Annex A CITY OF CASTLE PINES

A.1 Introduction

This annex details the hazard mitigation planning elements specific to the City of Castle Pines, a participating jurisdiction to the Douglas County LHMP Update. This annex is not intended to be a standalone document, but appends to and supplements the information contained in the base plan document. As such, all sections of the base plan, including the planning process and other procedural requirements apply to and were met by the City. This annex provides additional information specific to the City of Castle Pines, with a focus on providing additional details on the risk assessment and mitigation strategy for this community.

A.2 Planning Process

As described above, the City of Castle Pines followed the planning process detailed in Section 3.0 of the base plan. In addition to providing representation on the Douglas County Hazard Mitigation Planning Committee (HMPC), the City formulated their own internal planning team to support the broader planning process requirements. Internal planning participants included staff from the following City departments:

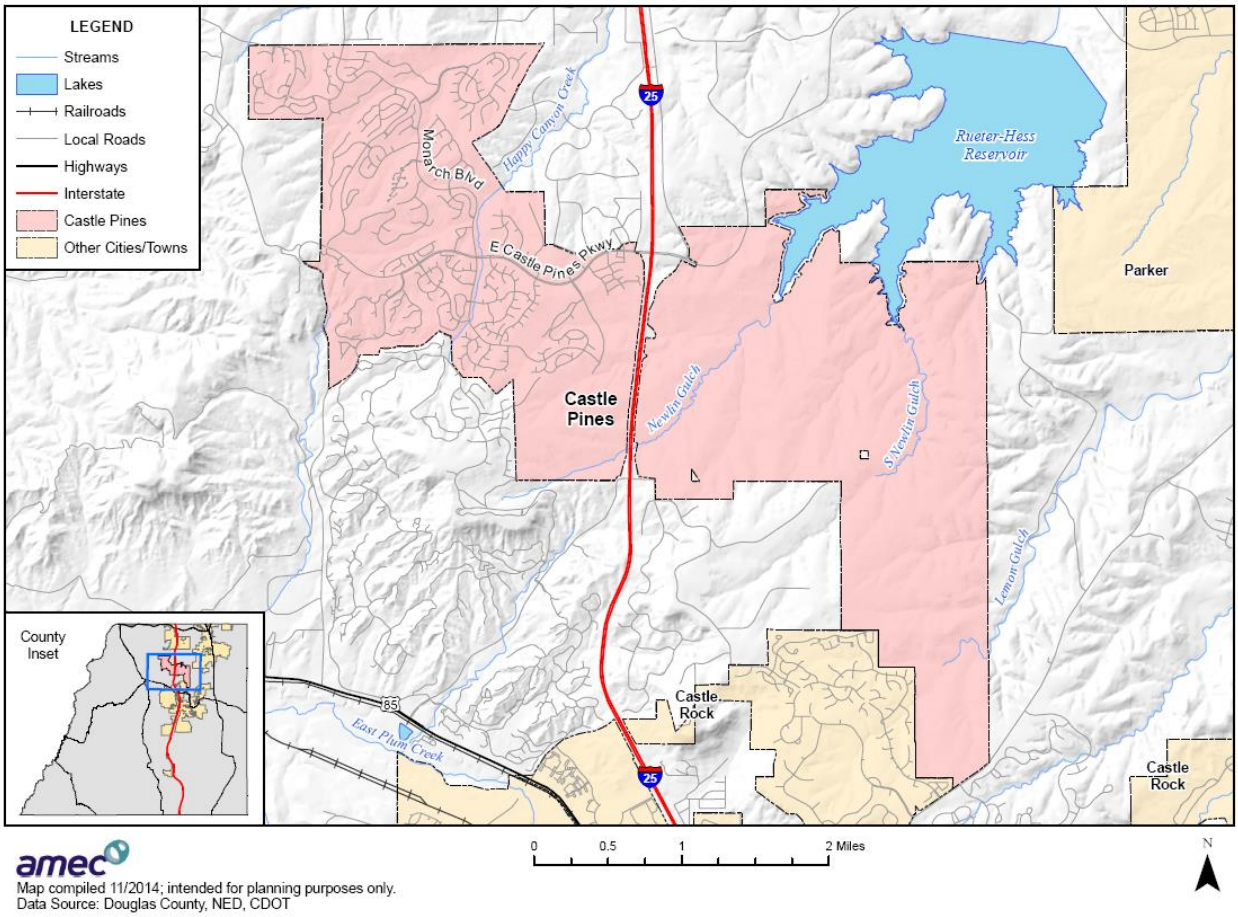
- Brad Meyering, Public Works
- Don Van Wormer, City Manager

Additional details on plan participation and City representatives are included in Appendix A.

A.3 Community Profile

The community profile for the City of Castle Pines is detailed in the following sections. Figure A.1 displays a map and the location of the City of Castle Pines within Douglas County.

Figure A.1. City of Castle Pines Base Map



A.3.1 Geography and Location

The 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.

Because of the City's close proximity to the Denver metro area and multi-modal transportation facilities, the area is attractive to new residents. The lands surrounding Castle Pines include 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.

A.3.2 History

The City of Castle Pines North 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.

A.3.3 Economy

The City of Castle Pines supports a healthy balance of economic development and enhanced quality of life for residents. The City has a collaborative relationship with the Castle Pines Chamber of Commerce, a nonprofit organization that supports local businesses and the establishment of new businesses to the area to support the City's growing community.

The City of Castle Pines local economy consists of firms whose economic activity is dependent largely on local economic conditions. The City has a large percentage of retail and service industries located in the Business District. These local firms provide goods and services to community residents. The City of Castle Pines has over 100 established businesses located within the city boundary and a large number of these are located in the Business District. The businesses range in industry sector, with the majority of businesses falling within the service and retail industries.

U.S. Census economic statistics were unavailable for Castle Pines. This is most likely due to the fact that the City was not incorporated until 2008.

A.3.4 Population

The 2013 American Community Survey population estimate for the City (the most recent available) indicates there are 10,471 residents of Castle Pines. The population estimate for the 2010 U.S. Census was 10,360.

A.4 Hazard Identification and Summary

This section details how the risk varies across the Douglas County Planning Area. The City's planning team identified the hazards that affect the City and summarized their frequency of occurrence; spatial extent, potential magnitude, and significance specific to Castle Pines (see Table A.1). In the context of the plan's Planning Area, there are no hazards that are unique to Castle Pines.

Information on past occurrences and the likelihood of future occurrences is detailed in Section 4, Risk Assessment, of the base plan. Additional information for high and medium significant hazards for the City is included in the Vulnerability Assessment section of this Annex.

Table A.1. City of Castle Pines Hazard ID Table

Hazard	Spatial Extent	Likelihood of Future Occurrences	Magnitude /Severity	Significance
Avalanche	Limited	Low	Low	Low
Drought	Extensive	Medium	Low	Low
Earthquake	Extensive	Low	Low	Low
Flood: Dam Failure	Limited	Low	Low	Low
Flood: 100/500 year	Limited	Low	Medium	Medium
Flood: Localized/ Stormwater	Limited	High	Medium	High
Landslides/ Mud & Debris Flows /Rockfalls	Limited	Medium	Medium	Medium
Severe Weather: Extreme Heat	Extensive	Low	Low	Low
Severe Weather: Hail	Significant	Medium	Medium	Medium
Severe Weather: High Winds	Extensive	Medium	Medium	Medium
Severe Weather: Lightning	Limited	Medium	Medium	Medium
Severe Weather: Thunderstorms/Heavy Rains	Extensive	High	Medium	Medium
Severe Weather: Tornado	Limited	Medium	Medium	Medium
Severe Weather: Winter Weather (includes snow/ice/extreme cold)	Extensive	High	High	High
Soil Hazards: Erosion & Deposition	Limited	Medium	Low	Low
Soil Hazards: Expansive Soils	Limited	Low	Low	Low
Soil Hazards: Subsidence	Limited	Low	Low	Low
Wildfire	Extensive	Low	Low	High
Hazardous Materials: Transportation Incidents	Significant	Low	Low	Low

Spatial Extent
Limited: Less than 10% of Planning Area
Significant: 10-50% of Planning Area
Extensive: 50-100% of Planning Area

Likelihood of Future Occurrences
Low: Occurs less than once every 10 years or more
Medium: Occurs less than once every 5 to 10 years
High: Occurs once every year or up to once every five years

Magnitude/Severity
Low: Negligible property damages (less than 5% of all buildings and infrastructure) Negligible loss of quality of life. Local emergency response capability is sufficient to manage the hazard.
Medium: Moderate property damages (15% to 50% of all buildings and infrastructure) Some loss of quality of life. Emergency response capability, economic and geographic effects of the hazard are of sufficient magnitude to involve one or more counties.
High: Property damages to greater than 50% of all buildings and infrastructure. Significant loss of quality of life Emergency response capability, economic and geographic effects of the hazard are of sufficient magnitude to require federal assistance.

Significance
Low: minimal potential impact
Medium: moderate potential impact
High: widespread potential impact

A.5 Vulnerability Assessment

The intent of this section is to assess Castle Pines' vulnerability separate from that of the Planning Area as a whole, which has already been assessed in Section 4.3 Vulnerability Assessment of the base plan. This vulnerability assessment provides an inventory of the population, property, and other assets located within the City and further analyzes those assets at risk to identified hazards ranked of medium or high significance (as listed in Table A.1) to the community. A brief discussion on erosion was included to compare Castle Pines' exposure to the rest of the Planning Area, despite being ranked low significance to the City. The erosion analysis is discussed in the landslide section. For more information about how hazards affect the County as a whole, see Chapter 4 Risk Assessment in the main plan.

A.5.1 Total Assets at Risk

This section identifies Castle Pines' total assets at risk, including values at risk, critical facilities and infrastructure, natural resources, and historic and cultural resources. Growth and development trends are also presented for the community. This data is not hazard specific, but is representative of total assets at risk within a community.

Values at Risk

The following data from the Douglas County Assessor's Office is based on joining assessor data to the 2014 parcel layer in GIS. This data should only be used as an indicator of overall values, as the information has some limitations. Table A.2 summarizes the parcels, improved parcels, structures, improved value, land value, and total value exposed in Castle Pines. It is 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.

Table A.2. City of Castle Pines Total Exposure

Property Type	Total Parcel Count	Improved Parcel Count	Total Structures Count	Improved Value	Total Land Value	Total Value
Agriculture	170	0	148	$0	$104,288	$104,288
Commercial	45	29	531	$80,733,884	$27,412,958	$108,146,842
Exempt	239	9	72	$36,347,705	$16,427,283	$52,774,988
HOA	241	0	68	$0	$0	$0
Industrial	0	0	0	$0	$0	$0
Producing Mine	0	0	0	$0	$0	$0
Residential	3,408	3,299	3,434	$1,163,462,447	$326,586,676	$1,490,049,123
Utilities	5	0	1	$0	$0	$0
Vacant Land	87	1	66	$719,766	$6,293,210	$7,012,976
Total	**4,195**	**3,338**	**4,320**	**$1,281,263,802**	**$376,824,415**	**$1,658,088,217**

Source: Douglas County Assessor's Data

Critical Facilities and Infrastructure

For 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.

This definition was refined by separating out three categories of critical facilities as further described in Section 4.3.1 of the base plan. These categories include At-Risk Populations, Essential Services, and High Potential Loss Facilities.

The Douglas County GIS data shows 18 critical facilities in Castle Pines, summarized in Table A.3 by category, facility type, and facility count.

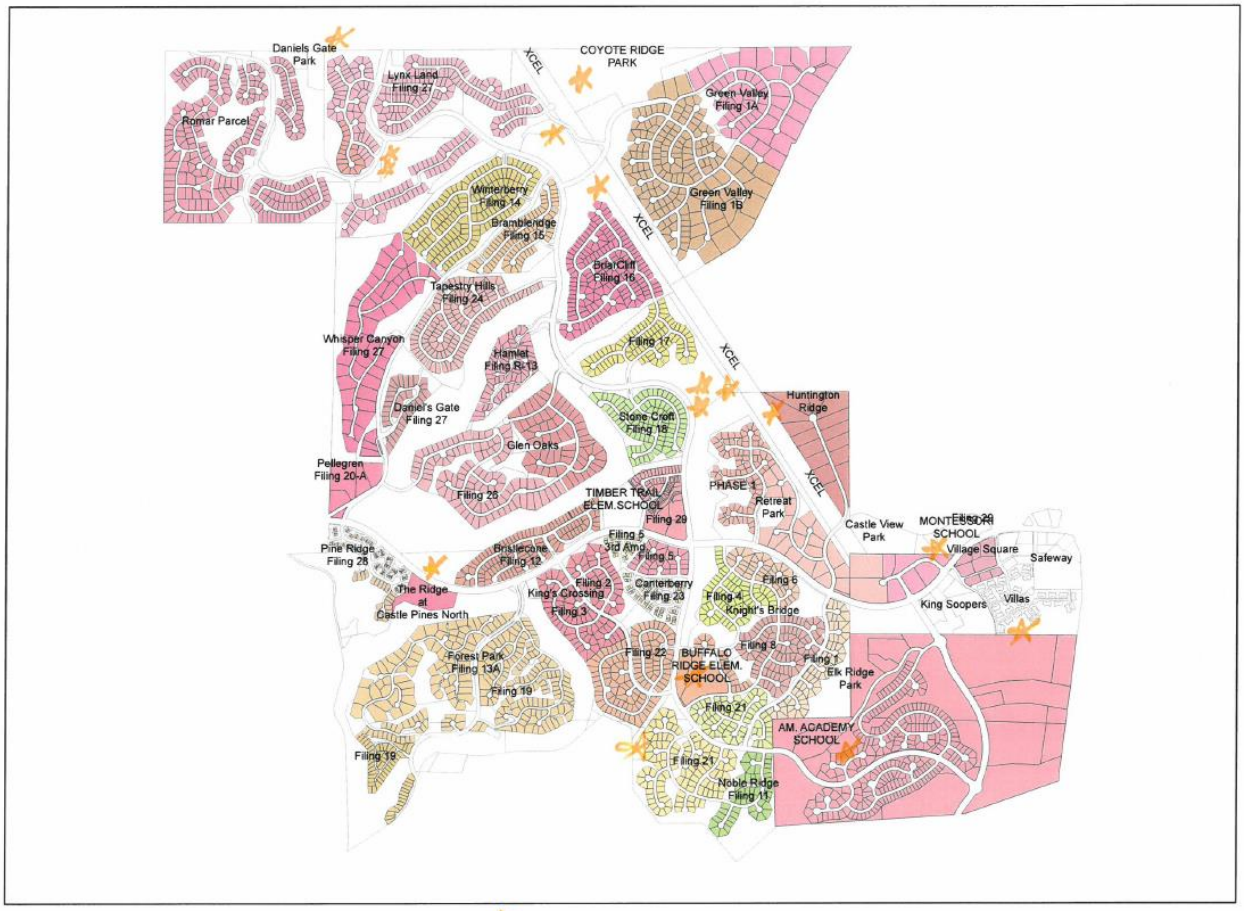
Table A.3. City of Castle Pines Critical Facilities

Category	Type	Facility Count
At-Risk Population Facilities	Assisted Living	1
	School	4
Essential Services Facilities	Cell Tower	3
	Microwave	2
	Water Hub/Treatment	1
High Potential Loss Facilities	Hazardous Material	7
Total		**18**

Source: Douglas County GIS

The approximate location of well heads and water treatment plants in Castle Pines is shown in Figure A.2.

Figure A.2. General Location of Well Heads and Treatment Plants in Castle Pines



Source: City of Castle Pines

Natural Resources

The City of Castle Pines and the areas surrounding it include a rich and diverse range of biological resources.

Vegetation

Because of the largely developed nature of the Castle Pines community, the majority of the City's sensitive resources lie within the dedicated open space areas that form the core of the City's open space system. Sensitive resources generally consist of native plant communities and habitat types, such as trees and shrubs, and natural grasses and other plant life. Another sensitive resource is wetland habitat. Castle Pines contains a number of areas that are protected by tree conservation areas. These areas were identified to protect the native Gambel oak, and other native species from development.

Wildlife Habitat

Castle Pines has two levels of wildlife habitat value. The west portion of the city boundaries contains a high habitat value, and the remaining portions of the boundary contain a moderate habitat value. Wildlife can be found in the open space areas, near watercourses or wetland areas. The neighboring areas of Daniels Park contain significant wildlife resources and are considered a high habitat value with critical habitat areas. The U.S. Fish and Wildlife Service (USFWS) has listed the following species as threatened, which may impact landowners in the City of Castle Pines - Preble's meadow jumping mouse and Ute Ladies Tresses Orchid. The Colorado Butterfly plant has been proposed by the USFWS to be listed as a threatened species.

Wildlife movement corridors are generally narrow strips of habitat that are or can be used by wildlife to move from one area of habitat to another. They are generally undeveloped as a result of floodplain restrictions, and serve as connection points between various blocks of habitat. While there are no delineated wildlife corridors within the City boundaries, the City has a variety of wildlife habitat generally located in the wetland areas, and the open space.

Historic and Cultural Resources

To inventory historic and cultural resources, the HMPC collected information from both the National Register of Historic Places and the Colorado State Register. Each program has different eligibility criteria and procedural requirements. These requirements are detailed in Section 4.3.1 of the base plan. As Castle Pines was only recently incorporated, there are no listed historic properties in the City.

Growth and Development Trends

Past Growth

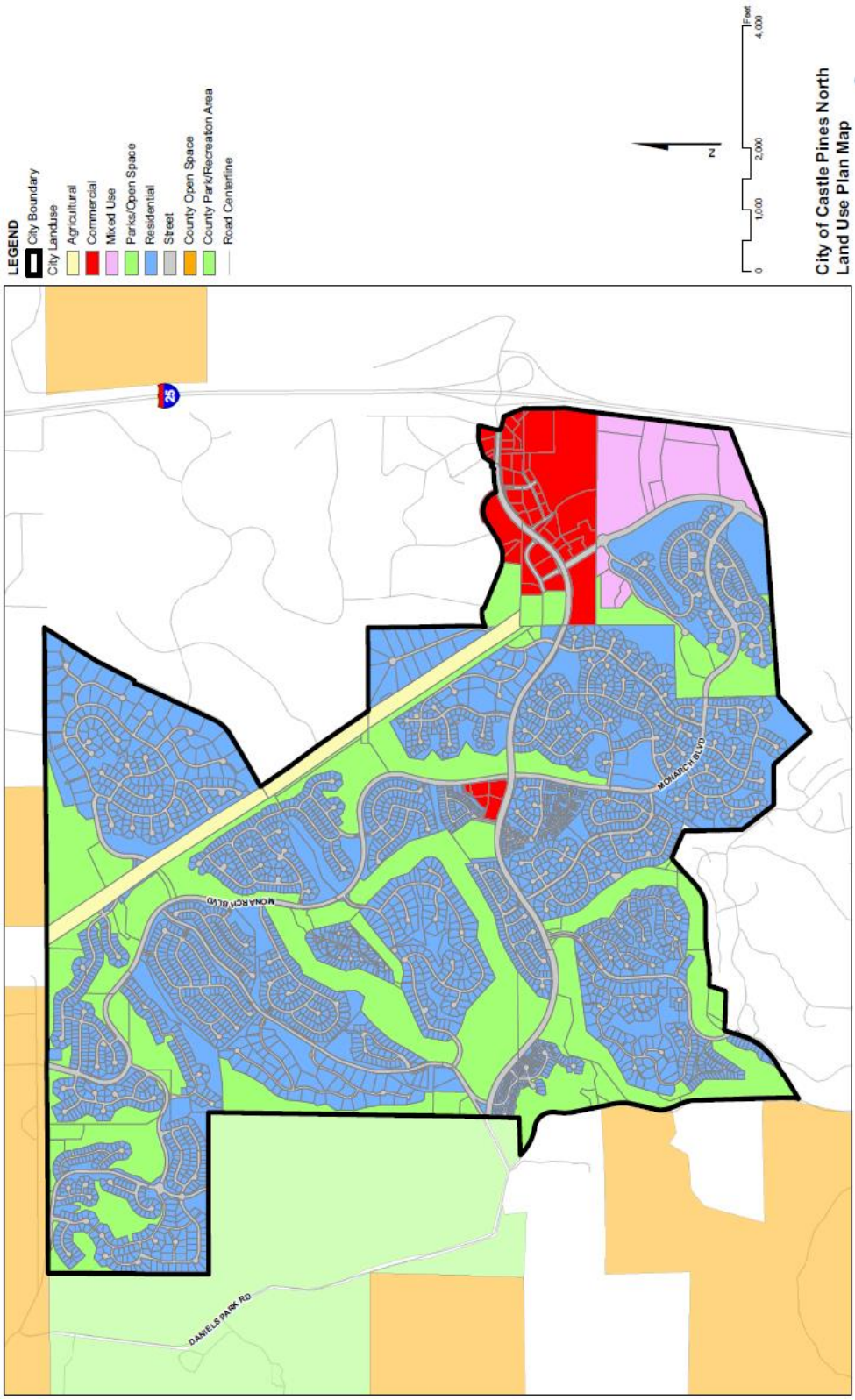
The City's development context consists of a suburban character with a variety of residential densities, mixed uses, with parks, trails, and open space. The history of the City's development and population growth periods are as follows:

- **1980s** - Development throughout the city boundary has been established since the early 1980s. Home construction activity began in the late 1980s. Shortly thereafter, the economic downturn of the late 1980's in combination with the overextension of infrastructure and the bankruptcy of the Castle Pines North Metropolitan District in the early 1990's slowed development considerably for several years
- **1990s** - Financial restructuring, new developer investments and a strong economy enabled home building to increase at a fairly rapid pace through the latter years of the 1990's, bringing the combined total of built residential lots to just over 2,000, roughly one-third of the estimated final build-out. Aggressive platting activity in Castle Pines during 1999 contributed to an inventory of 2,281 platted lots for the City of Castle Pines.

- **Early 2000s -** An additional 357 multifamily residential units were approved in early 2000 as a special use permit on land zoned Business, located south of Castle Pines Parkway near I-25.
- **2008** – The Lagae Ranch Planned Development was approved with an estimated 231 new single-family homes and 400 multi-family units. Construction had not yet been started as of May 2015.

Existing land uses within the City of Castle Pines have been generally urban development. Development within the City consists of planned development residential uses, commercial uses, mixed uses, parks and open space uses. Existing land use is shown in Figure A.3.

Figure A.3. Current Land Use in the City of Castle Pines



Source: 2009 City of Castle Pines North Comprehensive Plan

Table A.4 summarizes the number and value of structures built in Castle Pines from 2010 to 2014 based on a query of the 'year built' values in the County's parcel database. Over 200 structures, with a total value greater than $94 million, were built in that short period of time. The vast majority of these structures were residential, built to accommodate the rapidly growing population in the Planning Area. Additional analysis on recent development in Castle Pines' mapped hazard areas is discussed in the vulnerability assessments for flood, landslide/erosion, and wildfire.

Table A.4. Castle Pines 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
Commercial	2	2	10	$4,741,654	$738,994	$5,480,648
HOA	1	0	2	$0	$0	$0
Residential	191	191	193	$69,880,073	$19,390,250	$89,270,323
Total	**194**	**193**	**205**	**$74,621,727**	**$20,129,244**	**$94,750,971**

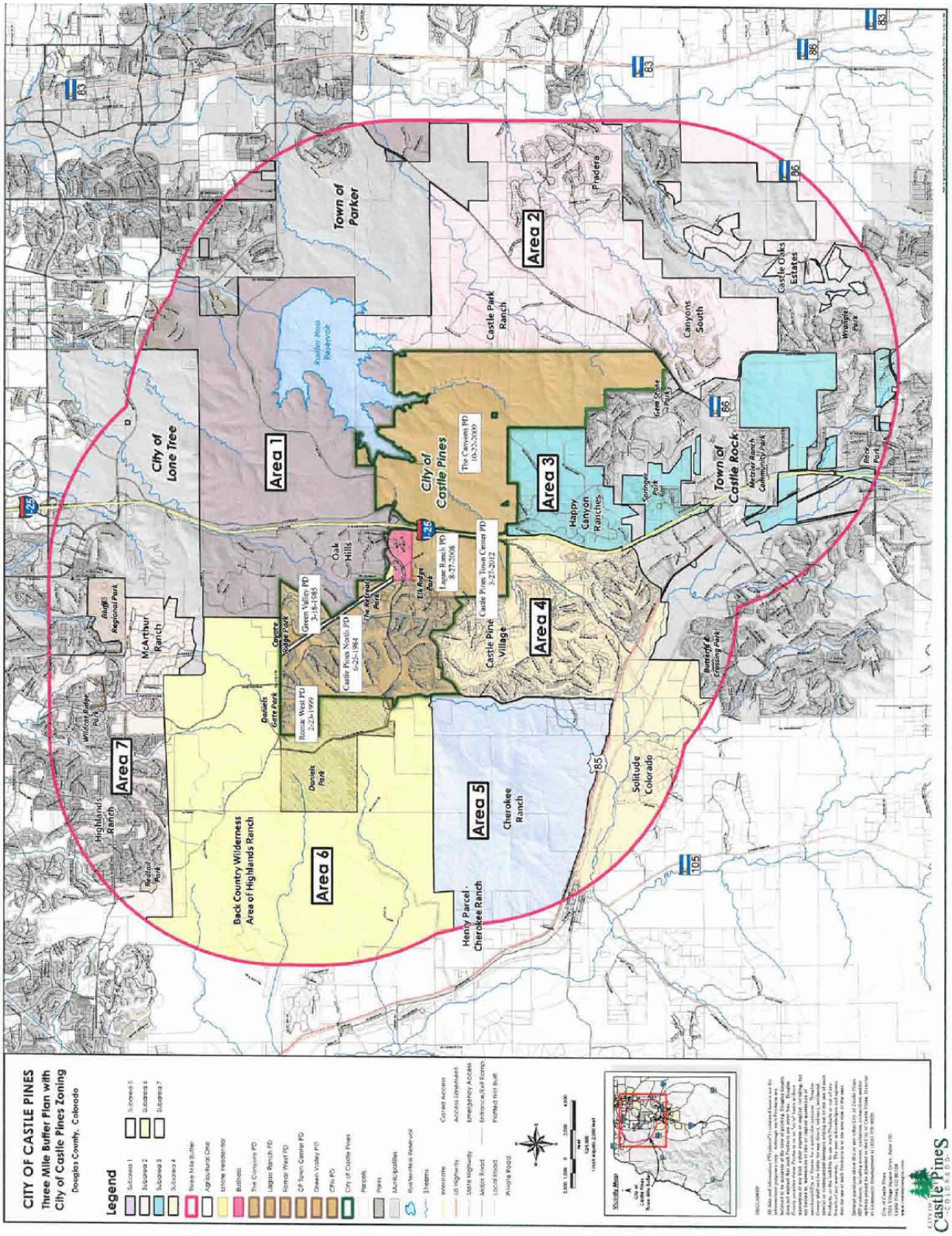
Source: Douglas County

Development Trends

Prior to 2009, it was thought that the City of Castle Pines was fully developed with the exception of Lagae Ranch and a few undeveloped platted lots located mainly in the City's Business District and immediately west at the intersection of Monarch and Castle Pines Parkway. Between 2010 and 2014, the City developed the Three-Mile Plan. The Three-Mile Plan establishes an approach to address future growth and development of land within a three-mile radius of the City's municipal boundaries. The Three-Mile Plan identifies land that may be considered for annexation and provides direction concerning land use and zoning issues, infrastructure needs and municipal services. The plan provides the existing conditions on lands outside of the City's boundaries, with the exception of incorporated lands/municipalities of the City of Lone Tree, the Town of Parker and the Town of Castle Rock. As reflected in the Three-Mile Plan, the City may annex lands subject to negotiation with individual landowners. However, it addresses the issues associated with annexation and provides guidelines, if a private landowner wishes to incorporate private property into the City of Castle Pines.

No lands in the Three-Mile Plan are specifically identified for future land uses. A map of the areas considered in the Three-Mile Plan is shown in Figure A.4.

Figure A.4. City of Castle Pines Three Mile Plan Map



Source: 2014 City of Castle Pines Three Mile Plan

A.5.2 Priority Hazards: Vulnerability Assessment

This section provides the vulnerability assessment, including any quantifiable loss estimates, for those hazards identified above in Table A.1 as high or medium significance hazards. Wildfire was also analyzed to compare Castle Pines' exposure to the rest of the Planning Area, despite being ranked low significance to the City. A brief discussion on erosion was included for the same reason. The erosion analysis is discussed in the landslide section. Impacts of past events and vulnerability of the City to specific hazards are further discussed below (see Section 4.1 Hazard Identification in the base plan for more detailed information about these hazards and their impacts on the Douglas County Planning Area). Methodologies for calculating loss estimates are the same as those described in Section 4.3 of the base plan.

An estimate of the vulnerability of the City to each identified hazard, in addition to the estimate of risk of future occurrence, is provided in each of 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.
- **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.

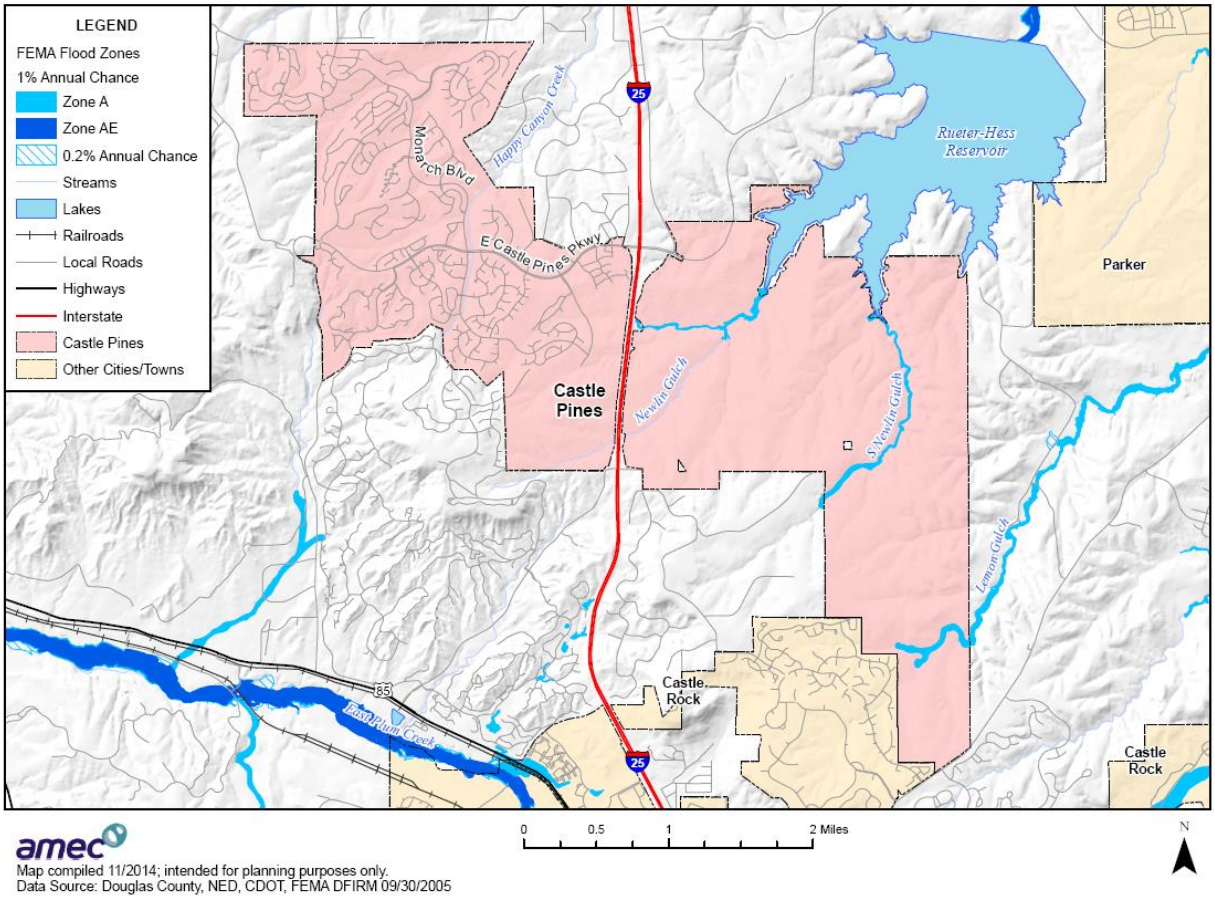
Flood: 100/500 year

Vulnerability to Flood: 100/500 year

Likelihood of Future Occurrence—Low
Potential Magnitude—Medium
Overall Vulnerability—Medium

Castle Pines has limited mapped flood hazard areas and does not have any structures located in a flood zone. No structures or people are exposed to 100/500-year flooding within City limits. Figure A.5 through Figure A.7 depict the location of flood hazards, critical facilities, and properties affected by flooding in Castle Pines. Note that no properties or critical facilities are affected by flooding.

Figure A.5. City of Castle Pines FEMA Flood Hazard Zones



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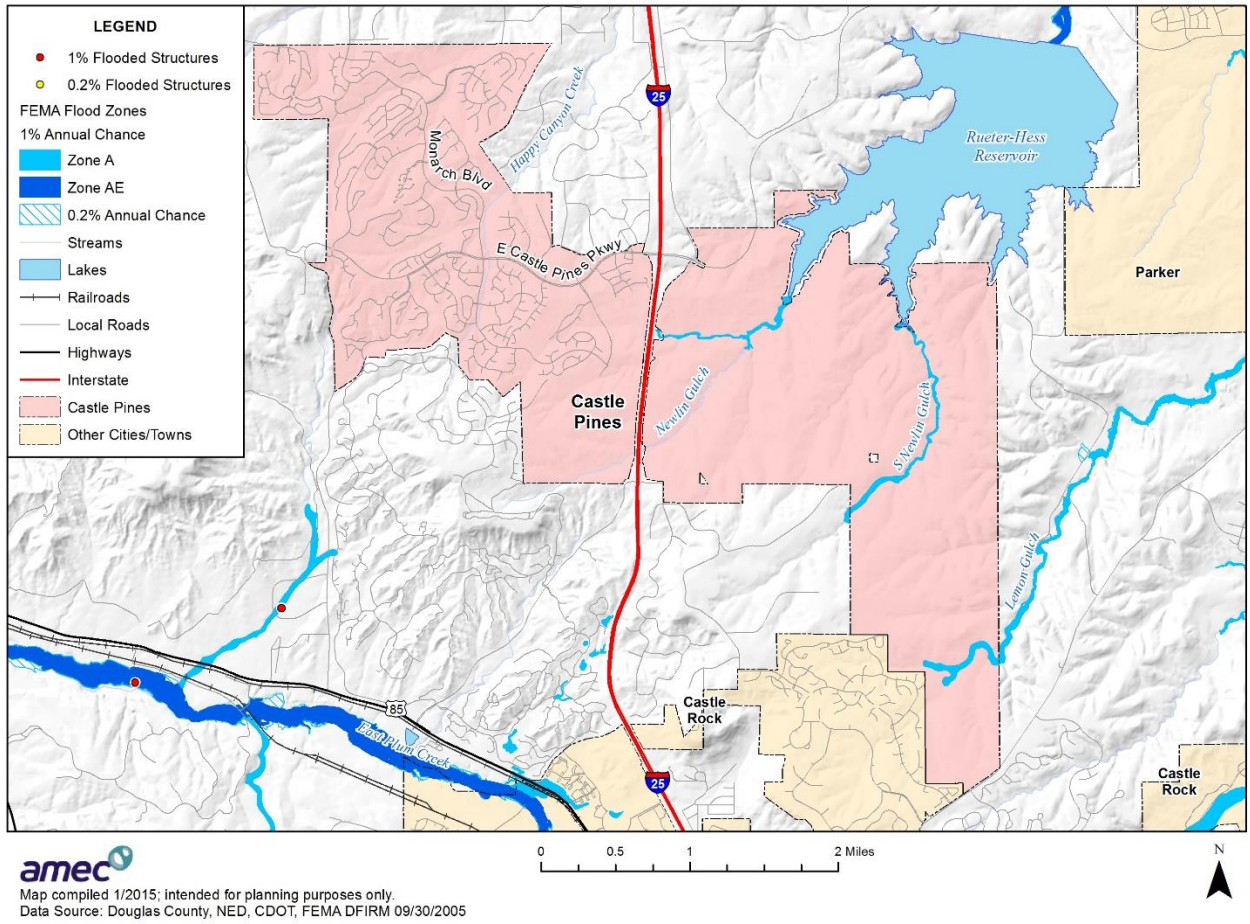
Map compiled 11/2014; intended for planning purposes only.
Data Source: Douglas County, NED, CDOT, FEMA DFIRM 09/30/2005

Figure A.6. City of Castle Pines Properties in FEMA Flood Hazard Zones



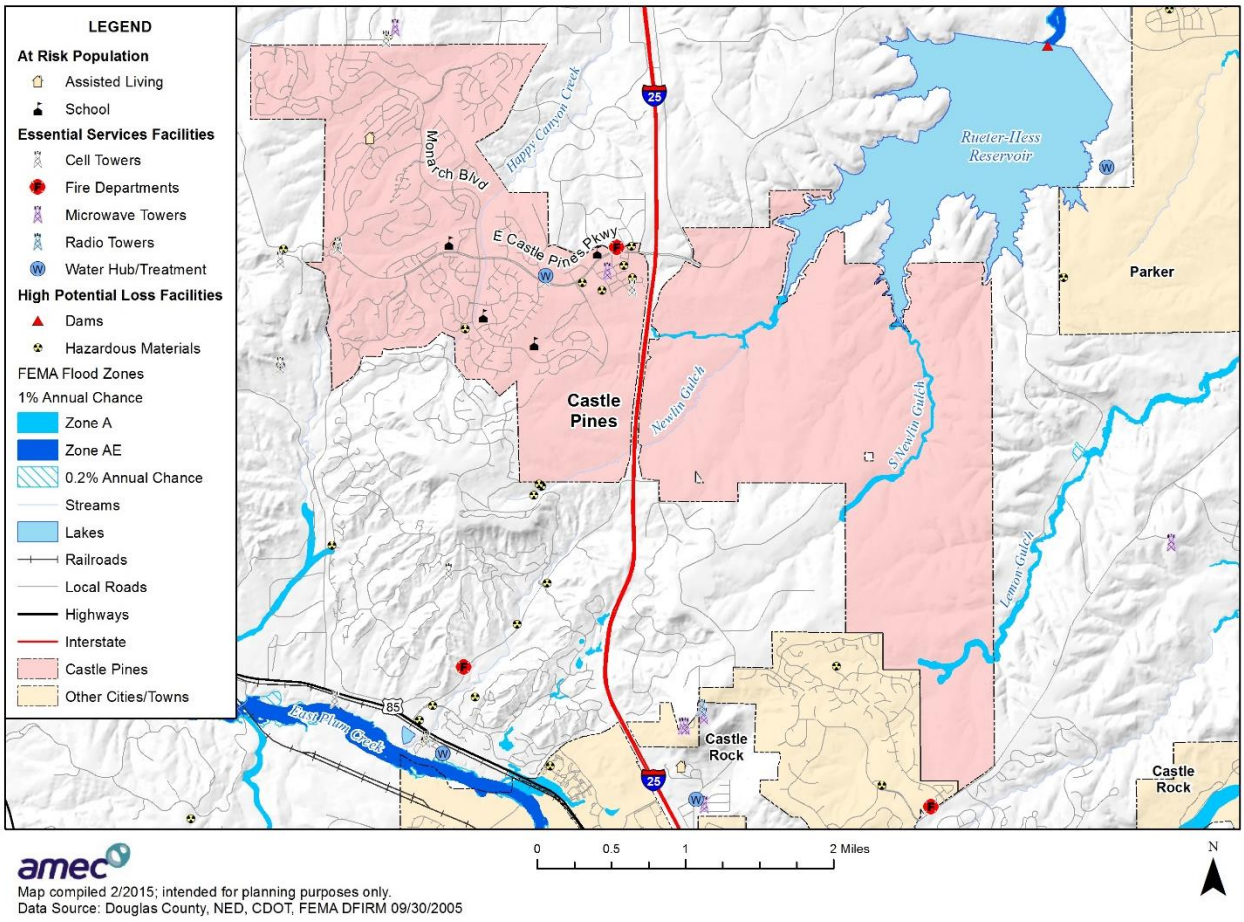
Population at Risk

No Castle Pines residents live in FEMA flood hazard zones.

Critical Facilities at Risk

Castle Pines has no critical facilities located in FEMA flood hazard zones.

Figure A.7. City of Castle Pines Critical Facilities and FEMA Flood Hazard Zones



Development Trends

Future development in Castle Pines is unlikely to be affected by flooding given the small area of 1% annual chance flood zones in the undeveloped eastern portion of the City. Should the spatial extent of this hazard ever change (after an annexation, for example) or growth in the eastern City occur, Castle Pines' continued adherence to the Douglas County Zoning and Subdivision Resolutions will help limit exposure of future development to this type of flooding.

An analysis of build-out from 2010 to 2014 in hazard areas was conducted for Castle Pines. Given the fact that Castle Pines has limited mapped flood hazard areas and does not have any structures located in a flood zone, the build-out analysis returned no results for 100/500-year flooding.

Flood: Localized/ Stormwater

Vulnerability to Flood: Localized/ Stormwater

Likelihood of Future Occurrence—High
Potential Magnitude—Medium

Overall Vulnerability—High

Castle Pines experiences localized stormwater flooding at least once per year during very heavy rain events. The City hopes to mitigate this issue in 2015 by reconstructing some stormwater pipe infrastructure for Monarch Boulevard near Stonemont Drive.

Development Trends

The City's plan to reconstruct stormwater infrastructure will mitigate localized stormwater flooding impacts to existing development along Monarch Boulevard near Stonemont Drive. No new or recent development (e.g. built within the past five years) will be affected. The City's stormwater management program follows the standards in the Douglas County Storm Drainage Design and Technical Criteria Manual, which was written with FEMA floodplain management regulations in mind. Drainage reports, analyses, and designs that impact FEMA designated floodplains must be submitted to FEMA for review. Drainage designs for future development must take these regulations into account.

Landslides/ Mud & Debris Flows /Rockfalls/Erosion

Vulnerability to Landslides/ Mud & Debris Flows /Rockfalls/Erosion

Likelihood of Future Occurrence—Medium for landslide and erosion
Potential Magnitude—Medium for landslide, Low for erosion
Overall Vulnerability—Medium for landslide, Low for erosion

The landslide hazard is made up of these attributes: debris-flow, rockfall-rockslide/debris, and slope-failure. Erosion hazards in Castle Pines are also discussed in this section, despite being ranked low significance, due to the property exposure in potential hazard areas.

The County's parcel layer was used as the basis for the inventory of all parcels within Castle Pines. 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. Castle Pines does not have any mapped areas exposed to debris flow or slope failure (landslides). However, the City has 109 structures with a total value of over $109 million potentially exposed to rockfall hazards, as detailed in Table A.5. Table A.6 summarizes exposure to moderate accelerated erosion. Erosion analysis does not include contents value since contents of buildings are unaffected by this hazard. Figure A.8 depicts Castle Pines' mapped rockfall and erosion hazard areas, which are primarily in the northwest portion of the City and along streambeds.

Table A.5. City of Castle Pines Total Exposure to Rockfall

Property Type	Total Parcel Count	Improved Parcel Count	Total Structures Count	Improved Value	Estimated Content Value	Land Value	Total Value
Commercial	2	1	3	$7,882	$7,882	$200,111	$215,875
Exempt	7	0	1	$0	$0	$160,545	$160,545
HOA	20	0	4	$0	$0	$0	$0
Residential	95	95	97	$60,738,828	$30,369,414	$16,768,250	$107,876,492
Vacant Land	4	1	4	$719,766	$0	$879,750	$1,599,516
Total	**128**	**97**	**109**	**$61,466,476**	**$30,377,296**	**$18,008,656**	**$109,852,428**

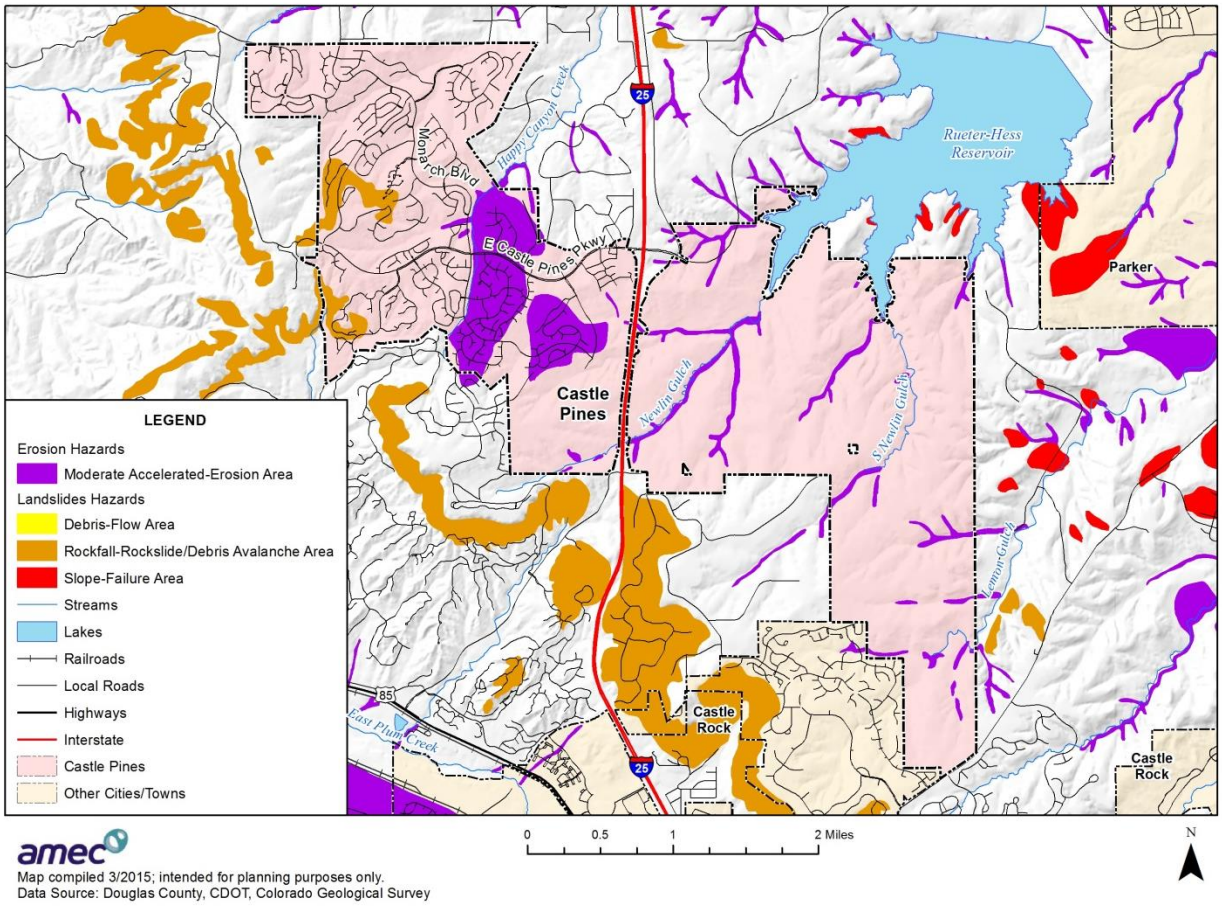
Source: Douglas County Assessor's Data

Table A.6. City of Castle Pines Total Exposure to Moderate Accelerated Erosion

Property Type	Total Parcel Count	Improved Parcel Count	Total Building Count	Improved Value	Land Value	Total Value
Agricultural	147	0	145	$0	$872	$872
Exempt	39	1	10	$6,517,936	$4,136,563	$10,654,499
HOA	39	0	15	$0	$0	$0
Residential	609	522	601	$145,393,417	$44,151,072	$189,544,489
Utilities	1	0	0	$0	$0	$0
Vacant Land	10	0	1	$0	$1,320,253	$1,320,253
Total	**845**	**523**	**772**	**$151,911,353**	**$49,608,760**	**$201,520,113**

Source: Douglas County Assessor's Data

Figure A.8. City of Castle Pines Landslide and Erosion Hazards



Population at Risk

An estimated 257 people are potentially exposed to rockfall hazards in Castle Pines. This estimate is based on the number of exposed improved residential parcels (95) multiplied by the average household size in Castle Pines according to the 2010 U.S. Census (2.70).

Critical Facilities at Risk

Landslide and erosion analysis was performed on the critical facility inventory in Castle Pines. GIS was used to determine whether Castle Pines' facility locations intersect the landslide and erosion hazard areas provided by Douglas County, and if so, which zones they intersect. There are no critical facilities located in landslide hazard areas in Castle Pines. One at-risk population facility, a school, is located in the moderate accelerated erosion hazard area.

Development Trends

Fortunately, the landslide and erosion hazard areas in Castle Pines are fairly small. The City also adheres to the Douglas County zoning regulations which discourage development on steep or

exposed slopes. Continued adherence to these regulations will help prevent future development from being located in rockfall hazard areas or slope-driven erosion areas. Castle Pines Public Works and Castle Pines North Metropolitan District also provide erosion control through their storm drainage programs in their respective service areas.

An analysis of recent development trends in hazard areas was conducted for Castle Pines. A total of 257 structures were built in rockfall and moderate-accelerated erosion hazard areas in the City between 2010 and 2014. Results of this analysis are shown in Table A.7.

Table A.7. Castle Pines Structures Built from 2010 to 2014: Summary of Assets Exposed to Rockfall and Moderate Accelerated-Erosion Areas

Hazard	Total Parcel Count	Improved Parcel Count	Total Building Count	Improved Value	Estimated Content Value	Land Value	Total Value
Rockfall	6	6	7	$4,728,514	$2,364,257	$1,209,000	$8,301,771
Moderate Accelerated Erosion	35	35	35	$9,346,720	$4,673,360	$2,776,250	$16,796,330
Total	**41**	**41**	**42**	**$14,075,234**	**$7,037,617**	**$3,985,250**	**$25,098,101**

Source: Douglas County GIS

Severe Weather: Hail

Vulnerability to Severe Weather: Hail

Likelihood of Future Occurrence—Medium
Potential Magnitude—Medium
Overall Vulnerability—Medium

Hail is one of the most damaging natural hazards in Colorado. It occurs in wide swaths, causing damage to large geographical areas at once. A single hailstorm could potentially impact all of Castle Pines at once. Hailstorms can also occur relatively frequently, especially in the summer, though they may not always cause significant damages. The impacts of hailstorms can vary substantially from one storm to another depending on weather conditions and the size of the hailstones. Losses are typically covered by insurance.

Development Trends

Any future development in Castle Pines will be exposed to hail. Impacts to people can be mitigated by staying indoors during a hailstorm, and some property such as cars can be protected with covered parking where available. Hail impacts are difficult to mitigate in general though, and insurance is one of the typical options for recouping property losses and reducing economic impacts.

Severe Weather: High Winds

Vulnerability to Severe Weather: High Winds

Likelihood of Future Occurrence—Medium
Potential Magnitude—Medium
Overall Vulnerability—Medium

High winds, often accompanying severe thunderstorms, can cause significant property and crop damage, threaten public safety, and have adverse economic impacts from business closures and power loss. Winds in Castle Pines are typically straight-line winds. Straight-line winds are generally any thunderstorm wind that is not associated with rotation (i.e., is not a tornado). These winds can overturn mobile homes, tear roofs off of houses, topple trees, snap power lines, shatter windows, and sandblast paint from cars. Other associated hazards include utility outages, arcing power lines, debris blocking streets, dust storms, and an occasional structure fire.

Development Trends

The impact of high winds on future development in Castle Pines can be mitigated with building codes and design criteria.

Severe Weather: Lightning

Vulnerability to Severe Weather: Lightning

Likelihood of Future Occurrence—Medium
Potential Magnitude—Medium
Overall Vulnerability—Medium

Colorado is one of the top states in the continental U.S. for lightning strikes, which can damage property and cause injury or even death to people. People are especially at risk in Colorado if they are outside in the early afternoon during the summer monsoons, though this is not the only time or place where people can be struck by lightning.

Castle Pines has been impacted by this hazard in the past. Lightning caused a house fire in Castle Pines on July 7, 2014. Two people were home at the time, and neither were injured by the event. The roof and attic of the home were damaged. The potential exists for similar events to occur in Castle Pines in the future.

Development Trends

Future development in Castle Pines will not influence where lightning strikes occur. However, growth and development can increase the number of people and structures exposed to lightning impacts. Lightning can also impact future development by igniting wildfires. Castle Pines has nearly 1,000 buildings in high and extreme wildfire risk zones, and future development in these

areas will place additional people and structures at risk to the secondary hazards caused by lightning.

Severe Weather: Thunderstorms/Heavy Rains

Vulnerability to Severe Weather: Thunderstorms/Heavy Rains

Likelihood of Future Occurrence—High
Potential Magnitude—Medium
Overall Vulnerability—Medium

According to historical hazard data, severe weather is an annual occurrence in Castle Pines. 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 City. Lightning often accompanies these storms and has caused damage to homes in Castle Pines in the past. However, actual damage associated with the primary effects of severe weather has been limited. It is the damage caused by secondary hazards such as floods and fire that have the greatest impact on Castle Pines. The risk and vulnerability associated with these secondary hazards are discussed in other sections where applicable.

Development Trends

New critical facilities such as communications towers should be built to withstand heavy rains and thunderstorms. 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 in the City is regulated by zoning and subdivision regulations, and future development is not expected to increase vulnerability to hazards.

Severe Weather: Tornado

Vulnerability to Severe Weather: Tornado

Likelihood of Future Occurrence—Medium
Potential Magnitude—Medium
Overall Vulnerability—Medium

Tornadoes can cause damage to property and loss of life. While most tornado damage is caused by violent winds, the majority of injuries and deaths generally result from flying debris. Property damage can include damage to buildings, fallen trees and power lines, broken gas lines, broken sewer and water mains, and the outbreak of fires. Agricultural crops and industries may also be damaged or destroyed. Access roads and streets may be blocked by debris, delaying necessary emergency response.

Figure 4.22 in Chapter 4 indicates that tornadoes can occur anywhere in Douglas County, especially in the eastern half. One F0 tornado was reported in the very southeastern tip of Castle Pines. The lack of other historical events in the City does not indicate that future events are unlikely to occur in Castle Pines.

Development Trends

Population growth and development expose more people to tornadoes in Castle Pines. The impact to people can be mitigated through warning systems and tornado shelters. Stringent building codes for high winds can help mitigate impacts from weaker tornadoes, and property insurance can reduce economic impacts.

Severe Weather: Winter Weather (includes snow/ice/extreme cold)

Vulnerability to Severe Weather: Winter Weather (includes snow/ice/extreme cold)

Likelihood of Future Occurrence—High
Potential Magnitude—High
Overall Vulnerability—High

Castle Pines typically experiences multiple winter storms in any given year. This hazard has been critical in its magnitude and severity in the past in Douglas County, as seen during the blizzards of March 2003 and December 2006. Vulnerability is high along busy roadways, particularly on Interstate 25, which run through the center of Castle Pines. 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 Castle Pines. 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; Castle Pines' 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 Castle Pines 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.

Castle Pines' Snow and Ice Control Plan establishes the procedures for the Public Works Department's response to winter storm events. City staff and Castle Pines residents can help mitigate the impacts of winter storms on people and roads by following the procedures in the Snow and Ice Control Plan. The City does not provide snow and ice removal services in some HOAs; the HOAs are responsible for this service themselves. The HOAs that are not covered by the City's snow and ice removal service include:

- Turquoise Terrace
- Amber Ridge
- Ventanna
- Esperanza
- Whisper Canyon
- Coyote Crossing
- Daniel's Ridge
- Lifestyle
- Buffalo Ridge
- Hamlet
- The Crossings
- Canterbury Park
- Broadwick
- Forest Park
- Castle Pointe

Wildfire

Vulnerability to Wildfire

Likelihood of Future Occurrence—Low
Potential Magnitude—Low
Overall Vulnerability—Low

An exposure analysis was performed to quantify risk to wildfire in Castle Pines. 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.

Table A.8 shows 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 in Castle Pines. Table A.9 summarizes this information by wildfire severity zone. Figure A.9 illustrates the wildfire severity zones in Castle Pines and the surrounding area.

Table A.8. City of Castle Pines Total Exposure to Wildfire by Property Type

Property Type	Total Parcel Count	Improved Parcel Count	Total Structure Count	Improved Value	Estimated Content Value	Land Value	Total Value/Loss Estimate
Extreme							
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**
High							
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**
Moderate							
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**
Low							
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**

Source: Douglas County GIS

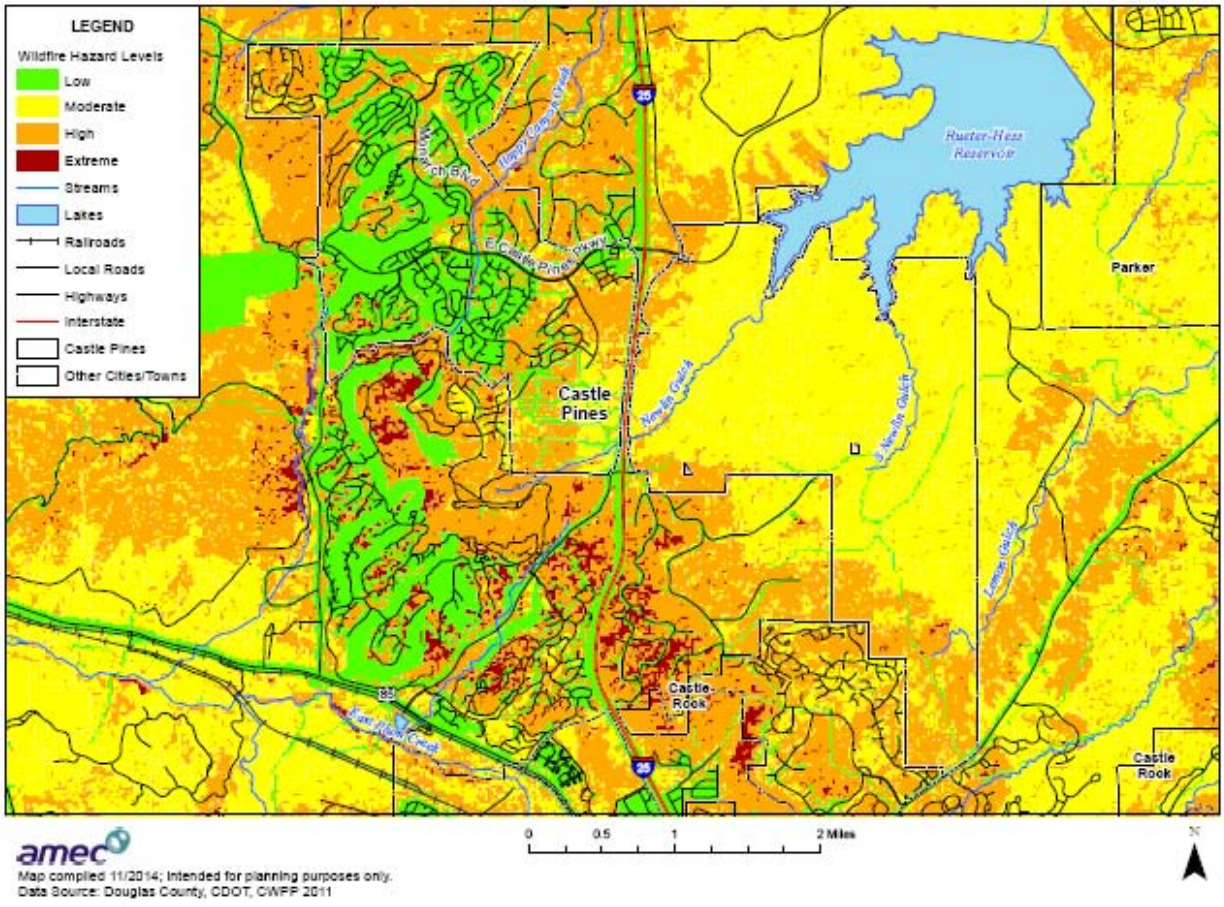
Table A.9. City of Castle Pines Total Exposure to Wildfire Summary

Wildfire Severity	Total Parcel Count	Improved Parcel Count	Total Building Count	Improved Value	Estimated Content Value	Land Value	Total Value/Loss Estimate
Extreme	54	39	46	$16,998,350	$8,499,175	$5,315,374	$30,812,899

Wildfire Severity	Total Parcel Count	Improved Parcel Count	Total Building Count	Improved Value	Estimated Content Value	Land Value	Total Value/Loss Estimate
High	987	674	949	$303,271,617	$163,516,776	$89,093,732	$555,882,125
Moderate	227	139	590	$124,281,672	$91,469,885	$37,624,986	$253,376,543
Low	2,927	2,486	2,735	$836,712,163	$435,326,977	$244,790,323	$1,516,829,463
Total	**67,901**	**59,835**	**74,819**	**$17,699,073,710**	**$10,837,873,385**	**$5,309,550,986**	**$33,846,498,081**

Source: Douglas County GIS

Figure A.9. Castle Pines Wildfire Hazard Potential



Population 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 hazard potential 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 size for each jurisdiction and unincorporated area, which is 2.70 in Castle Pines. Table A.10 summarizes the results of this analysis.

Table A.10. Population at Risk to Wildfire

	Extreme	High	Moderate	Low
Population	105	1,801	348	6,653
Improved Residential Parcels	39	667	129	2,464

Source: Douglas County GIS, 2010 U.S. Census

Critical Facilities at Risk

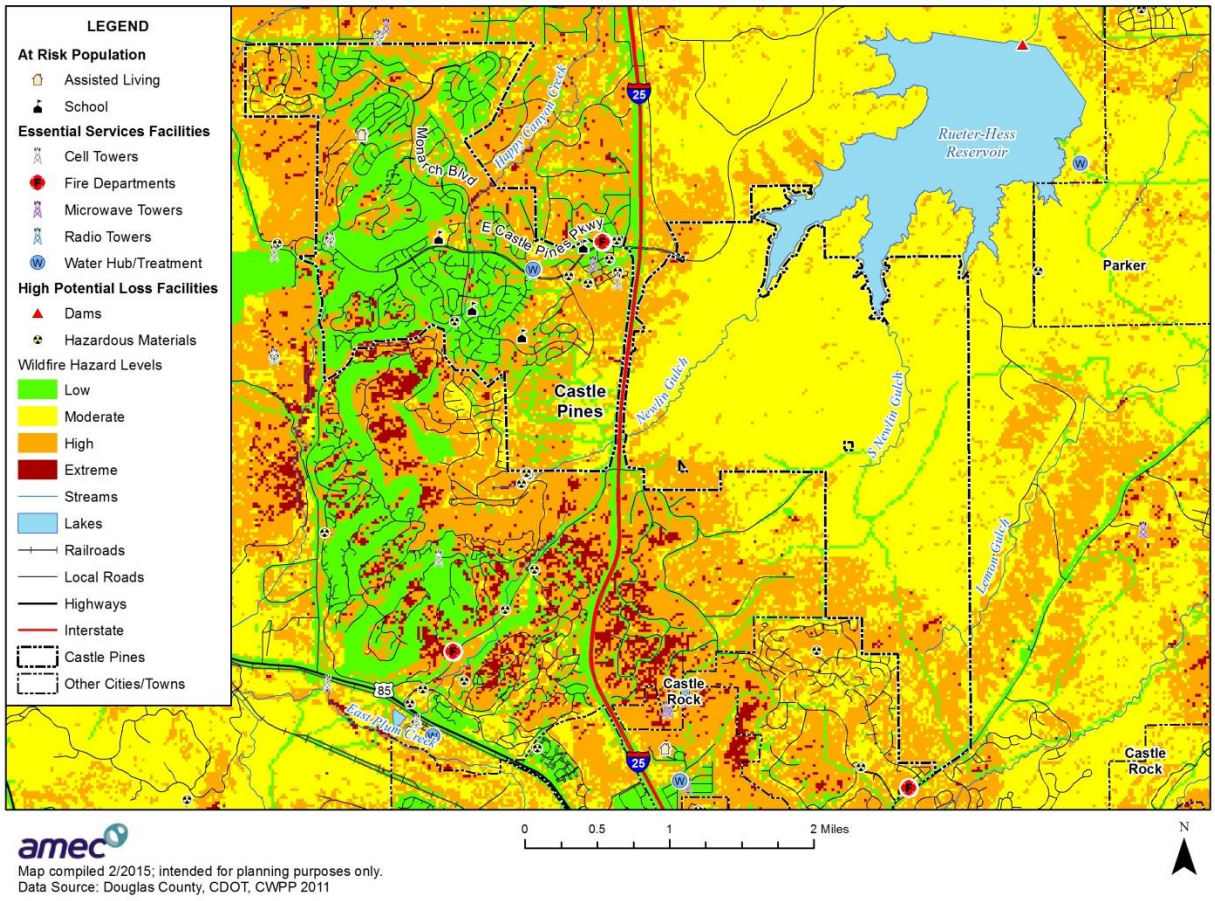
Wildfire analysis was performed on the critical facility inventory in Douglas County and all jurisdictions, including Castle Pines. GIS was used to determine whether the facility locations intersect a wildfire hazard area. Table A.11 summarizes the results of the GIS analysis for Castle Pines, and Figure A.10 depicts the location of critical facilities in relation to wildfire severity zones. Details of critical facility definition, type, name and address and jurisdiction by wildfire zone are listed in Appendix E.

Table A.11. Castle Pines– Critical Facilities at Risk to Wildfire Detail

Fire Risk	Category	Type	Facility Count
Extreme	High Potential Loss Facilities	Hazardous Material	1
	Total		**1**
High	At-Risk Population Facilities	Assisted Living	1
	At-Risk Population Facilities	School	2
	Essential Services Facilities	Cell Tower	2
	Essential Services Facilities	Microwave	2
	Essential Services Facilities	Water Hub/Treatment	1
	Total		**8**
Moderate	At-Risk Population Facilities	School	1
	High Potential Loss Facilities	Hazardous Material	2
	Total		**3**
Low	At-Risk Population Facilities	School	1
	Essential Services Facilities	Cell Tower	1
	High Potential Loss Facilities	Hazardous Material	4
	Total		**6**
GRAND TOTAL			**18**

Source: Douglas County GIS

Figure A.10. Castle Pines Wildfire Hazard Potential and Critical Facilities



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 WUI fire areas have long histories of wildland fires that burned only vegetation in the past. However, with new development, a wildland fire following a historical pattern now burns developed areas. Population growth and development in Castle Pines could potentially expose more people and structures to wildfires.

An analysis of recent development in extreme, high, and moderate wildfire hazard areas was conducted for Castle Pines. A total of 47 structures was built between 2010 and 2014. The total value of these structures is $35,888,604, with the majority located in the high wildfire hazard area. Results of this analysis are shown in Table A.12.

Table A.12. Castle Pines 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	1	1	1	$643,717	$321,859	$115,000	$1,080,576
High	35	34	36	$15,190,338	$7,595,169	$4,411,000	$27,196,507
Moderate	9	9	10	$4,259,014	$2,129,507	$1,223,000	$7,611,521
Total	**45**	**44**	**47**	**$20,093,069**	**$10,046,535**	**$5,749,000**	**$35,888,604**

Source: Douglas County GIS

A.6 Capability Assessment

Capabilities are the programs and policies currently in use to reduce hazard impacts or that could be used to implement hazard mitigation activities. This capability assessment is divided into five sections: regulatory mitigation capabilities, administrative and technical mitigation capabilities, fiscal mitigation capabilities, mitigation outreach and partnerships, and other mitigation efforts.

A.6.1 Regulatory Mitigation Capabilities

Table A.13 lists regulatory mitigation capabilities, including planning and land management tools, typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place in the City of Castle Pines.

Table A.13. City of Castle Pines Regulatory Mitigation Capabilities

Regulatory Tool (ordinances, codes, plans)	Y/N	Date	Comments
General plan	Y	2009	
Zoning ordinance	Y	2008	Adopted Douglas County Zoning Code
Subdivision ordinance	Y	2008	Adopted Douglas County Zoning Code
Growth management ordinance	N		
Floodplain ordinance	Y	2008	Adopted Douglas County Zoning Code
Other special purpose ordinance (stormwater, steep slope, wildfire)	Y	2012	Illicit Discharge ordinance
Building code	Y	2006	
BCEGS Rating	N		
Fire department ISO rating	Y	2008	South Metro Fire
Erosion or sediment control program	Y	2008	Adopted Douglas County GESC program
Stormwater management program	Y	2008	Adopted Douglas County GESC program
Site plan review requirements	Y	2008	Currently reviewed by SafeBuilt
Capital improvements plan	Y	2013	Pavement management plan
Economic development plan	Y		

Regulatory Tool (ordinances, codes, plans)	Y/N	Date	Comments
Local emergency operations plan	N		DCSO responsible
Community Wildfire Protection Plans	Y		DCSO and South Metro Fire
Flood insurance study or other engineering study for streams	Y	2005	Included as part of unincorporated Douglas County as the City wasn't incorporated at that time.
Elevation certificates	N		
Other			

Source: Amec Foster Wheeler Data Collection Guide

Comprehensive Plan (2009)

The City of Castle Pines Comprehensive Plan represents a step in the City's on-going efforts to build and maintain a balanced, sustainable community. This Plan is the first Comprehensive Plan prepared by the City; however, community planning began during the early 1980s. The Plan is a document that sets forth the policies for the future of the community and is designed to be a flexible "living" document that can be changed as the needs change for the Castle Pines community. The planning horizon for the Plan is a focus of 20 years in the future and is a resource for community leaders to use as a guide in formulating future policies for the City and guide growth and development. The Plan is currently in the initial stages of being rewritten. The updated version will more accurately represent Castle Pines' goals and character and will include updated City boundaries.

Goals and policies related to mitigation of natural hazards are as follows:

7.1 Goal	Recognize and respect natural geologic conditions.
	Ensure development is appropriate when weighed against hazards and constraints.

7.2 Goal	Limit land uses in floodplains
	Preclude damage to life and property.
	Maintain floodplains as open space.

7.3 Goal	Reduce the risks of loss from wildfire hazard
	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.

7.4 Goal	Avoid risk of wildfire hazards. Create compatible development in areas where allowed, and protect public safety.
	Preclude development in areas with severe wildfire potential.

7.6 Goal	Maintain high water quality and protect water resources.
	Use “best management practices” (BMP) to control soil-erosion sediments.

South Metro Fire Rescue Authority Community Wildfire Protection Plan (2009)

This document provides a comprehensive, scientifically based analysis of wildfire related hazards and risks in the Wildland-Urban Interface (WUI) areas of the South Metro Fire Rescue Authority (SMFRA) in Colorado. The City of Castle Pines contracts with SMFRA for fire services. The CWPP covers the area that includes the City of Castle Pines.

Ordinances

The City of Castle Pines has many ordinances related to mitigation. The relevant ordinances and regulations are discussed in further detail here:

Zoning

The City of Castle Pines adopted the Douglas County zoning code in 2008. County zoning codes related to hazard mitigation are discussed in Section 4.4.1.

Building Code Section (Chapter 18)

In order to provide minimum standards for the proper regulations of building construction, the following publications are hereby adopted by reference and incorporated in this Code, except as expressly amended or superseded by the provisions of this Code.

- The International Building Code, 2009 Edition, 3rd printing, as published by the International Code Council, 500 New Jersey Avenue, NW, 6th Floor, Washington, DC 20001, Chapters 1 through 35 inclusive, exclusive of any Appendices
- The International Residential Code, 2009 Edition, 3rd printing, as published by the International Code Council, 500 New Jersey Avenue, NW, 6th Floor, Washington, DC 20001, Chapters 1 through 44 inclusive and Appendices A, C, G, H and N.
- Pursuant to Title 31, Article 16, Part 2, C.R.S., there is adopted as the electrical code of the City, by reference thereto, the National Electrical Code, 2011 edition, published by the National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02269, and the rules and regulations thereunder, as adopted, amended and updated to the most current edition by the Colorado State Electrical Board.
- The International Mechanical Code, 2009 Edition, 3rd printing, as published by the International Code Council, 500 New Jersey Avenue, NW, 6th Floor, Washington, DC 20001, Chapters 1 through 15 inclusive.
- The International Plumbing Code, 2009 Edition, 3rd printing, as published by the International Code Council, 500 New Jersey Avenue, NW, 6th Floor, Washington, DC 20001, Chapters 1 through 13 inclusive.

- The International Fire Code, 2009 Edition, 4th printing, as publishing by International Code Council, 500 New Jersey Avenue, NW, 6th Floor, Washington, DC 20001, Chapters 1 through 47 inclusive and Appendices B, C and J only.
- The International Fuel Gas Code, 2009 Edition, 3rd printing, as published by the International Code Council, 500 New Jersey Avenue, NW, 6th Floor, Washington, DC 20001, Chapters 1 through 8 inclusive.
- The International Energy Conservation Code, 2009 Edition, 3rd printing as published by the International Code Council, 500 New Jersey Avenue, NW, 6th Floor, Washington, DC 20001, Chapters 1 through 6 inclusive.

Storm Drainage (Chapter 11, Article 2)

The *Douglas County – Storm Drainage Design and Technical Criteria Manual*, 1986 Edition, as amended and as published by the Board of County Commissioners of Douglas County, Colorado, 100 Third Street, Castle Rock, Colorado 80104, is hereby adopted by reference as the City of Castle Pines Storm Drainage Design and Technical Criteria Manual as if fully set out in this Article. The purpose and subject matter of the Criteria is to provide minimum technical criteria for the planning, analysis and design of storm drainage systems within the boundaries of the City.

A.6.2 Administrative/Technical Mitigation Capabilities

Table A.14 identifies the City department(s) responsible for activities related to mitigation and loss prevention in Castle Pines.

Table A.14. City of Castle Pines Administrative and Technical Mitigation Capabilities

Personnel Resources	Yes/No	Department/Position	Comments
Planner/Engineer with knowledge of land development/land management practices	Y	Community Development	Sam Bishop
Engineer/Professional trained in construction practices related to buildings and/or infrastructure	Y	Public Works	On-call engineer
Planner/Engineer/Scientist with an understanding of natural hazards	Y	Public Works	On-call engineer
Personnel skilled in GIS	Y	contracted	Douglas County
Full time building official	Y	contracted	SafeBuilt
Floodplain Manager	N		
Emergency Manager	Y	DCSO	DCSO handles EM
Grant writer	N		
Other personnel	Y		
GIS Data – Hazard areas	N		
GIS Data - Critical facilities	N		
GIS Data – Building footprints	Y	contracted	Douglas County
GIS Data – Land use	Y	contracted	Douglas County

Personnel Resources	Yes/No	Department/Position	Comments
GIS Data – Links to Assessor's data	Y	contracted	Douglas County
Warning Systems/Services (Reverse 9-11, cable override, outdoor warning signals)	Y	all	CodeRED
Other			

Source: Amec Foster Wheeler Data Collection Guide

A.6.3 Fiscal Mitigation Capabilities

Table A.15 identifies financial tools or resources that the City could potentially use to help fund mitigation activities.

Table A.15. City of Castle Pines Fiscal Mitigation Capabilities

Financial Resources	Accessible/Eligible to Use (Y/N)	Comments
Community Development Block Grants	Y	
Capital improvements project funding	Y	
Authority to levy taxes for specific purposes	Y	
Fees for water, sewer, gas, or electric services	N	City does not provide these services
Impact fees for new development	Y	
Incur debt through general obligation bonds	Y	
Incur debt through special tax bonds	Y	
Incur debt through private activities	Y	
Withhold spending in hazard prone areas	Y	
Other		

Source: Amec Foster Wheeler Data Collection Guide

A.6.4 Mitigation Outreach and Partnerships

The City partners with South Metro Fire and Rescue for wildfire mitigation. The City partners with the County, and has adopted the County EOP.

A.7 Mitigation Strategy

This section describes the mitigation strategy process and mitigation action plan for the City of Castle Pines' inclusion with the Douglas County Local Hazard Mitigation Plan update.

A.7.1 Mitigation Goals and Objectives

The City of Castle Pines adopts the hazard mitigation goals and objectives developed by the HMPC and described in Chapter 5 Mitigation Strategy of the base plan.

A.7.2 Continued Compliance with the NFIP

The City of Castle Pines does not currently participate in the NFIP, and has no future plans to join given the lack of structures within flood hazard areas in the community.

A.7.3 Mitigation Actions

The planning team for the City of Castle Pines identified and prioritized the following mitigation actions based on the risk assessment and in accordance with the process outline in Section 5, Mitigation Strategy, of the base plan. Background information and information on how each action will be implemented and administered, such as ideas for implementation, responsible office, potential funding, estimated cost, and timeline are also included. General processes and information on plan implementation and maintenance of this LHMP by all participating jurisdictions is included in Section 7, Plan Implementation and Maintenance, of the base plan.

City of Castle Pines Action #1

Action Title:	**Repair flooding hazard at Monarch Blvd and Stonemont Drive**
Priority:	High
Project Description, Issue & Background:	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.
Ideas for Implementation:	Make modifications to the street or modifications to the infrastructure that the water runs into.
Other Alternatives:	No action
Responsible Agency:	City of Castle Pines
Partners:	N/A
Potential Funding:	N/A
Cost Estimate:	$35,000.00 +/-
Benefits: (Losses Avoided)	Decrease the amount of flooding that occurs on the street that potentially affects the safety of motorists.
Timeline:	FY 2015
Status:	New in 2015

City of Castle Pines Action #2

Action Title:	**Wildfire prevention and preparation**
Priority:	Medium
Project Description, Issue & Background:	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.
Ideas for Implementation:	This project will be an ongoing discussion with emergency managers within the County, City, and fire authority to ensure changes over time are adapted too.
Other Alternatives:	No action
Responsible Agency:	South Metro Fire Rescue Authority
Partners:	Douglas County, City of Castle Pines
Potential Funding:	
Cost Estimate:	Low cost due to the use of previous designed plans and communication tools
Benefits: (Losses Avoided)	Ensuring that citizens are aware of the potential for wildfires and the need for them to work to mitigate damages caused from wildfires; to take evasive action should there be a fire and to take action to prevent the events in the first place.
Timeline:	Ongoing
Status:	New in 2015

Annex B TOWN OF CASTLE ROCK

B.1 Introduction

This annex details the hazard mitigation planning elements specific to the Town of Castle Rock, a participating jurisdiction to the Douglas County LHMP Update. This annex is not intended to be a standalone document, but appends to and supplements the information contained in the base plan document. As such, all sections of the base plan, including the planning process and other procedural requirements apply to and were met by the Town. This annex provides additional information specific to the Town of Castle Rock, with a focus on providing additional details on the risk assessment and mitigation strategy for this community.

B.2 Planning Process

As described above, the Town of Castle Rock followed the planning process detailed in Section 3.0 of the base plan. In addition to providing representation on the Douglas County Hazard Mitigation Planning Committee (HMPC), the Town formulated their own internal planning team to support the broader planning process requirements. Internal planning participants included staff from the following Town departments:

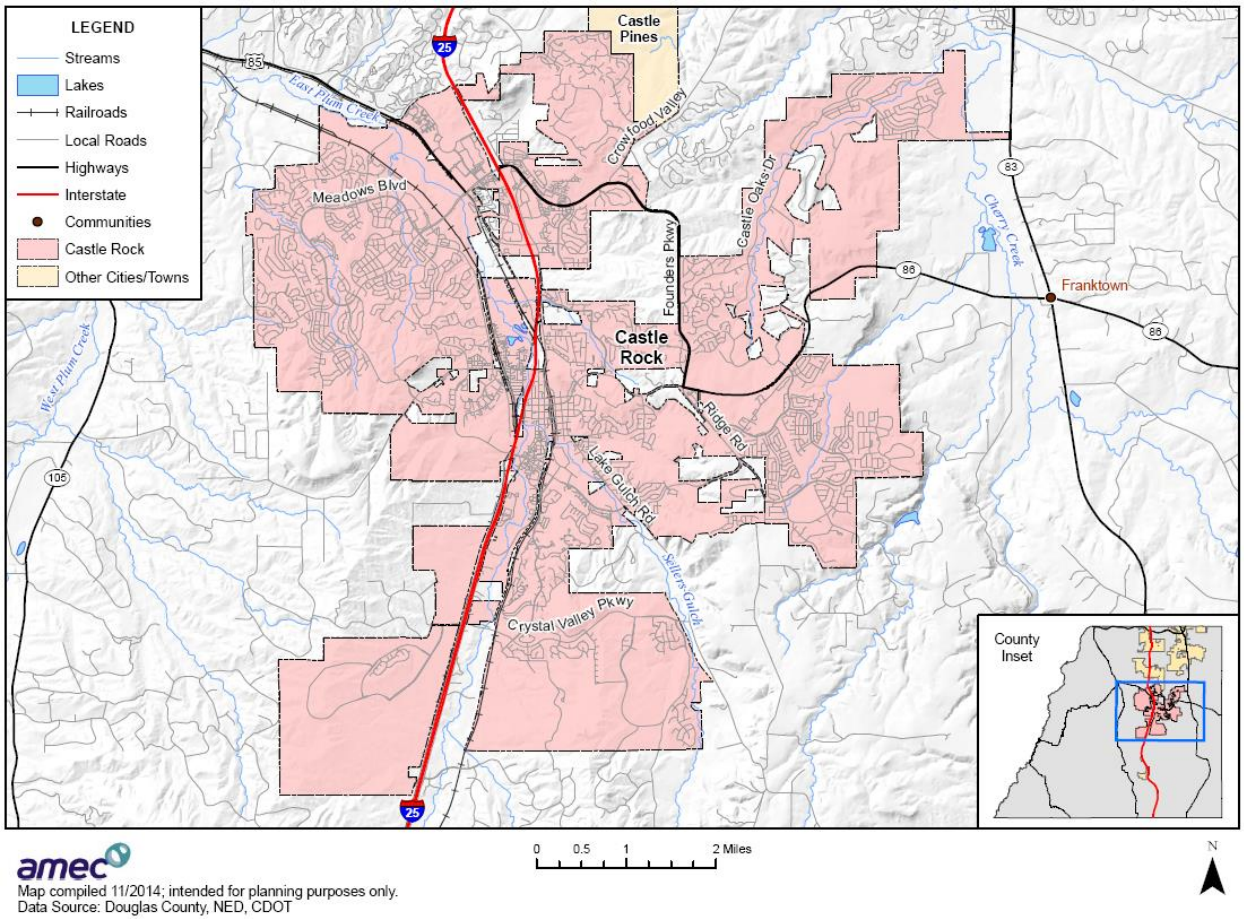
- Art Morales, Fire Chief

Additional details on plan participation and Town representatives are included in Appendix A.

B.3 Community Profile

The community profile for the Town of Castle Rock is detailed in the following sections. Figure B.1 displays a map and the location of the Town of Castle Rock within Douglas County.

Figure B.1. Town of Castle Rock Base Map



B.3.1 Geography and Location

The Town'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.

B.3.2 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. While the rate of annexation during the 1990's did not match that of the previous decade, the Town's incorporated limits reached approximately 31.5 square miles or just over 20,000 acres. The early 2000s saw continued growth in the Town. The Town more than doubled its population in that decade to 48,231 in 2010.

B.3.3 Economy

As the population of the Town has grown, so has its economy. Select economic characteristics and statistics for Castle Rock are shown in Table B.1.

Table B.1. Economic Characteristics for the Town of Castle Rock

Characteristic	2013
Families below Poverty Level	4.9%
Individuals below Poverty Level	6.4%
Median Home Value	$280,500
Median Household Income	$86,280
Per Capita Income	$35,173
Population in Labor Force*	26,822

Source: 2008-2013 US Census Bureau American Community Survey 5-year Estimates

B.3.4 Population

2013 population estimate for the Town (the most recent available) indicates there are 49,990 residents of Castle Rock. The population was estimated at 48,231 for the 2010 U.S. Census.

B.4 Hazard Identification and Summary

This section details how the risk varies across the Douglas County Planning Area. The Town's planning team identified the hazards that affect the Town and summarized their frequency of occurrence, spatial extent, potential magnitude, and significance specific to Castle Rock (see Table B.2). In the context of the entire Planning Area, there are no hazards that are unique to Castle Rock.

Information on past occurrences and the likelihood of future occurrences is detailed in Section 4, Risk Assessment, of the base plan. Additional information for high and medium significant hazards for the Town is included in the Vulnerability Assessment section of this Annex.

Table B.2. Town of Castle Rock Hazard ID Table

Hazard	Likelihood of Future Occurrence	Spatial Extent	Magnitude /Severity	Significance
Avalanche	Low	Limited	Low	Low
Drought	Low	Extensive	Medium	Low
Earthquake	Low	Extensive	Medium	High
Flood: Dam Failure	Low	Limited	Low	Low
Flood: 100/500 year	High	Limited	Low	Low
Flood: Localized/ Stormwater	High	Limited	Medium	Medium
Landslides/ Mud & Debris Flows /Rockfalls	Medium	Limited	Low	Low
Severe Weather: Extreme Heat	High	Extensive	Low	Low
Severe Weather: Hail	High	Extensive	Medium	High
Severe Weather: High Winds	High	Significant:	Medium	Medium
Severe Weather: Lightning	High	Limited	Low	Low
Severe Weather: Thunderstorms/Heavy Rains	High	Extensive	Medium	High
Severe Weather: Tornado	Medium	Limited	Medium	Medium
Severe Weather: Winter Weather (includes snow/ice/extreme cold)	High	Extensive	High	High
Soil Hazards: Erosion & Deposition	High	Limited	Low	Low
Soil Hazards: Expansive Soils	High	Limited	Low	Low
Soil Hazards: Subsidence	Medium	Limited	Low	Low
Wildfire	High	Limited	Medium	Medium
Hazardous Materials: Transportation Incidents	Medium	Limited	Medium	Medium

Spatial Extent
Limited: Less than 10% of Planning Area
Significant: 10-50% of Planning Area
Extensive: 50-100% of Planning Area

Likelihood of Future Occurrences
Low: Occurs less than once every 10 years or more
Medium: Occurs less than once every 5 to 10 years
High: Occurs once every year or up to once every five years

Magnitude/Severity
Low: Negligible property damages (less than 5% of all buildings and infrastructure) Negligible loss of quality of life. Local emergency response capability is sufficient to manage the hazard.
Medium: Moderate property damages (15% to 50% of all buildings and infrastructure) Some loss of quality of life. Emergency response capability, economic and geographic effects of the hazard are of sufficient magnitude to involve one or more counties.
High: Property damages to greater than 50% of all buildings and infrastructure. Significant loss of quality of life Emergency response capability, economic and geographic effects of the hazard are of sufficient magnitude to require federal assistance.

Significance
Low: minimal potential impact
Medium: moderate potential impact
High: widespread potential impact

B.5 Vulnerability Assessment

The intent of this section is to assess Castle Rock's vulnerability separate from that of the Planning Area as a whole, which has already been assessed in Section 4.3 Vulnerability Assessment of the base plan. This vulnerability assessment provides an inventory of the population, property, and other assets located within the Town and further analyzes those assets at risk to identified hazards ranked of medium or high significance (as listed in Table B.2) to the community. Landslide and erosion were also analyzed to compare Castle Rock's exposure to the rest of the Planning Area, despite being ranked low significance to the Town. For more information about how hazards affect the County as a whole, see Chapter 4 Risk Assessment in the main plan.

B.5.1 Total Assets at Risk

This section identifies Castle Rock's total assets at risk, including values at risk, critical facilities and infrastructure, natural resources, and historic and cultural resources. Growth and development trends are also presented for the community. This data is not hazard specific, but is representative of total assets at risk within a community.

Values at Risk

The following data from the Douglas County Assessor's Office is based on joining assessor data to the 2014 parcel layer in GIS. This data should only be used as an indicator of overall values in the County, as the information has some limitations. Table B.3 summarizes the parcels, improved parcels, structures, improved value, land value, and total value exposed in Castle Rock. It is 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.

Table B.3. Town of Castle Rock Total Exposure

Property Type	Total Parcel Count	Improved Parcel Count	Total Structures Count	Improved Value	Total Land Value	Total Value
Agricultural	1,307	4	1,105	$284,819	$644,075	$928,894
Commercial	453	418	1,733	$520,011,852	$200,631,577	$720,643,429
Exempt	1,401	119	479	$564,472,818	$116,157,729	$680,630,547
HOA	712	0	358	$0	$0	$0
Industrial	25	25	48	$20,583,498	$12,922,322	$33,505,820
Producing Mine	0	0	0	$0	$0	$0
Residential	18,067	17,084	18,449	$3,791,308,266	$844,168,844	$4,635,477,110
Utilities	18	0	8	$0	$0	$0
Vacant Land	2,636	6	2,339	$1,041,743	$94,677,962	$95,719,705
Total	**24,619**	**17,656**	**24,519**	**$4,897,702,996**	**$1,269,202,509**	**$6,166,905,505**

Source: Douglas County Assessor's Data

Critical Facilities and Infrastructure

For purposes of this plan, a critical facility is defined as:

> Any facility, including without limitation, a structure, infrastructure[1], 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.

This definition was refined by separating out three categories of critical facilities as further described in Section 4.3.1 of the base plan. These categories include At-Risk Populations, Essential Services, and High Potential Loss Facilities.

An inventory of critical facilities in the Town of Castle Rock from Douglas County GIS is provided in Table B.4. Details of critical facility definition, type, name and address and jurisdiction by hazard zone are listed in Appendix E.

Table B.4. Town of Castle Rock Critical Facilities: Summary Table

Category	Type	Facility Count
At Risk Population Facilities	Assisted Living	14
	School	17
Essential Services Facilities	Admin & Management	1
	Bridge	1
	Cell Tower	6
	Courts	1
	EOC	2
	Fire Department	5
	Hospital	1
	IT Infrastructure	2
	Jail	1
	Microwave	39
	Police	3
	Public Health	1
	Water Hub/Treatment	13
High Potential Loss Facilities	Hazardous Material	116
	Total Town of Castle Rock	**223**

Source: Douglas County GIS

[1] Essential Service Facilities include bridges, roads, power grids, and infrastructure held by private companies (e.g., utility lines and private levees) that are not mapped for security reasons and are not under the control of the County.

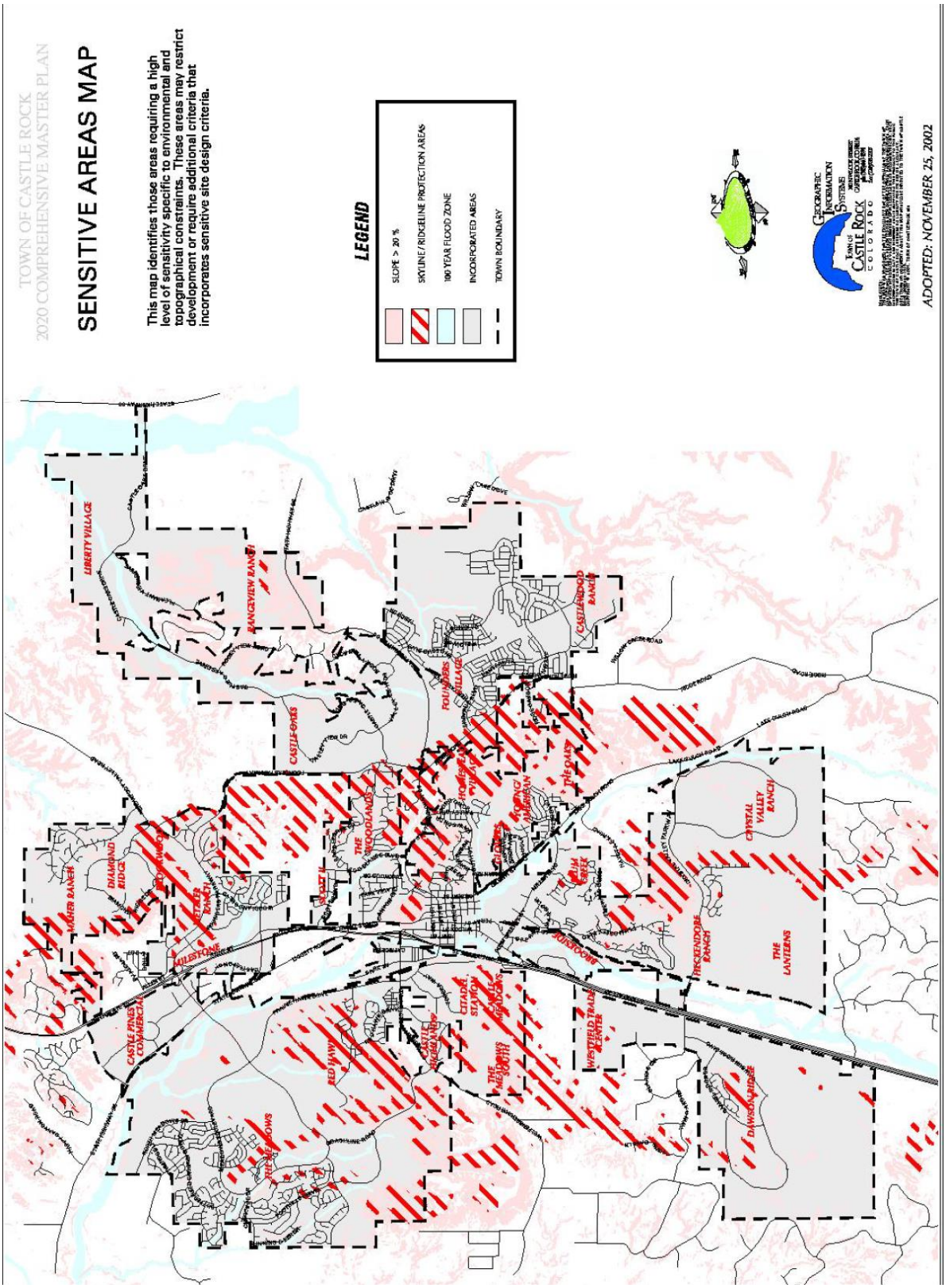
Natural Resources

The Town has undertaken a detailed environmental inventory that is depicted on the Sensitive Areas Map (see Figure B.2) from the Castle Rock Comprehensive Master Plan. Key elements identified below have been identified as critical to preserve through all appropriate means available to the Town:

- 100-year Floodplains: Shown along all drainages, streams and rivers, the 100-year floodplain is the extent of flooding which will occur in a 100-year storm event. This is a storm having a 1 percent probability of occurring in any given year. Town ordinances limit the ability to develop in the floodplain and adjacent floodway areas due to the high potential for loss of life and property.
- Areas of Geologic Hazard: Within Castle Rock, areas of subsidence, rock-fall, slope failure and debris flow are natural geologic conditions having the potential to result in loss of life, damage to property, and high public maintenance or management costs. These hazards are often associated with steep slopes and areas of former mining activities. The Town rated these hazards as having low significance in Table B.2.
- Steep Slopes (10% to 20% and 20% and Greater): Steep slopes are included as potential hazards because of their high susceptibility to erosion. This type of erosion results in increased sediment deposition in streams, and increases the potential for flooding and degraded water quality. Development on highly visible slopes can also have an undesirable visual impact.
- Ridgelines: The most central visual centerpiece in Town is undoubtedly the namesake Castle Rock. Located within the central portion of the Town, the Rock is visible from many miles around providing the Town with an unparalleled level of recognition. In addition to the Rock, several buttes dot the landscape. Strong ridgelines frame the Town and provide natural edges and gateways into the community.
- Vegetation: Significant stands of scrub oak and ponderosa pine have been identified as key elements of Castle Rock's environment worthy of preservation wherever possible. In addition to the negative visual impact that the loss of these species would cause, overlot grading and the removal of vegetation increases erosion, water quality degradation and undue loss of wildlife habitat.
- While continued development will displace much of this wildlife over time, a contiguous growth pattern emanating from existing developed areas has been shown to be the least disruptive to wildlife. In addition, the preservation of adequate open space and vegetative stands will allow a degree of wildlife to remain in the area. Riparian (stream) corridors in particular are critical to wildlife as habitat and migration routes. Over 75 percent of the species found in Colorado may be found in riparian areas, while over 50 percent of these species are dependent on riparian areas for some part of their life cycle. Connected, contiguous and preserved riparian areas are then the single most important factor in maintaining wildlife in an area. The scruboak habitat and bluff habitat are other important areas for wildlife.

- Plum Creek Watershed: This area contributes to several tributary wells that supply water to Castle Rock citizens and businesses. Alluvial (tributary) aquifers are directly supplied by surface water, and are thus extremely susceptible to surface and subsurface pollutants. An existing Town ordinance regulates uses such as underground petroleum storage tanks; hazardous waste storage; businesses utilizing any kind of chemical solvents; industrial users involved in the use, storage, or disposal of any hazardous waste; septic systems; salts and de-icing material storage; fertilizer or pesticide application; and any other use deemed a potential hazard for water quality.

Figure B.2. Town of Castle Rock Sensitive Areas Map



Source: 2020 Town of Castle Rock Comprehensive Master Plan

Historic and Cultural Resources

The Town of Castle Rock has a stock of historically significant homes, public buildings, and landmarks. To inventory these resources, the HMPC collected information from both the National Register of Historic Places and the Colorado State Register. Each program has different eligibility criteria and procedural requirements. These requirements are detailed in Section 4.3.1 of the base plan. Historical resources included in the programs above are identified in Table B.5.

Table B.5. Castle Rock Historical Resources

Name (Landmark Plaque Number)	National Register	Date Listed	State Landmark	State Designation	Town
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

Source: Colorado Office of Historical Preservation

Growth and Development Trends

Past Growth

Section B.3.2 gives past population growth in the Town. These numbers are captured in Table B.6.

Table B.6. Past Population Growth in the Town of Castle Rock

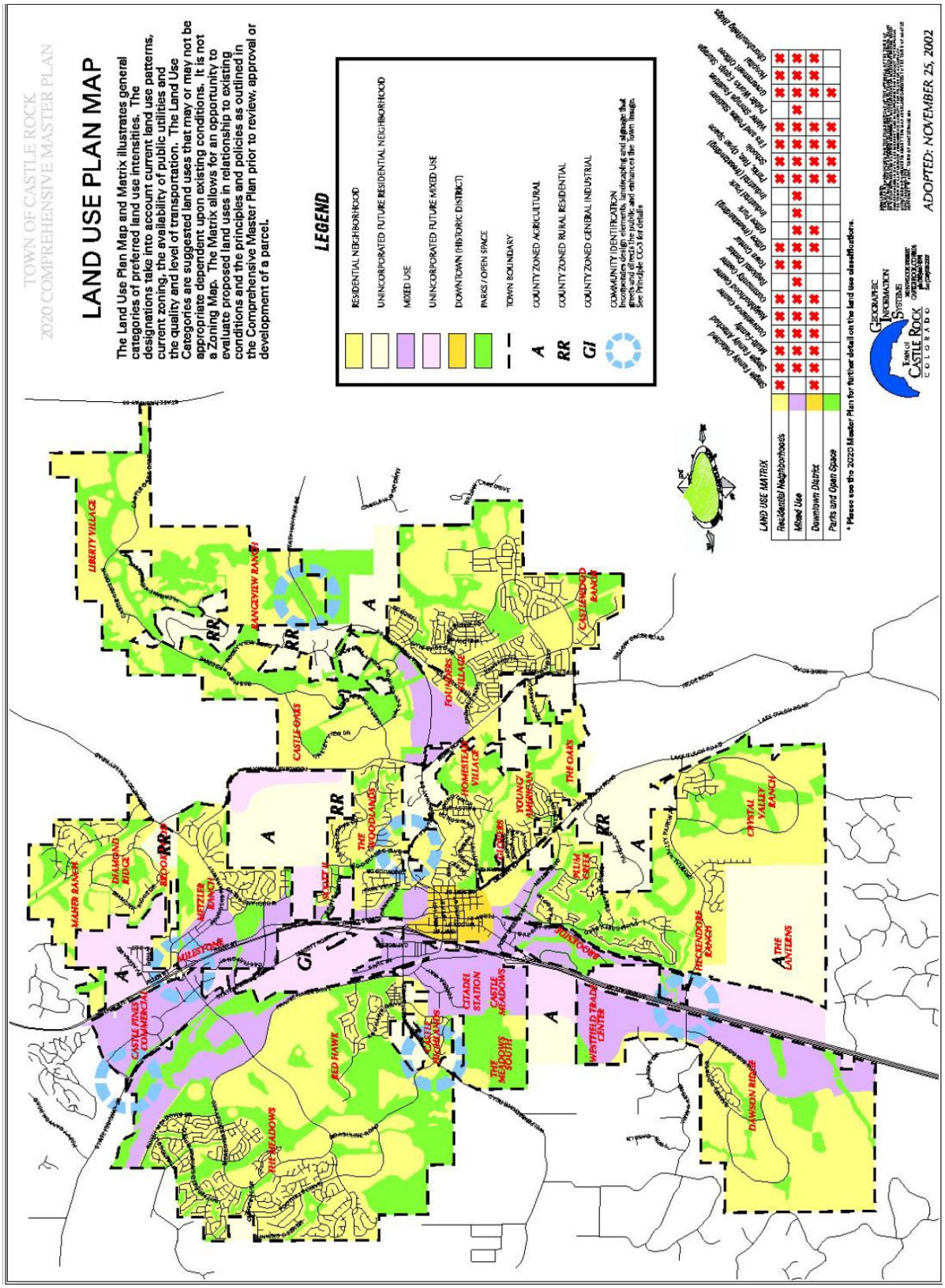
Year	Population	Population Change
1930	478	–
1940	488	100
1950	741	253
1960	1,154	413
1970	2,078	924
1980	3,921	1,843
1990	8,875	4,954
2000	20,224	11,349
2010	48,231	28,007
2013	49,990	1,759

Source: 2020 Town of Castle Rock Comprehensive Plan, U.S. Census Bureau, American Community Survey

Castle Rock's existing land use pattern features residential neighborhoods that surround a commercial and industrial core (see Figure B.3.) Defined in large part by topographic conditions, existing residential development is dispersed throughout the Town and many areas of

the community are physically separated from each other. Retail and service oriented commercial uses are beginning to develop in the outlying residential areas as the population of these areas increase. The Interstate 25 corridor serves as an anchor for the higher intensity and larger scale commercial and industrial uses. Interspersed throughout the community are large areas of public and private open spaces including parks, recreation areas and golf courses.

Figure B.3. Current Land Use in the Town of Castle Rock



Source: 2020 Town of Castle Rock Comprehensive Master Plan

Development since 2010 Plan

Table B.7 summarizes the number and value of structures built in Castle Rock from 2010 to 2014 based on a query of the 'year built' values in the County's parcel database. Over 1,100 structures, with a total value greater than $319 million, were built in that short period of time. The vast majority of these structures were residential, built to accommodate the rapidly growing population in the Planning Area. Additional analysis on recent development in Castle Rock's mapped hazard areas is discussed in the vulnerability assessments for flood, landslide/erosion, and wildfire.

Table B.7. Castle Rock Structures Built from 2010 to 2014: Total Assets by Property Type

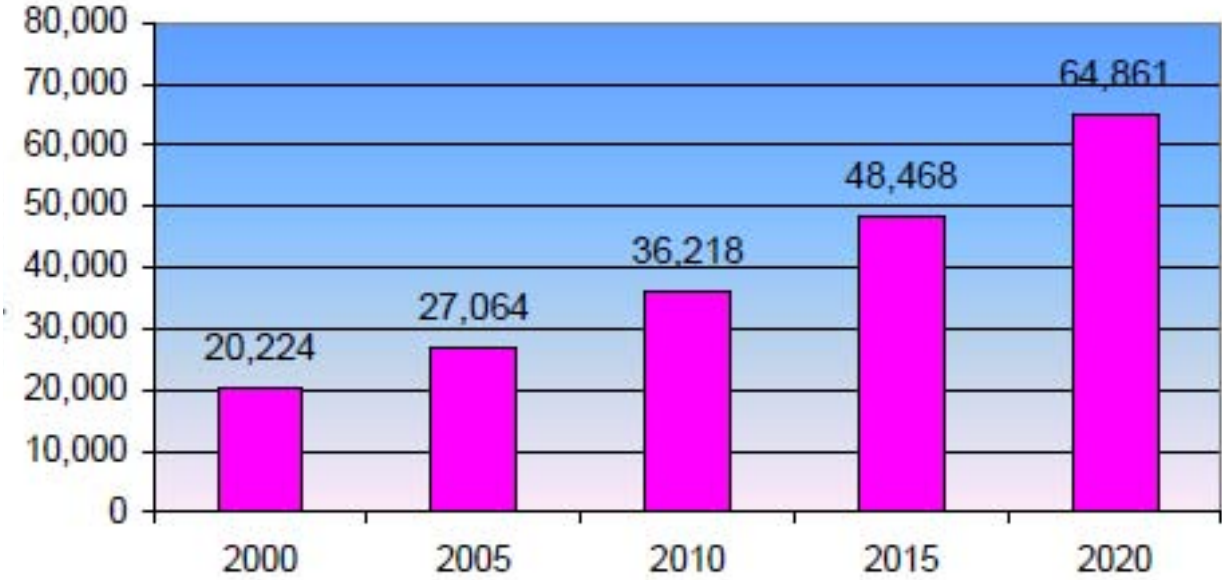
Jurisdiction	Total Parcel Count	Improved Parcel Count	Total Structure Count	Improved Value	Land Value	Total Value
Commercial	22	22	135	$14,776,953	$8,623,948	$23,400,901
Exempt	10	9	16	$41,187,563	$6,093,303	$47,280,866
Industrial	2	2	8	$1,764,935	$656,665	$2,421,600
Residential	926	926	950	$202,865,012	$43,484,605	$246,349,617
Total	**960**	**959**	**1,109**	**$260,594,463**	**$58,858,521**	**$319,452,984**

Source: Douglas County

Development Trends

In the 2020 Comprehensive Master Plan, the Town estimated future populations. The Town's population is projected to continue to increase substantially. For this effort, the Town is assuming an average annual growth rate of 6% per year through 2020. This growth rate is based on the Town's analysis of local and regional population trends. Using this assumed growth rate, the Town's population would grow to 64,861 by 2020. Projections are shown in Figure B.4. It should be noted that the 2013 American Community Survey estimate of 49,990 already exceeds the growth projections for 2015.

Figure B.4. Town of Castle Rock Population Projections 2000-2020



Source: 2020 Town of Castle Rock Comprehensive Master Plan

B.5.2 Priority Hazards: Vulnerability Assessment

This section provides the vulnerability assessment, including any quantifiable loss estimates, for those hazards identified above in Table B.2 as high or medium significance hazards. Landslide and erosion were also analyzed to compare Castle Rock's exposure to the rest of the Planning Area, despite being ranked low significance to the Town. Impacts of past events and vulnerability of the Town to specific hazards are further discussed below (see Section 4.1 Hazard Identification in the base plan for more detailed information about these hazards and their impacts on the Douglas County Planning Area). Methodologies for calculating loss estimates are the same as those described in Section 4.3 of the base plan.

An estimate of the vulnerability of the Town to each identified hazard, in addition to the estimate of risk of future occurrence, is provided in each of 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.
- **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.

Earthquake

Vulnerability to Earthquake

Likelihood of Future Occurrence—Low
Potential Magnitude—Medium
Overall Vulnerability—High

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).

Potential earthquake impacts specific to Castle Rock were not available; the HAZUS-MH 2.1 analysis provided in Section 4.3.4 in the base plan is countywide. Impacts to Castle Rock would likely be similar in nature to the countywide impacts.

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.

Flood: 100/500 year

Vulnerability to Flood: 100/500-Year

Likelihood of Future Occurrence—High
Potential Magnitude—Low
Overall Vulnerability—Low

The Planning Area, including Castle Rock, is prone to very intense rainfall. 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 Castle Rock to floods.

East Plum Creek and Sellers Gulch are the primary sources of 100/500-year flooding in Castle Rock. Major flooding events occurred in Castle Rock in 1965, 2012, and 2013. The strongest impacts typically occur in drainages in the Town. Minor flooding is localized to residences along drainages, and previous events have also caused roof leakage at the Castle Rock King Soopers and factory stores. The roof damages were estimated at $500,000.

The tables flood loss estimates for Castle Rock are located below. Table B.8 shows improved values at risk in the 1% annual chance flood zone, and Table B.9 shows this information for 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 value 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. Figure B.5 shows the FEMA flood zones in Castle Rock, and Figure B.6 shows the location of properties within those flood zones.

Table B.8. Castle Rock 1% Annual Chance Flood Loss Estimate by Property Type

Property Type	Total Parcel Count	Improved Parcel Count	Total Structure Count	Improved Value	Estimated Content Value	Total Value	Loss Estimate
Commercial	5	4	14	$3,015,500	$3,015,500	$6,031,000	$1,206,200
Exempt	81	1	11	$4,480	$4,480	$8,960	$1,792
HOA	1	0	1	$0	$0	$0	$0
Residential	39	34	48	$1,763,415	$881,708	$2,645,123	$529,025
Utilities	1	0	0	$0	$0	$0	$0
Vacant Land	14	1	5	$17,836	$0	$17,836	$3,567
Total	**141**	**40**	**79**	**$4,801,231**	**$3,901,688**	**$8,702,919**	**$1,740,584**

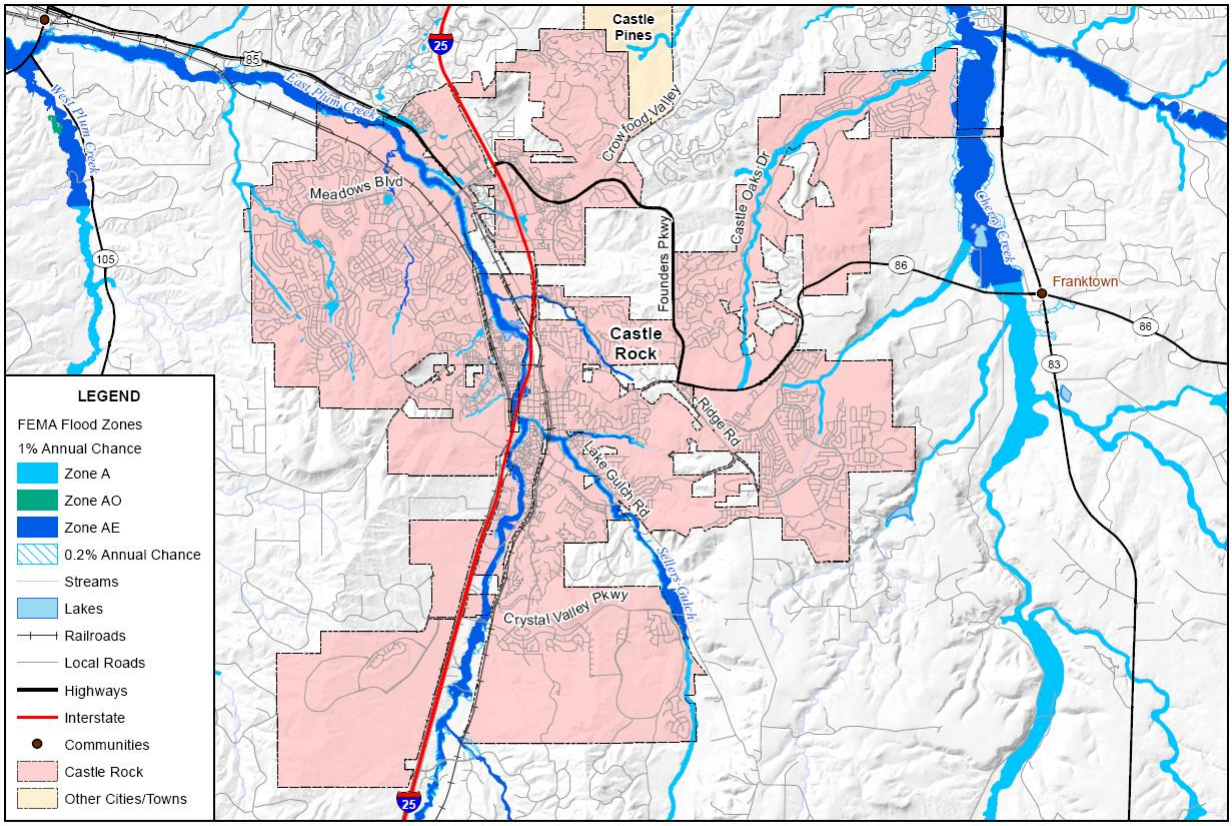
Source: Douglas County 2014 Assessor & Parcel Data; Douglas County DFIRM

Table B.9. Castle Rock 0.2% Annual Chance Flood Loss Estimate by Property Type

Property Type	Total Parcel Count	Improved Parcel Count	Total Structure Count	Improved Value	Estimated Content Value	Total Value	Loss Estimate
Agricultural	14	0	18	$0	$0	$0	$0
Commercial	2	2	16	$1,402,310	$1,402,310	$2,804,620	$560,924
Exempt	17	0	3	$0	$0	$0	$0
HOA	1	0	0	$0	$0	$0	$0
Industrial	1	1	1	$490,335	$735,503	$1,225,838	$245,168
Residential	9	9	9	$1,069,946	$534,973	$1,604,919	$320,984
Vacant Land	5	0	3	$0	$0	$0	$0
Total	**49**	**12**	**50**	**$2,962,591**	**$2,672,786**	**$5,635,377**	**$1,127,075**

Source: Douglas County 2014 Assessor & Parcel Data; Douglas County DFIRM

Figure B.5. Castle Rock FEMA Flood Hazards



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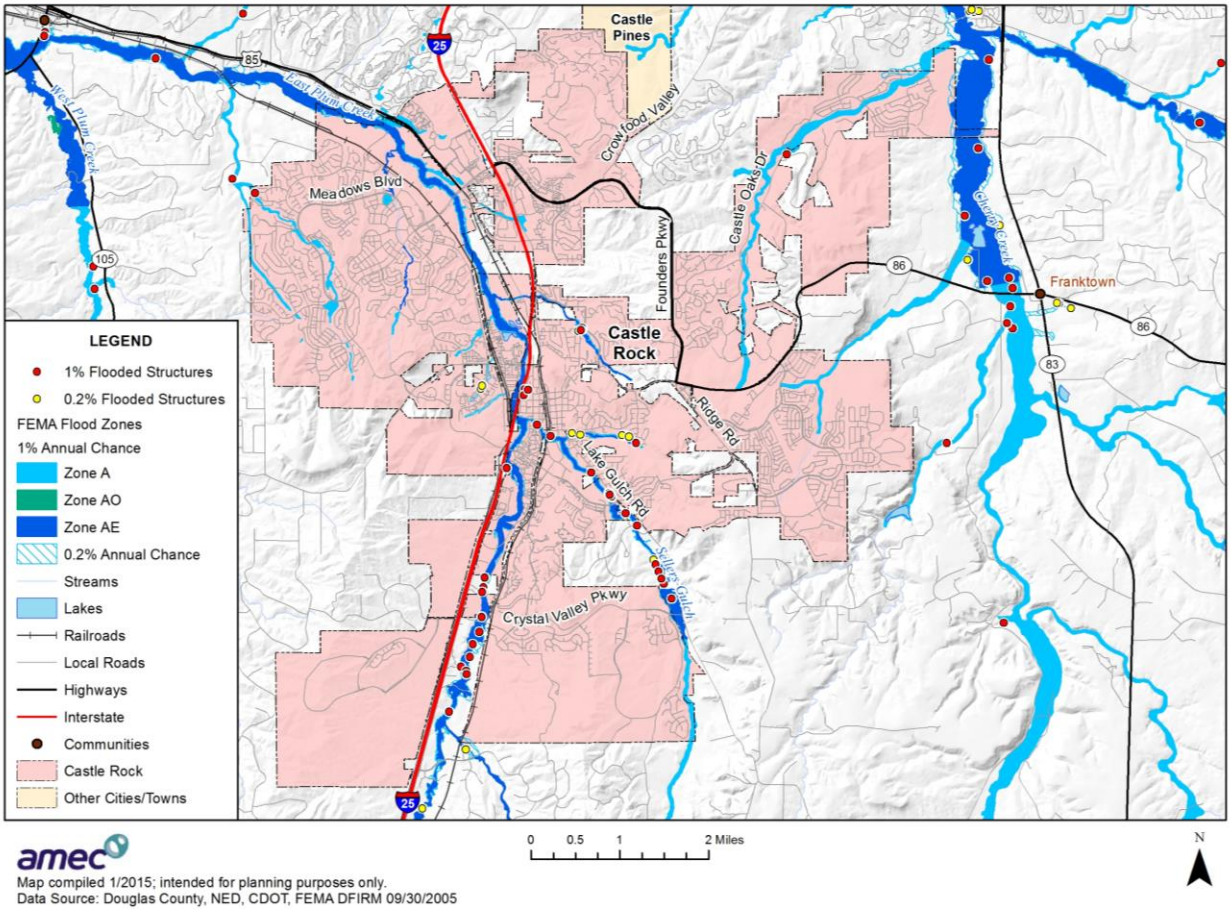
Map compiled 11/2014; intended for planning purposes only.
Data Source: Douglas County, NED, CDOT, FEMA DFIRM 09/30/2005

Figure B.6. Castle Rock FEMA Flood Hazards and Flood Prone Improved Properties



Population at Risk

A separate analysis was performed to determine population in flood zones. Using GIS, the DFIRM dataset was overlaid on the improved residential parcel data. Those parcel centroids that intersect a flood zone were counted and multiplied by the 2010 U.S. Census household factor of 2.86; results were tabulated by jurisdiction and flood zone (see Table B.10). According to this analysis, there is a population of 97 in the 1% annual chance flood zone, and 26 in the 0.2% annual chance flood zone in Castle Rock.

Table B.10. Castle Rock - Improved Residential Parcels and Population in Floodplain

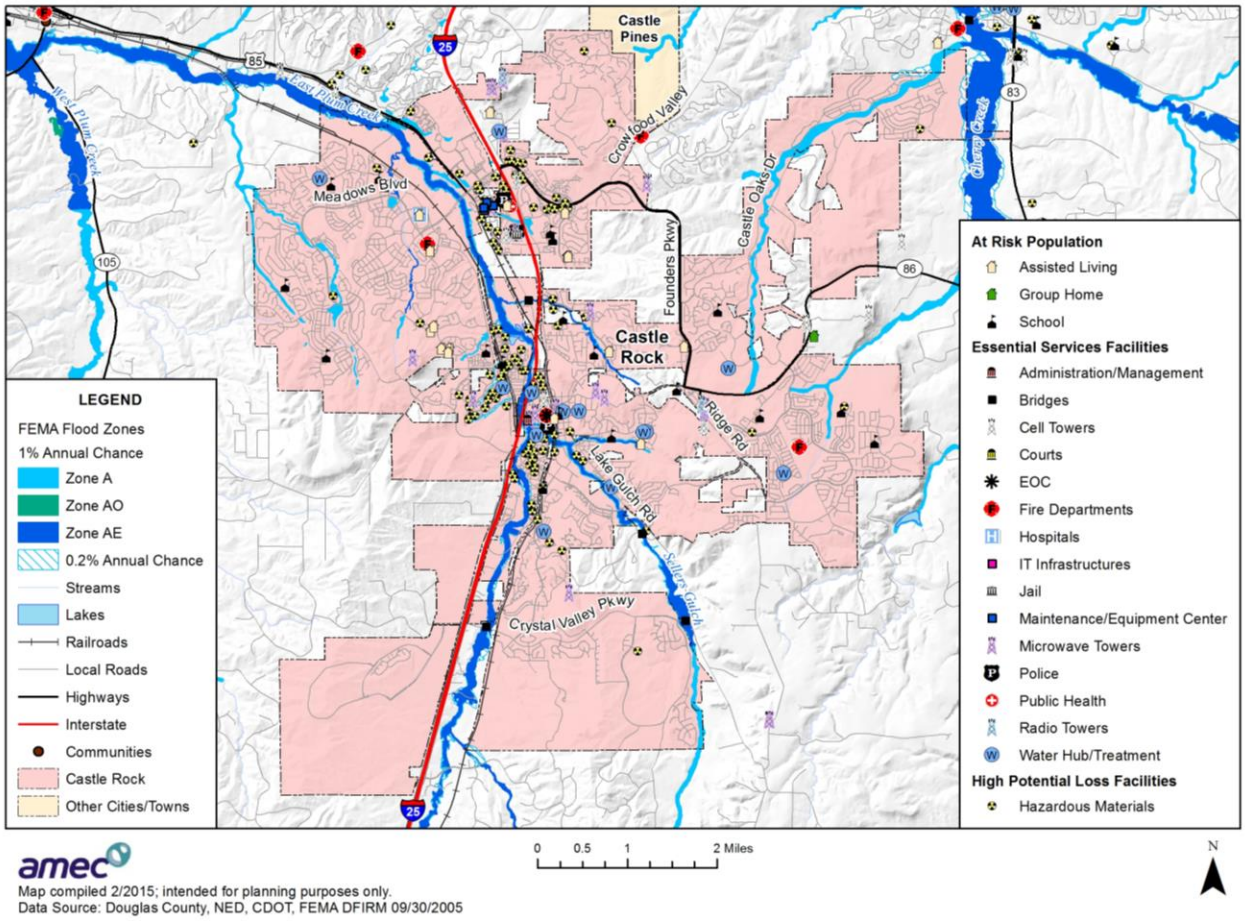
	1% Annual Chance		0.2% Annual Chance	
Jurisdiction	**Improved Residential Parcels**	**Population**	**Improved Residential Parcels**	**Population**
Castle Rock	34	97	9	26

Source: DFIRM, US Census Bureau, 2014 Douglas County Assessor & Parcel Data
* Census Bureau 2010 average household size for Castle Rock – 2.86

Critical Facilities at Risk

Two critical facilities in Castle Rock are located in the 1% annual chance flood zone, and no critical facilities are located in the 0.2% annual chance flood zone. Both are essential services facilities, specifically water hub/treatment facilities.

Figure B.7. Castle Rock FEMA Flood Hazards and Critical Facilities



Development Trends

The Town's floodplain regulations are laid out in Title 18 of the Castle Rock Municipal Code. These regulations prohibit various types of development within the floodplain overlay district. See section B.6.1 for details on Title 18.

Table B.11 summarizes development in the 1% and 0.2% annual chance flood zones between 2010 and 2014. Based on this data, Castle Rock has greatly minimized development in flood hazard areas.

Table B.11. Castle Rock Structures Built from 2010 to 2014: Assets Exposed to the 1% and 0.2% Annual Chance Flood Zone

Flood Zone	Total Parcel Count	Improved Parcel Count	Total Building Count	Improved Value	Estimated Content Value	Land Value	Total Value
1% Annual Chance	3	3	4	$110,764	$55,382	$30,000	$196,146
0.2% Annual Chance	1	1	1	$490,335	$735,503	$262,665	$1,488,503
Total	4	4	5	$601,099	$790,885	$292,665	$1,684,649

Source: Douglas County GIS

Flood: Localized/ Stormwater

Vulnerability to Flood: Localized/ Stormwater

Likelihood of Future Occurrence—High
Potential Magnitude—Medium
Overall Vulnerability—Medium

Stormwater flooding is relatively common in Castle Rock, occurring roughly every year. Stormwater flooding is most likely to occur in the spring and summer months when the Colorado monsoons bring heavy rains. Impacts generally include ponding, intersection flooding, and basement flooding in a handful of residences.

Development Trends

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.

Landslides/ Mud & Debris Flows /Rockfalls/Erosion

Vulnerability to Landslides/ Mud & Debris Flows /Rockfalls/Erosion

Likelihood of Future Occurrence—Medium for landslides, High for erosion
Potential Magnitude—Low for landslides and erosion
Overall Vulnerability—Low for landslides and erosion

The landslide hazard is made up of these attributes: debris-flow, rockfall-rockslide/debris, and slope-failure. Erosion hazards in Castle Rock are also discussed in this section, despite being ranked low significance, due to the property exposure in potential hazard areas.

The County's parcel layer was used as the basis for the inventory of all parcels within Castle Rock. 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. The Town has 826 structures with a total value of over $361 million potentially exposed to landslide hazards, as detailed in Table B.12. Table B.13 summarizes exposure to moderate accelerated erosion. Erosion analysis does not include contents value since contents of buildings are unaffected by this hazard. Figure B.8 depicts Castle Rock's mapped landslide and erosion hazard areas.

Table B.12. Town of Castle Rock Total Exposure to Landslide

Property Type	Total Parcel Count	Improved Parcel Count	Total Building Count	Improved Value	Estimated Content Value	Land Value	Total Value
Debris Flow Area							
Exempt	2	0	0	$0	$0	$7,380	$7,380
HOA	1	0	0	$0	$0	$0	$0
Residential	2	2	2	$623,841	$311,921	$104,000	$1,039,762
Vacant Land	5	0	5	$0	$0	$216,929	$216,929
Total	**10**	**2**	**7**	**$623,841**	**$311,921**	**$328,309**	**$1,264,071**
Rockfall/Rockslide/Debris Avalanche Area							
Agricultural	12	1	0	$3,344	$3,344	$12,252	$18,940
Commercial	2	2	27	$11,114,940	$11,114,940	$3,024,948	$25,254,828
Exempt	72	4	21	$319,053	$319,053	$6,456,548	$7,094,654
HOA	48	0	10	$0	$0	$0	$0
Residential	457	445	455	$165,347,125	$82,673,563	$30,863,139	$278,883,827
Vacant Land	156	0	149	$0	$0	$8,805,576	$8,805,576
Total	**747**	**452**	**662**	**$176,784,462**	**$94,110,900**	**$49,162,463**	**$320,057,825**
Slope-Failure Area							
Agricultural	3	0	0	$0	$0	$8,294	$8,294
Exempt	11	0	1	$0	$0	$294,420	$294,420
HOA	7	0	6	$0	$0	$0	$0
Residential	90	89	91	$21,056,449	$10,528,225	$5,336,721	$36,921,395
Vacant Land	63	0	59	$0	$0	$2,682,300	$2,682,300
Total	**174**	**89**	**157**	**$21,056,449**	**$10,528,225**	**$8,321,735**	**$39,906,409**
Grand Total	**931**	**543**	**826**	**$198,464,752**	**$104,951,046**	**$57,812,507**	**$361,228,305**

Source: Douglas County Assessor's Data

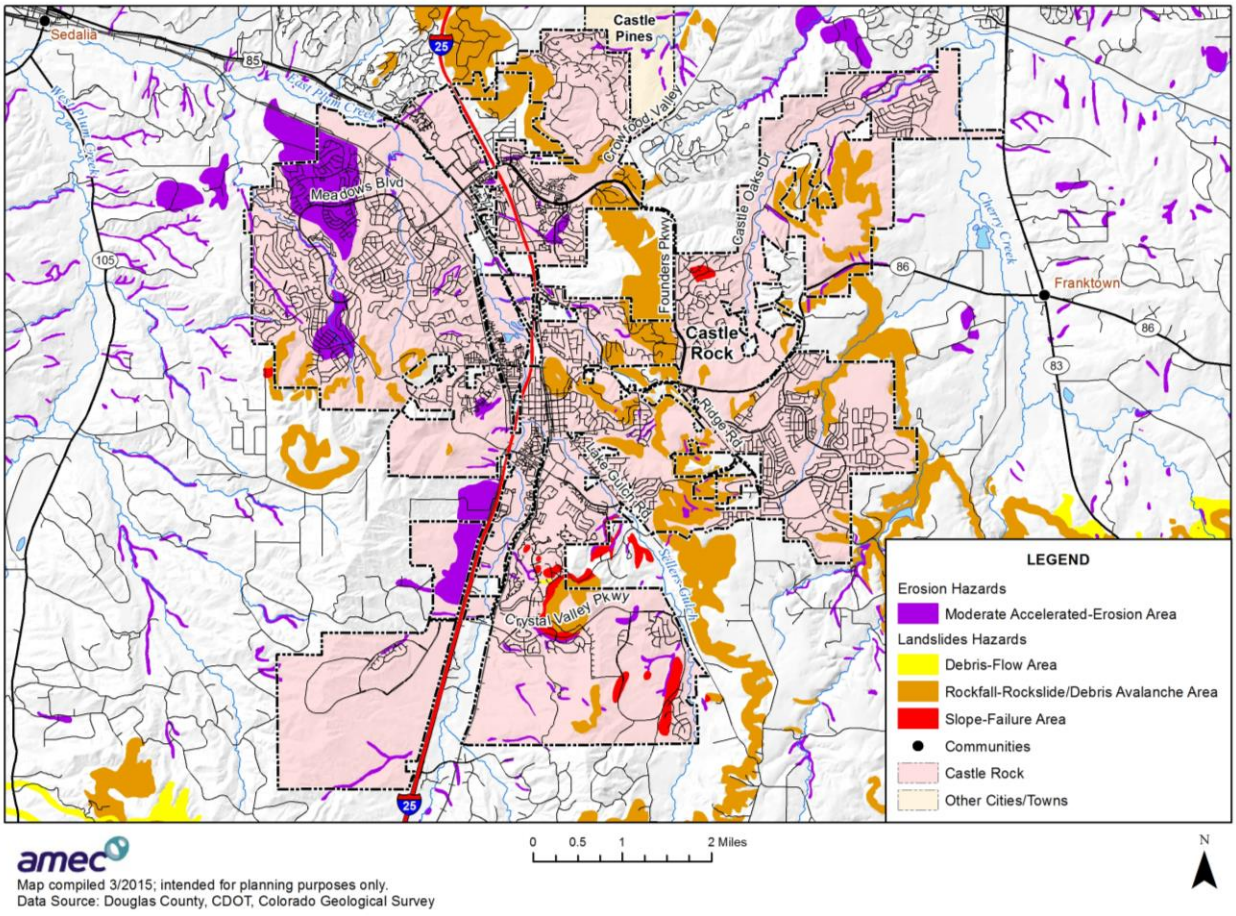
Table B.13. Town of Castle Rock Total Exposure to Moderate Accelerated Erosion

Property Type	Total Parcel Count	Improved Parcel Count	Total Building Count	Improved Value	Land Value	Total Value
Agricultural	61	0	51	$0	$3,409	$3,409
Commercial	8	5	9	$3,261,035	$3,011,879	$6,272,914
Exempt	63	3	14	$7,433,295	$2,958,962	$10,392,257
HOA	63	0	37	$0	$0	$0

Property Type	Total Parcel Count	Improved Parcel Count	Total Building Count	Improved Value	Land Value	Total Value
Industrial	1	1	1	$431,580	$588,060	$1,019,640
Residential	1,906	1,906	1,906	$372,771,572	$94,912,075	$467,683,647
Vacant Land	42	0	35	$0	$2,118,241	$2,118,241
Total	**2,144**	**1,915**	**2,053**	**$383,897,482**	**$103,592,626**	**$487,490,108**

Source: Douglas County Assessor's Data

Figure B.8. Castle Rock Erosion and Landslide Hazards



Population at Risk

An estimated 1,533 people are potentially exposed to landslide hazards in Castle Rock. This estimate is based on the number of exposed improved residential parcels (536) multiplied by the average household size in Castle Rock according to the 2010 U.S. Census (2.86).

Critical Facilities at Risk

Landslide and erosion analysis was performed on the critical facility inventory in Castle Rock. GIS was used to determine whether Castle Rock facility locations intersect the landslide and erosion hazard areas provided by Douglas County, and if so, which zones they intersect. There

are a total of 25 critical facilities located in rockfall and moderate accelerated erosion hazard areas in Castle Rock.

Table B.14. Castle Rock Critical Facilities in Landslide and Erosion Hazard Areas

Hazard	Category	Type	Facility Count
Moderate Accelerated Erosion	At-Risk Population Facilities	School	3
	Essential Services Facilities	Bridge	1
		Water Hub/Treatment	1
	High Potential Loss Facilities	Hazardous Material	2
	Total		**7**
Rockfall	At-Risk Population Facilities	Assisted Living	1
	Essential Services Facilities	Cell Tower	1
	Essential Services Facilities	Microwave	16
	Total		**18**
	Grand Total		**25**

Source: Douglas County GIS

Development Trends

Castle Rock has two regulatory mechanisms for dealing with erosion, including the 2011 Grading, Erosion, and Sediment Control (GESC) Manual and the 2011 Drainage, Erosion, and Sediment Control (DESC) Manual. Castle Rock's Municipal Code states that "[t]he provisions of the GESC Manual shall apply to all land within the incorporated areas of the Town of Castle Rock or served by the Town, including public lands" (Section 15.34.020 Applicability). The provisions in these documents will also apply to future development built within the Town's boundaries or service area.

An analysis of recent development trends in hazard areas was conducted for Castle Rock. A total of 124 structures were built in landslide and moderate-accelerated erosion hazard areas in the Town between 2010 and 2014. Results of this analysis are shown in Table B.15.

Table B.15. Castle Rock Structures Built from 2010 to 2014: Summary of Assets Exposed to Landslide and Moderate Accelerated-Erosion Areas

Hazard	Total Parcel Count	Improved Parcel Count	Total Building Count	Improved Value	Estimated Content Value	Land Value	Total Value
Debris Flow	1	1	1	$354,228	$177,114	$52,000	$583,342
Rockfall	16	16	16	$6,289,724	$3,144,862	$1,054,200	$10,488,786
Slope Failure	2	2	2	$208,974	$104,487	$130,000	$443,461
Moderate Accelerated Erosion	105	105	105	$20,306,057	$10,153,029	$4,995,400	$35,454,486
Total	**124**	**124**	**124**	**$27,158,983**	**$13,579,492**	**$6,231,600**	**$46,970,075**

Source: Douglas County GIS

Severe Weather: Hail

Vulnerability to Severe Weather: Hail

Likelihood of Future Occurrence—High
Potential Magnitude—Medium
Overall Vulnerability—High

Hail is one of the most damaging natural hazards in Colorado. It occurs in wide swaths, causing damage to large geographical areas at once. A single hailstorm could potentially impact all of Castle Rock at once. Hailstorms can also occur relatively frequently, especially in the summer, though they may not always cause significant damages. The impacts of hailstorms can vary substantially from one storm to another depending on weather conditions and the size of the hailstones. Losses are typically covered by insurance.

Development Trends

Any future development in Castle Rock will be exposed to hail. Impacts to people can be mitigated by staying indoors during a hailstorm, and some property such as cars can be protected with covered parking where available. Hail impacts are difficult to mitigate in general though, and insurance is one of the typical options for recouping property losses and reducing economic impacts.

Severe Weather: High Winds

Vulnerability to Severe Weather: High Winds

Likelihood of Future Occurrence—High
Potential Magnitude—Medium
Overall Vulnerability—Medium

High winds, often accompanying severe thunderstorms, can cause significant property and crop damage, threaten public safety, and have adverse economic impacts from business closures and power loss. Winds in Castle Rock are typically straight-line winds. Straight-line winds are generally any thunderstorm wind that is not associated with rotation (i.e., is not a tornado). These winds can overturn mobile homes, tear roofs off of houses, topple trees, snap power lines, shatter windows, and sandblast paint from cars. Other associated hazards include utility outages, arcing power lines, debris blocking streets, dust storms, and an occasional structure fire.

Development Trends

The impact of high winds on future development in Castle Rock can be mitigated with building codes and design criteria.

Severe Weather: Thunderstorms/Heavy Rains

Vulnerability to Severe Weather: Thunderstorms/Heavy Rains

Likelihood of Future Occurrence—High
Potential Magnitude—Medium
Overall Vulnerability—High

According to historical hazard data, severe weather is an annual occurrence in Castle Rock. 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 Town. Lightning often accompanies these storms and has caused damage to homes in Castle Rock in the past. However, actual damage associated with the primary effects of severe weather has been limited. It is the damage caused by secondary hazards such as floods and fire that have the greatest impact on Castle Rock. The risk and vulnerability associated with these secondary hazards are discussed in other sections where applicable.

Development Trends

New critical facilities such as communications towers should be built to withstand heavy rains and thunderstorms. 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 in the Town is regulated by zoning and subdivision regulations, and future development is not expected to increase vulnerability to hazards.

Severe Weather: Tornado

Vulnerability to Severe Weather: Tornado

Likelihood of Future Occurrence—Medium
Potential Magnitude—Medium
Overall Vulnerability—Medium

Tornadoes can cause damage to property and loss of life. While most tornado damage is caused by violent winds, the majority of injuries and deaths generally result from flying debris. Property damage can include damage to buildings, fallen trees and power lines, broken gas lines, broken sewer and water mains, and the outbreak of fires. Agricultural crops and industries may also be damaged or destroyed. Access roads and streets may be blocked by debris, delaying necessary emergency response.

Figure 4.22 in Chapter 4 indicates that tornadoes can occur anywhere in Douglas County, especially in the eastern half. Four F0 tornadoes and one F1 tornado were reported in Castle Rock.

Development Trends

Population growth and development expose more people to tornadoes in Castle Rock. The impact to people can be mitigated through warning systems and tornado shelters. Stringent building codes for high winds can help mitigate impacts from weaker tornadoes, and property insurance can reduce economic impacts.

Severe Weather: Winter Weather (includes snow/ice/extreme cold)

Vulnerability to Severe Weather: Winter Weather (includes snow/ice/extreme cold)

Likelihood of Future Occurrence—High
Potential Magnitude—High
Overall Vulnerability—High

Castle Rock typically experiences multiple winter storms in any given year. This hazard has been critical in its magnitude and severity in the past in Douglas County, as seen during the blizzards of March 2003 and December 2006. Vulnerability is high along busy roadways, particularly on Highway 470 and Interstate 25, the latter of which runs through the center of Castle Rock. 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 Castle Rock. 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; Castle Rock'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 Castle Rock 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.

Wildfire

Vulnerability to Wildfire

Likelihood of Future Occurrence—High
Potential Magnitude—Medium

Overall Vulnerability—Medium

An exposure analysis was performed to quantify risk to wildfire in Castle Rock. 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.

Table B.16 shows 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 in Castle Rock. Table B.17 summarizes this information by wildfire severity zone. Figure B.9 illustrates the wildfire severity zones in Castle Rock and the surrounding area.

Table B.16. Town of Castle Rock Total Exposure to Wildfire by Property Type

Property Type	Total Parcel Count	Improved Parcel Count	Total Structure Count	Improved Value	Estimated Content Value	Land Value	Total Value/Loss Estimate
Extreme							
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**
High							
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**
Moderate							
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

Property Type	Total Parcel Count	Improved Parcel Count	Total Structure Count	Improved Value	Estimated Content Value	Land Value	Total Value/Loss Estimate
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**
Low							
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
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**
Grand Total	**24,619**	**17,656**	**24,519**	**$4,897,702,996**	**$3,011,298,870**	**$1,269,202,509**	**$9,178,204,375**

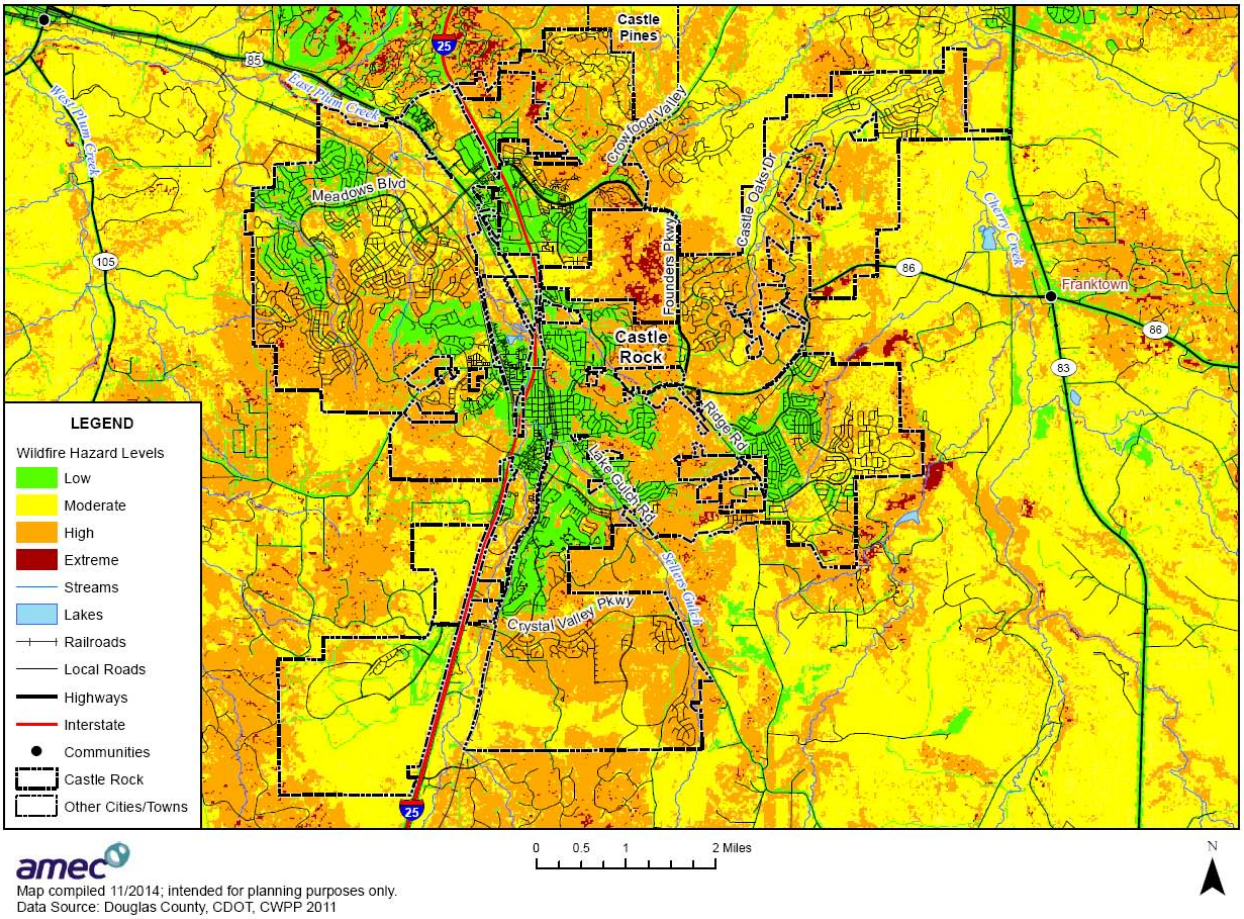
Source: Douglas County GIS

Table B.17. Town of Castle Rock Total Exposure to Wildfire Summary

Wildfire Severity	Total Parcel Count	Improved Parcel Count	Total Building Count	Improved Value	Estimated Content Value	Land Value	Total Value/Loss Estimate
Extreme	157	90	163	$52,590,013	$35,947,528	$11,807,993	$100,345,534
High	8,849	5,744	8,570	$1,730,795,701	$980,622,894	$434,446,621	$3,145,865,216
Moderate	5,387	2,961	5,235	$886,735,268	$540,375,876	$245,861,731	$1,672,972,875
Low	10,226	8,861	10,551	$2,227,582,014	$1,454,352,572	$577,086,164	$4,259,020,750
Total	**24,619**	**17,656**	**24,519**	**$4,897,702,996**	**$3,011,298,870**	**$1,269,202,509**	**$9,178,204,375**

Source: Douglas County GIS

Figure B.9. Castle Rock Wildfire Hazard Potential



Population 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 hazard potential 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 size for each jurisdiction and unincorporated area, which is 2.86 in Castle Rock. Table B.18 summarizes the results of this analysis.

Table B.18. Population at Risk to Wildfire

	Extreme	High	Moderate	Low
Population	252	16,219	8,323	24,067
Improved Residential Parcels	88	5,671	2,910	8,415

Source: Douglas County GIS, 2010 U.S. Census

Critical Facilities at Risk

Wildfire analysis was performed on the critical facility inventory in Douglas County and all jurisdictions, including Castle Rock. GIS was used to determine whether the facility locations intersect a wildfire hazard area. Table B.19 summarizes the results of the GIS analysis for Castle Rock, and Figure B.10 depicts the location of critical facilities in relation to wildfire severity zones. Details of critical facility definition, type, name and address and jurisdiction by wildfire zone are listed in Appendix E.

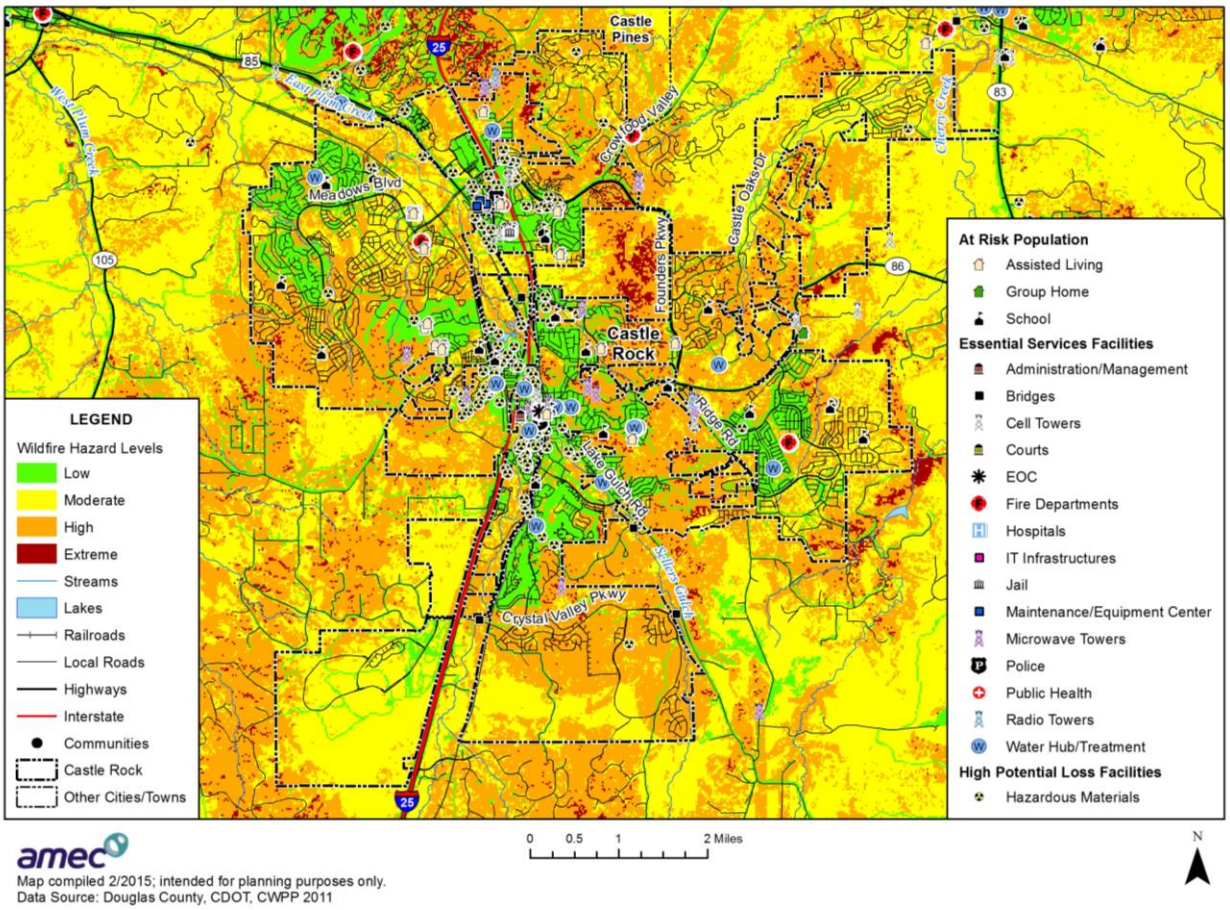
Table B.19. Castle Rock– Critical Facilities at Risk to Wildfire Detail

Fire Risk	Category	Type	Facility Count
High	At-Risk Population Facilities	Assisted Living	8
	At-Risk Population Facilities	School	12
	Essential Services Facilities	Bridge	1
	Essential Services Facilities	Cell Tower	3
	Essential Services Facilities	Fire Department	3
	Essential Services Facilities	Microwave	19
	Essential Services Facilities	Public Health	1
	Essential Services Facilities	Water Hub/Treatment	2
	High Potential Loss Facilities	Hazardous Material	30
	Total		**79**
Moderate	At-Risk Population Facilities	Assisted Living	2
	At-Risk Population Facilities	School	1
	Essential Services Facilities	Hospital	1
	Essential Services Facilities	Microwave	9
	Essential Services Facilities	Police	1
	Essential Services Facilities	Water Hub/Treatment	1
	High Potential Loss Facilities	Hazardous Material	16
	Total		**31**
Low	At-Risk Population Facilities	Assisted Living	4
	At-Risk Population Facilities	School	4
	Essential Services Facilities	Admin & Management	1
	Essential Services Facilities	Cell Tower	3
	Essential Services Facilities	Courts	1
	Essential Services Facilities	EOC	2
	Essential Services Facilities	Fire Department	2
	Essential Services Facilities	IT Infrastructure	2
	Essential Services Facilities	Jail	1
	Essential Services Facilities	Microwave	11
	Essential Services Facilities	Police	2
	Essential Services Facilities	Water Hub/Treatment	10

Fire Risk	Category	Type	Facility Count
	High Potential Loss Facilities	Hazardous Material	70
	Total		**113**
GRAND TOTAL			**223**

Source: Douglas County GIS

Figure B.10. Castle Rock Wildfire Hazard Potential and Critical Facilities



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 WUI fire areas have long histories of wildland fires that burned only vegetation in the past. However, with new development, a wildland fire following a historical pattern now burns developed areas. Population growth and development in Castle Rock could potentially expose more people and structures to wildfires.

An analysis of recent development in extreme, high, and moderate wildfire hazard areas was conducted for Castle Rock. A total of 512 structures was built between 2010 and 2014. The

total value of these structures is $230,481,837, with the majority located in the high wildfire hazard area. Results of this analysis are shown in Table B.20.

Table B.20. Castle Rock 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	1	1	1	$268,821	$134,411	$80,500	$483,732
High	323	322	350	$103,939,580	$43,744,447	$19,380,042	$167,064,069
Moderate	161	161	161	$36,895,395	$18,657,313	$7,381,328	$62,934,036
Total	**485**	**484**	**512**	**$141,103,796**	**$62,536,171**	**$26,841,870**	**$230,481,837**

Source: Douglas County GIS

Hazardous Materials: Transportation Incidents

Vulnerability to Hazardous Materials: Transportation Incidents

Likelihood of Future Occurrence—Medium
Potential Magnitude—Medium
Overall Vulnerability—Medium

Several major transportation routes cross through Castle Rock, including Interstate 25, 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 at potentially at risk to hazardous materials transportation incidents in Castle Rock.

Population at Risk

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 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 some locations in Castle Rock, individual population analysis was performed for each transportation corridor. Each buffered transportation corridor was intersected with improved residential parcels and therefore parcels could be counted more than once 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 Castle Rock are adjacent to each other so the majority of the population in this analysis is duplicated for each railroad. There are 15,350 people that live within the one-mile buffer of the Union Pacific Railroad that passes through Castle Rock. The BNSF Railroad (Burlington Northern Santa Fe Railroad) follows the same corridor through Castle Rock with an estimated population of 16,900. A population of 12,341 is within the proximity of Interstate 25 that passes through Castle Rock.

Development Trends

Development in Castle Rock occurs within existing town boundaries. As development in Castle Rock continues to grow, more people will be at risk to hazardous materials transportation incidents.

B.6 Capability Assessment

Capabilities are the programs and policies currently in use to reduce hazard impacts or that could be used to implement hazard mitigation activities. This capability assessment is divided into five sections: regulatory mitigation capabilities, administrative and technical mitigation capabilities, fiscal mitigation capabilities, mitigation outreach and partnerships, and other mitigation efforts.

B.6.1 Regulatory Mitigation Capabilities

Table B.21 lists regulatory mitigation capabilities, including planning and land management tools, typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place in the Town of Castle Rock.

Table B.21. Town of Castle Rock Regulatory Mitigation Capabilities

Regulatory Tool (ordinances, codes, plans)	Y/N	Date	Comments
Comprehensive plan	Y	2014	2035 Comprehensive Master Plan
Zoning ordinance	Y		
Subdivision ordinance	Y		
Growth management ordinance			Addressed in Comprehensive Master Plan
Floodplain ordinance	Y		

Regulatory Tool (ordinances, codes, plans)	Y/N	Date	Comments
Other special purpose ordinance (stormwater, steep slope, wildfire)	Y		
Building code	Y		
BCEGS Rating			
Fire department ISO rating			
Erosion or sediment control program	Y		
Stormwater management program	Y	2004	
Site plan review requirements	Y		
Capital improvements plan			
Economic development plan			Addressed in Comprehensive Master Plan
Local emergency operations plan	Y	2005	Incident Management Guidelines and Standards
Community Wildfire Protection Plans	Y	2007	Woodlands-Escavera CWPP
Flood insurance study or other engineering study for streams	Y	2005	
Elevation certificates			
Other	Y		Wastewater Master Plan Criteria Manuals Water Use Management Plan Water Resources Strategic Master Plan Water Facilities Master Plan Water Conservation Master Plan

Source: Amec Foster Wheeler Data Collection Guide

2035 Comprehensive Master Plan (2014)

The Comprehensive Master Plan is intended to provide direction to elected and appointed officials, the general citizenry, landowners and developers, and other area governmental entities for short-term and long-term growth and development of Castle Rock. It is a policy guide for community development decisions, to assist with community facility planning and budgeting, and guides future development of housing, employment, and cultural and educational opportunities for the Castle Rock community. The plan must be able to respond to changing conditions such as increased population and demand for public services, housing supply, legislative policies, technological development, and economic circumstances.

The plan includes the following sections:

- Land use
- Transportation
- Community Service
- Parks, Recreation, Trails and Open Space
- Community Character and Design
- Economic Development
- Natural Resources

Goals and policies related to mitigation of natural hazards are as follows:

Principle GM-2:	**Adequate community facilities and levels of services shall be provided for when considering the timing and location of development.**
Policy GM-2.1	Development will only be permitted where it can be efficiently served by critical public services such as transportation, water, wastewater, storm drainage, parks and recreation, fire and emergency services, and any other public facilities and services required by the Town.

Principle LU-4	**Environmentally Sensitive Development**
Policy LU-4.2	LU-4.2 Encourage clustering of development in order to avoid site constraints or preserve site amenities, such as steep or unstable slopes, rock outcroppings, ridgelines, floodplains or stands of trees.
Policy LU-4.4	Discourage development where natural hazards, unstable soils, or flood hazards exist. Development that increases these hazards for surrounding land uses shall not be allowed, nor shall it be allowed on steep slopes unsuitable for development when appropriate mitigation cannot be achieved.

Principle LU-8	**Interchange Districts**
Policy LU-8.1	Significant natural features, such as buttes, ridgelines, and major drainageways are critical to the character of Castle Rock and should be respected by all development. The Interchange Districts encourage a high-density built environment within these natural features through alternative form-based zoning regulations. The alternative form-based code will detail how these alternative regulations relate to the existing Municipal Code requirements. Incentives will be provided in the form-based code to promote the high-density, high-quality development desired at these interchanges.
Policy LU-8.2	The desired higher density urban level development will be required to protect significant natural drainageways by creating opportunities for natural design and added value; to protect the Plum Creek Corridor and its tributaries; to protect the designated floodplains and designated mouse habitat protection areas; and to integrate water conservation and water quality design concepts into the proposed land use plans.

Principle CS-1	**Water Supply**
Policy CS-1.1	Carefully evaluate water rights dedication (both actual conveyances and contract provisions) in conjunction with any new or amended Planned Development. Ensure compliance with the Town's existing water ordinance and policies.
Policy CS-1.2	Manage water demand to minimize infrastructure investments required to meet peak demands, to conserve the finite Denver Basin aquifer resource.
Policy CS-1.3	Implement water conserving principles related to landscape design, installation and maintenance.
Policy CS-1.4	Continue to manage peak demands in accordance with the Town’s Water Demand Management Plan.
Policy CS-1.5	Reuse treated wastewater for irrigation to reduce potable water demand.

Principle CS-2:	Water Supply Regional Interaction and Cooperation
Policy CS-2.1	CS-2.1 Develop alliances with other water providers, municipalities, special districts, and the County.
Policy CS-2.2	CS-2.2 Participate in planning, evaluation and implementation of water supply alternatives sponsored by the Douglas County Water Resource Authority and the Denver Regional Council of Governments.
Policy CS-2.3	CS-2.3 Secure an imported renewable water supply.

Principle CS-7	Storm Water Management
Policy CS-7.1	Ensure provisions for detaining storm water necessary to meet the legal requirement that storm flows leaving the property cannot exceed.
Policy CS-7.2	All development shall incorporate a master drainage plan.

Principle CS-8	Floodplain Development
Policy CS-8.1	Restrict land uses and activities that are hazardous to the public health in time of flood.
Policy CS-8.2	Restrict uses that are particularly vulnerable to flood damage, so to alleviate hardship and eliminate demands for public expenditures for relief and protection.
Policy CS-8.3	Require permitted floodplain uses, including public facilities, which serve such uses, to be protected against floods through the uses of flood proofing, and other protective measures at the time of initial construction or reconstruction.
Policy CS-8.4	Encourage low-intensity uses such as agriculture, parking lots, recreation, and open space within the floodplain
Policy CS-8.5	Protect the public from the burden of avoidable financial expenditures for flood control and relief by regulating all uses within the flood plain areas so as to produce a method of construction and a pattern of development, which will minimize the probability of damage to property and loss of life or injury to the inhabitants of the flood hazard areas.

Principle CS-11	Emergency Cooperation
CS-11.1	Continue to cooperate with nearby fire protection emergency response districts and departments in such areas as communications, mutual-aid, and training.

Principle CS-12	Wildfire Prevention Design Standards
CS-12.1	At the time of development application, the dangers of wildfires shall be recognized and appropriate building and site design, access, maintenance, and mitigation measures to reduce potential hazards should be achieved through design standards.

Principle NR-1	Protect Natural Resources to Sustain High Quality of Life
Policy NR-1.1	Minimize disruption to the natural topography, steep slopes, and significant stands of vegetation through creative site planning and through design and sensitive construction practices.

Principle NR-1	Protect Natural Resources to Sustain High Quality of Life
Policy NR-1.2	Use requirements in the Planned Development (PD) zone district to encourage open space dedication and the preservation of key visual and environmental elements.
Policy NR-1.3	Support and actively participate with other public and private organizations to acquire environmentally important open space areas in and around Castle Rock.

Principle NR-2	Environmentally Sensitive Development
Policy NR-2.1	Ensure that development demonstrates that any impacts to air and water quality are mitigated to the extent technically feasible and practical.
Policy NR-2.2	Encourage clean and non-polluting land uses for the Castle Rock community
Policy NR-2.3	NR-2.3 Protect unique or distinctive natural features and systems, critical wildlife habitats and environmental resources from adverse impacts through sound conservation practices
Policy NR-2.4	Use creative land planning approaches where site conditions warrant due to the prevalence of significant native vegetation and natural landforms, or steep slopes.
Policy NR-2.5	Grading for site development will be carried out in conformance with an approved grading plan intended to minimize site disturbance and control erosion.

Principle NR-4	Environmental Hazards and Constraints
Policy NR-4.1	Require an environmental audit of lands being proposed for public dedication, including all open space, park, school, and rights-of-way, to ensure that they are free of environmental hazards and to ensure that the Town will not be liable for any future cleanup.
Policy NR-4.2	Discourage developments where a significant risk to life and property exist, as in areas of floodplain, geologic hazard, unstable soils and excessively steep slopes.

Storm Drainage Design and Technical Criteria Manual

The Stormwater Drainage Design and Technical Criteria Manual was adopted in 2007. The manual presents the policies and minimum technical criteria for the planning, analysis and design of storm drainage systems within Town boundaries. The manual was developed in cooperation with Douglas County and Urban Drainage to improve consistency between neighboring jurisdictions.

Stormwater Master Plan

The Stormwater Master Plan was adopted in 2004 and updated in 2010. The plan commits the Town to a long-term program to ensure that drainage and other systems control stormwater runoff, protect the public during major storms, protect property values, safeguard Town streams from the high level of pollutants carried by urban runoff, and balance storm drainage planning approaches to complement open space and recreation corridors.

The plan outlines stormwater and floodplain problem areas and recommends time frames and priorities for specific drainageway improvement projects through 2020. The prioritization and

ranking of these capital improvement projects were based on an evaluation that included criteria such as property protection, public safety, flood risk and water quality enhancement.

Erosion and Sediment Control Manual

The Town has two permitting programs for erosion and sediment control on public and private construction projects within Town limits. The Drainage, Erosion and Sediment Control program covers residential construction on individual lots. The Grading, Erosion and Sediment Control program covers all other development and construction projects.

This GESC and DESC Manual (commonly known as the GESC Manual) describes the permitting programs that have been adopted to promote environmentally sound construction practices in Town. The goal of the program is to implement erosion and sediment control best management practices as a standard for all land-disturbance activities. The hope is to reduce increases in erosion and sedimentation over predevelopment conditions. Erosion caused by construction and downstream sedimentation can damage property and degrade the quality of streams and lakes.

Water Conservation Master Plan

The Water Conservation Master Plan outlines a goal-oriented, performance-based and cost-effective strategy that provides a practical approach to design and implementation, while providing measurable water savings. This plan outlines current and future water-use profiles, establishes conservation goals, identifies conservation measures, reflects the costs and benefits of conservation, defines regulations and incentives, outlines water budget rate structure and educational program, and establishes evaluation processes.

Water Facilities Master Plan

The Water Master Facilities Plan was adopted in 2006 and updated in 2010. The plan examines the existing water system infrastructure. It identifies water treatment and distribution capital improvement projects required to provide service to existing and future development through build-out of the Town's service area boundary. Specifically, the plan examines the following components of the water supply system:

- Existing water treatment and distribution system
- Potable water demands and finished water capacity
- Water treatment for meeting existing and future demands
- Water distribution system modeling for both existing and future conditions
- Recommended capital improvements for maintaining a safe reliable drinking water system

Water Resources Strategic Master Plan

The Water Resources Strategic Master Plan was adopted in 2006 and updated in 2010. This plan addresses the future water needs for the Town to achieve a sustainable long-term water supply.

The plan charts the path and identifies strategies for the Town to move toward a sustainable water future.

Currently, 100 percent of the Town's water demands are met by deep aquifer groundwater. Over the past several years, water providers, community leaders and the public have noted declining water levels throughout the region, including in Castle Rock. With or without growth, that existing groundwater supply is a non-renewing resource that is not sustainable for the Town's long-term future.

Water Use Management Plan

The Water Use Management Plan is designed as a demand-management tool to allow adequate volumes and pressures to the water distribution system during landscape irrigation season. This program is also intended to encourage wise use of a finite resource.

Criteria Manuals

The Water System Design Criteria Manual and the Wastewater Collection Design Criteria Manual contain the policies and minimum technical criteria for the planning, analysis and design of potable water and wastewater-collection systems in the Town, as well as areas served by the Town. The manuals outline requirements for utility reports and plans, analyses and designs. The primary goal of the new manuals is to bring criteria up to current construction and design standards. The most significant change to the criteria is aligning the manuals with the new development procedures, which moves detail to the back end of the process.

Wastewater Master Plan

The Wastewater Master Plan was adopted in 2004 and updated in 2010. The plan examines the existing wastewater system infrastructure. It identifies collection system capital improvement projects required to provide service to existing and future development through build-out of the Town’s service area boundary. The goals of the plan are to:

- Identify capital improvement projects that will provide adequate sanitary sewer service to the Town
- Establish capital improvement project costs
- Develop a capital improvement financial plan for the identified capital improvement projects

Ordinances

The Town of Castle Rock has many ordinances related to mitigation.

Zoning (Chapter 17)

This Title shall be enforced by the Town and its authorized officers, agents and representatives. Town officials may seek enforcement of this Title by injunctive or other equitable relief as necessary to protect the public health, safety and welfare.

All property within the Town shall be included within one of the primary Zoning Districts Residential, Business/Commercial/ Industrial, Open Space, or Planned Development.

Subdivision Regulations (Title 16)

These regulations are adopted to protect and to provide for the public health, safety and welfare of present and future residents of the Town and to guide the future growth and development of the Town. These regulations are designed, intended and should be administered to:

- Implement the Town's Comprehensive Master Plan and community vision statements, zoning and building ordinances, master plans and other development policies and ordinances;
- Provide for the coordinated development of adjoining properties to the benefit of future residents and the general public;
- Provide for adequate, safe and efficient public utilities and improvements; and provide for other general community facilities and public places;
- Provide for an adequate future water supply;
- Provide for optimum traffic circulation and stormwater drainage within the subdivision and throughout the Town;
- Provide necessary road and pedestrian connections to adjacent neighborhoods and to encourage pedestrian, bicycle and transit access;
- Provide for the preservation of important natural features, vegetation and view sheds;
- Provide for access to open space, recreational facilities and other amenities for all residents; and
- Provide for protection from fire, flood and other hazards.

Floodplain Regulations (Title 18)

In Title 29, Article 20, C.R.S., the State of Colorado has delegated the responsibility to local governments to adopt regulations designed to minimize flood losses. Therefore, the Town adopts the Floodplain Regulations set forth in this Title.

The flood hazard areas of the Town of Castle Rock are subject to periodic inundation, which can result in the 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 welfare of the public.

These flood losses are created by the cumulative effect of obstructions in floodplains or areas of special flood hazard which cause an increase in flood heights and velocities, and by the

occupancy of flood hazard areas by uses vulnerable to floods and hazardous to other lands because they are inadequately elevated, floodproofed or otherwise protected from flood damage.

It is the purpose of this Title to promote public health, safety and general welfare and to minimize public and private losses due to flood conditions in specific areas by provisions designed to:

- Protect human life and health;
- Minimize expenditure of public money for costly flood control projects;
- Minimize the need for rescue and relief efforts associated with flooding and generally undertaken at the expense of the general public;
- Minimize prolonged business interruptions;
- Minimize damage to critical facilities, infrastructure and other public facilities such as water, sewer and gas mains; electric and communications stations; and streets and bridges located in floodplains;
- Protect the storage capacity of floodplains and assure retention of sufficient floodway area to convey flood flows which can be reasonably expected to occur;
- Protect the hydraulic characteristics of small watercourses, including the gulches, sloughs and artificial water channels used for conveying floodwaters, which make up a portion of the urban drainage system;
- Help maintain a stable tax base by providing for sound use and development of flood-prone areas in such a manner as to minimize future flood blight areas; and
- Ensure that potential buyers are notified that property is located in a flood hazard area so as to protect individuals from purchasing floodplain lands for unsuitable purposes.

In order to accomplish its purposes, these Floodplain Regulations use the following methods:

- Delineate and describe areas that could be inundated by floods;
- 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;
- Require that uses vulnerable to floods, including facilities which serve such uses, be protected against flood damage at the time of initial construction;
- Control the alteration of natural floodplains, small watercourses and natural protective barriers, which are involved in the accommodation of floodwaters;
- Control filling, grading, dredging and other development which may increase flood damage; and
- Prevent or regulate the construction of flood barriers which will unnaturally divert floodwaters or which may increase flood hazards to other lands.

This Title shall apply to all Special Flood Hazard Areas and areas removed from the floodplain by the issuance of a FEMA Letter of Map Revision Based on Fill (LOMR-F) within the jurisdiction of the Town, including those areas incorporated through annexation.

A floodplain development permit shall be required to ensure conformance with the provisions of this Title. A floodplain development permit is required prior to issuance of a building permit, construction permit and any other development, use or change of the use of land located in the floodplain. The floodplain development permit is required in addition to other permits, including but not limited to building permits, construction permits, grading, erosion and sediment control/residential drainage, erosion and sediment control (GESC/DESC) permits and other local, state and federal permits. Conditions and restrictions may apply to other permits and approval processes as necessary to ensure compliance with this Title.

In all Special Flood Hazard Areas, the following provisions are required for all uses, including development, new construction and substantial improvements:

- All new construction or substantial improvements shall be designed (or modified) and adequately anchored to prevent flotation, collapse or lateral movement of the structure resulting from hydrodynamic and hydrostatic loads, including the effects of buoyancy;
- All new construction or substantial improvements shall be constructed by methods and practices that minimize flood damage;
- All new construction or substantial improvements shall be constructed with materials resistant to flood damage;
- All new construction or substantial improvements shall be constructed with electrical, heating, ventilation, plumbing and air conditioning equipment and other service facilities that are designed and/or located so as to prevent water from entering or accumulating within the components during conditions of flooding;
- Manufactured homes shall not be allowed in the floodplain;
- All new and replacement water supply systems shall be designed to minimize or eliminate infiltration of floodwaters into the system;
- New and replacement sanitary sewage systems shall be designed to minimize or eliminate infiltration of floodwaters into the system and discharge from the systems into floodwaters;
- On-site waste disposal systems shall be located to avoid impairment to them or contamination from them during flooding;
- The storage or processing of materials that are buoyant, flammable or which, in times of flooding, could be injurious to human, animal or plant life shall be at or above a point two feet above the Base Flood Elevation;
- The storage of materials or equipment which are not subject to major damage by floods, which are firmly anchored to prevent flotation or are readily removable from the flood hazard area within the time available after flood warning, may be permitted below the Base Flood Elevation; and
- The construction of levees and levee systems are prohibited in the Town.

In all Special Flood Hazard Areas outside the regulatory floodway where Base Flood Elevation data has been provided, the following provisions are required:

- Residential construction. New construction and substantial improvement of any residential structure shall have the lowest floor (including basement) elevated to two feet above the Base Flood Elevation. Upon completion of the structure, the elevation of the lowest floor, including basement, shall be certified by a registered Colorado professional engineer, architect or land surveyor. Such certification shall be submitted to the Floodplain Administrator prior to the release of the Certificate of Occupancy.
- Nonresidential construction. New construction and substantial improvements of any commercial, industrial or other nonresidential structure shall either have the lowest floor (including basement) elevated to two feet above the Base Flood Elevation or, together with attendant utility and sanitary facilities, be designed so that, at two feet above the Base Flood Elevation, the structure is watertight with walls substantially impermeable to the passage of water and with structural components having the capability of resisting hydrostatic and hydrodynamic loads and effects of buoyancy. A registered Colorado professional engineer or architect shall develop and/or review structural design, specifications and plans for the construction and shall certify that the design and methods of construction are adequate to withstand the flood depths, pressures, velocities, impact and uplift forces and other factors associated with the base flood. Upon completion of the structure, the work shall be certified by a registered Colorado professional engineer, architect or land surveyor. Such certification shall be submitted to the Floodplain Administrator prior to the release of the Certificate of Occupancy.
- Enclosures. New construction and substantial improvements, with fully enclosed areas below the lowest floor that are usable solely for building access or storage in an area other than a basement and which are subject to flooding, shall be designed to automatically equalize hydrostatic flood forces on exterior walls by allowing for the entry and exit of floodwaters. Designs for meeting this requirement must be certified by a registered Colorado professional engineer or architect and meet or exceed the following minimum criteria:
  - A minimum of two openings having a total net area of not less than one square inch for every square foot of enclosed area subject to flooding shall be provided.
  - The bottom of all openings shall be no higher than one foot above grade.
  - Openings may be equipped with screens, louvers, valves or other coverings or devices, provided that they permit the automatic entry and exit of floodwaters.
- Manufactured homes. No construction, placement or substantial improvement of manufactured homes or manufactured home parks shall be permitted under any circumstances within the floodway fringe district.
- Recreational vehicles. All recreational vehicles placed on sites within the Special Flood Hazard Area shall:
  - Be on the site for fewer than 180 consecutive days; and
  - Be fully licensed and ready for highway use.
    - A recreational vehicle is ready for highway use if it is on its wheels or jacking system, is attached to the site only by quick disconnect type utilities and security devices and has no permanently attached additions.

- Prior approved activities. Any activity for which a floodplain development permit was issued by the Town or a CLOMR was issued by FEMA prior to the effective date of this Title may be completed according to the standards in place at the time of the permit or CLOMR issuance and will not be considered in violation of this Title if it meets such standards.

Building Code Section (Title 15)

In order to provide minimum standards for the proper regulations of building construction, the following publications are hereby adopted by reference and incorporated in this Code, except as expressly amended or superseded by the provisions of this Code.

- International Building Code, 2012 Edition, for regulating and governing conditions and maintenance of all property, buildings and structures; by providing the standards for supplied utilities and facilities and other physical things and conditions essential to ensure the structures are safe, sanitary and fit for occupation and use; and the condemnation of buildings and structures unfit for human occupancy and use and the demolition of such structures, as hereafter set out (published by the International Code Council, Inc., 4051 West Flossmoor Road, Country Club Hills, IL 60478-5795).
- International Residential Code for One- and Two-Family Dwellings, 2012 Edition, including Appendices G, H, J and M, for regulating and governing the construction, alteration, movement, enlargement, replacement, repair, equipment, location, removal and demolition of detached one- and two-family dwellings and multiple single-family dwellings (townhouses) not more than three stories in height with separate means of egress, as hereafter set out (published by the International Code Council, Inc., 4051 West Flossmoor Road, Country Club Hills, IL 60478-5795).
- International Mechanical Code, 2012 Edition, regulating and governing the design, construction, quality of materials, erection, installation, alteration, repair, location, relocation, replacement and addition to, use or maintenance of mechanical systems in Castle Rock, as hereafter set out (published by the International Code Council, Inc., 4051 West Flossmoor Road, Country Club Hills, IL 60478-5795).
- International Plumbing Code, 2012 Edition, including Appendices B, D, E and F, regulating and governing the design, construction, quality of materials, erection, installation, alteration, repair, location, relocation, replacement, addition to, use or maintenance of plumbing systems, as hereafter set out (published by the International Code Council, Inc., 4051 West Flossmoor Road, Country Club Hills, IL 60478-5795).
- The National Electrical Code, 2011 Edition, as published by the National Fire Protection Association, One Batterymarch Park, Quincy, Massachusetts 02169-7471; and the corresponding National Electrical Code Handbook, Library of Congress. The subject matter of said code concerns are adopted as the minimum standards governing the planning, laying out and installing or the making of additions, alterations and repairs in the installation of wiring apparatus and equipment for electric light and power in the Town.
- International Energy Conservation Code, 2012 Edition, regulating and governing energy efficient building envelopes and installation of energy efficient mechanical, lighting and

power systems, as hereafter set out (published by the International Code Council, Inc., 4051 West Flossmoor Road, Country Club Hills, IL 60478-5795).

- International Fuel Gas Code, 2012 Edition, regulating and governing fuel gas systems and gas-fired appliances, as hereafter set out (published by the International Code Council, Inc., 4051 West Flossmoor Road, Country Club Hills, IL 60478-5795).
- International Fire Code, 2012 Edition, including Appendices B, C, D, E, F and I, as hereafter set out (published by the International Code Council, Inc., 4051 West Flossmoor Road, Country Club Hills, IL 60478-5795).
- National Fire Alarm Code, 2010 Edition, published by the National Fire Protection Association, One Batterymarch Park, Quincy, MA 02269-9101.
- Uniform Code for the Abatement of Dangerous Buildings, 1997 Edition, as hereafter set out (published by the International Code Council, Inc., 4051 West Flossmoor Road, Country Club Hills, IL, 60478-5795).
- International Existing Building Code, 2012 Edition, regulating and governing the use and reuse of existing buildings, as hereafter set out (published by the International Code Council, Inc., 4051 West Flossmoor Road, Country Club Hills, IL 60478-5795).
- International Swimming Pool and Spa Code, 2012 Edition, regulating and governing swimming pools, spas, hot tubs, aquatic facilities, as hereafter set out (published by the International Code Council, Inc., 4051 West Flossmoor Road, Country Club Hills, IL 60478-5795).
- ICC A117.1-2009 American National Standard – Accessible and Usable Buildings and Facilities (published by the International Code Council, 4051 W. Flossmoor Road, Country Club Hills, IL 60478-5795;
- ASME A17.1-2007 and ASME A17.3, 2005 Edition, and A18.1-2005 Elevator Codes (published by the American Society of Mechanical Engineers, 3 Park Avenue, New York, NY 10016-5990).

Health and Safety (Title 8)

The Castle Rock Fire Department, the Fire Chief, and his or her duly authorized representatives are hereby assigned as the designated emergency response authority for hazardous materials incidents within the Town of Castle Rock. The Fire Chief shall provide an emergency response to hazardous materials incidents by taking necessary initial action to minimize the effects of such an incident and provide continued supervision and authority over all further efforts to eliminate the threat of immediate and irreparable harm to the environment or public health and safety.

B.6.2 Administrative/Technical Mitigation Capabilities

Table B.22 identifies the Town department(s) responsible for activities related to mitigation and loss prevention in Castle Rock.

Table B.22. Town of Castle Rock Administrative and Technical Mitigation Capabilities

Personnel Resources	Yes/No	Department/Position	Comments
Planner/Engineer with knowledge of land development/land management practices	Y	Development Services Department	
Engineer/Professional trained in construction practices related to buildings and/or infrastructure	Y	Development Services Department	
Planner/Engineer/Scientist with an understanding of natural hazards			
Personnel skilled in GIS	Y	Division of Innovation and Technology	
Full time building official		Development Services Department	
Floodplain Manager			
Emergency Manager	Y	Castle Rock Fire and Rescue Department/Fire Chief	
Grant writer			
Other personnel			
GIS Data – Hazard areas	Y	Division of Innovation and Technology	
GIS Data - Critical facilities	Y	Division of Innovation and Technology	
GIS Data – Building footprints	Y	Division of Innovation and Technology	
GIS Data – Land use	Y	Division of Innovation and Technology	
GIS Data – Links to Assessor's data	Y	Division of Innovation and Technology	
Warning Systems/Services (Reverse 9-11, cable override, outdoor warning signals)	Y	Douglas County Emergency Telephone Service Authority/Castle Rock Fire and Rescue Department	CodeRED emergency mass notification system
Other			

Source: Amec Foster Wheeler Data Collection Guide

B.6.3 Fiscal Mitigation Capabilities

Table B.23 identifies financial tools or resources that the Town could potentially use to help fund mitigation activities.

Table B.23. Town of Castle Rock Fiscal Mitigation Capabilities

Financial Resources	Accessible/Eligible to Use (Y/N)	Comments
Community Development Block Grants	Y	
Capital improvements project funding	Y	Public Works Department budget

Financial Resources	Accessible/Eligible to Use (Y/N)	Comments
Authority to levy taxes for specific purposes	Y	Building use taxes
Fees for water, sewer, gas, or electric services	Y	
Impact fees for new development	Y	
Incur debt through general obligation bonds		
Incur debt through special tax bonds		
Incur debt through private activities		
Withhold spending in hazard prone areas		
Other		

Source: Amec Foster Wheeler Data Collection Guide

B.6.4 Mitigation Outreach and Partnerships

The Town partners with South Metro Fire and Rescue for wildfire mitigation. The Town also partners with the County, and has adopted the County EOP.

B.7 Mitigation Strategy

This section describes the mitigation strategy process and mitigation action plan for the Town of Castle Rock' inclusion with the Douglas County Local Hazard Mitigation Plan update.

B.7.1 Mitigation Goals and Objectives

The Town of Castle Rock adopts the hazard mitigation goals and objectives developed by the HMPC and described in Chapter 5 Mitigation Strategy of the base plan.

B.7.2 Continued Compliance with the NFIP

As a participant of the National Flood Insurance Program (NFIP), the Town of Castle Rock has administered floodplain management regulations that meet the minimum requirements of the NFIP. The management program objective is to protect people and property within the Town. The Town of Castle Rock will continue to comply with the requirements of the NFIP in the future.

The Town's regulatory activities apply to existing and new development areas of the Town; implementing flood protection measures for existing structures and maintaining drainage systems. The goal of the program is to enhance public safety, and reduce impacts and losses while protecting the environment.

The National Flood Insurance Program's (NFIP) Community Rating System (CRS) is a voluntary incentive program that recognizes and encourages community floodplain management

activities that exceed the minimum NFIP requirements. As a result, flood insurance premium rates are discounted to reflect the reduced flood risk resulting from the community actions meeting the three goals of the CRS which are to reduce flood losses, facilitate accurate insurance rating, and promote the awareness of flood insurance. The Town of Castle Rock does not currently participate in the CRS.

B.7.3 Mitigation Actions

The planning team for the Town of Castle Rock identified and prioritized the following mitigation actions based on the risk assessment and in accordance with the process outline in Section 5, Mitigation Strategy, of the base plan. Background information and information on how each action will be implemented and administered, such as ideas for implementation, responsible office, potential funding, estimated cost, and timeline are also included. General processes and information on plan implementation and maintenance of this LHMP by all participating jurisdictions is included in Section 7, Plan Implementation and Maintenance, of the base plan.

Town of Castle Rock Action #1

Action Title:	**Public awareness – support Douglas County citizen disaster preparedness guide**
Priority:	Medium, Ongoing
Project Description, Issue & Background:	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.
Ideas for Implementation:	Production and distribution of 5000 printed copies and 5000 smartphone copies summer of 2015. Continue standard order of 5000 printed versions and 5000 smartphone versions annually over subsequent 4 years.
Other Alternatives:	No action
Responsible Agency:	Douglas County OEM
Partners:	Town of Castle Rock, DC FFESS, DC Public Affairs, DCSO Community Resources
Potential Funding:	Douglas County
Cost Estimate:	Cost of materials
Benefits: (Losses Avoided)	Informative preparedness piece for citizens of Castle Rock, Douglas County, and other participating jurisdictions
Timeline:	Q2 2015 distribution and annually thereafter
Status:	New in 2015

Annex C TOWN OF LARKSPUR

C.1 Introduction

This annex details the hazard mitigation planning elements specific to the Town of Larkspur, a participating jurisdiction to the Douglas County LHMP Update. This annex is not intended to be a standalone document, but appends to and supplements the information contained in the base plan document. As such, all sections of the base plan, including the planning process and other procedural requirements apply to and were met by the Town. This annex provides additional information specific to the Town of Larkspur, with a focus on providing additional details on the risk assessment and mitigation strategy for this community.

C.2 Planning Process

As described above, the Town of Larkspur followed the planning process detailed in Section 3.0 of the base plan. In addition to providing representation on the Douglas County Hazard Mitigation Planning Committee (HMPC), the Town formulated their own internal planning team to support the broader planning process requirements. Internal planning participants included staff from the following Town departments:

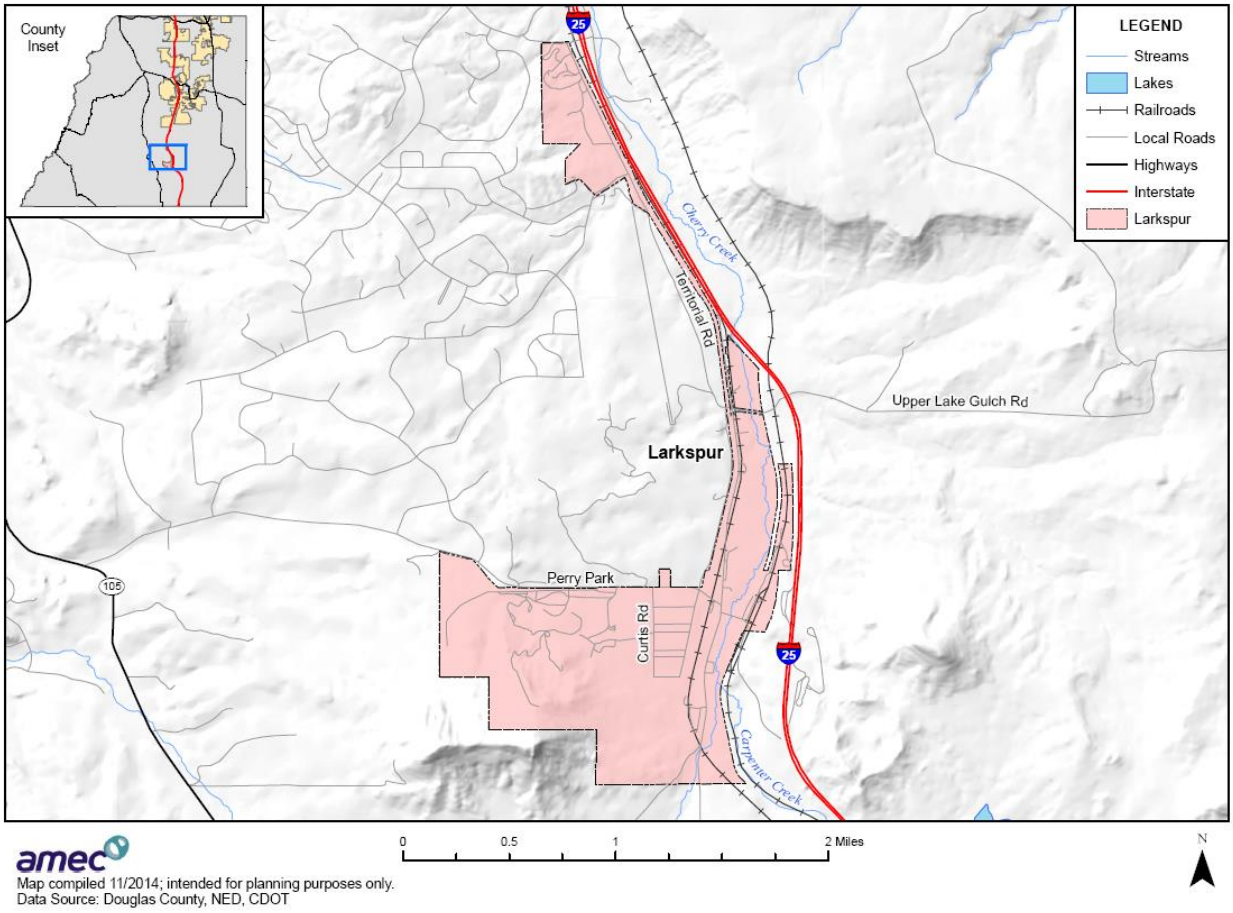
- Arlen Goertzen
- Becky Mobley
- Gerry Been
- Matt Krimmer

Additional details on plan participation and Town representatives are included in Appendix A.

C.3 Community Profile

The community profile for the Town of Larkspur is detailed in the following sections. Figure C.1 displays a map and the location of the Town of Larkspur within Douglas County.

Figure C.1. Town of Larkspur Base Map



C.3.1 Geography and Location

Larkspur is located in the southern half of Douglas County along Interstate 25. The lands surrounding Larkspur are primarily open space and agricultural lands. Spruce Meadows Open Space and Spruce Mountain Open Space are located to the south, residential areas and open space are located to the north, and open space surrounds the Town to the east and west. The elevation is 6,669 ft. The topography is hilly, with Larkspur Butte and Raspberry Butte located to the east and west of the Town, respectively. Monkey Face Mountain is above the Larkspur Station Mobile Home Park on the west side of Spruce Mountain Road.

C.3.2 History

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 Elizabeth Hunt, 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.

C.3.3 Economy

Select economic characteristics and statistics for Larkspur are shown in Table C.1. These statistics were pulled from the 2008-2013 American Community Survey and the 2000 U.S. Census to demonstrate how certain economic factors in Larkspur have changed over time.

Table C.1. Economic Characteristics for the Town of Larkspur

Characteristic	2000	2013
Families below Poverty Level	6.4%	6.5%
Individuals below Poverty Level	8.4%	9.2%
Median Home Value	$165,600	$162,500
Median Household Income (Larkspur Town Residents)	$43,750	$30,294 (2012)
Per Capita Income	$18,150	$26,779
Population in Labor Force*	200	97

Source: 2008-2013 US Census Bureau American Community Survey 5-year Estimates, 2000 U.S. Census

C.3.4 Population

The 2013 population estimate for the Town (the most recent available) indicates there are 217 residents of Larkspur. The population was estimated at 183 for the 2010 U.S. Census.

C.4 Hazard Identification and Summary

This section details how the risk varies across the Douglas County planning area. The Town's planning team identified the hazards that affect the Town and summarized their frequency of

occurrence, spatial extent, potential magnitude, and significance specific to Larkspur (see Table C.2). In the context of the plan's planning area, there are no hazards that are unique to Larkspur.

Information on past occurrences and the likelihood of future occurrences is detailed in Section 4, Risk Assessment, of the base plan. Additional information for high and medium significant hazards for the Town is included in the Vulnerability Assessment section of this Annex.

Table C.2. Town of Larkspur Hazard ID Table

Hazard	Spatial Extent	Likelihood of Future Occurrences	Magnitude /Severity	Significance
Avalanche	Limited	Low	Low	Low
Drought	Extensive	Medium	Low	High
Earthquake	Extensive	Low	Low	Low
Flood: Dam Failure	Limited	Low	Low	Low
Flood: 100/500 year	Extensive	Low	High	High
Flood: Localized/ Stormwater	Significant	Medium	Low	Low
Landslides/ Mud & Debris Flows /Rockfalls	Limited	Low	Low	Low
Severe Weather: Extreme Heat	Extensive	Medium	Low	High
Severe Weather: Hail	Significant	Medium	Medium	Medium
Severe Weather: High Winds	Extensive	Medium	Medium	High
Severe Weather: Lightning	Extensive	High	Low	High
Severe Weather: Thunderstorms/Heavy Rains	Extensive	High	Medium	High
Severe Weather: Tornado	Extensive	Low	High	High
Severe Weather: Winter Weather (includes snow/ice/extreme cold)	Extensive	High	Medium	High
Soil Hazards: Erosion & Deposition	Significant	Low	Medium	Medium
Soil Hazards: Expansive Soils	Significant	Low	Low	Low
Soil Hazards: Subsidence	Limited	Low	Low	Low
Wildfire	Extensive	High	High	High
Hazardous Materials: Transportation Incidents	Extensive	Low	High	High

Spatial Extent
Limited: Less than 10% of planning area
Significant: 10-50% of planning area
Extensive: 50-100% of planning area

Likelihood of Future Occurrences
Low: Occurs less than once every 10 years or more
Medium: Occurs less than once every 5 to 10 years
High: Occurs once every year or up to once every five years

Magnitude/Severity
Low: Negligible property damages (less than 5% of all buildings and infrastructure) Negligible loss of quality of life. Local emergency response capability is sufficient to manage the hazard.
Medium: Moderate property damages (15% to 50% of all buildings and infrastructure) Some loss of quality of life. Emergency response capability, economic and geographic effects of the hazard are of sufficient magnitude to involve one or more counties.
High: Property damages to greater than 50% of all buildings and infrastructure. Significant loss of quality of life Emergency

	response capability, economic and geographic effects of the hazard are of sufficient magnitude to require federal assistance. **Significance** **Low**: minimal potential impact **Medium**: moderate potential impact **High**: widespread potential impact

C.5 Vulnerability Assessment

The intent of this section is to assess Larkspur' vulnerability separate from that of the planning area as a whole, which has already been assessed in Section 4.3 Vulnerability Assessment of the base plan. This vulnerability assessment provides an inventory of the population, property, and other assets located within the Town and further analyzes those assets at risk to identified hazards ranked of medium or high significance (as listed in Table C.2) to the community. For more information about how hazards affect the County as a whole, see Chapter 4 Risk Assessment in the main plan.

C.5.1 Total Assets at Risk

This section identifies Larkspur' total assets at risk, including values at risk, critical facilities and infrastructure, natural resources, and historic and cultural resources. Growth and development trends are also presented for the community. This data is not hazard specific, but is representative of total assets at risk within a community.

Values at Risk

The following data from the Douglas County Assessor's Office is based on joining assessor data to the 2014 parcel layer in GIS. This data should only be used as an indicator of overall values in the County, as the information has some limitations. Table C.3 summarizes the parcels, improved parcels, structures, improved value, land value, and total value exposed in Larkspur. It is 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.

Table C.3. Town of Larkspur Total Exposure

Property Type	Total Parcel Count	Improved Parcel Count	Total Structures	Improved Value	Total Land Value	Total Value
Agricultural	6	0	3	$0	$6,108	$6,108
Commercial	27	16	79	$5,090,203	$3,635,643	$8,725,846
Exempt*	42	9	18	$5,215,004	$1,925,407	$7,140,411
HOA	0	0	0	$0	$0	$0
Industrial	1	1	5	$748,789	$126,187	$874,976
Producing Mine	0	0	0	$0	$0	$0
Residential	56	48	89	$6,108,699	$2,903,113	$9,012,005
Vacant Land	15	0	10	$0	$1,006,829	$1,006,829
Total	**151**	**74**	**204**	**$17,162,695**	**$9,603,287**	**$26,766,175**

Source: Douglas County Assessor's Data

*Includes utilities. Utilities has a total of 17 Structures that are Exempt (source CIRSA). New Well Project Capital Cost 3,500,000 as of April 2015

Critical Facilities and Infrastructure

For purposes of this plan, a critical facility is defined as:

> Any facility, including without limitation, a structure, infrastructure[1], 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.

This definition was refined by separating out three categories of critical facilities as further described in Section 4.3.1 of the base plan. These categories include At-Risk Populations, Essential Services, and High Potential Loss Facilities.

An inventory of critical facilities from Douglas County GIS was analyzed to determine which facilities are located in each jurisdiction. The GIS analysis did not show any facilities in Larkspur. However, the Town identified several critical facilities, which are listed below in Table C.4.

Table C.4. Town of Larkspur Critical Facilities: Summary Table

Name of Asset	Category of Critical Asset	Facility Type	Replacement Value	Hazard Information
Larkspur Fire Station	Essential	Fire station		This fire station is critical to the safety of the citizens of the Town of Larkspur and surrounding communities.
Larkspur School	High potential	Elementary school		There are approximately 298 students attending who would be at risk should a hazard occur.
Post Office	High potential	Commercial mail depot		This facility services all of Larkspur and surrounding areas. Inability to deliver mail would pose economic risk.
Spruce Mountain Road	Transportation/lifeline	Main arterial road		Spruce Mountain Road is a major arterial road through Larkspur and emergency vehicles utilize it every day.
Bridge over Fox Farm Road	Transportation/lifeline	Railroad bridge		Critical risk from hazard could pose a major risk to the community and its residents as the train runs through the middle of the town.

[1] Essential Service Facilities include bridges, roads, power grids, and infrastructure held by private companies (i.e. utility lines and private levees) that are not mapped for security reasons and are not under the control of the County.

Name of Asset	Category of Critical Asset	Facility Type	Replacement Value	Hazard Information
Railroads	Transportation/lifeline	Tracks and main crossing		BNSF & Denver Rio Grande are two railroad companies that use the tracks that run through the middle of town and haul hazardous materials.
Natural gas lines	Transportation/lifeline	Public utility facility		Gas lines pose a serious threat since the town is compact and one rupture would be felt by all.
Communication towers	Transportation/lifeline	Public utility facility		Inability to maintain communication would pose both economic and critical risk. The Douglas County Sheriff's Office is installing a new tower.
Frink House	Historical	Historical structure	Irreplaceable	This building is on the Douglas County and National Register of Historic Places listings
Federation Building	Historical	Historical structure	Irreplaceable	This building is on the Douglas County historical listing
Town Hall and property	High potential	Government	$583,000	
Town Hall Annex	High potential	Government	$265,270	
Town assets	High potential	Infrastructure	$1,884,602	Current wells and tanks, water and sewer treatment plants, maintenance building, town community park, etc.
New water well project	High potential	Infrastructure	$3,472,028	New Arapahoe water well, tank, water treatment plant, and water line
Actual value of all real property			$21,949,701	

Source: Town of Larkspur

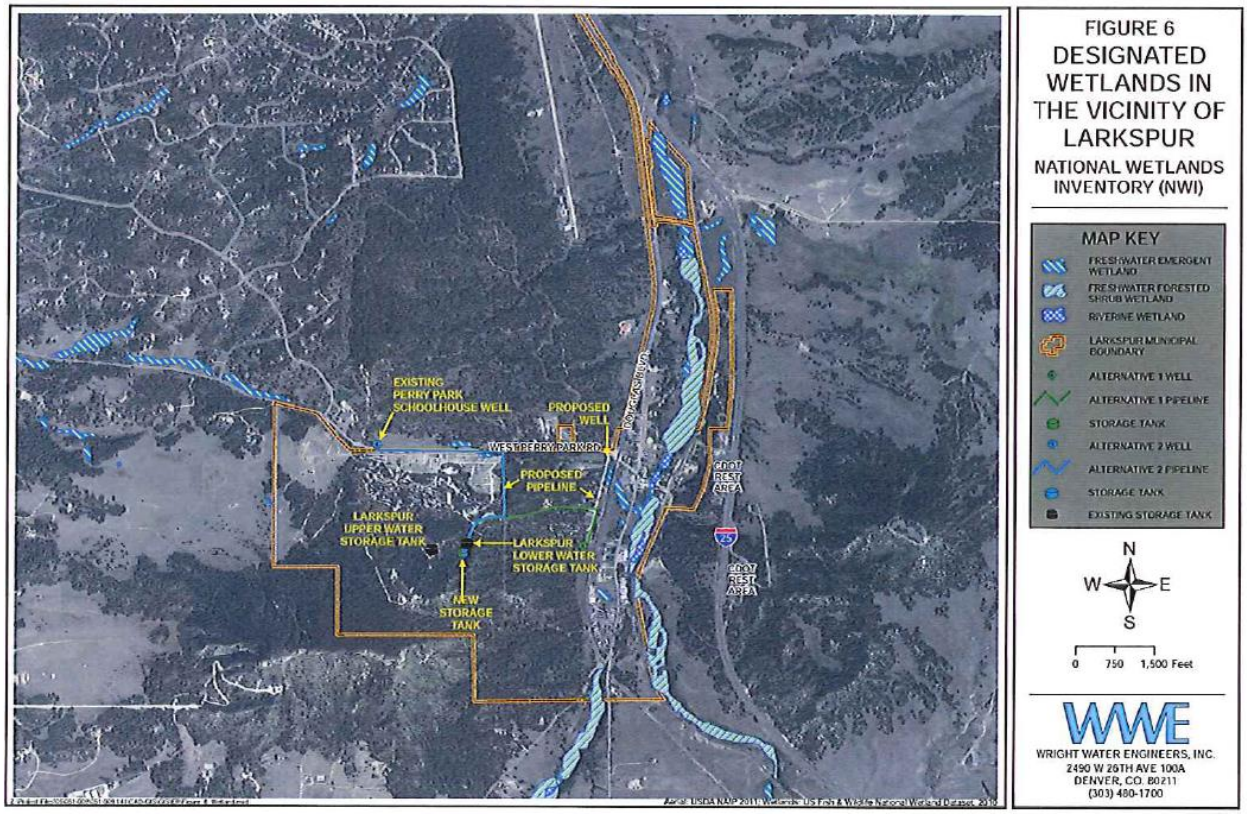
Natural Resources

The Town of Larkspur and the areas surrounding it include a rich and diverse range of biological resources.

Vegetation

Various types of wetlands exist within or near the Larkspur municipal boundaries. The locations of these resources are shown in Figure C.2.

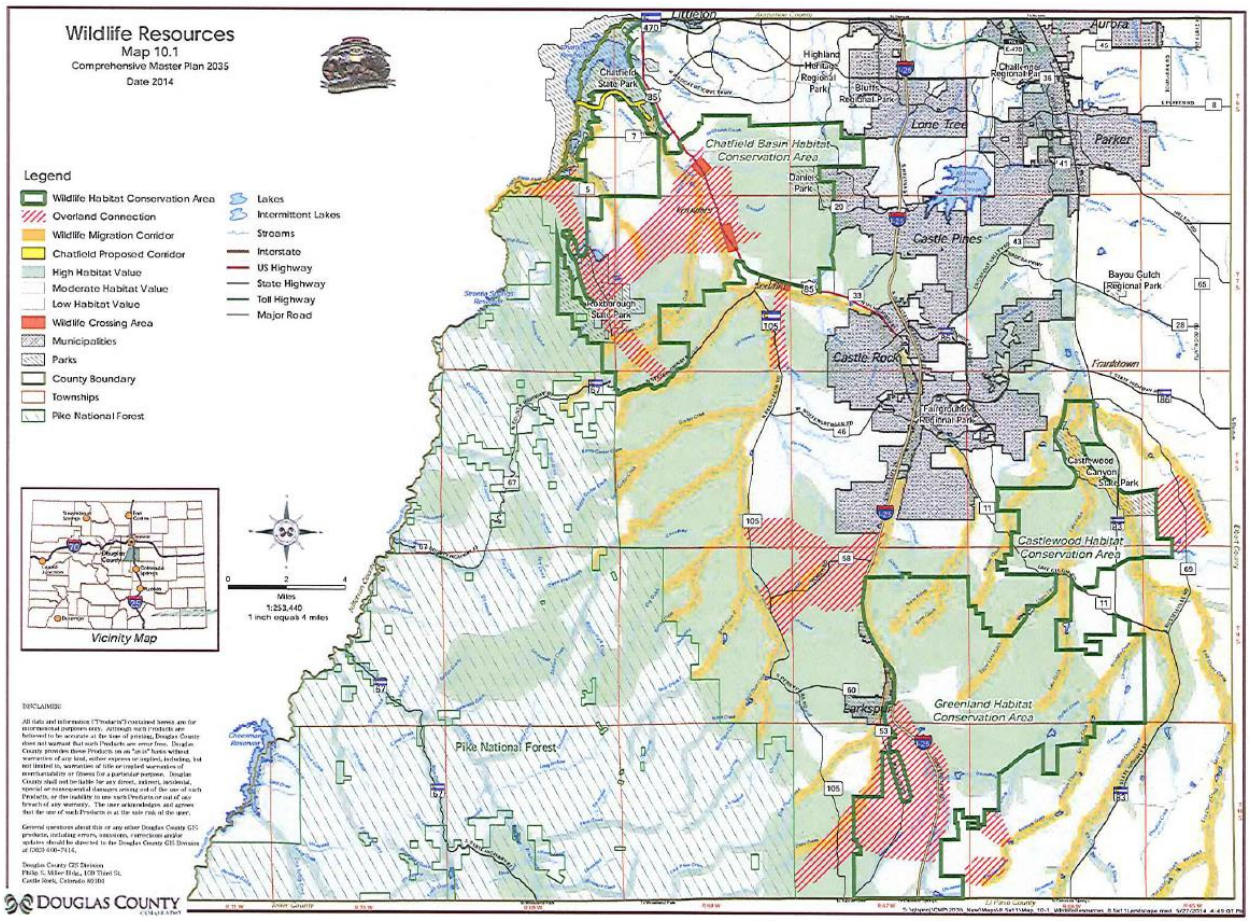
Figure C.2. Designated Wetlands in the Vicinity of Larkspur



Wildlife Habitat

Larkspur lies within a wildlife migration corridor and borders a wildlife habitat conservation area (see Figure C.3).

Figure C.3. Wildlife Resources in Douglas County



Historic and Cultural Resources

To inventory historically or culturally significant resources, the HMPC collected information from both the National Register of Historic Places and the Colorado State Register. Each program has different eligibility criteria and procedural requirements. These requirements are detailed in Section 4.3.1 of the base plan. Larkspur has two properties listed on the National Register of Historic Places: the Frink House and the American Federation of Human Rights Lodge.

Growth and Development Trends

Table C.5 summarizes the number and value of structures built in Larkspur from 2010 to 2014 based on a query of the 'year built' values in the County's parcel database. A total of 10 structures, with a total value greater than $1.2 million, were built in that short period of time. The vast majority of these structures were residential, built to accommodate the rapidly growing population in the Planning Area. Additional analysis on recent development in Larkspur's mapped hazard areas is discussed in the vulnerability assessments for flood, landslide/erosion, and wildfire.

Table C.5. Larkspur Structures Built from 2010 to 2014: Total Assets by Property Type

Property Type	Total Parcel Count	Improved Parcel Count	Total Structure Count	Improved Value	Land Value	Total Value
Commercial	1	1	2	$152,950	$44,000	$196,950
Exempt	2	2	2	$158,622	$80,000	$238,622
Residential	5	4	6	$610,643	$212,000	$822,643
Total	**8**	**7**	**10**	**$922,215**	**$336,000**	**$1,258,215**

Source: Douglas County

C.5.2 Priority Hazards: Vulnerability Assessment

This section provides the vulnerability assessment, including any quantifiable loss estimates, for those hazards identified above in Table C.2 as high or medium significance hazards. Impacts of past events and vulnerability of the Town to specific hazards are further discussed below (see Section 4.1 Hazard Identification in the base plan for more detailed information about these hazards and their impacts on the Douglas County planning area). Methodologies for calculating loss estimates are the same as those described in Section 4.3 of the base plan. In general, the most vulnerable structures are those located within the floodplain, unreinforced masonry buildings, wildland urban interface (WUI), and buildings built prior to the introduction of modern building codes.

An estimate of the vulnerability of the Town to each identified hazard, in addition to the estimate of risk of future occurrence, is provided in each of 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.
- **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.

Drought

Vulnerability to Drought

Likelihood of Future Occurrence—Medium
Potential Magnitude—Low

Overall Vulnerability—High

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.

Drought conditions can also cause soil to compact and not absorb water well, potentially making an area more susceptible to flooding. Water quality deterioration also is another potential problem. Wildfire protection, municipal usage, tourism, and recreation may also be impacted. Mandatory conservation measures are typically implemented during extended droughts.

Drought is considered to be a high significance hazard in Larkspur due to its connection to wildfire danger and impact on water resources. Larkspur is surrounded by open space and close to the Pike National Forest, making it vulnerable to wildfires. Drought can also impact the Town's agricultural economy; cattle Ranchers in the area would suffer loss with livestock. The Town's water resources consist of two wells, the Denver and Arapahoe. Of these wells one is going down and at the present time a new well has been drilled. The Town will improve its infrastructure significantly with the installation of a 461,000 gallon water tank, pump station, and waterline, which will help mitigate drought impacts.

Development Trends

Drought vulnerability will increase with future development as there will be increased demands for limited water resources. Larkspur can mitigate drought impacts by supporting water conservation measures such as wastewater reuse, xeriscaping, and water efficient fixtures.

Flood: 100/500-Year

Vulnerability to 100/500-Year Flooding

Likelihood of Future Occurrence—Low
Potential Magnitude—High
Overall Vulnerability—High

The Planning Area, including Larkspur, is prone to very intense rainfall. 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 Larkspur to floods.

The tables flood loss estimates for Larkspur are located below. Table C.6 shows improved values at risk in the 1% annual chance flood zone, and Table C.7 shows the same information for 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 value 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. Figure C.4 shows the FEMA flood zones in Larkspur, and Figure C.5 shows the location of properties within those flood zones.

Table C.6. Larkspur 1% Annual Chance Flood Loss Estimate by Property Type

Property Type	Total Parcel Count	Improved Parcel Count	Total Structure Count	Improved Value	Estimated Content Value	Total Value	Loss Estimate
Commercial	7	3	9	$974,510	$974,510	$1,949,020	$389,804
Exempt	12	2	5	$772,897	$772,897	$1,545,794	$309,159
Residential	9	9	10	$808,222	$404,111	$1,212,333	$242,467
Utilities	1	0	0	$3,500,000	$3,500,000	$7,000,000	$1,400,000
Total	**33**	**14**	**26**	**$6,055,629**	**$5,651,518**	**$11,707,147**	**$2,341,430**

Source: Douglas County 2014 Assessor & Parcel Data; Douglas County DFIRM

Table C.7. Larkspur 0.2% Annual Chance Flood Loss Estimate by Property Type

Property Type	Total Parcel Count	Improved Parcel Count	Total Structure Count	Improved Value	Estimated Content Value	Total Value	Loss Estimate
Commercial	2	1	5	$362,177	$362,177	$724,354	$144,871
Exempt	1	1	1	$147,670	$147,670	$295,340	$59,068
Residential	1	1	1	$124,985	$62,493	$187,478	$37,496
Total	**4**	**3**	**7**	**$634,832**	**$572,340**	**$1,207,172**	**$241,434**

Source: Douglas County 2014 Assessor & Parcel Data; Douglas County DFIRM

Figure C.4. Larkspur FEMA Flood Hazards

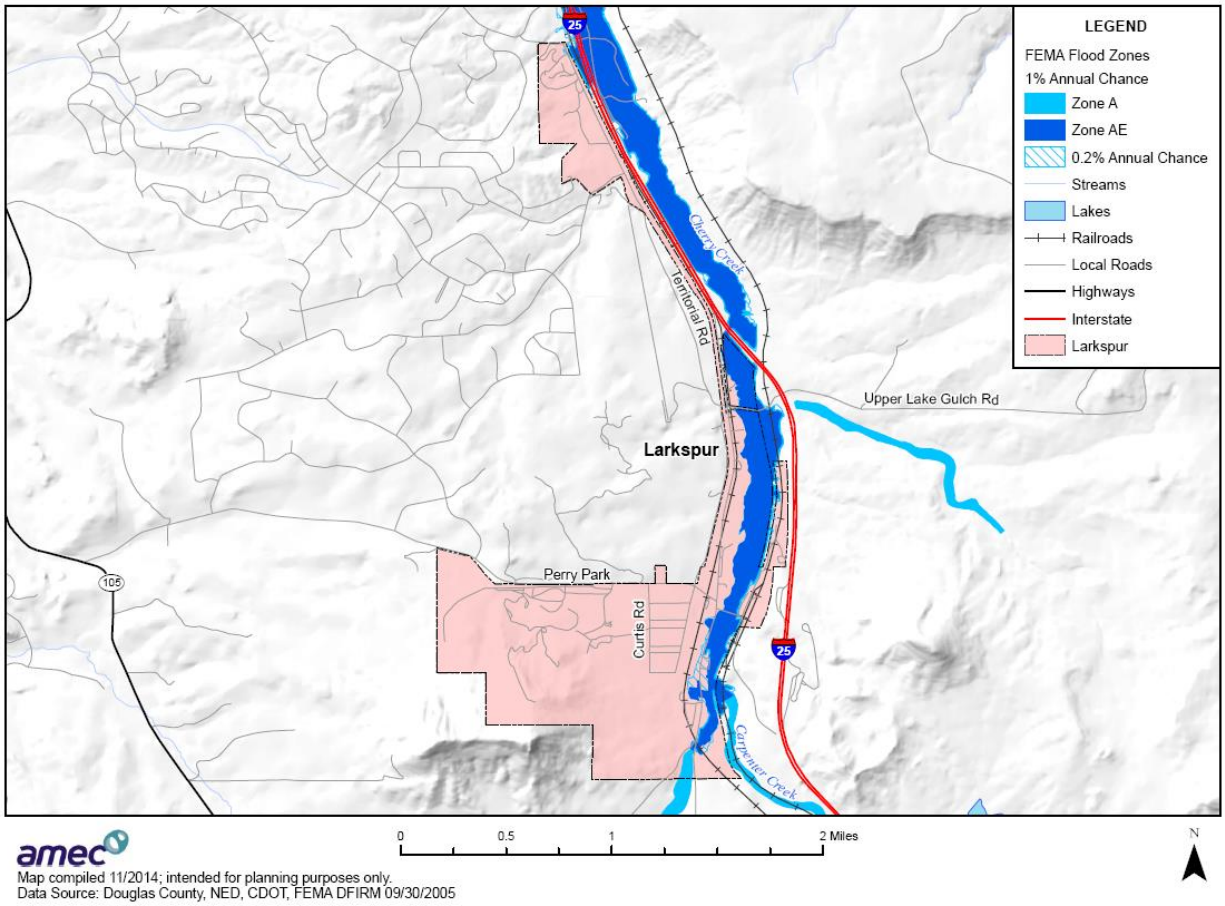
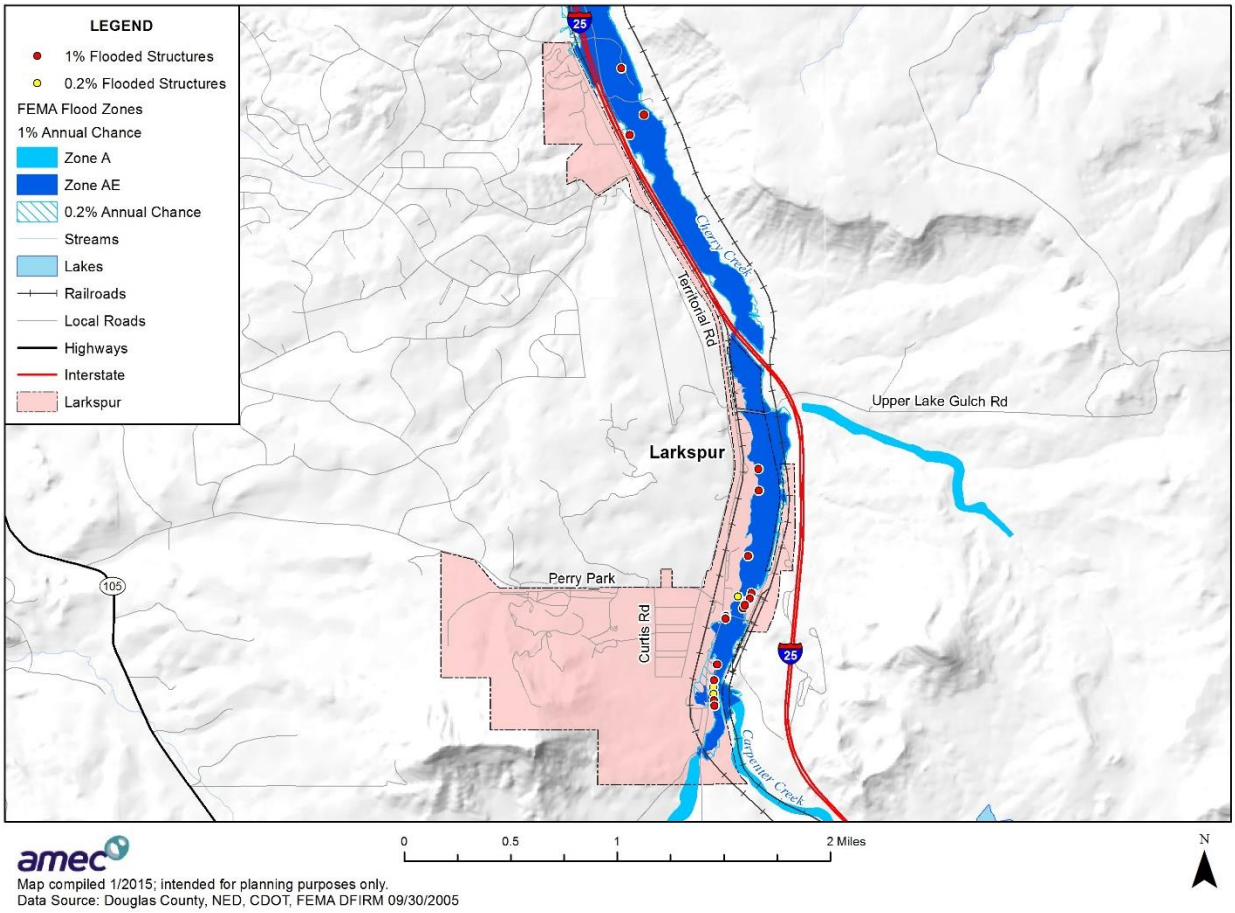


Figure C.5. Larkspur FEMA Flood Hazards and Flood Prone Improved Properties



Population at Risk

A separate analysis was performed to determine population in flood zones. Using GIS, the DFIRM dataset was overlaid on the improved residential parcel data. Those parcel centroids that intersect a flood zone were counted and multiplied by the 2010 U.S. Census household factor of 2.26; results were tabulated by jurisdiction and flood zone (see Table C.8). According to this analysis, there is a population of 20 in the 1% annual chance flood zone, and 2 in the 0.2% annual chance flood zone in Larkspur.

Table C.8. Larkspur - Improved Residential Parcels and Population in Floodplain

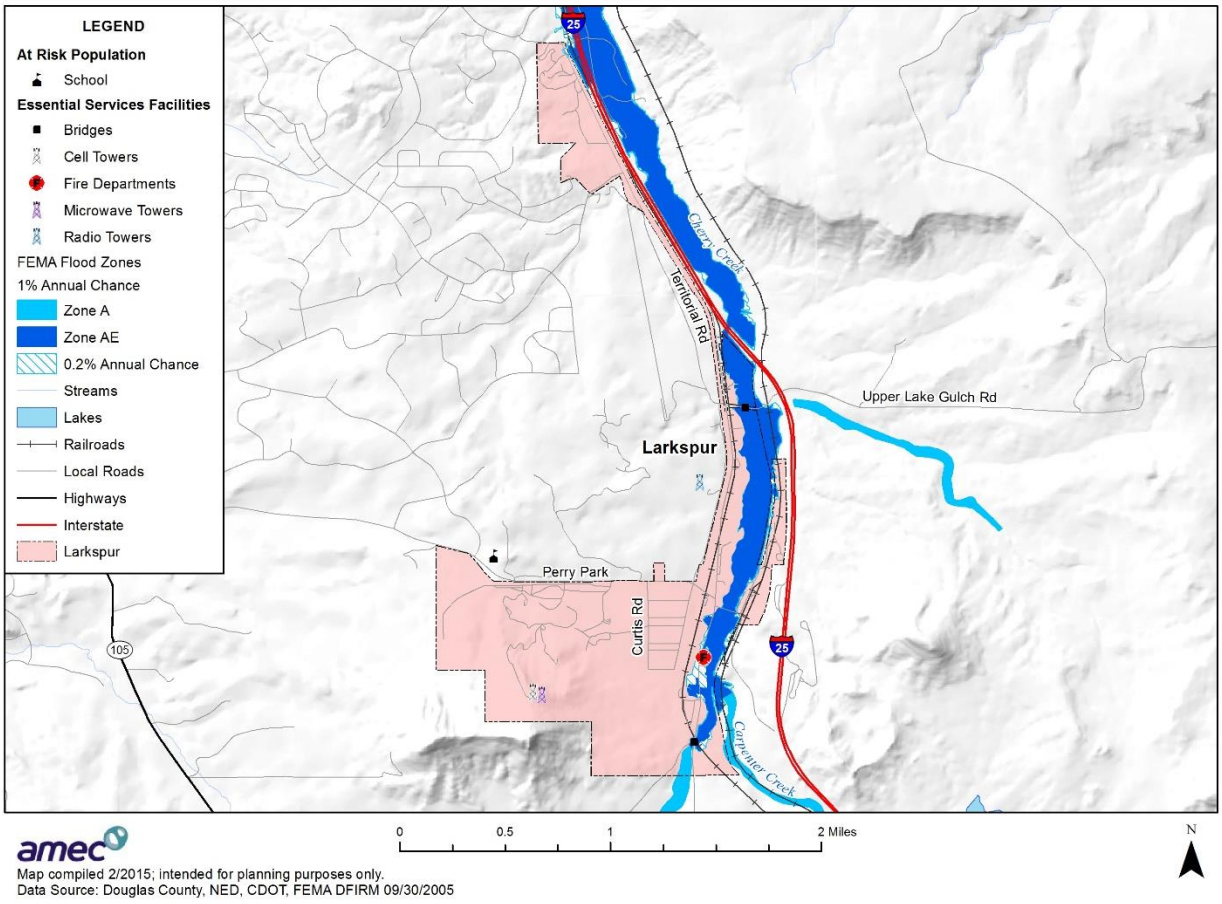
1% Annual Chance		0.2% Annual Chance	
Improved Residential Parcels	**Population**	**Improved Residential Parcels**	**Population**
9	20	1	2

Source: DFIRM, US Census Bureau, 2014 Douglas County Assessor & Parcel Data
* Census Bureau 2010 average household size for Larkspur – 2.26

Critical Facilities at Risk

Two critical facilities in Larkspur are located in the 1% annual chance flood zone, and no critical facilities are located in the 0.2% annual chance flood zone. Both are essential services facilities, specifically water hub/treatment facilities.

Figure C.6. Larkspur FEMA Flood Hazards and Critical Facilities



Development Trends

Table C.9 summarizes development in the 1% and 0.2% annual chance flood zones between 2010 and 2014. Based on this data, Larkspur has greatly minimized development in flood hazard areas.

Table C.9. Larkspur Structures Built from 2010 to 2014: Assets Exposed to the 1% and 0.2% Annual Chance Flood Zone

Flood Zone	Total Parcel Count	Improved Parcel Count	Total Building Count	Improved Value	Estimated Content Value	Land Value	Total Value
1% Annual Chance	2	2	2	$242,884	$121,442	$92,000	$456,326
0.2% Annual Chance	1	1	1	$147,670	$0	$40,000	$187,670
Total	**3**	**3**	**3**	**$390,554**	**$121,442**	**$132,000**	**$643,996**

Source: Douglas County GIS

Landslides/ Mud & Debris Flows /Rockfalls/Erosion

Vulnerability to Landslides/ Mud & Debris Flows /Rockfalls/Erosion

Likelihood of Future Occurrence—Low
Potential Magnitude—Low
Overall Vulnerability—Low

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. Areas susceptible to wildfire-driven erosion, which often result in debris flow or the erosion and deposition of soil into watersheds, also do not usually directly impact developed areas but can impact transportation and drainage infrastructure. Landslide hazards in Larkspur are also discussed in this section, despite being ranked low significance, due to the property exposure in potential hazard areas. 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 Larkspur. 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. The Town has 82 structures with a total value of over $8.9 million potentially exposed to landslide hazards, as detailed in Table C.10. Table C.11 summarizes exposure to moderate accelerated erosion. Erosion analysis does not include contents value since contents of buildings are unaffected by this hazard. Figure C.7 depicts Larkspur's mapped landslide and erosion hazard areas.

Table C.10. Town of Larkspur Total Exposure to Landslide

Property Type	Total Parcel Count	Improved Parcel Count	Total Building Count	Improved Value	Estimated Content Value	Land Value	Total Value
Debris Flow Area							
Agricultural	5	0	1	$0	$0	$534	$534
Commercial	2	2	2	$767,128	$767,128	$245,222	$1,779,478
Exempt	5	5	7	$685,901	$685,901	$291,500	$1,371,802
Residential	23	18	23	$2,603,483	$1,301,742	$926,000	$3,905,225
Utilities	1	0	0	$0	$0	$0	$0
Vacant Land	4	0	3	$0	$0	$154,000	$0
Total	**40**	**25**	**36**	**$4,056,512**	**$2,754,771**	**$1,617,256**	**$7,057,039**
Rockfall/Rockslide/Debris Avalanche Area							
Commercial	1	1	46	$686,486	$686,486	$427,329	$1,800,301
Exempt	1	0	0	$0	$0	$50,000	$50,000
Total	**2**	**1**	**46**	**$686,486**	**$686,486**	**$477,329**	**$1,850,301**
Grand Total	**42**	**26**	**82**	**$4,742,998**	**$3,441,257**	**$2,094,585**	**$8,907,340**

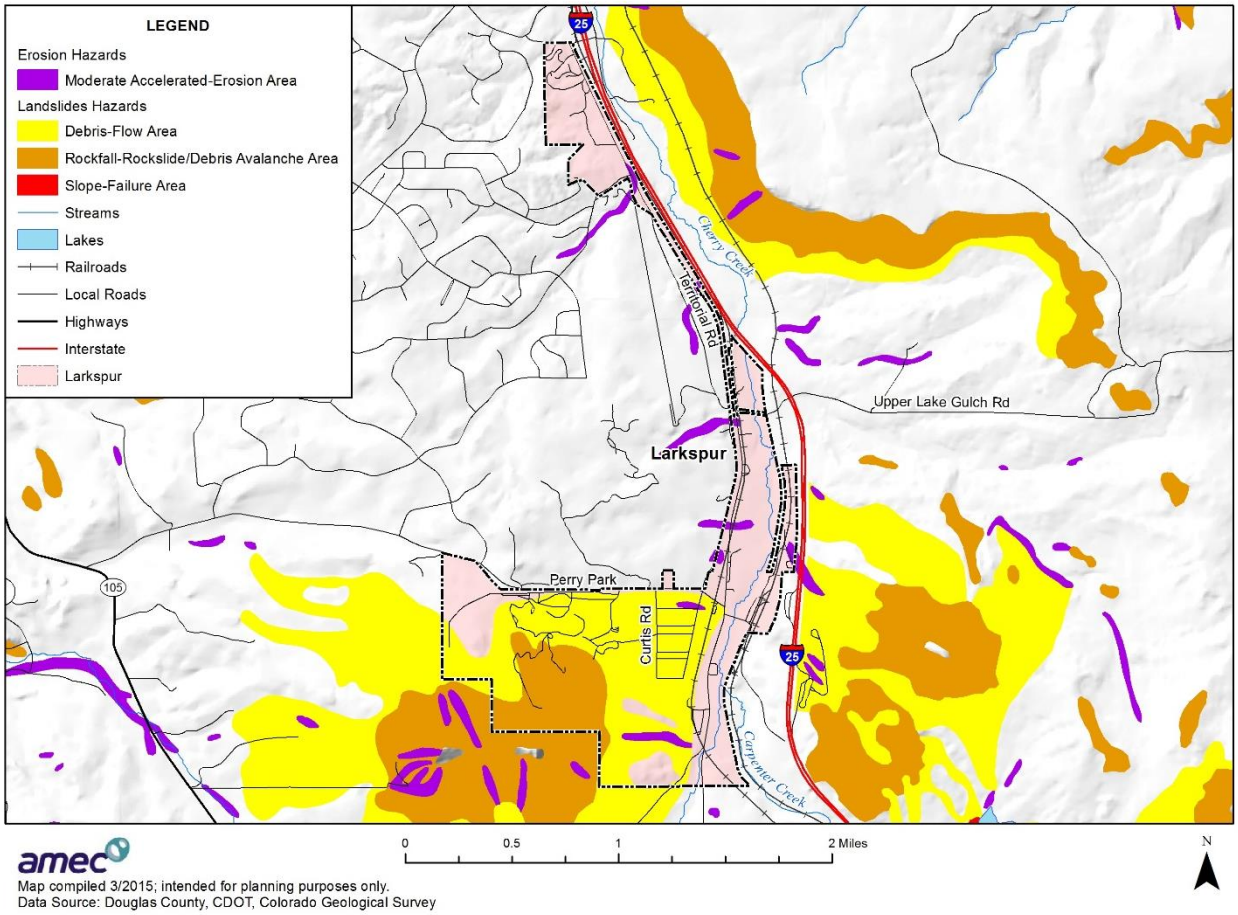
Source: Douglas County Assessor's Data

Table C.11. Town of Larkspur Total Exposure to Moderate Accelerated Erosion

Property Type	Total Parcel Count	Improved Parcel Count	Total Building Count	Improved Value	Land Value	Total Value
Exempt	2	0	1	$0	$1,030	$1,030
Utilities	1	0	0	$0	$0	$0
Total	**3**	**0**	**1**	**$0**	**$1,030**	**$1,030**

Source: Douglas County Assessor's Data

Figure C.7. Larkspur Erosion and Landslide Hazards



Population at Risk

An estimated 41 people are potentially exposed to landslide hazards, specifically debris flow hazards, in Larkspur. This estimate is based on the number of exposed improved residential parcels multiplied by the average household size in Larkspur according to the 2010 U.S. Census (2.26).

Critical Facilities at Risk

Landslide and erosion analysis was performed on the critical facility inventory in Larkspur. GIS was used to determine whether Larkspur facility locations intersect the landslide and erosion hazard areas provided by Douglas County, and if so, which zones they intersect. There are no critical facilities located in either landslide or moderate accelerated erosion hazard areas in Larkspur.

Development Trends

An analysis of recent development trends in hazard areas was conducted for Larkspur. A total of two structures were built in debris flow hazard areas in the Town between 2010 and 2014. Results of this analysis are shown in Table C.12.

Table C.12. Larkspur Structures Built from 2010 to 2014: Summary of Assets Exposed to Debris Flow Areas

Total Parcel Count	Improved Parcel Count	Total Building Count	Improved Value	Estimated Content Value	Land Value	Total Value
2	2	2	$118,254	$53,651	$76,000	$247,905

Source: Douglas County GIS

Severe Weather: Extreme Heat

Vulnerability to Extreme Heat

Likelihood of Future Occurrence—Medium
Potential Magnitude—Low
Overall Vulnerability—High

According to information provided by FEMA, extreme heat is defined as temperatures that hover 10°F or more above the average high temperature for the region and last for several weeks. Heat kills by taxing the human body beyond its abilities. In a normal year, about 175 Americans succumb to the demands of summer heat. According to the National Weather Service (NWS), among natural hazards, only the cold of winter—not lightning, hurricanes, tornados, floods, or earthquakes—takes a greater toll. In the 40-year period from 1936 through 1975, nearly 20,000 people were killed in the United States by the effects of heat and solar radiation. In the heat wave of 1980, more than 1,250 people died.

Heat disorders generally have to do with a reduction or collapse of the body's ability to shed heat by circulatory changes and sweating or a chemical (salt) imbalance caused by too much sweating. When heat gain exceeds the level the body can remove, or when the body cannot compensate for fluids and salt lost through perspiration, the temperature of the body's inner core begins to rise and heat-related illness may develop. Elderly persons, small children, people with chronic illnesses, those on certain medications or drugs, and persons with weight and alcohol problems are particularly susceptible to heat reactions, especially during heat waves in areas where moderate climate usually prevails.

Heat emergencies are often slower to develop, taking several days of continuous, oppressive heat before a significant or quantifiable impact is seen. Heat waves do not strike victims immediately, but rather their cumulative effects slowly take the lives of vulnerable populations. Heat waves do not cause damage or elicit the immediate response of floods, fires, earthquakes, or other more

"typical" disaster scenarios. While heat waves are obviously less dramatic, they are potentially more deadly.

Development Trends

Any future development in Larkspur will be exposed to extreme heat. Impacts to people can be mitigated by staying indoors, especially in places where air conditioning is available. Certain populations, such as the elderly and lower income, tend to be at higher risk. Social programs designed to check on people can help mitigate the impacts to these populations.

Severe Weather: Hail

Vulnerability to Hail

Likelihood of Future Occurrence—Medium
Potential Magnitude—Medium
Overall Vulnerability—Medium

Hail is one of the most damaging natural hazards in Colorado. It occurs in wide swaths, causing damage to large geographical areas at once. A single hailstorm could potentially impact all of Larkspur at once. Hailstorms can also occur relatively frequently, especially in the summer, though they may not always cause significant damages. The impacts of hailstorms can vary substantially from one storm to another depending on weather conditions and the size of the hailstones. Losses are typically covered by insurance.

Development Trends

Any future development in Larkspur will be exposed to hail. Impacts to people can be mitigated by staying indoors during a hailstorm, and some property such as cars can be protected with covered parking where available. Hail impacts are difficult to mitigate in general though, and insurance is one of the typical options for recouping property losses and reducing economic impacts.

Severe Weather: High Winds

Vulnerability to High Winds

Likelihood of Future Occurrence—Medium
Potential Magnitude—Medium
Overall Vulnerability—High

High winds, often accompanying severe thunderstorms, can cause significant property and crop damage, threaten public safety, and have adverse economic impacts from business closures and power loss. Winds in Larkspur are typically straight-line winds. Straight-line winds are generally any thunderstorm wind that is not associated with rotation (i.e., is not a tornado). These winds can

overturn mobile homes, tear roofs off of houses, topple trees, snap power lines, shatter windows, and sandblast paint from cars. Other associated hazards include utility outages, arcing power lines, debris blocking streets, dust storms, and an occasional structure fire.

Development Trends

The impact of high winds on future development in Larkspur can be mitigated with building codes and design criteria.

Severe Weather: Lightning

Vulnerability to Lightning

Likelihood of Future Occurrence—High
Potential Magnitude—Low
Overall Vulnerability—High

Colorado is one of the top states in the continental U.S. for lightning strikes, which can damage property and cause injury or even death to people. People are especially at risk in Colorado if they are outside in the early afternoon during the summer monsoons, though this is not the only time or place where people can be struck by lightning. Lightning can also ignite wildfires, which are a major concern for Larkspur given the Town's proximity to open space and Pike National Forest, as well as the elderly population living in the wildland/urban interface.

Development Trends

Future development in Larkspur will not influence where lightning strikes occur. However, growth and development can increase the number of people and structures exposed to lightning impacts. Lightning can also impact future development by igniting wildfires. Larkspur has nearly 134 buildings in extreme and high wildfire risk zones, and future development in these areas will place additional people and structures at risk to the secondary hazards caused by lightning.

Severe Weather: Thunderstorms/Heavy Rains

Vulnerability to Thunderstorms/Heavy Rains

Likelihood of Future Occurrence—High
Potential Magnitude—Medium
Overall Vulnerability—High

According to historical hazard data, severe weather is an annual occurrence in Larkspur. 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 Town. However, actual damage associated with the primary effects of severe weather has been limited. It is the damage caused by secondary hazards such as floods and fire that have the greatest

impact on Larkspur. The risk and vulnerability associated with these secondary hazards are discussed in other sections where applicable.

Development Trends

New critical facilities such as communications towers should be built to withstand heavy rains and thunderstorms. 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 in the Town is regulated by zoning and subdivision regulations, and future development is not expected to increase vulnerability to hazards.

Severe Weather: Tornado

Vulnerability to Tornado

Likelihood of Future Occurrence—Low
Potential Magnitude—High
Overall Vulnerability—High

Tornadoes can cause damage to property and loss of life. While most tornado damage is caused by violent winds, the majority of injuries and deaths generally result from flying debris. Property damage can include damage to buildings, fallen trees and power lines, broken gas lines, broken sewer and water mains, and the outbreak of fires. Access roads and streets may be blocked by debris, delaying necessary emergency response.

Figure 4.22 in Chapter 4 indicates that tornadoes can occur anywhere in Douglas County, especially in the eastern half. Figure 4.22 in the base plan does not show any recorded tornadoes within Larkspur, but a few F0s and F1s occurred within a few miles of the Town.

Development Trends

Population growth and development expose more people to tornadoes in Larkspur. The impact to people can be mitigated through warning systems and tornado shelters. Stringent building codes for high winds can help mitigate impacts from weaker tornadoes, and property insurance can reduce economic impacts.

Severe Weather: Winter Weather

Vulnerability to Winter Weather

Likelihood of Future Occurrence—High
Potential Magnitude—Medium
Overall Vulnerability—High

Larkspur typically experiences multiple winter storms in any given year. This hazard has been critical in its magnitude and severity in the past in Douglas County, as seen during the blizzards of March 2003 and December 2006. Vulnerability is high along busy roadways, particularly on Highway 470 and Interstate 25, the latter of which runs through the center of Larkspur. 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 Larkspur. 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; Larkspur'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 Larkspur 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.

Wildfire

Vulnerability to Wildfire

Likelihood of Future Occurrence—High
Potential Magnitude—High
Overall Vulnerability—High

An exposure analysis was performed to quantify risk to wildfire in Larkspur. 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.

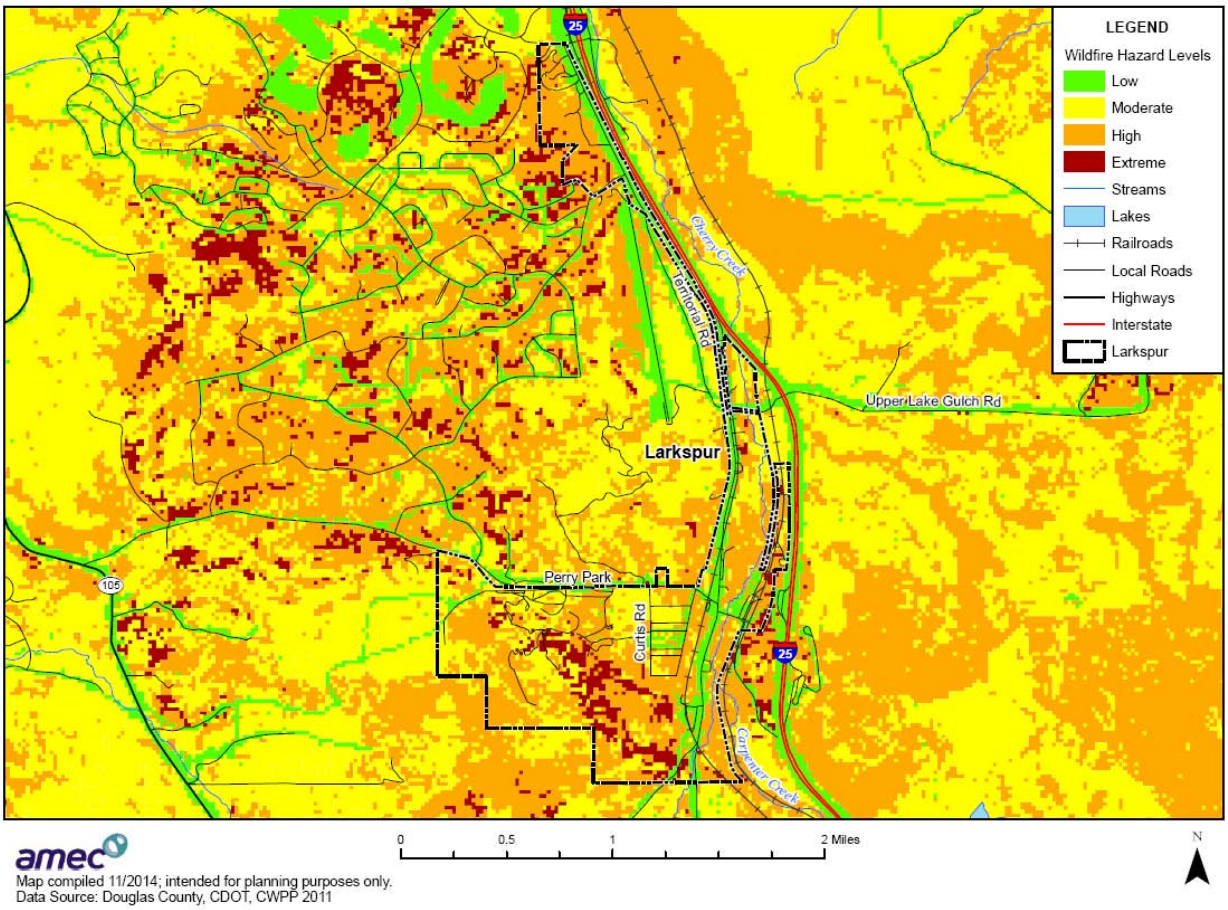
Table C.13 shows total parcel counts, improved parcel counts and their structure values by occupancy type (residential, industrial, etc.) and total land values within each fire severity zone in Larkspur. Figure C.8 illustrates the wildfire severity zones in Larkspur and the surrounding area.

Table C.13. Town of Larkspur Total Exposure to Wildfire by Property Type

Property Type	Total Parcel Count	Improved Parcel Count	Total Structure Count	Improved Value	Estimated Content Value	Land Value	Total Value/Loss Estimate
Extreme							
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**
High							
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**
Moderate							
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
Total	**30**	**16**	**25**	**$1,798,554**	**$1,133,545**	**$1,468,603**	**$4,400,702**
Low							
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**
Grand Total	**151**	**74**	**204**	**$13,662,695**	**$10,982,741**	**$9,603,287**	**$34,248,723**

Source: Douglas County GIS

Figure C.8. Larkspur Wildfire Hazard Potential



Population at Risk

Wildfire risk is greatest to those individuals residing in identified hazard areas. Larkspur has a high elderly population living in the wildland/urban interface. GIS analysis was performed to determine population in the different fire hazard areas. Using GIS, the Douglas County wildfire hazard potential 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 size for each jurisdiction and unincorporated area, which is 2.26 in Larkspur. Table C.14 summarizes the results of this analysis.

Table C.14. Population at Risk to Wildfire

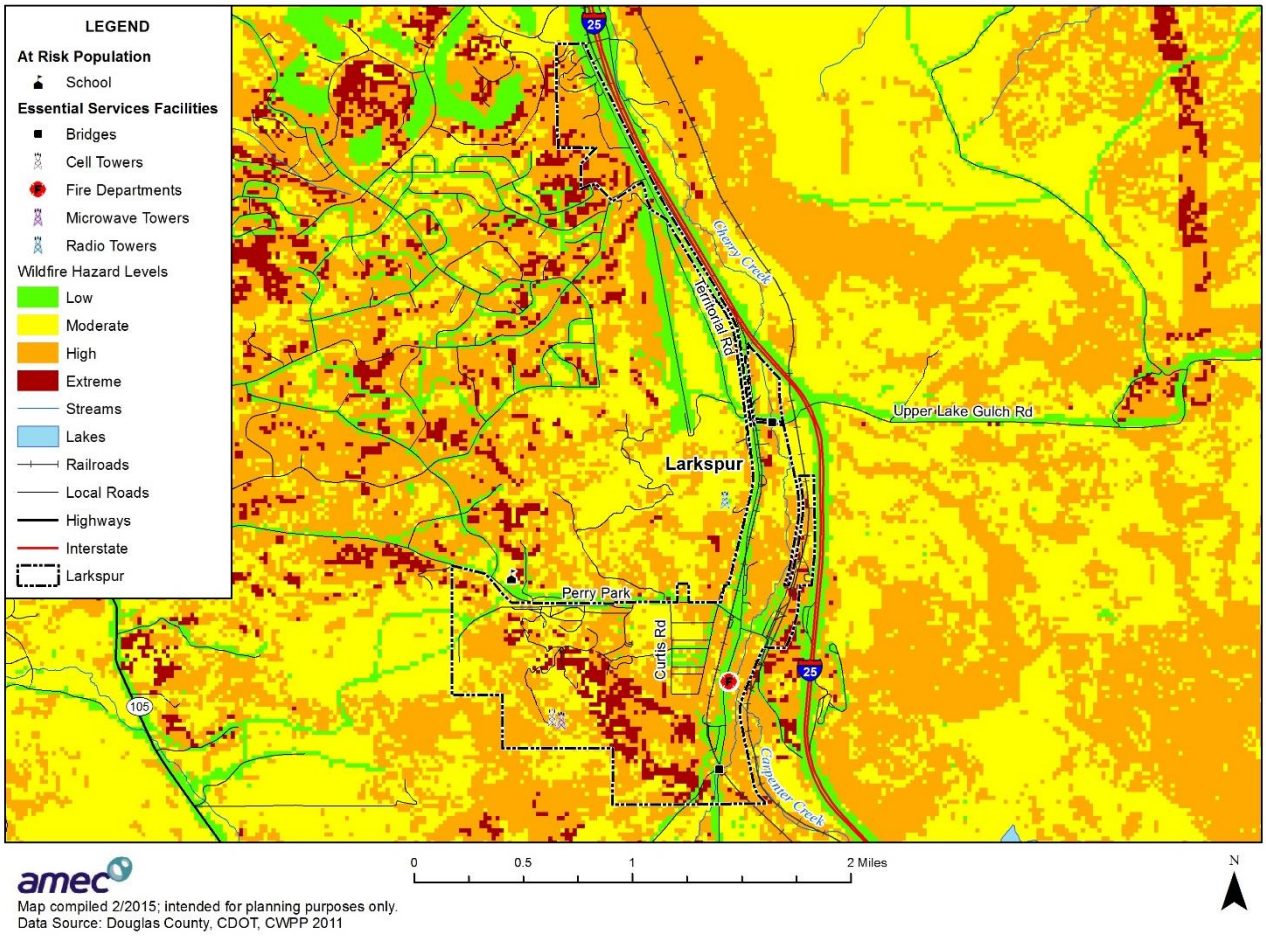
	Extreme	High	Moderate	Low
Population	2	36	29	41
Improved Residential Parcels	1	16	13	18

Source: Douglas County GIS, 2010 U.S. Census

Critical Facilities at Risk

Wildfire analysis was performed on the critical facility inventory in Douglas County and all jurisdictions, including Larkspur. GIS was used to determine whether the facility locations intersect a wildfire hazard area. No critical facilities are located in wildfire hazard areas in Larkspur. Further details of critical facility definition, type, name and address and jurisdiction by wildfire zone are listed in Appendix E.

Figure C.9. Larkspur Wildfire Hazard Potential and Critical Facilities



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 WUI fire areas have long histories of wildland fires that burned only vegetation in the past. However, with new development, a wildland fire following a historical pattern now burns developed areas. Population growth and development in Larkspur could potentially expose more people and structures to wildfires.

An analysis of recent development in extreme, high, and moderate wildfire hazard areas was conducted for Larkspur. A total of seven structures was built between 2010 and 2014. The total value of these structures is $1,510,237, with all of the structures being located in the high wildfire hazard area. Results of this analysis are shown in Table C.15.

Table C.15. Larkspur 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	-	-	-	-	-	-	-
High	6	6	7	$832,715	$413,522	$264,000	$1,510,237
Moderate	-	-	-	-	-	-	-
Total	**6**	**6**	**7**	**$832,715**	**$413,522**	**$264,000**	**$1,510,237**

Source: Douglas County GIS

Additionally, the new well project, existing water treatment plant, and wastewater treatment plant are all located among the pine trees on the west and east side of Spruce Mountain Road.

Hazardous Materials: Transportation Incidents

Vulnerability to Hazardous Materials: Transportation Incidents

Likelihood of Future Occurrence—Low
Potential Magnitude—High
Overall Vulnerability—High

Several major transportation routes cross through Larkspur, including Interstate 25, 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 at potentially at risk to hazardous materials transportation incidents in Larkspur.

Population at Risk

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 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 some locations in Larkspur, individual population analysis was performed for each transportation corridor. Each buffered transportation corridor was intersected with improved residential parcels and therefore parcels could be counted more than once 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 Larkspur are adjacent to each other so the majority of the population in this analysis is duplicated for each railroad. There are 109 people that live within the one-mile buffer of the Union Pacific Railroad, BNSF Railroad, and Interstate 25 that passes through Larkspur. This is approximately 50% of the Town's total population.

Development Trends

Development in Larkspur occurs within existing town boundaries. As development in Larkspur continues to grow, more people will be at risk to hazardous materials transportation incidents.

C.6 Capability Assessment

Capabilities are the programs and policies currently in use to reduce hazard impacts or that could be used to implement hazard mitigation activities. This capability assessment is divided into five sections: regulatory mitigation capabilities, administrative and technical mitigation capabilities, fiscal mitigation capabilities, mitigation outreach and partnerships, and other mitigation efforts.

C.6.1 Regulatory Mitigation Capabilities

Table C.16 lists regulatory mitigation capabilities, including planning and land management tools, typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place in the Town of Larkspur.

Table C.16. Town of Larkspur Regulatory Mitigation Capabilities

Regulatory Tool (ordinances, codes, plans)	Y/N	Date	Comments
Comprehensive plan	Y	2011 through 2016	IGA Disaster Emergency Mutual Aid and Assistance
Zoning ordinance	Y	12/18/2010	Ordinance 3.01-3-106
Subdivision ordinance	Y	3/21/2002	Ordinance 3.02 and 3.83
Growth management ordinance	N		
Floodplain ordinance	Y	1987-2014	Ordinance 3.35, 3.44, and 3.45, Flood Damage Prevention Ordinance 3.107
Other special purpose ordinance (stormwater, steep slope, wildfire)	Y	11/4/1987	Ordinance 3.35 was adapted from Douglas County Storm Drainage
Building code	Y	5/3/2001	Ordinance 3.42, 3.50, 3.51, and 3.75
BCEGS Rating	N		
Fire department ISO rating	Y	6/12/2003	Resolution 03-04 adopted the 1997 Uniform Fire Code. The ISO rating for the Town of Larkspur is 4.
Erosion or sediment control program	Y	7/18/1996	Ordinance 3.61
Stormwater management program	Y	7/18/1996	Ordinance 3.35 and 3.61
Site plan review requirements	Y	7/22/2004	Ordinance 3.77
Capital improvements plan	N		
Economic development plan	Y	7/22/2004	Ordinance 3.87
Local emergency operations plan	N		
Community Wildfire Protection Plans	Y	3/24/2004	Educational seminars provided by Keith Worley. Douglas County IMT Resolution 004-036 in place.
Flood insurance study or other engineering study for streams	Y	12/8/2005	Ordinance 3.89
Elevation certificates	N		
Other			

Source: Amec Foster Wheeler Data Collection Guide

Ordinances

The Town of Larkspur has many ordinances related to mitigation, as noted in the comments in Table C.16.

Ordinance 3.44 Flood Damage Prevention

1.4 Methods of Reducing Flood Losses

In order to accomplish its purposes, this ordinance includes methods and provisions for:

A. Restricting or prohibiting uses which are dangerous to health, safety, and property due to water or erosion hazards, or which result in damaging increases in erosion or in flood heights or velocities;

B. Requiring that uses vulnerable to floods, including facilities which serve uses, be protected against flood damage at the time of initial construction;

C. Controlling the alteration of natural floodplains, stream channels, natural protective barriers, which help accommodate or channel flood waters;

D. Controlling filling, grading, dredging, and other development which may increase flood damage; and

E. Preventing or regulating the construction of flood barriers which will unnaturally divert flood waters or which may increase flood hazards in other areas.

Ordinance 3.45

4.2 Designation of a Flood Plain Administrator

A Flood Plain Administrator shall be appointed from time to time by resolution of the Town Council to administer and implement this Ordinance by granting or denying development, permitting applications in accordance with its provisions.

Ordinance 3.107 Adopting Flood Damage Prevention Regulations within the Town of Larkspur

In order to accomplish its purposes, this ordinance uses the following methods:

A. Restricting or prohibiting uses which are dangerous to health, safety, and property in times of flood, or cause excessive increases in flood heights or velocities;

B. Requiring that uses vulnerable to floods, including facilities which serve such uses, be protected against flood damage at the time of initial construction;

C. Controlling the alteration of natural floodplains, stream channels, natural protective barriers, which are involved in the accommodation of flood waters;

D. Controlling filling, grading, dredging, and other development which may increase flood damage; and

E. Preventing or regulating the construction of flood barriers which will unnaturally divert flood waters or which may increase flood hazards to other lands.

C.6.2 Administrative/Technical Mitigation Capabilities

Table C.17 identifies the Town department(s) responsible for activities related to mitigation and loss prevention in Larkspur.

Table C.17. Town of Larkspur Administrative and Technical Mitigation Capabilities

Personnel Resources	Yes/No	Department/Position	Comments
Planner/Engineer with knowledge of land development/land management practices	Y	Town Planner	Planning Committee and outside consultant if needed are utilized
Engineer/Professional trained in construction practices related to buildings and/or infrastructure	Y	Town Manager/Professional Engineering Consultants	On call as needed
Planner/Engineer/Scientist with an understanding of natural hazards	Y	Douglas County Emergency Operations Plan	IGA with Douglas County
Personnel skilled in GIS	Y	Douglas County GIS Department	IGA with Douglas County
Full time building official	Y	Town Manager	Matt Krimmer
Floodplain Manager	Y	Town Manager	Matt Krimmer
Emergency Manager	Y	Town Manager/Mayor	Matt Krimmer/Gerry Been Town Charter §12.05
Grant writer	Y	Consultant	Margaret Dieote
Other personnel	Y	Council Members and administrative staff	Full time administrative and council members on call
GIS Data – Hazard areas	Y	Douglas County GIS Department	Douglas County Roads GIS Department
GIS Data - Critical facilities	Y	Douglas County GIS Department	Douglas County Roads GIS Department
GIS Data – Building footprints	Y	Douglas County Building Department	IGA with Douglas County
GIS Data – Land use	Y	Douglas County GIS and Assessor	IGA with Douglas County
GIS Data – Links to Assessor's data	Y	Douglas County Assessor website	IGA with Douglas County and Assessor's Office
Warning Systems/Services (Reverse 9-11, cable override, outdoor warning signals)	Y	CodeRED through Douglas County	Douglas County Sheriff's Office upgraded its emergency mass notification system. Now have high-speed telephone emergency notification.
Other	Y	Elected officials	Mayor, council members

Source: Amec Foster Wheeler Data Collection Guide with input from Town of Larkspur

C.6.3 Fiscal Mitigation Capabilities

Table C.18 identifies financial tools or resources that the Town could potentially use to help fund mitigation activities.

Table C.18. Town of Larkspur Fiscal Mitigation Capabilities

Financial Resources	Accessible/Eligible to Use (Y/N)	Comments
Community Development Block Grants	Y	Low income and infrastructure replacement grants
Capital improvements project funding	Y	New Arapahoe well – CDPHE and DOLA grants
Authority to levy taxes for specific purposes	Y	Town Charter
Fees for water, sewer, gas, or electric services	Y	Town Charter
Impact fees for new development	Y	Upon council approval
Incur debt through general obligation bonds	Y	Town Charter §8.01 Municipal Borrowing
Incur debt through special tax bonds	Y	
Incur debt through private activities	N	
Withhold spending in hazard prone areas	N	
Other		

Source: Amec Foster Wheeler Data Collection Guide with input from Town of Larkspur

C.6.4 Mitigation Outreach and Partnerships

Larkspur partners with organizations involved in mitigation and preparedness on a case by case basis. The Town's preparedness and mitigation partners include:

- Larkspur Fire Protection District and Forestry Service

C.7 Mitigation Strategy

This section describes the mitigation strategy process and mitigation action plan for the Town of Larkspur' inclusion with the Douglas County Local Hazard Mitigation Plan update.

C.7.1 Mitigation Goals and Objectives

The Town of Larkspur adopts the hazard mitigation goals and objectives developed by the HMPC and described in Chapter 5 Mitigation Strategy of the base plan.

C.7.2 Continued Compliance with the NFIP

As a participant of the National Flood Insurance Program (NFIP), the Town of Larkspur has administered floodplain management regulations that meet the minimum requirements of the NFIP. The management program objective is to protect people and property within the Town. The Town of Larkspur will continue to comply with the requirements of the NFIP in the future.

The Town's regulatory activities apply to existing and new development areas of the Town; implementing flood protection measures for existing structures and maintaining drainage systems. The goal of the program is to enhance public safety, and reduce impacts and losses while protecting the environment.

The Town provides public outreach activities through the Larkspur Fire Protection District

C.7.3 Mitigation Actions

The planning team for the Town of Larkspur identified and prioritized the following mitigation actions based on the risk assessment and in accordance with the process outline in Section 5, Mitigation Strategy, of the base plan. Background information and information on how each action will be implemented and administered, such as ideas for implementation, responsible office, potential funding, estimated cost, and timeline are also included. General processes and information on plan implementation and maintenance of this LHMP by all participating jurisdictions is included in Section 7, Plan Implementation and Maintenance, of the base plan.

Town of Larkspur Action #1

Action Title:	**Public awareness – support Douglas County citizen disaster preparedness guide**
Priority:	Medium, Ongoing
Project Description, Issue & Background:	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.
Ideas for Implementation:	Production and distribution of 5000 printed copies and 5000 smartphone copies summer of 2015. Continue standard order of 5000 printed versions and 5000 smartphone versions annually over subsequent 4 years.
Other Alternatives:	No action
Responsible Agency:	Douglas County OEM
Partners:	Town of Larkspur, DC FFESS, DC Public Affairs, DCSO Community Resources
Potential Funding:	Douglas County
Cost Estimate:	Cost of materials, staff time
Benefits: (Losses Avoided)	Informative preparedness piece for citizens of Larkspur, Douglas County, and other participating jurisdictions
Timeline:	Q2 2015 distribution and annually thereafter
Status:	New in 2015

Annex D CITY OF LONE TREE

D.1 Introduction

This annex details the hazard mitigation planning elements specific to the City of Lone Tree, a participating jurisdiction to the Douglas County LHMP Update. This annex is not intended to be a standalone document, but appends to and supplements the information contained in the base plan document. As such, all sections of the base plan, including the planning process and other procedural requirements apply to and were met by the City. This annex provides additional information specific to the City of Lone Tree, with a focus on providing additional details on the risk assessment and mitigation strategy for this community.

D.2 Planning Process

As described above, the City of Lone Tree followed the planning process detailed in Section 3.0 of the base plan. In addition to providing representation on the Douglas County Hazard Mitigation Planning Committee (HMPC), the City formulated their own internal planning team to support the broader planning process requirements. Internal planning participants included staff from the following City departments:

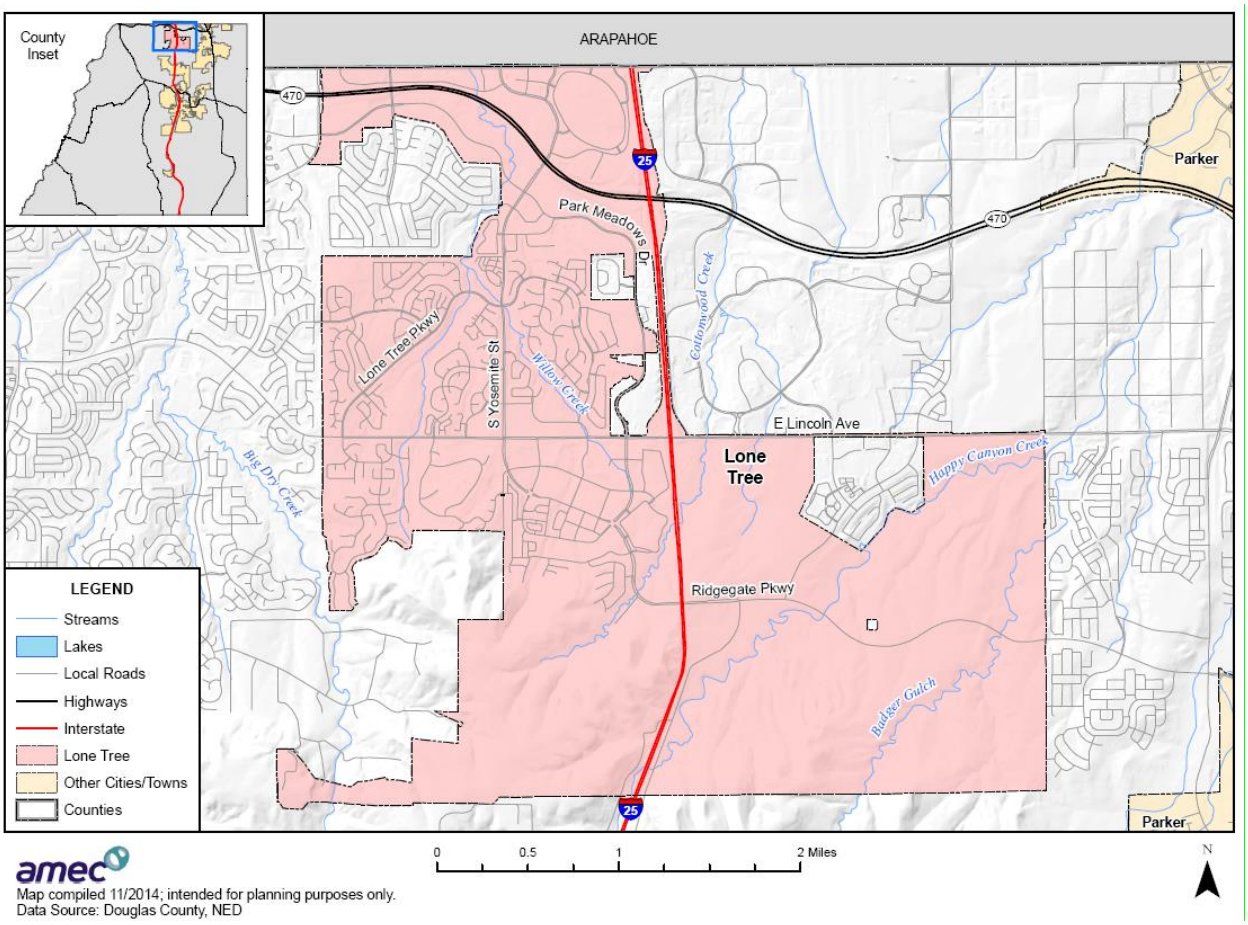
- Greg Weeks, City Engineer, Public Works
- Ron Pinson, Commander, Police Department
- Bill Sparkman, member, Public Safety Advisory Committee (PSAC)
- Darryl Jones, VP and Development Manager of Coventry

Additional details on plan participation and City representatives are included in Appendix A.

D.3 Community Profile

The community profile for the City of Lone Tree is detailed in the following sections. Figure D.1 displays a map and the location of the City of Lone Tree within Douglas County.

Figure D.1. City of Lone Tree Base Map



D.3.1 Geography and Location

The City of Lone Tree is located in northern Douglas County near the junction of Interstate 25 and Highway 470. The land consists of a wide range of topography encompassing mountain vistas, hills, and grass covered plains.

Because of the City's close proximity to the Denver metro area and multi-modal transportation facilities, the area is desirous to new residents. The lands surrounding Lone Tree include Highlands Ranch to the west, Centennial to the north, Stonegate to the east, and Castle Pines and open space to the south.

D.3.2 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."

D.3.3 Economy

As the population of the City has grown, so has its economy. Select economic characteristics and statistics for Lone Tree are shown in Table D.1. These statistics were pulled from the 2008-2013 American Community Survey and the 2000 U.S. Census to demonstrate how certain economic factors in Lone Tree have changed over time.

Table D.1. Economic Characteristics for the City of Lone Tree

Characteristic	2000	2013
Families below Poverty Level	<1%	2.9%
Individuals below Poverty Level	<1%	4.9%
Median Home Value	$292,500	$462,000
Median Household Income	96,308	$107,417
Per Capita Income	46,287	$57,081
Population in Labor Force*	2,907	6,409

Source: 2008-2013 US Census Bureau American Community Survey 5-year Estimates, 2000 U.S. Census

D.3.4 Population

The 2013 population estimate for the City (the most recent available) indicates there are 11,600 residents of Lone Tree. The population was estimated at 10,218 for the 2010 U.S. Census.

D.4 Hazard Identification and Summary

This section details how the risk of individual hazards varies across Lone Tree. The City's planning team identified the hazards that affect the City and summarized their frequency of occurrence, spatial extent, potential magnitude, and significance specific to Lone Tree (see Table D.2). In the context of the plan's planning area, there are no hazards that are unique to Lone Tree.

Information on past occurrences and the likelihood of future occurrences is detailed in Section 4, Risk Assessment, of the base plan. Additional information for high and medium significant hazards for the City is included in the Vulnerability Assessment section of this Annex.

Table D.2. City of Lone Tree Hazard ID Table

Hazard	Spatial Extent	Likelihood of Future Occurrences	Magnitude /Severity	Significance
Avalanche	Limited	Low	Low	Low
Drought	Significant	Medium	Medium	Medium
Earthquake	Significant	Low	Low	Low
Flood: Dam Failure	Limited	Low	Low	Low
Flood: 100/500 year	Limited	Low	Low	Low
Flood: Localized/ Stormwater	Limited	Medium	Low	Low
Landslides/ Mud & Debris Flows /Rockfalls	Significant	Medium	Medium	Low
Severe Weather: Extreme Heat	Extensive	Medium	Low	Low
Severe Weather: Hail	Extensive	High	Low	Low
Severe Weather: High Winds	Extensive	High	Low	Low
Severe Weather: Lightning	Extensive	Medium	Low	Low
Severe Weather: Thunderstorms/Heavy Rains	Extensive	High	Medium	Medium
Severe Weather: Tornado	Extensive	Medium	Low	Low
Severe Weather: Winter Weather (includes snow/ice/extreme cold)	Extensive	Medium	High	Medium
Soil Hazards: Erosion & Deposition	Significant	Medium	Low	Low
Soil Hazards: Expansive Soils	Significant	Medium	Low	Low
Soil Hazards: Subsidence	Limited	Medium	Low	Low
Wildfire	Significant/Extensive	High	Medium	Medium
Hazardous Materials: Transportation Incidents	Significant	High	Medium	Medium

Spatial Extent
Limited: Less than 10% of planning area
Significant: 10-50% of planning area
Extensive: 50-100% of planning area

Likelihood of Future Occurrences
Low: Occurs less than once every 10 years or more
Medium: Occurs less than once every 5 to 10 years
High: Occurs once every year or up to once every five years

Magnitude/Severity
Low: Negligible property damages (less than 5% of all buildings and infrastructure) Negligible loss of quality of life. Local emergency response capability is sufficient to manage the hazard.
Medium: Moderate property damages (15% to 50% of all buildings and infrastructure) Some loss of quality of life. Emergency response capability, economic and geographic effects of the hazard are of sufficient magnitude to involve one or more counties.
High: Property damages to greater than 50% of all buildings and infrastructure. Significant loss of quality of life Emergency response capability, economic and geographic effects of the hazard are of sufficient magnitude to require federal assistance.

Significance
Low: minimal potential impact
Medium: moderate potential impact
High: widespread potential impact

D.5 Vulnerability Assessment

The intent of this section is to assess Lone Tree's vulnerability separate from that of the planning area as a whole, which has already been assessed in Section 4.3 Vulnerability Assessment of the base plan. This vulnerability assessment provides an inventory of the population, property, and other assets located within the City and further analyzes those assets at risk to identified hazards ranked of medium or high significance (as listed in Table D.2) to the community. For more information about how hazards affect the County as a whole, see Chapter 4 Risk Assessment in the main plan.

D.5.1 Total Assets at Risk

This section identifies Lone Tree's total assets at risk, including values at risk, critical facilities and infrastructure, natural resources, and historic and cultural resources. Growth and development trends are also presented for the community. This data is not hazard specific, but is representative of total assets at risk within a community.

Values at Risk

The following data from the Douglas County Assessor's Office is based on joining assessor data to the 2014 parcel layer in GIS. This data should only be used as an indicator of overall values in the County, as the information has some limitations. Table D.3 summarizes the parcels, improved parcels, structures, improved value, land value, and total value exposed in Lone Tree. It is 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.

Table D.3. City of Lone Tree Total Exposure

Property Type	Total Parcel Count	Improved Parcel Count	Total Structures	Improved Value	Total Land Value	Total Value
Agricultural	47	0	14	$0	$90,606	$90,606
Commercial	195	169	2,230	$983,383,425	$369,222,226	$1,352,605,651
Exempt	455	29	149	$85,366,377	$28,780,801	$114,147,178
HOA	174	0	48	$0	$0	$0
Industrial	0	0	0	$0	$0	$0
Producing Mine	0	0	0	$0	$0	$0
Residential	3,578	3,398	3,796	$1,370,559,065	$368,018,250	$1,738,577,315
Utilities	0	0	0	$0	$0	$0
Vacant Land	166	0	45	$0	$25,124,423	$25,124,423
Total	**4,615**	**3,596**	**6,282**	**$2,439,308,867**	**$791,236,306**	**$3,230,545,173**

Source: Douglas County Assessor's Data

Critical Facilities and Infrastructure

For purposes of this plan, a critical facility is defined as:

> Any facility, including without limitation, a structure, infrastructure[1], 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.

This definition was refined by separating out three categories of critical facilities as further described in Section 4.3.1 of the base plan. These categories include At-Risk Populations, Essential Services, and High Potential Loss Facilities.

An inventory of critical facilities in the City of Lone Tree from Douglas County GIS is provided in Table D.4. Details of critical facility definition, type, name and address and jurisdiction by hazard zone are listed in Appendix E.

Table D.4. City of Lone Tree Critical Facilities: Summary Table

Category	Type	Facility Count
At Risk Population Facilities	Assisted Living	2
	School	4
Essential Services Facilities	Bridge	4
	Cell Tower	9
	Fire Department	1
	Hospital	1
	Microwave	14
	Police	1
	Public Health	1
	Water Hub/Treatment	1
	Hazardous Material	25
High Potential Loss Facilities	Assisted Living	2
	Total City of Lone Tree	**63**

Source: Douglas County GIS

Natural Resources

The City of Lone Tree and the areas surrounding it include a rich and diverse range of biological resources.

[1] Essential Service Facilities include bridges, roads, power grids, and infrastructure held by private companies (i.e. utility lines and private levees) that are not mapped for security reasons and are not under the control of the County.

Vegetation

According to Lone Tree's 2008 Comprehensive Plan, "[p]rominent native species in the area include a variety of short and tall grasses in meadow areas, cottonwood and native willow tree species along drainages, and a sprinkling of Gambel Oak and Mountain Mahogany shrubs along the sides and tops of the bluffs. These hardy native species should be protected and riparian areas restored where appropriate to enhance habitat for wildlife, to prevent soil erosion, to protect water quality, and for their intrinsic value" (pg. 3-4).

Wildlife Habitat

According to the Lone Tree Comprehensive Plan, "[w]ildlife habitat is fundamentally preserved through the continued implementation of this Plan, which supports compact land patterns as opposed to sprawl which fragments land available for wildlife habitat and movement corridors. While Lone Tree is an urbanizing community, the City has also worked to conserve important wildlife habitat through the preservation of large tracks of open space along the bluffs and important drainages throughout the City (see the Environmental Resources Map). Cooperative efforts are undertaken to restore and enhance areas important for wildlife, including restoration of wetland and riparian areas, the control of noxious weeds, measures to maintain water quality, and the use of wildlife compatible fencing" (pg. 3-6).

Historic and Cultural Resources

To inventory historically significant homes, public buildings, and landmarks in the Planning Area, the HMPC collected information from both the National Register of Historic Places and the Colorado State Register. Each program has different eligibility criteria and procedural requirements. These requirements are detailed in Section 4.3.1 of the base plan. Lone Tree does not have any historic structures or landmarks listed in the National Register. However, the Schweiger Ranch Foundation is known to be one of the oldest ranches and historical sites in Douglas County. The Schweiger Ranch falls under the municipality of Lone Tree and should be considered an important historical asset.

Growth and Development Trends

The City's development context consists of a variety of residential densities, commercial uses, and mixed uses, with parks, trails, and open space. The history of the City's development and population growth periods are as follows:

"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.

RidgeGate, a 3500-acre master planned community south of Lincoln (located on both sides of I-25), was annexed by a vote of Lone Tree residents in 2000. Because the property was already

zoned for development under County jurisdiction and would develop regardless, the City felt it was important to work with the landowner and take a direct role in shaping the master plan for the property. As a result of that effort, Lone Tree receives land dedication for public facilities including a new recreation center, police and fire stations, a City Hall, library, trails, parks, and open space, and land for a future City Center (to be located on the east side of I-25 and south of Lincoln Avenue). The City, along with Coventry Development Corporation, the owner of RidgeGate, have committed to preserve the historic Schweiger Ranch, providing the City an opportunity to appreciate its ranching legacy.

Annexations to the City in 2001 included Heritage Hills and commercial development to the north, bringing considerable economic benefit to the community and include a neighborhood that was already part of the local community of interest. Likewise, in 2001, the residential communities of Centennial Ridge and Carriage Club were also annexed.

Sky Ridge Medical Center was constructed in 2003, providing needed emergency medical care for residents in the region. That same year City offices were centralized in leased office space on South Yosemite Street.

In 2004, the City's police force was established, resulting in the hiring of the City's first employees. The City also reconstructed a new Civic Center on Lone Tree Parkway in 2004 (replacing what was the sales office for the original Lone Tree development). Other important additions to Lone Tree included the annexation of Southridge Preserve in 2004, a residential development planned south of Centennial Ridge. This land was annexed principally to establish specific limitations on location and design of homes to protect ridgeline views for future generations to enjoy.

Park Meadows Mall was annexed in 2006, enhancing revenues to the City, while also ensuring that revenues will be reinvested in the area to sustain its economic viability over time. Businesses continue to grow and thrive in the community, and toward that end, the Lone Tree Chamber of Commerce was established in 2006.

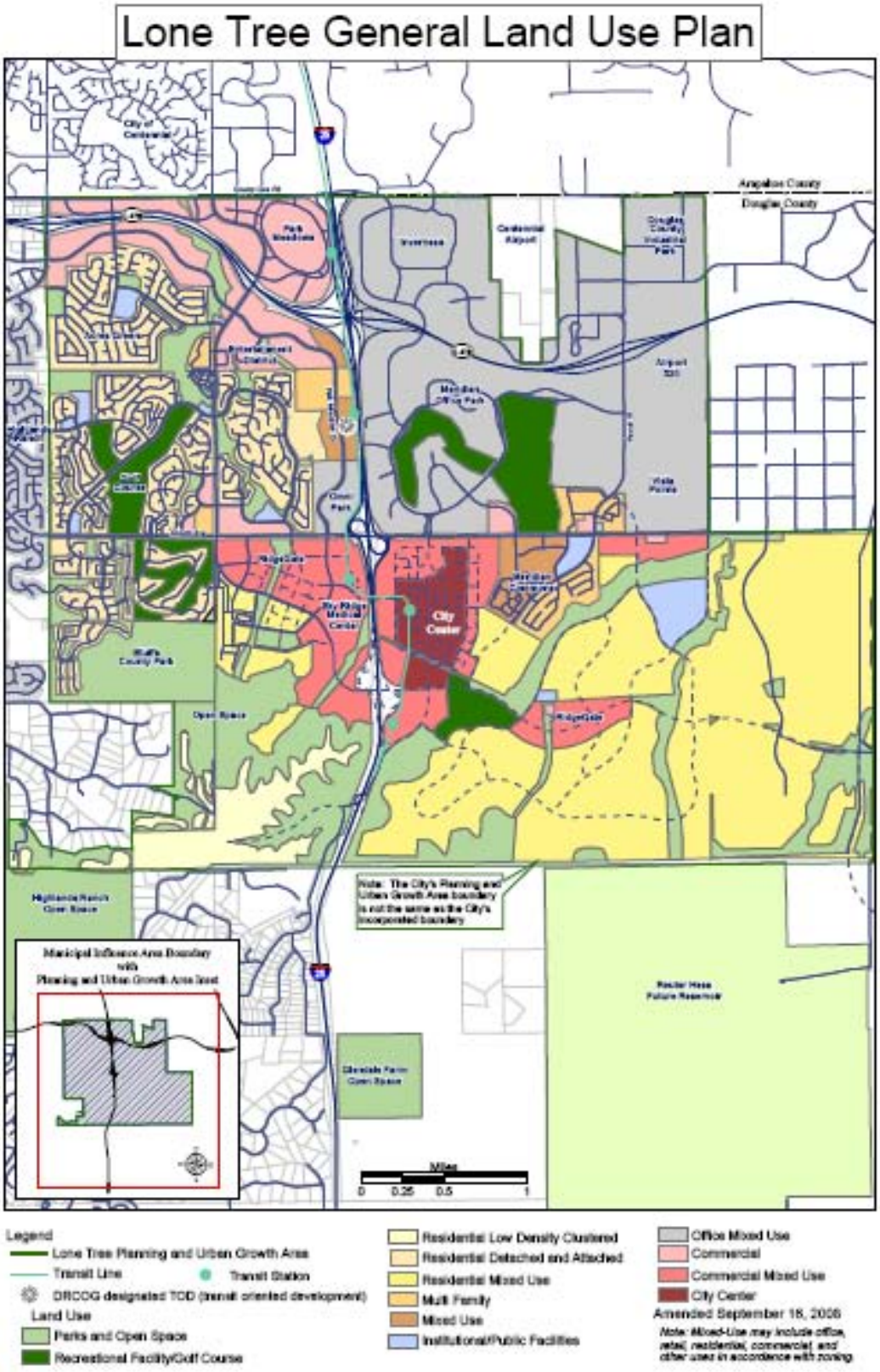
Light rail was extended to the Lone Tree community, with the first stop at Lincoln Station opening in 2006, followed by a stop at Park Meadows Mall in 2008. Future stops are planned at Sky Ridge Medical Center, the future City Center and a future end-of-the line station east of I-25.

The City renovated an existing office building and in April 2007, the City offices were relocated to their current location at 9220 Kimmer Drive."[2]

[2] "History of Lone Tree, a City that is growing…carefully." https://cityoflonetree.com/index.aspx?NID=276, accessed March 26, 2015.

Development within the City consists of planned development residential uses, commercial uses, office mixed uses, other mixed uses, and parks and open space uses. Existing land use is shown in Figure D.2.

Figure D.2. Current Land Use in the City of Lone Tree



Source: 2008 City of Lone Tree Comprehensive Plan

Table D.5 summarizes the number and value of structures built in Lone Tree from 2010 to 2014 based on a query of the 'year built' values in the County's parcel database. A total of 280 structures, with a total value greater than $166 million, were built in that short period of time. The vast majority of these structures were residential, built to accommodate the rapidly growing population in the Planning Area. Additional analysis on recent development in Lone Tree's mapped hazard areas is discussed in the vulnerability assessments for flood, landslide/erosion, and wildfire.

Table D.5. Lone Tree Structures Built from 2010 to 2014: Total Assets by Property Type

Property Type	Total Parcel Count	Improved Parcel Count	Total Structure Count	Improved Value	Land Value	Total Value
Commercial	15	15	71	$40,663,645	$27,106,153	$67,769,798
Residential	201	201	209	$78,345,513	$20,306,050	$98,651,563
Total	**216**	**216**	**280**	**$119,009,158**	**$47,412,203**	**$166,421,361**

Source: Douglas County

D.5.2 Priority Hazards: Vulnerability Assessment

This section provides the vulnerability assessment, including any quantifiable loss estimates, for those hazards identified above in Table D.2 as high or medium significance hazards. Lone Tree did not rank any hazards as high significance but does have several of medium significance. Flooding (100/500-year), landslide, and erosion were also analyzed to compare Lone Tree's exposure to the rest of the Planning Area, despite being ranked low significance to the City. Impacts of past events and vulnerability of the City to specific hazards are further discussed below (see Section 4.1 Hazard Identification in the base plan for more detailed information about these hazards and their impacts on the Douglas County Planning Area). Methodologies for calculating loss estimates are the same as those described in Section 4.3 of the base plan.

An estimate of the vulnerability of the City to each identified hazard, in addition to the estimate of risk of future occurrence, is provided in each of 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.
- **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.

Drought

Vulnerability to Drought

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.

The most significant qualitative impacts associated with drought in Lone Tree are those related to water intensive activities such as fire protection, municipal usage, commerce, tourism, recreation, and wildlife preservation. Mandatory conservation measures and water use restrictions are typically implemented during extended droughts. 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 Lone Tree. Some factors to consider include: 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. It can be assumed, however, that the loss of production in one sector of the economy would affect other sectors.

Development Trends

Drought vulnerability will increase with future development as there will be increased demands for limited water resources. Lone Tree supports water conservation measures through wastewater reuse, xeriscaping, water efficient fixtures, and best management practices established by the Colorado Water Wise Council.

The completion of the Rueter-Hess Reservoir helps mitigate drought impacts in parts of the City that fall within the Parker Water and Sanitation District service area. The District recognized the need to manage water supply, especially given the rapid growth rate in their service area. To help meet this need, the Rueter-Hess reservoir was constructed. 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.[3] The reservoir is primarily used for drinking water storage to supply current and future development in Lone Tree, Parker, Castle Rock, Castle Pines, and other local jurisdictions and will help mitigate future impacts to Lone Tree's water supply in future droughts

Flood: 100/500 year

Vulnerability to Flood: 100/500 year

Likelihood of Future Occurrence—Low
Potential Magnitude—Low
Overall Vulnerability—Low

The Planning Area, including Lone Tree, is prone to very intense rainfall. 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 Lone Tree to floods.

No structures or people are exposed to 100/500-year flooding within Lone Tree's limits. Figure D.3 through Figure D.5 depict the location of flood hazards, critical facilities, and properties affected by flooding in Lone Tree. Note that one critical facility, a bridge, is located in the 1% annual chance flood hazard zone.

[3] Town of Castle Rock, Colorado website. "Rueter-Hess Reservoir." http://www.crgov.com/index.aspx?NID=1277, accessed February 17, 2015.

Figure D.3. City of Lone Tree FEMA Flood Hazard Zones

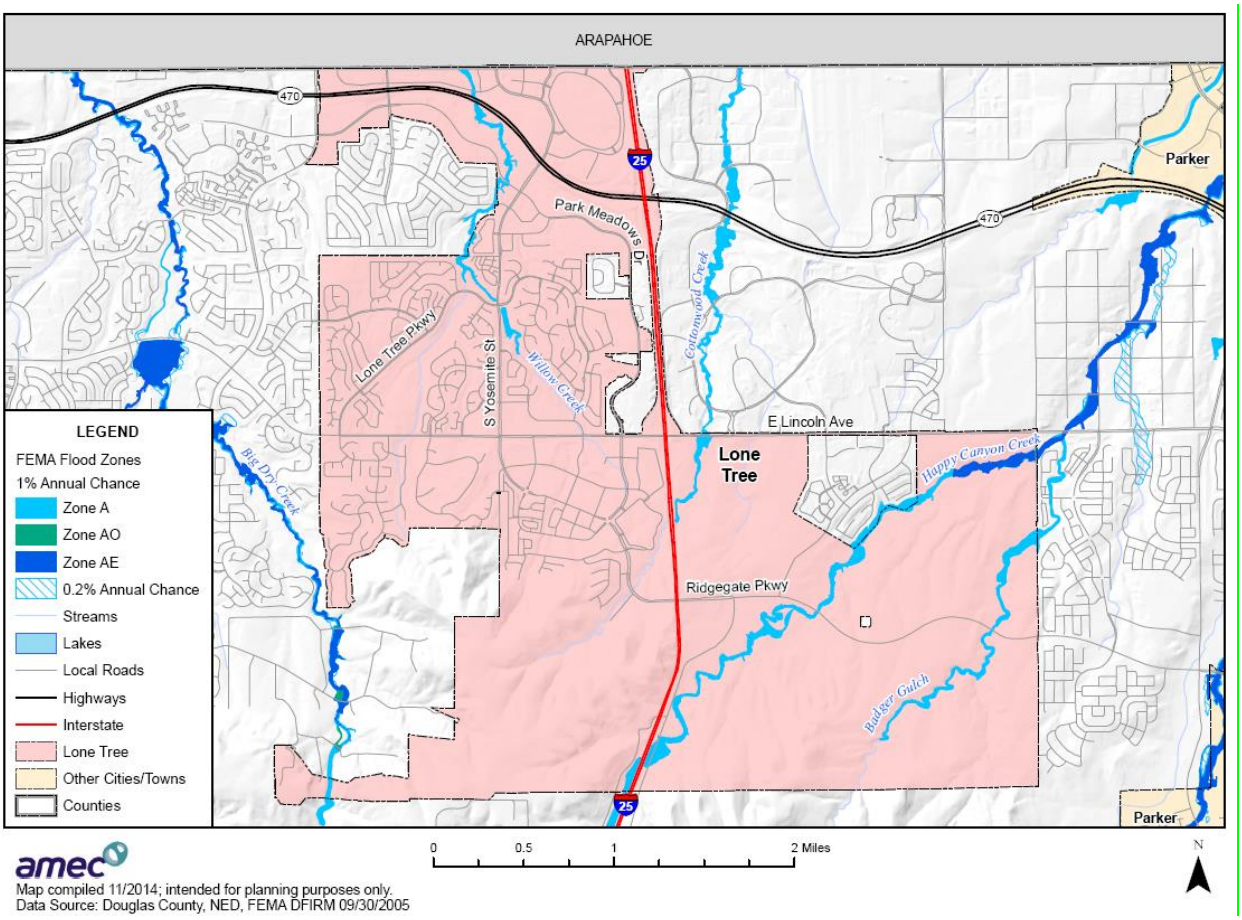
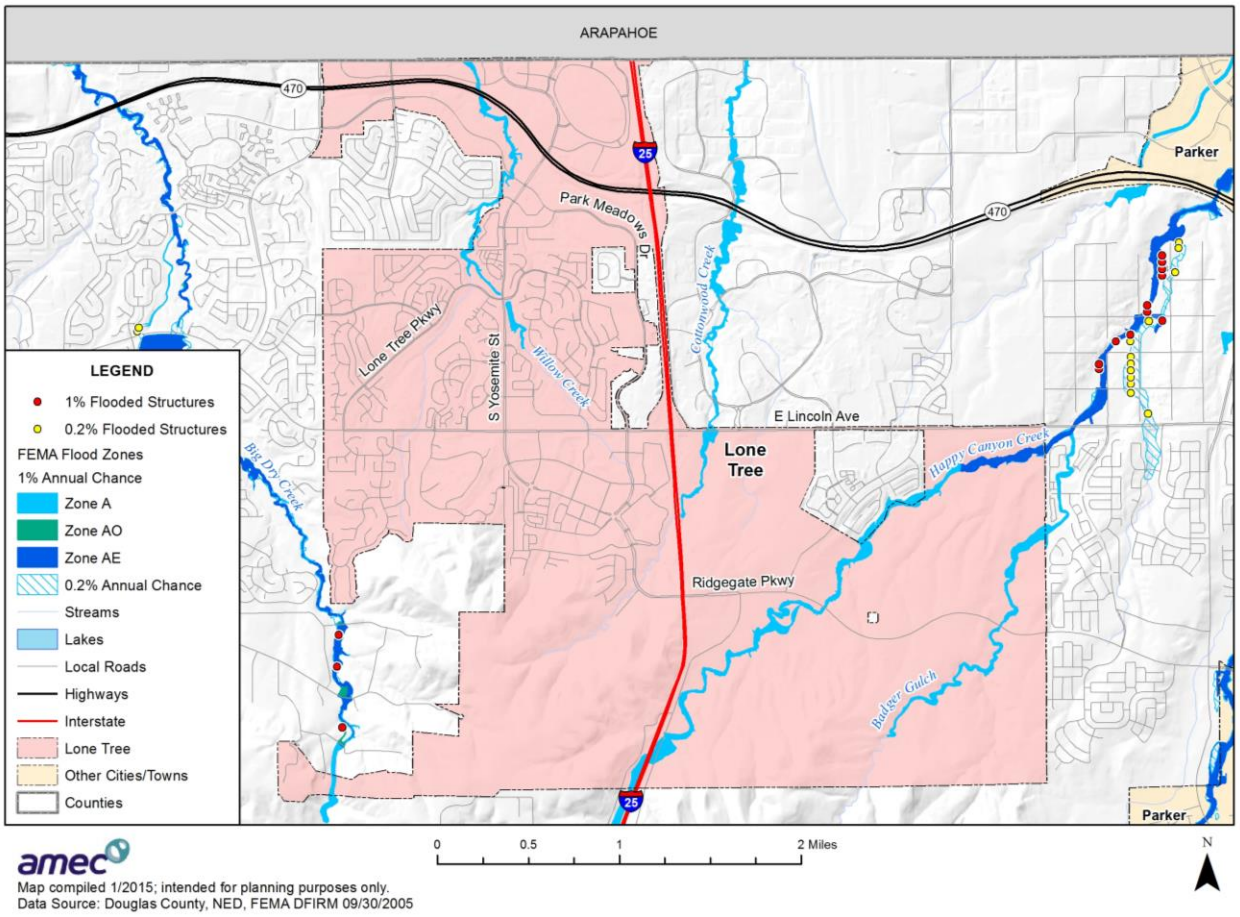


Figure D.4. City of Lone Tree Properties in FEMA Flood Hazard Zones



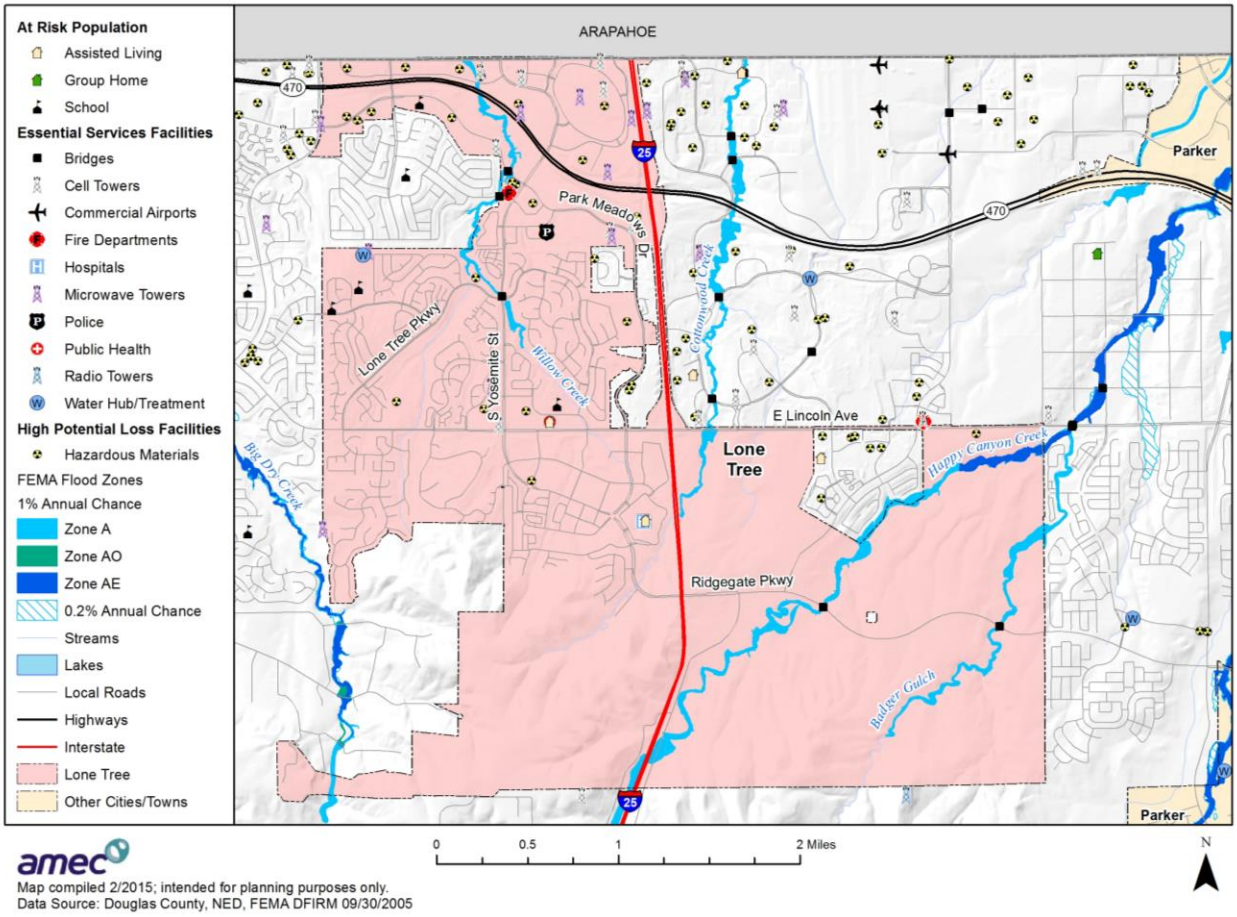
Population at Risk

No Lone Tree residents live in FEMA flood hazard zones.

Critical Facilities at Risk

Lone Tree has bridge, located at 1st Street over Happy Canyon Creek, that is subject to overtopping by the 1% annual chance flood event.

Figure D.5. City of Lone Tree Critical Facilities and FEMA Flood Hazard Zones



Development Trends

The flood hazard area in Lone Tree is relatively small. The spatial extent of this hazard could potentially change after an annexation, for example, or if growth occurred in the eastern and southern parts of the City. Chapter 15 of Lone Tree's municipal code, in particular Articles III and IV, will help limit exposure of future development to this type of flooding.

An analysis of build-out from 2010 to 2014 in hazard areas was conducted for Lone Tree. The build-out analysis returned no results for properties built since 2010 in 100/500-year flood zones.

Landslides/ Mud & Debris Flows /Rockfalls/Erosion

Vulnerability to Landslides/ Mud & Debris Flows /Rockfalls/Erosion

Likelihood of Future Occurrence—Medium for landslides and erosion
Potential Magnitude—Medium for landslides, Low for erosion
Overall Vulnerability—Low for landslides and erosion

The landslide hazard is made up of these attributes: debris-flow, rockfall-rockslide/debris, and slope-failure. Erosion hazards in Lone Tree are also discussed in this section, despite being ranked low significance, due to the property exposure in potential hazard areas. Collectively, these may be referred to as geologic hazards.

The County's parcel layer was used as the basis for the inventory of all parcels within Lone Tree. GIS was used to overlay the geologic 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. According to the Douglas County Comprehensive Master Plan, the geologic hazard layer is "based upon the coincidence of steeply dipping (tilted or upturned) layers of sedimentary expansive bedrock having dip angles of greater than 30 degrees from horizontal." Lone Tree does not have any mapped areas exposed to debris flow. However, the City has 46 structures with a total value of over $30 million potentially exposed to rockfall and slope-failure hazards, as detailed in Table D.6. Table D.7 summarizes exposure to moderate accelerated erosion. Erosion analysis does not include contents value since contents of buildings are unaffected by this hazard. Figure D.6 depicts Lone Tree's mapped landslide and erosion hazard areas.

Table D.6. City of Lone Tree Total Exposure to Landslide

Property Type	Total Parcel Count	Improved Parcel Count	Total Building Count	Improved Value	Estimated Content Value	Land Value	Total Value
Rockfall/Rockslide/Debris Avalanche Area							
Agricultural	1	0	0	$0	$0	$17	$17
Commercial	1	1	2	$7,190,731	$7,190,731	$3,188,069	$17,569,531
Exempt	3	0	1	$0	$0	$61,404	$61,404
Total	**5**	**1**	**3**	**$7,190,731**	**$7,190,731**	**$3,249,490**	**$17,630,952**
Slope-Failure Area							
Exempt	5	0	0	$0	$0	$743,760	$743,760
HOA	3	0	0	$0	$0	$0	$0
Residential	47	17	43	$5,770,241	$2,885,121	$3,319,156	$11,974,518
Total	**55**	**17**	**43**	**$5,770,241**	**$2,885,121**	**$4,062,916**	**$12,718,278**
Grand Total	**60**	**18**	**46**	**$12,960,972**	**$10,075,852**	**$7,312,406**	**$30,349,230**

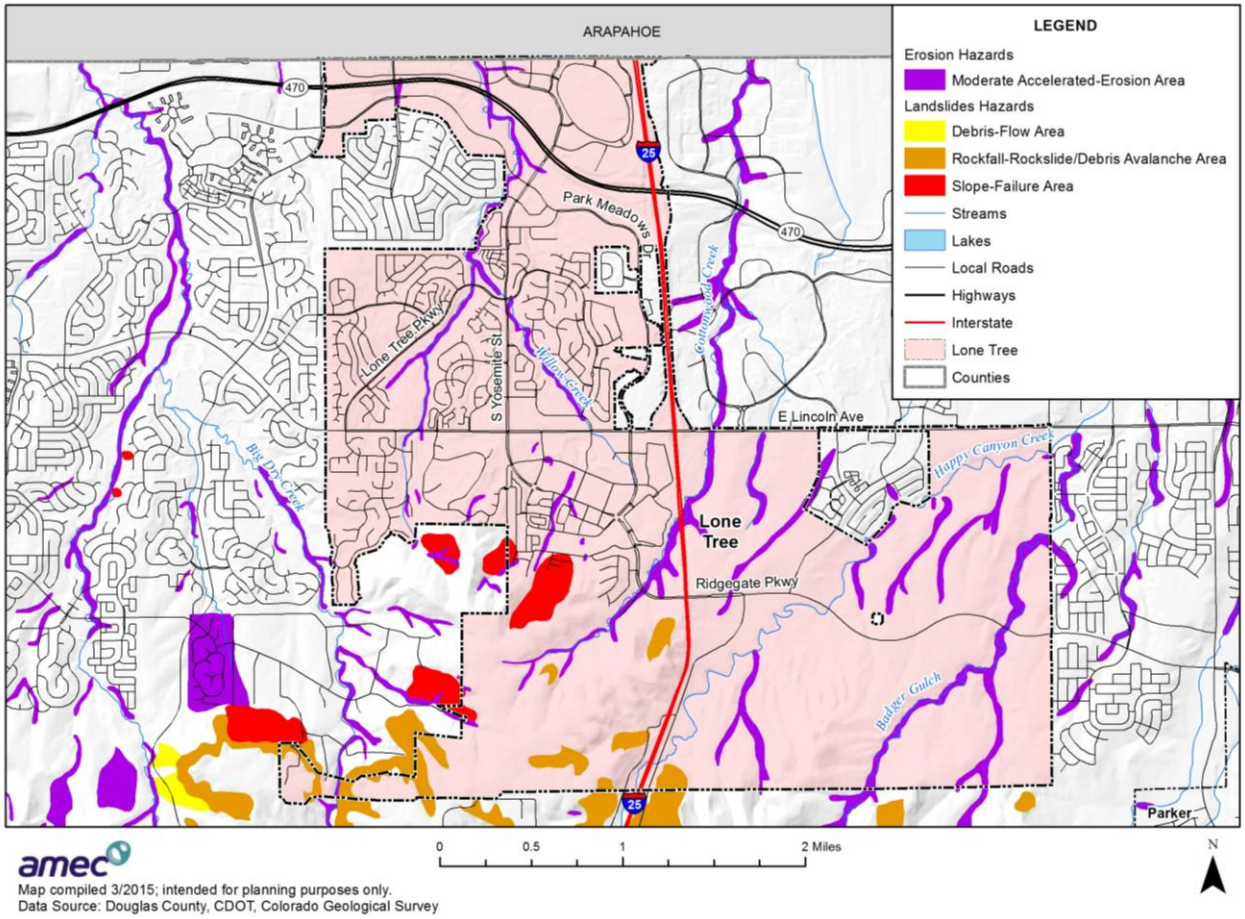
Source: Douglas County Assessor's Data

Table D.7. City of Lone Tree Total Exposure to Moderate Accelerated Erosion

Property Type	Total Parcel Count	Improved Parcel Count	Total Building Count	Improved Value	Land Value	Total Value
Agricultural	2	0	2	$0	$1,265	$1,265
Commercial	3	2	27	$9,842,790	$8,251,832	$18,094,622
Exempt	25	2	9	$7,225,815	$3,605,600	$10,831,415
Residential	10	10	11	$3,742,777	$730,050	$4,472,827
Total	**40**	**14**	**49**	**$20,811,382**	**$12,588,747**	**$33,400,129**

Source: Douglas County Assessor's Data

Figure D.6. City of Lone Tree Landslide and Erosion Hazards



Population at Risk

No people live within landslide or erosion hazard areas in Lone Tree; most of the geologic hazard issues are located along drainage channels or in undeveloped parts of the City, and no structures are at risk in these areas.

Critical Facilities at Risk

Landslide and erosion analysis was performed on the critical facility inventory in Lone Tree. GIS was used to determine whether Lone Tree's facility locations intersect the landslide and erosion hazard areas provided by Douglas County, and if so, which zones they intersect. There are no critical facilities located in landslide hazard areas in Lone Tree. Two essential services facilities (a bridge and a cell tower) and one high potential loss facility (with hazardous materials) are located in the moderate accelerated erosion hazard area.

Development Trends

Fortunately, the landslide and erosion hazard areas in Lone Tree are fairly small. The City's Municipal Code addresses erosion in Section 17-2-60, which states that that proposed development is subject to the regulations established in "Chapter 16 of [the] Code; the Roadway Design and Construction Standards; the Storm Drainage Design and Technical Criteria Manual; and the Grading, Erosion, and Sediment Control Manual. If applicable, the Soil Conservation District shall be consulted regarding erosion and sediment control." Section 16 of the Municipal Code regulates clearing, grading, and land disturbance.

An analysis of recent development trends in hazard areas was conducted for Lone Tree. A total of seven structures were built in moderate-accelerated erosion hazard areas in the City between 2010 and 2014. No structures were built in landslide hazard areas during that time. Results of this analysis are shown in Table D.8.

Table D.8. Lone Tree Structures Built from 2010 to 2014: Summary of Assets Exposed to Moderate Accelerated-Erosion Areas

Total Parcel Count	Improved Parcel Count	Total Building Count	Improved Value	Estimated Content Value	Land Value	Total Value
1	1	7	$4,964,468	$4,964,468	$3,372,415	$13,301,351

Source: Douglas County GIS

Severe Weather: Thunderstorms/Heavy Rains

Vulnerability to Severe Weather: Thunderstorms/Heavy Rains

Likelihood of Future Occurrence—High
Potential Magnitude—Medium
Overall Vulnerability—Medium

According to historical hazard data, severe weather is an annual occurrence in Lone Tree. 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 City. Lightning often accompanies these storms and has caused damage to homes in Lone Tree in the past. However, actual damage associated with the primary effects of severe weather has been limited. It is the damage caused by secondary hazards such as floods and fire that have the greatest impact on Lone Tree. The risk and vulnerability associated with these secondary hazards are discussed in other sections where applicable.

Development Trends

New critical facilities such as communications towers should be built to withstand heavy rains and thunderstorms. 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 in the City is regulated by zoning and subdivision regulations, and future development is not expected to increase vulnerability to hazards.

Severe Weather: Winter Weather (includes snow/ice/extreme cold)

Vulnerability to Severe Weather: Winter Weather (includes snow/ice/extreme cold)

Likelihood of Future Occurrence—Medium
Potential Magnitude—High
Overall Vulnerability—Medium

Lone Tree typically experiences multiple winter storms in any given year. This hazard has been critical in its magnitude and severity in the past in Douglas County, as seen during the blizzards of March 2003 and December 2006. Vulnerability is high along busy roadways, particularly on Highway 470 and Interstate 25, which intersect in Lone Tree. 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 Lone Tree. 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; Lone Tree'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 Lone Tree 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.

Wildfire

Vulnerability to Wildfire

Likelihood of Future Occurrence—High
Potential Magnitude—Medium
Overall Vulnerability—Medium

An exposure analysis was performed to quantify risk to wildfire in Lone Tree. Potential losses due 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.

Table D.9 shows 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 in Lone Tree. Table D.10 summarizes this information by wildfire severity zone. Figure D.7 illustrates the wildfire severity zones in Lone Tree and the surrounding area.

Table D.9. City of Lone Tree Total Exposure to Wildfire by Property Type

Property Type	Total Parcel Count	Improved Parcel Count	Total Structure Count	Improved Value	Estimated Content Value	Land Value	Total Value/Loss Estimate
Extreme							
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**
High							
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**
Moderate							
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**
Low							
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

Property Type	Total Parcel Count	Improved Parcel Count	Total Structure Count	Improved Value	Estimated Content Value	Land Value	Total Value/Loss Estimate
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**

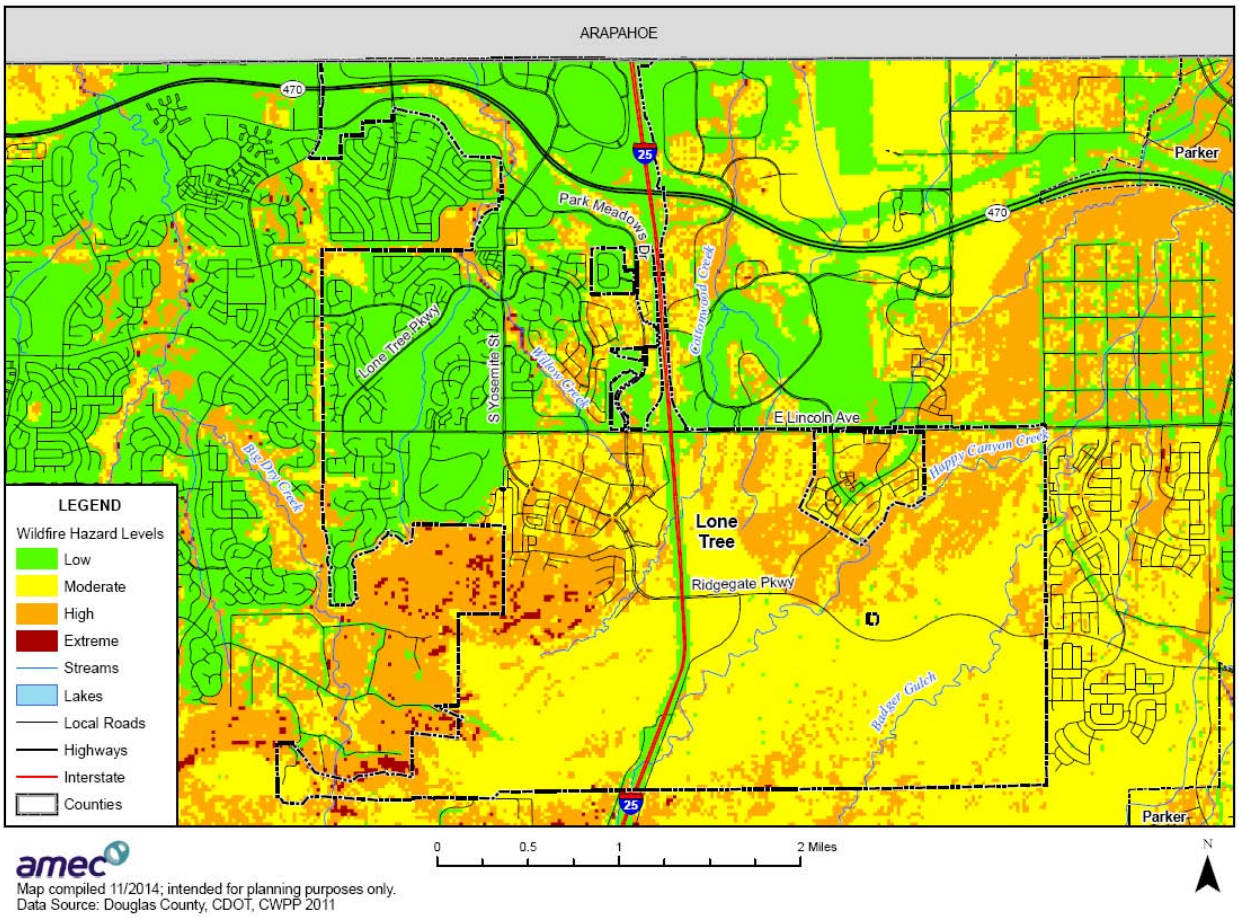
Source: Douglas County GIS

Table D.10. City of Lone Tree Total Exposure to Wildfire Summary

Wildfire Severity	Total Parcel Count	Improved Parcel Count	Total Building Count	Improved Value	Estimated Content Value	Land Value	Total Value/Loss Estimate
Extreme	10	5	45	$7,021,644	$6,059,483	$1,507,673	$14,588,800
High	765	493	1,296	$326,080,991	$208,606,021	$91,198,490	$625,885,502
Moderate	700	433	992	$578,295,376	$489,697,669	$171,272,191	$1,239,265,236
Low	3,140	2,665	3,949	$1,527,910,856	$1,049,666,162	$527,257,952	$3,104,834,970
Total	**4,615**	**3,596**	**6,282**	**$2,439,308,867**	**$1,754,029,335**	**$791,236,306**	**$4,984,574,508**

Source: Douglas County GIS

Figure D.7. Lone Tree Wildfire Hazard Potential



Population 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 hazard potential 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 size for each jurisdiction and unincorporated area, which is 2.54 in Lone Tree. Table D.11 summarizes the results of this analysis.

Table D.11. Population at Risk to Wildfire

	Extreme	High	Moderate	Low
Population	10	1,196	1,008	6,416
Improved Residential Parcels	4	471	397	2,526

Source: Douglas County GIS, 2010 U.S. Census

Critical Facilities at Risk

Wildfire analysis was performed on the critical facility inventory in Douglas County and all jurisdictions, including Lone Tree. GIS was used to determine whether the facility locations intersect a wildfire hazard area. Table D.12 summarizes the results of the GIS analysis for Lone Tree, and Figure D.8 depicts the location of critical facilities in relation to wildfire severity zones. Details of critical facility definition, type, name and address and jurisdiction by wildfire zone are listed in Appendix E.

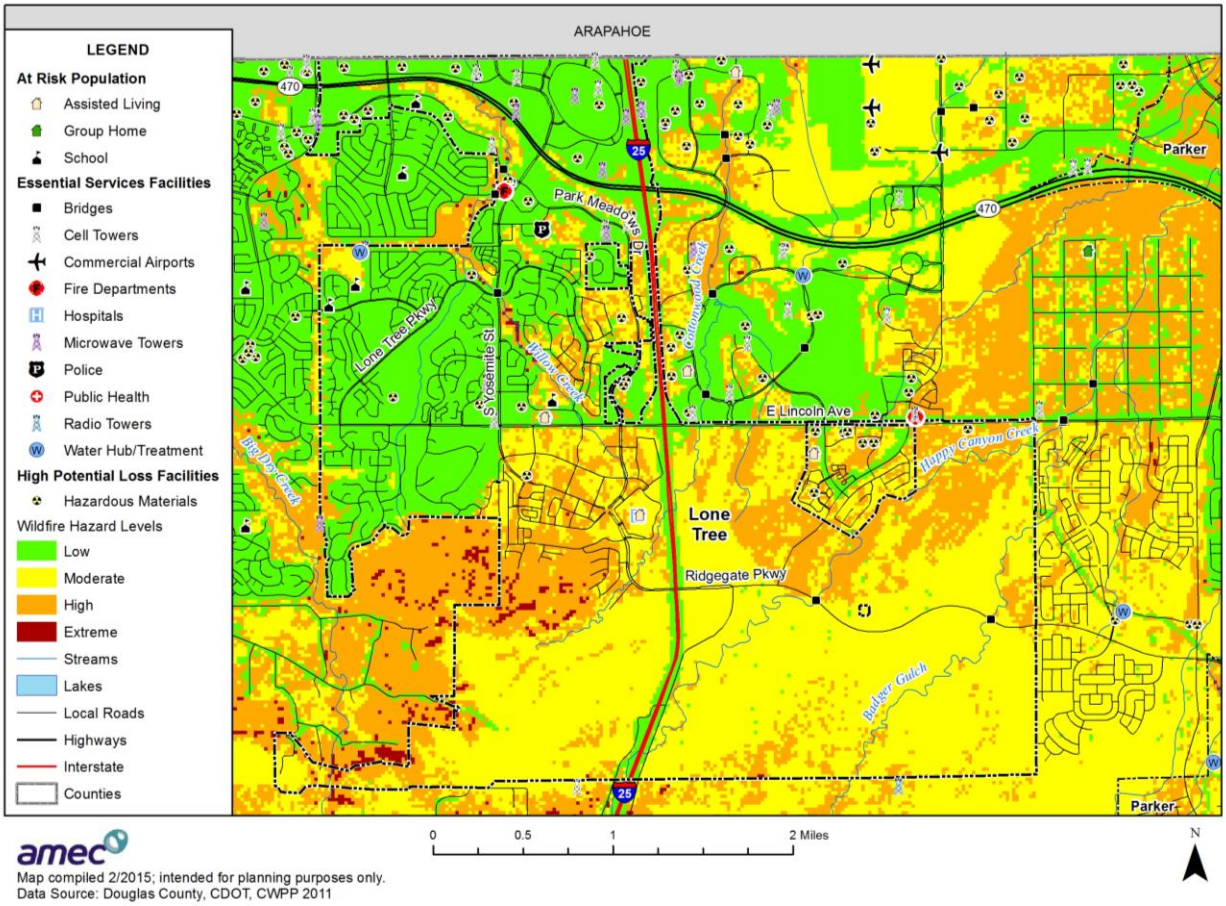
Table D.12. Lone Tree– Critical Facilities at Risk to Wildfire Detail

Fire Risk	Category	Type	Facility Count
High	At Risk Population Facilities	Assisted Living	1
	At Risk Population Facilities	School	1
	Essential Services Facilities	Bridge	2
	Essential Services Facilities	Cell Tower	1
	Essential Services Facilities	Fire Department	1
	Essential Services Facilities	Public Health	1
	Essential Services Facilities	Water Hub/Treatment	1
	High Potential Loss Facilities	Hazardous Material	5
	Total		**13**
Moderate	At Risk Population Facilities	Assisted Living	1
	Essential Services Facilities	Bridge	1
	Essential Services Facilities	Hospital	1
	High Potential Loss Facilities	Hazardous Material	3
	Total		**6**
Low	At Risk Population Facilities	School	3
	Essential Services Facilities	Bridge	1
	Essential Services Facilities	Cell Tower	8

Fire Risk	Category	Type	Facility Count
	Essential Services Facilities	Microwave	14
	Essential Services Facilities	Police	1
	High Potential Loss Facilities	Hazardous Material	17
	Total		**44**
GRAND TOTAL			**63**

Source: Douglas County GIS

Figure D.8. Lone Tree Wildfire Hazard Potential and Critical Facilities



Development Trends

The magnitude of wildfires throughout Colorado continues to grow as development increases. The City of Lone Tree has interface areas of grasslands and scrub brush along the bluffs. Embers from a grass fire in this location could potentially be carried into nearby residential areas given the right wind conditions.

An analysis of recent development in extreme, high, and moderate wildfire hazard areas was conducted for Lone Tree. A total of 57 structures was built between 2010 and 2014. The total

value of these structures is $44,880,114, with the majority located in the moderate wildfire hazard area. Results of this analysis are shown in Table D.13.

Table D.13. Lone Tree 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
High	21	21	23	$10,321,154	$5,160,577	$2,121,700	$17,603,431
Moderate	27	27	34	$14,239,466	$7,815,629	$5,221,588	$27,276,683
Total	**48**	**48**	**57**	**$24,560,620**	**$12,976,206**	**$7,343,288**	**$44,880,114**

Source: Douglas County GIS

Hazardous Materials: Transportation Incidents

Vulnerability to Hazardous Materials: Transportation Incidents

Likelihood of Future Occurrence—High
Potential Magnitude—Medium
Overall Vulnerability—Medium

Several major transportation routes cross through Lone Tree, including Interstate 25 and Highway 470. 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 at potentially at risk to hazardous materials transportation incidents in Lone Tree.

Population at Risk

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 Interstate 25 and Highway 470, 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 some overlapping of the corridors where Interstate 25 and Highway 470 meet in Lone Tree, individual population analysis was performed for each transportation corridor. Each buffered transportation corridor was intersected with improved residential parcels and therefore parcels could be counted more than once 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.

A population of 3,721 is within the proximity of Interstate 25 that passes through Lone Tree. The population within the Highway 470 buffer zone is 2,233.

Development Trends

Development in Lone Tree occurs within existing city boundaries. As development in Lone Tree continues to grow, more people will be at risk to hazardous materials transportation incidents.

D.6 Capability Assessment

Capabilities are the programs and policies currently in use to reduce hazard impacts or that could be used to implement hazard mitigation activities. This capability assessment is divided into five sections: regulatory mitigation capabilities, administrative and technical mitigation capabilities, fiscal mitigation capabilities, mitigation outreach and partnerships, and other mitigation efforts.

D.6.1 Regulatory Mitigation Capabilities

Table D.14 lists regulatory mitigation capabilities, including planning and land management tools, typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place in the City of Lone Tree.

Table D.14. City of Lone Tree Regulatory Mitigation Capabilities

Regulatory Tool (ordinances, codes, plans)	Y/N	Date	Comments
General plan	Y	4/07	City Comprehensive Plan On City website at http://www.cityoflonetree.com/index.aspx?nid=453
Zoning ordinance	Y	12/13	City Code*** - Chapter 16 (link below) (Municipal Code available at https://www.municode.com/library/co/lone_tree/codes/municipal_code
Subdivision ordinance	Y		City Code*** - Chapter 16 (link below)
Growth management ordinance	Y	4/07	City Comprehensive Plan

Regulatory Tool (ordinances, codes, plans)	Y/N	Date	Comments
Floodplain ordinance	Y	9/13	City Code*** –Chapter 15 – Art. III – Flood Damage Prevention & Art. IV – Floodplain Overlay District. NFIP and CWCB compliant ordinances.
Other special purpose ordinance (stormwater, steep slope, wildfire)	Y		Stormwater (see stormwater management program below); Others - Specific to Building Codes of the city. Link available on City Website at http://www.cityoflonetree.com/index.aspx?nid=139
Building code	Y	11/14	See City Website at http://www.cityoflonetree.com/index.aspx?nid=99
BCEGS Rating			
Fire department ISO rating	Y		Conducted by SMFD
Erosion or sediment control program	Y		Grading, Erosion & Sedimentation Control (GESC) – City Code*** - Sec.15-1-30. See City Code (Link above) and Link to GESC Standards at www.cityoflonetree.com/developmentreview
Stormwater management program	Y		City Code*** - Sec. 15-1-10
Site plan review requirements	Y		City Code*** - Chap. 16 – Sec. 27
Capital improvements plan	Y		
Economic development plan	Y		
Local emergency operations plan	Y		
Community Wildfire Protection Plans	Y		Work with SMFD and DC WMP
Flood insurance study or other engineering study for streams	Y		NFIP – DC FIRM/DFIRM Panels & FIS
Elevation certificates	Y		See Flood Plain Ordinance Standards (City Code Sec 15-3)
Other			

Source: Amec Foster Wheeler Data Collection Guide

***City Code Book available online at https://www.municode.com/library/co/lone_tree/codes/municipal_code

Comprehensive Plan (2008)

The City of Lone Tree Comprehensive Plan (Plan) represents another step in the City's on-going efforts to build and maintain a balanced, sustainable community. The Plan is a document that sets forth the policies for the future of the community and is designed to be a flexible "living" document that can be changed as the needs change for the Lone Tree community. The Comprehensive Plan is a provisional document and regular updates should occur in order to maintain the usefulness of the plan. The planning horizon for the Plan is a focus of 20 years in the future and is a resource for community leaders to use as a guide in formulating future policies for the City and guide growth and development.

Goals and policies related to mitigation of natural hazards are as follows:

Environmental Quality

Section	Objective:	Policy
Water Quality	Protect our water resources.	Control drainage and surface erosion and sedimentation problems and encourage the use of new technology to improve existing facilities.
Vegetation	Conserve and enhance the integrity of the natural and built landscape in ways compatible and complementary to our climate.	New development should be designed to conserve and enhance existing vegetation ecosystems, including woody vegetation species and grasslands (i.e., trees, ground cover, etc.) that serve to stabilize hillside areas, stream banks, eroded areas, and for wildlife habitat.
		Existing ground cover in undeveloped areas and on slopes exceeding 20% shall remain undisturbed except in cases where it is required for public improvements, surveying, fire prevention, or weed control. Existing vegetation to be retained should be carefully protected during construction.
		Grading shall be carried out in conformance with an approved grading plan intended to minimize on-site and off-site disturbance and erosion. In cases of disturbance, the City's Erosion Control Manual shall be followed.
Environmental Hazards	Ensure the safety of the community and the protection of public and private property through careful siting, appropriate monitoring, and mitigation.	Preserve the 100-year floodplain in its natural state. Where structural improvements are necessary, such as the channelization of the floodplain, provide transitions from natural areas to more urban settings. Any alteration to the floodplain will be in conformance with the City's Zoning Code, as well as any additional requirements of the Storm Drainage Criteria Manual or the U.S. Army Corps of Engineers. Structures are prohibited within the 100-year floodplain, except for those relating to flood control, wildlife, and recreation.
		Avoid development where geologic hazards exist, including but not limited to slope failure or rock fall areas, unless it can be demonstrated that methods are available to minimize potential hazards.
		Development should be designed for site-specific conditions so as to minimize the potential for slope instability. The following must be considered in the planning process: • Slope and geologic stability • Disruption of existing surface conditions • Historic and future drainage in relation to specific surface materials • Increased pedestrian or other traffic that may impact surface conditions • Erosion control, revegetation and reclamation of sensitive areas
		All proposed development on slopes of 12% to 20% must be sensitive to slope stability, visual impact, erosion, drainage, and infrastructure requirements.
		Development on slopes greater than 20% should be avoided.
		The City should closely monitor activities which may pose a risk to the community, such as the transport of hazardous waste along I-25 through the City's Municipal Influence Area. The City shall work with appropriate agencies to ensure that

Section	Objective:	Policy
		maximum precautions are taken to protect the health of the community.
		Implement land use and other measures to address the potential for wildfire along the City's southern boundary (urban wildland interface areas).

Community Facilities and Services

Section	Objective:	Policy
Fire Protection	Provide for fire protection and prevention for the Lone Tree community.	Actively solicit the input of the appropriate Fire District in review of all new development proposals.
Water Supply and Wastewater Treatment	Ensure safe and adequate water supply and wastewater treatment services.	The City supports amendments to district or regional plans when required to provide or expand capacity to accommodate the City's growth projections or where public health is threatened.
Stormwater Management	Ensure stormwater facilities are properly designed and maintained consistent with the City's land use and environmental quality goals and objectives.	Continue to coordinate and/or oversee drainage planning, design, construction and maintenance for the City and surrounding area in conjunction with the Urban Drainage and Flood Control District and Douglas County.
		Ensure all drainage improvements are constructed and designed in a manner complementary to the natural and built environment. Where structural improvements are necessary, such as the channelization of the floodplain, provide transitions from natural areas to more urban settings.
		Prohibit development within the defined 100-year floodplain except for those relating to flood control, wildlife and recreation. Proposed development shall comply with the City's Zoning Code, as well as any additional requirements of the Storm Drainage Criteria Manual or the U.S. Army Corps of Engineers.

Storm Drainage Design and Technical Criteria Manual

The Stormwater Drainage Design and Technical Criteria Manual was adopted in 2012 under Ordinance No. 12-09. The manual presents the policies and minimum technical criteria for the planning, analysis and design of storm drainage systems within City boundaries. The manual was developed in cooperation with Douglas County and Urban Drainage to improve consistency between neighboring jurisdictions.

City of Lone Tree Emergency Operations Plan

The City of Lone Tree Emergency Operations Plan (EOP) was adopted by Resolution No. 12-07. The EOP establishes the City's procedures for responding to emergency events, lines of succession, continuity of government, delegation of authority, concept of operations, roles and responsibilities, and command structure. The EOP includes several annexes for specific topics, such as communications, public warning and information, sheltering and mass care, etc. Several

of the annexes are based on the Emergency Support Functions (ESF) format established in the National Response Framework. The EOP also includes several hazard-specific appendices for both natural and human-caused hazards.

Snow Management, Snow Plowing, and De-icing Procedures

Lone Tree's Public Works Operations Department is responsible for snow removal within the City. Once three to four inches of snow has accumulated, the Operations Department first plows major roadways (primary routes), then main connectors that link subdivisions and collectors that distribute traffic (secondary routes), and lastly local roads and cul-de-sacs (tertiary routes). De-icing products and abrasive materials may be applied to roads to provide traction. Additional details on the City's snow removal and de-icing procedures are available here: https://www.cityoflonetree.com/index.aspx?NID=308.

Appendix IV of the City's EOP details Lone Tree's procedures and decision-making criteria for snow management and removal based on the severity of a given winter storm. Appendix IV establishes roles and responsibilities for Lone Tree personnel. The responsibilities of external agencies, such as CDOT and South Metro Fire Rescue Authority, are also discussed.

Ordinances

The City of Lone Tree has many ordinances related to mitigation in its Municipal Code. Key pieces of the most relevant codes are excerpted below:

Public Works Section (Chapter 15)

Sec. 15-1-10. - Adoption by reference: Storm Drainage Design and Technical Criteria Manual.

The Douglas County Storm Drainage Design and Technical Criteria Manual, as amended, revised and updated from time to time, is hereby adopted by reference and incorporated into this Article as though fully set forth herein as the City of Lone Tree Storm Drainage Design and Technical Criteria Manual. Except as otherwise provided, this code is adopted in full.

Sec. 15-1-30. - Adoption by reference: Grading, Erosion and Sediment Control Manual.

(a) The Douglas County Grading, Erosion and Sediment Control Manual, as amended, revised and updated from time to time, is hereby adopted by reference and incorporated into this Article as though fully set forth herein as the City of Lone Tree Grading, Erosion and Sediment Control (GESC) Manual. Except as otherwise provided, this code is adopted in full.

ARTICLE III - Flood Damage Prevention

Division 1 - General Provisions

Sec. 15-3-10. - Statement of purpose.

It is the purpose of this Article to promote the public health, safety and general welfare and to minimize public and private losses due to flood conditions in specific areas by provisions designed to:

(1) Protect human life and health;

(2) Minimize expenditure of public money for costly flood control projects;

(3) Minimize the need for rescue and relief efforts associated with flooding and generally undertaken at the expense of the general public;

(4) Minimize prolonged business interruption;

(5) Minimize damage to critical facilities, infrastructure and other public facilities and utilities such as water and gas mains, electric, telephone and sewer lines, streets and bridges located in floodplains;

(6) Help maintain a stable tax base by providing for the sound use and development of flood-prone areas in such a manner as to minimize future flood-blight areas;

(7) Ensure that potential buyers are notified that property is in a flood area and

(8) Meet the minimum requirements as set forth by the Colorado Water Conservation Board and the National Flood Insurance Program.

Sec. 15-3-20. - Methods of reducing flood losses.

In order to accomplish its purposes, this Article uses the following methods:

(1) Restricting or prohibiting uses that are dangerous to health, safety or property in times of flood, or cause excessive increases in flood heights or velocities;

(2) Requiring that uses vulnerable to floods, including facilities which serve such uses, be protected against flood damage at the time of initial construction;

(3) Controlling the alteration of natural floodplains, stream channels and natural protective barriers which are involved in the accommodation of floodwaters;

(4) Controlling filling, grading, dredging and other development which may increase flood damage; and

(5) Preventing or regulating the construction of flood barriers which will unnaturally divert floodwaters or which may increase flood hazards to other lands.

Sec. 15-3-130. - Designation of Floodplain Administrator.

The Director of Public Works is hereby appointed the Floodplain Administrator to administer and implement the provisions of this Article and other appropriate sections of 44 C.F.R. (National Flood Insurance Program regulations) pertaining to floodplain management. The Director of Public Works may appoint a designated representative to perform the Floodplain Administrator duties.

Division 2 - Flood Hazard Reduction

Sec. 15-3-210. - General standards.

In all special flood hazard areas, the following provisions are required for all new construction and substantial improvements:

(1) All new construction or substantial improvements shall be designed (or modified) and adequately anchored to prevent flotation, collapse or lateral movement of the structure resulting from hydrodynamic and hydrostatic loads, including the effects of buoyancy.

(2) All new construction or substantial improvements shall be constructed by methods and practices that minimize flood damage.

(3) All new construction or substantial improvements shall be constructed with materials resistant to flood damage.

(4) All new construction or substantial improvements shall be constructed with electrical, heating, ventilation, plumbing and air-conditioning equipment and other service facilities that are designed and/or located so as to prevent water from entering or accumulating within the components during conditions of flooding.

(5) All manufactured homes shall be installed using methods and practices which minimize flood damage. For purposes of this requirement, manufactured homes must be elevated and anchored to resist flotation, collapse or lateral movement. Methods of anchoring may include, but are not limited to, use of over-the-top or frame ties to ground anchors. This requirement is in addition to applicable state and local requirements for resisting wind forces.

(6) All new and replacement water supply systems shall be designed to minimize or eliminate infiltration of floodwaters into the system.

(7) New and replacement sanitary sewage systems shall be designed to minimize or eliminate infiltration of floodwaters into the system and discharge from the systems into floodwaters.

(8) On-site waste disposal systems shall be located to avoid impairment to them or contamination from them during flooding.

(9) For waterways with base flood elevations for which a regulatory floodway has not been designated, the Floodplain Administrator must require that no new construction, substantial improvements or other development (including fill) shall be permitted within Zones A1-30 and AE on the City's FIRM, unless it is demonstrated that the cumulative effect of the proposed development, when combined with all other existing and anticipated development, will not increase the water surface elevation of the base flood more than one-half (½) foot at any point within the City.

(10) Under the provisions of 44 C.F.R. Chapter 1, Section 65.12, of the National Flood Insurance Program regulations, the City may approve certain development in Zones A1-30, AE or AH on the City's FIRM which increases the water surface elevation of the base flood by more than one-half (½) foot, provided that the City first applies for a conditional FIRM revision through FEMA (Conditional Letter of Map Revision), fulfills the requirements for such revisions as established under the provisions of 44 C.F.R. Chapter 1, Section 65.12, and received FEMA approval.

ARTICLE IV - Floodplain - Overlay District

Sec. 15-4-30. - Nature of district.

The Floodplain Overlay District shall be applied as a supplemental regulation on existing zoned areas containing flood hazard areas, including Planned Developments (PDs). The Floodplain Overlay District is superimposed on the existing zoning, and the restrictions and requirements herein are in addition to those of the underlying zone. All land use review processes that apply to the underlying zoning district shall remain in full force and effect. In the case of overlapping or conflicting requirements, the most restrictive provision shall apply.

Sec. 15-4-40. - Concurrent floodplain regulation.

Article III of this Chapter provides additional regulations regarding development within or adjacent to floodplains. In the event of a conflict between this Article and Article III of this Chapter, the more restrictive requirement shall apply.

Sec. 15-4-60. - Uses prohibited.

The following uses are strictly prohibited within the Floodplain Overlay District:

(1) 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);

(2) Junk or salvage yards, solid waste disposal facilities or landfills;

(3) Storage or processing of materials that are buoyant, flammable, explosive, potentially dangerous or capable of causing injury in the time of flooding; and

(4) Critical facilities, except as allowed by a floodplain development permit, and in conformance with Article III of this Chapter, and provided that the critical facility is permitted in the underlying zoning district and to the extent that the critical facility does not impair the flood carrying capacity of the channel in compliance with the intent of this Article.

D.6.2 Administrative/Technical Mitigation Capabilities

Table D.15 identifies the City department(s) responsible for activities related to mitigation and loss prevention in Lone Tree.

Table D.15. City of Lone Tree Administrative and Technical Mitigation Capabilities

Personnel Resources	Yes/No	Department/Position	Comments
Planner/Engineer with knowledge of land development/land management practices	Y	Kelly First/ Community Development Director Greg Weeks / Public Works -City Engineer	
Engineer/Professional trained in construction practices related to buildings and/or infrastructure	Y	Building Department	
Planner/Engineer/Scientist with an understanding of natural hazards	Y	Public Works / Engineering	
Personnel skilled in GIS	Y	Public Works / GIS Coordinator	
Full time building official	Y	Matt Archer/ Building Official	
Floodplain Manager	Y	Greg Weeks / Public Works – City Engineer	
Emergency Manager		In process for formal identification	
Grant writer	Y	Police Department	
Other personnel	Y	Public Works Department Staff	
GIS Data – Hazard areas	Y	Public Works / GIS Coordinator	
GIS Data - Critical facilities	Y	Building Dept. – with Public Works / GIS Coordinator	
GIS Data – Building footprints	Y	Building Dept. – with Public Works / GIS Coordinator	
GIS Data – Land use	Y	Public Works / GIS Coordinator	
GIS Data – Links to Assessor's data	Y	Public Works / GIS Coordinator	

Personnel Resources	Yes/No	Department/Position	Comments
Warning Systems/Services (Reverse 9-11, cable override, outdoor warning signals)	Y	Police Department	
Other			

Source: Amec Foster Wheeler Data Collection Guide

D.6.3 Fiscal Mitigation Capabilities

Table D.16 identifies financial tools or resources that the City could potentially use to help fund mitigation activities.

Table D.16. City of Lone Tree Fiscal Mitigation Capabilities

Financial Resources	Accessible/Eligible to Use (Y/N)	Comments
Community Development Block Grants	Y	
Capital improvements project funding	Y	
Authority to levy taxes for specific purposes	Y (with Citizen Approval)	
Fees for water, sewer, gas, or electric services	Y	
Impact fees for new development	Y	Typically NO, but in some cases YES - Identified with new development
Incur debt through general obligation bonds	Y	With citizen approval
Incur debt through special tax bonds	Y	With citizen approval
Incur debt through private activities		
Withhold spending in hazard prone areas		
Other		

Source: Amec Foster Wheeler Data Collection Guide

D.6.4 Mitigation Outreach and Partnerships

Lone Tree participates in environmental education and recommends citizens to attend preparedness training within the County. For example, Lone Tree posts on the City Website notices for public education, such as the May 2, 2015 Wildfire Mitigation and Preparation Workshop being hosted by Douglas County.

Lone Tree partners with organizations involved in mitigation and preparedness on a case by case basis. The City's preparedness and mitigation partners include:

- South Metro Fire Rescue Authority (SMFRA)
- Douglas County Emergency Management

D.7 Mitigation Strategy

This section describes the mitigation strategy process and mitigation action plan for the City of Lone Tree's inclusion with the Douglas County Local Hazard Mitigation Plan update.

D.7.1 Mitigation Goals and Objectives

The City of Lone Tree adopts the hazard mitigation goals and objectives developed by the HMPC and described in Chapter 5 Mitigation Strategy of the base plan.

D.7.2 Continued Compliance with the NFIP

As a participant of the National Flood Insurance Program (NFIP), the City of Lone Tree administers floodplain management regulations that meet the minimum requirements of the NFIP. The City has adopted, and enforced, NFIP and CWCB compliant Floodplain Damage Prevention and associated Flood Plain Overlay District Ordinances. The City is not currently entered into the CRS program. The management program objective is to protect people and property within the City. The City of Lone Tree will continue to comply with the requirements of the NFIP in the future.

The City's regulatory activities apply to existing and new development areas of the City; implementing flood protection measures for existing structures and maintaining drainage systems. The goal of the program is to enhance public safety, and reduce impacts and losses while protecting the environment.

The City participates and cooperates with Urban Drainage and Flood Control District (UDFCD) with respect to UDFCD's mailing of its annual Flood Risk Brochure to all properties within the City which abut the identified 1% annual chance flood plain limits within the City.

D.7.3 Mitigation Actions

The planning team for the City of Lone Tree identified and prioritized the following mitigation actions based on the risk assessment and in accordance with the process outline in Section 5, Mitigation Strategy, of the base plan. Background information and information on how each action will be implemented and administered, such as ideas for implementation, responsible office, potential funding, estimated cost, and timeline are also included. General processes and information on plan implementation and maintenance of this LHMP by all participating jurisdictions is included in Section 7, Plan Implementation and Maintenance, of the base plan.

City of Lone Tree Action #1

Action Title:	**Drought mitigation**
Priority:	Medium
Project Description, Issue & Background:	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.
Ideas for Implementation:	The City will continue to implement the above development management techniques to minimize future water supply demands, and to reduce demand when necessary during drought conditions.
Other Alternatives:	No action
Responsible Agency:	Lone Tree Community Development
Partners:	Southgate Water District/Denver Water & Parker Water & Sanitation District.
Potential Funding:	
Cost Estimate:	Staff time
Benefits: (Losses Avoided)	Reduced water demand during water supply restrictions.
Timeline:	Ongoing
Status:	New in 2015

City of Lone Tree Action #2

Action Title:	**Hazardous materials mitigation**
Priority:	Medium
Project Description, Issue & Background:	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 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 side are performing their duties as expected. Therefore it is recommended that cross training between both groups of first responders be implemented.
Ideas for Implementation:	Work in conjunction with South Metro Fire Rescue Authority (SMFRA), Douglas County Sheriff's Office (DCSO), and local law enforcement to design cross awareness training and plan utilization.
Other Alternatives:	No action
Responsible Agency:	Lone Tree/Parker (Emergency Preparedness Coordinator)
Partners:	Douglas County, Lone Tree, Parker, Castle Rock and SMFRA
Potential Funding:	
Cost Estimate:	Manpower/Instructor salary and course design / implementation.
Benefits: (Losses Avoided)	Ensuring that first responders are able to quickly identify a hazardous material incident and properly respond to the incident to mitigate injury to the public and communities.
Timeline:	Completed by end of 2015
Status:	New in 2015

City of Lone Tree Action #3

Action Title:	**Continue to implement zoning and development regulations and grading/drainage plan reviews to mitigate flooding caused by thunderstorms/heavy rain**
Priority:	Medium
Project Description, Issue & Background:	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.
Ideas for Implementation:	The City will continue to implement the above development management techniques to minimize potential for surface flooding/drainage problems. If/when heavy rain induced incidents should occur, we will work with the impacted development(s) to evaluate potential ways to reduce or eliminate future potential.
Other Alternatives:	No action
Responsible Agency:	Lone Tree Public Works / Engineering
Partners:	Lone Tree Community Development (Building & Planning Departments).
Potential Funding:	Ongoing Public Works budgets – special funding if specific project need is identified.
Cost Estimate:	Staff time and physical improvements (if any) which may be recommended
Benefits: (Losses Avoided)	Elimination of future localized flooding damages – if any other than temporary inconveniences such as localized standing water in streets.
Timeline:	Ongoing
Status:	New in 2015

City of Lone Tree Action #4

Action Title:	**Continue to implement existing planning mechanisms related to severe winter weather mitigation**
Priority:	Medium
Project Description, Issue & Background:	The City of Lone Tree has 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.
Ideas for Implementation:	The City will continue to implement the above noted winter storm event management plans. Incidents and response results will be reviewed, and response plans will be updated as necessary.
Other Alternatives:	No action
Responsible Agency:	Lone Tree Police Department & Public Works
Partners:	Douglas County / CDOT
Potential Funding:	Annual budget item
Cost Estimate:	Annual winter snow/ice management budget is in the range of $830,000.
Benefits: (Losses Avoided)	Maintenance of City street access for residents, businesses and emergency services during winter storm events.
Timeline:	Ongoing
Status:	New in 2015

City of Lone Tree Action #5

Action Title:	**Wildfire prevention and preparation**
Priority:	Medium
Project Description, Issue & Background:	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.
Ideas for Implementation:	There will be ongoing discussion with emergency managers within the County, City, and fire authority to ensure changes over time are adapted too.
Other Alternatives:	No action
Responsible Agency:	South Metro Fire Rescue Authority
Partners:	Douglas County, Lone Tree, Parker, Castle Rock
Potential Funding:	
Cost Estimate:	Low cost due to the use of previously designed plans and available communication tools. However, there is a cost associated with providing information to the community through PSAs, brochures and printing of plan documents for affected areas.
Benefits: (Losses Avoided)	Ensuring that citizens are aware of the potential for wildfires and the need for them to work to mitigate damages caused from wildfires; to take evasive action should there be a fire and to take action to prevent the events in the first place.
Timeline:	Ongoing discussions and meetings with Emergency Managers Coordination Group (EMCG)
Status:	New in 2015

Annex E TOWN OF PARKER

E.1 Introduction

This annex details the hazard mitigation planning elements specific to the Town of Parker, a participating jurisdiction to the Douglas County LHMP Update. This annex is not intended to be a standalone document, but appends to and supplements the information contained in the base plan document. As such, all sections of the base plan, including the planning process and other procedural requirements apply to and were met by the Town. This annex provides additional information specific to the Town of Parker, with a focus on providing additional details on the risk assessment and mitigation strategy for this community.

E.2 Planning Process

As described above, the Town of Parker followed the planning process detailed in Section 3.0 of the base plan. In addition to providing representation on the Douglas County Hazard Mitigation Planning Committee (HMPC), the Town formulated their own internal planning team to support the broader planning process requirements. Internal planning participants included staff from the following Town departments:

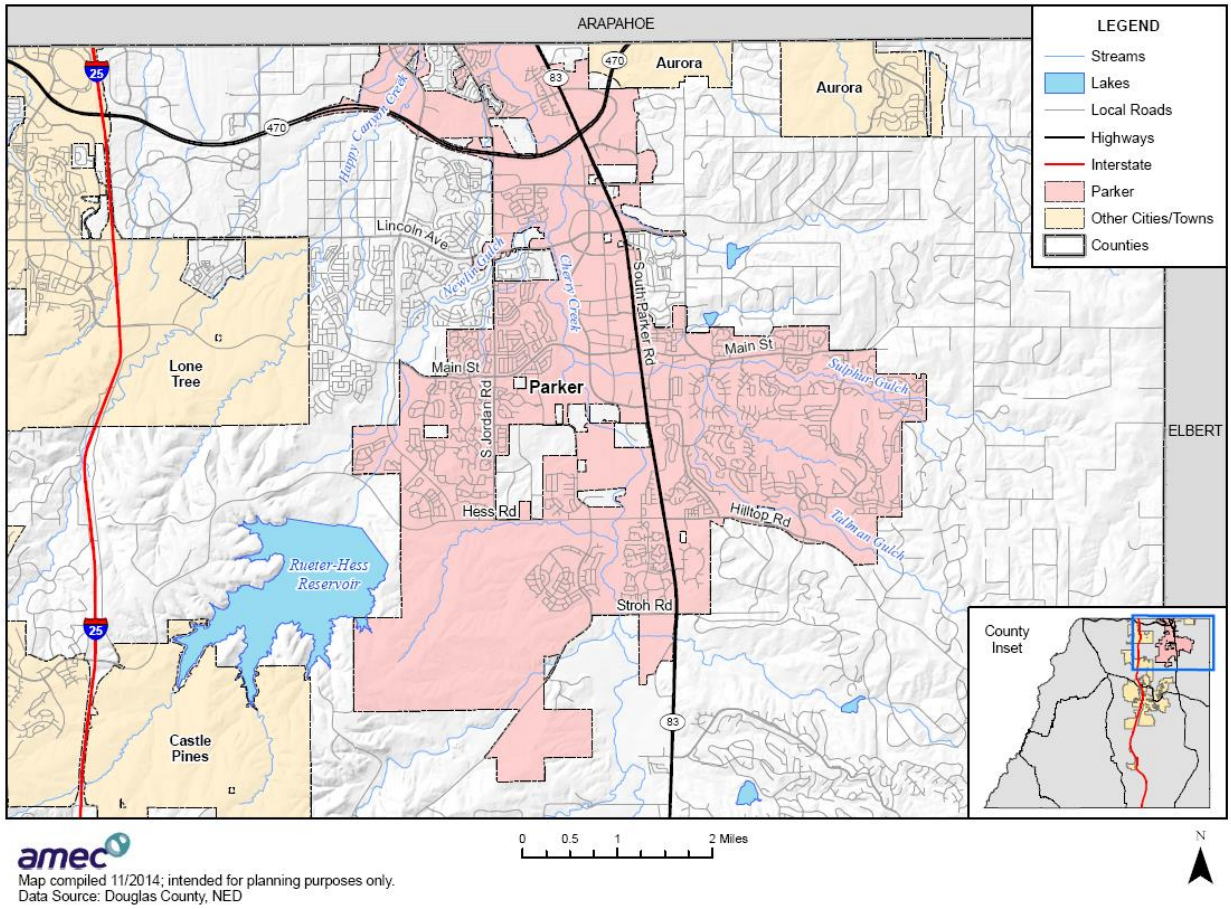
- Merlin Klotz, Parker Water and Sanitation District

Additional details on plan participation and Town representatives are included in Appendix A.

E.3 Community Profile

The community profile for the Town of Parker is detailed in the following sections. Figure E.1 displays a map and the location of the Town of Parker within Douglas County.

Figure E.1. Town of Parker Base Map



E.3.1 Geography and Location

Parker's boundary is located on the east side of Interstate 25. Highway 470 and South Parker Road come to a junction in the northern part of the Town. The 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 desirous to new residents. The lands surrounding Parker include Lone Tree, Castle Pines and open space to the west; Foxfield and Aurora to the north; unincorporated residential areas to the east; and The Pinery and Castle Rock to the south.

E.3.2 History

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 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 46,000 currently.

The Town of Parker was incorporated in May of 1981. The Town of Parker offers a variety of services to their citizens ranging from police protection to recreation. They have 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.[1]

E.3.3 Economy

As the population of the Town has grown, so has its economy. Select economic characteristics and statistics for Parker are shown in Table E.1. These statistics were pulled from the 2008-2013 American Community Survey and the 2000 U.S. Census to demonstrate how certain economic factors in Parker have changed over time.

Table E.1. Economic Characteristics for the Town of Parker

Characteristic	2000	2013
Families below Poverty Level	1.7%	3.2%
Individuals below Poverty Level	2.3%	4.2%
Median Home Value	194,600	284,200
Median Household Income	74,116	96,772
Per Capita Income	27,479	35,973
Population in Labor Force*	13,399	26,047

Source: 2008-2013 US Census Bureau American Community Survey 5-year Estimates, 2000 U.S. Census

E.3.4 Population

The 2013 population estimate for the Town (the most recent available) indicates there are 46,390 residents of Parker. The population was estimated at 45,297 for the 2010 U.S. Census.

[1] History, Town of Parker website. http://www.parkeronline.org/167/History, accessed March 26, 2015.

E.4 Hazard Identification and Summary

This section details how the risk varies across the Douglas County planning area. The Town's planning team identified the hazards that affect the Town and summarized their frequency of occurrence, spatial extent, potential magnitude, and significance specific to Parker (see Table E.2). In the context of the plan's planning area, there are no hazards that are unique to Parker.

Information on past occurrences and the likelihood of future occurrences is detailed in Section 4, Risk Assessment, of the base plan. Additional information for high and medium significant hazards for the Town is included in the Vulnerability Assessment section of this Annex.

Table E.2. Town of Parker Hazard ID Table

Hazard	Spatial Extent	Likelihood of Future Occurrences	Magnitude /Severity	Significance
Avalanche	None	None	None	None
Drought	Extensive	Low/Med	Med	Med
Earthquake	Significant	Low	Low	Low
Flood: Dam Failure	Significant	Low	Med	Med
Flood: 100/500 year	Limited	Med	Low/High*	Low/High*
Flood: Localized/ Stormwater	Significant	Med	Low	Low
Landslides/ Mud & Debris Flows /Rockfalls	Limited	Low	Low	Low
Severe Weather: Extreme Heat	Extensive	High	Low	Low
Severe Weather: Hail	Significant	High	Med	Med
Severe Weather: High Winds	Extensive	High	Low	Low
Severe Weather: Lightning	Significant	High	Low	Low
Severe Weather: Thunderstorms/Heavy Rains	Extensive	High	Low	Low
Severe Weather: Tornado	Limited	Low	Low	Med
Severe Weather: Winter Weather (includes snow/ice/extreme cold)	Extensive	High	Med	Low
Soil Hazards: Erosion & Deposition	Limited	Med	Low	Low
Soil Hazards: Expansive Soils	Limited	Med	Low	Low
Soil Hazards: Subsidence	Limited	Low	Low	Low
Wildfire	Limited	Med	Low	Low
Hazardous Materials: Transportation Incidents	Limited	Low	Med	Med

Spatial Extent
Limited: Less than 10% of planning area
Significant: 10-50% of planning area
Extensive: 50-100% of planning area

Likelihood of Future Occurrences
Low: Occurs less than once every 10 years or more
Medium: Occurs less than once every 5 to 10 years
High: Occurs once every year or up to once every five years

Magnitude/Severity
Low: Negligible property damages (less than 5% of all buildings and infrastructure) Negligible loss of quality of life. Local emergency response capability is sufficient to manage the hazard.
Medium: Moderate property damages (15% to 50% of all buildings and infrastructure) Some loss of quality of life. Emergency response capability, economic and geographic effects of the hazard are of sufficient magnitude to involve one or more counties.
High: Property damages to greater than 50% of all buildings and infrastructure. Significant loss of quality of life Emergency response capability, economic and geographic effects of the hazard are of sufficient magnitude to require federal assistance.

Significance
Low: minimal potential impact
Medium: moderate potential impact
High: widespread potential impact

*Low for 100-year, High for 500-year

E.5 Vulnerability Assessment

The intent of this section is to assess Parker's vulnerability separate from that of the planning area as a whole, which has already been assessed in Section 4.3 Vulnerability Assessment of the base plan. This vulnerability assessment provides an inventory of the population, property, and other assets located within the Town and further analyzes those assets at risk to identified hazards ranked of medium or high significance (as listed in Table E.2) to the community. For more information about how hazards affect the County as a whole, see Chapter 4 Risk Assessment in the main plan.

E.5.1 Total Assets at Risk

This section identifies Parker's total assets at risk, including values at risk, critical facilities and infrastructure, natural resources, and historic and cultural resources. Growth and development trends are also presented for the community. This data is not hazard specific, but is representative of total assets at risk within a community.

Values at Risk

The following data from the Douglas County Assessor's Office is based on joining assessor data to the 2014 parcel layer in GIS. This data should only be used as an indicator of overall values in the County, as the information has some limitations. Table E.3 summarizes the parcels, improved parcels, structures, improved value, land value, and total value exposed in Parker. It is 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.

Table E.3. Town of Parker Total Exposure

Property Type	Total Parcel Count	Improved Parcel Count	Total Structures	Improved Value	Total Land Value	Total Value
Agricultural	29	2	4	$90,127	$177,756	$267,883
Commercial	454	378	1,974	$765,090,166	$251,841,351	$1,016,931,517
Exempt	1,378	85	148	$260,629,379	$121,143,270	$381,772,649
HOA	705	0	40	$0	$0	$0
Industrial	24	24	66	$17,404,526	$5,948,290	$23,352,816
Producing Mine	1	0	0	$0	$58,292	$58,292
Residential	14,439	14,171	15,145	$3,008,303,994	$874,107,959	$3,882,411,953
Utilities	18	0	4	$0	$0	$0
Vacant Land	1,401	2	1,129	$117,696	$79,698,287	$79,815,983
Total	**18,449**	**14,662**	**18,510**	**$4,051,635,888**	**$1,332,975,205**	**$5,384,611,093**

Source: Douglas County Assessor's Data

Critical Facilities and Infrastructure

For purposes of this plan, a critical facility is defined as:

> Any facility, including without limitation, a structure, infrastructure[2], 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.

This definition was refined by separating out three categories of critical facilities as further described in Section 4.3.1 of the base plan. These categories include At-Risk Populations, Essential Services, and High Potential Loss Facilities.

An inventory of critical facilities in the Town of Parker from Douglas County GIS is provided in Table E.4. Details of critical facility definition, type, name and address and jurisdiction by hazard zone are listed in Appendix E.

Table E.4. Town of Parker Critical Facilities: Summary Table

Category	Type	Facility Count
At Risk Population Facilities	Assisted Living	1
	Group Home	2
	School	17
Essential Services Facilities	Cell Tower	16
	EOC	1
	Fire Department	2
	Hospital	1
	Microwave	9
	Police	1
	Water Hub/Treatment	31
High Potential Loss Facilities	Hazardous Material	174
TOTAL		**255**

Source: Douglas County GIS

Natural Resources

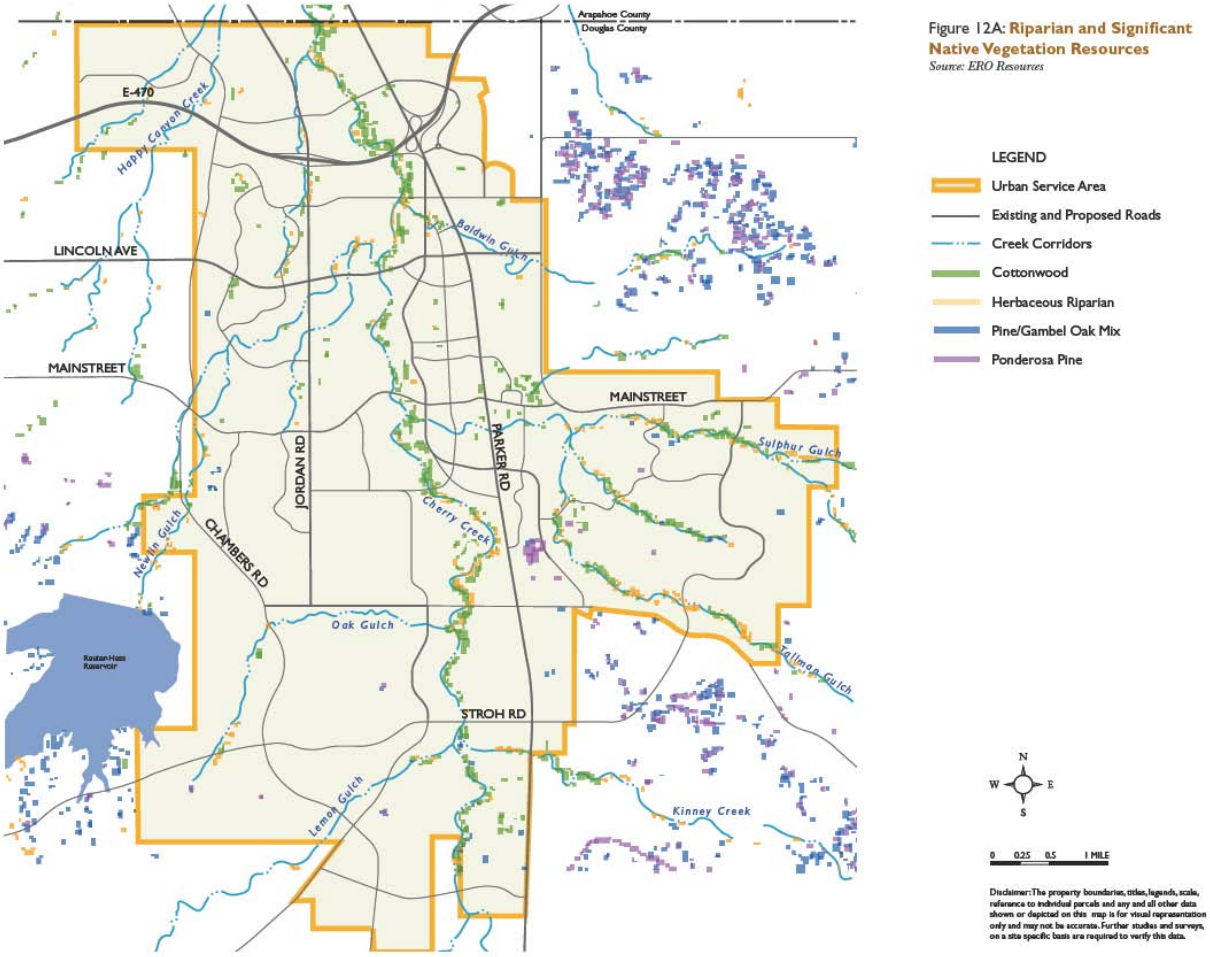
The Town of Parker and the areas surrounding it include a rich and diverse range of biological resources.

[2] Essential Service Facilities include bridges, roads, power grids, and infrastructure held by private companies (i.e. utility lines and private levees) that are not mapped for security reasons and are not under the control of the County.

Vegetation

The Parker Master Plan identifies riparian and vegetative resources within city boundaries and in the surrounding area. "In addition to…riparian features, the area just north of Hess Road and east of Parker Road is the site of an enclave of the Black Forest, a ponderosa pine community that is indigenous to the lower elevations of the Rocky Mountain Range. Additionally, stands of large Cottonwoods accentuate and frame the riparian corridors throughout the community. [Figure E.2] depicts these significant natural vegetative resources within our community" (pg. 12.2).

Figure E.2. Riparian and Vegetative Resources



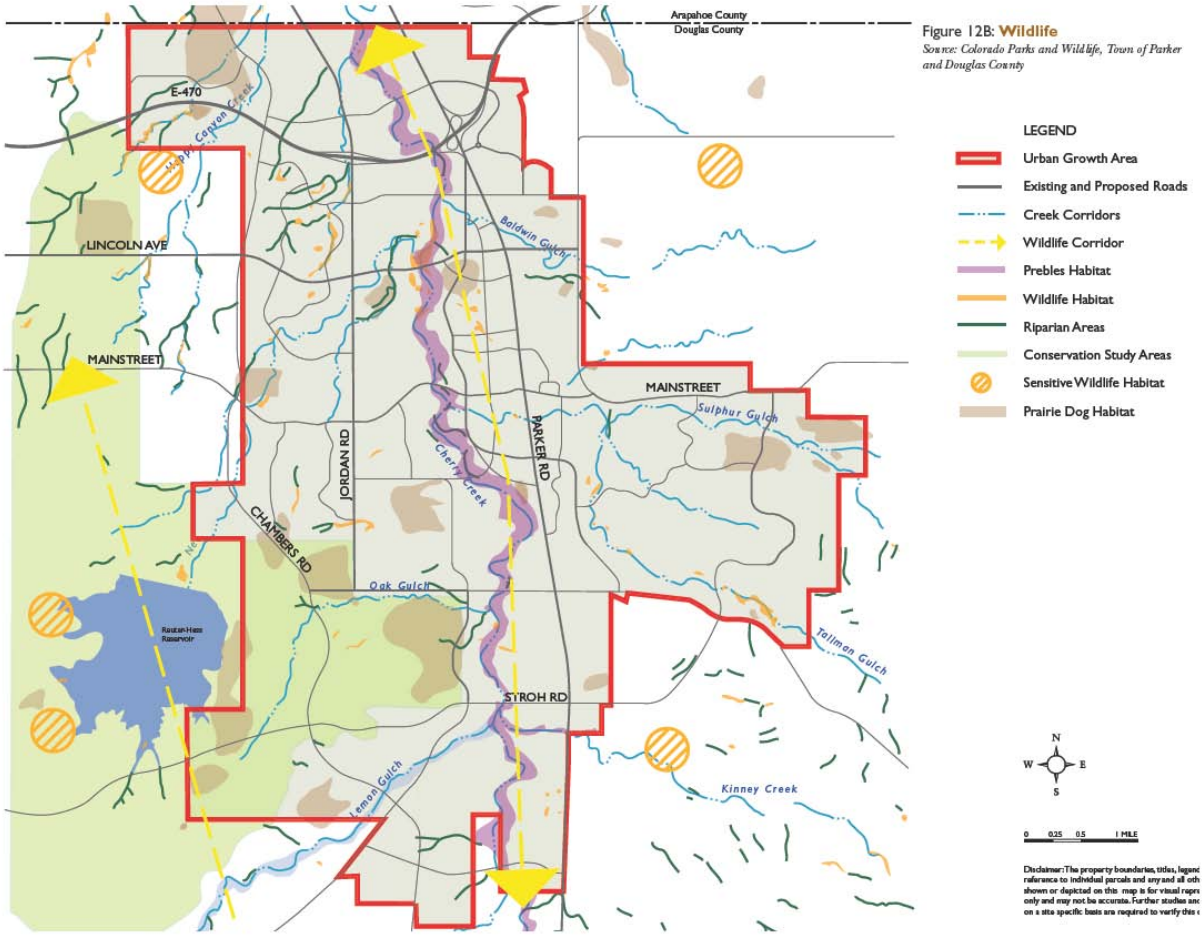
Source: 2014 Town of Parker Master Plan

Wildlife Habitat

According to the Parker Master Plan, "[v]egetation provides prime habitat for wildlife, while riparian corridors, such as Cherry Creek, also function as movement corridors. [Figure E.3] maps the primary wildlife habitat found in our community. The wildlife-movement corridors

and habitat areas, depicted on this map, will assist the Town in making land use decisions and will be updated as conditions warrant. It should be noted that delineation of movement corridors or wildlife value areas does not preclude development, as mitigation measures may be possible and appropriate in designated areas" (pg. 12.2).

Figure E.3. Wildlife Habitat and Movement Corridors



Source: 2014 Town of Parker Master Plan

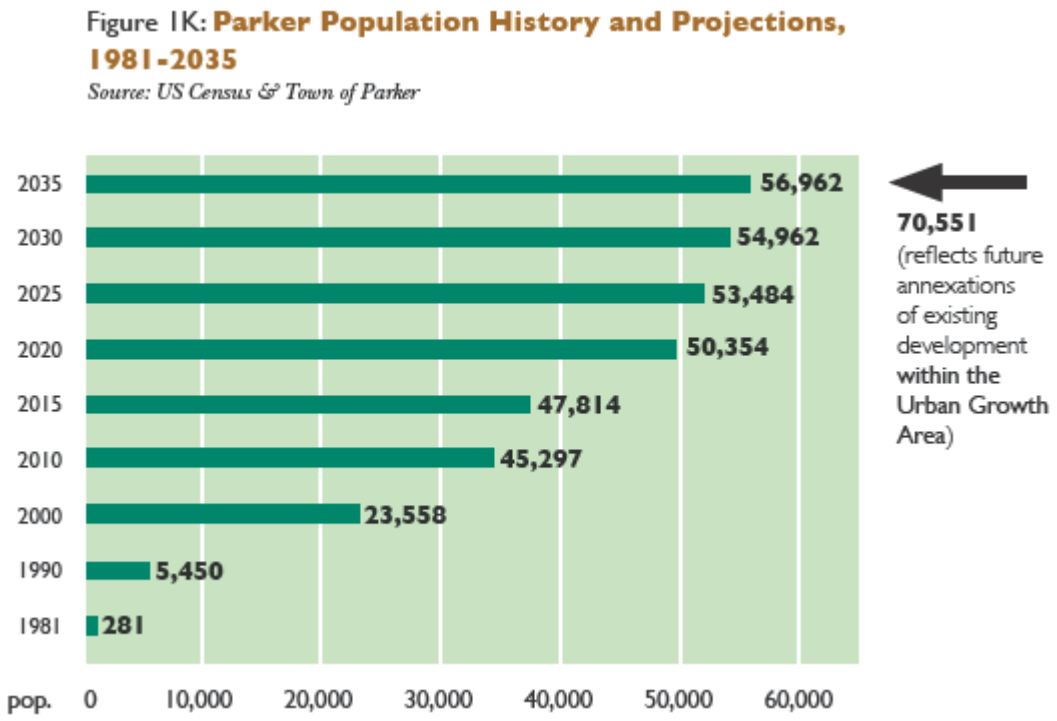
Historic and Cultural Resources

To inventory these resources, the HMPC collected information from both the National Register of Historic Places (NRHP) and the Colorado State Register. Each program has different eligibility criteria and procedural requirements. These requirements are detailed in Section 4.3.1 of the base plan. Parker has one resource listed in the NRHP: Ruth Memorial Methodist Episcopal Church.

Growth and Development Trends

Parker experienced unprecedented growth over the past few decades. Figure E.4 summarizes the Town's population growth beginning in 1981 and population projections through 2035. From 1981 to 2013 Parker's population grew by 16,409%, which averages to roughly 513% annually. Naturally, the Town experienced a building boom as well to accommodate the population. Parker's population is expected to continue increasing over the next 20 years, but at a much slower rate of growth.

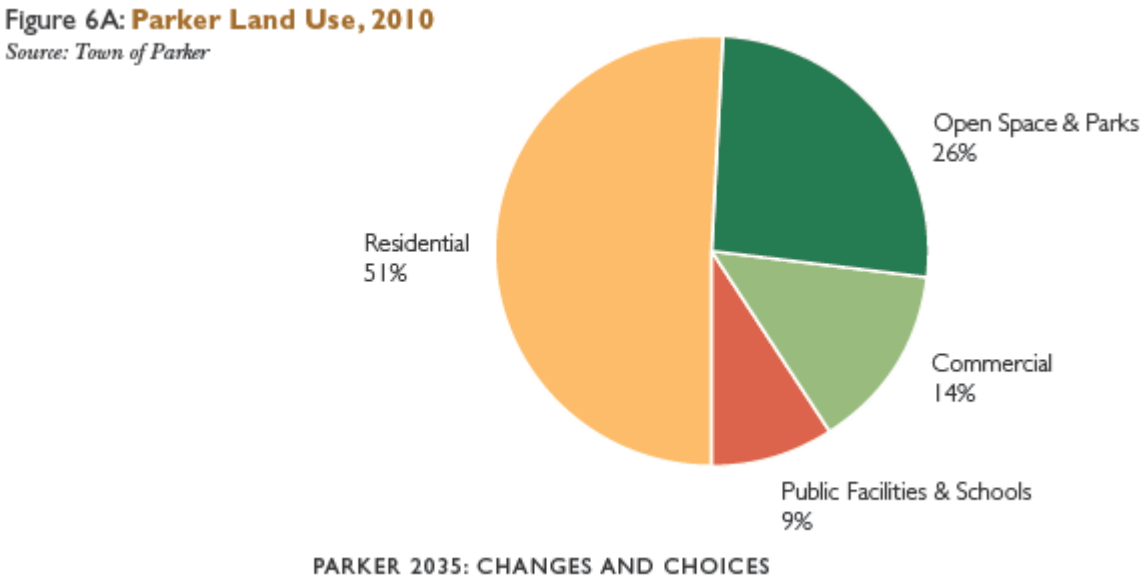
Figure E.4. Parker Population History and Projections 1981-2035



Source: 2014 Town of Parker Master Plan

Existing land uses within the Town of Parker have been generally urban or suburban residential development. Development within the Town consists of planned development residential uses, commercial uses, public facilities and schools, and parks and open space uses. Existing land use is broken down by percentage in Figure E.5.

Figure E.5. Current Land Use in the Town of Parker



Source: 2014 Town of Parker Master Plan

Parker's 2014 Master Plan includes a General Land Use Plan (Figure E.6) that represents the Town's vision for future growth and development through 2035. The majority of planned development within the Urban Growth Area boundary is expected to be medium or low density residential use. The Town's zoning map in Figure E.7 has more detailed information on planned developments, including planned community names and locations with the Town's Urban Growth Area boundary.

Figure E.6. Town of Parker General Land Use Plan

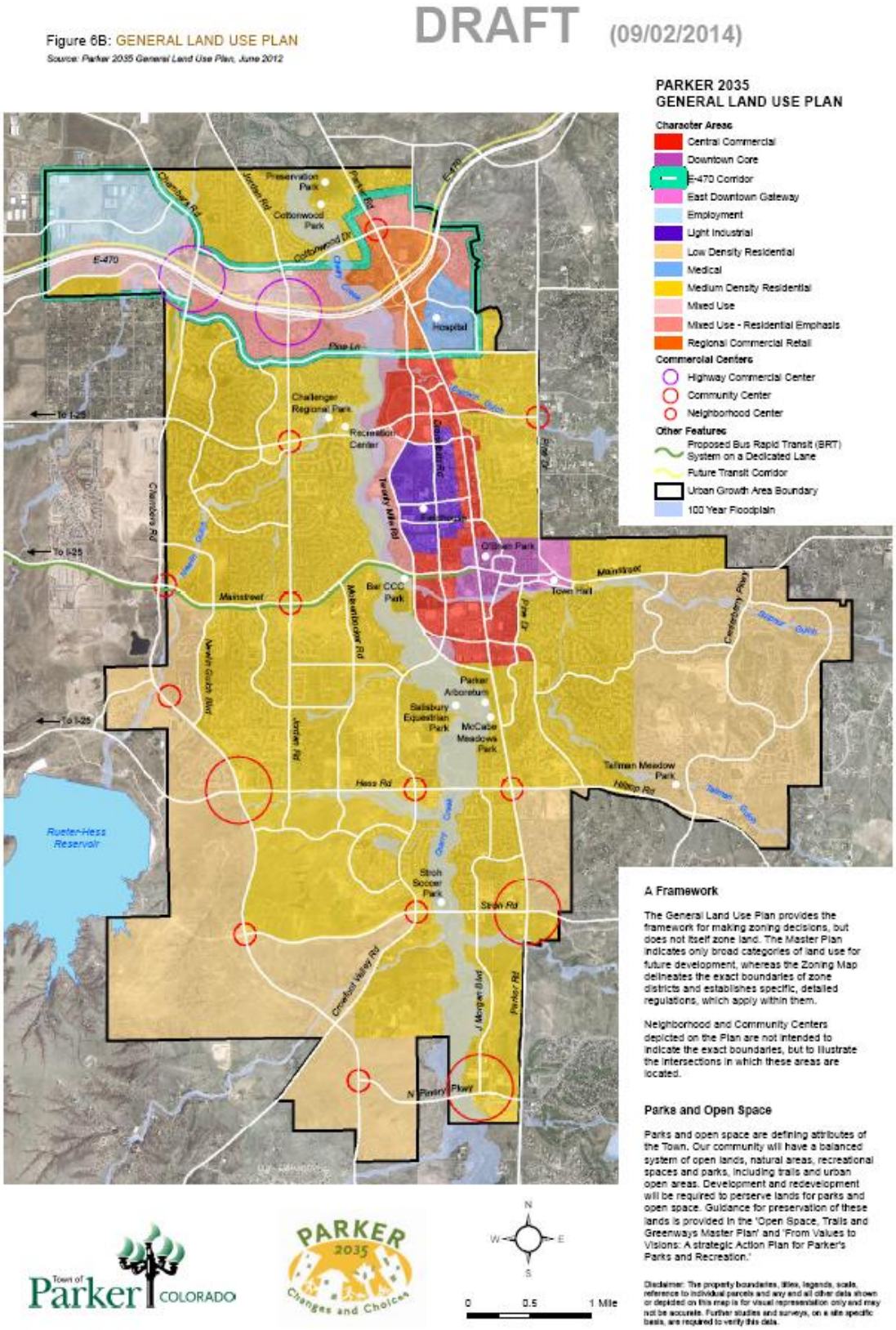


Figure E.7. Town of Parker Zoning Map with Planned Developments

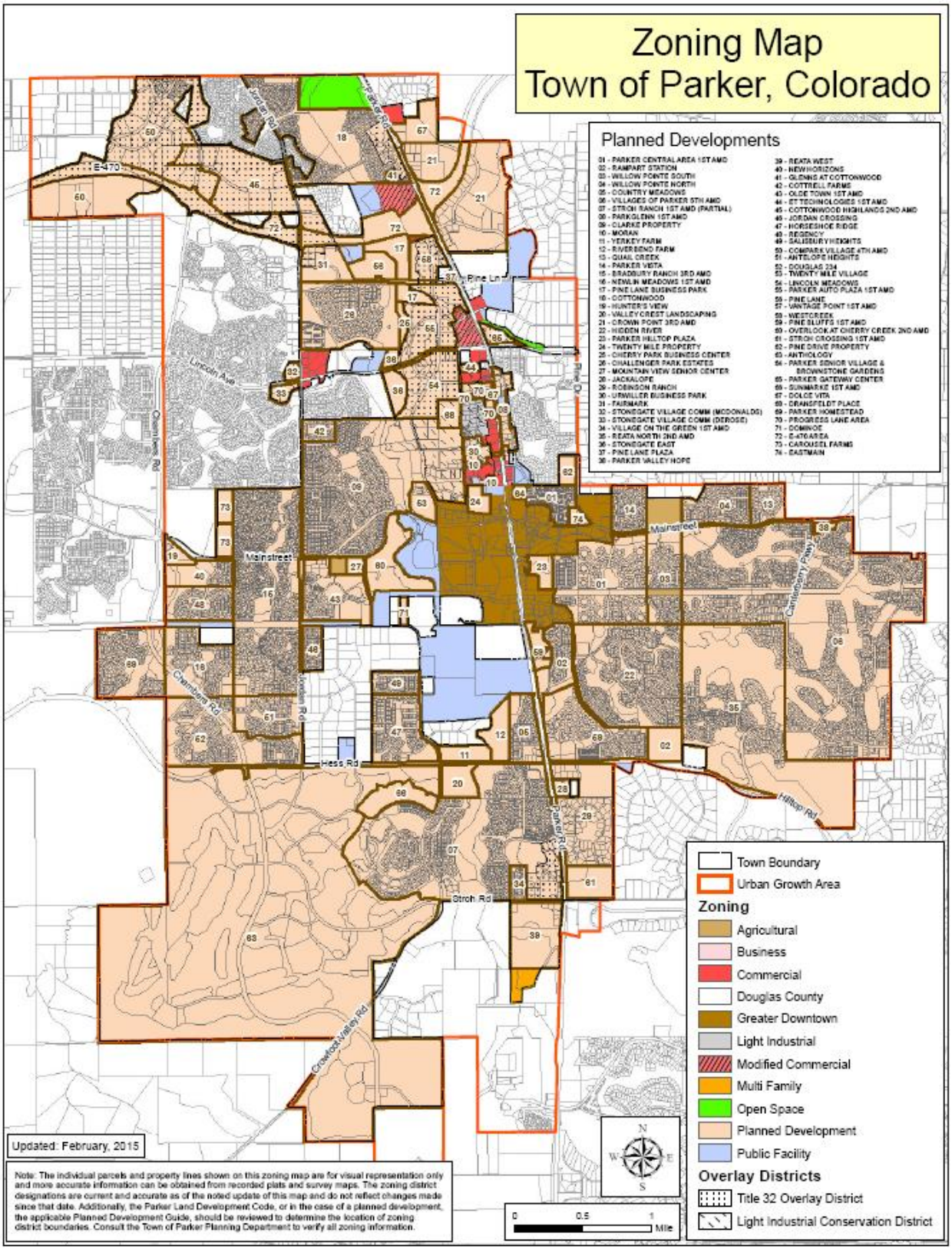


Table E.5 summarizes the number and value of structures built in Parker from 2010 to 2014 based on a query of the 'year built' values in the County's parcel database. Over 18,500 structures, with a total value greater than $5.3 billion, were built in that short period of time. The vast majority of these structures were residential, built to accommodate the rapidly growing population in the Planning Area. Additional analysis on recent development in Parker's mapped hazard areas is discussed in the vulnerability assessments for flood, landslide/erosion, and wildfire.

Table E.5. Parker 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	29	2	4	$90,127	$177,756	$267,883
Commercial	454	378	1,974	$765,090,166	$251,841,351	$1,016,931,517
Exempt	1,378	85	148	$260,629,379	$121,143,270	$381,772,649
HOA	705	0	40	$0	$0	$0
Industrial	24	24	66	$17,404,526	$5,948,290	$23,352,816
Producing Mine	1	0	0	$0	$58,292	$58,292
Residential	14,439	14,171	15,145	$3,008,303,994	$874,107,959	$3,882,411,953
Utilities	18	0	4	$0	$0	$0
Vacant Land	1,401	2	1,129	$117,696	$79,698,287	$79,815,983
Total	**18,449**	**14,662**	**18,510**	**$4,051,635,888**	**$1,332,975,205**	**$5,384,611,093**

Source: Douglas County

E.5.2 Priority Hazards: Vulnerability Assessment

This section provides the vulnerability assessment, including any quantifiable loss estimates, for those hazards identified above in Table E.2 as high or medium significance hazards. Wildfire was also analyzed to compare Parker's exposure to the rest of the Planning Area, despite being ranked low significance to the Town. A brief discussion on landslide and erosion was included for the same reason. Impacts of past events and vulnerability of the Town to specific hazards are further discussed below (see Section 4.1 Hazard Identification in the base plan for more detailed information about these hazards and their impacts on the Douglas County planning area). Methodologies for calculating loss estimates are the same as those described in Section 4.3 of the base plan. In general, the most vulnerable structures are those located within the floodplain or dam inundation areas, unreinforced masonry buildings, and buildings built prior to the introduction of modern building codes.

An estimate of the vulnerability of the Town to each identified hazard, in addition to the estimate of risk of future occurrence, is provided in each of 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.
- **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.

Drought

Vulnerability to Drought

Likelihood of Future Occurrence—Low/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.

The most significant qualitative impacts associated with drought in Parker are those related to water intensive activities such as fire protection, municipal usage, commerce, tourism, recreation, and wildlife preservation. Mandatory conservation measures and water use restrictions are typically implemented during extended droughts. 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 Parker. Some factors to consider include: 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. It can be assumed, however, that the loss of production in one sector of the economy would affect other sectors.

Development Trends

The Parker Water and Sanitation District recognized the need to manage water supply, especially given the rapid growth rate in the Planning Area and Parker in particular. To help meet this need, the Rueter-Hess reservoir was constructed. 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.[3] The reservoir is primarily used for drinking water storage to supply current and future development in Parker, Lone Tree, Castle Rock, Castle Pines, and other local jurisdictions and will help mitigate future impacts to the Town's water supply in future droughts

Flood: Dam Failure

Vulnerability to Dam Failure

Likelihood of Future Occurrence—Low
Potential Magnitude—Medium
Overall Vulnerability—Medium

The potential impacts from a dam failure are largely dependent on the specific dam or jurisdiction in question. Rueter-Hess dam poses the most immediate threat to Parker, but the dam was recently built and is actively monitored. As of mid-2015, the Rueter-Hess reservoir is only partially full, which further decreases the risk of dam failure in the short term. Parker experienced a dam failure event in 1933 when the Castlewood Dam failed and caused massive flooding on Cherry Creek. Historical accounts indicate that the Castlewood Dam had repeated problems due to structural issues, and downstream residents regularly expressed concern over the dam's safety. Castlewood Dam finally breached in August 1933 after heavy rains. Since the area was mainly agricultural at that point in time, the event caused extensive damage to farmland and crops. Bridges were also damaged by debris carried by the floodwaters.

A catastrophic dam failure would challenge local response capabilities and require timely evacuations to save lives in Parker. 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. Parker 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.

[3] Town of Castle Rock, Colorado website. "Rueter-Hess Reservoir." http://www.crgov.com/index.aspx?NID=1277, accessed February 17, 2015.

Flood: 100/500-Year

Vulnerability to 100/500-Year Flooding

Likelihood of Future Occurrence—Medium
Potential Magnitude—Low for 100-year, High for 500-year
Overall Vulnerability— Low for 100-year, High for 500-year

The Planning Area, including Parker, is prone to very intense rainfall. 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 Parker to floods.

The tables flood loss estimates for Parker are located below. Table E.6 shows improved values at risk in the 1% annual chance flood zone, and Table E.7 shows the same information for 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 value 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. Figure E.8 shows the FEMA flood zones in Parker, and Figure E.9 shows the location of properties within those flood zones. Based on this data, Parker has minimized risk in the 1% annual chance flood hazard areas. Development in the 0.2% annual chance zone exposes the Town to loss from this less frequent, but potentially devastating, flood event.

Table E.6. Parker 1% Annual Chance Flood Loss Estimate by Property Type

Property Type	Total Parcel Count	Improved Parcel Count	Total Structure Count	Improved Value	Estimated Content Value	Total Value	Loss Estimate
Agricultural	1	0	0	$0	$0	$0	$0
Commercial	2	0	0	$0	$0	$0	$0
Exempt	98	6	11	$691,591	$691,591	$1,383,182	$276,636
HOA	11	0	0	$0	$0	$0	$0
Residential	5	3	4	$653,552	$326,776	$980,328	$196,066
Utilities	1	0	0	$0	$0	$0	$0
Vacant Land	7	0	0	$0	$0	$0	$0
Total	**125**	**9**	**15**	**$1,345,143**	**$1,018,367**	**$2,363,510**	**$472,702**

Source: Douglas County 2014 Assessor & Parcel Data; Douglas County DFIRM

Table E.7. Parker 0.2% Annual Chance Flood Loss Estimate by Property Type

Property Type	Total Parcel Count	Improved Parcel Count	Total Structure Count	Improved Value	Estimated Content Value	Total Value	Loss Estimate
Agricultural	1	0	0	$0	$0	$0	$0
Commercial	18	10	62	$28,897,896	$28,897,896	$57,795,792	$11,559,158
Exempt	125	15	21	$23,698,806	$23,698,806	$47,397,612	$9,479,522
HOA	6	0	0	$0	$0	$0	$0
Residential	758	757	846	$131,232,921	$65,616,461	$196,849,382	$39,369,876
Vacant Land	36	0	22	$0	$0	$0	$0
Total	**944**	**782**	**951**	**$183,829,623**	**$118,213,163**	**$302,042,786**	**$60,408,557**

Source: Douglas County 2014 Assessor & Parcel Data; Douglas County DFIRM

Figure E.8. Parker FEMA Flood Hazard Zones

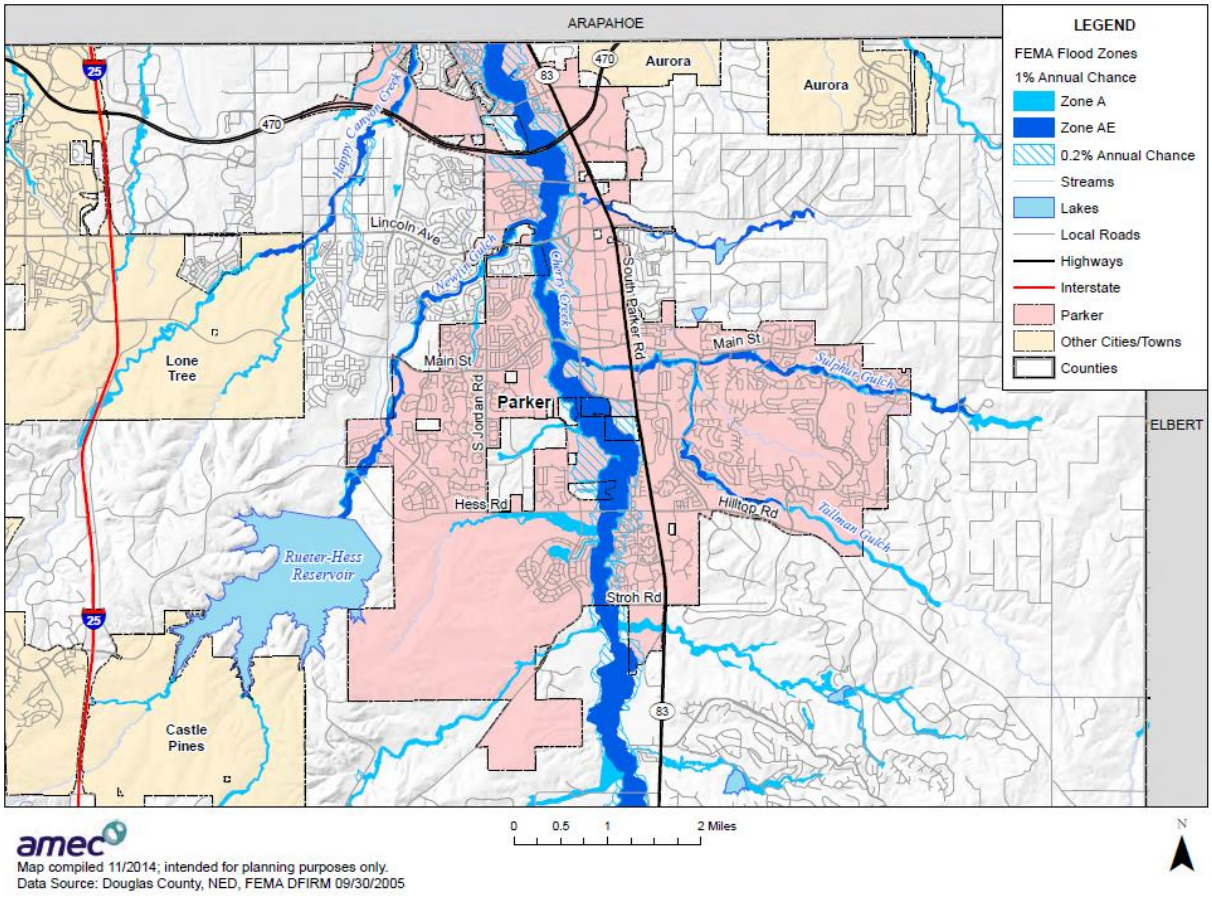
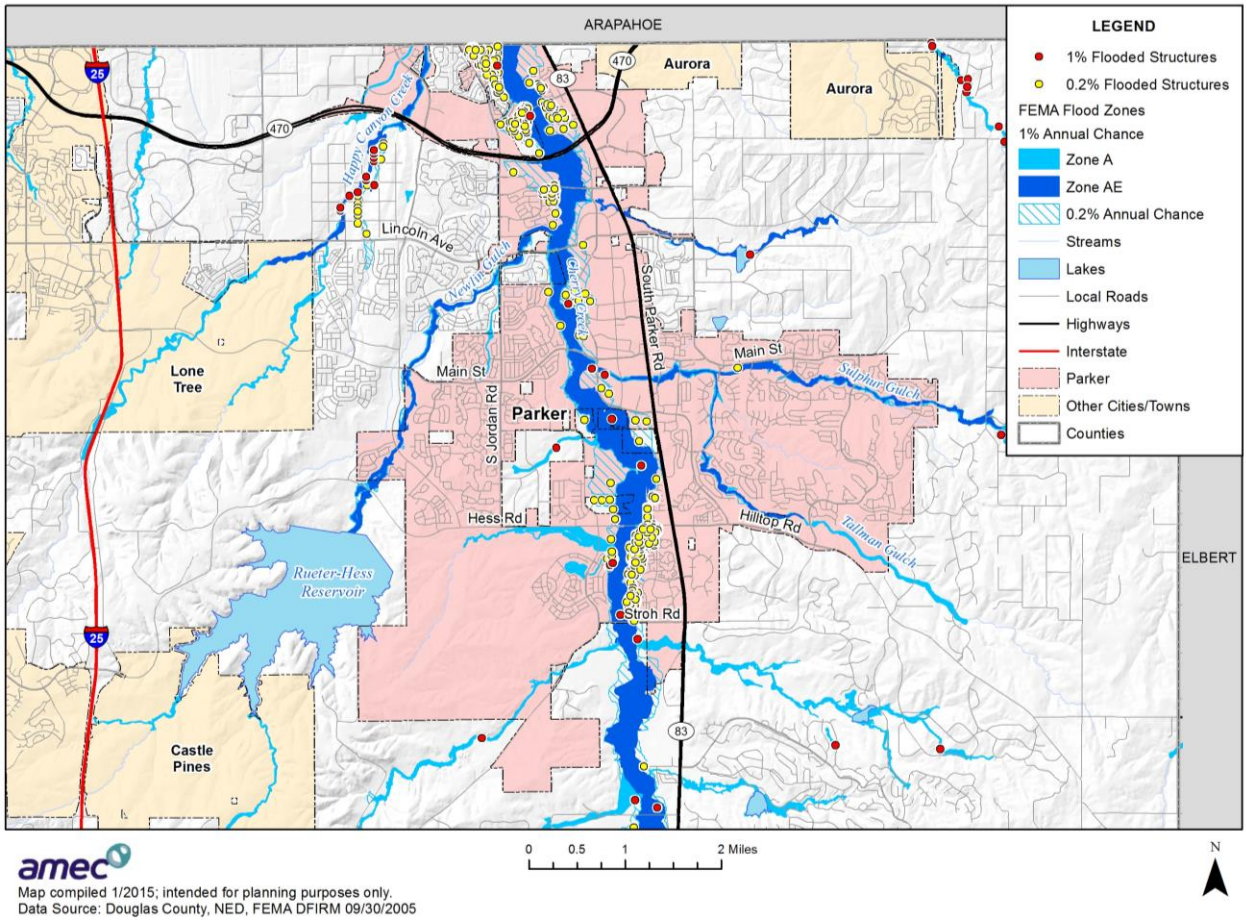


Figure E.9. Parker FEMA Flood Hazards and Flood Prone Improved Properties



Population at Risk

A separate analysis was performed to determine population in flood zones. Using GIS, the DFIRM dataset was overlaid on the improved residential parcel data. Those parcel centroids that intersect a flood zone were counted and multiplied by the 2010 U.S. Census household factor of 2.71; results were tabulated by jurisdiction and flood zone (see Table E.8). According to this analysis, there is a population of eight in the 1% annual chance flood zone, and 2,051 in the 0.2% annual chance flood zone in Parker.

Table E.8. Parker - Improved Residential Parcels and Population in Floodplain

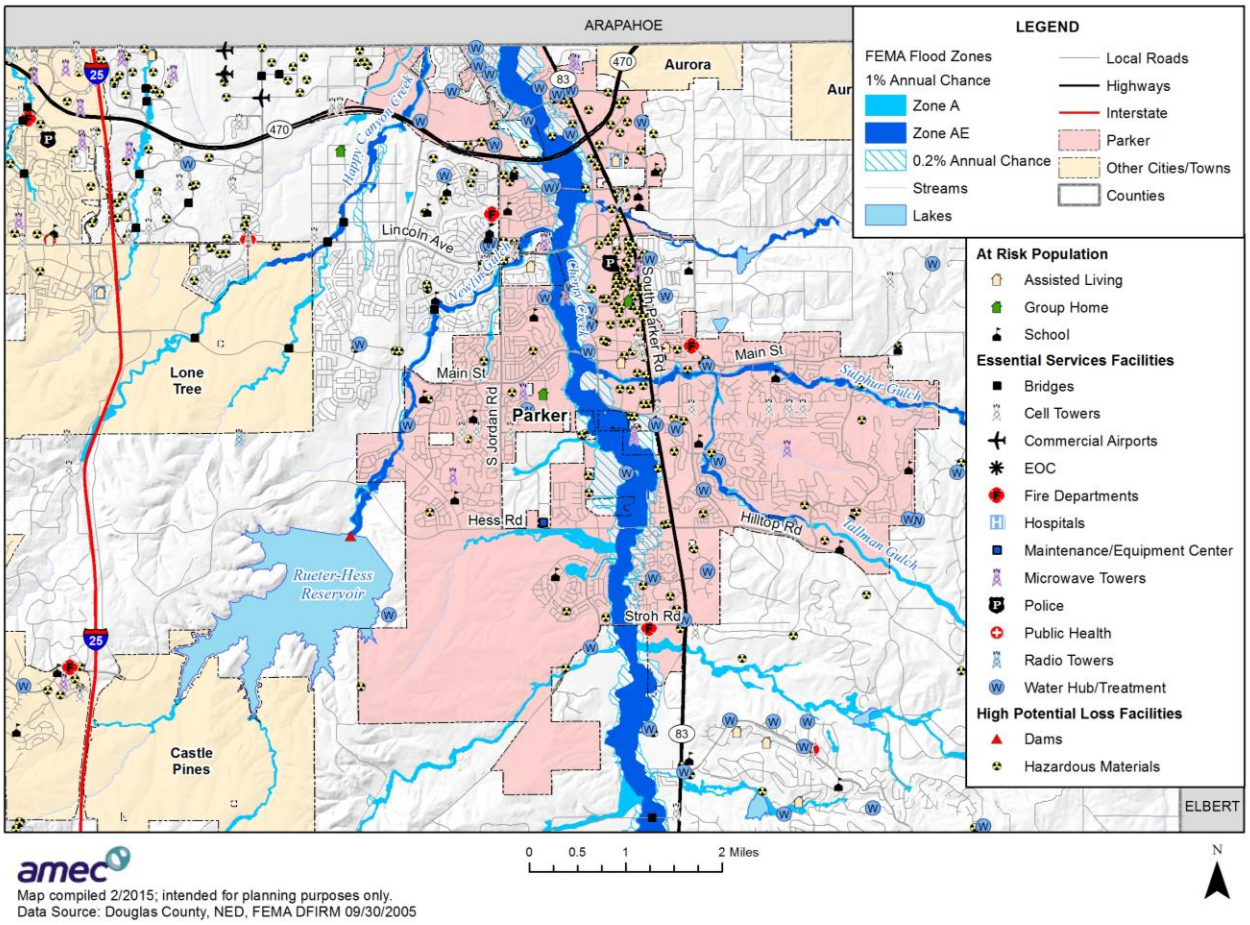
	1% Annual Chance		0.2% Annual Chance	
Jurisdiction	Improved Residential Parcels	Population	Improved Residential Parcels	Population
Parker	3	8	757	2,051

Source: DFIRM, US Census Bureau, 2014 Douglas County Assessor & Parcel Data
* Census Bureau 2010 average household size for Parker – 2.71

Critical Facilities at Risk

Two critical facilities in Parker are located in the 1% annual chance flood zone, and no critical facilities are located in the 0.2% annual chance flood zone. Both are essential services facilities, specifically water hub/treatment facilities.

Figure E.10. Parker FEMA Flood Hazards and Critical Facilities



Development Trends

The Town's floodplain regulations are laid out in Title 13 of the Parker Municipal Code. These regulations prohibit various types of development within the floodplain overlay district.

Largely the undeveloped area comprising the southwest quadrant of Parker within the Urban Growth Boundary (UGB)--south of Hess Road and west of Motsenbocker Road--has flood vulnerabilities due to lack of stormwater management infrastructure, which will be required with all new development. This area is included in the study area described below.

Oak Gulch Outfall Systems Planning Study Update

The Town, Douglas County and the Urban Drainage and Flood Control District (District) prepared an Outfall Systems Planning Study (OSP) in 2001 for Oak Gulch--which is a major drainageway and regulatory floodplain with our jurisdiction. OSPs are used by local communities within the District to identify flood and erosion hazards for major drainageways and to recommend mitigation measures. The OSPs are also used to properly plan future improvements necessary to mitigate the adverse effect of development within the watersheds.

The majority of the Oak Gulch watershed was undeveloped at the time of the study in 2001, however, assumptions on land use were made at the time. Since this study was completed, a Property Owner who owns the majority of the land within this watershed has been granted approval of Planned Development that varied from the original assumptions on land use. As a result, the Town and the District has initiated an update to this OSP to identify any required modifications to the mitigation measures necessary to prevent flood damage within the basin, with completion anticipated by the end of 2015.

Table E.9 summarizes development in the 1% and 0.2% annual chance flood zones between 2010 and 2014. Based on this data, Parker has greatly minimized development in the 1% annual chance flood hazard areas. No structures were built in the 1% annual chance flood zone between 2010 and 2014. Development in the 0.2% annual chance zone exposes the Town to loss from this less frequent flood event.

Table E.9. Parker Structures Built from 2010 to 2014: Assets Exposed to the 1% and 0.2% Annual Chance Flood Zone

Flood Zone	Total Parcel Count	Improved Parcel Count	Total Building Count	Improved Value	Estimated Content Value	Land Value	Total Value
1% Annual Chance	-	-	-	-	-	-	-
0.2% Annual Chance	38	38	57	$7,284,984	$3,642,160	$1,954,246	$12,881,390
Total	**38**	**38**	**57**	**$7,284,984**	**$3,642,160**	**$1,954,246**	**$12,881,390**

Source: Douglas County GIS

Landslide/Mud and Debris Flows/Rockfalls/Erosion

Vulnerability to Landslide/Mud and Debris Flows/Rockfalls/Erosion

Likelihood of Future Occurrence—Low
Potential Magnitude—Low
Overall Vulnerability—Low

The landslide hazard is made up of these attributes: debris-flow, rockfall-rockslide/debris, and slope-failure. Erosion hazards in Parker are also discussed in this section, despite being ranked

low significance, due to the property exposure in potential hazard areas. Landslide hazards in Parker are minimal. The Town identified Sulphur Gulch near the east end of Parker as one potential landslide hazard area. Erosion issues are fairly minor in developed areas but can be significant in undeveloped areas that lack stormwater management infrastructure.

The County's parcel layer was used as the basis for the inventory of all parcels within Parker. 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. The Town has 11 structures with a total value of over $7 million potentially exposed to landslide hazards, as detailed in Table E.10. Table E.11 summarizes exposure to moderate accelerated erosion. Erosion analysis does not include contents value since contents of buildings are unaffected by this hazard. Figure E.11 depicts Parker's mapped landslide and erosion hazard areas.

Table E.10. Town of Parker Total Exposure to Landslide

Property Type	Total Parcel Count	Improved Parcel Count	Total Building Count	Improved Value	Estimated Content Value	Land Value	Total Value
Slope-Failure Area							
HOA	1	0	1	$0	$0	$0	$0
Residential	10	10	10	$3,773,733	$1,886,867	$1,751,139	$7,411,739
Total	**11**	**10**	**11**	**$3,773,733**	**$1,886,867**	**$1,751,139**	**$7,411,739**

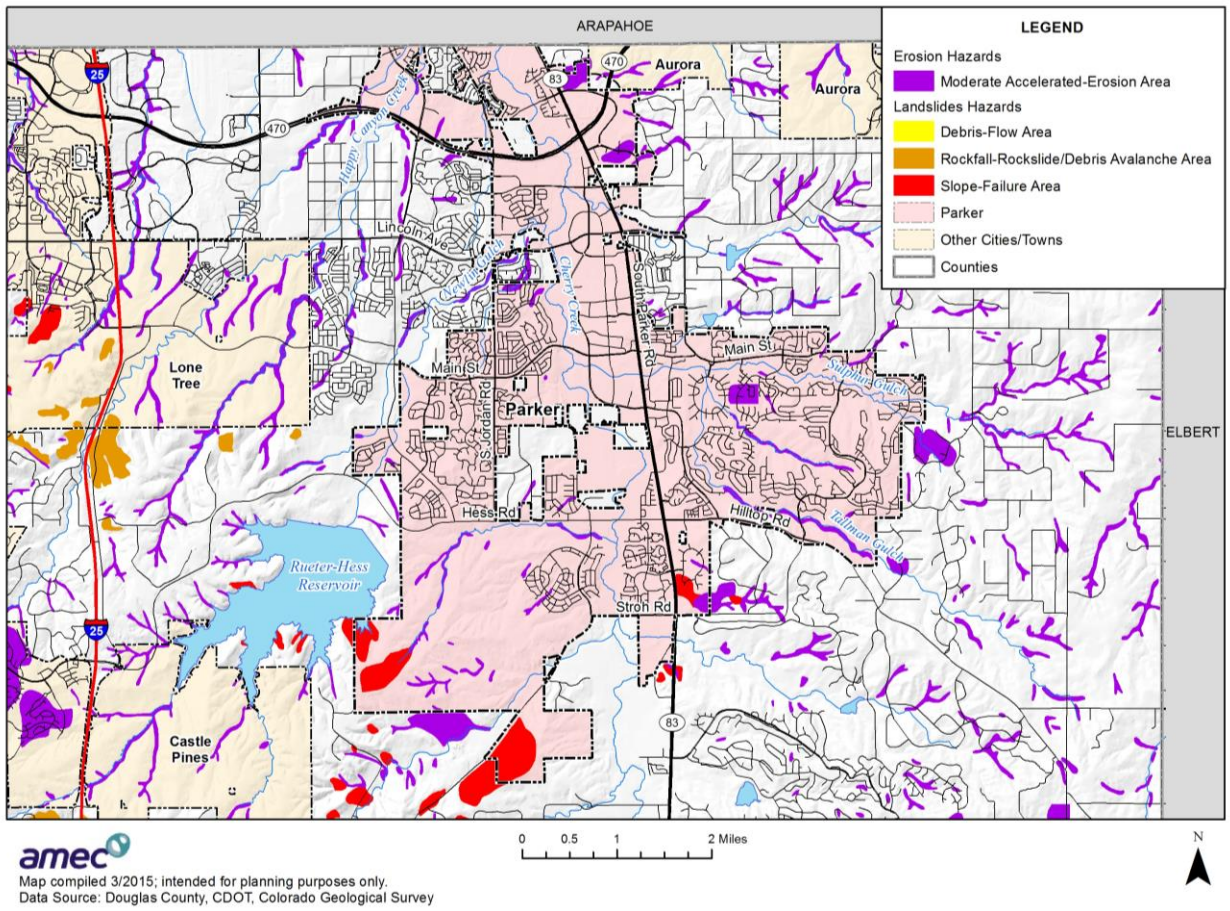
Source: Douglas County Assessor's Data

Table E.11. Town of Parker Total Exposure to Moderate Accelerated Erosion

Property Type	Total Parcel Count	Improved Parcel Count	Total Building Count	Improved Value	Land Value	Total Value
Agricultural	4	0	0	$0	$3,431	$3,431
Commercial	2	2	50	$127,335,551	$6,686,956	$134,022,507
Exempt	10	1	2	$2,516	$1,869,392	$1,871,908
HOA	14	0	0	$0	$0	$0
Residential	208	207	209	$39,974,450	$13,948,480	$53,922,930
Utilities	2	0	0	$0	$0	$0
Vacant Land	25	0	20	$0	$360,266	$360,266
Total	**265**	**210**	**281**	**$167,312,517**	**$22,868,525**	**$190,181,042**

Source: Douglas County Assessor's Data

Figure E.11. Parker Erosion and Landslide Hazards



Population at Risk

An estimated 27 people are potentially exposed to landslide hazards, specifically slope-failure areas, in Parker. This estimate is based on the number of exposed improved residential parcels multiplied by the average household size in Parker according to the 2010 U.S. Census (2.71).

Critical Facilities at Risk

Landslide and erosion analysis was performed on the critical facility inventory in Parker. GIS was used to determine whether Parker facility locations intersect the landslide and erosion hazard areas provided by Douglas County, and if so, which zones they intersect. There are a total of nine critical facilities located in moderate accelerated erosion hazard areas in Parker. No critical facilities are located in landslide hazard areas in the Town.

Table E.12. Parker Critical Facilities in Moderate Accelerated Erosion Hazard Areas

Category	Type	Facility Count
	Cell Tower	1
	Hospital	1
Essential Services Facilities	Water Hub/Treatment	1
High Potential Loss Facilities	Hazardous Material	6
TOTAL		**9**

Source: Douglas County GIS

Development Trends

An analysis of recent development trends in hazard areas was conducted for Parker. A total of 14 structures were built in moderate-accelerated erosion hazard areas in the Town between 2010 and 2014. No structures were built in landslide zones. Results of this analysis are shown in Table E.13.

Table E.13. Parker Structures Built from 2010 to 2014: Summary of Assets Exposed to Moderate Accelerated Erosion Areas

Hazard	Total Parcel Count	Improved Parcel Count	Total Building Count	Improved Value	Estimated Content Value	Land Value	Total Value
Moderate Accelerated Erosion	14	14	14	$2,907,881	$1,453,941	$848,050	$5,209,872
Total	**14**	**14**	**14**	**$2,907,881**	**$1,453,941**	**$848,050**	**$5,209,872**

Source: Douglas County GIS

Severe Weather: Hail

Vulnerability to Hail

Likelihood of Future Occurrence—High
Potential Magnitude—Medium
Overall Vulnerability—Medium

Hail is one of the most damaging natural hazards in Colorado. It occurs in wide swaths, causing damage to large geographical areas at once. A single hailstorm could potentially impact all of Parker at once. Hailstorms can also occur relatively frequently, especially in the summer, though they may not always cause significant damages. Approximately 5,100 residential and commercial roof permits were issued in Parker between 2011 and 2012 due to hail damages. Hailstorms have also damaged siding and windows, vehicles, rolling equipment, trees, and pastureland in Parker.

The impacts of hailstorms can vary substantially from one storm to another depending on weather conditions and the size of the hailstones. Losses are typically covered by insurance.

Development Trends

Any future development in Parker will be exposed to hail. Impacts to people can be mitigated by staying indoors during a hailstorm, and some property such as cars can be protected with covered parking where available. Hail impacts are difficult to mitigate in general though, and insurance is one of the typical options for recouping property losses and reducing economic impacts.

Severe Weather: Tornado

Vulnerability to Tornado

Likelihood of Future Occurrence—Low
Potential Magnitude—Low
Overall Vulnerability—Medium

Tornadoes can cause damage to property and loss of life. While most tornado damage is caused by violent winds, the majority of injuries and deaths generally result from flying debris. Property damage can include damage to buildings, fallen trees and power lines, broken gas lines, broken sewer and water mains, and the outbreak of fires. Access roads and streets may be blocked by debris, delaying necessary emergency response.

Figure 4.22 in Chapter 4 indicates that tornadoes can occur anywhere in Douglas County, especially in the eastern half. Figure 4.22 indicates that several F0 and F1 tornadoes were reported in Parker. A minor touchdown occurred in the Cottonwood Subdivision in the late 1990s, causing minor damage to fences and shingles.

Development Trends

Population growth and development expose more people to tornadoes in Parker. The impact to people can be mitigated through warning systems and tornado shelters. Stringent building codes for high winds can help mitigate impacts from weaker tornadoes, and property insurance can reduce economic impacts.

Wildfire

Vulnerability to Wildfire

Likelihood of Future Occurrence—Medium
Potential Magnitude—Low
Overall Vulnerability—Low

An exposure analysis was performed to quantify risk to wildfire in Parker. 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.

Table E.14 shows 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 in Parker. Figure E.12 illustrates the wildfire severity zones in Parker and the surrounding area.

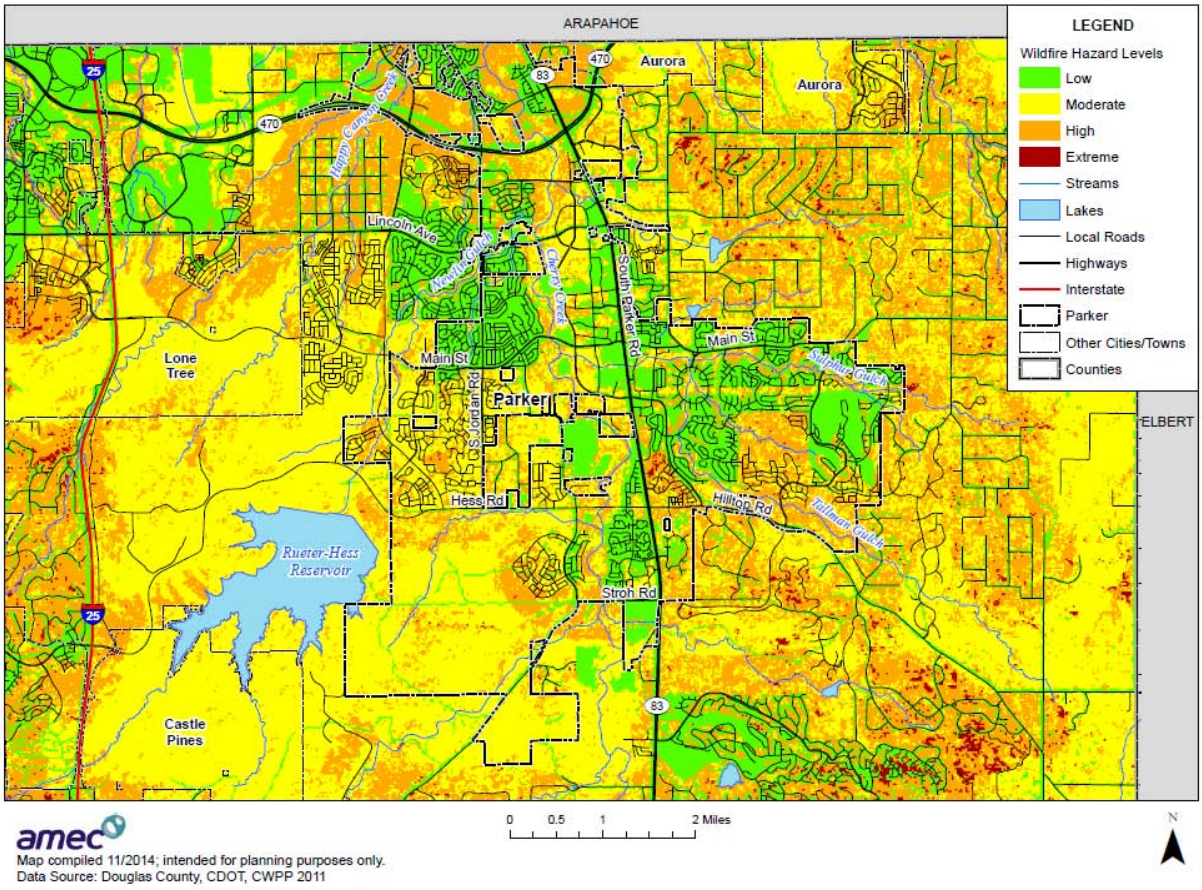
Table E.14. Town of Parker Total Exposure to Wildfire by Property Type

Property Type	Total Parcel Count	Improved Parcel Count	Total Structure Count	Improved Value	Estimated Content Value	Land Value	Total Value/Loss Estimate
Extreme							
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**
High							
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
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**
Moderate							
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**
Low							
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

Property Type	Total Parcel Count	Improved Parcel Count	Total Structure Count	Improved Value	Estimated Content Value	Land Value	Total Value/Loss Estimate
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**
Grand Total	**18,449**	**14,662**	**18,510**	**$4,051,635,888**	**$2,556,068,459**	**$1,332,975,205**	**$6,810,619,152**

Source: Douglas County GIS

Figure E.12. Parker Wildfire Hazard Potential



Population 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 hazard potential 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 size for each jurisdiction and unincorporated area, which is 2.71 in Parker. Table E.15 summarizes the results of this analysis.

Table E.15. Population at Risk to Wildfire

	Extreme	High	Moderate	Low
Population	14	5,016	8,434	24,940
Improved Residential Parcels	5	1,851	3,112	9,203

Source: Douglas County GIS, 2010 U.S. Census

Critical Facilities at Risk

Wildfire analysis was performed on the critical facility inventory in Douglas County and all jurisdictions, including Parker. GIS was used to determine whether the facility locations intersect a wildfire hazard area. Table E.16 summarizes the results of the GIS analysis for Parker, and Figure E.13 depicts the location of critical facilities in relation to wildfire severity zones. Details of critical facility definition, type, name and address and jurisdiction by wildfire zone are listed in Appendix E.

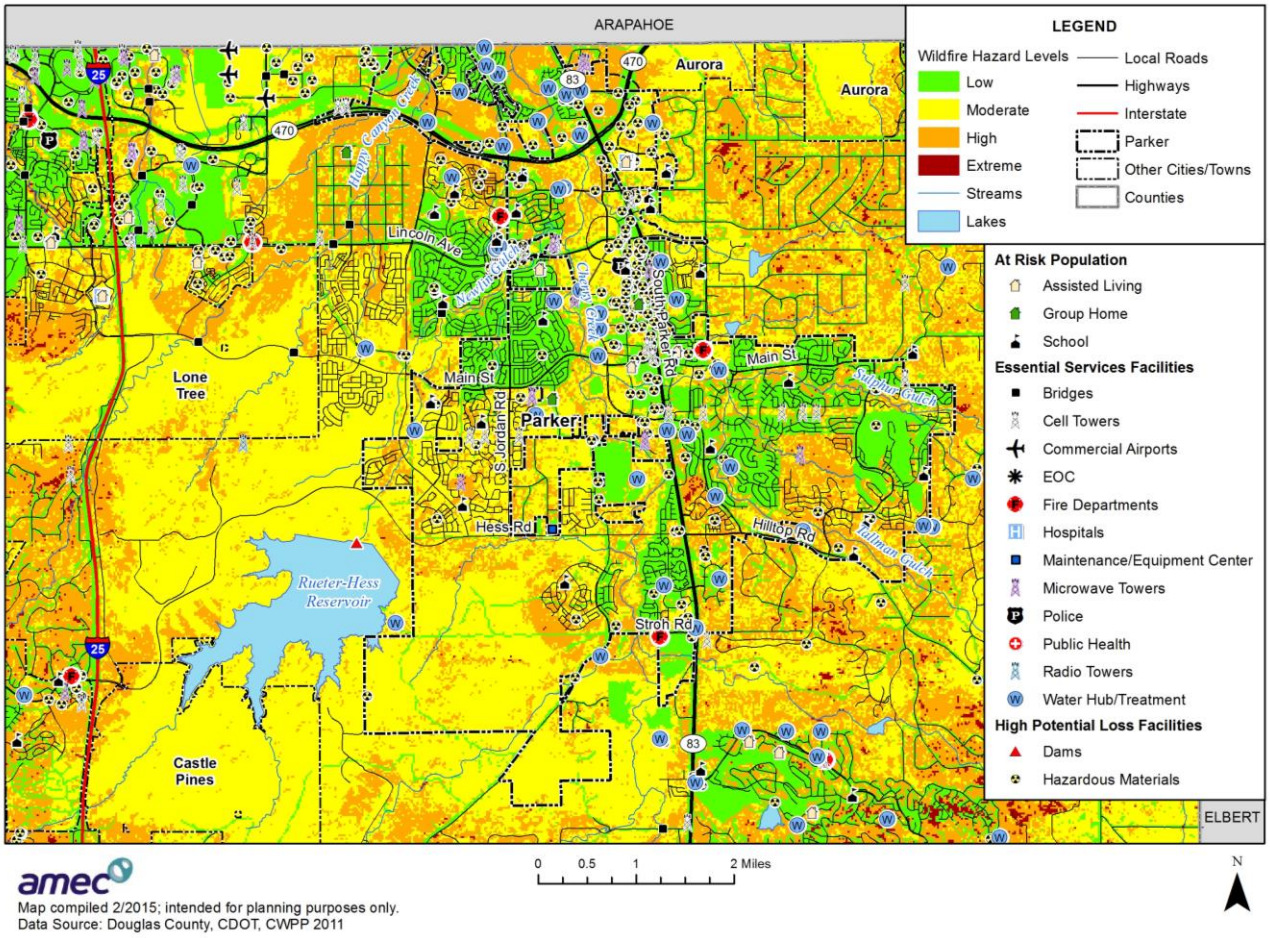
Table E.16. Parker– Critical Facilities at Risk to Wildfire Detail

Fire Risk	Category	Type	Facility Count
High	At Risk Population Facilities	Group Home	1
	At Risk Population Facilities	School	7
	Essential Services Facilities	Cell Tower	3
	Essential Services Facilities	Microwave	1
	Essential Services Facilities	Water Hub/Treatment	12
	High Potential Loss Facilities	Hazardous Material	54
	TOTAL		**78**
Moderate	At Risk Population Facilities	Assisted Living	1
	At Risk Population Facilities	School	4
	Essential Services Facilities	Cell Tower	7
	Essential Services Facilities	EOC	1
	Essential Services Facilities	Hospital	1
	Essential Services Facilities	Microwave	4
	Essential Services Facilities	Police	1
	Essential Services Facilities	Water Hub/Treatment	7
	High Potential Loss Facilities	Hazardous Material	44
	TOTAL		**70**
Low	At Risk Population Facilities	Group Home	1
	At Risk Population Facilities	School	6
	Essential Services Facilities	Cell Tower	6
	Essential Services Facilities	Fire Department	2
	Essential Services Facilities	Microwave	4
	Essential Services Facilities	Water Hub/Treatment	12
	High Potential Loss Facilities	Hazardous Material	76

Fire Risk	Category	Type	Facility Count
	TOTAL		**107**
Grand Total			**255**

Source: Douglas County GIS

Figure E.13. Parker Wildfire Hazard Potential and Critical Facilities



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 WUI fire areas have long histories of wildland fires that burned only vegetation in the past. However, with new development wildland fires have the potential to burn developed areas, as demonstrated by the Waldo Canyon Fire in Colorado Springs in 2012. Population growth and development in Parker could potentially expose more people and structures to wildfires.

An analysis of recent development in extreme, high, and moderate wildfire hazard areas was conducted for Parker. A total of 340 structures was built between 2010 and 2014. The total

value of these structures is $146,423,713, with the majority located in the high wildfire hazard area. Results of this analysis are shown in Table E.17.

Table E.17. Parker 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
High	108	108	132	$27,991,428	$14,121,352	$7,881,790	$49,994,570
Moderate	170	170	208	$51,157,664	$29,880,540	$15,390,939	$96,429,143
Total	**278**	**278**	**340**	**$79,149,092**	**$44,001,892**	**$23,272,729**	**$146,423,713**

Source: Douglas County GIS

Hazardous Materials: Transportation Incidents

Vulnerability to Hazardous Materials: Transportation Incidents

Likelihood of Future Occurrence—Low
Potential Magnitude—Medium
Overall Vulnerability—Medium

Hazardous materials are transported highways and railroads 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 at potentially at risk to hazardous materials transportation incidents in Parker.

Population at Risk

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. None of the hazardous materials corridors identified in this plan pass through Parker. Therefore, no at-risk populations were identified as part of this analysis. However, a hazardous materials spill in another part of the Planning Area could still affect Parker, depending on the nature of the spill, weather, wind speed and direction, etc.

Development Trends

Development in Parker occurs within existing city boundaries. As development in Parker continues to grow, more people will be at risk to hazardous materials transportation incidents.

E.6 Capability Assessment

Capabilities are the programs and policies currently in use to reduce hazard impacts or that could be used to implement hazard mitigation activities. This capability assessment is divided into five sections: regulatory mitigation capabilities, administrative and technical mitigation capabilities, fiscal mitigation capabilities, mitigation outreach and partnerships, and other mitigation efforts.

E.6.1 Regulatory Mitigation Capabilities

Table E.18 lists regulatory mitigation capabilities, including planning and land management tools, typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place in the Town of Parker.

Table E.18. Town of Parker Regulatory Mitigation Capabilities

Regulatory Tool (ordinances, codes, plans)	Y/N	Date	Comments
Comprehensive plan	Yes	2014	Master Plan 2035
Zoning ordinance	Yes	11-7-14	Master Plan 2035
Subdivision ordinance	Yes	11-7-14	Master Plan 2035
Growth management ordinance	Yes		Urban Growth Boundary-Mgmt. Tool
Floodplain ordinance	Yes	11-7-14	Master Plan 2035
Other special purpose ordinance (stormwater, steep slope, wildfire)	Yes	11-7-14	Master Plan 2035
Building code	Yes		2012 International Series, 2014 NEC
BCEGS Rating	Yes		3 - commercial, 4 - 1&2 Family Dwellings
Fire department ISO rating	Yes		ISO Rating 3
Erosion or sediment control program	Yes	2-2014	Storm Drainage & Environmental Criteria Manual
Stormwater management program	Yes		Storm Drainage & Environmental Criteria Manual
Site plan review requirements	Yes		Storm Drainage & Environmental Criteria Manual Section 8.4.1
Capital improvements plan	Yes		Annual - updated within annual budget
Economic development plan	Yes		Annual - updated within annual budget
Local emergency operations plan	Yes	6-2013	Town of Parker Emergency Ops. Plan
Community Wildfire Protection Plans	No		Incl. in Douglas County plans
Flood insurance study or other engineering study for streams	Yes		DFIRM Maps; annual stormwater review
Elevation certificates	No		Only Grading Certifications
Other			

Source: Amec Foster Wheeler Data Collection Guide

Master Plan (2014)

The Town of Parker Master Plan represents another step in the Town's on-going efforts to build and maintain a balanced, sustainable community. The Plan is a document that sets forth the policies for the future of the community and is designed to be a flexible "living" document that can be changed as the needs change for the Parker community. The planning horizon for the Plan is a focus of 20 years in the future and is a resource for community leaders to use as a guide in formulating future policies for the Town and guide growth and development.

Goals and policies related to mitigation of natural hazards are as follows:

Goal 12-2	**Locate development in areas free of environmental hazards and constraints.**
2.A.	Prohibit development within the 100-year floodplain unless associated with wildlife management, nonpolluting recreational uses, drainage improvements, or maintenance.
2.B.	Continue to prohibit development on slopes of 20% or greater and limit development on slopes of 15% or greater.
2.C.	Minimize disruption to the natural topography through creative site planning and through design and sensitive construction practices.

Goal 12-3	**Maintain high water quality and protect water resources.**
4.D.	Ensure that development adequately incorporates effective measures to protect groundwater and surface water from contamination.
4.E.	Ensure that development adequately incorporates design and engineering practices that minimize pollution of water resources from non-point sources (pavement water run-off) and point sources (discharge that can be linked to a specific source).
4.F.	Control short and long-term drainage and surface erosion or sedimentation problems.
4.I.	Implement stabilization and restoration projects to ensure natural drainageways are protected from the damaging effects of erosion.

Ordinances

The Town of Parker has many ordinances related to mitigation.

Zoning

The Town of Parker has adopted the Douglas County zoning code.

Chapter 13.05.010 Floodplain Regulations

(4) Methods of reducing flood losses.

In order to accomplish its purposes, this Section includes methods and provisions for:

a. Restricting or prohibiting uses which are dangerous to health, safety and property due to water or erosion hazards, or which result in damaging increases in erosion or in flood heights or velocities;

b. Requiring that uses vulnerable to floods, including facilities which serve such uses, be protected against flood damage at the time of initial construction;

c. Controlling the alteration of natural floodplains, stream channels and natural protective barriers, which help accommodate or channel floodwaters;

d. Controlling, filling, grading, dredging and other development which may increase flood damage; and

e. Preventing or regulating the construction of flood barriers which will unnaturally divert floodwaters or which may increase flood hazards in other areas.

(2) Designation of the Floodplain Administrator.

The Public Works Director is hereby appointed to administer and implement this Section by granting or denying floodplain development permit applications in accordance with its provisions and other appropriate sections of 44 C.F.R. (National Flood Insurance Program Regulations) pertaining to floodplain management. The Public Works Director may assign a designee to act as the Floodplain Administrator.

(e) Provisions for flood hazard reduction.

(1) General standards. In all areas of special flood hazard, the following standards are required:

a. Anchoring.

1. All new construction and substantial improvements shall be anchored to prevent flotation, collapse or lateral movement of the structure and capable of resisting the hydrostatic and hydrodynamic loads.

2. All manufactured homes must be elevated and anchored to resist flotation, collapse or lateral movement and capable of resisting the hydrostatic and hydrodynamic loads. Methods of anchoring may include, but are not limited to, use of over-the-top or frame ties to ground anchors. This requirement is in addition to applicable state and local anchoring requirements for resisting wind forces. Specific requirements may be:

a) Over-the-top ties be provided at each of the four (4) corners of the manufactured home, with two (2) additional ties per side at intermediate locations, with manufactured homes less than fifty (50) feet long requiring one (1) additional tie per side;

b) Frame ties be provided at each corner of the home with five (5) additional ties per side at intermediate points, with manufactured homes less than fifty (50) feet long requiring four (4) additional ties per side;

c) All components of the anchoring system be capable of carrying a force of four thousand eight hundred (4,800) pounds; and

d) Any additions to the manufactured home be similarly anchored.

b. Construction materials and methods.

1. All new planned developments, subdivisions, site plans and building permits for new buildings shall preclude any development within a designated one-hundred-year floodplain, with the exception of necessary roads, utilities, trails and other facilities found to be acceptable to the Planning Commission and the Town Council. Buildable lots may be partially located within a one-hundred-year floodplain provided that the developer demonstrates that a buildable envelope, suitable in area and dimensions, is located entirely outside of the floodplain.

2. All substantial improvements shall be constructed with materials and utility equipment resistant to flood damage.

3. All substantial improvements shall be constructed using methods and practices that minimize flood damage.

4. All substantial improvements shall be constructed with electrical, heating, ventilation, plumbing and air conditioning equipment and other service facilities that are designed and/or located so as to prevent water from entering or accumulating within the components during conditions of flooding.

c. Utilities.

1. All new and replacement water supply systems shall be designed to minimize or eliminate infiltration of floodwaters into the system;

2. New and replacement sanitary sewage systems shall be designed to minimize or eliminate infiltration of floodwaters into the systems and discharge from the systems into floodwaters; and

3. On-site waste disposal systems shall be located to avoid impairment to them or contamination from them during flooding.

d. Subdivision proposals.

1. All subdivision proposals shall be consistent with the need to minimize flood damage;

2. All subdivision proposals shall have public utilities and facilities such as sewer, gas, electrical and water systems located and constructed to minimize flood damage;

3. All subdivision proposals shall have adequate drainage provided to reduce exposure to flood damage; and

4. Base flood elevation data shall be provided for subdivision proposals and other proposed development which contain at least fifty (50) lots or five (5) acres (whichever is less).

(2) Specific standards. In all areas of special flood hazard where base flood elevation data has been provided as set forth in Paragraph (c)(2) or Subparagraph (d)(3)b. above, the following provisions are required:

a. Residential construction. New construction and substantial improvement of any residential structure shall have the lowest floor (including basement), electrical, heating, ventilation, plumbing and air conditioning equipment elevated, at a minimum, to two (2) feet above the base flood elevation.

b. Nonresidential construction. New construction and substantial improvement of any commercial, industrial or other nonresidential structure shall either have the lowest floor (including basement) elevated to two (2) feet above the base flood elevation or, together with attendant utility and sanitary facilities, shall:

1. Be floodproofed so that below two (2) feet above the base flood elevation the structure is watertight with walls substantially impermeable to the passage of water;

2. Have structural components capable of resisting hydrostatic and hydrodynamic loads and effects of buoyancy; and

3. Be certified by a registered professional engineer or architect that the design and methods of construction are in accordance with accepted standards of practice for meeting the provisions of this Paragraph. Such certifications shall be provided to the Floodplain Administrator as set forth in Subparagraph (d)(3)c.2. above.

c. Critical facilities. All new and substantially changed critical facilities and new additions to critical facilities, shall have a minimum freeboard of two (2) feet above the 100-year-flood elevation (base flood elevation).

d. Openings in enclosures below the lowest floor. For all new construction and substantial improvements, fully enclosed areas below the lowest floor that are subject to flooding shall be designed to automatically equalize hydrostatic flood forces on exterior walls by allowing for the entry and exit of floodwaters. Designs for meeting this requirement must either be certified by a registered professional engineer or architect or must meet or exceed the following minimum criteria:

1. A minimum of two (2) openings having a total net area of not less than one (1) square inch for every square foot of enclosed area subject to flooding shall be provided;

2. The bottom of all openings shall be no higher than one (1) foot above grade;

3. Openings may be equipped with screens, louvers or other coverings or devices, provided that they permit the automatic entry and exit of floodwaters.

Community Rating System

The National Flood Insurance Program's (NFIP) Community Rating System (CRS) is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. As a result, flood insurance premium rates are discounted to reflect the reduced flood risk resulting from the community actions meeting the three goals of the CRS which are to reduce flood losses, facilitate accurate insurance rating, and promote the awareness of flood insurance. The Town of Parker currently participates in the CRS and has a rating of 6. The Town of Parker has maintained a Class 6 rating since 2006, with the most recent verification visit by the CRS coordinator in 2013. Below is a summary of the Town's floodplain management programs that were provided during the verification visit:

Activity 310 – Elevation Certificates: The Town's Building Department maintains elevation certificates for new and substantially improved buildings. Copies of elevation certificates are made available upon request. Elevation certificates are also kept for post-FIRM buildings. (112 points)

Activity 320 – Map Information: The Town furnishes inquirers with flood zone information from the community's latest Flood Insurance Rate Map (FIRM), and publicizes the service annually in the monthly newsletter sent to all property owners. (140 points)

Activity 330 – Outreach Projects: A community brochure is mailed to all properties in the community on an annual basis (via Town monthly newsletter). (13 points)

Activity 340 – Hazard Disclosure: Credit is provided for the state regulation requiring disclosure of flood hazards. (12 points)

Activity 350 – Flood Protection Information: Credit is provided for floodplain information displayed on the Town's website. (12 points)

Activity 420 – Open Space Preservation: Credit is provided for preserving 855 acres in the Special Flood Hazard Area (SFHA) as open space. Credit is also provided for open space land that is deed restricted. (986 points)

Activity 430 – Higher Regulatory Standards: Credit is provided for enforcing regulations that require other higher regulatory standards, land development criteria, and state mandated regulatory standards. This credit is obtained through the Town's Stream Protection ordinance which was adopted by Council over 10 years ago. Credit is also provided for a BCEGS Classification of 4/3, adoption of the 2009 International Building Codes, and certification as a floodplain manager. (380 points)

Activity 450 – Stormwater Management: The Town enforces regulations for stormwater management, freeboard in non-SFHA zones, soil and erosion control, and water quality as provided in the Parker Storm Drainage and Environmental Criteria Manual and the associated programs and permits. (141 points)

Section 502 - Repetitive Loss Category: Parker is a Category A community for CRS purposes and no further action is required.

Activity 540 – Drainage System Maintenance: The Town's drainage system is inspected regularly throughout the year and maintenance is performed as needed by Town of Parker Public Works Department. Records are being maintained for both inspections and required maintenance through our Geographic Information System. The Town also enforces a regulation prohibiting dumping in the drainage system. (315 points)

Activity 630 – Dam Safety: All Colorado communities currently receive CRS credit for the state's dam safety program. (71 points)

E.6.2 Administrative/Technical Mitigation Capabilities

Table E.19 identifies the Town department(s) responsible for activities related to mitigation and loss prevention in Parker.

Table E.19. Town of Parker Administrative and Technical Mitigation Capabilities

Personnel Resources	Yes/No	Department/Position	Comments
Planner/Engineer with knowledge of land development/land management practices	Yes	Community Development	& Public Works staff
Engineer/Professional trained in construction practices related to buildings and/or infrastructure	Yes	Chief Building Official	& Civil Engineers

Personnel Resources	Yes/No	Department/Position	Comments
Planner/Engineer/Scientist with an understanding of natural hazards	Yes	Civil Engineers on staff	
Personnel skilled in GIS	Yes	Two specialists within IT	Department
Full time building official	Yes	Numerous within Building	Division
Floodplain Manager	Yes	Floodplain Administrator	is Public Works Director
Emergency Manager	Yes	Lieutenant with Parker PD	
Grant writer	No	Various individuals within	departments handle
Other personnel	Yes	Douglas County personnel	are available
GIS Data – Hazard areas	Yes	All floodplain maps/data	
GIS Data - Critical facilities	Yes	Locations and maps	
GIS Data – Building footprints	Yes	via aerial photography	
GIS Data – Land use	Yes	in GIS layers	
GIS Data – Links to Assessor's data	Yes	"	
Warning Systems/Services (Reverse 9-11, cable override, outdoor warning signals)	Yes		Code Red Mass Emergency Notification system
Other			

Source: Amec Foster Wheeler Data Collection Guide

E.6.3 Fiscal Mitigation Capabilities

Table E.20 identifies financial tools or resources that the Town could potentially use to help fund mitigation activities.

Table E.20. Town of Parker Fiscal Mitigation Capabilities

Financial Resources	Accessible/Eligible to Use (Y/N)	Comments
Community Development Block Grants	Yes	
Capital improvements project funding	Yes	
Authority to levy taxes for specific purposes	Yes, by Town Council	Ordinance and/or elections
Fees for water, sewer, gas, or electric services	No	
Impact fees for new development	Yes - Parker has Excise Tax	instead of Impact Fees
Incur debt through general obligation bonds	Yes	Requires an election approval
Incur debt through special tax bonds	No	
Incur debt through private activities	No	
Withhold spending in hazard prone areas	Yes	Per Council decision
Other		

Source: Amec Foster Wheeler Data Collection Guide

E.6.4 Mitigation Outreach and Partnerships

The Town's Stormwater Utility has designed and constructed numerous projects in the past 15 years focused on erosion and flood mitigation/protection. These projects include channel and stream stabilization projects that prevent damage to private properties and public infrastructure that can result from erosion. The Town has also constructed a number flood control projects including regional detention ponds and channel/infrastructure improvements during that time. Other programs include:

- A biennial Bridge Inspection and Maintenance Program
- Elevator inspections that occur semi-annually
- Periodic safety inspections performed by the Fire Authority

E.7 Mitigation Strategy

This section describes the mitigation strategy process and mitigation action plan for the Town of Parker' inclusion with the Douglas County Local Hazard Mitigation Plan update.

E.7.1 Mitigation Goals and Objectives

The Town of Parker adopts the hazard mitigation goals and objectives developed by the HMPC and described in Chapter 5 Mitigation Strategy of the base plan.

E.7.2 Continued Compliance with the NFIP

As a participant of the National Flood Insurance Program (NFIP), the Town of Parker has administered floodplain management regulations that meet the minimum requirements of the NFIP. The management program objective is to protect people and property within the Town. The Town of Parker will continue to comply with the requirements of the NFIP in the future.

The Town's regulatory activities apply to existing and new development areas of the Town; implementing flood protection measures for existing structures and maintaining drainage systems. The goal of the program is to enhance public safety, and reduce impacts and losses while protecting the environment.

E.7.3 Mitigation Actions

The planning team for the Town of Parker identified and prioritized the following mitigation actions based on the risk assessment and in accordance with the process outline in Section 5, Mitigation Strategy, of the base plan. Background information and information on how each action will be implemented and administered, such as ideas for implementation, responsible office, potential funding, estimated cost, and timeline are also included. General processes and

information on plan implementation and maintenance of this LHMP by all participating jurisdictions is included in Section 7, Plan Implementation and Maintenance, of the base plan.

Town of Parker Action #1

Action Title:	Creation of Emergency Action Plan (EAP) for significant contamination of stored water in Rueter-Hess Reservoir (RHR)
Priority:	High
Project Description, Issue & Background:	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.
Ideas for Implementation:	-Hold a brainstorming workshop to list & consider all known types of events that may lead to water contamination. -Evaluate, itemize and rank likelihood of occurrence. -Prepare mitigation and prevention plans for most probable events. -Prepare action plan(s), needed resources & call-down lists.
Other Alternatives:	No action
Responsible Agency:	Parker Water and Sanitation District (PWSD)
Partners:	Town of Parker, Douglas County, water storage partners
Potential Funding:	EMPG funds (Town of Parker), partner contributions
Cost Estimate:	$1,000 to $5,000
Benefits: (Losses Avoided)	-Prevention of very costly water treatment options, or in the worst case, draining of much or all of stored water. -Rapid response planning to minimize event impacts.
Timeline:	Completion by end of year 2017
Status:	New in 2015

Town of Parker Action #2

Action Title:	Achieving “Storm Ready Community” designation for Parker
Priority:	Medium
Project Description, Issue & Background:	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.
Ideas for Implementation:	Public Works and the Town’s Office of Emergency Management (OEM) will collaborate in gathering existing documents and procedures (program requirements) and determine those elements under the StormReady guidelines remaining to be developed/completed, then finalize a work plan.
Other Alternatives:	No action
Responsible Agency:	Parker Public Works
Partners:	OEM & Parker Police Department
Potential Funding:	Departmental budgets and/or EMPG funds.
Cost Estimate:	$500 to $1,000
Benefits: (Losses Avoided)	Acquisition of additional Community Rating System points for NFIP, improve hazardous weather alerts and warnings for members of our Community; reduce public and private vulnerabilities to storms; recognition through StormReady signage.
Timeline:	Begin 3rd quarter 2015, completion by 2nd quarter 2016, renewal in 2019.
Status:	New in 2015

Annex F DENVER WATER

F.1 Introduction

This annex details the hazard mitigation planning elements specific to Denver Water, a participating special district to the Douglas County LHMP Update. This annex is not intended to be a standalone document, but appends to and supplements the information contained in the base plan document. As such, all sections of the base plan, including the planning process and other procedural requirements apply to and were met by Denver Water. This annex provides additional information specific to Denver Water, with a focus on providing additional details on the risk assessment and mitigation strategy for this entity.

F.2 Planning Process

As described above, Denver followed the planning process detailed in Section 3.0 of the base plan. In addition to providing representation on the Douglas County Hazard Mitigation Planning Committee (HMPC), Denver Water formulated their own internal planning team to support the broader planning process requirements. Internal planning participants included the following Denver Water staff:

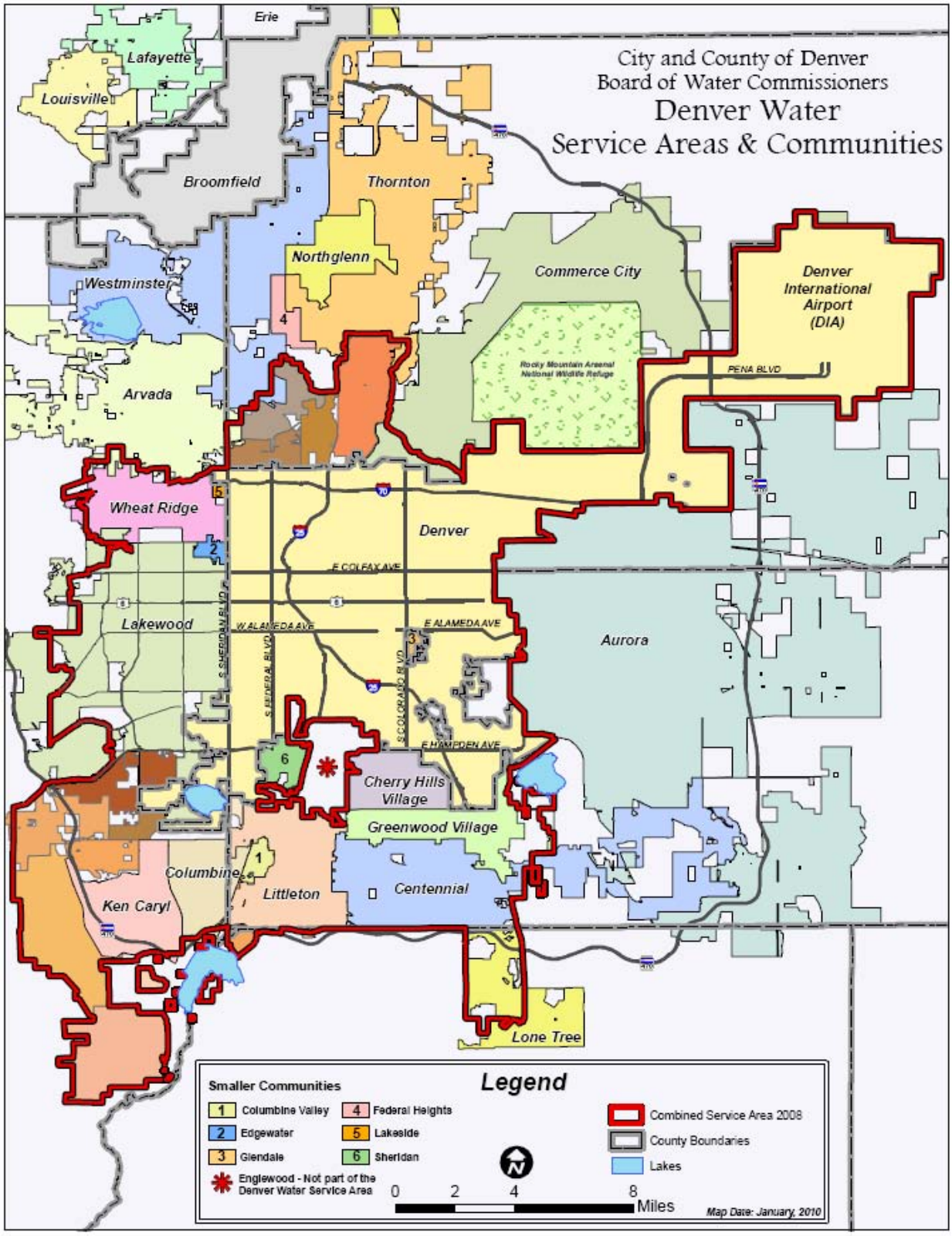
- Becky Franco, Denver Water Emergency Management

Additional details on plan participation and Denver Water representatives are included in Appendix A.

F.3 District Profile

Denver Water is an Article XX home-rule municipality governed by a board of five commissioners appointed by the Mayor as per Article X of the Denver City Charter. Denver Water provides water to approximately 1.5 million people in the Denver metropolitan area and is a property owner in Douglas County. Part of the City of Lone Tree and small area near Chatfield Reservoir lie within its service area. 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.

Figure F.1. Denver Water Service Area



F.4 Hazard Identification and Summary

Representatives of Denver Water identified the hazards that affect the District and summarized their geographic location, probability of future occurrence, potential magnitude or severity, and planning significance specific to the District and its facilities (see Table F.1). In the context of the countywide planning area, there are no hazards that are unique to Denver Water.

Table F.1. Denver Water—Hazard ID Table

Hazard	Spatial Extent	Likelihood of Future Occurrences	Magnitude /Severity	Significance
Avalanche		Low	Low	Low
Drought		High	Low	High
Earthquake		Low	Low	High
Flood: Dam Failure		Low	High	High
Flood: 100/500 year		Low	Medium	Medium
Flood: Localized/ Stormwater		Low	Low	Low
Landslides/ Mud & Debris Flows /Rockfalls		Low	Low	Low
Severe Weather: Extreme Heat		Medium	Low	Low
Severe Weather: Hail		Medium	Medium	Low
Severe Weather: High Winds		Medium	Low	Low
Severe Weather: Lightning		Medium	Low	Low
Severe Weather: Thunderstorms/Heavy Rains		Medium	Medium	Low
Severe Weather: Tornado		Medium	Low	Low
Severe Weather: Winter Weather (includes snow/ice/extreme cold)		Medium	Low	Low
Soil Hazards: Erosion & Deposition		Medium	Low	Low
Soil Hazards: Expansive Soils		Medium	Low	Low
Soil Hazards: Subsidence		Medium	Low	Low
Wildfire		High	Low	Low
Hazardous Materials: Transportation Incidents		Medium	Medium	Low

Spatial Extent
Limited: Less than 10% of planning area
Significant: 10-50% of planning area
Extensive: 50-100% of planning area

Likelihood of Future Occurrences
Low: Occurs less than once every 10 years or more
Medium: Occurs less than once every 5 to 10 years
High: Occurs once every year or up to once every five years

Magnitude/Severity
Low: Negligible property damages (less than 5% of all buildings and infrastructure) Negligible loss of quality of life. Local emergency response capability is sufficient to manage the hazard.
Medium: Moderate property damages (15% to 50% of all buildings and infrastructure) Some loss of quality of life. Emergency response capability, economic and geographic effects of the hazard are of sufficient magnitude to involve one or more counties.
High: Property damages to greater than 50% of all buildings and infrastructure. Significant loss of quality of life Emergency response capability, economic and geographic effects of the hazard are of sufficient magnitude to require federal assistance.

Significance
Low: minimal potential impact
Medium: moderate potential impact
High: widespread potential impact

F.5 Vulnerability Assessment

The intent of this section is to assess Denver Water's vulnerability separately from that of the planning area as a whole, which has already been addressed in Section 4.3 Vulnerability Assessment in the base plan. For more information about how hazards affect the County as a whole, see Chapter 4 Risk Assessment.

F.5.1 District Asset Inventory

Table F.2 lists critical facilities and other community assets identified by the District as important to protect in the event of a disaster.

Table F.2. Denver Water—Critical Facilities and Other Community Assets

Name of Asset	Facility Type	Replacement Value	Hazard Specific Info/Comments
Cheesman Dam and Reservoir	Dam and reservoir	$300 million	
Cheesman Dam Valve House	Valve house	$30 million	
Conduit 20 Diversion Dam (Marston Intake Dam)	Dam	$15 million	
Conduit 26	Conduit	$4 million (1,900 ft buried pipe)	
Foothills Spray Application Pump Station	Pump station	$1 million	
Foothills Treatment Plant	Treatment Plant	$600 million	
Foothills Overflow Holding Pond	Pond	$5 million	
High Line Canal Diversion Dam	Dam	$5 million	
High Line Canal Waterton Canyon	Canal		
Lone Tree Pump Station	Pump station	$10 million	
Lone Tree Treated Reservoir No. 1	Reservoir		
Lone Tree Treated Reservoir No. 2	Reservoir		
Platte Canyon Dam and Reservoir	Dam and reservoir	$25 million	
Strontia Springs Dam and Reservoir	Dam and reservoir	$400 million	

Sources: Denver Water

F.5.2 Priority Hazards: Vulnerability Assessment

This section examines those existing and future structures and other assets at risk to hazards ranked of medium or high significance that vary from the risks facing the entire planning area and estimates potential losses. The medium and high significance hazards for Denver Water include drought, earthquake, dam failure, and 100/500-year flooding.

An estimate of the vulnerability of Denver Water to each identified hazard, in addition to the estimate of risk of future occurrence, is provided in each of 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.
- **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.

Drought

Vulnerability to Drought

Likelihood of Future Occurrence—High
Potential Magnitude—Low
Overall Vulnerability—High

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.

The most significant qualitative impacts associated with drought in Denver Water are those related to water intensive activities such as wildfire protection and municipal usage. Mandatory conservation measures are typically implemented by the municipalities 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 Denver Water's service area within Douglas County. Some factors to consider include the impacts of drawdown of the groundwater table. In early 2015, Denver Water met with Douglas County, the South Metro Water, Infrastructure and Supply (WISE) Authority, and Aurora to discuss reserving a certain amount of WISE Project water for Douglas County to reduce the latter's dependence on groundwater. The County can choose to make the reserved water available if needed between now and January 2021.[1]

[1] Denver Water Board of Commissioners meeting summary, January 28, 2015. http://www.denverwater.org/docs/assets/F81AC0D6-FD97-FC5D-040C55F6AAEAC255/II-B-1.pdf, accessed April 6, 2015.

Development Trends

Drought vulnerability will increase with future development as there will be increased demands for limited water resources. Denver Water can mitigate drought impact by supporting water conservation measures such as water use audits, wastewater reuse, and water efficient transmission.

Earthquake

Vulnerability to Earthquake

Likelihood of Future Occurrence—Low
Potential Magnitude—Low
Overall Vulnerability—High

Ground shaking is the primary earthquake hazard, but cascading impacts can include landslides, rockfall, dam failure and ground failure. 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).

Potential earthquake impacts specific to Denver Water were not available but the primary concern is damage to water infrastructure and dams. The HAZUS-MH 2.1 analysis provided in Section 4.3.4 in the base plan is countywide and does not differentiate water infrastructure impacts specific to Denver Water. HAZUS does indicate an estimated $316M in potable water systems within the County. The 2,500 year probabilistic analysis results in 64 potable water pipeline leaks and 16 water pipeline breaks.

Development Trends

Damage to dams caused by earthquakes would be of particular concern to the District. Utilizing high development standards for dams and developing and exercising EAPs can help mitigate the impact of damages caused by earthquakes.

Flood: Dam Failure

Vulnerability to Dam Failure

Likelihood of Future Occurrence—Low
Potential Magnitude—High
Overall Vulnerability—High

A catastrophic dam failure would challenge local response capabilities and require timely evacuations to save lives in Denver Water's service area. 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. The economic impacts of a failure of a Denver Water-owned dam to the district would be considerable, in addition to water supply consequences that could impact multiple jurisdictions.

Development Trends

Flooding due to a dam failure event is likely to exceed the special flood hazard areas regulated through local floodplain ordinances. Denver Water should work with municipalities that are considering permitting development downstream of the high and significant hazard dams in Douglas County. 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.

Flood: 100/500-Year

Vulnerability to 100/500-Year Flooding

Likelihood of Future Occurrence—Low
Potential Magnitude—Medium
Overall Vulnerability—Medium

The Planning Area, including Denver Water's service area within the County, is prone to very intense rainfall. Floods have resulted from storms covering large areas with heavy general rainfall as well as from storms covering small area with extremely intense rainfall. For specific details on flooding issues in the City of Lone Tree within the service area, refer to Annex D.

Development Trends

The risk of flooding to future development can be minimized through flood ordinances and zoning. The individual municipalities ultimately have authority over these ordinances. Denver Water can utilize GIS mapping and floodplain mapping to ensure that future facilities are located outside of flood hazard areas.

Wildfire

Vulnerability to Wildfire

Likelihood of Future Occurrence—High
Potential Magnitude—Low

Overall Vulnerability—Low

Watersheds and the numerous associated reservoirs in Denver Water's service area in Douglas County could be significantly impacted by high severity wildfire. 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.

Watersheds can be considered as assets in their own right. Consultation with those water supply agencies with facilities, reservoirs, and properties should be included in mitigation discussions, and are in fact required to take part since the passage of Colorado House Bill 09-1162. Further consultation with members of a Burned Area Emergency Response Team may provide further guidance in mitigating and preparing for the effects of wildfire in a watershed.

Large wildfires have occurred in Denver Water's service area in Douglas County. From May 21-29, 2002, the Schoonover Fire burned 23 acres of Denver Water property near Cheesman Reservoir. In June of that same year, the Hayman Fire burned 4,245 acres of Denver Water property. More recently, the Foothills Fire burned four acres of Denver Water property near the Foothills Water Treatment Plant on July 4, 2014.

Development Trends

Continued growth of Douglas County's population will generally mean an expanded WUI and potential exposure of buildings, water infrastructure, and people. Additional water infrastructure in the WUI should be built with fire resistance in mind.

F.5.3 Growth and Development Trends

Denver Water does not have authority to manage growth or development within its district.

F.6 Capability Assessment

Capabilities are the programs and policies currently in use to reduce hazard impacts or that could be used to implement hazard mitigation activities. The capabilities assessment is divided into five sections: regulatory mitigation capabilities, administrative and technical mitigation capabilities, fiscal mitigation capabilities, mitigation outreach and partnerships, and other mitigation efforts.

F.6.1 Regulatory Mitigation Capabilities

Regulatory mitigation capabilities include the planning and land management tools typically used by local jurisdictions to implement hazard mitigation activities. Table F.3 lists planning and land management tools typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place in Denver Water. Many of the regulatory capabilities used by local jurisdictions are not applicable to Denver Water.

Table F.3. Denver Water Regulatory Mitigation Capabilities

Regulatory Tool (ordinances, codes, plans)	Y/N	Date	Comments
Comprehensive plan	N/A		
Zoning ordinance	N/A		
Subdivision ordinance	N/A		
Growth management ordinance	N/A		
Floodplain ordinance	N/A		
Other special purpose ordinance (stormwater, steep slope, wildfire)	N/A		
Building code	N/A		
BCEGS Rating			
Fire department ISO rating	N/A		
Erosion or sediment control program	N/A		
Stormwater management program	N/A		
Site plan review requirements	N/A		
Capital improvements plan	Yes		
Economic development plan	N/A		
Local emergency operations plan	Yes	8/2010	Denver Water implemented a new emergency management program for their utility to develop a comprehensive EM program that interfaces with all county EMS.
Community Wildfire Protection Plans			
Flood insurance study or other engineering study for streams	N/A		
Elevation certificates	N/A		
Other			Drought Response Plan All high hazard dams are required to have Emergency Action Plans (EAPs). Also have treatment and distribution plans.

Source: Amec Foster Wheeler Data Collection Guide

F.6.2 Administrative/Technical Mitigation Capabilities

Table F.4 identifies the personnel responsible for activities related to mitigation and loss prevention in Denver Water.

Table F.4. Denver Water Administrative and Technical Mitigation Capabilities

Personnel Resources	Yes/No	Department/Position	Comments
Planner/Engineer with knowledge of land development/land management practices			

Personnel Resources	Yes/No	Department/Position	Comments
Engineer/Professional trained in construction practices related to buildings and/or infrastructure	Y	Engineering	
Planner/Engineer/Scientist with an understanding of natural hazards	Y	Planning/Emergency Management	
Personnel skilled in GIS	Y	GIS/IT	
Full time building official			
Floodplain Manager	1	Emergency Management Section	
Emergency Manager	2	Emergency Management Section	
Grant writer			
Other personnel			
GIS Data – Hazard areas			
GIS Data - Critical facilities	Y		
GIS Data – Building footprints			
GIS Data – Land use			
GIS Data – Links to Assessor's data			
Warning Systems/Services (Reverse 9-11, cable override, outdoor warning signals)	1	Emergency Management Section	
Other			

Source: Amec Foster Wheeler Data Collection Guide

F.6.3 Fiscal Mitigation Capabilities

Fiscal mitigation capabilities are financial tools or resources that Denver Water could or already does use to help fund mitigation activities. Denver Water has received funding for watershed improvements from the Colorado State Forest Service.

F.6.4 Mitigation Outreach and Partnerships

Denver Water has public education programs related to water conservation, drought response, water quality, and a very active youth education program focusing on a variety of water-related topics. Additionally, Denver Water has a public affairs division that provides media relations, social media, marketing, publications, internal communication, stakeholder relations, government relations, community outreach, and website communications for both our combined service area of 1.3 million people and for the communities where Denver Water's watersheds and facilities are located.

F.6.5 Past Mitigation Efforts

Denver Water has partnered with USFS to improve forest and watershed conditions in parts of Colorado by implementing hazardous fuels treatments and removing hazardous biomass. Forests play a role in protecting areas important to surface drinking water. USFS maps these areas using

GIS before working with Denver Water on fuels treatment projects. This effort is part of the Forests to Faucets program.

F.7 Mitigation Goals and Objectives

Denver Water has adopted the hazard mitigation goals and objectives developed by the HMPC and described in Chapter 5 Mitigation Strategy.

F.8 Mitigation Actions

The planning team for Denver Water identified and prioritized the following mitigation actions based on the risk assessment and in accordance with the process outline in Section 5, Mitigation Strategy, of the base plan. Background information and information on how each action will be implemented and administered, such as ideas for implementation, responsible office, potential funding, estimated cost, and timeline are also included. General processes and information on plan implementation and maintenance of this LHMP by all participating jurisdictions is included in Section 7, Plan Implementation and Maintenance, of the base plan.

Denver Water Action #1

Action Title:	**Flood inundation maps**
Priority:	High
Project Description, Issue & Background:	New maps of Cheesman, Strontia, Platte Canyon and Robert's Tunnel reservoirs need to be updated to include the FEMA and FERC requirements of high waters, 100/500 storm waters, etc. and this will include a hydrology study and the critical infrastructure.
Ideas for Implementation:	
Other Alternatives:	No action
Responsible Agency:	Denver Water
Partners:	Douglas County OEM/GIS
Potential Funding:	Yes
Cost Estimate:	$80,000
Benefits: (Losses Avoided)	Pre-planning efforts for catastrophic dam failure. Warning, evacuation planning, etc.
Timeline:	2016-2021
Status:	New in 2015

Denver Water Action #2

Action Title:	**Watershed protection**
Priority:	High
Project Description, Issue & Background:	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.
Ideas for Implementation:	
Other Alternatives:	No action
Responsible Agency:	Denver Water
Partners:	Including both what the USFS is paying for and what DW is contributing
Potential Funding:	Yes
Cost Estimate:	
Benefits: (Losses Avoided)	Reduce potential frequency and magnitude of wildfires in project area
Timeline:	Completed through 2017 or earlier.
Status:	New in 2015

Denver Water Action #3

Action Title:	**Watershed protection**
Priority:	Medium
Project Description, Issue & Background:	Roll out emergency response plan training and conduct tabletop and functional exercises with local first response agencies at the Foothills treatment plant.
Ideas for Implementation:	
Other Alternatives:	No action
Responsible Agency:	Denver Water
Partners:	Douglas County OEM/Sheriff/West Metro Fire
Potential Funding:	Yes
Cost Estimate:	$10,000
Benefits: (Losses Avoided)	Pre-planning and response coordination
Timeline:	To be completed between 2016-2020
Status:	New in 2015

Denver Water Action #4

Action Title:	**Public education and outreach**
Priority:	Medium
Project Description, Issue & Background:	Continue with public education and outreach efforts on dam safety, water conservation, drought, etc. Producing presentations, brochures, etc.
Ideas for Implementation:	
Other Alternatives:	No action
Responsible Agency:	Denver Water
Partners:	Douglas County OEM
Potential Funding:	Yes
Cost Estimate:	Low
Benefits: (Losses Avoided)	Pre-planning and response coordination
Timeline:	To be completed between 2016-2020
Status:	New in 2015

Denver Water Action #5

Action Title:	**Sediment removal from Strontia Springs Dam**
Priority:	Low to Medium
Project Description, Issue & Background:	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.
Ideas for Implementation:	Install new slide gates on the upstream and downstream sides of the river bypass tunnel which was left in place after the construction of the dam. Once the gates are in place, the concrete plug within the tunnel can be removed and the reservoir will be flushed to remove accumulated sediment. The flushing can then occur on regular intervals to control the level of sediment accumulation.
Other Alternatives:	No action
Responsible Agency:	Denver Water
Partners:	City of Aurora
Potential Funding:	Yes
Cost Estimate:	$8,000,000
Benefits: (Losses Avoided)	Pre-planning and response coordination
Timeline:	Estimated completion between 2016-2021, pending modeling to confirm idea above and any necessary permitting.
Status:	New in 2015

Denver Water Action #6

Action Title:	**Defensible space in Waterton Canyon**
Priority:	Low to Medium
Project Description, Issue & Background:	To establish defensible space around critical infrastructure on Denver Water properties located in Waterton Canyon.
Ideas for Implementation:	
Other Alternatives:	No action
Responsible Agency:	Denver Water
Partners:	
Potential Funding:	Yes
Cost Estimate:	$10,000
Benefits: (Losses Avoided)	Reduce wildfire risk and magnitude
Timeline:	Estimated completion between 2016-2021
Status:	New in 2015