threat of wind gust of 40 to 58 mph or small hail less than 1 inch in diameter.

- **Severe Thunderstorm Watch**—Severe thunderstorms with large hail, damaging winds, and/or tornadoes are possible, but the exact time and location of storm development is still uncertain.
- **Severe Thunderstorm Warning**—A severe thunderstorm is imminent or occurring; it is either detected by weather radar or reported by storm spotters. A severe thunderstorm is one that produces winds 58 mph or stronger and/or hail 1 inch in diameter or larger. People should take shelter.

The NWS has five risk categories for severe storm events, as shown in Figure 13-1.

Figure 13-1. Severe Storm Risk Categories

THUNDERSTORMS (no label)	1 - MARGINAL (MRGL)	2 - SLIGHT (SLGT)	3 - ENHANCED (ENH)	4 - MODERATE (MDT)	5 - HIGH (HIGH)
No severe* thunderstorms expected	**Isolated severe thunderstorms possible**	**Scattered severe storms possible**	**Numerous severe storms possible**	**Widespread severe storms likely**	**Widespread severe storms expected**
Lightning/flooding threats exist with all thunderstorms	Limited in duration and/or coverage and/or intensity	Short-lived and/or not widespread, isolated intense storms possible	More persistent and/or widespread, a few intense	Long-lived, widespread and intense	Long-lived, very widespread and particularly intense
					
• Winds to 40 mph • Small hail	• Winds 40-60 mph • Hail up to 1" • Low tornado risk	• One or two tornadoes • Reports of strong winds/wind damage • Hail ~1", isolated 2"	• A few tornadoes • Several reports of wind damage • Damaging hail, 1 - 2"	• Strong tornadoes • Widespread wind damage • Destructive hail, 2" +	• Tornado outbreak • Derecho

Source: (NWS 2019)

Lightning

The severity of lightning refers to the frequency of lightning strikes during a storm. The Lightning Activity Level (LAL) is a scale from one to six reflecting frequency and character of cloud-to-ground lightning (NWCG 2025).

Hailstorms

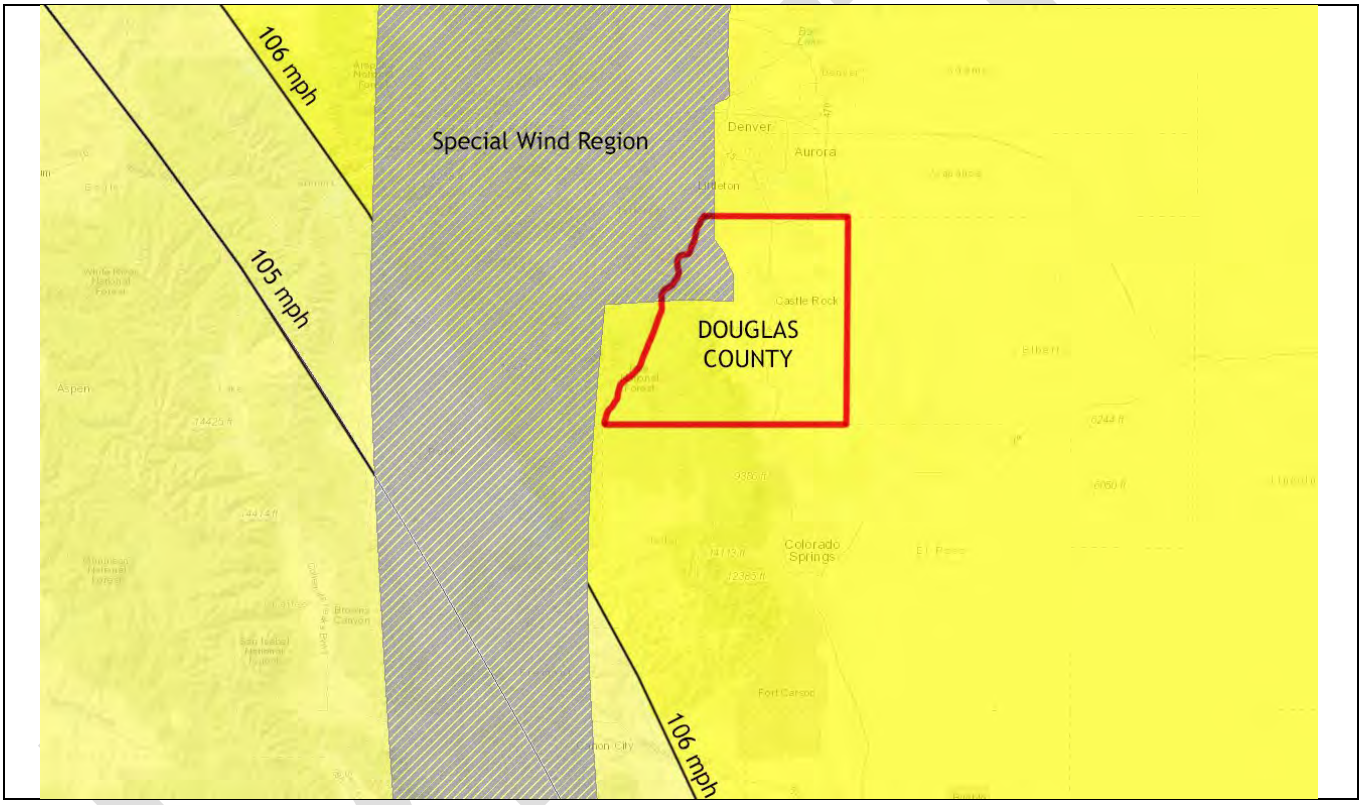
Hail can exhibit a variety of sizes. It is often estimated by comparing it to a known object, such as a pea or golf ball. Most hailstorms are made up of a mix of different sizes, and only the very largest hail stones pose serious risk to people caught in the open (NSSL 2021).

High Winds

The American Society of Civil Engineers (ASCE) identifies wind speeds to use in building design (ASCE 2025):

- For Risk Category II structures, which include most residential buildings, the ASCE standard calls for a design that can withstand the 3-second gust wind speed that has a 7 percent chance of occurring in a 50-year period. In Douglas County, that speed is 106 mph. Figure 13-2 shows the mapping of ASCE Risk Category II wind speeds in Douglas County and surrounding areas.
- For Risk Category IV structures, defined as buildings that are critical for emergencies and defense (such as shelters and other critical facilities), the ASCE design standard is the 3-second gust wind speed that has a 1.6 percent chance of occurring in a 50-year period. In County this is 117 mph.

Figure 13-2. ASCE Design Winds for Risk Category II Structures



Source: (ASCE 2025)

The northwest corner of Douglas County is within an ASCE-defined special wind region. Such regions are areas where mountainous terrain can result in highly variable wind speeds that may not be adequately defined by the surrounding wind mapping.

The NWS issues advisories, watches, and warnings as follows when wind speeds can pose a hazard or are life threatening (NWS n.d.):

- **High Wind Warnings** are issued when sustained, strong winds with even stronger gusts are happening.
- **High Wind Watches** indicate that sustained, strong winds are possible, based on local criteria.
- **Wind Advisories** indicate that strong winds are occurring but not so strong as to warrant a high wind warning.

Tornadoes

The Enhanced Fujita Scale (EF-Scale) is the standard used to measure the strength of a tornado. It assigns tornadoes a rating based on estimated wind speeds and related damage. When tornado damage is surveyed, it is compared to a list of damage indicators and degree of damage ratings to estimate the wind speeds that were produced by the tornado. From that, a rating is assigned, with six categories from EF0 to EF5, representing increasing degrees of damage (NWS n.d.). Figure 13-3 illustrates the relationship between EF ratings, wind speed, and expected tornado damage. Douglas County typically experience tornadoes ranging from EF0 to EF1.

Figure 13-3 Explanation of EF-Scale Ratings

EF Rating	Wind Speeds	Expected Damage	
EF-0	65-85 mph	'Minor' damage: shingles blown off or parts of a roof peeled off, damage to gutters/siding, branches broken off trees, shallow rooted trees toppled.	
EF-1	86-110 mph	'Moderate' damage: more significant roof damage, windows broken, exterior doors damaged or lost, mobile homes overturned or badly damaged.	
EF-2	111-135 mph	'Considerable' damage: roofs torn off well constructed homes, homes shifted off their foundation, mobile homes completely destroyed, large trees snapped or uprooted, cars can be tossed.	
EF-3	136-165 mph	'Severe' damage: entire stories of well constructed homes destroyed, significant damage done to large buildings, homes with weak foundations can be blown away, trees begin to lose their bark.	
EF-4	166-200 mph	'Extreme' damage: Well constructed homes are leveled, cars are thrown significant distances, top story exterior walls of masonry buildings would likely collapse.	
EF-5	> 200 mph	'Massive/incredible' damage: Well constructed homes are swept away, steel-reinforced concrete structures are critically damaged, high-rise buildings sustain severe structural damage, trees are usually completely debarked, stripped of branches and snapped.	

Source: (NWS 2015)

NOAA's SPC issues tornado watches and warnings. A tornado watch is when conditions are favorable for a tornado to form. A watch can cover parts of a state or span several states (NOAA-NSSL n.d.). A tornado warning is when a tornado is spotted by a radar and action should be taken to ensure safety. Warnings can cover parts of counties or several counties, depending on the tornado's path (NOAA-NSSL n.d.). The current average lead time for tornado warnings is 13 minutes. Occasionally, tornadoes develop so rapidly that little, if any, advance warning is possible (NWS n.d.).

Extreme Heat

The extent of extreme heat is generally measured through the NWS heat index. The index combines air temperature and relative humidity to provide a measure of how temperatures actually feel. The values are devised for shady, light wind conditions. Exposure to the full sun can increase the index by up to 15 ºF. The NWS includes heat index values in weather forecasts.

The NWS provides alerts when heat indices approach hazardous levels, as listed in Table 13-1, and aids state and local health officials in preparing civil emergency messages for severe heat waves. NWS special weather statements describe who is most at risk, safety rules for reducing risk, the extent of the hazard, and heat index values.

Table 13-1. National Weather Service Alerts

Alert	Criteria
Excessive Heat Watch	Issued when conditions are favorable for excessive heat in the next 24 to 72 hours
Excessive Heat Advisory	Issued within 12 hours of the onset of daytime heat index values of 100°F to 104°F for at least 2 consecutive hours
Excessive Heat Warning	Issued within 12 hours of the onset of daytime heat index values of 105°F or higher for at least 2 days and nighttime air temperatures not below 75°F

Source: (NWS 2025)

Severe Winter Weather

Blizzard, Heavy Snow, Ice Storm

The magnitude of a severe winter storm can be classified into five categories, as shown in Table 13-2 (NWS 2021). The NWS uses winter weather watches, warnings, and advisories as presented in Figure 13-4 to help people anticipate what to expect prior to an approaching storm (NWS 2021).

Table 13-2. Winter Storm Category Thresholds

Winter Storm Type	Threshold
Heavy Snowstorm	Accumulations of 4 inches or more of snow in a 6-hour period, or 6 inches of snow in a 12-hour period.
Sleet Storm	Significant accumulations of solid pellets that form from the freezing of raindrops or partially melted snowflakes, causing slippery surfaces and posing a hazard to pedestrians and motorists.
Ice Storm	Significant accumulation of rain or drizzle freezing on objects (trees, power lines, roadways) as it strikes them, causing slippery surfaces and damage from the weight of ice accumulations.
Blizzard	Wind velocity of 35 mph or more, temperatures below freezing, considerable blowing snow with visibility frequently below one-quarter mile prevailing over an extended period.
Severe Blizzard	Wind velocity of 45 mph, temperatures of 10°F or lower, a high density of blowing snow with visibility frequently measured in feet prevailing over an extended period.

Source: (NWS 2021)

Figure 13-4. Winter Storm Warning Thresholds

Source: (NWS 2021)

Extreme Cold

The extent of extreme cold temperatures is generally measured by the wind chill index. Wind chill describes what cold temperature feels like to the human skin in combination with wind blowing on the skin. The colder the air temperature and the higher the wind speeds, the colder the sensation on one's skin (NOAA n.d.).

13.1.4 Previous Occurrences

FEMA Disaster Declarations

There have been six severe-weather-related declarations for a major disaster (DR) or emergency (EM) that included Douglas County, as described in Table 13-3.

Table 13-3. FEMA Disaster Declarations for Severe Weather Events in Douglas County

Event Date	Declaration Date	Declaration Number	Description
June 19, 1965	June 19, 1965	DR-200-CO	Tornadoes, Severe Storms, Flooding
May 19, 1969	May 19, 1969	DR-261-CO	Severe Storms, Flooding
May 23, 1973	May 23, 1973	DR-385-CO	Heavy Rains, Snowmelt, and Flooding
March 17-20, 2003	April 9, 2003	EM-3185-CO	Snow
December 18-22, 2006	January 7, 2007	EM-3270-CO	Snow
June 8-23, 2023	August 25, 2023	DR-4731-CO	Severe Storms, Flooding, and Tornadoes

Source: (FEMA 2025)

USDA Declarations

Between 2019 and 2024, Douglas County was not included in any USDA disaster declarations related to severe weather (USDA 2025).

All Recent Events

Table 13-4 lists the major recorded severe-weather related events that impacted Douglas County since 2019. For earlier events, refer to the previous HMP. Due to the large number of severe weather events listed on the NOAA Storm Events Database, the table only shows events which met the following criteria:

- Was included in a presidentially declared disaster
- Had at least one reported death and/or injury
- Produced over $5,000 in reported property and/or crop damage

Table 13-4. Severe Weather Events in Douglas County (2019 to 2025)

Event Date	Declaration Number	Location Impacted	Description
October 29-30, 2019	N/A	Countywide	A storm system brought record breaking temperatures and up to a foot of snow. A weather-related traffic fatality in the foothills west of Denver closed State Highway 6. Numerous schools in and around Denver and to the east were closed. Snowfall totals included 10 inches near Parker and 7.5 inches near Castle Pines.
December 21-23, 2022	N/A	Countywide	A powerful arctic outbreak brought some of the coldest temperatures in nearly 30 years. Power outages impacted up to 6,400 customers in the I-25 Corridor. Numerous school districts and county government buildings were closed. Wind chill temperatures ranged from -25 ºF to -40 ºF. At least one person died from exposure to cold temperatures.
June 22, 2023	DR-4731-CO	Countywide	A supercell thunderstorm brought hail up to 2.5 inches in diameter. An EF1 tornado touched down just south of CO-470 in the city of Highlands Ranch. The tornado was on the ground for 6.3 miles. No injuries were reported but over 100 trees were downed. Some window/shingle damage occurred on residential and commercial properties. South Metro Fire Department responded to dozens of calls in Highlands Ranch south of CO-70 between Lucent and Quebec for storm related damage, including roof damage, trees down, natural gas leaks, and electrical problems. A tree fell on Northridge Elementary School and portions of the roof were ripped off. Valor Christian High School in Highlands Ranch also sustained damage. Most of the damage was rated EF0, with small pockets of EF1 damage.

Source: (FEMA 2025); (USDA 2025); (NOAA NCEI n.d.)

13.1.5 Probability of Future Occurrences

Information on previous severe weather in Douglas County was used to calculate the probability of future occurrence of such events. Table 13-5 lists the number of events from various sources over the 74-year period from 1950 to 2024, which is the most complete period of record for all sources reviewed. Based on these records and input from the Core Planning Team, the probability of occurrence for severe weather in the County is considered “highly likely.”

Table 13-5. Probability of Future Severe Weather Events in Douglas County

Hazard Type	Number of Occurrences Between 1950 and 2024	% Chance of Occurring in Any Given Year
Blizzard	18	24.32%
Cold/Wind Chill	3	4.05%
Excessive Heat	0	0.00%
Extreme Cold/Wind Chill	3	4.05%
Funnel Cloud	1	1.35%
Hail	204	100.00%
Heat	5	6.76%
Heavy Rain	3	4.05%
Heavy Snow	84	100.00%
High Wind	177	100.00%
Ice Storm	0	0.00%
Lightning	24	32.43%
Sleet	0	0.00%
Strong Wind	6	8.11%
Thunderstorm Wind	38	51.35%
Tornado	55	74.32%
Winter Storm	122	100.00%
Winter Weather	124	100.00%

Source: (FEMA 2025); (USDA 2025); (NOAA NCEI n.d.)
Note: 100% probability indicates that it is statistically likely for an event to occur every year. It does not indicate that the occurrence of an event is a certainty in any given year

13.1.6 **Cascading Hazards**

Severe summer weather may carry extreme rainfall that could exacerbate flooding. Severe winds can be destructive to the functionality of utilities by breaching power lines and disconnecting the utility systems. Electrical utility failure also has the potential to cause injuries or to start fires that can damage infrastructure and woodlands. Fallen trees from severe weather events can contribute to an increase in fuel for wildfires. Fallen vegetation also has the potential to reduce the soil stability of steep slopes, which can lead to an increased risk of landslides.

Extreme cold temperatures may require warming shelters to be opened. Heavy snow and ice can lead to utility failure and downed trees and wires. Snow and ice on roads make transportation accidents more likely, which may lead to utility and power lines being knocked over. Snow and ice melt may contribute to flooding.

Extreme heat can exacerbate the drought hazard and increase the potential risk of wildfires. It can accelerate evaporation rates, drying out the air and soils. Extreme heat can also dry out terrestrial species, making them more susceptible to catching fire.

13.2 VULNERABILITY AND IMPACT ASSESSMENT

The following sections provide qualitative descriptions of the County's vulnerability to severe weather.

13.2.1 Life, Health, and Safety

The impact of severe weather on life, health, and safety depends on the event's severity and the availability of timely warnings. Common consequences include immobility and utility loss, both of which can hinder emergency response and access to essential services. Downed trees, flying debris, and structural damage from high winds can cause injuries or fatalities. Extreme temperatures also pose significant health risks, potentially resulting in heat- or cold-related illness and death.

Winter storms result in hundreds of deaths in the U.S. every year. People can die in traffic accidents on icy roads, from heart attacks while shoveling snow, or of hypothermia from prolonged exposure to cold (NSSL 2021).

Populations lacking adequate shelter during thunderstorms, high winds, hail, or tornadoes are at increased risk, as are those unable to afford consistent heating or cooling. Individuals outdoors, whether working or engaged in recreational activities, are particularly vulnerable due to exposure and limited warning. Infants, older adults, and those with chronic medical conditions are especially susceptible to extreme heat and cold.

13.2.2 General Building Stock

The entire building stock of Douglas County is vulnerable during severe weather; however, properties in poor condition or in particularly vulnerable locations may be at a higher risk. Buildings located under or near overhead lines or near large trees are more susceptible to damage associated with downed trees and wires. Elevated summer temperatures increase the energy demand for cooling. Losses can be associated with the overheating of heating, ventilation, and air conditioning systems. Extreme cold temperature events can damage buildings through freezing/bursting pipes and freeze/thaw cycles, as well as increasing vulnerability to home fires. Manufactured homes and antiquated or poorly constructed facilities can have inadequate capabilities to withstand severe weather.

13.2.3 Community Lifelines and Other Critical Facilities

All critical facilities in Douglas County are vulnerable to the impacts of severe weather. Utility infrastructure is particularly at risk from high winds and falling debris, which can lead to power outages and the disruption of essential services. Power loss can impair other vital utilities, including potable water supply, wastewater treatment, and communications systems. Property owners with private wells may lose access to safe drinking water until power is restored. Additionally, outages at emergency services—such as police, fire, EMS, and hospitals—can severely limit the community's ability to respond effectively and ensure public safety. Backup power is recommended for critical facilities and infrastructure.

Infrastructure at risk for this hazard includes roadways that could be damaged due to the application of salt and intermittent freezing and warming conditions that can damage roads over time. Following the winter season, road maintenance and repair are required for winter-weather-related damage. including cracks and potholes caused by freezing or plowing (NWS 2019).

Heavy accumulations of snow and ice can bring down trees, electrical wires, telephone poles and lines, and communication towers. Communications and power can be disrupted for days while utility companies work to repair the extensive damage. Bridges and overpasses are particularly dangerous because they freeze before other surfaces (NWS 2019). Heavy snow can immobilize a region, shutting down air and rail transportation and disrupting medical and emergency services (NOAA 2023).

13.2.4 Economy

Economic impacts of severe weather events may include business interruptions, damage to inventory or agriculture, relocation expenses, wage losses, and rental income loss due to utility outages or building repairs. Business interruption losses specifically refer to the inability to operate due to storm-related damage, such as wind impacts. Additionally, residents displaced by such events may incur temporary living expenses, further contributing to the overall economic burden.

The cost of snow and ice removal and repair of roads from the freeze/thaw process can drain local financial resources. The loss of power and closure of roads due to severe winter storms prevents the commuter population traveling to work or school within and outside of the County and may cause a loss in economic productivity.

13.2.5 Natural Resources

Severe weather that includes heavy rainfall can erode natural banks along waterways and degrade soil stability for terrestrial species. Tornadoes can tear apart habitats, causing fragmentation across ecosystems. Excessive snowfall can significantly affect natural processes, such as the flow within rivers and streams. Rain that falls onto an existing snowpack and freezes, forming an ice crust, can exacerbate runoff rates during warming winter weather. Consequentially, these flow rates and excess volumes of water can erode banks, tear apart habitat along the banks, and disrupt terrestrial plants and animals.

Winter weather has residual impacts on the environment due to the methods communities use to maintain their infrastructure during severe winter conditions, such as applying road salt (NSIDC n.d.). Road-salt runoff can cause groundwater salinization, modify the soil structure, and result in loss or reduction in lake turnover. Additionally, road salt can cause changes in the composition of aquatic invertebrate assemblages and pose threats to birds, roadside vegetation, and mammals (Tiwari and Rachlin 2018).

Extreme freezing and warming weather patterns can create changes in natural processes. Extreme heat events can have negative impacts on aquatic systems, contributing to fish kills, aquatic plant die offs, and increased likelihood of harmful algal blooms. These extreme temperature events can also affect the surrounding ecosystems, destroying food webs and depleting resources in the environment.

13.2.6 Historic and Cultural Resources

Museums, historical societies, and any additional historic or cultural structures are vulnerable to physical damage from hail, tornados, and power outages. Impaired utilities threaten heating and cooling systems, which may be imperative to the preservation of historic features.

Extreme heat can increase the risk of fires. Fire causes material loss and deformation of cultural heritage assets and may increase the probability of cracking or splitting in built structures. Under extreme heat, stones can face both macro (e.g., cracking of stones, soot accumulation, color change in stone containing iron) and micro degradation (e.g., mineralogical and textural changes), leading to structural instability. Long-term impacts include weakened stones and increased susceptibility to deterioration processes such as salt weathering and temperature cycling (Sesana, et al. 2021).

Severe weather is a potential threat to cultural heritage sites as storm-caused precipitation exacerbates rates of decay. Moisture may aggravate the physical, chemical, and biological mechanisms causing degradation by affecting the structure or composition of building materials (Sesana, et al. 2021).

13.3 FUTURE CHANGES THAT MAY AFFECT RISK

13.3.1 Potential or Planned Development

The Douglas County Comprehensive Master Plan outlines goals such as enhancing existing infrastructure and focusing urban development within designated urban areas. Strengthening infrastructure can improve resilience to severe weather events. By concentrating development in urban zones, the County reduces the risk of placing isolated utilities and roadways in vulnerable rural areas, where they are more susceptible to disruption from severe weather (Douglas County, CO n.d.). Additionally, by increasing development, green space preservation will need to continue to be a priority to mitigate increased heat islands.

13.3.2 Projected Changes in Population

The County experienced an increase in population between the 2020 Census (357,978) and the 2023 American Community Survey estimated population of 368,283. The population is expected to continue to increase over the next few years. Any changes in population density may require utility system upgrades to keep up with utility demand (e.g., water, electricity) during extreme temperature events. Furthermore, changes in the density of population can create issues for residents during evacuation from severe weather events.

13.3.3 Other Identified Conditions

Important issues associated with severe weather events in Douglas County include the following:

- Buildings and critical facilities that lack backup power sources are vulnerable to power outages resulting from lightning strikes.
- Lightning strikes may result in wildfires. Much of Douglas County is vulnerable to wildfires.
- Mobile homes are vulnerable to damaging winds from tornadoes.
- Dead or dying trees are more susceptible to falling during a tornado.
- Power outages lead to disruption of services and communication.
- Older buildings in the County could be more vulnerable to winds associated with thunderstorms or roof snow loading from winter storms, as they may have been built to low or no code standards.
- Critical facilities may not have backup power; during power outages associated with high winds, these facilities might not function properly or provide the necessary needs to the County.
- The impacts of drought might lead to dead or dying trees that are more susceptible to falling during thunderstorms or during winter storms from the weight of snow and ice. This can cause power outages, close roadways, and damage buildings and property.
- High winds can spread wildfires and hinder efforts to suppress them.
- Freezing temperatures can lead to frost heaving that damages roads, bridges, buildings, and foundations.
- Downed power lines from the weight of snow and ice lead to power outages, leaving many homes without a source of heat.

14. WILDFIRE

14.1 HAZARD PROFILE

14.1.1 Hazard Description

Wildfires are unplanned fires that threaten natural landscapes such as forests, grasslands, and prairies. They can be ignited by both natural and human causes, though the majority are triggered by human activity, either intentionally or accidentally.

Wildfires cause both short-term and long-term losses. Short-term losses can include destruction of timber, wildlife habitat, scenic vistas, and watersheds. Long-term effects include smaller timber harvests, reduced access to affected recreational areas, and the destruction of cultural and economic resources and community infrastructure.

Types of Wildfire

The National Park Service (NPS) defines wildfire as one of two types of wildland fires; the other type is prescribed fire, which is ignited by fire managers under clearly defined conditions and is carefully monitored. Prescribed fires are carried out for specific purposes to manage natural and cultural landscapes (NPS 2025a). Wildfires may be mostly or entirely in areas of natural vegetation, such as national forests and parks, or in areas known was wildland/urban interface (WUI), where natural vegetation is adjacent to human-built structures (interface areas) or intermingles with such structures (intermix areas).

Wildfires also can be categorized by where they burn relative to the ground. Surface fires burn along the forest floor, moving slowly and killing or damaging trees. Ground fires are usually started by lightning and burn on or below the forest floor. Crown fires spread rapidly by wind and move quickly by jumping along the tops of trees.

Wildfire Behavior and Fire Ecology

Fire behavior is defined as the manner in which fuel ignites, flame develops, and fire spreads, which depend on interactions among fuel, weather, and topography. The potential for wildfire and its subsequent growth and severity are controlled by these three principal factors. Other factors include drought, which dries out vegetation; lightning, which can spark ignition; and high winds, which can carry embers and rapidly spread flames (NPS 2025c).

Topography

Movement of air over the terrain tends to direct a fire's course. A gulch or canyon can funnel air and act as a chimney, intensifying fire behavior and inducing faster spread. Saddles on ridgetops tend to offer lower resistance to passage of air and draw fires. Solar heating of drier, south-facing slopes produces upslope thermal winds that can complicate behavior. Slope is an important factor. If the percentage of uphill slope doubles, the rate the wildfire spread will most likely double as well. Terrain can inhibit wildfires: fire travels downslope much more slowly than it does upslope, and ridgetops often mark the end of a wildfire's rapid spread (NPS 2025c).

Fuel

Fuels are classified by fuel loading and by type. Fuel loading is the amount of vegetative material available (by weight or volume). If this amount doubles, energy released can also double. Fuel types are defined by a burn index—an estimate of the amount of potential energy that may be released, the effort required to ignite a fire in a given fuel, and the expected flame length. Different fuels have different burn qualities, and some burn more easily than others. Grass fires release relatively little energy but can sustain very high rates of spread (NPS 2025c).

Weather

Weather factors that can affect wildfire include temperature, relative humidity, wind speed and direction, cloud cover, precipitation, and stability of the atmosphere (NWS 2009). Extreme weather leads to extreme fires, and often a subsidence of severe weather marks the end of a wildfire's growth and the beginning of successful containment. High temperatures and low humidity can produce vigorous fire activity. Fronts and thunderstorms can produce winds that suddenly change in speed and direction, causing similar changes in fire activity. The rate of spread of a fire varies directly with wind velocity. The most damaging firestorms are typically marked by high winds (NPS 2025c). Firestorms are events of such extreme intensity that effective suppression is virtually impossible. They occur during extreme weather and generally burn until conditions change, or the available fuel is exhausted.

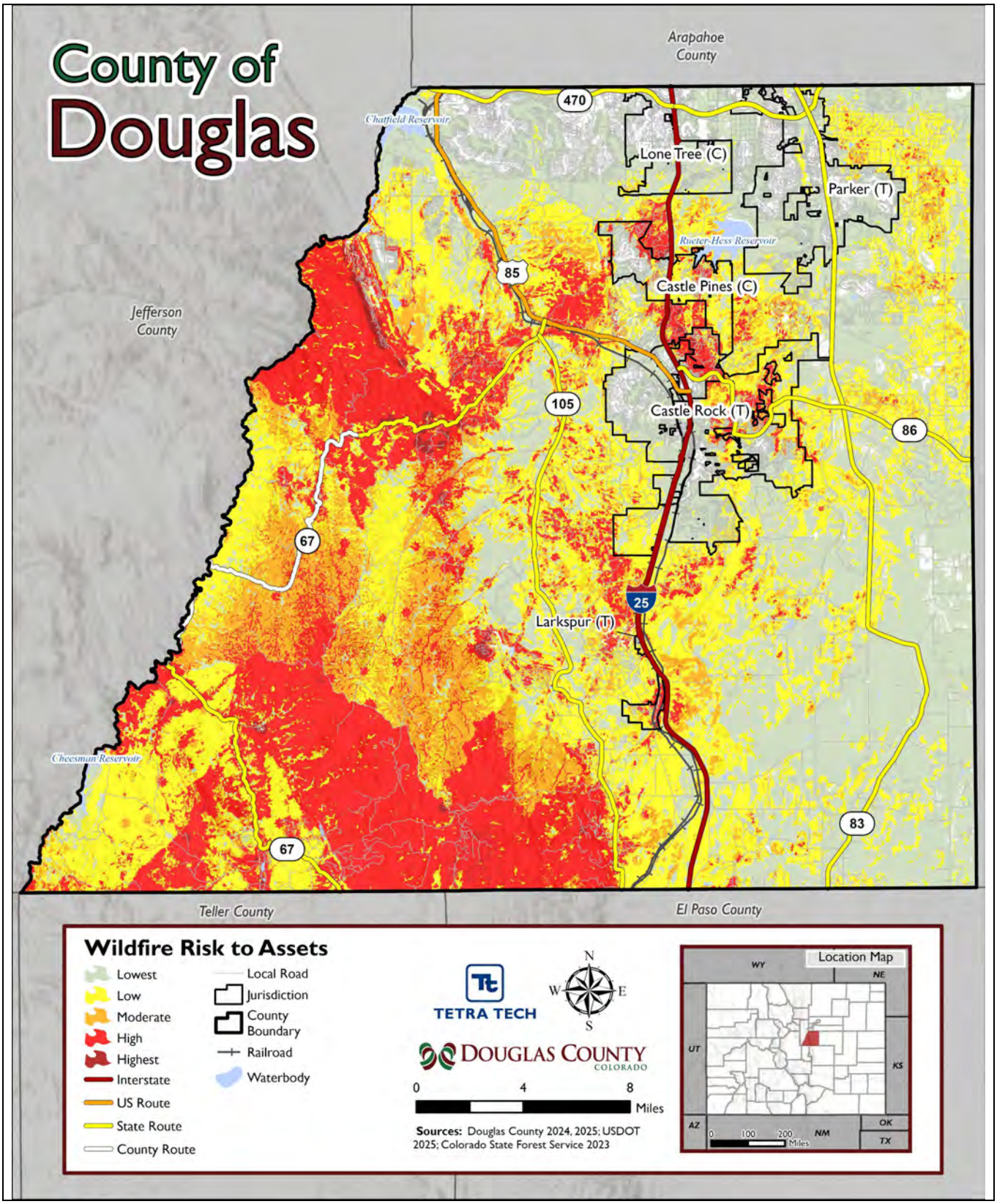
14.1.2 **Location**

The threat of wildfires is statewide in Colorado, with forests, grasslands, and WUI areas all at risk. The intensity and severity of the wildfire may vary with variations in wildland vegetation, defensible space, weather conditions and fuel sources.

The Colorado State Forest Service (CSFS) created a WUI Risk Index based on housing density and fire behavior to rate potential impact of wildfire on people and their homes. According to this Index, 11 percent of Douglas County is within the highest risk WUI area, 10 percent is in the high risk WUI area, 10 percent is in the moderate risk WUI area, 35 percent is in the low risk WUI area, and 33 percent is not in any WUI risk area (CSFS 2025a).

The Colorado Forest Atlas presents a map of risk to assets that is based on burn probability and a rating of values at risk. The risk ratings are weighted by wildland urban interface (housing density), forest assets, riparian assets, and watershed protection risk outputs. Figure 14-1 shows the risk to assets distribution in Douglas County (CSFS 2025).

Figure 14-1. Wildfire Hazard Areas in Douglas County



14.1.3 Extent

Douglas County's land cover predominantly consists of forest and rangelands, which together cover about 80 percent of the County's land area (refer to Chapter 3 for more information on land cover). These areas provide vegetative wildfire fuel, leading to large-scale fires in the western and southwestern portions of Douglas County. The outbreak of the mountain pine beetle is a significant concern related to wildfire, as it is killing trees that could fuel extreme fires.

Surface fuels and fire behavior fuel models contain parameters needed to compute surface fire behavior characteristics, such as rate of spread, flame length, and fire line intensity. There is a need for data to understand the effects of fuel reduction treatments and wildfires on understory species composition and surface fuels. This research aims to assess the effectiveness of restoration and wildfire in achieving landscape restoration goals. Additional information on various models and tools to assist in understanding the extent of the wildfire hazard in Douglas County is detailed under the following subheadings.

Colorado Forest Atlas Risk to Assets

Colorado Forest Atlas defines the hazard risk based on burn probability and a rating of values at risk. It identifies those forested areas with the greatest potential for adverse effects from wildfire.

The risk index has been calculated by combining the Forest Assets data with a measure of fire intensity using a Response Function approach. Those areas with the highest negative impact (-9) represent areas with high potential fire intensity and low resilience or adaptability to fire. Those areas with the lowest negative impact (-1) represent those areas with low potential fire intensity and high resilience or adaptability to fire. The response function outputs were combined into 5 qualitative classes; definitions for the five classes were not available on the Colorado Forest Atlas website.

This risk output is intended to provide an overall forest index for potential impact from wildfire. This can be applied to consider aesthetic values, ecosystem services, or economic values of forested lands.

Colorado Forest Atlas Fire Intensity Scale

The Colorado Forest Atlas defines a Fire Intensity Scale across the state of Colorado (CSFS 2025). This scale indicates four classes of fire intensity (lowest to highest intensity) based on weather conditions, fuels, and topography.

- **Class 1, Lowest Intensity**—Very small, discontinuous flames, usually less than 1 foot in length; very low rate of spread; no spotting. Fires are typically easy to suppress by firefighters with basic training and non-specialized equipment.
- **Class 2, Low**—Small flames, usually less than 2 feet long; small amount of very short-range spotting possible. Fires are easy to suppress by trained firefighters with protective equipment and specialized tools.
- **Class 3, Moderate**—Flames up to 8 feet in length; short-range spotting is possible. Trained firefighters will find these fires difficult to suppress without support from aircraft or engines, but dozer and plows are generally effective. Increasing potential for harm or damage to life and property.
- **Class 4, High**—Large Flames, up to 30 feet in length; short-range spotting common; medium range spotting possible. Direct attack by trained firefighters, engines, and dozers is generally ineffective, indirect attack may be effective. Significant potential for harm or damage to life and property.

Wildland Fire Assessment System National Fire Danger Rating System

The Wildland Fire Assessment System (WFAS) is an internet-based information system that provides a national view of weather and fire potential. Each day during the fire season, the WFAS produces national maps of selected fire weather and fire danger components of the National Fire Danger Rating System. Fire Danger Rating level considers current and antecedent weather, fuel types, and both live and dead fuel moisture. This information is provided by local station managers (WFAS 2023).

Fire Potential Index

The Fire Potential Index (FPI) is a moisture-based vegetation flammability indicator. It indicates the estimated percentage of vegetation that is dry enough to burn. The FPI is highest when dead fuel moisture and vegetation greenness are low. The FPI is calculated once daily for the continental United States. The maps provide a relative measure of fuel flammability, but do not indicate the chance that a large fire will occur (USGS 2023).

Fuel Moisture

Fuel moisture is a measure of the amount of water in vegetation, expressed as a percent of the dry weight of the vegetation. When fuel moisture is high, fires do not ignite readily, or at all, because heat energy must be used to evaporate and drive water from the plant before it can burn. When fuel moisture is low, fires start easily and spread rapidly because all the heat energy goes directly into the burning flame. When fuel moisture is less than 30 percent, the fuel is considered to be dead. Dead fuels are critical in determining fire potential (NOAA 2023). Fuel time lag, classified into four categories based on moisture (see Table 14-1), is a measure of how long it would take for two-thirds of dead fuel to respond to atmospheric moisture.

Table 14-1. Fuel Moisture Classifications

1-hour fuels	10-hour fuels	100-hour fuels	1000-hour fuels
Up to ¼-inch diameter–fine, flashy fuels that respond quickly to weather changes. Computed from observation time, temperature, humidity, and cloudiness.	¼-inch to 1-inch in diameter–computed from observation time, temperature, humidity, and cloudiness or can be an observed value.	1-inch to 3-inch in diameter–computed from 24-hour average boundary condition composed of day length (daylight hours), hours of rain, and daily temperature and humidity ranges.	3-inch to 8-inch in diameter–computed from a 7-day average boundary condition composed of day length, hours of rain, and daily temperature/humidity ranges.

Source: (NPS 2025b)

Keetch-Byram Drought Index

The Keetch-Byram Drought Index (KBDI) assesses the risk of fire by representing the net effect of evapotranspiration and precipitation in producing moisture deficiency in deep duff and upper soil layers. The KBDI measures the amount of precipitation necessary to return the soil to full field capacity. The index ranges from 0, the point of no moisture deficiency, to 800, the maximum drought that is possible, and represents a moisture regime from 0 to 8 inches of water through the soil layer. At 8 inches of water, the KBDI assumes saturation. At any point along the scale, the index number indicates the amount of net rainfall that is required to reduce the value to zero, or saturation (NIDIS 2023).

14.1.4 Previous Occurrences

FEMA Disaster Declarations

There have been three wildfire-related declarations for a major disaster (DR) or emergency (EM) that included Douglas County, as described in Table 14-2.

Table 14-2. FEMA Disaster Declarations for Wildfire Events in Douglas County

Event Date	Declaration Date	Declaration Number	Description
May 21-29, 2002	May 23, 2002	FM-2407-CO	Fire
April 23 - August 6, 2002	June 19, 2002	DR-1421-CO	Fire
October 29-31, 2003	October 29, 2003	FM-2510-CO	Fire

Source: (FEMA 2025)

USDA Declarations

Between 2019 and 2024, Douglas County was not included in any USDA disaster declarations related to wildfire (USDA 2025).

All Recent Events

Table 14-3 lists the recorded wildfire-related events that have impacted Douglas County since 2019. For earlier events, refer to the previous HMP.

Table 14-3. Wildfire Events in Douglas County (2019 to 2024)

Event Date	Declaration Number	Location Impacted	Description
July 30 - August 7, 2024	N/A	Region	The fire reached about 579 acres. No structures are believed to have been lost in the fire. Several firefighters were treated for heat exhaustion. Mandatory evacuations were ordered for the Deer Creek Mesa area and several subdivisions in the area of Ken Caryl.

Source: (NOAA NCEI n.d.)

In July 2025, two wildfires occurred in Douglas County—the Airport Fire and a small, 1-acre wildfire. The Airport Fire began July 13 near Highway 85 and Titan Court, close to the Town of Louviers. The fire burned for roughly three days, spreading across approximately 130 acres before reaching 100 percent containment on July 16. No buildings were reported damaged, nor were any injuries reported (CPR News 2025, DCSO 2025, DCSO 2025). The small, 1-acre wildfire southwest of Sedalia occurred on July 27 and was 100 percent contained by the morning of July 28. No structures were damaged (9News 2025).

14.1.5 Probability of Future Occurrences

Information on previous wildfire occurrences in the County was used to calculate the probability of future occurrence of such events. Table 14-4 lists the number of events from various sources over the 75-year period from 1950 to 2024, which is the most complete period of record for all sources reviewed. Based on these records

and input from the Core Planning Team, the probability of occurrence for wildfire in the County is considered "highly likely."

Table 14-4. Probability of Future Wildfire Events in Douglas County

Hazard Type	Number of Occurrences Between 1950 and 2025	% Chance of Occurring in Any Given Year
Wildfire	12	16.00%

Source: (NOAA NCEI n.d.); (National Interagency Fire Center 2025); (9News 2025); (CPR News 2025); (DCSO 2025); (DCSO 2025); (FEMA 2025)

Note: The time period presented in this table is the most complete period of record for the various data sources reviewed.

14.1.6 Cascading Hazards

Following wildfires, cascading hazards such as debris flows, landslides, and flooding may occur due to loss of stabilizing vegetation. As water moves across charred and denuded ground, it can pick up soil, sediment, and the debris and ash left from the fire and carry it in a stream of floodwaters. These mudflows have the potential to cause significant damage to impacted areas. Flooding after a wildfire is often more severe. Areas directly affected by fires and those located below or downstream of burn areas are most at risk for flooding (FEMA 2020).

Wildfire can exacerbate the impacts of droughts, as watersheds and reservoirs that supply water can be impacted by ash and debris flows, water treatment facilities may shut down with damage or loss of power, and crops can be destroyed (NIDIS 2023).

14.2 VULNERABILITY AND IMPACT ASSESSMENT

A vulnerability analysis was conducted to determine the County's exposure to the wildfire hazard using the latest wildfire data from the Colorado State Forest Service (2023). The lowest, low, moderate, high, and highest risk zones (see Figure 14-1) were used for the analysis. The County's assets (population, buildings, and critical facilities) were examined to quantify their presence within each risk zone.

14.2.1 Life, Health, and Safety

The populations living the five wildfire risk hazard areas are listed in Table 14-5 through Table 14-7. Nearly half of the County population lives in the lowest risk hazard area, and less than 1 percent of the population lives in the highest risk hazard area.

Table 14-5. Populations Located in the Lowest and Low Wildfire Risk Hazard Area

Jurisdiction	Total Population 2023 ACS	Population Living in the Lowest Wildfire Risk Hazard Area		Population Living in the Low Wildfire Risk Hazard Area	
		Number of Persons	Percent of Total	Number of Persons	Percent of Total
Castle Pines	12,573	5,931	47.2%	1,287	10.2%
Castle Rock	76,614	43,116	56.3%	10,415	13.6%
Larkspur	171	16	9.4%	56	32.7%
Lone Tree	14,136	4,007	28.3%	54	0.4%
Parker	60,115	37,141	61.8%	1,653	2.7%

Jurisdiction	Total Population 2023 ACS	Population Living in the Lowest Wildfire Risk Hazard Area		Population Living in the Low Wildfire Risk Hazard Area	
		Number of Persons	Percent of Total	Number of Persons	Percent of Total
Unincorporated County	204,674	86,689	42.4%	33,976	16.6%
Douglas County	**368,283**	**176,900**	**48.0%**	**47,441**	**12.9%**

Source: U.S. Census Bureau 2023 ACS; Douglas County 2025; FEMA/ESRI 2025; Microsoft 2020; Colorado State Forest Service 2023

Table 14-6. Populations Located in the Moderate and High Wildfire Risk Hazard Area

Jurisdiction	Total Population 2023 ACS	Population Living in the Moderate Wildfire Risk Hazard Area		Population Living in the High Wildfire Risk Hazard Area	
		Number of Persons	Percent of Total	Number of Persons	Percent of Total
Castle Pines	12,573	774	6.2%	1,991	15.8%
Castle Rock	76,614	3,078	4.0%	5,581	7.3%
Larkspur	171	23	13.5%	67	39.2%
Lone Tree	14,136	0	0.0%	0	0.0%
Parker	60,115	172	0.3%	77	0.1%
Unincorporated County	204,674	8,780	4.3%	13,252	6.5%
Douglas County	**368,283**	**12,827**	**3.5%**	**20,968**	**5.7%**

Source: U.S. Census Bureau 2023 ACS; Douglas County 2025; FEMA/ESRI 2025; Microsoft 2020; Colorado State Forest Service 2023

Table 14-7. Populations Located in the Highest Wildfire Risk Hazard Area

Jurisdiction	Total Population 2023 ACS	Population Living in the Highest Wildfire Risk Hazard Area	
		Number of Persons	Percent of Total
Castle Pines	12,573	141	1.1%
Castle Rock	76,614	109	0.1%
Larkspur	171	0	0.0%
Lone Tree	14,136	0	0.0%
Parker	60,115	0	0.0%
Unincorporated County	204,674	2,087	1.0%
Douglas County	**368,283**	**2,337**	**0.6%**

Source: U.S. Census Bureau 2023 ACS; Douglas County 2025; FEMA/ESRI 2025; Microsoft 2020; Colorado State Forest Service 2023

Wildfires have the potential to impact human health and life of residents and responders. Public health impacts associated with wildfire include difficulty in breathing, odor, and reduction in visibility. Smoke generated by wildfire contains particulate matter (soot, tar, water vapor, and minerals), gases (carbon monoxide, carbon dioxide, nitrogen oxides), and toxics (formaldehyde, benzene) and can have both short- and long-term health impacts.

14.2.2 General Building Stock

The estimated exposure of Douglas County buildings to each wildfire risk hazard areas is summarized in Table 14-8 through Table 14-10. In each jurisdiction except Larkspur and Lone Tree, the risk area with the greatest number and value of buildings is the lowest wildfire risk area. In Larkspur, the high wildfire risk area has the greatest number and value of buildings, and in Lone Tree the greatest number and value are in no risk areas. These summaries can be seen in Figure 14-2 and Figure 14-3.

Table 14-11 through Table 14-13 show the buildings in each wildfire risk hazard area by occupancy class with the most buildings located in the Wildfire Risk Hazard Areas is residential.

Potential damage is the loss that could occur to the exposed inventory measured by structural and content replacement cost value. Buildings constructed of wood or vinyl siding are generally more likely to be impacted by the wildfire hazard than buildings constructed of brick or concrete.

Table 14-8. Buildings in the Lowest and Low Wildfire Risk Hazard Area

Jurisdiction	Total Number of Buildings	Total RCV	Structures in the Lowest Wildfire Risk Hazard Area				Structures in the Low Wildfire Risk Hazard Area			
			Number of Buildings	Percent of Total	Total RCV of Buildings	Percent of Total	Number of Buildings	Percent of Total	Total RCV of Buildings	Percent of Total
Castle Pines	4,000	$5,969,347,390	1,893	47.3%	$2,925,983,769	49.0%	413	10.3%	$520,412,299	8.7%
Castle Rock	25,199	$32,358,886,100	14,306	56.8%	$18,721,344,483	57.9%	3,287	13.0%	$3,613,661,335	11.2%
Larkspur	421	$164,181,514	35	8.3%	$3,944,252	2.4%	129	30.6%	$37,104,650	22.6%
Lone Tree	4,285	$24,279,214,512	1,213	28.3%	$4,102,413,680	16.9%	18	0.4%	$16,756,214	0.1%
Parker	18,275	$26,842,000,546	11,141	61.0%	$16,732,281,173	62.3%	504	2.8%	$597,084,245	2.2%
Unincorporated County	87,526	$117,775,978,929	36,750	42.0%	$51,581,155,840	43.8%	15,666	17.9%	$13,956,984,013	11.9%
Douglas County	**139,706**	**$207,389,608,991**	**65,338**	**46.8%**	**$94,067,123,197**	**45.4%**	**20,017**	**14.3%**	**$18,742,002,757**	**9.0%**

Source: Douglas County 2025; FEMA/ESRI 2025; Microsoft 2020; Colorado State Forest Service 2023; RSMeans 2024

Table 14-9. Buildings in the Moderate and High Wildfire Risk Hazard Area

Jurisdiction	Total Number of Buildings	Total RCV	Structures in the Moderate Wildfire Risk Hazard Area				Structures in the High Wildfire Risk Hazard Area			
			Number of Buildings	Percent of Total	Total RCV of Buildings	Percent of Total	Number of Buildings	Percent of Total	Total RCV of Buildings	Percent of Total
Castle Pines	4,000	$5,969,347,390	242	6.1%	$274,346,825	4.6%	639	16.0%	$944,611,132	15.8%
Castle Rock	25,199	$32,358,886,100	969	3.8%	$1,036,706,286	3.2%	1,756	7.0%	$2,306,319,001	7.1%
Larkspur	421	$164,181,514	57	13.5%	$34,447,363	21.0%	180	42.8%	$79,892,128	48.7%
Lone Tree	4,285	$24,279,214,512	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Parker	18,275	$26,842,000,546	49	0.3%	$39,358,957	0.1%	22	0.1%	$19,307,104	0.1%
Unincorporated County	87,526	$117,775,978,929	3,971	4.5%	$3,737,320,212	3.2%	5,915	6.8%	$4,913,232,125	4.2%
Douglas County	**139,706**	**$207,389,608,991**	**5,288**	**3.8%**	**$5,122,179,643**	**2.5%**	**8,512**	**6.1%**	**$8,263,361,491**	**4.0%**

Source: Douglas County 2025; FEMA/ESRI 2025; Microsoft 2020; Colorado State Forest Service 2023; RSMeans 2024

Table 14-10. Buildings in the Highest Wildfire Risk Hazard Area

Jurisdiction	Total Number of Buildings	Total RCV	Structures in the Highest Wildfire Risk Hazard Area			
			Number of Buildings	Percent of Total	Total RCV of Buildings	Percent of Total
Castle Pines	4,000	$5,969,347,390	44	1.1%	$47,555,996	0.8%
Castle Rock	25,199	$32,358,886,100	37	0.1%	$57,959,291	0.2%
Larkspur	421	$164,181,514	0	0.0%	$0	0.0%
Lone Tree	4,285	$24,279,214,512	0	0.0%	$0	0.0%
Parker	18,275	$26,842,000,546	0	0.0%	$0	0.0%
Unincorporated County	87,526	$117,775,978,929	902	1.0%	$752,663,559	0.6%
Douglas County	**139,706**	**$207,389,608,991**	**983**	**0.7%**	**$858,178,846**	**0.4%**

Source: Douglas County 2025; FEMA/ESRI 2025; Microsoft 2020; Colorado State Forest Service 2023; RSMeans 2024

Figure 14-2. Distribution of General Building Stock Across Wildfire Risk Hazard Areas

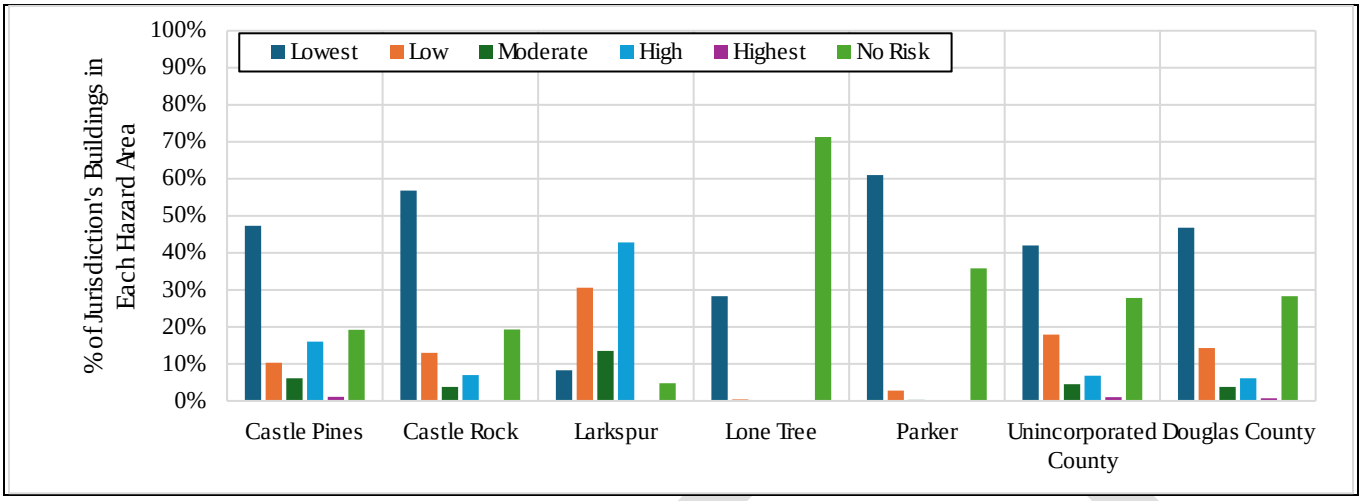


Figure 14-3. Distribution of General Building Stock Value Across Wildfire Risk Hazard Areas

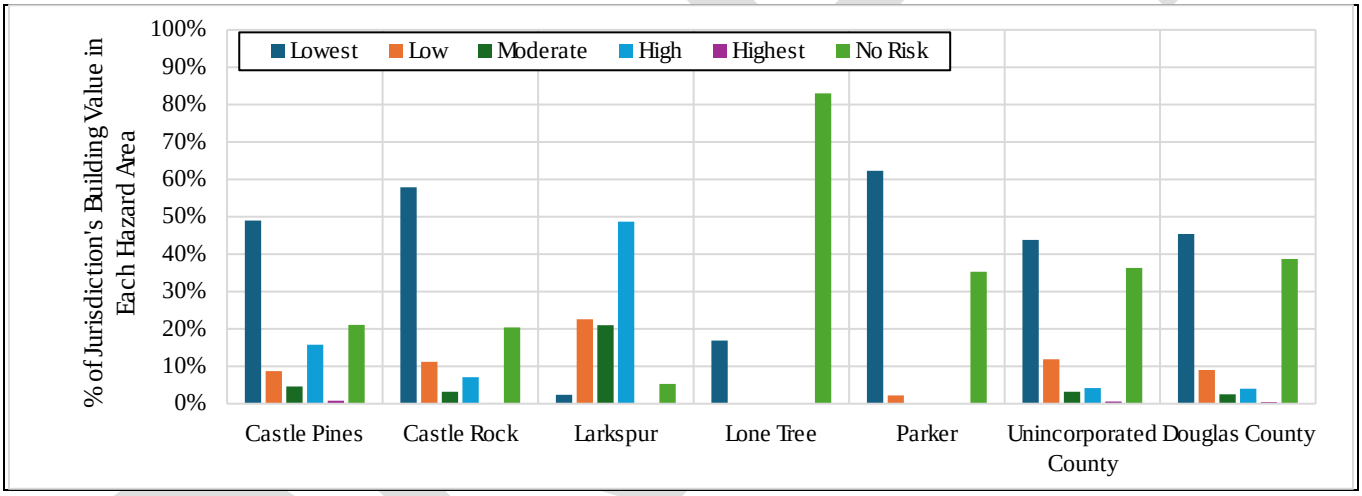


Table 14-11. Buildings in the Lowest and Low Wildfire Risk Hazard Area

Jurisdiction	Buildings in the Lowest Wildfire Risk Hazard Area by General Occupancy Class				Buildings in the Low Wildfire Risk Hazard Area by General Occupancy Class			
	Residential	Commercial	Industrial	Other	Residential	Commercial	Industrial	Other
Castle Pines	1,838	37	2	16	399	4	0	10
Castle Rock	13,334	735	47	190	3,221	34	4	28
Larkspur	33	1	0	1	111	15	0	3
Lone Tree	1,097	93	3	20	15	1	0	2
Parker	10,533	403	3	202	469	11	0	24
Unincorporated County	33,597	1,506	143	1,504	13,168	986	50	1,462
Douglas County	**60,432**	**2,775**	**198**	**1,933**	**17,383**	**1,051**	**54**	**1,529**

Source: Douglas County 2025; FEMA/ESRI 2025; Microsoft 2020; Colorado State Forest Service 2023
Note: Other = Government, Religion, Agricultural, and Education

Table 14-12. Buildings in the Moderate and High Wildfire Risk Hazard Area

Jurisdiction	Buildings in the Moderate Wildfire Risk Hazard Area by General Occupancy Class				Buildings in the High Wildfire Risk Hazard Area by General Occupancy Class			
	Residential	Commercial	Industrial	Other	Residential	Commercial	Industrial	Other
Castle Pines	240	2	0	0	617	12	0	10
Castle Rock	952	5	0	12	1,726	19	0	11
Larkspur	46	7	0	4	133	23	3	21
Lone Tree	0	0	0	0	0	0	0	0
Parker	49	0	0	0	22	0	0	0
Unincorporated County	3,403	264	22	282	5,136	369	12	398
Douglas County	**4,690**	**278**	**22**	**298**	**7,634**	**423**	**15**	**440**

Source: Douglas County 2025; FEMA/ESRI 2025; Microsoft 2020; Colorado State Forest Service 2023
Note: Other = Government, Religion, Agricultural, and Education

Table 14-13. Buildings in the Highest Wildfire Risk Hazard Area

Jurisdiction	Buildings in the Highest Wildfire Risk Hazard Area by General Occupancy Class			
	Residential	Commercial	Industrial	Other
Castle Pines	44	0	0	0
Castle Rock	34	3	0	0
Larkspur	0	0	0	0
Lone Tree	0	0	0	0
Parker	0	0	0	0
Unincorporated County	809	37	0	56
Douglas County	**887**	**40**	**0**	**56**

Source: Douglas County 2025; FEMA/ESRI 2025; Microsoft 2020; Colorado State Forest Service 2023
Note: Other = Government, Religion, Agricultural, and Education

14.2.3 Community Lifelines and Other Critical Facilities

The numbers of community lifelines exposed to the each wildfire risk hazard area are shown in Table 14-14 through Table 14-18 by lifeline category:

- Of 886 facilities in the lowest wildfire risk hazard area, the other critical facilities category has the majority of facilities (239).
- Of 464 facilities in the low wildfire risk hazard area, the communications category has the majority of facilities (181).
- Of 128 facilities in the moderate wildfire risk hazard area, the water systems category has the majority of facilities (43).
- Of 262 facilities in the high wildfire risk hazard area, the communications category has the majority of facilities (118).
- Of 43 facilities in the highest wildfire risk hazard area, the communications category has the majority of facilities (34).

Table 14-14. Facilities within the Lowest Wildfire Risk Hazard Area

Jurisdiction	Number of Facilities in the Lowest Wildfire Risk Hazard Area									Total Facilities in Hazard Area	
	Communications	Energy	Food, Hydration, Shelter	Hazardous Materials	Health & Medical	Safety & Security	Transportation	Water Systems	Other Critical Facilities	Count	% of Total
Castle Pines	0	0	2	0	1	1	0	0	7	11	44.0%
Castle Rock	29	0	5	9	24	21	5	1	43	137	47.7%
Larkspur	2	0	0	0	0	0	0	1	0	3	9.1%
Lone Tree	7	0	1	4	6	1	8	1	9	37	30.8%
Parker	27	0	4	5	19	16	1	6	32	110	47.6%
Unincorporated County	111	0	11	43	29	85	50	111	148	588	35.3%
Douglas County	**176**	**0**	**23**	**61**	**79**	**124**	**64**	**120**	**239**	**886**	**37.5%**

Source: Douglas County 2021, 2025; CDOT 2019, 2024; CDPHE 2018, 2019, 2023, 2025; ESRI 2024, 2025; HIFLD 2025; U.S. Energy Information Administration 2024; Colorado State Forest Service 2023

Table 14-15. Facilities within the Low Wildfire Risk Hazard Area

Jurisdiction	Number of Facilities in the Low Wildfire Risk Hazard Area									Total Facilities in Hazard Area	
	Communications	Energy	Food, Hydration, Shelter	Hazardous Materials	Health & Medical	Safety & Security	Transportation	Water Systems	Other Critical Facilities	Count	% of Total
Castle Pines	0	0	0	0	0	1	0	0	2	3	12.0%
Castle Rock	14	0	0	4	2	6	0	0	3	29	10.1%
Larkspur	7	0	0	0	0	0	0	0	2	9	27.3%
Lone Tree	2	0	0	0	0	0	1	0	1	4	3.3%
Parker	2	0	0	0	0	2	0	0	2	6	2.6%
Unincorporated County	156	0	0	14	3	24	19	162	86	464	27.8%
Douglas County	**181**	**0**	**0**	**18**	**5**	**33**	**20**	**162**	**96**	**515**	**21.8%**

Source: Douglas County 2021, 2025; CDOT 2019, 2024; CDPHE 2018, 2019, 2023, 2025; ESRI 2024, 2025; HIFLD 2025; U.S. Energy Information Administration 2024; Colorado State Forest Service 2023

Table 14-16. Facilities within the Moderate Wildfire Risk Hazard Area

Jurisdiction	Number of Facilities in the Moderate Wildfire Risk Hazard Area, by Lifeline Category									Total Facilities in Hazard Area	
	Communications	Energy	Food, Hydration, Shelter	Hazardous Materials	Health & Medical	Safety & Security	Transportation	Water Systems	Other Critical Facilities	Count	% of Total
Castle Pines	0	0	0	0	0	0	0	0	0	0	0.0%
Castle Rock	7	0	0	1	1	0	0	0	2	11	3.8%
Larkspur	2	0	0	0	0	0	0	3	2	7	21.2%
Lone Tree	0	0	0	0	0	0	0	0	0	0	0.0%
Parker	0	0	0	0	0	0	0	0	0	0	0.0%
Unincorporated County	30	1	0	1	2	12	7	40	17	110	6.6%
Douglas County	**39**	**1**	**0**	**2**	**3**	**12**	**7**	**43**	**21**	**128**	**5.4%**

Source: Douglas County 2021, 2025; CDOT 2019, 2024; CDPHE 2018, 2019, 2023, 2025; ESRI 2024, 2025; HIFLD 2025; U.S. Energy Information Administration 2024; Colorado State Forest Service 2023

Table 14-17. Facilities within the High Wildfire Risk Hazard Area

Jurisdiction	Number of Facilities in the High Wildfire Risk Hazard Area, by Lifeline Category									Total Facilities in Hazard Area	
	Communications	Energy	Food, Hydration, Shelter	Hazardous Materials	Health & Medical	Safety & Security	Transportation	Water Systems	Other Critical Facilities	Count	% of Total
Castle Pines	0	0	0	0	1	0	0	2	3	6	24.0%
Castle Rock	14	0	0	1	2	1	0	0	3	21	7.3%
Larkspur	0	0	0	0	1	2	0	0	11	14	42.4%
Lone Tree	0	0	0	0	0	0	0	0	0	0	0.0%
Parker	0	0	0	0	0	0	0	0	0	0	0.0%
Unincorporated County	104	0	2	1	2	16	2	38	56	221	13.2%
Douglas County	**118**	**0**	**2**	**2**	**6**	**19**	**2**	**40**	**73**	**262**	**11.1%**

Source: Douglas County 2021, 2025; CDOT 2019, 2024; CDPHE 2018, 2019, 2023, 2025; ESRI 2024, 2025; HIFLD 2025; U.S. Energy Information Administration 2024; Colorado State Forest Service 2023

Table 14-18. Facilities within the Highest Wildfire Risk Hazard Area

Jurisdiction	Number of Facilities in the Highest Wildfire Risk Hazard Area, by Lifeline Category									Total Facilities in Hazard Area	
	Communications	Energy	Food, Hydration, Shelter	Hazardous Materials	Health & Medical	Safety & Security	Transportation	Water Systems	Other Critical Facilities	Count	% of Total
Castle Pines	0	0	0	0	0	0	0	0	0	0	0.0%
Castle Rock	0	0	0	0	1	0	0	0	0	1	0.3%
Larkspur	0	0	0	0	0	0	0	0	0	0	0.0%
Lone Tree	0	0	0	0	0	0	0	0	0	0	0.0%
Parker	0	0	0	0	0	0	0	0	0	0	0.0%
Unincorporated County	34	0	0	0	0	4	0	1	3	42	2.5%
Douglas County	**34**	**0**	**0**	**0**	**1**	**4**	**0**	**1**	**3**	**43**	**1.8%**

Source: Douglas County 2021, 2025; CDOT 2019, 2024; CDPHE 2018, 2019, 2023, 2025; ESRI 2024, 2025; HIFLD 2025; U.S. Energy Information Administration 2024; Colorado State Forest Service 2023

Wildfires can have an impact on water supplies because of char or debris landing in water resources, which can clog wastewater pipes, culverts, etc. Wildfires may also impact transportation routes, with char and debris polluting the air and making it difficult to drive or flames near roadways making travel unsafe. Thes conditions can block or prevent access for residents and emergency service providers. A wildfire that impacts the following critical facilities could complicate response and recovery efforts:

- **Hazardous Materials and Fuel Storage**—During a wildfire event, these materials could rupture due to excessive heat and act as fuel for the fire, causing rapid spreading and escalating the fire to unmanageable levels. In addition, they could leak into surrounding areas, saturating soils, and seeping into surface waters, and have a disastrous effect on the environment.
- **Communication Facilities**—If these facilities become inoperable, it would exacerbate already difficult emergency response coordination in the planning area.
- **Fire Stations**—If fire stations were compromised during a wildfire event, it would make fire suppression and support services even more challenging.

14.2.4 Economy

Wildfire events can have major economic impacts on a community from the initial loss of structures and the subsequent loss of revenue from destroyed businesses and decreases in tourism. Wildfires can cost thousands of taxpayer dollars to suppress and control and can involve hundreds of operating hours on fire apparatus and thousands of labor-hours from volunteer firefighters. There are also many direct and indirect costs to local businesses that provide employees with time off to volunteer to fight these fires.

14.2.5 Natural Resources

Wildfire can lead to ancillary impacts such as landslides in steep ravine areas and flooding caused by the impacts of silt in local watersheds. Post-fire runoff polluted with debris and contaminants can be extremely harmful to ecosystem and aquatic life (USGS 2018). The age and density of infrastructure can exacerbate consequences of fires on the environment because of the increased amount of chemicals and contaminants that would be released from burning infrastructure. These chemicals, such as iron, lead, and zinc, may leach into stormwater, contaminate nearby streams, and impair aquatic life.

14.2.6 Historic and Cultural Resources

Wildfires are a major threat to historic and cultural resources, with the potential to cause extensive damage, and in some cases, complete destruction. The potential impacts on these resources from wildfire depend heavily on the materials used for construction. Many historic structures are made of wood, which is a highly flammable material. In many instances, historic structures house cultural resources and artifacts. Outdoor events are likely to be postponed or canceled as the result of wildfire conditions, as smoke conditions can have harmful impacts to the human body.

14.3 FUTURE CHANGES THAT MAY AFFECT RISK

14.3.1 Potential or Planned Development

Any new development in the mapped wildfire risk areas will be vulnerable to the wildfire hazard.

14.3.2 Projected Changes in Population

State population projections anticipate a continued growth in Douglas County's population through 2050. The increase in population will expose more people to the wildfire hazard if residents move into the wildfire risk areas.

14.3.3 Other Identified Conditions

The following issues were identified in Douglas County with regard to wildfire:

- A significant portion of western Douglas County is within Pike National Forest. Pike National Forest has been significantly impacted by Douglas-fir beetle, resulting in a large number of standing dead trees.
- Development in the wildfire risk areas should be managed or measures taken to implement preventative measures to mitigate impacts on these assets.
- Any increased frequency of drought events in the future could affect water supply, and prolonged heat waves could support increased risk of wildfire events.
- Local fire departments should continue to train on wildland-urban interface events and wildfire risk areas.
- Public education and outreach to people living in or near the fire hazard zones should include information about and assistance with mitigation activities such as defensible space, and advance identification of evacuation routes and safe zones.
- Residents and visitors must know the current fire restrictions and bans posted on the county's website and communicated through partner websites and social media notifications.
- Wildfires could cause landslides because vegetation is removed.
- Area fire districts need to continue to train on WUI fire events.
- Vegetation management activities should continue and be evaluated for additional needs.
- Both the natural and human-caused conditions that contribute to the wildland fire hazard are tending to exacerbate through time.
- Conservative forestry management practices have resulted in congested forests prone to fire and disease.
- The continued migration of residents to remote areas of the county increases the probability of human-caused ignitions from vehicles, grills, campfires, and electrical devices.

15. HAZARD RANKING

Each jurisdiction needs to recognize the hazards that pose the greatest risk to its community and direct its attention and resources accordingly to manage risk and reduce losses. To achieve this, the hazards of concern were ranked using methodologies promoted by FEMA and input from each participating jurisdiction. These rankings may vary among the jurisdictions—a hazard may be ranked low in one jurisdiction but, due to differences in vulnerability and impact, be ranked as high for the County or another jurisdiction. Jurisdictional ranking results are presented in each jurisdictional annex in Volume II.

15.1 HAZARD RANKING METHODOLOGY

15.1.1 Categories Used in Ranking

A relative hazard risk ranking process was conducted. The Risk Factor (RF) approach produces numerical values that allow identified hazards to be ranked against one another (the higher the RF value, the greater the hazard risk). The ranking methodology is based on five risk assessment categories (probability of occurrence, impact, spatial extent, warning time, and duration), with the following scoring parameters defined for each category (see Figure 15-1):

- **Level**—The level is a qualitative description of how each hazard rates in each category (such as low to high, or unlikely to frequent)
- **Criteria**—The criteria are clearly determinable quantities or descriptions that define which level should apply to each hazard
- **Index**—The index is the hazard's score in each category, based on the assigned level
- **Weight Value**—The weighting is a multiplier applied to each hazard's numeric value in each category, to represent the relative importance of the category (the higher the weighting, the more important the category)

identifies the five risk assessment categories, the criteria and associated risk level indices used to quantify their risk, and the suggested weighting factor (weight value) applied to each risk assessment category.

15.1.2 Total Ranking Score

To calculate the RF value for a given hazard, the assigned risk value for each category is multiplied by the weighting factor. The sum of all five categories equals the final RF value, as follows:

Risk Factor Methodology Equation

RF Value = [(Probability x .30) + (Impact x .30) + (Spatial Extent x .20) + (Warning Time x .10) + (Duration x.10)]

Hazards identified as high-risk have RFs greater than or equal to 2.5. RFs ranging from 2.0 to 2.4 are considered moderate-risk hazards. Hazards with RFs less than 2.0 are considered low risk hazards. The threat posed to life and property for moderate-risk and high-risk hazards is considered significant enough to warrant hazard-specific mitigation actions.

Figure 15-1. Summary of Risk Factor Approach

Risk Assessment Category	Degree of Risk			Weight Value
	Level	Criteria	Index	
PROBABILITY *What is the likelihood of a hazard event occurring in a given year?*	UNLIKELY	LESS THAN 1% ANNUAL PROBABILITY	1	30%
	POSSIBLE	BETWEEN 1% & 49.9% ANNUAL PROBABILITY	2	
	LIKELY	BETWEEN 50% & 90% ANNUAL PROBABILITY	3	
	HIGHLY LIKELY	GREATER THAN 90% ANNUAL PROBABILTY	4	
IMPACT *In terms of injuries, damage, or death, would you anticipate impacts to be minor, limited, critical, or catastrophic when a significant hazard event occurs?*	MINOR	VERY FEW INJURIES, IF ANY. ONLY MINOR PROPERTY DAMAGE & MINIMAL DISRUPTION ON QUALITY OF LIFE. TEMPORARY SHUTDOWN OF CRITICAL FACILITIES.	1	30%
	LIMITED	MINOR INJURIES ONLY. MORE THAN 10% OF PROPERTY IN AFFECTED AREA DAMAGED OR DESTROYED. COMPLETE SHUTDOWN OF CRITICAL FACILITIES FOR MORE THAN ONE DAY.	2	
	CRITICAL	MULTIPLE DEATHS/INJURIES POSSIBLE. MORE THAN 25% OF PROPERTY IN AFFECTED AREA DAMAGED OR DESTROYED. COMPLETE SHUTDOWN OF CRITICAL FACILITIES FOR MORE THAN ONE WEEK.	3	
	CATASTROPHIC	HIGH NUMBER OF DEATHS/INJURIES POSSIBLE. MORE THAN 50% OF PROPERTY IN AFFECTED AREA DAMAGED OR DESTROYED. COMPLETE SHUTDOWN OF CRITICAL FACILITIES FOR 30 DAYS OR MORE.	4	
SPATIAL EXTENT *How large of an area could be impacted by a hazard event? Are impacts localized or regional?*	NEGLIGIBLE	LESS THAN 1% OF AREA AFFECTED	1	20%
	SMALL	BETWEEN 1 & 10.9% OF AREA AFFECTED	2	
	MODERATE	BETWEEN 11 & 25% OF AREA AFFECTED	3	
	LARGE	GREATER THAN 25% OF AREA AFFECTED	4	
WARNING TIME *Is there usually some lead time associated with the hazard event? Have warning measures been implemented?*	MORE THAN 24 HRS	SELF-DEFINED	1	10%
	12 TO 24 HRS	SELF-DEFINED	2	
	6 TO 12 HRS	SELF-DEFINED	3	
	LESS THAN 6 HRS	SELF-DEFINED	4	
DURATION *How long does the hazard event usually last?*	LESS THAN 6 HRS	SELF-DEFINED	1	10%
	LESS THAN 24 HRS	SELF-DEFINED	2	
	LESS THAN 1 WEEK	SELF-DEFINED	3	
	MORE THAN 1 WEEK	SELF-DEFINED	4	

(NOTE: Levels of warning time and criteria that define them may be adjusted based on hazard addressed.)

15.2 HAZARD RANKING RESULTS

Using the methodology described above, the preliminary hazard ranking for the identified hazards of concern was determined for the County. Table 15-1 shows the countywide values of five risk assessment categories for each hazard and the resulting RF. The finalized hazard ranking for each jurisdiction can be found in the jurisdictional annexes in Volume II.

Table 15-1. Preliminary Hazard Ranking for Douglas County

Hazard Risk	Hazard	Risk Assessment Category					Risk Factor (RF)
		Probability	Impact	Spatial Extent	Warning Time	Duration	
HIGH	Severe Weather	4	3	4	1	3	3.3
	Drought	3	2	4	1	3	2.7
	Wildfire	2	2	3	4	3	2.5
MODERATE	Flood	2	3	3	1	2	2.4
	Hazardous Materials	2	2	2	4	3	2.3
	Pandemic and Disease Outbreak	2	2	3	1	4	2.3
	Geologic Hazards	2	2	2	4	1	2.1
LOW	Dam Failure	1	2	2	2	3	1.8
	Earthquake	1	1	2	4	1	1.5

PART 3: CAPABILITY ASSESSMENT

16. CAPABILITY ASSESSMENT

A capability assessment is an inventory of a community's missions, programs, and policies and an analysis of its capacity to carry them out (FEMA 2003). This integral part of the planning process analyzes current governmental programs, policies, regulations, and funding that could either facilitate or hinder mitigation. Through assessing its capabilities, a jurisdiction learns whether it can implement certain mitigation actions by determining the following:

- The range of local and/or state administrative, programmatic, regulatory, financial, and technical resources available to assist in implementing mitigation actions
- Types of mitigation actions that may be technically, legally, administratively, politically, or fiscally challenging or infeasible because they are outside of current capabilities
- Opportunities to enhance local capabilities to support long-term mitigation and risk reduction

This chapter summarizes existing capabilities at all levels of government (federal, state, county, local) for supporting hazard mitigation within the planning area. These capabilities are presented in three categories:

- Planning and regulatory capabilities
- Administrative and technical capabilities
- Fiscal capabilities

Each Planning Partner's annex in Volume II also includes a capability assessment specific to those jurisdictions. In addition to the above categories, the annexes review capabilities in the more localized categories of adaptive capacity and education and outreach. Participating jurisdictions evaluated the effectiveness of their capabilities for supporting hazard mitigation and identified opportunities to enhance those capabilities. Each jurisdiction identified how it has integrated hazard mitigation into its existing planning, regulatory, and operational/administrative framework and how it intends to promote ongoing integration.

16.1 PLANNING AND REGULATORY CAPABILITIES

Planning and regulatory capabilities are based on ordinances, policies, local laws, state statutes, plans, and programs that relate to managing growth and development. Planning and regulatory capabilities refer to current plans and regulations as well as the jurisdiction's ability to change and improve those plans and regulations as needed. This section summarizes planning and regulatory capabilities for Douglas County. Further information is provided in the jurisdictional annexes in Volume II.

16.1.1 Federal

Biggert Waters National Flood Insurance Reform Act of 2012

Under the Biggert-Waters National Flood Insurance Reform Act of 2012, long-term changes to the National Flood Insurance Program have been adopted that have increased rates overall to reflect the flood risk more accurately to buildings in flood hazard areas. This has significantly influenced construction and reconstruction within flood hazard areas.

Property owners are encouraged to consider long-term insurance costs when undertaking reconstruction or elevation of damaged buildings. An investment to reconstruct the lowest floor of a building an additional foot or two higher today may translate into significant future flood insurance savings.

Bunning-Bereuter-Blumenauer Flood Insurance Reform Act of 2004

The Flood Insurance Reform Act of 2004 amended the 1994 National Flood Insurance Reform Act of 1968 to reduce losses to properties for which repetitive flood insurance claim payments have been made. This Act established a program for mitigation of severe repetitive loss properties and gave FEMA the authority to fund mitigation activities for individual repetitive loss claims properties. The Act provides additional coverage for compliance with land-use and control measures. It helps residents with affordable flood insurance and gives additional tools to states and communities to mitigate severe repetitive loss properties.

Code of Federal Regulations, Local Hazard Mitigation Plans (44 CFR PART 201.6)

FEMA has prepared policies and procedures for FEMA's review and approval of local HMPs. A local HMP is the representation of a jurisdiction's commitment to reduce risks from natural hazards, serving as a guide for decision makers as they commit resources to reducing the effects of natural hazards. Local plans also serve as the basis for the state to provide technical assistance and to prioritize project funding.

Disaster Mitigation Act of 2000

The Disaster Mitigation Act (DMA) is the current federal legislation addressing hazard mitigation planning. The DMA replaced previous mitigation planning provisions with new requirements that emphasize the need for state, tribal, and local entities to closely coordinate mitigation planning and implementation efforts. It emphasizes planning for disasters before they occur. It requires plans to be in place before Hazard Mitigation Assistance grant funds are available to communities. The rules provide detailed guidance on what applicants should include in a plan. This plan is designed to meet the requirements of the DMA, improving eligibility for future hazard mitigation funds.

Disaster Recovery Reform Act

This bill amended the Robert T. Stafford Disaster Relief and Emergency Assistance Act as follows:

- It modified the Pre-disaster Hazard Mitigation Grant Program to permit the use of technical and financial assistance to establish and carry out enforcement activities to implement codes, specifications, and standards that incorporate the latest hazard-resistant designs.
- It directed the president to establish a National Public Infrastructure Pre-disaster Mitigation Fund.
- It authorized the president's contribution to the cost of hazard mitigation measures to be used to increase resilience in any area affected by a major disaster.
- It directed FEMA to issue a final rulemaking that defines the terms "resilient" and "resiliency."

Emergency Support Function #14, Long-Term Recovery Planning

Long-term community recovery is a mechanism for coordinating federal support to state, tribal, regional, and local governments, nongovernmental organizations, and the private sector to enable recovery from the long-term consequences of extraordinary disasters. Emergency Support Function (ESF) #14 accomplishes this by identifying and facilitating availability and use of sources of recovery funding and providing technical assistance (such as impact analyses) for community recovery and recovery planning (FEMA 2008).

ESF #14 may be activated for incidents that require a coordinated federal response to address significant long-term impacts (e.g., impacts on housing, government operations, agriculture, businesses, employment, community infrastructure, the environment, human health, and social services) to foster sustainable recovery. Actions coordinated under ESF #14 include pre-incident planning and coordination immediately prior to the incident, post-event planning, and operations (FEMA 2008).

Homeowner's Flood Insurance Affordability Act

This 2014 law repealed and modified certain provisions of the Biggert-Waters Flood Insurance Reform Act and made additional changes to some flood insurance aspects not covered by that Act. It lowered rate increases on some policies, prevented some future rate increases, implemented a surcharge on all policyholders, and repealed certain rate increases that had already gone into effect and provided for refunds to those policyholders.

National Flood Insurance Program

The National Flood Insurance Program (NFIP) is a federal program enabling property owners in participating communities to purchase insurance as a protection against flood losses in exchange for state and community floodplain management regulations that reduce future flood damage. Communities participate voluntarily in the NFIP by adopting and enforcing floodplain management ordinances to reduce future flood damage. The NFIP then makes federally backed flood insurance available to homeowners, renters, and business owners in these communities. Flood insurance is designed to provide an alternative to disaster assistance to reduce the escalating costs of repairing damage to buildings and their contents caused by floods.

In adopting floodplain management ordinances, NFIP-participating municipalities may adopt higher regulatory standards than minimum NFIP requirements, such as the following:

- **Building Elevation**: Base flood elevation is the elevation of surface water due to flooding that has a 1 percent chance of being equaled or exceeded in any given year. Where base flood elevation data is available, NFIP communities must require, as a minimum, that all new construction and substantial improvements of residential structures in FEMA-mapped flood zones have the lowest floor (including basement) elevated above the base flood level. Communities may choose to set a level higher than the base flood elevation as minimum standard
- **Cumulative Substantial Improvements/Damage:** The NFIP allows improvements valued at up to 50 percent of a building's pre-improvement value to be permitted without meeting flood protection requirements. Over the years, a community may issue a succession of permits—all below the 50 percent threshold—for different repairs or improvements to the same structure. This can greatly increase the overall value of structures that are vulnerable to flood damage. To address this, a community may choose to define "substantial improvement" cumulatively so that once a threshold of improvement within a certain length of time is reached, the structure is considered to be substantially improved and must meet flood protection requirements.

NFIP Community Rating System

The Community Rating System is a voluntary incentive program that encourages community floodplain management activities that exceed minimum NFIP requirements. It provides discounted flood insurance premium rates to reflect the reduced flood risk resulting from community actions that reduce flood losses, facilitate accurate insurance rating, or promote the awareness of flood insurance.

As of August 2025, Douglas County and the Town of Parker both participate in the Community Rating System.

Presidential Policy Directive 8

Presidential Policy Directive 8 requires that a Threat Hazard Identification and Risk Assessment (THIRA) be developed for a state to remain eligible for Homeland Security Grant Program and Emergency Management Program Grant funding. The Colorado Division of Homeland Security and Emergency Management (DHSEM) is the lead agency in preparing Colorado's THIRA.

Risk Mapping, Assessment, and Planning

Through the Risk Mapping, Assessment, and Planning (Risk MAP) program, FEMA works with federal, state, tribal, and local partners across the nation to identify flood risk and promote practices to reduce it. Risk MAP provides high-quality flood maps and information, tools to better assess the risk from flooding, and planning and outreach support to communities. Each Risk MAP project is tailored to the needs of the community and may involve different products and services.

Risk Rating 2.0: Equity in Action

FEMA's Risk Rating 2.0: Equity in Action considers specific characteristics of a building to provide individualized and equitable flood insurance rates. The rating methodology considers the frequency of flooding, multiple flood types, proximity to flood sources, and building characteristics such as first-floor heights and costs to rebuild. Homeowners that drop NFIP insurance policies no longer have access to Flood Mitigation Assistance funding for future mitigation efforts.

Robert T. Stafford Disaster Relief and Emergency Assistance Act

The Robert T. Stafford Disaster Relief and Emergency Assistance Act provides for assistance from the federal government to state and local governments in carrying out their responsibilities to alleviate the results of disasters. Its provisions include the following:

- Revising and broadening the scope of existing disaster relief programs
- Encouraging the development of comprehensive disaster preparedness and assistance plans, programs, capabilities, and organizations by state and local governments
- Achieving greater coordination and responsiveness of disaster preparedness and relief programs
- Encouraging individuals and state and local governments to protect themselves by obtaining insurance coverage to supplement or replace governmental assistance
- Encouraging hazard mitigation measures to reduce losses from disasters, including development of land-use and construction regulations
- Providing federal assistance programs for both public and private losses sustained in disasters

U.S. Army Corps of Engineers

The U.S. Army Corps of Engineers (USACE) can issue the following types of general permits under Section 404(e) of the Clean Water Act to authorize activities that have only minimal individual and cumulative adverse environmental effects:

- A nationwide permit is a general permit that authorizes activities across the country unless a district or division commander revokes the nationwide permit in a state or other geographic region. There are 54 nationwide permits, and they authorize a wide variety of activities, including transportation projects,

bank stabilization activities, residential development, commercial and industrial developments, aids to navigation, and maintenance activities (USACE 2017).

- Standard permits are individual permits that involve a full public interest review of an individual permit application and include the issuance of a public notice for any project that does not meet the terms and conditions of a nationwide permit or a letter of permission.
- Regional general permits are for small, specialized projects. In Douglas County, the Omaha District issues the regional general permit categories (USACE n.d.).

16.1.2 **State**

Statutes

Statutes are laws enacted by a legislative body. Table 16-1 provides a summary of Colorado statutes relevant to mitigation. Statutes relating to hazard mitigation generally fall into the following categories: legislative declarations, creation of specialized hazard mitigation committees and positions, creation of dedicated mitigation funds, and the expansion of duties for established hazard mitigation committees (State of Colorado 2023). The sections below provide additional information on three state laws relevant to hazard mitigation.

Table 16-1. State Statutes Relevant to Mitigation

Colorado Revised Statute Number	Title
General Mitigation	
10-4-114	Requirements on hazard insurance coverage for loans secured by real property
24-33.5-702	Purposes and limitations
24-33.5-710	Disaster prevention, mitigation, and recovery
24-33.5-1213.4	School all-hazard emergency planning and response
24-33.5-1606.5	Office of preparedness - creation - duties - posting of notice of NIMS classes - definition
24-38.5-102.6	Climate change mitigation and adaptation fund - creation -use
24-38.8-103	Development of statewide climate preparedness roadmap
24-65.1-103	Definitions pertaining to natural hazards
24-65.1-302	Functions of other state agencies
Wildfire Mitigation	
2-3-1601	Legislative declaration
2-3-1602	Wildfire matters review committee - creation
23-1-142	Commission directive - expansion of forestry and wildfire mitigation degree and certificate programs - simulator - legislative declaration - definitions
23-31-310	Forest restoration and wildfire risk mitigation grant program - technical advisory panel - legislative declaration - definitions
23-31-312	Community wildfire protection plans - biomass utilization plans - county governments - guidelines and criteria - legislative declaration - definitions
23-31-313	Healthy forests - vibrant communities - funds created - outreach working group - legislative declaration - definition
23-31-316	Colorado forest health council - legislative declaration
23-31-317	Biomass utilization study - legislative declaration - report - definitions

Colorado Revised Statute Number	Title
23-31-318	Wildfire mitigation incentives for local governments – grant awards - fund - reporting - definitions
23-31-320	Timber, forest health, and wildfire mitigation industries workforce development program - creation - policies and procedures - legislative declaration - definitions
23-81-102	Recruitment of wildland fire prevention and mitigation educators' program - report - definition
24-33-117	Wildfire mitigation capacity development fund – established - financing - legislative intent
24-33.5-1203	Duties of division
24-33.5-1221	State responsibility - determination by the director - intergovernmental agreements required - terms included - definitions - legislative declaration
24-33.5-1225	Emergencies
24-33.5-1227	Wildfire preparedness fund - creation - gifts, grants, and donations authorized - wildfire preparedness plan - report
24-33.5-1233	Colorado fire commission - creation - powers and duties - report - legislative declaration
24-33.5-1236	Wildfire resiliency code board - powers and duties - rules - cash fund - legislative declaration - definitions
24-65.1-302	Functions of other state agencies
29-20-105.5	Intergovernmental cooperation – intergovernmental agreements to address wildland fire mitigation - land owned by municipality for utility purposes - legislative declaration
29-22.5-101	Legislative declaration
30-15-401.7	Determination of fire hazard area - community wildfire protection plans - adoption - legislative declaration - definitions
32-18-109.	Wildfire mitigation measures - private land - reimbursement
37-92-602	Exemptions - presumptions - stream restoration projects - report - legislative declaration - definitions
39-22-543	Credit for wildfire hazard mitigation expenses – legislative declaration - definitions
Drought Mitigation	
35-1-114	Agricultural drought and climate resilience office – creation - grants for agrivoltaic demonstration and research projects - rules - definitions
37-60-123.2	Flood and drought response fund - created
37-60-124	Office of water conservation and drought planning - creation - powers and duties
37-60-126.5	Drought mitigation planning - programs - relationship to state assistance
Flood Mitigation	
24-65.1-302	Functions of other state agencies
30-30-102	Authority to remove obstructions in streams
32-11.5-102	Legislative declaration
37-60-106	Duties of the board - legislative declaration
37-60-121	Colorado water conservation board construction fund - creation - nature of fund - funds for investigations - contributions - use for augmenting the general fund – funds created - rules
37-60-123.2	Flood and drought response fund - created
37-92-602	Exemptions - presumptions - stream restoration projects - report - legislative declaration - definitions

Source: (State of Colorado 2023)

Local Government Land Use Control Enabling Act

The Local Government Land Use Control Enabling Act gives broad enabling authority to local governments to plan and regulate the use of land within their jurisdictions, including regulating development and activities in hazardous areas. The Act encourages the coordinated, adjusted, and harmonious development of the municipality and its environment.

Amendment to the Colorado Disaster Emergency Act

The Colorado Disaster Emergency Act provides a legal framework for managing disasters and emergencies, empowering the governor to declare a state of emergency and coordinate response efforts across state and local agencies. Amendment (HB-18-1394) includes provisions related to recovery, mitigation, and resiliency and to the roles and responsibilities of state and local agencies at all stages of emergency management.

Inter-governmental Cooperation to Address Wildfire Mitigation

Colorado Revised Statute Section 29-20-105.5 applies to any local government that owns land area for any reason other than utility purposes that is located entirely or partially outside its own territorial boundaries and inside the boundaries of a county that contains at least 50 percent forest land or land that constitutes a wildland area. The law requires such governments to enter into an inter-governmental agreement with the county or Colorado State Fire Service to mitigate forest land/wildland fires that affect contiguous land areas of the local government and county.

Regulations

Regulations for Regulatory Floodplains

The rules and regulations for regulatory floodplains in Colorado are included in the Code of Colorado Regulations 2 CCR 408-1, updated in 2022. This regulation is promulgated and overseen by the Colorado Water Conservation Board (State of Colorado 2023).

Regulations for Prescribed Burning in Colorado

Regulation 8 CCR 1507-32 dictates minimum standards for all prescribed burning in Colorado. The Division of Fire Prevention and Control (DFPC) is responsible for oversight and compliance (State of Colorado 2023).

Plans

Colorado Resiliency Framework

The Colorado Resiliency Framework is a strategic plan aimed at enhancing the state's resilience to challenges including climate change, social inequalities, and economic stability. The Colorado Resiliency Framework was developed in response to the wildfires in 2012 and floods in 2013, highlighting the need for proactive planning to protect communities and infrastructure. The original framework was established in 2015, and it has since been updated to address evolving challenges and strategies for resilience. The framework outlines 29 strategies across six priority areas to reduce risks and adapt to changes in the environment, society, and economy (DOLA 2020).

COVID-19 Regional Resiliency and Recovery Roadmaps

The Roadmaps Program brings together 16 Regional Community Teams made up of over 150 rural jurisdictions in addition to non-governmental partners. Since November 2021, these local partners have been actively working with the state and their own Roadmaps consultant to prioritize and strategize around shared regional objectives through a two-year planning and implementation process (DOLA n.d.). Each Regional Community Team has developed a Roadmap that will result in regionally aligned and actionable strategies that will help Colorado's rural communities recover from COVID and be more resilient to future disruptions (DOLA n.d.).

Colorado Wildfire Preparedness Plan

Colorado Revised Statute Section 24-33.5-1227(2)(a) requires the Division of Fire Prevention and Control to develop an annual Wildfire Preparedness Plan in collaboration with a representative of the County Sheriffs of Colorado, a representative of the Colorado State Fire Chiefs Association, the Director of the Office of Emergency Management, and the Adjutant General (DFPC 2025). The Wildfire Preparedness Plan must address the following (DFPC 2025):

- The amount of aerial firefighting resources necessary for Colorado at times of high and low wildfire risk
- The availability of aerial firefighting equipment and personnel at times of high fire risk to respond to a wildfire
- The availability of state wildfire engines and staffing of the engines at different levels of wildfire risk
- The availability of wildfire hand crews, including state inmate wildfire hand crews, at different levels of wildfire risk
- A process for dispatching aerial firefighting equipment and personnel that is consistent with the statewide mobilization plan (Colorado Revised Statutes Section 24-33.5-705.4).

State Emergency Operations Plan

The Colorado State Emergency Operations Plan (SEOP) presents guidelines on how the state carries out its response and recovery responsibilities to address an emergency or disaster event. This plan can only be activated through the issuance of a Governor's Executive Order. The director of the Office of Emergency Management (OEM) will lead state disaster or emergency response and recovery efforts. Once the plan is activated, all state departments and offices are mandated under the authority of the Colorado Disaster Emergency Act (Colorado Revised Statutes Section 24-33.5-701) and this plan to carry out assigned activities related to mitigating effects of an emergency or disaster and to cooperate fully with each other, the OEM, and other political subdivisions in providing emergency assistance (DHSEM 2023).

Colorado Emergency Preparedness Assessment

The Colorado Emergency Preparedness Assessment (CEPA) is prepared through sessions that accomplish the following (DHSEM n.d.):

- Help assess local risk, capabilities and the potential need for support and resources during and after emergencies or disasters.
- Assist local jurisdictions in efforts to obtain a greater understanding of local preparedness levels.
- Better position the state to support local disaster preparedness, response and recovery efforts.

The sessions are conducted through a standardized and repeatable process, so that subsequent sessions provide trend data and comparative analysis for local jurisdictions. DHSEM provides a facilitator for the CEPA session. Data gathered during the session is compiled into a comprehensive report that assesses current capabilities, compares current assessments with previous cycle analysis and supports jurisdictions' integrated preparedness plans.

Continuity Plan

DSHEM is authorized by Colorado Revised Statutes Section 24-33.5-1609 to adopt rules and regulations for the continuity of state government operations. The rules and regulations provide for the creation of planning guidance for state departments and agencies to use in developing plans for continuity of operations. The DHSEM Continuity Plan ensures that the mission-essential functions of state departments and agencies continue to be performed during a wide range of emergencies, including localized weather-related events (tornadoes, floods, blizzards), long-term power outages, law enforcement activities, and acts of terrorism (DHSEM n.d.).

Enhanced State Hazard Mitigation Plan

Colorado's Enhanced State Hazard Mitigation Plan establishes a process that leads to the implementation of hazard mitigation actions. It demonstrates Colorado's commitment to a comprehensive mitigation program focused on reducing risks from hazards and serves as a guide for state and local decision makers as they commit resources to reduce the effects of hazards (State of Colorado 2023).

The Colorado Water Plan

The Colorado Water Plan provides a framework for helping Colorado meet its water challenges through collaborative action around water development and water conservation. The Water Plan is a grassroots effort and relies on the Colorado water community to identify and implement basin-specific and/or statewide water projects that provide multiple benefits to the state's diverse water users. The Colorado Water Conservation Board creates and manages the Water Plan framework and supports the state's water community with funding and technical resources to implement programs and projects (CWCB 2023).

16.1.3 **County**

2040 Comprehensive Master Plan

Douglas County's Comprehensive Master Plan (CMP) seeks to find an appropriate balance in land use that will provide opportunities for preservation of open space and wildlife habitat, while meeting the needs of daily life, including jobs, housing, recreation, and services appropriate for both urban and nonurban lifestyles. The CMP incorporates general policies about how and where growth and development should occur while offering a broad, yet realistic plan for the County now and into the future (Douglas County 2019). It includes the following specific elements:

- **Mineral Extraction Plan—**The Mineral Extraction Plan attempts to balance the County's need for minerals against the potential impacts of extraction. Mineral extraction is necessary in the development of homes, roads, and office buildings and, therefore, contributes to the economic viability of the County. Reclaimed mineral extraction sites, provide opportunities for wildlife habitat, trail corridors, and other recreational uses (Douglas County 2019).

- **Recreation and Tourism Plan—**The Recreation and Tourism Plan establishes a foundation for future recreation and tourism planning by identifying opportunities and future needs. Douglas County's extensive natural resource base and rich rural heritage are the foundation of the existing recreation and tourism industry. Both private and public interests provide recreation and tourism opportunities. Community groups, clubs, private vendors, and governments sponsor a festivals and cultural activities around the County that bring residents and tourists together (Douglas County 2017).
- **2030 Parks, Trails and Open Space Master Plan—**The 2030 Douglas County Parks, Trails and Open Space Master Plan guides decision-making processes in the development and management of parks and trails, and in the preservation and conservation of open space within Douglas County. The Plan serves as a basis for community conversation among citizens, appointed and elected officials, and County staff as a means to protect and enhance parks, trails, and open space as an important component of the high quality of life within the County. It presents maps depicting a wide variety of conditions across the County, including existing and proposed park facilities, acquired and conserved open space lands, and existing County regional and open space trail corridors (Douglas County 2012).

2040 Transportation Master Plan

Douglas County's 2040 Transportation Master Plan (TMP) defines a long-range vision for a multimodal transportation system that offers more choices in how people travel in the County. The goals are to keep the traveling public safe, keep the traveling public and goods moving, and keep the economy growing. The TMP guides the County's capital improvement program and facilitates the effective investment of public funds for transportation system improvement. It includes the following (Douglas County 2019):

- A comprehensive evaluation of the existing status of the road network, including congestion levels and physical condition
- Projections for future demand based on pending and potential growth and development trends
- Integration of recent transportation planning efforts, including specialized studies and efforts by the County's municipalities and state and regional agencies

Comprehensive Emergency Management Plan

Douglas County maintains a Comprehensive Emergency Management Plan (CEMP), which provides uniform policies and procedures for the effective coordination of actions to prevent, prepare for, respond to, recover from, and mitigate natural or man-made disasters that might affect the health, safety, or general welfare of Douglas County residents and visitors. The CEMP articulates the roles and responsibilities of governmental entities and public and private partners. It is designed to accomplish the following (Douglas County 2021):

- Minimize suffering, loss of life, personal injury, and property damage resulting from hazardous or emergency conditions.
- Provide a framework for a comprehensive emergency management system that addresses all aspects of emergency prevention, preparedness, response, recovery, and mitigation.
- Minimize disaster-related material shortages and service system disruptions that could have adverse impacts on county residents and visitors.
- Provide immediate relief and promote short-term and long-term recovery following a disaster.

The CEMP is compiled of several additional plans and annexes. Those relative to hazard mitigation are outlined in the following sections.

Emergency Operations Plan

The Douglas County Emergency Operations Plan establishes the structure for a coordinated response to various types of natural, technological, and human-caused emergencies, disasters, or terrorist attacks. The EOP provides an overview of how Douglas County public safety partners collaborate, plan, and prepare for a hazardous incident that threatens lives, property, and natural resources (Douglas County 2021).

Damage Assessment Annex

The Damage Assessment Annex defines the operational concepts, organizational arrangements, responsibilities, and procedures for the assessment and reporting of damage to public and private property resulting from a disaster. This system meets the needs of the community and disaster declaration needs consistent with state and federal criteria (Douglas County 2017).

Severe Weather Annex

The Severe Weather Annex provides for response and recovery in the event of a severe weather emergency in Douglas County. It includes a basic overview of roles, responsibilities and actions that may be taken in response to these types of incidents (Douglas County 2021).

Wildland Fire Annex

The Wildland Fire Annex provides a framework for response and recovery in the event of a wildland fire emergency in Douglas County. It includes a basic overview of roles, responsibilities and actions that may be taken in response to these types of incidents (Douglas County 2021).

Rapid Needs Assessment Operating Plan

This operating plan provides agencies involved in rapid needs assessment with a tool for planning and implementing rapid needs assessment procedures. It provides local personnel with the following (Douglas County 2017):

- Skills and knowledge needed to collect and report disaster intelligence immediately following an event
- Procedures and forms needed to conduct rapid needs assessment

Disaster Recovery Plan

The Douglas County Disaster Recovery Plan provides a comprehensive framework for recovering from disasters and emergencies, particularly from incidents that are large or catastrophic. It is a guide for roles and responsibilities, prioritization, and decision-making practices in disaster recovery situations. The document outlines recovery actions that will result in a resilient and capable community. This plan assigns roles and responsibilities, accounting for any shifts that occur in the transition between short-term and long-term recovery (Douglas County 2019).

All Hazards Debris Management Plan

The All Hazards Debris Management Plan provides a framework for County government and other entities to clear and remove debris generated during a public emergency within the jurisdictional limits of Douglas County. It unifies the efforts of public and private organizations to accomplish the following (Douglas County 2022):

- Provide organizational structure, guidance, and standardized guidelines for the clearance, removal, and disposal of debris caused by a major debris-generating event.
- Establish the most efficient and cost-effective methods to resolve disaster debris removal and disposal issues.
- Initiate and coordinate private sector debris removal and disposal contracts to maximize cleanup efficiencies when deemed appropriate by Douglas County officials.
- Expedite debris removal and disposal efforts that provide visible signs of recovery designed to mitigate the threat to the health, safety, and welfare of citizens.
- Coordinate partnering relationships through communications and pre-planning with local, state, and federal agencies that have debris management responsibilities.
- Communicate with and guide citizen actions for clearing private properties.

Fire Operating Plan

This Fire Operating Plan sets forth standard operating procedures and responsibilities for cooperative wildfire protection on all lands in Douglas County. It serves as a guide for fire departments and organizations to respond effectively to emergencies, including natural disasters, technological emergencies, and biological incidents. The plan outlines the responsibilities and duties of personnel, establishes a framework for comprehensive emergency management, and facilitates coordination with local first responders (Douglas County 2021).

Planned Development Guide

Planned Development Guides have been developed for the following areas of Douglas County (Douglas County n.d.):

- Castle Pines Village (July 2015)
- Highlands Ranch (October 2023)
- Pinery (October 2015)
- Roxborough Village (May 2024)

Each guide accomplishes the following:

- Sets forth land uses and development standards
- Regulates the use of land and the use, bulk, maximum height, minimum lot area, minimum lot width, and minimum yard spaces of buildings
- Provides for a substantial nonurban use area
- Provides regulations for uses permitted therein and accessory buildings and uses
- Provides additional supplementary regulations

Public Health Improvement Plan

The public health improvement plan outlines strategies to enhance community health through data-driven approaches and stakeholder collaboration. To develop health priorities, the plan considered community input, the size and severity of the problem, and the opportunities and challenges that support or complicate the achievement of goals to improve the health and safety of Douglas County citizens (Douglas County 2022).

Community Health Assessment

The community health assessment describes the health of the population, identifies areas for health improvement, identifies contributing factors that impact health outcomes, and identifies community assets and resources that can be mobilized to improve population health (Douglas County 2021).

16.1.4 Local

Local planners typically consult with other local governments, community and regional experts, and community advocates. The key information sources regarding natural hazards at the local level include a local planning commission, engineering and public works officials, emergency managers, and the Local Emergency Planning Committee. Advisory plans may include a comprehensive land use plan, a local HMP, and/or an emergency operations plan (State of Colorado 2023).

Land Use

Colorado counties are required to develop comprehensive land use plans pursuant to state statute. Municipalities may have similar requirements under a Home Rule Charter or are otherwise bound by state planning laws. While the nature and extent of comprehensive land use plans vary across the state, the fundamental components of many plans include information on natural and technological constraints on various types of land uses. Information contained in a comprehensive land use plan is typically a key element in the land use decision process (State of Colorado 2023).

The Colorado Department of Local Affairs Division of Local Government (DLG) developed a program to help communities plan for and implement strategies for hazard avoidance and mitigation. DLG launched the *Planning for Hazards: Land Use Solutions for Colorado* guide and website to help local communities implement hazard mitigation into their land use planning. The guide includes information on how to conduct a local hazard identification and risk assessment and identifies over 20 land use strategies specific to Colorado that can be used to further hazard planning. The following sources of data typically convey information to decision-makers regarding the land use review process (State of Colorado 2023):

- Local community planners with knowledge provided via a local hazard mitigation planning process
- Expert referral agency consultations as required by state law
- The general public and other local referral bodies as required in local codes

Land use planners typically have responsibility for gathering and evaluating local hazard information, other local government comments, and state agency referrals for decision-maker review. Most significant land use decisions in Colorado are quasi-judicial, requiring a public process and the presentation of issues at public meetings and hearings. The format of the public process is determined by local officials and may include potential developer presentations, public workshops, and formal hearings before planning commissioners and/or local elected officials (State of Colorado 2023).

Local zoning and subdivision codes may also contain hazard information and avoidance requirements. It may be required that site-specific mitigation plans be developed for consideration by officials during the review process. Hazard information required in local codes typically includes flood and floodplain information, geologic hazards, and wildland fire risks. Other hazard data may also be required based on local conditions, such as mining hazards in mountain communities (State of Colorado 2023).

Building Codes

Local building codes are sound tools to consider when evaluating local policies related to hazard mitigation. The intention is to increase structural integrity and fire prevention; however, increased benefits can also be seen in natural hazard avoidance. Given Colorado's strong home rule tradition, building codes are typically implemented at the local level (State of Colorado 2023).

16.2 ADMINISTRATIVE AND TECHNICAL CAPABILITIES

This section summarizes administrative and technical capabilities in Douglas County. Further information is provided in the jurisdictional annexes in Volume II.

16.2.1 Federal

Federal Emergency Management Agency

FEMA provides assistance before, during, and after disasters, reviews HMPs and sets federal standards for local and state HMPs, and evaluates NFIP minimum compliance through audits known as Community Assistance Visits (CAVs) or Community Assistance Contacts (CACs).

CAVs and CACs are performed to ascertain community compliance with the NFIP, at entry into the Community Rating System, and to maintain participation in the Community Rating System. CAVs are generally more rigorous than CACs. FEMA may conduct these with its own regional staff, with state staff under the Compliance Assistance Program–State Support Services Element, or with private contractors. A compliance audit evaluates the following key areas:

- The community's flood damage prevention ordinance
- Mapping products and other ordinances used to regulate floodplain development
- Floodplain development permitting procedures
- Floodplain permit applications and other forms/records, including substantial damage and improvement determinations
- Floodplain development review and performance standards
- Floodplain development permits issued to applicants

Federal Energy Regulatory Commission Dam Safety Program

The Federal Energy Regulatory Commission (FERC) has the largest dam safety program in the United States, cooperating with many federal and state agencies to ensure and promote dam safety and, more recently, homeland security on dams associated with hydropower. Every 5 years, an independent consulting engineer, approved by the FERC, must inspect and evaluate projects with dams higher than 10 meters (32.8 feet) or with a total storage capacity of more than 2,000 acre-feet.

National Weather Service

The National Weather Service monitors weather and delivers weather forecasting for the United States. Colorado is serviced by four weather forecast offices: Pueblo, Grand Junction, Denver/Boulder, and Goodland. The Denver/Boulder Weather Forecast Office covers the counties of Jackson, Grand, Summit, Park, Clear Creek,

Gilpin, Boulder, Larimer, Weld, Morgan, Adams, Denver, Jefferson, Douglas, Arapahoe, Elbert, Lincoln, Washington, Logan, Phillips, and Sedgwick.

High Plains Regional Climate Center

The National Centers for Environmental Information manages the Regional Climate Center Program, which provides climate services to six regions encompassing the United States. The High Plains Regional Climate Center (HPRCC) covers Colorado, Kansas, Nebraska, North Dakota, South Dakota, and Wyoming. It provides climate services, develops climate data and information products, engages stakeholders, and conducts applied climate research. The HPRCC supports a staff of professionals focusing on the following areas (HPRCC n.d.):

- Climate services
- Database and product development
- Stakeholder engagement and outreach
- Climate monitoring
- Applied climate research

U.S. Army Corps of Engineers

USACE builds and maintains infrastructure projects that include dredging, storm damage reduction, and ecosystem restoration in and near waterways (USACE n.d.). USACE has numerous initiatives to support hazard mitigation measures:

- **Silver Jackets—**Silver Jackets is the state-level implementation program for the National Flood Risk Management Program. The program's goals are to leverage information and resources from federal, state, and local agencies to improve flood risk management; improve public risk communication through a united effort; and create a mechanism to collaboratively solve issues and implement initiatives beneficial to local communities. The USACE Omaha District organizes this program in Douglas County.
- **Planning Assistance to States Program—**USACE assists states, local governments, Native American tribes, and other non-federal entities in the preparation of plans for the development and conservation of water and related land resources. Types of water resource planning investigations that can be done include water quality studies, wetland evaluation studies, and floodplain management studies.
- **Floodplain Management Services Program—**USACE provides assistance on floodplain management planning. The program develops or interprets site-specific data on obstructions to flood flows, flood formation, and the timing, extent, duration, and frequency of flooding. Program services are available without charge to state, regional, and local governments, Native American tribes, and other non-federal public agencies.
- **Inspection of Completed Works Program—**Civil works structures whose failure could jeopardize the operational integrity of a facility, endanger the lives and safety of the public, or cause substantial property damage, are periodically inspected to ensure their structural stability, safety, and operational adequacy. For structures constructed by USACE and turned over to others for operation, the operating entity is responsible for the inspection. USACE may conduct the inspection on behalf of the project sponsor if reimbursement is made, or may participate in the inspection with the operating entity at the government's expense.
- **Rehabilitation and Inspection Program—**The USACE Rehabilitation and Inspection Program provides for inspection of flood control projects, the rehabilitation of damaged flood control projects, and the rehabilitation of federally authorized and constructed shore protection projects.

- **Dam Safety Program—**USACE is responsible for safety inspections of some federal and non-federal dams that meet the size and storage limitations specified in the National Dam Safety Act. USACE has inventoried dams and has surveyed each state and federal agency's capabilities, practices, and regulations regarding design, construction, operation, and maintenance of the dams. USACE has also developed guidelines for inspection and evaluation of dam safety.

U.S. Geological Survey

The U.S. Geological Survey (USGS) maintains a network of gauges that continuously measure lake, reservoir, stream, and tide levels. The data is transmitted to the USGS and made available over the internet. As project needs and funding levels change, gauges may be added or deactivated, and deactivated gauges may be reactivated (USGS 2023). USGS provides data to the state for drought determinations.

16.2.2 State

Colorado Climate Center

The Colorado Climate Center performs routine monitoring of statewide climate conditions, including drought and high-impact weather, provides regular updates including monthly climate summaries, webinars, presentations to the state Water Availability Task Force, and engagement with organizations and the public statewide, and offers wide-ranging climate services to diverse stakeholders.

Colorado Community Collaborative Rain, Hail, & Snow Network

The Colorado Community Collaborative Rain, Hail, & Snow Network provides high spatial coverage of precipitation reports and offers one of the most comprehensive datasets for hail measurements and characterization in the country. The network also provides educational outreach opportunities for reaching citizens.

Colorado Department of Agriculture Conservation Services Division Request-A-Bug Program

Biological pest control agents are seasonally available to help suppress weed and insect pests in Colorado. They can be requested by private landowners in the state or other governmental agencies concerned with controlling the spread of exotic invaders. Approximately 30 weed predators are being cultured, released, and established on weed infestations throughout the state. In addition to the biological weed control programs, this section conducts control programs for the alfalfa weevil and Oriental fruit moth, with a total of 12 beneficial species.

Colorado Department of Transportation Geohazards Services Program

The program provides internal mitigation design and review for projects funded by geohazards mitigation budget; performs site inspections during project construction; provides personnel designated as first responders during geologic hazard related emergencies; installs mitigation devices on slopes for prevention and/or protection; posts falling rock signs on highways; and maintains existing mitigation devices in a state of good repair. The program evaluates and prioritizes mitigation locations by combining geologic and climate information with traffic and slope data to rank geologic hazards according to severity of risk.

Division of Homeland Security and Emergency Management Hazard Mitigation Planning Programs

The DHSEM Office of Emergency Management Mitigation Team has two dedicated positions to provide technical assistance in the development of the SHMP as well as local HMPs. These positions facilitate and/or attend planning process meetings such as kickoff and mitigation strategy development and support public meetings and presentations to state agencies and local elected or appointed officials throughout the HMP's approval process, implementation and maintenance, and five-year eligibility cycle.

Colorado Geological Survey

The Colorado Geological Survey collects, analyzes, and disseminates geologic information and provides technical assistance to local governments. The Colorado Geological Survey determines areas of natural geologic hazards that could affect the safety of or economic loss to the citizens of Colorado, and assists, consults with, and advises existing state and local government agencies on geologic problems such as rain-caused instability due to soil saturation or additional instability and risk after a hazard event.

Colorado State Forest Service

Colorado Wildfire Risk Assessment

The Colorado Wildfire Risk Assessment is a web mapping tool providing access to statewide wildfire risk assessment information. The tool provides a consistent, comparable set of scientific results to be used as a foundation for wildfire mitigation and prevention planning in Colorado; creates public awareness about wildfire risk; provides state and local planners with information to support mitigation and prevention efforts; and identifies areas that may require additional planning related to wildfire mitigation projects.

Forestry Programs for Homeowners and Landowners

Colorado state foresters provide forestry-related technical assistance to homeowners and landowners to help them manage property and meet overall stewardship/management objectives, which includes wildfire risk reduction activities. Home assessments offer landowners recommendations on how to reduce wildfire risk and manage for healthy forests, depending on landowner objectives.

Colorado Department of Higher Education

Center for Colorado Policy Studies: Program on Growth Issues

Located at the University of Colorado, Colorado Springs, the Center for Colorado Policy Studies applies the latest research in land use and environmental economics, along with public finance and basic economic theory, to growth issues facing Colorado.

Center for the American West

Located at the University of Colorado, Boulder, the Center for the American West identifies and addresses multiculturalism, community building, fire policy, and land, water, and energy use. The Center illuminates challenges and opportunities facing Colorado's complicated geographic and cultural area.

Natural Hazards Research and Applications Information Center

Located at the University of Colorado Boulder, the Natural Hazards Research and Applications Information Center serves as a national and international clearinghouse of knowledge concerning social science and policy aspects of disasters. The Center collects and shares research and experience related to preparedness for, response to, recovery from, and mitigation of disasters, emphasizing links between hazard mitigation and sustainability to both producers and users of research and knowledge on extreme events. The work at the Center strengthens communication among researchers, individuals, organizations, and agencies concerned with reducing damage caused by disasters and promotes an all-hazards approach for addressing environmental extremes and is a leading proponent of cooperative partnerships among varying disciplines.

Western Forest Fire Research Center

The Western Forest Fire Research Center is an interdisciplinary research facility based at Colorado State University Fort Collins, associated with the Forest, Rangeland, and Watershed Stewardship programs.

Colorado Center for Community Development

Located at the University of Colorado, Denver, the Colorado Center for Community Development provides students opportunities to support community development and design, preservation, and other projects. The Center provides conceptual design and related work for communities and provides pre-and post-disaster assistance using students.

Colorado Department of Local Affairs

The Colorado Department of Local Affairs provides the following programs related to hazard mitigation:

- **Colorado Demography Office—**Provides technical assistance and information on population, housing and households, economy, labor force, census data, profiles, GIS; data can be accessed via the internet. Users include local governments, including special districts.
- **Watershed Resilience Pilot Program—**A holistic, strategic initiative designed to provide watershed restoration, risk mitigation, and community and economic development using a collaborative, coalition of partners approach.
- **Office of Smart Growth, Community Development Office—**Created to assist local governments in addressing public impacts of growth. The Office provides direct technical and financial assistance to local governments in the areas of land use planning and growth management.
- **Microgrids for Community Resilience—**Created to assist rural communities that are at significant risk of experiencing severe weather or natural disaster events and that have at least one "anchor institution" in the community (community resilience hub, government, emergency protective services, etc.).

Mountain Studies Institute

The Mountain Studies Institute collaborates among researchers, educators and policy makers with an interest in the San Juan Mountains and other mountain systems worldwide to provide increased knowledge and understanding of mountain environments and communities and the issues that affect them. The Institute has many established programs focusing on issues such as climate, history, land use, water and snow, air quality, and ecosystems in in southwest Colorado. The Institute provides pre- and post-fire education and research for communities, as well as post-fire ecosystem monitoring.

16.2.3 County and Local

Douglas County Building Division

The Douglas County Building Division performs building inspections and is responsible for the issuance of building permits for unincorporated areas of Douglas County. The Building Division also reviews construction documents and issues permits for the installation and alteration of buildings and structures, inspects the premises for permits that have been issued, and enforces compliance with the adopted code (Douglas County n.d.).

Douglas County Board of County Commissioners

Douglas County's three-member Board of County Commissioners is the main policy-making body in the County and works to represent the interests of the citizens of Douglas County at local, state, and national levels. Commissioners are elected at large from one of three geographic districts for four-year staggered terms. Commissioners are limited to serving two four-year terms (Douglas County n.d.).

Douglas County Administration

The County Manager is responsible for implementing policies set by the Board of County Commissioners, recommending best practices and overseeing county operations. The Manager and staff develop short- and long-term operational plans; evaluate planning systems, personnel, equipment, facilities and records; and establish procedures for effective county management. The office also serves as a liaison with other jurisdictions and agencies (Douglas County n.d.).

Douglas County Department of Community Development

The Department of Community Development (DCD) has a pivotal role in managing and protecting the County's resources, environment, and quality of life. The Department assists the Board of County Commissioners with recommendations to ensure that the County grows in a manner that is fiscally sound and economically beneficial to the County and its taxpayers and businesses. Meeting both responsibilities in a growing environment presents considerable challenges and opportunities. Community Development is also responsible for the Comprehensive Master Plan, and the Planning Commission and provides all Project Records Online. It includes the following key divisions (Douglas County n.d.):

- **Parks, Trails & Building Grounds—**This division creates spaces where nature and community come together. The County's vision is to foster a healthier and happier society by providing accessible, sustainable and vibrant parks and trails that inspire connection, recreation, and appreciation for the outdoors (Douglas County n.d.).
- **Planning Services—**This division oversees the County's land use planning. Its functions include long-range planning, development review, public assistance, and zoning inspection and compliance. It also manages the land use application process and provides tools to track development proposals, including important dates for public comments and public hearings. Planning Services provides staff support to the Planning Commission and the Board of Adjustment. The Planning Commission adopts the CMP and holds public hearings on land use applications on which it makes formal recommendations to the Board of County Commissioners. The Board of Adjustment hears requests for certain types of zoning standards, as well as appeals to interpretations and administrative decisions made by the Director of Community Development (Douglas County n.d.).

Douglas County Facilities, Fleet and Emergency Support Services

Facilities, Fleet and Emergency Support Services manage all Douglas County facilities, supporting all County departments. Staff provides assistance to emergency support services, facility maintenance, and the County's internal recycling program (Douglas County n.d.).

Douglas County Health Department

The Douglas County Health Department conducts disease surveillance to control the spread of communicable disease. This includes serious diseases such as E. coli, salmonella, and rabies. Illnesses are reported directly to the Douglas County Health Department and discovered through investigations. Communicable disease staff conduct interviews and investigations to learn about disease transmission and prevent further illness in Douglas County (Douglas County n.d.).

Douglas County Division of Emergency Preparedness and Response

The Douglas County Health Department's Division of Emergency Preparedness and Response (EPR) plays a crucial role in protecting the community's health during emergencies. EPR staff work with local, regional, and state partners to plan, train, and prepare for a wide range of public health threats, from pandemics and bioterrorism to wildfires and extreme weather events. Through regular training, drills, and full-scale exercises, EPR ensures that public health systems are ready to respond quickly and effectively in an emergency. These efforts strengthen the health department's own response capabilities and support and enhance the county's overall emergency response efforts (Douglas County n.d.).

Using an all-hazards approach, EPR focuses on early risk identification, mitigation strategies, and coordinated action. By collaborating proactively with emergency management, health care partners, and the broader community, EPR helps build a response system that is unified, adaptable, and resilient before, during, and after disasters (Douglas County n.d.).

Douglas County Division of Environmental Health

The Division of Environmental Health focuses on preventing foodborne illnesses in restaurants; preventing the spread of communicable diseases in childcare facilities, body art facilities, and water systems; and mitigating other environmental conditions that could be harmful to people's health (Douglas County n.d.).

Douglas County Division of Open Space and Natural Resources

The Division of Open Space and Natural Resources seeks to enhance the quality of life for residents by protecting wildlife habitats and natural resources in public access properties, trails, historic sites, and scenic views, while preserving Douglas County's rural heritage and providing a wide range of compatible outdoor recreation and educational opportunities. More than 65,000 acres of protected open space enhances the quality of life in Douglas County (Douglas County n.d.).

Douglas County Department of Public Works

The Department of Public Works maintains County roads and storm drainage systems, removes snow and ice, erects and maintains traffic signals, signage, and striping, constructs new transportation infrastructure, and controls noxious weeds. It oversees the design and construction of new developments, roads, and buildings. The Department includes Engineering, Operations, Traffic, Building, Development Review, and Stormwater (Douglas County n.d.).

Douglas County Sheriff's Office

The Sheriff's Office provides law enforcement to the residents of Douglas County, utilizing the experience from a diverse employee base (Douglas County n.d.). It includes the following programs relevant to hazard mitigation:

- **Office of Emergency Management—**The Office of Emergency Management is the main hub for the coordination of disaster management and training; homeland security; emergency preparedness and education; multi-agency cooperation; and emergency medical and trauma system coordination. OEM is responsible for emergency documents and Board-approved policies, including the County's Disaster Preparedness guide, aerial support for wildfires, fire restrictions, and coordinating animal shelters during an emergency. It oversees the Wildland Fire Handcrew that specializes in remote wildland fires that engines cannot access. OEM also provides information on evacuation plans, planning and building an emergency kit, and more (Douglas County n.d.).
- **Code Red—**CodeRED sends alerts by phone, email and text about emergencies in the area. It also provides instructions on what to do to protect life and property. The high-speed system works by sending out pre-recorded voicemails to phone and email about police activity, lost children, wildfires, and other emergencies nearby (Douglas County n.d.).

16.3 FISCAL CAPABILITIES

This section summarizes fiscal capabilities in Douglas County. Further information is provided in the jurisdictional annexes in Volume II. The *Hazard Mitigation Capabilities* section of the 2023 Colorado Enhanced State Hazard Mitigation Plan features a section on mitigation-related funding administered by state agencies that eligible jurisdictions can use to fund mitigation actions.

16.3.1 Federal

FEMA

Hazard Mitigation Assistance Programs

FEMA Hazard Mitigation Assistance (HMA) programs provide funding for eligible activities that reduce or eliminate long-term risk to people and property from future disasters. HMA includes the following programs (FEMA 2023):

- Hazard Mitigation Grant Program (HMGP)
- HMGP Post-Fire Grant
- Flood Mitigation Assistance (FMA) Program
- Pre-Disaster Mitigation (PDM) Program

States, local, tribal, and territorial governments may apply for this funding to help them build climate resilience. HMA grant funding is available to communities with a current HMP (this plan). Individual homeowners and business owners may not apply directly to FEMA. Eligible local governments may apply on their behalf (FEMA 2023). Most of the grants require a local share in the range of 10 to 25 percent of the total grant amount. Table 16-2 provides an overview of program funding eligibility and cost share. Individual HMP grant programs are described below.

Table 16-2. FEMA HMA Grant Cost Share Requirements

Programs	Cost Share (Percent of Federal / Non-Federal Share)
HMGP[a]	75 / 25
HMGP Post Fire	75 / 25
FMA (community flood mitigation, project scoping, individual mitigation of insured properties, and planning grants)	75 / 25
FMA—repetitive loss property[b]	90 / 10
FMA—severe repetitive loss property[b]	100 / 0
PDM	75 / 25
PDM—small and impoverished community	Up to 90 / 10

Source: (FEMA 2025)

a. Subapplicants should consult their state hazard mitigation officer for the percentage of HMGP subrecipient management cost funding their state has determined to be passed through subrecipients.

b. To be eligible for an increased federal cost share, a FEMA-approved state or tribal (standard or enhanced) mitigation plan that addressed repetitive loss properties must be in effect at the time of award, and the property is being submitted for consideration must be a repetitive loss property.

Hazard Mitigation Grant Program

HMGP assists in implementing long-term hazard mitigation planning and projects following a federal major disaster declaration. Grants can be used to fund cost-effective projects that will protect public or private property in an area covered by a federal disaster declaration or that will reduce the likely damage from future disasters. Examples of projects include acquisition and demolition of structures in hazard-prone areas, flood-proofing or elevation to reduce future damage, minor structural improvements, and development of state or local standards. Projects must fit into an overall mitigation strategy for the area identified as part of a local planning effort.

Applications are submitted to the state, placed in rank order for available funding, and submitted to FEMA for approval. Eligible projects not selected for funding are placed in an inactive status and may be considered as additional HMGP funding becomes available.

HMGP Post-Fire

The HMGP offers post-fire assistance to help communities implement hazard mitigation measures after wildfire disasters. States, federally recognized tribes, and territories affected by fires resulting in a Fire Management Assistance Grant (FMAG) declaration are eligible to apply. The application period opens with the state or territory's first FMAG declaration of the fiscal year and closes six months after the end of that fiscal year. Application extensions may be requested.

Flood Mitigation Assistance Program

FMA provides funds on an annual basis for planning and projects to reduce or eliminate risk of flood damage to buildings that are insured under the NFIP. Of the 25 percent of total eligible costs that must be provided by a non-federal source, no more than half can be provided as in-kind contributions from third parties. At minimum, a FEMA-approved local flood mitigation plan is required before a project can be approved. The FMA funds are distributed from FEMA to the state, which serves as the grantee and administrator for the program.

Pre-Disaster Mitigation Program

PDM provides funds on an annual basis to plan for and implement sustainable, cost-effective measures to reduce the risk to individuals and property from future natural hazards, while also reducing reliance on federal funding for future disasters. This funding is offered in addition to funds provided through other FEMA grant programs for projects that will support growing mitigation needs nationwide.

Extraordinary Circumstances

For HMGP and FMA, a FEMA region may apply extraordinary circumstances to allow grant awards to jurisdictions without currently approved mitigation plans when justification is provided and with concurrence from FEMA Headquarters. If this exception is granted, a local mitigation plan must be approved by FEMA within 12 months of the award of the project subaward to that community.

Extraordinary circumstances exist when a determination is made by the applicant and FEMA that the proposed project is consistent with the priorities and strategies identified in the state mitigation plan and that the jurisdiction meets at least one of the following criteria:

- The jurisdiction meets the small, impoverished community criteria.
- The jurisdiction had insufficient capacity due to lack of available funding, staffing, or other necessary expertise to satisfy the mitigation planning requirement prior to the current disaster or application deadline.
- The jurisdiction has been at low risk from hazards because of low frequency of occurrence or minimal damage from previous occurrences as a result of sparse development.
- The jurisdiction experienced significant disruption from a declared disaster or another event that impacts its ability to complete the mitigation planning process prior to award or final approval of a project award.
- The jurisdiction does not have a mitigation plan for reasons beyond the control of the state, federally recognized tribe, or local community, such as disaster relief fund restrictions that delay FEMA from granting a subaward prior to the expiration of the local or tribal mitigation plan.

The applicant must provide written justification that identifies the specific criteria or circumstance listed above, explains why there is no longer an impediment to satisfying the mitigation planning requirement, and identifies the specific actions or circumstances that eliminated the deficiency. When HMGP project funding is awarded under extraordinary circumstances, the recipient must acknowledge in writing to FEMA that a plan will be completed within 12 months of the subaward and provide a work plan for doing so. This requirement will be incorporated into the award.

Rehabilitation of High Hazard Potential Dams Program

The Rehabilitation of High Hazard Potential Dams (HHPD) grant program provides technical, planning, design, and construction assistance for rehabilitation activities that reduce dam-related risk and increase community preparedness. The HHPD Grant Program aids with technical, planning, design, and construction activities toward repair, removal, or rehabilitation of eligible high hazard potential dams.

Assistance to Firefighters Grant Program

Assistance to Firefighters Grants provide direct financial assistance to eligible fire departments, emergency medical services organizations, and state fire training academies. This funding is for critically needed resources

to equip and train emergency personnel to recognized standards, enhance operations efficiencies, foster interoperability, and support community resilience.

Emergency Management Performance Grants Program

The Emergency Management Performance Grant provides state, local, tribal, and territorial emergency management agencies with the resources required for implementation of the National Preparedness System. The program provides funds to build and sustain core capabilities across the prevention, protection, mitigation, response, and recovery mission areas.

Homeland Security Grant Program

The Homeland Security Grant Program supports the building, sustainment, and delivery of core capabilities across the prevention, protection, mitigation, response, and recovery mission areas. It has two priorities: building and sustaining law enforcement terrorism prevention capabilities; and maturation and enhancement of state and major urban area fusion centers.

The Homeland Security Grant Program is composed of three interconnected grant programs: the State Homeland Security Program, Urban Areas Security Initiative, and Operation Stonegarden. These programs fund a range of preparedness activities, including planning, organization, equipment purchase, training, exercises, and management and administration.

Public Assistance Program

Various types of assistance may be made available following a disaster. The types and levels of disaster assistance depend on the severity of the damage and the declarations that result from the disaster event. Public Assistance is a program that may be provided in the event of a federally declared major disaster. It provides cost reimbursement to local governments (state, county, local, municipal authorities, and school districts) and certain nonprofit agencies that were involved in disaster response and recovery programs or that suffered loss or damage to facilities or property used to deliver government-like services. This program is largely funded by FEMA; local and state matching contributions are required.

National Park Service Land and Water Conservation Fund

The Land and Water Conservation Fund was established to safeguard natural areas, water resources, and cultural heritage, and to provide recreation opportunities. The fund invests earnings from offshore oil and gas leasing to help strengthen communities, preserve history, and protect national lands and waters. The program provides grants to state and local governments as well as acquiring lands, waters, and interests to achieve objectives of federal land management agencies. The Land and Water Conservation Fund was permanently funded in August 2020.

U.S. Department of Agriculture

Community Facilities Direct Loan and Grant Program

This program provides affordable funding to develop essential community facilities, defined as facilities that provide an essential service to the local community for the orderly development of the community in a primarily rural area (excluding private, commercial, or business undertakings). Funds can be used to purchase, construct, or improve essential community facilities, purchase equipment, and pay related project expenses. Rural areas

including cities, villages, townships, towns, and federally recognized tribal lands, with no more than 20,000 residents according to the latest U.S. Census, are eligible.

Emergency Loan Program

The Emergency Loan Program is triggered when a natural disaster is designated by the Secretary of Agriculture, or a natural disaster or emergency is declared by the President under the Stafford Act. These loans help producers who suffer farm-related losses directly caused by the disaster in a county declared or designated as a primary disaster or quarantine area. Farmers in counties contiguous to the declared, designated, or quarantined area also may qualify for emergency loans. For production losses, a 30 percent reduction in a primary crop in a designated or contiguous county is required. Losses to quality, such as receiving a 30 percent reduced price for flood-damaged crops, may be eligible for assistance, too.

Emergency Watershed Protection Program

The Emergency Watershed Protection (EWP) Program offers technical and financial assistance to help local communities relieve imminent threats to life and property caused by floods, fires, windstorms, and other natural disasters that impair a watershed. EWP does not require a disaster declaration by federal or state government officials for program assistance to begin. The Natural Resources Conservation Service (NRCS) state conservationist can declare a local watershed emergency and initiate EWP program assistance in cooperation with an eligible sponsor. The sponsor must sign a cooperative agreement with NRCS. The EWP program offers financial and technical assistance for various activities, including the following:

- Remove debris from stream channels, road culverts, and bridges
- Reshape and protect eroded streambanks
- Correct damaged or destroyed drainage facilities
- Establish vegetative cover on critically eroding lands
- Repair certain conservation practices
- Buyouts

EWP-Recovery

The EWP–Recovery program is aimed at relieving imminent hazards to life and property caused by floods, fires, windstorms, and other natural occurrences. Public and private landowners are eligible for assistance but must be represented by a project sponsor that is a legal subdivision of the state, such as a city, county, township, or conservation district, or a Native American tribal government. NRCS will pay up to 75 percent of the construction cost of emergency measures. The remaining 25 percent must come from local sources and can be in the form of cash or in-kind services.

The EWP–Recovery program is designed for the installation of recovery measures to safeguard lives and property as a result of a natural disaster. NRCS completes a damage survey report, which provides a case-by-case investigation of the work necessary to repair or protect a site. Watershed impairments that the EWP Program addresses are debris-clogged stream channels, undermined and unstable streambanks, jeopardized water control structures and public infrastructures, wind-borne debris, and upland sites stripped of protective vegetation by fire or drought.

EWP-Floodplain Easement

Through the EWP–Floodplain Easement program, easements are restored to the natural environment to the extent practicable. Work can include both structural and nonstructural practices to restore flood storage and flow, control erosion, and improve the practical management of the easement. Eligibility includes either public or private lands that meet one of the following criteria:

- Lands that have been damaged by flooding at least once within the previous calendar year or have been subject to flood damage at least twice within the previous 10 years
- Other lands within the floodplain that would contribute to the restoration of flood storage and flow, provide for control of erosion, or improve the practical management of the floodplain easement
- Lands that would be inundated or adversely impacted as a result of a dam breach

Structures, including buildings, within the floodplain easement must be demolished and removed or relocated outside the 100-year floodplain or dam breach inundation area.

Regional Conservation Partnership Program

The Regional Conservation Partnership Program promotes coordination of NRCS conservation activities with partners that offer value-added contributions to expand the collective ability to address on-farm, watershed, and regional natural resource concerns. Through this program, NRCS seeks to co-invest with partners to implement projects that demonstrate innovative solutions to conservation challenges and provide measurable improvements and outcomes tied to the resource concerns they seek to address.

U.S. Department of Health and Human Services Social Services Block Grant Program

The Social Services Block Grant is a flexible funding source that allows states and territories to tailor social service programming to their population's needs. Through these grants, states provide essential social services that help to reduce dependency and promote self-sufficiency; protect children and adults from neglect, abuse, and exploitation; and help individuals who are unable to take care of themselves to stay in their homes or find the best institutional arrangements.

U.S. Department of Housing and Urban Development

Community Development Block Grants

Community Development Block Grants (CDBG) are federal funds to provide low and moderate-income households with viable communities, including decent housing, a suitable living environment, and expanded economic opportunities. Eligible activities include community facilities and improvements, roads and infrastructure, housing rehabilitation and preservation, development activities, public services, economic development, planning, and administration. Public improvements may include flood and drainage improvements. In limited instances, and during times of urgent need (e.g., post-disaster) as defined by the CDBG National Objectives, funding may be used to acquire a property located in a floodplain that was severely damaged by a recent flood, demolish a structure severely damaged by an earthquake, or repair a public facility severely damaged by a hazard event.

Community Development Block Grant Disaster Recovery (CDBG-DR) grant funds are appropriated by Congress and allocated by HUD to rebuild disaster-impacted areas and provide crucial seed money to start the long-term recovery process. These grants help cities, counties, tribes, and states recover from federally declared disasters,

especially in low-income areas. CDBG-DR assistance may fund a broad range of recovery activities, so it can help communities and neighborhoods that otherwise might not recover due to limited resources.

Disaster Housing Assistance Program

The Disaster Housing Assistance Program provides emergency assistance for housing, including minor repairs of homes to establish livable conditions, mortgage, and rental assistance.

HOME Investment Partnerships Program

The HOME Investment Partnerships Program provides grants for states and communities to use—often in partnership with local nonprofit groups—to fund activities such as building, buying, or rehabilitating affordable housing for rent or homeownership or providing rental assistance to low-income people. HOME is the largest federal block grant to state and local governments designed exclusively to create affordable housing for low-income households. HOME funds are awarded annually as grants to participating jurisdictions. The program's flexibility allows states and local governments to use HOME funds for grants, direct loans, loan guarantees or other forms of credit enhancements, or rental assistance or security deposits. Participating jurisdictions must match 25 cents of every dollar in program funds.

Section 108 Loan Guarantee Program

The Section 108 Loan Guarantee Program provides communities with low-cost, long-term financing for economic and community development projects. Section 108 financing provides an avenue for communities to undertake larger, more costly projects, where they may have limited resources to invest upfront. The program can fund economic development, housing, public facilities, infrastructure, and other physical development projects, including improvements to increase resilience against natural disasters. Section 108 assistance can be deployed in two ways:

- Directly by the community or its governmental or non-profit partner to carry out an eligible project
- Indirectly, with a community or its partner re-lending (or, in limited circumstances, granting) the funds to a developer or business to undertake an eligible project

U.S. Department of Transportation

Federal Highway Administration Emergency Relief

Federal Highway Administration (FHWA) Emergency Relief is a grant program that can be used for the repair or reconstruction of federal-aid highways and roads on federal lands that have suffered serious damage as a result of a disaster. Colorado serves as the liaison between local municipalities and FHWA, making the municipalities sub-applicants of the state. The program is appropriated $100 million annually.

Federal Transit Administration Emergency Relief

Federal Transit Authority (FTA) Emergency Relief is a grant program that funds capital projects to protect, repair, reconstruct, or replace equipment and facilities of public transportation systems. Administered by the FTA and directly allocated to mass transit and port authorities, this transportation-specific fund was created as an alternative to FEMA's Public Assistance.

Federal Highway Administration Recreational Trails

The Recreational Trails Program is an assistance program of the FHWA that provides funds to states to develop and maintain recreational trails and trail-related facilities for both nonmotorized and motorized recreational trail uses. The program requires that states use 30 percent of funds for non-motorized recreation, 30 percent for motorized recreation, and 40 percent for diverse recreational trail use.

Rebuilding American Infrastructure with Sustainability and Equity Grant Program

The Rebuilding American Infrastructure with Sustainability and Equity (RAISE) grant program provides an opportunity for the U.S. Department of Transportation to invest in road, rail, transit, and port projects that promise to achieve national objectives. The eligibility requirements of RAISE allow project sponsors at the state and local levels to obtain funding for multi-modal, multi-jurisdictional projects that are more difficult to support through traditional Department of Transportation programs.

RAISE can provide funding directly to any public entity, including municipalities, counties, port authorities, tribal governments, or others, in contrast to traditional federal programs that provide funding to very specific groups of applicants (mostly state departments of transportation and transit agencies). This flexibility allows RAISE and partners at the state and local levels to work directly with a host of entities that own, operate, and maintain much of that nation's transportation infrastructure but otherwise cannot turn to the federal government for support.

Recreational Trails Grant Program

The Recreational Trails Program (RTP) provides funds to develop and maintain recreational trails and trail-related facilities for nonmotorized and motorized recreational trail uses. The RTP is an assistance program of the FHWA. The program requires that states use 30 percent of funds for non-motorized recreation, 30 percent for motorized recreation, and 40 percent for diverse recreational trail use.

U.S. Economic Development Administration

The U.S. Economic Development Administration (USEDA) supports regional economic development in communities around the country. It provides funding to support comprehensive planning and makes strategic investments that foster employment creation and attract private investment in economically distressed areas of the United States.

Public Works Program

Through its Public Works Program, USEDA invests in key public infrastructure, including water and sewer system improvements, expansion of port and harbor facilities, brownfields, multitenant manufacturing and other facilities, business and industrial parks, business incubator facilities, redevelopment technology-based facilities, telecommunications facilities, and development facilities.

Economic Adjustment Program

Through its Economic Adjustment Program, USEDA administers its Revolving Loan Fund Program, which supplies small businesses and entrepreneurs with the gap financing needed to start or expand their business in areas that have experienced or are under threat of serious structural damage to the underlying economic base.

U.S. Environmental Protection Agency

Smart Growth Implementation Assistance Program

The Smart Growth Implementation Assistance program focuses on complex issues such as stormwater management, code revision, transit-oriented development, affordable housing, infill development, corridor planning, and green building. Applicants can submit proposals under four categories: community resilience to disasters, job creation, the role of manufactured homes in sustainable neighborhood design, or medical and social service facilities siting.

Clean Water Act Section 604(b) Water Quality Planning Grants

Water Quality Planning Grants provide funding to implement regional comprehensive water quality management planning activities as described in Section 604(b) of the federal Clean Water Act. Funds are to be used for water quality management planning activities, including tasks to determine the nature, extent, and causes of point and nonpoint source water pollution problems, and to develop plans to resolve these problems.

U.S. Fish and Wildlife Service Partners for Fish and Wildlife

The Partners for Fish and Wildlife Program provides free technical and financial assistance to landowners, managers, tribes, corporations, schools, and nonprofits interested in improving wildlife habitat on their land. These projects range in size from a wetland of a few acres to a grassland restoration covering several hundred thousand acres.

Many Partners for Fish and Wildlife projects take place on working landscapes such as forests, farms, and ranches. Efforts are focused on areas of conservation concern, such as upland forests, wetlands, native prairies, marshes, rivers, and streams. Projects are designed to benefit federal trust species, including migratory birds and endangered, threatened, or at-risk species.

U.S. Small Business Administration Individual Assistance

Various types of assistance may be made available following a disaster. The types and levels of disaster assistance depend on the severity of the damage and the declarations that result from the disaster event. Individual Assistance is a program that may be provided in the event of a federally declared major disaster. It provides help for homeowners, renters, businesses, and some nonprofit entities after disasters occur. This program is largely funded by the U.S. Small Business Administration.

Homeowners who suffered uninsured or underinsured losses may be eligible for a Home Disaster Loan to repair or replace damaged real estate or personal property (such as clothing, furniture, cars, and appliances). Renters are eligible for loans to cover personal property losses. Individuals may borrow up to $200,000 to repair or replace real estate, $40,000 to cover losses to personal property, and an additional 20 percent for mitigation.

Physical disaster loans of up to $2 million are available to qualified businesses or most private nonprofit organizations. For businesses, loans may be made to repair or replace disaster damage to property owned by the business, including real estate, machinery and equipment, inventory, and supplies. Businesses of any size are eligible. Nonprofit organizations such as charities, churches, private universities, etc. are also eligible. An Economic Injury Disaster Loan provides necessary working capital until normal operations resume after a physical disaster; these loans are restricted to small businesses.

16.3.2 **State**

Colorado Conservation Services Division Weed Management Grant Program

Organized private interests, conservation districts, and municipalities are eligible to apply for assistance from the Colorado Noxious Weed Management Fund to enhance weed management efforts within the State of Colorado. Additionally, the Noxious Weed Program administers federal noxious weed management funds from the U.S. Forest Service's State and Private Forestry program (State of Colorado 2023).

Colorado Department of Revenue Wildfire Mitigation Measures Tax

For tax years 2023 through 2027, landowners may claim a credit for wildfire mitigation measures if their federal taxable income does not exceed the applicable limit, depending on the tax year. In the case of real property owned by tenants in common or joint tenants, the credit is allowed to only one of the individuals of the ownership group (DOR 2025).

Subject to the applicable annual limit and depending on the tax year, the credit a landowner may claim is equal to a percentage of the actual out-of-pocket expenses they incur for wildfire mitigation measures performed in that tax year on their real property located in Colorado. In the case of two taxpayers filing a joint return, the total credit they may claim on their return cannot exceed the annual credit limit. In the case of two taxpayers who may legally file a joint return but actually file separate returns, only one of the taxpayers may claim the credit (DOR 2025).

Colorado Division of Fire Prevention and Control Wildfire Resilient Homes Grant Program

The program allows homeowners to apply to receive a grant for retrofitting or improving a house or other structure on the homeowner's property with strategies and technologies for structure hardening in order to make the house or structure more resilient to the risk of wildfire (State of Colorado 2023).

Colorado Division of Local Government

Energy/Mineral Impact Assistance Fund

The Energy/Mineral Impact Assistance Fund (EIAF) grant program assists political subdivisions that are socially and/or economically impacted by the development, processing, or energy conversion of minerals and mineral fuels. Funds come from the state severance tax on energy and mineral production and from a portion of the state's share of royalties paid to the federal government for mining and drilling of minerals and mineral fuels on federally owned land (DLG n.d.).

Conservation Trust Fund

The Department of Local Affairs distributes Conservation Trust Fund (CTF) dollars quarterly, on a per capita basis, to over 480 eligible local counties, cities, towns, and Title 32 special districts that provide park and recreation services in their service plans. Funding can be used for the acquisition, development, and maintenance of new conservation sites or for capital improvements or maintenance for recreational purposes on any public site. A public site is defined as a publicly owned site, or a site in which a public entity/local government holds an interest in land or water (DLG n.d.).

Microgrids for Community Resilience Program

The Microgrids for Community Resilience grant program is designed to build community resilience regarding electric grid disruptions through the development of microgrids. Microgrids are one solution for expanding grid reliability and resiliency. All utilities, local governments, and public/non-profit community anchor institutions serving Colorado communities are eligible to apply for the construction/implementation funding through the program. A microgrid is defined as a group of interconnected electric loads and distributed energy resources with clearly defined electrical boundaries that can function as a single, controllable entity with respect to the electric grid. Therefore, a microgrid can be connected to or disconnected from the electric grid to enable it to operate either in "grid-connected mode" or in "island mode" (DLG n.d.).

Rural Economic Development Initiative

The Rural Economic Development Initiative program helps rural communities diversify their local economy. Municipal and county governments are eligible to apply and can pass funds through to some partners as defined in the application instructions. In order to be characterized as rural, a county must have less than 50,000 people and a municipality must have less than 25,000 people and not be adjacent to a municipality with more than 25,000 people. Projects that will be funded include plans, construction, programs, and capacity building (DLG n.d.).

Agricultural Emergency Drought Response Program

The Agricultural Emergency Drought Response Program provides up to $1 million annually, in the form of loans or grants, for emergency drought-related water augmentation purposes to Colorado's agricultural water users. Agricultural organizations (augmentation companies, ditch and reservoir companies, conservancy districts, conservation districts) within counties where an emergency drought designation or a disaster emergency has been proclaimed are eligible to apply (DLG n.d.).

The program provides grant funds primarily for the cost of the emergency augmentation water but also can provide for engineering, attorney fees and other water acquisition administrative costs, not to exceed 5 percent of the grant amount. If the source of emergency augmentation water is through supplemental groundwater pumping, the additional operational costs of pumping are eligible for funding through the program. The program does not provide grants for general operational expenses, maintenance or rehabilitation of facilities, or research projects. The program does not provide funding for any anticipated costs associated with emergency augmentation, only for verified costs incurred during a previous irrigation season (DLG n.d.).

Colorado State Forest Service

Community Assistance Funds Adjacent to National Forest Lands

This competitive program makes federal funds available to communities to treat adjacent non-federal lands to protect communities when hazard reduction activities are planned on NFS lands. The program funds hazardous fuels reduction. Projects affiliated with approved community wildfire protection plans, demonstrating interagency collaboration, and incorporating a landscape scale approach are more competitive (State of Colorado 2023).

Forest Restoration and Wildfire Risk Mitigation Grant

This grant assists with funding community-level actions across the state that are implemented to protect populations and property in the wildland-urban interface and to promote forest health and the utilization of woody material. It includes funding for capacity building and the pre- and post-treatment monitoring of select projects to determine treatment effectiveness and gather information to assist with adaptive management. There is an annual appropriation of $8 million from the General Fund (State of Colorado 2023).

State Fire Assistance—Wildland Urban Interface Grant

This competitive program makes federal funds available to homeowner and property owner associations, subdivisions, fire departments, counties, and other groups to implement projects that mitigate wildfire hazards in the wildla-urban interface. The grant funds hazardous fuels reduction, fire information and education, and community and homeowner action. Projects affiliated with approved community wildfire protection plans, demonstrating interagency collaboration, incorporating a landscape scale approach, and having a documented maintenance schedule are more competitive (State of Colorado 2023).

Wildfire Mitigation Incentives for Local Governments

This program assists with funding local governments that dedicate revenue for local forest management and wildfire mitigation. It includes funding for capacity building (State of Colorado 2023).

Colorado Water Conservation Board

Water Project Loan Program

The Colorado Water Conservation Board (CWCB) Water Project Loan Program provides low-interest loans for the design and construction of agricultural, municipal and hydro projects in Colorado. A minimum loan request of $100,000 is recommended. Projects financed by the Water Project Loan Program must align with the goals identified in Colorado's Water Plan and its measurable objectives (CWCB n.d.).

Colorado Water Plan Grants

The Colorado Water Plan Grant Program supports implementation of the Colorado Water Plan. The Partner Actions within the plan offer examples of the types of project level work that CWCB can help support through this grant program. All grant applications will be assessed based on funds available for a particular Water Plan category (CWCB n.d.).

Water Supply Reserve Fund Grants

The Water Supply Reserve Fund Grant Program provides funding to assist Colorado water users in addressing their critical water supply issues and interests. The funds help eligible entities complete water activities, which may include competitive grants for the following (CWCB n.d.):

- Technical assistance regarding permitting, feasibility studies and environmental compliance
- Studies or analysis of structural, nonstructural, consumptive and nonconsumptive water needs, projects or activities
- Design of structural projects or activities
- Infrastructure replacement or maintenance projects

Projects Bill Grants

Projects Bill Grants (formerly Non-Reimbursable Project Investments) are CWCB Board authorized state-wide investments for regional supply needs that do not fit within other CWCB grant programs. Grants require approval by the General Assembly. Matching funds are typically required, and the amount of funding can vary annually, but is generally between $1 million and $10 million (CWCB n.d.).

Wild and Scenic Rivers Fund

The Colorado Wild and Scenic Rivers Fund fosters cooperative and collaborative processes aimed at the development of protections for river-dependent outstandingly remarkable values. These protections would be intended as an alternative to wild and scenic river designation under the federal Wild and Scenic Rivers Act, while also protecting Colorado's ability to fully use its compact and decree entitlements (CWCB n.d.).

Public Education, Participation, and Outreach Grant Program

The Public Education, Participation, and Outreach Grant Program provides grant funding for statewide education and outreach initiatives, as well as financial support for designated individual coordinators who support basin-specific outreach and education efforts alongside each of the state's basin roundtables. All applications and requested funds must be approved by one of the nine basin roundtables through a letter of support from the basin roundtable chair (CWCB n.d.).

Technical Assistance for Federal Cost-Sharing Program

The Technical Assistance for Federal Cost-Sharing Program (TAFC) helps Colorado water users secure and use federal money for water projects. The TAFC Program's main purpose is to provide technical and administrative support to organizations applying for federal funding. This program is helpful for water users who struggle to access federal funds due to limited staff or technical resources. It offers grants directly to water users. These grants can be used to hire consultants or get other necessary resources to create strong applications for federal funding. All projects funded by TAFC must align with the Colorado Water Plan and can include projects involving aging infrastructure. TAFC grants cannot be used for treated water projects or wastewater projects (CWCB n.d.).

Fish and Wildlife Resources Fund Grants

The legislature has made funds available to mitigate impacts on fish and wildlife resources. The Colorado Water Conservation Board grants money for mitigation, enhancement, and species recovery projects consistent with Colorado Revised Statutes Section 37-60-122.2 (CWCB n.d.).

16.3.3 **County and Local**

Douglas County and individual jurisdictions are legally able to fund mitigation projects though existing local budgets, local appropriations (including referendums and bonding), and a variety of federal and state loan and grant programs. Many jurisdictions noted throughout the planning process that they are faced with increasing fiscal constraints, including decreasing revenues, budget constraints, and tax caps. In an effort to overcome these fiscal challenges, jurisdictions have continued to leverage the sharing of resources and combining available funding with grants and other sources and note that plans and interjurisdictional cooperation are beneficial in obtaining grants.

Department of Community Development

Douglas County's Parks, Trails, Historic Resources & Open Space Fund accounts for revenues derived from the 0.17 percent sales and use tax most recently extended by voters in 2022. Funds are designated for the acquisition, administration, planning, development and construction, operations, and maintenance of parks, trails, historic resources, and open space. The Parks, Trails, Historic Resources & Open Space Fund must (Douglas County n.d.):

- Protect, maintain and add parks, trails, historic resources and open spaces, and wildlife habitats
- Buffer between communities
- Conserve lands along streams and lakes that also protect water quality
- Conserve working farms and ranches
- Preserve scenic views and landmarks
- Create and maintain recreational amenities
- Maintain and conserve historic preservation

16.4 EDUCATION AND OUTREACH CAPABILITIES

This section summarizes education and outreach capabilities in Douglas County. Further information is provided in the jurisdictional annexes in Volume II.

16.4.1 Federal

StormReady Program

The NWS StormReady program provides emergency managers with guidelines on how to improve their hazardous weather operations. To be recognized by the program, a community must do the following:

- Establish a 24-hour warning point and emergency operations center
- Have more than one way to receive severe weather warnings and forecasts and to alert the public
- Create a system that monitors weather conditions locally
- Promote the importance of public readiness through community seminars
- Develop a formal hazardous weather plan, which includes training severe weather spotters and holding emergency exercises

Douglas County and the Town of Parker are StormReady communities (NWS 2025).

Firewise Program

The Firewise USA program developed by the National Fire Protection Association helps communities prepare for wildfires and reduce the risk of property loss. It encourages residents to work together to create a safer environment by implementing actions that can protect homes and neighborhoods from wildfires.

The program teaches homeowners about wildfire risks and how to adapt their properties to withstand wildfires. This includes understanding the importance of the Home Ignition Zone, which encompasses the area around a home that can be modified to reduce fire risk.

Firewise promotes collaboration among neighbors to address wildfire risks. This includes sharing resources, knowledge, and strategies for fire prevention. Communities are encouraged to conduct wildfire risk assessments to identify vulnerabilities and prioritize actions to mitigate those risks.

Firewise USA sites in Douglas County include Grandview Estates, The Pinery, Misty Pines HOA, Roxborough Park, The Ridge at Castle Pines Village, Village Lake at The Village Castle Pines, Timber Ridge, Diamond Ridge Estates, New Haven in the Meadows-The Villas, Escavera Homeowners Association, Bell Mountain Ranch, Bear Dance HOA, Perry Park Metropolitan District, Valley Park/Hidden Valley, The Hidden Forest Homeowners Association, and Antlers at Sageport HOA (NFPA n.d.).

16.4.2 **State**

Colorado Department of Public Safety

The Division of Homeland Security and Emergency Management offers mitigation trainings and workshops to educate mitigation partners on how to develop local hazard mitigation plans, providing a common base of information to mitigation partners and building state and local capability.

Colorado State Forest Service

The Colorado State Forest Service conducts educational workshops, events, and programs for youth and adult audiences that focus on wildfire mitigation and fire ecology. The outreach opportunities seek to help individuals make informed decisions at the individual landowner and local level, resulting in action toward hazard mitigation in wildland areas.

Colorado Department of Higher Education

University activities around the state support and facilitate education opportunities and studies. These programs are successful in promoting and forwarding mitigation activities.

Governor's Office

The Governor's Office hosts Hazard Awareness Weeks in which the public is educated on the dangers of severe weather. Winter weather, severe weather, lightning, wildfire, and general preparedness are the primary topics. Local governments and the National Weather Service provide weather spotter training. Press releases and a Governor's proclamation are issued. ReadyColorado regularly disseminates preparedness information, including promoting Hazard Awareness Weeks and National Preparedness Month.

Colorado Department of Local Affairs

The Colorado Department of Local Affairs offers the following Land Use and Resilience Training and Webinars to educate interested persons:

- Planning for Hazards—Land Use Solutions for Colorado webinars and website
- "Mitigating Hazards through Land Use Solutions" workshops with DHSEM and FEMA
- "Resilient Leadership" Webinars on Pre- and Post-Disaster Recovery Planning

16.4.3 **County and Local**

Douglas County Office of Emergency Management

Citizen Disaster Preparedness Training

The Douglas County Office of Emergency Management periodically hosts public trainings to offer individuals the chance to learn the basics of personal preparedness for disasters with a two-part preparedness workshop (Douglas County n.d.).

Online Information

The Douglas County Office of Emergency Management webpage has information related to being prepared for hazard events, as well as links to additional information from outside agencies (Douglas County n.d.).

Douglas County Division of Emergency Preparedness and Response

The Douglas County Division of Emergency Preparedness and Response webpage has information related to being prepared for hazard events, as well as links to additional information from outside agencies (Douglas County n.d.).

PART 4: MITIGATION STRATEGY

17. MITIGATION STRATEGY

This chapter, together with the jurisdictional annexes in Volume II, presents the mitigation strategies by which Douglas County and the other jurisdictions participating in this HMP propose to reduce vulnerability and impacts identified in the risk assessment portion of this plan. The Core Planning Team reviewed the risk assessment and capability assessment to identify and develop these mitigation strategies.

> ***Hazard mitigation*** reduces the potential impacts of, and costs associated with, emergency and disaster-related events.
>
> ***Mitigation actions*** reduce impacts on the population, property, the economy, and the environment. They can include activities such as revisions to land-use planning, training and education, or structural and nonstructural safety measures.

17.1 PAST MITIGATION ACCOMPLISHMENTS

Douglas County, through previous and ongoing hazard mitigation activities, has demonstrated that it is proactive in protecting its physical assets and citizens against losses from natural hazards. Examples of previous and ongoing actions and projects include the following:

- The County facilitated the development of the original Douglas County HMP. The current planning process represents the regulatory five-year plan update process, which includes the participation of 10 jurisdictions in the County, along with key County and regional stakeholders.
- All municipalities participating in this HMP update, except the City of Castle Pines, participate in the National Flood Insurance Program (NFIP), which requires the adoption of FEMA floodplain mapping and certain minimum standards for building within the floodplain.
- Reports, plans, and studies relating to or including information on natural hazards or natural hazard policies affecting Douglas County have been reviewed and incorporated into this plan update as appropriate, as discussed in Sections 2.5 and 2.6.

17.2 MITIGATION GOALS AND OBJECTIVES

For this HMP, goals and objectives are defined as follows:

> "The hazard mitigation strategy shall include a description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards."
>
> *44 CFR 201.6(c)(3)(i)*

- **Goals** are general guidelines that explain what is to be achieved. They are usually broad, long-term, policy-type statements and represent global visions. Goals help define the benefits that the HMP is trying to achieve. The success of the HMP, once implemented, should be measured by the degree to which its goals have been met (that is, by the actual benefits in terms of hazard mitigation).
- **Objectives** are short-term aims that form a strategy or course of action to meet a goal. Objectives are stand-alone measurements of the effectiveness of a mitigation action. The objectives also are used to help establish priorities. Broadly defined mitigation objectives were eliminated from the updated strategy unless accompanied by discrete actions.

The Core Planning Team reviewed the 2021 goals and objectives and made revisions for the 2025 update based on the following considerations:

- Hazard events and losses since the 2021 plan
- The updated hazard profiles and risk assessment
- The goals and objectives established in the State of Colorado 2023 E-SHMP
- The Local Planning Committee's interests in integrating this plan with other planning mechanisms, including Douglas County and local risk management plans
- Direct input from the Core Planning Team, stakeholders, and the public on how the County and jurisdictions need to move forward to best manage their hazard risk
- Discussions and research on existing authorities, policies, programs, resources
- Support for mitigation through the protection of natural systems

As a result of this review process, the goals and objectives for the 2025 update were updated to the following:

- Goal 1: Enhance predictive measures, including the expansion and protection of warning systems and supporting technologies.
  - Objective 1.1: Improve systems that provide warning and emergency communications.
- Goal 2: Enhance the quality of assessments, analysis, and planning through the development and collection of data.
  - Objective 2.1: Improve hazard information databases and maps and increase accessibility to those resources.
- Goal 3: Increase public awareness of hazards and their mitigation.
  - Objective 3.1: Increase public awareness of risk.
  - Objective 3.2: Inform the public on the risk exposure to natural hazards and ways to increase the public's capability to prepare, respond, recover and mitigate the impacts of these events.
  - Objective 3.3: Improve understanding of the locations, potential impacts, and linkages among threats, hazards, vulnerability, and measures needed to protect life safety and health.
- Goal 4: Reduce impacts, costs, and damage from hazard events to people, property, local government and private assets, economy, and natural and cultural resources.
  - Objective 4.1: Identify projects that simultaneously reduce risk while increasing operational area resilience and sustainability.
  - Objective 4.2: Protect rare, endangered, unusual, or educationally important natural resources.
  - Objective 4.3: Encourage hazard mitigation measures that promote and enhance natural processes and minimize adverse impacts on the ecosystem.
  - Objective 4.4: Retrofit, purchase, or relocate structures in high hazard areas, especially those known to be repetitively damaged.
- Goal 5: Coordinate and integrate hazard mitigation activities with local land development planning activities and emergency operations planning to consider resiliency.
  - Objective 5.1: Research, develop, and promote adoption of cost-effective building and development laws, regulations, and ordinances.

    - Objective 5.2: Manage development in geologically hazardous areas and floodplains to protect life and property.
    - Objective 5.3: Incorporate risk reduction considerations in new and updated infrastructure and development plans to reduce the impacts of natural hazards.
    - Objective 5.4: Strengthen local building code enforcement.
    - Objective 5.5: Provide incentives for development and land use techniques that reduce risks.
    - Objective 5.6: Promote enforcement of relevant state regulations and local ordinances that significantly reduce life loss and injuries.
    - Objective 5.7: Modify structures, as necessary, to meet life safety standards.
    - Objective 5.8: Encourage the incorporation of mitigation measures into repairs, major alterations, new development, and redevelopment practices, especially in areas subject to substantial hazard risk.
    - Objective 5.9: Consider risk reduction in long-term planning.
- Goal 6: Strengthen communication and coordination among public entities, non-governmental organizations, businesses and private citizens.
    - Objective 6.1: Develop and provide updated information about threats, hazards, vulnerabilities, and mitigation strategies to state, regional, and local agencies, as well as private sector groups.
    - Objective 6.2: Establish and maintain partnerships among all levels of government, private sector, community groups, and institutions of higher learning that improve and implement methods to protect life and property.
    - Objective 6.3: Minimize impacts of hazard events to key employers.
    - Objective 6.4: Promote and enhance outreach and education efforts by state, regional and local agencies with hazard mitigation plans and programs to actively encourage engagement of stakeholder groups such as homeowners, private sector businesses, and nonprofit community organizations.
    - Objective 6.5: Establish a partnership among all levels of government and the business community to improve and implement methods to protect property.
- Goal 7: Support continuity of operations before, during, and after hazard events, including the support of community lifelines.
    - Objective 7.1: Reduce risks that may impact critical business operations.
    - Objective 7.2: Ensure continuity of operations of essential county government services.
- Goal 8 (new for the 2026 HMP): Address long-term vulnerabilities from hazardous dams.
    - Objective 8.1: Ensure that dam infrastructure is maintained.
    - Objective 8.2: Support the identification and access to funding to repair, rehabilitate, or replace dams.

17.3 MITIGATION STRATEGY DEVELOPMENT AND UPDATE

17.3.1 Update of Local Jurisdiction Mitigation Strategies

Review of Previous Actions

FEMA defines ***Mitigation Actions*** as specific actions that help to achieve the mitigation goals and objectives.

To evaluate progress on local mitigation actions, each Planning Partner completed a Mitigation Action Plan Review Worksheet that listed all actions identified for their jurisdiction in the prior (2021) plan. The Planning Partners indicated the status of each action ("In Progress," "Ongoing Capability," "No Progress," or "Complete") and provided comments to quantify the extent of progress and provide reasons for the level of progress. This information is included in the jurisdictional annexes in Volume II.

Mitigation actions identified as "Complete" have been removed from the Planning Partners' updated mitigation strategies. Actions identified as "No Progress" or "In Progress" have been carried forward for inclusion in the updated local mitigation strategies or discontinued for specific reasons. Updated action descriptions provide new details on these actions to better define the projects, identify benefits and costs, and improve implementation.

Actions from the previous plan identified as "Ongoing Capability" represent programs that are now fully integrated into the normal operational and administrative framework of the community. These are removed from the updated mitigation strategy (marked as "Discontinued") and identified in the capabilities assessment of each annex.

Identifying New Actions

At the kickoff and during subsequent local level planning meetings, all participating jurisdictions were further surveyed to identify potential new mitigation actions. Communities also were made aware as new actions became evident during the HMP update process (e.g., through the capability assessment, risk assessment, or the public and stakeholder outreach process).

Developing the Overall Strategy

Members of the Core Planning Team and contract consultants worked directly with each jurisdiction (by phone, email, or virtual meetings) to update their annex with mitigation strategies that focus on well-defined, implementable projects that meet the definition or characteristics of mitigation. Mitigation actions were selected with a careful consideration of benefits (risk reduction, losses avoided), costs, and possible funding sources (including mitigation grant programs).

Support meetings were held for Planning Partners to assist in the development of additional actions, foster collaboration between neighboring jurisdictions for mitigation actions, discuss actions that involve cooperation between the County and jurisdictions, and identify steps needed to complete the jurisdictional annexes.

Addressing Known Vulnerabilities

To help support the selection of an appropriate risk-based mitigation strategy, each annex includes a summary of hazard vulnerabilities. These were identified during the HMP update process by Planning Partner

representatives, through review of available plans and reports, or through the hazard profiling and risk assessment process.

A mitigation strategy workshop was conducted on October 15, 2025, for all participating jurisdictions to support the development of focused problem statements based on the impacts of hazards in the County and their communities. These problem statements provide a detailed description of a problem area, including its impacts on the jurisdiction; past damage; loss of service; etc. An effort was made to include the street address of the problem location, adjacent streets, water bodies, and well-known structures as well as a brief description of existing conditions (topography, terrain, hydrology) of the site. These problem statements form a bridge between the hazard risk assessment, which quantifies impacts on each community, and the development of actionable mitigation strategies.

Incorporating a Range of Action Types

Concerted efforts were made to ensure that Planning Partners develop updated mitigation strategies that cover the range of mitigation action types described in recent FEMA planning guidance (FEMA 2023):

- **Local Plans and Regulations**—These actions include government authorities, policies or codes that influence the way land and buildings are developed and built.
- **Structure and Infrastructure Project**—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 community lifelines and other critical facilities. This type of action also involves projects to construct structures to reduce the impact of hazards.
- **Natural Systems Protection**—These are actions that minimize damage and losses to natural systems and preserve or restore their functions.
- **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 National Flood Insurance Program, Community Rating System, StormReady, and Firewise.

Efforts were also made to develop mitigation strategies that cover the range of mitigation action types described in recent Community Rating System guidance (FEMA 2018):

- **Preventative Measures**—Government administrative or regulatory actions or processes that influence the way land and buildings are developed and built. Examples include planning and zoning, local floodplain laws, capital improvement programs, open space preservation, and stormwater management regulations.
- **Property Protection**—These actions include public activities to reduce hazard losses or actions that involve modification of existing buildings or structures to protect them from a hazard or removal of the structures from the hazard area. Examples include acquisition, elevation, relocation, structural retrofits, storm shutters, and shatter-resistant glass.
- **Public Information**—Actions to inform and educate citizens, elected officials, and property owners about hazards and potential ways to mitigate them. Such actions include outreach projects, real estate disclosure, hazard information centers, and educational programs for school-age children and adults.
- **Natural Resource Protection**—Actions that minimize hazard loss and also preserve or restore the functions of natural systems. These actions include sediment and erosion control, stream corridor restoration, watershed management, forest and vegetation management, and wetland restoration and preservation.

- **Structural Flood Control Projects**—Actions that involve the construction of structures to reduce the impact of a hazard. Such structures include dams, setback levees, floodwalls, retaining walls, and safe rooms.
- **Emergency Services**—Actions that protect people and property during and immediately following a disaster or hazard event. Services include warning systems, emergency response services, and the protection of essential facilities

Protecting Critical Facilities

Planning partner mitigation actions that address vulnerable critical facilities have been proposed in consideration of protection against worst-case scenarios. For projects funded through federal mitigation programs, the level of protection may be influenced by cost-effectiveness as determined through a formal benefit-cost analysis. For locally self-funded projects, local jurisdiction discretion must be recognized. It must be recognized that the County and jurisdictions have limited authority with regard to mitigation at any level of protection over privately owned critical facilities.

17.3.2 **Update of County Mitigation Strategy**

The update of the County-level mitigation strategies included a review of progress on the actions identified in the 2021 HMP using a process similar to that used to review local jurisdiction mitigation strategy progress. County department representatives completed a Mitigation Action Plan Review Worksheet listing all County-level actions from the 2021 plan. They indicated the status of each action ("In Progress," "Ongoing Capability," "No Progress," or "Complete") and provided comments on each. This information is included in the County's annex in Volume II.

Actions identified as "Complete" have been removed from this plan update. Actions identified as "No Progress" or "In Progress" were carried forward for inclusion in the County's updated mitigation strategy or discontinued for specific reasons. Actions identified as "Ongoing Capability" are included in the updated plan as capabilities identified in the capability assessment.

Throughout the course of the HMP update process, additional regional and County-level mitigation actions were identified by the following processes:

- Review of the results and findings of the updated risk assessment
- Review of available regional and County plans, reports, and studies
- Direct input from County departments and other regional agencies, including:
  - Douglas County Facilities, Fleet and Emergency Support Services
  - Douglas County Sheriff's Office and Office of Emergency Management
  - Douglas County Public Relations and Communication
  - Douglas County Administration
  - Douglas County Building Division
  - Douglas County Planning Department
  - Douglas County Health Department
  - Douglas County Open Space and Natural Resources Department
  - Douglas County Public Works Department

    - Douglas County Information Technology GIS
- Input received through the public and stakeholder outreach process

Various County departments and agencies included mitigation actions to address vulnerable critical facilities. These actions were proposed in consideration of protection against 500-year events or worst-case scenarios. However, for projects funded through federal mitigation programs, the level of protection can be influenced by cost-effectiveness, as determined through a formal benefit-cost analysis. For "self-funded" projects, local government authority can affect the ability to implement. Further, the County has limited authority over privately owned critical facility owners regarding mitigation at any level of protection.

17.3.3 **Mitigation Best Practices**

Catalogs of hazard mitigation best practices were developed that present a broad range of alternatives to be considered for use in the mitigation strategies, in compliance with 44 CFR Section 201.6(c)(3)(ii). One catalog was developed for each hazard of concern evaluated in this plan. The catalogs present alternatives that are categorized based on the following considerations:

- Who would have responsibility for implementation:
    - Individuals—personal scale
    - Businesses—corporate scale
    - Government—government scale
- What the alternatives would do:
    - Manipulate the hazard
    - Reduce vulnerability to the hazard
    - Reduce impacts from the hazard
    - Build local capacity to respond to or be prepared for the hazard

The alternatives presented include actions that will mitigate current risk from hazards and actions that will help reduce risk from any future changes in the impacts of these hazards. The catalogs provide a baseline of mitigation alternatives that are backed by a planning process, are consistent with the established goals and objectives, and are within the capabilities of the Planning Partners to implement. Some of these actions may not be feasible based on the selection criteria identified for this plan. The purpose of the catalogs was to provide a list of what could be considered to reduce risk from natural hazards within the planning area. Appropriate hazard mitigation actions were selected from among the alternatives in the catalogs for inclusion in the mitigation strategies. Actions in the catalog that are not included for the partnership's mitigation strategy were not selected for one or more of the following reasons:

- The action is not feasible
- The action is already being implemented
- There is an apparently more cost-effective alternative
- The action does not have public or political support.

The catalogs are included in Appendix B.

17.3.4 **Mitigation Strategy Evaluation**

Prioritization

Section 201.c.3.iii of 44 CFR establishes how mitigation strategies are to be prioritized, implemented, and administered by local jurisdictions. For this plan update, each mitigation strategy was prioritized using criteria suitable for evaluating hazard mitigation strategies. This method provided a systematic approach that considered the opportunities and constraints of implementing each mitigation action. The Core Planning Team chose a set of 12 evaluation criteria for this process:

1. Life Safety—How effective will the action be at protecting lives and preventing injuries? Will the proposed action adversely affect one segment of the population?
2. Property Protection—How significant will the action be at eliminating or reducing damage to structures and infrastructure? For example: development in the floodplain or high-risk areas?
3. Cost-Effectiveness—Are the costs to implement the action commensurate with the benefits achieved?
4. Political—Is there overall public support for the action? Is there the political will to support it? Is the action at odds with development pressures?
5. Legal—Does the jurisdiction have the authority to implement the action?
6. Fiscal—Can the action be funded under existing program budgets (i.e., is this action currently budgeted for)? Or would it require a new budget authorization or funding from another source such as grants?
7. Environmental—What are the potential environmental impacts of the action? Will it comply with environmental regulations? Are there co-benefits of this action?
8. Administrative—Does the jurisdiction have the personnel and administrative capabilities to implement the action and maintain it or will outside help be necessary? Does the scale and scope of the action align with the jurisdiction's capabilities?
9. Hazards of Concern—Does the action address one or more of the jurisdiction's high-ranked hazards?
10. Timeline—Can the action be completed in less than five years?
11. Community Lifelines—Does this action benefit community lifelines?
12. Other Local Objectives—Does the action advance other local objectives, such as capital improvements, economic development, environmental quality, or open space preservation? Does it support the policies of other plans and programs?

Participating jurisdictions were asked to use these criteria to prioritize their identified mitigation actions. For each mitigation action, the jurisdictions assigned a numeric score for each of the 14 evaluation criteria:

- 1 = Highly effective or feasible
- 0 = Neutral
- -1 = Ineffective or not feasible

Jurisdictions were asked to provide a brief summary of the rationale behind the numeric rankings assigned. The numerical results were totaled and then used by each jurisdiction to help prioritize the action or strategy as *low*, *medium*, or *high*. Actions that had a numerical value between 0 and 4 were categorized as *low priority*; actions with numerical values between 5 and 8 were categorized as *medium priority*; and actions with numerical values between 9 and 12 were categorized as *high priority*. While this provided a consistent, systematic methodology to support the evaluation and prioritization of mitigation actions, jurisdictions may have additional considerations that could influence their overall prioritization of mitigation actions.

It is noted that jurisdictions may be carrying forward mitigation actions from prior mitigation strategies that were prioritized using a different, but not inherently contrary, approach. Mitigation actions in the prior (2021) Douglas County HMP were qualitatively evaluated against the mitigation goals and objectives and other evaluation criteria. They were then prioritized into three categories: high, medium, and low. At their discretion, jurisdictions carrying forward prior actions were encouraged to re-evaluate their priority, particularly if conditions that would affect the prioritization criteria had changed.

For the HMP update there has been an effort to develop more clearly defined and action-oriented mitigation strategies. These local strategies include actions that are seen by the community as the most effective approaches to advance their local mitigation goals and objectives within their capabilities. In addition, each Planning Partner was asked to develop problem statements. With active support from DHSEM planning staff, the partners were able to develop action-oriented and achievable mitigation strategies. For that reason, many of the actions in the updated mitigation strategy were ranked as *high* or *medium* priority, as reflective of the community's clear intent to implement them, available resources not-withstanding. In general, actions that would have had *low* priority rankings were screened out during the local action evaluation process.

Benefit/Cost Review

Section 201.6.c.3iii of 44 CFR requires the prioritization of the mitigation strategy to emphasize a benefit/cost comparison of the proposed actions. For all actions identified in the local strategies, jurisdictions identified the associated costs and benefits as follows:

- **Costs** presented include the total project estimation. This can include administrative, construction (engineering, design, and permitting), and maintenance costs.
- **Benefits** are the savings from losses avoided through project implementation. These can include life safety, structure and infrastructure damage, loss of service or function, and economic and environmental damage and losses.

When possible, jurisdictions were asked to identify the actual or estimated dollar costs and associated benefits. Where estimates of costs and benefits were available, the ratings were defined follows:

Low < = $10,000 Medium = $10,000 to $100,000 High > = $100,000

Where numerical costs or benefits could not be quantified, jurisdictions were asked to evaluate project cost-effectiveness using qualitative *high*, *medium*, and *low* ratings based on the following definitions:

- Costs
  - High—Existing funding levels are not adequate to cover the costs of the proposed project, and implementation would require an increase in revenue through an alternative source (e.g., bonds, grants, and fee increases).
  - Medium—The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.
  - Low—The project could be funded under the existing budget. The project is part of or can be part of an existing, ongoing program.
- Benefits
  - High—Project will have an immediate impact on the reduction of risk exposure to life and property.

- Medium—Project will have a long-term impact on the reduction of risk exposure to life and property or will provide an immediate reduction in the risk exposure to property.
- Low—Long-term benefits of the project are difficult to quantify in the short-term.

Using this approach, projects with positive benefit versus cost ratios (such as high over high, high over medium, medium over low, etc.) are considered cost-effective.

For some of the Douglas County actions identified, the Local Planning Committee may seek financial assistance under FEMA's Hazard Mitigation Assistance (HMA) programs. These programs require detailed benefit/cost analysis as part of the application process. The benefit/cost review for the prioritization of actions in this update did not include the level of detail required by FEMA for project grant eligibility under HMA grant programs. These analyses will be performed when funding applications are prepared, using FEMA's Benefit-Cost Analysis model.

The Local Planning Committee is committed to implementing mitigation strategies with benefits that exceed costs. For projects not seeking financial assistance from grant programs that require this sort of analysis, the Local Planning Committee reserves the right to define benefits according to parameters that meet its needs and the goals and objectives of this plan.

PART 5: PLAN MAINTENANCE

18. PLAN MAINTENANCE AND IMPLEMENTATION PROCEDURES

This chapter details the formal process that will ensure that the hazard mitigation plan remains an active and relevant document and that the Local Planning Committee maintains its eligibility for applicable funding sources. The plan maintenance process includes a schedule for monitoring and evaluating the HMP annually and producing an updated plan every five years. In addition, this chapter describes how public participation will be integrated throughout the plan maintenance and implementation process. It explains how the mitigation strategies outlined in this plan update will be incorporated into existing planning mechanisms and programs, such as comprehensive land use planning processes, capital improvement planning, and building code enforcement and implementation.

18.1 HMP COORDINATOR AND JURISDICTION POINTS OF CONTACT

The HMP Coordinator is assigned to manage the maintenance and update of the HMP during its approval period (the five-year period between FEMA's approval of the HMP and its expiration), with the following responsibilities:

- Convene the Local Planning Committee
- Be the prime point of contact for questions regarding the HMP and its implementation
- Coordinate the incorporation of additional information into the HMP
- Manage the monitoring, evaluation, and updating responsibilities identified in this section

Currently, the Douglas County HMP Coordinator is designated as:

Michael Alexander, Director
Office of Emergency Management
Douglas County Sheriff's Office
4000 Justice Way,
Castle Rock, CO 80109
(303) 660-7589
Email: malexand@dcsheriff.net

Primary and secondary mitigation planning representatives (points of contact) as of the date of this plan are identified in each jurisdictional annex in Volume II. It will be the responsibility of each jurisdiction and its representatives to inform the HMP Coordinator of any changes in representation.

18.2 MAINTENANCE AND IMPLEMENTATION TASKS

The procedures for monitoring, evaluating, and updating the HMP are provided below. The plan maintenance matrix shown in Table 18-1 provides a synopsis of responsibilities for plan monitoring, integration, evaluation, and update, which are discussed in further detail in the sections below.

Table 18-1. Plan Maintenance Matrix

Task	Approach	Timeline	Lead Responsibility	Support Responsibility
Monitoring	Planning partners to recommend update of mitigation strategies, progress toward implementation of actions, identification of new actions, and update of information on funding opportunities.	Each June or after the occurrence of a federally declared disaster	Jurisdictional points of contact identified in Volume II	Jurisdictional implementation lead identified in Volume II
Integrating	Distribute the safe growth worksheet (see Table 18-2) for annual review and update by all participating jurisdictions.	June each year with interim email reminders to address integration in county and municipal activities	HMP Coordinator and jurisdictional points of contact identified in Volume II	HMP Coordinator
Evaluating	Review the status of previous actions, as submitted by the monitoring task lead, and assess the effectiveness of the HMP; compile and finalize update of mitigation strategy.	Updated progress report completed by September 30 of each year	Jurisdictional points of contact identified in Volume II	Alternate jurisdictional points of contact
Updating	Reconvene the Planning Partners to guide a comprehensive update to review and revise the HMP.	Every 5 years or upon major update to Comprehensive Master Plan or after the occurrence of a major disaster	HMP Coordinator	Jurisdictional points of contacts identified in Volume II
Grant Monitoring	Notify Planning Partners about grant opportunities, maintain a list of eligible jurisdiction-specific projects for funding consideration, and notify Planning Partners of fiscal year mitigation priorities.	Continuously and as grant opportunities are identified	HMP Coordinator	Jurisdictional points of contacts identified in Volume II
Public Involvement	Maintain the HMP, inform the public of hazard events via social media outlets, promote educational workshops on hazard topics, and track and file public comments received regarding the HMP.	Continuously	HMP Coordinator and jurisdictional points of contact identified in Volume II	Alternate jurisdictional points of contact

18.2.1 **Monitoring**

The Local Planning Committee will be responsible for monitoring progress on, and evaluating the effectiveness of, the HMP, and documenting annual progress. Each year, beginning one year after plan development, Douglas County and Local Planning Committee representatives will collect and process information from the departments, agencies and organizations involved in implementing mitigation projects or activities identified in their jurisdictional annexes by contacting persons responsible for each mitigation project. In addition to progress on the implementation of mitigation actions, including efforts to obtain outside funding, and obstacles or impediments to implementation of actions, the Local Planning Committee representatives will document the following as needed:

- Any grant applications filed on behalf of any of the participating jurisdictions
- Hazard events and losses occurring in their jurisdiction

- Additional mitigation actions believed to be appropriate and feasible
- Public and stakeholder input

18.2.2 **Integrating the HMP into Municipal Planning Mechanisms**

Hazard mitigation is sustained action taken to reduce or eliminate the long-term risk to human life and property from natural hazards. Integrating hazard mitigation into a community's existing plans, policies, codes, and programs leads to development patterns or redevelopment that reduce risk from known hazards. The Local Planning Committee was tasked with identifying how hazard mitigation is integrated into existing planning mechanisms. The jurisdictional annexes in Volume II describe how this is done for each Planning Partner. During this process, many partners recognized the importance and benefits of incorporating hazard mitigation into future local planning and regulatory processes.

Effective mitigation is achieved when hazard awareness and risk management approaches and strategies become an integral part of public activities and decision-making. Within the County, there are many existing plans and programs that support hazard risk management, and it is critical that this HMP integrate and coordinate with and complement those existing plans and programs.

The Capability Assessment (Chapter 16) provides a summary and description of the existing plans, programs, and regulatory mechanisms at all levels of government (federal, state, county, and local) that support hazard mitigation within the County. In the jurisdictional annexes in Volume II, each Planning Partner identified how it has integrated hazard risk management into its existing planning, regulatory, and administrative framework ("existing integration") and how they intend to promote this integration further ("opportunities for future integration").

It is the intention of Local Planning Committee representatives to incorporate mitigation planning as an integral component of daily government operations. Local Planning Committee representatives will work with local government officials to integrate the newly adopted hazard mitigation goals and actions into the general operations of government and partner organizations. The sample adoption resolution (Appendix A—Adoption Resolution) includes a resolution item stating the intent of the local governing body to incorporate mitigation planning as an integral component of government and partner operations. By doing so, the Local Planning Committee anticipates that:

- Hazard mitigation planning will be formally recognized as an integral part of overall emergency management efforts.
- The HMP, comprehensive plans, emergency management plans and other relevant planning mechanisms will become mutually supportive documents that work in concert to meet the goals and needs of county residents.

Other planning processes and programs to be coordinated with the recommendations of the HMP include the following:

- Emergency response plans
- Training and exercise of emergency response plans
- Debris management plans
- Recovery plans
- Capital improvement programs

- Municipal codes
- Community design guidelines
- Water-efficient landscape design guidelines
- Stormwater management programs
- Water system vulnerability assessments
- Community wildfire protection plans
- Comprehensive flood hazard management plans
- Resiliency plans
- Community Development Block Grant Disaster Recovery action plans
- Public information and improved public participation
- Educational programs
- Continued interagency coordination

During the HMP annual review process, participating jurisdictions will be asked to document how they are utilizing and incorporating the HMP into their day-to-day operations and planning and regulatory processes. Each municipality will identify additional policies, programs, practices, and procedures that could be modified to accommodate hazard mitigation actions and include these findings and recommendations in the annual HMP progress report. The checklist in Table 18-2, adapted from FEMA's 2013 Local Mitigation Handbook, will help a community analyze how hazard mitigation is integrated into local plans, ordinances, regulations, and policies. Completing the checklist will help jurisdictions identify areas that currently integrate hazard mitigation and where to make improvements and reduce vulnerability to future development.

Table 18-2. Safe Growth Check List

Planning Mechanisms	Yes	No	How is it being done or how will this be utilized in the future?
Operating, Municipal, and Capital Improvement Program Budgets			
When constructing upcoming budgets, are hazard mitigation actions funded as budget allows?			
Are construction projects evaluated to see if they meet the hazard mitigation goals?			
Does the municipality review mitigation actions when allocating funding during annual budget adoption processes?			
Do budgets limit expenditures on projects that would encourage development in areas vulnerable to natural hazards?			
Do infrastructure policies limit extension of existing facilities and services that would encourage development in areas vulnerable to natural hazards?			
Do budgets provide funding for hazard mitigation projects identified in the HMP?			
Human Resource Manual			
Do any job descriptions specifically include identifying and/or implementing mitigation projects/actions or other efforts to reduce natural hazard risk?			

Planning Mechanisms	Yes	No	How is it being done or how will this be utilized in the future?
Building and Zoning Ordinances			
Prior to zoning changes or development permitting, does the municipality review the HMP and other hazard analyses to ensure consistent and compatible land use?			
Does the zoning ordinance discourage development or redevelopment within natural areas, including wetlands, floodways, and floodplains?			
Does the zoning ordinance contain natural overlay zones that set conditions?			
Does the zoning ordinance require developers to take additional actions to mitigate natural hazard risk?			
Do rezoning procedures recognize natural hazard areas as limits on zoning changes that allow greater intensity or density of use?			
Does the zoning ordinance prohibit development within or filling of wetlands, floodways, and floodplains?			
Subdivision Regulations			
Do the subdivision regulations restrict the subdivision of land within or adjacent to natural hazard areas?			
Do the regulations provide for conservation subdivisions or cluster subdivisions in order to conserve environmental resources?			
Do the regulations allow density transfers where hazard areas exist?			
Comprehensive Master Plan			
Are the goals and policies of the plan related to those of the HMP?			
Does the future land use map clearly identify natural hazard areas?			
Does the plan provide adequate space for expected future growth in areas located outside natural hazard areas?			
Land Use			
Does the future land use map clearly identify natural hazard areas?			
Do the land use policies discourage development or redevelopment in natural hazard areas?			
Transportation Plan			
Does the transportation plan limit access to hazard areas?			
Is transportation policy used to guide growth to safe locations?			
Are transportation systems designed to function under disaster conditions (e.g., evacuation)?			
Environmental Management			
Are environmental systems that protect development from hazards identified and mapped?			
Do environmental policies maintain and restore protective ecosystems?			
Do environmental policies provide incentives to development located outside protective ecosystems?			

Planning Mechanisms	Yes	No	How is it being done or how will this be utilized in the future?
Grant Applications			
Are data and maps used as supporting documentation in grant applications?			
Municipal Ordinances			
Is hazard mitigation a priority when updating municipal ordinances?			
Economic Development			
Does the local economic development group take into account information regarding identified hazard areas when assisting new businesses in finding a location?			
Public Education and Outreach			
Does the municipality have any public outreach mechanisms/ programs in place to inform citizens on natural hazards, risk, and ways to protect themselves during such events?			

18.2.3 **Evaluating**

Evaluation of the mitigation plan is an assessment of whether the planning process and actions have been effective, whether the HMP goals are being achieved, and whether changes are needed. The HMP Coordinator will consult with the Local Planning Committee members to evaluate the effectiveness of the plan implementation and to reflect changes that could affect mitigation priorities or available funding.

The status of the HMP will be discussed and documented at an annual plan review meeting of the Local Planning Committee to be held either in person or via teleconference approximately one year from the date of local adoption of this update and successively thereafter. The HMP Coordinator will be responsible for calling participants and coordinating the annual plan review meeting and soliciting input regarding progress toward meeting plan goals and objectives. At least two weeks before the annual plan review meeting, the HMP Coordinator will advise Local Planning Committee members of the meeting date, agenda, and expectations of the members. These evaluations will assess whether:

- Goals and objectives address current and expected conditions
- The nature or magnitude of the risks has changed
- Current resources are appropriate for implementing the HMP and if different or additional resources are now available
- Actions were cost effective
- Schedules and budgets are feasible
- Implementation problems are present, such as technical, political, legal, or coordination issues with other agencies
- Outcomes have occurred as expected
- Changes in local resources impacted plan implementation (e.g., funding, personnel, and equipment)
- New agencies, departments, and staff are included, involving other local governments as defined under 44 CFR 201.6.

Specifically, the Local Planning Committee will review the mitigation goals, objectives, and activities using performance-based indicators, including:

- New agencies/departments
- Project completion
- Underspending/overspending
- Achievement of the goals and objectives
- Resource allocation
- Timeframes
- Budgets
- Lead/support agency commitment
- Resources
- Feasibility

Finally, the Local Planning Committee will evaluate how other programs and policies have conflicted with or augmented planned or implemented mitigation actions and will identify policies, programs, practices, and procedures that could be modified to accommodate hazard mitigation actions. Other programs and policies can include those that address:

- Economic development
- Environmental preservation
- Historic preservation
- Redevelopment
- Health and safety
- Recreation
- Land use and zoning
- Public education and outreach
- Transportation

The Local Planning Committee should refer to evaluation forms in the FEMA 386-4 guidance document to assist in the evaluation process (Worksheets #2 and #4; see Appendix F—Plan Review Tools). Further, the Local Planning Committee should refer to any process and plan review deliverables developed by the County or participating jurisdictions as a part of the HMP review processes established for prior or existing local HMPs within the county.

The HMP Coordinator will be responsible for preparing an annual HMP progress report for each year of the approval period based on the information provided by the Planning Partners and other information as appropriate. These annual reports will provide data for the five-year update of this HMP and will assist in pinpointing any implementation challenges. By monitoring the implementation of the HMP, the Local Planning Committee will be able to assess which actions are completed, which are no longer feasible, and which require additional funding.

Following any major disasters, the HMP will be evaluated and revised to determine if the recommended actions remain relevant and appropriate. The risk assessment will also be revisited to see if any changes are necessary based on the pattern of disaster damage or if data listed in the hazard profiles of this plan has been collected to facilitate the risk assessment. This is an opportunity to increase the community's disaster resistance and build a better and stronger community.

18.2.4 **Updating**

44 CFR 201.6.d.3 requires that local hazard mitigation plans be reviewed, revised as appropriate, and resubmitted for approval to remain eligible for benefits awarded under DMA 2000. It is the intent of the Douglas County HMP Local Planning Committee to update this plan on a five-year cycle from the date of initial plan adoption.

To facilitate the update process, the HMP Coordinator, with support of the Local Planning Committee, will use the second annual Local Planning Committee meeting to develop and commence the implementation of a detailed plan update program. Prior to the five-year update, the HMP Coordinator will invite representatives from the Colorado Division of Homeland Security and Emergency Services to provide guidance on plan update procedures. At a minimum, this will establish who will be responsible for managing and completing the HMP update effort, items that need to be included in the updated plan, and a detailed timeline with milestones to ensure that the update is completed according to regulatory requirements. At this meeting, the project team will determine what resources will be needed to complete the update and seek to secure these resources.

Following each 5-year update of the HMP, the updated plan will be distributed for public comment. After all comments are addressed, the HMP will be revised and distributed to all Planning Partners.

18.2.5 **Grant Monitoring and Coordination**

Douglas County intends to be a resource to the Local Planning Committee in the support of project grant writing and development. The degree of this support will depend on the level of assistance requested by the Planning Partners during openings for grant applications. As part of grant monitoring and coordination, Douglas County intends to provide the following:

- Notification to Planning Partners about impending grant opportunities
- A current list of eligible, jurisdiction-specific projects for funding pursuit consideration
- Notification about mitigation priorities for the fiscal year to assist the Planning Partners in the selection of appropriate projects.

18.2.6 **Continued Public Involvement**

The Planning Partners are committed to the continued involvement of the public in the hazard mitigation process. This HMP update will continue to be posted online at the following links: https://www.douglas.co.us/douglas-countys-hazard-mitigation-plan/ and http://bit.ly/4pVLmcU. In addition, public outreach and dissemination of the HMP will include the following:

- Links to the HMP on local websites of each jurisdiction with capability
- Continued utilization of existing social media outlets (Facebook, X) to inform the public of natural hazard events, such as floods and severe storms; the public can be educated via the jurisdictional websites on how these applications can be used in an emergency situation
- Promotion of articles or workshops on hazards to educate the public and keep them aware of the dangers of hazards

The HMP Coordinator will be responsible for receiving, tracking, and filing public comments regarding this HMP. The public will have an opportunity to comment on the HMP via the hazard mitigation website at any time. The HMP Coordinator will ensure that:

- Public and stakeholder comments and input on the HMP, and hazard mitigation in general, are collected, recorded, and addressed as appropriate.
- The Douglas County HMP website is maintained and updated as appropriate.
- Copies of the latest approved plan are available for review at appropriate county facilities, along with instructions to facilitate public input and comment on the HMP.
- Public notices, including media releases, are made (as appropriate) to inform the public of the availability of the HMP, particularly during plan update cycles.

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ACRONYMS AND DEFINITIONS

ACS—American Community Survey

ANSS—Advanced National Seismic System

APA—Approvable Pending Adoption

CAC—Community Assistance Contact

CAV—Community Assistance Visit

CCR—Code of Colorado Regulations

CDBG—Community Development Block Grants

CDC—U.S. Centers for Disease Control and Prevention

CDOT—Colorado Department of Transportation

CDPHE—Colorado Department of Public Health and Environment

CEMP—Comprehensive Emergency Management Plan

CEPA—Colorado Emergency Preparedness Assessment

CFR—Code of Federal Regulations

CMP—Comprehensive Master Plan

CSFS—Colorado State Forest Service

CTF—Conservation Trust Fund

CWCB—Colorado Water Conservation Board

DCD—Department of Community Development

DCSO—Douglas County Sheriff's Office

DFIRM—Digital Flood Insurance Rate Map

DFPC—Division of Fire Prevention and Control

DHS—Department of Homeland Security

DHSEM—Department of Homeland Security and Emergency Management

DLG—Division of Local Government

DMA 2000—Disaster Mitigation Act of 2000

DNR—Department of Natural Resources

DOH—Department of Health

DOLA—Department of Local Affairs

DOR—Department of Revenue

DOT—Department of Transportation

DR—Major Disaster Declaration (FEMA)

DWR—Division of Water Resources

EDC—Economic Development Corporation

EF—Enhanced Fujita Scale

EIAF—Energy/Mineral Impact Assistance Fund

EM—Emergency Declaration (FEMA)

EMS—Emergency Medical Services

EOC—Emergency Operation Center

EOP—Emergency Operations Plan

EPA—Environmental Protection Agency

EPR—Emergency Preparedness and Response

ESF—Emergency Support Function

EWP—Emergency Watershed Protection

FEMA— Federal Emergency Management Agency

FERC—Federal Energy Regulatory Commission

FHWA—Federal Highway Administration

FIRM—Flood Insurance Rate Map

FIS—Flood Insurance Study

FM—Fire Management

FMA— Flood Mitigation Assistance

FMAG—Fire Management Assistance Grant

FMCSA—Federal Motor Carrier Safety Administration

FPI— Fire Potential Index

FTA—Federal Transit Administration

GIS—Geographic Information System

GPS—Global Positioning System

HHPD—High Hazard Potential Dams

HIFLD—Homeland Infrastructure Foundation-Level Data

HMA—Hazard Mitigation Assistance

HMGP—Hazard Mitigation Grant Program

HMP—Hazard Mitigation Plan

HOA—Homeowners Association

HPRCC—High Plains Regional Climate Center

HUD—U.S. Department of Housing and Urban Development

IREA—Intermountain Rural Electric Association

IT—Information Technology

KBDI—Keetch-Bryam Drought Index

LAL—Lightning Activity Level

LEED—Leadership in Energy and Environmental Design

MERS—Middle East Respiratory Syndrome

MRP—Mean Return Period

NCDC—National Climate Data Center

NCEI—National Centers for Environmental Information

NDMC—National Drought Mitigation Center

NFIA—National Flood Insurance Act

NFIP—National Flood Insurance Program

NFS—National Forest System

NID—National Inventory of Dams

NIDIS—National Integrated Drought Information System

NIMS—National Incident Management System

NLCD—National Land Cover Database

NOAA—National Oceanic and Atmospheric Administration

NPL—National Priorities List (EPA)

NPS—National Park Service

NRCS—Natural Resources Conservation Service

NRDC—Natural Resources Defense Council

NSIDC—National Snow and Ice Data Center

NSSL—National Severe Storms Library

NWCG—National Wildfire Coordinating Group

NWS—National Weather Service

OEM—Office of Emergency Management

PDM—Pre-Disaster Mitigation Program

PDSI—Palmer Drought Severity Index

PGA—Peak Ground Acceleration

PHMSA—Pipeline and Hazardous Materials Safety Administration

PID—Public Improvement District

PSAF—Pandemic Severity Assessment Framework

PSI—Pandemic Severity Index

RCV—Replacement Cost Value

RF—Risk Factor

RSI—Regional Snowfall Index

RTP—Recreational Trails Program

SARS—Severe Acute Respiratory Syndrome

SEOP—State Emergency Operations Plan

SFHA—Special Flood Hazard Area

SHMP—State Hazard Mitigation Plan

SPC—Storm Prediction Center

TAFC—Technical Assistance for Federal Cost-Sharing Program

TBD—To Be Determined

THIRA—Threat Hazard Identification and Risk Assessment

TMP—Transportation Master Plan

USACE—United States Army Corps of Engineers

USDA—United States Department of Agriculture

USDOI—United States Department of the Interior

USDM—United States Drought Monitor

USDOT—United States Department of Transportation

USEDA—United States Economic Development Administration

USGS—United States Geological Survey

USSD—United States Society on Dams

WFAS—Wildland Fire Assessment System

WHO—World Health Organization

WIC—Women, Infants, and Children

WNV—West Nile Virus

WSD— Water and Sanitation District

WUI—Wildland/Urban Interface

WW—Wastewater