



FEMA

R8-MT

December 10, 2021

Douglas County Commission
100 Third Street
Castle Rock, Colorado 80104

Dear Douglas County Board of County Commissioners:

We are pleased to announce the approval of the Douglas County, Colorado Hazard Mitigation Plan Update as meeting the requirements of the Stafford Act and Title 44 Code of Federal Regulations 201.6 for a local hazard mitigation plan. The plan approval extends to Douglas County, the Cities of Castle Pines and Lone Tree, the Towns of Castle Rock, Larkspur and Parker, and the Districts of Centennial Water and Sanitation, Denver Water and Parker Water and Sanitation.

The jurisdictions are hereby eligible for FEMA Hazard Mitigation Assistance grant programs. All requests for funding will be evaluated individually according to the specific eligibility and other requirements of the particular programs under which the application is submitted. Approved mitigation plans may be eligible for points under the National Flood Insurance Program Community Rating System.

The plan is approved through December 9, 2026. A local jurisdiction must revise its plan and resubmit it for approval within five years to continue to be eligible for mitigation project grant funding. We have provided recommendations for the next plan update on the enclosed Plan Review Tool.

We wish to thank the jurisdictions for participating in the process and commend your continued commitment to mitigation planning. Please contact Mark Thompson, State Hazard Mitigation Officer, Colorado Division of Homeland Security and Emergency Management at markw.thompson@state.co.us or (720) 630-0770 with any questions on the plan approval or mitigation grant programs.

Sincerely,

A handwritten signature in cursive script that reads "Jeanine D. Petterson".

Jeanine D. Petterson
Mitigation Division Director

Enclosure

cc: Mark Thompson, State Hazard Mitigation Officer, Colorado Division of Homeland Security and Emergency Management

LOCAL MITIGATION PLAN REVIEW TOOL

The *Local Mitigation Plan Review Tool* demonstrates how the Local Mitigation Plan meets the regulation in 44 CFR §201.6 and offers States and FEMA Mitigation Planners an opportunity to provide feedback to the community.

- The Regulation Checklist provides a summary of FEMA’s evaluation of whether the Plan has addressed all requirements.
- The Plan Assessment identifies the plan’s strengths as well as documents areas for future improvement.
- The Multi-jurisdiction Summary Sheet is an optional worksheet that can be used to document how each jurisdiction met the requirements of each Element of the Plan (Planning Process; Hazard Identification and Risk Assessment; Mitigation Strategy; Plan Review, Evaluation, and Implementation; and Plan Adoption).

The FEMA Mitigation Planner must reference this *Local Mitigation Plan Review Guide* when completing the *Local Mitigation Plan Review Tool*.

Jurisdiction: Douglas County	Title of Plan: Douglas County, Colorado Hazard Mitigation Plan Update	Date of Plan: February 2021
Local Point of Contact: Mr. Tim Johnson	Address: 4000 Justice Way Castle Rock, CO 80109	E-Mail: TMJohnson@dcsheriff.net
Title: Director		
Agency: Douglas County Office of Emergency Management		
Phone Number: 303-660-7589		

State Reviewer: Patricia L. Gavelda	Title: DHSEM Local Hazard Mitigation Planning Program Manager;	Date: 4/15/2021;
Mark W. Thompson	State Hazard Mitigation Officer	6/10/2021; 6/14/2021

FEMA Reviewer: Laura Weinstein, IR Logan Sand, QC	Title: CERC Mitigation Planner Community Planner	Date: 7/16/2021 7/21/2021
Date Received in FEMA Region VIII	6/14/2021	
Plan Not Approved		
Plan Approvable Pending Adoption	7/21/2021	
Plan Approved	12/10/21	

**SECTION 1:
MULTI-JURISDICTION SUMMARY SHEET**

MULTI-JURISDICTION SUMMARY SHEET									
#	Jurisdiction Name	Jurisdiction Type	Jurisdiction Contact	Email	Requirements Met (Y/N)				
					A. Planning Process	B. HIRA	C. Mitigation Strategy	D. Update Rqmts.	E. Adoption Resolution
1	Douglas County	County	Tim Johnson	TMJohnson@dcsheriff.net	Y	Y	Y	Y	Y
2	City of Castle Pines	Home Rule Municipality	Larry Nimmo	Larry.Nimmo@castlepinesco.gov	Y	Y	Y	Y	Y
3	Town of Castle Rock	Home Rule Municipality	Norris W. Croom, III	ncroom@crgov.com	Y	Y	Y	Y	Y
4	Town of Larkspur	Home Rule Municipality	Randy Johnson	rjohnson@larkspurfire.org	Y	Y	Y	Y	Y
5	City of Lone Tree	Home Rule Municipality	Bill Medina	Bill.Medina@cityoflonetree.com	Y	Y	Y	Y	Y
6	Town of Parker	Home Rule Municipality	Greg Epp	gepp@parkeronline.org	Y	Y	Y	Y	Y
7	Centennial Water and Sanitation District	Special District	Jeff Case	JCase@highlandsranch.org	Y	Y	Y	Y	Y
8	Denver Water	Special District	Becky Franco	Rebecca.Franco@denverwater.org	Y	Y	Y	Y	Y
9	Parker Water and Sanitation District	Special District	Angelo Carrieri	acarrieri@pwsd.org	Y	Y	Y	Y	Y

**SECTION 2:
REGULATION CHECKLIST**

REGULATION CHECKLIST		Location in Plan (section and/or page number)	Met	Not Met
Regulation (44 CFR 201.6 Local Mitigation Plans)				
ELEMENT A. PLANNING PROCESS				
A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement §201.6(c)(1))	Section 3.2 – <ul style="list-style-type: none"> Section 3.2.1 Section 3.2.2 Table 3-2 Section 9 – Jurisdictional Annexes <ul style="list-style-type: none"> Section 9.X.1 Appendix B Appendix C	X		
A2. Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? (Requirement §201.6(b)(2))	Section 3.3 Appendix D	X		
A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1))	Section 3.3 Appendix D	X		
A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement §201.6(b)(3))	Section 3.4 Section 6 Section 9 - Jurisdiction Annexes <ul style="list-style-type: none"> Section 9.x.6 References	X		
A5. Is there discussion of how the community (ies) will continue public participation in the plan maintenance process? (Requirement §201.6(c)(4)(iii))	Section 3.5 Section 7.3 Appendix D	X		
A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle)? (Requirement §201.6(c)(4)(i))	Section 7 <ul style="list-style-type: none"> Section 7.1.1 Section 7.2 Section 7.3 Appendix G	X		
ELEMENT A: REQUIRED REVISIONS				
ELEMENT B. HAZARD IDENTIFICATION AND RISK ASSESSMENT				

REGULATION CHECKLIST		Location in Plan (section and/or page number)	Met	Not Met
Regulation (44 CFR 201.6 Local Mitigation Plans)				
B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction(s)? (Requirement §201.6(c)(2)(i))	<p>Section 5.2</p> <p>Section 5.4 – Hazard Profiles</p> <ul style="list-style-type: none"> Section 5.4.X.1 <p>Section 9 – Jurisdictional Annexes</p> <ul style="list-style-type: none"> Section 9.X.7 (Sections 9.1-9.6); Section 9.X.6 (Sections 9.7-9.10) Table 1-10 (Sections 9.1-9.6); Table 1-8 (Sections 9.7-9.10) 	X		
B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i))	<p>Section 5.4 – Hazard Profiles</p> <ul style="list-style-type: none"> Section 5.4.X-1 Section 5.4.X-1 <p>Section 9 – Jurisdictional Annexes</p> <ul style="list-style-type: none"> Section 9.X.7 (Sections 9.1-9.6); Section 9.X.6 (Sections 9.7-9.10) Table 1-10 (Sections 9.1-9.6); Table 1-8 (Sections 9.7-9.10) 	X		
B3. Is there a description of each identified hazard’s impact on the community as well as an overall summary of the community’s vulnerability for each jurisdiction? (Requirement §201.6(c)(2)(ii))	<p>Section 5.4 – Hazard Profiles</p> <ul style="list-style-type: none"> Section 5.4.X-1 Section 5.4.X-2 <p>Section 9</p> <p>Section 9.X.8 (Sections 9.1-9.6); Section 9.X.7 (Sections 9.7-9.10)</p>	X		
B4. Does the Plan address NFIP insured structures within the jurisdiction that have been repetitively damaged by floods? (Requirement §201.6(c)(2)(ii))	<p>Section 5.4.6 – Flood – Table 5.4.6-4</p> <p>Section 9 – Annexes</p> <p>Section 9.X.4</p> <p>Table 9.X-5 (Sections 9.1-9.6), Table 1-8</p>	X		

REGULATION CHECKLIST		Location in Plan (section and/or page number)	Met	Not Met
Regulation (44 CFR 201.6 Local Mitigation Plans)				
<u>ELEMENT B: REQUIRED REVISIONS</u>				
ELEMENT C. MITIGATION STRATEGY				
C1. Does the plan document each jurisdiction’s existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs? (Requirement §201.6(c)(3))	Section 9 – Annexes • Section 9.X.5, Sections 9.1-9.6 and Section 9.X.4, Sections 9.7-9.10 Sections 9.1-9.6 (Sections 9.X.6.2 and 9.X.6.3)	X		
C2. Does the Plan address each jurisdiction’s participation in the NFIP and continued compliance with NFIP requirements, as appropriate? (Requirement §201.6(c)(3)(ii))	Section 9 – Annexes Section 9.X.4; Table 9.X-5 (Sections 9.1-9.6), Table 1-8	X		
C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement §201.6(c)(3)(i))	Section 6 – Mitigation Strategy Section 6.4	X		
C4. Does the Plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? (Requirement §201.6(c)(3)(ii))	Section 6 – Mitigation Strategy - Subsection 6.5 Section 9.7 through 9.10 in Section 9.X.9 and Sections 9.1-9.6 in Section 9.X.10	X		
C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? (Requirement §201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))	Section 6 – Mitigation Strategy Subsection 6.6.2 and 6.6.3 Section 9.7 through 9.10 in Section 9.X.9 and Sections 9.1-9.6 in Section 9.X.10	X		
C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate? (Requirement §201.6(c)(4)(ii))	Section 9.1 through 9.10 in subsection 9.X.4	X		
<u>ELEMENT C: REQUIRED REVISIONS</u>				
ELEMENT D. PLAN REVIEW, EVALUATION, AND IMPLEMENTATION (applicable to plan updates only)				

REGULATION CHECKLIST		Location in Plan (section and/or page number)	Met	Not Met
Regulation (44 CFR 201.6 Local Mitigation Plans)				
D1. Was the plan revised to reflect changes in development? (Requirement §201.6(d)(3))	Section 4 – County Profile – subsections 4.3.5 and 4.4 <ul style="list-style-type: none"> Section 4.5.3 Section 9.1 through 9.6 Section 9.X.3	X		
D2. Was the plan revised to reflect progress in local mitigation efforts? (Requirement §201.6(d)(3))	Section 6 – Mitigation Strategy <ul style="list-style-type: none"> Section 6.4. – Section 9.1 through 9.6, Section 9.X.1.4 and Section 9.7.-9.10, Section 9.X.1.3 	X		
D3. Was the plan revised to reflect changes in priorities? (Requirement §201.6(d)(3))	Section 6 – Mitigation Strategy <ul style="list-style-type: none"> Section 3 Section 6.4 	X		
<u>ELEMENT D: REQUIRED REVISIONS</u>				
ELEMENT E. PLAN ADOPTION				
E1. Does the Plan include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval? (Requirement §201.6(c)(5))	NA	NA		
E2. For multi-jurisdictional plans, has each jurisdiction requesting approval of the plan documented formal plan adoption? (Requirement §201.6(c)(5))	To Be Completed	X		
<u>ELEMENT E: REQUIRED REVISIONS</u>				
OPTIONAL: HIGH HAZARD POTENTIAL DAM RISKS				
HHPD1. Did Element A4 (planning process) describe the incorporation of existing plans, studies, reports, and technical information for high hazard potential dams?	Section 5.4.2	X		
HHPD2. Did Element B3 (risk assessment) address HHPDs?	Section 5.4.2	X		
HHPD3. Did Element C3 (mitigation goals) include mitigation goals to reduce long-term vulnerabilities from high hazard potential dams that pose an unacceptable risk to the public?	Section 6.4.2	X		
HHPD4. Did Element C4-C5 (mitigation actions) address HHPDs prioritize mitigation actions to reduce vulnerabilities from high hazard potential dams that pose an unacceptable risk to the public?				X

REGULATION CHECKLIST		Location in Plan (section and/or page number)	Met	Not Met
Regulation (44 CFR 201.6 Local Mitigation Plans)				
<u>REQUIRED REVISIONS</u>				
HHPD4. This section of the review tool is optional and will not prevent the plan from being approved. You can only meet the 4 th one by having an action for a high hazard dam that's officially in Unsatisfactory condition.				
ELEMENT F. ADDITIONAL STATE REQUIREMENTS (OPTIONAL FOR STATE REVIEWERS ONLY; NOT TO BE COMPLETED BY FEMA)				
F1.				
F2.				
<u>ELEMENT F: REQUIRED REVISIONS</u>				

SECTION 3: PLAN ASSESSMENT

A. Plan Strengths and Opportunities for Improvement

This section provides a discussion of the strengths of the plan document and identifies areas where these could be improved beyond minimum requirements.

Element A: Planning Process

Strengths

State

- This plan has an excellent description of how neighboring jurisdictions contributed to this plan. It also has a very good community profile and discussion about Lifelines. These highlights show that Douglas County is well integrated with the other communities it shares hazards with and is “self-aware” of what’s important to and at risk within the County.

FEMA

- The Plan does a nice job of documenting the alignment of the planning process with the 10-step process required for credit under Activity 510 of FEMA’s CRS program. The integration of these two processes for one plan will benefit the many jurisdictions in Douglas County that actively participate as CRS communities during their next cycle verifications.
- In addition to including meeting invitations, agendas, minutes, sign-in sheets, and survey results, the Plan appendices also contain an impressive array of planning process questionnaires created by the Project Management Team (PMT) to help inform the Plan update. A remarkable amount of data was requested and collected from the Local Planning Committee (LPC) on topics such as population growth and development trends, hazard identification and risk ranking, capability assessment, goal setting, and action priorities. The questionnaires are comprehensive and user-friendly, making it easy and streamlined for participants to inform the Plan update.
- The Participation Matrix (Table B.1) is an excellent way to identify *how* each jurisdiction met participation requirements throughout plan development. This type of table is easy to read and highlights planning process responsibilities in a transparent manner. The Plan also clearly articulates the roles and responsibilities for participation as members of the LPC and the Plan Maintenance Matrix (Table 7-1) provides a comprehensive summary of responsibilities to address plan maintenance, including description of task, approach, timeline, and lead and support responsibility.
- The PMT did a good job of providing opportunities for the public to be informed and engaged in the planning process, including use of social media, informational bulletins and a public project webpage to report on update activities, invitation to public meetings and LPC workshops, distribution of surveys, and the public review period. The Public Outreach Strategy (Appendix D) developed by the Douglas County Department of Communication and Public Affairs is a wonderful asset to the Plan. This outreach strategy leverages all of Douglas County’s traditional and digital communication assets and recommends an appropriate mix

of engagement strategies and marketing tools to maximize outreach and ensure that content is engaging, accurate, timely and relevant.

- Concurring with the State’s assessment, the planning team did an excellent job of involving neighboring communities, local and regional agencies, and other agencies with the authority to regulate development. The surrounding counties were all invited to the planning process which is a small but often missed planning requirement which is commendable. In particular, it was great to see a request sent to surrounding counties to complete a 38-question survey. This type of plan integration highlights the fact that jurisdictions from the region share hazard risks, and opportunities for collaborative mitigation action.

Opportunities for Improvement

State

- Three jurisdictions didn’t initially meet the requirement to discuss how they incorporated existing plans (Element A4) into their annexes. Beyond just meeting a planning requirement, doing so early in the next update will efficiently make their annexes more inclusive of the jurisdictions as a whole.

FEMA

- The Plan Maintenance Matrix indicates that the Plan’s Annual progress reports will be evaluated by an oversight steering committee annually; however, the Plan does not specify who comprises this committee. To ensure involvement, in future updates, consider including a brief description of the persons and/or agencies desired to participate in this oversight steering committee.
- An appropriate range of stakeholders were engaged and given the opportunity to become involved in the planning process. However, there could have been greater active participation from several key stakeholders, such as, the Douglas County School District, Tri-County Board of Health, local historical societies and preservation boards, and the Douglas County Farm Bureau. In the next plan update, consider outreach and engagement tools, techniques, and opportunities that will generate more active participation from educational, medical, historical, and agricultural institutions. For example, think about hands-on opportunities for educators and students. Are there particular school events/projects, or periodic guest speaking opportunities for the LPC to engage with students about mitigation concepts and risk-reduction actions? Continue to find new opportunities to educate, engage, and involve the community (esp. the youth) in mitigation planning activities.
- It is difficult to tell exactly who was invited to the planning process. Pages 3-6 thru 3-8 note different types of groups who were invited to participate, however, it does not identify which of those groups were reached out to. For the next plan, please include exactly who was invited and participated. As presented, this information can be gleaned from the Appendices, but it is not completely clear in the main plan document.

Element B: Hazard Identification and Risk Assessment**Strengths****State**

- The HIRA in this plan does a very good job describing the risks and vulnerabilities each jurisdiction faces. This is an important step not only for the mitigation strategy but also because it can inform many other community plans related to land use, emergency management, and other departments that influence, or are influenced by, natural hazards.

FEMA

- There is a newly added section on climate change in each hazard profile for this Plan update. The reality is that climate uncertainty has the potential to change local hazards risk profiles over time, and to amplify cascading hazard impacts across the region. Also, the overall discussion of natural assets and historic/cultural resources conveys how important certain community values and the ecosystem are to the County and participating jurisdictions. The attention to wildlife assets such as Endangered Species is a noteworthy inclusion.
- Table 5-5 Identification of Natural Hazards of Concern for Douglas County clearly demonstrates the PMT's rationale for inclusion or omission of a hazard from the Plan.
- Social vulnerability is incorporated into the Hazard Mitigation Plan, including an overall summary in Section 2.7 as well as into the risk assessments of individual hazards. Through identification of potential impacts to vulnerable populations, the Planning Team shows a strong commitment to accommodating all members of the community and achieving greater resiliency and social equity. Additionally, the incorporation of spatial analyses (Figures 2-6 thru 2-10) is extremely beneficial to understand where vulnerable populations live and where hazards will occur. The wildfire hazard profile, among others, is an excellent example of effectively tying the social vulnerability maps back to the risk analysis, stating "of the population exposed, the most vulnerable include the economically disadvantaged and the population over age 65. In Douglas County, there are 11,333 persons in poverty and 35,801 persons over 65 years old." The paragraph then goes on to explain why these groups are at higher risk. This information is extremely useful in guiding creation of targeted mitigation actions.
- FEMA's Community Lifeline categories, along with other facilities of value identified by the LPC, are used in the Plan to classify critical facilities and infrastructure. The Lifelines construct is a growing area of interest in hazard mitigation planning and it is commendable to see Douglas County and the Project Management Team thinking ahead at how lifelines are incorporated into the Plan. The Plan's Risk Assessment thoughtfully integrates the lifeline construct by documenting which lifelines, if any, would be disrupted during an event or are at higher risk. The integration of lifelines into mitigation will evolve before the next update is due. For the next plan update, consider capitalizing on this evolution to further integrate Lifelines into the Plan. Problem statements may be especially helpful here to highlight the issues and impacts to particular lifelines. Those lifelines could then be prioritized for mitigation actions and funding. An example of integration into the mitigation strategy may be to include a column in the Mitigation Action Table to identify which Lifeline the action is associated with.

- Risk analyses are clearly articulated and connected to the mitigation strategy. Each hazard profile's risk assessment includes helpful narrative to justify current and future hazard significance to all jurisdictions. For example, the HIRA discusses development trends over time and highlights patterns such as growth within or near the floodplain and WUI or climate change increasing the area's vulnerability to drought. Again, this is type of contextual information connects well with projects described in the mitigation strategy (e.g., land use regs., CWPP update, implementation of water conservation strategies, etc.).
- The Plan's Hazard Ranking methodology is a clear and consistent way to evaluate, describe, and quantify the degree of relative risk for each hazard assessed. The fact that it was applied to determine risk scores/classifications for each hazard specific to each jurisdiction (versus the planning area as a whole) is commendable. To better link the results of the HIRA with the Mitigation Strategy, consider including risk scores as a component of the methodology for prioritizing plan actions.

Opportunities for Improvement

State

- There are a lot of dams in Douglas County and the discussion of dam failure focused on failure inundation areas. As more information becomes available, this hazard profile should also include operational release inundation to better understand the hazards and potential losses from dams.

FEMA

- The Erosion and Deposition Hazard Profile cites three past mudslide/flood events that occurred in burn areas. The profile also indicates that impacts of climate change may increase the probability of wildfire, thus increasing the likelihood for erosion to occur. While the Plan acknowledges that post-wildfire flood events are an ever-increasing threat, no data is given to demonstrate vulnerability and potential impacts. Because flood after fire events are unique in their origin, frequency, geography, severity, impact, and prevention and response efforts, it is recommended that they are profiled and discussed as part of the risk assessment. Summarizing the characteristics and risk of flood after fire will help with the creation of targeted mitigation strategies.
- Although county-level and multi-jurisdictional map products work well for most hazards, consider using more detailed, jurisdiction-specific maps for hazards such as floods and wildfires, which have more localized spatial extents. While this would increase the page count for the plan, the benefit of more discernable hazard areas for each jurisdiction could help in terms of visual risk communication.

Element C: Mitigation Strategy**Strengths****State**

- The mitigation strategy in this plan is comprehensive for several of the participating jurisdictions and addresses many of the hazards that are ranked high or medium.

FEMA

- The inventory and assessment of relevant local capabilities is thorough and well organized. The brief descriptions and excerpts from applicable policies, regulations, plans, and programs for each jurisdiction are helpful, and the tables/matrices used to summarize the inventory and analysis of existing capabilities are very effective. The comprehensive inventory demonstrates that Douglas County and the participating jurisdictions are thinking holistically about what already exists within the planning area to accomplish hazard mitigation.
- The Plan demonstrates an understanding of the importance of integrating hazard mitigation into other planning mechanisms, and vice versa. The Existing Integration and Opportunities for Future Integration subsections in each jurisdictional annex are impressive for their thoughtful guidance on ways to utilize the data aggregated for this Hazard Mitigation Plan to inform other plans, procedures, and programs. For future updates, also consider including additional details of the processes or schedules followed by the entities that are responsible for those planning mechanisms, to conduct those updates.
- The Mitigation Action Plan tables provide a nicely catalogued summary of each proposed mitigation action/initiative with relevant attribute information. Mapping each action back to its applicable goal(s) and objective(s) is a good way to document how specific actions are designed to support a more coordinated strategy for risk reduction. Additionally, Tables 6-2 thru 6-9 include a comprehensive and nicely organized catalog of actions considered for each hazard.
- The mitigation strategy included a number of land use planning, administration, and regulatory actions to strengthen the existing built environment and direct new growth away from hazard-prone areas. Initiatives such as revising the Land Development Code in the City of Castle Pines to promote water conservation measures, updating the Parker 2035 Master Plan to add goals and strategies that further address natural hazards and mitigation, mitigating flooding by developing and implementing zoning regulations in the City of Lone Tree, and adopting a new community wildfire protection plan for the Town of Castle Rock are excellent examples of land use and regulatory actions/projects that will have a positive impact to further reduce community hazard risk. FEMA appreciates the continued commitment to advance these planning and regulatory mitigation actions.
- The Mitigation Action Priority Tables found in the Mitigation Strategy section of each jurisdictional annex are informative and provide insight into the methodology used to prioritize implementation and grant pursuit for all actions identified. It is clear local jurisdictions are considering the benefits that may result from mitigation actions versus the cost of those actions.

- Where a mitigation action addresses a major issue identified for a hazard, the Project Management Team has included a cross-reference to the text noting the relevant Action(s) and/or Action Number(s). This is a thoughtful tactic to establish direct links between key vulnerabilities identified in the Plan's HIRA with specific actions proposed in the Mitigation Strategy. For example, on page 9.6-113 of the Plan Annex, bank stabilization is identified as a jurisdiction-specific issue for the Town of Parker. Cross reference is made to Action PAR5 which identifies four bank stabilization projects in drainage areas throughout the town limits.
- It is not often that Hazard Mitigation Plans include detailed vulnerability assessments for Special Improvement Districts. The Planning Team is praised for their efforts to capture hazard risk (specifically wildfire, flood, and drought) for the participating Water District and Water and Sanitation Districts.

Opportunities for Improvement

State

- Some of the actions included in the mitigation strategy are focused on response or preparedness actions that fall in the gray area between response and mitigation. During the next update it would be helpful to involve DHSEM earlier in the process to provide education and examples of actions that fall into the gray area vs. actions that are clearly mitigation.

FEMA

- The Plan identifies which communities participate in the NFIP and provides detailed narrative around what NFIP participation and compliance looks like in these communities. For the next update, please consider including supplemental narrative describing each jurisdiction's floodplain management program for continued compliance with NFIP requirements. Some of this information can be gleaned from proposed mitigation actions. However, it could be enhanced with a greater description of the floodplain management program, such as if there are any floodplain ordinances that have been adopted and are actively enforced, if mapping has been completed or requested, or if there have been any community assistance and monitoring activities. Also, it would be helpful to note if there have been any Risk MAP activities in the county.
- As previously highlighted, the Plan does an excellent job incorporating social vulnerability into the risk discussion; including use of spatial analysis to identify where vulnerable populations reside in proximity to known hazard areas and providing strong narrative to express the disproportionate impact of disasters on at risk communities. However, the Plan's Mitigation Strategy does not contain targeted actions to reduce impacts to those identified at-risk groups. For future updates, please include actions to reduce vulnerabilities and enhance outcomes for those groups that could be disproportionately affected by disasters. For example, low-income households living in flood hazard areas may have fewer financial resources to prepare or recover from a flood, may not have access to a vehicle for evacuation, and may be more likely to be uninsured or underinsured. Targeted actions to consider may include planning more efficient evacuations, upgrading early warning systems and improving access to information, upgrading infrastructure, offering financial support to

retrofit structures, determining resource needs and allocation, tailoring communication efforts, and educating homeowners about insurance options.

- Several jurisdictions identified Animal Disease and Infestation and Plant Disease as medium risk. However, no associated mitigation actions are included in the Plan’s Mitigation Strategy. If animal and plant disease continue to be a high-risk hazard at the time of the next update, the Project Management Team may want to consider adding additional actions to mitigate risk.

Element D: Plan Review, Evaluation, and Implementation (Plan Updates Only)

Strengths

FEMA

- The Project Management Team did a great job of being aware of and integrating the 2021 planning process with concurrent/anticipated local planning efforts, such as the Douglas County 2040 Comprehensive Master Plan and several regulatory updates for participating jurisdictions. These efforts help promote consistency between complementary plan and policy documents, which can support and reinforce actions across the region.
- Table 1-4, “Plan Change Crosswalk,” provides an excellent and clear snapshot of what specifically has changed since the previous plan.
- The Plan has a clear and actionable strategy for review, evaluation, and implementation.
- The Plan does a nice job discussing historical development patterns and projected future growth uncertainties for all jurisdictions. In addition to written descriptions, the Plan includes maps to depict projected population growth and to show locations of recent and anticipated development within or near hazard prone areas. The hazard exposure analyses are comprehensive and provide valuable information to aide in creation of targeted mitigation activities.

Opportunities for Improvement

FEMA

- Section 7.3 notes ways to continue community engagement. The County may also want to consider leveraging existing community events to attend and engage the community there. While social media campaigns and meetings can be effective and bolster engagement results, they are not a substitute for going out into the community to muster up engagement.

B. Resources for Implementing Your Approved Plan

FEMA FUNDING SOURCES

Hazard Mitigation Grant Program (HMGP). The HMGP is a post-disaster mitigation program. It is made available to states by FEMA after each Federal disaster declaration. The HMGP can provide up to 75 percent funding for hazard mitigation measures. The HMGP 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. Applicants who are eligible for the HMGP are state and local governments, certain nonprofit organizations or institutions that perform essential government services, and Indian tribes and authorized tribal organizations. Individuals or homeowners cannot apply directly for the HMGP; a local government must apply on their behalf. Applications are submitted to your state and placed in rank order for available funding and submitted to FEMA for final approval. Eligible projects not selected for funding are placed in an inactive status and may be considered as additional HMGP funding becomes available. More information: <https://www.fema.gov/hazard-mitigation-grant-program>

Building Resilient Infrastructure and Communities (BRIC) Grant Program. The BRIC program supports states, local communities, tribes and territories as they undertake hazard mitigation projects, reducing the risks they face from disasters and natural hazards. BRIC is a new FEMA pre-disaster hazard mitigation program that replaces the existing Pre-Disaster Mitigation (PDM) program. The BRIC program guiding principles are supporting communities through capability- and capacity-building; encouraging and enabling innovation; promoting partnerships; enabling large projects; maintaining flexibility; and providing consistency: <https://www.fema.gov/grants/mitigation/building-resilient-infrastructure-communities>

Rehabilitation of High Hazard Potential Dams (HHPD) Grant Program. This program provides technical, planning, design, and construction assistance in the form of grants for rehabilitation of eligible high hazard potential dams. For more information, please visit: <https://www.fema.gov/emergency-managers/risk-management/dam-safety/grants#hhpd>

Flood Mitigation Assistance (FMA) Grant Program. FMA provides funding to assist states and communities in implementing measures to reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insurable under the NFIP. The FMA is funded annually; no federal disaster declaration is required. Only NFIP insured homes and businesses are eligible for mitigation in this program. Funding for FMA is very limited and, as with the HMGP, individuals cannot apply directly for the program. Applications must come from local governments or other eligible organizations. The federal cost share for an FMA project is 75 percent. At least 25 percent of the total eligible costs must be provided by a non-federal source. Of this 25 percent, no more than half can be provided as in-kind contributions from third parties. FMA funds are distributed from FEMA to the state. More information: <https://www.fema.gov/flood-mitigation-assistance-grant-program>

Fire Management Assistance Grant (FMAG) Program. The FMAG program provides grants to states, tribal governments and local governments for the mitigation, management and control of any fire burning on publicly (non-federal) or privately owned forest or grassland that threatens such destruction as would constitute a major disaster. The grants are made in the form of cost sharing with the federal share being 75 percent of total eligible costs. Grant approvals are made within 1 to 72 hours from time of request. More information: <http://www.fema.gov/fire-management-assistance-grant-program>

Hazard Mitigation Grant Program (HMGP) Post Fire Grant Program. FEMA's Hazard Mitigation Grant Program (HMGP) has Post Fire assistance available to help communities implement hazard mitigation measures after wildfire disasters. States, federally-recognized tribes and territories affected by fires resulting in an [Fire Management Assistance Grant \(FMAG\)](#) declaration on or after October 5, 2018, are eligible to apply. More information:

<https://www.fema.gov/grants/mitigation/post-fire>

Fire Prevention and Safety (FP&S) Grants. FP&S Grants support projects that enhance the safety of the public and firefighters from fire and related hazards. The primary goal is to target high-risk populations and reduce injury and prevent death. Eligibility includes fire departments, national, regional, state, and local organizations, Native American tribal organizations, and/or community organizations recognized for their experience and expertise in fire prevention and safety programs and activities. Private non-profit and public organizations are also eligible. Interested applicants are advised to check the website periodically for announcements of grant availability:

<https://www.fema.gov/welcome-assistance-firefighters-grant-program>

OTHER MITIGATION FUNDING SOURCES

Grant funding is available from a variety of federal and state agencies for training, equipment, and hazard mitigation activities. Several of these programs are described below.

Program 15.228: Wildland Urban Interface Community and Rural Fire Assistance. [This program](#) is designed to implement the National Fire Plan and assist communities at risk from catastrophic wildland fires. The program provides grants, technical assistance, and training for community programs that develop local capability, including: Assessment and planning, mitigation activities, and community and homeowner education and action; hazardous fuels reduction activities, including the training, monitoring or maintenance associated with such hazardous fuels reduction activities, on federal land, or on adjacent nonfederal land for activities that mitigate the threat of catastrophic fire to communities and natural resources in high risk areas; and, enhancement of knowledge and fire protection capability of rural fire districts through assistance in education and training, protective clothing and equipment purchase, and mitigation methods on a cost share basis.

Secure Rural Schools and Community Self-Determination Act - Title III- County Funds. The Self-Determination Act has recently been reauthorized and now includes specific language regarding the Firewise Communities program. Counties seeking funding under Title III must use the funds to perform work under the Firewise Communities program. Counties applying for Title III funds to implement Firewise activities can assist in all aspects of a community's recognition process, including conducting or assisting with community assessments, helping the community create an action plan, assisting with an annual Firewise Day, assisting with local wildfire mitigation projects, and communicating with the state liaison and the national program to ensure a smooth application process. Counties that previously used Title III funds for other wildfire preparation activities such as the Fire Safe Councils or similar would be able to carry out many of the same activities as they had before. However, with the new language, counties would be required to show that funds used for

these activities were carried out under the Firewise Communities program. For more information, [click here](#).

Community Planning Assistance for Wildfire. Established in 2015 by Headwaters Economics and Wildfire Planning International, Community Planning Assistance for Wildfire (CPAW) works with communities to reduce wildfire risks through improved land use planning. CPAW is a grant-funded program providing communities with professional assistance from foresters, planners, economists and wildfire risk modelers to integrate wildfire mitigation into the development planning process. All services and recommendations are site-specific and come at no cost to the community. More information: <http://planningforwildfire.org/what-we-do/>

Urban and Community Forestry (UCF) Program. A cooperative program of the U.S. Forest Service that focuses on the stewardship of urban natural resources. With 80 percent of the nation's population in urban areas, there are strong environmental, social, and economic cases to be made for the conservation of green spaces to guide growth and revitalize city centers and older suburbs. UCF responds to the needs of urban areas by maintaining, restoring, and improving urban forest ecosystems on more than 70 million acres. Through these efforts the program encourages and promotes the creation of healthier, more livable urban environments across the nation. These grant programs are focused on issues and landscapes of national importance and prioritized through state and regional assessments. Information: <http://www.fs.fed.us/managing-land/urban-forests/ucf>

Western Wildland Urban Interface Grants. The National Fire Plan (NFP) is a long-term strategy for reducing the effects of catastrophic wildfires throughout the nation. The Division of Forestry's NFP Program is implemented within the Division's Fire and Aviation Program through the existing USDA Forest Service, State & Private Forestry, State Fire Assistance Program.

Congress has provided increased funding assistance to states through the U.S. Forest Service State and Private Forestry programs since 2001. The focus of much of this additional funding was mitigating risk in WUI areas. In the West, the State Fire Assistance funding is available and awarded through a competitive process with emphasis on hazard fuel reduction, information and education, and community and homeowner action. This portion of the National Fire Plan was developed to assist interface communities manage the unique hazards they find around them. Long-term solutions to interface challenges require informing and educating people who live in these areas about what they and their local organizations can do to mitigate these hazards.

The 10-Year Comprehensive Strategy focuses on assisting people and communities in the WUI to moderate the threat of catastrophic fire through the four broad goals of improving prevention and suppression, reducing hazardous fuels, restoring fire-adapted ecosystems, and promoting community assistance. The Western States Wildland Urban Interface Grant may be used to apply for financial assistance towards hazardous fuels and educational projects within the four goals of: improved prevention, reduction of hazardous fuels, and restoration of fire-adapted ecosystems and promotion of community assistance. More information: <https://www.westernforesters.org/wui-grants>

U.S. Fish & Wildlife Service, Rural Fire Assistance Grants. Each year, the U.S. Fish & Wildlife Service (FWS) provides Rural Fire Assistance (RFA) grants to neighboring community fire departments to

enhance local wildfire protection, purchase equipment, and train volunteer firefighters. Service fire staff also assist directly with community projects. These efforts reduce the risk to human life and better permit FWS firefighters to interact and work with community fire organizations when fighting wildfires. The Department of the Interior (DOI) receives an appropriated budget each year for an RFA grant program. The maximum award per grant is \$20,000. The DOI assistance program targets rural and volunteer fire departments that routinely help fight fire on or near DOI lands. More information: http://www.fws.gov/fire/living_with_fire/rural_fire_assistance.shtml

U.S. Bureau of Land Management, Community Assistance Program. BLM provides funds to communities through assistance agreements to complete mitigation projects, education and planning within the WUI. More information: <https://www.blm.gov/services/financial-assistance-and-grants>

NOAA Office of Education Grants. The Office of Education supports formal, informal and non-formal education projects and programs through competitively awarded grants and cooperative agreements to a variety of educational institutions and organizations in the United States. More information: <http://www.noaa.gov/office-education/grants>

NRCS Environmental Quality Incentives Program (EQIP). The Environmental Quality Incentives Program, administered through the NRCS, is a cost-share program that provides financial and technical assistance to agricultural producers to plan and implement conservation practices that improve soil, water, plant, animal, air and related natural resources on agricultural land and non-industrial private forestland. Owners of land in agricultural or forest production or persons who are engaged in livestock, agricultural or forest production on eligible land and that have a natural resource concern on that land may apply to participate in EQIP. Eligible land includes cropland, rangeland, pastureland, non-industrial private forestland and other farm or ranch lands. EQIP is another funding mechanism for landowner fuel reduction projects. More information: <https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/eqip/>

U.S. Department of Agriculture, Community Facilities Loans and Grants. Provides grants (and loans) to cities, counties, states and other public entities to improve community facilities for essential services to rural residents. Projects can include fire and rescue services; funds have been provided to purchase fire-fighting equipment for rural areas. No match is required. More information: http://www.usda.gov/wps/portal/usda/usdahome?navid=GRANTS_LOANS

General Services Administration, Sale of Federal Surplus Personal Property. This program sells property no longer needed by the federal government. The program provides individuals, businesses and organizations the opportunity to enter competitive bids for purchase of a wide variety of personal property and equipment. Normally, there are no restrictions on the property purchased. More information: <http://www.gsa.gov/portal/category/21045>

Hazardous Materials Emergency Preparedness Grants. Grant funds are passed through to local emergency management offices and HazMat teams having functional and active LEPC groups. More information: <http://www.phmsa.dot.gov/hazmat/grants>

U.S. Department of Homeland Security. Enhances the ability of states, local and tribal jurisdictions, and other regional authorities in the preparation, prevention, and response to terrorist attacks and other disasters, by distributing grant funds. Localities can use grants for planning, equipment, training and exercise needs. These grants include, but are not limited to areas of Critical Infrastructure Protection Equipment and Training for First Responders, and [Homeland Security Grants](#).

Community Development Block Grants (CDBG). The U.S. Department of Commerce administers the CDBG program which are intended to provide low and moderate-income households with viable communities, including decent housing, as 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 the times of “urgent need” (e.g. post disaster) as defined by the CDBG National Objectives, CDBG 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. CDBG funds can be used to match FEMA grants. More Information: https://www.hud.gov/program_offices/comm_planning/cdbg

Building Blocks for Sustainable Communities. The EPA Office of Sustainable Communities sometimes offers grants to support activities that improve the quality of development and protect human health and the environment. When these grants are offered, they will always be announced on www.grants.gov. More information: <https://www.epa.gov/smartgrowth/building-blocks-sustainable-communities#2016>

PUBLICLY AVAILABLE TOOLS

FEMA Community Engagement Prioritization Tool (CEPT).

<https://www.fema.gov/floodplain-management/manage-risk/community-engagement-prioritization-tool>

FEMA National Risk Index for Natural Hazards (NRI).

<https://hazards.geoplatform.gov/portal/apps/MapSeries/index.html?appid=ddf915a24fb24dc8863eed96bc3345f8>

FEMA Resilience Analysis and Planning Tool (RAPT).

<https://www.fema.gov/emergency-managers/practitioners/resilience-analysis-and-planning-tool>

FEMA Flood Assessment Structure Tool (FAST).

https://www.fema.gov/sites/default/files/2020-09/hazus_fast-factsheet.pdf

FEMA Hazus.

<https://www.fema.gov/flood-maps/products-tools/hazus>

Decision Support System for Water Infrastructure Security (DSS-WISE):

<https://dsswiseweb.ncche.olemiss.edu/>

CDC/ASTDR Social Vulnerability Index (SVI).

<https://www.atsdr.cdc.gov/placeandhealth/svi/index.html>

OTHER RESOURCES

FEMA: Grant Application Training. Each year, FEMA partners with the State on training courses designed to help communities be more successful in their applications for grants. Contact your State Hazard Mitigation Officer for course offering schedules. Example Courses:

- Unified Hazard Mitigation Grant Assistance Application Development Course
- [Benefit Cost Analysis \(BCA\)](#) Course

FEMA: Community Assistance Visit. It may be appropriate to set up a Community Assistance Visit with FEMA to provide technical assistance to communities in the review and/or updating of their floodplain ordinances to meet the new model ordinance. Consider contacting your State NFIP Coordinator for more information.

FEMA: Building Science. The Building Science branch develops and produces multi-hazard mitigation publications, guidance materials, tools, technical bulletins, and recovery advisories that incorporate the most up-to-date building codes, floodproofing requirements, seismic design standards, and wind design requirements for new construction and the repair of existing buildings. To learn more, visit: <https://www.fema.gov/building-science>

NOAA/NIDIS: U.S. Drought Portal. NOAA's National Integrated Drought Information System's [Drought Portal](#) provides resources for communities to understand their drought conditions, vulnerability, and impacts. The Portal includes data and maps down by city, county, state, zip code, and at watershed global scales. Communities can use this information to inform their hazard mitigation plans with update-to-date data regarding drought conditions, vulnerability, and impacts for sectors such as agriculture, water utilities, energy, and recreation.

EPA: Smart Growth in Small Towns and Rural Communities. EPA has consolidated resources just for small towns and rural communities to help them achieve their goals for growth and development while maintaining their distinctive rural character. To learn more, visit: <https://www.epa.gov/smartgrowth/smart-growth-small-towns-and-rural-communities>

EPA: Hazard Mitigation for Natural Disasters: A Starter Guide for Water and Wastewater Utilities. The EPA released guidance on how to mitigate natural disasters specifically for water and wastewater utilities. For more information, visit: <https://www.epa.gov/waterutilityresponse/hazard-mitigation-natural-disasters>

National Integrated Drought Information System. The National Drought Resilience Partnership may provide some additional resources and ideas to mitigate drought hazards and increase awareness of

droughts. Visit: <https://www.drought.gov/drought/what-nidis/national-drought-resilience-partnership>.

Beyond the Basics: Best Practices in Local Mitigation Planning. The product of a 5-year research study where the Coastal Hazards Center and the Center for Sustainable Community Design analyzed local mitigation plans to assess their content and quality. The website features numerous examples and best practices that were drawn from the analyzed plans. Visit: <http://mitigationguide.org/>

STAR Community Rating System. Consider measuring your mitigation success by participating in the STAR Community Rating System. Local leaders can use the STAR Community Rating System to assess how sustainable they are, set goals for moving ahead and measure progress along the way. To get started, go to <http://www.starcommunities.org/get-started>

Flood Economics. The Economist Intelligence Unit analyzed case studies and state-level mitigation data in order to gain a better understanding of the economic imperatives for investment in flood mitigation. To learn more, visit: <http://floodeconomics.com/>

Headwaters Economics. Headwaters Economics is an independent, nonprofit research group that works to improve community development and land management decisions in the West. To learn more, visit: <https://headwaterseconomics.org/>



Douglas County Local Natural Hazard Mitigation Plan 2021 Update



Volume I



TABLE OF CONTENTS

TABLE OF CONTENTS..... i

EXECUTIVE SUMMARY..... 1

Community involvement in the Hazard Mitigation Plan Update 1

Planning Area, Hazards of Concern, and Risk Assessment 2

Risk Ranking 4

Guiding Principle, Goals and Objectives..... 4

Mitigation Action Plans..... 6

Plan Implementation and Maintenance 6

SECTION 1 INTRODUCTION 1-1

1.1 BACKGROUND 1-1

1.1.1 DMA 2000 Origins - The Stafford Act..... 1-1

1.1.2 Benefits of Mitigation Planning 1-2

1.1.3 Organizations Involved in the Mitigation Planning Effort..... 1-2

1.1.4 Organization..... 1-4

1.1.5 Implementation of Prior and Existing Local Hazard Mitigation Plans..... 1-7

1.1.6 Implementation of the Planning Process..... 1-7

1.2 The Plan Update – What is Different? 1-7

SECTION 2 PLAN ADOPTION..... 2-12

2.1 Overview..... 2-12

2.1.1 Plan Adoption by Local Governing Bodies 2-12

SECTION 3 PLANNING PROCESS 3-1

3.1 Introduction..... 3-1

3.2 Organization of the Planning Process 3-1

3.2.1 Organization of the Local Planning Committee 3-2

3.2.2 Planning Activities 3-4

3.3 Stakeholder Outreach and Involvement 3-6

3.3.1 Federal, State, and County Departments..... 3-7

3.3.2 Regional and Local Stakeholders 3-8

3.3.3 Stakeholder Survey Summary	3-8
3.3.4 Public Outreach	3-10
3.4 Integration with Existing Planning Mechanisms and Programs	3-12
3.5 Continued Public Involvement	3-12
SECTION 4 COUNTY PROFILE	4-1
4.1 General Information.....	4-1
4.2 Major Past Hazard Events	4-1
4.3 Physical Setting	4-2
4.3.1 Location	4-2
4.3.2 Topography and Geology.....	4-2
4.3.3 Hydrography and Hydrology	4-2
4.3.4 Climate.....	4-3
4.3.5 Land Use and Land Cover	4-3
4.4 Population And Demographics.....	4-6
4.4.1 Vulnerable Populations.....	4-9
4.4.2 General Building Stock.....	4-17
4.5 Land Use And Population Trends.....	4-22
4.5.1 Land Use Trends	4-22
4.5.2 Population Trends.....	4-23
4.5.3 Future Growth and Development	4-24
4.6 CRITICAL FACILITIES AND LIFELINES	4-26
4.6.1 Safety and Security.....	4-27
4.6.1 Food, Water, Shelter Lifelines	4-31
4.6.2 Health and Medical Lifelines	4-38
4.6.3 Energy (Power and Fuel) Lifelines.....	4-38
4.6.4 Transportation Lifelines.....	4-40
4.6.5 Hazardous Materials Lifelines.....	4-40
4.6.6 User Defined Facilities	4-40

SECTION 5 RISK ASSESSMENT.....	5-1
5.1 Methodology	5-1
5.1.1 Asset Inventories	5-2
5.1.2 Methodology	5-3
5.1.3 Data Source Summary	5-10
5.2 IDENTIFICATION OF HAZARDS OF CONCERN	5-11
5.2.1 Changes from 2015 Hazard Mitigation Plan.....	5-11
5.2.2 Hazard Groupings.....	5-12
5.2.3 Summary of Hazards of Concern	5-18
5.3 HAZARD RANKING.....	5-18
5.3.1 Hazard Ranking Methodology	5-19
5.3.2 Hazard Ranking Results.....	5-20
5.4 Hazard Profiles	5-4-1
5.4.1 Animal Disease and Infestation and Plant Disease.....	5-4-1
5.4.2 Dam Failure.....	5-4-5
5.4.3 Drought	5-4-17
5.4.4 Earthquake	5-4-25
5.4.5 Extreme Temperature	5-4-44
5.4.6 Flood.....	5-4-53
5.4.7 Hazardous Material Transportation Incidents	5-4-86
5.4.8 Pandemic & Disease Outbreak.....	5-4-92
5.4.9 Severe Weather (Hail and Lightning).....	5-4-102
5.4.10 Severe Weather (Tornadoes).....	5-4-115
5.4.11 Severe Weather: Thunderstorms and Windstorms	5-4-123
5.4.12 Severe Winter Storm.....	5-4-132
5.4.13 Soil Hazards: Erosion and Deposition	5-4-147
5.4.14 Soil Hazards: Expansive Soils and Heaving Bedrock	5-4-161
5.4.15 Soil Hazards: Land Subsidence.....	5-4-170

5.4.16	Soil Hazards: Slope Failure.....	5.4-178
5.4.17	Wildfire.....	5.4-191
SECTION 6 MITIGATION STRATEGY		6-1
6.1	Background and Past Mitigation Accomplishments	6-1
6.2	General Mitigation Planning Approach.....	6-1
6.3	Strengths, Weaknesses, Obstacles, and Opportunities exercise	6-2
6.4	Review and Update of Mitigation Goals and Objectives	6-2
6.4.1	Guiding Principle.....	6-2
6.4.2	Goals and Objectives	6-3
6.5	CAPABILITY ASSESSMENT	6-8
6.5.1	Mitigation Best Practices	6-8
6.6	IMPLEMENTATION STRATEGY	6-13
6.6.1	Selection of Recommended Actions.....	6-13
6.6.2	Action Prioritization	6-13
6.6.3	Benefit/Cost Review	6-14
6.6.4	Analysis of Mitigation Actions	6-15
SECTION 7 PLAN MAINTENANCE PROCEDURES.....		7-1
7.1	Monitoring, Evaluating and Updating the Plan	7-2
7.1.1	Monitoring	7-3
7.1.2	Integration Process of the HMP into Jurisdictional Planning Mechanisms ..	7-3
7.1.3	Evaluating	7-6
7.1.4	Updating.....	7-7
7.1.5	Grant Monitoring and Coordination	7-8
7.2	Implementation of Mitigation Plan through Existing Programs	7-8
7.3	Continued Public Involvement	7-10

EXECUTIVE SUMMARY

Hazard mitigation planning for Douglas County and participating jurisdictions identifies ways to reduce risk from foreseeable natural and non-natural hazards that may impact the planning area. Douglas County prepared a hazard mitigation plan update in 2015, with five municipalities and one special purpose district in the County, participating as partners in the plan. The 2015 plan update was an update to the Denver Regional Natural Hazards Mitigation Plan, of which both the Town of Castle Rock and Douglas County participated. Since the completion of the 2015 plan update, the County has continued to experience major growth in residential, commercial and infrastructure development.

Between 2015 and 2019, the County's population grew from 306,974 people to 336,041 people. During that time, the County and its jurisdictions have added thousands of housing units and millions of square feet of new commercial and institutional structures. Current and future development in hazard prone areas may increase risks, impacts and vulnerabilities of people and property in the county.

To address these changes, and to meet federal requirements for keeping hazard mitigation plans current, Douglas County has completed the *2021 Douglas County Local Hazard Mitigation Plan Update* (HMP, Plan or Update). In preparing the 2021 Plan, Douglas County partnered with the City of Castle Pines, Town of Castle Rock, Town of Larkspur, City of Lone Tree, and Town of Parker, as well as Centennial Water and Sanitation, Denver Water, and Parker Water and Sanitation. Such multi-jurisdictional planning allows these planning partners to pool resources and eliminate redundant activities within a planning area that can have uniform risk exposure and vulnerabilities.

The 2021 Plan reduces risk for those who live, work, and visit within the Douglas County planning area. The resources and background information in the 2021 Plan are applicable across the County, and the Plan's goals and recommendations lay groundwork for local mitigation activities and partnerships.

Community involvement in the Hazard Mitigation Plan Update

This planning effort was led by a Core Planning Team (CPT) of staff from various Douglas County departments including the Office of Emergency Management (DCOEM) and consultant Tetra Tech, Inc. The broader Douglas County community participated in the development of the update through the following activities:

Defining Stakeholders—The CPT identified stakeholders to engage during the update. “Stakeholder” was defined as any person or entity that owns or operates facilities that would benefit from the mitigation actions of this plan or has a capability to support hazard mitigation actions.

Establishing the Planning Partnership—The team identified various local governments to engage through this Plan update process. Ultimately, eight joined the County and participated in the planning process (see Table ES-1).

Forming the Local Planning Committee (LPC)—Douglas County established a thirty-eight member Local Planning Committee that represents the entire planning partnership to oversee the planning process.

Reviewing Previous Hazard Mitigation Plan and Existing Programs—The CPT and LPC reviewed the 2015 hazard mitigation plan, as well as all laws, ordinances and programs in effect within the County that can affect hazard mitigation.

Public Outreach—The update effort included a webpage describing update activities, public polling distributed throughout the County to gather public input, the use of social media and informational bulletins to report on update activities, and public meetings to explain the update process and gather feedback. More than 100 people completed surveys.

Table ES-1. Hazard Mitigation Planning Partners Covered Under This Plan

Planning Partners	
Unincorporated Douglas County	
City of Castle Pines	Town of Parker
Town of Castle Rock	Centennial Water and Sanitation District
Town of Larkspur	Denver Water District
City of Lone Tree	Parker Water and Sanitation District

Planning Area, Hazards of Concern, and Risk Assessment

The planning area for the 2021 Plan consists of the jurisdictional boundaries for the unincorporated county, and planning partners. The Local Planning Committee considered the full range of natural hazards that could affect the planning area and then identified those that present the greatest concern.

Risk assessment is the process of estimating the potential loss of life, personal injury, economic injury, and property damage resulting from identified hazards. The risk assessments in the 2021 Plan describes the risks associated with each identified hazard of concern. The following steps were used to assess the risk of each hazard:

- Identification and profile hazards of concern
- Determine the planning areas “exposure” to each hazard—Exposure was assessed by overlaying hazard maps with an inventory of structures, facilities, and systems to decide which of them would be exposed to each hazard.
- Assess the “vulnerability” of exposed facilities—Vulnerability of exposed structures and infrastructure was evaluated by interpreting the probability of occurrence of each event and assessing potential damage to structures, facilities, and systems that are exposed to each hazard.

Table ES-2 summarizes the findings of the risk assessment.

Table ES-2. Key Findings from Risk Assessment of Hazard of Concern

Hazard of Concern	Exposure	Vulnerability
Animal Disease	Entire planning area exposed	No quantitative loss estimates
Dam and Levee Failure	<ul style="list-style-type: none"> • Areas and structures downstream of dams are exposed • Dam inundation areas unknown at time of 2021 update 	No quantitative loss estimates
Drought	Entire planning area exposed	No quantitative loss estimates
Earthquake	Entire planning area exposed	<ul style="list-style-type: none"> • 1 household displaced in 500-year earthquake, 31 households displaced in 250—year event

Hazard of Concern	Exposure	Vulnerability
		<ul style="list-style-type: none"> • \$77.5 million in estimated total damage from 500-year event • \$1.087 billion in estimated total damage from 2500-year event
Extreme Temperatures	Entire planning area exposed	No quantitative loss estimates
Flood	Entire planning area exposed, with special concern to the FEMA-designated areas of special and moderate flood hazards (comprising more than 28,000 acres, or 5.2% of County) 595 residents are in the Special Flood Hazard Area, and 4,775 are in the Moderate Flood Hazard Area (most of which are in Parker)	<ul style="list-style-type: none"> • 458 buildings are exposed to the 100-year flood zone and 2,143 buildings are exposed to the 500-year flood zone (representing \$3.4 billion in total value) • 158 lifelines are exposed to the areas of moderate or special flood hazard
Hazardous Materials	Entire planning area exposed, with highest risk on major roadways and along transportation corridors	No quantitative loss estimates
Pandemic/Disease Outbreak	Entire planning area exposed	No quantitative loss estimates
Severe Weather: Hail and Lightning	Entire planning area exposed	No quantitative loss estimates
Severe Weather: Thunderstorms	Entire planning area exposed	No quantitative loss estimates
Severe Weather: Tornadoes	Entire planning area exposed	No quantitative loss estimates
Severe Winter Storm	Entire planning area exposed	No quantitative loss estimates
Soil Hazards: Erosion	<ul style="list-style-type: none"> • Areas along Douglas County waterways are exposed (including the Special Flood Hazard Area and Area of Moderate Flood Hazard) • Approximately 852 residents are in the erosion hazard area, the vast majority of which are in Unincorporated Douglas County • Approximately one-half of Larkspur’s buildings are in the erosion hazard area 	No quantitative loss estimates
Soil Hazards: Expansive Soils	<ul style="list-style-type: none"> • Areas in the foothills of Douglas County, between Roxborough State Park and Perry Park • Approximately 7,800 residents are in a dipping bedrock hazards area, the vast majority of which are in Unincorporated Douglas County (7,175) • Total RCV exposed totals \$2.8 billion 	No quantitative loss estimates
Soil Hazards: Land Subsidence	<ul style="list-style-type: none"> • Scattered and isolated areas of land subsidence are found throughout Douglas County • Approximately 33,779 residents are in subsidence areas 	No quantitative loss estimates
Soil Hazards: Slope Failure	<ul style="list-style-type: none"> • Slope failure areas are found throughout Douglas County • Slope failure is more likely to occur in areas with high topographic relief • Approximately 0.26% of residents are in slope failure areas, exposing more than \$333 million in structures 	No quantitative loss estimates
Wildfire	Entire planning area exposed	<ul style="list-style-type: none"> • More than one-third of residents (35.5%) live in wildfire risk areas • Approximately 30.6% of Building RV (\$55.7 billion) is in wildfire risk areas • 421 of the County’s 971 lifelines are in wildfire risk areas (the majority of

Hazard of Concern	Exposure	Vulnerability
		which are food, water, and shelter lifelines

Risk Ranking

The 2021 Plan includes a risk ranking protocol for each planning partner, in which “risk” was calculated by multiplying probability by impact on people, property and the economy. The risk estimates were generated using methodologies promoted by FEMA. The Local Planning Committee reviewed, discussed and approved the methodology and results. The County-wide ranking results are listed in Table ES-3. All planning partners ranked risk for their own jurisdictions following the same methodology.

Table ES-3. Hazard Risk Ranking

Rank	Hazard Type	Risk Rating Score (Probability x Impact)	Category*
1	Wildfire	48	High
2	Drought	30	Medium
2	Pandemic	30	Medium
3	Hail	24	Medium
4	Animal Disease	18	Medium
4	Lightning	18	Medium
4	Severe Thunderstorms	18	Medium
4	Severe Winter Storm	18	Medium
4	Transportation Accidents	18	Medium
5	Earthquake	16	Medium
5	Tornadoes	16	Medium
6	Erosion	12	Low
6	Expansive Soils	12	Low
6	Extreme Temperatures	12	Low
6	Flood	12	Low
6	Land Subsidence	12	Low
6	Landslide	12	Low
6	Slope Failure	12	Low
7	Dam and Levee Failure	6	Low

*Scores of 31 or greater are rated as “high,” scores of 15 to 30 are “medium,” and scores of less than 14 are “low”

Guiding Principle, Goals and Objectives

The Local Planning Committee updated the 2021 HMP guiding Principle as follows:

The purpose of this plan update is to guide hazard mitigation planning, implement projects, and prioritize resources to better protect the people and property of the County from the effects of hazards. This plan demonstrates the community’s commitment to reducing risks from hazards and serves as a tool to help decision makers direct mitigation activities and resources. This plan was also developed to ensure Douglas County and participating jurisdictions’ continued eligibility for federal, state, and local disaster assistance including but not limited to the FEMA Hazard Mitigation Grant Program (HMGP), Building Resilient Infrastructure and Communities (BRIC), and the Flood Mitigation Assistance Program (FMA); and HUD Community Development Block Group-Mitigation (CDBG-MIT).

Completion also earns credits for the National Flood Insurance Program’s Community Rating System (CRS) which provides for lower flood insurance premiums in CRS communities.

Table ES-4 lists goals and objectives for this hazard mitigation plan update, as established by the Local Planning Committee.

Table ES-4. Mission Statement, Goals and Objectives

Goals	Objectives
<p>Goal 1 – Warning - Enhance predictive measures including the expansion and protection of warning systems and supporting technologies.</p> <p>Goal 2 – Data Collection - Enhance the quality of assessments, analysis and planning through the development and collection of data.</p> <p>Goal 3 – Outreach and Education - Increase public awareness of hazards and their mitigation.</p> <p>Goal 4 - Mitigate Structures and Protect Lives - Reduce impacts, costs, and damages from hazard events to people, property, local government and private assets, economy, and natural and cultural resources.</p> <p>Goal 5 - Planning - Coordinate and integrate hazard mitigation activities with local land development planning activities and emergency operations planning to consider resiliency.</p> <p>Goal 6 - Codes & Standards - Review, update, adopt and enforce local, state and federal plans, codes and regulations to reduce the impacts of natural hazards.</p> <p>Goal 7 - Entity Coordination - Strengthen communication and coordination among public entities, non-governmental organizations (NGOs), businesses and private citizens.</p> <p>Goal 8 - Continuity of Operations - Support continuity of operations pre-, during, and post- hazard events including the support of community lifelines.</p>	<ul style="list-style-type: none"> • Objective 1: Improve systems that provide warning and emergency communications. • Objective 2: Increase public awareness of risk. • Objective 3: Research, develop, and promote adoption of cost-effective building and development laws, regulations, and ordinances. • Objective 4: Improve hazard information databases and maps and increase accessibility to those resources. • Objective 5: 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: Manage development in geologically hazardous areas and floodplains to protect life and property. • Objective 7: Incorporate risk reduction considerations in new and updated infrastructure and development plans to reduce the impacts of natural hazards. • Objective 8: 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 9: Improve understanding of the locations, potential impacts, and linkages among threats, hazards, vulnerability, and measures needed to protect life safety and health. • Objective 10: Consider risk reduction in long-term planning. • Objective 11: Minimize impacts of hazard events to key employers. • Objective 12: Identify projects that simultaneously reduce risk while increasing operational area resilience and sustainability. • Objective 13: Establish a partnership among all levels of government and the business community to improve and implement methods to protect property. • Objective 14: Reduce risks that may impact critical business operations. • Objective 15: 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 16: 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 17: Modify structures, as necessary, to meet life safety standards. • Objective 18: Encourage the incorporation of mitigation measures into repairs, major alterations, new development, and redevelopment practices, especially in areas subject to substantial hazard risk. • Objective 19: Retrofit, purchase, or relocate structures in high hazard areas, especially those known to be repetitively damaged. • Objective 20: Encourage hazard mitigation measures that promote and enhance natural processes and minimize adverse impacts on the ecosystem. • Objective 21: Promote enforcement of relevant state regulations and local ordinances that significantly reduce life loss and injuries. • Objective 22: Strengthen local building code enforcement. • Objective 23: Ensure continuity of operations of essential county government services. • Objective 24: Protect rare, endangered, unusual, or educationally important natural resources.

Goals	Objectives
	<ul style="list-style-type: none"> Objective 25: Provide incentives for development and land use techniques that reduce risks.

Mitigation Action Plans

Catalogs of hazard mitigation best practices were developed that present a broad range of action alternatives to be considered for use by the planning partners. One catalog was developed for each hazard of concern. The alternatives include actions that will mitigate current risk from hazards and actions that will help reduce risk from changes in the impacts of these hazards resulting from climate change.

Hazard mitigation actions recommended in this plan were selected from an analysis of the alternatives presented in the catalogs. Each planning partner selected appropriate mitigation actions to establish an individual mitigation action plan for its jurisdiction. Actions were selected based on an analysis of the planning partner’s ability to implement the action and general feasibility.

The combined action plans of the nine planning partners include dozens of actions for mitigating hazard risks in Douglas County. The planning partners have prioritized the actions in their action plans and can begin to implement the highest-priority actions over the next five years.

Plan Implementation and Maintenance

The effectiveness of the 2021 Plan depends on its effective implementation and incorporation of the outlined action items as needed into each partner’s existing plans, policies, and programs. Douglas County will have lead responsibility for overseeing the plan implementation and maintenance strategy. Plan implementation will be a shared responsibility among all planning partnership members and agencies identified as lead agencies in the jurisdiction-specific action plans.

A formal implementation and maintenance process will ensure that the hazard mitigation plan remains an active and relevant document and that the planning partners maintain their eligibility for applicable funding sources. The plan maintenance process includes a schedule for monitoring and evaluating the plan annually and producing an updated plan every five years. The plan maintenance matrix shown in Table ES-5 provides a synopsis of responsibilities for the overall plan maintenance strategy.

Table ES-5. Plan Maintenance Matrix

Task	Approach	Timeline	Lead Responsibility	Support Responsibility
Monitoring-Progress Reporting	Preparation of status updates and action implementation tracking as part of submission for annual progress report.	April to April of each calendar year or upon full update to comprehensive plan or major disaster	Jurisdictional points of contact	Jurisdictional implementation lead
Evaluation	Annual progress reports will be evaluated by an oversight steering committee annually	Finalized progress report completed by April 1 of each year	Douglas County OEM	Jurisdictional points of contacts
Update	Reconvene the planning partners, at a minimum, every 5 years to guide a full review and revision of the plan.	Every 5 years or upon full update to comprehensive plan or major disaster	Douglas County OEM and Local Planning Committee	Jurisdictional points of contacts

Task	Approach	Timeline	Lead Responsibility	Support Responsibility
Grant Monitoring and Coordination	Monitor grant funding opportunities via agency notifications, state associations and post-disaster response	Ongoing	Douglas County OEM	Jurisdictional points of contacts
Plan Integration	Create a linkage between the hazard mitigation plan and individual jurisdictions' comprehensive plans or similar plans	Ongoing as opportunities for integration become available, or according to timelines identified in individual actions plans	Jurisdictional points of contact	Jurisdictional implementation lead
Continuing Public Involvement	Keep the website maintained and receive comments through it over the course of the plan. Planning partners will maintain links to the website. County-wide progress report will be posted to the website.	Ongoing. Progress reports to be posted annually.	Douglas County OEM will maintain the overall website and post the progress report annually. Each planning partner will provide a link to the website and may post individual progress reports.	Douglas County OEM and jurisdictional implementation lead

SECTION 1 INTRODUCTION

1.1 BACKGROUND

A Hazard Mitigation Plan (HMP) is a living document that communities use to reduce their vulnerability to hazards. It forms the foundation for a community's long-term strategy to reduce disaster losses and creates a framework for decision making to reduce damages to lives, property, and the economy from future disasters. Hazard Mitigation involves long- and short-term actions implemented before, during and after hazard events. Hazard mitigation activities include planning efforts, policy changes, programs, studies, improvement projects, and other steps to reduce the impacts of hazards. Ultimately, these actions reduce vulnerability, and communities are able to recover more quickly from damaging hazard events.

In response to the requirements of the Disaster Mitigation Act of 2000 (DMA 2000), Douglas County developed this HMP, which represents a regulatory update to the 2015 “Douglas County Local Hazard Mitigation Plan” The DMA 2000 amends the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act) and is designed to improve planning for, response to, and recovery from disasters by requiring state and local entities to implement pre-disaster mitigation planning and develop HMPs. The Federal Emergency Management Agency (FEMA) has issued guidelines for HMPs. Colorado Division of Homeland Security and Emergency Management (DHSEM) also supports plan development for jurisdictions in the State of Colorado.

Hazard Mitigation is any sustained action taken to reduce or eliminate the long-term risk and effects that can result from specific hazards.

FEMA defines a *Hazard Mitigation Plan* as the documentation of a state or local government evaluation of natural hazards and the strategies to mitigate such hazards.

Specifically, the DMA 2000 requires that states, with support from local governmental agencies, develop and update HMPs on a five-year basis to prepare for and reduce the potential impacts of natural hazards. The DMA 2000 is intended to facilitate cooperation between state and local authorities, prompting them to work together. This enhanced planning better enables local and State governments to articulate accurate needs for mitigation, resulting in faster allocation of funding and more effective risk reduction projects.

1.1.1 DMA 2000 Origins - The Stafford Act

In the early 1990s, a new federal policy regarding disasters began to evolve. Rather than reacting whenever disasters strike communities, the federal government began encouraging communities to first assess their vulnerability to various disasters and proceed to take actions to reduce or eliminate potential risks. The logic is that a disaster-resistant community can rebound from a natural disaster with less loss of property or human injury, at much lower cost, and, consequently, more quickly. Moreover, these communities minimize other costs associated with disasters, such as the time lost from productive activity by business and industries.

The DMA 2000 provides an opportunity for states, tribes, and local governments to take a new and revitalized approach to mitigation planning. The DMA 2000 amended the Stafford Act by repealing the previous mitigation planning provisions (Section 409) and replacing them with a new set of requirements (Section 322). Section 322 sets forth the requirements that communities evaluate natural hazards within their respective jurisdictions and develop an appropriate plan of action to mitigate those hazards, while






emphasizing the need for State, tribal and local governments to closely coordinate mitigation planning and implementation efforts.

The amended Stafford Act requires that each local jurisdiction identify potential natural hazards to the health, safety, and well-being of its residents and identify and prioritize actions that the community can take to mitigate those hazards—before disaster strikes. To remain eligible for hazard mitigation assistance from the federal government, communities must first prepare and then maintain and update an HMP (this plan).

Responsibility for fulfilling the requirements of Section 322 of the Stafford Act and administering the FEMA Hazard Mitigation Program has been delegated to the State of Colorado, specifically to the Colorado Division of Homeland Security and Emergency Management (DHSEM). FEMA also provides support through guidance, resources, and plan reviews.

1.1.2 Benefits of Mitigation Planning

The planning process helps prepare citizens and government agencies to better respond when damaging hazard events occur. Also, mitigation planning allows Douglas County and participating jurisdictions to remain eligible for mitigation grant funding for mitigation projects that will reduce the impact of future disaster events. Eligible projects include property acquisition and structure demolition, structure elevation, localized flood risk reduction projects, infrastructure retrofit, soil stabilization, wildfire mitigation, post-disaster code enforcement, wind retrofit for one- and two-family residences, and planning related activities. The long-term benefits of mitigation planning include the following:

National Benefit-Cost Ratio (BCR) Per Peril <small>*BCR numbers in this study have been rounded</small>		Beyond Code Requirements	Federally Funded
Overall Hazard Benefit-Cost Ratio		\$4:1	\$6:1
 Riverine Flood		\$5:1	\$7:1
 Hurricane Surge		\$7:1	Too few grants
 Wind		\$5:1	\$5:1
 Earthquake		\$4:1	\$3:1
 Wildland-Urban Interface Fire		\$4:1	\$3:1

Source: FEMA 2018; Federal Insurance Mitigation Administration 2018
 Note: Natural hazard mitigation saves \$6 on average for every \$1 spent on federal mitigation grants.

The long-term benefits of mitigation planning include the following:

- Building a more sustainable and disaster-resistant County.
- Reduced long-term impacts and damages to human health and structures.
- Increasing education and awareness of hazards and their threats, as well as their risks.
- An increased understanding of hazards faced by Douglas County
- Developing implementable and achievable actions for risk reduction in the County.
- 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 repair costs.

1.1.3 Organizations Involved in the Mitigation Planning Effort

Douglas County intends to implement this HMP with full coordination and participation of local departments, organizations and groups, and relevant state and federal entities. Coordination helps to ensure that stakeholders have established communication channels and relationships necessary to support mitigation planning and mitigation actions included in Section 6 (Mitigation Strategy).

Multiple Agency Support for Hazard Mitigation

Primary responsibility for the development and implementation of mitigation strategies and policies lies with local governments. However, local governments are not alone; various partners and resources at the regional, state, and federal levels are available to assist communities in the development and implementation of mitigation strategies. Within the State of Colorado, the Division of Homeland Security and Emergency Management (DHSEM) is the lead agency providing hazard mitigation planning assistance to local jurisdictions. DHSEM provides guidance to support mitigation planning. In addition, FEMA provides grants, tools, guidance, and training to support mitigation planning.

Additional input and support for this planning effort was obtained from a range of agencies and through public involvement (as discussed in Section 2). The Local Planning Committee for the County’s HMP update provided project management and oversight of the planning process. A list of Local Planning Committee, municipal, and special district POCs is provided in Section 2 (Planning Process), while Appendix B (Participation Matrix) provides further documentation of the broader level of jurisdictional involvement.

This HMP was prepared in accordance with the following regulations and guidance:

- FEMA *Local Mitigation Planning Handbook*, March 2013.
- FEMA *Integrating Hazard Mitigation into Local Planning*, March 1, 2013.
- FEMA *Plan Integration: Linking Local Planning Efforts*, July 2015.
- *Local Mitigation Plan Review Guide*, October 1, 2011.
- DMA 2000 (Public Law 106-390, October 30, 2000).
- 44 Code of Federal Regulations (CFR) Parts 201 and 206 (including: Feb. 26, 2002, Oct. 1, 2002, Oct. 28, 2003, and Sept. 13, 2004 Interim Final Rules).
- FEMA *How-To Guide for Using HAZUS for Risk Assessment* FEMA Document No. 433, February 2004.
- FEMA *Mitigation Planning How-to Series* (FEMA 386-1 through 4, 2002), available at: <http://www.fema.gov/fima/planhowto.shtm>.
- FEMA *Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards*, January 2013.
- 2018-2023 Colorado Hazard Mitigation Plan

Table 1-1 summarizes the requirements outlined in the DMA 2000 Interim Final Rule and provides the section where each is addressed in this 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 6; Appendix A
Planning Process	
Documentation of the Planning Process: §201.6(b) and §201.6(c)(1)	Section 2
Risk Assessment	
Identifying Hazards: §201.6(c)(2)(i)	Sections 4.2
Profiling Hazards: §201.6(c)(2)(i)	Section 5.4

Plan Criteria	Primary Location in Plan
Assessing Vulnerability: Overview: §201.6(c)(2)(ii)	Section 5.4
Assessing Vulnerability: Identifying Structures: §201.6(c)(2)(ii)(A)	Section 4 Section 5.4
Assessing Vulnerability: Estimating Potential Losses: §201.6(c)(2)(ii)(B)	Section 5.4
Assessing Vulnerability: Analyzing Development Trends: §201.6(c)(2)(ii)(C)	Section 4 and Section 8
Mitigation Strategy	
Local Hazard Mitigation Goals: §201.6(c)(3)(i)	Section 6
Identification and Analysis of Mitigation Actions: §201.6(c)(3)(ii)	Section 6
Implementation of Mitigation Actions: §201.6(c)(3)(iii)	Section 6
Jurisdictional Mitigation Actions: §201.6(c)(3)(iv)	Section 6
Plan Maintenance Process	
Monitoring, Evaluating, and Updating the Plan: §201.6(c)(4)(i)	Section 7
Incorporation into Existing Planning Mechanisms: §201.6(c)(4)(ii)	Section 7
Continued Public Involvement: §201.6(c)(4)(iii)	Section 7

1.1.4 Organization

The Douglas County Local Hazard Mitigation Plan Update (HMP) is organized in accordance with FEMA and DHSEM guidance. The HMP is organized in two volumes containing nine sections and associated appendices.

Volume I

- Section 1:** Introduction: Overview of participants and planning process.
- Section 2:** Plan Adoption: Information regarding adoption of the HMP by Douglas County and each participating jurisdiction.
- Section 3:** Planning Process: A description of the HMP methodology and development process; Local Planning Committee, Core Planning Team and stakeholder involvement efforts; and a description of how this HMP will be incorporated into existing programs.
- Section 4:** County Profile: An overview of Douglas County, including: general information, economy, land use trends, population and demographics, general building stock inventory, and critical facilities and lifelines.
- Section 5:** Risk Assessment: Documentation of the hazard identification and hazard risk ranking process, hazard profiles, and findings of the vulnerability assessment (estimates of the impact of hazard events on life, safety and health; general building stock; critical facilities and the economy); description of the status of local data; and planned steps to improve local data to support mitigation planning.
- Section 6:** Mitigation Strategy: Information regarding the mitigation goals and objectives identified by the Local Planning Committee in response to priority hazards of concern and the process by which local mitigation strategies have been developed or updated.

Section 7: Plan Maintenance Procedures: System established by the Local Planning Committee to continue to monitor, evaluate, maintain, and update the HMP.

Volume II

Section 8: Planning Partnership: Description of the participation requirements established by the Local Planning Committee, as well as instructions and templates that the partners used to complete their annexes.

Section 9: Jurisdiction Specific Annexes: Federally required jurisdiction-specific elements for each participating jurisdiction including general information, economy, land use trends, population and demographics, general building stock inventory, and critical facilities and lifelines; capability assessment; risk ranking; integration opportunities; and mitigation strategy.

Appendices

Appendix A: Resolution of Plan Adoption: Resolutions from the County and participating jurisdictions will be included as they formally adopt the HMP update.

Appendix B: Participation Matrix: A matrix is presented to give a broad overview of who attended meetings and when input was provided to the HMP update. Letters of Intent to Participate as described in Section 2 are also included in this appendix.

Appendix C: Meeting Documentation: Agendas, attendance sheets, minutes, and other documentation (as available and applicable) of planning meetings convened during the development of the plan.

Appendix D: 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 plan process. Survey results for both citizens and stakeholders are summarized as well.

Appendix E: Risk Assessment Supplementary Data: Supplemental information for the hazard profiles, including data from the 2015 Plan Update.

Appendix F: Mitigation Strategy Supplement: Supplemental information used to inform the mitigation strategy development.

Appendix G: Plan Maintenance Tools: Information that can be used by jurisdictions to maintain their plans through the next planned update.

Appendix H: Linkage Procedures: Provides instructions for non-participating jurisdictions to link to the current plan update.

Appendix I: Critical Facilities: Provides a list of critical facilities identified in the plan (not included in the public review document).

Goals and Objectives

The planning process included a review and update of the prior mitigation goals and objectives as a basis for the planning process and to guide the selection of appropriate mitigation actions addressing all hazards of concern. Further, the goal development process considered the mitigation goals expressed in the State of Colorado HMP, as well as other relevant county and local planning documents, as discussed in Section 6 (Mitigation Strategy).

Hazards of Concern

Douglas County and planning participants reviewed natural and non-natural hazards that caused measurable impacts based on events, losses, and information available since the development of the 2015 Douglas County Local Hazard Mitigation Plan Update and the 2018 Colorado Hazard Mitigation Plan. The County evaluated the risk and vulnerability due to each of the hazards of concern on the assets of the County and participating jurisdictions. While the overall hazard rankings were calculated for the County, the overall hazard rankings displayed reflect planning partner input. The hazard risk rankings were used to focus and prioritize the County and participating jurisdiction's mitigation strategies.

Plan Integration into Other Planning Mechanisms

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 thus it is critical that this HMP integrates, coordinates with, and complements those mechanisms. Comprehensive plans, codes and ordinances are among the sources of information to update the County's capabilities, to identify mitigation strategies, and to identify potential areas of future integration.

Section 5 (Capability Assessment) 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. Also in this section, the County identified how they have integrated hazard risk management into their existing planning, regulatory, and operational/administrative framework (*existing integration*), and how they intend to promote this integration (*opportunities for future integration*).

The eight goals of the Douglas County HMP.

Goal 1 – Warning: Enhance predictive measures including the expansion and protection of warning systems and supporting technologies.

Goal 2 - Data Collection: Enhance the quality of assessments, analysis and planning through the development and collection of data.

Goal 3 - Outreach and Education: Increase public awareness of hazards and their mitigation.

Goal 4 - Mitigate Structures and Protect Lives: Reduce impacts, costs, and damages from hazard events to people, property, local government and private assets, economy, and natural and cultural resources.

Goal 5 – Planning: Coordinate and integrate hazard mitigation activities with local land development planning activities and emergency operations planning to consider resiliency.

Goal 6 - Codes & Standards: Review, update, adopt and enforce local, state and federal plans, codes and regulations to reduce the impacts of natural hazards.

Goal 7 - Entity Coordination: Strengthen communication and coordination among public entities, non-governmental organizations (NGOs), businesses and private citizens.

Goal 8 - Continuity of Operations: Support continuity of operations pre-, during, and post- hazard events including the support of community lifelines.

1.1.5 Implementation of Prior and Existing Local Hazard Mitigation Plans

Section 6 (Mitigation Strategy) of the plan presents the status of the mitigation projects identified in the 2015 Douglas County HMP. Numerous projects and programs have been implemented that have reduced hazard vulnerability to assets in the planning area. Plan maintenance procedures in Section 7 (Plan Maintenance) were developed to include specific, implementable activities. Future actions include integrating hazard mitigation goals into comprehensive plan updates; reviewing the HMP during updates of codes, ordinances, zoning, and development; and ensuring a more thorough integration of hazard mitigation, with its related benefits, will be completed within the upcoming five-year planning period.

1.1.6 Implementation of the Planning Process

The planning process and findings are required to be documented in local HMPs. To support the planning process in developing this HMP, Douglas County and the participating jurisdictions have accomplished the following:

- Developed a Local Planning Committee and Core Planning Team.
- Reviewed the 2015 *Douglas County Local Hazard Mitigation Plan*
- Identified and reviewed those natural and non-natural hazards that are of greatest concern to the community (hazards of concern) to be included in the plan.
- Profiled the relevant hazards.
- Estimated the inventory at risk and potential losses associated with the relevant hazards.
- Reviewed and updated the hazard mitigation goals and objectives.
- Reviewed mitigation strategies identified in the 2015 Douglas County Local HMP.
- Developed new mitigation actions to address reduction of vulnerability of hazards of concern.
- Involved a wide range of stakeholders and the public in the plan process.
- Developed mitigation plan maintenance procedures to be executed after obtaining approval of the plan from DHSEM and FEMA.

As required by the DMA 2000, Douglas County has informed the public and provided opportunities for public comment and input. Numerous agencies and stakeholders have participated as core or support members by providing input and expertise throughout the planning process. Refer to Appendix D (Public and Stakeholder Outreach) for copies of public service announcements, newspaper articles, and social media posts.

This HMP update documents the process and outcomes of Douglas County and the planning partner's efforts. Section 6 (Mitigation Strategy) includes documentation that the prerequisites for plan approval have been met. Section 3 (Planning Process) includes additional information on the process to develop this plan.

1.2 The Plan Update – What is Different?

Douglas County's initial HMP was approved by FEMA and adopted by the County in 2015. The 2020 update builds on the 2015 plan and specifically includes the following changes or enhancements. This plan differed from its predecessor for a variety of reasons:

Updated data and tools provided for a more detailed and accurate risk assessment. ArcGIS Survey123 was utilized to update critical facility and critical lifeline data. Additional hazards of concern were added including animal and disease infestation and impacts of the COVID-19 pandemic. An exposure analysis

was utilized to determine risk for all soil hazards. The risk assessment was prepared to better support future grant applications by providing risk and vulnerability information that would directly support the measurement of “cost-effectiveness” required under FEMA mitigation grant programs.

The plan identified implementable actions with enough information to serve as the basis for policy and funding decisions and represent measurable impacts on resiliency and mitigation progress.

Table 1-2. Plan Changes Crosswalk

44 CFR Requirement	2015 Plan	2021 Updated Plan
<p><i>Requirement §201.6(b): In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include:</i></p> <p>(1) <i>An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;</i></p> <p>(2) <i>An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process; and</i></p> <p>(3) <i>Review and incorporation, if appropriate, of existing plans, studies, reports and technical information.</i></p>	<p>The 2015 plan followed an outreach strategy utilizing multiple media developed and approved by the Steering Committee. This strategy involved the following:</p> <ul style="list-style-type: none"> • Public participation on an oversight Steering Committee. • Public meetings between County employees and citizens. • Distribution of information at the Public Safety Advisory Committee meeting. • E-mails • Press releases. <p>Stakeholders were identified and coordinated with throughout the process. A comprehensive review of relevant plans and programs was performed by the planning team.</p>	<p>Building upon the success of the 2015 plan, the 2021 planning effort deployed a similar public engagement methodology. The plan included the following enhancements:</p> <ul style="list-style-type: none"> • Using social media. • Distribution of newsletters • Web-deployed survey and questionnaires <p>As with the 2015 plan, the 2021 planning process identified key stakeholders and coordinated with them throughout the process. A comprehensive review of relevant plans and programs was performed by the planning team.</p>
<p><i>§201.6(c)(2): The plan shall include a risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.</i></p>	<p>The 2015 plan included a risk assessment of hazards of concern. It looked at assets exposed to the hazard, vulnerability, frequency of occurrence, warning time, geographic extent, potential impact, land use and development trends, and hazard summary.</p>	<p>Similar methodology, using new, updated data, was deployed for the 2021 plan update. This included new American Community Survey data and data sources that enabled a GIS-based analysis of exposure to several hazards.</p>
<p><i>§201.6(c)(2)(i): [The risk assessment] shall include a) description of the ... location and extent of all-natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.</i></p>	<p>The 2015 plan presented a risk assessment of each hazard of concern. Each section included the following:</p> <ul style="list-style-type: none"> • Hazard/Problem Description • Past Occurrences • Likelihood of Future Occurrences • Vulnerability Assessment 	<p>A new format, using new and updated data, was used for the 2021 plan update. Each section of the risk assessment includes the following:</p> <ul style="list-style-type: none"> • Hazard profile, including maps of extent and location, previous occurrences, and probability of future events. • Climate change impacts on future probability.

44 CFR Requirement	2015 Plan	2021 Updated Plan
		<ul style="list-style-type: none"> • Vulnerability assessment including: impact on life, safety, and health, general building stock, critical facilities, and the economy, as well as future changes that could impact vulnerability. • The vulnerability assessment also includes changes in vulnerability since the 2015 plan. • Identified issues have been documented in each hazard profile.
<p><i>§201.6(c)(2)(ii): [The risk assessment] shall include a) description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i). This description shall include an overall summary of each hazard and its impact on the community.</i></p>	<p>Vulnerability was assessed for all hazards of concern. Each hazard of concern included a summary of assets exposed to the hazard (property risk/vulnerability, people risk/vulnerability, and environment risk/vulnerability).</p>	<p>A similar methodology was deployed for the 2021 plan update, using new and updated data. The 2021 plan update included the use of HAZUS computer model was used for the earthquake, flood, and hurricane hazards. These were Level 2 analyses using County data. Site-specific data on County-identified critical facilities were entered into the HAZUS model. HAZUS outputs were generated for other hazards by applying an estimated damage function to an asset inventory extracted from HAZUS-MH.</p>
<p><i>§201.6(c)(2)(ii): [The risk assessment] must also address National Flood Insurance Program insured structures that have been repetitively damaged floods.</i></p>	<p>A summary of NFIP insured properties including an analysis of repetitive loss property locations was included in the plan.</p>	<p>New NFIP data and participation stratus was included in the 2021 plan.</p>
<p><i>Requirement §201.6(c)(2)(ii)(A): The plan should describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure and critical facilities located in the identified hazard area.</i></p>	<p>A complete inventory of the numbers and types of buildings exposed was generated for each hazard of concern. The Steering Committee defined “critical facilities” for the planning area, and these were inventoried by exposure. Each hazard profile provides a discussion on future development trends.</p>	<p>The Local Planning Committee and Tera Tech staff comprehensively identified critical facilities and 2021 plan update using new and updated data.</p>
<p><i>Requirement §201.6(c)(2)(ii)(B): [The plan should describe vulnerability in terms of an] estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(i)(A) and a description of the methodology used to prepare the estimate.</i></p>	<p>Loss estimates were generated for all hazards of concern by using readily available information.</p>	<p>Quantitative loss estimates were generated for hazards of concern for which exposure data was available. These were generated by HAZUS for the earthquake, flood, wildfire, and soil hazards. For the other hazards, loss estimates were generated by</p>

44 CFR Requirement	2015 Plan	2021 Updated Plan
		applying a regionally relevant damage function to the exposed inventory or through qualitative analysis. The asset inventory was the same for all hazards and was generated in HAZUS.
<i>Requirement §201.6(c)(2)(ii)(C): [The plan should describe vulnerability in terms of] providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.</i>	There is a summary of anticipated development in the Community profile.	A similar methodology was deployed for the 2021 plan update using new and updated data.
<i>§201.6(c)(3):[The plan shall include a mitigation strategy that provides the jurisdiction’s blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.]</i>	The 2015 plan contained goals, objectives, and actions. The identified actions covered multiple hazards, goals, and objectives.	A similar methodology for setting goals, objectives, and actions was applied to the 2021 plan update. The Local Planning Committee reviewed and reconfirmed the goals and objectives for the plan. The County used the progress reporting from the plan maintenance and evaluated the status of actions identified in the 2015 plan. Actions that were completed or no longer considered to be feasible were removed. The balance of the actions was carried over to the 2021 plan, and in some cases, new actions were added to the action plan.
<i>Requirement §201.6(c)(3)(i): [The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.</i>	The Local Planning Committee identified goals and objectives targeted specifically for this hazard mitigation plan. These planning components supported the actions identified in the plan.	A similar methodology for setting goals, objectives, and actions was applied to the 2021 plan update. The Local Planning Committee reviewed and updated the mission statement, goals, and objectives for the plan to include a focus on increased resiliency. This resulted in the finalization of eight goals and 25 objectives to frame the plan.
<i>Requirement §201.6(c)(3)(ii): [The mitigation strategy shall include a] section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.</i>	For each identified hazard, goals and objectives were provided as part of the mitigation strategy for the County. The strategies were compiled into categories depending on the hazard they are related to. The strategies were then ranked.	The actions identified during the 2015 planning process were reviewed by the Core Planning Team and updated as necessary. This table was used to identify additional actions to include in the 2021 planning process.

44 CFR Requirement	2015 Plan	2021 Updated Plan
<i>Requirement: §201.6(c)(3)(ii): [The mitigation strategy] must also address the jurisdiction’s participation in the National Flood Insurance Program, and continued compliance with the program’s requirements, as appropriate.</i>	The County identified an action stating their commitment to maintain compliance and good standing under the program.	Ongoing participation in the NFIP for the County was included in ongoing capabilities.
<i>Requirement: §201.6(c)(3)(iii): [The mitigation strategy shall describe] how the actions identified in section (c)(3)(ii) will be prioritized, implemented and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.</i>	Each recommended action was prioritized using a qualitative methodology based on the objectives the project will meet, the timeline for completion, how the project will be funded, the impact of the project, the benefits of the project, and the costs of the project.	A revised methodology based on the STAPLEE criteria, incorporating new and updated data, was used for the 2021 plan update.
<i>Requirement §201.6(c)(4)(i): [The plan maintenance process shall include a] section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.</i>	The 2015 plan details a plan maintenance strategy stating that the plan will be revised and maintained as required and formally adopted by the County after each revision.	The 2021 plan details a plan maintenance strategy similar to that of the initial plan.
<i>Requirement §201.6(c)(4)(ii): [The plan shall include a] process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate.</i>	The 2015 plan details recommendations for incorporating the plan into other planning mechanisms.	The 2021 plan details recommendations for incorporating the plan into other planning mechanisms as identified by the jurisdictions.
<i>Requirement §201.6(c)(4)(iii): [The plan maintenance process shall include a] discussion on how the community will continue public participation in the plan maintenance process.</i>	The 2015 plan details a strategy for continuing public involvement.	A new plan maintenance strategy was developed for the 2021 plan.
<i>Requirement §201.6(c)(5): [The local hazard mitigation plan shall include] documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan (e.g., City Council, County Commissioner, Tribal Council).</i>	The County adopted the 2015 HMP.	The 2020 plan achieves DMA compliance for Douglas County and participating jurisdictions.

SECTION 2 PLAN ADOPTION

2.1 Overview

This section contains information regarding adoption of the plan by Douglas County and each participating jurisdiction.

2.1.1 Plan Adoption by Local Governing Bodies

Adoption by the local governing bodies such as the County Commissioners, City Council or Town Board demonstrates the commitment of Douglas County and each participating jurisdiction to fulfill the mitigation goals and strategies outlined in the plan. Adoption of the plan via a municipal resolution legitimizes the HMP and authorizes responsible agencies to execute their responsibilities.

The County and all participating jurisdictions will proceed with formal adoption proceedings when FEMA has completed review of the plan and provides conditional approval of this HMP update, known as Approval Pending Adoption (APA)

Following adoption or formal action on the plan, the jurisdiction must submit a copy of the resolution or other legal instrument showing formal adoption (acceptance) of the plan to the Douglas County Hazard Mitigation Coordinator in the Douglas County Office of Emergency Management. Douglas County will forward the executed resolutions to Colorado DHSEM after which they will be forwarded to FEMA for record. The jurisdictions understand that FEMA will transmit acknowledgement of verification of formal plan adoption and the official approval of the plan to Douglas County.

The resolutions issued by each jurisdiction to support adoption of the plan will be included in Appendix A.

In addition to being required by DMA 2000, adoption of the plan is necessary because:

It lends authority to the plan to serve as a guiding document for all local and state government officials. It gives legal status to the plan in the event it is challenged in court. It certifies the program and grant administrators that the plan's recommendations have been properly considered and approved by the governing authority and jurisdictions' 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 community's future.

Source: FEMA. 2003. *How to Series: Bringing the Plan to Life* (FEMA 386-4).

SECTION 3 PLANNING PROCESS

3.1 Introduction

This section includes a description of the planning process used to update the 2015 *Douglas County Local Natural Hazard Mitigation Plan* (HMP, also referred herein as the *Hazard Mitigation Plan* or *the plan*), including how it was prepared, who was involved in the process, and how the public was involved.

To ensure that the plan meets requirements of the DMA 2000 and that the planning process would have the broad and effective support of the participating jurisdictions, regional and local stakeholders, and the public, an approach to the planning process and plan documentation was developed to achieve the following:

- Douglas County invited multiple jurisdictions to join with them in the planning process. To date, five local municipal governments and three special districts in the County participated in the 2021 planning process. Jurisdictions that have not met participation requirements during the process will not be able to seek FEMA approval at the time of plan submittal nor will they be eligible to obtain FEMA mitigation grant funding. Any non-participating local government within the Douglas County planning area can “link” to this plan in the future following the linkage procedures defined in Appendix H (Linkage Procedures).
- The plan will consider natural and non-natural hazards of concern facing the area, thereby satisfying the natural hazards mitigation planning requirements specified in DMA 2000.
- The plan will be developed following the process outlined by the DMA 2000 and FEMA regulations. Following this process ensures that all the requirements are met and support HMP review.

The Douglas County HMP update was written using the best available information obtained from a wide variety of sources. Throughout the HMP update process, a concerted effort was made to gather information from jurisdictional and regional agencies and staff, as well as stakeholders, federal and state agencies, and the residents of the County. The HMP Local Planning Committee solicited information from local agencies and individuals with specific knowledge of certain natural hazards and past historical events. In addition, the Local Planning Committee and Planning Partnership took into consideration planning and zoning codes, ordinances, and recent land use planning decisions. The hazard mitigation strategies identified in this HMP update were developed through an extensive planning process involving local, county and regional agencies, residents, and stakeholders.

This section of the plan describes the mitigation planning process, including (1) Organization of the Planning Process; (2) Stakeholder Outreach and Involvement; (3) Integration of Existing Data, Plans, and Technical Information; (4) Integration with Existing Planning Mechanisms and Programs; and (5) Continued Public Involvement.

3.2 Organization of the Planning Process

This section of the plan identifies how the planning process was organized with the many planning partners involved and outlines the major activities that were conducted in the development of this HMP update.

3.2.1 Organization of the Local Planning Committee

A contract planning consultant (Tetra Tech, Inc. referred herein as *Tetra Tech*) was selected to guide Douglas County and the participating jurisdictions through the HMP update process. A contract between Tetra Tech and Douglas County was executed May 26, 2020. Specifically, Tetra Tech, the *contract consultant*, was tasked with the following:

- Assisting with the organization of the Core Planning Team and Local Planning Committee.
- Assisting with the development and implementation of a public and stakeholder outreach program.
- Data collection.
- Facilitation and attendance at meetings (Core Planning Team, Local Planning Committee, stakeholder, public and other).
- Review and update of the hazards of concern, hazard profiling and risk assessment.
- Assistance with the review and update of mitigation planning goals and objectives.
- Assistance with the review of past mitigation strategies 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.

To facilitate plan development, Douglas County established a Local Planning Committee to provide guidance and direction to the HMP update effort and to ensure the resulting document will be embraced both politically and by the constituency within the planning area (refer to Table 3-1). Specifically, the Local Planning Committee was charged with the following:

- Attending and participating in Local Planning Committee meetings.
- Assisting with the development and completion of certain planning elements, including:
 - Reviewing and updating the hazards of concern.
 - Developing and promoting a public and stakeholder outreach program.
 - Assuring that the data and information used in the plan update process are the best available.
 - Reviewing and updating the hazard mitigation mission statement, goals and objectives.
 - Identifying and screening of appropriate mitigation strategies and activities.
- Reviewing and commenting on plan documents prior to submission to DHSEM and FEMA.

Table 3-1. Steering Committee Members

Name	Title	Organization	LPC Member	Core Planning Team Member
Lisa Goudy	Safety and Security Coordinator	Douglas County	Yes	Yes
Tim Johnson	Director Office of Emergency Management	Douglas County	Yes	Yes
Tim Hallmark	Director of Facilities, Fleet, and Emergency Support Services	Douglas County	Yes	Yes
Joel Hanson	GIS Services and Land Solutions	Douglas County	Yes	Yes
Zachary Humbles	Special Projects Engineer	Douglas County	Yes	Yes
Steve Koster	Assistant Director of Planning Services	Douglas County	Yes	
Keith Mathena	Sergeant, Sherriff's Office	Douglas County	Yes	

Name	Title	Organization	LPC Member	Core Planning Team Member
Carrie Groce	Senior Communications Specialist	Douglas County	Yes	
Sean Owens	Special Projects Manager, Public Works	Douglas County	Yes	
Wendy Manitta Holmes	Director, Communications and Public Affairs	Douglas County	Yes	
Jeff Case	Director of Public Works	Centennial Water and Sanitation District	Yes	
Emmalyn White		Centennial Water and Sanitation District	Yes	
Larry Nimmo	Director of Public Works	City of Castle Pines	Yes	
Sam Bishop	Director of Community Development	City of Castle Pines	Yes	
Bill Medina	Administrative Services Director	City of Lone Tree	Yes	
Ron Pinson	Commander	City of Lone Tree	Yes	
Rebecca Franco	Emergency Management Manager	Denver Water	Yes	
Holly Piza	Engineering Services Manager	Mile High Flood District	Yes	
Angelo Carrieri	Maintenance Superintendent	Parker Water & Sanitation District	Yes	
Ron Redd	District Manager	Parker Water & Sanitation District	Yes	
Norris Croom	Fire Chief	Town of Castle Rock	Yes	
Craig Rollins	Assistant Fire Chief	Town of Castle Rock	Yes	
Randal Johnson	Fire Marshal	Town of Larkspur	Yes	
Sean Hogan	Town Clerk	Town of Larkspur	Yes	
Gregg Epp	Sergeant, Parker Police Department	Town of Parker	Yes	
Andrew Coleman	Commander, Parker Police Department	Town of Parker	Yes	
Steve Brueske	Vice Chairman	Douglas County Public Safety Advisory Committee	Yes	
Christine Duffy	Appointed Public Trustee	Douglas County		
Tom Cribley	Volunteer	Douglas County Search and Rescue	Yes	
John Zettler	Public Citizen		Yes	
Matt Fierro	Public Citizen		Yes	
Dan Qualmann	Public Citizen		Yes	
John Hoskinson	Public Citizen		Yes	
Bill Denning	Public Citizen		Yes	
Vicky Starkey	Public Citizen		Yes	
Janice Michael	Public Citizen		Yes	
Deb Watts	Emergency Management Liaison	Xcel Energy	Yes	
Tom Henley	Community and Local Government Affairs	Xcel Energy	Yes	

Appendix B (Participation Matrix), identifies those individuals who represented the municipalities during this planning effort and indicates how they contributed to the planning process.

3.2.2 Planning Activities

The Local Planning Committee, as well as key stakeholders, convened and/or communicated regularly to share information and participate in workshops to identify hazards; assess risks; review existing inventories of and identify new critical facilities; assist in updating and developing new mitigation goals and strategies; and provide continuity through the process to ensure that natural hazards vulnerability information and appropriate mitigation strategies were incorporated. All members of the Local Planning Committee had the opportunity to review the draft plan and supported interaction with other stakeholders and assisted with public involvement efforts.

A summary of the Local Planning Committee meetings held, and key milestones met during the development of the HMP update is included in Table 3-2 that also identifies which DMA 2000 requirements the activities satisfy. Documentation of meetings (agendas, sign-in sheets, minutes, etc.) are in Appendix C (Meeting Documentation). Table 3-2 identifies only the formal meetings held during plan development and does not reflect the planning activities conducted by individuals and groups throughout the planning process. In addition to these meetings, there was a great deal of communication between the County, Planning Partners, Local Planning Committee members, and the contract consultant through individual virtual meetings, electronic mail (email), and by phone.

After completion of the HMP update, implementation and ongoing maintenance will become a function of the Steering Committee as described in Section 7. The Steering Committee is responsible for reviewing the HMP and soliciting and considering public comment as part of the five-year mitigation plan update.

This table summarizes a list of mitigation planning activities and meetings and their respective participants. A more detailed list of participants for each meeting is provided in Appendix C. Refer to DMA 2000 (Public Law 106-390) for details on each of the planning requirements (<https://www.fema.gov/media-library-data/20130726-1524-20490-1790/dma2000.pdf>).

Table 3-2. Summary of Mitigation Planning Activities / Efforts

Date	DMA 2000 Requirement	Description of Activity	Participants
July 8, 2020	2	Planning Partnership Kick-off Meeting	Douglas County, City of Castle Rock, City of Lone Tree, Town of Castle Rock, Town of Larkspur, Town of Parke, Centennial Water & Sanitation District, Denver Water, Mile High Water & Sanitation, Parker Water & Sanitation District
July 22, 2020	2	Local Planning Committee Meeting #1: Established Committee Role/Ground rules and schedule; reviewed hazard mitigation planning and update process; defined the Planning Area for the update; defined and identified critical facilities/infrastructure; and confirmed hazards of	Representatives Douglas County and Planning Participants departments: OEM, Public Works, Communications, Planning, Vehicle and Fleet Services, Engineering, Facilities, Fleet, and Emergency Support Services, Safety and Security, Search and Rescue, Fire, Police, Administration, Xcel Energy, Tetra Tech; and the General Public

Date	DMA 2000 Requirement	Description of Activity	Participants
		concern, reviewed data collection status/ confirmed public involvement strategy and tracking of efforts.	
August 19, 2020	2, 4a	Steering Committee Meeting #2: Confirmed mission statement, Plan goals, and identified potential objectives for the Plan	Representatives Douglas County and Planning Participants departments: OEM, Public Works, Communications, Planning, Vehicle and Fleet Services, Engineering, Facilities, Fleet, and Emergency Support Services, Safety and Security, Search and Rescue, Fire, Police, Administration, Xcel Energy, Tetra Tech; and the General Public
September 16, 2020	2, 4b	Steering Committee Meeting #3: Established public outreach strategy, conducted a capability exercise to determine strengths, weaknesses, obstacles and opportunities; and confirmed Plan objectives.	Representatives Douglas County and Planning Participants departments: OEM, Public Works, Communications, Planning, Vehicle and Fleet Services, Engineering, Facilities, Fleet, and Emergency Support Services, Safety and Security, Search and Rescue, Fire, Police, Administration, Xcel Energy, Tetra Tech; and the General Public
October 28, 2020	2	Steering Committee Meeting #4: Reviewed draft risk assessment results, presented risk ranking methodology, and conducted risk ranking exercise.	Representatives Douglas County and Planning Participants departments: OEM, Public Works, Communications, Planning, Vehicle and Fleet Services, Engineering, Facilities, Fleet, and Emergency Support Services, Safety and Security, Search and Rescue, Fire, Police, Administration, Xcel Energy, Tetra Tech; and the General Public
November 18, 2020	1b, 2, 3a, 3b, 3c, 3d, 3e	Risk Assessment - Public Workshop	OEM, General Public, Tetra Tech
January 6, 2021	2, 4a, 4b, 4c	Planning Participants Mitigation Strategy Workshop: confirmed Risk Ranking of hazards and developed mitigation actions for the Plan.	Douglas County, City of Castle Rock, City of Lone Tree, Town of Castle Rock, Town of Larkspur, Town of Parke, Centennial Water & Sanitation District, Denver Water, Parker Water & Sanitation District
January 27, 2021	2, 5a, 5b, 5c	Steering Committee Meeting #5: Presentation of Draft Plan to Committee and provided instructions on how to submit edits and comments.	Representatives Douglas County and Planning Participants departments: OEM, Public Works, Communications, Planning, Vehicle and Fleet Services, Engineering, Facilities, Fleet, and Emergency Support Services, Safety and Security, Search and Rescue, Fire, Police, Administration, Xcel Energy, Tetra Tech; and the General Public
February 10, 2021	1b, 2	Solicit Public Comment on Draft Plan – Public Workshop	OEM, General Public, Tetra Tech
February 26, 2021	NA	Public Comment Period Closed	Representatives Douglas County and Planning Participants departments: OEM, Public Works, Communications, Planning, Vehicle and Fleet Services, Engineering, Facilities, Fleet, and Emergency Support Services, Safety and Security, Search and Rescue, Fire, Police, Administration, Xcel Energy, Tetra Tech; and the General Public

Date	DMA 2000 Requirement	Description of Activity	Participants
March 2021	NA	Final draft revised with public input to DHSEM for review	DHSEM
May 2021	NA	Plan submittal revised to address DHSEM comments provided to DHSEM for submittal to FEMA Region VIII for review	FEMA Region VIII
July 21, 2021	NA	Approval Pending Adoption received from FEMA Region VIII	FEMA Region VIII
July 2021	NA	Adoption window of final plan opens	Participating Jurisdictions
December 10, 2021	NA	Final plan approved by FEMA	FEMA Region VIII

Note: All activities/efforts were conducted during the National Emergency response to the COVID-19 pandemic.
 TBD = to be determined.

Each number in column 2 identifies specific DMA 2000 requirements, as follows:

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

3.3 Stakeholder Outreach and Involvement

This section details the outreach to and involvement of the many agencies, departments, organizations, non-profits, districts, authorities, and other entities that have a stake in managing hazard risk and mitigation, commonly referred to as *stakeholders*. Involving stakeholders in the planning process helps to develop support for the plan.

Diligent efforts were made to assure broad regional, county, and local representation in this planning process. To that end, a comprehensive list of stakeholders was developed with the support of the Steering and Planning Partnerships. Stakeholder outreach was performed early and throughout the planning process. This HMP update includes information and input provided by these stakeholders where appropriate, as identified in the references.

The following is a list of the various stakeholders that were invited to participate in the development of this plan, along with a summary of how these stakeholders participated and contributed. This summary discusses the various stakeholders that were invited to participate in the development of this HMP update and how they participated and contributed to the HMP. It should be noted that this summary listing cannot represent the sum total of stakeholders that were aware of and contributed to this HMP update, as outreach efforts were being made, both formally and informally, throughout the process by the many planning partners involved in the effort, and documentation of all such efforts is impossible. Instead, this summary

is intended to demonstrate the scope and breadth of the stakeholder outreach efforts made during the plan update process.

3.3.1 Federal, State, and County Departments

The following describes the various departments and agencies that were involved during the planning process.

Federal Agencies

FEMA Region VIII: Provided updated planning guidance, summarized and detailed NFIP data for planning area, and conducted plan review.

Other Agencies: Information regarding hazard identification and the risk assessment for this HMP update was requested and received or incorporated by reference from the following agencies and organizations:

- Bureau of Land Management
- National Centers for Environmental Information (NCEI)
- National Oceanic and Atmospheric Administration (NOAA)
- National Weather Service (NWS)
- Storm Prediction Center (SPC)
- U.S. Census Bureau
- United States Forest Service

State Agencies

Relevant state agencies were invited to participate in the plan development process and were kept apprised of plan development process through area meetings, data requests, inter-agency communication, and data sharing. Relevant agencies include:

- Colorado Division of Fire Protection and Control
- Colorado Division of Homeland Security and Emergency Management
- Colorado Division of Water Resources (Dam Safety Branch)
- Colorado State Forest Service
-

Douglas County and Participating Jurisdictional Departments

Several Douglas County and participating jurisdictional departments were represented on the Local Planning Committee and involved in the HMP update planning process. Appendix B (Participation Matrix) provides further details regarding regional and local stakeholder agencies. All responses to the stakeholder surveys are in Appendix D (Public and Stakeholder Outreach).

Douglas County Office of Emergency Management: The Director of Emergency Management is identified as the ongoing Douglas County HMP Coordinator and served in this role throughout the planning process. In addition, the Office provided critical data, assisted with the update of events and losses in the County, updated the previous mitigation strategy, facilitated outreach to stakeholders, contributed to the County's capability assessment, updated the mitigation strategy, and reviewed draft sections of the HMP.

Additionally, representatives from facilities, fleet, and emergency support services, safety and security, GIS services and land solutions, engineering, and flood plain management participated as part of the Core

Planning Team. Representatives emergency management, public works, communications, planning, engineering, planning, search and rescue, fire, police, community development, and administration participated as members of the Local Planning Committee.

3.3.2 Regional and Local Stakeholders

The stakeholders listed below were directly contacted by Douglas County to take a stakeholder survey, which included the identification of hazard risk, mitigation projects and/or review of the draft HMP. Appendix B (Participation Matrix) identifies the stakeholders that attended meetings. Appendix D (Public and Stakeholder Outreach) provides stakeholder survey results.

Adjacent Counties

Douglas County made an effort to keep surrounding counties and municipalities apprised of the project and allowed the opportunity to provide input to the planning process. Specifically, the following adjoining and nearby county representatives were contacted 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. The neighboring county survey was provided to the neighboring counties on October 2, 2020.

- Arapahoe County*
- El Paso County*
- Elbert County*
- Jefferson County*
- Teller County*
- Park County

County indicated by an asterisk (*) provided input to the planning process via the County online stakeholder survey.

3.3.3 Stakeholder Survey Summary

The following provides a summary of the results and feedback received by stakeholders who completed the survey. Feedback was reviewed by the Local Planning Committee and integrated where appropriate in the plan.

Neighboring County Survey

The neighbor survey was sent to the surrounding counties of Douglas County due to their proximity to the County and due to the fact that effects of hazard events that impact Douglas County would be similar to that of their neighbors. As of February 2, 2021, five counties completed the survey.

Respondents were asked to answer 38 questions to help Douglas County get an understanding of their involvement with the County. A summary of each county response is provided below.

Arapahoe County

Arapahoe County stated that they collaborate with Douglas County's comprehensive emergency operations planning and nearly all aspects of emergency management and public safety. Douglas County is also involved in Arapahoe County's comprehensive emergency operations planning. However, neither county is involved in each other's continuity of operations planning.

Information sharing is achieved through email, phone, text, radios, and in-person training and exercises. Additionally, the counties share risk and vulnerability assessments through GIS, Teams, and WebEOC.

Through participation in North Central Region (NCR), both counties collaborate on establishing evacuation routes and alternate evacuation routes. When making decisions about evacuation routes, coordination is conducted through various methods of communication and GIS. With regards to sheltering, the counties consult with each other for sheltering locations near their borders.

While the counties do not have a method of sharing information about mitigation projects, they do share information regarding mitigation during the planning and implementation phases of projects through participation in NCR.

Arapahoe County indicated that they are aware of projects that would require collaboration between the counties like floodplain projects or planning. This type of collaboration typically occurs through shared special districts.

El Paso County

El Paso County indicated that Douglas County is involved in their comprehensive emergency operations planning and they are involved in Douglas County's planning. El Paso County said that Douglas County has been a very strong partner and has included them in many events that have the potential to impact both counties. While Douglas County is not involved in El Paso County's continuity of operations planning, El Paso County is involved in Douglas County's through collaboration.

During an emergency event, the counties communication through direct contact from OEM leadership either prior to or during an event. The counties also both share risk and vulnerability assessments if needed. With regards to evacuation and sheltering, the El Paso and Douglas Counties collaborate on establishing evacuation routes and sheltering. Also, El Paso County has access to contacting the Douglas County emergency operations center. The counties have cross-collaborated on projects, including the I-25 gap roadway improvements.

Elbert County

Elbert County collaborates with Douglas County on multiple planning efforts and both participate in NCR coordination initiatives. Through NCR coordination, both counties are involved in their continuity of operations planning and share risk and vulnerability assessment data. Through collaboration and direct communication during an incident, Elbert and Douglas Counties consult one another before making evacuation decisions that could impact either county and collaborate on establishing and making sheltering decisions. In the event of an emergency, Elbert County has access to contact information for Douglas County's emergency operations center.

Each county offers information sharing between each other, including the planning and implementation phases of mitigation projects. The counties have OEM personnel involved in animal evacuation/sheltering outreach projects. Lastly, Elbert County has shared service agreements with Douglas County for IPAWS and dispatch.

Jefferson County

Jefferson County regularly communicates with Douglas County to share resources and best practices. The two counties participate in numerous regional planning committees. Jefferson and Douglas Counties

communicate through phone calls, emails, WebEOC, regional training and exercises, and regional committee participation. Jefferson County also has contact information for Douglas County OEM in the event of an emergency. Jefferson County indicated that they are not currently involved in Douglas County's continuity of operations planning; however, Jefferson County would welcome and assist Douglas County with any COOP needs that they are able to assist with.

Regarding evacuation and sheltering, if an accident occurred on or close to the county borders, the neighboring counties would reach out to each for assistance if an evacuation or re-routing is needed. For sheltering needs, both counties participate in the NCR Mass Care committee and contribute to shelter locations and resources to the NCR database. In the event either county needs to identify shelters in their neighboring counties, Jefferson and Douglas Counties would consult each other.

The counties worked together on the Waterton Canyon and Chatfield Reservoir project and have collaborated on grant applications. The counties developed grants for training, mass care planning, and animal evacuations. Jefferson County stated that leveraging each other's training and exercise planning are opportunities to optimize cooperation between the counties.

Teller County

Teller County and Douglas County are both involved in each of their comprehensive emergency operations planning through collaboration with Mountain Communities Fire District. Teller County is also involved in Douglas County's continuity of operations planning. Emergency communications between the two counties is done through dispatch, car-to-car, and between OEMs. They also share risk and vulnerability assessments. Information regarding mitigation is also shared between the two counties.

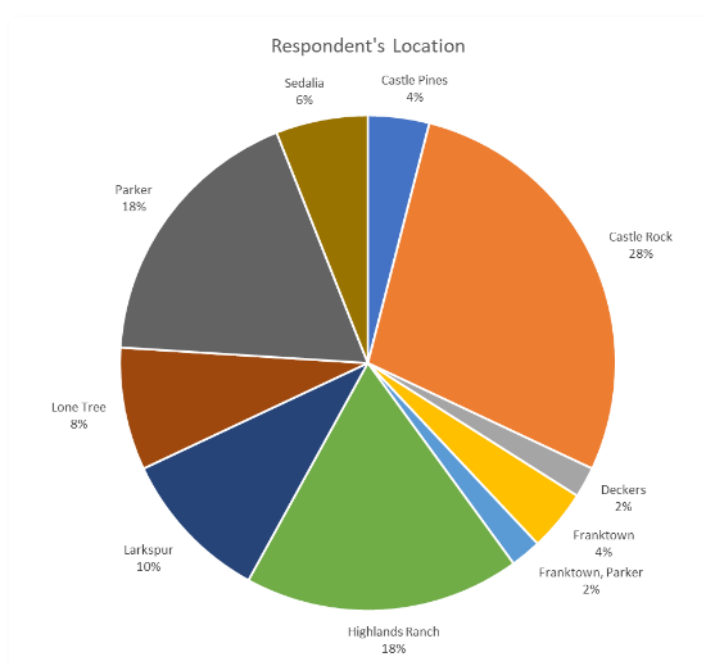
3.3.4 Public Outreach

The Core Planning Team and Local Planning Committee have made the following efforts toward public participation in the development and review of the HMP:

- A public outreach strategy was developed by the Douglas County Department of Communication and Public Affairs. Refer to Appendix D (Public and Stakeholder Outreach) for a copy of the developed outreach strategy.
- A public project webpage was developed and is being maintained to facilitate communication between the Core Planning Team, Local Planning Committee, public and stakeholders (<https://www.douglas.co.us/natural-hazard-mitigation-plan/>). The public webpage contains a project overview, contact information, access to the citizen's survey, Local Planning Committee meeting notes and bulletins; and sections of the HMP for public review and comment (see Figure 3-1).
- Participating jurisdictions, such as the City of Lone Tree, created links on their respective pages to the Douglas County HMP webpage.
- All LPC meetings were open to the general public and notifications of all LPC meetings and public workshops were posted on the Douglas County HMP webpage along with the corresponding meeting agendas. Additionally, notifications were sent out via social media outlets such as the County's Facebook and Twitter accounts. Meetings were also advertised on the project webpage. Follow-up materials such as meeting minutes were also posted on the project webpage.

- A series of questions, online polls, and a public survey were used to gauge household preparedness relevant to hazards in Douglas County and to assess the level of knowledge of tools and techniques to assist in reducing risk and loss of those hazards.

- A public survey was posted on the Douglas County HMP webpage starting in October 2020. The survey closed on January 1, 2021. A total of 50 responses were received. A majority of the responses came from residents who live in Castle Rock and Highlands Ranch. See Appendix D (Public and Stakeholder Outreach) for a copy of the survey and summary of the results.



- Additionally, the County utilized Nextdoor to generate four polling questions over the course of three months. A total of 66 responses were received. When asked if residents considered the impact that a natural or non-natural disaster could have on their home, 56% said yes that they considered the potential impact while 44% responded no. When asked if residents live in a wildfire risk area, 61% said yes and 39% said no. When asked if their home was located in or near a FEMA designated floodplain, 9% said yes, 57% said no and 35% said they were unsure. Lastly, when asked if they know of multiple ways to evacuate or get out of their neighborhood in the event of a hazard, 76% said yes and 24% said no.

Figure 3-1. Douglas County HMP Webpage



Starting in December 2021, draft sections of the plan (as available) were posted on the project website for public review and comment.

Once approved by Colorado DHSEM and FEMA Region VIII, the final HMP will be available on the County’s website.

3.4 Integration with Existing Planning Mechanisms and Programs

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 planning area there are many existing plans and programs that support hazard risk management, and thus it is critical that this hazard mitigation plan integrate, coordinate with, and complement, those existing plans and programs.

The *Capability Assessment* section of Section 6 (Mitigation Strategy) provides a summary and description of the existing plans, programs and regulatory mechanisms in the County that support hazard mitigation. A similar analysis of existing capabilities for each participating jurisdiction can be found in their respective annex in Section 9. A further summary of these continued efforts to develop and promote a comprehensive and holistic approach to hazard risk management and mitigation is presented in Section 7 (Plan Maintenance).

3.5 Continued Public Involvement

Douglas County is committed to the continued involvement of the public in the hazard mitigation process. This HMP update will be posted online at (<https://www.douglas.co.us/natural-hazard-mitigation-plan/>).

Due to COVID-19 and efforts to limit physical contact, electronic copies of the plan are available for download from the website.

A notice regarding annual updates of the plan and the location of plan copies will be publicized annually after the Steering Committee's annual evaluation and posted on the public website at: <https://www.douglas.co.us/natural-hazard-mitigation-plan/>.

The public will have an opportunity to comment on the plan as a part of the annual mitigation planning evaluation process and the next five-year mitigation plan update. The HMP Coordinator is responsible for coordinating the plan evaluation portion of the meeting, soliciting feedback, collecting and reviewing the comments, and ensuring their incorporation in the five-year plan update as appropriate. The purpose of these meetings would be to provide the public an opportunity to express concerns, opinions, and ideas about the plan.

Further details regarding continued public involvement are provided in Section 7 (Plan Maintenance).

After completion of this plan, implementation and ongoing maintenance will continue to be a function of the Steering Committee. The Steering Committee will review the plan and accept public comment as part of an annual review and as part of five-year mitigation plan updates.

A notice regarding annual updates of the plan and the location of plan copies will be publicized annually after the Steering Committee's annual evaluation and posted on the public web site.

Tim Johnson, Director for Douglas County Office of Emergency Management, is identified as the Douglas County HMP Coordinator in Section 7 (Plan Maintenance), and is responsible for receiving, tracking, and filing public comments regarding this plan.

SECTION 4 COUNTY PROFILE

This profile provides general information for Douglas County critical facilities located within the County. Examining the County's physical setting, population and demographics, general building stock, and land use and population trends leads to a better understanding of the study area, including economic, structural, and population assets at risk, and concerns that could be related to hazards analyzed later in this plan.

4.1 General Information

Established on November 1, 1861, along with 16 other original counties in the Colorado Territory, Douglas County was created by the Colorado Territorial Legislature. 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 located first in Franktown and then in California Ranch in 1863 before its final establishment in Castle Rock in 1874. While Douglas County originally extended as far eastward as the Kansas state border, this eastern-most boundary of the County was annexed by Elbert County in 1874. Douglas County includes the following subdivisions: City of Castle Pines, City of Lone Tree, Town of Castle Rock, Town of Larkspur, Town of Parker, and Unincorporated Douglas County.

4.2 Major Past Hazard Events

Presidential disaster declarations are issued for hazard events that cause more damage than state and local governments can handle without assistance from the federal government. No specific dollar loss threshold has been established for these declarations. A presidential disaster declaration puts operationalizes federal recovery programs to assist disaster victims, businesses and public entities. Programs can be matched by state programs. Review of presidential disaster declarations helps establish the probability of reoccurrence for each hazard and identify targets for risk reduction. Table 4-1 shows FEMA disaster declarations that have included Douglas County through 2020.

Douglas County has been subject to federal disaster declarations for two flooding events, three fires, one drought event, one tornado event, and two snow events. Additionally, the County was subject to a disaster declaration pertaining to the COVID-19 pandemic.

Table 4-1. History of Hazard Events in Douglas County, Colorado

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
DR-1421	June 19, 2002	April 23-August 26, 2002	Fire	Wildfires
FS-2407	May 23, 2002	May 21-May 29, 2002	Fire	Schoonover Fire
EM-3185	April 9, 2003	March 17-20, 2003	Snow	Snow
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
FM-2510	October 29, 2003	October 29-31, 2003	Fire	Cherokee Ranch Fire
EM-3436	March 13, 2020	January 20, 2020- Ongoing	Biological	COVID-19
DR-4498	March 28, 2020	January 20, 2020- Ongoing	Biological	COVID-19 Pandemic

4.3 Physical Setting

This section presents the physical setting of the County, including land use/land cover, location, climate, hydrography and hydrology, topography and geology.

4.3.1 Location

Douglas County is located in the central region of Colorado along the I-25 Corridor. The County lies between two major urban activity centers: Denver and Colorado Springs. Within its jurisdiction lies 540,000 acres of mountain vistas, dramatic ridgelines, hills, and grass covered plains. Elevations vary drastically within Douglas County, from as low as 5,400 feet in the northeastern regions to as high as 9,836 feet at Thunder Butte in Pike National Forest. Castle Rock, the county seat, is named after a castle tower-shaped butte that is located north of the Town. Douglas County has a total land area of 840.25 square miles (U.S. Census Bureau 2020).

4.3.2 Topography and Geology

Douglas County’s topography is known for its diverse range of land characteristics, 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 also vary greatly throughout the County, ranging from around 5,360 feet to over 9,835 feet in some parts of Pike National Forest. The Douglas County CWPP provides a more in-depth discussion of topography by area in Douglas County.

4.3.3 Hydrography and Hydrology

Douglas County is located in the Denver Basin and is primarily located 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 northerly 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 of the Creek extend easterly into Pike National Forest.

Chatfield Reservoir also serves as an impoundment for Plum Creek, which branches south of Sedalia near the intersection of Routes 67 and 105. From that point, East Plum Creek parallels Interstate 25 and passing near Larkspur to its headwaters near the border with El Paso County. Route 105 follows West Plum Creek to Larkspur, where its headwaters are located up Stark Creek in Pike National Forest.

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

4.3.4 Climate

Douglas County is characterized by its sunny and moderate climate, unlike its neighboring Rocky Mountains region to the west, which has extreme temperatures. The County averages over 300 days of sunshine a year. During the winter months, Douglas County typically has a short period of cold and snowy weather. The average high temperature is 87° F in July and 46°F in January. January’s low temperatures can fall in the teens. The average annual precipitation is 18.6 inches, and average annual snowfall is 71.3 inches. Due to its low humidity, Douglas County boasts pleasant climates, where winter days are generally sunny with temperatures in the 40s (USA.com 2020).

4.3.5 Land Use and Land Cover

Douglas County’s land cover predominantly consists of agriculture lands and forest lands, which together cover more than 84% of the County’s land area. Urbanized land cover is increasing in the County and is taking the place of agriculture and ranching land. Figure 4-2 shows the distribution of land use in Douglas County. Urbanized land is concentrated in the northern and central portion of the County, with forest comprising a large portion of the western portion of the County that is within Pike National Forest. Agricultural land is concentrated along the County’s waterways, as well as the burn area within Pike National Forest.

Table 4-2. Land Use Classification for Douglas County

Land Use Classification (National Land Use Land Cover 2016)	Area	
	Acres	Percent of Total
Agriculture	209,208	38.8%
Barren Land	78	<0.1%
Forest	244,368	45.3%
Urban Area	73,647	13.6%
Water	2,122	0.4%
Wetlands	10,284	1.9%
Douglas County (Total)	539,707	

Source: U.S.G.S. National Land Use Land Cover Dataset, 2016

Figure 4-1. Douglas County Base Map

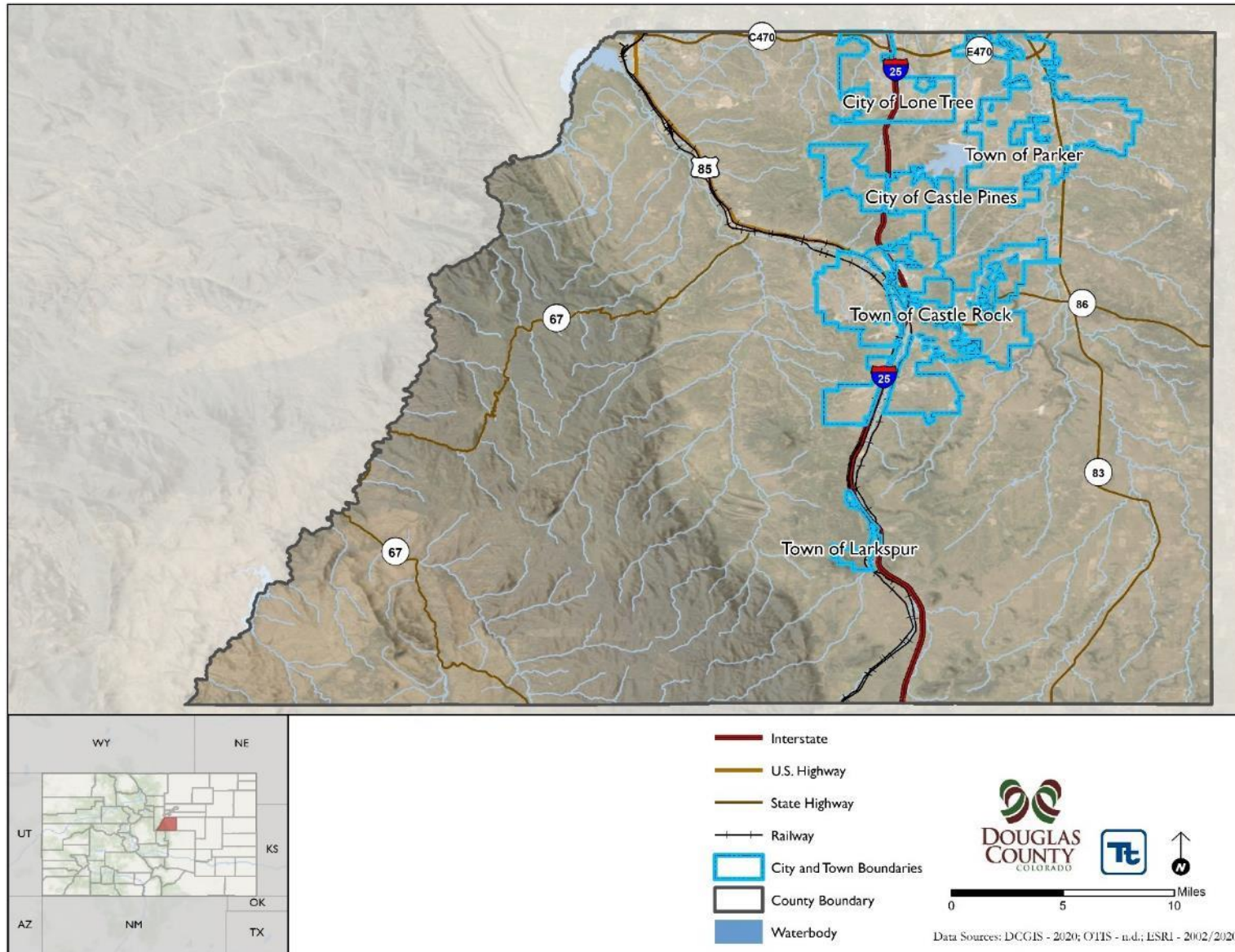
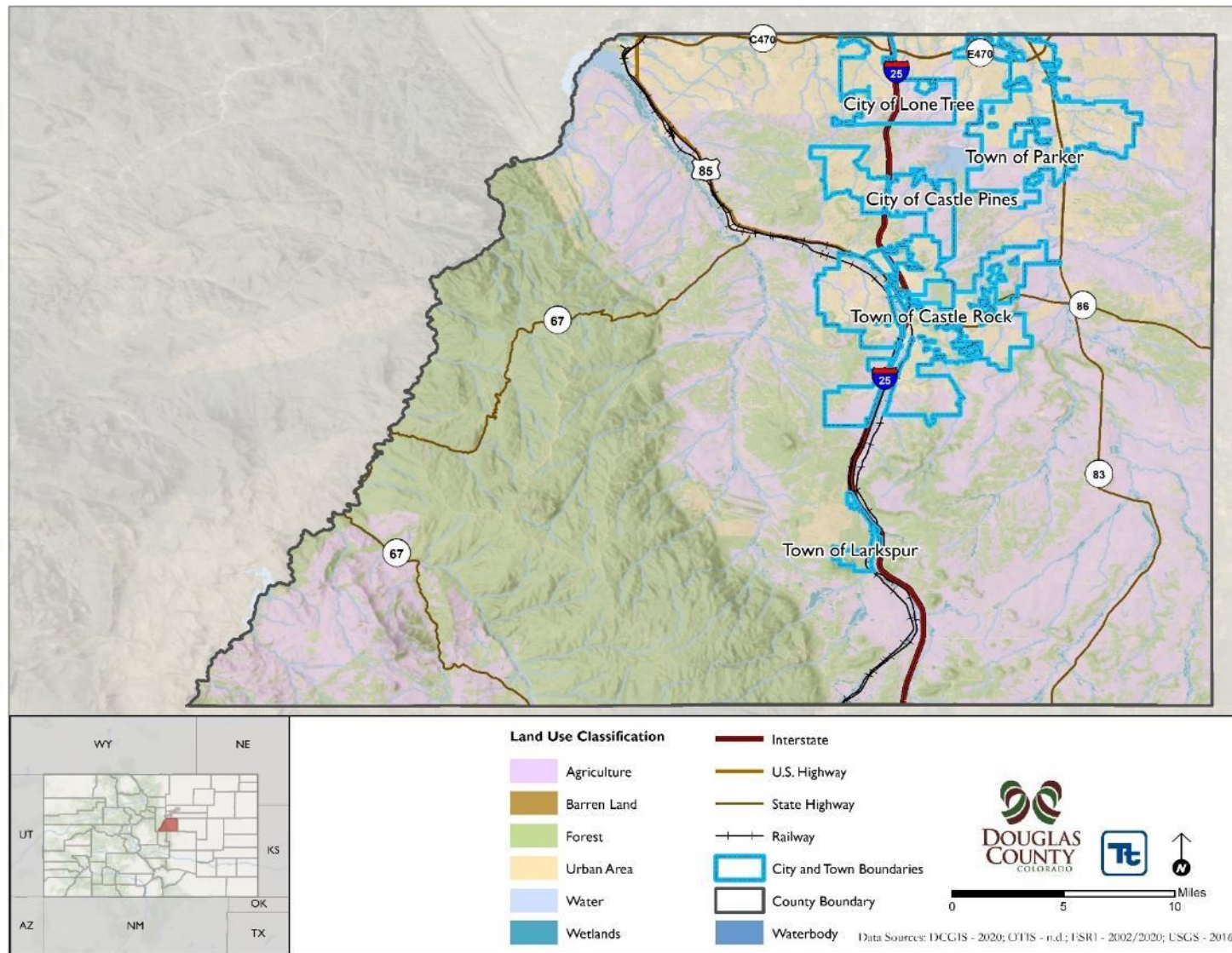


Figure 4-2. 2016 Land Use in Douglas County, Colorado



4.4 Population And Demographics

As of 2018, Douglas County has a population of 328,614 people, indicating a significant increase from the 2010 U.S. Census population of 285,465 people (United States Census Bureau 2018). Hazus demographic data will be used in the loss estimation analyses in Section 4 of this plan. All demographic data in Hazus corresponds to the 2010 U.S. Census data. The population statistics for Douglas County are highlighted in Table 3-3, which includes data from the 2000 and 2010 U.S. Census, along with the 2018 American Community Survey data. In Figure 3-3, data from the 2010 U.S. Census Bureau illustrates the distribution of the general population density (persons per square mile) in 2010 by Census block. For the purposes of this plan, the 2010 Census was used where the data was available and supplemented with Hazus data (representing 2010 data).

Table 4-3. Population Statistics in Douglas County

Municipality	2000 Census	2010 Census	2018 ACS
Douglas County	175,766	285,465	328,614

Source: US Census Bureau

Population and Demographic Trends

This section discusses population trends to use as a basis for estimating future changes that could result from the seasonal character of the population and 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 vulnerable areas.

According to the U.S. Census Bureau, Douglas County’s 2010 population was 285,465 people, indicating a population increase of 62.4% from 2000, when the 2000 Census showed a population of 175,166 people. This high growth rate has made Douglas County the fastest growing county in Colorado and has ranked the County as the 16th fastest growing county in the United States. During this 10 year period, the population aged 65 and over increased by 177.8%. Over the last 60 years, from 1960 to 2020, the County has seen notable population growth. The largest increase in absolute terms was between 2010 and 2018, whereas the largest increase in percentage came between 1980 and 1990.

Table 4-4. Douglas County Population Trends, 1960 to 2018

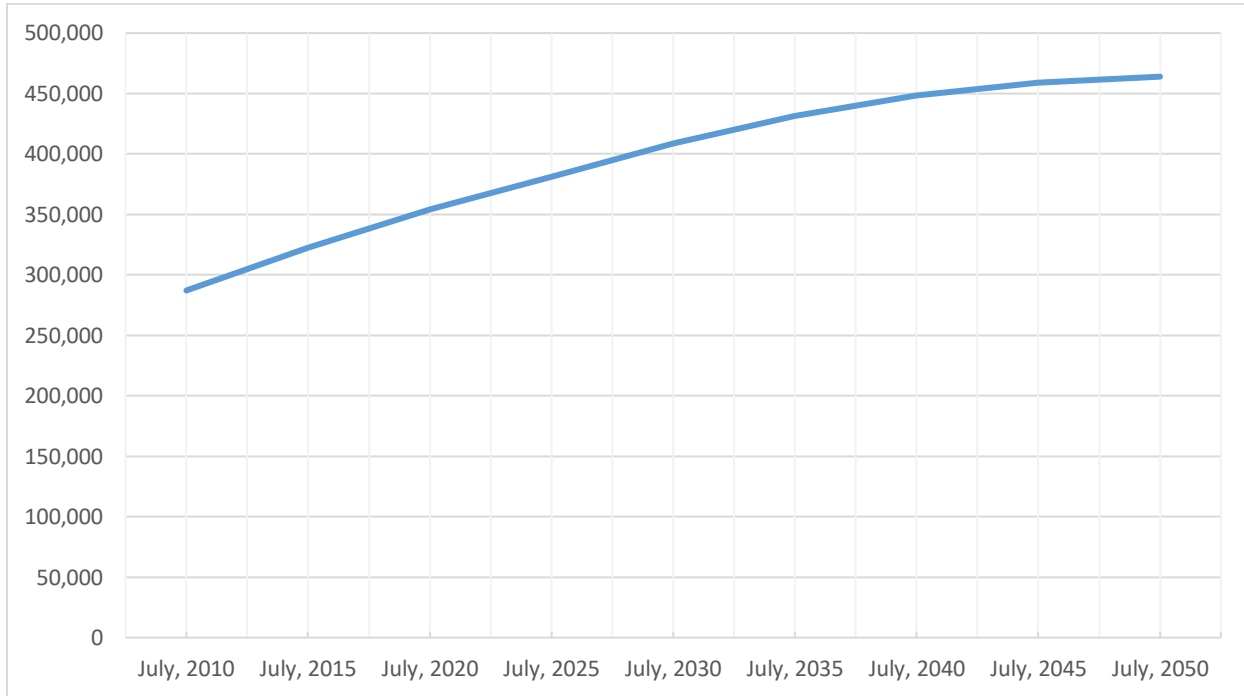
Year	Population	Change in Population	Percent (%) Population Change
1960	4,816	-	-
1970	8,407	3,591	74.5%
1980	25,153	16,746	199.2%
1990	60,391	35,238	140.1%
2000	175,766	115,375	191.0%
2010	285,465	109,699	62.4%
2018	328,614	43,149	15.1%

Source: Colorado State Demography Office; U.S. American Community Survey 2018 (Five-Year)

Note: Change in population and percent in population change were calculated from available data.

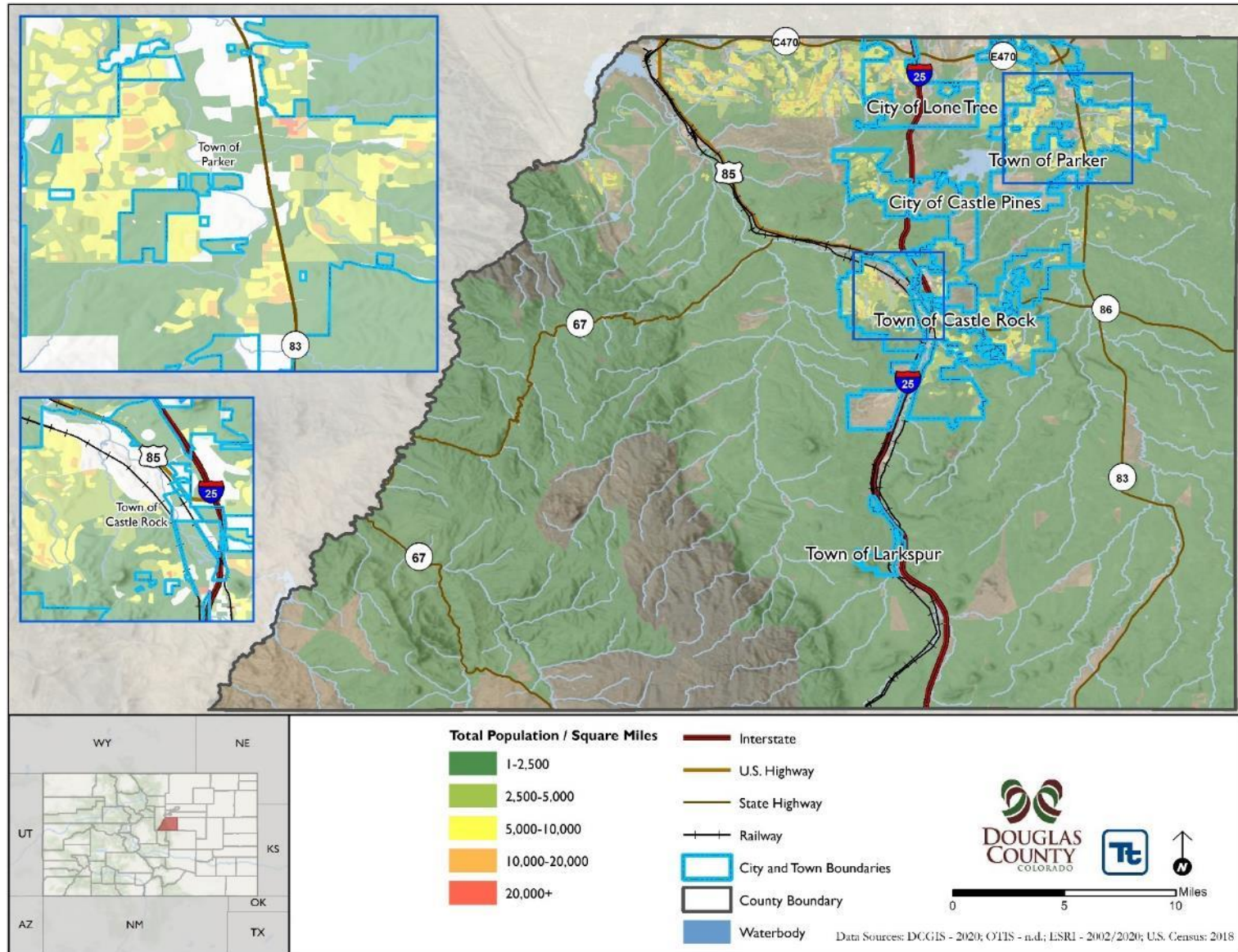
The Colorado State Demography Office has produced population estimates for the region based on 2010 Census data (Colorado State Demography Office 2020). The Office uses a demographic model that incorporates survival rates, fertility rates, migration, and other factors. Douglas County is considered part of the Denver-Metro Area, leading the SDO to calculate projections consistent with demographic distributions consistent with the methodology used by the Denver Regional Council of Governments.

Figure 4-3. Douglas County Population Estimates and Projection, 2015 to 2045



Source: Colorado State Demography Office

Figure 4-4. Distribution of General Population for Douglas County, Colorado



4.4.1 Vulnerable Populations

DMA 2000 requires that HMPs consider socially vulnerable populations. These populations can be more susceptible to hazard events, based on a number of factors including their physical and financial ability to react or respond during a hazard and the location and construction quality of their housing. For the purposes of this study, vulnerable populations shall include (1) the elderly (persons aged 65 and over) and (2) those living in low-income households. Figure 4-5 through Figure 4-7 illustrate the distribution of population under 5, population over 65, low-income population, population with a disability, and non-English-speaking population respectively.

It is noted that the Census data for household income provided in Hazus includes two ranges (\$0-10,000 and \$10,000-\$20,000/year) that were totaled to provide the “low-income” data used in this study. This does not correspond exactly with the “poverty” thresholds established by the 2019 U.S. Census Bureau, which identifies households with three adults and no children with an annual household income below \$19,998 per year, or households with one adult and two children with an annual household income below \$20,598 per year as “low income” for this region. This difference is not believed to be significant for the purposes of this planning effort. The 2018 American Community Survey data identified approximately 2,114 households in Douglas County living below the poverty line. This represents approximately 2.3 percent of the population.

Income

The 2018 American Community Survey 5-Year Estimates provides that the median household income in Douglas County was \$115,314. The U.S. Census Bureau identifies households with two adults and two children with an annual household income below \$25,465 per year as *low income* (U.S. Census 2018). The 2018 American Community Survey 5-Year Estimates indicates that a total of 3.7% of people and 2.3% of families are below the poverty line.

The spatial U.S. Census data for household income provided in HAZUS-MH includes two ranges (less than \$10,000 and \$10,000-\$20,000/year) that were totaled to provide the *low-income* data used in this study. This does not correspond exactly with the *poverty* thresholds established by the 2016 U.S. Census Bureau data. This difference is not believed to be significant for the purposes of this planning effort; therefore, for the exposure and loss estimations in the risk assessment, the 2010 U.S. Census data in HAZUS-MH is reported.

Physically or Mentally Disabled

According to the Centers for Disease Control, “Persons with a disability include those who have physical, sensory, or cognitive impairment that might limit a major life activity (Centers for Disease Control 2015).” Cognitive impairments can increase the level of difficulty that individuals might face during an emergency and reduce an individual’s capacity to receive, process, and respond to emergency information or warnings. Individuals with a physical or sensory disability can face issues of mobility, sight, hearing, or reliance on specialized medical equipment. According to the 2018 American Community Survey, 6.6 percent of residents in Douglas County are living with a disability.

Non-English Speakers

Individuals who are not fluent or working proficiency in English are vulnerable because they can have difficulty with understanding information being conveyed to them. Cultural differences also can add

complexity to how information is being conveyed to populations with limited proficiency of English (Centers for Disease Control 2015). According to the 2018 American Community Survey, nearly 9.2% of the County’s population over the age of 5 primarily speaks a language other than English at home. Approximately, 6,749 people (or 2.2%) speak limited English.

Table 4-5. Douglas County Vulnerable Population Statistics

Jurisdiction	U.S. Census 2010							2014-2018 American Community Survey 5-Year Estimates										
	Total Population	Population Over 65	Percent Over 65	Population Under 16	Percent Under 16	Low Income*	Percent Low Income*	Total Population	Population Over 65	Percent Over 65	Population Under 5	Percent Under 5	Population Below Poverty Level*	Percent Below Poverty Level	Population with a Disability	Percent with a Disability	Non-English-Speaking Population	Percent of Non-English-Speaking population
Castle Pines (C)	12,217	911	7.5%	4,093	33.5%	45	0.4%	10,573	1,373	13.0%	446	4.2%	226	2.1%	440	4.2%	127	1.2%
Castle Rock (T)	51,608	3,419	6.6%	16,523	32.0%	1,116	2.2%	59,680	5,670	9.5%	4,601	7.7%	2,560	4.3%	4,142	6.9%	1,026	1.7%
Larkspur (T)	316	38	12.0%	62	19.6%	1	0.3%	257	57	22.2%	15	5.8%	43	16.7%	78	30.4%	6	2.3%
Lone Tree (C)	14,555	953	6.5%	3,632	25.0%	307	2.1%	14,209	1,691	11.9%	835	5.9%	410	2.9%	699	4.9%	576	4.1%
Parker (T)	51,038	2,622	5.1%	16,473	32.3%	941	1.8%	52,563	3,631	6.9%	3,929	7.5%	2,058	3.9%	3,308	6.3%	1,337	2.5%
Unincorporated Douglas County	190,766	14,775	7.7%	56,185	29.5%	2,532	1.3%	191,332	23,379	12.2%	10,098	5.3%	6,036	3.2%	12,922	6.8%	3,677	1.9%
Douglas County (Total)	320,500	22,718	7.1%	96,968	30.3%	4,942	1.5%	328,614	35,801	10.9%	19,924	6.1%	11,333	3.4%	21,589	6.6%	6,749	2.1%

Source: American Community Survey (2018); Census 2010 (U.S. Census Bureau), Hazus v4.2;

Note: (C) = City, (T) = Town

* Individuals below poverty level (Census poverty threshold for a 3-person family unit is approximately \$18,500)

Figure 4-5. Distribution of Population Under 5 for Douglas County by Census Tract

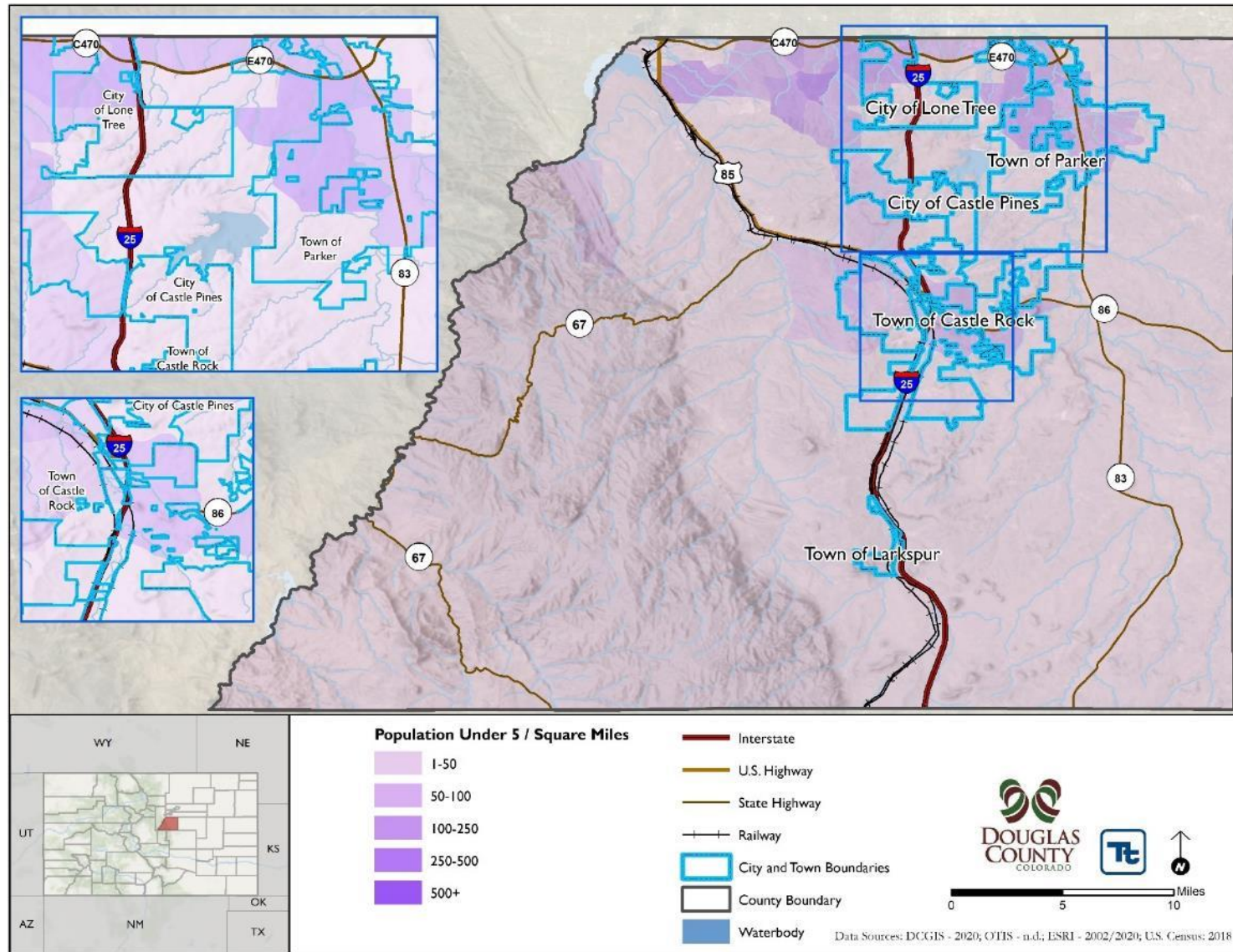


Figure 4-6. Distribution of Population Over 65 for Douglas County by Census Tract

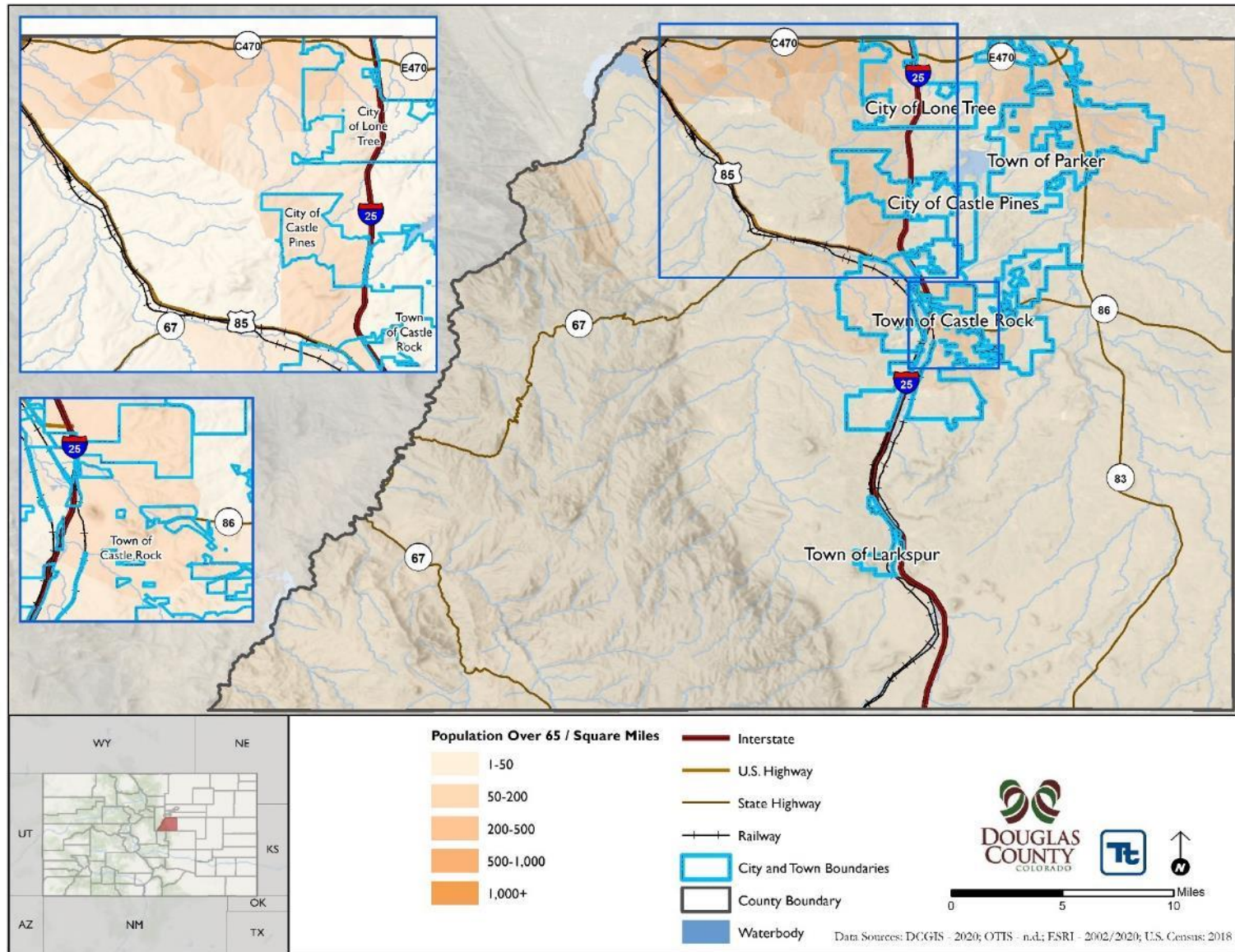


Figure 4-7. Distribution of Low-Income Population for Douglas County by Census Tract

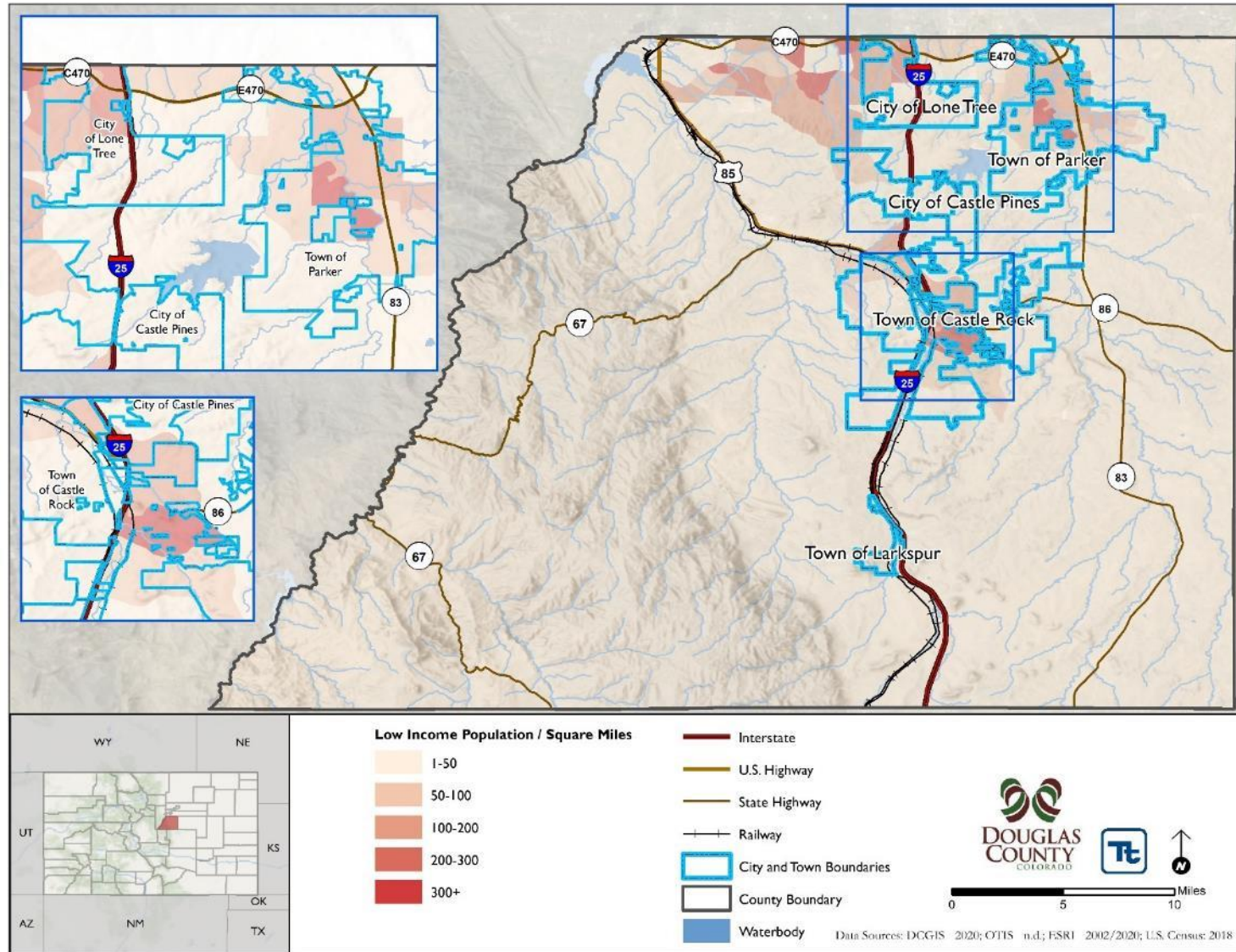


Figure 4-8. Distribution of Population with a Disability for Douglas County by Census Tract

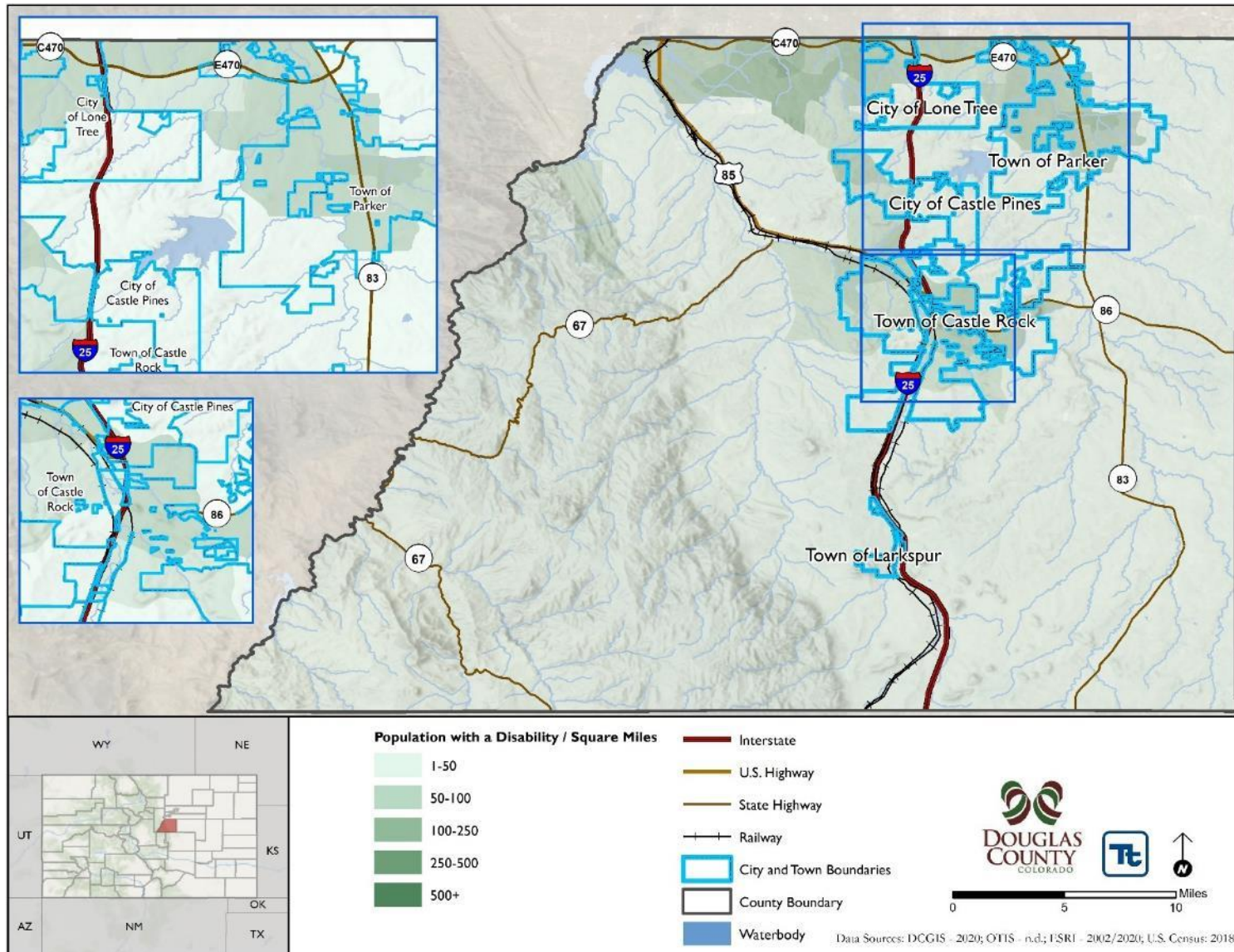
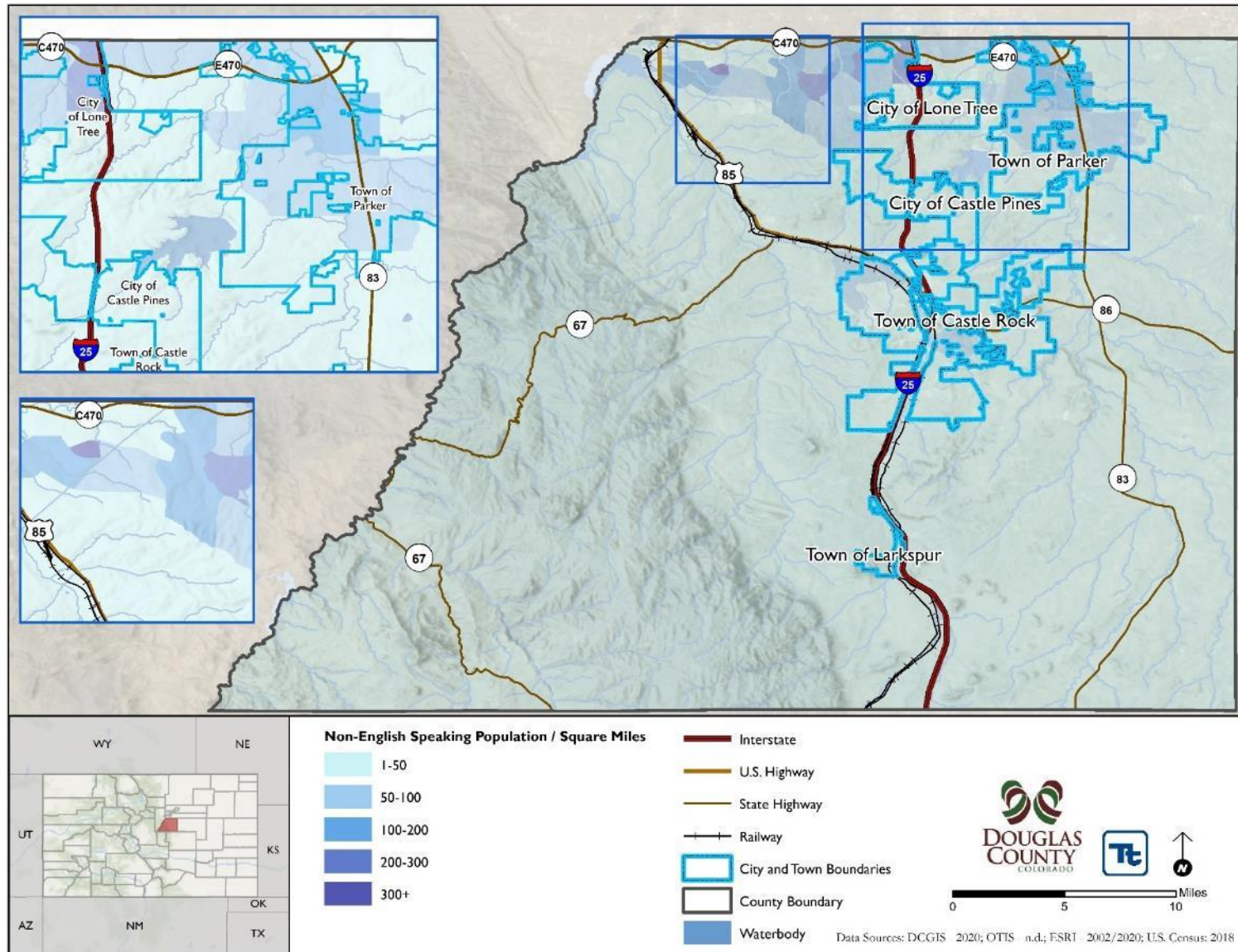


Figure 4-9. Distribution of Non-English-Speaking Population for Douglas County by Census Tract



4.4.2 General Building Stock

The 2018 American Community Survey data identified 117,426 households and 121,541 housing units in Douglas County. This represents a significant increase from 2010, when the American Community Survey identified 107,056 occupied units and 121,524 total units in the County. The U.S. Census defines household as all the persons who occupy a housing unit, and a housing unit as a house, an apartment, a mobile home, a group of rooms, or a single room that is occupied (or if vacant, is intended for occupancy) as separate living quarters. Therefore, there may be more than one household per housing unit. The median price of an owner-occupied housing unit in Douglas County was estimated at \$441,100 (U.S. American Community Survey, 2018).

For the HMP update, a custom-building inventory was developed to assess the current built environment's risk to natural hazards. The default general building stock in Hazus was updated and replaced with a custom building inventory for Douglas County both at the aggregate and structure level. The building stock update was performed using tax parcel and assessor data and building footprints provided by the County GIS Office. The replacement cost value was calculated using the square footage value of each building derived from the assessor information or the building footprint and RS Means 2020 data. There are approximately 135,156 structures included in the custom-building inventory with an estimated replacement cost value of approximately \$182.4 billion (structure and contents). Estimated content value was calculated by using 50-percent of the residential replacement cost value, and 100-percent or 150-percent for non-residential values (refer to Section 5.2 Methodology and Tools for more information). Actual content value varies widely depending on the usage of the structure. Using this methodology, there is approximately \$71.3 billion in contents within these properties. Approximately 93-percent of the total buildings in the County are residential, which make up approximately 72.1-percent of the building stock structural value associated with residential housing. Table 4-6 presents building stock statistics by occupancy class for the County.

The 2018 American Community Survey data identified that the majority of housing units (76.9% or 93,519 units) in Douglas County are single-family detached units. The Douglas County Economic Development Profile data identified 12,326 business establishments employing 125,683 people in Douglas County in 2018 (Douglas County, Colorado Department of Community Development 2019).

Figure 4-10 through Figure 4-12 show the distribution and exposure density of residential, commercial buildings, and industrial respectively, in Douglas County. Exposure density is the dollar value of structures per unit area, including building content value. The densities are shown in units of \$1,000 (\$K) per square mile.

Viewing exposure distribution maps, such as Figure 4-10 through Figure 4-12 can assist communities in visualizing areas of high exposure and in evaluating aspects of the study area in relation to the specific hazard risks.

Table 4-6. Number of Buildings and Improvement Value in Douglas County

Jurisdiction	All Occupancies			Residential		Commercial		Industrial		
	Count	Replacement Cost Value (Structure Only)	Replacement Cost Value (Contents Only)	Total Replacement Cost Value (Structure + Contents)	Count	Total Replacement Cost Value (Structure + Contents)	Count	Total Replacement Cost Value (Structure + Contents)	Count	Total Replacement Cost Value (Structure + Contents)
Castle Pines (C)	3,701	\$3,277,009,014	\$1,718,763,194	\$4,995,772,208	3,610	\$4,678,591,960	49	\$117,118,414	2	\$1,806,046
Castle Rock (T)	24,262	\$17,484,620,825	\$10,518,689,214	\$28,003,310,038	22,939	\$22,069,828,170	936	\$3,742,436,370	74	\$473,623,501
Larkspur (T)	394	\$75,370,566	\$60,354,010	\$135,724,576	330	\$61,629,261	32	\$26,178,377	3	\$10,251,063
Lone Tree (C)	4,190	\$12,498,111,066	\$11,166,692,151	\$23,664,803,217	3,835	\$9,414,618,130	289	\$13,868,238,675	3	\$60,684,598
Parker (T)	17,864	\$14,481,128,039	\$9,116,786,673	\$23,597,914,712	16,792	\$17,580,831,920	697	\$4,279,983,009	77	\$278,071,935
Unincorporated Douglas County	84,745	\$63,251,218,946	\$38,767,618,767	\$102,018,837,713	78,320	\$77,647,371,278	2,215	\$16,865,120,359	263	\$1,743,727,236
Douglas County (Total)	135,156	\$111,067,458,455	\$71,348,904,009	\$182,416,362,464	125,826	\$131,452,870,718	4,218	\$38,899,075,203	422	\$2,568,164,380

Source: Douglas County GIS – 2020, RS Means 2020

Notes: RCV = Replacement cost value.

Figure 4-10. Distribution of Residential Building Stock and Value Density in Douglas County

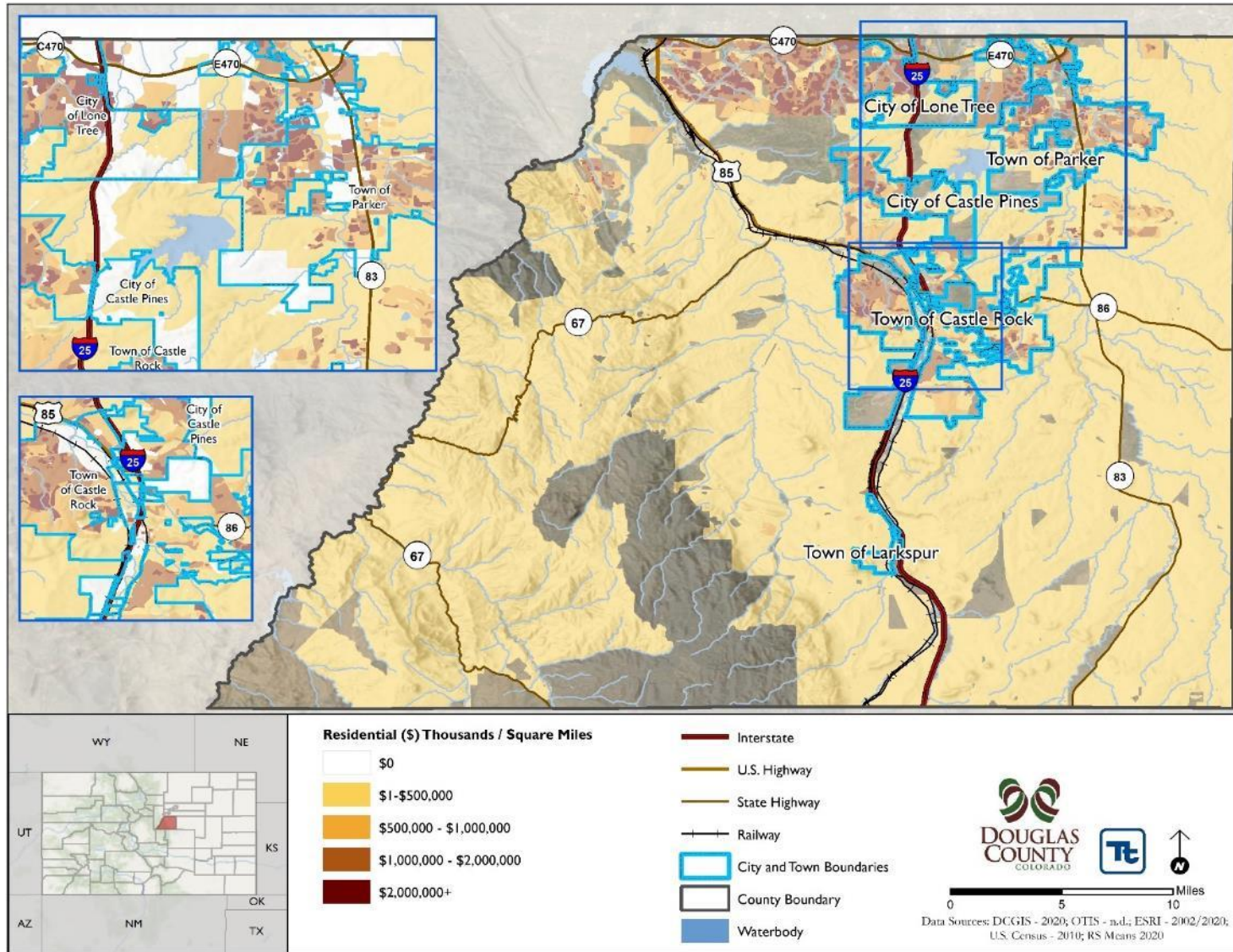


Figure 4-11. Distribution of Commercial Building Stock and Exposure Density in Douglas County

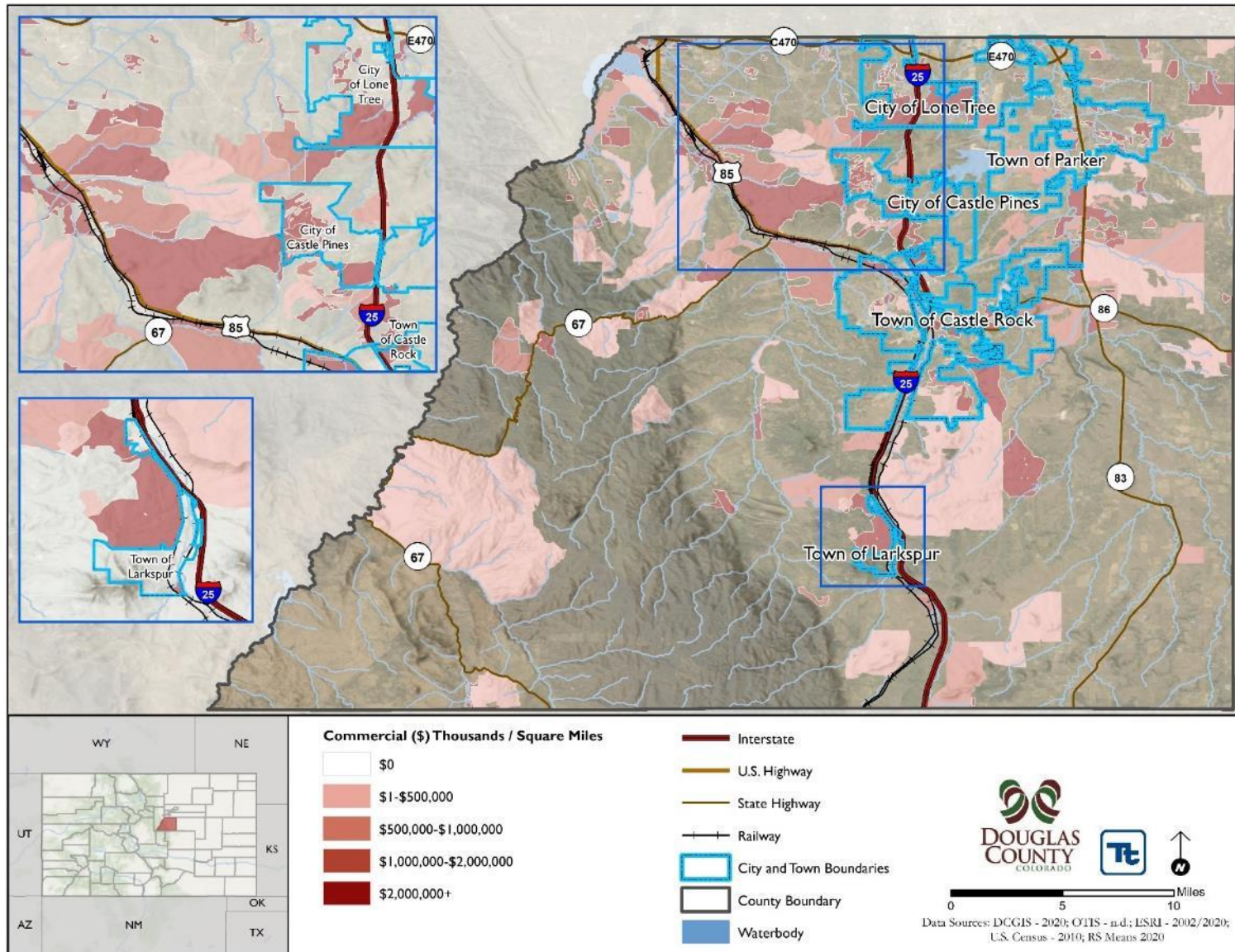
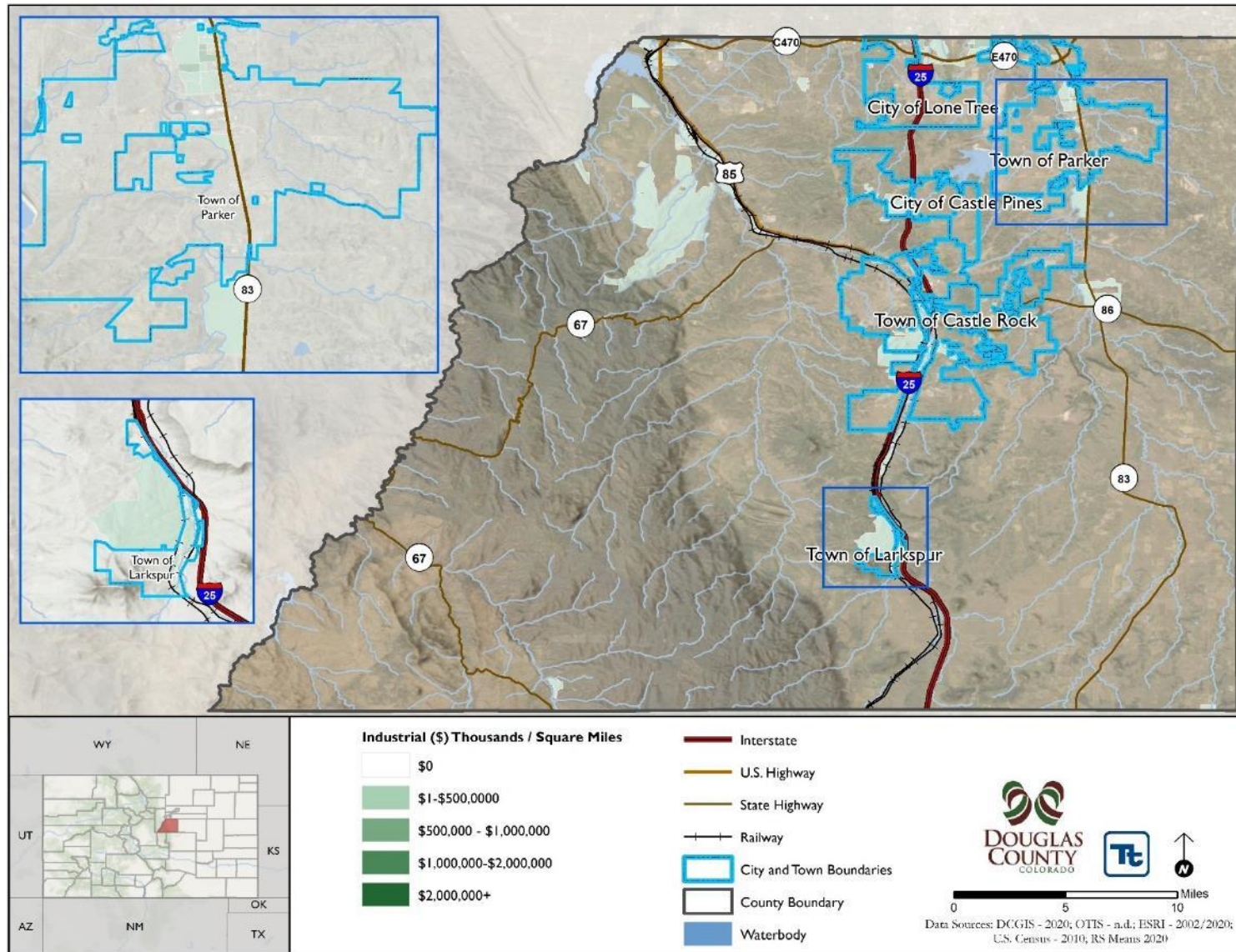


Figure 4-12. Distribution of Industrial Building Stock and Value Density in Douglas County



4.5 Land Use And Population Trends

The Colorado Constitution enables home rule charters for municipalities, allowing the city or town to have greater authority to regulate at the municipal level. 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. As of 2018, there are four home rule municipalities in Douglas County: Lone Tree, Parker, Castle Rock, and Larkspur (Legislative Council Staff 2018). In 2019, Castle Pines became a home rule community. Additionally, the County government controls land use for unincorporated portions of the County.

This Hazard Mitigation Plan provides a general overview of population, 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.

4.5.1 Land Use Trends

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 continues to grow in population through the 2010s, albeit at a slower rate. The 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. The County is growing alongside both the State and Denver Metro region in both population and employment.

Economy

The U.S. Census Bureau’s Economic Census provides an annual series of sub-national economic data by industry covering the majority of the country’s economic activity. According to the 2018 County Business Patterns data, there are more than 9,500 businesses in the County that employ nearly 115,000 workers. Annual payroll in the County totals \$6.9 billion. The largest employment sector in the County in terms of the number of employees is the retail trade, which employs approximately 18,558 workers. The professional services industry generates the largest payroll of any sector (\$946 million). This industry represents nearly 13.6 percent of the County’s total payroll but employs only eight percent of the County’s workforce. By contrast, the retail trade’s payroll is approximately eight percent of the County’s total yet employs more than 16 percent of the workforce.

Table 4-7. 2018 County Business Patterns for Douglas County, Colorado

Sector	# of Establishments	# of employees	Annual payroll (\$1,000)
Total for all sectors	9,504	114,980	\$6,915,988
Agriculture, forestry, fishing and hunting	25	57	\$1,606
Mining, quarrying, and oil and gas extraction	40	283	\$54,942
Utilities	10	323	\$64,066
Construction	956	9,435	\$652,997
Manufacturing	142	7,539	\$954,371
Wholesale trade	360	2,877	\$211,892

Sector	# of Establishments	# of employees	Annual payroll (\$1,000)
Retail trade	924	18,558	\$538,151
Transportation and warehousing	109	926	\$45,894
Information	223	7,781	\$647,312
Finance and insurance	706	7,309	\$626,224
Real estate and rental and leasing	819	1,829	\$97,310
Professional, scientific, and technical services	1,874	9,185	\$946,039
Management of companies and enterprises	67	1,587	\$297,984
Administrative and support and waste management and remediation services	488	8,021	\$346,438
Educational services	212	3,924	\$123,347
Health care and social assistance	1,003	13,770	\$796,960
Arts, entertainment, and recreation	162	2,848	\$64,017
Accommodation and food services	584	13,090	\$264,321
Other services (except public administration)	787	5,625	\$181,089
Industries not classified	13	13	\$1,028

Source: U.S. Census County Business Patterns (2018)

Agriculture

The amount of farmland in Douglas County has slightly increased, and farmland continues to play an important role in the County. The US Department of Agriculture produces a Census of Agriculture that tracks agricultural data on the County level. In Douglas County, the number of farms has increased by 10% since 2012, though the acreage of farms has decreased 8% in the same time. Though crops account for a significantly larger share of sales (62%) than livestock and poultry (38%), about three quarters (78%) of the County’s farm acreage is pastureland. Douglas County’s agriculture products generate almost \$19 million in sales each year (an increase of 38%), 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 (USDA 2017).

Corridors and Gateways

Douglas County is located in the greater Denver metropolitan area and functions as suburban and exurban area of Denver. However, the County is centrally located between both Denver and Colorado Springs along the Interstate 25 corridor that connects Colorado’s most populous communities. 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.

4.5.2 Population Trends

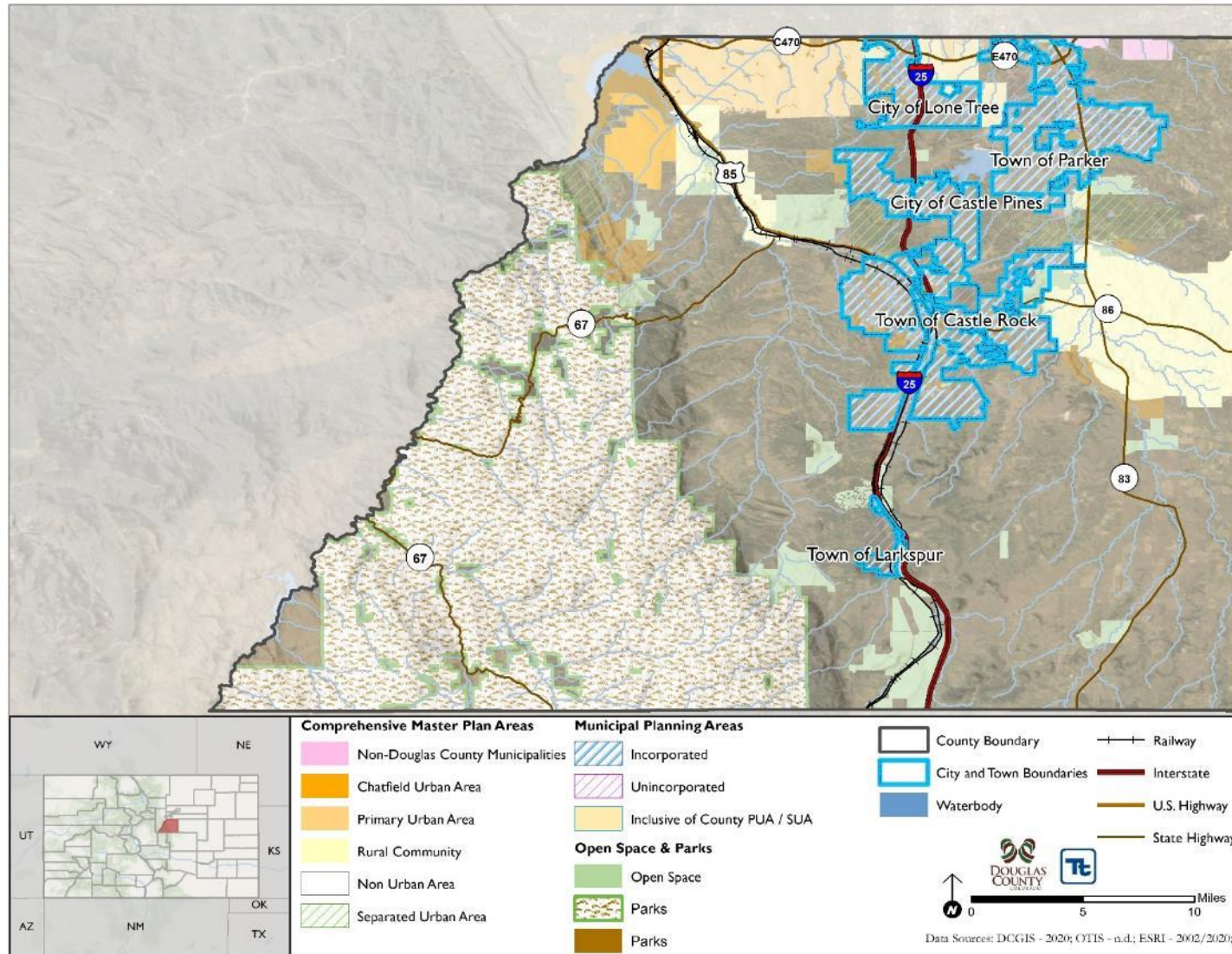
Douglas County, has grown significantly in recent years. Between 2010 and 2018 alone, the estimated population has increased from 285,465 residents to 328,614 residents- a 15% increase. The County has

grown steadily since 1960. By 1980, the County's population had multiplied more than 6 times to 25,153 residents. By 1990, it increased to 60,391 residents. Between 1990 and 2000, the County added 115,375 residents- almost doubling in size. The vast majority (91.5%) of the County's residents live in urban areas, with just 8.5% of residents living in nonurban areas. Douglas County's growth has slowed from its massive population increases in the 1980s and 1990s. However, the County continues to add new residents and employment, as well as see increases in wages and real estate sales. Development of non-commercial and residential space is continuing, with more than 1.5 million square feet of non-commercial space and 3,404 housing units added in 2019.

4.5.3 Future Growth and Development

Figure 4-13 shows the distribution of growth areas as determined by the 2040 Comprehensive Master Plan. A significant amount of development has occurred along Interstate 25, and new development is planned for the incorporated portions of municipalities and designated urban areas in the unincorporated county. Much of the County is in a designated non-urban area or is open space owing to Pike National Forest.

Figure 4-13. Future Land Use Map of Douglas County, Colorado



4.6 CRITICAL FACILITIES AND LIFELINES

Critical infrastructure and facilities are those that are essential to the health and welfare of the population. These facilities are especially important after any hazard event. Critical facilities are those that maintain essential and emergency functions and are typically defined to include police and fire stations, schools, and emergency operations centers. Critical infrastructure can include the roads and bridges that provide ingress and egress and allow emergency vehicles access to those in need and the utilities that provide water, electricity, and communication services to the community. Also included are Tier II facilities (hazardous materials) and rail yards; rail lines hold or carry significant amounts of hazardous materials with a potential to impact public health and welfare in a hazard event.

Beginning in 2017, FEMA developed a new construct to increase effectiveness for disaster operations and position response to catastrophic incidents. This construct, known as “community lifelines”, represents the most fundamental services in the community that, when stabilized, enable all other aspects of society. Following a disaster event, intervention is required to stabilize community lifelines. Lifelines are divided into seven categories which include:

- Safety and Security
- Food, Water, Shelter
- Health and Medical
- Energy (Power and Fuel)
- Communications
- Transportation
- Hazardous Materials

To facilitate consistency with the National Response Framework, FEMA Strategic Plan, and guidance for the Building Resilient Infrastructure and Communities grant program, critical facilities in Douglas County are discussed in terms of lifelines.

A comprehensive inventory of critical facilities and lifelines in Douglas County was developed from various sources including input from the Planning Committees. Overall, there are 1,164 critical facilities identified in the County of which 971 are considered community lifelines by the Planning Committee. The inventory of critical facilities presented in this section represents the current state of this effort at the time of publication of the HMP and was used for the risk assessment in Section 5 (Risk Assessment). Figure 4-14 through Figure 4-23 show the location of Douglas County lifelines.

Critical Facilities are those facilities considered critical to the health and welfare of the population and that are especially important following a hazard. As defined for this HMP, critical facilities include transportation systems, lifeline utility systems, high-potential loss facilities, and hazardous material facilities, and essential facilities

Essential facilities are a subset of critical facilities that include those facilities that are important to ensure a full recovery following the occurrence of a hazard event. For the county risk assessment, this category was defined to include police, fire, EMS, schools/colleges, shelters, senior facilities, and medical facilities.

Lifelines enable the continuous operation of critical business and government functions and are essential to human health and safety or economic security.

4.1.1 Safety and Security

This section provides information on Safety and Security lifelines. Components of this lifeline category include law enforcement/security, fire services, search and rescue services, government services, and community safety (e.g. dams).

Emergency Facilities

For the purposes of this Plan, emergency facilities include police, fire, emergency medical services (EMS) and emergency operations centers (EOC). There are 48 identified lifeline emergency facilities in Douglas County. Figure 4-14 identifies these facilities within Douglas County.

Law enforcement in the County includes the following agencies:

- Castle Rock Police Department
- Douglas County Sheriff's Office (Unincorporated Douglas County, Castle Pines, Larkspur)
- Lone Tree Police Department
- Parker Police Department

Fire departments and districts located in Douglas County include the following:

- Aurora Fire Rescue – Municipal Fire Department
- Castle Rock Fire and Rescue Department – Municipal Fire Department and Fire District (Title 32)
- Franktown Fire Protection District – Title 32
- Larkspur Fire Protection District – Title 32
- Jackson 105 Fire Protection District – Title 32
- West Douglas County Fire Protection District – Title 32
- South Metro Fire Rescue Authority – Title 32
- Mountain Communities Volunteer Fire Protection District -Title 32
- North Fork Fire Protection District – Title 32

Schools

Douglas County has approximately 108 school facilities identified as lifelines. The County's students attend the Douglas County School District, which is Colorado's third-largest in size. Figure 4-15 identifies educational facilities in Douglas County.

Dams

There are 51 identified dams in Douglas County. Refer to Section 5.4.2 which covers dams in more detail.

Government Facilities

There are 33 identified government facility lifelines in Douglas County, which include post offices, town halls, civic centers, administrative buildings, and similar structures. Figure 4-16 identifies government facilities in Douglas County.

Figure 4-14. Essential Facilities in Douglas County

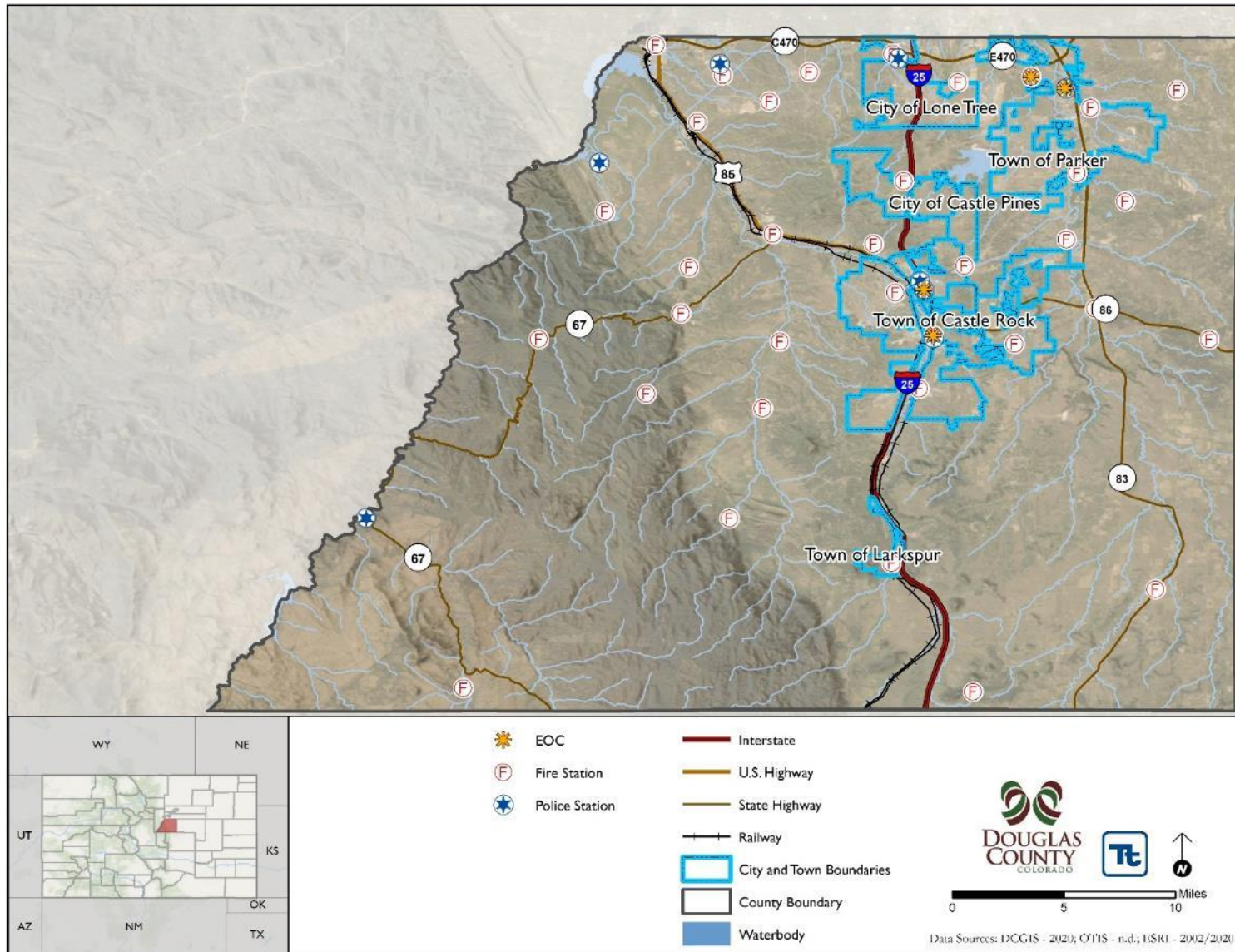


Figure 4-15. School Facilities in Douglas County

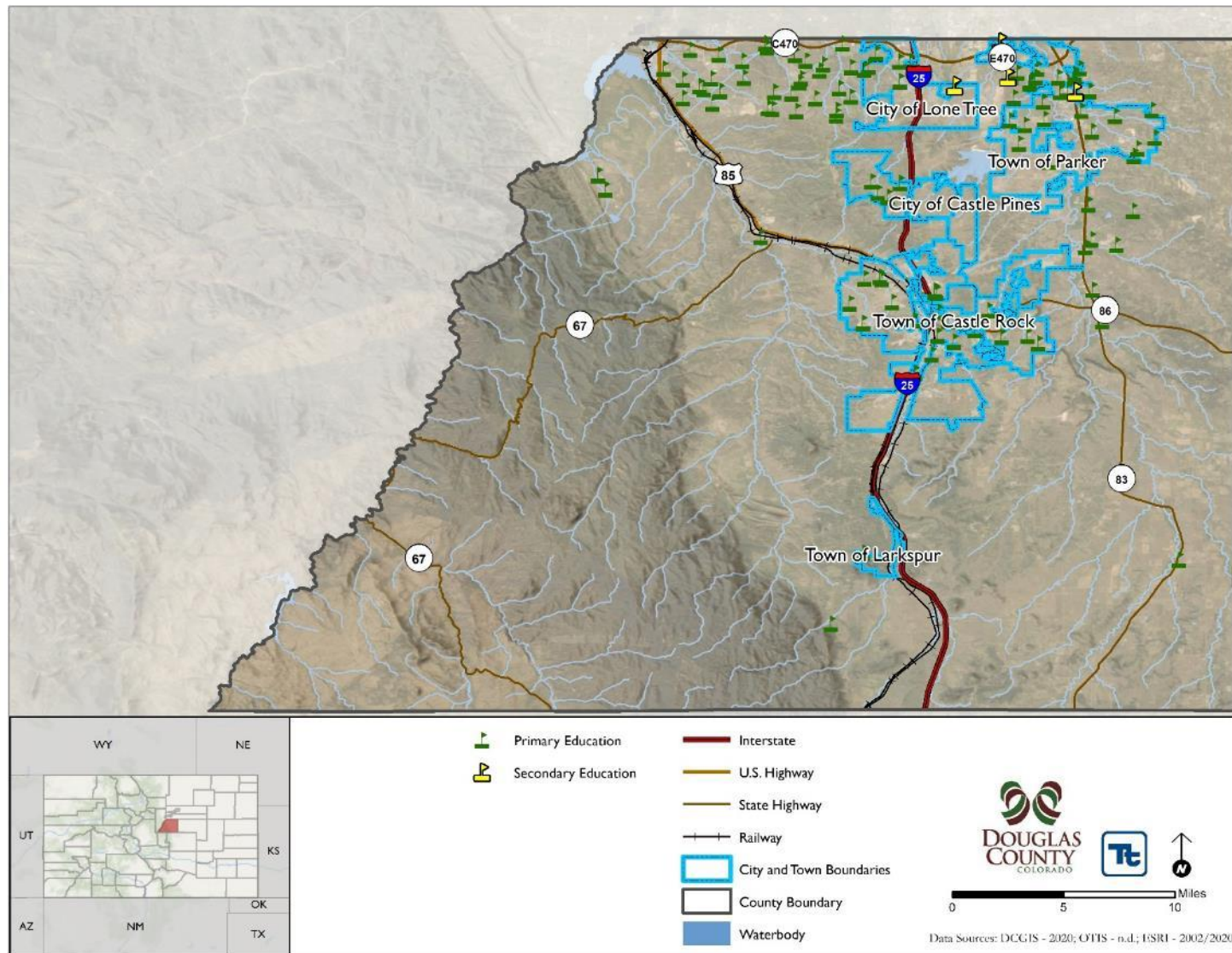
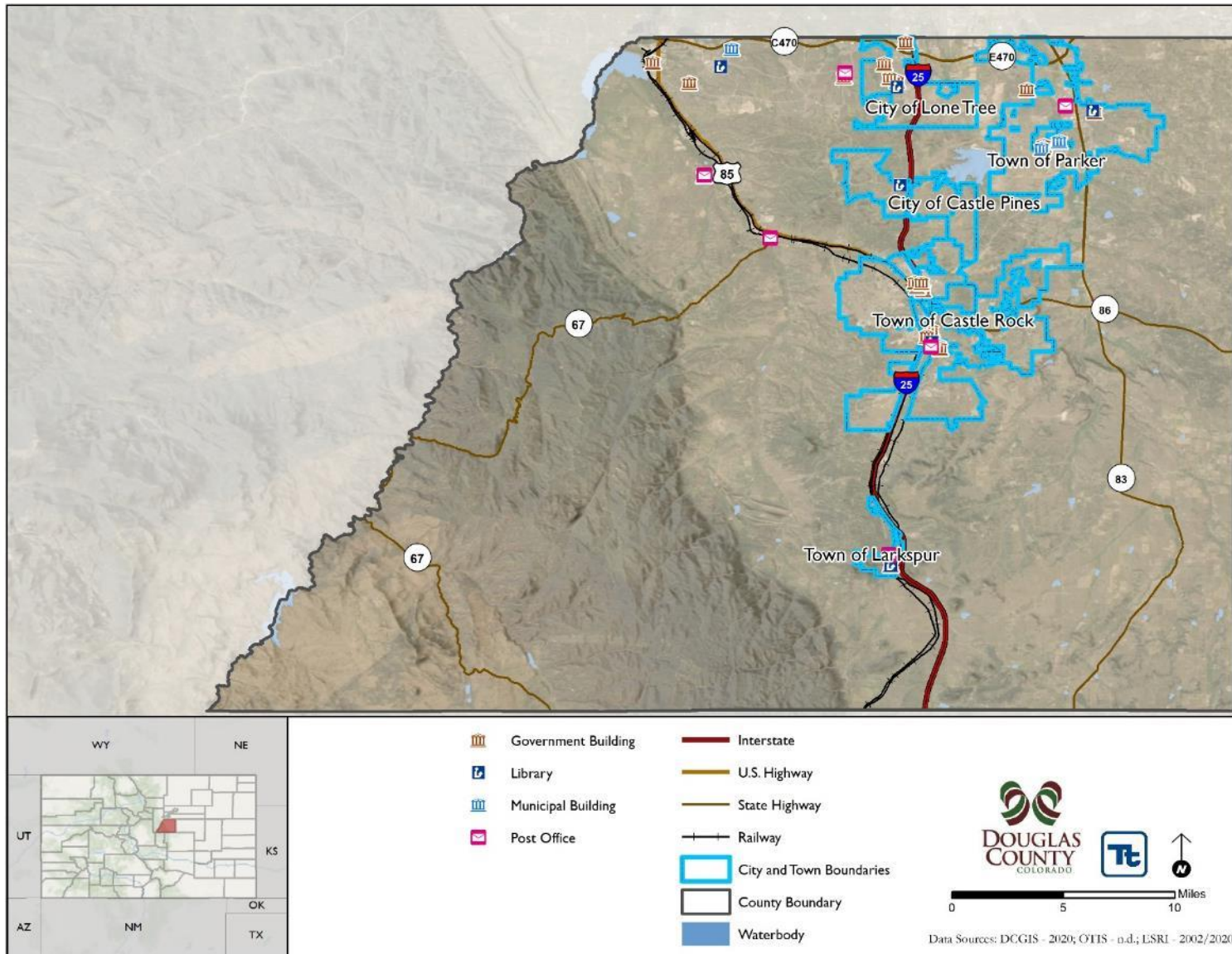


Figure 4-16. Government Facilities in Douglas County



4.6.1 Food, Water, Shelter Lifelines

Food, Water, and Shelter lifelines include facilities pertaining to food supply (distribution facilities, programs, and supply chain), water supply (including both potable and wastewater systems), shelter (housing and hotels), and agricultural facilities.

Food

There are 20 food distribution lifelines identified for Douglas County. Facilities are distributed throughout the County and are shown in Figure 4-17.

Shelter

There are 26 identified shelter lifelines in Douglas County, inclusive of educational facilities, County buildings, and religious buildings. Shelter lifelines are shown in Figure 4-18.

Potable Water

There are 375 potable water facilities in Douglas County, the vast majority of which consist of potable wells spread throughout the County. 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. Potable water facilities are identified in Figure 4-19.

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
- Solitude Metro District
- Southgate Water District
- Southwest Metro WSD
- Stonegate Village Metro
- Thunderbird Water and Sanitation District (4/3/08)
- Titan Road Industrial Park Water Association Inc.
- Town of Castle Rock
- Town of Larkspur
- View Ridge Mutual Water Company
- Westcreek Lakes Water District

Wastewater Facilities

There are six identified wastewater treatment lifelines in the County inclusive of treatment facilities and pump stations. Wastewater facilities in Douglas County are identified in Figure 4-20.

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
- Arapahoe County Water & Wastewater PID
- BMR Metropolitan District fka Bell Mtn Metro
- Castle Pines Metro District
- Castle Pines North Metro District
- Castle Pines Town Center Metro District 1,2,3
- Castle Pines Town Center Metro District 2
- Castle Pines Town Center Metro District 3
- Castleton Center Water & San District
- Castleton Center Water & San District and Town of Castle Rock
- Centennial Water & Sanitation District
- Centennial Water & Sanitation District and Highlands Ranch Metro and Highlands Ranch Metro #5
- Chatfield South Water District
- 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
- Crowfoot Valley Ranch Metro District 2
- Denver SE Suburban Water & San District
- Dominion Water & Sanitation District
- E-470 Potomac Metro District
- Hidden Pointe Metro District
- Highlands Ranch Metro District
- Highlands Ranch Metro District 5
- Highlands Ranch Metro District and Highlands Ranch Metro District 5
- Highlands Ranch Metro District and Southgate Sanitation District and Southgate Water District
- Inverness Water & Sanitation District
- Lincoln Park Metro District
- Lincoln Park Metro District
- Lincoln Park Metropolitan District and Parker Water & Sanitation District
- Louviers Water & Sanitation 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
- Perry Park Water & Sanitation District (Water)
- Perry Park Water & Sanitation District and Remuda Ranch Metro District
- Perry Park Water & Sanitation District and Town of Larkspur
- Ravenna Metro District
- Remuda Ranch Metro District
- Roxborough Water & Sanitation District
- Sedalia Water & Sanitation District
- Silver Heights Water & San District
- Silver Heights Water & San District and Town of Castle Rock
- Solitude Metro District
- South Meridian Metro District
- South Meridian Metro District Debt Service
- South Park Metro District
- South Santa Fe Metro District 1
- South Santa Fe Metro District 2
- Southgate Sanitation District and Southgate Water 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 4-17. Food Distribution Facilities in Douglas County

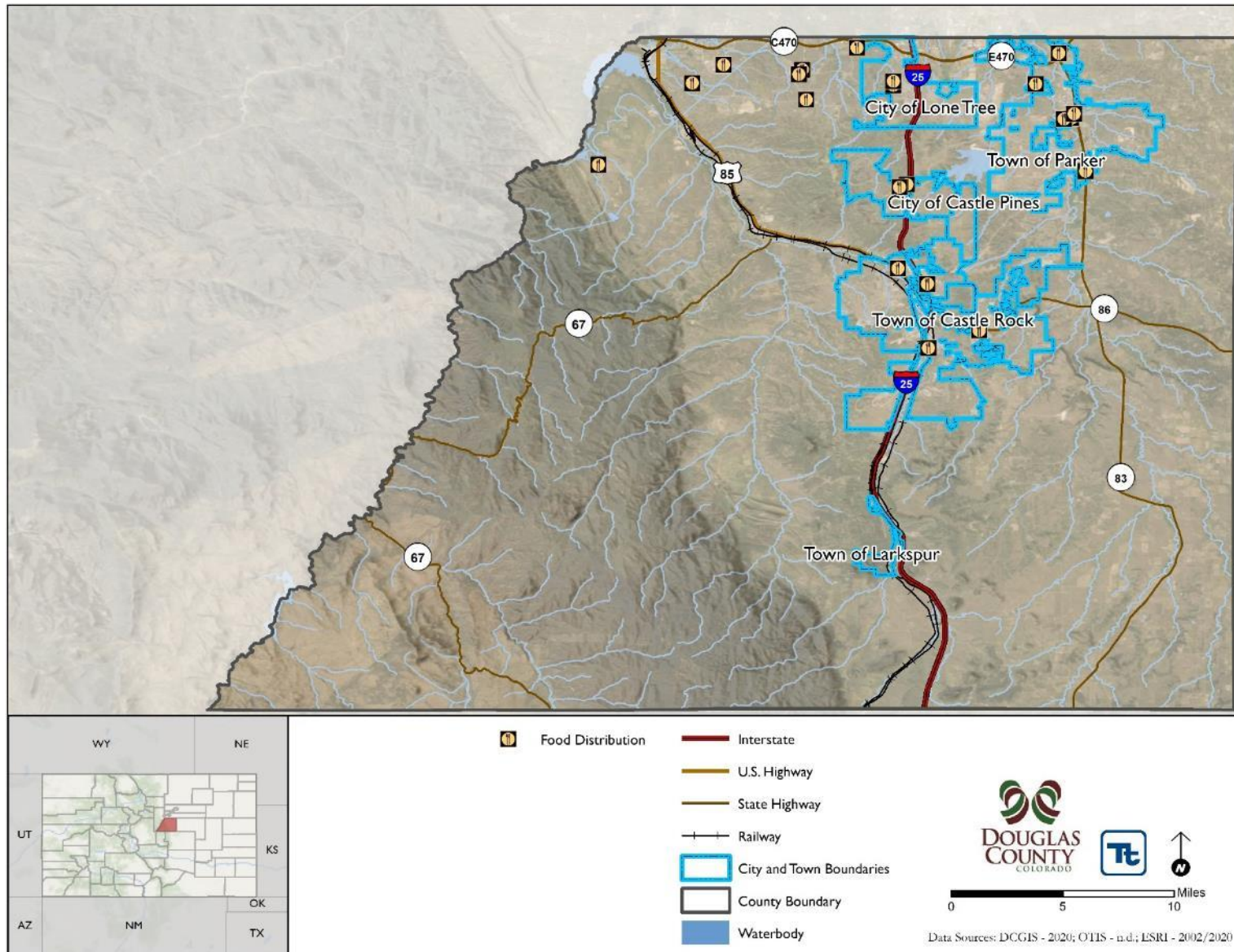


Figure 4-18. Shelters in Douglas County

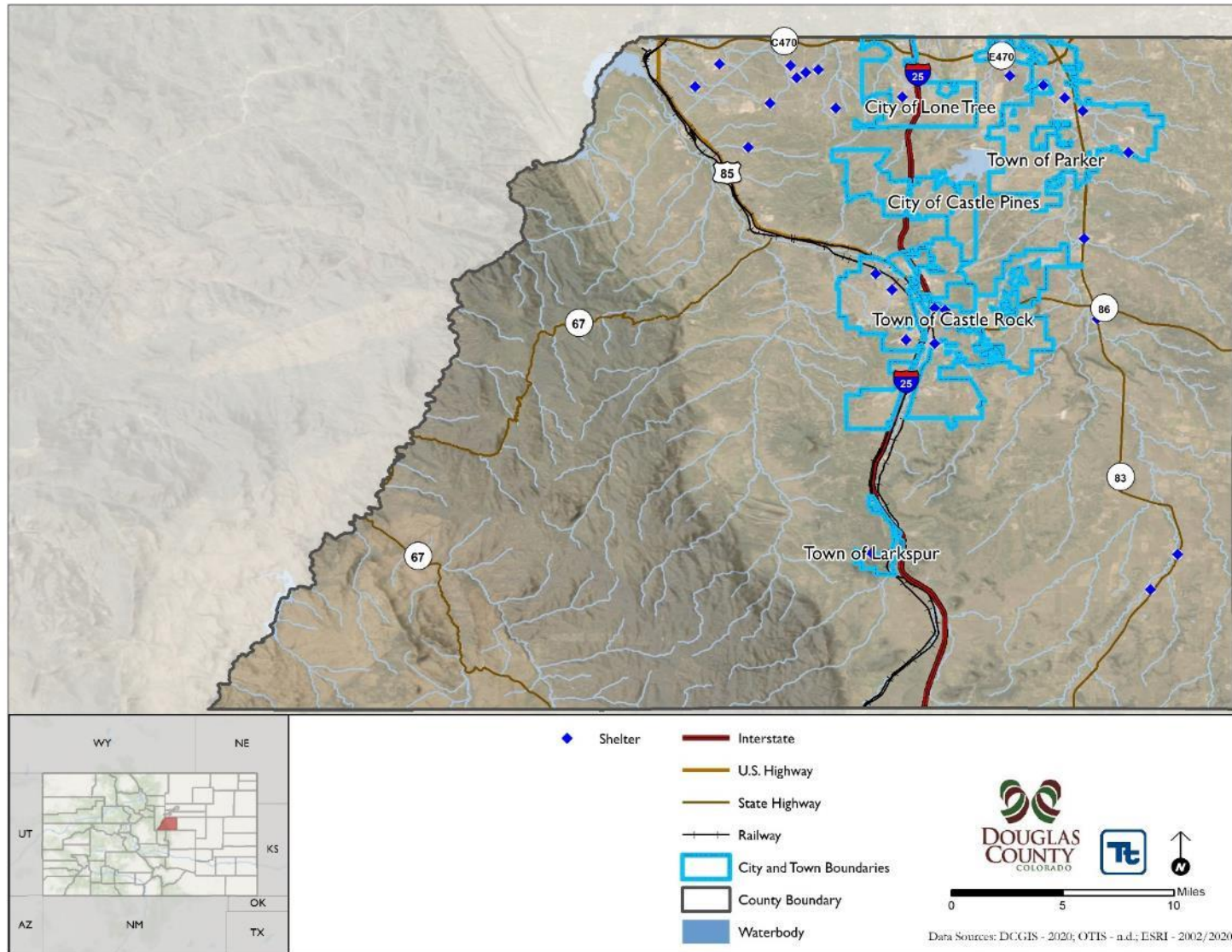


Figure 4-19. Potable Water Facilities in Douglas County

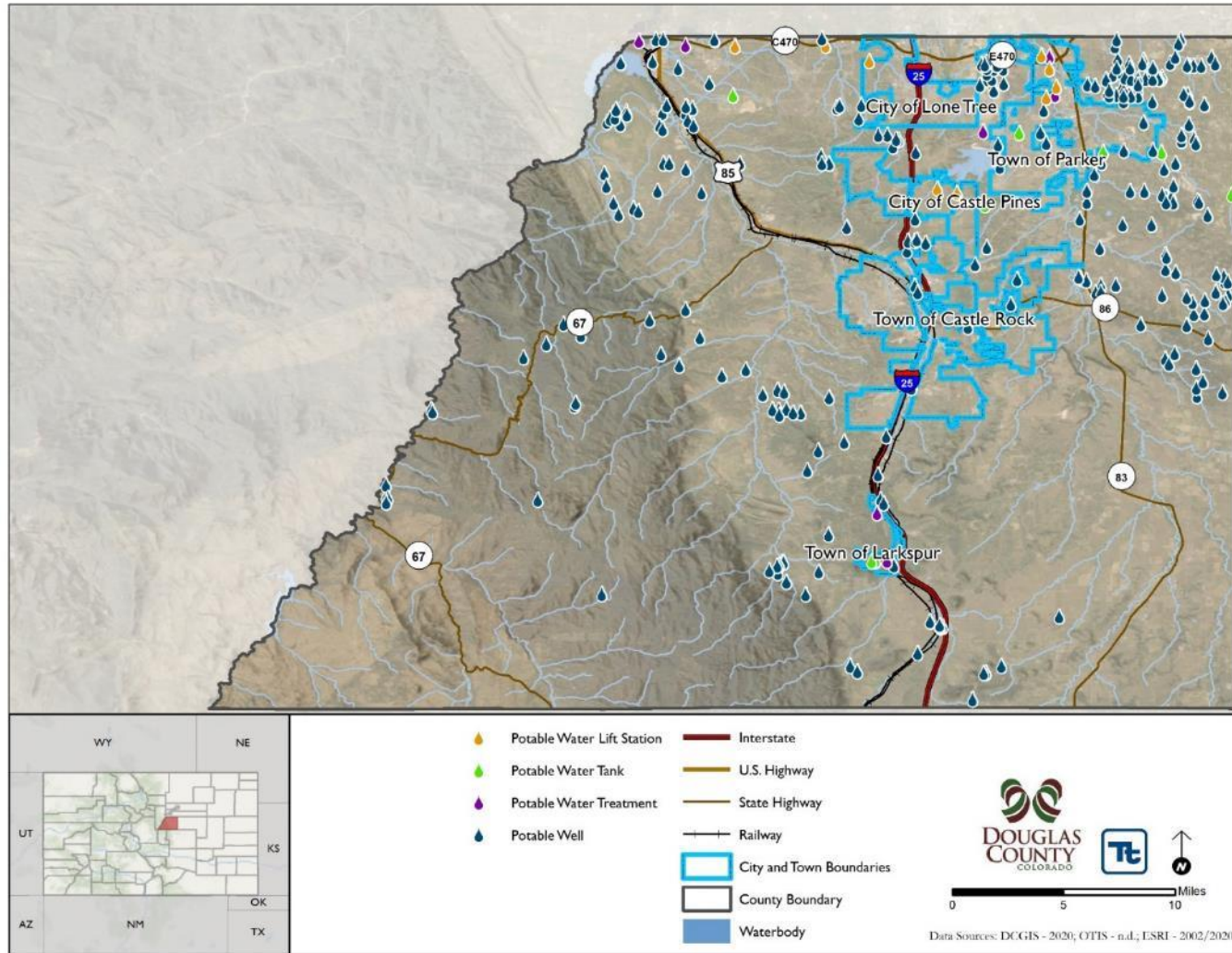
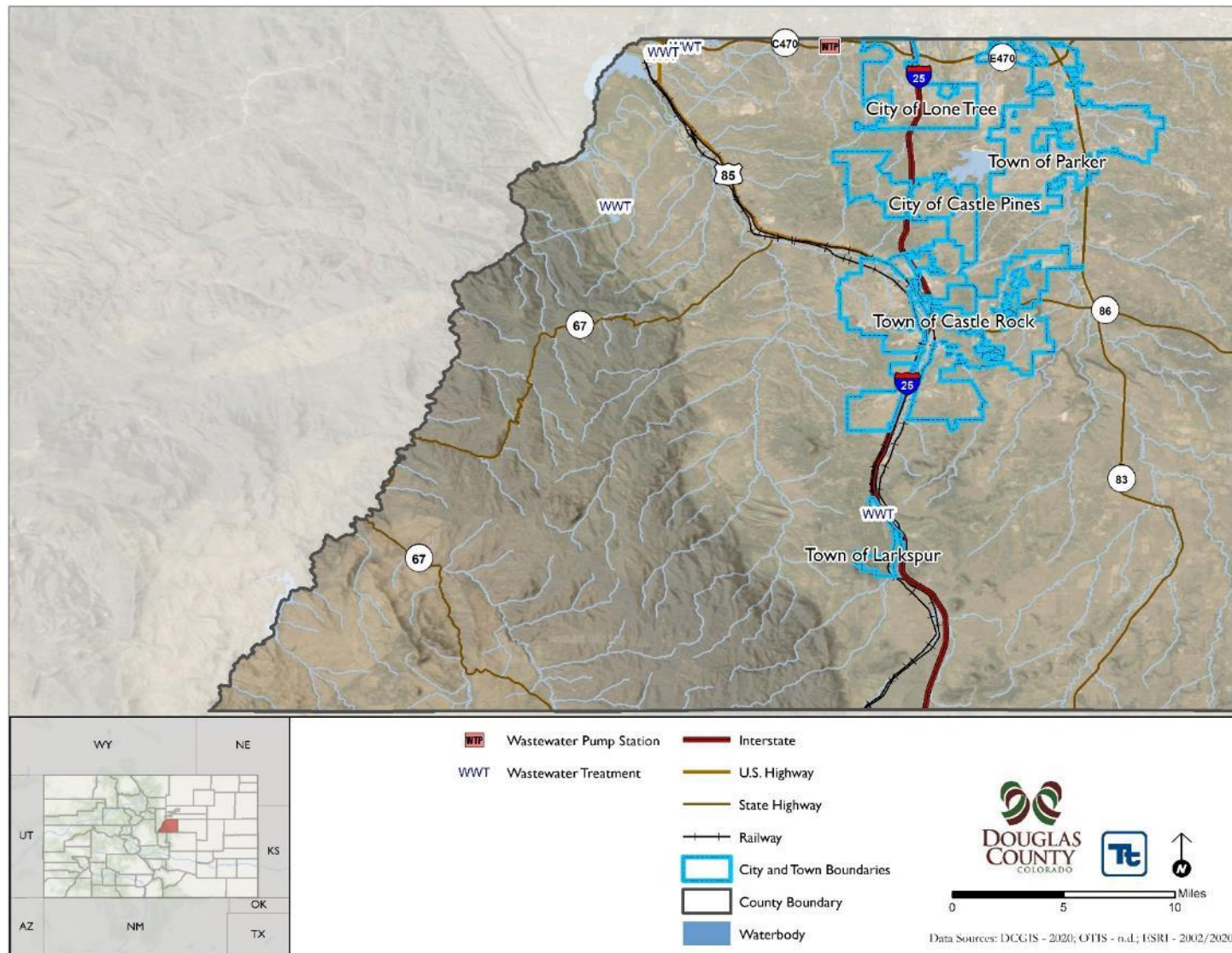


Figure 4-20. Wastewater Facilities in Douglas County



4.6.2 Health and Medical Lifelines

Hospitals and Medical Facilities

There are 203 health and medical facility lifelines identified in Douglas County. These lifelines are inclusive of assisted living facilities, hospitals, medical care offices, pharmacies, and urgent care facilities.

Figure 4-21 identifies hospitals and medical facilities in Douglas County.

4.6.3 Energy (Power and Fuel) Lifelines

Energy Resources

There are three electricity providers for Douglas County. The largest in size 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.

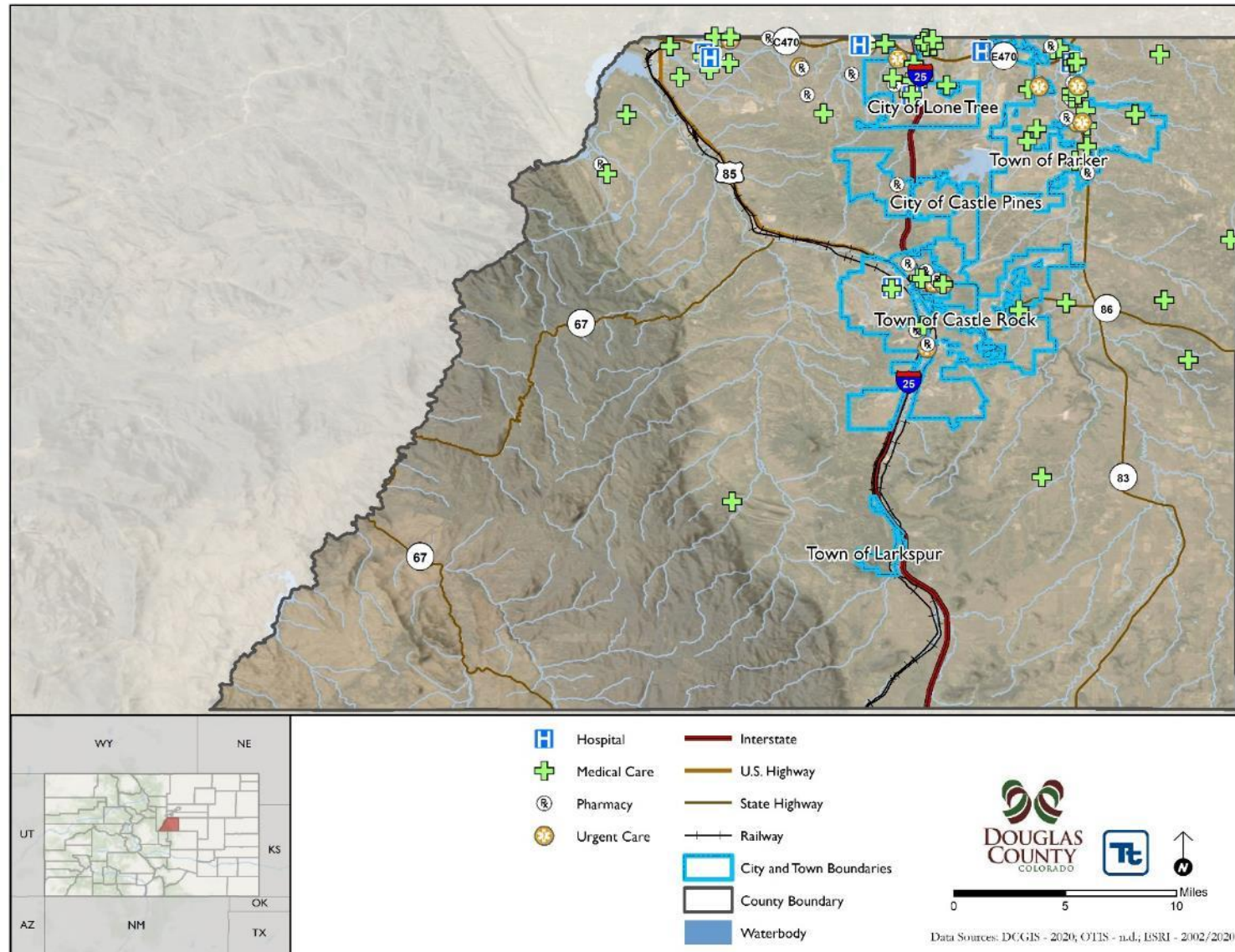
Much of Douglas County also receives natural gas service from utilities. The northern portion of the County, including Highlands Ranch, Lone Tree, and Parker, has natural gas service available through Xcel Energy. Black Hills Energy provides natural gas service south of the area served by Xcel Energy to the El Paso county line, inclusive of Castle Rock and Larkspur.

There are no identified energy lifelines in Douglas County. A discussion of energy infrastructure related to pipelines is found in Section 5.4.7.

Communications

There are no identified communication lifeline facilities in Douglas County. Various cell phone companies provide 4G 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. There are 25 registered antennas with the Federal Communications Commission (Federal Communications Commission, 2020).

Figure 4-21. Health and Medical Facilities in Douglas County



4.6.4 Transportation Lifelines

The transportation system of Douglas County is a network of roadways, highways, and rail lines that provide for travel within the Denver metro area. Figure 4-22 identifies the transportation systems found in Douglas County including airports, bridges, bus facilities, and light rail facilities.

Airport Facilities

There is one identified airport lifeline in Douglas County. The Federal Aviation Administration identifies 10 private heliports and airports in the County. Figure 4-22 shows the location of the identified airport, which is located near Larkspur. 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.

Bridges

There are 66 bridges identified as lifelines in Douglas County, of which, 51 bridges are under County jurisdiction. Figure 4-22 shows the location of bridges in Douglas County.

Mass Transit

Douglas County has 12 identified transportation lifelines related to mass transit in Douglas County. This includes seven bus facilities and five light rail stations served by the RTD E, F, and R lines. Figure 4-22 shows the location of these facilities.

4.6.5 Hazardous Materials Lifelines

Due to heightened security concerns, local utility lifeline data needed to complete the analysis were only partially obtained. There were no identified hazardous material lifelines in the County. A discussion of hazardous materials as a hazard is discussed in Section 5.4.7.

4.6.6 User Defined Facilities

The Planning Committee identified additional facilities as critical to be analyzed on an individual basis as part of the HMP risk assessment. These facilities include assisted living facilities, childcare facilities, historic locations, major businesses, polling sites, and recreation sites. shows the distribution of these additional facilities throughout the County. Figure 4-23 shows the location of user defined facilities in Douglas County.

Figure 4-22 Transportation Facilities in Douglas County

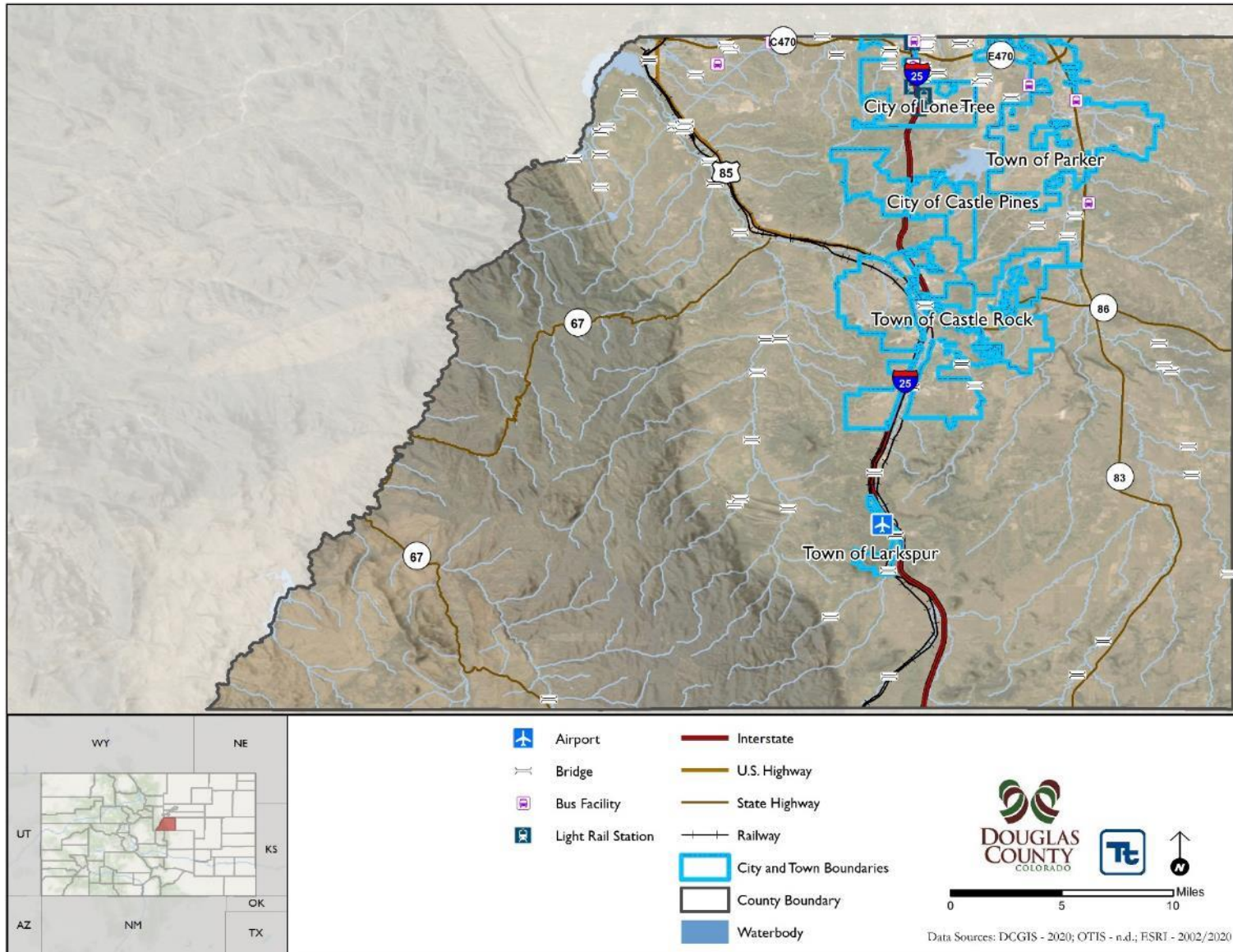
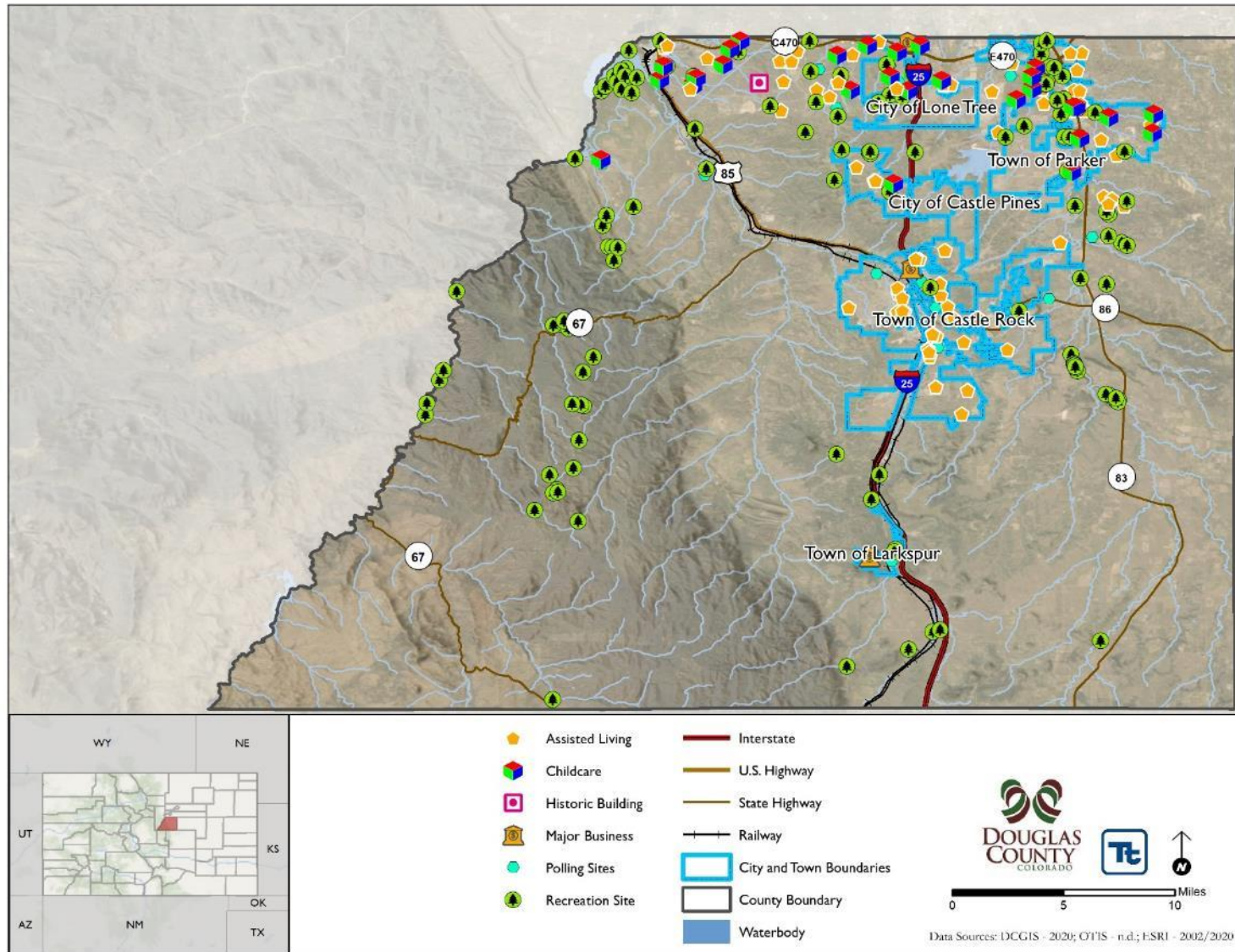


Figure 4-23 User Defined Facilities in Douglas County



SECTION 5 RISK ASSESSMENT

5.1 Methodology

A risk assessment is the process of measuring the potential loss of life, personal injury, and economic and property damage resulting from identified hazards. Identifying potential hazards and vulnerable assets allows planning personnel to address and reduce hazard impacts and 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 to a specified hazard. Past, present, and future conditions must be evaluated to most accurately assess risk for the county and each jurisdiction. The process focuses on the following elements:

- **Hazard identification**—Use all available information to determine what types of hazards may affect a jurisdiction.
- **Profile each hazard**—Understand each hazard in terms of:
 - Extent—Severity of each hazard.
 - Location—Geographic area most affected by the hazard.
 - Previous occurrences and losses
- **Assess Vulnerability** –
 - Exposure identification—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.
 - Vulnerability identification and loss estimation—Assess the impact of hazard events on the people, property, economy, and lands of the region, including estimates of the cost of potential damage or cost that can be avoided by mitigation.
 - Future changes that may impact vulnerability—Analyze how demographic changes, projected development and climate change impacts can alter current exposure and vulnerability.

The Douglas County risk assessment was updated using best available information.

- A custom-building stock inventory was created from tax assessor information, parcel data, and building footprints provided by Douglas County Office of GIS.
- 2014-2018 American Community Survey 5-year Population Estimates were utilized.
- A critical facility list was generated and reviewed by the Planning Partnership and County jurisdictions.
- Lifelines were identified in the critical facility inventory to align with FEMA's lifeline definition.
- Hazus was used to estimate potential impacts to the flood and seismic hazards.
- Best available hazard data was used as described in this section.

The following summarizes the asset inventories, methodology and tools used to support the risk assessment process.

5.1.1 Asset Inventories

Douglas County assets were identified to assess potential exposure and loss associated with the hazards of concern. For the HMP update, Douglas County assessed exposure and vulnerability of the following types of assets: population, buildings and critical facilities/infrastructure, new development, and the environment. Some assets may be more vulnerable because of their physical characteristics or socioeconomic uses. To protect individual privacy and the security of critical facilities, information on properties assessed is presented in aggregate, without details about specific individual personal or public properties.



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

Population

Total population statistics from the 2014-2018 American Community Survey (ACS) 5-year estimate were used to estimate the exposure and potential impacts to the County’s population in place of the 2010 U.S. Census block estimates. 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 is a more precise distribution of population across the County compared to only using the Census block or Census tract boundaries. Limitations of these analyses are recognized, and thus the results are used only to provide a general estimate for planning purposes.

As discussed in Section 4 (County Profile), research has shown that some populations are at greater risk from hazard events because of decreased resources or physical abilities. Vulnerable populations in Douglas County included in the risk assessment are children, elderly, population below the poverty level, non-English speaking individuals, and persons institutionalized with a disability.

Buildings

A custom-building stock inventory was developed for the HMP using tax assessor information, parcel data, and building footprints provided by Douglas County Office of GIS. The occupancy classes available in Hazus were condensed into the following categories (residential, commercial, industrial, agricultural, religious, governmental, and educational) to facilitate the analysis and the presentation of results. Residential loss estimates address both multi-family and single-family dwellings. Replacement cost value (RCV) is the current cost of returning an asset to its pre-damaged condition, using present-day cost of labor and materials. Total replacement cost value consists of both the structural cost to replace a building and the estimate value of contents of a building. Structural and content RCV were calculated for each building utilizing RS Means 2020 values. A regional location factor for Douglas County was applied (1.05 for residential buildings and 0.91 for all other building types). The content cost of a building was estimated to be about 50-percent of the structural cost for residential structures and parking garages, about 100-percent for most commercial structures, primary schools, government services, religious/non-profit structures, and agricultural structures, and approximately 150-percent for most industrial buildings, secondary education facilities, and essential government facilities.

Critical Facilities and Lifelines

A custom critical facility inventory, which includes essential facilities, utilities, transportation features and user-defined facilities was created from local, state, and federal data made available and was reviewed and accepted by the Planning Partnership and County jurisdictions. The inventory indicated if the critical facility is considered a lifeline in accordance with FEMA's definition; refer to Appendix E (Risk Assessment Supplement). To protect individual privacy and the security of assets, information is presented in aggregate, without details about specific individual properties or facilities.

A lifeline provides indispensable service that enables the continuous operation of critical business and government functions, and is critical to human health and safety, or economic security (FEMA).

Environment and Land Use Area

National land use land cover data created by the U.S. Geological Survey (USGS) in 2016 was used to assess land use characteristics of the County. This dataset was converted from a raster to a vector polygon, which informed spatial areas of residential, non-residential, and natural land use areas. Residential land-use types incorporated all classes listed as developed land use, except for those identified as vacant (i.e., Developed – Low Intensity, Developed – Medium Intensity, Developed – High Intensity). Non-residential land-use types included all other classes. Within non-residential land-use types, natural land areas were extracted into a new category, which includes forest, water, and wetlands. The natural land areas were referenced to calculate the total acres of natural land area exposed to hazard areas of concern.

New Development

In addition to assessing the vulnerability of the built environment, Douglas County examined recent development over the last 5 years and anticipated new development in the next 5 years. Each jurisdiction was asked to provide a list by parcel ID or address of major development that has taken place within these timeframes.

New development was identified as 1) anticipated in the next five years and 2) recently developed over the last five years. An exposure analysis was conducted in Geographic Information System (GIS) to determine hazard exposure to 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.

Identifying these changes and integrating new development into the risk assessment provides communities information to consider when developing the mitigation strategy to reduce these vulnerabilities in the future (one tool in the Mitigation Toolbox discussed in Section 6 – Mitigation Strategy). The new development is listed in Section 4 (County Profile) and hazard exposure analysis results are presented in Section 9 (Jurisdictional Annexes) as a table in each annex.

5.1.2 Methodology

To address the requirements of the DMA 2000 and to better understand potential vulnerability and losses associated with hazards of concern, Douglas County used standardized tools, combined with local, state, and federal data and expertise to conduct the risk assessment. Three different levels of analysis were used

depending upon the data available for each hazard as described below. Table 5-1 summarizes the type of analysis conducted by hazard of concern.

1. **Historic Occurrences and Qualitative Analysis** – This analysis includes an examination of historic impacts to understand potential impacts of future events of similar size. In addition, potential impacts and losses are discussed qualitatively using best available data and professional judgement.
2. **Exposure Assessment** – This analysis involves overlaying available spatial hazard layers, or hazards with defined extent and locations, with assets in GIS to determine which assets are located in the impact area of the hazard. The analysis highlights which assets are located in the hazard area and may incur future impacts.
3. **Loss estimation** — The FEMA Hazus modeling software was used to estimate potential losses for the following hazards: flood and earthquake. In addition, an examination of historic impacts and an exposure assessment was conducted for these spatially-delineated hazards.

Table 5-1. Summary of Risk Assessment Analyses

Hazard	Population	General Building Stock	Critical Facilities	New Development
Animal Disease	Q	Q	Q	Q
Dam Failure	Q	Q	Q	Q
Drought	Q	Q	Q	Q
Earthquake	Q	H	H	Q
Extreme Temperature	Q	Q	Q	Q
Flood	E, H	E, H	E, H	E
Hazmat Spill and Transportation	Q	Q	Q	Q
Pandemic	Q	Q	Q	Q
Severe Weather – Hail	Q	Q	Q	Q
Severe Weather – Tornadoes	Q	Q	Q	Q
Severe Weather – Wind	Q	Q	Q	Q
Severe Winter Storm	Q	Q	Q	Q
Soil Hazard – Erosion	E	E	E	E
Soil Hazard – Expansive Soil	E	E	E	E
Soil Hazard – Landslide Subsidence	E	E	E	E
Soil Hazard – Slope Failure	E	E	E	E
Wildfire	E	E	E	E

E – Exposure analysis; H – Hazus analysis; Q – Qualitative analysis

Hazards U.S. – Multi-Hazard (Hazus)

In 1997, FEMA developed a standardized model for estimating losses caused by earthquakes, known as Hazards U.S. or Hazus. Hazus was developed in response to the need for more effective national-, state-, and community-level planning and the need to identify areas that face the highest risk and potential for loss. Hazus was expanded into a multi-hazard methodology, Hazus with new models for estimating potential losses from wind (hurricanes) and flood (riverine) hazards. Hazus is a GIS-based software tool that applies engineering and scientific risk calculations, which have been developed by hazard and information technology experts, to provide defensible damage and loss estimates. These methodologies are accepted by FEMA and provide a consistent framework for assessing risk across a variety of hazards. The GIS

framework also supports the evaluation of hazards and assessment of inventory and loss estimates for these hazards.

Hazus uses GIS technology to produce detailed maps and analytical reports that estimate a community’s 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. 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. More information on Hazus is available at <http://www.fema.gov/hazus>.

In general, modeled losses were estimated in the program using depth grids for the flood analysis and probabilistic analyses were performed to develop expected/estimated distribution of losses (mean return period losses) for hurricane wind and seismic hazards. The probabilistic model generates estimated damages and losses for specified return periods (e.g., 100- and 500-year). Table 5-2 displays the various levels of analyses that can be conducted using the Hazus software.

Table 5-2. Summary of Hazus Analysis Levels

Hazus Analysis Levels	
Level 1	Hazus provides hazard and inventory data with minimal outside data collection or mapping.
Level 2	Analysis involves augmenting the Hazus provided hazard and inventory data with more recent or detailed data for the study region, referred to as “local data”
Level 3	Analysis involves adjusting the built-in loss estimation models used for the hazard loss analyses. This Level is typical done in conjunction with the use of local data.

Animal Disease

Animal Disease/Infestation is a new hazard of concern for the Douglas County HMP. All of Douglas County is exposed to animal disease/infestation occurrences, with the most vulnerable places being agricultural facilities and Pike National Forest. A qualitative assessment was conducted using data from the US Department of Agriculture, Colorado State Forest Service, and the Colorado Department of Public Health and the Environment.

Dam Failure

Dam failure was assessed qualitatively. Research from the Federal Emergency Management Agency, Colorado Division of Water Resources, US Army Corps of Engineers, and Association of State Dam Safety Officials was used to complete this profile.

Drought

Drought is a new hazard of concern for the Douglas County HMP. To assess the vulnerability of Douglas County to drought and its associated impacts, a qualitative assessment was conducted. The United States Department of Agriculture (USDA) Census of Agriculture 2017 was used to estimate economic impacts. Information regarding the number of farms and farmland area was extracted from the report and

summarized in the vulnerability assessment. Data from the US Drought Monitor was used to understand the extent and frequency of recent droughts.

Earthquake

A probabilistic assessment was conducted for Douglas County for the 500-year and the 2,500-year mean return period (MRPs) through a Level 2 analysis in Hazus to analyze the earthquake hazard and provide a range of loss estimates. The probabilistic method uses information from historic earthquakes and inferred faults, locations and magnitudes, and computes the probable ground shaking levels that may be experienced during a recurrence period by Census tract.

As noted in the Hazus Earthquake User Manual, *“Although the software offers users the opportunity to prepare comprehensive loss estimates, it should be recognized that uncertainties are inherent in any estimation methodology, even with state-of-the-art techniques. Any region or city studied will have an enormous variety of buildings and facilities of different sizes, shapes, and structural systems that have been constructed over a range of years under diverse seismic design codes. There are a variety of components that contribute to transportation and utility system damage estimations. These components can have differing seismic resistance.”* (FEMA 2020). However, Hazus’ potential loss estimates are acceptable for the purposes of this HMP.

Ground shaking is the primary cause of earthquake damage to man-made structures and soft soils **amplify** ground shaking. One contributor to the site amplification is the velocity at which the rock or soil transmits shear waves (S-waves). The National Earthquake Hazard Reductions Program (NEHRP) has developed five soil classifications defined by their shear-wave velocity that impact the severity of an earthquake. The soil classification system ranges from A to E, where A represents hard rock that reduces ground motions from an earthquake and E represents soft soils that amplify and magnify ground shaking and increase building damage and losses. Class D and E NEHRP soils are the two classes most susceptible to amplified ground motion during an earthquake.

Douglas County did not have an available dataset to indicate class D or E class soils. For the Hazus input, the FEMA 100-year and 500-year flood hazard area was used to assume class D soils. Generally, floodplain soils are softer and more susceptible to erosion and ground motion. As a result, an exposure analysis was not conducted for the County’s assets (population, building stock, critical facilities, and new development).

Groundwater was set at a depth of five (5) feet (default setting). The default assumption is a magnitude 7.0 earthquake for all return periods. Although damages are estimated at the census tract level, results were presented at the municipal level. Since there are multiple census tracts that contain more than one jurisdiction, the general building stock was used to determine the percent coverage of census tracts within a jurisdiction. The percentage was multiplied against the results calculated for each tract and summed for each jurisdiction.

Damage estimates are calculated for losses to buildings (structural and non-structural) and contents; structural losses include load carrying components of the structure, and non-structural losses include those to architectural, mechanical, and electrical components of the structure, such as nonbearing walls, veneer and finishes, HVAC systems, boilers, etc.

Extreme Temperatures

All of Douglas County is exposed to extreme temperature events. A qualitative assessment was conducted for the extreme temperatures hazard. Information from the National Weather Service, Centers for Disease Control and Prevention, Midwestern Regional Climate Center, and the Planning Partnership were used to assess the potential impacts to the County's assets.

Flood

The 1- 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 was used to evaluate exposure and determine potential future losses for this plan update:

- The Douglas County FEMA Effective Digital Flood Insurance Rate Map (DFIRM) dated September 4, 2020.
- The depth grid developed for the Douglas County HMP using data from the USGS 1 Meter resolution 2016 Digital Elevation Model, and the 2020 FEMA Effective DFIRM.

The effective Douglas County FEMA DFIRM published in 2020 was used to evaluate exposure and determine potential future losses. The depth grid generated for the HMP was integrated into the Hazus riverine flood model used to estimate potential losses for the 1-percent annual chance flood event.

To estimate exposure to the 1-percent- and 0.2-percent annual chance flood events, the DFIRM flood boundaries were overlaid on the centroids of updated assets (population, building stock, critical facilities, and new development). Centroids that intersected the flood boundaries were totaled to estimate the building replacement cost value and population vulnerable to the flood inundation areas. A Level 2 Hazus riverine flood analysis was performed. Both the critical facility and building inventories were formatted to be compatible with Hazus and its Comprehensive Data Management System (CDMS). Once updated with the inventories, the Hazus riverine flood model was run to estimate potential losses in Douglas County for the 1-percent annual chance flood events. A user-defined analysis was also performed for the building stock. Buildings located within the floodplain were imported as user-defined facilities to estimate potential losses to the building stock at the structural level. Hazus calculated the estimated potential losses to the population (default 2010 U.S. Census data across dasymetric blocks), potential damages to the general building stock, and potential damages to critical facility inventories based on the depth grids generated and the default Hazus damage functions in the flood model.

Hazardous Material Spill and Transportation

Hazardous material spills and transportation incidents occurrences were sourced from reports in news media, the US Department of Transportation- Pipeline and Hazardous Materials Safety Administration (PHMSA), and the North American Hazmat Situations and Deployments map. Additional transportation data was sourced from the Colorado Department of Transportation, US Department of Transportation – Federal Aviation Administration, and the National Transportation Safety Board.

Pandemic

Disease outbreak is a new hazard of concern for the Douglas County HMP. All of Douglas County is exposed to disease outbreak events, with impacts falling heavily on health and medical lifelines, people,

and the economy. A qualitative assessment was conducted. Research from the Centers for Disease Control and Prevention and the Colorado Department of Public Health & Environment was utilized to qualitatively assess the most recent COVID-19 outbreak. Data from the Colorado Department of Public Health & Environment was used to evaluate the occurrence of a range of infectious diseases, including COVID-19.

Severe Weather – Hail and Lightning, Tornadoes, and Wind

Because Douglas County is not located in an area impacted by tropical storm, Hazus models for probabilistic wind speeds were not used. More than 20 years of NOAA-NCEI severe weather events did not yield damage estimates. Though Douglas County located west of Interstate 25 is located within a Special Wind Region, damages from severe weather events appear to be limited. Aurora, Colorado, located to the northeast of Douglas County, noted annualized losses from hail, lightning, and severe wind events to be less than 0.01 percent of the total exposed value in the City. Given the lack of data, potential losses were estimated at 0.01-percent, 1-percent, and 5-percent thresholds. However, damage experienced in Douglas County from a severe weather event is likely to be closer to the 0.01-percent figure.

Severe Winter Storm

All of Douglas County is exposed and vulnerable to the winter storm hazard. In general, structural impacts include damage to roofs and building frames, rather than building content. Current modeling tools are not available to estimate specific losses for this hazard. A percentage of the custom-building stock structural replacement cost value was utilized to estimate damages that could result from winter storm conditions (i.e., 1-percent, 5-percent, and 10-percent of total replacement cost value). Given professional knowledge and currently available information, the potential losses for this hazard are considered to be overestimated; hence, providing a conservative estimate for losses associated with winter storm events.

Soil Hazard – Erosion, Expansive Soils, Land Subsidence, Slope Failure

The geological hazard data was obtained through the Douglas County GIS program, The Colorado Geological Survey and the United States Geological Survey (USGS). The GIS data included spatial layers for low and moderate risk to erosion susceptibility, dipping bedrock, karst topography, carbonate rock, slope failure, and debris flow. An exposure analysis was conducted on these spatial layers to determine what assets are exposed to geological hazards. The risk to erosion was categorized by low or moderate susceptibility. Dipping bedrock was used to assess risk to expansive soils due to the potential to expand or swell under exposure to flood and steep topography and could significantly damage infrastructure. The USGS karst topography and carbonate rock spatial layers were used to assess potential impact to land subsidence and the Colorado geological survey slope failure and debris flow spatial layers were used to analyze risk for slope failure. Assets with their centroid located in the hazard area were totaled to estimate the totals and values exposed to geological hazards.

Wildfire

The Wildland-Urban Interface (Interface and Intermix), Fire Intensity Scale (FIS), and Wildfire Risk data obtained through the Colorado CO-WRAP program. An exposure analysis was conducted on the wildfires risk spatial layer in reference to wildfire risk levels: highest, high, moderate, low, and lowest.

To determine what assets are exposed to wildfire, available and appropriate GIS data were overlaid with the hazard area. Assets with their centroid located in the hazard area were totaled to estimate the totals and values exposed to a wildfire event.

Considerations for Mitigation and Next Steps

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

- All Hazards
 - Create an updated user-defined general building stock dataset
 - Utilize updated and current demographic data. If 2020 U.S. Census demographic data is available at the U.S. Census block level during the next plan update, use the census block estimates and residential structures for a more precise distribution of population, or the current American Community Survey 5-Year Estimate populations counts at the Census tract level.
- Dam Failure
 - Identify and study exposure to dam inundation areas
- 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/recovery efforts at these properties can be developed.
 - Integrate NEHRP soil data into Hazus as spatial information becomes more available.
- Extreme Temperatures
 - Track extreme temperature data for injuries, deaths, shelter needs, pipe freezing, agricultural losses, and other impacts to determine distributions of most at risk areas.
- Flood
 - 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 exposure analysis and generate a more detailed flood depth grid that can be integrated into the current Hazus version.
- Geological Hazards
 - As more current studies on land subsidence, erosion risk, expansive soils, and slope failure become available, update the exposure analysis and updated the general building stock inventory to include attributes of building codes. These attributes can be weighed and assessed for likelihood of damaged cause by geological hazards.
 -
- Severe Storm
 - The general building stock inventory can be updated to include attributes regarding protection against strong winds, such as hurricane straps, to enhance loss estimates.
 - Integrate evacuation route data that is currently being developed.
- Wildfire
 - General building stock inventory can be updated to include attributes such as roofing material or fire detection equipment or integrate distance to fuels as another measure of vulnerability.

5.1.3 Data Source Summary

Table 5-3 summarizes the data sources used for the risk assessment for this plan.

Table 5-3. Risk Assessment Data Documentation

Data	Source	Date	Format
Population data	U.S. Census Bureau; American Community Survey 5-Year Estimates	2010; 2018	Digital (GIS) format
Building Inventory	Douglas Parcel Data, Tax Assessor Data, Tetra Tech	2020	Digital (GIS) format
Wildfire Fuel Hazard	CO-WRAP	2017	Digital (GIS) format
Critical facilities	Douglas Local Planning Committee and County Jurisdictions	2020	Digital (GIS) format
Digitized Effective FIRM maps (2020)	FEMA	2020	Digital (GIS) format
1-meter Resolution Digital Elevation Model	USGS	2016	Digital (GIS) format
Geological Hazards (Low/Moderate Erosion, Dipping Bedrock)	Colorado GIS/ Colorado Geological Survey	n.d.	Digital (GIS) format
Karst Topography	United States Geological Survey	n.d.	Digital (GIS) Format
Carbonate Rock	United States Geological Survey	1984	Digital (GIS) Format
New Development Data	Douglas Planning Partnership and County Jurisdictions	2020	Digital (GIS) Format
Disease Data	Colorado DPH&E; Tri-County Health Department	2020	Digital (CSV) Format
Weather Event Data	NOAA-NCEI	2020	Digital (CSV) Format

Limitations

Loss estimates, exposure assessments, and hazard-specific vulnerability 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:

- 1) Approximations and simplifications necessary to conduct such a study
- 2) Incomplete or dated inventory, demographic, or economic parameter data
- 3) The unique nature, geographic extent, and severity of each hazard
- 4) Mitigation measures already employed by the participating municipalities
- 5) The amount of advance notice residents have to prepare for a specific hazard event
- 6) Uncertainty of climate change projections

These factors can result in a range of uncertainty in loss estimates, possibly by a factor of two or more. Therefore, potential exposure 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 to collect additional data, 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 utilizing 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.

5.2 IDENTIFICATION OF HAZARDS OF CONCERN

To provide a strong foundation for mitigation actions considered in Sections 6 (Mitigation Strategy) and 9 (Jurisdictional Annexes), Douglas County focused on considering a full range of hazards that could impact the area and then identified and ranked those hazards that presented the greatest concern. The hazard of concern identification process incorporated input from the county and participating jurisdictions; review of the Colorado Enhanced State Hazard Mitigation Plan (CO E-SHMP 2018); review of the 2015 Douglas County Local Hazard Mitigation Plan Update; research and local, state, and federal information on the frequency, magnitude, and costs associated with the various hazards that have previously, or could feasibly, impact the region; and qualitative or anecdotal information regarding natural (not manmade) hazards and the perceived vulnerability of the study area’s assets to them. Table 5.2-1 documents the process of identifying the natural hazards of concern for further profiling and evaluation. Specific hazards not identified as a hazard of concern for Douglas County will not be further discussed in detail.

Hazards of Concern are those hazards that are considered most likely to impact a community. These are identified using available data and local knowledge.

Natural Hazards are those hazards that are a source of harm or difficultly created by a meteorological, environmental, or geological event.

5.2.1 Changes from 2015 Hazard Mitigation Plan

Since the development of the last plan, hazards and disasters not assessed in the prior plan have occurred in the County. These hazards were identified by the Project Management Team and Local Planning Committee as areas to address in this plan update.

Animal Disease/Infestation: The prior plan did not address animal disease and infestation as a hazard of concern. This plan identifies and assesses the hazard in light of the incidence of impacts to Pike National Forest from the Douglas-fir beetle, Douglas-Fir Tussock Moth, and increasing cases of animal bites.

Pandemic: The prior plan did not address pandemics and disease outbreaks as a hazard of concern. In 2020, Douglas County saw a number of infections of COVID-19. The County has seen more than 15,000 cases as of February 1, 2021. Incidence rates in Douglas County were slightly below those experienced in Adams and Arapahoe Counties and were lower than the State of Colorado’s overall infection rates.

Table 5-4. COVID-19 Infection by Municipality

Municipality	Count (1/29/21)	Population (ACS 5-Year 2018)	Rate per 1,000
Castle Pines	616	10,573	58.26
Castle Rock	3,935	59,680	65.93
Larkspur	9	257	35.02
Lone Tree	707	14,209	49.76
Parker	3,310	52,563	62.97
Unincorporated Douglas County	6,463	191,332	33.78
Douglas County Total	15,040	328,614	45.77
Statewide Total	396,179	5,513,141	71.86

Source: Colorado DPH&E; Tri-County Health Department 2020

The 2021 Douglas County Hazard Mitigation Plan Update includes best available data throughout the plan to present an updated understanding Douglas County’s risk. This includes the use of 2017 WUI data, updated HAZUS models using new Census estimates, 2020 Flood Insurance Rate Maps, new temperature data from the Midwest Regional Climate Center, new data from the US Drought Monitor, and exposure to soil hazards.

5.2.2 Hazard Groupings

As per the 2015 Douglas County HMP, the Project Management Team grouped hazards based on the similarity of hazard events, typical concurrence or impacts, consideration of how hazards have been grouped in Federal Emergency Management Agency (FEMA) guidance documents (*FEMA 386-2 Understanding Your Risks, Identifying Hazards and Estimating Losses; Multi-Hazard Identification and Risk Assessment – The Cornerstone of the National Mitigation Strategy; Local Mitigation Planning Handbook*), and consideration of hazard grouping in the Colorado E-SHMP.

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

Hazard	Is this a hazard that may occur in Douglas County?	If yes, does this hazard pose a significant threat to Douglas County?	Why was this determination made?	Source(s)
Animal Disease and Plant Infestation	Yes	Yes	<ul style="list-style-type: none"> The 2018 Colorado E-SHMP identifies Animal Disease as a hazard of concern for the State. Douglas County’s livestock inventory totals more than 20,000 animals. The County also has large sections of forest that are vulnerable to pests. Douglas County has seen a significant increase in animal bites since the last plan. Residents, flora, and fauna of Douglas County are at risk of animal disease and plant infestation. 	<ul style="list-style-type: none"> CDPH&E CSFS Input from Project Management Team and Local Planning Committee
Avalanche	Yes	No	<ul style="list-style-type: none"> The 2018 Colorado E-SHMP indicates that the County has negligible exposure to avalanches. Avalanches can occur in any situation where snow, slope and weather conditions combine to create proper conditions. About 90 percent of all avalanches start on slopes of 30 to 45 degrees and about 98 percent of all avalanches occur on slopes of 25 to 50 degrees. Steep slopes in Douglas County are a defining part of the landscape. Colorado experiences frequent occurrence of avalanche events based on statistics provided by Colorado Avalanche Information Center (CAIC) between 2000 and 2020. Due to Douglas County’s geography and the lack of occurrences, the Project Management Team and Local Planning Committee do not consider the hazard to be a significant concern. 	<ul style="list-style-type: none"> CO DHSEM CAIC Input from Project Management Team and Local Planning Committee
Dam Failure	Yes	Yes	<ul style="list-style-type: none"> The 2018 Colorado E-SHMP identifies dam failure as a hazard of concern for the State. There are 51 dams in Douglas County, seven of which are considered high hazards dams. Douglas County has experienced one historic dam failure incident, which occurred in Castlewood Canyon in 1933. The County is currently seeking to mitigate all high hazards dams. The Project Management Team and Local Planning Committee identified dam failure as a hazard of concern for the County. 	<ul style="list-style-type: none"> ASDO CO DHSEM NPDP NID Input from Project Management Team and Local Planning Committee
Drought	Yes	Yes	<ul style="list-style-type: none"> The 2018 Colorado E-SHMP identifies drought as a hazard of concern for the state. Douglas County has been impacted by several drought events that have occurred in the State. Colorado was included in one FEMA drought-related disaster declaration, which included Douglas County. There have been eight USDA disaster declarations due to drought in Douglas County since 2013. 	<ul style="list-style-type: none"> CO DHSEM FEMA USDA Input from Project Management Team and Local Planning Committee NOAA-NCEI

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

Hazard	Is this a hazard that may occur in Douglas County?	If yes, does this hazard pose a significant threat to Douglas County?	Why was this determination made?	Source(s)
			<ul style="list-style-type: none"> • According to the US Drought Monitor, protracted drought conditions have been experienced in Douglas County in 2016-2017, 2018, and 2020. • Douglas County has experienced moderate drought conditions at least annually since 2016. The current drought has taken place since May 2020. • Based on previous occurrences and input from the Project Management Team and Local Planning Committee, drought is identified as a hazard of concern for Douglas County. 	<ul style="list-style-type: none"> • NRCC
Earthquake	Yes	Yes	<ul style="list-style-type: none"> • The 2018 Colorado E-SHMP identified earthquake as a hazard of concern for the state, though the frequency of damaging earthquakes within the State is relatively low. • Colorado has not had a federal disaster declaration for earthquakes. • Douglas County has experienced two earthquakes since 1900. Neither earthquake caused major damage. • Based on the potential for significant loss and input from the Project Management Team, earthquake has been identified as a hazard of concern for Douglas County, even though it does not pose a significant threat to the county and there have not been any previous occurrences of major earthquakes within the county. 	<ul style="list-style-type: none"> • CO DHSEM • Input from Project Management Team and Local Planning Committee • USGS – Earthquake Hazards Program, Review of USGS Seismic Maps
Extreme Temperature	Yes	Yes	<ul style="list-style-type: none"> • The 2018 Colorado E-SHMP identified extreme heat as a hazard of concern for the State. Extreme cold was included as part of the State’s Severe Winter Weather hazard profile. • Douglas County experiences an increasing number of days with maximum temperatures greater than 90 degrees and a varying number of days each year with a maximum temperature of less than 32 degrees. • The Project Management Team identified extreme temperature as a hazard of concern for Douglas County. 	<ul style="list-style-type: none"> • CO DHSEM • Input from Project Management Team and Local Planning Committee • Midwest Regional Climate Center • NOAA-NCEI • USDA
Flood (riverine and flash)	Yes	Yes	<ul style="list-style-type: none"> • The 2018 Colorado E-SHMP identified flooding as a hazard of concern for Colorado. Between 1864 and 2017, the State experienced approximately three dozen flood events causing 372 deaths and \$7.5 billion in damages. • Between 2014 and 2020, there have been two floods and two flash floods in the County. Approximately \$15,000 in damage was reported in each event. • Based on the history of flooding and its impacts on Douglas County and input from the Project Management Team identified flooding as a hazard of concern for the county. 	<ul style="list-style-type: none"> • CO DHSEM • Input from Project Management Team and Local Planning Committee • FEMA • NOAA-NCEI
Hailstorm	Yes	Yes	Please see Severe Storm	

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

Hazard	Is this a hazard that may occur in Douglas County?	If yes, does this hazard pose a significant threat to Douglas County?	Why was this determination made?	Source(s)
Hazardous Material Transportation Incidents	Yes	Yes	<ul style="list-style-type: none"> The 2018 Colorado E-SHMP identified Hazardous Material releases as a hazard of concern. The E-SHMP notes significant damages to Douglas County owing to hazardous material incidents. Douglas County is crossed by a number of railroads, pipelines, and major roadways on which hazardous substances are transported. Eighteen hazardous material events have occurred in Douglas County since 2014. The Project Management Team identified hazardous material transportation incidents as a hazard of concern for Douglas County. 	<ul style="list-style-type: none"> North American Hazmat Situations and Deployments PHMSA Input from Project Management Team and Local Planning Committee
Ice Storm	Yes	Yes	Please see Severe Winter Storm	
Pandemic/Disease Outbreak	Yes	Yes	<ul style="list-style-type: none"> The 2018 Colorado E-SHMP identifies pandemic as a hazard of concern for the State. The County has been impacted by various diseases, including influenza, Lyme disease, and COVID-19. As of October 16, 2020, Douglas County totaled more than 15,000 COVID-19 infections. The Project Management Team and Local Planning Committee identified disease outbreak as a hazard of concern for Douglas County. 	<ul style="list-style-type: none"> CO DHSEM CO DPH&E Input from Project Management Team and Local Planning Committee
Severe Storm (windstorms, thunderstorms, lightning, hail and tornados)	Yes	Yes	<ul style="list-style-type: none"> The 2018 Colorado E-SHMP identified severe storms as a hazard of concern for Colorado. Severe storm events include severe wind, tornadoes, hail, and thunderstorms and lightning. Between 1954 and 2020, Douglas County was included in one FEMA severe storm-related declarations. <ul style="list-style-type: none"> FEMA-DR-200 (Tornado) – June 19th, 1965 According to the SPC, three tornados impacted Douglas County between 2014 and 2020. There have been more than 358 hail events and 26 lightning events since 1996 in Douglas County. There have been more than 180 wind events since 1953. Since 2014, wind storm events have caused few property damages. Based on previous occurrences and input from the Project Management Team and Local Planning Committee, severe storms are identified as a hazard of concern for Douglas County. 	<ul style="list-style-type: none"> CO DHSEM FEMA NOAA-NCEI SPC Input from Project Management Team and Local Planning Committee
Severe Winter Storm (heavy snow, blizzards, ice storms)	Yes	Yes	<ul style="list-style-type: none"> The 2018 Colorado E-SHMP identified severe winter weather, including extreme cold events, as a hazard of concern for the State. According to the E-SHMP, Douglas County experienced 267 events between 1960 and 2017 causing more than \$49.6 million in damages. FEMA included Douglas County in five winter storm-related disaster declarations: 	<ul style="list-style-type: none"> CO DHSEM FEMA NOAA-NCEI Input from Project Management Team

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

Hazard	Is this a hazard that may occur in Douglas County?	If yes, does this hazard pose a significant threat to Douglas County?	Why was this determination made?	Source(s)
			<ul style="list-style-type: none"> ○ FEMA-DR-3185 (Snow) – 2003 ○ FEMA-EM-3270 (Snow) – 2007 ● Based on previous occurrences and input from the Project Management Team, severe winter weather is identified as a hazard of concern for Douglas County. 	and Local Planning Committee
Soil Hazards: Erosion, Expansive Soils, Land Subsidence, Slope Failure	Yes	Yes	<ul style="list-style-type: none"> ● The 2018 Colorado E-SHMP identifies Erosion and Deposition; Expansive Soils and Heaving Bedrock; Landslides, Mud/Debris Flows, and Rockfalls; and Subsidence as hazards of concern for the State. ● There are no FEMA soil-related disaster declarations for Douglas County. ● Douglas County has experienced soil hazards to varying degrees of severity. Many of the mapped soil hazards have past occurrences and anticipated occurrences in the foothills of the Rampart Range, such as the area stretching between Roxborough State Park and Perry Park. Isolated incidents of soil hazards have occurred throughout the County. ● Based on available data, the Project Management Team identified soil hazards as a hazard of concern for Douglas County. 	<ul style="list-style-type: none"> ● CO DHSEM ● CGS ● Input from Project Management Team and Local Planning Committee ● FEMA
Tornado	Yes	Yes	Please see Severe Storm	
Volcano	No	No	<ul style="list-style-type: none"> ● The 2018 Colorado E-SHMP analyzed volcanos as a hazard but did not identify volcano as a hazard of concern for Douglas County and, therefore, the Project Management Team does not consider volcano to be a hazard of concern for Douglas County. 	<ul style="list-style-type: none"> ● CO DHSEM ● Input from Project Management Team and Local Planning Committee
Wildfire	Yes	Yes	<ul style="list-style-type: none"> ● The 2018 Colorado E-SHMP identified wildfire as a hazard of concern for Colorado. Douglas County is ranked in the E-SHMP as one of the County’s with the highest risk, and has the fourth-largest percent of area at risk of wildfire. ● Douglas County has been included in three FEMA wildfire-related disaster declarations. <ul style="list-style-type: none"> ○ FEMA-DR-1421: Colorado Wildfires (April 2002-August 2002) ○ FSA-2407-CO: Colorado Schoonover Fire (May 2002) ○ FEMA-EM-2510-C: Cherokee Ranch Fire (October 2003) ● Based on available data, the Project Management Team identified wildfire as a hazard of concern for Douglas County. 	<ul style="list-style-type: none"> ● CO DHSEM ● Input from Project Management Team and Local Planning Committee ● FEMA
Windstorm	Yes	Yes	Please see Severe Storm: Wind/Thunderstorm	

CGS Colorado Geological Survey
 CO DHSEM Colorado Division of Homeland Security and Emergency Management
 CO DPH&E Colorado Department of Public Health and Environment

DR Presidential Disaster Declaration Number
 EM Presidential Disaster Emergency Number
 FEMA Federal Emergency Management Agency



<i>M</i>	<i>Million (\$)</i>	<i>SPC</i>	<i>Storm Prediction Center</i>
<i>MRCC</i>	<i>Midwest Regional Climate Center</i>	<i>USDA</i>	<i>U.S. Department of Agriculture</i>
<i>NCEI</i>	<i>National Centers for Environmental Information</i>	<i>USGS</i>	<i>United States Geologic Survey</i>
<i>PGA</i>	<i>Peak ground acceleration</i>		

5.2.3 Summary of Hazards of Concern

In summary, a total of 17 hazards of concern were identified as significant hazards affecting the planning area, to be addressed at the county level in this plan (shown here in alphabetical order):

- Animal Disease/Infestation
- Dam Failure
- Drought
- Earthquake
- Extreme Temperatures
- Flood (riverine and flash)
- Hazardous Materials
- Pandemic/Disease Outbreak
- Severe Weather: Hail and Lightning
- Severe Weather: Tornado
- Severe Weather: Wind
- Severe Winter Storm
- Soil Hazards: Erosion
- Soil Hazards: Expansive Soils
- Soil Hazards: Land Subsidence
- Soil Hazards: Slope Failure
- Wildfire

Other hazards of concern that might occur in Douglas County were deemed to have a low potential to result in significant impacts and can be considered in future updates to this plan.

5.3 HAZARD RANKING

As discussed in Section 5.2 (Identification of Hazards of Concern), a comprehensive range of natural hazards that pose a significant risk to Douglas County were selected and considered during development of this plan; however, each community in Douglas County has differing levels of exposure and vulnerability to each of these hazards. It is important for each community participating in this plan to recognize those hazards that pose the greatest risk to their community and direct their attention and resources accordingly to most effectively and efficiently manage risk and reduce losses. The hazard ranking for the county and each participating jurisdiction can be found in their jurisdictional annexes in Volume II, Section 9 of this plan.

To this end, a hazard risk ranking process was conducted for Douglas County and its municipalities using the method described below. This method includes four risk assessment categories—probability of occurrence, impact (population, property, and economy), adaptive capacity, and changing future conditions (climate change). Each were assigned a weighting factor to calculate an overall ranking value for each hazard of concern. Depending on the calculation, each hazard was assigned a high, medium, or low ranking. Details regarding each of these categories is described below.

5.3.1 Hazard Ranking Methodology

The methodology used to rank the hazards of concern for Douglas County is described below. Estimates of risk for the county were developed using methodologies promoted by FEMA’s hazard mitigation planning guidance, generated by FEMA’s HAZUS-MH risk assessment tool, and input from Douglas County and participating jurisdictions. Table 5-6 shows the four risk assessment categories’ values for each of Douglas County’s hazards. Details for each category are further described below.

Probability of Occurrence

The probability of occurrence is the likelihood of a hazard event occurring in any given year. A review of historic events assists with this determination. Each hazard of concern is rated in accordance with the numerical ratings and definitions described in Table 5-6.

Impact

The impact of each hazard is considered in three categories: impact on population, impact on property (general building stock including critical facilities), and impact on the economy. Based on documented historic losses and individual assessments by each participating municipality, an impact rating of high, medium, or low is assigned with a corresponding numeric value for each hazard of concern. In addition, a weighting factor is assigned to each impact category: 3 for population, 2 for property, and 1 for economy. This gives the impact on population the greatest weight in evaluating the impact of a hazard. The total of each category is assigned a weighted value of 30%. Table 5-6 presents the numerical rating, weighted factor and description for each impact category.

Table 5-6. Summary of Hazard Ranking Approach

Category		Level / Category*	Degree of Risk / Benchmark Value	Numeric Value
Probability of Occurrence		No Exposure	There is no probability of occurrence	0
		Low	Hazard event is not likely to occur within 100 years	1
		Medium	Hazard event is likely to occur within 100 years	2
		High	Hazard event is likely to occur within 25 years	3
Impact (Sum of all 3)	Population	Low Impact	9% or less of population is exposed to a hazard with potential for measurable life safety impact due to its extent and location.	1
		Medium Impact	10% to 24% of population is exposed to a hazard with potential for measurable life safety impact due to its extent and location.	2
		High Impact	25% or more of population is exposed to a hazard with potential for measurable life safety impact due to its extent and location.	3
	Property	Low Impact	Property exposure is 14% or less of the total number of structures for community.	1
		Medium Impact	Property exposure is 15% to 29% of the total number of structures for community.	2
		High Impact	Property exposure is 30% or more of the total number of structures for community.	3
	Economy	Low Impact	Loss estimate is 9% or less of the total replacement cost for community.	1
		Medium Impact	Loss estimate is 10% to 19% of the total replacement cost for community.	2
		High Impact	Loss estimate is 20% or more of the total replacement cost for community.	3

Note: A numerical value of zero is assigned if there is no impact.

* For the purposes of this exercise, “impacted” means exposed for population and property and loss for economy.

Risk Ranking Value

Each impact was then weighted and the risk ranking for each hazard is then calculated using the following formula:

Example Risk Ranking Equation

$$\text{Risk Ranking} = [(\text{Impact on Population} \times 3) + (\text{Impact on Property} \times 2) + (\text{Impact on Economy} \times 1) \times 30\%] \times [\text{Probability of Occurrence}]$$

Based on the total for each hazard, a priority ranking is assigned to each hazard of concern (high, medium, or low). The rankings were categorized as follows: Low = values less than 14; Medium = values between 15 and 30; High = values greater than 31.

5.3.2 Hazard Ranking Results

Using the process described above, the risk ranking for the identified hazards of concern was determined for Douglas County. The hazard ranking for Douglas County is detailed in the subsequent tables that present the step-wise process for the ranking. The countywide risk ranking includes the entire planning area and might not reflect the highest risk indicated for any of the participating jurisdictions. The resulting ranks of each municipality indicate the differing degrees of risk exposure and vulnerability. The results support the appropriate selection and prioritization of initiatives to reduce the highest levels of risk for each municipality. Both the county and the participating jurisdictions have applied the same methodology to develop the countywide risk and local rankings to ensure consistency in the overall ranking of risk; jurisdictions had the ability to alter rankings based on local knowledge and experience in handling each hazard.

This hazard ranking exercise serves two purposes: 1) to describe the probability of occurrence for each hazard; and 2) to describe the impact each would have on the people, property, and economy. Estimates of risk for Douglas County were developed using methodologies promoted by FEMA’s hazard mitigation planning guidance, generated by FEMA’s HAZUS-MH risk assessment tool and input from the county and participating municipalities.

Table 5-7 shows the probability ranking assigned for likelihood of occurrence for each hazard.

Table 5-7. Probability of Occurrence Ranking for Hazards of Concern for Douglas County

Hazard of Concern	Probability	Numeric Value
Animal Disease	High	3
Dam and Levee Failure	Low	1
Drought	High	3
Earthquake	Medium	2
Erosion	Medium	2
Expansive Soils	Medium	2
Extreme Temperatures	Medium	2
Flood	Medium	2
Hail	High	3
Land Subsidence	Medium	2
Landslide	Medium	2

Hazard of Concern	Probability	Numeric Value
Lightning	High	3
Pandemic	High	3
Severe Thunderstorms	High	3
Severe Winter Storm	High	3
Slope Failure	Medium	2
Tornadoes	Medium	2
Transportation Accidents	High	3
Wildfire	High	3

Table 5-8 shows the impact evaluation results for each hazard of concern, including impact on property, structures, and the economy on the county level. It is noted that several hazards that have a high impact on the local jurisdictional level can have a lower impact when analyzed countywide. Jurisdictional ranking results are presented in each local annex in Section 9 (Jurisdictional Annexes) of this plan. The weighting factor results and a total impact for each hazard also are summarized.

Table 5-8. Impact Ranking for Hazards of Concern for Douglas County

Hazard of Concern	Population		Property		Economy		Relative Risk Factor (Population + Property + Economy)
	Numeric Value	Impact	Numeric Value	Impact	Numeric Value	Impact	Numeric Value
Animal Disease	1	Low	1	Low	1	Low	6.0
Dam and Levee Failure	1	Low	1	Low	1	Low	6.0
Drought	2	Medium	1	Low	2	Medium	10.0
Earthquake	1	Low	2	Medium	1	Low	8.0
Erosion	1	Low	1	Low	1	Low	6.0
Expansive Soils	1	Low	1	Low	1	Low	6.0
Extreme Temperatures	1	Low	1	Low	1	Low	6.0
Flood	1	Low	1	Low	1	Low	6.0
Hail	1	Low	2	Medium	1	Low	8.0
Land Subsidence	1	Low	1	Low	1	Low	6.0
Landslide	1	Low	1	Low	1	Low	6.0
Lightning	1	Low	1	Low	1	Low	6.0
Pandemic	2	Medium	1	Low	2	Medium	10.0
Severe Thunderstorms	1	Low	1	Low	1	Low	6.0
Severe Winter Storm	1	Low	1	Low	1	Low	6.0
Slope Failure	1	Low	1	Low	1	Low	6.0
Tornadoes	1	Low	2	Medium	1	Low	8.0
Transportation Accidents	1	Low	1	Low	1	Low	6.0
Wildfire	3	High	2	Medium	3	High	16.0

Table 5-9 presents the total calculations for each hazard ranking value for the hazards of concern.

Table 5-9. Total Hazard Ranking Values for the Hazards of Concern for Douglas County

Hazard of Concern	Probability Value	Relative Risk Factor	Risk Ranking Score	Risk Ranking
Animal Disease	3	6.0	18	Medium
Dam and Levee Failure	1	6.0	6	Low
Drought	3	10.0	30	Medium
Earthquake	2	8.0	16	Medium
Erosion	2	6.0	12	Low
Expansive Soils	2	6.0	12	Low
Extreme Temperatures	2	6.0	12	Low
Flood	2	6.0	12	Low
Hail	3	8.0	24	Medium
Land Subsidence	2	6.0	12	Low
Landslide	2	6.0	12	Low
Lightning	3	6.0	18	Medium
Pandemic	3	10.0	30	Medium
Severe Thunderstorms	3	6.0	18	Medium
Severe Winter Storm	3	6.0	18	Medium
Slope Failure	2	6.0	12	Low
Tornadoes	2	8.0	16	Medium
Transportation Accidents	3	6.0	18	Medium
Wildfire	3	16.0	48	High

Table 5-10 presents the jurisdictional hazard ranking for each hazard. An evaluation of the total risk ranking score determined ranking categories that were grouped into three categories, low, medium, and high. It also includes input by the municipalities. The rankings were categorized as follows: Low = values less than 14 colored yellow; Medium = values between 15 and 30 colored amber; High = values greater than 31 colored red.

These rankings have been used as one of the bases for identifying the jurisdictional hazard mitigation strategies included in Section 9 (Jurisdictional Annexes) of this plan. The summary rankings for the county reflect the results of the vulnerability analysis for each hazard of concern and can vary from the specific results of each jurisdiction. For example, the severe storm hazard may be ranked low in one jurisdiction, but due to the exposure and impact countywide, it is ranked as a high hazard county-wide and is addressed in the county mitigation strategy accordingly. This table was distributed to municipalities and any changes are noted in the municipal annex.

Table 5-10. Summary of Overall Ranking of Natural Hazards by Jurisdiction

HAZARD	Douglas County (Overall)	Castle Pines	Castle Rock	Larkspur	Lone Tree	Parker	Unincorporated Douglas County
Animal Disease	Medium	Medium	Medium	Medium	Medium	Medium	Medium
Dam and Levee Failure	Low	Low	Low	Low	Low	Low	Low
Drought	Medium	Medium	Medium	Medium	Medium	Medium	Medium
Earthquake	Medium	Medium	Medium	Medium	Medium	Medium	Medium
Erosion	Low	Low	Low	Medium	Low	Low	Low
Expansive Soils	Low	Low	Low	Low	Low	Low	Low
Extreme Temperatures	Low	Low	Low	Low	Low	Low	Low
Flood	Low	Low	Low	Low	Low	Low	Low
Hail	Medium	Medium	Medium	Medium	Medium	Medium	Medium
Land Subsidence	Low	Medium	Medium	Medium	Low	Low	Low
Landslide	Low	Low	Low	Low	Low	Low	Low
Lightning	Medium	Medium	Medium	Medium	Medium	Medium	Medium
Pandemic	Medium	Medium	Medium	Medium	Medium	Medium	Medium
Severe Thunderstorms	Medium	Medium	Medium	Medium	Medium	Medium	Medium
Severe Winter Storm	Medium	Medium	Medium	Medium	Medium	Medium	Medium
Slope Failure	Low	Low	Low	Low	Low	Low	Low
Tornadoes	Medium	Medium	Medium	Medium	Medium	Medium	Medium
Transportation Accidents	Medium	Medium	Medium	Medium	Medium	Medium	Medium
Wildfire	High	High	High	High	Medium	High	High

5.4 Hazard Profiles

5.4.1 Animal Disease and Infestation and Plant Disease

This section provides a hazard profile and vulnerability assessment of the animal and plant disease/pest infestation hazard for Douglas County.

Hazard Profile

This section presents information regarding the description, extent, location, previous occurrences and losses, climate change projections and probability of future occurrences for the animal disease and infestation hazard.

Description

Animal and plant diseases are disease outbreaks or infestations that are transmitted from plant-to-plant or from animal-to-animal. As a natural hazard profiled for this hazard mitigation plan, diseases of concern include those that generate significant impacts for ecosystems, economy, and the human population. Animal diseases, also known as Zoonotic diseases, include a new strain of virus not previously seen in the animal population, the reintroduction of a previously eliminated disease, and the accidental or intentional introduction of a foreign animal disease. The Colorado Enhanced State Hazard Mitigation Plan identifies zoonotic diseases as a significant hazard to State residents and livestock (State of Colorado 2018).

The Colorado Department of Public Health and Environment has identified the following Zoonotic disease outbreaks occurring between 2014 and 2019:

- Anthrax
- Brucellosis
- Chikungunya
- Colorado Tick Fever
- Dengue
- Hantavirus
- Lyme Disease
- Malaria
- Plague
- Psittacosis
- Q-Fever, Acute
- Q-Fever, Chronic
- Rabies, Human
- Rabies, Animal
- Rocky Mountain Spotted Fever
- Tick-borne Relapsing Fever
- Tularemia

An infestation is defined as a state of being invaded or overrun by parasites that attack plants, animals, and humans. Insect, fungi, and parasitic infestations can result in destruction of various natural habitats and cropland, impact human health, and cause disease and death among native plant, wildlife, and livestock. An infestation is the presence of a large number of pest organisms in an area or field, on the surface of a host, or in soil. They result from when an area is inhabited or overrun by these pest organisms, in numbers or quantities large enough to be harmful, threatening, or obnoxious to native plants, animals and humans. Pests are any organism (insects, mammals, birds, parasite/pathogen, fungi, non-native species) that are a threat to other living species in its surrounding environment. Pests compete for natural resources or they can transmit diseases to humans, crops, and livestock. Human populations are generally impacted by insect or animal infestations that can result in health impacts and can lead to potential epidemics or endemics, such as hantavirus and tularemia.

Extent and Location

The extent and location of infestations depends on the preferred habitat of the species, as well as the species’ ease of movement and establishment. However, each of these threats can impact most areas of Colorado, including Douglas County. Douglas County’s land use patterns are marked by relatively dense development in the northern section of the County, forest land in the western portion of the County, and exurban and agricultural areas in the southern section of the County. All areas of the County are vulnerable to these hazards to varying degrees.

Douglas County has over 200,000 acres of farms, 78% of which is pastureland and 13% of which is cropland. As of 2017, Douglas County’s livestock inventory totaled 20,773 animals, inclusive of 8,005 cattle and calves; 4,744 horses and ponies; 4,542 layers; and 1,127 goats. In 2017, the market value of agricultural products totaled \$18.8 million (USDA 2017). Livestock in Douglas County’s pastureland may be significantly impacted by animal diseases.

The magnitude of infestations ranges from nuisance to widespread. The threat is typically intensified when the ecosystem or host species is already stressed, such as periods of drought. The already weakened state of the ecosystem causes it to more easily be impacted to an infestation

Previous Occurrences and Losses

Information about animal disease and infestation events is limited. Many sources of information were sought in the documentation of previous occurrences, including various agencies at the State and County levels. Between 1953 and 2020, the Federal Emergency Management Agency (FEMA) did not declare a major disaster (DR) or emergency (EM) in the State of Colorado for animal disease or infestation. The U.S. Department of Agriculture (USDA) keeps records of agricultural disasters. Between 1996 and 2020, Douglas County was not included in disaster declarations related to infestation.

Table 5-11. Animal Disease and Infestation Events in Douglas County between 1996 and 2020

Dates of Event	Event Details*
1996- Ongoing	Pike National Forest is impacted by the Douglas-fir beetle. As of 2019, the Beetle continues to cause damage in County forests near Jarre Canyon, Perry Park, and Valley Park.
2014-2016	In 2014, larvae of Douglas-Fir Tussock Moth (DFTM) were observed in Douglas County forests. In 2015, 24,000 acres were defoliated by beetles, including nearly 6,000 acres near Perry Park and more than 2,800 acres at Jarre Canyon.
2014	Ten animal bites were reported in Douglas County
2015	A case of Brucellosis was reported in Douglas County. Twenty-two cases of animal bites were reported.
2015	A case of Dengue Fever was reported in Douglas County.
2016	Seventy-seven cases of animal bites were reported in Douglas County.
2017	Three cases of Dengue Fever and 86 animal bites were reported in Douglas County.
2018	Two cases of Dengue Fever and 141 animal bites were reported in Douglas County

Sources: CDPHE; CSFS

* Many sources were consulted to provide an update of previous occurrences and losses; event details and loss/impact information may vary and has been summarized in the above table.

Climate Change Projections

The relationship between diseases occurrence and climate change is difficult to predict with certainty. However, there may be linkages between the two. Changes in the environment may create a more livable

habitat for vectors carrying disease as suggested by the Centers for Disease Control and Prevention (CDC n.d.). Localized changes in climate and human interaction may also be a factor in the spread of disease.

Probability of Future Occurrences

Based on historical documentation, increased incidences of infestation throughout Colorado and the overall impact of changing climate trends, Douglas County and its jurisdictions will continue to experience animal disease and infestation events that may induce secondary hazards and health threats to the County population if infestations are not prevented, controlled or eradicated effectively.

Predicting the likelihood of future occurrences of animal diseases, infestations, and plant diseases is difficult. However, it is possible for this hazard to occur in Douglas County. The high concentration of farms in the County makes them susceptible to outbreaks among livestock and crops (Colorado State HMP 2018). Based on input from the Core Planning Team, the probability for this hazard is considered *frequent* (hazard event likely to occur within 25 years). Refer to Sections 5.1 and 5.3 for additional information on the hazard ranking methodology and probability criteria.

Vulnerability Assessment

To understand risk, a community must evaluate assets exposed to and vulnerable to the identified hazard. All of Douglas County is exposed to the animal disease and pest infestation hazard; therefore, all assets within the County (population, structures, critical facilities, and lifelines), as described in Section 4 (County Profile), are potentially vulnerable to an animal disease or pest infestation event. The following text evaluates and estimates the potential impact of the animal disease and pest infestation hazard in the County.

Impact on Life, Health, and Safety

Though animal disease and infestation primarily impact non-human species, the potential exists for these hazards to impact life, health, and safety. Animals can serve as vectors of disease for human infection, such as in the case of rabies. Additionally, plant infestations can cause mass die-offs of vegetation that can generate large amounts of fuel for wildfires. Therefore, impacts to the life, health, and safety of the population of Douglas County can be impacted by the impacts of animal disease or pest infestations.

Impact on General Building Stock

Animal diseases and pest infestations are not anticipated to impact the building stock of Douglas County. However, indirect impacts from infestations (such as dead vegetation) can lead to downed trees, damaging structures and infrastructure throughout the County. It can also enhance the risk of wildfires and exposure of the general building stock to wildfire impacts.

Impact on Critical Facilities

Animal and plant diseases will have few direct impacts to critical facilities but may cause a number of secondary impacts. Diseases impacting animals may put strain on the County's and region's network of veterinary services. Plant diseases may impact natural resources in recreational facilities and preserved habitats. Furthermore, infestations can result in restrictions of the use of these facilities.

Impact on the Economy

Though diminished significantly as the County's population increased and the region grows, agriculture plays a role in the County's economy. According to Land Use Land Cover data, approximately 38.8% of

Douglas County's land area is agricultural land and 45.3% is forest land. Just 2,285 acres of Douglas County is irrigated farmland, and 10,500 acres of cropland (the most of any category of product) is forage. The Douglas County portion of Pike-San Isabel National Forest generated 513 CCF of timber in 2016, representing 2.5% of the Forest's timber (Simmons et al. 2019).

The 2017 Census of Agriculture reports 1,223 farms in Douglas County comprising 201,574 acres – an increase of 10% and 1% since 2012, respectively. The market value of goods sold from Douglas County totaled \$18.8 million, with crops (predominantly nursery, greenhouse, floriculture, and sod) totaling \$11.7 million and livestock (predominantly cattle and calves) totaling \$7.1 million. Douglas County's nursery output is ranked eighth in the State, whereas its market value of horses, ponies, mules, burros, and donkeys is ranked third in the State. The USDA counts 2,174 total producers in Douglas County.

According to 2018 County Business Patterns data cited in the County Profile, the agriculture, forestry, fishing, and hunting sector includes 25 businesses, 57 employees, and \$1.6 million in annual payroll for Douglas County. Incidence of animal disease and pest infestation can cause economic losses for agricultural businesses in Douglas County and the County as a whole.

Future Changes that May Impact Vulnerability

Understanding future changes that impact vulnerability in the County can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. The County considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development.
- Projected changes in population.
- Other identified conditions as relevant and appropriate, including the impacts of climate change.

Projected Development

As discussed in Sections 4 (County Profile) and 9 (Jurisdictional Annexes), areas targeted for future growth and development have been identified across Douglas County. Land use changes have the potential to render some habitats more susceptible to invasive species, such as clearing the land and providing opportunities for invasive species to inhabit the area. Clearing the land may also reduce the habitat for predator species that could manage the spread of invasive species naturally. The specific areas of development are indicated in tabular form and/or on the hazard maps included in the jurisdictional annexes in Volume II, Section 9 of this plan.

Projected Changes in Population

The population of Douglas County is growing and is expected to continue growing into the future. Any growth can create changes in density throughout the County, which can affect the location of future development projects. As a result, habitat changes can impact the distribution of natural wildlife to mitigate against infestation and invasive species.

Furthermore, infestation to cropland and animals can have a wider impact on persons outside of Douglas County if the farmers within the County supply resources to areas outside of the County. Awareness of trends occurring around the County may reveal that infestations within agricultural and timber commodities provided by the County impacts a greater number of persons.

Climate Change

Climate change could exacerbate the impacts of these species in the County. As mentioned previously, changing weather patterns could create a change in the migration patterns for when these species move into and out of Douglas County. If the species have a more prolonged existence in the County, there may also be a greater number of animal disease or infestation events or a higher value of loss tied to infestation.

Change of Vulnerability since the 2015 HMP

The 2015 HMP did not include Animal Disease/Pest Infestation as a hazard. It is not anticipated that the County's vulnerability to this hazard has changed since 2015.

Issues Identified

The following have been identified as drought-related issues:

- Mass die-offs of vegetation can generate large amounts of fuel for wildfires. Spruce beetles and Douglas-fir beetles continue to result in dead trees in Douglas County and throughout Colorado.
- Animals in Douglas County have experienced Prairie Dog Disease, hantavirus, rabies, and tularemia. These diseases can cause infections in humans, posing serious health risks. The County has experienced an increase in cases of animal bites in the County between 2013-2018. Section 5.4.8 discusses the Pandemic/Disease Outbreak hazard in greater detail.

5.4.2 Dam Failure

The following section provides the hazard profile and vulnerability assessment for the dam failure hazard in Douglas County.

Profile

Hazard Description

Dams are man-made structures built across a stream or river that impound water and reduce the flow downstream (FEMA 2003). They are built for the purpose of power production, agriculture, water supply, recreation, and flood protection. However, at the same time, dams also present a risk to public safety. They require ongoing maintenance, monitoring, and safety inspections. Dam failure is any malfunction or abnormality outside of the design that adversely affects a dam's primary function of impounding water (FEMA 2018). The energy of water stored behind the dam is capable of causing rapid and unexpected flooding downstream, impacting lives and properties. Dams can fail for one or a combination of the following reasons:

- Overtopping caused by floods that exceed the capacity of the dam (inadequate spillway capacity due to uncontrolled release or exceedance of design);
- Prolonged periods of rainfall and flooding;
- Deliberate acts of sabotage (terrorism);
- Structural failure of materials used in dam construction;
- Movement and/or failure of the foundation supporting the dam;
- Settlement and cracking of concrete or embankment dams;
- Piping and internal erosion of soil in embankment dams;
- Inadequate or negligent operation, maintenance and upkeep;

- Failure of upstream dams on the same waterway; or
- Earthquake (liquefaction / landslides) (FEMA 2019).

Regulatory Oversight for Dams

Colorado Dam Safety Program

The Colorado Department of Natural Resources' Division of Water Resources, Dam Safety Branch monitors and regulates dams in Colorado. Dams having a statutory height of 10 feet or greater to the spillway crest or 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. This program is governed by the Code of Colorado Regulations 2CCR-402-1 (Colorado Division of Water Resources 2020). The following structures are exempt from the Rules and Regulations for Dam Safety and Dam Construction (Colorado Secretary of State 2020):

- Highways, road-fills and railroad embankments with an ungated outlet conduit
- Diversion dams if less than jurisdictional size, and all diversion dams of any size if low hazard or NPH
- Refuse embankments
- Structures which only store water below the lowest point of the natural ground unless an outlet works is constructed to develop water

National Dam Safety Act

Potential for catastrophic flooding due to dam failures led to passage of the National Dam Safety Act (Public Law 92-367). The National Dam Safety Program requires a periodic engineering analysis of the majority of 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.

The goal of this FEMA-monitored effort is to identify and mitigate the risk of dam failure so as to protect lives and property. The National Dam Safety Program is a partnership among states, federal agencies, and other stakeholders that encourages individual and community responsibility for dam safety. Under FEMA's leadership, state assistance funds have allowed all participating states to improve their programs through increased inspections, emergency action planning, and purchases of needed equipment. FEMA has also expanded existing and initiated new training programs. Grant assistance from FEMA provides support for improvement of dam safety programs that regulate most of the dams in the United States (FEMA 2020).

U.S. Army Corps of Engineers Dam Safety Program

The U.S. Army Corps of Engineers operates and maintains approximately 700 dams nationwide. It is also responsible for safety inspections of some federal and non-federal dams in the United States that meet the size and storage limitations specified in the National Dam Safety Act. The Corps 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 Corps maintains the National Inventory of Dams, which contains information

about a dam's location, size, purpose, type, last inspection and regulatory status (U.S. Army Corps of Engineers 2020).

Federal Energy Regulatory Commission Dam Safety Program

The Federal Energy Regulatory Commission (FERC) cooperates with a large number of federal and state agencies to ensure and promote dam safety. More than 3,000 dams are part of regulated hydroelectric projects in the FERC program. Two-thirds of these are more than 50 years old. As dams age, concern about their safety and integrity grows, so oversight and regular inspection are important.

FERC inspects hydroelectric projects on an unscheduled basis to investigate the following:

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

Every five years, an independent engineer approved by the FERC must inspect and evaluate projects with dams higher than 32.8 feet (10 meters), or with a total storage capacity of more than 2,000 acre-feet.

FERC monitors seismic research and applies it in performing structural analyses of hydroelectric projects. FERC also evaluates the effects of potential and actual large floods on the safety of dams. During and following floods, FERC visits dams and licensed projects, determines the extent of damage, if any, and directs any necessary studies or remedial measures the licensee must undertake. The FERC publication *Engineering Guidelines for the Evaluation of Hydropower Projects* guides the FERC engineering staff and licensees in evaluating dam safety. The publication is frequently revised to reflect current information and methodologies.

FERC requires licensees to prepare emergency action plans and conducts training sessions on how to develop and test these plans. The plans outline an early warning system if there is an actual or potential sudden release of water from a dam due to failure. The plans include operational procedures that may be used, such as reducing reservoir levels and reducing 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 everyone knows what to do in emergency situations (FERC 2020).

Extent

The Colorado Department of Natural Resources' Division of Water Resources, Dam Safety Branch classifies dams into four categories based on an evaluation of the consequences of the failure of the dam absent flooding conditions.

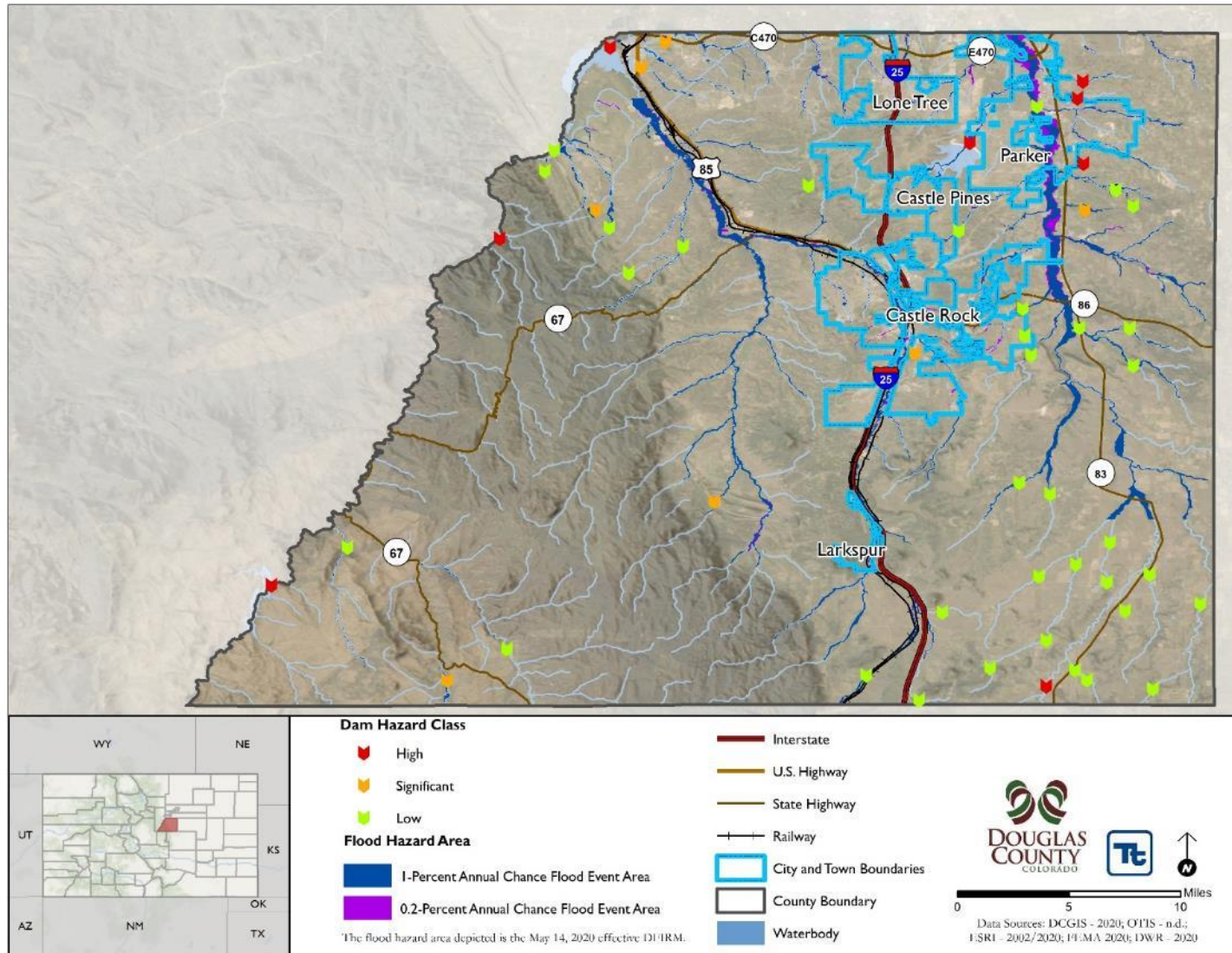
- A "Class I" (High Hazard) dam is a dam for which loss of human life is expected in the event of failure of the dam.
- A "Class II" (Significant Hazard) dam is a dam for which significant damage is expected to occur, but no loss of human life is expected in the event of failure of the dam. Significant 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 which damage will occur only to the dam owner's property in the event of failure of the dam (Code of Colorado Regulations).

Location

There are 51 dams in Douglas County and no levees. Of these dams, 7 are considered high hazard dams, 7 as significant hazard, and 35 as low hazard. Two dams did not have classifications. As of 2020, Douglas County is undertaking a mitigation project that will remove all high-hazard dams in the County. Upon completion, it is anticipated that the County’s risk to dam failures will be virtually eliminated. Figure 5-1 shows the location of these dams in Douglas County.

Figure 5-1. Dams in Douglas County



Source: Douglas County

Table 5-12. Dams in Douglas County

FACILITY NAME	LOCATION	PARCEL OWNER	OWNER TYPE	YEAR BUILT	DAM HAZARD CLASS
CASTLEWOOD RANCH POND B	CASTLE ROCK	TOWN OF CASTLE ROCK	PRIVATE	2003	LOW
MILLION DOLLAR	CASTLE ROCK	SW GREENS PLUM CREEK LLC	PRIVATE	1984	SIGNIFICANT
PARKER BAR CCC	PARKER	TOWN OF PARKER	DISTRICT	1984	LOW
ALLIS	UNINCORPORATED COUNTY	HARMONY LAND AND CATTLE LLC	PRIVATE	1906	LOW
AURORA-RAMPART	UNINCORPORATED COUNTY	CITY OF AURORA	CITY	1964	SIGNIFICANT
BAIRD #1	UNINCORPORATED COUNTY	COLORADO DEPT OF TRANSPORTATION	PRIVATE	1907	LOW
CHAMBERS RESERVOIR	UNINCORPORATED COUNTY	ARAPAHOE COUNTY WATER & WASTEWATER AUTHORITY	COUNTY	2012	HIGH
CHATFIELD DAM	UNINCORPORATED COUNTY	UNITED STATES OF AMERICA STATE OF COLORADO PARKS DEPT	<NULL>	<NULL>	<NULL>
CHEESMAN	UNINCORPORATED COUNTY	CITY & COUNTY OF DENVER	DISTRICT	1905	HIGH
CIRCLE 2 RANCH DET. #1	UNINCORPORATED COUNTY	REATA SOUTH METRO DISTRICT	DISTRICT	1964	LOW
FRANKTOWN PARKER FPA-1	UNINCORPORATED COUNTY	TONY M WARREN	COUNTY	1963	LOW
FRANKTOWN PARKER FPA-2	UNINCORPORATED COUNTY	HARMONY LAND AND CATTLE LLC	COUNTY	1963	LOW
FRANKTOWN PARKER FPA-4	UNINCORPORATED COUNTY	JOSEPH V TODD JR & MICHELE L TODD	COUNTY	1963	LOW
FRANKTOWN PARKER FPA-5	UNINCORPORATED COUNTY	HARMONY LAND AND CATTLE LLC	COUNTY	1963	LOW
FRANKTOWN PARKER FPA-6	UNINCORPORATED COUNTY	HARMONY LAND AND CATTLE LLC	COUNTY	1963	LOW
FRANKTOWN PARKER FPB-1	UNINCORPORATED COUNTY	CENTENNIAL RANCH HOMEOWNERS ASSOCIATION	COUNTY	1963	HIGH
FRANKTOWN PARKER FPE-7	UNINCORPORATED COUNTY	FLYING HORSE RANCH LLC	COUNTY	1964	LOW
FRANKTOWN PARKER FPE-8	UNINCORPORATED COUNTY	RONALD L PIETRAFESO & ADRIENNE E PIETRAFESO	COUNTY	1965	LOW
FRANKTOWN PARKER FPLG-1	UNINCORPORATED COUNTY	KEITH R PENRY & KAREN E PENRY	COUNTY	1962	LOW
FRANKTOWN PARKER FPLG-2	UNINCORPORATED COUNTY	TODD C MUCK	COUNTY	1962	LOW

FACILITY NAME	LOCATION	PARCEL OWNER	OWNER TYPE	YEAR BUILT	DAM HAZARD CLASS
FRANKTOWN PARKER FPM-1	UNINCORPORATED COUNTY	TENBAR INC	COUNTY	1962	LOW
FRANKTOWN PARKER FPP-1	UNINCORPORATED COUNTY	RANDY LASTAR & SARAH LASTAR	COUNTY	1963	HIGH
FRANKTOWN PARKER FPR-1	UNINCORPORATED COUNTY	INDIANOLA FARM INC	COUNTY	1964	LOW
FRANKTOWN PARKER FPR-2	UNINCORPORATED COUNTY	STEPHEN MALCOLM STRACHAN TRUST	COUNTY	1964	LOW
FRANKTOWN PARKER FPS-1	UNINCORPORATED COUNTY	DOUGLAS COUNTY BOARD OF COUNTY COMMISSIONERS	COUNTY	1963	HIGH
FRANKTOWN PARKER FPW-1	UNINCORPORATED COUNTY	LOST CANYON LLC	COUNTY	1963	LOW
GREENLAND L&C STOCKWATER	UNINCORPORATED COUNTY	HARMONY LAND AND CATTLE LLC	PRIVATE	1950	LOW
J. O. HILL	UNINCORPORATED COUNTY	WESTCREEK LAKES WATER DIST	DISTRICT	1964	SIGNIFICANT
JOE BLAKE WATER TREATMENT PLANT FOREBAY	UNINCORPORATED COUNTY	CENTENNIAL WATER & SAN DISTRICT	DISTRICT	1986	SIGNIFICANT
KIWANIS	UNINCORPORATED COUNTY	YMCA OF THE PIKES PEAK REGION INC C/O PROPERTY TAX DEPARTMENT	PRIVATE	1956	LOW
LAMBERT #3	UNINCORPORATED COUNTY	LAMBERT RANCH ASSOCIATION INC	DISTRICT	1996	LOW
LEMON GULCH	UNINCORPORATED COUNTY	LEMON GULCH LLC	PRIVATE	<NULL>	LOW
NELSON	UNINCORPORATED COUNTY	TOM BARENBERG	PRIVATE	1953	LOW
PINERY	UNINCORPORATED COUNTY	DENVER SOUTHEAST SUBURBAN WATER & SANITATION DISTRICT	DISTRICT	1970	SIGNIFICANT
PINERY #11 DETENTION POND	UNINCORPORATED COUNTY	DOUGLAS COUNTY BOARD OF COUNTY COMMISSIONERS	COUNTY	1988	LOW
PLATTE CANYON	UNINCORPORATED COUNTY	CITY & COUNTY OF DENVER BOARD OF WATER COMMISSIONERS	DISTRICT	1904	LOW
POND 14	UNINCORPORATED COUNTY	RAVENNA METRO DISTRICT	PRIVATE	2006	LOW
RAINBOW FALLS #5	UNINCORPORATED COUNTY	DOUGLAS L JAMESON & SUSAN L JAMESON & MARGARET SERVAAS	PRIVATE	1957	LOW
RUETER HESS	UNINCORPORATED COUNTY	PARKER WATER & SANITATION DISTRICT	DISTRICT	2012	HIGH
SANCTUARY POND NO. 14	UNINCORPORATED COUNTY	SANCTUARY INC C/O RUDY ZUPETZ	PRIVATE	1996	LOW
SPRING GULCH	UNINCORPORATED COUNTY	UNITED STATES OF AMERICA STATE OF COLORADO PARKS DEPT	FEDERAL	1973	SIGNIFICANT

FACILITY NAME	LOCATION	PARCEL OWNER	OWNER TYPE	YEAR BUILT	DAM HAZARD CLASS
SPRUCE MOUNTAIN	UNINCORPORATED COUNTY	SPRUCE MOUNTAIN PROPERTIES INC C/O SEMA CONSTRUCTION	PRIVATE	2002	LOW
STILLWATER	UNINCORPORATED COUNTY	CHARLES WHITESIDE	PRIVATE	1999	LOW
STRONTIA SPRINGS DAM AND RESERVOIR	UNINCORPORATED COUNTY	BETTGER CABIN TRUST	DISTRICT	<NULL>	<NULL>
W. CHERRY CREEK DET. #10	UNINCORPORATED COUNTY	DONNA J HARTMAN	COUNTY	1961	LOW
W. CHERRY CREEK DET. #11	UNINCORPORATED COUNTY	TERRY P OHLMAN	PRIVATE	1961	LOW
W. CHERRY CREEK DET. #7	UNINCORPORATED COUNTY	JAKE W THEKEN 2011 TRUST	COUNTY	1959	HIGH
W. CHERRY CREEK DET. #8	UNINCORPORATED COUNTY	CHARLES A KASTENS & CHRISTINE K KASTENS	COUNTY	1960	LOW
W. CHERRY CREEK DET. #9	UNINCORPORATED COUNTY	ROBERT LESTER COLODNY & JESSICA M COLODNY	COUNTY	1960	LOW
WAKEMAN	UNINCORPORATED COUNTY	DOUGLAS COUNTY BOARD OF COUNTY COMMISSIONERS	COUNTY	1959	LOW
WAUCONDA	UNINCORPORATED COUNTY	PERRY PARK COUNTRY CLUB INC	PRIVATE	1974	SIGNIFICANT

Source: Colorado Division of Water Resources Dam Safety Branch; Douglas County

*One Acre Foot=326,000 gallons

Previous Occurrences and Losses

According to available records from the Douglas County 2015 HMP, State of Colorado 2018 HMP, 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.

Table 5-13: Dam Incidents in Douglas County, Colorado

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 a State Park.
Unknown	J.O. Hill Dam	The Dam experienced a storm which generated a 100-year rainfall event on approximately 15% of the Dam’s 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 previously-unobserved 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	The Two Buttes Dam does not comply with the State’s Dam Safety Rules. Following a period of heavy rainfall, the reservoir level rose significantly. This raised concern that the spillway could flow and overtop the dam. The EAP was activated in response.
September 18, 2013	Gaynor	The owner of the Gaynor Dam reported seepage at the piping around the outlet works. 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 EAP.

Source: Association of State Dam Officials; Douglas County; History Colorado; National Inventory of Dams; National Performance of Dams Program; State of Colorado Hazard Mitigation Plan

Climate Change Projections

Climate change is anticipated to cause extreme precipitation events that strain dam infrastructure. With dams designed based on a river’s behavior, physical attributes, and basin-wide drainage patterns, dams are very sensitive to hydrologic changes caused by climate change and can cause decreases in safety margins (State of Colorado HMP 2018). According to NOAA, models predicting future precipitation changes owing to climate change are highly variable, with outcomes ranging between a 5% decrease to a 6% increase through 2050. The lack of agreement on precipitation outcomes indicates that there is a broad range of potential outcomes regarding water resources in the State of Colorado (NOAA 2014). Earthfill dams may be vulnerable to changes in vegetation due to drought, and non-erodible dams may be at risk due to extreme temperatures causing cracking or joint movement (State of Colorado HMP 2018).

Probability of Future Occurrences

The likelihood of a dam failure in Douglas County is difficult to predict. For dams, the risk of a failure increases for each dam as the dam’s age increases and/or frequency of maintenance decreases. Future climate change may impact storm patterns, increasing the probability of more frequent, intense storms with

varying duration. Since dam overtopping are often caused by excessive rainfall, it is appropriate to relate the future vulnerability of dams directly with the potential for more intense rainfall in the County.

There has been only one structural failure of a dam in Douglas County's history, which 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 failure incidents though some dams have experienced structural issues as reported in the previous section. The County's dam mitigation project will remove high hazard dams and is anticipated to mitigate the risk to human life from dam failures. Based on the lack of historical occurrences, the probability of a future event is considered *low* (not likely to occur in 100 years). Refer to Section 5.3 for additional information on the hazard ranking methodology and probability criteria.

Vulnerability Assessment

To understand risk, a community must evaluate assets exposed to and vulnerable to the identified hazard. The entire Douglas County is exposed and vulnerable to the dam failure hazard; therefore, all assets within the County (population, structures, critical facilities, and lifelines), as described in Section 4 (County Profile), are potentially vulnerable to a dam event. The following text evaluates and estimates the potential impact of the dam failure hazard in the County.

Impact on Life, Health and Safety

Dam failure impacts depend on several factors including severity of the event and whether or not adequate warning time is provided to residents. The population living in or near the inundation areas are considered exposed to the hazard. However, exposure should not be limited only to those who reside within a defined hazard zone, but everyone who may be affected by a hazard event (e.g., people are at risk while traveling in flooded areas, or their access to emergency services is compromised during an event); the degree of that impact varies and is not strictly measurable.

Vulnerable populations are all populations downstream from dam failures that are incapable of escaping the area within the allowable time frame. This population includes the elderly, young and individuals with disabilities, access or functional needs who may be unable to get themselves out of the inundation area. The vulnerable population also includes individuals who would not have adequate warning from the emergency warning system (e.g., television or radio); this would include residents and visitors. The population adversely affected by a dam failure may also include those beyond the disaster area that rely on the dam for providing potable water.

Floods created from a 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. For more detailed descriptions of these and additional threats to public health and safety, refer to Section 5.4.6 (Flood). 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.

Dam failures are severe threats to life and property in Douglas County. Areas downstream at a lower elevation are the most vulnerable to losses associated with a dam failure.

Impact on General Building Stock

Vulnerable properties are those closest to the dam inundation area. These properties would experience the largest, most destructive surge of water. Low-lying areas are also vulnerable since they are where the dam waters would collect. 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. Those that are most vulnerable are those that are already in poor condition and would not be able to withstand a large water surge. Utilities such as overhead power lines, cable and phone lines could also be vulnerable. Loss of these utilities could create additional isolation issues for the inundation areas.

Impact on Critical Facilities

Transportation routes are vulnerable to dam inundation and have the potential to be severely damaged, causing isolation for communities with limited access and significant disruption to travel, including all roads, railroads and bridges in the path of the dam inundation. Those that are most vulnerable are those that are transportation lifelines that are already in poor condition and would not be able to withstand a large water surge. Utilities such as overhead power lines, cable and phone lines in the inundation zone could also be vulnerable. 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.

Impact on the 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.

Impact on the Environment

The environment is vulnerable to a number of risks in the event of a dam failure. Water releases from dams usually contain very little suspended sediment; this can lead to scouring of river beds and banks. The inundation may introduce foreign elements into local waterways, resulting in destruction of downstream habitat and impacting many animal and plant species, especially endangered species. The subsequent rush of water downstream can rapidly increase flow rate and turbidity of streams and rivers in minor dam failures or overwhelm terrestrial habitat with floodwaters in severe dam failure events.

Dam failures can often result in the release of hazardous materials, either 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 take place upstream. After the flood waters subside, contaminated and flood damaged building materials and contents must be properly disposed. Contaminated sediment must be removed from buildings, yards and properties.

Dam failures may result in significant water quality and debris disposal issues. Flood waters can back up sanitary sewer systems and inundate wastewater treatment plants, causing raw sewage to contaminate residential and commercial buildings and the flooding waterway. The contents of unsecured containers of

oil, fertilizers, pesticides and other chemicals get added to flood waters. Water supplies and wastewater treatment could be off-line for weeks. After the flood waters subside, contaminated and flood damaged building materials and contents must be disposed of properly.

Future Changes that May Impact Vulnerability

Understanding future changes that effect vulnerability in the County can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The County considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development
- Projected changes in population
- Other identified conditions as relevant and appropriate, including the impacts of climate change

Projected Development

Any areas of growth could be potentially impacted by the dam failure hazard because the entire County is exposed and vulnerable. Areas downstream at a lower elevation are the most vulnerable to losses associated with a dam failure; therefore, any development downstream from dams will be more susceptible to dam failure impacts.

Projected Changes in Population

The County has experienced an increase in population between the 2010 Census (285,465) and the estimated 2018 American Community Survey estimated population of 328,614. The population of the County is expected to increase over the next few years. The increase in population will expose more people to the dam failure hazard.

Climate Change

An increasing average annual temperature will directly impact the atmospheric moisture potential. The probability of expanding atmospheric moisture leads to an increasing amount of rainfall during storm events. The increased potential volume of rainfall will directly lead to an increasing pressure placed on dam systems during future riverine flood events. Additionally, the aging dams increase the possibility of dam failure and the risk of catastrophic flooding inside dam inundation zones. Finally, increased drought conditions and changes in vegetation, along with more frequent fluctuations in water levels, may cause erosion along embankments. This will make earthfill dams more vulnerable (State of Colorado HMP 2018).

Change of Vulnerability Since the 2015 HMP

Douglas County's population increased since the last plan; increasing the number of people vulnerable during a dam failure event. Though there is a relatively small number of people living in the shadow of the dam, an increasing population means that the overall impacts to County residents will increase. The County's ongoing mitigation project will continue to reduce the vulnerability to the hazard.

Identified Issues

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

- The County is actively mitigating existing high hazard dams. The dams will be converted and de-certified, resulting in the removal of all high hazard dams currently in the County.
- Dam failures can occur from periods of heavy rain, flooding, earthquakes, and landslides.
- Dam infrastructure may require repair and improvement to withstand climate change impacts, such as changing in the timing and intensity of rain events.

5.4.3 Drought

This section provides a hazard profile and vulnerability assessment of the drought hazard for Douglas County.

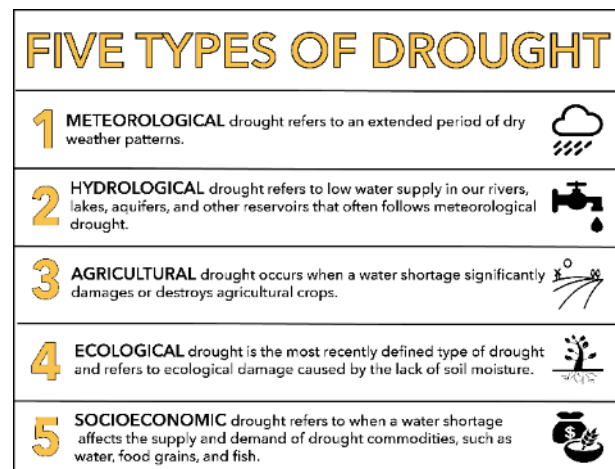
Hazard Profile

This section presents information regarding the description, extent, location, previous occurrences and losses, climate change projections and probability of future occurrences for the drought hazard.

Description

Drought is defined as the consequence of a natural reduction in the average amount of precipitation expected over an extended period of time, usually over a period of multiple years (State of Colorado HMP 2018). Drought conditions occur in virtually all climatic zones. Drought characteristics vary significantly from one region to another and are relative to the normal precipitation in that region. Drought can increase wildfire/brush fire risk and can affect agriculture, water supply, aquatic ecology, wildlife, and plant life. There are five classifications of drought, as presented in Figure 5-2

Figure 5-2: Types of Drought



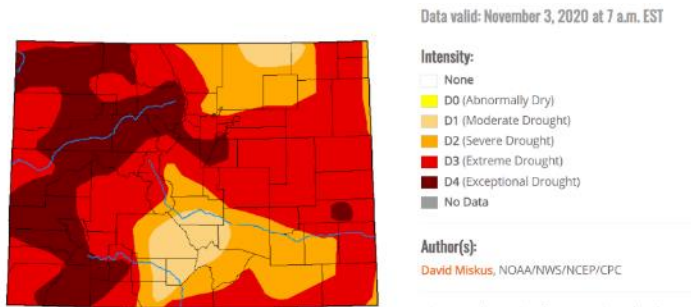
Source: University of Nevada Cooperative Extension 2020

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, as described in the Palmer Drought Severity Index (PDSI).

U.S. Drought Monitor

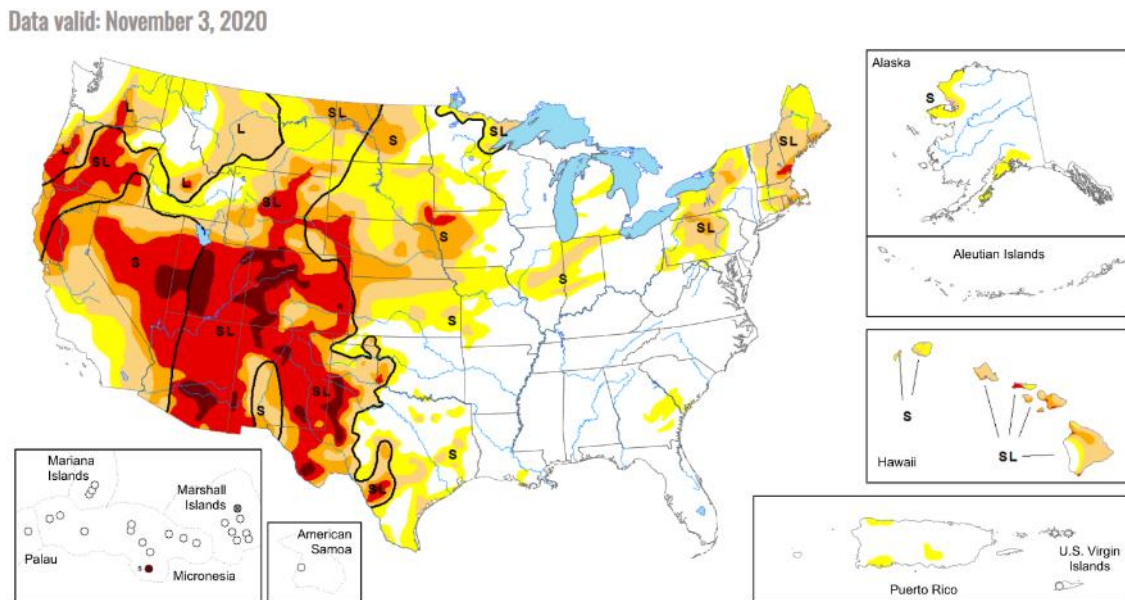
Figure 5-3 Drought Map for November 3, 2020



The U.S. Drought Monitor (USDM) is a map that shows the location and intensity of drought across the United States. The data is updated every Tuesday and the map is released on Thursdays. The USDM uses a five-category system, labeled Abnormally Dry or D0, (a precursor to drought, not actually drought), and Moderate (D1), Severe (D2), Extreme (D3) and

Exceptional (D4) Drought. Drought categories show experts' assessments of conditions related to dryness and drought including observations of how much water is available in streams, lakes, and soils compared to usual for the same time of year. USDM data goes back to 2000 (National Integrated Drought Information System 2020). Figure 5-4 shows the USDM for November 3, 2020. The figure shows that Douglas County was in a period of Exceptional Drought (D4) in the western portion of the County and Extreme Drought (D3) in the eastern portion of the County.

Figure 5-4. U.S. Drought Monitor for November 3, 2020



Palmer Drought Severity Index

The Palmer Drought Severity Index (PDSI) is primarily based on soil conditions. Soil with decreased moisture content is the first indicator of an overall moisture deficit. Table 5-14 lists the PDSI classifications. At the one end of the spectrum, 0 is used as normal and drought is indicated by negative numbers. For example, -2 is moderate drought, -3 is severe drought, and -4 is extreme drought. The PDSI can reflect excess precipitation using positive numbers; however, this is not shown in Table 5-14. The PDSI is commonly converted to the Palmer Drought Category (National Drought Mitigation Center [NDMC] 2013).

Table 5-14. Palmer Drought Category and Palmer Drought Index Descriptions

Category	Description	Possible Impacts (for Colorado)	Palmer Drought Index
D0	Abnormally Dry	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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: NDMC 2013 and 2020

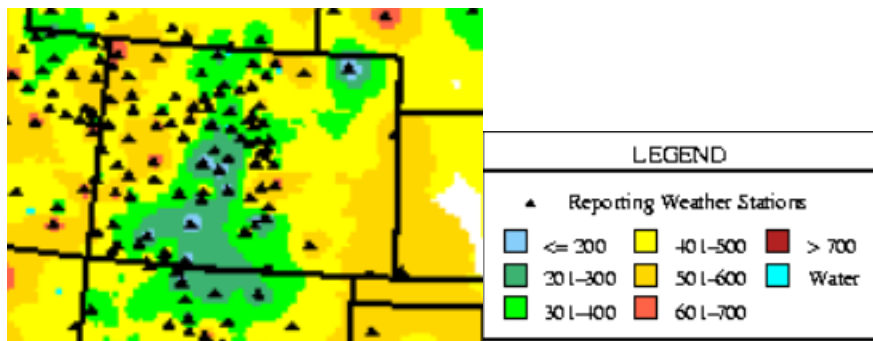
Keetch-Byram Drought Index (KBDI)

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

The KBDI is an index used in determining forest fire potential. The drought index is based on a daily water balance, where a drought factor is balanced with precipitation and soil moisture (assumed to have a maximum storage capacity of eight-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 2020). This index is derived from weather station latitude, maximum dry bulb temperature, mean annual precipitation, and the previous 24 hours of rainfall. Figure 5-5 shows the KBDI for Douglas County for November 9, 2020. The figure shows KBDI value of 200-300 for Douglas County.

	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 will 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.

Figure 5-5. KBDI for the State of Colorado, November 9, 2020



Location

A drought occurs on a regional scale; therefore, all of Douglas County is vulnerable and at risk. Droughts can occur at any time and have the potential to impact every person directly or indirectly in the County, as well as the local economy.

Previous Occurrences and Losses

Between 1953 and 2020, there was one Federal Emergency Management Agency (FEMA)-declared major disaster (DR) or emergency (EM) in the State of Colorado. Generally, drought-related disasters affect a wide region of the state and can impact many counties. Douglas County was included in the disaster declaration.

Table 5-15 FEMA Disaster Declarations for Douglas County

Designation Number	Incident Date(s)	Description of Disaster
EM-3025	January 29, 1977	Drought

The U.S. Department of Agriculture (USDA) keeps records of agricultural disasters. Between 2013 and 2020, Douglas County was included in eight declarations related to drought. Crop losses due to drought in Douglas County were reported in 2018.

Table 5-16. USDA Disaster Declarations for Douglas County, CO between 2013 and 2020

Designation Number	Begin Date	End Date	Description of Disaster	Damages
S3627	11/1/2013	12/26/2013	Drought	N/A
S4145	11/15/2016	N/A	Drought	N/A
S4331	4/3/2018	N/A	Drought	N/A
S4334	4/10/2018	N/A	Drought	N/A
S4468	11/1/2018	N/A	Drought	N/A
S4703	6/16/2020	N/A	Drought	N/A
S4798	7/21/2020	N/A	Drought	N/A
S4848	8/25/2020	N/A	Drought	N/A

Source: USDA Risk Management Agency 2020; USDA Farm Service Agency 2020

Based on available historical records, Douglas County has experienced to drought events, of all magnitudes. Table 5-11 lists known drought events between 2014 and 2020 that have occurred in Douglas County, as reported by NCEI, USDA, and U.S. Drought Monitor. Historical drought information shows drought activity across the County.

Table 5-17. Drought Events in Douglas County, CO between 2014 and 2020

Dates of Event	Duration	Event Details*
September 27, 2016–May 9, 2017	32 weeks/7.5 months	Nearly all of Douglas County was impacted by Moderate Drought conditions. In mid-March through early April 2017, portions of the County experienced a Severe Drought.
January 9, 2018 – August 14, 2018	31 weeks/7 months	Moderate Drought conditions
January 8, 2019 – March 12, 2019	9 weeks/2 months	Moderate Drought conditions
October 1, 2019 – November 5, 2019	5 weeks/1 month	Moderate Drought conditions for up to 10% of County residents.
May 19, 2020 – Present	26 weeks/6 months	A severe drought persisted from September 2020 through early October and impacted up to 41% of the County’s population. In October, the drought was classified as an exceptional drought. As of January 12, 2021, more than half of the County is in exceptional drought conditions.

Sources: USDA 2020; U.S. Drought Monitor 2020

* Many sources were consulted to provide an update of previous occurrences and losses; event details and loss/impact information may vary and has been summarized in the above table.

Climate Change Projections

Climate is defined not simply as average temperature and precipitation but also by the type, frequency and intensity of weather events. Both globally and at the local scale, climate change has the potential to alter the prevalence and severity of extremes such as droughts. While predicting changes of drought events under a changing climate is difficult, understanding vulnerabilities to potential changes is a critical part of estimating future climate change impacts on human health, society and the environment (U.S. Environmental Protection Agency [EPA], 2006).

In Colorado, predictions for future precipitation change are divergent. Projections under different emissions scenarios show annual changes between -5% and +6% by 2050 under RCP 4.5m and between -3% and +8% under RCP 8.5 by 2050. Projections also anticipate increased winter precipitation by 2050, but less precipitation falling during the May-September growing season. Projections indicate that average annual streamflow for most Colorado river basins will decrease by up to 30% due to the impacts of warmer

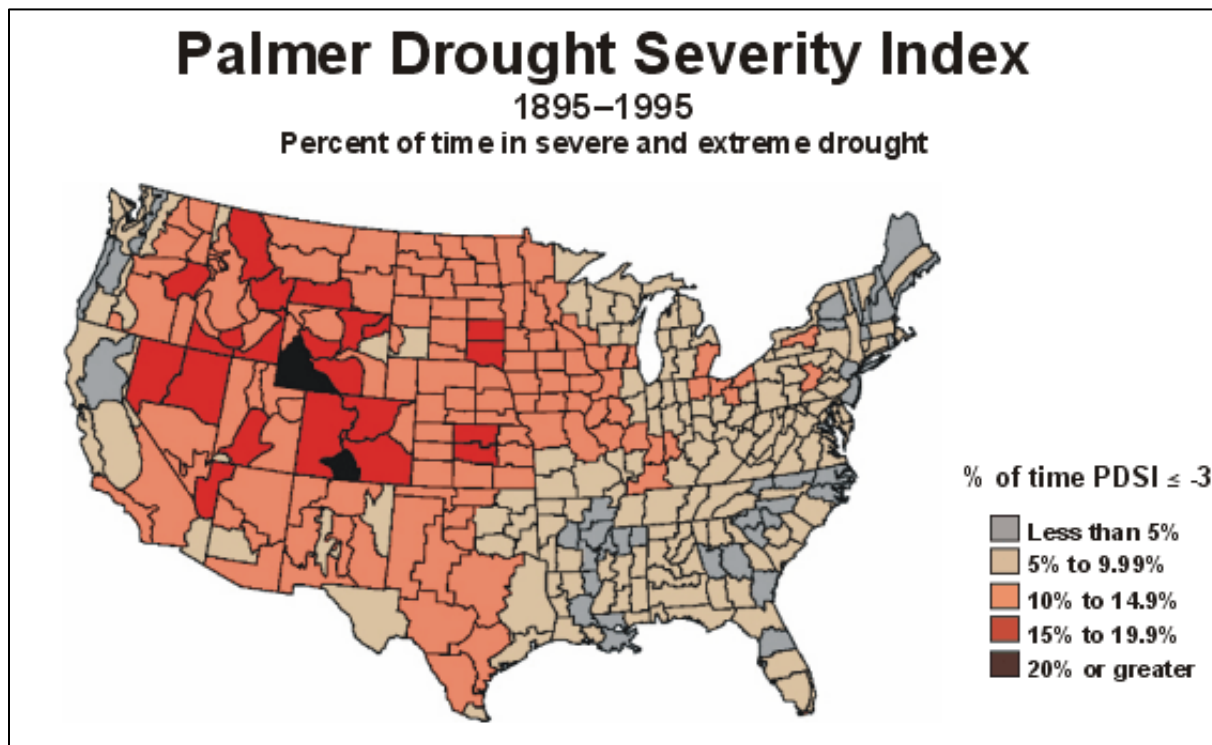
temperatures upon streamflow. However, some projections show increases in precipitations that may compensate for the impact of warming and thus lead to an increase of runoff. It is anticipated that droughts in the future will have more significant impacts than historic droughts due to lower streamflows resulting from warmer temperatures. Increasing temperatures will also cause winter precipitation to fall as rain rather than snow and decrease overall snowpack. This will affect water availability and seasonality.

With a warmer climate, droughts can become more frequent, more severe, and longer-lasting. According to the National Climate Assessment, variable precipitation and rising temperatures are intensifying droughts, increasing heavy downpours, reducing snowpack, and causing declines in water survey quality. Future warming will add to the stress on water supplies and impact the availability of water supply (U.S. Global Change Research Program 2018).

Probability of Future Occurrences

The frequency of droughts is difficult to forecast as drought occurrences are cyclical in nature and will occur in the future. Based on national annual data from 1895 to 1995, Douglas County underwent severe or extreme conditions approximately 15 to 19.9% of the time (illustrated in Figure 5-6).

Figure 5-6 Palmer Drought Severity Index (1895 to 1995)



Source: National Drought Mitigation Center 2020

For the 2021 HMP update, the most up-to-date data was collected to calculate the probability of future occurrence of drought events, of all magnitudes, for Douglas County. Information from NOAA-NCEI storm events database, the 2018 State of Colorado HMP, the 2015 Douglas County HMP, and the Drought Monitor were used to identify the number of drought events that occurred between 2000 and 2020. Using

these sources ensures the most accurate probability estimates possible. Table 5-18 presents the probability of future occurrence of drought events in Douglas County.

Table 5-18. Probability of Future Drought Events in Douglas County

Hazard Type	Number of Occurrences Between 2000 and 2020	Percent chance of occurrence in any given year
Drought	15	71%

Sources: NOAA NCEI 2020, State of Colorado 2018, Douglas County 2015, Drought Monitor
 Note: Occurrences include all calendar years for which a portion of the County was designated D2 (Moderate Drought).

Based on the 15 recorded drought events over 20 years, Douglas County typically experiences a drought in a given year. Some drought events have lasted multiple years. A drought event has a 71% chance of occurring in any given year in Douglas County. Based on the history of events and input from the Core Planning Team, the probability for drought occurring in the County is considered *frequent* (hazard event is likely to occur within 25 year). Refer to Sections 5.1 and 5.3 for additional information on the hazard ranking methodology and probability criteria.

Vulnerability Assessment

To understand risk, a community must evaluate assets exposed to and vulnerable to the identified hazard. The entire Douglas County is exposed to the drought hazard; therefore, all assets within the County (population, structures, critical facilities, and lifelines), as described in Section 4 (County Profile), are potentially vulnerable to a drought event. The following text evaluates and estimates the potential impact of the drought hazard in the County.

Impact on Life, Health, and Safety

The entire population of Douglas County is vulnerable to drought events (2018 American Community Survey 5-Year Estimate: 328,614 people). Drought conditions 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 age, health conditions, and limited ability to mobilize to shelters, cooling, and medical resources, the infirm, young, and elderly are particularly susceptible to drought and extreme temperatures, sometimes associated with drought conditions. Some drought-related health effects are short term, while others can be long term (CDC 2012).

Impact on General Building Stock

A drought event is not expected to directly affect any structures; however, a secondary hazard most commonly associated with drought is wildfire. Prolonged lack of precipitation dries out vegetation, which becomes increasingly susceptible to ignition as the duration of the drought extends. Though some structures can become vulnerable to wildfire that are within or near the wildfire urban interface, this is more likely following long periods of drought. Refer to Section 5.4.17 of the HMP for additional discussion of the wildfire hazard in Douglas County.

Impact on Critical Facilities

Water supply facilities may be affected by drought events. However, a majority of the critical facilities defined for this plan will continue to be operational during a drought.

Impact on the 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 can lead to other losses because so many sectors are affected—losses that include reduced income for farmers and 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.

Future Changes that May Impact Vulnerability

Understanding future changes that impact vulnerability in the County can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. The County considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development.
- Projected changes in population.
- Other identified conditions as relevant and appropriate, including the impacts of climate change.

Projected Development

Any areas of growth could be potentially 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 the available water resources. An increased drain on water resources would not only impact the county's population, but it would also exacerbate impacts to other areas of the county as discussed above, including agriculture and recreational facilities.

Projected Changes in Population

The County has experienced an increase in population between the 2010 Census (285, 465) and the estimated 2018 American Community Survey estimated population of 328,614. The population of the County is expected 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 demands 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.

Climate Change

As discussed earlier, climate change has the potential to impact the number of and the severity of droughts. In Colorado, the variability of precipitation changes and the nature of precipitation changes poses a serious threat for Douglas County. An increased incidence of drought might impact availability of water supplies, primarily placing an increased stress on the population. It is unlikely that structure exposure and

vulnerability would increase as a direct result of drought, although secondary impacts of drought, such as wildfire, could increase and threaten structures. If a wildfire were to occur during a drought, emergency services might face complications from a water shortage depending on their water source, and critical water-related service sectors might need to adjust management practices and actively manage resources. Increased incidence of drought increases the potential for impacts on the local economy, including the production of agricultural products.

Change of Vulnerability since the 2015 HMP

The 2015 HMP provided a summary of historic loss information and qualitative assessment for the drought hazard. For this HMP Update, a qualitative assessment was conducted for population, buildings and critical facilities. According to the U.S. Census Bureau 2018 Population Estimates, the population of Douglas County has increased since the 2010 Census; therefore, the number of people exposed to the drought hazard has increased. Overall, the County will continue to be exposed and vulnerable to drought events.

Issues Identified

The following have been identified as drought-related issues:

- The County's agricultural economy may face continued losses due to drought.
- The probability of drought frequencies and durations may increase due to climate change.
- The promotion of active water conservation even during non-drought periods should be encouraged.
- With the possibility of climate change, drought may become a larger issue due to warming trends and wider fluctuations in rainfall patterns that reduce snowpack.

5.4.4 Earthquake

This section provides a profile and vulnerability assessment for the earthquake hazard for Douglas County.

Hazard Profile

Description

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 by a manmade explosion (Federal Emergency Management Agency [FEMA] 2001, Shedlock and Pakiser 1995). Most earthquakes occur at the boundaries where the Earth's tectonic plates meet (faults); less than 10 percent of earthquakes occur within plate interiors. As plates continue to move and plate boundaries change geologically over time, weakened boundary regions become part of the interiors of the plates. These zones of weakness within the continents can cause earthquakes in response to stresses that originate at the edges of the plate or in the deeper crust (Shedlock and Pakiser 1995).

The location of an earthquake is commonly described by its focal depth and the geographic position of its epicenter. Focal depth of an earthquake is depth from earth's surface to the region where an earthquake's energy originates (the focus or hypocenter). The epicenter of an earthquake is the point on the earth's surface directly above the hypocenter (Shedlock and Pakiser 1997). Earthquakes usually occur without warning, and their effects can impact areas a great distance from the epicenter (FEMA 2001).

According to the U.S. Geological Society (USGS) Earthquake Hazards Program, an earthquake hazard is any disruption associated with an earthquake that may affect residents' normal activities. This includes surface faulting, ground shaking, landslides, liquefaction, tectonic deformation, tsunamis, and seiches; each of these terms is defined below:

- *Surface faulting*: Displacement that reaches the earth's surface during a slip along a fault. Commonly occurs with shallow earthquakes—those with an epicenter less than 20 kilometers.
- *Ground motion (shaking)*: The movement of the earth's surface from earthquakes or explosions. Ground motion or shaking is produced by waves that are generated by a sudden slip on a fault or sudden pressure at the explosive source and travel through the Earth and along its surface.
- *Landslide*: A movement of surface material down a slope.
- *Liquefaction*: A process by which water-saturated sediment temporarily loses strength and acts as a fluid, like the wet sand near the water at the beach. Earthquake shaking can cause this effect. Liquefaction susceptibility is determined by the geological history, depositional setting, and topographic position of the soil. Liquefaction effects may occur along the shorelines of the ocean, rivers, and lakes and they can also happen in low-lying areas away from water bodies in locations where the ground water is near the earth's surface.
- *Tectonic Deformation*: A change in the original shape of a material caused by stress and strain.
- *Tsunami*: A sea wave of local or distant origin that results from large-scale seafloor displacements associated with large earthquakes, major sub-marine slides, or exploding volcanic islands.
- *Seiche*: The sloshing of a closed body of water, such as a lake or bay, from earthquake shaking (USGS 2012).

Extent

An earthquake's magnitude and intensity are used to describe the size and severity of the event. Magnitude describes the size at the focus of an earthquake and intensity describes the overall felt severity of shaking during the event. The earthquake's magnitude is a measure of the energy released at the source of the earthquake. Magnitude was formerly expressed by ratings on the Richter scale but is now most commonly expressed using the moment magnitude (M_w) scale. This scale 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 $M_w > 8$
- Major $M_w = 7.0-7.9$
- Strong $M_w = 6.0-6.9$
- Moderate $M_w = 5.0-5.9$
- Light $M_w = 4.0-4.9$
- Minor $M_w = 3.0-3.9$
- Micro $M_w = 3.0-3.9$

The most commonly 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 5-19. The modified Mercalli intensity scale is generally represented visually using shake maps, which show the expected ground shaking at any given location produced by an earthquake with a specified magnitude and epicenter. An earthquake has only one magnitude and one epicenter, but it produces a range of ground shaking at sites throughout the region. 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. A USGS shake map shows the variation of ground shaking in a region immediately following significant earthquakes. Table 5-19 displays the MMI scale and its relationship to the areas peak ground acceleration.

Table 5-19 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 2016c

Table 5-20. Modified Mercalli Intensity and PGA Equivalents

Modified Mercalli Intensity	Acceleration (%g) (PGA)	Perceived Shaking	Potential Damage
I	< 0.17	Not Felt	None
II	0.17–1.4	Weak	None
III	0.17–1.4	Weak	None
IV	1.4–3.9	Light	None
V	3.9–9.2	Moderate	Very Light
VI	9.2–18	Strong	Light
VII	18–34	Very Strong	Moderate
VIII	34–65	Severe	Moderate to Heavy
IX	65–124	Violent	Heavy
X	>124	Extreme	Very Heavy

Source: Freeman et al. (Purdue University) 2004

Note: PGA 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. Damage levels

experienced in an earthquake vary with the intensity of ground shaking and with the seismic capacity of structures, as noted in Table 5-21.

Table 5-21. Damage Levels Experienced in Earthquakes

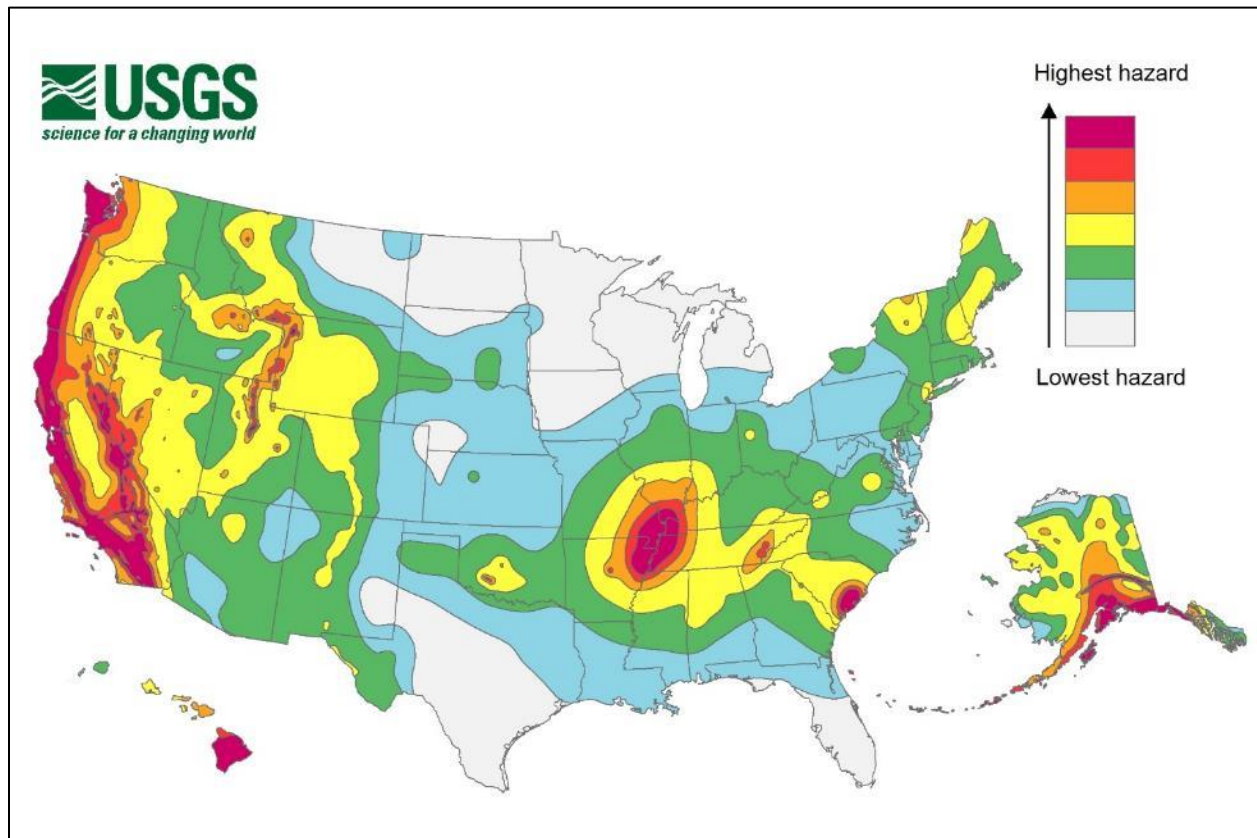
Ground Motion Percentage	Explanation of Damages
1-2%g	Motions are widely felt by people; hanging plants and lamps swing strongly, but damage levels, if any, are usually very low.
Below 10%g	Usually causes only slight damage, except in unusually vulnerable facilities.
10 - 20%g	May cause minor-to-moderate 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: NJOEM 2014

Note: %g Peak Ground Acceleration

National maps of earthquake shaking hazards 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 et al. 2001). The USGS updated the National Seismic Hazard Maps in 2018. New seismic, geologic, and geodetic information on earthquake rates and associated ground shaking were incorporated into these revised maps. The 2018 map represents the best available data, as determined by the USGS (see Figure 5-7). The figure shows that Douglas County has a moderate earthquake hazard relative to the Country.

Figure 5-7. Peak Ground Accelerations Map, 2% PGA in 50 Years



Source: USGS 2020

The Hazus earthquake model was run for two mean return period (MRP) events in Douglas County to provide a range of potential scenarios and associated impacts—the 500-year MRP event and the 2,500-year MRP event. Figure 5-8 and Figure 5-9 illustrate geographic distributions of the Modified Mercalli Scale based on PGAs (g) across Douglas County at the census-tract level for these two events. A 500-year MRP event is an earthquake with a 0.4 percent chance that mapped ground motion levels (PGA) will be exceeded in any given year. Douglas County is estimated to experience not felt shaking during a 500-year event. A 2,500-year MRP is an earthquake with 0.1 percent chance that mapped PGAs will be exceeded in any given year. Hazus estimates Douglas County will experience not felt and weak shaking during the 2,500-year event with moderate shaking and light damage.

Figure 5-8 Peak Ground Acceleration 500-Year Mean Return Period for Douglas County

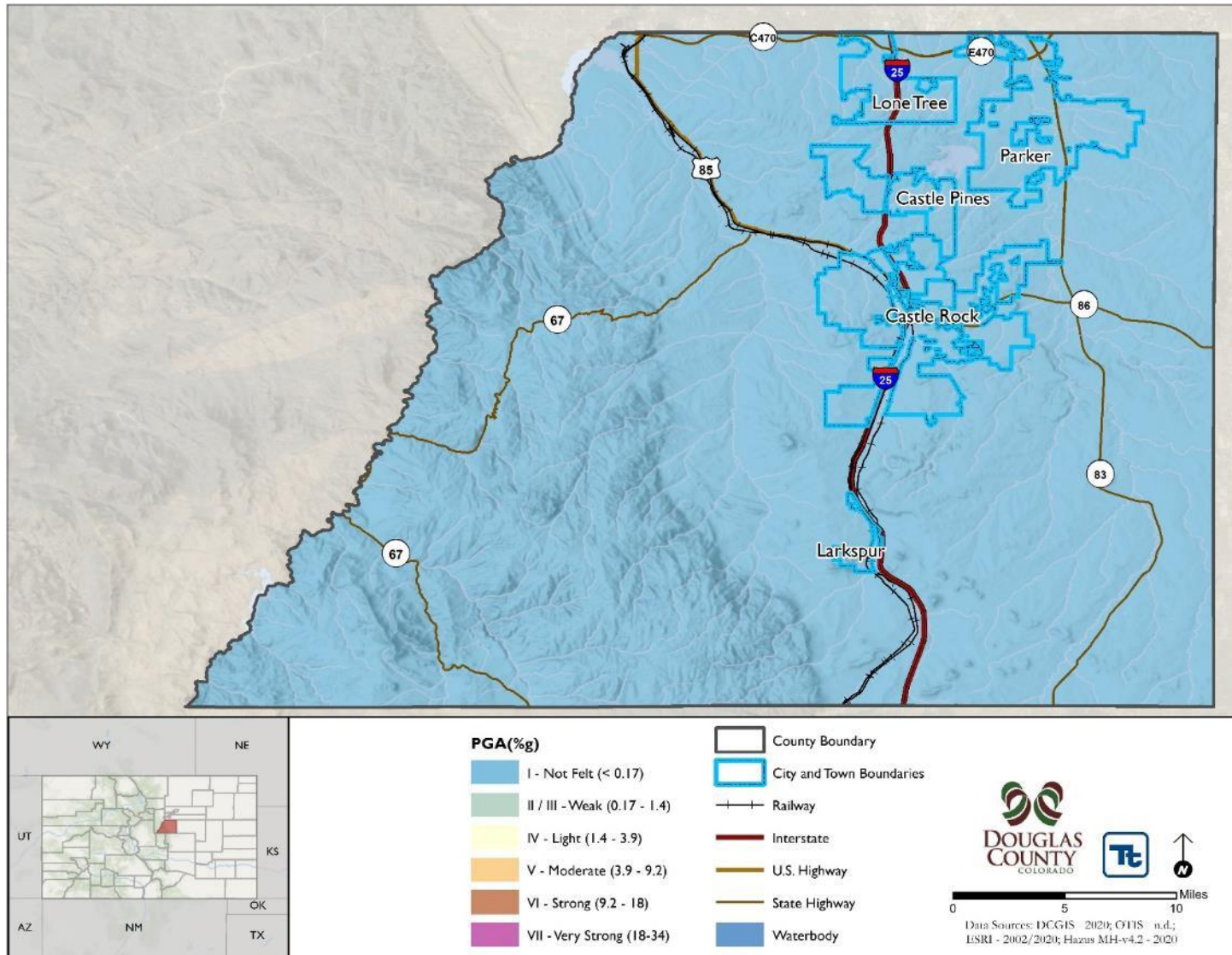
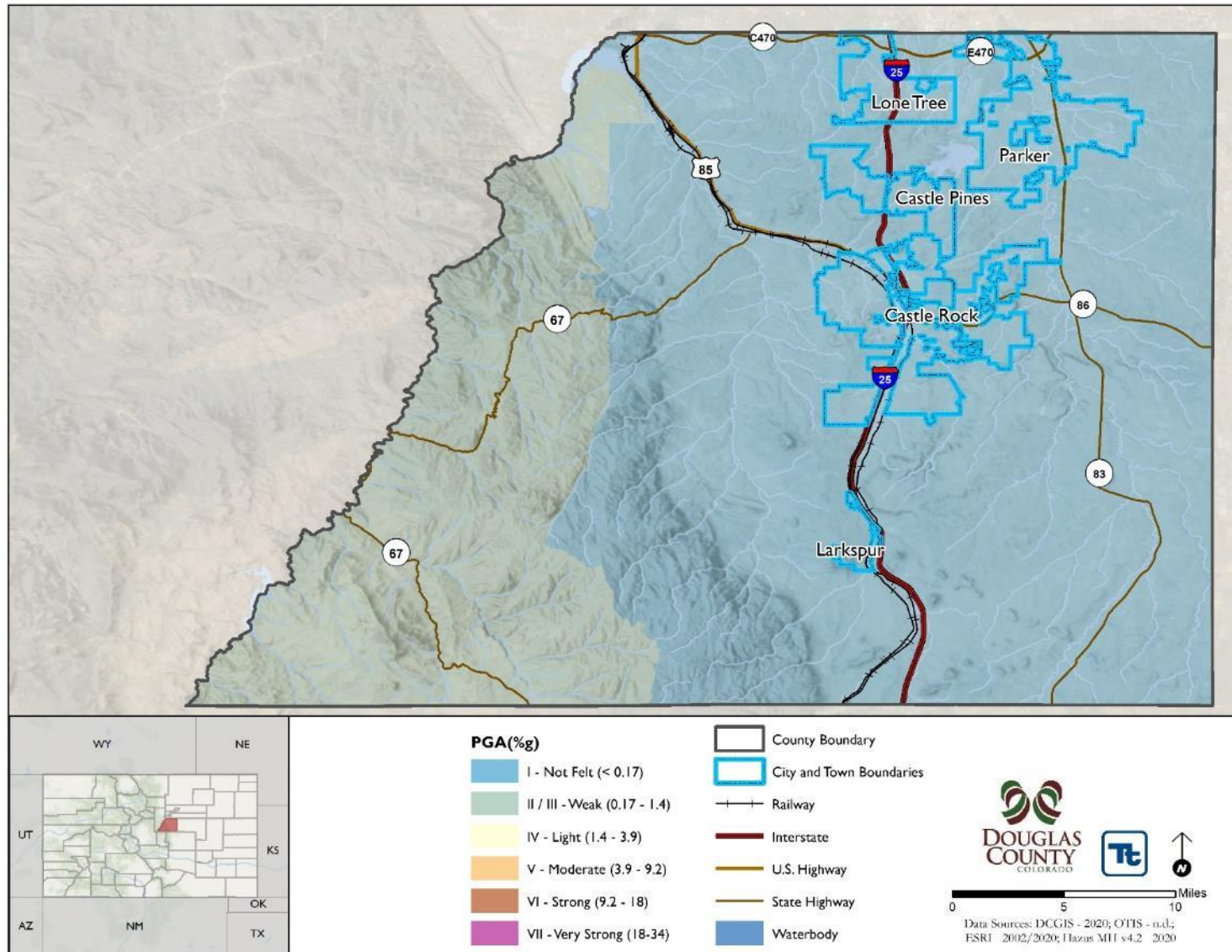


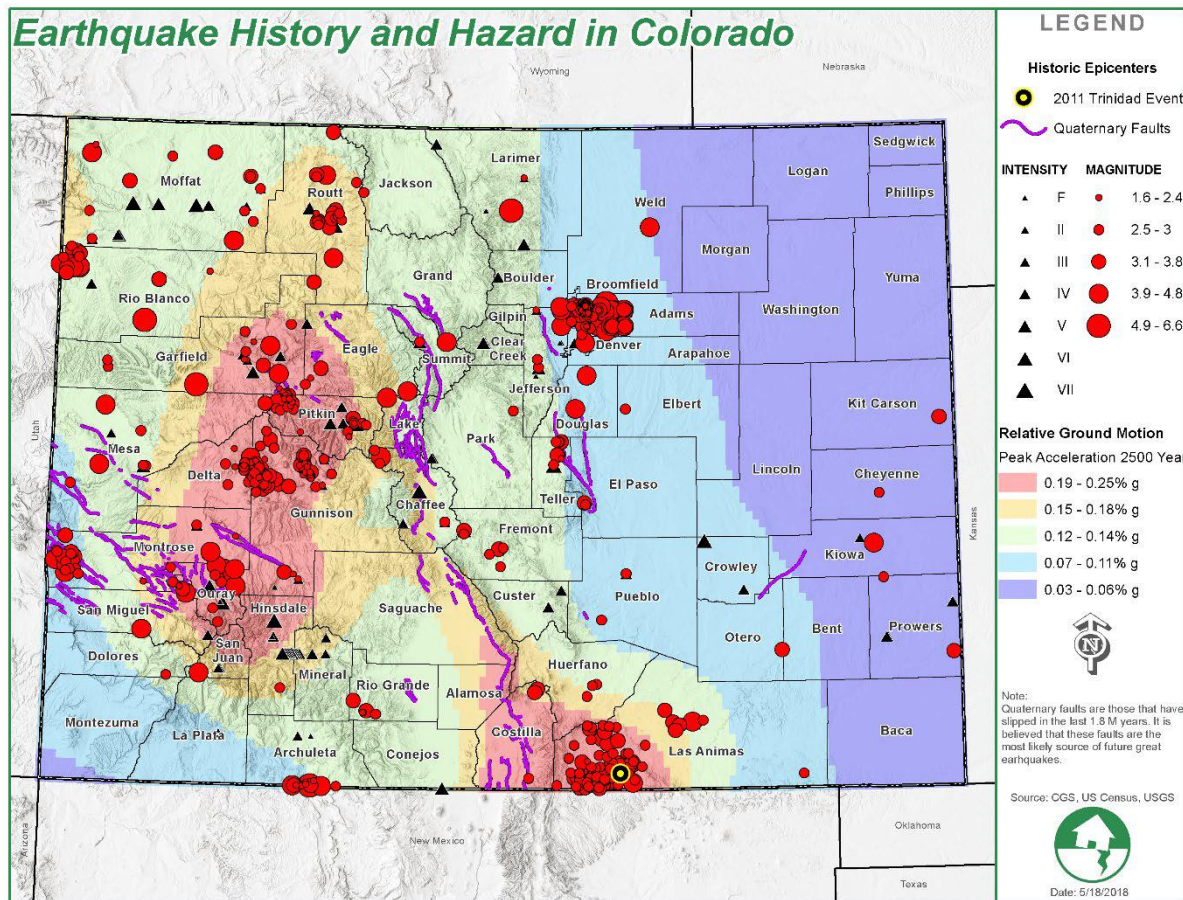
Figure 5-9 Peak Ground Acceleration 2,500-Year Mean Return Period for Douglas County



Location

In Colorado, the regions at greatest risk to earthquakes are in the western section of the State. However, earthquake hotspots exist throughout the State. Douglas County is located in central Colorado, where there has been relatively less earthquake activity and occurrences are rare. Some earthquake clusters are induced by human activities, such as fossil fuel extractions or underground injections.

Figure 5-10. Earthquake History in Colorado



Source: State of Colorado HMP

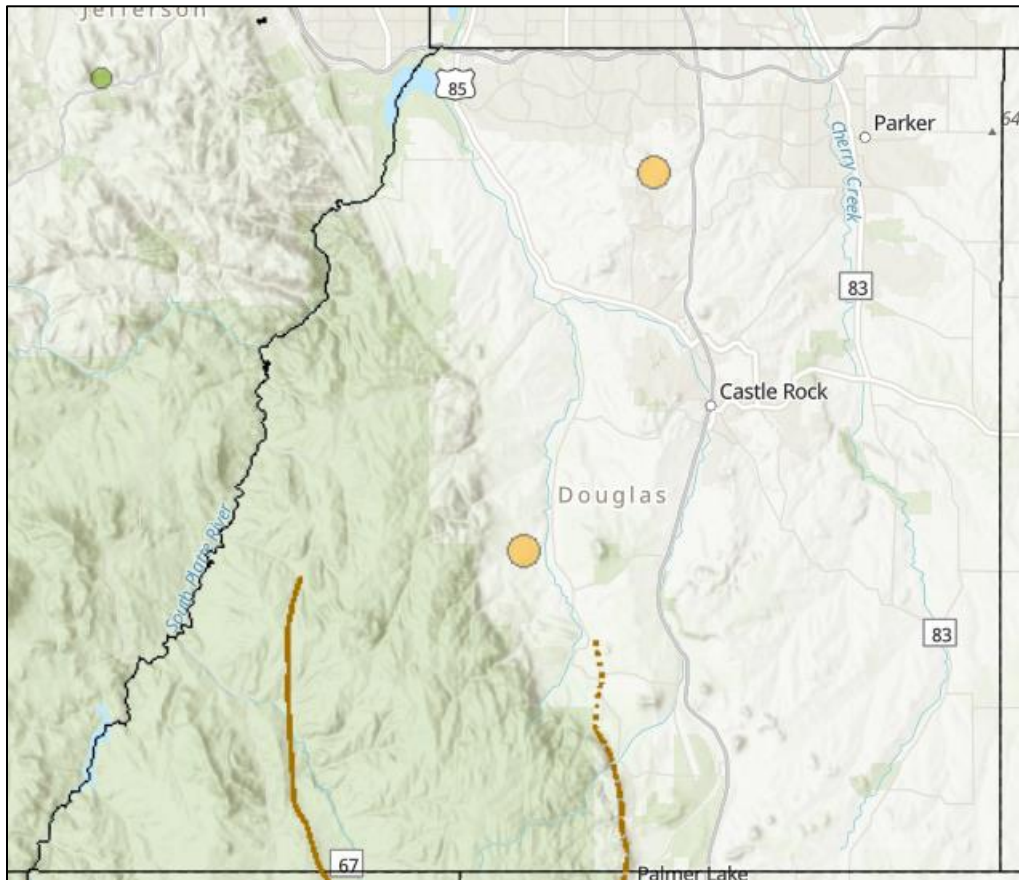
In Douglas County, the Rampart fault and the Ute fault are of concern. According to the US Geological Survey, the Rampart Range fault forms the east flank of the Rampart Range between Larkspur and Colorado Springs (USGS 1997).

The Advanced National Seismic System (ANSS) is run by USGS. When earthquakes strike, ANSS delivers real-time information, providing situational awareness for emergency-response personnel. In regions with sufficient seismic stations, that information includes –within minutes–a ShakeMap showing the distribution of potentially damaging ground shaking, information used to target post-earthquake response efforts. ANSS stations are situated in two locations in the State of Colorado, with one located just northwest of Douglas County in Idaho Springs (USGS 2020).

Previous Occurrences and Losses

According to the US Geological Survey and Colorado Geological Survey, there have been two earthquakes recorded in Douglas County. Figure 5-11 shows the earthquake history in Douglas County.

Figure 5-11: Earthquakes in Douglas County



Source: Colorado School of Mines

Douglas County has experienced two earthquakes since 1900. On September 9th, 1965 a M 4.8 earthquake was recorded with an epicenter located between Wildcat Mountain and Coyote Ridge Park in Castle Pines (Colorado School of Mines 2020). On Christmas Day in 1994, another earthquake occurred and was recorded at a magnitude of M 4.0. The earthquake’s epicenter was located six miles northeast of Larkspur in a sparsely-populated portion of Unincorporated Douglas County. The 1994 earthquake did not result in major damage (NWS 2018). No damage records for the 1965 earthquake were found as part of the HMP update.

It has been hypothesized that the 1965 earthquake – alongside a number of earthquakes observed in the Denver area during that time – was caused due to injection of chemical-waste fluids into an underground reservoir at the Rocky Mountain Arsenal approximately 23 miles to the northeast (Healy et al., 1968).

Climate Change Projections

The impacts of global climate change on earthquake probability are unknown. Some scientists say that melting glaciers could induce tectonic activity. As ice melts and water runs off, tremendous amounts of

weight are shifted on the earth's crust. As newly freed crust returns to its original, pre-glacier shape, it could cause seismic plates to slip and stimulate volcanic activity according to research into prehistoric earthquakes and volcanic activity. NASA and USGS scientists found that retreating glaciers in southern Alaska may be opening the way for future earthquakes (NASA 2004).

Secondary impacts of earthquakes could be magnified by climate change. Soils saturated by repetitive storms could experience liquefaction during seismic activity due to the increased saturation. Dams storing increased volumes of water due to changes in the hydrograph could fail during seismic events. There are currently no models available to estimate these impacts.

Probability of Future Events

Two reports of earthquakes have been recorded in Douglas County. Based on the lack of historical occurrences, the probability of a future event is considered *occasional* (hazard event is likely to occur within 100 years). However, the likelihood of a damaging earthquake to occur is very low. Refer to Sections 5.1 and 5.3 for additional information on the hazard ranking methodology and probability criteria.

Vulnerability Assessment

A probabilistic assessment was conducted for the 500-year and the 2,500-year MRPs through a Level 2 analysis in Hazus to analyze the earthquake hazard and provide a range of loss estimates. Figure 5-8 and Figure 5-9 shows the geographic distribution of the PGA in the County for the 500- and 2,500 year MRP events. Refer to Section 5.1 (Methodology and Tools) for additional details on the methodology used to assess earthquake risk.

Impact on Life, Health and Safety

Although the entire County may experience an earthquake, the degree of impact is dependent on many factors including the age and type of construction people live in, the soil types their homes are located on, and the intensity of the earthquake. NEHRP soil classes D and E can amplify ground shaking to damaging levels even during a moderate earthquake, and thus increase risk to the population. A NEHRP soil inventory was not available for Douglas County, therefore the floodplain boundary was used to assess softer soil classes in the Hazus earthquake analysis which are more at risk for ground shaking.

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 ornamentalations and chimneys that may be shaken loose and fall because of an earthquake.

Populations considered most vulnerable are those located in/near the built environment, particularly those near unreinforced masonry structures. Of these most vulnerable populations, socially vulnerable populations, including the elderly (persons over age 65) and individuals living below the census poverty threshold, are most susceptible. Factors leading to this higher susceptibility include decreased mobility and financial ability to react or respond during a hazard, and the location and construction quality of their housing. There are 35,801 persons over the age of 65 and 11,333 persons living in poverty in Douglas County. The distribution of these vulnerable populations can be found in Section 4 (County Profile).

Residents may be displaced or require temporary to long-term sheltering due to an earthquake event. 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. Table 5-22 summarizes the households Hazus v4.2 estimates will be displaced and population that may require short-term sheltering as a result of the 500- and the 2,500-year MRP earthquake events.

Table 5-22 Summary of Estimated Sheltering Needs for Douglas County

Scenario	Displaced Households	Persons Seeking Short-term Shelter
500-Year Earthquake	1	0
2500-Year Earthquake	31	14

Source: Hazus v4.2, Census 2010

A strong correlation exists between structural building damage and number of injuries and casualties from an earthquake event. Factors such as building material type, geographic location, and climate zone, and available resources could impact the ability to rescue and provide medical treatment (USGS, 2009). Further, time of day also exposes different sectors of the community to the hazard. For example, Hazus v4.2 considers residential occupancy at its maximum at 2:00 AM, whereas educational, commercial, and industrial sectors are at their maximum at 2:00 PM, and peak commute time is at 5:00 PM. Whether directly impacted or indirectly impacted, the entire population will be affected to some degree. Business interruption could prevent people from working, road closures could isolate populations, and loss of utilities could impact populations that suffered no direct damage from an event.

Table 5-23 and Table 5-24 summarize the County-wide injuries and casualties estimated for the 500- and 2,500-year MRP earthquake events.

Table 5-23 Estimated Number of Injuries and Casualties from the 500-Year MRP Earthquake Event

Level of Severity	Time of Day		
	2:00 AM	2:00 PM	5:00 PM
Injuries	3	5	4
Hospitalization	0	0	0
Casualties	0	0	0

Table 5-24 Estimated Number of Injuries and Casualties from the 2,500-Year MRP Earthquake Event

Level of Severity	Time of Day		
	2:00 AM	2:00 PM	5:00 PM
Injuries	29	46	37
Hospitalization	2	4	3
Casualties	0	0	0

Impact on General Building Stock

The entire County’s general building stock is considered at risk and exposed to this hazard. There is a strong correlation between PGA and damage a building might undergo (USGS n.d.). The Hazus model is based on best available earthquake science and aligns with these statements. The Hazus probabilistic earthquake model was applied to analyze effects from the earthquake hazard on general building stock in

Douglas County. See Figure 5-8 and Figure 5-9 earlier in this profile which illustrates the geographic distribution of PGA (g) across the County for the 500-year and 2,500-year MRP events at the Census-tract level.

A building’s construction determines how well it can withstand the force of an earthquake. The Colorado State Hazard Mitigation Plan indicated that although earthquakes are not frequent within the area, they could have greater losses due to non-reinforced structures (Colorado HMP, 2018). A building’s construction determines how well it can withstand the force of an earthquake. The 2009 FEMA Unreinforced Masonry Buildings and Earthquakes 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). Certain attributes can affect a building’s capability to withstand an earthquake’s force include its age, number of stories, and quality of construction. Hazus v4.2 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 evaluated using Hazus v4.2 across the following damage categories: none, slight, moderate, extensive, and complete. Table 5-25 provides definitions of these five categories of damage to a light wood-framed building; definitions of categories of damage to other building types appear in Hazus technical manual documentation.

Table 5-25 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

Building damage as a result of the 500- and 2,500-year MRP earthquake events was estimated using Hazus v4.2. Damage loss estimates include structural and non-structural damage to the building and loss of contents. Table 5-26 and Table 5-27 summarizes the estimated damages for the County by building type for the 500-year and 2,500-year MRP earthquake events. Hazus estimates that 18 structures in the County will face extensive damages due to a 500-year earthquake event and 247 structures will face extensive damage due to a 2,500-year earthquake event. The majority of these structures are reinforced masonry and wood building types. Hazus estimates that 246 structures will be moderately damaged in a 500-year earthquake event, and majority of the buildings are reinforced masonry (i.e., 95 total), followed by wood building types (i.e., 88 total). Hazus v4.2 also summarizes damage state estimates for buildings by general occupancy class. Table 5-28, Table 5-29, Table 5-30 and Table 5-31 and summarize the estimated structural and content damages for buildings categorized by general building stock for the 500-year and the 2,500-

year MRP earthquake events. Furthermore, Table 5-32 and Table 5-33 lists the severity of damage state structures will experience by the 500-year and the 2,500-year MRP earthquake event by general occupancy class.

Table 5-26 Estimated Number of Buildings Damaged by Building Type for 500-year MRP Earthquake Event

Building Category	Expected Number of Buildings Within Damage State Categories by Building Type				
	500-Year MRP				
	None	Slight	Moderate	Extensive	Complete
Wood	118,669	1,231	88	0	0
Steel	105	0	0	0	0
Concrete	1,598	27	5	0	0
Precast	975	20	12	2	0
Reinforced Masonry	9,963	206	95	10	0
Un-reinforced Masonry	1,279	92	39	6	1
Manufactured housing	703	20	7	0	0

Source: Hazus v4.2

Table 5-27 Estimated Number of Buildings Damaged by Building Type for 2,500-year MRP Earthquake Event

Building Category	Expected Number of Buildings Within Damage State Categories by Building Type				
	2,500-Year MRP				
	None	Slight	Moderate	Extensive	Complete
Wood	108,763	9,768	1,385	74	0
Steel	98	5	2	0	0
Concrete	1,415	153	58	4	0
Precast	831	87	72	19	0
Reinforced Masonry	8,869	747	552	105	1
Un-reinforced Masonry	985	236	149	40	7
Manufactured housing	577	98	51	5	0

Source: Hazus v4.2

Table 5-28 Estimated County-Wide 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	
			Building Count	Percent Buildings in Occupancy Class
Residential Exposure (Single and Multi-Family Dwellings)	125,826	None	124,121	98.6%
		Minor	1,472	1.2%
		Moderate	216	0.2%
		Severe	16	<0.1%
		Complete Destruction	1	<0.1%

Occupancy Class	Total Number of Buildings in Occupancy	Severity of Expected Damage	Earthquake 500-Year	
			Building Count	Percent Buildings in Occupancy Class
Commercial Buildings	4,218	None	4,137	98.1%
		Minor	61	1.4%
		Moderate	18	0.4%
		Severe	2	<0.1%
		Complete Destruction	0	0.0%
Industrial Buildings	422	None	408	96.8%
		Minor	8	1.9%
		Moderate	5	1.1%
		Severe	1	0.2%
		Complete Destruction	0	0.0%
Government, Religion, Agricultural, and Education Buildings	4,690	None	4,626	98.6%
		Minor	56	1.2%
		Moderate	8	0.2%
		Severe	0	0.0%
		Complete Destruction	0	0.0%

Source: Hazus v4.2

Table 5-29 Estimated County-Wide Building Damage Severity by General Occupancy Class for the 2,500-year MRP Earthquake Event

Occupancy Class	Total Number of Buildings in Occupancy	Severity of Expected Damage	Earthquake 2,500-Year	
			Building Count	Percent Buildings in Occupancy Class
Residential Exposure (Single and Multi-Family Dwellings)	125,826	None	113,264	90.0%
		Minor	10,328	8.2%
		Moderate	2,015	1.6%
		Severe	212	0.2%
		Complete Destruction	7	0.0%
Commercial Buildings	4,218	None	3,723	88.3%
		Minor	340	8.1%
		Moderate	133	3.1%
		Severe	23	0.5%
		Complete Destruction	0	0.0%
Industrial Buildings	422	None	350	82.9%
		Minor	35	8.4%
		Moderate	29	6.9%
		Severe	8	1.8%
		Complete Destruction	0	0.0%
Government, Religion, Agricultural, and	4,690	None	4,201	89.6%
		Minor	389	8.3%
		Moderate	92	2.0%

Occupancy Class	Total Number of Buildings in Occupancy	Severity of Expected Damage	Earthquake 2,500-Year	
			Building Count	Percent Buildings in Occupancy Class
Education Buildings		Severe	7	0.2%
		Complete Destruction	0	0.0%

Source: Hazus v4.2

Table 5-30 Estimated Building Value (Building and Contents) By General Occupancy Classes and Estimated Damage in the 500-Year MRP Earthquake Event

Jurisdiction	Replacement Cost Value (RCV)	Estimated Losses to the 500 Year Earthquake Mean Return Period Event				
		Estimated Total Damage	Percent of Total Building and Contents Replacement Cost Value	Estimated Residential Damage	Estimated Commercial Damage	Estimated Damages for All Other Occupancies
Castle Pines (C)	\$4,995,772,208	\$2,957,011	0.1%	\$2,691,498	\$210,935	\$54,578
Castle Rock (T)	\$28,003,310,038	\$11,167,058	<0.1%	\$8,881,615	\$1,300,777	\$984,665
Larkspur (T)	\$135,724,576	\$185,228	0.1%	\$142,427	\$10,691	\$32,111
Lone Tree (C)	\$23,664,803,217	\$6,418,385	<0.1%	\$4,122,630	\$2,209,903	\$85,851
Parker (T)	\$23,597,914,712	\$8,742,465	<0.1%	\$6,386,929	\$1,499,228	\$856,307
Unincorporated Douglas County	\$102,018,837,713	\$48,083,389	<0.1%	\$36,988,295	\$7,214,823	\$3,880,272
Douglas County (Total)	\$182,416,362,464	\$77,553,535	<0.1%	\$59,213,395	\$12,446,357	\$5,893,784

Source: Hazus v4.2

Notes: C = City; T= Town

Table 5-31 Estimated Building Value (Building and Contents) By General Occupancy Classes and Estimated Damage in the 2,500-Year MRP Earthquake Event

Jurisdiction	Replacement Cost Value (RCV)	Estimated Losses to the 2,500 Year Earthquake Mean Return Period Event				
		Estimated Total Damage	Percent of Total Building and Contents Replacement Cost Value	Estimated Residential Damage	Estimated Commercial Damage	Estimated Damages for All Other Occupancies
Castle Pines (C)	\$4,995,772,208	\$38,523,969	0.8%	\$33,590,402	\$4,125,486	\$808,081
Castle Rock (T)	\$28,003,310,038	\$157,493,971	0.6%	\$123,161,288	\$20,023,880	\$14,308,802
Larkspur (T)	\$135,724,576	\$2,487,575	1.8%	\$1,862,521	\$137,612	\$487,443
Lone Tree (C)	\$23,664,803,217	\$95,591,770	0.4%	\$54,568,517	\$39,828,675	\$1,194,578
Parker (T)	\$23,597,914,712	\$125,235,331	0.5%	\$90,219,485	\$22,784,345	\$12,231,501
Unincorporated Douglas County	\$102,018,837,713	\$668,576,839	0.7%	\$494,051,184	\$118,585,206	\$55,940,448
Douglas County (Total)	\$182,416,362,464	\$1,087,909,454	0.6%	\$797,453,397	\$205,485,204	\$84,970,854

Source: Hazus v4.2

Notes: C = City; T= Town

Hazus v4.2 estimates approximately \$77.6 million of damage as a result of the 500-year MRP event and \$1.1 billion as a results of the 2,500-year MRP event. These damages account for less than 0.1-percent of total replacement cost value in Douglas County for the 500-year MRP event and approximately 0.6-percent for the 2,500-year MRP event. The sum of damages calculated in Hazus v4.2 include structural damage,

non-structural damage, and loss of contents. Residential buildings account for majority of the building replacement cost damages.

Impacts on Critical Facilities

All critical facilities in Douglas County are considered exposed and vulnerable to the earthquake hazard. Refer to Section 4.6 (Critical Facilities) in the County Profile for a complete inventory of critical facilities in Douglas County.

The Hazus v4.2 earthquake model was used to assign a probability of each damage state category defined in Table 5-32 and Table 5-33 to every critical facility in the planning area for the 500-year and the 2,500-year MRP event, which was then averaged across the facility category. In addition, Hazus estimates the time to restore critical facilities to fully functional use. Results are presented as the probability of being functional at specified time increments (days after the event). For example, Hazus v4.2 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 percent probability of sustaining damage, the minimum and maximum damage estimated value for that facility type is presented. As a result of a 500-year MRP event, Hazus v4.2 estimates that critical facilities will be nearly 100-percent functional with negligible damages. Their risk for extensive damage is predicted to be range 0.2-percent and 0.5-percent to police stations and fire stations. During a 2,500-year earthquake event, there is an overall increased probability of potential damage thus lowering percent functionality. At Day 1 there are several critical facilities such as medical facilities, police facilities, fire facilities, and school facilities that predicted to have under 90-percent functionality at Day 1. Additionally, extensive damage could range from 1.5-percent to 4.5-percent to many critical facilities. There is minimal change of damage for utilities and transportation facilities during both the 500-year and 2,500-year MRP events.

Table 5-32 Damage State for Critical Facilities During a 500-Year MRP Earthquake Event

Name	Percent Probability of Sustaining Damage					Percent Functionality			
	None	Slight	Moderate	Extensive	Complete	Day 1	Day 7	Day 30	Day 90
Critical Facilities									
Medical	98.2%-99.1%	0.9%-1.6%	<0.1%	0.0%	0.0%	98.1%-99.1%	99.9%	99.9%	99.9%
Police	93.7%-97.3%	1.6%-3.5%	0.9%-2.3%	0.2%-0.5%	0.0%	93.7%-97.3%	97.1%-98.8%	99.7%	99.8%
Fire	94.6%-97.4%	1.5%-3.0%	0.9%-2.0%	0.2%-0.4%	0.0%	94.5%-97.4%	97.5%-98.9%	99.7%	99.8%
EOC	99.0%	0.9%	<0.1%	0.0%	0.0%	99.0%	99.8%	99.9%	99.9%
School	97.7%-98.3%	1.4%	0.5%	<0.1%	0.0%	97.6%-98.2%	99.2%-99.4%	99.9%	99.9%
Utilities									
Potable	94.6%-97.5%	1.5%-3.5%	0.8%-2.0%	0.2%	0.0%	96.1%-99.0%	99.6%-99.8%	99.9%	99.9%
Wastewater	96.6%	1.9%	1.2%	0.2%	0.0%	97.4%	99.6%	99.8%	99.9%
Transportation									
Airports	98.8%	1.1%	<0.1%	0.0%	0.0%	99.9%	99.9%	99.9%	99.9%
Bus	98.6%-99.0%	0.9%-1.2%	<0.1%	0.0%	0.0%	99.9%	99.9%	99.9%	99.9%
Bridges	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%	100.0%	100.0%
Light Rail	98.9%	1.0%	<0.1%	0.0%	0.0%	99.9%	99.9%	99.9%	99.9%

Source: Hazus v4.2
 Notes: EOC = Emergency Operation Center

Table 5-33 Damage State for Critical Facilities During a 2,500-Year MRP Earthquake Event

Name	Percent Probability of Sustaining Damage					Percent Functionality			
	None	Slight	Moderate	Extensive	Complete	Day 1	Day 7	Day 30	Day 90
Critical Facilities									
Medical	85.3%-92.0%	7.4%-13.0%	0.6%-1.7%	<0.1%	<0.1%	85.2%-92.0%	97.9%-99.1%	99.9%	99.9%
Police	69.2%-85.0%	7.5%-13.2%	6.0%-13%	1.5%-4.5%	<0.1%	69.2%-84.9%	82.1%-92.3%	95.4%-98.4%	97.6%-99.2%
Fire	73.6%-85.5%	7.3%-11.8%	5.8%-11%	1.4%-3.5%	<0.1%	73.6%-85.5%	85.1%-92.3%	96.4%-98.5%	98.1%-99.2%
EOC	90.8%-91.9%	7.0%-7.8%	1.2%	<0.1%	0.0%	90.8%-91.9%	98.5%	99.9%	99.9%
School	87.4%-90.7%	5.5%-7.0%	3.4%-4.8%	<0.1%	<0.1%	87.4%-90.1%	94.2%-96%	99.2%-99.5%	99.7%
Utilities									
Potable	73.6%-85.97%	7.1%-12.1%	5.5%-11.0%	1.4%-3.5%	<0.1%	82.4%-92.6%	97.1%-99.0%	98.4%-99.9%	98.9%-99.9%
Wastewater	81.1%-82.9%	83.9%-91.0%	6.7%-7.7%	1.8%-2.1%	<0.1%	85.0%-86.4%	97.2%-98.3%	98.1%-99.5%	99.8%
Transportation									
Airports	90.3%	8.8%	8.2%	<0.1%	0.0%	99.4%	99.9%	99.9%	99.9%
Bus	90.2%-91.5%	7.8%-8.9%	<0.1%	0.0%	0.0%	99.4%	99.9%	99.9%	99.9%
Bridges	99.9%	<0.1%	<0.1%	<0.1%	0.0%	99.9%	99.9%	99.9%	99.9%
Light Rail	90.1%	8.3%	7.41%	<0.1%	0.0%	99.4%	99.9%	99.9%	99.9%

Source: Hazus v4.2
 Notes: EOC = Emergency Operation Center

Impact on Economy

Earthquakes also impact the economy, including loss of business function, damage to inventory (buildings, transportation, and utility systems), relocation costs, wage loss, and rental loss due to repair and replacement of buildings. Hazus v4.2 estimates building-related economic losses, including income losses (wage, rental, relocation, and capital-related losses) and capital stock losses (structural, non-structural, content, and inventory losses). Economic losses estimated by Hazus v4.2 are summarized in Table.

Table 5-34 Building-Related Economic Losses from the 500- and 2,500-Year MRP Earthquake Events

Mean Return Period (MRP)	Inventory Loss	Relocation Loss	Building and Content Losses	Wages Losses	Rental Losses	Capital-Related Loss
500-year MRP	\$118,200	\$4,888,400	\$77,552,400	\$1,422,500	\$2,314,000	\$1,019,400
2,500-year MRP	\$2,205,200	\$50,945,000	\$1,087,908,800	\$18,102,700	\$22,921,700	\$11,374,100

Source: Hazus v4.2

Although the Hazus v4.2 analysis did not compute damage estimates for individual roadway segments and railroad tracks, assumedly 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.

Additionally, Hazus v4.2 estimates volume of debris that may be generated as a result of an earthquake event to enable the study region to prepare for and rapidly and efficiently manage debris removal and disposal. Debris estimates were divided into two categories: (1) reinforced concrete and steel that require special equipment to break up before transport can occur, and (2) brick, wood, and other debris that can be loaded directly onto trucks by use of bulldozers (Hazus Earthquake User’s Manual).

Hazus v4.2 estimated the generation of over 15,285 tons of debris during the 500-year MRP event and 123,076 tons of total debris during the 2,500-year MRP event, and 37 below lists estimated debris generated by these events.

Table 5-35 Estimated Debris Generated by the 500- and 2,500-year MRP Earthquake Event

Jurisdiction	500-Year		2,500-Year	
	Brick/Wood (tons)	Concrete/Steel (tons)	Brick/Wood (tons)	Concrete/Steel (tons)
Castle Pines (C)	557	365	3,221	3,594
Castle Rock (T)	1,340	740	9,163	7,521
Larkspur (T)	28	23	181	212
Lone Tree (C)	840	567	5,166	6,139
Parker (T)	738	579	5,722	5,473
Unincorporated Douglas County	5,611	3,897	37,729	39,029
Douglas County (Total)	9,115	6,170	61,183	61,968

Source: Hazus v4.2

Impact on the Environment

According to USGS, earthquakes can cause damage to the surface of the Earth in various forms depending on the magnitude and distribution of the event (USGS 2020). Surface faulting is one of the major seismic components to earthquakes that can create wide ruptures in the ground. Ruptures can have a direct impact on the landscape and natural environment because it can disconnect habitats for miles isolating animal species or tear apart plant roots.

Furthermore, ground failure as a result of soil liquefaction can have an impact on soil pores and retention of water resources (USGS 2020). The greater the seismic activity and liquefaction properties of the soil, the more likely drainage of groundwater can occur which depletes groundwater resources. In areas where there is higher pressure of groundwater retention, the pores can build up more pressure and make soil behave more like a fluid rather than a solid increasing risk of localized flooding and deposition or accumulation of silt.

Cascading Impacts to Other Hazards

The Global Geoengineering Research Group in USGS has been investigating the relationship earthquakes have with ground deformation, ground failure, and coastal erosion (USGS 2019). As mentioned in earlier sections, soft and loose soils are more susceptible to earthquake events. Ground failure can become

exacerbated due to earthquake events, causing landsliding and erosion. Areas of steep slopes are at greater risk of ground failure and potential erosion during earthquakes (USGS 2019).

Further, residual impacts from earthquakes could alter the floodplain extent for the County if ground failure and erosion occur. Damage to infrastructure controlling flood waters or waterbody sources may become breached as a result of an earthquake event, which could create flooding in the impacted areas.

Future Changes That May Impact Vulnerability

Understanding future changes that effect vulnerability in the County can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The County considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development
- Projected changes in population
- Other identified conditions as relevant and appropriate, including the impacts of climate change

Projected Development

As discussed and illustrated in Section 4 (County Profile), areas targeted for future growth and development have been identified across the County. Development built in areas with softer NEHRP soil classes, liquefaction, and landslide-susceptible areas may experience shifting or cracking in the foundation during earthquakes because of the loose soil 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. Refer to Section 4 and 9 for more information about the potential new development in Douglas County.

Projected Changes in Population

According to the State of Colorado Department of Local Affairs, the population in Douglas County has increased by approximately 2.07-percent or 6,946 persons between 2017 and 2018 (SOC DLA 2019). The increase in population will expose more people to the earthquake hazard. Persons that 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. As noted earlier, if moving into new construction, current building codes require seismic provisions that should render new construction less vulnerable to seismic impacts. Refer to Section 4 (County Profile), which includes a more thorough discussion about population trends for the County.

Climate Change

Because the impacts of climate change on earthquakes are not well understood, a change in the County's vulnerability as the climate continues to change is difficult to determine. However, climate change has the potential to magnify secondary impacts of earthquakes. As a result of the climate change projections discussed above, the County's assets located on areas of saturated soils and on or at the base of steep slopes, are at a relatively higher risk of landslides/mudslides because of seismic activity.

Changes in Vulnerability Since the 2015 HMP

Since the 2015 analysis, population statistics have been updated using the 5-Year 2014-2018 American Community Survey Population Estimates. A custom structure inventory was created using tax assessor

information, building footprints, and parcel data provided by the County. In addition, a critical facility inventory was generated and reviewed the planning partnerships. These inventories were imported into Hazus v4.2 to complete an earthquake model analysis. The NEHRP data was created using the Special Flood Hazard Area boundary and imported into Hazus as floodplain soils tend to be softer and have a greater potential of ground failure.

Overall, this vulnerability assessment uses a more accurate and updated building inventory which provides more accurate estimated exposure and potential losses for Douglas County.

Issues Identified

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 levee/dam failures and slope failures which could impact Douglas County, its municipalities, and districts.

5.4.5 Extreme Temperature

The following section provides the hazard profile and vulnerability assessment for the extreme temperature hazard in Douglas County.

Profile

Hazard Description

Extreme temperature includes both heat and cold events, which can have a significant impact to human health, commercial/agricultural businesses and primary and secondary effects on infrastructure (e.g., burst pipes and power failure). What constitutes *extreme cold* or *extreme heat* can vary across different areas of the country, based upon what the population is accustomed.

Extreme Heat

Extreme heat is defined as temperatures which hover 10 degrees or more above the average high temperature for a region. Because some areas are hotter than others, extreme heat temperatures vary based on regional averages and locations (CDC 2017). A heat wave is an extended period of extreme heat of two or more consecutive days is typically called a heat wave and is often accompanied by high humidity (NWS 2009). Extreme heat during the summer months is a common occurrence in the State of Colorado, including Douglas County.

Extreme Cold

Extreme cold events are when temperatures drop well below normal in an area. What constitutes as extreme cold varies in different parts of the country. In the southern United States, near freezing temperatures are considered extreme cold. Freezing temperatures can cause severe damage to citrus fruit crops and other vegetation. Pipes may freeze and burst in homes that are poorly insulated or without heat (NWS 2017). Douglas County typically does not experience extreme cold; however, the County does have a history of occurrence for extreme cold temperatures.

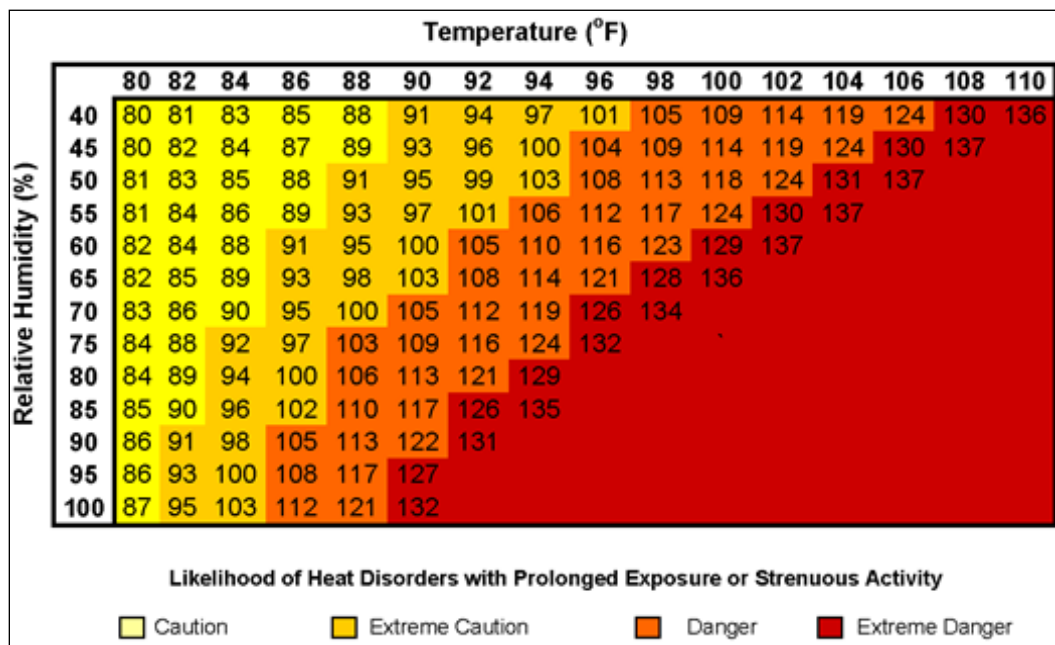
Extent

Extreme Heat

The extent of extreme heat temperatures generally is measured through the Heat Index, identified in Figure 5-12. Created by the NWS, the Heat Index is a chart that accurately measures apparent temperature of the air as it increases with the relative humidity. To determine the Heat Index, the temperature and relative humidity are needed. Once both values are identified, the Heat Index is the corresponding number of both the values. This provides a measure of how temperatures feel; however, the values are devised for shady, light wind conditions. Exposure to full sun can increase the index by up to 15 degrees.

Relative humidity is the amount of moisture in the air at a certain temperature compared to what the air can “hold” at that temperature...it is measured as a percentage or ratio of the amount of water vapor in a volume of air RELATIVE to a given temperature and the amount it can hold at that given temperature. Warm air can hold more moisture than cold air.

Figure 5-12. Heat Index Chart



Source: NWS 2016

The NWS provides alerts when Heat Indices approach hazardous levels. Table 5-36 explains these alerts.

Table 5-36 National Weather Service Alerts for Excessive Heat

Alert	Criteria
Excessive Heat Outlook	The Excessive Heat Outlook is issued when the potential exists for an excessive heat event in the next 3-7 days. An Outlook provides information to Heat Index forecast map for the contiguous United States for those who need considerable lead time to prepare or the event, such as public utilities, emergency management and public health officials.
Excessive Heat Watch	The Excessive Heat Watch is issued when conditions are favorable for an excessive heat event in the next 12 to 48 hours. A Watch is used when the risk of a heat wave has increased, but its occurrence and timing is still uncertain. A Watch provides enough lead time so those who need to prepare can do so, such as cities that have excessive heat event mitigation plans.

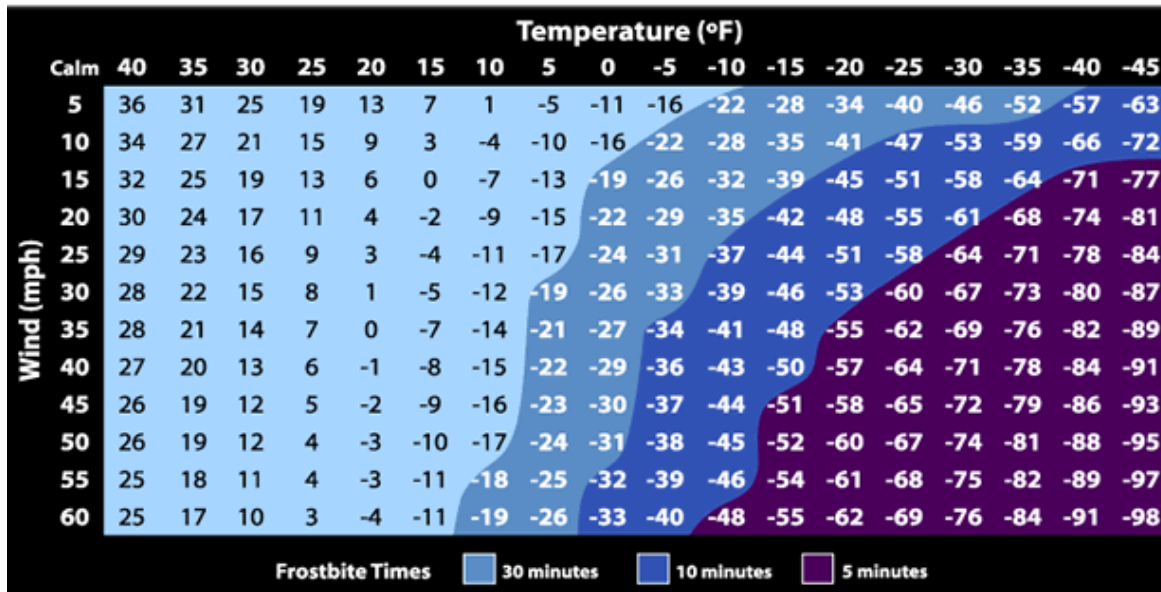
Alert	Criteria
Excessive Heat Warning/Advisory	The Excessive Heat Warning/Advisory is issued when an excessive heat event is expected in the next 36 hours. These products are issued when an excessive heat event is occurring, is imminent, or has a very high probability of occurring. The warning is used for conditions posing a threat to life or property. An advisory is for less serious conditions that cause significant discomfort or inconvenience and, if caution is not taken, could lead to a threat to life and/or property.

Source: Douglas County 2015

Extreme Cold

The extent (severity or magnitude) of extreme cold temperatures generally are measured through the Wind Chill Temperature (WCT) Index. The WCT Index uses advances in science, technology, and computer modeling to provide an accurate, understandable, and useful formula for calculating the dangers from wind chill. For details regarding the WCT Index, refer to: <http://www.nws.noaa.gov/om/winter/windchill.shtml>

Figure 5-13. NWS WCT Index



Source: NWS 2020

The NWS provides alerts when Wind Chill indices approach hazardous levels. Table 5-37 explains these alerts.

Table 5-37 National Weather Service Alerts for Extreme Cold

Alert	Criteria
Freeze Watch	A freeze warning is issued during the growing season when widespread temperatures are expected to drop to below 32 degrees.
Freeze Warning	A freeze warning is issued during the growing season when widespread temperatures are expected to drop to below 32 degrees.
Wind Chill Advisory	A wind chill advisory is issued on the plains when wind and temperature combine to produce wind chill values of minus 18 degrees to minus 25 degrees. A wind chill advisory is issued for the mountains and foothills when wind and temperature combine to produce wind chill values of minus 25 degrees.

Alert	Criteria
Wind Chill Watch	A wind chill watch is issued when wind chill warning criteria are possible in the next 12 to 36 hours.
Wind Chill Warning	A wind chill warning is issued for wind chills of at least minus 25 degrees on the plains, and minus 35 degrees in the mountains and foothills.

Source: NWS 2020

Location

Extreme temperature events can occur in any area of Douglas County. Metropolitan areas could experience more extreme heat events due to urban heat islands. Heat island describes built up areas that are hotter than nearby rural areas. According to the U.S. EPA, the annual mean air temperature of a city with 1 million people or more can be 1.8–5.4°F (1–3°C) warmer than its surroundings. In the evening, the difference can be as high as 22°F (12°C). Heat islands can affect communities by increasing summertime peak energy demand, air conditioning costs, air pollution and greenhouse gas emissions, heat-related illness and mortality, and water pollution (U.S. EPA 2020).

Previous Occurrences and Losses

Many sources have provided historical information regarding previous occurrences and losses associated with extreme temperatures in Douglas County. According to the NOAA-NCEI Storm Events Database, Douglas County has not been impacted by extreme temperature events between 2014 and 2020. Between 2014 and 2020, the State of Colorado was not included in extreme temperature-related disaster declarations related to extreme temperatures (FEMA 2020).

Douglas Colorado has been subject to one agricultural disaster declarations since 2014 related to extreme temperatures. The event occurred in 2014 and entailed excessive heat/high temperature (S3627) (USDA 2020).

In April 2020, coniferous trees throughout the County were damaged by a cold snap and temperature fluctuations. A warm winter caused the ponderosa pines and spruce trees to not enter dormancy before freezing occurred.

According to the National Center for Environmental Information, the mean number of days between 1948 and 2018 with a daily maximum temperature equal to or greater than 90°F was 36 days for Denver, Colorado. The greatest number of days which the County experienced extreme heat is 73 in 2020, while the highest temperature recorded was 100°F, recorded on June 27th, 2012 and July 2-3, 2012. Table 5-38 shows the number of days with a maximum temperature of 90°F for the Castle Rock station (USC00051401). 2020 featured the highest number of days since 2000 with a temperature above 90°F (73 days) followed by 2012 (40 days). 2004 and 2009 were years with the lowest number of days with a maximum temperature of 90°F (seven and nine days, respectively).

Table 5-38 Monthly Number of Days with Maximum Temperature ≥ 90°F

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2000	0	0	0	0	1	7	8	8	1	0	0	0	25
2001	0	0	0	0	0	6	13	0	0	0	0	0	19
2002	0	0	0	0	1	11	15	7	1	0	0	0	35
2003	0	0	0	0	1	0	22	9	0	0	0	0	32
2004	0	0	0	0	0	2	3	2	0	0	0	0	7

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2005	0	0	0	0	0	0	17	3	0	0	0	0	20
2006	0	0	0	0	0	9	10	0	0	0	0	0	19
2007	0	0	0	0	0	7	14	3	0	0	0	0	24
2008	0	0	0	0	0	0	18	5	0	0	0	0	23
2009	0	0	0	0	0	0	1	2	0	0	0	0	3
2010	0	0	0	0	0	5	9	5	3	0	0	0	22
2011	0	0	0	0	0	3	11	9	2	0	0	0	25
2012	0	0	0	0	1	11	20	6	2	0	0	0	40
2013	0	0	0	0	0	9	9	7	4	0	0	0	29
2014	0	0	0	0	0	0	7	0	2	0	0	0	9
2015	0	0	0	0	0	3	3	10	0	0	0	0	16
2016	0	0	0	0	0	2	11	6	0	0	0	0	19
2017	0	0	0	0	0	3	13	4	1	0	0	0	21
2018	0	0	0	0	0	10	14	2	5	0	0	0	31
2019	0	0	0	0	0	3	12	16	5	0	0	0	36
2020	0	0	0	0	4	17	21	22	9	0	0	0	73

Source: Midwest Regional Climate Center 2020

Notes:

- = indicates that there is no available data

* = indicates that the data are not complete

** = indicates that the value is being computed using only the years with complete data

Table 5-39 shows the number of days with maximum temperatures less than 32°F recorded at the Castle Rock weather station. 2020 had the lowest number of days with a temperature below 32°F (10 days), followed by 2000 (11 days). In 2007, there were 29 days when the temperature was less than 32°F – the highest amount in a year since 2000.

Table 5-39 Monthly Number of Days with Maximum Temperature ≤ 32°F

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2000	5	1	1	0	0	0	0	0	0	0	2	2	11
2001	3	3	2	1	0	0	0	0	0	0	2	1	12
2002	5	2	3	1	0	0	0	0	0	3	2	1	17
2003	0	6	2	0	0	0	0	0	0	1	2	2	13
2004	2	5	0	0	0	0	0	0	0	0	3	2	12
2005	3	3	2	1	0	0	0	0	0	0	1	9	19
2006	2	6	3	0	0	0	0	0	0	0	0	6	17
2007	7	5	3	2	0	0	0	0	0	0	3	9	29
2008	8	4	2	0	0	0	0	0	0	0	0	8	22
2009	4	0	2	2	0	0	0	0	0	2	0	12	22
2010	3	9	2	0	0	0	0	0	0	0	3	2	19
2011	4	6	1	0	0	0	0	0	0	1	0	5	17
2012	4	6	2	0	0	0	0	0	0	0	0	4	16
2013	5	3	5	0	0	0	0	0	0	0	1	6	20
2014	5	5	1	0	0	0	0	0	0	0	5	3	19
2015	4	4	4	0	0	0	0	0	0	0	0	0	12
2016	0	4	3	2	0	0	0	0	0	0	0	5	14

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2017	8	3	0	1	0	0	0	0	0	2	1	3	18
2018	3	5	0	0	0	0	0	0	0	1	2	4	15
2019	3	7	5	0	0	0	0	0	0	3	2	2	22
2020	0	4	0	1	0	0	0	0	0	0	2	3	10

Source: Midwest Regional Climate Center 2020

Notes:

- = indicates that there is no available data

* = indicates that the data are not complete

** = indicates that the value is being computed using only the years with complete data

Climate Change Projections

Colorado’s climate is changing and is warming. Much of Colorado has already warmed by between one and two degrees Fahrenheit within the last century (EPA 2017). The State is anticipated to warm between 2.5°F and 5°F by 2050 relative to a 1971-2000 baseline. In a higher emissions scenario (RCP 8.5), warming in Colorado could reach 6.5°F by 2050. A 2.5°F to 5°F warming would render the climate of the Douglas County region more similar to Pueblo in the southern part of the State, whereas a 6.5°F would render the County’s temperatures more similar to those found in Albuquerque, New Mexico (Climate.gov 2014). Warming is anticipated to result in impacts to the State’s hydrology and water sources, impacting the timing of snowmelt and runoff. Rising temperatures are also anticipated to result in heat waves, wildfires, and droughts that are increased in frequency and severity.

Probability of Future Occurrences

It is anticipated that Douglas County will experience extreme temperature events each year, with a majority of the days being extreme heat days. The probability of future occurrences for extreme temperatures can be determined by assessing historical averages. Based on the information provided by the Midwest Regional Climate Center for the years between 2000 and 2020, the County can expect, on average, approximately 25 days a year with temperatures greater than or equal to 90°F. Additionally, the County can expect, on average, approximately 17 days each year with temperatures less than or equal to 32°F.

Table 5-40 Probability of Occurrences of Extreme Temperature Events

Hazard Type	Number of Occurrences Between 2000 and 2020	% chance of occurrence in any given year
Temperature ≥ 90°F	528	100%
Temperature ≤ 32°F	356	100%
Total	884	100%

Source: Midwestern Regional Climate Center 2020

Note: Probability was calculated using the available data provided in the Midwest Regional Climate Center data for the Castle Rock station

Based on historical records and input from the Planning Committee, the probability of occurrence for extreme temperatures in Douglas County is considered *frequent* (hazard event is likely to occur within 25 years).

Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed and vulnerable. For the extreme temperature hazard, the entire County has been identified as exposed; therefore, all assets are potentially vulnerable. The following text estimated potential impacts of extreme temperatures on Douglas County.

Impact on Life, Health and Safety

The entire population (328,614) of Douglas County is exposed to the extreme temperature hazard. Extreme temperature events have potential health impacts including injury and death. According to the Centers for Disease Control and Prevention, populations most at risk to extreme cold and heat events include the following: 1) the elderly, who are less able to withstand temperatures extremes due to their age, health conditions, and limited mobility to access shelters; 2) infants and children up to four years of age; 3) individuals with chronic medical conditions (e.g., heart disease, high blood pressure), 4) low-income persons that cannot afford proper heating and cooling; and 5) the general public who may overexert during work or exercise during extreme heat events or experience hypothermia during extreme cold events (CDC 2017a).

Table 5-41 Vulnerable Populations in Douglas County

Jurisdiction	Population Over 65	Population Under 5	Population Below Poverty Threshold
Douglas County	35,801	19,924	11,333

Source: 2018 American Community Survey 5-Year Estimate

Exposure to excessive heat can pose a number of health risks to individuals. Table 5-42 and Table 5-43 identify different health hazards related to extreme temperature conditions.

Table 5-42 Health Effects of Extreme Cold

Health Hazard	Symptoms
Wind Chill	Wind chill is not the actual temperature but rather how wind and cold feel on exposed skin. As the wind increases, heat is carried away from the body at an accelerated rate, driving down the body temperature. Animals are also affected by wind chill; however, cars, plants and other objects are not.
Frostbite	Frostbite is damage to body tissue caused by extreme cold. A wind chill of -20°F will cause frostbite in just 30 minutes. Frostbite causes a loss of feeling and a white or pale appearance in extremities, such as fingers, toes, ear lobes or the tip of the nose. If symptoms are detected, get medical help immediately! If you must wait for help, slowly re-warm affected areas. However, if the person is also showing signs of hypothermia, warm the body core before the extremities.
Hypothermia	Hypothermia is a condition brought on when the body temperature drops to less than 95°F. It can kill. For those who survive, there are likely to be lasting kidney, liver and pancreas problems. Warning signs include uncontrollable shivering, memory loss, disorientation, incoherence, slurred speech, drowsiness and apparent exhaustion.

Source: CDC 2020

Table 5-43 Health Effects of Extreme Heat

Health Hazard	Symptoms
Sunburn	Redness and pain. In severe cases: swelling of skin, blisters, fevers, and headaches
Dehydration	Excessive thirst, dry lips, and slightly dry mucous membranes
Heat Cramps	Painful spasms, usually in muscles of legs and abdomen, and possible heavy sweating
Heat Exhaustion	Heavy sweating; weakness; cold, pale and clammy skin; weak pulse; possible fainting and vomiting

Health Hazard	Symptoms
Heat Stroke	High body temperature (104°F or higher), hot and dry skin, rapid and strong pulse, and possible coma

Source: CDC 2020

Meteorologists can accurately forecast extreme heat and cold event development and the severity of the associated conditions with several days of lead time. These forecasts provide an opportunity for public health and other officials to notify vulnerable populations, implement short-term emergency response actions, and focus on surveillance and relief efforts on those at greatest risk. Adhering to extreme temperature warnings can significantly reduce the risk of temperature-related deaths.

Impact on General Building Stock

All the building stock in the County is exposed to the extreme temperature hazard. Extreme heat generally does not impact buildings; however, elevated summer temperatures increase the energy demand for cooling. Losses can be associated with the overheating of heating, ventilation, and air conditioning (HVAC) systems. Extreme cold temperature events can damage buildings through freezing/bursting pipes and freeze/thaw cycles, as well as increasing vulnerability to home fires. Additionally, manufactured homes (mobile homes) and antiquated or poorly constructed facilities can have inadequate capabilities to withstand extreme temperatures.

Impact on Critical Facilities

All critical facilities in the County are exposed to the extreme temperature hazard. Impacts to critical facilities are the same as described for general building stock. Additionally, it is essential that critical facilities remain operational during natural hazard events. Extreme heat events can sometimes cause short periods of utility failures, commonly referred to as *brown-outs*, due to increased usage from air conditioners and other energy-intensive appliances. Similarly, heavy snowfall and ice storms, associated with extreme cold temperature events, can cause power interruption. Backup power is recommended for critical facilities and infrastructure.

Impact on Economy

Extreme temperature events also have impacts on the economy, including loss of business function and damage to and loss of inventory. Business-owners can be faced with increased financial burdens due to unexpected repairs caused to the building (e.g., pipes bursting), higher than normal utility bills, or business interruption due to power failure (i.e., loss of electricity, telecommunications).

Impact on the Environment

Extreme temperature events can have a major impact on the environment. For example, freezing and warming weather patterns create changes in natural processes. An excess amount of snowfall and earlier warming periods may affect natural processes such as flow within water resources (USGS 2020).

Cascading Impacts to Other Hazards

Extreme temperature events can exacerbate the drought hazard, increase the potential risk of wildfires, and escalate severe storm and severe winter weather events for the County. For example, extreme heat events may accelerate evaporation rates, drying out the air and soils. Extreme heat can also dry out terrestrial species, making them more susceptible to catching fire. Extreme variation in temperatures could create

ideal atmospheric conditions for severe storms or worsen the outcome of severe winter weather during freezing and thawing periods. Refer to Section 5.4.3 (Drought), Section 5.4.9-5.4.11 (Severe Storm), Section 5.4.12 (Severe Winter Storm), and Section 5.4.17 (Wildfire) for more information about these hazards of concern.

Future Changes that May Impact Vulnerability

Understanding future changes that impact vulnerability in the County can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. The County considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development.
- Projected changes in population.
- Other identified conditions as relevant and appropriate, including the impacts of climate change.

Projected Development and Change in Population

The ability of new development to withstand extreme temperature impacts lies in sound land use practices and consistent enforcement of codes and regulations for new construction. New development will change the landscape where buildings, roads, and other infrastructure potentially replace open land and vegetation. Surfaces that were once permeable and moist are now impermeable and dry. These changes cause urban areas to become warmer than the surrounding areas forming an *island* of higher temperatures (EPA 2009).

Climate Change

As the climate warms, extreme cold events might decrease in frequency, while extreme heat events might increase in frequency; the shift in temperatures could also result in hotter extreme heat events. With increased temperatures, vulnerable populations could face increased vulnerability to extreme heat and its associated illnesses, such as heatstroke and cardiovascular and kidney disease. Additionally, as temperatures rise, more buildings, facilities, and infrastructure systems may exceed their ability to cope with the heat.

Change of Vulnerability Since the 2015 HMP

Overall, the entire County remains vulnerable to extreme temperatures. As existing development and infrastructure continue to age they can be at increased risk to failed utility systems (e.g., HVAC) if they are not properly maintained. Similarly, an increase in the elderly population remaining in the County increases the vulnerable population.

Issues Identified

The potential issues identified with extreme temperature events include:

- Extreme temperature events can damage aging infrastructure and buildings as highways and roads are damaged by excessive heat as the asphalt softens, and roadways can be damaged from extreme cold temperatures causing frost heaving of road infrastructure.
- The aging population of the County may result in an increase of residents vulnerable to extreme temperature events as the senior population is less able to withstand extreme temperatures due to age and health conditions.

- Prolonged extreme heat events can lead to drought conditions and impact the drinking water supply for residents and result in more frequent and intense wildfires.

5.4.6 Flood

The following section provides the hazard profile and vulnerability assessment for the flood hazard in Douglas County

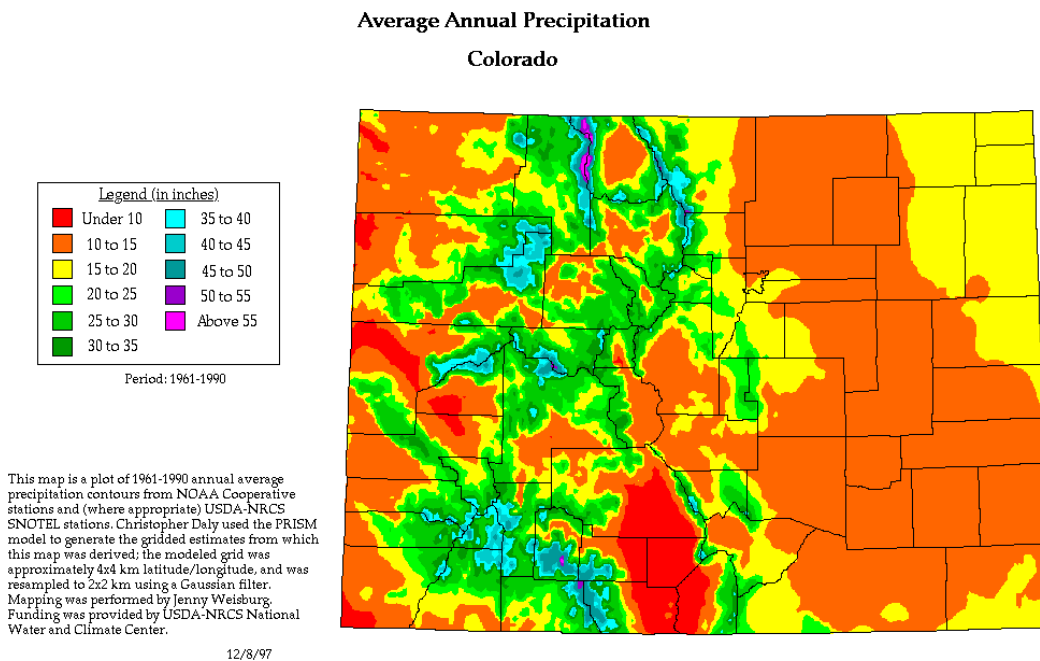
Profile

Hazard Description

Floods are one of the most common natural hazards in the U.S. They can develop slowly over a period of days or develop quickly, with disastrous effects that can be local (impacting a neighborhood or community) or regional (affecting entire river basins, coastlines and multiple counties or states) (FEMA 2007). As defined in the State of Colorado HMP, flooding is the general and temporary condition of partial or complete inundation of typically dry areas. This can result from overflow of stream banks, rapid accumulation of surface water runoff, or mudflows from the sudden collapse of a shoreline (State of Colorado HMP 2018).

In hydrologic analysis, runoff is that portion of rainfall which, in combination with other factors, contributes to the stream flow of any surface drainage way. When runoff exceeds the carrying capacity of the stream or drainage, flooding occurs. Runoff is a product of two major groups of factors, climate and physiographic. Climatic factors may include precipitation, evaporation, transpiration and interception. Physiographic factors would include the characteristics of the watershed such as size, shape and slope of the basin's drainage area, the general land use within the basin. With river networks spanning most of Colorado, runoff from snowmelt yields a high chance of flooding quite evenly throughout the State (State of Colorado HMP 2018). Figure 5-14 illustrates the annual average precipitation across the State. In Douglas County, the average precipitation is between 15 and 20 inches and up to 35 inches in the mountain region in the southern portion of the County.

Figure 5-14. Annual Average Runoff from Precipitation, in Inches (1961-1990)



Source: Boulder Area Sustainability Information Network

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. If the local basin drainage area is relatively flat, shallow, slow-moving floodwater can last for days. In drainage areas with substantial slope, or the channel is narrow and confined, rapidly moving and extreme high water conditions, called a flash flood, can occur (Colorado State HMP 2018).

Types of Flooding

Flooding generally takes one of the following forms:

- **Riverine Flooding**—Riverine flooding occurs when rivers overflow their banks in response to excessive precipitation levels and water runoff volumes within the watershed. 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.
- **Coastal Flooding**—Coastal flooding is primarily caused by storm surge, a cascading effect of hurricanes and coastal storms that pushes water toward the shore. The result can be waves that extend further inland, causing damage to development that would not normally be subject to wave action. Storm surge heights, and associated waves, are dependent upon the local width of the continental shelf and the depth of the ocean bottom. A narrow shelf, or one that drops steeply from the shoreline and subsequently produces deep water close to the shoreline, tends to produce a lower surge but higher and more powerful storm waves. Due to the high risk and vulnerability to this flood specific hazard, it was analyzed independently in this chapter rather than as a cascading effect of hurricanes.

- **Flash Flooding**—Most flash flooding is caused by slow-moving thunderstorms in a local area or by heavy rains associated with hurricanes and tropical storms. However, flash flooding events can also occur from accelerated snow melt due to heavy rains, a dam or levee failure within minutes or hours of heavy amounts of rainfall, or from a sudden release of water held by an ice jam. Although flash flooding occurs often along mountain streams, it is also common in urbanized areas where much of the ground is covered by impervious surfaces. Flash flood waters 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 decreased the ability of natural groundcover to absorb and retain surface water runoff.

For the purpose of this HMP and as deemed appropriate by Core Planning Team, riverine, flash, and urban flooding are the main flood types of concern for the County.

Extent

The severity of a flood event is typically determined by a combination of several factors including stream and river basin topography and physiography; precipitation and weather patterns; recent soil moisture conditions; and degree of vegetative clearing and impervious surface. Generally, floods are long-term events that may last for several days. Regarding the riverine flood hazard, once a river reaches flood stage, flood extent or severity categories used by the NWS include minor flooding, moderate flooding, and major flooding. Each category is defined as follows, based on property damage and level of public threat:

- 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 (NWS 2011).

USGS uses stream gages to determine the severity of flood at different points along a body of water. There are a number of gages in the County that actively monitor water levels and have had determined flood stages. The County relies on the gages to determine the height of the river during heavy rain events and to determine whether or not residents need to evacuate. Table 5-44 shows the two gages in the area of the County with their determined flood stage and their record flood event. 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/>).

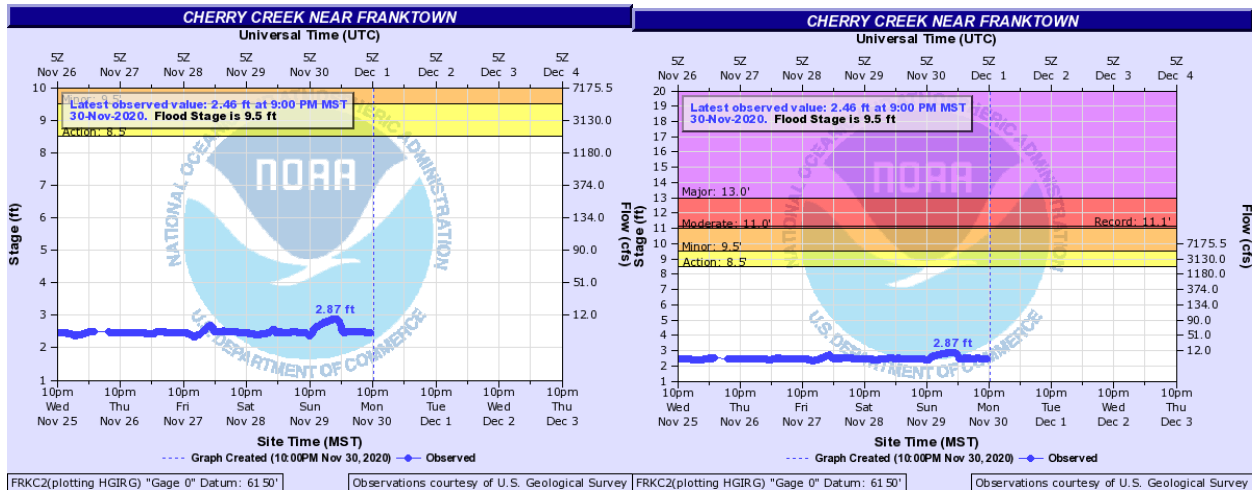
Table 5-44 Stream Gage Statistics for the Vicinity of Douglas County

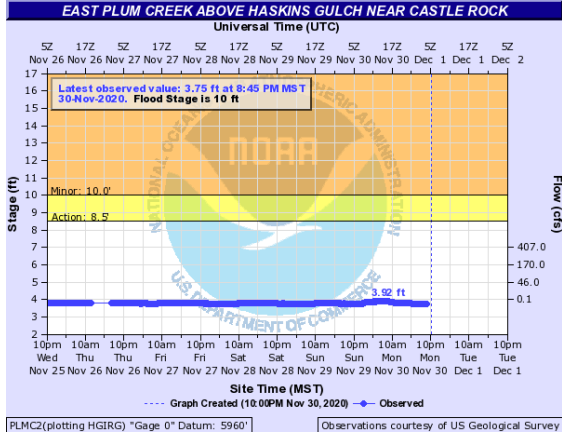
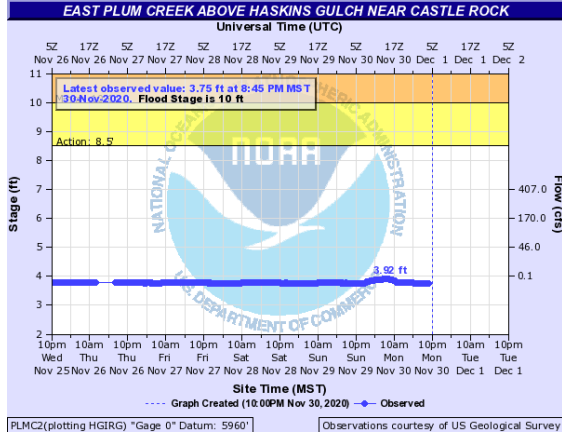
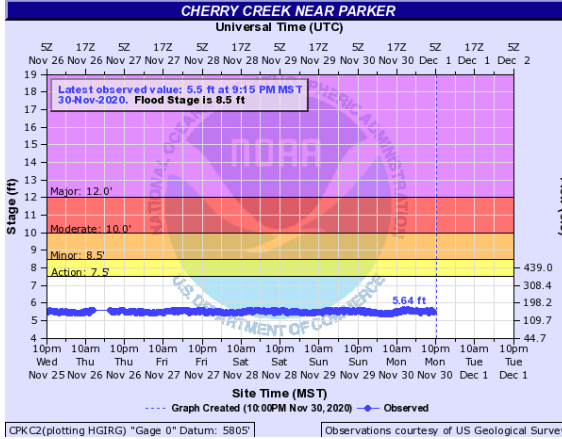
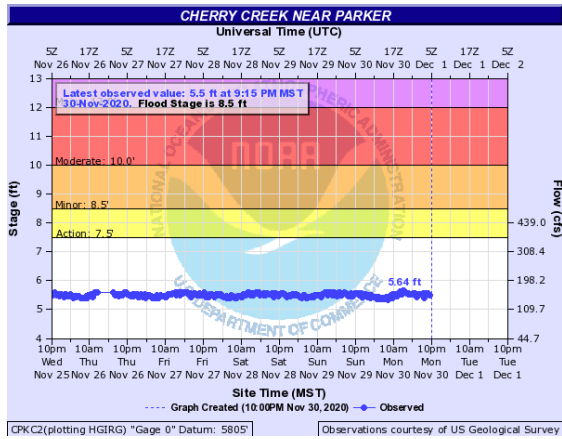
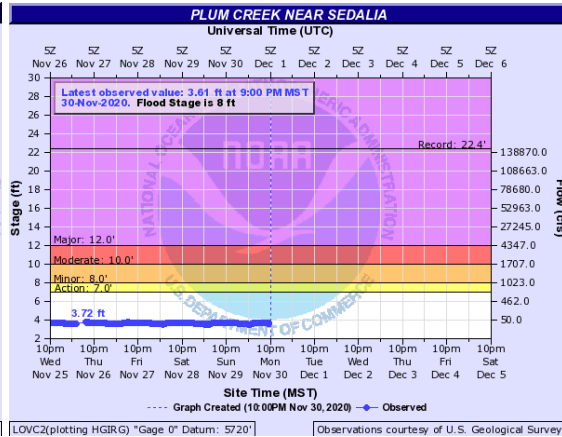
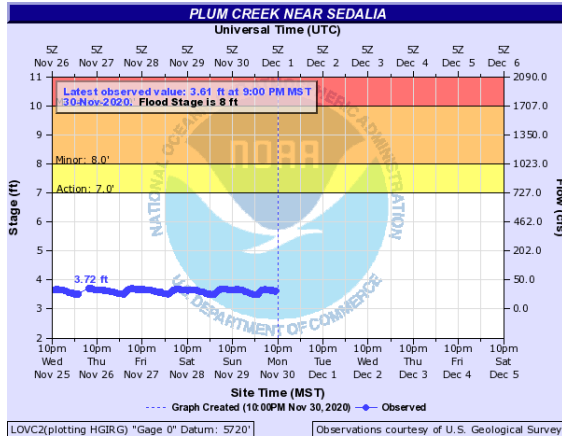
Gage Site Number	Site Name	Action Stage (feet)	Flood Stage (feet)	Moderate Flood Stage (feet)	Major Flood Stage (feet)	Record Flood
06712000	Cherry Creek at Franktown	8.5	9.95	11	13	11.13 feet (July 2 nd , 2006)
06709000	Plum Creek near Sedalia, CO	7	8	10	12	22.4 feet (June 16 th , 1965)
	West Plum Creek at Pine Cliff above Sedalia, CO	5	6.8	11	11.6	

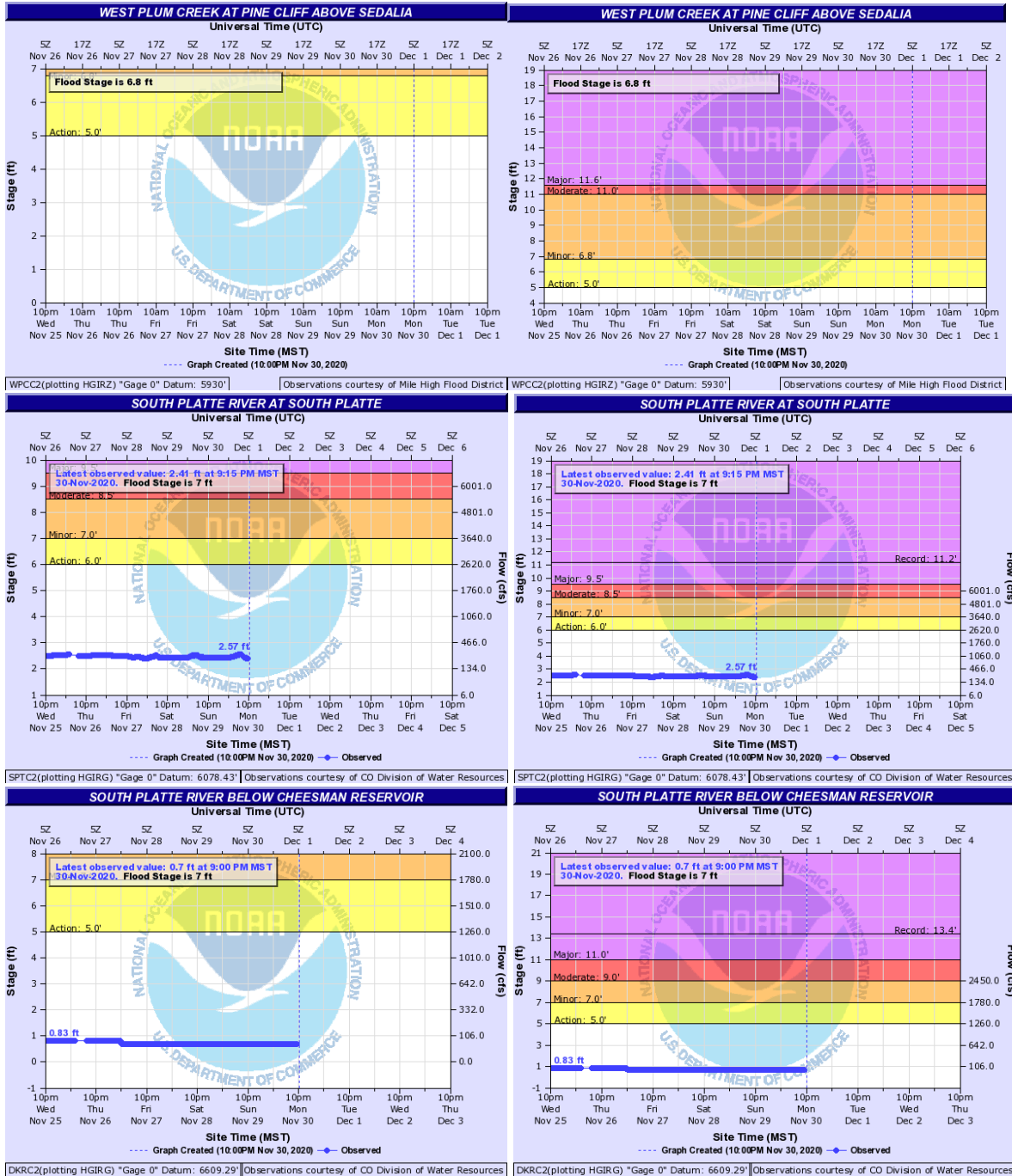
Gage Site Number	Site Name	Action Stage (feet)	Flood Stage (feet)	Moderate Flood Stage (feet)	Major Flood Stage (feet)	Record Flood
06709530	Plum Creek at Titan Road near Louviers, CO	N/A	N/A	N/A	N/A	11.45 feet (June 12, 2015)
393109104464500	Cherry Creek near Parker	7.5	8.5	10	12	12.29 feet (June 6, 2012)
06708800	East Plum Creek above Haskins Gulch near Castle Rock, CO	8.5	10	N/A	N/A	N/A
	East Plum Creek above Castle Rock	95.5	96.5	97.5	98.5	N/A
	South Platte River at Chatfield Reservoir	5,440				5,448.48 feet (June 19 th , 2015)
	South Platte River at South Platte	6	7	8.5	9.5	11.2 feet (July 12, 1996)
	South Platte River below Cheesman Reservoir	5	7	9	11	N/A

Source: USGS 2020; NWS 2020

Figure 5-15. Flood Hydrographs for the Gages in the Vicinity of Douglas County







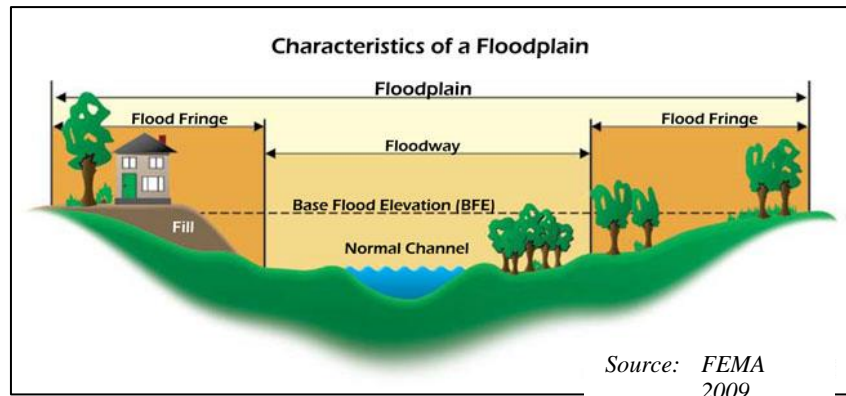
Source: NWS 2020

Location

Flooding potential is influenced by climatology, meteorology, and topography (elevations, latitude, and water bodies and waterways). Flooding potential for each type of flooding that affects the County is described in the subsections below.

Floodplains

A floodplain is defined as the land adjoining the channel of a river, stream, ocean, lake, or other watercourse or water body that becomes inundated with water during a flood. In Douglas County, floodplains line the rivers and streams of the County. The boundaries of the floodplains are altered as a result of changes in land use, the



amount of impervious surface, 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.

Flood Map Terms

- Flood hazard areas identified on the Flood Insurance Rate Map are identified as a Special Flood Hazard Area (SFHA).
- SFHA = the area that will be inundated by the flood event having a 1-percent chance of being equaled or exceeded in any given year.
- 1-percent annual chance flood = the base flood or 100-year flood.
- SFHAs are labeled as 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, and Zones V1-V30.
- Zone B or Zone X (shaded) = Moderate flood hazard areas and are the areas between the limits of the base flood and the 0.2-percent-annual-chance (or 500-year) flood.
- Zone C or Zone X (unshaded) = Areas of minimal flood hazard, which are the areas outside the SFHA and higher than the elevation of the 0.2-percent-annual-chance flood, are labeled Zone C or Zone X (unshaded).

Source: FEMA, 2018

Flood hazard areas are identified as Special Flood Hazard Area (SFHA). SFHA are defined as the area that will be inundated by the flood event having a 1 percent chance of being equaled to or exceeded in any given year. The 1 percent annual chance flood is also referred to as the base flood or 100-year flood. A 100-year floodplain is not a flood that will occur once every 100 years; the designation indicates a flood that has a 1-percent chance of being equaled or exceeded each year. Thus, the 100-year flood could occur more than once in a relatively short period of time. Similarly, the moderate flood hazard area (500-year floodplain) will not occur every 500 years but is an event with a 0.2-percent chance of being equaled or exceeded each year (FEMA 2018). The 1-percent annual chance floodplain establishes the area that has flood insurance and floodplain management requirements.

Locations of flood zones in the County as depicted on the FEMA preliminary Digital Flood Insurance Rate Map (DFIRM) are illustrated in Figure 5-16 through Figure 5-20 and Table 5-45 summarizes the total land

area in the floodplain, inclusive of waterbodies. Douglas County is located in three watersheds that cause flooding in the County: Upper South Platte, Middle South Platte, and Fountain. The South Fork of the South Platte is the major river in the County (Douglas County 2015).

The Digital Flood Insurance Rate Map (DFIRM) data provided by FEMA for the County show the following flood hazard areas:

- 1-Percent Annual Chance Flood Hazard: Areas subject to inundation by the 1-percent-annual-chance flood event. This includes Zone A, Zone AE, and Zone AO. Mandatory flood insurance requirements and floodplain management standards apply. Base flood elevations are provided in Zone AE. Zone AO has associated flood depths derived from detailed hydraulic analyses. Zone A has no determined flood depths.
- 0.2-Percent Annual Chance Flood Hazard: Area of minimal flood hazard, usually depicted on FIRMs as the 500-year flood level or Shaded X Zone.

Table 5-45 Total Land Area in the 1-Percent and 0.2-Percent Annual Chance Flood Zones (Acres)

Municipality	Total Area (acres)	1% Flood Event Hazard Area		0.2% Flood Event Hazard Area	
		Area (acres)	Percent (%) of Total	Area (acres)	Percent of Total
Castle Pines (C)	6,131	54	0.9%	54	0.9%
Castle Rock (T)	22,025	685	3.1%	937	4.3%
Larkspur (T)	1,013	118	11.6%	135	13.4%
Lone Tree (C)	6,280	124	2.0%	131	2.1%
Parker (T)	14,294	1,225	8.6%	2,010	14.1%
Unincorporated Douglas County	489,919	11,167	2.3%	12,208	2.5%
Douglas County (Total)	539,663	13,371	2.5%	15,475	2.9%

Source: FEMA 2020

Note: The area presented includes the area of waterways.

Flood Insurance in Douglas County

National Flood Insurance Program

Douglas County participates in the NFIP and has been in the program since 1987. All municipalities and the County with the exception of the City of Castle Pines participate in the National Flood Insurance Program. There are 385 policies in the County, with the vast majority of policies being in an unknown jurisdiction. Nearly \$118 million in property is covered, with over \$505,000 in losses paid.

Table 5-46 NFIP Status

Municipality	NFIP Status	Regular Program Entry Date	FIRM Effective Date
Castle Pines (C)	Not Participating	-	9/4/2020
Castle Rock (T)	Participating	8/15/1978	3/16/2016
Larkspur (T)	Participating	9/30/1987	9/30/2005
Lone Tree (C)	Participating	9/30/1980	9/4/2020
Parker (T)	Participating	9/30/1987	9/4/2020
Unincorporated Douglas County	Participating	9/30/1987	9/4/2020

Table 5-47 NFIP Statistics for Douglas County

Municipality	Total Premium	Total Policies	Value of Coverage	Total Losses	Losses Paid	RL	SRL
Castle Pines (C)	\$0	0	\$0	0	\$0	0	0
Castle Rock (T)	\$39,372	75	\$21,752,400	5	\$4,573	0	0
Larkspur (T)	\$7,131	2	\$732,000	0	\$0	0	0
Lone Tree (C)	\$11,425	20	\$6,140,000	4	\$4,105	0	0
Parker (T)	\$28,723	58	\$21,964,000	1	\$0	0	0
Unincorporated Douglas County	\$0	0	\$0	1	\$3,245	0	0
Unknown	\$125,305	230	\$67,339,800	43	\$493,120	0	0
Douglas County (Total)	\$211,956	385	\$117,928,200	54	\$505,043	0	0

Properties constructed after a FIRM has been adopted are eligible for reduced flood insurance rates. Such structures are less vulnerable to flooding since they were constructed after regulations and codes were adopted to decrease vulnerability. Properties built before a FIRM is adopted are more vulnerable to flooding because they do not meet code or are located in hazardous areas. The first FIRMs in Douglas County became available in 1977. New FIRM panels became effective in 1980, 1987, 1993, 1996, 2005, 2016, and 2017.

Community Rating System

The CRS is a voluntary program within the NFIP that encourages floodplain management activities that exceed the minimum NFIP requirements. Flood insurance premiums are discounted to reflect the reduced flood risk resulting from community actions meeting the following three goals of the CRS:

- Reduce flood losses.
- Facilitate accurate insurance rating.
- Promote awareness of flood insurance.

For participating communities, flood insurance premium rates are discounted in increments of 5 percent. For example, a Class 1 community would receive a 45 percent premium discount, and a Class 9 community would receive a 5 percent discount. (Class 10 communities are those that do not participate in the CRS; they receive no discount.) The discount partially depends on location of the property. Properties outside the SFHA receive smaller discounts: a 10-percent discount if the community is at Class 1 to 6 and a 5-percent discount if the community is at Class 7 to 9. The CRS classes for local communities are based on 18 creditable activities in the following categories:

- Public information
- Mapping and regulations
- Flood damage reduction
- Flood preparedness

CRS activities can help to save lives and reduce property damage. Communities participating in the CRS represent a significant portion of the nation’s flood risk; over 66 percent of the NFIP’s policy base is located

in these communities. Communities receiving premium discounts through the CRS range from small to large and represent a broad mixture of flood risks, including both coastal and riverine flood risks.

Multiple jurisdictions in Douglas County participate in the CRS program.

- Douglas County entered the CRS program on October 1, 1996 and is currently ranked as a Class 5 community. This provides residents within the SFHA, who have NFIP-backed flood insurance, a 25% discount on their flood insurance premiums.
- The Town of Parker entered the CRS program on October 1, 1992 and is currently ranked as a Class 5 community. This provides residents within the SFHA, who have NFIP-backed flood insurance, a 25% discount on their flood insurance premiums (FEMA 2020).

Figure 5-16. FEMA DFIRM Flood Hazard Areas in Douglas County

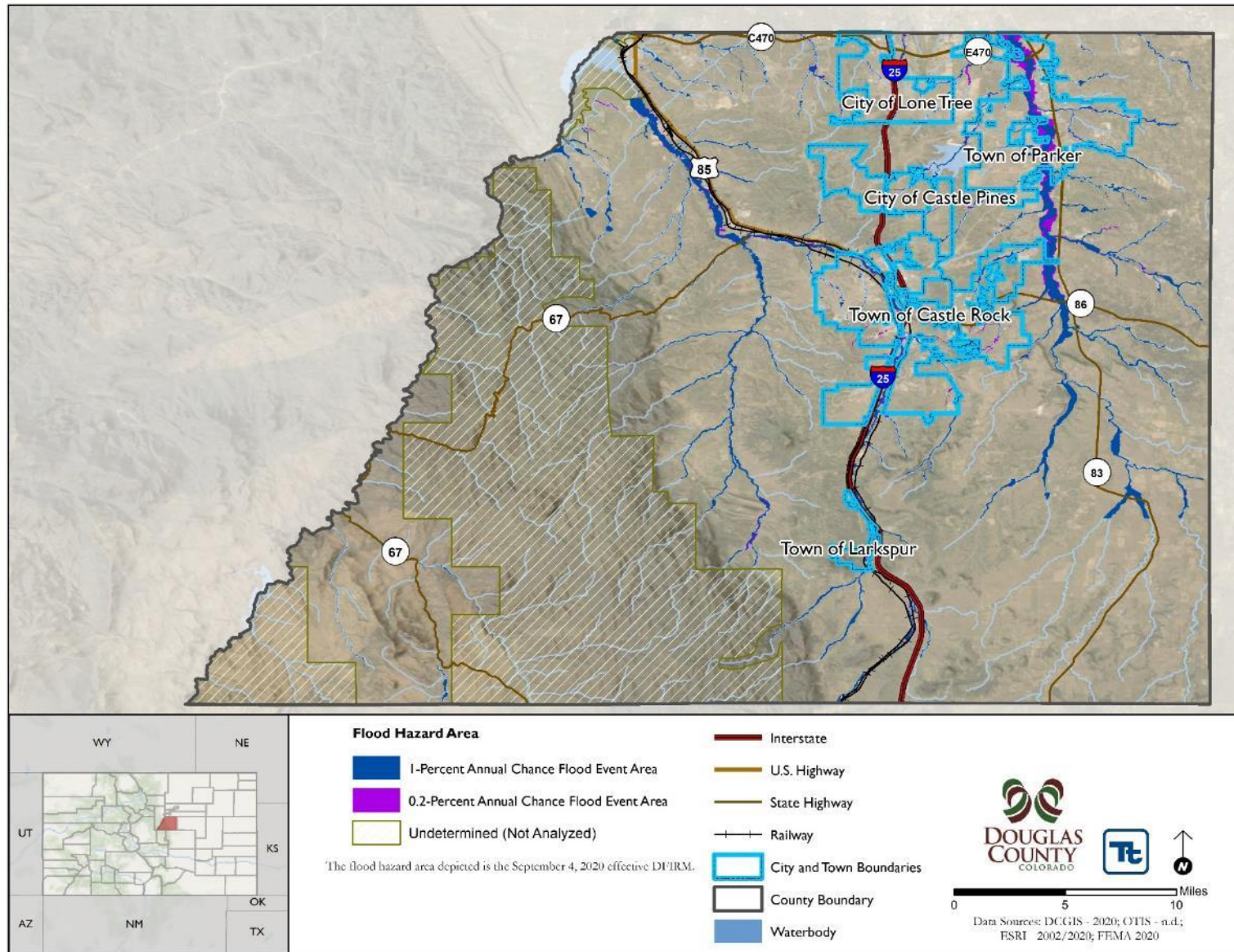


Figure 5-17. FEMA DFIRM Flood Hazard Areas in Douglas County (Northeast)

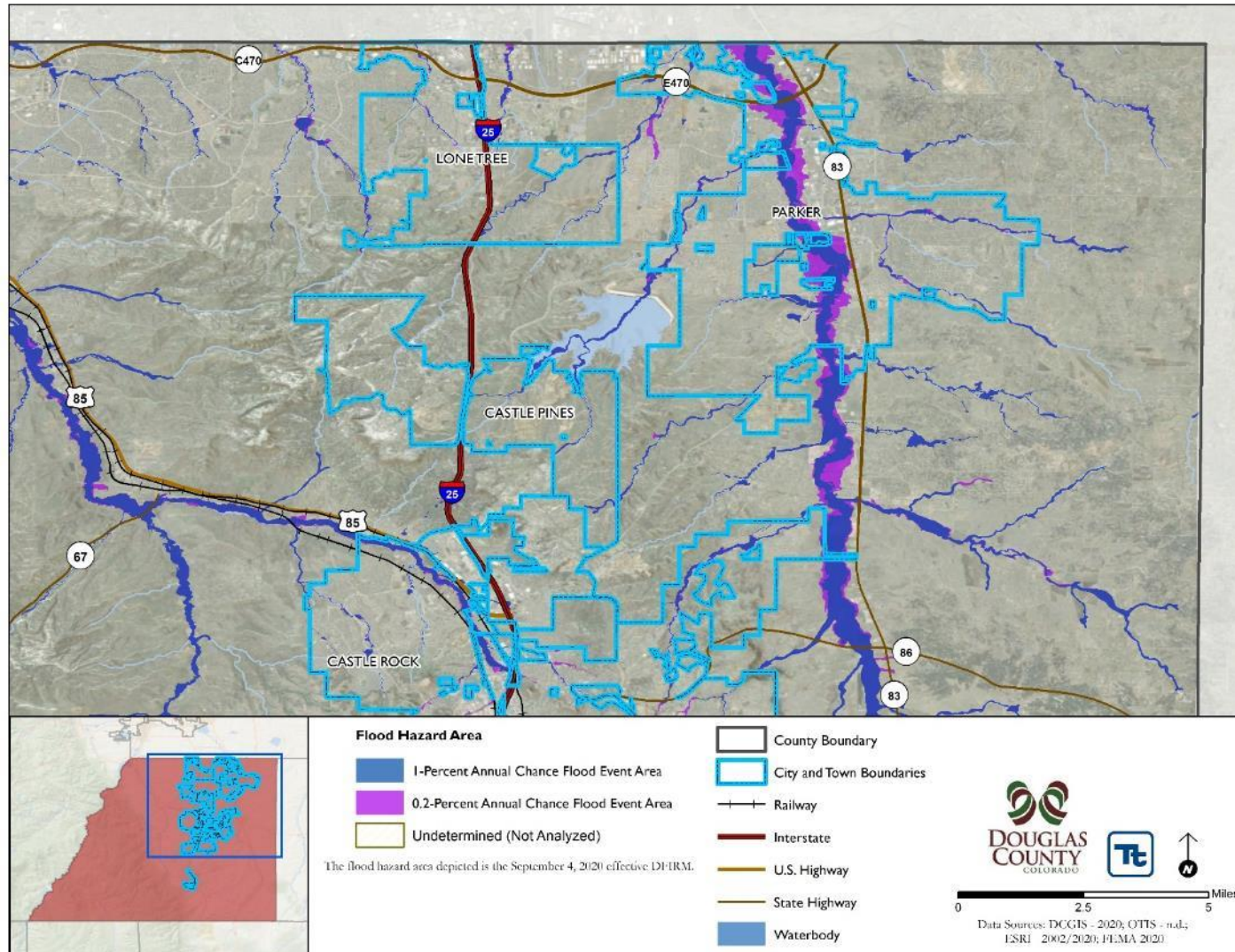


Figure 5-18. FEMA DFIRM Flood Hazard Areas in Douglas County (Northwest)

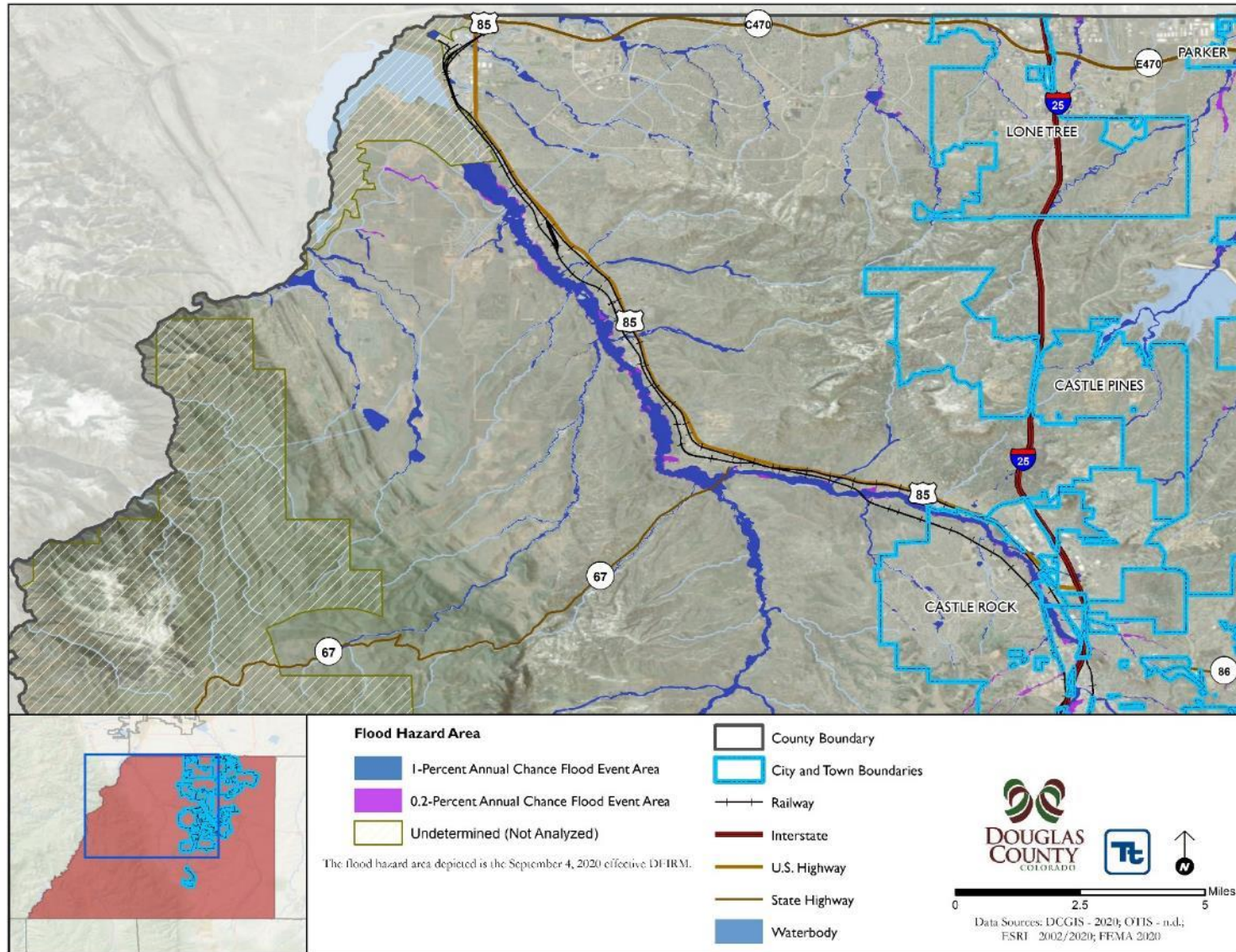


Figure 5-19. FEMA DFIRM Flood Hazard Areas in Douglas County (Southeast)

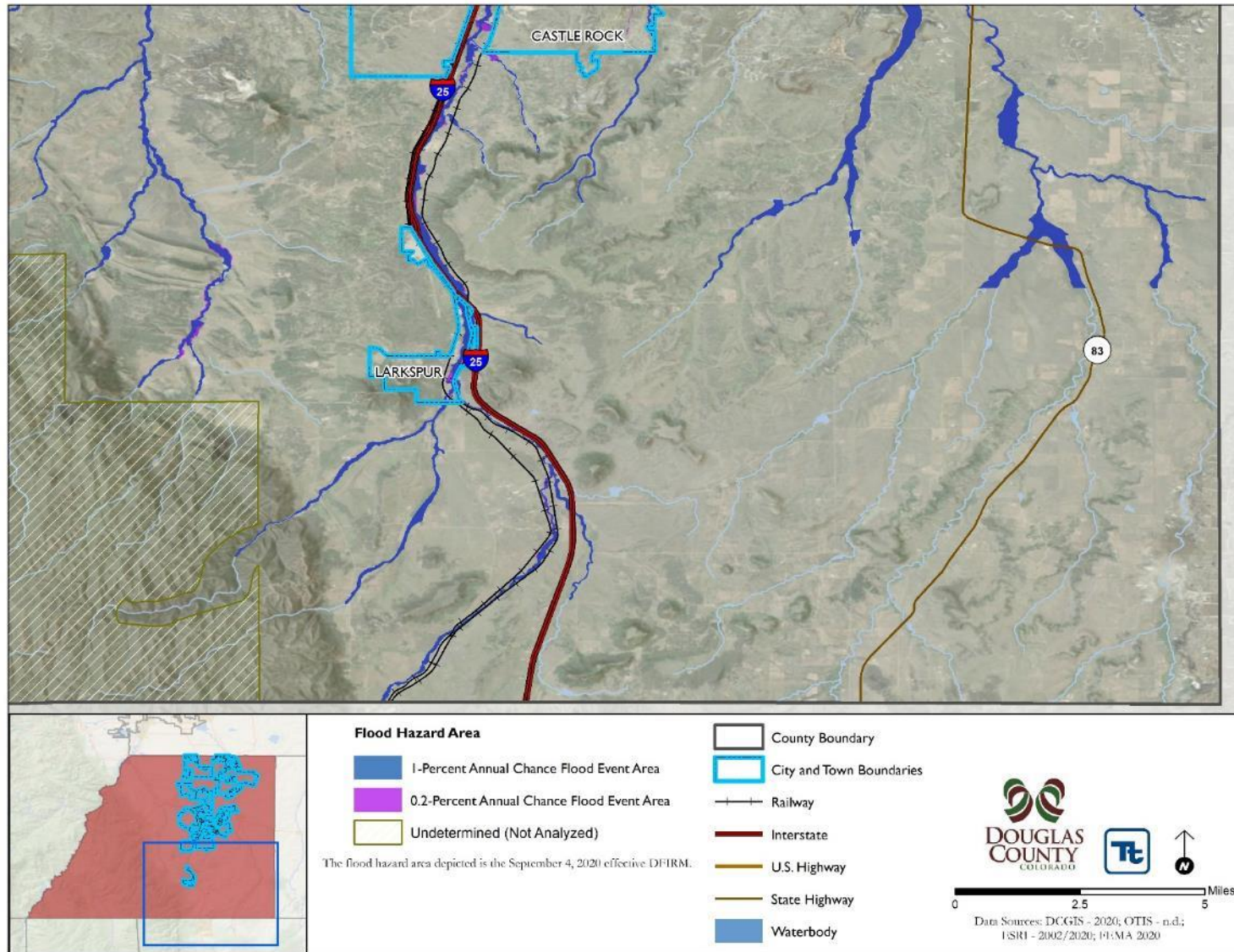
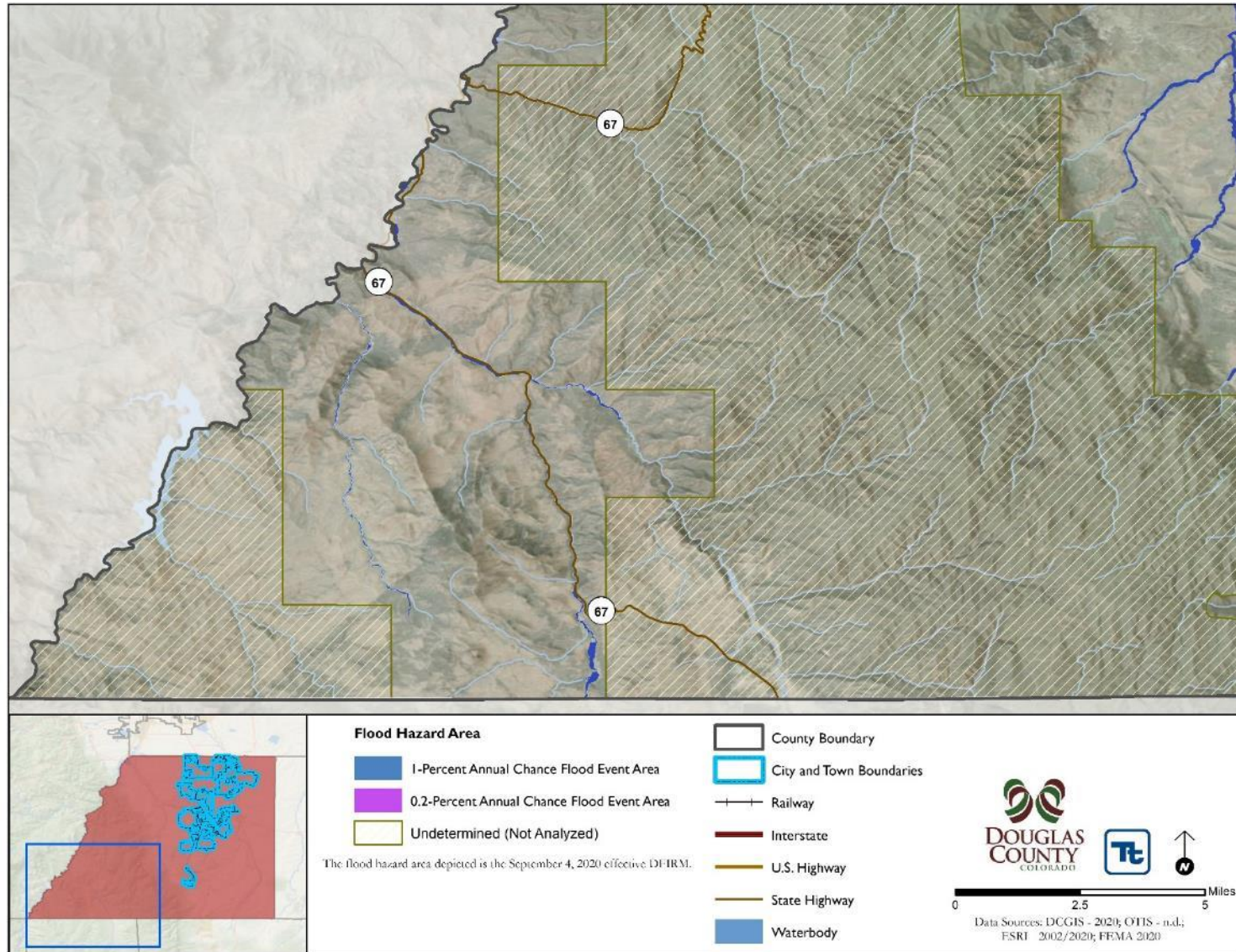


Figure 5-20. FEMA DFIRM Flood Hazard Areas in Douglas County (Southwest)



Previous Occurrences and Losses

Many sources have provided historical information regarding previous occurrences and losses associated with floods in Douglas County. According to the NOAA-NCEI Storm Events Database, Douglas County has been impacted by four flood events between 2014 and 2020 that caused \$60,000 in property damage (refer to Table 5-48).

Table 5-48 Flood Events in Douglas County, 2014-2020

Hazard Type	Number of Occurrences Between 2014 and 2020	Total Fatalities	Total Injuries	Total Property Damage (\$)	Total Crop Damage (\$)
Flash Flood	2	0	0	\$30,000	\$10,000
Flood	2	0	0	\$30,000	\$10,000
TOTAL	4	0	0	\$60,000	\$20,000

Source: NOAA-NCEI 2020

Between 1953 and 2020, FEMA included the State of Colorado in 13 flood-related major disaster (DR) or emergency (EM) declarations. Generally, these disasters cover a wide region of the State; therefore, they may have impacted many counties. Douglas County was included in two of these flood-related declarations; refer to Table 5-49 .

Table 5-49 Flood-Related FEMA Declarations for Douglas County, 1953 to 2020

FEMA Declaration Number	Date(s) of Event	Incident Type	Incident Title
DR-261	May 19, 1969	Flood	Severe Storms and Flooding
DR-385	May 23, 1973	Flood	Heavy Rains, Snowmelt, and Flooding

Source: FEMA 2020

This HMP update includes known flood events that have impacted Douglas County between 2014 and 2020. These events are shown in Table 5-50 . The events listed in Table 5-50 represent only those that were reported to the NOAA-NCEI Storm Events Database and/or resulted in a FEMA disaster declaration; therefore, the table may not represent all flood events that have occurred since 2014.

Table 5-50 Flood Events in Douglas County, 2014 to 2020

Dates of Event	Event Type	FEMA Declaration Number (if applicable)	County Designated?	Fatalities	Injuries	Damages	Event Details*
July 12, 2014	Flash Flood	N/A	N/A	0	0	\$15,000 in property damage, \$10,000 in crop damage	Douglas County experienced flash flooding, where heavy rain pushed mud and debris across US 85 near Airport Road. Floodwaters on Moore and Titan Roads were 6 to 8 inches deep.
June 11, 2015	Flash Flood	N/A	N/A	0	0	\$15,000 in property damage	Flash flooding in Douglas County resulted from thunderstorms producing heavy rainfall.
June 12, 2015	Flood	N/A	N/A	0	0	\$15,000 in property damage	The following day after flash flooding, Douglas County experienced flooding. The flooding closed four trails in Castle Rock. The flooding resulted from thunderstorms producing heavy rainfall.
June 14-June 22, 2015	Flood	N/A	N/A	0	0	\$15,000 in property damage, \$10,000 in crop damage	Douglas County and Jefferson County experienced flooding after thunderstorms produced heavy rain and hail, leading to snowmelt. This caused a prolonged period of flooding, with southwestern Douglas County being impacted the most. Various roads were closed, including Trumbull Bridge and South West Platte River Road, were damaged and remained closed. The South Platte River's use was restricted while the river was swollen.

Sources: NOAA-NCEI 2020; FEMA 2020; Douglas County Sheriff

* Many sources were consulted to provide an update of previous occurrences and losses; event details and loss/impact information may vary and has been summarized in the above table

- Not available/not recorded

FEMA Federal Emergency Management Agency

NCEI National Centers for Environmental Information

NOAA National Oceanic and Atmospheric Administration

NWS National Weather Service

Climate Change Projections

The climate of Colorado is changing. Most of the State has warmed between one to two degree Fahrenheit in the past century. In the eastern two-thirds of the State, average annual rainfall is increasing; however, the soil is becoming drier. Rainstorms are more frequent and intense, with precipitation increasingly falling as rain rather than snow. In the coming decades, storms are likely to become more severe in Colorado (EPA 2016). Major clusters of summertime thunderstorms in North America will grow larger, more intense, and more frequent later this century in a changing climate, leading to increased rainfall and posing a greater threat of flooding across wide areas (University Corporation for Atmospheric Research [UCAR] 2017).

Probability of Future Occurrences

Based on the historic and more recent flood events in Douglas County, and the future climate projections for this region, the County has a moderate probability of future flooding. It is anticipated that Douglas County will continue to experience direct and indirect impacts of flooding events annually that may induce secondary hazards such as infrastructure deterioration or failure, utility failures, power outages, water quality and supply concerns, and transportation delays, accidents and inconveniences. Additionally, climate change is expected to increase the severity and frequency of heavy rain events in Douglas County. This is likely to lead to an increase in flooding events and dam failure events.

As defined by FEMA, Douglas County’s 1-percent annual chance flood area is estimated to have a one-percent chance of flooding in any given year. A structure located within a 1-percent annual chance flood area has a 26-percent chance of suffering flood damage during the term of a 30-year mortgage. Similarly, the 0.2-percent annual chance flood has a 6-percent chance of occurring during a 30-year time period.

Table 5-51 calculates the probability of future flood events for Douglas County. Using FEMA disaster declarations and NOAA-NCEI storm events database, 46 flood events have impacted Douglas County between 1954 and 2020.

Table 5-51 Probability of Future Occurrence of Flood Events

Hazard Type	Number of Occurrences Between 1954 and 2020	% chance of occurrence in any given year
Flood	6	8.9%
Flash Flood	40	59.7%

Source: NOAA-NCEI 2020; FEMA 2020

Note: This calculation does not include all flood events that occurred in this time period due to data limitations. The numbers presented here are presented as low estimates.

Based on historical records and input from the Core Planning Team, the probability of occurrence for flood events in the County is considered *high* (likely to occur within 25 years). Refer to Sections 5.1 and 5.3 for additional information on the hazard ranking methodology and probability criteria.

Vulnerability Assessment

To assess Douglas County’s risk to the flood hazard, a spatial analysis was conducted using the best available spatially-delineated flood hazard areas. The 1-percent annual chance flood event was examined to determine the assets located in the hazard areas and to estimate potential loss using the FEMA Hazus v4.2 riverine model and an exposure analysis was conducted on both the 1- and 0.2-percent annual chance

flood event. These results are summarized below. Refer to Section 5.1 (Methodology) for additional details on the methodology used to assess flood risk.

Impact on Life, Health and Safety

The impact of flooding on life, health and safety is dependent upon several factors including the severity of the event and whether adequate warning time is provided to residents. Exposure represents the population living in or near floodplain areas that could be impacted should a flood event occur. However, exposure is not limited to persons who reside in a defined hazard zone, but includes all individuals who may be affected by the effects of a hazard event (e.g., people are at risk while traveling in flooded areas, or their access to emergency services is compromised during an event). The degree of that impact will vary and is not strictly measurable.

Based on the spatial analysis, there are an estimated 595 people living in the 1-percent annual chance flood event hazard area and 4,775 people living in the 0.2-percent annual chance flood event area (refer to Table 5-52). These residents may be displaced due to their homes flooding, requiring them to seek temporary shelter with friends and family or in emergency shelters.

The Town of Larkspur has the greatest percentage of its population located in the 1-percent annual chance flood event hazard area; approximately 5.8-percent or 257 persons. Douglas County unincorporated area has the greatest number of residents located in the 1- and the 0.2-percent annual chance flood event hazard area; approximately 540 persons and 1,581 persons, respectively. Overall, 1.5-percent of the Douglas County’s residence live in the 0.2-percent annual chance flood event hazard area. For this project, the potential population exposed is used as a guide for planning purposes.

Table 5-52 Estimated Population Exposed to the 1-Percent and 0.2-Percent Annual Chance Flood Event Hazard Areas

Jurisdiction	American Community Survey (2014-2018) Population	Estimated Population Exposed to the Flood Hazard Areas			
		1-percent Annual Chance Flood Hazard Event Area Number of People	Percent of Total	0.2-percent Annual Chance Flood Hazard Event Area Number of People	Percent of Total
Castle Pines (C)	10,573	0	0.0%	0	0.0%
Castle Rock (T)	59,680	3	<0.1%	122	0.2%
Larkspur (T)	257	15	5.8%	20	7.9%
Lone Tree (C)	14,209	0	0.0%	0	0.0%
Parker (T)	52,563	38	0.1%	3,052	5.8%
Unincorporated Douglas County	191,332	540	0.3%	1,581	0.8%
Douglas County (Total)	328,614	595	0.2%	4,775	1.5%

Sources: FEMA DFIRM 2020; American Community Survey 2018 (ACS 2014-2018)

Note: C= City; T= Town

Research has shown that some populations, while they may not have more hazard exposure, may experience exacerbated impacts and prolonged recovery if/when impacted. This is due to many factors including their physical and financial ability to react or respond during a hazard. Of the population exposed, the most vulnerable include the economically disadvantaged and the population over age 65. Economically disadvantaged populations may be more vulnerable because they are likely to evaluate their risk and make

decisions to evacuate based on net economic impacts on their families. The population over age 65 is also more vulnerable because they are more likely to seek or need medical attention that may not be available due to isolation during a flood event, and they may have more difficulty evacuating.

Within Douglas County, there are approximately 35,801 people over the age of 65 and 11,333 people below the poverty level (American Community Survey 2018).

The Centers for Disease Control and Prevention (CDC) 2016 Social Vulnerability Index (SVI) ranks U.S. Census tracts on socioeconomic status, household composition and disability, minority status and language, and housing and transportation. Douglas County’s overall score is 0.0175, indicating that its communities have a relatively low social vulnerability (CDC 2016). However, portions of the Town of Castle Rock have scores of 0.6058, indicating these communities have a relatively high social vulnerability (CDC 2016). These scores indicate that some County residents may not have enough resources to respond to flood events.

Using 2010 U.S. Census data, Hazus v4.2 estimates the potential sheltering needs as a result of a 1-percent annual chance flood event. For the 1-percent flood event, Hazus v4.2 estimates 2,552 persons will be displaced, and 67 people will seek short-term sheltering. These statistics are presented in Table 5-53 by jurisdiction. The estimated displaced population and number of persons seeking short-term sheltering differs from the number of persons exposed to the 1-percent annual chance flood because the displaced population numbers take into consideration that not all residents will be significantly impacted enough to be displaced or to require short-term sheltering during a flood event. Displaced population accounts for households in the inundation area that would be displaced due to evacuations or restricted access due to flooded roadways.

Table 5-53 Estimated Population Displaced or Seeking Short-Term Shelter from the 1-Percent Annual Chance Flood Event Hazard Area

Municipality	American Community Survey (2014-2018) Population	1-Percent Annual Chance Flood Event Area	
		Displaced Population	Persons Seeking Short-Term Sheltering
Castle Pines (C)	10,573	0	0
Castle Rock (T)	59,680	322	7
Larkspur (T)	257	4	0
Lone Tree (C)	14,209	20	0
Parker (T)	52,563	1,033	49
Unincorporated Douglas County	191,332	1,173	11
Douglas County (Total)	328,614	2,552	67

Sources: Hazus v4.2; FEMA 2020; American Community Survey 2018 (ACS 2014-2018)

Note: C= City; V= Village

*Population results generated by Hazus-MH v4.2 are using 2010 Census population statistics and may be underestimated

Injuries and Casualties

Total number of injuries and casualties resulting from typical riverine flooding are generally limited based on advance weather forecasting, blockades, and warnings. Injuries and deaths generally are not anticipated if proper warning and precautions occur. In contrast, warning time for flash flooding, ice jam, and dam failure is limited. These events are frequently associated with other natural hazard events such as earthquakes, landslides, or severe weather, which limits their predictability and compounds the hazard. Populations without adequate warning of the event are highly vulnerable to this hazard.

Public Health Impacts

Cascading impacts of flooding may also include exposure to pathogens such as mold. After flood events, excess moisture and standing water contribute to the growth of mold in buildings. Mold may present a health risk to building occupants, especially those with already compromised immune systems such as infants, children, the elderly and pregnant women. The degree of impact will vary and is not strictly measurable. Mold spores can grow in as short a period as 24-48 hours in wet and damaged areas of buildings that have not been properly cleaned. Very small mold spores can easily be inhaled, creating the potential for allergic reactions, asthma episodes, and other respiratory problems. Buildings should be properly cleaned and dried out to safely prevent mold growth (CDC 2015).

Molds and mildews are not the only public health risk associated with flooding. Floodwaters can be contaminated by pollutants such as sewage, human and animal feces, pesticides, fertilizers, oil, asbestos, and rusting building materials. Common public health risks associated with flood events also include:

- Unsafe food
- Contaminated drinking and washing water and poor sanitation
- Mosquitos and animals
- Carbon monoxide poisoning
- Secondary hazards associated with re-entering/cleaning flooded structures
- Mental stress and fatigue

Current loss estimation models such as Hazus are not equipped to measure public health impacts. The best level of mitigation for these impacts is to be aware that they can occur, educate the public on prevention, and be prepared to deal with these vulnerabilities in responding to flood events.

Impact on General Building Stock

Exposure to the flood hazard includes those buildings located in the flood zone or those that are built downstream in other flood inundation areas such as dam failure inundation areas. Potential damage is the modeled loss that could occur to the exposed inventory measured by the structural and content replacement cost value.

There are an estimated 458 buildings located in the 1-percent annual chance flood event hazard area with a value of approximately \$301 million of building and contents (based on replacement cost value). This represents approximately 0.2-percent of the County's total general building stock inventory replacement cost value (approximately \$182 billion). The Town of Larkspur has the greatest percentage of its buildings located in the floodplain; 6.9-percent or 27 buildings of its total building stock. Unincorporated areas in Douglas County have an estimated 392 buildings located in the 1-percent annual chance flood event area and 894 buildings located in the 0.2-percent annual chance flood event area. The Town of Parker has the largest number of buildings in the 0.2-percent annual chance flood event area (6.3-percent), 1,129 buildings and 7.1-percent of the total building stock (\$1.68 billion). Table 5-54 presents a summary of 1- and 0.2 percent flood inundation area exposure results by jurisdiction. Table 5-55 and Table 5-56 break down the 1-percent and 0.2-percent annual chance flood event exposure results for residential structures and commercial structures, respectively.

Furthermore, Hazus v4.2 estimates approximately \$25.6 million in building and content damage as a result of the 1-percent annual chance flood event (or less than 0.1-percent of the total building stock replacement

cost value). Of the \$25.6 million in potential loss, approximately \$15.2 million losses (59.4-percent) are estimated to occur to residential structures. Refer to Table 5-57 for the potential losses from the 1-percent annual chance flood event for all occupancies estimated by jurisdiction. Table 5-58, Table 5-59, and Table 5-60 summarize Hazus v4.2 estimated damages for residential, commercial occupancy classes, and all other occupancies, respectively.

Table 5-54 Estimated General Building Stock Exposure to the 1-Percent and 0.2-Percent Annual Chance Flood Events

Jurisdiction	Number of Buildings	Total Replacement Cost Value (RCV)	Estimated Building Stock Exposed to the Flood Hazard Areas (All Occupancies)							
			1-percent Annual Chance Flood Hazard Event Area				0.2-percent Annual Chance Flood Hazard Event Area			
			Number of Buildings	Percent of Total	Replacement Cost Value (RCV)	Percent of Total	Number of Buildings	Percent of Total	Replacement Cost Value (RCV)	Percent of Total
Castle Pines (C)	3,701	\$4,995,772,208	0	0.0%	\$0	0.0%	0	0.0%	\$0	0.0%
Castle Rock (T)	24,262	\$28,003,310,038	6	<0.1%	\$8,839,879	<0.1%	82	0.3%	\$649,788,001	2.3%
Larkspur (T)	394	\$135,724,576	27	6.9%	\$18,668,924	13.8%	38	9.6%	\$25,039,714	18.4%
Lone Tree (C)	4,190	\$23,664,803,217	0	0.0%	\$0	0.0%	0	0.0%	\$0	0.0%
Parker (T)	17,864	\$23,597,914,712	33	0.2%	\$19,612,863	0.1%	1,129	6.3%	\$1,679,537,656	7.1%
Unincorporated Douglas County	84,745	\$102,018,837,713	392	0.5%	\$253,956,677	0.2%	894	1.1%	\$761,156,674	0.7%
Douglas County (Total)	135,156	\$182,416,362,464	458	0.3%	\$301,078,343	0.2%	2143	1.6%	\$3,115,522,044	1.7%

Sources: FEMA 2020, Douglas County GIS 2020; RS Means 2020

Note: C= City; T = Town

Table 5-55 Estimated General Building Stock Exposure to the 1-percent and 0.2- Percent Annual Chance Flood Events – Residential Occupancy Class

Jurisdiction	Number of Buildings	Total Replacement Cost Value (RCV) - Residential Occupancy	Estimated Building Stock Exposed to the Flood Hazard Areas (Residential Occupancy)							
			1-percent Annual Chance Flood Hazard Event Area				0.2-percent Annual Chance Flood Hazard Event Area			
			Number of Buildings	Percent of Total	Replacement Cost Value (RCV)	Percent of Total	Number of Buildings	Percent of Total	Replacement Cost Value (RCV)	Percent of Total
Castle Pines (C)	3,610	\$4,678,591,960	0	0.0%	\$0	0.0%	0	0.0%	\$0	0.0%
Castle Rock (T)	22,939	\$22,069,828,170	1	<0.1%	\$1,707,902	<0.1%	47	0.2%	\$384,606,851	1.7%
Larkspur (T)	330	\$61,629,261	19	5.8%	\$6,734,550	10.9%	26	7.9%	\$8,915,380	14.5%
Lone Tree (C)	3,835	\$9,414,618,130	0	0.0%	\$0	0.0%	0	0.0%	\$0	0.0%
Parker (T)	16,792	\$17,580,831,920	12	0.1%	\$9,576,206	0.1%	975	5.8%	\$1,234,815,224	7.0%
Unincorporated Douglas County	78,320	\$77,647,371,278	224	0.3%	\$118,537,327	0.2%	647	0.8%	\$404,058,305	0.5%
Douglas County (Total)	125,826	\$131,452,870,718	256	0.2%	\$136,555,984	0.1%	1,695	1.3%	\$2,032,395,760	1.5%

Sources: FEMA 2020, Douglas County GIS 2020; RS Means 2020

Note: C= City; T = Town

Table 5-56 Estimated General Building Stock Exposure to the 1-percent and 0.2- Percent Annual Chance Flood Events – Commercial Occupancy Class

Jurisdiction	Number of Buildings	Total Replacement Cost Value (RCV) - Commercial Occupancy	Estimated Building Stock Exposed to the Flood Hazard Areas (Commercial Occupancy)							
			1-percent Annual Chance Flood Hazard Event Area				0.2-percent Annual Chance Flood Hazard Event Area			
			Number of Buildings	Percent of Total	Replacement Cost Value (RCV)	Percent of Total	Number of Buildings	Percent of Total	Replacement Cost Value (RCV)	Percent of Total
Castle Pines (C)	49	\$117,118,414	0	0.0%	\$0	0.0%	0	0.0%	\$0	0.0%
Castle Rock (T)	936	\$3,742,436,370	2	0.2%	\$3,418,167	0.1%	30	3.2%	\$218,900,743	5.8%
Larkspur (T)	32	\$26,178,377	4	12.5%	\$2,076,344	7.9%	6	18.8%	\$3,533,938	13.5%
Lone Tree (C)	289	\$13,868,238,675	0	0.0%	\$0	0.0%	0	0.0%	\$0	0.0%
Parker (T)	697	\$4,279,983,009	8	1.1%	\$5,937,509	0.1%	83	11.9%	\$269,373,365	6.3%
Unincorporated Douglas County	2,215	\$16,865,120,359	37	1.7%	\$29,136,715	0.2%	66	3.0%	\$79,279,881	0.5%
Douglas County (Total)	4,218	\$38,899,075,203	51	1.2%	\$40,568,734	0.1%	185	4.4%	\$571,087,928	1.5%

Sources: FEMA 2020, Douglas County GIS 2020; RS Means 2020

Note: C= City; T = Town

Table 5-57 Estimated General Building Stock Potential Loss to the 1-Percent Annual Chance Flood Event – All Occupancies

Jurisdiction	Total Replacement Cost Value	All Occupancies	
		Estimated Loss	Percent of Total
Castle Pines (C)	\$4,995,772,208	\$0	0.0%
Castle Rock (T)	\$28,003,310,038	\$246,320	0.0%
Larkspur (T)	\$135,724,576	\$103,107	0.1%
Lone Tree (C)	\$23,664,803,217	\$0	0.0%
Parker (T)	\$23,597,914,712	\$2,316,932	<0.1%
Unincorporated Douglas County	\$102,018,837,713	\$22,914,069	<0.1%
Douglas County (Total)	\$182,416,362,464	\$25,580,429	<0.1%

Sources: Hazus v4.2; FEMA 2020, Douglas County GIS 2020; RS Means 2020
 Note: C= City, T = Town

Table 5-58 Estimated General Building Stock Potential Loss to the 1-Percent Annual Chance Flood Event – Residential Occupancy Class

Jurisdiction	Total Replacement Cost Value	Residential		
		Total Replacement Cost Value (Residential Occupancy Class)	Estimated Loss	Percent of Total
Castle Pines (C)	\$4,995,772,208	\$4,678,591,960	\$0	0.0%
Castle Rock (T)	\$28,003,310,038	\$22,069,828,170	\$0	0.0%
Larkspur (T)	\$135,724,576	\$61,629,261	\$103,107	0.2%
Lone Tree (C)	\$23,664,803,217	\$9,414,618,130	\$0	0.0%
Parker (T)	\$23,597,914,712	\$17,580,831,920	\$36,293	<0.1%
Unincorporated Douglas County	\$102,018,837,713	\$77,647,371,278	\$15,058,753	<0.1%
Douglas County (Total)	\$182,416,362,464	\$131,452,870,718	\$15,198,153	<0.1%

Sources: Hazus v4.2; FEMA 2020, Douglas County GIS 2020; RS Means 2020
 Note: C= City, T = Town

Table 5-59 Estimated General Building Stock Potential Loss to the 1-Percent Annual Chance Flood Event – Commercial Occupancy Class

Jurisdiction	Total Replacement Cost Value	Commercial		
		Total Replacement Cost Value (Commercial Occupancy Class)	Estimated Loss	Percent of Total
Castle Pines (C)	\$4,995,772,208	\$117,118,414	\$0	0.0%
Castle Rock (T)	\$28,003,310,038	\$3,742,436,370	\$0	0.0%
Larkspur (T)	\$135,724,576	\$26,178,377	\$0	0.0%
Lone Tree (C)	\$23,664,803,217	\$13,868,238,675	\$0	0.0%
Parker (T)	\$23,597,914,712	\$4,279,983,009	\$233,840	<0.1%
Unincorporated Douglas County	\$102,018,837,713	\$16,865,120,359	\$585,469	<0.1%
Douglas County (Total)	\$182,416,362,464	\$38,899,075,203	\$819,309	<0.1%

Sources: Hazus v4.2; FEMA 2020, Douglas County GIS 2020; RS Means 2020
 Note: C= City, T = Town

Table 5-60 Estimated General Building Stock Potential Loss to the 1-Percent Annual Chance Flood Event – Agricultural, Industrial, Religious, Education, and Government Occupancies

Jurisdiction	Total Replacement Cost Value	Agricultural, Industrial, Religious, Education and Government		
		Total Replacement Cost Value (All Other Occupancy Classes)	Estimated Loss	Percent of Total
Castle Pines (C)	\$4,995,772,208	200,061,834	\$0	0.0%
Castle Rock (T)	\$28,003,310,038	2,191,045,499	\$246,320	<0.1%
Larkspur (T)	\$135,724,576	47,916,938	\$0	0.0%
Lone Tree (C)	\$23,664,803,217	381,946,412	\$0	0.0%
Parker (T)	\$23,597,914,712	1,737,099,783	\$2,046,799	0.1%
Unincorporated Douglas County	\$102,018,837,713	7,506,346,076	\$7,269,847	0.1%
Douglas County (Total)	\$182,416,362,464	12,064,416,543	\$9,562,966	0.1%

Sources: Hazus v4.2; FEMA 2020, Douglas County GIS 2020; RS Means 2020

Note: C= City, T = Town

NFIP Statistics

FEMA Region 8 provided a list of NFIP policies, past claims, and payments in Douglas County. According to FEMA, a RL property is a NFIP-insured structure that has had at least two paid flood losses of more than \$1,000 in any 10-year period since 1978 (FEMA, 2005). A SRL property is a NFIP-insured structure that has had four or more separate claim payments made under a standard flood insurance policy, with the amount of each claim exceeding \$5,000 and with the cumulative amount of such claims payments exceeding \$20,000; or at least two separate claims payments made under a standard flood insurance policy with the cumulative amount of such claim payments exceed the fair market value of the insured building on the day before each loss. Table 5-61 shows that the number of claims compared to the number of policies in Douglas County. In some cases, the number of claims may exceed the number of policies. This is likely because multiple repetitive loss properties submitted more than one flood loss claim under their NFIP policies. Note that specific locations of repetitive loss properties were not made available for this Plan.

Table 5-61 NFIP Data for Douglas County

Jurisdiction	Number of NFIP Policies	Number of Write Your Own Policies	Total Number of Policies	Number of NFIP Claims	Number of Write Your Own Claims	Total Claims	Total NFIP Payments	Total Write Your Own Payments	Total Payments
Castle Pines (C)	0	0	0	0	0	0	\$0	\$0	\$0
Castle Rock (T)	6	69	75	0	5	5	\$0	\$4,573	\$4,573
Larkspur (T)	0	2	2	0	5	5	\$0	\$0	\$0
Lone Tree (C)	2	18	2	0	4	4	\$0	\$4,105	\$4,105
Parker (T)	7	51	58	0	1	1	\$0	\$0	\$0
Unincorporated Douglas County	7	231	31	7	42	49	\$33,000	\$480,770	\$513,770
Douglas County (Total)	22	371	168	561	57	64	\$33,000	\$489,448	\$522,448

Source: FEMA Region 8, 2020

Note: NFIP = National Flood Insurance Program, C= City, T = Town

Impact on Land Uses

An exposure analysis was completed to determine the acres of developed residential land and developed non-residential land use types located in the 1-percent flood hazard area. To estimate exposure for developed residential and non-residential land use types to the 1-percent flood hazard area, the floodplain boundary was overlaid upon land use data. Refer to Table 5-62 for a complete summary of this analysis.

Table 5-62 Developed Residential and Non-Residential Land Use Exposed to 1-Percent and 0.2-Percent Annual Chance Flood Event Hazard Areas

Land Use Type	Total Acres for County	1-Percent Annual Chance Flood Hazard Event Area		0.2-Percent Annual Chance Flood Hazard Event Area	
		Acres	Percent of Total	Acres	Percent of Total
Residential Land	36,087	386	1.1%	919	2.5%
Non-Residential Land	501,498	12,644	2.5%	14,207	2.8%
Natural Land	254,730	6,443	2.5%	6,788	2.7%
Douglas County (Total Acres)	537,585	13,029	2.4%	15,126	2.8%

Sources: FEMA 2020, Douglas County GIS 2020; NLCD 2016

Notes: Land use areas do not include areas of water. Non-residential area = Agriculture, Barren, Developed – Open Space, Forest, Wetlands; This analysis does not incorporate areas delineated as water. Residential area = Developed – low intensity, Developed – medium intensity, and Developed – high intensity.

Impact on Critical Facilities

It is important to determine the critical facilities and infrastructure that may be at risk to flooding, and who may be impacted should damage occur. Critical services during and after a flood event may not be available if critical facilities are directly damaged or transportation routes to access these critical facilities are impacted. Roads that are blocked or damaged can isolate residents and can prevent access throughout the planning area to many service providers needing to reach vulnerable populations or to make repairs.

Critical facility exposure to the 1- and 0.2-percent annual chance flood hazard event boundary was examined. In addition, Hazus v4.2 was used to estimate the flood loss potential to critical facilities located in the FEMA mapped floodplains. Hazus results can be found in Section 9, Jurisdiction Annexes. Table 5-63 and Table 5-64 summarize the number of critical facilities exposed to the 1-percent and 0.2-percent flood inundation areas by jurisdiction. Table 5-65 and 68 provide the distribution of critical facilities in the 1-percent and 0.2-percent annual chance flood event boundary. Of the 75 critical facilities located in the 1-percent annual chance flood event boundary, 70 are considered lifelines for the County (Table 5-67). Table 5-67 summarizes the distribution of lifeline types and exposure to the 1-percent and 0.2-percent annual chance flood event. Overall, the majority of lifelines vulnerable to flood events are either for safety and security or for food, water, or shelter. Refer to Section 4 (County Profile) for more information about the critical facilities and lifelines in Douglas County.

Table 5-63 Number of Critical and Lifeline Facilities Located in the 1-Percent Annual Chance Flood Hazard Area

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Exposed to the 1-Percent Annual Chance Flood Event			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Castle Pines (C)	20	12	1	5.0%	1	8.3%
Castle Rock (T)	108	100	1	0.9%	1	1.0%
Larkspur (T)	15	9	2	13.3%	2	22.2%
Lone Tree (C)	54	42	1	1.9%	1	2.4%
Parker (T)	140	105	4	2.9%	1	1.0%
Unincorporated Douglas County	827	703	66	8.0%	64	9.1%
Douglas County (Total)	1,164	971	75	6.4%	70	7.2%

Sources: FEMA 2012, Douglas County GIS 2020

Notes: C= City; T= Town

Table 5-64 Number of Critical and Lifeline Facilities Located in the 0.2-Percent Annual Chance Flood Hazard Area

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Exposed to the 0.2-Percent Annual Chance Flood Event			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Castle Pines (C)	20	12	1	5.0%	1	8.3%
Castle Rock (T)	108	100	3	2.8%	3	3.0%
Larkspur (T)	15	9	6	40.0%	4	44.4%
Lone Tree (C)	54	42	2	3.7%	2	4.8%
Parker (T)	140	105	21	15.0%	9	8.6%
Unincorporated Douglas County	827	703	72	8.7%	69	9.8%
Douglas County (Total)	1,164	971	105	9.0%	88	9.1%

Sources: FEMA 2012, Douglas County GIS 2020

Notes: C= City; T= Town

Table 5-65 Distribution of Critical Facilities in the 1-Percent Annual Chance Flood Event Floodplain by Type and Jurisdiction

Jurisdiction	Critical Facilities Exposed to the 1-Percent Annual Chance Flood Hazard Event Area								
	Bridge	Dam	Fire Station	Government Building	Medical Care	Police Station	Potable Water Lift station	Potable Well	Recreation Site
Castle Pines (C)	0	0	0	0	0	0	1	0	0
Castle Rock (T)	0	0	0	1	0	0	0	0	0
Larkspur (T)	2	0	0	0	0	0	0	0	0
Lone Tree (C)	1	0	0	0	0	0	0	0	0
Parker (T)	0	1	0	0	0	0	0	0	3
Unincorporated Douglas County	32	12	1	0	1	1	0	17	2
Douglas County (Total)	35	13	1	1	1	1	1	17	5

Sources: FEMA 2012, Douglas County GIS 2020
 Notes: C= City; T= Town

Table 5-66 Distribution of Critical Facilities in the 0.2-Percent Annual Chance Flood Event Floodplain by Type and Jurisdiction

Jurisdiction	Critical Facilities Exposed to the 0.2-Percent Annual Chance Flood Hazard Event Area																
	Bridge	Childcare	Dam	Fire Station	Food Distribution	Government Building	Libraries	Medical Care	Pharmacy	Police Station	Polling Sites	Potable Water Lift station	Potable Water Treatment Facility	Potable Well	Primary Education	Recreation Site	Urgent Care
Castle Pines (C)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Castle Rock (T)	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1
Larkspur (T)	2	0	0	1	0	1	1	0	0	0	1	0	0	0	0	0	0
Lone Tree (C)	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Parker (T)	0	1	1	0	1	0	0	1	1	0	0	2	2	0	1	11	0
Unincorporated Douglas County	33	0	12	2	0	0	0	1	0	1	0	1	0	19	0	3	0
Douglas County (Total)	37	1	13	3	1	2	1	2	2	1	1	4	2	19	1	14	1

Sources: FEMA 2012, Douglas County GIS 2020
 Notes: C= City; T= Town

Table 5-67 Lifelines Exposed to the 1-Percent Annual Chance Flood Event Boundary

FEMA Lifeline Category	Number of Lifelines	Number of Lifelines Exposed to 1-Percent Annual Chance Flood Event Hazard	Number of Lifelines Exposed to 0.2-Percent Annual Chance Flood Event Hazard
Food, Water, Shelter	428	18	26
Hazardous Material	22	0	
Health and Medical	203	1	5
Safety and Security	239	16	20
Transportation	79	35	37
Douglas County (Total)	971	70	88

Sources: FEMA 2012, Douglas County GIS 2020

Notes: C= City; T= Town

Impact on the Economy

Flood events can significantly impact the local and regional economy. This includes but is not limited to general building stock damages and associated tax loss, impacts to utilities and infrastructure, business interruption, and impacts on tourism. In areas that are directly flooded, renovations of commercial and industrial buildings may be necessary, disrupting associated services. Refer to the ‘Impact on Buildings’ subsection earlier which discusses direct impacts to buildings in Douglas County.

Debris management may also be a large expense after a flood event. Hazus v4.2 estimates the amount of structural debris generated during a flood event. The model breaks down debris into three categories: (1) finishes (dry wall, insulation, etc.); (2) structural (wood, brick, etc.); and (3) foundations (concrete slab and block, rebar, etc.). These distinctions are necessary because of the different types of equipment needed to handle debris. Table 5-68 summarizes the Hazus v4.2 countywide debris estimates for the 1-percent annual chance flood event. This table only estimates structural debris generated by flooding and does not include non-structural debris or additional potential damage and debris possibly generated by wind that may be associated with a flood event or storm that causes flooding. Overall, Hazus estimates that there will be 2,272 tons of debris generated during the 1-percent annual chance flood event in Douglas County.

Table 5-68 Estimated Debris Generated from the 1-Percent Annual Chance Flood Event

Jurisdiction	1-Percent Annual Chance Flood Event Area			
	Total (tons)	Finish (tons)	Structure (tons)	Foundation (tons)
Castle Pines (C)	0	0	0	0
Castle Rock (T)	109	99	6	4
Larkspur (T)	3	1	1	1
Lone Tree (C)	114	94	10	10
Parker (T)	219	157	37	25
Unincorporated Douglas County	1,827	1,071	400	356
Douglas County (Total)	2,272	1,422	453	396

Sources: Hazus v4.2

Notes: C= City; T= Town

Impact on the Environment

As Douglas County and its jurisdictions evolve with changes in population and density, flood events may increase in frequency and/or severity as land use changes, more structures are built, and impervious surfaces expand. Furthermore, flood extents for the 1-percent annual chance flood event will continue to evolve alongside natural occurrences such as climate change and/or severe weather events. These flood events will inevitably impact Douglas County's natural and local environment.

Furthermore, the environmental impacts of a flood can include significant water-quality and debris-disposal issues. Flood waters can back up sanitary sewer systems and inundate wastewater treatment plants, causing raw sewage to contaminate residential and commercial buildings and the flooded waterway. The contents of unsecured containers of oil, fertilizers, pesticides, and other chemicals get added to flood waters. Hazardous materials may be released and distributed widely across the floodplain. Water supply and wastewater treatment facilities could be offline for weeks. After the flood waters subside, contaminated and flood-damaged building materials and contents must be properly disposed of. Contaminated sediment must be removed from buildings, yards, and properties. In addition, severe erosion is likely; such erosion can negatively impact local ecosystems.

Overall, the acreage of natural land makes up 47.4-percent of the County's total land area (USGS NLCD 2016). Natural land areas from the 2016 land use type dataset includes areas of forested land, and wetlands. Severe flooding will not only influence the habitat of these natural land areas, it can be disruptive to species that reside in these natural habitats. Overall, 2.5-percent and 2.7-percent of the natural land area in the County is exposed to the 1-percent and 0.2-percent annual chance flood event boundary, respectively.

Cascading Impacts on Other Hazards

Flood events can exacerbate the impacts of disease outbreaks and cause sedimentation and erosion problems. Floods may impact the volume of debris flow and cause further degradation of soil stability changing plant communities and potentially affecting exposure to geological hazards. Flooding could increase the risk of transmitting water-borne and vector diseases by contaminating drinking water facilities (WHO 2020). See Sections 5.4.13 through 5.4.16 and 5.4.8 for more information on the geological and pandemic hazards of concern, respectively.

Future Changes that May Impact Vulnerability

Understanding future changes that impact vulnerability in the County can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. The County considered the following factors to examine potential conditions that may affect hazard vulnerability:

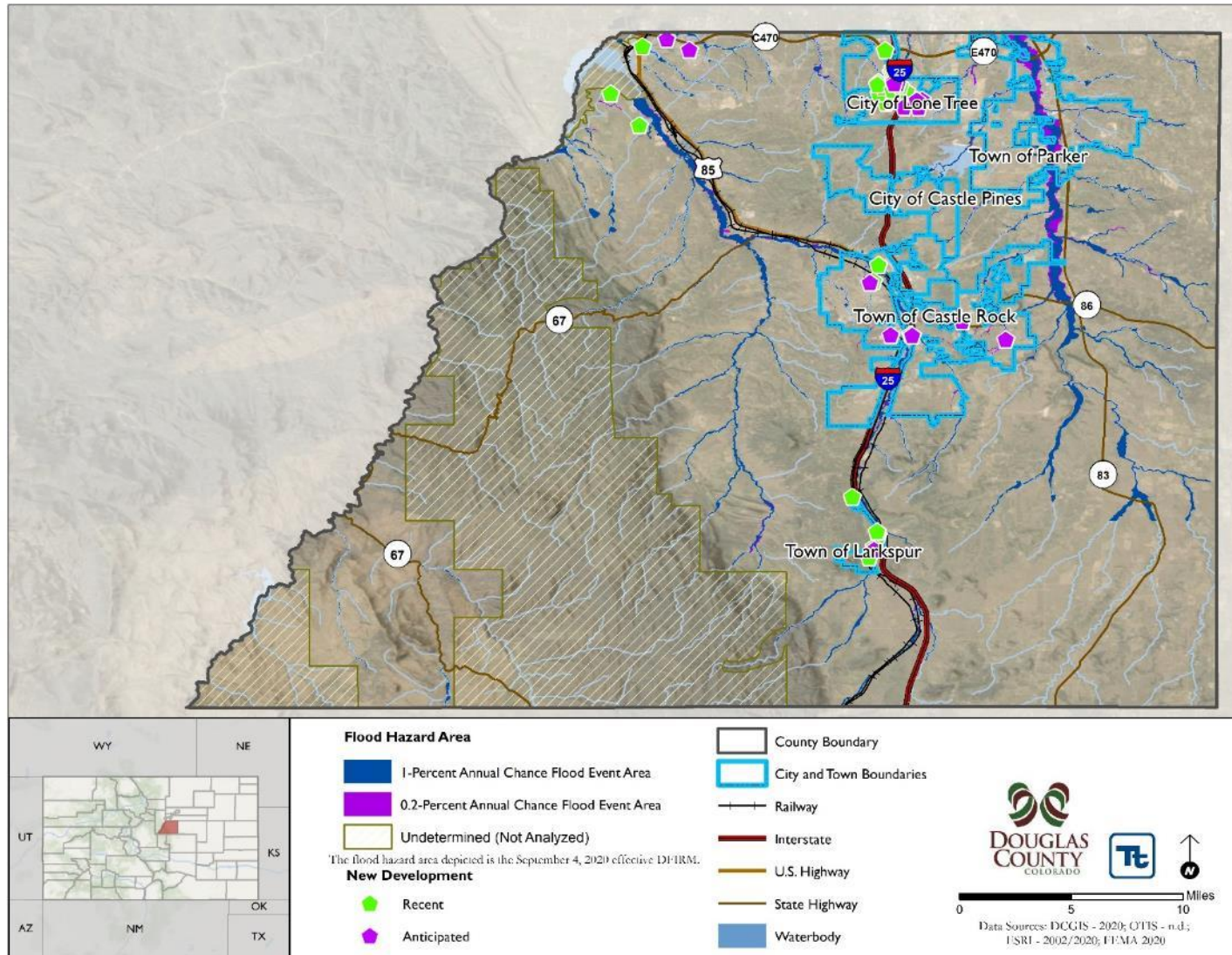
- Potential or projected development.
- Projected changes in population.
- Other identified conditions as relevant and appropriate, including the impacts of climate change.

Projected Development

As discussed and illustrated in Section 4 (County Profile), areas targeted for future growth and development have been identified across the County. Any areas of growth located in the flood inundation areas could be potentially impacted by flooding. Refer to the maps in the jurisdictional annexes (Section 9) to view the new development locations throughout the County and their proximity to the 1-percent annual chance flood

hazard event boundary. There are zero new development sites located within the 1-percent annual chance flood event hazard area and 1 new development sites located in the 0.2-percent annual chance flood event hazard area. Please refer to Figure 5-21 to see new development locations and their proximity to the flood hazard area.

Figure 5-21 New Development and 1- and 0.2-Percent Annual Chance Flood Event Hazard Area in Douglas County



Projected Changes in Population

According to the State of Colorado Department of Local Affairs, the population in Douglas County has increased by approximately 2.07-percent or 6,946 persons between 2017 and 2018 (SOC DLA 2019). As more people will reside in the County, there are possibilities that people will move to locations that are more susceptible than others to flooding. This includes areas that are directly impacted by flood events and those that are indirectly impacted (i.e., isolated neighborhoods, flood-prone roadways, etc.). Refer to Section 4 (County Profile) for additional discussion on population trends.

Climate Change

As discussed earlier, annual precipitation amounts in the region are projected to increase, primarily in the form of heavy rainfalls, which have the potential to increase the risk to flash flooding and riverine flooding, and flood critical transportation corridors and infrastructure (NYSERDA 2014). Increases in precipitation may alter and expand the floodplain boundaries and runoff patterns, resulting in the exposure of populations, buildings, and critical facilities and infrastructure that were previously outside the floodplain. This increase in exposure would result in an increased risk to life and health, an increase in structural losses, a diversion of additional resources to response and recovery efforts, and an increase in business closures affected by future flooding events due to loss of service or access.

Change of Vulnerability Since 2015 HMP

Since the 2015 analysis, population statistics have been updated using the 5-Year 2014-2018 American Community Survey Population Estimates. A flood exposure analysis and Hazus modeling was conducted via a customized general building stock and critical facility inventory rather than an analysis of National Flood Insurance Program (NFIP) properties. In addition, the FEMA 2020 Effective DFIRMs were referenced to assess the 1-percent and 0.2-percent annual chance flood extents. The updated building stock inventory and flood data was imported into Hazus v4.2 to complete a riverine analysis for the 1-percent annual chance flood event.

Overall, this vulnerability assessment uses a more accurate and updated building inventory which provides more accurate estimated exposure and potential losses for Douglas County.

Identified Issues

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.

5.4.7 Hazardous Material Transportation Incidents

This section provides the hazard profile and vulnerability assessment for the hazardous material and transportation incidents for Douglas County.

Profile

Hazard Description

Hazardous material transportation incidents are inter-related and predominantly anthropogenic-caused hazards. Hazardous substances are substances that are considered severely harmful to human health and the environment, as defined by the United States Environmental Protection Agency (USEPA) Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (Superfund Law). Many are commonly used substances which are harmless in their normal uses but are quite dangerous if released. The Superfund law designates more than 800 substances as hazardous and identifies many more as potentially hazardous due to their characteristics and the circumstances of their release (USEPA 2013). Superfund's definition of a hazardous substance includes the following:

- Any element, compound, mixture, solution, or substance designated as hazardous under section 102 of CERCLA.
- Any hazardous substance designated under section 311(b)(2)(a) of the Clean Water Act (CWA), or any toxic pollutant listed under section 307(a) of the CWA. There are over 400 substances designated as either hazardous or toxic under the CWA.
- Any hazardous waste having the characteristics identified or listed under section 3001 of the Resource Conservation and Recovery Act.
- Any hazardous air pollutant listed under section 112 of the Clean Air Act, as amended. There are over 200 substances listed as hazardous air pollutants under the Clean Air Act (CAA).
- Any imminently hazardous chemical substance or mixture which the EPA Administrator has "taken action under" section 7 of the Toxic Substances Control Act (USEPA 2013).

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. Many products containing hazardous substances are used and stored in homes and these products are shipped daily on highways, railroads, waterways, and pipelines.

Extent

The extent of a hazardous substance release will depend on whether it is from a fixed or mobile source, the size of impact, the toxicity and properties of the substance, duration of the release, and the environmental conditions (for example, wind and precipitation, terrain, etc.).

Hazardous substance releases can contaminate air, water, and soils, possibly resulting in death and/or injuries. Dispersion can take place rapidly when the hazardous substance is transported by water and wind. While often accidental, releases can occur as a result of human carelessness, intentional acts, or natural hazards. When caused by natural hazards, these incidents are known as secondary events. Hazardous substances can include toxic chemicals, radioactive substances, infectious substances, and hazardous wastes. Such releases can affect nearby populations and contaminate critical or sensitive environmental areas.

Location

Hazardous material transport incidents are likely to occur along corridors where high volumes of hazardous materials are transported, or in locations where materials are stored or manufactured. Recent hazardous

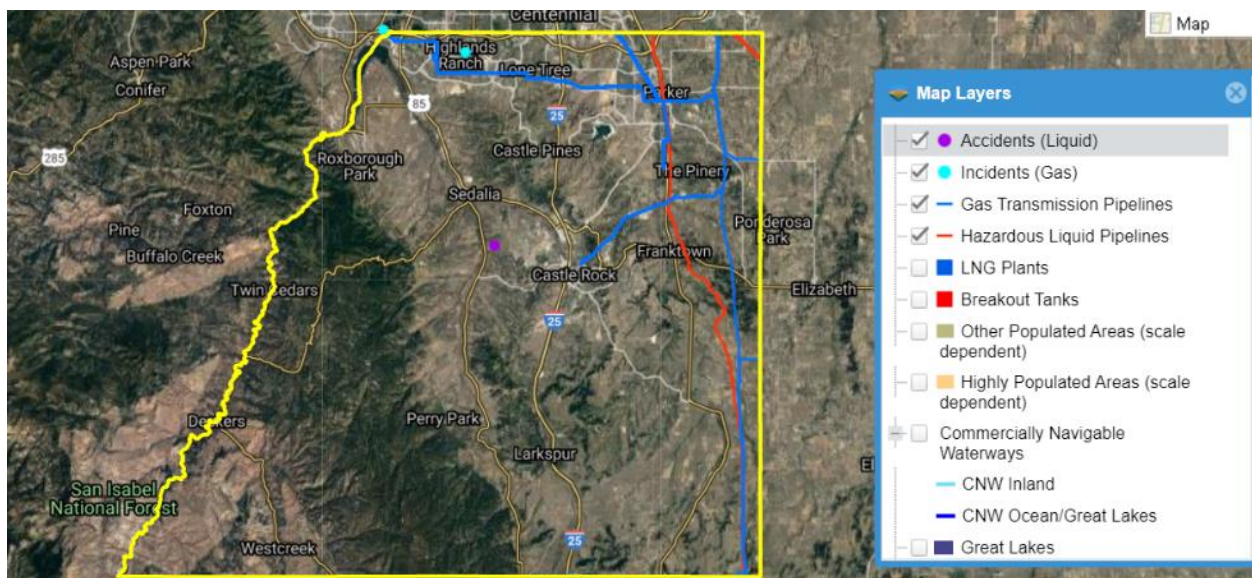
material incidents in Douglas County have occurred along natural gas distribution lines, as well as on roadways and in parking areas.

There are several major petroleum and gas pipelines that traverse Douglas County. The Magellan Pipeline Company operates the Rocky Mountain pipeline for refined oil that 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 operates the natural gas Pueblo-Watkins Mainline that also 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 runs west to Castle Rock and is owned by Black Hills Energy. In the Town of Parker, a natural gas pipeline operated by the Public Service Company of Colorado divides in Parker, with one line running west to Highlands Ranch and one running north to Cottonwood in the Town of Parker. Figure 5-22 shows the locations of pipelines in Douglas County.

In addition to pipelines, transportation networks carrying hazardous materials include railroads and roadways. The BNSF and Union Pacific Railroads carry freight through Douglas County. These railroad lines are connected to State, regional, and national railroad networks. Major roadways in Douglas County include Interstate 25 (which continues north to Canada and south to Mexico), US-85, and Colorado State Routes 83, 86, 67, and 105. These major roadways bolster the County’s connectivity and offer alternate routes to the interstate.

Figure 5-22: National Pipeline Mapping System for Douglas County



Sources: Pipeline and Hazardous Materials Safety Administration 2020

Previous Occurrences and Losses

Between 1953 and 2020, FEMA did not issue a disaster (DR) or emergency (EM) declaration for the State of Colorado for hazardous material or transportation-related events. For the 2021 HMP update, known hazardous material transportation incidents that have impacted Douglas County between 2014 and 2020 are identified in Table 5-69.

Table 5-69 Hazardous Material and Transportation Incidents in Douglas County, 2014 to 2020

Date(s) of Event	Event Type	FEMA Declaration Number (if applicable)	Douglas County Designated ?	Description
October 21, 2014	Gasoline Spill	N/A	N/A	A gasoline spill occurred at the Cottonwood Shopping Center in Parker.
December 6, 2014	Diesel Fuel Spill	N/A	N/A	Diesel fuel was noticed to be leaking by a driver in Parker, who then deployed mitigating measures to stop and clean up the leak.
December 30, 2014	Gasoline Spill	N/A	N/A	A driver in Highland Ranch struck a dumpster while unloading, resulting in the spill of 10 gallons of gasoline.
January 20, 2015	Fuel Spill	N/A	N/A	A semi-truck jackknifed on Interstate 25 in Lone Tree. The truck's fuel tank punctured, spilling 75 gallons of fuel.
August 26, 2015	Jet Fuel Spill	N/A	N/A	This hazardous material spill in Larkspur resulted from a broken component or device. The truck carrying the hazardous material had a breakage in its rear driven line, subsequently dragging along the highway. This caused the jet fuel to catch on fire, burning most of the fuel.
November 27, 2015	Chemical Burn	N/A	N/A	A paint-stripping truck caught fire in Castle Rock, resulting in the deployment of a Hazmat team.
January 8, 2016	Diesel Fuel Spill	N/A	N/A	Hazmat response was required when a semi-truck was involved in an automobile crash, resulting in the leak of diesel fuel in Castle Rock.
August 3, 2016	Gasoline Spill	N/A	N/A	A 20-foot hose broke when a driver in Littleton moved a tractor/trailer with the hoses attached to the tanks. This caused 1 gallon of fuel to spill, which the driver cleaned up with absorbent pads.
November 7, 2016	Gas Line Leak	N/A	N/A	A high pressure gas line lead at a construction site broke, resulting in the closure of Meadows Boulevard in Castle Rock.
January 12, 2017	Natural Gas Leak	N/A	N/A	A break occurred in a three-inch natural gas pipeline near the intersection of Parker Road and Twenty Mile Road in Parker.
June 20, 2017	Gasoline Spill	N/A	N/A	A driver in Littleton over-filled a tank and spilled 40 gallons of gasoline.
August 16, 2017	Diesel Spill	N/A	N/A	A driver of a vehicle in Parker inadvertently opened a trailer compartment and released 20 gallons of diesel fuel. The driver deployed booms to prevent the material from entering the storm drain and an environmental company was hired to clean up the spill.
March 26, 2018	Diesel Spill	N/A	N/A	In Castle Rock, a driver of a vehicle spilled one cup of diesel following the opening of a cap off hose.
April 20, 2018	Diesel Spill	N/A	N/A	A crash on Interstate 25 in Lone Tree caused a truck's 110-gallon tank of diesel fuel to leak.
July 6, 2018	Gasoline Spill	N/A	N/A	A suspected DUI resulted in a box truck/sedan collision in Parker, causing a fuel spill.
July 24, 2019	Corrosive Liquids Spill	N/A	N/A	A freight truck in Lone Tree was struck with equipment, which caused damage, releasing corrosive liquids. The dock personnel used absorbents, later placed in a container, for proper disposal.
August 31, 2019	Natural Gas Leak	N/A	N/A	A natural gas leak occurred at a construction site along Copperhead Trail in Parker.
March 30, 2020	Diesel Spill	N/A	N/A	A driver in Parker spilled 1 gallon of diesel. Driver cleaned up the spill with absorbent pads.

Sources: Pipeline and Hazardous Materials Safety Administration 2020; North American Hazmat Situations and Deployments Map 2020

Climate Change Projections

Climate change is expected to increase temperatures and the severity of storm events in Colorado. Hazardous material spills are non-natural incidents; therefore, there are no implications for impacts from climate change. However, climate change can have secondary impacts on this hazard. Increase in frequency or severity of severe weather events could lead to an increase in transportation incidents. This can cause an increase in transportation incidents with vehicles carrying hazardous materials. Additionally, secondary impacts, such as excessive heat on containers may occur, but also can occur during normal fluctuations in temperature.

Probability of Future Occurrences

Predicting hazardous material transportation incidents in Douglas County is difficult but can be modeled or anticipated using reviews of existing incident data and finding trends in accident times, locations, and environmental conditions. Broadly speaking, accidents can occur at anytime and anywhere in the County. Small spills occur throughout the year and the probability for these events are high. The risk of major incidents in a given year is rare. However, minor hazardous material incidents occur with some regularity in the County

Based on the recent incident events, the likelihood of future occurrence of hazardous material and transportation incidents in Douglas County can be considered *high* (hazard event is likely to occur within 25 years) as defined by the Risk Factor Methodology probability criteria (refer to Section 5.1).

Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed or vulnerable to the identified hazard. The following discusses Douglas County's vulnerability, in a qualitative nature, to the hazardous material transportation hazard.

Impact on Life, Health and Safety

Depending on the type and quantity of chemicals released and the weather conditions, an incident can affect larger areas that cross jurisdictional boundaries. When hazardous substances are released in the air, water or on land they may contaminate the environment and pose greater danger to human health. The general population may be exposed to a hazardous substances release through inhalation, ingestion or dermal exposure. Exposure may be either acute or chronic, depending upon the nature of the substance and extent of release and contamination.

For the purposes of this HMP, the entire population in Douglas County is exposed to hazardous material transportation incidents. Those particularly vulnerable to the effects of hazardous substances incidents are populations located along major transportation routes because of the quantities of chemicals transported on these major thoroughfares. Potential losses from hazardous substances incidences include human health and life and property resources. These types of incidents can lead to injury, illnesses, and/or death from both the involved persons and those living in the impacted areas. Human safety and welfare can become compromised from negative health effects of poisoning or exposure to toxic substances, fires, or explosions.

Impact on General Building Stock

Potential losses to the general building stock caused by a hazardous substance's incident is difficult to quantify. The degree of damages to the general building stock depends on the scale of the incident.

Potential losses may include inaccessibility, loss of service, contamination and/or potential structural and content losses if an explosion occurs. The closure of waterways, railroads, airports and highways as a result of a hazardous material spill 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.

Impact on Critical Facilities

Potential losses to critical facilities caused by a hazardous material spill is difficult to quantify. Potential losses may include inaccessibility, loss of service, contamination and/or potential structural and content losses if an explosion occurs. Refer to Section 4 (County Profile) which summarizes the number and type of critical facilities in Douglas County. All critical facilities in Douglas County are exposed to the hazard.

Impact on Economy

If a significant hazardous material spill occurred, not only would life, safety, and building stock be at risk, but the economy of Douglas County could be affected as well. A significant incident in an urban area may force businesses to close for an extended period of time because of contamination or direct damage caused by an explosion if one occurred. The exact impact on the economy is difficult to determine, given the uncertain nature of the size and scope of incidents.

Impact on the Environment

Hazardous material incidents can cause contamination of ecosystems, including air, water, and soil. Liquid spills occurring on transportation networks can immediately discharge to adjacent waterways or leach into the ground. Leaks of hazardous material gases can cause noxious aerosols that impact plant and animal life. Impacts to the environment can be mitigated through quick response and preparedness.

Cascading Impacts on Other Hazards

Severe storms, winter storms, earthquakes, soil incidents, floods, or wildfires can cause disruption to transportation networks that result in hazardous material incidents. Adverse meteorological conditions can be compounded by the need to respond to a hazardous material incident.

Future Changes that May Impact Vulnerability

Understanding future changes that impact vulnerability in the County can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. The County considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development
- Projected changes in population
- Other identified conditions as relevant and appropriate, including the impacts of climate change.

Projected Development

Any areas of growth could be potentially impacted by hazardous substances incidents because the entire County is exposed and vulnerable. An increase in development and population has the ability to increase the likelihood of a hazardous substance incident.

Projected Changes in Population

The County experienced an increase in population between the 2010 Census (285,465) and the estimated 2018 Community Survey estimated population of 328,614. The population of the County is expected to continue increasing. The increase in population will expose more people to hazardous material incidents as the region grows in population, requires additional services,

Climate Change

Because a hazardous substance or transportation incident is human-caused hazard, no direct climate change impacts are associated with the hazard. However, changes in precipitation and temperature can indirectly impact these incidents by making transportation networks more hazardous for transportation hazardous materials.

Changes in Vulnerability Since the 2015 HMP

The hazardous material transportation incident hazard is a new hazard identified in the 2021 Hazard Mitigation Plan Update

Identified Issues

- 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 to public health.

5.4.8 Pandemic & Disease Outbreak

This section provides the hazard profile and vulnerability assessment for the pandemic and disease outbreak hazard for Douglas County.

Profile

Hazard Description

A pandemic is a disease affecting the population of an extensive area that could range from countries to continents. Pandemic events can cause pervasive and sudden illness in all age groups, with the extent of infected people dependent on transmission mode, contact between infected and non-infected persons, and the ease of the illness' spread (Colorado 2018). There have been a number of pandemics in recent history, for which Douglas County is vulnerable.

Public health service in Douglas County is provided by the Tri-County Health Department (TCHD). The TCHD also serves Adams and Arapahoe Counties and provides a wide array of services, including infectious disease prevention, health care services, emergency preparedness and response, maternal health, and WIC benefits.

For the 2021 update, the pandemic and disease outbreak profile will discuss West Nile Virus, influenza, and the current COVID-19 pandemic.

West Nile Virus

West Nile Virus is a mosquito-transmitted disease that first appeared in the United States in 1999. West Nile Virus has been present globally for decades but has spread across the continental United States relatively recently. Though severe cases of West Nile Virus are rare (comprising less than 1% of people

infected), the West Nile Virus can cause brain inflammation (encephalitis) and inflammation of the brain's lining (Meningitis). Mild infection symptoms include fever, body aches, headaches, and skin rashes.

West Nile Virus is transmitted through mosquito bites, which become infected themselves when feeding on infected birds. The Virus can also be spread by blood transfusion, organ transplants, mother-to-unborn child, and breast milk. There is not a specific treatment for West Nile Virus, and prevention of the disease entails modifications to the environment to prevent standing water and habitat for mosquitos, wearing insect repellent, and avoiding mosquito bites more generally.

Influenza

The risk of a global influenza pandemic has increased over the last several years. This disease is capable of claiming thousands of lives and adversely affecting critical infrastructure and key resources. An influenza pandemic has the ability to reduce the health, safety, and welfare of the essential services workforce; immobilize core infrastructure; and induce fiscal instability.

Pandemic influenza is different from seasonal influenza (or "the flu") because outbreaks of seasonal flu are caused by viruses that are already among people. Pandemic influenza is caused by an influenza virus that is new to people and is likely to affect many more people than seasonal influenza. In addition, seasonal flu occurs every year, usually during the winter season, while the timing of an influenza pandemic is difficult to predict. Pandemic influenza is likely to affect more people than the seasonal flu, including young adults. A severe pandemic could change daily life for a time, including limitations on travel and public gatherings (Barry-Eaton District Health Department 2013).

At the national level, the CDC's Influenza Division has a long history of supporting the World Health Organization (WHO) and its global network of National Influenza Centers (NIC). With limited resources, most international assistance provided in the early years was through hands-on laboratory training of in-country staff, the annual provision of WHO reagent kits (produced and distributed by CDC), and technical consultations for vaccine strain selections. The Influenza Division also conducts epidemiologic research including vaccine studies and serologic assays and provided international outbreak investigation assistance (CDC 2010).

Coronavirus

Coronavirus disease (COVID-19) is an infectious disease first identified in 2019. The virus rapidly spread into a global pandemic by spring of 2020. Older people, and those with underlying medical problems like cardiovascular disease, diabetes, chronic respiratory disease, and cancer are more likely to develop serious illness (WHO 2020). With the virus being relatively new, information regarding transmission and symptoms of the virus is still new. The COVID-19 virus spreads primarily through droplets of saliva or discharge from the nose when an infected person coughs or sneezes. Reported illnesses have ranged from mild symptoms to severe illness and death. Reported symptoms include trouble breathing, persistent pain or pressure in the chest, new confusion or inability to arouse, and bluish lips or face. Symptoms may appear 2-14 days after exposure to the virus (based on the incubation period of MERS-CoV viruses) (CDC 2020)

In an effort to slow the spread of the virus, the federal government and states have urged the public to avoid touching of the face, properly wash hands often, use various social distancing measures, and wear masks while in public. At the time of this plan update, two vaccines are available for COVID-19 and distribution of vaccines has occurred nationally. Clinical trials evaluating potential treatments remain ongoing (WHO 2020).

Extent

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. The transmission rate of infectious diseases will depend on the mode of transmission of a given illness.

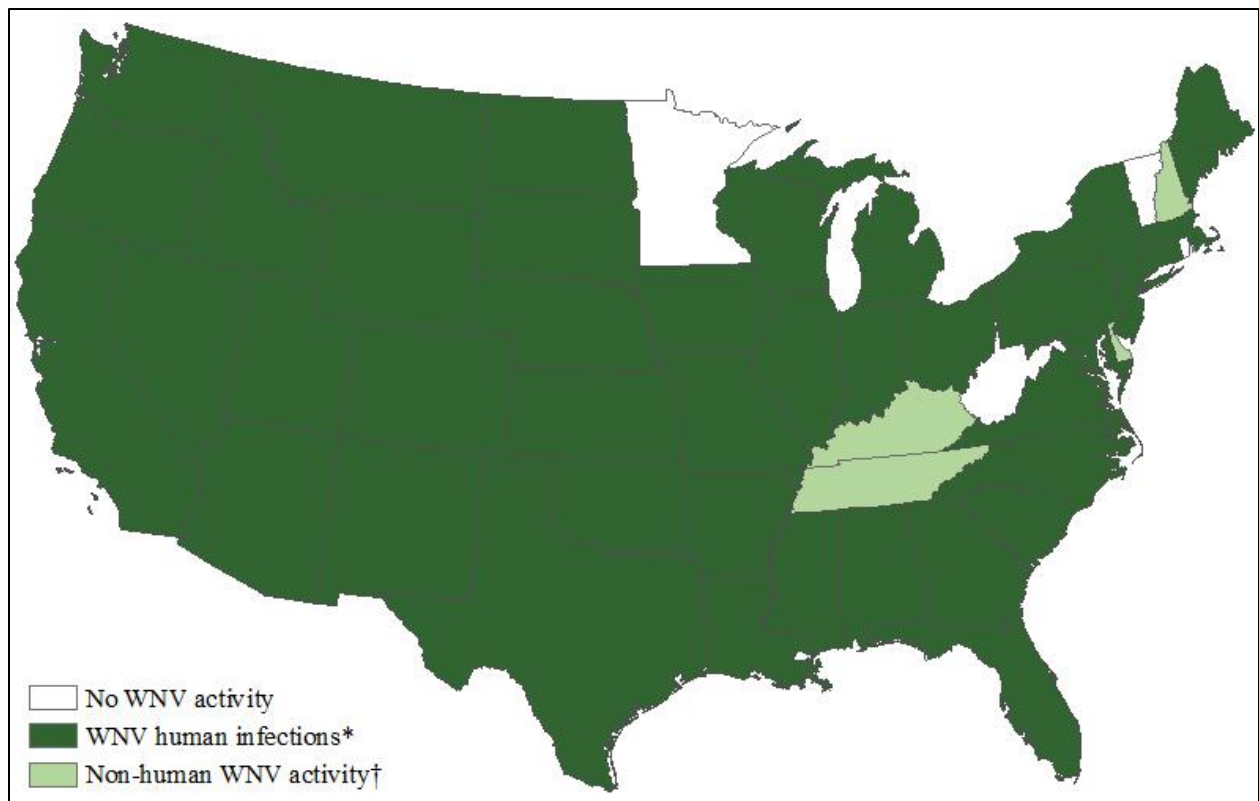
The extent and location of disease outbreaks depends on the preferred habitat of the species, as well as the species’ ease of movement and establishment. The magnitude of disease outbreaks species ranges from nuisance to widespread. The threat is typically intensified when the ecosystem or host species is already stressed, such as periods of drought. The already weakened state of the ecosystem causes it to more easily be impacted to an infestation.

West Nile Virus

Seasonality is a major factor in the spread of disease. For example, 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. Influenza, however, is most prevalent in the fall or winter (CDC 2020).

Since it was discovered in the western hemisphere, WNV has spread rapidly across North America, affecting thousands of birds, horses and humans. As of January 5, 2021, nearly every state, including Colorado, has reported WNV human infections. Figure 5-23 shows the activity of WNV by state. The figure shows that Douglas County has had reported WNV human infections.

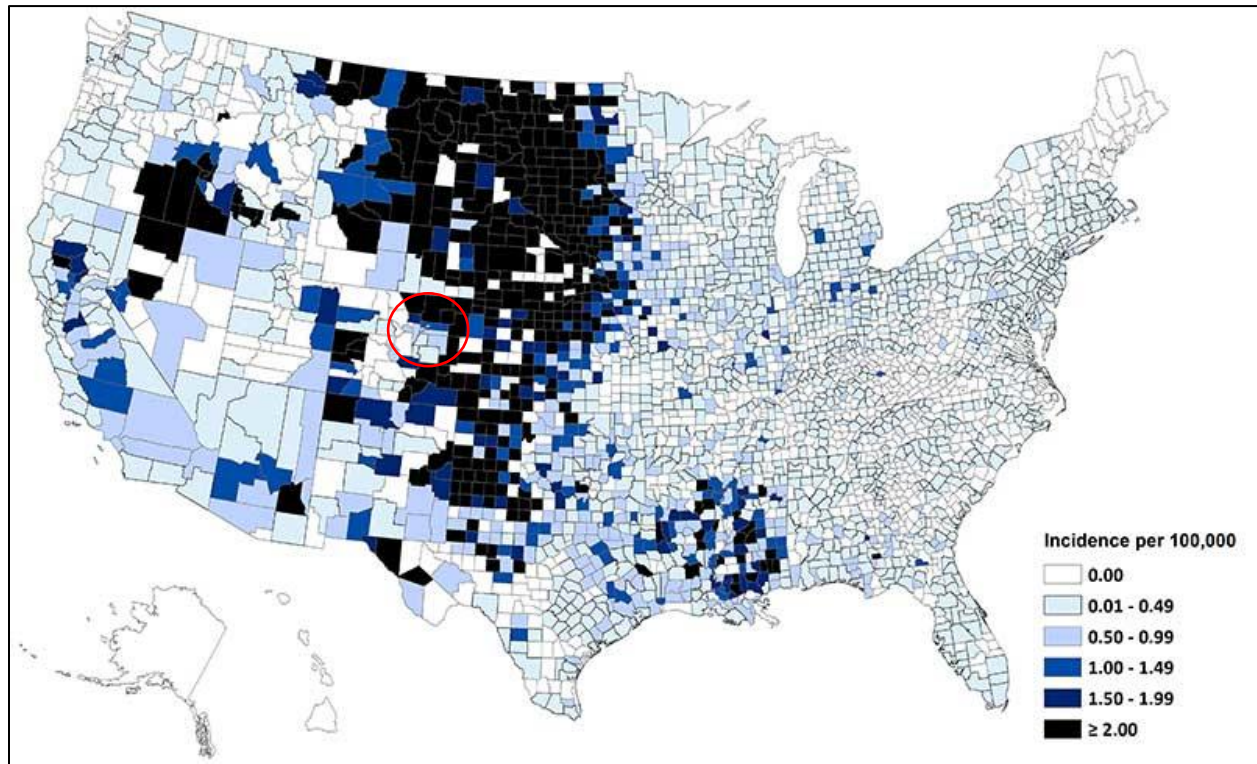
Figure 5-23. WNV Activity by State 2020



Source: CDC 2021

The CDC has a surveillance program for WNV. Data is collected on a weekly basis and reported for five categories: wild birds, sentinel chicken flocks, human cases, veterinary cases and mosquito surveillance (CDC 2019). Figure 5-24 illustrates WNV activity in the U.S. from 1999-2019. This figure shows that Douglas County has an average annual incidence rate of 0.01-0.49.

Figure 5-24. Average Annual Incidence of West Nile Virus Neuroinvasive Disease Reported to CDC by County, 1999-2019



Source: CDC 2019

Note: The circle indicates the approximate location of Douglas County.

Influenza and Coronavirus

The severity of a pandemic or infectious disease threat in Colorado and Douglas County will range significantly depending on the aggressiveness of the virus in question and the ease of transmission. Pandemics around the nation have the potential to affect the populated areas of the State of Colorado.

The CDC and Prevention Community Strategy for Pandemic Influenza Mitigation guidance introduced a Pandemic Severity Index (PSI), which uses the case fatality ratio as the critical driver for categorizing the severity of a pandemic. The index is designed to estimate the severity of a pandemic on a population to allow better forecasting of the impact of a pandemic, and to enable recommendations on the use of mitigation interventions that are matched to the severity of influenza pandemic.

In 1999, the WHO Secretariat published guidance for pandemic influenza and defined the six phases of a pandemic. Updated guidance was published in 2005 to redefine these phases. This schema is designed to provide guidance to the international community and to national governments on preparedness and response for pandemic threats and pandemic disease. Compared with the 1999 phases, the new definitions place more

emphasis on pre-pandemic phases when pandemic threats may exist in animals or when new influenza virus subtypes infect people but do not spread efficiently. Because recognizing that distinctions between the two inter-pandemic phases and the three pandemic alert phases may be unclear, the WHO Secretariat proposes that classifications be determined by assessing risk based on a range of scientific and epidemiological data (WHO 2009). The WHO pandemic phases are outlined in Table 5-70.

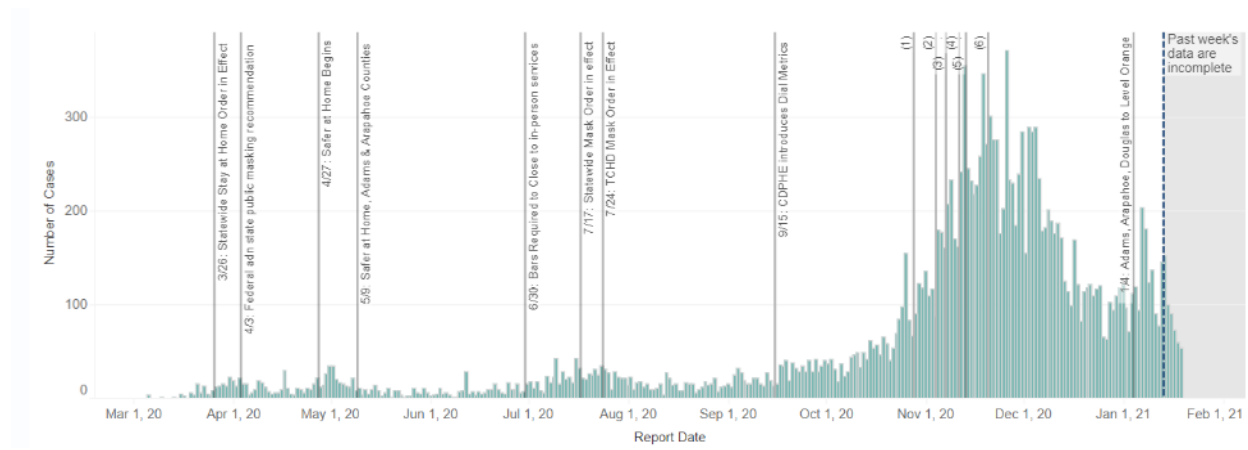
Table 5-70 WHO Global Pandemic Phases

Phase	Description
Preparedness	
Phase 1	No viruses circulating among animals have been reported to cause infections in humans.
Phase 2	An animal influenza virus circulating among 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. Limited human-to-human transmission may occur under some circumstances, for example, when there is close contact between an infected person and an unprotected caregiver. However, limited transmission under such restricted circumstances does not indicate that the virus has gained the level of transmissibility among humans necessary to cause a pandemic.
Response and Mitigation Efforts	
Phase 4	Human infection(s) are reported with a new subtype, but no human-to-human spread or at most rare instances of spread to a close contact.
Phase 5	Characterized by human-to-human spread of the virus into at least two countries in one WHO region. While most countries will not be affected at this stage, the declaration of Phase 5 is a strong signal that a pandemic is imminent and that the time to finalize the organization, communication, and implementation of the planned mitigation measures is short.
Phase 6	The pandemic phase, is characterized by community level outbreaks in at least one other country in a different WHO region in addition to the criteria defined in Phase 5. Designation of this phase will indicate that a global pandemic is under way.

Source: WHO 2009

The most recent large-scale pandemic is COVID-19, which is ongoing at the time of this report’s publication. Douglas County’s first case of COVID-19 was reported on March 5th, 2020. By March 26th, a statewide stay at home order was issued. The graph below shows the rate of cases in Douglas County through July 2020.

Figure 5-25: COVID-19 Cases in Douglas County, Colorado (As of January 19, 2021)



Source: Tri-County Health Department

A significant metric of COVID-19 has been hospital bed utilization. Efforts to “flatten the curve” of new reported cases are meant to avoid overwhelming medical systems by heading off hospital capacity issues. As of January 2021, Douglas County’s daily hospitalization rate was almost always the lowest of the Tri-County region. The percentage of hospital beds occupied by COVID-19 patients reached its highest point to date in December 2020 (19%), though by January 19th, 2021 this figure decreased to 8.4% (Tri-County Health Department 2020).

Location

Disease outbreaks can occur without regard for location. However, factors such as density, visitation, and the length of time in which the public spends in a location all contribute to the spread of infectious diseases. For example, the 2019 novel coronavirus (COVID-19) is more likely spread by persons in close contact. Indoor areas in which people are in close contact with each other appear to be significant vectors for the disease, which is spread through respiratory droplets. 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 diseases such as West Nile Virus. Diseases that can infect humans are variable in nature and methods of transmission. Ultimately, residents need to be vigilant about diseases altogether in order to better understand and respond to disease outbreak hazards.

Previous Occurrences and Losses

Many sources provided historical information regarding previous occurrences and losses associated with disease outbreak events throughout Colorado and Douglas County.

Between 1953 and 2020, FEMA issued a disaster (DR) or emergency (EM) declaration for the State of Colorado for one pandemic-related event. Douglas County was included in this declaration for COVID-19. For the 2021 HMP update, known disease outbreak incidents that have impacted Douglas County between 2002 and 2020 are identified in the table below.

Table 5-71 Public Health Events in Douglas County, 2002 to 2020

Date(s) of Event	Event Type	FEMA Declaration Number (if applicable)	Douglas County Designated?	Description
2002-Present	Biological	N/A	No	In 2002, the first case of West Nile Virus was recorded in Colorado.
2009-2010	Biological	N/A	No	The H1N1 (influenza A) virus occurred in 2009 as the first influenza pandemic of the 21 st century. By May 2010, there were more than 2,000 hospitalizations due to H1N1 in Colorado alone and 69 influenza-associated deaths.
March 2020-Present	Biological	DR-4498 EM-3436	Yes	A novel and highly infectious form of coronavirus began spreading and became a worldwide pandemic in 2020.

Sources: CDC 2020; Colorado Legislative Council Staff 2010; FEMA 2020; Tri-County Health Department

Table 5-71 shows the occurrences of various infectious diseases in Douglas County, Colorado between 2013 and 2018. During this time, the most frequently occurring infectious disease in the County was influenza (hospitalized), for which cases increased from 70 in 2013 to 169 in 2017. Hepatitis C (chronic) was the second-most widely occurring disease in the County, followed by animal bites. Both Hepatitis C and animal bites grew significantly during the reporting period, whereas infections of Pertussis saw decreases. Other frequently-encountered infectious diseases in Douglas County during this reporting period include Campylobacteria, Giardiasis, Group A invasive Strep, Salmonellosis, STEC, and chicken pox. In addition to the diseases listed in the following table, the County has also been impacted by Prairie Dog Disease, hantavirus, rabies, and tularemia.

Table 5-72 Infectious Diseases in Douglas County, 2013-2018

	2013	2014	2015	2016	2017	2018		2013	2014	2015	2016	2017	2018
Acute Flaccid Myelitis						2	INFLUENZA-hospitalized	70	125	91	78	169	144
ANIMAL BITES	36	10	22	77	86	141	LEGIONELLOSIS	1	3	2	2	6	5
BRUCELLOSIS			1				LISTERIOSIS					1	
CAMPYLOBACTER	35	21	33	34	38	44	LYME DISEASE					1	
Candidemia					9	13	MALARIA			2	1	2	
Carbapenem-Resistant Enterobacteriaceae (CRE)					12	12	MEASLES	2		1			
Carbapenem-Resistant Pseudomonas Aeruginosa (CRPA)					62	37	MENINGITIS ASEPTIC/VIRAL	15	6				
CRYPTOSPORIDIOSIS	5	1	8	6	7	5	MENINGOCOCCAL DISEASE					1	
CYCLOSPORIASIS			1		1	3	MUMPS					2	1
DENGUE FEVER			1		3	2	PERTUSSIS	63	63	48	57	60	36
ENCEPHALITIS OTHER					1	3	SALMONELLOSIS	38	31	32	26	42	32
GIARDIASIS	34	18	19	26	29	20	SHIGELLOSIS	2	1	6	18	1	5
GROUP A STREP INVASIVE	8	9	9	17	20	20	Spotted fever group rickettsia					2	1
GROUP B STREP INVASIVE	12	16	13	27	14	14	STEC (shiga toxin producing E.coli)	17	8	11	15	18	21
HAEMOPHILUS INFLUENZAE	2	2	2	5	6	3	STREP PNEUMO INVASIVE	11	12	9	12	13	26
HEMOLYTIC UREMIC SYNDRM	2					1	TOXIC SHOCK-OTHER			1		2	1
HEPATITIS A	4	1	2	2	3		TOXIC SHOCK-STREP		1		1		
HEPATITIS B, ACUTE		1		1			TYPHOID FEVER		1				1
HEPATITIS B, CHRONIC	13	15	27	25	20	23	VARICELLA(CHICKEN POX)	18	27	8	8	14	17
HEPATITIS C, ACUTE		1	1	2	1	2	Vibriosis					1	6
HEPATITIS C, CHRONIC	49	47	64	79	115	126	YERSINIOSIS		1		1	1	4
HEPATITIS D						1							

Source: Colorado Department of Public Health & Environment

Climate Change Projections

Climate change will likely have significant indirect impacts on disease outbreaks. In Colorado, higher temperatures, decreased water availability, and more severe storm events are anticipated due to climate change. According to the World Health Organization, changing climatic conditions are being studied for impacts upon disease transmission. Seasonal infectious diseases that are influenced by meteorological conditions may see significant variability in recurrence and duration. The World Health Organization concludes that variations in infectious disease transmission patterns are likely major consequences of climate change.

Probability of Future Occurrences

Though occurrences of disease outbreaks overall are often difficult to predict at the local level, it is anticipated that Douglas County will continue to be impacted by disease outbreaks for the foreseeable future. Seasonality for cold and flu is well established and anticipated in Colorado on an annual basis. The Tri-County Health Department undertakes a number of infectious disease mitigation and response activities that works to reduce risk for residents in the Tri-County region.

Based on the recent incident events, the future occurrence of disease outbreaks in Douglas County can be considered *frequent* (hazard event is likely to occur within 25 years) as defined by the Risk Factor Methodology probability criteria (refer to Section 5.1).

Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed or vulnerable to the identified hazard. The following discusses Douglas County's vulnerability, in a qualitative nature, to the disease outbreak hazard.

Impact on Life, Health and Safety

The entire population of Douglas County is vulnerable to the disease outbreak hazard. Due to a lack of quantifiable loss information, a qualitative assessment was conducted to evaluate the assets exposed to this hazard and the potential impacts associated with this hazard. Healthcare providers and first responders have an increased risk of exposure due to their frequent contact with infected populations. Areas with a higher population density also have an increased risk of exposure or transmission of disease to do the closer proximity of population to potentially infected people.

Most recently with COVID-19, the Centers for Disease Control and Prevention have indicated that persons over 65 years and older, persons living in a nursing home or long-term care facility, and persons with underlying medical conditions such as diabetes, severe obesity, serious heart conditions, etc. are at a higher risk of getting severely ill (CDC 2020). According to the 2018 American Community Survey, 10.9% of Douglas County residents (or approximately 35,801 people) are over the age of 65.

Impact on General Building Stock

No structures are anticipated to be directly affected by disease outbreaks.

Impact on Critical Facilities

Disease outbreaks would not directly affect critical facilities; however, they could experience secondary impacts. Hospitals and medical lifelines will likely see an increase in patients, but it is unlikely that there will be damages or interruption of services. However, large rates of infection may result in an increase in the rate of hospitalization which may overwhelm hospitals and medical facilities and lead to decreased services for those seeking medical attention. The 2020 coronavirus pandemic has led to overwhelmed hospitals in numerous hotspots. Continuity of operations of critical facilities could also be impacted due to the workforce becoming ill and unable to work. With limited staff, critical facility operations could be affected.

Impact on Economy

Disease outbreaks impacts on the economy and estimated dollar losses are difficult to measure and quantify. Costs associated with the activities and programs implemented to conduct surveillance and address disease outbreaks have not been quantified in available documentation. As evidenced in the COVID-19 outbreak, quarantines, shutdowns, and social distancing measures can have outsized economic impacts, particularly on the leisure, tourism, and food/accommodations sectors.

Impact on the Environment

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 disease like Zika, dengue, and yellow fever (Placer Mosquito and Vector Control District 2019). Secondary impacts from mitigating disease outbreaks could also have an impact on the environment. Pesticides used to control disease carrying insects like mosquitos have been reviewed by the EPA and the Colorado Department of Agriculture. If these sprays are applied in large concentrations, they could potentially leach into waterways and harm nearby terrestrial species. As a result, pesticides must be registered before they can be sold, distributed, or used in the state (Colorado State University Extension 2020).

Cascading Impacts on Other Hazards

Pandemic and disease outbreak events can be caused by Animal and Plant Diseases or infestations, which is discussed in Section 5.4.1.

Future Changes that May Impact Vulnerability

Understanding future changes that impact vulnerability in the County can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. The County considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development
- Projected changes in population
- Other identified conditions as relevant and appropriate, including the impacts of climate change.

Projected Development

Any areas of population growth and human habitation could be potentially impacted by the pandemic/disease outbreak hazard because the entire planning area is exposed and vulnerable. Additional development of structures in close proximity to waterbodies or areas with high population density are at an increased risk.

Projected Changes in Population

Douglas County experienced an increase in population between the 2010 Census and the 2018 American Community Survey estimates. The population of the County is expected to increase in the near future. The increase in population will expose more people to the pandemic hazard as residents move into area and the population exposed increases. Population density changes when households move throughout the County could influence the number of persons exposed to disease outbreaks. Higher density jurisdictions are not only at risk of greater exposure to disease outbreak, density may also reduce available basic services provided by critical facilities such as hospitals and emergency facilities for persons that are not affected by a disease.

Climate Change

The relationship between infectious diseases occurrence and climate change is difficult to predict with certainty. However, there may be linkages between the two. Changes in the environment may create a more livable habitat for vectors carrying disease as suggested by the Centers for Disease Control and Prevention (CDC n.d.). Localized changes in climate and human interaction may also be a factor in the spread of disease.

Changes in Vulnerability Since the 2015 HMP

Disease outbreak is a new hazard profile for the 2021 HMP update. The occurrence and prevalence of COVID-19 in the County underscores the need to address disease outbreak as part of the hazard mitigation planning process.

Identified Issues

- 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 has grown significantly in the last several years. As of the writing of this hazard mitigation plan, the cause of these increases has not yet been determined.
- Wild animals and the environment can be a source of human infection. Section 5.4.1 discusses the animal diseases and infestation hazard in Douglas County.

5.4.9 Severe Weather (Hail and Lightning)

The following section provides the hazard profile and vulnerability assessment for the hail and lightning hazard in Douglas County.

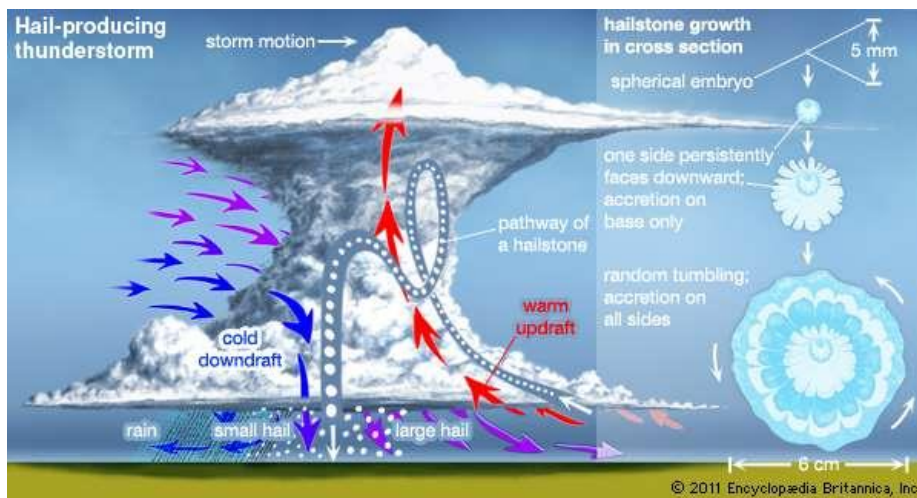
Profile

Hazard Description

Hail

Hail forms inside a thunderstorm where there are strong updrafts of warm air and downdrafts of cold water. If a water droplet is picked up by the updrafts, it can be carried well above the freezing level. Water droplets freeze when temperatures reach 32 °F or colder. As the frozen droplet begins to fall, it might thaw as it moves into warmer air toward the bottom of the thunderstorm, or the droplet might be picked up again 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 frozen droplet, with many layers of ice, falls to the ground as hail. Figure 5-26 shows the hail formation process. Most hail is small and typically less than two inches in diameter (NWS 2009).

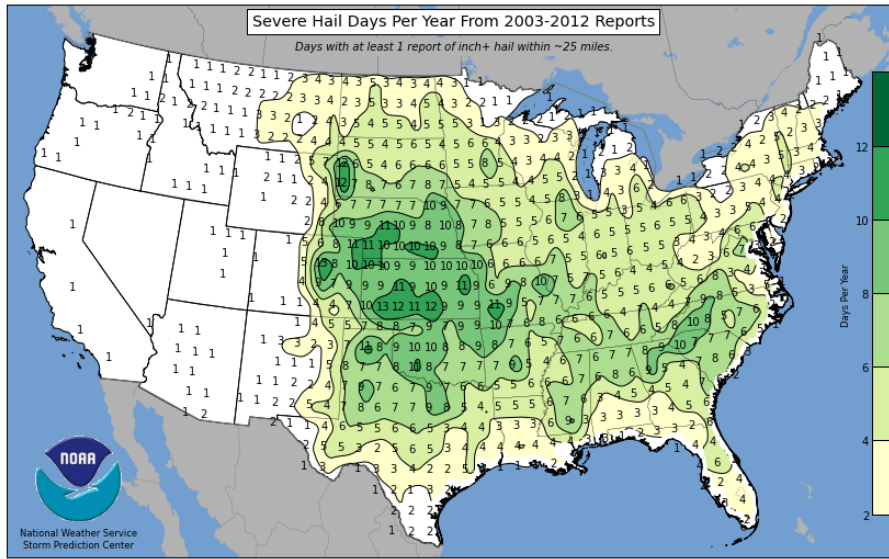
Figure 5-26. Hail Formation



Source: *Encyclopædia Britannica 2011*

Figure 5-27 shows the annual frequency of hailstorms in the United States as recorded from 2003 to 2012. Hailstorms have been observed in almost every location where thunderstorms occur throughout the United States. They are most frequent in the southern and central plain states where the climate produces violent thunderstorms. The figure shows that Douglas County experiences between two and six severe hail days each year. Severe hail day is defined as a day with at least one report of one-inch or more hail within 25 miles.

Figure 5-27. Severe Hail Days Per Year from 2003-2012

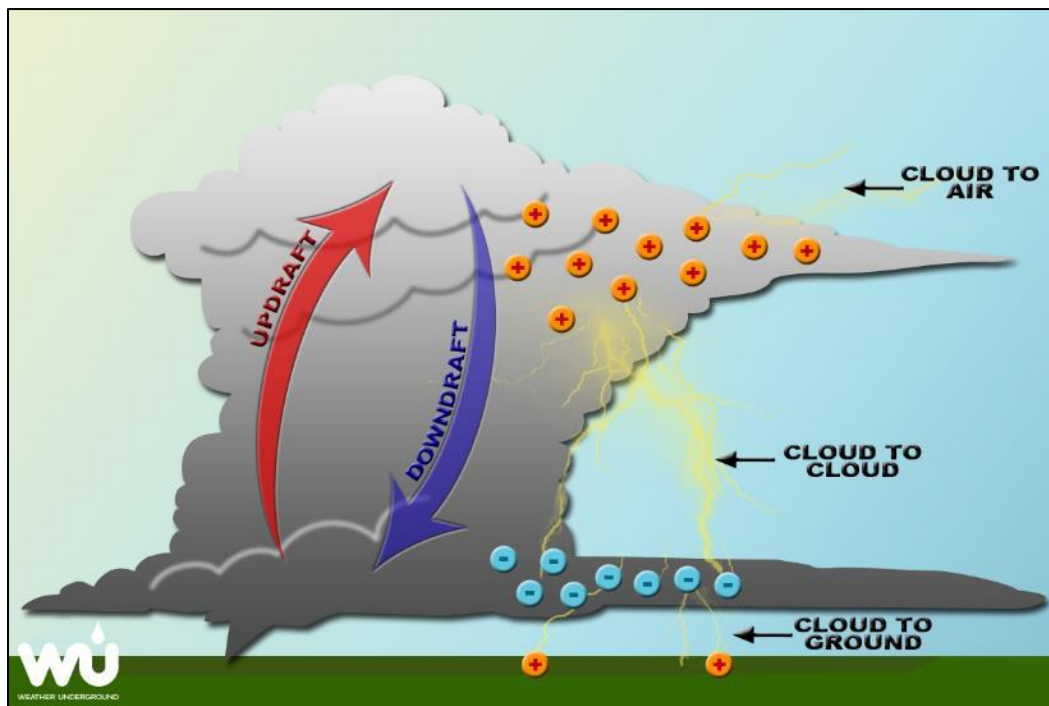


Source: SPC 2020

Lightning

Lightning is a giant spark of electricity in the atmosphere between clouds, the air, or the ground, produced by a thunderstorm (refer to Section 4.3.2 for details regarding the severe thunderstorm and wind storm hazard). Energy from lightning channel heats the air to around 18,000°F. This causes the air to rapidly expand, creating a sound wave known as thunder. Thunder can be heard up to 25 miles away from the lightning discharge (NSSL 2020). Figure 5-28 illustrates how lightning develops.

Figure 5-28. How Lightning Develops



Source: Weather Underground 2020

Lightning is a major cause of storm-related deaths in the United States, with an average of 43 reported fatalities and 243 injuries each year (NWS 2020). Between 1990 and 2003, 39 lightning-related deaths was reported in the State of Colorado, ranking third in the United States for deaths associated with lightning strikes (National Lightning Safety Institute 2003).

Extent

The severity of hail is measured by duration, hail size, and geographic extent. Most hail stones from hail events are made up of variety of sizes. Only the very largest hail stones pose serious risk to people, if exposed. The size of hail is estimated by comparing it to a known object. Table 5-73 describes how hail is measured.

Table 5-73 Hail Size

Severity	Size	Inches in Diameter
Non-Severe Hail Does not typically cause damage and does not warrant severe thunderstorm warning from NWS.	Pea	0.25 inch
	Marble/mothball	0.50 inch
	Dime/Penny	0.75 inch
	Nickel	0.875 inch
Severe Hail Research has shown that damage occurs after hail reaches around 1” in diameter and larger. Hail of this size will trigger a severe thunderstorm warning from NWS.	Quarter	1.0 inch
	Ping-Pong Ball	1.5 inches
	Golf Ball	1.75 inches
	Tennis Ball	2.5 inches
	Baseball	2.75 inches
	Tea Cup	3.0 inches
	Grapefruit	4.0 inches
Softball	4.5 inches	

Source: NOAA 2012; State of Colorado HMP 2018

Lightning is most often associated with moderate to severe thunderstorms. The NWS issues thunderstorm watches and warnings if a thunderstorm is considered severe enough to produce hail at least ¾ inch in diameter, winds of 58 mph or stronger, or a tornado (State of Colorado 2018).

The severity of lightning refers to the frequency of lightning strikes during a storm. The Lightning Activity Level (LAL) is a scale which describes lightning activity. The scale is part of the National Fire Danger Rating System. The scale is a range of numbers, from one to six, which reflects frequency and character of cloud-to-ground lightning (National Wildfire Coordinating Group 2020; NWS 2020).

Severe Thunderstorm Watch
 Severe thunderstorms are possible in and near the watch area. Stay informed and be ready to act if a severe thunderstorm warning is issued. The watch area is typically large, covering numerous counties or even states.

Severe Thunderstorm Warning
 Severe weather has been reported by spotters or indicated by radar. Warnings indicate imminent danger to life and property. Take shelter in a substantial building. Get out of mobile homes that can blow over in high winds. Warnings typically encompass a much smaller area (around the size of a city or small county) that may be impacted by a large hail or damaging wind identified by an NWS forecaster on radar or by a trained spotter/law enforcement who is watching the storm.

Table 5-74 Lightning Activity Level

Lightning Activity Level (LAL)	Conditions
1	No thunderstorms
2	Isolated thunderstorms. Light rain will occasionally reach the ground. Lightning is very infrequent, 1 to 5 cloud to ground strikes in a five minute period.
3	Widely scattered thunderstorms. Light to moderate rain will reach the ground. Lightning is infrequent, 6 to 10 cloud to ground strikes in a 5 minute period.
4	Scattered thunderstorms. Moderate rain is commonly produced Lightning is frequent, 11 to 15 cloud to ground strikes in a 5 minute period.
5	Numerous thunderstorms. Rainfall is moderate to heavy. Lightning is frequent and intense, greater than 15 cloud to ground strikes in a 5 minute period.
6	Dry lightning (same as LAL 3 but without rain). This type of lightning has the potential for extreme fire activity and is normally highlighted in fire weather forecasts with a Red Flag Warning.

Sources: National Wildfire Coordinating Group 2020; NWS 2020

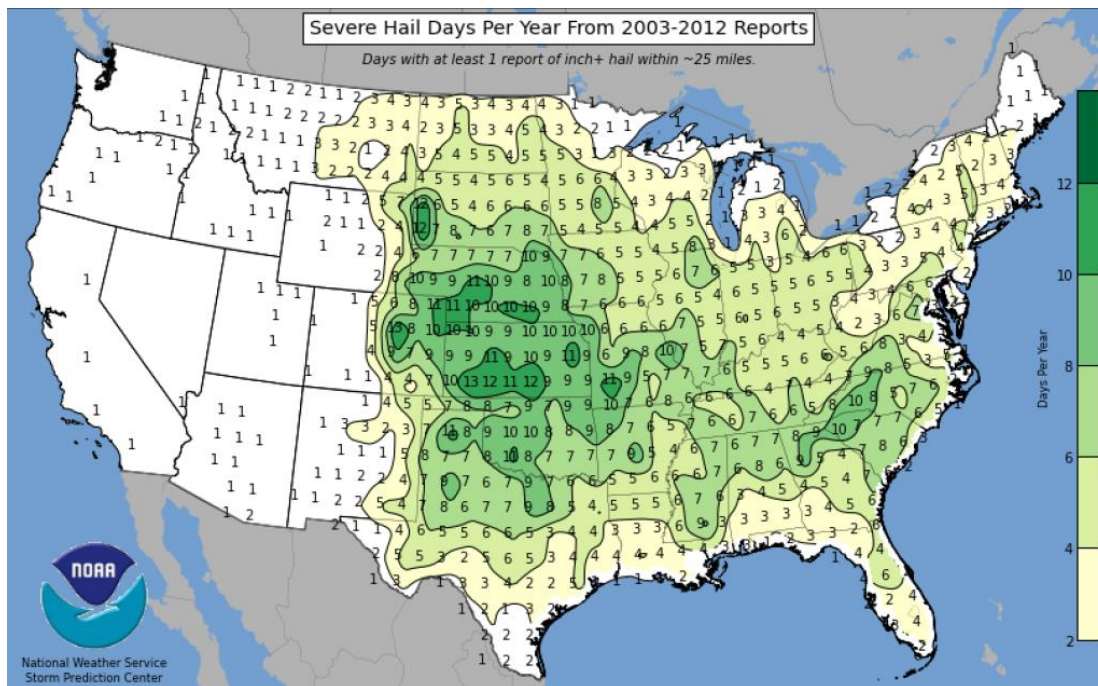
Location

All of Douglas County is exposed and vulnerable to hail and lightning events.

Hail

The State of Colorado is one of the most hail-prone states in the country. Colorado’s Front Range and Eastern Plains are within the United States’ "Hail Alley," a region spanning several states that receives the highest frequency of large hail. According to the figure below, Douglas County has experience approximately between two and six severe hail days each year.

Figure 5-29. Severe Hail Days Per Year from 2003 to 2012 Reports

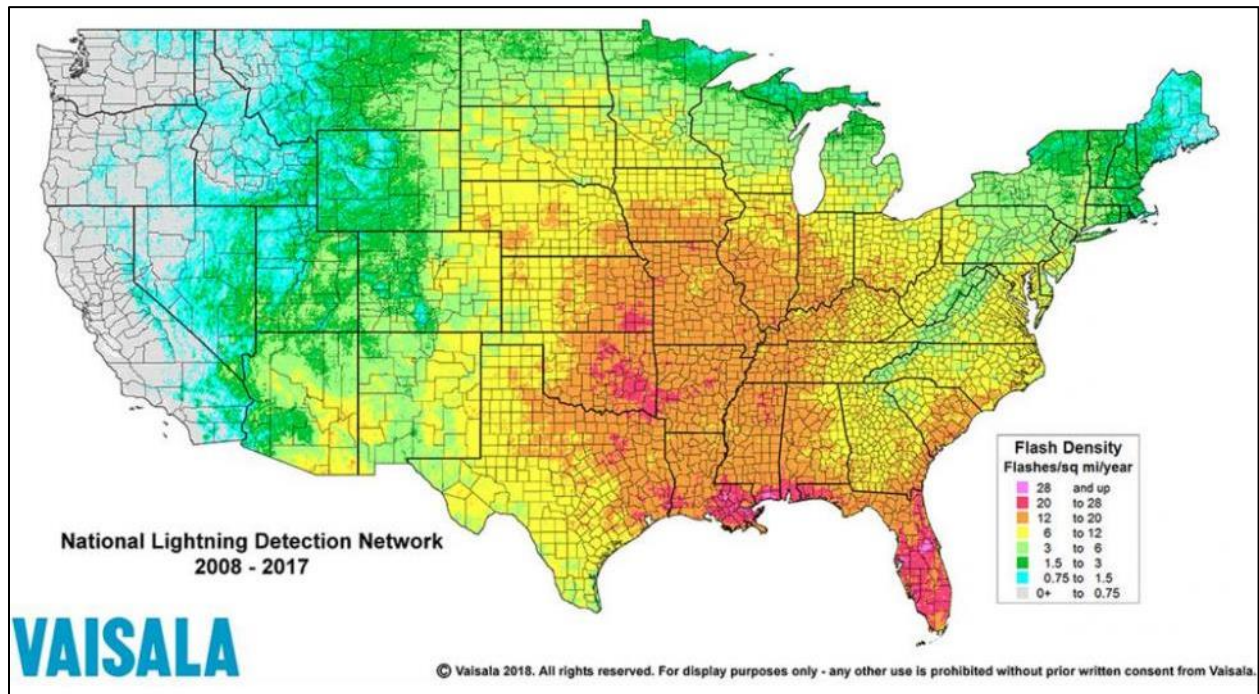


Source: State of Colorado 2018

Lightning

Lightning strike statistics indicate that the most lightning prone areas of Colorado are the foothills and plains areas between the Denver metro area and Colorado Springs, and the Raton Plateau south and southeast of Trinidad near the New Mexico border (State of Colorado 2018). Therefore, lightning can occur anywhere in Douglas County. The National Lightning Detection Network (NLDN) collects cloud-to-ground lightning data for the continental United States. Figure 5-30 illustrates the cloud-to-lightning incidence across the United States. The figure shows that Douglas County experienced 6 to 12 flashes per square mile each year.

Figure 5-30. Cloud-to-Lightning Incidence, 2008 to 2017



Source: Vaisala 2020

Previous Occurrences and Losses

Numerous sources provided historical information regarding previous occurrences and losses associated with hail and lightning events affecting Douglas County. With so many sources reviewed for the purpose of this HMP, loss and impact information for many events may vary. Therefore, the accuracy of monetary figures discussed is based only on the available information identified during research for this HMP.

Between 1953 and 2020, the State of Colorado has been included in three FEMA declared hail or lightning-related disasters (DR) or emergencies (EM). Douglas County was not included in these declarations, nor have there been USDA agriculture disasters caused by lightning since 2014.

For this 2021 update, known hail and lightning events that have impacted Douglas County between 2014 and 2020 are identified in Table 5-75. The events listed in this table represent only those that were reported to the NOAA-NCEI Storm Events Database and the Storm Prediction Center, and may not represent all hail events and damages that have occurred since 2014. However, the events tallied for this analysis does

not reflect a comprehensive count of hail or lightning events due to damage limitations and reporting inconsistencies. Therefore, Table 5-75 may not include all events that occurred in Douglas County.

According to the NOAA-NCEI Storm Events Database, Douglas County has been impacted by 107 hail events between 2014 and 2020. These events did not result in property damage that was reported to NOAA (refer to Table 5-75). However, there were five lightning events that caused \$16,000 in property damage, one death, and one injury as reported to NOAA-NCEI. According to the Storm Prediction Center’s Severe Weather Database, the largest hailstone on record was 2.5 inches on June 8, 2019 in Douglas County.

Table 5-75 Hail and Lightning Events in Douglas County, 2014 to 2020

Date(s) of Event	Event Type	Magnitude	Fatalities	Injuries	Damages	Event Details*
June 4, 2014	Hail	1 inch	0	0	\$0	Severe thunderstorms brought large hail to Douglas County, though there was no damage to property or crops.
June 5, 2014	Hail	1 inch	0	0	\$0	Severe thunderstorms produced large hail ranging from the size of a quarter to a golf ball. Wind gusts were as fast as 70 mph. The storm lasted for hours in Douglas County, initiating in Parker and making its way to Castle Rock and Franktown in the evening. While most observed hail was about 1 inch, Castle Rock experienced
June 6, 2014	Hail	1 inch	0	0	\$0	Thunderstorms produced hail ranging in the size of a quarter to a ping pong ball in Douglas County.
June 8, 2014	Hail	1.25 inches	0	0	\$0	A storm brought several tornados, strong winds, heavy rainfall, and large hail across northern Colorado, including in Douglas County’s open country. Hail was described as the size of half dollar.
June 14, 2014	Hail	1 inch	0	0	\$0	Severe thunderstorms brought large hail to Douglas County.
June 22, 2014	Lightning	N/A	0	0	\$1,000	A severe thunderstorm caused lightning strikes in Douglas County, leading to a fire near Elizabeth. There was \$1,000 worth of crop damage.
June 24, 2014	Hail	1-1.5 inches	0	0	\$0	Douglas County experienced significant hail events, with hail ranging from 1 inch to 1.5 inches.
July 7, 2014	Lightning	N/A	0	0	\$10,000	A lightning strike in Douglas County struck a home and caused a small attic fire, contributing to \$10,000 worth of property damage.
August 25, 2014	Hail	1 inch	0	0	\$0	Douglas County received hail up to the size of a quarter. Northern Douglas County had wind gusts up to 66 mph.
September 29, 2014	Hail	1 inch	0	0	\$0	A strong storm system produced large hail in Douglas County. Other counties experienced significant damage, though Douglas County did not.
May 1, 2015	Hail	0.75 inches	0	0	\$0	A thunderstorm produced hail in Douglas County.
May 15, 2015	Hail	1.25 inches	0	0	\$0	Severe thunderstorms produced nick to half dollar sized hail in Douglas County and surrounding counties.
June 3, 2015	Hail	1-1.75 inches	0	0	\$0	Thunderstorms in Douglas County and surrounding counties produced large hail, ranging from the size of a quarter to a tennis ball. Observations in Douglas County noted hail

Date(s) of Event	Event Type	Magnitude	Fatalities	Injuries	Damages	Event Details*
						ranging from 1 inch to 1.75 inches, the largest seen in Douglas County since 2014. This storm lasted for several hours into the evening.
June 5, 2015	Hail	0.88-1.5 inches	0	0	\$0	Severe thunderstorms brought hail to Douglas County that was as large as the size of a golf ball in some cases.
June 17, 2015	Hail	1 inch	0	0	\$0	Hail was observed as the size of a quarter to the size of a ping pong ball.
June 25, 2015	Hail	0.88-1 inch	0	0	\$0	Severe thunderstorms developed during the afternoon into the late evening, producing hail in Douglas County.
August 7, 2015	Hail	1.75 inches	0	0	\$0	Very large hail in Douglas County was observed during severe thunderstorms.
August 10, 2015	Hail	1 inch	0	0	\$0	Hail up to the size of a quarter was observed.
September 29, 2015	Hail	1.25 inches	0	0	\$0	Severe thunderstorms product heavy rain and hail, which impacted northern Douglas County the most.
April 25, 2016	Hail	0.75-1 inch	0	0	\$0	A thunderstorm produced hail in Douglas County, which was described as ranging in size from a nickel to a quarter.
May 26, 2016	Hail	0.75-1 inch	0	0	\$0	Severe thunderstorms produced hail in Douglas County.
June 6, 2016	Hail	0.75-1.75 inches	0	0	\$0	Potent thunderstorms along the Urban Corridor produced large hail, heavy rain, and lightning in Douglas County.
June 7, 2016	Hail	0.75- 1 inch	0	0	\$0	Hail was observed the size of a quarter.
June 13, 2016	Hail	0.75 inches	0	0	\$0	Severe thunderstorms produced hail, which in some areas was the size of a baseball.
June 19, 2016	Hail	0.75-1 inch	0	0	\$0	Hail was the size of a quarter.
June 20, 2016	Hail	1 inch	0	0	\$0	Hail in Douglas County and in surrounding counties ranged from the size of a quarter to a golf ball.
June 25, 2016	Hail	0.75 inches	0	0	\$0	A thunderstorm produced heavy rain and dime-sized hail.
July 1, 2016	Hail	1-2 inches	0	0	N/A	A potent thunderstorm produced large hail, ranging from 1 to 2 inches. Castle Rock experienced property damage with hail smashing cars and shattering windows. Damage also extended to shutters, roofs, siding, and fencing.
July 7, 2016	Hail	1 inch	0	0	\$0	Severe thunderstorms produced damaging straight-line winds and hail.
July 15, 2016	Hail	1 inch	0	0	\$0	Severe thunderstorms produced damaging hail.
May 6, 2017	Lightning	N/A	0	0	\$1,000	One woman was slightly injured from a dangerously close lightning strike. There was \$1,000 in property damage.
May 7, 2017	Lightning	N/A	1	1	\$5000	After lightning hit a nearby tree in Sedalia, a woman and her horse were killed. A teenage girl was also seriously injured. There was \$5,000 in property damage as well, after winds destroyed trees, power poles, and electrical lines.

Date(s) of Event	Event Type	Magnitude	Fatalities	Injuries	Damages	Event Details*
May 26, 2017	Hail	1-1.5 inches	0	0	\$0	Douglas County and surrounding counties experienced severe thunderstorms and large hail.
August 5, 2017	Hail	1.5 inches	0	0	\$0	A severe thunderstorm in Castle Rock produced hail with a 1.5 inch diameter.
August 15, 2017	Hail	1 inch	0	0	\$0	Douglas County and its surrounding counties experienced hail from a severe thunderstorm.
May 14, 2018	Hail	1 inch	0	0	\$0	Douglas Counties and its surrounding counties experienced severe thunderstorm and large hail. Clean up was required in Douglas County, as hail had accumulated several inches on roadways and stranded vehicles.
May 28, 2018	Hail	1 inch	0	0	\$0	Severe thunderstorms produced tornadoes and hail in Douglas County and surrounding counties.
May 30, 2018	Hail	0.88-1 inch	0	0	\$0	Douglas and Boulder counties experience severe thunderstorms and hail.
June 19, 2018	Hail	1 inch	0	0	\$0	Douglas County received 1 inch hail following a hail storm within the Front Range Urban Corridor and across the northeast plains of Colorado. The Rocky Mountain Insurance Information Association reported \$276.4 million in property damage, which included portions of Douglas County.
July 5, 2018	Hail	1 inch	0	0	\$0	Isolated thunderstorms in Douglas and Park counties brought hail to affected areas.
July 16, 2018	Hail	1 inch	0	0	\$0	Potent thunderstorms brought strong winds, heavy rain, and hail to Douglas County and surrounding counties. Hail was described to range in size from a quarter to a golf ball.
July 23, 2018	Hail	0.88 inches	0	0	\$0	Hail was described as the size of a nickel in Douglas County.
August 6- August 7, 2018	Hail	1.25 inches	0	0	\$0	A severe thunderstorm brought hail to Douglas County and surrounding counties.
June 6, 2018	Hail	0.88-2.5 inches	0	0	\$0	Potent thunderstorms spread eastward from the Denver area across the plains of Colorado, producing very large hail ranging from the size of a quarter to a tennis ball. Douglas and Elbert counties saw the largest hail. The storms produced a brief tornado, with wind gusts up to 64 mph.
June 30, 2019	Lightning	N/A	0	0	N/A	Eight hikers were injured, leaving one critically hurt, as a result of a nearby lightning strike. Two of the hikers required assistance and suffered from minor burns. Another victim was taken to the hospital after sustaining critical injuries.
July 4, 2019	Hail	1-1.5 inches	0	0	\$0	
July 15, 2019	Hail	1.25 inches	0	0	\$0	Potent thunderstorms in Douglas County and surrounding counties brought large hail and wind as fast as 60-70 mph. This caused minor property damage.
July 21, 2019	Hail	1 inch	0	0	\$0	Severe thunderstorms in Douglas County and surrounding counties produced large hail and strong winds.

Date(s) of Event	Event Type	Magnitude	Fatalities	Injuries	Damages	Event Details*
July 22, 2019	Hail	0.88 inches	0	0	\$0	Severe thunderstorms in Douglas County and surrounding counties produced large hail and strong winds.
September 6, 2019	Hail	1.25 inches	0	0	N/A	Severe thunderstorms produced large hail and heavy rain in Douglas County and its surrounding counties. A lightning strike caused extensive damage in Douglas County after causing a house fire.

Source(s): FEMA 2020; NOAA-NCEI 2020; SPC 2020

* Many sources were consulted to provide an update of previous occurrences and losses; event details and loss/impact information may vary and has been summarized in the above table

FEMA Federal Emergency Management Agency

HMP Hazard Mitigation Plan

NCEI National Centers for Environmental Information

NOAA National Oceanic and Atmospheric Administration

NWS National Weather Service

Climate Change Projections

The results of Colorado’s changing climate are not yet fully known, though climate change is generally anticipated to result in more frequent and severe weather events. Researchers at Colorado State University estimate that climate change may cause an additional three days of hail per year by 2100, as well as amplify human exposure by 178% in the same period (Childs et al. 2020).

Probability of Future Occurrences

Table 5-76 summarizes data regarding the probability of occurrences of hail events in Douglas County based on the historic record. The information used to calculate the probability of occurrences is based on the 2015 Douglas County HMP, the NOAA-NCEI Storm Events Database, and the Storm Prediction Center.

Table 5-76 Probability of Future Occurrence of Hail Events

Hazard Type	Number of Occurrences Between 1954 and 2020	% chance of occurrence in any given year
Hail	358	100%
Lightning	26	38.8%

Source: NOAA-NCEI 2020; SPC 2020

Note: Disaster occurrences include federally declared disasters since the 1950 Federal Disaster Relief Act, and selected storm events since 1968. Due to limitations in data, not all hail and lightning events occurring between 1954 and 1996 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is underestimated.

Douglas County is expected to continue experiencing the direct and indirect impacts of hail and lightning events each year that may induce secondary hazards such as infrastructure deterioration or failure, utility failures, power outages, and transportation delays, accidents and inconveniences. It is estimated that Douglas County will continue to experience hail and lightning events each year.

Based on historical records and input from the Core Planning Team, the probability of occurrence for hail events in the County is considered *frequent* (Hazard event is likely to occur within 25 years). Refer to Sections 5.1 and 5.3 for additional information on the hazard ranking methodology and probability criteria.

Vulnerability Assessment

To understand risk, a community must evaluate assets exposed to and vulnerable to the identified hazard. The entire Douglas County is exposed and vulnerable to the hail hazard; therefore, all assets within Douglas County (population, structures, critical facilities, and lifelines), as described in Section 4 (County Profile), are potentially vulnerable to a hail event. The following text evaluates and estimates the potential impact of the hail hazard in the County.

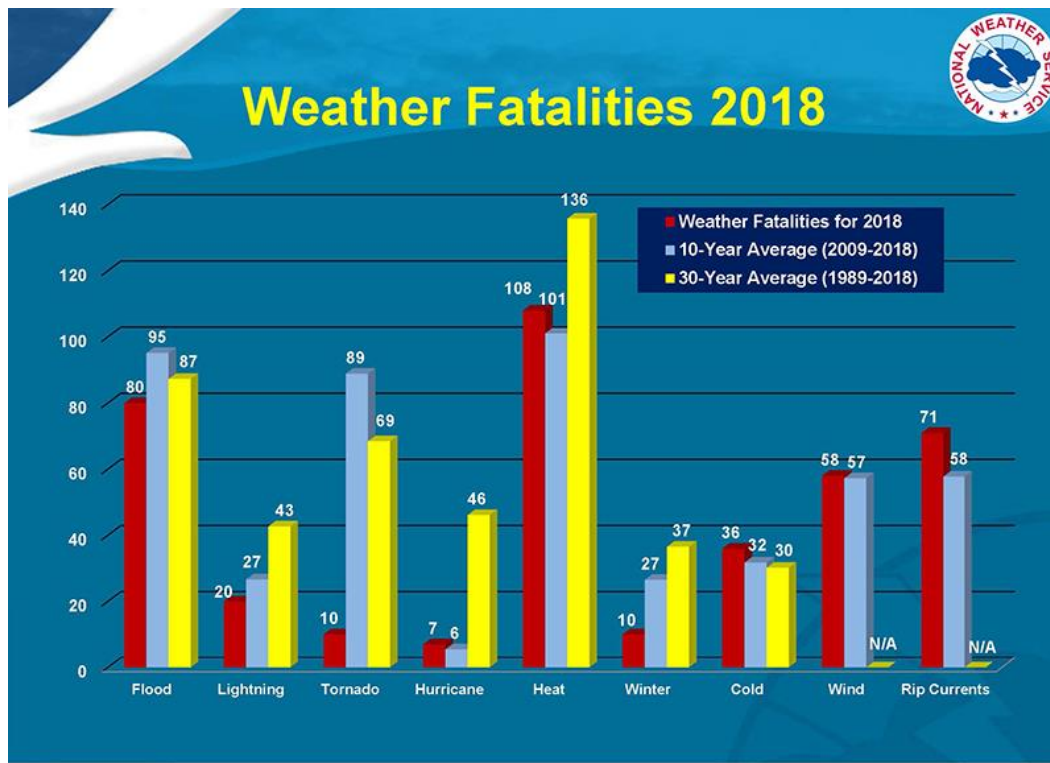
Impact on Life, Health and Safety

The impact of hail events on life, health, and safety is dependent upon several factors including the severity of the event and whether adequate warning time was provided to residents. The entire population of Douglas County (328,614) is assumed to be exposed to this hazard (U.S. Census 2018 ACS 5-Year Population Estimate).

People are vulnerable to the effects of hail events, including injuries, power outages, impacts on transportation routes, damage to homes, and damage to vehicles. First responders are also at risk of being injured during a significant hail event if they are responding to an incident. People located outdoors (e.g. recreational activities, farming, emergency responders) are considered most vulnerable to hailstorms because there is little to no warning time, and shelter might not be available. Moving to a lower risk location can decrease a person's vulnerability.

Across the United States, the 10-year average (2009 to 2018) for lightning-caused fatalities is 27, while the 30-year average (1989 to 2018) is 43 (NOAA 2020). Refer to Figure 5-31 for an illustration of these statistics. According to the NOAA-NCEI Storm Events Database, there has been one fatality and nine injuries as a result of lightning events from 2014 to 2020.

Figure 5-31. Weather Fatalities in the United States, 2018



Source: NOAA 2020

The impact of a lightning on life, health, and safety is dependent upon several factors including the severity of the event and whether adequate warning time was provided to residents. The entire population of Douglas County is assumed to be exposed to lightning strikes.

Lightning can be responsible for deaths, injuries, and property damage. Lightning-based deaths and injuries typically involve heart damage, inflated lungs, or brain damage, as well as loss of consciousness, amnesia, paralysis, and burns, depending on the severity of the strike. Additionally, most people struck by lightning survive, although they may have severe burns and internal damage. People located outdoors (i.e., recreational activities and farming) are considered most vulnerable to lightning strikes because there is little to no warning, and shelter might not be available. Moving to a lower risk location will decrease a person’s vulnerability.

Impact on General Building Stock

For the purpose of this plan update, the entire general building stock and all infrastructure in Douglas County are considered exposed to the hail and lightning hazards.

Depending on the size of the hail and severity of the storm, Douglas County could see damage from hail impacting structures. While damage to the building stock is possible as a result of hail or lightning, it is difficult to estimate and would not have as wide of an impact as a high wind or tornado event.

Lightning can spark wildfires or building fires, especially if structures are not protected by surge protectors on critical electronic, lighting, or information technology systems. While damage to the building stock is

possible as a result of lightning, it is difficult to estimate and would not have as wide of an impact as a high wind or tornado event.

Impact on Critical Facilities

All critical facilities in Douglas County are vulnerable to being affected by hail and lightning events.

Impact on Economy

Hail-producing severe storms impact the economy; impacts include loss of business function, damage to inventory, relocation costs, wage loss, and rental loss due to the repair or replacement of buildings. Additionally, vehicles parked outdoors are vulnerable to hail damage and could increase economic impacts of a storm.

According to NOAA's Technical Paper on *Lightning Fatalities, Injuries, and Damage Reports in the United States from 1959 - 1994*, monetary losses for lightning events range from less than \$50 to greater than \$5 million (larger losses associated with forest fires with homes destroyed and crop loss) (NOAA 1997).

Impact on the Environment

The impact of severe storm events on the environment varies, but researchers are finding that the long-term impacts of more severe weather can be destructive to the natural and local environment. National organizations such as USGS and NOAA have been studying and monitoring the impacts of extreme weather phenomena as it impacts long term climate change, streamflow, river levels, reservoir elevations, rainfall, floods, landslides, erosion, etc. (USGS 2017).

Cascading Impacts on Other Hazards

Hail and lightning events may escalate the impacts from other hazards of concern. Lightning can cause wildfires, which are discussed in Section 5.4.17. Hail and lightning often occur alongside severe storms that bring strong winds and flash floods.

Future Changes that May Impact Vulnerability

Understanding future changes that effect vulnerability in the County can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The County considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development.
- Projected changes in population.
- Other identified conditions as relevant and appropriate, including the impacts of climate change.

Projected Development

Any areas of growth could be potentially impacted by the hail hazard because the entire County is exposed and vulnerable.

Projected Changes in Population

The County experienced an increase in population between the 2010 Census (285,465) and the estimated 2018 American Community Survey estimated population of 328,614. The population of the County is

expected to increase over the next few years. The increase in population will expose more people to the hail and lightning hazard.

Climate Change

Colorado's climate is changing, though exact impacts to temperature, precipitation, and weather events are currently variable. However, climate change may amplify human exposure to hail by up to 178% by 2100, and there may be three additional days of hail per year by 2100. This may result in potential impacts to Douglas County's ecosystems, residents, and properties (Childs et al. 2020).

Scientists have correlated lightning flash rate to convective available potential energy (CAPE) multiplied by the precipitation rate. When examined as a proxy for climate models for the continental United States, scientists have predicted that lightning strikes may increase 12+/- 5% per degree Celsius of global warming and by approximately 50% over the course of the century (Romps et al. 2014).

Changes in Vulnerability Since the 2015 HMP

Douglas County's population increased since the last plan; increasing the number of people impacted during a lightning. Therefore, the entire County remains vulnerable to lightning.

Issues Identified

Important issues associated with hail and lightning 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.
- The increase in lightning strikes may result in additional wildfires resulting from strikes. Much of Douglas County is vulnerable to wildfires.

5.4.10 Severe Weather (Tornadoes)

The following section provides the hazard profile and vulnerability assessment for the tornado hazard in Douglas County.

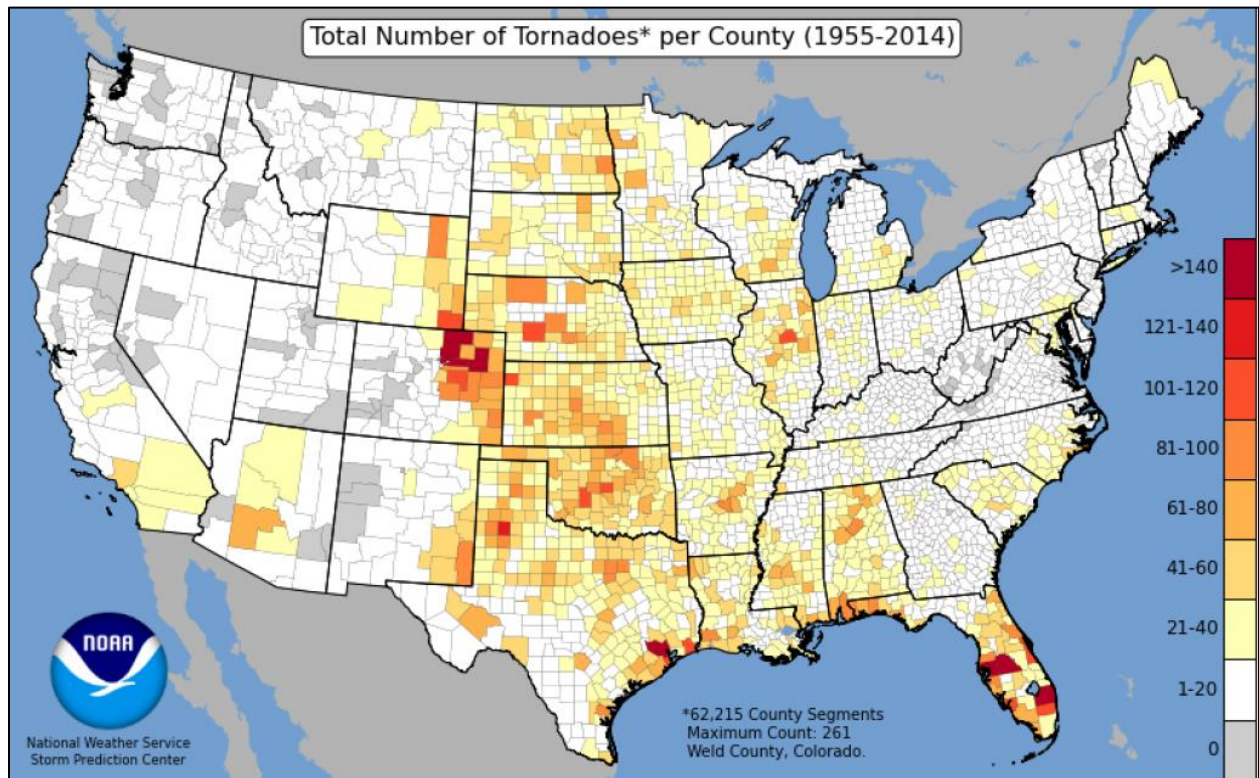
Profile

Hazard Description

A tornado appears as a rotating, funnel-shaped cloud that extends from a thunderstorm to the ground with whirling winds that can reach 250 miles per hour (mph). Damage paths can be greater than 1 mile wide and 50 miles long. Tornadoes typically develop from either a severe thunderstorm or hurricane as cool air rapidly overrides a layer of warm air. Tornadoes typically move at speeds between 30 and 125 mph and can generate combined wind speeds (forward motion and speed of the whirling winds) exceeding 300 mph. The lifespan of a tornado rarely is longer than 30 minutes (FEMA 1997). Tornadoes can occur at any time of the year, with peak seasons at different times for different states (NSSL 2013).

The figure below shows the total number of tornadoes, per county, between 1955 and 2014. The figure shows that Douglas County had between 41 and 60 tornadoes.

Figure 5-32. Tornadoes Per County, 1955 to 2014



Source: State of Colorado HMP 2018

Extent

Damage from tornadoes can vary from minor damage that breaks tree limbs to massive damage demolishing homes in its path. The type of damage depends on the intensity, size, and duration of the tornado. The magnitude or severity of a tornado is categorized using the Enhanced Fujita Tornado Intensity Scale (EF Scale). This is the scale now used exclusively for determining tornado ratings by comparing wind speed and actual damage. Figure 5-33 illustrates the relationship between EF ratings, wind speed, and expected tornado damage. The County can experience tornadoes ranking from EF0 to EF3.

Figure 5-33. 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. 

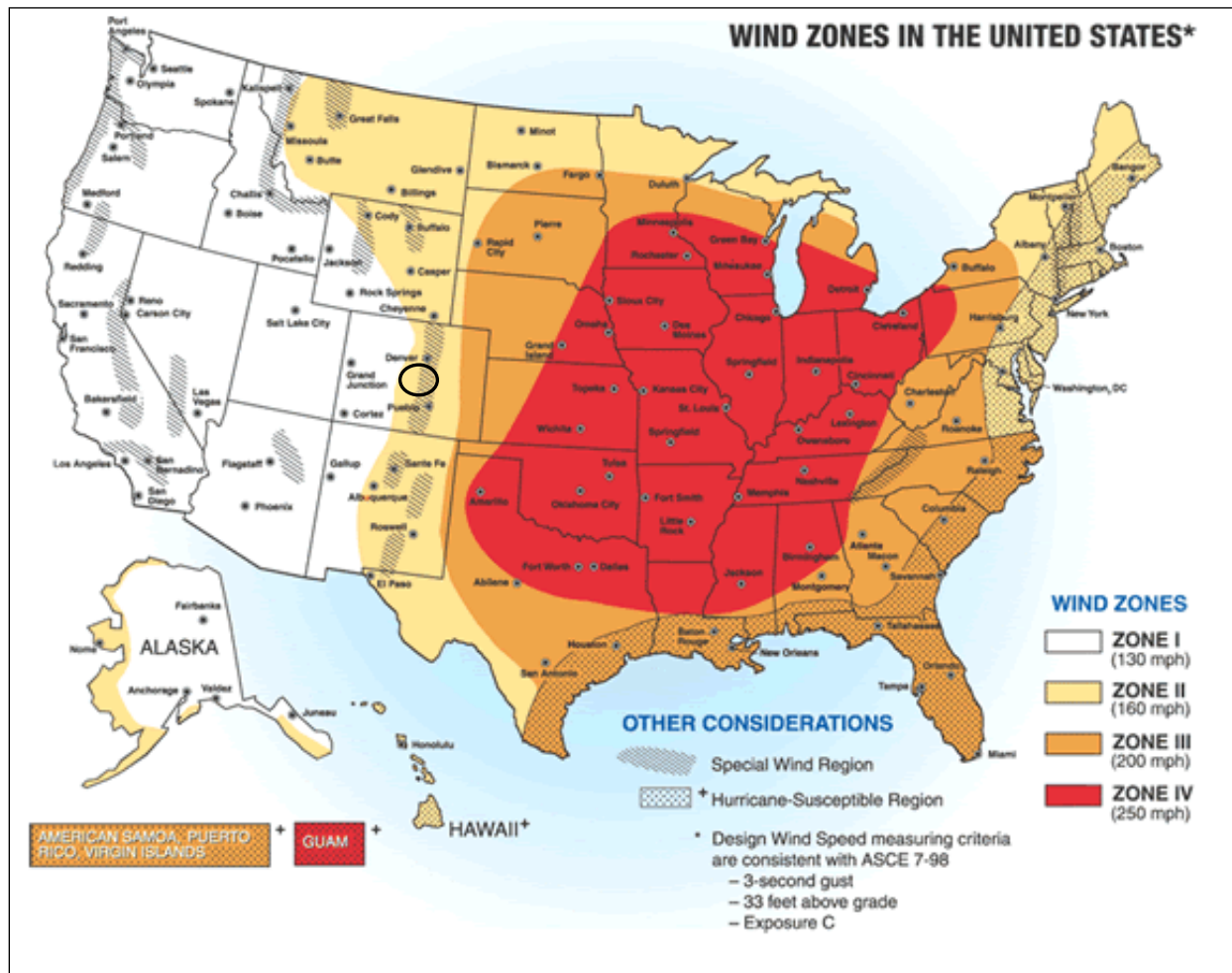
Source: NWS 2020

The NWS issues tornado watches and warnings. A tornado watch is issued by the SPC in Norman, Oklahoma. They are issued when conditions are favorable for the development of tornadoes in and close to the watch area. Their size can vary depending on the weather situation. Watches are typically issued for a duration of four to eight hours. A tornado warning is issued by the local NWS office and will include where the tornado was located and what municipalities will be in its path. It is issued when a tornado is indicated by a radar or spotters. Warnings are issued for a duration of 30 minutes (NWS 2020). The current average lead time for tornado warnings is 13 minutes. Occasionally, tornadoes develop so rapidly, that little, if any, advance warning is possible (NOAA 2011).

Location

Similar to that of thunderstorms, tornadoes do not have any specific geographic boundary and can occur anywhere in Douglas County. According to the FEMA Winds Zones of the United States map, Douglas County is located in Wind Zone II, where wind speeds can reach up to 160 mph. Figure 5-34 illustrates wind zones across the United States, which indicate the impacts of the strength and frequency of wind activity per region. The information on the figure is based on 40 years of tornado data and 100 years of hurricane data collected by FEMA.

Figure 5-34. Wind Zones in the United States



Source: FEMA 2014

Note: The black oval indicates the approximate location of Douglas County.

Previous Occurrences and Losses

Several different sources have provided historical information regarding previous occurrences and losses associated with tornadoes events in Douglas County. According to NOAA-NCEI Storm Events Database, Douglas County has been impacted by three tornado events that did not cause fatalities or reported property damage.

Table 5-77. Tornado Events 2014-2020

Hazard Type	Number of Occurrences Between 2014 and 2020	Total Fatalities	Total Injuries	Total Property Damage (\$)	Total Crop Damage (\$)
Tornado	3	0	0	N/A	\$0
TOTAL	3	0	0	N/A	\$0

Source: NOAA-NCEI 2020

Between 1953 and 2020, the State of Colorado was included in one tornado-related FEMA major disaster (DR) or emergency (EM) declarations. This disaster declaration included Douglas County (FEMA 2020). Table 5-49 lists the FEMA DR declaration for Douglas County.

Table 5-78 Tornado-Related FEMA Declarations for Douglas County, 1953 to 2020

FEMA Declaration Number	Date(s) of Event	Incident Type	Incident Title
DR-200	June 19 th , 1965	Tornado	Tornadoes, Severe Storms, and Flooding

Source: FEMA 2020; USDA 2020

The events listed in Table 5-79 represent only those that were reported to NOAA-NCEI and the Storm Prediction Center and may not represent all tornado events and damages that have occurred since 2000.

Table 5-79 Tornado Events in Douglas County, 2014 to 2020

Date(s) of Event	Event Type	Fatalities	Injuries	Damages	Event Details*
June 8, 2014	Tornado (EF0)	0	0	\$0 in property or crop damage	One of many tornadoes caused by an upper level weather disturbance and its associated cold front, this tornado touched down in the open country of Greenland, causing no damage to property or crops.
July 21, 2015	Tornado (EF1)	0	0	\$0 in property or crop damage	A tornado touched down in Pike National Forest, causing damage to the affected area. As it traveled eastward, no damages were seen in Douglas County.
September 6, 2019	Tornado (EF0)	0	0	N/A	A weak tornado touched down in an open field near Highland Ranch. As a result, Douglas County experienced large hail and heavy rain. In Douglas County, a bolt of lightning caused a house fire, yielding extensive damage.

Source(s): FEMA 2020; NOAA-NCEI 2020

* Many sources were consulted to provide an update of previous occurrences and losses; event details and loss/impact information may vary and has been summarized in the above table

N/A Not reported/not available

FEMA Federal Emergency Management Agency

NCEI National Centers for Environmental Information

Climate Change Projections

The results of Colorado’s changing climate are not yet fully known, though climate change is generally anticipated to result in more frequent and severe weather events. Researchers at Colorado State University estimate that climate change may cause an additional day of tornadoes per year by 2100, as well as amplify human exposure by more than double in the same period (Childs et al. 2020).

Probability of Future Occurrences

Tornadoes occur on an annual basis throughout the State of Colorado. Most tornadoes occur between May and July, with most occurring in June (State of Colorado HMP 2018). Table 5-80 summarizes data regarding the probability of occurrences of tornado events in Douglas County based on the historic record.

The information used to calculate the probability of occurrences is based on NOAA-NCEI storm events database results and the SPC severe weather database files.

Table 5-80 Probability of Future Occurrence of Tornado Events

Hazard Type	Number of Occurrences Between 1953 and 2020	% chance of occurrence in any given year
Tornado (all magnitudes)	63	92.7%

Source: NOAA-NCEI 2020; SPC 2020

Douglas County is expected to continue experiencing the direct and indirect impacts of tornadoes each year. Based on historical records and input from the Core Planning Team, the probability of occurrence for tornadoes in the County is considered *frequent* (hazard event is likely to occur within 25 years). However, due to the rarity of tornadoes resulting in a significant loss event, the probability of occurrence for tornadoes in the risk ranking was ranked to be *occasional* (Hazard event is likely to occur within 100 years). Refer to Sections 5.1 and 5.3 for additional information on the hazard ranking methodology and probability criteria.

Vulnerability Assessment

To understand risk, a community must evaluate assets exposed to and vulnerable to the identified hazard. The entire Douglas County planning area is exposed and vulnerable to the tornado hazard; therefore, all assets within the County (population, structures, critical facilities, and lifelines), as described in Section 4 (County Profile), are potentially vulnerable to a tornado event. The following text evaluates and estimates the potential impact of the tornado hazard in the County.

Impact on Life, Health and Safety

Impacts of a tornado on life, health, and safety depend on several factors, including severity of the event and whether adequate warning time was provided to residents. All residents in Douglas County are exposed to the tornado hazard.

Residents impacted by tornadoes may be displaced or require temporary to long-term sheltering. In addition, downed trees, damaged buildings, and debris carried by winds associated with tornadoes can lead to injury or loss of life. Similar to other natural hazards, socially vulnerable populations are most susceptible, based on a number of factors including their physical and financial ability to react or respond during a hazard and locations and construction quality of their housing. Economically disadvantaged populations are more vulnerable because they are likely to evaluate their risk and make decisions based on the major economic impact on their family and may not have funds to evacuate. The population over the age of 65 is also more vulnerable and, physically, they may have more difficulty evacuating. The elderly are considered most vulnerable because they require extra time or outside assistance during evacuations and are more likely to seek or need medical attention that may not be available due to isolation during a storm event. Section 4 (County Profile) presents the statistical information regarding these populations in the County.

Impact on General Building Stock

The entire County’s building stock is exposed to the tornado hazard. Damage to buildings depends on several factors, including wind speed, storm duration, path of the storm track or tornado, and distance from the tornado funnel.

Manufactured housing (i.e. mobiles homes) is particularly vulnerable to high winds and tornadoes. The U.S. Census Bureau defines manufactured homes as “movable dwellings, 8 feet or wider and 40 feet or more long, design to be towed on its own chassis, with transportation gear integral to the unit when it leaves the factory, and without need of a permanent foundation (Census, 2010).” They can include multi-wides and expandable manufactured homes but exclude travel trailers, motor homes, and modular housing. Due to their light-weight and often unanchored design, manufactured housing is extremely vulnerable to high winds and will generally sustain the most damage.

Table 5-81 displays the number of manufactured housing units in the County. Total counts were obtained from the 2014-2018 American Community Survey 5-Year Estimates. While the number is a very small percentage of total homes in the County (0.2% of the total housing units), the structures and the population living in the structures are vulnerable to tornado events.

Table 5-81 Manufactured Housing Units in Douglas County

Municipality	Number of Manufactured Homes
Douglas County	324

Source: U.S. Census 2018

Impact on Critical Facilities

Utility infrastructure could suffer damage from tornadoes associated with falling tree limbs or other debris, resulting in the loss of power or other utility service. Loss of service can impact residents, critical facilities, and business operations alike. Interruptions in heating or cooling utilities can affect populations, such as the young and elderly, who are particularly vulnerable to temperature-related health impacts. Loss of power can impact other public utilities, including potable water, wastewater treatment, and communications. In addition to public water services, property owners with private wells might not have access to potable water until power is restored. Lack of power to emergency facilities, including police, fire, EMS, and hospitals, will inhibit a community’s ability to effectively respond to an event and maintain the safety of its citizens.

Impact on Economy

Tornados also impact the economy, including loss of business function (e.g., tourism, recreation), damage to inventory, relocation costs, and wage loss and rental loss due to repair/replacement of buildings. Impacts on transportation lifelines affect both short-term (e.g., evacuation activities) and long-term (e.g., day-to-day commuting and goods transport) transportation needs. Utility infrastructure (power lines, gas lines, electrical systems) could sustain damage, and impacts could result in loss of power, which can affect business operations and provision of heating or cooling to the population.

Impact on Environment

The impact of severe storm events on the environment varies, but researchers are finding that the long-term impacts of more severe weather can be destructive to the natural and local environment. National organizations such as USGS and NOAA have been studying and monitoring the impacts of extreme weather

phenomena as it impacts long term climate change, streamflow, river levels, reservoir elevations, rainfall, floods, landslides, erosion, etc. (USGS 2017).

Cascading Impacts on Other Hazards

Severe storms events may escalate the impacts from other hazards of concern, such as drought or erosion. Loose soils can be disturbed and become airborne during tornado events, causing disruption to farms and the ecosystem.

Future Changes that May Impact Vulnerability

Understanding future changes that effect vulnerability in the County can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The County considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development.
- Projected changes in population.
- Other identified conditions as relevant and appropriate, including the impacts of climate change.

Projected Development

Any areas of growth could be potentially impacted by the tornado hazard because the entire County is exposed and vulnerable. Residential development, specifically manufactured homes, may be considered more vulnerable to the tornado hazard.

Projected Changes in Population

The County has experienced an increase in population between the 2010 Census (285,465) and the estimated 2018 American Community Survey estimated population of 328,614. The population of the County is expected to increase over the next few years. The increase in population will expose more people to the tornado hazard.

Climate Change

Colorado's climate is changing, though exact impacts to temperature, precipitation, and weather events are currently variable. However, climate change may amplify human exposure to tornadoes by up to 117% by 2100, and there may be one additional tornado day per year by 2100. This may result in potential impacts to Douglas County's ecosystems, residents, and properties (Childs et al. 2020).

Changes in Vulnerability Since the 2015 HMP

Douglas County's population increased since the last plan, increasing the number of people vulnerable during a tornado. Therefore, the entire County remains vulnerable to tornado events.

Issues Identified

Important issues associated with tornadoes in Douglas County include the following:

- 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 can cause disruption in communication

5.4.11 Severe Weather: Thunderstorms and Windstorms

The following section provides the hazard profile and vulnerability assessment for the thunderstorm and wind hazard in Douglas County.

Profile

Hazard Description

Thunderstorms

A thunderstorm is a storm with lightning and thunder produced by cumulonimbus cloud, usually producing gusty winds, heavy rain, and sometimes hail or tornadoes (NWS 2009). Thunderstorms are usually short-lived (less than two hours), but they can deliver strong winds and enough rain to cause urban or flash flooding. The NWS considers a thunderstorm severe only if it produces damaging wind gusts of 58 mph or higher or large hail one-inch (quarter size) in diameter or larger or tornadoes (NWS 2009). Thunderstorms can occur at any time. However, they are most common in the Southeast, Great Plains, and Mississippi River Valley. Thunderstorms are also frequent in the mountainous regions of New Mexico and Colorado [NSSL] 2020). For details on lightning events in Douglas County, refer to Section 5.4.9 (Hail and Lightning).

It is estimated that each year there are 16 million thunderstorms worldwide. Approximately 100,000 thunderstorms occur in the United States each year (NSSL 2020). Figure 5-35 illustrates the average number of days with thunderstorms using data from 1993 to 2018. This figure shows that Douglas County experiences between 54 and 63 days of thunderstorms each year.

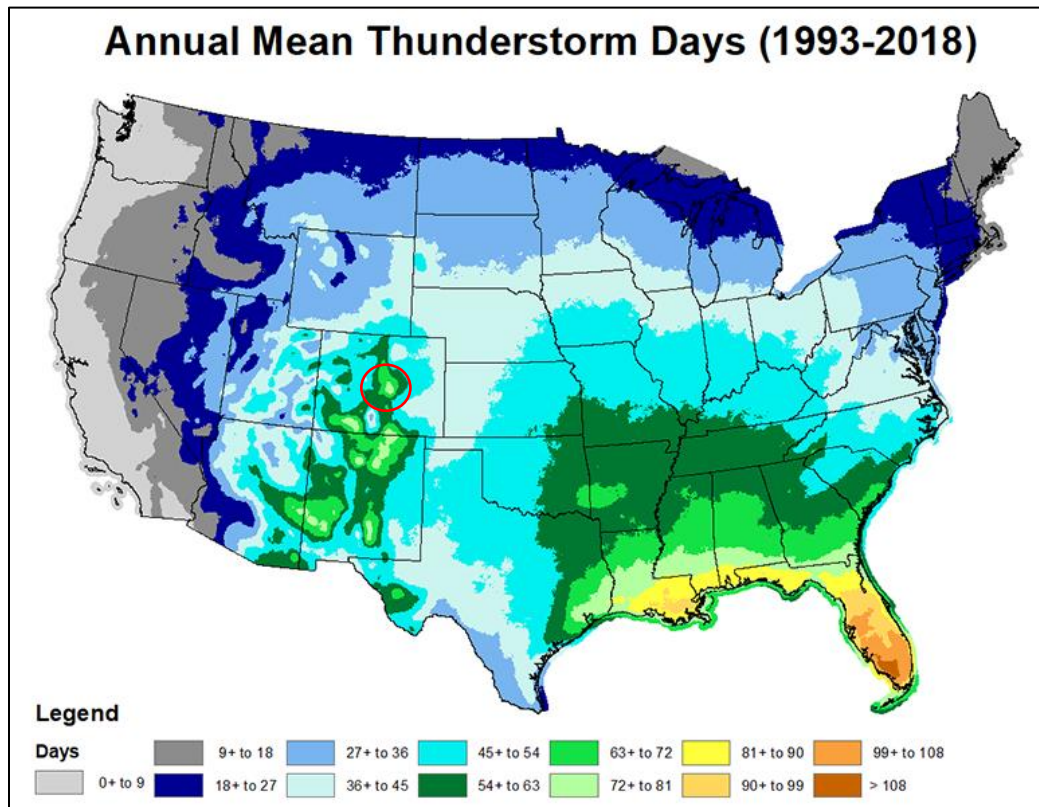
Thunderstorms can lead to flooding, landslides, strong winds, tornadoes, lightning, and hail. Roads could become impassable from flooding, downed trees or power lines, or a landslide. Strong straight-line winds (up to more than 12 mph) associated with thunderstorms can down trees and utility poles, causing utility outages. Thunderstorms can create tornadoes with winds of up to 300 mph. Lightning can damage homes and injure people. In the United States, an average of 300 people are injured and 80 people are killed by lightning each year. Thunderstorms can produce hail up to the size of softballs damaging cars and windows, and killing livestock caught out in the open (NSSL 2020).

Windstorms and High Winds

Wind begins with differences in air pressures and occurs through rough horizontal movement of air caused by uneven heating of the earth's surface. Wind occurs at all scales, 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, derechos, tornadoes, nor'easters, hurricanes, and tropical storms.

High winds are often associated by other severe weather events such as thunderstorms, tornadoes, hurricanes, and tropical storms. Wind begins with differences in air pressures. It is rough horizontal movement of air caused by uneven heating of the earth's surface. Wind occurs at all scales, from local breezes lasting a few minutes to global winds resulting from solar heating of the earth (Rosenstiel School of Marine & Atmospheric Science 2005).

Figure 5-35. Annual Mean Thunderstorm Days, 1993-2018



Source: National Weather Service 2020

Note: The approximate location of Douglas County is outlined in a red circle.

High winds in Colorado generated during the cold season are due to air pressure differences and Chinook winds developing across the Front Range. Winds traveling the leeward slopes of mountains (Bora) can cause episodic high winds. Generally, high winds can cause flying debris, reduced visibility due to dust, and structural damage. The National Weather Service issues high wind watches where the chance for high winds to develop in the following two days is greater than 50 percent. Bora winds can also cause low wind chill values (NWS 2020).

Extent







Severe thunderstorm watches and warnings are issued by the local NWS office and the Storm Prediction Center (SPC). The NWS and SPC will update the watches and warnings and notify the public when they are no longer in effect. Watches and warnings for thunderstorms in Douglas County are as follows:

- Severe Thunderstorm Warnings are issued when there is evidence based on radar or a reliable spotter report that a thunderstorm is producing, or forecast to produce, wind gusts of 58 mph or greater, structural wind damage, or hail one-inch in diameter or greater. A warning will include where the storm was located, what municipalities will be impacted, and the primary threat associated with the severe thunderstorm warning. After it has been issued, the NWS office will follow up periodically with Severe Weather Statements that contain updated information on the severe thunderstorm and advise the public when the warning is no longer in effect (NWS 2009, NWS 2010).

- Severe Thunderstorm Watches are issued by the SPC when conditions are favorable for the development of severe thunderstorms over a larger-scale region for a duration of at least three hours. Tornadoes are not expected in such situations, but isolated tornado development can also occur. Watches are normally issued well in advance of the actual occurrence of severe weather. During the watch, the NWS will keep the public informed on what is happening in the watch area and also advise public when the watch has expired or been cancelled (NWS 2009, NWS 2010).

Figure 5-36 presents the severe thunderstorm risk categories, as provided by the SPC.

Figure 5-36 Severe Thunderstorm Risk Categories.

Understanding Severe Thunderstorm 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
* NWS defines a severe thunderstorm as measured wind gusts to at least 58 mph, and/or hail to at least one inch in diameter, and/or a tornado. All thunderstorm categories imply lightning and the potential for flooding. Categories are also tied to the probability of a severe weather event within 25 miles of your location.					

Source: SPC 2017

Winds associated with thunderstorms are measured according to the Beaufort Wind Scale, as outlined in Table 5-82. This scale was one of the first to estimate wind speeds. In Colorado, wind speed is correlated with elevation. Differences in elevation, temperatures, and seasonality can cause wide variability of winds in the State (State of Colorado 2018).

Table 5-82 Beaufort Wind Scale

Force	Wind (Knots)	WMO Classification	Appearance of Wind Effects on Land
0	Less than 1	Calm	Calm, smoke rises vertically
1	1-3	Light Air	Smoke drift indicates wind direction, still wind vanes
2	4-6	Light Breeze	Wind felt on face, leaves rustle, vanes begin to move
3	7-10	Gentle Breeze	Leaves and small twigs constantly moving, light flags extended
4	11-16	Moderate Breeze	Dust, leaves, and loose paper lifted, small tree branches move
5	17-21	Fresh Breeze	Small trees in leaf begin to sway
6	22-27	Strong Breeze	Larger tree branches moving, whistling in wires
7	28-33	Near Gale	Whole trees moving, resistance felt walking against wind
8	34-40	Gale	Twigs breaking off trees, generally impedes progress
9	41-47	Strong Gale	Slight structural damage occurs, slate blows off roofs

Force	Wind (Knots)	WMO Classification	Appearance of Wind Effects on Land
10	48-55	Storm	Seldom experienced on land, trees broken or uprooted, considerable structural damage occurs
11	56-63	Violent Storm	If experienced on land, widespread damage
12	64+	Hurricane	Violence and destruction

Source: NWS 2020

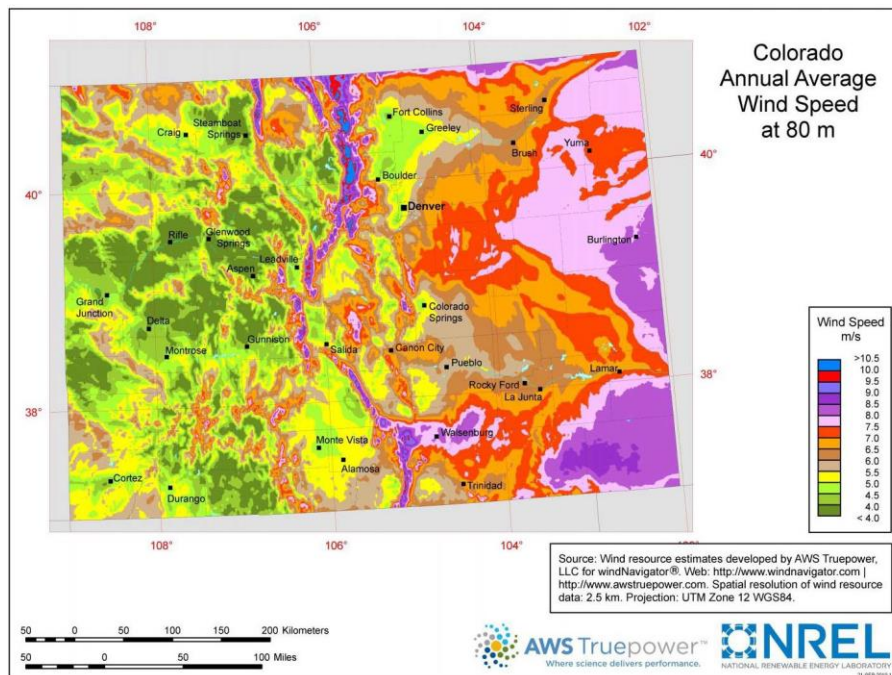
The NWS issues advisories and warnings for winds. Issuance is normally site-specific. High wind advisories, watches, and warnings are products issued by the NWS when wind speeds can pose a hazard or are life threatening. The criterion for each of these varies from state to state. According to the NWS, wind warnings and advisories for Douglas County are as follows:

- *High Wind Warnings* are issued when sustained wind speeds of 40 mph or greater lasting for one hour or longer or for winds of 58 mph or greater for any duration or widespread damage are possible.
- *Wind Advisories* are issues when sustained winds of 30 to 39 mph are forecast for one hour or longer, or wind gusts of 46 to 57 mph for any duration (NWS 2020; NHC 2020).

Location

Since thunderstorms can develop anywhere in the United States, all of Douglas County is exposed and vulnerable to the impacts of thunderstorms. In Colorado, reports of severe winds are most common in northeastern Colorado, including the northern Eastern Plains and the Front Range. The 2018 Enhanced State Hazard Mitigation Plan indicates that the foothills between Fort Collins and Trinidad (which includes Douglas County) are prone to 60 to 100 mph winds (State of Colorado 2018). Table 5-84 shows the distribution of average wind speeds in the State of Colorado.

Figure 5-37: Annual Average Wind Speeds at 80M



Source: National Renewable Energy Laboratory in the State of Colorado HMP

The northwestern portion of Douglas County is located within a Special Wind Region as designated in ASCE 7-10 (*Minimum Design Loads for Buildings and Other Structures*). The Special Wind Region results from exceptional wind speeds resulting from the County’s location in the Front Range, where mountains and gorges result in wind speed anomalies (CPPWind 2020).

Previous Occurrences and Losses

Many sources have provided historical information regarding previous occurrences and losses associated with thunderstorms in Douglas County. According to the NOAA-NCEI Storm Events Database, Douglas County has been impacted by 61 wind events between 2014 and 2020 that caused \$10,000 in property damage and no crop damage.

Table 5-83 Impacts from Wind Events in Douglas County, 2014-2020

Hazard Type	Number of Occurrences Between 2014 and 2020	Total Fatalities	Total Injuries	Total Property Damage (\$)	Total Crop Damage (\$)
High Wind	44	0	23	\$0	\$0
Strong Wind	2	0	0	\$10,000	\$0
Thunderstorm Wind	15	0	0	\$0	\$0

Source: NOAA-NCEI 2020

Note: Due to data limitations, historic data is not available for some years. These numbers reflect underestimations.

Between 2014 and 2020, Douglas County was not included in thunderstorm-related FEMA major disaster (DR) or emergency (EM) declarations. This HMP update includes known thunderstorm and wind events that have impacted Douglas County between 2014 and 2020. These events are shown in Table 5-84. The events listed in Table 5-84 represent only those that were reported to the NOAA-NCEI Storm Events Database and FEMA, and may not represent all thunderstorm and wind events that have occurred since 2014.

Table 5-84 Wind Events in Douglas County, 2014-2020

Date(s) of Event	Event Type	Magnitude (wind speed in knots)	Fatalities	Injuries	Damages	Event Details*
August 25, 2014	Thunderstorm Wind	57	0	0	N/A	As a result of this severe storm, hail the size of a quarter poured down on the County. Wind was as fast as 66 miles per hour in northern Douglas County.
August 27, 2014	Thunderstorm Wind	50	0	0	N/A	Thunderstorm winds produced large hail, which was described as ranging from the size of a nickel to a golf ball. Wind was as fast as 65 miles per hour.
November 10, 2014	Strong Wind	45	0	0	N/A	Strong winds followed an Arctic cold front, causing strong gusts above the timberline.
July 25, 2016	Thunderstorm Wind	52	0	0	N/A	The County experienced intense straight-line winds.
April 17, 2018	Strong Wind	74	0	0	N/A	A strong wind from a powerful post-frontal bora contributed to the spread of a fire that damaged several homes. A wind speed of 74 mph was recorded at the Cheesman

Date(s) of Event	Event Type	Magnitude (wind speed in knots)	Fatalities	Injuries	Damages	Event Details*
July 25, 2018	Thunderstorm Wind	60	0	0	N/A	Reservoir and tens of thousands of power outages were reported. This storm made its way across many counties throughout Colorado, traveling from Boulder, Douglas, Elbert, and Weld counties. Wind speeds up of 54 miles per hour in Sedalia and 60 miles per hour in Parker. This severe storm caused significant damage across the counties, though no damage was noted in Douglas County. However, damage in other counties included damage to homes and vehicles. Trees also fell as a result of this storm. Damage can be attributed to winds as high as 80 miles per hour in some regions, along with quarter sized hail and heavy rain. It was noted that a farm in Broomfield off of York Street experienced a loss of 200 acres of corn. The storm also resulted in power outages throughout affected areas that lasted for several hours.

Source(s): FEMA 2020; NOAA-NCEI 2020
 N/A Not available/not recorded
 FEMA Federal Emergency Management Agency
 NCEI National Centers for Environmental Information
 NOAA National Oceanic and Atmospheric Administration
 NWS National Weather Service

Climate Change Projections

Changes in wind speeds due to climate change vary on the continental scale. Models suggest an increase in wind speeds between the Hudson Bay region in Canada and Texas, which is a swathe of North America that includes portions of Colorado. However, there is overall uncertainty with the impact of climate change on wind speeds (Eichelberger et al. 2008).

Probability of Future Occurrences

Table 5-85 summarizes data regarding the probability of occurrences of thunderstorm events in Douglas County based on the historic record. The information used to calculate the probability of occurrences is based on the 2015 Douglas County HMP, the NOAA-NCEI Storm Events Database, SPC, and FEMA.

Table 5-85 Probability of Future Occurrence of Thunderstorm and Wind Events

Hazard Type	Number of Occurrences Between 1953 and 2020	% chance of occurrence in any given year
Strong Winds	4	5.9%
Thunderstorm Wind	32	47.7%
High Wind	148	100%

Source: NOAA-NCEI 2020; FEMA 2020
 Source: Due to data limitations, not all wind events between 1953 and 2020 are included here. These numbers reflect an underestimate.

Douglas County is expected to continue experiencing the direct and indirect impacts of wind events each year. Based on historical records and input from the Core Planning Team, the probability of occurrence for thunderstorm events in the County is considered *frequent* (Hazard event is likely to occur within 25 years). Refer to Sections 5.1 and 5.3 for additional information on the hazard ranking methodology and probability criteria.

Vulnerability Assessment

To understand risk, a community must evaluate assets exposed to and vulnerable to the identified hazard. The entire Douglas County is exposed and vulnerable to the thunderstorm and wind hazard; therefore, all assets within the County (population, structures, critical facilities, and lifelines), as described in Section 4 (County Profile), are potentially vulnerable to a thunderstorm event. The following text evaluates and estimates the potential impact of the thunderstorm hazard in the County.

Impact on Life, Health and Safety

The impact of thunderstorms on life, health, and safety is dependent upon several factors including the severity of the event and whether adequate warning time was provided to residents. The entire population of Douglas County (328,614) is assumed to be exposed to this hazard (U.S. Census 2018 ACS 5-Year Population Estimate).

The most common problems associated with thunderstorms are immobility and loss of utilities. Although the entire population of the County is exposed to thunderstorms, some populations are more vulnerable. Vulnerable populations include the elderly, low income, linguistically isolated populations, people with life-threatening illnesses, and residents living in areas that are isolated from major roads. Power outages can be life threatening to those dependent on electricity for life support. In general, populations who lack adequate shelter during a thunderstorm, those who are reliant on sustained sources of power in order to survive, and those who live in isolated areas with limited ingress and egress options are the most vulnerable.

People located outdoors (i.e., recreational activities and farming) are considered most vulnerable to hailstorms, thunderstorms, and tornadoes because there is little to no warning, and shelter might not be available. Moving to a lower risk location will decrease a person's vulnerability.

Economically disadvantaged populations are more vulnerable because they often evaluate evacuation needs and make decisions based on the economic impact to their family. The population over the age of 65 (35,801) is also vulnerable, can physically have difficulty evacuating, and are more likely to seek or need medical attention, which may not be available due to isolation during a storm event (U.S. Census 2018 ACS 5-Year Population Estimate). Section 4 (County Profile) provides for the statistics for these populations for Douglas County.

As a result of the impacts of thunderstorms, residents can be displaced or require temporary to long-term sheltering. In addition, downed trees, damaged buildings, and debris carried by high winds from thunderstorms can lead to injury or loss of life. Socially vulnerable populations are most susceptible, based on a number of factors, including their physical and financial ability to react or respond during a hazard and the location and construction quality of their housing.

Impact on General Building Stock

The entire building stock of Douglas County is vulnerable during a thunderstorm; 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 damages associated with downed trees and wires.

Impact on Critical Facilities

Overall, all critical facilities in Douglas County are vulnerable to being affected by thunderstorms. Utility infrastructure could suffer damage from high winds associated with falling tree limbs or other debris, resulting in the loss of power or other utility service. Loss of service can impact residents, critical facilities, and business operations alike. Interruptions in heating or cooling utilities can affect populations, such as the young and elderly, who are particularly vulnerable to temperature-related health impacts. Loss of power can impact other public utilities, including potable water, wastewater treatment, and communications. In addition to public water services, property owners with private wells might not have access to potable water until power is restored. Lack of power to emergency facilities, including police, fire, EMS, and hospitals, will inhibit a community's ability to effectively respond to an event and maintain the safety of its citizens.

Impact on Economy

Thunderstorm events can impact the economy of the County. Impacts include loss of business function, damage to inventory, relocation costs, wage loss, and rental loss due to the repair or replacement of buildings. HAZUS-MH v4.2 estimates the total economic loss associated with each probabilistic event (direct building losses and business interruption losses). Business interruption losses include losses associated with the inability to operate a business because of the wind damage sustained during a storm or the temporary living expenses for those displaced from their home because of an event.

Impact to the Environment

The impact of severe storm events on the environment varies, but researchers are finding that the long-term impacts of more severe weather can be destructive to the natural and local environment. National organizations such as USGS and NOAA have been studying and monitoring the impacts of extreme weather phenomena as it impacts long term climate change, streamflow, river levels, reservoir elevations, rainfall, floods, landslides, erosion, etc. (USGS 2017). For example, severe weather that creates longer periods of rainfall can erode natural banks along waterways and degrade soil stability for terrestrial species. Tornadoes can tear apart habitats causing fragmentation across ecosystems. Researchers also believe that a greater number of diseases will spread across ecosystems because of impacts that severe weather and climate change will have on water supplies (NOAA 2013c). Overall, as the physical environment becomes more altered, species will begin to contract or migrate in response, which may cause additional stressors to the entire ecosystem within Douglas County.

Cascading Impacts on Other Hazards

Severe storms events may escalate the impacts from other hazards of concern, such as coastal erosion or infestation and invasive species. Severe winds can be destructive to the natural coastlines if the coastal land area is left barren. Furthermore, changes in the land area caused by severe storm events can alter the distribution of species throughout the County, exacerbating the presence of invasive species who can survive in distressed environments.

Future Changes that May Impact Vulnerability

Understanding future changes that effect vulnerability in the County can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The County considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development.
- Projected changes in population.
- Other identified conditions as relevant and appropriate, including the impacts of climate change.

Projected Development

Understanding future changes that impact vulnerability in the County can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. Development contributes to increased exposure of people and property to the impacts of wind events. Areas targeted for potential future growth and development could be potentially impacted by thunderstorms since the entire County is exposed to the thunderstorm hazard.

Projected Changes in Population

The County experienced an increase in population between the 2010 Census (285,465) and the estimated 2014-2018 American Community Survey estimated population of 328,614. The population of the County is expected to increase over the next few years. The increase in population will expose more people to the thunderstorm hazard.

Climate Change

Major clusters of summertime thunderstorms in North America will grow larger, more intense, and more frequent later this century in a changing climate, unleashing far more rain and posing a greater threat of flooding across wide areas (UCAR 2017). An increase in storms will produce more wind events and may increase tornado activity. Additionally, an increase in temperature will provide more energy to produce storms that generate tornadoes (Climate Central 2016). Overall, Douglas County will continue to remain vulnerable to the thunderstorm hazard.

Anticipated changes in wind speeds due to climate change vary. Models suggest an increase in wind speeds between the Hudson Bay region in Canada and Texas, which is a swathe of North America that includes portions of Colorado. However, there is overall uncertainty with the impact of climate change on wind speeds (Eichelberger et al. 2008).

Changes in Vulnerability Since the 2015 HMP

Douglas County's population increased since the last plan; increasing the number of people impacted during a thunderstorm. Therefore, the entire County remains vulnerable to thunderstorms.

Issues Identified

Important issues associated with severe storm events in Douglas County include the following:

- Older building stock in the County could be more vulnerable to winds associated with thunderstorms as they may have been built to low or no code standards.

- Critical facilities and other structures may not have a source of 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. These trees are more susceptible to falling during thunderstorms. This can cause power outages, close roadways, and damage buildings and property.
- High winds can also spread wildfires and hinder efforts to suppress wildfires' spread.

5.4.12 Severe Winter Storm

The following section provides the hazard profile and vulnerability assessment for the severe winter storm hazard in Douglas County.

Profile

Hazard Description

Severe winter storms bring the threat of snow, freezing rain, and ice storms to Douglas County. A winter storm is a weather event in which the main types of precipitation are snow, sleet, or freezing rain. They can be a combination of heavy snow, blowing snow, and dangerous wind chills. According to the National Severe Storms Laboratory (n.d.), the three basic components needed to make a winter storm include the following:

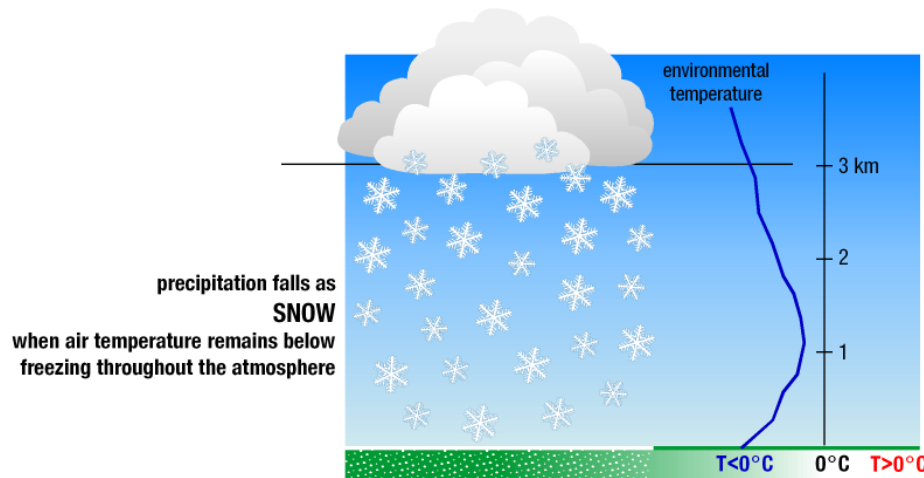
- Below freezing temperatures (cold air) in the clouds and near the ground to make snow and ice.
- Lift, something to raise the moist air to form clouds and cause precipitation, such as warm air colliding with cold air and being forced to rise over the cold dome or air flowing up a mountainside (orographic lifting).
- Moisture to form clouds and precipitation, such as air blowing across a large lake or the ocean.

Some winter storms are large enough to immobilize an entire region while others might only affect a single community. Winter storms typically are accompanied by low temperatures, high winds, freezing rain or sleet, and heavy snowfall. The aftermath of a winter storm can have an impact on a community or region for days, weeks, or even months; potentially causing cold temperatures, flooding, storm surge, closed and blocked roadways, downed utility lines, and power outages. In Douglas County, winter storms include snowstorms (heavy snow), blizzards, and ice storms. Extreme cold temperatures and wind chills are associated with winter storms; however, they are discussed in Section 5.4.5 (Extreme Temperatures).

Heavy Snow

According to the National Weather Service (NWS), snow is precipitation in the form of ice crystals, formed directly from the freezing of water vapor in the air. It originates in clouds when temperatures are below the freezing point (32 °F) and water vapor in the atmosphere condenses directly into ice without going through the liquid stage. Once an ice crystal has formed, it absorbs and freezes additional water vapor from the surrounding air, growing into snow crystals or a snow pellet, which then falls to the earth. Snow falls in different forms: snowflakes, snow pellets, or sleet. Figure 5-38 depicts snow creation.

Figure 5-38 Snow Creation



Source: NOAA-NSSL, 2015

Blizzards

A blizzard is a winter snowstorm with sustained or frequent wind gusts of 35 miles per hour (mph) or more, accompanied by falling or blowing snow reducing visibility to or below 0.25 mile, as the predominant conditions over a 3-hour period. Extremely cold temperatures often are associated with blizzard conditions but are not a formal part of the definition. The hazard, created by the combination of snow, wind, and low visibility, significantly increases when temperatures are below 20 °F. A severe blizzard is categorized as having temperatures near or below 10 °F, winds exceeding 45 mph, and visibility reduced by snow to near zero. Storm systems powerful enough to cause blizzards usually form when the jet stream dips far to the south, allowing cold air from the north to clash with warm, moister air from the south. Blizzard conditions often develop on the northwest side of an intense storm system. The difference between the lower pressure in the storm and the higher pressure to the west creates a tight pressure gradient, resulting in strong winds and extreme conditions caused by the blowing snow (The Weather Channel 2012).

Ice Storms

An ice storm describes those events when damaging accumulations of ice are expected during freezing rain situations. Significant ice accumulations typically are accumulations of 0.25-inches or greater (NWS 2013). 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 (NWS 2008).

Extent

In the State of Colorado and Douglas County, the winter storm season runs from November to April each year (State of Colorado 2018). The magnitude or severity of a severe winter storm depends on several factors, including a region’s climatological susceptibility to snowstorms, snowfall amounts, snowfall rates, wind speeds, temperatures, visibility, storm duration, topography, time of occurrence during the day and week (e.g., weekday versus weekend), and time of season.

The NWS uses the Winter Storm Severity Index (WSSI) to assist forecasters in maintaining situational awareness of the possible significant of weather-replated impacts. The index is also used to help communicate a general level of potential societal impacts; however, it does not depict official watches and warnings (State of Colorado 2018; Weather Prediction Center 2021).

Additionally, National Oceanic and Atmospheric Administration’s (NOAA’s) National Climatic Data Center (NCDC) is produces the Regional Snowfall Index (RSI) for significant snowstorms that impact the eastern two-thirds of the United States. The RSI ranks snowstorm impacts on a scale from 1 to 5 and is based on the spatial extent of the storm, the amount of snowfall, and the interaction of the extent and snowfall totals with population (based on the 2000 Census). The NCDC has analyzed and assigned RSI values to over 500 storms since 1900 (NOAA 2015). Table 5-86 presents the five RSI ranking categories.

Potential Winter Storm Impacts	
	No Impacts Impacts not expected.
	Limited Impacts Rarely a direct threat to life and property. Typically results in little inconveniences.
	Minor Impacts Rarely a direct threat to life and property. Typically results in an inconvenience to daily life.
	Moderate Impacts Often threatening to life and property, some damage unavoidable. Typically results in disruptions to daily life.
	Major Impacts Extensive property damage likely, life saving actions needed. Will likely result in major disruptions to daily life.
	Extreme Impacts Extensive and widespread severe property damage, life saving actions will be needed. Results in extreme disruptions to daily life.

Table 5-86 RSI Ranking Categories

Category	Description	RSI Value
1	Notable	1–3
2	Significant	3–6
3	Major	6–10
4	Crippling	10–18
5	Extreme	18.0+

Source: NOAA 2015

Note: RSI = Regional Snowfall Index

According to NWS (2009), the magnitude of a severe winter storm can be qualified into five main categories by event type:

- Heavy Snowstorm – snowfall accumulating to 4 inches or more in a 12 hours or less or snowfall accumulating to six inches or more in 24 hours or less.
- Sleet Storm – Significant accumulations of solid pellets that form from the freezing of raindrops or partially melted snowflakes causing slippery surfaces, 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 sheer weight of ice accumulations; significant ice accumulations are usually ¼” or greater.
- Blizzard – sustained winds or frequent gusts of 35 mph or more; 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.

The NWS uses winter weather watches, warnings, and advisories to ensure that people know what to expect in the coming hours and days.

- Watches

- Blizzard – Conditions are favorable for blizzard conditions to be met in the next 12 to 48 hours.
- Winter Storm - Issued when winter storm conditions, defined above, are possible within 24 to 48 hours.
- Warnings
 - Blizzard – Issued when sustained winds or frequent gusts ≥ 35 mph combined with blowing and or falling snow, reducing visibility below 1/4 mile for 3 hours or more, when imminent or expected within the next 36 hours. Temperatures are assumed below 32°F, and snow should accumulate at least one inch in 12 hours.
 - Winter Storm - Issued when the following conditions, capable of producing high impact and potentially life threatening conditions, are occurring or expected to occur within the 36 hours: snow - ≥ 1 inch in 12 hours; sleet - $\geq 1/2$ inch in 12 hours; and or a combination of snow, sleet, ice with snow or sleet meeting warning criteria
 - Ice Storm - Issued when $\geq 1/8$ inch of Ice is expected to accrete on trees, power lines, and bridges/overpasses for the entirety of the event. These conditions are capable of producing high impact and potentially life threatening conditions and are either occurring or expected to occur within the next 36 hours.
- Advisories
 - Winter Weather - Issued when the following conditions, capable of producing significant, but not necessarily life threatening, inconveniences, are occurring or expected to occur within the next 36 hours:
 - Snow: 1/2 to 1 inch in 12 hours
 - Sleet: $< 1/2$ inch in 12 hours
 - Ice: $< 1/8$ inch in 12 hours
 - Combination: Snow, sleet, and ice with snow or sleet meeting advisory criteria.

Location

Winter storms occur on a regional scale and can happen anywhere in the State of Colorado; therefore, the entire Douglas County can experience winter storm events.

Previous Occurrences and Losses

Many sources have provided historical information regarding previous occurrences and losses associated with severe winter storm events in Douglas County. According to the NOAA-NCEI storm events database, Douglas County has been impacted by 65 winter weather events between 2014 to 2020. Table 5-87 and Table 5-88 summarize these statistics, as well as the annual average number of events and the percent chance of these individual severe winter storm hazards occurring in Douglas County in future years (NOAA-NCEI 2020).

Table 5-87 Severe Winter Events 2014 to 2020

Hazard Type	Number of Occurrences Between 2014 to 2020	Total Fatalities	Total Injuries	Total Property Damage (\$)	Total Crop Damage (\$)
Blizzard	5	0	0	\$0	\$0
Heavy Snow	6	0	0	\$0	\$0
Ice Storm	0	0	0	\$0	\$0

Hazard Type	Number of Occurrences Between 2014 to 2020	Total Fatalities	Total Injuries	Total Property Damage (\$)	Total Crop Damage (\$)
Sleet	0	0	0	\$0	\$0
Winter Storm	25	0	0	\$0	\$0
Winter Weather	39	1	0	\$0	\$0
Total	65	1	0	\$0	\$0

Source: NOAA-NCEI 2020

Between 1954 and September 2020, FEMA included the State of Colorado in three winter storm-related major disaster (DR) declarations. Generally, these disasters cover a wide region of the state; therefore, they may have impacted many counties. As a result, Douglas County was included in two winter storm-related declarations in 2003 and 2007 (FEMA 2020). Douglas County has not been subject to any USDA disaster declarations for agricultural losses since 2017.

For this 2021 update, known severe winter storm events that have impacted Douglas County between 2014 and 2020 are identified in Table 5-88. The events listed in this table represent only those that were reported to the NOAA-NCEI Storm Events Database and FEMA, and may not represent all hail events and damages that have occurred since 2014. However, the events tallied for this analysis does not reflect a comprehensive count of winter storm events due to damage limitations and reporting inconsistencies. Therefore, Table 5-88 may not include all events that occurred in Douglas County.

Table 5-88 Severe Winter Weather Events in Douglas County, 2014 to 2020

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Event Details*
January 3, 2014	Winter Weather	N/A	N/A	Winter weather impacted Western Douglas County and surrounding counties, leading to heavy snow in parts of the North Central Mountains and parts of the Front Range Foothills. The heaviest snow was seen north of Interstate 70. Most of the affected region saw snowfall ranges of 4 to 8 inches, though some areas noted snowfall as high as 11.5 inches.
January 27, 2014	Winter Weather	N/A	N/A	Western Douglas County and surrounding counties experienced heavy snowfall, up to 10.5 inches in some areas. The Front Range Foothills experienced a period of moderate to heavy snowfall as a result of this storm.
January 30, 2014	Winter Storm, Winter Weather	N/A	N/A	This winter storm swept across most of Douglas County (North, Central, and West Douglas County) and many surrounding counties. Winter weather was noted East of Douglas County as a result of the storm. As a result, snow totals exceeded 2 feet over a 3-day period, with heavy snowfall spilling over into northern foothills and adjacent plains. The region north of Interstate 70 experienced the heaviest snowfall. Within the Urban Corridor and Northeast Plains, storm totals ranged from 5 to 11 inches. Prior to heavy snowfall within the Front Range Foothills was strong downslope winds with speeds greater than 80 mph.
March 1, 2014	Winter Weather	N/A	N/A	This winter weather resulted in a chain of accidents in the northbound lanes of Interstate 25 in Northern Douglas County. As a result of such poor driving conditions and excessive speed, 104 vehicles were involved in the chain of accidents.

Table 5-88 Severe Winter Weather Events in Douglas County, 2014 to 2020

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Event Details*
				with one fatality and 30 injuries. The interstate was closed for around 5 hours.
March 7, 2014	Winter Storm	N/A	N/A	A winter storm swept across West Douglas County and the surrounding area, bringing heavy snowfall to parts of the North Central Mountains and Front Range Foothills. Most of the region saw snowfall ranging from 5 to 9 inches, though a few towns experienced 10 to 11 inches of snow.
April 2, 2014	Winter Storm, Winter Weather	N/A	N/A	Affecting most of Douglas County (North, Central, West, and East Douglas County) and surrounding counties, this winter storm brought moderate to heavy snow, with storm totals as high as 21.5 inches in the Front Range Mountains, Foothills, and Urban Corridor.
April 12, 2014	Heavy Snow	N/A	N/A	West Douglas County and surrounding counties experienced heavy snow to the mountains and foothills of the Front Range. Snowfall ranged from 6 to 13 inches in affected areas.
May 11, 2014	Winter Storm	N/A	N/A	A strong storm system moved from southwest Colorado, impacting North, East, West, and Central Douglas County, along with the surrounding counties. This produced heavy snow over the Front Range, where snow fell as much as 2.5 feet, and adjacent plains. Snow in the mountains and foothills ranged between 11 to 30 inches, and snowfall in other affected areas ranged from 5.5 to 10.5 inches.
November 11, 2014	Winter Weather	N/A	N/A	Most of Douglas County (Central, East and West) and surrounding counties were impacted by winter weather, leading to moderate to heavy snowfall in and near the Front Range Mountains and Foothills. The storm lasted three days, with snowfall mostly ranging from 4 to 6 inches, but as high as 15.5 inches.
December 14, 2014	Winter Weather	N/A	N/A	Central and East Douglas County saw winter weather as a result of a storm system in the North Central Mountains that subsequently brought strong winds and heavy snow to the northeast plains of Colorado. In the surrounding regions of Douglas County, snowfall was as high as 4 feet deep.
December 25, 2014	Winter Storm, Winter Weather	N/A	N/A	A winter storm impacted West Douglas County and surrounding areas near the Front Range Foothills. This also brought winter weather to North, Central, and East Douglas County. Most storm totals ranged from 2 to 5 inches of snow, though Logan County received 1 to 2 feet of snow.
January 1, 2015	Winter Storm, Winter Weather	N/A	N/A	A winter storm swept through Central and East Douglas County, along with surrounding counties, resulting in winter weather in North Douglas County. This storm brought on moderate to heavy snow in affected area, with snowfall 2 miles south of Parker as high as 9 inches. The area northwest of Parker and six miles east-northeast of Centennial saw eight inches of snow, 7.5 inches just northeast of Castle Rock, and five inches in Aurora.
January 21, 2015	Winter Weather	N/A	N/A	Moderate to heavy snow developed in and near the Front Range Foothills, bringing winter weather to West, East, and Central Douglas County. Surrounding areas saw storm totals as high as 11.9 inches of snow.
January 31, 2015-February 1, 2015	Winter Storm, Winter Weather	N/A	N/A	A band of heavy snowfall developed over the Urban Corridor and extended to Parker, bringing 8 inches of snow to Parker. As a result of this heavy period of snowfall, winter weather was noted in North, Central, and East Douglas County. Snowfall mostly ranged from 3 to five inches in affected areas.
February 15, 2015	Winter Storm,	N/A	N/A	A winter storm swept through West Douglas County and surrounding counties as a result of heavy snow in and near the

Table 5-88 Severe Winter Weather Events in Douglas County, 2014 to 2020

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Event Details*
	Winter Weather			Front Range Foothills, bringing as much as 20 inches of snow to some towns. As a result, North, East, and Central Douglas County experienced winter weather. Though most affected areas had 3 to 7 inches of snow, Castle Pines received 8.5 inches of snow.
February 25, 2015	Heavy Snow, Winter Weather	N/A	N/A	A storm system brought heavy snow to West Douglas County and the surrounding area in and near the Front Range Foothills. As a result, Central, East, and North Douglas County and surrounding counties experienced winter weather. The onset of this storm system resulted in multiple accidents, including a multi-car pileup involving at least 50 cars eastbound along I-70. Additionally, Denver International Airport cancelled about 60 flights. Though some towns received up to almost 20 inches of snow, most affected areas received three to seven inches.
March 3, 2015	Winter Weather	N/A	N/A	West Douglas County and surrounding counties experienced winter weather as a result of a storm system that brought heavy snowfall to parts of the north central mountains and Front Range Foothills.
April 16, 2015	Winter Storm, Winter Weather	N/A	N/A	A storm system affecting West Douglas County and surrounding counties brought heavy, wet snowfall to parts of the Front Range Mountains and Foothills. There was a storm total of 52 inches of snow. Central and East Douglas County experienced winter weather as a result of this storm system.
May 9, 2015	Winter Storm	N/A	N/A	Moderate to heavy rain turned into snowfall as temperatures dropped in the evening, bringing heavy, wet snow. As a result, there was a range of tree damage, causing fatal damage to young trees and the loss of large limbs for old growth trees. Thousands were affected by power outages, and part of I-70 in the high county was shut down due to multiple crashes. This storm impacted Northern Douglas County and surrounding areas.
November 16, 2015	Blizzard, Winter Storm	N/A	N/A	A large Pacific storm system swept into southeast Colorado, bringing blizzard conditions to parts of east central Colorado, including Douglas County. There were many road closures south and southeast of Denver, such as the closure of I-70 in both directions and I-25 from Monument Hill to Castle Rock. The closure of I-25 resulted from a vehicle accident. Due to road closures, 100 to 150 vehicles were stranded. Schools were also closed, and Denver International Airport cancelled over 150 flights. Storm totals included: 14 inches, 3 miles south-southeast of Larkspur; 11 inches near Lone Tree, 7.5 inches near Castle Rock and 6 inches, 3 miles northeast of Parker. Castle Rock experience peak wind gusts of 45 mph. Near Larkspur, snowdrifts 4 to 6 feet deep were reported.
December 15, 2015	Winter Storm	N/A	N/a	A strong Pacific storm system swept into southeast Colorado. A deep upslope brought heavy snow in and near the Front Range Foothills, Palmer Divide, and northeast plains, impacting all of Douglas County and surrounding counties. Denver International Airport canceled about 500 flights, while hundreds of flights were delayed. School and government experienced cancellations, and multiple accidents were reported. 17 inches of snow were reported 6 miles northwest of Larkspur, and 11 inches of snow were reported 4 miles east

Table 5-88 Severe Winter Weather Events in Douglas County, 2014 to 2020

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Event Details*
				of Castle Rock and 3 miles southwest of Lone Tree and Parker.
February 1, 2016	Winter Storm	N/A	N/A	A storm system moved across the Four Corners region, strengthening as it traveled into southeastern Colorado and impacting Douglas County and surrounding counties. A deep east to northeasterly flow upslope created heavy snowfall in and near the Front Range Mountains, Foothills, and adjacent plains. Heavy winds drifted snow along the Palmer Divide and across the northeast plains of Colorado. I-70, I-76, and many roads and highways east of I-25 closed until the following day as a result of unsuitable conditions. Additionally, Denver International Airport cancelled 480 flights on the 1 st and 125 flights on the 2 nd . Storm totals included 19.5 inches near Parker and 18.5 inches 4 miles north-northwest of Larkspur.
March 17, 2016	Winter Storm, Winter Weather	N/A	N/A	Heavy snowfall in the northern mountains and near the foothills of Boulder and Larimer Counties brought a storm and winter weather to Douglas County and its surrounding area. This storm was produced by the enhanced banding associated with a strong upper level jet stream, combined with the low level upslope that resulted from the passage of a cold front.
March 23, 2016	Blizzard, Winter Storm	N/A	N/A	A storm system from Utah traveled into southeast Colorado, quickly intensifying and developing into a blizzard across the Front Range of Colorado, impacting all of Douglas County. The storm produced intense snowfall at a rate exceeding 3 inches per hour at its peak, though rates averaged 1 to 2 inches per hour. Combined with winds faster than 50 mph, the blizzard produced zero visibilities. Many roads, including I-76, I-70, and I-25 (from Castle Rock to Colorado Springs) became impassable as a result of the heavy snowfall and lack of visibility. Over 2,000 vehicles were trapped on I-25. Several thousand residents along the Front Range experienced power outages as heavy wet snow accumulated on trees. Due to the extensive power outages and blizzard conditions, Denver International Airport was closed for 7 hours, causing around 1,300 flights to be cancelled. Across the Front Range Urban Corridor, as much as 1 to 2 feet of snow fell during the storm, with most of the snow falling within a 12 hour period.
April 15-16, 2016	Heavy Snow	N/A	N/A	A potent spring snowstorm carried heavy, wet snow to the Front Range Foothills and Palmer Divide and its surrounding area, including Douglas County. Snowfall was as high as 2 to 4 feet in the Foothills and 1 to 2 feet across the Mountains and Palmer Divide. In the Urban Corridor, snowfall ranged from 6 to 20 inches. Denver International Airport cancelled 852 flights, mostly on April 16 th . Several trees' limbs broke from the weight of accumulated snow, causing power outages that persisted until the 17 th . Road closures lasted from 1 to 5 hours, including along I-70 and Highways 85, 24, 103, 287, 85, and 119. Storm totals included 20 inches near Castle Rock and Parker. Snow drifts up to 3 feet deep were noted near Castle Rock as a result of strong winds.
November 17, 2016	Winter Weather	N/A	N/A	A fast-moving storm system swept across Colorado, with heavy snow falling on the I-70 corridor, impacting West Douglas County. Road closures on both directions of I-70 for a couple of hours resulted from a 20-vehicle crash involving

Table 5-88 Severe Winter Weather Events in Douglas County, 2014 to 2020

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Event Details*
				semi-trucks. Roads has become wet, quickly turning icy and snowpacked. In the central mountains, snow totals ranged from 7 to 14 inches, while in the Front Range Foothills, totals were between 5 to 10 inches.
December 16, 2016	Winter Storm	N/A	N/A	First passing through West Douglas County and later into North Douglas County, along with surrounding regions, a heavy band of snowfall caused storm conditions across the Denver metro area for several hours. This storm was produced by a warm, moist southwesterly flow aloft overrunning an Arctic airmass with shallow post frontal upslope. Up to 2 inches per hour of snowfall were observed. Several accidents resulted in the evening as snow accumulated. Denver International Airport cancelled 300 flights the following day.
January 1, 2017	Winter Storm, Winter Weather	N/A	N/A	This winter storm brough heavy snow to the north central mountains, Front Range Foothills, and Urban Corridor, specifically impacting North and West Douglas County and the surrounding area. Storm totals ranged from 1 to 3 feet, with heavy snowfall across the I-25 corridor. I-70 eastbound was closed due to several vehicle accidents. 145 flights were cancelled at Denver International Airport.
February 1, 2017	Winter Weather	N/A	N/A	Winter weather, including freezing drizzle, caused road closures and vehicle accidents in the northeast plains of Colorado. North Douglas County and its surrounding region, including the Denver area, were impacted by this weather. There were many crashes on I-25, and delays at schools and businesses were reported. 32 flights were delayed at Denver International Airport.
March 24, 2017	Blizzard	N/A	N/A	Central and East Douglas County, along with surrounding counties, were hit with blizzard conditions as a result of a swiftly moving system that formed over southeastern Colorado. Wind speeds ranged between 45 to 60 mph. Storm totals mostly ranged between 7 to 11 inches. 3 miles northeast of Castle Rock, the storm total was 7 inches of snow. As a result of the blizzard and its drifting snow, Douglas County closed schools, roads, and highways.
April 3, 2017	Winter Weather	N/A	N/A	A period of heavy snowfall occurred in parts of the Front Range Mountains and Foothills, bringing winter weather to West Douglas County and surrounding counties. Storm totals ranged from 5 to 10 inches.
April 28, 2017	Winter Storm	N/A	N/A	This winter storm impacted all of Douglas County, along with several surrounding counties. Storm totals included: 13 inches in Parker, 11 inches at Castle Pines, 10.5 inches at Lone Tree, 10 inches in Larkspur, and 9.5 inches near Lone Tree.
May 17, 2017	Heavy Snow	N/A	N/A	A potent spring storm moved eastward from the Great Basin across Colorado, impacting West Douglas County. Hail as large as a nickel was reported after a series of thunderstorms persisted. Moderate to heavy snow fell across the Front Range mountains and foothills, which lasted for a few days. As rain turned to snow and accumulated on trees, trees were damaged and scattered power outages throughout the affected area. 800 trees on Colorado State University's campus were damaged.
October 8, 2017	Winter Storm	N/A	N/A	98,000 power outages swept across Denver and the surrounding metro area, impacting West Douglas County, as a result of an early season snowstorm that created heavy wet snow. Over half of the outages lasted longer than five minutes to as long as several hours.

Table 5-88 Severe Winter Weather Events in Douglas County, 2014 to 2020

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Event Details*
January 20- 21, 2018	Winter Storm	N/A	N/A	A storm system traveled eastward across Colorado, impacting Douglas County and its surrounding area. Douglas and Jefferson County experienced moderate to heavy snow, which developed in the nearby foothills. Storm totals ranged from 4 to 17 inches, though in Castle Pines, there were 6 inches of snowfall. As the storm traveled eastward, it traveled from West Douglas County at 6 pm on the 20 th to North, Central, and East Douglas County by midnight on the 21 st .
February 19, 2018	Winter Weather	N/A	N/A	A storm in and near the Front Range Foothills brought moderate to heavy snowfall to West Douglas County and its surrounding region.
March 18, 2018	Winter Weather	N/A	N/A	A storm system in the north-central mountains of Colorado brought heavy snowfall to the region, with moderate to heavy snow in the Palm Divide. Central and East Douglas County, along with its surrounding region, experienced winter weather. Storm totals included 5 inches in Lone Tree.
March 26, 2018	Winter Weather	N/A	N/A	Central, East, and West Douglas County and its surrounding area experienced winter weather as a result a storm that produced moderate to heavy snowfall in and near the southern Front Range Foothills and Palmer Divide.
October 30, 2018	Winter Weather	N/A	N/a	Central, East, and West Douglas County and its surrounding area experienced winter weather as a result a storm that produced moderate to heavy snowfall in and near the Front Range mountains, foothills, and Palmer Divide. Storm totals included 6 inches in Larkspur.
November 11, 2018	Winter Weather	N/A	N/A	Douglas County and its surrounding counties experienced winter weather when a storm system brought moderate to heavy upslope snowfall to the Front Range Mountains, Foothills, and Urban Corridor west of I-25. Storm totals in the foothills of Jefferson and Douglas counties ranged from 6 to 12 inches. 5 to 7 inches were noted in Castle Rock.
January 11, 2019	Heavy Snow, Winter Weather	N/A	N/A	Heavy snow in the southern Front Range Foothills and Palmer Divide, caused by an upslope snow event, brought light to moderate snowfall to Douglas County and surrounding counties.
January 21, 2019	Winter Storm, Winter Weather	N/A	N/A	A potent winter storm produced moderate to heavy snow in the southern Front Range Foothills and Palmer Divide, sweeping across Douglas County and its surrounding region. This storm brought strong northerly winds ranging from 45 to 55 mph. Blizzard conditions were noted along I-70 east of Aurora. Parts of I-25 and Highway 24 were closed for several hours, while I-70 was closed the following day after several accidents were reported. The southern Front Range Foothills and Palmer Divide experienced the heaviest snowfall. Castle Pines had a snow total of 5.5 inches.
February 6, 2019	Winter Weather	N/A	N/A	A storm system created light to moderate snowfall in northern Colorado, bringing winter weather to Douglas County and its surrounding region. Heaviest snowfall was reported in and near the Front Range mountains and foothills, though most storm totals were between 4 to 7 inches.
February 22, 2019	Heavy Snow, Winter Weather	N/A	N/A	Snow falling at a rate of 2 to 3 inches per hour impacted Douglas County and its surrounding area, including Denver. Lone Tree received 7.5 inches of snow, and Parker received 6 inches.
March 2, 2019	Winter Weather	N/A	N/A	A potent westerly flow aloft produced heavy snow and strong winds in the north central mountains of Colorado, conducive for avalanches. This produced winter weather in Douglas

Table 5-88 Severe Winter Weather Events in Douglas County, 2014 to 2020

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Event Details*
				County and surrounding counties. Avalanches were reported, notably along I-70 the following day, trapping vehicles on the interstate. No one was injured during this event. 9 hours of avalanche mitigation work was completed on the 5 th , causing further interstate closures.
March 13, 2019	Blizzard	N/A	N/A	North Douglas County and surrounding counties experienced hurricane strength winds when storm system or bomb cyclone intensified across the northeast plains.
April 10, 2019	Winter Weather	N/A	N/A	Douglas County and its surrounding counties were impacted by moderate snowfall and strong gusty winds produced by a storm system. Wind gusts ranged from 35 to 55 mph, developing near blizzard conditions with drifting snow and low visibility in some affected areas. Storm totals included 6 inches near Larkspur and Lone Tree. Elsewhere, storm totals ranged from 2 to 5 inches.
October 9, 2019	Winter Weather	N/A	N/A	A strong winter storm created potent wind gusts ranging from 50 to 60 mph, uprooting some trees. The storm also brought a cold front and produced light rain that turned into snow on the 10 th . The cold front brought drastic temperature changes: it was 83 degrees during the afternoon on the 9 th , but soon dropped to 13 degrees early the next day. The subsequent snow affected the Front Range mountains, foothills, and urban corridor, sweeping into North and West Douglas County and surrounding regions. This weather led to over 300 vehicle crashes.
October 23, 2019	Winter Storm, Winter Weather	N/A	N/A	Douglas County and surrounding counties, notably Jefferson County, received moderate to heavy snow. Most of the foothills received 4 to 9 inches of snow, as seen in Castle Rock, which received 5.5 inches of snow.
October 27, 2019	Winter Weather	N/A	N/A	Douglas County and surrounding areas in the mountains and foothills received light to moderate snow, along with freezing drizzle. Most storm totals ranged between 4 to 8 inches, though 12 inches was the maximum.
October 29, 2019	Winter Storm, Winter Weather	N/A	N/A	A strong storm system over the northern Rockies and across Colorado brought record low temperatures to affected areas, including Douglas County. I-70 was closed due to poor visibility from snow and wind. Storm totals included 10 inches 2 miles east of Parker and 7.5 inches near Castle Pines. Due to poor conditions, there was one fatal car accident on State Highway 6, causing the highway to close. Additionally, many schools closed and flights at Denver International Airport were either delayed or cancelled, leaving 800 passengers stranded overnight at the airport.
November 25, 2019	Winter Storm	N/A	N/A	Heavy snowfall on the Front Range Mountains, Foothills, I-25 corridor, and northeast plains affected all of Douglas County. As heavy snow first developed in and near the Front Range Foothills, West Douglas County was first impacted, followed by the rest of the County 3 hours later. All schools were closed on the 25 th and 26 th , including universities and colleges in northeast and north central Colorado. All government offices (federal, state, city, and county) were closed on the 25 th . I-70 in both directions, I-76, and some east/west highways including US 34 and US 36, were closed due to poor visibility. Denver International Airport cancelled 500 flights. Storm totals included: 16.5 inches in east Parker, 12 inches near Castle Rock and Elizabeth, and 10 inches in Lone Tree.

Table 5-88 Severe Winter Weather Events in Douglas County, 2014 to 2020

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Event Details*
February 3, 2020	Winter Weather	N/A	N/A	The Front Range mountains and foothills received a period of moderate to heavy snowfall, bringing winter weather to Douglas County and its surrounding counties. Storm totals typically ranged from 6 to 11 inches.
February 6, 2020	Winter Weather	N/A	N/A	A prolonged period of heavy snow and strong winds resulted from a combined upper level jetstream and deep fetch of Pacific moisture. This prolonged storm began in the early morning, impacting West Douglas County and the surrounding area. The storm later swept through the rest of Douglas County and surrounding counties in the evening. Wind gusts ranged from 55 to 65 mph. Travel became nearly impossible due to poor conditions. Storm totals typically ranged from 4 to 10 inches, though the mountains had totals from 2 to 4.5 feet.
March 19, 2020	Blizzard, Winter Storm	N/A	N/A	A potent storm brought blizzard conditions to Douglas County and surrounding counties in Colorado’s northeast plains. Storm totals included: 10.5 inches near Lone Tree, 9 inches near Castle Rock, and 8.5 inches near Parker. Peak wind gusts were 40 mph, which when combined with snow, caused near zero visibility. Many roads, including portions of eastbound I-70 and I-76 and westbound I-70, were closed during the storm.
April 11, 2020	Winter Weather	N/A	N/A	West Douglas County and its surrounding area experienced winter weather as a result of a cold northerly flow combined with a low level upslope, which created moderate to heavy snowfall. This snow fell in and near the foothills.
April 15, 2020	Winter Weather	N/A	N/A	North and West Douglas County and its surrounding counties experienced winter weather as a result of a Rocky Mountains storm that produced moderate to heavy snow over parts of the mountains, foothills, and plains. The foothills north of I-70 and across the plains north of I-76 saw the heaviest snowfall. An avalanche near Red Peak killed one backcountry skier.

Sources: FEMA 2020; NOAA-NCEI 2020

* Many sources were consulted to provide an update of previous occurrences and losses; event details and loss/impact information may vary and has been summarized in the above table

- FEMA Federal Emergency Management Agency
- Mph Miles per Hour
- NCEI National Centers for Environmental Information
- NOAA National Oceanic and Atmospheric Administration
- N/A Not Applicable

Climate Change Projections

Climate change in Colorado has broadly caused higher temperatures, increased precipitation, and changes to surface water flow. However, precipitation will increasingly take the form of rain rather than snow, resulting in less snowpack and an earlier spring thaw in the Rocky Mountains (National Conference of State Legislatures 2008). Climate change will likely cause fewer extreme cold months, and snowpack in lower elevation areas (e.g. below 8,200 feet) will decline precipitously (Ray et al. 2008).

Probability of Future Occurrences

For the 2021 HMP update, the most up-to-date data was collected to calculate the probability of future occurrence of winter storm events, of all types, for Douglas County. Table 5-89 summarizes data regarding the probability of occurrences of severe winter storm events in Douglas County based on the historic record.

The information used to calculate the probability of occurrences is based solely on NOAA-NCEI storm events database results.

Table 5-89 Probability of Future Occurrence of Severe Winter Weather Events in Douglas County

Hazard Type	Number of Occurrences Between 1954 and 2020	% chance of occurrence in any given year
Blizzard	16	23.8%
Heavy Snow	83	100%
Ice Storm	0	N/A
Sleet	0	N/A
Winter Storm	102	100%
Winter Weather	69	100%
Total	270	100%

Source: NOAA-NCEI 2020

Note: Disaster occurrences include federally declared disasters since the 1950 Federal Disaster Relief Act, and selected storm events since 1968. Due to limitations in data, not all hail and lightning events occurring between 1954 and 1996 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is underestimated.

Based on the number of winter weather events, the County averages several winter weather events each year. A winter weather event has a 100% chance of occurring in any given year. Based on the history of events and input from the Core Planning Team, the probability for severe winter storm events occurring in the County is considered *frequent* (Hazard event is likely to occur within 25 years). Refer to Sections 5.1 and 5.3 for additional information on the hazard ranking methodology and probability criteria.

Vulnerability Assessment

To understand risk, a community must evaluate assets exposed to and vulnerable to the identified hazard. The entire Douglas County is exposed and vulnerable to the severe winter storm hazard; therefore, all assets within the County (population, structures, critical facilities, and lifelines), as described in Section 4 (County Profile), are potentially vulnerable to a winter weather event. The following text evaluates and estimates the potential impact of the severe winter storm hazard in the County.

Impact on Life, Health and Safety

Winter weather events can immobilize a region and paralyze a city, stranding commuters, closing airports, stopping supply chains, and disrupting emergency services. Accumulations of snow can cause roofs to collapse, and can knock down trees and power lines. Homes and farms may be isolated for days, and unprotected livestock may be lost. Late season heavy snows will typically cause some plant and crop damages. In the mountains, heavy snow can lead to avalanches. The cost of snow removal, repairing damages, and loss of business can have severe economic impacts on cities and towns (State of Colorado HMP 2018).

According to the 2018 ACS 5-Year Population Estimate, 10.9 percent of the population in Douglas County is 65 and over. Winter storm events can reduce the ability of these populations to access emergency services.

For the purposes of this HMP, the entire population of the County (328,614) is exposed to winter storm events (U.S. Census 2013-2017 ACS 5-Year Population Estimate). The homeless and elderly are considered most susceptible to this hazard; the homeless due to their lack of shelter and the elderly due to their increased risk of injuries and death from falls and overexertion, hypothermia

from attempts to clear snow and ice, unable to access medical care if isolated, or limited in-home medical equipment use if power outages occur.

Impact on General Building Stock

The entire general building stock inventory in Douglas County is exposed and potentially vulnerable to the severe winter storm hazard; however, properties in poor condition or in particularly vulnerable locations may be at risk to the most damage. In general, structural impacts include damage to roofs and building frames rather than building content. Current modeling tools are not available to estimate specific losses for this hazard.

Impact on Critical Facilities

Full functionality of critical facilities, such as police, fire, and medical facilities is essential for response during and after a severe winter storm event. These critical facility structures are largely constructed of concrete and masonry; therefore, they should only suffer minimal structural damage from severe winter storm events. Heavy accumulations of ice can bring down trees, electrical wires, telephone poles, utility lines, and communication towers. Communications and power can be disrupted for days while utility companies work to repair the extensive damage. Even small accumulations of ice can cause extreme hazards to motorists and pedestrians. Bridges and overpasses are particularly dangerous because they freeze before other surfaces (NSSL 2006). Winter weather events, such as ice storms, can lead to power outages. Therefore, it is recommended that critical facilities install backup power sources.

Infrastructure at risk for this hazard includes roadways that could be damaged due to salt application and intermittent freezing and warming conditions that can damage roads over time. Severe snowfall requires the clearing roadways and alerting citizens to dangerous conditions; following the winter season, resources for road maintenance and repair might be required.

Impact on Economy

The cost of snow and ice removal and repair of roads from the freeze/thaw process can drain local financial resources. Impacts on the economy also include commuter difficulties into or out of the area for work or school. The loss of power and closure of roads prevent commuters within the County.

Impact on the Environment

Severe winter weather can have a major impact on the environment. Not only does winter weather create changes in natural processes, the residual impacts of a community's methods to maintain its infrastructure through winter weather maintenance may also have an impact on the environment. For example, an excess amount of snowfall and earlier warming periods may affect natural processes such as flow within water resources (USGS n.d.). Rain-on-snow events can also exacerbate runoff rates with warming winter weather. Consequentially, these flow rates and excess volumes of water can erode banks, tear apart habitat along the banks and coastline, and disrupt terrestrial plants and animals.

Furthermore, chemically based winter maintenance practices have its own effect on the natural environment. Melting snow and ice that carry deicing chemicals onto vegetation and into soils can contaminate the local waterways. Elevated salt levels may hinder vegetation from absorbing nutrients, slowing plant growth (The Environmental Literacy Council 2015).

Cascading Impacts on Other Hazards

Severe winter weather events may exacerbate flooding. As discussed, the freezing and thawing of snow and ice associated with winter weather events can create major flooding issues in the County. Maintaining winter weather hazards through snow and ice removal could minimize the potential risk of flooding during a warming period.

Future Changes that May Impact Vulnerability

Understanding future changes that impact vulnerability in the County can assist in planning for future development and ensure that appropriate mitigation, planning, and preparedness measures are in place. The County considered the following factors to examine potential conditions that can affect hazard vulnerability:

- Potential or projected development.
- Projected changes in population.
- Other identified conditions as relevant and appropriate, including the impacts of climate change.

Projected Development

Any areas of growth could be potentially impacted by the severe winter storm hazard because the entire County is exposed and vulnerable. The ability of new development to withstand severe winter storm impacts lies in sound land use practices and consistent enforcement of codes and regulations for new construction.

Projected Changes in Population

The County has experienced an increase in population between the 2010 Census (285,465) and the estimated 2018 American Community Survey estimated population of 328,614. The population of the County is expected to increase over the next few years. With an increase in population, more people will be exposed to winter weather events. Additionally, the age of the population, changes in their geography, and how climate change could alter the winter weather received (rain versus snow) will be important to continue to assess future changes in vulnerability.

Climate Change

Climate is defined not just as average temperature and precipitation, but also by type, frequency, and intensity of weather events. Both globally and at the local level, climate change can potentially alter prevalence and severity of weather extremes, such as winter storms. While predicting changes in winter storm events under a changing climate is difficult, understanding vulnerabilities to potential changes is a critical part of estimating future climate change impacts on human health, society, and the environment (U.S. EPA 2006). Based on the projections, the County can expect to experience increasing rain rather than snow during the winter months. In the immediate future, Douglas County can anticipate continuing to experience the impacts of winter weather events.

Change of Vulnerability Since 2015 HMP

Douglas County's population increased since the last plan; increasing the number of people impacted during a winter weather event. Therefore, the entire County remains vulnerable to severe winter storm events.

Issues Identified

Important issues associated with a severe winter storm in the planning area include the following:

- Older building stock in the County might be more vulnerable to aftermath of a winter storm event. Heavy snow loads on the roofs of buildings might not be able to withstand the extra weight.
- Ice and freezing temperatures can lead to frost heaving, damaging roads, bridges, buildings, and foundations of homes and buildings.
- The impacts of drought can lead to dead or dying trees. These trees are more susceptible to falling during winter storm events from the weight of snow and ice causing power outages, closed roadways, and damage to buildings and property.
- Downed power lines from the weight of snow and ice lead to power outages, leaving many homes without a source of heat.

5.4.13 Soil Hazards: Erosion and Deposition

The following section provides the hazard profile and vulnerability assessment for the erosion and deposition hazard in Douglas County.

Hazard Profile

Description

Erosion entails the transportation and removal of earth materials from one location to another by moving ice, water, waves, or wind. Erosion occurs naturally but can be exacerbated by anthropogenic activity that modifies the built environment. Deposition is the placing of the eroded material in a new location. All material that is eroded is later deposited in another location. In Colorado, erosion typically occurs due to water and winds, though can also occur due to landslides and debris flows, excessive runoff, and wildfire (State of Colorado 2018).

Erosion caused by water is the primary concern for Douglas County. Water erosion is the detachment and removal of soil by water. The process can occur naturally or be accelerated by human activity. The rate of 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 (Ritter 2018; USDA 2001).

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 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) (Soil Science Society of America 2020).

Erosion 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 (Ritter 2018).

Extent and Location

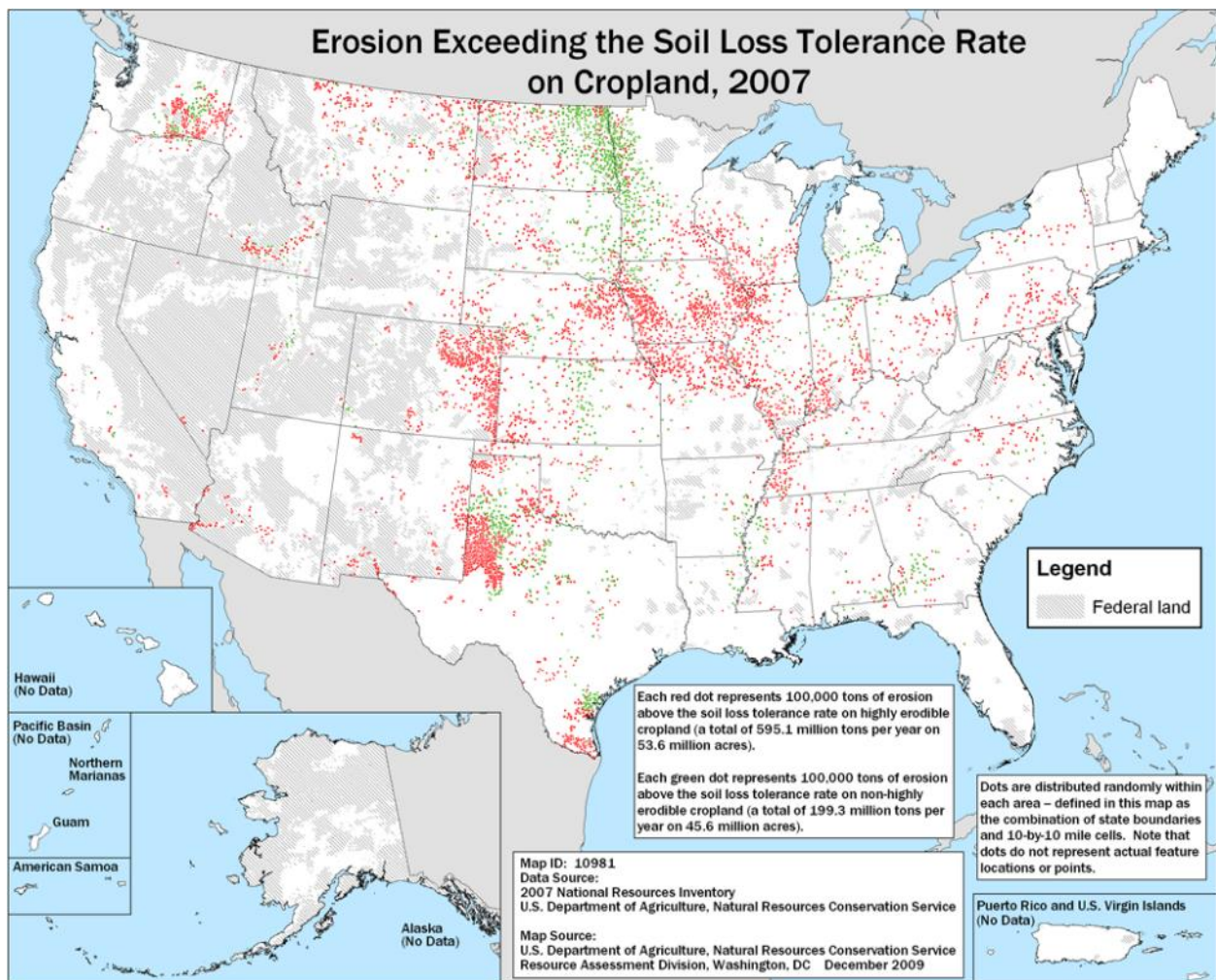
It is difficult to directly measure erosion and the risk of erosion. There are other properties, however, that can be used to measure erosion: soil surface stability, aggregate stability, infiltration, compaction, and content of organic matter. Measuring these properties can help with understanding the susceptibility of

erosion at a specific location. Comparing visual observations along with quantitative measurements can help provide information about soil surface stability, sedimentation, and soil loss (USDA 2001).

Erosion and deposition pose 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. Figure 5-39 illustrates the locations of where erosion exceeded the soil loss tolerance rates across the United States. Each red dot represents 100,000 tons of erosion above the soil loss tolerance. According to this figure, areas of erosion exceeding the soil loss tolerance rates was not identified in the area of Douglas County.

Figure 5-40 through Figure 5-43 show the risk of erosion in Douglas County. As seen in the maps, erosion-susceptible areas are most commonly found along the County’s streams and waterways.

Figure 5-39 National Erosion Loss Rates



Source: NRI 2010

Figure 5-40 Erosion Risk in Douglas County

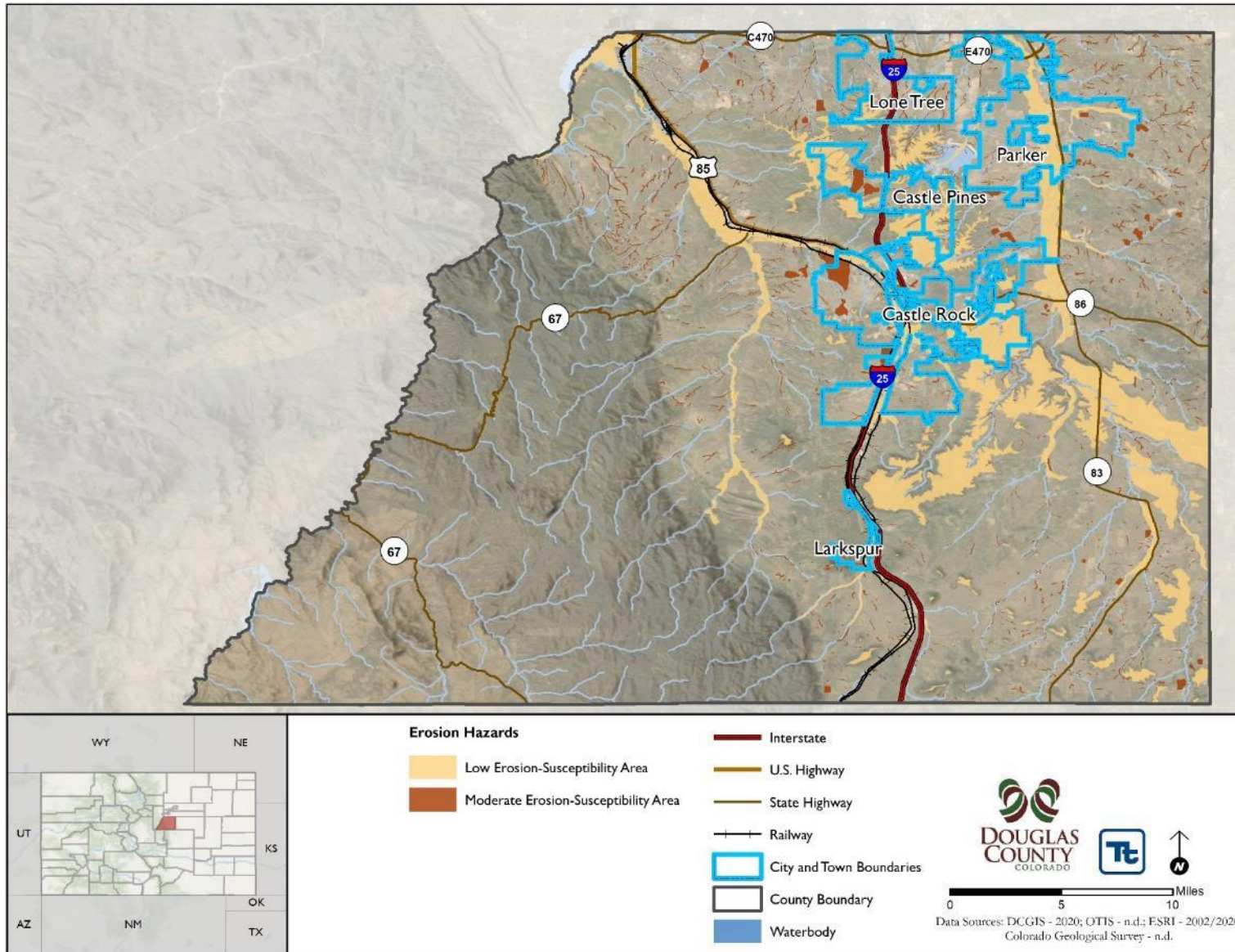


Figure 5-41 Erosion Risk in Douglas County (Northeast)

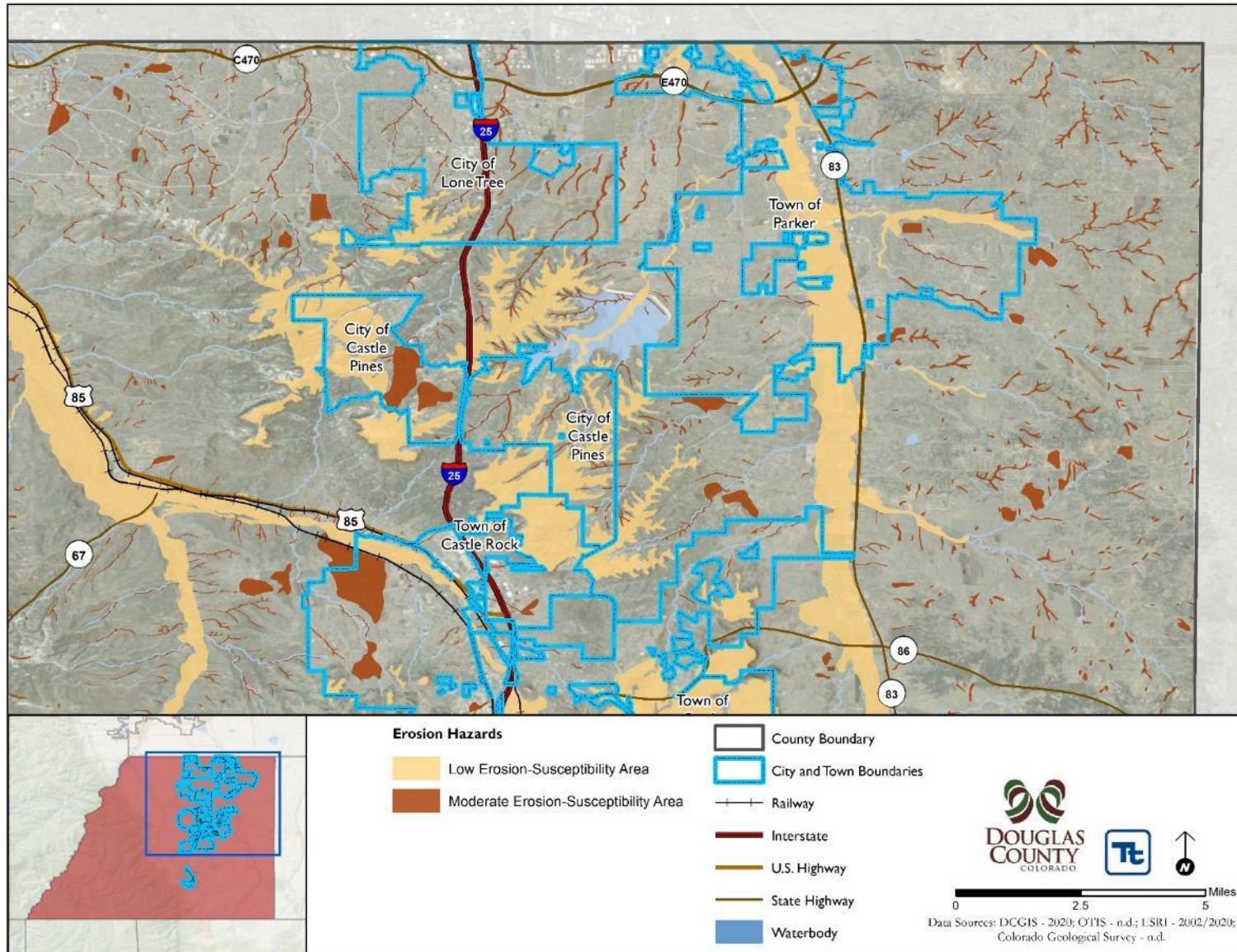


Figure 5-42 Erosion Risk in Douglas County (Northwest)

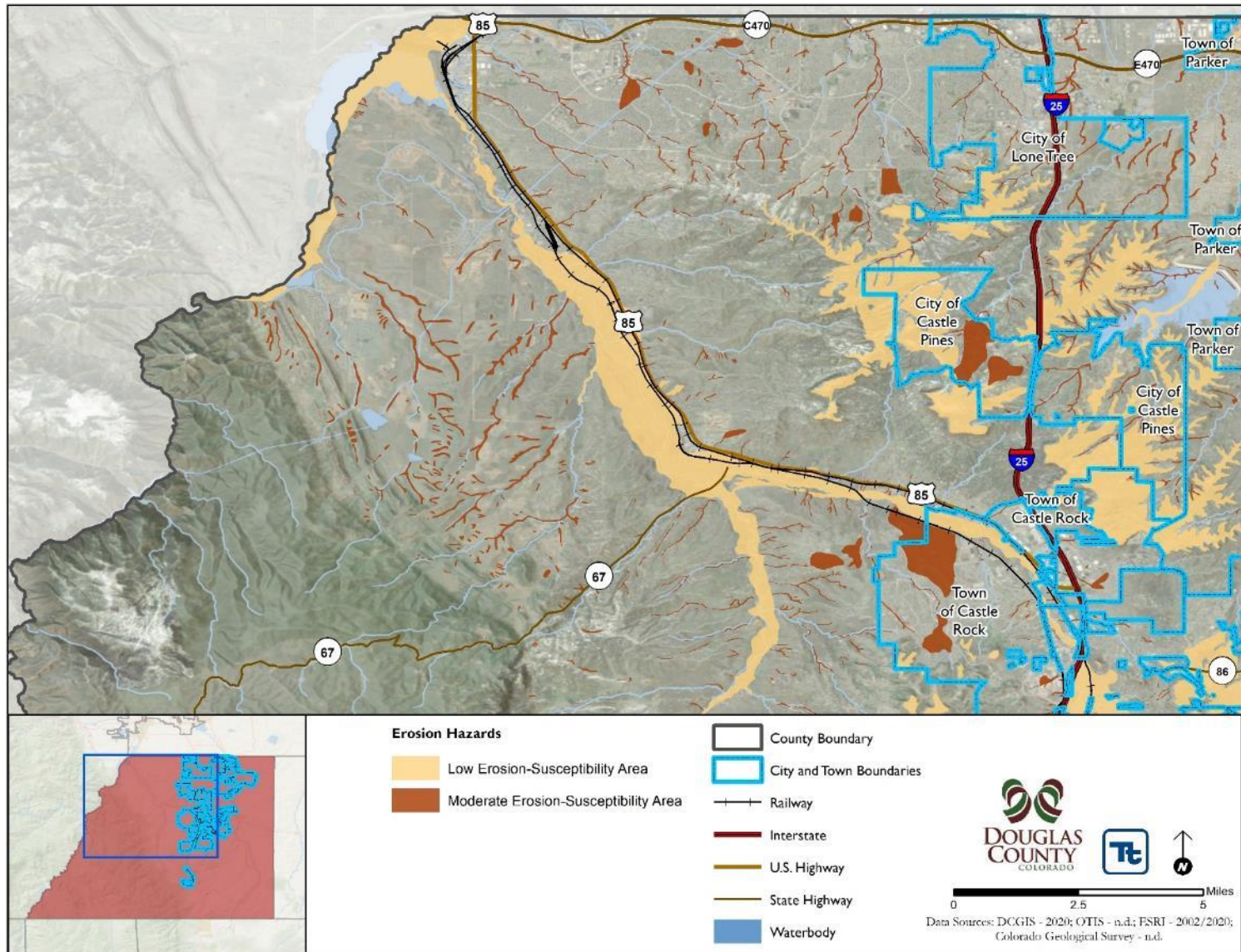
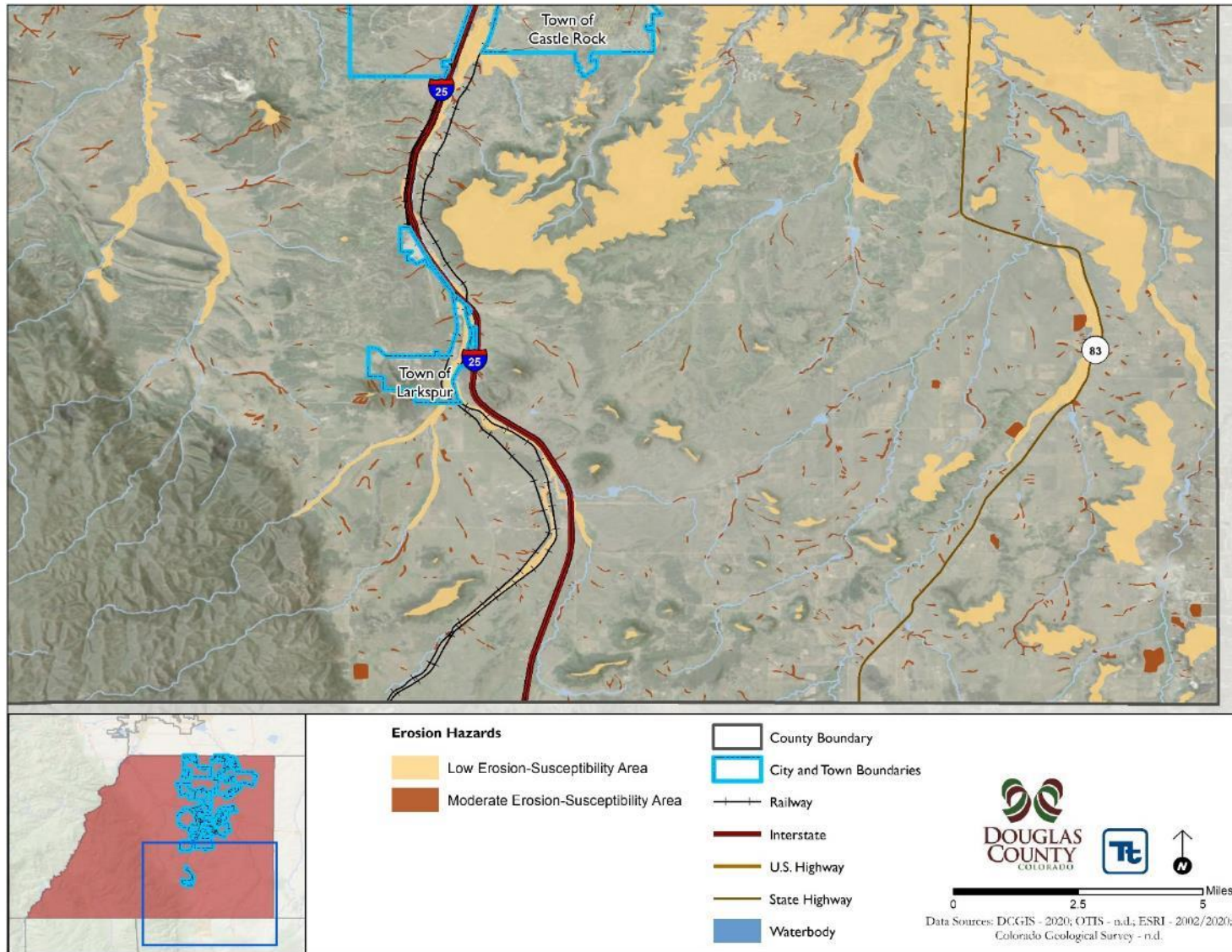


Figure 5-43 Erosion Risk in Douglas County (Southeast)



Previous Occurrences and Losses

Between 1953 and January 2021, the State of Colorado and Douglas County were not included in any erosion-related FEMA disaster declarations. For the 2021 HMP Update, there was limited information regarding erosion in Douglas County. The following information was obtained from local sources, the prior hazard mitigation plan update, and geological reports.

- 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 occurred in the burn area that brought 160,000 cubic yards of eroded, decomposed granite washed into Strontia Springs at the County boundary. Erosion occurred again in the wake of the Hayman fire, impacting the Cheesman Reservoir (Hartman 2020).
- In August 2003, flash flooding occurred in the wake of heavy rains at the confluence of the Westcreek and Trail Creek. Drainage along the Trail Creek was notably eroded, resulting in flattened vegetation. This erosive event occurred in the Hayman Fire burn area.
- In August 2004, flash flooding occurred in the Hayman Fire burn area. Mudslides closed US Highway 67 for several hours, and the vicinity of the Shady Brook YMCA camp experienced erosion of culverts and roads.
- 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 mitigation project is currently being undertaken to arrest erosion (Chatfield Reservoir Mitigation Company 2020).

Climate Change Projections

Climate change may impact storm patterns, increasing the probability of more frequent, intense storms with varying duration. Increase in global temperature could affect the snowpack and its ability to hold and store water. Warming temperatures also could increase the occurrence and duration of droughts, which would increase the probability of wildfire, reducing the vegetation that helps to support steep slopes. All of these factors would increase the probability for erosion to occur.

Probability of Future Events

It is anticipated that erosion will continue to occur in Douglas County. As the frequency of erosion-causing events occur due to climate change, the probability for future events will likely increase as well. Based on historical records and input from the Core Planning Team, the probability of occurrence for erosion events in the County is considered occasional (hazard event is likely to occur within 100 years). Refer to Sections 5.1 and 5.3 for additional information on the hazard ranking methodology and probability criteria.

Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed or vulnerable to the identified hazard. Erosion may impact public safety, property, infrastructure, environmental resources and local economies. The following text evaluates and estimates the potential impact of erosion on Douglas County.

Impact on Life, Health and Safety

Overall, an event related to erosion would be an isolated incident and impact the population within the immediate area of the incident. Erosion can cause damage to residential buildings and displacing residents

and erosion events could event block off or damage major roadways, inhibiting travel for emergency responders or populations trying to evacuate the area.

Erosion can create water quality problems in surface waters and drainage ways. These problems can adversely impact the health and biological diversity of water bodies. According to the USDA, this includes:

- Excess nutrients impact water quality through eutrophication, a process where excess nitrogen and phosphorus causes unwanted biological growth in water bodies.
- Sediment reduces water quality by making the water cloudy. 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.
- Sediment can build up in stream channels, lowering flow capacity. The problem of low stream capacity is compounded as runoff increases from newly built-up or paved areas and causes stream channels to receive larger amounts of water in shorter periods of time. This leads to more frequent flooding in areas that never or only rarely flooded in the past. In floodprone areas, levees may need to be built or enlarged to better protect public safety.
- A financial burden results from cleanup of sediment-damaged areas. Taxpayers often bear the cost of removing sediment from public roads, road ditches, culverts or streams; not to mention damage to homes and the safety hazards associated with flooding. Other costs of erosion that are borne by the public are degraded soils, a polluted environment, more runoff, greater need for irrigation, and aesthetically unpleasing sites (USDA 2000).

Vulnerable populations such as persons over 65 may have more difficulty seeking medical attention that may not be available during a hazard event. In Douglas County, there are 11,333 persons in poverty and 35,801 persons over 65 years old (American Community Survey 2018). Additionally, vulnerable populations below poverty are likely to evaluate their risk and make decisions to reconstruct and repair structures and evacuate based on net economic impacts on their families. Based on the spatial analysis, the Town of Castle Rock has the greatest number of persons exposed to the moderate erosion susceptibility area, 15,415 individual or 25.8-percent. The City of Castle Pines has the greatest percentage of persons exposed to the moderate erosion-susceptibility area, 50.7-percent or 5,360 persons. Table 5-90 shows the estimated population living in the low and moderate erosion susceptibility area.

Table 5-90 Estimated Population Located in the Erosion-Susceptibility Hazard Area in Douglas County

Jurisdiction	American Community Survey (2014-2018) Population	Estimated Population Exposed			
		Low Erosion-Susceptibility Hazard Area		Moderate Erosion-Susceptibility Hazard Area	
		Number of People	Percent of Total	Number of People	Percent of Total
Castle Pines (C)	10,573	1,974	18.7%	5,360	50.7%
Castle Rock (T)	59,680	5,323	8.9%	15,415	25.8%
Larkspur (T)	257	3	1.2%	65	25.2%
Lone Tree (C)	14,209	48	0.3%	7	0.1%
Parker (T)	52,563	895	1.7%	7,218	13.7%
Unincorporated Douglas County	191,332	4,336	2.3%	5,714	3.0%
Douglas County (Total)	328,614	12,580	3.8%	33,779	10.3%

Source: American Community Survey 2018 (ACS 2014-2018); Colorado Geological Survey, n.d.
 Notes: C=City; T = Town

Impact on General Building Stock

Erosion can impact structures located along the banks of waterways, having the potential to destabilize the foundation of structures. It can also impact infrastructure such as dams, levees, roads, and other developed land. To estimate the buildings exposed to the erosion hazard, the low and moderate erosion susceptibility areas were overlaid upon the updated building inventory at the structure level. The replacement cost value of the structures with their center in the wildfire risk hazard areas were totaled (refer to Table 5-91 for the distribution of estimated exposure within moderate and low erosion hazard areas). Overall, 4,943 buildings with a replacement cost value of \$6.4 billion is exposed to the moderate erosion hazard area and 14,207 building with a replacement cost value of \$14.9 billion is exposed to the low erosion hazard area in Douglas County.

Table 5-91 Building Stock Replacement Cost Value and Building Count within the Low and Moderate Erosion Susceptibility Hazard Area in Douglas County

Jurisdiction	Number of Buildings	Total Replacement Cost Value	Estimated Building Stock Exposed				Estimated Building Stock Exposed			
			Low Erosion-Susceptibility Hazard Area		Moderate Erosion-Susceptibility Hazard Area		Low Erosion-Susceptibility Hazard Area		Moderate Erosion-Susceptibility Hazard Area	
			Number of Buildings	Percent of Total	Replacement Cost Value (RCV)	Percent of Total	Number of Buildings	Percent of Total	Replacement Cost Value (RCV)	Percent of Total
Castle Pines (C)	3,701	\$4,995,772,208	1,864	50.4%	\$2,288,695,181	45.8%	692	18.7%	\$726,977,612	14.6%
Castle Rock (T)	24,262	\$28,003,310,038	6,312	26.0%	\$6,691,280,912	23.9%	2,079	8.6%	\$1,936,031,592	6.9%
Larkspur (T)	394	\$135,724,576	99	25.1%	\$36,213,532	26.7%	9	2.3%	\$3,298,123	2.4%
Lone Tree (C)	4,190	\$23,664,803,217	3	0.1%	\$2,302,544	0.0%	18	0.4%	\$69,543,894	0.3%
Parker (T)	17,864	\$23,597,914,712	2,573	14.4%	\$3,319,401,335	14.1%	294	1.6%	\$1,304,265,480	5.5%
Unincorporated Douglas County	84,745	\$102,018,837,713	3,356	4.0%	\$2,655,672,185	2.6%	1,851	2.2%	\$2,348,746,384	2.3%
Douglas County (Total)	135,156	\$182,416,362,464	14,207	10.5%	\$14,993,565,690	8.2%	4,943	3.7%	\$6,388,863,086	3.5%

Source: Douglas County GIS, 2020, RS Means 2020, Colorado Geological Survey, n.d.
 Notes: C=City; T = Town

Impact on the Critical Facilities

It is recognized that a number of critical facilities are located in the low and moderate erosion susceptibility hazard area. Majority of the critical facilities exposed to the erosion hazard areas are potable water facilities, bridges, recreation sites, and assisted living facilities. Impact to these resources could directly impact vulnerable population over 65 or impact the ability to evacuate if critical transportation infrastructure is impacted. Table 5-92 through Table 5-93 summarize the distribution of critical facilities exposed to the erosion hazard areas by critical facility type and jurisdiction. Out of the incorporated communities in Douglas County, the Town of Castle Rock has the greatest number of critical facilities built in the low erosion susceptibility area (i.e., 40) of which 36 are lifelines. Douglas County’s unincorporated area has the greatest number of critical facilities located in the moderate erosion area (i.e., 25) of which 24 are lifelines. The exposed lifelines are categorized into FEMA lifeline groupings and are summarized in

Table 5-96, the majority of which are under the “food, water, or shelter” FEMA lifeline category. Additionally, the number of critical facilities and lifelines within the soil erosion hazard areas by jurisdiction are shown in Table 5-94 and Table 5-95.

Table 5-92 Critical Facilities and Lifelines by Type in the Low Erosion-Susceptibility Hazard Area in Douglas County

Jurisdiction	Critical Facilities Exposed to the Low Erosion-Susceptibility Area																							
	Assisted Living	Bridge	Childcare	Dam	EOC	Fire Station	Food Distribution	Government Building	Hazardous Material Facility	Libraries	Medical Care	Municipal Building	Pharmacy	Police Station	Polling Sites	Post Office	Potable Water Lift station	Potable Water Tank	Potable Water Treatment Facility	Potable Well	Primary Education	Recreation Site	Shelter	Urgent Care
Castle Pines (C)	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
Castle Rock (T)	10	0	0	2	1	4	2	6	1	1	0	0	1	1	3	1	0	0	0	0	5	0	1	1
Larkspur (T)	0	2	0	0	0	1	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Lone Tree (C)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Parker (T)	1	0	3	1	0	1	4	0	0	0	2	1	2	0	0	1	1	0	2	0	2	9	0	1
Unincorporated Douglas County	0	12	1	4	0	3	0	0	6	0	1	0	0	0	0	1	0	1	1	21	2	15	2	0
Douglas County (Total)	12	14	4	7	1	9	6	7	7	2	3	1	3	1	4	3	1	1	3	21	10	25	3	2

Source: Douglas County GIS 2020; Colorado Geological Survey, n.d.
Notes: C=City; T = Town

Table 5-93 Critical Facilities and Lifelines by Type in the Moderate Erosion-Susceptibility Hazard Area in Douglas County

Jurisdiction	Critical Facilities Exposed to the Moderate Erosion-Susceptibility Area									
	Bridge	Dam	Food Distribution	Hazardous Material Facility	Medical Care	Pharmacy	Potable Well	Primary Education	Recreation Site	Urgent Care
Castle Pines (C)	0	0	0	0	0	0	0	1	1	0
Castle Rock (T)	1	0	0	0	0	0	0	2	0	1
Larkspur (T)	0	0	0	0	0	0	0	0	0	0
Lone Tree (C)	1	0	0	0	0	0	0	0	0	0
Parker (T)	0	0	0	0	2	2	0	0	0	0
Unincorporated Douglas County	8	3	1	1	2	0	9	0	1	0
Douglas County (Total)	10	3	1	1	4	2	9	3	2	1

Source: Douglas County GIS 2020; Colorado Geological Survey, n.d.
 Notes: C=City; T = Town

Table 5-94 Critical Facilities and Lifelines in the Low Erosion-Susceptibility Hazard Area in Douglas County

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Exposed to Low Erosion Hazard Area			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Castle Pines (C)	20	12	3	15.0%	2	16.7%
Castle Rock (T)	108	100	40	37.0%	36	36.0%
Larkspur (T)	15	9	6	40.0%	4	44.4%
Lone Tree (C)	54	42	0	0.0%	0	0.0%
Parker (T)	140	105	31	22.1%	19	18.1%
Unincorporated Douglas County	827	703	70	8.5%	54	7.7%
Douglas County (Total)	1,164	971	150	12.9%	115	11.8%

Source: Douglas County GIS 2020; Colorado Geological Survey, n.d.
 Notes: C=City; T = Town

Table 5-95 Critical Facilities and Lifelines in the Moderate Erosion-Susceptibility Hazard Area in Douglas County

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Exposed to Moderate Erosion Hazard Area			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Castle Pines (C)	20	12	2	10.0%	1	8.3%
Castle Rock (T)	108	100	4	3.7%	4	4.0%
Larkspur (T)	15	9	0	0.0%	0	0.0%
Lone Tree (C)	54	42	1	1.9%	1	2.4%
Parker (T)	140	105	4	2.9%	4	3.8%
Unincorporated Douglas County	827	703	25	3.0%	24	3.4%
Douglas County (Total)	1,164	971	36	3.1%	34	3.5%

Source: Douglas County GIS 2020; Colorado Geological Survey, n.d.
 Notes: C=City; T = Town

Table 5-96 Lifelines Exposed to the Erosion Hazard Areas

FEMA Lifeline Category	Number of Lifelines	Number of Lifelines Exposed to the Low Erosion-Susceptibility Hazard Area	Number of Lifelines Exposed to the Moderate Erosion Susceptibility Hazard Area
Food, Water, Shelter	428	35	10
Hazardous Material	22	7	1
Health and Medical	203	20	7
Safety and Security	239	39	6
Transportation	79	14	10
Douglas County (Total)	971	115	70

Source: Douglas County GIS 2020; Colorado Geological Survey, n.d.

Notes: C=City; T = Town

Impact on the Economy

The impact of erosion on the economy and estimated dollar losses are difficult to measure. Erosion and other geological hazards can impose direct and indirect impacts on society. Direct costs include the actual damage sustained by buildings, property and infrastructure. Indirect costs, such as clean-up costs, business interruption, loss of tax revenues, reduced property values, and loss of productivity are difficult to measure (USGS 2003).

Impact on the Environment

Erosion and deposition cause ecological impacts by disrupting the normal distribution of sediment in water bodies. Excessive levels of turbidity (suspended stream sediment) can negatively impact ecosystem health, including fish, invertebrates, and aquatic vegetation. Water quality of impacted water bodies can also be adversely impacted (EPA 2020).

Cascading Impacts on Other Hazards

Erosion can be exasperated from intense flooding events. Even wildfires can impact the stability of soils and slopes. Flash flooding is particularly common after wildfires and can occur quickly and within areas that are not usually prone to flood risk. People are at a greater risk of flooding due to recent wildfire burn areas and could rain at risk for up to 5 years after a fire (Colorado Division of Homeland Security and Emergency Management, n.d.). Intense floods cause increased problems in erosion and sediment transportation. Thus, increasing risk and economic impacts to buildings, infrastructure and people after a wildfire events.

Furthermore, soil and sediment runoff can accumulate downslope potentially blocking waterways and roadways and impacting quality of streams and other water bodies. Mudflows that erode into downstream waterways can threaten the life of freshwater species (USGS 2020). The impacts of eroded landscape can travel for miles downstream into adjacent waterways and create issues for surrounding watersheds.

Future Changes that May Impact Vulnerability

Understanding future changes that affect vulnerability in the County can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The County considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development
- Projected changes in population
- Other identified conditions as relevant and appropriate, including the impacts of climate change.

Projected Development

Any areas of growth could be affected by erosion if the growth areas are within identified hazard areas. Areas targeted for potential future growth and development could be potentially impacted by erosion if they are located within areas prone to erosion. There are six new development sites located within the erosion hazard area; five within the low erosion risk area. Refer to the maps in each jurisdictional annex (Section 9 of this HMP) to view the new development project areas and their proximity to the erosion risk hazard areas.

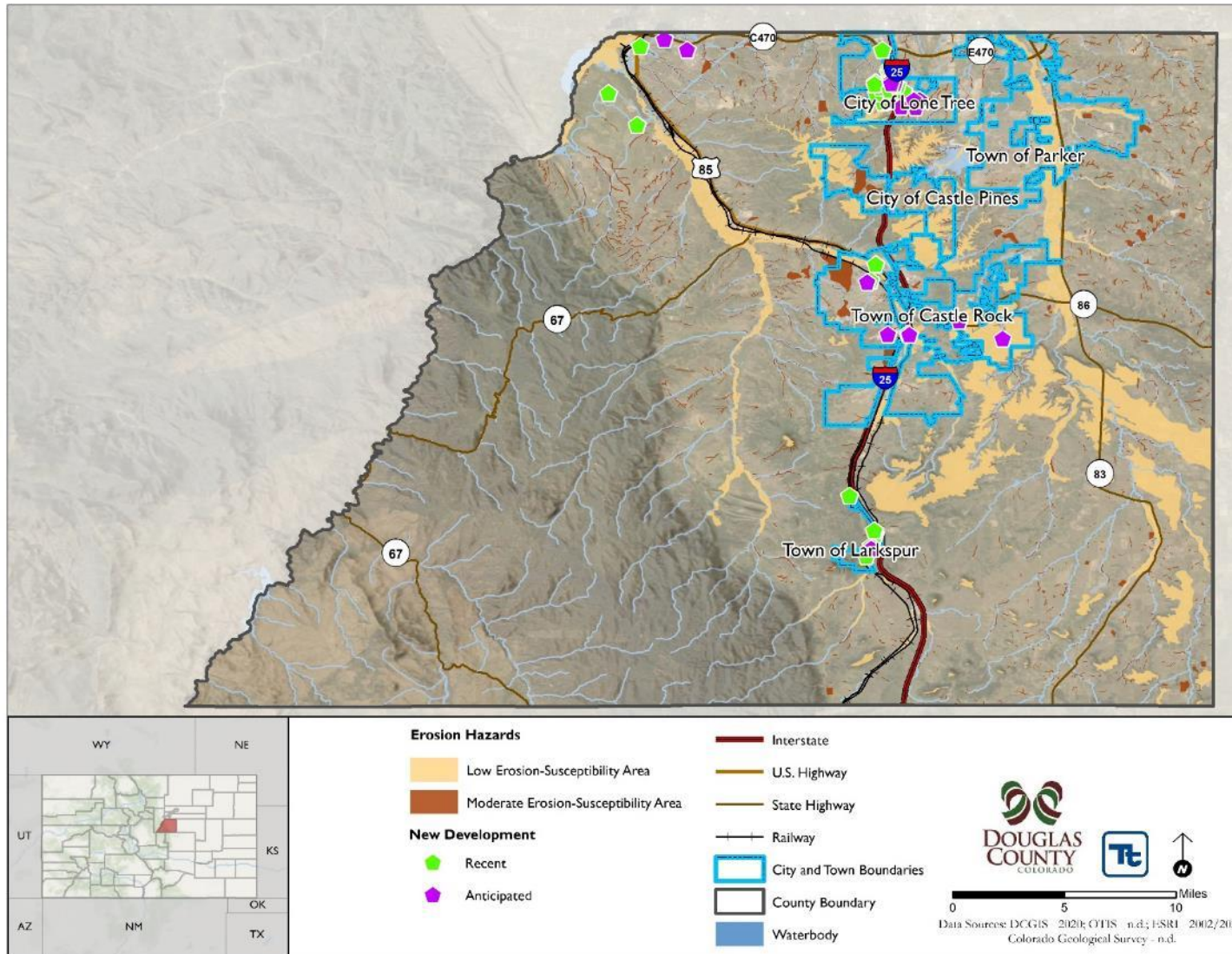
Projected Changes in Population

The County experienced an increase in population between the 2010 Census (285,465) and the estimated 2018 American Community Survey estimated population of 328,614. The population of the County is expected to increase over the next few years. As stated in the County Profile (section 4), the County is the 16th fastest growing county in the United States. The increase in population will expose more people to the erosion hazard area as residents move into these areas.

Climate Change

A direct impact of climate change on erosion is difficult to determine. Multiple secondary effects of climate change have the potential to increase the likelihood of erosion. Warming temperatures resulting in wildfires would reduce vegetative cover along steep slopes and destabilize the soils due to destruction of the root system; increased intensity of rainfall events would increase saturation of soils on steep slopes.

Figure 5-44 New Development and Erosion Risk in Douglas County



Change of Vulnerability since the 2015 HMP

For this hazard mitigation plan update, the erosion susceptibility hazard spatial layer from the Colorado Geological Survey was referenced to determine areas within Douglas County that are vulnerable to erosion. Population statistics have also been updated using the 5-Year 2014-2018 American Community Survey Population Estimates. A customized general building stock was created using RS Means 2020 replacement cost values, building footprints and tax assessor and parcel information provided by the County. Additionally, the critical facility inventory was reviewed by Douglas County. Refer to the Methodology Section (5.1) of the plan for more information about the hazard data and exposure analysis

Overall, this vulnerability assessment uses a more accurate and updated building inventory which provides more accurate estimated exposure and potential losses for Douglas County.

Identified Issues

Identified issues associated with geological hazards in the County include the following:

- Wildfire burn areas will continue to pose erosive threats for Douglas County waterways and water supplies.
- Erosion can cause negative environmental consequences, including water quality degradation.
- Impact the integrity of the levee and the properties located behind the levee system.

5.4.14 Soil Hazards: Expansive Soils and Heaving Bedrock

The following section provides the hazard profile and vulnerability assessment for the expansive soils hazard in Douglas County.

Hazard Profile

Description

Expansive soils and heaving bedrock entail movement of underlying soil and rock resulting in surface damage. Expansive soils and heaving bedrock both cause changes to the Earth's surface that result in damage to property and infrastructure. Ground deformation is localized and linear, resulting in highly variable damage (Noe and Dodson 1999). In this hazard profile, heaving/dipping bedrock is recognized as the primary type of expansive soil hazard of concern for Douglas County.

Expansive soils are soils that contain minerals, such as clays, that are capable of absorbing water. When the soils absorb water, they increase in volume. This change in volume can exert enough force on a building or structure to cause damage. Expansive soils can also shrink when they dry out. Shrinking soils can remove support from buildings or other structures and result in damages as well. Fissures (large cracks in the ground that are formed as a result of land subsidence) in the soil can also develop. These fissures can facilitate the deep penetration of water when moist conditions or runoff occurs. Over time, the cycle of swelling and shrinking soils places repetitive stress on structures and damage will worsen over time (King 2020).

Heaving bedrock is a geological hazard that is similar to expansive soils and occurs where steeply dipping sedimentary bedrock containing claystone is encountered at the ground surface. Bedrock heaves in a linear fashion and is caused by differential rebound movements or swelling within the bedrock (State of Colorado 2018).

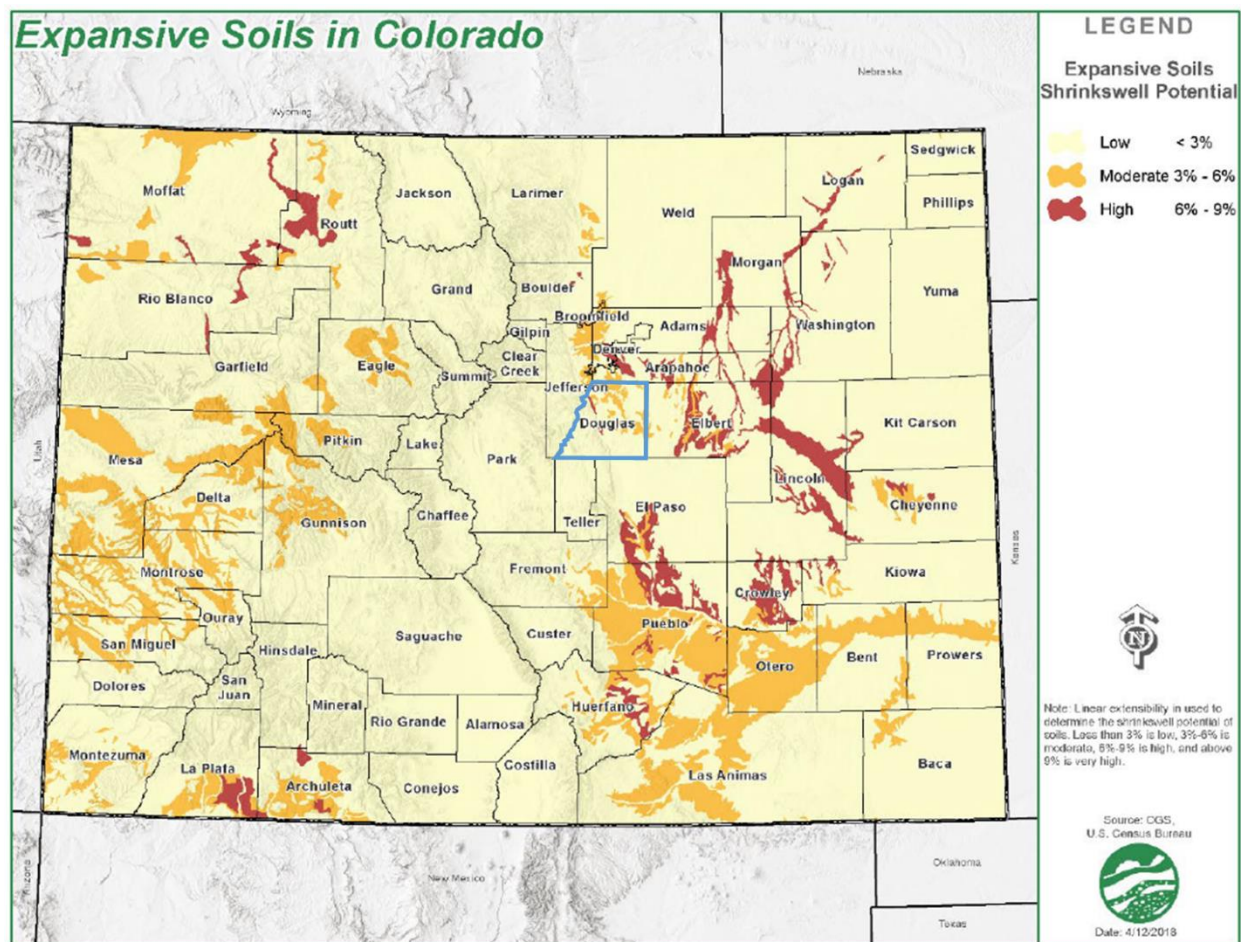
The shrink-swell potential of soils is determined by linear extensibility. Linear extensibility is the change in length of an unconfined clod (lump of earth or clay) as moisture content decreases from a moist to a dry state (State of Colorado 2018).

Extent and Location

The extent of expansive soils is determined by 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 three percent are considered to have a low shrink-swell potential, whereas those with linear extensibility between three and six percent are considered moderate and soils with linear extensibility greater than six percent is considered high (State of Colorado 2018)

Figure 5-45 shows areas of expansive soils in the State of Colorado. In the Front Range region, which includes Douglas County, there are small and relatively isolated areas of soils with high shrink-swell potential. The Colorado Geological Survey classifies some lands in the northern and central part of the County as having soils of moderate shrink-swell potential (between three and six percent).

Figure 5-45: Expansive Soils in Colorado

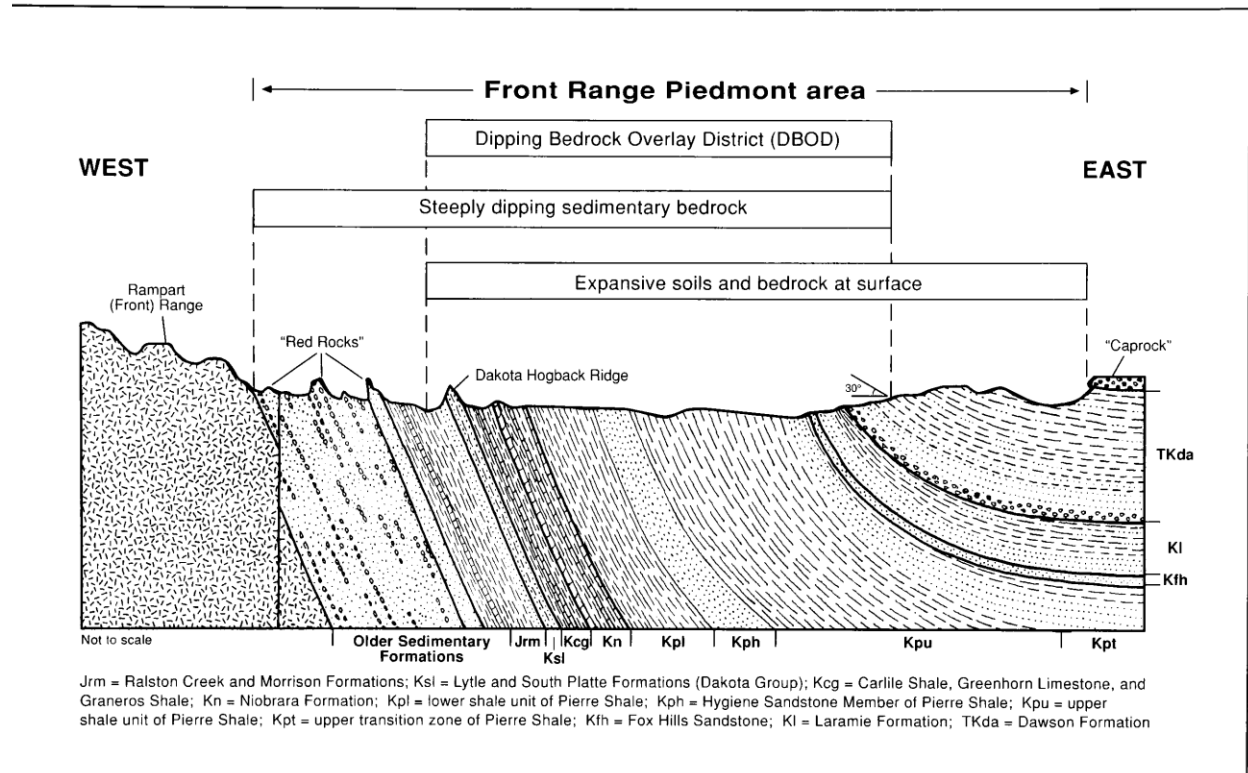


Source: State of Colorado Hazard Mitigation Plan
 Note: Douglas County is outlined in blue.

Mapped areas of dipping bedrock in Douglas County are limited to Front Range piedmont found between Chatfield Reservoir and East Plum Creek at the mouth of Stone Canyon. The area impacted by dipping bedrock is approximately 23 miles long from north to south and varies between 1,000 feet and 2.5 miles wide. The area includes much of a proposed Dipping Bedrock Overlay District that was developed to revise zoning regulations to mitigate the dipping bedrock hazard.

Figure 5-46 shows a cross section of the proposed overlay district. The figure demonstrates the 30-degree angle at which bedrock dips into the ground. Figure 5-47 shows the location of dipping bedrock within Douglas County.

Figure 5-46: Schematic Geological Cross-Section of the Proposed Dipping Bedrock Overlay District



Source: Colorado Geological Survey

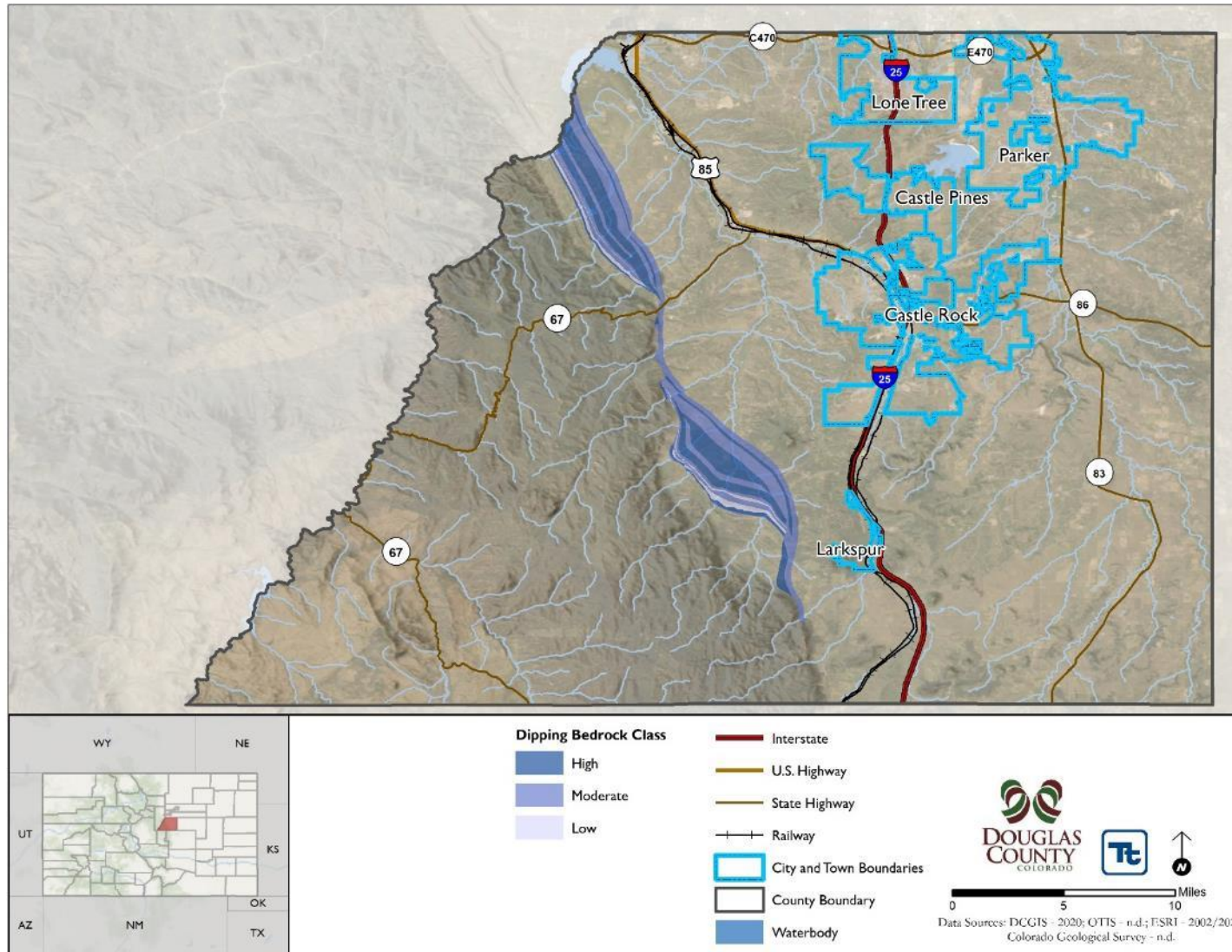
Previous Occurrences and Losses

Specific instances of occurrences of heaving bedrock and expansive soils in Douglas County were not found or reported in the 2015 Hazard Mitigation Plan Update or in the 2018 Enhanced State Hazard Mitigation Plan. However, a 1999 study by the Colorado Geological Survey noted that heaving-bedrock hazards had resulted in millions of dollars in damages to suburban-style development beginning in the 1980s (Noe and Dodson 1999).

Climate Change Projections

Climate change is not anticipated to have a direct impact on expansive soils. However, the Colorado Enhanced State Hazard Mitigation Plan notes that the projected increase in duration and frequency of droughts may increase the frequency of expansive soil events (State of Colorado 2018).

Figure 5-47 Location of Dipping Bedrock in Douglas County



Probability of Future Events

Despite the lack of recent reported damages 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 County’s climate changes, and as the County continues to build out in areas susceptible to the hazards.

Based on historical records and input from the Core Planning Team, the probability of occurrence for expansive soils and heaving bedrock events in the County is considered *occasional* (Hazard event is likely to occur within 100 years). Refer to Sections 5.1 and 5.3 for additional information on the hazard ranking methodology and probability criteria.

Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed or vulnerable to the identified hazard. Expansive soils and heaving/dipping bedrock may impact public safety, property, infrastructure, environmental resources and local economies. The following text evaluates and estimates the potential impact of expansive soils on Douglas County. An exposure analysis was conducted with the dipping bedrock spatial layer from the Colorado Geological Survey.

Impact on Population

Damages from expansive soils are most prevalent when periods of moderate to high rainfall are followed by drought conditions and then followed again by periods of heavy rain. Pipelines, sewer lines, and water lines that are buried in areas of expansive soils are also at risk. Since the County has only a concentrated area of dipping bedrock mainly located in the undeveloped portions of the County, the number of persons living on lands that contain expansive soils are low. Historic occurrences also indicate that the impacts to life, health and safety are minimal for expansive soils. Overall, only 2.4% of the County’s population is located within the dipping bedrock hazard layer.

According to the 2018 American Community Survey (ACS) five-year estimate, Douglas County had a population of 328,614 people. Douglas County’s unincorporated area has the highest number populations at risk of events caused by expansive soils, 7,175 persons or 3.8%. Refer to Figure 5-48 which illustrates the geographical extent of dipping bedrock within the County. Table 5-97 and Table 5-98 summarize the population located within the dipping bedrock hazard area.

Table 5-97 Estimated Population in the Dipping Bedrock Hazard Area (Low, Moderate, and High Class)

Jurisdiction	American Community Survey (2014-2018) Population	Estimated Population Exposed					
		Dipping Bedrock - High Class		Dipping Bedrock - Moderate Class		Dipping Bedrock - Low Class	
		Number of People	Percent of Total	Number of People	Percent of Total	Number of People	Percent of Total
Castle Pines (C)	10,573	0	0.0%	0	0.0%	0	0.0%
Castle Rock (T)	59,680	0	0.0%	0	0.0%	442	0.7%
Larkspur (T)	257	0	0.0%	0	0.0%	0	0.0%
Lone Tree (C)	14,209	0	0.0%	0	0.0%	152	1.1%
Parker (T)	52,563	0	0.0%	0	0.0%	56	0.1%
Unincorporated Douglas County	191,332	4,265	2.2%	2,721	1.4%	188	0.1%

Jurisdiction	American Community Survey (2014-2018) Population	Estimated Population Exposed					
		Dipping Bedrock - High Class		Dipping Bedrock - Moderate Class		Dipping Bedrock - Low Class	
		Number of People	Percent of Total	Number of People	Percent of Total	Number of People	Percent of Total
Douglas County (Total)	328,614	4,265	1.3%	2,721	0.8%	839	0.3%

Source: American Community Survey 2018 (ACS 2014-2018); Colorado Geological Survey, n.d.
Notes: C=City; T = Town

Table 5-98 Estimated Population in the Dipping Bedrock Hazard Area (All Classes)

Jurisdiction	American Community Survey (2014-2018) Population	Estimated Population Exposed to Dipping Bedrock (High, Moderate, Low)	
		Number of People	Percent of Total
Castle Pines (C)	10,573	0	0.0%
Castle Rock (T)	59,680	442	0.7%
Larkspur (T)	257	0	0.0%
Lone Tree (C)	14,209	152	1.1%
Parker (T)	52,563	56	0.1%
Unincorporated Douglas County	191,332	7,175	3.8%
Douglas County (Total)	328,614	7,825	2.4%

Source: American Community Survey 2018 (ACS 2014-2018); Colorado Geological Survey, n.d.
Notes: C=City; T = Town

Impact on General Building Stock

Residential structures and one-story commercial structures are more susceptible to damage by expansive soils compared to 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 from evapotranspiration or by evaporation from under heated buildings (Table 5-99 and Table 5-100 summarize the estimated number of buildings currently built on the dipping bedrock hazard areas: low, moderate, and high. Approximately 1,860 buildings or 1.4% of the structure inventory is located within the high dipping bedrock hazard area within Douglas County’s unincorporated area. There are no buildings located within the incorporated cities of Douglas County built on soils that contain the high dipping bedrock hazard area. Overall, only 2.6% of the structure inventory is built on soils that contain low, moderate, or high dipping bedrock hazard areas.

Table 5-99 Estimated Building Exposure to the Dipping Bedrock Hazard Areas (All Classes)

Jurisdiction	Number of Buildings	Total Replacement Cost Value	Estimated Building Stock Exposed to Dipping Bedrock (High, Moderate, Low)			
			Number of Buildings	Percent of Total	Replacement Cost Value (RCV)	Percent of Total
Castle Pines (C)	3,701	\$4,995,772,208	0	0.0%	\$0	0.0%
Castle Rock (T)	24,262	\$28,003,310,038	170	0.7%	\$168,889,761	0.6%
Larkspur (T)	394	\$135,724,576	0	0.0%	\$0	0.0%
Lone Tree (C)	4,190	\$23,664,803,217	41	1.0%	\$49,678,029	0.2%
Parker (T)	17,864	\$23,597,914,712	19	0.1%	\$19,091,044	0.1%

Jurisdiction	Number of Buildings	Total Replacement Cost Value	Estimated Building Stock Exposed to Dipping Bedrock (High, Moderate, Low)			
			Number of Buildings	Percent of Total	Replacement Cost Value (RCV)	Percent of Total
Unincorporated Douglas County	84,745	\$102,018,837,713	3,230	3.8%	\$2,588,371,223	2.5%
Douglas County (Total)	135,156	\$182,416,362,464	3,460	2.6%	\$2,826,030,057	1.5%

Source: Douglas County GIS, 2020, RS Means 2020, Colorado Geological Survey, n.d.

Notes: C=City; T = Town

Table 5-100 Estimated Building Exposure to the Dipping Bedrock Hazard Areas

Jurisdiction	Number of Buildings	Total Replacement Cost Value	Estimated Building Stock Exposed											
			Dipping Bedrock - High Class				Dipping Bedrock - Moderate Class				Dipping Bedrock - Low Class			
			Number of Buildings	Percent of Total	Replacement Cost Value (RCV)	Percent of Total	Number of Buildings	Percent of Total	Replacement Cost Value (RCV)	Percent of Total	Number of Buildings	Percent of Total	Replacement Cost Value (RCV)	Percent of Total
Castle Pines (C)	3,701	\$4,995,772,208	0	0.0%	\$0	0.0%	0	0.0%	\$0	0.0%	0	0.0%	\$0	0.0%
Castle Rock (T)	24,262	\$28,003,310,038	0	0.0%	\$0	0.0%	0	0.0%	\$0	0.0%	170	0.7%	\$168,889,761	0.6%
Larkspur (T)	394	\$135,724,576	0	0.0%	\$0	0.0%	0	0.0%	\$0	0.0%	0	0.0%	\$0	0.0%
Lone Tree (C)	4,190	\$23,664,803,217	0	0.0%	\$0	0.0%	0	0.0%	\$0	0.0%	41	1.0%	\$49,678,029	0.2%
Parker (T)	17,864	\$23,597,914,712	0	0.0%	\$0	0.0%	0	0.0%	\$0	0.0%	19	0.1%	\$19,091,044	0.1%
Unincorporated Douglas County	84,745	\$102,018,837,713	1,860	2.2%	\$1,503,965,824	1.5%	1,285	1.5%	\$988,700,543	1.0%	85	0.1%	\$95,704,855	0.1%
Douglas County (Total)	135,156	\$182,416,362,464	1,860	1.4%	\$1,503,965,824	0.8%	1,285	1.0%	\$988,700,543	0.5%	315	0.2%	\$333,363,689	0.2%

Source: Douglas County GIS, 2020, RS Means 2020, Colorado Geological Survey, n.d.

Notes: C=City; T = Town

Impact on the Critical Facilities

It is recognized that a number of critical facilities are located in the dipping bedrock hazard areas. The majority of the critical facilities exposed are potable water facilities, bridges, and dams. There are two fire stations and one food distribution site within the hazard area. Impact to these resources could directly impact government agencies from providing aid during other emergencies or local residents may have trouble obtaining access to food distribution sites or may have utility failures. Table 5-101 summarizes the distribution of critical facilities exposed to the dipping bedrock hazard areas by critical facility type and jurisdiction. There are 37 critical facilities located in the hazard area in which 32 are considered lifelines. The exposed lifelines are categorized into FEMA lifeline groupings and are summarized in Table 5-103, the majority of which belong in the “food, water, or shelter” FEMA lifeline category. Additionally, number of critical facilities and lifelines within the dipping bedrock hazard areas by jurisdiction are shown in Table 5-102.

Table 5-101 Critical Facilities and Lifelines by Type in Dipping Bedrock Hazard Area in Douglas County (All Classes)

Jurisdiction	Critical Facilities Exposed to Dipping Bedrock Hazard Area (Low, Moderate, High Class)													
	Bridge	Childcare	Dam	Fire Station	Food Distribution	Medical Care	Municipal Building	Pharmacy	Police Station	Polling Sites	Potable Well	Primary Education	Recreation Site	Wastewater Treatment Facility
Castle Pines (C)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Castle Rock (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Larkspur (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lone Tree (C)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Parker (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Unincorporated Douglas County	8	1	4	2	1	1	1	1	1	1	10	2	3	1
Douglas County (Total)	8	1	4	2	1	1	1	1	1	1	10	2	3	1

Source: Douglas County GIS 2020; Colorado Geological Survey, n.d.
 Notes: C=City; T = Town

Table 5-102 Critical Facilities and Lifelines in Dipping Bedrock Hazard Area in Douglas County (All Classes)

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Exposed to Dipping Rock Hazard Area (Low, Moderate, High Class)			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Castle Pines (C)	20	12	0	0.0%	0	0.0%
Castle Rock (T)	108	100	0	0.0%	0	0.0%
Larkspur (T)	15	9	0	0.0%	0	0.0%
Lone Tree (C)	54	42	0	0.0%	0	0.0%
Parker (T)	140	105	0	0.0%	0	0.0%
Unincorporated Douglas County	827	703	37	4.5%	32	4.6%
Douglas County (Total)	1,164	971	37	3.2%	32	3.3%

Source: Douglas County GIS 2020; Colorado Geological Survey, n.d.
 Notes: C=City; T = Town

Table 5-103 Lifelines in Dipping Bedrock Hazard Area in Douglas County (All Classes)

FEMA Lifeline Category	Number of Lifelines	Number of Lifelines Exposed to Dipping Bedrock (Low, Moderate, High Class)
Food, Water, Shelter	428	12
Hazardous Material	22	0
Health and Medical	203	2

FEMA Lifeline Category	Number of Lifelines	Number of Lifelines Exposed to Dipping Bedrock (Low, Moderate, High Class)
Safety and Security	239	10
Transportation	79	8
Douglas County (Total)	971	32

Source: Douglas County GIS 2020; Colorado Geological Survey, n.d.

Notes: C=City; T = Town

Impact on the Economy

As summarized by FEMA, the greatest damage from expansive soils is to highways and roads. Damages result from differential vertical movement that occurs as clay moisture content adjusts to the changed environment. 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). Infrastructure damage is costly and can impact the local and regional economy.

Impact on the Environment

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, impacted rooted plants. The instability of this soil type may not be the most ideal habitat for species in the County.

Cascading Impacts to Other Hazards

There are no known cascading impacts expansive soils cause to other hazards of concern for the County.

Future Changes that May Impact Vulnerability

Understanding future changes that affect vulnerability in the County can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The County considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development
- Projected changes in population
- Other identified conditions as relevant and appropriate, including the impacts of climate change.

Projected Development

Any new development in terms of structures and infrastructure (e.g. highways and streets) on known expansive soils could be potentially impacted. Proper grading and building regulations/code including proper slab design and emplacement procedures can mitigate structural damage to new development in areas where expansive soils exist. In most cases, structural damage due to expansive soils is not covered by insurance (FEMA 1997).

Projected Changes in Population

The County experienced an increase in population between the 2010 Census (285,465) and the estimated 2018 Community Survey estimated population of 328,614. The population of the County is expected to increase over the next few years. Even through there are increasing population trends in the major

metropolitan areas, dipping bedrock is solely located within Douglas County's unincorporated areas in areas of smaller populations. Therefore, it is not likely that as development increases there is a larger risk to expansive soils. There are no new development sites located within the low dipping bedrock hazard area. Refer to section 9 for potential new development in the County and their proximity to the dipping bedrock hazard area.

Climate Change

A combination of dry and wet weather leads to damages from expansive soils. As the climate changes, it could increase the risk of the severity of expansive soils.

Typically, land subsidence poses a greater risk to property than to human life. The average annual damage throughout the United States from all types of subsidence is estimated to be at least \$125 million. Damage consists primarily of direct structural damage and property loss and depreciation of land values. It also includes business and personal losses that accrue during periods of repair (FEMA 1997).

Change of Vulnerability Since the 2015 HMP

For this hazard mitigation plan update, the dipping bedrock hazard from Colorado Geological Survey was referenced to determine areas within Douglas County that are vulnerable to expansive soils. Population statistics have also been updated using the 5-Year 2014-2018 American Community Survey Population Estimates. A customized general building stock was created using RS Means 2020 replacement cost values, building footprints and tax assessor and parcel information provided by the County. Additionally, the critical facility inventory was reviewed by Douglas County.

Overall, this vulnerability assessment uses a more accurate and updated building inventory which provides more accurate estimated exposure and potential losses for Douglas County.

Identified Issues

No issues have been identified pertaining to the expansive soils hazard. Douglas County will continue to monitor conditions as they pertain to this hazard to inform future updates to this plan.

5.4.15 Soil Hazards: Land Subsidence

The following section provides the hazard profile and vulnerability assessment for the land subsidence hazard in Douglas County.

Hazard Profile

Description

Ground subsidence entails the settlement of native low-density soils or the sinking of land over voids that could be underground or manmade. Subsidence can be caused by natural sediment compaction, sinkholes, settling of mines, or the melting of permafrost. Subsidence can occur slowly or suddenly, and in Colorado subsidence occurs most frequently in sedimentary rocks underlain by coal, clay mines, and hard rock. Hydro-compaction can also occur when settling or collapsing soils are wettened or subjected to weight. Subsidence can also occur due to withdrawn water from underground (State of Colorado HMP 2018).

Land subsidence is one of the most varied forms of ground failure affecting the United States, ranging from broad regional lowering of land surfaces to local collapses. Regional lowering may aggravate the flood

potential or permanently inundate an area, particularly in coastal or riverine settings. Local collapse may damage or destroy buildings, roads, and utilities (FEMA 1997; National Research Council Commission on Engineering and Technical Systems 1991). Other impacts of subsidence include, but are not limited to 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 from forces generated by compaction of fine-grained materials in aquifer systems. In some coastal areas, subsidence has resulted in tides moving into low-lying areas that were once above high-tide levels (Leake 2004).

Extent

To determine the extent of the subsidence hazard, the affected areas need to be identified and the probability of the subsidence occurring within some time period needs to be assessed. Natural variables that contribute to the overall extent of potential subsidence activity in any particular area include soil properties, and underlying geologic feature. Predicting subsidence is difficult, even under ideal conditions. As a result, the subsidence hazard is often represented by presence of evaporite or carbonate rock.

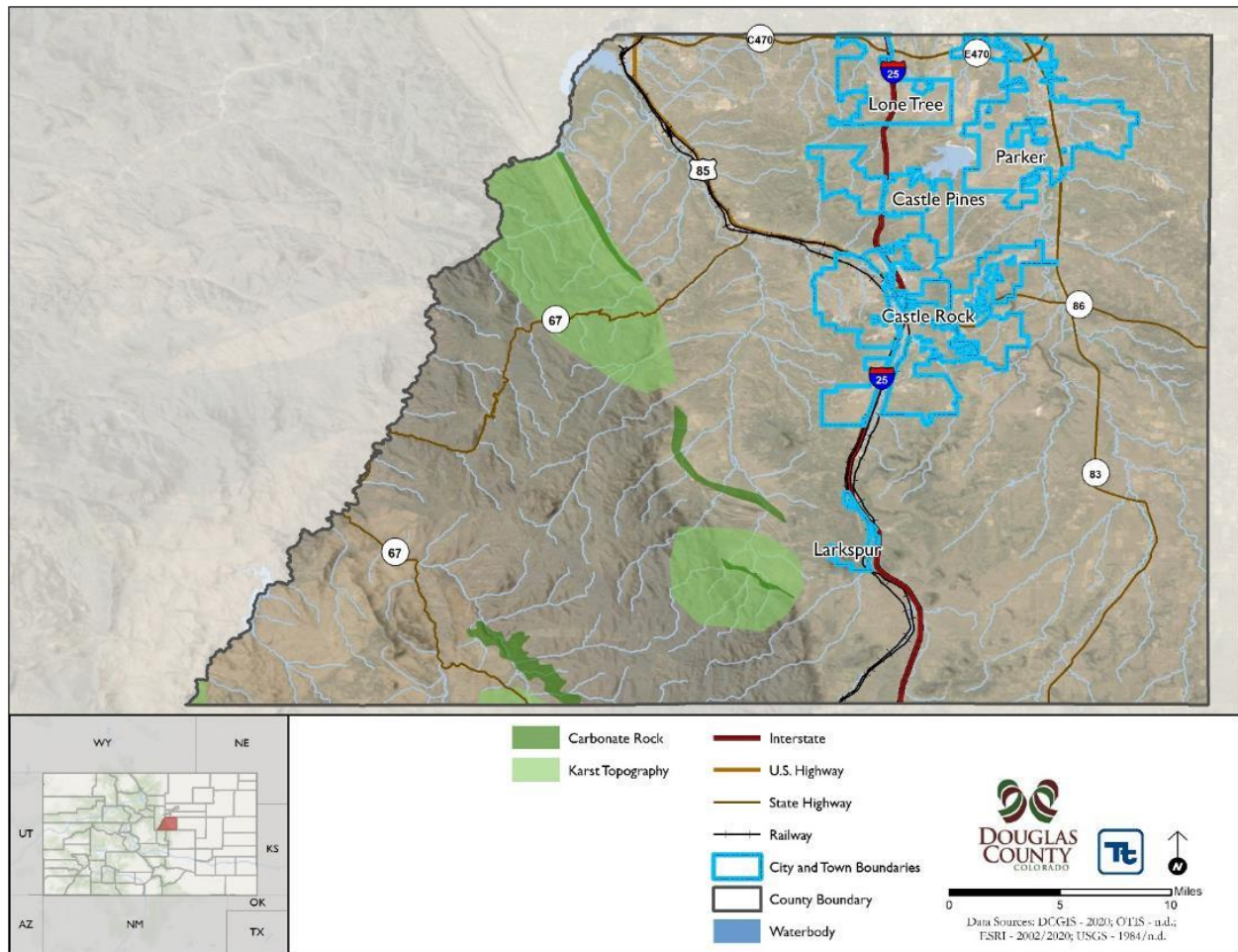
Location

Land subsidence occurs throughout the United States. More than 17,000 square miles in 45 states have been directly impacted by subsidence (USGS 2020). Areas underlain by carbonate bedrock are the most susceptible to land subsidence and sinkhole incidents. Areas of limestone, carbonate rock, salt beds, or rocks that can naturally be dissolved by groundwater are more prone to sinkholes. As the rock dissolves, spaces and caverns develop underground, leading to sinkholes (USGS 2018).

In Colorado, subsidence due to withdrawn water and mining is less common than in other western states (State of Colorado 2018). According to the Colorado Geological Survey, the northwestern section of Douglas County is underlain by inactive coal mines that pose subsidence risks (State of Colorado 2018). In addition to this area, various portions of Douglas County are underlain by carbonate rock and Karst topography. This includes a large area stretching from the County boundary southeast across Highway 67 to Garber Creek and east to Roxborough State Park. Much of this area is underlain by Karst topography, with carbonate rock comprising the sliver along Roxborough State Park. Other narrow bands of carbonate rock stretch northwest from Larkspur towards Garber Creek, along the foothills near Starr Canyon, and along Trout Creek. Other areas of Karst topography include the area in the confluence of West Plum Creek and Gove Creek, and the area southwest of the Rainbow Falls Riding Area in Pike National Forest.

Though the State Hazard Mitigation Plan and the County Comprehensive Plan do not reference the subsidence hazard in Douglas County, instances of subsidence were reported in the 2015 Douglas County Hazard Mitigation Plan in the Castle Meadows area resulting from abandoned clay mines. The Class 3 Hazards map in the County's Comprehensive 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. Please refer to Figure 5-48 to see carbonate rock and karst topography located within Douglas County.

Figure 5-48 Karst Topography and Carbonate Rock in Douglas County



Previous Occurrences and Losses

Douglas County has experienced occasional subsidence issues. The 2015 Hazard Mitigation plan noted isolated incidents in Castle Meadows associated with abandoned clay mines. Northern Douglas County has been reported as susceptible to collapsible soils (White and Greenman 2008).

Climate Change Projections

Climate change may impact storm patterns, increasing the probability of more frequent, intense storms with varying duration. Increase in global temperature could affect the snowpack and its ability to hold and store water. Warming temperatures also could increase the occurrence and duration of droughts, which would increase the probability of wildfire, reducing the vegetation that helps to support steep slopes. All of these factors would increase the probability for erosion, including land subsidence, to occur.

Probability of Future Events

Land subsidence may continue to develop from other types of below-ground withdrawals or from natural or man-made forces. The State of Colorado identifies evaporative karst subsidence, abandoned land 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 lead to varying groundwater withdrawals, and this can lead to more incidences of land subsidence/sinkholes (State of Colorado HMP 2018).

Based on historical records and input from the Core Planning Team, the probability of occurrence for land subsidence events in the County is considered *occasional* (Hazard event is likely to occur within 100 years). Refer to Sections 5.1 and 5.3 for additional information on the hazard ranking methodology and probability criteria.

Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed or vulnerable to the identified hazard. Land subsidence may impact public safety, property, infrastructure, environmental resources and local economies. The following text evaluates and estimates the potential impact of land subsidence on Douglas County. A spatial analysis was conducted using the United States Geological Survey karst topography and carbonate hazard area overlaid over the population, general building stock, and critical facility spatial layers to calculate impacts to the population and the economy.

Impact on Life, Health, and Safety

Table 5-104 summarizes the population located in the karst topography hazard area and the carbonate rock hazard area. There is no impact to Douglas County’s incorporated cities. Approximately 3.4-percent of Douglas County’s population within unincorporated areas are living on lands that contain karst topography and 1-percent of the unincorporated population is living on lands that contain the carbonate rock hazard area. Overall, there are approximately 8,448 persons exposed to the land subsidence hazard areas.

Table 5-104 Estimated Population Located in the Karst Topography and Carbonate Rock Hazard Area in Douglas County

Jurisdiction	American Community Survey (2014-2018) Population	Estimated Population Exposed to Karst Topography Hazard Area		Estimated Population Exposed to Carbonate Rock Hazard Area	
		Number of People	Percent of Total	Number of People	Percent of Total
Castle Pines (C)	10,573	0	0.0%	0	0.0%
Castle Rock (T)	59,680	0	0.0%	0	0.0%
Larkspur (T)	257	0	0.0%	0	0.0%
Lone Tree (C)	14,209	0	0.0%	0	0.0%
Parker (T)	52,563	0	0.0%	0	0.0%
Unincorporated Douglas County	191,332	6,501	3.4%	1,947	1.0%
Douglas County (Total)	328,614	6,501	2.0%	1,947	0.6%

Source: American Community Survey 2018 (ACS 2014-2018); United States Geological Survey, n.d./1984

Notes: C=City; T = Town

Impact on General Building Stock

In general, the built environment located in the land subsidence area and the population, structures and infrastructure located downslope are vulnerable to this hazard. There are 2,885 buildings with a replacement cost value of approximately \$2.2 billion located in the karst topography hazard area countywide and 828 buildings with a replacement cost value of approximately \$620 million located in the

carbonate rock hazard area. Table 5-105 and Table 5-106 summarizes the exposed building stock located in the land subsidence area throughout the county by jurisdiction.

Table 5-105 Building Stock Replacement Cost Value and Building Count within Karst Topography Hazard Area in Douglas County

Jurisdiction	Number of Buildings	Total Replacement Cost Value	Estimated Building Stock Exposed to Karst Topography Hazard Area			
			Number of Buildings	Percent of Total	Replacement Cost Value (RCV)	Percent of Total
Castle Pines (C)	3,701	\$4,995,772,208	0	0.0%	\$0	0.0%
Castle Rock (T)	24,262	\$28,003,310,038	0	0.0%	\$0	0.0%
Larkspur (T)	394	\$135,724,576	0	0.0%	\$0	0.0%
Lone Tree (C)	4,190	\$23,664,803,217	0	0.0%	\$0	0.0%
Parker (T)	17,864	\$23,597,914,712	0	0.0%	\$0	0.0%
Unincorporated Douglas County	84,745	\$102,018,837,713	2,885	3.4%	\$2,160,421,157	2.1%
Douglas County (Total)	135,156	\$182,416,362,464	2,885	2.1%	\$2,160,421,157	1.2%

Source: Douglas County GIS, 2020; RS Means 2020, United States Geological Survey, n.d.

Notes: C=City; T = Town

Table 5-106 Building Stock Replacement Cost Value and Building Count within Carbonate Rock Hazard Area in Douglas County

Jurisdiction	Number of Buildings	Total Replacement Cost Value	Estimated Building Stock Exposed to Carbonate Rock Hazard Area			
			Number of Buildings	Percent of Total	Replacement Cost Value (RCV)	Percent of Total
Castle Pines (C)	3,701	\$4,995,772,208	0	0.0%	\$0	0.0%
Castle Rock (T)	24,262	\$28,003,310,038	0	0.0%	\$0	0.0%
Larkspur (T)	394	\$135,724,576	0	0.0%	\$0	0.0%
Lone Tree (C)	4,190	\$23,664,803,217	0	0.0%	\$0	0.0%
Parker (T)	17,864	\$23,597,914,712	0	0.0%	\$0	0.0%
Unincorporated Douglas County	84,745	\$102,018,837,713	828	1.0%	\$620,357,854	0.6%
Douglas County (Total)	135,156	\$182,416,362,464	828	0.6%	\$620,357,854	0.3%

Source: Douglas County GIS, 2020; RS Means 2020; United States Geological Survey, n.d., 1984.

Notes: C=City; T = Town

Impact on the Critical Facilities

It is recognized that a number of critical facilities are located in the karst topography and carbonate rock hazard areas. The majority of the critical facilities exposed to land subsidence hazard areas are potable water facilities, recreation sites and dams. Impact to these resources could cause utility failure or flood control issues if there are any breaches to dams. Table 5-107 through Table 5-110 summarize the distribution of critical facilities exposed to the subsidence hazard areas by critical facility type and jurisdiction. Douglas County’s unincorporated area has the greatest number of critical facilities located in the subsidence hazard areas. The exposed lifelines are categorized into FEMA lifeline groupings and are summarized in Table 5-111, the majority of which are under the “food, water, or shelter” FEMA lifeline category. Additionally, the number of critical facilities and lifelines within the subsidence hazard areas by jurisdiction are shown in Table 5-107 and Table 5-108.

Table 5-107 Critical Facilities and Lifelines by Type in the Karst Topography Hazard Area in Douglas County

Jurisdiction	Critical Facilities Exposed to Karst Topography				
	Bridge	Dam	Fire Station	Potable Well	Recreation Site
Castle Pines (C)	0	0	0	0	0
Castle Rock (T)	0	0	0	0	0
Larkspur (T)	0	0	0	0	0
Lone Tree (C)	0	0	0	0	0
Parker (T)	0	0	0	0	0
Unincorporated Douglas County	2	5	2	15	10
Douglas County (Total)	2	5	2	15	10

Source: Douglas County GIS, 2020, United States Geological Survey, n.d.
Notes: C=City; T = Town

Table 5-108 Critical Facilities and Lifelines by Type in the Carbonate Rock Hazard Area in Douglas County

Jurisdiction	Critical Facilities Exposed to the Carbonate Rock Hazard Area		
	Bridge	Dam	Potable Well
Castle Pines (C)	0	0	0
Castle Rock (T)	0	0	0
Larkspur (T)	0	0	0
Lone Tree (C)	0	0	0
Parker (T)	0	0	0
Unincorporated Douglas County	2	2	2
Douglas County (Total)	2	2	2

Source: Douglas County GIS, 2020, United States Geological Survey, 1984
Notes: C=City; T = Town

Table 5-109 Critical Facilities and Lifelines by Type in the Karst Topography Hazard Area in Douglas County

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Exposed to Karst Topography			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Castle Pines (C)	20	12	0	0.0%	0	0.0%
Castle Rock (T)	108	100	0	0.0%	0	0.0%
Larkspur (T)	15	9	0	0.0%	0	0.0%
Lone Tree (C)	54	42	0	0.0%	0	0.0%

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Exposed to Karst Topography			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Parker (T)	140	105	0	0.0%	0	0.0%
Unincorporated Douglas County	827	703	34	4.1%	24	3.4%
Douglas County (Total)	1,164	971	34	2.9%	24	2.5%

Source: Douglas County GIS, 2020, United States Geological Survey, n.d.

Notes: C=City; T = Town

Table 5-110 Critical Facilities and Lifelines by Type in the Carbonate Rock Hazard Area in Douglas County

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Exposed to Carbonate Rock Hazard Area			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Castle Pines (C)	20	12	0	0.0%	0	0.0%
Castle Rock (T)	108	100	0	0.0%	0	0.0%
Larkspur (T)	15	9	0	0.0%	0	0.0%
Lone Tree (C)	54	42	0	0.0%	0	0.0%
Parker (T)	140	105	0	0.0%	0	0.0%
Unincorporated Douglas County	827	703	6	0.7%	6	0.9%
Douglas County (Total)	1,164	971	6	0.5%	6	0.6%

Source: Douglas County GIS, 2020, United States Geological Survey, 1984

Notes: C=City; T = Town

Table 5-111 Lifelines Exposed to the Karst Topography and Carbonate Rock Hazard Area Douglas County

FEMA Lifeline Category	Number of Lifelines	Number of Lifelines Exposed to Karst Topography	Number of Lifelines Exposed to the Carbonate Rock Hazard Area
Food, Water, Shelter	428	15	2
Hazardous Material	22	0	0
Health and Medical	203	0	0
Safety and Security	239	7	2
Transportation	79	2	2
Douglas County (Total)	971	24	6

Source: Douglas County GIS, 2020, United States Geological Survey, n.d./1984

Notes: C=City; T = Town

Impact on the Economy

Geological hazards such as land subsidence can impose direct and indirect impacts on society. Direct costs include the actual damage sustained by buildings, property and infrastructure. Indirect costs, such as clean-

up costs, business interruption, loss of tax revenues, reduced property values, and loss of productivity are difficult to measure (USGS, 2003). Additionally, subsidence can cause damages to buildings and decrease property value as saltwater encroachment increases in coastal areas.

Impact on the Environment

A landslide or sinkhole/subsidence event will alter the landscape. In addition to changes in topography, vegetation and wildlife habitats may be damaged or destroyed, and soil and sediment runoff will accumulate downslope potentially blocking waterways and roadways and impacting quality of streams and other water bodies. Additional environmental impacts include loss of forest productivity.

Furthermore, soil and sediment runoff can accumulate downslope potentially blocking waterways and roadways and impacting quality of streams and other water bodies. Mudflows that erode into downstream waterways can threaten the life of freshwater species (USGS 2020). The impacts of eroded landscape can travel for miles downstream into adjacent waterways and create issues for surrounding watersheds.

Cascading Impacts on Other Hazards

Landslide events can have cascading impacts on soil erosion. Landslides can alter topography, uproot vegetation and disturb soil stability. This could lead to potential impacts to erosion susceptibility and debris flow. Additionally, landslide events can cause transport of material possibly distributing contaminants from contained sites to other areas. More information about slope failures can be found in Section 5.4.16.

Future Changes that May Impact Vulnerability

Understanding future changes that affect vulnerability in the County can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The County considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development
- Projected changes in population
- Other identified conditions as relevant and appropriate, including the impacts of climate change.

Projected Development

Due the lack of exposure and impacts from these hazards, future development in the County is not likely to be impacted by land subsidence in the short term. However, as a changing climate continues to influence the frequency, severity and magnitude of hazard events, there could be impacts on future development. Future updates to this plan will have to measure those possibilities as it assesses land subsidence. There are no new development sites located within the landslide hazard area. Refer to the maps in each jurisdictional annex (Section 9 of this HMP) to view the new development project areas and their proximity to the carbonate rock and karst topography areas.

Projected Changes in Population

The County experienced an increase in population between the 2010 Census (285,465) and the estimated 2018 Community Survey estimated population of 328,614. The population of the County is expected to increase over the next few years. Increasing population trends in the major metropolitan areas will lead to

increasing groundwater withdrawals from surface aquifers, and this can lead to more incidences of land subsidence/sinkholes.

Climate Change

More frequent and severe rainfall events, as is predicted for the region, will alter the hydrologic conditions and stability of the soil through increased erosion and changes in soil saturation. With increases in extreme temperatures and precipitation more landslide events are likely to occur with greater magnitudes (Huggel, C., Khabarov, N., Korup, O., & Obersteiner, M., 2012).

Change of Vulnerability Since the 2015 HMP

For this hazard mitigation plan update, the carbonate rock and karst topography hazard spatial layer from the United States Geological Survey was referenced to determine areas within Douglas County that are vulnerable to land subsidence. Population statistics have also been updated using the 5-Year 2014-2018 American Community Survey Population Estimates. A customized general building stock was created using RS Means 2020 replacement cost values, building footprints and tax assessor and parcel information provided by the County. Additionally, the critical facility inventory was reviewed by Douglas County.

Overall, this vulnerability assessment uses a more accurate and updated building inventory which provides more accurate estimated exposure and potential losses for Douglas County.

Identified Issues

Identified issues pertaining to land subsidence include the following:

- According to existing geological data, subsidence is most likely to occur in portions of the County that are sparsely populated. However, subsidence still poses a threat to infrastructure, people, and property in these areas.
- The Douglas County Comprehensive Master Plan 2040 maps small areas of subsidence on its Class 3 hazards plan. However, the Comprehensive Plan itself and the State Hazard Mitigation Plan do not mention collapsible soil or subsidence areas in the County.

5.4.16 Soil Hazards: Slope Failure

The following section provides the hazard profile and vulnerability assessment for the slope failure and debris flow hazard in Douglas County.

Hazard Profile

Description

Landslides, slope failures and debris flows include several types of soil hazards that result in abrupt movements of rock and soil. Landslides include processes that result in the outward and downward movement of slope-forming materials that include, but are not limited to, artificial fill, soil, and rock. Slope failures include movements by sliding, spreading, flowing, toppling, and falling. There are different types of landslides, as seen in Figure 5-49. In Douglas County, the more common slope failures include landslides, mud/debris flows, and rockfalls. Landslides occur in all 50 states and are estimated to cause between 25 and 50 deaths and result in more than \$1 billion in damage annually. Though slope failures are singular events, they can have multiple causes and variables impacting the extent and severity of the hazard.

Figure 5-49 Types of Landslides

Type of movement	Type of material		
	Bedrock	Engineering soils	
		Predominantly coarse	Predominantly fine
Falls	Rock fall	Debris fall	Earth fall
Topples	Rock topple	Debris topple	Earth topple
Slides	Rotational	Rock slide	Debris slide
	Translational		
Lateral Spreads	Rock spread	Debris spread	Earth spread
Flows	Rock flow (deep creep)	Debris flow	Earth flow
		Soil creep	
Complex	Combination of two or more principal types of movement		

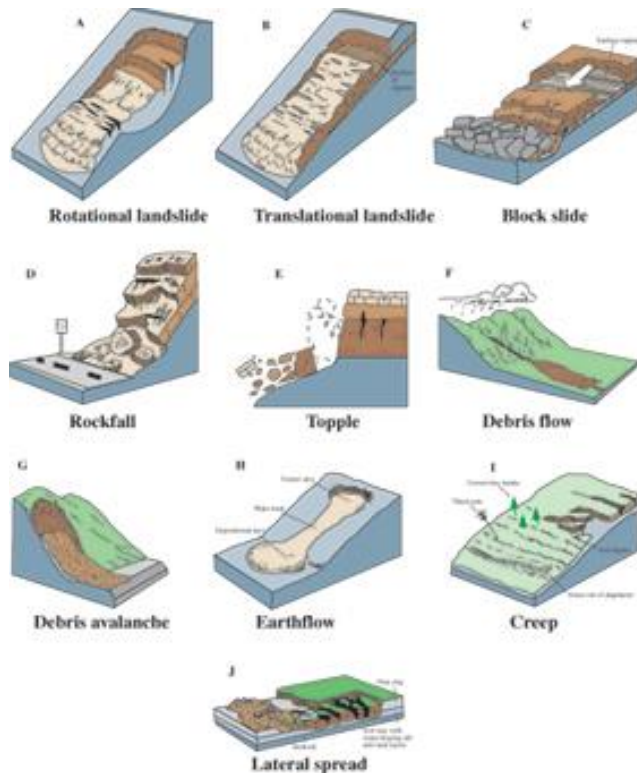
Source: USGS

Landslides are the downward and outward movement of slopes composed of one or a combination of natural rock, soils, and artificial fills. Common types of landslides include slump, rockslide, debris slide, lateral spreading, debris avalanche, earth flow, and soil creep (State of Colorado HMP 2018). Figure 5-50 illustrates these different types of landslides.

Mud/debris flows are a mass of water and fine-grained earth materials that flows down a stream, ravine, canyon, arroyo, or gulch. If more than half of the solids in the mass are larger than sand grains, this event is called a debris flow (State of Colorado HMP 2018). They are similar to flash floods and can occur suddenly without time for adequate warning. When the drainage channel eventually becomes less steep, the liquid mass spreads out and slows down to form a part of a debris fan or a mud flow deposit. In the steep channel itself, erosion is the dominant process as the flow picks up more solid material (Douglas County HMP 2015). Of particular concern to Douglas County are post-wildfire debris-flows. Rains in the wake of wildfire events can cause debris flows due to root decay and the loss of soil strength. Post-fire debris flows can move very quickly and with little warning, causing drainage blockage, structure damages, and further strip vegetation. Additionally, wildfires can further de-stabilize pre-existing deep-seated landslides over a long period of time.

Rockfalls are the fastest type of landslide and occur most frequently in mountains or steep areas during early spring. Rockfalls are caused by the loss of support from underneath or detachment from a larger rock mass. Ice wedging, root growth, or ground shaking, as well as a loss of support through erosion or chemical weathering may start the fall (Douglas County HMP 2015).

Figure 5-50 Types of Landslides (Illustrated)



Source: USGS

Extent

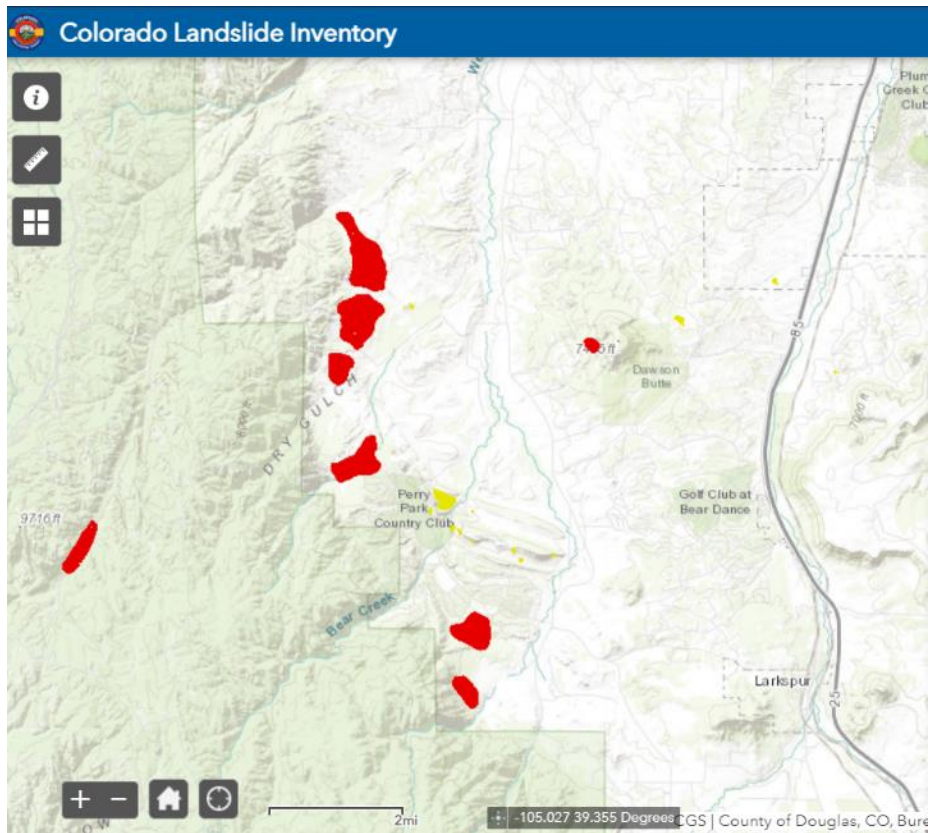
Landslides are difficult to predict on an individual basis. However, landslides can be anticipated through an understanding of an area’s underlying geologic and soil conditions, the known occurrence of past landslide events, high topographic relief, and precipitation events. The occurrence of disruptive human activities such as large-scale excavation can also affect the extent of a slope failure event. The extent of a wildfire burn area can also inform the extent of slope failures due to changes in vegetation and soil strength.

Location

According to the US Geological Survey, landslides in Colorado typically occur along the Front Range, central mountains, and western part of the State where there are significant slopes. Slope failures typically occur in mountainous regions, such as those of Pike National Forest found in the western portion of Douglas County. However, slope failures 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.

According to the Colorado Landslide Inventory, landslides have been limited in their occurrence 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 of landslides was recorded at the vicinity of the Perry Park Country Club, along Dry Gulch, and along Jackson Creek near Devils Head in the Rampart Range. Figure 5-51 shows the historic occurrences of landslides in Douglas County.

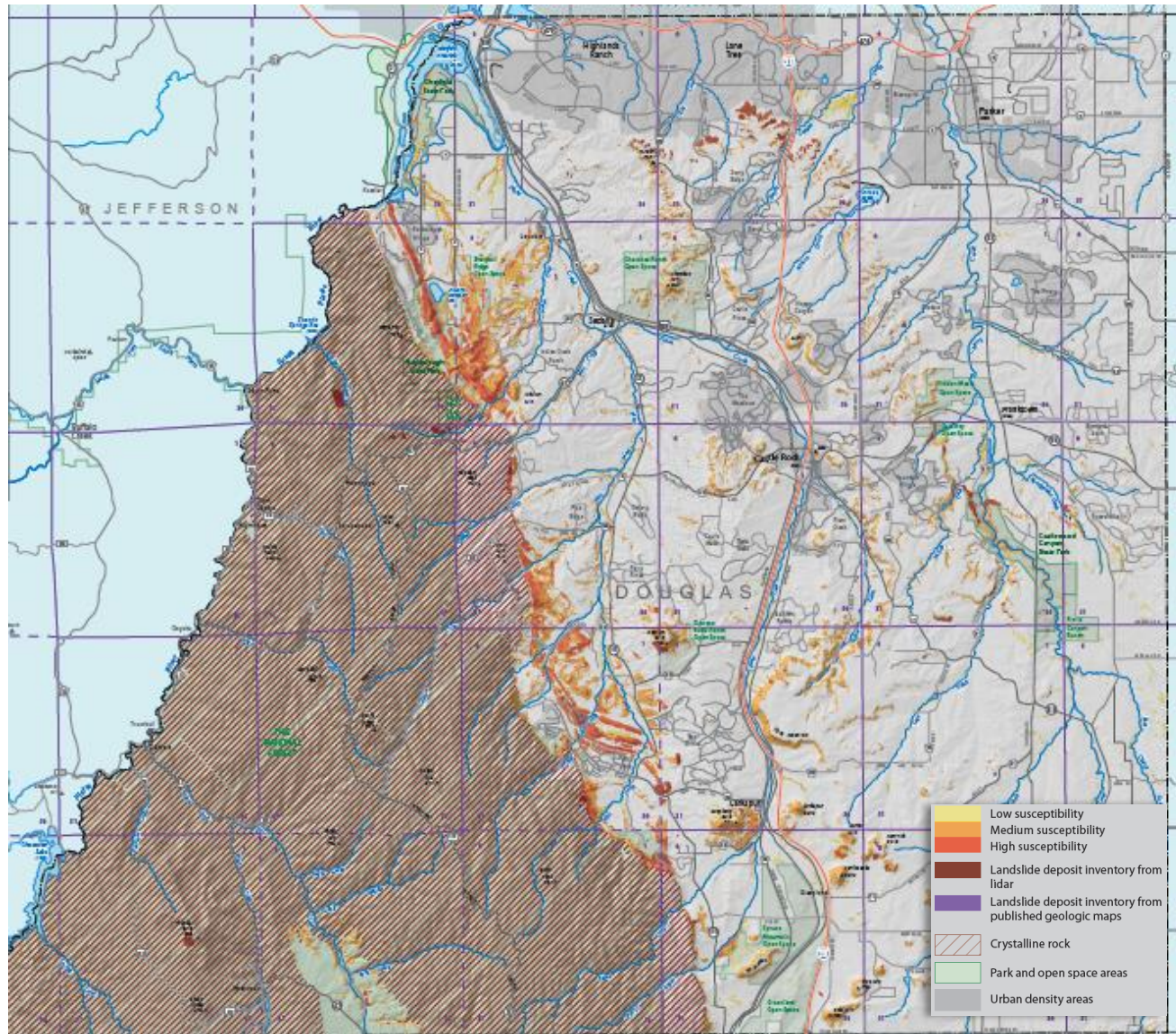
Figure 5-51 Landslide Occurrences in Douglas County



Source: Colorado Landslide Inventory

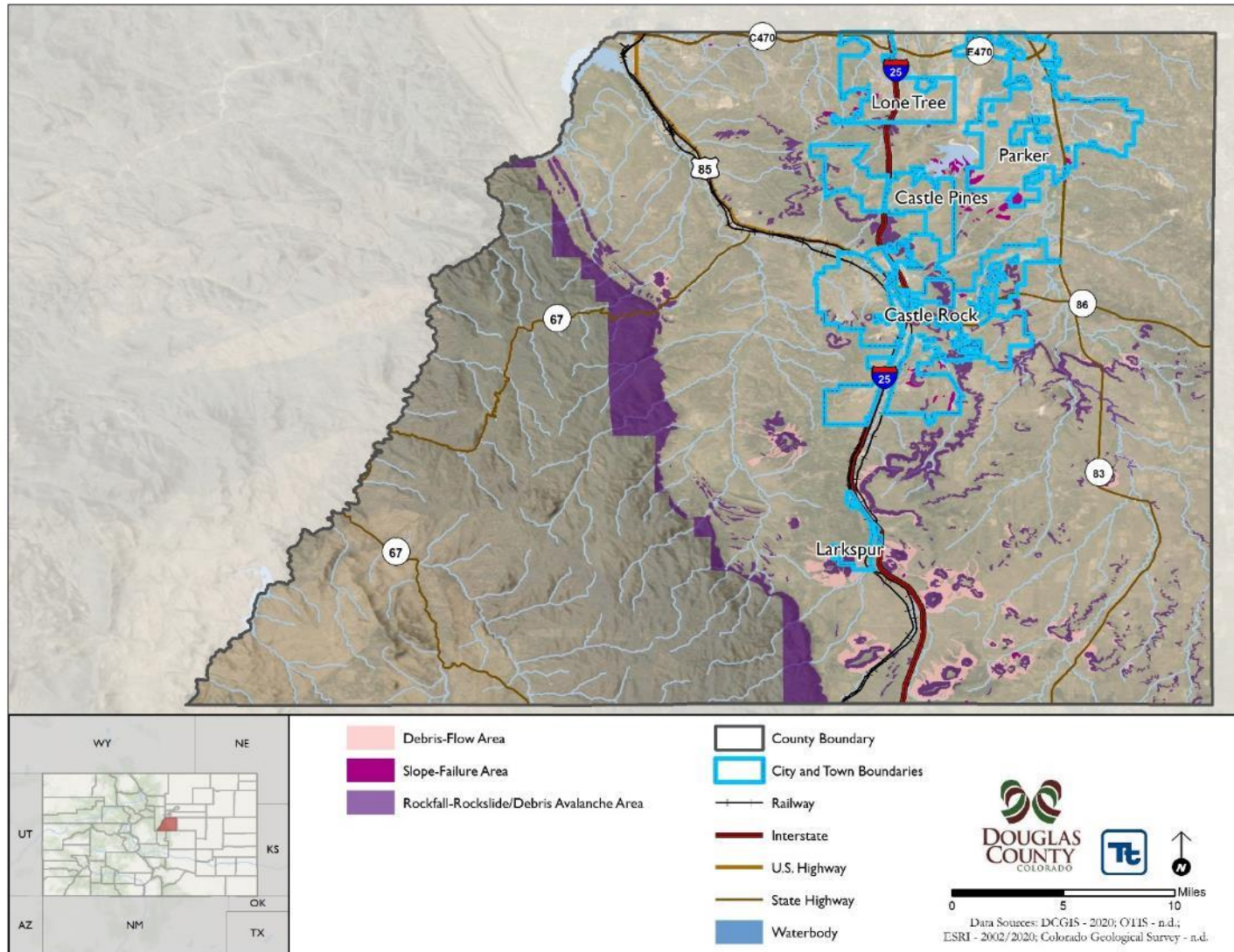
The Colorado Geological Survey has mapped landslide susceptibility in Douglas County using factors such as relief, slope classes, and geologic rock unit. The Geological Survey also identified landslide deposits from LIDAR and published geologic maps. Landslide deposits were found in scattered locations across the County, such as between Lone Tree and Castle Pines North, Castlewood Canyon State Park, and Roxborough State Park. Areas of medium and high susceptibility to landslides are found along the County's buttes and mountain ridges, particularly along the Pike National Forest boundary. Figure 5-52 shows landslide susceptibility in Douglas County.

Figure 5-52 Landslide Susceptibility Map of Douglas County, Colorado



Source: Colorado Geological Survey

Figure 5-53 Debris Flow, Slope Failure, and Rockfall-Rockslide/Debris Avalanche Hazard Area in Douglas County



Previous Occurrences and Losses

Douglas County has not experienced landslide events since the 2015 Hazard Mitigation Plan. The 2015 plan reports two past occurrences of landslides in 2004 and 2007 resulting from localized flash flooding in the Hayman burn area. In the August 2004 landslide incident, the Westcreek subdivision and several roads were damaged by floodwaters that reached eight inches deep. The July 2007 rock and mudslide event occurred near Trout Ranch Road. The Hayman Creek burn area stretches from Trout Creek to the County line and may be the location of future landslides or unrecorded landslides occurring since the fire.

Climate Change Projections

Climate change is anticipated to cause more intense precipitation events along with more frequent and intense droughts and wildfires. The combination of these meteorological and climatological impacts will make conditions for slope failures more favorable and frequent.

Probability of Future Events

The underlying geologic causes of slope failures will continue to remain in Douglas County. Though slope failures are relatively rare events, the potential for future events to occur remains and may increase due to human activity and meteorological conditions. Climate change will likely increase the frequency of slope failures occurring in Douglas County.

Based on historical records and input from the Planning Team, the probability of occurrence for slope failure events in the County is considered *occasional* (likely to occur in 100 years). Refer to Sections 5.1 and 5.2 for additional information on the hazard ranking methodology and probability criteria.

Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed or vulnerable to the identified hazard. Slope failure and debris flows may impact public safety, property, infrastructure, environmental resources and local economies. The following text evaluates and estimates the potential impact of rockfall and slope failure on Douglas County. An exposure analysis was conducted with the geological hazard spatial layers from the Colorado Geological Survey.

Impact on Population

Landslides occur in all 50 states and are estimated to cause between 25 and 50 deaths and result in more than \$1 billion in damage annually. Though slope failures are singular events, they can have multiple causes and variables impacting the extent and severity of the hazard. Based on previous occurrences and severity, impacts to life, health and safety are minimal for landslide events.

According to the 2018 ACS annual estimate, Douglas County had a population of 328,614 people. The City of Castle Pines has the highest percentage of persons exposed to the rockfall-rockslide/debris avalanche area, 2.7-percent and 281 persons. Overall, Douglas county has a low percentage of population exposed to the slope-failure hazard area and the rockfall-rockslide/debris avalanche area, 0.3-percent and 1.6-percent respectively. Refer to Figure 5-52 which illustrates the geographical location of slope-failure and rockfall-rockslide/debris hazard area within the County. Table 5-112 summarizes the population located within the slope failure and rockfall hazard area.

The Town of Larkspur has the greatest percentage of persons living in the debris-flow hazard area, 52.7-percent or 136 persons. Refer to Table 5-112 for the estimated population living in the debris-flow hazard area.

Table 5-112 Estimated Population Located in the Debris Flow Hazard Area in Douglas County

Jurisdiction	American Community Survey (2014-2018) Population	Estimated Population Exposed to the Debris Flow Hazard Area	
		Number of People	Percent of Total
Castle Pines (C)	10,573	0	0.0%
Castle Rock (T)	59,680	18	<0.1%
Larkspur (T)	257	136	52.7%
Lone Tree (C)	14,209	0	0.0%
Parker (T)	52,563	0	0.0%
Unincorporated Douglas County	191,332	699	0.4%
Douglas County (Total)	328,614	852	0.3%

Source: American Community Survey 2018 (ACS 2014-2018); Colorado Geological Survey, n.d.
Notes: C=City; T = Town

Table 5-113 Estimated Population in the Slope-Failure Hazard Area and the Rockfall-Rockslide/Debris Avalanche Hazard Area

Jurisdiction	American Community Survey (2014-2018) Population	Estimated Population Exposed to the Slope-Failure Hazard Area		Estimated Population Exposed to the Rockfall-Rockslide/Debris Avalanche Hazard Area	
		Persons Exposed	Percent of Total	Persons Exposed	Percent of Total
Castle Pines (C)	10,573	0	0.0%	281	2.7%
Castle Rock (T)	59,680	442	0.7%	1,501	2.5%
Larkspur (T)	257	0	0.0%	2	0.9%
Lone Tree (C)	14,209	152	1.1%	0	0.0%
Parker (T)	52,563	56	0.1%	0	0.0%
Unincorporated Douglas County	191,332	188	0.1%	3,620	1.9%
Douglas County (Total)	328,614	839	0.3%	5,405	1.6%

Source: American Community Survey 2018 (ACS 2014-2018); Colorado Geological Survey, n.d.
Notes: C=City; T = Town

Impact on Life, Health, and Safety

Generally, a landslide event would be an isolated incidents and impact the populations within the immediate area of the incident. Specifically, the population located downslope of the landslide hazard areas are particularly vulnerable to this hazard. In addition to causing damages 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.

Impact on General Building Stock

Table 5-114 and Table 5-115 summarizes the estimated number of buildings currently built within the slope failure hazard and the rockfall hazard area. The Town of Castle Rock has the largest number of buildings

(170) located within the slope failure hazard area with an estimated replacement cost values of \$168 million. Furthermore, the City of Castle Pines has the highest percentage (2.6%) of buildings located in the rockfall hazard area, whereas Unincorporated Douglas County has the largest number of buildings in the rockfall hazard area. Overall, impacts from slope-failure are low for the County; 0.2% of the structure inventory is located within the slope failure hazard area and 1.7-percent is located within the rockfall hazard area. Additionally, 557 buildings are located in the debris flow area with a replacement cost value of \$270 million.

Table 5-114 Estimated Building Exposure to the Slope-Failure Hazard Area

Jurisdiction	Number of Buildings	Total Replacement Cost Value	Estimated Building Stock Exposed to the Slope-Failure Hazard Area			
			Number of Buildings	Percent of Total	Replacement Cost Value (RCV)	Percent of Total
Castle Pines (C)	3,701	\$4,995,772,208	0	0.0%	\$0	0.0%
Castle Rock (T)	24,262	\$28,003,310,038	170	0.7%	\$168,889,761	0.6%
Larkspur (T)	394	\$135,724,576	0	0.0%	\$0	0.0%
Lone Tree (C)	4,190	\$23,664,803,217	41	1.0%	\$49,678,029	0.2%
Parker (T)	17,864	\$23,597,914,712	19	0.1%	\$19,091,044	0.1%
Unincorporated Douglas County	84,745	\$102,018,837,713	85	0.1%	\$95,704,855	0.1%
Douglas County (Total)	135,156	\$182,416,362,464	315	0.2%	\$333,363,689	0.2%

Source: Douglas County GIS, 2020, RS Means 2020, Colorado Geological Survey, n.d.

Notes: C=City; T = Town

Table 5-115 Estimated Building Exposure to the Rockfall-Rockslide/Debris Avalanche Hazard Area

Jurisdiction	Number of Buildings	Total Replacement Cost Value	Estimated Building Stock Exposed to the Rockfall-Rockslide/Debris Avalanche Area			
			Number of Buildings	Percent of Total	Replacement Cost Value (RCV)	Percent of Total
Castle Pines (C)	3,701	\$4,995,772,208	97	2.6%	\$154,658,985	3.1%
Castle Rock (T)	24,262	\$28,003,310,038	590	2.4%	\$604,488,757	2.2%
Larkspur (T)	394	\$135,724,576	7	1.8%	\$1,188,219	0.9%
Lone Tree (C)	4,190	\$23,664,803,217	1	<0.1%	\$25,906,834	0.1%
Parker (T)	17,864	\$23,597,914,712	0	0.0%	\$0	0.0%
Unincorporated Douglas County	84,745	\$102,018,837,713	1,631	1.9%	\$1,226,678,761	1.2%
Douglas County (Total)	135,156	\$182,416,362,464	2,326	1.7%	\$2,012,921,555	1.1%

Source: Douglas County GIS, 2020, RS Means 2020, Colorado Geological Survey, n.d.

Notes: C=City; T = Town

Table 5-116 Building Stock Replacement Cost Value and Building Count within the Debris Flow Hazard Area in Douglas County

Jurisdiction	Number of Buildings	Total Replacement Cost Value	Estimated Building Stock Exposed to the Debris Flow Hazard Area			
			Number of Buildings	Percent of Total	Replacement Cost Value (RCV)	Percent of Total
Castle Pines (C)	3,701	\$4,995,772,208	0	0.0%	\$0	0.0%
Castle Rock (T)	24,262	\$28,003,310,038	7	<0.1%	\$7,823,267	<0.1%
Larkspur (T)	394	\$135,724,576	185	47.0%	\$45,357,554	33.4%
Lone Tree (C)	4,190	\$23,664,803,217	0	0.0%	\$0	0.0%
Parker (T)	17,864	\$23,597,914,712	0	0.0%	\$0	0.0%
Unincorporated Douglas County	84,745	\$102,018,837,713	365	0.4%	\$217,249,684	0.2%
Douglas County (Total)	135,156	\$182,416,362,464	557	0.4%	\$270,430,506	0.1%

Source: Douglas County GIS, 2020, RS Means 2020, Colorado Geological Survey, n.d.

Notes: C=City; T = Town

Impact on the Critical Facilities

It is recognized that a number of critical facilities are located in the slope failure or rockfall hazard area. Some of the critical facilities exposed to the hazard areas are potable water facilities dams, assisted living, and medical facilities. Impact to these resources could directly impact vulnerable population over 65 or impact the ability to evacuate if medical centers and assisted living facilities are disrupted. Table 5-117 and Table 5-118 summarize the distribution of critical facilities exposed to the geological hazard areas by critical facility type and jurisdiction. Overall, the County has 34 lifelines located within the slope failure or rockfall hazard area. The exposed lifelines are categorized into FEMA lifeline groupings and are summarized in Table 5-119, the majority of which are under the “food, water, or shelter” FEMA lifeline category. Table 5-120 and Table 5-121 show impacts on critical facilities and lifelines for debris flow hazard areas in Douglas County.

Table 5-117 Critical Facilities and Lifelines by Type in Slope-Failure Hazard Area in Douglas County

Jurisdiction	Critical Facilities Exposed to the Slope-Failure Hazard Area		
	Bridge	Municipal Building	Potable Well
Castle Pines (C)	0	0	0
Castle Rock (T)	0	0	0
Larkspur (T)	0	0	0
Lone Tree (C)	0	0	0
Parker (T)	0	0	0
Unincorporated Douglas County	1	1	2
Douglas County (Total)	1	1	2

Table 5-118 Critical Facilities and Lifelines in Rockfall-Rockslide/Debris Avalanche Hazard Area in Douglas County

Jurisdiction	Critical Facilities Exposed to the Rockfall-Rockslide/Debris Avalanche Hazard Area								
	Assisted Living	Bridge	Dam	Fire Station	Medical Care	Potable Water Tank	Potable Well	Primary Education	Recreation Site
Castle Pines (C)	0	0	0	0	0	0	0	0	0
Castle Rock (T)	2	0	0	0	0	0	0	0	0
Larkspur (T)	0	0	0	0	0	3	0	0	0
Lone Tree (C)	0	0	0	0	0	0	0	0	0
Parker (T)	0	0	0	0	0	0	0	0	0
Unincorporated Douglas County	1	1	5	1	2	0	14	1	2
Douglas County (Total)	3	1	5	1	2	3	14	1	2

Source: Douglas County GIS 2020; Colorado Geological Survey, n.d.
Notes: C=City; T = Town

Table 5-119 Lifelines in the Rockfall-Rockslide/Debris Avalanche and Slope-Failure Hazard Area in Douglas County

FEMA Lifeline Category	Number of Lifelines	Number of Lifelines Exposed to the Rockfall-Rockslide/Debris Avalanche Hazard Area	Number of Lifelines Exposed to the Slope-Failure Hazard Area
Food, Water, Shelter	428	17	2
Hazardous Material	22	0	0
Health and Medical	203	5	0
Safety and Security	239	7	1
Transportation	79	1	1
Douglas County (Total)	971	30	4

Source: Douglas County GIS 2020; Colorado Geological Survey, n.d.
Notes: C=City; T = Town

Table 5-120 Critical Facilities and Lifelines by Type in the Debris Flow Hazard Area in Douglas County

Jurisdiction	Critical Facilities Exposed to the Debris Flow Hazard Area						
	Bridge	Dam	Fire Station	Major Business	Potable Water Treatment Facility	Potable Well	Recreation Site
Castle Pines (C)	0	0	0	0	0	0	0
Castle Rock (T)	0	0	0	0	0	0	0
Larkspur (T)	0	0	0	1	1	0	0

Jurisdiction	Critical Facilities Exposed to the Debris Flow Hazard Area						
	Bridge	Dam	Fire Station	Major Business	Potable Water Treatment Facility	Potable Well	Recreation Site
Lone Tree (C)	0	0	0	0	0	0	0
Parker (T)	0	0	0	0	0	0	0
Unincorporated Douglas County	1	3	1	0	0	4	2
Douglas County (Total)	1	3	1	1	1	4	2

Source: Douglas County GIS 2020; Colorado Geological Survey, n.d.
 Notes: C=City; T = Town

Table 5-121 Critical Facilities and Lifelines in the Debris Flow Hazard Area in Douglas County

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Exposed to Debris Flow Hazard Area			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Castle Pines (C)	20	12	0	0.0%	0	0.0%
Castle Rock (T)	108	100	0	0.0%	0	0.0%
Larkspur (T)	15	9	2	13.3%	1	11.1%
Lone Tree (C)	54	42	0	0.0%	0	0.0%
Parker (T)	140	105	0	0.0%	0	0.0%
Unincorporated Douglas County	827	703	11	1.3%	9	1.3%
Douglas County (Total)	1,164	971	13	1.1%	10	1.0%

Source: Douglas County GIS 2020; Colorado Geological Survey, n.d.
 Notes: C=City; T = Town

Impact on the Economy

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.

Impact on the Environment

Geological hazards can impose direct and indirect impacts on society. Direct costs include the actual damage sustained by buildings, property and infrastructure. Indirect costs, such as clean-up costs, business interruption, loss of tax revenues, reduced property values, and loss of productivity are difficult to measure (USGS, 2003).

Cascading Impacts to Other Hazards

As stated earlier, slope failures include movements by sliding, spreading, flowing, toppling, and falling. In addition to changes in topography, vegetation and wildlife habitats may be damaged or destroyed, and soil and sediment runoff will accumulate downslope potentially blocking waterways and roadways and

impacting quality of streams and other water bodies. Additional environmental impacts include loss of forest productivity.

Some of the largest debris-flow events happen during the first post-fire storm season. It takes less rainfall to trigger debris in areas that were burned than in areas that were not affected by fires (USGS 2020). Fires reduce the rate in which water can permeate the soil triggering debris flow occurrence can by surface erosion and land sliding caused by steep slopes (USGS 2020). To learn more about flooding and wildfire hazards refer to section 5.4.6 and 5.4.17 respectively.

Future Changes that May Impact Vulnerability

Understanding future changes that affect vulnerability in the County can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The County considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development
- Projected changes in population
- Other identified conditions as relevant and appropriate, including the impacts of climate change.

Projected Development

Any new development in terms of structures and infrastructure (e.g. highways and streets) in debris flow and slope failure areas could be potentially impacted. Proper grading and building regulations/code including proper slab design and emplacement procedures can mitigate structural damage to new development in areas where these hazard areas exist.

Projected Changes in Population

The County experienced an increase in population between the 2010 Census (285,465) and the estimated 2018 Community Survey estimated population of 328,614. The population of the County is expected to increase over the next few years. Increasing population trends in the major metropolitan areas will lead to an increase in development and construction could occur in areas of slope failure or rockfall hazard areas. There is one new development site located within the slope failure hazard area and no new development sites located within the rockfall hazard area. Refer to section 9 for potential new development in the County and their proximity to the geological hazards.

Climate Change

A combination of dry and wet weather leads to damages from slope-failure and debris flows/rockfall. As the climate changes, it could increase the risk of the severity of these hazards. In particular, the increase of non-snow precipitation can impact

Change of Vulnerability Since the 2015 HMP

For this hazard mitigation plan update, the slope-failure and rockfall spatial layer from the Colorado Geological Survey was referenced to determine areas within Douglas County that are vulnerable to slope failure. Population statistics have also been updated using the 5-Year 2014-2018 American Community Survey Population Estimates. A customized general building stock was created using RS Means 2020 replacement cost values, building footprints and tax assessor and parcel information provided by the County. Additionally, the critical facility inventory was reviewed by Douglas County.

Overall, this vulnerability assessment uses a more accurate and updated building inventory which provides more accurate estimated exposure and potential losses for Douglas County.

Identified Issues

The following issues were identified for the Slope Failure hazard:

- Slope failures triggered by meteorological events may increase due to climate change impacts resulting in increased precipitation.
- Slope failures in Douglas County can disrupt roadways and infrastructure, thereby creating challenges for emergency response in the event that a slope failure occurs.

5.4.17 Wildfire

This section provides the hazard profile and vulnerability assessment for the wildfire hazard for Douglas County.

Profile

Hazard Description

A wildfire is an unplanned fire that burns natural areas such as forests, grasslands, or prairies. They can threaten lives and property if not contained. Wildfires can be defined as wildland, interface or intermix, catastrophic, and prescribed fires. Wildfires are fueled almost exclusively by natural vegetation while interface or intermix fires are urban/wildland fires in which vegetation and the built environment provide the fuel. Wildfires can occur anytime of the year in the State of Colorado (State of Colorado HMP 2018). In Douglas County, wildfires are an ongoing concern, especially fires that occur in the wildland/urban interface (Douglas County HMP 2015).

Figure 5-54. Fire Burning in Parker, October 13, 2016



Three main factors influence wildfire behavior - topography, fuel, and weather. Other hazards can contribute to the potential for wildfires or can influence wildfire behavior. High winds can down power lines, earthquakes can crack gas lines, and lightning can spark fires. Lightning is a major cause of structural fires and wildfires. Drought conditions increase wildfire potential by decreasing fuel moisture. Warm winters, hot and dry summers, severe drought, insect and disease infestations, years of fire suppression, and growth in the Wildland-Urban Interface (WUI) continue to increase wildfire risk and the potential for catastrophic wildland fires in Colorado (State of Colorado HMP 2018).

Extent

Colorado Wildfire Risk Assessment Portal (CO-WRAP) is the primary tool used by the Colorado Forest Atlas to deploy risk information and create awareness about wildfire issues across the State of Colorado. CO-WRAP provides Characteristic Fire Intensity Scale (FIS). The FIS determines potential fire intensity based on high to extreme weather conditions, fuels, and topography where there are five classes: Lowest to

Highest Intensity. Table 5-122 shows the distribution of the FIS in Douglas County (Colorado Forest Atlas, 2019).

Wildfire risk ranges from lowest, low, moderate, high, and highest risk areas; 38.1-percent of the County is located in the moderate risk area and 32.5-percent of the County is located in the high-risk area. Table 5-122 summarizes the acres exposed to the wildfire risk areas in Douglas County.

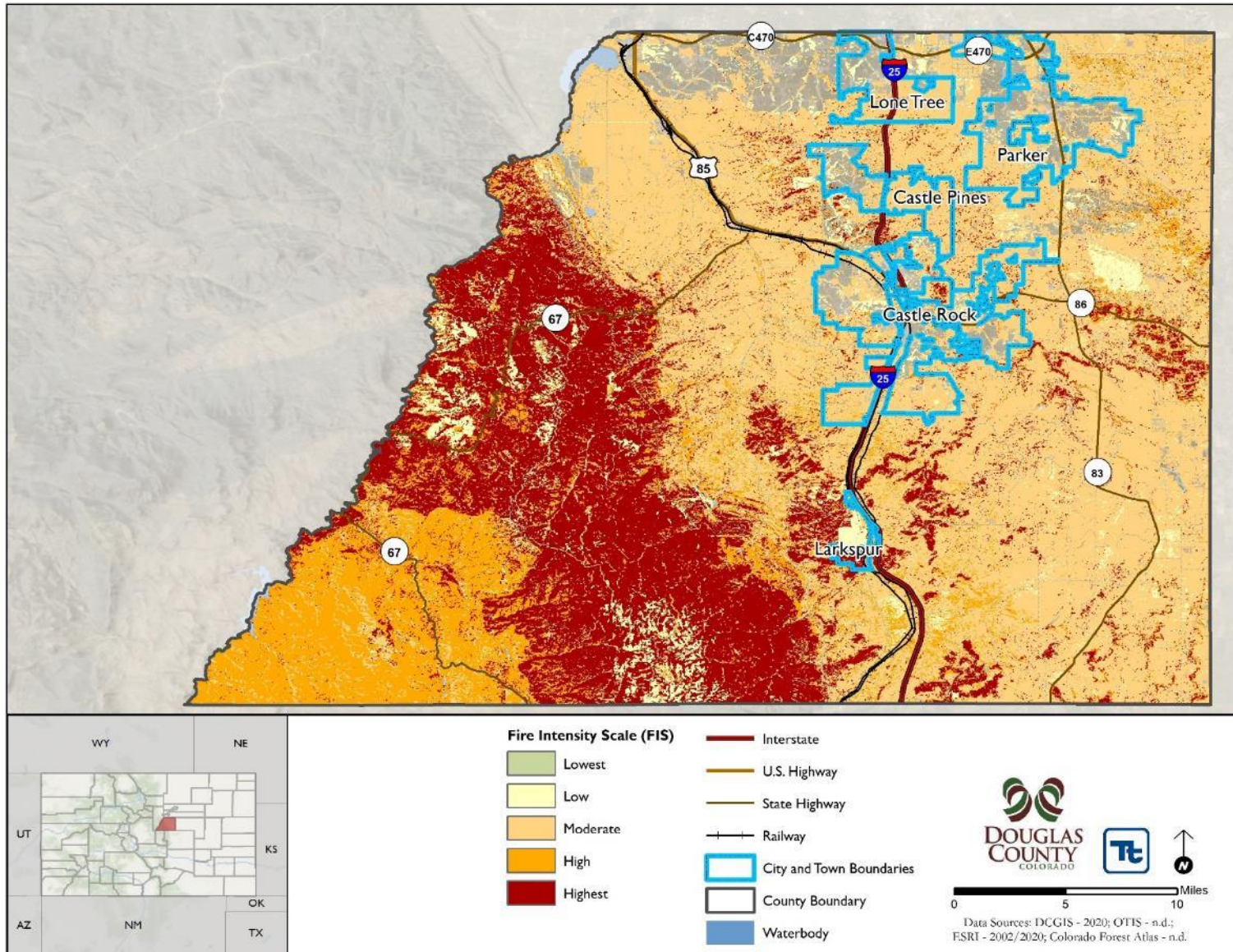
Table 5-122 Land Acres exposed to Wildfire Risk Hazard Areas in Douglas County

Hazard Area Type	Acres Exposed to Wildfire Hazard Areas	Percent of Total
Highest Wildfire Risk Area	31,369	5.8%
High Wildfire Risk Area	174,788	32.5%
Moderate Wildfire Risk Area	205,045	38.1%
Low Wildfire Risk Area	40,492	7.5%
Lowest Wildfire Risk Area	36,322	6.8%
Douglas County (Total)	537,585	

Source: USGS National Land Cover Data 2016; Colorado Forest Atlas, 2017

Notes: C=City; T = Town; Water areas were not included in acreage totals

Figure 5-55 CO-WRAP Fire Intensity Scale for Douglas County



Wildfire events can range in size and intensity; much of which depends on weather and human activity.

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. Fire behavior is one of the most important aspects of wildfires because almost all actions in response to a fire depend on how it behaves. Potential for wildfire and its subsequent development (growth) and severity are controlled by the three principal factors of topography, fuel, and weather, described as follows:

Topography – Topography can powerfully influence wildfire behavior. 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 spreads 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 (FEMA 1997).

Fuel – Fuels are classified by weight or volume (fuel loading) and by type. Fuel loading is used to describe the amount of vegetative material available. If this amount doubles, energy released can also double. Each fuel type is given a burn index—an estimate of amount of potential energy that may be released, effort required to ignite a fire in a given fuel and 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 (FEMA 1997). According to the U.S. Forest Service (USFS), a forest stand may consist of several layers of live and dead vegetation in the understory (surface fuels), midstory (ladder fuels), and overstory (crown fuels):

- Surface fuels consist of grasses, shrubs, litter, and woody material lying on the ground. Surface fires burn low vegetation, woody debris, and litter. Under the right conditions, surface fires reduce likelihood that future wildfires will grow into crown fires.
- Ladder fuels consist of live and dead small trees and shrubs; live and dead lower branches from larger trees, needles, vines, lichens, mosses; and any other combustible biomass between the top of surface fuels and bottom of overstory tree crowns.
- Crown fuels are suspended above the ground in treetops or other vegetation and consist mostly of live and dead fine material. When historically low-density forests become overcrowded, tree crowns may merge and form a closed canopy. Tree canopies constitute the primary fuel layer in a forest crown fire (USFS 2003).

Fire behavior is strongly influenced by these fuels.

Weather / Air Mass – Weather is the most important factor influencing fire behavior, but it is always changing. Air mass, defined by the National Weather Service (NWS) as a body of air covering a relatively wide area and exhibiting horizontally uniform properties, can affect wildfire through climatic factors that include temperature and relative humidity, local wind speed and direction, cloud cover, precipitation amount and duration, and stability of the atmosphere at the time of the fire (NWS 2009). Extreme weather leads to extreme events, 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 radically and suddenly change in speed and direction, causing similar changes in fire activity. The rate of spread of a fire varies directly with wind velocity. Winds may play a dominant role in directing the course of a fire. The most damaging firestorms are typically marked by high winds (FEMA 1997).

Several tools are available to estimate fire potential, extent, danger, and growth, including, but not limited to, the following:

The *Colorado State Forest Service's Wildfire Risk Public Viewer* contains mapped wildfire data that includes historical occurrences, burn probability, fire intensity, and social vulnerability.

The *Wildland Fire Assessment System (WFAS)* is an internet-based information system that provides a national view of weather and fire potential, including national fires danger, weather maps, and satellite-derived "greenness" maps (USFS, No Date [n.d.]).

The *Fire Potential Index (FPI)* is derived by combining information on daily weather and vegetation condition and can identify areas most susceptible to fire ignition (Burgan et al. 2000).

Fuel Moisture (FM) content is quantity of water in a fuel particle expressed as a percent of oven-dry weight of the fuel particle and is an expression of cumulative effects of past and present weather events, to help evaluate the effects of current or future weather on fire potential (Burgan et al. 2000).

The *Keetch-Byram Drought Index (KBDI)* is designed for fire potential assessment and is a number representing the net effect of evapotranspiration and precipitation in producing cumulative moisture deficiency in deep duff and upper soil layers (USFS n.d.).

The *Haines Index*, also known as the Lower Atmosphere Stability Index, is a fire weather index based on stability and moisture content of the lower atmosphere that measures potential for existing fires to become large fires (USFS n.d.).

The *Buildup Index (BUI)* is a number that reflects combined cumulative effects of daily drying and precipitation in fuels with a 10-day time lag constant (North Carolina Forest Service 2007).

Location

The Wildland-Urban Interface (WUI) definition in the Federal Register was developed to identify communities at risk in the vicinity of public lands; the area where houses meet or intermingle with undeveloped vegetation. The entire County can expect to experience wildfires in the future; especially the areas of the County located within the WUI area. The intensity and severity of the wildfire may vary within the County due to variations in wildland vegetation, defensible space, weather conditions and fuel sources.

According to the Wildland-Urban Interface Risk Index created by the Colorado State Forest Service, 45% of Douglas County residents live in areas with an index of 2, indicating nearly half of residents live in an area characterized as having between a low and least negative impact for wildfire risk. The proportion of residents at no risk who do not live within the Wildland-Urban Interface is 18%, whereas the proportion of those who live in the area with the highest negative impact is 14%.

In addition to the WUI, Colorado Forest Atlas created a wildfire risk spatial layer that calculates the probability of loss or harm from a wildfire by combining burn probability and fire effects. Areas affected are weighted by population, forest assets, riparian assets, and drinking water importance values (Colorado

State Forest Service, 2018). Approximately 35.5-percent of the County’s population is located within the wildfire risk area and 50,760 buildings are exposed to the wildfire risk area. Figure 5-56 through Figure 5-60 shows the wildfire risk area in Douglas County.

Figure 5-56 Wildfire Risk in Douglas County

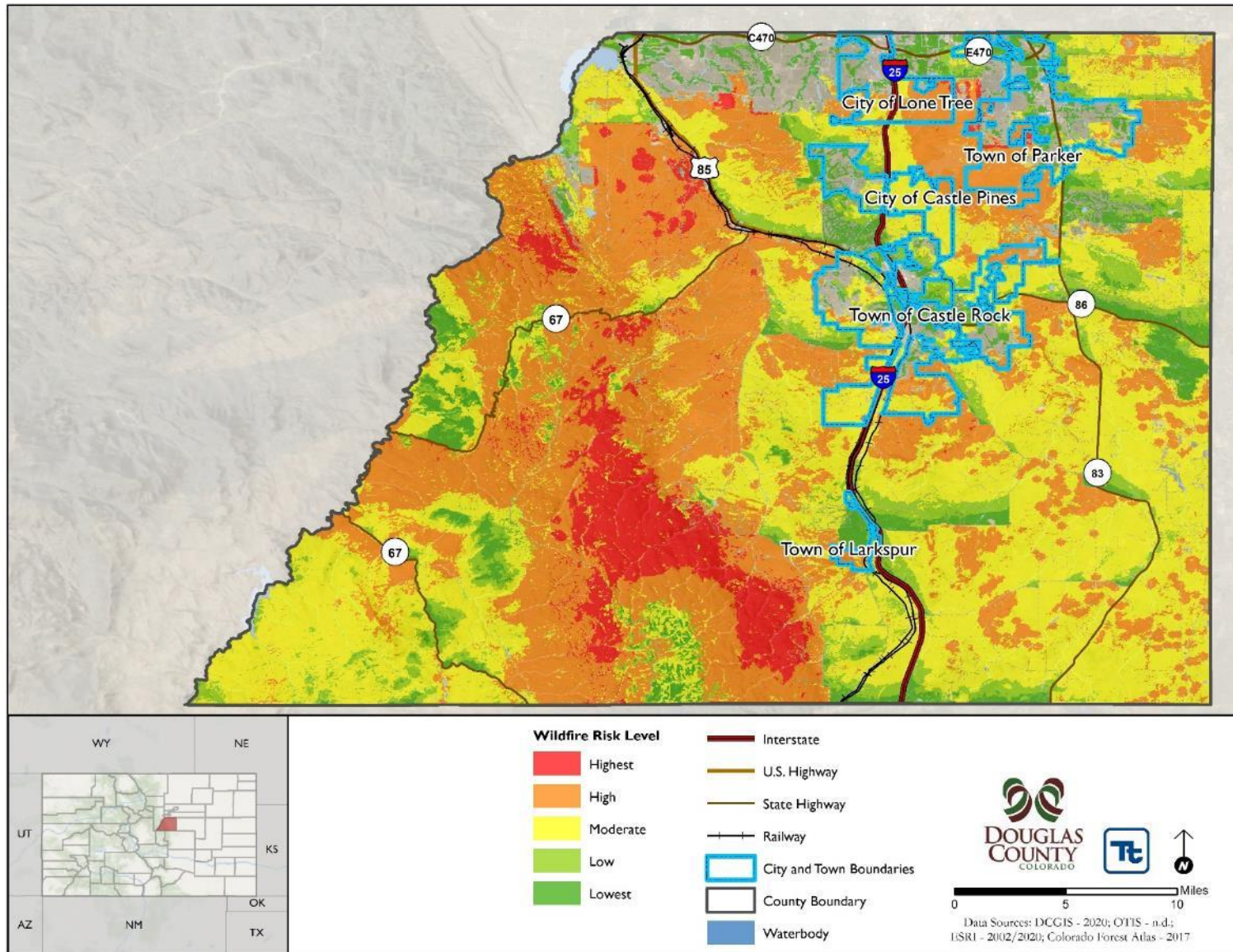


Figure 5-57 Wildfire Risk in Douglas County (Northwest)

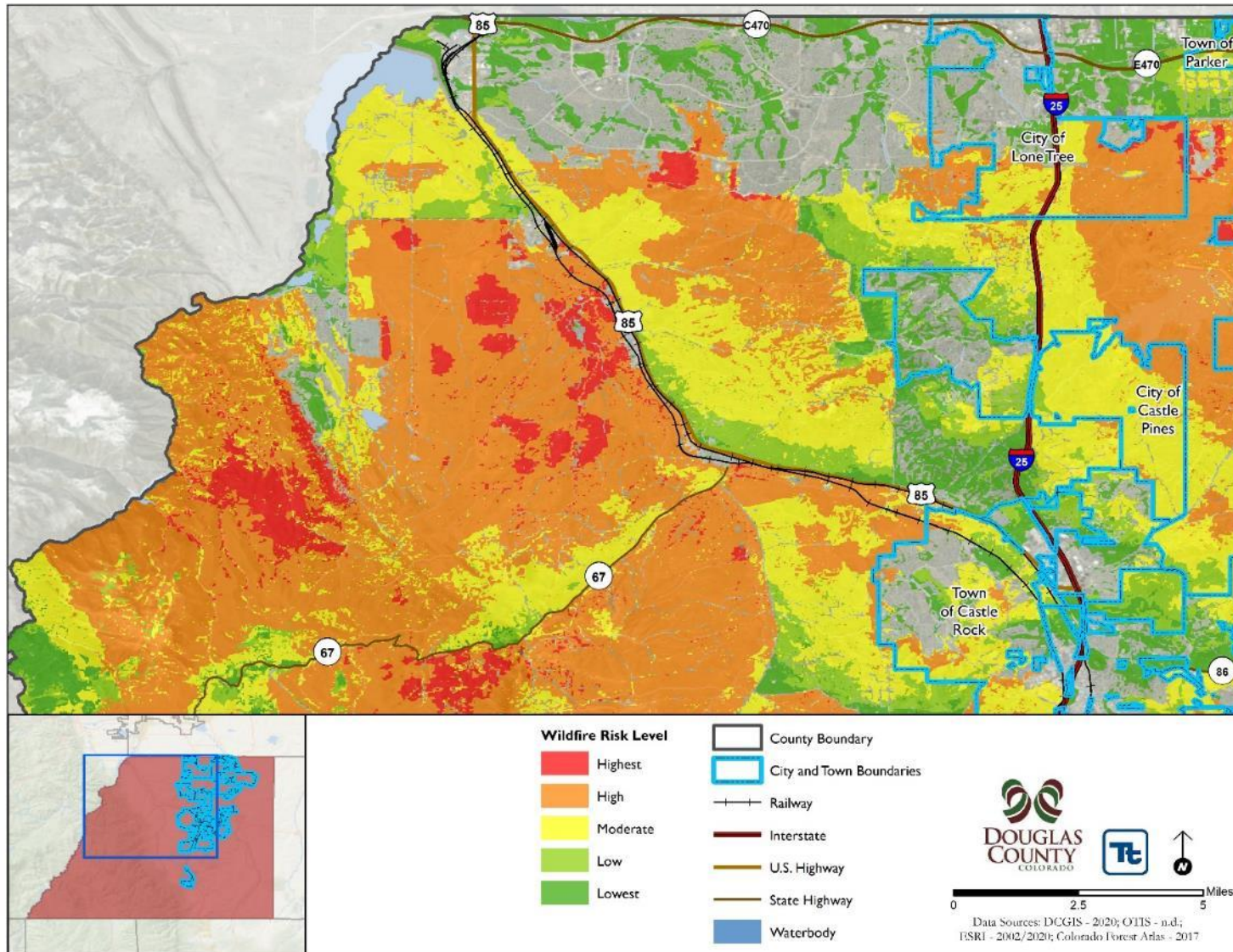


Figure 5-58 Wildfire Risk in Douglas County (Northeast)

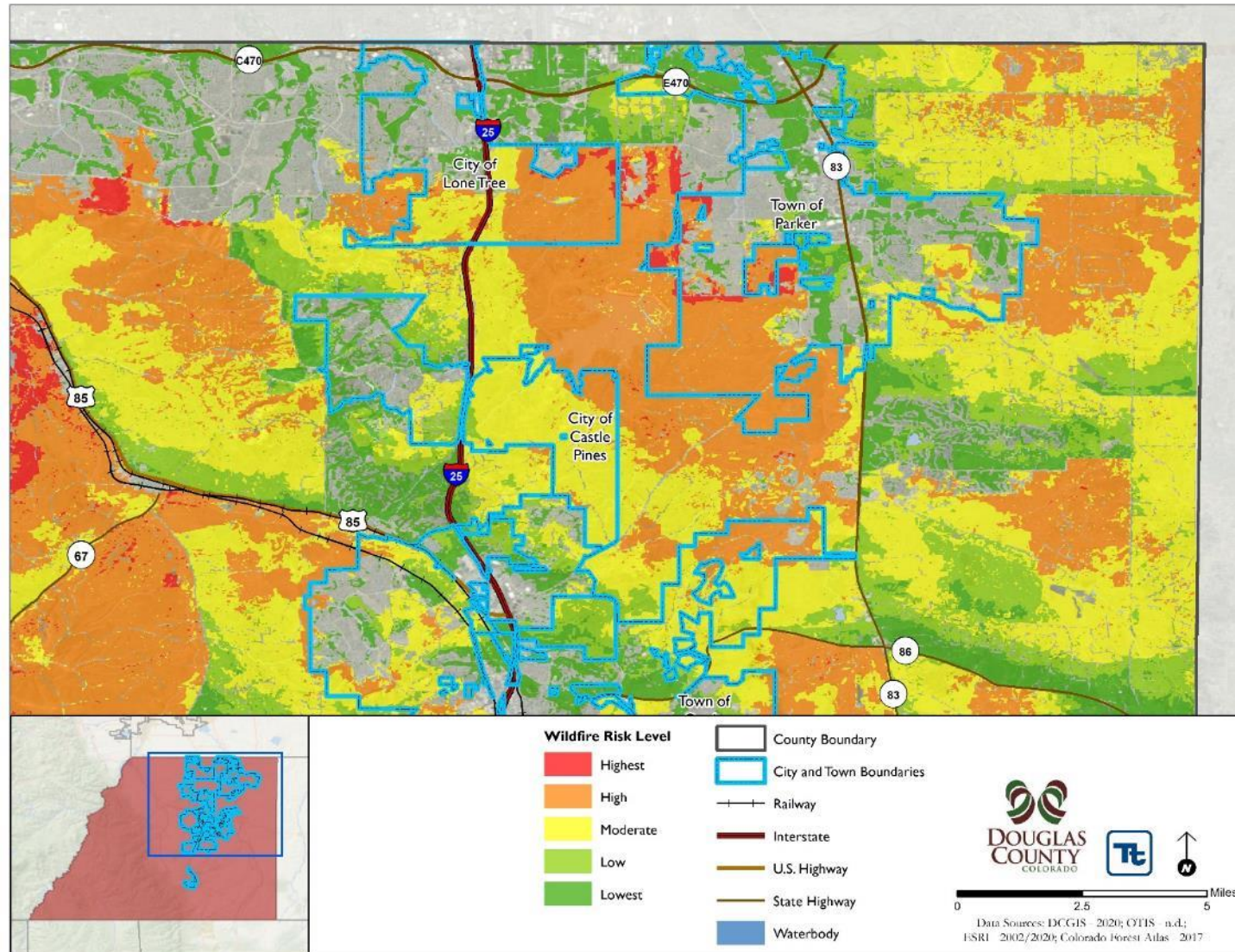


Figure 5-59 Wildfire Risk in Douglas County (Southwest)

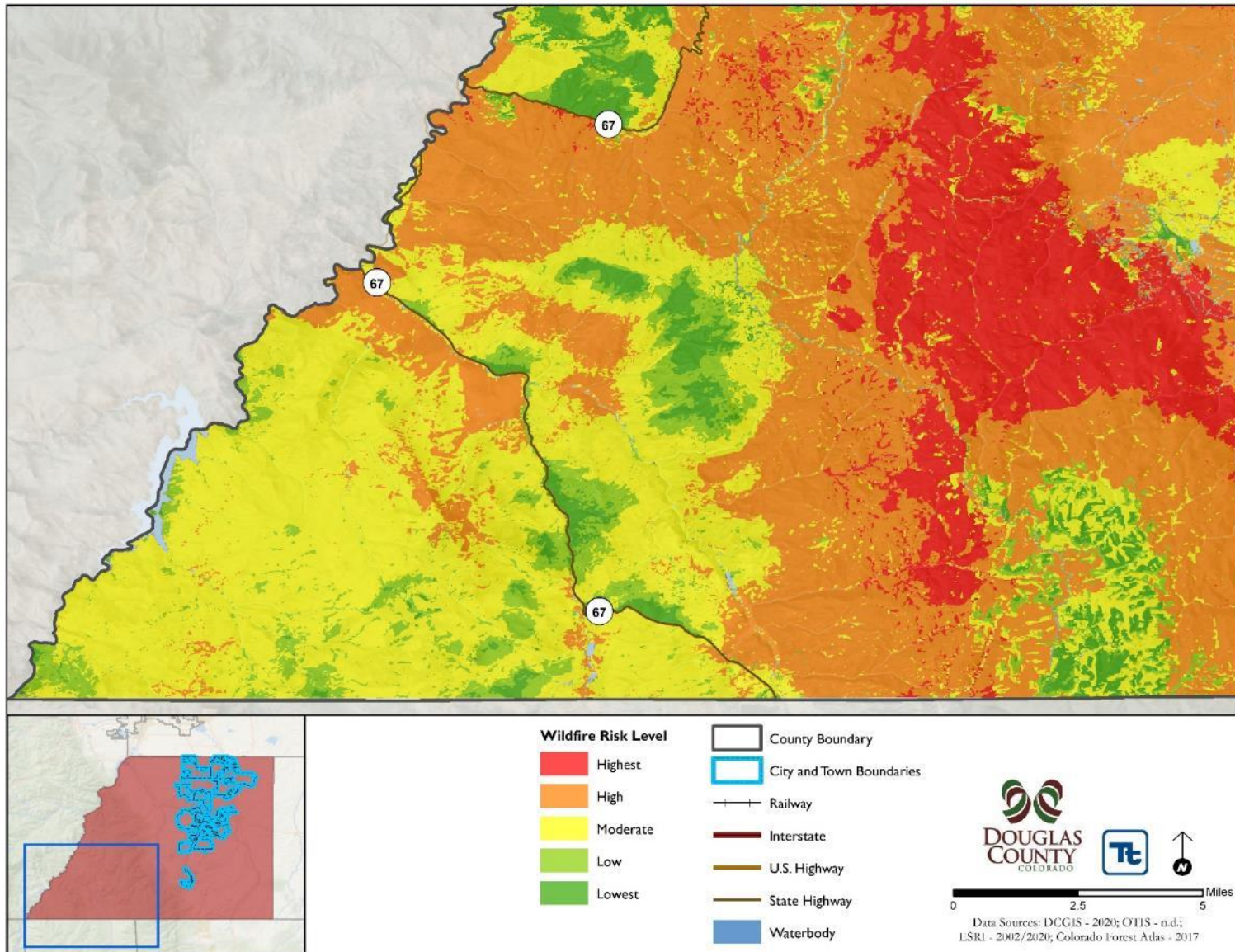
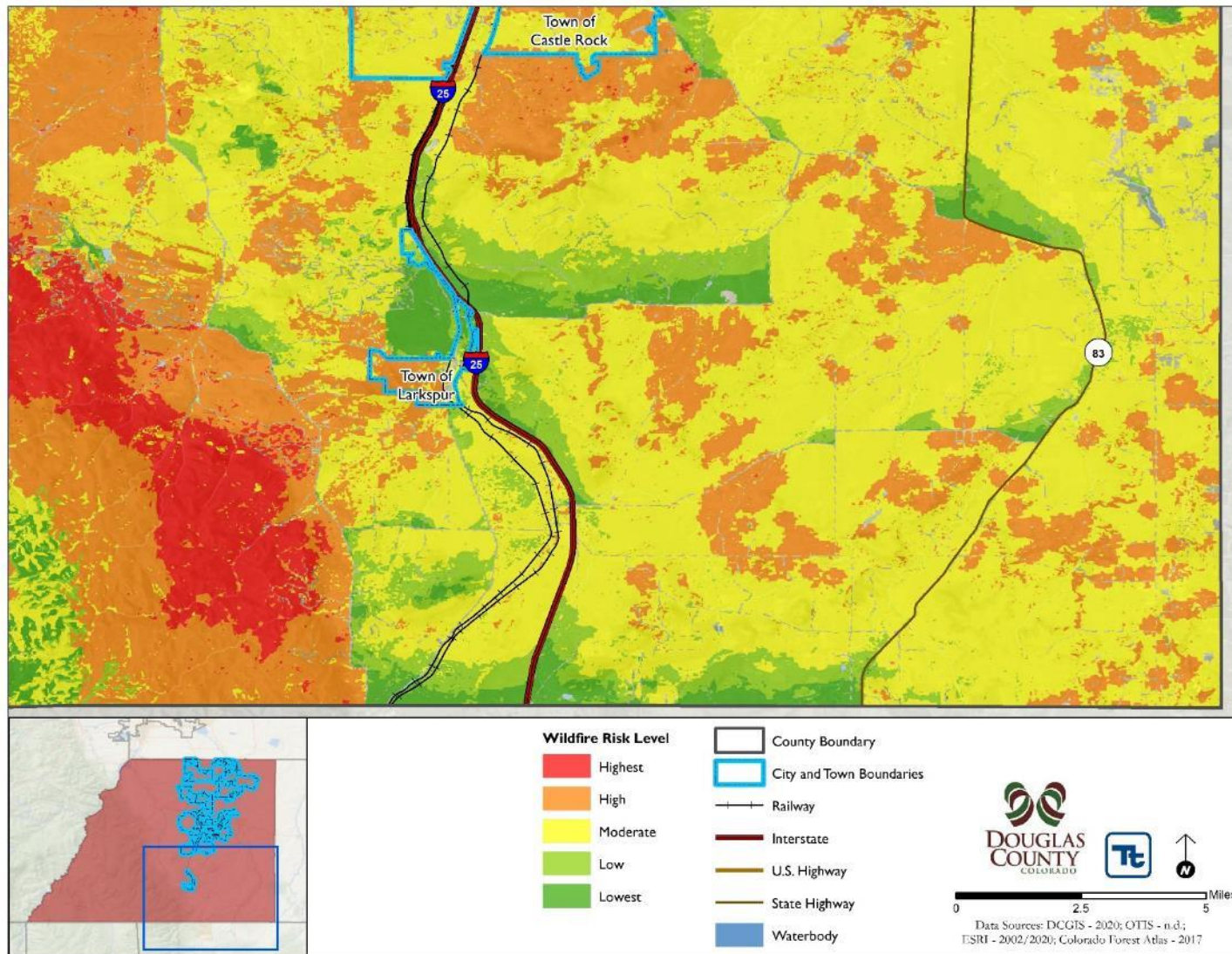


Figure 5-60 Wildfire Risk in Douglas County (Southeast)



Previous Occurrences and Losses

Between 1953 and January 2021, FEMA included the State of Colorado in 71 fire-related major disaster (DR), emergency (EM), or fire management assistance (FM) declarations. Generally, these disasters cover a wide region of the state; therefore, they may have impacted many counties. Douglas County was included in three fire-related FEMA declarations.

Table 5-123 Wildfire-Related FEMA Declarations for Douglas County, 1953 to 2020

FEMA Declaration Number	Date(s) of Event	Incident Type	Incident Title
DR-1421	June 19, 2002	Fire	Hayman Fire
FS-2407	May 23, 2002	Fire	Schoonover Fire
FM-2510	October 29, 2003	Fire	Cherokee Ranch Wildfire

Source: FEMA 2020, USDA 2020

According to the NOAA-NCEI Storm Events Database, there was one recorded wildfire impacting Douglas County from 1996 to 2020. According to the National Interagency Fire Center, there have been six reports of wildfires within Douglas County from 2003 to 2020 (NIFC 2020). Lastly, the USGS Federal Wildland Fire Occurrence Map Viewer was queried for any wildfires in Douglas County. From 1980 to 2020, the map showed a number of wildfire events in the County. Major wildfire events are discussed in the following table.

Table 5-124 Previous Wildfire Events in Douglas County, 2002 to 2020

Date(s) of Event	Incident Title	FEMA Declaration Number	County Designated?	Description
May 23, 2002	Schoonover Fire	FS-2407	Yes	Nearly 3,500 acres of Pike National Forest in southwestern Douglas County burned near Spring Gulch.
June 19, 2002	Hayman Fire	DR-1421	Yes	Until recently, the Hayman Fire was the most damaging in the State’s history. Douglas County evacuated 19 neighborhood and saw \$8 million in property damage.
October 29, 2003	Cherokee Ranch Wildfire	FM-2510	Yes	The Cherokee Ranch fire burned 1,042 acres near Daniels Park
March 24, 2011	Burning Tree Fire	N/A	N/A	Approximately 1,662 acres burned in Bayou Gulch. The area burned stretched from Bayou Gulch Regional Park to East Burning Tree Lane.
April 26, 2012	Illinois Gulch Fire (Incident 332)	N/A	N/A	Approximately 85 acres burned near Illinois Gulch near Turkey Track.
June 24, 2012	Trout Creek	N/A	N/A	A 40 acre fire burned near Trout Creek.
August 26, 2015	Greenland Open Space Fire	N/A	N/A	A small brush fire burned at the Greenland Rangeland near Larkspur.
February 6, 2017	South Lake Gulch Road Fire	N/A	N/A	An electrical transformer was suspected of generating a 70-acre brush fire in the vicinity of South Lake Gulch Road south of Castle Rock. No structures were damaged and the fire occurred on private property.
April 13, 2017	Turkey Track 7	N/A	N/A	A wildfire resulting from visitor activity burned 40 acres near a shooting range in Pike National Forest west of state Highway 67.

Source: Douglas County Sheriff; NIFC

Climate Change Projections

The size and number of western forest fires has increased significantly since 1985. Droughts and higher temperatures are anticipated to increase the extent, frequency, and severity of wildfires in Colorado. According to the Colorado State Forest Service, Colorado's climate has warmed by two degrees over the past 30 years. Further warming is expected by another 2.5 to 6.5 degrees by 2050 based on global climate models. Continued warming will reduce snowpack levels, resulting in lower runoff and water availability for ecosystems. The US Forest Service anticipates that more fire is expected in rangelands and western forests due to the prevalence of ecosystem types in which drought is correlated with burned area.

Probability of Future Occurrences

In Douglas County, wildfire events will continue to occur. The likelihood of one of those fires attaining significant size and intensity cannot be predicted and is highly dependent on environmental conditions and firefighting response. Climate change is also likely to increase the probability of future wildfires. Prolonged periods of drought caused by climate change can potentially increase the length of the wildfire season and provide a more favorable climate for ignition.

Colorado experiences nearly 2,500 wildfires annually, the vast majority of which are contained under 100 acres. Douglas County has seen six significant wildfires during the last decade and will continue to be at risk for future fires owing to its wildland-urban interface, vast forests in Pike National Forest, and climatic conditions (State of Colorado 2018).

In Section 5.3, the ranking of identified hazards of concern for Douglas County is provided. The probability of occurrence, or likelihood of the event, is one parameter used for ranking hazards. Based on historical records and input from the Planning Committee, the probability of occurrence for wildfire in the county is considered 'frequent' (hazard event is likely to occur within 25 years).

Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed and vulnerable in the identified hazard area. A spatial analysis was conducted using the 2017 wildfire risk spatial layer from the Colorado Forest Atlas. For the purposes of the assessment, an asset (population, structures, critical facilities, and lifelines) is considered exposed and potentially vulnerable to the wildfire hazard if it is located in the wildfire risk hazard area. The wildfire risk spatial layer calculates the probability of loss or harm from a wildfire by combining burn probability and fire effects. Areas affected are weighted by population, forest assets, riparian assets, and drinking water importance values (Colorado State Forest Service, 2018).

Impact on Life, Health and Safety

Potential losses from wildfire include human health and life of residents and responders, structures, infrastructure and natural resources. The most vulnerable populations include emergency responders and those within a short distance of the interface between the built environment and the wildland environment. Based on the spatial analysis, 116,499 individuals, or 35.5- percent of the County's population, are located in the wildfire risk area. Refer to Table 5-125 which summarizes the estimated population living in the hazard area.

Of the population exposed, the most vulnerable include the economically disadvantaged and the population over age 65. In Douglas County, there are 11,333 persons in poverty and 35,801 persons over 65 years old (American Community Survey 2018). Economically disadvantaged populations are more vulnerable because they are likely to evaluate their risk and make decisions to evacuate based on net economic impacts on their families. The population over age 65 is also more vulnerable because they are more likely to seek or need medical attention that may not be available due to isolation during a wildfire event, and they may have more difficulty evacuating. Smoke and air pollution from wildfires can be a severe health hazard, especially for sensitive populations, including children, the elderly, and those with respiratory and cardiovascular diseases. Smoke generated by wildfire consists of visible and invisible emissions that contain particulate matter (soot, tar, water vapor, and minerals), gases (carbon monoxide, carbon dioxide, nitrogen oxides), and toxics (formaldehyde, benzene). Emissions from wildfires depend on the type of fuel, the moisture content of the fuel, the efficiency (or temperature) of combustion, and the weather. Public health impacts associated with wildfire include difficulty in breathing, odor, and reduction in visibility.

Based on the analysis, an estimated 116,499 residents, or approximately 35.5-percent of the County's population, are located in the wildfire risk hazard area. The Town of Castle Rock has 34.9-percent or 20,800 individuals located in the wildfire risk area and Douglas County's unincorporated area has 42.2-percent or 80,737 individuals located in the wildfire risk area.

Table 5-125 Estimated Population Located in the Wildfire Risk Hazard Areas in Douglas County

Jurisdiction	American Community Survey (2014-2018) Population	Estimated Population Exposed to the Wildfire Risk Areas											
		Highest Wildfire Risk Area		High Wildfire Risk Area		Moderate Wildfire Risk Area		Low Wildfire Risk Area		Lowest Wildfire Risk Area		All Wildfire Risk Areas	
		Number of People	Percent of Total	Number of People	Percent of Total	Number of People	Percent of Total	Number of People	Percent of Total	Number of People	Percent of Total	Number of People	Percent of Total
Castle Pines (C)	10,573	0	0.0%	0	0.0%	586	5.5%	135	1.3%	920	8.7%	1,640	15.5%
Castle Rock (T)	59,680	8	<0.1%	6,507	10.9%	6,491	10.9%	2,482	4.2%	5,313	8.9%	20,800	34.9%
Larkspur (T)	257	0	0.0%	118	45.8%	48	18.8%	10	3.9%	7	2.7%	183	71.2%
Lone Tree (C)	14,209	0	0.0%	689	4.9%	159	1.1%	11	0.1%	1,123	7.9%	1,982	14.0%
Parker (T)	52,563	1,349	2.6%	2,423	4.6%	2,598	4.9%	1,221	2.3%	3,565	6.8%	11,156	21.2%
Unincorporated Douglas County	191,332	5,309	2.8%	29,193	15.3%	25,448	13.3%	6,833	3.6%	13,954	7.3%	80,737	42.2%
Douglas County (Total)	328,614	6,665	2.0%	38,930	11.8%	35,331	10.8%	10,692	3.3%	24,881	7.6%	116,499	35.5%

Source: American Community Survey 2018 (ACS 2014-2018); Colorado Forest Atlas, 2017

Notes: C=City; T = Town

Impact on General Building Stock

The most vulnerable structures to wildfire events are those within wildfire risk hazard area. Buildings constructed of wood or vinyl siding are generally more likely to be impacted by the fire hazard than buildings constructed of brick or concrete. To estimate the buildings exposed to the wildfire hazard, wildfire risk hazard areas were overlaid upon the updated building inventory at the structure level. The replacement cost value of the structures with their center in the wildfire risk hazard areas were totaled (refer to Table 5-126, Table 5-127, and Table 5-128 for the distribution of estimated exposure within the high, high, moderate, low, and lowest wildfire risk areas). Overall, 50,760 buildings with a replacement cost value of \$55.8 billion are exposed to the wildfire risk hazard area in Douglas County.

Table 5-126 Building Stock Replacement Cost Value and Building Count within the Wildfire Risk Hazard Area in Douglas County (All Risk Areas)

Jurisdiction	Number of Buildings	Total Replacement Cost Value (RCV)	Estimated Building Stock Exposed to Wildfire Risk Areas Highest, High, Moderate, Low, Lowest Wildfire Risk Area			
			Number of Buildings	Percent of Total	Replacement Cost Value (RCV)	Percent of Total
Castle Pines (C)	3,701	\$4,995,772,208	593	16.0%	\$936,182,189	18.7%
Castle Rock (T)	24,262	\$28,003,310,038	8,318	34.3%	\$10,019,034,981	35.8%
Larkspur (T)	394	\$135,724,576	279	70.8%	\$80,876,628	59.6%
Lone Tree (C)	4,190	\$23,664,803,217	572	13.7%	\$3,346,930,260	14.1%
Parker (T)	17,864	\$23,597,914,712	3,838	21.5%	\$5,783,119,895	24.5%
Unincorporated Douglas County	84,745	\$102,018,837,713	37,160	43.8%	\$35,588,600,017	34.9%
Douglas County (Total)	135,156	\$182,416,362,464	50,760	37.6%	\$55,754,743,970	30.6%

Source: Douglas County GIS 2020; Colorado Forest Atlas, 2017

Notes: C=City; T = Town

Table 5-127 Building Stock Replacement Cost Value and Building Count within the Wildfire Risk Hazard Area in Douglas County (Highest, High, and Moderate Risk Areas)

Jurisdiction	Number of Buildings	Total Replacement Cost Value (RCV)	Estimated Building Stock Exposed to Wildfire Risk Areas											
			Highest Wildfire Risk Area				High Wildfire Risk Area				Moderate Wildfire Risk Area			
			Number of Buildings	Percent of Total	Replacement Cost Value (RCV)	Percent of Total	Number of Buildings	Percent of Total	Replacement Cost Value (RCV)	Percent of Total	Number of Buildings	Percent of Total	Replacement Cost Value (RCV)	Percent of Total
Castle Pines (C)	3,701	\$4,995,772,208	0	0.0%	\$0	0.0%	0	0.0%	\$0	0.0%	213	5.8%	\$223,843,532	4.5%
Castle Rock (T)	24,262	\$28,003,310,038	4	<0.1%	\$3,109,077	<0.1%	2,533	10.4%	\$2,397,992,336	8.6%	2,601	10.7%	\$3,495,197,936	12.5%
Larkspur (T)	394	\$135,724,576	0	0.0%	\$0	0.0%	162	41.1%	\$34,929,551	25.7%	79	20.1%	\$25,085,506	18.5%
Lone Tree (C)	4,190	\$23,664,803,217	1	<0.1%	\$2,224,056	<0.1%	194	4.6%	\$234,541,678	1.0%	47	1.1%	\$403,511,476	1.7%
Parker (T)	17,864	\$23,597,914,712	436	2.4%	\$456,320,686	1.9%	800	4.5%	\$854,095,276	3.6%	868	4.9%	\$1,055,340,083	4.5%
Unincorporated Douglas County	84,745	\$102,018,837,713	2,309	2.7%	\$2,116,932,019	2.1%	13,520	16.0%	\$11,273,604,704	11.1%	11,955	14.1%	\$8,340,916,002	8.2%
Douglas County (Total)	135,156	\$182,416,362,464	2,750	2.0%	\$2,578,585,838	1.4%	17,209	12.7%	\$14,795,163,546	8.1%	15,763	11.7%	\$13,543,894,534	7.4%

Source: Douglas County GIS 2020; Colorado Forest Atlas, 2017

Notes: C=City; T = Town

Table 5-128 Building Stock Replacement Cost Value and Building Count within the Wildfire Risk Hazard Area in Douglas County (Low, Lowest, Risk Areas)

Jurisdiction	Number of Buildings	Total Replacement Cost Value (RCV)	Estimated Building Stock Exposed to Wildfire Risk Areas							
			Low Wildfire Risk Area				Lowest Wildfire Risk Area			
			Number of Buildings	Percent of Total	Replacement Cost Value (RCV)	Percent of Total	Number of Buildings	Percent of Total	Replacement Cost Value (RCV)	Percent of Total
Castle Pines (C)	3,701	\$4,995,772,208	52	1.4%	\$62,062,087	1.2%	328	8.9%	\$650,276,570	13.0%
Castle Rock (T)	24,262	\$28,003,310,038	991	4.1%	\$1,173,882,972	4.2%	2,189	9.0%	\$2,948,852,660	10.5%
Larkspur (T)	394	\$135,724,576	26	6.6%	\$13,759,356	10.1%	12	3.0%	\$7,102,215	5.2%
Lone Tree (C)	4,190	\$23,664,803,217	4	0.1%	\$5,559,588	0.0%	326	7.8%	\$2,701,093,463	11.4%
Parker (T)	17,864	\$23,597,914,712	430	2.4%	\$516,935,575	2.2%	1,304	7.3%	\$2,900,428,275	12.3%
Unincorporated Douglas County	84,745	\$102,018,837,713	3,134	3.7%	\$2,398,656,212	2.4%	6,242	7.4%	\$11,458,491,080	11.2%
Douglas County (Total)	135,156	\$182,416,362,464	4,637	3.4%	\$4,170,855,789	2.3%	10,401	7.7%	\$20,666,244,264	11.3%

Source: Douglas County GIS 2020; Colorado Forest Atlas, 2017

Notes: C=City; T = Town

Impact on Critical Facilities

It is recognized that a number of critical facilities are located in the wildfire hazard area and are also vulnerable to the threat of wildfire. A majority of the critical facilities exposed to the wildfire risk hazard areas are potable water facilities, recreation sites, dams, and medical care facilities. Table 5-129 through Table 5-139 summarize the distribution of critical facilities exposed to the wildfire risk hazard area by critical facility type and jurisdiction. 129 critical facilities are exposed to the highest and high wildfire risk areas, the majority of which are potable wells, recreation sites, and bridges. Douglas County’s unincorporated area has the greatest number of critical facilities built in the wildfire risk hazard areas (i.e., 426) of which 365 are lifelines. The exposed lifelines are categorized into FEMA lifeline groupings and are summarized in Table 5-141. Additionally, the number of critical facilities and lifelines within the wildfire hazard areas by jurisdiction are shown in Table 5-129 through Table 5-140.

Table 5-129 Critical Facilities and Lifelines in the Highest Wildfire Risk Hazard Areas in Douglas County

Jurisdiction	Critical Facilities Exposed to the Highest Wildfire Risk Area			
	Assisted Living	Hazardous Material Facility	Potable Well	Recreation Site
Castle Pines (C)	0	0	0	0
Castle Rock (T)	0	0	0	0
Larkspur (T)	0	0	0	0
Lone Tree (C)	0	0	0	0
Parker (T)	2	0	0	0
Unincorporated Douglas County	1	1	5	1
Douglas County (Total)	3	1	5	1

Source: Douglas County GIS 2020; Colorado Forest Atlas, 2017

Notes: C=City; T = Town

Table 5-130 Critical Facilities and Lifelines in the High Wildfire Risk Hazard Areas in Douglas County

Jurisdiction	Critical Facilities Exposed to High Wildfire Risk Area													
	Assisted Living	Bridge	Dam	Fire Station	Government Building	Major Business	Medical Care	Municipal Building	Potable Water Lift station	Potable Water Tank	Potable Water Treatment Facility	Potable Well	Primary Education	Recreation Site
Castle Pines (C)	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Castle Rock (T)	1	0	1	1	0	0	0	0	0	0	0	0	0	0
Larkspur (T)	0	0	0	0	0	1	0	0	0	3	1	0	0	0
Lone Tree (C)	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Parker (T)	0	0	0	1	0	0	1	1	0	0	0	0	1	0
Unincorporated Douglas County	1	11	8	4	1	0	2	0	1	2	1	59	2	13
Douglas County (Total)	2	12	9	6	1	1	3	1	2	5	2	59	3	13

Source: Douglas County GIS 2020; Colorado Forest Atlas, 2017

Notes: C=City; T = Town

Table 5-131 Critical Facilities and Lifelines in the Moderate Wildfire Risk Hazard Areas in Douglas County

Jurisdiction	Critical Facilities Exposed to Moderate Wildfire Risk Area													
	Assisted Living	Bridge	Dam	Fire Station	Light Rail Station	Medical Care	Polling Sites	Potable Water Lift station	Potable Water Tank	Potable Well	Primary Education	Recreation Site	Shelter	Wastewater Treatment Facility
Castle Pines (C)	0	0	0	0	0	0	1	1	0	0	0	1	0	0
Castle Rock (T)	1	0	0	1	0	1	0	0	0	0	4	0	1	0
Larkspur (T)	0	0	0	0	0	0	0	0	0	0	0	3	0	0
Lone Tree (C)	0	0	0	0	2	0	0	0	0	0	0	0	0	0
Parker (T)	0	0	0	0	0	1	0	0	0	0	1	0	0	0
Unincorporated Douglas County	0	3	24	5	0	6	0	0	2	124	4	31	1	1
Douglas County (Total)	1	3	24	6	2	8	1	1	2	124	9	35	2	1

Source: Douglas County GIS 2020; Colorado Forest Atlas, 2017

Notes: C=City; T = Town

Table 5-132 Critical Facilities and Lifelines in the Low Wildfire Risk Hazard Areas in Douglas County

Jurisdiction	Critical Facilities Exposed to Low Wildfire Risk Area														
	Assisted Living	Bridge	Dam	Fire Station	Hazardous Material Facility	Hospital	Medical Care	Pharmacy	Police Station	Potable Water Treatment Facility	Potable Well	Primary Education	Recreation Site	Urgent Care	Wastewater Treatment Facility
Castle Pines (C)	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Castle Rock (T)	1	0	0	0	0	0	0	1	0	0	0	1	0	0	0
Larkspur (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lone Tree (C)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Parker (T)	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0
Unincorporated Douglas County	2	4	2	1	1	1	0	0	1	2	24	2	4	0	1
Douglas County (Total)	3	4	2	1	1	1	1	1	1	2	25	3	5	1	1

Source: Douglas County GIS 2020; Colorado Forest Atlas, 2017

Notes: C=City; T = Town

Table 5-133 Critical Facilities and Lifelines in the Lowest Wildfire Risk Hazard Areas in Douglas County

Jurisdiction	Critical Facilities Exposed to the Lowest Wildfire Risk Area																					
	Airport	Assisted Living	Bridge	Bus Facility	Childcare	Dam	Fire Station	Government Building	Hospital	Libraries	Light Rail Station	Medical Care	Pharmacy	Police Station	Polling Sites	Potable Water Lift station	Potable Well	Primary Education	Recreation Site	Secondary Education	Shelter	Wastewater Pump Station
Castle Pines (C)	0	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0
Castle Rock (T)	0	2	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0
Larkspur (T)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lone Tree (C)	0	2	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
Parker (T)	0	1	0	0	2	1	0	0	0	1	0	2	0	0	0	2	1	4	8	1	0	0
Unincorporated Douglas County	1	5	1	1	0	9	1	2	1	1	0	5	0	1	1	0	21	5	9	0	1	1
Douglas County (Total)	1	12	1	1	3	11	1	2	1	3	1	7	1	1	1	2	22	10	20	1	1	1

Source: Douglas County GIS 2020; Colorado Forest Atlas, 2017

Notes: C=City; T = Town

Table 5-134 Critical Facilities and Lifelines in the Wildfire Risk Hazard Areas in Douglas County (Highest, High, Moderate, Low, Lowest Areas)

Jurisdiction	Critical Facilities Exposed to the Lowest Wildfire Risk Area																												
	Airport	Assisted Living	Bridge	Bus Facility	Childcare	Dam	Fire Station	Government Building	Hazardous Material Facility	Hospital	Libraries	Light Rail Station	Major Business	Medical Care	Municipal Building	Pharmacy	Police Station	Polling Sites	Potable Water Lift station	Potable Water Tank	Potable Water Treatment Facility	Potable Well	Primary Education	Recreation Site	Secondary Education	Shelter	Urgent Care	Wastewater Pump Station	Wastewater Treatment Facility
Castle Pines (C)	0	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	5	0	0	0	0	0
Castle Rock (T)	0	5	0	0	0	2	2	0	0	0	0	0	1	0	0	2	0	0	0	0	0	0	6	0	0	1	0	0	0
Larkspur (T)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	3	1	0	0	0	3	0	0	0	0	0

Jurisdiction	Critical Facilities Exposed to the Lowest Wildfire Risk Area																												
	Airport	Assisted Living	Bridge	Bus Facility	Childcare	Dam	Fire Station	Government Building	Hazardous Material Facility	Hospital	Libraries	Light Rail Station	Major Business	Medical Care	Municipal Building	Pharmacy	Police Station	Polling Sites	Potable Water Lift station	Potable Water Tank	Potable Water Treatment Facility	Potable Well	Primary Education	Recreation Site	Secondary Education	Shelter	Urgent Care	Wastewater Pump Station	Wastewater Treatment Facility
Lone Tree (C)	0	2	1	0	0	0	0	0	0	0	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Parker (T)	0	3	0	0	2	1	1	0	0	0	1	0	0	5	1	0	0	0	2	0	0	2	6	8	1	0	1	0	0
Unincorporated Douglas County	1	9	19	1	0	43	11	3	2	2	1	0	0	13	0	0	2	1	1	4	3	233	13	58	0	2	0	1	2
Douglas County (Total)	1	21	20	1	3	46	14	3	2	2	3	3	1	19	1	2	2	2	5	7	4	235	25	74	1	3	1	1	2

Source: Douglas County GIS 2020; Colorado Forest Atlas, 2017

Notes: C=City; T = Town

Table 5-135 Critical Facilities and Lifelines in the Highest Wildfire Risk Hazard Areas in Douglas County

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Exposed to Wildfire Risk Area - Highest			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Castle Pines (C)	20	12	0	0.0%	0	0.0%
Castle Rock (T)	108	100	0	0.0%	0	0.0%
Larkspur (T)	15	9	0	0.0%	0	0.0%
Lone Tree (C)	54	42	0	0.0%	0	0.0%
Parker (T)	140	105	2	1.4%	2	1.9%
Unincorporated Douglas County	827	703	8	1.0%	7	1.0%
Douglas County (Total)	1,164	971	10	0.9%	9	0.9%

Source: Douglas County GIS 2020; Colorado Forest Atlas, 2017

Notes: C=City; T = Town

Table 5-136 Critical Facilities and Lifelines in the High Wildfire Risk Hazard Areas in Douglas County

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Exposed to Wildfire Risk Area -High			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Castle Pines (C)	20	12	1	5.0%	1	8.3%
Castle Rock (T)	108	100	3	2.8%	3	3.0%
Larkspur (T)	15	9	5	33.3%	4	44.4%
Lone Tree (C)	54	42	1	1.9%	1	2.4%
Parker (T)	140	105	4	2.9%	4	3.8%
Unincorporated Douglas County	827	703	105	12.7%	92	13.1%
Douglas County (Total)	1,164	971	119	10.2%	105	10.8%

Source: Douglas County GIS 2020; Colorado Forest Atlas, 2017

Notes: C=City; T = Town

Table 5-137 Critical Facilities and Lifelines in the Moderate Wildfire Risk Hazard Areas in Douglas County

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Exposed to Wildfire Risk Area -Moderate			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Castle Pines (C)	20	12	3	15.0%	1	8.3%
Castle Rock (T)	108	100	8	7.4%	8	8.0%
Larkspur (T)	15	9	3	20.0%	0	0.0%
Lone Tree (C)	54	42	2	3.7%	2	4.8%
Parker (T)	140	105	2	1.4%	2	1.9%
Unincorporated Douglas County	827	703	201	24.3%	170	24.2%
Douglas County (Total)	1,164	971	219	18.8%	183	18.8%

Source: Douglas County GIS 2020; Colorado Forest Atlas, 2017

Notes: C=City; T = Town

Table 5-138 Critical Facilities and Lifelines in the Low Wildfire Risk Hazard Areas in Douglas County

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Exposed to Wildfire Risk Area -Low			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Castle Pines (C)	20	12	1	5.0%	0	0.0%
Castle Rock (T)	108	100	3	2.8%	3	3.0%
Larkspur (T)	15	9	0	0.0%	0	0.0%
Lone Tree (C)	54	42	0	0.0%	0	0.0%
Parker (T)	140	105	3	2.1%	3	2.9%
Unincorporated Douglas County	827	703	45	5.4%	41	5.8%
Douglas County (Total)	1,164	971	52	4.5%	47	4.8%

Source: Douglas County GIS 2020; Colorado Forest Atlas, 2017

Notes: C=City; T = Town

Table 5-139 Critical Facilities and Lifelines in the Lowest Wildfire Risk Hazard Areas in Douglas County

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Exposed to Wildfire Risk Area -Lowest			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Castle Pines (C)	20	12	6	30.0%	2	16.7%
Castle Rock (T)	108	100	5	4.6%	5	5.0%
Larkspur (T)	15	9	0	0.0%	0	0.0%
Lone Tree (C)	54	42	4	7.4%	3	7.1%
Parker (T)	140	105	23	16.4%	12	11.4%
Unincorporated Douglas County	827	703	66	8.0%	55	7.8%
Douglas County (Total)	1,164	971	104	8.9%	77	7.9%

Source: Douglas County GIS 2020; Colorado Forest Atlas, 2017

Notes: C=City; T = Town

Table 5-140 Critical Facilities and Lifelines in the Wildfire Risk Hazard Areas in Douglas County (High, Highest, Moderate, Low, Lowest Areas)

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Exposed to Wildfire Risk Area			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Castle Pines (C)	20	12	11	55.0%	4	33.3%
Castle Rock (T)	108	100	19	17.6%	19	19.0%
Larkspur (T)	15	9	8	53.3%	4	44.4%
Lone Tree (C)	54	42	7	13.0%	6	14.3%
Parker (T)	140	105	34	24.3%	23	21.9%
Unincorporated Douglas County	827	703	425	51.4%	365	51.9%
Douglas County (Total)	1,164	971	504	43.3%	421	43.4%

Source: Douglas County GIS 2020; Colorado Forest Atlas, 2017

Notes: C=City; T = Town

Table 5-141 Lifelines Exposed to the Wildfire Risk Hazard Areas

FEMA Lifeline Category	Total Number of Lifelines	Estimated Lifeline Exposed to Wildfire Risk Areas					
		Highest Wildfire Risk Area Number of Lifelines	High Wildfire Risk Area Number of Lifelines	Moderate Wildfire Risk Area Number of Lifelines	Low Wildfire Risk Area Number of Lifelines	Lowest Wildfire Risk Area Number of Lifelines	All Wildfire Risk Areas Number of Lifelines
Food, Water, Shelter	428	5	68	130	28	26	257
Hazardous Material	22	1	0	0	1	0	2
Health and Medical	203	3	5	9	7	21	45
Safety and Security	239	0	20	39	7	26	92
Transportation	79	0	12	5	4	4	25
Douglas County (Total)	971	9	105	183	47	77	421

Source: Douglas County GIS 2020; Colorado Forest Atlas, 2017

Notes: C=City; T = Town

Impact on 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 business and decrease 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 volunteer man hours from the volunteer firefighters. There are also many direct and indirect costs to local businesses that excuse volunteers from working to fight these fires.

Impact on the Environment

According to the USGS, post-fire runoff polluted with debris and contaminants can be extremely harmful to ecosystem and aquatic life (USFS 2020). Studies show that urban fires in particular are more harmful to the environment compared to forest fires (USFS 2020). The age and density of infrastructure within Douglas County 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 the storm water, contaminate nearby streams, and impair aquatic life.

Cascading Impacts on Other Hazards

Wildfires result in the uncontrolled destruction of forests, brush, field crops, grasslands, real estate, and personal property, and have secondary impacts on other hazards such as flooding, by removing vegetation and destroying watersheds. Flash flooding is particularly common after wildfires and can occur quickly and within areas that are not usually prone to flood risk. People are at a greater risk of flooding due to recent wildfire burn areas and could remain at risk for up to 5 years after a fire (Colorado Division of Homeland Security and Emergency Management, 2020). Intense floods cause increased problems in erosion and sediment transportation, thus increasing risk and economic impacts to buildings, infrastructure and people after a wildfire events. Some of the largest debris-flow events happen during the first post-fire storm season. It takes less rainfall to trigger debris in areas that were burned than in areas that were not affected by fires (USGS, 2020). Fires reduce the rate in which water can permeate the soil triggering debris flow occurrence can by surface erosion and land sliding caused by steep slopes (USGS, 2020). To learn more about flooding and geological hazards refer to section 5.4.6 and 5.4.13 through 5.4.16.

Future Changes that May Impact Vulnerability

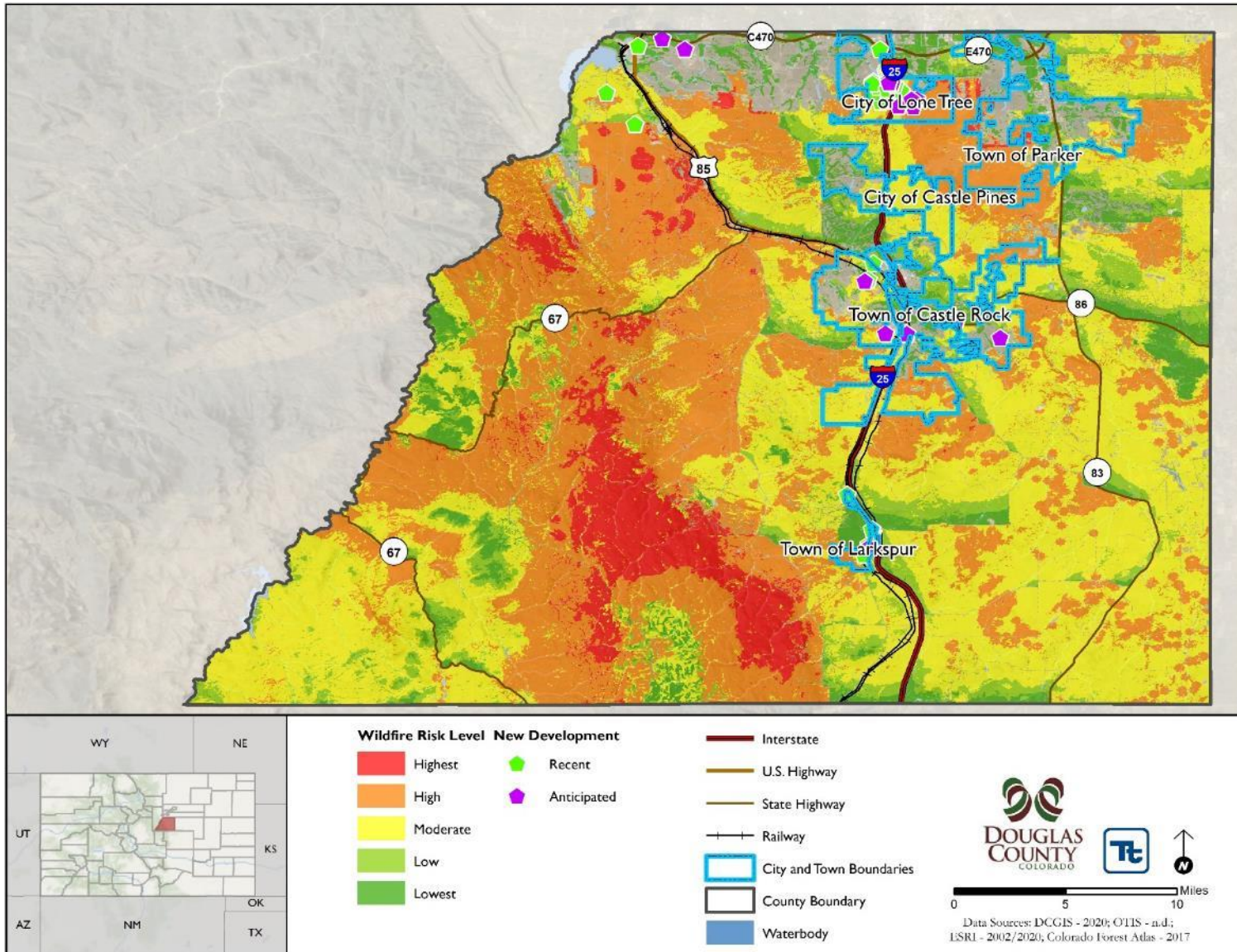
Understanding future changes that impact vulnerability in the County can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. The County considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development
- Projected changes in population
- Other identified conditions as relevant and appropriate, including the impacts of climate change.

Projected Development

As discussed in Section 4, areas targeted for future growth and development have been identified across the County. Any areas of growth located in the wildfire risk hazard areas could be at risk. Refer to the maps in each jurisdictional annex (Section 9 of this HMP) to view the new development project areas and their proximity to the wildfire risk hazard areas. There are 33 new development sites located within the wildfire risk hazard area; 9 within the high-risk area, 8 within the moderate risk area and 16 within the low risk area. Refer to Figure 5-61 for potential new development in the County and their proximity to the wildfire risk area.

Figure 5-61 Potential New Development in the Wildfire Risk Area



Projected Changes in Population

The County experienced an increase in population between the 2010 Census (320,500) and the estimated 2018 Community Survey estimated population of 328,614. The population of the County is expected to increase over the next few years. The increase in population will expose more people to the wildfire hazard as residents move into the wildfire risk areas.

Climate Change

Climate change has the potential to affect multiple elements of the wildfire system: fire behavior, ignitions, fire management, and vegetation fuels. Hot dry spells create the highest fire risk. Increased temperatures may intensify wildfire danger by warming and drying out vegetation. Changes in climate patterns may impact the distribution and perseverance of insect outbreaks that create dead trees (increase fuel). Fire interacts with climate and vegetation (fuel) in predictable ways. Understanding the climate/fire/vegetation interactions is essential for addressing issues associated with climate change that include:

- Effects on regional circulation and other atmospheric patterns that affect fire weather
- Effects of changing fire regimes on the carbon cycle, forest structure, and species composition, and
- Complications from land use change, invasive species and an increasing wildland-urban interface (USFS 2020).

It is projected that higher summer temperatures will likely increase the high fire risk by 10- to 30-percent. Fire occurrence and/or area burned could increase across the U.S. due to the increase of lightning activity, the frequency of surface pressure and associated circulation patterns conducive to surface drying, and fire-weather conditions, in general, which is conducive to severe wildfires. Warmer temperatures will also increase the effects of drought and increase the number of days each year with flammable fuels and extending fire seasons and areas burned (USFS 2020).

Future changes in fire frequency and severity are difficult to predict. Global and regional climate changes associated with elevated greenhouse gas concentrations could alter large weather patterns, thereby affecting fire-weather conducive to extreme fire behavior (USFS 2020).

Change of Vulnerability Since the 2015 HMP

For this hazard mitigation plan update, the wildfire risk hazard spatial layer from the Colorado Forest Atlas was referenced to determine areas within Douglas County that are vulnerable to wildfires. Population statistics have also been updated using the 5-Year 2014-2018 American Community Survey Population Estimates. A customized general building stock was created using RS Means 2020 replacement cost values, building footprints and tax assessor and parcel information provided by the County. Additionally, the critical facility inventory was reviewed by Douglas County.

Overall, this vulnerability assessment uses a more accurate and updated building inventory which provides more accurate estimated exposure and potential losses for Douglas County.

Identified Issues

- A significant portion of Douglas County's western section 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.
- Climate change could affect the wildfire hazard as increased frequency of drought events 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 as a secondary natural hazard because vegetation is removed.
- Climate change could affect the wildfire hazard.
- 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.

SECTION 6 MITIGATION STRATEGY

This section presents mitigation strategies for Douglas County to reduce potential exposure and losses identified as concerns in the Risk Assessment portion of this plan. The Local Planning Committee reviewed the Risk Assessment to identify and develop these mitigation actions, which are presented herein.

6.1 Background and Past Mitigation Accomplishments

In accordance with the requirements of the Disaster Mitigation Act of 2000, detailed on Page 1-1 in Section 1 (Introduction), a discussion regarding past mitigation activities and an overview of past efforts is provided as a foundation for understanding the mitigation goals, objectives, and activities outlined in this plan update. 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:

Hazard mitigation - reduces the potential impacts of, and costs associated with, emergency and disaster-related events. Mitigation actions address a range of impacts, including impacts on the population, property, the economy, and the environment.

Mitigation actions - can include activities such as revisions to land-use planning, training and education, and structural and nonstructural safety measures.

- The County facilitated the development of the 2021 Douglas County Local Natural Hazard Mitigation Plan. The current planning process represents the regulatory five-year update process, which includes participation of the County, five municipalities, three special purpose districts, and key county and regional stakeholders.
- 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 Section 3 (Planning Process and References).

6.2 General Mitigation Planning Approach

The overall approach used to update the County and local hazard mitigation strategies are based on FEMA and Colorado regulations and guidance regarding local mitigation plan development, including the following:

- DMA 2000 regulations, specifically 44 CFR 201.6 (local mitigation planning).
- FEMA *Local Mitigation Planning Handbook*, March 2013.
- FEMA *Local Mitigation Plan Review Guide*, October 1, 2011.
- FEMA *Integrating Hazard Mitigation into Local Planning*, March 1, 2013.
- FEMA *Plan Integration: Linking Local Planning Efforts*, July 2015.
- FEMA *Mitigation Planning How-To Guide #3, Identifying Mitigation Actions and Implementing Strategies* (FEMA 386-3), April 2003.
- FEMA *Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards*, January 2013.

The mitigation strategy update approach includes the following steps that are further detailed in later subsections:

- Section 6.3 – Identification of Strengths, Weaknesses, Obstacles and Opportunities
- Section 6.4 - Review and update mitigation goals and objectives.
- Section 6.5 (Jurisdiction Specific Annex Section 9) - Identify mitigation capabilities and evaluate their capacity and effectiveness to mitigate and manage hazard risk.
- Section 6.6 (Jurisdiction Specific Annex Section 9) - Prepare an implementation strategy, including:
 - Identify progress on previous County and jurisdictional mitigation strategies.
 - Develop updated County and jurisdictional mitigation strategies.
 - Prioritize projects and initiatives in the updated mitigation strategy.

6.3 Strengths, Weaknesses, Obstacles, and Opportunities exercise

The Local Planning Committee participated in an online Strengths Weaknesses Obstacles and Opportunities (SWOO) survey in September 2020, focusing on the 11 hazards being included in the 2021 update. The survey focused on the hazards of concern and what the County’s strengths, weaknesses, obstacles, and opportunities are for each hazard. The results were compiled and presented to the planning partnership at the risk assessment presentation. The results were also used by the participants to help identify capabilities and potential mitigation actions. The following provides a summary of strengths, weaknesses, obstacles, and opportunities identified by the Local Planning Committee:

- Strengths – coordination between various agencies (county and local), planning, flood warning systems, codes and standards, emergency response capabilities, and public outreach.
- Weaknesses – existing structures located in hazard areas, ability to incentivize homeowners to mitigate their properties, lack of warning systems for all hazards, limited resources for large-scale events, and potential dam failures and other potential impacts from catastrophic events.
- Obstacles – availability of shelters, climate change, mitigating private properties, community complacency, continuity of operations, data collection, funding, resources, and education and outreach.
- Opportunities – outreach and education, planning, grant funding, training, reviewing codes and ordinances, data collection, local awareness training and programs, and enhance notification systems.

6.4 Review and Update of Mitigation Goals and Objectives

This section documents the County’s efforts to develop hazard mitigation goals and objectives that are established to reduce or avoid long-term vulnerabilities to the identified hazards.

6.4.1 Guiding Principle

Per FEMA guidance (386-1), a mission statement or guiding principle describes the overall duty and purpose of the planning process and serves to identify the principle message of the plan. It focuses or constrains the range of goals and objectives identified. This is not a goal because it does not describe outcomes, rather it is broad in scope, and provides a direction for the HMP update.

As part the of the 2021 HMP update process, the Douglas County Local Planning Committee reviewed and updated the 2015 HMP guiding statement as noted below:

“The purpose of this plan update is to guide hazard mitigation planning, implement projects, and prioritize resources to better protect the people and property of the County from the effects of hazards. This plan demonstrates the community’s commitment to reducing risks from hazards and serves as a tool to help decision makers direct mitigation activities and resources. This plan was also developed to ensure Douglas County and participating jurisdictions’ continued eligibility for federal, state, and local disaster assistance including but not limited to the FEMA HMGP, BRIC, and FMA; and HUD CDBG-MIT. Completion also earns credits for the National Flood Insurance Program’s CRS which provides for lower flood insurance premiums in CRS communities.”

6.4.2 Goals and Objectives

According to CFR 201.6(c)(3)(i): “The hazard mitigation strategy shall include a description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.” The mitigation goals were developed based on the risk assessment results, discussions, research, and input from the committee, existing authorities, polices, programs, resources, stakeholders, and the public.

For the purposes of this plan, goals and objectives are defined as follows:

Goals are general guidelines that explain what is to be achieved. They are broad, long-term, policy-type statements that represent global visions. Goals help define the benefits that the plan is trying to achieve. The success of the plan, 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, which when combined form a strategy or course of action to meet a goal. Unlike goals, objectives are specific and measurable.

During the 2021 plan update process, the Local Planning Committee reviewed the goals and objectives established in the 2015 HMP in consideration of the hazard events and losses since the 2015 plan, the updated hazard profiles and vulnerability assessment, the goals and objectives established in the State of Colorado 2018 Hazard Mitigation Plan, and county and local plans. The update incorporates direct input for how the County and municipalities need to move forward to best manage their hazard risk. Amendments include additions and edits to goals and objectives to express the planning partnership’s interests in integrating this plan with other planning mechanisms/programs and to support mitigation through the protection and preservation of natural systems, including particular reference to certain goals and objectives in the State of Colorado 2018 Hazard Mitigation Plan update, as identified below.

As a result of this review process, the goals and objectives for the 2021 update were amended as presented in below. Objectives identified meet multiple goals, as demonstrated in Table 6-1.

Goals

- Goal 1 – Warning - Enhance predictive measure including the expansion and protection of warning systems and supporting technologies.

FEMA defines **Goals** as general guidelines that explain what should be achieved. Goals are usually broad, long-term, policy statements, and represent a global vision.

FEMA defines **Objectives** as strategies or implementation steps to attain mitigation goals. Unlike goals, objectives are specific and measurable, where feasible.

FEMA defines **Mitigation Actions** as specific actions that help to achieve the mitigation goals and objectives.

- Goal 2 – Data Collection - Enhance the quality of assessments, analysis and planning through the development and collection of data.
- Goal 3 – Outreach and Education - Increase public awareness of hazards and their mitigation.
- Goal 4 - Mitigate Structures and Protect Lives - Reduce impacts, costs, and damages from hazard events to people, property, local government and private assets, economy, and natural and cultural resources.
- Goal 5 - Planning - Coordinate and integrate hazard mitigation activities with local land development planning activities and emergency operations planning to consider resiliency.
- Goal 6 - Codes & Standards - Review, update, adopt and enforce local, state and federal plans, codes and regulations to reduce the impacts of natural hazards.
- Goal 7 - Entity Coordination - Strengthen communication and coordination among public entities, non-governmental organizations (NGOs), businesses and private citizens.
- Goal 8 - Continuity of Operations - Support continuity of operations pre-, during, and post- hazard events including the support of community lifelines.

Objectives

- Objective 1 - Improve systems that provide warning and emergency communications.
- Objective 2 - Increase public awareness of risk.
- Objective 3 - Research, develop, and promote adoption of cost-effective building and development laws, regulations, and ordinances.
- Objective 4 - Improve hazard information databases and maps and increase accessibility to those resources.
- Objective 5 - 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 - Manage development in geologically hazardous areas and floodplains to protect life and property.
- Objective 7 - Incorporate risk reduction considerations in new and updated infrastructure and development plans to reduce the impacts of natural hazards.
- Objective 8 - 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 9 - Improve understanding of the locations, potential impacts, and linkages among threats, hazards, vulnerability, and measures needed to protect life safety and health.
- Objective 10 - Consider risk reduction in long-term planning.
- Objective 11 - Minimize impacts of hazard events to key employers.
- Objective 12 - Identify projects that simultaneously reduce risk while increasing operational area resilience and sustainability.
- Objective 13 - Establish a partnership among all levels of government and the business community to improve and implement methods to protect property.
- Objective 14 - Reduce risks that may impact critical business operations.
- Objective 15 - 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 16 - 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 17 - Modify structures, as necessary, to meet life safety standards.
- Objective 18 - Encourage the incorporation of mitigation measures into repairs, major alterations, new development, and redevelopment practices, especially in areas subject to substantial hazard risk.
- Objective 19 - Retrofit, purchase, or relocate structures in high hazard areas, especially those known to be repetitively damaged.
- Objective 20 - Encourage hazard mitigation measures that promote and enhance natural processes and minimize adverse impacts on the ecosystem.
- Objective 21 - Promote enforcement of relevant state regulations and local ordinances that significantly reduce life loss and injuries.
- Objective 22 - Strengthen local building code enforcement.
- Objective 23 - Ensure continuity of operations of essential county government services.
- Objective 24 - Protect rare, endangered, unusual, or educationally important natural resources.
- Objective 25 - Provide incentives for development and land use techniques that reduce risks.

Table 6-1 Douglas County Hazard Mitigation Plan Goals and Objectives

Objective #	Objective Statement	Goal 1 – Warning	Goal 2 – Data Collection	Goal 3 – Outreach and Education	Goal 4 - Mitigate Structures and Protect Lives	Goal 5 – Planning	Goal 6 – Codes and Standards	Goal 7 – Entity Coordination	Goal 8 – Continuity of Operations
1	Improve systems that provide warning and emergency communications.	X							
2	Increase public awareness of risk.	X	X	X				X	
3	Research, develop, and promote adoption of cost-effective building and development laws, regulations, and ordinances.		X		X		X		
4	Improve hazard information databases and maps and increase accessibility to those resources.	X	X	X				X	X
5	Develop and provide updated information about threats, hazards, vulnerabilities, and mitigation strategies to state, regional, and local agencies, as well as private sector groups.	X	X	X	X	X		X	X
6	Manage development in geologically hazardous areas and floodplains to protect life and property.						X	X	
7	Incorporate risk reduction considerations in new and updated infrastructure and development plans to reduce the impacts of natural hazards.		X		X	X	X	X	
8	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.	X	X	X	X	X		X	X
9	Improve understanding of the locations, potential impacts, and linkages among threats, hazards, vulnerability, and measures needed to protect life safety and health.		X	X	X	X		X	
10	Consider risk reduction in long-term planning.		X		X		X	X	
11	Minimize impacts of hazard events to key employers.	X	X	X	X	X		X	X
12	Identify projects that simultaneously reduce risk while increasing operational area resilience and sustainability.	X	X	X	X	X	X	X	X
13	Establish a partnership among all levels of government and the business community to improve and implement methods to protect property.		X	X	X	X		X	X
14	Reduce risks that may impact critical business operations.	X	X	X	X	X		X	X
15	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.		X	X	X	X		X	X
16	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.	X	X	X	X	X	X	X	X
17	Modify structures, as necessary, to meet life safety standards.			X	X		X	X	X

Objective #	Objective Statement	Goal 1 – Warning	Goal 2 – Data Collection	Goal 3 – Outreach and Education	Goal 4 - Mitigate Structures and Protect Lives	Goal 5 – Planning	Goal 6 – Codes and Standards	Goal 7 – Entity Coordination	Goal 8 - Continuity of Operations
18	Encourage the incorporation of mitigation measures into repairs, major alterations, new development, and redevelopment practices, especially in areas subject to substantial hazard risk.		X	X	X	X	X	X	
19	Retrofit, purchase, or relocate structures in high hazard areas, especially those known to be repetitively damaged.		X	X	X	X	X	X	
20	Encourage hazard mitigation measures that promote and enhance natural processes and minimize adverse impacts on the ecosystem.		X	X	X	X	X	X	
21	Promote enforcement of relevant state regulations and local ordinances that significantly reduce life loss and injuries.		X	X	X	X	X	X	
22	Strengthen local building code enforcement.		X	X	X		X	X	
23	Ensure continuity of operations of essential county government services.		X	X	X	X		X	X
24	Protect rare, endangered, unusual, or educationally important natural resources.		X	X		X	X	X	
25	Provide incentives for development and land use techniques that reduce risks.		X	X	X	X	X	X	

6.5 CAPABILITY ASSESSMENT

As part of the HMP update process, the planning team performed an inventory and analysis of existing authorities and capabilities called a “capability assessment.” A capability assessment creates an inventory of a jurisdiction’s mission, programs and policies, and evaluates its capacity to carry them out. Each participating jurisdictional annex (Section 9) reflects the jurisdictional analysis of their respective (1) administrative and technical capabilities, (2) administrative fiscal capabilities, and (3) legal/regulatory capabilities. Specifically each annex displays the following:

- The Jurisdiction’s Capability Assessment — reviewed to identify capabilities that the jurisdiction does not currently have but should consider pursuing or capabilities that should be revisited and updated to include best available information; also reviewed to determine how existing capabilities can be leveraged to increase or improve hazard mitigation in the jurisdiction.
- The Jurisdiction’s National Flood Insurance Program Compliance Table — reviewed to identify opportunities to increase floodplain management capabilities.
- The Jurisdiction’s Identified Opportunities for Future Integration — reviewed to identify specific integration actions to be included in the mitigation strategy.
- Jurisdiction-Specific Vulnerabilities — reviewed to identify actions that will help reduce known vulnerabilities.
- The Mitigation Best Practices Catalog — reviewed to identify actions that the jurisdiction should consider including in its action plan.
- Public Input — reviewed to identify potential actions and community priorities.

6.5.1 Mitigation Best Practices

Catalogs of hazard mitigation best management practices based on practical examples from across the country were provided and discussed to present a broad range of alternatives to be considered for use in the planning area, in compliance with 44 CFR (Section 201.6(c)(3)(ii)). One catalog was developed for each hazard of concern evaluated in this HMP update, which is relevant to most of the hazards of concern in this HMP update. The catalogs for each hazard are listed in Table 6-2 through Table 6-9.

These catalogs were provided to the planning partnership as a resource to support the identification and development of mitigation actions for this plan. Hazard mitigation initiatives recommended in this HMP were selected from among the alternatives presented in the catalogs. 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 jurisdictions to implement.

Table 6-2. Catalog of Potential Mitigation Actions for the Dam Failure Hazard

Government-Scale
<p>Manipulate the hazard:</p> <ul style="list-style-type: none"> ❖ Remove dams ❖ Harden dams <p>Reduce exposure to the hazard:</p> <ul style="list-style-type: none"> ❖ Replace earthen dams with hardened structures ❖ Relocate critical facilities out of dam inundation areas ❖ Consider open space land use in designated dam inundation areas <p>Reduce vulnerability to the hazard:</p> <ul style="list-style-type: none"> ❖ Adopt higher floodplain standards in mapped dam inundation areas

Government-Scale
<ul style="list-style-type: none"> ❖ Retrofit critical facilities within dam inundation areas <p>Build local capacity to respond to or prepare for the hazard:</p> <ul style="list-style-type: none"> ❖ Map dam failure inundation areas ❖ Enhance emergency operations plan to include a dam failure component ❖ Institute monthly communications checks with dam operators ❖ Inform the public on risk reduction techniques ❖ Adopt real-estate disclosure requirements for the re-sale of property located within dam failure inundation areas ❖ Consider the probable impacts of climate change in assessing the risk associated with the dam failure hazard ❖ Establish early warning capability downstream of listed high hazard dams ❖ Consider the residual risk associated with protection provided by dams in future land use decisions

Table 6-3. Catalog of Potential Mitigation Actions for the Drought Hazard*

Government-Scale
<p>Manipulate the hazard:</p> <ul style="list-style-type: none"> ❖ Groundwater recharge through stormwater management ❖ Develop a water recycling program ❖ Increase “above-the-dam” regional natural water storage systems <p>Reduce exposure to the hazard:</p> <ul style="list-style-type: none"> ❖ Identify and create groundwater backup sources <p>Reduce vulnerability to the hazard:</p> <ul style="list-style-type: none"> ❖ Water use conflict regulations ❖ Reduce water system losses ❖ Distribute water saving kits ❖ Increase conventional storage that is filled during high-flow periods <p>Build local capacity to respond to or prepare for the hazard:</p> <ul style="list-style-type: none"> ❖ Public education on drought resistance ❖ Identify alternative water supplies for times of drought; mutual aid agreements with alternative suppliers ❖ Develop drought contingency plan ❖ Develop criteria “triggers” for drought-related actions ❖ Improve accuracy of water supply forecasts ❖ Modify rate structure to influence active water conservation techniques ❖ Consider the probable impacts of climate change on the risk associated with the drought hazard

**Addressed with the Severe Weather Hazard*

Table 6-4. Catalog of Potential Mitigation Actions for the Earthquake Hazard

Government-Scale
<p>Manipulate the hazard:</p> <ul style="list-style-type: none"> ❖ None <p>Reduce exposure to the hazard:</p> <ul style="list-style-type: none"> ❖ Locate critical facilities or functions outside hazard area where possible <p>Reduce vulnerability to the hazard:</p> <ul style="list-style-type: none"> ❖ Harden infrastructure ❖ Provide redundancy for critical functions

Government-Scale
<ul style="list-style-type: none"> ❖ Adopt higher regulatory standards <p>Build local capacity to respond to or prepare for the hazard:</p> <ul style="list-style-type: none"> ❖ Provide better hazard maps ❖ Provide technical information and guidance ❖ Enact tools to help manage development in hazard areas (e.g., tax incentives, information) ❖ Include retrofitting and replacement of critical system elements in capital improvement plan ❖ Develop strategy to take advantage of post-disaster opportunities ❖ Warehouse critical infrastructure components such as pipe, power line, and road repair materials ❖ Develop and adopt a continuity of operations plan ❖ Initiate triggers guiding improvements (such as <50% substantial damage or improvements) ❖ Further enhance seismic risk assessment to target high hazard buildings for mitigation opportunities. ❖ Develop a post-disaster action plan that includes grant funding and debris removal components.

Table 6-5 Catalog of Potential Mitigation Actions for the Flood Hazard

Government-Scale	
<p>Manipulate the hazard:</p> <ul style="list-style-type: none"> ❖ Maintain drainage system ❖ Institute low-impact development techniques on property ❖ Dredging, levee construction, and providing regional retention areas ❖ Structural flood control, levees, channelization, or revetments. ❖ Stormwater management regulations and master planning ❖ Acquire vacant land or promote open space uses in developing watersheds to control increases in runoff <p>Reduce exposure to the hazard:</p> <ul style="list-style-type: none"> ❖ Locate or relocate critical facilities outside of hazard area ❖ Acquire or relocate identified repetitive loss properties ❖ Promote open space uses in identified high hazard areas via techniques such as: planned unit developments, easements, setbacks, greenways, sensitive area tracks. ❖ Adopt land development criteria such as planned unit developments, density transfers, clustering ❖ Institute low impact development techniques on property ❖ Acquire vacant land or promote open space uses in developing watersheds to control increases in runoff 	<ul style="list-style-type: none"> ❖ Facilitate managed retreat from, or upgrade of, the most at-risk areas ❖ Require accounting of sea level rise in all applications for new development in shoreline areas ❖ Implement Assembly Bill 162 (2007) requiring flood hazard information in local general plans <p>Build local capacity to respond to or prepare for the hazard:</p> <ul style="list-style-type: none"> ❖ Produce better hazard maps ❖ Provide technical information and guidance ❖ Enact tools to help manage development in hazard areas (stronger controls, tax incentives, and information) ❖ Incorporate retrofitting or replacement of critical system elements in capital improvement plan ❖ Develop strategy to take advantage of post-disaster opportunities ❖ Warehouse critical infrastructure components ❖ Develop and adopt a continuity of operations plan ❖ Consider participation in the Community Rating System ❖ Maintain and collect data to define risks and vulnerability ❖ Train emergency responders ❖ Create an elevation inventory of structures in the floodplain

Government-Scale	
<ul style="list-style-type: none"> ❖ Preserve undeveloped and vulnerable shoreline ❖ Restore existing flood control and riparian corridors <p>Reduce vulnerability to the hazard:</p> <ul style="list-style-type: none"> ❖ Harden infrastructure, bridge replacement program ❖ Provide redundancy for critical functions and infrastructure ❖ Adopt regulatory standards such as freeboard standards, cumulative substantial improvement or damage, lower substantial damage threshold; compensatory storage, non-conversion deed restrictions. ❖ Stormwater management regulations and master planning. ❖ Adopt “no-adverse impact” floodplain management policies that strive to not increase the flood risk on downstream communities 	<ul style="list-style-type: none"> ❖ Develop and implement a public information strategy ❖ Charge a hazard mitigation fee ❖ Integrate floodplain management policies into other planning mechanisms within the planning area. ❖ Consider the probable impacts of climate change on the risk associated with the flood hazard ❖ Consider the residual risk associated with structural flood control in future land use decisions ❖ Enforce National Flood Insurance Program requirements ❖ Adopt a Stormwater Management Master Plan ❖ Develop an adaptive management plan to address the long-term impacts of sea level rise

Table 6-6 Catalog of Potential Mitigation Actions for the Landslide Hazard

Government-Scale
<p>Manipulate the hazard:</p> <ul style="list-style-type: none"> ❖ Stabilize slope (dewater, armor toe) ❖ Reduce weight on top of slope <p>Reduce exposure to the hazard:</p> <ul style="list-style-type: none"> ❖ Acquire properties in high-risk landslide areas. ❖ Adopt land use policies that prohibit the placement of habitable structures in high-risk landslide areas. <p>Reduce vulnerability to the hazard:</p> <ul style="list-style-type: none"> ❖ Adopt higher regulatory standards for new development within unstable slope areas. ❖ Armor/retrofit critical infrastructure against the impact of landslides. <p>Build local capacity to respond to or prepare for the hazard:</p> <ul style="list-style-type: none"> ❖ Produce better hazard maps ❖ Provide technical information and guidance ❖ Enact tools to help manage development in hazard areas: better land controls, tax incentives, information ❖ Develop strategy to take advantage of post-disaster opportunities ❖ Warehouse critical infrastructure components ❖ Develop and adopt a continuity of operations plan ❖ Educate the public on the landslide hazard and appropriate risk reduction alternatives. ❖ Consider the probable impacts of climate change on the risk associated with the landslide hazard

Table 6-7 Catalog of Potential Mitigation Actions for the Severe Weather Hazard

Government-Scale
<ul style="list-style-type: none"> • Manipulate the hazard: <ul style="list-style-type: none"> ❖ None • Reduce exposure to the hazard: <ul style="list-style-type: none"> ❖ Develop an urban heat island reduction program that includes an urban forest program or plan • Reduce vulnerability to the hazard: <ul style="list-style-type: none"> ❖ Harden infrastructure such as locating utilities underground ❖ Trim trees back from power lines ❖ Designate snow routes and strengthen critical road sections and bridges • Build local capacity to respond to or be prepared for the hazard: <ul style="list-style-type: none"> ❖ Support programs such as “Tree Watch” that proactively manage problem areas through use of selective removal of hazardous trees, tree replacement, etc. ❖ Establish and enforce building codes that require all roofs to withstand snow loads ❖ Increase communication alternatives ❖ Modify land use and environmental regulations to support vegetation management activities that improve reliability in utility corridors. ❖ Modify landscape and other ordinances to encourage appropriate planting near overhead power, cable, and phone lines ❖ Provide NOAA weather radios to the public ❖ Consider the probable impacts of climate change on the risk associated with the severe weather hazard ❖ Review and update heat response plan in light of climate change (heat events) projections

Table 6-8 Catalog of Potential Mitigation Actions for the Severe Winter Weather Hazard

Government-Scale
<ul style="list-style-type: none"> • Manipulate the hazard: <ul style="list-style-type: none"> ❖ None • Reduce exposure to the hazard: <ul style="list-style-type: none"> ❖ Develop an urban heat island reduction program that includes an urban forest program or plan • Reduce vulnerability to the hazard: <ul style="list-style-type: none"> ❖ Harden infrastructure such as locating utilities underground ❖ Trim trees back from power lines ❖ Designate snow routes and strengthen critical road sections and bridges • Build local capacity to respond to or be prepared for the hazard: <ul style="list-style-type: none"> ❖ Support programs such as “Tree Watch” that proactively manage problem areas through use of selective removal of hazardous trees, tree replacement, etc. ❖ Establish and enforce building codes that require all roofs to withstand snow loads ❖ Increase communication alternatives ❖ Modify land use and environmental regulations to support vegetation management activities that improve reliability in utility corridors. ❖ Modify landscape and other ordinances to encourage appropriate planting near overhead power, cable, and phone lines ❖ Provide NOAA weather radios to the public ❖ Consider the probable impacts of climate change on the risk associated with the severe weather hazard ❖ Review and update heat response plan in light of climate change (heat events) projections

Table 6-9 Catalog of Potential Mitigation Actions for the Wildfire Hazard

Government-Scale
<p>Manipulate the hazard:</p> <ul style="list-style-type: none"> ❖ Clear potential fuels on property such as dry underbrush and diseased trees ❖ Implement best management practices on public lands <p>Reduce exposure to the hazard:</p> <ul style="list-style-type: none"> ❖ Create and maintain defensible space around structures and infrastructure ❖ Locate outside of hazard area ❖ Enhance building code to include use of fire resistant materials in high hazard area. <p>Reduce vulnerability to the hazard:</p> <ul style="list-style-type: none"> ❖ Create and maintain defensible space around structures and infrastructure ❖ Use fire-resistant building materials ❖ Use fire-resistant plantings in buffer areas of high wildfire threat. ❖ Consider higher regulatory standards (such as Class A roofing) ❖ Establish biomass reclamation initiatives ❖ Reintroduce fire (controlled or prescribed burns) to fire-prone ecosystems ❖ Manage fuel load through thinning and brush removal ❖ Establish integrated performance standards for new development to harden homes. <p>Build local capacity to respond to or prepare for the hazard:</p> <ul style="list-style-type: none"> ❖ More public outreach and education efforts, including an active Firewise USA program ❖ Possible weapons of mass destruction funds available to enhance fire capability in high-risk areas ❖ Identify fire response and alternative evacuation routes and establish where needed ❖ Seek alternative water supplies ❖ Become a Firewise USA community ❖ Use academia to study impacts/solutions to wildfire risk ❖ Establish/maintain mutual aid agreements between fire service agencies ❖ Develop, adopt, and implement integrated plans for mitigating wildfire impacts in wildland areas bordering on development ❖ Consider the probable impacts of climate change on the risk associated with the wildfire hazard in future land use decisions ❖ Establish a management program to track forest and rangeland health ❖ Provide incentives to for existing structures to be hardened against wildfire.

6.6 IMPLEMENTATION STRATEGY

6.6.1 Selection of Recommended Actions

The selection of mitigation actions was based on the risk assessment of identified hazards of concern and the defined hazard mitigation goals and objectives. Each annex lists the recommended hazard mitigation actions that make up the action plan. The timeframe indicated in the tables is defined as follows:

- Short Term = to be completed in 1 to 5 years
- Long Term = to be completed in greater than 5 years
- Ongoing = currently being funded and implemented under existing programs.

6.6.2 Action Prioritization

44 CFR requires actions identified in the Plan to be prioritized (Sections 201.6(c)(3)(iii)). The planning team developed a methodology for prioritizing the action plans that meets the needs of the partnership and the requirements of 44 CFR. All identified actions were prioritized in two categories — implementation and grant pursuit — as defined by the following criteria:

Implementation priority

- High Priority — an action that meets multiple objectives, has benefits that exceed costs, and has a secured source of funding. Action can be completed in the short term (1 to 5 years).
- Medium Priority — an action that meets multiple objectives, has benefits that exceed costs, and is eligible for funding though no funding has yet been secured for it. Action can be completed in the short term (1 to 5 years) once funding is secured. Medium-priority actions become high-priority actions once funding is secured.
- Low Priority — an action that will mitigate the risk of a hazard, has benefits that do not exceed the costs or are difficult to quantify, has no secured source of funding, and is not eligible for any known grant funding. Action can be completed in the long term (1 to 10 years). Low-priority actions are generally “wish-list” actions. They may be eligible for grant funding from programs that have not yet been identified.

Grant pursuit priority

- High Priority — an action that meets identified grant eligibility requirements, has high benefits, and is listed as high or medium implementation priority; local funding options are unavailable or available local funds could be used instead for actions that are not eligible for grant funding.
- Medium Priority — an action that meets identified grant eligibility requirements, has medium or low benefits, and is listed as medium or low implementation priority; local funding options are unavailable.
- Low Priority — an action that has not been identified as meeting any grant eligibility requirements.

These priority definitions are dynamic and can change from one category to another based on changes to a parameter such as availability of funding. For example, a project might be assigned a medium priority because of the uncertainty of a funding source, but be changed to high priority once a funding source has been identified. The prioritization schedule for this plan will be reviewed and updated as needed annually through the plan maintenance strategy.

6.6.3 Benefit/Cost Review

44 CFR requires the prioritization of the action plan to emphasize a benefit/cost analysis of the proposed actions. Because some actions may not be implemented for up to 10 years, benefit/cost analysis was qualitative and not of the detail required by FEMA for project grant eligibility under the Hazard Mitigation Assistance (HMA) grant program. A review of the apparent benefits versus the apparent cost of each project was performed. Parameters were established for assigning subjective ratings (high, medium, and low) to benefits and costs as follows:

Benefit ratings:

- High — the action will have an immediate impact on the reduction of risk exposure to life and property.
- Medium — the action 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 action are difficult to quantify in the short-term.

Cost ratings:

- High — existing funding levels are not adequate to cover the costs of the proposed action; implementation would require an increase in revenue through an alternative source (for example, bonds, grants, and fee increases).

- Medium — the action could be implemented with existing funding but would require a reapportionment of the budget or a budget amendment, or the cost of the action would have to be spread over multiple years.
- Low — the action could be funded under the existing budget. The action is part of or can be part of an existing, ongoing program.

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-beneficial and are prioritized accordingly. For many of the strategies identified in this action plan, funding might be sought under FEMA’s HMA program. This program requires detailed benefit/cost analysis as part of the application process. These analyses will be performed on projects at the time of application preparation. The FEMA benefit-cost model will be used to perform this review. For projects not seeking financial assistance from grant programs that require this sort of analysis, the planning partners reserve the right to define “benefits” according to parameters that meet their needs and the goals and objectives of this plan.

6.6.4 Analysis of Mitigation Actions

All planning partners reviewed their recommended actions to classify each action based on the hazard it addresses and the type of mitigation it involves. Mitigation types used for this categorization are as follows:

- Prevention — government, administrative or regulatory actions that influence the way land and buildings are developed to reduce hazard losses. Includes planning and zoning, floodplain laws, capital improvement programs, open space preservation, and stormwater management regulations.
- Property Protection — modification of buildings or structures to protect them from a hazard or removal of structures from a hazard area. Includes acquisition, elevation, relocation, structural retrofit, storm shutters, and shatter-resistant glass.
- Public Education and Awareness — actions to inform citizens and elected officials about hazards and ways to mitigate them. Includes outreach projects, real estate disclosure, hazard information centers, and school-age and adult education.
- Natural Resource Protection — actions that minimize hazard loss and preserve or restore the functions of natural systems. Includes sediment and erosion control, stream corridor restoration, watershed management, forest and vegetation management, and wetland restoration and preservation.
- Emergency Services — actions that protect people and property during and immediately after a hazard event. Includes warning systems, emergency response services, and the protection of essential facilities.
- Structural Projects — actions that involve the construction of structures to reduce the impact of a hazard. Includes dams, setback levees, floodwalls, retaining walls, and safe rooms.
- Community Capacity Building — actions that increase or enhance local capabilities to adjust to potential damage, to take advantage of opportunities, or to respond to consequences. Includes staff training, memorandums of understanding, development of plans and studies, and monitoring programs.

These categories include categories identified in the Community Rating System (CRS) 2017 CRS Coordinators Manual (OMB No. 1660-0022, Figure 510-4). The CRS categories expand on the four categories in FEMA’s 2013 Local Mitigation Handbook. They provide a more comprehensive range of options, thus increasing integration opportunities.

SECTION 7 PLAN MAINTENANCE PROCEDURES

This section details the formal process that will ensure that the HMP remains an active and relevant document and that the Planning Partnership maintains their eligibility for applicable funding sources. The plan maintenance process includes a schedule for monitoring and evaluating the plan annually and producing an updated plan every five years. In addition, this section 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. The plan’s format allows sections to be reviewed and updated when new data become available, resulting in a plan that will remain current and relevant.

The below checklist provides a guide for key activities to address plan maintenance.

Annual Mitigation Plan Maintenance Checklist

- ✓ Month 1: Document municipal and special district adoption resolutions and confirm ongoing Planning Partnership membership contact information
- ✓ Month 11: Preparation of status updates and action implementation tracking as part of submission for Annual Progress Report.
- ✓ Month 11: In order for integration of mitigation principles action to become an organic part of the ongoing county, municipal and special district activities, the county will incorporate the distribution of the safe growth worksheet (see 7.1.2 below) for annual review and update by all participating jurisdictions.
- ✓ Ongoing – Months 1-12: Review the status of previous actions as submitted by the monitoring task lead and support to assess the effectiveness of the plan.
- ✓ Month 12: Generate and finalize the Annual Progress Report.
- ✓ Month 12: Distribute Annual Progress Report to all participating communities to document project implementation successes.
- ✓ Month 36 from initial plan approval position for funding of plan update including application for grant funding.

The plan maintenance matrix shown in Table 7-1 provides a synopsis of responsibilities for plan monitoring, evaluation, and update, which are discussed in further detail in the sections below.

Table 7-1 Plan Maintenance Matrix

Task	Approach	Timeline	Lead Responsibility	Support Responsibility
Monitoring	Preparation of status updates and action implementation tracking as part of submission for Annual Progress Report.	[April] or upon major update to Comprehensive Plan or major disaster	Jurisdictional points of contact identified in Section 8 (Planning Partnership) and Section 9 (Jurisdictional Annexes)	Jurisdictional implementation lead identified in Section 8 (Planning Partnership) and Section 9 (Jurisdictional Annexes)
Integration	In order for integration of mitigation principles action to	[April] each year with interim email	HMP Coordinator and jurisdictional points of	HMP Coordinator

Task	Approach	Timeline	Lead Responsibility	Support Responsibility
	become an organic part of the ongoing county, municipal and special district activities, the county will incorporate the distribution of the safe growth worksheet (see 7.1.2 below) for annual review and update by all participating jurisdictions.	reminders to address integration in county, municipal, and special district activities.	contact identified in Section 8 (Planning Partnership) and Section 9 (Jurisdictional Annexes)	
Evaluation	Review the status of previous actions as submitted by the monitoring task lead and support to assess the effectiveness of the plan; compile and finalize the Annual Progress Report	Finalized progress report completed by April of each year	Steering Committee; Plan Maintenance element	Jurisdictional points of contacts identified in Section 9 (Jurisdictional Annexes)
Update	Reconvene the planning partners, at a minimum, every 5 years to guide a comprehensive update to review and revise the plan.	Every 5 years or upon major update to Comprehensive Plan or major disaster	Douglas County HMP Coordinator	Jurisdictional points of contacts identified in Section 9 (Jurisdictional Annexes)

7.1 Monitoring, Evaluating and Updating the Plan

The procedures for monitoring, evaluating, and updating the plan are provided below.

The HMP Coordinator is assigned to manage the maintenance and update of the plan during its performance period. The HMP Coordinator will chair the Planning Committee and be the prime point of contact for questions regarding the plan and its implementation as well as to coordinate incorporation of additional information into the plan.

The Planning Committee shall fulfill the monitoring, evaluation and updating responsibilities identified in this section which is comprised of a representative from each participating jurisdiction. Each jurisdiction is expected to maintain a representative on the Planning Committee throughout the plan performance period (five years from the date of plan adoption). As of the date of this plan, primary and secondary mitigation planning representatives (points-of-contact) are identified in each jurisdictional annex in Section 9 (Jurisdictional Annexes).

Regarding the composition of the committee, it is recognized that individual commitments change over time, and it shall be the responsibility of each jurisdiction and its representatives to inform the HMP Coordinator of any changes in representation. The HMP Coordinator will strive to keep the committee makeup as a uniform representation of planning partners and stakeholders within the planning area.

Currently, the Douglas County HMP Coordinator is designated as:

Tim Johnson, Director
 Douglas County Office of Emergency Management
 4000 Justice Way
 Castle Rock, CO 80109
 (303) 660-7589

Email: tmjohnso@dcsheriff.net

7.1.1 Monitoring

The Planning Committee shall be responsible for monitoring progress on, and evaluating the effectiveness of, the plan, 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 (Section 9) of this plan, by contacting persons responsible for initiating and/or overseeing the mitigation projects.

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 information that Planning Committee representatives shall be expected to document, as needed and appropriate include:

- 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.

7.1.2 Integration Process of the HMP into Jurisdictional 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 that do no increased risk from known hazards or leads to redevelopment that reduces risk from known hazards. The Douglas County Planning Partnership was tasked with identifying how hazard mitigation is integrated into existing planning mechanisms. Refer to Section 9 (Jurisdictional Annexes) for how this is done for each participating jurisdiction. During this process, many jurisdictions recognized the importance and benefits of incorporating hazard mitigation into future planning and regulatory processes.

The Planning Partnership representatives will incorporate mitigation planning as an integral component of daily government and special district operations. Planning Partnership representatives will work with local government and special district officials to integrate the newly adopted hazard mitigation goals and actions into the general operations of government and partner organizations. Further, the sample adoption resolution (Section 2 – Plan Adoption) 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 Planning Partnership anticipates that:

1. Hazard mitigation planning will be formally recognized as an integral part of overall planning and emergency management efforts;
2. The Hazard Mitigation Plan, 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.

During the HMP annual review process, each participating jurisdiction will be asked to document how they are utilizing and incorporating the Douglas County HMP into their day-to-day operations and planning and

regulatory processes. Additionally, each jurisdiction 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 following checklist was adapted from FEMA’s Local Mitigation Handbook (2013), Appendix A, Worksheet 4.2. This checklist will help a community analyze how hazard mitigation is integrated into local plans, ordinances, regulations, ordinances, and policies. By completing the checklist, it will help participating jurisdictions identify areas that integrate hazard mitigation currently and where to make improvements and reduce vulnerability to future development. In this manner, the integration of mitigation into jurisdictional activities will evolve into an ongoing culture within the county and participating jurisdictions.

Table 7-2 Safe Growth Check List

Planning Mechanisms	Do you Do This?		Notes: How is it being done or how will this be utilized in the future?
	Yes	No	
Operating, Municipal and Capital Improvement Program Budgets			
<ul style="list-style-type: none"> When constructing upcoming budgets, hazard mitigation actions will be funded as budget allows. Construction projects will be evaluated to see if they meet the hazard mitigation goals. 			
<ul style="list-style-type: none"> Annually, during adoption process, the municipality will review mitigation actions when allocating funding. 			
<ul style="list-style-type: none"> Do budgets limit expenditures on projects that would encourage development in areas vulnerable to natural hazards? 			
<ul style="list-style-type: none"> Do infrastructure policies limit extension of existing facilities and services that would encourage development in areas vulnerable to natural hazards? 			
<ul style="list-style-type: none"> Do budgets provide funding for hazard mitigation projects identified in the County HMP? 			
Human Resource Manual			
<ul style="list-style-type: none"> Do any job descriptions specifically include identifying and/or implementing mitigation projects/actions or other efforts to reduce natural hazard risk? 			
Building and Zoning Ordinances			
<ul style="list-style-type: none"> Prior to, zoning changes, or development permitting, the jurisdiction will review the hazard mitigation plan and other hazard analyses to ensure consistent and compatible land use. 			
<ul style="list-style-type: none"> Does the zoning ordinance discourage development or redevelopment within natural areas including wetlands, floodways, and floodplains? 			
<ul style="list-style-type: none"> Does it contain natural overlay zones that set conditions 			
<ul style="list-style-type: none"> Does the ordinance require developers to take additional actions to mitigate natural hazard risk? 			
<ul style="list-style-type: none"> Do rezoning procedures recognize natural hazard areas as limits on zoning changes that allow greater intensity or density of use? 			
<ul style="list-style-type: none"> Do the ordinances prohibit development within, of filling of, wetlands, floodways, and floodplains? 			
Subdivision Regulations			
<ul style="list-style-type: none"> Do the subdivision regulations restrict the subdivision of land within or adjacent to natural hazard areas? 			

Planning Mechanisms	Do you Do This?		Notes: How is it being done or how will this be utilized in the future?
	Yes	No	
<ul style="list-style-type: none"> Do the subdivision regulations restrict the subdivision of land within or adjacent to natural hazard areas? 			
<ul style="list-style-type: none"> Do the regulations provide for conservation subdivisions or cluster subdivisions in order to conserve environmental resources? 			
<ul style="list-style-type: none"> Do the regulations allow density transfers where hazard areas exist? 			
Comprehensive Plan			
<ul style="list-style-type: none"> Are the goals and policies of the plan related to those of the County HMP? 			
<ul style="list-style-type: none"> Does the future land use map clearly identify natural hazard areas? 			
<ul style="list-style-type: none"> Do the land use policies discourage development or redevelopment with natural hazard areas? 			
<ul style="list-style-type: none"> Does the plan provide adequate space for expected future growth in areas located outside natural hazard areas? 			
Land Use			
<ul style="list-style-type: none"> Does the future land use map clearly identify natural hazard areas? 			
<ul style="list-style-type: none"> Do the land use policies discourage development or redevelopment with natural hazard areas? 			
<ul style="list-style-type: none"> Does the plan provide adequate space for expected future growth in areas located outside natural hazard areas? 			
Transportation Plan			
<ul style="list-style-type: none"> Does the transportation plan limit access to hazard areas? 			
<ul style="list-style-type: none"> Is transportation policy used to guide growth to safe locations? 			
<ul style="list-style-type: none"> Are transportation systems designed to function under disaster conditions (e.g. evacuation)? 			
Environmental Management			
<ul style="list-style-type: none"> Are environmental systems that protect development from hazards identified and mapped? 			
<ul style="list-style-type: none"> Do environmental policies maintain and restore protective ecosystems? 			
<ul style="list-style-type: none"> Do environmental policies provide incentives to development that is located outside protective ecosystems? 			
Grant Applications			
<ul style="list-style-type: none"> Data and maps will be used as supporting documentation in grant applications. 			
Municipal Ordinances			
<ul style="list-style-type: none"> When updating municipal ordinances, hazard mitigation will be a priority 			
Economic Development			
<ul style="list-style-type: none"> Local economic development group will take into account information regarding identified hazard areas when assisting new businesses in finding a location. 			
Public Education and Outreach			
<ul style="list-style-type: none"> Does the jurisdiction have any public outreach mechanisms / programs in place to inform citizens on natural hazards, risk, and ways to protect themselves during such events? 			

7.1.3 Evaluating

The evaluation of the mitigation plan is an assessment of whether the planning process and actions have been effective, if the HMP goals are being achieved, and whether changes are needed. The HMP will be evaluated on an annual basis to determine the effectiveness of the programs, 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 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. At least two weeks before the annual plan review meeting, the Douglas County HMP Coordinator will advise Planning Committee members of the meeting date, agenda and expectations of the members.

The Douglas County HMP Coordinator will be responsible for calling and coordinating the annual plan review meeting and Soliciting input regarding progress toward meeting plan goals and objectives. 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, such as technical, political, legal or coordination issues with other agencies are presents.
- Outcomes have occurred as expected.
- Changes in county, city, town or special district resources impacted plan implementation (e.g., funding, personnel, and equipment)
- New agencies/departments/staff should be included, including other local governments as defined under 44 CFR 201.6.

Specifically, the Planning Committee will review the mitigation goals, objectives, and activities using performance-based indicators, including:

- New agencies/departments
- Project completion
- Under/over spending
- Achievement of the goals and objectives
- Resource allocation
- Timeframes
- Budgets
- Lead/support agency commitment
- Resources
- Feasibility

Finally, the Planning Committee will evaluate how other programs and policies have conflicted or augmented planned or implemented measures, and shall identify policies, programs, practices, and

procedures that could be modified to accommodate hazard mitigation actions (“Implementation of Mitigation Plan through Existing Programs” subsection later in this section discusses this process). Other programs and policies can include those that address:

- Economic development
- Environmental preservation
- Historic preservation
- Redevelopment
- Health and/or safety
- Recreation
- Land use/zoning
- Public education and outreach
- Transportation

The Planning Committee should refer to the evaluation forms, Worksheets #2 and #4 in the FEMA 386-4 guidance document, to assist in the evaluation process (see Appendix G – Plan Review Tools). Further, the Planning Committee should refer to any process and plan review deliverables developed by the county or participating jurisdictions as a part of the plan review processes established for prior or existing local HMPs within the county.

The Douglas County HMP Coordinator shall be responsible for preparing an Annual HMP Progress Report for each year of the performance period, based on the information provided by the local Planning Committee members, information presented at the annual Planning Committee meeting, and other information as appropriate and relevant. 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 on an annual basis, the Planning Committee will be able to assess which projects are completed, which are no longer feasible, and what projects should require additional funding.

The Annual HMP Progress Report shall be posted on the Douglas County Local Natural Hazard Mitigation webpage to keep the public apprised of the plan’s implementation (<https://www.douglas.co.us/natural-hazard-mitigation-plan/>). Additionally, the website provides details on the HMP update planning process. For communities who might choose to join the NFIP CRS program, this report will also be provided to each CRS participating community in order to meet annual CRS recertification requirements. To meet this recertification timeline, the Planning Committee will strive to complete the review process and prepare an Annual HMP Progress Report by April of each year.

The HMP will also be evaluated and revised following any major disasters, 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 damages or if data listed in the Section 5.4 (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.

7.1.4 Updating

44 CFR 201.6.d.3 requires that local hazard mitigation plans be reviewed, revised as appropriate, and resubmitted for approval in order to remain eligible for benefits awarded under DMA 2000. It is the intent

of the Douglas County HMP Planning Committee to update this plan on a five-year cycle from the date of initial plan adoption.

To facilitate the update process, the Douglas County HMP Coordinator, with support of the Planning Committee, shall use the second annual Planning Committee meeting to develop and commence the implementation of a detailed plan update program. The Douglas County HMP Coordinator shall invite representatives from the Colorado DHSEM to this meeting to provide guidance on plan update procedures. This program shall, at a minimum, establish who shall be responsible for managing and completing the plan update effort, what needs to be included in the updated plan, and a detailed timeline with milestones to assure that the update is completed according to regulatory requirements.

At this meeting, the Planning Committee shall determine what resources will be needed to complete the update. The Douglas County HMP Coordinator shall be responsible for assuring that needed resources are secured.

Following each five-year update of the mitigation plan, the updated plan will be distributed for public comment. After all comments are addressed, the HMP will be revised and distributed to all planning group members and the Colorado State Hazard Mitigation Officer.

7.1.5 Grant Monitoring and Coordination

Douglas County recognizes the importance of having an annual coordination period that helps each planning partner become aware of upcoming mitigation grant opportunities identifies multi-jurisdiction projects to pursue. Grant monitoring will be the responsibility of each municipal and special district partner as part of their annual progress reporting. The Douglas County HMP Coordinator will keep the planning partners apprised of Hazard Mitigation Assistance grant openings and assist in developing letters of intent for grant opportunities when practicable.

Douglas County intends to be a resource to the planning partnership in the support of project grant writing and development. The degree of this support will depend on the level of assistance requested by the partnership during open windows 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.

Grant monitoring and coordination will be integrated into the annual progress report or as needed based on the availability of non-HMA or post-disaster funding opportunities.

7.2 Implementation of Mitigation Plan through Existing Programs

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 thus it is critical that this hazard mitigation plan integrate and coordinate with, and complement, those existing plans and programs.

The “Capability Assessment” section of Section 6 (Mitigation Strategy) 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. Within each jurisdictional annex in Section 9 (Jurisdictional Annexes), the county and each participating jurisdiction identified how they have integrated hazard risk management into their existing planning, regulatory and operational/administrative framework (“existing integration”), and how they intend to promote this integration (“opportunities for future integration”).

It is the intention of Planning Committee representatives to incorporate mitigation planning as an integral component of daily government operations. 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. Further, the sample adoption resolution (Section 2 – Plan Adoption) 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 Planning Committee anticipates that:

- 1) Hazard mitigation planning will be formally recognized as an integral part of overall emergency management efforts;
- 2) The Hazard Mitigation Plan, 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 hazard mitigation plan 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/education plans

Some action items do not need to be implemented through regulation. Instead, these items can be implemented through the creation of new educational programs, continued interagency coordination, or improved public participation.

During the annual plan evaluation process, the Planning Committee representatives 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.

7.3 Continued Public Involvement

Douglas County and participating jurisdictions are committed to the continued involvement of the public in the hazard mitigation process. This HMP update will continue to be posted on-line (<https://www.douglas.co.us/natural-hazard-mitigation-plan/>). In addition, public outreach and dissemination of the HMP will include:

- Links to the plan on websites of each jurisdiction with capability.
- Continued utilization of existing social media outlets (Facebook, Twitter, and Nextdoor) to inform the public of natural hazard events, such as floods and severe storms. Educate the public via the jurisdictional websites on how these applications can be used in an emergency situation.
- Development of annual articles or workshops on high risk hazards to educate the public and keep them aware of the dangers in the planning partnership area.

Planning Committee representatives and the Douglas County 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 plan via the hazard mitigation website at any time. The HMP Coordinator will maintain this website, posting new information and maintaining an active link to collect public comments.

The public can also provide input at the annual review meeting for the HMP and during the next five-year plan update. The Douglas County HMP Coordinator is responsible for coordinating the plan evaluation portion of the meeting, soliciting feedback, collecting and reviewing the comments, and ensuring their incorporation in the five-year plan update as appropriate. Additional meetings might also be held as deemed necessary by the planning group. The purpose of these meeting would be to provide the public an opportunity to express concerns, opinions, and ideas about the mitigation plan.

The Planning Committee representatives shall be responsible to assure that:

- Public comment and input on the plan, and hazard mitigation in general, are recorded and addressed, as appropriate.
- Copies of the latest approved plan (or draft in the case that the five-year update effort is underway) are available for review, along with instructions to facilitate public input and comment on the Plan.
- Appropriate links to the Douglas County Hazard Mitigation Plan website are included on jurisdictional websites.
- Public notices are made as appropriate to inform the public of the availability of the plan, particularly during Plan update cycles.

The Douglas County HMP Coordinator shall be responsible to assure that:

- Public and stakeholder comment and input on the plan, and hazard mitigation in general, are 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 plan.
- Public notices, including media releases, are made as appropriate to inform the public of the availability of the plan, particularly during plan update cycles.



Douglas County Local Natural Hazard Mitigation Plan 2021 Update



Appendices



APPENDIX A. ADOPTION RESOLUTIONS

The Douglas County and municipal adoption resolutions will be included in this appendix upon receipt of the Federal Emergency Management Agency (FEMA) Approval Pending Adoption (APA) status. Please refer to Section 8 (Planning Partnership) for additional information on plan adoption procedures.

This appendix also includes an example resolution to be submitted by Douglas County and participating jurisdictions authorizing adoption of the Douglas County Hazard Mitigation Plan Update.

RESOLUTION NO. R-021- 092

A RESOLUTION OF THE BOARD OF COUNTY COMMISSIONERS OF DOUGLAS COUNTY, COLORADO TO UPDATE THE DOUGLAS COUNTY LOCAL HAZARD MITIGATION PLAN

WHEREAS, Douglas County and its incorporated communities are exposed to flooding, wildfire, severe weather, and other natural hazards that increase the vulnerability to life, property, environment and the County's economy; and

WHEREAS, hazard mitigation planning will create an operational framework for reducing losses from these hazards; and

WHEREAS, hazard mitigation planning is a requirement of the Robert T. Stafford Disaster Mitigation Act of 2000 (DMA 2000) and continued eligibility for certain sources of federal mitigation funding programs that support loss reduction activities; and

WHEREAS, Douglas County has updated its Douglas County Local Hazard Mitigation Plan, in accordance with FEMA's DMA 2000 to remain eligible for future federal disaster funding; and

WHEREAS, Douglas County and its flood-prone incorporated communities participate in the National Flood Insurance Program (NFIP); and

WHEREAS, the Colorado Division of Emergency Management and Federal Emergency Management Agency, Region VIII, officials have reviewed the 2021 Douglas County Hazard Mitigation Plan and have approved said plan as meeting the requirements of the Stafford Act and Title 44 Code of Federal Regulations 201.6 for a local hazard mitigation plan.

NOW THEREFORE, BE IT RESOLVED by the Board of County Commissioners of Douglas County, Colorado that Douglas County hereby adopts the Douglas County Hazard Mitigation Plan as the multi-hazard mitigation plan for Douglas County, Colorado.

PASSED AND ADOPTED this 24th day of August 2021, in Castle Rock, Douglas County, Colorado.

**THE BOARD OF COUNTY COMMISSIONERS
OF THE COUNTY OF DOUGLAS, COLORADO**

DocuSigned by:
BY: *Lora L. Thomas*

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LORA L. THOMAS, Chair

ATTEST:

DocuSigned by:
Kristin Randlett

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KRISTIN RANDETT, Clerk to the Board

DocuSigned by:



**CITY OF CASTLE PINES
RESOLUTION NO. 21-48**

**A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF CASTLE PINES,
COLORADO ADOPTING VOLUME I AND SECTION 9.4 OF VOLUME II OF THE
DOUGLAS COUNTY LOCAL NATURAL HAZARD MITIGATION PLAN 2021
UPDATE**

WHEREAS, to meet federal requirements for keeping hazard mitigation plans current, Douglas County staff has prepared the Douglas County Local Natural Hazard Mitigation Plan 2021 Update (“2021 Plan Update”); and

WHEREAS, in preparing the 2021 Plan Update, Douglas County (“County”) partnered with the City of Castle Pines, City of Lone Tree, Town of Castle Rock, Town of Larkspur, and Town of Parker, as well as Centennial Water and Sanitation District, Denver Water, and Parker Water and Sanitation District to pool resources and eliminate redundant activities within a planning area that can have uniform risk exposure and shared vulnerability; and

WHEREAS, the 2021 Plan Update serves to reduce the entire County’s vulnerability to natural hazards and thus reduce or eliminate long-term risk to people and property; and

WHEREAS, the 2021 Plan Update also serves as a tool to help decision makers direct mitigation activities and resources; and

WHEREAS, the 2021 Plan Update will help maintain Douglas County’s and the City’s continued eligibility for federal, state, and local disaster assistance and will earn credits for the National Flood Insurance Program’s Community Rating System (“CRS”) which provides for lower flood insurance premiums in CRS communities; and

WHEREAS, the City Council of the City of Castle Pines has reviewed the 2021 Plan Update, a copy of which is available on Douglas County’s website at <https://www.dcsheriff.net/sheriffs-office/divisions/emergency-management/local-natural-hazard-mitigation-plan/>; and

WHEREAS, in furtherance of the public health, safety and welfare of the community, the City Council wishes to adopt the 2021 Plan Update, and will endeavor, in conjunction with Douglas County, to review and approve an updated Plan every five years hereafter.

NOW, THEREFORE, BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF CASTLE PINES, COLORADO:

Section 1. The City Council hereby: (a) approves the Douglas County Local Natural Hazard Mitigation Plan 2021 Update, in substantially the form presented to City Council and published on Douglas County’s website; and (b) authorizes City staff to work with the County to resolve any minor technical issues and to revise the 2021 Plan Update accordingly.

Section 2. **Effective Date.** This Resolution shall take effect upon its approval by the City Council.

INTRODUCED, READ AND ADOPTED AT A REGULAR MEETING OF THE CITY COUNCIL OF THE CITY OF CASTLE PINES, COLORADO by a vote of 7 in favor, 0 against this 12th day of October, 2021.

BY:

DocuSigned by:



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Tera Stave Radloff, Mayor

ATTEST:

DocuSigned by:



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Tobi Duffey CMC, City Clerk

Approved as to form:

DocuSigned by:



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Linda C. Michow, City Attorney

RESOLUTION NO. 2021-083

**A RESOLUTION APPROVING THE 2021 DOUGLAS COUNTY
NATURAL HAZARD MITIGATION PLAN**

WHEREAS, natural hazards along the front range historically have caused significant disasters with losses of life and property and damage to natural resources; and

WHEREAS, undertaking hazard mitigation actions will reduce the potential for harm to people and property from future hazard occurrences; and

WHEREAS, under the Federal Disaster Mitigation Act of 2000, the adoption of a natural hazard mitigation plan is required as a condition of future funding for mitigation projects under multiple Federal Emergency Management Agency (“FEMA”) pre- and post-disaster mitigation grant programs; and

WHEREAS, a natural hazard mitigation plan been prepared by Douglas County and participating jurisdictions in accordance with FEMA requirements set forth at 44 C.F.R. 201.6; and

WHEREAS, as one of eight participating jurisdictions, the Town of Castle Rock has been actively involved in the FEMA-prescribed hazard mitigation planning process organized by Douglas County.

NOW, THEREFORE BE IT RESOLVED BY THE TOWN COUNCIL OF THE TOWN OF CASTLE ROCK AS FOLLOWS:


Section 1. The Town of Castle Rock hereby adopts the Douglas County Local Natural Hazard Mitigation Plan – 2021 Update (the “Plan”) as an official plan conditioned upon approval by the Colorado Division of Homeland Security and Emergency Management and FEMA.

Section 2. The Town of Castle Rock will submit this Resolution to the Douglas County Office of Emergency Management and the FEMA Region VIII Office to enable the Plan’s final approval by FEMA.

Section 3. This Resolution shall be in full force and effect upon obtaining final approval for the Plan from FEMA.

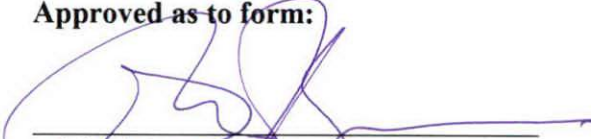
PASSED, APPROVED AND ADOPTED this 21st day of September, 2021, by the Town Council of the Town of Castle Rock, Colorado, on first and final reading by a vote of 7 for and 0 against.

ATTEST:



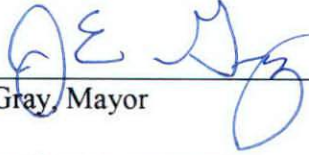
Lisa Anderson, Town Clerk

Approved as to form:



Michael J. Hyman, Town Attorney

TOWN OF CASTLE ROCK



Jason Gray, Mayor

Approved as to content:



Norris W. Croom III, Fire Chief





Board Resolution


TITLE: RESOLUTION ADOPTING THE DOUGLAS COUNTY MULTI-HAZARD MITIGATION PLAN 2021 AS IT PERTAINS TO DENVER WATER.

ADOPTED AND APPROVED ON SEPTEMBER 22, 2021 BY THE CITY AND COUNTY OF DENVER ACTING BY AND THROUGH ITS BOARD OF WATER COMMISSIONERS

DocuSigned by:

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Gary M. Reiff, Board President

DocuSigned by:

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James S. Lochhead, CEO/Manager

WHEREAS, Douglas County requested that the City and County of Denver, acting by and through its Board of Water Commissioners (“Denver Water”), as a property owner in Douglas County, participate in mitigation planning prescribed by the Disaster Mitigation Act of 2000 by assisting in the preparation of Douglas County’s Multi-Hazard Mitigation Plan; and

WHEREAS, Denver Water recognizes the threat that natural hazards pose to people and facilities within Douglas County; and

WHEREAS, undertaking hazard mitigation actions will reduce the potential for harm to people and property from future hazard occurrences; and

WHEREAS, the Colorado Department of Emergency Management and the Federal Emergency Management Agency (FEMA) Region VIII officials have reviewed the Douglas County Multi-Hazard Mitigation Plan and approved it contingent upon official adoption of the participating governing body; and

WHEREAS, Denver Water desires to comply with the requirements of the Disaster Mitigation Act where it specifically references Denver Water within the Douglas County Multi-Hazard Mitigation Plan; and

WHEREAS, Denver Water, in conjunction with Douglas County Government is recognizing the FEMA approval of the Douglas County Multi-Hazard Mitigation Plan, which inventories the threat that natural hazards pose to people and property within that community; and

WHEREAS, an adopted Multi-Hazard Mitigation Plan is required as a condition of future funding for mitigation projects under multiple FEMA pre- and post-disaster mitigation grant programs; and

Adopted by the Board on September 22, 2021

WHEREAS, Denver Water has facilities within the Planning Area, and participated in the mitigation planning process to prepare this Multi-Hazard Mitigation Plan; and

NOW, THEREFORE, BE IT RESOLVED: The City and County of Denver, acting by and Through its Board of Water Commissioners, hereby adopts the Douglas County Multi-Hazard Mitigation Plan as it pertains to Denver Water with the changes shown in the Addendum.

Adopted by the Board on September 22, 2021

**CENTENNIAL WATER AND SANITATION DISTRICT
BOARD COMMUNICATION**

DATE	SUBJECT	AGENDA NUMBER
9/27/21	DOUGLAS COUNTY NATURAL HAZARD MITIGATION PLAN	CWSD 21-140

INITIATED BY JEFF CASE

STAFF RECOMMENDATION

Adopt Resolution No. 21-140 with the following actions:

- Adoption of Douglas County's Local Natural Hazard Mitigation Plan 2021 Update

BACKGROUND INFORMATION

Hazard mitigation planning for Douglas County and participating jurisdictions identifies ways to reduce risk from foreseeable natural and non-natural hazards that may impact the planning area. Douglas County prepared a hazard mitigation plan update in 2015, with five municipalities and one special purpose district in the County, participating as partners in the plan. The 2015 plan update was an update to the Denver Regional Natural Hazards Mitigation Plan, of which both the Town of Castle Rock and Douglas County participated. Since the completion of the 2015 plan update, the County has continued to experience growth in residential, commercial, and infrastructure development.

To address these changes, and to meet federal requirements for keeping hazard mitigation plans current, Douglas County has completed the *2021 Douglas County Local Hazard Mitigation Plan Update* (HMP, Plan or Update). In preparing the 2021 Plan, Douglas County partnered with the City of Castle Pines, Town of Castle Rock, Town of Larkspur, City of Lone Tree, and Town of Parker, as well as Centennial Water and Sanitation District, Denver Water, and Parker Water and Sanitation. Such multi-jurisdictional planning allows these planning partners to pool resources and eliminate redundant activities within a planning area that can have uniform risk exposure and vulnerabilities.

The 2021 Plan reduces risk for those who live, work, and visit within the Douglas County planning area. The resources and background information in the 2021 Plan are applicable across the County, and the Plan's goals and recommendations lay groundwork for local mitigation activities and partnerships.

CWSD participated in this planning effort as part of our involvement in the Douglas County Emergency Management Group which meets to discuss current risks and resources to manage those risks throughout the County. These efforts are a function of the Douglas County Office of Emergency Management. As implied by the Plan's title, this effort addresses risks posed by natural events such as severe weather, flooding, wildfires and earthquakes that may result in significant damage to a local or regional area. Adoption of the Plan by FEMA is also an important step in the event a severe event might lead to requests for resources or funding.


JK

DATE	SUBJECT	PAGE NUMBER
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9/27/21

DOUGLAS COUNTY NATURAL HAZARD MITIGATION PLAN

CWSD 21-140

FINANCIAL INFORMATION

The Douglas County Local Natural Hazard Mitigation Plan is a planning document that does not require any financial commitment by CWSD. Risks and identified mitigation measures may be considered in the development of annual budgets.



SS

CENTENNIAL WATER AND SANITATION DISTRICT

RESOLUTION NO. 21-140

WHEREAS, Centennial Water and Sanitation District has gathered information prepared in the Douglas County Local Natural Hazard Mitigation Plan 2021 Update;

WHEREAS, the Douglas County Local Natural Hazard Mitigation Plan 2021 Update has been prepared in accordance with FEMA requirements at 44C.F.R. 201.6;

WHEREAS, the Centennial Water and Sanitation District is a local unit of government, and in cooperation with Douglas County, has afforded the citizens an opportunity to comment and provide input on the Plan and the actions in the Plan; and

WHEREAS, Centennial Water and Sanitation District has reviewed the Plan and affirms that, in cooperation with Douglas County, the Plan will be updated no less than every five years.

NOW THEREFORE, BE IT RESOLVED that Centennial Water and Sanitation District hereby adopts the Douglas County Local Natural Hazard Mitigation Plan 2021 Update, as approved by FEMA, as this jurisdiction's Multi-Hazard Mitigation Plan, and resolves to act in accordance with the Plan.

Adopted this 27th day of September, 2021

Ayes 4 Nays Abstained Absent 1

Certified by  Secretary

**TOWN OF LARKSPUR
RESOLUTION NO. 2021-11**

**A RESOLUTION OF THE TOWN COUNCIL OF THE TOWN OF
LARKSPUR ADOPTING A MULTI-HAZARD MITIGATION PLAN**

WHEREAS, the Town of Larkspur, Colorado (“Town”) is a home rule municipality duly organized and existing under the Constitution of the State of Colorado and the Home Rule Charter of the Town; and

WHEREAS, the Town with the assistance from (Chrissie Angeletti, JD Tetra Tech), has gathered information and prepared the 2021 Douglas County Hazard Mitigation Plan (“Plan”); and,

WHEREAS, the 2021 Douglas County Hazard Mitigation Plan attached hereto as Exhibit A and incorporated herein, has been prepared in accordance with FEMA requirements at 44 C.F.R. 201.6; and,

WHEREAS, the Town is a local unit of government that has afforded the citizens an opportunity to comment and provide input in the Plan and the actions in the Plan; and

WHEREAS, the Town Council of the Town of Larkspur has reviewed the Plan and affirms that the Plan will be updated no less than every five years.

**NOW, THEREFORE, BE IT RESOLVED BY THE TOWN COUNCIL OF THE
TOWN OF LARKSPUR, COLORADO, AS FOLLOWS:**

Section 1. The Town of Larkspur hereby adopts the 2021 Douglas County Hazard Mitigation Plan as approved by FEMA, attached hereto as Exhibit A and incorporated by reference, as the Town of Larkspur’s Multi-Hazard Mitigation Plan, and resolves to execute the actions in the Plan.

**INTRODUCED, PASSED AND ADOPTED AT A REGULAR MEETING OF THE TOWN
COUNCIL OF THE TOWN OF LARKSPUR THIS 19TH DAY OF AUGUST 2021.**



Votes Approved: 6
Votes Opposed: 0
Abstained: 0
Absent: 1

ATTEST:

**TOWN COUNCIL OF THE
TOWN OF LARKSPUR, COLORADO**

Sean Hogan
Sean Hogan
Town Clerk

Isaac Levy
Isaac Levy
Mayor

RESOLUTION NO. 21-34

**A RESOLUTION ADOPTING THE DOUGLAS COUNTY LOCAL NATURAL
HAZARD MITIGATION PLAN 2021 UPDATE**

WHEREAS, to meet federal requirements for keeping hazard mitigation plans current, Douglas County staff has prepared the Douglas County Local Natural Hazard Mitigation Plan 2021 Update (“2021 Plan Update”); and

WHEREAS, in preparing the 2021 Plan Update, Douglas County partnered with the City of Lone Tree, City of Castle Pines, Town of Castle Rock, Town of Larkspur, and Town of Parker, as well as Centennial Water and Sanitation District, Denver Water, and Parker Water and Sanitation District to pool resources and eliminate redundant activities within a planning area that can have uniform risk exposure and shared vulnerability; and

WHEREAS, the 2021 Plan Update serves to reduce the entire County’s vulnerability to natural hazards and thus reduce or eliminate long-term risk to people and property; and

WHEREAS, the 2021 Plan Update also serves as a tool to help decision makers direct mitigation activities and resources; and

WHEREAS, the 2021 Plan Update will help maintain Douglas County’s and the City’s continued eligibility for federal, state, and local disaster assistance and will earn credits for the National Flood Insurance Program’s Community Rating System (“CRS”) which provides for lower flood insurance premiums in CRS communities; and

WHEREAS, the City Council of the City of Lone Tree has reviewed the 2021 Plan Update, a copy of which is available on the City’s website at cityoflonetree.com; and

WHEREAS, in furtherance of the public health, safety and welfare of the community, the City Council wishes to adopt the 2021 Plan Update, and will endeavor, in conjunction with Douglas County, to review and approve an updated Plan every five years hereafter.

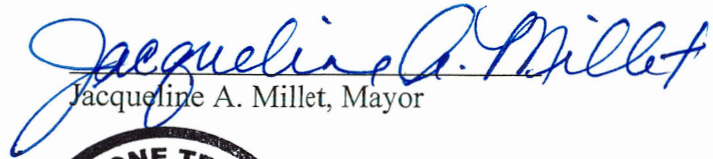
NOW THEREFORE, BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF LONE TREE, COLORADO:

Section 1. The Douglas County Local Natural Hazard Mitigation Plan 2021 Update, as presented to City Council and as published on the City’s website, is hereby adopted.

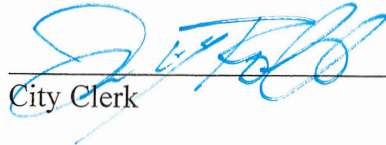
Section 2. This Resolution is effective upon adoption.

APPROVED AND ADOPTED THIS 20th DAY OF JULY 2021.

CITY OF LONE TREE


Jacqueline A. Millet, Mayor

ATTEST:


City Clerk



RESOLUTION NO. 21-050 , Series of 2021

TITLE: A RESOLUTION TO APPROVE THE DOUGLAS COUNTY LOCAL MITIGATION PLAN, COMPREHENSIVE 2021 UPDATE, VOLUMES I AND II

WHEREAS, the Douglas County Office of Emergency Management, with the assistance of the Town of Parker, has gathered information and prepared the *Douglas County Local Hazard Mitigation Plan, Comprehensive Update 2021*;

WHEREAS, the *Douglas County Local Hazard Mitigation Plan, Comprehensive Update 2021* (the "Plan") has been prepared in accordance with FEMA requirements at 44 C.F.R. 201.6;

WHEREAS, the Town of Parker, Colorado, in conjunction with Douglas County, has afforded the citizens an opportunity to comment and provide input in the Plan and the actions in the Plan; and

WHEREAS, Douglas County, Colorado, has reviewed the Plan and affirms that the Plan will be updated no less than every five years.

NOW, THEREFORE, BE IT RESOLVED BY THE TOWN COUNCIL OF THE TOWN OF PARKER, COLORADO, AS FOLLOWS:

Section 1. The Town Council of the Town of Parker hereby approves the *Douglas County Local Hazard Mitigation Plan, Comprehensive Update 2021*. The Plan is available through a link on the Town's website at www.parkeronline.org.

RESOLVED AND PASSED this 6th day of December, 2021.

TOWN OF PARKER, COLORADO



Jeff Toboog, Mayor

ATTEST:



Chris Vanderpool, Town Clerk

RESOLUTION 2021-10

A RESOLUTION OF THE BOARD OF DIRECTORS OF THE PARKER WATER AND SANITATION DISTRICT ADOPTING THE DOUGLAS COUNTY LOCAL NATURAL HAZARD MITIGATION PLAN 2021 UPDATE

WHEREAS, the Parker Water and Sanitation District with the assistance from Tetra Tech Engineering, has gathered information prepared in the Douglas County Local Natural Hazard Mitigation Plan 2021 Update;

WHEREAS, the Douglas County Local Natural Hazard Mitigation Plan 2021 Update has been prepared in accordance with FEMA requirements at 44C.F.R. 201.6;

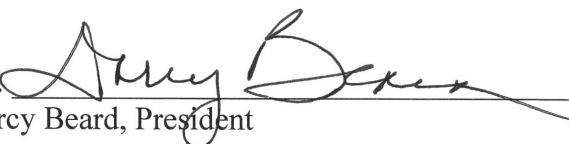
WHEREAS, the Parker Water and Sanitation District is a local unit of government that has afforded the citizens an opportunity to comment and provide input on the Plan and the actions in the Plan; and

WHEREAS, the Parker Water and Sanitation District has reviewed the Plan and affirms that the Plan will be updated no less than every five years.

NOW THEREFORE, BE IT RESOLVED by Board of Directors of the Parker Water and Sanitation District hereby adopts the Douglas County Local Natural Hazard Mitigation Plan 2021 Update, as approved by FEMA, as this jurisdiction's Multi-Hazard Mitigation Plan, and resolves to execute the actions in the Plan.

ADOPTED this 23rd day of September, 2021, at the meeting of the Board of Directors of the Parker Water and Sanitation District.

PARKER WATER AND SANITATION DISTRICT

By: 
Darcy Beard, President

ATTEST:

By:  _____

Secretary

APPENDIX B. PARTICIPATION MATRIX

The matrix in Appendix B is intended to give a broad overview of FEMA, the State of Colorado, county, municipal and stakeholder personnel that participated in the Douglas County HMP update planning process. Meeting attendees and input provided are also included. All participants were encouraged to attend the kick-off meeting and mitigation workshop. During the planning process the consultant contacted each participant to offer support, explain the process, and facilitate the submittal and review of critical documents.

The participating jurisdictions agreed to abide by the Planning Partner Expectations and Planning Committee Guidelines which established a Local Planning Committee. Letters of Intent to Participate indicating jurisdictional planning efforts are included in this appendix. The Local Planning Committee served as the core of the working group. Participation is defined as having input to the hazard analysis (providing critical facility, hazard event, vulnerability data), and as having participated in the mitigation workshop or alternate annex meetings as described in the HMP for the purpose of creating a mitigation strategy to be included in each municipalities annex in Section 9. A list of participating jurisdictions and representatives is found in Table B-1.

A Strengths, Weakness, Obstacles and Opportunities exercise (SWOO) was completed by the planning partnership. Participants were asked to fill out the SWOO for each of the hazards of concern for the 2021 HMP update. The results were compiled and presented to the planning partnership at the risk assessment presentation.

Additionally, the Local Planning Committee completed a capability exercise and were asked to review and rank each statement for the planning area. The primary objective for these exercises was to inform the identification and prioritization of actions that could increase the core capabilities of the planning partnership, and to identify limitations in capability to implement mitigation actions. Both exercises and a summary of the results can be found as attachments to Appendix B.

Table B-1. Participation Matrix

Attendee	Title/Position	Planning Partnership Kick-off Meeting July 8, 2020	Local Planning Committee Meeting #1 July 22, 2020	Local Planning Committee Meeting #2 August 19, 2020	Local Planning Committee Meeting #3 September 16, 2020	Local Planning Committee Meeting #4 October 28, 2020	Risk Assessment - Public Workshop November 18, 2020	Planning Participants Mitigation Strategy Workshop January 6, 2021	Local Planning Committee Meeting #5 January 27, 2021	Solicit Public Comment on Draft Plan - Public Workshop February 10, 2021	Steering Committee Member	Designated Project Point of Contact
DOUGLAS COUNTY												
Tim Johnson	Director Office of Emergency Management	X	X	X	X	X	X	X	X	X	X	X
Lisa Goudy	Safety and Security Coordinator	X	X	X	X	X	X	X	X	X	X	X
Tim Hallmark	Director of Facilities, Fleet, and Emergency Support Services			X	X	X		X	X		X	
Joel Hanson	GIS Services and Land Solutions		X		X						X	
Zachary Humbles	Special Projects Engineer	X	X		X			X	X		X	
Steve Koster	Assistant Director of Planning Services	X	X		X	X		X			X	
Carrie Groce	Senior Communications Specialist		X				X	X	X		X	
Sean Owens	Special Projects Manager, Public Works				X			X	X		X	
Wendy Holmes	Director, Communications and Public Affairs				X				X		X	
Steve Brueske	Vice Chairman, Douglas County Public Safety Advisory Committee	X	X	X	X							
Christine Duffy	Appointed Public Trustee	X	X	X		X						
Tom Cribley	Volunteer, Douglas County Search and Rescue		X	X								
CENTENNIAL WATER & SANITATION DISTRICT – HIGHLANDS RANCH												
Jeff Case	Director of Public Works	X	X	X	X	X		X	X	X	X	X
Emmalyn White		X	X	X	X	X		X			X	

Attendee	Title/Position	Planning Partnership Kick-off Meeting July 8, 2020	Local Planning Committee Meeting #1 July 22, 2020	Local Planning Committee Meeting #2 August 19, 2020	Local Planning Committee Meeting #3 September 16, 2020	Local Planning Committee Meeting #4 October 28, 2020	Risk Assessment - Public Workshop November 18, 2020	Planning Participants Mitigation Strategy Workshop January 6, 2021	Local Planning Committee Meeting #5 January 27, 2021	Solicit Public Comment on Draft Plan – Public Workshop February 10, 2021	Steering Committee Member	Designated Project Point of Contact
CITY OF CASTLE PINES												
Larry Nimmo	Director of Public Works					X		X				X
Sam Bishop	Director of Community Development	X	X	X	X			X			X	X
CITY OF LONE TREE												
Bill Medina	Administrative Services Director	X	X	X	X	X		X			X	X
Ron Pinson	Commander							X	X	X	X	X
DENVER WATER												
Rebecca Franco	Emergency Management Manager	X	X	X	X	X		X			X	X
MILE HIGH FLOOD CONTROL DISTRICT – ELECTED NOT TO PARTICIPATE												
Holly Piza	Engineering Services Manager			X								
Kevin Stewart	Engineering Services Manager	X	X									
PARKER WATER & SANITATION DISTRICT												
Angelo Carrieri	Maintenance Superintendent	X	X	X		X		X	X		X	X
TOWN OF CASTLE ROCK												
Norris Croom	Fire Chief							X				
Craig Rollins	Assistant Fire Chief	X	X	X		X		X	X		X	X
David Vandellen	Castle Rock, Stormwater Manager	X	X	X	X			X	X		X	
TOWN OF LARKSPUR												

Attendee	Title/Position	Planning Partnership Kick-off Meeting July 8, 2020	Local Planning Committee Meeting #1 July 22, 2020	Local Planning Committee Meeting #2 August 19, 2020	Local Planning Committee Meeting #3 September 16, 2020	Local Planning Committee Meeting #4 October 28, 2020	Risk Assessment - Public Workshop November 18, 2020	Planning Participants Mitigation Strategy Workshop January 6, 2021	Local Planning Committee Meeting #5 January 27, 2021	Solicit Public Comment on Draft Plan – Public Workshop February 10, 2021	Steering Committee Member	Designated Project Point of Contact
Randal Johnson	Fire Marshal	X	X	X	X	X		X			X	X
Marvin Cardenas	Mayor							X				
Sean Hogan	Town Clerk							X	X		X	X
TOWN OF PARKER												
Gregg Epp	Sergeant, Parker Police Department			X	X			X			X	X
Andrew Coleman	Commander, Parker Police Department		X			X		X			X	

Douglas County HMP Capability Exercise

1. Are you answering this survey on behalf of the County or one of the following participating municipalities?

- Douglas County
- City of Castle Pines
- City of Lone Tree
- Town of Castle Rock
- Town of Larkspur
- Town of Parker

2. Please rank the following statements:

	Agree	Somewhat Agree	Neutral	Somewhat Disagree	Disagree
Emergency management is provided by a unified authority or program.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Current land uses within identified hazard areas are appropriate for the risk posed by each hazard.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There is a good understanding of the risk posed by hazards the planning area is susceptible to.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Emergency response functions for the County/ municipality are clearly defined and are effective.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Members of the public know where to find information about hazards and risk.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Areas that provide natural resource protection are identified and protected.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Existing flood control systems are effective and well maintained.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Roles and responsibilities for emergency management within the County/ municipality clearly defined.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Agree	Somewhat Agree	Neutral	Somewhat Disagree	Disagree
County/ municipality staff are knowledgeable about hazards and their impacts and are willing to share that knowledge with the public.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The capability to assess and mitigate risk from natural hazards is high.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
County/ municipality staff members with emergency management functions are adequately trained.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Citizens have a good understanding of natural hazard exposure and risk.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The funding to support risk reduction within the planning area is adequate.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Strong collaboration and coordination exist between the County/ municipality, neighboring jurisdictions, the County and state and federal agency partners.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Appropriate and timely warning systems are in place.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The County/ municipality currently has a variety of regulatory and non-regulatory strategies to reduce risk.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Agree	Somewhat Agree	Neutral	Somewhat Disagree	Disagree
The County/ municipality currently has adopted policies that encourage development to be located outside of high-risk areas.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Risk from natural hazards within the planning area is adequately mapped and regulated.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There is strong public support for risk reduction within the planning area.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The planning area is prepared for the probable impacts on natural hazards due to the impacts from a changing climate.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

3. Please rank the following statements:

	Agree	Somewhat Agree	Neutral	Somewhat Disagree	Disagree
Coordinated public outreach regarding risk from all hazards convey clear, consistent messaging to the public.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The planning area risk management programs are fair and equitable.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Information on flood insurance is readily available within the planning area.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There is political support for risk management within the planning area.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
All relevant stakeholders are engaged in the County's/ municipality's risk management efforts.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The County/ municipality development regulations for new development within identified hazards zones are adequate to address that risk.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There is a coordinated program to maintain drainage systems free of debris.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Agree	Somewhat Agree	Neutral	Somewhat Disagree	Disagree
The enforcement of Codes and Standards within the planning area is strong.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
As a citizen of the County/ municipality, I feel confident that I am prepared for the impacts from any natural hazard that may impact my property.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Real Estate professionals adequately disclose risk exposure from natural hazards at the time of sale of real property.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

This content is neither created nor endorsed by Microsoft. The data you submit will be sent to the form owner.

 Microsoft Forms

Douglas County HMP Capability Exercise

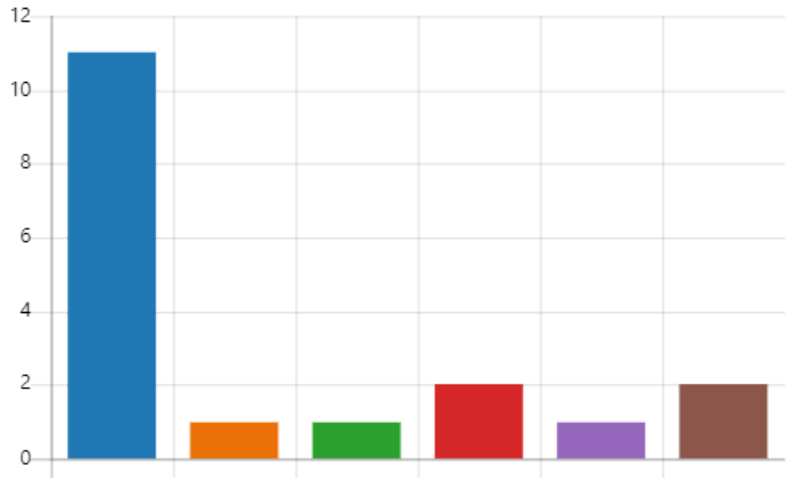
18
Responses

05:43
Average time to complete

Active
Status

1. Are you answering this survey on behalf of the County or one of the following participating municipalities?

● Douglas County	11
● City of Castle Pines	1
● City of Lone Tree	1
● Town of Castle Rock	2
● Town of Larkspur	1
● Town of Parker	2



2. Please rank the following statements:

Agree Somewhat Agree Neutral Somewhat Disagree Disagree

Emergency management is provided by a unified authority or program.



Current land uses within identified hazard areas are appropriate for the risk posed by each hazard.



There is a good understanding of the risk posed by hazards the planning area is susceptible to.



Emergency response functions for the County/ municipality are clearly defined and are effective.



Members of the public know where to find information about hazards and risk.



Areas that provide natural resource protection are identified and protected.



Existing flood control systems are effective and well maintained.



Roles and responsibilities for emergency management within the County/ municipality clearly defined.



County/ municipality staff are knowledgeable about hazards and their impacts and are willing to share th...



The capability to assess and mitigate risk from natural hazards is high.



County/ municipality staff members with emergency management functions are adequately trained.



Citizens have a good understanding of natural hazard exposure and risk.



The funding to support risk reduction within the planning area is adequate.



Strong collaboration and coordination exist between the County/ municipality, neighboring jurisdictions,...



Appropriate and timely warning systems are in place.



The County/ municipality currently has a variety of regulatory and non-regulatory strategies to reduce...



The County/ municipality currently has adopted policies that encourage development to be located...



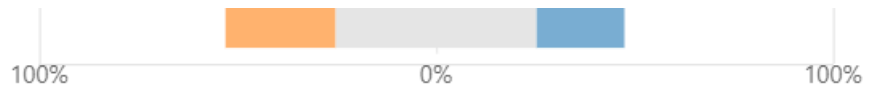
Risk from natural hazards within the planning area is adequately mapped and regulated.



There is strong public support for risk reduction within the planning area.



The planning area is prepared for the probable



3. Please rank the following statements:

■ Agree
 ■ Somewhat Agree
 ■ Neutral
 ■ Somewhat Disagree
 ■ Disagree

Coordinated public outreach regarding risk from all hazards convey clear, consistent messaging to the...



The planning area risk management programs are fair and equitable.



Information on flood insurance is readily available within the planning area.



There is political support for risk management within the planning area.



All relevant stakeholders are engaged in the County's/ municipality's risk management efforts.



The County/ municipality development regulations for new development within identified hazards zones ar...



There is a coordinated program to maintain drainage systems free of debris.



The enforcement of Codes and Standards within the planning area is strong.



As a citizen of the County/ municipality, I feel confident that I am prepared for the impacts from a...



Real Estate professionals adequately disclose risk exposure from natural hazards at the time of sale of...



Hazards of Concern

Rank hazards depending on your perception of risk the hazard poses to the County.

1. Animal Disease Outbreak



2. Avalanche



3. Dam Failure



4. Drought



5. Earthquake



6. Epidemic / Pandemic



7. Erosion & Deposition



8. Expansive Soils & Heaving Bedrock



9. Extreme Heat



10. Flooding



11. Hail



12. Hazardous Materials Release



13. Landslide / Mud / Debris Flows / Rockfall / Rockslide



14. Severe Wind



15. Sinkholes / Subsidence / Abandoned Mine



16. Thunderstorm / Lightening



17. Tornado



18. Wildfire



19. Others

This content is neither created nor endorsed by Microsoft. The data you submit will be sent to the form owner.



Hazards of Concern

26
Responses

08:47
Average time to complete

Active
Status

1. Animal Disease Outbreak

25
Responses

★ ★ ☆ ☆ ☆
2.20 Average Rating

2. Avalanche

25
Responses

★ ★ ☆ ☆ ☆
1.56 Average Rating

3. Dam Failure

25
Responses

★ ★ ☆ ☆ ☆
2.44 Average Rating

4. Drought

25
Responses

★ ★ ★ ★ ☆
4.28 Average Rating

5. Earthquake

25
Responses



6. Epidemic / Pandemic

25
Responses



7. Erosion & Deposition

25
Responses



8. Expansive Soils & Heaving Bedrock

25
Responses



9. Extreme Heat

25
Responses



10. Flooding

25
Responses



11. Hail

25
Responses



12. Hazardous Materials Release

25
Responses



13. Landslide / Mud / Debris Flows / Rockfall / Rockslide

25
Responses



14. Severe Wind

25
Responses



15. Sinkholes / Subsidence / Abandoned Mine

25
Responses



16. Thunderstorm / Lightening

25
Responses



17. Tornado

25

Responses



3.36 Average Rating

18. Wildfire

25

Responses



4.68 Average Rating

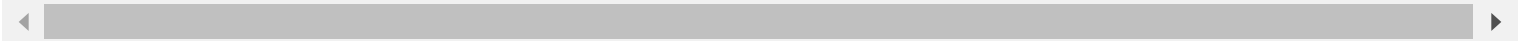
19. Others

8

Responses

Latest Responses

"Blizzard"



Douglas County Strengths, Weaknesses, Obstacles, and Opportunities (SWOO)

The purpose of the Strengths, Weaknesses, Obstacles, and Opportunities (SWOO) is to identify mitigation strategies and capabilities that will meet the goals and objectives of the plan update. It is also used to develop potential mitigation actions for the participating jurisdictions.

- Strengths – what we do well; what we can capitalize on
- Weaknesses – what could we do better; what do we need to strengthen
- Obstacles – things that stand in the way, and either prevents you from doing something or something that needs to be overcome (e.g. regulatory, geographical, environmental, financial)
- Opportunities – used to develop mitigation strategies.

For the current plan, a total of 10 natural hazards and 1 non-natural hazard of concern are identified as significant hazards affecting the entire planning area:

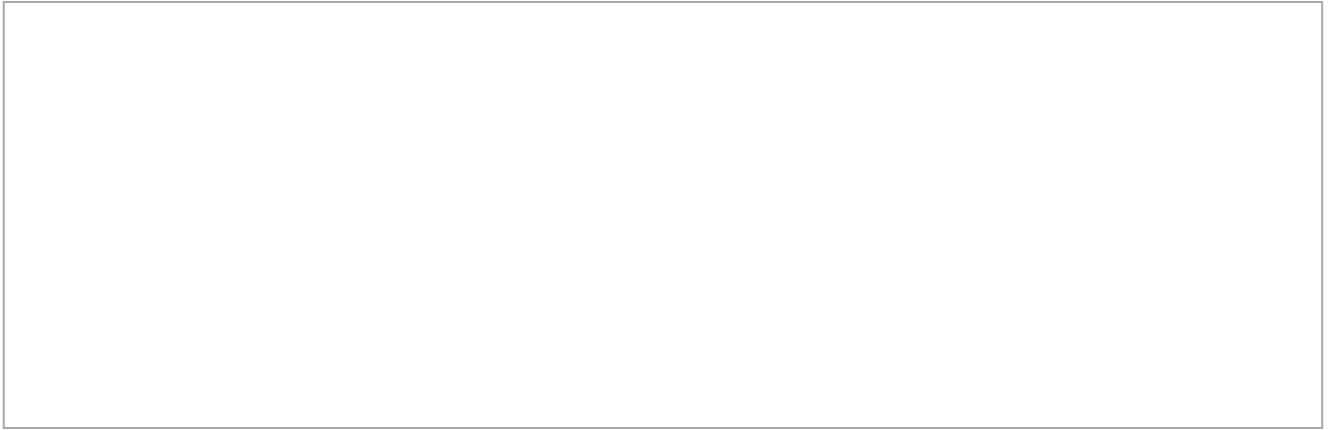
1. Wildfire
2. Drought
3. Severe Weather: Winter Weather / Extreme Heat
4. Severe Storm: Thunderstorm / Lightening / Hail
5. Flooding
6. Tornado / High Wind
7. Dam Failure
8. Soils: Expansive Soils / Erosion & Deposition / Landslide / Subsidence & Sinkholes
9. Epidemic / Pandemic
10. Animal Disease & Pest Outbreak
11. Hazardous Materials Release - Transportation

Please use this survey to identify Strengths, Weaknesses, Obstacles, and Opportunities for each hazard.

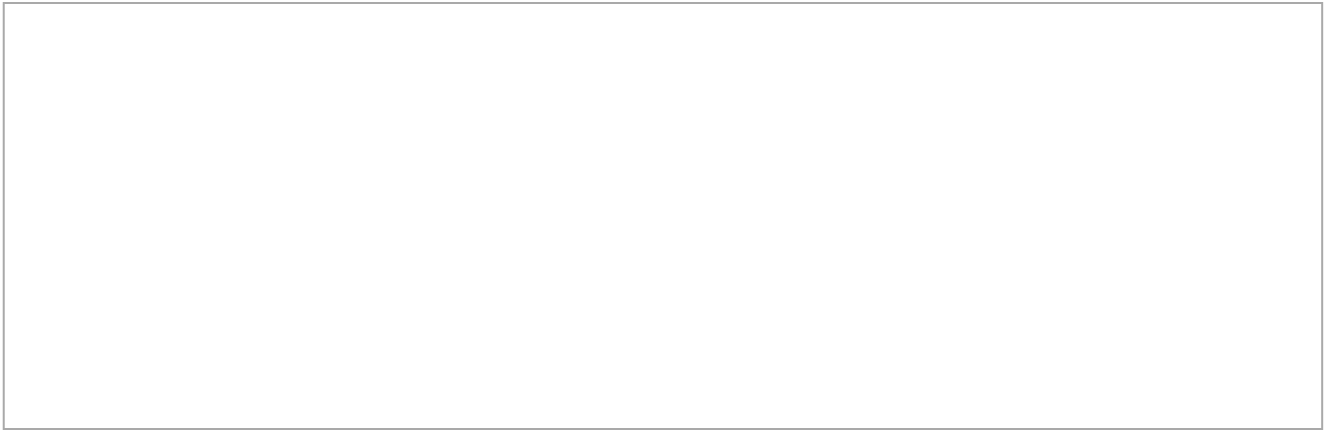
Wildfire

Please identify any Strengths, Weaknesses, Obstacles, or Opportunities regarding County and/or plan participant capabilities to mitigating hazard impacts.

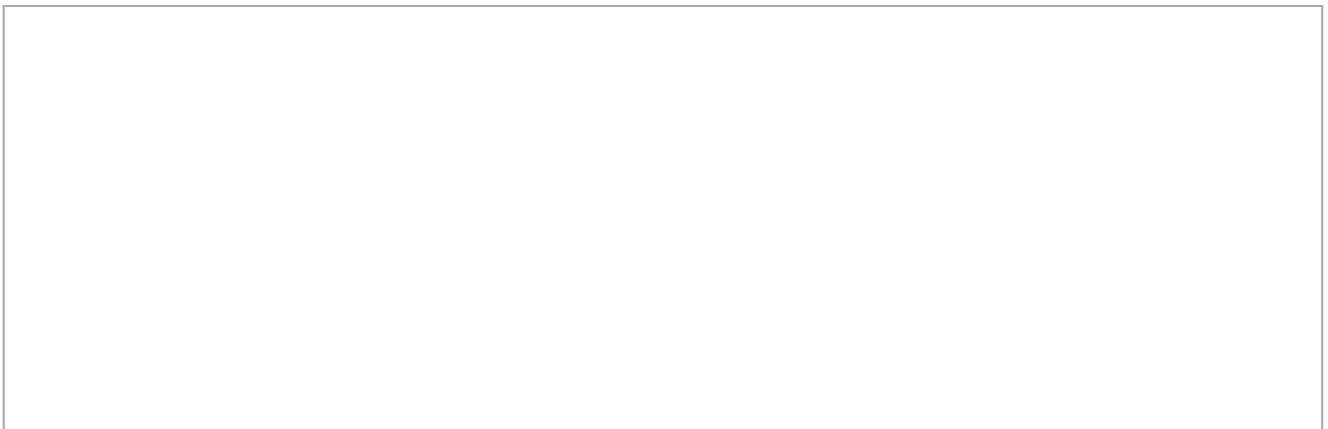
1. Strengths

A large, empty rectangular box with a thin black border, intended for writing the strengths of a project or organization.

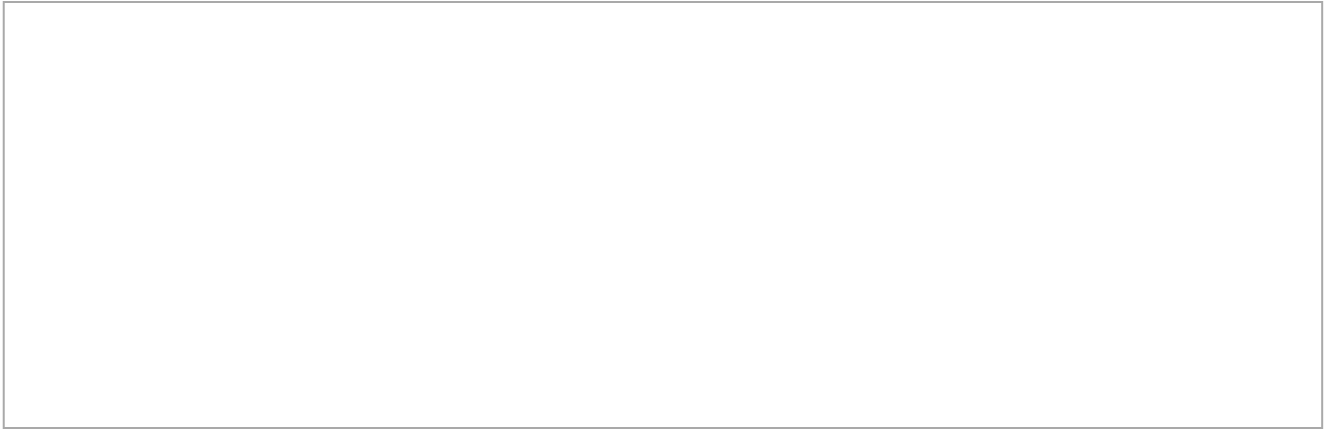
2. Weaknesses

A large, empty rectangular box with a thin black border, intended for writing the weaknesses of a project or organization.

3. Obstacles

A large, empty rectangular box with a thin black border, intended for writing the obstacles of a project or organization.

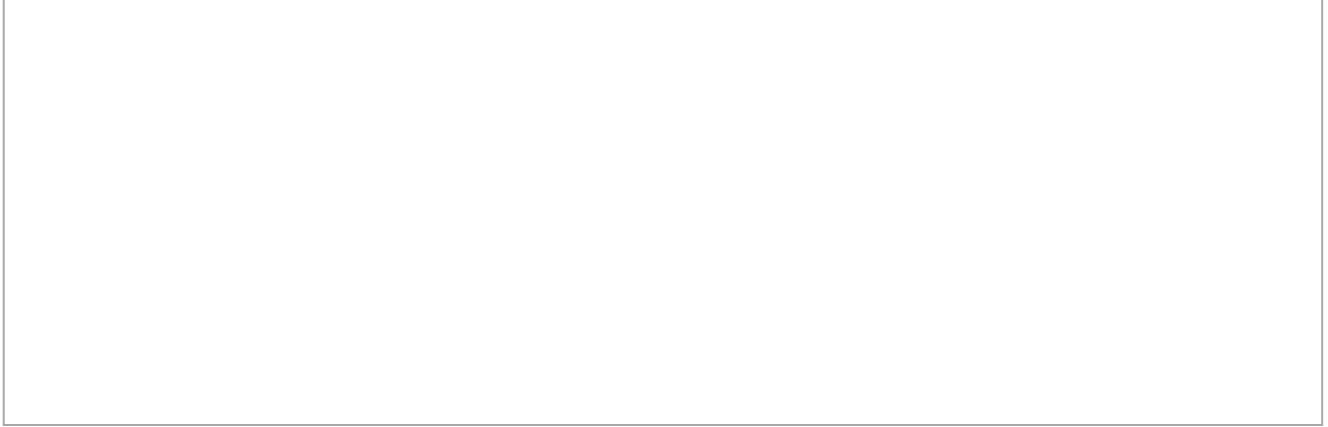
4. Opportunities

A large, empty rectangular box with a thin black border, intended for user input or content. It occupies the upper half of the page below the section header.

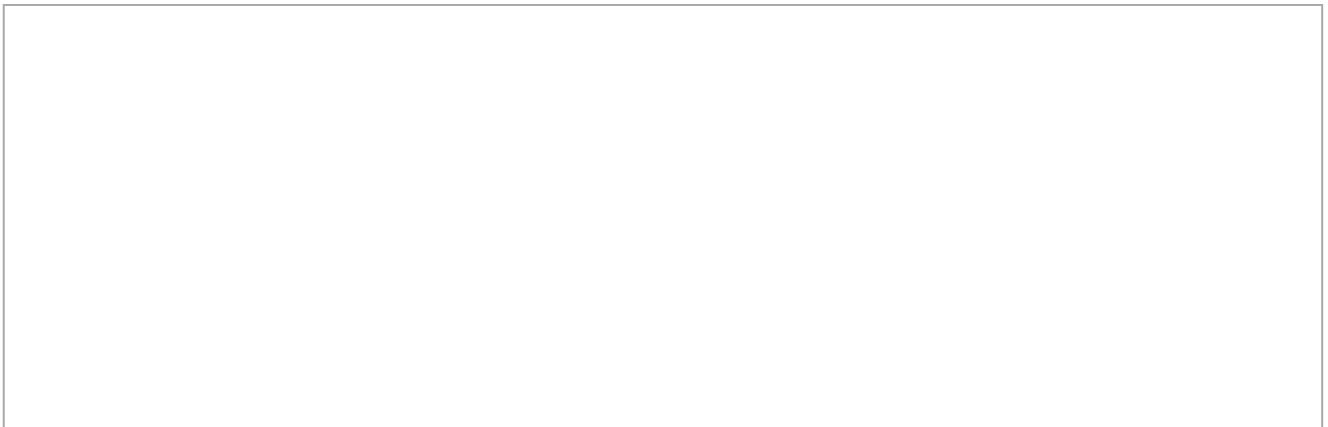
Drought

Please identify any Strengths, Weaknesses, Obstacles, or Opportunities regarding County and/or plan participant capabilities to mitigating hazard impacts.

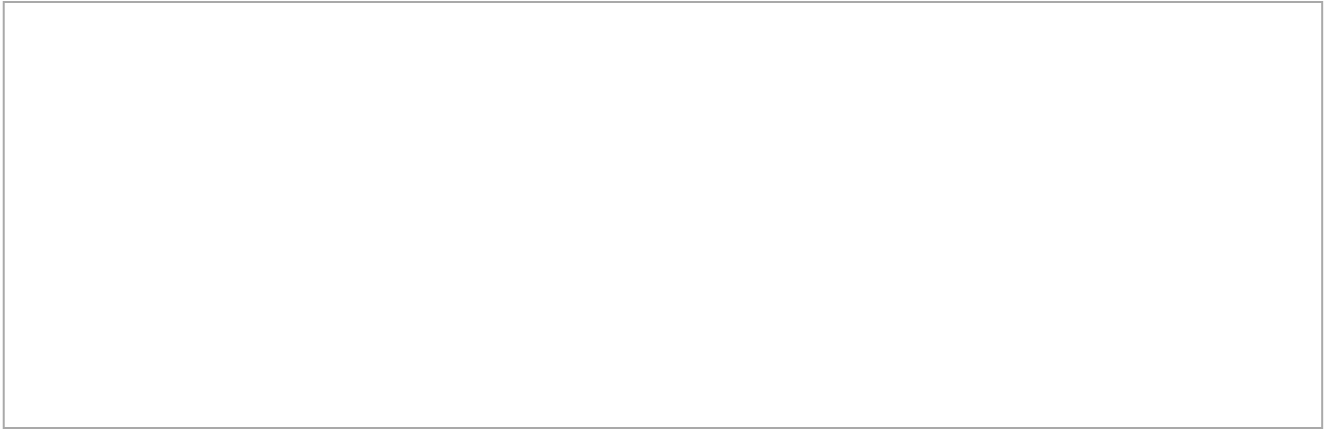
5. Strengths



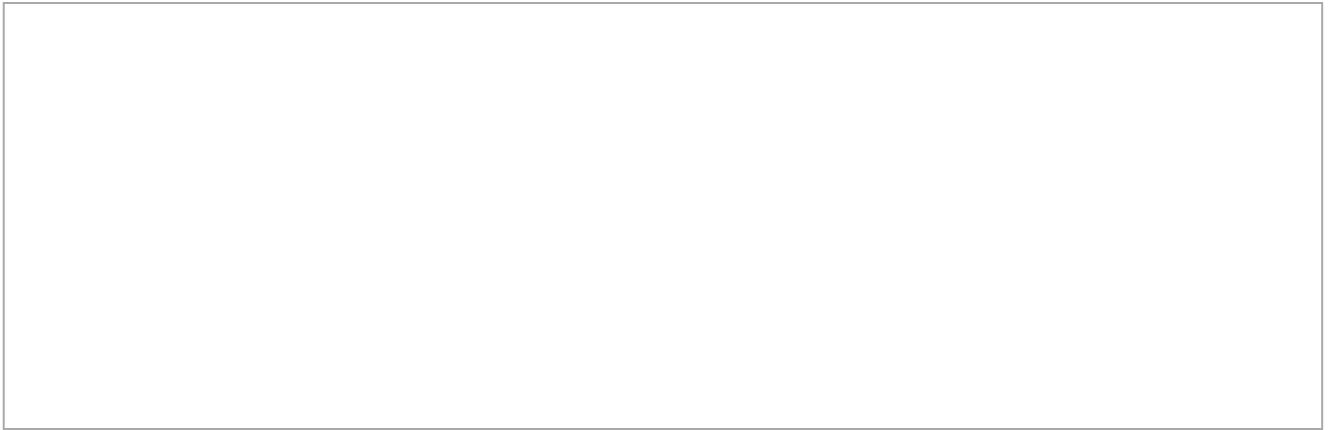
6. Weaknesses



7. Obstacles



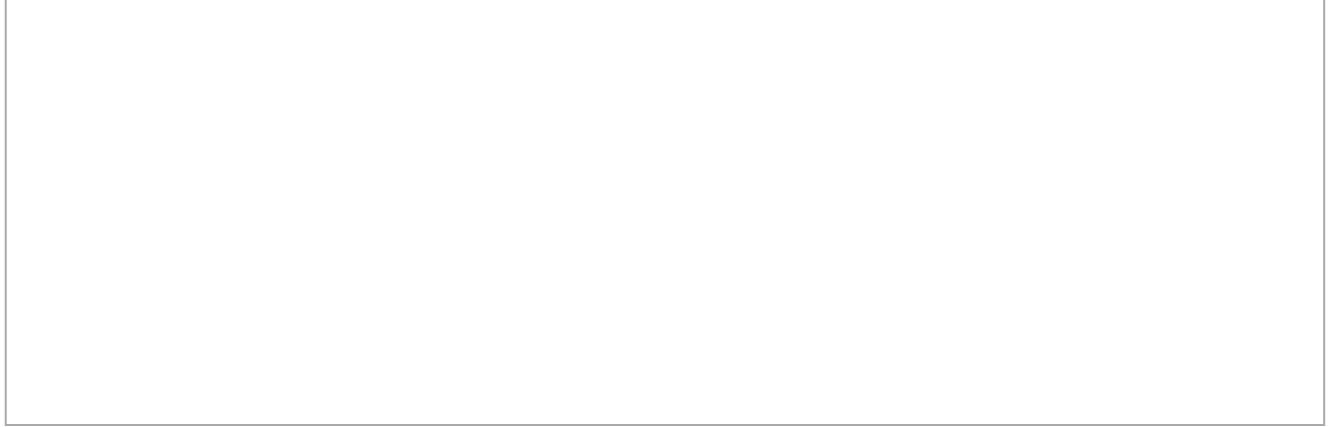
8. Opportunities



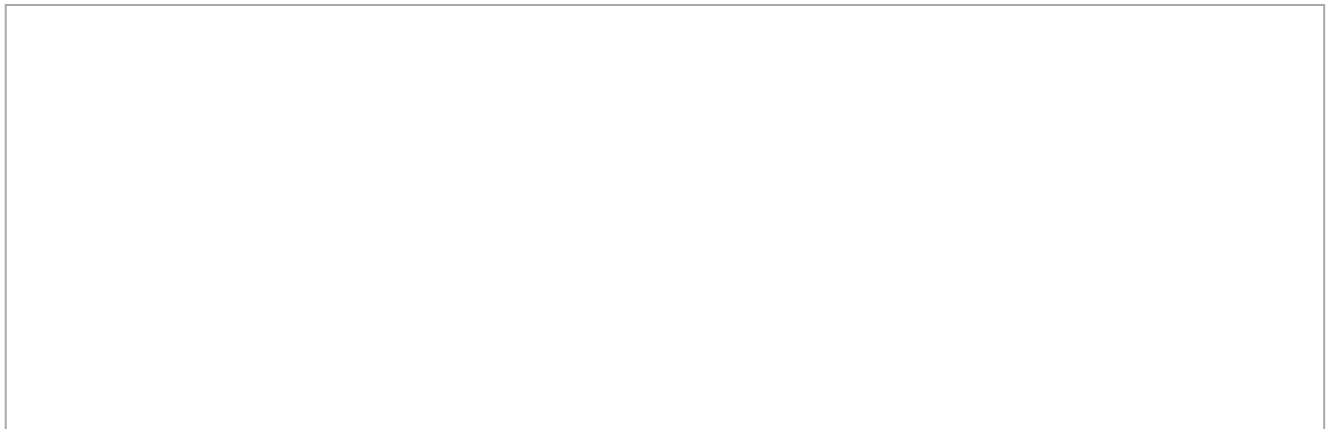
Severe Weather: Winter Weather / Extreme Heat

Please identify any Strengths, Weaknesses, Obstacles, or Opportunities regarding County and/or plan participant capabilities to mitigating hazard impacts.

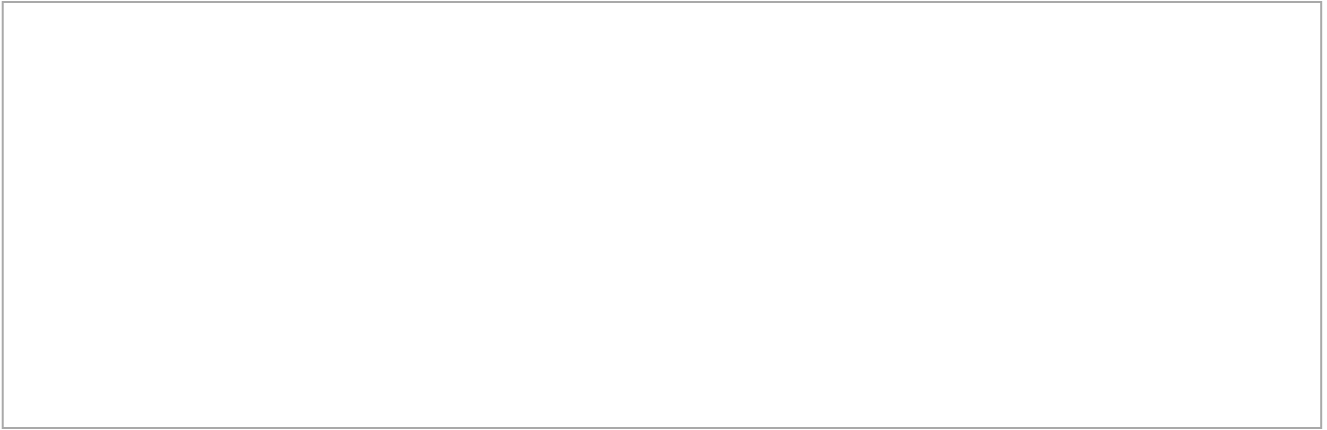
9. Strengths



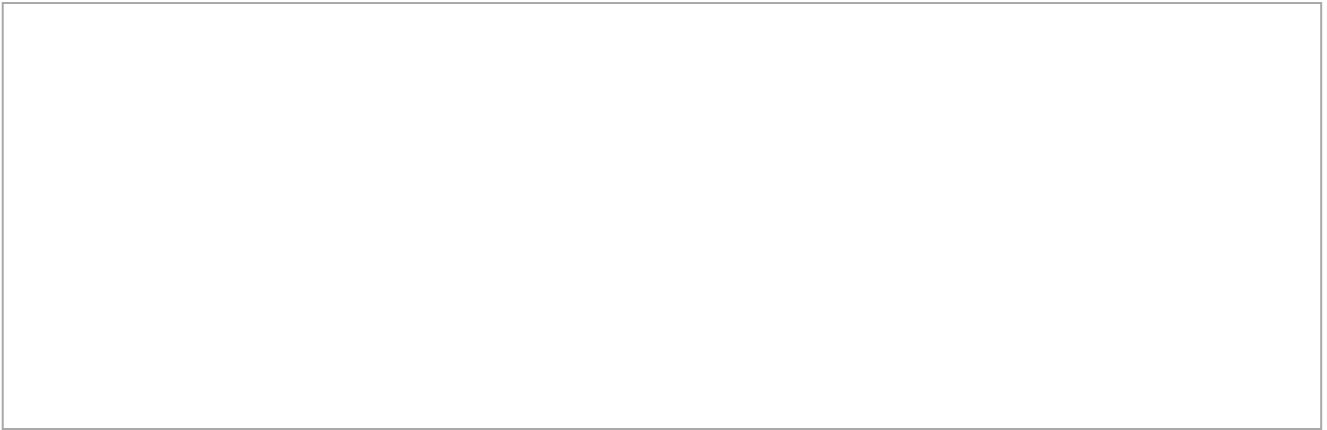
10. Weaknesses



11. Obstacles



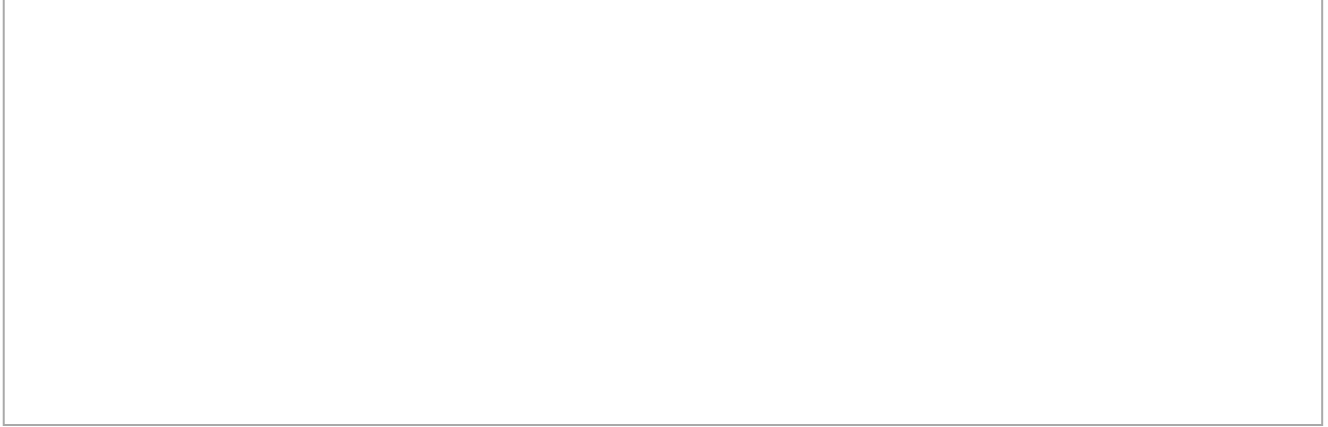
12. Opportunities



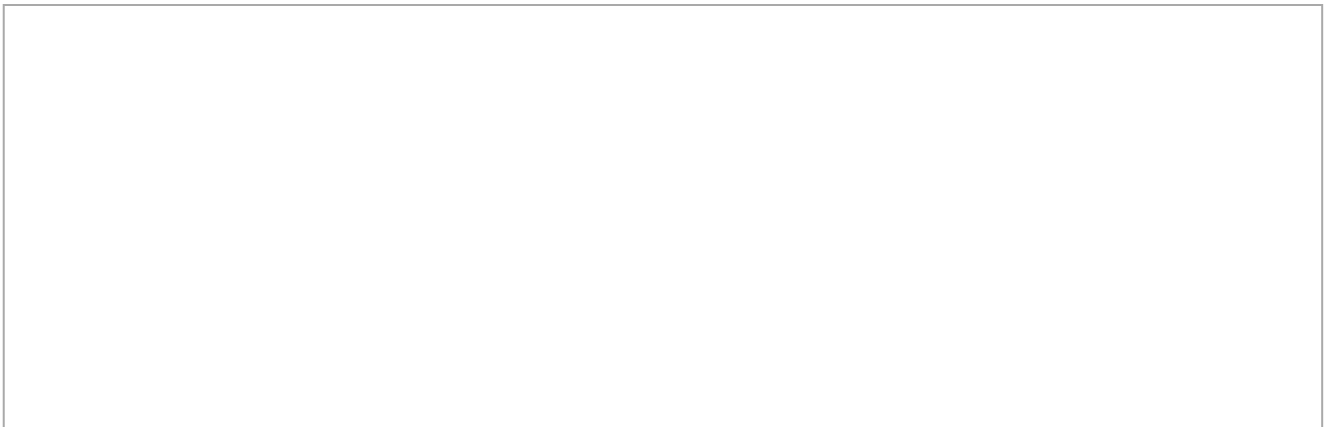
Severe Storm : Thunderstorm / Lightening / Hail

Please identify any Strengths, Weaknesses, Obstacles, or Opportunities regarding County and/or plan participant capabilities to mitigating hazard impacts.

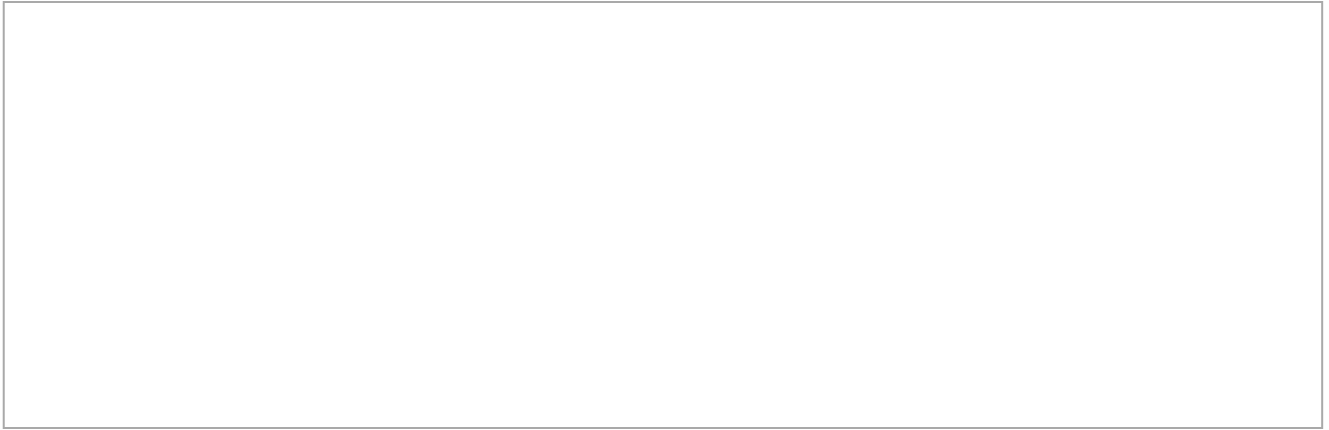
13. Strengths



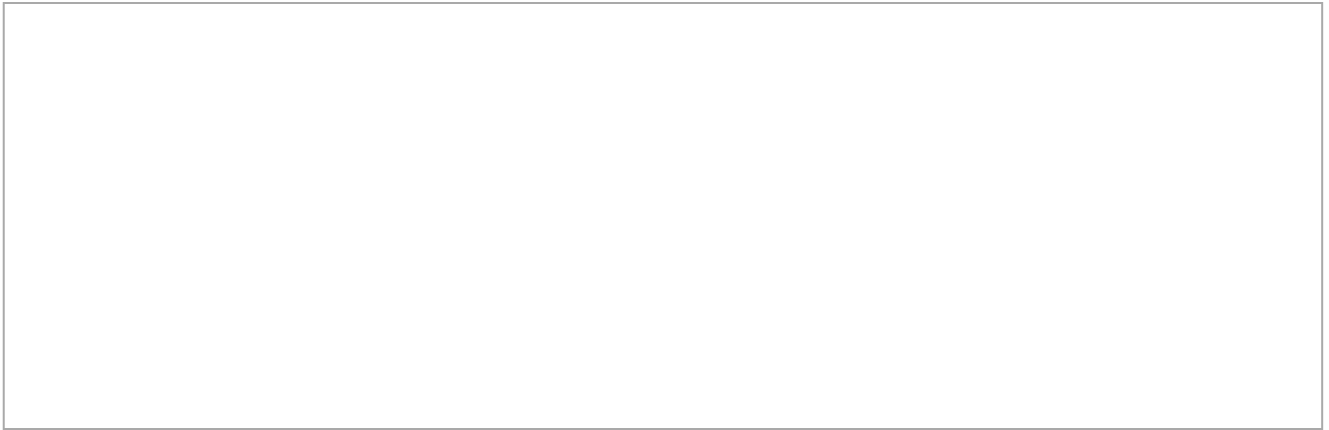
14. Weaknesses



15. Obstacles



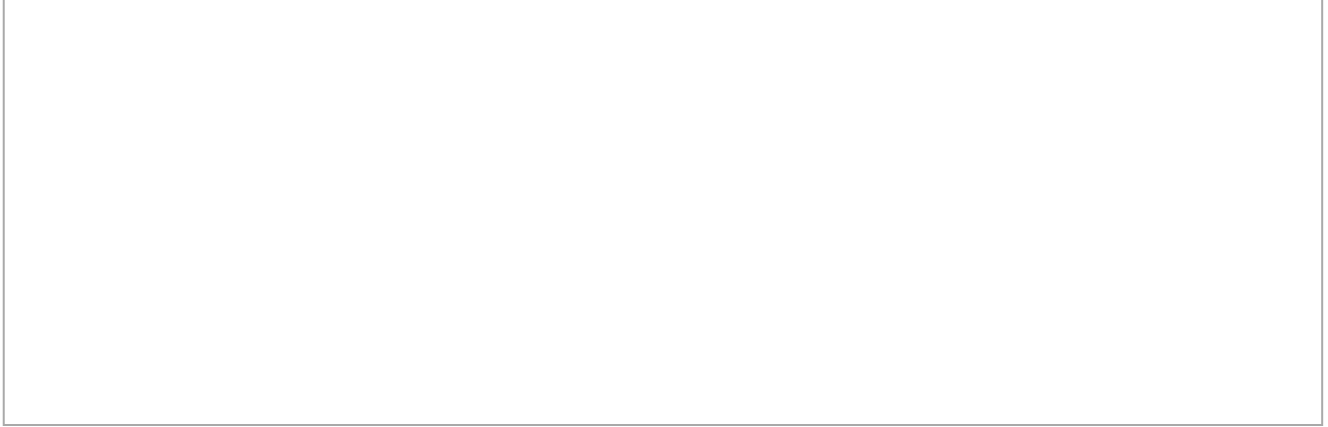
16. Opportunities



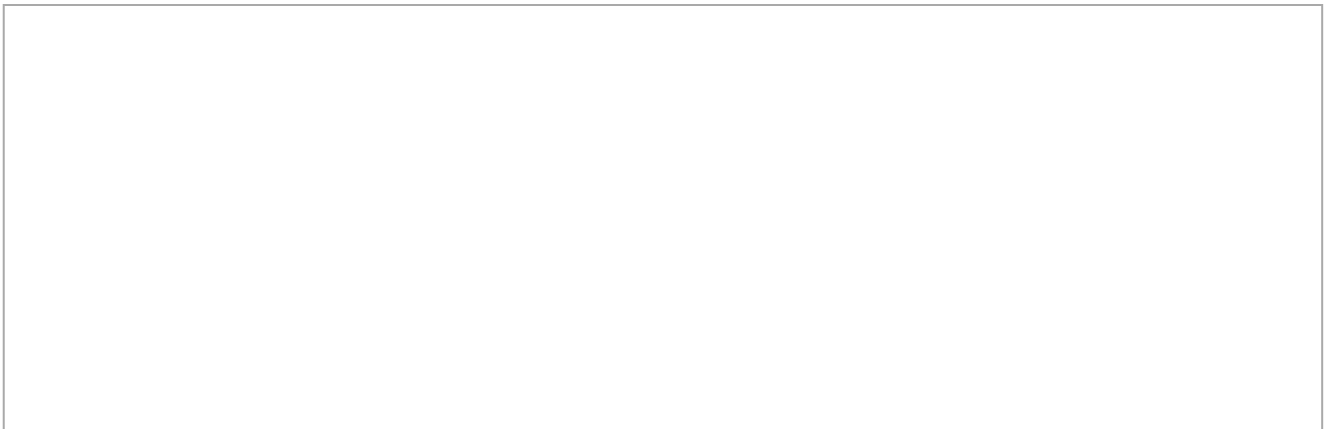
Flooding

Please identify any Strengths, Weaknesses, Obstacles, or Opportunities regarding County and/or plan participant capabilities to mitigating hazard impacts.

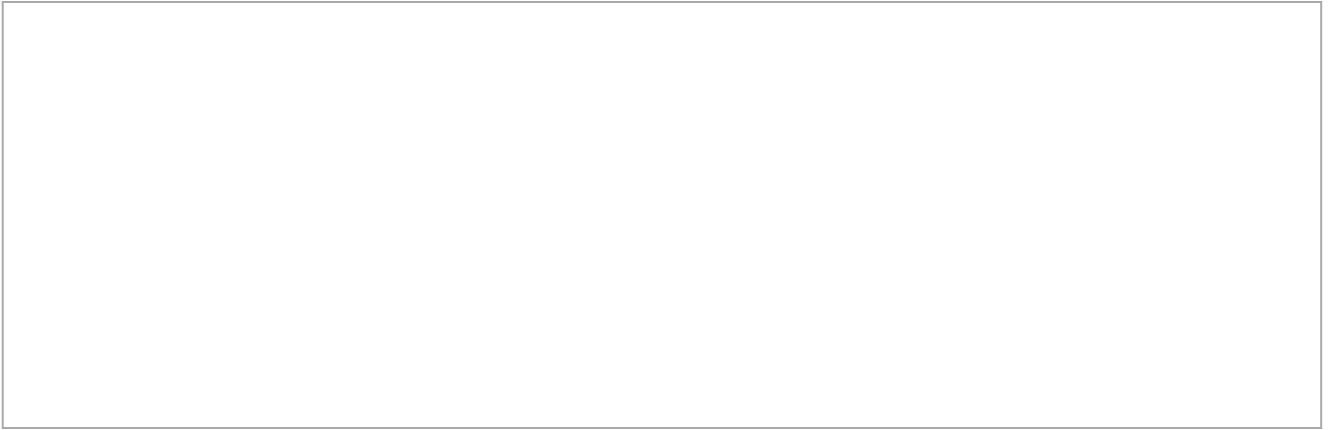
17. Strengths



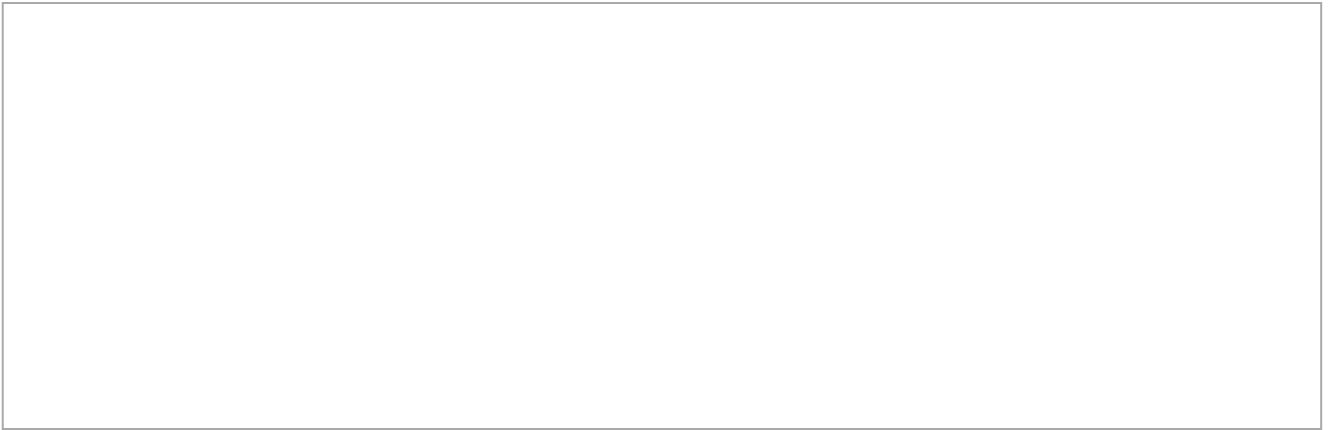
18. Weaknesses



19. Obstacles



20. Opportunities



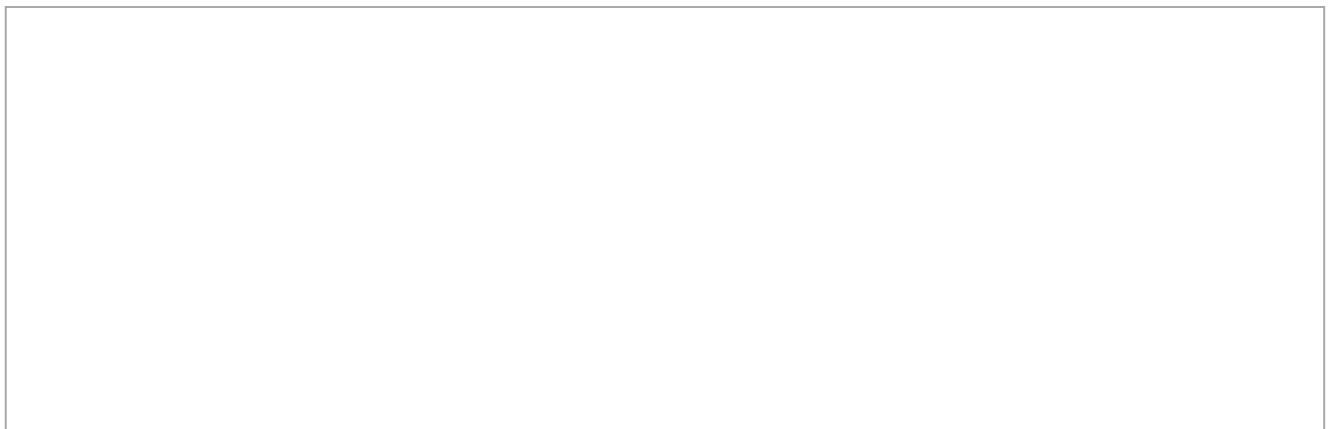
Tornado / High Wind

Please identify any Strengths, Weaknesses, Obstacles, or Opportunities regarding County and/or plan participant capabilities to mitigating hazard impacts.

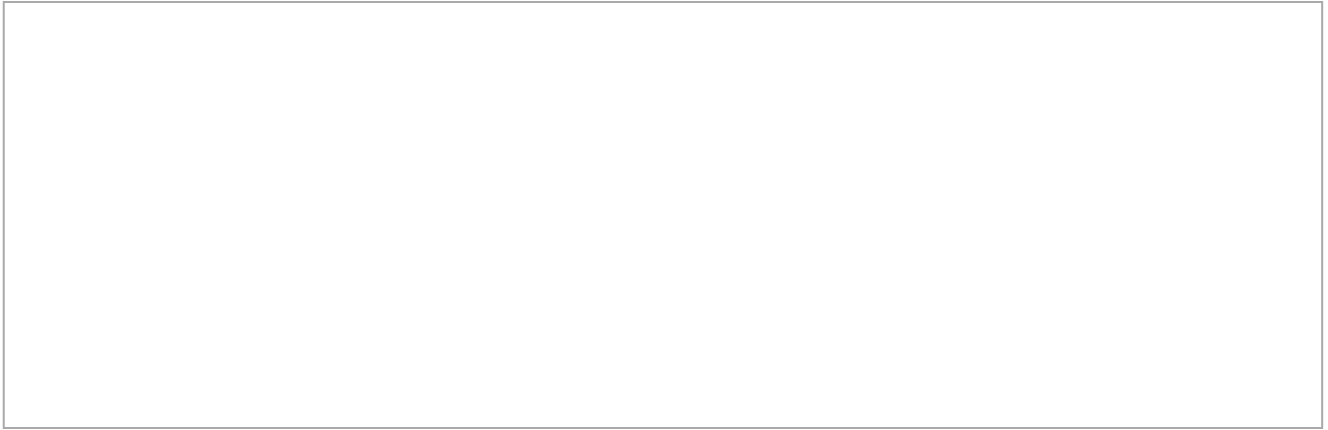
21. Strengths



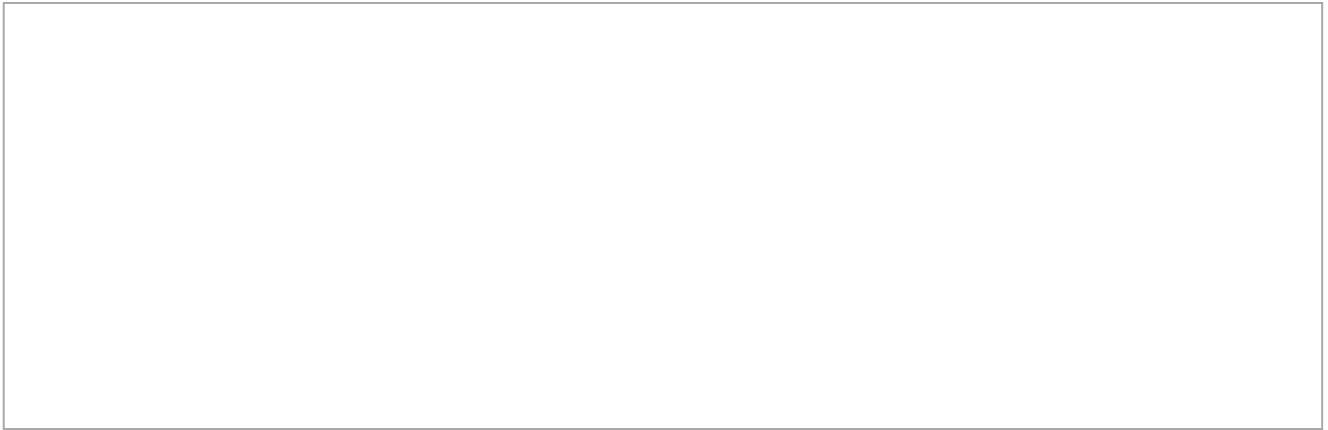
22. Weaknesses



23. Obstacles



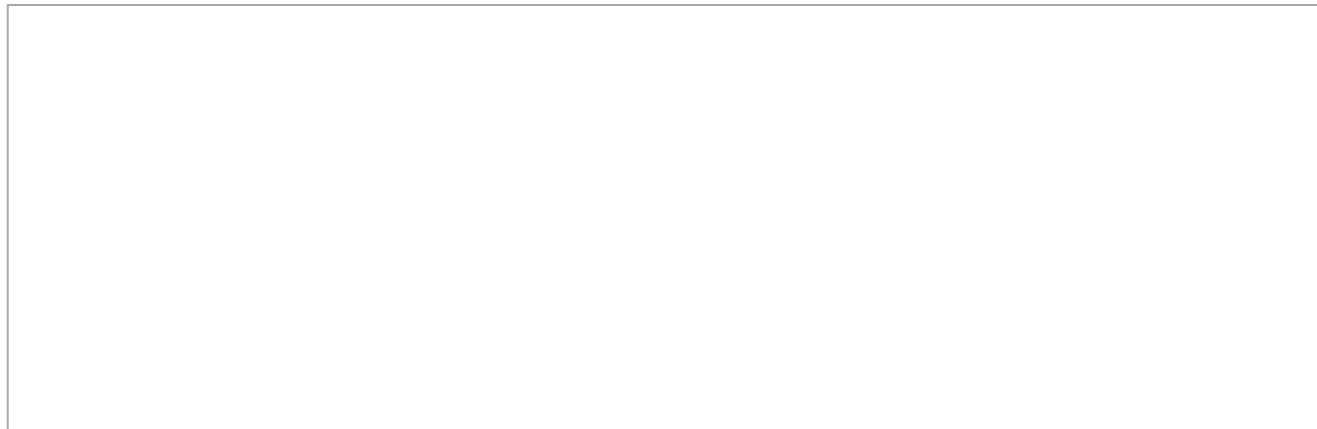
24. Opportunities



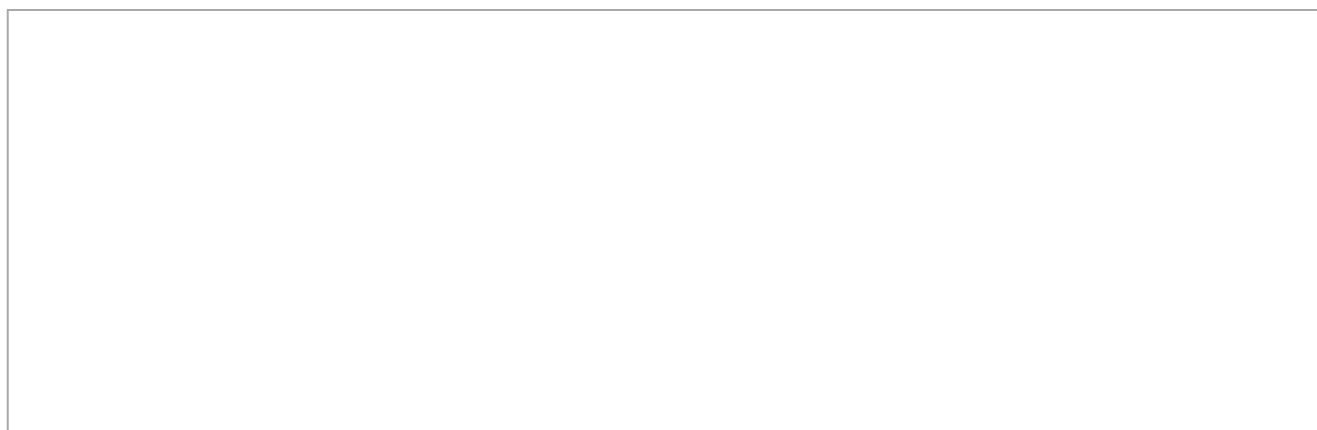
Dam Failure

Please identify any Strengths, Weaknesses, Obstacles, or Opportunities regarding County and/or plan participant capabilities to mitigating hazard impacts.

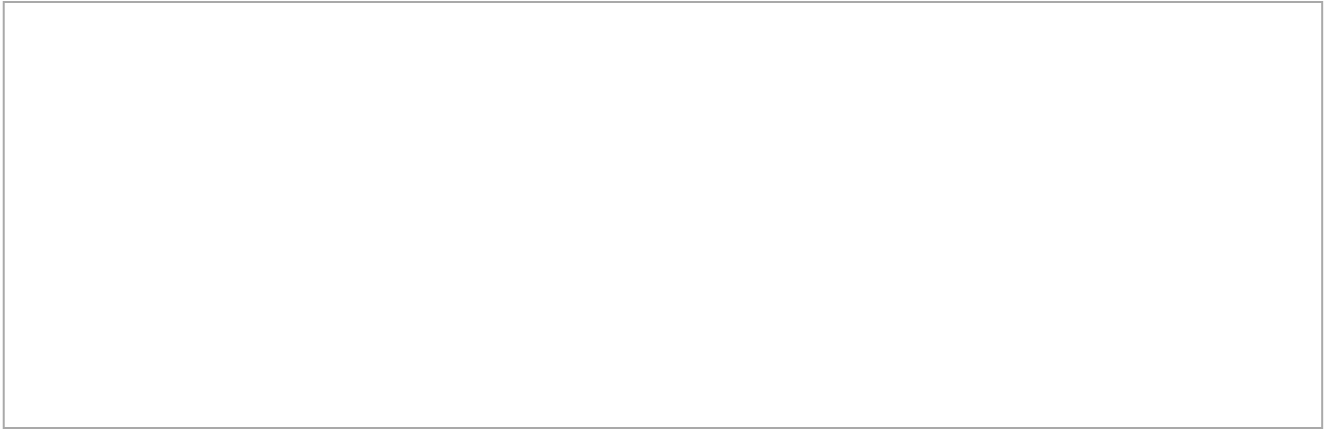
25. Strengths



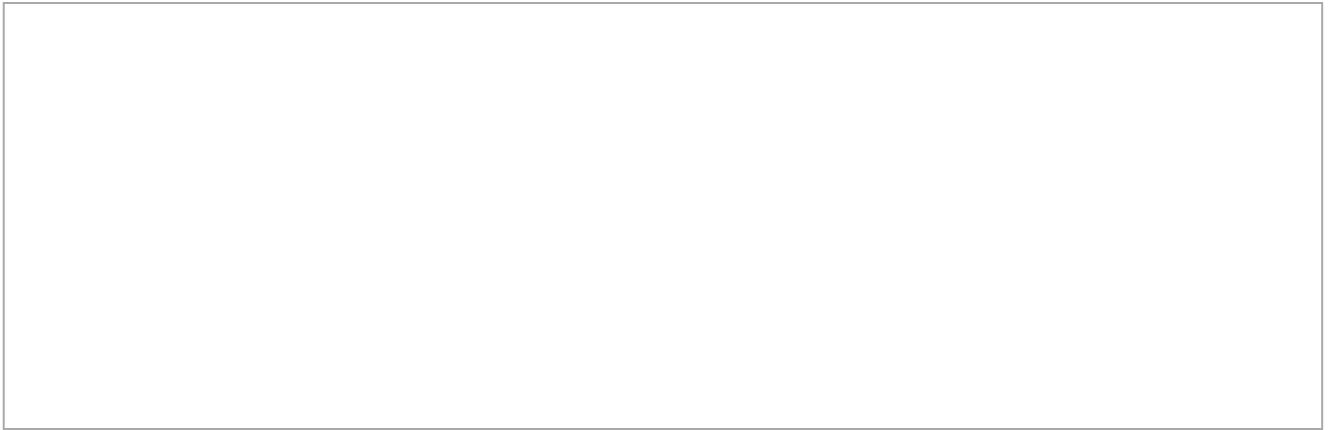
26. Weaknesses



27. Obstacles



28. Opportunities



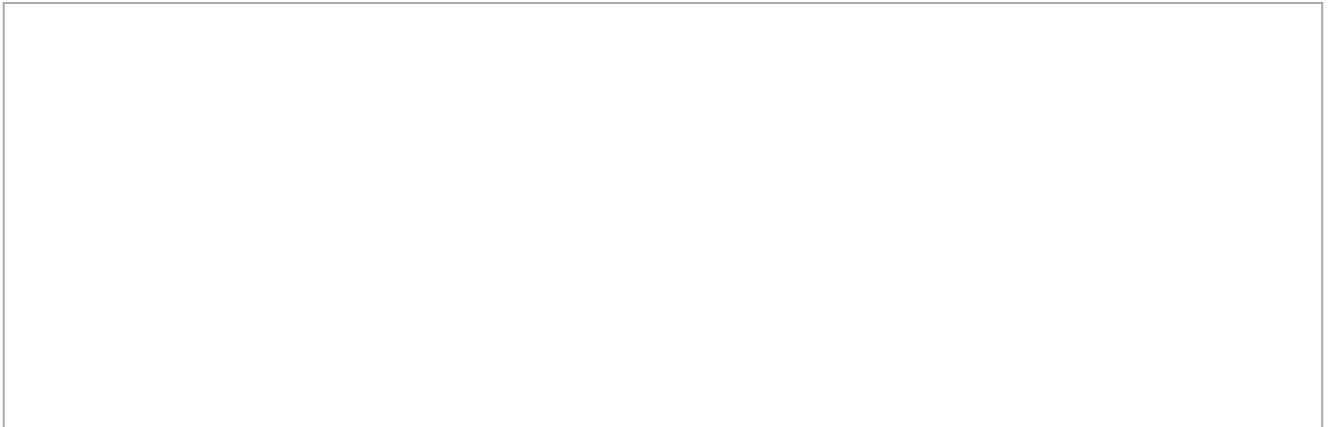
Soils: Expansive Soils / Erosion & Deposition / Landslide / Subsidence & Sinkholes

Please identify any Strengths, Weaknesses, Obstacles, or Opportunities regarding County and/or plan participant capabilities to mitigating hazard impacts.

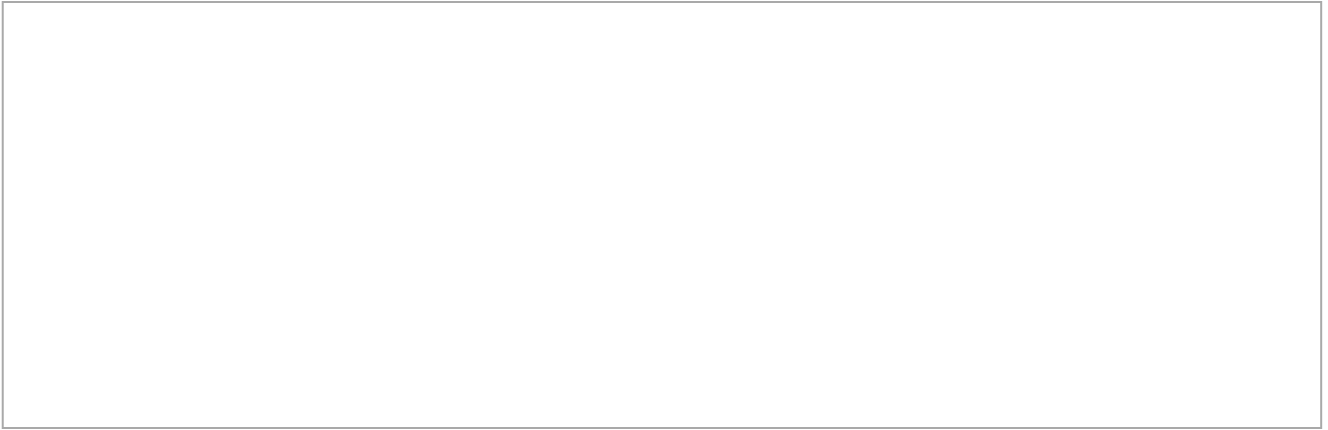
29. Strengths



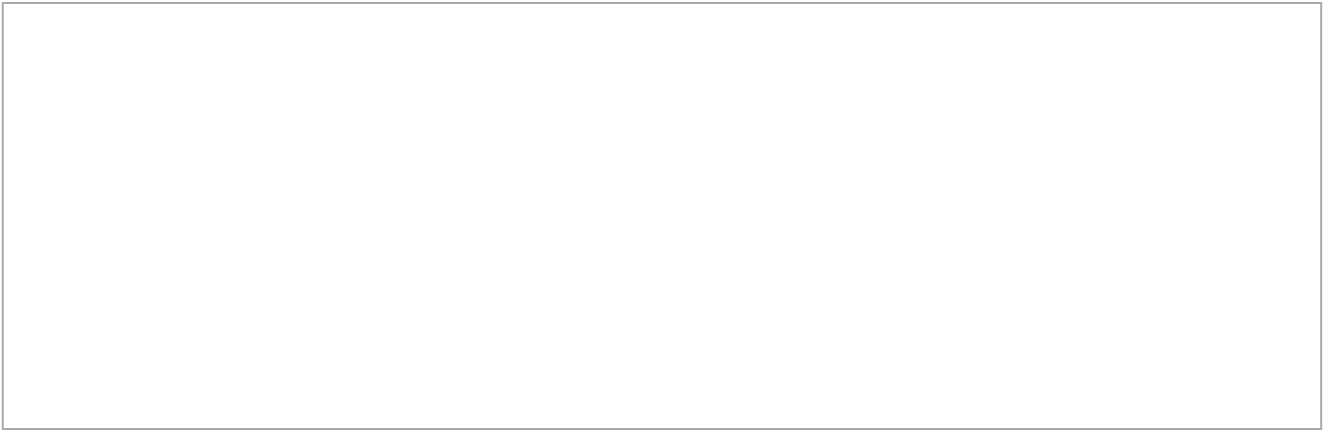
30. Weaknesses



31. Obstacles



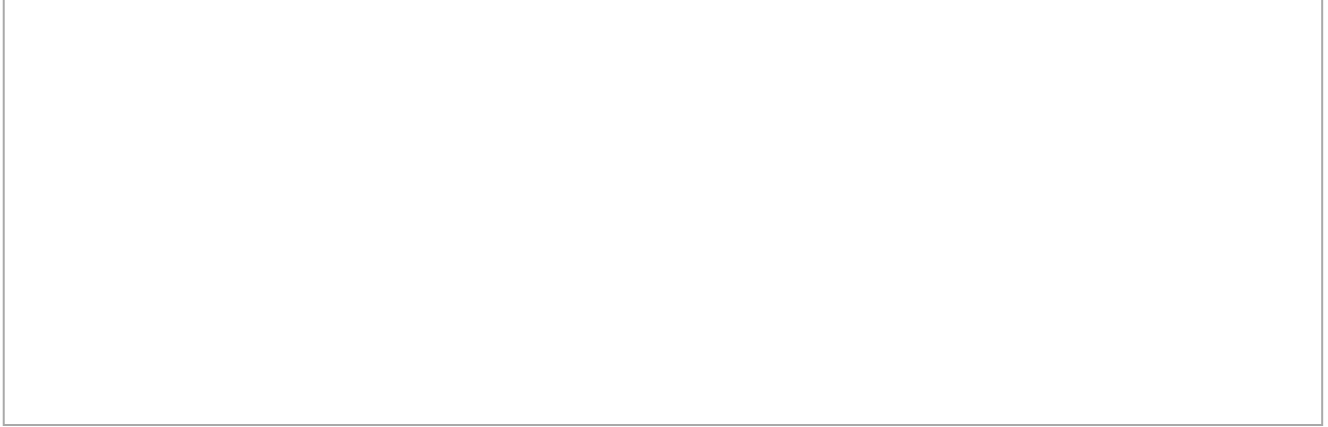
32. Opportunities



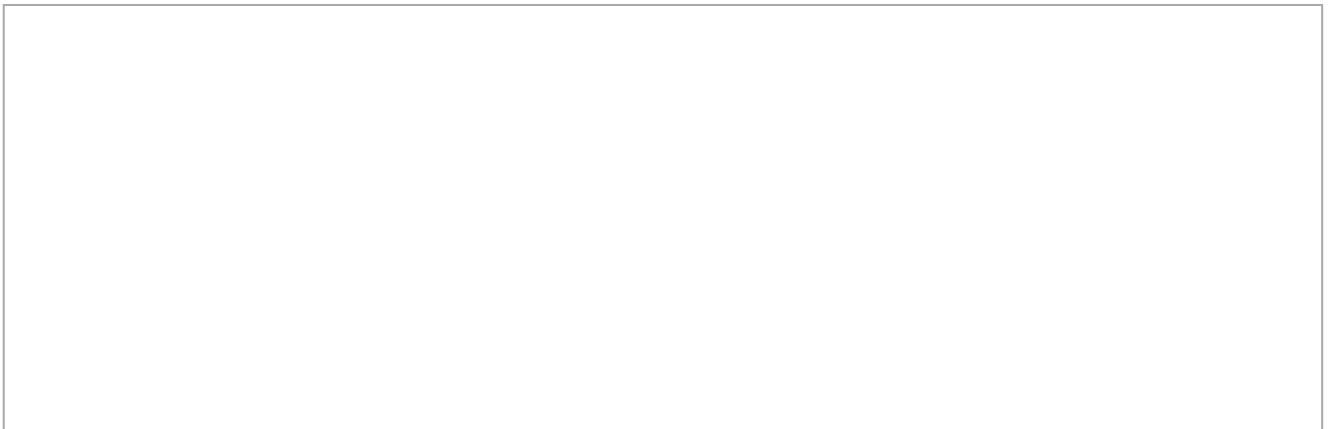
Epidemic / Pandemic

Please identify any Strengths, Weaknesses, Obstacles, or Opportunities regarding County and/or plan participant capabilities to mitigating hazard impacts.

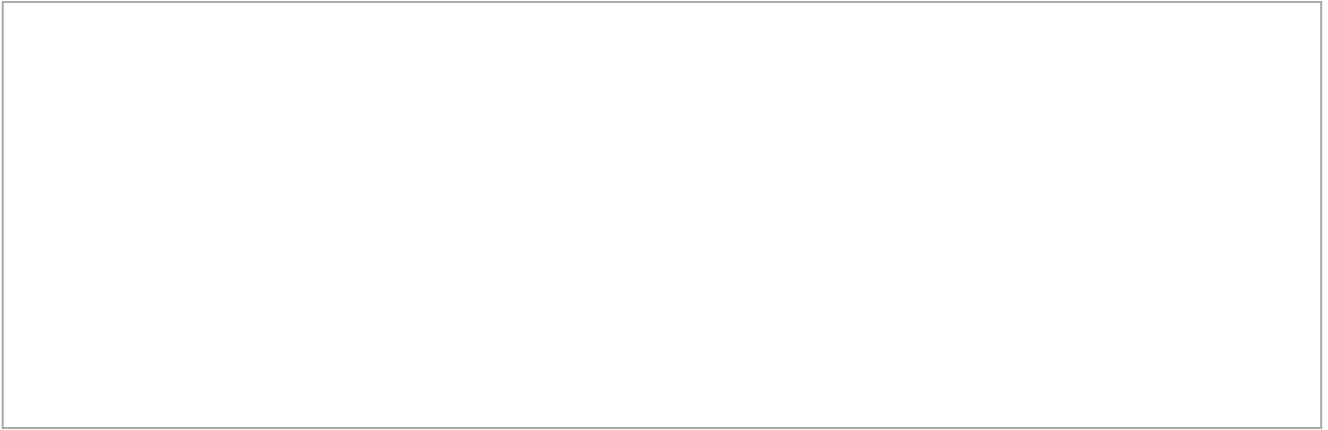
33. Strengths



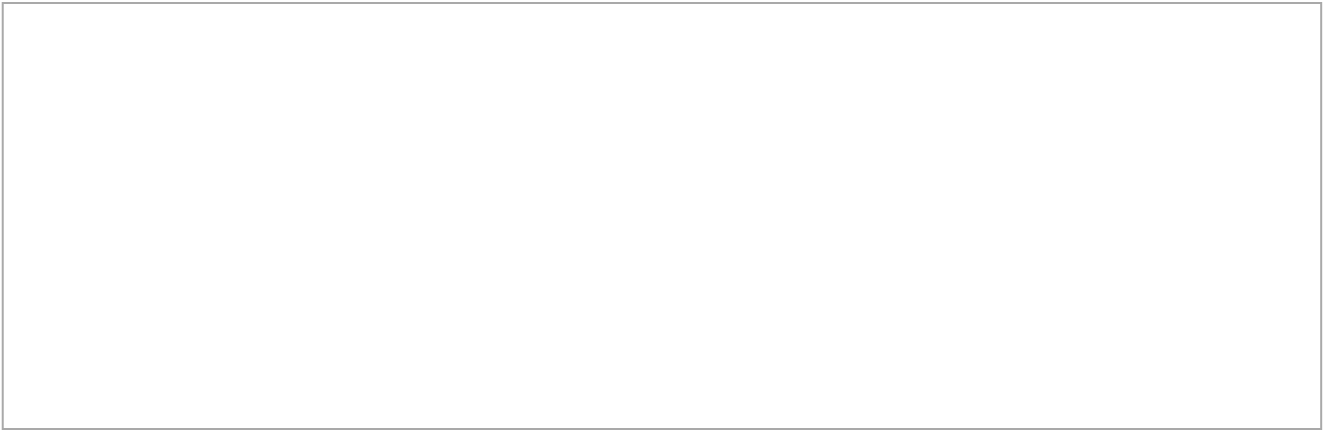
34. Weaknesses



35. Obstacles



36. Opportunities



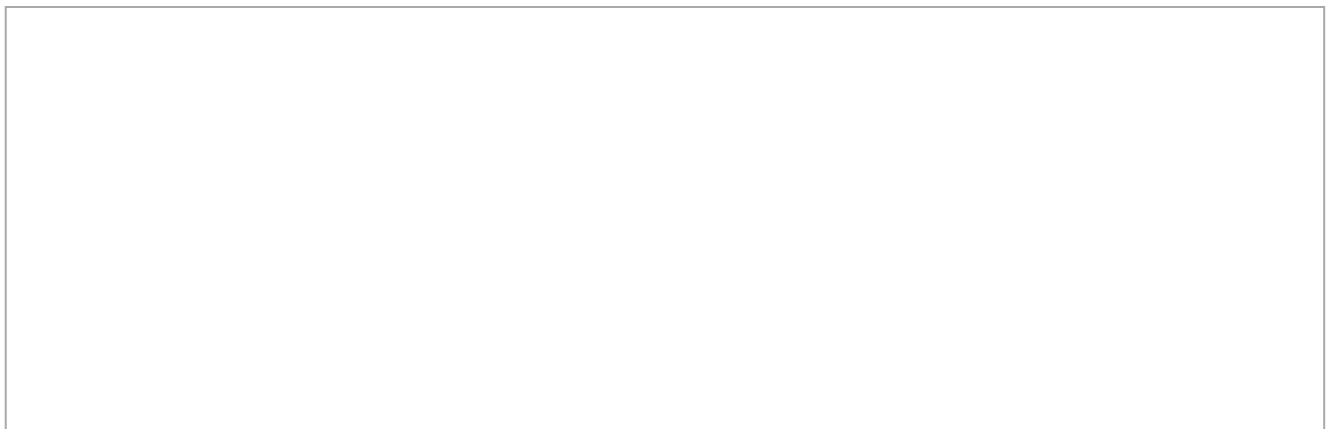
Animal Disease & Pest Outbreak

Please identify any Strengths, Weaknesses, Obstacles, or Opportunities regarding County and/or plan participant capabilities to mitigating hazard impacts.

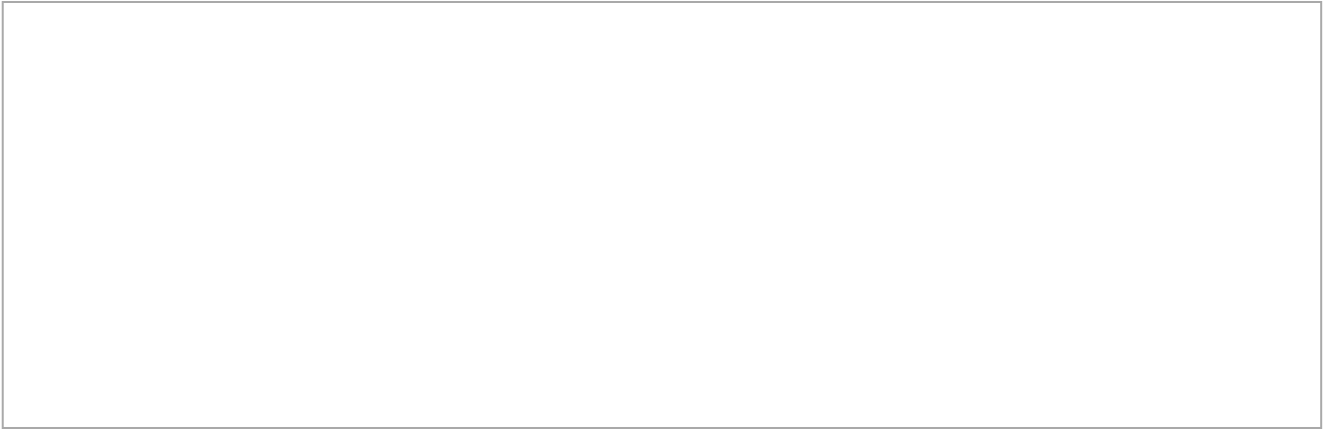
37. Strengths



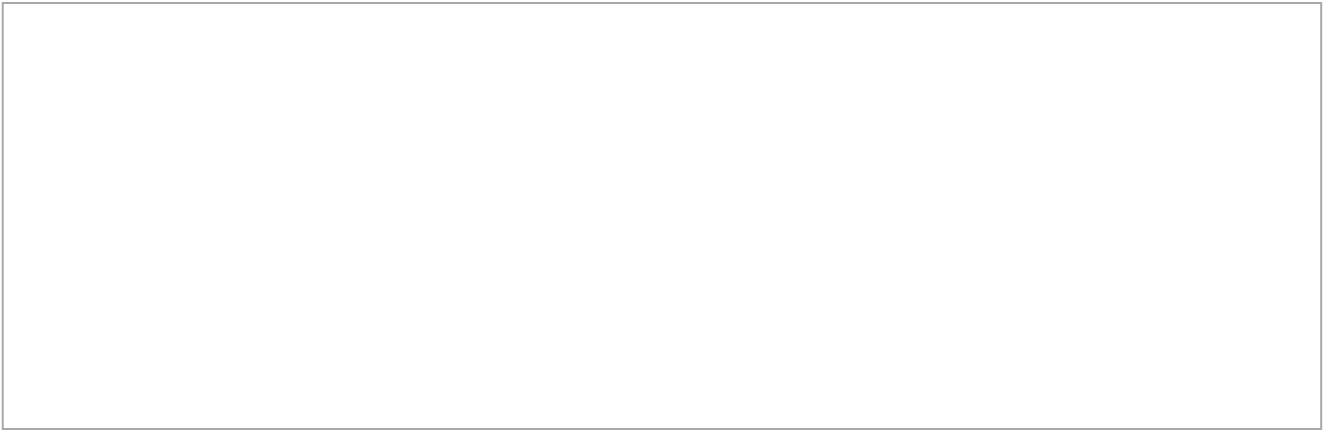
38. Weaknesses



39. Obstacles



40. Opportunities



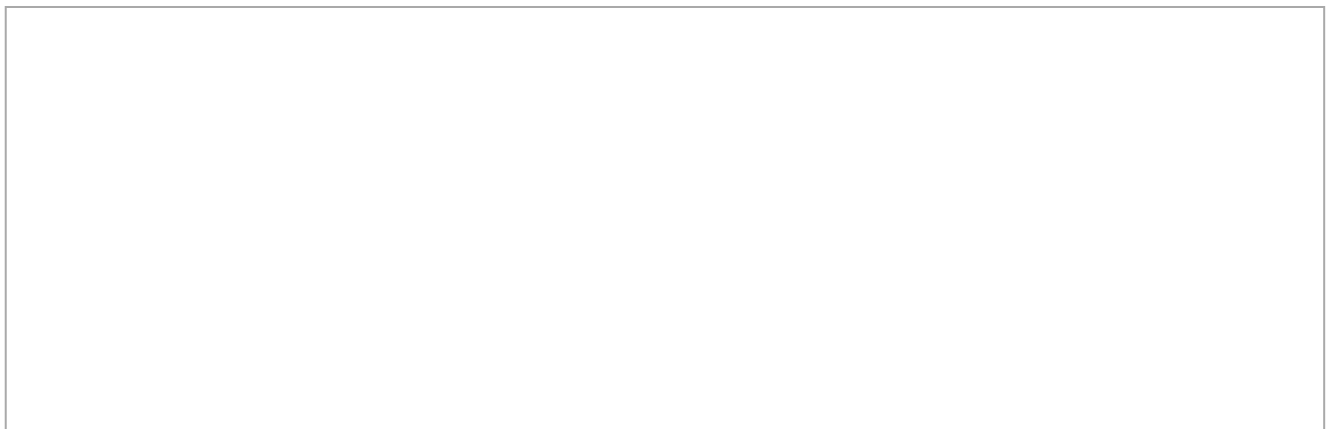
Hazardous Material Release - Transportation

Please identify any Strengths, Weaknesses, Obstacles, or Opportunities regarding County and/or plan participant capabilities to mitigating hazard impacts.

41. Strengths

A large, empty rectangular box with a thin black border, intended for the user to list strengths.

42. Weaknesses

A large, empty rectangular box with a thin black border, intended for the user to list weaknesses.

43. Obstacles

44. Opportunities

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DOUGLAS COUNTY HMP SWOO RESULTS

Wildfire				
ID	Strengths1	Weaknesses1	Obstacles1	Opportunities1
1	DC4, DC8, DC1	DC3, DC2	DC1,DC3	DC5, DC6, DC7
2	warning, outreach and education, planning dc7, dc8	dc2 dc4 dc7	dc6 dc7	dc6 dc8 dc7
3	DC1, DC3, DC5, DC7, DC8	DC4, DC7	DC7	DC7, DC8, DC1
4	Outreach and Education Warning Planning	Entity Coordination- USFS, State	DC7	DC7 DC8 DC1
5	Entity coordination in the area is strong.	Community awareness of wildfire danger in many areas of the front range is not very widespread.	Wildfire fighting resources are in high demand locally, regionally and nationally during fire season.	Educate homeowners on simple things they can do to reduce risk on their property.
6	Planning DC 5, Warning DC 1,	Outreach and education DC 3	Data collection DC 2, Mitigate structures and protect lives DC 4	Codes and standards DC 6
7		Warning. More education in regard to current systems in place for notifications		
8	communication with SMFR on fire mitigation techniques.	proximity to dense vegetation, topography, altitude, wind, etc.	lack of staff, educational resources, getting the word out	be proactive
9	- strong initial incident response and management - county-based mitigation crew	- multiple communication and dispatch centers without integrated cad-to-cad systems - multiple neighborhoods that are at risk for wildland fire incident	- mitigation on private property - proprietary dispatch software systems (cad-to-cad) - agency reluctance to grant access to cad-to-cad - no adopted wildland-urban interface standard	- adoption of the International wildland urban interface (IWUI) standard - development of a regional cad-to-cad link

10	A known and well understood issue. Resources and plans are currently implemented to address wildfire issues.		Public resistance to and cost of wildfire mitigation. Forest/brush thinning and/or controlled burns to reduce fuel loads are expensive and potentially dangerous and change/modify the existing ecosystem/landscape.	
11	Coordination of fire agencies and county for the response to incidents. Initial subdivision design control by Planning and Building department. Good support for mitigation information for homeowners.	Ability to incentivize homeowners to continue mitigation/prevention aspects on their property. There is no maintenance codes or ordinances that I am aware of that encourage/enforce continued compliance with standards.	There is a reluctance and perhaps constitutional issues to mandate on-going mitigation by a property owner. Property owners may be unable physically or financially to continue mitigation even if they want to.	A shared funding mechanism or a team to mitigate, if necessary, for a homeowner.
12	The Town of Larkspur (TOI) is currently working on a CWPP for the Town. There are currently 5 CWPPs in place in neighborhoods adjoining or near to the TOL. There are 3 active forest management/fire mitigation programs in progress within or adjoining the TOL. The Larkspur Fire Protection District (which the TOL is within) has a active fire mitigation education program available to all citizens of the LFPD.	All of the TOL is within a wildfire hazard area.	Overcoming some citizens concerns to modify an environment they perceive as natural and perfect as is - & why they chose to live there. For actual fire mitigation work in the field - many fixed income families that can't afford to contract the work out and/or do not have the physical abilities or time to do the work themselves.	Every time we have "smoke in the air" from fires in other places or when a fire occurs close to the community that draws attention.

14	<p>2. Drought. Castle Rock has a strong water conservation program.</p> <p>5. Flooding. We coordinate flood warning systems between jurisdictions. We coordinate on flood hazard mapping efforts.</p> <p>8. Soils. We coordinate criteria for erosion control and drainage.</p> <p>11. Hazardous Materials Release. We coordinate on spills through the MS4 permit.</p>	<p>2. Drought. Residents over irrigate due to type of landscaping in this arid climate. Current reliance on non-renewable water sources.</p> <p>5. Flooding. The Counties funding source for flood control projects is very limited.</p> <p>8. Soils. The Counties funding source for stream channel reclamation is very limited.</p> <p>11. Hazardous Materials Release. Releases generally cross multiple jurisdictional lines and can create confusion with regard to enforcement and cleanup orders.</p>	<p>2. Drought. Often water conservation efforts by municipalities are in conflict with HOA covenants.</p> <p>5. Flooding. Environmental regulations often make it challenging to construct a project in the floodplain.</p> <p>8. Soils. Environmental regulations often make it challenging to construct a project in the floodplain.</p> <p>11. Hazardous Materials Release. Unknown.</p>	<p>2. Drought. Conversions away from high water use landscaping to reduce overall water demand. Regional partnerships to bring more renewable water projects to the county.</p> <p>5. Flooding. Seek additional funding at the county level to address flood control.</p> <p>8. Soils. Seek additional funding at the county level to address stream channel stabilization.</p> <p>11. Hazardous Materials Release. Unknown.</p>
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Drought				
ID	Strengths2	Weaknesses2	Obstacles2	Opportunities2
1	DC2, DC5	DC1, DC3, DC4	DC8, DC7, DC6	DC8, DC7, DC6
2		dc1 dc3 dc5	dc8	dc1 dc2
3		DC3	DC5	DC7
4		DC3	DC5	DC7
5	Our community seems to have social responsibility when it comes to conserving natural resources.	Our lifestyles tend to ignore that fact that we will in a rather dry environment.	There is a perception that there will also be enough water.	Develop water conservation strategies and habits before we are forced to do so in a crisis.
6	DC 7 Entity Coordination, Data Collection DC 2	Warning, DC 1, Planning DC 5, Codes and Standards DC 6, Continuity of Operations DC 8	Mitigate structures and protect lives, Planning	Outreach and Education
7		Entity Coordination. Better communication and coordination between the County Municipalities and NGO's or Metro Districts for a longer term or more severe event.		
9			green lawns	
10	Water issues...or lack of water issues are reoccurring and well understood. Water is already closely measured, monitored and regulated throughout Colorado.	Increased drought risk with changing climate. Definite increased demand for finite water supply from rapid population and residential growth along the front range.	Negative public attitude toward water restrictions and increased regulation of available water.	Increased efficiency of water use is possible though public education, changes in landscape/lawns...residential lifestyles, enhanced recycling, agricultural changes.

11	<p>Deep wells for water delay drinking water depletion for a while if the drought is not too extensive.</p> <p>Low dependence on surface water.</p> <p>Development of Reuter-Hess reservoir for storage during non-drought times.</p>	<p>Too many lawns developed in the county with an increasing population. Demand for water for lawns</p>	<p>Ordinances and covenants mandate grass areas on the lot.</p>	<p>Work with cities and developers to require less grass and promote less water demanding landscapes.</p>
12	<p>None at the local level.</p>	<p>Any restriction of public water uses during a drought.</p>	<p>Very little can be done to thwart or intervene with any effective measures for drought conditions.</p>	<p>Very little can be done to thwart or intervene with any effective measures for drought conditions.</p>

Severe Weather: Winter Weather / Extreme Heat				
ID	Strengths ³	Weaknesses ³	Obstacles ³	Opportunities ³
1	DC1, DC2, DC3, DC7		DC5	DC6
2	dc5 dc7 dc8	dc1 dc3	dc4	dc1
3	DC5, DC7	DC3	DC1	
4	DC5 DC7	DC3	DC1	
5	Most residents are accustomed to severe winter weather and know how to prepare for it.	We are beginning to experience types of severe weather that have not normally been seen in the area and are less prepared for those events.	This experience at times results in residents downplaying forecasts of severe weather.	Learn from other communities that have experience with severe heat, tornadoes, etc.
6	Warning,	Planning,	Entity Coordination, Continuity of Operations	Outreach and Education
7	Overall good warning systems in place for local residents, in particular advanced warnings for winter events. Good coordination with local media and National weather service.	Planning efforts are improving, could be better coordination and support, in particular for winter events.	Buy in from administration and other stakeholders.	
9	- coordinated response and planning - shelter planning (typical response)	- communication with CDOT in advance of road closures (winter weather) - shelter planning during pandemic (unknown)	- availability of shelter locations - willingness of CDOT to actively participate/communicate in planning and during response - climate change, increasing frequency of severe weather and temperature changes	self-awareness education, preparedness home/vehicle-awareness education and preparation
10	Well understood issues and appropriate responses. Occur often enough that appropriate machinery (snow plows, etc.) are available and community is knowledgeable and aware of how to respond.	Uncontrollable and recurring phenomena. What is controllable is the human response to the event.		Effective communication with the public can have immediate, appropriate and effective response from the public.

11	County OEM, county agencies and local governments working together to respond to the incident.	Being able to get individuals from going out in the weather and becoming stranded.	Having individuals listen to warnings. Traffic through the county on I-25 is hard to control when highway is shut down.	Greater capability to warn individuals of danger.
12	Past education, encouraging citizen preparedness and having effective warning systems - little can be done prior to events.	Past education, encouraging citizen preparedness and having effective warning systems - little can be done prior to events.	The inability to defend against such events.	Move to a different location with different weather patterns.

Severe Storm: Thunderstorm / Lightning / Hail				
ID	Strengths4	Weaknesses4	Obstacles4	Opportunities4
1	DC1, DC2, DC3	DC4		DC7, DC8
2	dc5 dc7	dc2		
3	DC5, DC7	DC1	DC3	
4	Dc5	Dc1		
5	These is community awareness about these events occurring during certain times of year	Warning areas that are in danger can be difficult.	Warning methods compete for the public's attention with other media.	Establish more accurate detection methods that will allow for more precisely targeted warnings.
6	Warning, Outreach and Education	Data Collection, Codes and standards	Entity Coordination, Continuity of Operations, Mitigate Structures and protect lives	
7	Good warning systems in place from NWS and Storm Ready Communities.			
9	the community has a lot of experience with severe storms and hail	rapidly developing strong storms highly localized storms	sudden development limiting the effectiveness of warning systems (local media, social media) community complacency	adopt code for hail-resistant roofing PSA at the beginning of "storm season" on severe storm/hail safety
10	Fairly well understood and expected to routinely occur by majority of the population.	Uncontrollable.	Uncontrollable.	Effective communication with public is best mitigation activity.
11	Good EMS system if still alive. Good fire response for homes struck by lightning.	No warning system to detect the potential for lightning in the area unless individuals monitor apps on phone. Few homes have lightning protection systems.	Cost of lightning protection systems. System for alerting population of lightning in the area.	System detecting lightning and area that could be tied to cellphones in that area like an amber alert?
12	Provide public education, encourage citizen preparedness and provide adequate warnings.	Provide public education, encourage citizen preparedness and provide adequate warnings.	Defensive and preparation mechanisms/options are almost non-existent.	Defensive and preparation mechanisms/options are almost non-existent.

Flooding				
ID	Strengths5	Weaknesses5	Obstacles5	Opportunities5
1	DC1, DC2	DC3	DC4	DC5, DC6, DC7, DC8
2	dc1 dc5 dc7	dc4	dc6	dc7 dc6
3	DC4, DC5, DC1	DC3	DC6	DC1, DC3, DC7
4	DC4 Dc5 Dc1	Dc3	DC6	DC1 DC7 Dc3
5	Our municipal code as it refers to flood plain management is strong.	There is little public awareness about flooding in the community.	Lack of routine non-emergency flood events lowers the public view of possible significant flood events.	Participate in the CRS and establish strong flood mitigation and response procedures in the event that flooding becomes a greater risk in the changing environment.
6	Planning, Codes and Standards	Continuity of Operations, Mitigate Strictures and Protect Lives	Warning	
7	Codes and standards as well as control structures in place	Lack of coordination and planning in particular for a large scale event, 500 yr or equivalent.		Table top exercise
9	county, municipality planning efforts	none known	the community may considered this a low or non-risk	public education on flood risks, and potential
10	Relatively infrequent and small scale. Multiply mitigation actions have already been taken to address many flood issues.			
11	Good dams and inspections?	Localized flash flooding due to storms that do not move.	Alerting systems for early warning of streams and rivers.	Having sensors on streams to alert folks along that watershed.

12	Zoning limiting flood plain development.	Existing structures within flood plains.	Cost and public opposition to emanate domain takings to remove the values at risk from the hazard areas.	Purchase properties as they become available if there is funding to do so. Improvements to drainage ways, bridges and other infrastructure elements within a floodplain to reduce flooding impacts.
13	run off holding areas, improved building codes in urban areas.	rural areas lacking in flood control measures	government over reach	public education

Tornado / High Wind				
ID	Strengths6	Weaknesses6	Obstacles6	Opportunities6
1	DC1, DC2, DC3	DC4	DC6	DC7, DC8
2	dc1 dc3	dc4		
3	DC1, DC3	DC8		DC1, DC3, DC4
4	Dc1 Dc3	DC8		Dc4
6	Entity coordination, Continuity of Operation		Outreach and Education, Data Collection, Warning	
7		Warning-	No frequency of events so no belief they will occur.	Review of notification system and alerts or updates to notification system, public or community wide.
9		communication and cooperation with CDOT when closing road for high winds	community complacency (always windy in Colorado) willingness of CDOT to contact and communicate in advance of road closures localized micro weather patterns causing dramatic variation in wind speeds	
10	Usually weak tornadoes...so limited damage and damage area.	Short notice warnings/notifications.	Uncontrollable. Can't eliminate the phenomena.	Increased communication and education can help mitigate impacts.
11	Usually good early warning. Good building construction codes.			
12	Public education and warning systems.	Little that can be done at a practical level.	Funding.	Little that can be done at a practical level.

Dam Failure				
ID	Strengths7	Weaknesses7	Obstacles7	Opportunities7
1	DC1, DC2	DC3	DC4	DC6, DC7, DC8
2	dc1 dc2 dc5 dc6	dc3 dc8	dc6	dc3 dc1
3	DC1, DC2, DC5, DC6	DC3, DC8	DC6	DC1, DC3
4	DC1, DC2, DC5, DC7	DC3, DC9	DC7	DC1, DC4
6	Planning, codes and standards	Mitigate structures and protect lives	Data Collection	outreach and education
7		Entity Coordination, Warning system.		Table top exercise, planning
8				
9	mandatory planning	a lot of residents living on the downstream side of a dam	community complacency	local awareness training, emergency/evacuation notification
10	Known and identifiable hazard.			
11	Good inspections.	Unknown.		
12	Assumed state and/or federal inspection of dams and early warnings of any potential failures. The ability to provide rapid reverse notification for those downstream.	Undetected evidence of potential dam failure and/or catastrophic rainfall event or extreme winter snow pack with a rapid melt that would impact the dam structure.	Willingness of downstream residents to prepare for such a rare event.	Utilize other unfortunate dam failures as a education opportunities.

Soils: Expansive Soils / Erosion & Deposition / Landslide / Subsidence & Sinkholes

ID	Strengths8	Weaknesses8	Obstacles8	Opportunities8
1	DC5, DC6, DC2, DC4	DC1, DC3		DC8
2	dc7 dc1	dc3	dc6	dc4
3	DC7, DC1	DC3	DC6	DC4
4	Dc7 Dc1	dc3	Dc6	Dc4
6	Codes and Standards, planning		Continuity of operations	Outreach and education, data collection
9	unknown	under education about the risk in the area	lack of understanding	mapping of at-risk areas
10	Known phenomena.	Landslide threats change after wildfires. So adjustments to threat must be communicated to threatened population and areas.		
11	Have little of these other than minor erosion in construction sites as far as I am aware. Do have expansive soils. Good enforcement of erosion control expansive soils mitigated during construction process.	Potential for erosion after a wildfire event.	Getting vegetation replanted .	Civic groups to volunteer to replant providing labor and perhaps funding to buy trees and seed.
12	Existing zoning and building codes.	Possible unidentified areas for such events. Existing structures on known hazard areas constructed prior to code and zoning requirements.	None	Further exploration in areas that might be suspected of harboring such hazards.

Epidemic/Pandemic				
ID	Strengths9	Weaknesses9	Obstacles9	Opportunities9
1	DC1, DC2, DC3	DC4	DC6, DC7, DC8	
2	dc1 dc3 dc5 dc6 dc7 dc8	dc2	dc7	dc7
3	DC1, DC3, DC5, DC6, DC7, DC8	DC2	DC7	DC7
4	DC1, DC3, DC5, DC6, DC7, DC8	Dc2	Dc7	Dc7
6	Outreach and education	continuity of operations	data collection	entity coordination, codes and standards
7		Entity Coordination-		
9	relevance to current events county/municipality planning and response	supply chain management staffing (people over-tasked with additional responsibilities)	availability of needed materials community "compliance exhaustion"	education, education, education medical countermeasure (MCM) planning
10	Routinely occurring, so response community has had practice dealing with/responding to threat.	Fluid situations that require flexible response.	Money, resources, knowledge and information.	
11	Great communications.	Testing with quick turnaround.	Having resources to do testing in communities.	Using Mobile healthcare units visiting neighborhoods where people can walk to be tested.

12	Proactive DC elected officials Increased hospitals & patient capacities over the last few years. Ability of governments to rapidly and widely communicate with residents.	Political decisions at other levels of government and from quasi governmental agencies.	Low stockpiles of needed PPE and medical counter measures.	Learn and plan ahead based on the realities of the current pandemic.
13	Supportive community, well educated, excellent health care.	government over reach, Community elements lack of faith in vaccines.	Misinformation, social media.	Improved public information and education

Animal Disease & Pest Outbreak				
ID	Strengths10	Weaknesses10	Obstacles10	Opportunities10
1	DC1, DC2, DC3	DC5		DC6, DC7, DC8
2	dc7	dc8		dc1 dc2
3	DC3, DC7	DC8		DC1, DC2
4	Dc7	Dc8		Dc2
5				
6	entity coordination, codes and standards		outreach and education,	planning, data collection
10		Sometimes slow identification and response.	Limited resources.	
11	Unsure	Unsure	??	??
12	I do not have the background to comment on this.	I do not have the background to comment on this.	I do not have the background to comment on this.	I do not have the background to comment on this.

Hazardous Materials Release - Transportation				
ID	Strengths11	Weaknesses11	Obstacles11	Opportunities11
1	DC1, DC6, DC5	DC3, DC4		DC7, DC8
2	dc1 dc3 dc7	dc2 dc6	dc6	dc6 dc2
3	DC1, DC3, DC7	DC2, DC6	DC6	DC6, DC2
4	Dc1 Dc3 Dc7	Dc2 Dc6	dc6	dc6 Dc2
5				
6	entity coordination,		Mitigate structures and protect lives, codes and standards	Outreach and education, planning,
7		Planning		Continuity of operations- training
9	regional response cooperation regional residential HAZMAT disposal days	limited number of "technician" resources clunky state-wide reporting system (tier II facilities)	funding for training, multi-jurisdictional training	grant funding for training "facilitated" multi-jurisdictional training
10	Hazmet teams with appropriate training are in place and equipped. Many first responders at least partially trained on how to handle the events.	Limited resources to respond to a large event.	Resources...money.	
11	Good haz mat response capability through county cooperation of county and fire departments.	Being able to warn people down wind or at lower elevations of potential exposure.	Community understanding good shelter in place strategies and quick effective warning in direction of concern.	Education opportunities for training. Short video to explain why and how to shelter in place.

12	<p>Rapid response by qualified first responders.</p> <p>Ability to rapidly expand command and control.</p> <p>Ability to rapidly evacuate affected areas if needed.</p>	<p>Many transportation corridors through densely populated areas could cause massive escalation of an event.</p> <p>Some population centers around point source incidents - see above.</p> <p>Massive traffic issues possible to the detriment of first responder arrival and population evac.</p> <p>Scale of the incident may preclude early resolution.</p>	<p>Time of day - rush hour traffic complications - night time sleeping populations</p> <p>Event scale vs. agency capabilities.</p> <p>Time frame of control through cleanup</p>	<p>Review of zoning regs and allowances for where point source hazardous materials can be stored and used.</p> <p>Multi agency hazardous material release drills to hone response efficiency.</p> <p>Education of the public for awareness and evac.</p>
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Appendix C. MEETING DOCUMENTATION

Appendix C includes meeting agendas, sign-in sheets and minutes (where applicable and available) for meetings convened during the development of the Douglas County Hazard Mitigation Plan Update.



 DOUGLAS COUNTY
COLORADO



Local Natural Hazard
Mitigation Plan

Local Planning
Committee

UPDATE

AUG
2020

CORE PLANNING TEAM

CHAIRPERSON

Tim Johnson

TMJohnso@dcsheriff.net

VICE-CHAIRPERSON

Tim Hallmark

THallmar@douglas.co.us

PROJECT MANAGER

Chrissie Angeletti

Chrissie.angeletti@tetrattech.
com

OUTREACH COORDINATOR

Lisa Goudy

Mgoudy@douglas.co.us

MEDIA RELATIONS

Wendy Holmes

Wholmes@douglas.co.us

NEXT STEERING COMMITTEE MEETING

AUG. 19, 2020

1:30 - 3:30 p.m.

Virtual Meeting

<https://bit.ly/2XTLM8T>

Welcome and Thank You....

Douglas County greatly appreciates the varied perspectives, leadership and guidance the citizens of Douglas County who are serving as members of the Local Planning Committee (LPC) bring to the planning process.

The County is vulnerable to many natural hazards that may cause a disaster and is committed to reducing future impacts from hazard events and maintaining eligibility for mitigation-related federal funding. This plan update demonstrates our community's commitment to reducing risks and along with the county Emergency Operations Plan is a part of the Douglas County Comprehensive Emergency Management Plan.

Provision of public safety is a County core priority and this update aims to enhance public safety, protect lives, property and the environment, and restore affected communities quickly and efficiently following a disaster...*Continued on Page 2*



July 22 Steering Committee Meeting Re-cap

On July 22, 2020, the Core Planning Team hosted the 1st Local Planning Committee Meeting (LPC) for the Douglas County All Hazards Mitigation Plan with 26 persons in attendance. The Committee established the following:

- Ground rules for future meetings and overall planning process.
- Overview and milestones of the planning process were discussed.
- The following meeting schedule was established:
 - LPC #2 - Aug. 19, 2020
 - LPC #3 - Sept. 16, 2020
 - LPC #4 - Oct. 21, 2020
 - LPC #5 – Jan. 20, 2021
- Definition of critical facilities presented, amended and approved.
- Public involvement strategy presented.
- Public survey was amended and approved for distribution.
- Identified hazards of concern and conducted hazard ranking exercise (see table to the right).

Hazard	Ranking
Wildfire	4.68
Epidemic / Pandemic	4.52
Drought	4.28
Hail	4.28
Thunderstorm / Lightning	3.96
Flooding	3.64
Hazardous Materials Release	3.6
Severe Wind	3.36
Tornado	3.36
Extreme Heat	3.2
Erosion & Deposition	2.56
Landslide / Mud / Debris Flows / Rockfall / Rockslide	2.52
Dam Failure	2.44
Expansive Soils & Heaving Bedrock	2.28
Animal Disease Outbreak	2.2
Sinkholes / Subsidence / Abandoned Mine	1.96
Earthquake	1.84
Avalanche	1.56

Action Item 1	Review the 2018 State of Colorado Hazard Mitigation Plan and become familiar with the current hazards, goals and objectives at www.colorado.gov/pacific/mars/colorado-natural-hazard-mitigation-plan
Action Item 2	Review the 2015 Douglas County HMP at www.douglas.co.us/natural-hazard-mitigation-plan/
Action Item 3	Distribute Public Survey – Media packet will be provided to all LPC members to be distributed through their various media outlets including social media.
Action Item 4	Planning Partners - please submit a “Letter of Intent to Participate” to Tim Johnson at TMJohnso@dcsheriff.net
Action Item 5	Planning Partners: Phase 1 Annex Template to be completed by August 31, 2020. Please email completed templates to Chrissie Angeletti at Chrissie.angeletti@tetrattech.com

Continued from Page 1

As part of our commitment to the safety of our citizens, Douglas County, five local jurisdictions and four special districts, are participating in a Local Hazard Mitigation Plan (LHMP) update to the 2016 Douglas County Local Hazard Mitigation Plan.

Information from the plan will guide and direct hazard mitigation planning, activities and resources to best protect the people and property of the County from the effects of hazardous events. Proactive mitigation planning helps reduce the cost of disaster response and recovery to communities and their residents by protecting critical community facilities, reducing liability exposure, and minimizing overall community impacts and disruptions.

Tim Johnson, Director Emergency Management



MEETING SUMMARY

Date/Time of Meeting: Wednesday July 22, 2020
1:30PM-3:30PM

Location: Virtual Meeting

Subject: 1st Local Planning Committee Meeting

Project Name: Douglas County Local Natural Hazard Mitigation Plan Update

In Attendance ***Attendees: 26 Persons***
Core Planning Team: Tim Johnson, Lisa Goudy, Zak Humbles, Chrissie Angeletti

Summary Prepared by: Chrissie Angeletti

Quorum – Yes or No Yes

Welcome and Introductions

- Tim Johnson, Chairman of the LPC, welcomed the Committee members to the meeting and facilitated group introductions.
- Chrissie Angeletti, the Tetra Tech project manager, confirmed that a quorum was present and reviewed the meeting agenda. No modifications were made to the agenda.
- Distributed handouts: Power point presentation; LPC Expectations; Hazards of Concern Exercise; Draft Public Survey

Hazard Mitigation Planning and Update Overview

- Overview of the Hazard Mitigation Planning and Update discussed.
- Any taxing entity can develop an HMP including a municipality, special district, or county.
- The County's HMP will be a multi-jurisdiction plan.
- The project will include the gathering of hazard data, the development of a hazard risk assessment, a review of the previous plan, establishment of priorities based on the hazard data, and establishment of action items.
- The HMP is a working document that seeks to prevent and minimize damages from disasters.
- The HMP is a prerequisite for funding for hazard mitigation projects and the HMP will provide the County and Planning Partners with a better understanding of community hazards. The HMP will list and prioritize projects for implementation when funding is available. When funding is available, an application may be completed and often includes a benefit cost analysis.
- Once approved, the plan is good for 5 years.
- Hazard Mitigation planning can also earn the County and Planning Partners Community Rating System (CRS) credits. The CRS is a voluntary program that encourages floodplain management that meet and exceed the National Flood Insurance Program (NFIP). CRS membership by the



Douglas County Local Natural Hazard Mitigation Plan Update – July 22, 2020 LPC Meeting Summary

County and Planning Partners also provides discounts to County and Planning Partner residents on flood insurance.

The Steering Committee Role/Ground rules

- The purpose and expectations of the Steering Committee was discussed.
- The Chairperson and Vice Chairperson were named as well as the roles of these positions. Tim Johnson, serves as the Chairman of the LPC. Tim Hallmark, will serve as the Vice Chairman.
- Quorum was established as 13 members plus at least 1 of the co-chairs.
- Alternates can be designated in the event a committee member is unable to attend.
- Decision-making – process will seek consensus. If consensus cannot be reached, a decision will be confirmed by a majority vote. A dissenting opinion can be recorded upon request.
- Recommendations from meetings will be recorded in meeting summaries.
- Attendance – if the committee member is unable to attend, they can send their alternate if one has been designated. Repeated no-shows, member or alternate, will be contacted by the Chair to see if they are still able to support the process
- To meet CRS requirements, the County and Planning Partner staff must consist of no more than 20 percent of the LPC.
- Notes will be taken at each meeting and posted to the County’s website. A bulletin will also be developed to highlight planning activities and posted to the website.
- Public Involvement – all meetings are open to the public and will be advertised as such. LPC members are encouraged to share the bulletins with their constituents as well as help with public participation, public workshops, and use various media to disburse planning information.

Schedule

- Overview and Milestones of the planning process were discussed
- The following Meeting Schedule was established: (PP = Planning Partners/ LPC = Local Planning Committee)
 - PP Phase I – 7/8/20
 - LPC Kick-off - 7/22/2020
 - LPC #2 - 8/19/2020
 - PP Phase I Due – 8/31/2020
 - LPC #3 - 9/16/2020
 - PP Phase II - 9/16/2020
 - LPC #4 - 10/21/2020
 - Risk Assessment Public Workshop - 11/18/20
 - PP Phase II Due - 11/18/2020
 - PP Phase III Workshop 12/16/20
 - PP Phase III Due 1/13/2021
 - LPC #5 – 1/20/2020
 - Public Comment Period 2/8/21-2/22/21
 - Draft Plan to State Mid-March
- The next LPC meeting will be August 19th, 2020; LPC will confirm Hazards, Establish Mission Statement, Goals
- LPC #3 September 16th, 2020; LPC will confirm Objectives, SWOO (Hazard Specific) Exercise
- LPC #4 October 21st, 2020; LPC will Review Risk Assessment Results, Confirm Risk Ranking, Review Critical Facilities Analysis Draft



- LPC #5 January 20th, 2021; LPC will Review Draft Plan, Provide Draft Comments

Defined Planning Area for the update

- Multi-Jurisdictional Plan - Planning Partners include:
- Local Government:
 - Douglas County
 - City of Castle Pines
 - City of Lone Tree
 - Town of Castle Rock
 - Town of Larkspur
 - Town of Parker
- Special Districts:
 - Centennial Water & Sanitation/Highlands Ranch Metro District
 - Denver Water
 - Mile High Flood Control
 - Parker Water and Sanitation

Critical Facilities/Infrastructure Definition

- Attendees reviewed the previous definition, and approved the following updated definition:

Any facility and asset, including without limitation, a structure, infrastructure, property, and equipment, that if adversely affected during a hazard event may result in severe consequences to public health and safety or interrupt essential services and operations for the community at any time before, during and after the hazard event.

A critical facility is classified by the following categories: (1) Essential Services Facilities; (2) High Potential Loss Facilities; and (3) At-Risk Populations Facilities The list of critical facilities will include:

Essential Service Facilities

- Public safety
- Emergency response
- Emergency medical
- Designated emergency shelters
- Designated staging areas
- Communications
- Public utility facilities
- Essential government operations
- Transportation systems
- Private sector facilities that provide essential services

High Potential loss Facilities

- Dams
- Hazardous materials facilities
- Major pipelines

At Risk Population Facilities

- Schools
- Daycare centers with 12 or more children
- Group homes, and assisted living residential or congregate care facilities with 12 or more residents

Hazards of Concern

- Hazards from the previous plan were discussed.
- Additional Hazards to comply with the State Plan were reviewed and approved.
- Ms. Angeletti noted that for state purposes the FEMA will only review natural hazards in the HMP, but the County and Planning Partners are free to list and develop actions to address non-natural hazards in the HMP.



Douglas County Local Natural Hazard Mitigation Plan Update – July 22, 2020 LPC Meeting Summary

- The LPC conducted an exercise to rank a list of hazards for the planning area followed by a discussion regarding the results.

Hazard	Ranking
Wildfire	4.68
Epidemic / Pandemic	4.52
Drought	4.28
Hail	4.28
Thunderstorm / Lightening	3.96
Flooding	3.64
Hazardous Materials Release	3.6
Severe Wind	3.36
Tornado	3.36
Extreme Heat	3.2
Erosion & Deposition	2.56
Landslide / Mud / Debris Flows / Rockfall / Rockslide	2.52
Dam Failure	2.44
Expansive Soils & Heaving Bedrock	2.28
Animal Disease Outbreak	2.2
Sinkholes / Subsidence / Abandoned Mine	1.96
Earthquake	1.84
Avalanche	1.56

Public Involvement Strategy/Tracking

- The County has established a website for the HMP Update - <https://www.douglas.co.us/natural-hazard-mitigation-plan/>
- The website has information on hazard mitigation planning, public notices, project bulletins, meeting notes, and will provide a link to the public survey. It will also include links to the 2015 plan. LPC members are encouraged to link to the site and share information regarding the project on their own websites and through social media.
- Tracking Public Outreach Efforts
 - Email – Chrissie.angeletti@tetrattech.com & cc Tim Johnson and Lisa Goudy.
- Media Request – Lisa Goudy (mgoudy@douglas.co.us)
- A sample public survey was developed by Tetra Tech for the LPC’s review. The purpose of the survey will be to help gauge the public’s perception of risk. Using the survey will help pinpoint the public’s concerns regarding community hazards. The LPC provided input on the survey questions and it was approved with changes. The LPC will also set a target goal for completed surveys.

Homework (before the next LPC meeting)

- Review the October 2018 CO State Hazard Mitigation Plan (<https://www.colorado.gov/pacific/mars/colorado-natural-hazard-mitigation-plan>)
- Review the 2015 Douglas County HMP (<https://www.douglas.co.us/natural-hazard-mitigation-plan/>)
- Distribute Public Survey



Douglas County Local Natural Hazard Mitigation Plan Update – July 22, 2020 LPC Meeting Summary

- Public Survey Link: <https://bit.ly/2PAz0HK>
- A media packet for the survey will be distributed to the LPC and Planning Partners to be distributed through their media outlets including social media sources.

Planning Participants

- Planning partners complete Letter of Intent to participate in the Plan Update.
- Phase 1 of the Jurisdictional Annex Process due by August 31, 2020

Adjourn

- Meeting was adjourned at 3:30 pm



Douglas County

Natural Hazard Mitigation Plan Update

Local Planning Committee Kick-Off Meeting

Wednesday July 22, 2020



Speaker

Chrissie Angeletti JD - Tetra Tech, Inc.

- Subject matter expert in Disaster Management and Environmental Compliance.
- Expertise include FEMA Public Assistance, including 406 Hazard Mitigation, and 428 under the Sandy Recovery Improvement Act and Hazard Mitigation Assistance grant programs for over 30 major disasters.
- Lead FEMA's Hazard Mitigation Technical Assistance (HMTAP) contract for Hurricane Harvey.
- Managing contracts with local communities for multi-programmatic financial recovery including hazard mitigation planning, grant development, and BCA support; and CDBG-Mitigation.

Today's Discussion

- Introductions – Project Management Team
- Why are you here?
- Disaster Mitigation Act
- Douglas County 2015 Plan
- The Local Planning Committee
- Douglas County 2021 Plan Update
- Local Planning Committee Ground Rules and Expectations
- Hazards of Concern Exercise
- Public Participation Strategy - Public Survey
- Confirm Critical Facilities Definition
- Next Steps?

The Project Management Team

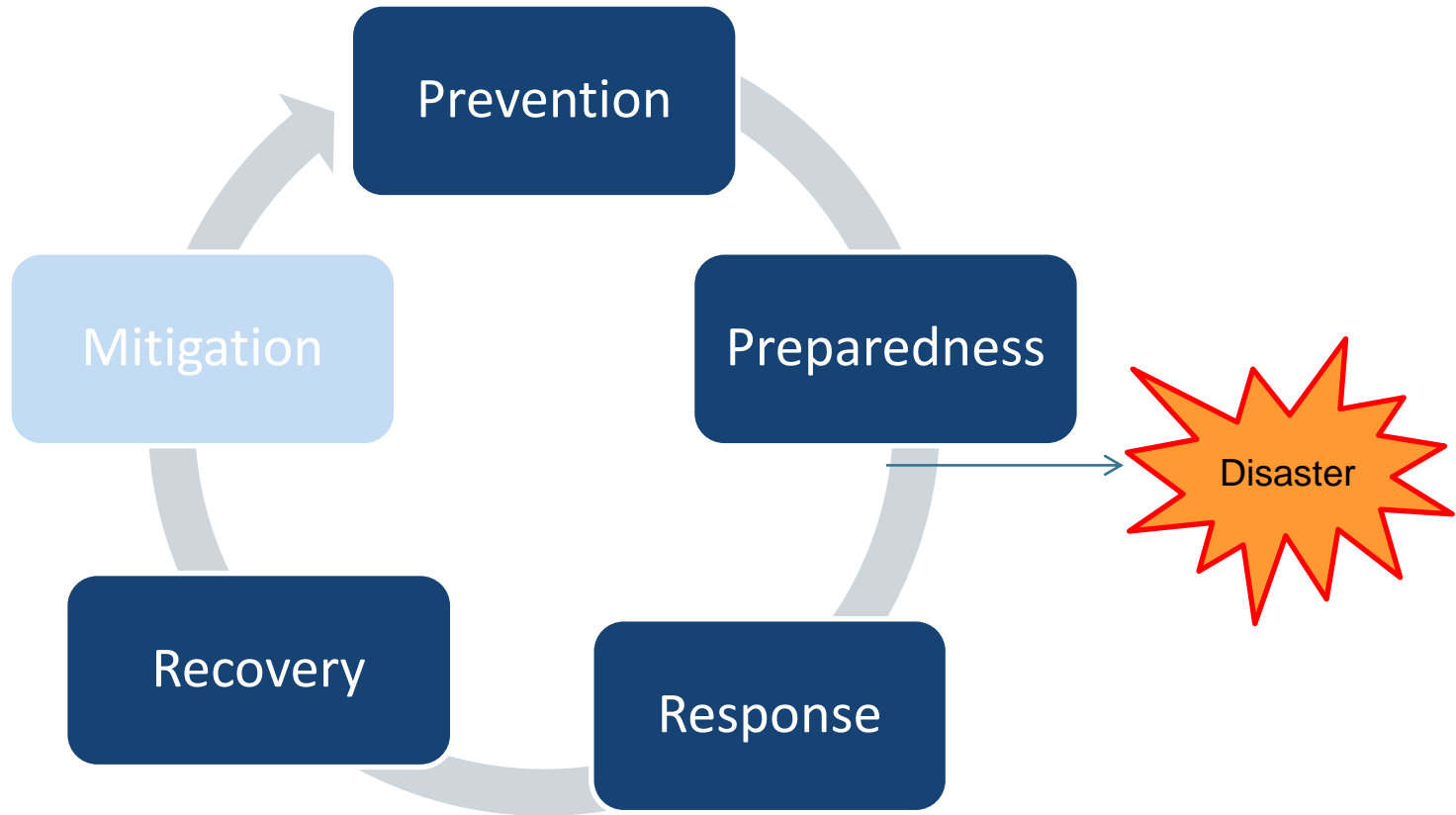
- The Project Management Team (PMT) is made up of discipline leads from the Tetra Tech team as well as key staff from Douglas County.
- The PMT is primarily responsible for overall project management, facilitating meetings/workshops, and developing the updated Hazard Mitigation Plan (HMP)
 - ✓ **Tim Johnson**, Douglas County Project Manager/LPC Chairman
 - ✓ **Lisa Goudy**, Douglas County Safety and Security Coordinator
 - ✓ **Tim Hallmark**, Douglas County Director Emergency Services
 - ✓ **Joel Hanson**, Douglas County GIS Services
 - ✓ **Zak Humbles, P.E.**, Douglas County flood Plain Administrator
 - ✓ **Chrissie Angeletti**, Tetra Tech - Project Manager
 - ✓ **Brian Kemp**, Tetra Tech - Lead Project Planner
 - ✓ **Magda UsarekWitek**, Tetra Tech - GIS/HAZUS lead

Why are you here?

- You have been identified as a stakeholder within Douglas County.
- CRS Activity 510, step 2 planning requirements
 - ✓ Police / Fire Departments / Dispatch
 - ✓ Public Works / Utilities
 - ✓ Communications
 - ✓ Engineering
 - ✓ Health Authority
 - ✓ Emergency Management
 - ✓ Schools/ Higher Education
 - ✓ Medical Facilities
 - ✓ Environmental Entities
 - ✓ Economic Development
 - ✓ Regulatory Agencies

What is Mitigation?

“Mitigation is sustained action taken to reduce or eliminate long-term risk to life and property.”



5 Phases of Emergency Management

Examples of Mitigation Strategies

- Enhance warning systems
- Studies and Plans that inform risk and risk reduction
- Public Outreach and Education
- Structural protective measures - retrofit, elevation, flood-proofing, acquisition
- Continuity of Operations - generators, telecommunications
- Policies— building codes and zoning
- Incentives – grants or financial assistance for risk reduction at business and household level

What is the Disaster Mitigation Act (DMA)?

Federal legislation that establishes a pre-disaster hazard mitigation program and new requirements for the national post-disaster Hazard Mitigation Grant Program (HMGP).

=

Federal \$\$\$ for pre-disaster and post-disaster hazard mitigation projects in Douglas County.

Provisions of the Disaster Mitigation Act (DMA)

- Encourages and rewards local and state pre-disaster planning (\$\$\$ for projects)
- Integrates state and local planning
- Specifies required plan components:
 - risk assessment
 - public outreach and participation
 - process for update
 - formal review State and FEMA review
 - documentation of acceptance by the community

Other Benefits to Hazard Mitigation Planning

- Hazard Mitigation Plans contribute to a community's Community Rating System (CRS) score
- What is Community Rating System?
 - A FEMA/National Flood Insurance voluntary incentive program that encourages floodplain management activities
 - Reduces potential flood damages and can decrease flood insurance rates \$\$

Participating in CRS

- Douglas County- Class 5 (Effective May 2020)
- Town of Parker- Class 5 (Effective 2017)

Not Participating in CRS

- Town of Castle Rock
- Town of Larkspur
- City of Lone Tree
- City of Castle Pines

- ✓ 7 Planning Partners
- ✓ Identified and prioritized over 46 actions
- ✓ Expires in 2020
- ✓ Letter of Extraordinary Circumstances

The 2015 Plan

Douglas County

Local Hazard Mitigation Plan

Comprehensive Update
June 2015



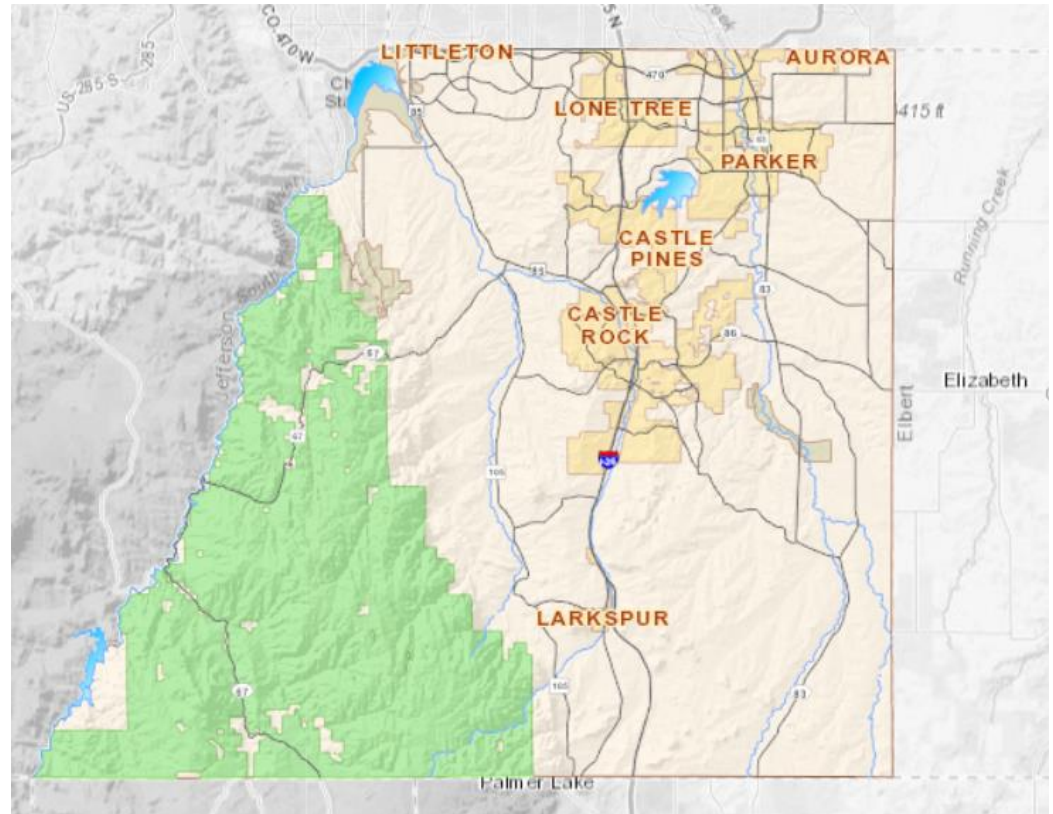
2021 Planning Partners

Municipalities:

- ✓ Douglas County
- ✓ City of Castle Pines
- ✓ City of Lone Tree
- ✓ Town of Castle Rock
- ✓ Town of Larkspur
- ✓ Town of Parker

Special Districts:

- ✓ Centennial Water & Sanitation/Highlands Ranch Metro District
- ✓ Denver Water
- ✓ Mile High Flood Control
- ✓ Parker Water and Sanitation



The Work Plan



- 7 phase scope of work
- Follow the 10-Step Planning script from FEMA's Community Rating System (CRS Program).
- Centers on a comprehensive risk assessment and active public engagement strategy



Time Line

HAZARD MITIGATION ACTION PLAN TIMELINE

Hazard Mitigation Action Plan Update Tasks	M1 M2 M3 M4 M5 M6 M7 M8 M9 M10 M11 M12											
	D	M	T	W	T	F	S	S	M	T	W	T
Mitigation Project Management Team Coordination	◆											
Project Initiation Meeting with Project Management Team (PMT)		◆										
Project Kick Off Meeting			◆									
PMT Meetings with Local Planning Committee (LPC)												
Stakeholder/Agency Coordination												
PMT Program Review												
Public Involvement Strategy												
LPC confirms Public Outreach Strategy		◆										
Website*												
Press Releases				◆								
Social media releases				◆								
Phase 1 Outreach					◆							
Phase 2 Outreach						◆						
Risk Assessment and Vulnerabilities												
Prepare list of all data needed to perform the analysis - collect												
Gather Data												
Perform a thorough risk assessment of each hazard												
Conduct vulnerability assessment of the planning area to each hazard identified												
Model hazard impacts not addressed by HAZUS modeling, using GIS applications												
Develop maps and illustrations to be used to support public meetings and outreach regarding planning efforts												
Present findings and recommendations to PMT and LPC												
Update Goals, Objectives, Capabilities and Actions												
Confirm Vision, Goals and Objectives												
PMT to complete core capability assessment												
Prior Action review												
Identify and prioritize new Action Plan												
Assemble the Plan												
Plan Maintenance: Develop guidelines for plan implementation												
Plan Maintenance: Propose methodology for annual progress reporting												
Plan Maintenance: Create triggers for future comprehensive plan updates												
Plan Maintenance: Develop strategy of integration of plan into existing planning mechanisms												
Plan Maintenance: Create strategy for continuing public involvement												
Plan Framework to LPC												
Internal Review Draft												
Public Review Draft												
Agency Submittal Draft												
Final Draft**												
Plan Review and Adoption												
PMT to complete Plan Review Tool												
Plan Submittal to DHSEM**												
Anticipated APA from FEMA (estimated 90 days post submittal)												
Adoption on following APA (estimated 30 days post APA from FEMA)												
Final Approval by FEMA**												

PP Phase I – 7/8/20

LPC Kick-off - 7/22/2020

LPC #2 - 8/19/2020

PP Phase I Due – 8/31/2020

LPC #3 - 9/16/2020

PP Phase II - 9/16/2020

LPC #4 - 10/21/2020

Risk Assessment Public Workshop - 11/18/20

PP Phase II Due - 11/18/2020

PP Phase III Workshop 12/16/20

PP Phase III Due 1/13/2021

LPC #5 – 1/20/2020

Public Comment Period 2/8/21-2/22/21

Draft Plan to State Mid-March

- **Expedited Schedule Draft to State March 2021**
- **This schedule all depends on you!**

The Local Planning Committee

The Local
Planning
Committee

Will operate under a set of ground rules

Will participate in the Public Involvement Strategy

Will act as spokespersons for the process

Minimum of 2 hours per meeting

Will oversee plan development

Local Planning Committee Ground Rules

- Attendance
- Alternates
- Quorum
- Decision Making
- Courtesy
- Public Participation
- Meeting Dates/Times
- Confirmation of LPC Members and Alternates (Due Friday 7/24/2020)

Public Participation Strategy

- Public Engagement Meetings
- Planning Coordination (Meeting Notes/Bulletins)
- Additional Outreach Capabilities (suggestions welcomed)
 - Website – <https://www.douglas.co.us/natural-hazard-mitigation-plan/>
 - Questionnaire/Public Survey
 - Press/media
 - Social Media
- Tracking Public Outreach Efforts
 - Email (Chrissie.angeletti@tetrattech.com) & cc Tim J. and Lisa G.
- Media Request – Lisa Goudy (mgoudy@douglas.co.us)

Local Planning Committee Meetings

Kick-Off Meeting July 22nd 2020

- Confirm Ground Rules, Confirm Public Survey, Confirm Definition Critical Facilities, Hazards of Concern Exercise

LPC #2 August 19th 2020

- Confirm Hazards, Establish Mission Statement, Goals

LPC #3 September 16th 2020

- Confirm Objectives, SWOO (Hazard Specific) Exercise

LPC #4 October 21st 2020

- Review Risk Assessment Results, Confirm Risk Ranking, Review Critical Facilities Analysis Draft

LPC #5 January 20th 2021

- Review Draft Plan, Provide Draft Comments

Hazards of Concern Exercise

10 Minutes to Complete

Rank 18 hazards 1-5

Link: <https://bit.ly/30GDO3c>

Hazards of Concern

Rank hazards depending on your perception of risk the hazard poses to the County.

1. Animal Disease Outbreak



2. Avalanche



3. Dam Failure



Critical Facilities Definition

Any facility, including without limitation, a structure, infrastructure, property, equipment or service, that if adversely affected during a hazard event may result in severe consequences to public health and safety or interrupt essential services and operations for the community at any time before, during and after the hazard event.

A critical facility is classified by the following categories: (1) Essential Services Facilities; (2) High Potential Loss Facilities; and (3) At-Risk Populations Facilities:

Essential Service Facilities

- ✓ Public Safety
- ✓ Emergency Response
- ✓ Emergency Medical
- ✓ Designated Emergency Shelters.
- ✓ Communications
- ✓ Public Utility Plant Facilities
- ✓ Essential Government Operations
- ✓ Transportation Lifeline Systems

High Potential loss Facilities

- ✓ Dams
- ✓ Hazardous Materials Facilities

At Risk Population Facilities

- ✓ Schools
- ✓ Daycare centers with 12 or more children
- ✓ Group homes, and assisted living residential or congregate care facilities with 12 or more residents

Public Survey Confirmation

Purpose:

- Assessing our residents' level of awareness regarding hazards;
- Determining areas vulnerable to various types of hazards;
- Coordinating activities to reduce the risk of injury or property damage in the future; and
- Public Participation Requirements

5-10 Min to Review

Link: <https://bit.ly/2BkQTXm>

Complete answers after each section with feedback to add/delete/edit questions or responses.

Completion by this Friday 7/24/20

Once finalized – Distribute throughout your networks

GOAL: 500 Responses!!!

Next Steps

Local Planning Committee

- Review the October 2018 CO State Hazard Mitigation Plan (<https://www.colorado.gov/pacific/mars/colorado-natural-hazard-mitigation-plan>)
- 2015 Douglas County HMP (<https://www.douglas.co.us/natural-hazard-mitigation-plan/>)
- Select Questions from Sample Survey

Planning Participants

- Those planning partners that have not already submitted an LOI should submit by July 31, 2020.
- Phase 1 of the Jurisdictional Annex Process due by August 31, 2020

Questions ?



Local Natural Hazard Mitigation Plan

Local Planning Committee

UPDATE

SEPT 2020

CORE PLANNING TEAM

CHAIRPERSON

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TMJohnso@dcsheriff.net

VICE-CHAIRPERSON

Tim Hallmark

THallmar@douglas.co.us

PROJECT MANAGER

Chrissie Angeletti

Chrissie.angeletti@tetrattech.com

OUTREACH COORDINATOR

Lisa Goudy

Mgoudy@douglas.co.us

MEDIA RELATIONS

Wendy Holmes

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NEXT STEERING COMMITTEE MEETING

Sept. 16, 2020

1:30 - 3:30 p.m.

Virtual Meeting

<https://bit.ly/2QPET4o>

Aug. 19, 2020 Steering Committee Meeting Re-cap

On Aug. 19, 2020, the Core Planning Team hosted the 2nd Local Planning Committee Meeting for the Douglas County All Hazards Mitigation Plan.

The Committee finalized mission statement for 2020 HMP: “The purpose of this plan update is to guide hazard mitigation planning, implement projects, and prioritize resources to better protect the people and property of the County from the effects of hazards. This plan demonstrates the community’s commitment to reducing risks from hazards and serves as a tool to help decision makers direct mitigation activities and resources....”. As well as reviewed previous goals and approved updated goals for 2020 HMP Update. Final 2020 HMP Goals including:

- **Goal 1:** Reduce impacts, costs, and damages from hazard events to people, property, local government and private assets, economy, and natural and cultural resources.
- **Goal 2:** Increase public awareness of hazards and their mitigation.
- **Goal 3:** Strengthen communication and coordination among public entities, non-governmental organizations (NGOs), businesses and private citizens.
- **Goal 4:** Coordinate and integrate hazard mitigation activities with local land development planning activities and emergency operations planning to consider resiliency.
- **Goal 5:** Enhance predictive measure including the expansion and protection of warning systems and supporting technologies.
- **Goal 6:** Enhance the quality of assessments, analysis and planning through the development and collection of data.
- **Goal 7:** Review, update, adopt and enforce local, state and federal plans, codes and regulations to reduce the impacts of natural hazards.
- **Goal 8:** Support continuity of operations pre-, during, and post- hazard events including the support of community lifelines.

The committee also reviewed the Definition of Objectives that were presented and ranked current capabilities relating to the County or municipality. Refer to the Capability Exercise table on the next page.

Capability Description	Ranking
Emergency management is provided by a unified authority or program.	1.61
County/ municipality staff members with emergency management functions are adequately trained.	1.67
County/ municipality staff are knowledgeable about hazards and their impacts and are willing to share that knowledge with the public.	1.72
Emergency response functions for the County/ municipality are clearly defined and are effective.	1.78
Strong collaboration and coordination exist between the County/ municipality, neighboring jurisdictions, the County and state and federal agency	1.78
Roles and responsibilities for emergency management within the County/ municipality clearly defined.	1.94
Appropriate and timely warning systems are in place.	1.94
There is a good understanding of the risk posed by hazards the planning area is susceptible to.	2.00
The capability to assess and mitigate risk from natural hazards is high.	2.17
The County/ municipality currently has adopted policies that encourage development to be located outside of high-risk areas.	2.17
Current land uses within identified hazard areas are appropriate for the risk posed by each hazard.	2.22
The County/ municipality currently has a variety of regulatory and non-regulatory strategies to reduce risk.	2.22
All relevant stakeholders are engaged in the County's/ municipality's risk management efforts.	2.22
Risk from natural hazards within the planning area is adequately mapped and regulated.	2.28
There is political support for risk management within the planning area.	2.28
As a citizen of the County/ municipality, I feel confident that I am prepared for the impacts from any natural hazard that may impact my property.	2.33
Coordinated public outreach regarding risk from all hazards convey clear, consistent messaging to the public.	2.39
Information on flood insurance is readily available within the planning area.	2.39
Areas that provide natural resource protection are identified and protected.	2.44
The planning area risk management programs are fair and equitable.	2.44
Existing flood control systems are effective and well maintained.	2.50
The County/ municipality development regulations for new development within identified hazards zones are adequate to address that risk.	2.56
There is a coordinated program to maintain drainage systems free of debris.	2.56
The enforcement of Codes and Standards within the planning area is strong.	2.56
There is strong public support for risk reduction within the planning area.	2.61
The funding to support risk reduction within the planning area is adequate.	2.94
The planning area is prepared for the probable impacts on natural hazards due to the impacts from a changing climate.	2.94
Members of the public know where to find information about hazards and risk.	3.00
Citizens have a good understanding of natural hazard exposure and risk.	3.39
Real Estate professionals adequately disclose risk exposure from natural hazards at the time of sale of real property.	3.39

Local Planning Committee

Action Item 1

Complete Objectives Exercise on Survey Monkey by September 4, 2020 at <https://www.surveymonkey.com/r/8F7KJWD>

Planning Partners

Action Item 1

Phase 1 Annex Template to be completed by August 31, 2020. Please email completed templates to Chrissie Angeletti.

Action Item 2

Phase 2 Annex to be released September 16, 2020.

Please contact a member of the Core Planning Team for assistance with any issue, so we may work on finishing the required deliverables.



Douglas County Local Natural Hazard Mitigation Plan Update – August 19, 2020 LPC Meeting Summary

Date/Time of Meeting:	Wednesday August 19, 2020 1:30PM-3:30PM
Location:	Virtual Meeting
Subject:	2nd Local Planning Committee Meeting
Project Name:	Douglas County Local Natural Hazard Mitigation Plan Update
In Attendance	Attendees: 21 Persons Core Planning Team: Tim Johnson, Lisa Goudy, Zak Humbles, Chrissie Angeletti Carrie Groce, Tim Hallmark
Summary Prepared by:	Chrissie Angeletti
Quorum – Yes or No	Yes

Welcome and Review Meeting Minutes

- Tim Johnson, Chairman of the LPC, welcomed the Committee members to the meeting and facilitated group introductions.
- Chrissie Angeletti, the Tetra Tech project manager, confirmed that a quorum was present and reviewed the meeting agenda. Mrs. Angeletti then asked the Steering Committee for a vote to approve the meeting minutes from the Steering Committee meeting conducted on July 22, 2020.
 - Hazards of Concern Exercise results presented. A note was made to replace Avalanche with Severe Winter Weather, Blizzard or Bomb Cyclone.
 - The minutes were approved.
- Distributed handouts included: Power Point presentation, Goal Setting Exercise, Objectives Definition and Examples, Capabilities Exercise

Mission Statement

- Attendees reviewed the 2015 Douglas County HMP Mission Statement, along with the 2018 Colorado Hazard Mitigation Plan.
- After reviewing the mission statements for both the 2015 Douglas County and 2018 State Plan, the LPC participated in a 15-minute activity to update the 2015 Douglas County HMP Mission Statement. This activity included considering any changes or enhancements to the 2015 Douglas County HMP Mission Statement for the 2020 Douglas County HMP Update.
- Attendees reviewed the previous definition, and approved the following updated definition:

The purpose of this plan update is to guide hazard mitigation planning, implement projects, and prioritize resources to better protect the people and property of the County from the effects of hazards. This plan demonstrates the community's commitment to reducing risks from hazards and serves as a tool to help decision makers direct mitigation activities and resources. This plan was also developed to ensure Douglas County and participating jurisdictions' continued eligibility for federal, state, and local disaster assistance including but not limited to the FEMA Hazard Mitigation Grant Program (HMGP), Pre-Disaster Mitigation Program (PDM), and the Flood Mitigation Assistance Program (FMA); and HUD Community Development Block Group-Mitigation (CDBG-MIT). Completion also earns credits for the National Flood Insurance Program's Community Rating System (CRS) which provides for lower flood insurance premiums in CRS communities.



Capability Exercise

- 10-minute activity to rank current capabilities relating to the County or municipal capabilities in general.
 - Link to exercise: <https://bit.ly/2YbLEI4>
- The activity relied on a Likert Scale, which gauged the LPC’s opinions on current capabilities. The scale allowed the LPC to choose from the following options: agree, somewhat agree, neutral, somewhat disagree, disagree.
- This exercise was helpful to inform goal and objective setting for the 2020 Douglas County HMP Update.
- This exercise was also helpful to inform the Mitigation Strategy and project development.
- Results from the capability exercise:

Capability Description	Ranking
Emergency management is provided by a unified authority or program.	1.61
County/ municipality staff members with emergency management functions are adequately trained.	1.67
County/ municipality staff are knowledgeable about hazards and their impacts and are willing to share that knowledge with the public.	1.72
Emergency response functions for the County/ municipality are clearly defined and are effective.	1.78
Strong collaboration and coordination exist between the County/ municipality, neighboring jurisdictions, the County and state and federal agency	1.78
Roles and responsibilities for emergency management within the County/ municipality clearly defined.	1.94
Appropriate and timely warning systems are in place.	1.94
There is a good understanding of the risk posed by hazards the planning area is susceptible to.	2.00
The capability to assess and mitigate risk from natural hazards is high.	2.17
The County/ municipality currently has adopted policies that encourage development to be located outside of high-risk areas.	2.17
Current land uses within identified hazard areas are appropriate for the risk posed by each hazard.	2.22
The County/ municipality currently has a variety of regulatory and non-regulatory strategies to reduce risk.	2.22
All relevant stakeholders are engaged in the County's/ municipality's risk management efforts.	2.22
Risk from natural hazards within the planning area is adequately mapped and regulated.	2.28
There is political support for risk management within the planning area.	2.28
As a citizen of the County/ municipality, I feel confident that I am prepared for the impacts from any natural hazard that may impact my property.	2.33
Coordinated public outreach regarding risk from all hazards convey clear, consistent messaging to the public.	2.39
Information on flood insurance is readily available within the planning area.	2.39
Areas that provide natural resource protection are identified and protected.	2.44
The planning area risk management programs are fair and equitable.	2.44
Existing flood control systems are effective and well maintained.	2.50
The County/ municipality development regulations for new development within identified hazards zones are adequate to address that risk.	2.56
There is a coordinated program to maintain drainage systems free of debris.	2.56
The enforcement of Codes and Standards within the planning area is strong.	2.56
There is strong public support for risk reduction within the planning area.	2.61
The funding to support risk reduction within the planning area is adequate.	2.94
The planning area is prepared for the probable impacts on natural hazards due to the impacts from a changing climate.	2.94
Members of the public know where to find information about hazards and risk.	3.00
Citizens have a good understanding of natural hazard exposure and risk.	3.39
Real Estate professionals adequately disclose risk exposure from natural hazards at the time of sale of real property.	3.39

Goal Setting

- Attendees participated in a 30-minute goal setting activity.
- The LPC reviewed the goals from the 2015 HMP and the 2018 Colorado State Plan, while seeing a side-by-side comparison of the two plans’ goals.
- Reviewed the guidelines for setting goals and defined the idea of goals more clearly. The LPC reviewed goals as:
 - General guidelines that explain what you want to achieve
 - Broad, long-term, policy-type statements and represent long term global vision
 - Define the benefits that the plan is trying to achieve



Douglas County Local Natural Hazard Mitigation Plan Update – August 19, 2020 LPC Meeting Summary

- The success of the plan, once implemented, should be measured by the degree to which its goals have been met
- Should be compatible with the needs and goals expressed in other available community planning documents and the 2018 Colorado State HMP.
- Looked at other examples of goals from other HMPs that align with mitigation activity types and supporting community lifelines.
- Attendees drafted and approved the following updated goals for the 2020 Update:
 - 1) *Reduce impacts, costs, and damages from hazard events to people, property, local government and private assets, economy, and natural and cultural resources.*
 - 2) *Increase public awareness of hazards and their mitigation.*
 - 3) *Strengthen communication and coordination among public entities, non-governmental organizations (NGOs), businesses and private citizens.*
 - 4) *Coordinate and integrate hazard mitigation activities with local land development planning activities and emergency operations planning to consider resiliency.*
 - 5) *Enhance predictive measure including the expansion and protection of warning systems and supporting technologies.*
 - 6) *Enhance the quality of assessments, analysis and planning through the development and collection of data.*
 - 7) *Review, update, adopt and enforce local, state and federal plans, codes and regulations to reduce the impacts of natural hazards.*
 - 8) *Support continuity of operations pre-, during, and post- hazard events including the support of community lifelines.*

Objectives Exercise

- The definition of an objective was discussed. Objectives were clearly defined as:
 - Short-term aims which, when combined, form a strategy or course of action to meet a goal.
 - Defining implementation steps to attain the identified goals.
 - Unlike goals, objectives are specific measurable.
- The LPC reviewed the objectives from the 2015 HMP and 2018 State Plan with a side-by-side comparison of the two plans' objectives.
- Link to the Objectives Exercise to be completed as homework prior to the next LPC meeting

Homework (before the next LPC meeting)

- Complete Objectives Exercise on Survey Monkey by 9/4/2020
 - <https://www.surveymonkey.com/r/8F7KJWD>

Planning Participants

- Phase 1 of the Jurisdictional Annex Process is due by August 31, 2020

Adjourn

- Meeting was adjourned at 3:30



Douglas County Natural Hazard Mitigation Plan Update

Local Planning Committee Meeting

Wednesday August 19, 2020

Meeting Agenda

Review Meeting Minutes

- July 22, LPC – Meeting Notes/Bulletin
- Hazards of Concern Exercise

Mission Statement

- Review 2015 Mission Statement
- Changes or Enhancements?

Capability exercise

- Ranking of current capabilities

Goal Setting

- Review the goals from the 2015 HMP & State Plan
- Changes or enhancements?
- Approve goals for 2020 Update (if quorum is present)

Objective's exercise

- What is an objective
- Review the objectives from the 2015 HMP and State Plan
- Objectives exercise

Hazards of Concern Exercise Results

Hazard	Ranking
Wildfire	4.68
Epidemic / Pandemic	4.52
Drought	4.28
Hail	4.28
Thunderstorm / Lightening	3.96
Flooding	3.64
Hazardous Materials Release	3.6
Severe Wind	3.36
Tornado	3.36
Extreme Heat	3.2
Erosion & Deposition	2.56
Landslide / Mud / Debris Flows / Rockfall / Rockslide	2.52
Dam Failure	2.44
Expansive Soils & Heaving Bedrock	2.28
Animal Disease Outbreak	2.2
Sinkholes / Subsidence / Abandoned Mine	1.96
Earthquake	1.84
Avalanche	1.56

Update Mission Statement – 15 Min

The purpose of this plan update is to guide hazard mitigation planning to better protect the people and property of the County from the effects of hazard events. This plan demonstrates the community's commitment to reducing risks from hazards and serves as a tool to help decision makers direct mitigation activities and resources. This plan was also developed, among other things, to ensure Douglas County and participating jurisdictions' continued eligibility for certain federal disaster assistance: specifically, the FEMA Hazard Mitigation Grant Program (HMGP), Pre-Disaster Mitigation Program (PDM), and the Flood Mitigation Assistance Program (FMA). Completion also earns credits for the National Flood Insurance Program's Community Rating System (CRS) which provides for lower flood insurance premiums in CRS communities. -

Section 1.1, 2015 Douglas County HMP Update

The State Plan is the demonstration of Colorado's commitment to reduce risks from hazards and serves as a guide for state decision makers as they commit resources to reducing the effects of hazards. - ***2018 Colorado Hazard Mitigation Plan***

Capability Ranking Exercise – 10 Minutes

Rank statements relating to County or municipal capabilities in general.

- Agree/Somewhat Agree/Neutral/Somewhat Disagree/Disagree
- Inform goal & objective setting
- Inform Mitigation Strategy and project development
- <https://bit.ly/2YbLEI4>

Goal Setting – 30 Min

CFR 201.6(c)(3)(i): “The hazard mitigation strategy shall include a description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.”

- ✓ **Goals are general guidelines that explain what you want to achieve.**
- ✓ **They are broad, long-term, policy-type statements and represent long term global visions.**
- ✓ **Goals define the benefits that the plan is trying to achieve.**
- ✓ **The success of the plan, once implemented, should be measured by the degree to which its goals have been met.**
- ✓ **Goals should be compatible with the needs and goals expressed in other available community planning documents and the 2018 Colorado State HMP.**

2018 Colorado State Plan Goals vs. 2015 Douglas County Goals

2018 Colorado State Plan HMP Goals

- a) Minimize the loss of life and personal injuries from all-hazard events.
- b) Reduce losses and damages to state, tribal, and local governments, as well as special districts and private assets, and support similar local effort.
- c) Reduce federal, state, tribal, local, and private costs of disaster response and recovery.
- d) Support mitigation initiatives and policies that promote disaster resiliency, nature-based solutions, cultural resources and historic preservation, and climate adaptation strategies.
- e) Minimize interruption of essential services and activities
- f) Incorporate equity considerations into all mitigation strategies.
- g) Support improved coordination of risk mitigation between and among the public, private, and non-profit sectors.
- h) Create awareness and demand for mitigation as a standard of practice.

2015 Douglas County HMP Goals

- 1) Reduce impacts and damages from hazard events to people, property, local government assets, economy and natural resources.
- 2) Increase public awareness of hazards and their mitigation.
- 3) Strengthen communication and coordination among public agencies, non-governmental organizations (NGOs), businesses and private citizens.
- 4) Coordinate and integrate hazard mitigation activities with local land development planning activities and emergency operations planning.
- 5) Reduce costs of disaster response and recovery.

Other examples of Goals: City of Sugar Land, TX HMP Goals

Goal 1: Warning — Enhance predictive measure including the expansion and protection of warning systems and supporting technologies.

Goal 2: Data Collection, Studies & Planning — Enhance the quality of assessments, analysis and planning through the development and collection of data.

Goal 3: Public Outreach — Develop and enhance communications and education capabilities to the public regarding hazards, including the steps that can be taken to mitigate their impact.

Goal 4: Mitigate Structures & Protect Lives — Implement protective measures to reduce the effect of natural, technological and human caused hazards including measures that enhance public safety and reduce the risk of damage to public and private property.

Goal 5: Protect Natural & Cultural Resources — Reduce adverse environmental, natural resource, cultural resource, and economic impacts from natural, technological, and human-caused hazard events.

Goal 6: Codes and Standards — Review update, adopt and enforce local, state and federal plans, codes and regulations to reduce the impacts of natural hazards.

Goal 7: Coordination — Enhance coordination between private sector, local, state, tribal, and federal agencies to improve mitigation capabilities and reduce the risk of natural, technological and human caused hazard events.

Goal 8: Continuity of Operations — Support continuity of operations pre-, during, and post- hazard events including the support of community lifelines.

Objective Setting - 30 Min

- ✓ Objectives are short-term aims which, when combined, form a strategy or course of action to meet a goal.
- ✓ Objectives define implementation steps to attain the identified goals.
- ✓ Unlike goals, objectives are specific and measurable.

Example: “Objective 1: Manage development in geologically hazardous areas and floodplains to protect life and property.”

Goals Met: Codes and standards, protect structures and lives, protect natural resources, and promote coordination between government, public & private sector.

2018 Colorado State Plan Goals vs. 2015 Douglas County Objectives

2018 Colorado State Plan HMP Objectives

- Promote activities that are climate neutral and supportive of appropriate renewable and alternative energy.
- Strengthen hazard risk communication tools and procedures.
- Strengthen continuity of operations to ensure the delivery of essential services.
- Strengthen cross-sector connections.
- Identify specific areas at risk to natural hazards and zones of vulnerability .
- Expand public awareness, education, and information programs relating to hazards and mitigation methods and techniques.
- Develop mitigation projects focused on preventing loss of life, injuries, and negative impacts to natural resources and reliant community sectors from natural, technological, and human-caused hazards.
- Reduce downtime and revenue losses, resulting from hazard events, for local governments and private nonprofit organizations.
- Through training, grants, and technical assistance, increase local government use of land use strategies that reduce risks to hazards.

2015 Douglas County HMP Objectives

- Maintain the flood mitigation programs to provide 100-year flood protection
- Protect critical facilities to the 500-year flood
- Educate citizens about wildfire defensible space actions
- Increase awareness about natural hazards.

2020 Douglas County HMP Objectives Exercise

<https://www.surveymonkey.com/r/8F7KJWD>

Local Planning Committee

- Complete Objectives Exercise -
<https://www.surveymonkey.com/r/8F7KJWD>

Planning Participants

- Phase 1 of the Jurisdictional Annex Process due by August 31, 2020

Questions ?





Local Natural Hazard
Mitigation Plan

Local Planning
Committee

UPDATE

Oct.
2020

CORE PLANNING TEAM

CHAIRPERSON

Tim Johnson

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PROJECT MANAGER

Chrissie Angeletti

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OUTREACH COORDINATOR

Lisa Goudy

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MEDIA RELATIONS

Wendy Holmes

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NEXT STEERING COMMITTEE MEETING

Oct. 28, 2020

1:30 - 3:30 p.m.

Virtual Meeting

<https://bit.ly/33namlm>

Are you and your family natural disaster-resilient?

*Douglas County seeks your input on the countywide Local Natural
Hazard Mitigation Plan.*

Your opinion is needed on the County's plan to create a safer, more disaster-resilient community.

During the next four months we will be reaching out, asking for your input on the County's update to the [FEMA-required Local Natural Hazard Mitigation Plan](#), starting now with a recently-posted, [quick public opinion poll](#), and ending with your input on the draft plan in January 2021.

Why is the plan important? "As just one example, the threat we saw from wildfires this year was mitigated by excellent planning and execution of that plan, ensuring that natural hazards didn't become natural disasters," said Abe Laydon Douglas County Commissioner. "The county's role in averting loss of life and property damage is successful because of the ongoing engagement of our exceptional citizens and community partners in proactive hazard mitigation planning."

That's why Douglas County and multiple local and regional government partners and stakeholders are engaged in the development of a [Local Natural Hazard Mitigation Plan update](#). This plan will help us reduce the County's vulnerability to these natural hazards – and thus reduce or eliminate long-term risk to people and property from hazards.

First steps first.... in fewer than 10 minutes your input will make a huge difference in community resiliency during a disaster. Please help us become better informed by participating [in a quick questionnaire](#) regarding your concerns and your level of preparedness.

According to the US Department of Homeland Security, hazard mitigation planning and the implementation of risk reduction activities can significantly reduce the physical, financial, and emotional losses caused by disasters.

For more information visit douglas.co.us and search Local Natural Hazard Mitigation Plan.



Sept. 16, 2020 Steering Committee Meeting Re-cap

On September 16, 2020, the Core Planning Team hosted the 3rd Local Planning Committee Meeting for the Douglas County All Hazards Mitigation Plan with 23 persons in attendance. The Committee established the following:

- Participated in Integrated Communications and Citizen Engagement Strategy Presentation. Reviewed outcome of the Capability Exercise.
- Reviewed proposed Plan Objectives and associated confirmed Goals. Objectives to be finalized by 9/23/2020.
- Presented with instructions and description of the SWOO Exercise. SWOO to be completed by 9/25/2020. Link to SWOO is available by visiting <https://bit.ly/3c1Kleg>.

Local Planning Committee

Action Item 1	Confirm objectives. Complete SWOO at https://bit.ly/3c1Kleg
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Planning Partners

Action Item 1	<p>Update Development Trends and Critical Facilities data by 10/9/2020</p> <p>Development Trends Survey - Base Map Reference at https://arcg.is/11jOPD and Survey Link at https://arcg.is/oOzoLWo</p> <p>Critical Facilities Survey - Survey Link with Base Map at https://arcg.is/bPqq9 and Larger Reference Base Map at https://arcg.is/o8PHLj</p>
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Action Item 2	Phase II of the Jurisdictional Annex Process due by November 18, 2020
	Please contact a member of the Core Planning Team for assistance with any issue, so we may work on finishing the required deliverables.



Date/Time of Meeting: Wednesday September 16, 2020
1:30PM-3:30PM

Location: Virtual Meeting

Subject: 3rd Local Planning Committee Meeting

Project Name: Douglas County Local Natural Hazard Mitigation Plan Update

In Attendance ***Attendees: 23 Persons***

Core Planning Team: Tim Johnson, Lisa Goudy, Tim Hallmark, Zak Humbles, Joel Hanson, Chrissie Angeletti

Summary Prepared by: Chrissie Angeletti

Quorum – Yes or No Yes

Welcome and Review Meeting Minutes

- Tim Johnson, Chairman of the LPC, welcomed the Committee members to the meeting and facilitated group introductions.
- Chrissie Angeletti, the Tetra Tech project manager, confirmed that a quorum was present and reviewed the meeting agenda. Mrs. Angeletti then asked the Steering Committee for a vote to approve the meeting minutes from the Steering Committee meeting conducted on August 19, 2020.
 - The minutes were approved.
- Reviewed Capability Ranking Results
- Distributed handouts included: Power Point presentation, Proposed Objectives, Integrated Communications and Citizen Engagement Strategy, and SWOO Exercise.

Integrated Communications and Citizen Engagement Strategy

- Introduction by Wendy Manitta Holmes, APR, Director, Communications Public Affairs at Douglas County, Colorado
- Participants attended a 20-minute presentation by Ms. Manitta Holmes, which discussed:
 - Multi-jurisdictional Communications Task Force
 - Social Media
 - Print Advertising
 - Digital Advertising
 - Visual Content Production (video and still photography)
 - Live Town Hall Production
 - Media Relations
 - Graphic Design & Logo Standards
 - Web page Content Management and Online Newsroom

Objective Setting

- Prior to discussing objective setting, the group was presented with the Confirmed Goals for the 2020 HMP Update. The Confirmed Goals are listed as follows:



Douglas County Local Natural Hazard Mitigation Plan Update – September 16, 2020 LPC Meeting Summary

- *DC1 Warning - Enhance predictive measure including the expansion and protection of warning systems and supporting technologies.*
- *DC2 Data Collection - Enhance the quality of assessments, analysis and planning through the development and collection of data.*
- *DC3 Outreach and Education - Increase public awareness of hazards and their mitigation.*
- *DC4 Mitigate Structures and Protect Lives - Reduce impacts, costs, and damages from hazard events to people, property, local government and private assets, economy, and natural and cultural resources.*
- *DC5 Planning - Coordinate and integrate hazard mitigation activities with local land development planning activities and emergency operations planning to consider resiliency.*
- *DC6 Codes & Standards - Review, update, adopt and enforce local, state and federal plans, codes and regulations to reduce the impacts of natural hazards.*
- *DC7 Entity Coordination - Strengthen communication and coordination among public entities, non-governmental organizations (NGOs), businesses and private citizens.*
- *DC8 Continuity of Operations - Support continuity of operations pre-, during, and post-hazard events including the support of community lifelines.*
- Attendees reviewed the definition of objectives, along with an example of an objective and how it related to a goal.
- Review ranked objectives selected from Objectives Survey.
- After reviewing ranked objectives, attendees discussed any changes or enhancements to the objectives.
- Proposed objectives for 2020 Update are as follows:
 - *Obj 1: Improve systems that provide warning and emergency communications. (DC-1)*
 - *Obj 2: Increase public awareness of risk. (DC-1, 2, 3, 7)*
 - *Obj 3: Research, develop, and promote adoption of cost-effective building and development laws, regulations, and ordinances. (DC-2, 4, 6)*
 - *Obj 4: Improve hazard information databases and maps and increase accessibility to those resources. (DC – 1, 2, 3, 7, 8)*
 - *Obj 5: Develop and provide updated information about threats, hazards, vulnerabilities, and mitigation strategies to state, regional, and local agencies, as well as private sector groups. (DC – 1, 2, 3, 4, 5, 8)*
 - *Obj 6: Manage development in geologically hazardous areas and floodplains to protect life and property. (DC – 6, 7)*
 - *Obj 7: Incorporate risk reduction considerations in new and updated infrastructure and development plans to reduce the impacts of natural hazards. (DC – 2, 4, 5, 6, 7)*
 - *Obj 8: 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. (DC – 1, 2, 3, 4, 5, 7, 8)*
 - *Obj 9: Improve understanding of the locations, potential impacts, and linkages among threats, hazards, vulnerability, and measures needed to protect life safety and health. (SL -2, 3, 4, 5, 7)*
 - *Obj 10: Consider risk reduction in long-term planning. (DC – 2, 4, 6, 7)*
 - *Obj 11: Minimize impacts of hazard events to key employers. (DC – 1, 2, 3, 4, 7, 8)*
 - *Obj 12: Develop and provide updated information about threats, hazards, vulnerabilities, and mitigation strategies to state, regional, and local agencies, as well as private sector groups. (DC - 1, 2, 3, 4, 5, 7, 8)*



- *Obj 13: Identify projects that simultaneously reduce risk while increasing operational area resilience and sustainability. (DC – 1, 2, 3, 4, 5, 6, 7, 8)*
- *Obj 14: Establish a partnership among all levels of government and the business community to improve and implement methods to protect property. (DC – 2, 3, 4, 5, 7, 8)*
- *Obj 15: Reduce risks that may impact critical business operations. (DC– 1, 2, 3, 4, 5, 7, 8)*
- *Obj 16: 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. (DC – 2, 3, 4, 5, 7, 8)*
- *Obj 17: 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. (DC– 1, 2, 3, 4, 5, 6, 7)*
- *Obj 18: Modify structures, as necessary, to meet life safety standards. (DC – 3, 4, 6, 7, 8)*
- *Obj 19: Encourage the incorporation of mitigation measures into repairs, major alterations, new development, and redevelopment practices, especially in areas subject to substantial hazard risk. (DC – 2, 3, 4, 5, 6, 7)*
- *Obj 20: Retrofit, purchase, or relocate structures in high hazard areas, especially those known to be repetitively damaged. (DC– 2, 3, 4, 5, 6, 7)*
- *Obj 21: Encourage hazard mitigation measures that promote and enhance natural processes and minimize adverse impacts on the ecosystem. (DC– 2, 3, 4, 5, 6, 7)*
- *Obj 22: Promote enforcement of relevant state regulations and local ordinances that significantly reduce life loss and injuries. (DC– 2, 3, 4, 5, 6, 7)*
- *Obj 23: Strengthen local building code enforcement. (DC– 2, 3, 4, 6, 7)*
- *Obj 24: Ensure continuity of operations of essential county government services. (DC – 2, 3, 4, 5, 7, 8)*
- *Obj 25: Protect rare, endangered, unusual, or educationally important natural resources. (DC – 2, 3, 5, 6, 7)*
- *Obj 26: Provide incentives for development and land use techniques that reduce risks. (DC- 2, 3, 4, 5, 6, 7)*

SWOO Exercise

- Attendees were presented with the SWOO Exercise and a description of how to complete it as their homework before the next LPC meeting. For each Hazard of Concern (10 Natural and 1 Non-Natural) Identify:
 - Strengths- What does the County of Plan Participant do well to mitigate the hazard? What can we capitalize on?
 - Weaknesses- What could we do better? What do we need to strengthen?
 - Objectives- Things that are preventative or need to be overcome (e.g. regulatory, geographical, environmental, financial)
 - Opportunities- Identify specific projects/ programs to mitigate the hazard
- Survey link: <https://bit.ly/3c1Kleg>

Homework (before the next LPC meeting)

- Confirm Objectives
- Complete SWOO - <https://bit.ly/3c1Kleg>



Planning Participants

- Update Development Trends and Critical Facilities data by 10/9/2020
- Phase II of the Jurisdictional Annex Process due by November 18, 2020

Adjourn

- Meeting was adjourned at 3:30 pm.



Douglas County Natural Hazard Mitigation Plan Update

Local Planning Committee Meeting

Wednesday September 16, 2020

Review Meeting Minutes

- August 19, LPC – Meeting Notes/Bulletin
- Capability Ranking Results

Integrated Communications & Citizen Engagement Strategy

- Introduction
- Presentation

Objective Setting

- Review ranked objectives selected from survey
- Changes or enhancements?
- Approve objectives for 2020 Update (if quorum is present)

SWOO exercise

- For each Hazard of Concern Identify'
 - Strengths, Weaknesses, Objectives, and Opportunities

Hazards of Concern Exercise Results

Capability Description	Ranking
Emergency management is provided by a unified authority or program.	1.61
County/ municipality staff members with emergency management functions are adequately trained.	1.67
County/ municipality staff are knowledgeable about hazards and their impacts and are willing to share that knowledge with the public.	1.72
Emergency response functions for the County/ municipality are clearly defined and are effective.	1.78
Strong collaboration and coordination exist between the County/ municipality, neighboring jurisdictions, the County and state and federal agency	1.78
Roles and responsibilities for emergency management within the County/ municipality clearly defined.	1.94
Appropriate and timely warning systems are in place.	1.94
There is a good understanding of the risk posed by hazards the planning area is susceptible to.	2.00
The capability to assess and mitigate risk from natural hazards is high.	2.17
The County/ municipality currently has adopted policies that encourage development to be located outside of high-risk areas.	2.17
Current land uses within identified hazard areas are appropriate for the risk posed by each hazard.	2.22
The County/ municipality currently has a variety of regulatory and non-regulatory strategies to reduce risk.	2.22
All relevant stakeholders are engaged in the County's/ municipality's risk management efforts.	2.22
Risk from natural hazards within the planning area is adequately mapped and regulated.	2.28
There is political support for risk management within the planning area.	2.28

Hazards of Concern Exercise Results

As a citizen of the County/ municipality, I feel confident that I am prepared for the impacts from any natural hazard that may impact my property.	2.33
Coordinated public outreach regarding risk from all hazards convey clear, consistent messaging to the public.	2.39
Information on flood insurance is readily available within the planning area.	2.39
Areas that provide natural resource protection are identified and protected.	2.44
The planning area risk management programs are fair and equitable.	2.44
Existing flood control systems are effective and well maintained.	2.50
The County/ municipality development regulations for new development within identified hazards zones are adequate to address that risk.	2.56
There is a coordinated program to maintain drainage systems free of debris.	2.56
The enforcement of Codes and Standards within the planning area is strong.	2.56
There is strong public support for risk reduction within the planning area.	2.61
The funding to support risk reduction within the planning area is adequate.	2.94
The planning area is prepared for the probable impacts on natural hazards due to the impacts from a changing climate.	2.94
Members of the public know where to find information about hazards and risk.	3.00
Citizens have a good understanding of natural hazard exposure and risk.	3.39
Real Estate professionals adequately disclose risk exposure from natural hazards at the time of sale of real property.	3.39

Integrated Communications & Citizen Engagement Strategy

Introduction –

Wendy Manitta Holmes, APR

Director, Communications Public Affairs at Douglas County, Colorado

Presentation – 20 Min

- Multi-Jurisdictional Communications Task Force
- Social Media
- Print Advertising
- Digital Advertising
- Visual Content Production (video and still photography)
- Live Town Hall Production
- Media Relations
- Graphic Design & Logo Standards
- Web page Content Management and Online Newsroom

Confirmed Goals

DC1 Warning - Enhance predictive measure including the expansion and protection of warning systems and supporting technologies.

DC2 Data Collection - Enhance the quality of assessments, analysis and planning through the development and collection of data.

DC3 Outreach and Education - Increase public awareness of hazards and their mitigation.

DC4 Mitigate Structures and Protect Lives - Reduce impacts, costs, and damages from hazard events to people, property, local government and private assets, economy, and natural and cultural resources.

DC5 Planning - Coordinate and integrate hazard mitigation activities with local land development planning activities and emergency operations planning to consider resiliency.

DC6 Codes & Standards - Review, update, adopt and enforce local, state and federal plans, codes and regulations to reduce the impacts of natural hazards.

DC7 Entity Coordination - Strengthen communication and coordination among public entities, non-governmental organizations (NGOs), businesses and private citizens.

DC8 Continuity of Operations - Support continuity of operations pre-, during, and post- hazard events including the support of community lifelines.

Objective Setting

- ✓ Objectives are short-term aims which, when combined, form a strategy or course of action to meet a goal.
- ✓ Objectives define implementation steps to attain the identified goals.
- ✓ Unlike goals, objectives are specific and measurable.

Example: “Objective 1: Manage development in geologically hazardous areas and floodplains to protect life and property.”

Goals Met: Codes and standards, protect structures and lives, protect natural resources, and promote coordination between government, public & private sector.

Objective Results

Obj 1: Improve systems that provide warning and emergency communications. (DC-1)

Obj 2: Increase public awareness of risk. (DC-1, 2, 3, 7)

Obj 3: Research, develop, and promote adoption of cost-effective building and development laws, regulations, and ordinances. (DC-2, 4, 6)

Obj 4: Improve hazard information databases and maps and increase accessibility to those resources. (DC – 1, 2, 3, 7, 8)

Obj 5: Develop and provide updated information about threats, hazards, vulnerabilities, and mitigation strategies to state, regional, and local agencies, as well as private sector groups. (DC – 1, 2, 3, 4, 5, 8)

Obj 6: Manage development in geologically hazardous areas and floodplains to protect life and property. (DC – 6, 7)

Obj 7: Incorporate risk reduction considerations in new and updated infrastructure and development plans to reduce the impacts of natural hazards. (DC – 2, 4, 5, 6, 7)

Obj 8: 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. (DC – 1, 2, 3, 4, 5, 7, 8)

Obj 9: Improve understanding of the locations, potential impacts, and linkages among threats, hazards, vulnerability, and measures needed to protect life safety and health. (SL -2, 3, 4, 5, 7)

Obj 10: Consider risk reduction in long-term planning. (DC – 2, 4, 6, 7)

Obj 11: Minimize impacts of hazard events to key employers. (DC – 1, 2, 3, 4, 7, 8)

Obj 12: Develop and provide updated information about threats, hazards, vulnerabilities, and mitigation strategies to state, regional, and local agencies, as well as private sector groups. (DC - 1, 2, 3, 4, 5, 7, 8)

Objective Results

- Obj 13:** Identify projects that simultaneously reduce risk while increasing operational area resilience and sustainability. (DC – 1, 2, 3, 4, 5, 6, 7, 8)
- Obj 14:** Establish a partnership among all levels of government and the business community to improve and implement methods to protect property. (DC – 2, 3, 4, 5, 7, 8)
- Obj 15:** Reduce risks that may impact critical business operations. (DC– 1, 2, 3, 4, 5, 7, 8)
- Obj 16:** 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. (DC – 2, 3, 4, 5, 7, 8)
- Obj 17:** 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. (DC– 1, 2, 3, 4, 5, 6, 7)
- Obj 18:** Modify structures, as necessary, to meet life safety standards. (DC – 3, 4, 6, 7, 8)
- Obj 19:** Encourage the incorporation of mitigation measures into repairs, major alterations, new development, and redevelopment practices, especially in areas subject to substantial hazard risk. (DC – 2, 3, 4, 5, 6, 7)
- Obj 20:** Retrofit, purchase, or relocate structures in high hazard areas, especially those known to be repetitively damaged. (DC– 2, 3, 4, 5, 6, 7)
- Obj 21:** Encourage hazard mitigation measures that promote and enhance natural processes and minimize adverse impacts on the ecosystem. (DC– 2, 3, 4, 5, 6, 7)
- Obj 22:** Promote enforcement of relevant state regulations and local ordinances that significantly reduce life loss and injuries. (DC– 2, 3, 4, 5, 6, 7)
- Obj 23:** Strengthen local building code enforcement. (DC– 2, 3, 4, 6, 7)
- Obj 24:** Ensure continuity of operations of essential county government services. (DC – 2, 3, 4, 5, 7, 8)
- Obj 25:** Protect rare, endangered, unusual, or educationally important natural resources. (DC – 2, 3, 5, 6, 7)
- Obj 26:** Provide incentives for development and land use techniques that reduce risks. (DC- 2, 3, 4, 5, 6, 7)

SWOO – 30 Minutes

For each Hazard of Concern (10 Natural & 1 Non-Natural) Identify:

Strength – What does the County of Plan Participant do well to mitigate the hazard

Weakness – What could we do better; what do we need to

Obstacle – Things that is preventative or needs to be overcome (e.g. regulatory, geographical, environmental, financial)

Opportunities – Identify specific projects/programs to mitigate the hazard

SURVEY LINK - <https://bit.ly/3c1Kleg>

Next Steps

Local Planning Committee

- Complete SWOO
 - <https://bit.ly/3c1Kleg>

Planning Participants

- Phase II of the Jurisdictional Annex Process due by November 18, 2020

Questions ?





 DOUGLAS COUNTY
COLORADO



Local Natural Hazard
Mitigation Plan

Local Planning
Committee

UPDATE

Nov.
2020

CORE PLANNING TEAM

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VICE-CHAIRPERSON

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OUTREACH COORDINATOR

Lisa Goudy

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MEDIA RELATIONS

Wendy Holmes

Wholmes@douglas.co.us

NEXT STEERING COMMITTEE MEETING

January 27, 2021

3 to 4 p.m.

Virtual Meeting

<https://bit.ly/2QPET4o>

You can help reduce your community's vulnerability to natural hazards

*Join a virtual 2021 Local Natural Hazard Mitigation Plan Risk
Assessment Presentation, Wednesday, Nov. 18 at 5:30 p.m.*

Do you wish to know how to better prepare your family for and understand the risks posed by natural hazards to our community?

Douglas County is currently working to update the FEMA-required Local Natural Hazard Mitigation Plan and welcomes your input at a virtual public presentation sharing the 2020 Risk Assessment on Wednesday, Nov. 18 at 5:30 p.m.

Join in to learn more about local hazards and the potential for human and economic losses identified by the Risk Assessment while sharing your input. You will also get a sneak peek of key findings from the recent Local Natural Hazard Mitigation Opinion Poll.

This presentation is just one opportunity for you to participate in the Local Natural Hazard Mitigation Plan update over the next few months. Your input along the way will make a huge difference in community resiliency during a disaster.

If you haven't already responded to the opinion poll, please help us become better informed by completing the quick questionnaire regarding your concerns and your level of preparedness.

Whether new to Douglas County or a long-time resident, you know that severe weather, wildfires or floods can have a significant impact on our families and our communities. Please join in as we create this plan that will help reduce the County's vulnerability to natural hazards – and thus reduce or eliminate long-term risk to people and property.

For more information visit [douglas.co.us](https://www.douglas.co.us) and search Local Natural Hazard Mitigation Plan.



Oct. 28, 2020 Steering Committee Meeting Re-cap

On October 28, 2020, the Core Planning Team hosted the 4th Local Planning Committee Meeting for the Douglas County All Hazards Mitigation Plan with 22 persons in attendance. The Committee established the following:

- Approved the Local Natural Hazard Mitigation Plan objectives for the 2021 Update.
- Reviewed the results of the online SWOO (Strengths, Weaknesses, Obstacles, and Opportunities) exercise.
- Reviewed the Risk Assessment methodology and results for each hazard effecting the Planning Area.
- Reviewed the Risk Ranking Methodology and current risk rankings for each hazard; and discussed the adjustment of Hazard Risk Ranking to reflect the potential impacts of certain hazards more accurately.
- Public Outreach includes Next Door Polling and Public Poll (closed Jan. 1, 2021) located at douglas.co.us/natural-hazard-mitigation-plan/local-natural-hazard-mitigation-plan-poll/
- Risk Assessment Public Presentation, November 18, 2020 at 5:30 p.m.

Planning Partners

Action Item 1	Complete Phase II of the Jurisdictional Annex, Due November 18, 2020.
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We understand this is a busy time of year and the first time many of you have been involved in a hazard mitigation planning process. We hope you are making progress on completing these deliverables and know that some of you may have questions. Please contact a member of the Core Planning Team for assistance with any issue, we can work with you to finish the required deliverables!



Date/Time of Meeting: Wednesday October 28, 2020
2:30PM-4PM

Location: Virtual Meeting

Subject: 4th Local Planning Committee Meeting

Project Name: Douglas County Local Natural Hazard Mitigation Plan Update

In Attendance **Attendees: 22 Persons**

Core Planning Team: Tim Johnson, Lisa Goudy, Tim Hallmark, Zak Humbles, Joel Hanson, Chrissie Angeletti

Summary Prepared by: Chrissie Angeletti

Quorum – Yes or No Yes

Welcome and Review Meeting Minutes

- Tim Johnson, Chairman of the LPC, welcomed the Committee members to the meeting and facilitated group introductions.
- Chrissie Angeletti, the Tetra Tech project manager, confirmed that a quorum was present and reviewed the meeting agenda. Mrs. Angeletti then asked the Steering Committee for a vote to approve the meeting minutes from the Steering Committee meeting conducted on September 16, 2020.
 - The minutes were approved.
- Distributed handouts included: Power Point presentation, Agenda, September 16, 2020 Meeting notes.

Objective Confirmation

The Objectives were reviewed and confirmed as the following:

- *Obj 1: Improve systems that provide warning and emergency communications. (DC-1)*
- *Obj 2: Increase public awareness of risk. (DC-1, 2, 3, 7)*
- *Obj 3: Research, develop, and promote adoption of cost-effective building and development laws, regulations, and ordinances. (DC-2, 4, 6)*
- *Obj 4: Improve hazard information databases and maps and increase accessibility to those resources. (DC – 1, 2, 3, 7, 8)*
- *Obj 5: Develop and provide updated information about threats, hazards, vulnerabilities, and mitigation strategies to state, regional, and local agencies, as well as private sector groups. (DC – 1, 2, 3, 4, 5, 7, 8)*
- *Obj 6: Manage development in geologically hazardous areas and floodplains to protect life and property. (DC – 6, 7)*
- *Obj 7: Incorporate risk reduction considerations in new and updated infrastructure and development plans to reduce the impacts of natural hazards. (DC – 2, 4, 5, 6, 7)*
- *Obj 8: 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. (DC – 1, 2, 3, 4, 5, 7, 8)*



Douglas County Local Natural Hazard Mitigation Plan Update – October 28, 2020 LPC Meeting Summary

- *Obj 9: Improve understanding of the locations, potential impacts, and linkages among threats, hazards, vulnerability, and measures needed to protect life safety and health. (SL -2, 3, 4, 5, 7)*
- *Obj 10: Consider risk reduction in long-term planning. (DC – 2, 4, 6, 7)*
- *Obj 11: Minimize impacts of hazard events to key employers. (DC – 1, 2, 3, 4, 7, 8)*
- *Obj 12: Identify projects that simultaneously reduce risk while increasing operational area resilience and sustainability. (DC – 1, 2, 3, 4, 5, 6, 7, 8)*
- *Obj 13: Establish a partnership among all levels of government and the business community to improve and implement methods to protect property. (DC – 2, 3, 4, 5, 7, 8)*
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- *Obj 25: Provide incentives for development and land use techniques that reduce risks. (DC- 2, 3, 4, 5, 6, 7)*

SWOO Review

- Review results of online survey and summary to date of the Strengths, Weaknesses, Objectives, and Opportunities (SWOO) exercise.
 - Major area for improvement across all hazards was education/outreach regarding risk and what individuals can do regarding mitigation.

Risk Assessment Update

- Presented Risk Assessment Methodology. Identified how each hazard was evaluated based on the type of information available.
 - HAZUS
 - Qualitative Analysis
- Review Preliminary Risk Assessment Results
 - Discussed correlation between occurrence of fire and subsequent occurrence of landslide



Risk Ranking Exercise

- Review Hazards of Concern Exercise Results from first LPC meeting and how they compared to the risk Assessment results
- Present Risk Ranking Methodology
- Present Current Risk Rankings
- Adjust Hazard Risk Ranking
 - E.g. Earthquake may not appropriately ranked due to implication that all structures would be impacted.

Public Outreach

- Present current outreach efforts and results to date
 - Next Door Polls
- Deadline for online public survey through HMP website - January 1, 2021
- Public Risk Assessment Presentation November 18th 2020.
 - <https://bit.ly/3mNoNpQ>

Next Steps

- Promote Public Risk Assessment Presentation November 18th 2020, at 5:30pm.
- Planning Participants Phase III
- Next/Final LPC Meeting January 27th 2021 – Review Draft Plan.

Adjourn

- Meeting was adjourned at 4pm.



Local Natural Hazard
Mitigation Plan

Local Planning
Committee

UPDATE

Jan.
2021

CORE PLANNING TEAM

CHAIRPERSON

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TMJohnso@dcsheriff.net

VICE-CHAIRPERSON

Tim Hallmark

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PROJECT MANAGER

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OUTREACH COORDINATOR

Lisa Goudy

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MEDIA RELATIONS

Wendy Holmes

Wholmes@douglas.co.us

Comment on 2021 Draft Plan Update

Public Meeting

February 10, 2021

5 p.m.

Virtual Meeting

Your feedback is needed on a countywide plan to create a natural disaster-resilient community

*Join a virtual 2021 Local Natural Hazard Mitigation Draft Plan
presentation, Wednesday, Feb. 10 at 5:30 p.m.*

Are you and your family prepared for the natural hazard risks that can occur in Douglas County?

Whether new to Douglas County or a long-time resident, you know that severe weather, wildfires, or floods can have a significant impact on our families and our communities.

Throughout the past year, Douglas County officials have been working with a local planning committee to update the FEMA-required Local Natural Hazard Mitigation Plan.

Please join your neighbors and friends on Wednesday, Feb. 10 at 5:30 p.m. and hear more about the plan to help reduce the County's vulnerability to natural hazards – and thus reduce or eliminate long-term risk to people and property.

The 2021 plan update includes input received from previous virtual meetings held during 2020, as well as results from a public opinion poll.

Click here to join the meeting or dial (audio only) 213-357-2812 and enter Conference ID: 836 568 866#.

Be among the first to receive news as it happens. Sign up here and select your specific news focus and delivery preferences.

For more information visit [douglas.co.us](https://www.douglas.co.us) and search Local Natural Hazard Mitigation Plan.



Jan 27, 2021 Steering Committee Meeting Re-cap

On Jan. 27, 2021, the Core Planning Team hosted the 5th and final Local Planning Committee Meeting for the Douglas County Local Natural Hazards Mitigation Plan with 25 persons in attendance. The Committee established the following

- Planning Participants attended a Phase III Jurisdictional Annex workshop and have submitted Draft Phase III. All Planning Participants will continue to develop the Phase III Jurisdictional annex with Core Planning Team support.
- Review of the 2021 Draft Plan Update - Updates and Additions to the 2021 Plan include updated critical facilities and addition of lifelines; additional/enhanced hazards of concern; Pandemic – COVID-19; Animal/Disease Infestation; Conducted and exposure analysis for all soil hazards; Wildfire Hazard updated with the 2017 Wildfire Layer; Drought Hazard updated with 2020 Drought Monitor data; Flood Hazard updated with 2020 FIRMS; and Updated Census estimates to account for growth/development.
- Review structure of Draft Plan Vol I, II, and Appendices.
- Inquired if National Flood Insurance Program – Community Rating System participating communities (Douglas County and Town of Parker) will meet multiple times a year to evaluate the plan to earn additional CRA credit?
- Discussed methodology to provide feedback on the 2021 Draft Plan through pdf, email, and an online survey.
- The period to receive public comments on the Draft Plan will open February 10, 2021 and close on February 26, 2021.
- A virtual public meeting to review the draft plan and provide public comment will be hosted on February 10 at 5:30 p.m.

Planning Partners

Action Item 1	Complete Phase III of the Jurisdictional Annex, Due January 29, 2021
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We understand this is a busy time of year and the first time many of you have been involved in a hazard mitigation planning process. We hope you are making progress on completing these deliverables and know that some of you may have questions. Please contact a member of the Core Planning Team for assistance with any issue, we can work with you to finish the required deliverables!



Date/Time of Meeting: Wednesday, January 27, 2021
3PM-4PM

Location: Virtual Meeting

Subject: 5th Local Planning Committee Meeting

Project Name: Douglas County Local Natural Hazard Mitigation Plan Update

In Attendance ***Attendees: 25 Persons***

Core Planning Team: Tim Johnson, Lisa Goudy, Tim Hallmark, Zak Humbles, Joel Hanson, Chrissie Angeletti

Summary Prepared by: Chrissie Angeletti

Quorum – Yes or No Yes

Welcome and Review Meeting Minutes

- Tim Johnson, Chairman of the LPC, welcomed the Committee members to the meeting and facilitated group introductions.
- Chrissie Angeletti, the Tetra Tech project manager, confirmed that a quorum was present and reviewed the meeting agenda.
- Distributed handouts included: Power Point presentation, and Agenda

Project Status

- PMT is currently finalizing Draft Plan
- Planning Participants attended the Phase III Workshop
 - All planning participants have submitted a draft Phase III Annex
 - PMT continued coordination to assist with completion of the Annex.

Review Draft Plan

- Updates and Additions
 - Updated critical facilities and addition of lifelines
 - Survey123 online mapping
 - Additional/enhanced hazards of concern
 - Pandemic
 - Animal/Disease Infestation
 - Exposure analysis for all soil hazards
 - Wildfire – 2017 Wildfire Layer
 - Updated Drought data – Drought Monitor
 - Updated all HAZUS models
 - 2020 FIRMS
 - Updated Census estimates to account for growth/development
 - Enhanced public and stakeholder outreach
 - Online polling
 - Nextdoor Poll
 - Risk assessment graphics and supplement appendix
- Review of Draft Plan Sections (Vol 1)
 - Section 1 – Introduction



Douglas County Local Natural Hazard Mitigation Plan Update – January 27, 2021 LPC Meeting Summary

- Section 2 – Plan Adoption
- Section 3– Planning Process
 - Stakeholder Outreach & Involvement
 - Public Outreach
- Section 4 – County Profile
- Section 5 – Risk Assessment
 - Methodology and Tools
 - Hazard Identification
 - Hazard Sections
 - Hazard Ranking
- Section 6 – Mitigation Strategy
 - Mission Statement
 - Goals and Objectives
 - Past Mitigation Action Status
 - Past Mitigation Accomplishments
 - Strengths and Weaknesses Exercise
 - 2021 Strategy
 - Warning
 - Data Collection/Studies/Planning
 - Public Outreach
 - Structural
 - Natural Resource Protection
 - Code Development, Update, Enforcement
 - Coordination
 - Continuity of Operations
- Section 7 - Plan Adoption, Implementation, Maintenance
 - Monitoring
 - Evaluating
 - Integrating
- Review of Draft Plan Sections (Vol II)
 - Section 8 – Planning Partnership
 - Section 9 – Jurisdiction Specific Annex
 - Location/Climate
 - History
 - Population/Development Trends
 - Status of previous actions
 - Capability Assessment
 - Integration into Planning
 - Jurisdiction specific hazard history/ranking
 - New Actions
- Review of Draft Plan Sections (Appendices)
 - Appendix A – Adoption Resolution
 - Appendix B – Meeting Documentation
 - Appendix C – Public and Stakeholder Outreach Documentation
 - Appendix E – Risk Assessment Supplement
 - Appendix E – Mitigation Strategy Supplement
 - Appendix F – Plan Review Tools

Plan Maintenance

- Determine if CRS communities would like to meet more than once a year to gain additional credit?



Consider Public and Stakeholder Comments

- How and When comments will be collected, reviewed, and incorporated

Public Outreach

- Publicize February 10th 2021 Public Presentation, 5:30 p.m.
 - <https://bit.ly/39EAXwa>
 - LPC does not need to attend
- Public Comment Period Ends February 26, 2021

Next Steps

- March Submit Draft Plan to State for review/comment
 - Address State comments
- Submit to FEMA for review/comment
- FEMA provides Approval Pending Adoption (APA)
 - Participating jurisdictions formally adopt Plan
 - Signed adoption documentation sent to FEMA
- FEMA issues Final Approval

Adjourn

- Meeting was adjourned at 4pm.



Douglas County Natural Hazard Mitigation Plan Update

Local Planning Committee Meeting

Wednesday January 27, 2021

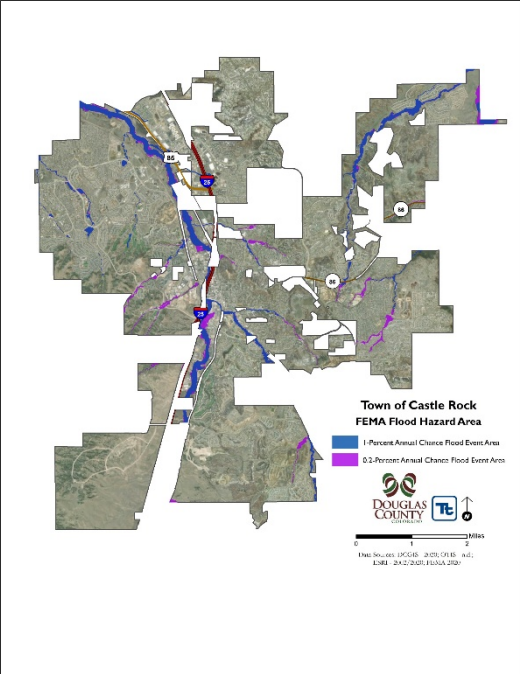
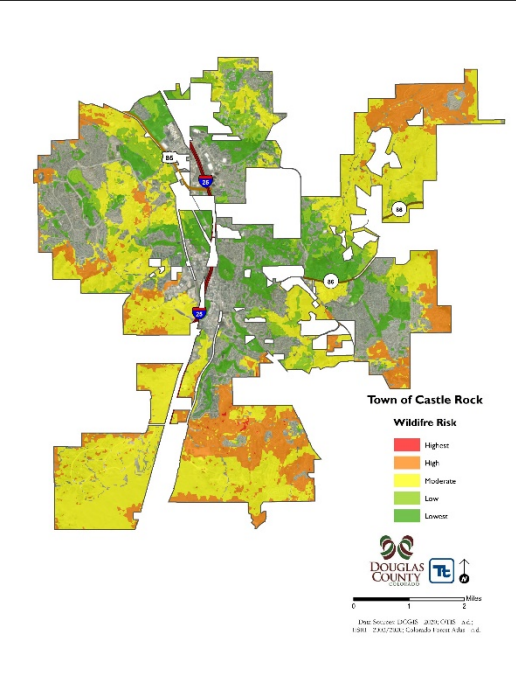
Today's Discussion

- Welcome and Opening Remarks
- Project Status
- Review Draft Plan
- Plan Maintenance
- Consider Public and Stakeholder Comments
- Next Steps
- General Discussion/Q&A
- Wrap-up

What is new in the 2021 HMP update?

- Updated critical facilities and addition of lifelines
 - Survey123 online mapping
- Additional/enhanced hazards of concern
 - Pandemic
 - Animal/Disease Infestation
 - Exposure analysis for all soil hazards
 - Wildfire – 2017 Wildfire Layer
 - Updated Drought data – Drought Monitor
 - Updated all HAZUS models
 - 2020 FIRMS
 - Updated Census estimates to account for growth/development
- Enhanced public and stakeholder outreach
 - Online polling
 - Nextdoor Poll
- Risk assessment graphics and supplement appendix

New Additions



CORE PLANNING TEAM

CHAIRPERSON
 Tim Johnson
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VICE-CHAIRPERSON
 Tim Hallmark
 THallmar@douglas.co.us

PROJECT MANAGER
 Chrissie Angeletti
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OUTREACH COORDINATOR
 Lisa Goudy
 Mgoudy@douglas.co.us

MEDIA RELATIONS
 Wendy Holmes
 WHolmes@douglas.co.us

NEXT STEERING COMMITTEE MEETING

Oct. 28, 2020
 1:30 - 3:30 p.m.
 Virtual Meeting
<https://bit.ly/33namlm>

Are you and your family natural disaster-resilient?

Douglas County seeks your input on the countywide Local Natural Hazard Mitigation Plan.

Your opinion is needed on the County's plan to create a safer, more disaster-resilient community.

During the next four months we will be reaching out, asking for your input on the County's update to the FEMA-required Local Natural Hazard Mitigation Plan, starting now with a recently-posted, quick public opinion poll, and ending with your input on the draft plan in January 2021.

Why is the plan important? "As just one example, the threat we saw from wildfires this year was mitigated by excellent planning and execution of that plan, ensuring that natural hazards didn't become natural disasters," said Abe Laydon Douglas County Commissioner. "The county's role in averting loss of life and property damage is successful because of the ongoing engagement of our exceptional citizens and community partners in proactive hazard mitigation planning."

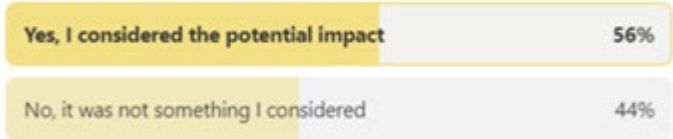
That's why Douglas County and multiple local and regional government partners and stakeholders are engaged in the development of a Local Natural Hazard Mitigation Plan update. This plan will help us reduce the County's vulnerability to these natural hazards – and thus reduce or eliminate long-term risk to people and property from hazards.

First steps first... in fewer than 10 minutes your input will make a huge difference in community resiliency during a disaster. Please help us become better informed by participating in a quick questionnaire regarding your concerns and your level of preparedness.

According to the US Department of Homeland Security, hazard mitigation planning and the implementation of risk reduction activities can significantly reduce the physical, financial, and emotional losses caused by disasters.

For more information visit douglas.co.us and search Local Natural Hazard Mitigation Plan.

Question: When you moved into your home, did you consider the impact that a natural or non-natural disaster could have on your home?



181 votes Closed

Draft Plan Review Section Contents

Volume I

- Section 1 – Introduction
- Section 2 – Plan Adoption
- Section 3– Planning Process
 - Stakeholder Outreach & Involvement
 - Public Outreach
- Section 4 – County Profile
- Section 5 – Risk Assessment
 - Methodology and Tools
 - Hazard Identification
 - Hazard Sections
 - Hazard Ranking

Hazards of Concern Assessed – Natural

2021 Hazard Mitigation Plan Hazards of Concern

NATURAL HAZARDS	NATURAL HAZARDS CONT'D
Dam Failure	Severe Weather – Lightning
Drought	Severe Weather – Hail
Earthquake (HAZUS)	Severe Weather – Thunderstorms and Wind
Extreme Temperatures – heat and cold	Tornadoes
Flood (HAZUS)	Wildfire
Geological – Erosion, Land Subsidence, & Sinkholes	NON-NATURAL HAZARDS
Geological – Expansive Soils	Animal Disease & Pest Outbreak
Geological – Slope Failure & Landslide	Pandemic/Epidemic
Severe Winter Storm	Hazardous Materials Spills – Transportation and Pipelines

- Planning, Legal, and Regulatory Capacity
- Administrative and Technical Capacity
- Fiscal Capacity
- Education and Outreach Capacity
- Community Classifications
 - NFIP - CRS
 - Building Codes
 - Firewise
- National Flood Insurance Program
 - Flood Management
- Adaptive Capacity
 - Future Hazard Conditions
- Plan Integration

Draft Plan Review – Section 6 Mitigation Strategy

- Mission Statement
- Goals and Objectives
- Past Mitigation Action Status
- Past Mitigation Accomplishments
- Strengths and Weaknesses Exercise
- 2021 Strategy
 - Warning
 - Data Collection/Studies/Planning
 - Public Outreach
 - Structural
 - Natural Resource Protection
 - Code Development, Update, Enforcement
 - Coordination
 - Continuity of Operations

MONITORING - The Core Planning Team

- Monitoring progress and evaluating the effectiveness of the plan, and documenting annual progress
- Collect information from entities involved in implementing mitigation projects.
 - Efforts to obtain outside funding
 - Obstacles or impediments to implementation of actions
- Grant Applications filed by planning participants
- Hazard events and losses occurring in their jurisdiction
- Additional mitigation actions believed to be appropriate and feasible
- Public and stakeholder input

EVALUATING

- The HMP will be evaluated on a ___?___ basis to determine the effectiveness of the programs, and to reflect changes that could affect mitigation priorities or available funding – Annual Report
- Appendix - Plan Review Tools, FEMA Guidance Evaluation Forms
- 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, such as technical, political, legal or coordination issues with other agencies are presents
 - Outcomes have occurred as expected
 - Changes in city resources impacted plan implementation (e.g., funding, personnel, and equipment)
 - New agencies/departments/staff should be included, including other local governments as defined under 44 CFR 201.6

Draft Plan Review – Section 7 Plan Adoption, Implementation, Maintenance

Table 7-2. Safe Growth Check List

Planning Mechanisms	Do you Do This?		Notes: How is it being done or how will this be utilized in the future?
	Yes	No	
Operating, Municipal and Capital Improvement Program Budgets			
<ul style="list-style-type: none"> When constructing upcoming budgets, hazard mitigation actions will be funded as budget allows. Construction projects will be evaluated to see if they meet the hazard mitigation goals. 			
<ul style="list-style-type: none"> Annually, during adoption process, the municipality will review mitigation actions when allocating funding. 			
<ul style="list-style-type: none"> Do budgets limit expenditures on projects that would encourage development in areas vulnerable to natural hazards? 			
<ul style="list-style-type: none"> Do infrastructure policies limit extension of existing facilities and services that would encourage development in areas vulnerable to natural hazards? 			
<ul style="list-style-type: none"> Do budgets provide funding for hazard mitigation projects identified in the City HMP? 			
Human Resource Manual			
<ul style="list-style-type: none"> Do any job descriptions specifically include identifying and/or implementing mitigation projects/actions or other efforts to reduce natural hazard risk? 			
Building and Zoning Ordinances			
<ul style="list-style-type: none"> Prior to, zoning changes, or development permitting, the municipality will review the hazard mitigation plan and other hazard analyses to ensure consistent and compatible land use. 			

INTEGRATING

Integrating Hazard Mitigation into existing capabilities

Volume II

- Section 8 – Planning Partnership
- Section 9 – Jurisdiction Specific Annex
 - Location/Climate
 - History
 - Population/Development Trends
 - Status of previous actions
 - Capability Assessment
 - Integration into Planning
 - Jurisdiction specific hazard history/ranking
 - New Actions

Draft Plan Review – Appendices

- Appendix A – Adoption Resolution
- Appendix B – Meeting Documentation
- Appendix C – Public and Stakeholder Outreach Documentation
- Appendix E – Risk Assessment Supplement
- Appendix E – Mitigation Strategy Supplement
- Appendix F – Plan Review Tools

County Website, Draft Posted February 10th – 90%

Ways to comment:

- Survey Link
- Email pdf with comments
- Email comment text

1. Name
2. Section
3. Page #
4. Comment

Comment #	Reviewer	Section Reviewed	Page #	Comment	Direction from Steering Committee
1	Maya Lardo (County Health Officer) – County Health Department	Disease Outbreak		The Essex County Department of Health would like us to add the following communicable diseases to the Disease Outbreak section of the plan: measles, TB, hepatitis A	Added to Disease Outbreak section as per Captain Esposito
2	Maya Lardo (County Health Officer) – County Health Department	County Annex		Problem: While the major hospitals that serve Essex County each have a Community Health Needs Assessment, the County does not have one that specifically looks at countywide using primary data sources. Solution: Essex County Health Department will lead the efforts to conduct a Community Health Needs Assessment for the County. They will use primary source health data through the municipal health departments, conduct a community health survey, and involve other county and community stakeholders. This assessment will determine the top three health issues in Essex County. After the assessment is complete, the Health Department will develop appropriate public outreach and education materials.	Added to County Annex
3	Maya Lardo (County Health Officer) – County Health Department	Capability Assessment		The Health Department services all of Essex County's 22 municipalities in the areas of solid waste enforcement. The Health Department is the CEHA agency overseeing Essex Regional Health Commission for noise, air, pesticide, and odor. The Health Department strives to be an impactful, visible and valuable environmental health education resource for all of Essex County.	Added to Capability Assessment
4	John D'Ascensio	Utility Interruption		Utility Interruptions, thankful you, you have identified the water supply issues and the need for Water Tenders. I would like to see add to that although we acquire tenders from other areas of the State, we are depleting those areas of the line protection.	Updated Utility Interruption section
5	John D'Ascensio	Public outreach		Why/how were the three languages selected for the multi-lingual outreach?	Email correspondence with reply to John sent on January 5, 2020. <i>We selected Spanish and Portuguese because, after English, they are the top two languages spoken in the County as identified by the American Community Survey.</i>
6	Hudson County Engineer (Tom Malavasi) – shared information during Hudson County Mitigation Strategy Workshop	County Annex		Tetra Tech emailed Sanjeev and and Captain Esposito on January 20, 2020 seeking review and approval of the following new mitigation action in the County annex (#22). Problem: There are four bridges that cross the Passaic River that are owned with Essex County: 1. Clay Street; 2. Jackson Street; 3. Harrison Ave.; 4. Keyland Ave. These bridges serve as evacuation routes and increased capacity is needed in addition to addressing issues with erosion/pilings.	TBD

2021 Local Natural Hazard Mitigation Plan
Public Comment Opportunity – February 10, 5:30 p.m.
<https://bit.ly/39EAXwa>

February 26th Public Comment Period Ends

- March – Draft Plan submitted to State for review/approval
 - Respond to State comments
- Submit to FEMA review/approval
 - Respond to FEMA comments
- Adopt plan upon FEMA Approval-Pending Adoption
 - Planning Participants to adopt by resolution
- Submit signed resolutions to FEMA for Final Approval



Questions ?

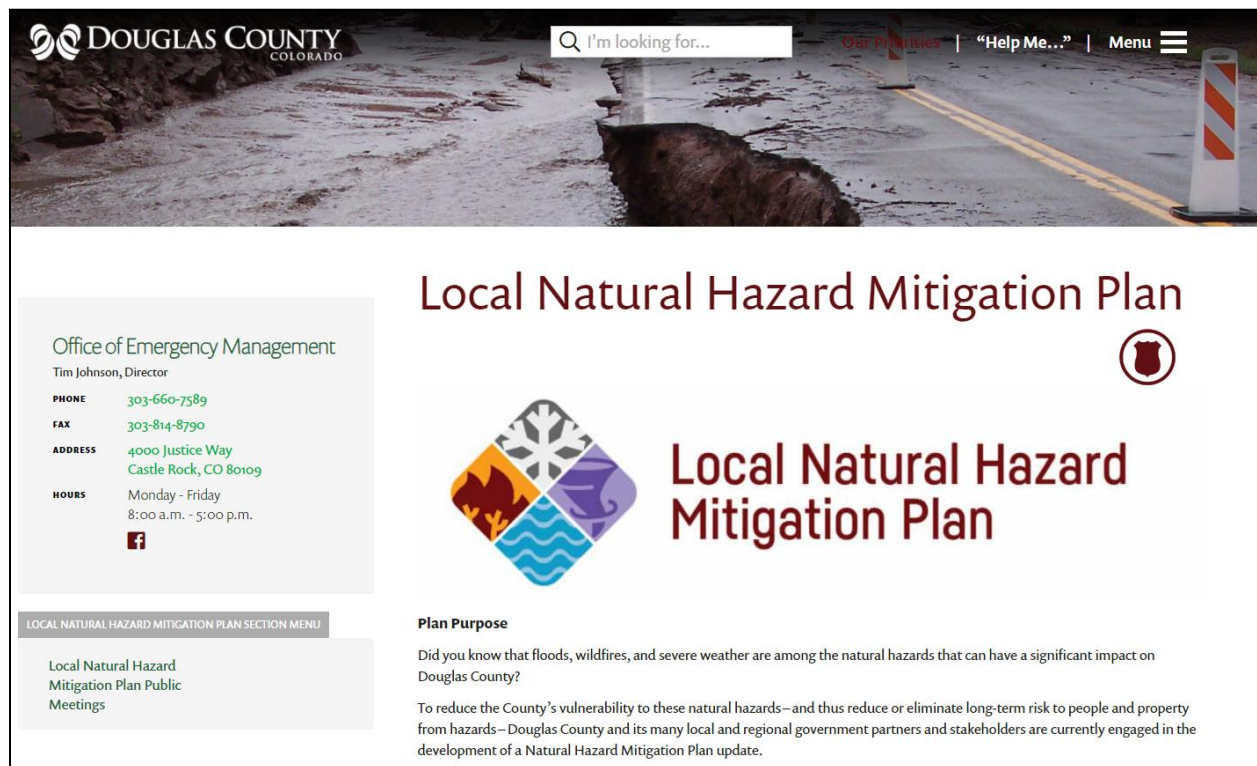
APPENDIX D. PUBLIC AND STAKEHOLDER OUTREACH

This appendix provides documentation of public and stakeholder outreach. Stakeholder involvement in this planning process was broad and productive as discussed and further documented in Section 3 (Planning Process). Public and stakeholder input has been incorporated throughout this HMP as appropriate, as identified in Section 3 and the References section, as well as within specific mitigation initiatives identified within the jurisdictional annexes (Section 9). Respondent feedback filtered by jurisdiction is included in each jurisdictional annex as available to provide an indication of community resident concerns related to natural hazards.

D.1 Website and Social Media Posts

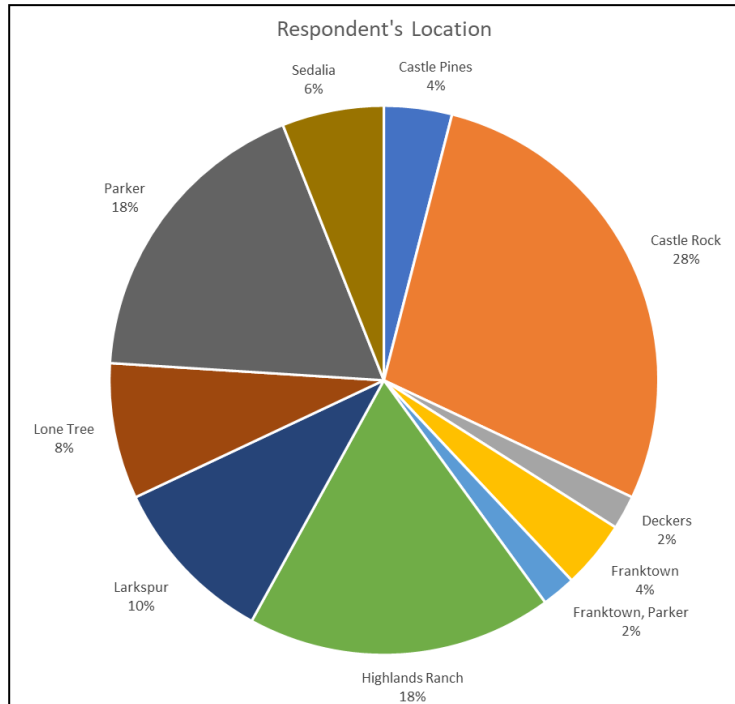
Douglas County uses Nextdoor, Facebook, Twitter, and LinkedIn for social media outreach. They maintained an HMP webpage (<https://www.douglas.co.us/natural-hazard-mitigation-plan/>) to provide updates to the planning process, notification of upcoming meetings, videos of meetings, and newsletters. The following provides screenshots of websites, news articles, and social media posts.

Figure D-1. Local Natural Hazard Mitigation Plan Webpage



D.2 Douglas County Citizen Survey Results

The County is present on several social media platforms: Nextdoor, Facebook, Twitter, LinkedIn, and YouTube. This helped the County maximize community outreach and engagement throughout the planning process. To gather input from residents, the County set up a series of polls and online surveys using Nextdoor and Microsoft Forms.



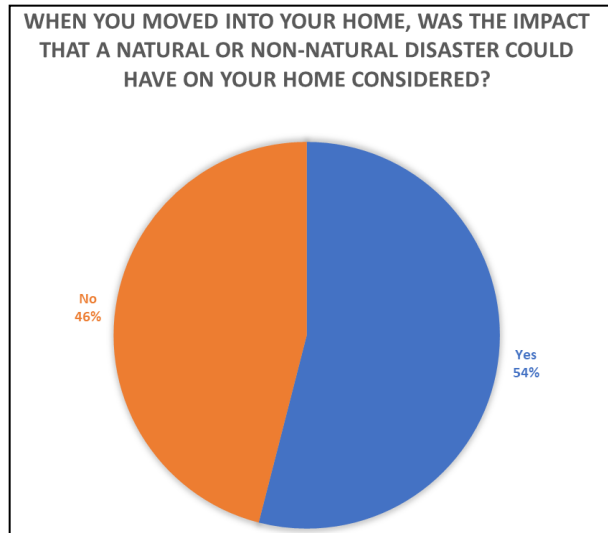
This section contains information and results gathered from a series of surveys completed by residents of Douglas County. The main objective of this survey was to gather information from citizens regarding their level of knowledge regarding hazard vulnerability and knowledge of hazard mitigation information for their local communities. Fifty respondents completed the survey over a period of three months during the planning process. The surveys were made available starting on October 19, 2020 and ran through the end of December 2020. A majority of the respondents who completed the survey live in Castle Rock (28%), followed by Highlands Ranch (18%) and Parker (18%). The following provides a summary of how respondents answered each question.

The first question asked respondents to indicate how concerned they are with the identified hazards of concern for Douglas County. Respondents were also asked to identify any other hazards they are concerned with. This list included chemical spills from train accidents, climate change, hail, tornadoes, wildfires, and the drying up of Bear Creek.

- For wildfire, 16% of all respondents indicated they are extremely concerned, while 28% stated they were concerned. Just 6% said that they are not concerned about wildfire, with respondents stating they live in Castle Rock and Highlands Ranch. Those that selected extremely concerned are from Castle Rock, Deckers, Larkspur, Parker and Sedalia.
- For drought, one-third of the respondents (32%) indicated that they are concerned about drought, where only 18% stated that they are extremely concerned. Those that selected extremely concerned are from Castle Rock, Larkspur, Sedalia, Lone Tree, and Parker. Just 2% stated they are not concerned with drought.
- For erosion and deposition, 36% of respondents stated they are somewhat or not concerned about this hazard. No one identified being very or extremely concerned. The respondents who selected somewhat or not concerned reside in Castle Pines, Castle Rock, Deckers, Franktown, Highlands Ranch, Larkspur, Lone Tree, Parker, and Sedalia.
- For flood, a majority of respondents (72%) stated that they are not concerned about flooding. Those who stated that they are somewhat concerned (20%) live in Castle Rock, Franktown, Highlands Ranch, and Parker.
- For landslides, a majority of respondents (64%) stated that they are not concerned about this hazard, while 8% said they are concerned and 28% said they are somewhat concerned. Those that showed some concern live in Castle Rock, Deckers, Highlands Ranch, Larkspur, Parker, and Sedalia.
- For severe winter weather, nearly all respondents stated that they are somewhat to very concerned for winter weather hazards. Just 4% said they are extremely concerned and 4% said they are not concerned.

- For thunderstorms and lightning, approximately half of the respondents said they are somewhat concerned or concerned; 22% said they are very or extremely concerned; and 10% said they are not concerned. Those that stated they are not concerned live in Parker, Highlands Ranch, and Sedalia.

Another question asked was whether or not residents considered the impact of natural and non-natural hazards when they purchased their homes. Over half of the respondents said yes, while the other respondents said no. The location of respondents was split over the two answers.



The next set of questions asked the public if they lived in specific hazard areas. For wildfire, 58% of respondents said they live in an area at risk for wildfire and 40% said they do not. Those that answered ‘yes’ live in Castle Rock, Deckers, Franktown, Highlands Ranch, Larkspur, Lone Tree, Parker, and Sedalia. Those that answered ‘no’ live in Castle Pines, Castle Rock, Highlands Ranch, Lone Tree, Parker, and Sedalia. Next, respondents were asked if they live in or near a FEMA-designated floodplain. Out of the 50 responses, only two said yes (Deckers and Parker). Thirty-three said they do not live in or near a floodplain, and 15 were unsure whether or not they live in a floodplain. When asked if they have flood insurance, only one person said yes, three were unsure, and 45 said no. The last hazard-related question asked whether or not their homes are located in a dam failure zone. None of the respondents said yes, 40 said no, and 10 were not sure. Those that answered unsure live in Sedalia, Parker, Highlands Ranch, Castle Pines, Deckers, and Castle Rock.

Respondents were asked if they know multiple ways to evacuate or get out of their neighbors in the event of a hazard. A majority (88%) said yes and 12% said no. Those that said no live in Franktown, Parker, Larkspur, and Castle Rock.

Flashlights
 Flood and Water
 Fire Extinguisher
 First Aid/CPR Training
 Designated Meeting Place
 Fire Escape Plan
 Medical Supplies
 Smoke Detectors
 Batteries

The last set of questions were related to preparedness. Nearly all respondents identified as least one way their household has prepared for natural and non-natural disasters. When asked how prepared respondents are in the event of a natural-caused hazard, 5 said adequately prepared, 6 are not prepared at all, 33 somewhat prepared, 1 very prepared, and 4 well prepared. Forms of emergency notification used by residents include email, text messages, CodeRed, radio, social media (Facebook, Twitter, Nextdoor), and television. Some respondents also said they receive

notifications from their local fire and police departments.

APPENDIX E. RISK ASSESSMENT SUPPLEMENT

This appendix contains supporting information for the Risk Assessment (Section 5) as available. It contains excerpts of the previous events and losses as presented in the 2015 HMP, organized by hazard of concern. This information has been compiled into one appendix for ease of reference; however, it has not been updated and is reproduced as documented in the 2015 plan.

In order to create a more streamlined plan, the 2021 HMP was reorganized and condensed into a practical and more readable document for the public with the goal of providing a plan easier to implement for the County and all jurisdictions to support future risk reduction. The information in this appendix supplements the information provided in Section 4.3 of this plan.

This Appendix also addresses differences in vulnerability noted between the 2015 and 2021 plans.

E.1 EXPOSURE AND LOSS ESTIMATE CHANGES

In Section 5.1, the Methodology used in the 2021 risk assessment is extensively described. The 2021 Plan Update includes updated data and new sources that result in differences in exposure and loss estimates. Since 2015, the County's population and building stock has increased. This appendix includes the vulnerability from the 2015 plan, which can be compared against the individual vulnerability assessments found in Section 5.4.

E.2 CRITICAL FACILITIES AND LIFELINES

The identification of community lifelines across Douglas County provides an enhancement to the 2021 HMP. The Local Planning Committee and participating jurisdictions created a new critical facility and lifeline list for the 2021 plan. Tetra Tech collected data provided by the County GIS division, compiled the information into a list, and distributed the list via Survey123 to participating jurisdictions.

FEMA defines a lifeline as: *“providing indispensable service that enables the continuous operation of critical business and government functions, and is critical to human health and safety, or economic security.”* Identifying community lifelines will help government officials and stakeholders to prioritize, sequence, and focus response efforts towards maintaining or restoring the most critical services and infrastructure within their respective jurisdiction(s). Identifying potential impacts to lifelines can help to inform the planning process and determining priorities in the event an emergency occur. The following page is FEMA's factsheet that describes lifelines.

E.3 HISTORY OF HAZARD EVENTS IN THE COUNTY

To supplement the information provided in this plan, events documented in the 2015 HMP are included below by hazard of concern. With many sources reviewed for the purpose of this HMP, loss and impact information for events could vary depending on the source. Therefore, the accuracy of monetary figures discussed is based only on the available information identified during research for this HMP.



National Response Framework Update (Fourth Edition)

A lifeline provides indispensable service that enables the continuous operation of critical business and government functions, and is critical to human health and safety, or economic security.

Why a lifelines construct?

Decision-makers must rapidly determine the scope, complexity, and interdependent impacts of a disaster. Applying the lifelines construct allows decision-makers to:

- Prioritize, sequence, and focus response efforts towards maintaining or restoring the most critical services and infrastructure
- Utilize a common lexicon to facilitate unity of purpose across all stakeholders
- Promote a response that facilitates unity of purpose and better communication amongst the whole community (Federal, state, tribal, territorial, and local governments, and private sector and non-governmental entities)
- Clarify which components of the disaster are complex (multifaceted) and/or complicated (difficult), requiring cross-sector coordination

How will lifelines be used?

- Enhance the ability to gain, maintain, and communicate situational awareness for the whole community in responding to disasters
- Analyze impacts to the various lifelines and develop priority focus areas for each operational period during response
- Identify and communicate complex interdependencies to identify major limiting factors hindering stabilization
- Update the National Response Framework to reflect use of lifelines in response planning

What are the opportunities of lifelines?

- Enable a true unity of effort between government, non-governmental organizations, and the private sector, including infrastructure owners and operators
- Integrate preparedness efforts, existing plans, and identify unmet needs to better anticipate response requirements
- Refine reporting sources and products to enhance situational awareness, best determine capability gaps, and demonstrate progress towards stabilization

Lifelines



Visit us at <http://www.fema.gov/national-planning-frameworks>

4.3 Vulnerability Assessment

Requirement §201.6(c)(2)(ii): [The risk assessment shall include a] description of the jurisdiction’s vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community.

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

Requirement §201.6(c)(2)(ii)(B): [The plan should describe vulnerability in terms of an] estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(i)(A) of this section and a description of the methodology used to prepare the estimate.

Requirement §201.6(c)(2)(ii)(C): [The plan should describe vulnerability in terms of] providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.

With Douglas County’s hazards identified and profiled, the HMPC conducted a vulnerability assessment to describe the impact that each priority hazard would have on the County. The vulnerability assessment quantifies, to the extent feasible using best available data, assets at risk to hazards and estimates potential losses. This section focuses on the risks to the County as a whole. Where available, data from the individual participating jurisdictions was evaluated and integrated here and in the jurisdictional annexes, and noted where the risk differs for a particular jurisdiction within the Planning Area.

This vulnerability assessment followed the methodology described in the FEMA publication *Understanding Your Risks—Identifying Hazards and Estimating Losses*. The vulnerability assessment first describes the total vulnerability and values at risk and then discusses vulnerability by hazard.

Data used to support this assessment included the following:

- County GIS data (hazards, base layers, and assessor’s data);
- Statewide GIS datasets compiled by the Colorado DHSEM to support mitigation planning;
- County CWPP GIS datasets;
- FEMA’s HAZUS-MH 2.1 GIS-based inventory data
- Written descriptions of inventory and risks provided by participating jurisdictions;
- Existing plans and studies; and
- Personal interviews with planning team members and staff from the County and participating jurisdictions.

4.3.1 Douglas County Vulnerability and Assets at Risk

As a starting point for analyzing the Planning Area's vulnerability to identified hazards, the HMPC used a variety of data to define a baseline against which all disaster impacts could be compared. This section describes significant assets at risk if a catastrophic disaster was to occur in the Planning Area. Data used in this baseline assessment included:

- Total values at risk;
- Critical facility inventory;
- Cultural, historical, and natural resources; and
- Growth and development trends.

Total Values at Risk

The following data from the Douglas County Assessor's Office is based on joins and relates of assessor data to the 2014 parcel layer in GIS. This data should only be used as a guideline to overall values in the County, as the information has some limitations. It is also important to note, in the event of a disaster, it is generally the value of the infrastructure or improvements to the land that is of concern or at risk. Generally, the land itself is not a loss.

Methodology

The 2014 Assessor inventory data was joined to the parcel layer by the parcel number to get a complete inventory of values by property type. By performing this process assessor data was associated with the parcel layer for further analysis. An analysis that was performed is shown in the following tables to show the number of structures, land value and total improved structure value for each parcel by occupancy type and by jurisdiction. The structure count was derived from a building footprint GIS layer. Each parcel record was attributed with its jurisdiction name (Castle Pines, Larkspur, Parker, etc.) based on whether its geographic center fell in or out of those jurisdictional boundaries. For the purposes of tabulating data, the unincorporated county was considered a jurisdiction and is listed in the table as such. A relationship table within the assessor database was used to categorize the property types or Account Types and was summarized into simpler groups for this analysis. One hundred forty six parcels did not have a parcel number or did not join between the parcel and assessor database join; these were put in the Vacant Land category. Nine hundred seventy-one of the parcel records did not have associated improved assessor values, and were therefore left at \$0 and treated as unimproved parcels.

Douglas County has a total land value of \$11,063,233,441. There are 126,767 parcels in the County with a total improved value of \$32,402,076,962. Castle Rock has the most structures and value of the County's jurisdictions; there are 24,519 structures with a total value of \$4.9 billion. Parker is close behind with 18,510 structures totaling \$4 billion of improved values. Table 4.42 shows the 2014 parcel values for the entire Douglas County Planning Area (i.e., the total values at risk) by jurisdiction. The values for unincorporated Douglas County are provided in Table 4.43 by

property type showing that residential structures dominate with a count of 81,561 and a total value including improvements and land values of \$26.9 billion.

Table 4.42. Douglas County Assessor's Inventory: By Jurisdiction

Jurisdiction	Total Parcel Count	Improved Parcel Count	Total Structure Count	Improved Value	Land Value	Total Value
Aurora*	637	152	536	\$46,384,067	\$25,761,714	\$72,145,781
Castle Pines	4,195	3,338	4,320	\$1,281,263,802	\$376,824,415	\$1,658,088,217
Castle Rock	24,619	17,656	24,519	\$4,897,702,996	\$1,269,202,509	\$6,166,905,505
Larkspur	151	74	204	\$13,662,695	\$9,603,287	\$23,265,982
Littleton*	42	4	111	\$3,583,664	\$12,347,389	\$15,931,053
Lone Tree	4,615	3,596	6,282	\$2,439,308,867	\$791,236,306	\$3,230,545,173
Parker	18,449	14,662	18,510	\$4,051,635,888	\$1,332,975,205	\$5,384,611,093
Unincorporated	74,059	58,160	81,561	\$19,668,534,983	\$7,245,282,616	\$26,913,817,599
Total	126,767	97,642	136,043	\$32,402,076,962	\$11,063,233,441	\$43,465,310,403

Source: 2014 Douglas County Assessor and Parcel
 *Aurora and Littleton are not participating in this plan.

Table 4.43. Douglas County Assessor's Inventory of Unincorporated County by Property Type

Property Type	Total Parcel Count	Improved Parcel Count	Total Structures Count	Improved Value	Land Value	Total Value
Agricultural	3,527	1,011	2,351	\$408,387,527	\$24,891,100	\$433,278,627
Commercial	835	700	9,855	\$2,120,214,546	\$711,957,157	\$2,832,171,703
Exempt	5,386	346	1,767	\$943,117,742	\$879,583,701	\$1,822,701,443
HOA	1,307	1	435	\$2,522,088	\$360,000	\$2,882,088
Industrial	140	137	261	\$164,583,796	\$57,464,699	\$222,048,495
Producing Mine	20	0	6	\$0	\$1,221,200	\$1,221,200
Residential	58,087	55,948	61,681	\$16,026,843,365	\$5,243,000,700	\$21,269,844,065
Utilities	148	0	71	\$0	\$197,376	\$197,376
Vacant Land	4,609	17	5,134	\$2,865,919	\$326,606,683	\$329,472,602
Total	74,059	58,160	81,561	\$19,668,534,983	\$7,245,282,616	\$26,913,817,599

Source: 2014 Douglas County Assessor and Parcel

Critical Facility Inventory

For the purposes of this plan, a critical facility is defined as:

Any facility, including without limitation, a structure, infrastructure, property, equipment or service, that if adversely affected during a hazard event may result in

severe consequences to public health and safety or interrupt essential services and operations for the community at any time before, during and after the hazard event.

A critical facility is classified by the following categories: (1) Essential Services Facilities; (2) High Potential Loss Facilities; and (3) At-Risk Populations Facilities:

- **Essential Services Facilities** include, without limitation, public safety, emergency response, emergency medical, designated emergency shelters, communications, public utility plant facilities and equipment, and government operations. Sub-Categories:
 - **Public Safety** – Police stations, fire and rescue stations, emergency operations centers
 - **Emergency Response** – Emergency vehicle and equipment storage and essential governmental work centers for continuity of government operations.
 - **Emergency Medical** – Hospitals, emergency care, urgent care, ambulance services.
 - **Designated Emergency Shelters.**
 - **Communications** – Main hubs for telephone, main broadcasting equipment for television systems, radio and other emergency warning systems.
 - **Public Utility Plant Facilities** – including equipment for treatment, generation, storage, pumping and distribution (hubs for water, wastewater, power and gas).
 - **Essential Government Operations** – Public records, courts, jails, building permitting and inspection services, government administration and management, maintenance and equipment centers, and public health.
 - **Transportation Lifeline Systems** – Airports, helipads, and critical highways, roads, bridges and other transportation infrastructure (Note: Critical highways, roads, etc. will be determined during any hazard-specific evacuation planning and are not identified in this plan).
- **High Potential Loss Facilities** include those facilities that would have a high loss or impact on the community:
 - **Dams**
 - **Hazardous Material Facilities** that include, without limitation, any facility that could, if adversely impacted, release hazardous material(s) in sufficient amounts during a hazard event that would create harm to people, the environment and property.
- **At Risk Population Facilities** include, without limitation, pre-schools, public and private primary and secondary schools, before and after school care centers with 12 or more students, daycare centers with 12 or more children, group homes, and assisted living residential or congregate care facilities with 12 or more residents

A fully detailed list of all critical facilities in the planning area can be found in Appendix E. A summary of critical facilities in the County can be found in Table 4.44.

Table 4.44. Douglas County Critical Facilities Summary Table

Category	Type	Facility Count
----------	------	----------------

Category	Type	Facility Count
At-Risk Population Facilities	Assisted Living	34
	Group Home	5
	School	99
Essential Services Facilities	Administration and Management	1
	Bridge	70
	Cell Tower	138
	Commercial Airports	3
	Courts	1
	EOC	3
	Fire Department	34
	Hospital	3
	IT Infrastructure	3
	Jail	1
	Maintenance/Equipment Center	9
	Microwave	232
	Police	6
	Public Health	2
	Radio Tower	8
Water Hub/Treatment	103	
High Potential Loss Facilities	Dam	3
	Hazardous Material	753
Total		1,511

Source: Douglas County GIS

Cultural, Historical, and Natural Resources

Assessing Douglas County's vulnerability to disaster also involves inventorying the natural, historical, and cultural assets of the area. This step is important for the following reasons:

- The community may decide that these types of resources warrant a greater degree of protection due to their unique and irreplaceable nature and contribution to the overall economy.
- In the event of a disaster, an accurate inventory of natural, historical and cultural resources allows for more prudent care in the disaster's immediate aftermath when the potential for additional impacts is higher.
- The rules for reconstruction, restoration, rehabilitation, and/or replacement are often different for these types of designated resources.
- Natural resources can have beneficial functions that reduce the impacts of natural hazards, for example, wetlands and riparian habitat which help absorb and attenuate floodwaters and thus support overall mitigation objectives.

Cultural and Historical Resources

Douglas County has a large stock of historically significant homes, public buildings, and landmarks. To inventory these resources, the HMPC collected information from the following sources.

- The **National Register of Historic Places** is the nation’s official list of cultural resources worthy of preservation. The National Register is part of a national program to coordinate and support public and private efforts to identify, evaluate, and protect historic and archeological resources. Properties listed include districts, sites, buildings, structures, and objects that are significant in American history, architecture, archeology, engineering, and culture. The National Register is administered by the National Park Service, which is part of the U.S. Department of the Interior.
- **The Colorado State Register** contains listings for buildings, structures, sites, objects, or districts designated through the Colorado State Register nomination process. The State Register includes the following:
 - National Register Multiple Resource Areas
 - National Register Thematic Resources
 - State Historical Landmarks
 - Certified Local Districts
 - World Heritage Sites

Historical resources included in the programs above are identified in Table 4.45.

Table 4.45. Douglas County Historical Resources in the State and Federal Register

Name (Landmark Plaque Number)	National Register	Date Listed	State Landmark	State Designation	City
Castle Rock Depot	Y	10/11/1974	Y	5DA.216	Castle Rock
Castle Rock Elementary School	Y	9/20/1984	Y	5DA.342	Castle Rock
First National Bank of Douglas County	Y	4/14/1995	Y	5DA.661	Castle Rock
Benjamin Hammer House	Y	2/3/1993	Y	5DA.645	Castle Rock
Keystone Hotel	Y	6/20/1997	Y	5DA.681	Castle Rock
Castlewood Dam	Y	9/13/1995	Y	5DA.567	Franktown
Cherry Creek Bridge	Y	10/15/2002	Y	5DA1519	Franktown
Evans Homestead Rural Historic Landscape	Y	4/25/2012	Y	5DA.2841	Franktown
Franktown Cave	Y	2/1/2006	Y	5DA.272	Franktown
Pike’s Peak Grange No. 163	Y	10/1/1990	Y	5DA.341	Franktown
Rock Ridge Ranch Barn	Y	11/9/1994	Y	5DA.1010	Franktown
American Federation of Human Rights Headquarters	Y	3/19/1998	Y	5DA.1097	Larkspur
Ben Quick Ranch & Fort	Y	10/1/1974	Y	5DA.215	Larkspur

Name (Landmark Plaque Number)	National Register	Date Listed	State Landmark	State Designation	City
Glen Grove School	Y	11/5/1974	Y	5DA.214	Larkspur
John Kinner House	Y	10/11/1974	Y	5DA.213	Larkspur
Lone Tree School	Y	3/8/1995	Y	5DA.344	Larkspur
Reginald Sinclair House	Y	9/20/1991	Y	5DA.966	Larkspur
Spring Valley School / The School House	Y	12/18/1978	Y	5DA.219	Larkspur
Lamb Spring	Y	11/9/1994	Y	5DA.83	Littleton
Louviers Village	Y	7/2/1999	Y	5DA.1391	Louviers
Louviers Village Club	Y	9/22/1995	Y	5DA.1016	Louviers
Ruth Memorial Methodist Episcopal Church	Y	5/1/1989	Y	5DA.890	Parker
Tallman-Newlin House	Y	12/10/1997	Y	5DA.1090	Parker
Bear Cañon Agricultural District	Y	10/29/1975	Y	5DA.212	Sedalia
Cherokee Ranch	Y	10/21/1994	Y	5DA.708	Sedalia
Church of St. Philip-in-the-Field / Bear Cañon Cemetery	Y	4/11/1973	Y	5DA.217	Sedalia
Daniels Park	Y	6/30/1995	Y	5DA.1009	Sedalia
Devils Head Lookout	Y	4/22/2003	Y	5DA.960	Sedalia
Indian Park School	Y	2/8/1978	Y	5A.211	Sedalia
Santa Fe Railway Water Tank / Sedalia Water Tank	Y	4/18/2003	Y	5DA.1385	Sedalia
Roxborough State Archaeological District	Y	1/27/1983	Y	5DA.343	Waterton

Source: Colorado Office of Historical Preservation

It should be noted that these lists may not be complete, as they may not include those currently in the nomination process and not yet listed. Additionally, as defined by the National Environmental Policy Act (NEPA), any property over 50 years of age is considered a historic resource and is potentially eligible for the National Register. Thus, in the event that the property is to be altered, or has been altered, as the result of a major federal action, the property must be evaluated under the guidelines set forth by CEQA and NEPA. Structural mitigation projects are considered alterations for the purpose of this regulation.

Douglas County also maintains a Registry of Landmarks designated by the Board of County Commissioners. The landmarks included in the County's registry are listed below in Table 4.46. Three additional sites are slated to be designated between April and June 2015.

Table 4.46. Historical Resources in the Douglas County Registry of Landmarks

Name (Landmark Plaque Number)	Date Listed	City
Abbe Ranch House	2/3/2004	Larkspur
American Federation of Human Rights	5/6/2008	Larkspur

Name (Landmark Plaque Number)	Date Listed	City
Blackfoot Cave	4/14/2015	Cherry Valley
Cedar Hill Cemetery	12/21/2004	Castle Rock
Devil's Head Lookout	2/28/2006	Sedalia
Fletcher Ranch	3/18/2003	Sedalia
Franktown Cemetery	12/27/2005	Franktown
Freedom School	3/24/2015	Larkspur
Friendly-Manhart House	11/7/2000	Sedalia
Frink House	1/6/2009	Larkspur
Gideon Pratt Homestead and Harry C. Pratt Grave	12/12/2000	Franktown
Greenland Townsite	9/13/2011	South of Larkspur, west of I-25
Hilltop School	3/18/2003	Parker
Horace Persse Homestead	9/30/2008	Roxborough
Kleinert Homestead	2/24/2014	Franktown
Kreutzer Homestead	4/11/2000	Sedalia
Lorraine Ranch	4/14/2015	Spring Valley
Louviers Village Clubhouse	4/15/2008	Louviers
Lowell's OV Ranch	3/30/2010	South of Castle Rock
Lucas Dairy/Shady Spring Ranch	6/30/2009	Cherry Valley
Manhart House	11/18/2014	Sedalia
Pikes Peak Grange #163	5/22/2012	Franktown
Prairie Canyon Ranch	10/3/2000	South of Franktown along Highway 83
Pretty Woman Ranch	4/4/2006	Sedalia
Rock Ridge Cemetery	6/29/1999	Cherry Valley
Rock Ridge Ranch	12/12/2000	Cherry Valley
Russellville Ranch	2/3/2004	Franktown
Schweiger Ranch	3/16/2004	Lone Tree
Sedalia Fire Station	3/13/1999	Sedalia
Sedalia School House	11/7/2000	Sedalia
Sedalia Water Tank	2/3/2004	Sedalia
Silicated Brick Company	6/19/2007	Southdowns at Roxborough
Spring Valley School District No. 3	3/17/2009	Spring Valley
Twin Creek Ranch	2/9/1999	Castle Rock
YMCA Camp Shady Brook	1/6/2009	Deckers

Source: Douglas County Landmarks Program

Natural Resources

Natural resources are important to include in benefit/cost analyses for future projects and may be used to leverage additional funding for mitigation projects that also contribute to community goals for protecting sensitive natural resources. Awareness of natural assets can lead to opportunities

for meeting multiple objectives. For instance, protecting wetlands areas protects sensitive habitat as well as reducing the force of and storing floodwaters.

Due to Douglas County's unique topography, climate, and location on the Colorado Piedmont, the flora and fauna are representative of both the High Plains and the southern Rocky Mountains. This diverse mixture of geography, geology, and biology, or ecotones, contributes to Douglas County's unique ecological character. Transition zones like these tend to support higher levels of biological diversity than other "non-transitional" areas.

No vertebrates and few invertebrates at the species level are endemic solely to Douglas County; however, there are some species endemic to the Colorado Piedmont that are found in the County, such as Preble's meadow jumping mouse. In some ways, the vegetation of the County is typical of the foothills/prairie ecotone on Colorado's Front Range. Grasslands of the northern County are on well drained sandy soils and receive less moisture than those to the south near the Palmer Divide. The resulting composition of grasslands generally follows this north/south hydrological gradient, with typical shortgrass prairie species such as blue grama (*Bouteloua gracilis*) dominating in the north, and midgrass species such as western wheatgrass (*Agropyron smithii*), needle-and-thread grass (*Stipa comata*), and little bluestem (*Schizachyrium scoparium*) becoming more common to the south. Tallgrass species such as big bluestem (*Andropogon gerardii*) are not uncommon in the uplands.

Gambel oak (*Quercus gambelii*) shrublands are a dominant feature of the Douglas County flora, creating a mosaic of shrubs and grassland that covers the rolling hills of most of the central regions of the County. These shrublands also occur in areas of mixed woodland with ponderosa pine. Riparian areas consist of dense shrubs, especially hawthorn and coyote willow, with some stands of small cottonwoods. Wetlands comprise a small but important portion of the County and are comprised mainly of graminoid types at springs or seeps, or shrub-dominated riparian areas. Coniferous forests of ponderosa pine dominate the mountainous western portions of the County and extend eastward on the higher mesas and along the Palmer Divide. Cooler microhabitats on north-aspect slopes contain mostly Douglas-fir forests with patches of aspen.

Special Status Species

To further understand natural resources that may be particularly vulnerable to a hazard event, as well as those that need consideration when implementing mitigation activities, it is important to identify at-risk species (i.e., endangered species) in the Planning Area. The U.S. Fish and Wildlife Service (USFWS) maintains a list of threatened and endangered species in Colorado. State and federal laws protect the habitat of these species through the environmental review process. Several additional species are of special concern or candidates to make the protected list.

Table 4.47 summarizes Douglas County's special status animal species in the USFWS database.

Table 4.47. Threatened and Endangered Animals in Douglas County

Name	Scientific Name	Status
Whooping crane	<i>Grus americana</i>	Experimental Population, Non-Essential
Bald eagle	<i>Haliaeetus leucocephalus</i>	Recovery
American peregrine falcon	<i>Falco peregrinus anatum</i>	Recovery
Mexican spotted owl	<i>Strix occidentalis lucida</i>	Threatened
Piping Plover	<i>Charadrius melodus</i>	Threatened
Least tern	<i>Sterna antillarum</i>	Endangered
Greenback Cutthroat trout	<i>Oncorhynchus clarki stomias</i>	Threatened
Pawnee montane skipper	<i>Hesperia leonardus montana</i>	Threatened
Black-footed ferret	<i>Mustela nigripes</i>	Experimental Population, Non-Essential
Preble's meadow jumping mouse	<i>Zapus hudsonius preblei</i>	Threatened

Source: U.S. Fish and Wildlife Service

Table 4.48. Threatened and Endangered Plants in Douglas County

Name	Scientific Name	Status
Colorado Butterfly plant	<i>Gaura neomexicana var. coloradensis</i>	Threatened
Ute ladies'-tresses	<i>Spiranthes diluvialis</i>	Threatened

Source: U.S. Fish and Wildlife Service

Natural and Beneficial Functions

Floodplains can have natural and beneficial functions. Wetlands function as natural sponges that trap and slowly release surface water, rain, snowmelt, groundwater and flood waters. Trees, root mats, and other wetland vegetation also slow the speed of floodwaters and distribute them more slowly over the floodplain. This combined water storage and braking action lowers flood heights and reduces erosion. Wetlands within and downstream of urban areas are particularly valuable, counteracting the greatly increased rate and volume of surface-water runoff from pavement and buildings. The holding capacity of wetlands helps control floods and prevents water logging of crops. Preserving and restoring wetlands, together with other water retention, can often provide the level of flood control otherwise provided by expensive dredge operations and levees.

Figure 4.39 in Section 4.2.13 illustrates the locations of floodplains. These areas, as well as areas of riparian habitat along the rivers and streams in the County may accommodate floodwaters for purposes of groundwater recharge and stormwater management.

Growth and Development Trends

As part of the planning process, the HMPC looked at changes in growth and development, both past and future, and examined these changes in the context of hazard-prone areas, and how the

changes in growth and development affect loss estimates and vulnerability.

More specific information on growth and development for each participating jurisdiction can be found in the jurisdictional annexes.

Current Status and Past Development

The U.S. Census Bureau estimated the population of Douglas County for January 1, 2010 was 287,465, representing an almost thirty-fold increase from just over 8,400 people in 1970. Douglas County’s 2014 Demographic Summary states that “between 2000 and 2010, the population of Douglas County increased 62.4%, which made Douglas County the fastest growing county in Colorado, and the 16th fastest growing county in the nation” (<http://www.douglas.co.us/documents/douglas-county-demographics-summary.pdf>). Table 4.49 illustrates the pace of population growth in Douglas County (for both incorporated and unincorporated areas) dating back to 1940. Table 4.50 shows more recent population trends for each jurisdiction.

Table 4.49. Historical Population of Douglas County

	1930	1940	1950	1960	1970	1980	1990	2000	2010
Population	3,498	3,496	3,507	4,816	8,407	25,153	60,391	175,776	285,465
Change	-	-0.1%	0.3%	37.3%	74.6%	199.2%	140.1%	191.0%	62.4%

Source: U.S. Census Bureau

Table 4.50. Population Growth for Jurisdictions in Douglas County from 1990-2010

	1990	2000	2010	Growth 1990-2000	Growth 2000-2010
Castle Pines*	-	-	10,360	-	-
Castle Rock	8,708	20,224	48,231	132.2%	138.5%
Larkspur	232	234	183	0.1%	-21.8%
Lone Tree**	-	4,873	10,218	-	109.7%
Parker	5,450	53,558	45,297	332.3%	92.3%

Source: U.S. Census Bureau

*Castle Pines did not become a city until 2008.

**Lone Tree was not incorporated until 1996.

Future Population Growth

The 2035 Douglas County Comprehensive Master Plan estimated future population growth for the County. Between 2014 and 2040, the County’s population will increase by over 196,000 people as a result of both natural growth through childbirths and in-migration from other parts of the state and nation. Future population projections for Douglas County are shown in Table 4.51.

Table 4.51. Douglas County Population Projections

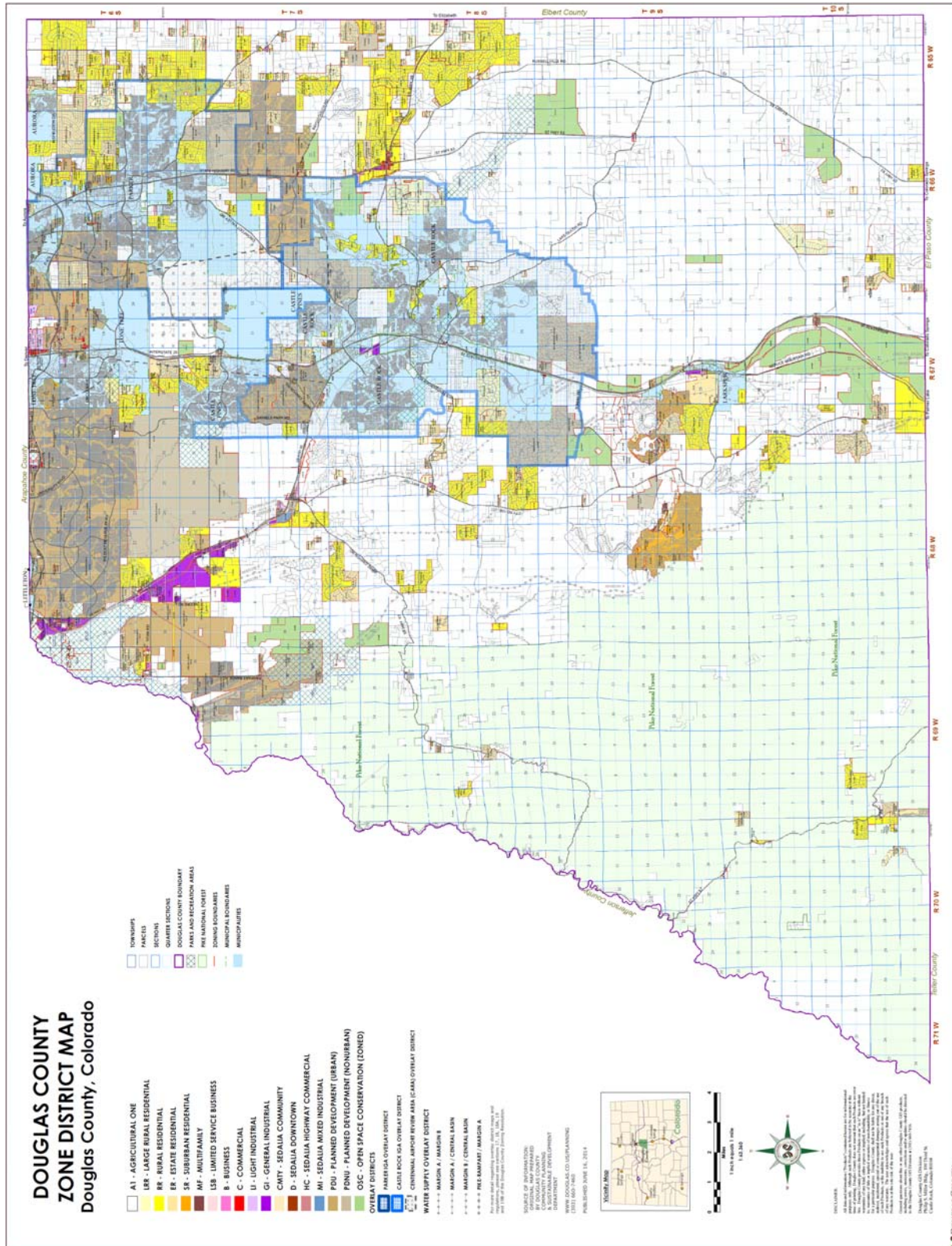
Projections	2010	2020	2030	2040
Douglas County	285,465	352,000	418,000	484,000

Source: 2035 Douglas County Comprehensive Master Plan

Current Land Use/Zoning

Land use and growth management strategies in Douglas County aim to concentrate future development into and toward existing communities through various policies relating to zoning and minimum development standards and requirements. Zoning designations prescribe allowed land uses and minimum lot sizes for the purpose of supporting efficient infrastructure design, conservation of natural resources, and to avoid conflicting uses. The Zoning Resolution (discussed further in Section 4.4.1) governs the use of land for residential and non-residential purposes, limits the height and bulk of buildings and other structures, limits lot occupancy and determines the setbacks and provides for open spaces, by establishing standards of performance and design. Figure 4.47 shows current land use designations in Douglas County.

Figure 4.47. Douglas County Zoning Map



Source: Douglas County Department of Community Development

Future Growth Areas

New Growth Areas

A major new growth area is the planned Sterling Ranch development in the Chatfield Urban Area. Sterling Ranch comprises 3,400 acres south of Chatfield Reservoir and Chatfield State Park, west of Highway 85. The Sterling Ranch website describes the community as follows:

“This mixed-use, master planned community of authentic Colorado architecture and treasured natural surroundings will be vitalized by mindful, sustainable resources and forward-thinking technologies. All brought together in a shared experience – the quality of nature and the quality of a promising new day come together as one. Sterling Ranch, Colorado will soon be home to over 12,000 new residences, spaciouly sweeping across nine unique villages all radiating outward from an amenity-rich town center and grand civic gathering place. Pedestrian friendly planning and design focused on connectivity offers 30 miles of trails, beautiful open space, 2 state parks and 3 regional parks.”¹¹

Development since 2010 Plan

Douglas County has been one of the fastest growing counties by rate of growth in the nation for roughly the last 20 years. Development in Douglas County is encouraged to occur in existing designated urban areas. This is well-illustrated in Table 4.53, which shows that most permits for new housing in 2013 were issued for urban rather than non-urban units. The number of housing permits issued receded sharply in 2008 and 2009 during the collapse of the U.S. housing bubble (Table 4.54). Housing development in the County began to climb in 2010 and continued to experience positive growth through 2014.

Table 4.52. Annual Housing Growth Rates

Year	Total Housing Units	Annual Growth Rate (%)
2007	102,737	
2008	104,864	2.1%
2009	106,071	1.2%
2010	107,200	1.1%
2011	108,185	0.9%
2012	109,884	1.6%
2013	112,354	2.2%
2014	114,379	1.8%

Source: Douglas County Growth and Development Profile 2013 and 2014 Summary

¹¹ “The Nature of Sterling Ranch, Colorado.” <http://sterlingranchcolorado.com/>, accessed February 17, 2015

Table 4.53. 2013 Permits for Housing Units

Unit Type	Amount*	% of Total
Single-family residential	1,833	68%
Condos and townhouses	233	9%
Apartments	613	23%
Unincorporated	1,291	48%
Incorporated	1,388	52%
Urban	2,585	96%
Non-Urban	94	4%

Source: Douglas County Growth and Development Profile 2013

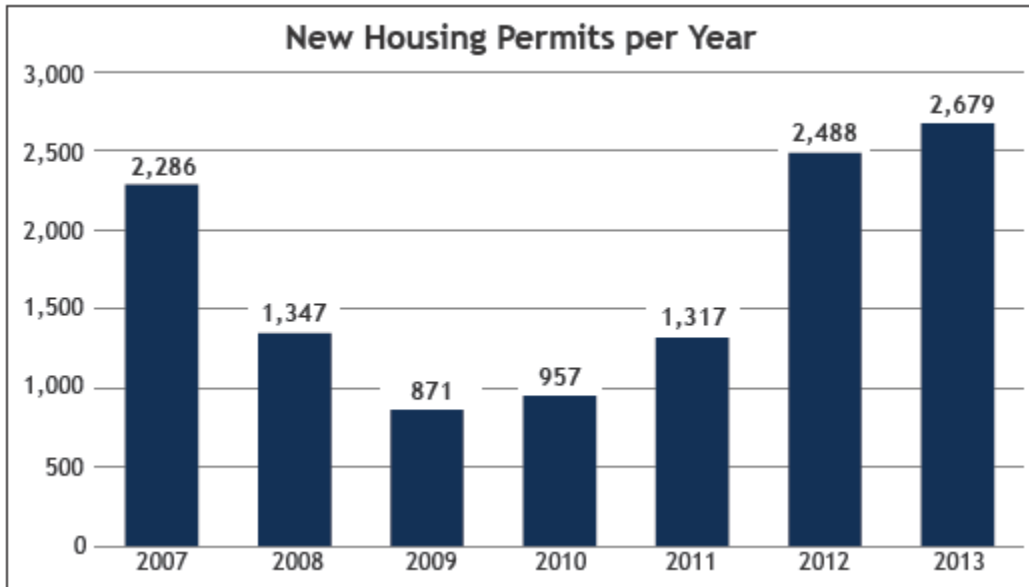
*2,679 total new permits for housing units in 2013

Table 4.54. New Housing Permits

Year	Permits	% Change
2007	2,286	
2008	1,347	-41.1%
2009	871	-35.3%
2010	957	9.9%
2011	1,317	37.6%
2012	2,488	88.9%
2013	2,679	7.7%
2014	3,357	25.3%

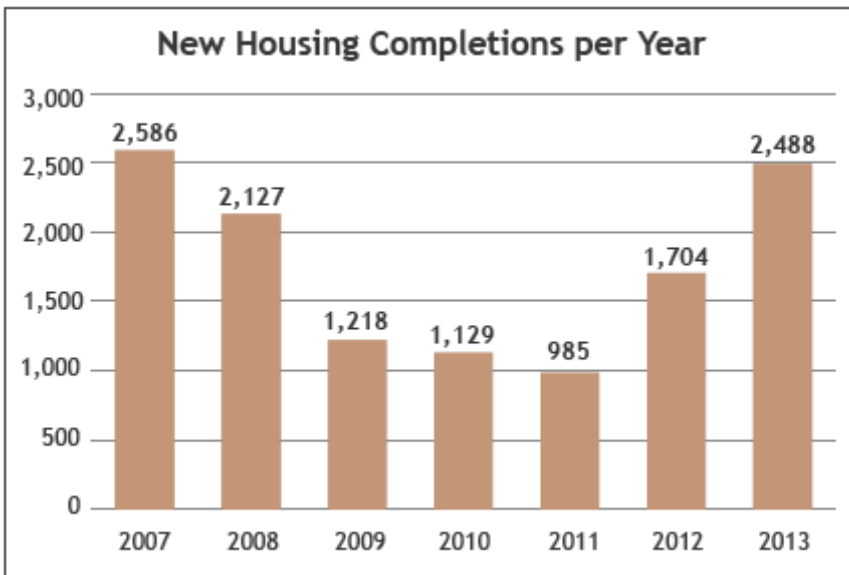
Source: Douglas County Growth and Development Profile 2013 and 2014 Summary

Figure 4.48. Douglas County New Housing Permits per Year



Source: Douglas County Growth and Development Profile 2013

Figure 4.49. Douglas County New Housing Completions per Year



Source: Douglas County Growth and Development Profile 2013

Table 4.55 and Table 4.56 summarize the number and value of structures built in Douglas County from 2010 to 2014 based on a query of the ‘year built’ values in the parcel database. Over 6,000 structures, with a total value greater than \$2.1 billion, were built in that short period of time. The vast majority of these structures were residential, built to accommodate the County’s rapidly

growing population. The jurisdictional annexes examine the property type analysis for each participating community. Additional countywide analysis on recent development in mapped hazard areas is discussed in the vulnerability assessments for flood (Section 4.3.6), landslide (Section 4.3.7), erosion (Section 4.3.10), and wildfire (Section 4.3.11).

Table 4.55. Douglas County Structures Built from 2010 to 2014: Total Assets by Jurisdiction

Jurisdiction	Total Parcel Count	Improved Parcel Count	Total Structure Count	Improved Value	Land Value	Total Value
Aurora*	10	10	10	\$3,009,235	\$720,000	\$3,729,235
Castle Pines	194	193	205	\$74,621,727	\$20,129,244	\$94,750,971
Castle Rock	960	959	1,109	\$260,594,463	\$58,858,521	\$319,452,984
Larkspur	8	7	10	\$922,215	\$336,000	\$1,258,215
Lone Tree	216	216	280	\$119,009,158	\$47,412,203	\$166,421,361
Parker	791	791	864	\$182,211,133	\$56,753,690	\$238,964,823
Unincorporated	3,148	3,147	3,692	\$1,008,625,520	\$303,066,747	\$1,311,692,267
Total	5,327	5,323	6,170	\$1,648,993,451	\$487,276,405	\$2,136,269,856

Source: Douglas County

*The City of Aurora is not participating in this plan

Table 4.56. Douglas County Structures Built from 2010 to 2014: Total Assets by Property Type

Jurisdiction	Total Parcel Count	Improved Parcel Count	Total Structure Count	Improved Value	Land Value	Total Value
Agricultural	66	66	65	\$24,311,429	\$648,699	\$24,960,128
Commercial	29	29	319	\$81,005,028	\$23,792,546	\$104,797,574
Exempt	19	19	33	\$27,699,059	\$13,066,887	\$40,765,946
HOA	1	0	1	\$0	\$0	\$0
Industrial	10	10	40	\$6,664,955	\$3,957,784	\$10,622,739
Residential	3,021	3,021	3,232	\$868,197,359	\$261,163,481	\$1,129,360,840
Vacant Land	2	2	2	\$747,690	\$437,350	\$1,185,040
Total	3,148	3,147	3,692	\$1,008,625,520	\$303,066,747	\$1,311,692,267

Source: Douglas County

The completion of the Rueter-Hess reservoir has had a significant impact on development in Douglas County. The construction of the reservoir lasted from 2004 to 2012, and Parker Water and Sanitation District began gradually filling it in 2012. Rueter-Hess is primarily supplied by surface water from Cherry Creek, Newlin Gulch, and return flows from nearby water districts.¹²

¹² Town of Castle Rock, Colorado website. "Rueter-Hess Reservoir." <http://www.crgov.com/index.aspx?NID=1277>.

The reservoir is primarily used for drinking water storage to supply current and future development in Parker, Castle Rock, Castle Pines, and other local jurisdictions. Recreational uses for the reservoir are under consideration.

4.3.2 Douglas County Vulnerability to Specific Hazards

The Disaster Mitigation Act regulations require that the HMPC evaluate the risks associated with each of the medium and high significance hazards identified in the planning process. This section summarizes the possible impacts and quantifies, where data permits, the County's vulnerability to each of the hazards identified as a priority hazard in Section 4.2.20 Hazards Summary. Where specific hazards vary across the County, additional information can be found in the jurisdictional annexes. The hazards evaluated further as part of this vulnerability assessment include:

- Drought
- Earthquake
- Flood: Dam Failure
- Flood: 100/500 year and Localized Stormwater
- Landslides/ Mud & Debris Flows /Rockfalls
- Severe Weather: Thunderstorms/Heavy Rains
- Severe Weather: Winter Weather
- Soil Hazards: Erosion and Deposition
- Wildfire
- Hazardous Materials: Transportation Incidents

The hazards that were not evaluated include: avalanche, extreme heat, hail, high winds, lightning, tornado, expansive soils, and subsidence. These hazards were all ranked low significance due to a lack of notable past events and damages or low probabilities of occurrence. Earthquake was profiled, despite being ranked low significance, due to the occurrence of damaging and/or widespread earthquakes in the Denver Metro area in the past and the potential, while less likely, for damaging events.

An estimate of the vulnerability of the County to each identified hazard, in addition to the estimate of risk of future occurrence, is provided in the hazard-specific sections that follow. Vulnerability is measured in general, qualitative terms and is a summary of the potential impact based on past occurrences, spatial extent, and damage and casualty potential. It is categorized into the following classifications:

- **Low**—Minimal potential impact. The occurrence and potential cost of damage to life and property is minimal.

accessed February 17, 2015.

-
- **Medium**—Moderate potential impact. This ranking carries a moderate threat level to the general population and/or built environment. Here the potential damage is more isolated and less costly than a more widespread disaster.
 - **High**—Widespread potential impact. This ranking carries a high threat to the general population and/or built environment. The potential for damage is widespread. Hazards in this category may have occurred in the past.

Vulnerability can be quantified in those instances where there is a known, identified hazard area, such as a mapped floodplain. In these instances, the numbers and types of buildings subject to the identified hazard can be counted and their values tabulated. Other information can be collected in regard to the hazard area, such as the location of critical community facilities (e.g., a fire station), historic structures, and valued natural resources (e.g., an identified wetland or endangered species habitat). Together, this information conveys the impact, or vulnerability, of that area to that hazard.

The HMPC identified five hazards in the Planning Area for which specific geographical hazard areas have been defined and for which sufficient data exists to support a quantifiable vulnerability analysis. These five hazards are: earthquake; flood; hazardous materials: transport incidents; landslide/mud and debris flow/rockfalls; and wildfire. Because these hazards have discrete hazard risk areas, their risk varies by jurisdiction. For flood, landslide, and wildfire, the HMPC inventoried the following for each community, to the extent possible, to quantify vulnerability in identified hazard areas:

- General hazard-related impacts, including impacts to life, safety, and health
- Insurance coverage, claims paid, and repetitive losses (if available)
- Values at risk (i.e., types, numbers, and value of land and improvements)
- Identification of critical facilities at risk
- Identification of cultural and natural resources at risk
- Development trends within the identified hazard area

The HMPC used FEMA's loss estimation software, HAZUS-MH, to analyze the County's vulnerability to earthquakes.

The vulnerability and potential impacts from priority hazards that do not have specific mapped areas nor the data to support additional vulnerability analysis are discussed in more general terms. These include:

- Drought
- Flood: Localized/Stormwater
- Severe Weather: Heavy Rain and Storms
- Severe Weather: Winter Weather

Dam failure does have specific mapped areas; however, the information is deemed too sensitive to

be discussed in this public document. Inundation mapping is included in the Emergency Action Plans (EAPs) of each high hazard dam in the County and kept on file with the dam owners.

4.3.3 Drought Vulnerability Assessment

Likelihood of Future Occurrence—Medium

Potential Magnitude—Medium

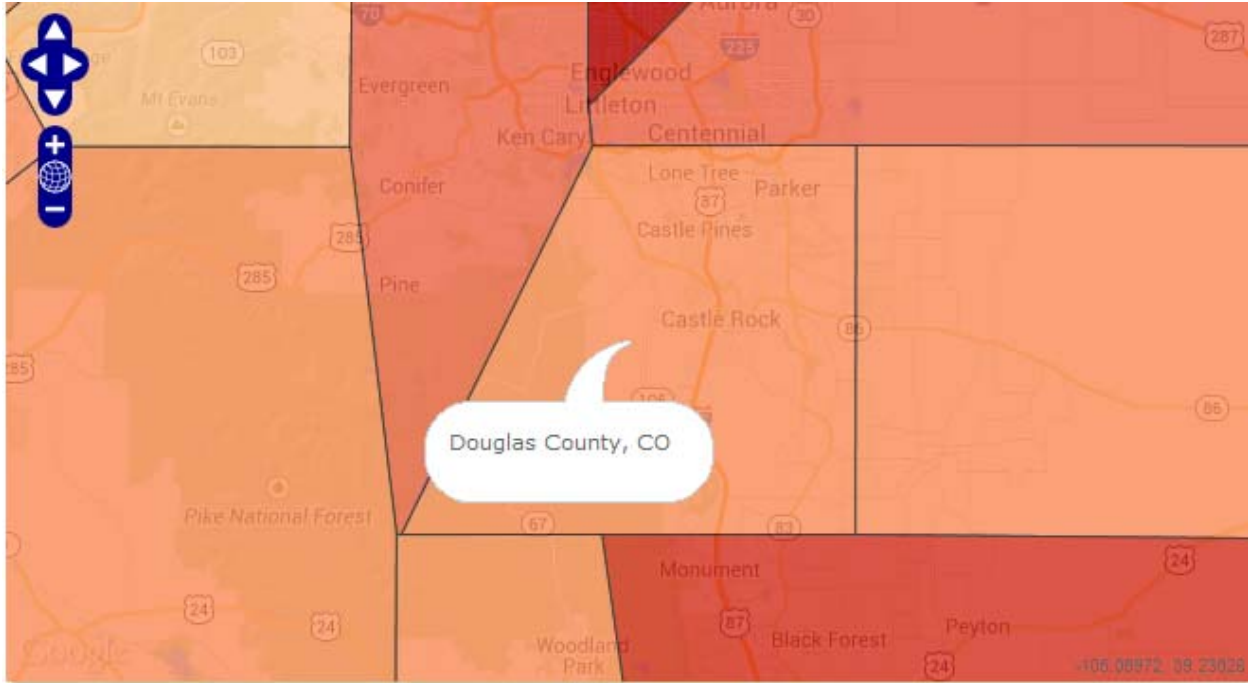
Overall Vulnerability—Medium

Drought is different than many of the other natural hazards in that it is not a distinct event and usually has a slow onset. Drought can severely impact a region both physically and economically. Drought affects different sectors in different ways and with varying intensities. Adequate water is the most critical issue for agricultural, manufacturing, tourism, recreation, and commercial and domestic use. As the population in the area continues to grow, so too will the demand for water.

Based on historical information, the occurrence of drought in Colorado, including Douglas County, is cyclical, driven by weather patterns. Drought has occurred in the past and will occur in the future. Periods of actual drought with adverse impacts can vary in duration, and the period between droughts is often extended. Although an area may be under an extended dry period, determining when it becomes a drought is based on impacts to individual water users. The vulnerability of Douglas County to drought is countywide, but impacts may vary and include reduction in water supply, agricultural losses, and an increase in dry fuels.

Drought impacts are wide-reaching and may be economic, environmental, and/or societal. Tracking drought impacts can be difficult. The Drought Impact Reporter from the NDMC is a useful reference tool that compiles reported drought impacts nationwide. Figure 4.50 and Table 4.57 show drought impacts for the Douglas County Planning Area from 1850 to November 2014. The data represented is skewed, with the majority of these impacts from records within the past ten years.

Figure 4.50. Drought Impact Reporter for Douglas County Planning Area (1850 to 2013)



Source: National Drought Mitigation Center

Table 4.57. Douglas County Drought Impacts

Category	Number
Agriculture	381
Business and Industry	28
Energy	5
Fire	134
Plans & Wildlife	174
Relief, Response, and Restrictions	214
Society and Public Health	138
Tourism and recreation	41
Water Supply and Quality	191
Total	1306

Source: National Drought Mitigation Center

The most significant qualitative impacts associated with drought in the Planning Area are those related to water intensive activities such as agriculture, wildfire protection, municipal usage, commerce, tourism, recreation, and wildlife preservation. Mandatory conservation measures are typically implemented during extended droughts. A reduction of electric power generation and water quality deterioration are also potential problems. Drought conditions can also cause soil to compact and not absorb water well, potentially making an area more susceptible to flooding.

It is difficult to quantitatively assess drought impacts to Douglas County. Some factors to consider include: the impacts of fallowed agricultural land, habitat loss and associated effects on wildlife, and the drawdown of the groundwater table. The most direct and likely most difficult drought impact to quantify is to local economies, especially agricultural economies. It can be assumed, however, that the loss of production in one sector of the economy would affect other sectors.

Few county-specific drought studies have been conducted, apart from the State of Colorado Drought Mitigation and Response Plan, last updated in 2013. The Colorado Drought Plan evaluated each county's drought vulnerability in seven different sectors, including state assets, agriculture, energy, environment, municipal and industrial, recreation and tourism, and socioeconomics. Each sector examined multiple impact categories. For example, the agricultural sector included three impact categories: livestock, crops, and green industry. The vulnerability of every county was evaluated and given a numerical score for each impact category. A county's overall vulnerability score in a particular sector was based on the combined scores of each impact category. The Colorado Drought Plan results found that Douglas County was highly vulnerable to drought in the agricultural sector and moderately vulnerable in the recreation/tourism and socioeconomic sectors. Specific details for each sector are provided below:

- Agriculture: overall vulnerability score of 3-3.39. Douglas County was in the highest impact score group for livestock inventory and vulnerability and middle group for crop inventory and vulnerability.
- Recreation and tourism: overall vulnerability score of 2-2.9. The County had a high vulnerability score for boating which contributed to its moderate overall vulnerability score, despite having only low or moderate vulnerability scores in other recreation areas such as golf or camping.
- Socioeconomic: overall vulnerability score of 2-2.9. The County was given a score of three out of four in the population growth impact ranking which contributed to its moderate overall vulnerability score.

Development Trends

Drought vulnerability will increase with future development as there will be increased demands for limited water resources. The Douglas County Comprehensive Master Plan discusses this issue in Section 8 Water Quality. Refer to Section 4.4.1 of this plan for additional information on the County's capabilities, goals, and policies regarding drought vulnerability and water resources.

4.3.4 Earthquake Vulnerability Assessment

Likelihood of Future Occurrence—Low

Potential Magnitude—Low

Overall Vulnerability—Low

Although the HMPC feels this is a low significance hazard, due to the existing faults in the County and the potential significance of an earthquake in Colorado, analysis of earthquake is included here.

Earthquake vulnerability is primarily based on population and the built environment. Urban areas in high seismic hazard zones are the most vulnerable, while uninhabited areas are less vulnerable.

Ground shaking is the primary earthquake hazard. Many factors affect the survivability of structures and systems from earthquake-caused ground motions. These factors include proximity to the fault, direction of rupture, epicenter location and depth, magnitude, local geologic and soils conditions, types and quality of construction, building configurations and heights, and comparable factors that relate to utility, transportation, and other network systems. Ground motions become structurally damaging when average peak accelerations reach 10 to 15% of gravity, average peak velocities reach 8 to 12 centimeters per second, and when the Modified Mercalli Intensity Scale is about VII (18-34% peak ground acceleration), which is considered to be very strong (general alarm; walls crack; plaster falls).

Earthquake losses will vary across the Douglas County Planning Area depending on the source and magnitude of the event. The earthquake scenario provides a good estimate of loss to the Planning Area based on a realistic earthquake scenario. The results of this scenario are described below.

2015 Earthquake Scenarios

HAZUS-MH 2.1 was utilized to model earthquake losses for Douglas County. Level 1 analyses were run, meaning that only the default data was used and not supplemented with local building inventory or hazard data. There are certain data limitations when using the default data, so the results should be interpreted accordingly; this is a planning level analysis.

The methodology for running the probabilistic earthquake scenario used probabilistic seismic hazard contour maps developed by the U.S. Geological Survey (USGS) for the 2008 update of the National Seismic Hazard Maps that are included with HAZUS-MH. The USGS maps provide estimates of potential ground acceleration and spectral acceleration at periods of 0.3 second and 1.0 second, respectively. The 2,500 year return period analyzes ground shaking estimates with a 2% probability of being exceeded in 50 years from the various seismic sources in the area. The International Building Code uses this level of ground shaking for building design in seismic areas and is considered more of a worst-case scenario.

The results of the probabilistic scenario are captured in Table 4.58. Key losses included the following:

- Total economic loss estimated for the earthquake was \$211.87 million, which includes building losses and lifeline losses based on the HAZUS-MH inventory.
- Building-related losses, including direct building losses and business interruption losses,

totaled \$191.86 million.

- Over 4% of the buildings in the County were at least moderately damaged. Eleven buildings were completely destroyed.
- Over 68% of the building- and income-related losses were residential structures. Eighteen percent of the estimated losses were related to business interruptions.
- The early evening earthquake scenario caused the most casualties, though the number is still quite low with one fatality, one life-threatening injury, and four injuries requiring hospitalization.

Table 4.58. Douglas County HAZUS-MH 2,500-year Earthquake Scenario Results

Impacts/Earthquake	Model Results
Residential Buildings Damaged (Based upon 66,000 buildings)	Slight: 6,470 Moderate: 2,182 Extensive: 293 Complete: 11
Building Related Loss	\$191,860,000
Total Economic Loss	\$211,870,000
Injuries (Based upon 2am time of occurrence)	Without requiring hospitalization: 32 Requiring hospitalization: 3 Life Threatening: 0 Fatalities: 0
Injuries (Based upon 2pm time of occurrence)	Without requiring hospitalization: 28 Requiring hospitalization: 3 Life Threatening: 0 Fatalities: 0
Injuries (Based upon 5pm time of occurrence)	Without requiring hospitalization: 28 Requiring hospitalization: 4 Life Threatening: 1 Fatalities: 1
Essential Facility Damage (Based upon 98 buildings)	None with at least moderate damage
Transportation and Utility Lifeline Damage	None with at least moderate damage
Households w/out Power & Water Service (Based upon 60,924 households)	Power loss @ Day 1: 0 Water loss @ Day 1: 0 Power loss @ Day 3: 0 Water loss @ Day 3: 0 Power loss @ Day 7: 0 Water loss @ Day 7: 0 Power loss @ Day 30: 0 Water loss @ Day 30: 0
Displaced Households	29
Shelter Requirements	15
Debris Generation	60,000 tons

Source: HAZUS-MH 2.1

Development Trends

Although new growth and development corridors would fall in the area potentially affected by earthquake, given the small chance of major earthquake and the building codes in effect, development in the earthquake area will continue to occur.

4.3.5 Flood: Dam Failure

Likelihood of Future Occurrence—Low

Potential Magnitude—Medium

Overall Vulnerability—Medium

Douglas County has 41 dams, 5 of which are rated as high hazard, 5 as significant hazard, and 31 as low hazard. Douglas County has had some minor dam incidents but no complete failures. The potential impacts from a dam failure in the County are largely dependent on the specific dam or jurisdiction in question. Small dams in the County would only cause localized damage in rural areas. Rueter-Hess Dam is only partially full and poses a low risk to Parker. Failure of Cheesman Dam would have a significant impact with floodwaters cascading to Strontia Springs and Chatfield Dam. A catastrophic dam failure of this magnitude would challenge local response capabilities and require timely evacuations to save lives in the western portions of the county. Impacts to life safety would depend on the warning time available and the resources to notify and evacuate the public. Major loss of life could result as well as potentially catastrophic effects to roads, bridges, and homes. Associated water quality and health concerns could also be an issue. Due to homeland security concerns specific impacts are not included here.

Development Trends

Flooding due to a dam failure event is likely to exceed the special flood hazard areas regulated through local floodplain ordinances. The County and towns should consider the dam failure hazard when permitting development downstream of the high and significant hazard dams. Low hazard dams could become significant or high hazard dams if development occurs below them. Regular monitoring of dams, exercising and updating of EAPs, and rapid response to problems when detected at dams are ways to mitigate the potential impacts of these rare, but potentially catastrophic, events.

4.3.6 Flood: 100/500-year and Localized Stormwater Vulnerability Assessment

Likelihood of Future Occurrence—Low for 100/500-year and Medium for localized stormwater

Potential Magnitude—Medium for 100/500-year and Low for localized stormwater

Overall Vulnerability—Medium for both 100/500-year and localized stormwater

Douglas County is located in an area that is prone to very intense rainfall, sometimes of cloudburst magnitude. Floods have resulted from storms covering large areas with heavy general rainfall as well as from storms covering small area with extremely intense rainfall. This section quantifies the vulnerability of the Planning Area to floods.

Historically, the Planning Area has been at risk to stormwater flooding primarily during the spring and summer months when river systems in the County swell with heavy rainfall. Localized flooding also occurs throughout the Planning Area at various times throughout the year with

several areas of primary concern unique to the County and each jurisdiction.

Methodology

Unincorporated Douglas County and its incorporated jurisdictions have mapped FEMA flood hazard areas. GIS was used to determine the possible impacts of flooding within the County and how the risk varies across the Planning Area by jurisdiction. The following methodology was followed in determining improved parcel counts and values at risk to the 1% and 0.2% annual chance flood events.

Douglas County's parcel and associated 2014 assessor data was used as the basis for the countywide inventory of developed parcels, acres, and structure value. The FEMA DFIRM, effective date September 30, 2005, was used as the flood hazard layer for this analysis.

GIS was used to create a centroid, or point representing the center of the parcel polygon. DFIRM flood data was then overlaid on the parcel centroids. For the purposes of this analysis, the flood zone that intersected a parcel centroid was assigned the flood zone for the entire parcel. The model assumes that every parcel with a structure value greater than zero is improved in some way. Specifically, an improved parcel assumes there is a building on it. This approach was used to support the parcel layer analysis as there was no associated building layer available for this analysis. In addition to the centroid analysis, parcel boundary analysis was performed to get total acres and flooded acres by flood zone for each parcel. The parcel layer was intersected with the FEMA DFIRM to obtain the acres flooded values. Once completed the parcel boundary layer was joined to the centroid layer and flooded acre values were transferred based on parcel number.

It is important to note that there could be more than one structure or building on an improved parcel (i.e., condo complex occupies one parcel but might have several structures). Only improved parcels and the value of their improvements were analyzed. The end result is an inventory of the number and types of parcels and buildings subject to the hazards. Results are presented by unincorporated county and incorporated jurisdictions. Detailed tables show counts of parcels by jurisdictions and land use type (Agriculture, Commercial, Exempt, HOA, Industrial, Producing Mine, Residential, Utilities and Vacant Land) within each flood zone.

Each of the flood zones that begins with the letter 'A' depict the Special Flood Hazard Area, or the 1% annual chance flood event (commonly referred to as the 100-year flood). Table 4.59 explains the difference between mapped flood zones. These zones are shown on Figure 4.39.

Table 4.59. Flood Hazard Zones in Douglas County

Flood Zone	Description
1% Annual Chance	100-year Flood: Also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year.
Zone A	100-year Flood: No base flood elevations provided
Zone AE	100-year Flood: Base flood elevations provided

Flood Zone	Description
Zone AO	100-year Flood: Sheet flow areas, base flood depths provided
0.2% Annual Chance	500-year Flood
Zone D	Areas in which flood hazards are undetermined, but possible
Zone X	No flood hazard

Source: HAZUS

Values at Risk

The methodology described previously produced loss estimates for this vulnerability assessment. The methodology and results should be considered ‘reasonable’ and should be used for flood risk mitigation, emergency preparedness, and response and recovery. Uncertainties are inherent in any loss estimation methodology, and losses will vary depending on the magnitude of the flood event. Other limitations may include incomplete or inaccurate inventories of the built environment. The assessed values, for example, are well below the actual market values; thus, the actual value of assets at risk may be significantly higher than those included therein. Also, this loss estimation assumes no mitigation and does not account for buildings that may have been elevated above the 1% annual chance event according to local floodplain management regulations.

Douglas County Planning Area

Table 4.60 and Table 4.61 contain flood analysis results for the entire Douglas County Planning Area. This includes unincorporated Douglas County and the incorporated communities. These tables show the number of parcels and values exposed to the 1% annual chance and 0.2% annual chance flood events by jurisdiction and land use type for the entire Douglas County Planning Area. Figure 4.51 shows the location of properties in FEMA flood zones.

Table 4.60. Douglas County Exposure to 1% Annual Chance Flood Zone by Jurisdiction and Property Type

Jurisdiction	Property Type	Total Parcel Count	Improved Parcel Count	Total Structure Count	Improved Value	Land Value	Total Value
Castle Rock	Commercial	5	4	14	\$3,015,500	\$1,578,076	\$4,593,576
	Exempt	81	1	11	\$4,480	\$4,881,361	\$4,885,841
	HOA	1	0	1	\$0	\$0	\$0
	Residential	39	34	48	\$1,763,415	\$933,678	\$2,697,093
	Utilities	1	0	0	\$0	\$0	\$0
	Vacant Land	14	1	5	\$17,836	\$1,002,333	\$1,020,169
	Total		141	40	79	\$4,801,231	\$8,395,448
Larkspur	Commercial	7	3	9	\$974,510	\$632,188	\$1,606,698
	Exempt	12	2	5	\$772,897	\$1,142,901	\$1,915,798

Jurisdiction	Property Type	Total Parcel Count	Improved Parcel Count	Total Structure Count	Improved Value	Land Value	Total Value
	Residential	9	9	10	\$808,222	\$455,000	\$1,263,222
	Utilities	1	0	0	\$0	\$0	\$0
	Vacant Land	4	0	2	\$0	\$327,868	\$327,868
	Total	33	14	26	\$2,555,629	\$2,557,957	\$5,113,586
Lone Tree	Agricultural	2	0	1	\$0	\$1,797	\$1,797
	Exempt	4	0	1	\$0	\$89,556	\$89,556
	Total	6	0	2	\$0	\$91,353	\$91,353
Parker	Agricultural	1	0	0	\$0	\$1,190	\$1,190
	Commercial	2	0	0	\$0	\$17,700	\$17,700
	Exempt	98	6	11	\$691,591	\$12,531,887	\$13,223,478
	HOA	11	0	0	\$0	\$0	\$0
	Residential	5	3	4	\$653,552	\$207,705	\$861,257
	Utilities	1	0	0	\$0	\$0	\$0
	Vacant Land	7	0	0	\$0	\$743,741	\$743,741
Total	125	9	15	\$1,345,143	\$13,502,223	\$14,847,366	
Unincorporated	Agricultural	104	46	65	\$13,789,952	\$949,030	\$14,738,982
	Commercial	13	11	15	\$2,017,855	\$2,295,072	\$4,312,927
	Exempt	240	13	99	\$3,581,017	\$26,063,528	\$29,644,545
	HOA	22	0	13	\$0	\$0	\$0
	Industrial	6	6	7	\$624,040	\$1,511,492	\$2,135,532
	Residential	125	110	120	\$24,861,032	\$15,928,416	\$40,789,448
	Utilities	4	0	0	\$0	\$0	\$0
	Vacant Land	38	0	11	\$0	\$2,890,243	\$2,890,243
Total	552	186	330	\$44,873,896	\$49,637,781	\$94,511,677	
Grand Total	857	249	452	\$53,575,899	\$74,184,762	\$127,760,661	

Source: Douglas County 2014 Assessor & Parcel Data; Douglas County DFIRM

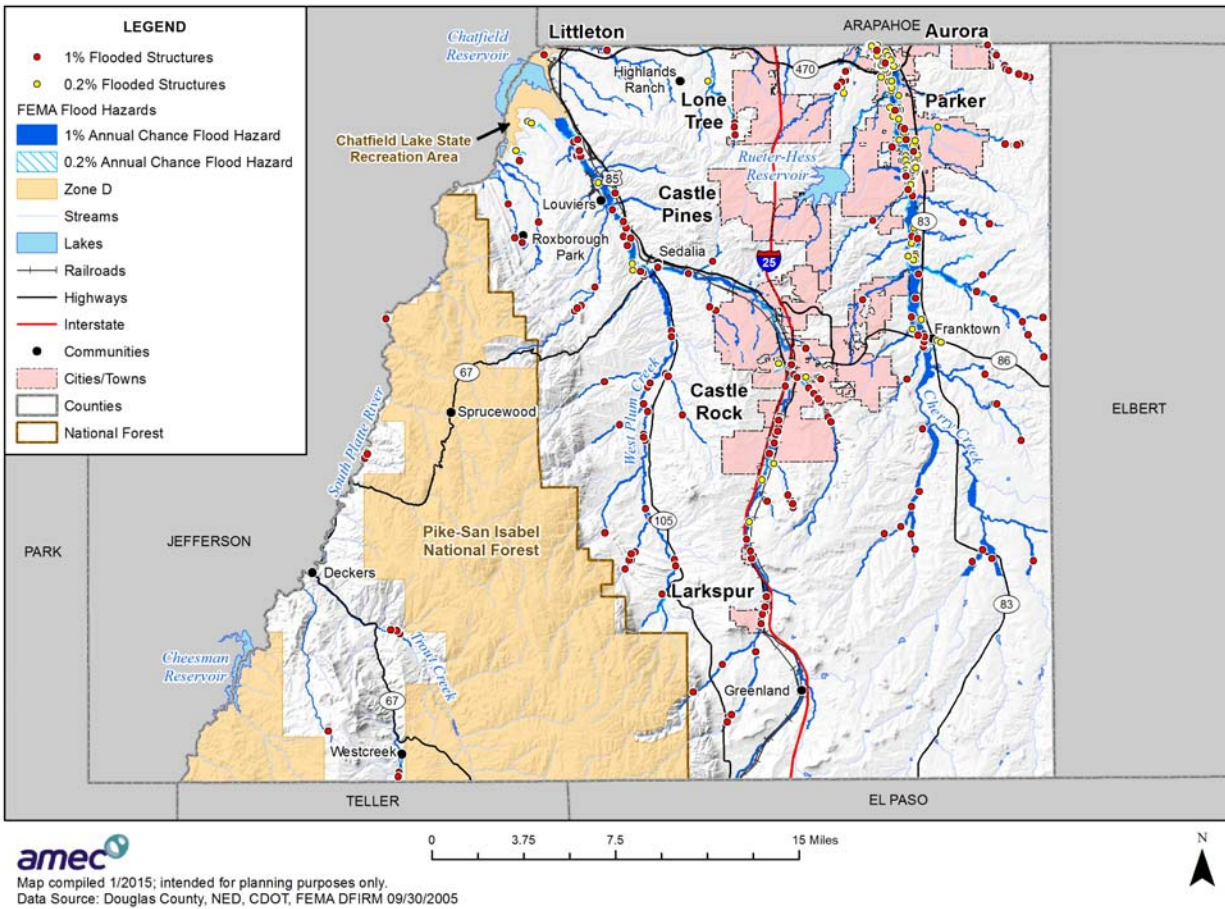
Table 4.61. Douglas County Exposure to 0.2% Annual Chance Flood Zone by Jurisdiction and Property Type

Jurisdiction	Property Type	Total Parcel Count	Improved Parcel Count	Total Structure Count	Improved Value	Land Value	Total Value
Castle Rock	Agricultural	14	0	18	\$0	\$2,741	\$2,741
	Commercial	2	2	16	\$1,402,310	\$391,090	\$1,793,400
	Exempt	17	0	3	\$0	\$74,668	\$74,668
	HOA	1	0	0	\$0	\$0	\$0
	Industrial	1	1	1	\$490,335	\$262,665	\$753,000
	Residential	9	9	9	\$1,069,946	\$170,250	\$1,240,196
	Vacant Land	5	0	3	\$0	\$908,582	\$908,582

Jurisdiction	Property Type	Total Parcel Count	Improved Parcel Count	Total Structure Count	Improved Value	Land Value	Total Value
	Total	49	12	50	\$2,962,591	\$1,809,996	\$4,772,587
Larkspur	Commercial	2	1	5	\$362,177	\$213,870	\$576,047
	Exempt	1	1	1	\$147,670	\$40,000	\$187,670
	Residential	1	1	1	\$124,985	\$80,000	\$204,985
	Total	4	3	7	\$634,832	\$333,870	\$968,702
Parker	Agricultural	1	0	0	\$0	\$810	\$810
	Commercial	18	10	62	\$28,897,896	\$17,554,185	\$46,452,081
	Exempt	125	15	21	\$23,698,806	\$5,404,382	\$29,103,188
	HOA	6	0	0	\$0	\$0	\$0
	Residential	758	757	846	\$131,232,921	\$39,094,720	\$170,327,641
	Vacant Land	36	0	22	\$0	\$5,827,345	\$5,827,345
	Total	944	782	951	\$183,829,623	\$67,881,442	\$251,711,065
Unincorporated	Agricultural	11	6	7	\$872,623	\$137,162	\$1,009,785
	Commercial	4	4	13	\$3,198,128	\$2,297,812	\$5,495,940
	Exempt	30	3	14	\$54,553	\$3,191,908	\$3,246,461
	HOA	6	0	6	\$0	\$0	\$0
	Industrial	3	3	5	\$416,106	\$891,198	\$1,307,304
	Residential	307	305	640	\$89,380,034	\$21,258,054	\$110,638,088
	Utilities	1	0	1	\$0	\$0	\$0
	Vacant Land	14	1	11	\$318	\$626,093	\$626,411
Total	376	322	697	\$93,921,762	\$28,402,227	\$122,323,989	
Grand Total		1,373	1,119	1,705	\$281,348,808	\$98,427,535	\$379,776,343

Source: Douglas County 2014 Assessor & Parcel Data; Douglas County DFIRM

Figure 4.51. Douglas County Flood Hazards and Floodprone Improved Properties



According to the flood analysis represented in Table 4.60; Castle Rock and Larkspur have the highest total values exposed in the 1% annual chance flood zone with Castle Rock having 40 improved parcels and total value of improvements at \$4.8 million at risk, not including contents. Larkspur has 14 improved parcels with an improved value of \$2.6 million at risk, not including contents, in the 1% annual chance flood zone.

Loss Estimates

Table 4.62 shows improved values at risk in the 1% annual chance flood zone and Table 4.63 summarizes improved values at risk in the 0.2% annual chance flood zone. Contents values were estimated as a percentage of building value based on their property type, using FEMA/HAZUS estimated content replacement values. This includes 100% of the structure value for agricultural, commercial, exempt, HOA and utility, 50% for residential, 150% for industrial and 0% for vacant land use classifications. A 20% damage factor was applied to each flood zone’s total value of improvements and estimated content to obtain a loss estimate. This analysis is based on a FEMA depth damage function which assumes a two foot deep flood. Land value was not included in this analysis as the land itself is usually not a loss. The unincorporated County has the largest loss

estimate of \$15.5 million with Castle Rock having the second highest loss estimate of \$1.7 million for the 1% annual chance flood. Parker has the largest loss estimate for the 0.2% annual chance flood at \$60.4 million, and the unincorporated County has the second highest loss estimate at over \$28.6 million.

Table 4.62. Douglas County Estimated Loss Estimate to 1% Annual Chance Flood Zone Summary

Jurisdiction	Total Parcel Count	Improved Parcel Count	Total Structure Count	Improved Value	Estimated Content Value	Total Value	Loss Estimate
Castle Rock	141	40	79	\$4,801,231	\$3,901,688	\$8,702,919	\$1,740,584
Larkspur	33	14	26	\$2,555,629	\$2,151,518	\$4,707,147	\$941,429
Lone Tree	6	0	2	\$0	\$0	\$0	\$0
Parker	125	9	15	\$1,345,143	\$1,018,367	\$2,363,510	\$472,702
Unincorporated	552	186	330	\$44,873,896	\$32,755,400	\$77,629,296	\$15,525,859
Total	857	249	452	\$53,575,899	\$39,826,973	\$93,402,872	\$18,680,574

Source: Douglas County 2014 Assessor & Parcel Data; Douglas County DFIRM

Table 4.63. Douglas County Estimated Loss Estimate to 0.2% Annual Chance Flood Zone Summary

Jurisdiction	Total Parcel Count	Improved Parcel Count	Total Structure Count	Improved Value	Estimated Content Value	Total Value	Loss Estimate
Castle Rock	49	12	50	\$2,962,591	\$2,672,786	\$5,635,377	\$1,127,075
Larkspur	4	3	7	\$634,832	\$572,340	\$1,207,172	\$241,434
Lone Tree	0	0	0	\$0	\$0	\$0	\$0
Parker	944	782	951	\$183,829,623	\$118,213,163	\$302,042,786	\$60,408,557
Unincorporated	376	322	697	\$93,921,762	\$49,439,480	\$143,361,242	\$28,672,248
Total	1,373	1,119	1,705	\$281,348,808	\$170,897,768	\$452,246,576	\$90,449,315

Source: Douglas County 2014 Assessor & Parcel Data; Douglas County DFIRM

Flooded Acres

Also of interest is the land area affected by the various flood zones. The following is an analysis of flooded acres in the County in comparison to total area within the unincorporated county and city limits of each jurisdiction.

Methodology

GIS was used to calculate acres flooded by FEMA flood zones and property type categories. The Douglas County parcel layer and effective DFIRM data were intersected, and each segment divided by the intersection of flood zone and parcels was calculated for acres. This process was conducted for 1% flood chance areas, with each segment being defined by zone type (A, AE, AO)

and acres, and the process repeated for 0.2% flood chance areas. The resulting data tables with flooded acreages were then imported into a database and linked back to the original parcels, including total acres and land/improvement values, by parcel number. Once this was completed, each parcel contained acreage values for flooded acre by zone type within the parcel. In some cases, a single parcel had multiple flooded acres values (e.g., parcels overlapping a 1%-0.2% flood chance boundary). In the tables below each flood zone is represented and then split out by property type, their total flooded acres, total improved acres, and percent of improved acres that are flooded.

Limitations

One limitation of this analysis is that the parcel layer does not contain right-of-ways. Due to this there are voids of land that are not calculated; thus the analysis only represents total parcel acres. The other limitation created by this type of analysis is that improvements are uniformly found throughout the parcel, while in reality, only portions of the parcel are improved, and improvements may or may not fall within the flood zone portion of a parcel; thus, areas of improvements flooded calculated through this method may be higher or lower than those actually seen in a similar real world event.

Table 4.64 represent a detailed and summary analysis of total acres for each FEMA DFIRM flood zone. Table 4.64 gives detailed information for the Planning Area. This information is available for each jurisdiction in their respective annexes.

Table 4.64. Douglas County Planning Area – Flooded Acres by Jurisdiction

Flood Zone	Jurisdiction	Total Parcels Count	Improved Parcel Count	Total Structures Count	Total Acres	Total Flooded Acres	Total Acres with Improvements	Total Flood Acres with Improvements
Zone A	Castle Rock	47	2	18	257	147	0	0
	Lone Tree	6	0	2	70	20	0	0
	Parker	9	0	0	74	30	0	0
	Unincorporated	259	90	152	6,198	1,750	2,963	756
	Total Zone A	321	92	172	6,599	1,947	2,964	757
Zone AE	Castle Rock	94	38	61	272	142	6	4
	Larkspur	33	14	26	148	96	64	38
	Parker	116	9	15	1,069	829	119	90
	Unincorporated	284	92	173	4,605	2,504	1,732	890
	Total Zone AE	527	153	275	6,095	3,571	1,922	1,022
Zone AO	Unincorporated	9	4	5	57	17	30	8
	Total Zone AO	9	4	5	57	17	30	8

Flood Zone	Jurisdiction	Total Parcels Count	Improved Parcel Count	Total Structures Count	Total Acres	Total Flooded Acres	Total Acres with Improvements	Total Flood Acres with Improvements
0.2% Annual Chance	Castle Rock	49	12	50	134	16	5	1
	Larkspur	4	3	7	7	2	6	1
	Parker	944	782	951	749	490	394	264
	Unincorporated	376	322	697	1,329	300	819	155
	Total 0.2%	1,373	1,119	1,705	2,219	808	1,224	422
Grand total	2,230	1,368	2,157	14,970	6,343	6,140	2,209	

Source: Douglas County 2014 Assessor & Parcel Data; Douglas County DFIRM

Insurance Coverage, Claims Paid, and Repetitive Losses

Unincorporated Douglas County joined the NFIP on September 3, 1980. Castle Rock, Larkspur, Parker, and Lone Tree also participate in the NFIP. Table 4.65 summarizes NFIP insurance data as of November 30, 2014. Table 4.66 lists the number of total losses, closed losses, open losses, closed-without-pay (CWOP) losses, and total payments for the participating communities in Douglas County.

Table 4.65. NFIP Policy Summary

Jurisdiction	Join Date	# of Policies	Insurance In Force
Douglas County	9/3/1980	283	\$69,933,300
Castle Rock	8/15/1978	81	\$19,880,500
Larkspur	9/30/1987	1	\$144,100
Lone Tree	4/8/2005	24	\$6,001,000
Parker	9/30/1987	71	\$18,144,000
Total	-	460	\$114,102,900

Source: FEMA

Table 4.66. NFIP Loss Summary

Jurisdiction	Total Losses	Closed Losses	Open Losses	CWOP Losses	Total Payments
Douglas County	31	21	0	10	\$487,024.36
Castle Rock	1	0	0	1	\$0.00
Larkspur	-	-	-	-	-
Lone Tree	1	1	0	0	\$2,471.80
Parker	1	0	0	1	\$0.00
Total	34	22	0	12	\$489,496.16

Source: FEMA

Repetitive Loss Data

Douglas County's vulnerability to flooding is further indicated by its number of Repetitive Loss properties. According to the June 30, 2014 data from FEMA on NFIP communities, there are no

repetitive loss (RL) buildings in the unincorporated County or municipalities.

Populations at Risk

A separate analysis was performed to determine population in flood zones. Using GIS, the DFIRM Flood dataset was overlaid on the improved residential parcel data. Those parcel centroids that intersect a flood zone were counted and multiplied by the Census Bureau Douglas County household factor; results were tabulated by jurisdiction and flood zone (see Table 4.67). According to this analysis, there is a population of 433 in the 1% annual chance flood event, and 2,930 in the 0.2% annual chance flood event.

Table 4.67. Douglas County Planning Area - Improved Residential Parcels and Population in Floodplain

Jurisdiction	1% Annual Chance		0.2% Annual Chance	
	Improved Residential Parcels	Population	Improved Residential Parcels	Population
Castle Pines	-	-	-	-
Castle Rock	34	97	9	26
Larkspur	9	20	1	2
Lone Tree	-	-	-	-
Parker	3	8	757	2,051
Unincorporated	110	307	305	851
Total	156	433	1,072	2,930

Source: DFIRM, US Census Bureau, 2014 Douglas County Assessor & Parcel Data

* Census Bureau 2010 average household sizes are: Castle Pines – 2.70; Castle Rock – 2.86; Larkspur – 2.26; Lone Tree – 2.54; Parker – 2.71; Unincorporated County – 2.79.

Critical Facilities at Risk

Fifty-two critical facilities in unincorporated Douglas County are located in the 1% annual chance or 0.2% annual chance flood zone, as shown in Table 4.69. Specifics on the other jurisdictions' critical facilities in flood zones are listed in their respective annexes.

Table 4.68. Douglas County Planning Area – Critical Facilities Exposure to FEMA Floodplains

Jurisdiction	1% Annual Chance	0.2% Annual Chance	Total Facility Count
Castle Rock	2	-	2
Lone Tree	1	-	1
Parker	1	28	29
Unincorporated County	45	7	52
Total	49	35	84

Source: Douglas County GIS

Table 4.69. Unincorporated Douglas County Critical Facilities At Risk to FEMA Floodplains

Zone	Category	Type	Facility Count
Zone A	Essential Services Facilities	Bridge	17
Zone A	Essential Services Facilities	Water Hub/Treatment	1
Zone A	High Potential Loss Facilities	Dam	1
Zone A	High Potential Loss Facilities	Hazardous Material	1
Zone AE	Essential Services Facilities	Bridge	19
Zone AE	Essential Services Facilities	Cell Tower	1
Zone AE	Essential Services Facilities	Water Hub/Treatment	1
Zone AE	High Potential Loss Facilities	Dam	1
Zone AE	High Potential Loss Facilities	Hazardous Material	1
Zone AO	Essential Services Facilities	Fire Department	1
Zone AO	Essential Services Facilities	Water Hub/Treatment	1
0.2% Annual Chance	Essential Services Facilities	Fire Department	2
0.2% Annual Chance	Essential Services Facilities	Microwave	3
0.2% Annual Chance	Essential Services Facilities	Water Hub/Treatment	1
0.2% Annual Chance	High Potential Loss Facilities	Hazardous Material	1
Total			52

Source: 2014 Douglas County Assessor & Parcel Data

Cultural and Natural Resources at Risk

The Douglas County Planning Area has significant cultural and natural resources located throughout the County as previously described. Risk analysis of these resources was not possible due to data limitations. However, natural areas within the floodplain often benefit from periodic flooding as a naturally recurring phenomenon. These natural areas often reduce flood impacts by allowing absorption and infiltration of floodwaters.

Development Trends

The County’s zoning regulations prohibit various types of development within the floodplain overlay district:

- 1805.01** Habitable structures, or commercial/industrial structures, except fish hatcheries, water-related recreational facilities, single-family dwellings on nonconforming lots, and reconstruction of nonconforming structures as allowed by a Floodplain Development Permit
- 1805.02** Storage or processing of materials that are buoyant, flammable, explosive, or could be dangerous or cause injury in the time of flooding
- 1805.03** Junk or salvage yards, or solid waste disposal facilities or landfills

Section 4.4.1 discusses the County’s floodplain regulations in more depth.

Through these regulations the County has minimized, but not eliminated, development in flood zones. Table 4.70 and Table 4.71 summarize development in the 1% and 0.2% annual chance flood zones between 2010 and 2014.

Table 4.70. Douglas County Structures Built from 2010 to 2014: Assets Exposed to the 1% Annual Chance Flood Zone

Jurisdiction	Total Parcel Count	Improved Parcel Count	Total Building Count	Improved Value	Estimated Content Value	Land Value	Total Value
Castle Rock	3	3	4	\$110,764	\$55,382	\$30,000	\$196,146
Larkspur	2	2	2	\$242,884	\$121,442	\$92,000	\$456,326
Unincorporated	8	8	10	\$1,454,476	\$512,781	\$649,435	\$2,616,692
Total	13	13	16	\$1,808,124	\$689,605	\$771,435	\$3,269,164

Source: Douglas County GIS

Table 4.71. Douglas County Structures Built from 2010 to 2014: Assets Exposed to the 0.2% Annual Chance Flood Zone

Jurisdiction	Total Parcel Count	Improved Parcel Count	Total Building Count	Improved Value	Estimated Content Value	Land Value	Total Value
Castle Rock	1	1	1	\$490,335	\$735,503	\$262,665	\$1,488,503
Larkspur	1	1	1	\$147,670	\$0	\$40,000	\$187,670
Parker	38	38	57	\$7,284,984	\$3,642,160	\$1,954,246	\$12,881,390
Unincorporated	16	16	28	\$4,232,229	\$2,116,274	\$1,224,550	\$7,573,053
Total	56	56	87	\$12,155,218	\$6,493,936	\$3,481,461	\$22,130,615

Source: Douglas County GIS

While the County has done an excellent job minimizing development in the 100-year floodplain, there are a significant number of structures in the 500-year floodplain, including several that were built in the last five years (see Table 4.61 and Table 4.71). Much of this development has occurred in Parker in particular. The 0.2% annual chance flood zone is less regulated; while these floods are a fairly rare occurrence, people and structures in this zone are still at risk.

The risk of stormwater/localized flooding to future development can be minimized by accurate recordkeeping of repetitive localized storm activity. Mitigating the root causes of the localized stormwater or choosing not to develop in areas that often are subject to localized flooding will reduce future risks of losses due to stormwater/localized flooding.

4.3.7 Landslide/Mud and Debris Flow/Rockfalls Vulnerability Assessment

Likelihood of Future Occurrence—High

Potential Magnitude—Low

Overall Vulnerability—Medium

Landslides in Douglas County include a wide variety of processes resulting in downward and outward movement of soil, rock, and vegetation. Common names for landslide types include slumps, rockslides, debris slides, lateral spreading, debris avalanches, earth flows, and soil creep. Although landslides are primarily associated with slopes greater than 15%, they can also occur in relatively flat areas and as cut-and-fill failures, river bluff failures, lateral spreading landslides, failures associated with quarries, and open-pit mines. Landslides may be triggered by both natural- and human-caused activity.

Methodology

The landslide hazard is made up of these attributes: debris-flow, rockfall-rockslide/debris and slope-failure. The County's parcel layer was used as the basis for the inventory of all parcels within Douglas County. GIS was used to overlay the landslide hazard layer with the parcel layer centroids and where the zones intersected a parcel centroid, it was assigned with that hazard zone for the entire parcel.

Values at Risk

The landslide, debris-flow, rockfall-rockslide/debris and slope-failure layers were intersected with the county parcel layer in GIS to obtain results. This is shown in Figure 4.52. Table 4.72 summarizes the parcels and values exposed to landslides hazards in the jurisdictions and unincorporated Douglas County. The unincorporated County has the most area exposed to landslide with 2,028 total parcels and 1,053 improved parcels with an improved value of \$367,441,524 and a total value of \$778,835,562. Castle Rock follows with 931 total and 543 improved parcels with and improved value of \$198,464,752 and a total value of \$361,228,304 exposed to landslides. Table 4.73 shows the unincorporated County's exposure by property type and landslide hazard. Additional details for the jurisdictions are available in their individual annexes.

Figure 4.52. Douglas County Planning Area - Landslide Hazards

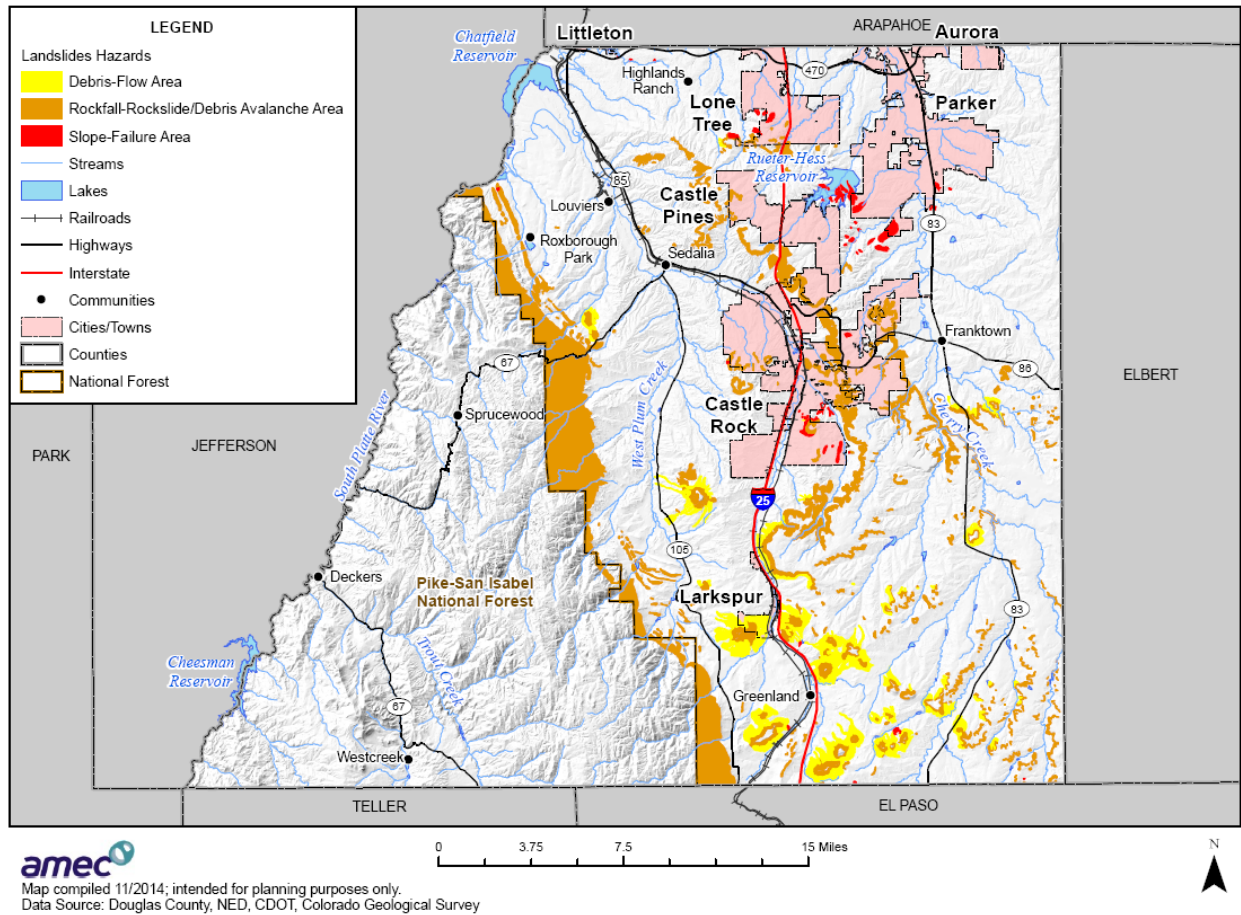


Table 4.72. Douglas County Planning Area – Assets Exposed to Landslide

Jurisdiction	Total Parcel Count	Improved Parcel Count	Total Building Count	Improved Value	Estimated Content Value	Land Value	Total Value
Castle Pines	128	97	109	\$61,466,476	\$30,377,296	\$18,008,656	\$109,852,428
Castle Rock	931	543	826	\$198,464,752	\$104,951,045	\$57,812,507	\$361,228,304
Larkspur	42	26	82	\$4,742,998	\$3,441,257	\$2,094,585	\$8,907,340
Lone Tree	60	18	46	\$12,960,972	\$10,075,852	\$7,312,406	\$30,349,230
Parker	11	10	11	\$3,773,733	\$1,886,867	\$1,751,139	\$7,411,739
Unincorporated	2,028	1,053	1,738	\$367,441,524	\$202,777,717	\$218,333,950	\$778,835,562
Total	3,200	1,747	2,812	\$648,850,455	\$353,510,032	\$305,313,243	\$1,296,584,601

Source: Douglas County assessors data

Table 4.73. Unincorporated Douglas County – Assets Exposed to Landslide by Property Type

Property Type	Total Parcel Count	Improved Parcel Count	Total Building Count	Improved Value	Estimated Content Value	Land Value	Total Value
Debris Flow Area							
Agricultural	62	28	44	\$12,047,092	\$12,047,092	\$453,397	\$24,547,581
Exempt	42	2	17	\$1,168,701	\$1,168,701	\$12,955,995	\$15,293,397
Residential	71	62	70	\$18,917,251	\$9,458,626	\$8,165,388	\$28,375,877
Utilities	3	0	0	\$0	\$0	\$0	\$0
Vacant Land	15	0	8	\$0	\$0	\$1,552,241	\$0
Total	193	92	139	\$32,133,044	\$22,674,419	\$23,127,021	\$68,216,855
Rockfall/Rockslide/Debris Avalanche Area							
Agricultural	184	47	83	\$18,195,145	\$18,195,145	\$1,695,060	\$38,085,350
Commercial	7	4	4	\$3,532,649	\$3,532,649	\$1,397,675	\$8,462,973
Exempt	142	19	46	\$2,821,821	\$2,821,821	\$45,273,319	\$50,916,961
HOA	40	0	4	\$0	\$0	\$0	\$0
Producing Mine	1	0	1	\$0	\$0	\$9,207	\$9,207
Residential	925	840	927	\$287,755,333	\$143,877,667	\$116,593,013	\$548,226,013
Vacant Land	454	7	469	\$20,003	\$0	\$22,191,153	\$22,211,156
Total	1,753	917	1,534	\$312,324,951	\$168,427,282	\$187,159,427	\$667,911,660
Slope-Failure Area							
Agricultural	4	1	1	\$294,397	\$294,397	\$6,459	\$595,253
Commercial	3	1	2	\$74,107	\$74,107	\$116,496	\$264,710
Exempt	18	0	8	\$0	\$0	\$429,788	\$429,788
Residential	46	42	44	\$22,615,025	\$11,307,513	\$6,720,283	\$40,642,821
Vacant Land	11	0	10	\$0	\$0	\$774,476	\$774,476
Total	82	44	65	\$22,983,529	\$11,676,017	\$8,047,502	\$42,707,048
Grand Total	2,028	1,053	1,738	\$367,441,524	\$202,777,718	\$218,333,950	\$778,835,563

Source: Douglas County Assessor's data

Populations at Risk

GIS analysis was performed to determine population in the landslide areas. Using GIS, the Douglas County landslide layer was overlaid on the entire parcel layer. Those parcel centroids that intersect the landslide areas were counted and multiplied by the 2010 Census Bureau average household factors for each jurisdiction and the unincorporated County; results were tabulated by jurisdiction (see Table 4.74). According to this analysis, the unincorporated County has the most people exposed to landslides, followed by Castle Rock.

Table 4.74. Douglas County Planning Area – Population Exposed to Landslide

Jurisdiction	Debris-Flow Area		Rockfall-Rockslide/Debris Avalanche Area		Slope-Failure Area	
	Improved Residential Parcels	Population	Improved Residential Parcels	Population	Improved Residential Parcels	Population
Castle Pines	-	-	95	257	-	-
Castle Rock	2	6	445	1,273	89	255
Larkspur	18	41	-	-	-	-
Lone Tree	-	-	-	-	-	-
Parker	-	-	-	-	10	27
Unincorporated	62	173	840	2,344	42	117
Total	82	219	1,380	3,873	141	399

Source: Douglas County Assessor's data

Critical Facilities at Risk

Landslide analysis was performed on the critical facility inventory in Douglas County and all jurisdictions. GIS was used to determine whether the facility locations intersect the landslide hazard areas provided by Douglas County, and if so, which zones they intersect. There are 58 facilities in the Planning Area in landslide zones, as shown in Table 4.75. Castle Rock and the unincorporated County are the only areas with critical facilities in landslide hazard areas. More details on landslide issues in Castle Rock may be found in the town's annex. Table 4.76 summarizes the critical facilities at risk to landslides in the unincorporated County by hazard area, critical facility category, facility type, and facility count. Details of critical facility definition, type, name and address and jurisdiction by landslide zone are listed in Appendix E.

Table 4.75. Douglas County Planning Area – Critical Facilities at Risk from Landslide

Jurisdiction	Facility Count
Castle Rock	18
Unincorporated County	40
Total	58

Source: Douglas County GIS

Table 4.76. Unincorporated Douglas County– Critical Facilities at Risk from Landslide

Landslide Hazard	Category	Type	Facility Count
Debris-Flow Area	Essential Services Facilities	Bridge	1
Debris-Flow Area	Essential Services Facilities	Fire Department	1
Total			2
Rockfall/Avalanche Area	At Risk Population Facilities	School	1
Rockfall/Avalanche Area	Essential Services Facilities	Bridge	1
Rockfall/Avalanche Area	Essential Services Facilities	Cell Tower	2
Rockfall/Avalanche Area	Essential Services Facilities	Fire Department	1
Rockfall/Avalanche Area	Essential Services Facilities	Microwave	28
Rockfall/Avalanche Area	Essential Services Facilities	Radio Tower	2
Rockfall/Avalanche Area	At Risk Population Facilities	Hazardous Material	1
Total			36
Slope-Failure Area	Essential Services Facilities	Bridge	1
Slope-Failure Area	Essential Services Facilities	Water Hub/Treatment	1
Total			2
Grand Total			40

Source: Douglas County GIS

Development Trends

Landslide hazard areas are located in every participating jurisdiction in this plan. Development in Douglas County is primarily encouraged in existing urban areas, and because landslide hazard areas are present in every jurisdiction in this plan, new structures in any of the jurisdictions could be at risk. Fortunately, the landslide hazard area in most jurisdictions is fairly small. Castle Rock and the unincorporated County have the most land at risk.

A total of 83 structures were built in landslide hazard areas in the unincorporated County, Castle Rock, Castle Pines, and Larkspur between 2010 and 2014. The large majority of these structures are located in rockfall hazard areas in the unincorporated County. Results of this analysis are shown in Table 4.77 and Table 4.78.

Table 4.77. Douglas County Structures Built from 2010 to 2014: Summary of Assets Exposed to Landslide Hazard Areas

Jurisdiction	Total Parcel Count	Improved Parcel Count	Total Building Count	Improved Value	Estimated Content Value	Land Value	Total Value
Castle Pines	6	6	7	\$4,728,514	\$2,364,257	\$1,209,000	\$8,301,771
Larkspur	2	2	2	\$118,254	\$53,651	\$76,000	\$247,905
Castle Rock	19	19	19	\$6,852,926	\$3,426,463	\$1,236,200	\$11,515,589
Unincorporated	54	54	55	\$21,003,852	\$10,816,843	\$7,234,834	\$39,055,529
Total	81	81	83	\$32,703,546	\$16,661,214	\$9,756,034	\$59,120,794

Source: Douglas County GIS

Table 4.78. Douglas County Structures Built from 2010 to 2014: Assets Exposed to Landslide/Debris Flows/Rockfall Hazard Areas

Property Type	Total Parcel Count	Improved Parcel Count	Total Building Count	Improved Value	Estimated Content Value	Land Value	Total Value
Debris Flow Area							
Castle Rock	1	1	1	\$354,228	\$177,114	\$52,000	\$583,342
Larkspur	2	2	2	\$118,254	\$53,651	\$76,000	\$247,905
Unincorporated	4	4	4	\$1,410,552	\$1,020,193	\$244,925	\$2,675,670
Total	7	7	7	\$1,883,034	\$1,250,958	\$372,925	\$3,506,917
Rockfall/Rockslide/Debris Avalanche Area							
Castle Pines	6	6	7	\$4,728,514	\$2,364,257	\$1,209,000	\$8,301,771
Castle Rock	16	16	16	\$6,289,724	\$3,144,862	\$1,054,200	\$10,488,786
Unincorporated	49	49	50	\$19,015,834	\$9,507,917	\$6,905,909	\$35,429,660
Total	71	71	73	\$30,034,072	\$15,017,036	\$9,169,109	\$54,220,217
Slope-Failure Area							
Castle Rock	2	2	2	\$208,974	\$104,487	\$130,000	\$443,461
Unincorporated	1	1	1	\$577,466	\$288,733	\$84,000	\$950,199
Total	3	3	3	\$786,440	\$393,220	\$214,000	\$1,393,660
Grand Total	81	81	83	\$32,703,546	\$16,661,214	\$9,756,034	\$59,120,794

Source: Douglas County GIS

4.3.8 Severe Weather: Thunderstorms and Heavy Rains Vulnerability Assessment

Likelihood of Future Occurrence—High

Potential Magnitude—Medium

Overall Vulnerability—Medium

According to historical hazard data, severe weather is an annual occurrence in Douglas County.

Damage and disaster declarations related to severe weather have occurred and will continue to occur in the future. Heavy rain and thunderstorms are the most frequent type of severe weather occurrences in the County. Lightning often accompanies these storms and has caused damage in the past. However, actual damage associated with the primary effects of severe weather has been limited. It is the secondary hazards caused by weather, such as floods, fire, and agricultural losses that have had the greatest impact on the County. The risk and vulnerability associated with these secondary hazards are discussed in other sections (Section 4.3.6 Flood: 100/500-year and Localized Stormwater).

Development Trends

New critical facilities such as communications towers should be built to withstand heavy rains and thunderstorms. While damages have occurred in the Planning Area in the past due to this kind of severe weather, it is difficult to quantify future deaths, injuries, or damages due to heavy rains or thunderstorms. Future development projects should consider severe weather hazards at the planning, engineering and architectural design stage with the goal of reducing vulnerability. Development trends in the County are not expected to increase vulnerability to the hazard.

4.3.9 Severe Weather: Winter Weather

Likelihood of Future Occurrence—High

Potential Magnitude—Low

Overall Vulnerability—Medium

Douglas County typically experiences multiple winter storms in any given year. This hazard has been critical in its magnitude and severity in the past, as seen during the blizzards of March 2003 and December 2006. Vulnerability is high along busy roadways, particularly on Interstate 25 and Highway 470, where severe winter weather conditions may cause traffic related deaths and injuries. Road closures due to winter weather conditions also restrict or prevent the movement of people and goods and services (including food and gas), which can create the need for emergency sheltering for travelers. Poor road conditions can also delay emergency response.

It is difficult to identify specific winter weather hazard areas within Douglas County. Data was not available to identify specific structures at risk or estimate potential losses to these structures. NCDC data did not provide enough details on past damages and casualties to obtain an average annual loss assessment. If the March 2003 blizzard is used as the event of record, then the Denver Metro area could expect over \$31 million in property damages from a severe winter storm. Note that this damage estimate is spread over the entire Denver Metro area; Douglas County's share of the damage would be smaller.

Development Trends

Future residential or commercial buildings built to code should be able to withstand snow loads from severe winter storms. Population growth in the County and growth in visitors will increase

problems with road, business, and school closures and increase the need for snow removal and emergency services related to severe winter weather events.

4.3.10 Soil Hazards: Erosion and Deposition

Likelihood of Future Occurrence—High

Potential Magnitude—Low

Overall Vulnerability—Medium

Two different areas of existing development are vulnerable to erosion. Erosion of soils due to slope grade, soil content and cover, and exposure to weather conditions is fairly limited and generally falls within underdeveloped areas. This is also due to the concurrence of erosion potential with other geologic hazard areas, such as dipping bedrock, which have been mapped by the County. Areas susceptible to wildfire-driven erosion, which often result in debris flow or the erosion and deposition of soil into watersheds, also does not usually directly impact developed areas but can impact transportation and drainage infrastructure. There are some areas of variance, particularly in the wildland-urban interface, where debris flows may impact housing and commercial districts. The larger concern centers on the pollution of the watersheds by soils, which impacts wildlife balances and degrades water quality for downstream habitats. Continued erosion and movement of soils in wildfire areas usually degrade watershed quality and thus exert a larger or disproportionate impact on the larger Planning Area. In addition, recovery for the washed out areas may be prolonged or difficult, as demonstrated in the burn areas of the Hayman fire, due to the loss of nutrient-rich soil. In this sense, ‘existing development’ may refer to any area vulnerable to wildfire, which covers an extensive portion of the Planning Area.

In addition to the general areas of existing vulnerability, scour critical bridges are also vulnerable to the effects of erosion and deposition. Erosion around bridges may compromise the construction of the structure, making them unsafe. Deposition may also press up against the structures, causing structural strain or sweeping out the structure by debris. In this instance, the vulnerability overlaps those identified in the debris flow section that follows.

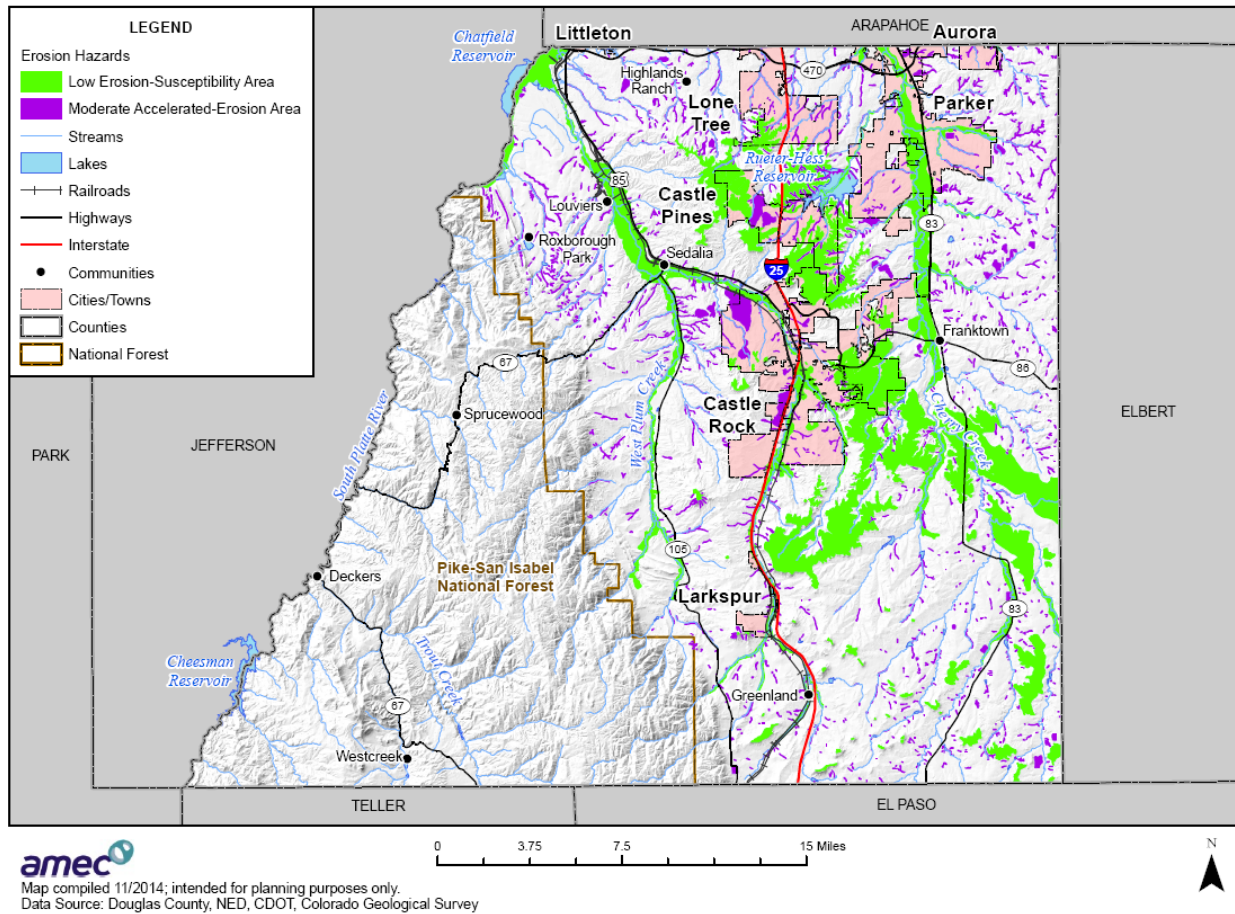
Response and recovery costs to address erosion problems from the Buffalo Creek fire in Jefferson County cost Denver Water alone over \$24 million. The cost of the Buffalo Creek fire can be used as an estimate of future losses in Douglas County. However, the exact cost will vary depending on whether wildfires and resulting erosion problems affect critical watersheds. Erosion has been an ongoing issue in the Hayman burn area and will likely continue to cause problems.

Methodology

According to the geologic hazard layer obtained by Douglas County and created by the Colorado Geological Survey there are erosion hazards in the Planning Area (see Figure 4.53). The geologic hazard layer includes spatial data on low and moderate accelerated erosion susceptibility. The County’s parcel layer was used as the basis for the inventory of all parcels within Douglas County. GIS was used to overlay the erosion hazard layer with the parcel layer centroids and where the

zones intersected a parcel centroid, it was assigned with that hazard zone for the entire parcel.

Figure 4.53. Douglas County Planning Area - Erosion Hazards



Values at Risk

The erosion layers, low and moderate accelerated erosion susceptibility, were intersected with the county parcel layer in GIS to obtain an estimate of property exposed to erosion hazards. Table 4.79 and Table 4.80 summarize the exposure of each jurisdiction to low erosion susceptibility areas and moderate accelerated erosion areas, respectively. Table 4.81 summarizes the exposure of jurisdictions and unincorporated Douglas County to the erosion hazard. More site specific analyses would be needed to characterize the true risk. There is significant exposure within the low erosion susceptibility areas with a total value of \$3.9 billion, which is a combination of improved values and land values. Castle Rock has the highest exposure to this hazard with a total value of \$1.5 billion. Castle Rock also has the most parcels exposed with 6,568 with 4,997 being improved parcels with an improved value of \$1.2 billion. Moderate accelerated erosion areas also have an impact to Douglas County with a total value of exposure of \$1.6 billion. Castle Rock has the most parcels exposed to moderate accelerated erosion with 2,144 with 1,915 being improved parcels and an improved value of \$384 million.

Table 4.79. Douglas County Planning Area – Summary of Assets Exposed to Low Erosion Susceptibility Areas

Jurisdiction	Total Parcel Count	Improved Parcel Count	Total Building Count	Improved Value	Land Value	Total Value
Castle Pines	2,095	1,818	1,986	\$657,534,162	\$180,677,968	\$838,212,130
Castle Rock	6,568	4,997	6,702	\$1,203,158,081	\$328,063,774	\$1,531,221,855
Larkspur	56	27	79	\$4,892,112	\$4,233,861	\$9,125,973
Lone Tree	16	1	3	\$554,071	\$411,624	\$965,695
Parker	2,686	2,073	3,326	\$583,712,863	\$233,560,551	\$817,273,414
Unincorporated	2,733	1,371	2,310	\$468,730,634	\$245,917,237	\$714,647,871
Total	14,154	10,287	14,406	\$2,918,581,923	\$992,865,015	\$3,911,446,938

Source: Douglas County Assessor's data

Table 4.80. Douglas County Planning Area – Summary of Assets Exposed to Moderate Accelerated Erosion Area

Jurisdiction	Total Parcel Count	Improved Parcel Count	Total Building Count	Improved Value	Land Value	Total Value
Castle Pines	845	523	772	\$151,911,353	\$49,608,760	\$201,520,113
Castle Rock	2,144	1,915	2,053	\$383,897,482	\$103,592,626	\$487,490,108
Larkspur	3	0	1	\$0	\$1,030	\$1,030
Lone Tree	40	14	49	\$20,811,382	\$12,588,747	\$33,400,129
Parker	265	210	281	\$167,312,517	\$22,868,525	\$190,181,042
Unincorporated	1,838	1,444	1,901	\$542,634,425	\$174,865,929	\$717,500,354
Total	5,135	4,106	5,057	\$1,266,567,159	\$363,525,617	\$1,630,092,776

Source: Douglas County Assessor's data

Table 4.81. Douglas County Planning Area – Summary of Assets Exposed to Erosion and Deposition – Low and Moderate Total

Jurisdiction	Total Parcel Count	Improved Parcel Count	Total Building Count	Improved Value	Land Value	Total Value
Castle Pines	2,940	2,341	2,758	\$809,445,515	\$230,286,728	\$1,039,732,243
Castle Rock	8,712	6,912	8,755	\$1,587,055,563	\$431,656,400	\$2,018,711,963
Larkspur	59	27	80	\$4,892,112	\$4,234,891	\$9,127,003
Lone Tree	56	15	52	\$21,365,453	\$13,000,371	\$34,365,824
Parker	2,951	2,283	3,607	\$751,025,380	\$256,429,076	\$1,007,454,456
Unincorporated	4,571	2,815	4,211	\$1,011,365,059	\$420,783,166	\$1,432,148,225
Total	19,289	14,393	19,463	\$4,185,149,082	\$1,356,390,632	\$5,541,539,714

Source: Douglas County Assessor's data

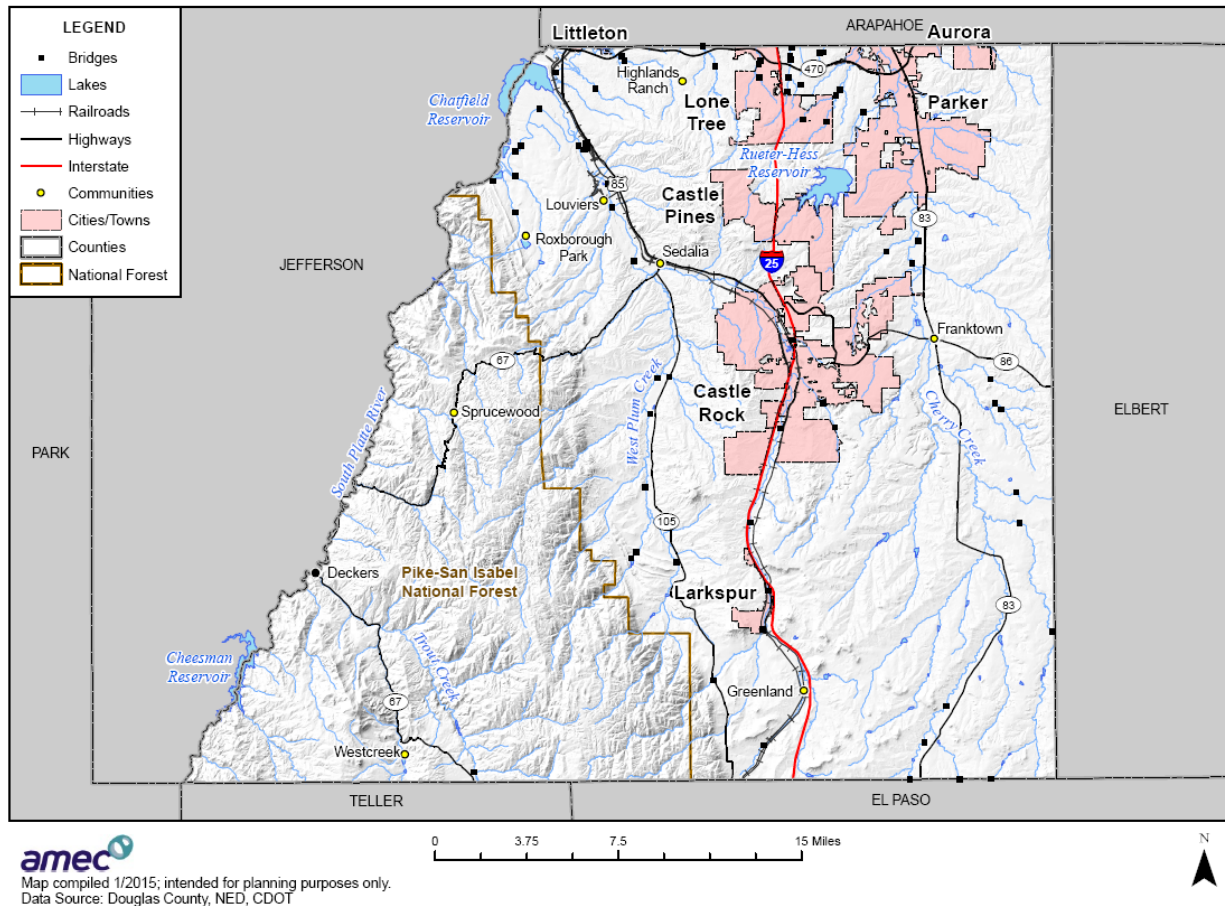
In addition to the general areas of existing vulnerability, scour critical bridges are also vulnerable to the effects of erosion and deposition. These bridges are depicted graphically in Figure 4.54. Table 4.82 lists the scour critical bridges in the Planning Area. Erosion around bridges may compromise the construction of the structure, making them unsafe. Deposition may also press up against the structures, causing structural strain or sweeping out the structure by debris.

Table 4.82. Scour Critical Bridges

Name	Road	Scour Index
Draw	SH 105	3
East Plum Creek	SH 67	3
West Cherry Creek	SH 83	3
Antelope Creek	SH 83	3

Source: Douglas County, NED, CDOT

Figure 4.54. Douglas County Bridges



Critical Facilities at Risk

Erosion analysis was performed on the critical facility inventory in Douglas County and all jurisdictions. GIS was used to determine whether the facility locations intersect erosion hazard areas provided by Douglas County, and if so, which zone they intersect. There are 294 total facilities in the Planning Area at risk in erosion zones, as shown in Table 4.83. The portion of Littleton that lies within Douglas County also has two critical facilities at risk to erosion. More details on erosion issues specific to each affected jurisdiction may be found in the individual annexes. Table 4.84 summarizes the critical facilities at risk to erosion in the unincorporated County by hazard area, critical facility category, facility type, and facility count. Details of critical facility definition, type, name and address and jurisdiction by landslide zone are listed in Appendix E.

Table 4.83. Douglas County Planning Area – Critical Facilities Exposure to Erosion

Jurisdiction	Low Erosion	Moderate Accelerated	Total Facility Count
Castle Pines	7	1	8
Castle Rock	74	7	81
Littleton	2	-	2
Lone Tree	-	3	3
Parker	52	9	61
Unincorporated County	121	18	139
Total	256	38	294

Source: Douglas County GIS

Table 4.84. Unincorporated Douglas County– Critical Facilities Exposure to Erosion

Erosion Hazard	Category	Type	Facility Count
Low Erosion Susceptibility Area	At Risk Population Facilities	Group Home	1
Low Erosion Susceptibility Area	At Risk Population Facilities	School	2
Low Erosion Susceptibility Area	Essential Services Facilities	Bridge	14
Low Erosion Susceptibility Area	Essential Services Facilities	Cell Tower	12
Low Erosion Susceptibility Area	Essential Services Facilities	Fire Department	4
Low Erosion Susceptibility Area	Essential Services Facilities	Microwave	25
Low Erosion Susceptibility Area	Essential Services Facilities	Radio Tower	3
Low Erosion Susceptibility Area	Essential Services Facilities	Water Hub/Treatment	6
Low Erosion Susceptibility Area	High Potential Loss Facilities	Dam	2
Low Erosion Susceptibility Area	High Potential Loss Facilities	Hazardous Material	52
Total			121
Moderate Accelerated Erosion Area	At Risk Population Facilities	Assisted Living	3
Moderate Accelerated Erosion Area	At Risk Population Facilities	Group Home	1
Moderate Accelerated Erosion Area	Essential Services Facilities	Bridge	8
Moderate Accelerated Erosion Area	High Potential Loss Facilities	Hazardous Material	6
Total			18
Grand Total			139

Source: Douglas County GIS

Development Trends

Development on steep slopes is discouraged in the County’s Comprehensive Master Plan (Section 9); therefore, future development exposed to slope-driven erosion is unlikely. Future developments may be vulnerable to erosion exacerbated by flooding, high winds, and wildfires.

A total of 257 structures were built in moderate-accelerated erosion hazard areas in the unincorporated County, Castle Rock, Castle Pines, Parker, and Lone Tree between 2010 and 2014. Results of this analysis are shown in Table 4.85.

Table 4.85. Douglas County Structures Built from 2010 to 2014: Summary of Assets Exposed to Moderate Accelerated-Erosion Areas by Jurisdiction

Jurisdiction	Total Parcel Count	Improved Parcel Count	Total Building Count	Improved Value	Estimated Content Value	Land Value	Total Value
Castle Pines	35	35	35	\$9,346,720	\$4,673,360	\$2,776,250	\$16,796,330
Castle Rock	105	105	105	\$20,306,057	\$10,153,029	\$4,995,400	\$35,454,486
Lone Tree	1	1	7	\$4,964,468	\$4,964,468	\$3,372,415	\$13,301,351
Parker	14	14	14	\$2,907,881	\$1,453,941	\$848,050	\$5,209,872
Unincorporated	95	95	96	\$33,820,811	\$17,597,547	\$9,800,846	\$61,219,204
Total	250	250	257	\$71,345,937	\$38,842,344	\$21,792,961	\$131,981,242

Source: Douglas County GIS

4.3.11 Wildfire Vulnerability Assessment

Likelihood of Future Occurrence—High

Potential Magnitude—High

Overall Vulnerability—High

Risk and vulnerability to the Douglas County Planning Area from wildfire is of significant concern, with some areas of the Planning Area being at greater risk than others as described further in this section. High fuel loads in parts of the Planning Area, along with geographical and topographical features, create the potential for both natural and human-caused fires that can result in loss of life and property. These factors, combined with natural weather conditions common to the area, including periods of drought, high temperatures, low relative humidity, and periodic winds, can result in frequent and sometimes catastrophic fires. During fire season, the dry vegetation and hot and sometimes windy weather, combined with continued growth in the WUI areas, results in an increase in the number of ignitions. Any fire, once ignited, has the potential to quickly become a large, out-of-control fire. As development continues throughout the Planning Area, especially in these interface areas, the risk and vulnerability to wildfires will likely increase.

Douglas County Community Wildfire Protection Plan

The 2011 Douglas County CWPP was developed by a Core Team derived from 11 local fire protection districts; Douglas County Emergency Management, Open Space and Natural Resources, Engineering, Public Works Operations Division, and Public Affairs; CSFS, Denver Water, and USFS South Platte Ranger District (SPRD). The full list of collaborating agencies is provided on pages 2 and 11 of the CWPP.

The Wildfire Hazard Potential Map from the CWPP, shown in Figure 4.55, was used as a basis for the quantitative wildfire vulnerability analysis. This map shows wildfire hazard across Douglas County's as a composite analysis of controllability, values, and ignition risk. The Wildfire Hazard Potential Map has detailed information making it possible to develop a more precise quantitative

vulnerability analysis. The methodology is discussed in further detail in the next section.

The Douglas County CWPP contains a second map (Figure 4.56) showing land ownership, wildfire treatment recommendations, and community hazard rankings. The community hazard rankings are based on an average of the values shown in the Wildfire Hazard Potential map. Community hazard rankings include mixed, moderate, high, very high, and extreme hazard, listed in increasing order of the severity. The mixed category is used where hazard rankings can vary within a community. It is important to note that many of the larger mixed areas are located within major urban communities such as Castle Rock and Lone Tree. Colorado has experienced devastating fires in well-developed areas, such as the High Park and Waldo Canyon fires of 2012.

Figure 4.55. Douglas County Wildfire Hazard Potential

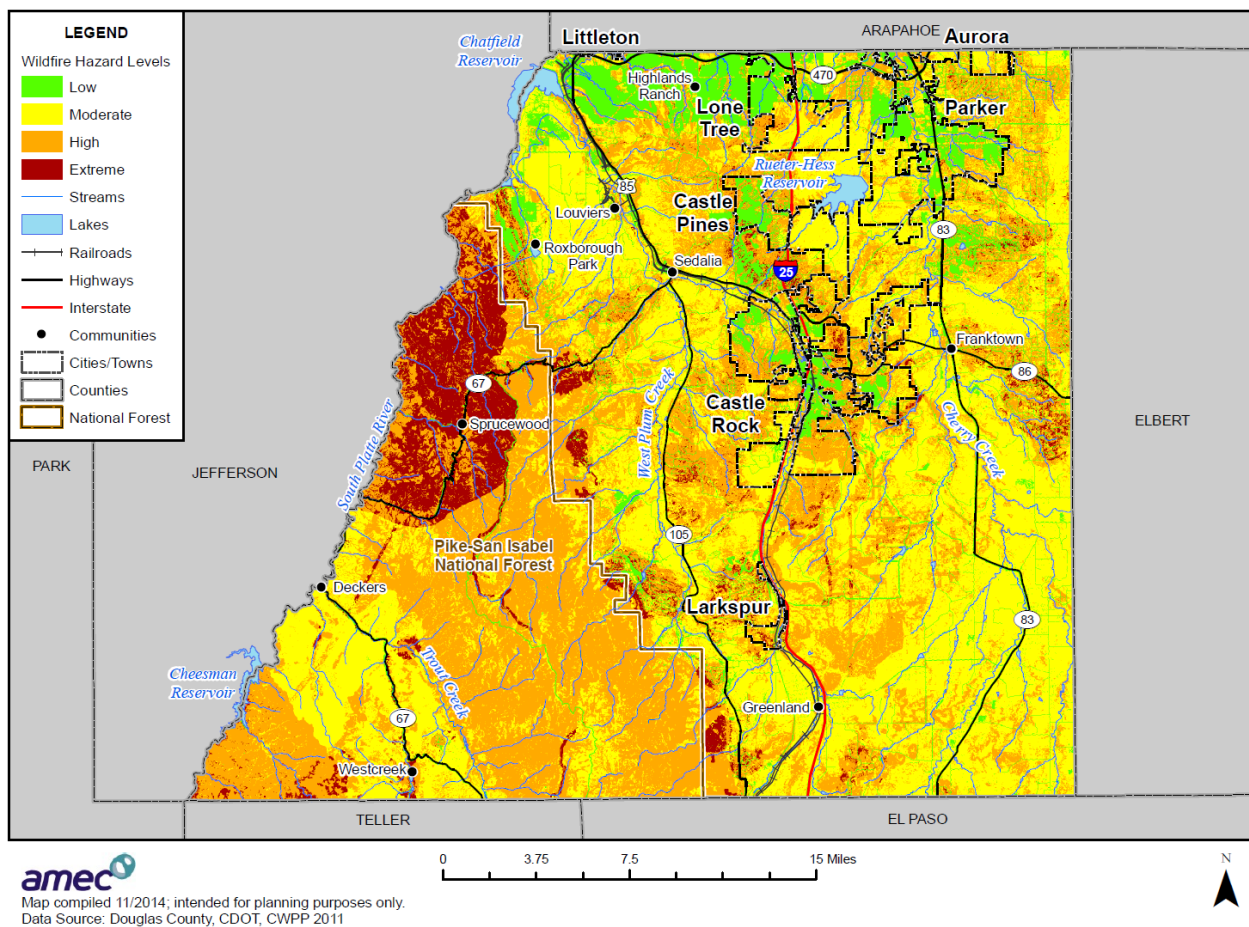
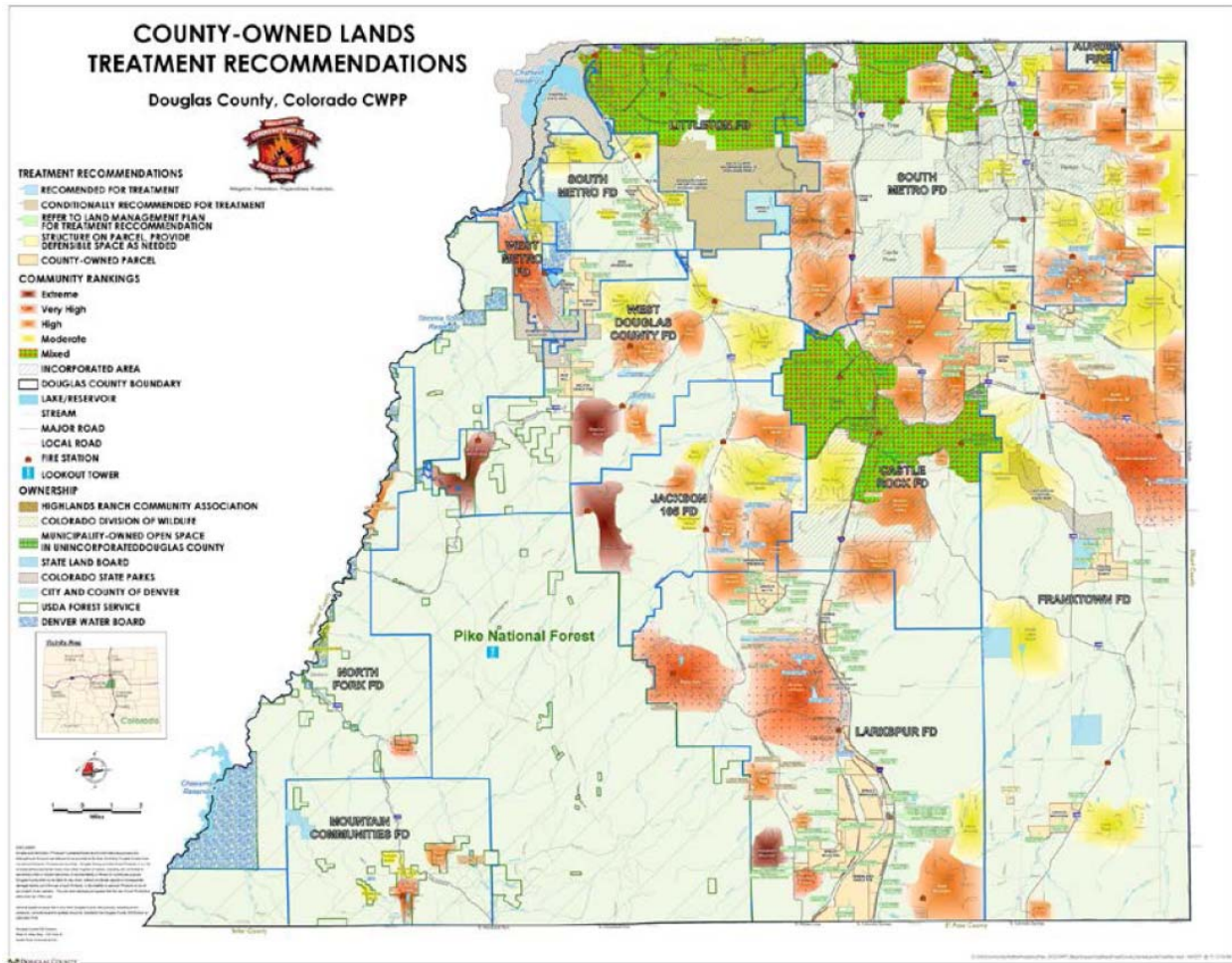


Figure 4.56. County-Owned Lands Treatment Recommendations Map



Methodology

An exposure analysis was performed to quantify risk to wildfire. Potential losses to wildfire were estimated using a countywide Wildfire Hazard Potential GIS layer (created for the Douglas County Community Wildfire Protection Plan) and assessor’s data from Douglas County. Potential losses were examined in terms of structures, property value, critical facilities, and people at risk. For all analyses, the threat levels were classified as low, medium, high, and extreme. According to the CWPP, “[t]here is no absolute set of conditions that cause an area to be identified as being in a particular hazard category. Instead, the hazard category identified is a function of the combined factors that influence controllability, values, and ignition risk” (pg. 59).

GIS was used to create a centroid, or point representing the center of the parcel polygon. The CWPP’s Wildfire Hazard Potential layer was then overlaid on the parcel centroids. For the purposes of this analysis, the fire hazard zone that intersected a parcel centroid was assigned the severity zone for the entire parcel. The model assumes that every parcel with a structure value greater than zero is improved in some way. Specifically, an improved parcel assumes there is a

building on it.

It is important to note that there could be more than one structure or building on an improved parcel (e.g., condo complex occupies one parcel but might have several structures). Only improved parcels and the value of their improvements were analyzed. The end result is an inventory of the number and types of parcels and buildings subject to the hazards. Results are presented by unincorporated county and incorporated jurisdictions. Detailed tables show counts of parcels by jurisdictions and land use type (Agriculture, Commercial, Exempt, HOA, Industrial, Producing Mine, Residential, Utilities and Vacant Land) within each fire zone.

Fire Severity Values at Risk

Results are represented and sorted by the unincorporated county and jurisdictions. Detailed tables show total parcel counts, improved parcel counts and their structure values by occupancy type (residential, industrial, etc.) and total land values within each fire severity zone. Table 4.86 shows the total counts and structure values of improved parcels in Douglas County.

According to the analysis represented in Table 4.86, Unincorporated Douglas County has 1,440 improved parcels and over \$995 million in total value in the extreme severity zone. Of the 1,440 parcels, 1,394 are residential. There is a total of 21,134 improved parcels in the high fire severity zone, 20,514 of which are residential. The total value and loss estimate for the high fire hazard is \$15.6 billion which includes estimated content, improved value and land value.

Table 4.86. Fire Risk by Jurisdiction and Property Type

Jurisdiction	Property Type	Total Parcel Count	Improved Parcel Count	Total Structure Count	Improved Value	Estimated Content Value	Land Value	Total Value/Loss Estimate
Extreme								
Castle Pines	Agricultural	1	0	0	\$0	\$0	\$110	\$110
	Commercial	2	0	0	\$0	\$0	\$17,438	\$17,438
	Exempt	6	0	4	\$0	\$0	\$216,876	\$216,876
	HOA	3	0	0	\$0	\$0	\$0	\$0
	Residential	42	39	42	\$16,998,350	\$8,499,175	\$5,080,950	\$30,578,475
	Total	54	39	46	\$16,998,350	\$8,499,175	\$5,315,374	\$30,812,899
Castle Rock	Agricultural	2	0	0	\$0	\$0	\$786	\$786
	Commercial	1	1	27	\$11,113,512	\$11,113,512	\$2,836,488	\$25,063,512
	Exempt	11	1	2	\$8,191,530	\$8,191,530	\$1,286,612	\$17,669,672
	HOA	12	0	2	\$0	\$0	\$0	\$0
	Residential	100	88	100	\$33,284,971	\$16,642,486	\$5,881,772	\$55,809,229
	Vacant Land	31	0	32	\$0	\$0	\$1,802,335	\$1,802,335
	Total	157	90	163	\$52,590,013	\$35,947,528	\$11,807,993	\$100,345,534
Larkspur	Exempt	1	0	0	\$0	\$0	\$50,000	\$50,000
	Residential	1	1	1	\$408,667	\$204,334	\$120,000	\$733,001
	Total	2	1	1	\$408,667	\$204,334	\$170,000	\$783,001
Lone Tree	Agricultural	1	0	0	\$0	\$0	\$3,605	\$3,605
	Commercial	1	1	39	\$5,097,321	\$5,097,321	\$222,679	\$10,417,321
	Exempt	2	0	0	\$0	\$0	\$628,752	\$628,752
	Residential	6	4	6	\$1,924,323	\$962,162	\$652,637	\$3,539,122
	Total	10	5	45	\$7,021,644	\$6,059,483	\$1,507,673	\$14,588,800
Parker	Exempt	3	0	0	\$0	\$0	\$201,924	\$201,924
	HOA	2	0	0	\$0	\$0	\$0	\$0
	Residential	5	5	5	\$1,550,702	\$775,351	\$370,000	\$2,696,053
	Vacant Land	1	0	1	\$0	\$0	\$43,368	\$43,368
	Total	11	5	6	\$1,550,702	\$775,351	\$615,292	\$2,941,345
Unincorporated	Agricultural	52	19	37	\$6,416,024	\$6,416,024	\$208,170	\$13,040,218
	Commercial	11	3	4	\$808,207	\$808,207	\$850,640	\$2,467,054
	Exempt	137	19	76	\$5,130,889	\$5,130,889	\$48,860,971	\$59,122,749
	HOA	53	0	9	\$0	\$0	\$0	\$0
	Producing Mine	1	0	1	\$0	\$0	\$9,207	\$9,207
	Residential	1,504	1,394	1,500	\$476,585,766	\$238,292,883	\$179,488,883	\$894,367,532
	Vacant Land	563	5	530	\$4,753	\$0	\$26,618,913	\$26,623,666
	Total	2,321	1,440	2,157	\$488,945,639	\$250,648,003	\$256,036,784	\$995,630,426
Grand Total	2,555	1,580	2,418	\$567,515,015	\$302,133,873	\$275,453,116	\$1,145,102,004	

Jurisdiction	Property Type	Total Parcel Count	Improved Parcel Count	Total Structure Count	Improved Value	Estimated Content Value	Land Value	Total Value/Loss Estimate
High								
Castle Pines	Agricultural	91	0	81	\$0	\$0	\$15,506	\$15,506
	Commercial	6	3	53	\$10,480,397	\$10,480,397	\$4,669,961	\$25,630,755
	Exempt	78	3	42	\$14,001,304	\$14,001,304	\$2,216,824	\$30,219,432
	HOA	60	0	20	\$0	\$0	\$0	\$0
	Residential	726	667	721	\$278,070,150	\$139,035,075	\$78,531,194	\$495,636,419
	Utilities	4	0	1	\$0	\$0	\$0	\$0
	Vacant Land	22	1	31	\$719,766	\$0	\$3,660,247	\$4,380,013
	Total	987	674	949	\$303,271,617	\$163,516,776	\$89,093,732	\$555,882,125
Castle Rock	Agricultural	254	2	201	\$277,506	\$277,506	\$536,121	\$1,091,133
	Commercial	40	31	131	\$94,535,214	\$94,535,214	\$25,335,193	\$214,405,621
	Exempt	462	33	134	\$132,224,647	\$132,224,647	\$45,624,269	\$310,073,563
	HOA	310	0	214	\$0	\$0	\$0	\$0
	Industrial	3	3	9	\$1,950,632	\$2,925,948	\$1,384,097	\$6,260,677
	Residential	6,146	5,671	6,339	\$1,501,319,158	\$750,659,579	\$313,622,015	\$2,565,600,752
	Utilities	3	0	1	\$0	\$0	\$0	\$0
	Vacant Land	1,631	4	1,541	\$488,544	\$0	\$47,944,926	\$48,433,470
Total	8,849	5,744	8,570	\$1,730,795,701	\$980,622,894	\$434,446,621	\$3,145,865,216	
Larkspur	Agricultural	3	0	3	\$0	\$0	\$5,803	\$5,803
	Commercial	13	7	62	\$2,589,647	\$2,589,647	\$2,736,850	\$7,916,144
	Exempt	22	6	10	\$1,123,252	\$1,123,252	\$1,405,019	\$3,651,523
	Industrial	1	1	5	\$748,789	\$1,123,184	\$126,187	\$1,998,160
	Residential	18	16	49	\$2,630,693	\$1,315,347	\$1,176,113	\$5,122,153
	Utilities	3	0	0	\$0	\$0	\$0	\$0
	Vacant Land	7	0	4	\$0	\$0	\$758,829	\$758,829
	Total	67	30	133	\$7,092,381	\$6,151,429	\$6,208,801	\$19,452,611
Lone Tree	Agricultural	13	0	1	\$0	\$0	\$9,392	\$9,392
	Commercial	20	16	513	\$80,388,930	\$80,388,930	\$20,747,847	\$181,525,707
	Exempt	71	6	27	\$10,742,121	\$10,742,121	\$3,905,144	\$25,389,386
	HOA	31	0	7	\$0	\$0	\$0	\$0
	Residential	586	471	734	\$234,949,940	\$117,474,970	\$61,363,582	\$413,788,492
	Vacant Land	44	0	14	\$0	\$0	\$5,172,525	\$5,172,525
	Total	765	493	1,296	\$326,080,991	\$208,606,021	\$91,198,490	\$625,885,502
Parker	Agricultural	13	1	1	\$3,942	\$3,942	\$12,096	\$19,980
	Commercial	60	41	205	\$79,048,137	\$79,048,137	\$32,299,144	\$190,395,418
	Exempt	208	16	24	\$69,031,437	\$69,031,437	\$42,672,922	\$180,735,796
	HOA	165	0	12	\$0	\$0	\$0	\$0
	Industrial	1	1	1	\$246,834	\$370,251	\$152,460	\$769,545
	Producing Mine	1	0	0	\$0	\$0	\$58,292	\$58,292

Jurisdiction	Property Type	Total Parcel Count	Improved Parcel Count	Total Structure Count	Improved Value	Estimated Content Value	Land Value	Total Value/Loss Estimate
	Residential	1,971	1,851	2,073	\$474,077,857	\$237,038,929	\$139,668,558	\$850,785,344
	Utilities	2	0	0	\$0	\$0	\$0	\$0
	Vacant Land	515	0	502	\$0	\$0	\$32,858,315	\$32,858,315
	Total	2,936	1,910	2,818	\$622,408,207	\$385,492,696	\$247,721,787	\$1,255,622,690
Unincorporated	Agricultural	853	254	549	\$120,519,044	\$120,519,044	\$7,962,593	\$249,000,681
	Commercial	123	83	977	\$292,815,314	\$292,815,314	\$87,033,084	\$672,663,712
	Exempt	1,158	85	476	\$259,127,986	\$259,127,986	\$355,746,449	\$874,002,421
	HOA	388	0	103	\$0	\$0	\$0	\$0
	Industrial	15	15	55	\$35,655,210	\$53,482,815	\$8,607,296	\$97,745,321
	Producing Mine	8	0	0	\$0	\$0	\$121,339	\$121,339
	Residential	12,415	11,838	13,844	\$4,220,933,381	\$2,110,466,691	\$1,624,930,848	\$7,956,330,920
	Utilities	33	0	12	\$0	\$0	\$197,376	\$197,376
	Vacant Land	1,686	8	1,491	\$2,531,254	\$0	\$132,971,553	\$135,502,807
	Total	16,679	12,283	17,507	\$4,931,582,189	\$2,836,411,850	\$2,217,570,538	\$9,985,564,577
	Grand Total	30,283	21,134	31,273	7,921,231,086	4,580,801,665	3,086,239,969	15,588,272,720
Moderate								
Castle Pines	Agricultural	36	0	27	\$0	\$0	\$81,846	\$81,846
	Commercial	11	8	412	\$50,457,223	\$50,457,223	\$14,185,679	\$115,100,125
	Exempt	20	2	6	\$8,200,874	\$8,200,874	\$4,104,896	\$20,506,644
	HOA	17	0	5	\$0	\$0	\$0	\$0
	Residential	139	129	139	\$65,623,575	\$32,811,788	\$18,367,843	\$116,803,206
	Utilities	1	0	0	\$0	\$0	\$0	\$0
	Vacant Land	3	0	1	\$0	\$0	\$884,722	\$884,722
	Total	227	139	590	\$124,281,672	\$91,469,885	\$37,624,986	\$253,376,543
Castle Rock	Agricultural	939	0	817	\$0	\$0	\$94,130	\$94,130
	Commercial	40	33	167	\$62,343,982	\$62,343,982	\$29,676,239	\$154,364,203
	Exempt	226	15	101	\$124,658,072	\$124,658,072	\$37,942,118	\$287,258,262
	HOA	169	0	57	\$0	\$0	\$0	\$0
	Industrial	1	1	2	\$3,783,814	\$5,675,721	\$956,186	\$10,415,721
	Residential	3,313	2,910	3,467	\$695,396,201	\$347,698,101	\$148,062,762	\$1,191,157,064
	Utilities	5	0	0	\$0	\$0	\$0	\$0
	Vacant Land	694	2	624	\$553,199	\$0	\$29,130,296	\$29,683,495
Total	5,387	2,961	5,235	\$886,735,268	\$540,375,876	\$245,861,731	\$1,672,972,875	
Larkspur	Agricultural	2	0	0	\$0	\$0	\$289	\$289
	Commercial	2	1	2	\$201,920	\$201,920	\$267,612	\$671,452
	Exempt	7	2	3	\$266,615	\$266,615	\$379,702	\$912,932
	Residential	14	13	16	\$1,330,019	\$665,010	\$675,000	\$2,670,029
	Utilities	1	0	0	\$0	\$0	\$0	\$0
	Vacant Land	4	0	4	\$0	\$0	\$146,000	\$146,000

Jurisdiction	Property Type	Total Parcel Count	Improved Parcel Count	Total Structure Count	Improved Value	Estimated Content Value	Land Value	Total Value/Loss Estimate
	Total	30	16	25	\$1,798,554	\$1,133,545	\$1,468,603	\$4,400,702
Lone Tree	Agricultural	33	0	13	\$0	\$0	\$77,609	\$77,609
	Commercial	47	30	442	\$373,391,194	\$373,391,194	\$109,645,101	\$856,427,489
	Exempt	91	6	23	\$27,708,768	\$27,708,768	\$8,961,283	\$64,378,819
	HOA	33	0	5	\$0	\$0	\$0	\$0
	Residential	448	397	493	\$177,195,414	\$88,597,707	\$40,626,251	\$306,419,372
	Vacant Land	48	0	16	\$0	\$0	\$11,961,947	\$11,961,947
	Total	700	433	992	\$578,295,376	\$489,697,669	\$171,272,191	\$1,239,265,236
Parker	Agricultural	11	1	2	\$86,185	\$86,185	\$162,992	\$335,362
	Commercial	100	72	407	\$307,127,785	\$307,127,785	\$72,655,017	\$686,910,587
	Exempt	291	21	56	\$91,363,483	\$91,363,483	\$32,749,203	\$215,476,169
	HOA	190	0	17	\$0	\$0	\$0	\$0
	Industrial	3	3	17	\$3,610,095	\$5,415,143	\$612,585	\$9,637,823
	Residential	3,223	3,112	3,389	\$780,282,226	\$390,141,113	\$224,286,253	\$1,394,709,592
	Utilities	12	0	4	\$0	\$0	\$0	\$0
	Vacant Land	714	2	561	\$117,696	\$0	\$32,258,760	\$32,376,456
Total	4,544	3,211	4,453	\$1,182,587,470	\$794,133,709	\$362,724,810	\$2,339,445,989	
Unincorporated	Agricultural	2,474	688	1,685	\$266,017,677	\$266,017,677	\$16,093,927	\$548,129,281
	Commercial	109	85	1,383	\$357,467,930	\$357,467,930	\$106,350,371	\$821,286,231
	Exempt	1,181	115	453	\$180,464,428	\$180,464,428	\$291,244,814	\$652,173,670
	HOA	300	1	149	\$2,522,088	\$2,522,088	\$360,000	\$5,404,176
	Industrial	33	32	54	\$29,588,590	\$44,382,885	\$14,142,056	\$88,113,531
	Producing Mine	11	0	5	\$0	\$0	\$1,090,654	\$1,090,654
	Residential	8,550	7,253	9,665	\$2,554,513,763	\$1,277,256,882	\$990,120,854	\$4,821,891,499
	Utilities	58	0	32	\$0	\$0	\$0	\$0
	Vacant Land	1,745	3	2,165	\$16,604	\$0	\$115,525,270	\$115,541,874
	Total	14,461	8,177	15,591	\$3,390,591,080	\$2,128,111,890	\$1,534,927,946	\$7,053,630,916
Grand Total	25,349	14,937	26,886	\$6,164,289,420	\$4,044,922,572	\$2,353,880,267	\$12,563,092,259	
Low								
Castle Pines	Agricultural	42	0	40	\$0	\$0	\$6,826	\$6,826
	Commercial	26	18	66	\$19,796,264	\$19,796,264	\$8,539,880	\$48,132,408
	Exempt	135	4	20	\$14,145,527	\$14,145,527	\$9,888,687	\$38,179,741
	HOA	161	0	43	\$0	\$0	\$0	\$0
	Residential	2,501	2,464	2,532	\$802,770,372	\$401,385,186	\$224,606,689	\$1,428,762,247
	Vacant Land	62	0	34	\$0	\$0	\$1,748,241	\$1,748,241
	Total	2,927	2,486	2,735	\$836,712,163	\$435,326,977	\$244,790,323	\$1,516,829,463
Castle Rock	Agricultural	112	2	87	\$7,313	\$7,313	\$13,038	\$27,664
	Commercial	372	353	1,408	\$352,019,144	\$352,019,144	\$142,783,657	\$846,821,945
	Exempt	702	70	242	\$299,398,569	\$299,398,569	\$31,304,730	\$630,101,868

Jurisdiction	Property Type	Total Parcel Count	Improved Parcel Count	Total Structure Count	Improved Value	Estimated Content Value	Land Value	Total Value/Loss Estimate
	HOA	221	0	85	\$0	\$0	\$0	\$0
	Industrial	21	21	37	\$14,849,052	\$22,273,578	\$10,582,039	\$47,704,669
	Residential	8,508	8,415	8,543	\$1,561,307,936	\$780,653,968	\$376,602,295	\$2,718,564,199
	Utilities	10	0	7	\$0	\$0	\$0	\$0
	Vacant Land	280	0	142	\$0	\$0	\$15,800,405	\$15,800,405
	Total	10,226	8,861	10,551	\$2,227,582,014	\$1,454,352,572	\$577,086,164	\$4,259,020,750
Larkspur	Agricultural	1	0	0	\$0	\$0	\$16	\$16
	Commercial	12	8	15	\$2,298,636	\$2,298,636	\$631,181	\$5,228,453
	Exempt	12	1	5	\$325,137	\$325,137	\$90,686	\$740,960
	Residential	23	18	23	\$1,739,320	\$869,660	\$932,000	\$3,540,980
	Vacant Land	4	0	2	\$0	\$0	\$102,000	\$102,000
	Total	52	27	45	\$4,363,093	\$3,493,433	\$1,755,883	\$9,612,409
Lone Tree	Commercial	127	122	1,236	\$524,505,980	\$524,505,980	\$238,606,599	\$1,287,618,559
	Exempt	291	17	99	\$46,915,488	\$46,915,488	\$15,285,622	\$109,116,598
	HOA	110	0	36	\$0	\$0	\$0	\$0
	Residential	2,538	2,526	2,563	\$956,489,388	\$478,244,694	\$265,375,780	\$1,700,109,862
	Vacant Land	74	0	15	\$0	\$0	\$7,989,951	\$7,989,951
	Total	3,140	2,665	3,949	\$1,527,910,856	\$1,049,666,162	\$527,257,952	\$3,104,834,970
Parker	Agricultural	5	0	1	\$0	\$0	\$2,668	\$2,668
	Commercial	294	265	1,362	\$378,914,244	\$378,914,244	\$146,887,190	\$904,715,678
	Exempt	876	48	68	\$100,234,459	\$100,234,459	\$45,519,221	\$245,988,139
	HOA	348	0	11	\$0	\$0	\$0	\$0
	Industrial	20	20	48	\$13,547,597	\$20,321,396	\$5,183,245	\$39,052,238
	Residential	9,240	9,203	9,678	\$1,752,393,209	\$876,196,605	\$509,783,148	\$3,138,372,962
	Utilities	4	0	0	\$0	\$0	\$0	\$0
	Vacant Land	171	0	65	\$0	\$0	\$14,537,844	\$14,537,844
Total	10,958	9,536	11,233	\$2,245,089,509	\$1,375,666,703	\$721,913,316	\$4,342,669,528	
Unincorporated	Agricultural	148	50	80	\$15,434,782	\$15,434,782	\$626,410	\$31,495,974
	Commercial	592	529	7,491	\$1,469,123,095	\$1,469,123,095	\$517,723,062	\$3,455,969,252
	Exempt	2,910	127	762	\$498,394,439	\$498,394,439	\$183,731,467	\$1,180,520,345
	HOA	566	0	174	\$0	\$0	\$0	\$0
	Industrial	92	90	152	\$99,339,996	\$149,009,994	\$34,715,347	\$283,065,337
	Residential	35,618	35,463	36,672	\$8,774,810,455	\$4,387,405,228	\$2,448,460,115	\$15,610,675,798
	Utilities	57	0	27	\$0	\$0	\$0	\$0
	Vacant Land	615	1	948	\$313,308	\$0	\$51,490,947	\$51,804,255
Total	40,598	36,260	46,306	\$10,857,416,075	\$6,519,367,538	\$3,236,747,348	\$20,613,530,961	
Grand Total	67,901	59,835	74,819	\$17,699,073,710	\$10,837,873,385	\$5,309,550,986	\$33,846,498,081	

Analysis results for the entire Douglas County Planning Area are summarized in Table 4.87 which summarizes total parcel counts, improved parcel counts, structure counts and their structure and land values.

Table 4.87. Summary of Fire Risk by Jurisdiction

Jurisdiction	Total Parcel Count	Improved Parcel Count	Total Building Count	Improved Value	Estimated Content Value	Land Value	Total Value/Loss Estimate
Extreme							
Castle Pines	54	39	46	\$16,998,350	\$8,499,175	\$5,315,374	\$30,812,899
Castle Rock	157	90	163	\$52,590,013	\$35,947,528	\$11,807,993	\$100,345,534
Larkspur	2	1	1	\$408,667	\$204,334	\$170,000	\$783,001
Lone Tree	10	5	45	\$7,021,644	\$6,059,483	\$1,507,673	\$14,588,800
Parker	11	5	6	\$1,550,702	\$775,351	\$615,292	\$2,941,345
Unincorporated	2,321	1,440	2,157	\$488,945,639	\$250,648,003	\$256,036,784	\$995,630,426
Total	2,555	1,580	2,418	\$567,515,015	\$302,133,873	\$275,453,116	\$1,145,102,004
High							
Castle Pines	987	674	949	\$303,271,617	\$163,516,776	\$89,093,732	\$555,882,125
Castle Rock	8,849	5,744	8,570	\$1,730,795,701	\$980,622,894	\$434,446,621	\$3,145,865,216
Larkspur	67	30	133	\$7,092,381	\$6,151,429	\$6,208,801	\$19,452,611
Lone Tree	765	493	1,296	\$326,080,991	\$208,606,021	\$91,198,490	\$625,885,502
Parker	2,936	1,910	2,818	\$622,408,207	\$385,492,696	\$247,721,787	\$1,255,622,690
Unincorporated	16,679	12,283	17,507	\$4,931,582,189	\$2,836,411,850	\$2,217,570,538	\$9,985,564,577
Total	30,283	21,134	31,273	\$7,921,231,086	\$4,580,801,665	\$3,086,239,969	\$15,588,272,720
Moderate							
Castle Pines	227	139	590	\$124,281,672	\$91,469,885	\$37,624,986	\$253,376,543
Castle Rock	5,387	2,961	5,235	\$886,735,268	\$540,375,876	\$245,861,731	\$1,672,972,875
Larkspur	30	16	25	\$1,798,554	\$1,133,545	\$1,468,603	\$4,400,702
Lone Tree	700	433	992	\$578,295,376	\$489,697,669	\$171,272,191	\$1,239,265,236
Parker	4,544	3,211	4,453	\$1,182,587,470	\$794,133,709	\$362,724,810	\$2,339,445,989
Unincorporated	14,461	8,177	15,591	\$3,390,591,080	\$2,128,111,890	\$1,534,927,946	\$7,053,630,916
Total	25,349	14,937	26,886	\$6,164,289,420	\$4,044,922,572	\$2,353,880,267	\$12,563,092,259
Low							
Castle Pines	2,927	2,486	2,735	\$836,712,163	\$435,326,977	\$244,790,323	\$1,516,829,463
Castle Rock	10,226	8,861	10,551	\$2,227,582,014	\$1,454,352,572	\$577,086,164	\$4,259,020,750
Larkspur	52	27	45	\$4,363,093	\$3,493,433	\$1,755,883	\$9,612,409
Lone Tree	3,140	2,665	3,949	\$1,527,910,856	\$1,049,666,162	\$527,257,952	\$3,104,834,970
Parker	10,958	9,536	11,233	\$2,245,089,509	\$1,375,666,703	\$721,913,316	\$4,342,669,528
Unincorporated	40,598	36,260	46,306	\$10,857,416,075	\$6,519,367,538	\$3,236,747,348	\$20,613,530,961
Total	67,901	59,835	74,819	\$17,699,073,710	\$10,837,873,385	\$5,309,550,986	\$33,846,498,081

Populations at Risk

Wildfire risk is greatest to those individuals residing in identified hazard areas. GIS analysis was performed to determine population in the different fire hazard areas. Using GIS, the Douglas County wildfire layers were overlaid on the entire parcel layer. Those parcel centroids that intersect the wildfire hazard potential areas were counted and multiplied by the 2010 Census Bureau average household factors for each jurisdiction and unincorporated area: Castle Pines (2.70), Castle Rock (2.86), Larkspur (2.26), Lone Tree (2.54), Parker (2.71) and Unincorporated areas (2.79); results were tabulated by jurisdiction (see Table 4.88). According to this analysis, there is a total population of 99,947 at risk to moderate, high and extreme wildfire hazards with a total population of 4,272 in the extreme area, 57,297 in the high area, and 38,378 in the moderate hazard area. The Castle Rock jurisdiction has the highest population of potential risk for fire hazards. There is an estimated population of 252 in Castle Rock at risk in the extreme area, 16,219 in the high area, and 8,323 in the moderate area.

Table 4.88. Population at Risk to Wildfire

Jurisdiction	Extreme		High		Moderate		Low	
	Improved Residential Parcels	Population	Improved Residential Parcels	Population	Improved Residential Parcels	Population	Improved Residential Parcels	Population
Castle Pines	39	105	667	1,801	129	348	2,464	6,653
Castle Rock	88	252	5,671	16,219	2,910	8,323	8,415	24,067
Larkspur	1	2	16	36	13	29	18	41
Lone Tree	4	10	471	1,196	397	1,008	2,526	6,416
Parker	5	14	1,851	5,016	3,112	8,434	9,203	24,940
Unincorporated	1,394	3,889	11,838	33,028	7,253	20,236	35,463	98,942
Total	1,531	4,272	20,514	57,297	13,814	38,378	58,089	161,058

Critical Facilities at Risk

Wildfire analysis was performed on the critical facility inventory in Douglas County and all jurisdictions. GIS was used to determine whether the facility locations intersect a wildfire hazard area. There are 15 facilities in the extreme fire severity zone, 513 facilities in the high fire severity zone, 301 facilities in the moderate fire severity zone, and 682 facilities in the low fire severity zones, as shown in Table 4.89. Details of critical facility definition, type, name and address and jurisdiction by wildfire zone are listed in Appendix E.

Table 4.89. Douglas County Planning Area – Critical Facilities at Risk to Wildfire Summary

Jurisdiction	Extreme	High	Moderate	Low
Castle Rock	-	79	31	113
Littleton*	-	1	-	2
Lone Tree	-	13	6	44
Parker	-	78	70	107
Unincorporated County	15	342	194	416
Total	15	513	301	682

Source: Douglas County GIS

*Littleton is not a participating jurisdiction in this plan, but a portion of the city lies in Douglas County

Table 4.90. Unincorporated Douglas County– Critical Facilities at Risk to Wildfire Detail

Fire Risk	Category	Type	Facility Count
Extreme	At Risk Population Facilities	Assisted Living	1
	Essential Services Facilities	Bridge	2
	Essential Services Facilities	Cell Tower	1
	Essential Services Facilities	Fire Department	1
	Essential Services Facilities	Microwave	3
	Essential Services Facilities	Radio Tower	2
	High Potential Loss Facilities	Dam	1
	High Potential Loss Facilities	Hazardous Material	4
	TOTAL		
High	At Risk Population Facilities	Assisted Living	4
	At Risk Population Facilities	Group Home	3
	At Risk Population Facilities	School	23
	Essential Services Facilities	Bridge	29
	Essential Services Facilities	Cell Tower	38
	Essential Services Facilities	Fire Department	12
	Essential Services Facilities	Maint/Equip Center	1
	Essential Services Facilities	Microwave	91
	Essential Services Facilities	Radio Tower	3
	Essential Services Facilities	Water Hub/Treatment	31
	High Potential Loss Facilities	Hazardous Material	107
	TOTAL		
Moderate	At Risk Population Facilities	Assisted Living	3
	At Risk Population Facilities	School	11
	Essential Services Facilities	Bridge	11
	Essential Services Facilities	Cell Tower	19
	Essential Services Facilities	Commercial Airports	3
	Essential Services Facilities	Fire Department	4
	Essential Services Facilities	IT Infrastructure	1
	Essential Services Facilities	Maint/Equip Center	2
	Essential Services Facilities	Microwave	53
	Essential Services Facilities	Police	1
	Essential Services Facilities	Radio Tower	3
	Essential Services Facilities	Water Hub/Treatment	18
	High Potential Loss Facilities	Dam	1
	High Potential Loss Facilities	Hazardous Material	64
TOTAL			194
Low	At Risk Population Facilities	Assisted Living	9
	At Risk Population Facilities	School	27

Fire Risk	Category	Type	Facility Count
	Essential Services Facilities	Bridge	23
	Essential Services Facilities	Cell Tower	48
	Essential Services Facilities	Fire Department	9
	Essential Services Facilities	Maint/Equip Center	6
	Essential Services Facilities	Microwave	23
	Essential Services Facilities	Water Hub/Treatment	9
	High Potential Loss Facilities	Dam	1
	High Potential Loss Facilities	Hazardous Material	261
	TOTAL		416
GRAND TOTAL			967

Source: Douglas County GIS

Cultural and Natural Resources at Risk

The Douglas County Planning Area has substantial cultural and natural resources located throughout the County as previously described. In addition, there are other natural resources at risk when wildland-urban interface fires occur. One is the watershed and ecosystem losses that occur from wildfires. This includes impacts to water supplies and water quality as well as air quality. Another is the aesthetic value of the area. Major fires that result in visible damage detract from that value. Other assets at risk include wildland recreation areas, wildlife and habitat areas, rangeland, and timber resources. The loss to these natural resources can be significant.

Other Assets at Risk

In addition to the vulnerability of the County and its jurisdictions, many other stakeholders reside or have significant assets in the area that should be considered in a vulnerability analysis. These stakeholders include individuals, agencies or business entities that could be directly impacted by a catastrophic wildfire. Impacts to stakeholders could range from increased demands on administrative and firefighting resources, to direct loss of life and assets.

Development Trends

The pattern of increased damages is directly related to increased urban growth spread into historical forested areas that have wildfire as part of the natural ecosystem. Many historical wildfires burned only vegetation in the past. However, with new development, a wildfire following a historical pattern now burns developed areas. The Douglas County CWPP identified this trend as well, stating that “[f]uture fires may be more intense than historical fires because the vegetation is denser and the built environment is denser than a century ago...Older developed areas of the County may be at more risk to potential loss from wildfire because of the increased amount of vegetation around homes and the construction materials of the structures” (pg. 25-27). Wildfire risk to new development can be mitigated through building and construction codes and defensible space activities.

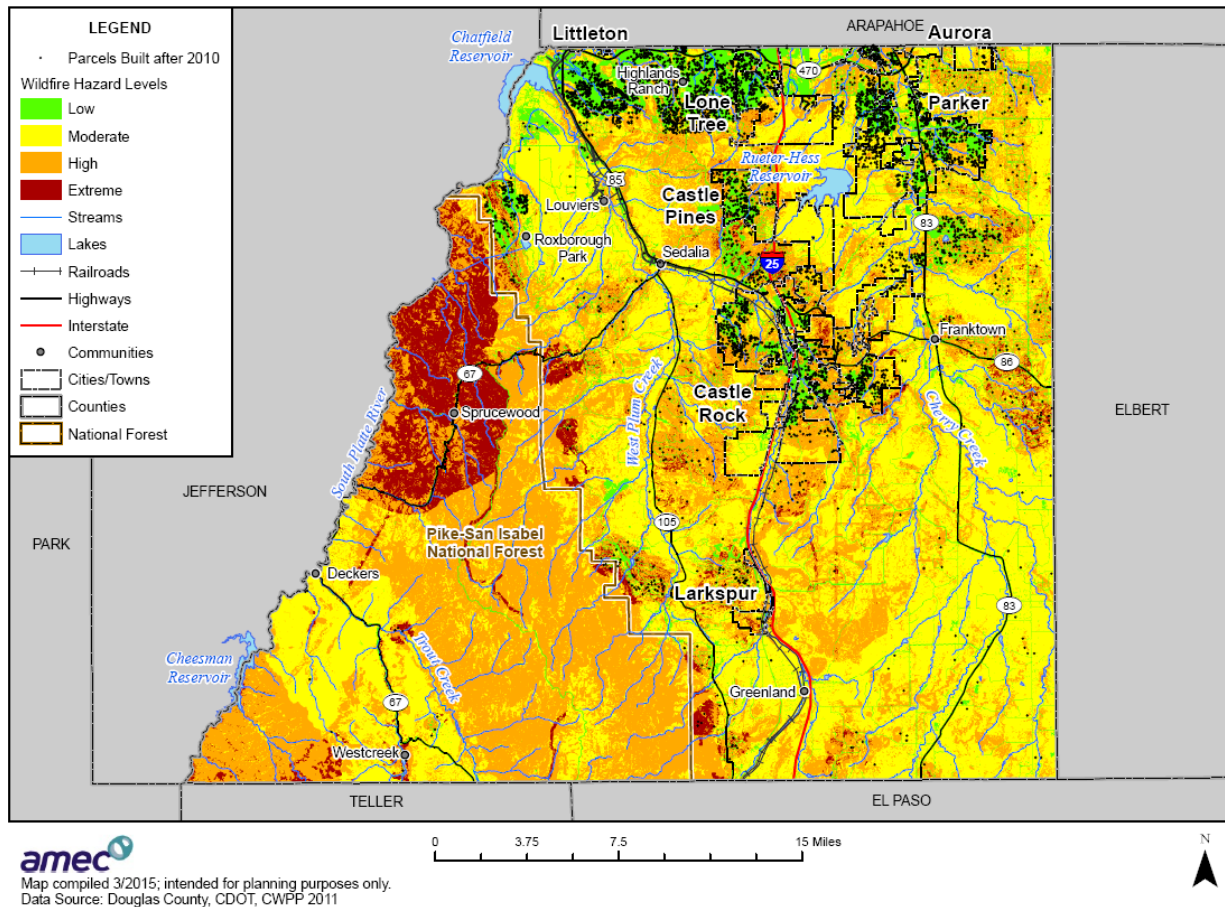
A total of 2,348 structures were built in extreme, high, and moderate wildfire hazard areas in the Planning Area between 2010 and 2014. The total value of these structures is \$1,304,881,645, with the majority located in the high wildfire hazard area. The unincorporated County and Castle Rock have the highest number of structures and highest total value at risk. Results of this analysis are shown in Table 4.91 and depicted in Figure 4.57.

Table 4.91. Douglas County Structures Built from 2010 to 2014: Assets Exposed to Wildfire by Hazard Level

Hazard Level	Total Parcel Count	Improved Parcel Count	Total Building Count	Improved Value	Estimated Content Value	Land Value	Total Value
Extreme							
Castle Pines	1	1	1	\$643,717	\$321,859	\$115,000	\$1,080,576
Castle Rock	1	1	1	\$268,821	\$134,411	\$80,500	\$483,732
Unincorporated	80	80	82	\$26,649,148	\$13,347,703	\$9,189,438	\$49,186,289
Total	82	82	84	\$27,561,686	\$13,803,972	\$9,384,938	\$50,750,596
High							
Castle Pines	35	34	36	\$15,190,338	\$7,595,169	\$4,411,000	\$27,196,507
Castle Rock	323	322	350	\$103,939,580	\$43,744,447	\$19,380,042	\$167,064,069
Larkspur	6	6	7	\$832,715	\$413,522	\$264,000	\$1,510,237
Lone Tree	21	21	23	\$10,321,154	\$5,160,577	\$2,121,700	\$17,603,431
Parker	108	108	132	\$27,991,428	\$14,121,352	\$7,881,790	\$49,994,570
Unincorporated	684	683	807	\$262,481,604	\$138,148,866	\$88,257,868	\$488,888,338
Total	1,177	1,174	1,355	\$420,756,819	\$209,183,931	\$122,316,400	\$752,257,150
Moderate							
Castle Pines	9	9	10	\$4,259,014	\$2,129,507	\$1,223,000	\$7,611,521
Castle Rock	161	161	161	\$36,895,395	\$18,657,313	\$7,381,328	\$62,934,036
Lone Tree	27	27	34	\$14,239,466	\$7,815,629	\$5,221,588	\$27,276,683
Parker	170	170	208	\$51,157,664	\$29,880,540	\$15,390,939	\$96,429,143
Unincorporated	443	443	496	\$164,271,724	\$91,618,377	\$51,732,416	\$307,622,517
Total	810	810	909	\$270,823,263	\$150,101,366	\$80,949,271	\$501,873,900
Grand Total	2,069	2,066	2,348	\$719,141,768	\$373,089,268	\$9,384,938	\$1,304,881,645

Source: Douglas County GIS

Figure 4.57. Douglas County Build-Out in Wildfire Hazard Areas:2010-2014



4.3.12 Hazardous Material: Transport Incidents Vulnerability Assessment

Likelihood of Future Occurrence—Medium

Potential Magnitude—High

Overall Vulnerability—High

Several major transportation routes cross through Douglas County, including Interstate 25, Highway 470, the Union Pacific railroad, and the Burlington Northern Santa Fe (BNSF) railroad. Hazardous materials are transported along these corridors regularly, if not every day. Residential areas are located in the immediate vicinity of the corridors, potentially presenting a serious public health and safety concern if a hazardous materials incident were to occur in a populated area. GIS analysis was used to determine the number of people potentially at risk to hazardous materials transportation incidents in Douglas County.

Populations at Risk to Hazardous Materials from Transportation Corridors

To determine an estimate of populations at risk from a transportation-related hazardous materials

release within identified transportation corridors, an analysis was performed using GIS. A one-mile buffer was applied to both sides of Highway 470 and Interstate 25 and the Union Pacific and Burlington Northern Santa Fe (BNSF) Railroads, creating a two-mile buffer zone around each corridor. The buffer distance was based on guidelines in the U.S. Department of Transportation’s Emergency Response Guidebook that suggest distances useful to protect people from vapors resulting from spills involving dangerous goods considered toxic if inhaled. The recommended buffer distance referred to in the guide as the “protective action distance” is the area surrounding the incident in which people are at risk of harmful exposure. For purposes of this plan, an average buffer distance of one mile was used on either side of the transportation corridor. Actual buffer distances will vary depending on the nature and quantity of the release, whether the release occurred during the night or daytime, and prevailing weather conditions.

Since there is overlapping of the corridors in many locations throughout the County and jurisdictions, individual population analysis was performed for each transportation corridor. In Table 4.92, each buffered transportation corridor was intersected with improved residential parcels and therefore parcels could be counted more than once within this table due to the individual analysis of each corridor. It is important to note that populations associated with commercial, industrial and other property types may also be affected by a hazardous materials release, but no census/population data is associated with these property types and are therefore excluded from this analysis. It is also important to note that the population at risk to a specific incident could vary greatly and would be dependent on accident location, severity and weather conditions.

The two railroads that go through Douglas County are adjacent to each other so the majority of the population in this analysis is duplicated for each railroad. There are 28,853 people that live within the one-mile buffer of the Union Pacific Railroad that passes through Castle Rock and Larkspur. The BNSF Railroad (Burlington Northern Santa Fe Railroad) follows the same corridor through Castle Rock and Larkspur with an estimated population of 30,710. There are 27,560 total people that live within the proximity of Highway 470 that passes through the northern portion Douglas County (which included the Highlands Ranch community) and Lone Tree. A population of 23,081 is within the proximity of Interstate 25 that passes through the Castle Pines, Castle Rock, Larkspur and Lone Tree.

Table 4.92. Populations Exposed by Transportation Corridor

Transportation Corridor	Corridor Length (mi.)	Population*		
		Cities	Unincorporated	Total
Interstate 25	31.7	17,194	5,887	23,081
Highway 470	9.6	2,233	25,328	27,560
Union Pacific Railroad	43.4	15,458	13,395	28,853
BNSF Railroad*	42.5	17,008	13,702	30,710

Source: Douglas County GIS, NED, CDOT 2013 HAZMAT Map

*A grand total is not given for affected population because some people may be counted more than once due to the fact that some parcels are intersected by multiple transportation corridors.

Development Trends

Development in the County largely occurs in existing urban areas, many of which lie along transportation corridors. As development in these areas continues to grow, more people will be at risk to hazardous materials transportation incidents.

4.4 Douglas County's Mitigation Capabilities

Thus far, the planning process has identified the hazards posing a threat to the Planning Area and described, in general, the vulnerability of the County to these risks. The next step is to assess what loss prevention mechanisms are already in place. This part of the planning process is the mitigation capability assessment. Combining the risk assessment with the mitigation capability assessment results in the County's net vulnerability to disasters, and more accurately focuses the goals, objectives, and proposed actions of this plan.

The HMPC used a two-step approach to conduct this assessment for the County. First, an inventory of common mitigation activities was made through the use of a matrix. The purpose of this effort was to identify policies and programs that were either in place, needed improvement, or could be undertaken if deemed appropriate. Second, the HMPC conducted an inventory and review of existing policies, regulations, plans, and programs to determine if they contributed to reducing hazard-related losses or if they inadvertently contributed to increasing such losses.

This section presents Douglas County's mitigation capabilities and discusses select state and federal mitigation capabilities that are applicable to Douglas County. Information about capabilities specific to the other participating jurisdictions can be found in the annexes.

Similar to the HMPC's effort to describe hazards, risks, and vulnerability of Douglas County, this mitigation capability assessment describes the County's existing capabilities, programs, and policies currently in use to reduce hazard impacts or that could be used to implement hazard mitigation activities. This assessment is divided into four sections: regulatory mitigation capabilities are discussed in Section 4.4.1; administrative and technical mitigation capabilities are discussed in Section 4.4.2; fiscal mitigation capabilities are discussed in Section 4.4.3; and mitigation outreach and partnerships are discussed in Section 4.4.4.

4.4.1 Douglas County's Regulatory Mitigation Capabilities

Table 4.93 lists planning and land management tools typically used by local jurisdictions to implement hazard mitigation activities, and indicates those that are in place in Douglas County. Excerpts from applicable policies, regulations, and plans and program descriptions follow to provide more detail on existing mitigation capabilities.

APPENDIX F. MITIGATION STRATEGY SUPPLEMENT

This appendix summarizes additional activities and resources provided to plan participants to support the update of the mitigation strategy.

IMPORTANT! READ THIS

Phase 1 and Phase 2 templates were previously provided to your jurisdiction for completion. If your jurisdiction returned completed Phase 1 and Phase 2 templates:

- The Phase 1 and Phase 2 content you provided is already incorporated into your Phase 3 template.
- Please review the template to see if we have inserted any comments requesting further work to be done on Phase 1 and Phase 2
 - ***If any comments are included, please address them.*** Then, begin your work on Phase 3 following the Phase 3 instructions beginning on page 10.
 - If no comments are included, then you **DO NOT** need to do any further work on the Phase 1 and Phase 2 content. ***Go directly to the instructions for Phase 3, beginning on page 9.***

If your jurisdiction has **NOT** yet done any work on the Phase 1 and Phase 2 templates, then follow the instructions below for providing the Phase 1 and Phase 2 information.

If your jurisdiction started work on the Phase 1 or Phase 2 template but never completed and submitted it, please copy the work you had completed so far into the new template you received for Phase 3. Then complete Phases 1 and 2 following the instructions provided here.

PHASE 1 AND PHASE 2 INSTRUCTIONS

CHAPTER TITLE

Your jurisdiction's name has already been entered as the title of the chapter. Please review and correct if needed.

HAZARD MITIGATION PLAN POINT OF CONTACT

Provide the name, title, mailing address, telephone number, and e-mail address for the primary point of contact for your jurisdiction. This should be the person responsible for monitoring, evaluating and updating the annex for your jurisdiction. This person should also be the principle liaison between your jurisdiction and the Steering Committee overseeing development of this plan.

In addition, designate an alternate point of contact. This would be a person to contact should the primary point of contact be unavailable or no longer employed by the jurisdiction.

Note: Both of these contacts should match the contacts that were designated in your jurisdiction's letter of intent to participate in this planning process. If you have changed the primary or secondary contact, please let the planning team know by inserting a comment into the document.

JURISDICTION PROFILE

Provide information specific to your jurisdiction as indicated, in a style similar to the examples provided below. This should be information that will not be provided in the overall mitigation plan document.

Location

Describe the community's location, size and prominent features, similarly to the example below

The City of Jones is in the northwest portion of Smith County, along the Pacific Coast in northern California. It is almost 300 miles of San Francisco. The city's total area is 4.2 square miles, with boundaries generally extending north-south from State Highway 111 to the Johnson River and east-west from Coast Road to East Frank Avenue. The City of Allen is to the north, unincorporated county is to the west, the City of Bethany is to the south, and the Pacific Ocean is to the west.

Jones is home to the University of Arbor, Bickerson Manufacturing, and the western portion of Soosoo National Park.

History

Describe the community's history, focusing on economy and development, and note its year of incorporation, similarly to the example below

The City of Jones was incorporated in 1858. The area was settled during the gold rush in the 1850s as a supply center for miners. As the gold rush died down, timber and fishing became the area's major economic resources. By 1913, the Jones Teachers College, a predecessor to today's University of Arbor, was founded. Recently, the presence of the college has come to shape Jones' population into a young and educated demographic. In 1981 the City developed the Jones Marsh and Wildlife sanctuary, an environmentally friendly sewage treatment enhancement system.

With numerous annexations since its original incorporation, the city's area has almost doubled. Today it features a commercial core in the center of the city, with mostly residential areas to the north and south, the university to the west and the national park on the east.

Climate

Describe the community's key climate characteristics, similarly to the example below

Jones' weather is typical of the Northern California coast, with mild summers and cool, wet winters. It rarely freezes in the winter and it is rarely hot in the summer. Annual average rainfall is over 40 inches, with 80 percent of that falling from November through April. The average year-round temperature is 59°F. Humidity averages 72 to 87 percent. Prevailing winds are from the north, and average 5 mph.

Governing Body Format

Describe the community's key governance elements, similarly to the example below

The City of Jones is governed by a five-member city council. The City consists of six departments: Finance, Environmental Services, Community Development, Public Works, Police and the City Manager's Office. The City has 13 commissions and task forces, which report to the City Council.

The City Council assumes responsibility for the adoption of this plan; the City Manager will oversee its implementation.

Complete the table providing the names and titles of members of the local mitigation planning team responsible for completion of this annex. Team membership should consist of agencies with authority to regulate development and enforce local ordinances or regulatory standards, such as building/fire code enforcement, emergency management,

emergency services, floodplain management, parks and recreation, planning/community development, public information, public works/engineering, stormwater management, transportation, or infrastructure.

CURRENT TRENDS

Population

For population data, use the most current population figure for your jurisdiction based on an official means of tracking (e.g., the U.S. Census or state office of financial management).

According to California Department of Finance, the population of Jones as of July 2018 was 17,280. Since 2010, the population has grown at an average annual rate of 1.2 percent, though that rate is declining, with an annual average of only 0.8 percent since 2015.

Development

In the yellow-highlighted text that says “Describe trends in general,” provide a brief description of your jurisdiction’s recent development trends similar to the following example:

Anticipated development levels for Jones are low to moderate, consisting primarily of residential development. The majority of recent development has been infill. Residentially, there has been a focus on affordable housing and a push for more secondary mother-in-law units on properties.

The City of Jones adopted its general plan in July 2000. The plan focuses on issues of the greatest concern to the community. City actions, such as those relating to land use allocations, annexations, zoning, subdivision and design review, redevelopment, and capital improvements, must be consistent with the plan. Future growth and development in the city will be managed as identified in the general plan.

Complete the table titled “Recent and Expected Future Development Trends.” Please note:

- The portion of the table requesting the number of permits by year is specifically looking for development permits for new construction. If your jurisdiction does not have the ability to differentiate between permit types, please list the total number of permits and indicate “N/A” (not applicable) for the permit sub-types.
- If your jurisdiction does not have the ability to track the number of permits for each hazard area, please delete the bullet list of hazard areas and insert a qualitative description of where development has occurred.
- Examples of qualitative descriptions of buildout in the jurisdiction are as follows:
 - The Town is close to being built out. Most new projects involve the demolition of an existing residence and construction of a new replacement residence. A few subdivisions are processed each year.
 - There are five parcels of underdeveloped land within the city limits. According to the General Plan, the total potential units for these parcels is 33 units.

CAPABILITY ASSESSMENT

Please note that it is unlikely that you will be able to complete all sections of the capability assessment on your own. You will likely need to reach out to other departments within your local government, such as planning, finance, public works, etc. It may be beneficial to provide these individuals with background information about this planning process, as you will want input from them again during Phase 3 of your annex development.

Fill in your jurisdiction’s name where indicated on the first line of the first paragraph under the heading “1.4 Capability Assessment.”

Legal and Regulatory Capability

In the table titled “Legal and Regulatory Capability,” indicate “Yes” or “No” for each listed code, ordinance, requirement or planning document in each of the following columns:

- **Local Authority**—Enter “Yes” if your jurisdiction has prepared or adopted the identified item; otherwise, enter “No.” If yes, then enter the code, ordinance number, or plan name and its date of adoption in the comments column. *Note: If you are entering yes, please be sure that you are providing a comment with the appropriate code, ordinance or plan.*
- **Other Jurisdiction Authority**—Enter “Yes” if there are any regulations that may impact your jurisdiction that are enforced or administered by another agency (e.g., a state agency or special purpose district) or if you know that there are any state or federal regulations or laws that would prohibit local implementation of the identified item; otherwise, enter “No.” *Note: If you answer yes, please indicate the other agency in the comments.*
- **State Mandated**—Enter “Yes” if state laws or other requirements enable or require the listed item to be implemented at the local level; otherwise, enter “No.” *Note: If you are entering yes, please be sure that you are providing a comment.*
- **Integration Opportunity**—Enter “Yes” if your jurisdiction has opportunities for integration of the code, ordinance or plan with the hazard mitigation plan. Consider entering “Yes” in the Integration Opportunity column if you answer “yes” to any of the following:
 - If you answered “Yes” in the Local Authority column for this code, ordinance or plan:
 - Does the code, ordinance or plan already address hazards and their potential impacts?
 - If so, should it be updated or revised to reflect new information about risk?
 - If not, will (or should) the code, ordinance or plan be updated over the performance period of the hazard mitigation plan (5 years)?
 - Does the code, ordinance or plan include specific projects that should be reviewed to incorporate hazard mitigation goals?
 - Does the code, ordinance or plan include specific projects that should be included as action items in the hazard mitigation action plan?
 - If you answered “No” in the Local Authority column for this code, ordinance or plan:
 - Will your jurisdiction develop the code, ordinance or plan during the performance period of the hazard mitigation plan?

Note: Each capability with a “Yes” answer to Integration Opportunity will be discussed in more detail later in the annex. You may wish to keep notes when assessing the Integration Opportunity or review the “Integration with Other Planning Initiatives” section below.

- **Comments**—Enter the code number and adoption date for any local code indicated as being in place; provide other comments as appropriate to describe capabilities for each entry. **PLEASE DO NOT OVERLOOK THIS STEP**

For the category “Capital Improvement Plan,” answer the specific question regarding plan update frequency, in addition to completing the four columns indicating level of capability.

Development and Permit Capabilities

Complete the table titled “Development and Permitting Capabilities.”

Fiscal Capability

Complete the table titled “Fiscal Capability” by indicating whether each of the listed financial resources is accessible to your jurisdiction. Enter “Yes” if the resource is fully accessible to your jurisdiction. Enter “No” if there are limitations or prerequisites that may hinder your eligibility for this resource.

Administrative and Technical Capability

Complete the table titled “Administrative and Technical Capability” by indicating whether your jurisdiction has access to each of the listed personnel resources. Enter “Yes” or “No” in the column labeled “Available?”. If yes, then enter the department and position title in the right-hand column. If you have contract support staff with these capabilities, you can still answer “Yes.” Indicate in the department column that this resource is provided through contract support.

Education and Outreach Capabilities

Complete the table titled “Education and Outreach” to indicate your jurisdiction’s capabilities and existing efforts regarding natural hazard mitigation education and outreach.

National Flood Insurance Program Compliance

Complete the table titled “National Flood Insurance Program Compliance” by indicating your jurisdiction’s capabilities related to each question in the table.

Classification in Hazard Mitigation Programs

Complete the table titled “Community Classifications” to indicate your jurisdiction’s participation in various national programs related to natural hazard mitigation. For each program enter “Yes” or “No” in the second column to indicate whether your jurisdiction participates. If yes, then enter the classification that your jurisdiction has earned under the program in the third column and the date on which that classification was issued in the fourth column; enter “N/A” in the third and fourth columns if your jurisdiction is not participating. If you do not know your current classification, information is available at the following websites:

- **Community Rating System**— https://www.fema.gov/media-library-data/1503240360683-30b35cc754f462fe2c15d857519a71ec/20_crs_508_oct2017.pdf
- **Storm Ready**— <https://www.weather.gov/stormready/communities>
- **Firewise**— <http://www.firewise.org/usa-recognition-program/map-of-active-participants.aspx>
- **Building Code Effectiveness Grading Schedule (BCEGS)**— <https://www.isomitigation.com/bcegs/iso-s-building-code-effectiveness-grading-schedule-bcegs.html>
- **Public Protection Classification**— <https://firechief.iso.com/FCWWeb/mitigation/ppc0001.jsp>

INTEGRATION WITH OTHER PLANNING INITIATIVES

For hazard mitigation planning, “integration” means that hazard mitigation information is used in other relevant planning mechanisms, such as general planning and capital facilities planning, and that relevant information from those sources is used in hazard mitigation. The goal of plan integration is to ensure that the potential impact of hazards is considered in planning for future development. FEMA recommends integration as follows:

- Integrate hazard mitigation plan goals with community objectives (e.g. incorporate the goals for risk reduction and safety into the policies of other plans).

- Use the risk assessment to inform plans and policies (e.g. incorporate risk assessment findings into land use plans, site plan review, emergency operations plans).
- Implement mitigation actions through existing mechanisms (e.g. include mitigation projects in the capital improvement plan).
- Think about mitigation before and after a disaster (e.g. build recovery planning on existing mitigation plans and goals).

After reviewing the plans, programs and ordinances identified in the capability assessment tables, identify all plans and programs that have already been integrated with the hazard mitigation plan, and those that offer opportunities for future integration. The simplest way to do this is to review the Legal and Regulatory Capabilities table to see which items were marked as “Yes” under the Integration Opportunity column.

Existing Integration

In the highlighted bullet list, list items for which you entered “Yes” under the Integration Opportunity column of the “Legal and Regulatory Capability” table because the plan or ordinance already addresses potential impacts or includes specific projects that should be included as action items in the mitigation action plan. Consider listing items marked as Completed in the “Status of Previous Plan Actions” table if they were indicated as being ongoing actions. Provide a brief description of how the plan or ordinance is integrated. Examples are as follows:

- **Capital Improvement Plan**—The capital improvement plan includes projects can help mitigate potential hazards. The City will act to ensure consistency between the hazard mitigation plan and the current and future capital improvement plans. The hazard mitigation plan may identify new possible funding sources for capital improvement projects and may result in modifications to proposed projects based on results of the risk assessment.
- **Building Code and Fire Code**—The City’s adoption of the 2016 California building and fire codes incorporated local modifications to account for the climatic, topographic and geographic conditions that exist in the City.
- **General Plan**—The general plan includes a “Safety, Services, and Infrastructure” element to protect the community from unreasonable risk by establishing policies and actions to avoid or minimize the following hazards:
 - Geologic and seismic hazards
 - Fire hazards
 - Hazardous materials
 - Flood control

Note: Any plans that fall into this category should be reviewed during the development of the mitigation strategy in Phase 3 and included as appropriate.

Opportunities for Future Integration

List any remaining items that say “Yes” in the Integration Opportunity column in the Legal and Regulatory Capabilities and explain the process by which integration will occur. Examples follow:

- **Zoning Code**—The City of Smithburg is conducting a comprehensive update to its zoning code. The opportunity to incorporate additional mitigation and abatement measures will be contemplated for inclusion into the Code.
- **Capital Improvement Projects**—Capital improvement project proposals may take into consideration hazard mitigation potential as a means of evaluating project prioritization.

- **Post-Disaster Recovery Plan**—Smithburg does not have a recovery plan and intends to develop one as a mitigation planning action during the next five years. The plan will build on the mitigation goals and objectives identified in the mitigation plan.

After you have accounted for all items marked as “Yes” under the Integration Opportunity column, consider other programs you may have in place in your jurisdiction that include routine consideration and management of hazard risk. Examples of such programs may include: tree pruning programs, right-of-way mowing programs, erosion control or stream maintenance programs, etc. Please add any such programs to the integration discussion and provide a brief description of how these program manage (or could be adapted to manage) risk from hazards.

STATUS OF PREVIOUS PLAN ACTIONS

Please note that this section only applies to jurisdictions that are conducting updates to previously approved hazard mitigation plans. If your jurisdiction has not previously participated in an approved plan, please enter a note stating this, and we will remove this section in your final annex.

All action items identified in prior mitigation planning efforts must be reconciled in this plan update. Action items must all be marked as **ONE** of the following; check the appropriate box (place an X) and provide the following information:

- **Completed**—If an action has been completed since the prior plan was prepared, please check the appropriate box and provide a date of completion in the comment section. If an action has been initiated and is an ongoing program (e.g. annual outreach event), you may mark it as completed and note that it is ongoing in the comments. If an action addresses an ongoing program you would like to continue to include in your action plan, please see the Carried Over to Plan Update bullet below.
- **Removed**—If action items are to be removed because they are no longer feasible, a reason must be given. Lack of funding does not mean that it is no longer feasible, unless the sole source of funding for an action is no longer available. Place a comment in the comment section explaining why the action is no longer feasible or barriers that prevented the action from being implemented (e.g., “Action no longer considered feasible due to lack of political support.”). If the wording and/or intent of a previously identified action is unclear, this can be a reason for removal. A change in community priorities may also be a reason for removal and should be discussed in the comments.
- **Carried Over to Plan Update**—If an action is in progress, is ongoing, or has not been initiated and you would like to carry it over to the plan update, please check the “Check if Yes” column under “Carried Over to Plan Update.” Selecting this option indicates that the action will be included in the mitigation action plan for this update. If you are carrying over an action to the update, please include a comment describing any action that has been taken or why the action was not taken (specifically, any barriers or obstacles that prevented the action from moving forward or slowed progress). Leave the last column, “Action # in Update,” blank at this point. This will be filled in after completing the updated action plan in Phase 3.

Please ensure that you have provided **a status and a comment for each action.**

REVIEW AND INCORPORATION OF INFORMATION FOR THIS ANNEX

Please note that this section will ultimately describe all information sources used to develop this annex, but that only the sources used for Phases 1 and 2 will be listed at this point. Additional sources will be added with the preparation of the Phase 3 annex template.

This section should describe what resources you used to complete the annex and how you used them. Several items are started for you, but please be sure to update and enhance any descriptions. This may seem trivial or unimportant, but it is a requirement to pass the state and FEMA review process.

THIS COMPLETES PHASES 1 AND 2

PHASE 3 INSTRUCTIONS

JURISDICTION-SPECIFIC NATURAL EVENT HISTORY

In the table titled “Past Natural Hazard Events,” list in chronological order (most recent first) any natural hazard event that has caused damage to your jurisdiction in the last 5 years. Include the date of the event and the estimated dollar amount of damage it caused. You are welcome to include any events, but special attention should be made to include major storms and federally declared disasters. We recommend including most large-scale disasters, unless you know that there were no impacts to your jurisdiction. Specifically, we recommend that you include these events if you have damage estimate information or can provide a brief description of impacts that occurred within your community. Other potential sources of damage information include:

- Preliminary damage estimates your jurisdiction filed with the county or state
- Insurance claims data
- Newspaper archives
- Other plans/documents that deal with emergency management (safety element of a comprehensive plan, emergency response plan, etc.)
- Resident input.

If you do not have estimates for dollars of damage caused, please list “Not Available” in the appropriate column or simply list a brief description of the damages (e.g. Main Street closed as a result of flooding, downed trees and residential damages). Please note that tracking such damages is a valid and useful mitigation action if your jurisdiction does not currently track such information. For your reference, we have inserted known major events that impacted the county as a whole as well as your specific jurisdiction.

HAZARD RISK RANKING

The risk ranking performed for the overall planning area is presented in the risk assessment section of the overall hazard mitigation plan. However, each jurisdiction has differing degrees of risk exposure and vulnerability and, therefore, needs to rank risk for its own area, using the same methodology as used for the overall planning area. The risk-ranking exercise assesses two variables for each hazard: its probability of occurrence; and its potential impact on people, property and the economy.

Enter Risk Rank Based on Loss Matrix Spreadsheet and Local Knowledge

Tetra Tech has developed a draft risk ranking for your jurisdiction. The hazard with the highest risk rating (probability x impact) was given a rank of 1; the hazard with the second highest rating is listed with a rank of 2; and so on. Two hazards with equal risk ratings were given the same rank. “High,” “Medium,” and “Low” assignments were given for each hazard of concern based on a total score. To complete this section of the annex template, you need to review the risk ranking provided and then do one of the following:

- **If you agree with the results**, provide a comment that you agree with the ranking.
- **If the results differ from what you know based on substantiated data and documentation**, you may alter the ranking based on this knowledge, and enter the revised ranking into the risk ranking table in your annex.

If you modify the risk ranking based on local knowledge, please note this fact in your template and include what you believe the rank should be and why. For example, a low risk rank may be assigned to drought, but you know that the local economy is heavily reliant on water-using industries, such as agriculture or manufacturing, so you

believe it should be ranked as medium. Remember that this exercise is about categorizing hazards into broad levels of risk (high, medium, low), not precise calculations.

In modifying any risk ratings, keep in mind that one of the purposes of this exercise is to support the selection and prioritization of actions in your plan. **You will need to have at least one true mitigation action for each hazard rated as “high” or “medium.”** This is discussed in more detail in the Hazard Mitigation Action Plan section of these instructions.

Review Risk Ranking Process Used in the Loss Matrix

The sections below describe the methodology that was used to derive the risk ranking. They are provided for your information in reviewing the risk ranking prepared for your jurisdiction.

Probability of Occurrence for Each Hazard

A probability factor is assigned based on how often a hazard is likely to occur. The probability of occurrence of a hazard event is generally based on past hazard events in an area, although weight can be given to expected future probability of occurrence based on established return intervals. For example, if your jurisdiction has experienced two damaging floods in the last 25 years, the probability of occurrence is high for flooding and scores a 3 under this category. If your jurisdiction has experienced no damage from landslides in the last 100 years, your probability of occurrence for landslide is low, and scores a 1 under this category. Each hazard was assigned a probability factor as follows:

- High—Hazard event is likely to occur within 25 years (Probability Factor = 3)
- Medium—Hazard event is likely to occur within 100 years (Probability Factor = 2)
- Low—Hazard event is not likely to occur within 100 years (Probability Factor = 1)
- None—If there is no exposure to a hazard, there is no probability of occurrence (Probability Factor = 0)

Potential Impacts of Each Hazard

The impact of each hazard is divided into three categories: impacts on people, impacts on property, and impacts on the economy. These categories are also assigned weighted values. Impact on people was assigned a weighting factor of 3, impact on property was assigned a weighting factor of 2 and impact on the economy was assigned a weighting factor of 1. Impact factors for each category (people, property, economy) are described below.

Impacts on People

Values are assigned based on the percentage of the total *population exposed* to the hazard event. The degree of impact on individuals will vary and is not measurable, so the calculation assumes for simplicity and consistency that all people exposed to a hazard because they live in a hazard zone will be equally impacted when a hazard event occurs. Impact factors were assigned as follows:

- High—25 percent or more of the population is exposed to a hazard (Impact Factor = 3)
- Medium—10 percent to 24 percent of the population is exposed to a hazard (Impact Factor = 2)
- Low—9 percent or less of the population is exposed to the hazard (Impact Factor = 1)
- No impact—None of the population is exposed to a hazard (Impact Factor = 0)

For hazards that do not have a defined extent, the entire population or a portion of the population is considered to be exposed, depending on the hazard. For the drought hazard, it is common for jurisdictions to list “low” or “none,” because all people in the planning area would be exposed to drought, but impacts to the health and safety of individuals are expected to be minimal.

Impacts on Property

Values are assigned based on the percentage of the total *property value exposed* to the hazard event:

- High—25 percent or more of the total replacement value is exposed to a hazard (Impact Factor = 3)
- Medium—10 percent to 24 percent of the total replacement value is exposed to a hazard (Impact Factor = 2)
- Low—9 percent or less of the total replacement value is exposed to the hazard (Impact Factor = 1)
- No impact—None of the total replacement value is exposed to a hazard (Impact Factor = 0)

For those hazards that do not have a defined extent and location (e.g. severe weather) the entire building stock is generally considered to be exposed. For the drought hazard, it is common for jurisdictions to list “low” or “none,” because all structures in the planning area would be exposed to drought, but impacts to structures are expected to be minimal.

Impacts on the Economy

Values were assigned based on the percentage of the total *property value vulnerable* to the hazard event. Values represent estimates of the loss from a major event of each hazard in comparison to the total replacement value of the property exposed to the hazard. For some hazards, such as wildland fire and landslide, vulnerability may be considered to be the same or a portion of exposure due to the lack of loss estimation tools specific to those hazards.

- High—Estimated loss from the hazard is 10 percent or more of the total replacement value (Impact Factor = 3)
- Medium—Estimated loss from the hazard is 5 percent to 9 percent of the total replacement value (Impact Factor = 2)
- Low—Estimated loss from the hazard is 4 percent or less of the total replacement value (Impact Factor = 1)
- No impact—No loss is estimated from the hazard (Impact Factor = 0).

For those hazards that have a defined extent and location, but do not have modelled loss results, loss estimates can be the same as exposure or a portion thereof. For example, a large percentage of the building stock may be exposed to landslide or wildland fire risk, but it would not be expected that one event that resulted in loss to all exposed structures would occur. For those hazards that do not have a defined extent and location, exposure is based on the hazard type.

Risk Rating for Each Hazard

A risk rating for each hazard was determined by multiplying the assigned probability factor by the sum of the weighted impact factors for people, property and the economy:

$$\text{Risk Rating} = \text{Probability Factor} \times \text{Weighted Impact Factor \{people + property + economy\}}$$

This is the number shown in the risk ranking table in your template. Generally, scores of 30 or greater are rated “high”, scores between 15 and 30 are rated “medium”, and scores of less than 15 are rated “low”.

JURISDICTION-SPECIFIC VULNERABILITIES

Repetitive Loss Properties

A repetitive loss property is any property for which FEMA has paid two or more flood insurance claims in excess of \$1,000 in any rolling 10-year period since 1978. In the space provided, Tetra Tech has inserted the following information based on data provided by FEMA:

- The number of any FEMA-identified repetitive-loss properties in your jurisdiction.
- The number of any FEMA-identified severe-repetitive-loss properties in your jurisdiction.
- The number (if any) of repetitive-loss or severe-repetitive-loss properties in your jurisdiction that have been mitigated. Mitigated for this exercise means that flood protection has been provided to the structure.

Please note that if your jurisdiction has any repetitive loss properties, we would strongly encourage you to include a mitigation action that addresses mitigating these properties.

Other Vulnerabilities

List any noted vulnerabilities in your jurisdiction related to hazard mitigation that may not be apparent from the risk assessment and other information provided. This may include things such as the following:

- An urban drainage issue that results in localized flooding every time it rains.
- An area of the community that frequently loses power due to a lack of tree maintenance.
- A critical facility, such as a police station, that is not equipped with a generator.
- A neighborhood that has the potential to have ingress and egress cut off as the result of a hazard event, such as a flood or earthquake (e.g. bridge only access).
- Substantial number of buildings in one area of the community are unreinforced masonry or soft-story construction.
- An area along the river is eroding and threatening public and/or private property.
- A large visitor population that may not be aware of tsunami risk.

Spending some time thinking about the results of the risk assessment and other noted vulnerabilities will be a big help in the development of your mitigation strategy. An example is shown in the table below.

Noted Vulnerability	Example Mitigation Action
<p>An urban drainage issue results in localized flooding every time it rains.</p>	<p>Replace undersized culverts that are contributing to localized flooding. Priority areas include:</p> <ul style="list-style-type: none"> • The corner of Main Street and 1st Street • Old Oak subdivision.

HAZARD MITIGATION ACTION PLAN AND EVALUATION OF RECOMMENDED ACTIONS

This section is the heart of your jurisdictional annex. This is where you will identify the actions your jurisdiction would like to pursue with this plan. All of the work that you have done thus far should provide you with a plethora of ideas for actions. With this in mind, we recommend that you review the following and develop a list of potential actions:

- **Capability Assessment Section of Annex**—Review the Legal and Regulatory Capability table, the Fiscal Capability table, the Administrative and Technical Capability table, the Education and Outreach table, and the Community Classification table.
 - For any capability that you indicated that you did not have, ask yourself – should we have this capability? If yes, consider including an action to develop/acquire the capability.
 - Example: Ensure a staff person from public works and planning are trained in the use of FEMA’s benefit-cost analysis software.
 - Review the Legal and Regulatory capabilities. If any have not been reviewed and updated in more than 10 years, consider an action to review and update the capability and, as appropriate, incorporate hazard mitigation principles or information obtained in the risk assessment (Note: actions such as this should also be identified in the opportunities for future integration section). Also, consider including projects or actions that have been identified in other plans and programs such as Capital Improvement Plans, Strategic Plans, etc. as actions in this plan.
 - For any capability that you indicated you do have, consider how this capability can be leveraged to increase or improve hazard mitigation in the jurisdiction.
- **National Flood Insurance Program Compliance Table of this Annex**—Review the table and consider the following:
 - If you have no certified floodplain managers and you have flood risk, consider adding an action to provide key staff members with training appropriate to obtain certification.
 - If your flood damage prevention was last updated in or before 2004, you should identify an action to update your ordinance to ensure it is compliant with NFIP requirements.
 - If you have any outstanding NFIP compliance issues, be sure to add an action to address them.
 - If flood hazard maps do not adequately address the flood risk within your jurisdiction, consider actions to request new mapping or conduct studies.
 - If you don’t participate in CRS or you would like to improve your classification, consider this as an action.
 - If the number of flood insurance policies in your jurisdiction is low relative to the number of structures in the floodplain, consider an action that will promote flood insurance in your jurisdiction.
- **Opportunities for Future Integration Section in this Annex**—Review the items you identified in this section. For items that address land use, include them in the prepopulated action in your template that reads as follows: *Integrate the hazard mitigation plan into other plans, ordinances and programs that dictate*

Wording Your Action Descriptions:

Descriptions of your actions need not provide great detail. That will come when you apply for a project grant. Provide enough information to identify the project’s scope and impact. The following are typical descriptions for an action plan action:

- **Action 1**—Address repetitive-loss properties. Through targeted mitigation, acquire, relocate or retrofit the five repetitive loss structures in the County as funding opportunities become available.
- **Action 2**—Perform a non-structural, seismic retrofit of City Hall.
- **Action 3**—Acquire floodplain property in the Smith subdivision.
- **Action 4**—Enhance the County flood warning capability by joining the NOAA "Storm Ready" program.

land use decisions in the community, including _____. For other items listed in this section, consider an action that specifically says what the plan, code, ordinance etc. is and how it will be integrated.

- **Jurisdiction-Specific Vulnerabilities Section in this Annex**—Review the items that you have identified in this section and consider actions that will help reduce these vulnerabilities (see mitigation best practices catalog).
- **Mitigation Best Practices Catalog**—A catalog that includes FEMA and other agency identified best practices. Review the catalog and identify those actions that your jurisdiction should consider including in its action plan.
- **Prior Mitigation Planning Efforts**—If your jurisdiction participated in a previous hazard mitigation plan, please be sure to remember to include any actions that were identified as “carry over” actions. Once you have carried them over, return to the Status of Previous Actions table and record the new action number (see discussion below).

Be sure to consider the following factors in your selection of actions:

- Select actions that are consistent with the overall purpose, goals, and objectives of the hazard mitigation plan.
- Identify actions where benefits exceed costs.
- Include any action that your jurisdiction has committed to pursuing regardless of grant eligibility.
- **You must identify at least one true mitigation action (i.e. not a preparedness or response action) that is clearly defined and actionable for hazards ranked as “high” or “medium.”**

Review Actions Recommended for All Partners

These actions should be included in every annex and should not be removed, although the specifics should be adjusted as needed for the particulars of each community.

- Where appropriate, support retrofitting, purchase or relocation of structures located in high hazard areas, prioritizing those structures that have experienced repetitive losses and/or are located in high or medium ranked hazard areas.
- Integrate the hazard mitigation plan into other plans, ordinances and programs that dictate land use decisions within the community.
- Actively participate in the plan maintenance protocols outlined in Volume 1 of the hazard mitigation plan.
- Continue to maintain good standing and compliance under the NFIP through implementation of floodplain management programs that, at a minimum, meet the NFIP requirements:
 - Enforce the flood damage prevention ordinance.
 - Participate in floodplain identification and mapping updates.
 - Provide public assistance/information on floodplain requirements and impacts.

We also recommend that every planning partner strongly consider the following additional actions, adjusted as needed for the particulars of each community:

- Develop and implement a program to capture perishable data after significant events (e.g. high water marks, preliminary damage estimates, damage photos) to support future mitigation efforts including the implementation and maintenance of the hazard mitigation plan.
- Develop a post-disaster recovery plan and a debris management plan.
- Develop and/or update plans that support or enhance continuity of operations following disasters.
- Purchase generators for critical facilities and infrastructure that lack adequate back-up power.

Complete the Table

Complete the table titled “Hazard Mitigation Action Plan Matrix” for all the actions you have identified and would like to include in the plan:

- Enter the action number and description. Replace the “xxx” included in the template with the letter code for your jurisdiction as follows:
 - Douglas County—DC1, DC2, DC3...
 - Castle Pines—CP1, CP2, CP3...
 - Castle Rock—CR1, CR2, CR3...
 - Larkspur—LAR1, LAR2, LAR3...
 - Lone Tree—LT1, LT2, LT3...
 - Parker—PAR1, PAR2, PAR3...
- If the action is carried over from your previous hazard mitigation plan, return to the “Status of Previous Plan Actions” table you completed in Phase 1 and enter the new action number in the column labeled Action # in Update.
- Indicate whether the action mitigates hazards for new and/or existing assets.
- Identify the specific hazards the action will mitigate (note: you must list the hazards, simply indicating all hazards is not deemed acceptable).
- Identify by number the mitigation plan objectives that the action addresses. Indicate who will be the lead in administering the action. This will most likely be a department within your jurisdiction (e.g. planning or public works). If you wish to indicate more than one department, please ensure that it is clear who the lead agency will be and list supporting agencies in the appropriate column.
- Enter an estimated cost in dollars if known; otherwise, enter “High,” “Medium” or “Low” as determined for the prioritization process described in the following section.
- Identify funding sources for the action. If it is a grant, include the funding sources for the cost share. Refer to your fiscal capability assessment to identify possible sources of funding and refer to **the table below** for project eligibility for FEMA’s hazard mitigation assistance grant programs.
- Indicate the time line as “short-term” (1 to 5 years) or “long-term” (5 years or greater) or “ongoing” (a continual program)

Eligible Activities	Hazard Mitigation Grant Program	Building Resilient Infrastructure & Communities	Flood Mitigation Assistance
Property Acquisition and Structure Demolition	√	√	√
Property Acquisition and Structure Relocation	√	√	√
Structure Elevation	√	√	√
Mitigation Reconstruction	√	√	√
Dry Floodproofing of Historic Residential Structures	√	√	√
Dry Floodproofing of Non-residential Structures	√	√	√
Generators	√	√	
Localized Flood Risk Reduction Projects	√	√	√
Non-Localized Flood Risk Reduction Projects	√	√	
Structural Retrofitting of Existing Buildings	√	√	√
Non-Structural Retrofitting of Existing Buildings and Facilities	√	√	√
Safe Room Construction	√	√	
Wind Retrofit for One- and Two-Family Residences	√	√	
Infrastructure Retrofit	√	√	√
Soil Stabilization	√	√	√
Wildland fire Mitigation	√	√	

Post-Disaster Code Enforcement	√		
Advance Assistance	√		
5 Percent Initiative Projects*	√		
Aquifer and Storage Recovery**	√	√	√
Flood Diversion and Storage**	√	√	√
Floodplain and Stream Restoration**	√	√	√
Green Infrastructure**	√	√	√
Miscellaneous/Other**	√	√	√
Hazard Mitigation Planning	√	√	√
Technical Assistance			√
Management Costs	√	√	√

* FEMA allows increasing the 5% Initiative amount up to 10% for a Presidential major disaster declaration under HMGP. The additional 5% can be used for activities that promote disaster-resistant codes for all hazards. As a condition of the award, a disaster-resistant building code must be adopted or an improved Building Code Effectiveness Grading Schedule is required.

** Proposed actions will be evaluated against program requirements. Eligible projects will be approved if funding is available.

Prioritization of Mitigation Actions

Complete the information in the table titled “Mitigation Strategy Priority Schedule” as follows:

- **Action #**—Indicate the action number from the previous annex table (Hazard Mitigation Action Plan Matrix).
- **# of Objectives Met**—Enter the number of objectives the action will meet.
- **Benefits**—Enter “High,” “Medium” or “Low” as follows:
 - High: Action will have an immediate impact on the reduction of risk exposure to life and property.
 - Medium: Action will have a long-term impact on the reduction of risk exposure to life and property, or action will provide an immediate reduction in the risk exposure to property.
 - Low: Long-term benefits of the action are difficult to quantify in the short term.
- **Costs**—Enter “High,” “Medium” or “Low” as follows:
 - High: Would require an increase in revenue via an alternative source (i.e., bonds, grants, fee increases) to implement. Existing funding levels are not adequate to cover the costs of the proposed action.
 - Medium: Could budget for under existing work-plan, but would require a reapportionment of the budget or a budget amendment, or the cost of the action would have to be spread over multiple years.
 - Low: Possible to fund under existing budget. Action is or can be part of an existing ongoing program.
 - If you know the estimated cost of an action because it is part of an existing, ongoing program, indicate the amount.
- **Do Benefits Exceed the Cost?**—Enter “Yes” or “No.” This is a qualitative assessment. Enter “Yes” if the benefit rating (high, medium or low) is the same as or higher than the cost rating (high benefit/high cost; high benefit/medium cost; medium benefit/low cost; etc.). Enter “No” if the benefit rating is lower than the cost rating (medium benefit/high cost, low benefit/medium cost; etc.)
- **Is the Action Grant-Eligible?**—Enter “Yes” or “No.” Refer to the fact sheet on HMGP, PDM and FMA and the table above.
- **Can Action Be Funded Under Existing Program Budgets?**—Enter “Yes” or “No.” In other words, is this action currently budgeted for, or would it require a new budget authorization or funding from another source such as grants?
- **Implementation Priority**— Enter “High,” “Medium” or “Low” as follows:

- **High Priority**—An action that meets multiple objectives, has benefits that exceed costs, and has a secured source of funding. Action can be completed in the short term (1 to 5 years).
 - **Medium Priority**—An action that meets multiple objectives, has benefits that exceed costs, and is eligible for funding though no funding has yet been secured for it. Action can be completed in the short term (1 to 5 years), once funding is secured. Medium-priority actions become high-priority actions once funding is secured.
 - **Low Priority**—An action that will mitigate the risk of a hazard, has benefits that do not exceed the costs or are difficult to quantify, has no secured source of funding, and is not eligible for any known grant funding. Action can be completed in the long term (1 to 10 years). Low-priority actions are generally “wish-list” actions. They may be eligible for grant funding from programs that have not yet been identified.
- **Grant Pursuit Priority**— Enter “High,” “Medium” or “Low” as follows:
 - **High Priority**—An action that meets identified grant eligibility requirements, has high benefits, and is listed as high or medium implementation priority; local funding options are unavailable or available local funds could be used instead for actions that are not eligible for grant funding.
 - **Medium Priority**—An action that meets identified grant eligibility requirements, has medium or low benefits, and is listed as medium or low implementation priority; local funding options are unavailable.
 - **Low Priority**—An action that has not been identified as meeting any grant eligibility requirements.

This prioritization is a simple way to determine that your identified actions meet one of the primary objectives of the Disaster Mitigation Act. It is not the detailed benefit/cost analysis required for HMGP/PDM /FMA action grants. The prioritization will identify any actions whose probable benefits will not exceed the probable costs. Those actions identified as high-priority grant funding actions should be closely reviewed for consideration when grant funding opportunities arise.

Note: If a jurisdiction wishes to identify an action as high priority that is outside of the prioritization scheme for high priorities, a note indicating so should be inserted and a rationale should be provided.

An example completed table is provided below.

Table 1-9. Mitigation Strategy Priority Schedule

Action #	# of Objectives Met	Benefits	Costs	Do Benefits Equal or Exceed Costs?	Is Action Grant-Eligible?	Can Action Be Funded Under Existing Programs/Budgets?	Implementation Priority	Grant Pursuit Priority
EX-1	3	High	High	Yes	Yes	No	Medium	High
EX-2	7	Medium	Low	Yes	No	Yes	High	Low
EX-3	2	Low	Medium	No	No	Maybe	Low	Low
EX-4	10	Low	Low	Yes	No	Yes	High	Low
EX-5	3	Low	Low	Yes	No	Yes	High	Low
EX-6	6	Medium	Low	Yes	No	Yes	High	Low
EX-7	3	Medium	Low	Yes	No	Yes	High	Low
EX-8	1	Medium	Medium	Yes	Yes	No	Medium	High
EX-9	2	Medium	Low	Yes	No	Yes	High	Low
EX-10	7	Medium	Low	Yes	No	Yes	High	Medium
EX-11	3	High	Medium	Yes	Yes	No	Medium	High

Analysis of Mitigation Actions

Complete the table titled “Analysis of Mitigation Actions” summarizing the mitigation actions by hazard of concern and the following eight mitigation types. Please note that an action can be more than one mitigation type:

- **Emergency Services/Warning**—Actions that protect people and property during and immediately after a hazard event. Includes warning systems, emergency response services, continuity of operations, and the protection of essential facilities.
- **Community Capacity Building**—Actions that increase or enhance local capabilities to adjust to potential damage, to take advantage of opportunities, or to respond to consequences. Includes entity coordination, staff training, memorandums of understanding, data collection, development of plans and studies, and monitoring programs.
- **Prevention**—Government, administrative or regulatory actions that influence the way land and buildings are developed to reduce hazard losses. Includes adoption of codes and standards, planning and zoning, floodplain laws, capital improvement programs, open space preservation, and stormwater management regulations.
- **Property Protection**—Modification of buildings or structures to protect them from a hazard or removal of structures from a hazard area. Includes acquisition, elevation, relocation, structural retrofit, storm shutters, and shatter-resistant glass.
- **Public Education and Awareness**—Actions to inform residents and elected officials about hazards and ways to mitigate them. Includes outreach projects, real estate disclosure, hazard information centers, and school-age and adult education.
- **Natural Resource Protection**—Actions that minimize hazard loss and preserve or restore the functions of natural systems. Includes sediment and erosion control, stream corridor restoration, watershed management, forest and vegetation management, wetland restoration and preservation, and green infrastructure.
- **Structural Projects**—Actions that involve the construction of structures to reduce the impact of a hazard. Includes dams, setback levees, floodwalls, retaining walls, and safe rooms.

This exercise demonstrates that the jurisdiction has selected a comprehensive range of actions. Planning partners should aim to identify at least one action in each category (although this is not required) and should make sure there is at least one action to address “high” and “medium” ranked hazards:

An example completed table is provided below.

Analysis of Mitigation Actions							
Hazard Type	Prevention	Property Protection	Public Education and Awareness	Natural Resource Protection	Emergency Services	Structural Projects	Community Capacity Building
Dam Failure	EX-2, 3, 4, 5	EX-1, 6	EX-4, 6		EX-8, 11		EX-3, 9, 10
Drought	EX-2	EX-1	EX-4				EX-8, 9, 10
Earthquake	EX-2, 3, 4, 5	EX-1, 7	EX-4		EX-8, 11		EX-3, 4, 8, 9
Flooding	EX-2, 3, 4, 5	EX-1, 6, 7	EX-4, 6	EX-9	EX-8, 11	EX-4	EX-3, 4, 8, 9
Landslide	EX-2, 3, 4, 5	EX-1, 7	EX-4		EX-8, 11	EX-4	EX-3, 4, 10
Severe Weather	EX-2, 3, 4, 5	EX-1, 7, 9	EX-4		EX-8, 9, 11		EX-8, 9, 10
Wildland fire	EX-2, 3, 4, 5	EX-1, 7, 9	EX-4, 9	EX-9	EX-8, 11		EX-3, 9, 10

REVIEW AND INCORPORATION OF INFORMATION FOR THIS ANNEX

Please note that this section will ultimately describe all information sources used to develop this annex. You should have previously listed the sources used for Phases 1 and 2. You should now add any further sources used for the preparation of Phase 3.

This section should describe what resources you used to complete the annex and how you used them. Several items are started for you, but please be sure to update and enhance any descriptions. This may seem trivial or unimportant, but it is a requirement to pass the state and FEMA review process.

FUTURE NEEDS TO BETTER UNDERSTAND RISK/VULNERABILITY

In this section, identify any future studies, analyses, reports, or surveys your jurisdiction needs to better understand its vulnerability to identified or currently unidentified risks. These could be needs based on federal or state agency mandates. Please note that this section is optional.

ADDITIONAL COMMENTS

Use this section to add any additional information pertinent to hazard mitigation and your jurisdiction not covered in this template. Please note that this section is optional.

NEXT STEPS

After all jurisdictions have submitted their annexes, the draft plan will be submitted for public comment. Following the public comment period and any revisions responsive to public comment, the plan will be submitted to state and federal review agencies. At that point planning partners will be asked to begin making preparations to formally adopt the plan.

Once FEMA has reviewed the plan and issued an approved-pending-adoption (APA) notice, planning partners will be asked to adopt the plan. Each planning partner must have its governing board adopt this plan via resolution or ordinance. Once adopted, planning partners will submit adoption information to Tetra Tech, who will submit the proof of adoption to FEMA. Once such adoption has been received, FEMA will issue final approval via a letter for those planning partners who have adopted the plan.

It is important to understand that approval is not final until proof of adoption has been received by FEMA and they have issued a letter specifically naming your jurisdiction. More information on the review and approval process, along with adoption support materials, will be provided at a later date.

Douglas County Hazard Mitigation Plan - Goals

DC1 Warning - Enhance predictive measure including the expansion and protection of warning systems and supporting technologies.

DC2 Data Collection - Enhance the quality of assessments, analysis and planning through the development and collection of data.

DC3 Outreach and Education - Increase public awareness of hazards and their mitigation.

DC4 Mitigate Structures and Protect Lives - Reduce impacts, costs, and damages from hazard events to people, property, local government and private assets, economy, and natural and cultural resources.

DC5 Planning - Coordinate and integrate hazard mitigation activities with local land development planning activities and emergency operations planning to consider resiliency.

DC6 Codes & Standards - Review, update, adopt and enforce local, state and federal plans, codes and regulations to reduce the impacts of natural hazards.

DC7 Entity Coordination - Strengthen communication and coordination among public entities, non-governmental organizations (NGOs), businesses and private citizens.

DC8 Continuity of Operations - Support continuity of operations pre-, during, and post- hazard events including the support of community lifelines.

Douglas County Hazard Mitigation Plan - Objectives

Obj 1: Improve systems that provide warning and emergency communications. (DC-1)

Obj 2: Increase public awareness of risk. (DC-1, 2, 3, 7)

Obj 3: Research, develop, and promote adoption of cost-effective building and development laws, regulations, and ordinances. (DC-2, 4, 6)

Obj 4: Improve hazard information databases and maps and increase accessibility to those resources. (DC – 1, 2, 3, 7, 8)

Obj 5: Develop and provide updated information about threats, hazards, vulnerabilities, and mitigation strategies to state, regional, and local agencies, as well as private sector groups. (DC – 1, 2, 3, 4, 5, 7, 8)

Obj 6: Manage development in geologically hazardous areas and floodplains to protect life and property. (DC – 6, 7)

Obj 7: Incorporate risk reduction considerations in new and updated infrastructure and development plans to reduce the impacts of natural hazards. (DC – 2, 4, 5, 6, 7)

Obj 8: 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. (DC – 1, 2, 3, 4, 5, 7, 8)

Obj 9: Improve understanding of the locations, potential impacts, and linkages among threats, hazards, vulnerability, and measures needed to protect life safety and health. (SL -2, 3, 4, 5, 7)

Obj 10: Consider risk reduction in long-term planning. (DC – 2, 4, 6, 7)

Obj 11: Minimize impacts of hazard events to key employers. (DC – 1, 2, 3, 4, 7, 8)

Obj 12: Identify projects that simultaneously reduce risk while increasing operational area resilience and sustainability. (DC – 1, 2, 3, 4, 5, 6, 7, 8)

Obj 13: Establish a partnership among all levels of government and the business community to improve and implement methods to protect property. (DC – 2, 3, 4, 5, 7, 8)

Obj 14: Reduce risks that may impact critical business operations. (DC– 1, 2, 3, 4, 5, 7, 8)

Obj 15: 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. (DC – 2, 3, 4, 5, 7, 8)

Obj 16: 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. (DC– 1, 2, 3, 4, 5, 6, 7)

Obj 17: Modify structures, as necessary, to meet life safety standards. (DC – 3, 4, 6, 7, 8)

Obj 18: Encourage the incorporation of mitigation measures into repairs, major alterations, new development, and redevelopment practices, especially in areas subject to substantial hazard risk. (DC – 2, 3, 4, 5, 6, 7)

Obj 19: Retrofit, purchase, or relocate structures in high hazard areas, especially those known to be repetitively damaged. (DC– 2, 3, 4, 5, 6, 7)

Obj 20: Encourage hazard mitigation measures that promote and enhance natural processes and minimize adverse impacts on the ecosystem. (DC– 2, 3, 4, 5, 6, 7)

Obj 21: Promote enforcement of relevant state regulations and local ordinances that significantly reduce life loss and injuries. (DC– 2, 3, 4, 5, 6, 7)

Obj 22: Strengthen local building code enforcement. (DC– 2, 3, 4, 6, 7)

Obj 23: Ensure continuity of operations of essential county government services. (DC – 2, 3, 4, 5, 7, 8)

Obj 24: Protect rare, endangered, unusual, or educationally important natural resources. (DC – 2, 3, 5, 6, 7)

Obj 25: Provide incentives for development and land use techniques that reduce risks. (DC- 2, 3, 4, 5, 6, 7)

APPENDIX G. PLAN MAINTENANCE TOOLS

This appendix includes tools and worksheets to facilitate plan maintenance and review by the Douglas County Project Management Team and Local Planning Committee.

In the first year of the performance period, an online performance progress reporting system, the BAToolSM will provide municipal and county representatives direct access to their mitigation initiatives to easily update the status of each project, document successes or obstacles to implementation, add or delete projects to maintain mitigation project implementation. This online program will capture information and roll all input into a report to summarize mitigation strategy progress.

The FEMA 386-4 guidance worksheets are also available to assist with progress reporting. These worksheets are provided below for ease of access to the HMP Coordinator and Local Planning Committee to maintain the 2021 HMP throughout its period of performance.

Plan Goal(s)/Objective(s) Addressed:

Goal: _____

Objective: _____

Indicator of Success (e.g., losses avoided as a result of the acquisition program):

In most cases, you will list losses avoided as the indicator. In cases where it is difficult to quantify the benefits in dollar amounts, you will use other indicators, such as the number of people who now know about mitigation or who are taking mitigation actions to reduce their vulnerability to hazards.

Status (Please check pertinent information and provide explanations for items with an asterisk. For completed or canceled projects, see Worksheet #2 — to complete a project evaluation):

Project Status

Project on schedule

Project completed

Project delayed*

*explain: _____

Project canceled

Project Cost Status

Cost unchanged

Cost overrun*

*explain: _____

Cost underrun*

*explain: _____

Summary of progress on project for this report:

A. What was accomplished during this reporting period?

B. What obstacles, problems, or delays did you encounter, if any?

C. How was each problem resolved?

<i>When gearing up for the plan evaluation, the planning team should reassess its composition and ask the following questions:</i>	YES	NO
Have there been local staffing changes that would warrant inviting different members to the planning team?		
Comments/Proposed Action:		
Are there organizations that have been invaluable to the planning process or to project implementation that should be represented on the planning team?		
Comments/Proposed Action:		
Are there any representatives of essential organizations who have not fully participated in the planning and implementation of actions? If so, can someone else from this organization commit to the planning team?		
Comments/Proposed Action:		
Are there procedures (e.g., signing of MOAs, commenting on submitted progress reports, distributing meeting minutes, etc.) that can be done more efficiently?		
Comments/Proposed Action:		
Are there ways to gain more diverse and widespread cooperation?		
Comments/Proposed Action:		
Are there different or additional resources (financial, technical, and human) that are now available for mitigation planning?		
Comments/Proposed Action:		

If the planning team determines the answer to any of these questions is “yes,” some changes may be necessary.

Project Name and Number: _____

Project Budget: _____

Project Description: _____

Associated Goal and Objective(s): _____

Indicator of Success (e.g., losses avoided): _____



Was the action implemented? YES NO



Why not?

Was there political support for the action?

Were enough funds available?

Were workloads equitably or realistically distributed?

Was new information discovered about the risks or community that made implementation difficult or no longer sensible?

Was the estimated time of implementation reasonable?

Were sufficient resources (for example staff and technical assistance) available?

YES NO



What were the results of the implemented action? _____

	YES	NO
Were the outcomes as expected? If No, please explain:		
Did the results achieve the goal and objective(s)? Explain how:		
Was the action cost-effective? Explain how or how not:		
What were the losses avoided after having completed the project?		
If it was a structural project, how did it change the hazard profile?		
Additional comments or other outcomes:		

Date: _____
Prepared by: _____

Risk Assessment Steps	Questions	YES	NO	COMMENTS
Identify hazards	Are there new hazards that can affect your community?			
Profile hazard events	Are new historical records available?			
	Are additional maps or new hazard studies available?			
	Have chances of future events (along with their magnitude, extent, etc.) changed?			
	Have recent and future development in the community been checked for their effect on hazard areas?			
Inventory assets	Have inventories of existing structures in hazard areas been updated?			
	Is future land development accounted for in the inventories?			
	Are there any new special high-risk populations?			
Estimate losses	Have loss estimates been updated to account for recent changes?			

If you answered "Yes" to any of the above questions, review your data and update your risk assessment information accordingly.

Worksheet #1

Progress Report

step 2

Page 1 of 3

Progress Report Period: October 1, 2003 to December 31, 2003
(date) (date)

Project Title: Raging River Views Park Flood Acquisition Project Project ID#: HVMP-2003-01

Responsible Agency: Hazardville Department of Planning

Address: 1909 Burnham Way

City/County: Hazardville, Emergency

Contact Person: Eustoe Eudlid Title: Grants Administrator

Phone #(s): (555) 555-8478 email address: eeudlid@town.hazardville.oh

List Supporting Agencies and Contacts:

Hazardville Department of Housing: Noah Hudson (555) 555-8465

Hazardville Habitat for Humanity: Carter Goodman (555) 555-9432

Total Project Cost: \$360,000

Anticipated Cost Overrun/Underrun: \$N/A

Date of Project Approval: July 21, 2003 Start date of the project: November 15, 2003

Anticipated completion date: Summer 2005

Description of the Project (include a description of each phase, if applicable, and the time frame for completing each phase):

Acquire and demolish 14 structures located at the Raging River Views Park. Work with Habitat for Humanity and the Department of Housing to construct new housing or rehabilitate existing housing for displaced low-income residents. The Department of Housing will also provide funds for temporary housing to displaced residents.

Milestones	Complete	Projected Date of Completion
Conduct surveys of ground and first-floor elevations	✓	
Obtain Notices of Intent by owners	✓	
Conduct structure appraisals	✓	
Send letters of offer to homeowners		1/31/04
Perform title work		3/30/04
Acquire structures		6/30/04
Begin construction of new housing or reconstruction of existing housing for relocated residents		6/30/04
Send payment for relocation to centers		9/30/04
Finalize contract for demolition		1/12/05
Demolish structures		4/26/05
Landscape open parcels		6/30/05

Plan Goal(s)/Objective(s) Addressed:

Goal: Minimize losses to existing and future structures within hazard areas.

Objective: Reduce potential damages to the manufactured home park in the floodplain.

Indicator of Success (e.g., losses avoided as a result of the acquisition program):

In most cases, you will list losses avoided as the indicator. In cases where it is difficult to quantify the benefits in dollar amounts, you will use other indicators, such as the number of people who now know about mitigation or who are taking mitigation actions to reduce their vulnerability to hazards.

Losses Avoided. After a major flood (100-year), the Department of Economic Development will assist the Planning Department in calculating the losses avoided.

Status (Please check pertinent information and provide explanations for items with an asterisk. For completed or canceled projects, see Worksheet #2 — to complete a project evaluation):

Project Status	Project Cost Status
<input checked="" type="checkbox"/> Project on schedule	<input checked="" type="checkbox"/> Cost unchanged
<input type="checkbox"/> Project completed	<input type="checkbox"/> Cost overrun*
<input type="checkbox"/> Project delayed*	*explain: _____
*explain: _____	_____
<input type="checkbox"/> Project canceled	<input type="checkbox"/> Cost underrun*
	*explain: _____

Summary of progress on project for this report:

A. What was accomplished during this reporting period?

The Department of Planning contacted the owners of the properties vulnerable to floods to determine their willingness to sell their properties. Of the 14 property owners contacted, 10 agreed to have their homes acquired. An appraiser contracted by the Department of Planning estimated the value of the 10 properties.

B. What obstacles, problems, or delays did you encounter, if any?

The owners of four properties refused to sell. There has been some limited neighborhood opposition to various suggestions for the community open space created by the acquisitions.

C. How was each problem resolved?

The Department of Planning has proposed to the residents a design charrette to develop alternatives for the open space that would be created, with the understanding that no permanent structures can be constructed on the open parcels after acquisition and demolition has been completed. Recreational activities will be limited to passive uses such as trails and bike paths.

Worksheet #2 Evaluate Your Planning Team step **3**

<i>When gearing up for the plan evaluation, the planning team should reassess its composition and ask the following questions:</i>	YES	NO
Have there been local staffing changes that would warrant inviting different members to the planning team?		✓
Comments/Proposed Action: NA		
Are there organizations that have been invaluable to the planning process or to project implementation that should be represented on the planning team?	✓	
Comments/Proposed Action: Hazardville Habitat for Humanity has been invaluable to assisting the relocation of former Ragin River Views Park residents. The organization should be invited to participate in THORR.		
Are there any representatives of essential organizations who have not fully participated in the planning and implementation of actions? If so, can someone else from this organization commit to the planning team?	✓	
Comments/Proposed Action: It is essential that the Department of Public Works be represented at each meeting because so many mitigation actions involve them. However, representatives from the department have been unable to attend meetings consistently since the development of the plan. THORR will work with the department's director to find consistent, active representation.		
Are there procedures (e.g., signing of MOAs, commenting on submitted progress reports, distributing meeting minutes, etc.) that can be done more efficiently?	✓	
Comments/Proposed Action: Again, the Department of Public Works has been unable to provide timely progress reports of its mitigation actions. Administrative duties and paperwork have fallen through the cracks since the department has been assigned numerous new duties to Hazardville's mitigation efforts. Perhaps the department, in partnership with THORR, should approach the Town Council for funding for more department staff.		
Are there ways to gain more diverse and widespread cooperation?	✓	
Comments/Proposed Action: THORR members believe that better publicity about mitigation actions will garner more interest from the public, affected/interested organizations, and state agencies.		
Are there different or additional resources (financial, technical, and human) that are now available for mitigation planning?	✓	
Comments/Proposed Action: THORR has learned about new PDM funding. The state has asked that local jurisdictions submit applications for brick and mortar projects and risk assessments studies.		

If the planning team determines the answer to any of these questions is "yes," some changes may be necessary.



Worksheet #3 Evaluate Your Project Results **step 3**

page 1 of 2

Project Name and Number:

Raging River Views Park Flood Acquisition Project (HVMP-2003-01)

Project Budget:

\$360,000

Project Description:

Acquisition and demolition of 14 flood-prone structures

Associated Goal and Objective(s):

Goal: Minimize losses to existing and future structures within hazard areas

Objective: Reduce potential damages to the manufactured home park in the floodplain

Indicator of Success (e.g., losses avoided):

Losses avoided by acquisition and demolition of flood-prone structures



Town of Hazardville Composite Loss Map developed previously during risk assessment (see FEMA 386-2).

Was the action implemented? YES NO

IF NO

Why not?

Was there political support for the action?

YES NO

Were enough funds available?

Were workloads equitably or realistically distributed?

Was new information discovered about the risks or community that made implementation difficult or no longer sensible?

Was the estimated time of implementation reasonable?

Were sufficient resources (for example staff and technical assistance) available?

IF YES

What were the results of the implemented action?

Of the 14 proposed properties, 10 were acquired. The benefit-cost ratio is 2.19, based on project benefits of \$789,000 and costs of \$360,274. Benefits are based on the net present value of the avoided damages over the project life. Furthermore, about 40 people are no longer in the path of a potential flood, making emergency rescue operations in that area less likely and evacuation easier.

	YES	NO
Were the outcomes as expected? If No, please explain:		<input checked="" type="checkbox"/>
The project originally set out to acquire 14 properties. Four of the 14 owners did not want to participate in the buyout program.		
Did the results achieve the goal and objective(s)? Explain how:	<input checked="" type="checkbox"/>	
Despite four properties still in harm's way, the objective has been largely met. See additional comments.		
Was the action cost-effective? Explain how or how not:	<input checked="" type="checkbox"/>	
The FEMA Limited Data module was used to perform the benefit-cost analysis. Data for the analysis was collected from historical flood data and used as benchmarks in the before mitigation section of the analysis. The damages after mitigation section was left blank, due to the properties being permanently acquired, and the economic risk removed completely. The analysis resulted in a benefit-cost ratio of 2.19, with benefits totaling \$789,000 for 10 properties.		
What were the losses avoided after having completed the project?		
Total avoided losses are \$789,000 over the lifetime of the project (estimated at 100 years).		
If it was a structural project, how did it change the hazard profile?		
N/A		
Additional comments or other outcomes:		
The Planning Department has agreed to work with the remaining four homeowners in evaluating other flood-proofing options.		

Date: October 12, 2005

Prepared by: Hazardville Department of Economic Development
Hazardville Department of Planning

Worksheet #4 Revisit Your Risk Assessment **step 4**

Risk Assessment Steps	Questions	YES	NO	COMMENTS
Identify hazards	Are there new hazards that can affect your community?		✓	
Profile hazard events	Are new historical records available?		✓	
	Are additional maps or new hazard studies available?	✓		Recently completed maps and studies showing vulnerability of the new coastal development to erosion and tidal surge are available.
	Have chances of future events (along with their magnitude, extent, etc.) changed?		✓	
	Have recent and future development in the community been checked for their effect on hazard areas?	✓		
Inventory assets	Have inventories of existing structures in hazard areas been updated?	✓		
	Is future land development accounted for in the inventories?	✓		The Planning Department is preparing a coastal development plan to ensure that any future development is set back far enough to be outside the erosion zones and the coastal high hazard areas. Current and future road configurations will also be studied to ensure adequate evacuation routes before hurricane events.
	Are there any new special high-risk populations?	✓		Coastal residents and business owners.
Estimate losses	Have loss estimates been updated to account for recent changes?	✓		

If you answered "Yes" to any of the above questions, review your data and update your risk assessment information accordingly.



APPENDIX H. LINKAGE PROCEDURES

This Appendix contains the linkage procedures for the Douglas County Local Hazard Mitigation Plan Update.

H.1 Administrative Process for “Linkage” to the Douglas County Local Hazard Mitigation Plan Update

Even though that initial development of the Douglas County Local Hazard Mitigation Plan Update (the Plan) included 10 planning partners, not all eligible jurisdictions within the defined planning area are included in this plan. Completed jurisdictional annexes are presented in Section 9. Any non-participating local governments and other local jurisdictions such as Fire Districts, Utility Districts, School Districts and any other eligible local government as defined in 44 CFR 201.2 within the Douglas County planning area can join this plan as a participating jurisdiction and to ultimately achieve approved status by following the linkage procedures defined in this appendix.

It is assumed that some or all these non-participating local governments may choose to "link" to the Plan at some point in time to gain eligibility for programs under the DMA. In addition, some of the current partnership may not continue to meet eligibility requirements due to the lack of active participation as prescribed by the plan. These "linkage" procedures will define the requirements established by the Douglas County Local Planning Committee and all planning partners for dealing with the increase or decrease in planning partners linked to this plan. It should be noted that currently non-participating jurisdictions within the defined planning area are not obligated to link to this plan. These jurisdictions can choose to do their own “complete” plan that addresses all required elements of section 201.6 of 44CFR.

H.1.1 Increasing the Partnership Through Linkage

Eligibility

Eligible jurisdictions located in the planning area may link to this plan at any point during the plan’s performance period. Eligible jurisdictions located in the planning area may link to this plan at any point during the plan’s performance period (5 years after final approval). Eligibility will be determined by the following factors:

- The linking jurisdiction is a local government as defined by the Disaster Mitigation Act.
- The boundaries or service area of the linking jurisdiction is completely contained within the boundaries of the planning area established during the 2021 hazard mitigation plan development process.
- The linking jurisdiction’s critical facilities were included in the critical facility and infrastructure risk assessment completed during the 2021 plan development process.

Requirements

It is expected that linking jurisdictions will complete the requirements outlined below and submit their completed template to the lead agency Douglas County Office of Emergency Management for review within six months of beginning the linkage process:

1. The Douglas County Local Planning Committee has established an annual window for which linkage to the plan can occur. Linking jurisdictions are instructed to complete the following procedures during this time frame.

2. The current non-participating jurisdiction contacts the Douglas County Hazard Mitigation Planning Coordinator for the Plan and requests a "Linkage Package". The Douglas County Hazard Mitigation Project Contact is:

Tim Johnson, Director
Douglas County Office of Emergency Management
oem@dcsheriff.net

3. The Douglas County Hazard Mitigation Planning Coordinator will provide a linkage packages that includes:
 - Copy of Volume 1 and 2 of the Plan (CD-ROM or flash drive).
 - Planning Partner's Expectations Sheet.
 - A Sample "Letter of Intent" to Link to the Plan.
 - A Jurisdictional Template and Instructions.
 - Catalog of Hazard Mitigation Alternatives or the Mitigation Catalog.
 - A copy of Section 201.6 of Chapter 44, the Code of Federal Regulations (44CFR), which defines the federal requirements for a local hazard mitigation plan.
4. The new jurisdiction will be required to review both volumes of the Plan which includes the following key components for the planning area:
 - The Douglas County risk assessment;
 - The plan's goals and objectives;
 - Plan implementation and maintenance procedures;
 - Catalog of potential mitigation actions; and
 - County-wide initiatives.

Once this review is complete, the jurisdiction will complete its specific jurisdictional annex by following the template and its instructions for completion provided by the Douglas County Hazard Mitigation Planning Coordinator. Technical assistance can be provided upon request by completing the request for technical assistance (TA) form provided in the linkage package. This TA may be provided by the Douglas County Hazard Mitigation Planning Coordinator or any other resource within the Planning Partnership such as a member of the Local Planning Committee or a currently participating jurisdiction. The Douglas County Hazard Mitigation Planning Coordinator will determine who will provide the TA and the possible level of TA based on resources available at the time of the request.

5. The new jurisdiction will also be required to develop a public involvement strategy that ensures their public's ability to participate in the plan development process. At a minimum, the new jurisdiction must try to solicit public opinion on hazard mitigation at the onset of this linkage process and a minimum of one public meeting to present their draft jurisdiction specific annex for comment, prior to adoption by the governing body. The Planning Partnership will have available resources to aid in the public involvement strategy such as the Plan website. However, it will be the new jurisdiction's responsibility to implement and document this strategy for incorporation into their annex.

It should be noted that the Jurisdictional Annex templates do not include a section for the description of the public process. This is because the original partnership was covered under a uniform public involvement strategy that covered the operational area that is described in volume 1 of the plan. Since the new partner was

not addressed by that strategy, they will have to initiate a new strategy, and add a description of that strategy to their annex. For consistency, new partners are encouraged to follow the public involvement format utilized by the initial planning effort as described in Volume I of the Plan.

6. Once their public involvement strategy is completed and they have completed their template, the new jurisdiction will submit the completed package to the Douglas County Hazard Mitigation Planning Coordinator for a pre-adoption review to ensure conformance with the Regional plan format.
7. The Douglas County Hazard Mitigation Planning Coordinator will review for the following:
 - Documentation of public involvement and mitigation action development strategies;
 - Conformance of template entries with guidelines outlined in instructions;
 - Chosen actions are consistent with goals, objectives, and mitigation catalog of Douglas County Hazard Mitigation Plan; and
 - Designated point of contact.

The Douglas County Hazard Mitigation Planning Coordinator may utilize members of the Local Planning Committee or other resources to complete this review. All proposed linked annexes will be submitted to the HMP Planning Committee for their review and comment prior to submittal to the Colorado Division of Homeland Security and Emergency Management.

8. Plans approved and accepted by the Local Planning Committee will then be forwarded to the Colorado Division of Homeland Security and Emergency Management for review with cover letter stating the forwarded plan meets local approved plan standards and whether the plan is submitted with local adoption or for criteria met/plan not adopted review.
9. The Colorado Division of Homeland Security and Emergency Management will review plans for state and federal compliance. Non-compliant plans are returned to the jurisdiction for correction. Compliant plans are forwarded to FEMA Region 8 office for review with annotation as to the adoption status.
10. FEMA Region 8 reviews the new jurisdiction's plan in association with the approved plan to ensure DMA compliance. Region 8 notifies new jurisdiction of results of review with copies to the Colorado Division of Homeland Security and Emergency Management and approved planning authority.
11. New jurisdiction corrects plan's shortfalls (if necessary) and resubmits to the Colorado Division of Homeland Security and Emergency Management through the approved plan lead agency.
12. For plans with no shortfalls that have not been adopted from the Region 8 review or outstanding corrected shortfalls, the new jurisdiction governing authority adopts the plan (if not already accomplished) and forwards adoption resolution to Region 8f with copies to lead agency and the Colorado Division of Homeland Security and Emergency Management.
13. Region 8 Director notifies new jurisdiction governing authority of plan approval.

The new jurisdiction plan is then included with the Douglas County Local Hazard Mitigation Plan Update and the linking jurisdiction is committed to participate in the ongoing plan implementation and maintenance identified in Volume 1 of the HMP.

APPENDIX I. CRITICAL FACILITIES

Due to the sensitive nature of this information, details of each have been redacted for the public document. A full list of critical facilities identified for the vulnerability analysis is available at the Douglas County Office of Emergency Management. Contact the Hazard Mitigation Coordinator, Tim Johnson, to view the list.



Douglas County Local Natural Hazard Mitigation Plan 2021 Update

Volume II



CONTENTS

9.1	Unincorporated Douglas County	9.1-4
9.1.1	Hazard Mitigation Plan Point of Contact.....	9.1-4
9.1.2	Jurisdiction Profile	9.1-4
9.1.3	Current Trends	9.1-5
9.1.4	Status of Previous Plan Actions	9.1-7
9.1.5	Capability Assessment.....	9.1-9
9.1.6	Review and Incorporation of Information for This Annex	9.1-13
9.1.7	Jurisdiction-Specific Natural Hazard Event History	9.1-16
9.1.8	Hazard Risk Ranking.....	9.1-19
9.1.9	Jurisdiction-Specific Vulnerabilities	9.1-20
9.1.10	Hazard Mitigation Action Plan and Evaluation of Recommended Actions.....	9.1-20
9.2	City of Castle Pines	9.2-30
9.2.1	Hazard Mitigation Plan Point of Contact.....	9.2-30
9.2.2	Jurisdiction Profile	9.2-30
9.2.3	Current Trends	9.2-31
9.2.4	Status of Previous Plan Actions	9.2-32
9.2.5	Capability Assessment.....	9.2-32
9.2.6	Review and Incorporation of Information for This Annex	9.2-36
9.2.7	Jurisdiction-Specific Natural Hazard Event History	9.2-38
9.2.8	Hazard Risk Ranking.....	9.2-38
9.2.9	Jurisdiction-Specific Vulnerabilities	9.2-39
9.2.10	Hazard Mitigation Action Plan and Evaluation of Recommended Actions.....	9.2-39
9.3	Town of Castle Rock	9.3-46
9.3.1	Hazard Mitigation Plan Point of Contact.....	9.3-46
9.3.2	Jurisdiction Profile	9.3-46
9.3.3	Current Trends	9.3-47
9.3.4	Status of Previous Plan Actions	9.3-48
9.3.5	Capability Assessment.....	9.3-49
9.3.6	Review and Incorporation of Information for This Annex	9.3-53
9.3.7	Jurisdiction-Specific Natural Hazard Event History	9.3-56
9.3.8	Hazard Risk Ranking.....	9.3-57
9.3.9	Jurisdiction-Specific Vulnerabilities	9.3-58
9.3.10	Hazard Mitigation Action Plan and Evaluation of Recommended Actions.....	9.3-58
9.3.11	Future Needs to Better Understand Risk/Vulnerability	9.3-61
9.3.12	Additional Comments.....	9.3-61
9.4	Town of Larkspur	9.4-65
9.4.1	Hazard Mitigation Plan Point of Contact.....	9.4-65
9.4.2	Jurisdiction Profile	9.4-65
9.4.3	Current Trends	9.4-66
9.4.4	Status of Previous Plan Actions	9.4-67
9.4.5	Capability Assessment.....	9.4-68
9.4.6	Review and Incorporation of Information for This Annex	9.4-73
9.4.7	Opportunities for Future Integration	9.4-74
9.4.8	Jurisdiction-Specific Natural Hazard Event History	9.4-74
9.4.9	Hazard Risk Ranking.....	9.4-74
9.4.10	Jurisdiction-Specific Vulnerabilities	9.4-75
9.4.11	Hazard Mitigation Action Plan and Evaluation of Recommended Actions.....	9.4-76
9.4.12	Future Needs to Better Understand Risk/Vulnerability	9.4-82

9.5	City of Lone Tree	9.5-83
9.5.1	Hazard Mitigation Plan Point of Contact.....	9.5-83
9.5.2	Jurisdiction Profile	9.5-83
9.5.3	Current Trends	9.5-84
9.5.4	Status of Previous Plan Actions	9.5-85
9.5.5	Capability Assessment.....	9.5-86
9.5.6	Review and Incorporation of Information for This Annex	9.5-91
9.5.7	Jurisdiction-Specific Natural Hazard Event History	9.5-94
9.5.8	Hazard Risk Ranking.....	9.5-95
9.5.9	Jurisdiction-Specific Vulnerabilities	9.5-95
9.5.10	Hazard Mitigation Action Plan and Evaluation of Recommended Actions.....	9.5-96
9.5.11	Future Needs to Better Understand Risk/Vulnerability	9.5-99
9.6	Town of Parker.....	9.6-103
9.6.1	Hazard Mitigation Plan Point of Contact.....	9.6-103
9.6.2	Jurisdiction Profile	9.6-103
9.6.3	Current Trends	9.6-104
9.6.4	Status of Previous Plan Actions	9.6-105
9.6.5	Capability Assessment.....	9.6-106
9.6.6	Review and Incorporation of Information for This Annex	9.6-111
9.6.7	Jurisdiction-Specific Natural Hazard Event History	9.6-112
9.6.8	Hazard Risk Ranking.....	9.6-112
9.6.9	Jurisdiction-Specific Vulnerabilities	9.6-113
9.6.10	Hazard Mitigation Action Plan and Evaluation of Recommended Actions.....	9.6-113
9.7	Centennial Water and Sanitation District	9.7-119
9.7.1	Hazard Mitigation Plan Point of Contact.....	9.7-119
9.7.2	Jurisdiction Profile	9.7-119
9.7.3	Status of Previous Plan Actions	9.7-120
9.7.4	Capability Assessment.....	9.7-121
9.7.5	Review and Incorporation of Resources for This Annex.....	9.7-123
9.7.6	Jurisdiction-Specific Natural Hazard Event History	9.7-124
9.7.7	Hazard Risk Ranking.....	9.7-124
9.7.8	Jurisdiction-Specific Vulnerabilities	9.7-125
9.7.9	Hazard Mitigation Action Plan and Evaluation of Recommended Actions.....	9.7-126
9.7.10	Review and Incorporation of Resources for This Annex.....	9.7-128
9.8	Denver Water	9.8-132
9.8.1	Hazard Mitigation Plan Point of Contact.....	9.8-132
9.8.2	Jurisdiction Profile	9.8-132
9.8.3	Status of Previous Plan Actions	9.8-133
9.8.4	Capability Assessment.....	9.8-134
9.8.5	Review and Incorporation of Resources for This Annex.....	9.8-135
9.8.6	Hazard Risk Ranking.....	9.8-137
9.8.7	Jurisdiction-Specific Vulnerabilities	9.8-138
9.8.8	Hazard Mitigation Action Plan and Evaluation of Recommended Actions.....	9.8-138
9.8.9	Review and Incorporation of Resources for This Annex.....	9.8-140
9.9	Mile High Flood Control District	9.9-144
9.10	Parker Water Sanitation District.....	9.10-145
9.10.1	Hazard Mitigation Plan Point of Contact.....	9.10-145
9.10.2	Jurisdiction Profile	9.10-145
9.10.3	Status of Previous Plan Actions	9.10-146
9.10.4	Capability Assessment.....	9.10-146
9.10.5	Review and Incorporation of Resources for This Annex.....	9.10-148

9.10.6	Jurisdiction-Specific Natural Hazard Event History	9.10-149
9.10.7	Jurisdiction-Specific Vulnerabilities	9.10-150
9.10.8	Hazard Risk Ranking.....	9.10-150
9.10.9	Hazard Mitigation Action Plan and Evaluation of Recommended Actions.....	9.10-150
9.10.10	Review and Incorporation of Resources for This Annex.....	9.10-153

9.1 UNINCORPORATED DOUGLAS COUNTY

9.1.1 Hazard Mitigation Plan Point of Contact

Primary Point of Contact	Alternate Point of Contact
Tim Johnson, Director of The Office of Emergency Management 4000 Justice Way Castle Rock, CO, 80109 Telephone: 303-660-7589 E-mail Address: tjohnso@dcsheriff.net	Tim Hallmark, Director of Facilities, Fleet & Emergency Support Services 3026 N Industrial Way Castle Rock, CO, 80109 Telephone: 303-663-7275 E-mail Address: thallmar@douglas.co.us

9.1.2 Jurisdiction Profile

Location

Much of Douglas County consists of unincorporated land, with incorporated towns in much of the area directly east and west of Interstate 25 in the northern half of the County. As much of Douglas County is made up of unincorporated land, the region is bordered by Jefferson County to the West, Park County to the Southwest, Teller County and El Paso County to the South, Elbert County to the East, and Arapahoe County to the North. The land consists of a wide range of topography encompassing mountain vistas, dramatic ridgelines, hills, and grass covered plains. Three state parks, Castlewood Canyon State Park, Chatfield State Park, and Roxborough State Park are located within the unincorporated regions of Douglas County.

Unincorporated Douglas County is dispersed throughout Douglas County, namely comprising the Western half of the county, as well as the Southern half and Eastern-most regions of Douglas County. Unincorporated Douglas County is bound by South Platte River to the West and Delbert Road to the East, encompassing an area of 766 square miles.

History

Unincorporated Douglas County is shaped by its County’s history, which began in 1861 with the Colorado Territory Sessions Laws with the creation of Douglas County, after Stephen A. Douglas. While Douglas County used to encompass much of the land from the Rocky Mountains to Colorado’s border with Kansas, it now sits in Central Colorado. Much of Unincorporated Douglas County consists of permanently protected land, which can be attributed to the Douglas County Open Space Program, offering over 146,000 acres of recreational land and green space.

Climate

Douglas County is characterized by a moderate climate and significant sun exposure (more than 300 days per year). The County features low humidity, approximately 18 inches of rain each year, and 71 inches of snowfall. Temperatures range from highs of 85 degrees in July to 45 degrees in January (according to USA.com).

Governing Body Format

Unincorporated Douglas County is governed by the Board of County Commissioners. This Board, comprised of three members, acts as the legislative and administrative body for the unincorporated regions of the county. The Board of County Commissioners also makes all policy decisions, including adopting

ordinances and resolutions. The Board of County Commissioners is responsible for appointing other relevant County officials, such as the County Manager and County Attorney. The County Manager oversees the implementation of policy and leads County staff, while the County Attorney is an advisor and representative of the Board and elected officials, department heads, and other pertinent governmental staff in Douglas County. Other county elected officials include the Assessor, Clerk and Recorder, Coroner, Sheriff, Surveyor, and Treasurer.

The Douglas County Board of County Commissioners assumes responsibility for the adoption of this plan; Office of Emergency Management and Facilities, Fleet & Emergency Support Services will oversee its implementation. Development of this annex was carried out by the members of the local mitigation planning team, whose members are listed in Table 9.1-1.

Table 9.1-1. Local Mitigation Planning Team Members

Name	Title
Tim Johnson	Director of Office of Emergency Management
Tim Hallmark	Director of Facilities, Fleet and Emergency Support Services
Steve Koster	Assistant Director Planning Services / Community Development
Matt Williams	Assistant Director Engineering / Public Works Engineering
Dan Avery	Chief Planner / Community Development
Joel Hanson	GIS Manager / Information Technology
Sean Owens	Special Projects Manager / Public Works Engineering
Zak Humbles	Engineer IV Special Projects / Public Works Engineering
Nathan Wysocki	Senior GIS Analyst / Information Technology
Lisa Goudy	Safety and Security Coordinator / Facilities, Fleet and Emergency Support Services

9.1.3 Current Trends

Population

According to the U.S. Census Bureau, the population of Unincorporated Douglas County as of 2020 was 205,800. The population of all of Douglas county was 362,390. Since 2010, the population of Unincorporated Douglas County has grown at an average annual rate of 1.71% percent. Since 2010, the population of all of Douglas County has grown at an average annual rate of 2.36% percent.

Development

From 2015 to 2019 unincorporated Douglas County grew at annual growth rates of between 2.5 and 3.7%. Much of the growth occurred in the northern portion of the County, where substantial suburban-density development has occurred. Single-family residential units continue to be the majority of permits issued, but multifamily development and attached single-family are a growing market segment. Sterling Ranch, a master-planned community in the northwestern portion of the County, will continue to be a significant source of new residential development for the next 10 years or more.

Beyond the development occurring in the unincorporated portions of the County, much of the County’s overall growth has occurred in the municipalities of Lone Tree, Parker, Castle Pines, and Castle Rock.

Table 9.1-2 summarizes development trends in the performance period since the preparation of the previous hazard mitigation plan, as well as expected future development trends.

Table 9.1-2. Recent and Expected Future Development Trends

Criterion	Response																																										
Has your jurisdiction annexed any land since the preparation of the previous hazard mitigation plan?	No																																										
<ul style="list-style-type: none"> If yes, give the estimated area annexed and estimated number of parcels or structures. 																																											
Is your jurisdiction expected to annex any areas during the performance period of this plan?	No																																										
<ul style="list-style-type: none"> If yes, describe land areas and dominant uses. 																																											
<ul style="list-style-type: none"> If yes, who currently has permitting authority over these areas? 																																											
Are any areas targeted for development or major redevelopment in the next five years?	No																																										
<ul style="list-style-type: none"> If yes, briefly describe, including whether any of the areas are in known hazard risk areas 																																											
How many permits for new construction were issued in your jurisdiction since the preparation of the previous hazard mitigation plan?	<table border="1"> <thead> <tr> <th></th> <th>2015</th> <th>2016</th> <th>2017</th> <th>2018</th> <th>2019</th> </tr> </thead> <tbody> <tr> <td>Single Family</td> <td>890</td> <td>847</td> <td>933</td> <td>1004</td> <td>931</td> </tr> <tr> <td>Multi-Family</td> <td>521</td> <td>585</td> <td>697</td> <td>512</td> <td>581</td> </tr> <tr> <td>Other (commercial, mixed use, etc.)</td> <td>2101</td> <td>3824</td> <td>9066</td> <td>5478</td> <td>5640</td> </tr> <tr> <td></td> <td>85</td> <td>56</td> <td>59</td> <td>70</td> <td>21</td> </tr> <tr> <td>Total</td> <td>211,5</td> <td>383,8</td> <td>908,2</td> <td>549,3</td> <td>565,5</td> </tr> <tr> <td></td> <td>96</td> <td>88</td> <td>89</td> <td>86</td> <td>33</td> </tr> </tbody> </table>		2015	2016	2017	2018	2019	Single Family	890	847	933	1004	931	Multi-Family	521	585	697	512	581	Other (commercial, mixed use, etc.)	2101	3824	9066	5478	5640		85	56	59	70	21	Total	211,5	383,8	908,2	549,3	565,5		96	88	89	86	33
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	85	56	59	70	21																																						
Total	211,5	383,8	908,2	549,3	565,5																																						
	96	88	89	86	33																																						
Provide the number of new-construction permits for each hazard area or provide a qualitative description of where development has occurred.	<p>Douglas County maps environmental constraints and hazard areas in the County in consultation with the Colorado Geological Survey (geophysical), Colorado State Forest Service (wildfire), and Federal Emergency Management Agency (flood risk) as part of its Comprehensive Master Planning processes.</p> <p>The information within the hazard maps is general in nature and is supplemented through site-specific studies performed during the development review process, primarily at the preliminary subdivision plan phase of review. These land use review processes are designed to ensure that development occurs outside of identified hazard areas, or that hazards are mitigated in accordance with professional recommendations.</p> <p>Additionally, wildfire hazard areas are identified within the adopted Wildfire Hazard Area-Overlay District Map. For lands designated as subject to wildfire by this map, a site-specific analysis of wildfire hazard and proposed mitigation is required at the time of land use review applications and building permit requests.</p> <p>County-wide, over 95% of permits are issued in the northern urbanized portion of the County. This portion of the County is largely free of identified hazard areas.</p>																																										
Describe the level of buildout in the jurisdiction, based on your jurisdiction's buildable lands inventory. If no such inventory exists, provide a qualitative description.	<p>Douglas County's Comprehensive Master plan identifies areas of the County in which urban development is anticipated. Over the years, the effect of these planning efforts has been the concentration 90% of the population to 18% of the County's total land area. Through 2040, the County CMP does not envision expansion of designated urban areas. Douglas County anticipates accommodating approximately 200,000 new residents within currently designated urban areas, which as previously noted are largely free of identified hazard areas.</p>																																										

9.1.4 Status of Previous Plan Actions

Table 9.1-3 summarizes the actions that were recommended in the previous version of the hazard mitigation plan and their implementation status at the time this update was prepared.

Table 9.1-3. Status of Previous Plan Actions

Action Item	Completed	Removed; No Longer Feasible	Carried Over to Plan Update	
			Check if Yes	Enter Action #
Multijurisdictional Action #1: Citizen Disaster Preparedness Guide. Revise and Update the Citizen Preparedness Guide using a new format with a focus on disaster preparedness for all Douglas County Citizens. Components include Warning systems, Citizen Information, Preparing a Family Disaster Plan, Stockpile Checklist, Shelter & Recovery, Access & Functional Needs, Pet Preparedness and Evacuation, Thunderstorms & Lightning, Winter Storms & Extreme Cold, Floods, Tornadoes, Wildfires, Terrorism, Active Shooter, Public Health Emergency, Pandemic Flu, Hazardous Materials, and Helpful Resources. Printed and electronic versions available as well as an application for smart phones.	x		x	DC1
Comment: Updates to guides are done annually and distributed to citizens.				
Performance assessments for small NRCS dams- There are about 24 small dams owned by the NRCS in the County. Most are over 60 years old and are located on Cherry Creek. This project would develop assessments of the dams to determine if they still function as intended or need repair or rehabilitation.	x		x	DC2
Comment: 1 dam has been completed and others are being studied				
Flood Hazard Inventory Tool- Connect flood response to Inventory Tool and develop a flood response plan for the County. The Inventory Tool will connect to the County's GIS system.	x		x	DC3
Comment: Gauges are linked to our GIS system: https://arcg.is/1Wu50S0 this is a webmap from AGOL				
Highline Canal studies for stormwater runoff and improvement- The Highline Canal is being decommissioned by Denver Water as infrastructure for water transport in the metro area. Fifteen miles of the canal traverses the County. A feasibility study has been completed that shows it could be repurposed for stormwater quality and quantity enhancements.	x			
Comment: Staff continues to work with Denver Water and other stakeholders regarding the repurposing of the Highline Canal for stormwater and recreational purposes. Additional studies/analysis is not required at this time as the County will work with stakeholders on a case-by-case basis.				
Plum Creek geomorphological assessment- Plum Creek has a history of problems with aggradation and erosion. This project entails a geomorphological study to identify stability problems with Plum Creek and recommend alternatives for stream restoration/stabilization. Comment: This Project is ongoing and may see construction improvements with a Plum Creek regional sanitary sewer project that the County is currently studying.		X		
Comment: New Action item				
Continue to implement fuels management strategies identified on Douglas County properties- The management strategies for County-Owned lands categorized as forested properties include a hazardous fuels reduction component as part of a larger forest management /forest restoration strategy for protection of the property, the financial investment of tax payers, the natural resources values as well as social, recreational, and intrinsic values. Management strategies for smaller properties in hazardous subdivisions contain a hazardous fuels reduction component where appropriate.			x	DC4

Action Item	Completed	Removed; No Longer Feasible	Carried Over to Plan Update Check if Yes	Enter Action #
Implementation projects are guided by hazard analysis, the Douglas County CWPP and the current process for approval and implementation with Douglas County Open Space and Natural Resources. The County maintains a spreadsheet of county-owned properties that have the potential for mitigation action. Mitigation actions may include hand work, equipment work, County work, contractor work, and prescribed fire.				
<i>Comment:</i> This is ongoing and the CWPP is being updated with anticipated completion in 2021				
Use prescribed fires to protect and enhance resource values- Douglas County can use prescribed fires as a management tool to protect and enhance resource values where appropriate and in concert with additional resource management tools that guide the management activities to meet the goals of the property in question. Prescribed fires implemented by Douglas County have been limited to areas with grass fuels. Prescribed fires in forested areas have been implemented by CSFS and USFS.			x	DC5
<i>Comment:</i> This will continue to be a viable tool we will utilize when appropriate				
Commodity flow along major highways in Douglas County- This project would request and obtain a hazardous materials commodity flow study to determine what is being transported along Douglas County roadways. This study would read placards on vehicles along I-25, E-470, C-470, Highway 85, and Highway 83 for a designated period of time.			x	DC6
<i>Comment:</i> New Action item				
Hazardous materials public education TV PSA- Develop a series of Hazardous Materials Public Service Announcements. PSA Topics: #1 - Reassurance for DC citizens that while this is a topic to be mindful of, there is no need for alarm. DC local, State & Federal agencies and first responders as well as area businesses and railroads are working together to enhance preparedness and response for any hazardous materials release. #2 – Railroad, Water Treatment Safety & Preparedness Overview #3 – Sheltering In Place		x		
<i>Comment:</i> Remove				
Debris management plan development- The Debris Management Plan will be developed beginning Q3 2015, completion scheduled for Q2 2016. The Debris Management Plan is used following a large scale disaster such as flooding or a tornado. These events tend to have an extraordinary amount of debris and trash associated with them to the extent that a plan is needed for managing the waste.	x		x	DC7
<i>Comment:</i> Ongoing and plan will be updated in 2022				
Facility retrofit for generator back-up- Douglas County has identified three facilities that provide critical support for the overall response and continuation of DC Government mission essential services. These designated facilities would be retro-fit to allow for emergency generator power. This project includes the purchase of two 50 kw generators on trailers so the generators can be transported and “plugged” in at all facilities equipped with the appropriate receptacles.	x		x	DC26
<i>Comment:</i> New action item for additional critical facilities				
Evacuation plan revision and execution- DCSO began development on the Emergency Operations Plan Evacuation Annex in 2012 as a response to lessons learned by Colorado Springs PD during the Waldo Canyon Fire. The Evacuation Annex is partially complete and will be completed in phases over the next 3 years.	x		x	DC8
<i>Comment:</i> Plan fully complete and will be updated in 3-4 years – ongoing				

Action Item	Completed	Removed; No Longer Feasible	Carried Over to Plan Update	
			Check if Yes	Enter Action #
Horse Creek stream stabilization- Horse Creek is a tributary of the South Platte River that drains the Hayman Burn area. Stream stability and erosion has been an issue for many years. The erosion and deposition affects Denver Water supply, including Strontia Springs reservoir, and fish habitat. Newer private driveway culverts are inadequate and prone to washout, complicating erosion problems	X			
Comment: Complete				
120,000 gallon Water Cistern installed at the USFS Work Station at Hwy 67 and Rampart Range Road- Douglas County would like to put a 120,000 gallon water cistern at the USFS Work Station to assist the West Douglas Fire Protection District in fire suppression along Highway 67. A significant water source located at this workstation would help with fire suppression in this heavily wooded area of the Pike National Forest. There are numerous homes and businesses located in the area, including those located in Moon Ridge, Sprucewood, the Round-up Ranch (which has 1400 children visit annually) and the Silverstate Youth Camp (which has 3000 children visit annually). Water supply is always limited in this area, and an ISO-approved water tank could also have a positive impact on insurance costs for the residents and businesses in that area		X		
Comment: No longer feasible with USFS				

9.1.5 Capability Assessment

Unincorporated Douglas County performed an assessment of its existing capabilities for implementing hazard mitigation strategies. The introduction at the beginning of this volume of the hazard mitigation plan describes the components included in the capability assessment and their significance for hazard mitigation planning. This section summarizes the following findings of the assessment:

- An assessment of legal and regulatory capabilities is presented in Table 9.1-4.
- Development and permitting capabilities are presented in Table 9.1-5.
- An assessment of fiscal capabilities is presented in Table 9.1-6.
- An assessment of administrative and technical capabilities is presented in Table 9.1-7.
- An assessment of education and outreach capabilities is presented in Table 9.1-8.
- Information on National Flood Insurance Program (NFIP) compliance is presented in Table 9.1-9.
- Classifications under various community mitigation programs are presented in Table 9.1-10.

Findings of the capability assessment were reviewed to identify opportunities to expand, initiate or integrate capabilities to further hazard mitigation goals and objectives. Where such opportunities were identified and determined to be feasible, they are included in the action plan. The “Analysis of Mitigation Actions” table in Section 9.1.10 identifies these as community capacity building mitigation actions.

Table 9.1-4. Legal and Regulatory Capability

	Local Authority	Other Jurisdiction Authority	State Mandated	Integration Opportunity?
Codes, Ordinances, & Requirements				
Building Code	Yes	No	Yes	Yes
<i>Comment:</i>	The Douglas County Board of County Commissioners approved the adoption of the 2018 International Building, Residential, Plumbing, Mechanical, Fuel Gas, Energy Conservation and Fire Codes with amendments on Nov. 12, 2019. The Building Official enforces the code and the County has a full time Chief Building Official.			
	All building code information is available on the Douglas County Building Division website via the following link: https://www.douglas.co.us/land/building/adopted-building-codes/			
Zoning Code	Yes	Yes	Yes	Yes
<i>Comment:</i>	Douglas County Zoning Resolution			
Subdivisions	Yes	No	Yes	Yes
<i>Comment:</i>	Douglas County Zoning Resolution			
Stormwater Management	Yes	No	Yes	Yes
<i>Comment:</i>				
Post-Disaster Recovery	Yes	No	No	Yes
<i>Comment:</i>				
Real Estate Disclosure	No	Yes	Yes	No
<i>Comment:</i>				
Growth Management	No	No	No	No
<i>Comment:</i>				
Site Plan Review	Yes	No	No	Yes
<i>Comment:</i>	Component of the Zoning Resolution			
Environmental Protection	Yes	No	Yes	Yes
<i>Comment:</i>				
Flood Damage Prevention	Yes	No	Yes	Yes
<i>Comment:</i>				
Emergency Management	Yes	No	Yes	Yes
<i>Comment:</i>				
Climate Change	No	No	No	No
<i>Comment:</i>				
Other none				
<i>Comment:</i>				
Planning Documents				
General Plan	Yes	No	Yes	Yes
<i>Comment:</i>	2040 Comprehensive Master Plan			
Capital Improvement Plan	Yes	No	Yes	Yes
<i>How often is the plan updated?</i>	5 years			
<i>Comment:</i>				
Disaster Debris Management Plan	Yes	No	No	Yes
<i>Comment:</i>				
Floodplain or Watershed Plan				
<i>Comment:</i>	FP/SW/UW combined below			
Stormwater Plan				
<i>Comment:</i>	FP/SW/UW combined below			
Urban Water Management Plan				
<i>Comment:</i>	FP/SW/UW combined below			
Habitat Conservation Plan	Yes	No	No	No
<i>Comment:</i>				
Economic Development Plan	No	No	No	No
<i>Comment:</i>				
Shoreline Management Plan				
<i>Comment:</i>	N/A			
Community Wildfire Protection Plan	Yes	No	Yes	Yes
<i>Comment:</i>				

	Local Authority	Other Jurisdiction Authority	State Mandated	Integration Opportunity?
Forest Management Plan	No	No	No	No
<i>Comment:</i>				
Climate Action Plan	No	No	No	No
<i>Comment:</i>				
Comprehensive Emergency Management Plan	Yes	No	No	Yes
<i>Comment:</i>				
Threat & Hazard Identification & Risk Assessment (THIRA)	No	No	No	No
<i>Comment:</i>				
Post-Disaster Recovery Plan	Yes	No	No	Yes
<i>Comment:</i>				
Continuity of Operations Plan	Yes	No	No	No
<i>Comment:</i>				
Public Health Plan	Yes	Yes	Yes	No
<i>Comment:</i>				
Other Floodplain/Stormwater/Urban Water plan	Yes	No	Yes	Yes
<i>Comment:</i>				

Table 9.1-5. Development and Permitting Capability

Criterion	Response
Does your jurisdiction issue development permits?	Yes
<ul style="list-style-type: none"> If no, who does? If yes, which department? 	Public Works Engineering - Building, Public Works Engineering - Engineering, Community Development -Planning
Does your jurisdiction have the ability to track permits by hazard area?	Yes it is possible
Does your jurisdiction have a buildable lands inventory?	No

Table 9.1-6. Fiscal Capability

Financial Resource	Accessible or Eligible to Use?
Community Development Block Grants	Pending
Capital Improvements Project Funding	Yes
Authority to Levy Taxes for Specific Purposes	Yes with voter approval
User Fees for Water, Sewer, Gas or Electric Service	No - Douglas County does not have a stormwater utility or stormwater service fees.
Incur Debt through General Obligation Bonds	Yes with voter approval
Incur Debt through Special Tax Bonds	Maybe with voter approval
Incur Debt through Private Activity Bonds	No, County cannot incur debt through Private Activity Bonds, only private entities can. Douglas County does have ability to approve issuance
Withhold Public Expenditures in Hazard-Prone Areas	No
State-Sponsored Grant Programs	Yes
Development Impact Fees for Homebuyers or Developers	Limited ability but don't
Other	No

Table 9.1-7. Administrative and Technical Capability

Staff/Personnel Resource	Available?	Department/Agency/Position
Planners or engineers with knowledge of land development and land management practices	Yes	Community Development, Public Works Operations, Public Works Engineering
Engineers or professionals trained in building or infrastructure construction practices	Yes	Public Works Operations, Public Works Engineering
Planners or engineers with an understanding of natural hazards	Yes	Community Development, Public Works Engineering
Staff with training in benefit/cost analysis	Yes	Community Development, Public Works Engineering
Surveyors	Yes	Public Works Engineering
Personnel skilled or trained in GIS applications	Yes	Community Development, Public Works Engineering, Public Works Operations, Information Technology, Assessors, Sheriff's Office
Scientist familiar with natural hazards in local area	No	
Emergency manager	Yes	OEM
Grant writers	No	
Other	Yes	Resiliency Planner – Douglas County

Table 9.1-8. Education and Outreach Capability

Criterion	Response
Do you have a public information officer or communications office?	Yes
Do you have personnel skilled or trained in website development?	Yes
Do you have hazard mitigation information available on your website?	Yes
• If yes, briefly describe.	County Webpage
Do you use social media for hazard mitigation education and outreach?	Yes
• If yes, briefly describe.	Various
Do you have any citizen boards or commissions that address issues related to hazard mitigation?	Yes
• If yes, briefly describe.	Planning Commission
Do you have any other programs already in place that could be used to communicate hazard-related information?	Yes
• If yes, briefly describe.	Code Red, CERT, Social Media, Disaster Preparedness Guides, Public outreach, Training and exercise programs
Do you have any established warning systems for hazard events?	Yes
• If yes, briefly describe.	IPAWS, Code Red, Social Media, NWS, EAS, Weather radios, Local media (radio and TV)

Table 9.1-9. National Flood Insurance Program Compliance

Criterion	Response
What local department is responsible for floodplain management?	Public Works Engineering
Who is your floodplain administrator? (department/position)	Janet Herman
Are any certified floodplain managers on staff in your jurisdiction?	Yes
What is the date that your flood damage prevention ordinance was last amended?	5/10/2016

Criterion	Response
Does your floodplain management program meet or exceed minimum requirements?	Exceeds
<ul style="list-style-type: none"> If exceeds, in what ways? 	Structures are not allowed to be placed in SFHA's.
When was the most recent Community Assistance Visit or Community Assistance Contact?	May 2019
Does your jurisdiction have any outstanding NFIP compliance violations that need to be addressed?	No
<ul style="list-style-type: none"> If so, state what they are. 	
Are any RiskMAP projects currently underway in your jurisdiction?	No
<ul style="list-style-type: none"> If so, state what they are. 	
Do your flood hazard maps adequately address the flood risk within your jurisdiction?	Yes
<ul style="list-style-type: none"> If no, state why. 	
Does your floodplain management staff need any assistance or training to support its floodplain management program?	No
<ul style="list-style-type: none"> If so, what type of assistance/training is needed? 	
Does your jurisdiction participate in the Community Rating System (CRS)?	Yes
<ul style="list-style-type: none"> If yes, is your jurisdiction interested in improving its CRS Classification? 	Yes
<ul style="list-style-type: none"> If no, is your jurisdiction interested in joining the CRS program? 	
How many flood insurance policies are in force in your jurisdiction?	224
<ul style="list-style-type: none"> What is the insurance in force? 	\$68,884,800
<ul style="list-style-type: none"> What is the premium in force? 	\$121,967
How many total loss claims have been filed in your jurisdiction?	44
<ul style="list-style-type: none"> How many claims are still open or were closed without payment? 	19
<ul style="list-style-type: none"> What were the total payments for losses? 	\$493,120

a. According to FEMA statistics as of November, 2020

Table 9.1-10. Community Classifications

	Participating?	Classification	Date Classified
Community Rating System	Yes	5	5/2019
Building Code Effectiveness Grading Schedule	Yes	4	11/2019
Public Protection ISO	No Individual fire departments participate	-	-
Storm Ready	Yes	n/a	1/2019
Firewise	No		

9.1.6 Review and Incorporation of Information for This Annex

The goal of plan integration is to ensure that the potential impact of hazards is considered in planning for future development. FEMA recommends integration as follows:

- Integrate hazard mitigation plan goals with community objectives (e.g. incorporate the goals for risk reduction and safety into the policies of other plans).

- Use the risk assessment to inform plans and policies (e.g. incorporate risk assessment findings into land use plans, site plan review, emergency operations plans).
- Implement mitigation actions through existing mechanisms (e.g. include mitigation projects in the capital improvement plan).
- Think about mitigation before and after a disaster (e.g. build recovery planning on existing mitigation plans and goals).

Existing Reports, Plans, Regulatory Tools and Other Resources

The following technical reports, plans, and regulatory mechanisms were reviewed to provide information for this annex.

- Flood Insurance Study (FIS) - Douglas County is required to have a Flood Insurance Study (FIS) and Flood Insurance Rate Maps to participate in the National Flood Insurance Program. An effective FIS has been maintained in Douglas County for more than 40 years. The most current effective date is February 17, 2017.
- Douglas County Wildfire Partnership (2021) - The mission of the DCWP is to increase collaboration among local, state & federal agencies, local fire districts, homeowner groups, NGO's, etc. (stakeholders) to reduce the negative effect of wildfire and post fire impacts, protect critical watersheds and support and enhance recreation and wildlife. The mission is not to create a partnership – but rather build a partnership to achieve specific goals.
- 2040 Douglas County Comprehensive Master Plan (2019). <https://apps.douglas.co.us/planning/projects/download.aspx?PosseObjectId=64569763>
- Comprehensive Emergency Management Plan <https://www.dcsheriff.net/sheriffs-office/divisions/emergency-management/douglas-county-comprehensive-emergency-management-plan-cemp/>
- High Line Canal (2019). <https://highlinecanal.org/plan/>
- High Line Canal Stormwater and Operations Master Plan (2018). <https://2wvq1t1cqijt89rrweqcedrn-wpengine.netdna-ssl.com/wp-content/uploads/2019/05/20181031-HLC-Master-Plan-Final-Report.pdf>
- Douglas County Zoning Resolution. <https://www.douglas.co.us/land/regulations-and-procedures/zoning/zoning-resolution/>
- Douglas County Subdivision Resolution. <https://www.douglas.co.us/land/regulations-and-procedures/subdivision-resolution/>
- Various meetings were held to discuss and complete both Phase I, Risk Assessment and Phase II for the HMP update:
- Phase I annex update meeting 8/5/2020 1pm attendees: Tim Johnson, Tim Hallmark, Zak Humbles, Dan Avery, Joel Hanson, Lisa Goudy
- Phase I action item meeting 8/26/2020 2pm attendees: Matt Williams, Tim Johnson, Steve Koster, Lisa Goudy
- Phase I update review meeting 9/2/2020 11:30am attendees: Tim Johnson, Tim Hallmark, Dan Avery, Joel Hanson, Zak Humbles, Steve Koster, Lisa Goudy
- Risk Assessment work session meeting 10/7/2020 12:30pm attendees: Tim Johnson, Tim Hallmark, Zak Humbles, Joel Hanson, Sean Owens, Dan Avery, Steve Koster, Lisa Goudy
- Risk Assessment ‘dam profile format’ meeting 10/9/2020 1:30pm attendees: Tim Johnson, Tim Hallmark, Zak Humbles, Joel Hanson, Sean Owens, Steve Koster, Lisa Goudy

- Risk Assessment ‘dam finalization’ meeting 10/15/2020 Noon attendees: Tim Johnson, Zak Humbles, Lisa Goudy
- Phase II prep meeting 10/23/2020 1:00pm attendees: Tim Johnson, Tim Hallmark, Zak Humbles, Sean Owens, Steve Koster, Matt Williams, Dan Avery, Joel Hanson, Nathan Wysocki, Lisa Goudy
- HMP Wildfire discussion 11/10/2020 3:00pm attendees: Tim Johnson, Randy Johnson (Larkspur), Lisa Goudy
- Phase II Q&A meeting 11/10/2020 4:00pm attendees: Tim Johnson, Steve Koster, Lisa Goudy
- **Technical Reports and Information**—The following outside resources and references were reviewed:
 - Hazard Mitigation Plan Annex Development Tool-kit—The tool-kit was used to support the development of this annex including past hazard events, noted vulnerabilities, risk ranking and action development.

Existing Integration

- **NFIP** - Douglas County is required to continually comply with NFIP requirements to ensure that flood insurance coverage is available to County residents. Douglas County floodplain regulations exceed NFIP minimum standards, are included in the Douglas County Zoning Resolution, and are enforced as other Zoning violations would be enforced.
- **Erosion/Sediment Control Program** - Douglas County has an erosion and sediment control program that was first developed and implemented in 1993. The program has evolved and is viewed as a model nationally. The current program and criteria are available on the County website: <https://www.douglas.co.us/land/drainage-and-erosion-control/grading-erosion-and-sediment-control-manual-gesc-drainage-erosion-and-sediment-control-desc/>
- **Douglas County Wildfire Partnership** – in the beginning of 2021, the County began creating a partnership with federal, state, and local departments and agencies to increase the collaboration among different agencies, fire districts, homeowner groups, and stakeholders and reduce the negative effects of wildfire and post-fire impacts. The partnership has developed several goals that they plan to build out once feedback is received from the core committee.
- Douglas County does not allow structures in the FEMA Special Flood Hazard Area (SFHA). Consistent with our annual CRS Recertification response, there may be situations where Pre-FIRM structures or structures placed in the SFHA through updated floodplain studies would be substantially improved. If that situation were to arise, the County would follow all NFIP requirements for construction in the SFHA, including requiring and maintaining a copy of an Elevation Certificate.
- The **Douglas County Zoning Resolution** (“DCZR”) requires that applicants for rezoning’s identify natural and man-made hazards impacting the subject property. The approval criteria for rezoning’s then include an assessment by the Planning Commission and Board of County Commissioners of whether the property is suitable for the proposed uses. The DCZR includes the Wildfire Hazard Overlay District and the Floodplain Overlay District which set expectations for mitigation or avoidance of flood and wildfire hazards to be integrated into new developments in designated hazard areas.
- The **Douglas County Subdivision Resolution** (“DCSR”) requires identification of natural and man-made hazards as part of the submittal requirements for new subdivisions. Approval criteria for subdivisions of land require demonstration by an applicant that hazards have been or can be mitigated or avoided. Public land dedication standards in the DCSR require that lands proposed

for dedication as public parks and schools be evaluated for hazards that would preclude development prior to acceptance of the dedication by the county.

- The DCZR contains standards for review of site plans for development of nonresidential, multi-family, and public facility projects. Mitigation or avoidance of hazards is evaluated in the review process for all three application types (use by special review, site improvement plan, and location and extent).
- The **Douglas County 2040 Comprehensive Master Plan** (“2040 CMP”) includes mapping of environmental constraints and hazards across the county. That information is then supplemented by site-specific studies performed as part of land use applications. Goals, objectives, and policies in the 2040 CMP support development outside of hazard areas or mitigation of hazards if they cannot be avoided. Conformance with the 2040 CMP is an approval criterion for all significant land use application types in the DCZR and DCSR.

Opportunities for Future Integration

- **Zoning Code**—Douglas County revised our Floodplain Overlay District in the Zoning Resolution in May of 2016 to stay consistent with State and Federal regulations. The County constantly reviews our Floodplain regulations against State and Federal regulations and updates as needed.

9.1.7 Jurisdiction-Specific Natural Hazard Event History

Table 9.1-11 lists past occurrences of natural hazards for which specific damage was recorded in Unincorporated Douglas County hazard events that broadly affected the entire planning area, including Unincorporated Douglas County, are listed in the risk assessments in Volume 1 of this hazard mitigation plan.

Table 9.1-11. Past Natural Hazard Events

Type of Event	FEMA Disaster #	Date	Damage Assessment
Blizzard (Bomb Cyclone)	State #	3/12/2018	\$334,488,.97
Pandemic (COVID-19)	EM-3436/DR-4498	January 20 th , 2020 - Present	\$see below
* Indicates County-wide event			

Bomb Cyclone Blizzard Specifics

The blizzard weather event was well forecasted by meteorologists. The Office of Emergency Management (OEM), the Sheriff’s Office and a variety of County departments and agencies began to “lean forward” with the County Emergency Operations Center (EOC) activated at 10:00 a.m. March 13th. Early rain was already turning to snow with high winds. While the weather was expected, the 40-car pile-up on I-25 a little after 10:00 a.m. was not. This multi-vehicle crash stage for what would become more than 24 hours of rescues of stranded drivers off the highways and roads of Douglas County.

With I-25 shutdown, first due to the large crash and then due to CDOT’s closure of I-25 from Lone Tree to the EL Paso County line, motorists began to leave I-25 both east and west, looking for county roads and highways that would divert them around the closures. Instead of finding the easier routes they were looking for they instead drove straight into the worst part of the blizzard on narrower side roads and highways and quickly became overcome by blowing snow, treacherous road conditions and the blocking of routes by other drivers who slid off roads, into other vehicles or had to stop due to snow drifting.

The EOC Team launched a concerted effort to create rescue Task-Forces comprised of Douglas County Sheriff Patrol Cars teamed up with Snow Plows and Douglas County School District Buses. These Rescue Task-Forces swept through county roads rescuing stranded travelers from their vehicles. In addition the EOC Team, with the help of the Red Cross, opened and supplied emergency sheltering where rescued travelers could be dropped for a safe, warm shelter for the duration of the storm.

Douglas County made a Local Disaster Declaration, signed by Commissioner Lora Thomas on Wednesday afternoon. This declaration made state resources accessible to Douglas County for this emergency period.

In all, more than 700 individuals were rescued and sheltered during the blizzard event and then transported safely back to their vehicles the next day. The list of individuals and agencies who worked together on this effort is extensive and includes the Douglas County OEM Staff & EOC Volunteer Team, DCSO, Douglas County Facilities and the Fairground, Douglas County Public Works, Douglas County School District, New Covenant Church in Larkspur, New Hope Church in Castle Rock, the City of Castle Rock MAC Rec Center, Lone Tree Rec Center, the Red Cross, Castle Rock Fire, Larkspur Fire, Franktown Fire, Douglas County Search and Rescue, CDOT and the Colorado State Patrol.

It was a large and well-coordinated effort, achieved with a few minor injuries and no casualties.

Summary of Costs - March 2019 Blizzard					
Assignment	Personnel Costs		Equipment Cost	Material Costs	Total
	Hours	Costs			
Douglas County Personnel	Detentions	12.75	\$737.82		\$737.82
Douglas County Personnel	OEM	7.00	\$424.94		\$424.94
Douglas County Personnel	Various Depts	100.00	\$4,100.00		\$4,100.00
	Grand Total	112.75	\$4,837.82		\$4,837.82
EOC Personnel	food				\$3,427.84
PW - Road & Bridge					
Highlands Ranch	Snow Plowing	305.5	\$12,769.68	\$14,484.38	\$23,553.69
Snow Route #1	Snow Plowing	494.5	\$24,141.03	\$26,422.12	\$36,931.49
Snow Route #2	Snow Plowing	343.5	\$17,616.95	\$20,534.80	\$11,039.92
Snow Route #3	Snow Plowing	195.5	\$8,660.83	\$11,382.08	\$8,229.80
Snow Route #4	Snow Plowing	265.5	\$12,050.38	\$15,524.83	\$31,065.50
Snow Route #5	Snow Plowing	273	\$9,935.36	\$8,829.82	\$27,586.54
Other Misc. Routes	Snow Plowing	76.5	\$2,718.42	\$1,216.47	\$1,529.22
	Grand Totals	1954	\$ 87,892.65	\$ 98,394.50	\$ 139,936.16
					\$ 326,223.31

Pandemic Specifics

The COVID-19 pandemic reached Colorado on March 5, 2020, when the state's first two cases were confirmed, one of which was a Douglas County resident. This initiated the activation of the Douglas County EOC on March 6th. On March 11th Governor Jared Polis issued a written State of Emergency and on March 13th President Trump declared COVID-19 a pandemic and issued an emergency declaration. That same day, Douglas County made a Disaster Declaration. Within days all municipalities in Douglas County had also issued Disaster Declarations.

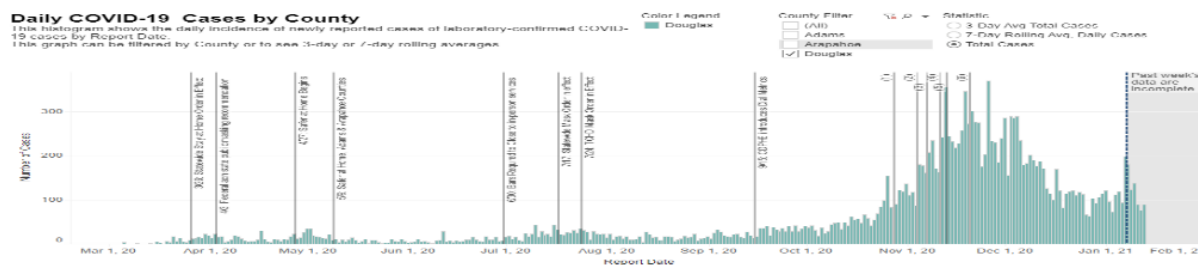
By March 25th Governor Polis had issued a Stay-At-Home Order for the state of Colorado and schools closed. Businesses, unless they were met the criteria of Essential Service also closed. Throughout the

following months of April and May, COVID-19 cases, hospitalizations and fatalities continued to rise (see Figure 1 below).

Douglas County, recognizing the impact that school and business closures would have on the residents of the County rapidly formed a range of Taskforces based out of the EOC. Initial Taskforces included a Human Needs Taskforce, an Economic Taskforce, a FEMA Grants Taskforce, a Hospital Surge Taskforce, a Communications Taskforce and a County Human Resources Taskforce. Later Taskforces included a Testing Taskforce and Vaccination Taskforce. Unemployment claims climbed and businesses began to go out of business.

Governor Jared Polis issued a statewide mask mandate in mid-July to avoid the sharp surge of COVID-19 cases and deaths being observed in neighboring states. Over the summer months COVID cases, hospitalizations and fatalities declined only to rebound in the late fall. By November 2020, COVID-19 was again surging in Colorado and Douglas County.

As of the date of this summary, January 13, 2021 TCHD reported 17,720 total COVID-19 cases for Douglas County. The County’s death toll stands at 215. As of January 13, 4.8% of county residents have been positively diagnosed with COVID-19^[6] and the 7-day moving average of new COVID-19 cases is 128 cases per day.^[5] As of January 13, 2020, 11,450 COVID-19 vaccine doses have been administered in Douglas County, equivalent to approximately 3% of the population.



Event	Federal	County
Bomb Cyclone*	-	????
CARES ACT for COVID 19**		
Testing/Tracing	1,129,276	
PPE/Facility Improvements/Cleanin	3,365,873	
Repurposed Employees	344,291	
EOC Employees	57,326	
COVID Sick/Childcare	372,799	
IT Purchases	199,155	
IT Additional Employees	16,954	
HHS Support (rent/food/utility)	755,742	
HHS Employees	342,861	
Small Business Support	14,151,213	5,000,000
Not for Profit Support	1,119,278	
Public Awareness	240,000	
Municipality Support	8,011,344	
Misc	18,370	99,781
Total	30,124,482	5,099,781
FEMA for COVID 19		
Testing/Tracing (projected)	750,000	250,000
PPE/Facility Improvements/Cleanin	158,567	52,856
EOC Employees	13,037	4,346
Total	921,604	307,201

9.1.8 Hazard Risk Ranking

Table 9.1-12 presents a local ranking for Unincorporated Douglas County of all hazards of concern for which this hazard mitigation plan provides complete risk assessments. This ranking summarizes how hazards vary for this jurisdiction. As described in detail in Volume 1, the ranking process involves an assessment of the likelihood of occurrence for each hazard, along with its potential impacts on people, property and the economy. Mitigation actions target hazards with high and medium rankings.

Table 9.1-12. Hazard Risk Ranking

Rank	Hazard Type	Risk Rating Score (Probability x Impact)	Category
1	Wildfire	48	High
2	Drought	30	Medium
2	Pandemic	30	Medium
3	Hail	24	Medium
4	Animal Disease	18	Medium
4	Lightning	18	Medium
4	Severe Thunderstorms	18	Medium
4	Severe Winter Storm	18	Medium
4	Transportation Accidents	18	Medium

Rank	Hazard Type	Risk Rating Score (Probability x Impact)	Category
5	Earthquake	16	Medium
5	Tornadoes	16	Medium
6	Erosion	12	Low
6	Expansive Soils	12	Low
6	Extreme Temperatures	12	Low
6	Flood	12	Low
6	Land Subsidence	12	Low
6	Landslide	12	Low
6	Slope Failure	12	Low
7	Dam and Levee Failure	6	Low

NOTE: The process used to assign risk ratings and rankings for each hazard is described in Volume 1 of this hazard mitigation plan.

9.1.9 Jurisdiction-Specific Vulnerabilities

The hazard profiles in Section 5 (Risk Assessment) provide detailed information regarding each plan participant’s vulnerability to the identified hazards. The following summarizes the hazards of greatest concern and risk to the County. For additional vulnerability information relevant to this jurisdiction, refer to Section 5 (Risk Assessment).

Repetitive Loss Properties

Repetitive loss records are as follows:

- Number of FEMA-identified Repetitive-Loss Properties: 0
- Number of FEMA-identified Severe-Repetitive-Loss Properties: 0
- Number of Repetitive-Loss Properties or Severe-Repetitive-Loss Properties that have been mitigated: 0

Other Noted Vulnerabilities

The following jurisdiction-specific issues have been identified based on a review of the results of the risk assessment, public involvement strategy, and other available resources:

- NRCS-owned dams throughout the County (DC2)
- The County does not have a flood response plan (DC3)
- The County lacks a debris management plan. By not having a formal plan in place, the County cannot properly plan for or respond to debris-creating events such as tornadoes and floods (DC6).

Mitigation actions addressing these issues were prioritized for consideration in the action plan presented in Section 9.2.10.

9.1.10 Hazard Mitigation Action Plan and Evaluation of Recommended Actions

Table 9.1-13 lists the actions that make up the hazard mitigation action plan for this jurisdiction. Table 9.1-14 identifies the priority for each action. Table 9.1-15 summarizes the mitigation actions by hazard of concern and mitigation type.

Table 9.1-13. Hazard Mitigation Action Plan Matrix

Applies to New or Existing Assets	Objectives Met	Lead Agency	Support Agency	Estimated Cost	Sources of Funding	Timeline ^a
Action DC1— Citizen Disaster Preparedness Guide. Revise and Update the Citizen Preparedness Guide using a new format with a focus on disaster preparedness for all Douglas County Citizens. Components include Warning systems, Citizen Information, Preparing a Family Disaster Plan, Stockpile Checklist, Shelter & Recovery, Access & Functional Needs, Pet Preparedness and Evacuation, Thunderstorms & Lightning, Winter Storms & Extreme Cold, Floods, Tornadoes, Wildfires, Terrorism, Active Shooter, Public Health Emergency, Pandemic Flu, Hazardous Materials, and Helpful Resources. Printed and electronic versions available as well as an application for smartphones. Comment: Updates to guides are done annually and distributed to citizens.						
<i>Hazards Mitigated:</i> Wildfire, Flood, Drought, Pandemic, Hail, Lightning, Severe Thunderstorms, Winter storm, Tornado, Earthquake, Extreme temps						
Both	#1, 2, 5, 8, 9, 11, 15, 16	OEM	Facilities Admin BOCC	\$30,000	General Fund	On-going
Action DC2— Performance assessments for small NRCS dams. There are about 24 small dams owned by the NRCS in the County. Most are over 60 years old and are located on Cherry Creek. This project would develop assessments of the dams to determine if they still function as intended or need repair or rehabilitation. Comment: 1 dam has been completed and others are being studied						
<i>Hazards Mitigated:</i> Flood, Severe Thunderstorms, Dam and Levee failure						
Existing	#6	PWE PWOPs	N/A	\$500K	General Fund	2023
Action DC3— Flood Hazard Inventory Tool. Connect flood response to Inventory Tool and develop a flood response plan for the County. The Inventory Tool will connect to the County's GIS system. Comment: Gauges are linked to our GIS system: https://arcg.is/1Wu50S0 this is a webmap from AGOL						
<i>Hazards Mitigated:</i> Flood, Severe Thunderstorms, Dam and Levee failure						
New and Existing	# 2, 4, 5	PWE County GIS	N/A	\$350K	General fund	2023
Action DC4— Continue to implement fuels management strategies identified on Douglas County properties. The management strategies for County-Owned lands categorized as forested properties include a hazardous fuels reduction component as part of a larger forest management /forest restoration strategy for protection of the property, the financial investment of tax payers, the natural resources values as well as social, recreational, and intrinsic values. Management strategies for smaller properties in hazardous subdivisions contain a hazardous fuels reduction component where appropriate. Implementation projects are guided by hazard analysis, the Douglas County CWPP and the current process for approval and implementation with Douglas County Open Space and Natural Resources. The County maintains a spreadsheet of county-owned properties that have the potential for mitigation action. Mitigation actions may include hand work, equipment work, County work, contractor work, and prescribed fire. Comment: This is ongoing and the CWPP is being updated with anticipated completion in 2021						
<i>Hazards Mitigated:</i> Wildfire, Erosion, Flooding, Landslide						
Existing	#2, 4, 5, 8, 9, 10, 12, 13, 16, 20, 24	OEM, County Wildfire Mitigation	Building Dept. Open Space and Natural Resources	Staff	General fund	On-going
Action DC5— Use prescribed fires to protect and enhance resource values. Douglas County can use prescribed fires as a management tool to protect and enhance resource values where appropriate and in concert with additional resource management tools that guide the management activities to meet the goals of the property in question. Prescribed fires implemented by Douglas County have been limited to areas with grass fuels. Prescribed fires in forested areas have been implemented by DFPC and USFS. Comment: This will continue to be a viable tool we will utilize when appropriate. Comment: This will continue to be a viable tool we will utilize when appropriate						
<i>Hazards Mitigated:</i> Wildfire, Erosion						
New and Existing	#2, 16, 20, 24	OEM	DFPC, USFS, Open Space and Natural Resources, Local fire districts	100K	General fund	On-going
Action DC6— Debris management plan development. The Debris Management Plan will be developed beginning Q3 2015, completion scheduled for Q2 2016. The Debris Management Plan is used following a large scale disaster such as flooding or a tornado. These events tend to have an extraordinary amount of debris and trash associated with them to the extent that a plan is needed for managing the waste Comment: Ongoing and plan will be updated in 2022						
<i>Hazards Mitigated:</i> Wildfire, Flooding, Severe Thunderstorms, Winter Storm						
N/A	#3, 7, 9, 10, 18, 22, 23	OEM	Public Works Operations, Facilities, Tri-County Health Dept.	Steff cost	General fund	2022

Applies to New or Existing Assets	Objectives Met	Lead Agency	Support Agency	Estimated Cost	Sources of Funding	Timeline ^a
Action DC7 – Evacuation plan revision and execution - DCSO began development on the Emergency Operations Plan Evacuation Annex in 2012 as a response to lessons learned by Colorado Springs PD during the Waldo Canyon Fire. The Evacuation Annex is partially complete and will be completed in phases over the next 3 years. Comment: plan fully complete and will be updated in 3-4 years ongoing						
<i>Hazards Mitigated:</i> Wildfire, Flood, Tornado, Transportation accidents, Severe Thunderstorms, Sever Winter Storms, Earthquake, Landslide, Dam & Levee failure						
New and Existing	#1, 2, 4, 8, 9, 10, 13, 15, 16	OEM	Facilities, Red Cross, Sheriff's Office	Staff cost	General fund	On-going
Action DC8 CERT certification To enhance public outreach, OEM schedules a seven session Citizen Preparedness Training, utilizing the national CERT curriculum and Stop the Bleed practicum training.						
<i>Hazards Mitigated:</i> Wildfire, Flood, Drought, Pandemic, Hail, Lightning, Severe Thunderstorms, Winter Storms, Transportation accidents, Tornadoes, Earthquake						
N/A	#1, 2, 8, 9, 15, 16	OEM	SAR, Fire Depts	\$2250.00	General fund	Annual
Action DC9 Wildland Fire Preparedness Seminars – for HOAs and for the General Public This seminar features and an examination of lessons learned from recent wildfire disasters in other communities similar to Douglas County, evacuation readiness tips, and a discussion panel of panel of emergency management, firefighter and law enforcement subject matter experts. In addition, this workshop will provide individual, hands-on assistance – helping participants register to receive early-warning alerts via CodeRED, PulsePoint and Twitter.						
<i>Hazards Mitigated:</i> Wildfire						
New and Existing	#2, 16, 15, 20, 24	OEM		Staff cost	General fund	Spring and Summer months on-going
Action DC10 – Hazmat ESRI commodity flow identification project.						
<i>Hazards Mitigated:</i> Transportation accidents						
New and Existing	#1, 2, 4, 5, 8, 9, 10, 13, 14, 15, 16, 20, 21, 23, 24	OEM	DCSO Hazmat team, County GIS team	\$150K	FEMA Grant	3 yr
Action DC11 - Franktown Area Wildfire Evacuation Drills – (to include the HOAs and localities of Bannockburn, Burning Tree, Comanche Pines and Whispering Pines) Wildfire evacuation drills provide participants with a realistic evacuation experience that includes receiving CodeRed alerts via phone, text and emails, or a knock on the door by law enforcement personnel; instruction to evacuate the area by vehicle and direction to a “evacuation point”. Participants then “execute” their home and family evacuation plan and travel to the designated evacuation point where they gather together to receive evacuation preparedness information and handouts, have the opportunity to ask questions of local authorities, and make connections and network with their neighbors regarding continued community preparedness planning.						
<i>Hazards Mitigated:</i> Wildfire						
New and Existing	#1, 2, 4, 5, 9, 10, 13, 15, 16, 20, 24	OEM	Sheriff's office and Fire depts.	Staff time	General fund	Spring and Summer months On-going
Action DC12 - Greater Larkspur Wildfire Mitigation Project Collaborative effort between Douglas County, Colorado State Forest Service, US Forest Service and Perry Park Metro District. Goal is reduce hazardous wildfire fuels bordering public and private lands, focusing on dead vegetation created by the Tussock Moth infestation. Desired end result is more resilient landscape and private property that can withstand wildfire and give firefighters better opportunities for suppression.						
<i>Hazards Mitigated:</i> Wildfire, Erosion, Landslide						
New and Existing	#2, 4, 5	OEM	County Wildfire Mitigation, PP Metro, CSFS, Larkspur Fire, USFS, Open Space and Natural Resources	\$2,065,000.00	CSFS Grant, General Fund	2025 all phases
Action DC13 - Douglas County Fire and Aviation Facility Permanent facility to house the Douglas County Emergency Services Unit and Wildfire Suppression Aviation Program. Goal is to improve wildfire suppression effectiveness and capability by co-housing county wildfire program managers with contract aviation assets. Permanent facility would improve training opportunities, situational awareness, response times and equipment longevity and safety.						
<i>Hazards Mitigated:</i> Wildfire, Transportation accidents						
Existing	#1, 4, 7, 8, 9, 10, 12, 15, 20	OEM	Cty Admin, BOCC, PWE, PWO, Fire depts	5Mil	General fund	2024 all phases
Action DC14 - Develop a top-down science-based wildfire strategy for agency officials that includes preparedness, risk reduction (mitigation), and personal responsibility with an emphasis on home ignition.						
<i>Hazards Mitigated:</i> Wildfire						
	#1, 2, 5, 6, 8, 9, 10, 12, 14, 17, 21	OEM, County Wildfire Mitigation	Public Relations	Staff cost	None unless consultant requested	18-24 months

Applies to New or Existing Assets	Objectives Met	Lead Agency	Support Agency	Estimated Cost	Sources of Funding	Timeline ^a
Action DC15 - Establish with partner agencies, a coordinated group, reflective of a wildfire working group to establish and commit to using consistent, accurate, science-based messaging on wildfire preparedness and risk reduction practices in the Home Ignition Zone (HIZ). Establish science-based BMPs for native vegetation as species as it relates to wildfire. Identify opportunities and methods for thought provoking and engaging communication.						
<i>Hazards Mitigated:</i> Wildfire						
New and Existing	#1, 2, 4, 5, 8, 9, 10, 12, 13, 16, 17, 21, 24, 25, 26	CSFS, County Wildfire Mitigation	OEM, FPDs, DC Wildland Coordinators	Staff cost	No additional	12 months
Action DC16 - Educate through individual property and community wildfire assessment and risk reduction recommendations and assist in the design and execution of community-based wildfire mitigation projects.						
<i>Hazards Mitigated:</i> Wildfire						
New and Existing	#1, 2, 4, 5, 8, 9, 10, 12, 13, 16, 21	County Wildfire mitigation, CSFS		Staff cost	Community, grant assisted	Ongoing/as needed
Action DC17 - Completed two development-wide wildfire mitigation/hazardous fuels reduction projects in both a new community of high-density homes and 2 new filings for new home construction in existing communities. As these projects come through, we will continue to develop these hazardous fuels reduction projects.						
<i>Hazards Mitigated:</i> Wildfire						
New and Existing	#2, 7, 9, 10, 13, 17, 19, 21, 25, 26	County Wildfire mitigation		No cost	Developer	Ongoing/as needed
Action DC18 —Happy Canyon Creek at Interstate 25 Stream Stabilization						
<i>Hazards Mitigated:</i> Flooding, Erosion, Slope Failure						
New and Existing	#8, 20	Douglas County – Public Works Engineering	Mile High Flood District	\$3.5M	Douglas County Mile High Flood District Cherry Creek Basin Water Quality Authority	Preliminary Design Underway. Construction in 2022-2023
Action DC19 — Happy Canyon Creek North of Lincoln Avenue						
<i>Hazards Mitigated:</i> Flooding, Erosion, Slope Failure						
New and Existing	#2, 8, 9, 20	Douglas County – Public Works Engineering	Mile High Flood District	\$4.0M	Douglas County Mile High Flood District	Initiate Preliminary Design in 2021
Action DC20 —Major Drainageway Planning Study for Cherry Creek from Reservoir to Bayou Gulch Road						
<i>Hazards Mitigated:</i> Flooding, Erosion						
Existing	#2, 6, 7, 8, 10, 12, 18	Mile High Flood District	Douglas County	\$130K	Douglas County Town of Parker Mile High Flood District Southeast Metro Stormwater Authority	Study Kicked off in Fall 2020
Action DC21 - Maintain Culverts Reduce flood hazard to public by ensuring culvert inventory is fully functional, passing design flows and capacities. Also creates the possibility of brining substandard pipes to meet contemporary criteria. Primarily achieved through trenchless rehabilitation.						
<i>Hazards Mitigated:</i> Flooding						
Existing	#6	DC	DC PW EN	\$750K	General fund	Annual
Action DC22 - Surveil Culverts Inspect and video culverts throughout the county to identify hazards to the public that may include sub-design capacities (flooding), structural failures (road collapse), and related hazards resulting from a failed culvert. This routine annual program informs and prioritizes the culvert rehabilitation program.						
<i>Hazards Mitigated:</i> Flooding						
Existing	#4	DC	DC PW EN	\$250K	General fund	Annual
Action DC23 – CWPP The DC CWPP is going through the update process. The CWPP process authorized Under Title 1 of the 2003 HFRA and required in the State of Colorado under SB 09-001 is a collaborative effort to identify and implement locally based solutions for protection of life, property and critical infrastructure in the WUI. The process brings together a diverse group of stakeholders and must meet the minimum standards set forth by the State Forester.						

Applies to New or Existing Assets	Objectives Met	Lead Agency	Support Agency	Estimated Cost	Sources of Funding	Timeline ^a
Hazards Mitigated: Wildfire						
New and Existing	#2, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 19, 21, 22, 24, 25	County Wildfire mitigation	CSFS, OEM, FPD	Staff cost	Unknown – new challenge	12 months
Action DC24 - Continue the Douglas County Water Alternatives Program. The program assists homeowners and small domestic water providers in developing renewable water supply alternatives through the funding of feasibility studies and engineering costs. Participants in the program may also have the ability to use the support as leverage for additional grant funding. Diversification of water supplies by entities that provide water to existing developments can improve their capability to withstand drought conditions.						
Hazards Mitigated: Drought						
New and Existing	#5, 9, 10, 12, 13	Department of Community Development, Community and Resource Services Div.	Public Works Engineering	Low	County general fund and leveraged grant dollars	On-going
Action DC25 - Continue providing technical support for water resource planning. Douglas County staff offers technical support to homeowners, small communities, and water districts and aids those entities with limited resources in addressing water resources planning needs. Support could include fostering relationships, providing research assistance, or coordinating public outreach efforts. Diversification of water supplies by entities that provide water to existing developments can improve their capability to withstand drought conditions.						
Hazards Mitigated: Drought						
New and Existing	#5, 9, 10, 12, 13	Department of Community Development, Community and Resource Services Div.		Low	County General fund	On-going
Action DC26 - Develop fuels management strategies for County park and trail properties. Douglas County owns several parks and trails in the wildland urban interface, particularly on the edges of developed subdivisions. Fuel management strategies could include fuel reduction or development of fire breaks						
Hazards Mitigated: Wildfire						
N/A	#7, 10, 18	Department of Community Development, Parks, Trails, & Building Grounds Div.	Douglas County Wildfire Mitigation	Low	County general fund	On-going

a. Short-term = Completion within 5 years; Long-term = Completion within 10 years; Ongoing= Continuing new or existing program with no completion date
See the introduction to this volume for list of acronyms used here.

Table 9.1-14. Mitigation Action Priority

Action #	# of Objectives Met	Benefits	Costs	Do Benefits Equal or Exceed Costs?	Is Project Grant-Eligible?	Can Project Be Funded Under Existing Programs/Budgets?	Implementation Priority ^a	Grant Pursuit Priority ^a
DC1	8	Medium	Low	Yes	No	Yes	High	Low
DC2	1	High	Low	Yes	Yes	Yes	High	Low
DC3	3	High	Low	Yes	Yes	Yes	High	Medium
DC4	11	Medium	Low	Yes	Yes	Yes	High	Medium
DC5	4	High	Low	Yes	Yes	Yes	High	Medium
DC6	7	Medium	Low	Yes	No	Yes	High	Low
DC7	9	High	Low	Yes	No	Yes	High	Low
DC8	6	Medium	Low	Yes	No	Yes	High	Low
DC9	5	Medium	Low	Yes	Yes	Yes	High	Medium
DC10	15	Medium	High	Yes	Yes	No	High	High

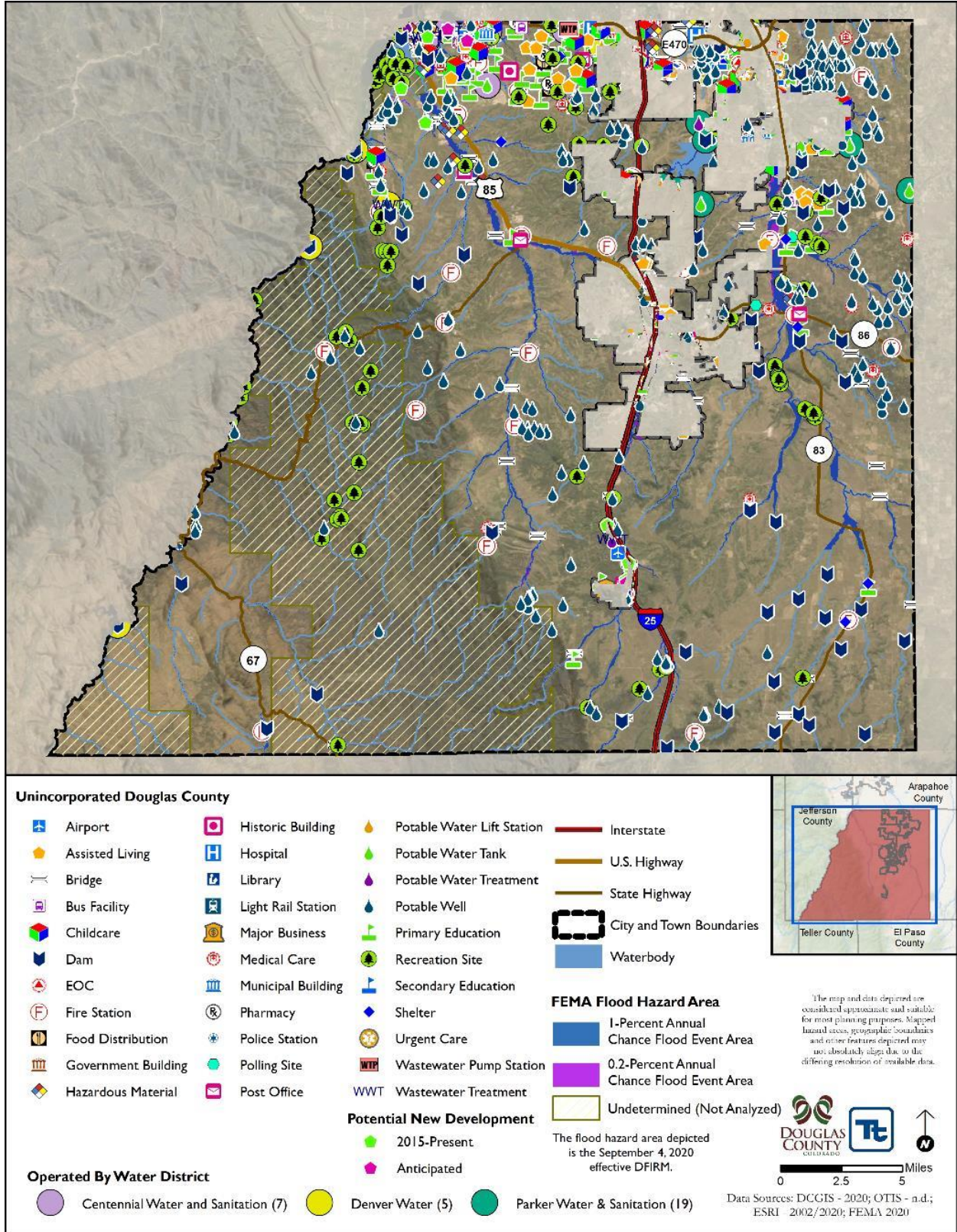
Action #	# of Objectives Met	Benefits	Costs	Do Benefits Equal or Exceed Costs?	Is Project Grant-Eligible?	Can Project Be Funded Under Existing Programs/Budgets?	Implementation Priority ^a	Grant Pursuit Priority ^a
DC11	11	Medium	Low	Yes	Yes	Yes	High	Medium
DC12	3	Medium	Medium	Yes	Yes	Yes	High	Medium
DC13	9	Low	Low	Yes	No	Yes	Medium	Low
DC14	11	Medium	Low	Yes	Yes	Yes	Medium	Medium
DC15	15	Medium	Low	Yes	Yes	Yes	Medium	Medium
DC16	11	Medium	Low	Yes	Yes	Yes	Medium	Medium
DC17	10	Low	Low	Yes	Yes	Yes	Low	Medium
DC18	2	Low	Medium	Yes	Yes	Yes	Low	Medium
DC19	4	Low	Medium	Yes	Yes	Yes	Low	Medium
DC20	7	Medium	Medium	Yes	Yes	Yes	Medium	Medium
DC21	1	High	Low	Yes	No	Yes	Medium	Low
DC22	1	High	Low	Yes	No	Yes	Medium	Low
DC23	20	Medium	High	Yes	Yes	Yes	Medium	Medium
DC24	5	Medium	Medium	Yes	Yes	Yes	Medium	Medium
DC25	5	Medium	Low	Yes	No	Yes	Medium	Low
DC26	3	Low	Low	Yes	No	Yes	Low	Low

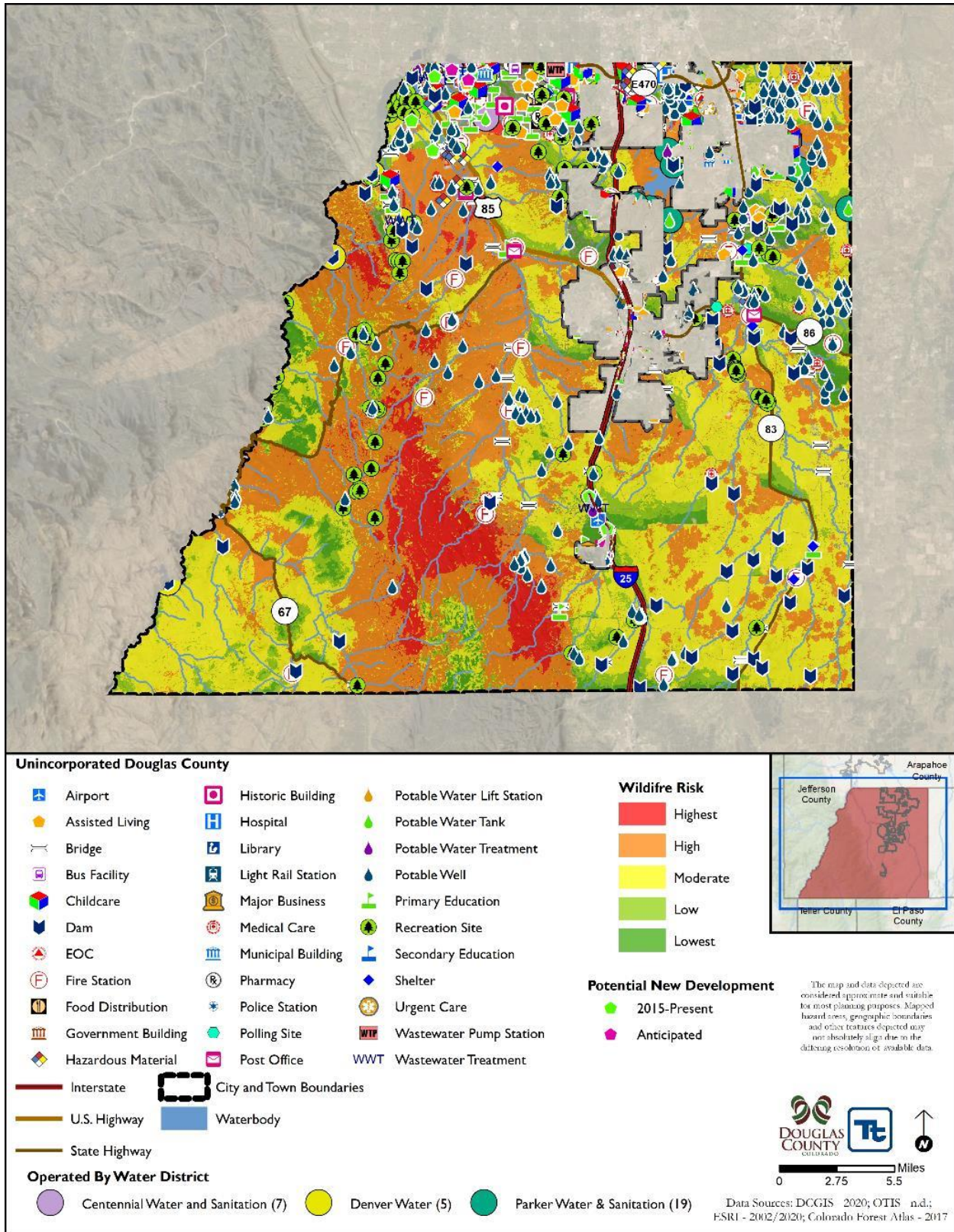
a. See the introduction to this volume for explanation of priorities.

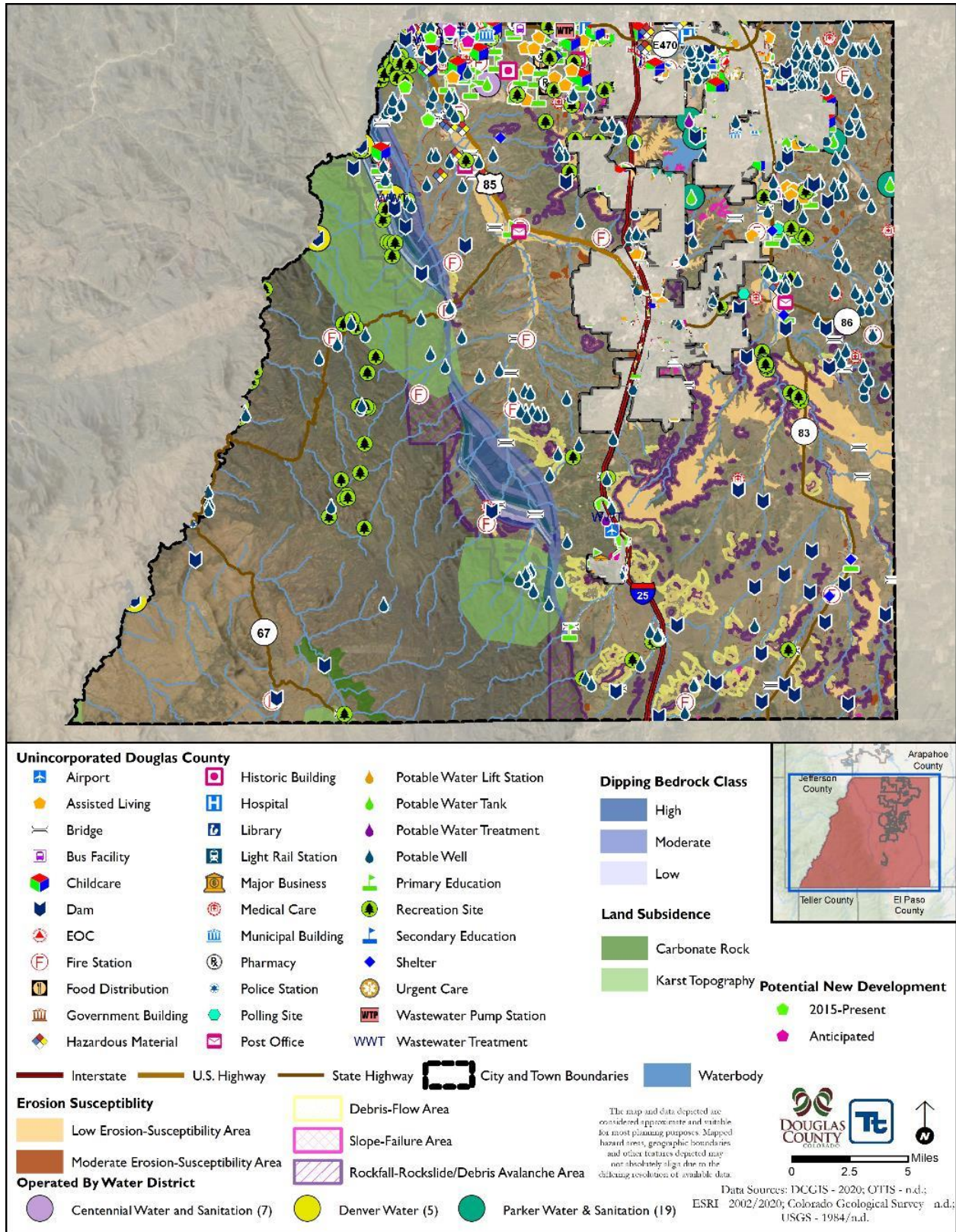
Table 9.1-15. Analysis of Mitigation Actions

Hazard Type	Action Addressing Hazard, by Mitigation Type ^a						
	Prevention	Property Protection	Public Education and Awareness	Natural Resource Protection	Emergency Services	Structural Projects	Community Capacity Building
High-Risk Hazards							
Wildfire	DC4, 5, 6, 12, 14, 17, 23, 26	DC23, 26	DC1, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 23, 26	DC4, 5, 6, 7, 12, 14, 15, 16, 17, 23, 26	DC1, 4, 5, 6, 7, 8, 9, 10, 11, 13	DC12	DC1, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 23
Medium-Risk Hazards							
Animal Disease							
Drought			DC1, 8, 24, 25	DC24, 25	DC1, 8,		DC1, 8, 24, 25
Earthquake			DC1, 7, 8	DC7	DC1, 7, 8		DC1, 7, 8
Hail			DC1, 8		DC1, 8		DC1, 8
Lightning			DC1, 8		DC1, 8		DC1, 8
Pandemic			DC1, 8		DC1, 8		DC1, 8
Severe Thunderstorms	DC2, 3, 6	DC2, 3	DC1, 3, 7, 8	DC2, 3, 6, 7	DC1, 3, 6, 7, 8	DC2, 3	DC1, 3, 6, 7, 8
Severe Winter Storm	DC6		DC1, 6, 7, 8	DC7	DC1, 6, 7, 8		DC1, 6, 7, 8
Transportation Accidents			DC1, 7, 8, 10, 13	DC7,	DC1, 7, 8, 10, 13		DC1, 7, 8, 10, 13
Tornadoes			DC1, 7, 8	DC7	DC1, 7, 8		DC1, 7, 8
Low-Risk Hazards							
Dam and Levee Failure	DC2, 3	DC2, 3	DC3, 7	DC2, 3, 7	DC3, 7	DC2, 3	DC3, 7
Erosion	DC4, 5, 12, 18, 19, 20	DC20	DC12	DC4, 5, 12, 18, 19, 20	DC5, 6	DC18, 19	DC4, 5, 12,
Expansive Soils							
Extreme Temperatures			DC1		DC1		DC1
Flooding	DC2, 3, 4, 6, 18, 19, 20, 21, 22,	DC2, 3, 18, 19, 20, 21, 22,	DC1, 3, 4, 7, 8,	DC2, 3, 4, 6, 7, 18, 19, 20,	DC1, 3, 4, 6, 7, 8, 21, 22,	DC2, 3, 18, 19, 21	DC1, 3, 4, 6, 7, 8
Land Subsidence							
Landslide	DC5		DC7	DC5, 8	DC5, 7		DC5, 7
Slope Failure	DC18, 19			DC18, 19		DC18, 19	

a. See the introduction to this volume for explanation of mitigation types.







9.2 CITY OF CASTLE PINES

9.2.1 Hazard Mitigation Plan Point of Contact

Primary Point of Contact	Alternate Point of Contact
Larry Nimmo, Public Works Director 360 Village Square Lane, Suite B Castle Pines, CO 80108 Telephone: 303.705.0216 e-mail Address: Larry.Nimmo@castlepinesco.gov	Sam Bishop, Community Development Director 360 Village Square Lane, Suite B Castle Pines, CO 80108 Telephone: 303.705.0225 e-mail Address: sam.bishop@castlepinesco.gov

9.2.2 Jurisdiction Profile

Location

City of Castle Pines is set at the base of Daniels Park and situated on 2,433 acres of upland Ponderosa Pine, shrub lands, and grassy plains. The City is bisected by Interstate 25. The land consists of a wide range of topography encompassing mountain vistas, dramatic ridgelines, hills, and grass covered plains.

The current boundaries generally extend from Cherokee Ranch and Daniels Park primarily to the west, Highlands Ranch Open Space Conservation Area to the north, open space and agricultural lands to the east, and agricultural lands to the south, which serve as a physical boundary between the City, Castle Pines Village, and Castle Rock. The City of Castle Pines encompasses an area of 9.55 square miles.

History

City of Castle Pines was incorporated in February 2008. Although the City government is fairly new, residents have been established in the area since the early 1980s, when the first subdivision was platted in unincorporated Douglas County. During this time, the area began a fast growth period during the 1980s, with an historic population of a few thousand, and then slowed down in growth during the early 1990s. In the late 1990s and early 2000s, the population began to increase as new housing and adequate infrastructure became available. In November 2010, the residents of Castle Pines voted to drop the term “North” from the City’s title. In November of 2018, Castle Pines residents opted to move towards Home Rule with the establishment of the Home Rule Charter Commission. The City’s government structure was officially changed on May 14, 2019 to Home Rule, making Castle Pines the latest home rule municipality in Colorado.

Climate

The climate of Douglas County is characterized by a moderate climate and significant sun exposure (more than 300 days per year). The County features low humidity, approximately 18 inches of rain each year, and 71 inches of snowfall. Temperatures range from highs of 85 degrees in July to 45 degrees in January (according to USA.com).

Governing Body Format

With the adoption of home rule, Castle Pines follows Colorado laws and operates under a mayor- council government system. The city council and mayor are elected officials. These positions are voluntary, and both the Council and mayor make a multitude of policy decisions on behalf of the jurisdiction. Elections for City Council commence on odd-numbered years, where three to four seats are typically open for election. The Mayor and Council members serve four year terms.

The Castle Pines City Council assumes responsibility for the adoption of this plan; the City Manager will oversee its implementation. Development of this annex was carried out by the members of the local mitigation planning team, whose members are listed in Table 9.2-1.

Table 9.2-1. Local Mitigation Planning Team Members

Name	Title
Larry Nimmo	City of Castle Pines Public Works Director
Sam Bishop	City of Castle Pines Community Development Director

9.2.3 Current Trends

Population

According to the U.S. Census Bureau the population of City of Castle Pines as of July 2019 was 10,763. Since 2010, the population has grown at an average annual rate of four percent.

Development

At the time of incorporation, the City of Castle Pines was approximately 2,417 acres with a small business district, consisted of 3,912 households and contained a 250 acre undeveloped residential development. Subsequent to the City’s incorporation, the City has annexed over 3,600 acres allowing for an additional 6,000 dwelling units and 2.6 million square feet of commercial land uses; these properties have entitlements and are currently being developed. With the addition of these properties, the City of Castle Pines will effectively triple its current population, more than double its housing stock, open space, parks and provide the opportunity for commercial development. The City has grown its original municipal boundary area from 2417 acres to approximately 6,117 acres or 9.55 square miles.

Table 9.2-2 summarizes development trends in the performance period since the preparation of the previous hazard mitigation plan, as well as expected future development trends.

Table 9.2-2. Recent and Expected Future Development Trends

Criterion	Response					
Has your jurisdiction annexed any land since the preparation of the previous hazard mitigation plan?	Yes					
If yes, give the estimated area annexed and estimated number of parcels or structures.	2 acres/ 3 parcels					
Is your jurisdiction expected to annex any areas during the performance period of this plan?	No					
If yes, describe land areas and dominant uses.						
If yes, who currently has permitting authority over these areas?						
Are any areas targeted for development or major redevelopment in the next five years?	Yes					
If yes, briefly describe, including whether any of the areas are in known hazard risk areas	Development is anticipated on the east side of I-25 over the next five years. The development activity will primarily consist of residential, commercial and recreational land uses. There are no known hazard risk areas where development is anticipated to occur.					
How many permits for new construction were issued in your jurisdiction since the		2015	2016	2017	2018	2019
	Single Family	<10	<10	<30	_97_	_254_

Criterion	Response					
preparation of the previous hazard mitigation plan?	Multi-Family	0	0	0	0	0
	Other (commercial, mixed use, etc.)	0	0	0	0	0
	Total	<10	<10	<30	97	254
Provide the number of new-construction permits for each hazard area or provide a qualitative description of where development has occurred.	Special Flood Hazard Areas: #0 Landslide: #0 High Liquefaction Areas: #0 Wildfire Risk Areas: #0					
Describe the level of buildout in the jurisdiction, based on your jurisdiction's buildable lands inventory. If no such inventory exists, provide a qualitative description.	It is anticipated the City will continue to develop and buildout over the next twenty years with a total anticipated population of just over 30,000. Today, the City is less than half developed.					

9.2.4 Status of Previous Plan Actions

Table 9.2-3 summarizes the actions that were recommended in the previous version of the hazard mitigation plan and their implementation status at the time this update was prepared.

Table 9.2-3. Status of Previous Plan Actions

Action Item	Completed	Removed; No Longer Feasible	Carried Over to Plan Update	
			Check if Yes	Enter Action #
Repair flooding hazard at Monarch Blvd. and Stonemont Dr.- On a yearly basis, when heavy rainfall occurs in the City, flooding occurs on the street at Monarch and Stonemont. The City's engineers have been tasked with designing a modification to fix this issue in the future. We hope to have the repair completed in FY 2015.	Yes			
<i>Comment:</i>				
Wildfire prevention and preparation- The City of Castle Pines has identified the potential for wildfires within portions of our community as having the potential of having a medium significance. The City of Castle Pines will continue to work with South Metro Fire Rescue Authority to develop plans to mitigate the impact of future wildfires within our community. In addition, Castle Pines has put into place means of communicating with the community during the time of an actual emergency (CodeRED) as well as providing ongoing communication on fire prevention and mitigation strategies for the citizens. The City also works in conjunction with Douglas County to identify situations when the fire danger is higher and incorporate additional restrictions associated with open fires.	Ongoing		Yes	CP-001
<i>Comment:</i> This is an ongoing operation.				

9.2.5 Capability Assessment

City of Castle Pines performed an assessment of its existing capabilities for implementing hazard mitigation strategies. The introduction at the beginning of this volume of the hazard mitigation plan describes the components included in the capability assessment and their significance for hazard mitigation planning. This section summarizes the following findings of the assessment:

- An assessment of legal and regulatory capabilities is presented in Table 9.2-4.
- Development and permitting capabilities are presented in Table 9.2-5.

- An assessment of fiscal capabilities is presented in Table 9.2-6.
- An assessment of administrative and technical capabilities is presented in Table 9.2-7.
- An assessment of education and outreach capabilities is presented in Table 9.2-8.
- Information on National Flood Insurance Program (NFIP) compliance is presented in Table 9.2-9.
- Classifications under various community mitigation programs are presented in Table 9.2-10.

Findings of the capability assessment were reviewed to identify opportunities to expand, initiate or integrate capabilities to further hazard mitigation goals and objectives. Where such opportunities were identified and determined to be feasible, they are included in the action plan. The “Analysis of Mitigation Actions” table in Section identifies these as community capacity building mitigation actions.

Table 9.2-4. Legal and Regulatory Capability

	Local Authority	Other Jurisdiction Authority	State Mandated	Integration Opportunity?
Codes, Ordinances, & Requirements				
Building Code	Yes	No	Yes	Yes
<i>Comment:</i>	<i>Last adopted in 2009</i>			
Zoning Code	Yes	No	Yes	Yes
<i>Comment:</i>	<i>The City adopted the Douglas County Zoning Code in 2008</i>			
Subdivisions	Yes	No	Yes	Yes
<i>Comment:</i>	<i>The City adopted the Douglas County Zoning Code in 2008</i>			
Stormwater Management	Yes	Yes	Yes	Yes
<i>Comment:</i>	<i>Special Districts Included, for the City it is Chapter 11-Article 2 of the Municipal code</i>			
Post-Disaster Recovery	No	No	No	Yes
<i>Comment:</i>				
Real Estate Disclosure	No	No	No	Yes
<i>Comment:</i>				
Growth Management	Yes	No	Yes	Yes
<i>Comment:</i>	<i>Three Mile Plan</i>			
Site Plan Review	Yes	No	Yes	Yes
<i>Comment:</i>				
Environmental Protection	Yes	Yes	Yes	Yes
<i>Comment:</i>	<i>City it is Chapter 11-Article 6 of the Municipal code</i>			
Flood Damage Prevention	Yes	Yes	Yes	Yes
<i>Comment:</i>	<i>MHFCD and Chapter 18 Article 1 Sec 18-1-30 of the Municipal Code</i>			
Emergency Management	Yes	Yes	Yes	Yes
<i>Comment:</i>	<i>South Metro Fire and Rescue Department and the Douglas County</i>			
Climate Change	No	No	No	No
<i>Comment:</i>				
Other	No	No	No	No
<i>Comment:</i>				
Planning Documents				
General Plan	Yes	No	Yes	Yes
<i>Comment:</i>				
Capital Improvement Plan	Yes	No	No	Yes
<i>How often is the plan updated?</i>	<i>Annually</i>			
<i>Comment:</i>	<i>The Five Year Capital Projections is part of the annual budget and is approved by the City Council. This plan approves the current year and projects future investments in capital projects as directed by the City Council.</i>			
Disaster Debris Management Plan	No	No	No	Yes
<i>Comment:</i>	<i>The City will rely upon contracted resources initially and will call upon a mutual aid agreement if organic assets are overwhelmed. In the event that a state of emergency is declared the City may call upon state or federal resources.</i>			
Floodplain or Watershed Plan	No	Yes	Yes	Yes
<i>Comment:</i>	<i>Watershed plans are conducted for major drainageways through a partnership with the City and Mile High Flood District</i>			

	Local Authority	Other Jurisdiction Authority	State Mandated	Integration Opportunity?
Stormwater Plan	Yes	Yes	Yes	Yes
<i>Comment:</i>	<i>City of Castle Pines MS4 Plan</i>			
Urban Water Management Plan	No	No	No	No
<i>Comment:</i>				
Habitat Conservation Plan	No	No	No	No
<i>Comment:</i>				
Economic Development Plan	Yes	No	No	Yes
<i>Comment:</i>	<i>The City has an Economic Action Plan adopted in 2019</i>			
Shoreline Management Plan	No	No	No	No
<i>Comment:</i>				
Community Wildfire Protection Plan	No	No	No	Yes
<i>Comment:</i>	<i>No standalone Wildfire Protection Plan yet exists.</i>			
Forest Management Plan	No	No	No	Yes
<i>Comment:</i>				
Climate Action Plan	No	No	No	No
<i>Comment:</i>				
Comprehensive Emergency Management Plan	No	Yes	No	Yes
<i>Comment:</i>	<i>No formal plan has been developed, but any plan will be integrated in conjunction with the County as well as South Metro Fire and Rescue who has fire protection and hazardous materials response responsibilities in the City.</i>			
Threat & Hazard Identification & Risk Assessment (THIRA)	No	No	No	Yes
<i>Comment:</i>	<i>No formal plan has been developed, but any plan will be integrated in conjunction with the County as well as South Metro Fire and Rescue who has fire protection and hazardous materials response responsibilities in the City.</i>			
Post-Disaster Recovery Plan	No	No	No	Yes
<i>Comment:</i>	<i>No formal plan has been developed, but any plan will be integrated into the Emergency Management Plan in conjunction with the County as well as South Metro Fire and Rescue.</i>			
Continuity of Operations Plan	Yes	Yes	No	Yes
<i>Comment:</i>	<i>The Continuity of Operations Plan was developed and approved by City Council in coordination with Douglas County, and for various service providers in the City.</i>			
Public Health Plan	No	Yes	Yes	Yes
<i>Comment:</i>	<i>The City of Castle Pines does not have a Public Health Department. The Local Public Health Authority for the City is Tri-County Health Department. We integrate with that Department to implement any Public Health Plans.</i>			
Other	No	No	No	No
<i>Comment:</i>				

Table 9.2-5. Development and Permitting Capability

Criterion	Response
Does your jurisdiction issue development permits?	Yes
If no, who does? If yes, which department?	Community Development Department
Does your jurisdiction have the ability to track permits by hazard area?	Yes
Does your jurisdiction have a buildable lands inventory?	No

Table 9.2-6. Fiscal Capability

Financial Resource	Accessible or Eligible to Use?
Community Development Block Grants	Yes
Capital Improvements Project Funding	Yes
Authority to Levy Taxes for Specific Purposes	Yes, subject to voter approval
User Fees for Water, Sewer, Gas or Electric Service	N/A

Financial Resource	Accessible or Eligible to Use?
Incur Debt through General Obligation Bonds	Yes, subject to voter approval
Incur Debt through Special Tax Bonds	Yes, subject to voter approval
Incur Debt through Private Activity Bonds	No
Withhold Public Expenditures in Hazard-Prone Areas	Yes
State-Sponsored Grant Programs	Yes
Development Impact Fees for Homebuyers or Developers	Currently No
Other	N/A

Table 9.2-7. Administrative and Technical Capability

Staff/Personnel Resource	Available?	Department/Agency/Position
Planners or engineers with knowledge of land development and land management practices	Yes	In-house
Engineers or professionals trained in building or infrastructure construction practices	Yes	In-house
Planners or engineers with an understanding of natural hazards	Yes	In-house
Staff with training in benefit/cost analysis	Yes	Contracted
Surveyors	Yes	Contracted
Personnel skilled or trained in GIS applications	Yes	Contract
Scientist familiar with natural hazards in local area	Yes	Contract
Emergency manager	N/A	N/A
Grant writers	Yes	In-house/Contract
Other	No	N/A

Table 9.2-8. Education and Outreach Capability

Criterion	Response
Do you have a public information officer or communications office?	Yes
Do you have personnel skilled or trained in website development?	Yes
Do you have hazard mitigation information available on your website?	Yes
If yes, briefly describe.	
Do you use social media for hazard mitigation education and outreach?	Yes
If yes, briefly describe.	
Do you have any citizen boards or commissions that address issues related to hazard mitigation?	No
If yes, briefly describe.	
Do you have any other programs already in place that could be used to communicate hazard-related information?	Yes
If yes, briefly describe.	Email/Electronic newsletter database
Do you have any established warning systems for hazard events?	No
If yes, briefly describe.	

Table 9.2-9. National Flood Insurance Program Compliance

Criterion	Response
What local department is responsible for floodplain management?	Public Works Department
Who is your floodplain administrator? (department/position)	Larry Nimmo
Are any certified floodplain managers on staff in your jurisdiction?	Contracted
What is the date that your flood damage prevention ordinance was last amended?	2012
Does your floodplain management program meet or exceed minimum requirements? If exceeds, in what ways?	Meets However, not a participating NFIP member
When was the most recent Community Assistance Visit or Community Assistance Contact?	Unable to determine if there has been a Visit

Criterion	Response
Does your jurisdiction have any outstanding NFIP compliance violations that need to be addressed? If so, state what they are.	Not a NFIP member
Are any RiskMAP projects currently underway in your jurisdiction? If so, state what they are.	No
Do your flood hazard maps adequately address the flood risk within your jurisdiction? If no, state why.	No Limited FEMA mapping for drainages
Does your floodplain management staff need any assistance or training to support its floodplain management program? If so, what type of assistance/training is needed?	Yes Need to join NFIP
Does your jurisdiction participate in the Community Rating System (CRS)? If yes, is your jurisdiction interested in improving its CRS Classification? If no, is your jurisdiction interested in joining the CRS program?	No No No
How many flood insurance policies are in force in your jurisdiction? ^a What is the insurance in force? What is the premium in force?	0 \$0 \$0
How many total loss claims have been filed in your jurisdiction? ^a How many claims are still open or were closed without payment? What were the total payments for losses?	0 \$0 \$0

a. According to FEMA statistics as of October 26, 2020

Table 9.2-10. Community Classifications

	Participating?	Classification	Date Classified
Community Rating System	No	-	-
Building Code Effectiveness Grading Schedule	No	-	-
Public Protection	No	-	-
Storm Ready	No	-	-
Firewise	No	-	-

9.2.6 Review and Incorporation of Information for This Annex

The goal of plan integration is to ensure that the potential impact of hazards is considered in planning for future development. FEMA recommends integration as follows:

- Integrate hazard mitigation plan goals with community objectives (e.g. incorporate the goals for risk reduction and safety into the policies of other plans).
- Use the risk assessment to inform plans and policies (e.g. incorporate risk assessment findings into land use plans, site plan review, emergency operations plans).
- Implement mitigation actions through existing mechanisms (e.g. include mitigation projects in the capital improvement plan).
- Think about mitigation before and after a disaster (e.g. build recovery planning on existing mitigation plans and goals).

Existing Reports, Plans, Regulatory Tools and Other Resources

The following technical reports, plans, and regulatory mechanisms were reviewed to provide information for this annex.

- **Castle Pines Municipal Code**—The municipal code was reviewed for the full capability assessment and for identifying opportunities for action plan integration.
- **Castle Pines Flood Damage Prevention Ordinance**—The flood damage prevention ordinance was reviewed for compliance with the National Flood Insurance Program.
- **Castle Pines Comprehensive Plan**—The Comp Plan sets forth goals that recognize and respect natural geologic conditions and hazard risks; specifically, ensure development is appropriate when weighed against hazards and natural constraints, discourage and avoid development in areas with high potential for wildfire, where mitigation is impractical or excessive, or other significant constraints and hazards are present, identify and mitigate wildfire hazards in areas determined appropriate for development, coordinate with local fire and emergency service providers, as well as county and state level wildlife departments on pertinent wildlife management issues.
- **Technical Reports and Information**—The following outside resources and references were reviewed:
- **Hazard Mitigation Plan Annex Development Tool-kit**—The tool-kit was used to support the development of this annex including past hazard events, noted vulnerabilities, risk ranking and action development.

Existing Integration

- **Capital Improvement Plan**— Integration with special districts
- **Storm Water Plan** - Opportunity to integrate with MHFCD, CCBWQA

Opportunities for Future Integration

- **Zoning Code**—The City of Castle Pines is conducting a comprehensive update to its zoning code. The opportunity to incorporate additional mitigation and abatement measures will be contemplated for inclusion into the Code.- Opportunity to integrate with SMFR, Douglas County
- **Capital Improvement Projects**—Capital improvement project proposals may take into consideration hazard mitigation potential as a means of evaluating project prioritization.- Integration with special districts
- **Wildfire Mitigation Plan** – No standalone plan exist - Opportunity to integrate with SMFR, Douglas County
- **Post-Disaster Recovery Plan**—The City of Castle Pines does not have a recovery plan and intends to develop one as a mitigation planning action during the next five years. The plan will build on the mitigation goals and objectives identified in the mitigation plan.- Opportunity to integrate with SMFR, Douglas County
- **Stormwater Management** - The City has a stormwater management program (Chapter 11) as a part of the MS4 permit and this program can include policies and procedures for responding to flooding events.
- **Environmental Protection** – The City is currently in the process of updating its Comprehensive Plan and is considering integrating requirements for the provisions that will support the City’s MS4 program.

- Flood Damage Prevention - The City has a floodplain code (Chapter 18) that incorporates the regulatory standards than the National Flood Insurance Program and periodically reviews this code to ensure the health and safety of the public.
- Pandemic Response/Mitigation – No standalone plan exists.
- Floodplain or Watershed Plan - The City partners with other governmental agencies to prepare and update watershed plans. Integration of natural hazards in watershed plans can take place as these plans are updated.
- Stormwater Plan - The City is in the process of creating a Stormwater plan which will in part identify risks and vulnerabilities to the existing storm infrastructure network and put a plan in place to address those areas.
- Habitat Conservation Plan – The City’s Comprehensive Plan, as well as several plans specific to Planned Developments in the City, identify habitat conservation goals and policies, however, no stand-alone plan exists and this represents an opportunity for future integration.
- Economic Development Plan – In 2019 the City adopted an Economic Development Action Plan.
- Wildfire Protection Plan – The City does not currently have a stand-alone Wildfire Protection Plan and this is an area for future integration and possible collaboration with regional partners.

9.2.7 Jurisdiction-Specific Natural Hazard Event History

Table 9.2-11 lists past occurrences of natural hazards for which specific damage was recorded in City of Castle Pines hazard events that broadly affected the entire planning area, including City of Castle Pines, are listed in the risk assessments in Volume 1 of this hazard mitigation plan.

Table 9.2-11. Past Natural Hazard Events

Type of Event	FEMA Disaster #	Date	Damage Assessment
Pandemic (COVID-19)	EM-3436/DR-4498	January 20 th , 2020 - Present	\$ 382,000.00
* Indicates County-wide event			

9.2.8 Hazard Risk Ranking

Table 9.2-12 presents a local ranking for City of Castle Pines of all hazards of concern for which this hazard mitigation plan provides complete risk assessments. This ranking summarizes how hazards vary for this jurisdiction. As described in detail in Volume 1, the ranking process involves an assessment of the likelihood of occurrence for each hazard, along with its potential impacts on people, property and the economy. Mitigation actions target hazards with high and medium rankings.

Table 9.2-12. Hazard Risk Ranking

Rank	Hazard Type	Risk Rating Score (Probability x Impact)	Category
1	Wildfire	36	High
2	Drought	30	Medium
2	Pandemic	30	Medium
6	Land Subsidence	12	Low
6	Animal Disease	12	Low
4	Hail	18	Medium
4	Lightning	18	Medium
4	Severe Thunderstorms	18	Medium
4	Severe Winter Storm	18	Medium

Rank	Hazard Type	Risk Rating Score (Probability x Impact)	Category
6	Transportation Accidents	12	Low
6	Earthquake	10	Low
6	Tornadoes	10	Low
6	Erosion	12	Low
6	Expansive Soils	12	Low
6	Extreme Temperatures	12	Low
6	Flood	12	Low
6	Landslide	12	Low
6	Slope Failure	12	Low
7	Dam and Levee Failure	6	Low

NOTE: The process used to assign risk ratings and rankings for each hazard is described in Volume 1 of this hazard mitigation plan.

9.2.9 Jurisdiction-Specific Vulnerabilities

Volume 1 of this hazard mitigation plan provides complete risk assessments for each identified hazard of concern. This section provides information on key vulnerabilities identified by the jurisdiction. Available jurisdiction-specific risk maps of the hazards are provided at the end of this annex.

Repetitive Loss Properties

The City of Castle Pines does not participate in the NFIP; therefore, the City does not have any repetitive loss or severe repetitive loss properties.

Other Noted Vulnerabilities

The following jurisdiction-specific issues have been identified based on a review of the results of the risk assessment, public involvement strategy, and other available resources:

- Wildfire – the City is located within the WUI and needs to identify fuel load throughout the higher risk areas (CP-001)
- Severe Weather – the City currently does not have a protocol for extreme weather conditions to address cancellation and evacuation for outdoor events (CP-004)

Mitigation actions addressing these issues were prioritized for consideration in the action plan presented in Section 9.2.10.

9.2.10 Hazard Mitigation Action Plan and Evaluation of Recommended Actions

Table 9.2-13 lists the actions that make up the hazard mitigation action plan for this jurisdiction. Table 9.2-14 identifies the priority for each action. Table 9.2-15 summarizes the mitigation actions by hazard of concern and mitigation type.

Table 9.2-13. Hazard Mitigation Action Plan Matrix

Applies to New or Existing Assets	Objectives Met	Lead Agency	Support Agency	Estimated Cost	Sources of Funding	Timeline ^a
Action CP-001— Wildfire prevention and fuel reduction. City of Castle Pines will coordinate with South Metro Fire Rescue to reduce fuel load throughout high risk areas of the City, including WUI areas of Castle Pines and unincorporated Douglas County.						
<i>Hazards Mitigated:</i>	Wildfire					

Applies to New or Existing Assets	Objectives Met	Lead Agency	Support Agency	Estimated Cost	Sources of Funding	Timeline ^a
New	2, 4, 7, 9, 14	City of Castle Pines	SMFR and Douglas County	\$10,000 Annually	City Budget; HMGP; BRIC; Fire Grants	Ongoing
Action CP-002— Update Land Development Code. Update land development code to promote water conservation measures, including a requirement for future commercial development to include 50% xeriscaping when feasible. ETC.						
<u>Hazards Mitigated:</u> Wildfire, drought, water consumption/conservation, and flood mitigation.						
New	3, 10, 21, 22	Special Districts	City of Castle Pines	Staff Time	City Budget; HMGP; BRIC; FMA	Ongoing
Action CP-003—Pandemic Preparedness Plan. Coordinate with various divisions from City, County, State and Federal entities to identify vulnerable populations and facilities; and develop a preparedness plan to ensure continuity of operations during a potential epidemic or pandemic.						
<u>Hazards Mitigated:</u> Pandemic						
New	4, 8, 9, 10, 13, 15	CDPHE	Tri-County Health, Douglas County, City of Castle Pines	\$50,000	Cares Act	Ongoing
Action CP-004 – Lightning/ Severe Weather protocols for outside events. Develop a City-wide protocol for extreme weather conditions to address cancellation and evacuation for outdoor events; and ensure all attendees at outside events are aware of safety precautions.						
<u>Hazards Mitigated:</u> Lightning, Severe Thunderstorm, Hail, Tornado, and Wildfire						
New	1, 2, 15, 16	City of Castle Pines	Douglas Country	Staff Time	City Budget	1 year
Action CP-005- Enhanced Warning and Weather Service. Purchase weather service specific to Castle Pines to provide real-time data to increase warning capacity for high-hazard events.						
<u>Hazards Mitigated:</u> Lightning, Severe Thunderstorm, Severe Winter Storm, Hail, Extreme Temperatures, and Tornado						
New	1, 2, 15, 16	City of Castle Pines	-	\$50,000 Annually	City Budget; HMGP; BRIC	Ongoing
Action CP-006 International Building Code Update. The City has adopted the 2015 International Building and Fire Code with Amendments. Integration opportunities will be considered as part of the next cycle of code updates planned in 2022. These codes establish the minimum requirements for building codes for all new construction and tenant finishes and the fire and life safety codes for new and existing businesses						
<u>Hazards Mitigated:</u> Severe winter storms, high winds, lighting, and wildfire						
New	3, 10, 21, 22	City of Castle Pines	-	Staff Time	City Budget; HMGP; BRIC	1 year
Action CP-007 Douglas County Wildfire Partnership. Castle Pines will join the Douglas County Wildfire Partnership (DCWP). Castle Pines along with South Metro Fire and Rescue and various state, federal, NGO, and private stakeholders, will work with the Partnership to assess impact from wildfire; identify opportunities to maintain continuity of operations; and develop a comprehensive mitigation strategy to identify projects that will reduce wildfire risk, increase natural resource protection, encourage the incorporation of wildfire management principles into local planning, land use and building codes, and promote public awareness of wildfire risk.						
<u>Hazards Mitigated:</u> Wildfire						
New	#2, 7, 9, 11, 14, 20, 23	City of Castle Pines	DCWP; SMFR	Staff Time	City Budget, Grants	Ongoing

a. Short-term = Completion within 5 years; Long-term = Completion within 10 years; Ongoing= Continuing new or existing program with no completion date
See the introduction to this volume for list of acronyms used here.

Table 9.2-14. Mitigation Action Priority

Action #	# of Objectives Met	Benefits	Costs	Do Benefits Equal or Exceed Costs?	Is Project Grant-Eligible?	Can Project Be Funded Under Existing Programs/Budgets?	Implementation Priority ^a	Grant Pursuit Priority ^a
CP-001	5	High	High	Data Not Available	Yes	Partial/No	High	High
CP-002	4	High	High	Data Not Available	Yes	No	Medium	High
CP-003	6	High	High	Data Not Available	Yes	Partial/No	High	High
CP-004	4	High	Low	Data Not Available	Yes	Yes	Medium	High
CP-005	4	High	Medium	Data Not Available	Yes	Partial/Yes	High	High
CP-006	4	High	Low	Data Not Available	Yes	Partial/Yes	High	Medium
CP-007	7	High	Low	Data Not Available	Yes	Partial/Yes	High	Medium

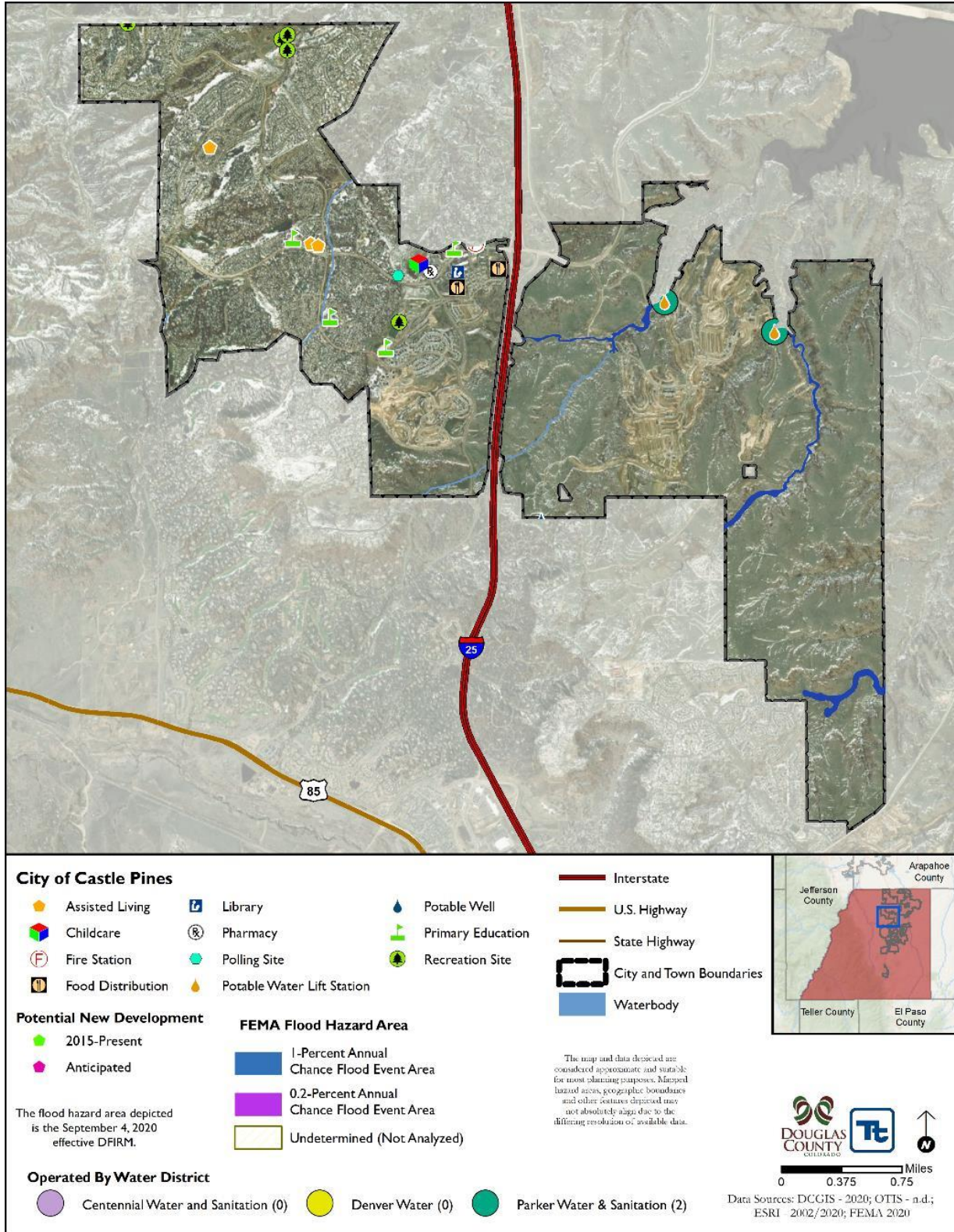
a. See the introduction to this volume for explanation of priorities.

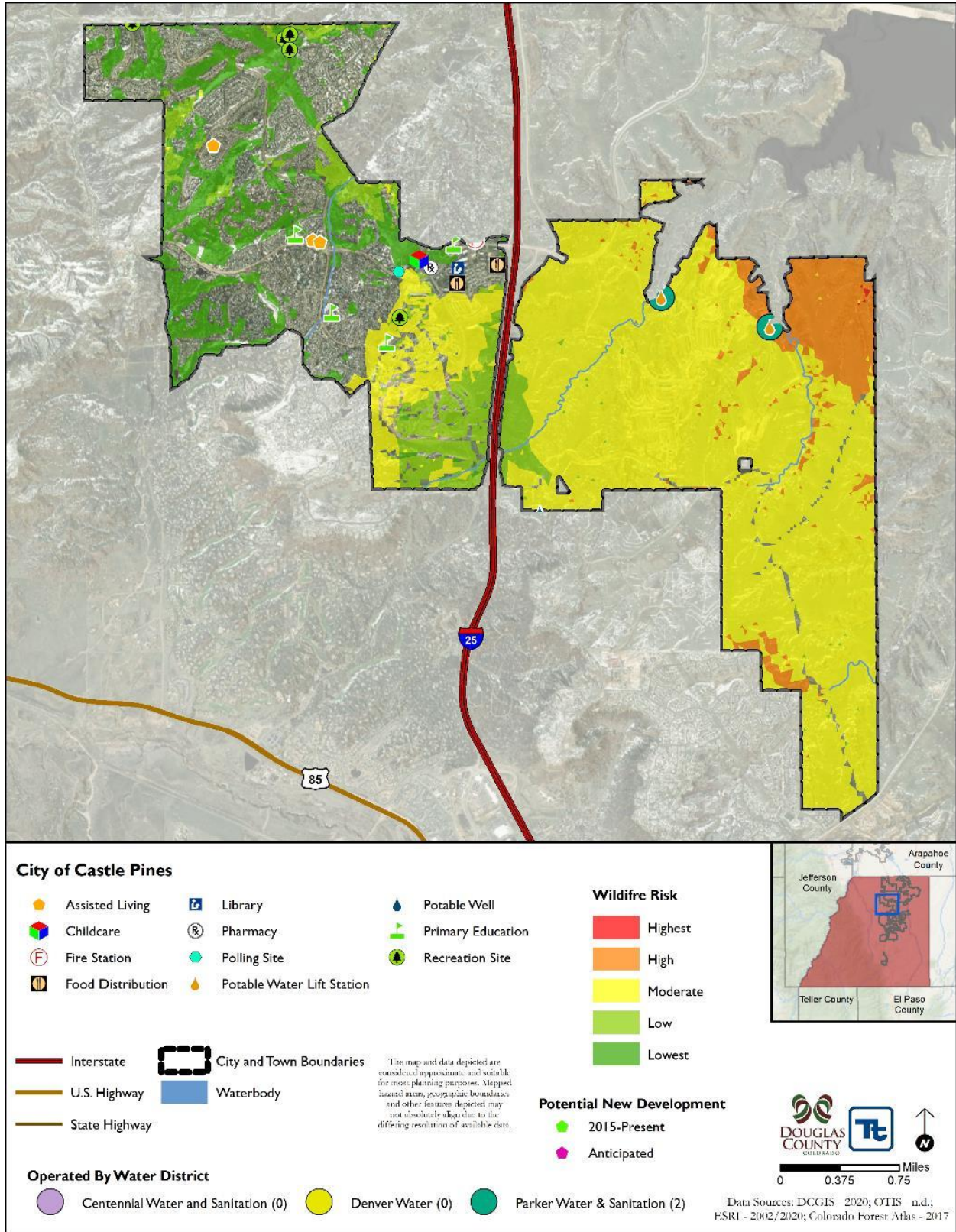
Table 9.2-15. Analysis of Mitigation Actions

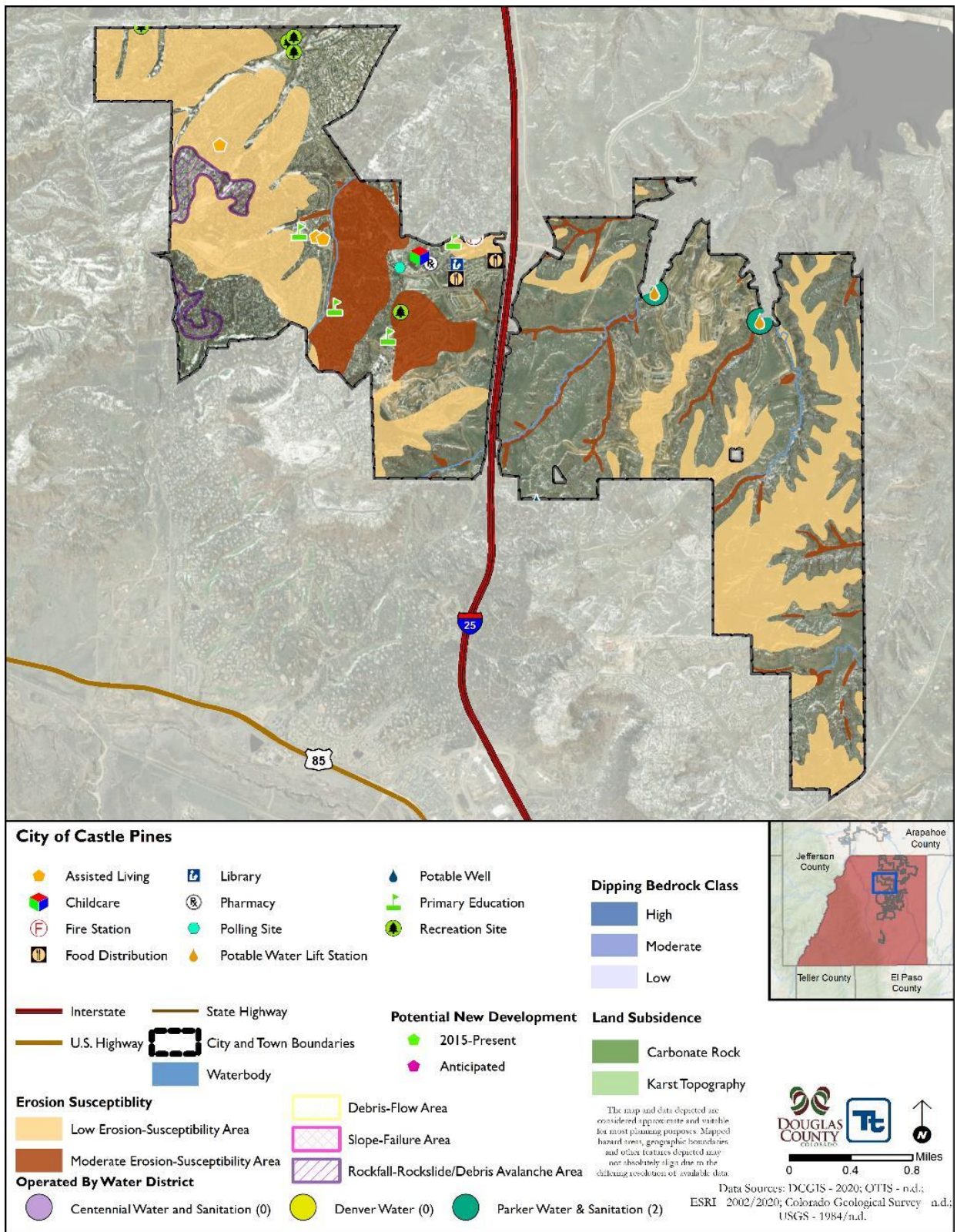
Hazard Type	Action Addressing Hazard, by Mitigation Type ^a						
	Prevention	Property Protection	Public Education and Awareness	Natural Resource Protection	Emergency Services	Structural Projects	Community Capacity Building
High-Risk Hazards							
Wildfire	CP-001, 007	CP-001	CP-001, 007	CP-001, 007	CP-001		CP-001, 006, 007
Medium-Risk Hazards							
Drought	CP-002		CP-002	CP-002			CP-002
Pandemic	CP-003		CP-003		CP-003		
Severe Thunderstorms (Hail, Lighting, and High Wind)	CP-004	CP-004	CP-004	CP-004	CP-004		CP-004, 006, 007
Severe Winter Storm	CP-005		CP-005		CP-005		CP-006, 007
Low-Risk Hazards							
Land Subsidence							
Animal Disease							
Transportation Accidents							
Earthquake							
Tornados							
Erosion							
Expansive Soils							

Hazard Type	Action Addressing Hazard, by Mitigation Type ^a						
	Prevention	Property Protection	Public Education and Awareness	Natural Resource Protection	Emergency Services	Structural Projects	Community Capacity Building
Extreme Temperatures							
Flood							
Landslide							
Slope Failure							
Dam and Levee Failure							

a. See the introduction to this volume for explanation of mitigation types.







9.3 TOWN OF CASTLE ROCK

9.3.1 Hazard Mitigation Plan Point of Contact

Primary Point of Contact	Alternate Point of Contact
Norris W. Croom, III, Fire Chief 300 Perry St. Castle Rock, CO 80104 Telephone: 303-660-1066 e-mail Address: ncroom@crgov.com	Craig Rollins, Assistant Chief 300 Perry St. Castle Rock, CO 80104 Telephone: 303-660-1066 e-mail Address: crollins@crgov.com

9.3.2 Jurisdiction Profile

Location

The Town of Castle Rock’s physical setting gives it a natural shape and identity. Steeply sloping terrain, buttes and ridgelines surround the Town, rising 300 to 800 feet above the 6,200-foot average elevation. Creeks and gulches meander through the many drainage basins and ponderosa pine and scrub oak cover the landscape. Panoramic views of the Rocky Mountains extend from Pike’s Peak in the south to Long’s Peak to the north.

The current boundaries generally extend from Happy Canyon Road, south to Dawson Ridge and from the Meadows, east to Castlewood Ranch Cobblestone Ranch, encompassing an area of 34.2 square miles.

History

The Town of Castle Rock was incorporated in 1881, after having been selected the County seat seven years earlier. Much of the early Town was built on the availability of rail transportation and the presence of the quarries that the railroads served. Settlers, attracted by the Homestead Act of 1862, joined gold prospectors, quarry, sawmill and railroad workers and ranchers in building the new community. The Town’s population initially grew slowly and steadily after its founding, topping 300 in 1900, and reaching 478 in 1930. By 1940 the Town added another 100 residents.

From 1950 to 1960, the Town grew by over 400 residents, from 741 to 1,154 persons. By the time the 1970 Census was conducted, Castle Rock’s population reached 2,078 persons. This was just under 25 percent of the County’s total population of 8,407.

The Denver area’s rapid sub-urbanization in the 1970’s strongly affected the Town as new, urban density developments were approved and began to develop. From 1970 to 1980 Castle Rock added 1,843 new residents, an increase of 88 percent to 3,921 persons. During this decade, the Town population dropped to 16 percent of the County’s total of 25,153. During the 1980’s the Town’s population grew at a much faster rate. At the end of 1989, the population of the Town was estimated at 8,875, an increase of 126 percent from 1980. Castle Rock’s population has steadily increased since 1990, growing by nearly two and one-half times during that decade from 8,612 to 20,224 persons.

Climate

Douglas County is characterized by a moderate climate and significant sun exposure (more than 300 days per year). The County features low humidity, approximately 18 inches of rain each year, and 71 inches of snowfall. Temperatures range from highs of 85 degrees in July to 45 degrees in January (according to USA.com).

Governing Body Format

Castle Rock is governed by the Town Council, which includes seven elected officials: five Council Members, who each represent an election district, the Mayor, and the Mayor Pro Tem. Among its duties, the Town council adopts ordinances to become local law and approves the budget, financial plans, land-use decisions, and the Town’s Comprehensive and Master Plans. The Castle Rock Town Council assumes responsibility for the adoption of this plan; Castle Rock Fire and Rescue Department, serving as the Emergency Management Agency for the Town will oversee its implementation. Development of this annex was carried out by the members of the local mitigation planning team, whose members are listed in Table 9.3-1.

Table 9.3-1. Local Mitigation Planning Team Members

Name	Title
Norris W. Croom III	Fire Chief
Craig Rollins	Assistant Chief
David Van Dellen	Stormwater Manager
Phil Kranz	Business Administration Manager
Joseph Montoya	Chief Building Official

9.3.3 Current Trends

Population

According to U.S. Census Bureau, the population of Town of Castle Rock as of 2019 was 68,484. Since 2010, the population has grown at an average annual rate of 41.9% percent.

Development

The Town of Castle Rock has experienced a sustained period of large growth in the residential arena for the last several years. This primarily consists of single family homes, but recently the Multi family segment has seen a significant increase in growth. Following the 2008 recession, the Town has averaged 840 new single family homes annually. The last three years have seen an average increase of 997 single family homes annually. The last five years have seen an average of 294 Multi Family units added inside the Town as well. Prior to this recent increase the Town had seen minimal activity on Multi Family since the early 2000s.

Commercially, the Town has seen a dramatic increase as well. This is primarily due to a large commercial, retail and restaurant development on the north end of the Town, The Promenade. There are also two notable mixed-use projects in the downtown core (Riverwalk, Encore) that incorporate multi-family units (apartment and condominium) with retail development. The Town has seen over one million square feet of commercial growth since 2015.

Future development in the Town looks as though it will follow the current trending barring any large changes to the overall economy.

Table 9.3-2 summarizes development trends in the performance period since the preparation of the previous hazard mitigation plan, as well as expected future development trends.

Table 9.3-2. Recent and Expected Future Development Trends

Criterion	Response					
Has your jurisdiction annexed any land since the preparation of the previous hazard mitigation plan?	Yes					
If yes, give the estimated area annexed and estimated number of parcels or structures.	222.4006					
Is your jurisdiction expected to annex any areas during the performance period of this plan?	Yes					
If yes, describe land areas and dominant uses.	The Town of Castle Rock is expect to annex various parcels during the performance period of this plan. The anticipated use are open space, parks, residential housing, light commercial.					
If yes, who currently has permitting authority over these areas?	Douglas County					
Are any areas targeted for development or major redevelopment in the next five years?	Yes					
If yes, briefly describe, including whether any of the areas are in known hazard risk areas	Over the next five years there are several development projects anticipated. However, none of them are within a known hazard risk area.					
How many permits for new construction were issued in your jurisdiction since the preparation of the previous hazard mitigation plan?		2015	2016	2017	2018	2019
	Single Family	794	756	862	1029	901
	Multi-Family	83	380	402	372	23
	Other (commercial, mixed use, etc.)	51	79	129	58	44
	Total	92	1,1	1,393	1,459	968
Provide the number of new-construction permits for each hazard area or provide a qualitative description of where development has occurred.	Special Flood Hazard Areas: # 16 Landslide: #0 High Liquefaction Areas: #0 Wildfire Risk Areas: the entire Town is subject to wildfire risk					
Describe the level of buildout in the jurisdiction, based on your jurisdiction’s buildable lands inventory. If no such inventory exists, provide a qualitative description.	The Town of Castle Rock is roughly 51% built out based on current buildable land inventory. Between the years of 2015 and 2019, The Town built out an estimated 8% of the available buildable land inventory to include annexations within that same timeframe.					

9.3.4 Status of Previous Plan Actions

Table 9.3-3 summarizes the actions that were recommended in the previous version of the hazard mitigation plan and their implementation status at the time this update was prepared.

Table 9.3-3. Status of Previous Plan Actions

Action Item	Completed	Removed; No Longer Feasible	Carried Over to Plan Update	
			Check if Yes	Enter Action #
Public awareness – support Douglas County citizen disaster preparedness guide. Revise and Update the Citizen Preparedness Guide using a new format with a focus on disaster preparedness for all Douglas County Citizens. Components include Warning systems, Citizen Information, Preparing a Family Disaster Plan, Stockpile Checklist, Shelter & Recovery, Access & Functional Needs, Pet Preparedness and Evacuation, Thunderstorms & Lightning, Winter Storms & Extreme Cold, Floods, Tornadoes, Wildfires, Terrorism, Active Shooter, Public Health Emergency,	CRFD continues to distribute disaster Preparedness Guides at all Town and Department			

Action Item	Completed	Removed; No Longer Feasible	Carried Over to Plan Update Check if Yes	Enter Action #
Pandemic Flu, Hazardous Materials, and Helpful Resources. Printed and electronic versions available as well as an application for smart phones.	public events			
<i>Comment: On-going</i>				
Flood Insurance Rate Map (FIRM) and Flood Insurance Study (FIS) Update- The Town of Castle Rock, in partnership with Douglas County and Urban Drainage and Flood Control District, is updating the FIRM and FIS to incorporate new flood hazard studies and changes to the special flood hazard area since 2005.	Complete			
<i>Comment: Adopted per ordinance 2016-001</i>				
Stream Stabilization and Flood Control on Major Drainageways- This project includes stream channel stabilization for East Plum Creek, Sellars Gulch and their tributaries within Town boundaries. Projects are identified and prioritized per the Stormwater Master Plan as scheduled activities. Stream improvements generally include natural or engineered segments of vegetated stream between engineered hard points that reduce channel slope and erosive velocities. Improvements also ensure adequate flood capacity in the channel to reduce flood potential for adjacent properties.	Complete and on-going		Yes	CR1
<i>Comment: On-going: Projects are established per the Castle Rock Stormwater Master Plan adopted by resolution 2017-098. Completed projects as follows: 2016: East Plum Creek Stabilization at Meadows Pkwy 2017: East Plum Creek Stabilization at Perry Street, Sellars Gulch Culvert Rehab at Plum Creek Pkwy, Omni Tributary Culvert at Wolfensberger Road 2018: 6400 South Tributary Stabilization at Red Hawk, Douglas Lane Tributary Stabilization, Hangmans Gulch Stabilization 2020: Industrial Tributary Stabilization, McMurdo Gulch Stabilization</i>				
Plum Creek /North Meadows Extension Flood Erosion Protection-Storm Drainage System- Construction of 100-year storm drainage collection system to East Plum Creek to slow storm-water flow and prevent swift-water erosion to East Plum Creek banks. The existing area collection system is under-sized and has led to significant erosion to the area. Through installation of a regional detention facility, adequately sized storm-sewer pipes and downstream outfall protection, water speeds will be reduced and erosion minimized.	Complete			
<i>Comment:</i>				
Crystal Valley Stormwater Collection Re-design- Re-construction of Crystal Valley storm drainage collection system to Crystal Valley regional detention pond to slow storm-water flow and prevent swift-water erosion to the area. The existing area collection system is too steep, has failed, and has led to significant erosion to the area. Through installation of new storm- sewer pipes and drop chambers, water speeds will be reduced and erosion minimized.	Complete			
<i>Comment:</i>				
Woodlands/Escavera Wildland Mitigation Program- The wildland open space area that runs through the Woodlands and Escavera residential developments of Castle Rock poses a significant wildfire threat the surrounding residential areas. Aggressive mastication and mitigation efforts which began in 2007 have continued to present day, and regrowth continuously has to be addressed on an annual basis.			x	CR2
<i>Comment: On-going: This is part of a larger CWPP goal within the 2020-2024 Community Driven Strategic Plan</i>				

9.3.5 Capability Assessment

Town of Castle Rock performed an assessment of its existing capabilities for implementing hazard mitigation strategies. The introduction at the beginning of this volume of the hazard mitigation plan

describes the components included in the capability assessment and their significance for hazard mitigation planning. This section summarizes the following findings of the assessment:

- An assessment of legal and regulatory capabilities is presented in Table 9.3-4.
- Development and permitting capabilities are presented in Table 9.3-5.
- An assessment of fiscal capabilities is presented in Table 9.3-6.
- An assessment of administrative and technical capabilities is presented in Table 9.3-7
- An assessment of education and outreach capabilities is presented in Table 9.3-8.
- Information on National Flood Insurance Program (NFIP) compliance is presented in Table 9.3-9.
- Classifications under various community mitigation programs are presented in Table 9.3-10.

Findings of the capability assessment were reviewed to identify opportunities to expand, initiate or integrate capabilities to further hazard mitigation goals and objectives. Where such opportunities were identified and determined to be feasible, they are included in the action plan. The “Analysis of Mitigation Actions” table in Section 9.3.11 identifies these as community capacity building mitigation actions.

Table 9.3-4. Legal and Regulatory Capability

	Local Authority	Other Jurisdiction Authority	State Mandated	Integration Opportunity?
Codes, Ordinances, & Requirements				
Building Code	Yes	No	No	No
<i>Comment:</i>	<i>Building code ordinance; the Town is currently operating under the 2018 ICC codes. As of October 2020, the BCEGS rating for the Town is Class 5 for both residential and commercial/industry.</i>			
Zoning Code	Yes	No	No	No
<i>Comment:</i>				
Subdivisions	Yes	No	No	Yes
<i>Comment:</i>	<i>2020-2024 CRFD Strategic Plan: Strategic Goal #1 Community Wildfire Protection Plan (2020-010)</i>			
Stormwater Management	Yes	No	Yes	No
<i>Comment:</i>	<i>Storm Drainage Design and Technical Criteria Manual and Temporary Erosion and Sediment Control Manual Ordinance 2019-013</i>			
Post-Disaster Recovery	Yes	Yes	No	Yes
<i>Comment:</i>	<i>No existing Post-Disaster Recovery Plan</i>			
Real Estate Disclosure	No	No	No	No
<i>Comment:</i>				
Growth Management	No	No	No	No
<i>Comment:</i>				
Site Plan Review	Yes	No	No	Yes
<i>Comment:</i>	<i>DEVELOPMENT SERVICES</i>			
Environmental Protection	Yes	No	Yes	No
<i>Comment:</i>	<i>IDDE Ordinance: Resolution 2012-024</i>			
Flood Damage Prevention	Yes	No	Yes	No
<i>Comment:</i>	<i>Chapter 18 of the Town charter discusses the rolls and responsibilities of the floodplain administrator, permitting procedures and variance process. The Town maintains elevation certificates, as required in 18.10.020. The Director of Castle Rock Water is designated as the Floodplain Administrator for the Town. Their duties include enforcing this chapter of the town charter, as outlined in the chapter. If a person wants to develop in a floodplain, they must complete a permit application and, if approved, meet all requirements for building in a SFHA.</i>			
Emergency Management	Yes	No	No	Yes
<i>Comment:</i>	<i>2019 Emergency Operations Plan: Resolution 2019-055</i>			
Climate Change	N/A	N/A	N/A	N/A
<i>Comment:</i>				
Other	N/A	N/A	N/A	N/A
<i>Comment:</i>				
Planning Documents				
Capital Improvement Plan	Yes	No	No	Yes

	Local Authority	Other Jurisdiction Authority	State Mandated	Integration Opportunity?
How often is the plan updated?	Annually			
Comment:				
Disaster Debris Management Plan	No	Yes	No	No
Comment:	Douglas County Debris Management Plan			
Floodplain or Watershed Plan	Yes	No	No	No
Comment:	Stormwater Master Plan Update: Resolution 2017-098			
Stormwater Plan	Yes	No	No	No
Comment:	Storm Water Master Plan 2017-098			
Urban Water Management Plan	Yes	No	No	Yes
Comment:	Water Resource Strategic Master Plan Resolutions 2017-012 and 2018-043			
Habitat Conservation Plan	Yes	Yes	No	No
Comment:	Douglas County Habitat Conservation Plan			
Economic Development Plan	No	No	No	No
Comment:	The Town of Castle Rock partners with the The Castle Rock Economic Development Council to evaluates proposed commercial development activities within Town limits.			
Shoreline Management Plan	N/A	N/A	N/A	N/A
Comment:	N/A			
Community Wildfire Protection Plan	Yes	Yes	No	Yes
Comment:	2020-2024 CRFD Strategic Plan: Strategic Goal #1 Community Wildfire Protection Plan (2020-010); the 2017 CWPP was never approved but the Town is currently working on an update and we have it formally adopted by the end of 2021.			
Forest Management Plan	N/A	N/A	N/A	N/A
Comment:	N/A			
Climate Action Plan	No	No	No	No
Comment:				
Comprehensive Emergency Management Plan	Yes	Yes	No	Yes
Comment:	Castle Rock Fire Department is the Emergency Management Agency for the Town of Castle Rock and is limited to the 2019 adoption of the Emergency Operations Plan (2019-055)			
Threat & Hazard Identification & Risk Assessment (THIRA)	No	No	Yes	No
Comment:	The Town of Castle Rock relies on the Douglas County THIRA process			
Post-Disaster Recovery Plan	No	No	No	No
Comment:				
Continuity of Operations Plan	No	No	No	Yes
Comment:	COOPs are department specific			
Public Health Plan	No	Yes	Yes	No
Comment:	TRI-COUNTY HEALTH DEPARTMENT			
Other	No	No	No	No
Comment:				

Table 9.3-5. Development and Permitting Capability

Criterion	Response
Does your jurisdiction issue development permits?	Yes
If no, who does? If yes, which department?	Development Services
Does your jurisdiction have the ability to track permits by hazard area?	Yes
Does your jurisdiction have a buildable lands inventory?	Yes

Table 9.3-6. Fiscal Capability

Financial Resource	Accessible or Eligible to Use?
Community Development Block Grants	Yes

Financial Resource	Accessible or Eligible to Use?
Capital Improvements Project Funding	Yes
Authority to Levy Taxes for Specific Purposes	Yes
User Fees for Water, Sewer, Gas or Electric Service	Yes, Water And Sewer – the Town charges for stormwater service fees on every water account for both residential and commercial
Incur Debt through General Obligation Bonds	Yes
Incur Debt through Special Tax Bonds	Yes
Incur Debt through Private Activity Bonds	Yes
Withhold Public Expenditures in Hazard-Prone Areas	No
State-Sponsored Grant Programs	Yes
Development Impact Fees for Homebuyers or Developers	Yes
Other	No

Table 9.3-7. Administrative and Technical Capability

Staff/Personnel Resource	Available?	Department/Agency/Position
Planners or engineers with knowledge of land development and land management practices	Yes	Development Services, Development Review, And Planning, Fire Department
Engineers or professionals trained in building or infrastructure construction practices	Yes	Development Services, Building, Fire Department, Castle Rock Water, Public Works
Planners or engineers with an understanding of natural hazards	Yes	Development Services, Development Review, And Planning, Castle Rock Water
Staff with training in benefit/cost analysis	Yes	Business Administrative Division, Finance Department, Town Manager Office
Surveyors	No	Provided By 3 rd Party
Personnel skilled or trained in GIS applications	Yes	Doit, Fire, Public Works, Water, Development Services
Scientist familiar with natural hazards in local area	No	
Emergency manager	Yes	Fire Department – Part-Time Responsibility
Grant writers	Yes	As Needed By Department Submitting
Resiliency Planner	No	-
Other	Yes	<ul style="list-style-type: none"> • Transportation planner in the Public Works Department • Full-time building code official in the Development Services Department

Table 9.3-8. Education and Outreach Capability

Criterion	Response
Do you have a public information officer or communications office?	Yes
Do you have personnel skilled or trained in website development?	Yes
Do you have hazard mitigation information available on your website?	No
If yes, briefly describe.	
Do you use social media for hazard mitigation education and outreach?	No
If yes, briefly describe.	
Do you have any citizen boards or commissions that address issues related to hazard mitigation?	Yes
If yes, briefly describe.	Public Safety Commission, Planning Commission, Town Council
Do you have any other programs already in place that could be used to communicate hazard-related information?	Yes
If yes, briefly describe.	Social Media, Code Red
Do you have any established warning systems for hazard events?	Yes
If yes, briefly describe.	Code Red

Table 9.3-9. National Flood Insurance Program Compliance

Criterion	Response
What local department is responsible for floodplain management?	CASTLE ROCK WATER
Who is your floodplain administrator? (department/position)	Stormwater Manager
Are any certified floodplain managers on staff in your jurisdiction?	YES
What is the date that your flood damage prevention ordinance was last amended?	March 2016
Does your floodplain management program meet or exceed minimum requirements?	EXCEEDS
If exceeds, in what ways?	Two-Foot Freeboard requirement
When was the most recent Community Assistance Visit or Community Assistance Contact?	2009
Does your jurisdiction have any outstanding NFIP compliance violations that need to be addressed?	No
If so, state what they are.	The Town is in good standing with the NFIP. Chapter 18 of the Town Charter discusses the rolls and responsibilities of the floodplain administrator, permitting procedures, and variance process.
Are any RiskMAP projects currently underway in your jurisdiction?	NO
If so, state what they are.	-
Do your flood hazard maps adequately address the flood risk within your jurisdiction?	YES
If no, state why.	-
Does your floodplain management staff need any assistance or training to support its floodplain management program?	NO
If so, what type of assistance/training is needed?	-
Does your jurisdiction participate in the Community Rating System (CRS)?	NO
If yes, is your jurisdiction interested in improving its CRS Classification?	-
If no, is your jurisdiction interested in joining the CRS program?	-
How many flood insurance policies are in force in your jurisdiction? ^a	Insert appropriate information
What is the insurance in force?	\$21,572,400
What is the premium in force?	\$36,708
How many total loss claims have been filed in your jurisdiction? ^a	5
How many claims are still open or were closed without payment?	3
What were the total payments for losses?	\$4,573

a. According to FEMA statistics as of December 02, 2020

Table 9.3-10. Community Classifications

	Participating?	Classification	Date Classified
Community Rating System	NO	N/A	N/A
Public Protection (ISO)	YES	2/2X	2016
Storm Ready	NO	N/A	N/A
Firewise	NO	N/A	N/A

9.3.6 Review and Incorporation of Information for This Annex

The goal of plan integration is to ensure that the potential impact of hazards is considered in planning for future development. FEMA recommends integration as follows:

- Integrate hazard mitigation plan goals with community objectives (e.g. incorporate the goals for risk reduction and safety into the policies of other plans).
- Use the risk assessment to inform plans and policies (e.g. incorporate risk assessment findings into land use plans, site plan review, emergency operations plans).

- Implement mitigation actions through existing mechanisms (e.g. include mitigation projects in the capital improvement plan).
- Think about mitigation before and after a disaster (e.g. build recovery planning on existing mitigation plans and goals).

Existing Reports, Plans, Regulatory Tools and Other Resources

The following technical reports, plans, and regulatory mechanisms were reviewed to provide information for this annex.

- **2020-2024 Castle Rock Fire and Rescue Department: Community Driven Strategic Plan** – this plan details the department’s Community Wildfire Protection Plan.
- **2019 Town of Castle Rock Emergency Operations Plan** – this plan is the foundational document of the Town of Castle Rock’s emergency management plan.
- **2018 Building and Fire Code** – Establish minimum building safety requirements for new and tenant finish construction and life and life safety guidelines for commercial and business inspections.
- **2020 Flood Insurance Study** – FEMA updated the Douglas County Flood Insurance Study (FIS) on September 4, 2020. The FIS revises and updates information on the existence and severity of flood hazards in the geographic area of Douglas County, Colorado, including: the Towns of Castle Rock, Larkspur, and Parker; the Cities of Castle Pines and Lone Tree; and the unincorporated areas of Douglas County (hereinafter referred to collectively as Douglas County).
- **Zoning Codes** – Establish minimum setback and allowed zoning use for residential and commercial new and remodel permits.
- **Development Services Procedures Manual** – This procedural manual is associated with development from annexation through certificate of occupancy detailing the processes required for development at all stages to ensure all Town entities and outside agencies who are coordinated with regarding development have all of their requirements and regulations adhered to.
- **Storm Drainage Design and Technical Criteria Manual and Temporary Erosion and Sediment Control Manual (TESC Manual)** – These documents are adopted by reference in Municipal Code and last updated in 2019. The TESC Manual describes the permitting program that has been adopted to promote environmentally sound construction practices in Town. The goal of the program is to implement erosion and sediment control measures as a standard for all land-disturbance activities. The hope is to reduce increases in erosion and sedimentation over pre-development conditions. Erosion caused by construction and downstream sedimentation can damage property and degrade the quality of streams and lakes. The manual is available online (<http://crgov.com/2669/TESC-Manual>)
- **2017 Stormwater Master Plan Update** – This document provides a five-year planning window for stormwater management practices and capital improvements within the Town of Castle Rock. Flood mapping, stormwater quality, maintenance and drainageway master planning efforts. Stormwater management is funded through the stormwater enterprise fund including development impact fees and monthly service charges.

- **Erosion/Sediment Control Program** – The Town has an erosion/sediment control program which is managed by the Town’s stormwater division at Castle Rock Water.
- **Water Resource Strategic Master Plan** – This document is updated every five years and details the water supply and water conservation projects that are necessary to become a community that relies upon renewable water resources for at least 75% of its supply. It also details the capital investments that are necessary to achieve this goal.
- **Elevation Certificates** – The Town maintains elevation certificates in accordance with the Town’s floodplain regulations.
- **Technical Reports and Information**—The following outside resources and references were reviewed:
 - **Hazard Mitigation Plan Annex Development Tool-kit**—The tool-kit was used to support the development of this annex including past hazard events, noted vulnerabilities, risk ranking and action development.

Existing Integration

- **Capital Improvement Plan**— This CIP is updated annually and approved via Town Council as part of the annual budget process.
- **Building Code and Fire Code** - The Town adopted the 2018 Unified Building and Fire Codes via resolution 2019-012. These codes establish the minimum requirements for building codes for all new construction and tenant finishes and the fire and life safety codes for new and existing businesses.
- **2030 Comprehensive Master Plan** — This plan was adopted in 2017 and provides an overview and plan for the built environment in the Town to enhance it’s natural environment. The plan also identifies building blocks of the community using four cornerstones: Distinct Town Identity, Responsible Growth, Community Services and Thriving Economy. Each of the cornerstones provides guidance to the community and its decision-makers.
- **Emergency Operations Plan** – The Emergency Operations plan was updated and adopted by the Town of Castle Rock Town Council via ordinance 2019-055 and provide a high-level guideline for the Town of Castle Rock during a large-scale or extended emergency or disaster event.

Opportunities for Future Integration

- **Zoning Code**—The Town of Castle Rock has a comprehensive zoning code and will periodically review the code, looking for opportunities to incorporate mitigation and abatement measures into the Code.
- **Capital Improvement Projects**—Capital improvement project proposals may take into consideration hazard mitigation potential as a means of evaluating project prioritization. (TMO, Matt Gohl)
- **Subdivision** – The Castle Rock Fire and Rescue Department is coordinating with other Town department and local agencies to determine the feasibility for developing a Community Wildfire

Protection Plan (CWPP) that has the potential to include subdivision or neighborhood specific mitigation plans.

- **Post-Disaster Recovery** – The Town of Castle Rock does not have a local post-disaster recovery plan, but closely coordinates with Douglas County Office of Emergency Management during all significant events that affect the Town. The Town of Castle Rock intends to explore the feasibility of developing a Town specific disaster recovery plan during the next five years. The plan will build on the mitigation goals and objectives identified in this mitigation plan.
- **Site Plan Review** – The Town of Castle Rock current site plan review process includes a review of certain risks/hazards. The Town will evaluate the feasibility of updating the site review plan process to include other identified risk and mitigation efforts determined within this plan
- **Emergency Management** – The Castle Rock Fire and Rescue Department also serves as the Emergency Management Agency for the Town of Castle Rock. Those roles and responsibilities are part-time duties of the Fire Chief and Assistant Chief. The Castle Rock Fire and Rescue Department and Town of Castle Rock will review the current staffing and deployment model related to the functions of Town-wide emergency management, and consider the need of a full-time dedicated emergency manager.
- **Urban Water Management Plan** – The Town of Castle Rock should evaluate its Water Resource Master Plan to determine the potential for additional or increased renewable water resources.
- **Community Wildfire Protection Plan** – The Castle Rock Fire and Rescue Department is coordinating with other Town departments and local agencies to determine the feasibility for developing a Community Wildfire Protection Plan (CWPP) that has the potential to include subdivision or neighborhood specific mitigation plans.
- **Continuity of Operations Plan** – Currently, each Town department is responsible for its own Continuity of Operations Plan (COOP). Within the next five years, the Town of Castle Rock will develop a Town-wide COOP plan to ensure minimum levels of service are maintained as well as supporting all mission essential functions.

9.3.7 Jurisdiction-Specific Natural Hazard Event History

Table 9.3-11 lists past occurrences of natural hazards for which specific damage was recorded in the Town of Castle Rock hazard events that broadly affected the entire planning area, including the Town of Castle Rock, are listed in the risk assessments in Volume 1 of this hazard mitigation plan.

Table 9.3-11. Past Natural Hazard Events

Type of Event	FEMA Disaster #	Date	Damage Assessment
Hail	N/A	7/7/2016	\$579,695
Hail	N/A	6/12/2019	\$1,828
Winter Weather*	N/A	March 2019	\$25,755
Pandemic (COVID-19)*	EM-3436/DR-4498	3/1/2020 – 1/31/2021	\$3,766,510
* Indicates County-wide event			

1.7.1 Pandemic Response

In response to the COVID-19 Pandemic and ongoing response, The Town of Castle Rock was forced to transition to a 100% remote working environment rapidly in order to perform mission essential functions and maintain minimum levels of service while providing for customer, community, and employee safety. The table below details the category of expenses and the total as of January 31, 2021.

Description of expense	CARES Act Subcategory	Value (\$)
Medical Expenses	Emergency medical response expenses	\$126,165.37
Public Health Expenses	Communication and enforcement	\$128,598.41
	Acquisition and distribution of medical and protective supplies	\$269,190.37
	Disinfection of public areas and other facilities	\$42,650.82
	Public safety measures	\$149,993.87
	Quarantining individuals	\$444.96
	COVID-19 testing	\$140.00
Payroll Expenses	Public safety, public health, health care, human services, and similar employees whose services are dedicated to mitigating/responding to COVID-19	\$641,751.30
Economic Support	Expenditures related to the provision of grants to small businesses to reimburse the costs of business interruption and other related business assistance programs	\$1,927,623.86
Facilitate Compliance	Improve telework capabilities for public employees to enable compliance	\$410,567.61
	Expenses of providing paid sick and paid family and medical leave to public employees	\$66,383.27
Other Expenses	Any other COVID-19 related expenses	\$3,000.00

9.3.8 Hazard Risk Ranking

Table 9.3-12 presents a local ranking for Town of Castle Rock of all hazards of concern for which this hazard mitigation plan provides complete risk assessments. This ranking summarizes how hazards vary for this jurisdiction. As described in detail in Volume 1, the ranking process involves an assessment of the likelihood of occurrence for each hazard, along with its potential impacts on people, property and the economy. Mitigation actions target hazards with high and medium rankings.

Table 9.3-12. Hazard Risk Ranking

Rank	Hazard Type	Risk Rating Score (Probability x Impact)	Category
1	Wildfire	48	High
2	Drought	30	Medium
2	Pandemic	30	Medium
3	Hail	24	Medium
4	Land Subsidence	18	Medium
4	Lightning	18	Medium
4	Severe Thunderstorms	18	Medium
4	Severe Winter Storm	18	Medium
4	Transportation Accidents	18	Medium
5	Tornadoes	16	Medium
6	Erosion	12	Low
6	Expansive Soils	12	Low
6	Extreme Temperatures	12	Low
6	Flood	12	Low
6	Landslide	12	Low
6	Slope Failure	12	Low
7	Dam and Levee Failure	6	Low
6	Animal Disease	12	Low
7	Earthquake	6	Low

NOTE: The process used to assign risk ratings and rankings for each hazard is described in Volume 1 of this hazard mitigation plan.

9.3.9 Jurisdiction-Specific Vulnerabilities

Volume 1 of this hazard mitigation plan provides complete risk assessments for each identified hazard of concern. This section provides information on key vulnerabilities identified by the jurisdiction. Available jurisdiction-specific risk maps of the hazards are provided at the end of this annex.

Repetitive Loss Properties

Repetitive loss records are as follows:

- Number of FEMA-identified Repetitive-Loss Properties: 0
- Number of FEMA-identified Severe-Repetitive-Loss Properties: 0
- Number of Repetitive-Loss Properties or Severe-Repetitive-Loss Properties that have been mitigated: 0

Other Noted Vulnerabilities

The following jurisdiction-specific issues have been identified based on a review of the results of the risk assessment, public involvement strategy, and other available resources:

- Wildfire – a needs assessment and wildfire risk assessment is needed to get an understanding of wildfire risk to the areas around and adjacent to the Town’s critical infrastructure (see CR12 in Table 9.3-13).

Mitigation actions addressing these issues were prioritized for consideration in the action plan presented in Section 9.2.10.

9.3.10 Hazard Mitigation Action Plan and Evaluation of Recommended Actions

Table 9.3-13 lists the actions that make up the hazard mitigation action plan for this jurisdiction. Table 9.3-14 identifies the priority for each action. Table 9.3-15 summarizes the mitigation actions by hazard of concern and mitigation type.

Table 9.3-13. Hazard Mitigation Action Plan Matrix

Applies to New or Existing Assets	Objectives Met	Lead Agency	Support Agency	Estimated Cost	Sources of Funding	Timeline ^a
Action CR1 - Stream Stabilization and Flood Control on Major Drainageways- This project includes stream channel stabilization for East Plum Creek, Sellars Gulch and their tributaries within Town boundaries. Projects are identified and prioritized per the Stormwater Master Plan as scheduled activities. Stream improvements generally include natural or engineered segments of vegetated stream between engineered hard points that reduce channel slope and erosive velocities. Improvements also ensure adequate flood capacity in the channel to reduce flood potential for adjacent properties.						
<u>Hazards Mitigated:</u>	Flood and Erosion Control					
Existing	# 2, 4, 6, 7, 12, 14, 17, 19, 20, 23, 24	Castle Rock Water	N/A	\$10 million	Stormwater Enterprise Fund	Short

Applies to New or Existing Assets	Objectives Met	Lead Agency	Support Agency	Estimated Cost	Sources of Funding	Timeline ^a
Action CR2 — Reconstruction/rehabilitation of small scale jurisdictional dams retaining stormwater runoff for recreational use. Older retention pond embankments previously used for agricultural purposes exist within Town of Castle Rock boundaries. These facilities require reconstruction and/or major upgrades to bring them into compliance with state engineering standards. These actions will reduce the potential for public risk associated with dam failure.						
<u>Hazards Mitigated:</u> Dam Failure						
New	# 6, 14, 17, 18, 19, 24	Castle Rock Water	Castle Rock Parks and Recreation	\$3.5 million	Stormwater Enterprise Fund, Castle Rock General Fund	Short
Action CR3—Castle Rock Reservoir No. 2 – A 1,130 acre-foot raw water storage reservoir that will be used to store Castle Rock’s reuse water and other junior surface water rights from Plum Creek. The water will subsequently be pumped back either to Castle Rock for treatment, or to Rueter-Hess Reservoir for additional storage (and later treatment by Parker Water and Sanitation District and delivery to Castle Rock).						
<u>Hazards Mitigated:</u> Drought						
New	# 2, 6, 7, 12, 14, 17, 19, 20, 21, 24	Castle Rock Water	Colorado Division of Natural Resources	\$15 million	Water Resource Fund	Short
Action CR4—Update and implement a comprehensive wildland fire mitigation program through the creation of a Community Wildfire Protection Plan (CWPP). Once finalized, send to the State for review and approval.						
<u>Hazards Mitigated:</u> Wildfire						
Existing	#2, 8, 12, 15, 16, 20	Castle Rock Fire and Rescue Department	Castle Rock Parks and Recreation	\$100k	Existing Budget	Short
Action CR5— <u>Plum Creek to Rueter Hess Reservoir Pipeline, Pump Station and Outlet Structure</u> – An eight mile, 12-inch pipeline that will transfer up to 1,100 acre-feet per year of water from the Plum Creek watershed to Rueter-Hess Reservoir for storage and later treatment by Parker Water and Sanitation District and delivery to Castle Rock.						
<u>Hazards Mitigated:</u> Drought						
New Assets (currently in design phase)	# 2, 7, 12, 14, 19, 20, 21, 24	Castle Rock Water	Parker Water and Sanitation District	\$7 million	Water Resources Fund	Short
Action CR6— <u>Chatfield Westside Pumpback Project</u> – A pump station and pipeline from Chatfield Reservoir to Castle Rock Reservoirs #1 and #2.						
<u>Hazards Mitigated:</u> Drought						
New Asset (Conceptual Engineering Phase)	#2, 7, 12, 14, 19, 20, 21, 24	Castle Rock Water	Denver Water, Dominion Water and Sanitation District	\$25 million	Water Resources Fund	Long
Action CR7— <u>Rueter-Hess Fill Pipeline</u> – A an outlet pipeline from the WISE Project infrastructure in Parker Water and Sanitation District into RHR.						
<u>Hazards Mitigated:</u> Drought						
New Asset	#2, 7, 12, 14, 20, 21, 24	Castle Rock Water	Parker Water and Sanitation District	\$2 million	Water Resources Fund	Short
Action CR8 — Develop a Town-wide Continuity of Operations Plan (COOP).						

Applies to New or Existing Assets	Objectives Met	Lead Agency	Support Agency	Estimated Cost	Sources of Funding	Timeline ^a
<u>Hazards Mitigated:</u> All-Hazard						
New	#4, 5, 8, 11, 12, 13, 14, 15, 17, 23	Castle Rock Fire and Rescue Department	Town Manager's Office	\$150,000	TBD	Short
Action CR9 — Post Disaster Recovery Plan - The Town of Castle Rock will explore the feasibility of developing a Town specific disaster recovery plan.						
<u>Hazards Mitigated:</u> All-Hazard						
New	#8, 9, 11, 13, 14	Castle Rock Fire and Rescue Department	Town Manager's Office Finance Department	\$50,000	Existing/proposed budget	Short
Action CR10 — Perform a needs assessment and gap analysis to determine the need for a full-time Emergency Manager						
<u>Hazards Mitigated:</u> All-Hazard						
New	#2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Castle Rock Fire and Rescue Department	Town Manager's Office	\$10,000	Existing/Proposed Budget	Short
Action CR11 — Develop a Public Safety Message on Flood Safety. Flood safety messaging is needed to educate the public on risks associated with development and property adjacent to floodplains and behaviors around flood control facilities. Messaging to cover topics including insurance coverage, regulations and restrictions, where to find information and safe practices.						
<u>Hazards Mitigated:</u> Flooding						
New	# 2, 3, 5, 6, 15, 16	Castle Rock Water	Community Relations	\$20,000	Stormwater Enterprise Fund	Short
Action CR12 – Douglas County is currently working on developing a countywide wildfire partnership. Working with the County, the Town will perform a needs assessment and wildfire risk assessment for the areas immediately around and adjacent to the Town's critical infrastructure sites.						
<u>Hazards Mitigated:</u> Wildfire						
New and Existing	#2, 7, 9, 11, 14, 20, 23	Castle Rock Fire and Rescue Department	Town Manager's Office	\$20,000	Existing / Proposed Budget	Ongoing

a. Short-term = Completion within 5 years; Long-term = Completion within 10 years; Ongoing = Continuing new or existing program with no completion date

Table 9.3-14. Mitigation Action Priority

Action #	# of Objectives Met	Benefits	Costs	Do Benefits Equal or Exceed Costs?	Is Project Grant-Eligible?	Can Project Be Funded Under Existing Programs/Budgets?	Implementation Priority ^a	Grant Pursuit Priority ^a
CR1 (previous action)	11	High	High	Yes	Yes	Yes	Low	Low
CR2	6	Low	Low	Yes	Yes	No	Low	Low

Action #	# of Objectives Met	Benefits	Costs	Do Benefits Equal or Exceed Costs?	Is Project Grant-Eligible?	Can Project Be Funded Under Existing Programs/Budgets?	Implementation Priority ^a	Grant Pursuit Priority ^a
(previous action)								
CR3	10	High	High	Yes	Yes	Yes	High	Low
CR4 (previous action)	6	High	Medium	Yes	No	Yes	High	Low
CR5	8	High	Medium	Yes	Yes	Yes	High	Low
CR6	8	High	High	Yes	Yes	No	Low	Low
CR7	7	Medium	Low	Yes	Yes	Yes	Medium	Low
CR8	10	High	Low	Yes	Yes	Yes	Low	Low
CR9	5	High	Low	Yes	Yes		Low	Low
CR10	24	High	Low	Yes	No	Yes	Medium	N/A
CR11	6	Medium	Low	Yes	Yes	Yes	Low	Low
CR12	7	Medium	Low	Yes	Yes	Yes	Medium	Low

a. See the introduction to this volume for explanation of priorities.

Table 9.3-15. Analysis of Mitigation Actions

Hazard Type	Action Addressing Hazard, by Mitigation Type ^a						
	Prevention	Property Protection	Public Education and Awareness	Natural Resource Protection	Emergency Services	Structural Projects	Community Capacity Building
High-Risk Hazards							
Wildfire	CR4	CR4	CR4	CR4	CR4, 12		
Multiple Hazard	CR8, 9, 10	CR8, 9	CR8, 9, 10		CR10		
Medium-Risk Hazards							
Drought	CR3, CR5, CR6, CR7	CR3	CR3, CR5, CR6, CR7	CR3, CR5, CR6, CR7			
Low-Risk Hazards							
Dam Failure	CR2		CR11			CR2	
Flooding	CR1	CR1	CR11	CR1		CR1	

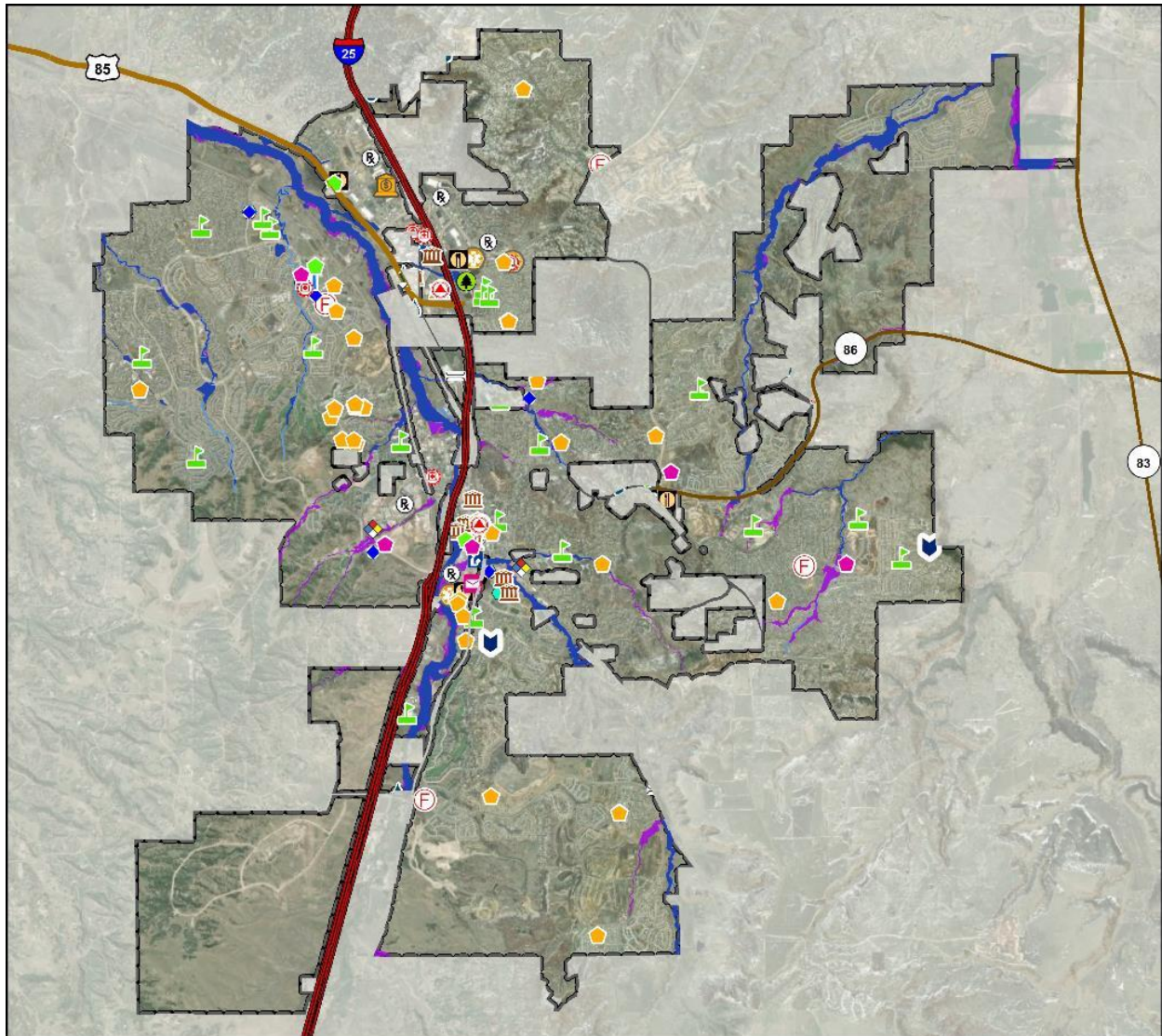
a. See the introduction to this volume for explanation of mitigation types.

9.3.11 Future Needs to Better Understand Risk/Vulnerability

No additional comments

9.3.12 Additional Comments

No additional comments



Town of Castle Rock

- | | | |
|---------------------|--------------------|-------------------|
| Assisted Living | Hazardous Material | Polling Site |
| Bridge | Hospital | Post Office |
| Dam | Library | Potable Well |
| EOC | Major Business | Primary Education |
| Fire Station | Medical Care | Recreation Site |
| Food Distribution | Pharmacy | Shelter |
| Government Building | Police Station | Urgent Care |

- Interstate
- U.S. Highway
- State Highway
- City and Town Boundaries
- Waterbody



The map and data depicted are considered approximations and suitable for most planning purposes. Mapped hazard areas, geographic boundaries and other features depicted may not absolutely align due to the differing resolution of available data.

Potential New Development The flood hazard area depicted is the September 4, 2020 effective DFIRM.

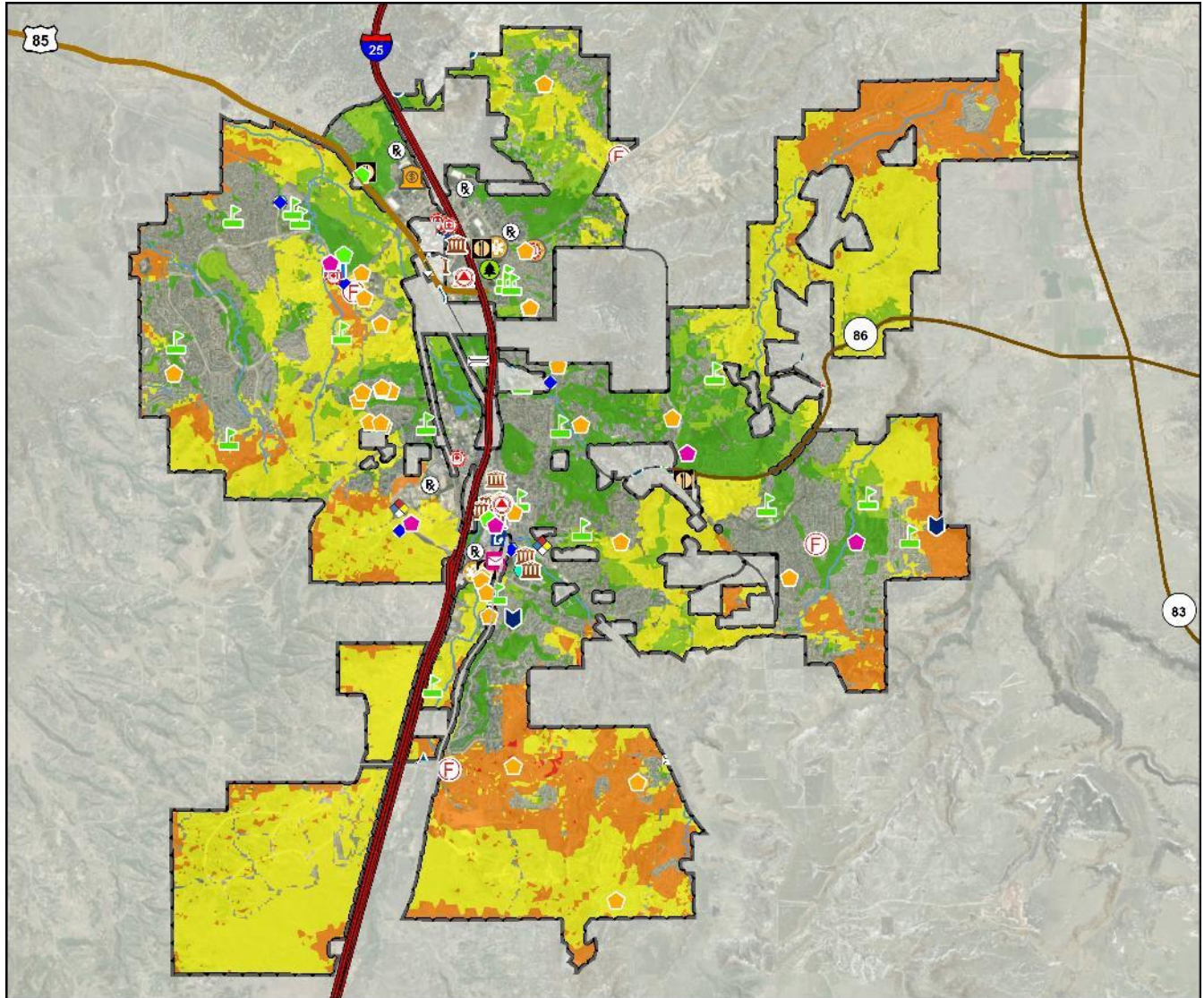
- 2015-Present
- Anticipated

- FEMA Flood Hazard Area**
- 1-Percent Annual Chance Flood Event Area
 - 0.2-Percent Annual Chance Flood Event Area
 - Undetermined (Not Analyzed)

- Operated By Water District**
- Centennial Water and Sanitation (0)
 - Denver Water (0)
 - Parker Water & Sanitation (0)



Data Sources: DCGIS - 2020; OTIS - n.d.; ESRI - 2002/2020; FEMA 2020



Town of Castle Rock

- | | | |
|---------------------|--------------------|-------------------|
| Assisted Living | Hazardous Material | Polling Site |
| Bridge | Hospital | Post Office |
| Dam | Library | Potable Well |
| EOC | Major Business | Primary Education |
| Fire Station | Medical Care | Recreation Site |
| Food Distribution | Pharmacy | Shelter |
| Government Building | Police Station | Urgent Care |

- Wildfire Risk**
- Highest
 - High
 - Moderate
 - Low
 - Lowest

- | | |
|---------------|--------------------------|
| Interstate | City and Town Boundaries |
| U.S. Highway | Waterbody |
| State Highway | |

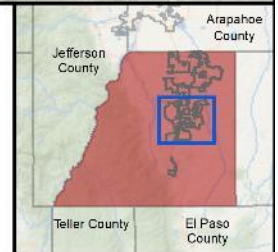
The map and data depicted are considered approximate and suitable for most planning purposes. Mapped hazard areas, geographic boundaries and other features depicted may not absolutely align due to the differing resolution of available data.

Potential New Development

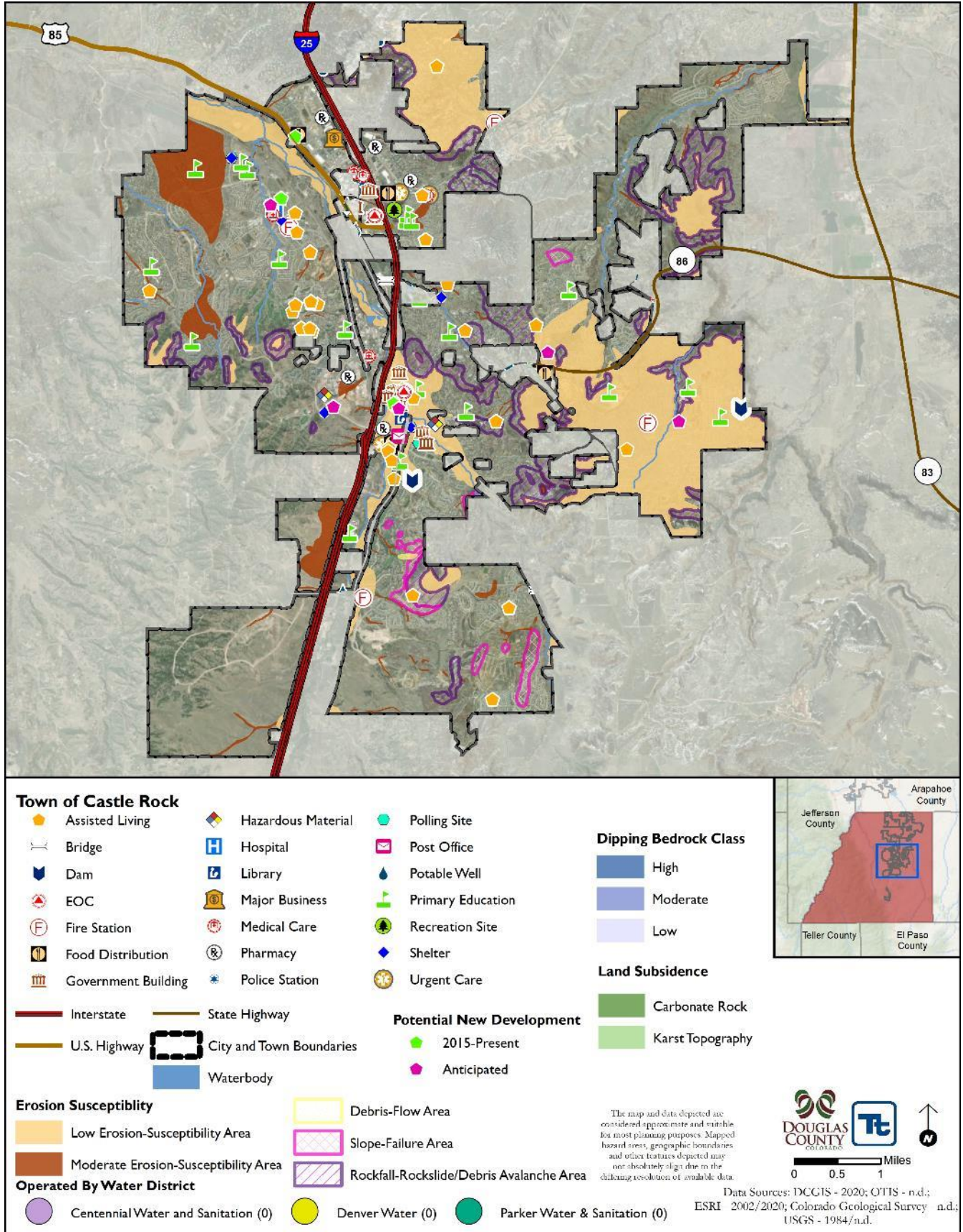
- 2015-Present
- Anticipated

Operated By Water District

- | | | |
|-------------------------------------|------------------|-------------------------------|
| Centennial Water and Sanitation (0) | Denver Water (0) | Parker Water & Sanitation (0) |
|-------------------------------------|------------------|-------------------------------|



Data Sources: DCGIS - 2020; OTIS - n.d.; FSR1 - 2002/2020; Colorado Forest Atlas - 2017



9.4 TOWN OF LARKSPUR

9.4.1 Hazard Mitigation Plan Point of Contact

Primary Point of Contact	Alternate Point of Contact
Randy Johnson, Fire Marshal 9414 Spruce Mountain Road Larkspur CO 80118 Telephone: (303) 681-3284 e-mail Address: rjohnson@larkspurfire.org	Sean Hogan, Town Clerk 8720 Spruce Mountain Rd. Larkspur, CO 80118 Telephone: (303) 681-2324 e-mail Address: shogan@townoflarkspur.org

9.4.2 Jurisdiction Profile

Location

The Town of Larkspur is located between Castle Rock and the Tri-Lakes area. It is located in southern Douglas County on the west side of Interstate Highway 25, approximately 10 miles south of the Town of Castle Rock.

The current boundaries generally extend from Exit 173 (Spruce Mountain Road to West Fox Farm Road) and the west side of 1-25 on Perry Park Road just past the Colorado Renaissance Festival, encompassing an area of 1.59 sq miles.

History

The Town of Larkspur was incorporated in 1979. The Town of Larkspur website (<http://townoflarkspur.org/about-us/larkspur-history/>) summarizes the Town's history as follows:

Before arrival of the pioneers, the Larkspur area was occupied by the Ute, Kiowa, Cheyenne, and Arapahoe tribes. What began as a stage stop along the Territorial Road soon became a resort and eventually a town.

On January 22, 1862, a territorial post office was established at what was called Huntsville, Douglas County, Colorado named after Territorial Governor Alexander Hunt. The post office was discontinued on August 29, 1867 and re-established on April 8, 1869. With the arrival of the Rio Grande Railroad the name Huntsville was changed to Larkspur on December 13, 1871, by then Governor Edward McCook, for the abundant purple flowers growing in the area. Larkspur, rich in lumber, red sandstone, gypsum, and potash, prospered with the railroad and added two sawmills, a blacksmith shop, a hotel, two general stores, a school, and a casino.

In 1916 the American Federation of Human Rights, a Co-Masonic Fraternal Order, purchased land in Larkspur and built their administration building which is still in use today. In 1965, Plum Creek, which runs along the east side of town, flooded and destroyed much of early day Larkspur including the Carlson Frink Creamery. Larkspur was incorporated in 1979.

Climate

Douglas County is characterized by a moderate climate and significant sun exposure (more than 300 days per year). The County features low humidity, approximately 18 inches of rain each year, and 71 inches of snowfall. Temperatures range from highs of 85 degrees in July to 45 degrees in January (according to USA.com).

Governing Body Format

The Town of Larkspur operates as a Home Rule Municipality. The Town’s City Council is made up of elected officials, including the Mayor, Vice Mayor, and three Council Members.

The Larkspur Town Council assumes responsibility for the adoption of this plan; the Town of Larkspur will oversee its implementation. Development of this annex was carried out by the members of the local mitigation planning team, whose members are listed in Table 9.4-1.

Table 9.4-1. Local Mitigation Planning Team Members

Name	Title
Randy Johnson	Fire Marshal
Reed Lutter	Accounting Assistant
Marvin Cardenas	Mayor
Sean Hogan	Town Clerk

9.4.3 Current Trends

Population

According to U.S. Census Bureau the population of Town of Larkspur as of July 1, 2019 was 212. Since 2010, the population has grown at an average annual rate of 16 percent.

Development

Development trends for the Town of Larkspur have been modest commercial activity, with the exceptions of the Jellystone RV Campground and the Travel Center projects. Residential development has only seen one new home constructed.

Future trends will see limited commercial development primarily along Spruce Mountain Road, the completion of the Travel Center complex, very limited single family housing, and one or two multifamily housing developments.

Table 9.4-2 summarizes development trends in the performance period since the preparation of the previous hazard mitigation plan, as well as expected future development trends.

Table 9.4-2. Recent and Expected Future Development Trends

Criterion	Response				
	2015	2016	2017	2018	2019
Has your jurisdiction annexed any land since the preparation of the previous hazard mitigation plan?	No				
If yes, give the estimated area annexed and estimated number of parcels or structures.					
Is your jurisdiction expected to annex any areas during the performance period of this plan?	No				
If yes, describe land areas and dominant uses.					
If yes, who currently has permitting authority over these areas?					
Are any areas targeted for development or major redevelopment in the next five years?	Yes/No				
If yes, briefly describe, including whether any of the areas are in known hazard risk areas	Yes, there is currently a Travel Center in the works and a possible apartment complex with 4 additional store fronts.				
	2015	2016	2017	2018	2019

Criterion	Response					
How many permits for new construction were issued in your jurisdiction since the preparation of the previous hazard mitigation plan?	Single Family	0	3	0	0	0
	Multi-Family	0	0	0	0	0
	Other (commercial, mixed use, etc.)	0	1	1	4	10
	Total	0	4	1	4	10
Provide the number of new-construction permits for each hazard area or provide a qualitative description of where development has occurred.	<ul style="list-style-type: none"> • Special Flood Hazard Areas: #0 • Landslide: #0 • High Liquefaction Areas: #0 • Wildfire Risk Areas: #19 					
Describe the level of buildout in the jurisdiction, based on your jurisdiction's buildable lands inventory. If no such inventory exists, provide a qualitative description.	<ul style="list-style-type: none"> • Larkspur has a few underdeveloped areas within Town limits. There are some projects that are under review and in the works. A 12 apartment and 4 retail stores on the lot next to the Spur, a tree/landscape company, and the travel center. • 12 acres of buildable commercial property yet to be developed. 					

9.4.4 Status of Previous Plan Actions

Table 9.4-3 summarizes the actions that were recommended in the previous version of the hazard mitigation plan and their implementation status at the time this update was prepared.

Table 9.4-3. Status of Previous Plan Actions

Action Item	Completed	Removed; No Longer Feasible	Carried Over to Plan Update	
			Check if Yes	Enter Action #
Establishing a fire break along the new Town of Larkspur water line (East - West fire break) crossing the property of the American Federation of Human Rights (AFHR) - The Town of Larkspur is currently installing a new major upgrade to the existing water system with additional water storage capacity and new water line to the new water treatment plant. The existing water tank capacities are: Tank # 1 128,000 gallons, Tank # 2 161,000 gallons. The new tank will tremendously increase the water storage capacity for the Town of Larkspur. The new tank capacity is 451,000 gallons. The construction and installation of this system is scheduled for completion mid-2016. As part of this construction project the Town of Larkspur proposes to add a fire break to run along the easement of this system. The pipeline easement/firebreak is 50' wide and runs from the to be constructed water treatment, plant located near the southern end of Douglas Blvd., west 0.44 miles to the water tank location. The Agreement and Deed for Water Line Easement with the dimensions is attached.	Yes			
<i>Comment:</i>				
Mitigation Along East Plum Creek from north end to south end of the Town of Larkspur- East Plum Creek runs along the east town limits of the Town of Larkspur. The creek banks have not been maintained in recent years and are overgrown. The overgrowth needs to be removed to reduce both wildfire damage and improve conveyance during high flow events.	No		Yes	LR1
<i>Comment:</i>	<i>Its ongoing and we wish to carry this over.</i>			
Mitigation Along East town limits of the Town of Larkspur- The Town of Larkspur will initiate a mitigation project to remove the accumulated brush and debris from the east town limits of the Town of Larkspur. This project will run from Upper Gulch Lake Road south to Fox Farm Road and west to east from Frank Road to I-25. This wildfire mitigation to protect the business along the east edge of the town	No		Yes	
<i>Comment:</i>	<i>Its ongoing and we wish to carry this over.</i>			

Action Item	Completed	Removed; No Longer Feasible	Carried Over to Plan Update	
			Check if Yes	Enter Action #
The AFHR will work with the Colorado State Forest Service to establish and implement a plan of fire mitigation for their property with grant assistance over a ten year time frame.	Phase 1 and Phase 2 complete with continued annual or biannual implementation anticipated		Yes	LR2
<i>Comment:</i>	<i>Its ongoing and we wish to carry this over. This action is identified as Action LR2 in Table 9.4-13 and has been rephrased to meet the current needs of the Town.</i>			
Assessment of Yogi Bear’s Jellystone Park and RV Camp to determine mitigation needs and to establish evacuation routes- Yogi Bear’s Jellystone Park and RV Camp is a 104-acre property that contains a 35-acre campground and RV park. It sits at the intersection of I-25 and exit 174 and the address is 650 Sky View Ln, Larkspur, CO 80118. This site is a privately owned commercial venture. The Jellystone campground was sold and redeveloped into a much large campground facility. 95% of the site was stripped of native fuels regraded and developed into a high end RV park with numerous amenities. There is little wildland fire hazard present at this time from within the property.	Yes			LR3
<i>Comment:</i>	<i>This action is identified as Action LR3 in Table 9.4-13 and has been rephrased to meet the current needs of the Town.</i>			
Water share with the U. S. Forest Service, Pike National Forest, Rampart Range Area: This was not a feasible project given geographic distance from the Pike National Forest and no action was taken.	No	No Longer Feasible		
<i>Comment:</i>				
Public awareness – support Douglas County citizen disaster preparedness guide- Revise and Update the Citizen Preparedness Guide using a new format with a focus on disaster preparedness for all Douglas County Citizens. Components include Warning systems, Citizen Information, Preparing a Family Disaster Plan, Stockpile Checklist, Shelter & Recovery, Access & Functional Needs, Pet Preparedness and Evacuation, Thunderstorms & Lightning, Winter Storms & Extreme Cold, Floods, Tornadoes, Wildfires, Terrorism, Active Shooter, Public Health Emergency, Pandemic Flu, Hazardous Materials, and Helpful Resources. Printed and electronic versions available as well as an application for smart phones. This will be used in conjunction with the Larkspur Fire Department’s disaster and mitigation meetings and disaster potential guide for the Town.	Yes		Yes	LR4
<i>Comment:</i>	<i>Its ongoing and we wish to carry this over. This action is identified as Action LR4 in Table 9.4-13 and has been rephrased to meet the current needs of the Town</i>			

9.4.5 Capability Assessment

The Town of Larkspur performed an assessment of its existing capabilities for implementing hazard mitigation strategies. The introduction at the beginning of this volume of the hazard mitigation plan describes the components included in the capability assessment and their significance for hazard mitigation planning. This section summarizes the following findings of the assessment:

- An assessment of legal and regulatory capabilities is presented in Table 9.4-4.
- Development and permitting capabilities are presented in Table 9.4-5.
- An assessment of fiscal capabilities is presented in Table 9.4-6.
- An assessment of administrative and technical capabilities is presented in Table 9.4-7.
- An assessment of education and outreach capabilities is presented in Table 9.4-8.
- Information on National Flood Insurance Program (NFIP) compliance is presented in Table 9.4-9.
- Classifications under various community mitigation programs are presented in Table 9.4-10.

Findings of the capability assessment were reviewed to identify opportunities to expand, initiate or integrate capabilities to further hazard mitigation goals and objectives. Where such opportunities were identified and determined to be feasible, they are included in the action plan. The “Analysis of Mitigation Actions” table in Section 9.4.11 identifies these as community capacity building mitigation actions.

Table 9.4-4. Legal and Regulatory Capability

	Local Authority	Other Jurisdiction Authority	State Mandated	Integration Opportunity?
Codes, Ordinances, & Requirements				
Building Code	Yes	No	No	No
<i>Comment:</i>	<i>All building in locally controlled; last updated in 2012</i>			
Zoning Code	Yes	No	No	No
<i>Comment:</i>	<i>All zoning in locally controlled</i>			
Subdivisions	Yes	No	No	No
<i>Comment:</i>	<i>All subdivisions are locally controlled</i>			
Stormwater Management	Yes	No	No	No
<i>Comment:</i>	<i>Storm water drainage is locally controlled and reviewed</i>			
Post-Disaster Recovery	Yes	Yes	Yes	Yes
<i>Comment:</i>				
Real Estate Disclosure	No	Yes	Yes	No
<i>Comment:</i>				
Growth Management	Yes	No	No	No
<i>Comment:</i>	<i>Growth management of the town is locally controlled</i>			
Site Plan Review	Yes	No	No	No
<i>Comment:</i>	<i>Locally controlled</i>			
Environmental Protection	Yes	Yes	Yes	Yes
<i>Comment:</i>	<i>State management compliance from CDPHE</i>			
Flood Damage Prevention	Yes	Yes	No	Yes
<i>Comment:</i>	<p><i>The Town’s floodplain regulations Larkspur, Colorado - Municipal Code CHAPTER 16 - Zoning ARTICLE 14 - FLOOD DAMAGE PREVENTION is currently meets NFIP requirements. The Town identifies flood hazard areas as areas subject to periodic inundation that can result in loss of life and property, health and safety hazards, disruption of commerce and governmental services and extraordinary public expenditures for flood protection and relief, all of which adversely affect the health, safety and general welfare of the public. To accomplish this, the Town uses the following methods:(1)Restrict or prohibit uses that are dangerous to health, safety or property in times of flood, or cause excessive increases in flood heights or velocities.(2)Require that uses vulnerable to floods, including facilities which serve such uses, be protected against flood damage at the time of initial construction.(3)Control the alteration of natural floodplains, stream channels and natural protective barriers which are involved in the accommodation of floodwaters.(4)Control filling, grading, dredging and other development which may increase flood damage.(5)Prevent or regulate the construction of flood barriers which will unnaturally divert floodwaters or which may increase flood hazards to other lands.</i></p> <p><i>The Town Manager is the identified floodplain administrator and is responsible for enforcing the floodplain regulations for the Town.</i></p> <p><i>Any new construction or substantial improvements in the Town must have their lowest floor and utilities elevated one foot above the base flood elevation.</i></p>			
Emergency Management	Yes	Yes	No	Yes
<i>Comment:</i>				
Climate Change	Yes	Yes	No	No
<i>Comment:</i>	<i>Town recently just put solar panels on the Town Hall</i>			
Other	No	No	No	No
<i>Comment:</i>				
Planning Documents				
General Plan	Yes	Yes	Yes	Yes
<i>Comment:</i>	<i>Updated master plan with need to include hazardous mitigation in the master plan</i>			
Capital Improvement Plan	Yes	NO	NO	No

	Local Authority	Other Jurisdiction Authority	State Mandated	Integration Opportunity?
<i>Comment:</i>	<i>We are currently in the process of creating the Town's first capital improvement plan that is scheduled to be completed by December 31st. The plan is to update this every 5 years</i>			
Disaster Debris Management Plan	No	no	no	yes
<i>Comment:</i>	<i>We currently do not have this</i>			
Floodplain or Watershed Plan	Yes	no	Yes	yes
<i>Comment:</i>	<i>There is a plan to build a retention pond in the town park</i>			
Stormwater Plan	Yes	yes	yes	yes
<i>Comment:</i>	<i>There is a plan to build a retention pond in the town park</i>			
Urban Water Management Plan	Yes	Yes	yes	no
<i>Comment:</i>	<i>The Town is working to develop water management plan. We share our main water source with surrounding communities and water conservation will be key for the success of the future.</i>			
Habitat Conservation Plan	no	no	yes	no
<i>Comment:</i>	<i>The state reviews the impact of development on the habitat. The protected Preble's Meadow Jumping Mouse habitat is a priority in the town</i>			
Economic Development Plan	no	no	no	no
<i>Comment:</i>				
Shoreline Management Plan	no	no	no	no
<i>Comment:</i>	<i>NA</i>			
Community Wildfire Protection Plan	Yes	no	no	yes
<i>Comment:</i>	<i>Currently working on developing our wildfire protection plan; once developed and approved by the Town, it will be sent to the State for their review and approval</i>			
Forest Management Plan	No	no	Yes	no
<i>Comment:</i>	<i>Colorado Parks and wildlife manage area forest areas</i>			
Climate Action Plan	no	no	yes	no
<i>Comment:</i>				
Comprehensive Emergency Management Plan	Yes	Yes	no	no
<i>Comment:</i>	<i>Working with the county to develop emergency management planning</i>			
Threat & Hazard Identification & Risk Assessment (THIRA)	Yes	Yes	no	no
<i>Comment:</i>	<i>Working with the county to develop hazard mitigation plan</i>			
Post-Disaster Recovery Plan	no	no	no	no
<i>Comment:</i>				
Continuity of Operations Plan	No	no	no	no
<i>Comment:</i>				
Public Health Plan	No	no	no	no
<i>Comment:</i>				
Other	no	no	no	no
<i>Comment:</i>				

Table 9.4-5. Development and Permitting Capability

Criterion	Response
Does your jurisdiction issue development permits? If no, who does? If yes, which department?	Yes
Does your jurisdiction have the ability to track permits by hazard area?	No
Does your jurisdiction have a buildable lands inventory?	No

Table 9.4-6. Fiscal Capability

Financial Resource	Accessible or Eligible to Use?
Community Development Block Grants	Yes
Capital Improvements Project Funding	Yes
Authority to Levy Taxes for Specific Purposes	Yes

Financial Resource	Accessible or Eligible to Use?
User Fees for Water, Sewer, Gas or Electric Service	Yes water and sewer; no stormwater service fees
Incur Debt through General Obligation Bonds	Yes
Incur Debt through Special Tax Bonds	No
Incur Debt through Private Activity Bonds	No
Withhold Public Expenditures in Hazard-Prone Areas	No
State-Sponsored Grant Programs	Yes
Development Impact Fees for Homebuyers or Developers	No
Other	No

Table 9.4-7. Administrative and Technical Capability

Staff/Personnel Resource	Available?	Department/Agency/Position
Planners or engineers with knowledge of land development and land management practices	Yes	GMS Engineering
Engineers or professionals trained in building or infrastructure construction practices	Yes	GMS Engineering
Planners or engineers with an understanding of natural hazards	Yes	GMS Engineering
Staff with training in benefit/cost analysis	Yes	DNash Accounting & Tax Services
Surveyors	Yes	Archer and Associates
Personnel skilled or trained in GIS applications	Yes	GMS Engineering
Scientist familiar with natural hazards in local area	Yes	Keith Worley / Larkspur Fire Dept.
Emergency manager	No	Coordinate with county and sheriffs dept. on MOU
Grant writers	No	We hire on an as needed basis
Resiliency Planner	No	The Town of Larkspur does not have a full-time resiliency planner; however, there is a team consisting of representatives from engineering, security, facilities, and IT who meet once a week for safety and security and once every 6 months for an overall district review in which mitigation concepts and projects are reviewed and updated.
Other	No	none

Table 9.4-8. Education and Outreach Capability

Criterion	Response
Do you have a public information officer or communications office?	No
Do you have personnel skilled or trained in website development?	Yes
Do you have hazard mitigation information available on your website?	No
If yes, briefly describe.	When mitigation plan complete we will post on town website
Do you use social media for hazard mitigation education and outreach?	No
If yes, briefly describe.	Will work on town face book page
Do you have any citizen boards or commissions that address issues related to hazard mitigation?	No
If yes, briefly describe.	Will look at developing board for Hazard Mitigation
Do you have any other programs already in place that could be used to communicate hazard-related information?	Yes Douglas County Code Red
If yes, briefly describe.	
Do you have any established warning systems for hazard events?	Yes
If yes, briefly describe.	Douglas County Code Red

Table 9.4-9. National Flood Insurance Program Compliance

Criterion	Response
What local department is responsible for floodplain management?	Planning Commission
Who is your floodplain administrator? (department/position)	Town Manager
Are any certified floodplain managers on staff in your jurisdiction?	No
What is the date that your flood damage prevention ordinance was last amended?	7-21-2016
Does your floodplain management program meet or exceed minimum requirements?	Meets; The Town of Larkspur does not allow structures in the FEMA Special Flood Hazard Area (SFHA). There may be situations where Pre-FIRM structures or structures placed in the SFHA through updated floodplain studies would be substantially improved. If that situation were to arise, the Town would follow all NFIP requirements for construction in the SFHA, including requiring the lowest floor and utilities be elevated at least one foot above the BFE and requiring and maintaining a copy of an Elevation Certificate.
If exceeds, in what ways?	Adopted flood plain maps from FEMA
When was the most recent Community Assistance Visit or Community Assistance Contact?	N/A
Does your jurisdiction have any outstanding NFIP compliance violations that need to be addressed?	No
If so, state what they are.	Insert appropriate information
Are any RiskMAP projects currently underway in your jurisdiction?	No
If so, state what they are.	
Do your flood hazard maps adequately address the flood risk within your jurisdiction?	Yes
If no, state why.	
Does your floodplain management staff need any assistance or training to support its floodplain management program?	Yes
If so, what type of assistance/training is needed?	
Does your jurisdiction participate in the Community Rating System (CRS)?	No
If yes, is your jurisdiction interested in improving its CRS Classification?	No
If no, is your jurisdiction interested in joining the CRS program?	No
How many flood insurance policies are in force in your jurisdiction? ^a	2
What is the insurance in force?	\$732,000
What is the premium in force?	\$7,131
How many total loss claims have been filed in your jurisdiction? ^a	0
How many claims are still open or were closed without payment?	0
What were the total payments for losses?	\$0

a. According to FEMA statistics as of November 13, 2020

Table 9.4-10. Community Classifications

	Participating?	Classification	Date Classified
Community Rating System	No	-	-
Building Code Effectiveness Grading Schedule	No	-	-

	Participating?	Classification	Date Classified
Public Protection	Yes	4	2018
Storm Ready	No	-	-
Fire wise	No	-	Study to incorporate as part of CWPP

9.4.6 Review and Incorporation of Information for This Annex

The goal of plan integration is to ensure that the potential impact of hazards is considered in planning for future development. FEMA recommends integration as follows:

1. Integrate hazard mitigation plan goals with community objectives (e.g. incorporate the goals for risk reduction and safety into the policies of other plans).
2. Use the risk assessment to inform plans and policies (e.g. incorporate risk assessment findings into land use plans, site plan review, emergency operations plans).
3. Implement mitigation actions through existing mechanisms (e.g. include mitigation projects in the capital improvement plan).
4. Think about mitigation before and after a disaster (e.g. build recovery planning on existing mitigation plans and goals).

Existing Reports, Plans, Regulatory Tools and Other Resources

The following technical reports, plans, and regulatory mechanisms were reviewed to provide information for this annex.

- **Technical Reports and Information**—The following outside resources and references were reviewed:
 - **Hazard Mitigation Plan Annex Development Tool-kit**—The tool-kit was used to support the development of this annex including past hazard events, noted vulnerabilities, risk ranking and action development.
 - **Community Wildfire Protection Plan---** The Town is currently completing the protection plan.

Existing Integration

- Flood Insurance Study - The Town of Larkspur is required to have a Flood Insurance Study (FIS) and Flood Insurance Rate Maps to participate in the National Flood Insurance Program. An effective FIS has been maintained in The Town of Larkspur for more than 32 years. The most current effective date is September 4, 2020.
- Capital Improvement Plan-The development of the CIP is underway and is projected to be completed in March.
- Building Code and Fire Code- The Town undertook a fire code adoption workshop with the Larkspur Fire Protection District.
- Emergency Operations Plan- The EOP is covered by Larkspur Fire District and has identified a need to work with county on MOU with the Douglas County Code Red Program.
- Community Wildfire Protection Plan-Currently working on developing our wildfire protection plan.

- Stormwater Plan- There is a plan to build a retention pond in the town park.
- Floodplain or Watershed Plan- There is a plan to build a retention pond in the town park.
- Disaster Debris Management Plan-The Town currently does not have a plan in place.
- General Plan-Update master plan with need to include hazardous mitigation in the master plan.
- Emergency Management- Do a review of current plan for opportunities and updates.
- Flood Damage Prevention-Coordinate Flood Damage prevention with water conservation, Flood Plain watershed plan to ensure mitigation.
- Environmental Protection- Working with CDPHE to ensure State management compliance.
- Post-Disaster Recovery-Conduct a Review of current Ordinances to ensure sufficiency in post disaster Recovery.

9.4.7 Opportunities for Future Integration

- **Capital Improvement Projects**— *The Town is currently completing capital improvement to obtain financing and grants for water main replacement.*
- **Post-Disaster Recovery Plan**— *Larkspur does not have a recovery plan and intends to develop one as a mitigation planning action during the next five years. The plan will build on the mitigation goals and objectives identified in the mitigation plan.*

9.4.8 Jurisdiction-Specific Natural Hazard Event History

Table 9.4-11 lists past occurrences of natural hazards for which specific damage was recorded in the Town of Larkspur hazard events that broadly affected the entire planning area, including the Town of Larkspur, are listed in the risk assessments in Volume 1 of this hazard mitigation plan.

Table 9.4-11. Past Weather Events

Type of Event	FEMA Disaster #	Date	Damage Assessment
Winter Weather*	N/A	3/6/2017	
High Wind*	N/A	6/8/2020	-
Winter Weather*	N/A	9/7/2020	-
Pandemic (COVID-19)	EM-3436/DR-4498	January 20 th , 2020 - Present	\$ <u>520,000</u>
* Indicates County-wide event			

COVID-19 Impacts

Larkspur continues to mitigate the pandemic risk. The Town experienced \$520,000 in revenue decreases due to the cancellation of the annual Colorado Renaissance Festival, which was cancelled as a COVID-19 precaution.

9.4.9 Hazard Risk Ranking

Table 9.4-12 presents a local ranking for the Town of Larkspur of all hazards of concern for which this hazard mitigation plan provides complete risk assessments. This ranking summarizes how hazards vary for

this jurisdiction. As described in detail in Volume 1, the ranking process involves an assessment of the likelihood of occurrence for each hazard, along with its potential impacts on people, property and the economy. Mitigation actions target hazards with high and medium rankings.

Table 9.4-12. Hazard Risk Ranking

Rank	Hazard Type	Risk Rating Score (Probability x Impact)	Category
1	Wildfire	48	High
2	Drought	30	Medium
2	Pandemic	30	Medium
3	Erosion	24	Medium
3	Hail	24	Medium
4	Animal Disease	12	Low
4	Land Subsidence	18	Medium
4	Lightning	18	Medium
4	Severe Thunderstorms	18	Medium
4	Severe Winter Storm	18	Medium
4	Transportation Accidents	18	Medium
5	Earthquake	12	Low
5	Tornadoes	16	Medium
6	Expansive Soils	12	Low
6	Extreme Temperatures	12	Low
6	Flood	12	Low
6	Landslide	12	Low
6	Slope Failure	12	Low
7	Dam and Levee Failure	6	Low

NOTE: The process used to assign risk ratings and rankings for each hazard is described in Volume 1 of this hazard mitigation plan.

9.4.10 Jurisdiction-Specific Vulnerabilities

Volume 1 of this hazard mitigation plan provides complete risk assessments for each identified hazard of concern. This section provides information on key vulnerabilities identified by the jurisdiction. Available jurisdiction-specific risk maps of the hazards are provided at the end of this annex.

Repetitive Loss Properties

Repetitive loss records are as follows:

- Number of FEMA-identified Repetitive-Loss Properties: 0
- Number of FEMA-identified Severe-Repetitive-Loss Properties: 0
- Number of Repetitive-Loss Properties or Severe-Repetitive-Loss Properties that have been mitigated: 0

Other Noted Vulnerabilities

The following jurisdiction-specific issues have been identified based on a review of the results of the risk assessment, public involvement strategy, and other available resources:

- Severe Weather/Flood/Wildfire – The Town currently debris clearing program from streams and under trees that can help reduce or prevent streams from overflowing its banks or create fuel for wildfires (see LR-1 in Table 9.4-13).

- All hazards – the Town needs to enhance their early warning systems and ways of communication to keep residents informed before, during, and after a hazard event (see LR-5 in Table 9.4-13).

Mitigation actions addressing these issues were prioritized for consideration in the action plan presented in Section 9.4.10.

9.4.11 Hazard Mitigation Action Plan and Evaluation of Recommended Actions

Table 9.4-13 lists the actions that make up the hazard mitigation action plan for this jurisdiction. Table 9.4-14 identifies the priority for each action. Table 9.4-15 summarizes the mitigation actions by hazard of concern and mitigation type.

Table 9.4-13. Hazard Mitigation Action Plan Matrix

Applies to New or Existing Assets	Objectives Met	Lead Agency	Support Agency	Estimated Cost	Sources of Funding	Timeline ^a
Action LR1— Lead and develop a county-wide stream clearing strategy including the development of thresholds for response / action. Clear fuels (dry underbrush, diseased trees) on land that can trigger and maintain wildfires.						
<i>Hazards Mitigated:</i>	Severe Weather, Flood, Wildfire					
Wild Fire / Flooding	OBJ-6, OBJ-18, OBJ-20	Larkspur Fire Dept	Douglas County Sheriff’s Department	4,000	Town General Fund	5 Years
Action LR2— Clear fuels (dry underbrush, diseased trees) on land that can trigger and maintain wildfires, Implement Best Management Practices on public lands .						
<i>Hazards Mitigated:</i>	Wildfire					
Wildfire	OBJ-6, OBJ-9, OBJ-18, OBJ-20	Larkspur Fire Dept	Douglas County Sheriff’s Department	4,000	Town General Fund	5 Years
Action LR3— Working with Yogi Bear’s Jellystone Park and RV Camp, the Town will establish and implement a plan of fire mitigation for their property.						
<i>Hazards Mitigated:</i>	Wildfire					
Wildfire	OBJ-9, OBJ-12, OBJ-18	the Colorado State Forest Service	Larkspur Fire Department	200,000	Grant	10 years
Action LR4— Support Douglas County citizen disaster preparedness guide. Provide technical information and guidance on appropriate mitigation options available to businesses and homeowners						
<i>Hazards Mitigated:</i>	Extreme Temperature, Flood, Severe Weather, Severe Winter Storm, Wildfire					
ALL	OBJ-8, OBJ-13, OBJ-15	Larkspur Fire Dep	Douglas County Sheriff’s Dept	2,500	Town General Fund	2 Years
Action LR5—Increase communication alternatives for early warning systems for the Town						
<i>Hazards Mitigated:</i>	Extreme Temperature, Flood, Severe Weather, Severe Winter Storm, Wildfire					
Lightning	OBJ-1, OBJ-15, OBJ-16	Larkspur Fire Dept	Douglas County Sheriff’s Dept	75,000	Grant	5 years
Action LR6 -Following current Tri County Health and state of Colorado guidance and mandates. To reduce vulnerability to the hazard, Increasing regular cleaning of work environments, Increase Capability: Storage of PPE Equipment for monitoring/treatment Trainings for staff Public outreach.						
<i>Hazards Mitigated:</i>	Extreme Temperature, Flood, Severe Weather, Severe Winter Storm, Wildfire					
Pandemic	OBJ-1, OBJ-16, OBJ-18	Town Administration	Douglas County	10,000	Grant	2 years

Applies to New or Existing Assets	Objectives Met	Lead Agency	Support Agency	Estimated Cost	Sources of Funding	Timeline ^a
Action LR7— Incorporate retrofitting / replacement of critical facilities and infrastructure in Capital Improvement Plans (CIPs), Promote the use of vegetation/plants as green erosion control measure to reduce localized flooding. Establish stream maintenance programs with stakeholders (e.g. Soil and Water Conservation District)						
<u>Hazards Mitigated:</u>	Extreme Temperature, Flood, Severe Weather, Severe Winter Storm, Wildfire					
Flood	OBJ-3, OBJ-7, OBJ-8, OBJ-10, OBJ-12	Town Administration	Douglas County	300,000	Grant	5 years
Action LR8—Trimming trees back from power lines, Adopt ordinances that regulate the type and quantity of trees planted near utility lines						
<u>Hazards Mitigated:</u>	Severe Weather, Severe Winter Storm, Wildfire					
Tornados	OBJ-9, OBJ-20	Town Administration	Town Administration	11,347	Town General Fund	2 years
Action LR9— Create and maintain defensible space around structure and infrastructure, Evaluate and repair water main supply and hydrants. Add or replace new Hydrants as needed. Develop Community Wildfire Protection Plan.						
<u>Hazards Mitigated:</u>	Wildfire					
Wildfire	OBJ-9	Town Administration	Larkspur Fire Dept	1.5 million	Grant	5 years
Action LR10— Provide backup power sources at vital critical facilities, Develop or enhance the capacity/capability of stormwater conveyance systems.						
<u>Hazards Mitigated:</u>	Extreme Temperature, Flood, Severe Weather, Severe Winter Storm					
Severe Winter Storm	OBJ-11, OBJ-12, OBJ-17	Town Administration	Larkspur Fire Dept	100,000	Grant	5 years
Action LR11 – Douglas County Wildfire Partnership - The Town of Larkspur intends to join the Douglas County Wildfire Partnership (DCWP). Larkspur along with Douglas County FIRE DEPT/DIV] and various state, federal, NGO, and private stakeholders, will work with the Partnership to assess impact from wildfire; identify opportunities to maintain continuity of operations; and develop a comprehensive mitigation strategy to identify projects that will reduce wildfire risk, increase natural resource protection, encourage the incorporation of wildfire management principles into local planning, land use and building codes, and promote public awareness of wildfire risk.						
<u>Hazards Mitigated:</u>	Wildfire					
New and Existing	#2, 7, 9, 11, 14, 20, 23	Town of Larkspur	DCWP	Staff Time	Town Budget, Grants	Ongoing

a. Short-term = Completion within 5 years; Long-term = Completion within 10 years; Ongoing= Continuing new or existing program with no completion date

See the introduction to this volume for list of acronyms used here.

Table 9.4-14. Mitigation Action Priority

Action #	# of Objectives Met	Benefits	Costs	Do Benefits Equal or Exceed Costs?	Is Project Grant-Eligible?	Can Project Be Funded Under Existing Programs/ Budgets?	Implementation Priority ^a	Grant Pursuit Priority ^a
LR6	3	High	High	Yes	Yes	No	1	6
LR1	3	High	Low	Yes	Yes	Yes	2	5
LR2	4	High	Low	Yes	Yes	Yes	3	4
LR3	3	High	High	Yes	Yes	No	4	7
LR4	3	Medium	Low	Yes	Yes	Yes	5	3
LR9	2	High	High	Yes	Yes	No	6	1
LR7	5	Medium	High	No	Yes	No	7	8
LR8	2	Low	Medium	No	Yes	No	8	9

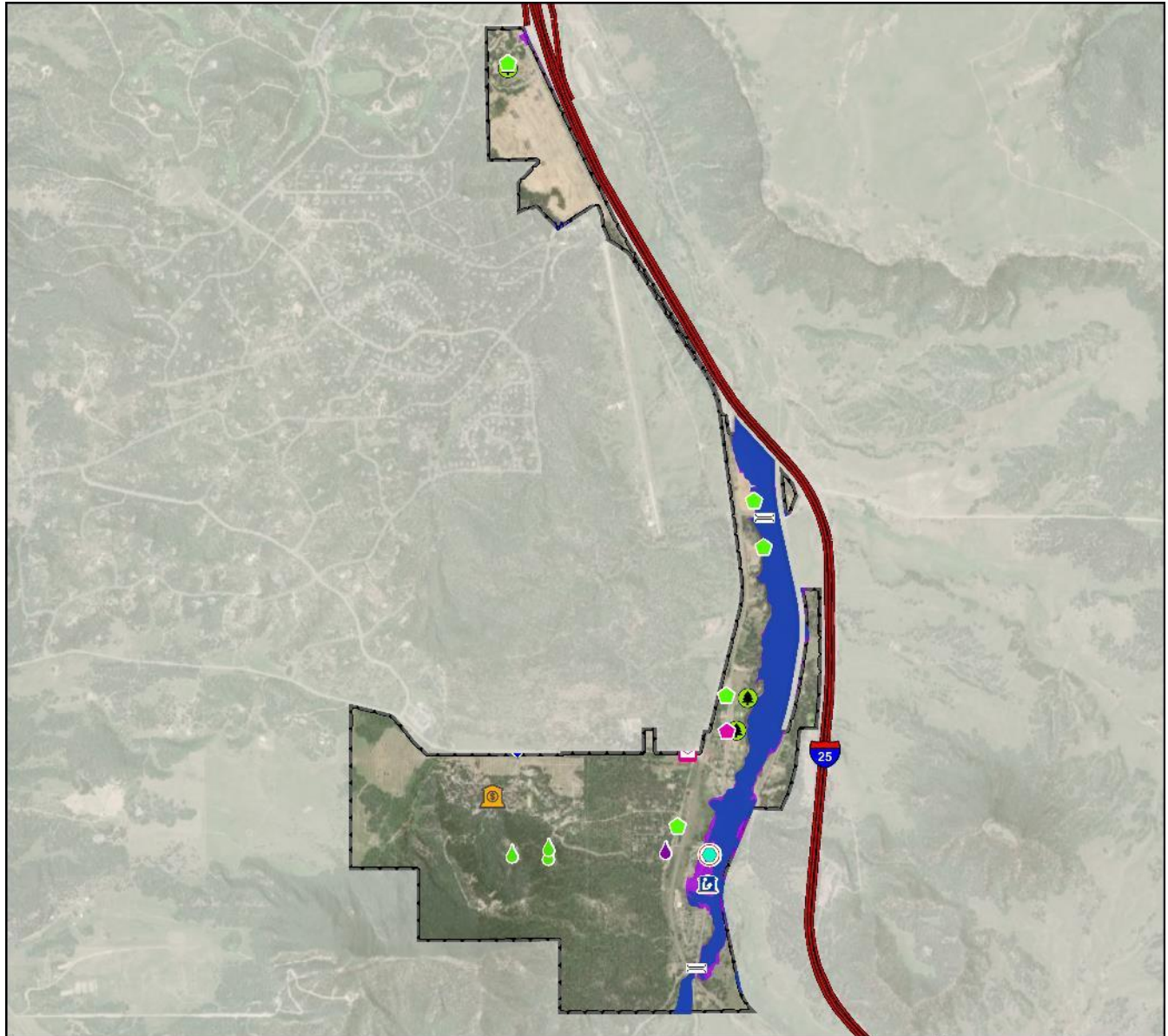
Action #	# of Objectives Met	Benefits	Costs	Do Benefits Equal or Exceed Costs?	Is Project Grant-Eligible?	Can Project Be Funded Under Existing Programs/Budgets?	Implementation Priority ^a	Grant Pursuit Priority ^a
LR10	3	Medium	High	Yes	Yes	No	9	2
LR5	3	Low	High	No	Yes	No	10	10

a. See the introduction to this volume for explanation of priorities.

Table 9.4-15. Analysis of Mitigation Actions

Hazard Type	Action Addressing Hazard, by Mitigation Type ^a						
	Prevention	Property Protection	Public Education and Awareness	Natural Resource Protection	Emergency Services	Structural Projects	Community Capacity Building
High-Risk Hazards							
Wild Fire	X	X	X	X			
Medium-Risk Hazards							
Pandemic	X		X				
Severe Winter Weather		X					X
Tornados / High Winds		X			X		
Thunder Storms			X		X		
Low-Risk Hazards							
Flood	X	X		X			

a. See the introduction to this volume for explanation of mitigation types.



Town of Larkspur

- | | | | |
|---------------------|--------------------|--------------------------|--------------------------|
| Bridge | Major Business | Potable Water Treatment | Interstate |
| Fire Station | Polling Site | Recreation Site | U.S. Highway |
| Government Building | Post Office | Shelter | State Highway |
| Library | Potable Water Tank | WWT Wastewater Treatment | City and Town Boundaries |
| | | | Waterbody |



The map and data depicted are considered appropriate and suitable for most planning purposes. Mapped hazard areas, geographic boundaries and other features depicted may not absolutely align due to the differing resolution of available data.

Potential New Development The flood hazard area depicted is the September 4, 2020 effective DFIRM.

- 2015-Present
- Anticipated

FEMA Flood Hazard Area

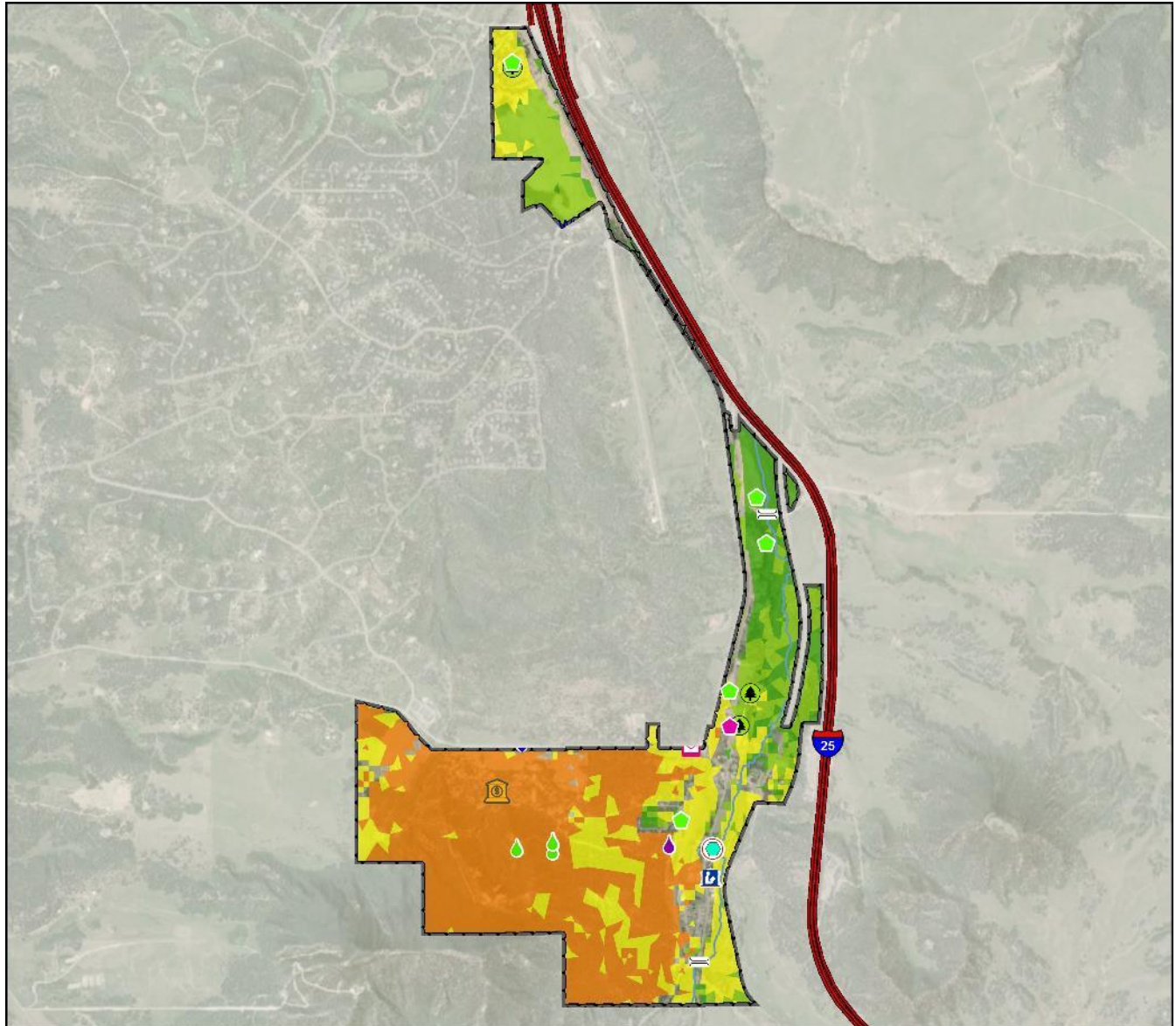
- 1-Percent Annual Chance Flood Event Area
- 0.2-Percent Annual Chance Flood Event Area
- Undetermined (Not Analyzed)

Operated By Water District

- Centennial Water and Sanitation (0)
- Denver Water (0)
- Parker Water & Sanitation (0)



Data Sources: DCGIS - 2020; OTIS - n.d.; ESRI - 2002/2020; FEMA 2020



Town of Larkspur

- | | | |
|-------------------------------------|--------------------------|-------------------------------|
| Bridge | Major Business | Potable Water Treatment |
| Fire Station | Polling Site | Recreation Site |
| Government Building | Post Office | Shelter |
| Library | Potable Water Tank | WWT Wastewater Treatment |
| Interstate | City and Town Boundaries | |
| U.S. Highway | Waterbody | |
| State Highway | | |
| Operated By Water District | | |
| Centennial Water and Sanitation (0) | Denver Water (0) | Parker Water & Sanitation (0) |

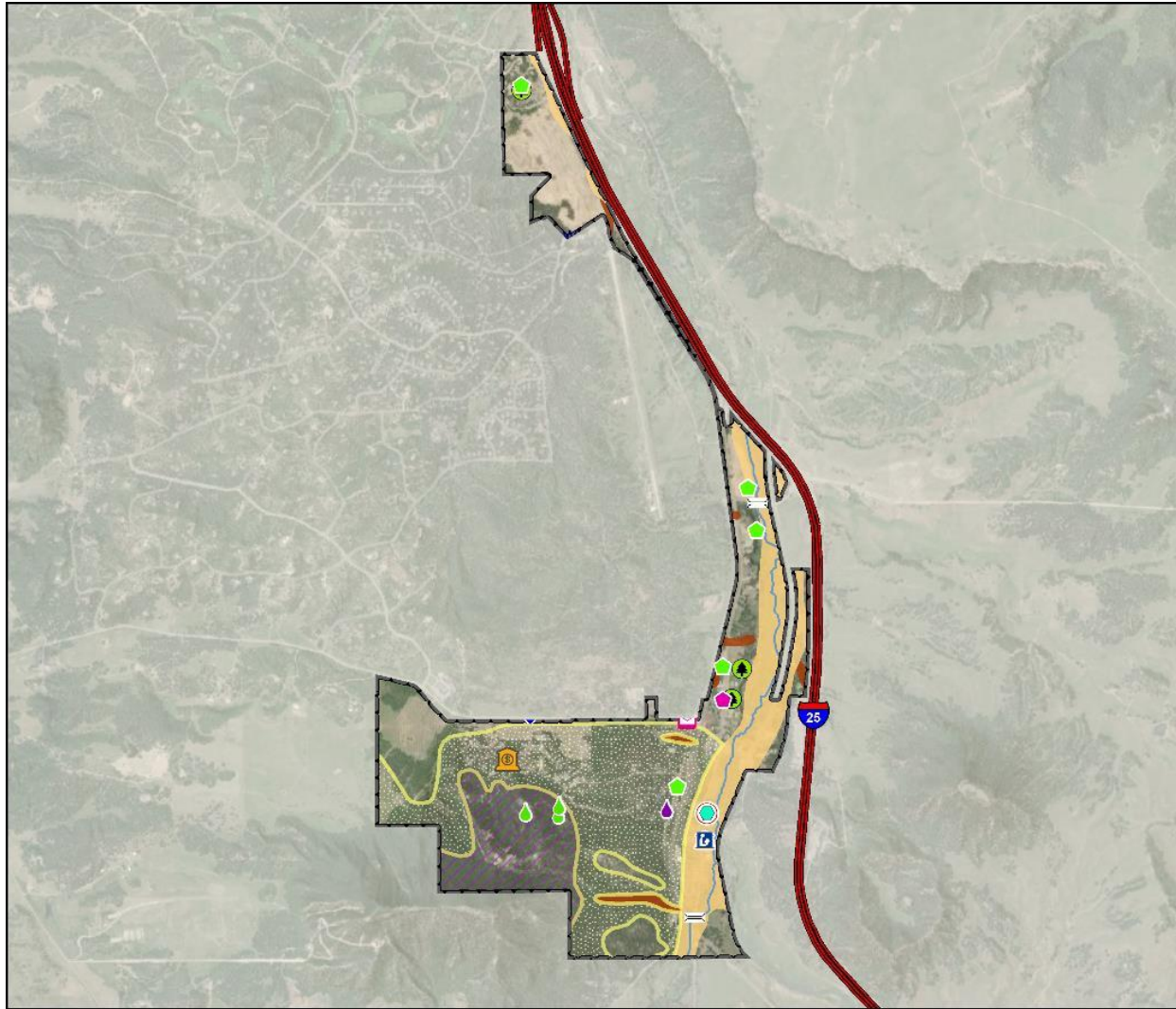
- Wildfire Risk**
- Highest
 - High
 - Moderate
 - Low
 - Lowest

- Potential New Development**
- 2015-Present
 - Anticipated

The map and data depicted are considered approximations, and suitable for more planning purposes. Mapped hazard areas, geographic boundaries and other features depicted may not be absolute alpha due to the differing resolution of available data.

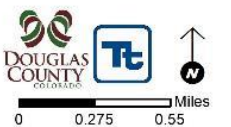


Data Sources: DCGIS - 2020; OTIS - n.d.; FSR1 - 2002/2020; Colorado Forest Atlas - 2017



Town of Larkspur

Bridge	Major Business	Potable Water Treatment	Dipping Bedrock Class High Moderate Low
Fire Station	Polling Site	Potable Well	
Government Building	Post Office	Recreation Site	
Library	Potable Water Tank	Shelter	Land Subsidence Carbonate Rock Karst Topography
Interstate	State Highway	WWT Wastewater Treatment	
U.S. Highway	City and Town Boundaries	Potential New Development 2015-Present Anticipated	<p>The map and data depicted are considered approximate and suitable for most planning purposes. Mapped hazard areas, geographic boundaries and other features depicted may not absolutely align due to the differing resolution of available data.</p> <p>Data Sources: DCGIS - 2020; OTIS - n.d.; ESRI 2002/2020; Colorado Geological Survey - n.d.; USGS - 1984/n.d.</p>
Waterbody	Debris-Flow Area	Slope-Failure Area	
Erosion Susceptibility Low Erosion-Susceptibility Area Moderate Erosion-Susceptibility Area	Rockfall-Rockslide/Debris Avalanche Area		
Operated By Water District Centennial Water and Sanitation (0) Denver Water (0) Parker Water & Sanitation (0)			



9.4.12 Future Needs to Better Understand Risk/Vulnerability

The Town of Larkspur is working to complete the Community Wildfire Protection Plan, as well as a water study through GMS Engineering for our water management plan.

9.5 CITY OF LONE TREE

9.5.1 Hazard Mitigation Plan Point of Contact

Primary Point of Contact	Alternate Point of Contact
Bill Medina, Administrative Services Director 9220 Kimmer Dr., Suite 100 Lone Tree, Colorado 80124 Telephone: 303-708-1818 e-mail Address: Bill.Medina@cityoflonetree.com	Ron Pinson, Commander of Professional Standards 9220 Kimmer Dr., Suite 100 Lone Tree, Colorado 80124 Telephone: 303-339-8150 e-mail Address: Ron.Pinson@cityoflonetree.com

9.5.2 Jurisdiction Profile

Location

The City of Lone Tree, in northern Douglas County, is located due south of Colorado State Highway 470 and is bisected by Interstate 25. The current boundaries generally extend from Highlands Ranch to the west, the City of Centennial to the north, unincorporated Douglas County and the Town of Parker to the east, and low density residential, open space and undeveloped land in Douglas County to the south.

Lone Tree comprises 9.8 square miles. The land consists of a wide range of topography encompassing mountain vistas, hills, and grass covered plains. Because of the City’s position in the Denver metro area and multi-modal transportation facilities, the area is desirable to new residents.

History

The City of Lone Tree was incorporated in 1995. The City’s website states that “A major impetus for incorporation was resident’s concerns relating to land use, the quality of development along the C-470 corridor, and their desire for greater input over development decisions affecting their future. Through the tireless efforts of dedicated residents, the decision to incorporate was carefully evaluated, and through a vote of the electorate, was determined to be in the best interest of the community. Initially, the City boundary followed that of the Park Meadows Metropolitan District and consisted of the subdivision of Lone Tree and surrounding developments, and some commercial development along C-470. In only a short amount of time, the City has grown and changed in a number of important ways, consistent with its vision for growth.”

Climate

The climate of Douglas County is characterized by a moderate climate and significant sun exposure (more than 300 days per year). The County features low humidity, approximately 18 inches of rain each year, and 71 inches of snowfall. Temperatures range from highs of 85 degrees in July to 45 degrees in January (according to USA.com).

Governing Body Format

The City of Lone Tree operates through five elected officials, including the mayor and four Council Members. While the mayor serves at-large, the Council Members represent one of two districts in Lone Tree. Each elected official serves a four year term and is able to serve two consecutive terms (8 years).

The City of Lone Tree City Council assumes responsibility for the adoption of this plan; the City Manager will oversee its implementation. Development of this annex was carried out by the members of the local mitigation planning team, whose members are listed in Table 9.5-1.

Table 9.5-1. Local Mitigation Planning Team Members

Name	Title
Kelly First	Community Development Director
Justin Schmitz	Director of Public Works and Mobility
Roshana Floyd	Senior Planner
Jacob James	City Engineer

9.5.3 Current Trends

Population

The current population of City of Lone Tree is 14,914. The 2025 population estimate for the City is 20,300; this estimate accounts for the population within proposed annexations, as well as the projected populations for current planned developments and future estimated residential units.

Development

The City of Lone Tree experienced consistent residential and commercial growth between 2015 and 2019. During this time, the City completed five annexations that included a combination of residential, commercial, open space and utility/infrastructure land uses. The City saw continued development and buildout of residential subdivisions and commercial uses, as well as the initial development of a new multi-family project.

Moving into the planning period 2020-2025, the City is expected to see significant residential (and some commercial) development in the RidgeGate Planned Development District east of I-25. Development in this area will contribute to increasing Lone Tree’s population and will also expand the City’s open space and recreational amenities. However, development in this region will also require additional development review processes due to its proximity to Special Flood Hazard Areas, the existence of expansive soils and steep slopes, and the interface between development and natural grasslands and riparian habitats that may present increased wildfire risks.

Table 9.5-2 summarizes development trends in the performance period since the preparation of the previous hazard mitigation plan, as well as expected future development trends.

Table 9.5-2. Recent and Expected Future Development Trends

Criterion	Response
Has your jurisdiction annexed any land since the preparation of the previous hazard mitigation plan?	Yes
If yes, give the estimated area annexed and estimated number of parcels or structures.	78 acres; estimated 135 parcels and 75 structures
Is your jurisdiction expected to annex any areas during the performance period of this plan?	No
If yes, describe land areas and dominant uses.	

Criterion	Response					
If yes, who currently has permitting authority over these areas?						
Are any areas targeted for development or major redevelopment in the next five years?	Yes					
If yes, briefly describe, including whether any of the areas are in known hazard risk areas	Approval of a 700 acre residential mixed-use development is anticipated in the first quarter of 2021, buildout of the first two phases of development are anticipated in the next 5 years. This development is in a moderate to high risk wildfire zone and also includes areas of flooding and erosion risk.					
How many permits for new construction were issued in your jurisdiction since the preparation of the previous hazard mitigation plan?		2015	2016	2017	2018	2019
	Single Family	88	34	47	23	21
	Multi-Family	1	0	0	0	0
	Other (commercial, mixed use, etc.)	6	6	1	6	5
	Total	95	40	48	29	26
Provide the number of new-construction permits for each hazard area or provide a qualitative description of where development has occurred.	Special Flood Hazard Areas: #4 Landslide: #0 High Liquefaction Areas: #0 Wildfire Risk Areas: #0					
Describe the level of buildout in the jurisdiction, based on your jurisdiction's buildable lands inventory. If no such inventory exists, provide a qualitative description.	Buildout of developable land within the City is currently at approximately 70%. The City has over 700 acres of park, open space and floodplain land inventory that are not considered developable. The majority of the 30% of remaining developable land inventory resides in the RidgeGate Planned Development District, and specifically, in that portion of the planned development area east of I-25.					

9.5.4 Status of Previous Plan Actions

Table 9.5-3 summarizes the actions that were recommended in the previous version of the hazard mitigation plan and their implementation status at the time this update was prepared.

Table 9.5-3. Status of Previous Plan Actions

Action Item	Completed	Removed; No Longer Feasible	Carried Over to Plan Update	
			Check if Yes	Enter Action #
Drought mitigation- As noted in the Chapter 4 Risk Assessment (Section 4.2.10 Drought) write-up, drought is a gradual phenomenon. All development within the City of Lone Tree is serviced by public water systems, with water provided either through Southgate Water District/Denver Water or by Parker Water & Sanitation District. The City cooperates with these water suppliers in terms of water use restrictions if/when such restrictions are implemented. Additionally, City Planning recommends/requires low water use landscaping and water monitoring/conserving irrigation systems for new development	No		X	#LT3
<i>Comment:</i> Waterwise principles are applied in the City's Landscape Design Guidelines and Standards for Areas in and Along Public Rights-of-Way; Zoning Code Chapter 16, Landscaping Requirements; Design Guidelines, Landscaping. Additionally, the City's Zoning Enforcement Officer assesses and cites development for code violations.				
Hazardous materials mitigation- The City of Lone Tree has identified the potential for hazardous materials –transportation incidents as having a potential of medium significance. The City of Lone Tree has two major highways that travel through the community. There are no railroads within the jurisdiction. Hazardous materials are transported on a daily basis along I-25 and C-470, normally in quantities that do not pose a substantial threat to the community. However; there are opportunities that a major incident could occur on a daily basis. Past history indicates the majority of hazardous materials incidents are associated with the fuel spills from accidents and not the actual cargo carried. The City recognizes the need to work in conjunction with the teams designed and trained to address hazardous material should there be an actual or potential incident. Identification of the incident at the onset will be a major priority to ensure safety for the community. The first responders need to be properly trained in recognition of potential events and the proper safety precautions to take. A portion of this training is	No		X	Action #LT4

Action Item	Completed	Removed; No Longer Feasible	Carried Over to Plan Update	
			Check if Yes	Enter Action #
already conducted within individual department yearly training (fire and police). However, there is little cross training that has occurred within this realm to ensure both sides are performing their duties as expected. Therefore, it is recommended that cross training between both groups of first responders be implemented.				
<i>Comment:</i> The Regional Hazardous Materials Board of Arapahoe/Douglas Counties was disbanded in 2019. In 2019 the City of Lone adopted its Emergency Operations Plan which includes plans and processes for HAZMAT Incident response The City will modify its Emergency Operations Plan to designate South Metro Fire and Rescue as its Designated Emergency Response Agency. The City will rely upon Douglas County for any HAZMAT incidence response where evidence collection and preservation is a factor.				
Continue to implement zoning and development regulations and grading/drainage plan reviews to mitigate flooding caused by thunderstorms/heavy rain- High intensity, relatively short duration, rain events are not uncommon during the rainy seasons. Localized surface flooding potential exists from these cloud-burst type events. However, incidents of significant flooding are not frequent (no specific records on file). The City of Lone Tree reviews proposed grading and drainage plans for development within the City through zoning codes, development standards, and engineering plans reviews – with consideration for appropriate drainage management to minimize such drainage hazards.	No		X	#LT5
<i>Comment:</i> Ongoing, Subdivision and Site Plan process through Chapters 15, 16 and 17 of Municipal Code.				
Severe winter weather mitigation- The City of Lone Tree has snow plowing and de-icing procedures in place to address winter storm related events within the City (see City Website). Additionally, the City of Lone Tree Emergency Operations Plan addresses the City’s plan for dealing with Winter Storm related events. Winter Storm impacts on C-470 and/or I-25 are addressed by CDOT.	No		X	Action #LT2
<i>Comment:</i> There is a CDOT Region 1 generated Douglas County I-25 South Traffic Incident Management Plan established which includes addressing winter storm events impacts on I-25. The City of Lone Tree was a participant in development of this Plan, and will cooperate as required in the Plan implementation.				
Wildfire prevention and preparation- The City of Lone Tree has identified the potential for wildfire impacts within portion of the City as having a medium significance. The City of Lone Tree will continue to work with South Metro Fire/Rescue Authority to develop plans to mitigate the impact of future wildfires within our community. In addition, Lone Tree has put into place means of communicating with the community during the time of an actual emergency as well as providing ongoing communication on fire prevention and mitigation strategies for the citizens. The city also works in conjunction with Douglas County to identify situations when the fire danger is higher and incorporate additional restrictions associated with open fires.	No		X	Action #LT3
<i>Comment:</i> The City of Lone Tree developed its Emergency Operations Plan in 2019 which identified wildfires as a potential hazard. The plan, which includes incident specific responses, was coordinated with supporting and partner organizations to include South Metro Fire and Rescue and Douglas County Office of Emergency Management. The adoption of this plan puts the City in a much better position to respond to and mitigate the negative effects of a wildfire. The City also coordinates development referrals with the Douglas County Wildfire Mitigation Specialist in areas of medium to high wildfire risk and requires developers to prepare wildfire mitigation plans when necessary. Additionally, South Suburban Parks and Recreation District manages Lone Tree Open Space areas and the District’s Open Space Maintenance Standards include mowing standards for active open space areas that comply with Douglas County’ recommended mowing standards.				

9.5.5 Capability Assessment

City of Lone Tree performed an assessment of its existing capabilities for implementing hazard mitigation strategies. The introduction at the beginning of this volume of the hazard mitigation plan describes the components included in the capability assessment and their significance for hazard mitigation planning. This section summarizes the following findings of the assessment:

- An assessment of legal and regulatory capabilities is presented in Table 9.5-4.
- Development and permitting capabilities are presented in Table 9.5-5.
- An assessment of fiscal capabilities is presented in Table 9.5-6.
- An assessment of administrative and technical capabilities is presented in Table 9.5-7.
- An assessment of education and outreach capabilities is presented in Table 9.5-8.
- Information on National Flood Insurance Program (NFIP) compliance is presented in Table 9.5-9.

- Classifications under various community mitigation programs are presented in Table 9.5-10.

Findings of the capability assessment were reviewed to identify opportunities to expand, initiate or integrate capabilities to further hazard mitigation goals and objectives. Where such opportunities were identified and determined to be feasible, they are included in the action plan. The “Analysis of Mitigation Actions” table in Section 9.5.11 identifies these as community capacity building mitigation actions.

Table 9.5-4. Legal and Regulatory Capability

	Local Authority	Other Jurisdiction Authority	State Mandated	Integration Opportunity?
Codes, Ordinances, & Requirements				
Building Code	Yes	Yes	Yes	Yes
Comment:	<i>City of Lone Tree Municipal Code Chapter 18, w/ additional review by South Metro Fire and Rescue Authority and area Metro Districts. It was adopted on December 4, 2018 and became effective on January 1, 2019.</i>			
Zoning Code	Yes	No	No	Yes
Comment:	<i>City of Lone Tree Municipal Code Chapter 16.</i>			
Subdivisions	Yes	No	Yes	Yes
Comment:	<i>City of Lone Tree Municipal Code Chapter 17.</i>			
Stormwater Management	Yes	No	Yes	Yes
Comment:	<i>City of Lone Tree Municipal Code Chapter 15</i>			
Post-Disaster Recovery	No	No	No	Yes
Comment:	<i>The City of Lone Tree Home Rule Charter and Code contains an article (Article XVII, Section 1) addressing Emergency Powers for the Mayor and City Manager to address immediate danger or threat to the preservation of the public health, welfare, peace, safety or property. This applies to the “Recovery” phase as well.</i>			
Real Estate Disclosure	Yes	Yes	No	Yes
Comment:	<i>Select disclosures (i.e. an Avigation Notice) are required for lands in proximity to Centennial Airport, w/ additional oversight provided by the Airport Authority on a parcel, by parcel scenario relative to private purchase agreements.</i>			
Growth Management	Yes	No	No	Yes
Comment:	<i>The City’s Comprehensive Plan addresses growth areas and provides guidance for these planning areas.</i>			
Site Plan Review	Yes	No	No	Yes
Comment:	<i>City of Lone Tree Municipal Code Chapter 16</i>			
Environmental Protection	Yes	No	Yes	Yes
Comment:	<i>City of Lone Tree MS4 Program Description Document and Municipal Code Chapter 15</i>			
Flood Damage Prevention	Yes	Yes	Yes	Yes
Comment:	<i>City of Lone Tree Municipal Code Chapter 15. The City is good standing with the NFIP. In order to remain in good standing, the City updated Chapter 15 of the City of Lone Tree Municipal Code in 2020 which adopted the latest FIS. Chapter 15 of the Code includes all allowable and prohibited activities within the SFHA which complies with the NFIP and State of Colorado requirements. The City’s code also has a few higher regulatory standards as well. This section of the code is administered by the Public Works Department with enforcement assistance by the Community Development Department. The City requires permits for allowable uses in the floodplain and reviews all land use applications vs. applicable sections of the City’s municipal code.</i>			
Emergency Management	Yes	Yes	No	Yes
Comment:	<i>The City of Lone Tree Home Rule Charter and Code contains an article (Article XVII, Section 1) addressing Emergency Powers for the Mayor and City Manager to address immediate danger or threat to the preservation of the public health, welfare, peace, safety or property.</i>			
Climate Change	Yes	No	No	Yes
Comment:	<i>Although not specifically addressed as Climate Change policies, the City’s fee schedule provides for reduced fees for Site Improvement Plan Amendments to permit the addition of solar panels. Ch. 16 of City Code also allows for parking reductions for developments near transit locations to encourage the use of regional transportation. The City’s Forestry Plan focuses on measures to increase the scope of the City’s urban forest and ways to maintain its health and sustainability. Additionally, the City has a staff-led Sustainability Committee and a resident-led Sustainability Team. Additionally, the City’s building code includes energy conservation measures.</i>			
Other: Pandemic Response/Mitigation	No	Yes	Yes	Yes
Comment:	<i>The City Charter grants the Mayor and City Manager authorities to act in the event of a crisis to include a pandemic. The City is currently considering flexible zoning and design guidelines that will support our business community’s ability to respond more flexibly to pandemics in the future.</i>			
Planning Documents				
General Plan	No	No	No	No
Comment:				
Capital Improvement Plan	Yes	Yes	No	Yes
How often is the plan updated?	Annually			
Comment:	<i>The Five Year Capital Projections is part of the annual budget and is approved by the City Council. This plan approves the current year and projects future investments in capital projects as directed by the City Council adopted “Capital Reserve Policy”. Many of the projects in the projection are funded and executed in conjunction with other jurisdictions.</i>			

	Local Authority	Other Jurisdiction Authority	State Mandated	Integration Opportunity?
Disaster Debris Management Plan	Yes	Yes	No	Yes
Comment:	<i>The City's Emergency Operations Plan dedicates an Annex to Debris removal. The City will rely upon contracted resources initially and will call upon a mutual aid agreement if organic assets are overwhelmed. In the event that a state of emergency is declared the City may call upon state or federal resources.</i>			
Floodplain or Watershed Plan	Yes	Yes	No	Yes
Comment:	<i>Watershed plans are conducted for major drainageways through a partnership with the City and Mile High Flood District</i>			
Stormwater Plan	Yes	No	Yes	Yes
Comment:	<i>City of Lone Tree MS4 Program Description Document</i>			
Urban Water Management Plan	No	No	No	No
Comment:				
Habitat Conservation Plan	No	No	No	Yes
Comment:	<i>The City's Comprehensive Plan identifies policy goals for habitat conservation but there is not yet a standalone plan in place.</i>			
Economic Development Plan	No	No	No	Yes
Comment:	<i>The City attempted to acquire EDA funding to develop an Economic Development Strategy and Response Plan in light of the COVID-19 pandemic and remains interested in developing such a plan in the future.</i>			
Shoreline Management Plan	No	No	No	No
Comment:				
Community Wildfire Protection Plan	No	No	No	Yes
Comment:	<i>The City has required two residential developments to provide wildfire mitigation measures in private covenants, however, no standalone Wildfire Protection Plan yet exists.</i>			
Forest Management Plan	Yes	No	No	Yes
Comment:	<i>The City has a Forestry Plan and a City Forester.</i>			
Climate Action Plan	No	No	No	No
Comment:				
Comprehensive Emergency Management Plan	Yes	Yes	No	Yes
Comment:	<i>This plan was developed and approved by the City Council in 2019. The plan is formally reviewed every three years. This plan was developed and integrated in conjunction with the County as well as South Metro Fire and Rescue who has fire protection and hazardous materials response responsibilities in the City.</i>			
Threat & Hazard Identification & Risk Assessment (THIRA)	Yes	Yes	No	Yes
Comment:	<i>The Emergency Operations Plan contains a Threat and Hazard Identification and Risk Assessment. This assessment was developed and integrated in conjunction with the County as well as South Metro Fire and Rescue who has fire protection and hazardous materials response responsibilities in the City.</i>			
Post-Disaster Recovery Plan	Yes	Yes	No	Yes
Comment:	<i>Our Emergency Operations Plan was prepared under the comprehensive emergency management concept including all five phases to include "Recovery".</i>			
Continuity of Operations Plan	Yes	Yes	No	Yes
Comment:	<i>The Continuity of Operations Plan was adopted by City Council at the end of 2019. The plan is reviewed annually. The plan was developed in coordination with plans that exist in Douglas County, South Metro Fire and Rescue and for various service providers in the City.</i>			
Public Health Plan	No	Yes	No	No
Comment:	<i>The City of Lone Tree does not have a Public Health Department. The Local Public Health Authority for the City is Tri-County Health Department. We integrate with that Department to implement any Public Health Plans.</i>			
Other	No	No	No	No
Comment:				

Table 9.5-5. Development and Permitting Capability

Criterion	Response
Does your jurisdiction issue development permits?	Yes
If no, who does? If yes, which department?	Community Development Department - Building Division/ Public Works Department
Does your jurisdiction have the ability to track permits by hazard area?	No
Does your jurisdiction have a buildable lands inventory?	No

Table 9.5-6. Fiscal Capability

Financial Resource	Accessible or Eligible to Use?
Community Development Block Grants	Yes via an agreement with Douglas County
Capital Improvements Project Funding	Yes
Authority to Levy Taxes for Specific Purposes	Yes, but only with voter approval

Financial Resource	Accessible or Eligible to Use?
User Fees for Water, Sewer, Gas or Electric Service	No - the City of Lone Tree does not have stormwater service fees. The city maintains its stormwater system using operational funding approved in the City budget.
Incur Debt through General Obligation Bonds	No
Incur Debt through Special Tax Bonds	Yes - Sales and Use Tax Revenue Bonds but only with voter approval
Incur Debt through Private Activity Bonds	No
Withhold Public Expenditures in Hazard-Prone Areas	No
State-Sponsored Grant Programs	Yes
Development Impact Fees for Homebuyers or Developers	No
Other	No

Table 9.5-7. Administrative and Technical Capability

Staff/Personnel Resource	Available?	Department/Agency/Position
Planners or engineers with knowledge of land development and land management practices	Yes	Community Development: 2 AICP Public Works: 3 PEs and 1 AICP
Engineers or professionals trained in building or infrastructure construction practices	Yes	Community Development: 2 building officials Public Works: 3 PEs
Planners or engineers with an understanding of natural hazards	Yes	Public Works: 1 PE, CFM Community Development: 1 AICP, CFM
Staff with training in benefit/cost analysis	Yes	Finance / Budget Analyst
Surveyors	Yes	Consultant
Personnel skilled or trained in GIS applications	Yes	Public Works / GIS Analyst
Scientist familiar with natural hazards in local area	No	None
Emergency manager	Yes	City Manager's Office / Emergency Manager
Grant writers	Yes	The Lone Tree Arts Center, Public Works Department, Police Department, Community Development Department, City Clerk's Office, and City Manager's Office all have staff with grant writing experience.
Resiliency Planner	No	-
Other	No	-

Table 9.5-8. Education and Outreach Capability

Criterion	Response
Do you have a public information officer or communications office?	Yes
Do you have personnel skilled or trained in website development?	Yes
Do you have hazard mitigation information available on your website?	Yes
If yes, briefly describe.	The City has an Emergency Preparedness page on our website. This page links visitors to County, State and Federal Resources for hazard mitigation.
Do you use social media for hazard mitigation education and outreach?	Yes
If yes, briefly describe.	The City actively uses Facebook and Twitter to connect with the Community on various topics to include hazard mitigation.
Do you have any citizen boards or commissions that address issues related to hazard mitigation?	Yes

Criterion	Response
If yes, briefly describe.	The City Council, Planning Commission and the Citizen’s Recreation Advisory Committee deal with issues related to hazard mitigation.
Do you have any other programs already in place that could be used to communicate hazard-related information?	Yes
If yes, briefly describe.	The Police Department reaches out to various populations in the City with our Community Partnership Unit.
Do you have any established warning systems for hazard events?	Yes
If yes, briefly describe.	We encourage the Community to opt in to CodeRed reverse 911 system and the City is covered by the County’s Integrated Public Alert and Warning System.

Table 9.5-9. National Flood Insurance Program Compliance

Criterion	Response
What local department is responsible for floodplain management?	Department of Public Works and Mobility
Who is your floodplain administrator? (department/position)	Department of Public Works and Mobility / City Engineer
Are any certified floodplain managers on staff in your jurisdiction?	Yes 2 CFMs
What is the date that your flood damage prevention ordinance was last amended?	9/4/2020
Does your floodplain management program meet or exceed minimum requirements?	Exceeds
If exceeds, in what ways?	City of Lone Tree Municipal Code Chapter 15, 0 foot floodway and 2 feet of freeboard requirements. The City of Lone Tree does not allow structures in the FEMA Special Flood Hazard Area (SFHA). Therefore, there are not properties in the SFHA that require elevation certificates.
When was the most recent Community Assistance Visit or Community Assistance Contact?	N/A
Does your jurisdiction have any outstanding NFIP compliance violations that need to be addressed?	No
If so, state what they are.	N/A
Are any RiskMAP projects currently underway in your jurisdiction?	No
If so, state what they are.	N/A
Do your flood hazard maps adequately address the flood risk within your jurisdiction?	Yes
If no, state why.	N/A
Does your floodplain management staff need any assistance or training to support its floodplain management program?	No
If so, what type of assistance/training is needed?	N/A
Does your jurisdiction participate in the Community Rating System (CRS)?	No
If yes, is your jurisdiction interested in improving its CRS Classification?	N/A
If no, is your jurisdiction interested in joining the CRS program?	Yes
How many flood insurance policies are in force in your jurisdiction? ^a	19
What is the insurance in force?	\$5,860,000
What is the premium in force?	\$10,553
How many total loss claims have been filed in your jurisdiction? ^a	4
How many claims are still open or were closed without payment?	0
What were the total payments for losses?	\$4,105

a. According to FEMA statistics as of November 02, 2020

Table 9.5-10. Community Classifications

	Participating?	Classification	Date Classified
Community Rating System	No	-	Date
Building Code Effectiveness Grading Schedule	Yes	N/A	Date
Public Protection	No	-	Date
Storm Ready	No	-	Date
Firewise	No	-	Date

9.5.6 Review and Incorporation of Information for This Annex

The goal of plan integration is to ensure that the potential impact of hazards is considered in planning for future development. FEMA recommends integration as follows:

- Integrate hazard mitigation plan goals with community objectives (e.g. incorporate the goals for risk reduction and safety into the policies of other plans).
- Use the risk assessment to inform plans and policies (e.g. incorporate risk assessment findings into land use plans, site plan review, emergency operations plans).
- Implement mitigation actions through existing mechanisms (e.g. include mitigation projects in the capital improvement plan).
- Think about mitigation before and after a disaster (e.g. build recovery planning on existing mitigation plans and goals).

Existing Reports, Plans, Regulatory Tools and Other Resources

The following technical reports, plans, and regulatory mechanisms were reviewed to provide information for this annex.

- City of Lone Tree Comprehensive Plan; January 15, 2019; Used to complete the jurisdiction profile and to explain the development trends.
- City of Lone Tree Strategic Plan 2019-2021; Used to determine where various action items were addressed within the Big Ideas and subordinate objectives.
- City of Lone Tree Emergency Operations Plan; June 17, 2019; Identification of natural, biological and technological hazards and the City’s planned response to various incident types.
- City of Lone Tree Continuity of Operations Plan; September 3, 2019; used to identify critical infrastructure and essential services.
- City of Lone Tree Municipal Code; Used as reference for ongoing regulations for development.
- City of Lone Tree Design Guidelines
- City of Lone Tree Forestry Plan
- Various Planned Development District and Sub-Area Plans for lands within the City.

- City of Lone Tree Five Year Capital Improvements Projection

Existing Integration

- **Emergency Management** – The emergency management powers granted to the Mayor and City Manager within the City Charter and code are sufficient for them to address preservation of the public health, welfare, peace, safety or property for conditions precipitated by the hazards contemplated in this plan. During the 2020 pandemic the Municipal Code was updated to allow for the Lone Tree Police Department to enforce orders promulgated under this authority.
- **Comprehensive Emergency** – The City’s Emergency Operations Plan will undergo a formal review in 2022. While the current plan is integrated with the existing Natural Hazards Mitigation Plan, during the EOP review we will update the hazard specific responses consistent with the new plan.
- **Threat and Hazard Identification and Risk Assessment** – The current Emergency Operations Plan contains a Threat and Hazard Identification and Risk Assessment. When the EOP goes through formal review in 2022 it will be updated with the most recent hazards and risk assessments from this plan.
- **Post Disaster Recovery Plan** – The recovery phase of our EOP will be updated to reflect this plan in the 2022 formal review.
- **Continuity of Operations Plan** – The critical infrastructure list in the COOP will be updated in 2021 once this new plan is published.
- **Building Code and Fire Code** —The City has adopted the 2018 International Building and Fire Code with Amendments. Integration opportunities will be considered as part of the next cycle of code updates planned in 2022. Building Code provides the Building Official with the authority to require additional geologic testing in areas of steep slopes or geological hazards. Within the City of Lone Tree Community Development Department, there is a full time Chief Building Official who manages two other staff members.
- **Zoning Code** – The City’s Zoning Code includes hazard assessment requirements for developments prior to City approval. Zoning Code is evaluated periodically and updates are planned in the next 2-5 years. Integration opportunities, to include direct reference to this Hazard Mitigation Plan, will be evaluated as part of these processes.
- **Subdivision Code** – The City adopted amendments to its Subdivision Code in September 2020. Subdivision Code includes requirements for the identification of known hazards (both natural and man-made), an avigation notice in areas proximal to Centennial airport, as well as requirements for geological reports, and biological and environmental assessments. Additional integration opportunities will be evaluated in future updates to the Subdivision Code.
- **Real Estate Disclosures** – Subdivision Code requires avigation notices be recorded with all plats in areas proximal to Centennial airport. Additional integration opportunities will continue to be assessed.
- **Growth Management** – The City’s Comprehensive Plan was updated in 2019 and includes a Planning and Growth Area identified for its compatibility for future residential and commercial development. Additional integration opportunities exist to refine this area to prevent development in areas of high hazard risk and to protect these areas as open space opportunities.
- **Site Plan Review** – The City’s Zoning Code includes site plan review criteria that require all development sites to be assessed for hazard potential. Additional integration opportunities exist.

- **Climate Change** – As discussed in Table 1-3, the City mitigates aspects of climate change via a variety of Codes and regulations, however, additional integration opportunities exist.
- **Forest Management Plan** – The City’s Forestry Plan was adopted in 2018 and includes measures to expand and protect the City’s urban forest. Additional integration opportunities exist.
- **Disaster Debris Management Plan** – This is not a stand-alone plan but part of the EOP. This plan was developed in conjunction with our contractors and the County.
- **Douglas County Grading Erosion and Sediment Control Manual** - The City of Lone Tree has adopted the Douglas County Grading Erosion and Sediment Control Manual and the City’s erosion/sediment control program is administered through the Construction Control Measure of the City’s MS4 permit.
- **Flood Insurance Study** - The City of Lone Tree is required to have a Flood Insurance Study (FIS) and Flood Insurance Rate Maps to participate in the National Flood Insurance Program. The City of Lone Tree has maintained this information current, and the most recent effective date is September 4, 2020.
- **Maintaining NFIP Requirements** - The City updated Chapter 15 of the City of Lone Tree Municipal Code in 2020 which adopted the latest FIS. Chapter 15 of the Code includes all allowable and prohibited activities within the SFHA which complies with the NFIP and State of Colorado requirements. The City’s code also has a few higher regulatory standards as well. This section of the code is administered by the Public Works Department with enforcement assistance by the Community Development Department. The City requires permits for allowable uses in the floodplain and reviews all land use applications vs. applicable sections of the City’s municipal code.
- Within the City of Lone Tree Public Works and Mobility Department there is a Mobility Manager who develops and implements multi-modal transportation plans. This planner works in concert with regional transportation partners and with other jurisdictions to most efficiently and effectively ensure that multi modal transportation within the City connects and integrates with those transportation networks in other jurisdictions.
- Within the City of Lone Tree Community Development Department there is a Planning Division consisting of three staff members. Their roles include plan development and review that considers resiliency within the City. The City also has a cross-departmental Sustainability Committee that among other things considers how the City Staff and officials can promote resiliency in our community. This Committee meets on a monthly basis and more frequently if required. The Committee will play a pivotal role in reviewing and implementing mitigation projects that are proposed in this plan.

Opportunities for Future Integration

- **Stormwater Management** - The City has a stormwater management program as a part of the MS4 permit and this program can include policies and procedures for responding to flooding events.
- **Capital Improvement Plan**— The Five Year Capital Projections is part of the annual budget and is approved by the City Council. This plan will be evaluated once the Natural Hazards Mitigation Plan is complete to determine if there are hazard mitigation projects that should be included in the five year projection.
- **Environmental Protection** – The City is currently in the process of updating its Zoning Code and is considering integrating requirements for the provision of pet waste management components for

multi-family developments; such a provision will support the City’s MS4 program. The City is also considering refining its requirements for snow storage areas in commercial and residential developments; this will further support the MS4 program.

- **Flood Damage Prevention** - The City has a floodplain code (Chapter 15) that incorporates higher regulatory standards than the National Flood Insurance Program and periodically reviews this code to ensure the health and safety of the public.
- **Pandemic Response/Mitigation** – The City is currently in the process of updating its Zoning Code and is assessing the inclusion of measures that will allow for flexible and/or temporary reuse of commercial buildings in an effort to support the community’s economic resiliency. The City has an Economic Recovery Task Force that provides a variety of business and community support functions, in collaboration with regional partners. Additional integration exists and will be assessed.
- **Floodplain or Watershed Plan** - The City partners with other governmental agencies to prepare and update watershed plans. Integration of natural hazards in watershed plans can take place as these plans are updated.
- **Stormwater Plan** - The City is in the process of creating a Stormwater plan which will in part identify risks and vulnerabilities to the existing storm infrastructure network and put a plan in place to address those areas.
- **Habitat Conservation Plan** – The City’s Comprehensive Plan, as well as several plans specific to Planned Developments in the City, identify habitat conservation goals and policies, however, no stand-alone plan exists and this represents an opportunity for future integration.
- **Economic Development Plan** – In 2020 the City unsuccessfully pursued grant funding to develop an economic development strategy for the City. The City has an Economic Development Director on staff and developing such a plan remains a need for the City, and an area for future integration opportunities.
- **Wildfire Protection Plan** – The City has required subdivisions to provide wildfire mitigation plans as part of their development application, however, the City does not currently have a stand-alone Wildfire Protection Plan and this is an area for future integration and possible collaboration with regional partners.

9.5.7 Jurisdiction-Specific Natural Hazard Event History

Table 9.5-11 lists past occurrences of natural hazards for which specific damage was recorded in City of Lone Tree hazard events that broadly affected the entire planning area, including City of Lone Tree, are listed in the risk assessments in Volume 1 of this hazard mitigation plan.

Table 9.5-11. Past Natural Hazard Events

Type of Event	FEMA Disaster #	Date	Damage Assessment
Pandemic (COVID-19)	EM-3436/DR-4498	January 20 th , 2020 – Present The Pandemic of 2020 has caused extensive and potentially long-lasting economic damage. The actual impacts are hard to quantify but we can get some	\$-

		<p>indication by referring to common economic indicators. Unemployment across the country reached levels not seen since the Great Depression. While different demographics and sectors were affected differently the year finished out at a rate of 6.7%. Tax revenue is another indicator of the impact on the economy. Local tax collection was down by 27% in 2020 compared to the previous year.</p>	
* Indicates County-wide event			

9.5.8 Hazard Risk Ranking

Table 9.5-12 presents a local ranking for City of Lone Tree of all hazards of concern for which this hazard mitigation plan provides complete risk assessments. This ranking summarizes how hazards vary for this jurisdiction. As described in detail in Volume 1, the ranking process involves an assessment of the likelihood of occurrence for each hazard, along with its potential impacts on people, property and the economy. Mitigation actions target hazards with high and medium rankings.

Table 9.5-12. Hazard Risk Ranking

Rank	Hazard Type	Risk Rating Score (Probability x Impact)	Category
1	Drought	30	Medium
1	Pandemic	30	Medium
2	Wildfire	27	Medium
3	Hail	24	Medium
4	Flood	18	Medium
4	Lightning	18	Medium
4	Severe Thunderstorms	18	Medium
4	Severe Winter Storm	18	Medium
4	Transportation Accidents	18	Medium
5	Earthquake	16	Medium
5	Tornadoes	16	Medium
6	Erosion	12	Low
6	Expansive Soils	12	Low
6	Extreme Temperatures	12	Low
6	Animal Disease	12	Low
6	Land Subsidence	12	Low
6	Landslide	12	Low
18	Slope Failure	12	Low
19	Dam and Levee Failure	6	Low

NOTE: The process used to assign risk ratings and rankings for each hazard is described in Volume 1 of this hazard mitigation plan.

9.5.9 Jurisdiction-Specific Vulnerabilities

Volume 1 of this hazard mitigation plan provides complete risk assessments for each identified hazard of concern. This section provides information on key vulnerabilities identified by the jurisdiction. Available jurisdiction-specific risk maps of the hazards are provided at the end of this annex.

Repetitive Loss Properties

Repetitive loss records are as follows:

- Number of FEMA-identified Repetitive-Loss Properties: NA
- Number of FEMA-identified Severe-Repetitive-Loss Properties: NA
- Number of Repetitive-Loss Properties or Severe-Repetitive-Loss Properties that have been mitigated: NA

Other Noted Vulnerabilities

The following jurisdiction-specific issues have been identified based on a review of the results of the risk assessment, public involvement strategy, and other available resources:

- The City of Lone Tree has two major highways that travel through the community. There are no railroads within the jurisdiction. Hazardous materials are transported on a daily basis along I-25 and C-470, normally in quantities that do not pose a substantial threat to the community. However; there are opportunities that a major incident could occur on a daily basis. Past history indicates the majority of hazardous materials incidents are associated with the fuel spills from accidents and not the actual cargo carried (LT1).
- Water supply concerns during drought conditions (LT4)

Mitigation actions addressing these issues were prioritized for consideration in the action plan presented in Section 9.2.10.

9.5.10 Hazard Mitigation Action Plan and Evaluation of Recommended Actions

Table 9.5-13 lists the actions that make up the hazard mitigation action plan for this jurisdiction. Table 9.5-14 identifies the priority for each action. Table 9.5-15 summarizes the mitigation actions by hazard of concern and mitigation type.

Table 9.5-13. Hazard Mitigation Action Plan Matrix

Applies to New or Existing Assets	Objectives Met	Lead Agency	Support Agency	Estimated Cost	Sources of Funding	Timeline ^a
<p>Action LT1— Hazardous materials mitigation: The City of Lone Tree has identified the potential for hazardous materials –transportation incidents medium risk. The City of Lone Tree has two major highways that travel through the community. There are no railroads within the jurisdiction. Hazardous materials are transported on a daily basis along I-25 and C-470, normally in quantities that do not pose a substantial threat to the community. However; there are opportunities that a major incident could occur on a daily basis. Past history indicates the majority of hazardous materials incidents are associated with the fuel spills from accidents and not the actual cargo carried.</p> <p>The City recognizes the need to work in conjunction with the teams designed and trained to address hazardous material should there be an actual or potential incident. Identification of the incident at the onset will be a major priority to ensure safety for the community. The first responders need to be properly trained in recognition of potential events and the proper safety precautions to take. A portion of this training is already conducted within individual department yearly training (fire and police). However, there is little cross training that has occurred within this realm to ensure both sides are performing their duties as expected. Therefore, it is recommended that cross training between both groups of first responders be implemented. There is additional need to exercise multijurisdictional command and control for a complex HAZMAT incident response.</p>						
<u>Hazards Mitigated:</u>	Transportation Accidents					
Existing	Obj 1, Obj 8, Obj 11, Obj 14,	LTPD	SMFR	\$5,000	City Budget	Short Term

Applies to New or Existing Assets	Objectives Met	Lead Agency	Support Agency	Estimated Cost	Sources of Funding	Timeline ^a
Action LT2—Severe Winter Weather traffic impact mitigation to include protection of people and property: The City of Lone Tree has snow plowing and de-icing procedures in place to address winter storm related events within the City (see City Website). Additionally, the City of Lone Tree Emergency Operations Plan addresses the City’s plan for dealing with Winter Storm related events. Winter Storm impacts on C-470 and/or I-25 are addressed by CDOT. There is a CDOT Region 1 generated Douglas County I-25 South Traffic Incident Management Plan established which includes addressing winter storm events impacts on I-25. The City of Lone Tree was a participant in development of this Plan, and will cooperate as required in the Plan implementation						
<i>Hazards Mitigated:</i> Severe Winter Storm, Transportation Accidents, Extreme Temperatures						
Existing	Obj 2, Obj 5, Obj 8, Obj 9, Obj 11,	PW	LTPD	Staff Time	City Budget	Short Term
Action LT3—Wildfire prevention and protection plan review and implementation: The City of Lone Tree has identified the potential for wildfire impacts within portion of the City as having a medium significance. The City of Lone Tree will continue to work with South Metro Fire/Rescue Authority to develop plans to mitigate the impact of future wildfires within our community. In addition, Lone Tree has put into place means of communicating with the community during the time of an actual emergency as well as providing ongoing communication on fire prevention and mitigation strategies for the citizens. The city also works in conjunction with Douglas County to identify situations when the fire danger is higher and incorporate additional restrictions associated with open fires. The City also coordinates development referrals with the Douglas County Wildfire Mitigation Specialist in areas of medium to high wildfire risk and requires developers to prepare wildfire mitigation plans when necessary. Additionally, South Suburban Parks and Recreation District manages Lone Tree Open Space areas and the District’s Open Space Maintenance Standards include mowing standards for active open space areas that comply with Douglas County’ recommended mowing standards.						
<i>Hazards Mitigated:</i> Wildfire, Lightening, Extreme Temperatures, Drought						
Existing	Obj 1, Obj 2, Obj 5, Obj 8, Obj 9, Obj 14	CMO	LTPD	Staff Time	City Budget	Short Term
Action LT4 – Drought Mitigation: All development within the City of Lone Tree is serviced by public water systems, with water provided either through Southgate Water District/Denver Water or by Parker Water & Sanitation District. The City cooperates with these water suppliers in terms of water use restrictions if/when such restrictions are implemented. Additionally, City Planning recommends/requires low water use landscaping and water monitoring/conserving irrigation systems for new development. Waterwise principles are applied in the City’s Landscape Design Guidelines and Standards for Areas in and Along Public Rights-of-Way; Zoning Code Chapter 16, Landscaping Requirements; Design Guidelines, Landscaping. Additionally, the City’s Zoning Enforcement Officer assesses and cites development for code violations.						
<i>Hazards Mitigated:</i> Drought, Extreme Temperatures						
Existing	Obj 2, Obj 3, Obj 5, Obj 7, Obj 10, Obj 13, Obj 21, Obj 26	CDD	PW	>\$20,000	Grants, City Budget	Ongoing
Action LT5—Mitigate flooding by developing and implementing zoning and development regulations: . High intensity, relatively short duration, rain events are not uncommon during the rainy seasons. Localized surface flooding potential exists from these cloud-burst type events. However, incidents of significant flooding are not frequent (no specific records on file). The City of Lone Tree reviews proposed grading and drainage plans for development within the City through zoning codes, development standards, and engineering plans reviews – with consideration for appropriate drainage management to minimize such drainage hazards.						
<i>Hazards Mitigated:</i> Flood, Severe Thunderstorms, Erosion						
Existing	Obj 3, Obj 5, Obj 7, Obj 9, Obj 10, Obj 19, Obj 21, Obj 23, Obj 26	CDD	PW	>\$25,000	Grants, City Budget	Ongoing
Action LT6 - Lone Tree intends to join the Douglas County Wildfire Partnership (DCWP). Lone Tree Emergency Management and Public Works along with and various state, federal, NGO, and private stakeholders, will work with the Partnership to assess impact from wildfire; identify opportunities to maintain continuity of operations; and develop a comprehensive mitigation strategy to identify projects that will reduce wildfire risk, increase natural resource protection, encourage the incorporation of wildfire management principles into local planning, land use and building codes, and promote public awareness of wildfire risk. review and implementation.						
<i>Hazards Mitigated:</i> Wildfire						
Existing	Obj 1, Obj 2, Obj 5, Obj 8, Obj 9, Obj 14	CMO	LTPD	Staff Time	City Budget	Short Term
Action LT7 - Pandemic preparation, mitigation, and response. The City of Lone Tree was very successful in responding to the 2020 COVID-19 Pandemic. However, we learned many lessons that can improve our response and lessen the effects of future pandemics. We intend to take these lessons learned and document them in the Pandemic Annex of the Emergency Operations Plan. We will archive our Pandemic Specific City Policies that provided for the health and safety of the staff and public by governing the operations of City Facilities. We have several facility upgrades dealing with symptom monitoring, creating natural ventilation, HAVC upgrades, touchless operations, social distancing barriers, and advanced oxidation cell purifications units. We will seek to improve our staff’s remote work capabilities and the capability of the						

Applies to New or Existing Assets	Objectives Met	Lead Agency	Support Agency	Estimated Cost	Sources of Funding	Timeline ^a
city to continue the delivery of critical services when faced with extreme social distancing requirements. This may include equipping our City Council Chambers for hybrid public meetings and researching how to move some activities into outdoor spaces at City Facilities.						
<u>Hazards Mitigated:</u>	Pandemic					
New	Obj 2, Obj 3, Obj 5, Obj 7, Obj 10, Obj 13, Obj 21, Obj 26	Emergency Management	PW, City Clerk, CMO	>\$75,000	Grants, City Budget	Ongoing

a. Short-term = Completion within 5 years; Long-term = Completion within 10 years; Ongoing= Continuing new or existing program with no completion date
See the introduction to this volume for list of acronyms used here.

Table 9.5-14. Mitigation Action Priority

Action #	# of Objectives Met	Benefits	Costs	Do Benefits Equal or Exceed Costs?	Is Project Grant-Eligible?	Can Project Be Funded Under Existing Programs/Budgets?	Implementation Priority ^a	Grant Pursuit Priority ^a
LT1	4	Medium	Medium	Yes	Yes	Yes	High	Medium
LT2	5	Medium	Low	Yes	Yes	Yes	Medium	Medium
LT3	6	Medium	Low	Yes	Yes	Yes	Medium	Medium
LT4	8	Medium	Medium	Yes	Yes	No	Medium	High
LT5	9	Medium	Medium	Yes	Yes	No	Medium	High
LT6	6	Medium	Medium	Yes	Yes	Yes	Medium	Medium
LT7	8	Medium	Medium	Yes	Yes	Yes	Medium	Medium

a. See the introduction to this volume for explanation of priorities.

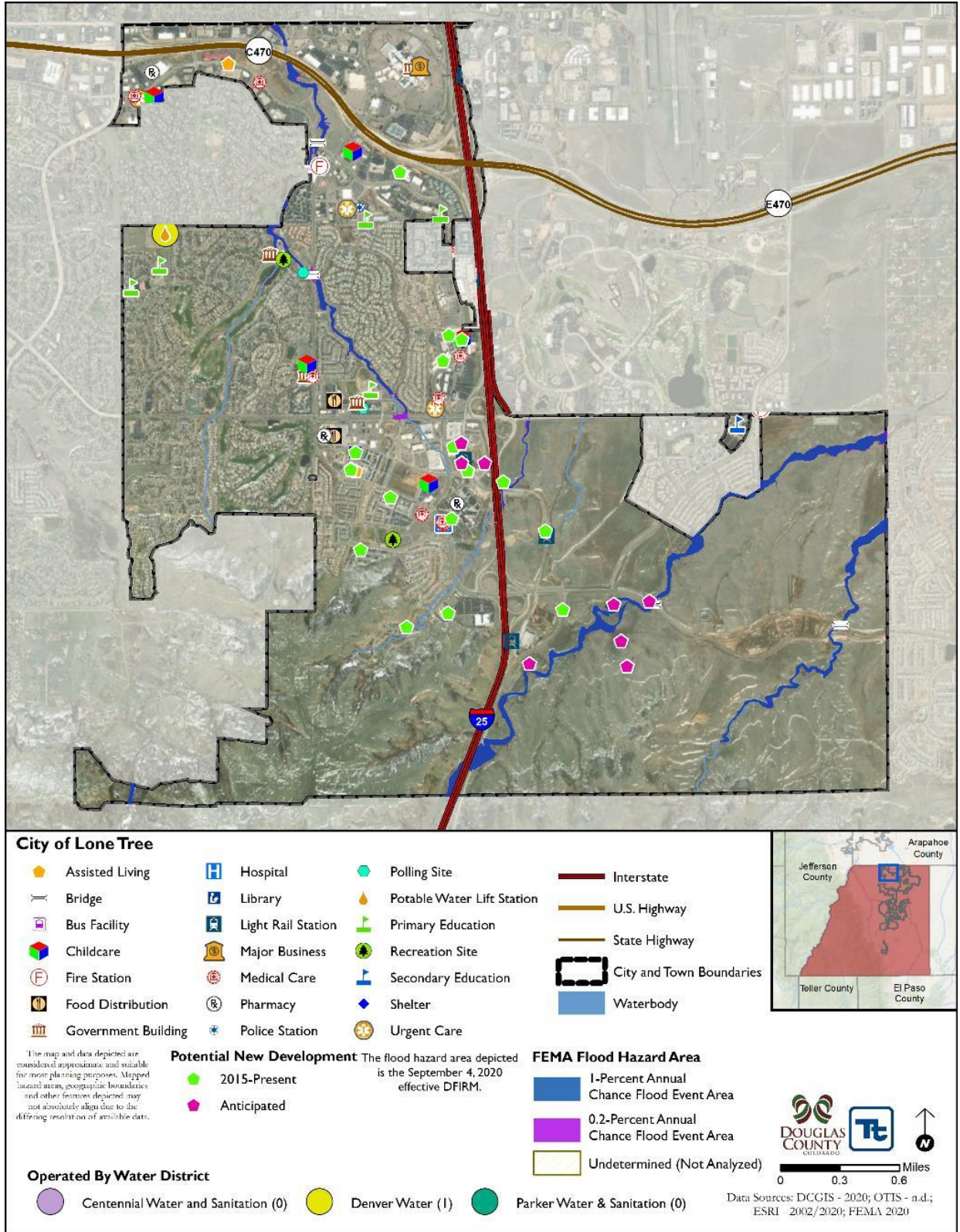
Table 9.5-15. Analysis of Mitigation Actions

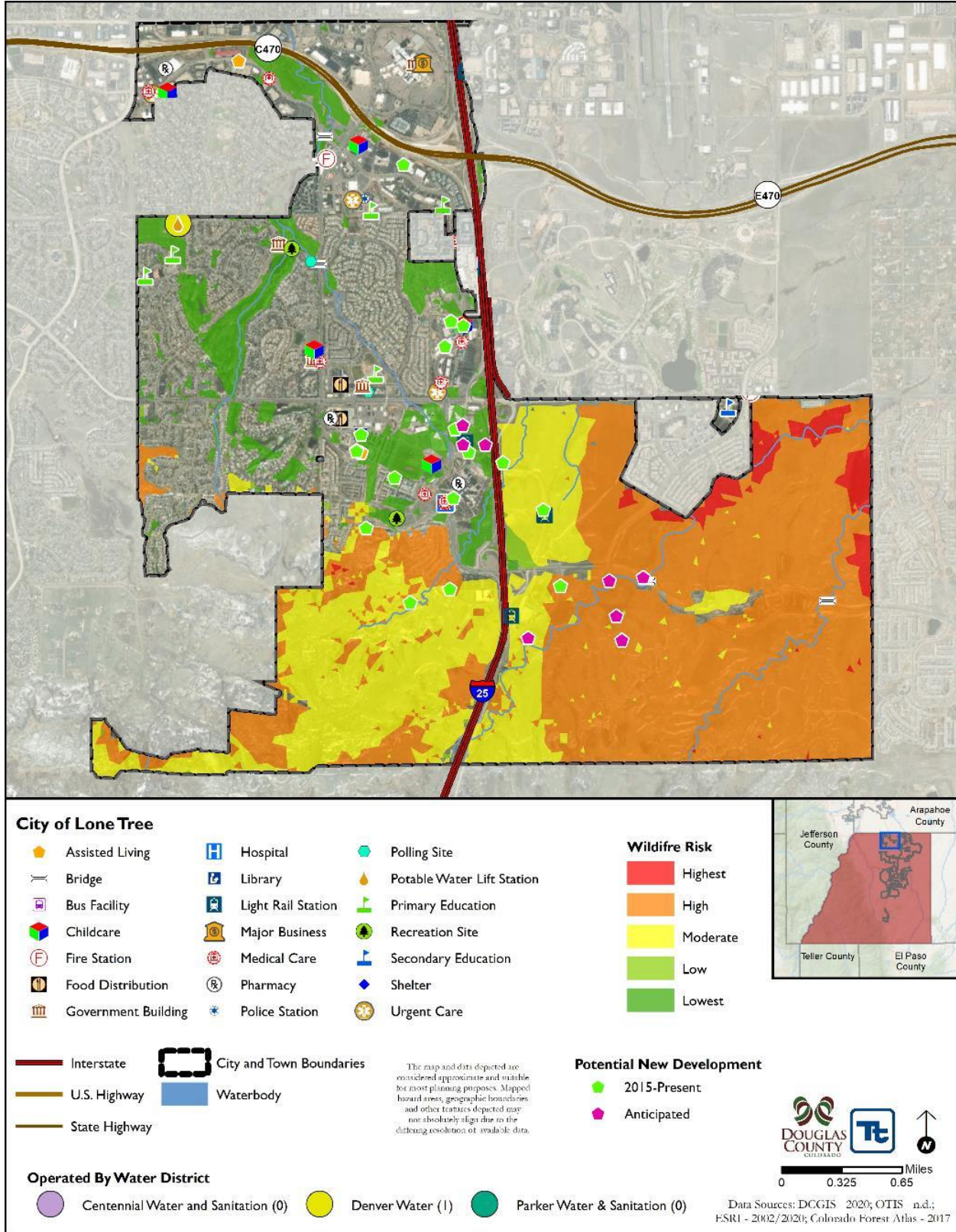
Hazard Type	Action Addressing Hazard, by Mitigation Type ^a						
	Prevention	Property Protection	Public Education and Awareness	Natural Resource Protection	Emergency Services	Structural Projects	Community Capacity Building
High-Risk Hazards							
Medium-Risk Hazards							
Transportation Accidents		LT1			LT1		LT1
Severe Winter Storm		LT2	LT2		LT2		LT2
Lightening		LT2	LT3	LT3	LT3		LT3
Drought		LT3, LT4	LT3, LT4	LT3, LT4	LT3		LT3
Flood	LT5	LT5	LT5	LT5			
Severe Thunderstorms		LT5	LT5	LT5			
Wildfire	LT6	LT6			LT6		LT6
Pandemic	LT7		LT7		LT7		
Low-Risk Hazards							
Extreme Temperatures		LT2, LT3, LT4	LT2, LT3, LT4	LT3, LT4	LT2, LT3		LT2, LT3
Erosion	LT5	LT5	LT5	LT5			

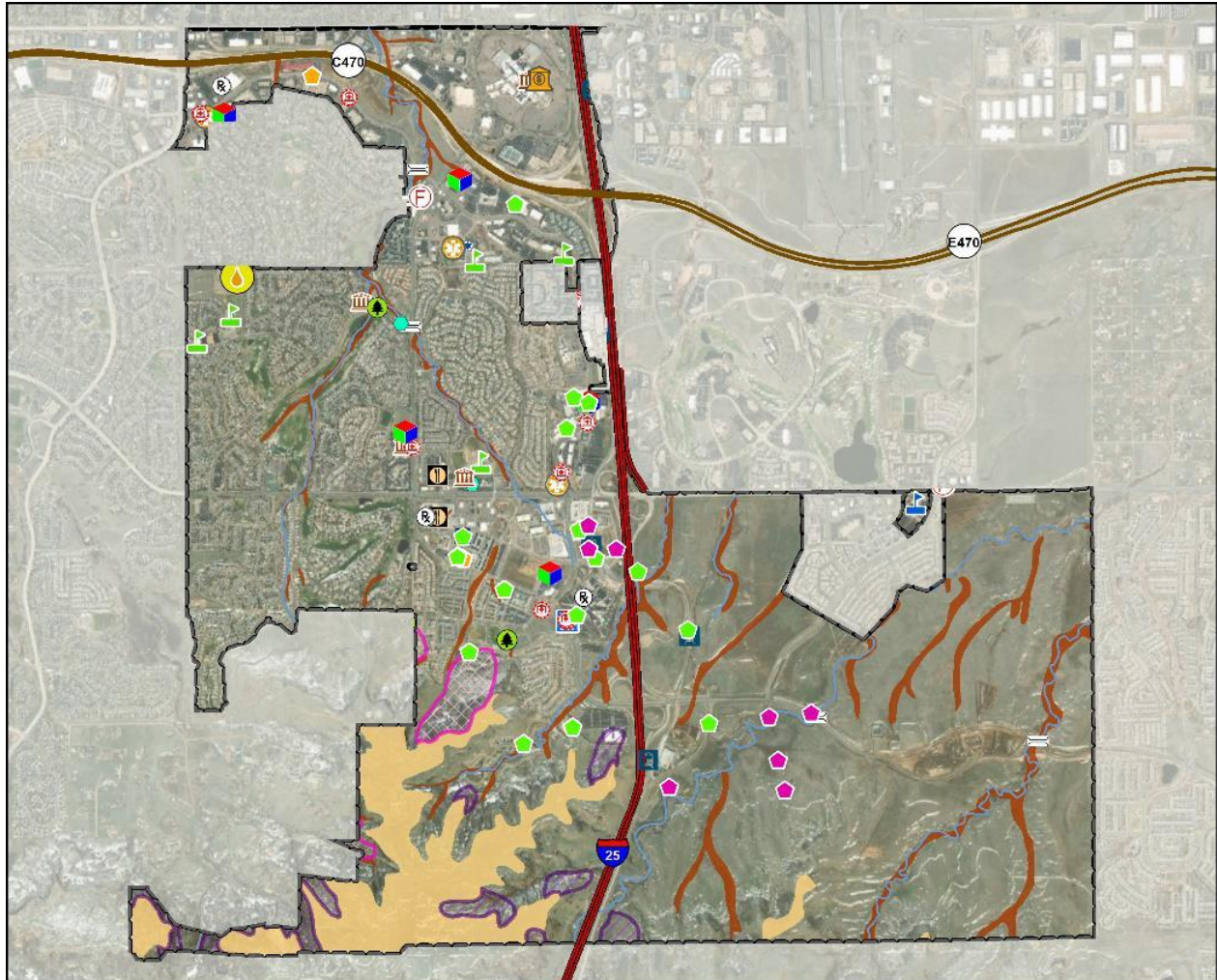
a. See the introduction to this volume for explanation of mitigation types.

9.5.11 Future Needs to Better Understand Risk/Vulnerability

No needs have been identified.







City of Lone Tree

- | | | |
|---------------------|--------------------|----------------------------|
| Assisted Living | Hospital | Polling Site |
| Bridge | Library | Potable Water Lift Station |
| Bus Facility | Light Rail Station | Primary Education |
| Childcare | Major Business | Recreation Site |
| Fire Station | Medical Care | Secondary Education |
| Food Distribution | Pharmacy | Shelter |
| Government Building | Police Station | Urgent Care |

Dipping Bedrock Class

- High
- Moderate
- Low

Land Subsidence

- Carbonate Rock
- Karst Topography

Potential New Development

- 2015-Present
- Anticipated

- Interstate
- State Highway
- U.S. Highway
- City and Town Boundaries
- Waterbody

Erosion Susceptibility

- Low Erosion-Susceptibility Area
- Moderate Erosion-Susceptibility Area
- Debris-Flow Area
- Slope-Failure Area
- Rockfall-Rockslide/Debris Avalanche Area

Operated By Water District

- Centennial Water and Sanitation (0)
- Denver Water (1)
- Parker Water & Sanitation (0)



The map and data depicted are considered approximate and suitable for most planning purposes. Mapped hazard areas, geographic boundaries and other features depicted may not absolutely align due to the differing resolution of available data.



Data Sources: DCGIS - 2020; OTIS - n.d.; ESRI 2002/2020; Colorado Geological Survey n.d.; USGS - 1984/n.d.

9.6 TOWN OF PARKER

9.6.1 Hazard Mitigation Plan Point of Contact

Primary Point of Contact	Alternate Point of Contact
Greg Epp, Sergeant 18600 E Lincoln Meadows Pkwy. Parker, CO 80134 Telephone: (303) 841-9800 e-mail Address: gepp@parkeronline.org	Andrew Coleman, Police Commander 18600 E Lincoln Meadows Pkwy. Parker, CO 80134 Telephone: (303) 841-9800 e-mail Address: AColeman@parkeronline.org

9.6.2 Jurisdiction Profile

Location

The Town of Parker’s land consists of a wide range of topography encompassing mountain vistas, dramatic ridgelines, hills, and grass covered plains. Because of the Town’s close proximity to the Denver metro area and multi-modal transportation facilities, the area is desirable to new residents. The lands surrounding Parker include Lone Tree, Castle Pines and open space to the west; Foxfield, Centennial and Aurora to the north; unincorporated residential areas to the east; and The Pinery and Castle Rock to the south.

The current boundaries generally extend from the east side of Interstate 25. Highway 470 and South Parker Road come to a junction in the northern part of the Town ,encompassing an area of 20.8 square miles.

History

The Town of Parker was incorporated in 1981. Parker can trace its colorful recent history to the establishment of the Pine Grove Post Office by Alfred Butters around 1862. Prior to that time, the area was used for hunting by Indians, including the ancient (prehistoric) Indians, the Plains-Woodland Indians and later (circa 1800s) mostly Arapaho, Cheyenne and Ute Indians.

The Town of Parker was incorporated in May of 1981 and included the Rowley Downs subdivision, the downtown area and the Parker Square and Parker Plaza commercial areas. The incorporated area encompassed approximately one square mile and included 285 residents. Soon after incorporation in 1981, the Town adopted zoning and subdivision ordinances. The Town increased from one square mile at incorporation to 20.8 square miles currently. The Town's population has increased from less than 300 at incorporation to more than 57,000 currently. The Town of Parker offers a variety of services to their citizens ranging from police protection to recreation.

Climate

Douglas County is characterized by a moderate climate and significant sun exposure (more than 300 days per year). The County features low humidity, approximately 18 inches of rain each year, and 71 inches of snowfall. Temperatures range from highs of 85 degrees in July to 45 degrees in January (according to USA.com).

Governing Body Format

Parker has a Council/ Administration form of government with Town Council and Mayor elected at large and an appointed Town Administrator who oversees the day-to-day operations of the organization. According to the Town of Parker website <http://www.parkeronline.org/90/Mayor-and-Town-Council> ,

“Councilmembers make policy decisions for the local government and approve the Town budget. They are given the power by the Town Charter to enact and provide for the enforcement of ordinances, which are Town laws.”

The Parker Town Council assumes responsibility for the adoption of this plan; The Office of Emergency Management, within the Parker Police Department will oversee its implementation. Development of this annex was carried out by the members of the local mitigation planning team, whose members are listed in Table 9.6-1.

Table 9.6-1. Local Mitigation Planning Team Members

Name	Title
Greg Epp	Police Sergeant
Andrew Coleman	Police Commander
Jim Gilbert	Deputy Director of Operations
Bryce Matthews	Planning Manager
Danny Smith	Operations Manager
Chris Hudson	Dep. Director of Engineering
Randy Sale	Chief Building Official

9.6.3 Current Trends

Population

According to the U.S. Census Bureau the population of Town of Parker as of 2019 was 57,706. Since 2010, the population has grown 27.2% percent.

Development

Development trends within the jurisdictional boundaries for the Town of Parker are estimated to continue based on historical trends. Much of the development in the Parker area has been with a focus on residential, including single family and multifamily residences. The areas to the south and west in town are the current areas experiencing the most single family residential building while infill areas throughout town are experiencing multifamily dwelling construction. As the residential base continues to grow bringing additional commercial development into town as well. The Town of Parker has seen growth over the past five years in excess of the predicted models based on the last census numbers. The Town is also currently in the process of updating their Land Development Ordinance.

Table 9.6-2 summarizes development trends in the performance period since the preparation of the previous hazard mitigation plan, as well as expected future development trends.

Table 9.6-2. Recent and Expected Future Development Trends

Criterion	Response
Has your jurisdiction annexed any land since the preparation of the previous hazard mitigation plan?	Yes
<ul style="list-style-type: none"> If yes, give the estimated area annexed and estimated number of parcels or structures. 	506 acres

Criterion	Response					
Is your jurisdiction expected to annex any areas during the performance period of this plan?	Yes					
<ul style="list-style-type: none"> If yes, describe land areas and dominant uses. 	Currently Zoned agricultural, and adding current in-fill areas still under Douglas County Jurisdiction.					
<ul style="list-style-type: none"> If yes, who currently has permitting authority over these areas? 	Douglas County					
Are any areas targeted for development or major redevelopment in the next five years?	Yes					
<ul style="list-style-type: none"> If yes, briefly describe, including whether any of the areas are in known hazard risk areas 	Hess Ranch and Anthology North are both large planned developments, floodplains and steep slopes exist on portions of the properties but are preserved as open space and will not be developed upon.					
How many permits for new construction were issued in your jurisdiction since the preparation of the previous hazard mitigation plan?	2015	2016	2017	2018	2019	
	Single Family	312	291	421	294	393
	Multi-Family	454	419	377	824	195
	Other (commercial, mixed use, etc.)	13	27	35	43	321
	Total	779	737	833	1,161	909
Provide the number of new-construction permits for each hazard area or provide a qualitative description of where development has occurred.	<ul style="list-style-type: none"> Special Flood Hazard Areas: #0 Landslide: #0 High Liquefaction Areas: #0 Wildfire Risk Areas: #0 					
Describe the level of buildout in the jurisdiction, based on your jurisdiction's buildable lands inventory. If no such inventory exists, provide a qualitative description.	Based on the General land use plan and potential growth, current estimates are for a population of 80,000 to 90,000 residents by 2040. Current zoned projects allow for an additional un-platted or planned dwelling units of 9,330.					

9.6.4 Status of Previous Plan Actions

Table 9.6-3 summarizes the actions that were recommended in the previous version of the hazard mitigation plan and their implementation status at the time this update was prepared.

Table 9.6-3. Status of Previous Plan Actions

Action Item	Completed	Removed; No Longer Feasible	Carried Over to Plan Update	
			Check if Yes	Enter Action #
Creation of Emergency Action Plan (EAP) for significant contamination of stored water in Rueter-Hess Reservoir (RHR)- Analysis and evaluation of various water contamination risks from natural or man- made sources, both intentional and accidental, resulting in an EAP. Due to the “slow-fill” nature of RHR any significant source of contamination must be quickly identified and contained, requiring well-thought out response and remediation plans.		X		
<i>Comment:</i>	<i>Parker Water and Sanitation District in completion of the Risk and Resiliency planning under EPA requirements determined that any type of contamination, based on the volume of water stored in Reuter Hess reservoir would require such a large scale amount or quantity of contaminant that this is very low or negligible as a risk requiring an EAP:</i>			

Action Item	Completed	Removed; No Longer Feasible	Carried Over to Plan Update	
			Check if Yes	Enter Action #
Achieving “Storm Ready Community” designation for Parker- Receiving recognition via the National Weather Service (NWS) StormReady program means a community is better prepared for extreme weather events, has planned for infrastructure needs and developed expertise and systems for protecting property and minimizing the potential for loss of life. Continuous maintenance of Parker’s CRS rating of 6 or better is important.	X			
<i>Comment: Completed with final acknowledgement from NOAA/NWS in 2018</i>				

9.6.5 Capability Assessment

The Town of Parker performed an assessment of its existing capabilities for implementing hazard mitigation strategies. The introduction at the beginning of this volume of the hazard mitigation plan describes the components included in the capability assessment and their significance for hazard mitigation planning. This section summarizes the following findings of the assessment:

- An assessment of legal and regulatory capabilities is presented in Table 9.6-4.
- Development and permitting capabilities are presented in Table 9.6-5.
- An assessment of fiscal capabilities is presented in Table 9.6-6.
- An assessment of administrative and technical capabilities is presented in Table 9.6-7.
- An assessment of education and outreach capabilities is presented in Table 9.6-8.
- Information on National Flood Insurance Program (NFIP) compliance is presented in Table 9.6-9.
- Classifications under various community mitigation programs are presented in Table 9.6-10.

Findings of the capability assessment were reviewed to identify opportunities to expand, initiate or integrate capabilities to further hazard mitigation goals and objectives. Where such opportunities were identified and determined to be feasible, they are included in the action plan. The “Analysis of Mitigation Actions” table in Section 6 identifies these as community capacity building mitigation actions.

Table 9.6-4. Legal and Regulatory Capability

	Local Authority	Other Jurisdiction Authority	State Mandated	Integration Opportunity?
Codes, Ordinances, & Requirements				
Building Code	Yes	No	Yes and No	Yes
<i>Comment:</i>	<i>International Codes adopted through Town Municipal Code and national Electric Code per state. The Town is currently enforcing the 2018 International codes (ICC). They will adopt the 2021 ICC codes on January 1, 2022. The Town updates their codes every 3 years which means the next cycle will be in 2025 with the 2024 codes.</i>			
Zoning Code	Yes	No	No	No
<i>Comment:</i>	<i>Municipal Code section 13</i>			
Subdivisions	Yes	No	No	No
<i>Comment:</i>	<i>Municipal Code section 13</i>			
Stormwater Management	Yes	Yes	Yes	No
<i>Comment:</i>				
Post-Disaster Recovery	No	No	No	No
<i>Comment:</i>				
Real Estate Disclosure	No	No	Yes/No	No
<i>Comment:</i>				
Growth Management	No	No	No	No
<i>Comment:</i>				

	Local Authority	Other Jurisdiction Authority	State Mandated	Integration Opportunity?
Site Plan Review	Yes	No	No	No
<i>Comment:</i>	<i>Municipal Code section 13</i>			
Environmental Protection	Yes	No	No	No
<i>Comment:</i>	<i>Municipal Code section 13</i>			
Flood Damage Prevention	Yes	Yes	No	No
<i>Comment:</i>	<p><i>The Town's floodplain regulations (Ch. 13.05.010 from ordinances 3.171.3 §1, 2016; 1.467 §§31, 32, 2015; 3.01.102 §1, 2013) are currently meeting or exceed current NFIP requirements. The Town is also recognized by FEMA as having automatic adoption language for all new maps and studies to keep the Town in compliance without amending Town Code. Additionally, enforcement exceeds NFIP requirements as all areas of the SFHA are within stream buffer areas as defined by the Town's stream protection standards (Ch. 13.10.220 [Stream Protection Standards] from ordinances 3.171.3 §2, 2016; 1.467 §32, 2015; 3.171.2 §1, 2006; 3.171.1 §1, 2003; 3.171 §1, 2001). All new and redevelopment must comply with these standards to receive any development permits from the Town. The ordinance also prohibits unauthorized camping in designated floodplains (Ch. 13.05.015 from ordinance 3.01.123 §1, 2020).</i></p> <p><i>The Director of Engineering is the Floodplain administrator for the Town of Parker and is responsible for enforcing the code, reviewing permits, determining the base flood elevation as needed, obtaining and maintaining information related to elevations of new or substantially improved structures, variance procedures, and enforcing provisions to reduce flood hazards in the Town.</i></p>			
Emergency Management	Yes	No	No	No
<i>Comment:</i>	<i>EOP adopted in 2020</i>			
Climate Change	No	No	No	No
<i>Comment:</i>				
Other	No	No	No	No
<i>Comment:</i>				
Planning Documents				
General Plan	Yes	No	Yes	No
<i>Comment:</i>	<i>Parker 2035 Master Plan</i>			
Capital Improvement Plan	Yes	No	No	Yes
<i>How often is the plan updated?</i>	<i>Reviewed annually</i>			
<i>Comment:</i>				
Disaster Debris Management Plan	No	No	No	Yes
<i>Comment:</i>				
Floodplain or Watershed Plan	Yes	No	Yes	No
<i>Comment:</i>	<i>Town Ordinances</i>			
Stormwater Plan	Yes	No	Yes	No
<i>Comment:</i>	<i>Town Stormwater Drainage Manual</i>			
Urban Water Management Plan	No	No	No	No
<i>Comment:</i>	<i>N/A</i>			
Habitat Conservation Plan	Yes	Yes	No	No
<i>Comment:</i>	<i>Joint Preble's jumping mouse with Douglas County</i>			
Economic Development Plan	No	No	No	No
<i>Comment:</i>				
Shoreline Management Plan	No	No	No	No
<i>Comment:</i>				
Community Wildfire Protection Plan	No	No	No	Yes
<i>Comment:</i>				
Forest Management Plan	No	No	No	No
<i>Comment:</i>				
Climate Action Plan	No	No	No	No
<i>Comment:</i>				
Comprehensive Emergency Management Plan	Yes	No	Yes	No
<i>Comment:</i>				
Threat & Hazard Identification & Risk Assessment (THIRA)	No	No	No	Yes
<i>Comment:</i>				

	Local Authority	Other Jurisdiction Authority	State Mandated	Integration Opportunity?
Post-Disaster Recovery Plan	No	No	No	No
<i>Comment:</i>				
Continuity of Operations Plan	No	No	No	No
<i>Comment:</i>				
Public Health Plan	Yes	Yes	Yes	Yes
<i>Comment:</i>	Tri County Health Dept.			
Other	No	No	No	No
<i>Comment:</i>				

Table 9.6-5. Development and Permitting Capability

Criterion	Response
Does your jurisdiction issue development permits?	Yes
• If no, who does? If yes, which department?	Community Development and Public Works
Does your jurisdiction have the ability to track permits by hazard area?	Yes
Does your jurisdiction have a buildable lands inventory?	No

Table 9.6-6. Fiscal Capability

Financial Resource	Accessible or Eligible to Use?
Community Development Block Grants	Yes
Capital Improvements Project Funding	Yes
Authority to Levy Taxes for Specific Purposes	No
User Fees for Water, Sewer, Gas or Electric Service	Yes (Stormwater Utility – see Chapter 4.08 of the Town code)
Incur Debt through General Obligation Bonds	Yes
Incur Debt through Special Tax Bonds	No
Incur Debt through Private Activity Bonds	Yes
Withhold Public Expenditures in Hazard-Prone Areas	No
State-Sponsored Grant Programs	Yes
Development Impact Fees for Homebuyers or Developers	Yes
Other	No

Table 9.6-7. Administrative and Technical Capability

Staff/Personnel Resource	Available?	Department/Agency/Position
Planners or engineers with knowledge of land development and land management practices	Y	Community Development & Engineering/Public Works
Engineers or professionals trained in building or infrastructure construction practices	Y	Community Development, Engineering/Public Works, Building Division
Planners or engineers with an understanding of natural hazards	Y	Community Development & Engineering/Public Works
Staff with training in benefit/cost analysis	Y	Community Development & Engineering/Public Works
Surveyors	N	On-call surveying consulting firms (when needed via Engineering/Public Works contract)
Personnel skilled or trained in GIS applications	Y	Information Technology
Scientist familiar with natural hazards in local area	Y	On-call geotechnical consulting firms (when needed via Engineering/Public Works contract)
Emergency manager	N	Position to be filled in 2021
Grant writers	Y	Community Development
Other	N	

Table 9.6-8. Education and Outreach Capability

Criterion	Response
Do you have a public information officer or communications office?	Yes
Do you have personnel skilled or trained in website development?	Yes
Do you have hazard mitigation information available on your website? • If yes, briefly describe.	Yes Be Prepared links
Do you use social media for hazard mitigation education and outreach? • If yes, briefly describe.	Yes Be Prepared link on website and social media updates as needed
Do you have any citizen boards or commissions that address issues related to hazard mitigation? • If yes, briefly describe.	Yes Planning Commission
Do you have any other programs already in place that could be used to communicate hazard-related information? • If yes, briefly describe.	Yes Weather Spotter Classes
Do you have any established warning systems for hazard events? • If yes, briefly describe.	Yes Code Red

Table 9.6-9. National Flood Insurance Program Compliance

Criterion	Response
What local department is responsible for floodplain management?	Engineering/Public Works
Who is your floodplain administrator? (department/position)	Engineering/Public Works / Director
Are any certified floodplain managers on staff in your jurisdiction?	Yes
What is the date that your flood damage prevention ordinance was last amended?	March 7 th 2016
Does your floodplain management program meet or exceed minimum requirements? • If exceeds, in what ways?	Exceeds - The Town's floodplain regulations (Ch. 13.05.010 from ordinances 3.171.3 §1, 2016; 1.467 §§31, 32, 2015; 3.01.102 §1, 2013) are currently meeting or exceed current NFIP requirements. The Town is also recognized by FEMA as having automatic adoption language for all new maps and studies to keep the Town in compliance without amending Town Code. Additionally, enforcement exceeds NFIP requirements as all areas of the SFHA are within stream buffer areas as defined by the Town's stream protection standards (Ch. 13.10.220 from ordinances 3.171.3 §2, 2016; 1.467 §32, 2015; 3.171.2 §1, 2006; 3.171.1 §1, 2003; 3.171 §1, 2001). All new and redevelopment must comply with these standards to receive any development permits from the Town. The Town also maintains elevation certificates through the Building Department who collects and maintains the certificates in eTRAKit. Currently rated as a Class 5 Community with the Community Rating System (CRS)
When was the most recent Community Assistance Visit or Community Assistance Contact?	March 14 th 2020
Does your jurisdiction have any outstanding NFIP compliance violations that need to be addressed? • If so, state what they are.	No
Are any RiskMAP projects currently underway in your jurisdiction? • If so, state what they are.	No
Do your flood hazard maps adequately address the flood risk within your jurisdiction? • If no, state why.	Yes

Criterion	Response
Does your floodplain management staff need any assistance or training to support its floodplain management program?	No
<ul style="list-style-type: none"> If so, what type of assistance/training is needed? 	
Does your jurisdiction participate in the Community Rating System (CRS)?	Yes
<ul style="list-style-type: none"> If yes, is your jurisdiction interested in improving its CRS Classification? 	No looking to maintain a Class 5 rating
<ul style="list-style-type: none"> If no, is your jurisdiction interested in joining the CRS program? 	
How many flood insurance policies are in force in your jurisdiction? ^a	57
<ul style="list-style-type: none"> What is the insurance in force? 	\$21,859,000
<ul style="list-style-type: none"> What is the premium in force? 	\$28,493
How many total loss claims have been filed in your jurisdiction? ^a	1
<ul style="list-style-type: none"> How many claims are still open or were closed without payment? 	0
<ul style="list-style-type: none"> What were the total payments for losses? 	\$0.00

a. According to FEMA statistics as of October 31, 2020

Table 9.6-10. Community Classifications

	Participating?	Classification	Date Classified
Community Rating System	Yes	Class 5	October 20 th 2016
Building Code Effectiveness Grading Schedule	Yes	4/3	3/7/2017
Public Protection	No	-	-
Storm Ready	Yes	-	2018
Firewise	No	-	-

9.6.6 Review and Incorporation of Information for This Annex

The goal of plan integration is to ensure that the potential impact of hazards is considered in planning for future development. FEMA recommends integration as follows:

- Integrate hazard mitigation plan goals with community objectives (e.g. incorporate the goals for risk reduction and safety into the policies of other plans).
- Use the risk assessment to inform plans and policies (e.g. incorporate risk assessment findings into land use plans, site plan review, emergency operations plans).
- Implement mitigation actions through existing mechanisms (e.g. include mitigation projects in the capital improvement plan).
- Think about mitigation before and after a disaster (e.g. build recovery planning on existing mitigation plans and goals).

Existing Integration

- **Capital Improvement Plan** - As of review of this document, hazard mitigation is not considered in the capital improvements plan. Going forward, hazard mitigation could potentially be included in the scoring process.
- **General Plan 2030**—Parker 2035 Master Plan
- **Erosion/Sediment Control Program** - as outlined and enforced by Ch. 13.10.040 for development applications and Ch. 11.10 for unpermitted earth movement

Opportunities for Future Integration

- **Zoning Code**— The Town of Parker is conducting a comprehensive update to its Land Development Ordinance. The opportunity to incorporate additional mitigation and abatement measures will be contemplated for inclusion into the Code. The project is at about its mid-point with a projected completion at the end of 2021
- **Capital Improvement Projects** – Town of Parker Capital improvement project proposals may take into consideration hazard mitigation potential as a means of evaluating project prioritization in the future. As of review of this document, hazard mitigation is not considered in the capital improvement plan. The potential addition of hazard mitigation into the process will be a future committee decision.
- **Post-Disaster Recovery Plan**—Parker does not have a recovery plan and intends to develop one as a mitigation planning action during the next five years. The plan will build on the goals and objectives identified in the mitigation plan.

9.6.7 Jurisdiction-Specific Natural Hazard Event History

Table 9.6-11 lists past occurrences of natural hazards for which specific damage was recorded in the Town of Parker hazard events that broadly affected the entire planning area, including the Town of Parker, are listed in the risk assessments in Volume 1 of this hazard mitigation plan.

Table 9.6-11. Past Natural Hazard Events

Type of Event	FEMA Disaster #	Date	Damage Assessment
Pandemic (COVID-19)	EM-3436/DR-4498	January 20 th 2020- Present	On going

9.6.8 Hazard Risk Ranking

Table 9.6-12 presents a local ranking for the Town of Parker of all hazards of concern for which this hazard mitigation plan provides complete risk assessments. This ranking summarizes how hazards vary for this jurisdiction. As described in detail in Volume 1, the ranking process involves an assessment of the likelihood of occurrence for each hazard, along with its potential impacts on people, property and the economy. Mitigation actions target hazards with high and medium rankings.

Table 9.6-12. Hazard Risk Ranking

Rank	Hazard Type	Risk Rating Score (Probability x Impact)	Category
1	Wildfire	39	High
2	Drought	30	Medium
2	Pandemic	30	Medium
3	Hail	24	Medium
4	Animal Disease	18	Medium

4	Lightning	18	Medium
4	Severe Thunderstorms	18	Medium
4	Severe Winter Storm	18	Medium
4	Transportation Accidents	18	Medium
5	Earthquake	16	Medium
5	Tornadoes	16	Medium
6	Erosion	12	Low
6	Expansive Soils	12	Low
6	Extreme Temperatures	12	Low
6	Flood	12	Low
6	Land Subsidence	12	Low
6	Slope Failure	12	Low
7	Dam and Levee Failure	6	Low
7	Landslide	6	Low

NOTE: The process used to assign risk ratings and rankings for each hazard is described in Volume 1 of this hazard mitigation plan.

9.6.9 Jurisdiction-Specific Vulnerabilities

Volume 1 of this hazard mitigation plan provides complete risk assessments for each identified hazard of concern. This section provides information on key vulnerabilities identified by the jurisdiction. Available jurisdiction-specific risk maps of the hazards are provided at the end of this annex.

Repetitive Loss Properties

Repetitive loss records are as follows:

- Number of FEMA-identified Repetitive-Loss Properties: 0
- Number of FEMA-identified Severe-Repetitive-Loss Properties: 0
- Number of Repetitive-Loss Properties or Severe-Repetitive-Loss Properties that have been mitigated: 0

Other Noted Vulnerabilities

The following jurisdiction-specific issues have been identified based on a review of the results of the risk assessment, public involvement strategy, and other available resources:

- The current master plan does not include goals or strategies that address natural hazards or mitigation actions (PAR2)
- Bank stabilization projects are needed throughout the Town (PAR5)
- Wildfires (PAR4 and PAR6)

9.6.10 Hazard Mitigation Action Plan and Evaluation of Recommended Actions

Table 9.6-13 lists the actions that make up the hazard mitigation action plan for this jurisdiction. Table 9.6-14 identifies the priority for each action. Table 9.6-15 summarizes the mitigation actions by hazard of concern and mitigation type.

Table 9.6-13. Hazard Mitigation Action Plan Matrix

Applies to New or Existing Assets	Objectives Met	Lead Agency	Support Agency	Estimated Cost	Sources of Funding	Timeline ^a
Action PAR1 — Maintain current building codes and adopted new codes as they are implemented						
<u>Hazards Mitigated:</u>	All hazards					
Existing	3, 7, 22	Building Division	Staff and Council	3k-5k	Budget Line	3 yrs
Action PAR2 — Update the Parker 2035 Master Plan to add goals and strategies that further address natural hazards and mitigation						
<u>Hazards Mitigated:</u>	Flooding, Slope Failure, and Drought					
Existing	3, 10, 15	Community Development	Staff	50k	Budget Line	3 yrs
Action PAR3 — Update to Land Development Ordinance to further address and preserve areas of natural hazard and mitigate impact associated with natural hazards and update to landscaping code for more drought tolerant plant materials and design						
<u>Hazards Mitigated:</u>	Flooding, landslide, drought					
Existing	3, 10, 15	Community Development	Staff	50k	Budget Line	2 yrs
Action PAR4 — Development of a coordinated wildfire response within town limits between South Metro Fire and Douglas County OEM						
<u>Hazards Mitigated:</u>	Wildfire					
Existing	1	OEM	Staff/ SMFD/ Douglas OEM	3k	Budget Line	3 yrs
Action PAR5 - Identification of bank stabilization projects in drainage areas throughout town limits (Flood mitigation). Prioritization determined based on yearly evaluations. Current stabilization projects identified include.						
<ul style="list-style-type: none"> • Lemon Gulch (4000') bank stabilization • West Stroh Gulch at Anthology (5,100') bank stabilization • Cherry Creek at Dransfeldt (2,500') bank stabilization • Jordan Tributary (3,600') bank stabilization 						
<u>Hazards Mitigated:</u>	Flooding, Severe Weather					
Existing		Building Division	Staff and Council	\$10,000+	Budget Line; HMGP or FMA grants as available	Within 5 years
Action PAR6 - Parker intends to join the Douglas County Wildfire Partnership (DCWP). The Town of Park along with and various state, federal, NGO, and private stakeholders, will work with the Partnership to assess impact from wildfire; identify opportunities to maintain continuity of operations; and develop a comprehensive mitigation strategy to identify projects that will reduce wildfire risk, increase natural resource protection, encourage the incorporation of wildfire management principles into local planning, land use and building codes, and promote public awareness of wildfire risk. review and implementation.						
<u>Hazards Mitigated:</u>	Wildfire					
Existing	1, 2, 5, 8, 9, 14	CMO	LTPD	Staff Time	Town Budget	Short Term

a. Short-term = Completion within 5 years; Long-term = Completion within 10 years; Ongoing= Continuing new or existing program with no completion date

See the introduction to this volume for list of acronyms used here.

Table 9.6-14. Mitigation Action Priority

Action #	# of Objectives Met	Benefits	Costs	Do Benefits Equal or Exceed Costs?	Is Project Grant-Eligible?	Can Project Be Funded Under Existing Programs/ Budgets?	Implementation Priority ^a	Grant Pursuit Priority ^a
PAR1	3	Low	Low	Yes	No	Yes	Medium	Low
PAR2	3	Medium	Low	Yes	No	Yes	Medium	Low
PAR3	3	Medium	Low	Yes	No	Yes	Medium	Low
PAR4	1	Medium	Low	Yes	No	Yes	Medium	Low

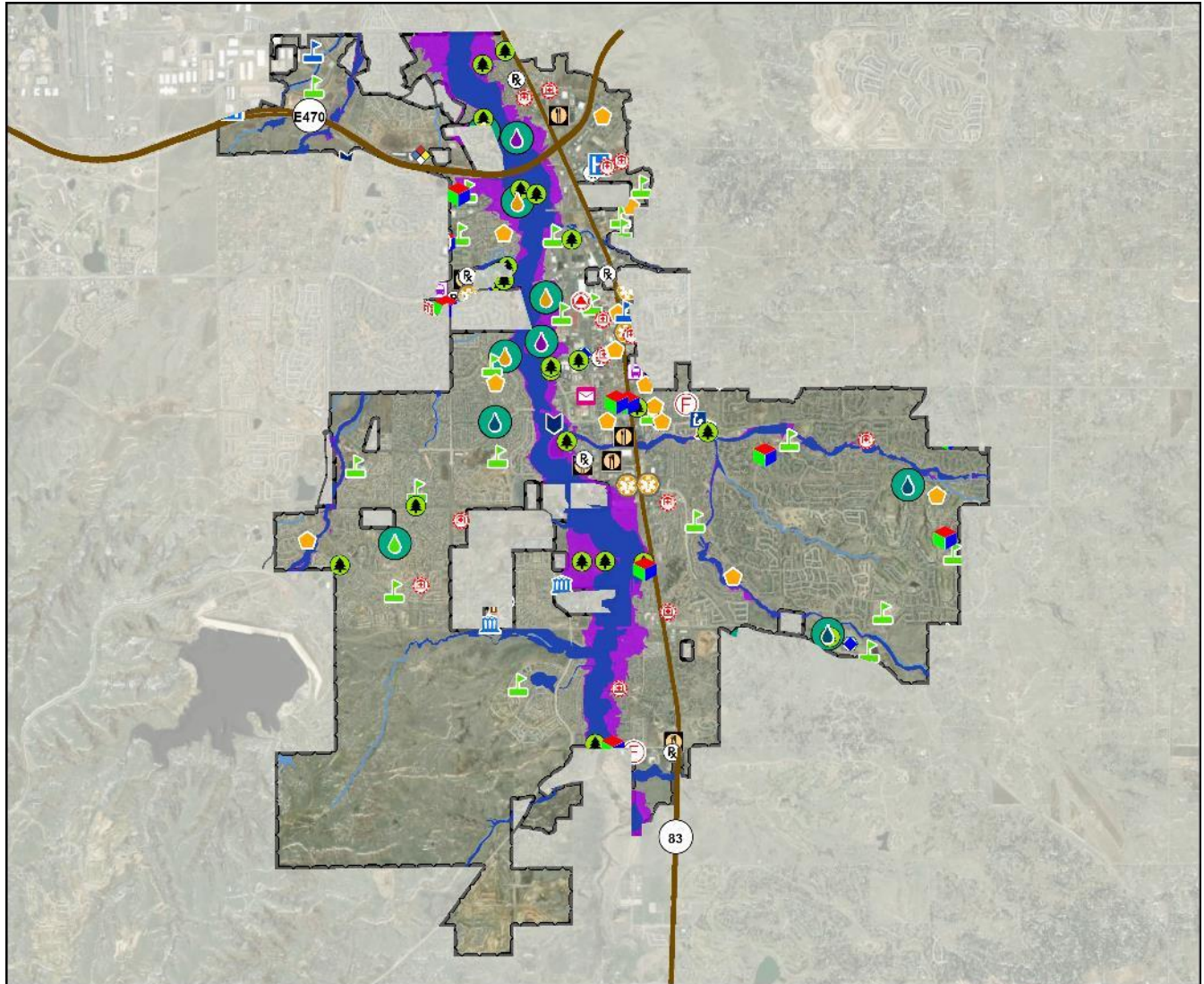
Action #	# of Objectives Met	Benefits	Costs	Do Benefits Equal or Exceed Costs?	Is Project Grant-Eligible?	Can Project Be Funded Under Existing Programs/Budgets?	Implementation Priority ^a	Grant Pursuit Priority ^a
PAR5		Medium	Low	Yes	Yes/No	Yes	Medium	Medium
PAR6	6	Medium	Low	Yes	No	Yes	Medium	Low

a. See the introduction to this volume for explanation of priorities.

Table 9.6-15. Analysis of Mitigation Actions

Hazard Type	Action Addressing Hazard, by Mitigation Type ^a						
	Prevention	Property Protection	Public Education and Awareness	Natural Resource Protection	Emergency Services	Structural Projects	Community Capacity Building
High-Risk Hazards							
Wildfire	PAR2 PAR4 PAR6	PAR6	PAR6	PAR6	PAR4 PAR6		
Medium-Risk Hazards							
Drought	PAR2						
Severe Thunderstorms	PAR1	PAR5			PAR5	PAR5	
Low-Risk Hazards							
Slope Failure	PAR2						
Flood	PAR2						

a. See the introduction to this volume for explanation of mitigation types.



Town of Parker

- | | | |
|---------------------|----------------------------|-------------------------|
| Assisted Living | Hospital | Potable Water Tank |
| Bus Facility | Library | Potable Water Treatment |
| Childcare | Medical Care | Potable Well |
| Dam | Municipal Building | Primary Education |
| EOC | Pharmacy | Recreation Site |
| Fire Station | Police Station | Secondary Education |
| Food Distribution | Polling Site | Shelter |
| Government Building | Post Office | Urgent Care |
| Hazardous Material | Potable Water Lift Station | |
| Interstate | City and Town Boundaries | |
| U.S. Highway | Waterbody | |
| State Highway | | |

The flood hazard area depicted is the September 4, 2020 effective DFIRM.

- Potential New Development**
- 2015-Present
 - Anticipated
- FEMA Flood Hazard Area**
- 1-Percent Annual Chance Flood Event Area
 - 0.2-Percent Annual Chance Flood Event Area
 - Undetermined (Not Analyzed)

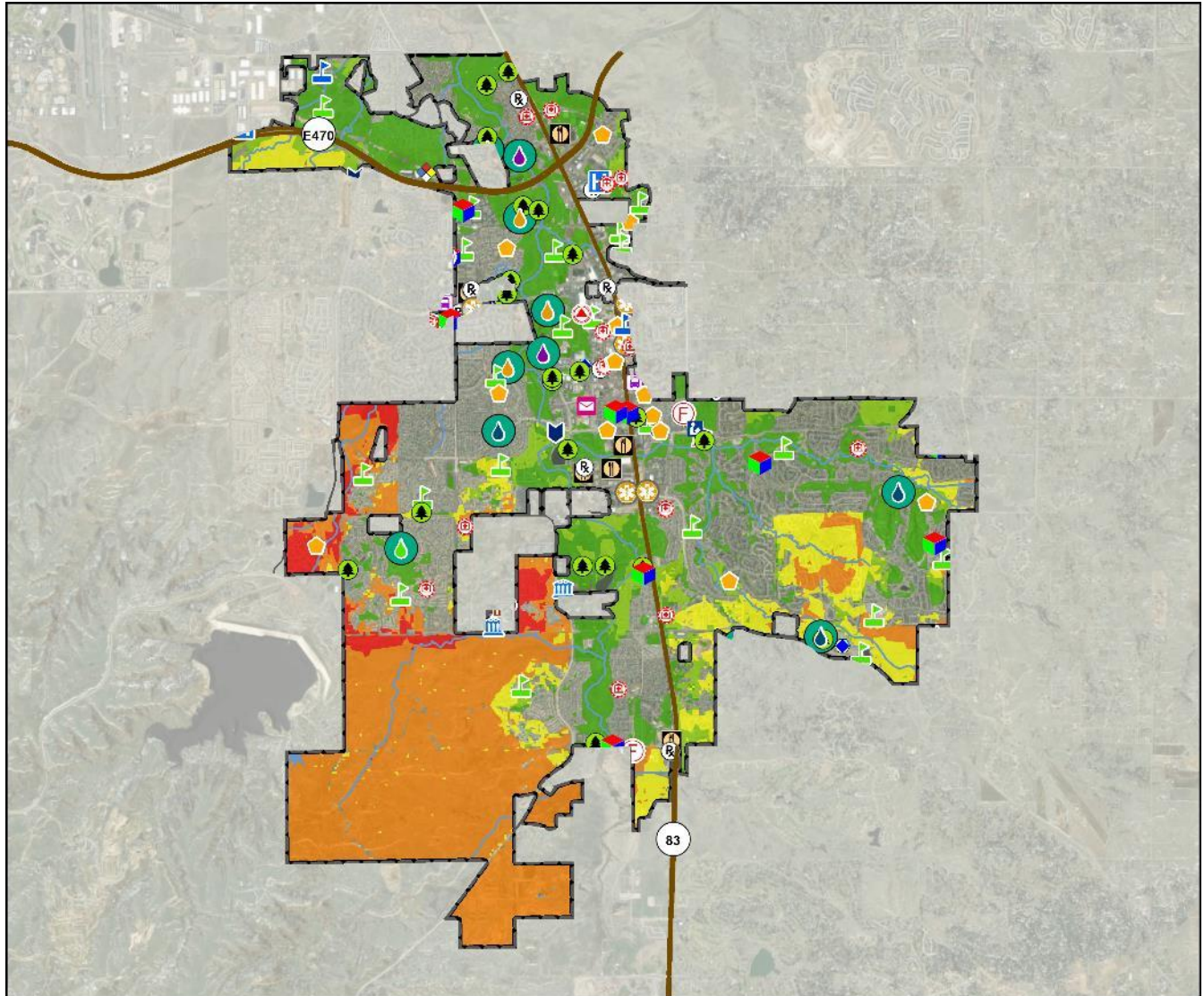
Operated By Water District

- Centennial Water and Sanitation (0)
- Denver Water (0)
- Parker Water & Sanitation (11)



The map and data depicted are considered approximate and suitable for most planning purposes. Mapped hazard areas, geographic boundaries and other features depicted may not absolutely align due to the differing resolution of available data.

Data Sources: DCGIS - 2020; OTIS - n.d.; ESRI - 2002/2020; FEMA 2020



Town of Parker

- | | | |
|---------------------|----------------------------|-------------------------|
| Assisted Living | Hospital | Potable Water Tank |
| Bus Facility | Library | Potable Water Treatment |
| Childcare | Medical Care | Potable Well |
| Dam | Municipal Building | Primary Education |
| EOC | Pharmacy | Recreation Site |
| Fire Station | Police Station | Secondary Education |
| Food Distribution | Polling Site | Shelter |
| Government Building | Post Office | Urgent Care |
| Hazardous Material | Potable Water Lift Station | |
- Interstate City and Town Boundaries
 U.S. Highway Waterbody
 State Highway
- Operated By Water District**
- | | | |
|-------------------------------------|------------------|--------------------------------|
| Centennial Water and Sanitation (0) | Denver Water (0) | Parker Water & Sanitation (11) |
|-------------------------------------|------------------|--------------------------------|

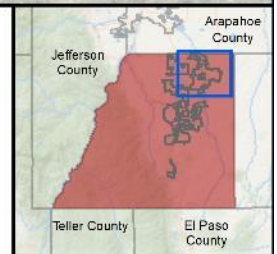
The map and data depicted are considered approximate and suitable for most planning purposes. Mapped hazard areas, geographic boundaries and other features depicted may not absolutely align due to the differing resolution of available data.

Wildfire Risk

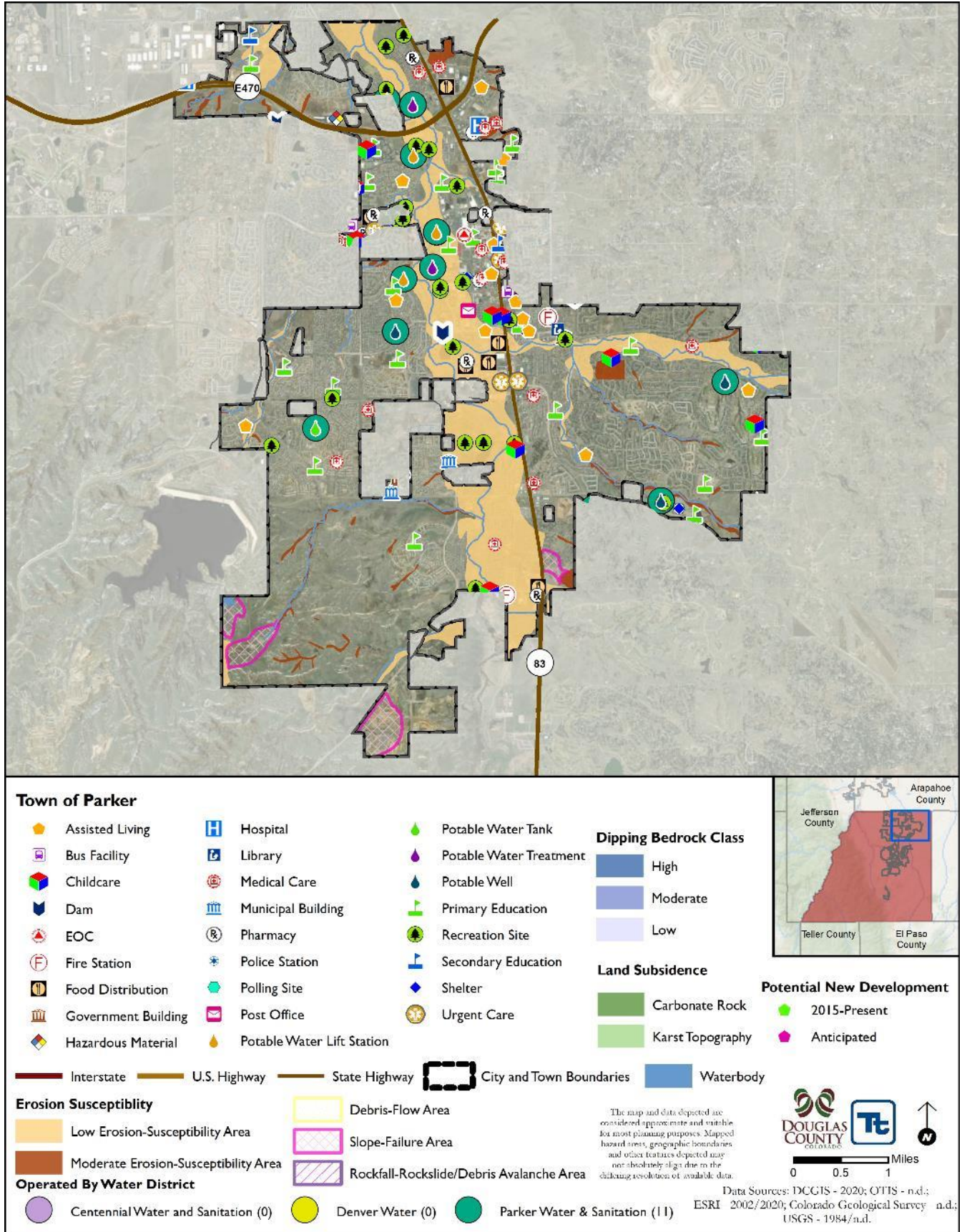
- Highest
- High
- Moderate
- Low
- Lowest

Potential New Development

- 2015-Present
- Anticipated



Data Sources: DCGIS - 2020; OTIS - n.d.; ESRI - 2002/2020; Colorado Forest Atlas - 2017



9.7 CENTENNIAL WATER AND SANITATION DISTRICT

9.7.1 Hazard Mitigation Plan Point of Contact

Primary Point of Contact	Alternate Point of Contact
Jeff Case, Director of Public Works 62 Plaza Drive Highlands Ranch, CO 80129 Telephone: 720-240-4931 E-mail Address: JCase@highlandsranch.org	Emmalyn White, Contract Administrator 62 Plaza Drive Highlands Ranch, CO 80129 Telephone: 303-791-0430 E-mail Address: EWhite@highlandsranch.org

9.7.2 Jurisdiction Profile

Overview

Centennial Water and Sanitation District, a water and sanitation district organized as a political subdivision of the State of Colorado and as a quasi-municipal corporation created pursuant to Title 32, Colorado Revised Statutes, as amended, was organized in 1980. The District provides wholesale water and sewer service to other Colorado special districts within its' service area. These districts in turn retail these services to the ultimate user. Centennial's current full service customers are:

- Highlands Ranch Metropolitan District ("HRMD"). HRMD, the primary customer, provides service to Highlands Ranch, a master planned community in northern Douglas County, Colorado.
- Northern Douglas County Water and Sanitation District ("Northern Douglas") which serves areas in Douglas County adjacent to Highlands Ranch.
- Mirabelle Metropolitan District (Mirabelle) which serves a future community of 1100 homes adjacent to the south property line of Chatfield State Park.
- The service area, which encompasses Highlands Ranch as its primary area as well as small adjacent areas to the east and west, is located in Douglas County, Colorado which is located at the southern edge of the Denver metropolitan area.

The District operates under a Board - General Manager form of government. Policymaking and legislative authority is vested in the Board, which consists of five non-partisan members elected at large. The Board is responsible, among other things, for passing resolutions, adopting the budget, appointing committees and hiring the District's general manager and the District's attorney. Boardmembers are elected to four-year staggered terms with either two or three Board members elected every two years.

The District's primary revenue sources are rates assessed based on water usage and consumption and reserved capacity fees based on tap fees assessed against new property as it is connected. The rates are designed to fund general operation and maintenance expenses, debt service, major repair reserves and portions of the water acquisition program. Reserved capacity fees pay for capital projects. The district does not receive revenue from property tax.

The Centennial Water and Sanitation District assumes responsibility for the adoption of this plan; Centennial Water and Sanitation District will oversee its implementation.

Service Area and Trends

The district serves a population of 100,000. Its service area covers an area of 36 square miles.

Centennial Water and Sanitation District has seen a substantial growth in population over the past 35 years. Centennial serves the planned community of Highlands Ranch and miscellaneous adjacent properties and is approaching full buildout of the community. The service area is a mix of residential and commercial uses along with the associated municipal and service facilities. Growth of the service population should not increase significantly into the future.

Assets

Table 9.7-1 summarizes the critical assets of the district and their value.

Table 9.7-1. Special Purpose District Assets

Asset		Value
Property		
315 acres of land		\$13.7M
Critical Infrastructure and Equipment		
Treatment Plants		\$71.4M
Raw Water Storage and Wells		\$74.8M
Pumping and Water Tanks		\$40.7M
Transmission and Collection Pipelines		\$76.6M
Offices		\$2.4M
<i>Total:</i>		<i>\$279.6M</i>
Critical Facilities	<i>Address</i>	
Joe Blake Water Treatment Plant	Information withheld from public copy of plan.	\$32.1M
Marcy Gulch Wastewater Plant		\$39.3M
Zone 4C Pump Station		\$8.3M
S. Platte Reservoir		\$51.1M
Big Dry Lift Station		\$3.5M
Zone I Water Storage Tanks		\$5.0M
<i>Total:</i>		<i>\$139.3M</i>

9.7.3 Status of Previous Plan Actions

Table 9.7-2 summarizes the actions that were recommended in the previous version of the hazard mitigation plan and their implementation status at the time this update was prepared. Centennial Water and Sanitation did not participate in the prior planning process. As a result, there are no previous plan actions for this update.

Table 9.7-2. Status of Previous Plan Actions

Action Item	Completed	Removed; No Longer Feasible	Carried Over to Plan Update	
			Check if Yes	Enter Action #
No actions	N/A	N/A	N/A	N/A
<i>Comment:</i>				

9.7.4 Capability Assessment

An assessment of the district’s current capabilities was conducted to identify opportunities to expand, initiate or integrate capabilities in order to further hazard mitigation goals and objectives. Where such opportunities were identified and determined to be feasible, they are included in the action plan. The “Analysis of Mitigation Actions” table in Section 1.9 identifies these as community capacity building mitigation actions.

Planning and Regulatory Capabilities

Jurisdictions develop plans and programs and implement rules and regulations to protect and serve residents. When effectively prepared and administered, these plans, programs and regulations can support the implementation of mitigation actions. Table 9.7-3 summarizes existing codes, ordinances, policies, programs or plans that are applicable to this hazard mitigation plan.

Table 9.7-3. Planning and Regulatory Capability

	Date of Most Recent Update	Comment
Highlands Ranch Water and Sewer Standard Specifications	May 2020	Updated As Needed
Comprehensive Annual Financial Report – Through 12/31/19	June 2020	Prepared Annually
Centennial W&S District CityWorks Asset Inventory	Continuous	Includes All Facilities
Colorado Department of Health and Environment Regulations	Continuous	Agency that Enforces Safe Drinking Water Act
Annual Budget and Exhibit B to the Rules and Regulations	Annually	Adoption of Capital Plan & Operational Plan; during the preparation of the annual budget, Centennial will review the current hazard mitigation plan and identify opportunities to implement measures to prevent or mitigate identified risks.
Comprehensive Master Plan	1980 and updated regularly	This master plan created the framework for the infrastructure and services that are the responsibility of the district. As the community has grown, Centennial has prepared detailed studies, specifications, rules and regulations, operational plans and annual reports on the many aspects of providing water and wastewater services.

Fiscal, Administrative and Technical Capabilities

Fiscal capability is an indicator of a jurisdiction’s ability to fulfill the financial needs associated with hazard mitigation projects. An assessment of fiscal capabilities is presented in Table 9.7-4. Administrative and technical capabilities represent a jurisdiction’s staffing resources for carrying out the mitigation strategy. An assessment of administrative and technical capabilities is presented in Table 9.7-5.

Table 9.7-4. Fiscal Capability

Financial Resource	Accessible or Eligible to Use?
Capital Improvements Project Funding	Yes - Centennial has a capital improvements plan that is updated and adopted in July of each year. Information from this plan is then included in the preparation of annual budgets, long range financial planning and adoption of rates and fees.
Authority to Levy Taxes for Specific Purposes	No
User Fees for Water, Sewer, Gas or Electric Service	Yes - Centennial does not charge a stormwater service fee as part of its rate structure, however, the Highlands Ranch Metropolitan District,

Financial Resource	Accessible or Eligible to Use?
	whose boundaries are identical to Centennial's, does charge a stormwater fee. HRMD charges a monthly fee to all properties for costs associated with the maintenance and improvements of drainage channels, including water quality. The residents within Centennial's boundaries are also served by Mile High Flood Control District that provides capital and maintenance funding for drainage channels including Centennial's service area.
Incur Debt through General Obligation Bonds	Yes
Incur Debt through Special Tax Bonds	No
Incur Debt through Private Activity Bonds	No
State-Sponsored Grant Programs	Yes
Development Impact Fees for Homebuyers or Developers	Yes
Federal Grant Programs	Yes
Other	NA

Table 9.7-5. Administrative and Technical Capability

Staff/Personnel Resource	Available?	Department/Agency/Position
Planners or engineers with knowledge of land development and land management practices	Yes	Public Works Engineering
Engineers or professionals trained in building or infrastructure construction practices	Yes	Public Works Engineering
Planners or engineers with an understanding of natural hazards	Yes	Public Works Engineering
Staff with training in benefit/cost analysis	Yes	Public Works Engineering
Surveyors	No	Consultant
Personnel skilled or trained in GIS applications	Yes	Public Works Engineering
Scientist familiar with natural hazards in local area	Yes	Engineering and Operations Staff
Emergency manager	Yes	Public Works Engineering
Grant writers	Yes	Operations/ Regulatory Administrator
Licensed Operators for Water and Wastewater Treatment	Yes	Important Skills for Interim Operations
Resiliency Planner	No	Centennial does not have a full-time resiliency planner; however there is a team consisting of representatives from Public Works, Plant Operations, Collections and Distribution, Finance and IT who meet quarterly for an overall district review in which mitigation concepts and projects are reviewed.

Education and Outreach Capabilities

Outreach and education capability identifies the connection between government and community members, which opens a dialogue needed for a more resilient community. An assessment of education and outreach capabilities is presented in Table 9.7-6.

Table 9.7-6. Education and Outreach

Criterion	Response
Do you have a public information officer or communications office?	Yes
Do you have personnel skilled or trained in website development?	Yes
Do you have hazard mitigation information available on your website?	No
<ul style="list-style-type: none"> If yes, please briefly describe 	
Do you use social media for hazard mitigation education and outreach?	Yes
<ul style="list-style-type: none"> If yes, please briefly describe 	Cemtennialwater.org & Highlands ranch.org

Criterion	Response
Do you have any citizen boards or commissions that address issues related to hazard mitigation? • If yes, please briefly specify	No
Do you have any other programs already in place that could be used to communicate hazard-related information? • If yes, please briefly describe	Yes Websites/Mailers/Eblasts
Do you have any established warning systems for hazard events? • If yes, please briefly describe	No

9.7.5 Review and Incorporation of Resources for This Annex

The goal of plan integration is to ensure that the potential impact of hazards is considered in planning for future development. FEMA recommends integration as follows:

- Integrate hazard mitigation plan goals with community objectives (e.g. incorporate the goals for risk reduction and safety into the policies of other plans).
- Use the risk assessment to inform plans and policies (e.g. incorporate risk assessment findings into land use plans, site plan review, emergency operations plans).
- Implement mitigation actions through existing mechanisms (e.g. include mitigation projects in the capital improvement plan).
- Think about mitigation before and after a disaster (e.g. build recovery planning on existing mitigation plans and goals).

Existing Reports, Plans, Regulatory Tools and Other Resources

The following technical reports, plans, and regulatory mechanisms were reviewed to provide information for this annex.

- Centennial Water and Sanitation District – Comprehensive Annual Financial Report for the Years ending December 31, 2019 and 2018.
- Centennial Water and Sanitation District 2021 Adopted Budget and Rates - adopted December 16, 2020.
- Centennial Water and Sanitation District 2021 Capital Improvement Plan – adopted December 16, 2020.
- Risk and Resiliency Assessment Summary for Centennial Water and Sanitation District 2020
- Staff and Local Stakeholder Involvement in Annex Development
- Water Treatment Plant Forebay Evaluation; Deere & Ault Engineering dated 1/27/20
- **Hazard Mitigation Plan Annex Development Tool-kit**—The tool-kit was used to support the development of this annex including past hazard events, noted vulnerabilities, risk ranking and action development.

Existing Integration

- Drought –
 - The Centennial Board of Directors adopted a **Drought Response Plan** on March 29, 2021 for all customers served by Centennial. This extensive plan identifies the key assets of Centennial that are at risk during a drought and establishes criteria for the declaration of different stages

of a drought. These measures are intended to reduce demand within the community while also adding water supply sources that will compensate for the reduction in supply during the drought. This plan has specific actions at each stage of drought for the reduction of demand across all customer classes through voluntary and mandatory restrictions, outdoor irrigation limitations, increased rates and additional enforcement of violations.

- Centennial also has several ongoing programs to offer customers incentives for the conversion of their landscapes to drought tolerant plants, installation of additional low flow fixtures and public outreach programs to encourage conservation. Annual cost \$10,000.
- In order to increase the storage capacity of raw water so that Centennial can mitigate the impacts of drought cycles, an Aquifer Storage and Recovery program was created in 1992 to place potable water into non-tributary wells that may be used when surface reservoirs are at low levels. This program requires the installation of specialized equipment at each well and incurring the cost of treatment for water from which there will not be a near term return of revenue. The specialized equipment requires replacement every 8-10 years and Centennial averages one replacement per year at a cost of \$100,000.

9.7.6 Jurisdiction-Specific Natural Hazard Event History

Table 9.7-7 lists past occurrences of natural hazards for which specific damage was recorded Unincorporated Douglas County. Other hazard events that broadly affected the entire planning area, Unincorporated Douglas County, are listed in the risk assessments in Volume 1 of this hazard mitigation plan.

Table 9.7-7. Natural Hazard Events

Type of Event	FEMA Disaster #	Date	Damage Assessment
Pandemic (COVID-19)	EM-3436/DR-4498	January 20 th , 2020 - Present	\$5,000
Chatridge Fire		6/29/20	\$10,000
* Indicates County-wide event			

9.7.7 Hazard Risk Ranking

Table 9.7-8 presents a local ranking for the District of all hazards of concern for which this hazard mitigation plan provides complete risk assessments. This ranking summarizes how hazards vary for this jurisdiction. As described in detail in Volume 1, the ranking process involves an assessment of the likelihood of occurrence for each hazard, along with its potential impacts on people, property and the economy. Mitigation actions target hazards with high and medium rankings.

Table 9.7-8. Hazard Risk Ranking

Rank	Hazard Type	Risk Rating Score (Probability x Impact)	Category
1	Wildfire	30	Medium
2	Drought	18	Medium
2	Severe Winter Storm	18	Medium
3	Transportation Accidents	16	Medium
3	Lightning	16	Low
3	Severe Thunderstorms	16	Low
3	Hail	16	Low
3	Flood	16	Low
3	Extreme Temperatures	16	Low

Rank	Hazard Type	Risk Rating Score (Probability x Impact)	Category
4	Erosion	12	Low
4	Dam and Levee Failure	12	Low
4	Tornadoes	12	Low
4	Pandemic	12	Low
4	Animal Disease	12	Low
4	Earthquake	12	Low
4	Expansive Soils	12	Low
5	Land Subsidence	6	Low
5	Landslide	6	Low
5	Slope Failure	6	Low

NOTE: The process used to assign risk ratings and rankings for each hazard is described in Volume 1 of this hazard mitigation plan.

9.7.8 Jurisdiction-Specific Vulnerabilities

Volume 1 of this hazard mitigation plan provides complete risk assessments for each identified hazard of concern. The following jurisdiction-specific issues have been identified based on a review of the results of the risk assessment, public involvement strategy, and other available resources:

- Centennial has 22 water supply wells located in the southern portion of Highlands Ranch that is designated as open space. These wells provide a significant amount of water production during the summer months (15%-20% of summer demands). This open space reserve is approximately 8000 acres and populated with native grasses, shrubs and trees. This area has experienced major wildland fires with fires that exceed 10 acres occurring every 2-3 years on average. These fires may damage power supply to the wells and also make them inaccessible during the event.
- Centennial relies on its surface water supplies (primarily the South Platte River Basin) for 85% of its water supply annually. Centennial has developed several surface water storage reservoirs over the past 40 years, but is still vulnerable to a drought that lasts 2 years or longer.
- As noted earlier, parts of Centennial’s water supply network are distributed in areas that can be rendered inaccessible during a major blizzard. Treatment and distribution facilities (pump stations, storage tanks) must run 24 hours a day/ 365 days a year. In the event of a major blizzard, staff may be severely limited in mobility and availability. Loss of power at key facilities due to a blizzard is also a matter of concern.
- Centennial has some essential facilities very close to major transportation corridors. McLellan Reservoir, which is located in Arapahoe County and approximately 2000 feet from our Water Treatment Plant is also immediately downstream of C-470, a 6 lane highway that has a portion of it draining into McLellan. There are portions of C-470 that are within 500 feet at the closest point. In the event of a major accident within that basin, McLellan could be at risk of a hazardous materials spill that could contaminate a portion of McLellan. There have been accidents in the past that have resulted in minor spills, but they have been contained by first responders and did not travel down the drainageway to McLellan, but the risk is present.
- Centennial’s Wastewater Treatment Plant is also within 600 feet, at its closest point, to the Union Pacific and Burlington Northern railroad lines which transport a considerable amount of freight regionally. These corridors can be at risk of a derailment and if the cargo is hazardous, the spill could endanger this facility. This could put the staffing of the plant at risk and require shutdown. Centennial has not experienced such a consequential accident, but has had grass fires on the immediate adjacent property from sparks emitted from the trains. The amount of traffic could place Centennial at risk in the future.

Mitigation actions addressing these issues were prioritized for consideration in the action plan presented in Section 1.9.

9.7.9 Hazard Mitigation Action Plan and Evaluation of Recommended Actions

Table 9.7-9 lists the actions that make up the hazard mitigation action plan for this jurisdiction. Table 9.7-10 identifies the priority for each action. Table 9.7-11 summarizes the mitigation actions by hazard of concern and mitigation type.

Table 9.7-9. Hazard Mitigation Action Plan Matrix

Applies to New or Existing Assets	Objectives Met	Lead Agency	Support Agency	Estimated Cost	Sources of Funding	Timeline ^a
Action CWS1 — Upgrade wells to allow emergency generator hook up after fire event						
<u>Hazards Mitigated:</u>	Wildfire damage to well network and loss of overhead power supply lines to existing wells					
New	Quick Recovery	Operations	-	\$75,000	Internal – Rates	Short term
Action CWS2 —Install additional fire hydrants and open water storage vessels (ponds and stock tanks) to aid firefighting						
<u>Hazards Mitigated:</u>	Wildfire damage to well network and loss of overhead power supply lines to existing wells					
New	Reduce Damage	Operations	Public Works	\$50,000	Internal – Rates	Short term
Action CWS3 —Expand water aquifer storage and recovery production into non-tributary wells to increase seasonal storage						
<u>Hazards Mitigated:</u>	Shortage of water supply due to short term and long term drought					
New and Existing	Reduce impact	Operations	Water Resources	\$500,000	Internal – Rates	Long term
Action CWS4 —Provide emergency power generators at all key facilities such as pump stations, lift stations, administration buildings						
<u>Hazards Mitigated:</u>	Loss of power and accessibility at key facilities due to blizzard					
Existing	Provide power	Public Works	Operations	\$500,000	Internal – Rates	Short term
Action CWS5 - An element of normal operations of a water and wastewater utilities is to perform regularly scheduled inspections and preventative maintenance activities of our assets, including major pipelines, pump stations, reservoirs and groundwater wells. As a result of these inspections, the following measures are taken as risks are identified. Pipelines, manholes and vaults that are within the 100 year floodplain are inspected annually or after a major storm event. Those at risk of exposure or loss of structural support are reinforced with concrete caps, cutoff walls across the channel, and installation of 18”-24” fractured stone (rip-rap) across and around the element to protect from erosion.						
<u>Hazards Mitigated:</u>	Flood, Severe Weather					
New and Existing	9, 12, 14, 23	Operations and Public Works	-	\$25,000- \$50,000	FEMA HMGP, FMA Annual Budget	Short Term
Action CWS6 - An element of normal operations of a water and wastewater utilities is to perform regularly scheduled inspections and preventative maintenance activities of our assets, including major pipelines, pump stations, reservoirs and groundwater wells. As a result of these inspections, the following measures are taken as risks are identified. The Joe Blake Water Treatment Plant has a 4 acre raw water storage forebay that includes an earthen embankment that is designated as a jurisdictional dam by the State Engineer. Recent inspections of this project have determined that there is a pipeline and some utility conduits that are within the embankment zone and could compromise the integrity of the dam. Work to remove this risk from the embankment zone and install replacement lines is under design and a contract to make these changes is anticipated in 2022.						
<u>Hazards Mitigated:</u>	Flood, Severe Weather					
New and Existing	9, 12, 14, 23	Operations and Public Works	-	\$400,000	FEMA HMGP, FMA Annual Budget	Short Term
Action CWS7 - All District well sites that are not located in developed neighborhoods are at risk of serious damage or being disabled by wildfires that can occur almost any year. Each well site has monthly mowing operations to reduce fuel loads in the						

Applies to New or Existing Assets	Objectives Met	Lead Agency	Support Agency	Estimated Cost	Sources of Funding	Timeline ^a
immediate vicinity of the well site. The operational area of the well site that contains electrical cabinets, controls, and wellhead assets are surrounded by large gravel to eliminate the growth of grasses and shrubs which can provide fuel for a wildfire.						
<u>Hazards Mitigated:</u>	Wildfire					
Existing	9, 12, 14, 23	Operations and Public Works	-	\$10,000/annually	Annual Budget	Ongoing
Action CWS8 - Centennial intends to join the Douglas County Wildfire Partnership (DCWP). Centennial along with South Metro Fire Rescue and various state, federal, NGO, and private stakeholders, and will work with the Partnership to assess impact from wildfire; identify opportunities to maintain continuity of operations; and develop a comprehensive mitigation strategy to identify projects that will reduce wildfire risk, increase natural resource protection, encourage the incorporation of wildfire management principles into local planning, land use and building codes, and promote public awareness of wildfire risk.						
<u>Hazards Mitigated:</u>	Wildfire					
Existing	1, 2, 5, 8, 9, 14	Operations and Public Works	-	Staff Time	Annual Budget	Short Term

a. Short-term = Completion within 5 years; Long-term = Completion within 10 years; Ongoing= Continuing new or existing program with no completion date
See the introduction to this volume for list of acronyms used here.

Table 9.7-10. Mitigation Action Priority

Action #	# of Objectives Met	Benefits	Costs	Do Benefits Equal or Exceed Costs?	Is Project Grant-Eligible?	Can Project Be Funded Under Existing Programs/Budgets?	Implementation Priority ^a	Grant Pursuit Priority ^a
CWS1	2	High	Medium	Yes	No	Yes	High	Low
CWS2	2	Medium	Low	Yes	No	Yes	Medium	Low
CWS3	2	Medium	High	No	No	Yes	low	Low
CWS4	2	Medium	Medium	Yes	No	Yes	Medium	Low
CWS5	4	Medium	Low-Medium	Yes	Yes	Yes	Medium	Medium
CWS6	4	Medium	Low-Medium	Yes	Yes	Yes	Medium	Medium
CWS7	4	Medium	Low	Yes	No	Yes	Medium	Low
CWS8	6	Medium	Low	Yes	No	Yes	High	Low

a. See the introduction to this volume for explanation of priorities.

Table 9.7-11. Analysis of Mitigation Actions

Hazard Type	Prevention	Action Addressing Hazard, by Mitigation Type ^a					Community Capacity Building
		Property Protection	Public Education and Awareness	Natural Resource Protection	Emergency Services	Structural Projects	
Medium-Risk Hazards							
Wildland Fire	CWS1, 2, 7, 8	CWS2, 7, 8	CWS8	CWS2, 7, 8	CWS1, 7, 8	CWS1,2, 7	CWS1,2, 7, 8
Drought	CWS1,3			CWS1,3,3			CWS1,3

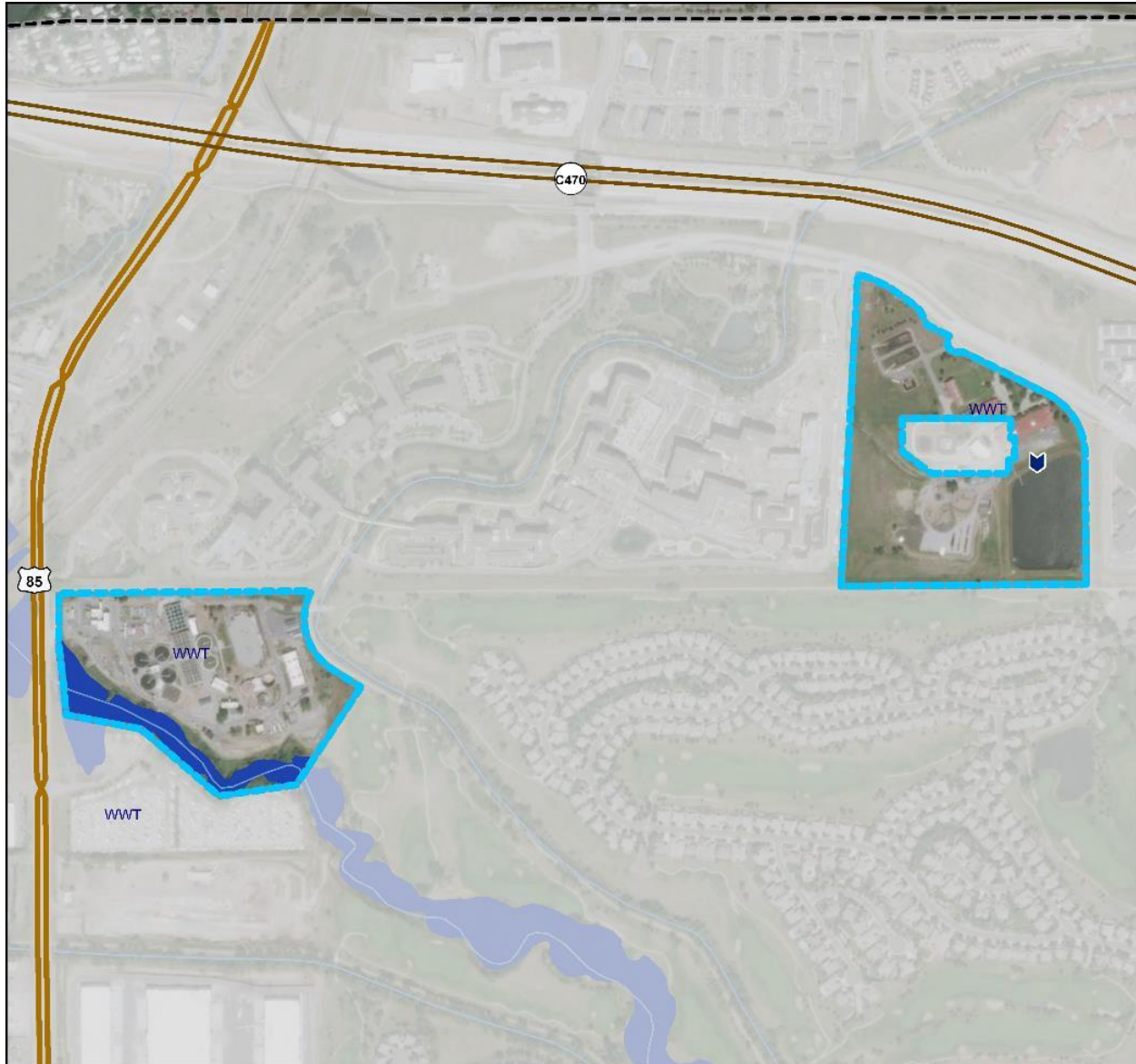
Hazard Type	Action Addressing Hazard, by Mitigation Type ^a						
	Prevention	Property Protection	Public Education and Awareness	Natural Resource Protection	Emergency Services	Structural Projects	Community Capacity Building
Severe Winter Weather		CWS4			CWS4	CWS4	CWS4
Transportation Accidents	-	-	-	-	-	-	-
Low-Risk Hazards							
Lightning	-	-	-	-	-	-	-
Severe Thunderstorms	CWS5, 6	CWS5, 6			CWS5, 6		
Hail	-	-	-	-	-	-	-
Flood	CWS5, 6	CWS5, 6			CWS5, 6		
Extreme Temperatures	-	-	-	-	-	-	-
Erosion	-	-	-	-	-	-	-
Dam and Levee Failure	-	-	-	-	-	-	-
Tornadoes	-	-	-	-	-	-	-
Pandemic	-	-	-	-	-	-	-
Animal Disease	-	-	-	-	-	-	-
Earthquake	-	-	-	-	-	-	-
Expansive Soils	-	-	-	-	-	-	-
Land Subsidence	-	-	-	-	-	-	-
Landslide	-	-	-	-	-	-	-
Slope Failure	-	-	-	-	-	-	-

a. See the introduction to this volume for explanation of mitigation types.

9.7.10 Review and Incorporation of Resources for This Annex

Staff and Local Stakeholder Involvement in Annex Development




This annex was developed over the course of several months with a review of material from different areas of tasks including operations, budgeting, and the planning sectors. Information was gathered to contribute to the development of the annex, material was reviewed, and collaborated to use the most vital details for the annex. Discussions were held to identify the capability assessment, planning initiatives, hazard assessment and ranking, and future action plans. Once actions had been identified and compiled in the annex, the draft was circulated for review, comments, and adjustments.









Centennial Water Sanitation District

-  Dam
- WWT** Wastewater Treatment

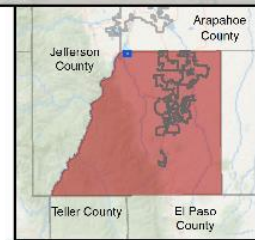
FEMA Flood Hazard Area

-  1-Percent Annual Chance Flood Event Area
-  0.2-Percent Annual Chance Flood Event Area
-  Undetermined (Not Analyzed)

The flood hazard area depicted is the September 4, 2020 effective DFIRM.

-  Interstate
-  U.S. Highway
-  State Highway
-  City and Town Boundaries
-  Water District
-  Waterbody

The map and data depicted are considered approximate and suitable for most planning purposes. Mapped features, geographic boundaries and other features depicted may not be absolute a sign due to the differing resolution of available data.



Data Sources: DCGIS - 2020; OTIS - n.d.; ESRI - 2002/2020; FEMA 2020





9.8 DENVER WATER

9.8.1 Hazard Mitigation Plan Point of Contact

Primary Point of Contact	Alternate Point of Contact
Becky Franco, Emergency Management Manager 1600 W. 12 th Ave. Denver, CO 80204 Telephone: 303-250-1575 cell / 303-607-3160 office E-mail Address: Rebecca.Franco@denverwater.org	Jason Taussig, Director EMSS 1600 W. 12 th Ave. Denver, CO 80204 Telephone: 303.229.1206cell / 303-628-6517 office E-mail Address: Lisa.Ciazza@denverwater.org

9.8.2 Jurisdiction Profile

Overview

Denver Water is an independent, autonomous and non-political agency of the City and County of Denver, organized and existing under the home rule charter of the City. Denver Water is the State’s oldest and largest water utility, established in 1918. It is funded by water rates and new tap fees, as opposed to taxes. Denver Water is run by a five-member Board of Water Commissioners. A designated CEO/Manager is appointed by the Board to execute its policies and orders.

Denver Water owns property and operates water collection facilities throughout the state of Colorado, However, in Douglas County, Denver Water owns critical infrastructure which is part of the Denver Water collection system. Portions of Douglas County receive Denver Water via our distributor agreements. Refer to the countywide maps in Chapter 3 and in Douglas County’s annex (Section 9.1).

The Denver Water Board of Commissioners assumes responsibility for the adoption of this plan; Denver Water Emergency Management will oversee its implementation via the existing Denver Water structure.

Service Area and Trends

The district serves a population of 1.5 million people. Denver Water serves Denver and its surrounding suburbs. The majority of Denver Water’s water comes from rivers and streams fed by mountain snowmelt. The South Platte River, Blue River, Williams Fork River and Fraser River watersheds are Denver Water’s primary water sources, but it also uses water from the South Boulder Creek, Ralston Creek and Bear Creek watersheds.

Denver Water serves about a quarter of the state's population but uses less than two percent of all water, treated and untreated, in Colorado.

- General Service Area Map <https://www.denverwater.org/sites/default/files/2017-05/Service%20Area%20General.pdf>
- Service Area Map – Municipalities <https://www.denverwater.org/sites/default/files/2017-05/Service%20Area%20Map%20-%20Municipalities.pdf>

Assets

Table 9.8-1 summarizes the critical assets of the district and their value.

Table 9.8-1. Special Purpose District Assets

Asset	Value
Property	
60K acres – watershed - undeveloped	N/A
Critical Infrastructure and Equipment	
Cheesman Dam and Reservoir*	\$ 25,743,987.72
Cheesman Dam Valve House	\$ 350,362.61
Conduit 20 Diversion Dam* (Marston Intake Dam)	\$ 6,572,922.93
Conduit 26	\$ 21,525,375.21
Foothills Spray Application Pump Station	\$4,208,547.37
Foothills Treatment Plant	\$103,071,864.8
Foothills Overflow Holding Pond	\$ 20,461,238.21
High Line Canal Diversion Dam	\$ 2,457,824.54
High Line Canal Waterton Canyon‡	\$ 1,778,902.34
Lone Tree Pump Station	\$ 1,605,777.18
Lone Tree Treated Reservoir No. 1	\$ 6,219,469.82
Lone Tree Treated Reservoir No. 2	\$ 8,048,129.47
Platte Canyon Dam and Reservoir	\$4,425,956.1
Strontia Springs Dam and Reservoir*	\$ 28,685,222.64
Total:	\$ 235,155,580.94

9.8.3 Status of Previous Plan Actions

Table 9.8-2 summarizes the actions that were recommended in the previous version of the hazard mitigation plan and their implementation status at the time this update was prepared.

Table 9.8-2. Status of Previous Plan Actions

Action Item	Completed	Removed; No Longer Feasible	Carried Over to Plan Update	
			Check if Yes	Enter Action #
Watershed Protection: Continue with the watershed protection plan with United State Forest Service (USFS). This project entails forest hazardous fuels reduction in the Pike National Forest and is based on contract acreage with the USFS. The Pike National Forest includes Jefferson, Douglas, Teller and Park counties. There will be over 25,000 acres treated in this project.	Continuous		x	1
Comment:				
Training/exercising at Foothills Treatment Plant and Strontia Springs Dam: Roll out emergency response plan training and conduct tabletop and functional exercises with local first response agencies at the Foothills treatment plant.	Continuous		x	4
Comment:				
Public Education and Outreach: Continue with public education and outreach efforts on dam safety, water conservation, drought, etc. Producing presentations, brochures, etc.	Continuous		x	5
Comment:				
Sediment removal from Strontia Springs Dam: Flush sediment from the reservoir. Sediment run-off due to several major forest fires followed by regular storm events has caused a build-up of sediment within the reservoir. Continued sediment inflow without a plan to remove it efficiently can become a long-term Dam Safety and Operational issue if the sediment plume reaches the dam.	Continuous	Remove	NO	3
Comment:				

Action Item	Completed	Removed; No Longer Feasible	Carried Over to Plan Update	
			Check if Yes	Enter Action #
Post Fire Plan Denver Water would like to increase preparedness for the post-fire recovery process in the watershed. This plan would include recommendations based on the watershed area for infrastructure and water supply protection in Denver Water’s watersheds.	New		x	6
Comment:				

9.8.4 Capability Assessment

An assessment of the district’s current capabilities was conducted to identify opportunities to expand, initiate or integrate capabilities in order to further hazard mitigation goals and objectives. Where such opportunities were identified and determined to be feasible, they are included in the action plan. The “Analysis of Mitigation Actions” table in Section 1.10 identifies these as community capacity building mitigation actions.

Planning and Regulatory Capabilities

Jurisdictions develop plans and programs and implement rules and regulations to protect and serve residents. When effectively prepared and administered, these plans, programs and regulations can support the implementation of mitigation actions. Table 9.8-3 summarizes existing codes, ordinances, policies, programs or plans that are applicable to this hazard mitigation plan.

Table 9.8-3. Planning and Regulatory Capability

	Date of Most Recent Update	Comment
Engineering Standards	5/2020	Engineering Standards
FERC Regulations for Hydro Dams	7/2015	FERC Regulations for Hydro Dams
State Engineering Regulation for State Dams	1/2020	State Engineering Regulation for State Dams
EPA AWIA Regulations for Treatment Plants	1/2018	EPA AWIA Regulations for Treatment Plants
Integrated Resource Plan (IRP)	-	The Denver Water Integrated Resource Plan (IRP) is an adaptive plan to meet our customers’ water needs for the next 50 years. Through a cross-divisional, cutting-edge process, we continue in our legacy to proactively plan for the future. The IRP provides the necessary strategic framework to address important long-term questions

Fiscal, Administrative and Technical Capabilities

Fiscal capability is an indicator of a jurisdiction’s ability to fulfill the financial needs associated with hazard mitigation projects. An assessment of fiscal capabilities is presented in Table 9.8-4. Administrative and technical capabilities represent a jurisdiction’s staffing resources for carrying out the mitigation strategy. An assessment of administrative and technical capabilities is presented in Table 9.8-5.

Table 9.8-4. Fiscal Capability

Financial Resource	Accessible or Eligible to Use?
Capital Improvements Project Funding	Yes – Denver Water has a comprehensive capital improvement plan in place

Financial Resource	Accessible or Eligible to Use?
Authority to Levy Taxes for Specific Purposes	Yes – Water rates only; Denver Water is not responsible for stormwater
User Fees for Water, Sewer, Gas or Electric Service	Yes
Incur Debt through General Obligation Bonds	Yes
Incur Debt through Special Tax Bonds	No
Incur Debt through Private Activity Bonds	No
State-Sponsored Grant Programs	Yes
Development Impact Fees for Homebuyers or Developers	No
Federal Grant Programs	Yes
Other	N/A

Table 9.8-5. Administrative and Technical Capability

Staff/Personnel Resource	Available?	Department/Agency/Position
Planners or engineers with knowledge of land development and land management practices	NA	-
Engineers or professionals trained in building or infrastructure construction practices	Yes	Engineering
Planners or engineers with an understanding of natural hazards	Yes	Planning
Staff with training in benefit/cost analysis	Yes	Finance
Surveyors	Yes	Engineering
Personnel skilled or trained in GIS applications	Yes	GIS
Scientist familiar with natural hazards in local area	Yes	Planning
Emergency manager	Yes	Emergency Management
Grant writers	No	
Other	No	-

Education and Outreach Capabilities

Outreach and education capability identifies the connection between government and community members, which opens a dialogue needed for a more resilient community. An assessment of education and outreach capabilities is presented in Table 9.8-6.

Table 9.8-6. Education and Outreach

Criterion	Response
Do you have a public information officer or communications office?	Yes
Do you have personnel skilled or trained in website development?	Yes
Do you have hazard mitigation information available on your website? <ul style="list-style-type: none"> If yes, please briefly describe 	Yes - For internal planning usage only.
Do you use social media for hazard mitigation education and outreach? <ul style="list-style-type: none"> If yes, please briefly describe 	No
Do you have any citizen boards or commissions that address issues related to hazard mitigation? <ul style="list-style-type: none"> If yes, please briefly specify 	No
Do you have any other programs already in place that could be used to communicate hazard-related information? <ul style="list-style-type: none"> If yes, please briefly describe 	No
Do you have any established warning systems for hazard events? <ul style="list-style-type: none"> If yes, please briefly describe 	Yes - Internal systems only

9.8.5 Review and Incorporation of Resources for This Annex

The goal of plan integration is to ensure that the potential impact of hazards is considered in planning for future development. FEMA recommends integration as follows:

- Integrate hazard mitigation plan goals with community objectives (e.g. incorporate the goals for risk reduction and safety into the policies of other plans).
- Use the risk assessment to inform plans and policies (e.g. incorporate risk assessment findings into land use plans, site plan review, emergency operations plans).
- Implement mitigation actions through existing mechanisms (e.g. include mitigation projects in the capital improvement plan).
- Think about mitigation before and after a disaster (e.g. build recovery planning on existing mitigation plans and goals).

Existing Reports, Plans, Regulatory Tools and Other Resources

The following technical reports, plans, and regulatory mechanisms were reviewed to provide information for this annex.

- **Hazard Mitigation Plan Annex Development Tool-kit**—The tool-kit was used to support the development of this annex including past hazard events, noted vulnerabilities, risk ranking and action development.
- The **Denver Water Integrated Resource Plan (IRP)** is an adaptive plan to meet our customers' water needs for the next 50 years. Through a cross-divisional, cutting-edge process, we continue in our legacy to proactively plan for the future. The IRP provides the necessary strategic framework to address important long-term questions
- **Sustainability Program** - Under Environmental Stewardship, Denver Water conducts the following:
 - Best practices and compliance with environmental requirements - Denver Water will comply with all applicable environmental laws, regulations and standards, and will develop and adhere to environmental best practices and performance standards to achieve environmental sustainability beyond minimum legal requirements.
 - Leading by example - Denver Water will be a leader and engage with environmental communities, government, industry and academic research agencies to learn and further develop the environmental stewardship programs and share our experience and expertise. We will develop progressive positions on evolving environmental issues impacting the interests of the organization and our customers.
 - Healthy built environment - Denver Water is committed to workforce safety, health, wellness and quality of work life through buildings and grounds integrated with the natural environment and promotion of indoor environmental quality.
 - Responsible operations - Denver Water is committed to the responsible management and sustainable growth and operation of all our assets. We recognize the impacts to the environment from our operations and will take active measures to minimize this footprint. Denver Water will continue to improve environmental best practice standards and will include such standards in procurement and contract processes. Employees will work to recognize and resolve environmental impacts within Denver Water facilities, operations and policies.
 - Waste diversion and pollution prevention - Denver Water is steadfast in our commitment to responsible solid and electronic waste management. This includes reuse, recycling and compost programs, and the careful and proper use, tracking, storage and disposal of hazardous materials.

- Climate adaptation and mitigation - Denver Water is a nationally recognized leader in understanding and preparing for the complex challenges of climate change. A multi-faceted approach focuses on partnerships, knowledge generation and transfer, research, long-range planning and operationalizing adaptation practices across the organization. Denver Water will minimize our own climate impacts by measuring and tracking goals for the reduction of climate changing emissions, including updating an annual greenhouse gas inventory and incorporating climate adaptation and mitigation into current and future operations, plans and policies.
- Environmental management system - Annually, and considering internal and external stakeholder input, the environmental compliance section will conduct a review of the environmental management system and Denver Water's compliance. The environmental compliance section will recommend changes in Denver Water's operations to achieve better environmental performance.
- Environmental education and awareness – New employee orientation will include a review of the commitments, related policies, introduction to the environmental management system and best sustainability practices.

Existing Integration

- Emergency Management – we follow FEMA CPG planning guidelines, EPA Water/Waste Water Planning, FERC/State Engineering Requirements (See how our plans are fully integrated to support our water operations in attachment). Master plans include the EOP, COOP, Crisis Communications, Safety and Security Plan (all developed under designated regs/requirements)
- Resiliency Planner – we have a Certified Business Continuity Planner (CBCP) under EM that developed the COOP plans. The COOP plans have been tested for the past five years and went into full operational mode in 3/2020 due to Covid all without water interruption.
 - Denver Water also has watershed scientists who work on their watershed management programs. Due to the fires from 2020, our focus for 2021 in these burn areas will be the debris impact/sediment management.
 - Cyber Security SMEs on board – Denver Water participated in regional Cyber Security exercises and continue to build out this capability.
 - Drought Planners on board – manage/maintain the drought plan
- Lead Reduction Program - <https://www.denverwater.org/your-water/water-quality/lead/lead-service-lines>

Opportunities for Future Integration

- Denver Water follows EPA AWIA processes. During scheduled updates of plans, Denver Water will review the current hazard mitigation plan and integrate portions of the plan where applicable.

9.8.6 Hazard Risk Ranking

Table 9.8-7 presents a local ranking for Denver Water of all hazards of concern for which this hazard mitigation plan provides complete risk assessments. This ranking summarizes how hazards vary for this jurisdiction. As described in detail in Volume 1, the ranking process involves an assessment of the likelihood of occurrence for each hazard, along with its potential impacts on people, property and the economy. Mitigation actions target hazards with high and medium rankings.

Denver Water utilizes their own internal risk management threat assessment. We have contingency plans to respond to various types of hazards that could impact our water system.

Table 9.8-7. Hazard Risk Ranking

Rank	Hazard Type	Risk Rating Score (Probability x Impact)	Category
1	Wildfire	30	Medium
2	Drought	18	Medium
2	Severe Winter Storm	18	Medium
3	Hazardous Materials	16	Low
3	Lightning	16	Low
3	Severe Thunderstorms	16	Low
3	Hail	16	Low
3	Flood	16	Low
3	Extreme Temperatures	16	Low
4	Erosion	12	Low
4	Dam and Levee Failure	12	Low
4	Tornadoes	12	Low
4	Pandemic	12	Low
4	Animal Disease	12	Low
4	Earthquake	12	Low
4	Expansive Soils	12	Low
5	Land Subsidence	6	Low
5	Landslide	6	Low
5	Slope Failure	6	Low

9.8.7 Jurisdiction-Specific Vulnerabilities

Other Noted Vulnerabilities

- Flood, Drought, Severe Weather - Working to identify ways to reduce sediment transport to Strontia Springs Reservoir, which provides drinking water to parts of Douglas County (DW-1).
- All Hazards - Need to increase training and education for Denver Water employees (DW-4)
- Wildfire - Watersheds and the numerous associated reservoirs in the county could be significantly impacted by high severity wildfire, which could have cascading impacts on water quality and Denver Water infrastructure. For example, the damage to Strontia Springs Reservoir caused by siltation from the 1996 Buffalo Creek Fire took fifteen years to complete and cost Denver Water over \$30 million (DW-2, 3).

9.8.8 Hazard Mitigation Action Plan and Evaluation of Recommended Actions

Table 9.7-9 lists the actions that make up the hazard mitigation action plan for this jurisdiction. Table 9.7-10 identifies the priority for each action. Table 9.7-11 summarizes the mitigation actions by hazard of concern and mitigation type.

Table 9.8-8. Hazard Mitigation Action Plan Matrix

Applies to New or Existing Assets	Objectives Met	Lead Agency	Support Agency	Estimated Cost	Sources of Funding	Timeline ^a
Action DW-1: Watershed Sediment Protection Plan: Denver Water is developing a sustainable watershed sediment management plan to explore partnerships and identify projects that reduce sediment transport to Strontia Springs Reservoir. The focus area for projects in Douglas County will be the watersheds draining to the South Platte upstream of Strontia Springs Reservoir and below Cheesman Reservoir.						
<u>Hazards Mitigated:</u>						
Existing	3, 7, 18, 20	Denver Water	-	\$220,000	Denver Water	Ongoing
Action DW2: Denver Water intends to join the Douglas County Wildfire Partnership (DCWP). Denver Water and various state, federal, NGO, and private stakeholders, and will work with the Partnership to assess impact from wildfire; identify opportunities to maintain continuity of operations; and develop a comprehensive mitigation strategy to identify projects that will reduce wildfire risk, increase natural resource protection, encourage the incorporation of wildfire management principles into local planning, land use and building codes, and promote public awareness of wildfire risk.						
<u>Hazards Mitigated:</u>						
Existing	1, 2, 5, 8, 9, 14	Denver Water	-	Staff Time	Denver Water	Short Term
Action DW-3: Proactive Forest Management (From Forests to Faucets Program and DW Forest and Land Management Services Agreement) - Continue proactive forest management with the United States Forest Service (USFS), Colorado State Forest Service (CSFS), and the Natural Resources Conservation Service (NRCS). This project entails forest hazardous fuels reduction on the Arapaho National Forest, private properties, and Denver Water property to advance wildfire risk reduction.(Watershed Protection Program: Forest to Faucets).						
<u>Hazards Mitigated:</u>						
N/A	2, 5, 7, 10, 15	Denver Water	U.S. Forest Service, Colorado State Forest Service, and the Natural Resources Conservation Service.	\$2 million	Denver Water, USFS, CSFS, and NRCS	2023
Action DW-4: Training & Exercise Program - Denver Water is a complex water system that falls under several federal/state regulating agencies all with differing requirements, training, qualifications, and exercise requirements etc. Denver Water has eight divisions all focusing on their specified requirements. Our Training and exercise program interfaces with local emergency management, LEPCs, and regional planning efforts to ensure that training and exercise efforts by/between the water agency is occurring with local first responders.						
<u>Hazards Mitigated:</u>						
N/A	2, 5, 10, 15	Denver Water	N/A	\$40,000	Denver Water	Ongoing
Action DW-5: Public Education and Outreach - Denver Water is a complex water system that falls under several federal/state regulating agencies all with differing requirements, training, qualifications, and exercise requirements etc. Denver Water has eight divisions all focusing on their specified requirements. Our External Affairs division is responsible for interfacing with the local entities for media, public affairs, stakeholder relations and crisis management coordination.						
<u>Hazards Mitigated:</u>						
N/A	2, 5, 10, 15	Denver Water	N/A	N/A	Denver Water	Ongoing
Action DW-6: Post Fire Plan - Denver Water would like to increase preparedness for the post-fire recovery process in the watershed. This plan would include recommendations based on the watershed area for infrastructure and water supply protection in Denver Water’s watersheds.						
<u>Hazards Mitigated:</u>						
Existing	1, 2, 8, 9	Denver Water	N/A	Low	Denver Water	Ongoing

a. Short-term = Completion within 5 years; Long-term = Completion within 10 years; Ongoing= Continuing new or existing program with no completion date

See the introduction to this volume for list of acronyms used here.

Table 9.8-9. Mitigation Action Priority

Action #	# of Objectives Met	Benefits	Costs	Do Benefits Equal or Exceed Costs?	Is Project Grant-Eligible?	Can Project Be Funded Under Existing Programs/Budgets?	Implementation Priority ^a	Grant Pursuit Priority ^a
DW-1	4	High	Low	Yes	Yes	Yes	High	High
DW-2	6	Medium	Low	Yes	No	Yes	High	Low
DW-3	5	Medium	High	Yes	Yes	Yes	High	High
DW-4	4	High	Low	Yes	No	Yes	Low	Low
DW-5	4	Medium	Medium	Yes	No	Yes	Low	Low
DW-6	4	High	Low	Yes	Yes	Yes	High	High

a. See the introduction to this volume for explanation of priorities.

Table 9.8-10. Analysis of Mitigation Actions

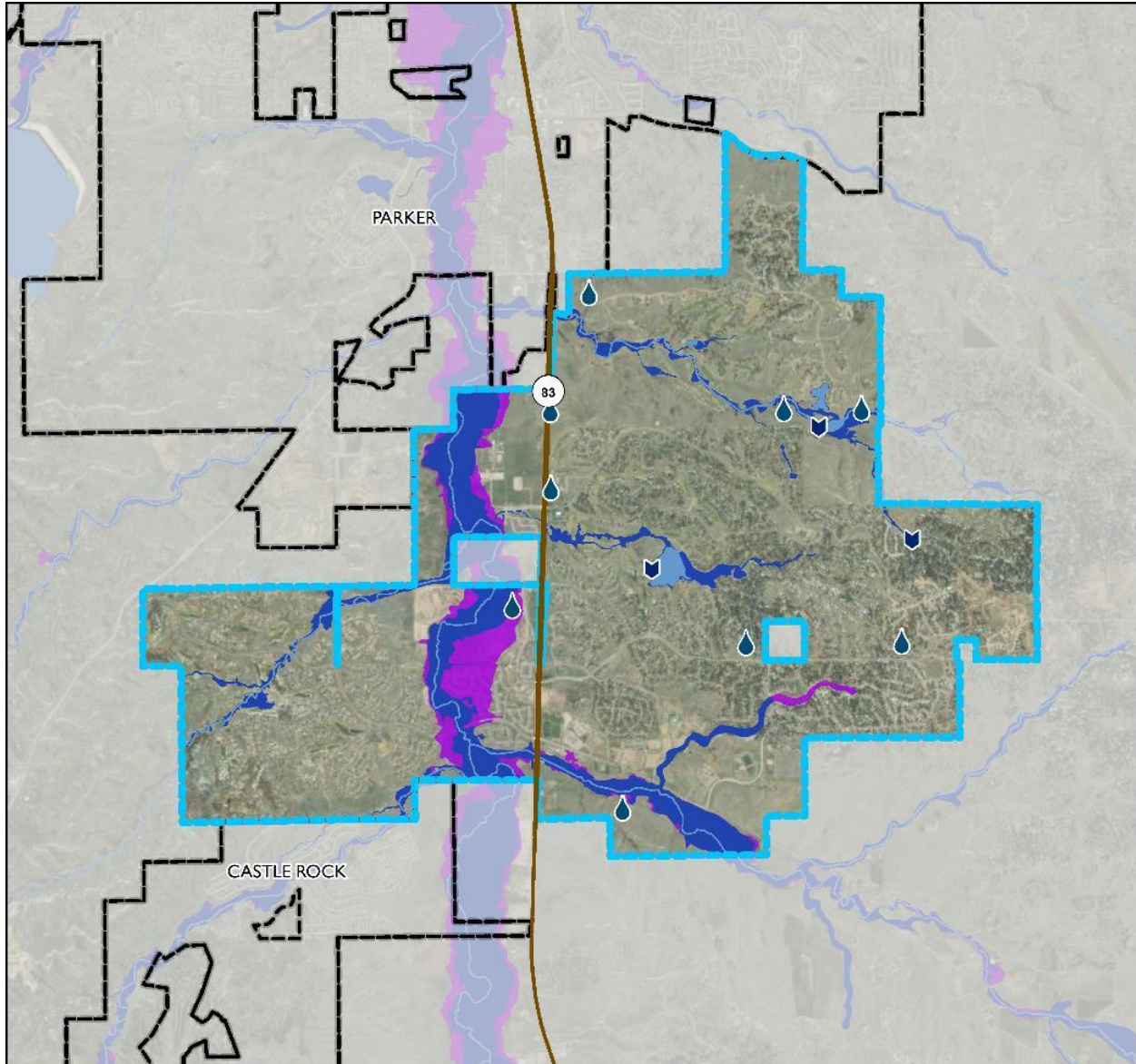
Hazard Type	Action Addressing Hazard, by Mitigation Type ^a						
	Prevention	Property Protection	Public Education and Awareness	Natural Resource Protection	Emergency Services	Structural Projects	Community Capacity Building
Medium-Risk Hazards							
Wildfire	DW-1; DW-2; DW-3; DW-4; DW-5; DW-6	DW-2 and 3	DW-4; DW-5	DW-2 and 3; DW-6	DW-2		DW-2; DW-6
Drought	DW-1; DW-4; DW-5	DW-1; DW-4; DW-5	DW-1; DW-4; DW-5		DW-1; DW-4; DW-5		DW-1; DW-4; DW-5
Low-Risk Hazards							
Dam and Levee Failure	DW-4; DW-5	DW-4; DW-5	DW-4; DW-5		DW-4; DW-5		DW-4; DW-5
Severe Thunderstorms	DW-4; DW-5	DW-4; DW-5	DW-4; DW-5		DW-4; DW-5		DW-4; DW-5
Severe Winter Weather	DW-4; DW-5	DW-4; DW-5	DW-4; DW-5		DW-4; DW-5		DW-4; DW-5

a. See the introduction to this volume for explanation of mitigation types.

9.8.9 Review and Incorporation of Resources for This Annex

Staff and Local Stakeholder Involvement in Annex Development




This annex was developed over the course of several months with a review of material from different areas of tasks including operations, budgeting, and the planning sectors. Information was gathered to contribute to the development of the annex, material was reviewed, and collaborated to use the most vital details for the annex. Discussions were held to identify the capability assessment, planning initiatives, hazard assessment and ranking, and future action plans. Once actions had been identified and compiled in the annex, the draft was circulated for review, comments, and adjustments.









Denver Water District

-  Dam
-  Potable Well

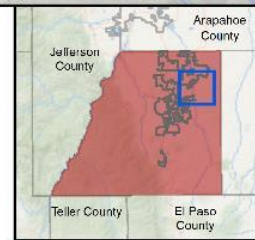
FEMA Flood Hazard Area

-  1-Percent Annual Chance Flood Event Area
-  0.2-Percent Annual Chance Flood Event Area
-  Undetermined (Not Analyzed)

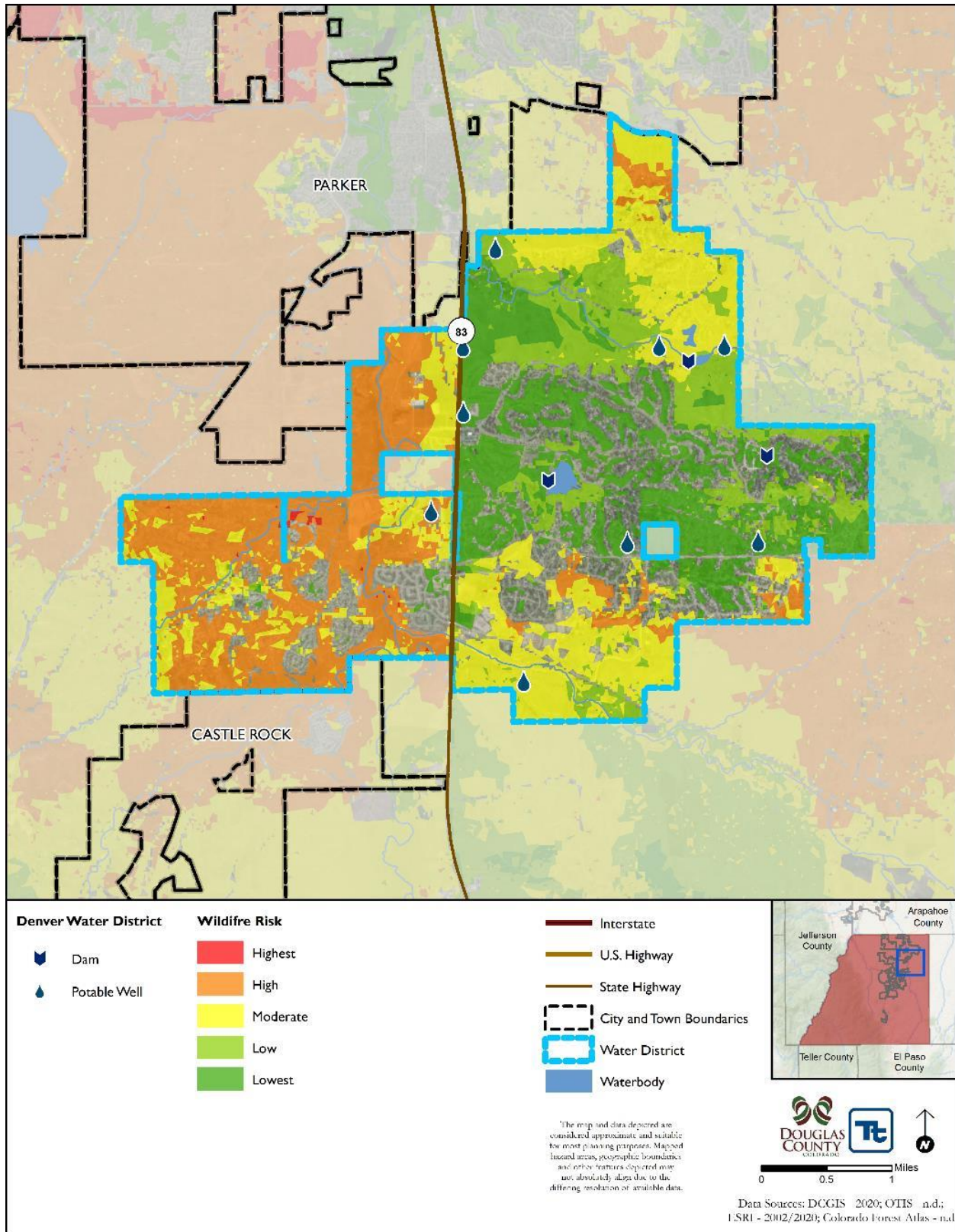
The flood hazard area depicted is the September 4, 2020 effective DFIRM.

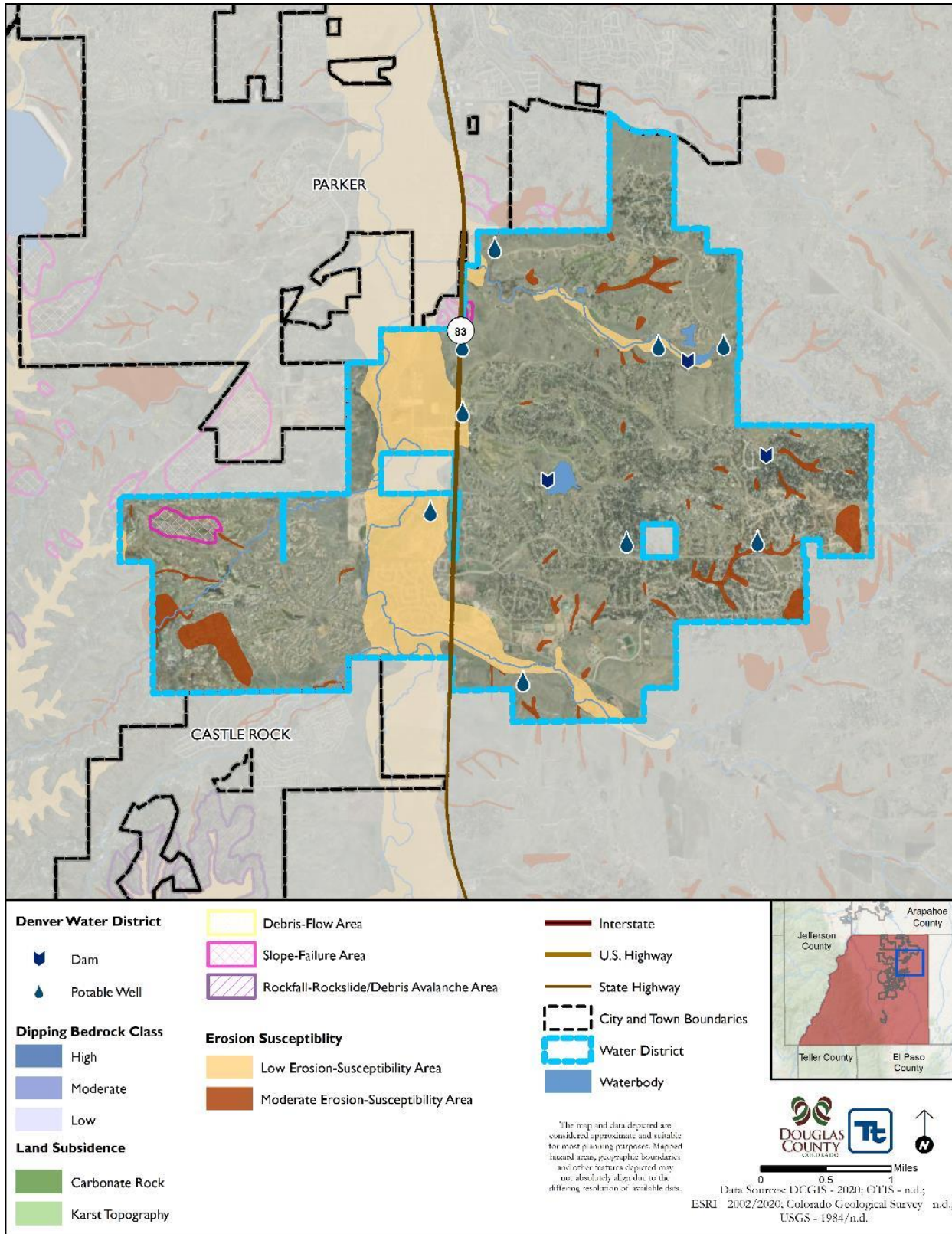
-  Interstate
-  U.S. Highway
-  State Highway
-  City and Town Boundaries
-  Water District
-  Waterbody

The map and data depicted are considered approximate and suitable for most planning purposes. Mapped features, geographic boundaries and other features depicted may not be absolute or accurate due to the differing resolution of available data.



Data Sources: DCGIS - 2020; OTIS - n.d.; ESRI - 2002/2020; FEMA 2020





9.9 MILE HIGH FLOOD CONTROL DISTRICT

The Mile High Flood Control District did not participate in the 2021 plan update. The District can seek inclusion in the plan pursuant to the Linkage Procedures in Appendix H.

9.10 PARKER WATER SANITATION DISTRICT

9.10.1 Hazard Mitigation Plan Point of Contact

Primary Point of Contact	Alternate Point of Contact
Angelo Carrieri, Safety & Security Manager 18100 E. Woodman Drive Parker, CO 80134 Telephone: 303-842-4257 E-mail Address: acarrieri@pwsd.org	Ron Redd, District Manager 18100 E. Woodman Drive Parker, CO 80134 Telephone: 303-841-4627 E-mail Address: rredd@pwsd.org

9.10.2 Jurisdiction Profile

Overview

The Parker Water & Sanitation District is a special district created in 1962 to provide water and sewer service to the Town of Parker and unincorporated areas. The District's designated service area expanded throughout the years to include Lone Tree, Castle Pines and Parker. A five-member elected Board of Directors governs the District. As of August 28, 2020, the District serves 17,485 water connections and 16,874 sewer connections, with a current staff of 103. Funding comes primarily through rates, tap fees, and revenue bonds.

The Board assumes responsibility for the adoption of this plan; the District Manager will oversee its implementation.

Service Area and Trends

The district serves a population of 56,000. Its service area covers an area of 43.5 square miles. Residential and Commercial services are increasing at 4% per year

Assets

Table 9.10-1 summarizes the critical assets of the district and their value.

Table 9.10-1. Special Purpose District Assets

Asset		Value
Property		
The acreage of land value is covered in the Critical Facilities values.		See facility values
Critical Infrastructure and Equipment		
Total miles of distribution piping (342 miles)		\$ 288,921,600
Total miles of collections piping (249 miles)		\$210,355,200
16 Emergency Generators located at critical facilities		\$ 4,020,000
Rueter Hess Reservoir and Dam		\$ 246,425,760
<i>Total:</i>		\$ 749,722,560
Critical Facilities	<i>Address</i>	
Rueter Hess Water Purification Facilities	Information removed from public plan.	\$ 66,914,400
Regional Well House/Pump Station		\$ 22,034,8800
Rueter Hess Well House		\$ 9,313,920
South Water Reclamation Facility		\$ 22,181,600
North Water Reclamation Facility		\$ 96,647,840

Asset	Value
Hess Tank	\$ 3,534,720
Bradbury Tank	\$ 4,933,000
Butterfield Tank	\$ 448,000
Crestview Tank	\$ 169,120
Singing Hills tank	\$ 3,277,120
Clarke Farms Lift station	\$ 1,004,640
Lincoln Meadows Lift station	\$ 463,680
Challenger Park Lift Station	\$ 948,640
Cottonwood South Lift station	\$ 629,440
Sierra Ridge Lift station	\$ 1,079,680
Newlin Lift station	\$ 5,111,165
West Newlin Lift station	\$ 5,111,165
Reata North Well House	\$ 7,669,760
Parker Ridge Well House	\$ 4,539,360
<i>Total:</i>	<i>\$ 256,012,730</i>

9.10.3 Status of Previous Plan Actions

Table 9.10-2 summarizes the actions that were recommended in the previous version of the hazard mitigation plan and their implementation status at the time this update was prepared. Parker Water was not involved in previous years. No previous plans exist.

Table 9.10-2. Status of Previous Plan Actions

Action Item	Completed	Removed; No Longer Feasible	Carried Over to Plan Update Check if Yes Enter Action #
No prior actions.			
Comment:			

9.10.4 Capability Assessment

An assessment of the district’s current capabilities was conducted to identify opportunities to expand, initiate or integrate capabilities in order to further hazard mitigation goals and objectives. Where such opportunities were identified and determined to be feasible, they are included in the action plan. The “Analysis of Mitigation Actions” table in Section 9.10.9 identifies these as community capacity building mitigation actions.

Planning and Regulatory Capabilities

Jurisdictions develop plans and programs and implement rules and regulations to protect and serve residents. When effectively prepared and administered, these plans, programs and regulations can support the implementation of mitigation actions. Table 9.10-3 summarizes existing codes, ordinances, policies, programs or plans that are applicable to this hazard mitigation plan.

Table 9.10-3. Planning and Regulatory Capability

	Date of Most Recent Update	Comment
PWSD Emergency Response Plan	2018	Reviewed every 2 years; during the review, PWSD incorporates the HMP as applicable
PWSD Emergency Action Plan – Rueter Hess Reservoir	2019	Reviewed every 2 years
PWSD Physical Security Master Plan	2018	Reviewed every 2 years
PWSD Rules & Regulations	2020	Annual Review
PWSD Water and Wastewater Master Plan	2020	Reviewed every 3 years
Environmental, Regulatory and Legislative Strategies	2020	Annual review, support/advisors from Brownstein Hyatt Farber Schreck
PWSD Master Plan	2020	-
PWSD Facilities Master Plan	2020	-

Fiscal, Administrative and Technical Capabilities

Fiscal capability is an indicator of a jurisdiction’s ability to fulfill the financial needs associated with hazard mitigation projects. An assessment of fiscal capabilities is presented in Table 9.10-4. Administrative and technical capabilities represent a jurisdiction’s staffing resources for carrying out the mitigation strategy. An assessment of administrative and technical capabilities is presented in Table 9.10-5.

Table 9.10-4. Fiscal Capability

Financial Resource	Accessible or Eligible to Use?
Capital Improvements Project Funding	Yes – the current HMP is incorporated in to PWSD’s 10-year Capital Improvement Plan
Authority to Levy Taxes for Specific Purposes	Yes
User Fees for Water, Sewer, Gas or Electric Service	Yes – for water; stormwater is done through the Town of Parker
Incur Debt through General Obligation Bonds	Yes
Incur Debt through Special Tax Bonds	Yes
Incur Debt through Private Activity Bonds	Yes
State-Sponsored Grant Programs	Yes
Development Impact Fees for Homebuyers or Developers	Yes
Federal Grant Programs	Yes
Other	Yes. “The District has the ability to take advantage of grants through FEMA and The Colorado Special Districts Fund for qualified expenses”

Table 9.10-5. Administrative and Technical Capability

Staff/Personnel Resource	Available?	Department/Agency/Position
Planners or engineers with knowledge of land development and land management practices	Yes	Engineering department (Engineers with knowledge in planning, engineering technicians who perform development review)
Engineers or professionals trained in building or infrastructure construction practices	Yes	Engineering department (Construction inspectors)
Planners or engineers with an understanding of natural hazards	Yes	Engineering department (Engineers with knowledge of dam safety)
Staff with training in benefit/cost analysis	Yes	Finance department(?)
Surveyors	No	N/A
Personnel skilled or trained in GIS applications	Yes	Engineering department (GIS coordinator, GIS analyst)
Scientist familiar with natural hazards in local area	No	N/A
Emergency manager	Yes	Emergency Preparedness Committee
Grant writers	No	N/A

Staff/Personnel Resource	Available?	Department/Agency/Position
Other	N/A	N/A

Education and Outreach Capabilities

Outreach and education capability identifies the connection between government and community members, which opens a dialogue needed for a more resilient community. An assessment of education and outreach capabilities is presented in Table 9.10-6.

Table 9.10-6. Education and Outreach

Criterion	Response
Do you have a public information officer or communications office?	Yes
Do you have personnel skilled or trained in website development?	Yes
Do you have hazard mitigation information available on your website?	No
If yes, please briefly describe	
Do you use social media for hazard mitigation education and outreach?	Yes
If yes, please briefly describe	We use social media as a tool to communicate with the public about potential hazards on an as-needed basis. Our communications channels include Twitter, Facebook and Nextdoor.
Do you have any citizen boards or commissions that address issues related to hazard mitigation?	No
If yes, please briefly specify	
Do you have any other programs already in place that could be used to communicate hazard-related information?	Yes
If yes, please briefly describe	Reverse 911 is available as needed.
Do you have any established warning systems for hazard events?	Yes
If yes, please briefly describe	We will use social media and reverse 911 if an event requires public notification.

9.10.5 Review and Incorporation of Resources for This Annex

Existing Reports, Plans, Regulatory Tools and Other Resources

The following technical reports, plans, and regulatory mechanisms were reviewed to provide information for this annex.

- **Hazard Mitigation Plan Annex Development Tool-kit**—The tool-kit was used to support the development of this annex including past hazard events, noted vulnerabilities, risk ranking and action development.
- **Capital Improvement Projects** – PWSD is currently working on four projects:
 - Cheery Creek Interceptor
 - North Water Reclamation Facility
 - Water Purification Facility Residuals Ponds Expansion
 - Long-Term Water Supply Plan
- **2018 Rueter-Hess Reservoir Watershed Management Plan** – the purpose of this plan is to server as a comprehensive plan of action for achieving high level of water quality in the Rueter-Hess Reservoir.

Existing Integration

PWSD conducts the following:

- Mitigation of vegetation is conducted regularly by our District Services Department to include grasses, trees, bushes, etc.
- Structural inspections are conducted every five years or after any significant weather event (or other) in the area.
- Access to all sites is maintained regularly – pavement, road base, grating, plowing, etc.
- Capital purchases of generators in 2021/2022 for high priority locations (major producers and pumping stations)
- Generator hook up equipment being installed over the next 5 years. To enable immediate “plug in” of a generator to power the location
- Dams
 - The Rueter-Hess Dam is inspected by PWSD staff monthly and the state dam engineer conducts a comprehensive inspection annually. Vegetation and animal control is also conducted regularly. PWSD conducts continuous monitoring of the dam’s integrity is done using piezometers, crack and joint measuring devices, weir boxes for seepage, etc.
 - Twice a year measurements are taken and compared using inclinometers, PWSD also has a yearly first order survey – highest accuracy survey – dam/tower/terminal building (includes the top of the dam, water side slope, upstream slope, spillway, elevation, position, density, etc.).
 - The EAP for the dam is reviewed each year for POCs, action items, procedures, and regulation updates.

Staff and Local Stakeholder Involvement in Annex Development

This annex was developed with input from many district departments including operations, finance, and engineering. Each department was met with to discuss information required. Each provided information which has been included in this annex. No previous action plan exists since Parker Water & Sanitation is just joining this plan. Any follow up or action requirements will be presented through the proper channels within Parker Water’s managers and directors.

9.10.6 Jurisdiction-Specific Natural Hazard Event History

Table 9.10-7 lists past occurrences of natural hazards for which specific damage was recorded Unincorporated Douglas County. Other hazard events that broadly affected the entire planning area, Unincorporated Douglas County, are listed in the risk assessments in Volume 1 of this hazard mitigation plan.

Table 9.10-7. Natural Hazard Events

Type of Event	FEMA Disaster #	Date	Damage Assessment
Pandemic (COVID-19)	EM-3436/DR-4498	January 20 th , 2020 - Present	\$106,000.00

COVID-19 Impacts

Parker Water and Sanitation was impacted by COVID-19 and experienced losses totaling \$106,000 due to expenses for virus contact mitigation, including disinfecting efforts, material supplies, modification of work spaces, labor, infection testing, and lost time by employees.

9.10.7 Jurisdiction-Specific Vulnerabilities

Other Noted Vulnerabilities

The following jurisdiction-specific issues have been identified based on a review of the results of the risk assessment, public involvement strategy, and other available resources:

- Lack of backup power for several critical facilities owned by PWS (PWS1, PWS2, PWS3, PWS4, and PWS5).
- Need to identify different ways to enable water delivery from northeastern Colorado to the Town of Parker (PWS6).

9.10.8 Hazard Risk Ranking

Table 9.10-8 presents a local ranking for Park Water Sanitation District of all hazards of concern for which this hazard mitigation plan provides complete risk assessments. This ranking summarizes how hazards vary for this jurisdiction. As described in detail in Volume 1, the ranking process involves an assessment of the likelihood of occurrence for each hazard, along with its potential impacts on people, property and the economy. Mitigation actions target hazards with high and medium rankings.

Table 9.10-8. Hazard Risk Ranking

Rank	Hazard Type	Risk Rating Score (Probability x Impact)	Category
1	Wildfire	48	High
2	Drought	30	Medium
2	Pandemic	30	Medium
3	Hail	24	Medium
4	Animal Disease	18	Medium
4	Lightning	18	Medium
4	Severe Thunderstorms	18	Medium
4	Severe Winter Storm	18	Medium
4	Transportation Accidents	18	Medium
5	Earthquake	16	Medium
5	Tornadoes	16	Medium
6	Erosion	12	Low
6	Expansive Soils	12	Low
6	Extreme Temperatures	12	Low
6	Flood	12	Low
6	Land Subsidence	12	Low
6	Landslide	12	Low
6	Slope Failure	12	Low
7	Dam and Levee Failure	6	Low

9.10.9 Hazard Mitigation Action Plan and Evaluation of Recommended Actions

Table 9.10-9 lists the actions that make up the hazard mitigation action plan for this jurisdiction. Table 9.10-10 identifies the priority for each action. Table 9.10-11 summarizes the mitigation actions by hazard of concern and mitigation type.

Table 9.10-9. Hazard Mitigation Action Plan Matrix

Applies to New or Existing Assets	Objectives Met	Lead Agency	Support Agency	Estimated Cost	Sources of Funding	Timeline ^a
Action PWS1 — Install emergency generator connections and power transfer switches in Canyons and Ridgegate Well Houses.						
Hazards Mitigated:	Enable to connect portable generators to mitigate the loss of power causing loss of water production, distribution and treatment.					
New	#13, #15	PWSD Engineering	PWSD Maintenance	>\$365K	Capital budgeting within PWSD	Short term
Action PWS2 — Install generator(s) for backup power at Rueter Hess Well House and Canyons Pump Station.						
Hazards Mitigated:	Loss of power causing loss of water production, distribution and treatment.					
Existing	#13, #15	PWSD Engineering	PWSD Maintenance	>\$1.25m	Capital budgeting within PWSD	Short term
Action PWS3 — Install generator(s) for backup power at Regional Pump Station and Reata Well House.						
Hazards Mitigated:	Loss of power causing loss of water production, distribution and treatment.					
Existing	#13, #15	PWSD Engineering	PWSD Maintenance	>\$2.0m	Capital budgeting within PWSD	Short term
Action PWS4 — Install generator(s) for backup power at Parker North and Rowley Downs.						
Hazards Mitigated:	Loss of power causing loss of water production, distribution and treatment.					
Existing	#13, #15	PWSD Engineering	PWSD Maintenance	<\$1.0m	Capital budgeting within PWSD	Short term
Action PWS5 — Install emergency generator connections and power transfer switches in Parker Ridge and Clarke Farms Well Houses.						
Hazards Mitigated:	Enable to connect portable generators to mitigate the loss of power causing loss of water production, distribution and treatment.					
Existing	#13, #15	PWSD Engineering	PWSD Maintenance	>\$365K	Capital budgeting within PWSD	Short term
Action PWS6 — Conduct a feasibility study to determine ways to enable bringing water from Northeastern Colorado to Parker. Once study is complete, PWSD will determine the best solutions and implement those projects.						
Hazards Mitigated:	Drought causing water supply loss locally within Parker Water’s District.					
New	#2, #7, #13, #15	PWSD Engineering	Private Engineering TBD	\$100,000 for the study	Bonds, levies, loans, capital budgeting	Long term
Action PWS7 - PWSD intends to join the Douglas County Wildfire Partnership (DCWP). PWSD and various state, federal, NGO, and private stakeholders, and will work with the Partnership to assess impact from wildfire; identify opportunities to maintain continuity of operations; and develop a comprehensive mitigation strategy to identify projects that will reduce wildfire risk, increase natural resource protection, encourage the incorporation of wildfire management principles into local planning, land use and building codes, and promote public awareness of wildfire risk.						
<u>Hazards Mitigated:</u>	Wildfire					
Existing	1, 2, 5, 8, 9, 14	Operations and Public Works	-	Staff Time	Annual Budget	Short Term

a. Short-term = Completion within 5 years; Long-term = Completion within 10 years; Ongoing = Continuing new or existing program with no completion date

See the introduction to this volume for list of acronyms used here.

Table 9.10-10. Mitigation Action Priority

Action #	# of Objectives Met	Benefits	Costs	Do Benefits Equal or Exceed Costs?	Is Project Grant-Eligible?	Can Project Be Funded Under Existing Programs/Budgets?	Implementation Priority ^a	Grant Pursuit Priority ^a
PWS1	2	Medium	Low	Yes	No	Yes	Medium	Low
PWS2	2	High	Medium	Yes	No	Yes	Medium	Low
PWS3	2	High	Medium	Yes	No	Yes	Medium	Low
PWS4	2	High	Medium	Yes	No	Yes	Medium	Low
PWS5	2	Medium	Low	Yes	No	Yes	Low	Low
PWS6	4	High	High	Yes	No	No	Medium	Low
PWS7	6	Medium	Low	Yes	No	Yes	High	Low

a. See the introduction to this volume for explanation of priorities.

Table 9.10-11. Analysis of Mitigation Actions

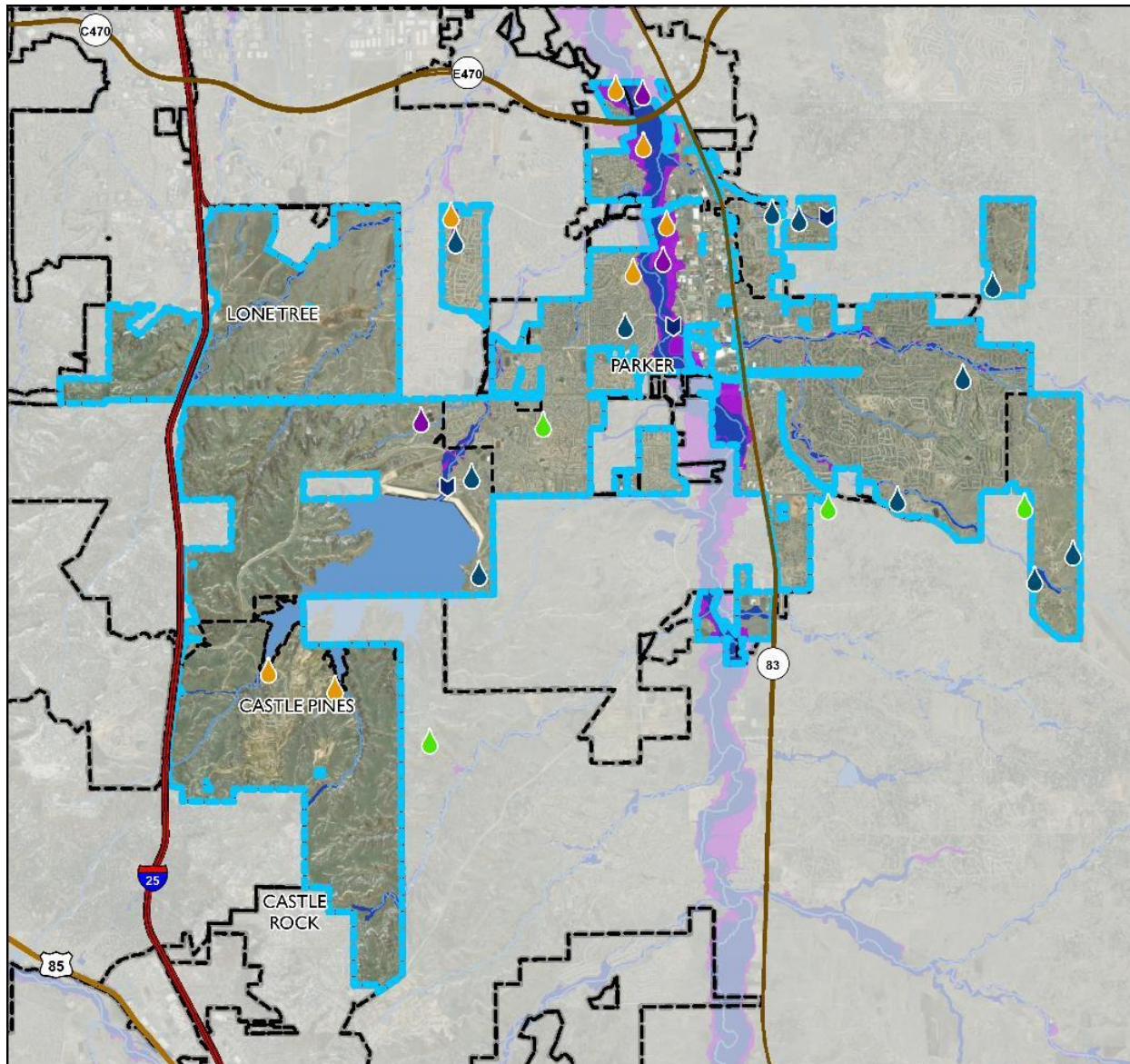
Hazard Type	Action Addressing Hazard, by Mitigation Type ^a						
	Prevention	Property Protection	Public Education and Awareness	Natural Resource Protection	Emergency Services	Structural Projects	Community Capacity Building
High-Risk Hazards							
Wildfire	PWS-1,2,3,4,5, 7	PWS-7	PWS-7	PWS-7	PWS – 1 thru 7	-	PWS-7
Low-Risk Hazards							
Erosion	-	-	-	-	-	-	-
Expansive Soils	-	-	-	-	-	-	-
Extreme Temperatures	-	-	-	-	-	-	-
Flood	PWS-1,2,3,4,5	-	-	-	PWS – 1 thru 6	-	-
Land Subsidence	-	-	-	-	-	-	-
Landslide	-	-	-	-	-	-	-
Slope Failure	-	-	-	-	-	-	-
Dam and Levee Failure	-	-	-	-	-	-	-
Medium-Risk Hazards							
Drought	PWS – 1 thru 6	PWS – 6	-	PWS – 6	PWS – 1 thru 6	PWS – 6	-
Pandemic	-	-	-	-	-	-	-
Hail	-	-	-	-	-	-	-
Animal Disease	-	-	-	-	-	-	-
Lightning	PWS-1,2,3,4,5	-	-	-	PWS – 1 thru 6	-	-
Severe Thunderstorms	PWS-1,2,3,4,5	-	-	-	PWS – 1, 2, 3, 4, 5	PWS – 1, 5	-
Severe Winter Storm	PWS-1,2,3,4,5	-	-	-	PWS – 1 thru 6	-	-
Transportation Accidents	-	-	-	-	-	-	-
Earthquake	-	-	-	-	-	-	-
Tornadoes	-	-	-	-	-	-	-

a. See the introduction to this volume for explanation of mitigation types.

9.10.10 Review and Incorporation of Resources for This Annex

Staff and Local Stakeholder Involvement in Annex Development

This annex was developed over the course of several months with a review of material from different areas of tasks including operations, budgeting, and the planning sectors. Information was gathered to contribute to the development of the annex, material was reviewed, and collaborated to use the most vital details for the annex. Discussions were held to identify the capability assessment, planning initiatives, hazard assessment and ranking, and future action plans. Once actions had been identified and compiled in the annex, the draft was circulated for review, comments, and adjustments.



Parker Water & Sanitation District

- Dam
- Potable Water Lift Station
- Potable Water Tank
- Potable Water Treatment
- Potable Well

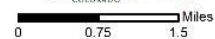
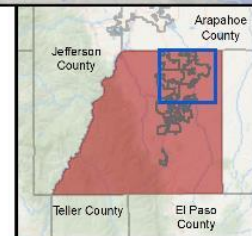
FEMA Flood Hazard Area

- 1-Percent Annual Chance Flood Event Area
- 0.2-Percent Annual Chance Flood Event Area
- Undetermined (Not Analyzed)

The flood hazard area depicted is the September 4, 2020 effective DFIRM.

- Interstate
- U.S. Highway
- State Highway
- City and Town Boundaries
- Water District
- Waterbody

The maps and data depicted are considered approximate and suitable for general planning purposes. Mapped hazard areas, geographic boundaries and other features depicted may not absolutely align due to the differing resolution of available data.



Data Sources: DCGIS - 2020; OTIS - n.d.; ESRI - 2002/2020; FEMA 2020

