



Adams County Hazard Mitigation Plan

August 2020



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1 Introduction

1.1 Executive Summary

The purpose of hazard mitigation is to reduce or eliminate long-term risk to people and property from disasters or hazard events. Studies have found that hazard mitigation is extremely cost-effective, with every dollar spent on mitigation saving an average of \$6 in avoided future losses. Adams County and its participating jurisdictions developed this hazard mitigation plan to reduce future losses to the County and its communities from natural and human-caused hazards.

This plan builds on the 2004 and 2011 Denver Regional Natural Hazard Mitigation Plans developed by the Denver Regional Council of Governments (DRCOG), as well as the 2014 Imagine Adams County Comprehensive Plan. This updated Plan will be integrated into the next update of the County's Comprehensive Plan.

The 2020 Adams County Hazard Mitigation Plan is a multi-jurisdictional plan that includes the following communities and special districts:

- Adams County
- Town of Bennett
- City of Brighton
- City of Commerce City
- Denver Water

Details of how the risk and vulnerability varies for these jurisdictions, along with their proposed mitigation actions, are included in jurisdictional **Annexes**. Information on other Adams County communities has been included in the plan where feasible.

The County's planning process followed a methodology prescribed by FEMA, which began with the reconvening of the Hazard Mitigation Planning Committee (HMPC) comprised of key participants from Adams County agencies, participating jurisdictions, neighboring counties and stakeholders, and state and federal agencies. The planning process is described in detail in **Section 3**.

The risk and vulnerability assessment associated with these hazards is captured in **Section 4**. The previous mitigation plans mentioned above identified and profiled several natural hazards that have the potential to impact the County, and these were updated. For the 2020 update, the HMPC elected to include a number of human-caused hazards of concern to the County. While climate change was not profiled as a separate hazard, the potential impacts of climate change on each of the above hazards is addressed in each hazard profile. All these hazards were analyzed based on their geographic location, probability of future occurrence, and magnitude or severity, and then ranked based on the overall significance they pose to Adams County.

The following hazards were ranked as high significance:

- Thunderstorms
- Tornado/Damaging Wind
- Winter Weather

The following hazards were ranked as medium significance:

- Flood
- Dam Failure/Incident
- Drought
- Hazardous Materials Incident

The following hazards were ranked as low significance:

- Cyber Incident
- Earthquake
- Subsidence
- Terrorism/Active Shooter
- Wildfire

An assessment of the County's mitigation capabilities was conducted to evaluate programs and policies currently in use to reduce hazard impacts or that could be used to implement hazard mitigation activities, as well as to identify opportunities for enhancement. This capability assessment is detailed in **Section 5**.

Section 6 describes the mitigation strategy the HMPC developed to address vulnerabilities identified in the risk assessment. The HMPC developed the following goals for reducing risk from hazards:

Goal 1: Increase community awareness of Adams County's vulnerability to natural and human-caused hazards

Goal 2: Reduce vulnerability to, and protect people, property, and the environment from natural and human-caused hazards

Goal 3: Increase internal capabilities and coordination to reduce the impacts to natural and human-caused hazards

Goal 4: Strengthen communication and coordination among public agencies, NGO's, businesses, and residents

Objectives for implementing these goals were also developed, along with a broad range of targeted mitigation actions.

This Plan is meant to be a living document that guides and integrates mitigation activities throughout the County. **Section 7** provides an overview of the strategy for plan implementation and maintenance, and outlines the method and schedule for monitoring, evaluating, and updating the Plan. This plan will be revised and updated every five years in accordance with FEMA guidelines.

The 2020 Adams County Hazard Mitigation Plan had been formally adopted by the governing bodies of Adams County and the participating jurisdictions listed above. Records of adoption can be found in **Appendix C**.

1.2 Purpose

Adams County and several participating jurisdictions have prepared this updated local hazard mitigation plan to guide hazard mitigation planning, in order to make the County more disaster resistant and to better protect the people and property of the County from hazard events. This plan demonstrates the communities' commitment to reducing risks from hazards and serves as a tool to help decision makers direct mitigation activities and resources.

Information in this plan will be used to help guide and coordinate mitigation activities and decisions for local land use policy in the future. Proactive mitigation planning will help reduce the cost of disaster response and recovery to communities and their residents by protecting critical community facilities, reducing liability exposure, and minimizing overall community impacts and disruptions. The Adams County planning area has been affected by hazards in the past and is thus committed to reducing future impacts from hazard events and becoming eligible for mitigation-related federal funding.

This plan was also developed to make and maintain Adams County's and participating jurisdiction's eligibility for certain federal disaster assistance, specifically the Federal Emergency Management Agency's (FEMA), Hazard Mitigation Assistance (HMA) grants including the Hazard Mitigation Grant Program (HMGP), Flood Mitigation Assistance (FMA), and Building Resilient Infrastructure and Communities (BRIC) grant program, as well as the Rehabilitation of High Hazard Potential Dam grant program (HHPD).

1.3 Background & Scope

Each year in the United States, natural disasters take the lives of hundreds of people and injure thousands more. Nationwide, taxpayers pay billions of dollars annually to help communities, organizations, businesses, and individuals recover from disasters. These monies only partially reflect the true cost of disasters, because additional expenses to insurance companies and nongovernmental organizations are not reimbursed by tax dollars. Many natural disasters are predictable, and much of the damage caused by these events can be alleviated or even eliminated.

Hazard mitigation is defined by FEMA as "any sustained action taken to reduce or eliminate long-term risk to human life and property from a hazard event." A congressionally mandated independent study assessing future savings from mitigation activities determined that mitigation activities are highly cost-effective; on average, each dollar spent on mitigation saves society an average of \$6 in avoided future losses in addition to saving lives and preventing injuries (Natural Hazard Mitigation Saves: 2017 Interim Report).

Hazard mitigation planning is the process through which hazards that threaten communities are identified, likely impacts of those hazards are determined, mitigation goals are set, and appropriate strategies to lessen impacts are determined, prioritized, and implemented. This plan documents the planning process that was followed, analyzes relevant hazards and vulnerabilities, assesses mitigation capabilities, and identifies strategies the County and participating jurisdictions will use to decrease vulnerability and increase resiliency in Adams County.

This plan builds on previous mitigation planning in Adams County going back more than 15 years, first with the 2004 Denver Regional Council of Governments (DRCOG) Regional Hazard Mitigation Plan; the 2011 update of that plan; and the 2014 Imagine Adams County Comprehensive Plan which incorporated mitigation planning throughout the document. The plan is intended to be a living document through ongoing implementation and regular updates, and will be integrated into the County's next Comprehensive Plan update.

1.4 Multi-Jurisdictional Planning

The 2020 Adams County Mitigation Plan is a multijurisdictional plan that geographically covers everything within Adams County's jurisdictional boundaries (hereinafter referred to as the planning area). The following communities and special districts participated fully throughout the planning process:

- Adams County
- City of Brighton
- City of Commerce City
- Town of Bennett
- Denver Water

Each jurisdiction developed its own annex, which provides a more detailed assessment of the jurisdiction's unique risks as well as their mitigation strategy to reduce long-term losses. Each jurisdictional annex contains the following:

- Community profile summarizing geography and climate, history, economy, population growth and development trends

- Hazard information on location, previous occurrences, probability of future occurrences, climate change considerations, and magnitude/severity (extent) for each hazard
- Hazard map(s) at an appropriate scale for the jurisdiction, if available
- Number and value of buildings, critical facilities, and other community assets located in hazard areas, if available
- Vulnerability information in terms of future growth and development in hazard areas
- A capability assessment describing existing regulatory, administrative, technical, and fiscal resources and tools as well as outreach efforts and partnerships and past mitigation projects. Includes an assessment of opportunities to enhance existing capabilities as well.
- Mitigation actions specific to the jurisdiction, including a review of previous actions from the 2014 plan and progress made on implementation.

The following additional jurisdictions in the planning area participated in the planning process as stakeholders. These jurisdictions are already included in other FEMA-approved hazard mitigation plans, and therefore chose not to “fully” participate in this plan update as defined by FEMA. Information from these stakeholder jurisdictions has been into the 2020 Adams County Plan where feasible.

- City of Arvada (covered by the 2016 Jefferson County HMP)
- City of Aurora (covered by the 2016 City of Aurora HMP)
- City of Federal Heights (covered by the 2017 Thornton, Federal Heights, and Northglenn HMP)
- City of Northglenn (covered by the 2017 Thornton, Federal Heights, and Northglenn HMP)
- City of Thornton (covered by the 2017 Thornton, Federal Heights, and Northglenn HMP)
- City of Westminster (covered by the 2018 City of Westminster HMP)

2 Community Profile

Located on the northern edge of the Denver metropolitan area, Adams County is the 5th most populous county in Colorado, and 39th largest in terms of size. Adams County is part of the Denver–Aurora–Lakewood, CO Metropolitan Statistical Area.

2.1 County History

In 1901, the Colorado General Assembly voted to split what was then Arapahoe County into three parts: a new Adams County, a new consolidated City and County of Denver, and the remainder of the Arapahoe County to be renamed South Arapahoe County. Adams County was named after Alva Adams, a popular governor who was in office at the time. A ruling by the Colorado Supreme Court, subsequent legislation, and a referendum delayed the creation of Adams County until November 15, 1902. The first meeting of the Adams County Board of Commissioners was held Dec. 4, 1902, in Brighton. Governor James Bradley Orman designated Brighton as the temporary Adams County Seat; this was made permanent by popular vote on November 8, 1904.

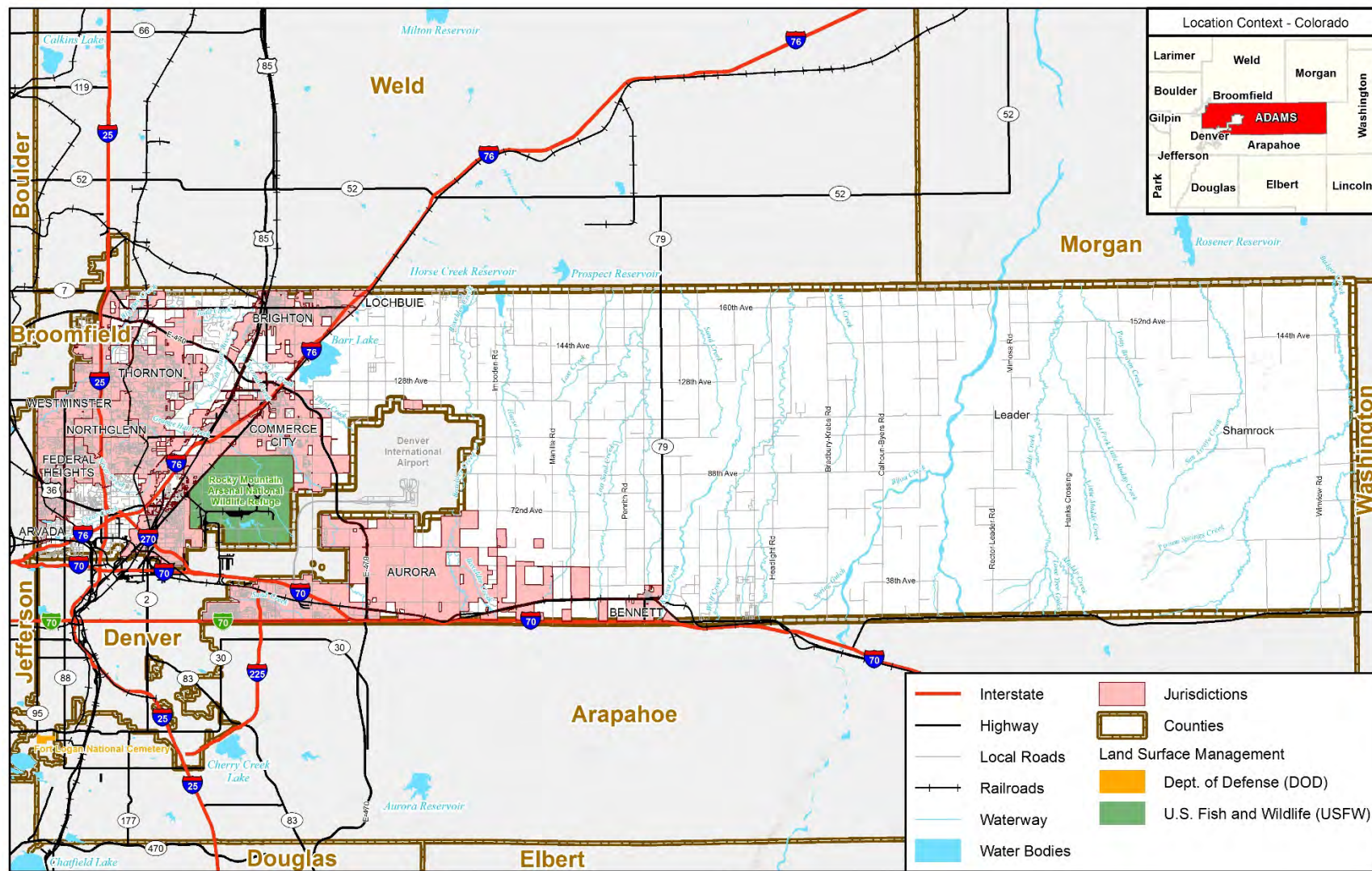
Adams County originally stretched 160 miles from present-day Sheridan Boulevard to the Kansas state border. On May 12, 1903, the eastern 88 miles of Adams County was transferred to the new Washington County and the new Yuma County, reducing the length of Adams County to the present 72 miles.

A 1989 vote transferred 53 square miles of Adams County to the City and County of Denver for the Denver International Airport, leaving the densely populated western portion of the county as two oddly shaped peninsulas. Adams County lost the tip of its northwest corner when the consolidated City and County of Broomfield was created on November 15, 2001.

2.2 Geography

Adams County contains a total of 1,185 square miles (759,000 acres). The County stretches approximately 17 miles in latitude (north to south) and is approximately 72 miles wide (east to west). Adams County is bordered to the south by the City & County of Denver and Arapahoe County; to the west by Jefferson County and the City & County of Broomfield, to the north by Weld County, and to the east by Morgan and Washington Counties.

Figure 2-1 Adams County



wood.

Map compiled 9/2019;
intended for planning purposes only.
Data Source: Adams County GIS,
Colorado Information Marketplace,
CO BLM, ESRI World Terrain Map

0 15 30 Miles



2.3 Cities and Communities

Eight incorporated cities and two towns are wholly or partially located in Adams County:

- City of Arvada (part in Jefferson County)
- City of Aurora (part in Arapahoe & Douglas Counties)
- City of Brighton (part in Weld County)
- City of Commerce City
- City of Federal Heights
- City of Northglenn (part in Weld County)
- City of Thornton (part in Weld County)
- City of Westminster (part in Jefferson County)
- Town of Bennett (part in Arapahoe County)
- Town of Lochbuie (part in Weld County)

Adams County also includes the following unincorporated communities:

- Berkley
- Derby
- Henderson
- North Washington
- Shaw Heights
- Sherrelwood
- Strasburg (mostly in Arapahoe Co.)
- Todd Creek
- Twin Lakes
- Watkins (mostly in Arapahoe Co.)
- Welby

The County is served by 10 fire districts, 12 school districts, and 45 water and sanitation districts.

Colleges and universities located within Adams County include:

- University of Colorado Denver Anschutz Medical Campus
- Colorado State University Extension
- Front Range Community College – Brighton Center
- Front Range Community College – Westminster campus

2.4 Demographics

This section was updated using data from the U.S. Census Bureau's 2012-2017 American Community Survey (ACS) 5-Year Estimates, and the Colorado State Demography Office.

As of 2017, the U.S. Census Bureau estimated Adams County's total population at 487,850. This constitutes a 10% increase in population since 2012 (442,996), and a 169% increase since 1970 (187,062). Since 2000, the County's growth has come equally from natural change (49.1%) and from migration (49.7%). Table 2-1 below lists population estimates for each jurisdiction and shows how they have changed in the last five years.

Table 2-2 and Table 2-3 show several key demographic and social characteristics of Adams County, how those characteristics have changed over the last five years, and how those characteristics compare to the rest of the state and nation.

Table 2-1 Adams County Population Change, 2012-2017

Jurisdiction	2012	2013	2014	2015	2016	2017	Growth 2012-2017
Adams County	442,996	452,030	461,558	471,206	479,977	487,850	10%
Arvada	106,965	108,300	109,800	111,658	113,532	115,320	8%
Aurora	326,249	332,820	339,480	345,867	351,131	357,323	10%
Bennett	1,996	1,900	1,898	1,915	2,097	2,291	15%
Brighton	33,219	34,247	35,004	35,582	36,307	38,016	14%
Commerce City	45,537	47,239	48,792	50,346	51,731	52,905	16%
Federal Heights	11,598	11,654	11,835	12,037	12,173	12,449	7%
Lochbuie	4,799	4,947	5,127	5,222	5,367	5,675	18%
Northglenn	35,958	36,471	37,075	37,754	38,128	38,473	7%
Thornton	118,747	121,814	124,707	127,688	130,511	132,310	11%
Westminster	106,750	108,042	109,296	110,598	111,770	111,895	5%
Colorado	5,042,853	5,119,329	5,197,580	5,278,906	5,359,295	5,436,519	8%

Source: U.S. Census Bureau American Community Survey, www.census.gov/.

Table 2-2 Adams County Demographic and Social Characteristics, 2012-2017

Adams County	2012	2017	% Change
Population	442,996	487,850	10.1%
Median Age	32.4	33.4	3.1%
Total Housing Units	163,245	169,275	3.7%
Housing Occupancy Rate	92.5%	96.0%	3.8%
% of Housing Units with no Vehicles Available	4.8%	5.3%	10.4%
Median Home Value	\$188,100	\$241,900	28.6%
Unemployment	9.5%	5.1%	-46.3%
Mean Travel Time to Work (minutes)	28.3	29.2	3.2%
Median Household Income	\$56,633	\$64,087	13.2%
Per Capita Income	\$24,357	\$27,487	12.9%
% of Individuals Below Poverty Level	14.2%	12.2%	-14.1%
% Without Health Insurance	21.0%	13.4%	-36.2%
# of Households	151,034	162,508	7.6%
Average Household Size	2.91	2.98	2.4%
% of Population Over 25 with high school diploma	81.1%	82.6%	1.8%
% of Population Over 25 with bachelor's degree or higher	20.7%	23.1%	11.6%
% with Disability	9.5%	10.7%	12.6%
% Speak English less than "very well"	13.5%	11.5%	-14.8%

Source: U.S. Census Bureau American Community Survey www.census.gov/

Table 2-3 Demographic and Social Characteristics Compared to the State and Nation

Demographic & Social Characteristics (as of 2017)	County	Colorado	U.S.
Median Age	33.4	36.5	37.8
Housing Occupancy Rate	96.0%	89.8%	87.8%
% of Housing Units with no Vehicles Available	5.3%	5.3%	8.8%
Median Home Value	\$241,900	\$286,100	\$193,500
Unemployment	5.1%	5.2%	6.6%
Mean Travel Time to Work (minutes)	29.2	25.2	26.4
Median Household Income	\$64,087	\$65,458	\$57,652
Per Capita Income	\$27,487	\$38,845	\$31,177
% of Individuals Below Poverty Level	12.2%	11.5%	14.6%
% Without Health Insurance	13.4%	9.4%	10.5%
Average Household Size	2.98	2.55	2.63
% of Population Over 25 with high school diploma	82.6%	91.1%	87.3%
% of Population Over 25 with bachelor's degree or higher	23.1%	39.4%	30.9%
% with Disability	10.7%	10.6%	12.6%
% Speak English less than "very well"	11.5%	6.0%	8.5%

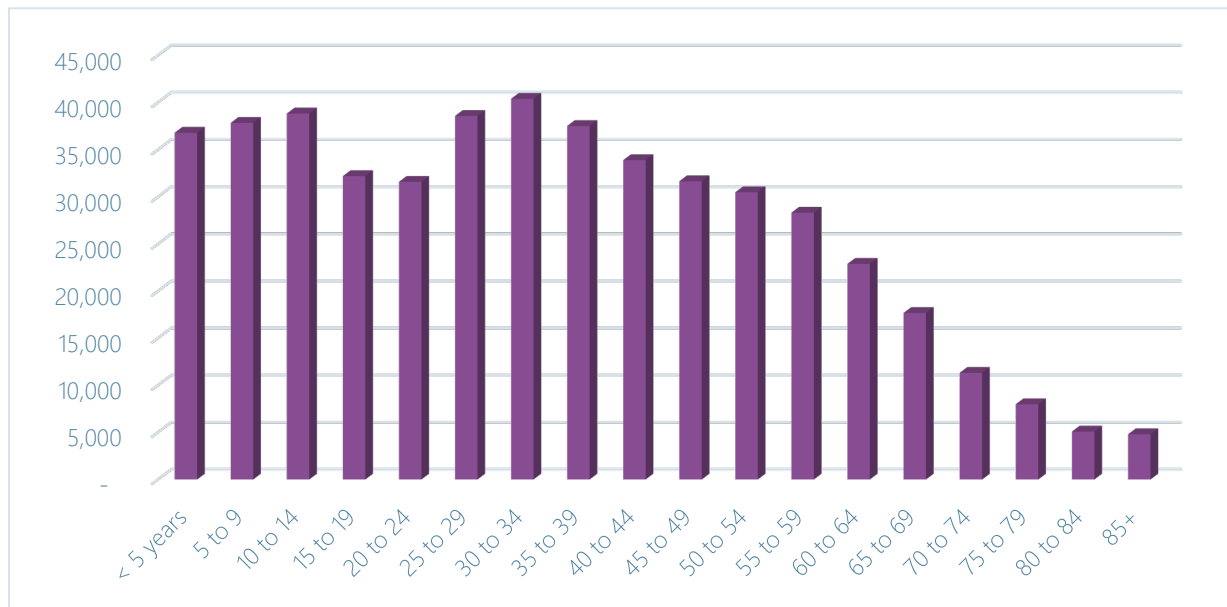
Source: U.S. Census Bureau American Community Survey www.census.gov/

Table 2-4 and Figure 2-2 break down the demographics of the county by sex, race, and age.

Table 2-4 Demographics by Race and Sex

Adams County	Population	%
Total Population	487,850	
Male	245,840	50.4%
Female	242,010	49.6%
White, not Hispanic	249,239	51.1%
Hispanic or Latino	191,857	39.3%
Black	15,681	3.2%
Asian	19,067	3.9%
American Indian and Alaska Native	5,843	1.2%
Native Hawaiian and Other Pacific Islander	604	0.1%
Some other race	25,235	5.2%
Two or more races	17,023	3.5%

Source: U.S. Census Bureau American Community Survey www.census.gov/

Figure 2-2 Adams County Population by Age

Source: U.S. Census Bureau American Community Survey www.census.gov/

Housing Characteristics

The table below presents the 2017 American Community Survey estimates for types of housing units.

Table 2-5 Types and Total Amounts of Housing Units in Adams County

Type of housing units	Total	Percentage
Total housing units	169,275	
1-unit detached	105,653	62.4%
1-unit attached	12,400	7.3%
2 units	1,459	0.9%
3 or 4 units	4,423	2.6%
5 to 9 units	7,947	4.7%
10 to 19 units	12,029	7.1%
20 or more units	14,578	8.6%
Mobile home	10,684	6.3%
Boat, RV, van, etc.	102	0.1%

Source: U.S. Census Bureau American Community Survey www.census.gov/

According to the 2017 American Community Survey, Adams county had 169,275 total housing units, of which 162,508 (96.0%) were occupied. 64.8% of the occupied housing units were owner-occupied and 35.2% renter-occupied. More than half the total housing units (56%) were built in 1980 or later, and more than a quarter (27%) were built in 2000 or later. Half of residents (50%) had been in their current housing for eight years or less. Only 5.3% of occupied housing units have no vehicles available for private use, which is on par with the state average (5.3%) but well below the national average (8.8% respectively). 73.6% of occupied housing units use utility gas for heating, with another 23.8% using electric heating.

Housing Costs: The median value of owner-occupied housing units in 2017 was \$241,900, a 28.6% increase since 2012; this is below the statewide average for Colorado (\$286,100) but well above the national average (\$193,500). More than 76% of owner-occupied units were valued between \$150,000 and \$500,000. Most owner-occupied units had a mortgage (76.4%), with a median mortgage payment of

\$1,559 per month. 29.5% of owner-occupied mortgaged homes paid more than 30% of their household income on housing.

The median rent cost in 2017 was \$1,172 with 90% falling between \$500 and 2,000 a month. 51.2% of renters were paying 30% or more of their income on housing.

Households and Families: Out of 162,508 total households in 2017, 115,202 (70.9%) were family households. The average household size was 2.98 persons, although the average family size was 3.51.

Income and Employment: The median household income in 2017 was \$64,087, a 13.2% increase over 2012; this is below the statewide average of \$65,458. Per capita income increased similarly during this period, from \$24,357 to \$27,487 (12.9%). There were 260,199 people in the labor force with an unemployment rate of 5.1%, down sharply from 9.5% in 2012. Figure 2-3 shows the breakdown of households earning different income levels in the County as of 2017.

Figure 2-3 Income Distribution in Adams County



Source: U.S. Census Bureau American Community Survey www.census.gov/

Poverty: In 2017, 12.2% of Adams County residents lived in poverty, a decrease of 14.1% since 2012. 16.4% of children under 18 were below the poverty level, compared with 8.5% of people 65 years old and over. 9.3% of families had incomes below the poverty level, although that number increases to 23.8% for families with a female householder and no adult male present.

Language: Among people at least five years old living in Adams County in 2017, 71.4% spoke primarily English at home. Spanish was spoken in 23.3% of homes, followed by Asian and Pacific Islander languages (2.9%) and other Indo-European languages (1.8%). 11.5% of households reported they spoke English less than "very well", which is above the statewide and national averages (6.0% and 8.5% respectively).

Education: In 2017, 82.6% of people 25 years and over had at least graduated from high school, and 23.1% had a bachelor's degree or higher; both of these are increases since 2012 (1.8% and 11.6% respectively), but are still below average for Colorado and the Nation. The total school enrollment in Adams County was 129,656. Nursery school and kindergarten enrollment was 15,621 and elementary through high school enrollment was 89,910 children. College or graduate school enrollment was 24,125.

People with Disabilities: 51,764 persons (10.7%) were living with some form of disability in 2017. This was a 12.6% increase from 2012 and is close to statewide averages (10.6%) and slightly below the national average (12.6%).

Health Insurance Coverage: As of 2017, 13.4% of residents had no health insurance coverage, including 16.6% of employed individuals and 37.0% of unemployed individuals. Of those with health insurance, 62.6% had private insurance and 32.1% had public insurance.

2.5 Social Vulnerability

Social vulnerability refers to a community's capacity to prepare for and respond to the stress of hazardous events ranging from natural disasters, such as tornadoes or disease outbreaks, to human caused threats, such as toxic chemical spills. Social vulnerability considerations were included in this plan update to identify areas across the County that might be more vulnerable to hazard impacts based on a number of factors.

The Center for Disease Control and Prevention (CDC) has developed a social vulnerability index (SoVI) as a way to measure the resilience of communities when confronted by external stresses such as natural or human-caused disasters or disease outbreaks. The SoVI is broken down to the census tract level, and provides insight into particularly vulnerable populations to assist emergency planners and public health officials identify communities more likely to require additional support before, during, and after a hazardous event. The SoVI index combines four main themes of vulnerability, which are in turn broken down into subcategories for a total of 15 vulnerability factors. Table 2-6 displays those 15 factors and shows how Adams County compares to other counties in Colorado and nationally. The rankings show the percentage of counties that Adams County is more vulnerable than, i.e. – high numbers are worse.

Table 2-6 Social Vulnerability in Adams County

Theme	Variable	Ranking Compared to Colorado Counties	Ranking Compared to US Counties	Vulnerability
Socioeconomic status		65%	40%	Below Average
	Below poverty	44%	28%	Below Average
	Unemployment	46%	31%	Below Average
	Income	48%	31%	Below Average
	No high school diploma	94%	74%	High
Household composition and disability		63%	40%	Below Average
	Age 65 or older	0%	1%	Low
	Age 17 or younger	95%	93%	High
	Disability	33%	9%	Low
	Single-parent households	95%	85%	High
Minority status and language		98%	94%	High
	Minority	95%	88%	High
	Speaking English "less than well"	95%	94%	High
Housing and transportation		65%	55%	Above Average
	Multiunit structures	83%	95%	High
	Mobile homes	35%	30%	Below Average
	Crowding	95%	93%	High
	No vehicle	52%	32%	Below Average
	Group quarters	24%	9%	Low
Overall Social Vulnerability		79%	59%	Above Average

Source: U.S. CDC <https://svi.cdc.gov> (using data from U.S. Census Bureau American Community Survey, 2014-2018)

Adams County's social vulnerability is above average overall compared to the rest of the United States, and high compared to the rest of Colorado:

- Additional information on the CDC's Social Vulnerability Index can be found at <https://svi.cdc.gov>.

Map compiled 2/2020;
intended for planning purposes only.
Data Source: Adams County GIS,
Colorado Information Marketplace,
CO BLM, ESRI World Terrain Map,
CDC, July 2018

wood.

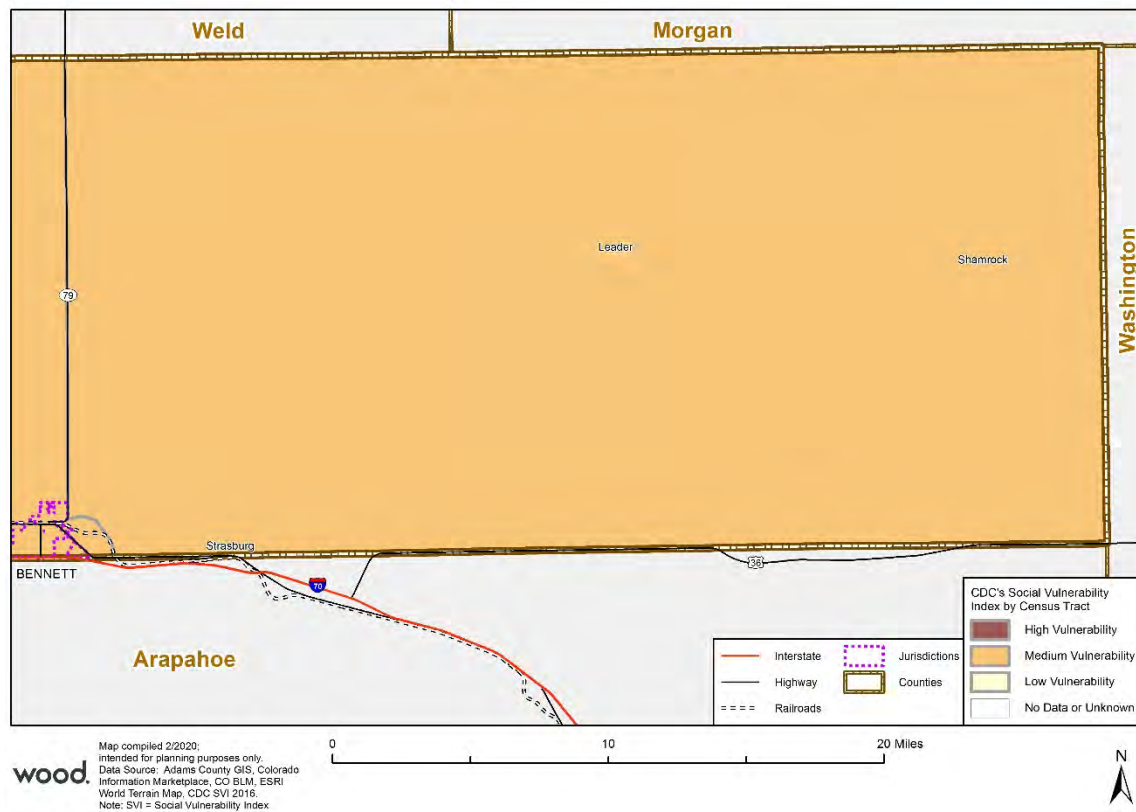
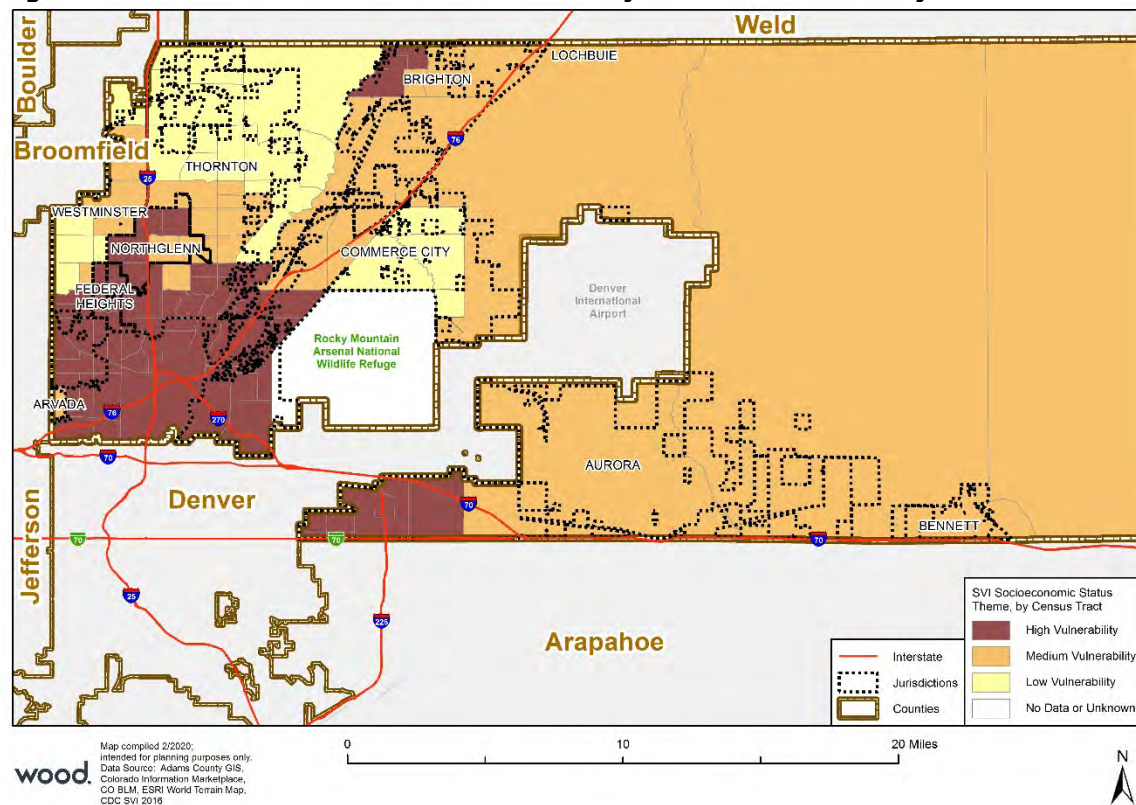
Figure 2-5 Overall Social Vulnerability in East Adams County**Figure 2-6 Socioeconomic Status Vulnerability in West Adams County**

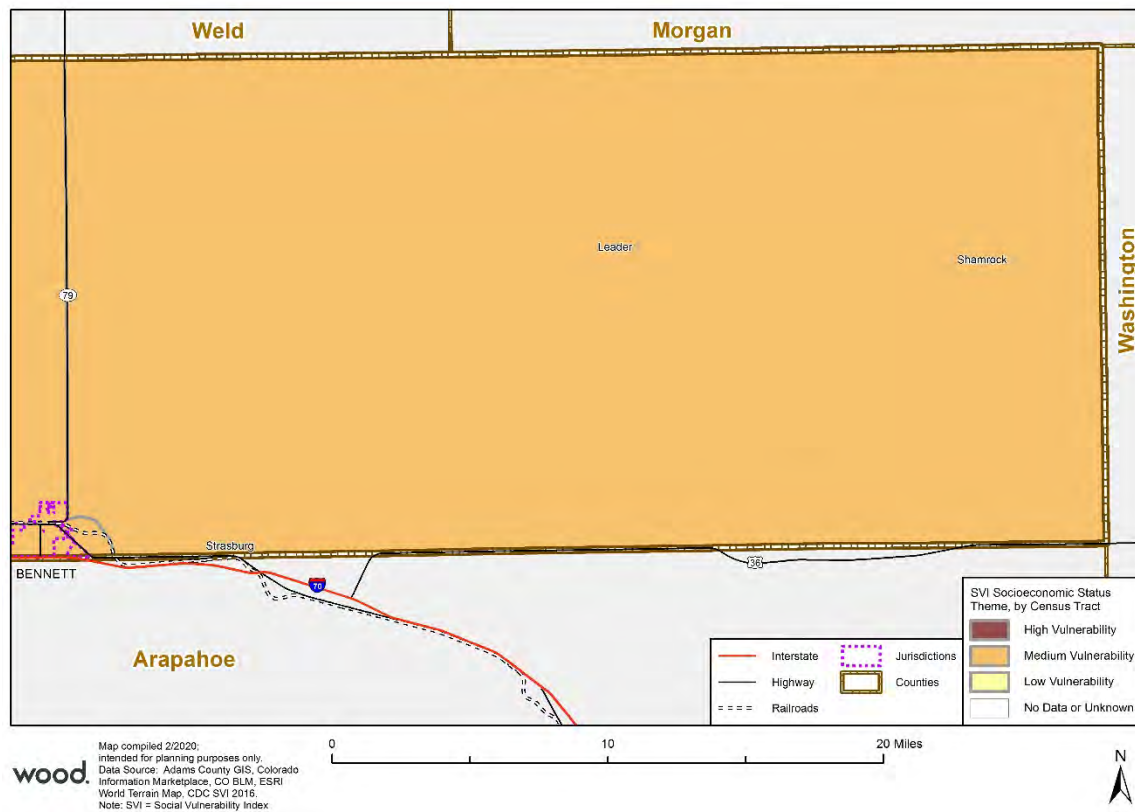
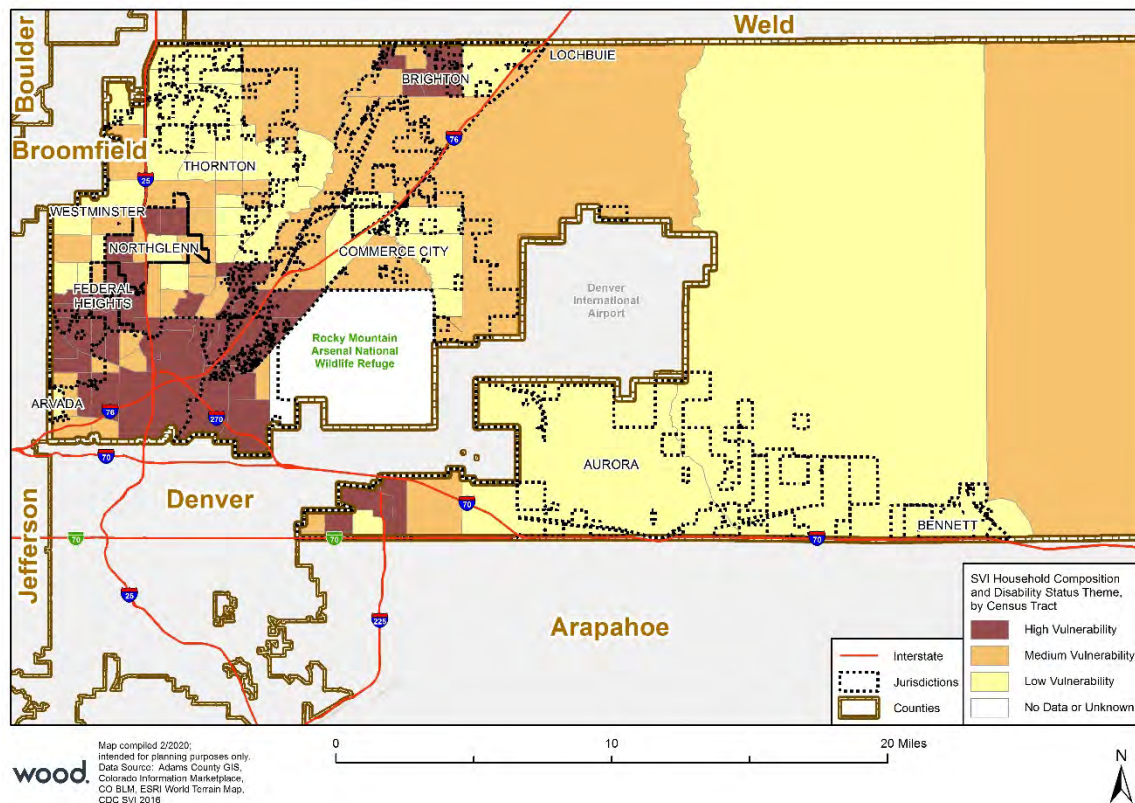
Figure 2-7 Socioeconomic Status Vulnerability in East Adams County**Figure 2-8 Household Composition and Disability Status in West Adams County**

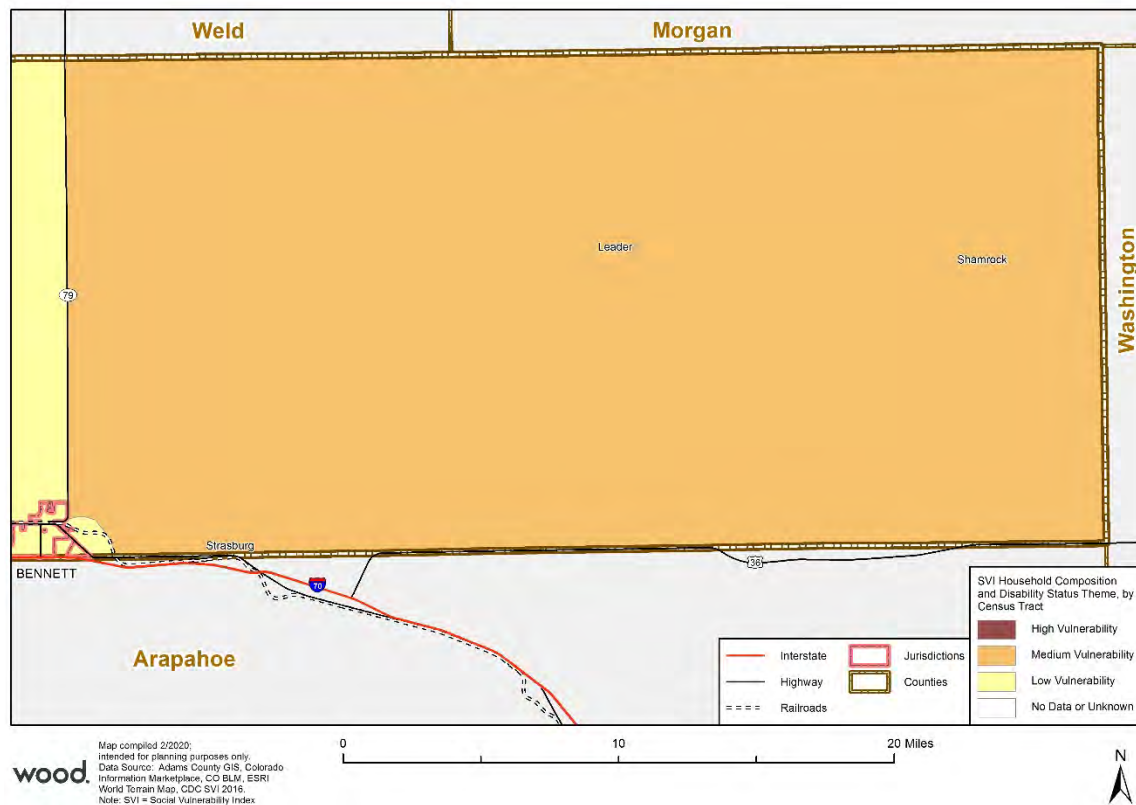
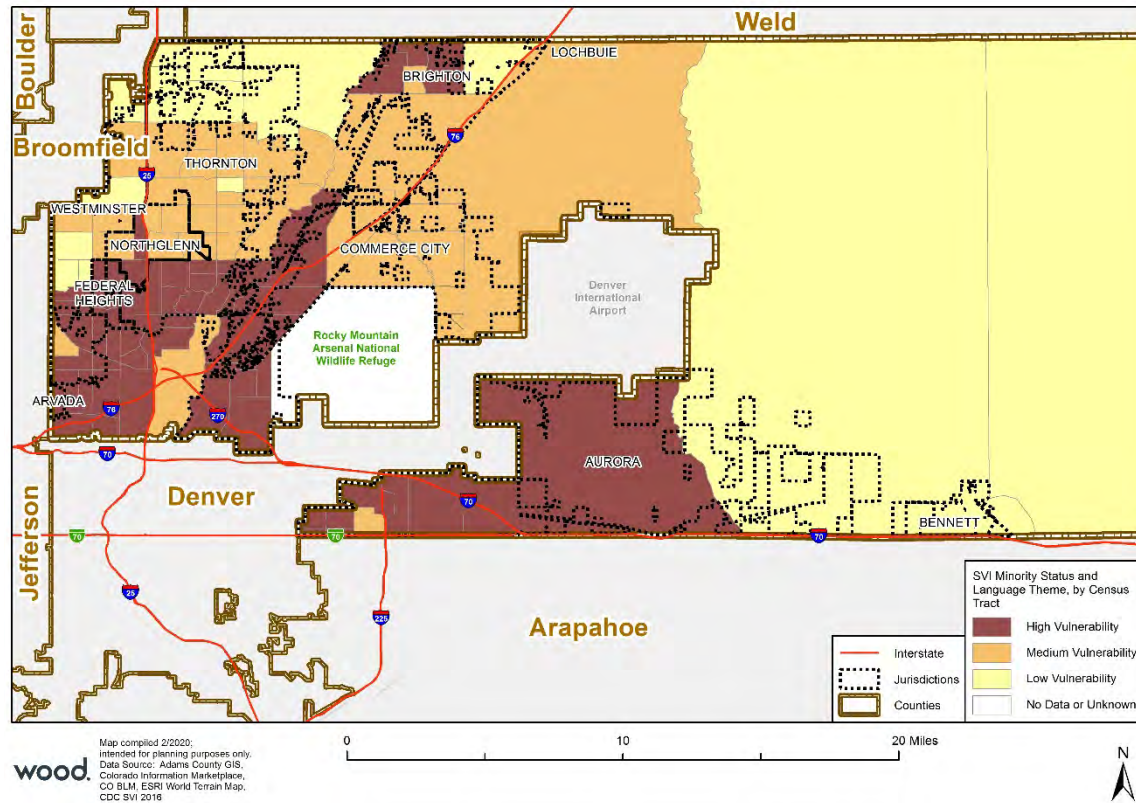
Figure 2-9 Household Composition and Disability Status in East Adams County**Figure 2-10 Minority Status and Language Vulnerability in West Adams County**

Figure 2-11 Minority Status and Language Vulnerability in East Adams County

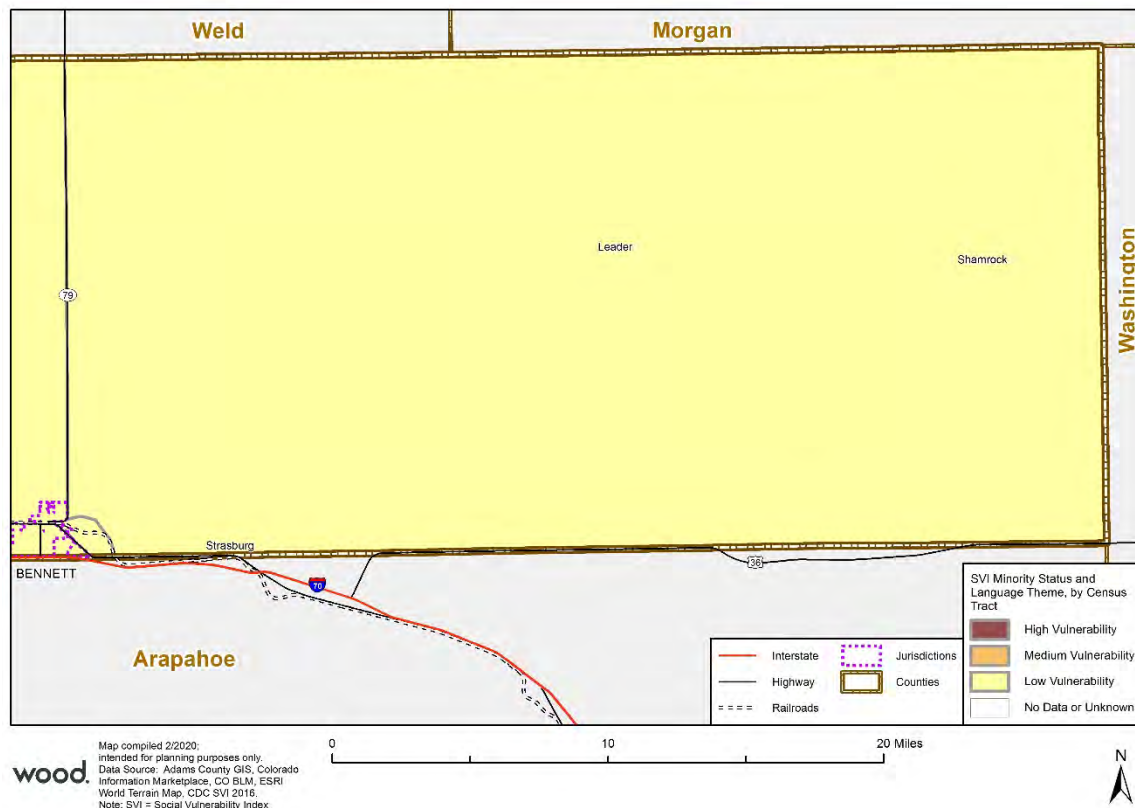


Figure 2-12 Housing and Transportation Vulnerability in West Adams

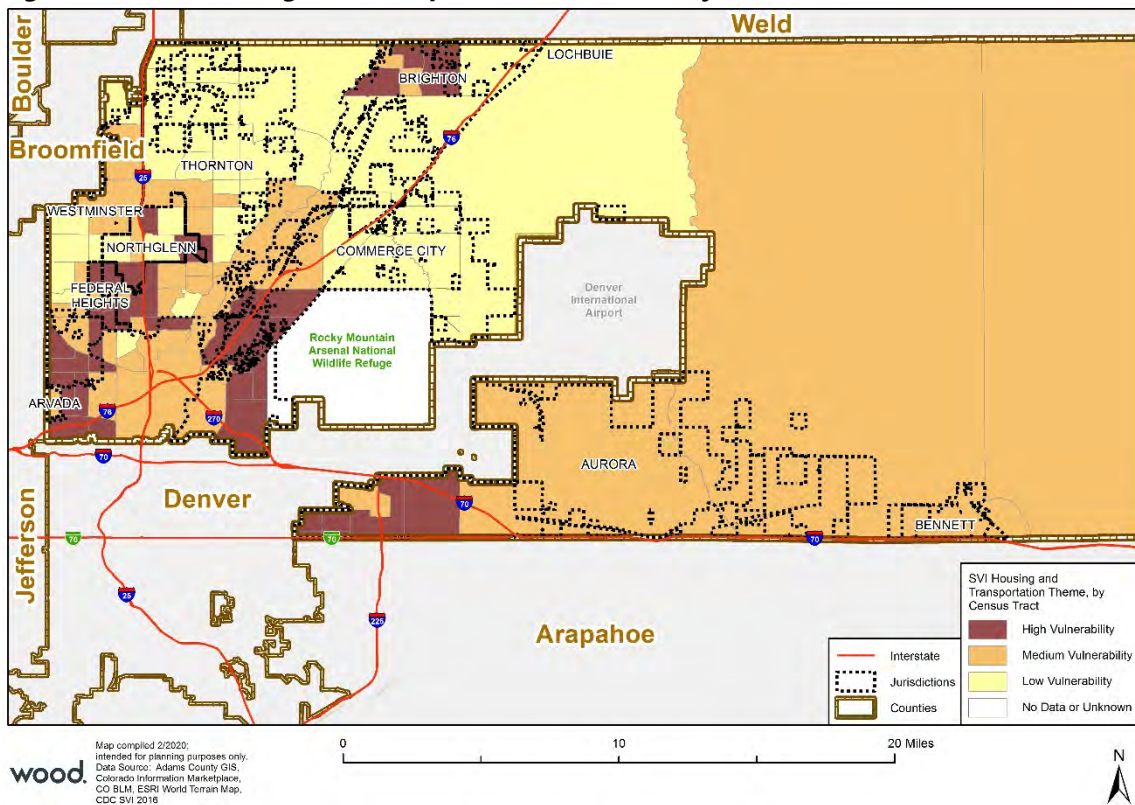
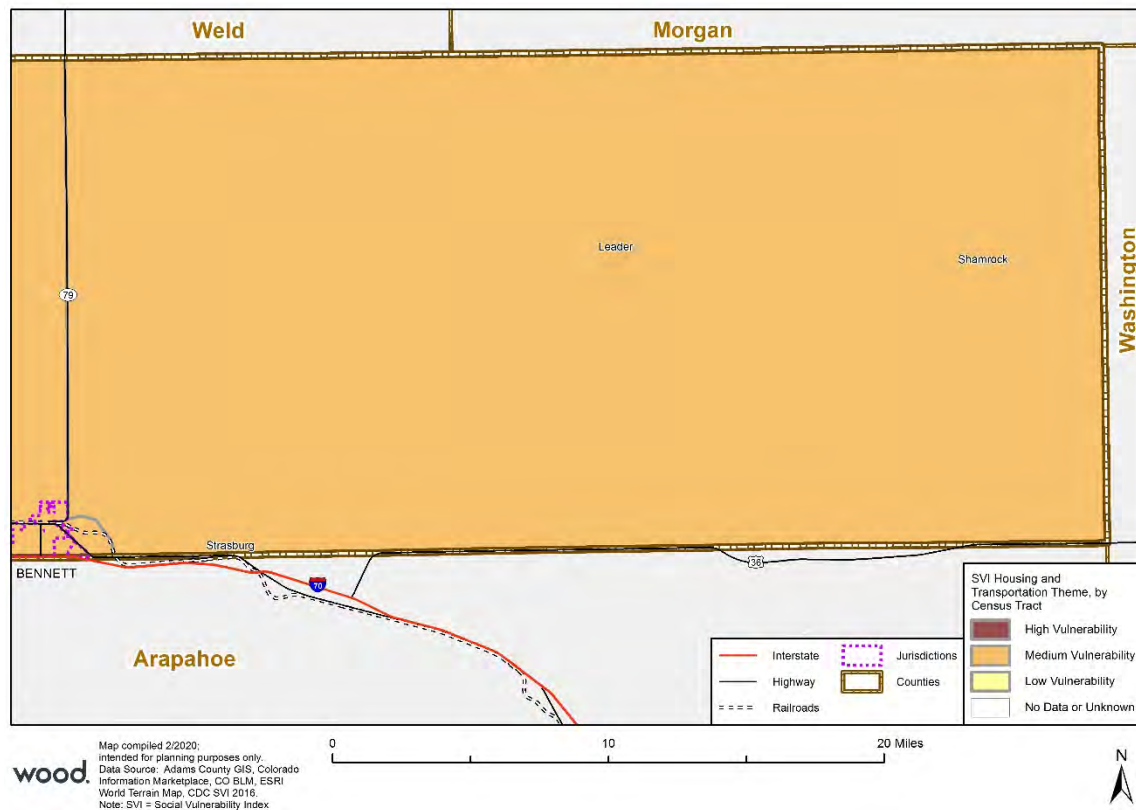
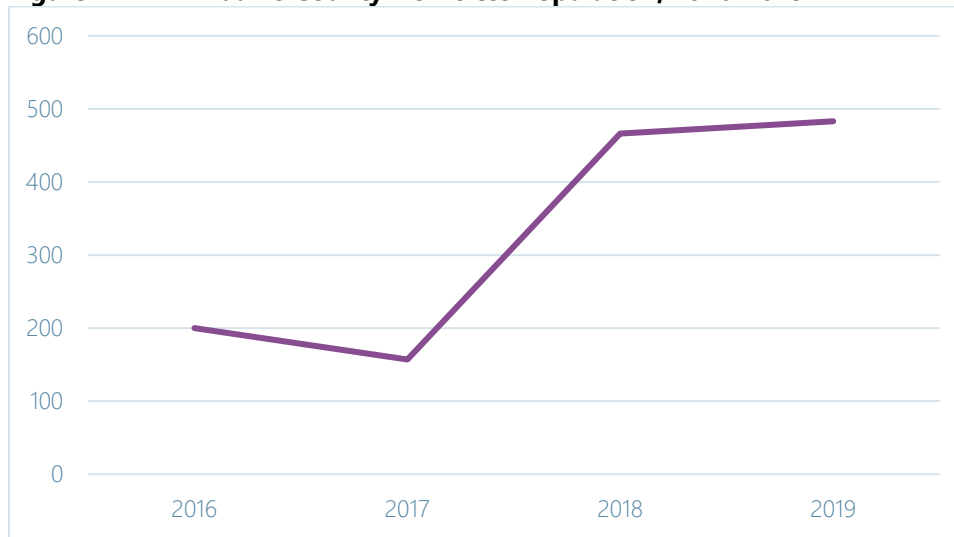


Figure 2-13 Housing and Transportation Vulnerability in East Adams County

2.5.1 Homeless Population

The Metro Denver Homeless Initiative (MDHI) releases annual Point In Time estimates of the homeless population in the Denver metropolitan area; these are only snapshot estimates, and MDHI cautions against placing too much stock in exact numbers. Nevertheless, they can show broad trends over time.

For 2019 MDHI estimated Adams County's homeless population at 483, a 142% increase since the 2016 estimate of 200 persons. (Data from before 2016 is not included due to changes in counting methodology.) This represents 8.4% of the homeless population in the Denver metropolitan area, which was estimated at 5,755 in 2019. It is worth noting that the homeless population across the Denver metro area has remained relatively consistent since 2016; the increased homeless population in Adams County seems to be primarily the result of people moving from neighboring counties.

Figure 2-14 Adams County Homeless Population, 2016-2019

Source: Metro Denver Homeless initiative <https://www.mdhi.org/pit>

Table 2-7 Adams County Homeless Population Characteristics

Characteristic	#
Total estimated homeless population	483
Unsheltered	139
Emergency Shelter	297
Transitional Housing	47
Newly Homeless	66
Chronically Homeless	128
Veterans	44
Families	33
Unaccompanied Youth (<25)	19
Fleeing Domestic Violence	32

Source: Metro Denver Homeless initiative <https://www.mdhi.org/pit>

2.6 Economy

The civilian workforce in Adams County, defined as all employed residents 16 years or older, was 246,450 in 2017. This is an increase of 15.3% since 2012, which exceeds the County's population growth of 10.1% and is reflected in the lower unemployment rate. 82.8% of those employed worked 35 or more hours per week. The breakdown of workers by class of work is shown in Table 2-8, while Table 2-9 shows the breakdown by industry.

Table 2-8 Civilian Employed Population in Adams County by Class of Work

CLASS OF WORKER	2012	2017	% Increase	% of Total
Civilian employed population 16 years and over	213,794	246,450	15.3%	100%
Private wage and salary workers	178,229	205,956	15.6%	83.6%
Government workers	24,973	27,606	10.5%	11.2%
Self-employed in own not incorporated business workers	10,396	12,637	21.6%	5.1%
Unpaid family workers	196	251	28.1%	0.1%

Source: U.S. Census Bureau American Community Survey www.census.gov/

Table 2-9 Civilian Employed Population in Adams County by Industry

INDUSTRY	2012	2017	% Increase	% of Total
Civilian employed population 16 years and over	213,794	246,450	15.3%	100%
Educational services, and health care and social assistance	34,129	42,025	23.1%	17.1%
Construction	22,539	29,650	31.5%	12.0%
Retail trade	26,442	27,825	5.2%	11.3%
Professional, scientific, and management, and administrative and waste management services	24,287	27,593	13.6%	11.2%
Arts, entertainment and recreation, and accommodation and food services	19,365	25,154	29.9%	10.2%
Manufacturing	19,804	20,918	5.6%	8.5%
Transportation and warehousing, and utilities	15,827	17,999	13.7%	7.3%
Other services, except public administration	11,119	12,659	13.9%	5.1%
Finance and insurance, and real estate and rental and leasing	12,936	12,106	-6.4%	4.9%
Public administration	9,489	10,158	7.1%	4.1%
Wholesale trade	8,634	9,206	6.6%	3.7%
Information	6,426	6,759	5.2%	2.7%
Agriculture, forestry, fishing and hunting, and mining	2,797	4,398	57.2%	1.8%

Source: U.S. Census Bureau American Community Survey www.census.gov/

59.9% of employed County residents worked outside of Adams County. The median commuting time (whether employed inside or outside the County) was 29.2 minutes, an increase of 3.2% since 2012, and slightly above both Colorado and National averages (25.2 minutes and 26.4 minutes respectively).

44,138 workers (16.1%) were classified as government workers, of which 41,383 were employed in state or local government, 1,121 were employed by the federal government, and 1,634 were in the military.

Total personal income of Adams County residents was over \$21B, a 24% increase since 2012. 71.8% of that income came from labor earnings and 28.2% from non-labor sources such as interest, dividends, and age or hardship payments.

2.7 Climate

Adams County lies within the semi-arid, continental climate zone. It has four distinct seasons and receives most of its precipitation from April through August. Due to its inland location on the High Plains at the foot of the Rocky Mountains, the County can be subject to sudden changes in weather. Similarly, the weather can vary widely in different parts of the County.

May is the wettest month in Adams County with 9.7 days of precipitation, and January is the driest month with only 4.4 precipitation days. There are 79.5 rainy days annually in Adams County, which is about average compared to other places in Colorado. The wettest months are May through August when it rains 31% of the time and the driest are October through February with only a 18% chance of precipitation.

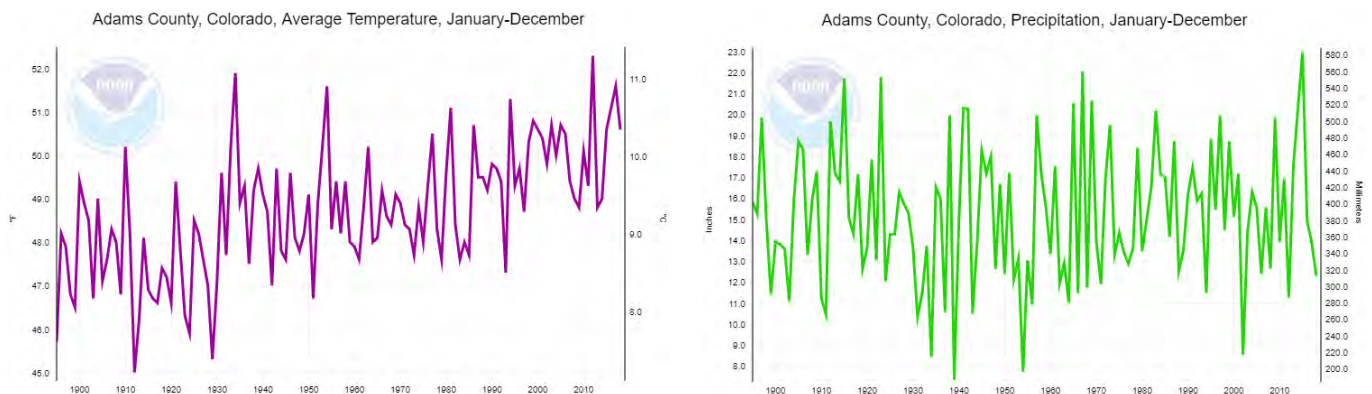
An annual snowfall of 52.3 inches in Adams County means that it is about average compared to other places in Colorado. March is the snowiest month in Adams County with 10.1 inches of snow, and 9 months of the year have recorded snowfall.

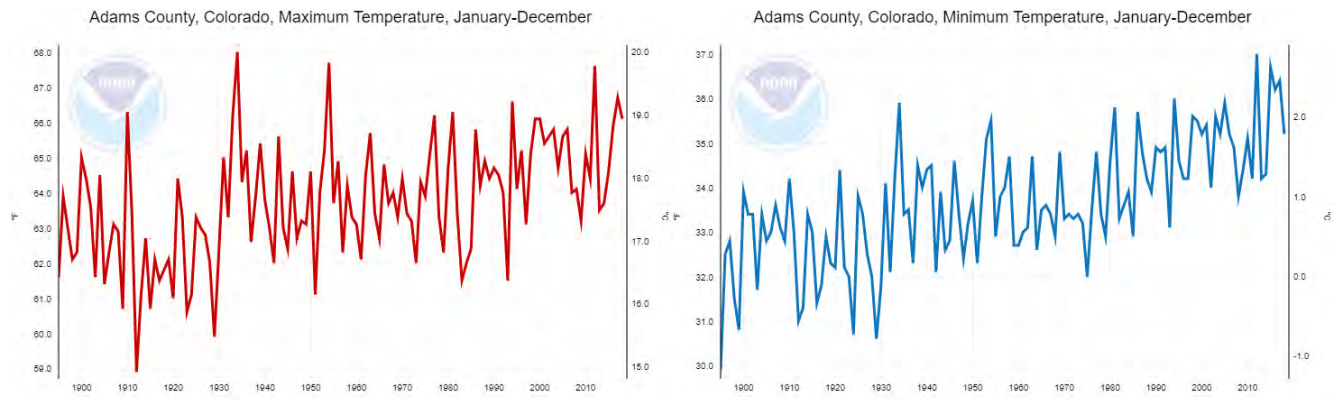
Table 2-10 Adams County Climate

	Adams County
Rainfall, annual average	16"
Snowfall, annual average	52"
Sunny Days, annual average	245
Days with some precipitation (≥ 0.1 "), annual average	80
Summer High, average (July)	89.7°
Days with highs above 90°, annual average	40
Winter Low, average (December)	16.9°
Nights with lows below 32°, annual average	156
Nights with lows below 0°, annual average	6
Wettest month (May)	2.3"
Driest month (January)	0.5"
Snowiest month (March)	10.1"

The following charts from the National Weather Service show the annual average temperature, average precipitation, average maximum temperature, and average minimum temperature for Adams County from 1890 to 2019.

Figure 2-15 Temperature and Precipitation Trends for Adams county, 1890-2019





Source: National Weather Service Climate at a Glance: <https://www.ncdc.noaa.gov/cag/>

2.8 Governing Body

The Board of County Commissioners consists of five constitutional officers who act collectively as the governing board. The board manages the affairs of the County as authorized by the state. Powers granted to the board by the state are broad, which allow the board independence in judgment.

The County Manager implements the policies and priorities of the Board of County Commissioners and oversees the day-to-day operations of the county.

Other County elected officials include the County Assessor, Clerk and Recorder, Coroner, District Attorney (17th Judicial District), Sheriff, Surveyor, and Treasurer.

2.9 Transportation Systems

Several transportation systems including interstate and state highways, freight and commuter rail lines, as well as a regional and an international airport are located in and/or traverse through Adams County. The following is a breakdown of the major transportation systems that serve the County and the region.

Major Highways

The County's roadway network follows one-mile section lines in the western portion while the eastern portion network is sparse and predominately unpaved roads (Adams County 2012). The following are the major interstate highways that traverse the County and provide regional and statewide connections:

- I-25
- I-70
- I-76
- I-225
- I-270

All of these major interstates also serve as hazardous material and nuclear material routes. Refer to Chapter 4 Risk Assessment for additional information of the County's vulnerability to hazardous material incidents.

Additional highway routes in the County include:

- E-470 – Tollway and part of Denver metropolitan area's beltway.
- U.S. 36 – Extends from I-25 in Adams County to City of Boulder.
- U.S. 85 – Travels through Adams County north to City of Greeley and south to City and County of Denver.
- SH 79 – Travels north through the Town of Bennett. Also known as Kiowa-Bennett Road.

Rail Lines

Freight railroad lines for Union Pacific Railroad (UPRR) and Burlington Northern Santa Fe Railway (BNSF) traverse through Adams County. The UPRR mainline tracks run parallel to U.S. 85; according to the County's 2012 Transportation Plan, this mainline averages 11 to 15 trains per day. Another UPRR line travels through the County parallel to Smith Road/Colfax Avenue and averages 6 to 8 trains per day (Adams County 2012). The BNSF mainline tracks run parallel to State Highway 2 and north of the I-76 interchanges and averages 28 to 30 trains per day. The BNSF also has a railroad line in the southwest corner of the County traveling from Denver to Boulder that averages 1 to 3 trains per day (Adams County 2012).

Regional Transportation District

The Regional Transportation District (RTD) provides commuter rail services around the Denver metropolitan area. Currently the G and A Lines are the only constructed commuter lines that traverse portions of western Adams County. The A Line runs from Denver's Union Station to Denver International Airport, while the G Line runs from Union Station to Arvada. Both of these rail lines were part of RTD's FasTracks project, a multi-billion dollar comprehensive transit expansion plan to build 122 miles of new commuter rail and light rail services as well as 18 miles of rapid bus transit for convenient bus and rail connections across the eight-counties RTD serves (RTD 2016). As part of FasTracks, RTD is planning to construct the N Line from Union Station to Thornton, bringing passenger services to Commerce City, Northglenn, Thornton and north unincorporated Adams County. As commuter and light rail services expand throughout the County, both RTD, Adams County and several jurisdictions in the County including, Commerce City, Northglenn, Westminster and Thornton are promoting transit oriented development (TOD) along and around these new rail lines through Station Area Master Plans. In addition to providing rail services, RTD also provides local and regional bus services with several stops located throughout the western portion of Adams County. RTD is planning expansion and improvement of services along many of the existing bus lines that serve the County.

Airports

There are two commercial airports located within or adjacent to Adams County. Denver International Airport (DIA) is the 5th busiest airport in the U.S. with 1600 flights per day on average and a total of 69 million passengers in 2019. While DIA is located in the City and County of Denver, it is surrounded by Adams County and all flights cross over Adams County.

The Colorado Air and Space Port (CASP), formerly known as Front Range Airport, is a general aviation airport averaging 259 flights per day. Originally owned by the Front Range Airport Authority, it has been owned and operated by Adams County since 2014. CASP serves as the base of several flying schools, flight clubs, maintenance services, and air rescue training facilities, as well as a Colorado Army National Guard Armory. In 2018, the Federal Aviation Administration (FAA) approved CASP's designation as a spaceport for sub-orbital horizontal takeoff flights.

Future Transportation Systems and County Transportation Priorities

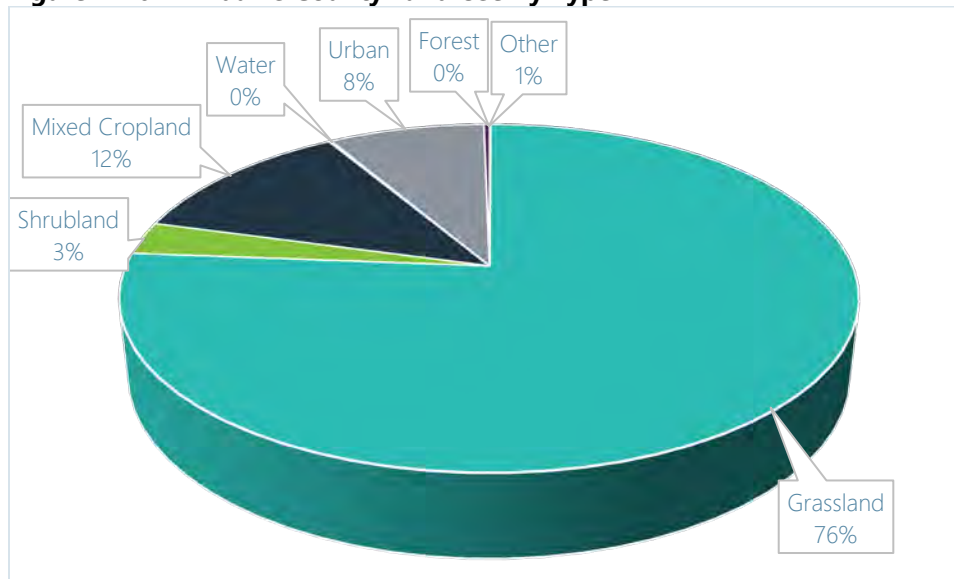
The following are the County's transportation priorities and transportation systems that are planned for future service for Adams County.

- RTD N Line – Providing train service through Denver, Commerce City, Northglenn, Thornton, and northwest Adams County.
- Denver Regional Council of Governments (DRCOG) Multimodal Freight Plan – Seeks to create a shared vision, a feasible action plan, and identify strategies to improve freight and the movement of goods throughout the Denver region.
- 88th Avenue Widening Environmental Assessment – County is participating in the Commerce City's evaluation of environmental impacts for the 88th Ave project which proposes to widen and make improvements to E. 88th Ave between I-76 and State Highway 2.
- Federal Boulevard Multi-modal Transportation Study – Partnership between Westminster, Federal Heights, and Adams County to complete a multimodal study for north Federal Boulevard.
- I-70 Airpark-Watkins Interchange Study – Collaborative project with Arapahoe County, the City of Aurora, and the Colorado Department of Transportation.

The County has Collaborative Transportation Planning Intergovernmental Agreements (IGAs) with all the incorporated jurisdictions in Adams County as well as the City and County of Broomfield. Through the IGAs, the County works with each of the municipalities to prioritize regional transportation improvements.

2.10 Land Use

Land uses range from intensive urban activities in the western County, to crop and grazing land in the central and eastern County. Eight incorporated cities and two towns are wholly or partially located in Adams County, comprising 15% of the County's total land area. Agricultural activities are the single largest land use throughout the County, accounting for more than three quarters of the land area. An extensive network of canals in the northwest part of the County supports most of the irrigated farmland. The central portion of the County primarily produces wheat, while the eastern area is primarily pasture. A breakdown of land use in the County by type is shown in Figure 2-16.

Figure 2-16 Adams County Land Use By Type

Source: NASA MODIS Land Cover Type Yearly L3 Global 1km MOD12Q1, 2006.

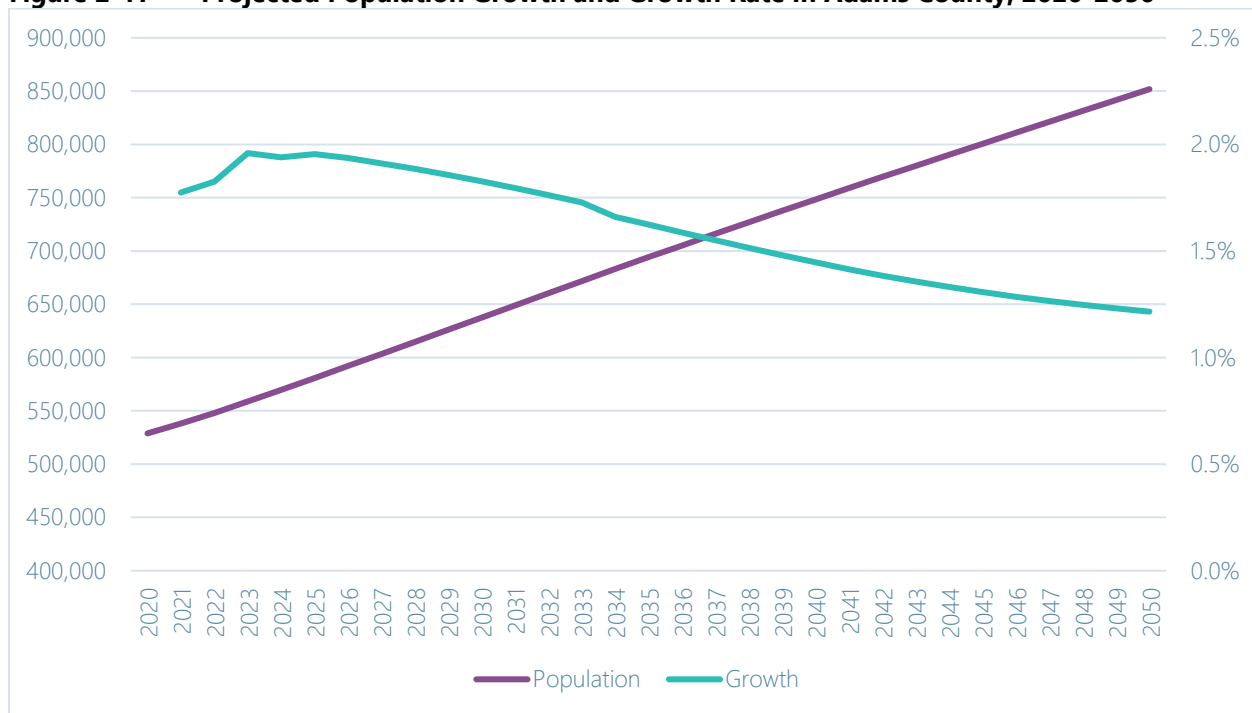
2.10.1 Brownfield Sites

In 2015, Adams County was awarded a \$200,000 Brownfields Assessment Grant from the Environmental Protection Agency (EPA). A brownfield is defined by the EPA as “abandoned, idled or under-used industrial and commercial facilities where expansion or redevelopment is complicated by real or perceived environmental contamination.” Through the grant, the Adams County Brownfields Program was formed to identify, assess and revitalize brownfield properties. The target area for the program is the Clear Creek Valley Area along I-76 between Federal Blvd. and Huron St. due to its history of gravel mining and landfills and the proximity to planned RTD light rail stations. Through remediation of brownfield sites, properties can potentially be redeveloped generating tax revenues, creating new jobs, and removing blight from the community.

A current inventory of identified brownfields can be found on the County’s website at <http://www.adcogov.org/brownfields-program>.

2.11 Development Trends

According to the Colorado State Demography Office, between 2020 and 2050 Adams County’s population is projected to grow at an average of 1.6% a year; this is above the State’s projected growth rate of 1.1% over the same time period. As shown in Figure 2-17, the County’s growth rate is forecasted to average 1.9% per year through 2030, after which it is projected to fall off to an average of 1.3% in the 2040s. The County’s population is projected to exceed 600,000 by the year 2027, 700,000 by 2036, and 500,000 by 2045.

Figure 2-17 Projected Population Growth and Growth Rate in Adams County, 2020-2050

Source: Colorado State Demography Office <https://demography.dola.colorado.gov/>

As mentioned in Section 2.9, in August 2018, the Federal Aviation Administration granted a site operator license to Colorado Air and Space Port (CASP), located six miles southeast of Denver International Airport. CASP will serve as America's hub for commercial space transportation, research, and development and will also provide a boost to the state's economy by keeping the nearly 200,000 aerospace jobs in Colorado and creating new employment opportunities. County representatives have been working hard to pave the way for business expansion. Japan-based PD Aerospace LTD. recently signed a letter of intent to explore the possibilities of the development and expansion of its commercial activities at CASP. PD Aerospace is a spacecraft manufacturer with business offices in Nagoya, Japan, and a research and development facility in Hekinan City.

Adams County is a popular location for notable new commercial development. Maxar Technologies, Inc., Denver Premium Outlets, and Gaylord Rockies Resort & Convention Center have all become part of the Adams County landscape within the past year. Much of the open land surrounding Denver International Airport, the fifth-busiest airport in the U.S., is in Adams County. A regional aerotropolis concept is in the works, bringing a boon of commercial development to that corner of the county.

The county's increased economic prosperity has also directly benefited its educational prospects. In 2019, 60 Adams County high school students were awarded scholarships totaling more than \$1 million to attend Colorado public higher education institutions. The scholarships were funded with a voter-approved three percent sales tax on retail marijuana sales in unincorporated Adams County, and the Colorado Opportunity Scholarship Initiative matched the sales tax funds to increase the scholarship pool.

3 Planning Process

DMA Requirements §201.6(b) and §201.6(c)(1):

An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include:

An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;

An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia, and other private and non-profit interests to be involved in the planning process; and

Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.

[The plan shall document] the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.

3.1 Background on Mitigation Planning in Adams County

The primary purpose of the Adams County Hazard Mitigation Plan (HMP) update is to reduce or eliminate long-term risk to people and property from natural and human-caused hazards and their effects on the Adams County planning area. Recognizing the importance of hazard mitigation planning, Adams County participated in the 2004 Denver Regional Council of Governments (DRCOG) Denver Regional Natural Hazards Plan, as well as the 2011 update of that plan. In 2014 Adams County developed their own Local Hazard Mitigation Plan specific to the County, and fully integrated the plan with the County's Comprehensive Plan, *Imagine Adams County*. Additional details on the previous planning effort can be referenced in the 2014 Plan.

The Hazard Mitigation Plan (HMP) underwent a comprehensive update in 2020. The planning process followed during the update was similar to what was used in the original plan development. This planning process utilized the input from a multi-jurisdictional Hazard Mitigation Planning Committee (HMPC). A significant change from the 2014 Plan is the inclusion of three incorporated communities within the planning area, as well the inclusion of Denver Water. A consultant, Wood Environment & Infrastructure Solutions, Inc (Wood) was procured to assist with the update in 2020. The plan update process is described further in this section and documented in Appendix A.

3.2 What's New in the Plan Update

DMA Requirement §201.6(d)(3):

A local jurisdiction must review and revise its plan to reflect changes in development, progress in local mitigation efforts, and changes in priorities, and resubmit it for approval within 5 years in order to continue to be eligible for mitigation project grant funding.

The updated HMP complies with Federal Emergency Management Agency (FEMA) guidance for Local Hazard Mitigation Plans. The update followed the requirements noted in the Disaster Mitigation Act (DMA) of 2000 and FEMA's 2013 Local Hazard Mitigation Planning Handbook.

This multi-jurisdictional, multi-hazard mitigation plan update involved a comprehensive review and update of each section of the 2014 plan and includes an assessment of Adams County's success in evaluating, monitoring, and implementing the mitigation strategy outlined in the initial plan. The process

followed to review and revise the chapters of the plan during the 2019-2020 update is detailed in Table 3-1. All sections of the plan were reviewed and updated to reflect new data and methodologies on hazards and risk, risk analysis processes, capabilities, participating jurisdictions and stakeholders, and mitigation strategies. The plan was also revised to reflect changes in development, including using the latest version of the assessor's office data as the basis for identifying overall and hazard exposure for developed parcels by County and jurisdiction. Only the information and data still valid from the 2014 plan was carried forward as applicable to this plan update.

The County received funding from the Board of County Commissioners to procure consultant assistance during the 2019-2020 update.

Table 3-1 2020 Plan Update Summary of Changes by Chapter

Plan Section	Update Review and Analysis
1 INTRODUCTION 1.1 Executive Summary 1.2 Purpose 1.3 Background & Scope 1.4 Multi-Jurisdictional Planning	Added an executive summary. Updated language to describe purpose and requirements of the Plan and the update process. Identified new participating jurisdictions and their participation.
2 COMMUNITY PROFILE 2.1 County History 2.2 Geography 2.3 Cities and Communities 2.4 Demographics 2.5 Social Vulnerability 2.6 Economy 2.7 Climate 2.8 Governing Body 2.9 Transportation Systems 2.10 Land use 2.11 Development Trends	Updated with American Community Survey 5-Year Estimates, 2013-2017 census data and current economy description. Included social vulnerability analysis using the Social Vulnerability Index developed by the CDC.
3 PLANNING PROCESS 3.1 Background on Mitigation Planning in Adams County 3.2 What's New in the Plan Update 3.3 Local Government Participation 3.4 The 10-Step Planning Process	Formerly 2014 Comprehensive Plan Chapters 1, 6 and Appendix E Described and documented the planning process for the 2020 update, including coordination among agencies and integration with other planning efforts. Described any changes in participation in detail. Described 2020 public participation process.
4 RISK ASSESSMENT 4.1 Hazard Identification	Added a subsection on Climate Change Considerations to discuss where climate change could affect the frequency and severity of hazards in the future.

Plan Section	Update Review and Analysis
<p>4.2 Asset Summary 4.3 Hazard Analysis and Risk Assessment</p>	<p>Revisited former hazards list for possible modifications. Including adding dam failure as a separate hazard; previously dam failure was profiled under the flood profile.</p> <p>Added the following human-caused hazards, each profiled separately: cyber threats, hazardous materials, and terrorism/active shooters.</p> <p>Added lightning and hail to thunderstorms profile; previously each hazard was profiled separately.</p> <p>Reviewed hazards from the 2018 Colorado State Hazard Mitigation Plan for consistency.</p> <p>Included the potential for catastrophic releases from abandoned mines as a component of the hazardous materials hazard profile.</p> <p>Updated list of disaster declarations to include 2014-2019 data.</p> <p>Updated NCEI hazard data to include 2014-2019 data.</p> <p>Updated past occurrences for each hazard to include 2014-2019 data.</p> <p>Updated critical facilities identification from the 2014 plan.</p> <p>Updated growth and development trends to include Census 2010, American Community Survey 5-Year Estimates, 2013-2017 and local data sources.</p> <p>Updated historic and cultural resources using Colorado State Historic Preservation Office and other local/state/national sources.</p> <p>Updated property values for vulnerability and exposure analysis.</p> <p>Updated critical facilities and infrastructure data and lists, including alignment with FEMA Lifelines categories.</p> <p>Updated NFIP flood insurance policy data and Repetitive Loss structure data.</p> <p>Incorporated new hazard loss estimates since 2014, as applicable.</p> <p>A Hazus-MH Level I earthquake vulnerability analysis data was updated with Hazus Version 4.2 and incorporated.</p> <p>Updated information regarding specific vulnerabilities to hazards, including maps and tables of specific assets at risk, specific critical facilities at risk, and specific populations at risk; organized information into subsections on General Property, People, Critical Facilities and Infrastructure, Economy, Historic, Cultural, and Natural Resources, and Future Development.</p> <p>Developed a Risk Summary subsection to summarize problem statements and vulnerabilities.</p> <p>Updated maps in the plan where appropriate.</p>
<p>5 CAPABILITY ASSESSMENT</p> <p>2.1 Planning and Regulatory Capabilities</p> <p>2.2 Administrative and Technical Capabilities</p> <p>2.3 Financial Capabilities</p> <p>2.4 Other Mitigation Partnerships</p> <p>2.5 Opportunities for Enhancement</p>	<p>From 2014 Comp Plan Appendix B, D – Updated in 2020. Reviewed mitigation capabilities and updated to reflect current capabilities.</p>

Plan Section	Update Review and Analysis
<p>6 MITIGATION STRATEGY</p> <p>6.1 Mitigation Strategy: Overview</p> <p>6.2 Goals and Objectives</p> <p>6.3 Progress on Previous Mitigation Actions</p> <p>6.4 Identification and Analysis of Mitigation Actions</p> <p>6.5 Mitigation Action Plan</p>	<p>Reviewed mitigation capabilities and updated to reflect current capabilities. Indicated what projects have been implemented that may reduce previously identified vulnerabilities.</p> <p>Updated Chapter 6 based on the results of the updated risk assessment, completed mitigation actions, and implementation obstacles and opportunities since the completion of the previous plan.</p> <p>Reviewed goals and objectives to determine if they are still representative of the participants' mitigation strategy and aligned with the 2018 Colorado State Hazard Mitigation Plan goals.</p> <p>Revised the goals and objectives based on HMPC input.</p> <p>Revised to include more information on the Community Rating System (CRS) categories of mitigation measures (structural projects, natural resource protection, emergency services, etc.) and how they are reviewed when considering the options for mitigation.</p> <p>Included more information on how actions are prioritized.</p> <p>Reviewed mitigation actions from the 2014 plan and developed a status report for each; identified if action has been completed, deleted, deferred, or is still ongoing.</p> <p>Identified and detailed new mitigation actions proposed by the HMPC.</p>
<p>7 PLAN IMPLEMENTATION AND MAINTENANCE</p> <p>7.1 Implementation</p> <p>7.2 Plan Maintenance</p> <p>7.3 Integration Into Other Planning Mechanisms</p> <p>7.4 Continued Public Involvement</p>	<p>Reviewed and updated procedures for monitoring, evaluating, and updating the plan.</p> <p>Revised to reflect current methods.</p> <p>Updated the system for monitoring progress of mitigation activities by identifying additional criteria for plan monitoring and maintenance.</p> <p>Expanded guidance on how the HMP can inform other plans and planning mechanisms in Adams County.</p>
<p>Jurisdictional Annexes (NEW)</p>	<p>Annex A — Town of Bennett</p> <p>Annex B — City of Brighton (Previously part of 2016 Weld County HMP)</p> <p>Annex C — City of Commerce City</p> <p>Annex D — Denver Water</p> <p>Annex E — 2016 City of Aurora HMP</p> <p>Annex F — 2017 Thornton, Federal Heights, & Northglenn HMP</p> <p>Annex G — 2018 City of Westminster HMP</p> <p>Annex H — 2016 Jefferson County HMP – City of Arvada Annex</p>
<p>Appendices (NEW)</p>	<p>Appendix A — Updated planning process documentation</p> <p>Appendix B — Updated Hazard Mitigation Planning Committee members</p> <p>Appendix C — 2020 Adoption Resolutions</p> <p>Appendix D — Mitigation Action Worksheets</p> <p>Appendix E — References</p> <p>Appendix F — Glossary</p>

3.3 Local Government Participation

DMA Requirement §201.6(a)(3):

Multi-jurisdictional plans may be accepted, as appropriate, as long as each jurisdiction has participated in the process and has officially adopted the plan.

Adams County invited every incorporated city, town, and special district in the County to participate in the 2020 Multi-Jurisdictional Mitigation Plan update. The Disaster Mitigation Act requires that each jurisdiction participate in the planning process and officially adopt the multi-jurisdictional hazard mitigation plan in order to be eligible for FEMA Hazard Mitigation Assistance grants. The jurisdictions that chose to participate in the planning process and development of the plan or its update were required to meet strict plan participation requirements defined at the beginning of the process, which included the following:

- Designate a representative to serve on the HMPC
- Participate in HMPC meetings
- Complete and return updates on Mitigation Actions since 2014 to Wood
- Identify new mitigation actions for the plan
- Review and comment on plan drafts
- Inform the public, local officials, and other interested parties about the planning process and provide opportunity for them to comment on the plan
- Formally adopt the mitigation plan and re-adopt every 5 years

The City of Brighton, the City of Commerce City, the Town of Bennett, and Denver Water committed to participating in the plan update, and met all of these participation requirements. The City of Brighton had previously participated in the 2016 Weld County Hazard Mitigation Plan, the Town of Bennett had previously participated in the 2015 Arapahoe County Hazard Mitigation Plan, and Commerce City previously participated in the 2010 Denver Regional Natural Hazard Mitigation Plan. Denver Water also participated in this plan update as a multi-county special district that serves Adams County. In most cases, the representative for each jurisdiction brought together a planning team to help collect data, identify mitigation actions and implementation strategies, and review annex drafts. Appendix B shows the attendance of representatives at each HMPC meeting; sign-in sheets are included in Appendix A Planning Process Documentation.

3.4 The 10-Step Planning Process

Wood and the Adams County Office of Emergency Management worked together to establish the framework and process for this planning effort using FEMA's Local Multi-Hazard Mitigation Planning Guidance (2013). The guidance and this plan are structured around FEMA's original four-phase process:

- 1) Organize resources
- 2) Assess risks
- 3) Develop the mitigation plan
- 4) Implement the plan and monitor progress

Into this four-phase process, Wood integrated a more detailed 9-step process laid out in the 2013 Local Mitigation Planning Handbook, along with the 10-step planning process used for FEMA's Community Rating System (CRS) and Flood Mitigation Assistance programs. Thus, the modified 10-step process used

for this plan meets the funding eligibility requirements of the Hazard Mitigation Assistance grants (including Hazard Mitigation Grant Program, Building Resilient Infrastructure and Communities grant, High Hazard Potential Dams grant, and Flood Mitigation Assistance grant), Community Rating System, and the flood control projects authorized by the U.S. Army Corps of Engineers (USACE). Table 3-2 shows how the modified 10-step process fits into FEMA's four-phase process.

Table 3-2 Mitigation Planning Process Used to Develop the Plan

FEMA’s 4-Phase DMA Process	Modified 10-Step CRS Process	FEMA Local Mitigation Planning Handbook Tasks
1) Organize Resources		
201.6(c)(1)	1) Organize the Planning Effort	1: Determine the planning area and resources
201.6(b)(1)	2) Involve the Public	2: Build the planning team - 44 CFR 201.6 (C)(1)
201.6(b)(2) and (3)	3) Coordinate with Other Departments and Agencies	3: Create an outreach strategy - 44 CFR 201.6(b)(1)
		4: Review community capabilities - 44 CFR 201.6 (b)(2)&(3)
2) Assess Risks		
201.6(c)(2)(i)	4) Identify the Hazards	5: Conduct a risk assessment - 44 CFR 201.6 (C)(2)(i) 44 CFR 201.6(C)(2)(ii)&(iii)
201.6(c)(2)(ii)	5) Assess the Risks	
3) Develop the Mitigation Plan		
201.6(c)(3)(i)	6) Set Goals	6: Develop a mitigation strategy - 44 CFR 201.6(c)(3)(i); 44 CFR 201(c)(3)(ii) and 44 CFR 201.6(c)(3)(iii)
201.6(c)(3)(ii)	7) Review Possible Activities	
201.6(c)(3)(iii)	8) Draft an Action Plan	
4) Implement the Plan and Monitor Progress		
201.6(c)(5)	9) Adopt the Plan	7: Review and adopt the plan
201.6(c)(4)	10) Implement, Evaluate, and Revise the Plan	8: Keep the plan current
		9: Create a safe and resilient community - 44 CFR 201.6(c)(4)

3.4.1 Phase 1 Organize the Resources

Step 1: Organize the Planning Effort

This section describes the planning process used during the 2020 update. The original planning process effort is well documented and can be referenced in the 2004 and 2010 DRCOG plans, and the 2014 Comprehensive Plan. The Adams County Emergency Manager took the lead on coordinating and reconvening the HMPC, identifying the key county, municipal, and other local government and initial stakeholder representatives. An email invitation was sent to them with a request to participate as a member of the HMPC and to attend a kickoff meeting. Representatives from the following County and municipal departments and special districts participated on the HMPC and the update of the plan:

Adams County

- Office of Emergency Management
- Community Safety & Well-Being
- Community Development Department
- Public Works Department

- Parks, Open Space & Cultural Arts Department
- Office of the Coroner
- Finance Department
- Assessor's Department
- Communications Department
- Information Technology & Innovation Department
- County Manager's Office
- Facilities & Fleet Management Department

Participating Jurisdictions

- City of Brighton Office of Emergency Management
- City of Commerce City Office of Emergency Management
- Town of Bennett Safety Officer
- Town of Bennett Public Works Department
- Town of Bennett Community Development Department
- Denver Water Office of Emergency Management

The Adams County Office of Emergency Management emailed letters of invitation to each meeting to county, municipal, district, state, and other stakeholder representatives. This list is included in Appendix A. Stakeholder participation was significant during the 2020 update; stakeholders are listed in subsection Step 3: Coordinate with Other Departments and Agencies.

The Disaster Mitigation Act requires that each jurisdiction participate in the planning process and officially adopt the multi-jurisdictional hazard mitigation plan. A planning committee was created that includes representatives from each participating jurisdiction, departments of the County, and other local, state, and federal organizations responsible for making decisions in the plan and agreeing upon the final contents. Kickoff meeting attendees discussed potential participants and made decisions about additional stakeholders to invite to participate on the HMPC.

The HMPC contributed to this planning process by:

- Providing facilities for meetings,
- Attending meetings,
- Collecting data,
- Managing administrative details,
- Making decisions on plan process and content,
- Submitting mitigation action implementation worksheets,
- Reviewing and editing drafts, and
- Coordinating and assisting with public involvement and plan adoptions.

The HMPC communicated during the planning process with a combination of face-to-face meetings, phone interviews, and email correspondence. A folder on the website Box.com was hosted by Wood was used to share drafts of the plan and its annexes for jurisdictional review and input. The HMPC met in person four times during the planning period (October 17, 2019 to February 5, 2020). The meeting schedule and topics are listed in Table 3-3. The sign-in sheets and agendas for each of the meetings are included in Appendix A.

Table 3-3 Schedule of HMPC Meetings

Meeting	Topic	Date
Kickoff Meeting	Introduction to DMA and the planning process. Identification of hazards impacting Adams County	October 17, 2019
HMPC #2	Review of updated risk assessment	December 12, 2019
HMPC #3	Review of goals and objectives. Review of status updates of 2014 mitigation actions. Development of new mitigation actions.	January 14, 2020
HMPC #4	Prioritization of mitigation actions.	February 5, 2020

HMPC Meeting #1 — Kickoff Meeting

The plan update process officially began with a kickoff meeting in Brighton, Colorado, on October 17, 2019. Twenty HMPC members and stakeholders attended. During the kickoff meeting, Wood presented information on the scope and purpose of the plan update, participation requirements of HMPC members, and the proposed project work plan and schedule. Plans for public involvement (Step 2) and coordination with other agencies and departments (Step 3) were discussed. Wood also introduced the hazard identification requirements and data. The HMPC discussed jurisdictional priorities and concluded that there had been no significant changes to priorities that would affect this mitigation plan. The HMPC discussed past events and impacts and future probability for each of the hazards required by FEMA for consideration in a local hazard mitigation plan. The HMPC revised the hazards list from the 2014 plan, adding dam failure/incident as a separate hazard while rolling lightning and hail into the Thunderstorm profile. Three human-caused hazards were also added: cyber threats, hazardous materials incidents, and terrorism/active shooter. Each jurisdiction provided updates on past events since 2014, existing capabilities and ongoing mitigation efforts through a data collection workbook created by Wood or provided information directly to Wood for incorporation into the plan update.

HMPC Meeting #2 — Risk Assessment Update

On December 12, 2019, the HMPC convened in person to review and discuss the results of the risk and vulnerability assessment update. Eighteen members of the HMPC and stakeholders were present for the discussion. Wood presented the results the risk assessment for natural and human-caused hazards. A handout summarizing the hazard significance for each jurisdiction was shared for the HMPC to review. The group went through each hazard together and discussed the results as well as shared any local insight to inform the HIRA update. Refer to the meeting summary in Appendix A for notes related to each hazard discussed. Some of this discussion was also related to the capability assessment update.

HMPC Meeting #3 — Goals and Objectives Development

The HMPC convened on January 14, 2020 with sixteen people in attendance to discuss goals and objectives for this planning process. Wood reviewed the hazard significances discussed at meeting #2. Wood then shared the results of the public survey and reviewed the hazards the public identified as the highest concern. The group was provided a handout that summarized current goals and objectives from the County's 2014 Comprehensive Plan, other jurisdiction's HMPs, the State HMP, and other planning documents. The HMPC reviewed the previous plan's goals to determine if they were still valid, comprehensive, and reflect current priorities and updated risk assessments. Revisions to the goals can be found in Chapter 6 Mitigation Strategy. The meeting ended with a review of the next steps and planning process schedule. The meeting ended with each HMPC member developing a new mitigation action using new mitigation action worksheets distributed by Wood.

Town of Bennett Planning Team Meeting

In addition to the four HMPC meetings, the Town of Bennett held a Planning Team meeting on January 23, 2020. Four of the Bennett Planning Team members were present as well as the Adams County

Emergency Manager and three members of the Wood consulting team. Wood presented the results of the risk assessment specific to the Town of Bennett. The Planning Team then shared the statuses of the Town's previous mitigation actions and discussed possible new mitigation actions.

HMPC Meeting #4 — Mitigation Strategy Workshop

On February 5, 2020 the HMPC convened in person to prioritize the new mitigation actions developed at meeting 3 to include in the updated plan. Sixteen HMPC members and stakeholders attended. The group discussed the criteria for mitigation action selection and prioritization using a worksheet provided by Wood (refer to Appendix A). The group reviewed each possible new mitigation action and additional details were provided by the HMPC. Following the review of potential actions, a sticky dot exercise was used as an initial prioritization on the new mitigation actions, refer to Chapter 6 Mitigation Strategy for more details on the prioritization exercise.

Step 2: Involve the Public

DMA Requirement §201.6(b):

An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include: (1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval.

At the kickoff meeting, the HMPC discussed options for soliciting public input on the mitigation plan and developed an outreach strategy by consensus. An online public survey was developed by Wood and shared with the HMPC to share through their respective channels. Wood worked with a Communication Specialist with the County's Communication Department to include a link to the survey on the County's website and in the County's newsletter. A link to the survey was also posted on some of the participating jurisdiction's websites as well as through social media posts; screenshots from both can be found in Appendix A.

Online Public Survey

As noted above, during the plan update's initial drafting stage, an online public survey was used to gather public input to the HMPC. The survey provided an opportunity for public input during the planning process, prior to finalization of the plan update. The survey gathered public feedback on concerns about hazards and input on mitigation strategies to reduce their impacts. The survey was released on December 3, 2019 and closed on January 14, 2020. The HMPC provided links to the public survey by distributing it using social media, email, and posting the link on websites. Eighty people filled out the survey online. Results showed that the public perceives the most significant hazards to be severe thunderstorms, severe winter weather, cyber threats and tornadoes. Figure 3-1 shows the responses to question 3 of the survey, which solicited the public's opinion on the mitigation actions that should have the highest priority in the updated hazard mitigation plan. Improve reliability of communications systems, indoor/outdoor warning, generators for critical facilities, and public education and awareness were cited as the most popular mitigation actions. This information was shared with the HMPC during the update of the mitigation strategy as a source of potential mitigation ideas and the following mitigation actions were developed by the HMPC after reviewing the survey results. Refer to Chapter 6 Mitigation Strategy and Table 6-2 Adams County 2020 Mitigation Action Plan for additional details on each mitigation action.

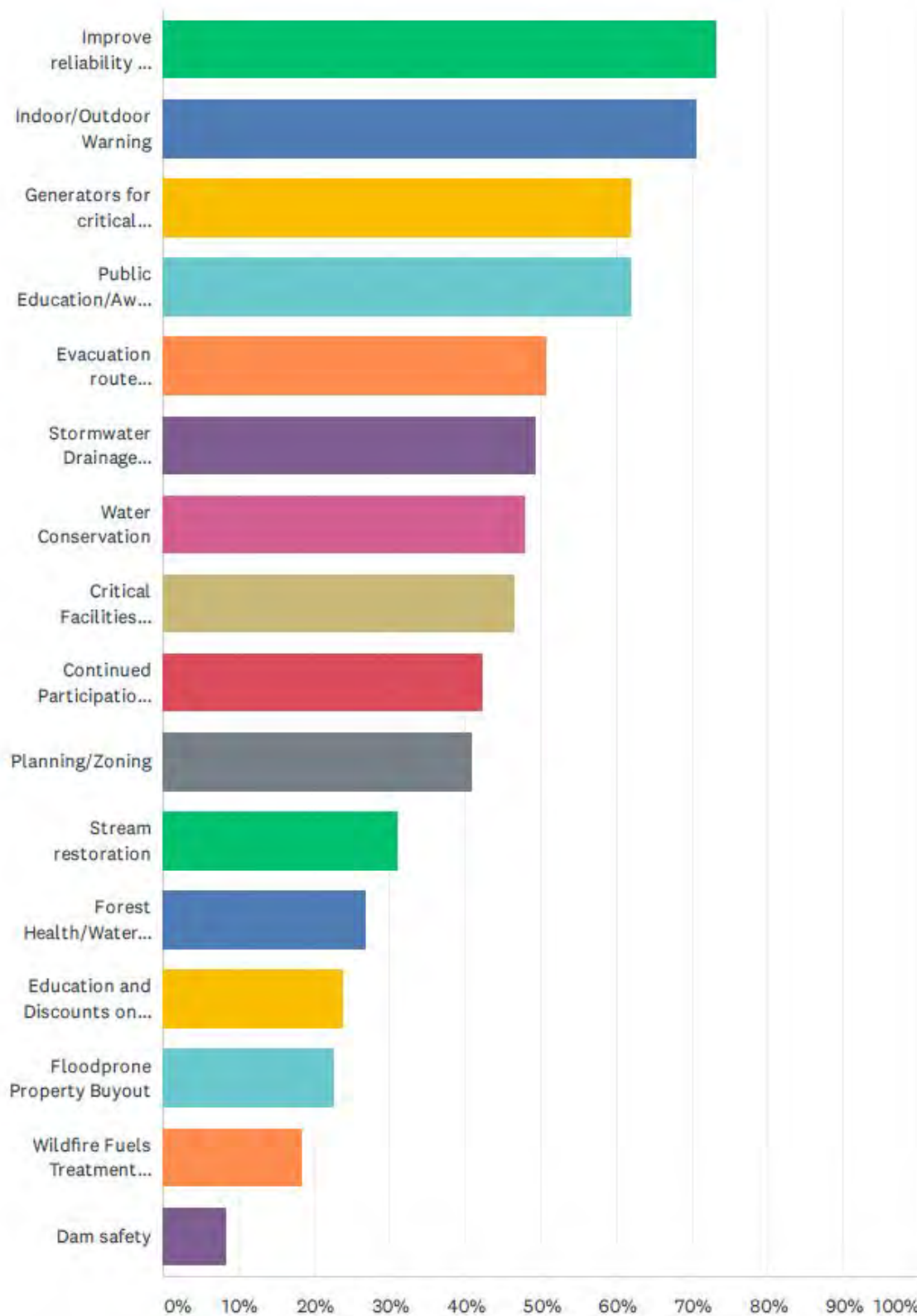
- AD-21: Provide zoning and future land use guidance to map vulnerable populations. Create a toolkit to assist and educate owners/developers on development concerns and ways to mitigate in particular areas.

- AD-22: Dam Safety Alerting System.
- TOB-1: Develop hazard mitigation brochure.
- COB-3: Public/Emergency Shelter Generator for Eagle View Adult Center. Eagle View Adult Center is the main shelter location for the city.

A summary of all the survey data and documentation of the public feedback can be found in Appendix A.



Figure 3-1 Sample of Public Survey Responses



Source: Wood online survey: "Please indicate the types of mitigation actions that you think should have the highest priority in the Adams County Hazard Mitigation Plan."

Local Emergency Planning Committee (LEPC) Meeting

The Adams County Local Emergency Planning Committee (LEPC) holds monthly meetings that are open to the public. Wood attended the LEPC meeting on January 27, 2020 to give an overview of the planning process, review the risk assessment results, and discuss the updated goals and objectives, along with the results from the public survey. LEPC members discussed the risk and vulnerability assessment rankings, particularly the hazardous materials section. The LEPC was invited to comment on the draft plan, and their comments were incorporated into the plan.

Public Review Period

The public was also given an opportunity to provide input on a draft of the complete plan prior to its submittal to the State and FEMA. Adams County provided the plan draft for review and comment on the County website from June 2 to July 10, 2020. (Due to the ongoing Covid-19 pandemic at that time, hard copy plans were not made available for comment.) The jurisdictions announced the availability of the draft plan and the public comment period through social and traditional media announcements. Copies of these notices is provided in Appendix A. An online form to collect comments was posted with the plan. Two members of the public indicated that they reviewed the draft plan but neither provided comments on the online form.

Step 3: Coordinate with Other Departments

DMA Requirement §201.6(b):

An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include: (2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process. (3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.

There are numerous organizations whose goals and interests' interface with hazard mitigation in Adams County. Coordination with these organizations and other community planning efforts is vital to the success of this plan update. The Adams County Office of Emergency Management invited other local, state, and federal agencies to the kickoff meeting to learn about and participate in the hazard mitigation planning initiative. Many of the agencies participated throughout the planning process in meetings described in Step 1: Organize the Planning Effort. In addition, the HMPC developed a list of neighboring communities and local and regional agencies involved in hazard mitigation activities, as well as other interested parties to keep informed on the plan update process.

Stakeholders included local and regional agencies involved in hazard mitigation activities or those beyond the County and local government that have the authority to regulate development. Stakeholders could participate in various ways, either by contributing input at HMPC meetings, being aware of planning activities through an email group, providing information to support the effort, or reviewing and commenting on the draft plan. Representatives from the following agencies and organizations were invited to participate as stakeholders in the process; an asterisk indicates they attended HMPC meetings.

Other Government and Stakeholder Representatives

- Colorado Division of Homeland Security and Emergency Management (DHSEM)*
- FEMA*
- City of Thornton Long Range Planning*
- Southeast Weld Fire Protection District
- Adams/Jefferson County Hazmat*
- City of Westminster Office of Emergency Management*
- North Metro Fire
- Mile High Flood District*
- Tri-County Health Department*
- Northglenn Police Department*
- Adams County Fire Protection District*
- Brighton Fire
- City of Aurora Office of Emergency Management
- Suncor Energy - Fire

Many of these groups found it beneficial to participate on the committee. As part of the HMPC and public outreach processes, stakeholders were invited to review and comment on the plan prior to submittal to Colorado DHSEM and FEMA.

As part of the public review and comment period for the draft plan, key agencies were again specifically solicited as well as the neighboring jurisdictions of Arapahoe, Weld and Denver counties and the incorporated jurisdictions not participating in this HMP update, to provide any final input to the draft plan document. This input was solicited by direct emails to key groups and associations to review and comment on the plan. As part of this targeted outreach, these key stakeholders were also specifically invited to attend the HMPC to discuss any outstanding issues and to provide input on the draft document and final mitigation strategies. This met the requirements of planning steps 2 and 3 in the FEMA Local Mitigation Planning Handbook.

Incorporation of Existing Plans and Other Information

Coordination and synchronization with other community planning mechanisms and efforts are vital to the success of hazard mitigation planning. Existing plans, policies, regulations, codes, tools, and other actions designed to reduce a community's risk and vulnerability from natural hazards should be identified and reviewed to have a thorough evaluation of hazard mitigation practices already in place. Adams County uses a variety of mechanisms to guide growth and development. Integrating existing planning efforts, mitigation policies, and action strategies into this plan establishes a credible, holistic document that weaves the common threads of a community's values together.

The County's 2014 HMP was fully integrated into the 2014 Adams County Comprehensive Plan. It was noted at the kickoff meeting that it was important to the HMPC to continue this integration in future updates of both plans. While the HMP is being updated separately from the Comprehensive Plan in order for the HMP to meet 5-year update cycle requirements, the risk information from the 2020 HMP will be incorporated during the next Comprehensive Plan Update; the planning process is expected to begin by end of 2020. The development and update of this plan involved a comprehensive review of existing plans, studies, reports, and initiatives from Adams County and participating municipalities related to hazards or hazard mitigation. A high-level summary of the key plans, studies and reports is summarized in the table below, with notes on how they informed the update.

Table 3-4 Summary of Review of Key Plans, Studies and Reports

Plan, Study, Report Name	How Plan informed LHMP
Adams County Comprehensive Plan (2014) and Appendix C: Hazard Identification and Risk Assessment	Provided background information on the county including some information related to jurisdictions. Informed the Community Profile in Chapter 2 and Chapter 4 Risk Assessment.
Adams County Transportation Plan (2012)	Informed Chapter 2 Community Profile
Arapahoe County Hazard Mitigation Plan (2015)	Provided information on past events and vulnerabilities specific to the Town of Bennett.
City of Aurora Hazard Mitigation Plan (2016)	Informed the risk and vulnerability assessment in Chapter 4.
Thornton, Federal Heights, and Northglenn Natural Hazard Mitigation Plan (2017)	Informed the risk and vulnerability assessment in Chapter 4.
Colorado State Hazard Mitigation Plan (2018)	Informed the HIRA (Chapter 4) with risk information specific to Adams County and hazard profile information for each of the hazards.
Town of Bennett Comprehensive Plan (2015)	Provided background information on the Town of Bennett, including potential areas for future development.
Adams County Flood Insurance Study (2018)	Reviewed for information on past floods and flood problems to inform risk assessment (Chapter 4) Utilized Digital Flood Insurance Rate Maps effective September 2018 to update maps and flood risk assessment in Chapter 4.
Town of Bennett Draft CAIMP Master Plan (2015)	Informed the flood risk analysis for the Town of Bennett and was used in the discussion on developing new mitigation actions for the Town.
Weld County Hazard Mitigation Plan (2016)	Provided information on past events and vulnerabilities specific to the City of Brighton.
Sustainable Adams County 2030 Plan (2015)	Informed the Capability Assessment (Chapter 5) and was referenced during the goals and objectives development workshop.
City of Westminster Hazard Mitigation Plan (2018)	Informed the risk assessment (Chapter 4).
Adams County Community Report (2019)	Informed the Community Profile (Chapter 2)
Middle South Platte-Cherry Creek Hydrologic Unit Code 10190003 Rapid Assessment (2009)	Informed the flood profile and risk assessment in Chapter 4.
Colorado State Drought Response and Mitigation Plan (2018)	Informed the drought hazard profile and vulnerability assessment in Chapter 3 risk assessment.
Colorado Water Conservation Board – Colorado Water Availability Study (2018)	Informed the drought hazard vulnerability assessment in Chapter 4 risk assessment.
Adams County Land Use and Development Code. Chapter 3 Zone District Regulations	Informed the County's capabilities assessment and provided information for the parcel analysis.

Other technical data, reports and studies were reviewed and considered, as appropriate, during the collection of data to support Planning Steps 4 and 5, which include the hazard identification, vulnerability assessment, and capability assessment. Information from the following agencies and groups were reviewed in the development and update of this plan. Specific references relied on in the development of

this plan are also sourced throughout the document as appropriate. These sources are documented throughout the plan and specifically in the capability assessment sections of each jurisdictional annex.

- Colorado Department of Public Health and Environment (CDPHE)
- Colorado Department of Transportation (CDOT)
- Colorado Division of Water Resources – Dam Safety
- Colorado Earthquake Information Database
- Colorado Geological Survey
- Colorado State Demography Office
- Colorado Wildfire Risk Assessment Portal (CO-WRAP)
- Federal Wildland Fire Occurrence Database
- FEMA Community Information System
- Headwaters Economics
- National Drought Mitigation Center – Drought Impact Reporter
- National Fire Protection Association (NFPA)
- National Interagency Fire Center (NIFC)
- National Oceanic and Atmospheric Administration’s (NOAA) National Center for Environmental Information (NCEI)
- National Register of Historic Places
- National Weather Service (NWS)
- U.S. Army Corp of Engineers’(USACE) National Inventory of Dams (NID)
- U.S. Census Bureau
- U.S. Center for Disease Control and Prevention (CDC)
- U.S. Coast Guard’s National Response Center (NRC)
- U.S. Department of Agriculture (USDA) – Farm Service Agency (FSA)
- U.S. Department of Transportation (DOT)
- U.S. Drought Monitor
- U.S. Environmental Protection Agency (EPA)
- U.S. Geological Survey
- Western Regional Climate Center

3.4.2 Phase 2 Assess Risk

Step 4: Identify the Hazards

Wood led the HMPC in an effort to review the list of hazards identified in the 2014 plan and document all the hazards that have impacted or could impact the planning area, including documenting recent events. The HMPC refined the list of hazards to make it more relevant to Adams County. The profile of each of these hazards was then developed and updated in 2020 with information from the HMPC and additional sources. Web resources, existing reports and plans, and existing GIS layers were used to compile information about past hazard events and determine the location, previous occurrences, probability of future occurrences, and magnitude/severity of each hazard. Information on the methodology and resources used to identify and profile hazards is provided in Chapter 4.

Step 5: Assess the Risks

After profiling the hazards that could affect Adams County, the HMPC collected information to describe the likely impacts of future hazard events on the participating jurisdictions. This step included two parts: a vulnerability assessment and a capability assessment.

Vulnerability Assessment—Participating jurisdictions inventoried their assets at risk to natural and human-caused hazards—overall and in the identified hazard areas. These assets included total number and value of structures; critical facilities and infrastructure; natural, historic, and cultural assets; and economic assets. The HMPC also analyzed development trends in hazard areas. The County’s DFIRM was used to refine the estimated flood losses during the update, where available for the NFIP participating communities.

Capability Assessment—This assessment consisted of identifying the existing mitigation capabilities of participating jurisdictions. This involved collecting information about existing government programs, policies, regulations, ordinances, and plans that mitigate or could be used to mitigate risk to disasters. Participating jurisdictions collected information on their regulatory, administrative, fiscal, and technical capabilities, as well as ongoing initiatives related to interagency coordination and public outreach. This information is included in the jurisdictional annexes. Refer to Chapter 5 Capabilities Assessment for the results of the existing capabilities as well as the jurisdictions identified opportunities for enhancing capabilities.

A more detailed description of the risk assessment process and the results are included in Chapter 4 Risk Assessment.

3.4.3 Phase 3 Develop the Mitigation Plan

Step 6: Set Goals

Wood facilitated a brainstorming and discussion session with the HMPC during their third meeting to identify goals and objectives for the overall multi-jurisdictional mitigation plan update. The HMPC discussed definitions and examples of goals, objectives, and actions; and considered the goals of the State Hazard Mitigation Plan and other relevant plans when forming their own goals and objectives. The 2014 HMP was fully integrated into the County’s Comprehensive Plan, and while the Comprehensive Plan’s goals addressed hazard mitigation, for the 2020 update the HMPC decided that a separate set of mitigation goals and objectives should be developed in alignment with the Comprehensive Plan goals but more focused on reducing losses from hazards. The group discussed the ideas and came to consensus on the final goals and objectives for the multi-jurisdictional plan update, which are further discussed in Chapter 6.

Step 7: Review Possible Activities

The HMPC identified mitigation actions at their third meeting and prioritized them at their fourth meeting. The group was presented with six different categories of mitigation actions and example actions for each identified hazard. The HMPC then participated in a brainstorming process, in which committee members identified actions to address each of the plan’s four goals. The HMPC then reviewed potential mitigation alternatives and identified new actions by hazard and jurisdiction to ensure that all the plan’s high- and medium-significance hazards were addressed, and that all participating jurisdictions had at least one new mitigation action.

The HMPC discussed criteria for narrowing down and prioritizing the identified actions. The group approved the STAPLEE criteria, which assesses the Social, Technical, Administrative, Political, Legal, Economic, and Environmental implications of each action. Each member used these criteria to vote for their highest priority projects. Projects were then sorted into high, medium, or low priority based upon the number of votes they received. This process is described in more detail in Chapter 6 Mitigation Strategy.

The HMPC also identified the responsible agency for implementing each action. The identified agencies then completed a mitigation action implementation worksheet for each action. The purpose of these

worksheets is to document background information, ideas for implementation, alternatives, responsible agency, partners, potential funding, cost estimates, benefits, and timeline for each identified action.

Each HMPC member from the participating jurisdictions was responsible for completing a mitigation action implementation worksheet for actions specific to their jurisdiction. The jurisdictional worksheets include details on what will be needed to implement the mitigation action on the jurisdictional level. The jurisdictions were also responsible for working with their local staff to submit additional mitigation actions unique to their jurisdiction. Each jurisdiction provided input on the progress made on actions identified in the 2014 plan, or in the case of Bennett and Brighton updates to their actions from the Arapahoe County and Weld County plans.

Step 8: Draft the Plan

The first complete draft of the plan update, including annexes for each of the participating jurisdictions, were developed and submitted to the HMPC for review in March 2020. Once the committee's comments were incorporated, a complete draft of the plan was made available online and in hard copy for review and comment by the public and other agencies and interested stakeholders, as discussed above under Step 2 Involve the Public. This review period was from June 2 – July 10, 2020. Methods for inviting interested parties and the public to review and comment on the plan were discussed in Steps 2 and 3, and materials are provided in Appendix A.

3.4.4 Phase 4 Implement the Plan and Monitor Progress

Step 9: Adopt the Plan

To secure buy-in and officially implement the plan, the governing bodies of each participating jurisdiction adopted the plan and their jurisdictional annex. Scanned copies of resolutions of adoption are included in Appendix C Local Plan Adoptions.

Step 10: Implement, Evaluate, and Revise the Plan

The true worth of any mitigation plan is in the effectiveness of its implementation. Up to this point in the plan update process, all of the HMPC's efforts have been directed at researching data, coordinating input from participating entities, and updating and developing appropriate mitigation actions. Each recommended action includes key descriptors, such as hazard(s) addressed, lead manager and priority, to help initiate implementation. An overall implementation strategy is described in Chapter 7 Plan Implementation and Monitoring, which also addresses how the previous plan was implemented and evaluated.

Finally, there are numerous organizations within Adams County planning area whose goals and interests' interface with hazard mitigation. Coordination with these other planning efforts, as addressed in Planning Step 3, is paramount to the ongoing success of this plan and of mitigation in Adams County and is addressed further in Chapter 7. A plan update and maintenance schedule and a strategy for continued public involvement are also included in Chapter 7.

4 Risk Assessment

DMA Requirement §201.6(c)(2):

[The plan shall include] A risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.

Risk, for the purposes of this plan and as defined by FEMA, is a combination of hazard, vulnerability, and exposure. It is the impact that a hazard would have on people, services, facilities, and structures in a community, and refers to the likelihood of a hazard event resulting in an adverse condition that causes injury or damage.

The risk assessment process identifies and profiles relevant hazards and assesses the exposure of lives, property, and infrastructure to these hazards. The process allows for a better understanding of a jurisdiction's potential risk to hazards and provides a framework for developing and prioritizing mitigation actions to reduce risk from future hazard events.

This risk assessment builds upon the methodology described in the 2013 FEMA Local Mitigation Planning Handbook, which recommends a four-step process for conducting a risk assessment:

1. Describe Hazards
2. Identify Community Assets
3. Analyze Risks
4. Summarize Vulnerability

In essence, the risk assessment evaluates potential loss from hazards by assessing the vulnerability of the county's population, build environment, critical facilities, and other assets. Data collected through this process has been incorporated into the following sections of this section:

Subsection 4.1: Hazard Identification - identifies the hazards that threaten the Planning Area and describes why some hazards have been omitted from further consideration.

Subsection 4.2: Asset Summary - describes the methodology for inventorying assets as the basis for determining vulnerability of the planning area to the identified hazards.

Subsection 4.3: Hazard Analysis and Risk Assessment - discusses the threat to the Planning Area and describes previous occurrences of hazard events and the likelihood of future occurrences. It also includes a vulnerability assessment considering property, critical facilities, and historic/cultural/natural assets at risk, as well as possible effects to the economy and future development trends.

This risk assessment covers the entire geographical area of Adams County. Since this plan is a multi-jurisdictional plan, the HMPC also evaluated how the hazards and risks vary from jurisdiction to jurisdiction. While these differences are noted in this section, they are expanded upon in the annexes of the participating jurisdictions. If no additional data is provided in an annex, it should be assumed that the risk and potential impacts to the affected jurisdiction are similar to those described here for the entire Adams County planning area.

4.1 Hazard Identification

DMA Requirement §201.6(c)(2)(i):

[The risk assessment shall include a] description of the type of all-natural hazards that can affect the jurisdiction.

The first step in developing a risk assessment is identifying the hazards. The Adams County HMPC conducted a hazard identification study to determine the hazards that threaten the planning area.

4.1.1 Methodology and Results

Colorado's Front Range region is susceptible to a number of hazards. This HMP profiles the most significant of these hazards. Historical data, catastrophic potential, relevance to the jurisdiction, and the probability and potential magnitude of future occurrences were all used to reduce and prioritize the list of hazards to those most relevant to Adams County. Hazards data was obtained from various federal, state, and local sources such as FEMA, the Colorado Geological Survey (CGS), the National Oceanic and Atmospheric Administration (NOAA) National Center for Environmental Information (NCEI), the United States Geological Survey (USGS), and others. Local and national news reports were also used to research historic events. Together, these sources were examined to assess the significance of these hazards to the County. The hazards selected for inclusion in this plan include those that have occurred historically or have the potential to cause significant human and/or monetary losses in the future.

The update process included a comprehensive, parcel-level risk analysis with GIS where available data permitted. Many new maps and tables were added that capture the potential losses. Additional details on the loss analysis at the jurisdictional level, including a breakdown of hazard losses by community and property type, can be referenced in Appendix E and the jurisdictional annexes.

The following table explains changes in the hazards profiled in 2014 compared to the 2020 update. The major change was the inclusion of human caused hazards in the 2020 Plan.

Table 4-1 2019-2020 Updates to Hazards Profiled

2020 Hazards	When Identified	Comments
Natural Hazards		
Drought	In 2014 HIRA	
Earthquake	In 2014 HIRA	
Flood	In 2014 HIRA	
Severe Winter Weather	In 2014 HIRA	
Subsidence	In 2014 HIRA	
Thunderstorms	In 2014 HIRA	Lightning & hail were profiled separately in 2014 HIRA
Tornado/Damaging Wind	In 2014 HIRA (tornado)	Damaging wind added to hazard profile
Wildfire	In 2014 HIRA	
Human-Caused Hazards		
Cyber Incident	New in 2020	
Dam Failure/Incident	New in 2020	
Hazardous Materials	New in 2020	
Terrorism/Active Shooter	New in 2020	

While not profiled as a separate hazard, the potential impacts of climate change were incorporated into all hazard profiles.

The HMPC also reviewed the list of hazards profiled in the 2018 Colorado State Hazard Mitigation Plan. Several of those hazards were deemed to not be a significant risk in Adams County. For other hazards, the risk in Adams County does not differ significantly from the State as a whole. The HMPC decided not to include the following hazards in the Adams County Hazard Mitigation Plan:

- Animal Disease Outbreak
- Avalanche
- Critical Infrastructure Disruption/Failure (addressed under Terrorism hazard)
- Chemical, Biological, Radiological, and Nuclear Attacks (addressed under Terrorism hazard)
- Dense Fog
- Erosion and Deposition
- Expansive Soils and Heaving Bedrock
- Explosive Attack (addressed under Terrorism hazard)
- Landslide/Mud/Debris Flows/Rock Fall/Rockslide
- Mine Accident
- Pandemic/Epidemiology
- Pest Infestation
- Power Failure
- Radiological Release (addressed under Terrorism hazard)
- Radon/Carbon Monoxide/Methane/Other Seeps
- Telecommunications Failure
- Wildlife Vehicle Collisions

The HMPC discussed adding pandemic and related biological hazards, but concluded that profiling them in this plan would be redundant with existing pandemic plans maintained by the County and by Tri-County Health Care.

The HMPC also discussed adding airplane crash as an additional hazard, due to the County's proximity to DIA as well as the Colorado Air and Space Port. However, the HMPC decided to treat airplane crashes as a component of hazardous materials incidents rather than profiling it separately.

Overall Hazard Significance Summary

Table 4-2 shows overall hazard significance, based on a combination of geographic area, probability of future occurrence and potential magnitude/severity as defined below. The individual ratings are based on or interpolated from the analysis of the hazards in the sections that follow. During the 2019-2020 Plan update process, the individual ratings and significance of the hazards was revisited and updated. Public concern was also considered via input at public meetings and an online survey.

Table 4-2 Adams County Hazard Significance

Hazard	Geographic Location	Probability of Future Occurrence	Magnitude/Severity (Extent)	Overall Significance
Thunderstorms	Extensive	Highly Likely	Limited	High
Tornado/Damaging Wind	Extensive	Highly Likely	Limited	High
Winter Weather	Extensive	Highly Likely	Limited	High
Flood	Limited	Likely	Critical	Medium

Hazard	Geographic Location	Probability of Future Occurrence	Magnitude/Severity (Extent)	Overall Significance
Dam Failure/Incident	Limited	Unlikely	Critical	Medium
Drought	Extensive	Likely	Negligible	Medium
Hazardous Materials Incident	Limited	Likely	Limited	Medium
Earthquake	Limited	Occasional	Limited	Low
Subsidence	Limited	Occasional	Limited	Low
Wildfire	Limited	Likely	Negligible	Low
Terrorism/Active Shooter	Limited	Occasional	Limited	Low
Cyber Incident	Limited	Likely	Limited	Low
Geographic Location Limited: Less than 10% of planning area Significant: 10-50% of planning area Extensive: 50-100% of planning area Probability of Future Occurrences Highly Likely: Near 100% chance of occurrence in next year or happens every year. Likely: Between 10 and 100% chance of occurrence in next year or has a recurrence interval of 10 years or less. Occasional: Between 1 and 10% chance of occurrence in the next year or has a recurrence interval of 11 to 100 years. Unlikely: Less than 1% chance of occurrence in next 100 years or has a recurrence interval of greater than every 100 years.		Magnitude/Severity (Extent) Catastrophic—More than 50% of property severely damaged; shutdown of facilities for more than 30 days; and/or multiple deaths Critical—25-50% of property severely damaged; shutdown of facilities for at least two weeks; and/or injuries and/or illnesses result in permanent disability Limited—10-25% of property severely damaged; shutdown of facilities for more than a week; and/or injuries/illnesses treatable do not result in permanent disability Negligible—Less than 10% of property severely damaged, shutdown of facilities and services for less than 24 hours; and/or injuries/illnesses treatable with first aid Significance Low: minimal potential impact Medium: moderate potential impact High: widespread potential impact		

4.1.2 Disaster Declaration History

One method used to identify hazards was to examine events that triggered federal and/or state disaster declarations. Federal and/or state declarations may be granted when the severity and magnitude of an event surpasses the ability of the local government to respond and recover. Disaster assistance is supplemental and sequential. When the local government's capacity has been surpassed, a state disaster declaration may be issued, allowing for the provision of state assistance. Should the disaster be so severe that both the local and state governments' capacities are exceeded; a federal emergency or disaster declaration may be issued allowing for the provision of federal assistance.

The federal government may issue a disaster declaration through FEMA, the USDA, and/or the Small Business Administration (SBA). FEMA also issues emergency declarations, which are more limited in scope and without the long-term federal recovery programs of major disaster declarations. The quantity and types of damage are the determining factors.

A USDA disaster declaration certifies that the affected county has suffered at least a 30% loss in one or more crop or livestock areas and provides affected producers with access to low-interest loans and other programs to help mitigate the impact of the disaster. In accordance with the Consolidated Farm and Rural Development Act, all counties neighboring those receiving disaster declarations are named as contiguous disaster counties and, as such, are eligible for the same assistance. Table 4-3 lists state and federal disaster declarations received by Adams County. Many of the disaster events were regional or statewide; therefore, reported costs are not accurate reflections of losses to Adams County.

Table 4-3 Disaster Declaration History in Adams County, 1953-Present

Year	Hazard	Declaration Type	Disaster No.
2020	Covid-19 Pandemic	President Disaster	DR-4498
2020	Covid-19 Pandemic	Emergency Declaration	EM-3436
2019	Flooding (declaration amendment/extension)	State Declaration	D 2019-001
2018	Hail, high winds, rain, and tornadoes	USDA Disaster	S4404
2018	Cybersecurity	State Declaration	D 2018-001
2017	Wildfire	State Declaration	D 2017-017
2017	Drought	USDA Disaster	S4145
2016	Blizzard	State Declaration	
2016	Flooding (declaration amendment/extension)	State Declaration	D 2016-005
2015	Severe storms, tornadoes, flooding, landslides, and mudslides	Presidential Disaster	DR-4229
2015	Severe Weather, Flooding, Landslides (amendment/extension)	State Declaration	D 2015-006
2015	Severe Weather, Flooding, Landslides (amendment/extension)	State Declaration	D 2015-008
2014	Extreme weather	State Declaration	
2014	Flooding (declaration amendment/extension)	State Declaration	D 2014-001
2014	Flooding (declaration amendment/extension)	State Declaration	D 2014-002
2014	Flooding (declaration amendment/extension)	State Declaration	D 2014-006
2014	Flooding (declaration amendment/extension)	State Declaration	D 2014-012
2013	Flooding	Presidential Emergency Presidential Disaster	EM-3365 DR-4145
2013	Drought	USDA Disaster	S3548
2013	Drought	USDA Disaster	S3456
2013	Winter storm	State Declaration	
2012	Hail, high winds, and flash flooding	USDA Disaster	S3347
2012	Drought, excessive heat, high winds	USDA Disaster	S3260
2009	Severe blizzard	State Declaration	
2009	Severe sprint snowstorm	State Declaration	
2006	Drought, fire, heat and high winds	USDA Disaster	
2006	Snow	Presidential Emergency	EM-3270
2003	Snow	Presidential Emergency	EM-3185
2003	Snow emergency	State Declaration	
2002	Wildfires	Presidential Disaster	DR-1421
2002	Wildfires	State Declaration	
2002	Drought	USDA Disaster	
2002	Drought	State Declaration	
2001	Severe winter storms	State Declaration	
2000	Drought	USDA Disaster	
1982	Severe winter storm	State Declaration	
1982	Dam safety	State Declaration	
1981	Tornadoes	State Declaration	
1973	Dam failure	Presidential Disaster	DR-385
1969	Heavy rains, snowmelt and flooding	Presidential Disaster	DR-261
1965	Tornadoes, severe storms & flooding	Presidential Disaster	DR-200

Source: State of Colorado Hazard Mitigation Plan 2018; fema.gov; usda.gov; Colorado Governor Executive Orders 2014-2019

Out of 32 declared disasters, ten have been for severe winter storms, blizzards, or snow; this includes three Presidential declarations. There have been eight declarations for drought, all but one of which was a USDA declaration. Seven disasters have been declared for severe weather (non-winter), including flooding, tornadoes, hail, and high winds. The most damaging disaster in Colorado's history was the severe flooding in 2013 (EM-336 & DR-4145), which led to over \$26M in Public Assistance funds.

4.1.3 Climate Change Considerations Summary

Addressing the potential for climate change to affect the frequency, intensity, or even location of hazards in the future is new to this hazard mitigation plan update round. This complies with recent FEMA regulations which require consideration and integration of climate change planning and actions into ongoing and future programs, policies, and operations.

4.1.4 Overview of Hazard Identification and Risk Assessment

The hazards identified in Section 4.1 Hazard Identification are profiled individually in this section. The section will conclude by summarizing the probability of future occurrence and potential magnitude of each hazard for each jurisdiction, as well as assigning an overall vulnerability, or planning significance, rating of high, moderate, or low for each hazard.

The sources used to collect information for these profiles include the following:

- Disaster declaration history from FEMA, the State of Colorado's Governor Executive Orders, and the USDA Farm Service Agency
- State of Colorado Hazard Mitigation Plan (2018)
- Adams County Comprehensive Plan (2012)
- Internet resources on past hazard events, such as the National Oceanic and Atmospheric Administration's National Centers for Environmental Information (NCEI) databases, the National Drought Mitigation Center's Drought Impact Reporter, the National Response Center, and the Global Terrorism Database.
- Geographic information systems (GIS) data from the Adams County GIS Department
- Statewide GIS datasets compiled by state and federal agencies (e.g. The Homeland Infrastructure Foundation-Level Data, or HIFLD dataset for critical facilities and infrastructure)
- Other existing plans and reports
- Personal interviews with HMPC members and other stakeholders
- Adams County Data Collection Guides completed by each participating jurisdiction
- City of Aurora Hazard Mitigation Plan (2016)
- Thornton, Federal Heights, & Northglenn Hazard Mitigation Plan (2017)
- City of Westminster Hazard Mitigation Plan (2018)
- Jefferson County Hazard Mitigation Plan (2016)
- Weld County Hazard Mitigation Plan (2016)

Detailed profiles for each of the identified hazards include information on the following characteristics of the hazard:

Hazard Description

This section consists of a general description of the hazard and the general impacts it may have on a community.

Geographic Location

This section describes the geographic coverage, or location, of the hazard in the planning area and assesses the affected areas as isolated, small, medium, or large.

- Large: More than 50% of the planning area affected
- Medium: 25-50% of the planning area affected
- Small: 10-25% of the planning area affected
- Isolated: Less than 10% of the planning area affected

Previous Occurrences

This section includes information on historic incidents, including impacts and costs, if known. A historic incident worksheet was used to capture information from participating jurisdictions on past occurrences. Information from the HMPC was combined with other data sources, including those previously mentioned.

Probability of Future Occurrence

The frequency of past events is used to gauge the likelihood of future occurrences. Based on historical data, the Probability of Future Occurrence is categorized as follows:

- Highly Likely: Near 100% chance of occurrence next year or happens every year
- Likely: 10-100% chance of occurrence in next year or has a recurrence interval of 10 years or less
- Occasional: 1-10% chance of occurrence in the next year or has a recurrence interval of 11 to 100 years
- Unlikely: Less than 1% chance of occurrence in next 100 years or has a recurrence interval of greater than every 100 years

The probability, or chance of occurrence, was calculated where possible based on existing data. Probability was determined by dividing the number of events observed by the number of years and multiplying by 100. This gives the percent chance of the event happening in any given year. An example would be three droughts occurring over a 30-year period, which suggests a 10% chance of a drought occurring in any given year.

Magnitude/Severity

This section summarizes the magnitude/severity or extent of a hazard event in terms of deaths, injuries, property damage, and interruption of essential facilities and services. Magnitude and severity are classified in the following manner:

- Catastrophic: Multiple deaths; property destroyed and severely damaged; and/or interruption of essential facilities and service for more than 72 hours
- Critical: Isolated deaths and/or multiple injuries and illnesses; major or long-term property damage that threatens structural stability; and/or interruption of essential facilities and services for 24-72 hours
- Limited: Minor injuries and illnesses; minimal property damage that does not threaten structural stability; and/or interruption of essential facilities and services for less than 24 hours
- Negligible: No or few injuries or illnesses; minor quality of life loss; little or no property damage; and/or brief interruption of essential facilities and services

Climate Change Considerations

As summarized in Section 4.1.3 above, this sub-section will discuss the known or potential impacts of climate change on the specific hazard.

Vulnerability Assessment

The vulnerability assessment further defines and quantifies populations, buildings, critical facilities and infrastructure, natural/cultural resources, and other community assets at risk to the profiled hazards, as well as the potential impacts to the economy and future development trends of the planning area. The vulnerability assessment includes these sub-sections per applicable hazard:

- People (including vulnerable populations)
- General Property

- Critical Facilities and Infrastructure
- Economy
- Historic, Cultural, and Natural Resources
- Future Development
- Risk Summary

The data and other assets inventory used in the vulnerability assessment for each hazard is described in more detail in the following Section 4.2 Asset Summary.

4.2 Asset Summary

4.2.1 People

For hazards with a geospatial component and for which data was available for GIS-based parcel analysis, population estimates were calculated. These were based on multiplying the average persons per household for Adams County as of 2018, times the number of properties of Residential nature in each of the vulnerability analyses which found parcels at risk of the various hazards. Hence, if 'X' number of properties of Residential nature were found to overlap with a hazard layer, the total population exposed to that hazard would be obtained by taking 'X' times 3.0, then adding the results by jurisdiction, parcel type, and/or hazard classification. This average number of persons per household value was obtained from the Colorado Counties and Municipalities Population and Household Estimates summary, published by the Colorado Demographer's Office (under the Department of Local Affairs). For more details on Economic Assets, development trends, and other population and demographic information refer to Section 2 Community Profile.

4.2.2 General Property

General property exposure to hazards is based on Adams County's parcel data containing assessor information such as total number of parcels, improvement values, and parcel type classification by jurisdiction. Note that only those parcels with improvement values greater than \$0, or those which were classified as "exempt" or "state assessed" were accounted here; non-developed or non-improved parcels were excluded for the purposes of conducting the vulnerability assessments under Section 4.3. Vacant parcels, due to their improvement values equaling \$0, were also excluded from the exposure valuation analysis.

Counts and values are based on the latest county assessor's data (as of January 15, 2020), which was provided in GIS and tabular (spreadsheet) formats. Improvement values and parcel type attributes were joined to the parcel geometries in GIS, to enable spatial analysis and mapping. Content values were estimated as a percent of the improvement value based on parcel type, specifically: 50% of the improvement value for residential structures, 150% for industrial parcels, 100% for agricultural, commercial, and state assessed parcels (though state assessed parcels did not include improvement value information), and 50% for exempt parcels. These percentage calculations are based on standard FEMA Hazus methodologies. Finally, Total Values were aggregated by adding the improvement and content values for each jurisdiction. Table 4-4 shows the total number of improved parcels, properties, and their improvement and content values by jurisdiction.

Table 4-4 Improved Parcel Exposure Values by Jurisdiction

Jurisdiction	Improved Parcels	Improved Values	Content Values	Total Values
Arvada	1,206	\$38,743,010	\$28,899,895	\$67,642,905
Aurora	10,477	\$1,092,469,780	\$939,805,810	\$2,032,275,590
Bennett	851	\$23,730,980	\$15,409,080	\$39,140,060
Brighton	11,158	\$466,980,810	\$306,035,065	\$773,015,875
Commerce City	17,958	\$653,291,400	\$467,969,010	\$1,121,260,410
Federal Heights	1,343	\$69,862,170	\$48,793,010	\$118,655,180
Lochbuie	2	\$30,490	\$15,245	\$45,735
Northglenn	10,311	\$362,846,830	\$224,978,315	\$587,825,145
Thornton	39,028	\$1,286,306,890	\$770,662,310	\$2,056,969,200
Westminster	20,883	\$975,014,030	\$626,372,510	\$1,601,386,540
Unincorporated	30,016	\$1,211,031,220	\$799,609,300	\$2,010,640,520
TOTAL	143,233	\$6,180,307,610	\$4,228,549,550	\$10,408,857,160

Source: Adams County GIS/Assessor's Office, Wood analysis.

Table 4-5 summarizes the same information as above, but this time by parcel type. The below information indicates that most properties in Adams County are residential in nature, followed by exempt, commercial, agricultural, state assessed, and industrial. The Total Values of parcels available for assessment is over \$9.8 billion including both improvement values and content values. A total of 143,233 parcels were summed up for this exposure summary.

For those vulnerability analyses to follow in Section 4.3 Hazard Analysis and Risk Assessment, the total parcels exposed to the hazards available in geospatial format were obtained by overlaying the hazard threat layers with the parcel layer in GIS. The following hazards will have vulnerability summaries at the parcel level, due to the availability of hazard data for the geospatial overlay analysis: Dam Failure/Incidents, Flood, and Wildfire. Earthquake will also include damage and loss estimates to general property based on the Hazus-derived information (see Section 4.3.4 Earthquake for details).

Table 4-5 Improved Parcel Exposure Values by Parcel Type

Parcel Type	Improved Parcels	Improved Values	Content Values	Total Values
Agricultural	1,075	\$33,376,140	\$33,376,140	\$66,752,280
Commercial	4,927	\$1,781,604,870	\$1,781,604,870	\$3,563,209,740
Exempt	5,229	\$1,196,925,890	\$598,462,945	\$1,795,388,835
Industrial	339	\$230,905,240	\$346,357,860	\$577,263,100
Residential	131,270	\$2,937,495,470	\$1,468,747,735	\$4,406,243,205
State Assessed	393	\$0	\$0	\$0
TOTAL	143,233	\$6,180,307,610	\$4,228,549,550	\$10,408,857,160

Source: Adams County GIS/Assessor's Office, Wood analysis.

4.2.3 Critical Facilities and Infrastructure

A critical facility may be defined as one that is essential in providing utility or direction either during the response to an emergency or during the recovery operation. Table 4-6 summarizes the inventory of critical facilities by FEMA Lifeline and type (based on best available data) in Adams County. These data were provided by the Adams County GIS Department and supplemented by the Homeland Infrastructure Foundation-Level Data (HIFLD), a federal resource for open geospatial data geared towards supporting community preparedness, resiliency, and research. Table 4-7 summarizes these facilities by jurisdiction. The locations of these facilities are displayed in Figure 4-1 below. For context, FEMA Lifelines are the U.S. Department of Homeland Security's current recommended way to standardize the classification of critical facilities and infrastructure which provide indispensable service, operation, or function to a community. Per the Community Lifelines information sheet, "A lifeline provides indispensable service that enables the

continuous operation of critical business and government functions, and is critical to human health and safety, or economic security” (FEMA Community Lifelines, 2019). These categorizations are particularly useful as they:

- Enable effort consolidations between government and other organizations (e.g. infrastructure owners and operators)
- Enable integration of preparedness efforts among plans; easier identification of unmet critical facility needs
- Refine sources and products to enhance awareness, capability gaps, and progress towards stabilization
- Enhance communication amongst critical entities, while enabling complex interdependencies between government assets
- Highlight lifeline related priority areas regarding general operations as well as response efforts.

Specific information on facilities, names, and other key details by participating community can be found in the jurisdictional annexes.

Table 4-6 Critical Facilities and Infrastructure in Adams County By FEMA Lifeline and Facility Type

FEMA Lifeline	Critical Facility Type	Total
Communications	Communication Towers	73
TOTAL		73
Energy	Electric Substations	30
TOTAL		30
Food/Water/Shelter	EO Emergency Shelters	65
	Gravel Mines/Ponds	80
	Wastewater Treatment Plant	8
TOTAL		153
Hazardous Material	Environmental Hazard Superfund	86
	Environmental Hazard Toxic Site	36
	HazMat EO RMP Sites	14
	HazMat EO Tier II Sites	707
TOTAL		843
Health and Medical	Adult Day Care	2
	Assisted Living	27
	Dialysis Center	8
	Hospice	1
	Hospital	4
	Hospital/Surgical Center	8
	Medical Center	2
	Mental Health Center	3
	Nursing Home	18
	Senior Housing	2
	Urgent Care	3
TOTAL		78
Safety and Security	Fire Stations	39
	Government Facilities	32
	Landfills/Govt. Services	199
	Police Station	7
	Schools	225
TOTAL		502
Transportation	Airport	1
	Fishing Pier Bridge	1
	Golf Course Bridge	16
	Major Bridge	119
	Minor Bridge	77
	Pedestrian Bridge	27
	RTD Commuter Rail Station	8
TOTAL		249
GRAND TOTAL		1,928

Source: Adams County GIS, HIFLD, Wood analysis

Table 4-7 Critical Facilities and Infrastructure in Adams County By Jurisdiction

Jurisdiction	Total
Arvada	7
Aurora	141
Bennett	14
Brighton	76
Commerce City	273
Federal Heights	12
Lochbuie	2
Northglenn	47
Thornton	203
Westminster	76
Unincorporated	1,077
TOTAL	1,928

Source: Adams County GIS, HIFLD, Wood analysis



Figure 4-1 Critical Facilities in West Adams County

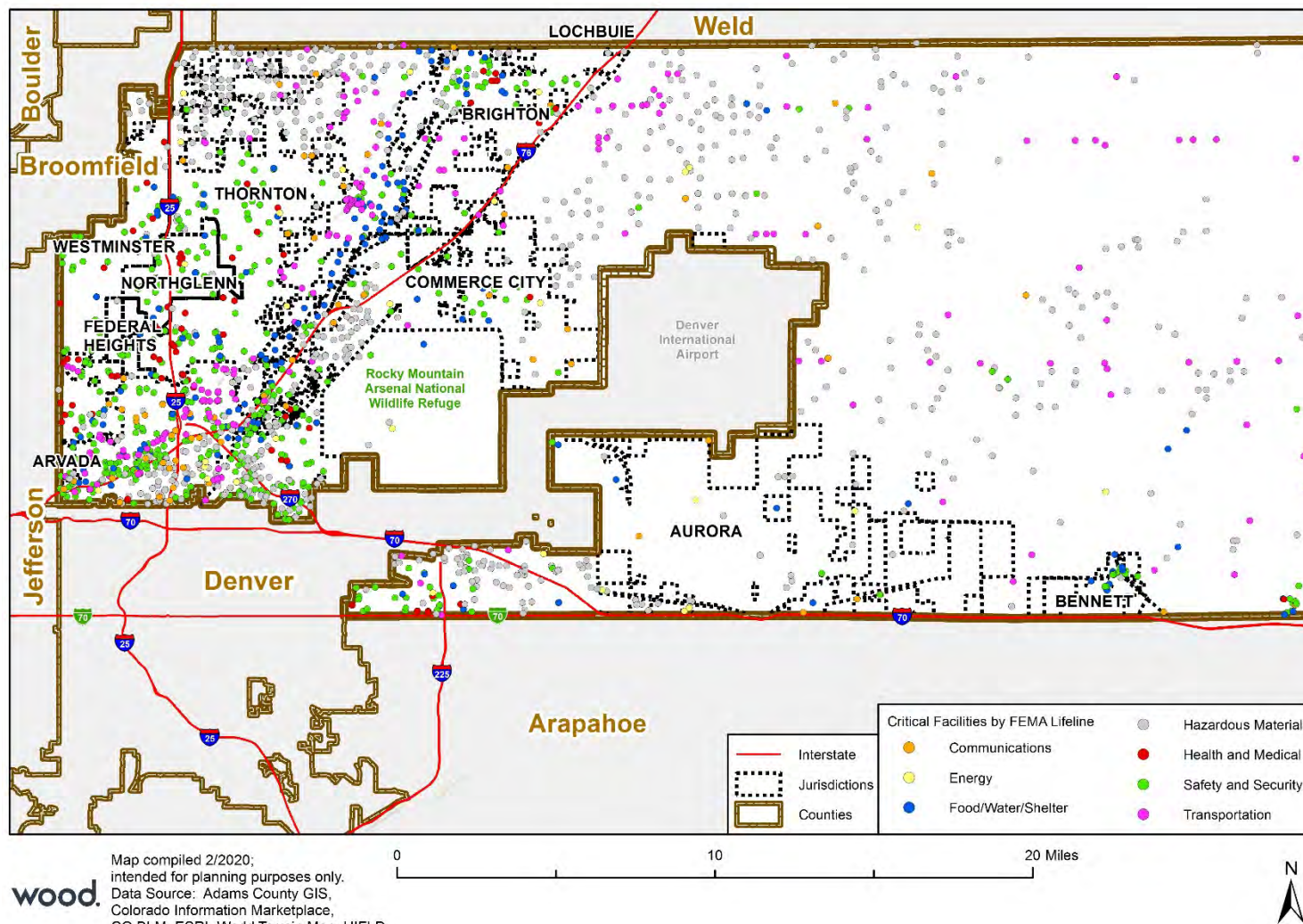
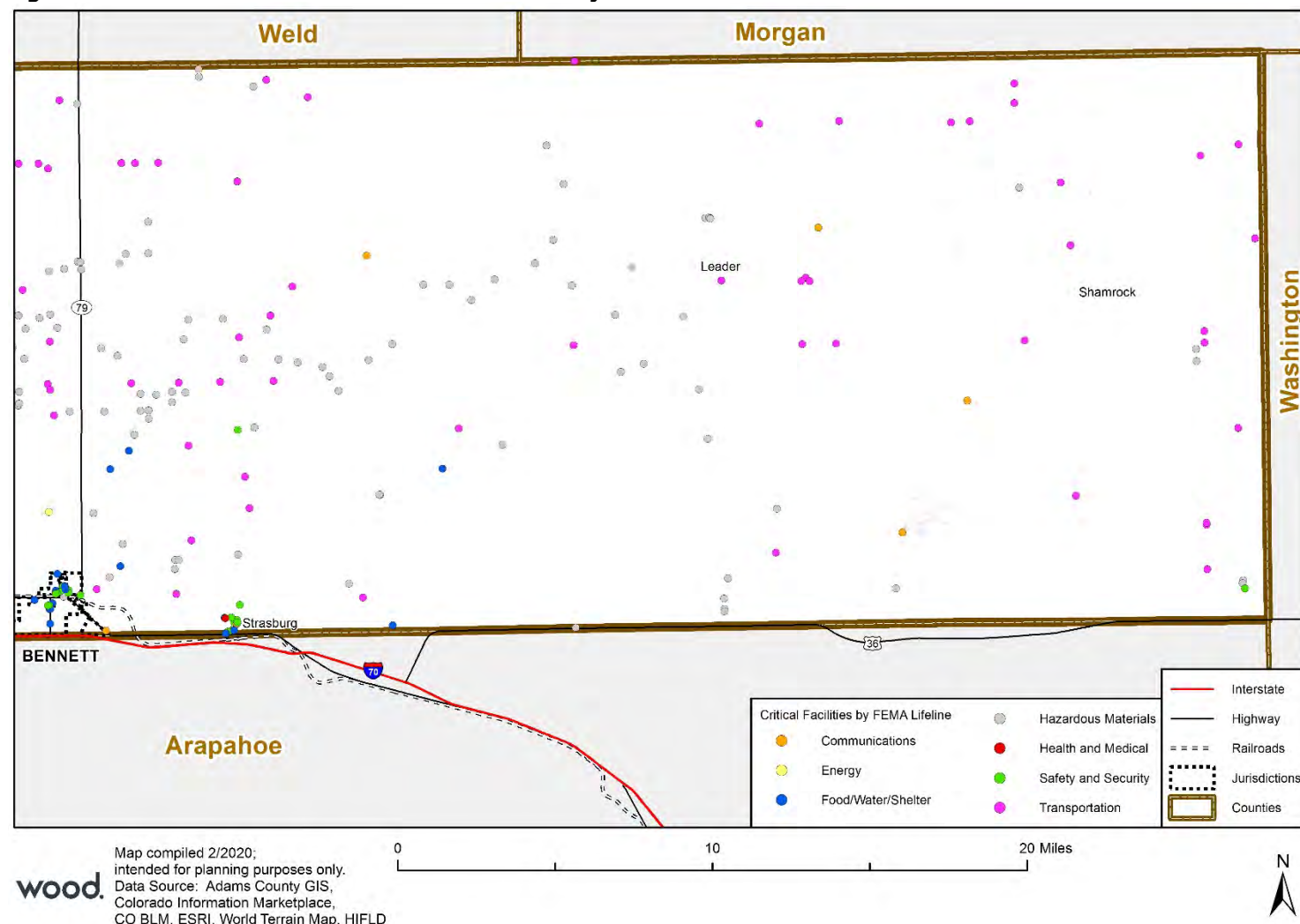


Figure 4-2 Critical Facilities in East Adams County

4.2.4 Historic, Cultural, and Natural Resources

Assessing the vulnerability of Adams County to disasters also involves inventorying the natural, historic, and cultural assets of the area. This step is important for the following reasons:

- The community may decide that these types of resources warrant a greater degree of protection due to their unique and irreplaceable nature and contribution to the overall economy.
- If these resources are impacted by a disaster, knowing so ahead of time allows for more prudent care in the immediate aftermath, when the potential for additional impacts are higher.
- The rules and laws for reconstruction, restoration, rehabilitation, and/or replacement are often specific for these types of designated resources (e.g. under the [NEPA and Section 106 of the National Historic Preservation Act](#)).
- Natural resources can have beneficial functions that reduce the impacts of natural hazards, such as wetlands and riparian habitat, which help absorb and attenuate floodwaters.

Historical and Cultural Resources

A historic property not only includes buildings or other types of structures such as bridges and dams but can also refer to prehistoric or Native American sites, roads, byways, historic landscapes, and such other features. Given the history of the County, these types of historic properties exist; some are inventoried and listed in this plan and used in appropriate GIS analyses to determine potential vulnerability to hazards.

Historic properties and cultural resources are also valuable economic assets that increase property values and attract businesses and tourists. Far from being at odds with economic development, preservation of these assets is often an important catalyst for economic development (e.g., historic downtown revitalization programs leading to growth in heritage tourism). Some key information on historic assets and properties in Adams County was obtained from the National Register of Historic Places (NRHP). The NRHP database is the Nation's official list of cultural resources worthy of preservation, and the NRHP overall is part of a national program to coordinate and support public and private efforts to identify, evaluate, and protect historic and archeological resources. Properties listed include districts, sites, buildings, structures, and objects that are significant in American history, architecture, archeology, engineering, and culture. The National Register is administered by the National Park Service (NPS), which is part of the U.S. Department of the Interior.

Based on this NRHP database and the Adams County GIS Department-provided data used throughout this plan, there are 13 historic resources as summarized in the following table:

Table 4-8 Historic and Cultural Resources Noted by the NRHP and Adams County HMPC

Location	Historic Place Name	Date Entered into Register	Data Source
Aurora	Wilson, Blanche A., House	11/7/1996	NRHP
	Robidoux, M.J. Lavina, House	9/15/2011	NRHP
	Fuller, Granville, House	3/16/2012	NRHP
Brighton	Bromley Farm--Koizuma Hishinuma Farm	8/16/2007	NRHP
	Brighton High School	1/23/1998	NRHP
	Adams County Courthouse	10/4/2006	NRHP
Commerce City	64th/Colorado Fast Track Station	Unknown	Adams County GIS
Thornton	Eastlake Farmers Co-Operative Elevator Company	5/17/2010	NRHP
Westminster	Bowles House	11/3/1988	NRHP
	Harris Park School	8/30/1990	NRHP
	Gregory, William J., House	2/23/1996	NRHP
	Union High School	1/14/2000	NRHP

Location	Historic Place Name	Date Entered into Register	Data Source
Unincorporated	Westminster University	8/10/1979	NRHP

Note: NRHP = National Register of Historic Places

Source: NPS NRHP; Adams County GIS

Colorado has a similar historical resource record version, called the Colorado State Register of Historic Properties. This database contains the state's significant cultural resources worthy of preservation for the future education and enjoyment of Colorado's residents and visitors. Properties listed in the Colorado State Register include individual buildings, structures, objects, districts, and historic and archaeological sites. The Colorado State Register program is administered by the Office of Archaeology and Historic Preservation within the Colorado Historical Society. Properties listed in the National Register of Historic Places are automatically placed in the Colorado State Register. Based on this statewide record set, Adams County contains an additional 12 existing resources deemed historic preservation-worthy:

Table 4-9 Adams County Historic and Cultural Resources in the Colorado Historic Register

Historic Place Name	Location	Date Entered into Register
Brannan Sand and Gravel Pit #8, Lake Sangraco and Boat Complex	Address restricted, Denver vicinity	8/16/2011
Bruderlin House	Barr Lake State Park, 13401 Picadilly Rd., Brighton	9/11/1996
Colorado Sanitary Canning Factory	224 N. Main Street, Brighton	3/15/2016
Denver Tramway Streetcar #0.04	W 58th Pl and Tennyson St	6/14/2000
Engelbrecht Farm	2024 Strasburg Road, Strasburg	12/10/2014
First Presbyterian Church (Brighton)	147 S. 1st Ave., Brighton	6/9/1999
Fitzsimons General Hospital, Main Hospital Building	12101 E. Colfax Ave., Aurora	3/10/1999
Gottlieb & Rose Egli House	72nd & Quebec St., Rocky Mountain Arsenal National Wildlife Refuge, Commerce City vicinity	8/14/2002
Metzger Farm	12080 Lowell Blvd., Westminster	3/20/2013
Riverside Cemetery	5201 Brighton Blvd., Commerce City vicinity	10/28/1994
Savery Savory Mushroom Farm Water Tower	110th Ct. and Federal Blvd., Westminster	12/16/2005
Thede Farmhouse	3190 W. 112th Ave., Northglenn	1/30/1988

Source: State of Colorado Register Listed Historic Properties; <https://www.historycolorado.org/national-state-register-listed-properties>

It should be noted that as defined by the National Environmental Policy Act (NEPA), any property over 50 years of age is considered a historic resource and is potentially eligible for the National Register, also as stated under the National Historic Preservation Act (NHPA). Thus, in the event that the property is to be altered or has been altered as the result of a major federal action, the property must be evaluated under the guidelines set forth by NEPA and the NHPA regarding this key age period. In addition, by law under the NHPA, "members of the public have a voice when federal actions will affect properties that qualify for the National Register of Historic Places, the nation's official list of historic properties" (A Citizen's Guide to Section 106 Review, 2016). Structural mitigation projects are considered alterations for the purpose of these NEPA/NHPA regulations, if regarding historical properties and places.

Natural Resources

Natural resources are important to include in benefit-cost analyses for future projects and may be used to leverage additional funding for projects that also contribute to community goals for protecting sensitive natural resources. Awareness of natural assets can lead to opportunities for meeting multiple objectives.

For instance, protecting wetland areas protects sensitive habitat as well as attenuates and stores floodwaters.

A number of natural resources exist in Adams County including parks, open spaces, wetlands, and endangered or threatened species, for example. A summary of parks, open spaces, and trails is included in the table below:

Table 4-10 Parks, Trails, and Open Spaces in Adams County

Name	Use	Address
55th & Lowell Trailhead	Trailhead	3550 W 55th Pl
Big Dry Creek Greenway (Coday)	Open Space	14100 Washington St
Brighton Road Trailhead	Trailhead	13645 Brighton Rd
City View Park	Park	8150 City View Dr
Clear Creek Bottomlands	Open Space	1030 W 68th Ave
Coronado Parkway	Trail	2250 Coronado Pkwy S
E-470 Open Space	Open Space	13645 Brighton Rd
Elaine T Valente Open Space	Open Space	6990 E 104th Ave
Engineer Lake	Open Space	3200 Highway 224
Government Center Natural Park	Open Space	4430 S Adams County Pkwy
Jim Baker Reservoir	Open Space	5994 Tennyson St
Kalcevic Gulch	Drainage	1030 W 68th Ave
Little Dry Creek Lake	Drainage	2400 W 64th Ave
Lowell Ponds	Open Space	--
Pelican Ponds Open Space	Open Space	--
Regional Park	Park	9755 Henderson Rd
Riverdale Bluffs Open Space	Open Space	13655 Riverdale Rd
Rotella Park	Park	1824 Coronado Parkway S
Sandhofer Open Space	Open Space	7880 Ogden Ct
Siegrist Lake	Open Space	3200 Highway 224
Steele Street Park	Trailhead	7850 Steele St
TRI Property/Big Dry Buffer	Open Space	700 E 144th Ave
Twin Lakes Park	Park	200 W 70th Ave

Source: Adams County GIS

Wetlands

Wetlands are a valuable natural resource for communities due to their benefits to water quality, wildlife protection, recreation, and education, and play an important role in hazard mitigation. Wetlands reduce flood peaks and slowly release floodwaters to downstream areas. When surface runoff is dampened, the erosive powers of the water are greatly diminished. Furthermore, the reduction in the velocity of inflowing water as it passes through a wetland helps remove sediment being transported by the water. They also provide drought relief in water-scarce areas where the relationship between water storage and streamflow regulation is vital (Wetland Functions and Values, 2016).

The U.S. Fish and Wildlife National Wetlands Inventory recently updated wetlands data applicable to Adams County, under the Colorado Eastern Plains Riparian Metadata Addendum effort. This data is current as of 2019 and contains studied wetlands of two types for the planning area: Forested/Shrub Riparian, the most widely available throughout the county, and an Herbaceous Riparian type, more prevalent in the western portions of the county, especially north and east of the Commerce City/Rocky Mountain Arsenal National Wildlife Refuge area. The acreage for the two mapped wetland types for Adams County is listed below. The amount of wetlands of various kinds is helpful to note because these areas may require special attention during future development efforts across the county.

- Forested/Shrub Riparian: 3,433 acres
- Herbaceous Riparian: 234 acres

Endangered Species

To further understand natural resources that may be particularly vulnerable to a hazard event, as well as those that need consideration when implementing mitigation activities, it is important to identify at-risk species (endangered and threatened species) in the planning area. An *endangered* species is any species of fish, plant life, or wildlife that is in danger of extinction throughout all or most of its range. A *threatened* species is a species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. Both endangered and threatened species are protected by law and any future hazard mitigation projects are subject to these laws. Candidate species are a third category of plants and animals at risk, but these have been proposed as endangered or threatened but are not currently listed.

According to the U.S. Fish and Wildlife Service (USFW) Environmental Conservation Online System (ECOS), there were 13 federally endangered, threatened, or candidate/proposed/under/other status review species in Adams County (as of January 2020). These are listed in Table 4-11.

Table 4-11 At-Risk Wildlife in Adams County

Type of Species (Group)	Common Name	Scientific Name	Species Status
Birds	Whooping crane	<i>Grus americana</i>	Experimental Population, Non-Essential
Birds	Bald eagle	<i>Haliaeetus leucocephalus</i>	Recovery
Birds	Bald eagle	<i>Haliaeetus leucocephalus</i>	Recovery
Birds	Bald eagle	<i>Haliaeetus leucocephalus</i>	Recovery
Birds	Bald eagle	<i>Haliaeetus leucocephalus</i>	Recovery
Birds	Bald eagle	<i>Haliaeetus leucocephalus</i>	Recovery
Birds	American peregrine falcon	<i>Falco peregrinus anatum</i>	Recovery
Birds	Mexican spotted owl	<i>Strix occidentalis lucida</i>	Threatened
Flowering Plants	Ute ladies'-tresses	<i>Spiranthes diluvialis</i>	Threatened
Flowering Plants	Western prairie fringed Orchid	<i>Platanthera praeclara</i>	Threatened
Mammals	Black-footed ferret	<i>Mustela nigripes</i>	Endangered
Mammals	Preble's meadow jumping mouse	<i>Zapus hudsonius preblei</i>	Threatened
Mammals	Little brown bat	<i>Myotis lucifugus</i>	Under Review

Source: USFW ECOS, 2020

4.3 Hazard Analysis and Risk Assessment

4.3.1 Cyber Incident

Hazard Description

The 2018 Colorado State Hazard Mitigation Plan defines cyber attacks as “deliberate exploitation of computer systems, technology-dependent enterprises, and networks.” Cyber-attacks use malicious code to alter computer operations or data. The vulnerability of computer systems to attacks is a growing concern as people and institutions become more dependent upon networked technologies. The Federal Bureau of Investigation (FBI) reports that, “cyber intrusions are becoming more commonplace, more dangerous, and more sophisticated,” with implications for private- and public-sector networks.

There are many types of cyber attacks. Among the most common is a **direct denial of service, or DDoS** attack. This is when a server or website will be queried or pinged rapidly with information requests, overloading the system and causing it to crash.

Malware, or malicious software, can cause numerous problems once on a computer or network, from taking control of users' machines to discreetly sending out confidential information. **Ransomware** is a specific type of malware that blocks access to digital files and demands a payment to release them. Hospitals, school districts, state and local governments, law enforcement agencies, businesses, and even individuals can be targeted by ransomware. A 2017 study found ransomware payments over a two-year period totaled more than \$16 million. Even if a victim is perfectly prepared with full offline data backups, recovery from a sophisticated ransomware attack typically costs far more than the demanded ransom. However, according to a 2016 study by Kaspersky Lab, roughly one in five ransomware victims who pay their attackers are still not able to retrieve their data.

Cyber spying or espionage is the act of illicitly obtaining intellectual property, government secrets, or other confidential digital information, and often is associated with attacks carried out by professional agents working on behalf of a foreign government or corporation. According to cybersecurity firm Symantec, in 2016 "...the world of cyber espionage experienced a notable shift towards more overt activity, designed to destabilize and disrupt targeted organizations and countries."

A major **data breach** is when hackers gain access to large amounts of personal, sensitive, or confidential information and have become increasingly common. A 2018 report from the security firm Symantec found that more than seven billion identities have been exposed in data breaches over the last eight years. In addition to networked systems, data breaches can occur due to the mishandling of external drives.

Cyber crime can refer to any of the above incidents when motivated primarily by financial gain or other criminal intent.

The most severe type of attack is **cyber terrorism**, which aims to disrupt or damage systems in order to cause fear, injury, and loss to advance a political agenda.

The 2018 Colorado State Hazard Mitigation Plan concludes: "This is a newly developing threat, so as more resources are devoted to countering the hazard, the risk of a disruption would hopefully decrease. Mitigation opportunities for this hazard include continued diligence of the state's Office of Information Technology (OIT), as well as for other government and private sector entities to continue to monitor, block, and report cyber-attacks, and continually assess the vulnerability of systems."

Phishing is a technique employed in many of the above attacks, and involves sending fraudulent emails purporting to be from known contacts or reputable companies to induce individuals to reveal personal information, such as passwords and credit card numbers, or to click on links that put the user at risk.

Geographic Location

Cyber disruption events can occur and/or impact virtually any location in the state where computing devices are used. Incidents may involve a single location or multiple geographic areas. A disruption can have far-reaching effects beyond the location of the targeted system; disruptions that occur far outside the state can still impact people, businesses, and institutions within Adams County.

Previous Occurrences

Symantec reports there were a total of 1,209 data breaches worldwide in 2016, 15 of which involved the theft of more than 10 million identities. While the number of breaches has remained relatively steady, the average number of identities stolen has increased to almost one million per incident. The report also

found that one in every 131 emails contained malware, and the company's software blocked an average of 229,000 web attacks every day.

The Privacy Rights Clearinghouse, a nonprofit organization based in San Diego, maintains a timeline of 9,741 data breaches resulting from computer hacking incidents in the United States from 2005-2019. The database lists 69 data breaches potentially affecting Colorado, totaling over 11 million impacted records. While none of those breaches involved servers in Adams County, it is probable that some County residents were affected; similarly, some Adams County residents were likely affected by national and international data breaches.

In February 2018, the Colorado Department of Transportation (CDOT) server was breached as part of a ransomware attack. The following narrative describes the incident.

Between February 21st and the 23rd, malware began encrypting CDOT workstations and servers. This was a ransomware attack which denied user access to their e-mail, electronic files, data, and computer applications. This attack impacted approximately 3,800 laptops (~50% infected), 200 desktops, 354 servers (~40% infected), and a host of other electronic devices and applications. Each device needed to be individually assessed and have multiple security patches applied.

Upon the completion of an initial situational assessment, the CDOT Executive Director activated a Departmental Incident Management Team on February 26th, with the sole responsibility of being the central entity to direct all internal activities related the ransomware virus incident. This included: the reassignment of departmental resources (as needed); establish prioritized lists of actions to be taken; coordination with the Office of Information Technology (OIT) on technical measures to confine and eradicate the virus as well as restore the network; and provide a public information message for staff, vendors, the media and the public. There were no previous incidents (nationwide) to draw upon to assist in identifying our actions to respond to or recover from an event of this scale or scope.

On February 28th, the CDOT network had been assessed as clean and authorization was given for non-infected workstations to be brought back online following a second assessment and remediation. By March 1st, new infections had been detected along with unexplained activity on the network. All recovery efforts were halted, and additional computer security resources were requested. The entire network was shut down, which included commercial vendors as well as the Colorado National Guard Cyber Team and other federal assets. The Recovery process restarted on March 7th.

While the technological side of the incident was being resolved, the prioritization of business functions continued. The first priority was to enable the appropriate software package(s) to process invoices and payments. Then, a move onto the other 55 computer applications that the department utilizes on a daily basis. By March 11th, small portions of the network were turned on to staff.

On March 19th, the formal recovery phase began with the goal of reconstituting the entire network.

Other jurisdictions have been impacted by ransomware attacks in recent years. The City of Atlanta was hit by a major ransomware attack in 2018, recovery from which wound up costing a reported \$2.6 million, significantly more than the \$52,000 ransom demand. A similar attack against the City of Baltimore in 2019 affected the city government's email, voicemail, property tax portal, water bill and parking ticket payment systems, and delayed more than 1,000 pending home sales. In March 2019, Orange County, North Carolina was attacked with a ransomware virus, causing slowdowns and service problems at key public offices such as the Register of Deeds, the sheriff's office and county libraries. The attack impacted a variety

of county services, including disrupting the county's capability to process real estate closings, issue marriage licenses, process fees or permits, process housing vouchers, and verify tax bills.

A large, sophisticated malware attack, known as Olympic Destroyer, was launched against the 2018 Winter Olympics in PyeongChang, South Korea. The attack initially took down servers, email, Wi-Fi, and ticketing systems, which could have severely disrupted the games. Fortunately, the organizing committee had a robust cybersecurity group that was able to quickly restore most functions.

Probability of Future Occurrence

Cyber attacks occur daily, but most have negligible impacts at the local or regional level. The possibility of a larger disruption affecting systems within the County is a constant threat, but it is difficult to quantify the exact probability due to such highly variable factors as the type of attack and intent of the attacker. Minor attacks against business and government systems have become a commonplace occurrence but are usually stopped with minimal impact. Similarly, data breaches impacting the information of residents of Adams County are almost certain to happen in coming years. Major attacks specifically targeting systems or infrastructure in the County are less likely but cannot be ruled out.

Magnitude/Severity

The extent or magnitude/severity of a cyber disruption event is variable depending on the nature of the event. A disruption affecting a small, isolated system could impact only a few functions or processes. Disruptions of large, integrated systems could impact many functions or processes, as well as many individuals that rely on those systems. Data breaches are often described in terms of the number of records or identities exposed.

There is no universally accepted scale to quantify the severity of cyber attacks. The strength of a DDoS attack is sometimes explained in terms of a data transmission rate. One of the largest DDoS disruptions ever, which brought down some of the internet's most popular sites on October 21, 2016, peaked at 1.2 terabytes per second.

Climate Change Considerations

There are no known impacts of climate change on this hazard.

Vulnerability

As discussed above, the impacts from a cyber attack vary greatly depending on the nature, severity, and success of the attack. A major cyber attack has the potential to undermine public confidence and build doubt in their government's ability to protect them from harm.

People

Injuries or fatalities from cyber attacks would generally only be possible from a major cyber terrorist attack against critical infrastructure.

General Property

Short of a major cyber terrorist attacks against critical infrastructure, property damage from cyber-attacks is typically limited to computer systems.

Critical Facilities and Infrastructure

Agencies that rely on electronic backup of critical files are vulnerable. The delivery of services can be impacted since governments rely, to a great extent, upon electronic delivery of services. An attack could raise questions regarding the security of using electronic systems for government services.

While the vast majority of cyber attacks affect only data and computer systems, sophisticated attacks against utilities and infrastructure sites have occurred. Such attacks typically target the Supervisory Control And Data Acquisition (SCADA) systems of critical infrastructure, which can potentially result in system failures on a scale equal with natural disasters. Facilities and infrastructure, such as the electrical grid, could become unusable as a result of a cyber attack.

Economy

Large scale cyber attacks can greatly affect the economy. Symantec reports that in the last three years, businesses have lost \$3 billion due to phishing email scams alone. In an electronic-based commerce society, any disruption to daily activities can have disastrous impacts to the economy. It is difficult to measure the true extent of the impact.

Historic, Cultural, and Natural Resources

The vast majority of cyber incidents have little to no impact on historic, cultural or natural resources. A major cyber terrorism attack could potentially impact the environment by triggering a release of a hazardous materials, or by causing an accident involving hazardous materials by disrupting traffic-control devices.

Future Development

Our society's increasing reliance on technology and internet-based services means that the risk of cyber attacks is likely to increase. However newer systems and facilities are more likely to incorporate good cybersecurity systems and practices, potentially making them less vulnerable compared to older systems.

Risk Summary

The overall significance of cyber attacks in Adams County is Low.

- Most data breaches and hacking incidents only impact a few individuals or businesses at a time and have minimal broader impact.
- Ransomware attacks, particularly against state and local governments, have increased significantly in recent years and could have major impacts on County services.
- Major cyber attacks against infrastructure and systems are also happening with more frequency worldwide, but there is no data to suggest that Adams County is likely to be targeted.
- Effects on people: Cyber attacks can impact personal data and accounts. Injuries or fatalities could potentially result from a major cyber terrorist attacks against critical infrastructure.
- Effects on property: Short of a major cyber terrorist attacks against critical infrastructure, property damage from cyber attacks is typically limited to computer systems.
- Effects on economy: Could greatly affect the economy. In an electronic-based commerce society, any disruption to daily activities can have disastrous impacts to the economy. It is difficult to measure the true extent of the impact.
- Effects on critical facilities and infrastructure: Sabotage of utilities and infrastructure from a major cyber terrorist attacks could potentially result in system failures that damage property on a scale equal with natural disasters. Facilities and infrastructure could become unusable as a result of a major cyber-attack.
- Related hazards: Terrorism, Dam Failure/Incident, and Hazardous Materials incident.

Table 4-12 Cyber Incident Risk Summary

Jurisdiction	Geographic Location	Probability of Future Occurrence	Magnitude/Severity	Overall Significance
Adams County	Limited	Likely	Limited	Low
Bennett	Extensive	Likely	Critical	High
Brighton	Limited	Likely	Limited	Low
Commerce City	Limited	Likely	Limited	Medium
Denver Water	Limited	Likely	Limited	Low

4.3.2 Dam Failure/Incident

Hazard Description

Dams are constructed for a variety of uses, including flood protection, power, agriculture/irrigation, water supply, and recreation. Dams typically are constructed of earth, rock, concrete, or mine tailings. Two factors that influence the potential severity of a full or partial dam failure are the amount of water impounded and the density, type, and value of development and infrastructure located downstream.

Dam failures can result from any one or a combination of the following causes:

- Prolonged periods of rainfall and flooding, which result in overtopping (overtopping is the primary cause of earthen dam failure)
- Earthquake/seismic activity
- Inadequate spillway capacity resulting in excess overtopping flows
- Internal erosion caused by embankment or foundation leakage or piping or rodent/wildlife activity
- Improper design
- Improper maintenance
- Negligent operation
- Failure of upstream dams on the same waterway

Dam inundation can also occur from non-failure events, such as overtopping due to heavy rains. Controlled releases to allow water to escape when a reservoir is overfilling actually can help prevent future overtopping or failure, and is an important strategy to consider when dealing with significant and high hazard dams.

The Colorado Dam Safety branch developed a tool in recent years that can support public awareness, planning, and emergency preparedness and response involving high hazard dams across the state. This tool evaluates dams and their capabilities regarding operational and flood release functions to prevent or minimize potential future damages (Flood Hazard Mitigation Plan for Colorado 2018).

Geographic Location

The geographic coverage of this hazard in Adams County ranges from **Limited** to **Significant**, based on the planning area at risk. The U.S. Army Corps of Engineers National Inventory of Dams (NID) 2018 database was queried for those dams either inside the Adams County boundaries, or upstream of it so that they may cause inundation into the county if the structures failed. This source lists 88 dams of concern in or upstream of the County, and classifies them based on the potential hazard to the downstream areas as a result of failure or mis-operation of the dam or facilities:

- **High Hazard Potential**—Probable loss of life

- **Significant Hazard Potential**—No probable loss of human life but can cause economic loss, environment damage, disruption of lifeline facilities, or other major impacts; often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure
- **Low Hazard Potential**—No probable loss of human life and low economic and/or environmental losses; losses are principally limited to the owner's property

Note that the hazard potential ratings do not reflect the likelihood of dam failure, merely the consequences if a failure did occur. Based on these classifications, there are 51 high hazard dams, 18 significant hazard dams, and 19 low hazard dams either inside of Adams County or upstream of it so that they are considered dams of concern. These dams are listed in Table 4-13 and illustrated in Figure 4-3 and Figure 4-4. All of the high and significant hazard dams have emergency action plans (EAPs) in place, while the low hazard dams are not required to have these EAPs.

Table 4-13 Dams of Concern for Adams County

Dam Name	Waterway	Downstream City	Dam Type	Storage Capacity (Acre-Feet)	Emergency Action Plan?	Primary Purpose	Hazard Rating
Arapahoe Lake	Goldsmith Gulch	Denver	Earth	45	Yes	Recreation	Significant
Badding	South Platte River-Tr	Northglenn	Earth	60	Yes	Water Supply	Significant
Barr Lake	Beebe Draw	Hudson	Earth	47,000	Yes	Irrigation	High
Bear Creek Dam	Bear Creek	Denver	Earth	75,000	Yes	Flood Control	High
Beers Sisters Lake	S. Platte River-Tr	Littleton	Earth	91	Yes	Irrigation	Significant
Blunn	Ralston Creek	Arvada	Earth	7,839	Yes	Recreation	High
Bramkamp	Muddy Creek	Fort Morgan	Earth	1,630	Not Required	Irrigation	Low
Cabin Creek Lower	South Clear Creek	Georgetown	Rockfill	1,990	Yes	Hydroelectric	High
Cabin Creek Upper	South Clear Creek	Georgetown	Rockfill	1,800	Yes	Hydroelectric	High
Carmody	Sanderson Gulch-Os	Lakewood	Earth	82	Yes	Recreation	Significant
Chatfield Dam	South Platte River	Denver	Earth	355,000	Yes	Flood Control	High
Cherokee NW	South Platte-Os	Commerce City	Earth	157	Not Required	Other	Low
Cherry Creek Dam	Cherry Creek	Denver	Earth	134,470	Yes	Flood Control	High
Clear Lake	South Clear Creek	Georgetown	Earth	1,100	Yes	Hydroelectric	High
Croke No. 7	Tr.Of South Platte River-Os	Northglenn	Earth	200	Not Required	Irrigation	Low
Derby	South Platte River-Os	Commerce City	Earth	1,230	Yes	Irrigation	Significant
Devinney	S. Lakewood Gulch	Lakewood	Earth	64	Yes	Irrigation	Significant
Dunes	South Platte River-Os	Brighton	Earth	5,644	Yes	Water Supply	High
East	Weir Gulch-Os	Lakewood	Earth	190	Yes	Irrigation	High
East Lake #2	Brantner Gulch-Tr	Thornton	Earth	176	Yes	Flood Control	Significant
Englewood	Willow Creek	Littleton	Earth	3,500	Yes	Flood Control	High
Evergreen	Bear Creek	Evergreen	Earth	800	Yes	Recreation	High
Exposition Park	Westerly Creek	Aurora	Earth	293	Yes	Flood Control	High
Fort Logan Dam	Bear Creek-Tr	Sheridan	Earth	98	Yes	Irrigation	Significant
Fortune	Big Dry Creek-Tr	Westminster	Earth	10,219	Yes	Water Supply	High
Genesee No. 2	--		Gravity	127	Yes	Water Supply	High
Great Western	Walnut Creek	Westminster	Earth	4,459	Yes	Water Supply	High
Havana Street Dam	South Platte River-Tr		Earth	397	Not Required	Flood Control	Low
Hidden Lake	Clear Creek-Os	Westminster	Earth	650	Not Required	Recreation	Low
Holly	Little Dry Creek	Littleton	Earth	455	Yes	Flood Control	High
Hyatt	Van Bibber Creek-Tr	Arvada	Earth	1,000	Yes	Irrigation	High
Jewell Wetland Detention	Westerly Creek-Tr	Aurora	Earth	96	Yes	Flood Control	Significant
Kalcevic	Clear Creek-Tr	Westminster	Earth	59	Yes	Flood Control	High
Kelly Road Detention	Westerly Creek	Denver	Earth	800	Yes	Flood Control	High
Ketner	Walnut Creek-Tr	Westminster	Earth	434	Yes	Fish and Wildlife Pond	High
La Dore	South Platte River-Os	Commerce City	Earth	510	Not Required	Water Supply	Low
Lambertson Lakes No. 3	--	Thornton	Earth	86	Not Required	Recreation	Low

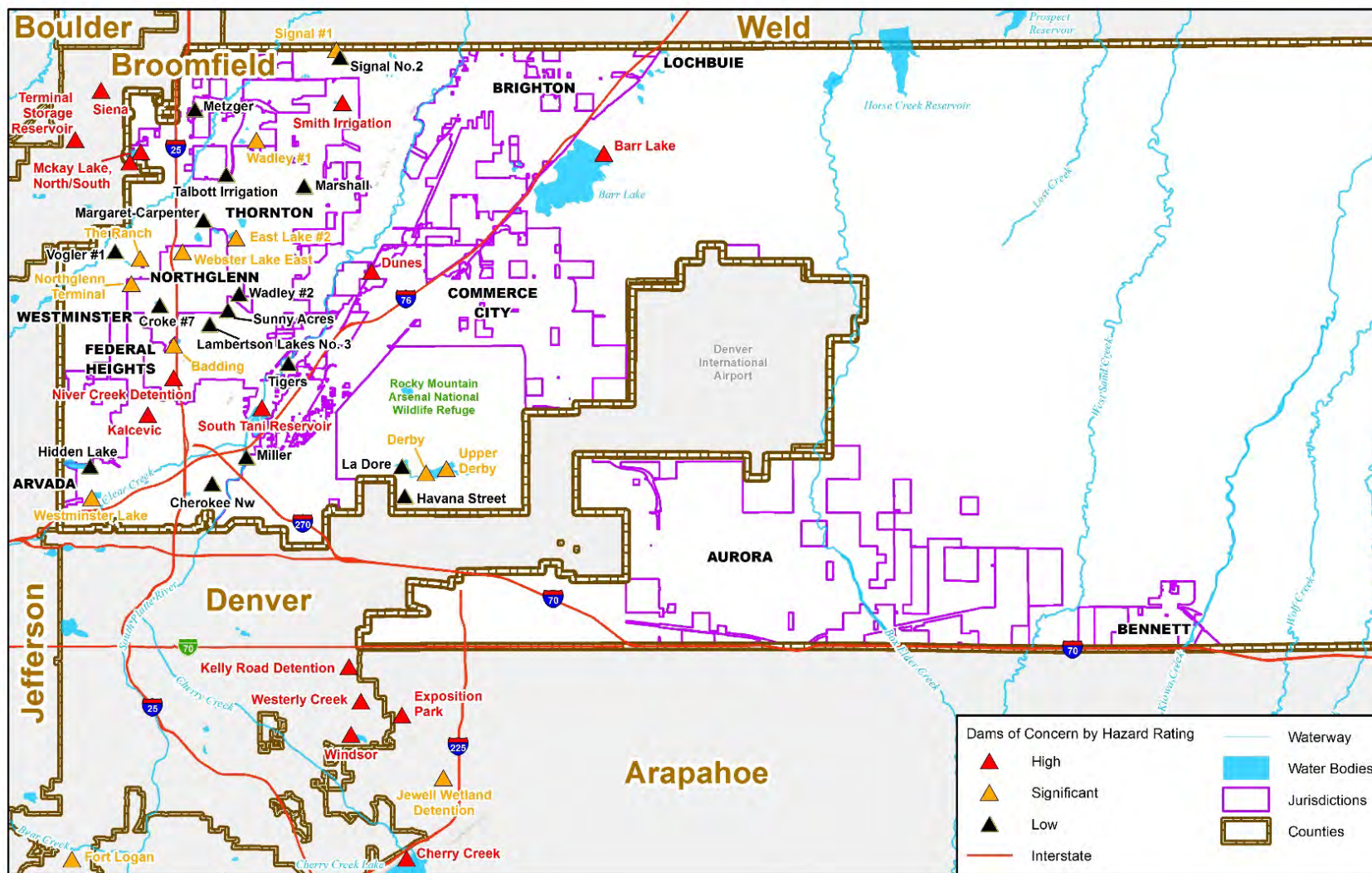
Dam Name	Waterway	Downstream City	Dam Type	Storage Capacity (Acre-Feet)	Emergency Action Plan?	Primary Purpose	Hazard Rating
Leyden	Leyden Creek	Arvada	Earth	1,300	Yes	Flood Control	High
Lookout Mountain	Clear Creek-Tr	Golden	Earth	128	Yes	Water Supply	High
Magic Mountain #1	Jackson Gulch	Pleasant View	Earth	189	Yes	Other	High
Main	Weir Gulch-Os	Lakewood	Earth	1,320	Yes	Irrigation	High
Maple Grove	Lena Gulch	Lakewood	Earth	1,585	Yes	Water Supply	High
Margaret-Carpenter	Grange Hall Creek	Thornton	Earth	105	Not Required	Irrigation	Low
Marshall	Brantner Gulch-Tr	Brighton	Earth	98	Not Required	Flood Control	Low
Marston Lake - East Dam	South Platte River-Os	Denver	Earth	21,100	Yes	Water Supply	High
Marston Lake - North Dam	South Platte River-Os	Denver	Earth	22,500	Yes	Water Supply	High
Marston Lake - Northwest Dike	South Platte River-Os	Denver	Earth	21,100	Yes	Water Supply	High
Marston Lake - South Dam	South Platte River-Os	Denver	Earth	21,100	Yes	Water Supply	High
Mc Lellan	Dad Clark Gulch	Littleton	Earth	9,700	Yes	Water Supply	High
Mckay Lake - East	Big Dry Creek-Tr	Westminster	Earth	445	Yes	Irrigation	High
Mckay Lake - South	Big Dry Creek-Os	Westminster	Earth	445	Yes	Recreation	High
Metzger	Big Dry Creek-Tr	Westminster	Earth	55	Not Required	Irrigation	Low
Miller	South Platte-Tr	Commerce City	Earth	2,262	Not Required	Water Supply	Low
Morrison Raw Water	Bear Creek-Tr	Morrison	Earth	42	Yes	Water Supply	High
Niver Creek Detention	South Platte River-Tr	Thornton	Earth	837	Yes	Flood Control	High
No Name 1-1 #1	Muddy Creek	Ft. Morgan	Earth	725	Not Required	Irrigation	Low
Noonen	Muddy Creek	Fort Morgan	Earth	2,640	Not Required	Irrigation	Low
Northglenn Terminal	Big Dry Creek-Os	Westminster	Earth	147	Yes	Water Supply	Significant
Pomona No. 2 And No. 3	Little Dry Creek-Os	Arvada	Earth	178	Yes	Flood Control	Significant
Quincy	West Toll Gate Creek	Aurora	Earth	4,560	Yes	Recreation	High
Ralston	Ralston Creek	Arvada	Earth	15,900	Yes	Water Supply	High
Senac	Senac Creek	Aurora	Earth	40,400	Yes	Recreation	High
Siena	Coal Creek-Tr	Lafayette	Earth	640	Yes	Water Supply	High
Signal #1	Big Dry Creek-Tr	Fort Lupton	Earth	345	Yes	Irrigation	Significant
Signal No.2	Big Dry Ck-Offstream	Fort Lupton	Earth	2,186	Not Required	Irrigation	Low
Smith	Bear Creek-Os	Lakewood	Earth	822	Yes	Irrigation	High
Smith Irrigation	Todd Creek	Brighton	Earth	429	Yes	Fish and Wildlife Pond	High
South Platte Reservoir	South Platte River-Os	Littleton	Earth	7,435	Yes	Water Supply	High
South Tani Reservoir	South Platte River-Os	Thornton	Earth	7,530	Yes	Water Supply	High
Spring Gulch	Spring Gulch	Denver	Earth	1,752	Yes	Irrigation	High
Standley Lake	Big Dry Creek	Westminster	Earth	54,740	Yes	Irrigation	High
Sunny Acres	South Platte River-Tr	Northglenn	Earth	30	Not Required	Fire Protection/Stock/Small Fish Pond	Low
Talbott Irrigation	Big Dry Creek-Os	Thornton	Earth	61	Not Required	Irrigation	Low
Terminal Storage Reservoir	Big Dry Creek-Os	Westminster	Earth	514	Yes	Water Supply	High
The Ranch	Big Dry Creek-Tr	Westminster	Earth	28	Yes	Irrigation	Significant
Tigers	South Platte River-Os	Thornton	Earth	2,974	Not Required	Water Supply	Low

Dam Name	Waterway	Downstream City	Dam Type	Storage Capacity (Acre-Feet)	Emergency Action Plan?	Primary Purpose	Hazard Rating
Tucker Lake - North Dam	Ralston Creek-Os	Arvada	Earth	882	Yes	Irrigation	High
Tucker Lake - South Dam	Ralston Creek-Os	Arvada	Earth	1,250	Yes	Irrigation	High
Upper Church Lakes	Big Dry Creek	Westminster	Earth	381	Yes	Irrigation	Significant
Upper Derby	South Platte River-Tr	Commerce City	Earth	620	Yes	Water Supply	Significant
Vogler #1	Big Dry Creek-Tr	Westminster	Earth	50	Not Required	Irrigation	Low
Wadley #1	Big Dry Creek-Os	Fort Lupton	Earth	74	Yes	Irrigation	Significant
Wadley #2	Big Dry Creek-Os	Thornton	Earth	126	Not Required	Irrigation	Low
Webster Lake East	Big Dry Creek-Os	Northglenn	Earth	129	Yes	Fish and Wildlife Pond	Significant
Westerly Creek	Westerly Creek	Denver	Earth	9,300	Yes	Flood Control	High
Westminster Lake	Clear Creek-Os	Westminster	Earth	1,196	Yes	Recreation	Significant
Windsor	Westerly Creek-Os	Denver	Earth	735	Yes	Irrigation	High
Woman Creek	Woman Creek-Os	Westminster	Earth	1,155	Yes	Flood Control	High

Source: USACE National Inventory of Dams 2018, Wood analysis



Figure 4-3 Dams of Concern in or Upstream of West Adams County

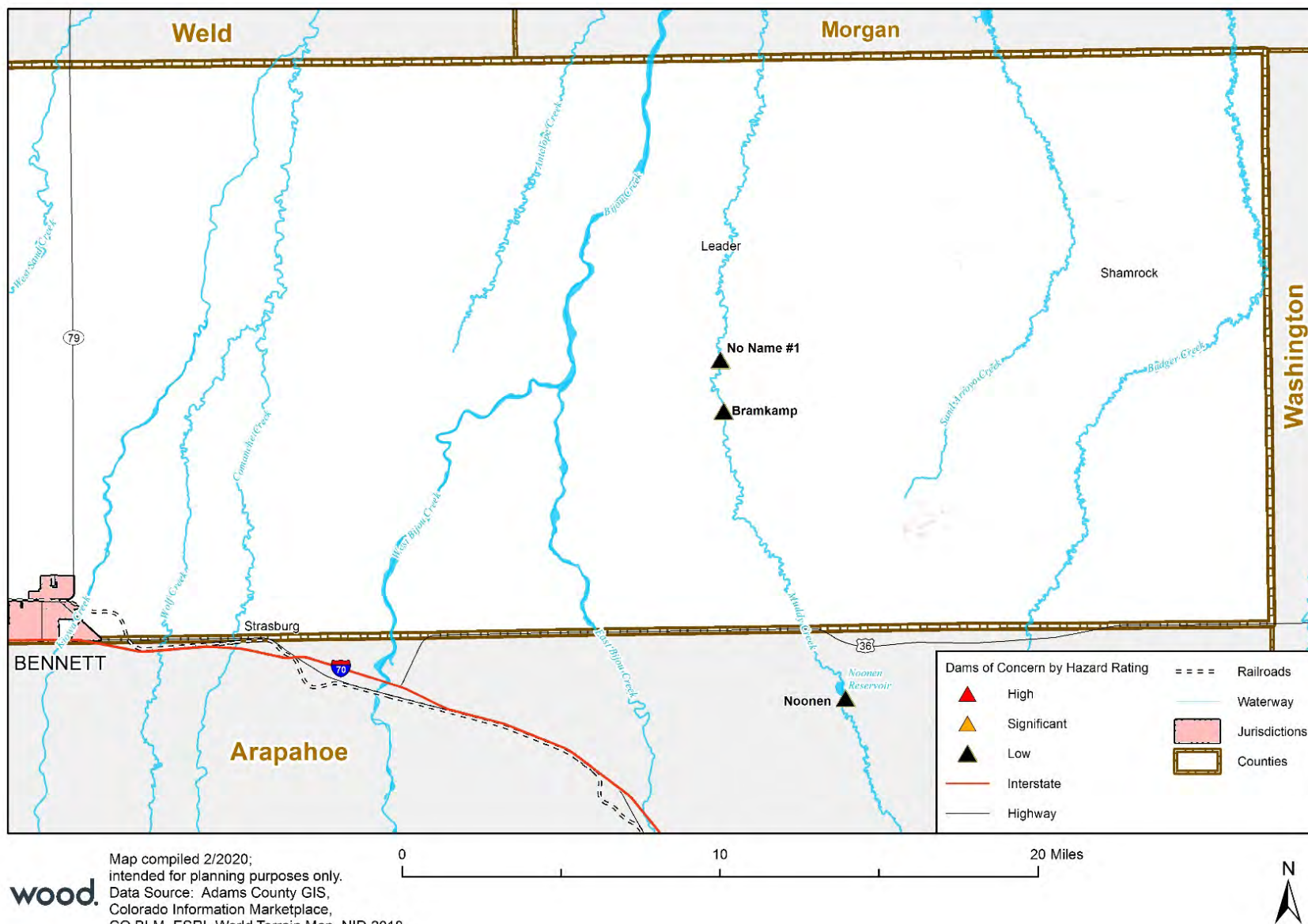


wood.

Map compiled 2/2020;
intended for planning purposes only.
Data Source: Adams County GIS, Colorado
Information Marketplace, CO BLM, ESRI
World Terrain Map, NID 2018

0 10 20 Miles



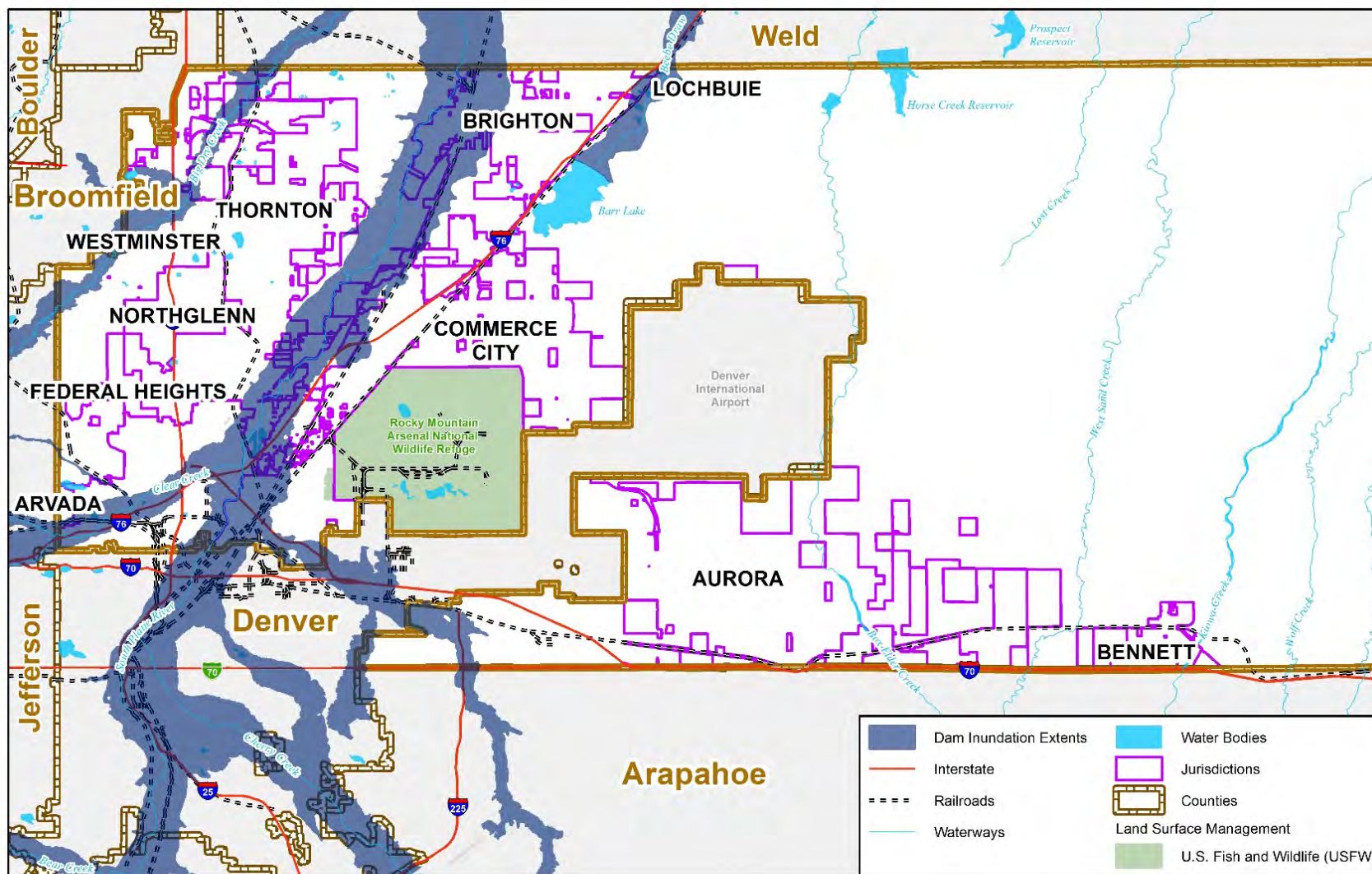
Figure 4-4 Dams of Concern in or Upstream of East Adams County

Dam inundation mapping is available for two significant and 24 high hazard dams located in or upstream of Adams County, as displayed in Figure 4-5 and Figure 4-6 below. This data was obtained from the Colorado Dam Safety program (under the Division of Water Resources, a part of the Colorado Department of Natural Resources).

The communities of Arvada, Aurora, Brighton, Commerce City, Lochbuie, Thornton, and Westminster are all exposed to dam inundation, as available in map form. The main affected areas would be those along the South Platte River, Clear Creek, Bijou Creek, Big Dry Creek, Beebe Draw, Sand Creek, Little Dry Creek, Toll Gate Creek, Westerly Creek, and smaller portions of other waterways in the western portion of Adams County such as Second and Third Creeks. Dams as far west as the Clear Lake Dam and the Upper and Lower Cabin Creek Dams in Clear Creek County have the potential to affect Adams County based on the inundation mapping available. If one of the more upstream dams were to fail and cause flooding along Clear Creek, it would potentially overload others downstream, leading to compound overflow and hence additional inundation from other structures until reaching the planning area.

More information on the potential risk to life, property, infrastructure, and other assets and county resources are contained in discussions, tables, and maps under the Vulnerability Assessment section for this hazard.

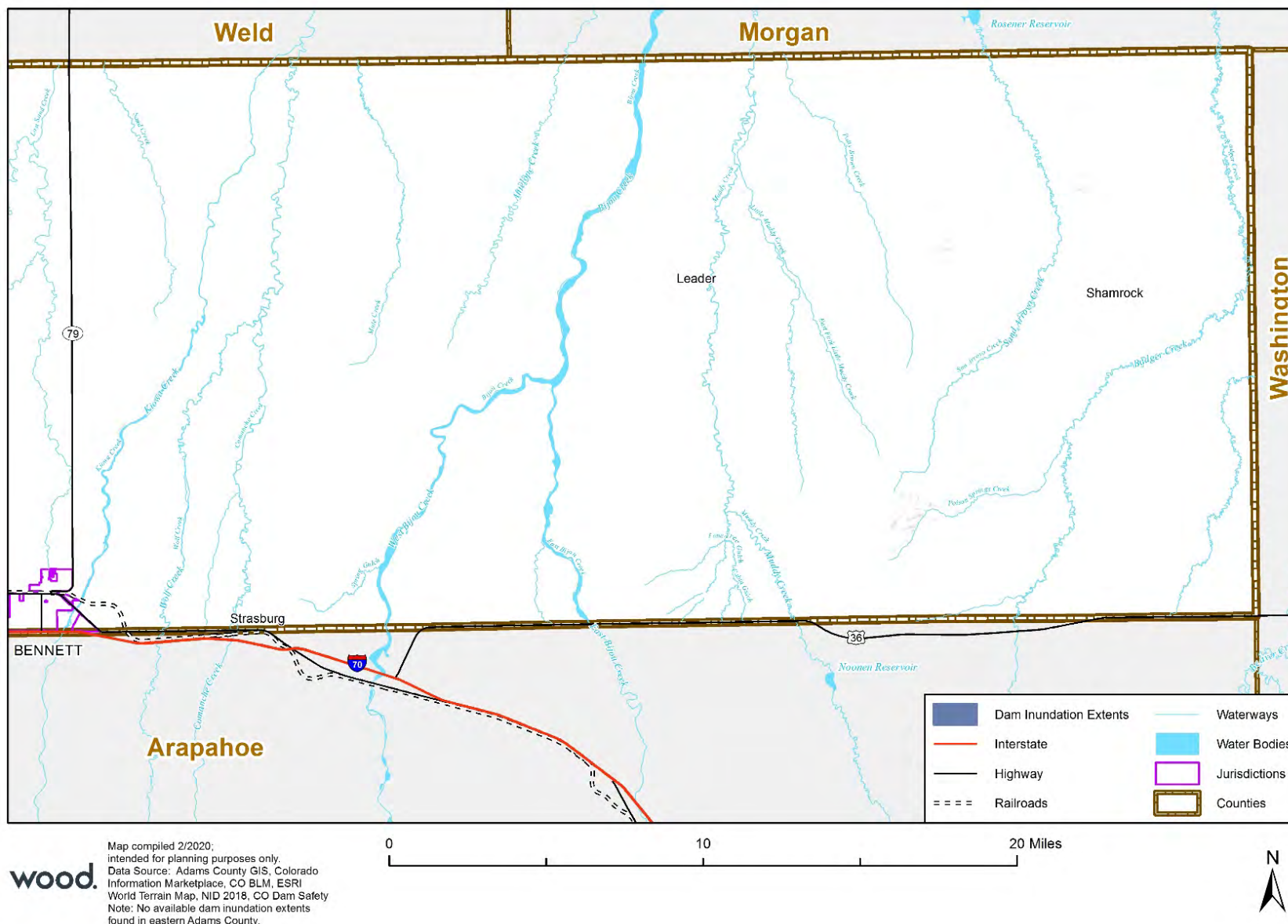
Figure 4-5 Dam Inundation Extents in West Adams County



wood.

Map compiled 2/2020;
intended for planning purposes only.
Data Source: Adams County GIS, Colorado
Information Marketplace, CO BLM, ESRI
World Terrain Map, NID 2018, CO Dam Safety

Figure 4-6 Dam Inundation Extents in East Adams County



Previous Occurrences

January 3, 1996 - The Standley Lake dam failed in 1996, due to wind waves on the Standley Lake reservoir along Big Dry Creek. While this dam is located in Jefferson County, its proximity to Adams County and present-day inundation mapping makes it possible that inundation took place within the planning area ([NPDP 2019](#)).

April 15, 1994 - The Leyden Dam, located in Jefferson County northeast of the Blunn as well as the Tucker Lake North and South Dams had a failure event on April 15, 1994. This incident took place due to inadequate dam spillway capacity, though no additional details are available. While the dam is not within Adams County boundaries, based on present-day inundation mapping, it is possible that flooding occurred within the planning area ([NPDP 2019](#)).

Probability of Future Occurrence

Occasional—1-10% chance of occurrence in the next year, though this is a mere estimation of potential occurrence based on the presence of significant and high hazard dams. Because dam failure is a human-caused hazard, it is difficult to accurately predict when or how a dam will fail and cause inundation downstream. Using the methodology adopted for natural hazards in this plan, only two past events near the planning area represents an occasional probability of future occurrence in Adams County.

Magnitude/Severity

Catastrophic—Failure of a significant or high hazard dam could lead to multiple deaths; property destroyed and severely damaged; and/or interruption of essential facilities and services for more than 72 hours.

Water released by a failed dam generates tremendous energy and can cause a flood that is catastrophic to life and property located in the inundation area (downstream). The largest three dams in terms of maximum storage in or upstream of Adams County are: the Chatfield Dam in Douglas County along the South Platte River (with a capacity of 355,000 acre-feet); the Cherry Creek Dam in Arapahoe County along the Cherry Creek River (with a capacity of 134,470 acre-feet); and the Bear Creek Dam in Jefferson County, along Bear Creek (with a capacity of 75,000 acre-feet).

As mentioned in the Geographic Location section of this chapter, a total of 26 dams have inundation mapping available that crosses the boundaries of Adams County. The majority of these are rated as high hazard structures (24 dams), with two being significant hazard dams that could cause inundation in the planning area. Based on the data available and the mapping provided in Figure 4-5, the worst possible dam-based flooding could take place in the western portions of Adams County, where structures such as the Chatfield and Cherry Creek Dams could affect large areas in major population centers in the county. A total of just over 156 square miles of potential land in the county would be at risk of dam inundation, based on best available mapping. However, it is worth noting that this mapping is not comprehensive due to reasons such as ongoing studies for other dams in or upstream of the planning area, and the presence of low hazard dams which do not require EAPs and hence inundation mapping.

The overall significance rating for this hazard is **High**.

Climate Change Considerations

With a potential for increase in extreme precipitation events, climate change may result in large floods that could stress dams and thus potentially increase the risk of dam failure. Dams are designed based on calculations of a river's flow behavior, and any changes in weather patterns can have significant effects on the hydrologic information used for the design of a dam. Climate change may alter the dam profile and

affect the designed margin of safety. However, these potential effects could be offset by generally lower reservoir levels if storage water resources become more limited or stretched in the future due to climate change, drought and/or population growth.

Vulnerability

A dam incident can range from a small, uncontrolled release to a catastrophic failure. Vulnerability to dam failures is confined to the areas and populations subject to inundation downstream of the structure. Secondary losses could include loss of the multi-use functions of the dam itself and associated revenues that accompany those functions, as well as damage to roads, utilities, and other infrastructure. GIS analysis was carried out using dam inundation extents from the Colorado Dam Safety Program as well as the Adams County parcel data (from the Assessor's Office), and the critical facility/infrastructure inventory. In this process, asset data was overlaid with the dam inundation layers to arrive at total units or facilities at risk.

People

Persons located downstream of a dam are at risk of a dam failure, though the level of risk can be tempered by topography, amount of water or material in the reservoir/dam/structure, and time of day of the breach. Injuries and fatalities can occur from debris, drowning, or release of sludge or other hazardous material. People in the inundation area may need to be evacuated, cared for, and possibly permanently relocated. Impacts could include hundreds of evacuations and possibly casualties, depending on the dam involved. Specific population impacts are noted in Table 4-14 and Table 4-15 below; total people at risk were calculated by multiplying the average number of persons per household in Adams County based on Census estimates (which equals 3.0) times the number of properties of Residential nature where the dam inundation extents were overlapping. An estimated total of 36,966 people could be at risk countywide based on the rough estimation used, though again it is unlikely that all the parcels or properties found to overlap with dam inundation extents will be populated by the total persons shown or actually affected by a dam failure event simultaneously. This estimate does not account for non-resident or visitor population.

The impacts of flooding from a dam failure or incident on vulnerable populations can be more severe. Comparing Figure 4-5 and Figure 4-6 with the social vulnerability maps in Section 2-5 shows that many of the areas at greatest risk of dam inundation also have higher social vulnerability stemming from socioeconomic status, household composition and disabilities, minority status and language proficiency, or housing and transportation resources. Families in this area may have fewer financial resources to prepare for or recover from a flood, and may be more likely to be uninsured or underinsured. Individuals with disabilities may need more time to evacuate, so evacuation notices will need to be issued as soon as feasible, and communicated by multiple, inclusive methods.

General Property

The total properties at risk and their improvements were found by counting the number of parcels intersecting with the dam inundation extents available and summing those improvement values. Content value calculations are based on FEMA Hazus software standards based on parcel type, as described in more detail under Section 4.2 Asset Summary. Total value is the combination of improved and content values. Finally, the loss estimate column takes 50% of the total values column, which represents an estimate value of damage potential based on parcels exposed to this hazard (using FEMA depth damage function guideline estimates). Results are presented in Table 4-14 and Table 4-15 by jurisdiction and by parcel type, respectively.

Table 4-14 Parcels Exposed to Dam Inundation Extents – Estimates by Jurisdiction

Jurisdiction	Total Improved Parcels	Improved Values	Content Values	Total Values	Loss Estimate (50% of the Total Value)	Population
Arvada	32	\$10,094,430	\$11,782,160	\$21,876,590	\$10,938,295	3
Aurora	1,893	\$101,028,570	\$81,967,100	\$182,995,670	\$91,497,835	4,977
Brighton	4,955	\$168,061,240	\$115,714,860	\$283,776,100	\$141,888,050	12,855
Commerce City	1,760	\$114,269,880	\$99,377,785	\$213,647,665	\$106,823,833	3,732
Lochbuie	1	\$0	\$0	\$0	\$0	--
Thornton	1,958	\$92,668,280	\$57,265,530	\$149,933,810	\$74,966,905	5,454
Westminster	2,215	\$80,550,950	\$48,575,490	\$129,126,440	\$64,563,220	6,093
Unincorporated	2,201	\$387,975,450	\$252,549,170	\$640,524,620	\$320,262,310	3,852
TOTAL	15,015	\$954,648,800	\$667,232,095	\$1,621,880,895	\$810,940,448	36,966

Source: USACE National Inventory of Dams 2018, Colorado Dam Safety Program, Adams County GIS, U.S. Census Bureau, Wood analysis

Table 4-15 Parcels Exposed to Dam Inundation Extents – Estimates by Parcel Type

Parcel Type	Improved Parcels	Parcel Values	Content Values	Total Values	Loss Estimate (50% of the Total Value)	Population
Agricultural	81	\$4,235,480	\$4,235,480	\$8,470,960	\$4,235,480	--
Commercial	1,249	\$279,340,670	\$279,340,670	\$558,681,340	\$279,340,670	--
Exempt	1,069	\$376,606,900	\$188,303,450	\$564,910,350	\$282,455,175	--
Industrial	132	\$48,119,620	\$72,179,430	\$120,299,050	\$60,149,525	--
Residential	12,322	\$246,346,130	\$123,173,065	\$369,519,195	\$184,759,598	36,966
State Assessed	162	\$0	\$0	\$0	\$0	--
TOTAL	15,015	\$954,648,800	\$667,232,095	\$1,621,880,895	\$810,940,448	36,966

Source: USACE National Inventory of Dams 2018, Colorado Dam Safety Program, Adams County GIS, U.S. Census Bureau, Wood analysis

Based on these results, the majority of the dam inundation exposed parcels are Residential, followed by the Commercial, Exempt, State Assessed, Industrial, and Agricultural categories. The largest numbers of exposed parcels are located in Brighton, followed by Westminster, the Unincorporated County areas, Thornton, Aurora, Commerce City, Arvada, and Lochbuie. Total exposed parcel values add up to \$1.62 billion based on the over 15,000 parcels falling within these available dam inundation areas.

Critical Facilities and Infrastructure

A total dam failure can cause catastrophic impacts to areas downstream of the water body, including critical facilities and infrastructure. Any critical asset located under the dam in an inundation area would be susceptible to the impacts of a dam failure. Of particular risk would be roads and bridges that could be vulnerable to washouts, further complicating response and recovery by cutting off impacted areas. Based on the critical facility inventory considered in the updating of this plan and intersected with the dam inundation extents available, 583 critical facilities were found to be at risk. These at-risk facilities are listed in the three tables below, first by jurisdiction (Table 4-16), then by Lifeline classification as based on the FEMA Lifeline categories (Table 4-17), and lastly by facility type (Table 4-18).

Table 4-16 Critical Facilities in Dam Inundation Extents by Jurisdiction

Jurisdiction	Total Critical Facilities
Unincorporated	319
Commerce City	154
Brighton	39
Thornton	39
Aurora	15
Westminster	13
Arvada	3

Jurisdiction	Total Critical Facilities
Lochbuie	1
TOTAL	583

Source: USACE National Inventory of Dams 2018, Colorado Dam Safety Program, Adams County GIS, HIFLD, Wood analysis

Table 4-17 Critical Facilities in Dam Inundation Extents by FEMA Lifeline

FEMA Lifeline	Total Critical Facilities
Hazardous Material	197
Safety and Security	191
Transportation	88
Food/Water/Shelter	78
Communications	18
Energy	6
Health and Medical	5
TOTAL	583

Source: USACE National Inventory of Dams 2018, Colorado Dam Safety Program, Adams County GIS, HIFLD, FEMA Lifelines, Wood analysis

Table 4-18 Critical Facilities in Dam Inundation Extents by Critical Facility Type

Critical Facility Type	Total Critical Facilities
Landfills/Govt. Services	144
HazMat EO Tier II Sites	111
Environmental Hazard Superfund	67
Gravel Mines/Ponds	64
Schools	26
Pedestrian Bridge	25
Major Bridge	24
Minor Bridge	19
Communication Towers	18
Government Facilities	17
Golf Course Bridge	16
Environmental Hazard Toxic Site	15
EO Emergency Shelters	10
Electric Substations	6
Fire Stations	4
HazMat EO RMP Sites	4
Wastewater Treatment Plant	4
Nursing Home	3
RTD Light Rail Station	3
Assisted Living	2
Fishing Pier Bridge	1
TOTAL	583

Source: USACE National Inventory of Dams 2018, Colorado Dam Safety Program, Adams County GIS, HIFLD, FEMA Lifelines, Wood analysis

The analysis results indicate that the largest category of critical facilities are Hazardous Materials (HazMat) sites, followed by Safety and Security (which includes sites such as fire stations, government facilities, landfills/government services, and others), Transportation, and Food/Water/Shelter facilities. Communications, Energy facilities, and Health and Medical facilities make up a small portion of the critical facilities at risk. Based on location, the largest number of critical facilities in dam inundation extents are within the unincorporated areas, with Commerce City next.

Economy

Extensive and long-lasting economic impacts could result from a major dam failure or inundation event, including the long-term loss of water in a reservoir, which may be critical for potable water needs or local wildlife. A major dam failure and loss of water from a key structure could bring about direct business and industry damages and potential indirect disruption of the local economy, and potentially affect important transportation routes enabling business and tourism into the county.

Historic, Cultural, and Natural Resources

A GIS analysis of historic properties and resources based on dam inundation mapping was also conducted, using the historic asset inventory discussed under Section 4.2 Asset Summary of this document. Based on the available data, it was found that three properties are located in dam inundation areas in Adams County, as shown in Table 4-19.

Table 4-19 Historic Properties and Resources in Dam Inundation Extents in Adams County

Jurisdiction	Historic Place Name	Historic Source Date	Data Source
Brighton	Brighton High School	1/23/1998	National Register of Historic Places
	Adams County Courthouse	10/4/2006	National Register of Historic Places
Commerce City	64th/Colorado Fast Track Station	Unknown	Adams County GIS

Source: Adams County GIS, National Register of Historic Places, Colorado Dam Safety Program, Wood Analysis

In addition, there are many other natural resources potentially exposed to dam inundation based on best available mapping. For example, 18 known parks, trails, and open spaces were found to be in inundation areas in Adams County, and are listed below:

- 55th & Lowell Trailhead
- Big Dry Creek Greenway (Coday) Open Space
- Brighton Road Trailhead
- Clear Creek Bottomlands Open Space
- E-470 Open Space
- Elaine T Valente Open Space
- Engineer Lake Open Space
- Jim Baker Reservoir Open Space
- Kalcevic Gulch
- Little Dry Creek Lake
- Lowell Ponds Open Space
- Pelican Ponds Open Space
- Regional Park
- Riverdale Bluffs Open Space
- Siegrist Lake
- Steele Street Park
- TRI Property/Big Dry Buffer Open Space
- Twin Lakes Park

Future Development

Flooding due to a water related dam failure event is likely to exceed the special flood hazard areas regulated through local floodplain ordinances and usually mapped by FEMA's National Flood Hazard Layer (NFHL) dataset. The County and jurisdictions should consider a dam failure hazard when permitting development downstream of the high hazard and significant hazard dams, in particular. There are currently 19 low hazard dams in the area of interest, and these 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, especially given the compounding effect one dam failure could have on additional downstream structures based on the local built environment and growing populations.

Risk Summary

- The overall significance of dam failure and incident hazards is **Medium** for Adams County.

- 51 High hazard dams (leading to probable loss of life if failure was to occur) are located in or upstream of Adams County, along with 18 Significant hazard dams and 19 Low hazard dams, for a total of 88 dams.
- The largest storage capacity dams that could affect Adams County if failure was to take place are: Chatfield Dam in Douglas County, Cherry Creek Dam in Arapahoe County, and the Bear Creek Dam in Jefferson County.
- Brighton, Westminster, and the Unincorporated County areas contain the largest population at risk to a dam failure as well as the highest amount of parcels and total values exposed. Over 15,000 parcels are found in dam inundation extents, with over \$1.43 billion of exposed values, and almost 37,000 people potentially at risk.
- A total of 583 critical facilities and infrastructure are found within dam inundation extents in the county, most of which belong to the Hazardous Materials and Safety and Security categories (based on FEMA Lifelines, described in more detail under Section 4.2, Asset Summary)
- New development in dam inundation areas increases risk and may cause dam hazard rankings to change (e.g. from Low to Significance hazard rating).

Table 4-20 Dam Failure/Incident Risk Summary

Jurisdiction	Geographic Location	Probability of Future Occurrence	Magnitude/Severity	Overall Significance
Adams County	Limited	Unlikely	Critical	Medium
Bennett	Limited	Unlikely	Critical	Medium
Brighton	Significant	Occasional	Catastrophic	High
Commerce City	Limited	Occasional	Limited	Low
Denver Water	Limited	Unlikely	Critical	Medium

4.3.3 Drought/Extreme Heat

Hazard Description

Drought is a slow-onset hazard, generally defined by a long-term deficiency in precipitation resulting in water shortages causing adverse impacts on vegetation, animals, and/or people. Droughts occur gradually, which often makes it difficult to define when a drought begins and ends. Per the National Drought Mitigation Center, there are four basic approaches to defining a drought based on its effects:

- **Meteorological drought** is based on the degree and duration of dryness, usually defined by a period of below average precipitation.
- **Agricultural drought** links dryness to agricultural impacts and occurs when there is an inadequate water supply to meet the needs of crops, livestock, and other agricultural operations. It is measured by precipitation shortages, differences between actual and potential evapotranspiration, soil water deficits, reduced groundwater or reservoir levels, and other factors. Agricultural drought is dependent on the variable needs of different crops during different stages of development.
- **Hydrological drought** concerns deficiencies in surface and subsurface water supplies and is typically defined on a watershed scale. It is generally measured as streamflow, snowpack, and as lake, reservoir, and groundwater levels. Measuring drought with this approach may result in a slower recognition of drought conditions compared to meteorological and agricultural drought because the impacts of precipitation deficiencies can take a while to be seen in the hydrologic system.

- **Socioeconomic drought** is associated with the supply and demand of water or other related goods. It occurs when a drought impacts health, well-being, and quality of life, or when a drought starts to have an adverse economic impact on a region.

Each of the above definitions of drought can be measured on different scales and scopes and by a variety of metrics, such as precipitation, soil moisture, streamflow, and surface water and groundwater levels. Additionally, each definition can provide a different point of view or understanding of drought severity and impacts. Several unique indices have been developed to describe drought and measure its severity. It's important to understand that each of these indices measures drought as it occurs but does not predict future drought conditions.

The **Palmer Drought Severity Index** (PDSI) devised in 1965, was the first drought indicator to assess moisture status comprehensively. The PDSI uses temperature and precipitation data to calculate water supply and demand, incorporates soil moisture, and is considered most effective for unirrigated cropland. It primarily reflects long-term drought and has been used extensively to initiate drought relief.

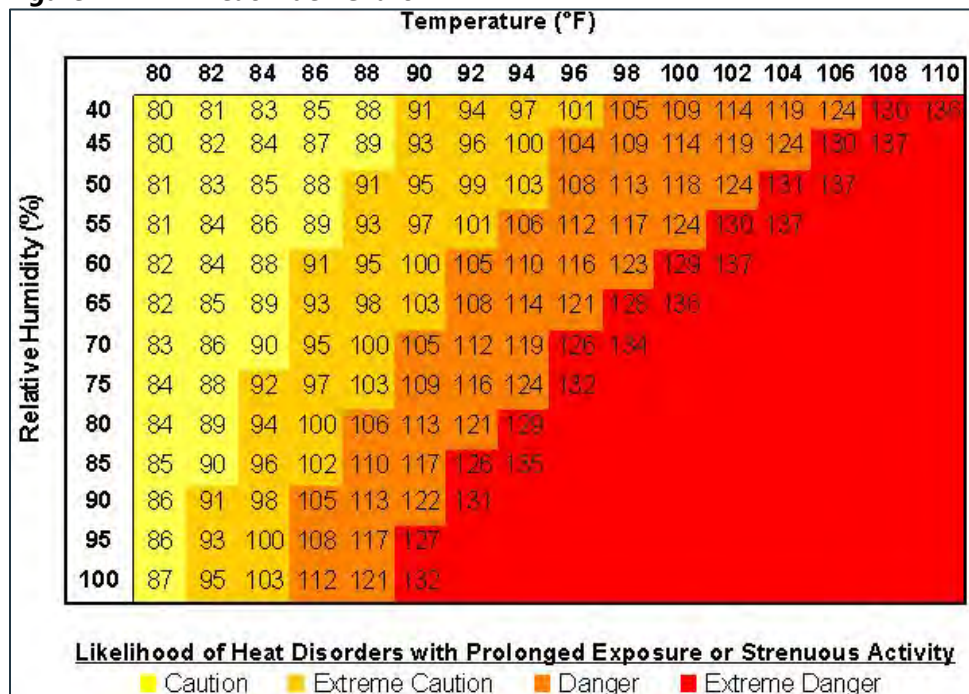
The **Standardized Precipitation Index** (SPI), like the PDSI, index is negative for drought, and positive for wet conditions. However, the SPI is a probability index that considers only precipitation.

The **U.S. Drought Monitor** provides a summary of drought conditions across the United States and Puerto Rico. Often described as a blend of art and science, the Drought Monitor map is updated weekly by combining a variety of data-based drought indices and indicators as well as local expert input into a single composite drought indicator.

Colorado has a Drought Mitigation and Response Plan that encompasses drought monitoring, assessment, response, and mitigation statewide. Additionally, the Colorado Water Conservation Board (CWCB) maintains a Drought Response page that encompasses the above definitions of drought and supports both local and state drought planning as well as water supply planning. The CWCB also provides a Drought Planning Toolbox designed to assist with planning and responding to drought.

Extreme heat is defined in the State Hazard Mitigation Plan as "temperatures over 90 degrees for an extended period of time, or that hover 10 degrees or more above the average high temperature for the region and last for multiple consecutive days." It's useful to consider the extreme heat hazard in conjunction with drought because of the direct impact high temperatures can have on drought incidence. Extreme heat can occur quickly and without warning. Older adults, children, and sick or overweight individuals are more vulnerable to extreme heat.

Heat conditions are a product of ambient air temperature and relative humidity. Humidity increases the feeling of heat as measured by heat index. The Heat Index Chart in Figure 4-7 shows how ambient temperature and relative humidity impact the relative intensity of heat conditions. The shaded zone above 105°F corresponds to a heat index that may cause increasingly severe heat disorders with continued exposure and/or physical activity.

Figure 4-7 Heat Index Chart

Source: National Weather Service (NWS) http://www.nws.noaa.gov/os/heat/heat_index.shtml

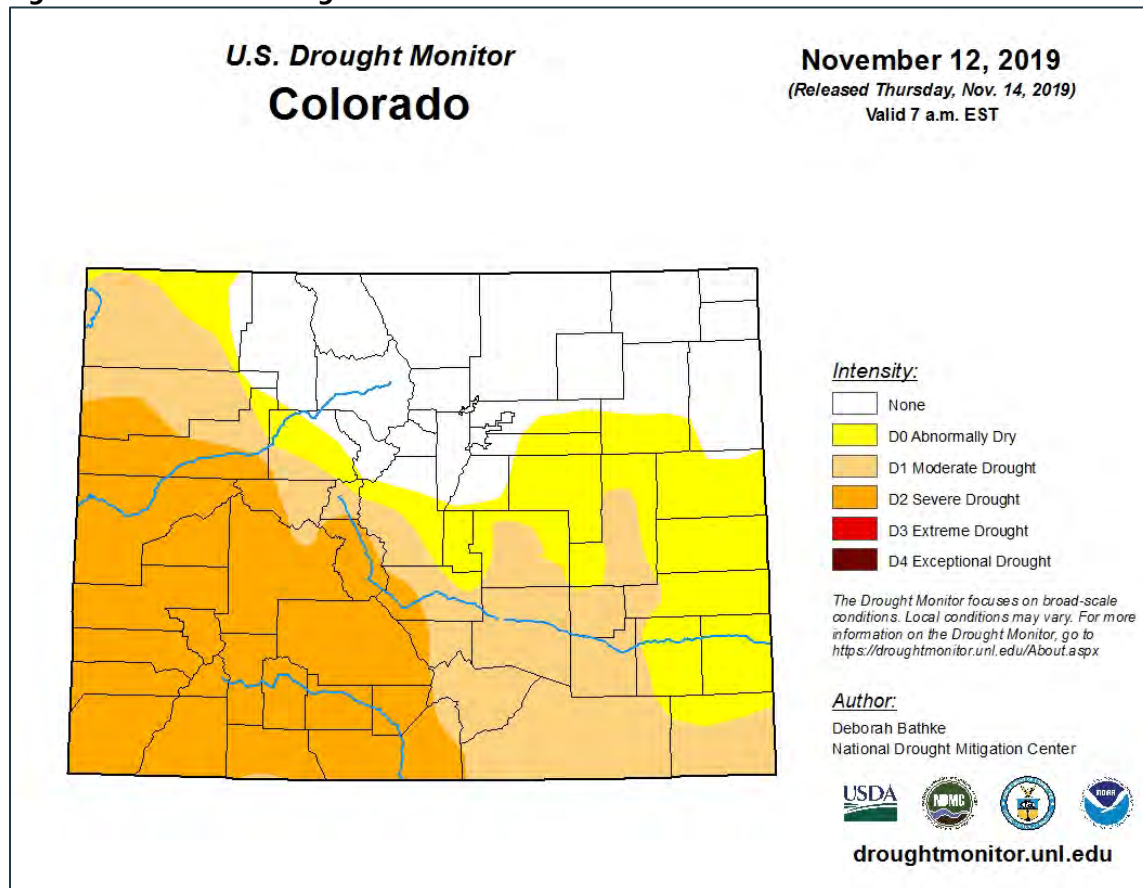
Note: Exposure to direct sun can increase Heat Index values by as much as 15°F.

Although lower relative humidity contributes to a lower overall heat index, excessively dry and hot weather can also be dangerous. These conditions can cause dust storms and low visibility and can contribute to more severe drought as well as dangerous fire conditions.

Geographic Location

Drought is regional in nature and can occur anywhere in Adams County, affecting all or part of the County at any given time. Given the increased vulnerability of agriculture to drought, the central and eastern portions of the County, where most of the County's agricultural activities are concentrated, may have greater exposure and vulnerability to drought.

Figure 4-8 shows the U.S. Drought Monitor for Colorado as of November 12, 2019, illustrating the regional nature of drought.

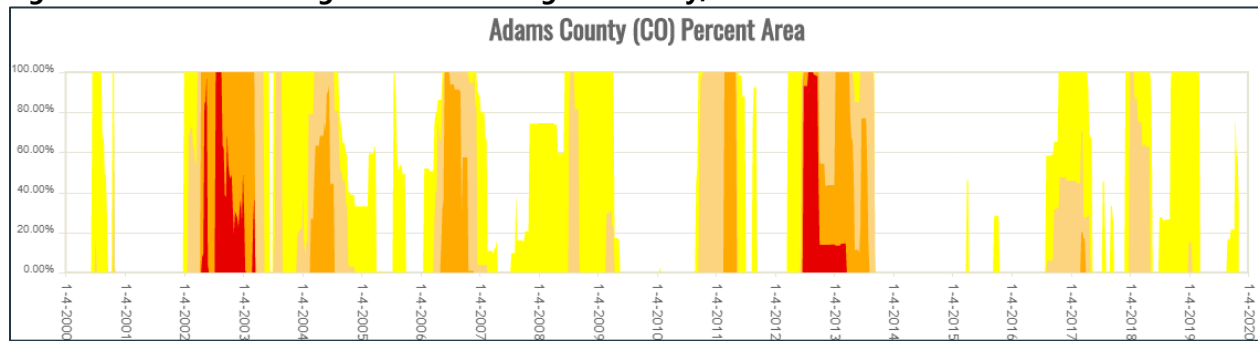
Figure 4-8 U.S. Drought Monitor

Extreme heat is also regional in nature; however, urbanized areas can experience pockets of heightened temperatures where surfaces such as pavement and roofs become hotter than the air temperatures, a phenomenon known as the urban heat island effect. These hot surfaces also retain heat, causing high temperatures to persist even when air temperature drops. Per the EPA, "the annual mean air temperature of a city with 1 million people or more can be 1.8–5.4°F (1–3°C) warmer than its surroundings. On a clear, calm night, however, the temperature difference can be as much as 22°F" (US EPA).

Previous Occurrences

As reported in Table 4-3, Adams County has received seven USDA disaster declarations and one State disaster declaration due to drought.

The U.S. Drought Monitor maintains weekly records of drought by county. Per these records, during the 991-week period from January 2000 through December 2018, all or portions of Adams County spent 595 weeks (60% of the time period) in some level of drought, defined as Abnormally Dry (D0) or worse conditions. Figure 4-9 illustrates the severity and duration of drought conditions during this time, using the same color coding for each category of drought intensity as shown in Figure 4-8 above. This period includes 173 weeks of Severe Drought (D2) or worse and 73 weeks reaching Extreme Drought (D3). The most significant droughts on record during this period were between 2002–2003 and 2012–2013. During the 2012 drought, over 90% of the County was in Extreme Drought for 13 consecutive weeks.

Figure 4-9 U.S. Drought Monitor Drought Intensity, 2000-2020

Source: U.S. Drought Monitor

Another source of data on previous drought occurrences is the National Drought Mitigation Center (NDMC), located at the University of Nebraska in Lincoln, which provides a clearinghouse for information on the effects of drought based on reports from media, observers, impact records, and other sources.

According to the NDMC's Drought Impact Reporter, during the 20-year period from January 1999 through December 2018, 809 drought impacts were recorded for the State of Colorado, of which 46 were reported to affect Adams County. Table 4-21 summarizes the number of impacts reported by category and the years impacts were reported for each category, where available. Note that the Drought Impact Reporter assigns multiple categories to each impact.

Table 4-21 NDMC Drought Impact Reporter, 1999-2018

Impact Category	Count of Impacts	Years Reported
Agriculture	7	2013, 2012
Business & Industry	4	2018, 2017, 2012, 2011, 2010, 2003, 2002
Fire	2	2002
Plants & Wildlife	9	2018, 2013, 2012, 2011, 2010
Relief, Response & Restrictions	18	2018, 2013, 2012
Society & Public Health	1	n/a
Tourism & Recreation	6	2018, 2017, 2013, 2012, 2003, 2002
Water Supply & Quality	23	2018, 2013, 2012

Source: National Drought Mitigation Center Drought Impact Reporter (<https://droughtreporter.unl.edu/map/>)

The United States Department of Agriculture (USDA) Risk Management Agency (RMA) maintains a database of all crop insurance claims across the country by location and cause of loss. This data helps to quantify the economic impact of drought on agriculture. In Adams County, crop insurance claims were made as a result of drought in 11 of the 12 years during the period from 2007 through 2018. In total, over 332,000 acres were affected and over \$20.6 million in losses were claimed.

Table 4-22 Crop Insurance Claims Paid Due to Drought, 2007-2018

Year	Determined Acres	Indemnity Amount
2007	12,817.84	\$503,968
2008	49,030.74	\$3,529,313
2009	10,719.54	\$723,133
2010	7,246.27	\$216,685
2011	33,110.91	\$2,822,833
2012	40,674.43	\$2,776,135
2013	72,746.57	\$4,950,549
2015	660.03	\$20,521

Year	Determined Acres	Indemnity Amount
2016	2,390.87	\$96,626
2017	31,607.78	\$1,519,018
2018	71,199.82	\$3,486,813
Total	332,204.80	\$20,645,594

Source: USDA RMA

The USDA also tracks disaster declarations issued due to drought as part of its disaster assistance programs. Per these records, Adams County has been listed in four USDA Disaster Declarations resulting from drought since 2012, detailed in Table 4-23.

Table 4-23 USDA Secretarial Disaster Declarations for Adams County due to Drought, 2012-2019

Designation Number	Begin Date	Crop Year	Description
S3260	1/1/2012	2012	Drought, excessive heat, high winds
S3456	11/1/2012	2013	Drought-FAST TRACK
S3548	5/1/2013	2013	Drought-FAST TRACK
S4145	11/15/2016	2017	Drought-FAST TRACK

Source: USDA Farm Service Agency

NOAA's National Centers for Environmental Information (NCEI) reports five heat events between 1999 and 2018. There are no deaths, injuries, property damages, or crop damages recorded in association with these events. Event narratives from NCEI are detailed below:

- **June-July 2000:** July 15th marked the end of a near record hot streak for the Denver area. The maximum high temperature at Denver International Airport equaled or exceeded the 90 degree mark for 17 consecutive days, from June 29th-July 15th; one day short of tying the all-time record. The record of 18 consecutive days was set in two different years, July 1st-July 18th, 1874 and July 6th-23rd, 1901.
- **September 2000:** On September 17th, the record high temperature of 95 at Denver International Airport broke three record extremes. The afternoon maximum temperature broke the previous record for the day of 94 set in 1895. It also marked the warmest it has been so late in the month of September, which incidentally was set the previous day. Also, the afternoon high temperature marked the 61st time during the year that the 90 degree mark was met or exceeded, breaking the record of 60 days set in 1994 and then tied the previous day.
- **June 2012:** June 2012 was the hottest June in Denver since weather records began back in 1872. There were a total of seventeen 90 degree days in the month of June. The highlight of the month was a stretch of five consecutive 100 degree days from the 22nd to the 26th. This was only the third time in Denver weather history in which this happened. Two of the high temperatures during the stretch peaked at 105 degrees, which set the all-time record for the month of June and also tied the all-time maximum temperature for Denver.

Additionally, the National Weather Service Denver/Boulder Forecast Office maintains summer heat records from 1872 to the present. Per these records, during 10 of the last 20 years the Denver area experienced 2 or more days per year with high temperatures at or above 100 degrees. The greatest number of 100+ degree days occurred in 2012, with 13 days, followed by 2005 with 7 days.

Probability of Future Occurrence

According to information from the Colorado Drought Mitigation and Response Plan, Colorado was in drought for 50 of the past 126 years (1893-2018). Thus, there is a 39.7% chance that a drought will

happen in Colorado in any given year, and a drought can be expected somewhere in the state every 2.5 years.

Historical drought occurrence and intensity data reported by the U.S. Drought Monitor indicates that over the 991-week period from January 2000 through December 2018 Adams County experienced 173 weeks of Severe Drought or worse conditions. If future occurrences continue to follow this trend, Adams County has a 17% chance of experiencing severe drought conditions in any given week. Short duration droughts are likely, but longer periods of intense drought are less common. Considered on the level of annual probability, Adams County experienced Severe Drought or worse conditions during 8 of the 19 years during this period, which equates to a 40% annual chance of severe drought conditions.

Based on NCEI records of five heat-related events over the 20-year period from 1999 through 2018, Adams County has at least a 25% annual chance of experiencing heat-related hazards.

Drought and extreme heat probability may increase in the future due to climate change, discussed in greater detail below.

Magnitude/Severity

Drought severity can be defined in terms of intensity using the U.S. Drought Monitor scale. The U.S. Drought Monitor Scale measures drought episodes with input from the Palmer Drought Severity Index, the Standardized Precipitation Index, the Keetch-Byram Drought Index, soil moisture indicators, and other inputs as well as information on how drought is affecting people. Figure 4-10 details the classifications used by the U.S. Drought Monitor. A category of D2 (severe) or higher on the U.S. Drought Monitor Scale can likely result in crop or pasture losses, water shortages, and the need to institute water restrictions.

Figure 4-10 U.S. Drought Monitor Classifications

Category	Description	Possible Impacts	Ranges				
			Palmer Drought Severity Index (PDSI)	CPC Soil Moisture Model (Percentiles)	USGS Weekly Streamflow (Percentiles)	Standardized Precipitation Index (SPI)	Objective Drought Indicator Blends (Percentiles)
D0	Abnormally Dry	<ul style="list-style-type: none"> Going into drought: <ul style="list-style-type: none"> short-term dryness slowing planting, growth of crops or pastures Coming out of drought: <ul style="list-style-type: none"> some lingering water deficits pastures or crops not fully recovered 	-1.0 to -1.9	21 to 30	21 to 30	-0.5 to -0.7	21 to 30
D1	Moderate Drought	<ul style="list-style-type: none"> Some damage to crops, pastures Streams, reservoirs, or wells low, some water shortages developing or imminent Voluntary water-use restrictions requested 	-2.0 to -2.9	11 to 20	11 to 20	-0.8 to -1.2	11 to 20
D2	Severe Drought	<ul style="list-style-type: none"> Crop or pasture losses likely Water shortages common Water restrictions imposed 	-3.0 to -3.9	6 to 10	6 to 10	-1.3 to -1.5	6 to 10
D3	Extreme Drought	<ul style="list-style-type: none"> Major crop/pasture losses Widespread water shortages or restrictions 	-4.0 to -4.9	3 to 5	3 to 5	-1.6 to -1.9	3 to 5
D4	Exceptional Drought	<ul style="list-style-type: none"> Exceptional and widespread crop/pasture losses Shortages of water in reservoirs, streams, and wells creating water emergencies 	-5.0 or less	0 to 2	0 to 2	-2.0 or less	0 to 2

Source: US Drought Monitor

The National Weather Service Heat Index Program provides a measure of the extent of typical health impacts of exposure to heat, summarized in Table 4-24. During these conditions, the human body has difficulties cooling through the normal method of the evaporation of perspiration, and health risks rise.

Table 4-24 Typical Health Impacts of Extreme Heat by Heat Index

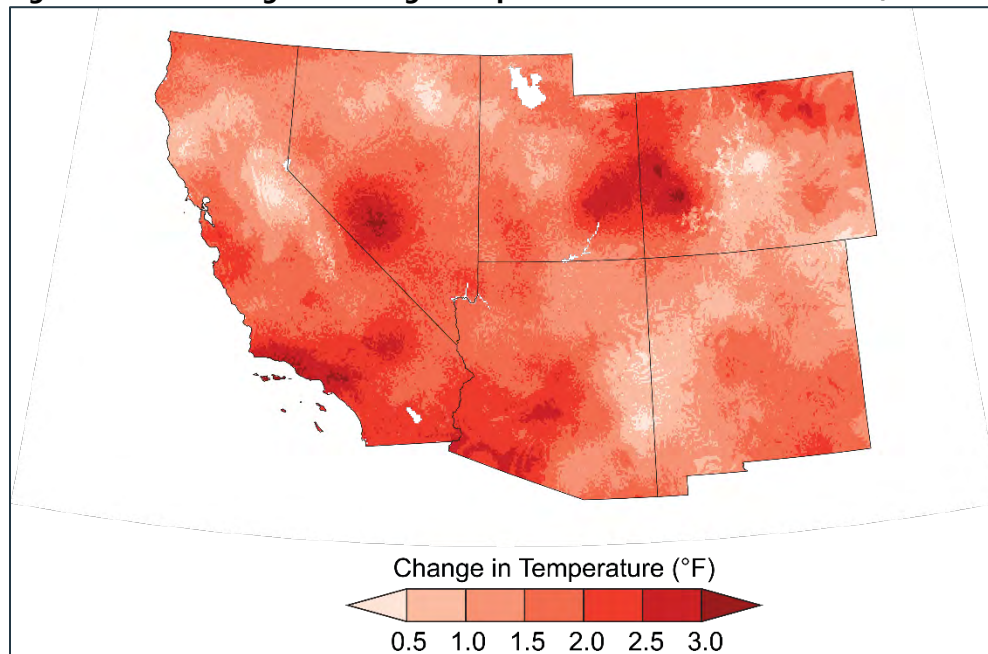
Heat Index (HI)	Disorder
80-90° F (HI)	Fatigue possible with prolonged exposure and/or physical activity
90-105° F (HI)	Sunstroke, heat cramps, and heat exhaustion possible with prolonged exposure and/or physical activity
105-130° F (HI)	Heatstroke/sunstroke highly likely with continued exposure

Source: National Weather Service Heat Index Program, www.weather.gov/os/heat/index.shtml

Climate Change Considerations

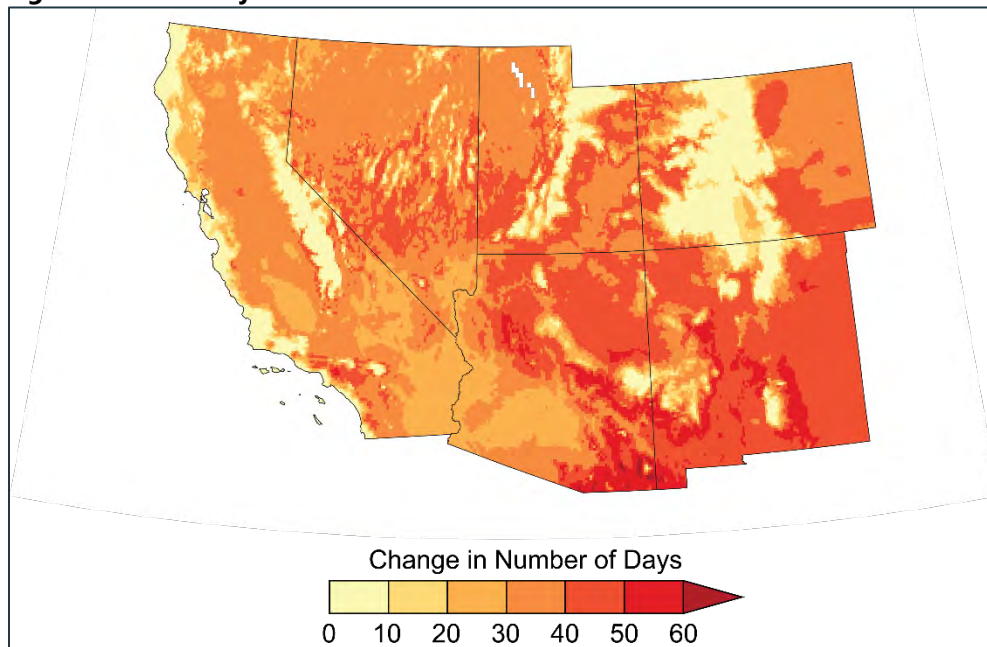
Current climate change projections suggest that drought conditions may become even more common in the future due to a variety of factors, including higher temperatures and increased evapotranspiration, reduced snowpack from less snowfall and earlier spring melt, and severe soil moisture drought.

Research cited in the Fourth National Climate Assessment indicates that average temperatures have already increased across the Southwest and will likely continue to rise. Figure 4-11 shows the difference between the 1986-2016 average temperature and the 1901-1960 average temperature. This trend toward higher temperatures is expected to continue and would cause more frequent and severe droughts in the Southwest as well as drier future conditions and an increased risk of megadroughts—dry periods lasting 10 years or more. Additionally, current models project decreases in snowpack, less snow and more rain, shorter snowfall seasons, and earlier runoff, all of which may increase the probability of future water shortages (Gonzalez et al., 2018).

Figure 4-11 Change in Average Temperature Across the Southwest, 1901-1960 to 1986-2016

Source: Fourth National Climate Assessment

In conjunction with rising average temperatures and their projected impact on drought, extreme heat is also expected to increase in frequency. Figure 4-12 shows projected increases in extreme heat as an increase in the number of days per year when the temperature exceeds 90°F by the period 2036-2065 compared to the period 1976-2005. Under the high emissions scenario, the number of days of extreme heat would increase in Adams County by 30 to 50 days.

Figure 4-12 Projected Increases in Extreme Heat

Source: Fourth National Climate Assessment

Vulnerability

People

Drought can affect people's physical and mental health. For those economically dependent on a reliable water supply, drought may cause anxiety or depression about economic losses, reduced incomes, and other employment impacts. Adams County has a large agricultural sector that is particularly vulnerable to these impacts. Drought may also cause health problems due to poorer water quality from lower water levels.

Though physical injury or death are not typically a result of drought, extreme heat can cause heat stroke or even fatality. The most dangerous place to be during an extreme heat incident is in a permanent home, with little or no air conditioning. Those most vulnerable to heat-related illness include people 65 years of age and older, young children, people with chronic health problems such as heart disease, people who are obese, people who are socially isolated, and people who are on certain medications. Low income families are less likely to have air conditioning and may be disproportionately impacted by rising water costs. Even young and healthy individuals are susceptible if they participate in strenuous physical activities during hot weather or are not acclimated to hot weather.

Those who are homeless and are limited in their ability to seek shelter from extreme temperatures are also more vulnerable to extreme heat. At the time of the Adams County 2019 Point in Time homelessness assessment, there were an estimated 483 people experiencing homelessness in Adams County, including 139 individuals who were unsheltered and therefore may face greater exposure to extreme heat.

Aside from direct health impacts, in extreme cases of drought, conflicts may arise over water shortages. People may be forced to pay more for water, food, and utilities affected by increased water costs.

General Property

Drought does not have a direct impact on buildings. Developed areas may experience damages to landscaping if water use restrictions are put in place, however these losses are not considered significant.

Exposure of agricultural property to drought is high in Adams County. Per the 2017 Census of Agriculture, there are 905 farms in the county with an estimated market value of \$126,500,000 in crops and livestock. Approximately 309,468 acres, or 44% of the total farm acreage, is covered by crop insurance. According to the USDA RMA, during the 12-year period from 2007-2018, the sum of claims paid for drought in Adams County was \$20,645,594. The 44% crop insurance coverage was factored into this data to estimate total losses of insured and uninsured crops. The adjusted estimate of 12-year drought losses is \$46,921,805. These losses equate to an annualized loss of \$3,910,150 or 3.1% of the total market value.

Critical Facilities and Infrastructure

Buildings and infrastructure are not vulnerable to direct impact from drought; however, critical systems related to water supply can be affected. Decreased water levels in dams can cause structural damage. Low water levels can also affect wildfire protection capability.

Secondary hazards exacerbated by drought, such as wildfire and expansive soils, can cause direct structural impacts on critical facilities and infrastructure.

Prolonged heat exposure can have devastating impacts on infrastructure. Prolonged high heat exposure increases the potential of pavement deterioration, as well as railroad warping or buckling. High heat also puts a strain on energy systems and consumption, as air conditioners are run at a higher rate and for longer. Extreme heat can also reduce transmission capacity over electric systems.

Economy

The main industry to experience the effects of drought is agriculture. Agriculture accounts for only a small percentage of employment in Adams County, but over 94% of all land use. Farmers may face crop losses or increased livestock costs. Businesses that depend on farming may experience secondary impacts.

Extreme drought also has the potential to impact local businesses in landscaping, recreation and tourism, and public utilities.

Historic, Cultural, and Natural Resources

Drought can affect local wildlife by shrinking food supplies and damaging habitats. Sometimes this damage is only temporary, and other times it is irreversible. Wildlife may face increased disease rates due to limited access to food and water. Increased stress on endangered species could cause extinction. Reduced food supply can also drive wildlife into greater proximity with humans. Extreme heat can have similar direct health impacts on natural resources such as plants, wildlife, and livestock.

Drought conditions can also provide a substantial increase in wildfire risk. As plants and trees die from a lack of precipitation, increased insect infestations, and diseases—all of which are associated with drought—they become fuel for wildfire. Long periods of drought can result in more intense wildfires, which bring additional consequences for the economy, the environment, and society. Drought may also increase likelihood of wind and water erosion of soils.

Future Development

Drought vulnerability is likely to be impacted by future development. Public demand for water, which impacts water levels, can exacerbate drought. Adams County has a semi-arid climate, which means precipitation is already limited under normal climate conditions. Per the State's Drought Mitigation and Response Plan, all of Colorado depends on precipitation for its water supply. Additionally, public water supply is or may soon become inadequate for much of Adams County and its incorporated areas, especially in the face of development plans and pressures (Adams County <http://www.adcogov.org/news/h2-ohh%E2%80%A6>, 2019). A 2011 gap analysis done for the Colorado Water Conservation Board, shown in Figure 4-13, indicates that water demand may surpass supply as

soon as 2025 in the South Platte Basin and 2030 in the Metro Basin (CDM, 2011). As the gap between water supply and water demand shrinks, departures from normal hydrologic conditions may be felt more easily in Adams County. Water rights issues further complicate this matter.

Figure 4-13 Water Supply Gap Analysis

Municipal and Industrial Gap and Estimated Beginning Year for 100%, Inter basin Compact Committee (IBCC) Alternative Portfolio (Optimistic), and Status Quo Portfolio (Realistic) Scenarios						
Basin/Area	Gap under 100% Scenario (AF)	Gap Begins	Gap when IPPs at IBCC Alternative Portfolio (Optimistic) Scenario (AF)	Gap Begins	Gap when IPPs at Status Quo Portfolio (Realistic) Scenario (AF)	Gap Begins
South Platte Basin	55,000	2040	110,000	2025	130,000	2025
Metro Basin	66,000	2045	130,000	2030	150,000	2030
Arkansas Basin	54,000	2040	64,000	2035	78,000	2035
Front Range ¹	150,000	2040	270,000	2030	320,000	2030
Colorado Basin	27,000	2040	33,000	2040	33,000	2040
Gunnison Basin	3,600	2045	5,200	2040	5,200	2040
Yampa - White Basin	36,000	2020	37,000	2020	37,000	2020
Southwest Basin	7,600	2040	12,000	2035	12,000	2035
Rio Grande Basin	2,800	2040	3,500	2040	3,500	2040
North Platte Basin	0	2055	0	2050	0	2050
Statewide	250,000	2040	390,000	2030	450,000	2030

1) Front Range includes South Platte Northern, Denver Metro, South Metro, Arkansas Urban Counties

Source: CWCBC

Risk Summary

- Annualized crop loss due to drought in Adams County is estimated at \$3,910,150 or 3.1% of the total market value.
- Related hazards: Wildfire

Table 4-25 Drought Risk Summary

Jurisdiction	Geographic Location	Probability of Future Occurrence	Magnitude/Severity	Overall Significance
Adams County	Extensive	Likely	Negligible	Medium
Bennett	Extensive	Likely	Critical	High
Brighton	Extensive	Likely	Negligible	Medium
Commerce City	Limited	Occasional	Negligible	Low
Denver Water	Extensive	Likely	Negligible	Medium

4.3.4 Earthquake

Hazard Description

An earthquake is the motion or trembling of the ground produced by a sudden slip on a fault in the Earth's crust. Stress builds up and rocks slip suddenly, releasing energy in waves that travel through the earth's crust and cause the shaking that is felt during an earthquake. Earthquake seismicity may stem from *triggered* events, meaning that the causes are natural reasons (e.g. tectonic movement, volcanism, ground instability issues such as natural landslides), or *induced* by human activity, such as mining-related explosions or blasting, collapse of mines and caverns, and potentially even extreme changes in aquifer depths attributed to over-pumping water (as has been the case in places like California, with groundwater

depletion, and even here in Colorado, such as with pumping of fluid waste back in the 1960s) (Colorado SHMP, 2018).

Earthquakes can affect large areas of land, cause damage to property measured in the tens of billions of dollars, result in injury or death to hundreds of thousands of persons, and disrupt the social and economic functioning of the affected area. Negative impacts and losses incurred will also depend on secondary effects and hazards such as dam failure, wildfire, seiches, avalanche, and land subsidence. The severity of earthquakes is site-specific and influenced by proximity to the earthquake epicenter and soil type (including liquefaction potential), among other factors.

Liquefaction occurs when ground shaking causes the mechanical properties of some fine grained, saturated soils to liquefy and act as a fluid (liquefy). It is the result of a sudden loss of soil strength due to a rapid increase in soil pore water pressures caused by ground shaking. In order for liquefaction to occur, three general geotechnical characteristics should be present: 1) ground water should be present within the potentially liquefiable zone, 2) the potentially liquefiable zone should be granular and meet a specific range in grain-size distribution, and 3) the potentially liquefiable zone should be of low relative density. If those criteria are present and strong ground motion occurs, then those soils could liquefy. Liquefaction that produces surface effects generally occurs in the upper 40 to 50 feet of the soil column, although the phenomenon can occur deeper than 100 feet. The duration of ground shaking is also an important factor in causing liquefaction to occur. The larger the earthquake magnitude, and the longer the duration of strong ground shaking, the greater the potential there is for liquefaction to occur.

Most earthquakes are caused by the release of stresses accumulated as a result of the rupture of rocks along opposing fault planes in the Earth's outer crust. These fault planes are typically found along borders of the Earth's 10 tectonic plates. These plate borders generally follow the outlines of the continents, with the North American plate following the continental border with the Pacific Ocean in the west but following the mid-Atlantic trench in the east. As earthquakes occurring in the mid-Atlantic trench usually pose little danger to humans, the greatest earthquake threat in North America is along the Pacific Coast. The areas of greatest tectonic instability occur at the perimeters of the slowly moving plates because these locations are subjected to the greatest strains from plates traveling in opposite directions and at different speeds.

Geographic Location

The geographic coverage potential of this hazard in Adams County is **Limited**. Faults with capacity for large magnitude seismic events are located in central and western Colorado, so the northeastern portion of the state where Adams County's boundaries are has lower earthquake activity potential. Thousands of faults have been mapped in Colorado, but scientists believe only about 90 of these were active in the past 1.6 million years.

The location of historic epicenters, Quaternary faults, and hazard potential in terms of peak ground acceleration potential in Adams County are displayed in Figure 4-14 and Figure 4-15 below. Quaternary faults are those recognized to have moved in the past 1,600,000 or so years, during a portion of the quaternary geologic epoch (more details on faults and geologic periods in the following bullets). Peak ground acceleration is used to portray relative ground motion of seismic activity, and it represents the maximum ground acceleration which took place during an earthquake shaking event at the mapped location.

Faults are classified based on the geologic time frame of their latest suspected movement (in order of activity occurrence, with the most recent is listed first):

- H—Holocene (within past 15,000 years)

- LQ—Late Quaternary (15,000-130,000 years)
- MLQ—Middle to Late Quaternary (130,000 - 750,000 years)
- Q—Quaternary (approximately past 1.6-2 million years)
- LC—Late Cenozoic (approximately past 23.7 million years)

As portrayed in the map below, the only quaternary fault located nearby Adams County is the Golden Fault. This fault is about 10 miles south-southwest of the county and crosses the Interstate 70 highway in a north-south fashion. This fault is a west-dipping, high-angle, range-front thrust fault, and forms the east flank of the Front Range near the City of Golden in Jefferson County. It was last active around 23.03 million years ago. ([USGS, 1998](#)).

Figure 4-14 Earthquake Faults, History, and Hazard Potential in or Near West Adams County

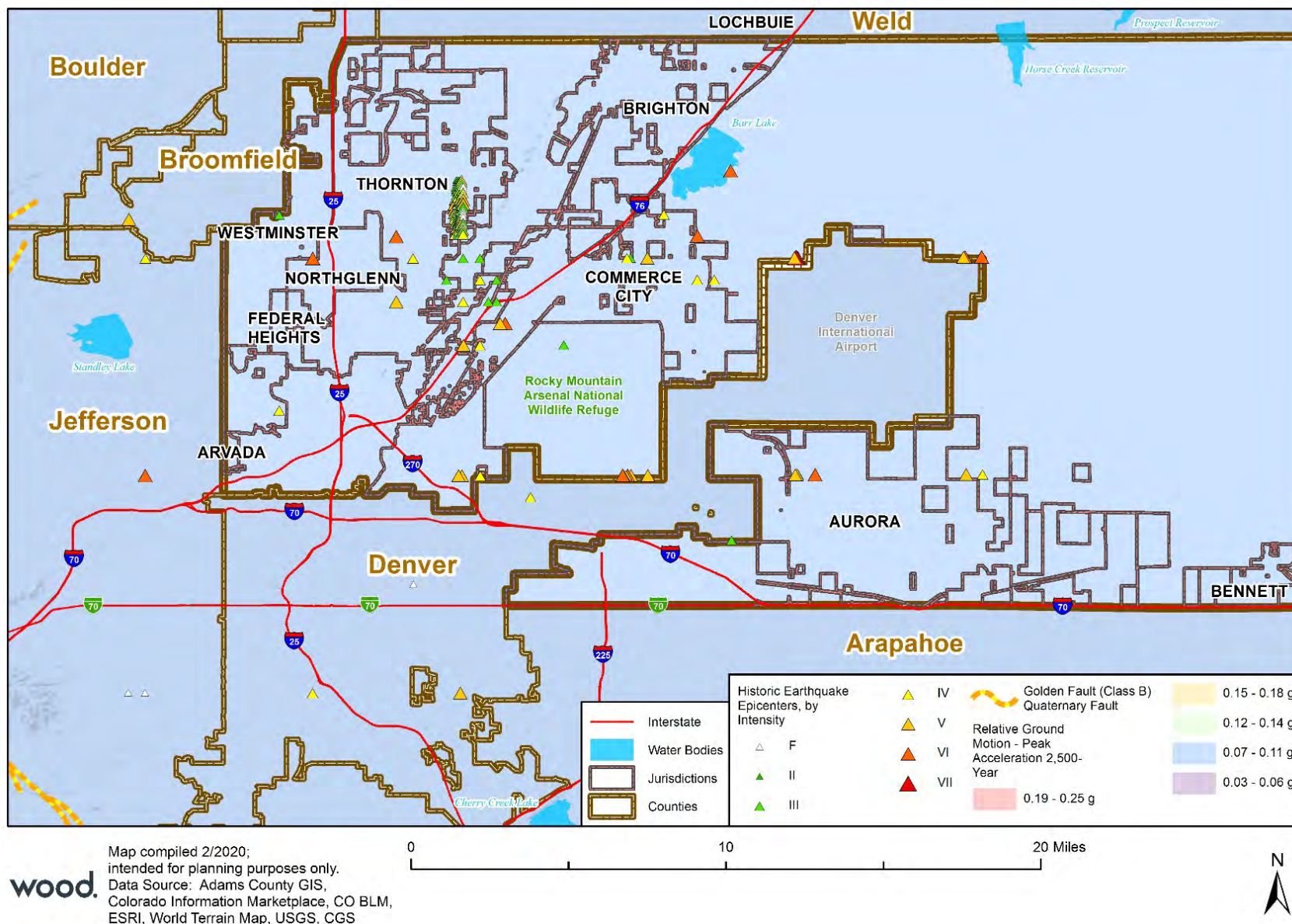
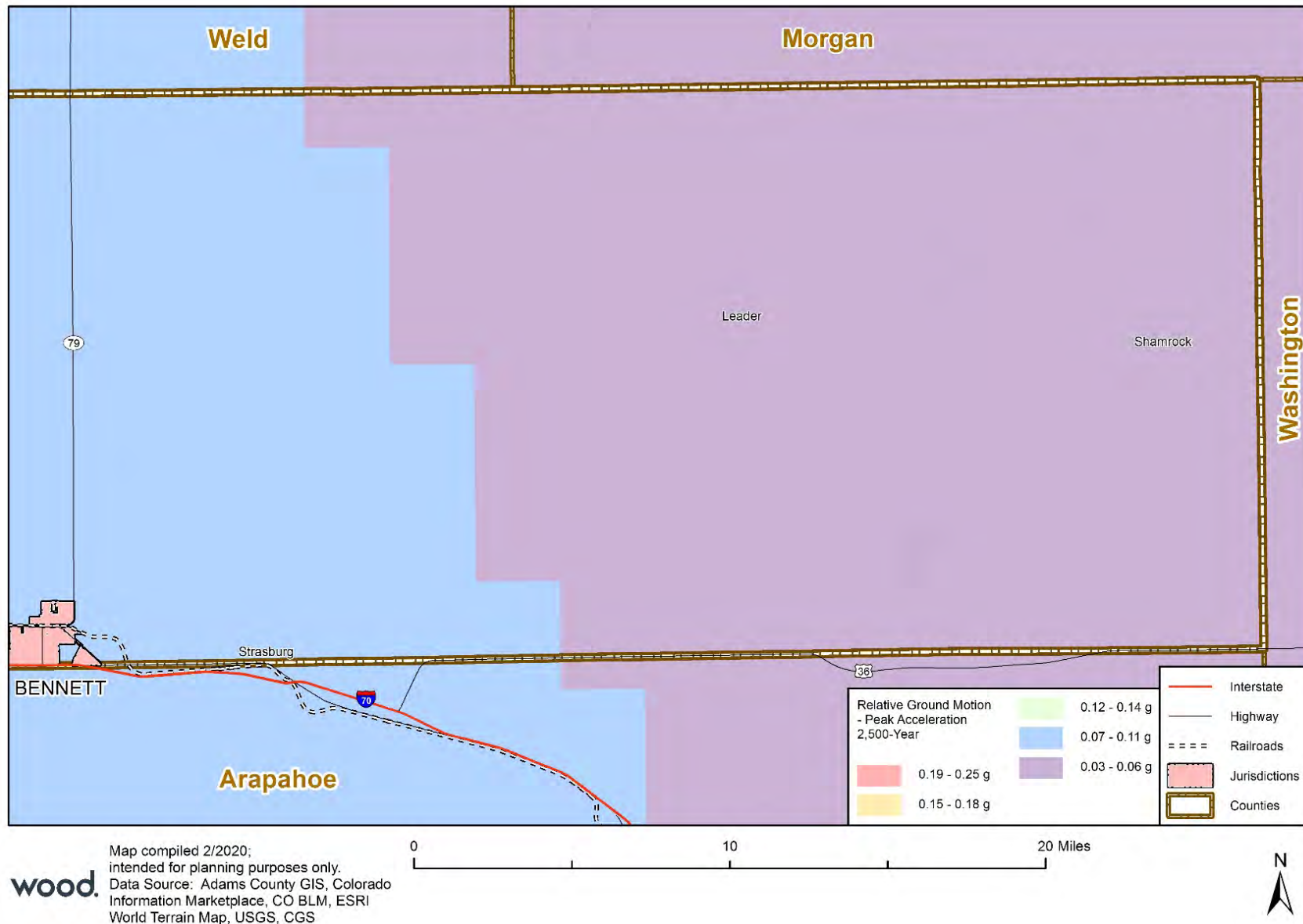


Figure 4-15 Earthquake Faults, History, and Hazard Potential in or Near East Adams County

Previous Occurrences

Hundreds of earthquake tremors of magnitude 2.5 or higher have been recorded in Colorado since 1867. High magnitude earthquakes have only occurred a few times in the last 150 years. A list of Colorado's larger earthquakes can be found on the most recent State Hazard Mitigation Plan, updated in 2018. In addition, Adams County's earthquake event history is unique since it has often been triggered by human-caused activity. In the 1960s there was a project by the U.S. Army Corps of Engineers where injection of contaminated wastewater took place into the Precambrian crystalline bedrock underneath the Rocky Mountain Arsenal (now a wildlife refuge). This waste fluid matter pumping, which was drilled to a depth of over 3,600 meters, led to critical pressure buildup which in turn triggered quakes in the area shortly after. From April of 1962 until August of 1967 there were an estimated 1,500+ recorded earthquakes recorded at the Bergen Park seismograph station. Many of these quakes surpassed Richter magnitudes of 3 and 4, and three exceeded magnitude 5.

In large part due to the Rocky Mountain Arsenal earthquakes, historical earthquake activity for Adams County is above the average occurrence in Colorado. Figure 4-14 above shows earthquake epicenter locations available from the Colorado Geological Survey (CGS), in and around Adams County. As displayed with the numerous intensity-rated triangles on the western portion of the county, especially around southern Thornton, Commerce City, Northglenn, and parallel to Interstate 70 to the north, there have been many low- or moderately-ranked intensity earthquakes in Adams County, with magnitudes ranging from 1.6 to 5.3. (For additional details on the magnitude, intensity, and felt effects of earthquakes refer to the Magnitude/Severity subsection of this chapter.) Per the epicenter map above, there have been 198 earthquake epicenters within the boundaries of Adams County since 1962, with the majority located north-northeast of Denver. However, the most recent earthquakes in or around Adams County took place on November 8, 1989 and February 25, 1984; these were registered as 2.5 magnitude events.

Adams County has had five recorded earthquakes greater than magnitude 4.8. All five were associated with the Rocky Mountain Arsenal groundwater injection described above.

- 11/27/1967 (Magnitude 5.2)
- 8/9/1967 (Magnitude 5.3)
- 4/10/1967 (Magnitude 4.9)
- 1/5/1966 (Magnitude 5.0)
- 2/16/1965 (Magnitude 4.9)

Probability of Future Occurrence

Future probability of this hazard is **Occasional**. Although on average several earthquakes are expected to occur in the state and in the Adams County area, they are likely to be of smaller magnitude and hence unlikely to be felt or even lead to damages or injured populations. A 5+ magnitude quake could be expected near or in Adams County once or twice per decade based on historic records.

Probabilistic ground motion maps are typically used to assess the magnitude and frequency of seismic events. These maps measure the probability of exceeding a certain ground motion, expressed as percent Peak Ground Acceleration (%PGA), over a specified period of years. Figure 4-14 also shows levels of horizontal shaking that have a 2% chance of being exceeded in a 50-year period.

The blue shaded areas on western Adams County indicate the risk of shaking from an earthquake relates to the range of 0.07 to 0.11% G (gravitational force), with the eastern county portion falling in the lowest category of relative ground motion potential at 0.03-0.06% G. Overall, this means Adams County's risk based on the relative ground motion potential falls within the lower two ranges of recorded values.

Based on all documented events since the year 1962, the probability of future occurrences of small magnitude earthquakes within Adams County is high, though larger and damaging event probability is rather low. It is however extremely difficult to determine probability of future occurrence in a specific area within the county with any degree of accuracy, though as demonstrated in Figure 4-14 and Figure 4-15 with the relative ground motion probability map, the western portion of the county is more likely to experience seismic activity and quakes than the eastern portion in the future. In addition, Table 4-26 under the Magnitude/Severity subsection below describes some useful attributes tied to intensity and magnitude that can be expected with regards to frequency in earthquake occurrence.

Magnitude/Severity

The potential magnitude/severity of earthquake hazards in Adams County is **Limited**, based on the estimation of potential damaged or destroyed property, mass fatalities, impact to critical lifelines, and the impact to the county's government ability to provide service or respond to an event due to seismic activity/earthquakes.

Earthquakes are measured in terms of their magnitude and intensity, but other helpful characteristics used to describe and categorize them include the effects felt on people and property, and the frequency of occurrence. *Magnitude* is measured using the Richter Scale, an open-ended logarithmic scale that describes the energy release of an earthquake through a measure of shock wave amplitude (Table 4-26). Each unit increase in magnitude on the Richter Scale corresponds to a 10-fold increase in wave amplitude, or a 32-fold increase in energy. *Intensity* is most commonly measured using the Modified Mercalli Intensity (MMI) Scale based on direct and indirect measurements of seismic effects. This scale's levels are typically described using Roman numerals in increasing order based on destruction potential (from less catastrophic to most catastrophic). More detailed descriptions of the MMI Scale of earthquake intensity and correspondence to the Richter Scale, as well as descriptions of effects and frequency intervals are given in Table 4-26 below.

Table 4-26 Earthquake Magnitude, Intensity Measurements, and Associated Characteristic

Richter Magnitude	MMI	Description of Effects	Frequency
Less than 2.0	I	Microearthquakes, not felt or rarely felt; recorded by seismographs.	Continual
2.0-2.9	I to II	Felt slightly by some people; damages to buildings.	Over 1M per year
3.0-3.9	II to IV	Often felt by people; rarely causes damage; shaking of indoor objects noticeable.	Over 100,000 per year
4.0-4.9	IV to VI	Noticeable shaking of indoor objects and rattling noises; felt by most people in the affected area; slightly felt outside; generally, no to minimal damage.	10K to 15K per year
5.0-5.9	VI to VIII	Can cause damage of varying severity to poorly constructed buildings; at most, none to slight damage to all other buildings. Felt by everyone.	1K to 1,500 per year
6.0-6.9	VII to X	Damage to a moderate number of well-built structures in populated areas; earthquake-resistant structures survive with slight to moderate damage; poorly designed structures receive moderate to severe damage; felt in wider areas; up to hundreds of miles/kilometers from the epicenter; strong to violent shaking in epicentral area.	100 to 150 per year
7.0-7.9	VIII<	Causes damage to most buildings, some to partially or completely collapse or receive severe damage; well-designed structures are likely to receive damage; felt across great distances with major damage mostly limited to 250 km from epicenter.	10 to 20 per year
8.0-8.9	VIII<	Major damage to buildings, structures likely to be destroyed; will cause moderate to heavy damage to sturdy or earthquake-resistant buildings; damaging in large areas; felt in extremely large regions.	One per year
9.0 and Greater	VIII<	At or near total destruction - severe damage or collapse to all buildings; heavy damage and shaking extends to distant locations; permanent changes in ground topography.	One per 10-50 years

Source: USGS

The destructiveness of an earthquake depends on a number of factors, including the magnitude of the tremor, direction of the fault, distance from the epicenter, regional geology, and the design characteristics of buildings and infrastructure. As stated in the 2014 hazard mitigation plan, Adams County considers a Modified Mercalli Intensity Scale of III to be a minimum severity and a Modified Mercalli Intensity Scale of VI to be a major severity.

Ground shaking can lead to the collapse of buildings and bridges and disrupt gas lines, electricity, and phone service. Most property damage and earthquake-related deaths are caused by the failure and collapse of structures due to ground shaking. The level of damage depends upon the amplitude and duration of the shaking, which are directly related to the earthquake size, distance from the fault, site, and regional geology. Death, injuries, and extensive property damage are possible vulnerabilities from this hazard. Some secondary hazards caused by earthquakes in the Adams County area may include fire, hazardous material release, landslides, ground subsidence, flash flooding, and dam failure.

The age of older historic buildings and infrastructure would probably make damages in an earthquake above magnitudes 5.5 devastating in terms of the economy and the structures of the area. Earthquakes of a magnitude above 5.5 might threaten dams, with potentially severe impacts to communities downstream. They could also cause some dislocation of Front Range communities due to the loss of water (principal owners of the stored water). The costs of engineering studies on each of the buildings in the area would probably overwhelm building owners who are beset by tightening economies and increasing costs.

Climate Change Considerations

Although climate change is not expected to affect earthquake frequency or intensity, it could exacerbate indirect or secondary impacts of quake activity. For example, since climate change could increase the frequency and intensity of extreme precipitation events, this may then lead to higher probabilities of landslides and liquefaction events during an earthquake if the earthquake coincided with a wet cycle. Another secondary way in which climate change may influence earthquake indirectly has to do with wildfires. Since utility lines and other infrastructure breaking, bursting, or causing explosions after earthquake activity can lead to wildfires, a warmer and dryer climate could exacerbate these potential after-earthquake fires if weather and environmental conditions are prime for fires quickly starting, spreading, and intensifying.

Vulnerability

This section offers specifics on loss estimation potential to life, property, critical facilities/infrastructure, the economy, historical/natural/cultural resources, and potential future development in Adams County. These loss estimations are based on a 2,500-year probabilistic earthquake scenario performed using FEMA's Hazus 4.2 software. The Hazus loss estimation program was used as part of this mitigation plan's update in 2019-2020 to further quantify the earthquake damage potential in Adams County. The 2,500-year scenario takes into account worst-case ground shaking from a variety of seismic sources.

Hazus is a GIS based, standardized, nationally applicable multi-hazard loss estimation methodology and software. Local, state and federal government officials use Hazus for preparedness, emergency response, and mitigation planning. A Level 1 Hazus analysis was performed for the following vulnerability assessment, which estimates damage based on an inventory database compiled at a national level aggregated to by Census Tracts. The International Building Code uses this level of ground shaking for building design in seismic areas. Note that this version of Hazus (4.2) provides estimates based on U.S. Census data from 2010, and so the mentioned structure inventory or population results are likely off based on today's actual estimates. Therefore, and as with any model, there are uncertainties in the resulting data; results should be considered approximate for planning purposes.

People

The model estimates that 235 households will be displaced due to the earthquake, with 170 people seeking temporary shelter in public shelters.

Hazus also estimates the number of people that will be injured and killed by the earthquake scenario modeled. Ground movement during an earthquake is seldom the direct cause of death or injury. Most earthquake-related injuries result from collapsing walls, flying glass, and falling objects as a result of the ground shaking, or people trying to move more than a few feet during the shaking. The casualties are broken down into four severity levels that describe the extent of the injuries. The levels are as follows:

- Severity Level 1: Injuries will require medical attention, but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening.
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent several periods of the day when different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is at its maximum (i.e. most people are asleep at home). The 2:00 PM estimate considers that the educational and business sector loads, including commercial and industrial occupancies, are at their maximum (i.e. schools in session and office or other personnel working during the standard workweek). The 5:00 PM estimate represents peak commute time (i.e. in transit populations via cars and other transportation mediums). These estimates report that 1 or more casualties in all the three scenarios would be expected, and risk to populations would be highest from a 2 p.m. modeled scenario (as this scenario yields 129 minor injuries, 17 hospitalizations, 1 life-threatening injury, and 2 deaths). The casualty estimates are summarized in Table 4-27 below, with the most damaging scenario in terms of injuries and casualties enclosed in a red rectangle.

Table 4-27 Hazus Earthquake Injury and Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	1.45	0.20	0.02	0.03
	Commuting	0.00	0.00	0.00	0.00
	Educational	0.00	0.00	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	2.02	0.25	0.02	0.03
	Other-Residential	26.49	2.85	0.10	0.19
	Single Family	51.87	5.92	0.41	0.78
	Total	82	9	1	1
2 PM	Commercial	81.41	11.05	0.86	1.65
	Commuting	0.00	0.00	0.00	0.00
	Educational	18.09	2.38	0.18	0.34
	Hotels	0.00	0.00	0.00	0.00
	Industrial	14.79	1.86	0.12	0.22
	Other-Residential	5.06	0.55	0.02	0.04
	Single Family	9.18	1.09	0.08	0.15
	Total	129	17	1	2
5 PM	Commercial	57.66	7.88	0.62	1.18
	Commuting	0.02	0.02	0.04	0.01
	Educational	1.23	0.16	0.01	0.02
	Hotels	0.00	0.00	0.00	0.00
	Industrial	9.25	1.16	0.07	0.14
	Other-Residential	9.69	1.06	0.04	0.07
	Single Family	19.98	2.36	0.17	0.32
	Total	98	13	1	2

Source: Hazus 4.2, Wood analysis

The impacts of earthquakes on vulnerable populations can be more severe. Comparing the earthquake maps in this section with the social vulnerability maps in Section 2-5 shows that many of the areas at greatest risk of earthquake also have higher social vulnerability stemming from socioeconomic status, household composition and disabilities, minority status and language proficiency, or housing and transportation resources. Families in this area may have fewer financial resources to prepare for or recover from an earthquake, and may be more likely to be uninsured or

underinsured. Poorer families are more likely to live in poorly constructed homes that are more likely to be damaged. Individuals with disabilities may need more assistance after an earthquake, especially if transportation or utility services are disrupted.

General Property

Figure 4-16 and Figure 4-17 displays the Hazus-derived total losses based on the Adams County census tracts. Potential for the highest losses is just north of Denver, in the unincorporated census tract between Interstate-76 and Interstate-270 east of Arvada, crossed by Clear Creek and the South Platte River, as well as in the tract crossed by of I-270, north of I-70 by Sand Creek. Other areas where larger damages would be expected include southern Adams County west of Aurora along the I-70 corridor; just east of Arvada in the unincorporated southern portion of the county (just north of Denver); and in the tract along the fringe of Thornton and Westminster, to the east of I-25. The rest of the county would expect damages at the census tract level amounting to \$10 million or less. Table 4-28 summarizes the scenario results for Adams County based on the various assets assessed.

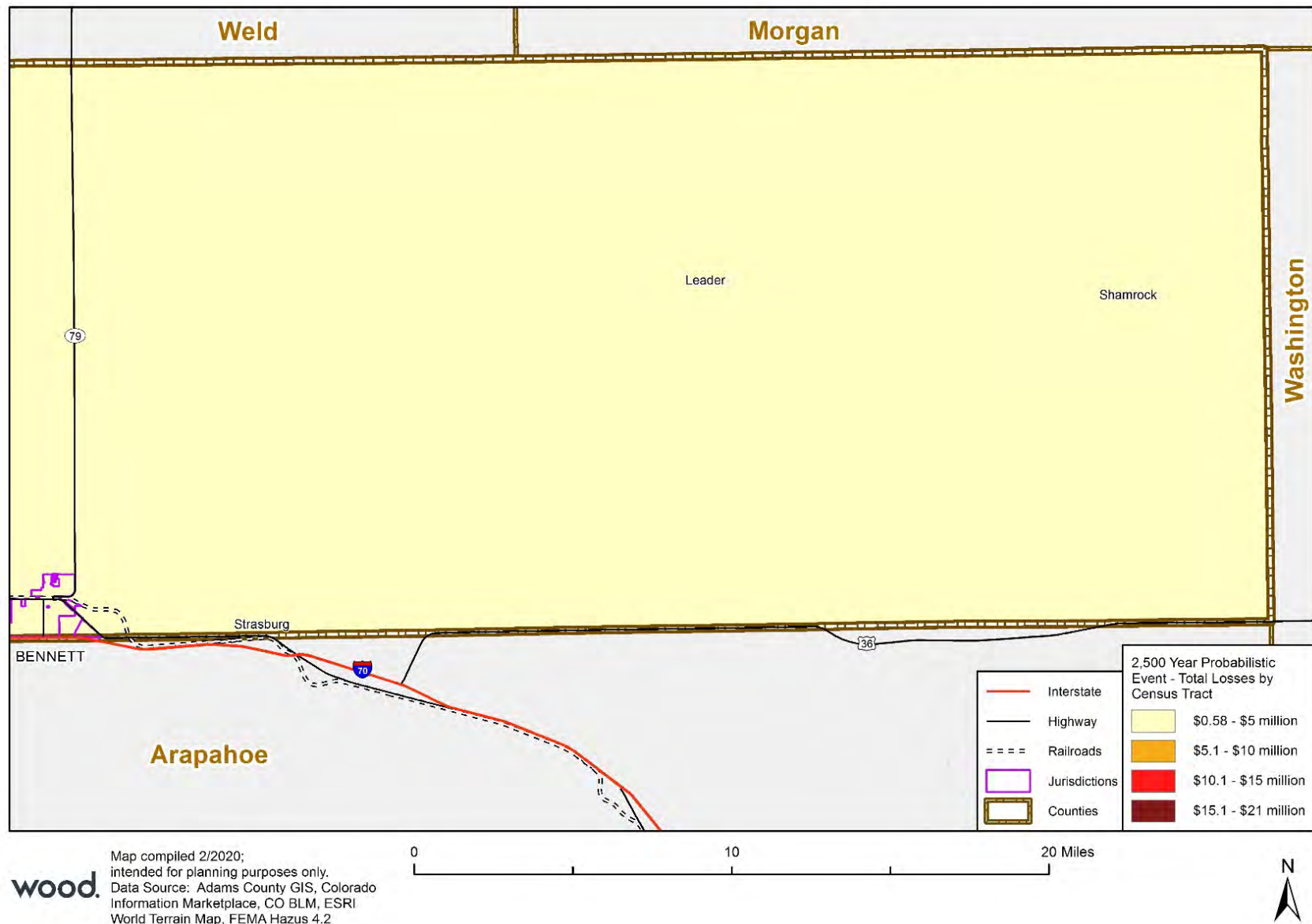
Table 4-28 Earthquake Loss Estimates in Adams County Based on the 2,500-Year Hazus Scenario

Type of Impact	Hazus-Derived Impacts to County
Total Buildings Damaged (out of 138,000 estimated buildings in the county)	Slight: 12,196 Moderate: 4,776 Extensive: 668 Complete: 29
Building and Income Related Losses	\$529.61 million 64% of damage related to residential structures 16% of loss due to business interruption
Total Economic Losses (includes building, income and lifeline/critical facility losses)	\$568.5 million
Casualties (based on 2 a.m. time of occurrence)	Not requiring hospitalization (Level 1): 82 Requiring hospitalization (Level 2): 9 Life threatening (Level 3): 1 Fatalities (Level 4): 1
Casualties (based on 2 p.m. time of occurrence)	Not requiring hospitalization (Level 1): 129 Requiring hospitalization (Level 2): 17 Life threatening (Level 3): 1 Fatalities (Level 4): 2
Casualties (based on 5 p.m. time of occurrence)	Not requiring hospitalization (Level 1): 98 Requiring hospitalization (Level 2): 13 Life threatening (Level 3): 1 Fatalities (Level 4): 2
Damage to Transportation Systems	\$3.91 million in economic losses to transportation systems
Damage to Essential Facilities	No damages categorized as moderate or worse to essential facilities. Facilities include hospitals, schools, Emergency Operation Centers, Police Stations, and Fire Stations
Damage to Utility Systems	\$34.96 million in economic losses to utility systems (from potable water, wastewater, natural gas, and communication components)
Households without Power/Water Service (Based on 153,764 Total Households)	No households without power or water service after event
Expected Utility System Pipeline Damages	71 Leaks and 18 Breaks on Potable Water Pipelines 36 Leaks and 9 Breaks on Wastewater Pipelines 12 Leaks and 3 Break on Natural Gas Pipelines 0 Leaks and 0 Breaks on Oil Pipelines
Displaced Households	235
Persons Seeking Temporary Shelter	170
Debris Generation	137,000 tons

Source: Wood analysis with FEMA Hazus 4.2 for Earthquake

Map compiled 2/2020;
intended for planning purposes only.
Data Source: Adams County GIS, Colorado
Information Marketplace, CO BLM, ESRI
World Terrain Map, FEMA Hazus 4.2

wood.

Figure 4-17 East Adams County Hazus 2,500-Year Probabilistic Earthquake Scenario – Total Losses by Census Tract

The results of the earthquake scenario analysis show moderate damages and losses, especially with regards to economic losses from loss of income, and damaged buildings, lifelines, or critical facilities.

According to this probabilistic scenario, the majority of properties affected are expected to be residential in nature (about 64% of the total number of buildings damaged across the county), followed by Commercial, Industrial, and Others (Religion-Related, Agricultural, Education, and Government structures).

Building codes reduce the risk of structural damage, especially when considering potential impacts from earthquakes which heavily test building safety and integrity, particularly older structures constructed with materials like wood and masonry. Historic buildings constructed of unreinforced masonry are most vulnerable to seismic ground shaking, though based on the Hazus analysis, Adams County's buildings made of wood, manufactured housing materials, and reinforced masonry are the top three categories that will see the highest damages. Jurisdictions most vulnerable to seismic events will likely be those with many historic or older buildings (such as Arvada, which was established in 1870) not retrofitted or mitigated to sustain ground shaking.

Critical Facilities and Infrastructure

General Critical Facility Inventory: Hazus breaks critical facilities into several groups. For the purposes of this particular scenario, the following types of facilities will be discussed: essential facilities, transportation systems, and utility system lifelines.

Essential Facility Damage: Essential facilities include hospitals (4 in the county), schools (152 in the county), fire stations (15 in the county), police stations (10 in the county). The model did not result in any expected damages to emergency operation center facilities from the earthquake event.

Transportation Systems Inventory: There are 7 transportation systems that include highways, railways, light rail, bus, ports, ferry, and airports; the replacement value for this critical facility category would be around \$4.38 billion. This inventory includes over 349 miles of highways and 467 bridges. The transportation systems inventory related expected damages from the earthquake would be moderate, at \$3.91 million. More details are summarized in Table 4-29 below.

Utility Lifeline Systems Inventory: There are 6 utility systems that include over 13,527 linear miles of the following: potable water, wastewater, natural gas, crude & refined oil, electric power, and communications lines. The replacement value of the utility lifeline systems is estimated to be \$1.35 billion. These utility system facility damages in terms of economic losses in millions of dollars are summarized in Table 4-30. Site specific expected utility system pipeline damages (including their inventory) are included in Table 4-31. The model did not predict potable water or electric power system performance limitations or damages that could affect household availability post-earthquake.

Table 4-29 Transportation System Economic Losses in Millions of Dollars

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	3319.7232	0.0000	0.00
	Bridges	759.9167	0.2033	0.03
	Tunnels	0.0000	0.0000	0.00
	Subtotal	4079.6399	0.2033	
Railways	Segments	187.4375	0.0000	0.00
	Bridges	1.9089	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Facilities	23.9670	2.6372	11.00
	Subtotal	213.3134	2.6372	
Light Rail	Segments	0.0000	0.0000	0.00
	Bridges	0.0000	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	0.0000	0.0000	
Bus	Facilities	1.0573	0.1215	11.49
	Subtotal	1.0573	0.1215	
Ferry	Facilities	0.0000	0.0000	0.00
	Subtotal	0.0000	0.0000	
Port	Facilities	0.0000	0.0000	0.00
	Subtotal	0.0000	0.0000	
Airport	Facilities	10.6510	0.9443	8.87
	Runways	75.9280	0.0000	0.00
	Subtotal	86.5790	0.9443	
	Total	4,380.59	3.91	

Source: Hazus 4.2, Wood analysis



Table 4-30 Utility System Economic Losses in Millions of Dollars

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.0000	0.0000	0.00
	Facilities	32.3010	1.5474	4.79
	Distribution Lines	217.7121	0.3196	0.15
	Subtotal	250.0131	1.8670	
Waste Water	Pipelines	0.0000	0.0000	0.00
	Facilities	323.0100	13.4388	4.16
	Distribution Lines	130.6273	0.1605	0.12
	Subtotal	453.6373	13.5993	
Natural Gas	Pipelines	0.0000	0.0000	0.00
	Facilities	23.2606	0.5796	2.49
	Distribution Lines	87.0848	0.0550	0.06
	Subtotal	110.3454	0.6346	
Oil Systems	Pipelines	0.0000	0.0000	0.00
	Facilities	0.9700	0.0473	4.88
	Subtotal	0.9700	0.0473	
Electrical Power	Facilities	533.5000	18.7840	3.52
	Subtotal	533.5000	18.7840	
Communication	Facilities	0.7760	0.0311	4.01
	Subtotal	0.7760	0.0311	
	Total	1,349.24	34.96	

Source: Hazus 4.2, Wood analysis

Table 4-31 Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (miles)	Number of Leaks	Number of Breaks
Potable Water	6,764	71	18
Waste Water	4,058	36	9
Natural Gas	2,706	12	3
Oil	0	0	0

Source: Hazus 4.2, Wood analysis

Economy

Hazus estimates the long-term economic impacts to the county post-earthquake. The model quantifies this information in terms of income and employment changes within the county. The total economic loss from the earthquake is estimated at \$568.5 million, which includes building and lifeline related losses based on the county's available inventory.

Building losses are broken into two categories: direct building losses and business interruption losses. Building related losses, which summarize estimates costs to fix or replace structures and damages to properties and their contents, are discussed in more detail in the General Property section of this chapter. The estimated losses related to the business interruption of the area (Adams County) were 16% of the specific building-related losses (which amounted to \$529.6 million).

Business interruption losses are summarized in more detail below (Table 4-32). They included the temporary living expenses (relocation based) for people displaced from their homes because of the earthquake event. Income losses amounted to \$20.2 million, while capital stock losses were about \$137.9 million.

Table 4-32 Business-Related Economic Loss Estimates in Millions of Dollars

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.0000	0.4791	2.4024	0.0567	0.1285	3.0667
	Capital-Related	0.0000	0.2046	2.6416	0.0325	0.0205	2.8992
	Rental	1.3176	2.5060	1.3641	0.0219	0.0670	5.2766
	Relocation	4.6824	1.8602	1.8583	0.1846	0.3717	8.9572
	Subtotal	6.0000	5.0499	8.2664	0.2957	0.5877	20.1997
Capital Stock Losses							
	Structural	7.3938	3.8863	2.2381	0.3904	0.3945	14.3031
	Non_Structural	31.1578	30.9373	7.5005	1.6805	1.3107	72.5868
	Content	13.4901	10.0959	4.8520	1.0866	0.9116	30.4362
	Inventory	0.0000	0.0000	0.1274	0.2028	0.0168	0.3470
	Subtotal	52.0417	44.9195	14.7180	3.3603	2.6336	117.6731
	Total	58.04	49.97	22.98	3.66	3.22	137.87

Source: Hazus 4.2, Wood analysis

Historic, Cultural, and Natural Resources

Earthquake effects on the environment, natural resources, and historic and cultural assets could be very destructive depending on the actual type of seismic activity experienced and secondary/cascading effects from seismic activity (e.g. wildfire). The biggest impacts would likely be on older historic properties and facilities in older cities such as Arvada and Westminster, which may contain vulnerable structures built out of wood, unreinforced masonry, or manufactured housing materials. However, it is worth noting that only a small portion of Arvada and Westminster actually falls within Adams County boundaries, so vulnerabilities may not be as pronounced within the planning area examined in this plan.

Future Development

All participating jurisdictions within the County have adopted either building codes or some sort of design and construction standards to ensure structural stability and the longevity of the built environment as exposed to natural hazards. Adams County enforces the 2018 International Building Codes; Commerce City, Brighton, and Bennett have adopted the 2012 International Building Codes. As previously stated, building codes substantially reduce the potential for loss of life from earthquakes, helping to reduce the amount of damages to future structures by introducing strict requirements, which indirectly safeguard the populations in or near those structures. Continued growth of population in the County could potentially expose more people to earthquakes and their related hazards, though again this hazard was deemed to pose an overall Low Significance in the county.

Risk Summary

- The overall significance of this earthquake hazard is Low.
- There have been 198 earthquake epicenters within the boundaries of Adams County since 1962, with the majority located north-northeast of Denver. However, the majority of these were quite small in terms of intensity.
- The Hazus 2,500-year probabilistic scenario assessment conducted to estimate Adams County's earthquake vulnerability yielded the following:
 - Total economic losses would be around \$568.5 million
 - At least 5,473 buildings would be at least moderately damaged.
 - Building- and income-related losses in the county would amount of \$529.6 million
 - The most destructive scenario modeled in terms of injuries and casualties to people would be the 2 p.m. scenario, with a total of 149 people affected.
 - The model estimates that 235 households would be displaced due to earthquake activity, with 170 persons seeking temporary shelter.
 - The damages to transportation systems would equal \$3.91 million; damages to essential facilities would not be expected; and, damages to utility systems would amount to \$34.96 million
 - An estimated 137,000 tons of debris would be generated with this earthquake event.
- Related hazards: wildfire, dam failure/incident, flood, hazardous material incident, subsidence.

Table 4-33 Earthquake Risk Summary

Jurisdiction	Geographic Location	Probability of Future Occurrence	Magnitude/Severity	Overall Significance
Adams County	Limited	Occasional	Limited	Low
Bennett	Limited	Occasional	Limited	Low
Brighton	Limited	Occasional	Limited	Low
Commerce City	Limited	Occasional	Limited	Low
Denver Water	Limited	Occasional	Limited	Low

4.3.5 Flood

Hazard Description

Floods involve inundation of normally dry land or other areas. Common types of flooding applicable to Adams County include riverine flooding, localized or flash flooding (including storm generated flash floods), stormwater drainage flooding, and dam or levee failure inundation (see Section 4.3.2).

Floods can cause substantial damage to structures, landscapes, and utilities as well as cause life safety issues. Certain related health hazards are also common to flood events. Standing water and wet materials in structures can become breeding grounds for microorganisms such as bacteria, mold, and viruses. This can cause disease, trigger allergic reactions, and damage materials long after the flood. When flood waters contain sewage or decaying animal carcasses, infectious disease becomes a concern. Direct impacts to populations such as drowning can be limited with adequate warning and public education about what to do during floods. Where flooding occurs in populated areas, warning and evacuation will be of critical importance to reduce life and safety impacts.

Riverine flooding is defined as when a watercourse exceeds its “bank-full” capacity, and is usually the most common type of flood event in Colorado. Riverine flooding generally occurs as a result of prolonged rainfall, or rainfall that is combined with soils already saturated from previous rain events. It also occurs as a result from snowmelt, in which case the extent of flooding depends on the depth of winter snowpack and spring weather patterns.

A change in environmental conditions or land uses can create localized flooding problems inside and outside of natural floodplains by altering or confining natural drainage channels (e.g. leading to flash flooding). These changes are most often created by human activity in developed areas, but can also be created by other natural events such as wildland fires which cause compound effects. For example, wildfires create hydrophobic soils, a hardening or “glazing” of the earth’s surface that prevents rainfall from being absorbed into the ground, thereby increasing runoff, erosion, and downstream sedimentation of channels.

Flash flooding events can occur from sudden intense storms, a dam or levee failure, or from a rapid release of water held by an ice jam or snowmelt. Most flash flooding is caused by slow-moving thunderstorms in a local area or by heavy rains associated with hurricanes and tropical storms. Flash flooding occurs most often in Adams County around urbanized areas where much of the ground is covered by impervious surfaces. Flash floodwaters move at very high speeds due to the sudden rush of water, leading to “walls” of water which can reach heights of 10 to 20 feet. Flash floodwaters and the accompanying debris can uproot trees, roll boulders, and damage or destroy buildings, bridges, and roads.

Stormwater refers to water that collects on the ground surface or is carried in the stormwater system when it rains. In runoff events where the amount of stormwater is too great for the system, or if the channel system is disrupted by vegetation or other debris that blocks inlets or pipes, excess water remains on the surface. This water may pond in low-lying areas, often in street intersections. This is known as stormwater flooding. Stormwater flooding and ponding can carry debris, dirt, chemicals, and pollutants from impervious surfaces, leading to health issues as briefly described above.

Dam inundation can occur as a result of structural failure, overtopping, seismic activity, or other reasons described in more detail under Section 4.3.2 Dam Failure/Incident, which cause the dam to release its contents (often water), leading to flooding. With tens of dams of various types in or upstream of Adams County, dam inundation could cause serious issues and affect populations, property, and critical facilities or infrastructure. Other water and flood control structure-based flooding, such as that arising from levee failure, could also affect the county. For more information on levee and other structure-induced flooding refer to the 2018 Colorado State Hazard Mitigation Plan, and the 2018 Flood Hazard Mitigation Plan for Colorado.

The area adjacent to a river or stream channel is its floodplain. In its common usage, the term floodplain most often refers to that area that is inundated by the 100-year flood, or the flood that has a 1% chance in any given year of being equaled or exceeded. The 100-year flood is the national standard to which communities regulate their floodplains through the Federal Emergency Management Agency (FEMA) National Flood Insurance Program (NFIP).

Adams County is one of the richest irrigated and dry land farming areas across the U.S., with a hydrography characterized by a majority of intermittent flowing streams. According to the latest Adams County Flood Insurance Study (FIS), dated September 28, 2018, principal flood problems on the major waterways stem from the South Platte River and its tributaries' snow melt and summer weather front (e.g. thunderstorms) flooding characteristics, especially when coupled with the tributary basins' structure as they are narrow, hydraulically steep, and composed of highly erodible clay and loam soils. Almost all major floods from the South Platte River have been generated near the river's headwaters near Monument Divide, between Castle Rock and Colorado Springs. But significant snowmelt and intensive rain storms over the tributaries can often spread to Adams County, reaching waterways such as Sand Creek.

According to the FIS report, most flooding events on the South Platte and major streams like Sand Creek have occurred due to cloudbursts of intensive rainstorms which normally take place late spring through late summer (May-August). The South Platte River is often aggravated by snowmelt runoff during these key wet periods.

Geographic Location

The geographic coverage potential of this flooding hazard in Adams County is **Limited**.

Adams County entirely falls within the South Platte River Basin, which has Hydrologic Unit Code 6 (HUC 6) 101900. The South Platte basin encompasses all or part of 25 counties in Colorado, and is about 24,151 square miles in area. Elevation in the basin ranges from 14,000 feet at the Continental Divide to 3,400 feet at the Colorado-Nebraska state line. The South Platte River is the major stream in the basin. Some of the State's most devastating floods have taken place in the South Platte basin. The major sub-basins in the South Platte River Basin, which are classified as HUC 8, are listed and briefly described in the bullet points below; these are displayed in Figure 4-18 and Figure 4-19 along with major water features in and near Adams County:

- Middle South Platte-Cherry Creek (HUC 10190003) – This watershed encompasses about 45% of Adams County, and runs north-south through the majority of its western portion. Some vegetation and land cover/land use types in this watershed within Adams County include irrigated agriculture, dryland agriculture, general grasses, and rangeland (among others) (USDA 2009).
- Clear (HUC 10190004) – Clear crosses very slightly into Adams County, from its western-most edge, reaching into Arvada and Westminster. The main waterway in this watershed is Clear Creek, which runs west-east.
- Kiowa (HUC 10190010) – Kiowa Creek is the main waterway in this watershed, though Wolf Creek and Comanche Creek contribute to the overall drainage and catchment of water in this watershed. The Kiowa watershed cuts Adams County north-south and is located immediate to the east of the Middle South Platte-Cherry Creek watershed, and to the west of the Bijou watershed.
- Bijou (HUC 10190011) – The Bijou watershed also cuts Adams County north-south, and its main waterway is Bijou Creek. Other major streams in the watershed include East Bijou Creek, West Bijou Creek, and Muddy Creek.
- Middle South Platte-Sterling (HUC 10190012) – The Middle South Platte-Sterling watershed is located on the eastern portion of Adams County, encompassing its northeast corner and south-southeast area (along with the Beaver watershed). It is located immediate east of the Bijou watershed, and its major waterways within Adams County include Badger Creek and Sand Arroyo Creek.
- Beaver (HUC 10190013) – This watershed only crosses Adams County slightly, on its southeastern-most corner. The main stream present in the county from this watershed is Wetzel Creek.

Figure 4-18 Basins and General Water Features in West Adams County

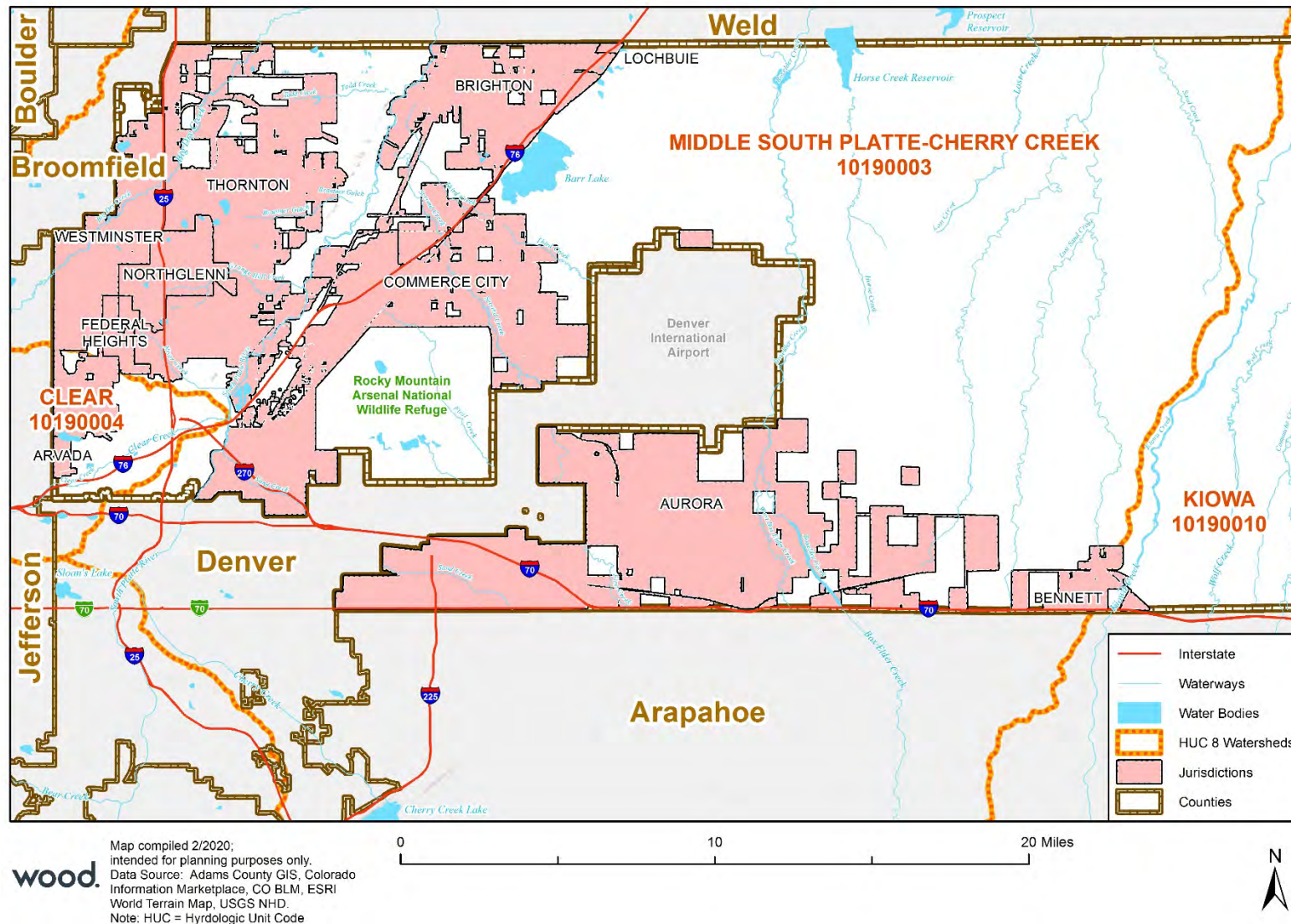
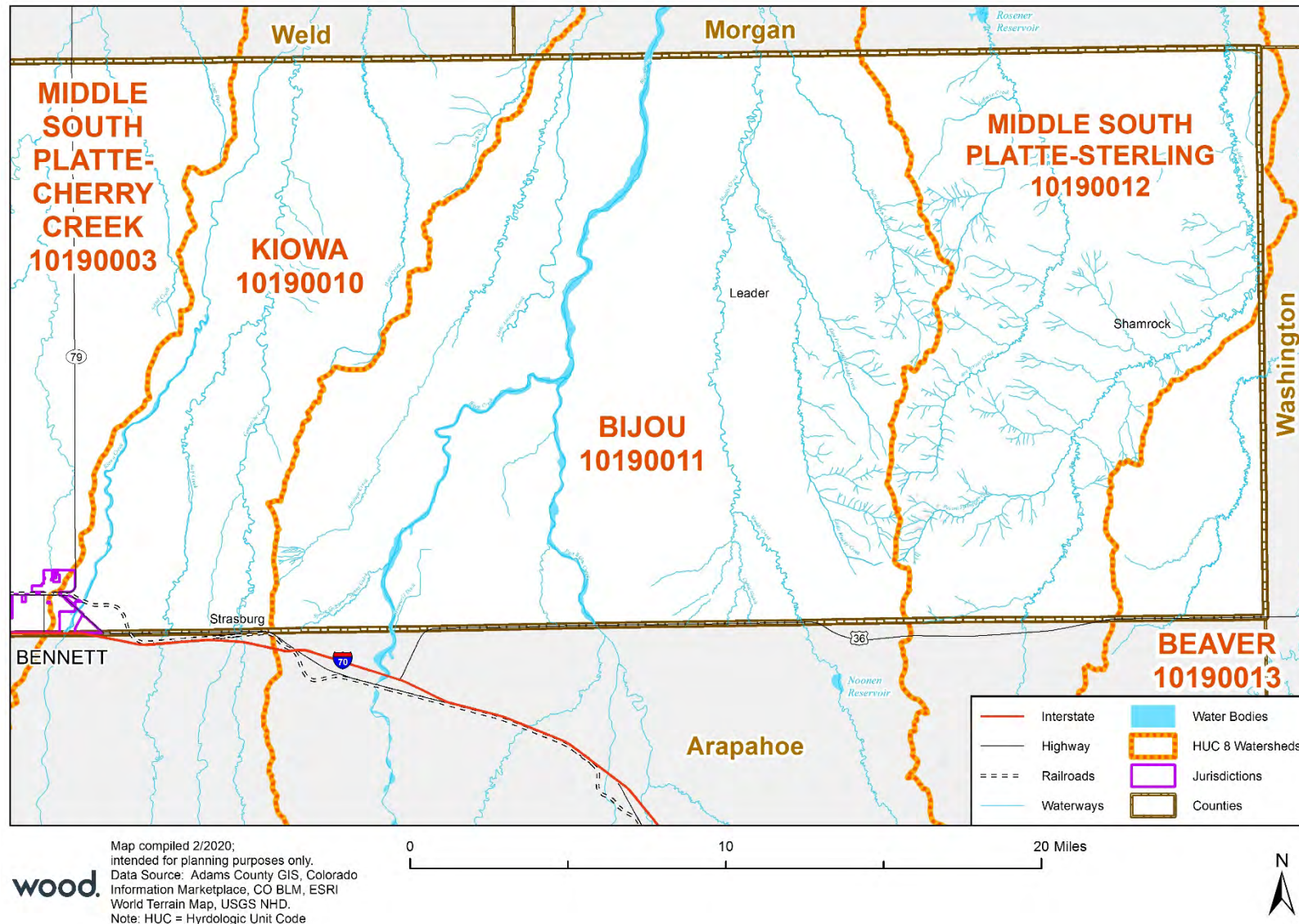


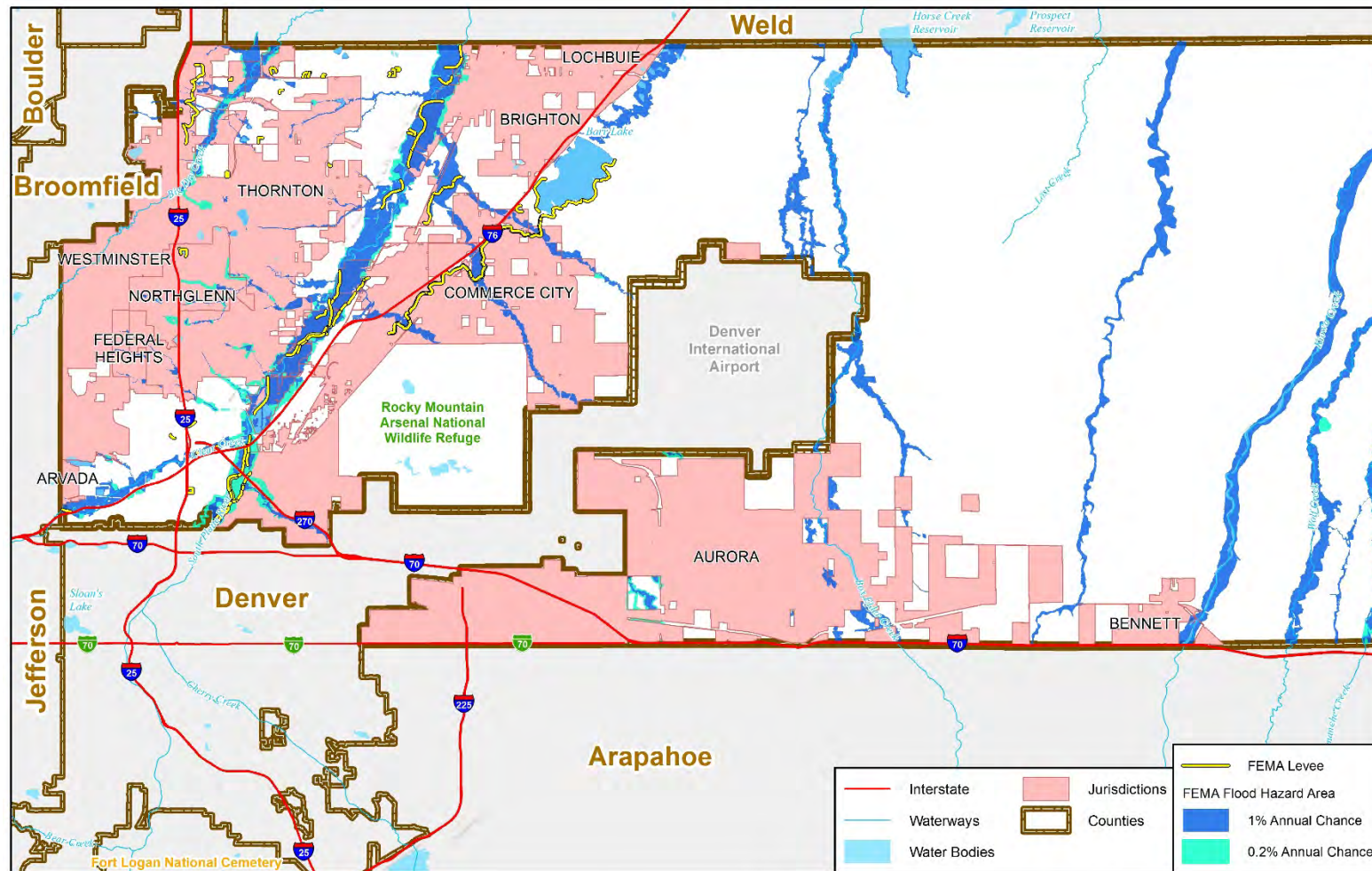
Figure 4-19 Basins and General Water Features in East Adams County



To accurately assess the risk of flooding, it is necessary to know what areas of a community may be the most susceptible to flooding. FEMA's National Flood Hazard Layer (NFHL) depicts high flood risk areas, referred to as Special Flood Hazard Areas (SFHAs), as well as other components such as Base (1%-annual-chance) Flood Elevations (BFEs), 0.2% annual chance floodplains (i.e. where the 500-year flood event would occur based on studied water features), and even built levee structures. The current NFHL with SFHAs for Adams County is dated October 29, 2019, and these floodplains and FEMA levees are displayed in Figure 4-20 and Figure 4-21. As the map shows, most of the higher risk areas are located in the western portion of the county, especially along the South Platte River which runs between the Thornton/Northglenn and Commerce City/Brighton areas, as well as along major river tributaries. Some of these high population areas where floodplains are present are covered by levees, as displayed by the yellow lines. Other floodplains posing risk to the planning area are located along the middle portion of Adams County, to the west and east of Highway 79, with other flood hazard areas along Bijou Creek and Muddy Creek farthest east of the county. The main waterways of concern in terms of flooding hazard as mapped by FEMA are listed below:

- South Platte River
- Clear Creek
- Niver Creek
- Sand Creek
- First Creek
- Second Creek
- Third Creek
- Todd Creek
- Big Dry Creek
- Brantner Gulch
- Boxelder Creek
- Lost Sand Creek
- Kiowa Creek
- Bijou Creek
- Wolf Creek
- Comanche Creek
- Muddy Creek

Figure 4-20 FEMA Special Flood Hazard Areas and Levees in West Adams County

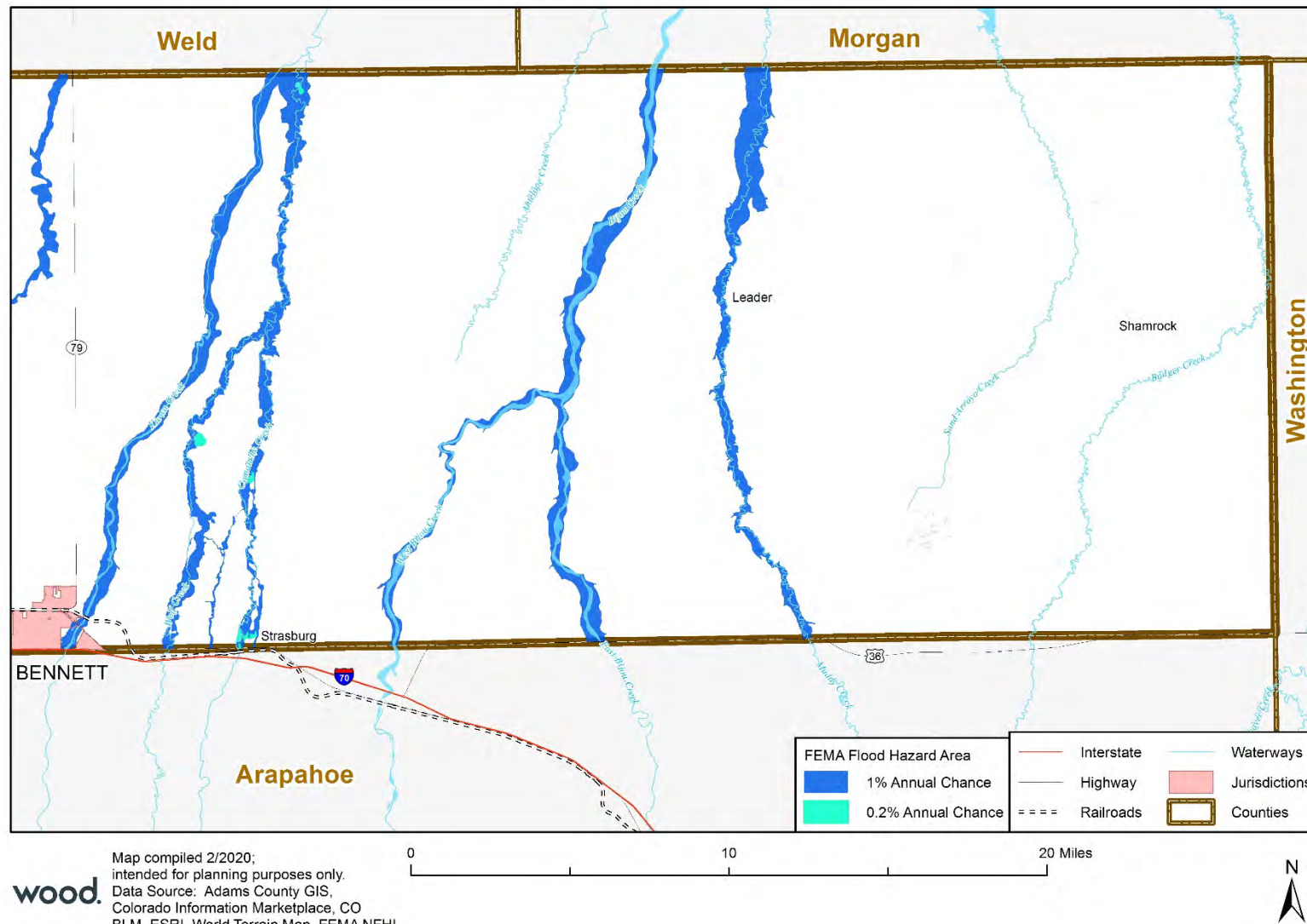


Map compiled 2/2020;
intended for planning purposes only.
Data Source: Adams County GIS, Colorado
Information Marketplace, CO BLM, ESRI
World Terrain Map, FEMA NFHL

0 10 20 Miles



Figure 4-21 FEMA Special Flood Hazard Areas and Levees in East Adams County



Previous Occurrences

There have been a number of past flooding events throughout the County, ranging widely in terms of location, magnitude, and impacts. The most frequent flooding events are quite localized in nature, resulting from heavy rains in a short period of time over urbanized areas that are not able to appropriately handle stormwater runoff. These events typically do not significantly threaten lives or property and will not result in emergency or disaster declarations; however, per the record set below, some events can definitely lead to injuries and death, as well as thousands or millions of incurred damages. Notable flood events from 1997 to 2019 are summarized in the bullet list below. These events include event-related injuries, deaths, and property or crop damages as applicable.

- **June 6, 1997** – A nearly stationary line of thunderstorms dumped 4.6 inches of rain onto portions of Thornton. Extensive flooding of streets, underpasses and other low lying areas was reported. Several businesses were flooded and basements in the area damaged.
- **July 29, 1997** - Heavy rain caused flooding to occur in the Rancho Pecos apartment building, in Westminster. Several residents had to be evacuated from their apartments, and property damages were around \$20,000. Flooding in that area, as well as near Strasburg on the eastern portion of the county, occurred on and off until August 4th of that year.
- **July 25, 1998** – A newspaper source indicated there was flash flooding in Aurora starting late afternoon on the 25th of July 1998. That same day, a trained spotter reported flood and flash flooding occurring north of Strasburg, on the eastern portion of Adams County, as 2.51 inches of rain fell in an hour. The deluge resulted in considerable flooding of local streets and county roads.
- **August 4, 1999** - Flooding and flash flooding problems developed over portions of the Urban Corridor on western Adams County, as slow moving thunderstorms dumped 2 to 3.5 inches of rainfall in approximately 3 hours. Near the junction of Interstate 25 and State Highway 36, up to 4 feet of water flooded an auto dealership, and approximately 45 cars were ruined. Sections of Interstate 25 and State Highway 36 near the interchange were closed due to floodwaters. Damage estimates to the dealership alone were approximately \$500,000. Floodwaters up to 5 feet deep forced the evacuation of two mobile home parks in Federal Heights. In addition, railroad tracks were washed out near Federal Blvd. and 64th Avenue. Numerous outages were reported with widespread blackouts in Thornton and Littleton. Along Massey Draw, near Carr Street and Chatfield Reservoir, 4 homes were flood damaged and portions of their backyards washed out.
- **August 5, 1999** - A dog kennel east of Denver International Airport was flooded when a small dam, upstream in Elbert County, reportedly breached. The floodwaters, up to 4 feet deep, washed away some 6-foot fences and other small buildings. Ten of the 70 dogs boarded at the kennel drowned.
- **July 16, 2000** - Very moist and unstable conditions combined with upslope during the late afternoon and evening hours triggered widespread urban and small stream flooding in and around the Denver metropolitan area. Rainfall amounts generally ranged from 1 to 3 inches, with the heaviest rainfall occurring during the evening hours. Since the rain fell in a relatively open area, no flood damage was reported.
- **August 17, 2000** - Thunderstorms producing very heavy rain of up to 3.5 inches in areas caused flooding and flash flooding problems in and around the Denver Metropolitan area. In Commerce City, a 37-yr old firefighter drowned while attempting to rescue a stranded motorist. According to a fire department spokesman, the firefighters were wading through the water when one of the men lost his footing and was sucked into a 10-ft deep culvert. He

was swept away before anyone could reach him. One death was therefore reported from this flash flood incident.

- **August 2, 2001** - Severe thunderstorms producing heavy rain and hail either washed out or damaged several county roads in the Watkins and Bennett areas (on the south-central portions of Adams County).
- **June 6, 2003** - Thunderstorms producing heavy rain caused flash flooding across extreme eastern sections of Adams County. Approximately 11 to 12 miles south of Leader, there was 1 to 2 feet of water covering the roadway. The highway department reportedly conducted major work on the road the following day to fix the damage caused by the flooding.
- **June 18, 2003** - Heavy rain caused flash flooding east of Leader, on the central-eastern portion of Adams County. Water up to 6 inches deep ran over bridges. In addition, several locations along Irondale Road (near East 88th Ave) had water flowing over them.
- **July 23, 2004** - Heavy rain caused flooding and flash flooding problems in and around the Federal Heights and Thornton areas. Several streets were inundated with anywhere from 2 to 4 feet of water including: 84th Ave. and Grant St., Conifer St. and Huron Blvd., 102nd St. and Melody as well as 83rd St. and Washington. Several cars were stranded in the floodwaters.
- **September 12-14, 2013** (known as the "2013 Colorado Floods") - Continuous heavy rainfall produced flash flooding, and floodwaters were reportedly breaking through basement windows west of Brighton, as well as impacting the Barr Lake area, Thornton, residences in Commerce City, and Henderson (in the unincorporated area between Thornton and Commerce City). A deep southerly flow over Colorado, ahead of a near stationary low pressure system over the Great Basin, pumped copious amounts of monsoonal moisture into the area. Commerce City officials ordered about 400 residents to leave a neighborhood near the Rocky Mountain Arsenal National Wildlife Refuge due to potential retention pond breaches. Homes, roads, and other properties were often covered under several feet of standing water across impacted communities. The storm headwaters then moved down the South Platte River and caused widespread flooding with record flood stages in northeastern Colorado counties. The floodwaters from the torrential rain hence resulted in widespread evacuations, road closures, and numerous water treatment facilities were contaminated and had to be shut down. Governor Hickenlooper declared a disaster emergency on September 13th in 11 counties across northeast Colorado including: Adams, Arapahoe, Broomfield, Boulder, Denver, Jefferson, Larimer, Logan, Morgan, Washington and Weld. By September 15th, federal emergency declarations covered those counties as well as Clear Creek County. Overall property damages for the Adams County area were estimated to be \$2,140,000.
- **May 22, 2014** - A severe thunderstorm in the Denver area produced nickel to quarter size hail in parts of Adams and Denver Counties. The line of stationary thunderstorms causing heavy rainfall also produced localized flash flooding near Bennett. Over one foot of water was observed rushing over the junction of US 36 and Kiowa-Bennett Road. An estimated \$10,000 was incurred in property damages.
- **August 30, 2016** - A wet microburst produced an intense thunderstorm with very heavy rain and hail in Westminster (with up to 3.6 inches of radar-estimated rainfall). Several vehicles were stranded in 2 to 3 feet of moving water at the intersection of 72nd Ave. and Pecos St. Street, and flooding was also reported on U.S. 36 at Pecos St.

Table 4-34 summarizes the flood events recorded in the National Oceanic and Atmospheric Administration (NOAA) National Centers for Environmental Information (NCEI) storm events database for Adams County, since 1997. Of the 22 flood events, 18 have been categorized as flash flood events, 1 led to a human death, and 4 resulted in property damages being incurred. All these were described in more detail in the bullet points above.

Table 4-34 Flood Related Deaths and Damages in Adams County, 1997-2019

Event Type	Number of Events	Deaths	Property Damage
Flash Flood	18	1	\$510,000
Flood	4	0	\$2,160,000
TOTAL	22	1	\$2,670,000

Source: NOAA NCEI, 2019

Almost all record floods on the South Platte River have been generated near the river's headwaters on the slopes of Monument Divide. The following flood events, principal flood problems, and general terrain and flood related information for Adams County were pulled from the county's September 28, 2018 Flood Insurance Study report:

- Major recorded floods have occurred on the South Platte River and its tributaries since 1844 in the Adams County area.
 - Specifically, 11 devastating floods occurred on the South Platte River, 3 on Clear Creek, and 3 each on Box Elder, Comanche Creek, and Bijou Creek.
- Major flooding in the Town of Bennett has been well documented back to 1875, where a major flood along Kiowa Creek overflowed the channel banks and destroyed the Town. After that flooding event, the Town was moved to its present-day location.
- The most significant floods of recent times on the South Platte River occurred in 1912, 1921, 1933, 1935, 1942, 1965, and 1973. The discharges for these floods were 13,000 cubic feet per second (cfs), 8,790 cfs, 22,000 cfs, 12,320 cfs, 10,200 cfs, 40,300 cfs, and 33,000 cfs, respectively, at the Denver gage. Clear Creek experienced flood discharges of 8,700 cfs, 5,390 cfs, and 5,250 cfs in 1888, 1933, and 1956, respectively recorded at the Golden gauge. Citizens interviewed in Watkins, Strasburg, Byers, and Deer Trail recalled severe damage and lives lost in 1905, 1933, 1935, and 1965 floods on Box Elder Creek, Comanche Creek, West Bijou Creek, and East Bijou Creek.
- In 1965, a unique combination of orthographic effects and meteorological conditions in the South Platte River Basin caused the worst flooding in the region's recorded history. Severe thunderstorms commenced over the headwaters of Plum Creek and Cherry Creek on June 16 and moved northeasterly down the creeks following and augmenting peak flows. More than 14 inches of rain were recorded at Palmer Lake in 4 hours. Overnight, westerly winds moved the storm front to a position over the Kiowa and Bijou Creek Basins where it met with thunderstorms forming just south of Agate. Here, 5.25 inches fell in 45 minutes. The net results of these conditions were six people drowned, two other deaths caused by flood-related activities, and estimated damages of \$500 million in the South Platte River Basin, of which \$300 million occurred in the Denver area.
- Severe flood runoff is transported through the City of Federal Heights as both overland shallow flow and as channel flow. The steep slope of the land, the close proximity of mobile homes to Tributary M of Niver Creek, and the presence of several culverts that are inadequate to convey major storm runoff combine to create flooding problems.
- The first major contribution to flood control in Adams County streams took place in the late 1800s, when Castlewood Dam was completed with the primary intention being irrigation uses. However, in August of 1933, this dam burst under pressure of water from severe thunderstorms in the upper Cherry Creek Basin.
- Throughout the study segment of the South Platte River in Adams County, levees have also been constructed as flood protection measures (some of which are displayed in Figure 4-20). However, past evidence shows these levees to be ineffective against 1-percent-annual-chance floods. On large segments of the South Platte River, historical records indicate that the 1965 and 1973 floods were of the 1-percent-annual-chance magnitude or greater.

- Nonstructural measures of flood protection are also used to aid in the prevention of future flood damage. These are the result of regulations of the Mile High Flood District.

Urban and stormwater drainage within the County has largely been associated with flooding of roadways during storm events. Adams County currently monitors several problem areas and is proactive in clearing the areas and closing the roads.

Probability of Future Occurrence

The probability of future occurrence of this flooding hazard in Adams County is **Likely**.

Periodic flooding of lands adjacent to rivers and streams is a natural occurrence in the county, and it can be expected to take place based upon established flood recurrence intervals.

A *100-year* flood, which has a 1% chance (1 in 100) of occurring in a given year, is a regulatory standard used by federal agencies, states, and NFIP- participating communities to administer and enforce floodplain management programs, as well as set insurance requirements nationwide.

The *500-year* flood event, which has a 0.2% chance (1 in 500) chance of occurring in a given year, is another commonly mapped and studied event by FEMA flood related programs and efforts.

For context, the main flood recurrence intervals used in planning, floodplain studies, and other regulatory contexts are summarized in Table 4-35, and more detailed descriptions of FEMA special flood hazard zones applicable to Adams County are contained in Table 4-36. The most recent FEMA special flood hazard areas mapped, which contain the 100- and 500-year events and hence where riverine flooding is expected to primarily occur in the future, are shown on Figure 4-20 under the Geographic Location subsection of this chapter.

Table 4-35 Annual Probability of Flooding Based on Recurrence Intervals

Flood Recurrence Interval	Annual Chance of Occurrence
10-year	10%
50-year	2%
100-year	1%
500-year	0.2%

Source: FEMA

Table 4-36 FEMA Special Flood Hazard Zones Present in Adams County

Flood Zone	Definitions
FEMA Special Flood Hazard Areas (SFHAs) Subject to Inundation by the 100- or 500-Year Floods	
Zone A	100-year floodplain, or areas with a 1% annual chance of flooding. Because detailed analyses are not performed these areas, no depths or base flood elevations are shown in Zone A areas.
Zone AE	Detailed studies for the 100-year floodplain. The base floodplain where base flood elevations are provided. AE Zones are now used on new format FIRMs instead of A1-A30 zones.
Zone AO	River or stream flood hazard areas and areas with a 1% or greater chance of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from 1 to 3 feet. Average flood depths derived from detailed analyses.
Other Flood Areas	
Floodway	A regulatory floodway is the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height.
Zone X (shaded)	Areas with a 0.2% annual chance flooding (1 in 500 chance), between the limits of the 100-year and 500-year floodplains. This zone is also used to designate base floodplains of lesser

Flood Zone	Definitions
	hazards, such as areas protected by levees from the 100-year flood, shallow flooding areas with average depths of less than one foot, or drainage areas less than 1 square mile.
Zone X (unshaded)	500-year floodplain (0.2% annual chance). Area of minimal flood hazard.

Source: FEMA Flood Map Service Center, 2018

Based on the details provided in this chapter, flooding remains a likely occurrence throughout the identified flood hazard areas in the county. Smaller floods caused by heavy rains or inadequate drainage capacity in urbanized areas may be more frequent, but not as costly as the large-scale floods, which may occur at much less frequent intervals. In addition, dam or flood control structure failure could additionally take place and lead to flooding in an unexpected manner, in which likelihood of occurrence estimations would be more difficult to obtain.

Magnitude/Severity

The magnitude, or severity, of flooding hazards in Adams County is **Significant**.

The severity of a flooding event is determined by the following key aspects: 1) a combination of stream and river basin topography and physiography; 2) precipitation and weather patterns; 3) recent soil moisture conditions; 4) the degree of vegetative clearing, and 5) effects on life, property, the environment, and the economy in terms of injuries and deaths, and damages or losses to structures, crops, resources, and critical facilities.

As previously discussed, major floods can induce property damages that threaten structural integrity, result in death and injuries, and impact critical services, facilities, and infrastructure. Flooding impacts a community only to the degree that it affects the lives or property of its citizens and the community's overall ability to function. Therefore, the most vulnerable areas of a community will be those most affected by floodwaters in terms of potential losses, damages, and disruption of community services and utilities. For example, an area with large developments on the floodplain is significantly more vulnerable to the impacts of flooding than a rural or undeveloped zone where potential floodwaters would have little impact on the community due to lack of the built environment and human presence.

A number of factors contribute to the relative vulnerabilities of certain areas in the floodplain. Development, or the presence of people and property in the hazardous areas, is a critical factor in determining vulnerability to flooding. Additional factors that contribute to flood vulnerability range from specific characteristics of the floodplain to characteristics of the structures located within the floodplain. The following is a brief discussion of some of these flood factors which pose risk.

- **Flood depth:** The greater the depth of flooding, the higher the potential for significant damages due to larger availability of flooding waters.
- **Flood duration:** The longer duration of time that floodwaters are in contact with building components, such as structural members, interior finishes, and mechanical equipment, the greater the potential for damage.
- **Velocity:** Flowing water exerts forces on the structural members of a building, increasing the likelihood of significant damage (e.g. such as scouring).
- **Elevation:** The lowest possible point where floodwaters may enter a structure is the most significant factor contributing to its vulnerability to damage, due to the higher likelihood that it will come into contact with water for a prolonged amount of time.
- **Construction Type:** Certain types of construction and materials are more resistant to the effects of floodwaters than others. Typically, masonry buildings, constructed of brick or concrete blocks, are the most resistant to damages simply because masonry materials can be

in contact with limited depths of flooding without sustaining significant damage. Wood frame structures are more susceptible to damage because the construction materials used are easily damaged when inundated with water.

Floods may also be caused by structural or hydrologic failures of dams or levees. Each of these causes results in floods that have distinct characteristics relative to flow rate, rate of rise, volume, duration, and flood season. For more information on dam and structural inundation hazards, refer to Section 4.3.2 Dam Failure/Incident.

Climate Change Considerations

The 2014 Climate Change Assessments from the Western Water Assessment program (part of the NOAA Rise Team) includes an increase in intensity of heavy precipitation events, which could affect the nature and frequency of future floods. Additionally, with wildfires already being a problem in many parts of Colorado, increasing periods of drought and lack of precipitation are expected to exacerbate conditions for fires to occur, and in turn likely worsen the potential for runoff and flooding associated with burned areas. While Adams County fire history has not been significant in recent years, the potential for added development in the Wildland Urban Interface (WUI) could worsen risks to this hazard, in turn affecting future flooding due to changing climate conditions. For more information on fire hazards and WUI issues, refer to Section 4.3.13 Wildfire.

Vulnerability

Flood hazards affect most of the communities in the County, will continue to occur in the future, and can be critical in their magnitude causing injuries or even deaths, and damaging property and infrastructure. The following sub-sections discuss the results of the parcel analysis conducted for Adams County, using parcel centroids and the latest FEMA National Flood Hazard Layer (NFHL) data, updated as of October 29, 2019. Other data sources and vulnerability assessment methods may be used for assets not available in geospatial format, or to supplement existing GIS analysis (e.g. discussion of properties insured by the NFIP).

People

Based on the GIS analysis performed, where the FEMA special flood hazard areas were overlaid with the Adams County parcel layer to obtain the number of vulnerable properties (i.e. those falling in the hazard layer), the total at-risk population to this hazard was estimated. The total population exposed to flooding hazards was calculated by multiplying the average persons per household value for Adams County (which is 3.0) by the total properties of residential nature found to intersect with the flood hazard layers. This assessment yielded that 927 people may potentially fall in the 100-year floodplains, while 1,578 people may be found in the 500-year floodplains. For more details, refer to Table 4-37.

The impacts of flooding on vulnerable populations can be more severe. Comparing Figure 4-20 and Figure 4-21 with the social vulnerability maps in Section 2-5 shows that many of the areas at greatest risk of flooding also have higher social vulnerability stemming from socioeconomic status, household composition and disabilities, minority status and language proficiency, or housing and transportation resources. Families in this area may have fewer financial resources to prepare for or recover from a flood, and may be more likely to be uninsured or underinsured. Individuals with disabilities may need more time to evacuate, so evacuation notices will need to be issued as soon as feasible, and communicated by multiple, inclusive methods.

General Property

Vulnerability to flooding was determined by summing potential losses to Adams County's parcels in GIS, by using the latest FEMA NFHL data along with the County parcel layer the provided by the Assessor's Office. FEMA's NFHL data depicts the 1% annual chance (100-year) and the 0.2% annual chance (500-year) flood events. Flood zones A, AE, and AO are variations of the 1% annual chance event and were included in the analysis due to being present in Adams County. The "Shaded Zone X" along with the subtype 0.2% annual chance hazard zone were used to represent the 500-year flood event.

GIS was used to create a centroid, or point, representing the center of each parcel polygon. Only parcels with improvement values greater than zero were used in the analysis (with the exception of "Exempt" parcels, which were included regardless of improvement values); this assumes that improved parcels have a structure of some type. The FEMA flood zones were overlaid in GIS on the parcel centroid data to identify structures that would likely be inundated during a 1% annual chance or 0.2% annual chance flood event. Property improvement values for the points were based on the assessor's parcel data and summed by parcel type and jurisdiction across the county, along with content values and total values.

Content values were calculated based on improvement values and parcel types, using FEMA Hazus guidance as described under Section 4.2: Asset Summary. Property improvements and content values were then totaled, and a 25% loss estimation factor was applied based on those totals, per the FEMA depth damage functions.

Results of the overlay analysis are summarized in Table 4-37 by flood zone, jurisdiction, and parcel type. Based on these results, there are 959 improved properties in the 1% annual chance flood zone. The total parcel exposure value in the 1% annual chance flood zone is \$63.6 million, with a loss estimate of \$15.9 million. In the 0.2% annual chance flood there are 620 additional improved parcels, with a total exposure value of \$29.9 million and a loss estimate of almost \$7.5 million.

The greatest potential losses from either 100-year or 500-year flooding would occur in the Unincorporated Adams County areas, followed by Thornton, Northglenn, Brighton, Commerce City, Westminster, Arvada, and Federal Heights. Overall, there are a total of 1,579 parcels at risk countywide, with a total value of \$99.2 million and a loss estimate of almost \$24.8 million.

Table 4-37 Parcels Exposed to FEMA's Special Flood Hazard Areas in Adams County

Jurisdiction	Flood Event	Total Improved Parcels	Improved Value	Content Value	Total Value	Loss Estimate (25% of Total Value)	Population
Arvada	100-year	5	\$1,232,850	\$1,232,850	\$2,465,700	\$616,425	--
TOTAL		5	\$1,232,850	\$1,232,850	\$2,465,700	\$616,425	-
Brighton	100-year	32	\$219,530	\$109,765	\$329,295	\$82,324	3
	500-year	93	\$3,847,180	\$2,066,205	\$5,913,385	\$1,478,346	249
TOTAL		125	\$4,066,710	\$2,175,970	\$6,242,680	\$1,560,670	252
Commerce City	100-year	89	\$7,980,310	\$6,176,635	\$14,156,945	\$3,539,236	9
	500-year	18	\$1,445,830	\$1,593,885	\$3,039,715	\$759,929	-
TOTAL		107	\$9,426,140	\$7,770,520	\$17,196,660	\$4,299,165	9
Federal Heights	100-year	4	\$10,450	\$5,225	\$15,675	\$3,919	3
TOTAL		4	\$10,450	\$5,225	\$15,675	\$3,919	3
Northglenn	100-year	28	\$1,117,930	\$1,346,195	\$2,464,125	\$616,031	48
	500-year	146	\$3,630,590	\$1,825,880	\$5,456,470	\$1,364,118	411

Jurisdiction	Flood Event	Total Improved Parcels	Improved Value	Content Value	Total Value	Loss Estimate (25% of Total Value)	Population
TOTAL		174	\$4,748,520	\$3,172,075	\$7,920,595	\$1,980,149	459
Thornton	100-year	138	\$710,050	\$464,215	\$1,174,265	\$293,566	27
	500-year	124	\$2,587,870	\$1,564,865	\$4,152,735	\$1,038,184	333
TOTAL		262	\$3,297,920	\$2,029,080	\$5,327,000	\$1,331,750	360
Westminster	100-year	13	\$152,740	\$0	\$152,740	\$38,185	-
TOTAL		13	\$152,740	\$0	\$152,740	\$38,185	-
Unincorporated	100-year	650	\$26,376,260	\$21,308,330	\$47,684,590	\$11,921,148	837
	500-year	239	\$6,833,810	\$5,345,850	\$12,179,660	\$3,044,915	585
TOTAL		889	\$33,210,070	\$26,654,180	\$59,864,250	\$14,966,063	1,422
GRAND TOTAL		1,579	\$56,145,400	\$43,039,900	\$99,185,300	\$24,796,325	2,505

Source: FEMA NFHL 2019, Adams County GIS, U.S. Census Bureau, Wood analysis.

The loss estimates for this vulnerability assessment are a planning level analysis suitable for flood risk mitigation, emergency preparedness, response, and recovery. The methodology and results should be considered 'reasonable.' Uncertainties are inherent in any loss estimation methodology, and losses will vary depending on the magnitude of the flood event and current assets present. Other limitations may include incomplete or inaccurate inventories of the built environment, lack of mitigation information regarding built structures (e.g. structure elevation details), or even potential mitigation projects in place such as flood control projects. As such, this loss estimation assumes no mitigation and does not account for buildings that may have been elevated above the 1% annual chance event according to local floodplain management regulations. Another limitation to this analysis is that flooding does occur outside of available mapped floodplains due to poor drainage, stormwater overflow, and lack of FEMA or other data for those areas adjacent to streams that have not been analyzed.

Critical Facilities and Infrastructure

The impacts of floodwater on critical facilities such as police and fire stations, health facilities, and water or wastewater treatment facilities among others can greatly increase the overall effect of a flood event on a community (e.g. if critical potable facilities are impacted). In general, most of these facilities are located in areas with lower risk to flooding due to recent requirements for developers to consider hazard risks in their plans. However, the GIS analysis performed indicates the following critical facilities (Table 4-38) were found to be located within 100- or 500-year floodplains and are hence at risk of riverine flood hazards.

Table 4-38 Critical Facilities in Flood Hazard Areas in Adams County, by FEMA Lifeline and Location

Jurisdiction	Flood Event	FEMA Lifeline	Total
Brighton	100-year	Food/Water/Shelter	1
		Transportation	1
TOTAL			2
Commerce City	100-year	Food/Water/Shelter	5
		Hazardous Material	3
		Safety and Security	8
		Transportation	3
	500-year	Hazardous Material	6
		Safety and Security	4
TOTAL			29

Jurisdiction	Flood Event	FEMA Lifeline	Total
Federal Heights	100-year	Food/Water/Shelter	1
TOTAL			1
Northglenn	500-year	Safety and Security	2
TOTAL			2
Thornton	100-year	Food/Water/Shelter	8
		Hazardous Material	15
		Safety and Security	3
		Transportation	3
	500-year	Hazardous Material	1
TOTAL			30
Westminster	100-year	Hazardous Material	1
		Transportation	2
TOTAL			3
Unincorporated	100-year	Communications	5
		Energy	1
		Food/Water/Shelter	28
		Hazardous Material	40
		Safety and Security	37
		Transportation	94
	500-year	Communications	1
		Food/Water/Shelter	3
		Hazardous Material	5
		Safety and Security	3
TOTAL			219
GRAND TOTAL			286

Source: Adams County GIS, HIFLD, FEMA NFHL, Wood analysis

The majority are found in the Unincorporated portions of the county, followed by Thornton, Commerce City, Westminster, Brighton, Northglenn, and Federal Heights. A total of 259 facilities are located in the 1% annual chance flood event (100-year), while only 27 fall in the 0.2% annual chance flood event (500-year). The table below breaks up these critical facilities located in FEMA special flood hazard areas, but this time by facility type. Table 4-39 shows that the largest single category of those facilities is Tier HazMat II Sites, which raises the potential of toxic materials being released during a flood and impacting downstream communities. A large number of landfills/government service sites, bridges, and gravel mines/ponds are also found in floodplains.

Table 4-39 Critical Facilities in Flood Hazard Areas in Adams County, by Facility Type

Critical Facility Type	Total
HazMat EO Tier II Sites	60
Major Bridge	54
Landfills/Govt. Services	47
Gravel Mines/Ponds	44
Pedestrian Bridge	20
Golf Course Bridge	16
Minor Bridge	14
Communication Towers	6
Environmental Hazard Superfund	6
Government Facilities	6
Environmental Hazard Toxic Site	4
Schools	3
Electric Substations	1
EO Emergency Shelters	1
Fire Stations	1
HazMat EO RMP Sites	1
RTD Light Rail Station	1

Critical Facility Type	Total
Wastewater Treatment Plant	1
TOTAL	286

Source: Adams County GIS, HIFLD, FEMA NFHL, Wood analysis

Economy

Flooding can have a major economic impact on the economy, including indirect losses such as business interruption, lost wages, reduced tourism and visitation, and other downtime costs. Flooding often coincides with the summer tourism months and may hence impact, directly or indirectly (such as from the negative perception of potential danger to his hazard), the revenues of tourist agencies, hotel bookings, outdoor activity companies, and other such businesses in the commercial and industrial sectors.

National Flood Insurance Program (NFIP) Policies and Repetitive Flood Properties

FEMA insures properties against flooding losses through the NFIP. Table 4-40 below provides detailed information on National Flood Insurance Program (NFIP) policies in the plan-participating county jurisdictions, current as of September 12, 2019.

Table 4-40 Community Participation in the NFIP and Summary Information

Community	Date Joined (Regular Entry)	Current Map Date	Study Underway?	Policies in Force	Insurance in Force	Number of Paid Losses	Total Losses Paid
Adams County	2/1/79	9/28/18	Yes	177	\$54,342,200	19	\$114,092
Commerce City	2/15/78	2/17/17	Yes	20	\$5,802,000	--	--
Town of Bennett	9/12/14	3/5/07	Yes	--	--	--	--
City of Brighton	11/16/77	3/5/07	Yes	9	\$2,224,000	2	\$3,293

Source: FEMA NFIP, September 2019

NFIP insurance data indicates that as of September 12, 2019, there were 206 flood insurance policies in force in the jurisdictions in Adams County which are participating in this plan update process (including the unincorporated county), with \$62,368,200 of combined coverage.

As part of the process to reduce or eliminate repetitive flooding to structures across the United States, FEMA has developed an official Repetitive Loss Strategy. The purpose behind the national strategy is to identify, catalog, and propose mitigation measure to reduce flood losses to the relatively few numbers of structures that absorb the majority of the premium dollars from the national flood insurance fund. A repetitive loss property is defined by FEMA as "a property for which two or more NFIP losses of at least \$1,000 each have been paid within any 10-year period since 1978". A repetitive loss property may or may not be currently insured by the NFIP.

There are 2 repetitive loss buildings in Adams County's unincorporated areas, 1 of which is insured. Losses-wise, 4 repetitive losses have been reported to the NFIP, 2 of which are insured properties. The total payments for repetitive loss buildings amounts to \$15,252 between the two flood hazard area zones applicable to the county: zones AE, A, A1-A30, AO, and AH; and, zones B, C, X. The majority of the repetitive loss payments were incurred in zones B, C, and X.

There are no repetitive loss properties or severe repetitive loss properties in Commerce City, the City of Brighton, or the Town of Bennet as of 2019.

Community Rating System (CRS)

The NFIP Community Rating System (CRS) is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP

requirements. The three main goals of the CRS are to (1) reduce flood damage to insurable property, (2) strengthen and support the insurance aspects of the NFIP, and (3) encourage a comprehensive approach to floodplain management. The CRS offers flood insurance policy premium discounts for communities which develop and apply additional measures past minimum requirements related to floodplain management, and each community's eligibility is based on regular NFIP participation as well as maintaining full compliance with said program. Discounts range from 0% to 45% depending on given credits/scores, which assess the amount and degree of floodplain management measures and activities geared towards minimizing flood related damages, protecting the community and its resources, and developing according to best available codes ([FEMA Appendix F: CRS, 2019](#)).

There are 9 CRS classes that can qualify for discounts. Class 9, the lowest level, gives policy holders a 5% premium reduction. Class 1 is the highest level and gives premium discounts of 45% for properties located in the SFHA and 10% for properties outside the SFHA. There are many of activities recognized as measures for minimizing or eliminating exposure to floods. Credit points are assigned to each activity, and the activities are organized under 4 main categories:

- Public Information
- Mapping and Regulation
- Flood Damage Reduction
- Flood Preparedness

As of May 2019, Adams County's CRS class was 9. This means that the unincorporated portions of the county qualify for a 5% discount based on both SFHA and non-SFHA properties. Note that, for the purpose of determining these CRS discounts, all AR and A99 zones are treated as non-SFHAs. No other participating jurisdictions in this Plan update are currently participating in the CRS program, although several non-participating jurisdictions in the county are in the CRS program. The potential benefits of CRS participation are discussed in more detail in Section 5.5 of the Capability Assessment.

Historic, Cultural, and Natural Resources

There are significant historic, cultural, and natural resources and assets located throughout the County (e.g. trails and natural spaces, lakes). Natural areas within the floodplain often benefit from periodic flooding as a naturally recurring phenomenon. These natural areas often reduce flood impacts by allowing absorption and infiltration of floodwaters. Natural resources are generally resistant to flooding except where natural landscapes and soil compositions have been altered for human development or after periods of previous disasters such as drought and fire. Wetlands, for example, exist because of natural flooding incidents. Areas that are no longer wetlands may suffer from oversaturation of water, as will areas that are particularly impacted by drought. Areas which may have recently suffered from wildfire damage may erode because of flooding, which can permanently alter an ecological system.

Future Development

The risk of flooding to future development should be minimized by the floodplain management programs of the County and its municipalities, if properly enforced. Risk could be further reduced by strengthening floodplain ordinances and floodplain management programs beyond minimum NFIP minimum requirements.

Risk Summary

- The overall significance of flooding hazards is **High**.
- Over 1,500 parcels are exposed to flood hazards as portrayed by the latest FEMA NFHL data available. The majority are Residential in nature, followed by Exempt parcels.

- It is estimated that over 2,500 people may be found in special flood hazard areas based on the latest FEMA NFHL data available.
- A total of 286 critical facilities are found in flood hazard areas in the County.
- Related hazards: Dam Failure, Earthquake, Winter Weather, Thunderstorms.

Table 4-41 Flood Risk Summary

Jurisdiction	Geographic Location	Probability of Future Occurrence	Magnitude/Severity	Overall Significance
Adams County	Significant	Likely	Critical	High
Bennett	Extensive	Likely	Catastrophic	High
Brighton	Limited	Likely	Limited	Medium
Commerce City	Significant	Highly Likely	Limited	Medium
Denver Water	Limited	Likely	Limited	Medium

4.3.6 Hazardous Materials Incident

Hazard Description

Generally, a hazardous material is a substance or combination of substances which, because of quantity, concentration, or physical, chemical, or infectious characteristics, may either cause or significantly contribute to, an increase in mortality or an increase in serious, irreversible, or incapacitating reversible, illness. Hazardous materials may also pose a substantial present or potential hazard to human health or environment when improperly treated, stored, transported, disposed of, or otherwise managed.

Hazardous material incidents can occur while a hazardous substance is stored at a fixed facility, or while the substance is being transported along a road corridor or railroad line or via an enclosed pipeline or other linear infrastructure. In Adams County there are also environmentally contaminated properties also known as brownfields that pose a risk to residents as well as makes redeveloping the sites for future uses challenging. The Environmental Protection Agency (EPA) defines brownfields as, "abandoned, idled or under-used industrial and commercial facilities where expansion or redevelopment is complicated by real or perceived environmental contamination".

The U.S. Department of Transportation (DOT), U.S. Environmental Protection Agency (EPA) and the Occupational Safety and Health Administration (OSHA) all have responsibilities relating to the transportation, storage, and use of hazardous materials and waste. The Right to Know Network maintained by the U.S. Coast Guard's National Response Center (NRC) is a primary source of information on the use and storage of hazardous materials, as well as data regarding spills and releases. In Colorado, the manufacture, use, storage, and transportation of hazardous materials is regulated by the Colorado Department of Public Health and the Environment (CDPHE). Hazardous materials carriers are subject to Colorado Public Utility Commission (PUC) registration and insurance requirements. Colorado statutes require that any person transporting hazardous materials that require placarding to obtain a Hazardous Materials Permit from the Public Utilities Commission. Safety oversight is the jurisdiction of the Colorado State Patrol.

The U.S. Department of Transportation divides Hazardous materials into the following classes:

- Explosives
- Compressed gases: flammable, non-flammable compressed, poisonous
- Flammable liquids: flammable (flashpoint below 141 degrees Fahrenheit) combustible (flashpoint from 141 - 200 degrees)
- Flammable solids: spontaneously combustible, dangerous when wet

- Oxidizers and organic peroxides
- Toxic materials: poisonous material, infectious agents
- Radioactive material
- Corrosive material: destruction of human skin, corrodes steel

Adams County Development Standards and Regulations defines a hazardous materials facility as a facility that produces or stores high volatile, flammable, explosive, toxic and/or water reactive materials (Adams County 2011). These facilities may include:

- Chemical and pharmaceutical plants (chemical plant, pharmaceutical manufacturing);
- Laboratories containing highly volatile, flammable, explosive, toxic, and/or water-reactive materials;
- Refineries;
- Hazardous waste storage and disposal sites; and
- Above ground gasoline or propane storage or sales center.

It is also common to see hazardous materials releases result as escalating incidents from other hazard incidents such as floods and wildfires. The release of hazardous materials can greatly complicate or even eclipse the response to the natural hazards disaster that caused the spill.

Geographic Location

Hazmat incidents can occur at fixed facilities or during transportation, as discussed below. Overall, the geographic coverage of this hazard in Adams County is limited—less than 10% of the planning area affected based on historical experience – but depending on the type and quantity of spills and the medium affected, the geographic coverage could become large.

Fixed Facilities

Generally, with a fixed facility, the hazards are pre-identified. The U.S. Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986 requires industries to report on the storage, use, and releases of hazardous substances to federal, state, and local governments. Facilities in Colorado must submit an emergency and hazardous chemical inventory form (Tier II form) to the Colorado Department of Public Health and Environment (CDPHE) and, if required by local reporting regulations, the Local Emergency Planning Committee (LEPC) and local fire departments annually. Tier II forms provide state and local officials and the public with information on the general hazard types and locations of hazardous chemicals present at facilities during the previous calendar year. The inventory forms require basic facility identification information, employee contact information for both emergencies and non-emergencies, and information about chemicals stored or used at the facility. The EPA also requires facilities containing certain extremely hazardous substances to generate Risk Management Plans (RMPs) and resubmit these plans every five years.

The Adams County Office of Emergency Management administers the EPCRA program for the planning area through the Adams County LEPC. As of January 2020, there are 707 Tier II facilities and 14 RMP sites in Adams County, the most of any Colorado county. Of these, 462 are located in unincorporated Adams County; refer to Table 4-44 below for a breakdown of Tier II Facilities and RMP sites in each jurisdiction. The Colorado Department of Public and Environmental Health (CDPHE), lists one permitted hazardous waste facility in the county, located on west 56th Avenue.

GIS analysis was used to overlay the location of each Tier II facility and RMP sites with dam inundation layers, wildland urban interface (WUI) intermix layers and 100-year and 500-year floodplain layers. Of the 707 Tier II facilities in Adams County, 36 are located in the 100-year floodplain, all of which are located in unincorporated county except for 2 located in Commerce City; 8 are located in the 500-year floodplain,

with an even split between (4) unincorporated areas and (4) Commerce City; 13 are located in low density WUI, one is located in Brighton and the remaining in unincorporated areas; 77 Tier II facilities are located in a dam inundation path, located in unincorporated areas, Commerce City and Brighton. Each RMP site and the natural hazard the site is exposed to is listed in Table 4-42.

Table 4-42 Risk Management Plan Sites in Adams County

Name	Jurisdiction	Risk of Hazard
Colorado Interstate Gas Company, LLC - Totem Storage Facility	Unincorporated	
Henderson Fertilizer & Chemical - Agfinity Inc.	Unincorporated	Dam Inundation (<i>Chatfield and Cherry Creek dams</i>)
Wattenberg Gas Plant - Anadarko Petroleum Corp	Unincorporated	
BASF Construction Chemicals - BASF Corp.	Commerce City	
Denver Products Terminal - Sinclair Transportation Co.	Commerce City	
Denver Water - Recycling Plant	Commerce City	500-year flood (<i>Bear Creek and Spring Gulch</i>) and Dam Inundation (<i>Chatfield and Cherry Creek dams</i>)
Klein Water Treatment Plant - S. Adams Co. Water and Sanitation District	Commerce City	
Lineage Logistics - Henderson	Commerce City	
SEUSA Commerce City Refinery - Suncor Energy (U.S.A.) Inc.	Commerce City	Dam Inundation (<i>Chatfield and Cherry Creek dams</i>)
Veolia Environmental Services - Veolia ES Technical Solutions, L.L.C	Commerce City	Dam Inundation (<i>Chatfield and Cherry Creek dams</i>)

Source: Adams County GIS

Transportation

In transit, hazardous materials generally follow major transportation routes, including road, rail, and pipelines, creating a risk area immediately adjacent to these routes. There are five major interstates and highways that traverse Adams County, all of which have the potential for a hazardous materials incident. In particular concern for the western portion of the planning area is Interstate 70, and Interstate 25, both major corridors for the state and the nation and designated as Nuclear and Hazardous Materials routes. Closure on either Interstate due to a hazardous materials incident would significantly disrupt traffic flow between the Denver metropolitan area and the eastern plains leading to severe economic impacts to the Adams County area. State Highway (SH) 79 crosses north-south through the Town of Bennett and is also designated as a hazardous materials route. The County would be severely impacted if an incident were to occur on any of the routes, especially one that caused soil or water contamination.

There are two commercial airports located within and near Adams County, the Colorado Air and Space Port (formerly known as Front Range Airport) in unincorporated eastern Adams County, and Denver International Airport (DIA). DIA, although not part of Adams County jurisdictions, is surrounded by County lands and some flight paths from DIA are above Adams County and incorporated jurisdictions. The HMPC noted aviation incidents being a concern especially for Commerce City.

Both the Union Pacific Railroad (UPRR) and Burlington Northern Santa Fe Railway (BNSF) have mainline tracks that cross through Adams County, particularly in the western portion of the county. According to the Adams County Comprehensive Plan, the UPRR mainline track, which parallels US 85 averages 11 to 15 trains per day. The BNSF mainline track, adjacent to SH 2 and I-76 north of the interchange averages 28-30 trains per day. One of the UPRR rail lines bisects the Town of Bennett at-grade and has been a concern for the HMPC in the past.

Refer to the Adams County website for additional information on RMP sites, Tier II facilities, and pipelines in the county.

While the western, industrialized portion of the county is where many of the hazardous materials facilities are located, hazardous material incidents can also occur in agricultural areas in the eastern portion of the county; these types of facilities typically use pesticides, fertilizers, and other agricultural chemicals that are potentially harmful to people and the environment if a spill or misuse was to happen. For example, agricultural pesticides and fertilizers are often transported daily around the planning area. Illegal drug operations and dumping sites have also been known to pose a hazardous materials threat.

Zoning

Zoning in the United States were originally developed to help keep residential properties away from the harmful outputs of industrial uses. Zoning allows the County to determine where certain uses (i.e. residential, commercial, industrial, agricultural) are located in their community. Zone districts are created by law in Adams County to control the use of land and development in the county. Current zoning was obtained through Adams County GIS parcel data from the County GIS Department. The following table show a breakdown of the location of Tier II facilities and RMP sites and the corresponding zone district in unincorporated Adams County only. Both Tier II and RMP facilities are most commonly found in agriculturally zoned areas. A majority of hazardous material facilities in the unincorporated areas are located in the Agricultural-3 District (A-3), which primary purpose is to all for dryland or irrigated farming, pasturage, or other related food production uses. Single family dwellings are permitted in the A-3 district, where the majority of Tier II facilities are located.

Table 4-43 Hazardous Materials Facilities, Tier II Facilities and RMP Site by Current Zoning Type (Unincorporated only)

Current Zoning ¹	# of Tier II Facilities	# of RMP Sites
A-1	30	
A-2	9	
A-3	310	2
AV	1	
C-0	2	
C-4	1	
I-1	4	1
I-2	27	
I-3	22	
PL	1	
P.U.D	12	
P.U.D (P)	15	
R-1-C	1	
RE	13	

Source: Adams County GIS

1 A-1: Agricultural-1 District – Purpose is to provide rural single-family dwelling district where the minimum lot area for a home site is intended to provide a rural living experience. Limited farming uses are permitted including the keeping of a limited number of animals for individual homeowner's use. This district is primarily designed for the utilization and enjoyment of the County's rural environment.

A-2: Agricultural-2 District - Purpose is to provide a district for rural subdivisions of at least ten (10) acres in size where adequate provisions are made for internal and external roads and access, water and sewer facilities, fire protection and other emergency services, and other public services and utilities. Farming uses are permitted, including the cultivation of land and the keeping of a limited number of animals.

A-3: Agricultural-3 District - Purpose is to provide land primarily in holdings of at least thirty-five (35) acres for dryland or irrigated farming, pasturage, or other related food production uses.

AV: Aviation District - intended to provide for non-residential land uses associated with aviation operations while minimizing risks to public safety and hazards to aviation users including those employed at public aviation facilities.

C-0: Commercial-0 District – Purpose is to provide an office district designed to provide administration and professional services, local employment and services, and provide a small local retail district designed to provide small convenient retail shopping and personal services for persons residing in adjacent residential areas.

C-4: Commercial-4 District - Purpose is to serve as a general retail and service district designed to provide services and products for both the general and traveling public in a regional context.

I-1: Industrial-1 District - Purpose is to provide a general commercial and limited industrial district designed to provide for a variety of compatible business, warehouse, wholesale, offices and very limited industrial uses.

I-2: Industrial-2 District: Purpose is to accommodate light manufacturing, processing, fabrication, assembly, and storage of non-hazardous and/or non-obnoxious material and products as well as allowing service facilities for industries and their employees.

I-3: Industrial-3 District - Purpose is to provide a heavy industrial district designed to accommodate most industrial enterprises.

PL: Public Lands, Parks, Open Space and Facilities District – Purpose is to protect established public lands and to provide an area in the County for location of parks, public open space, government buildings and facilities, schools and school grounds, quasi-public buildings and facilities, and related open space.

P.U.D: Planned Unit Development - The purpose and objective is to encourage the development of land as a single unit. Allows greater flexibility in the design of a development, more variety and diversification in the relationships between buildings, open spaces and uses, and conservation and retention of historical and natural topographic features while meeting the goals, policies and objectives of the comprehensive plan.

P.U.D (P): P.U.D. permitted

R-1-C: Residential -1-C District - The purpose of the Residential-1-C District is to serve exclusively as a single-family district for smaller home sites and smaller homes.

RE: Residential Estate - Purpose is to serve exclusively as a single family detached residential district for larger lots and larger homes in a spacious, open environment away from higher density uses and where agricultural uses and the keeping of livestock are substantially restricted.

The following table shows a breakdown of the number of Tier II facilities and RMP sites in each incorporated jurisdiction in Adams County.

Table 4-44 Hazardous Materials Facilities, Tier II Facilities and RMP Site by Jurisdiction

Jurisdiction	# of Tier II Facilities	# of RMP Sites
Arvada	3	
Aurora	76	2
Bennett	1	
Brighton	15	
Commerce City	72	7
Federal Heights	2	
Lochbuie	2	
Northglenn	2	1
Thornton	77	1
Westminster	9	
Unincorporated	448	3
Total	707	14

Source: Adams County GIS

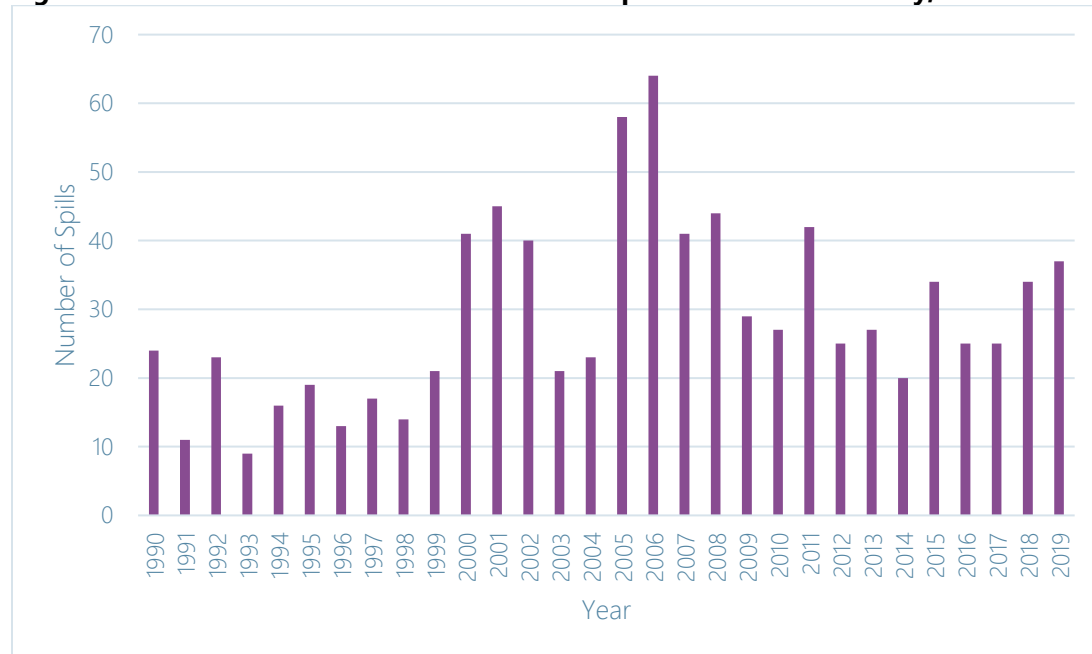
Previous Occurrences

Hazardous materials incidents occur regularly in Adams County. The 2018 Colorado State Hazard Mitigation Plan notes that Adams County has more transportation and fixed facility hazardous materials releases than any other Colorado county (excluding oil and gas well spills).

Statistics from the National Response Center (NRC), which serves as the primary national point of contact for reporting all oil, chemical, radiological, biological, and etiological discharges into the environment

anywhere in the United States and its territories, indicate that between 1990 and the end of 2019, 869 hazardous materials incidents were reported in Adams County. This number almost certainly excludes a number of very small spills that were not reported to the NRC. This translates to an average of 29 incidents per year. The trend over the last 30 years shows fewer incidents in the 1990s (average of 17 incidents per year), with the number of incidents more than doubling during the 2000s (average of 39 incidents per year), followed by a slight decline during the 2010s (average of 30 incidents per year).

Figure 4-22 Hazardous Materials Incidents Reported in Adams County, 1990-2019



Source: National Response Center

As shown in Table 4-45, the most common types of hazardous material incidents are fixed, with over half of incidents taking place at a fixed facility followed by mobile incidents.

Table 4-45 Hazardous Materials Incidents by Type, 1990 – 2019

Type of Incident	Number of Incidents	Percentage
Fixed	443	51%
Mobile	257	30%
Storage Tank	84	10%
Pipeline	51	5.9%
Unknown Sheen	14	1.6%
Railroad	6	0.7%
Continuous	5	0.6%
Aircraft	5	0.6%
Railroad Non-Release	4	0.5%
Total	869	

Source: National Response Center

While hazardous materials incidents can happen any time of day the most common month for an incident to occur is in the summer months, particularly in June and August. The following figures show the average number of hazardous materials incidents in Adams County in a given month.

Figure 4-23 Average Hazardous Materials Incidents by Month, 1990-2019

Source: National Response Center

Of these 869 reported incidents listed in the NRC data from 1990 through 2019, only 81 (9%) resulted in any reported injuries, fatalities, evacuations, or property damage. Those 81 incidents are listed as resulting in 8 fatalities, 108 injuries (93 requiring hospitalization), 22 evacuations (a total of 899 people) and \$399,000 in property damages. However, it is important to note that the NRC counts all injuries or damages resulting from an accident where hazardous materials were involved, whether or not the injuries or damages were caused by exposure to the hazardous substance; closer analysis shows that a majority of the injuries, fatalities, and property damages were from the physical impacts of the accident that caused the release, rather from exposure to hazardous materials themselves.

Probability of Future Occurrence

It is almost certain that a hazardous material incident will occur in Adams County in the next 10 years. While the County experiences 29 hazardous materials incidents per year on average, only 2.7 incidents a year cause injuries, fatalities, damage, or evacuations. The probability of future occurrence may be more likely in the City of Commerce City as a majority of the fixed facilities are located in the City's planning area.

Magnitude/Severity

Hazardous materials come in the form of explosives, flammable and combustible substances, poisons and radioactive materials. Hazards can occur during production, manufacturing, storage, transportation, use, or disposal. Impacts from hazardous materials releases can include:

- Fatalities
- Injury
- Evacuations
- Property damage
- Animal fatalities (livestock, fish & wildlife)
- Air pollution
- Surface or ground water pollution/contamination
- Interruption of commerce and transportation

Numerous factors influence the impacts of a hazardous materials release, including the type and quantity of material, location of release, method of release, weather conditions, and time of day. This makes it difficult to predict precise impacts. The impact to life and property from any given release depends primarily on:

- The type and quantity of material released.
- The human act(s) or unintended event(s) necessary to cause the hazard to occur.
- The length of time the hazard is present in the area.
- The tendency of a hazard, or that of its effects, to either expand, contract, or remain confined in time, magnitude, and space.
- Characteristics of the location and its physical environment that can either magnify or reduce the effects of a hazard.

The release or spill of hazardous materials can also require different emergency responses depending on the amount, type, and location of the spill incident.

The impacts of major hazardous materials incidents are potentially catastrophic, causing multiple deaths, property damage, and/or interruption of essential facilities and service for more than 72 hours. However, historically the impact of hazardous materials incidents in Adams County have been limited.

Climate Change Considerations

There are no known effects of climate change on human-caused hazards such as hazardous material incidents.

Vulnerability

As described above, GIS analysis was used to overlay the location of each Tier II facility and RMP site with dam inundation layers, wildland urban interface (WUI) intermix layers and 100-year and 500-year floodplain layers. The following table breakdown the number of Tier II facilities and RMP sites that are at risk of dam inundation, flooding or located within the WUI. Most hazardous materials facilities are located vulnerable to dam inundation followed by flooding. In total 189 hazardous materials facilities are at risk of a natural hazard event.

Table 4-46 Hazardous Material Facilities and Potential Hazard Risk

Hazard	# of Tier II Facilities	# of RMP Sites
Flood ¹	60	1
Dam Inundation	111	4
WUI Intermix Zones	13	
Total	184	5
Grand Total	189	

Source: Adams County GIS

¹Includes both 100-year and 500-year flood risk

People

Hazardous materials incidents impact on people is highly dependent on the location of the incident, but can cause injuries, hospitalizations, and even fatalities to people nearby. People living near hazardous facilities and along transportation routes may be at a higher risk of exposure, particularly those living or working downstream and downwind from such facilities. For example, a toxic spill or a release of an airborne chemical near a populated area can lead to significant evacuations and have a high potential for loss of life. As shown in Table 4-37, most of the Tier II facilities and RMP sites in unincorporated Adams County many are located in zone districts which permit single family residential uses.

Vulnerable populations can be more severely impacted by hazardous materials incidents. People with existing health risks or compromised immune systems could be severely affected by releases of even relatively low-impact materials. Low income families may be more likely to live in industrial areas or near hazardous materials routes. Individuals with disabilities may need more time to evacuate, so evacuation notices will need to be issued as soon as feasible, and communicated by multiple, inclusive methods.

General Property

The impact of most fixed facility incidents is typically localized to the property where the incident occurs. The impact of small spills during transportation may also be limited to the extent of the spill and remediated if needed. While cleanup costs from major spills can be significant, they do not typically cause significant long-term impacts to property.

Critical Facilities and Infrastructure

Impacts of hazardous material incidents on critical facilities are most often limited to the area or facility where they occurred, such as at a transit station, airport, fire station, hospital, or railroad. However, they can cause long-term traffic delays and road closures resulting in major delays in the movement of goods and services. These impacts can spread beyond the planning area to affect neighboring counties, or vice-versa. While cleanup costs from major spills can be significant, they do not typically cause significant long-term impacts to critical facilities.

Economy

The primary economic impact of hazardous material incidents results from lost business, delayed deliveries, property damage, and potential contamination. Large and publicized hazardous material-related events can deter tourists and recreationists and could potentially discourage residents and businesses. Economic effects from major transportation corridor closures can be significant not only for Adams County but also for the entire Denver-metro region.

Even small incidents have cleanup and disposal costs, and for a larger scale incident, these could be extensive and protracted. Evacuations can disrupt home and business activities. Large-scale incidents can easily reach \$1 million or more in direct damages, with clean-ups that can last for years.

Historic, Cultural, and Natural Resources

Hazardous material incidents may affect a small area at a regulated facility or cover a large area outside such a facility. Widespread effects occur when hazards contaminate the groundwater and eventually the municipal water supply, or they migrate to a major waterway or aquifer. Impacts on wildlife and natural resources can also be significant.

Future Development

While hazardous material sites are occasionally located near incompatible uses such as single-family homes, the County has set forth in their Comprehensive Plan to develop policies for the development of future hazardous materials facilities away from existing residential uses as well as a goal of increased coordination between the Planning Commission and the LEPC when reviewing development applications including changes to a parcels existing zone type.

Risk Summary

- There were 869 hazardous materials incidents reported between 1990-2019, an average of 29 incidents per year. Roughly half of these incidents were at fixed facility sites.
- Only 81 incidents resulted in injuries, fatalities, or evacuations, an average of 2.7 per year. However, most of the fatalities or injuries were caused by the accident, rather than from exposure to a hazardous material.

- 10 incidents between 1990-2019 caused damages to property resulting in \$399,000 in damages.
- There are 707 Tier II facilities and 14 RMP sites classified as Risk Management Plan facilities.
- *Related Hazards:* Cyber Incident, Dam Failure, Earthquake, Flood, Severe Thunderstorms, and Wildfire

Table 4-47 Hazardous Materials Incident Risk Summary

Jurisdiction	Geographic Location	Probability of Future Occurrence	Magnitude/Severity	Overall Significance
Adams County	Limited	Likely	Limited	Medium
Bennett	Significant	Likely	Limited	Medium
Brighton	Limited	Likely	Limited	Medium
Commerce City	Significant	Highly Likely	Critical	High
Denver Water	Limited	Likely	Negligible	Low

4.3.7 Winter Weather

Hazard Description

Winter storms can include heavy snow, ice, blizzard conditions, and extreme cold temperatures. Heavy snow can immobilize a region, stranding commuters, stopping the flow of supplies, and disrupting emergency and medical services. Accumulations of snow can collapse roofs and knock down trees and power lines. Severe winter storms can cause homes and farms to be isolated for days, and unprotected livestock may be lost. The cost of snow removal, damage repair, and business losses can have a tremendous impact on communities.

Heavy accumulations of ice can bring down trees, electrical wires, telephone poles and lines, and communication towers. Communications and power can be disrupted for days until damage can be repaired. Even small accumulations of ice may cause extreme hazards to motorists and pedestrians.

Some winter storms are accompanied by strong winds, creating blizzard conditions with blinding wind-driven snow, severe drifting, and dangerous wind chills. Strong winds with these intense storms and cold fronts can knock down trees, utility poles, and power lines. Blowing snow can reduce visibilities to only a few feet in areas where there are no trees or buildings. Serious vehicle accidents can result with injuries and deaths.

Extreme cold often accompanies a winter storm or is left in its wake. Prolonged exposure to the cold can cause frostbite or hypothermia and can become life-threatening. Infants and the elderly are most susceptible. Pipes may freeze and burst in homes or buildings that are poorly insulated or without heat. Extreme cold is most likely to occur in the winter months of December, January, and February. What constitutes extremely cold temperatures varies across different areas of the United States, based on normal climate temperatures for the time of year. In Colorado, cold temperatures are normal during the winter. When temperatures drop at least 20 degrees below normal winter lows, the cold is considered extreme and begins to impact the daily operations of a community. Extreme cold/wind chill impacts inanimate objects, plants, animals, and water supplies.

The effects of extremely cold temperatures are amplified by strong to high winds that can accompany winter storms. Wind-chill measures how wind and cold feel on exposed skin and is not a direct measurement of temperature. Animals are also affected by wind-chill; however, cars, buildings, and other objects are not.

Winter storms in Adams County, including intense winds and blizzard conditions, can result in property damage, localized power and phone outages, and closures of streets, highways, schools, businesses, and

nonessential government operations. People can also become isolated from essential services in their homes and vehicles. A winter storm can escalate, creating life threatening situations when emergency response is limited by severe winter conditions. Other issues associated with severe winter weather include hypothermia and the threat of physical overexertion that may lead to heart attacks or strokes. Snow removal costs can also impact budgets significantly. Heavy snowfall during winter can also lead to flooding or landslides during the spring if the area snowpack melts too quickly.

Geographic Location

Extensive - The entire County is susceptible to severe winter storms, and winter storms typically affect significant portions of the County.

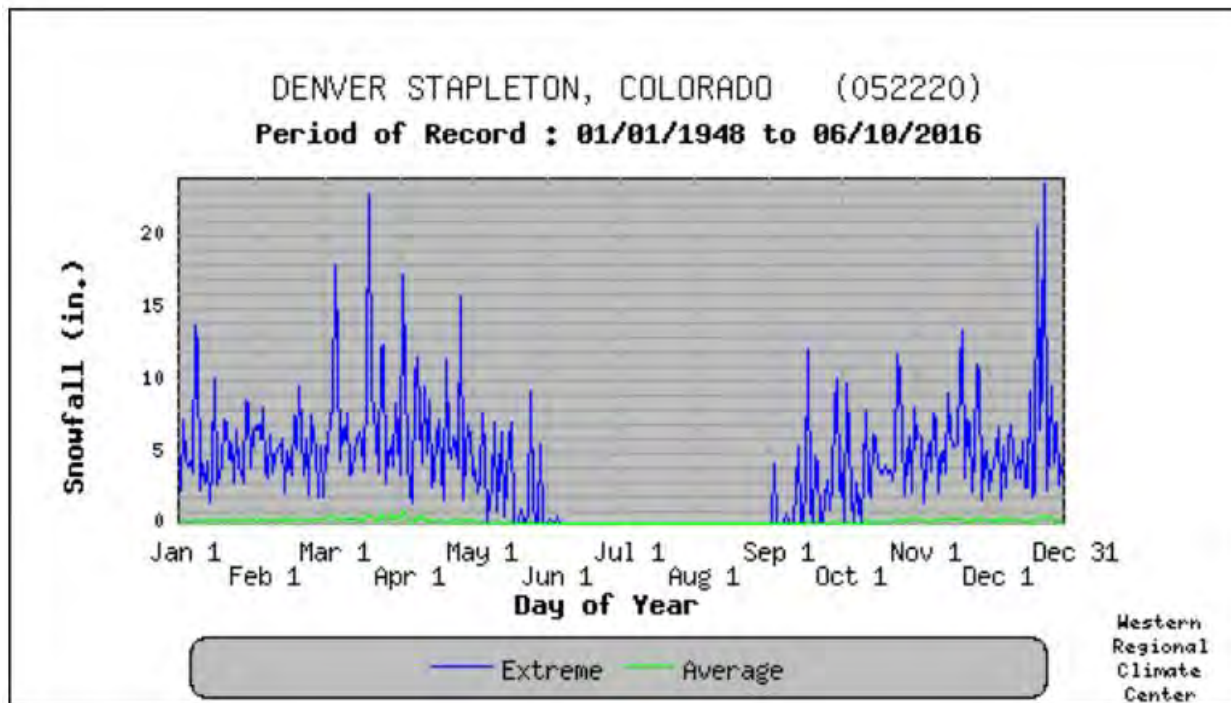
Adams County weather can be severe during the spring and winter months. There can be long periods of sub-degree temperatures in the winter. Blizzards can occur in late spring. Wind and snow blizzards cause whiteouts and drifting snow of 2 to 3 feet and more. Winds can be extremely strong, up to 100 mph in the spring.

Adams County is uniformly exposed to severe winter storms. Winter storms occur in many forms and can vary significantly in size, strength, intensity, duration, and impact. High winds create snowdrifts, which can block roads and create dangerous wind chill factors. Storms or freezing temperatures are not needed for wind chill conditions to become dangerous. The NWS issues a wind chill advisory when wind and temperature combine to produce wind chill values of 20 degrees from zero to 35 degrees below zero. Hypothermia and frostbite are two consequences of wind chill. Hypothermia is the most common winter weather killer in Colorado. Ice accumulation becomes a hazard by creating dangerous travel conditions. When ice accumulates on roadways, the risk of losing control of a vehicle becomes much greater.

Previous Occurrences

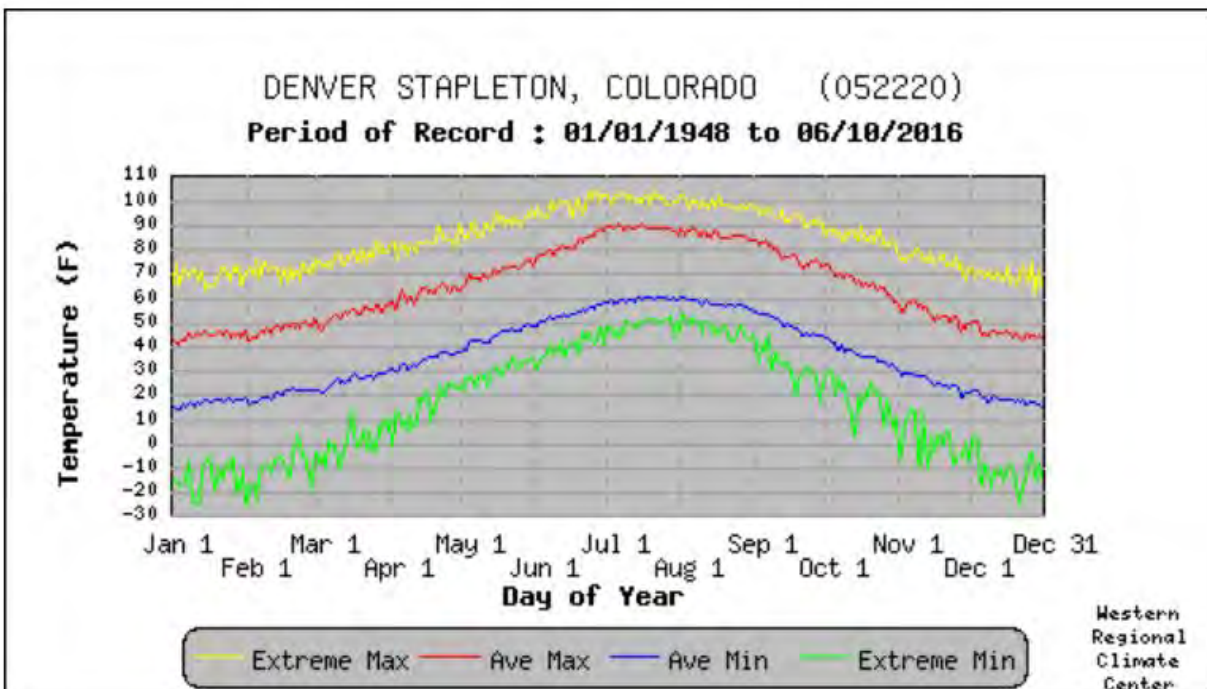
September through April is primary season for significant snowfalls, with December/January producing colder and dryer snow storms and March/April producing wet and heavy snowfall. The Western Regional Climate Center reports data from weather stations in and around Adams County. The data reported here is from the Denver WSFO AP, COOP Station number 052220 with a period of record of January 1, 1948 to June 10, 2016. Table 4-50 contains winter weather summaries for this weather station. Figure 4-24 and Figure 4-25 show daily snowfall and temperature averages and extremes.

Figure 4-24 Adams County Snowfall Averages and Extremes: 1948-2016



Source: Western Regional Climate Center

Figure 4-25 Adams County Temperature Averages and Extremes: 1948 – 2016



Source: Western Regional Climate Center

Several major winter storms and blizzards have occurred in the planning area over the past several decades. Profiles of some of the more severe storms were obtained from the NCEI Storm Events Database. According to the Database there have been 185 severe winter storm events (includes blizzard, heavy

snow, winter storm and winter weather events) between January 1, 1950 and December 31, 2018 that have impacted Adams County. Those 185 events resulted in four deaths, all of which were a result of extreme cold, and 17 injuries as a result of a blizzard event or extreme cold. The following table summarizes the events recorded in the Storm Events Database.

Table 4-48 NCEI Severe Winter Storm Event Reports for Adams County, 1950-2018

Event Type	# of Events	Property Damage (\$)	Crop Damage (\$)	Deaths	Injuries
Winter Storm	73	0	0	0	0
Winter Weather	34	0	0	0	0
Heavy Snow	45	0	0	0	0
Blizzard	25	\$18,600,000	0	0	2
Cold/Extreme Cold/Wind Chill	6	0	0	4	15
Frost/Freeze	2	0	\$10,000,000	0	0
Totals	185	\$18,600,000	\$10,000,000	4	17

Source: National Center for Environmental Information Storm Events Database, www.ncdc.noaa.gov/stormevents/

*Hazards with wide extents have losses which reflect larger zones that extend beyond Adams County

The Storm Events Database collects information on each event from a variety of sources including but not limited to, county, state and federal emergency management officials, newspaper clipping services, the insurance industry and the general project. Crop damages recorded in the Database should be considered broad estimates according to the National Weather Service. As discussed in the Section 4.3.3 Drought, the Cause of Loss Database maintained by the USDA Risk Management Agency helps to quantify the economic impact different natural hazards have on the agriculture in the County.

Crop losses as a result of winter weather events including, cold wet weather, cold winter, freeze and frost events, occurred in Adams County every year between 2007 and 2018. Freeze was the most common cause of loss, occurring in all 11 years. While the year 2015 experienced the most crop losses with over \$2 million in losses claimed and over 44,000 acres affected. In total, over 57,000 acres were affected, and over \$3 million losses claimed in that 11-year period due to winter weather related hazards.

Table 4-49 Crop Insurance Claims due to Winter Weather Related Hazards, 2007-2018

Year	Cause of Loss	Determined Acres	Indemnity Amount
2007	Frost	25.34	\$462
	Freeze	373.31	\$35,635
	Cold Winter	63	\$11,264
2008	Frost	31.34	\$2,885
	Freeze	760.20	\$59,440
	Cold Winter	261.80	\$67,228
2009	Freeze	297.81	\$15,214
	Cold Wet Weather	1,252.66	\$34,191
2010	Cold Winter	120.29	\$1,121
2011	Freeze	148.44	\$14,048
	Cold Winter	243.27	\$23,331
2012	Freeze	88.35	\$22,607
2013	Freeze	1,472.77	\$107,775
	Cold Winter	110.68	\$8,178
	Cold Wet Weather	380.49	\$13,799
2014	Freeze	165.13	\$8,604
2015	Freeze	33,544.18	\$1,523,813

Year	Cause of Loss	Determined Acres	Indemnity Amount
2016	Cold Winter	8,057.12	\$620,256
	Cold Wet Weather	3,101.31	\$176,386
	Freeze	77.70	\$5,191
	Cold Winter	105.86	\$9,818
2017	Frost	281.84	\$89,804
	Freeze	850.92	\$46,388
	Cold Winter	5,960.60	\$204,478
2018	Freeze	0.00	\$9,977
Total		57,774	\$3,111,892

Source: USDA RMA

The following event narratives were recorded in the Storm Events Database:

December 18, 1998 - An Arctic air mass settled in over northeastern Colorado dropping overnight temperatures well below zero for 6 consecutive days. Overnight temperatures bottomed out at 19 degrees below zero on the morning of the 22nd. At least 15 people, mostly homeless, were treated for hypothermia at area hospitals. The bitter cold weather was responsible, either directly or indirectly, for at least 5 fatalities. Three of the victims died directly from exposure. The cold weather also caused intermittent power outages. Following the cold snap, thawing water pipes cracked and burst in several homes and business causing extensive damage. No estimate of the damage, however, was available.

March 17, 2003 - A very moist, intense and slow moving Pacific storm system made its way across the four corners area and into southeastern Colorado from March 17th to the 19th, allowing for a deep easterly upslope flow to form along the Front Range. The storm dumped 31.8 inches of snow at the former Stapleton International Airport, good enough for second place in the Denver weather history record book. The storm also managed to vault March 2003 into first place for the snowiest March in Denver history and fifth place for the wettest March on record. In addition, the storm allowed the month of March to break a streak of 19 consecutive months of below normal precipitation in Denver. The Mayor of Denver said, "This is the storm of the century a backbreaker, a record breaker, a roof breaker." The heavy wet snow caused roofs of homes and businesses to collapse across the Urban Corridor. The snow also downed trees branches and power lines. Up to 135,000 people lost power at some point during the storms and it took several days in some areas to restore power. Avalanches in the mountains and foothills closed many roadways including Interstate 70 in both directions stranding hundreds of skiers and travelers. Denver International Airport (D.I.A.) was also closed stranding approximately 4000 travelers. In all the estimated cost of the damage to property alone (not including large commercial buildings) was \$93 million making it easily the costliest snowstorm ever in Colorado. The second costliest snowstorm was the 1997 blizzard where damage totaled \$10.5 million.

The HMPC shared the following severe winter storm event:

March 13 -14, 2019 – A "bomb" cyclone including extreme cold and blizzard conditions lasting for two days impacted the Denver metro area in March 2019. The Town of Bennett reported the Town's tornado siren was damaged as well as the roofs of several buildings. Businesses, schools and government operations, with the exception of Public Works in Bennett were closed for two day. Interstate 70 was also closed during the event leaving drivers stranded and vehicles abandoned. The Bennett Recreation Center was opened as a shelter for stranded drivers.

The City of Commerce City was also impacted by the severe winter storm and reported downed trees and power outages as a result of downed electrical lines. The City experienced minor damage to some of the

City's building roofs. Businesses and schools were closed for two days and government buildings for one days. East 96th Avenue was closed for the extent of the storm.

Probability of Future Occurrence

More damaging severe storms may have a slightly lower frequency of occurrence. Based on the data presented above, it is likely that a damaging winter storm will occur every 2.7 years. Based on the data presented above, there have been 185 winter storm events in the past 68 years that have occurred within the planning area. It is highly likely that in a given year the planning area will experience a severe winter storm.

Magnitude/Severity

Table 4-50 contains winter weather summaries from the Denver WSFO AP, COOP Station number 052220 with a period of record of January 1, 1948 to June 10, 2016.

Table 4-50 Adams County Winter Weather Summary in Inches

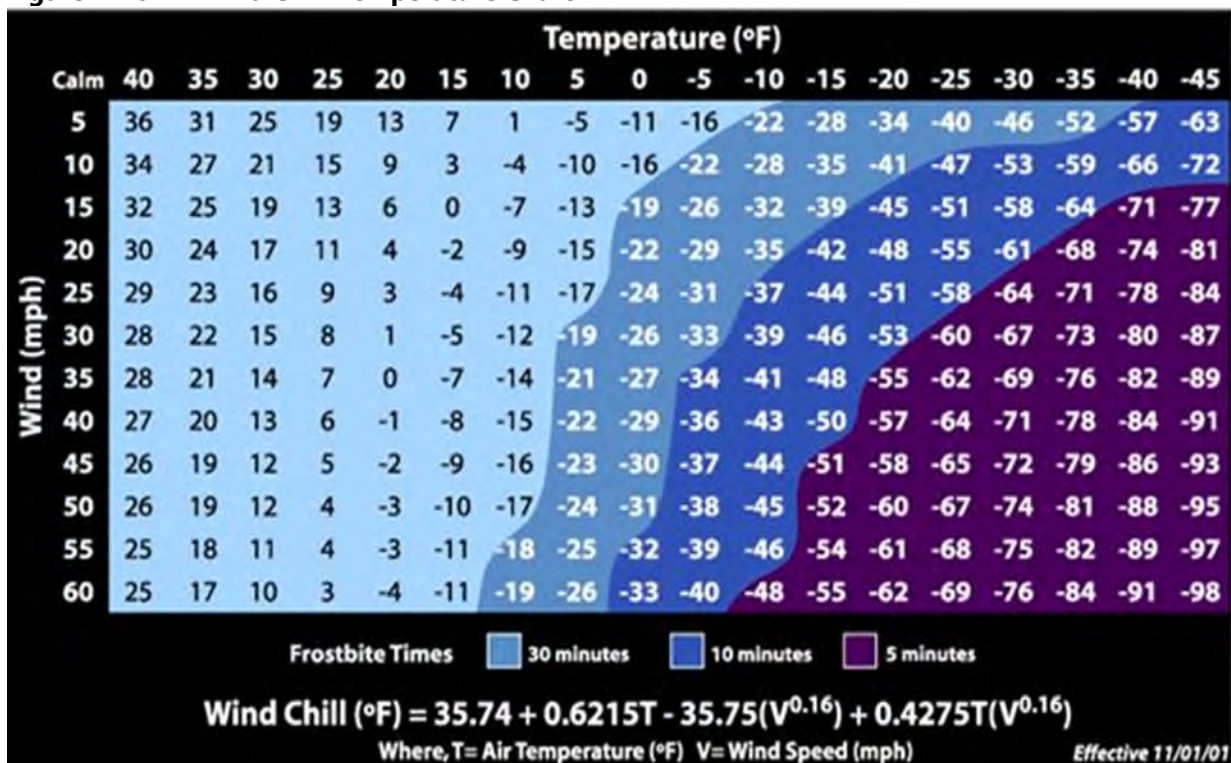
Average Annual Snowfall	Snowiest Month/Average Snowfall	Highest Daily Snowfall	Highest Monthly Snowfall	Highest Seasonal Snowfall	Average Snow Depth	Winter Average Minimum Temp.	Minimum Temp.	# of Days <32°F/Year
58	March 11.9"	35.2" March 2003	35.2" March 2003	112.0" 1959	1"	18.5°F	-25°F 2/1/1951	155.5

Source: Western Regional Climate Center, www.wrcc.dri.edu/ *Winter Months; December, January, February *Period of Record: 1/1/1948 – 6/10/2016

Overall, severe winter storm impacts could be limited, but the potential for heavy snow and blizzard events as defined by the National Weather Service are possible. Snow removal costs can impact budgets significantly. High snow loads also cause damage to buildings and roofs. Most property damages with winter storms are related to the heavy snow loads and vehicle accidents. The highest risk will be to travelers that attempt to drive during adverse conditions. People can also become isolated from essential services in their homes and vehicles. Economic impacts occur because of power outages and closures of Interstate 70 due leaving residents and visitors stranded as well as interrupting the transport of supplies and services into the area for an extended period. A winter storm can escalate, creating life threatening situations when emergency response is limited by severe winter conditions. Extreme cold associated with a severe winter storm can lead to frozen pipes as well as physical risks of hypothermia and the threat of physical overexertion that may lead to heart attacks or strokes.

In 2001, the National Weather Service (NWS) implemented an updated Wind Chill Temperature index, which is reproduced in Figure 4-26. This index was developed to describe the relative discomfort/danger resulting from the combination of wind and temperature. Wind chill is based on the rate of heat loss from exposed skin caused by wind and cold. As the wind increases, it draws heat from the body, driving down skin temperature and eventually the internal body temperature.

Figure 4-26 Wind Chill Temperature Chart



Source: National Weather Service

The NWS has defined winter season watches, warnings, and advisories based on specific criteria. The following is a breakdown on the various warnings that could be issued:

- **Ice Storm Warning** is issued when a period of freezing rain is expected to produce ice accumulations of 1/4" or greater, or cause significant disruptions to travel or utilities.
- **Heavy Sleet Warning** is issued when a period of sleet is expected to produce ice accumulations of 1" or greater, or cause significant disruptions to travel or utilities.
- **Heavy Snow Warning** is issued when snow is expected to accumulate 4 inches or more in 12 hours, or 6 inches or more in 24 hours.
- **Winter Storm Warning** is issued for a winter weather event in which there is more than one hazard present, and one of the warning criteria listed above is expected to be met.
- **Blizzard Warning** is issued for sustained wind or frequent gusts greater than or equal to 35 mph accompanied by falling and/or blowing snow, frequently reducing visibility to less than 1/4 mile for three hours or more. Watches are issued when conditions may be met 12 to 48 hours in the future.
- **Wind Chill Warning** is issued when wind and temperature combine to produce wind chill values of -35°F.
- **Winter Weather Advisory** is issued when wintry weather is expected, and caution should be exercised. Light amounts of wintry precipitation of patchy blowing snow will cause slick conditions and could affect travel if precautions are not taken

Climate Change Considerations

Climate change has the potential to exacerbate the severity and intensity of winter storms, including potential heavy amounts of snow. A warming climate may also result in warmer winters, the benefits of which may include lower winter heating demand, less cold stress on humans and animals, and a longer

growing season. However, these benefits are expected to be offset by the negative consequences of warmer summer temperatures which could have statewide economic impacts.

The effects of climate change in Colorado have already been observed. The following climate change observations are noted in the 2018 Colorado State Hazard Mitigation Plan:

- Snowpack, as measured by April 1, 2018 snow-water equivalent (SWE), has been mainly below average since 2000 in all of Colorado's river basins, but long-term (30-year, 50-year) declining trends have been detected.
- The timing of snowmelt and peak runoff has shifted earlier in the spring by 1 to 4 weeks across the state's river basins over the past 30 years, due to the combination of lower SWE since 2000, the warming trend in spring temperatures, and enhanced solar absorption from dust-on-snow.

Vulnerability

People

The threat to public safety is typically the greatest concern when it comes to impacts of winter storms. While virtually all aspects of the population are vulnerable to the potential indirect impacts of a winter storm, others may be more vulnerable, such as the elderly, particularly if there is a loss of electrical power. The weight of heavy continued snowfall and/or ice accumulating on power lines often brings them to the ground causing service disruptions for thousands of customers. According to data from the U.S. Department of Health and Human Services' empower Map site, 7,448 of the 56,909 Medicare Beneficiaries in the Adams County rely on electric-dependent medical equipment such as ventilators, to live independent in their homes. In addition, prolonged power outages can also have economic impacts if there is a loss of food in grocery stores and other facilities such as restaurants.

Cold and extreme cold temperatures have caused the majority of winter weather related casualties in the County. Infants, elderly and the homeless population are most vulnerable to the impacts of extreme cold. Exposure to extreme cold can cause frostbite or hypothermia and, in some cases, even death.

The region can experience high winds and drifting snow during winter storms that can occasionally isolate individuals and entire communities and lead to serious damage to infrastructure. Travelers on I-70 in the eastern portions of the planning area and residents of the Town of Bennett, can become isolated and visitors can become stranded, requiring search and rescue assistance and shelter provisions.

The impacts of winter weather on vulnerable populations can be more severe. As noted above, senior citizens in particular are much more vulnerable to cold temperatures, and slipping on ice can lead to severe injuries. People with disabilities or those who rely on home health care may be at increased risk if travel becomes difficult; similarly, individuals who are need regular dialysis treatments can become medical emergencies if roads are impassible.

General Property

Structural losses to buildings are possible and structural damage from winter storms in Colorado have resulted from severe snow loads on rooftops. Older buildings are more at risk, as are buildings with large flat rooftops (often found in public buildings such as schools). Vulnerability is influenced both by architecture and type of construction material and should be assessed on a building-by-building basis.

Critical Facilities and Infrastructure

Roads are especially susceptible to the effects of a winter storm, which can temporarily hinder transportation and require resources for snow removal. Interstate 70 is the only through road in the eastern Adams County and closure of the highway would leave the Town of Bennett isolated from emergency services. As noted under the people section, heavy snow accumulation may also lead to

downed power lines not only causing disruption to customers but also have potentially negative impacts on critical facilities in the county which may have cascading impacts on the County governments ability to operate.

Economy

Closure of Interstate 70 in eastern Adams County during winter storms could temporarily isolate Bennett. Depending on the length of the closure it could also hinder the local economy and the movement of goods through the county.

Historic, Cultural, and Natural Resources

Natural resources may be damaged by the severe winter weather, including broken trees and death of wildlife. Unseasonable storms may damage or kill plants and wildlife, which may impact natural food chains until the next growing seasons. Most of these impacts would be short-term. As noted previously, older, historic buildings could potentially be more vulnerable to roof and structural damage from heavy snow.

Future Development

Future buildings that conform to local building codes should be able to withstand snow loads from severe winter storms. Given building and population trends in the planning area, it is not anticipated that more persons will be exposed to the winter storm hazard in the future.

Risk Summary

- Winter storms often bring heavy snow and sometimes blizzard conditions to the County.
- In the past 68 years the County has experienced 185 winter storm events.
- Exposure to extreme cold has led to the majority of casualties (19) in Adams County.
- 7,448 Medicare Beneficiaries in the County rely on electric equipment and are more vulnerable to power outages due to a winter storm event.
- Winter weather resulted in over \$3 million in crop insurance claims and affected over 57,000 acres between 2007-2018. Freeze was the most common cause of loss.
- Severe winter weather can isolate residents and travelers by closing I-70 into and out of the eastern portions of the County.
- Heavy snow can lead to limited structural damage.
- Power outages are possible in severe winter storms.
- Related Hazards: Damaging wind

Table 4-51 Winter Weather Risk Summary

Jurisdiction	Geographic Location	Probability of Future Occurrence	Magnitude/Severity	Overall Significance
Adams County	Extensive	Highly Likely	Limited	High
Bennett	Extensive	Highly Likely	Critical	High
Brighton	Significant	Highly Likely	Limited	Medium
Commerce City	Significant	Highly Likely	Limited	Medium
Denver Water	Limited	Highly Likely	Negligible	Low

4.3.8 Subsidence

As defined by the United States Geological Survey (USGS), subsidence is the gradual settling or sudden sinking of earth's surface due to movement of earth materials. Primary causes of subsidence include

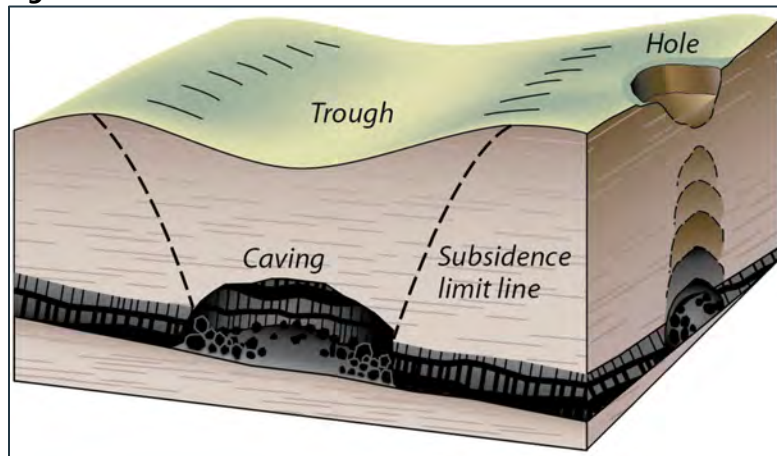
aquifer-system compaction, drainage of organic soils, underground mining, hydrocompaction, natural compaction, sinkholes, and thawing permafrost (USGS 2017). Depending on the cause, subsidence can occur rapidly or gradually, and it can be highly localized or uniformly affect a wide area.

Subsidence can be affected by periods of drought and precipitation. Collapsing soils are generally strong when dry but are subject to rapid collapse and can reduce in volume by 10 to 15% when wet.

Per the 2018 Colorado State Hazard Mitigation Plan, land subsidence is most common and of greatest concern in the sedimentary rocks over abandoned coal, hard rock, and clay mines. These areas are also referred to as undermined areas.

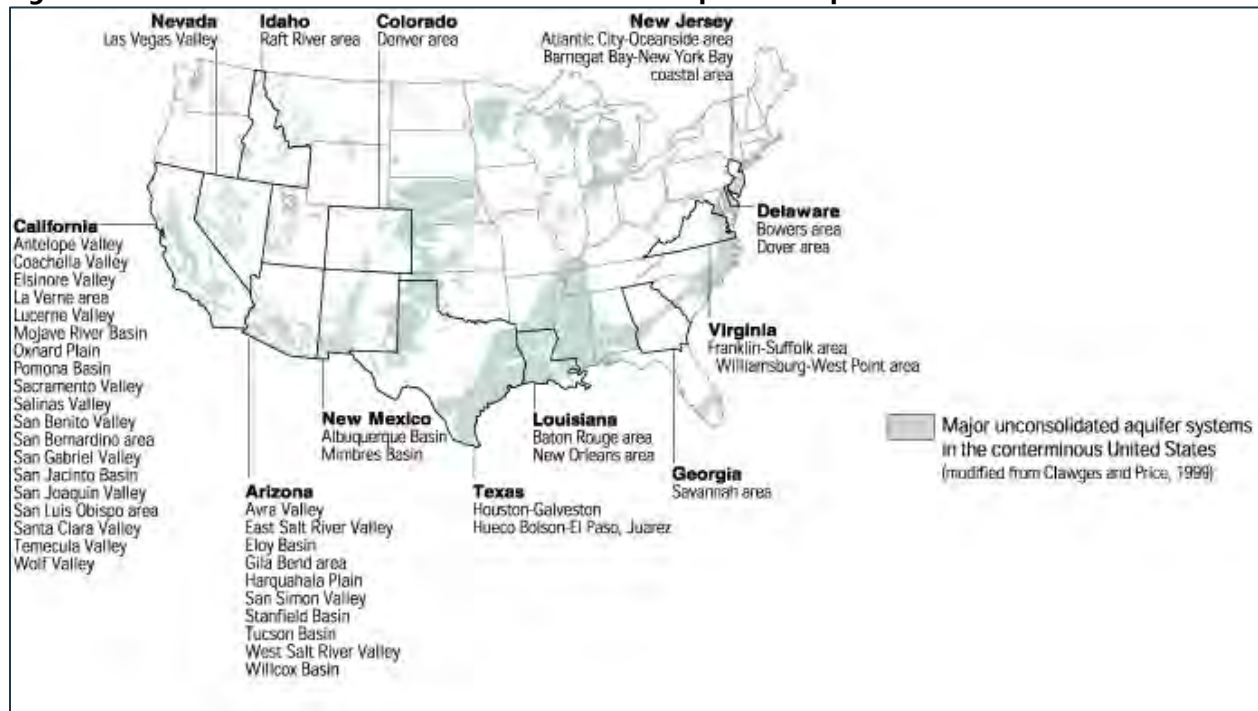
The Colorado Geological Survey defines mine subsidence as “the movement of the earth’s surface caused by the collapse of underground mine voids or entries. Over time, gravity and the weight of the rock overlying the mine cause the layers of rock to shift and fall downward into the mine area. As one layer falls down, the void moves upward toward the ground surface where it can cause holes, cracks, tilting, and sags. Even a few inches of settlement can cause significant damage to structures, roads, and utilities. Mine subsidence can occur abruptly or gradually over many years.” Figure 4-27 illustrates the underground causes of coal mine subsidence and depicts how the impacts can manifest at the surface (CGS 2010).

Figure 4-27 Coal Mine Subsidence

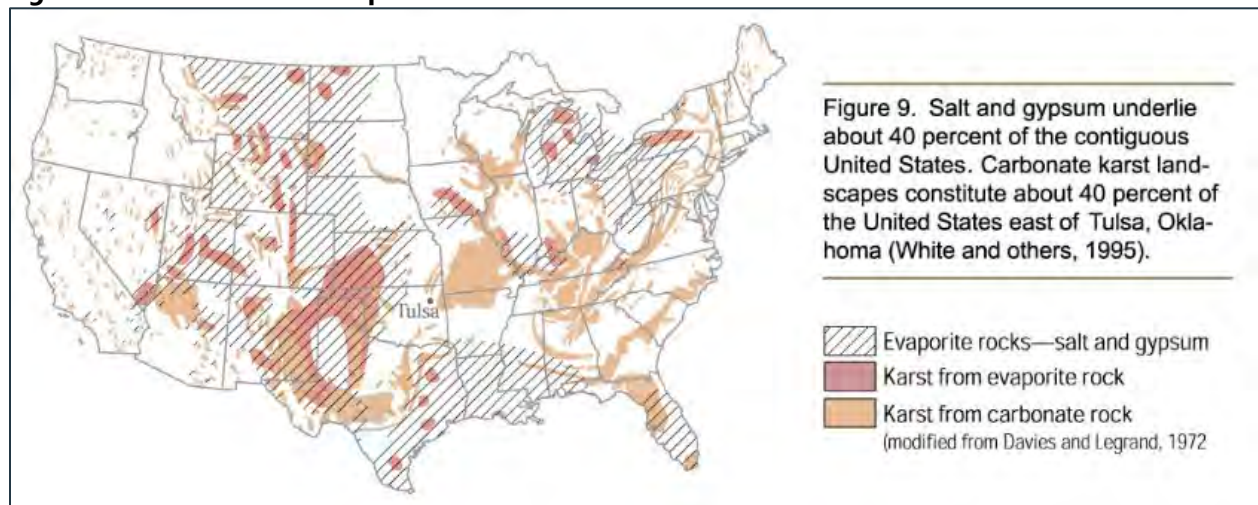


Source: Colorado Geological Survey

The State plan notes that land subsidence can also happen where significant groundwater extraction occurs as well as where evaporite bedrock dissolves and forms areas with karst morphology, which are characterized by underground drainage systems such as caverns or caves. Figure 4-28 shows that there is some potential for subsidence due to aquifer compaction around Adams County. Figure 4-29 shows that evaporite rocks generally underlie the Adams County area. However, these rock formations may not be near enough to the surface to pose a subsidence risk.

Figure 4-28 Areas of Potential Subsidence Due to Aquifer Compaction

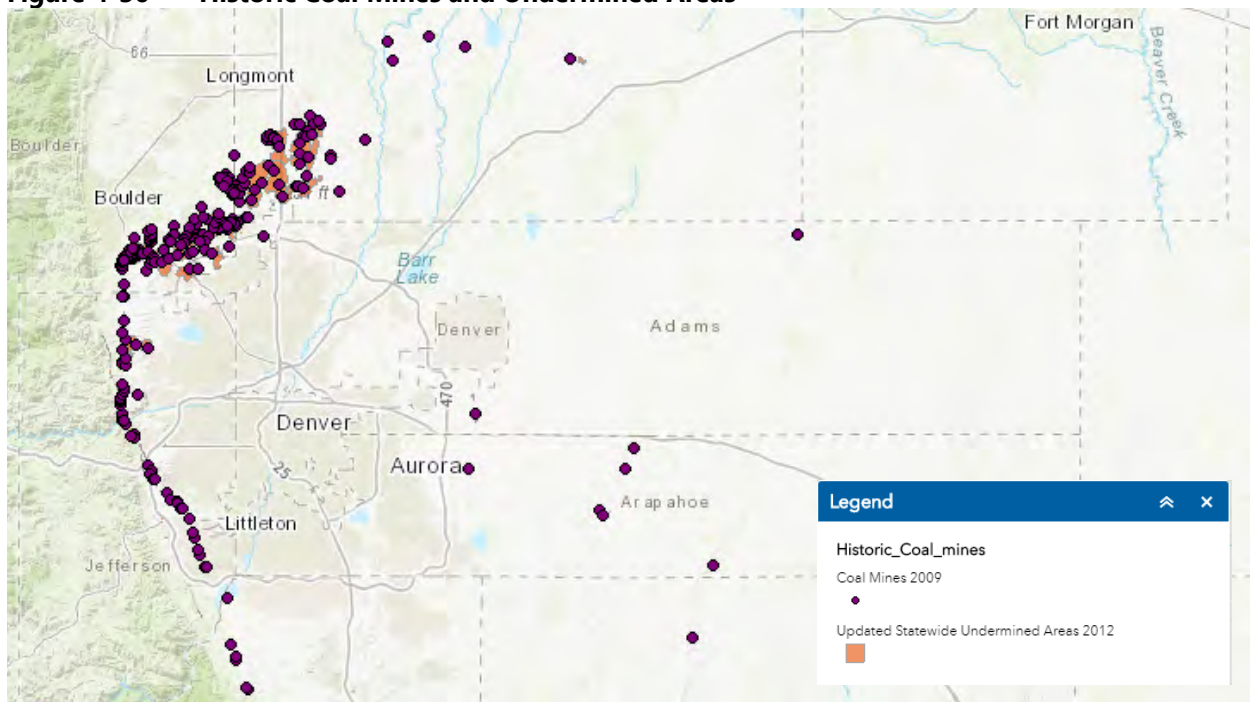
Source: USGS Fact Sheet-165-00, December 2000

Figure 4-29 Karst and Evaporite Rock Formations

Source: USGS Fact Sheet-165-00, December 2000

Geographic Location

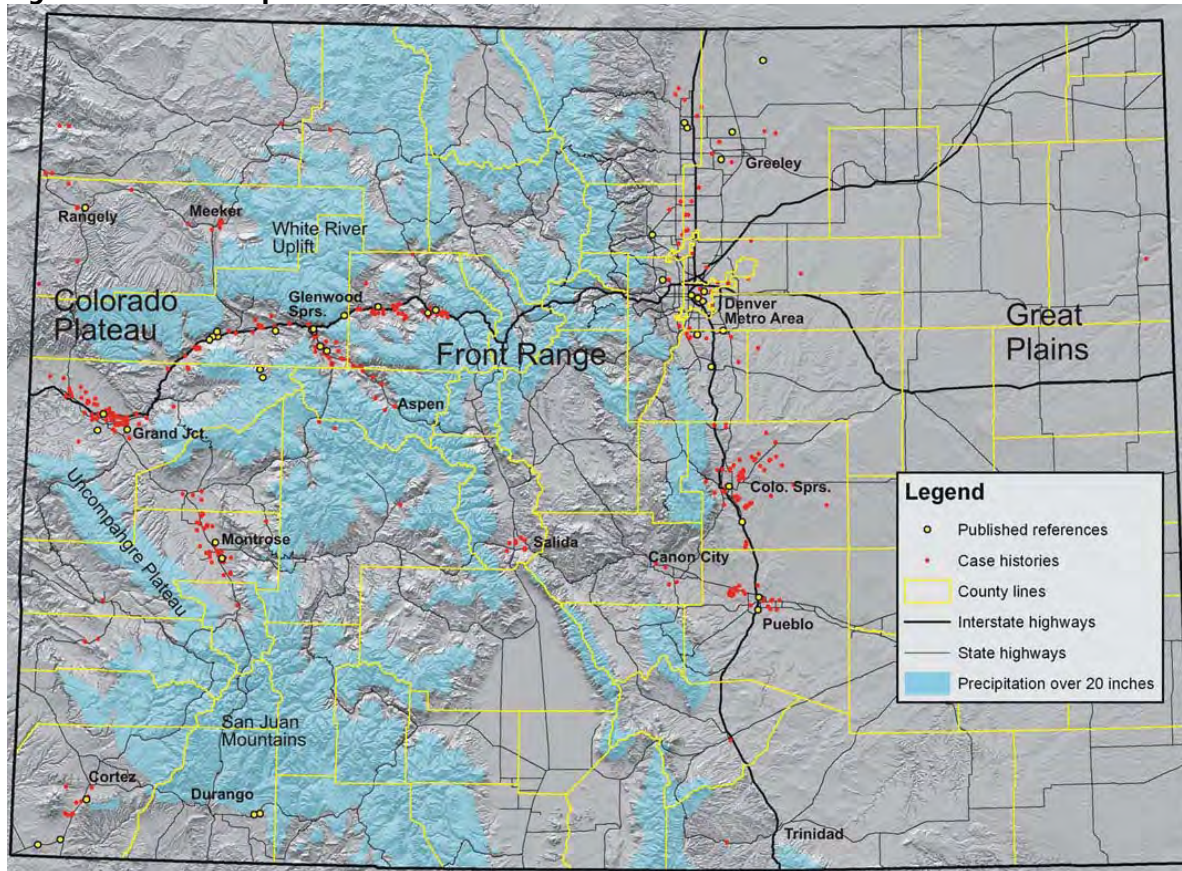
According to the 2018 Colorado State Hazard Mitigation Plan and data from the Colorado Geological Survey, Adams County does not contain potential natural subsidence areas, karst, or sinkholes. However, there are a number of known abandoned mines in the county, as shown in Figure 4-30. (Each dot may represent more than one mine.) These historic coal mines indicate areas of potential undermined areas. Additionally, areas of historic collapsible soil events, shown in Figure 4-31, may be susceptible to future subsidence.

Figure 4-30 Historic Coal Mines and Undermined Areas

Source: Colorado Geological Survey

Previous Occurrences

Subsidence has been an issue historically along the Front Range; however, Adams County has limited case history of collapsible soil issues. Colorado Geological Survey identifies several past collapsible soil incidents in the County, as shown in Figure 4-31, but event details are not available.

Figure 4-31 Collapsible Soil Case Histories in Colorado

Source: Colorado Geological Survey cited in 2018 Colorado State Hazard Mitigation Plan

Probability of Future Occurrence

Due to the presence of collapsible soils and historic coal mines in the planning area, future subsidence events are possible. However, without clear data on historic occurrences, future probability is difficult to predict.

Probability of subsidence is influenced by flood and drought, both of which are likely to occur. Periodic flooding and draining of abandoned mines can cause shifts in mine structures and increase the risk of subsidence. Development activities that cause ground vibrations may also accelerate subsidence. Additionally, as development continues and expands into undermined areas, the probability of damaging subsidence events will increase. Similarly, with continued demand for mined materials, mining activities may expand and increase the area of exposure to subsidence and the probability of subsidence occurrences.

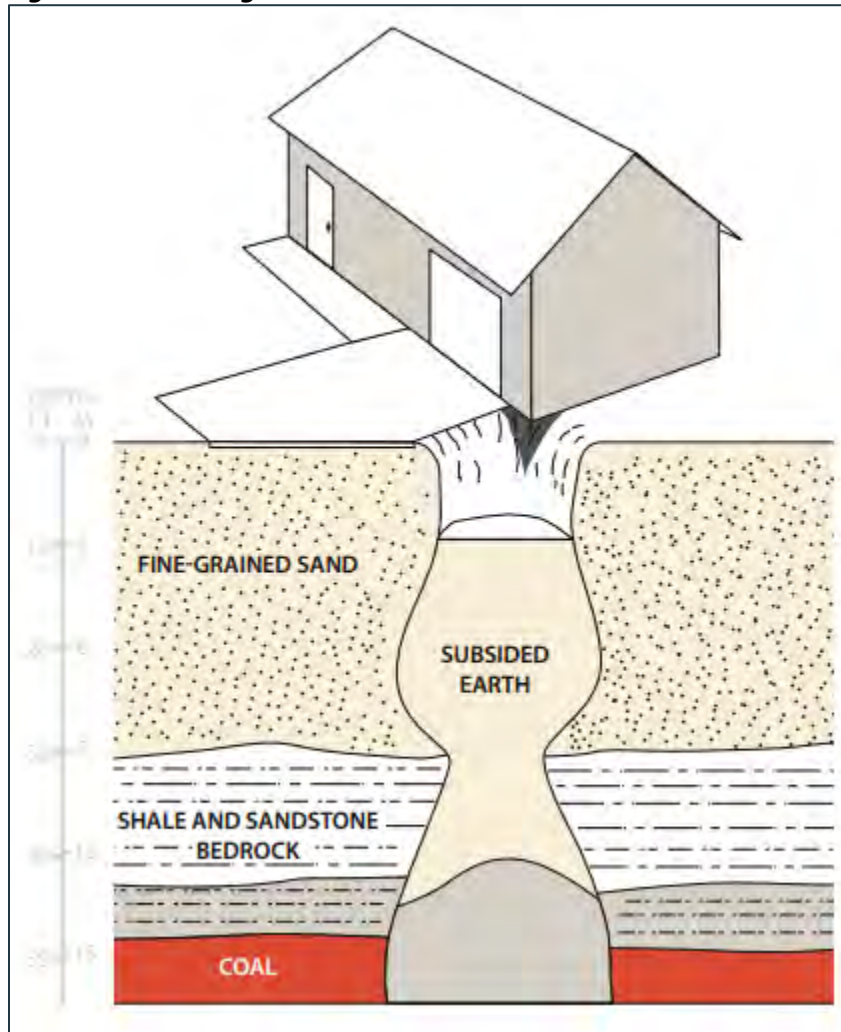
Given there is some limited evidence of past occurrences, it can be reasonably concluded that there is at least a 1% annual chance of some degree of subsidence within the County; therefore, future probability is considered occasional. On a smaller scale, an individual property can be examined for subsidence probability by performing site-specific investigations and exploratory drilling to determine whether the area is undermined. These tests can also allow for mitigation prior to construction.

Magnitude/Severity

The magnitude of a subsidence event can vary substantially, from a gradual settling to an abrupt ground opening. The extent of subsidence depends on the soil composition and susceptibility to collapse. In the case of subsidence related to undermined areas, the severity depends on the depth and geometry of the mine, how much coal was extracted, the overlying geology, and groundwater fluctuations (CGS 2010). Areas can appear to be free of subsidence for many years, and then undergo renewed gradual or even drastic subsidence.

Figure 4-32 shows an example of how a subsidence hole might form under a structure.

Figure 4-32 Diagram of Subsidence Pit Under a Structure



Source: State of Colorado Department of Natural Resources Colorado Division of Reclamation, Mining & Safety and the Colorado Geological Survey; Turney, J.E., 1985, Special Publication 26, Subsidence Above Inactive Coal Mines: Information for the Homeowner

Climate Change Considerations

The future impacts of climate change are not expected to influence future subsidence or abandoned mine land hazard events. However, related hazards of drought and flood, which may affect subsidence occurrence and severity, are likely to be impacted by climate change. See Section 4.3.3. and Section 4.3.5 for discussions of climate change considerations for drought and flood, respectively.

Vulnerability

Risk to subsidence is difficult to quantify for Adams County due to the limited data on undermined areas and collapsible soils. Additionally, risk varies greatly depending on the magnitude of the event. The vulnerability information below is based on qualitative and anecdotal information.

People

In most cases of subsidence, injuries and fatalities are unlikely to occur. However, when abandoned mine lands or collapsible soils result in sinkholes, people may be injured if they are directly at the event location or are in structures or infrastructure that are affected by the event.

General Property

Subsidence can cause anything from minor cracking in structures and building foundations to complete undermining of structural integrity and building collapse. Roads, irrigation ditches, underground utilities, and pipelines can also be impacted. It is possible that many homes have been built over undermined areas and may be at risk to subsidence.

Critical Facilities and Infrastructure

Roads, utilities, irrigation ditches, pipelines, and other critical facilities may sustain damage from subsidence, ranging from minor cracking in road surfaces to major destruction. Damages to roads or utilities may cause interruptions in continuity of services.

Economy

Localized subsidence events are unlikely to affect the County's economy, however the repair costs for buildings, irrigation works, roads, utilities, and other infrastructure can be high. Additionally, remediation costs can be high due to costly foundation shoring or cost of stabilization of the hole itself.

Historic, Cultural, and Natural Resources

When subsidence occurs as a result of groundwater pumping it can have irreversible consequences for water supply. Excessive pumping can cause soil compaction that reduces the size and number of open pore spaces in the soil that previously held water, resulting in a permanent loss of storage in the aquifer system.

Future Development

Future growth and development throughout Adams County will increase demand for water. If this increased demand results in increases in groundwater extraction, land subsidence due to aquifer compaction may become more common.

Future development may also increase risk by increasing exposure to subsidence. Many old mines are located near present urban areas, and as urban areas grow and expand, development may occur over undermined areas. According to the 2018 Colorado State Hazard Mitigation Plan, as Colorado's population has grown in the past 25 years, many homes have been built over abandoned mines and many homeowners are unaware of this hazard.

Risk Summary

- Adams County is at risk to subsidence from collapsible soils and undermined areas.
- Related hazards: Flood, Drought

Table 4-52 Subsidence Risk Summary

Jurisdiction	Geographic Location	Probability of Future Occurrence	Magnitude/Severity	Overall Significance
Adams County	Limited	Occasional	Limited	Low
Bennett	Limited	Unlikely	Limited	Low
Brighton	Limited	Occasional	Limited	Low
Commerce City	Limited	Likely	Negligible	Low
Denver Water	Limited	Unlikely	Limited	Low

4.3.9 Terrorism/Active Shooter

Hazard Description

There is no single globally agreed-upon definition of terrorism. In a broad sense, terrorism is the use of violence and threats to intimidate or coerce, especially against civilians, in the pursuit of political aims. Terrorism is defined in the United States by the Code of Federal Regulations as “the unlawful use of force or violence against persons or property to intimidate or coerce a government, civilian population, or any segment thereof, in furtherance of political or social objectives.”

For this analysis, this hazard encompasses the following sub-hazards: terrorist attack, biological terrorism, agroterrorism, chemical terrorism, and radiological terrorism. Active shooter incidents, while not usually politically motivated, are also included in this profile. Cyber terrorism is discussed under Section 4.3.1 Cyber Incident.

A **terrorist attack** is an attack by terrorist groups or individuals against civilians. Another term sometimes used for these types of incidents is “violent extremist attacks.” These may involve:

- Coordinated tactical assaults by multiple attackers, such as the 2008 attacks on Mumbai, India;
- Sniping attacks from a distance, as with the 2014 Pennsylvania State Police barracks attack;
- Use of explosives, such as the 2013 Boston Marathon bombing;
- Arson, as in the 1998 arson attack at Vail Ski Resort.

The term **CBRNE** is also sometimes used to refer to the malicious use of Chemical, Biological, Radiological, Nuclear, or Explosive weapons and devices with the intent to cause significant harm or disruption. These weapons are detailed separately below.

Historically **explosives** have been the most common terrorist weapon, accounting for 51% of all attacks since 1970. Hazard impacts are typically instantaneous; secondary devices may be used, lengthening the duration of the hazard until the attack site is determined to be clear. The extent of damage is determined by the type and quantity of explosive. Effects are generally static other than cascading consequences and incremental structural failures. Some areas could experience direct weapons’ effects: blast and heat; others could experience indirect weapons’ effect.

Biological terrorism is the use of biological agents against persons or property. Liquid or solid contaminants can be dispersed using sprayers/aerosol generators or by point of line sources such as munitions, covert deposits and moving sprayers. Biological agents vary in the amount of time they pose a threat. They can be a threat for hours to years depending upon the agent and the conditions in which it exists.

A biological attack could also take the form of **agroterrorism**, directed at causing societal and economic damage through the intentional introduction of a contagious animal disease or fast-spreading plant disease that affects livestock and food crops and disrupts the food supply chain. Such an attack could

require the agriculture industry to destroy livestock and food crops, disrupt the food supply both nationally and globally, and could also affect consumer confidence in the food supply resulting in tremendous economic damage for potentially an extended period.

Chemical terrorism involves the use or threat of chemical agents against persons or property. Effects of chemical contaminants are similar to biological agents.

Radiological terrorism is the use of radiological materials against persons or property. Radioactive contaminants can be dispersed using sprayers/aerosol generators, or by point of line sources such as munitions, covert deposits and moving sprayers or by the detonation of a nuclear device underground, at the surface, in the air or at high altitude.

The U.S. Department of Homeland Security (DHS) defines an **active shooter** as “an individual engaged in attempting to kill people in a confined space or populated area.” While many terrorist attacks can also be described as active shooter incidents, here the term is used to refer to non-politically motivated incidents such as recent tragic incidents at schools, places of worship, and workplaces; these attacks are also sometimes called mass shootings. Active shooters typically use firearms although for the purposes of this plan the definition of active shooter is broad and intended to include attacks such as vehicle and knife attacks. The motivations for committing such acts range from retribution for a perceived injustice; to acts of violence against racial minorities, LGBTQ persons, or others; to promoting a specific social or political goal. Typically, active shooters are not interested in taking hostages or attaining material gain, and frequently aren’t even interested in their own survival. Unlike organized terrorist attacks, most active shooter incidents are carried out by one or two individuals.

The U.S. State Department designates 63 groups as Foreign Terrorist Organizations around the world. There is no similar list of domestic terrorist groups. The Global Terrorism Database (GTD) maintained by the National Consortium for the Study of Terrorism and Responses to Terrorism lists 241 groups known or suspected of carrying out terrorist attacks on U.S. soil since 1970.

The Southern Poverty Law Center (SPLC) reports 22 active hate groups in Colorado, as shown in Table 4-53. The SPLC defines a hate group as any group with “beliefs or practices that attack or malign an entire class of people – particularly when the characteristics being maligned are immutable.” It is important to note that inclusion on the SPLC list is not meant to imply that a group advocates or engages in violence or other criminal activity. None of the hate groups identified by the SPLC have a specifically identified footprint in Adams County, although several are located in the Denver metro area and any group with a statewide footprint may also have a presence in the area.

Table 4-53 Hate Groups Active in Colorado

Group	Ideology	City
ACT for America	Anti-Muslim	Denver
American Guard	General Hate	Statewide
Asatru Folk Assembly	General Hate	Statewide
Atomwaffen Division	Neo-Nazi	Statewide
Colorado Alliance for Immigration Reform	Anti-Immigrant	Lakewood
Family Research Institute	Anti-LGBT	Colorado Springs
Generations	Anti-LGBT	Elizabeth
Identity Evropa	White Nationalist	Denver
Identity Evropa	White Nationalist	Colorado Springs
Identity Evropa	White Nationalist	Boulder

Group	Ideology	City
Israel United In Christ	Black Nationalist	Denver
Mass Resistance	Anti-LGBT	Denver
MSR Productions	Hate Music	Wheat Ridge
Nation of Islam	Black Nationalist	Denver
Northern Kingdom Prophets	Black Nationalist	Pueblo
Patriot Front	White Nationalist	Statewide
Pray in Jesus Name Project, The	Anti-LGBT	Colorado Springs
Proud Boys	General Hate	Statewide
Scriptures for America Worldwide Ministries	Christian Identity	Laporte
Soldiers of Odin	Anti-Muslim	Denver
The Right Stuff	White Nationalist	Statewide
Traditionalist Worker Party	Neo-Nazi	Statewide

Source: Southern Poverty Law Center www.splcenter.org/states/colorado

Terrorist attacks and active shooter incidents can happen anywhere and generally take place with no warning. Duration is dependent on the parameters of the incident; while the incidents themselves are usually relatively short, residual impacts on the community can be long-lasting. The threat of terrorism, both international and domestic, is ever present, and an attack can occur when least expected.

Geographic Location

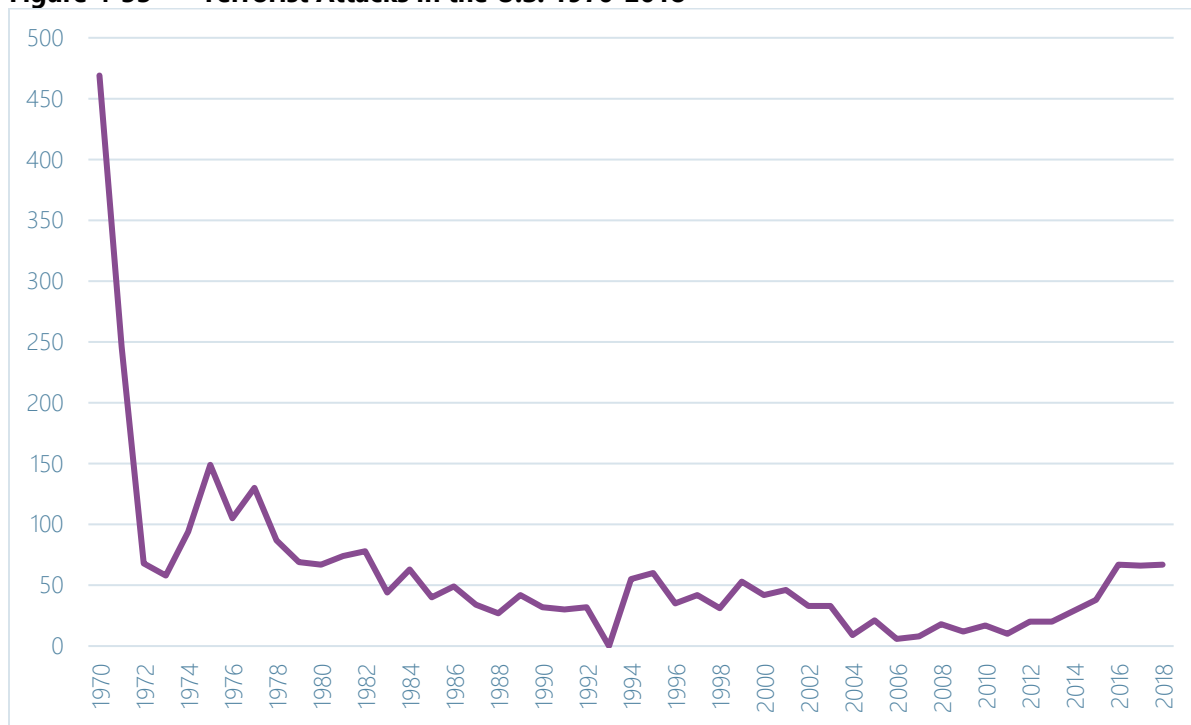
Terrorist attacks can occur at any location, but are more likely to target highly populated areas, critical infrastructure, or symbolic locations.

Active shooter incidents can potentially happen at any mass gathering, including workplaces, schools, places of worship, or concerts and special events. A 2014 FBI study of 160 active shooter incidents between 2000 and 2013 found that 45.6% of the incidents took place in a commercial environment, followed by 24.3% in an educational location, with the remaining 30.1% divided between outdoors, military and other government properties, residential properties, houses of worship, and health care facilities.

Previous Occurrences

Terrorism

The Global Terrorism Database (GTD) includes more than 190,000 terrorist attacks dating back to 1970. GTD data shows that despite public perception the number of terrorist attacks on US soil has decreased over recent decades, as shown in Figure 4-33. From an average of 147.5 incidents per year in the 1970s, the frequency of attacks declined to 51.8 per year in the 1980s, then to 37.0 per year in the 1990s, and to 22.8 per year in the 2000s. An increase in attacks from 2015 through 2018 brought that average back up to 39.6 incidents per year for 2011 through 2018 (the most recent year the GTD has analyzed), but this is still well below the frequency seen in the 70s and 80s.

Figure 4-33 Terrorist Attacks in the U.S. 1970-2018

Source: Study of Terrorism and Responses to Terrorism (START) Global Terrorism Database (GTD) <https://www.start.umd.edu/gtd/>

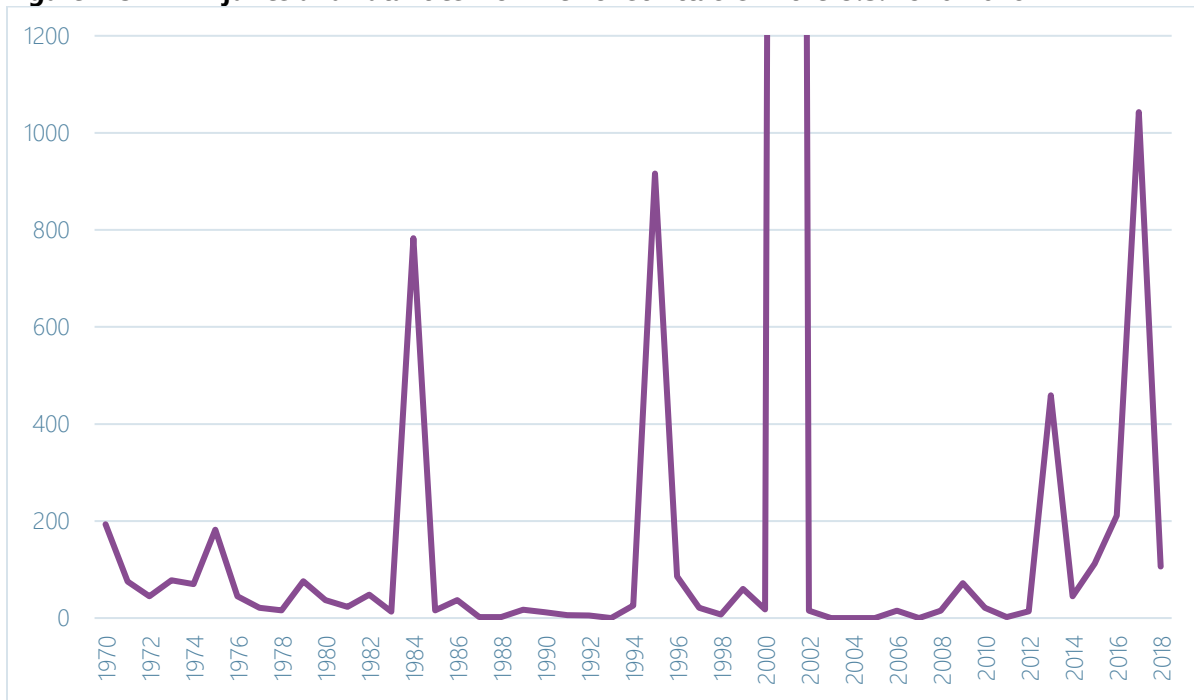
A 2017 U.S. Government Accountability Office report “Countering Violent Extremism” found that of 85 violent extremist incidents resulting in death in the U.S. since September 12, 2001, right wing groups were responsible for 73% of attacks while radical Islamist groups were responsible for 27%.

Unfortunately, the number of people injured or killed in terrorist attacks in the U.S. has not matched the decline in number of attacks, as can be seen in Figure 4-34. (Note that the 12,645 people injured or killed in 2001 extends off the top of the graph in order to make the differences between other years easier to see.) However, this data is to a large extent skewed by a handful of deadly attacks:

- The September 11, 2001 attacks on New York and Washington D.C., which killed 1,385 and injured 10,878 – more than all other terrorist attacks in the U.S. since 1970 combined.
- The October 1, 2017 shooting at the Route 91 Harvest Festival concert in Las Vegas, Nevada, which killed 59 and wounding 851.
- The April 4, 2013 Boston Marathon Bombing killed 3 and injured 264.
- The April 19, 1995 bombing of the Murrah Federal Building in Oklahoma City, killing 168 and injuring 650.
- The September – October 1984 salmonella food poisoning attack in Dalles, Oregon, which sickened 751 people.

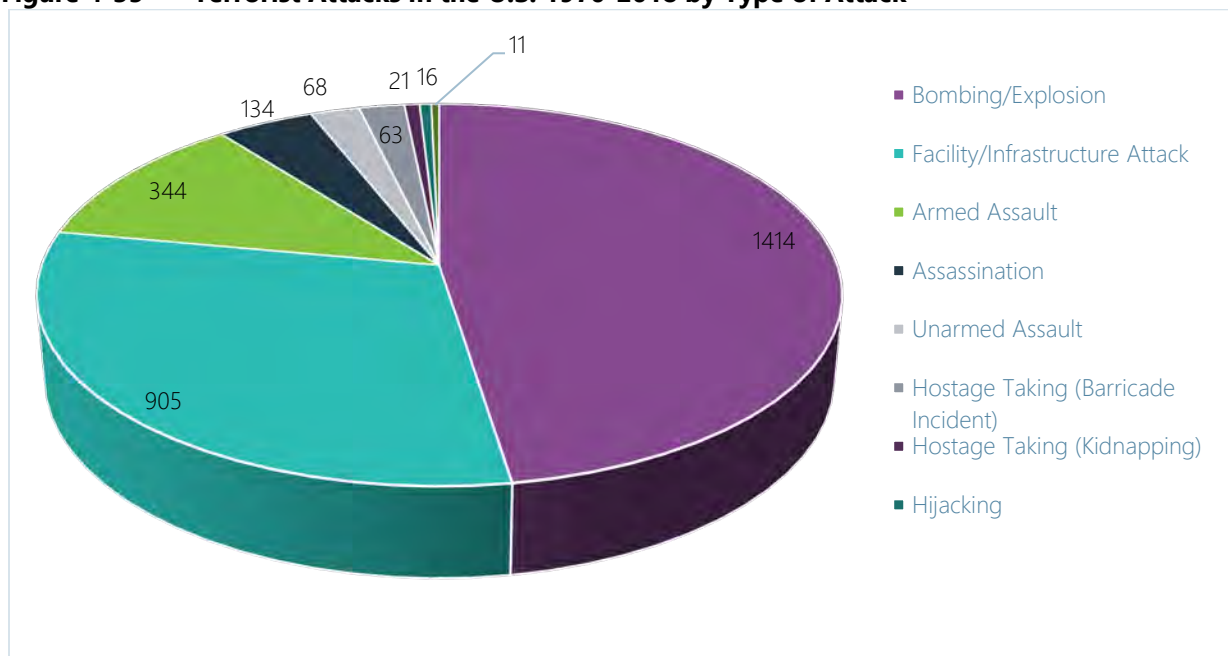
Of the 49 years since 1970 through 2018, only 10 (20%) saw more than 100 injuries or fatalities nationally, and most years saw fewer than 25 casualties.

Figure 4-34 Injuries and Fatalities from Terrorist Attacks in the U.S. 1970-2018



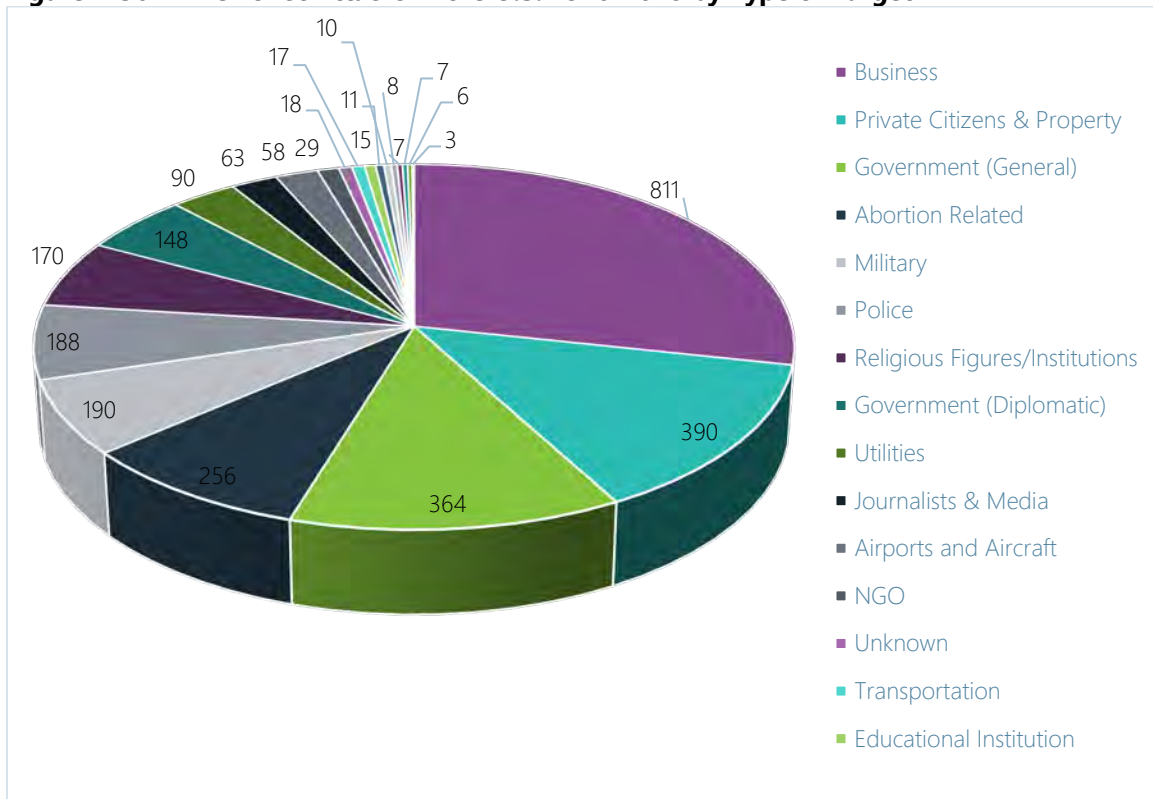
Source: Study of Terrorism and Responses to Terrorism (START) Global Terrorism Database (GTD) <https://www.start.umd.edu/gtd/>

Figure 4-35 Terrorist Attacks in the U.S. 1970-2018 by Type of Attack



Source: Study of Terrorism and Responses to Terrorism (START) Global Terrorism Database (GTD) <https://www.start.umd.edu/gtd/>

Figure 4-36 Terrorist Attacks in the U.S. 1970-2018 by Type of Target

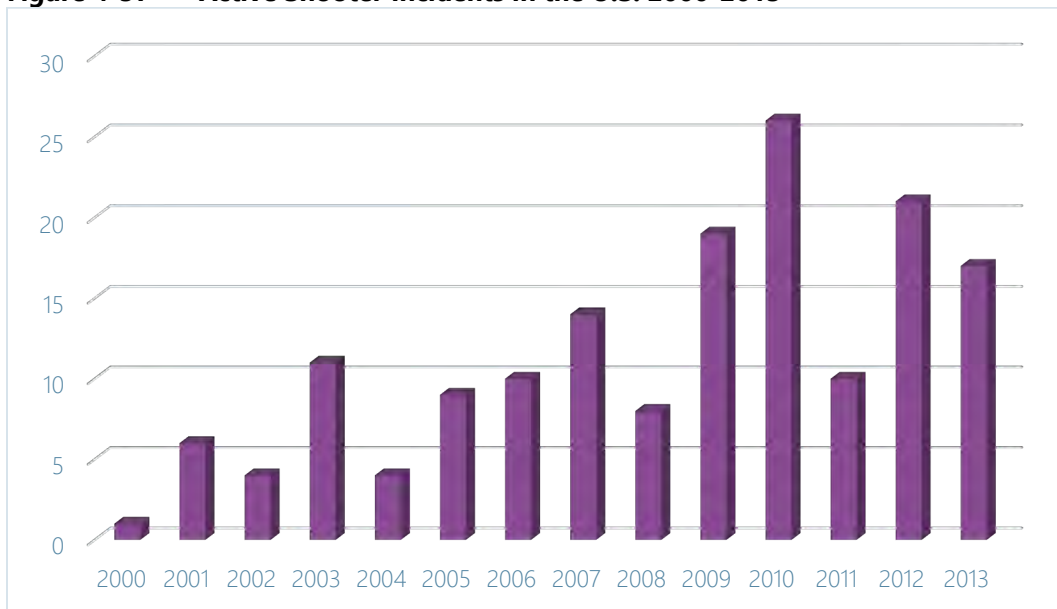


Source: Study of Terrorism and Responses to Terrorism (START) Global Terrorism Database (GTD) <https://www.start.umd.edu/gtd/>

The use of CBRNE weapons other than explosives outside of war zones is rare but not unprecedented. Nonetheless, the high potential impact of such attacks makes them a hazard of concern nationally.

Active Shooter Incidents

Figure 4-37 Active Shooter Incidents in the U.S. 2000-2013



Source: FBI, A Study of Active Shooter Incidents in the United States Between 2000 and 2013

While the number of terrorist attacks in the U.S. has generally declined in recent decades, the number of active shooter incidents appears to be on the rise. Although there is much uncertainty and debate around exactly what constitutes an active shooter incident, the 2014 FBI study reported that 160 such incidents took place between 2000 and 2013. The frequency of attacks increased sharply during the 13 years of the study, from an average of 6.4 incidents per year in the first seven years of the study to 16.4 per year in the last seven years. The 160 incidents resulted in 1,043 casualties (486 killed and 557 wounded, excluding the shooters), an average of 6.5 casualties per incident.

School violence is sometimes considered as a subset of active shooter incidents (although not all school incidents involve the use of firearms). The U.S. Secret Service conducted a study of incidents of "targeted school violence" in the U.S. from 2008 to 2017, which they defined as "any incident in which (i) a current or recently former K-12 school student (ii) purposefully used a weapon (iii) to cause physical injury to, or the death of, at least one other student and/or school employee (iv) in or on the immediate property of the school (v) while targeting in advance one or more specific and/or random student(s) and/or employee(s)." The study excluded spontaneous incidents that resulted from unplanned fights or were tied to other criminal acts such as gang violence or drug trafficking.

The Secret Service study found 41 incidents that met the criteria from 2008 to 2017, an average of 4 per year. As with active shooter incidents, the number of incidents has increased. From 2008 through 2012, the nation saw an average of 2.6 incidents per year; from 2013 through 2017, that number had risen to 5.4 per year. 61% of attacks used firearms, while 39% used knives. In the 41 attacks, 98 victims were harmed, including 79 injured and 19 killed; this averages out to 1.9 persons injured and 0.5 killed per incident.

Figure 4-38 Incidents of Targeted School Violence in the US 2008-2017



Source: U.S. Secret Service Analysis of Targeted School Violence, 2019

Colorado has not been immune to active shooter and school violence incidents, including:

- June 25, 2006, Safeway Warehouse, Denver:** A 22-year-old man armed with a handgun began shooting in a Safeway warehouse in Denver after having recently been passed over for a job promotion. After shooting at his co-workers, he began setting fires in the warehouse. One person was killed and five were wounded, including one police officer. The shooter was killed by police during an exchange of gunfire.

- **December 9, 2007, Youth With a Mission Training Center/New Life Church, Arvada:** A 24 year old man armed with a rifle, two handguns, and smoke bombs entered the Youth With a Mission Training Center and began shooting. The shooter had been expelled from the training center three years prior to the incident. He then walked 70 miles overnight to the New Life Church in Colorado Springs, Colorado, and began shooting again. The shooter committed suicide after being shot by church security. A total of four people were killed and five were wounded.
- **November 7, 2009, Sandbar Sports Grill, Vail:** A 63-year-old man armed with a handgun began shooting in the Sandbar Sports Grill in Vail, Colorado. Before the attack, Moreau had an argument inside the bar and was escorted out by security. One person was killed; three were wounded. The shooter was apprehended by responding police.
- **February 23, 2010, Deer Creek Middle School, Littleton:** A 32-year-old man armed with a rifle began shooting in Deer Creek Middle School in Littleton, Colorado. No one was killed, but two people were wounded. The shooter was restrained by teachers until police arrived and took him into custody.
- **May 17, 2010, Boulder Stove and Flooring, Boulder:** A 53-year-old man armed with a handgun began shooting at the owners in the back office of Boulder Stove and Flooring in Boulder, Colorado. Two people were killed; no one was wounded. The shooter committed suicide before police arrived.
- **July 20, 2012, Cinemark Century 16 Aurora:** A 24-year-old man armed with a rifle, a shotgun, and a handgun began shooting after releasing tear gas canisters in a theater at the Cinemark Century 16 movie theaters in, Colorado. Twelve people were killed and 58 were wounded, at that time the highest casualty count from an active shooter incident in the U.S. The shooter, who was wearing body armor, was apprehended by police. Police later found the shooter's apartment booby-trapped with explosives.
- **December 13, 2013, Arapahoe High School, Centennial:** An 18-year-old male student armed with a shotgun, machete, and three Molotov cocktails, began shooting in the hallways of Arapahoe High School in Centennial, Colorado. As he moved through the school and into the library, he fired one additional round and lit a Molotov cocktail, throwing it into a bookcase and causing minor damage. One person was killed; no one was wounded. The shooter committed suicide as a school resource officer approached him.
- **May 7, 2019, STEM School Highlands Ranch, Littleton:** Two male students, 18 and 16 years old, armed with handguns and a rifle hidden in guitar cases opened fire in two separate areas of the school. One student was killed while trying to disarm one shooter, who was then restrained by other students. The other shooter injured eight students before police arrived and detained him.

Probability of Future Occurrence

The unpredictable and highly variable nature of these incidents makes it difficult to accurately analyze the probability of future incidents. Based on the GTD data, since 2001 the U.S. has averaged 28 terrorist attacks a year, with an average of 21 people killed and 105 injured. It remains to be seen if the increase in terrorist attacks since 2013 will continue or not. Nevertheless, we can assume there is effectively a 100% chance that the nation will experience a terrorist attack in any given year for the foreseeable future.

The FBI study determined that the U.S. averaged 16.4 active shooter incidents as of 2014, and it is likely that we will continue to experience such attacks on a regular basis for the next several years. The probability of an attack specifically in Adams County is difficult to estimate and depends on many different factors, not all of which are well understood. Assuming 16.4 active shooter incidents per year across 3,142 counties (or county-equivalents), there is roughly a 0.5% chance of an incident occurring in any given county in any given year, all other things being equal. Similarly, assuming 5 incidents of

targeted school violence per year, we can infer a 0.17% chance of an incident occurring in a given county in a given year.

Magnitude/Severity

As seen above, the impact of a terrorist incident varies widely based on many factors, including the incident site, weapon(s), location, time of day, and the effectiveness of prevention/protection efforts, among other circumstances. As a general rule, terrorist and active shooter incidents are targeted where they can do the most damage and have the maximum impact possible.

Active shooters have demonstrated the capability to kill or injure large numbers of people. The 160 incidents studied in the 2014 FBI report resulted in 1,043 casualties (486 killed and 557 wounded excluding the shooters), an average of 6.5 casualties per incident. The 41 school violence incidents in the U.S. Secret Service study injured 79 people and killed 19, an average of 1.9 persons injured and 0.5 killed per incident. The psychological impact of these types of incidents is often even worse than the direct impacts and can impact a community for years.

The extent of damage caused by an explosive attack depends on many factors including the size, construction, composition, application, and placement of the explosive. The high-pressured blast caused by an explosion can send debris flying and lift people off the ground. The injuries that are most common to explosions are overpressure damage, fragmentation injuries, impact injuries, and thermal injuries. Some health effects caused by explosions such as eye injuries and abdominal injuries may not be apparent initially. An explosion near a building, public transportation, or other facility there could be extensive damage done to structures and infrastructure. An explosive attack may cause disruption in services such as electricity, water, communications, and transportation.

Chemical attacks can cause injury or fatalities if inhaled or absorbed through the skin. The harm caused by these attacks ultimately depends on: 1) their degree of toxicity, 2) the concentration of the chemical, 3) the route of exposure, and 4) the duration of the exposure. Symptoms of exposure to most toxic chemicals would appear in minutes to hours. Different chemicals have varying effects on the body. Depending on the chemical agent, symptoms can appear either minutes or hours after exposure.

The severity of a biological attack would vary widely depending on the disease or agent used and how it is spread. Some biological agents can be easily disseminated or transmitted from person to person and could result in high mortality rates and potential for major public health impacts. Other agents are more difficult to disseminate and would likely result in only moderate morbidity rates.

Radioactive materials are commonly used throughout a host of different professions, including manufacturing, construction, health, and research, and are typically categorized based on the primary type of radiation they emit: alpha, beta, gamma, or neutron. Individuals can be exposed to radiation (energy), and/or become contaminated with radioactive materials, resulting in ongoing exposure. Internal contamination through inhaling or ingesting radioactive material is particularly dangerous.

A nuclear attack could have the most devastating and far reaching consequences out of all the possible disasters and hazards. Direct effects would include intense heat, blast energy, and high-intensity nuclear radiation. Following an attack, residual radioactive material would be propelled into the atmosphere and return as radioactive fallout. Secondary effects could range from the destruction of critical infrastructure and systems, to a shortage of adequate shelter, food, water, health, and other necessities.

Vulnerability

People

Most terrorist attacks are primarily intended to kill and injure as many people as possible. Physical harm from a firearms attack or explosive device is not completely dependent on location, but risk is greater in areas where higher numbers of people gather. If a biological or chemical agent were released indoors, it could result in exposure to a high concentration of pathogens, whereas an outdoors release could affect many more people but probably at a lower dose. Symptoms of illness from a biological or chemical attack could go undetected for days or even weeks. Local healthcare workers may observe a pattern of unusual illness or early warning monitoring systems may detect airborne pathogens. People could also be affected by an attack on food and water supply. In addition to impacts on physical health, any terrorist attack would likely cause significant stress and anxiety.

Similarly, most active shooters primarily target people, attempting to kill or injure large numbers of individuals. The number of injuries and fatalities are highly variable, dependent on many factors surrounding the attack including the location, the number of type of weapons used, the shooter's skill with weapons, the amount of people at the location, and law enforcement response time. Statistics indicate an average of 6.5 casualties per active shooter incident. Psychological effects of the incident, on not only victims and responders but also the general public, may last for years.

General Property

The potential for damage to property is highly dependent on the type of attack. Terrorist attacks involving explosives or other CBRNE weapons, may damage buildings and infrastructure. For most attacks, impacts are highly localized to the target of the attack, although CBRNE attacks could potentially have much broader impacts.

Active shooter incidents rarely result in significant property damage, although crime scene measures may deny the use of targeted facilities for days after the incident.

Critical Facilities and Infrastructure

Terrorists often target critical infrastructure, and attacks using explosives or other CBRNE weapons can potentially have devastating impacts.

While active shooter incidents rarely cause major property damage directly, indirect effects can be significant, such as the loss of critical facilities for days or weeks due to crime scene concerns.

Economy

Terrorist attacks can have major economic impacts. As an extreme example, after the September 11, 2001 terrorist attacks in New York and Washington the U.S. stock market lost \$1.4 trillion, the Gross Domestic Product of New York City lost an estimated \$27 billion, and commercial air travel decreased by 20%. Smaller attacks can still have severe economic impacts, primarily by deterring people away from certain areas or activities. Cleanup after a CBRNE attack could be lengthy and highly expensive. Terrorist attacks could also deter businesses from relocating to impacted areas, although there is not significant research to support this conclusion.

As noted above, over 45% of active shooter incidents in the FBI study took place at a commercial establishment. Nonetheless, most active shooter incidents have minimal impacts on the broader economy beyond the individual business affected. This can vary based on the location of the incident; an incident at a mall for example could cause temporary business interruption and closures due to crime scene investigation.

Historic, Cultural, and Natural Resources

Most terrorist or active shooter attacks do not cause widespread damage to the environment. However, terrorists have been known to target sites with historic or cultural significance.

Future Development

The link between increased development and terrorist attacks is uncertain at best. Many terrorist attacks have targeted larger metropolitan areas, so a larger population could potentially make public events more attractive targets. Population growth and development could expose more people and property to the impacts of an explosive or CBRNE attack.

There is no clear link between increased development and active shooter incidents.

Risk Summary

- While the number of terrorist attacks on U.S. soil has been declining since the 1970s, active shooter incidents and school violence have risen in recent years.
- Effects on people: The primary aim of most active shooters is to injure and kill as many people as possible.
- Effects on property: Active shooter incidents rarely cause significant property damage.
- Effects on economy: Most active shooter incidents have minimal impacts on the economy.
- Effects on critical facilities and infrastructure: Crime scene concerns can lead to the loss of use of critical facilities for days or weeks.
- Related Hazards: Cyber Incident, Hazardous Materials

Table 4-54 Terrorism Risk Summary

Jurisdiction	Geographic Location	Probability of Future Occurrence	Magnitude/Severity	Overall Significance
Adams County	Limited	Occasional	Limited	Low
Bennett	Extensive	Occasional	Critical	High
Brighton	Limited	Occasional	Limited	Low
Commerce City	Limited	Likely	Limited	Medium
Denver Water	Limited	Likely	Limited	Medium

4.3.10 Thunderstorms

Hazard Description

A thunderstorm is classified as severe when it contains one or more of the following phenomena: hail that is three-quarters of an inch or greater, winds in excess of 50 knots (57.5 mph), or a tornado.

Approximately 10% of the thunderstorms that occur each year in the United States are classified as severe.

Thunderstorm winds are defined by the National Weather Service (NWS) as winds arising from convection (occurring within 30 minutes of lightning being observed or detected), with speeds of at least 50 knots (58 mph), or winds of any speed (non-severe thunderstorm winds below 50 knots) producing a fatality, injury, or damage. Events with maximum sustained winds or wind gusts less than 50 knots (58 mph) are entered as a Storm Data event only if they result in fatalities, injuries, or serious property damage.

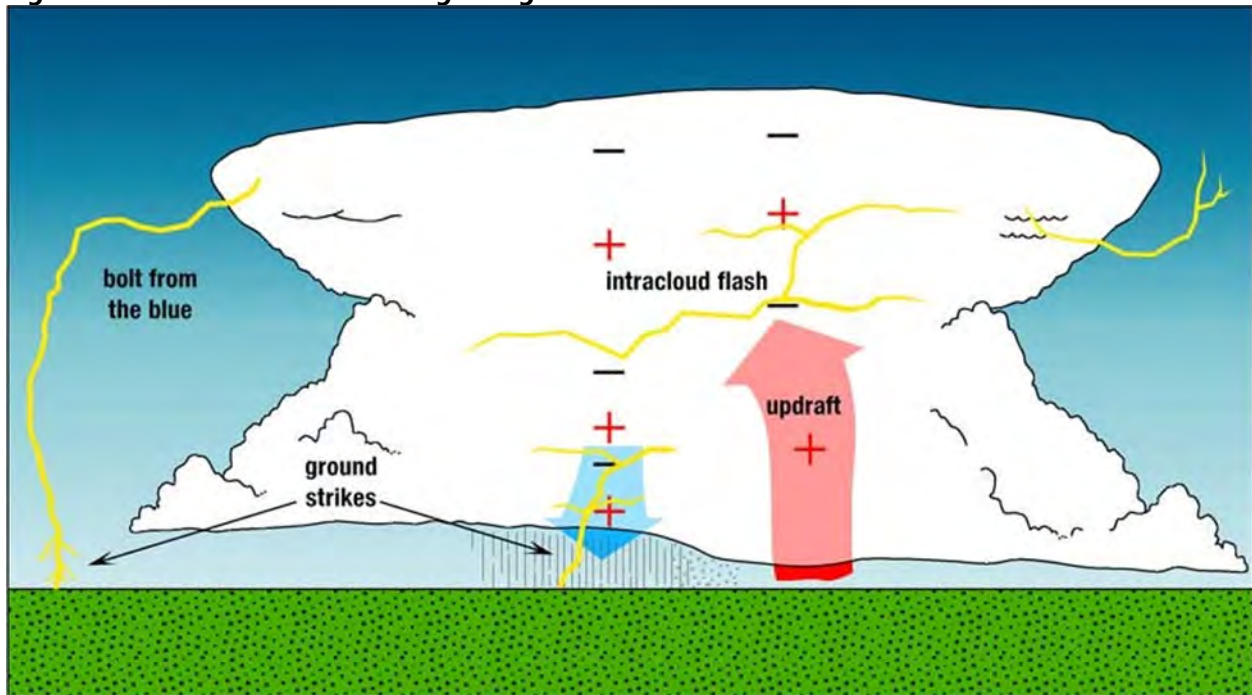
Hail is formed when water droplets freeze and thaw as they are thrown high into the upper atmosphere by the violent internal forces of thunderstorms. Hail is sometimes associated with severe storms within the Adams County planning area. Hailstones are usually less than two inches in diameter and can fall at

speeds of 120 miles per hour (mph). Severe hailstorms can be quite destructive, causing damage to roofs, buildings, automobiles, vegetation, livestock and crops.

Lightning is defined as any and all of the various forms of visible electrical discharge caused by thunderstorms. Thunderstorms and lightning are usually (but not always) accompanied by rain. Intra-cloud lightning is the most common type of discharge. This occurs between oppositely charged centers within the same cloud. Usually it takes place inside the cloud and looks from the outside of the cloud like a diffuse brightening that flickers. However, the flash may exit the boundary of the cloud, and a bright channel, similar to a cloud-to-ground flash, can be visible for many miles.

Cloud-to-ground lightning is the most damaging and dangerous type of lightning, though it is also less common. Most flashes originate near the lower-negative charge center and deliver negative charge to earth. However, a large minority of flashes carry positive charge to earth. These positive flashes often occur during the dissipating stage of a thunderstorm's life. Positive flashes are more common as a percentage of total ground strikes during the winter months. This type of lightning is particularly dangerous for several reasons. It frequently strikes away from the rain core, either ahead or behind the thunderstorm. It can strike as far as 5 or 10 miles from the storm in areas that most people do not consider to be a threat (see Figure 4-39). Positive lightning also has a longer duration, so fires are more easily ignited. And, when positive lightning strikes, it usually carries a high peak electrical current, potentially resulting in greater damage.

Figure 4-39 Cloud to Ground Lightning



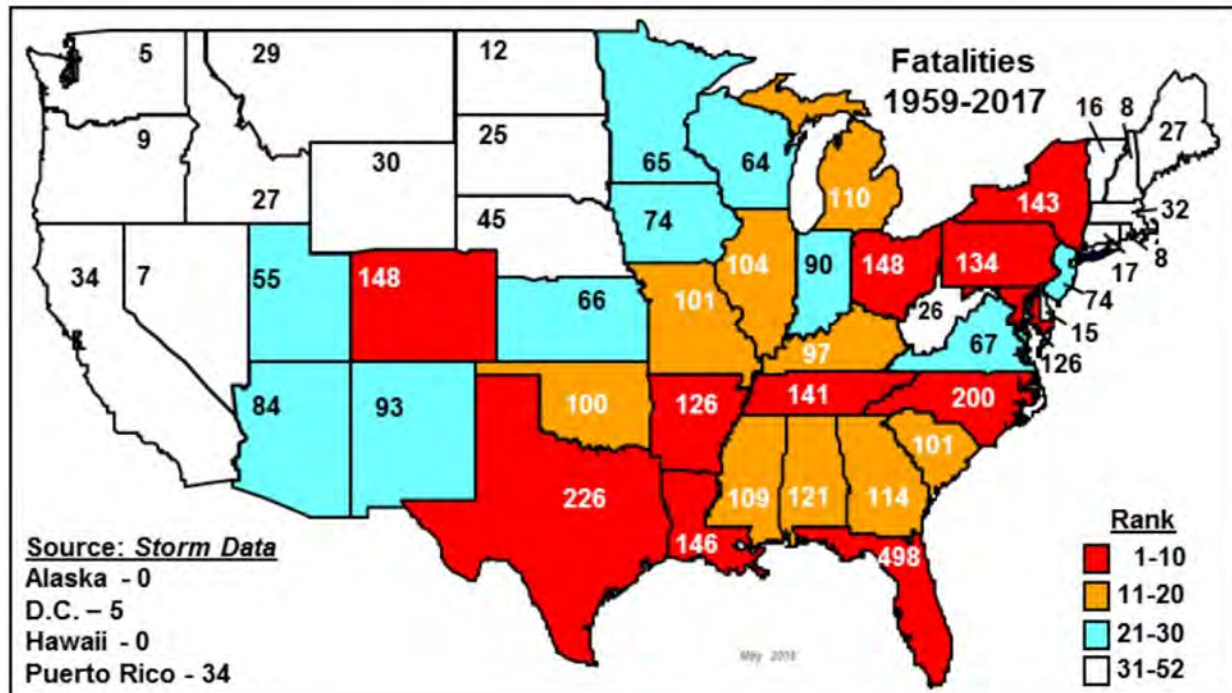
Source: National Weather Service Pueblo Office

According to the National Weather Service, Colorado ranks 19th in the nation with respect to the number of cloud-to-ground lightning flashes, with an average number of 490,164 flashes per year (based on data collected between 2008 and 2017). Colorado ranks 31st in terms of cloud-to-ground flash density in the United States, with an average 4.7 flashes per kilometer squared (National Weather Service).

Figure 4-40 shows state-by-state lightning deaths between 1959 and 2017. Colorado ranks fourth for the number of deaths at 148. Florida (498), Texas (226), and North Carolina (200) were ranked higher. Based

on National Weather Service data since 1980 an average of 3 people are killed and 12 are injured in Colorado per year.

Figure 4-40 Lightning Fatalities in the United States, 1959-2017



Source: National Weather Service

Geographic Location

Thunderstorms are generally expansive in size. The entire county is susceptible to any of the effects of a severe thunderstorm, including hail, lightning, heavy rain and thunderstorm winds. Figure 4-41 and Figure 4-42 shows the reported locations of hail storms from 1955 to 2017, including the event magnitudes. Note that these are NOAA-reported events and may not be comprehensive, particularly in the less-populated parts of the County.

Figure 4-41 NOAA Hail Events in West Adams County, 1955-2017

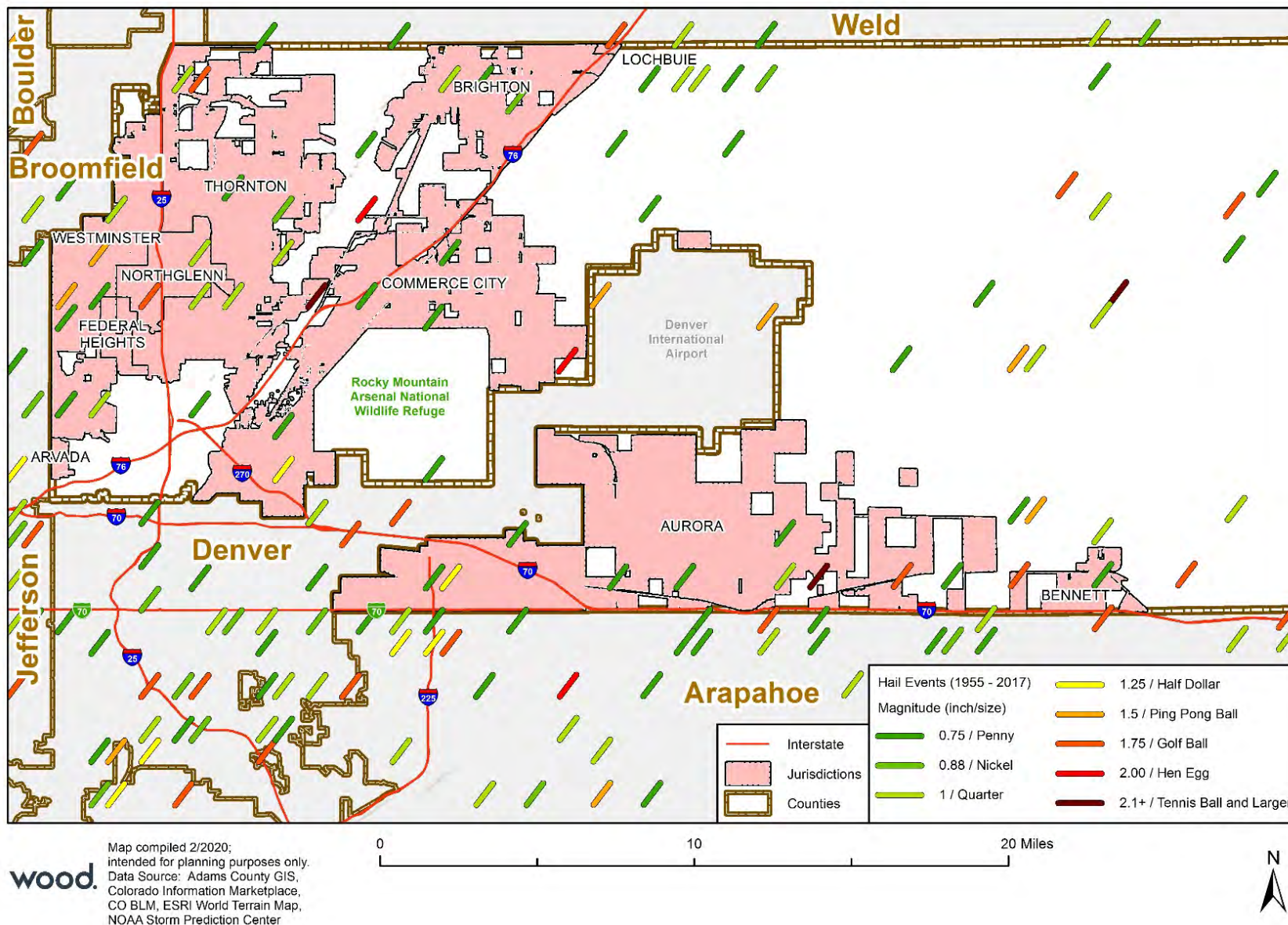
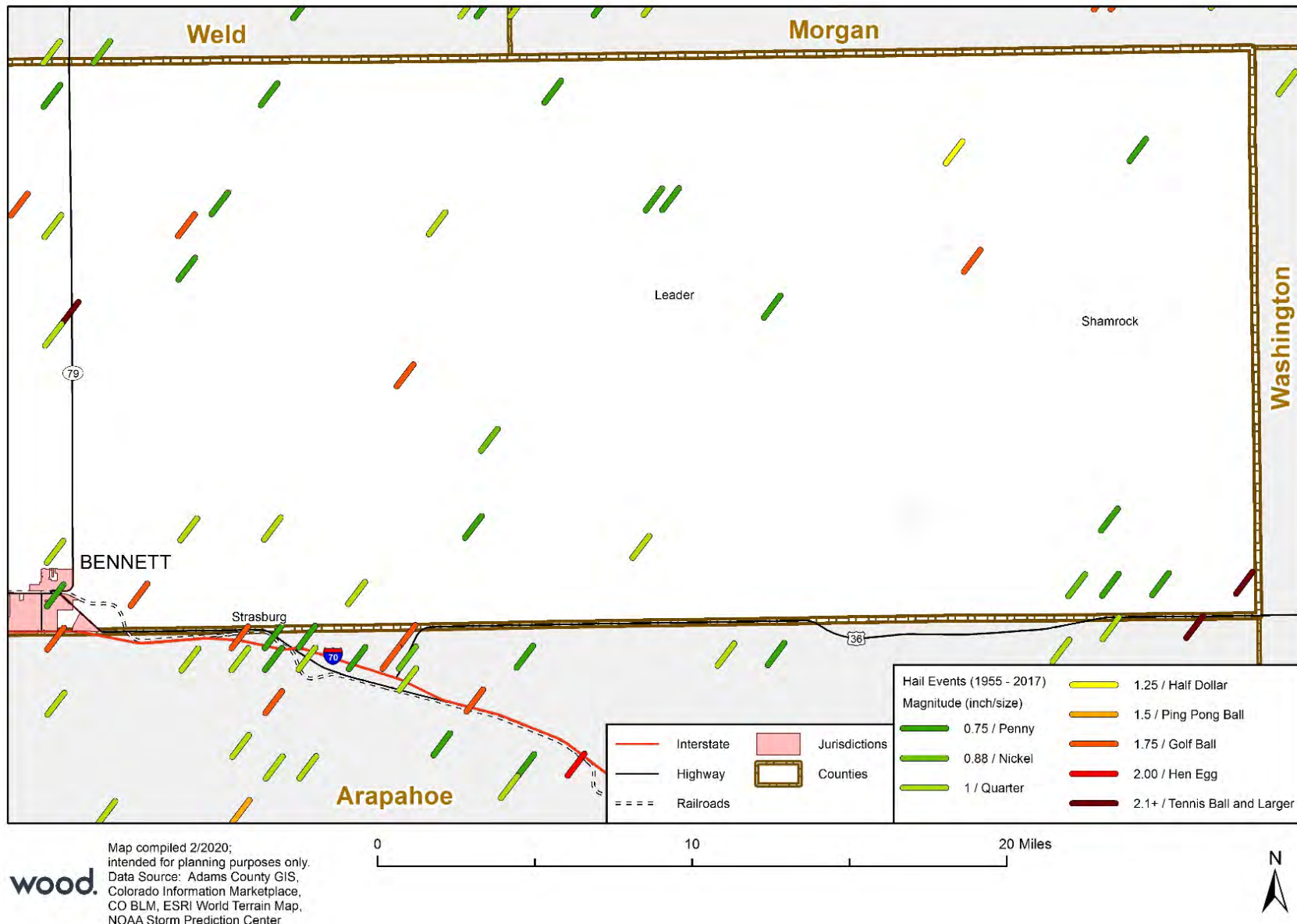


Figure 4-42 NOAA Hail Events in East Adams County, 1955-2017



Previous Occurrences

Thunderstorms are regular occurrences in Adams County from spring through late summer or early fall. Typically, more severe storms occur in midsummer. NOAA's National Center for Environmental Information (NCEI) Storm Events Database records 494 severe thunderstorm events for Adams County between 1955 and 2018. (The search included hail, heavy rain, lighting and thunderstorm wind.) Of these events 27 resulted in property or crop damages. The following table summarize the recorded events.

Table 4-55 Severe Thunderstorm Events, 1955-2018*

Event Type	# of Events	Property Damage	Crop Damage	Deaths	Injuries
Lightning	20	\$391,000	\$0	2	3
Hail	380	\$438,800,500	\$50,000	0	7
Thunderstorm Wind	94	\$76,500	\$0	0	9
Total	494	\$439,268,000	\$50,000	2	19

Source: NCEI *The Storm Events Database only has recorded lighting events from 1996-2015

The Storm Events Database collects information on each event from a variety of sources including but not limited to, county, state and federal emergency management officials, newspaper clipping services, the insurance industry and the general project. Crop damages recorded in the Database should be considered broad estimates according to the National Weather Service. As discussed in the Section 4.3.3 Drought, the Cause of Loss Database maintained by the USDA Risk Management Agency helps to quantify the economic impact different natural hazards have on the agriculture in the County. Note that the NCEI database only includes uninsured crop losses; insured losses are much greater as shown in Table 4-56. Crop losses as a result of thunderstorm hazards, including excess moisture/rain/precipitation and hail, occurred in Adams County every year between 2007 and 2018. During this 11-year time period, hail caused a majority of the damages to crops affected, 165,334 acres and the amount of losses claimed, \$13,037,201. In total, over 197,000 acres were affected, and over \$15 million losses claimed in that 11-year period due to thunderstorm related hazards.

Table 4-56 Crop Insurance Claims due to Thunderstorm Related Hazards, 2007-2018

Year	Cause of Loss	Determined Acres	Indemnity Amount
2007	Hail	18,419.14	\$1,152,198
	Excess Moisture/ Precip./Rain	97.77	\$11,839
2008	Hail	15,216.68	\$1,403,659
2009	Hail	13,411.54	\$1,078,454
	Excess Moisture/ Precip./Rain	882.41	\$54,063
2010	Hail	14,919.75	\$1,129,280
	Excess Moisture/ Precip./Rain	2,975.14	\$181,479
2011	Hail	2,009.25	\$211,158
	Excess Moisture/ Precip./Rain	361.90	\$19,747
2012	Hail	1,045.21	\$71,169
2013	Hail	14,944.71	\$1,462,717
	Excess Moisture/ Precip./Rain	1,973.22	\$206,144
2014	Hail	17,160.49	\$2,284,272

Year	Cause of Loss	Determined Acres	Indemnity Amount
	Excess Moisture/ Precip./Rain	934.34	\$32,586
2015	Hail	9,593.61	\$641,160
	Excess Moisture/ Precip./Rain	16,193.92	\$1,223,294
2016	Hail	28,364.97	\$1,833,154
	Excess Moisture/ Precip./Rain	3,572.68	\$171,865
2017	Hail	1,927.89	\$99,394
	Excess Moisture/ Precip./Rain	4,954.17	\$321,170
2018	Hail	28,320.41	\$1,670,586
Total		197,279	\$15,259,389

Source: USDA RMA

The following is a summary of the events of record collected from the NCEI Storm Events Database for severe thunderstorm events specific to Adams County.

October 2, 1983 (Thunderstorm Wind Event) – 87 mph winds reported in Adams County.

July 13, 2011 (Hail Event) - Severe thunderstorms produced extensive damage as they moved across the Urban Corridor. At Denver International Airport alone, large hail up to golf ball size (2.5-inch diameter), very heavy rain, and wind gusts to 59 mph caused substantial damage to 40 planes and stranded approximately 1,500 passengers overnight. Damage to aircraft alone was nearly \$5 million. In addition, 83 cars in airport parking lots were damaged, along with some police cars and maintenance vehicles. In Watkins, two people suffered minor injuries and 35 to 40 homes were damaged. As many as 200 residents in a mobile home park were left homeless by the storm, causing the Red Cross to open a shelter at Bennett High School. Hailstones the size of softballs cratered the north sides of the mobile homes. Some farmers in the area said they lost as much as 85% of their total wheat crop. Power lines were damaged affecting about 1,200 customers in Watkins. The strong winds also flipped over a tractor-trailer rig on Interstate 70 near Watkins Road. Insurance claims for the Watkins, Bennett and Brighton areas was estimated to be \$17 million. The total damage estimate across the entire Urban Corridor was \$164.8 million and included 17,200 automobile claims and 12,600 homeowner claims.

No heavy rain events have been recorded in the Storm Events Database but the HMPC reported the following events:

May 2, 2014 – Rain in excess of 2" in an hour in the Town of Bennett. The heavy rain lead to erosion and sediment issues leading to temporary road closures and transportation impacts for 1.5 miles along Kiowa-Bennett Road. Other property damages included impacts to fences and ditches. The direct cleanup costs from the event were reported to be \$15,000.

July 13, 2019 – Rainfall in excess of 2" in an hour occurred in the Town of Bennett. The event led to temporary road closures on 1.5 miles of Kiowa-Bennett Road. The direct cleanup costs were approximately \$5,000. The HMP reported that only cleanup occurred, and no improvements have been made to prevent future occurrences at this time.

The National Weather Service has been tracking lightning casualties by county in Colorado since 1980. The NWS statistics only include lighting casualties through 2018. As shown in Table 4-57, Adams County has not experienced a documented casualty due to lightning since 2010. Most of the events took place in the afternoon and in the summer months between June and August. According to the State of Colorado

2018 HMP, in any given day in July or August over 4,000 lightning flashes are expected to occur in Colorado.

Table 4-57 Lightning Causalities and Injuries in Adams County, 1984-2010

Year	Month	Day	Time	Fatalities	Injuries
1984	August	4	16:34	0	1
1986	June	16	19:30	0	5
1987	May	12	16:30	0	1
1988	April	21	16:10	1	1
1992	June	5	10:30	0	1
	August	1	19:05	0	1
1995	August	21	17:15	0	1
1997	August	11	15:00	0	1
2001	May	18	21:00	1	0
2006	June	11	14:45	1	0
		21	16:15	1	0
	August	31	13:47	0	1
2010	May	26	12:30	0	1
Total				4	14

Source: National Weather Service

Probability of Future Occurrence

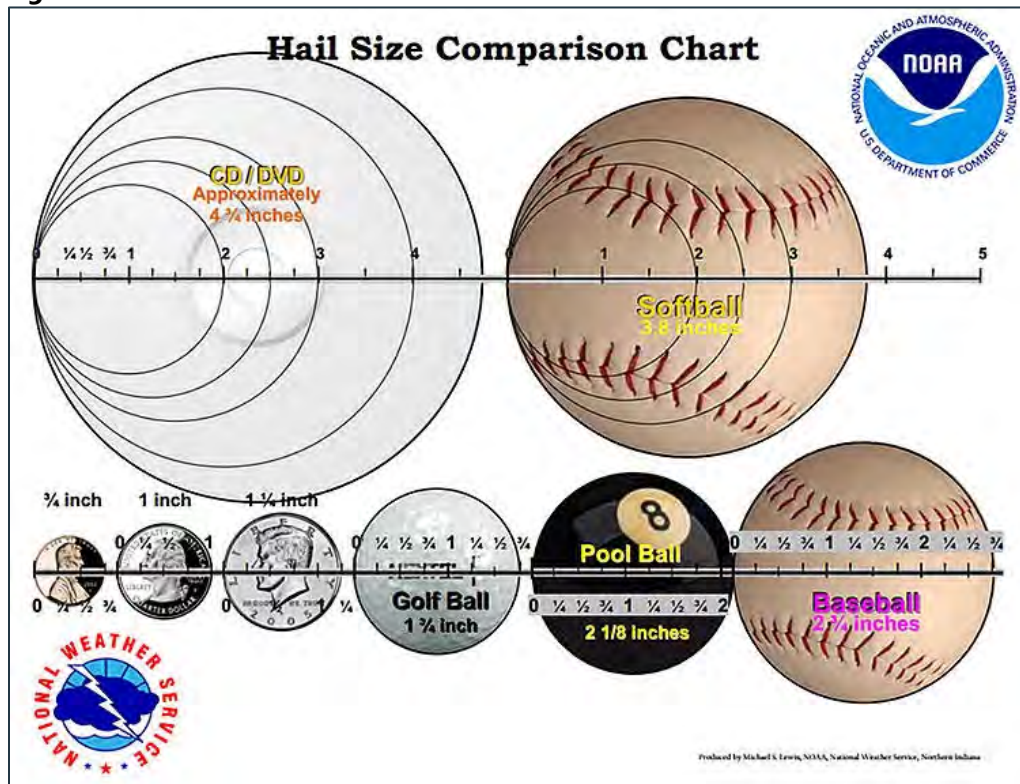
Thunderstorms that produce lightning, heavy rain and hail are highly likely to occur. These events are well-documented seasonal occurrences that will continue to occur annually in Adams County.

Magnitude/Severity

Common problems associated with severe storms include the loss of utilities or immobility. Loss of life is uncommon but can occur during severe storms. Immobility can occur when roads become impassable due to heavy rains causing flooding, erosion issues, or downed trees. Loss of power lines can occur due to downed trees from high winds or lightning.

The severity of severe thunderstorms that involve heavy rain, high wind hail can be measured according to hail by diameter sizes and wind speed. The NWS classifies hail by diameter size, and corresponding everyday objects to help relay scope and severity to the population. Figure 4-43 below shows the hailstone measurements utilized by the NWS.

There is no clear distinction between storms that do and do not produce hailstones. Nearly all severe thunderstorms probably produce hail aloft, though it may melt before reaching the ground. Multi-cell thunderstorms produce many hailstones, but not usually the largest hailstones. In the life cycle of the multi-cell thunderstorm, the mature stage is relatively short so there is not much time for growth of the hailstone. Supercell thunderstorms have sustained updrafts that support large hail formation by repeatedly lifting the hailstones into the very cold air at the top of the thunderstorm cloud. In general, golf ball sized hail or larger is associated with supercells, but non-supercell storms are also capable of producing golf ball size hail.

Figure 4-43 Hail Measurements

Source: National Weather Service

Lightning is measured by the Lightning Activity Level (LAL) scale, created by the NWS to define lightning activity into a specific categorical scale. The LAL is a common parameter that is part of fire weather forecasts nationwide. Adams County is at risk to experience lightning in any of these categories. The LAL is reproduced in Table 4-58.

Table 4-58 Lightning Activity Level Scale

Lightning Activity Level	
LAL 1	No thunderstorms
LAL 2	Isolated thunderstorms. Light rain will occasionally reach the ground. Lightning is very infrequent, 1 to 5 cloud to ground strikes in a five-minute period.
LAL 3	Widely scattered thunderstorms. Light to moderate rain will reach the ground. Lightning is infrequent, 6 to 10 cloud to ground strikes in a five-minute period.
LAL 4	Scattered thunderstorms. Moderate rain is commonly produced. Lightning is frequent, 11 to 15 cloud to ground strikes in a five-minute period.
LAL 5	Numerous thunderstorms. Rainfall is moderate to heavy. Lightning is frequent and intense, greater than 15 cloud to ground strikes in a five-minute period.
LAL 6	Dry lightning (same as LAL 3 but without rain). This type of lightning has the potential for extreme fire activity and is normally highlighted in fire weather forecasts with a Red Flag warning.

Source: National Weather Service

Isolated deaths and/or multiple injuries and illnesses; major or long-term property damage that threatens structural stability; and/or interruption of essential facilities and services for 24-72 hours

Lightning can cause deaths, injuries, and property damage, including damage to buildings, communications systems, power lines, and electrical systems. It also causes wildland fires.

Lightning can occur anywhere in Adams County, and it is not possible to identify specific hazard areas. Data was not available to identify specific structures at risk. Data on average annual losses was limited but based on NCEI records \$391,000 in lightning-related damages occurred between 1996 and 2018. One of the most serious risks associated with lightning is its potential to cause wildland fires. This in particular could result in losses for the County particularly in the eastern portion. For specific details on loss and vulnerability associated with wildland fires, please see the wildland fire vulnerability discussion.

Climate Change Considerations

As average temperatures increase over time, this generally will result in higher extreme temperatures and more warming in the atmosphere can trigger climate changes, which could result in more frequent extreme weather events. Climate change models are estimating an increase in temperature by the end of the century. Lightning specifically tends to occur with warmer temperatures as heat energy fuels storm clouds. A study published in the Journal of Science in November of 2014 showed the possibility of a 12% increase of lightning events for every degree of warming. On average the United States experiences 20 million lightning strikes with the possibility of 30 million lightning strikes over the continental U.S. by 2100 (Scientific American 2014).

Vulnerability

People

Exposure is the greatest danger to people from severe thunderstorms. People can be hit by lightning, pelted by hail, and caught in rising waters due to heavy rain.

Aspects of the population who rely on constant, uninterrupted electrical supplies may have a greater, indirect vulnerability to lightning. Elderly or disabled people, especially those with home health care services, often rely heavily on an uninterrupted source of electricity. Resident populations in nursing homes, residential facilities, or other special needs housing may also be vulnerable if electrical outages are prolonged. If they do not have a back-up power source, rural residents and agricultural operations reliant on electricity for heating, cooling, and water supplies are also especially vulnerable to power outages. According to the data obtained from emPower.com, a website maintained by the U.S. Department of Health and Human Services, 13% of the Medicare beneficiaries in the County rely, or 7,448 of the 56,909 of beneficiaries on medical equipment that is depended on electricity in order to live independently.

The impacts of thunderstorms on vulnerable populations can be more severe. Low income families are more likely to live in poorly constructed homes that are more likely to be damaged, and are more likely to be uninsured or underinsured, making it more difficult for them to recover from hail or lightning events. Individuals with disabilities may need more assistance after a major storm, especially if transportation or utility services are disrupted. Severe weather warnings must use methods that reach vision or hearing impaired people and those with limited English proficiency.

General Property

Severe thunderstorm events in Adams County are seasonal events that are most likely to occur in the summer months. These thunderstorm events can include significant precipitation as well as high winds, hail and lightning. These storms have resulted in injury and damages to property in several Adams County communities in the past. Lightning in particular can cause deaths, injuries, and property damage,

including damage to buildings, communications systems, power lines, and electrical systems. Lightning strikes cause intense but localized damage. Structural fires, localized damage to buildings, damage to electrical powerlines and communications outages are typical consequences of a lightning strike. High winds in the planning area often result in downing of trees and damage to properties. Given the nature of these types of storms, the entire County is potentially at risk.

Critical Facilities and Infrastructure

Because of the unpredictability of severe thunderstorm events strength and path, most critical infrastructure that is above ground is equally exposed to the storm's impacts. Due to the random and widespread nature of these hazards, a more specific risk assessment was not able to be conducted.

Economy

Economic impact of a severe thunderstorm is typically short term, although it can be significant. Lightning events can cause power outages and fires. Generally, long-term economic impacts center more around hazards that cascade from a severe thunderstorm, such as flooding, or wildfires ignited by lightning. In general, all severe thunderstorms pose a risk to the agricultural economy in the County. As noted in the Previous Occurrences subsection above, between 2007 and 2018, hail and heavy rain in Adams County led to over \$15 million in the crop insurance claims and have affected over 197,000 acres (refer to Table 4-56).

Historic, Cultural, and Natural Resources

Severe thunderstorms are a natural environmental process. Environmental impacts include the sparking of potentially destructive wildfires by lightning and localized flattening of plants by thunderstorm wind.

Future Development

New critical facilities such as communication towers should be built to withstand heavy rain, hail, wind, and lighting damage. Future development projects should consider severe thunderstorm hazards at the planning, engineering and architectural design stage with the goal of reducing vulnerability. Development trends in the County are not expected to increase overall vulnerability to the hazard, but all development will be affected by severe thunderstorm events and any population growth will increase potential exposure to hazards such as severe thunderstorms.

Risk Summary

- Severe thunderstorms can include hail, lightning, thunderstorm and heavy rain.
- 495 severe thunderstorm events have been reported in the County since 1955.
- Hail has been the most frequent (380 events) and most damaging hazard; resulting in \$438,800,500 in property damages since 195.
- Between 2007-2018 hail and heavy rain events have caused damages to 197,279 acres of crops and \$15,259,389 in crop loss.
- Heavy rain events have led to temporary closures of Kiowa-Bennett Road in the Town of Bennett
- Vulnerable populations are at risk of losing electricity due to a severe thunderstorm event. 13% of Medicare beneficiaries in the County rely on equipment that is electricity dependent.
- Related Hazards: Flood, Tornado/Damaging Wind

Table 4-59 Thunderstorms Risk Summary

Jurisdiction	Geographic Location	Probability of Future Occurrence	Magnitude/Severity	Overall Significance
Adams County	Extensive	Highly Likely	Limited	High
Bennett	Extensive	Highly Likely	Limited	High
Brighton	Extensive	Highly Likely	Limited	High
Commerce City	Significant	Highly Likely	Limited	Medium
Denver Water	Limited	Highly Likely	Limited	Low

4.3.11 Tornado/Damaging Wind

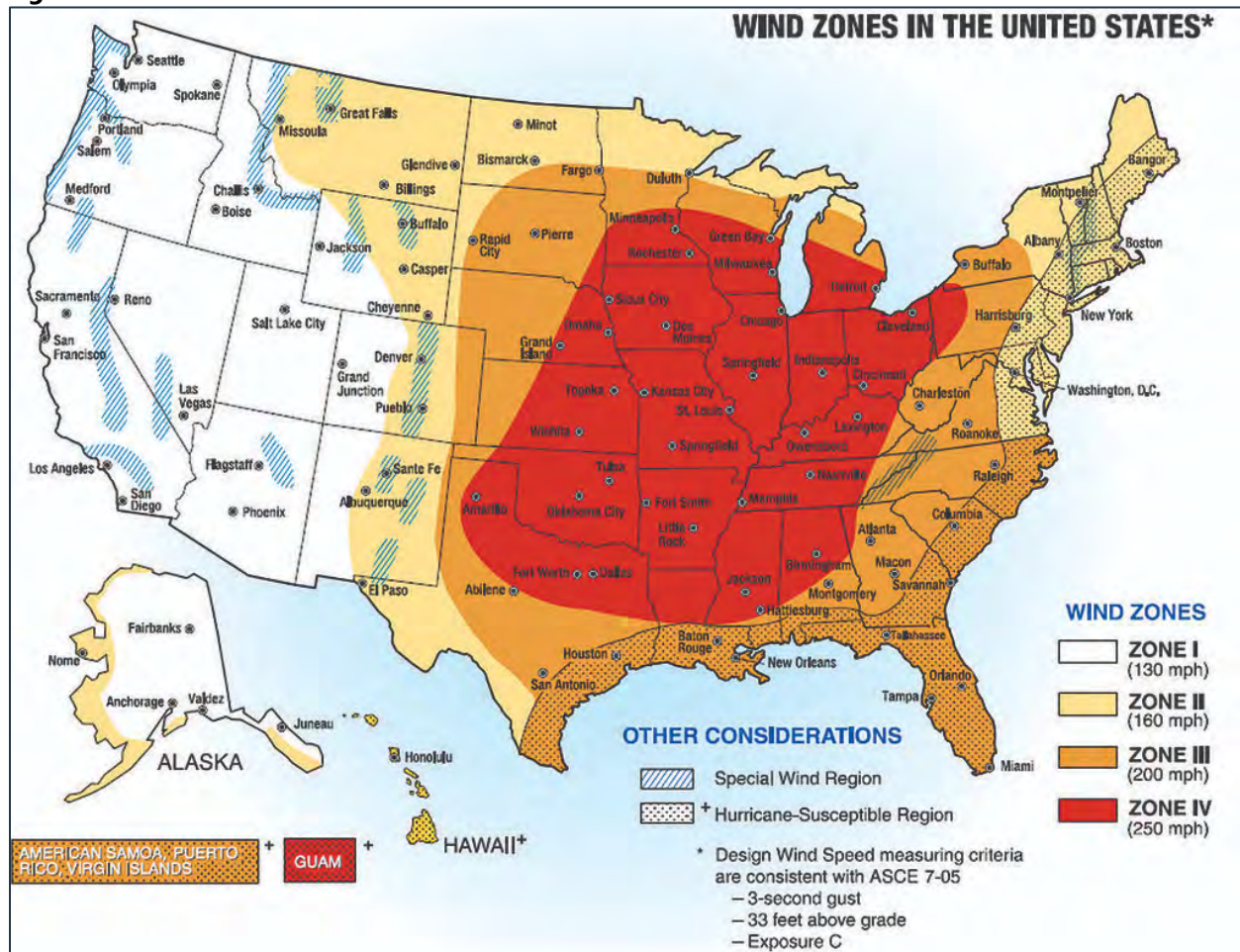
Hazard Description

Tornadoes are another severe weather hazard that can affect Adams County. Tornadoes are rotating columns of air marked by a funnel-shaped downward extension of a cumulonimbus cloud whirling at destructive speeds of up to 300 miles per hour (mph), usually accompanying a thunderstorm. Tornadoes are the most powerful storms that exist. They can have the same pressure differential that fuels 300-mile-wide hurricanes across a path only 300-yards wide or less. Tremendous destruction can occur in paths over a mile wide and 50 miles long with winds reaching 300 mph. Figure 4-49 below illustrates the potential impact and damage from a tornado according to the Enhanced Fujita Scale ratings (refer to the Magnitude/Severity section below).

In the Colorado Front Range, tornadoes have been reported in nine months out of the year, with the peak season for tornados extending from mid-May through mid-August. June is by far the month with the most recorded tornadoes. Tornadoes have occurred every time of the day, with over half of them developing between 3 p.m. and 6 p.m., and 88% occurring between 1 p.m. and 9 p.m. MDT. They occur statewide, but by far the greatest number develop east of I-25. Since 1950, Weld and Adams counties are the two counties with the most tornadoes in the state.

According to the National Severe Storms Laboratory (NSSL) there are several types of damaging winds including straight-line wind, downdraft, macroburst, microburst, downburst and derecho all of which can cause significant property and crop damage, threaten public safety, and have adverse economic impacts from business closures and power loss. Damaging windstorms in Adams County 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). It is these winds, which can exceed 100 mph and are responsible for most wind damage related to thunderstorms. These winds can overturn mobile homes, tear roofs off 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.

Figure 4-44 depicts wind zones for the United States. The map shows that the entirety of Adams County falls into Zone II, which is characterized by damaging winds of up to 160 mph.

Figure 4-44 Wind Zones in the United States

Source: FEMA

Geographic Location

The entire county is susceptible to any of the effects of severe tornados and damaging winds.

Previous Occurrences

Tornado season typically is March through August; however, a tornado can occur in any month.

Since 1950, Adams County has experienced 269 wind events (note: database search included tornado, high wind and strong wind) as recorded by NCEI Storm Events Database. The following table summarizes the events recorded in the Database.

Table 4-60 NCEI Recorded Tornado and Damaging Wind Events Summary, 1950-2018

Event Type	# of Events	Property Damage (\$)	Crop Damage (\$)	Deaths	Injuries
Tornado	175	\$26,901,270	\$6,500,000	0	43
High Wind	91	\$135,000	\$5,000	1	12
Strong Wind	3	\$21,000	\$0	0	0
Totals	269	\$27,057,270	\$6,505,000	1	55

Source: NOAA

The Storm Events Database collects information on each event from a variety of sources including but not limited to, county, state and federal emergency management officials, newspaper clipping services, the

insurance industry and the general project. Crop damages recorded in the Database should be considered broad estimates according to the National Weather Service. As discussed in the Section 4.3.3 Drought, the Cause of Loss Database maintained by the USDA Risk Management Agency helps to quantify the economic impact different natural hazards have on the agriculture in the County.

Note that the NCEI data shown above only includes uninsured crop losses. Insured crop losses from damaging wind occurred in Adams County every year between 2007 and 2018. During this 11-year period, over 43,000 acres were affected, and over \$3 million losses claimed due to damaging wind. The greatest losses occurred in 2009 with over 20,000 acres affected and over \$1 million in losses claimed.

Table 4-61 Crop Insurance Claims due to Damaging Wind, 2007-2018

Year	Determined Acres	Indemnity Amount
2007	711.27	\$35,499
2008	1,947.45	\$151,677
2009	20,682.38	\$1,765,149
2010	1,669.42	\$68,351
2011	2,548.54	\$401,011
2012	3,785.77	\$504,004
2013	2,970.20	\$249,744
2014	791.805	\$78,079
2015	358.37	\$9,483
2016	3,513.33	\$202,499
2017	2,062.37	\$142,225
2018	2,081.77	\$149,235
Total	43,123	\$3,756,956

Source: USDA RMA

The following is a summary of the narratives for the events of reordered from the NCEI Storm Events Database for damaging wind and tornado events specific to Adams County.

April 17, 2018 - Powerful post frontal bora winds blasted along the Front Range Foothills and across Northeast and East-Central Colorado. The damaging wind gusts ranged from 60 to 90 mph. The winds uprooted trees, shattered windows, sprayed roof shingles, tossed outdoor furniture like toys, and knocked over semitrailer trucks. It also blew up dust and debris, limiting visibility for motorists. The storm toppled trees onto homes and vehicles. A 70-foot spruce tree slammed into the roof of a residence and cut through the ceiling of the master bedroom; a 3-month-old infant was sleeping in the room but was not injured. The gusty conditions forced officials to close a number of roadways or place high-wind restrictions. Around 64,000 Xcel Energy customers experienced some sort of outage related to near-hurricane force winds that toppled trees and power poles. Service was not restored for approximately 5,000 customers until the following day. At Denver International Airport, delays occurred as two runways were temporarily shut down and 25 flights were diverted. Peak wind reports included: 71 mph at Bennett, 70 mph at Denver International Airport, 67 mph near Brighton, Buckley AFB and Strasburg.

May 15, 2015 - Two tornadoes touched down briefly in Adams County; an EF1 tornado north of Strasburg caused \$15,000 in property damages, and an EF0 north northwest touched down in an open field causing no damage.

July 13, 1996 - A fast moving tornado (F2) ripped a 12-mile path of destruction near Strasburg, in eastern Adams County. The tornado caused extensive structural damage to several galvanized metal grain silos, farm buildings and sheds in the area. The roof of a two-story log home was completely torn off; the

home received substantial damage from the wind and heavy rain that followed the tornado. \$220,000 damages to property and \$6,500,000 in crop damages were recorded.

June 3, 1981 – An F2 tornado caused 42 injuries and \$25,000,000 in property damages.

Figure 4-45 through Figure 4-48 show the past tornado and damaging wind events in Adams County and the associated Fujita Scale. Refer to the magnitude/severity section below for further information on the magnitude of past wind events in Adams County. Note that both maps appear to show fewer events and weaker events in the eastern half of the County; this is likely at least in part because tornados in the less populated portions of the County are less likely to be reported and/or cause damage.

Figure 4-45 Tornado Events in West Adams County 1950-2017

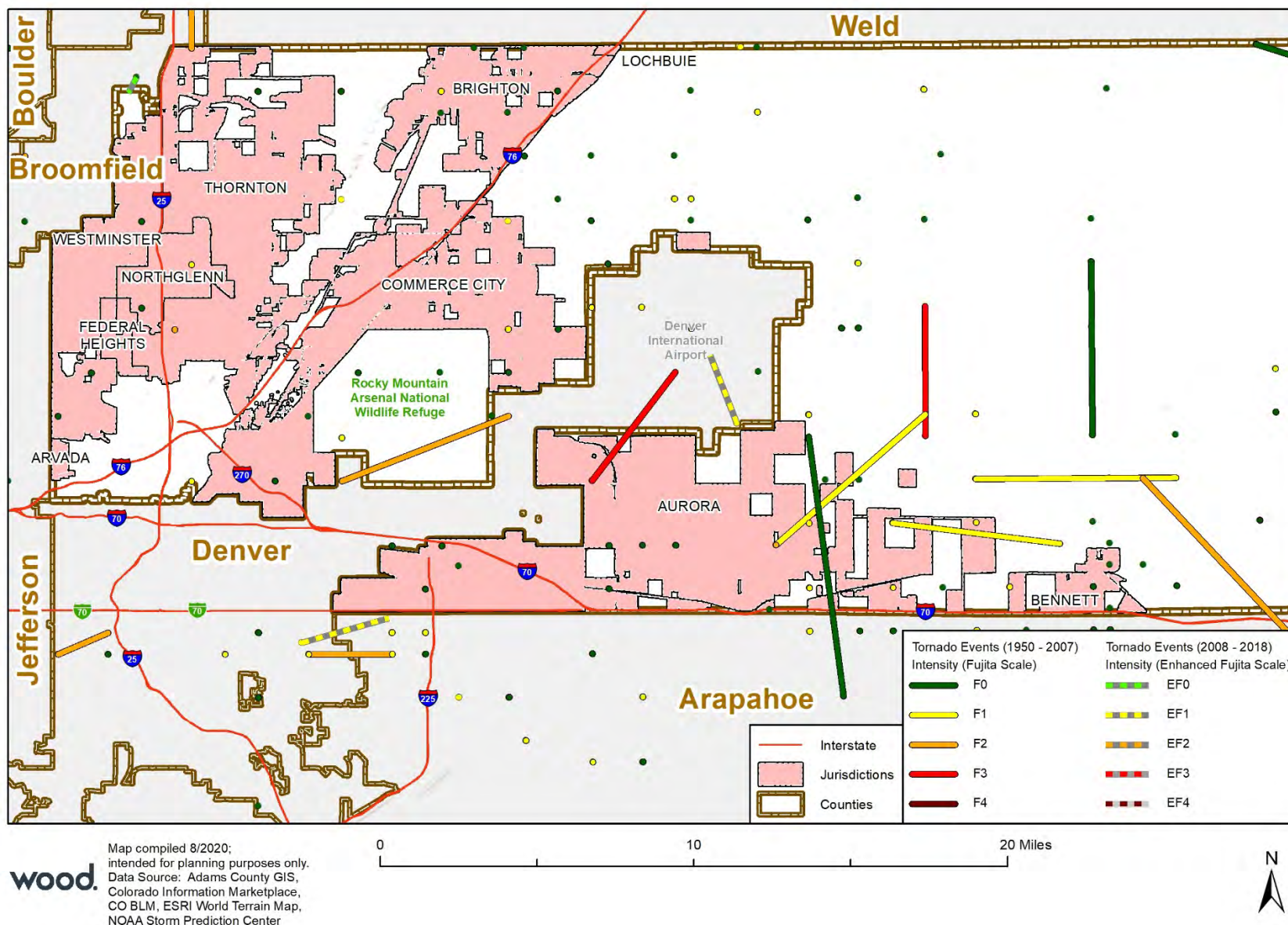
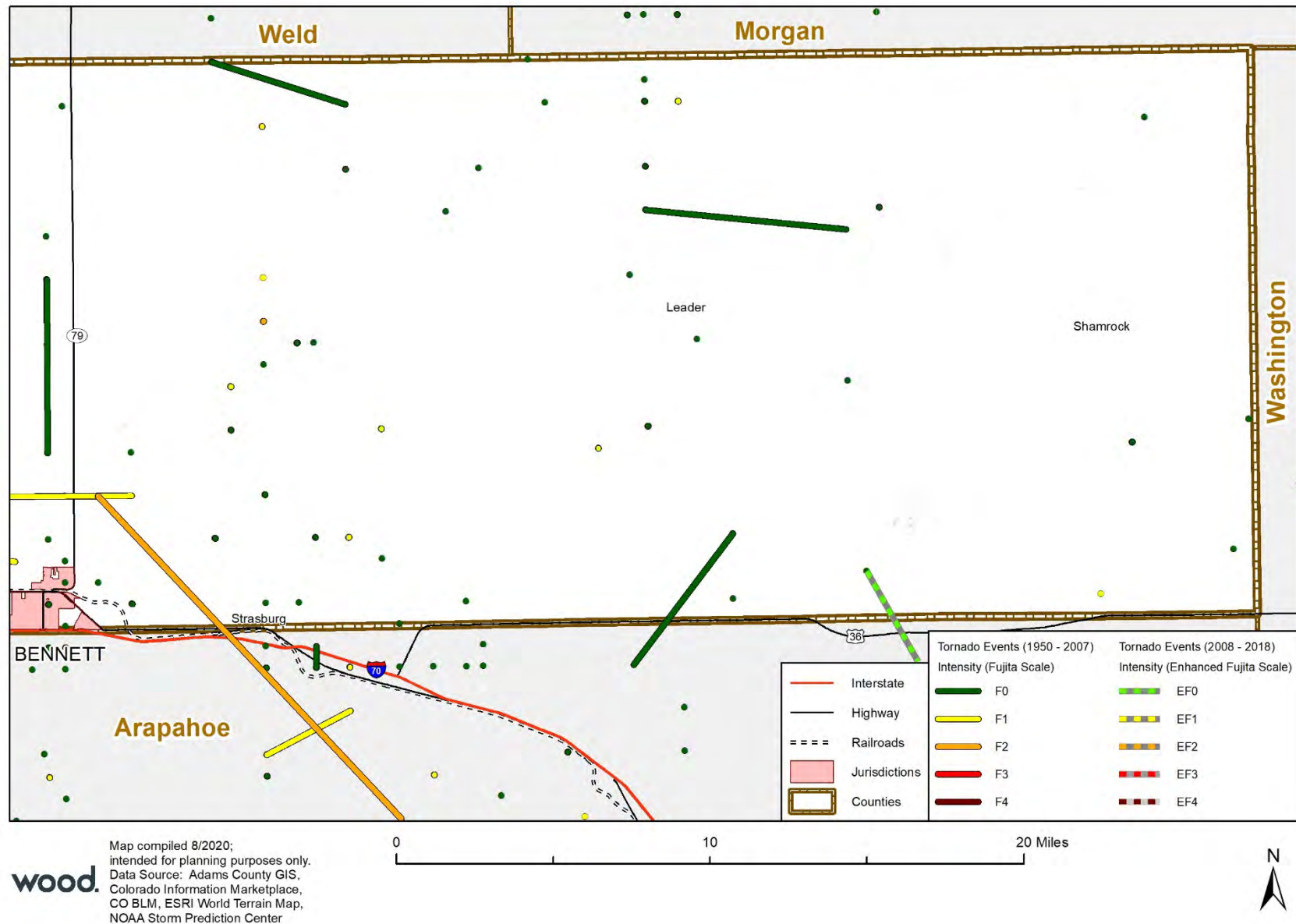
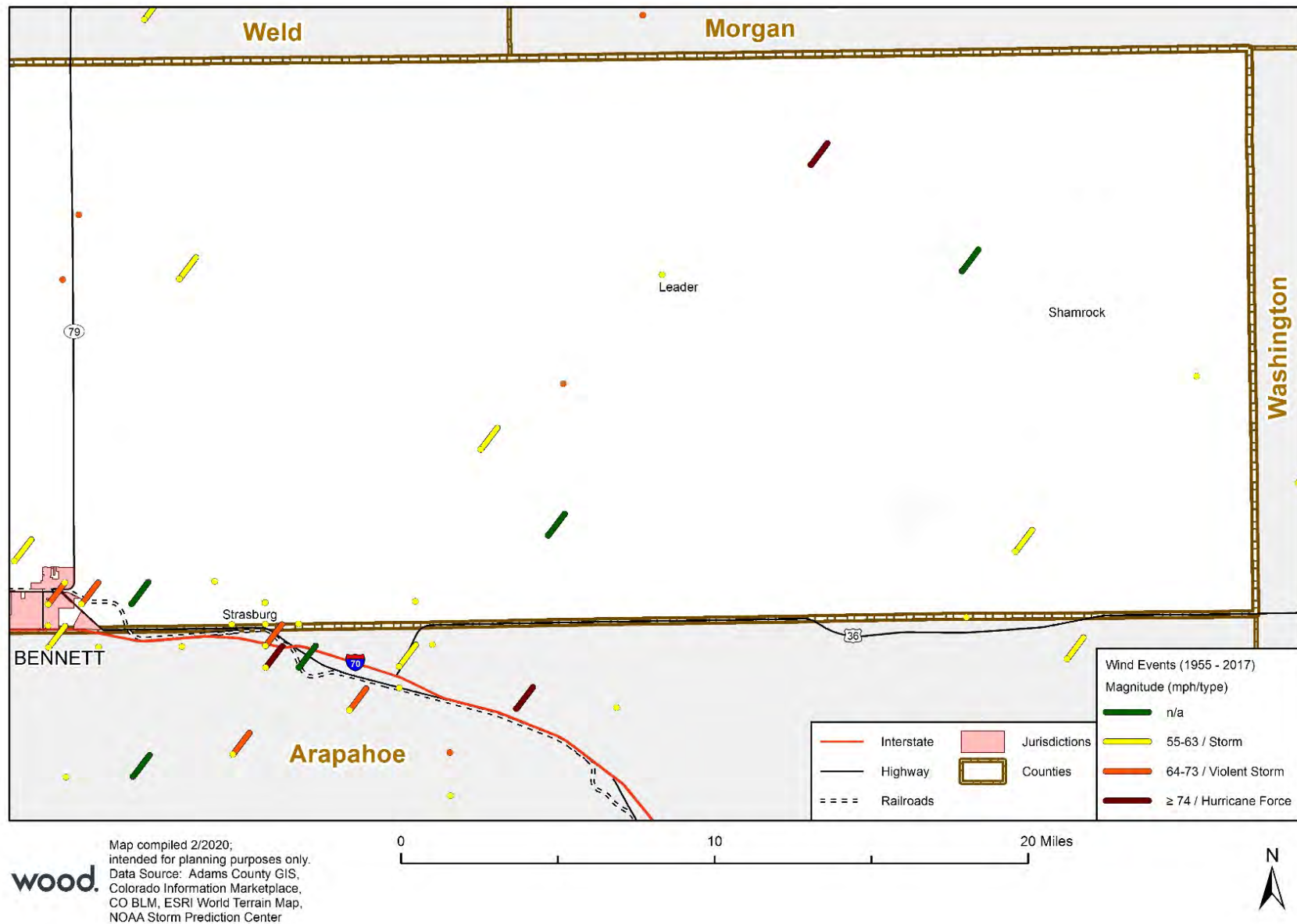


Figure 4-46 Tornado Events in East Adams County 1950-2017

Map compiled 2/2020;
intended for planning purposes only.
Data Source: Adams County GIS,
Colorado Information Marketplace,
CO BLM, ESRI World Terrain Map,
NOAA Storm Prediction Center

wood.

Figure 4-48 Wind Events in East Adams County 1955-2017

Probability of Future Occurrence

Two hundred and sixty-nine (269) damaging wind and tornado events have occurred in Adams County over 68 years of record keeping. Historical wind activity within the planning area indicates that the area is highly likely to continue to experience damaging wind during thunderstorm events with a potential of the formation of funnel clouds and low intensity tornadoes during adverse weather conditions.

Magnitude/Severity

Tornadoes can cause damage to property and loss of life. While most tornado property 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.

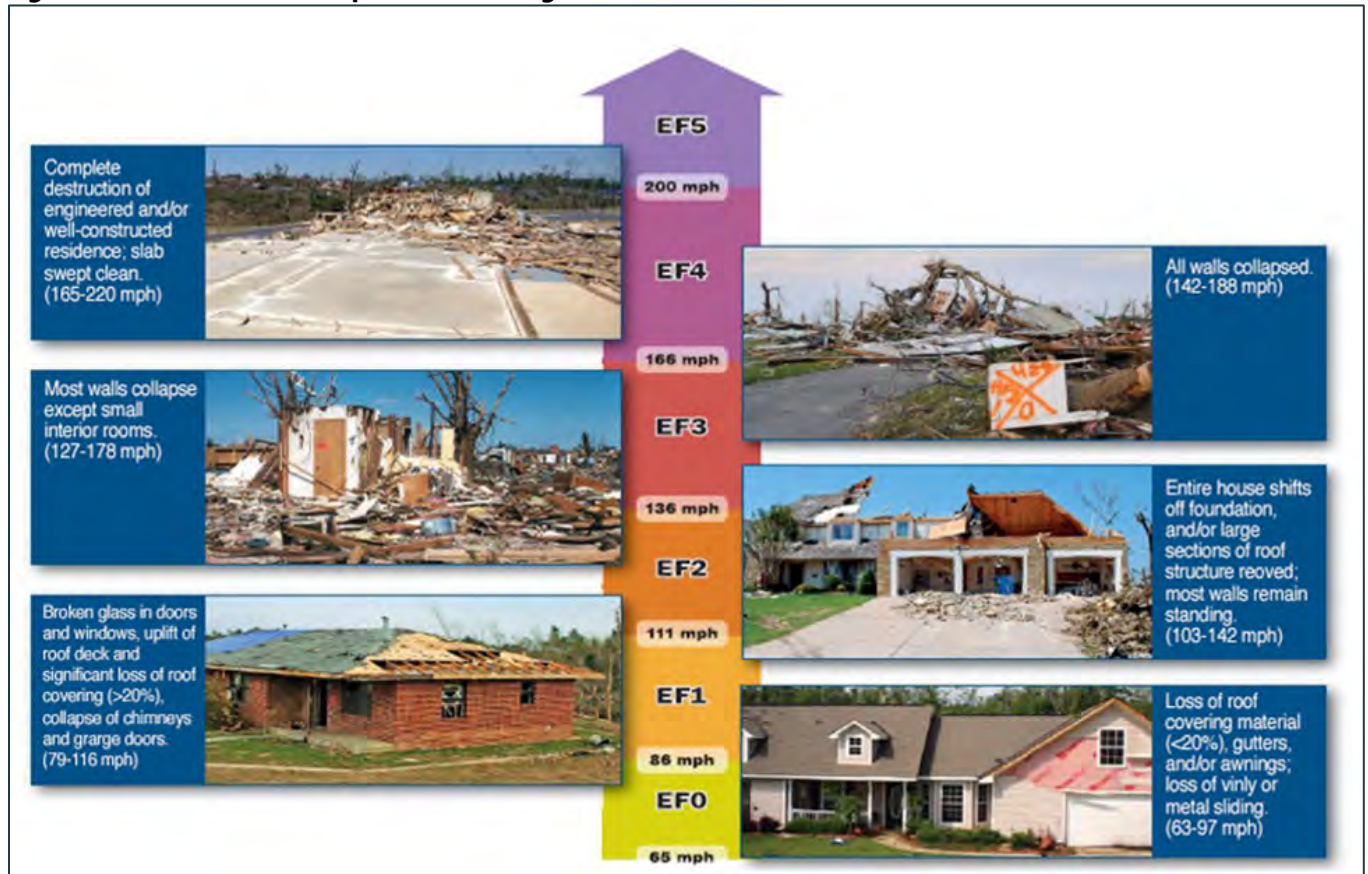
Prior to February 1, 2007, tornado intensity was measured by the Fujita (F) scale. This scale was revised and is now the Enhanced Fujita scale. Both scales are sets of wind estimates (not measurements) based on damage. The new scale provides more damage indicators (28) and associated degrees of damage, allowing for more detailed analysis and better correlation between damage and wind speed. It is also more precise because it takes into account the materials affected and the construction of structures damaged by a tornado. Table 4-62 shows the wind speeds associated with the Enhanced Fujita Scale ratings and Figure 4-49 describes the potential damage at each EF scale.

Table 4-62 Enhanced Fujita Scale

Enhanced Fujita (EF) Scale	Wind Speed Estimate (mph)
EF0	65-85
EF1	86-110
EF2	111-135
EF3	136-165
EF4	166-200
EF5	Over 200

Source: National Oceanic and Atmospheric Administration Storm Prediction Center, www.spc.noaa.gov/faq/tornado/f-scale.html

Figure 4-49 Potential Impact and Damage from a Tornado



Source: NOAA National Weather Service, Storm Prediction Center

Damaging wind is measured using the Beaufort Wind Scale as shown in Table 4-63 . This scale only reflects land-based effects and does not take into consideration the effects of wind over water

Table 4-63 Beaufort Wind Scale

Beaufort Number	Description	Wind speed (MPH)	Land Conditions
0	Calm	<1	Calm. Smoke rises vertically.
1	Light air	1 – 3	Wind motion visible in smoke.
2	Light breeze	3 – 7	Wind felt on exposed skin. Leaves rustle.
3	Gentle breeze	8 – 12	Leaves and smaller twigs in constant motion.
4	Moderate breeze	13 – 17	Dust and loose paper raised. Small branches begin to move.
5	Fresh breeze	18 – 24	Branches of a moderate size move. Small trees begin to sway.
6	Strong breeze	25 – 30	Large branches in motion. Whistling heard in overhead wires. Umbrella use becomes difficult. Empty plastic garbage cans tip over.
7	High wind, Moderate gale, Near gale	31 – 38	Whole trees in motion. Effort needed to walk against the wind. Swaying of skyscrapers may be felt, especially by people on upper floors.

Beaufort Number	Description	Windspeed (MPH)	Land Conditions
8	Gale, Fresh gale	39 – 46	Some twigs broken from trees. Cars veer on road. Progress on foot is seriously impeded.
9	Strong gale	47 – 54	Some branches break off trees, and some small trees blow over. Construction/temporary signs and barricades blow over. Damage to circus tents and canopies.
10	Storm, Whole gale	55 – 63	Trees are broken off or uprooted, saplings bent and deformed. Poorly attached asphalt shingles and shingles in poor condition peel off roofs.
11	Violent storm	64 – 72	Widespread vegetation damage. Many roofing surfaces are damaged; asphalt tiles that have curled up and/or fractured due to age may break away completely.
12	Hurricane	≥ 73	Very widespread damage to vegetation. Some windows may break; mobile homes and poorly constructed sheds and barns are damaged. Debris may be hurled about.

Source: National Oceanographic and Atmospheric Association, <http://www.spc.noaa.gov/faq/tornado/beaufort.html>

The following table summarizes the magnitude of past tornado events as recorded in the NCEI Storm Events Database. There have been 217 tornado events with a recorded magnitude since 1950 in Adams County. The highest recorded wind event in Adams county was 89 miles per hour (mph) and the highest magnitude tornado recorded is an F3. The most commonly recorded tornado events in the Storm Events Data Base are F0/EF0 and F1/EF1 tornadoes.

Table 4-64 Summary of Magnitudes of Past Tornado Events in Adams County

Magnitude	# of Events
F0	88
F1	47
F2	9
F3	2
F4	0
F5	0
EF0	24
EF1	47
EF2	0
EF3	0
EF4	0
EF5	0
Total	217

Climate Change Considerations

There presently is not enough data or research to quantify the magnitude of change that climate change may have related to tornado frequency and intensity. NASA's Earth Observatory has conducted studies which aim to understand the interaction between climate change and tornadoes. Based on these studies meteorologists are unsure why some thunderstorms generate tornadoes and others don't, beyond knowing that they require a certain type of wind shear. Tornadoes spawn from approximately one percent of thunderstorms, usually supercell thunderstorms that are in a wind shear environment that promotes rotation. Some studies show a potential for a decrease in wind shear in mid-latitude areas. Because of uncertainty with the influence of climate change on tornadoes, future updates to the mitigation plan should include the latest research on how the tornado hazard frequency and severity could change. The level of significance of this hazard should be revisited over time.

Vulnerability

People

Community members are the most vulnerable to damaging wind and tornado events. The availability of sheltered locations such as basements, buildings constructed using tornado-resistant materials and methods, and public storm shelters, all reduce the exposure of the population. However, there are also segments of the population that are especially exposed to the indirect impacts of damaging winds and tornadoes, particularly the loss of electrical power. These populations include the elderly or disabled, especially those with medical needs and treatments dependent on electricity. Nursing homes, community-based residential facilities, and other special needs housing facilities are also vulnerable if electrical outages are prolonged, since backup power generally operates only minimal functions for a short time.

The impacts of tornado and damaging wind on vulnerable populations can be more severe. Comparing the maps in this section with the social vulnerability maps in Section 2-5 shows that the areas with the greatest social vulnerability have experienced high wind and tornado events. Families in this area may have fewer financial resources to prepare for or recover from a disaster, and may be more likely to be uninsured or underinsured. Poorer families are more likely to live in poorly constructed homes that are more likely to be damaged. Individuals with disabilities may need more assistance after an event, especially if transportation or utility services are disrupted. Severe weather warnings must use methods that reach vision or hearing impaired people and those with limited English proficiency.

General Property

General damages can be both direct and indirect. Direct damage refers to what the wind event physically destroys. Indirect damage focuses on additional costs, damages and losses from secondary hazards spawned by the event. Depending on the magnitude of the wind events as well as the size of the tornado and its path, a tornado is capable of damaging and eventually destroying almost anything. Construction practices and building codes can help maximize the resistance of the structures to damage. The County's current building code (2018 International Building Code) requires structures to be built to withstand a 90-mph wind event (EF1). According to the previous HMP, a significant portion of structures in the County were built under earlier building codes that may have had lower standards for wind resistance.

Secondary impacts of damage caused by wind events often result from damage to infrastructure. Downed power and communications transmission lines, coupled with disruptions to transportation, create difficulties in reporting and responding to emergencies. These indirect impacts of a wind event put tremendous strain on a community. In the immediate aftermath, the focus is on emergency services.

Critical Facilities and Infrastructure

Because of the unpredictability of wind events' strength and path, most critical infrastructure that is above ground is equally exposed to the storm's impacts. Due to the random nature of these hazards, a more specific risk assessment was not able to be conducted.

Economy

Both winds and tornadoes can impact exposed critical infrastructure; depending on the impact and the function, this could cause a short-term economic disruption. The most common problems associated with tornadoes and damaging winds are loss of utilities. Downed power lines can cause power outages, leaving large parts of the county isolated, and without electricity, water, and communication. Damage may also limit timely emergency response and the number of evacuation routes. Downed electrical lines following a storm can also increase the potential for lethal electrical shock, and can also lead to other hazard events such as wildfires.

Historic, Cultural, and Natural Resources

Damaging winds and tornadoes can cause massive damage to the natural environment, uprooting trees and other debris.

Future Development

As the County continues to increase in population, the number of people and housing developments exposed to the hazard increases. Adherence to current building codes, coupled with proper education on building techniques and the use of sturdy building materials, attached foundations, and other structural techniques may minimize the property vulnerabilities. Public shelters at parks and open spaces may help reduce the impacts of tornadoes and damaging wind events on the recreational populations exposed to storms.

Risk Summary

- 269 wind events have been recorded in Adams County in the past 68 years, including 175 tornados.
- Past wind events have resulted in a total of \$27,057,270 in property damages, 1 fatality, and 55 injuries.
- Between 2007 and 2018 over 43,000 acres were affected by damaging wind and over \$3 million losses claimed due to the hazard.
- Vulnerable populations are at higher risk of power outages from wind events
- Related Hazards: Thunderstorms, wildfire
- Overall significance is **High**

Table 4-65 Tornado/Damaging Wind Risk Summary

Jurisdiction	Geographic Location	Probability of Future Occurrence	Magnitude/Severity	Overall Significance
Adams County	Extensive	Highly Likely	Limited	High
Bennett	Extensive	Highly Likely	Catastrophic	High
Brighton	Extensive	Highly Likely	Limited	High
Commerce City	Significant	Highly Likely	Limited	Medium
Denver Water	Limited	Highly Likely	Negligible	Low

4.3.12 Wildfire

Hazard Description

Wildfire is defined as an unplanned and uncontained wildland fire, including unauthorized human-caused fires, which can be intentional or unintentional; escaped wildland fire use events, which are naturally ignited wildfires that are then managed for specific objectives; and escaped prescribed fire projects, which are fires ignited intentionally to meet specific objectives. In addition to forest fires, wildfires also include prairie fires or brushfires. Wildfires have the ability to consume large areas, including infrastructure, property, and resources.

The 2018 Colorado State Hazard Mitigation Plan defines four general categories of wildfire:

- **Wildland Fire** – fuel consists mainly of natural vegetation.
- **Interface or Intermix Fire** – urban/wildland fires that consist of vegetation and human-made fuels.
- **Catastrophic Fire** – a very intense event that makes suppression exceedingly difficult and negatively impacts human values.

- **Prescribed Fire** – any fire ignited by management actions to meet specific objectives. A written, approved prescribed fire plan must exist, and National Environmental Policy Act (NEPA) programmatic agreement requirements (where applicable) must be met, prior to ignition. Escaped prescribed fires are considered wildfires.

Three main factors influence wildfire behavior – topography, fuel, and weather. Fires can spread more quickly when flaming fronts meet upslope fuels; but valley bottoms and ridge tops can act as barriers to fire spread (Holsinger et al. 2016). During intense fires, understory vegetation, such as leaves, small branches, and other organic materials that accumulate on the ground, can become additional fuel for the fire. The most explosive conditions occur when dry, gusty winds blow across dry vegetation, causing the fire to spread rapidly.

Most of the eastern half of the County is dominated by agricultural and grazing lands. Fuel loads on grazing lands are moderate to heavy, and large fires have occurred with this fuel type during springtime wind events. Cultivated agricultural lands include both irrigated and non-irrigated crop land. Typically, this category of land has very dynamic burning characteristics and seasons. The dynamic nature of the fuel locations and seasons of availability adds to the challenge of wildfire suppression and mitigation.

Other hazards can influence wildfire probability and severity. Damaging winds can down power lines, earthquakes can crack gas lines, and lightning can spark fires. Lightning is a major cause of structural fires and wildfires. Drought conditions increase wildfire potential by decreasing fuel moisture. Climate trends including warm winters, hot and dry summers, and severe drought, continue to increase wildfire risk and the potential for catastrophic wildland fires in Colorado. Forest insect epidemics and forest parasites also contribute to wildfire potential by increasing fuel loading. Per the 2018 Colorado State Hazard Mitigation Plan, over the past two decades Colorado has experienced an increase in insect infestations that have left vast areas of forest vulnerable to wildfire.

Geographic Location

Wildland fires can occur anywhere that natural vegetation exists as a fuel source, including forests and grasslands. Of greatest concern is the area where this vegetation meets and intermingles with developed areas, known as the Wildland-Urban Interface (WUI), because this is the area where wildfire can directly impact people and property. Figure 4-50 and Figure 4-51 show the high, medium, and low density WUI Zones with vegetation coverage of 50% or more in Adams County.

For additional details on the WUI Intermix vs. Interface areas, refer to the Vulnerability section below.

Figure 4-50 Wildland Urban Interface (WUI) Intermix Areas in West Adams County

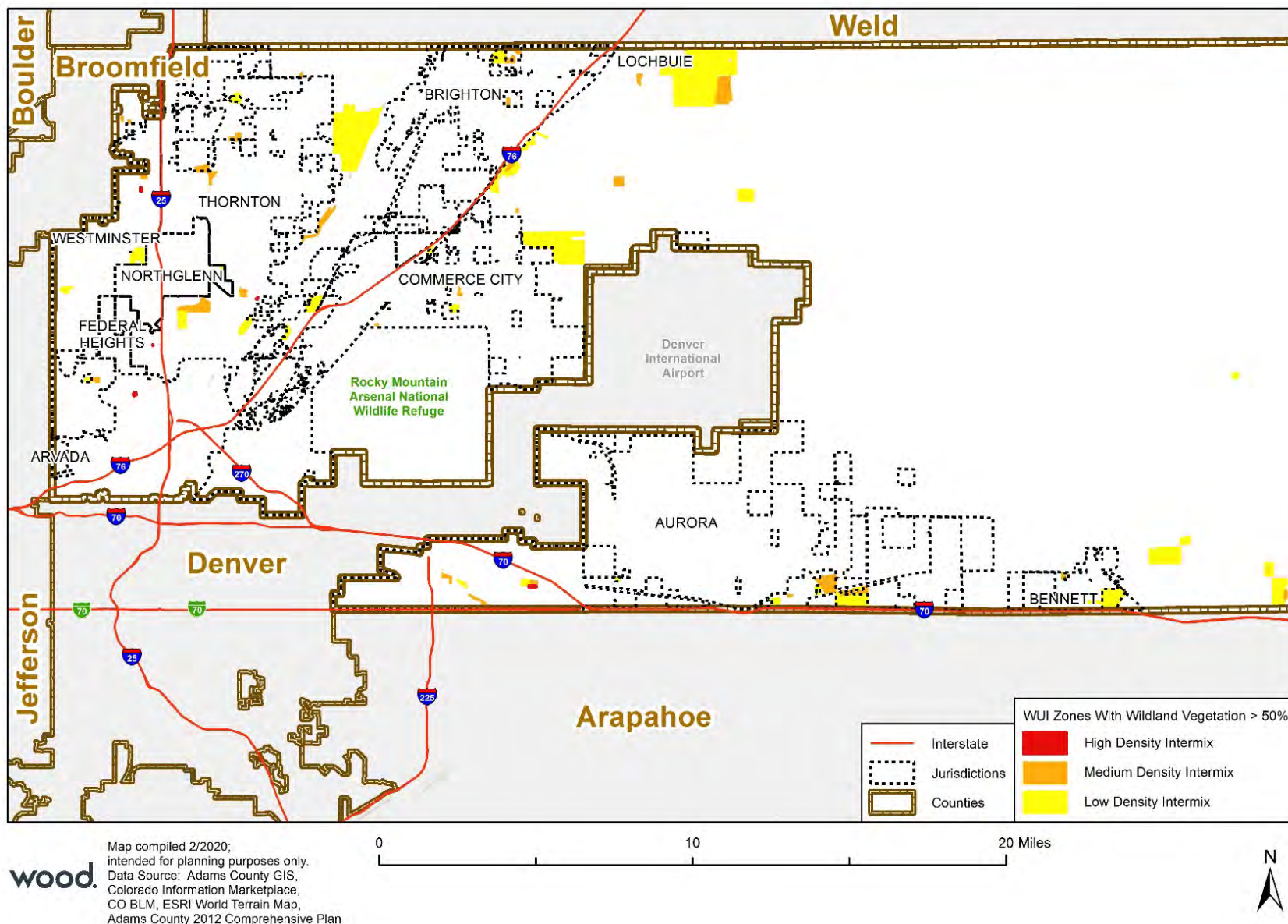
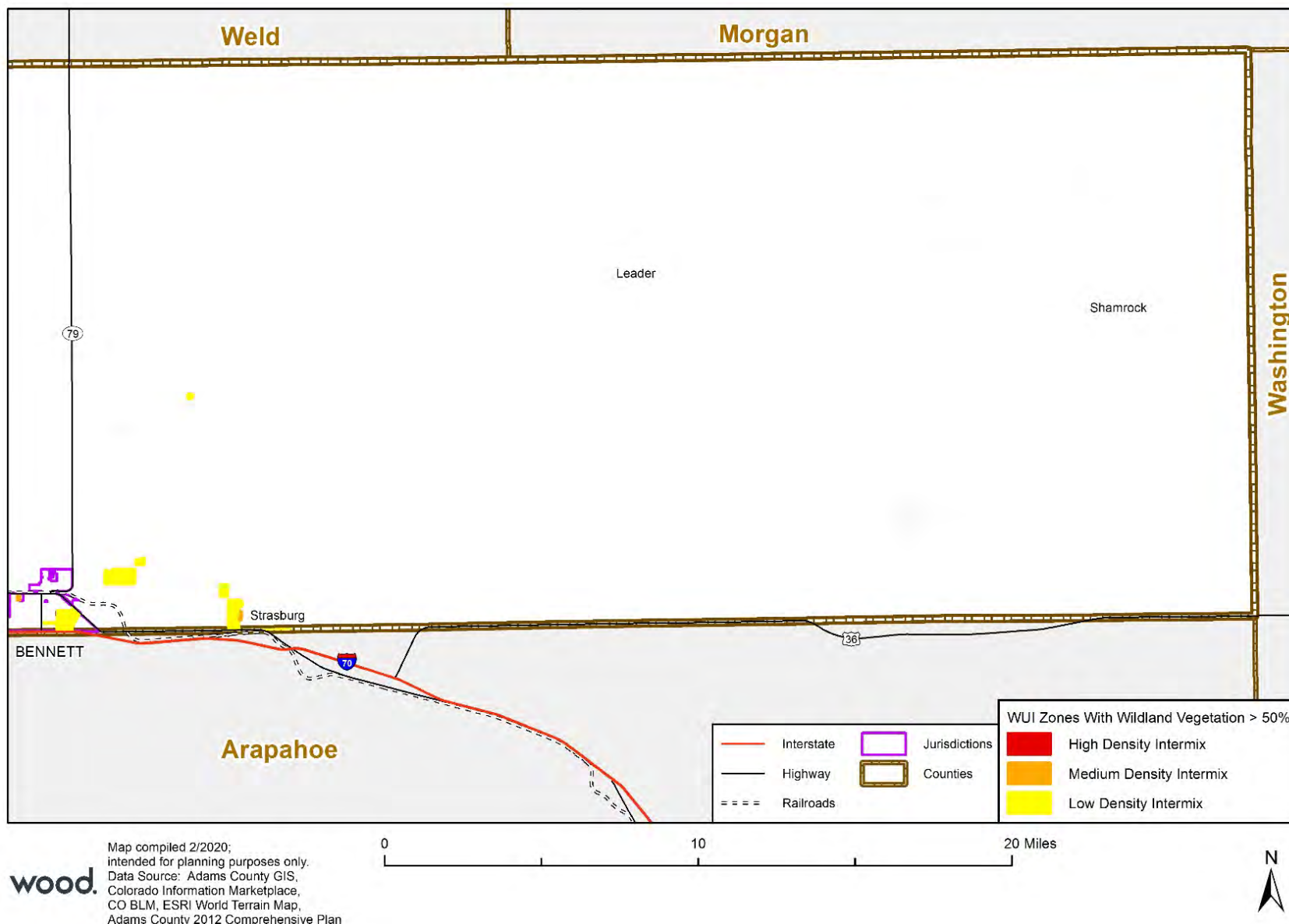


Figure 4-51 Wildland Urban Interface (WUI) Intermix Areas in East Adams County

Previous Occurrences

Table 4-66 details past fire events in Adams County from 2000 through 2018 according to data from the Federal Wildland Fire Occurrence database. During this timeframe, Adams County experienced 15 fire events that burned a total of 250.90 acres. Two-thirds of these events were human-caused. The most significant events in terms of acreage burned were the Section 32 Fire in 2006 and the Rattlesnake Hill fire in 2016.

Table 4-66 Adams County Fire History, 2000-2018

Year	Fire Name	Cause	Acres Burned
2006	Havana Fire	Natural	0.60
2006	James Fire	Natural	8.30
2006	Section 32 Fire	Natural	98.50
2007	Bison Fire	Human	1.30
2008	Gateway	Human	0.20
2010	Corral	Human	0.50
2011	Arsenal Fire	Natural	6.50
2012	Derby	Natural	0.40
2013	Lift Station	Human	0.10
2014	North Adams	Human	0.10
2014	South Adams	Human	0.10
2015	6th E	Human	0.10
2015	Center Post	Human	0.10
2016	IA 1601	Human	0.10
2016	Rattlesnake Hill	Human	134.00
TOTAL			250.90

Source: Federal Wildland Fire Occurrence database/GeoMAC (which accounts for USGS, BLM, BIA, FS, and NPS Fires), Wood analysis

Probability of Future Occurrence

Based on the above record of past events, Adams County has a 79% annual chance of experiencing a wildfire event, but only a 13% chance of that wildfire being a significant event. Conditions that cause wildfire, including drought, fuel loading, lightning strikes, and other human activities are expected to continue.

Magnitude/Severity

The Keetch-Byram Drought Index (KBDI) monitors fire danger using maximum daily temperature, and daily, antecedent, and annual precipitation. The index ranges from 0 (no drought) to 800 (extreme drought) (U.S. Forest Service Wildland Fire Assessment System 2019). Adams County considers an index of 400 to be minimum severity and an index of 600 to be a major severity for wildfire.

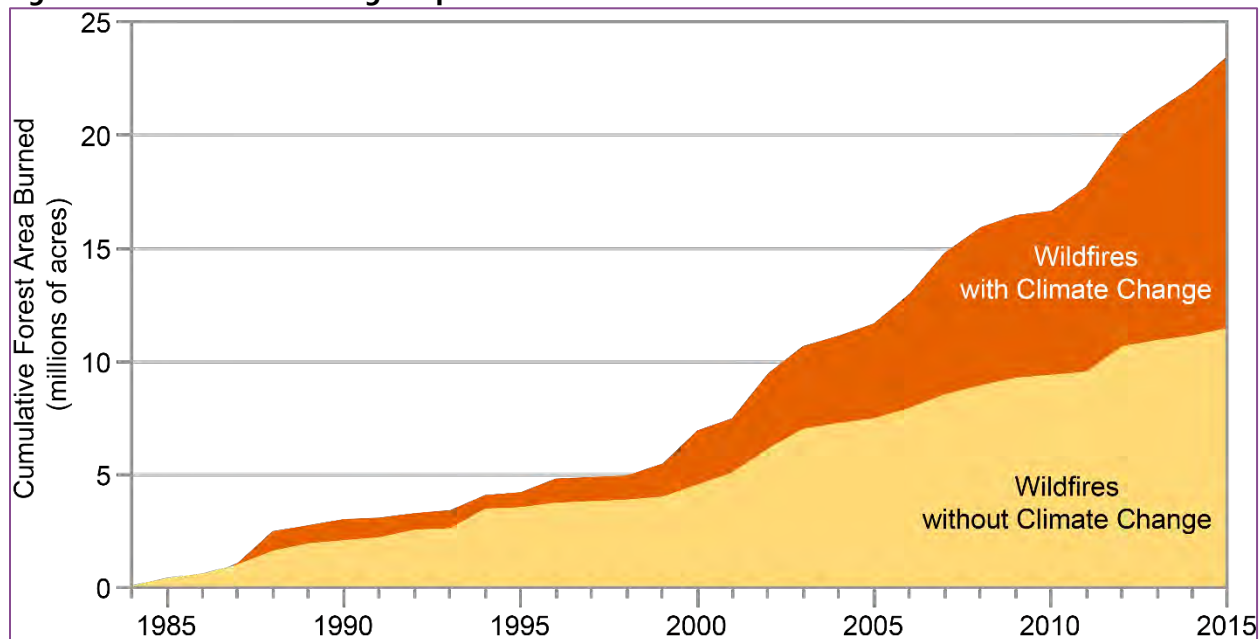
Table 4-67 Keetch-Byram Drought Index (KBDI)

KBDI	Description
0-200	Soil and fuel moisture are high. Most fuels will not readily ignite or burn. However, with sufficient sunlight and wind, cured grasses and some light surface fuels will burn in spots and patches.
200-400	Fires more readily burn and will carry across an area with no gaps. Heavier fuels will still not readily ignite and burn. Also, expect smoldering and the resulting smoke to carry into and possibly through the night.
400-600	Fire intensity begins to significantly increase. Fires will readily burn in all directions exposing mineral soils in some locations. Larger fuels may burn or smolder for several days creating possible smoke and control problems.
600-800	Fires will burn to mineral soil. Stumps will burn to the end of underground roots and spotting will be a major problem. Fires will burn through the night and heavier fuels will actively burn and contribute to fire intensity.

Source: U.S. Forest Service Wildland Fire Assessment System, 2019

Climate Change Considerations

Per analyses cited in the Fourth National Climate Assessment, it is estimated that “the area burned by wildfire across the western United States from 1984 to 2015 was twice what would have burned had climate change not occurred.” This trend is shown in Figure 4-52. Additionally, “tree death in mid-elevation conifer forests doubled from 1955 to 2007 due, in part, to climate change. Allowing naturally ignited fires to burn in wilderness areas and preemptively setting low-severity prescribed burns in areas of unnatural fuel accumulations can reduce the risk of high-severity fires under climate change.” Overall, climate change is driving wildfire increase by drying forests and making them more susceptible to burning (Gonzalez et al. 2018).

Figure 4-52 Climate Change Impacts on Wildfires in the Western United States

Source: Fourth National Climate Assessment

Vulnerability

Potential exposure to wildfire was estimated using the Adams County Wildland Urban Interface (WUI) data, as firefighting costs in WUI areas are a major concern, and not just in Colorado but across the U.S. (USDA 2015). Within the WUI data in particular, both interface and intermix areas are available, but the "intermix" is used for analysis and mapping purposes herein; this is because it is within the Intermix where housing and wildland vegetation are intermingled and hence the coverage of vegetative content is proportionally higher. The table below defines in more detail the WUI areas and their vegetative content coverage percentages.

Table 4-68 WUI and Vegetated Classes and Definitions

Area	Description
WUI Areas	
Intermix	Areas with ≥ 6.18 houses per km^2 and ≥ 50 percent cover of wildland vegetation.
Interface	Areas with ≥ 6.18 houses per km^2 and < 50 percent cover of vegetation located < 2.4 km of an area $\geq 5 \text{ km}^2$ in size that is ≥ 75 percent vegetated.
Non-WUI Vegetated Areas	
No Housing	Areas with ≥ 50 percent cover of wildland vegetation and no houses (e.g., protected areas, steep slopes, mountain tops).
Very Low Housing Density	Areas with ≥ 50 percent cover of wildland vegetation and < 6.18 houses per km^2 (e.g., dispersed rural housing outside neighborhoods).
Non-Vegetated or Agriculture Areas	
Low and Very Low Housing Density	Areas with < 50 percent cover of wildland vegetation and < 49.42 houses per km^2 (e.g., agricultural lands and pasturelands).
Medium and High Housing Density	Areas with < 50 percent cover of wildland vegetation and ≥ 49.42 houses per km^2 (e.g., urban and suburban areas, which may have vegetation but not dense vegetation).

Source: USDA Forest Service - The 2010 Wildland-Urban Interface of the Conterminous United States, 2010. Available at https://www.fs.fed.us/nrs/pubs/rmap/rmap_nrs8.pdf

Based on the above table and descriptions, the WUI zones data where wildland vegetation was greater than 50% in the Intermix was used for the following parcel and critical facility analyses. Within the WUI Intermix zones where wildland vegetation was $> 50\%$, three categories of WUI zones were relevant to the planning area: Low Density Intermix, Medium Density Intermix, and High Density Intermix. The highest concern WUI Intermix area is the High Density Intermix, which is sporadically found across the county as displayed in Figure 4-50.

People

In addition to the potential for fatalities, wildfire and the resulting diminished air quality pose health risks. Exposure to wildfire smoke can cause serious health problems within a community, including asthma attacks and pneumonia, and can worsen chronic heart and lung diseases. Vulnerable populations include children, the elderly, and people with respiratory problems or heart disease. Even healthy otherwise healthy individuals may experience minor symptoms, such as sore throats and itchy eyes.

The last column of Table 4-69 below summarizes the number of people at risk to wildfire in the analyzed WUI Intermix zones, broken out by jurisdiction and WUI zone. Unincorporated areas of the County have the most potential population exposure (with 3,555 people), followed by Thornton (with over 2,300 people), Westminster (with 906), Commerce City (with 360), Northglenn (with 315), Aurora (with 183), Brighton (with 114), and Bennett (with 0 people exposed). These totals were estimated by multiplying the average persons per household in Adams County, which is 3.0, times the number of residential properties

falling within the considered WUI zones. Overall, the county has an estimated 7,791 potential people exposed in these WUI intermix zones based on the analysis and estimation methodology described.

General Property

Buildings, crops, and livestock are vulnerable in the event of a wildfire. Buildings without fire suppression systems are more vulnerable.

In addition, WUI Intermix areas were overlaid with the parcel data in GIS to estimate potential parcels exposed as well as their values, based on the methodology described under this vulnerability section introduction as well as Section 4.2 Asset Summary. Results of the spatial analysis are summarized, by WUI zone as well as jurisdiction, in Table 4-69 below. This analysis indicates that most exposed parcels are found in Low Density Intermix zones (for a total of 1,891), followed by the Medium Density Intermix zones (with a total of 810 parcels in those areas), and finally the High Density Intermix zones (with 47 parcels exposed). The breakdown of parcels and values found in WUI intermix zones is summarized based on parcel type under Table 4-70. Based on the second table, most parcels falling inside WUI intermix areas are residential, followed by exempt parcels and then commercial, agricultural, and state assessed parcels.

Table 4-69 Parcels Found in WUI Intermix Areas with Wildland Vegetation Higher than 50%, by WUI Zone and Jurisdiction

Jurisdiction	WUI Zone	Total Improved Parcels	Improved Value	Content Value	Total Value	Population Exposed
Aurora	Low Density Intermix	9	\$114,500	\$57,250	\$171,750	15
	Medium Density Intermix	43	\$819,770	\$409,885	\$1,229,655	129
	High Density Intermix	32	\$295,570	\$147,785	\$443,355	39
	TOTAL	84	\$1,229,840	\$614,920	\$1,844,760	183
Bennett	Low Density Intermix	1	\$0	\$0	\$0	-
	Medium Density Intermix	2	\$0	\$0	\$0	-
	TOTAL	3	\$0	\$0	\$0	-
Brighton	Low Density Intermix	2	\$0	\$0	\$0	-
	Medium Density Intermix	38	\$878,560	\$439,280	\$1,317,840	114
	TOTAL	40	\$878,560	\$439,280	\$1,317,840	114
Commerce City	Low Density Intermix	105	\$2,201,930	\$1,100,965	\$3,302,895	306
	Medium Density Intermix	18	\$330,360	\$165,180	\$495,540	54
	TOTAL	123	\$2,532,290	\$1,266,145	\$3,798,435	360
Northglenn	Low Density Intermix	106	\$1,843,080	\$921,540	\$2,764,620	315
	TOTAL	106	\$1,843,080	\$921,540	\$2,764,620	315
Thornton	Low Density Intermix	376	\$10,970,770	\$7,167,335	\$18,138,105	1,089
	Medium Density Intermix	428	\$9,910,040	\$5,283,625	\$15,193,665	1,251
	High Density Intermix	6	\$81,070	\$40,535	\$121,605	18
	TOTAL	810	\$20,961,880	\$12,491,495	\$33,453,375	2,358
Westminster	Low Density Intermix	239	\$11,527,520	\$6,566,430	\$18,093,950	690
	Medium Density Intermix	78	\$2,544,520	\$1,767,495	\$4,312,015	216
	TOTAL	317	\$14,072,040	\$8,333,925	\$22,405,965	906
Unincorporated	Low Density Intermix	1,053	\$30,894,310	\$16,269,295	\$47,163,605	2,976
	Medium Density Intermix	203	\$5,074,080	\$2,537,040	\$7,611,120	555
	High Density Intermix	9	\$123,120	\$61,560	\$184,680	24
	TOTAL	1,265	\$36,091,510	\$18,867,895	\$54,959,405	3,555
GRAND TOTAL		2,748	\$77,609,200	\$42,935,200	\$120,544,400	7,791

Source: Adams County 2014 HMP, Adams County GIS/Assessor's Office, U.S. Census Bureau, Wood analysis

Table 4-70 Parcels Found in WUI Intermix Areas with Wildland Vegetation Higher than 50%, by Parcel Type

Parcel Type	Total Improved Parcels	Improved Value	Content Value	Total Value	Population Exposed
Agricultural	20	\$550,010	\$550,010	\$1,100,020	--
Commercial	25	\$7,711,190	\$7,711,190	\$15,422,380	--
Exempt	104	\$1,720,740	\$860,370	\$2,581,110	--
Residential	2,597	\$67,627,260	\$33,813,630	\$101,440,890	7,791
State Assessed	2	\$0	\$0	\$0	--
TOTAL	2,748	\$77,609,200	\$42,935,200	\$120,544,400	7,791

Source: Adams County 2014 HMP, Adams County GIS/Assessor's Office, U.S. Census Bureau, Wood analysis

Critical Facilities and Infrastructure

Wildfires frequently damage community infrastructure, including roadways, communication networks and facilities, power lines, and water distribution systems. Efforts to restore roadways include the costs of maintenance and damage assessment teams, field data collection, and replacement or repair costs. Direct impacts to municipal water supply may occur through contamination of ash and debris during the fire, destruction of aboveground distribution lines, and soil erosion or debris deposits into waterways after the fire. Utilities and communications repairs are also necessary for equipment damaged by a fire. This includes power lines, transformers, cell phone towers, and phone lines.

Based on the GIS analysis performed, 27 critical facilities were found to be located within WUI Zones with wildland vegetation greater than 50%. These facilities are detailed by WUI Zone type, jurisdiction, FEMA lifeline, and type in Table 4-71.

Table 4-71 Critical Facilities in WUI Zones with Wildland Vegetation >50%

Wildfire	Jurisdiction	FEMA Lifeline	Critical Facility Type	Total
Low Density Intermix	Aurora	Safety and Security	Landfills/Govt. Services	1
	TOTAL			1
	Brighton	Hazardous Material	HazMat EO Tier II Sites	1
	TOTAL			1
	Unincorporated	Transportation	Minor Bridge	2
		Safety and Security	Landfills/Govt. Services	2
		Safety and Security	Government Facilities	1
		Safety and Security	Fire Stations	1
		Hazardous Material	HazMat EO Tier II Sites	12
		Hazardous Material	Environmental Hazard Superfund	1
		Food/Water/Shelter	Gravel Mines/Ponds	1
		Communications	Communication Towers	3
	TOTAL			23
Low Density Intermix Total				25
Medium Density Intermix	Unincorporated	Transportation	Minor Bridge	1
		Communications	Communication Towers	1
	TOTAL			2
Medium Density Intermix Total				2
GRAND TOTAL				27

Source: Adams County GIS and 2012 Comprehensive Plan, HIFLD, Wood analysis

Economy

Economic consequences of wildfire can include the cost of fire suppression, reduced property values, lost sales and business revenues, reduced tourism, and increased water treatment costs.

Historic, Cultural, and Natural Resources

Wildfires have the potential to destroy forest and forage resources and damage natural habitats. Wildfire can also damage agricultural crops, timber, and other resources.

Secondary hazards can often follow a wildfire. For example, when vegetation burns and bare ground is exposed, severe erosion can result. When followed by heavy rains and flooding, mudslides and landslides may occur.

Following a wildfire, burned areas may be susceptible to the spread of invasive species.

Future Development

Exposure to wildfire will likely increase as development continues in interface areas, expanding the WUI. The 2018 Colorado State Hazard Mitigation Plan assigns Adams County an overall exposure projection of "High," despite a relatively low wildfire risk index, because the County population is projected to grow by 48% from 2010 to 2030.

Risk Summary

- There are 27 critical facilities at risk to wildfire in Adams County, primarily in unincorporated areas. The majority of these facilities are hazardous material sites.
- Related hazards: Drought, Thunderstorm (Lighting), Damaging Wind, Flood

Table 4-72 Wildfire Risk Summary

Jurisdiction	Geographic Location	Probability of Future Occurrence	Magnitude/Severity	Overall Significance
Adams County	Limited	Likely	Negligible	Low
Bennett	Limited	Highly Likely	Negligible	Low
Brighton	Limited	Likely	Negligible	Low
Commerce City	Limited	Occasional	Negligible	Low
Denver Water	Extensive	Highly Likely	Limited	Medium

5 Capability Assessment

This section summarizes Adams County's existing mitigation capabilities, which are the policies and programs in place that are used to reduce hazard impacts or that can be used to implement hazard mitigation activities. Operational or training capabilities were not assessed. The purpose of conducting a capability assessment is to understand the County's capacity for implementing mitigation activities. With a complete understanding of current capabilities, the County can better develop feasible mitigation activities and can identify opportunities to enhance capability in support of future mitigation. This assessment evaluates planning and regulatory capabilities, administrative and technical capabilities, financial capabilities, and other mitigation partnerships.

The County originally conducted this assessment in 2012 in support of development of the 2014 Comprehensive Plan. This original assessment was produced by compiling information from existing plans, policies, and staff interviews. As part of the 2020 HMP update, County staff completed a Data Collection Guide to identify key regulatory, administrative, technical, fiscal, and other policies, programs, and resources for mitigation. Based on this County input as well as additional staff research, this section was revised to capture changes since 2014 and reflect current capabilities. Revisions were also made to the organization of this section to focus on pre-disaster mitigation priorities.

This update process afforded the County and its participating jurisdictions the opportunity to review their previous capabilities and note the ways in which these capabilities have improved or expanded since the adoption of the previous plan. Additionally, in summarizing their current capabilities and identifying gaps, plan participants also considered their ability to expand or improve upon existing policies and programs as potential new mitigation strategies. Section 6 Mitigation Strategy includes mitigation actions aimed at improving community capability to reduce hazard risk and vulnerability.

Capability assessment information for the participating jurisdictions can be found in their annexes.

5.1 Planning and Regulatory Capabilities

Table 5-1 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 Adams County. Excerpts from applicable policies, regulations, and plans and program descriptions follow to provide more detail on existing mitigation capabilities. For each of the profiled hazards, several ordinances, regulations, plans and programs were identified in various communities within County. These are listed here to serve as a reference for related planning efforts.

Table 5-1 Planning and Regulatory Resources

Regulatory Tool (ordinance, code, plans)	Yes/No	Comments
Comprehensive Plan	Yes	2014. Contains the previous Hazard Mitigation Plan . Scheduled for update in 2020-2021.
Zoning ordinance	Yes	Adams County Development Standards and Regulations
Subdivision ordinance	Yes	Chapter 5 of the Adams County Development Standards and Regulations (linked above)
Growth Management ordinance	Yes	Adams County abides by the Denver Regional Council on Government's Metro Vision regional plan
Floodplain ordinance	Yes	C.R.S. 32-11-218
Building codes	Yes	2018 International Building Code (IBC)
Fire department ISO rating	NA	Adams County is served by multiple Fire Districts including: Adams County Fire Protection District, Bennett Fire Protection

Regulatory Tool (ordinance, code, plans)	Yes/No	Comments
		District, Brighton Fire District, Byers Fire District, Deer Trail Fire District, North Metro Fire District, Sable-Altura Fire District, South Adams County Fire District, Southeast Weld County Fire District, Strasburg Fire District
Erosion or sediment control program	Yes	Stormwater Quality (SWQ) Permit for Construction Activities
Storm water management program	Yes	Adams County Stormwater Utility
Site plan review requirements	Yes	Our site plans, other than planned unit developments, are reviewed at the building permit stage by planning staff.
Capital improvement plan	Yes	Adams County Public Works 5-Year Capital Improvement Program (CIP), 2018 – 2022
Economic development plan	Yes	Adams County has a designated economic development specialist and partnerships with various economic development nonprofits within the region. See our website page for this information.
Local emergency operations plan	Yes	2014 Emergency Management and Recovery Plan is currently being updated to a Disaster Management Plan
Other special plans	Yes	Adams County has subarea plans, housing plans, and open space/parks plans that are available on the following webpages: http://www.adcogov.org/long-range-planning , http://www.adcogov.org/master-plans-maps
Flood insurance study or other engineering study for streams	Yes	Mile High Flood District master drainage studies, flood hazard area delineations, and design reports
Elevation certificates (for floodplain development)	Yes	Yes, required for the Community Rating System managed under FEMA

Source: Data Collection Guide

5.1.1 Adams County Comprehensive Plan

Since adopting its first Comprehensive Plan in 1968, the County has conducted regular amendments and updates to address changing conditions and needs. Targeted updates to the County's original plan were conducted in 1975 and 1984, followed by a major update in 1999. Targeted updates to the 1999 Plan were made in 2004 to address the completion of E-470, the formation of the City and County of Broomfield, and rapid growth in the north Metro area.

The most recent update to the Comprehensive Plan in 2014 was titled "Imagine Adams County" and includes four distinct, but closely integrated components:

- Comprehensive Plan Update
- Transportation Plan Update
- Open Space, Parks, and Trails Master Plan
- Hazard Mitigation Plan

Integrating these four efforts, both in terms of the overall process and the resulting plans, represented a significant departure from previous planning efforts in Adams County and around the country. While the integration of land use and transportation efforts has become increasingly common in comprehensive plans, incorporating hazard mitigation was relatively new. This level of integration reflects Adams County's commitment to a more resilient and sustainable future.

In addition, the Imagine Adams County process was closely coordinated with the County's concurrent Open Space, Parks, and Trails Master Plan process, which provides direction for the future of the program.

The County is preparing for another update to the Comprehensive Plan in 2020-2021.

5.1.2 Emergency Operations and Recovery Plan

The Adams County Office of Emergency Management (OEM) is responsible for maintaining a County emergency operations plan. In a shift from previous plans, the County's updated Emergency Operations and Recovery Plan (EORP) incorporates recovery as a key element of emergency management.

The plan identifies the roles, responsibilities and actions required of elected officials, county departments, and partner agencies in preparing for, responding to, and recovering from emergencies and disasters. The plan establishes fundamental policies, strategies, and assumptions for a county-wide program that is guided by an all-hazards approach, the principles of the National Incident Management System (NIMS), and the planning guidance in FEMA's Comprehensive Preparedness Guide (CPG) 101. Additionally, the National Preparedness Guidelines (2007) and the National Response Framework (January 2008) were referenced to ensure that the Adams County EORP would be aligned with state and federal guidelines.

The plan approval process required review with each agency identified within the EORP, allowing for each agency to meet one-on-one with OEM; discuss plan components, roles and responsibilities; and provide input on the plan. Additionally, an EORP workshop allowed stakeholders the ability to clarify their roles and responsibilities and ensure a common understanding of the planning goals and objectives.

The base EORP and all of the supporting annexes are not developed and updated simultaneously. While the base plan serves as the foundation and legal basis for an emergency management program, much of the material pertaining to the actions taken to respond to disasters is located in the Emergency Support Function (ESF) Annexes. Annexes are developed and implemented through coordination of the lead and support agencies, but do not require Board of County Commissioners approval.

The EORP not only sets the procedures for emergency management within Adams County, but also exemplifies the administrative collaboration necessary for effective response, recovery, and mitigation.

5.1.3 Local Emergency Planning Commission

As noted in Section 4.3, Adams County's risk from hazardous materials incidents is among the highest in the state. Despite this risk, the legal and regulatory capabilities of the County to mitigate the additional risk created by hazardous materials facilities in the County are uncertain. State statute requires that the primary governing body having jurisdiction over the local emergency planning district, the County Commissioners, shall provide nominations for membership on the Local Emergency Planning Committee (LEPC), upon the request of the Colorado Emergency Planning Commission (CEPC) (24-32-2604, C.R.S.). Alternatively, the CEPC shall appoint members of an LEPC for each emergency planning district in accordance with the federal act. For local emergency planning districts for which no nominations have been submitted by the governing body, the commission may designate either the County commissioners or city council, as the case may be, to serve as the local emergency planning committee (24-32-2604, C.R.S.).

Adams County formally nominates and appoints LEPC members through the Board of County Commissioners. The mission of the LEPC is to enhance and create plans directing the response to hazardous materials incidents, increase compliance with hazardous materials reporting requirements, and continue to offer access to information on the storage of such materials for the benefit of the County's residents, businesses, and industries.

As the coordinating entity, OEM must satisfy all requirements mandated by the County, state, and federal governments including regulations pertaining to Tier II facilities. This includes records requests,

emergency planning responsibilities, and appropriate data management. The OEM has developed partnerships with numerous industries in the area to serve as members on the LEPC including Conoco Phillips, Suncor, Sinclair Oil, BASF, Atlas Roofing, Denver Water, Xcel Energy, and many of the local fire districts serving the area.

As shown on the EPA's website, "if a tank, drum, container, pipe, or other process at your facility contains any of the extremely hazardous toxic and flammable substances listed in the Code of Federal Regulations (CFR) at 40 CFR 68.130 in an amount above the threshold quantity specified for that substance, you are required to develop and implement a risk management program under a rule issued by the EPA." This is known as the Risk Management Program (RMP) rule and in Colorado, RMP information is submitted to CDPHE, but not necessarily the LEPC. In other words, without proper governance, expertise, and integration, both the Planning Commission and the LEPC may not have knowledge of the permitted use and effects of facilities within their own jurisdiction.

Information on Tier II facility locations is housed separately from the County planning function and the Planning Commission as required by state statute. A key goal of integrating comprehensive planning and hazard mitigation planning is to address future incorporation of the LEPC with the existing Planning Commission. The incorporation of these two commissions should help in the creation of an integrated planning process that addresses how hazardous materials facilities are impacted by the natural hazards in Adams County as well as how they impact current and future land use development.

5.1.4 Land Development Standards and Regulations

Zoning District Regulations

Zoning Districts are defined in Chapter 3 of the Adams County Development Standards and Regulations, which also includes a use chart outlining use categories that are permitted, conditionally permitted, and prohibited within each defined Zoning District. Zoning Districts were reviewed with a focus on spatially defined hazards that can be mitigated through growth management and development regulations, including hazardous materials incidents, flood, and subsidence.

With regard to hazardous materials incidents, uses that are permitted within Industrial, Institutional, Commercial, and Residential areas were reviewed. The Zone District definitions include three industrial zones:

- Industrial-1 District - general commercial and restricted industrial district designed to provide for a variety of compatible business, warehouse, wholesale, offices, and very limited industrial uses.
- Industrial-2 District - light manufacturing, processing, fabrication, assembly, and storage of non-hazardous and/or non-obnoxious material and products as well as allowing service facilities for industries and their employees.
- Industrial-3 District - heavy industrial district designed to accommodate most industrial enterprises.

According to the use chart, accessory dwelling units; institutional care facilities such as boarding houses, nursing homes, and hospitals; neighborhood indoor uses such as libraries, community centers, and recreation centers; and outdoor public uses such recreation areas, parks, and picnic areas are all permitted within the Industrial-3 Zoning District. This potentially allows facilities that house or serve vulnerable populations, including young children, elderly individuals, and others, to be constructed in areas where hazardous materials may be stored.

Aside from accessory dwelling units, residential uses are prohibited from Zone District I-3, preventing the ability for most residential units to be constructed in an area where toxic chemicals could be stored.

Additionally, Industrial uses such as heavy industry, heavy manufacturing or processing, light industry, light manufacturing or processing, moderate industry, and moderate manufacturing or processing are not permitted in any residential or commercial zones. This prevents the ability for industries that may store toxic chemicals to be constructed in residential or commercial areas where citizens unfamiliar with the dangers would live and work.

A zoning analysis was conducted using GIS parcel and zone district data obtained from the County GIS Department to analyze the location of Tier II facilities and RMP facilities and the corresponding zone district they are found in unincorporated Adams County. Refer to Section 4.3.6 Hazard Materials Incident, Table 4-42 for additional information on the findings of the analysis. The County's Development Standards and Regulations include the following Overlay Zoning Districts which impact hazard mitigation in Adams County:

Flammable Gas Overlay (FGO) District

It is the purpose of the Flammable Gas Overlay District to establish reasonable and uniform limitations, safeguards, and controls over uses of land designated as and/or adjacent to an operating or former solid waste disposal site. Any building, excavation, construction, or other use proposed in the FGO District shall require testing and/or mitigation related to flammable gas prior to obtaining a building permit and after receiving a certificate of occupancy. This Overlay District intended to ensure the protection of life and property from such related hazards as flammable gas, gas migration, asphyxiation, and explosion.

Flood Control Overlay (FCO) District

The FCO District is intended to limit land uses and thus reduce potential damages within the high risk flood zones. The FCO District incorporates the minimum requirements of the National Flood Insurance Program (NFIP) as well as some higher regulatory standards for additional protection.

The regulations encourage maximizing the FCO areas for open space and recreational/wildlife preservation uses outside of the urban developed areas of the County. Within urbanized areas, channelization is encouraged, however restrictions are established to limit potential associated problems including erosion and channel migration and to require no rise in the base flood elevation within floodway areas. Additionally, any proposed development must be shown not to reduce floodway capacity or increase base flood elevation.

Throughout the FCO, building restrictions are established to limit flood damages, including floodproofing and elevation requirements. With some exceptions, proposed development within the FCO requires a floodplain use permit and a certificate of occupancy.

Natural Resources Conservation Overlay (NRCO) District

Also relevant to flood hazard reduction, the NRCO District requires proposed development within the District to provide an open space set aside based on the acreage of floodplains, riparian areas, wetlands, lakes/reservoirs, and hydric soils within the site.

Mineral Conservation Overlay (MCO) District

The MCO District is relevant to mitigation of subsidence and undermined areas hazards. The MCO District establishes limitations and controls for the conservation and wise utilization of natural resources and for rehabilitation of excavated land. Land within this classification is designated as containing commercial mineral deposits in sufficient size parcels and in areas where extraction and rehabilitation can be undertaken while still protecting the health, safety, and welfare of the inhabitants of the area and the County. In cases where the location of the district or use abuts other zoning or use of land, structures, excavation, and rehabilitation may be restricted to be compatible with and protect the adjoining area. The

MCO prohibits excavation within 125 feet of existing residential development and prohibits excavation using rock crushers within 250 feet of residential development. It also sets slope stabilization and revegetation requirements.

Cluster Development and Transfer of Development Rights

Section 3-30 of the Development Standards and Regulations details provisions for Planned Unit Development (P.U.D.) which encourages development of land as a single unit and allows for greater flexibility in design. Among these provisions, P.U.D. standards allow for cluster development and transfer of development rights (TDR). Cluster development allows for increased density on one portion of a site in exchange for placing the undeveloped land on the site in a Conservation Easement.

Transfer of Development Rights allows for a similar trade in density but is accomplished across multiple sites, where certain areas intended to be preserved as open space are designated as sending areas and areas that can accommodate increased density are designated as receiving areas. Through TDR, a property owner may establish a Conservation Easement on a site in a sending area and use the development rights of that property to increase density of a development in a receiving area. The degree to which density can be increased in a receiving area is dictated by the acreage set aside in a Conservation Easement and the sending area ratio for development rights. The following areas are designated as sending areas in the Adams County TDR program:

- Airport Influence Zone: Includes the noise overlay for Denver International Airport and the Airport Influence Zone surrounding the Colorado Air and Space Port. Sending area ratio = 5:1.
- Important Farmlands: Includes farmlands of national or state importance and ranches and grazing lands of local or regional importance. The areas are based on geographic data from the 1999 Metro Vision Open Space Plan (DRCOG). Sending area ratio = 10:1.
- Natural Resource Conservation Overlay: Includes mapped floodplains in the western area of the County and areas east of the Barr Lake Buffer Zone. Sending area ratio = 15:1.
- Barr Lake/South Platte River: Includes the floodplain and important habitat area around the South Platte River as well as the Barr Lake Buffer Zone. Sending area ratio = 25:1.

Floodplain Management

Adams County has been a regular participant in the NFIP since February 1, 1979, which is also the date of the County's first Flood Insurance Rate Map (FIRM). Adams County joined the Community Rating System (CRS) on October 1, 2016 and is currently rated as a Class 9 community, which provides policyholders in the County with a five percent discount on their flood insurance premiums. The County is credited under the CRS program for a variety of flood hazard reduction activities, including maintaining elevation certificates, providing flood hazard map information, conducting outreach, providing flood protection information, preserving open space in high risk flood areas, adopting higher regulatory standards, and maintaining stormwater management activities. Adams County's higher standards, which go beyond the minimum requirements of the NFIP, include adoption of the International Building Code, local drainage protection requirements, protection of critical facilities, and a freeboard requirement.

Building Regulations

Adams County has adopted the 2018 IBC. The 2018 IBC specifically references the ASCE 7-16 Chapter 13 Seismic Design Requirements for Nonstructural Components Criteria. Colorado has traditionally been listed in the lowest seismic zone with wind and snow loads controlling building design. Buildings designed to meet the requirements of the 2018 IBC standards are expected to be adequate to withstand the severity of an earthquake in Colorado.

Additional Land Development Standards and Regulations

Table 5-2 describes additional specific codes/standards related to hazard mitigation.

Table 5-2 Land Development Codes Applicable to Hazard Mitigation

Code	Language
4-10-02-03 Extraction And Disposal Uses	Compliance with Colorado Department of Natural Resources. Requirements contained in this section shall not exempt the owner or operator of an extractive industry from compliance with the requirements of Colorado Department of Natural Resources. Prior to the approval of a Conditional Use Permit by the Board of County Commissioners, a reclamation contract shall be signed and approved by the owner or operator and the Colorado Department of Natural Resources.
4-10-02-03-02 Oil And Gas Well Drilling And Production	1. Purpose: The purpose of these oil and gas regulations is to protect the health, safety, and welfare of Adams County residents, to provide for sound environmental practices through the control of all oil and gas operations in the unincorporated areas of Adams County, and to prevent damage to County roads and bridges.
4-10-02-03-02 Oil And Gas Well Drilling And Production	4. Special Performance Standards: a. When Special Performance Standards Apply: Special Performance Standards may be imposed if a proposed oil or gas well location is not compatible with the surrounding area or if a proposed oil or gas well would have an adverse effect on the future development of the area. b. Incompatible Well: The oil or gas well is not compatible with the surrounding area when one (1) or more of the following occur: (1) Well Within 1,000 Feet of Dwelling (2) Well Within ½ Mile of Public Facility (3) Impact on Health, Safety and Welfare: The proposed facility would have an adverse impact on the health, safety, and welfare of the local inhabitants.
4-10-02-03-03 Solid And Hazardous Waste Disposal	1. General Operating and Performance Standards: The following General Operating and Performance Standards are applicable to all Solid Waste Disposal Sites and/or Processing Facilities: a. Compliance with Colorado Solid Waste Act b. Compliance with State Standards and Regulations....
4-10-02-04-03 Chemical, Petroleum, And Explosive Manufacturing	2. Fire District Review.... 4. Outdoor Activities Prohibited 5. Security Fence and Fire Proof Building 6. Prohibited Accessory Uses: Service stations, dwellings, or research laboratories are not considered accessory uses involved in the manufacture and storage of chemicals, petroleum products, or explosives
4-11-01-08 Prioritization Of Open Space Types	The following list represents the relative desirability of different types of open space/conservation areas, and should be used as the basis for determining the optimum location for open space/conservation areas within a proposed Open Space Subdivision: 1. Critical areas including riparian areas and floodplain.
4-11-02-04 Individual Protected Resources And NRCO District	PURPOSE: Waterbodies and wetlands provide critical functions in controlling floodwaters, providing wildlife habitat, cleansing water resources and contributing to the special scenic quality of Adams County. Reserving the one hundred year (100) year floodplain protects against the loss of life and property during flood events. The purposes of this Section are to define critical resources, and establish protection standards for waterbodies, floodplains, and wetlands.
4-11-02-04-02 Individual Protected Resources	1. Purpose: This Section establishes the protection standards for waterbodies, floodplains, and wetlands in order to protect the community as a whole from potential negative impacts caused by development which may affect these resources or their functions. This Section prohibits development on and within a certain distance of these resources.

Code	Language
5-02-07 Required Improvements Prior To The Issuance Of Building Permits	The following improvements shall be required, completed, and have preliminary acceptance granted by the Department of Public Works prior to issuance of a building permit for construction of residential, commercial, or industrial structures: 7. Utilities (including communications, electric power, gas, water, sewer).
5-03-02-04 Hazardous Conditions To Be Avoided Or Eliminated	Land subject to hazardous conditions such as landslides, mud or debris flows, flooding, subsidence, shallow water tables, geologic hazards, open quarries, floods, and non-potable water supply shall be identified and shall not be subdivided until the hazards have been eliminated or will be eliminated by the subdivision construction plans.
5-03-02-06 Design To Not To Encroach Into Floodplains	No developable lots shall be subject to inundation by a 100-year (1% frequency) flood unless an acceptable plan is submitted to alleviate the flooding condition...
5-03-02-08 Designed To Be Protected From Water Hazards	If a subdivision includes a water hazard such as an irrigation canal, water body or other water channel, necessary design precautions shall be taken to minimize any hazard to life or property, and additional measures such as fencing, water depth indicators, and erection of warning signs shall be taken, to the extent reasonably feasible.
5-04-05-01 Water Supply Approval	New water supply systems for irrigation, fire protection or other purposes required by the Board of County Commissioners shall be reviewed and approved by the appropriate Fire Protection District, Tri-County Health Department, Colorado Division of Water Resources, and the Colorado Department of Public Health and Environment Water Quality Control Division.
5-04-06-01 Individual Wastewater System Approval	New individual wastewater systems for sanitation or other purposes required by the Board of County Commissioners shall be reviewed and approved by the Tri- County Health Department.
9-01-03-09 Floodplain Management Floodplain Management	As part of its zoning resolutions, the County has adopted floodplain regulations necessary to preserve and promote the general health, welfare, and economic wellbeing of the region. The general purposes of floodplain regulations are summarized as follows: To reduce the hazard of floods to life and property;
9-01-03-10 Retention	In those areas of the County where no outlet presently exists for positive drainage to a major drainage system, the County will require retention of the runoff from a 24-hour, 100-year storm event plus one foot of freeboard until such connection becomes available...
9-01-11 Bridges	The hydraulic and hydrologic design of bridges within the County shall be in accordance with the Urban Drainage Criteria Manual Volume 2, Structures, Section 4 Bridges for this section. The Federal Highway Administration Hydraulics of Bridge Waterways or other County-approved resources shall also be used to determine the possible impacts on the drainage way (both upstream and downstream), scour potential and mitigation techniques for a proposed bridge structure. Based upon federal and state requirements, all new and replacement bridges shall comply with the floodplain regulations.

5.1.5 Sustainable Adams County 2030 Plan

In April 2015, Adams County completed the Sustainable Adams County 2030 Plan, which identifies four cornerstones of sustainability and sets 16 goals for ensuring long-term environmental, social, and fiscal sustainability in Adams County. The four cornerstones identified by the plan are Responsible and

Innovative Regional Leadership, Waste Management and Reduction, Conservation of Energy and Resources, and Respect for Adams County's Heritage. Within the Conservation of Energy and Resources cornerstone, the following goals align with hazard mitigation efforts pertinent to drought:

- Reduce the use of potable water at county buildings and parks by 30%
- Support policies and provide incentives to reduce water used by residential and commercial buildings throughout the county

By aiming to reduce baseline water use, the County can limit the impact of drought conditions including reducing the probability of socioeconomic drought by lowering the overall demand for water.

Within the Respect for Adams flood Heritage cornerstone, the following two goals align with hazard mitigation efforts pertinent to drought:

- Maintain the conservation of acres of high quality agricultural lands
- To protect water quantity and quality, increase the number of publicly accessible acres conserved with reservoirs or within water corridors by 10%

By conserving land, especially near water corridors or reservoirs, the County can limit potential increases in hazard extent and property exposure caused by increased development.

The plan is set to be re-evaluated in 2020, which presents the opportunity for greater integration with the goals and actions identified in this hazard mitigation plan.

5.1.6 Transportation Plan

The Adams County Transportation Plan (2012), profiles the existing transportation systems as well as planned future regional transportation priorities that traverse through the County. The Plan also identifies the hazardous and nuclear material routes and the main railroad lines that traverse through the County. The Plan is closely tied to the County's Capital Improvement Plan (CIP) with many of the identified projects in the Transportation Plan being funding through the CIP budgets. The Transportation Plan element of the County's Comprehensive Plan will be going through an update process in 2020-2021. Refer to Section 2.9 of the Community Profile for information on the County's transportation systems.

5.2 Administrative and Technical Capabilities

Adams County OEM is the primary agency responsible for emergency management and hazard mitigation in the County. However, mitigation is an interdisciplinary effort that requires collaboration across numerous departments and individuals. Administrative and technical resources are summarized in Table 5-3. Per this assessment, the County is well-staffed and equipped to assess and mitigate hazards, and to manage exposure through land management and building requirements. Additionally, the County has grant specialists to support efforts to pursue and manage outside funding for mitigation projects.

Table 5-3 Administrative and Technical Resources

Personnel Resources	Yes/No	Department/Position
Planner/engineer with knowledge of land development/land management practices	Yes	All of Community & Economic Development Department (CEDD) trained staff
Engineer/professional trained in construction practices related to buildings and/or infrastructure	Yes	CEDD
Planner/engineer/scientist with an understanding of natural hazards	Yes	CEDD

Personnel Resources	Yes/No	Department/Position
Personnel skilled in GIS	Yes	IT Department - GIS group
Full time building official	Yes	CEDD / building reviewers and chief building official
Floodplain manager	Yes	Floodplain Administrator in CEDD
Emergency manager	Yes	Full time
Grant writer	Yes	Grant Specialists within the Finance Department
GIS Data Resources (Hazard areas, critical facilities, land use, building footprints, etc.)	Yes	GIS system has layers for environmental hazards – i.e. brownfields, floodplains, etc./Maintained by data provided from outside agencies to GIS staff in IT
Warning Systems/Services (Reverse 911, cable override, outdoor warning signals)	Yes	CodeRed administered by AdCom911
Other Key personnel	Yes	Extensive County department resources headed by Department Directors and the Executive Leadership Team.

Source: Data Collection Guide

5.2.1 Office of Emergency Management

The Adams County Office of Emergency Management (OEM), located within the Department of Community Safety and Well-being, is the primary County agency responsible for the planning and coordination of local disaster services, including disaster prevention, mitigation, preparedness, response, and recovery. OEM is lead agency for ensuring the County has a Hazard Mitigation Plan, Emergency Response Plan along with supporting functional annexes, a Recovery Plan, and Continuity of Operations Plans. OEM is responsible for public outreach related to hazards, including educating the public on preparedness and mitigation actions.

OEM is also tasked with coordinating and supporting the Hazard Mitigation Planning Committee (HMPC), making them a key player in the implementation and maintenance of this Plan, as described in Section 7.

5.2.2 Community & Economic Development Department

The Community & Economic Development Department (CEDD) is the County's primary land use and planning agency. This department is responsible for a wide variety of programs and activities related to planning, zoning, permits, water conservation, stormwater, energy and housing for the unincorporated portion of the County. Staff often take hazards into consideration when reviewing development applications and updating the County land use plans, as the Department is responsible for applying the County's Land Use Code, Comprehensive Plan, and Building Code to each land use and construction permit application.

5.2.3 Public Works Department

The Public Works Department administers all construction activities within county public rights-of-way, and maintains and improves the County's infrastructure, including roadways, bridges and drainage facilities. The Department manages the development and implementation of the County's Capital Improvement Plan.

One of the programs run by the Public Works Department is the snow and ice control program. During storm events, snow and ice control takes precedence over all other operations division activities. Snow and ice control is one of the most cost and labor intensive programs managed by the operations division and includes not only plowing activities, but also the application of a liquid deicer both pre- and post-storm event, and disbursement of solid deicer and anti-skid material. Adams County has assigned three priority levels to roadways based upon road classification, emergency vehicle routes, and traffic volume.

During storm events where snow accumulation is less than eight inches, only priority routes 1 and 2 will be cleared. For storm events with greater than eight inches of snow accumulation, all routes will be served.

5.2.4 Parks, Open Space & Cultural Arts Department

The Parks, Open Space & Cultural Arts Department provides planning, management and maintenance of the county parks system that includes developed parks, open space, public park buildings, regional park / fairgrounds, trails, and the memorial bench program. The Department administers the Open Space Sales Tax, a 1/4 of one percent sales tax that goes to benefit parks, recreation, trails, and open space projects countywide.

5.2.5 Local Boards, Commissions, Committees

Adams County has several boards, commissions, and committees that are or could be involved in hazard mitigation activities. A few are described briefly below:

- **Adams County Foundation:** supports and strengthens programs and activities that improve the health, welfare, mobility and independence of Adams County Citizens.
- **Board of Fire Code Appeals:** this five-member Board interprets provisions of the International Fire Code in instances where it is alleged that the code has been incorrectly interpreted, provisions of the code do not fully apply, or an equivalent method of protection or safety is proposed.
- **Building Code Board of Appeals:** this five-member Board interprets the County's building codes in instances where it is alleged that the true intent of the code has been incorrectly interpreted, the provisions of the code do not fully apply, or the requirements of the code are adequately satisfied by other means. The Board has no authority to waive the provisions of the code.
- **Community Services Block Grant Advisory Council:** this nine-member board represents low-income, private and public sectors in the use of Community Services Block Grant funds and makes recommendations to the Board of Commissioners regarding grant awards.
- **Planning Commission:** a statutorily authorized board, appointed by the Board of County Commissioners, the commission prepares and adopts a county master plan, and reviews and makes recommendations concerning development applications within the county.
- **Tri-County Health Department Board:** a statutorily authorized board serving Adams, Arapahoe and Douglas Counties, the board is responsible for adopting policies for the public health administrator in administering and enforcing district public health laws, orders and rules, as well as the orders, rules and regulations of the state. The board also accepts and administers public health funds.

5.3 Financial Capabilities

The Finance Department provides all necessary accounting, budget, payroll, and purchasing and sales tax support and information to all County departments and the citizens of Adams County.

Table 5-4 details a variety of financial tools that can be used for mitigation and their availability to Adams County. Per this assessment, many of these funding mechanisms are eligible in Adams County but would require additional development to be accessible to use. For example, new taxes would require voter approval, CDBG funding would require further collaboration with CEDD staff, and withholding spending in hazard areas would require developing a formal program to manage.

Table 5-4 Financial Resources

Financial Resources	Accessible / Eligible to Use	Has Been Used in the Past	Comments
Community Development Block Grant	Yes	Yes	Would need to coordinate with CEDD staff that work with the CDBG funding to see if it can be allocated for HMP purposes.
Capital Improvements Project funding	Yes	Yes	Projects go through a CIP committee for recommendation to the County Manager for inclusion in the budget.
Authority to levy taxes for specific purposes	Yes	Unknown	Requires voter approval
Fees for water, sewer, gas, or electric services	Yes	Yes	County provides a Stormwater Utility to portions of Unincorporated Adams County.
Impact fees for new development	Yes	Yes	Traffic Impact fees for Roads & Bridges. public land dedication fee for Parks.
Incur debt through general obligation bonds	Yes	Unknown	Requires voter approval
Incur debt through special tax bonds	Yes	Unknown	Requires voter approval
Incur debt through private activities	Yes	Unknown	Provided that the County could/would not be responsible for debt.
Withhold spending in hazard prone areas	Yes	Unknown	For items where County controls the appropriation. Would need to have a program in place to withhold funding where hazards are identified.

Source: Data Collection Guides

With regard to mitigation and emergency management, the Finance Department is responsible for the following:

- Providing emergency procedures for purchasing supplies and/or equipment necessary for response and recovery operations in the disaster or emergency situation.
- Maintaining detailed financial records of all Adams County incident payroll accrued during an emergency or disaster and preparing reports for reimbursement accounting purposes.
- Providing County financial information to state and federal governments for emergency and recovery disaster relief.
- Coordinating with the elected officials, appointed officials, and department heads on fiscal policy, records, and expenditures.
- Providing necessary financial documentation for local, state, and federal damage assessment activities.
- Supply all appropriate forms and organizational items necessary for tracking costs per FEMA requirements.
- Coordinating disaster reimbursement where such state and federal disaster reimbursement policy requires such coordination.

5.4 Other Mitigation Programs and Partnerships

5.4.1 Public Outreach

Successful sustained mitigation depends upon robust collaboration between the public and private sector, different levels of government, municipal jurisdictions, departments, agencies and community groups within Adams County. In 2012, OEM created a Public Education and Outreach position to address this

issue. As of this plan update, OEM's outreach activities include giving a number of community presentations on community preparedness and hazard specific events, including tornado and winter storm, as well as providing educational information through social media.

5.4.2 Storm Ready

Adams County and the City of Arvada are currently certified as StormReady communities by the National Weather Service, which established the StormReady program to help local governments handle extreme weather and improve the timeliness and effectiveness of hazardous weather related warnings for the public. To be officially StormReady, a community must:

- Establish a 24-hour warning point and emergency operations center
- Have more than one way to receive severe weather warnings and forecasts and to alert the public
- Create a system that monitors weather conditions locally
- Promote the importance of public readiness through community seminars, and
- Develop a formal hazardous weather plan, which includes training severe weather spotters and holding emergency exercises

5.4.3 Firewise

Firewise USA® is a voluntary program that provides a framework to help neighbors get organized, find direction, and take action to increase the ignition resistance of their homes and community. The program is co-sponsored by the USDA Forest Service, the U.S. Department of the Interior, and the National Association of State Foresters. Adams County and its jurisdictions do not currently participate in the FireWise program.

5.4.4 National Flood Insurance Program (NFIP) and the Community Rating System (CRS)

Adams' County's participation in the National Flood Insurance Program (NFIP) and the Community Rating System (CRS) is described in detail in Section 4.3.5. The benefits of increased CRS participation are discussed in the next section.

5.5 Opportunities for Enhancement

Adams County has a number of financial tools that could potentially fund mitigation but many of these tools require further development before they can be used to fund a project. The County may want to consider further investigating the ability to use CDBG funds for mitigation projects so that projects can be proposed for any available funds. Additionally, the County may want to regularly develop a backlog of projects that could be submitted for CIP funding in order to anticipate and budget for future funds available for mitigation action implementation.

The Sustainable Adams County 2030 Plan, originally completed in 2015, is set to be re-evaluated in 2020. This planned update offers an opportunity to consider the ways in which building resiliency and mitigating hazards to prevent future losses may support the County's vision of environmental and financial sustainability. By integrating the Sustainable Adams County 2030 Plan with this Hazard Mitigation Plan, the County can identify and prioritize actions that meet goals of both plans.

Another opportunity to reduce flood losses in Adams County would be for the County to increase its CRS rating, and for other jurisdictions to join the CRS program or increase their ratings. Table 5-5 and Table 5-6 show the potential annual savings to flood insurance policy holders for each CRS Rating, along with the current ratings and savings for comparison. The direct financial benefits for Bennett, Brighton, and

Commerce City are relatively low, due to the small number of policies; however, the benefits of the County increasing its CRS rating would be approximately \$9,000 per year, per step.

Table 5-5 CRS Participation and Summary Information

Community	Current Rating	Policies	Total Premiums	Current Annual Saving
Adams County	9	170	\$218,920	\$9,849
Arvada	5	376	\$495,249	\$140,202
Aurora	7	271	\$171,365	\$14,677
Bennett	None	1	\$43	\$0
Brighton	None	7	\$2,615	\$0
Commerce City	None	21	\$13,025	\$0
Federal Heights	None	8	\$1,945	\$0
Northglenn	None	29	\$23,899	\$0
Thornton	6	66	\$42,688	\$5,228
Watkins	None	0	\$0	\$0
Westminster	6	101	\$58,369	\$3,318

Source: FEMA, as of 8/13/20

Table 5-6 Potential Benefits of CRS Ratings By Jurisdiction

Community	Class 9 Annual Savings	Class 8 Annual Savings	Class 7 Annual Savings	Class 6 Annual Savings	Class 5 Annual Savings	Class 4 Annual Savings	Class 3 Annual Savings	Class 2 Annual Savings	Class 1 Annual Savings
Adams County	\$9,849	\$18,794	\$27,740	\$37,589	\$46,535	\$55,480	\$64,426	\$73,372	\$82,318
Arvada	\$28,990	\$56,397	\$83,805	\$112,795	\$140,202	\$167,609	\$195,017	\$222,424	\$249,832
Aurora	\$5,118	\$9,867	\$14,677	\$19,795	\$24,574	\$29,354	\$34,133	\$38,912	\$43,692
Bennett	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Brighton	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Commerce City	\$216	\$311	\$406	\$622	\$717	\$812	\$907	\$1,002	\$1,097
Federal Heights	\$29	\$58	\$86	\$115	\$144	\$173	\$202	\$230	\$259
Northglenn	\$997	\$1,795	\$2,593	\$3,590	\$4,388	\$5,186	\$5,984	\$6,782	\$7,580
Thornton	\$1,373	\$2,614	\$3,855	\$5,228	\$6,469	\$7,711	\$8,952	\$10,193	\$11,434
Watkins	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Westminster	\$1,032	\$1,659	\$2,287	\$3,318	\$3,946	\$4,573	\$5,201	\$5,829	\$6,456

Source: FEMA, as of 8/13/20

6 Mitigation Strategy

DMA Requirement §201.6(c)(3):

[The plan shall include] a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.

6.1 Mitigation Strategy: Overview

This section describes the mitigation strategy process and mitigation action plan developed by the HMPC for Adams County. It describes how the County met the following requirements from the 10-step planning process:

- Planning Step 6: Set Goals
- Planning Step 7: Review Possible Activities
- Planning Step 8: Draft an Action Plan

The results of the planning process, the risk assessment, the goal setting, the identification of mitigation actions, and the hard work of the HMPC are captured in this mitigation strategy and mitigation action plan. The mitigation strategy was developed through a collaborative group process and consists of goals, objectives, and mitigation actions.

- **Goals** are general guidelines that explain what you want to achieve. Goals are defined before considering how to accomplish them so that they are not dependent on the means of achievement. They are usually long-term, broad, policy-type statements.
- **Objectives** define strategies or implementation steps to attain the identified goals and are specific and measurable.
- **Mitigation Actions** are specific actions that help achieve goals and objectives.

To support the updated goals, the mitigation actions from 2014 were also reviewed and assessed for their value in reducing risk and vulnerability to the planning area from identified hazards and evaluated for their inclusion in this plan update. Opportunities to better enhance mitigation efforts throughout the County were also identified and discussed.

6.2 Goals and Objectives

DMA Requirement §201.6(c)(3)(i):

[The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.

As part of the 2020 plan update process, a comprehensive review and update of the mitigation strategy portion of the plan was conducted by the HMPC. The goals and objectives set forth in the 2014 Comprehensive Plan were revisited and revised as needed. The result is a mitigation strategy that reflects the updated risk assessment, progress on mitigation actions, and the new priorities of this plan update.

6.2.1 2014 Comprehensive Plan Goals, Policies, and Strategies

The 2014 Comprehensive Plan did not have a separate set of goals and objectives for hazard mitigation, but instead integrated mitigation throughout the Comprehensive Plan's Goals, Policies, and Strategies. The HMPC began by reviewing those Goals, Policies, and Strategies.

A key goal of the 2014 Comprehensive Plan is “to protect the health, safety, and welfare of Adams County’s inhabitants.” To accomplish this, the plan adopted policies and strategies “intended to reduce injuries and loss of life; trauma; damage to property, equipment and infrastructure; community disruption; and economic, environmental, and other losses caused by natural and industrial hazards that are likely to impact the County resulting in a more resilient and sustainable Adams County.”

The Goals of the 2014 Comprehensive Plan are:

- Goal 1: Promote Coordinated and Connected Growth
- Goal 2: Protect the Health, Safety, and Welfare of Adams County’s Inhabitants
- Goal 3: Foster Regional Collaboration and Partnerships
- Goal 4: Reduce the Fiscal Impact of Growth
- Goal 5: Promote Economic Vitality
- Goal 6: Preserve the County’s Natural Resources

Policies in the 2014 Comprehensive Plan related to mitigation include:

- Policy 2.4: Promote Regional Cooperation
- Policy 7.1: Boost Drainage and Flood Control Capacity
- Policy 7.3: Protect Water Supplies
- Policy 9.3: Preserve Water Corridors and Reservoirs
- Policy 9.4: Protect Culturally and Historically Significant Resources
- Policy 12.1: Reduce Risk and Effects of Natural Hazards
- Policy 12.2: Increase Public Awareness of Hazard Risks
- Policy 12.3: Limit Building in High-Risk Areas and Improve Disaster Prevention.

6.2.2 Updated Goals and Objectives for 2020 Hazard Mitigation Plan

Rather than revising the Comprehensive Plan Goals, Policies, and Strategies, the HMPC decided to adopt a set of goals and objectives for this plan update specific to hazard mitigation to better provide direction for reducing hazard-related losses in Adams County. In addition to the 2014 Comprehensive Plan Goals, Policies, and Strategies, the HMPC reviewed goals and objectives from other state and local plans to ensure that this Plan’s mitigation goals align with existing plans and policies. The following plans were reviewed:

- Colorado State Multi-Hazard Mitigation Plan (2018)
- Adams County Open Space, Parks & Trail Plans Master Plan (2012)
- Thornton, Federal Heights, & Northglenn Hazard Mitigation Plan (2017)
- City of Aurora Hazard Mitigation Plan (2016)
- City of Westminster Hazard Mitigation Plan (2018)
- Arapahoe County Multi-Hazard Mitigation Plan (2015)
- Jefferson County Multi-Hazard Mitigation Plan (2016)
- Weld County Multi-Jurisdictional Hazard Mitigation Plan (2016)

These goals and objectives were evaluated on their ability to address the results of the updated risk assessment, particularly the inclusion of human-caused hazards.

Goals were defined for the purpose of this mitigation plan as broad-based public policy statements that:

- Represent basic desires of the community;
- Encompass all aspects of community, public and private;

- Are nonspecific, in that they refer to the quality (not the quantity) of the outcome;
- Are future-oriented, in that they are achievable in the future; and
- Are time-independent, in that they are not scheduled events.

Goals are stated without regard to implementation. Implementation cost, schedule, and means are not considered. Goals are defined before considering how to accomplish them so that they are not dependent on the means of achievement. Goal statements form the basis for objectives and actions that will be used as means to achieve the goals. Objectives define strategies to attain the goals and are more specific and measurable.

Based on the risk assessment review and goals development process, the HMPC identified the following goals and objectives to provide direction for reducing future hazard-related losses within Adams County. These goals maintain alignment with the 2014 Comprehensive Plan goals and strategies, and will be used to inform the next update of that plan.

Goal 1: Increase community awareness of Adams County's vulnerability to natural and human-caused hazards

Objective 1.1: Inform and educate the community about the types of hazards Adams County is exposed to, where they occur, and recommended responses.

- Continue the OEM outreach programs
- Coordinate public education preparedness programs and delivery
- Maintain OEM social media (Facebook, Twitter, Nextdoor, workplace) platforms
- Coordinate with County Communications Department for internal & external messaging

Goal 2: Reduce vulnerability and protect people, property, and the environment from natural and human-caused hazards

Objective 2.1: Provide mechanisms to enhance life safety

Objective 2.2: Reduce impacts to critical facilities and services

- Identify and protect critical facilities
- Protect hazardous materials facilities

Objective 2.3: Reduce impacts to existing buildings to the extent possible

Objective 2.4: Reduce impacts to future development to the extent possible

Objective 2.5: Reduce impacts to County natural resources

Objective 2.6: Reduce impacts to public health

Goal 3: Increase internal capabilities and coordination to reduce the impacts of natural and human-caused hazards

Objective 3.1: Improve planning coordination

Objective 3.2: Improve funding coordination

Objective 3.3: Improve response coordination

Goal 4: Strengthen communication and coordination among public agencies, NGO's, businesses, and residents

Objective 4.1: Strengthen community and regional partnerships at all levels

6.3 Progress on Previous Mitigation Actions

The 2014 Comprehensive Plan also identified a number of mitigation actions, which the County has been successful in implementing to work steadily towards meeting the 2014 plan goals. During the 2020 plan update process the County reported on the status of the 2014 actions through the use of a reporting tool, describing if the action had been completed, was deferred (not yet implemented, but still relevant for the updated plan), was in progress, or should be deleted.

The 2014 mitigation strategy contained seventeen mitigation actions, six of which have been completed. The completed actions address flood as well as multiple hazards, and many relate to increasing coordination between County departments or between the County and incorporated jurisdictions. Refer to Table 6-1 for more information on the completed actions. Four of the 2014 actions are implemented annually or are currently in progress, and five have not been completed and are being carried forward into the 2020 Mitigation Strategy.

The Town of Bennett had four mitigation actions identified in the 2015 Arapahoe County Hazard Mitigation Plan, of which one has been completed, two are in progress and one was indicated as not having been started.

The City of Brighton also reported on the ten mitigation actions they had identified in the 2016 Weld County Hazard Mitigation Plan. Brighton has completed two actions; the other eight are in progress or have not been completed.

Because this is Commerce City's first hazard mitigation plan, they did not have any previous actions to review. Similarly, Denver Water did not have any previous actions to review in Adams County.

Across all jurisdictions, nine mitigation actions from their previous mitigation plans have been completed and twenty actions are ongoing or in progress. Table 6-1 provides a summary of the mitigation actions that have been completed and deleted. More details on in-progress ongoing and new actions can be found in Section 6.5 and Table 6-2.

Table 6-1 Completed and Deleted Mitigation Actions

Jurisdiction	Hazard(s)	Mitigation Action	Priority	Comments
Adams County	Multi-Hazard: Thunderstorm, Tornado, Drought, Earthquake, Winter Weathers, Flood, Subsidence, Wildfire, Hazmat	Municipal IGA's for Preparedness Partnerships: Development of a Countywide IGA to integrate preparedness actions and response costs where not otherwise provided in state mutual aid agreements. Such IGA would provide for staffing of EOC resources, damage assessment teams, public works trucks and other equipment and labor pools.	High	Completed. IGA is in place, auto renewal every 5 years (needs to be updated)
Adams County	Flood	Storm Water and Flood Control Master Planning: Initiate where necessary master planning efforts, implement storm drainage improvements and storm warning systems.	High	Completed. Implementation of projects identified in the County's Drainage Master Plan has resulted in 38 structures removed from the floodplain.
Adams County	Multi-Hazard: Thunderstorm,	Warning Systems: Investigate more effective warning systems for unincorporated Adams	High	Deleted. Determined to be not feasible. Warning

Jurisdiction	Hazard(s)	Mitigation Action	Priority	Comments
	Tornado, Flood, Wildfire, Hazmat	County. Examine Firstcall system, Notify Me and other systems owned or otherwise operated by Adams County Government that will provide effective notification for citizens and businesses.		systems are administered by AdCom-911. No systems administered by Adams County.
Adams County	Multi-Hazard: Severe Storms, Drought, Flood, Tornado, Wildfire, Winter Weather, Dam Failure, Land Subsidence, Earthquake	Ensure uninterrupted communication is available between County Departments during emergency periods: Determine which County facilities currently have radios, assess the appropriateness and feasibility of hardwiring, and investigate other options to ensure constant and uninterrupted communication is maintained during critical events. Address the internal department communications to integrate Public Works, Assessors, and First Responders.	Non-ranked	Completed. County uses ReGroup for internal notifications through email, text, phone. Radios are available in OEM and EOC for contact with 1st Responders.
Adams County	Flood	Hoffman Drainage Way: Enlarge undersized creek watercourse in order to remove more than 20 structures from the 100-year floodplain.	Non-ranked	Completed.
Adams County	Multi-Hazard: Severe Storms, Drought, Flood, Tornado, Wildfire, Winter Weather, Dam Failure, Land Subsidence, Earthquake	Dispatch Coordination: Implement NetCAD Capabilities into EOC operations for incident dispatch and coordination between dispatching agencies. Adams County has 5 different dispatch agencies that operate off the CAD system. Emergency managers operate off of WebEOC. These systems need coordination so as to better manage situational information and resource ordering between jurisdictions within the County.	Non-ranked	Completed. Received authorization to include CAD in the EOC and working with AdCom to implement. NCR is also working on Regional Coordination Framework and Resource Management Framework.
Adams County	Flood	Little Dry Creek Flood Mitigation: Since Little Dry Creek is close to residential areas that are within the floodplain, property improvements include reconstruction and elevation of 68th Avenue, and creating a park that will incorporate a regional detention pond. Creating a detention pond will help mitigate potential flooding of existing residences and provide recreational opportunities for Adams County citizens.	Non-ranked	Completed.
Town of Bennett	Flood	Town of Bennett to join the NFIP	High	Completed. Joined 9/12/2014.
City of Brighton	Flood	North Outfall Phase II. The core residential area of Brighton must have an upgraded outfall system. Complete engineering civil drawings and construct the outfall system. Design and construct a larger outfall system to convey flows to South Platte River. Add additional inlets and piping network to more efficiently collect storm runoff.	High	Completed.

Jurisdiction	Hazard(s)	Mitigation Action	Priority	Comments
City of Brighton	Flood	11th and Bridge Improvements. This intersection frequently floods after minor and major storm systems. Have the engineering team creating the City's master drainage plan look for the cause of the issues at this location. Complete any necessary improvements recommended by the engineering firm.	High	Completed. Analysis did not identify a cause for this. Modeling shows that no structures are at risk of flooding in the 100-year event at this location. No improvements required. This is likely due to system clogging.

6.3.1 Continued Compliance with NFIP

Recognizing the importance of the NFIP in mitigating flood losses, an emphasis will be placed on continued compliance with the NFIP by Adams County and its participating communities including the City of Brighton, Commerce City, and the Town of Bennett. As NFIP participants, these communities have and will continue to make every effort to remain in good standing with NFIP. This includes continuing to comply with the NFIP's standards for updating and adopting floodplain maps and maintaining and updating the floodplain zoning ordinance. Other details related to NFIP participation are discussed in the flood vulnerability discussion in Section 4.3.5, in the capability assessment in Section 5, and the individual jurisdictional annexes.

6.4 Identification and Analysis of New Mitigation Actions

DMA Requirement §201.6(c)(3)(ii):

[The mitigation strategy shall include a] section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.

The natural and human-caused hazards identified in Section 4 Risk Assessment were evaluated to identify and select mitigation actions to support the mitigation goals and objectives described in Section 6.2. The HMPC decided to focus their mitigation efforts on those hazards identified as being high or medium significance. These priority hazards are:

- Thunderstorms (high)
- Tornado/Damaging Wind (high)
- Winter Weather (high)
- Flood (medium)
- Dam Failure/Incident (medium)
- Drought (medium)
- Hazardous Materials Incident (medium)

While the HMPC's focus was on mitigation against the above high and medium priority hazards, individual mitigation actions were suggested for some of the following low priority hazards, which are also addressed in public awareness mitigation actions, or in jurisdictional-specific actions where these hazards may be a higher priority.

- Earthquake
- Subsidence
- Wildfire

- Terrorism/Active Shooter
- Cyber Incident

Once it was determined which hazards warranted the development of specific mitigation actions, the HMPC analyzed viable mitigation options that supported the identified goals and objectives. The HMPC was provided with the following list of categories of mitigation actions, which originate from the Community Rating System:

- **Prevention:** Administrative or regulatory actions or processes that influence the way land and buildings are developed and built.
- **Property protection:** Actions that involve the modification of existing buildings or structures to protect them from a hazard or remove them from the hazard area.
- **Structural:** Actions that involve the construction of structures to reduce the impact of a hazard.
- **Natural resource protection:** Actions that, in addition to minimizing hazard losses, also preserve or restore the functions of natural systems.
- **Emergency services:** Actions that protect people and property during and immediately after a disaster or hazard event.
- **Public information/education and awareness:** Actions to inform and educate citizens, elected officials, and property owners about the hazards and potential ways to mitigate them.

At HMPC meeting number 3, the planning team was provided with a matrix showing examples of potential mitigation action alternatives for each of the above categories, for each of the identified hazards. The HMPC was also provided a handout that explains the categories and provided further examples. Another reference document titled "Mitigation Ideas" developed by FEMA was distributed to the HMPC via an online link. This document lists the common alternatives for mitigation by hazard. The HMPC was also instructed to consider both future and existing buildings in considering possible mitigation actions. Attendees were then asked to submit mitigation action worksheets prior to the next meeting.

6.4.1 Prioritization Process

At HMPC meeting number 4, each mitigation action proposed for the County was posted on the wall for members to review and discuss. The HMPC was provided with several decision-making tools, including FEMA's recommended prioritization criteria, STAPLEE, to assist in deciding why one recommended action might be more important, more effective, or more likely to be implemented than another. STAPLEE stands for the following:

- **Social:** Does the measure treat people fairly? (e.g., different groups, different generations) Does it consider social equity, disadvantaged communities, or vulnerable populations?
- **Technical:** Will it work? (Is the action technically feasible? Does it solve the problem?)
- **Administrative:** Is there capacity to implement and manage the project? (adequate staffing, funding, and other capabilities to implement the project?)
- **Political:** Who are the stakeholders? Did they get to participate? Will there be adequate political and public support for the project?
- **Legal:** Does the jurisdiction have the legal authority to implement the action? Is it legal? Are there liability implications?
- **Economic:** Is the action cost-beneficial? Is there funding available? Will the action contribute to the local economy?
- **Environmental:** Does the action comply with environmental regulations? Will there be negative environmental consequences from the action?

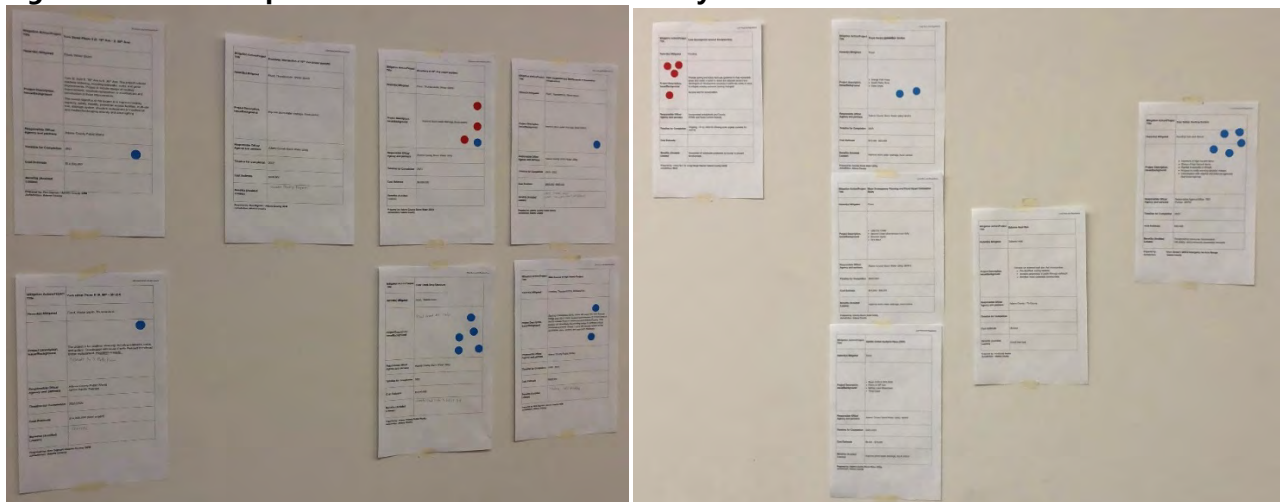
In accordance with the Disaster Mitigation Act requirements, an emphasis was placed on the importance of a benefit-cost analysis in determining action priority. Other criteria used to assist in evaluating the benefit-cost of a mitigation action included:

- Does the action address hazards or areas with the highest risk?
- Does the action protect lives?
- Does the action protect infrastructure, community assets or critical facilities?
- Does the action meet multiple objectives (Multiple Objective Management)?
- What will the action cost?
- What is the timing of available funding?

A facilitated discussion then took place to examine and analyze each proposed action. Attendees were given a table listing each proposed action, the type of project, and the hazards it addressed, and spaces for attendees to rank each project according to the STAPLEE criteria to determine which of the identified actions were most likely to be implemented and effective. Appendix A includes the matrix of alternatives considered, the mitigation categories, multi-hazard actions, and criteria, along with the project worksheets.

With these criteria in mind, team members were given a set of four blue sticky-dots and one red sticky-dot. The team was asked to use the dots to prioritize projects with the above criteria in mind, with the red dot going to the action they think should be the County's top priority. The number of dots per project was used to rank the projects as high, medium, or low priority, with red dots counting twice. This process provided both consensus and priority for the recommendations and helped the HMPC come to consensus and collectively prioritize recommended mitigation actions.

Figure 6-1 Examples of HMPC Prioritization Activity



Source: Amy Carr, taken on 2/5/2020

Emphasis was placed on the importance of a benefit-cost review in determining project priority; however, this was not a quantitative analysis. Benefit-cost was also considered in greater detail in the development of the Mitigation Action Plan detailed below in subsection 6.4. Specifically, each action developed for this plan contains a description of the problem and proposed project, expected project benefits, the entity with primary responsibility for implementation, a cost estimate, potential funding sources, and a schedule for implementation.

Recognizing the limitations in prioritizing actions from multiple jurisdictions and departments and the regulatory requirement to prioritize by benefit-cost to ensure cost-effectiveness, the HMPC decided to

pursue mitigation action strategy development and implementation according to the nature and extent of damages, the level of protection and benefits each action provides, political support, project cost, available funding, and individual jurisdiction and department priority. This process drove the development of a prioritized action plan for the Adams County planning area. Cost-effectiveness will be considered in greater detail through a formal benefit-cost analysis when seeking FEMA mitigation grant funding for eligible actions associated with this plan.

As discussed in Section 6.3, the HMPC reviewed the mitigation actions identified in the 2014 Comprehensive Plan and reported on the status of each of those actions. Actions that were not completed or deleted were also re-prioritized and are included in the updated mitigation strategy in Section 6.5.

The prioritization of mitigation actions in HMPC meeting number 4 focused on County-level actions, although the jurisdictions participated in the process. Follow up discussions were then held with each jurisdiction, and the emergency managers from each jurisdiction conducted their own process to identify and prioritize mitigation actions for their jurisdictions. While jurisdictions were given the freedom to develop their own prioritization criteria, they all chose to use the STAPLEE criteria to maintain consistency with the County process. These jurisdictional mitigation actions are included in Table 6-2 below.

Overall, a total of 19 new mitigation actions were developed for all of the participating jurisdictions in the 2020 Mitigation Strategy for Adams County.

6.5 Mitigation Action Plan

DMA Requirement §201.6(c)(3)(iii):

[The mitigation strategy section shall include] an action plan describing how the actions identified in section (c)(3)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.

This action plan was developed to present the recommendations developed by the HMPC for how the Adams County planning area will reduce the vulnerability of people, property, infrastructure, and natural and cultural resources to future disaster losses. Over time the implementation of these projects will be tracked as a measure of demonstrated progress on meeting the plan's goals.

The action plan summarizes who is responsible for implementing each of the prioritized actions as well as when and how the actions will be implemented. Each action summary also includes a discussion of the benefit-cost review conducted to meet the regulatory requirements of the Disaster Mitigation Act. Table 6-2 identifies the updated mitigation actions for Adams County and participating jurisdictions. Actions specific to other participating jurisdictions are detailed in the jurisdictional annexes.

It is important to note that Adams County and the participating jurisdictions have numerous existing, detailed action descriptions in other planning documents, such as general plan elements, community wildfire protection plans and capital improvement budgets and reports. These actions are considered to be part of this plan; refer to their original source documents for additional details. The Adams County planning area also realizes that new needs and priorities may arise as a result of a disaster or other circumstances and reserves the right to support new actions as necessary, as long as they conform to the overall goals of this plan.

The results of the 2020 action identification and prioritization exercise are summarized below in Table 6-2. The actions are grouped by corresponding goals of this plan. Included in the table are actions carried forward from the 2014 plan, which are noted as continuing-not completed or in progress projects in the

Project Status column. Continuing projects are those identified in 2014 that may have been started but either more work remains, or they are annually implemented projects. The summary table can be used for reference during future HMPC meetings to track progress moving forward. Additional details can be found in the Mitigation Action Worksheets included in Appendix D.

There are actions in the table that mitigate impacts to existing as well as new buildings and infrastructure. Actions that mitigate losses to future development are denoted by an '*' in the table on the action ID.

Table 6-2 Adams County 2020 Mitigation Action Plan

ID	Related Goal(s)	Hazard(s) Mitigated	Description / Background / Benefits	Lead Agency and Partners	Cost Estimate	Potential Funding	Priority	Timeline	Status / Implementation Notes
Adams County Mitigation Actions									
AD-1	3	Multi-Hazard: Thunder-storm, Tornado, Earthquake, Winter Weather, Flood, Wildfire, Hazardous Materials	Redundant Emergency Operations Center Communication System: Develop an internal county team to identify current and potential fail points in the current system as well as to assess and develop recommendations to implement a secondary communication system to assure redundancy. Investigate the implementation of a redundant communication system in the Adams County EOC and the County Government Center where the EOC is located. Phone system currently utilized is VOIP. Cell phone coverage is limited or non-existent in some areas and land lines into the government center do not currently exist. While ARES capabilities are present in the EOC, they are not sufficient to manage the volume that may be necessary to support Type I or II Incident support.	Adams County OEM, IT	\$4,000,000	HMA grants and General Funds	High	2021	Continue – Not completed. No action; cell-phones provide back-up to landlines. ReGroup internal messaging system can also be used.
AD-2	2	Multi-Hazard: Thunder-storm, Tornado, Flood	Regional Park Access: Develop at least one alternative point of ingress and egress into the regional facility to ensure the safe movement of personnel, visitors, and vehicles during an emergency event. Provide additional access to the Adams County Regional Park to improve emergency vehicle access.	Adams County Parks	\$10,000	HMA grants and General Funds	High	2021	Continue – Not completed.
AD-3	3,4	Multi-Hazard: Thunder-storm, Tornado, Drought, Earthquake, Winter Weather, Flood, Wildfire, Hazardous Materials	Develop a Communications Plan for Critical Facilities within the County: Investigate options and develop a communications plan for critical facilities with input and assistance from County personnel including but not limited to: County Emergency Management, Emergency Medical Services (EMS), Tri-County Health Department, care facilities & hospitals, and Adams County schools. 1) Investigate and develop a communication plan with the at-risk population facilities. More specifically, facilities with large numbers of	County OEM and Tri-County Health	\$15,000	Grants and Adams County and Tri-Health	High	2021	Continue – Not completed. Alert & warning are generated through CodeRed, not the EOC. In addition to CodeRed, information is sent to the public through social media sites such as Nextdoor, Twitter

ID	Related Goal(s)	Hazard(s) Mitigated	Description / Background / Benefits	Lead Agency and Partners	Cost Estimate	Potential Funding	Priority	Timeline	Status / Implementation Notes
			<p>residents currently are not effectively connected to receive notification, warning and information from the County EOC. A communications plan and system are required to provide proper situational information and resources for public health needs.</p> <p>2) Investigate improved emergency communications systems with Adams County schools. County schools own their own communications systems to connect internally within their district. School districts within Adams County sit within multiple different municipal jurisdictions and are not effectively connected to receive notification, warning, and information from the County EOC. A communications plan and system are required to provide proper situation information and resources to the schools and the communities they serve.</p> <p>3) Emergency Medical Services (EMS) lead is needed for proper Public Health/Hospital Coordination. EMS Agencies are a part of the Public Health Plan, but due to statutory provisions there is no lead EMS agency at the state or local level. While legislation is needed to rectify on a state scale, Adams County requires a communications plan to effectively coordinate EMS agencies during any event where multiple EMS agencies are involved.</p>						
AD-4	1,2,4	Multi-Hazard: Thunderstorm, Tornado, Drought, Earthquake, Winter Weather, Flood, Subsidence, Wildfire,	<p>Public Education and Awareness Campaign:</p> <p>Initiate with municipalities and businesses a collaborative emergency management public education and information program. Investigate effective marketing strategies needed to provide education and information.</p> <p>1) Design a program to encourage residents and businesses to take preparedness actions on their own behalf. The program should utilize and build upon communication platforms such as YouTube and Webinars, to educate the public on hazards of greatest risk</p>	Adams County OEM	Little to no cost	Adams County and FEMA Grants	High	2021	<p>In progress.</p> <p>Currently developing a number of community education programs and events to include a county safety fair.</p>

ID	Related Goal(s)	Hazard(s) Mitigated	Description / Background / Benefits	Lead Agency and Partners	Cost Estimate	Potential Funding	Priority	Timeline	Status / Implementation Notes
		Hazardous Materials	to the community. 2) Work with county businesses to develop disaster resistant business programs. 3) Develop public education & outreach to address ADA requirements for those who have access and functional needs. 4) Develop multi-lingual disaster education and functional needs preparedness into the community. 5) Develop public outreach materials addressing drought and water conservation.						
AD-5	3	Multi-Hazard: Thunder-storm, Drought, Flood, Tornado, Wildfire, Winter Weather, Dam Failure, Subsidence, Earthquake	Develop Recovery Plan and Integrate Emergency Planning and County Comprehensive Plan Activities: Assess the update cycle of the County Emergency Operation Plan and associated annexes as they support the County Comprehensive Plan. Determine activities to ensure that all plans are current and coordinated with the hazard mitigation hazard identification and risk assessment process and the Comprehensive Plan.	Adams County OEM	\$5,000	General fund budget and EM grants	Low	2020	In progress. County Disaster Management Plan scheduled for revision in 2020, to include appropriate annexes and support plans for response and recovery.
AD-6	2	Multi-Hazard: Thunder-storm, Flood, Tornado, Wildfire, Winter Weather, Earthquake	Regional Park Secondary Power: Investigate the implementation of a backup generator to help power the pump to the water supply.	Adams County Parks	\$3,000	County Parks budget	Low	2021	Continue – Not completed. Action added in 2014.
AD-7*	2,3,4	Multi-Hazard: Thunder-storm, Drought, Flood, Tornado, Wildfire, Winter Weather, Dam Failure,	Hazard Mitigation Steering Committee: Broaden and formalize the participation of the Mitigation Steering Committee to include City representatives and partner organizations. Educate them on the importance of their participation in the plan development process, updates and other periphery endeavors.	Adams County OEM	Little to no cost	General fund budget and EM grants	Low	2021	Annual implementation. Current steering committee is in place with invites to all partner agencies. Plan to include annual review of HM projects as part of on-going maintenance program.

ID	Related Goal(s)	Hazard(s) Mitigated	Description / Background / Benefits	Lead Agency and Partners	Cost Estimate	Potential Funding	Priority	Timeline	Status / Implementation Notes
		Subsidence, Earthquake							
AD-8	2	Multi-Hazard: Flooding, Thunderstorm, Wildfire	96th Avenue Bridge Repair Project: Repair the 96th Avenue bridge over Bijou Creek located approximately 2.3 miles west of Rector-Leader Road in unincorporated Adams County. This project will rehabilitate the existing bridge to address critical structural problems. Phase 1 work will include repairs to the abutments, piers, girders, and approach roadways.	Adams County Public Works	\$662,000	HMA grants and General Funds	Low	2020-2021	New in 2020. Will mitigate impacts on 1 of 2 bridges on creek.
AD-9	2	Multi-Hazard: Thunderstorm, Tornado, Winter Weather, Flood, Dam Failure, Hazardous Materials, Earthquake, Subsidence, Wildfire, Terrorism	ADA Five Areas Project: Project will assist with evacuation and post-event mobility by providing better access in compliance with Americans with Disabilities Act improvements (curb, gutter, and sidewalks) in the following areas: <ul style="list-style-type: none"> • Area 1: 68th Ave – Washington St – York St • Area 2: E. 66th Ave – Washington St – York St • Area 3: Steele St – Niver Creek Tr – E. 86th Ave • Area 4: E 56th Ave – Lincoln St. – Washington St. • Area 5: E 55th Ave – Lincoln St. – Washington St. 	Adams County Public Works	Areas 1-4: \$5,360,000 Area 5: \$680,000	General Funds	High	2021	New in 2020.
AD-10	2	Multi-Hazard: Winter Storm, Flood, Thunderstorm	E. 88th Ave and Welby Road Intersection Improvements: This project will make improvements to E. 88th and Welby Road to address localized flooding at intersection. Project will also include traffic signals and ADA-compliant curb ramps to improve access and evacuation routes.	Adams County Public Works	\$613,978	General Funds	Low	2022	New in 2020. Adjacent to Steele St. project (AD-11).
AD-11	2	Multi-Hazard: Winter Storm, Hazmat	Steele Street Project: Extension of Steele St north of 86th Avenue to 88th Avenue to improve evacuation routes for hazmat incidents and during winter storms	Adams County Public Works /Thornton, RTD	\$1,700,000	General Funds	Low	2021	New in 2020.

ID	Related Goal(s)	Hazard(s) Mitigated	Description / Background / Benefits	Lead Agency and Partners	Cost Estimate	Potential Funding	Priority	Timeline	Status / Implementation Notes
AD-12	2	Multi-Hazard: Winter Storm, Flood, Thunder-storm	Broadway at 59th Ave: Improve storm water drainage and flood control.	County Storm Water Utility and CDOT	\$8,000,000	HMA grants and General Funds	High	2023	New in 2020.
AD-13	2	Multi-Hazard: Flood, Thunder-storm	Clear Creek Drop Structure. Work with County Parks and MHFD to complete a flood hazard mitigation study. Currently flooding is impacting BNSF railroad. Working with BNSF to get structure out of floodway.	County Storm Water Utility and County Parks, MHFD, BNSF	\$3,000,000	HMA grants and General Funds, BNSF, MHFD	Medium	2021	New in 2020.
AD-14	2	Multi-Hazard: Winter Storm, Flood, Thunder-storm	Video Inspection and Maintenance of Stormwater Infrastructure. Will help with getting more accurate GIS data on infrastructure and better flood mitigation efforts, as well as stormwater management following thunderstorms and winter storms.	County Storm Water Utility	\$900,000	HMA grants and General Funds	Low	2020-2023	New in 2020. Current effort that has been ongoing since the 2013 floods.
AD-15	2	Thunder-storm, Tornado	Regional Park Sheltering: Review funding options as well as storm shelter alternatives (retro fitting or new construction) to provide Safe Rooms at the Regional Park. Provide adequate sheltering for severe storms and tornados. Currently the Regional Park is identified as the secondary location for an Alternate Care Facility and local transfer point for a public health event. Additionally, the park is the largest event center in unincorporated Adams County and frequently hosts events where thousands of people are in attendance. The Regional Park does not have adequate structures or facilities to shelter citizens during a significant weather event requiring immediate sheltering for life safety.	Adams County Parks	\$100,000	Grants and General Fund	High	2021	Continue – Not completed. No specific building(s) are designated as storm shelters, although there are several structures that can be used during severe weather.
AD-16	2	Flood	Acquisition projects: Purchase land located in problematic flood areas. Remove flood hazard via acquisition in the following areas thereby having the ability to limit or prohibit future land development in these areas: 1) Big Dry Creek Acquisition 2) South Platte River Acquisition	Adams County Parks and MHFD	\$1,000,000	Lottery monies and Open Space sales tax	High	Annual Implementation	Ongoing. Action added in 2014. Acquisition allows the County to limit or prohibit land development in these areas. The intent is for acquired land to be kept as open space.

ID	Related Goal(s)	Hazard(s) Mitigated	Description / Background / Benefits	Lead Agency and Partners	Cost Estimate	Potential Funding	Priority	Timeline	Status / Implementation Notes
			3) Second Creek Acquisition 4) Clear Creek Acquisition 5) Third Creek Acquisition 6) Beebe Seep Canal Acquisition 7) Box Elder Creek Acquisition 8) Coyote Run Acquisition 9) Horse Creek Acquisition 10) Kiowa Creek Acquisition						
AD-17	2	Flood	Flood plans and studies: Conduct the following plans and studies. (1) Major drainageway planning and flood hazard delineation for Little Dry Creek, Second Creek (downstream from DIA), Brantner Gulch, and DFA0054; (2) Flood Hazard Delineation Studies for Grange Hall Creek, South Platte River, and Clear Creek; (3) Update Outfall Systems Plans for Basin 4100 & DFA 0056, Pecos & 54th, and Third Creek	Adams County Storm Water Utility and MHFD	\$14,000-\$30,000	HMA grants and General Funds, MHFD	Low	2021	New in 2020.
AD-18	2	Flood	Dahlia outfall system: Enlarge Dahlia Pond at southwest corner of I-76 to accept more stormwater. Dahlia St Project (Dahlia St from Hwy 224-I76).	County Public Works and MHFD	\$25,000,000	HMA grants and General Funds, MHFD	Medium	Mid 2021	New in 2020. This is a major basin as identified in FHAD developed by MHFD.
AD-19	2	Flood	York Street Phase II: E. 78th -E. 88th Ave. This project includes roadway widening, including sidewalks, curbs, and gutter improvements. Project to include design of roadway improvements, structure replacement or modifications and construction of those improvements. The overall objective of this project is to improve roadway capacity, safety, mobility, pedestrian access facilities, multi-use trail, drainage system, structure replacement or modification, and median/landscaping amenity and street lighting.	County Public Works	\$14,500,000	HMA grants and General Funds	Low	2021	New in 2020.
AD-20	2	Flood	York Street Phase III: Coordination with Union Pacific Railroad (UPR) on bridge replacement.	County Public Works and UPR	\$14,500,000	UPR, HMA grants and	Low	2021-2022	New in 2020. Adjacent to S. Platte River. Currently major floodplain issue.

ID	Related Goal(s)	Hazard(s) Mitigated	Description / Background / Benefits	Lead Agency and Partners	Cost Estimate	Potential Funding	Priority	Timeline	Status / Implementation Notes
						General Funds			
AD-21*	1,2,3	Flood	Provide zoning and future land use guidance to map vulnerable populations: Create a toolkit to assist and educate owners/developers on development concerns related to planning and design related to vulnerable populations (senior facilities, low income, special needs) and ways to mitigate those concerns.	County and Incorporated Jurisdictions	Little to no cost	Staff Time/ Dept Budget	High	2023-2025	New in 2020.
AD-22	2,3,4	Dam Failure/ Incident	Dam Safety Alerting System: Coordination with internal and external agencies to enhance the County's alerting capabilities. <ul style="list-style-type: none"> • Inventory of high hazard dams • Status of high hazard dams • Rainfall thresholds to fill/spill • Process to notify warning decision makers 	County and MHFD, DWR Dam Safety, Denver Water	\$50,000	FEMA HMA Grants	Medium	2023	New in 2020.
AD-23*	2,3	Hazardous Materials	Hazardous Materials Facilities Planning and Regulation: Investigate the various methods of regulating incompatible land uses. 1) Review of existing zoning regulations; 2) Investigate a new zoning classification, performance standards, buffering requirements for critical facilities from schools, special needs facilities, and critical infrastructure; 3) Develop policies for a coordinated review process internal to the County for all Tier II Facilities; and, 4) Develop integration opportunities between the LEPC and the Adams County Planning Commission.	Adams County Community Development	Little to no cost	Adams County General Fund and Possible Grants	High	Annual Implementation	In progress. This is currently being done through the various planning committees and permitting departments.
Town of Bennett Mitigation Actions									
TOB-1	1,2	Multi-Hazard: Thunderstorm, Tornado,	Develop hazard mitigation brochure: Develop a brochure to made available to the public in hard copy and placed on the Town's website that will provide public information on	Town of Bennett - Safety Officer and	Little to no cost	Staff Time/ Dept. Budget	Medium	2020	New in 2020.

ID	Related Goal(s)	Hazard(s) Mitigated	Description / Background / Benefits	Lead Agency and Partners	Cost Estimate	Potential Funding	Priority	Timeline	Status / Implementation Notes
		Winter Weather, Flood, Dam Failure, Hazardous Materials, Earthquake, Subsidence, Wildfire, Terrorism, Cyber	how to prepare for hazard events as well as mitigate vulnerabilities on their property.	Community Development					
TOB-2*	1,2,4	Flood	Participation and adoption of MHFD master plans.	Town of Bennett - Public Works, MHFD	Little to no cost	Staff Time/ Dept. Budget	Medium	2022	In progress. Town uses District's criteria and have adopted the standards. Not adoption ready
TOB-3*	2	Flood	Develop Stormwater Drainage Master Plan	Town of Bennett - Public Works	\$10,000 - \$100,000	HMA grants; Staff Time/ Dept. Budget	Medium	2022	In progress. Draft version was created but funding fell short before finalization. Currently pursuing new funding.
TOB-4*	2,3	Wildfire	Wildfire Mitigation Planning: Mitigation plan will be incorporated into Code of adoption of specific ordinance by the Town of Bennett	Bennett FPD	\$10,000-\$100,000	HMA Grants	High	2025	Continue – Not Completed.
TOB-5	2	Hazardous Materials	Stoplight and intersection infrastructure at Marketplace Drive and Hwy 79. This is a high traffic intersection right off I-70 with multiple businesses including King Soopers, Love's Travel w/truck stop, McDonalds, and a Tractor Supply. Redesign and installation of a stoplight area will assist with traffic safety for commercial vehicles as well as residential vehicles.	Town of Bennett - Public Works	\$1.2M	CIP Budget	Medium	2022	New in 2020.
TOB-6	2	Flood, Winter Weather	Replacement of culverts of on Kiowa-Bennett Road and Hwy 36. When Bennett experiences heavy rains and/or snowfall in this area, the Kiowa-Bennett road has experienced flooding and erosion issues. Replacement of	Town of Bennett - Public Works	\$500,000	CIP Budget	High	2021	New in 2020.

ID	Related Goal(s)	Hazard(s) Mitigated	Description / Background / Benefits	Lead Agency and Partners	Cost Estimate	Potential Funding	Priority	Timeline	Status / Implementation Notes
			culverts is expected to reduce and/or eliminate the flooding and erosion.						
TOB-7	2	Flood	Design of expansion for wastewater treatment facility. With the growth that the Town of Bennett is experiencing, it is necessary to begin the process for design of expansion of this facility to accommodate the growth. The site also experienced stormwater flooding in 2019.	Town of Bennett - Public Works	\$350,000	CIP Budget	High	2021	New in 2020.
City of Brighton Mitigation Actions									
COB-1	1,2,4	Multi-Hazard: Drought, Earthquake, Subsidence, Flood, Winter Weather, Thunderstorm, Tornado, Wildfire, Hazmat	Integrate mitigation & preparedness planning into existing public education programs: Integrate in programs around the city to enhance resiliency of the community around all hazard vulnerabilities. Residents must be aware of local hazards and the mitigation & preparedness actions they can take to assist in protecting themselves and their families from the adverse effects, and to enhance community resiliency. Continued and additional community education and training to specifically address local hazards, containing detailed recommendations around potential community action items, which are crucial to continue to reinforce the need to take personal and individual action to mitigate risk related to local hazards. Add information about local hazards and mitigation strategies into existing citizen centered trainings and/or developed hazard and response specific training for citizens as needed to provide information to residents about mitigation/preparedness options in their community.	City of Brighton/ Brighton Fire Rescue District's OEM	\$5,000	HSGP, EMPG, local budgets	High	2021	In progress. Community education programs (CERT, Citizen Police Academy, Weather Spotter etc.) contain the most recent assessment of local hazards and mitigations actions that can be undertaken by community members to promote resiliency. This program is always in process as additional classes are hosted and hazards are evaluated.
COB-2	2	Multi-Hazard: Thunderstorm, Tornado,	Emergency Services Support Generator: Currently, the city maintains only a small generator at the Brighton Police Department, capable only of supporting minimal	City of Brighton	\$200,000	FEMA HMA funding, City of Brighton Capital	High	2022	Continue – Not Completed. A project to develop backup power for shelter

ID	Related Goal(s)	Hazard(s) Mitigated	Description / Background / Benefits	Lead Agency and Partners	Cost Estimate	Potential Funding	Priority	Timeline	Status / Implementation Notes
		Winter Weather, Flood, Dam Failure, Hazardous Materials, Earthquake, Subsidence, Wildfire, Terrorism, Cyber	emergency lighting, the security of detention cells, and limited communication systems. The current generator cannot support the emergency coordination functions which take place at this location. Install a generator and associated wiring to support emergency functions during a short- or long-term power outage. The wiring and installation of a 500KVA generator and a 1200amp transfer switch would allow for a reliable back up power source at a critical city facility. This generator would support key city staff and services at this location and would allow for the relocation of staff and continuity of critical services. In addition, emergency support related services and functions are coordinated from this location. Critical emergency support functions such as operation of the Emergency Operations Center (EOC), location of the Policy Group meeting area and information center, the Joint Information Center (JIC) and local law enforcement operations are designated to take place at this location.			Improvements budget			sites was determined to be higher priority and has been underway since 2015.
COB-3	2	Multi-Hazard: Winter Weather, Thunderstorm, Tornado	Public/Emergency Shelter Generator for Eagle View Adult Center: Eagle View Adult Center is the main shelter location for the city. It does not have a generator nor is the building wired to accept a generator. Project would be purchasing a generator and wiring the building to setup the generator. Benefits: Ability to safely shelter residents during power loss.	City of Brighton OEM and Parks and Rec	\$250,000 - \$300,000	HMA grants and General Funds	High	2025-2030	New in 2020. UASI funding was secured in 2015 to wire the Eagle View Adult Center for receiving a generator, but due to an extreme overrun in expected construction costs, this project was never implemented, and funding was returned to UASI.
COB-4	2	Tornado	Expansion of Outdoor Warning System: Expand the City's siren system to cover portions of unincorporated Adams and Weld Counties. Several areas within the Brighton Fire Rescue District and the north area (Weld County) of the City of Brighton are without	City of Brighton, Brighton Fire Rescue District	\$45,000 per unit	HMA funding	High	2021	In progress. Sirens scheduled to be installed at Great Rock and Todd Creek Fire Stations with HMP funds have been completed.

ID	Related Goal(s)	Hazard(s) Mitigated	Description / Background / Benefits	Lead Agency and Partners	Cost Estimate	Potential Funding	Priority	Timeline	Status / Implementation Notes
			outdoor warning sirens. Installation of additional warning sirens in the locations lacking coverage to warn residents of potential hazards.						Plans for an additional unit to be placed at Vestas have been put on hold pending the development of an easement for public safety facility.
COB-5	2	Flood	North Outfall Phase III: Complete engineering civil drawings and construct the outfall system. Design and construct a larger outfall system to convey flows to South Platte River. Add additional inlets and piping network to more efficiently collect storm runoff.	City of Brighton	\$4,800,000	Storm water impact fees, monthly fees and MHFD.	High	2021	In progress. City has 50-percent design plans. Will be under contract for 100-percent design plans in 2020.
COB-6	2	Flood	Master Drainage Plan: Comprehensive master planning efforts are needed to provide guidance to the City. The City needs to hire an engineering consulting firm to complete a comprehensive master drainage plan.	City of Brighton, MHFD	\$25,000	Already available stormwater funding	Medium	End of 2020	In progress. Project budgeted for end of 2020.
COB-7	2	Flood	Second and Egbert Drainage Improvements: An undersized drainage pipe and lack of inlet do not provide appropriate drainage at this intersection. Design and construct drainage infrastructure to alleviate flooding at this intersection.	City of Brighton	\$250,000	Stormwater impact fees and monthly fees.	Low	2023	Continue – Not Completed.
COB-8	2	Flood	Third Creek and Brighton Road: The Third Creek Crossing under Brighton Road has become silted and is not adequately sized to pass 100-year flows. Complete engineering civil drawings and construct a 100-year crossing under Brighton Road.	City of Brighton	\$4,000,000	Storm water impact fees, monthly fees and MHFD.	Low	2025	Continue – Not Completed.
COB-9	2	Flood	South Brighton Outfall: The far southern portion of the City needs drainage improvements to convey storm flows to the South Platte River. Design and construct an outfall system to convey flows to South Platte River. Complete engineering civil drawings and construct the outfall system.	City of Brighton	\$20,000,000	Storm water impact fees, monthly fees and MHFD.	Medium	2025	Continue – Not Completed.

ID	Related Goal(s)	Hazard(s) Mitigated	Description / Background / Benefits	Lead Agency and Partners	Cost Estimate	Potential Funding	Priority	Timeline	Status / Implementation Notes
COB-10	2	Flood	Recreation Center Tributary Outfall: Design and construct an outfall to serve the properties surrounding the intersection of Bridge and Telluride Street to prevent localized flooding of public roadways.	City of Brighton and MHFD	\$4,500,000	Storm water impact fees, monthly fees and MHFD.	High	2025	New in 2020.
City of Commerce City Mitigation Actions									
CC-1	2	Multi-Hazard: Winter Weather, Thunderstorm, Tornado, Flood, High Wind	Protect critical infrastructure from power outages with emergency generators: Retrofit public government buildings with back-up emergency generators. Commerce City has there three critical buildings that don't have emergency back-up power supply. In the event of a power outages, these critical buildings will not be operational. The buildings are two recreation centers that have been designated as emergency shelters and the municipal service center which maintains the city's fleet vehicles and equipment. In the past, natural disasters such as blizzards created major power outages; therefore the city could not use their designated emergency shelters facilities and also hinder fleet support services. The lack of capability of maintaining operational readiness of emergency shelters and fleet support services during power outages as the potential of creating hardships in providing emergency sheltering and fleet support services.	City of Commerce City Public Work / Commerce City OEM	\$500,000	HMA Grants with General Budget Funds	High	2021-2023	New in 2020. This project will help maintain operational readiness of critical infrastructure to perform mission essential functions such as emergency shelter operations and sustainment of Fleet services.
CC-2	2	Multi-Hazard: Winter Weather, Thunderstorm, Tornado, Flood, High Wind	Sustain mobile fleet by providing internal fuel storage dispensing capability: Install a permanent fuel storage/dispensing facility. Commerce City doesn't have internal fuel storage/dispensing capability to maintain the city's fleet vehicles. Currently the city uses public retail vendors such as gas stations to provide fuel for its vehicles. In the events of blizzards, major flooding and power outages public gas stations maybe be closed or out of fuel which will severely decrease the city's	City of Commerce City Public Work / Commerce City OEM	\$225,000	HMA Grants with General Budget Funds	High	2021-2022	New in 2020. This project will help maintain operational readiness and sustainment of city's fleet and equipment.

ID	Related Goal(s)	Hazard(s) Mitigated	Description / Background / Benefits	Lead Agency and Partners	Cost Estimate	Potential Funding	Priority	Timeline	Status / Implementation Notes
			capability in maintaining their fleet and operational readiness. Two critical fleet sections are first responder vehicles and snowplow trucks which if these vehicles don't have fuel will create a public safety emergency.						
CC-3		Flood	Fairfax Park Drainage Reconstruction: The first phase of this project is a study through Mile High Flood District to study the drainage for the Core part of the City and to determine what infrastructure improvements are needed to better drain the Fairfax Park/Regional Detention Pond. The next phase of the project will be to replace the outfall pipe from Fairfax Park to the South Platte River. We anticipate that this project will be done over a three-year period. The majority of the storm water from the historic portion of Commerce City drains to Fairfax Park. Fairfax Park functions as a regional drainage facility and as a regional park for the City. The outfall system from Fairfax Park to the South Platte is undersized, the pond frequently overtops, and the flooding negatively affects the surrounding neighborhood. In addition, during large storm events it takes several days for Fairfax to drain. This affects the use of the site as a regional park.	City of Commerce City Public Work / Commerce City OEM	\$4,350,000	Mitigation grant funds, Mile High Flood District funds with general budget funds	High	2021-2024	New in 2020. Benefits: Maintain operational readiness of critical infrastructure to perform mission essential functions such as maintaining emergency routes during major flood events and sustainment of storm sewer infrastructure.
Denver Water Mitigation Actions									
DW-1	2	Flood	Slope armoring of reservoirs: Design and construct slope armoring to protect the west bank of Howe-Haller A, Howe-Haller B, and Hazeltine Reservoirs from erosion caused by flood events. This will protect the West Bank from damage, costly repairs, and regulatory disruption.	Denver Water	\$6,000,000	HMA grants and District Budget	Low	2023-2024	New in 2020. This project will protect the West Bank from damage, costly repairs, and regulatory disruption.

ID	Related Goal(s)	Hazard(s) Mitigated	Description / Background / Benefits	Lead Agency and Partners	Cost Estimate	Potential Funding	Priority	Timeline	Status / Implementation Notes
DW-2	2	Flood	Henderson Creek Improvement. Design and construct an improved drainage channel downstream of Dunes Reservoir spillway. Dunes' spillway is designed to pass the Probable Maximum Flood (PMF). The capacity and performance of the downstream channel is currently unknown, and Dunes Reservoir has a 1 foot storage restriction until the downstream channel is improved.	Denver Water and MHFD/ County	\$48,840	HMA grants and District Budget	Low	2029	New in 2020. This project will allow Dunes Reservoir to be operated to its maximum capacity without restriction.
DW-3	2	Erosion	Downstream North Complex Reservoir Riprap. Design and construct a ribbon of riprap around the perimeter of Howe-Haller A, Howe-Haller B, and Hazeltine Reservoirs to protect the reservoir slopes from wave run-up erosion.	Denver Water	\$10,500,000	HMA grants and District Budget	Low	2025-2026	New in 2020. Protects the reservoir slopes from damage caused by wave erosion.
DW-4	2	Drought	Hazeltine Final Grading. Perform grading and construct a low-flow channel in Hazeltine Reservoir. Final grading is required prior to the construction of the Hazeltine Pump Station and operation of the reservoir.	Denver Water	\$3,900,000	HMA grants and District Budget	High	2020-2021	New in 2020. This project will allow operations of Hazeltine Reservoir, pump station construction, and ultimately, operation of the North Complex.
DW-5	2	Drought	North Complex Hazeltine Pump Station. Design and construct a pump station with up to 220 cfs capacity to operate the DRWSP North Complex (Dunes, Tanabe, Howe-Haller A, Howe-Haller B, and Hazeltine).	Denver Water	\$121,500,000	HMA grants and District Budget	High	2020-2026	New in 2020. This project will allow the North Complex to operate for water exchange and drought recovery.

6.5.1 Additional Actions Considered

Several additional mitigation actions were proposed at HMPC meetings 3 and 4 that did not move forward as actions in the updated mitigation action plan for various reasons. Some were deemed to duplicate an already existing action or ongoing program. Others were suggested by outside stakeholders but a lead department within the County or participating jurisdictions was not identified. These additional actions are captured in Table 6-3 and may be considered for inclusion in future planning efforts.

Table 6-3 Additional Mitigation Actions Identified and Considered in 2020 Mitigation Strategy

Proposed Mitigation Action	Hazard(s)
Develop an extreme heat plan	Extreme Heat
Update and update existing snow fences; increase snowplow equipment	Winter Weather
2019 Logan Court Drainage Basin Storm design	Flood
2019 E 152nd Ave and Imboden Drainage	Flood, Thunderstorm, Winter Storm
Broadway Intersection of 62nd Ave (minor system)	Flood, Thunderstorm, Winter Storm
Update building and construction codes. Review existing building codes and adopt latest version of IBC when published.	Multi-Hazard: Earthquake, strong winds, extreme temps, severe Thunderstorms, winter weathers

7 Plan Implementation and Maintenance

Implementation and maintenance of the plan is the final step of the 10-step planning process, and is critical to the overall success of hazard mitigation planning. This chapter provides an overview of the strategy for plan implementation and maintenance, and outlines the method and schedule for monitoring, evaluating, and updating the plan. The chapter also discusses incorporating the plan into existing planning mechanisms and how to ensure continued public involvement in mitigation planning.

7.1 Implementation

DMA Requirement §201.6(c)(4)(ii):

[The plan shall include a] process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate.

Once adopted, the plan faces the truest test of its worth: implementation. While this plan contains many worthwhile actions, the participating jurisdictions will need to decide which action(s) to undertake first. Two factors will help with making that decision: the priority assigned the actions in the planning process and funding availability. Low or no-cost actions most easily demonstrate progress toward successful plan implementation.

Implementation will be accomplished by adhering to the schedules identified for each mitigation action in Table 6-2 in Section 6 Mitigation Strategy, and through pervasive efforts to network and highlight the multi-objective, win-win benefits of each project to the Adams County community and its stakeholders. These efforts include the routine actions of monitoring agendas, attending meetings, and promoting a safe, sustainable community.

Mitigation is most successful when it is incorporated into the day-to-day functions and priorities of government and development. Implementation will be accomplished through the routine actions of monitoring agendas, as well as attending meetings, and promoting a safe, sustainable community. Additional mitigation strategies could include consistent and ongoing enforcement of existing policies and vigilant review of programs for coordination and multi-objective opportunities.

Simultaneously to these efforts, it is important to maintain a constant monitoring of funding opportunities that can be leveraged to implement some of the costlier recommended actions. This will include creating and maintaining a bank of ideas on how to meet local match or participation requirements, should grants be pursued; this will help ensure participating jurisdictions are in a position to capitalize on the opportunity when funding becomes available. Funding opportunities to be monitored include special pre- and post-disaster funds, special district budgeted funds, state and federal earmarked funds, and other grant programs, including those that can serve or support multi-objective applications.

7.1.1 Implementation and Maintenance of the 2014 Plan

The 2014 Plan included a general process for implementation and maintenance of the comprehensive plan, which was generally followed. The 2014 Plan did not include details on how the hazard mitigation plan portions would be monitored and maintained in accordance with FEMA guidelines, and did not specify how often the Hazard Mitigation Planning Committee (HMPC) would meet. Implementation of the plan including the status of mitigation actions and success stories are captured in Chapter 6. In general, the County has made considerable progress on the implementation of the plan, and on decreasing the County's vulnerability to hazards.

7.1.2 Role of the Hazard Mitigation Planning Committee in Implementation and Maintenance

With adoption of this plan Adams County, Commerce City, the City of Brighton, the Town of Bennett, and Denver Water will be tasked with plan implementation and maintenance. This will be accomplished by keeping the HMPC active throughout the lifecycle of the plan. The participating jurisdictions agree to:

- Act as a forum for hazard mitigation issues,
- Disseminate hazard mitigation ideas and activities to all participants,
- Pursue the implementation of high-priority, low/no-cost recommended actions,
- Keep the concept of mitigation in the forefront of community decision making by identifying plan recommendations when other community goals, plans, and activities overlap, influence, or directly affect increased community vulnerability to disasters,
- Maintain a monitoring of multi-objective cost-share opportunities to help the community implement the plan's recommended actions for which no current funding exists,
- Monitor and assist in implementation and update of this plan,
- Report on plan progress and recommended changes to the County Commissioners, City/Town Councils, governing boards, and other partners, and
- Inform and solicit input from the public.

Other duties include reviewing and promoting mitigation proposals, considering stakeholder concerns about hazard mitigation, passing concerns on to appropriate entities, and posting relevant information on the County and municipal websites, in the local newspaper, and on social media. Other Adams County jurisdictions not participating in this plan may nevertheless be integrated into mitigation implementation where possible.

7.2 Plan Maintenance

DMA Requirement §201.6(c)(4)(i):

[The plan maintenance process shall include a] section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.

The Adams County Hazard Mitigation Plan is a living document that may be adjusted or updated as conditions change, actions progress, or new information becomes available. This section describes the method and schedule for monitoring, evaluating, and updating the Plan over the next five years.

7.2.1 Monitoring

Monitoring refers to tracking the implementation of the plan over time. Adams County OEM will be responsible for reaching out to lead and supporting agencies identified in the Mitigation Actions table for status on those mitigation actions. OEM will also coordinate with HMPC members at least annually in October to identify and track any significant changes in their agencies' mitigation efforts.

OEM will use the following process to track progress, note changes in vulnerabilities, and consider changes in priorities as a result of project implementation:

- A representative from the responsible entity identified in each mitigation action will be responsible for tracking and reporting to the HMPC when project status changes. The representative will provide input on whether the project as implemented meets the defined goals and objectives, and is likely to be successful in reducing vulnerabilities.
- If the project does not meet identified goals and objectives, the HMPC may select alternative projects for implementation.

- Projects that were not ranked high priority but were identified as potential mitigation strategies will be reviewed periodically to determine feasibility of future implementation.
- New mitigation projects identified will require an individual assigned to be responsible for defining the project scope, implementing the project, monitoring success of the project.
- Mitigation activities not identified as actions in this plan will also be tracked to ensure a comprehensive hazard mitigation program, and to assist with future updates.

7.2.2 Evaluating

Evaluating refers to assessing the effectiveness of the plan at achieving its stated purpose and goals. Evaluation of progress can be achieved by monitoring changes in vulnerabilities identified in the plan, such as:

- Decreased vulnerability because of implementing recommended actions,
- Increased vulnerability because of failed or ineffective mitigation actions, and/or
- Increased vulnerability because of new development (and/or annexation).

The HMPC will meet at least annually or following every declared disaster or significant hazard event to evaluate the implementation of the plan and consider any changes in priorities that may be warranted. Completed projects will be evaluated to determine how they have reduced vulnerability. Changes will be made to the plan to accommodate for projects that have failed or are not considered feasible after a review for their consistency with established criteria, the time frame, priorities, and/or funding resources.

7.2.3 Updating

The Adams County Hazard Mitigation Plan will be reviewed and revised at least once every five years in accordance with the DMA 2000 requirements and latest FEMA and DHSEM hazard mitigation planning guidance. Updates to this plan will:

- Consider changes in vulnerability due to project implementation,
- Document success stories where mitigation efforts have proven effective,
- Document areas where mitigation actions were not effective,
- Document any new hazards that may arise or were previously overlooked,
- Document hazard events and impacts that occurred within the five-year period,
- Incorporate new data or studies on hazards and risks,
- Incorporate new capabilities or changes in capabilities,
- Document continued public involvement,
- Document changes to the planning process, which may include new or additional stakeholder involvement,
- Incorporate growth and development-related changes to building inventories,
- Incorporate new project recommendations or changes in project prioritization,
- Include a public involvement process to receive public comment on the updated plan prior to submitting the updated plan to DHSEM/FEMA, and
- Include re-adoption by all participating entities following DHSEM/FEMA approval.

7.3 Integration Into Other Planning Mechanisms

Another important implementation mechanism that is highly effective and low-cost is the incorporation of the hazard mitigation plan recommendations and their underlying principles into other jurisdictional plans and mechanisms. Mitigation is most successful when it is incorporated into the day-to-day functions and priorities of government and development. The mitigation plan can be considered as the hub of a wheel

with spokes radiating out to other related planning mechanisms that will build from the information and recommendations contained herein. Properly implemented, the HMP should serve as one of the foundational documents of the jurisdictions' emergency management programs, since everything emergency management does should relate back in one way or another to the hazards the jurisdiction faces.

As stated in Section 7.1 of this Plan, implementation through existing plans and/or programs is recommended wherever possible. Based on this Plan's capability assessment and progress made on mitigation actions noted in Chapters 5 and 6, the participating jurisdictions continue to implement policies and programs to reduce losses to life and property from natural and human-caused hazards. The HMPC will be responsible for integrating the data, goals and objectives, and other elements of this Plan into other plans, as appropriate.

The following section provides some guidance on how Adams County will use the updated HMP to inform and improve other state plans, procedures, and programs.

7.3.1 Comprehensive Plans

The Adams County Comprehensive Plan was last updated in 2014, and the 2014 Hazard Mitigation Plan was integrated throughout that document. However, this complicated the plan update process because hazard mitigation plans are required to be updated every five years, whereas comprehensive plans are updated less frequently. Although this Plan update is being developed as a standalone plan, the County plans to adopt it as an annex to the Comprehensive Plan replacing the previous mitigation plan sections. The Comprehensive Plan itself is scheduled to be updated over the next 1-2 years. Adams County OEM will work with the County Planning Department to ensure that hazards data and mitigation goals and objectives inform the comprehensive plan update.

The City of Brighton Comprehensive Plan was last updated in 2016. Brighton OEM will work with the Town Planning Department to ensure that hazards data and mitigation goals and objectives inform the next comprehensive plan update.

The Commerce City Comprehensive Plan was last updated in 2010, and the City is beginning the process of updating their comprehensive plan beginning in 2020. Commerce City OEM will work with the City Planning Department to ensure that hazards data and mitigation goals and objectives inform the comprehensive plan update.

The Town of Bennett Comprehensive Plan was last updated in 2015. Bennett OEM will work with the Town Planning Department to ensure that hazards data and mitigation goals and objectives inform the next comprehensive plan update.

7.3.2 Threat and Hazard Identification and Risk Assessment (THIRA)

Beginning in 2020, Adams County will be required to complete a County-level Threat and Hazard Identification and Risk Assessment (THIRA). CPG201 "Threat and Hazard Identification and Risk Assessment (THIRA) establishes Step 1 as "Identify the Threats and Hazards of Concern" and lists HIRAs and HMPs as possible sources of threat/hazard information.

The criteria for selecting which Threats/Hazards are "of concern" are defined as:

- Factor #1: Likelihood of a Threat or Hazard Affecting a Community
- Factor #2: The Impacts of a Threat or Hazard

Each natural and human-caused hazard profiled in the HIRA (Section 4) contains a section analyzing the probability of future events, which provides a data-driven answer to Factor #1. Similarly, the vulnerability assessment section of the hazard profiles address what impacts can realistically be expected from both routine and extreme events of each hazard, which specifically addresses Factor #2.

Step 2 of CPG 201 is to “Give the Threats and Hazards Context” by creating a scenario for each hazard of concern, with specifics like time of day, area, and magnitude of the event, which are then used to establish capability targets for each of the 32 core capabilities. All the hazards profiled in the HIRA contain detailed information to ensure the hazard scenarios are plausible. For some hazards, such as flood or earthquake, detailed Hazus modeling runs have been done that can easily be incorporated as THIRA scenarios. Other hazards include details on the most extreme historical events on record that can quickly be updated to modern scenarios.

7.3.3 Response and Recovery Plans

The Adams County Emergency Operations and Recovery Plan (EORP) is currently being updated as the County Disaster Management Plan (DMP). The City of Brighton Emergency Operations Plan (EOP) was last updated in 2018 and is scheduled to be updated in 2020. The Commerce City EOP was last updated in 2011 and is scheduled to be updated in 2021. The Town of Bennett does not currently have an Emergency Operations Plan or Recovery Plan.

The Adams County EORP contains hazard-specific sections addressing information and concerns specific to each hazard type, which were written based on the data and analysis in the 2014 HIRA. The updated DMP will incorporate updated hazard information from this Plan update. Local EOPs will also incorporate information from this HMP into future updates. At a minimum, all high significance hazards identified in this Plan should be addressed in future EOP updates.

Similarly, the risk and vulnerability data in the HMP should help inform the post-disaster recovery planning process, especially by ensuring that the recovery elements of those plans fully take into account the dangers posed by other hazards, rather than focusing exclusively on the most recent hazard event. The HMP in turn will be revisited during recovery to help identify opportunities to incorporate mitigation in the recovery and rebuilding process, including maximizing FEMA PA and HMGP funding where applicable.

The FEMA publication Pre-Disaster Recovery Planning Guide for State Governments notes:

“...much of the research involved in the development of mitigation plans can be used to inform the pre-disaster recovery planning effort.

“The pre-disaster recovery planning process will benefit from and build upon hazard mitigation as:

- *The mitigation planning process identifies local hazards, risks, exposures, and vulnerabilities;*
- *Implementation of mitigation policies and strategies will reduce the likelihood or degree of disaster-related damage, decreasing demand on resources post-disaster;*
- *The process will identify potential solutions to future anticipated community problems; and*
- *Mitigation activities will increase public awareness of the need for disaster preparedness.*

“Pre-disaster recovery planning efforts also increase resilience by:

- *Establishing partnerships, organizational structures, communication resources, and access to resources that promote a more rapid and inclusive recovery process;*

- *Describing how hazard mitigation will underlie all considerations for reinvestment;*
- *Laying out a process for implementation of activities that will increase resilience; and*
- *Increasing awareness of resilience as an important consideration in all community activities.”*

Several other operational or functional response plans are also influenced by information contained in the HMP. These plans include but are not limited to:

- **Damage Assessment Plan:** A review of the vulnerability and estimated losses detailed in the hazard profiles can help identify what areas to initially prioritize following a hazard event. Similarly, a review of Section 4.2 Asset Summary can help identify what critical facilities need to be assessed following a hazard event.
- **Debris Management Plan:** Hazus runs conducted for earthquake and flood scenarios include an estimate of how many tons of debris would likely be generated by those scenarios. These estimates can be used as bounding limits for how much and what type of debris generation is likely to be required, as well as what areas are most likely to see heavy debris generations.
- **Evacuation & Sheltering Plan:** A review of the vulnerability and estimated losses detailed in the hazard profiles can help identify what areas are more likely to need evacuation in different hazard scenarios. The Community Profile in Section 2 can help identify not only how many people would potentially be impacted by disasters, but how many are likely to need assistance with transportation, special medical or sheltering needs, etc. This review can also help evaluate the impacts of multiple or cascading hazards, so that evacuees are not relocated into an area that puts them at risk from other hazards.

7.3.4 Continuity of Operations Plans (COOP)

All departments and agencies of Adams County government are required to maintain a Continuity Of Operations Plan (COOP) that details that agency’s critical functions and how they will protect those functions in order to continue to provide essential services during a disaster or interruption. By defining and describing the hazards facing the County, including frequency and severity, the HIRA informs agency COOP plans by giving context to what types of disasters or interruptions are most likely to occur. Critical facilities and assets located in hazard areas in Section 4.2 should be prioritized for COOP planning.

7.3.5 Training and Exercise Plans

Training on hazard mitigation principles and procedures should be included in the County’s training and exercise planning. Any training and exercise needs identified in the Capabilities Assessment (Section 5) and Mitigation Strategy (Section 5) should also be included in the County’s training and exercise planning.

7.3.6 Critical Infrastructure Protection Plan

Critical facilities and assets identified in Section 4.2 should be included in Critical Infrastructure Protection Planning (CIPP), with prioritization given to assets located in hazard-prone areas. Hazardous materials facilities in particular should be viewed both as critical assets in need of protection, and as potential hazards in their own right.

7.3.7 Community Preparedness Strategy

The County’s ongoing public education and outreach efforts should reflect the hazards and vulnerabilities described in this Plan. In addition to preparing for disasters, public education should include ways in

which the public can reduce their vulnerability to natural and human caused hazards. Furthermore, mitigation activities and success stories should be communicated to the public to show the benefits of effective mitigation planning.

7.3.8 Capital Improvements Plan

Many of the mitigation actions listed in the Mitigation Strategy (Section 6.4.2) came from the County's Capital Improvements Plan, and thus have already been identified for funding. Other high-dollar actions listed or identified in the future can also be added to the Capital Improvements Plan to ensure that hazard mitigation projects continue to receive funding. The prioritization of actions listed in Table 6-2, while not binding on capital improvement planning, can be used to inform the prioritization of those actions. Even projects for which the County intends to seek grant funding may also need to be addressed in the Capital Improvements Plan, given that most mitigation grants require significant local matching funds.

7.3.9 Drainage and Stormwater Plans

The Stormwater Quality Division in the Adams County Public Works Department has completed multiple drainage projects and plans, which are referenced in the mitigation strategy.

7.3.10 Sustainability Plan

Sustainability is a separate area of concern from hazard mitigation, but there are areas where the two fields overlap and influence one another positively or negatively.

Sustainability plans should be reviewed to identify where there may be synergy between sustainability and mitigation/resiliency. For example, sustainability efforts aimed at increasing Adams County's adaptability to climate change can also make the County more resilient to drought and severe weather. Increasing the percentage of food obtained locally could make the County more resilient to supply-chain interruptions or the impacts of disasters in other states. Adding more trees and grass to urban areas to reduce the heat island effect could help mitigate the impact of extreme weather events, as well as reducing flood risk by increasing the amount of permeable surfaces. This may help raise the priority of some sustainability efforts, as well as suggest complimentary mitigation efforts.

It is equally important to identify areas where sustainability efforts may work to reduce the County's resilience to hazards. For example, a sustainability goal of promoting use of public transit and reducing private car ownership could potentially make it harder to evacuate the public during a disaster if public transit is damaged and offline (as was observed during Hurricane Sandy). Similarly, reduced production of solid waste could lead to a reduction in the number of public resources such as dump trucks, which means that in a disaster those resources would not be available for debris removal and similar tasks. The intent of this review is not to say that sustainability goals should not be pursued, but rather to identify areas of concern that should be considered during implementation of these goals. For example, evacuation plans may need to be revised to reflect a larger percentage of families without cars; or contracts may need to be put in place to obtain additional dump trucks in a disaster.

As noted previously, the Sustainable Adams County 2030 Plan (dated 2015) helped inform the Capability Assessment (Chapter 5), and was included in the list of goals and objectives reviewed when developing the mitigation goals in Section 6-2. A potential follow-on action would be to review the goals and target actions contained in that plan for their potential impacts on hazard mitigation.

7.4 Continued Public Involvement

Continued public involvement is also imperative to the overall success of the Plan's implementation. This updated HMP will be posted on the County's website for reference, and can be used to help inform the County's ongoing public education and outreach program as described above in Section 7.3.7. Mitigation success stories, such as the completion of mitigation actions that reduce the community's vulnerability, can be shared with the public through forums like the Local Emergency Planning Committee (LEPC), public meetings, and through social media. This helps keep the concept of hazard mitigation alive, and helps show the public that their government officials are working to keep them safe.

The update process provides an opportunity to publicize success stories from the Plan implementation and seek additional public comment. When the HMPC reconvenes for the five-year plan update, they will coordinate with all stakeholders participating in the planning process—including those that joined the committee since the planning process began—to update and revise the plan. The plan maintenance and update process will include continued public and stakeholder involvement and input through participation in designated committee meetings, surveys, web postings, and press releases to local media.

A Town of Bennett

This Annex consolidates information specific to the Town of Bennett and goes into more detail about risk, capabilities, and mitigation strategies unique to that jurisdiction.

A.1 Mitigation Planning History and 2020 Update Process

The Town of Bennett is situated in both Adams and Arapahoe Counties. The Town of Bennett had previously participated in the 2015 Arapahoe County Hazard Mitigation Plan. The Town committed to participating in the 2020 Adams County plan update and met all participation requirements. The Town participated in the County multi-jurisdictional Hazard Mitigation Planning Committee (HMPC), and also brought together a Local Planning Team (LPT) to help collect data, identify and prioritize Town mitigation actions and implementation strategies, and review annex drafts.

Table A-1 Town of Bennett Local Planning Team

Department or Stakeholder	Title
Public Works	Safety Officer
Public Works	Utilities Supervisor
Community Works	Town Engineer
Community Development	Manager

More details on the planning process and participating jurisdictions, service districts and stakeholders can be found in Section 3 of the Base Plan, along with the public's role during the 2020 update.

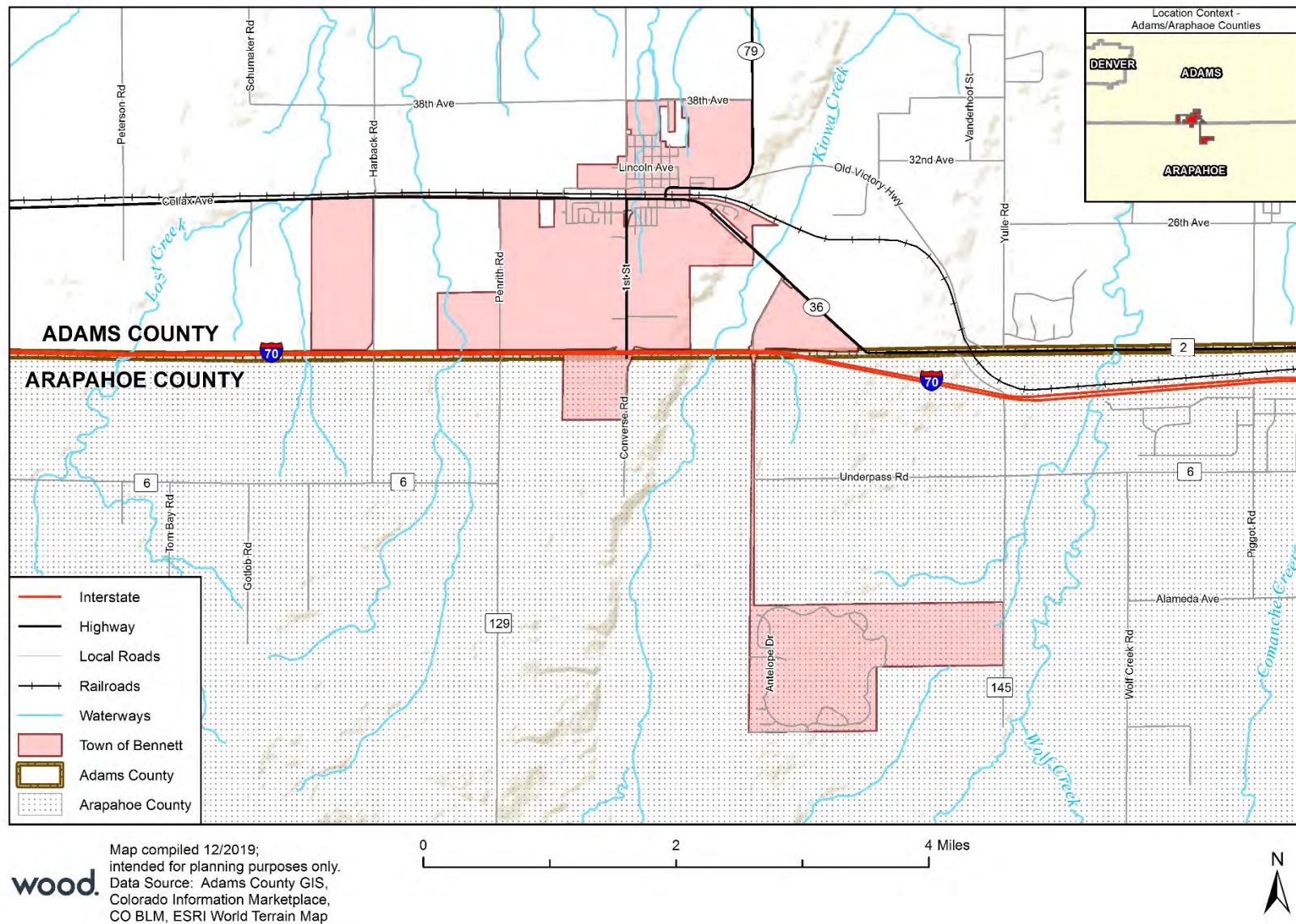
A.2 Community Profile

The Town of Bennett is a growing community in south-central Adams County. The Town is conveniently located 25 minutes from Downtown Denver, with the main part of Town located just north of I-70 at the intersection of State Highways 36 and 79.

The Town was incorporated in 1930 and has steadily grown into a thriving and self-sustaining community with an excellent public school system, abundant open spaces and trails, and a growing hub for goods and services along the I-70 corridor. The availability of land for development only 25 minutes from downtown Denver makes Bennett an inviting place to do business and a fast-growing community.

Figure A-1 shows a map of the Town of Bennett and its location within Adams and Arapahoe Counties.

Figure A-1 Map of the Town of Bennett



A.2.1 Demographics

This section was updated using data from the U.S. Census Bureau's 2012-2017 American Community Survey (ACS) 5-Year Estimates, and the Colorado State Demography Office.

As of 2017, the U.S. Census Bureau estimated Bennett's total population at 2,291. This constitutes a 14.8% increase in population since 2012 (1,996), and a 274% increase since 1970 (613). Table A-2 below lists population estimates for the Town alongside those of Adams County and the State of Colorado, showing how they have changed in the last five years.

Table A-2 Bennett Population Change, 2012-2017

Jurisdiction	2012	2013	2014	2015	2016	2017	Growth 2012-2017
Bennett	1,996	1,900	1,898	1,915	2,097	2,291	15%
Adams County	442,996	452,030	461,558	471,206	479,977	487,850	10%
Colorado	5,042,853	5,119,329	5,197,580	5,278,906	5,359,295	5,436,519	8%

Source: U.S. Census Bureau American Community Survey, www.census.gov/.

Table A-3 and Table A-4 show several key demographic and social characteristics of Bennett, how those characteristics have changed over the last five years, and how those characteristics compare to the rest of the County and the State.

Table A-3 Bennett Demographic and Social Characteristics, 2012-2017

Bennett	2012	2017	% Change
Population	1,996	2,291	14.8%
Median Age	36.2	41.0	13.3%
Total Housing Units	837	895	6.9%
Housing Occupancy Rate	90.9%	96.4%	6.1%
% of Housing Units with no Vehicles Available	2.40%	2.40%	0.0%
Median Home Value	\$150,800	\$181,300	20.2%
Unemployment	8.0%	5.2%	-35.0%
Mean Travel Time to Work (minutes)	33.5	28.8	-14.0%
Median Household Income	\$58,860	\$51,708	-12.2%
Per Capita Income	\$23,539	\$28,553	21.3%
% of Individuals Below Poverty Level	8.5%	12.1%	42.4%
% Without Health Insurance	15.1%	5.4%	-64.2%
# of Households	761	863	13.4%
Average Household Size	2.62	2.65	1.1%
% of Population Over 25 with High School Diploma	92.5%	92.2%	-0.3%
% of Population Over 25 with Bachelor's Degree or Higher	17.2%	18.0%	4.7%
% with Disability	13.9%	11.2%	-19.4%
% Speak English less than "Very Well"	1.7%	0.2%	-88.2%

Source: U.S. Census Bureau American Community Survey, www.census.gov/.

Table A-4 Demographic and Social Characteristics Compared to the County and State

Demographic & Social Characteristics (as of 2017)	Bennett	County	Colorado
Median Age	41	33.4	36.5
Housing Occupancy Rate	96.4%	96.00%	89.80%
% of Housing Units with no Vehicles Available	2.4%	5.30%	5.30%
Median Home Value	\$181,300	\$241,900	\$286,100
Unemployment	5.2%	5.10%	5.20%
Mean Travel Time to Work (minutes)	28.8	29.2	25.2
Median Household Income	\$51,708	\$64,087	\$65,458
Per Capita Income	\$28,553	\$27,487	\$38,845
% of Individuals Below Poverty Level	12.1%	12.20%	11.50%
% Without Health Insurance	5.4%	13.40%	9.40%
Average Household Size	2.65	2.98	2.55
% of Population Over 25 with High School Diploma	92.2%	82.60%	91.10%
% of Population Over 25 with bachelor's degree or Higher	18.0%	23.10%	39.40%
% with Disability	11.2%	10.70%	10.60%
% Speak English less than "Very Well"	0.2%	11.50%	6.00%

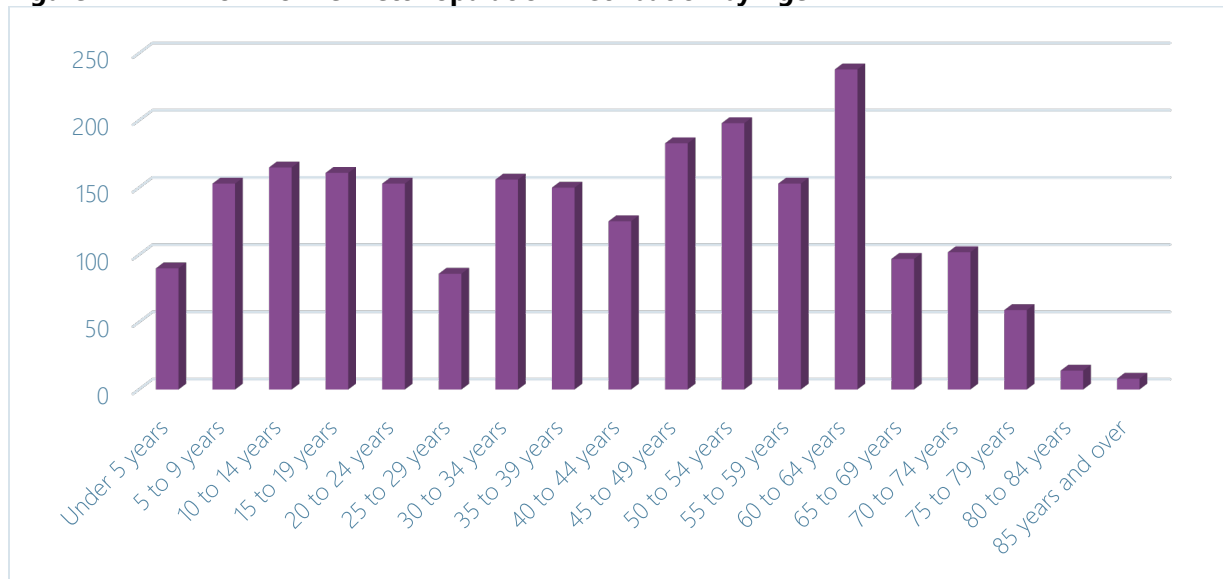
Source: U.S. Census Bureau American Community Survey, www.census.gov/.

Table A-5 and Figure A-2 break down the demographics of the Town by sex, race, and age.

Table A-5 Demographics by Race and Sex

Bennett	Population	%
Total Population	2,291	
Male	1,247	54.4%
Female	1,044	45.6%
White, not Hispanic	1,948	85.0%
Hispanic or Latino	195	8.5%
Black	11	0.5%
Asian	18	0.8%
American Indian and Alaska Native	45	2.0%
Native Hawaiian and Other Pacific Islander	0	0.0%
Some other race	79	3.4%
Two or more races	100	4.4%

Source: U.S. Census Bureau American Community Survey, www.census.gov/.

Figure A-2 Town of Bennett Population Distribution by Age

Source: U.S. Census Bureau American Community Survey, www.census.gov/.

A.2.2 Housing and Economy

Table A-6 presents 2017 American Community Survey estimates for types of housing units in the Town.

Table A-6 Types and Total Amounts of Housing Units in Bennett

Type of housing units	Total	Percentage
Total housing units	895	
1-unit detached	769	85.92%
1-unit attached	8	0.89%
2 units	3	0.34%
3 or 4 units	14	1.56%
5 to 9 units	18	2.01%
10 to 19 units	0	0.00%
20 or more units	41	4.58%
Mobile home	42	4.69%
Boat, RV, van, etc.	0	0.00%

Source: U.S. Census Bureau American Community Survey, www.census.gov/.

As of 2017 the median home value in the Town was \$181,300, a 20% increase since 2012. That still remains well below the average for Adams County (\$241,900) and the State (\$286,100). Relatively low housing prices is a major factor driving Bennett's growth. Bennett's housing occupancy rate is 96.4%, well above the County and State averages.

The median age in Bennett is 41, almost 8 years older than the County average of 33.4 years.

The Town's per capita income in 2017 was \$28,553, a 21.3% increase since 2012, showing that income has done a good job of keeping up with rising housing costs. The Town's per capita income is above that of Adams County as a whole (\$27,487) but well below the average for Colorado (\$38,845). Figure A-3 shows the distribution of income in the Town

Figure A-3 Town of Bennett Income Distribution

Source: U.S. Census Bureau American Community Survey, www.census.gov/.

A.3 Hazard Identification and Profiles

The Town of Bennett's Local Planning Team (LPT) identified the hazards that affect the community and summarized their geographic location, probability of future occurrence, potential magnitude or severity, and overall significance specific to the Town, as shown in Table A-7. There are no hazards that are unique to Bennett.

Table A-7 Town of Bennett Hazard Significance

Hazard	Geographic Location	Probability of Future Occurrence	Magnitude/Severity (Extent)	Overall Significance
Thunderstorms	Extensive	Highly Likely	Limited	High
Tornado/Damaging Wind	Extensive	Highly Likely	Catastrophic	High
Winter Weather	Extensive	Highly Likely	Critical	High
Flood	Extensive	Likely	Catastrophic	High
Drought	Extensive	Likely	Critical	High
Terrorism/Active Shooter	Extensive	Occasional	Critical	High
Cyber Incident	Extensive	Likely	Critical	High
Dam Failure/Incident	Limited	Unlikely	Critical	Medium
Hazardous Materials Incident	Significant	Likely	Limited	Medium
Earthquake	Limited	Occasional	Limited	Low
Subsidence	Limited	Unlikely	Limited	Low
Wildfire	Limited	Highly Likely	Negligible	Low

<p>Geographic Location Limited: Less than 10% of planning area Significant: 10-50% of planning area Extensive: 50-100% of planning area</p> <p>Probability of Future Occurrences Highly Likely: Near 100% chance of occurrence in next year or happens every year. Likely: Between 10 and 100% chance of occurrence in next year or has a recurrence interval of 10 years or less. Occasional: Between 1 and 10% chance of occurrence in the next year or has a recurrence interval of 11 to 100 years. Unlikely: Less than 1% chance of occurrence in next 100 years or has a recurrence interval of greater than every 100 years.</p>	<p>Magnitude/Severity (Extent) Catastrophic—More than 50% of property severely damaged; shutdown of facilities for more than 30 days; and/or multiple deaths Critical—25-50% of property severely damaged; shutdown of facilities for at least two weeks; and/or injuries and/or illnesses result in permanent disability Limited—10-25% of property severely damaged; shutdown of facilities for more than a week; and/or injuries/illnesses treatable do not result in permanent disability Negligible—Less than 10% of property severely damaged, shutdown of facilities and services for less than 24 hours; and/or injuries/illnesses treatable with first aid</p> <p>Significance Low: minimal potential impact Medium: moderate potential impact High: widespread potential impact</p>
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Information on past events can be found in in the hazard profiles in Section 4.3 of the Base Plan.

A.4 Vulnerability Assessment

The intent of this section is to assess Bennett’s vulnerability separate from that of the County as a whole, which has already been assessed in Section 4.3 Vulnerability Assessment of the Base Plan. For many of the hazards listed in Table A-7, hazard and vulnerability do not vary significantly from the County overall, or vulnerability data is difficult to compile or estimate below county level. As a result, only cyber incident, dam failure/incident, drought, flood, hazardous materials incident, terrorism/active shooter, and wildfire are profiled separately in this annex. For the purpose of this plan, only the parts of the Town that lie specifically within Adams County have been assessed for vulnerability data.

For more information about how hazards affect Adams County, see Section 4 (Risk Assessment) of the Base Plan.

A.4.1 Community Asset Inventory

Table A-8 shows the total number of improved parcels, properties, and their improvement and content values for the Town of Bennett. Only those parcels with improvement values greater than \$0 or those classified as “exempt” were counted here and in the vulnerability assessments to follow. Counts and values are based on the latest County assessor’s data (as of September 2019), which was provided in GIS format. Content values were estimated as a percent of the improvement value here and under the hazard vulnerability assessment based on standard FEMA Hazus methodologies: 100% of the improvement value for commercial structures, and 50% for residential structures and exempt or vacant parcels.

Table A-8 Town of Bennett Property Exposure

Parcel Type	Improved Parcels	Improved Value	Content Value	Total Value
Agricultural	1	\$1,490	\$1,490	\$2,980
Commercial	44	\$6,873,290	\$6,873,290	\$13,746,580
Exempt	90	\$6,040,350	\$3,020,175	\$9,060,525
Industrial	2	\$106,200	\$159,300	\$265,500
Residential	711	\$10,709,650	\$5,354,825	\$16,064,475
State Assessed	3	\$0	\$0	\$0
TOTAL	851	\$23,730,980	\$15,409,080	\$39,140,060

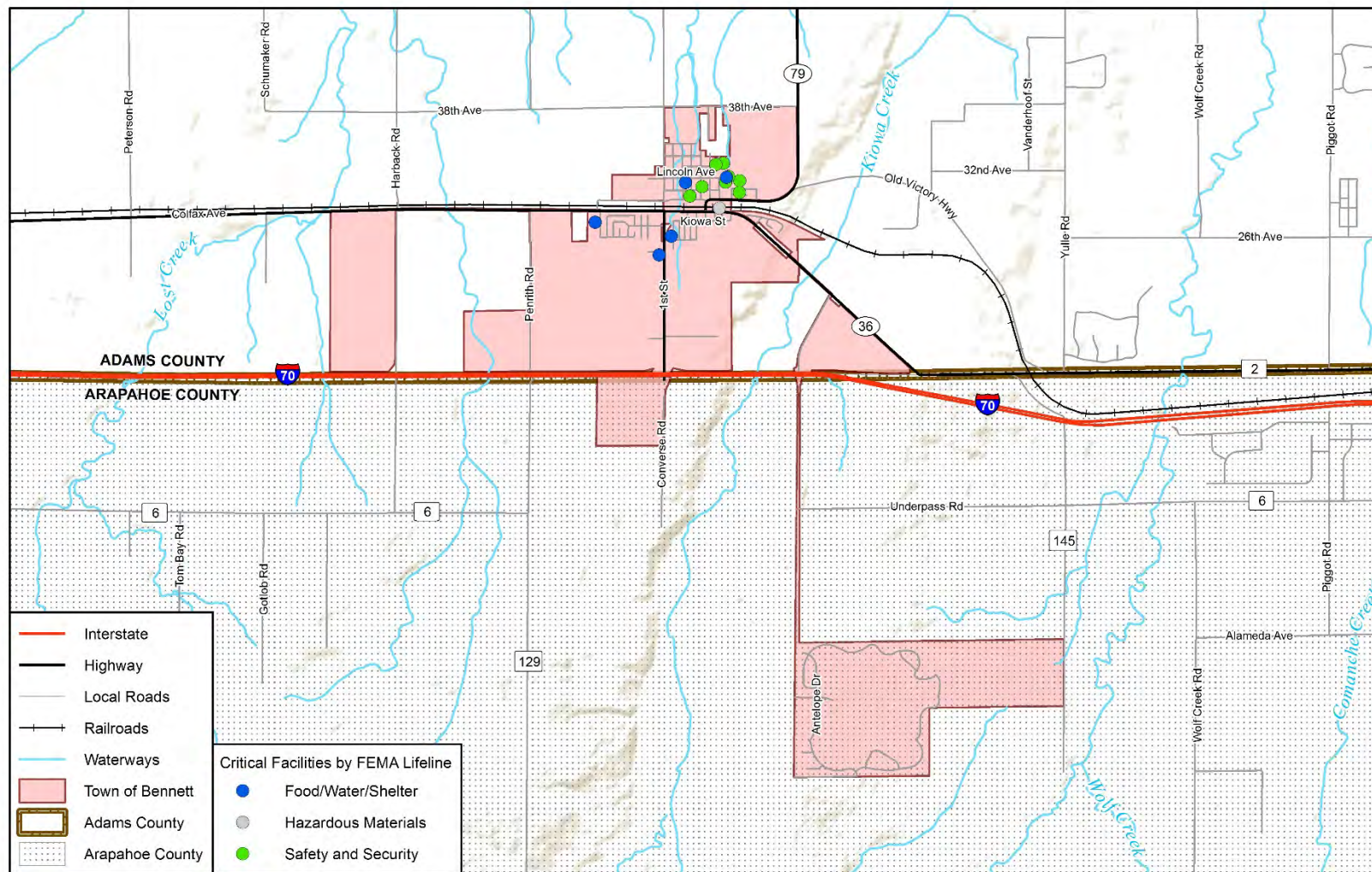
Source: Adams County GIS/Assessor's Office, Wood analysis.

Table A-9 lists summary information about the 25 critical facilities and other community assets identified by the Town's LPT as important to protect or that provide critical services in the event of a disaster. These facilities are mapped in Figure A-4. For additional information on the definitions behind each critical facility category, source, and other details refer to Section 4.3.2 of the Base Plan.

Table A-9 Town of Bennett Critical Facilities and Infrastructure Summary

FEMA Lifeline	Critical Facility Type	Total
Food/Water/Shelter	Emergency Shelters	5
	Water Storage Tank	1
	Well House	5
	WWTP	1
Hazardous Material	HazMat EO Tier II Sites	1
Safety and Security	Fire Stations	2
	Government Facilities	5
	Schools	5
TOTAL		25

Source: Adams County GIS/Assessor's Office, Wood analysis.

Figure A-4 Town of Bennett Critical Facilities and Infrastructure

wood. Map compiled 1/2020;
intended for planning purposes only.
Data Source: Adams County GIS, CO
Information Marketplace, HIFLD,
CO BLM, ESRI World Terrain Map

0 2 4 Miles



A.4.2 Cyber Incident Vulnerability

Overall, the LPT felt Bennett's risk from cyber incidents is **High**. Internet capability in the Town of Bennett area is not high quality. Additionally, several Town employees have the capability to work from home and in the field accessing the Town's server from those remote areas.

A.4.3 Dam Failure/Incident Vulnerability

As can be seen in Figure 4-5 in the Base Plan, there are no known dam inundation extents in the Town of Bennett. With no people, property, or critical facilities threatened, the overall risk to the Town is **Low**.

A.4.4 Drought Vulnerability

Overall, the LPT felt Bennett's risk from drought is **High**. The Town of Bennett is surrounded by a significant amount of farmland. Numerous businesses located in the Town of Bennett would be affected if the farmers were in a drought situation as they deliver grain to the elevator, purchase fuel from gas stations, shop at local stores, etc.

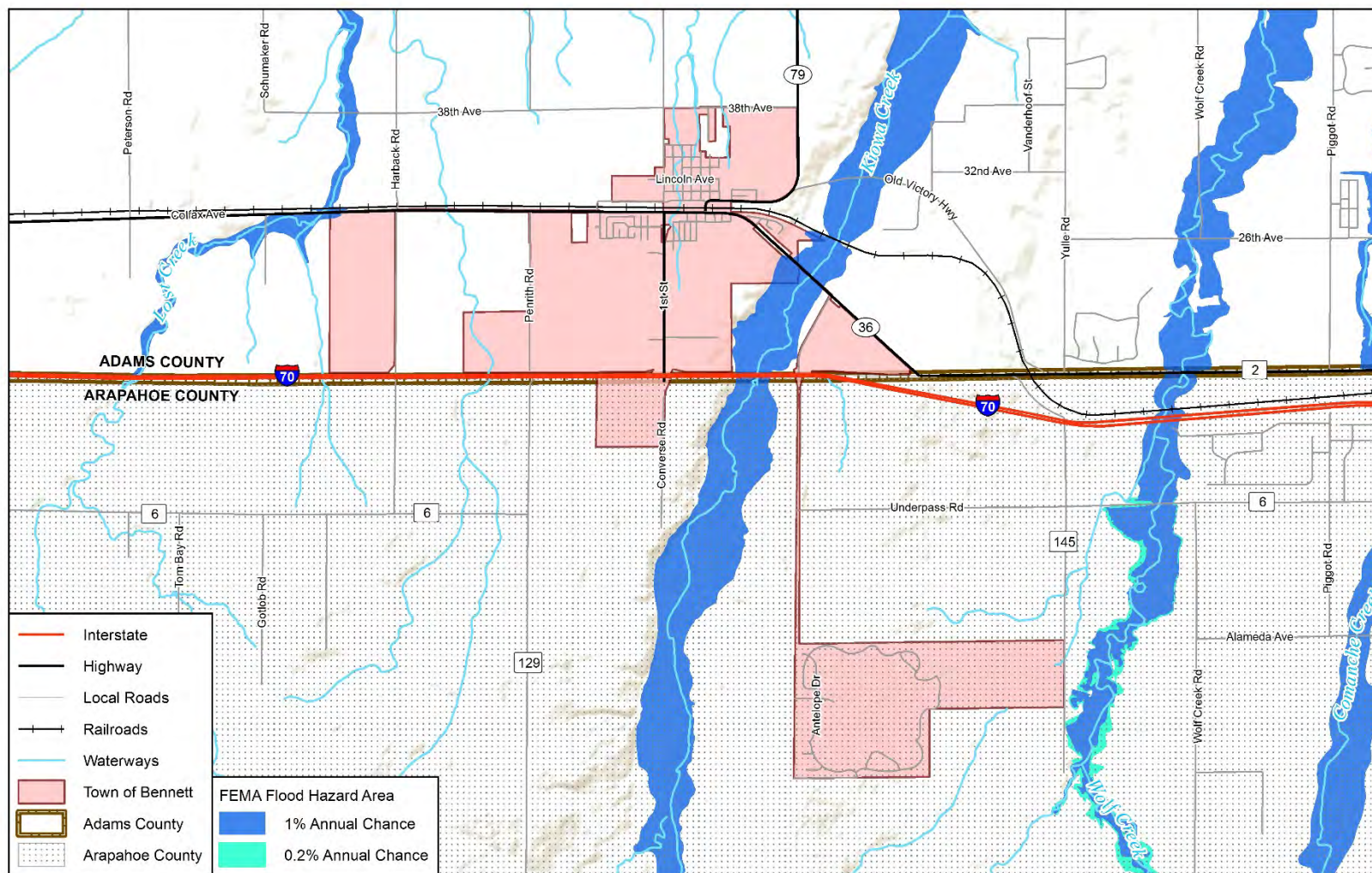
A.4.5 Flood Vulnerability

The Town of Bennett spans three major stormwater drainage basins, Lost Creek (aka Lost Sand Creek), Kiowa Creek, and Wolf Creek, from west to east. These drainageways typically only carry flows as a result of rainfall or snowmelt. Figure A-5 shows the mapped floodplains in the latest version of FEMA's National Flood Hazard Layer (NFHL). The NFHL maps both the 1% annual chance (100-year) and the 0.2% annual chance (500-year) flood events, as described in more detail in Section 4.3.5 of the Base Plan.

According to the NFHL, there are no improved or exempt parcels located in the 100-year and 500-year floodplains in the Town of Bennett. There are similarly no critical facilities in the floodplain. Despite this, historically flooding has had significant impacts to roads and related infrastructure in the Bennett area, leading to road closures and transportation impacts. Based on this, the Town LPT determined that Bennett's risk from flooding is **High**.

National Flood Insurance Program Policy Analysis

Bennett has participated in the National Flood Insurance Program (NFIP) since September 12, 2014. NFIP insurance data shows that as of September 2019, there were no flood insurance policies in force in the Town. There have been no historical claims for flood losses, and therefore no repetitive or severe repetitive loss structures as defined by the NFIP as of September 2019. The Town of Bennett does not participate in the Community Rating System (CRS) program.

Figure A-5 FEMA Special Flood Hazard Areas in the Town of Bennett

wood.
 Map compiled 1/2020;
 intended for planning purposes only.
 Data Source: Adams County GIS, CO
 Information Marketplace, FEMA NFHL,
 CO BLM, ESRI World Terrain Map

A.4.6 Hazardous Materials Incident

Overall, the LPT felt Bennett's risk from hazardous materials incidents is **Medium**, the same as the County as a whole.

The National Response Center (NRC) records 12 hazardous materials incidents in or near the Town of Bennett from 1990 through 2018; as noted in Section 5.3.13 of the Base Plan, this likely excludes a large number of unreported minor spills. This constitutes 1.4% of the 832 hazardous materials incidents reported countywide during the same time frame and averages out to roughly one incident every 2.4 years. As noted in Section 5.3.13, only around 6% of reported hazardous materials incidents result in injuries, fatalities, or evacuations.

The rail line running through Bennett is also of concern to the LPT. If a train accident involving hazardous materials were to occur in or near the Town, it could have a significant impact on life and property due to the Town's limited response capacity.

As of January 2020, there is one EPA Tier II facility and no Risk Management Plan (RMP) facilities located in the Town.

A.4.7 Terrorism/Active Shooter Vulnerability

Overall, the LPT felt Bennett's risk from terrorism/active shooter incidents is **High**. Despite its recent growth, the Town of Bennett is still considered to be in a rural setting. Currently, the Town of Bennett does not have its own law enforcement department and has a contract with Adams/Arapahoe County Sheriff's Department for law enforcement coverage.

A.4.8 Wildfire Vulnerability

Overall, the LPT felt Bennett's risk from wildfires is Low, the same as the County as a whole.

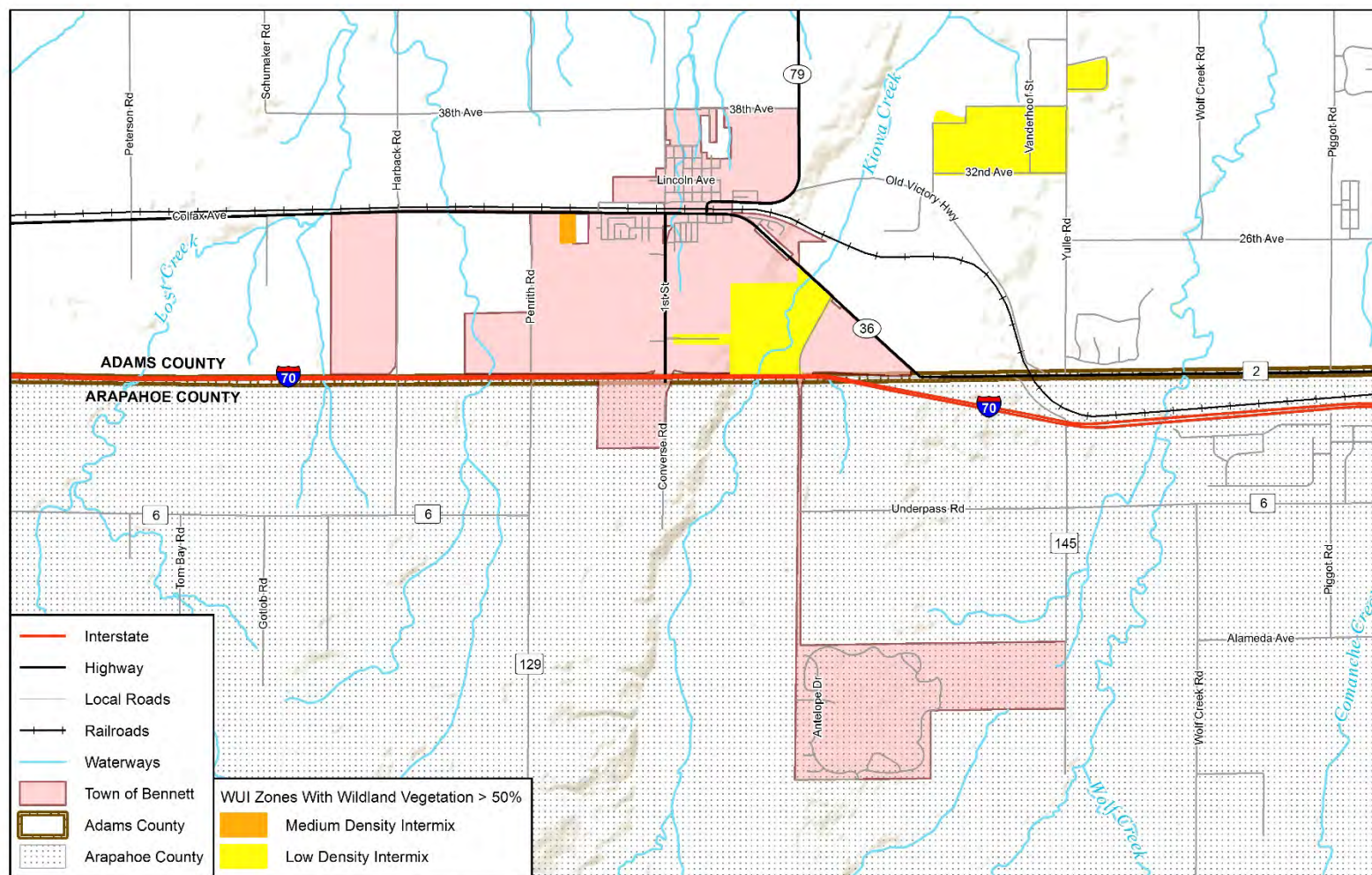
Figure A-6 shows the Wildland Urban Interface (WUI) areas in and near the Town of Bennett by medium and low density; the Town does not have any high density WUI areas.

Table A-10 calculates the people, property, and critical facilities located in the low and medium density WUI areas. There are only 3 improved parcels in the Town of Bennett in WUI zones, which have no improved values or population. There are similarly no critical facilities in WUI zones.

Table A-10 Town of Bennett Parcels and Exposure in Wildland Urban Interface (WUI) Zones

WUI Intermix Zone	Parcel Type	Total Improved Parcels	Improved Value	Content Value	Total Value	Population
Low Density	Exempt	1	--	--	--	--
Medium Density	Residential	2	--	--	--	--
TOTAL		3	--	--	--	--

Source: Adams County GIS/Assessor's Office, Wood analysis.

Figure A-6 Wildland Urban Interface (WUI) Intermix Areas in the Town of Bennett

wood.
 Map compiled 1/2020;
 intended for planning purposes only.
 Data Source: Adams County GIS, CO
 Information Marketplace, CO BLM,
 ESRI World Terrain Map, Adams County
 2012 Comprehensive Plan

0 2 4 Miles



A.4.9 Growth and Development Trends

The Town's Capital Asset Inventory & Master Plan (C.A.I.M.P) is a dynamic Master Planning framework embedded in GIS technology to capture, store, manipulate, analyze, manage and present a variety of spatial and geographical data in one accessible location. This new system, especially when it comes to local government planning and monitoring, will be an essential part of asset management for the Town for years to come. Beginning in early 2019, Town staff, engineers, and consultants focused efforts on providing a complete review of all the Town's assets covering utilities, roads, buildings, parks and planning cases. Through this process, a robust and thorough inventory was provided to paint a clear picture for planning for the future. Land use and future developments were analyzed to show when and where the developments will occur along with the impacts on the Town's infrastructure and facilities. The C.A.I.M.P. project looks at the development in the Town of over a three, five and 10-year time span.

A.5 Capability Assessment

This section profiles the programs and policies currently in use by the Town of Bennett to reduce hazard impacts or that could be used to implement hazard mitigation activities. The capabilities assessment is divided into five sections: planning and regulatory mitigation capabilities, administrative and technical mitigation capabilities, fiscal mitigation capabilities, past and ongoing mitigation outreach, and other mitigation efforts.

A.5.1 Planning and Regulatory Mitigation Capabilities

Table A-11 lists planning and land management tools typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place in Bennett.

Table A-11 Town of Bennett Planning and Regulatory Mitigation Capabilities

Regulatory Tool (ordinance, code, plans)	Yes/No	Comments
Comprehensive Plan	Yes	2015 Town of Bennett Comprehensive Plan
Zoning ordinance	Yes	2014 Land Use Code Update
Subdivision ordinance	Yes	Located in Chapter 16, Article IV of the Municipal Code
Growth management ordinance	No	
Floodplain ordinance	Yes	Chapter 16, Article VII, of the Municipal Code
Building codes	Yes	Currently on 2012 IBC, working on adopting the 2018 IBC by 7/1/2020
Fire department ISO rating	Yes	ISO rating is 3 (anywhere w/fire hydrants)
Erosion or sediment control program	No	
Storm water management program	No	The Town currently uses the State of Colorado guidelines
Site plan review requirements	Yes	The Town currently uses the State of Colorado guidelines
Capital improvement plan	Yes	Referenced in the Town's Applicants Guide
Economic development plan	Yes	Referenced in Capital Asset Inventory & Master Plan (CAIMP)
Local emergency operations plan	No	
Other special plans	No	
Flood insurance study or other engineering study for streams	No	
Elevation certificates (for floodplain development)	No	

Several key planning and regulatory tools used by Bennett are described below.

2015 Town of Bennett Comprehensive Plan

The Town's Comprehensive Plan, adopted in 2015, states:

The Town of Bennett, Colorado, is uniquely positioned to capture the next wave of growth within the Denver metropolitan area. Bennett's close proximity to Denver International Airport (DIA), the Front Range Airport, I-70, E-470, and the Union Pacific Railroad are all factors that will have a direct impact on the future growth of the Town; an incorporated area that currently totals 4.3 square miles.

Bennett's community leaders are visionary and willing to take bold steps to secure the Town's future. As a first step in implementing recommendations from a study completed in 2011 for the I-70 Regional Economic Advancement Partnership (REAP), the Town has identified a 91.4 square mile "Area of Planning Interest". Bennett's growth intentions are reflected by its objective to introduce a renewable water supply into its Area of Planning Interest. The prospect for growth associated with a renewable water supply is a fundamental tenet of this comprehensive plan.

2017 Source Water Protection Plan

In 2017, the Town of Bennett worked collaboratively with area stakeholders to develop a Source Water Protection Plan for their drinking water sources: groundwater wells in the Denver Basin Aquifer system. The plan identifies the area in need of protection, potential sources of contamination, and management approaches to reduce the risk of contaminants entering the source waters.

2014 Land Use Code Update

- Consolidated the industrial zoning districts into one industrial zoning category
- Revised the R-3 zoning district to allow for higher density and increased the maximum building height
- Created three new overlay zone districts within the downtown area
- Residential mixed use district
- Commercial mixed use district
- Main Street District
- Provided additional flexibility to the Zoning Administrator to administratively approve PD amendments

2010 Downtown Planning Study

- Identified a realignment for SH79
- Developed a Downtown Mainstreet Concept Plan
- Created Downtown Design Guidelines
- Developed a pedestrian friendly street scape concept

2009 Parks, Trails, and Open Space Master Plan

- Created a regional open space and trail system that connected the historic town center to outlying subdivisions

A.5.2 Administrative and Technical Mitigation Capabilities

Table A-12 identifies the personnel responsible for activities related to mitigation and loss prevention in Bennett.

Table A-12 Town of Bennett Administrative and Technical Mitigation Capabilities

Personnel Resources	Yes/No	Department/Position
Planner/engineer with knowledge of land development/land management practices	Yes	Town has an engineer on contract
Engineer/professional trained in construction practices related to buildings and/or infrastructure	Yes	Town has an engineer on contract
Planner/engineer/scientist with an understanding of natural hazards	Yes	Town has an engineer on contract
Personnel skilled in GIS	No	The Town uses North Line for GIS matters
Full time building official	Yes	
Floodplain manager	No	
Emergency manager	No	
Grant writer	Yes	Grant writing is done thru the Finance Department
GIS Data Resources (Hazard areas, critical facilities, land use, building footprints, etc.)	Yes	North Line provides the Town with these resources
Warning Systems/Services (Reverse 911, cable override, outdoor warning signals)	Yes	Tornado siren
Other Key personnel	Yes	Public Works Dept., Code Enforcement/Animal Control

A.5.3 Fiscal Mitigation Capabilities

Table A-13 identifies financial tools or resources that Bennett could potentially use to help fund mitigation activities.

Table A-13 Town of Bennett Fiscal Mitigation Capabilities

Financial Resources	Accessible / Eligible to Use	Has Been Used in the Past	Comments
Community Development Block Grant	Yes	Yes	Funds have been used to donate PPE to business' for COVID-19 mitigation relief
Capital Improvements Project funding	Yes	Yes	Highway Safety Improvement Funds used for repair of culverts and drainage on Kiowa-Bennett Road
Authority to levy taxes for specific purposes	Yes	No	
Fees for water, sewer, gas, or electric services	Yes	No	Fees are earmarked for the new mechanical wastewater treatment facility
Impact fees for new development	Yes	No	
Incur debt through general obligation bonds	Yes	No	
Incur debt through special tax bonds	Yes	Yes	Road improvements
Incur debt through private activities	No	No	
Withhold spending in hazard prone areas	Yes	No	

Some key planning and regulatory tools used by Bennett are described below.

2014 Adoption of Model Service Plan

- Allows for the creation of financing mechanisms, including provisions for single & multiple districts
- Metropolitan Districts in Colorado are viewed as an excellent vehicle for financing public improvements and increasing savings to developers and landowners

A.5.4 Past and Ongoing Mitigation Efforts

Elevated Water Storage Tank

Bennett's tallest landmark, the new elevated water storage tank, went into commission in October 2017. The half million gallon elevated water storage tank stands 197 ft. high and significantly improves the availability, reliability, and water quality of the Town of Bennett's water supply. The tank reduces the Town's risk of water supply outages and also improves reliable water pressure to our residents and businesses, and upgraded fire flows for the Bennett Fire Protection District.

New Wastewater Treatment Facility

The Town of Bennett celebrate the opening of a Water Resource Recovery Facility on May 1, 2019. The Town was able to replace the old aerated lagoon wastewater plant with this state-of-the-art modern mechanical treatment facility. This allows the Town to meet current requirements and anticipated future requirements for treated effluent discharge permit.

Public Education and Outreach

The Town holds several Engage, Shape & Building public meetings that show the public the new infrastructure plans as they come along. The Town does not have any local citizen groups that communicate hazard risks. The Town does not currently participate in Firewise or StormReady.

A.5.5 Opportunities for Enhancement

Based on the capability assessment, Bennett has several existing mechanisms in place that already help to mitigate hazards. There are also opportunities for the Town to expand or improve on these policies and programs to further protect the community. Future improvements may include providing training for staff members related to hazards or hazard mitigation grant funding in partnership with the County and DHSEM. Additional training opportunities will help to inform Town staff and Town Council on how best to integrate hazard information and mitigation projects into the Town policies and ongoing duties of the Town. Continuing to train Town staff on mitigation and the hazards that pose a risk to the Town will lead to more informed staff members who can better communicate this information to the public.

A.6 Mitigation Goals and Objectives

The Town of Bennett has adopted the hazard mitigation goals and objectives developed by the HMPC and described in Section 6.2 of the Base Plan.

A.7 Mitigation Actions

The local planning team identified and prioritized the following mitigation actions for the Town of Bennett based on the risk assessment. Information on how each action will be implemented and administered, such as ideas for implementation, responsible agency, potential funding, estimated cost, and timeline also are included. These actions are also captured in Table 6-2 in the Base Plan.

Table A-14 Town of Bennett 2020 Mitigation Action Plan

ID	Related Goal(s)	Hazard(s) Mitigated	Description / Background / Benefits	Lead Agency and Partners	Cost Estimate	Potential Funding	Priority	Timeline	Status / Implementation Notes
TOB -1	1,2	Multi-Hazard: Thunderstorm, Tornado, Winter Weather, Flood, Dam Failure, Hazardous Materials, Earthquake, Subsidence, Wildfire, Terrorism, Cyber	Develop hazard mitigation brochure: Develop a brochure to be made available to the public in hard copy and placed on the Town's website that will provide public information on how to prepare for hazard events as well as mitigate vulnerabilities on their property.	Town of Bennett - Safety Officer and Community Development	Little to no cost	Staff Time/ Dept. Budget	Medium	2020	New in 2020.
TOB -2*	1,2,4	Flood	Participation in and adoption of MHFD master plans to identify stormwater drainage/flood hazards and mitigation options.	Town of Bennett - Public Works, MHFD	Little to no cost	Staff Time/ Dept. Budget	Medium	2022	In progress. Town uses District's criteria and have adopted the standards. Not adoption ready
TOB -3*	2	Flood	Develop Stormwater Drainage Master Plan	Town of Bennett - Public Works	\$10,000 - \$100,000	HMA grants; Staff Time/ Dept. Budget; MHFD	Medium	2022	In progress. Draft version was created but funding fell short before finalization. Currently pursuing new funding.
TOB -4*	2,3	Wildfire	Wildfire Mitigation Planning: Mitigation plan will be incorporated into Code of adoption of specific ordinance by the Town of Bennett	Bennett FPD	\$10,000-\$100,000	HMA Grants	High	2025	Continue – Not Completed.
TOB -5	2	Hazardous Materials	Stoplight and intersection infrastructure at Marketplace Drive and Hwy 79. This is a high traffic intersection right off I-70 with multiple businesses including King Soopers, Love's Travel	Town of Bennett - Public Works	\$1.2M	CIP Budget	Medium	2022	New in 2020.

ID	Related Goal(s)	Hazard(s) Mitigated	Description / Background / Benefits	Lead Agency and Partners	Cost Estimate	Potential Funding	Priority	Timeline	Status / Implementation Notes
			w/truck stop, McDonalds, and a Tractor Supply. Redesign and installation of a stoplight area will assist with traffic safety for commercial vehicles as well as residential vehicles.						
TOB-6	2	Flood, Winter Weather	Replacement of culverts of on Kiowa-Bennett Road and Hwy 36. When Bennett experiences heavy rains and/or snowfall in this area, the Kiowa-Bennett road has experienced flooding and erosion issues. Replacement of culverts is expected to reduce and/or eliminate the flooding and erosion.	Town of Bennett - Public Works	\$500,000	CIP Budget	High	2021	New in 2020.
TOB-7	2	Flood	Design of expansion for wastewater treatment facility. With the growth that the Town of Bennett is experiencing, it is necessary to begin the process for design of expansion of this facility to accommodate the growth. The site also experienced stormwater flooding in 2019.	Town of Bennett - Public Works	\$350,000	CIP Budget	High	2021	New in 2020.

A.7.1 Continued Compliance with the National Flood Insurance Program

Recognizing the importance of the National Flood Insurance Program (NFIP) in mitigating flood losses, the Town of Bennett will place an emphasis on continued compliance with the NFIP. As an NFIP participant, the Town has and will continue to make every effort to remain in good standing with NFIP. This includes continuing to comply with the NFIP's standards for updating and adopting floodplain maps and maintaining and updating the floodplain zoning ordinance as well as review of any potential development in special flood hazard areas.

A.8 Implementation and Maintenance

This section provides an overview of the Town's strategy for plan implementation and maintenance, and outlines the method and schedule for monitoring, evaluating, and updating the plan. The section also discusses incorporating the plan into existing planning mechanisms and how to ensure continued public involvement in mitigation planning.

A.8.1 Incorporation into Existing Planning Mechanisms

The information contained within this plan, including results from the Vulnerability Assessment, and the Mitigation Strategy will be used by the Town to help inform updates and the development of local plans, programs and policies, as described in Section 7.3 of the Base Plan. The following mitigation actions listed in Table A-14 specifically address development of local plans that will be informed by the information in this HMP:

- TOB-2: Participation in and adoption of MHFD master plans to identify stormwater drainage/flood hazards and mitigation options.
- TOB-3: Develop Stormwater Drainage Master Plan
- TOB-4: Wildfire Mitigation Planning: Mitigation plan will be incorporated into Code of adoption of specific ordinance by the Town of Bennett

The Town of Bennett was not included in the 2014 Adams County Hazard Mitigation Plan, and as such did not incorporate elements of that plan into other planning mechanisms.

A.8.2 Monitoring, Evaluation and Updating the Plan

The Town Safety Officer, located within the Public Works Department, will be responsible for monitoring, evaluating, and updating this plan using the process outlined in Section 7 of the Base Plan. The Town will continue to involve the public in mitigation, as described in Section 7.4 of the Base Plan. The Town Safety Officer will be responsible for representing the Town on the Adams County HMPC, and for coordination with Town staff and departments during plan updates. The Town will review this annex regularly and will update it every five years in accordance with the Disaster Mitigation Act Requirements.

B City of Brighton

This Annex consolidates information specific to the City of Brighton and goes into more detail about risk, capabilities, and mitigation strategies unique to that jurisdiction.

B.1 Mitigation Planning History and 2020 Update Process

The City of Brighton is situated in both Adams and Weld Counties. The City of Brighton had previously participated in the 2016 Weld County Hazard Mitigation Plan. The City committed to participating in the 2020 Adams County plan update and met all participation requirements. The City participated in the County's multi-jurisdictional Hazard Mitigation Planning Committee (HMPC), and also brought together a Local Planning Team (LPT) to help collect data, identify and prioritize City mitigation actions and implementation strategies, and review annex drafts.

Table B-1 City of Brighton Local Planning Team

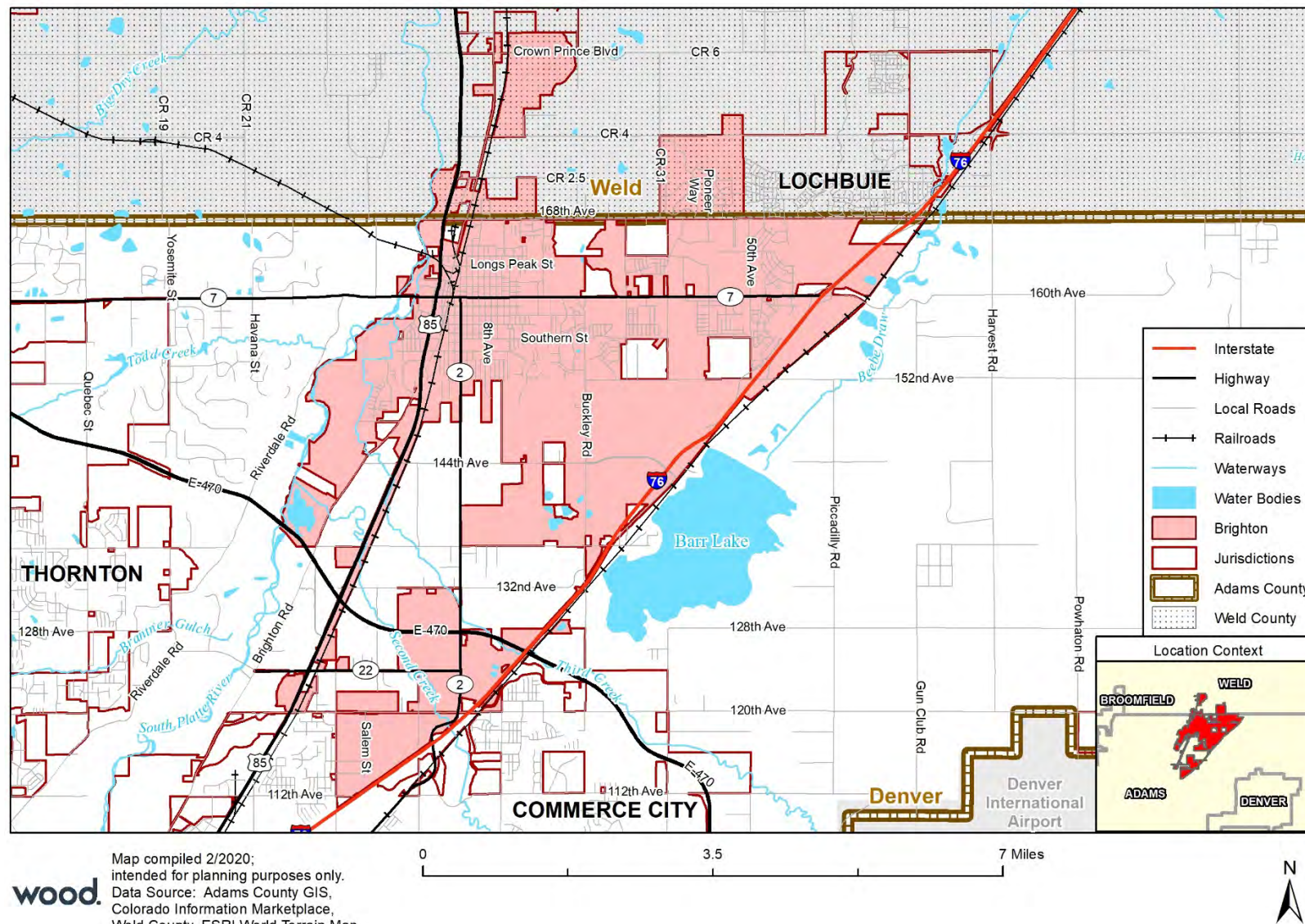
Department or Stakeholder	Title
Office of Emergency Management	Emergency Manager
Finance Department	Finance Director
Utilities Department	Stormwater & Environmental Division
Community Development	Community Development Director

More details on the planning process and participating jurisdictions, service districts and stakeholders can be found in Section 3 of the Base Plan, along with the public's role during the 2020 update.

B.2 Community Profile

The City of Brighton is located 20 miles north of downtown Denver and has a land area of 19.98 square miles. Incorporated in 1887, the city sits along the banks of the South Platte River, and is situated in both Adams and Weld Counties. The opening of Denver International Airport in the 1990s led to many changes for the City of Brighton. Rapid and numerous annexations were necessary to accommodate the increase in population driven by increased accessibility. Once a small town with agricultural roots, the City of Brighton is now one of the fastest growing cities in Colorado.

Figure B-1 shows a map of the City of Brighton and its location within Adams and Weld Counties.

Figure B-1 Map of the City of Brighton

B.2.1 Demographics

This section was updated using data from the U.S. Census Bureau's 2012-2017 American Community Survey (ACS) 5-Year Estimates, and the Colorado State Demography Office.

As of 2017, the U.S. Census Bureau estimated Brighton's total population at 38,016. This constitutes a 14% increase in population since 2012 (33,219), and a 358% increase since 1970 (8,309). Table B-2 below lists population estimates for the City alongside those of Adams County and the State of Colorado, showing how they have changed in the last five years.

Table B-2 Brighton Population Change, 2012-2017

Jurisdiction	2012	2013	2014	2015	2016	2017	Growth 2012-2017
Brighton	33,219	34,247	35,004	35,582	36,307	38,016	14%
Adams County	442,996	452,030	461,558	471,206	479,977	487,850	10%
Colorado	5,042,853	5,119,329	5,197,580	5,278,906	5,359,295	5,436,519	8%

Source: U.S. Census Bureau American Community Survey, www.census.gov/.

Table B-3 and Table B-4 show several key demographic and social characteristics of Brighton, how those characteristics have changed over the last five year, and how those characteristics compare to the rest of the County and the State.

Table B-3 Brighton Demographic and Social Characteristics, 2012-2017

Brighton	2012	2017	% Change
Population	33,219	38,016	14.4%
Median Age	32.5	32.8	0.9%
Total Housing Units	11,136	12,215	9.7%
Housing Occupancy Rate	94.7%	97.1%	2.5%
% of Housing Units with no Vehicles Available	4.7%	5.4%	14.9%
Median Home Value	\$192,200	\$240,400	25.1%
Unemployment	5.4%	3.1%	-42.6%
Mean Travel Time to Work (minutes)	28.2	29.6	5.0%
Median Household Income	\$62,246	\$67,024	7.7%
Per Capita Income	\$23,916	\$29,263	22.4%
% of Individuals Below Poverty Level	9.0%	10.9%	21.1%
% Without Health Insurance	20.5%	12.6%	-38.5%
# of Households	10,545	11,865	12.5%
Average Household Size	2.98	3.06	2.7%
% of Population Over 25 with High School Diploma	82.2%	84.7%	3.0%
% of Population Over 25 with Bachelor's Degree or Higher	16.8%	21.4%	27.4%
% with Disability	8.1%	9.6%	18.5%
% Speak English less than "Very Well"	12.5%	9.8%	-21.6%

Source: U.S. Census Bureau American Community Survey, www.census.gov/.

Table B-4 Demographic and Social Characteristics Compared to the County and State

Demographic & Social Characteristics (as of 2017)	Brighton	County	Colorado
Median Age	32.8	33.4	36.5
Housing Occupancy Rate	97.10%	96.00%	89.80%
% of Housing Units with no Vehicles Available	5.40%	5.30%	5.30%
Median Home Value	\$240,400	\$241,900	\$286,100
Unemployment	3.10%	5.10%	5.20%
Mean Travel Time to Work (minutes)	29.6	29.2	25.2
Median Household Income	\$67,024	\$64,087	\$65,458
Per Capita Income	\$29,263	\$27,487	\$38,845
% of Individuals Below Poverty Level	10.90%	12.20%	11.50%
% Without Health Insurance	12.60%	13.40%	9.40%
Average Household Size	3.06	2.98	2.55
% of Population Over 25 with High School Diploma	84.70%	82.60%	91.10%
% of Population Over 25 with bachelor's degree or Higher	21.40%	23.10%	39.40%
% with Disability	9.60%	10.70%	10.60%
% Speak English less than "Very Well"	9.80%	11.50%	6.00%

Source: U.S. Census Bureau American Community Survey, www.census.gov/.

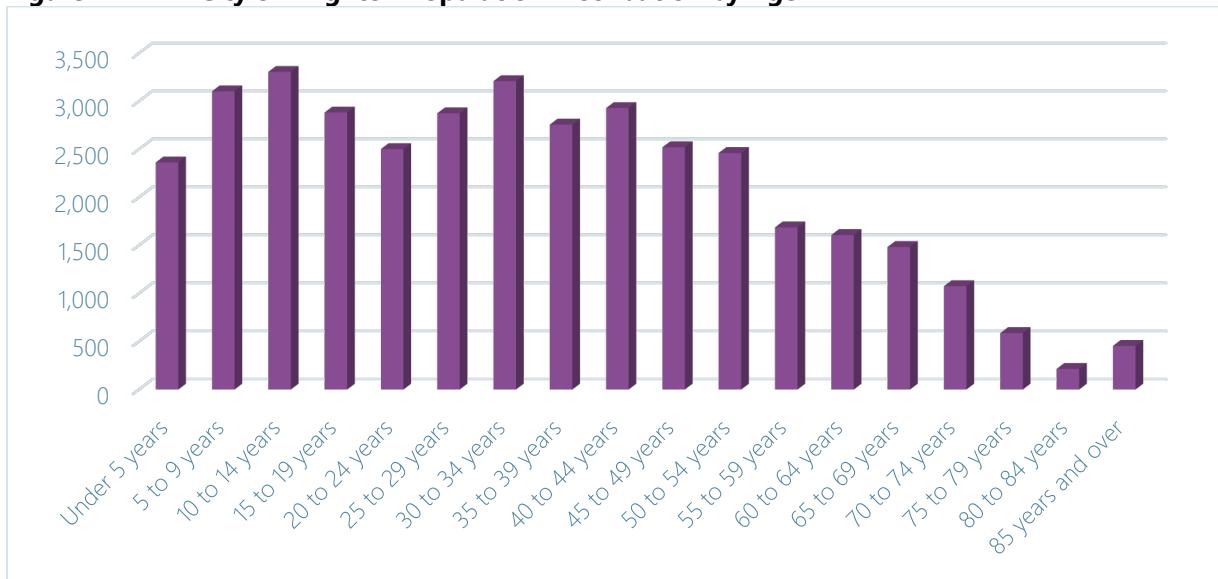
Table B-5 and Figure B-2 break down the demographics of the City by sex, race, and age.

Table B-5 Demographics by Race and Sex

Brighton	Population	%
Total Population	38,016	
Male	19,603	51.6%
Female	18,413	48.4%
White, not Hispanic	20,655	54.3%
Hispanic or Latino	14,601	38.4%
Black	603	1.6%
Asian	1,000	2.6%
American Indian and Alaska Native	288	0.8%
Native Hawaiian and Other Pacific Islander	171	0.4%
Some other race	1,453	3.8%
Two or more races	1,355	3.6%

Source: U.S. Census Bureau American Community Survey, www.census.gov/.

Figure B-2 City of Brighton Population Distribution by Age



Source: U.S. Census Bureau American Community Survey, www.census.gov/.

B.2.2 Housing and Economy

Table B-6 presents the 2017 American Community Survey estimates for types of housing units in the City.

Table B-6 Types and Total Amounts of Housing Units in Brighton

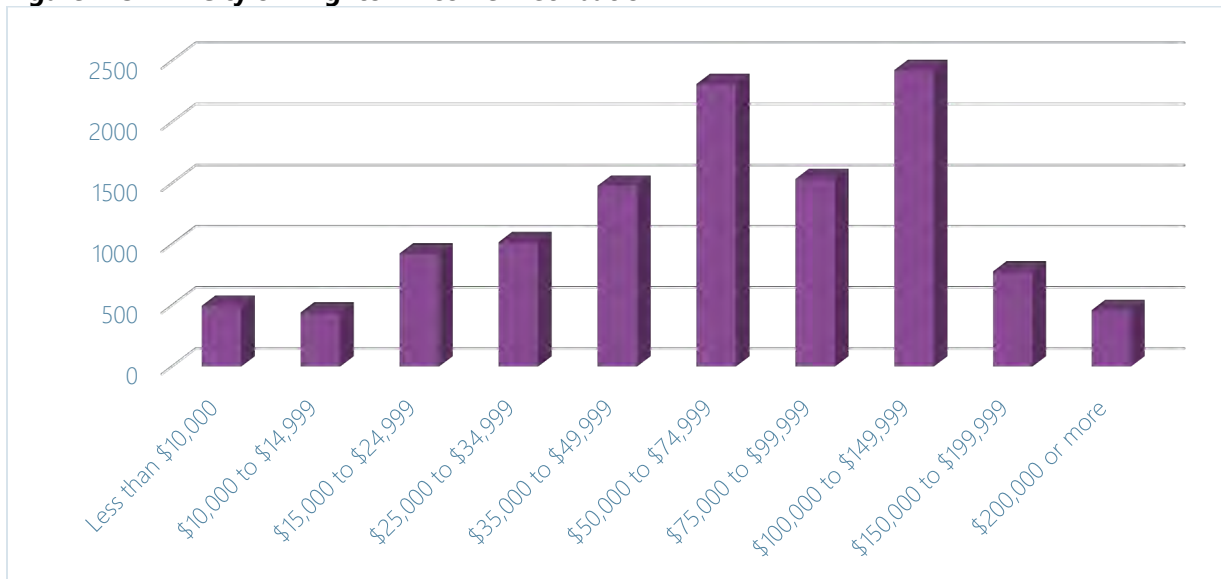
Type of housing units	Total	Percentage
Total housing units	12,215	
1-unit detached	8,521	69.76%
1-unit attached	981	8.03%
2 units	119	0.97%
3 or 4 units	377	3.09%
5 to 9 units	230	1.88%
10 to 19 units	478	3.91%
20 or more units	1,078	8.83%
Mobile home	431	3.53%
Boat, RV, van, etc.	0	0.00%

Source: U.S. Census Bureau American Community Survey, www.census.gov/.

As of 2017 the median home value in the City was \$240,400, a 25% increase since 2012. However, that remains slightly below the average for Adams County (\$241,900) and the State (\$286,100). Brighton's housing occupancy rate is 97.1%, well above the County and State averages.

The City's per capita income in 2017 was \$29,263, a 22.4% increase since 2012, showing that income has not quite kept up with rising housing costs. The City's per capita income is above that of Adams County as a whole (\$27,487) but well below the average for Colorado (\$38,845). Figure B-3 shows the distribution of income in the City. Unemployment in 2017 was 3.10%, well below the County average of 5.10%.

Figure B-3 City of Brighton Income Distribution



Source: U.S. Census Bureau American Community Survey, www.census.gov/.

B.3 Hazard Identification and Profiles

The City of Brighton's Local Planning Team (LPT) identified the hazards that affect the community and summarized their geographic location, probability of future occurrence, potential magnitude or severity, and overall significance specific to the City, as shown in Table B-7. There are no hazards that are unique to Brighton.

Table B-7 City of Brighton Hazard Significance

Hazard	Geographic Location	Probability of Future Occurrence	Magnitude/Severity (Extent)	Overall Significance
Tornado/Damaging Wind	Highly Likely	Extensive	Critical	High
Dam Failure/Incident	Occasional	Limited	Critical	High
Winter Weather	Highly Likely	Extensive	Limited	High
Hazardous Materials Incident	Highly Likely	Limited	Critical	High
Thunderstorms	Highly Likely	Extensive	Negligible	Medium
Flood	Occasional	Limited	Limited	Medium
Wildfire (Brush Fire)	Highly Likely	Limited	Negligible	Medium
Terrorism/Active Shooter	Occasional	Limited	Critical	Medium
Cyber Incident	Likely	Limited	Limited	Medium
Drought	Occasional	Extensive	Negligible	Low
Earthquake	Unlikely	Significant	Limited	Low
Subsidence	Unlikely	Limited	Limited	Low

<p>Geographic Location Limited: Less than 10% of planning area Significant: 10-50% of planning area Extensive: 50-100% of planning area</p> <p>Probability of Future Occurrences Highly Likely: Near 100% chance of occurrence in next year or happens every year. Likely: Between 10 and 100% chance of occurrence in next year or has a recurrence interval of 10 years or less. Occasional: Between 1 and 10% chance of occurrence in the next year or has a recurrence interval of 11 to 100 years. Unlikely: Less than 1% chance of occurrence in next 100 years or has a recurrence interval of greater than every 100 years.</p>	<p>Magnitude/Severity (Extent) Catastrophic—More than 50% of property severely damaged; shutdown of facilities for more than 30 days; and/or multiple deaths Critical—25-50% of property severely damaged; shutdown of facilities for at least two weeks; and/or injuries and/or illnesses result in permanent disability Limited—10-25% of property severely damaged; shutdown of facilities for more than a week; and/or injuries/illnesses treatable do not result in permanent disability Negligible—Less than 10% of property severely damaged, shutdown of facilities and services for less than 24 hours; and/or injuries/illnesses treatable with first aid</p> <p>Significance Low: minimal potential impact Medium: moderate potential impact High: widespread potential impact</p>
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Information on past events can be found in in the hazard profiles in Section 4.3 of the Base Plan.

B.4 Vulnerability Assessment

The intent of this section is to assess Brighton’s vulnerability separate from that of the County as a whole, which has already been assessed in Section 4.3 Vulnerability Assessment of the Base Plan. For most of the hazards listed in Table B-7, hazard and vulnerability do not vary significantly from the County overall, or vulnerability data is difficult to compile or estimate below county level. As a result, only Dam Failure/Incident, Flood, Hazardous Materials Incidents, and Wildfire are profiled separately in this annex. For the purpose of this plan, only the parts of the city that lie specifically within Adams County have been assessed for vulnerability data.

For more information about how hazards affect Adams County, see Section 4 (Risk Assessment) of the Base Plan.

B.4.1 Community Asset Inventory

Table B-8 shows the total number of improved parcels, properties, and their improvement and content values for the City of Brighton. Only those parcels with improvement values greater than \$0 or those classified as “exempt” were counted here and in the vulnerability assessments to follow. Counts and values are based on the latest county assessor’s data (as of September 2019), which was provided in GIS format. Content values were estimated as a percent of the improvement value here and under the hazard vulnerability assessment based on standard FEMA Hazus methodologies: 100% of the improvement value for commercial structures, and 50% for residential structures and exempt or vacant parcels.

Table B-8 City of Brighton Property Exposure

Parcel Type	Improved Parcels	Improved Value	Content Value	Total Value
Agricultural	10	\$338,640	\$338,640	\$677,280
Commercial	475	\$137,165,720	\$137,165,720	\$274,331,440
Exempt	568	\$117,696,370	\$58,848,185	\$176,544,555
Industrial	7	\$3,792,480	\$5,688,720	\$9,481,200
Residential	10,071	\$207,987,600	\$103,993,800	\$311,981,400
State Assessed	27	\$0	\$0	\$0
TOTAL	11,158	\$466,980,810	\$306,035,065	\$773,015,875

Source: Adams County GIS/Assessor's Office, Wood analysis.

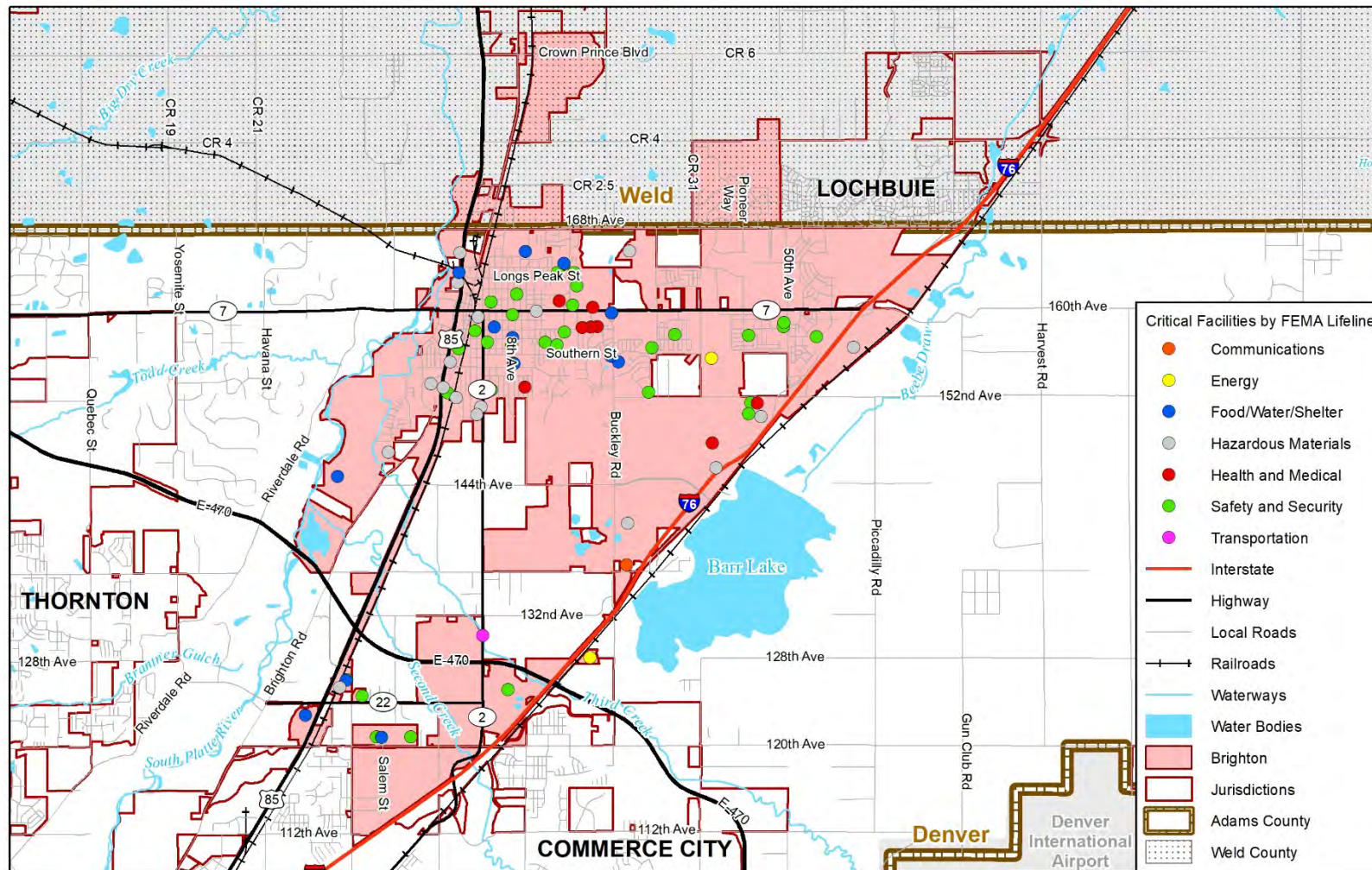
Table B-9 lists summary information about the 76 critical facilities and other community assets identified by the City's LPT as important to protect or that provide critical services in the event of a disaster. These facilities are mapped in Figure B-4. For additional information on the definitions behind each critical facility category, source, and other details refer to Section 4.3.2 of the Base Plan.

Table B-9 City of Brighton Critical Facilities and Infrastructure Summary

FEMA Lifeline	Critical Facility Type	Total
Communications	Communication Towers	1
Energy	Electric Substations	2
Food/Water/Shelter	Emergency Shelters	9
	Gravel Mines/Ponds	3
	Wastewater Treatment Plant	1
Hazardous Material	Environmental Hazard Superfund	1
	Environmental Hazard Toxic Site	1
	HazMat EO Tier II Sites	15
Health and Medical	Assisted Living	3
	Dialysis Center	1
	Medical Center	1
	Nursing Home	3
Safety and Security	Fire Stations	2
	Government Facilities	6
	Landfills/Govt. Services	4
	Police Station	1
	Schools	21
Transportation	Minor Bridge	1
TOTAL		76

Source: Adams County GIS/Assessor's Office, Wood analysis.

Figure B-4 City of Brighton Critical Facilities and Infrastructure



Map compiled 2/2020;
intended for planning purposes only.
Data Source: Adams County GIS,
Colorado Information Marketplace, HIFLD
Weld County, ESRI World Terrain Map

wood.

0 3.5 7 Miles



B.4.2 Dam Failure/Incident Vulnerability

Overall, the LPT felt the City's risk from a dam failure or incident is High, due to the large number of people and critical facilities potentially at risk compared to the County as a whole.

Table B-10 (excerpted from Table 4-13 in the Base Plan) lists the primary dams in and immediately upstream of the City of Brighton. These dams, along with their potential dam inundation extents are mapped in Figure B-5.

Table B-10 Dams of Concern for the City of Brighton

Dam Name	Waterway	Dam Type	Storage Capacity (Acre-Feet)	Emergency Action Plan?	Primary Purpose	Hazard Rating
Cherry Creek Dam	Cherry Creek	Earth	134,470	Yes	Flood Control	High
Dunes	South Platte River-Os	Earth	5,644	Yes	Water Supply	High
Marshall	Brantner Gulch-Tr	Earth	98	Not Required	Flood Control	Low
Smith Irrigation	Todd Creek	Earth	429	Yes	Fish & Wildlife Pond	High

Source: USACE National Inventory of Dams 2018, Wood analysis

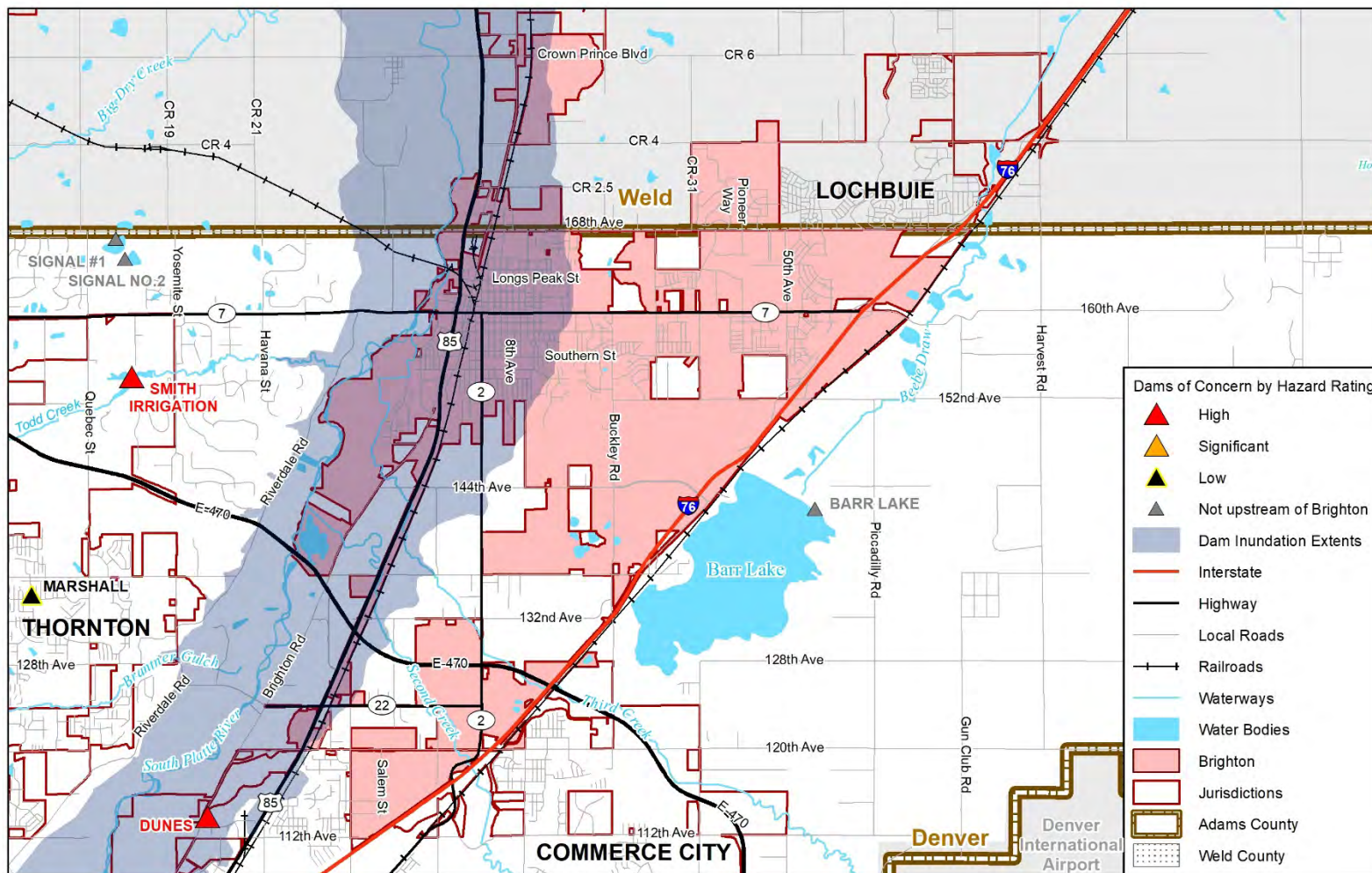
Table B-11 and Table B-12 calculate the people, property, and critical facilities potentially at risk of dam inundation. Based on this analysis, there are 12,855 people and 39 critical facilities potentially at risk of inundation from a dam failure or incident. Projected losses total more than \$141B, although it is important to note that any single dam incident would be unlikely to affect all parcels potentially at risk, with the possible exception of Cherry Creek Dam. A major dam failure could also impact several major transportation corridors, including E-470, and US 85, potentially disrupting traffic in the area.

Table B-11 City of Brighton Parcels and Exposure in Dam Inundation Zones

Parcel Type	Improved Parcels	Improved Value	Content Value	Total Value	Loss Estimate (50% of Total Value)	Population
Agricultural	2	\$264,610	\$264,610	\$529,220	\$264,610	--
Commercial	391	\$57,308,190	\$57,308,190	\$114,616,380	\$57,308,190	--
Exempt	247	\$28,728,610	\$14,364,305	\$43,092,915	\$21,546,458	--
Industrial	6	\$2,897,840	\$4,346,760	\$7,244,600	\$3,622,300	--
Residential	4,285	\$78,861,990	\$39,430,995	\$118,292,985	\$59,146,493	12,855
State Assessed	24	\$0	\$0	\$0	\$0	--
TOTAL	4,955	\$168,061,240	\$115,714,860	\$283,776,100	\$141,888,051	12,855

Source: Adams County GIS/Assessor's Office, Wood analysis.

Figure B-5 City of Brighton Dams of Concern and Dam Inundation Zones



wood.
Map compiled 2/2020;
intended for planning purposes only.
Data Source: Adams County GIS,
Colorado Information Marketplace,
Weld County, ESRI World Terrain Map
NID 2018, Colorado Dam Safety

0 3.5 7 Miles



Table B-12 City of Brighton Critical Facilities in Dam Inundation Zones

FEMA Lifeline	Critical Facility Type	Total
Food/Water/Shelter	EO Emergency Shelters	5
	Gravel Mines/Ponds	3
	Wastewater Treatment Plant	1
Hazardous Material	Environmental Hazard Superfund	1
	Environmental Hazard Toxic Site	1
	HazMat EO Tier II Sites	10
Health and Medical	Assisted Living	1
	Nursing Home	1
Safety and Security	Fire Stations	1
	Government Facilities	1
	Landfills/Govt. Services	3
	Schools	11
TOTAL		39

Source: Adams County GIS/Assessor's Office, Wood analysis.

B.4.3 Flood Vulnerability

Overall, the LPT felt the City's flood risk is Medium, due to the lower numbers of people, property, and critical facilities potentially at risk compared to the County as a whole.

The major drainageway in the Brighton area is the South Platte River, which runs along the City's west side. Major tributaries that cross through the City include Second creek and Third Creek. Barr Lake and Beebe Draw border the east side of the City.

Figure B-6 shows the mapped floodplains in the latest version of FEMA's National Flood Hazard Layer (NFHL). The NFHL maps both the 1% annual chance (100-year) and the 0.2% annual chance (500-year) flood events, as described in more detail in Section 4.3.5 of the Base Plan.

Table B-13 and Table B-14 summarize the people, property, and critical facilities located in the 100-year and 500-year floodplains. Based on this analysis, there are 3 people, 32 properties with a potential for \$64,971 worth of property damage, and 2 critical facilities potentially at risk of a 1% annual chance flood. For a 0.2% annual chance flood, that vulnerability increases by 249 people and \$1.5M worth of property damage in addition to what would be affected by the 1% flood. As with Dam Failure/Incident above, several critical transportation corridors could be disrupted.

Table B-13 City of Brighton Parcels and Exposure in Flood Zones

Flood Event	Parcel Type	Total Improved Parcels	Improved Value	Content Value	Total Value	Loss Estimate (25% of Total Value)	Population
100-year	Exempt	31	\$138,820	\$69,410	\$208,230	\$52,058	--
	Residential	1	\$80,710	\$40,355	\$121,065	\$30,266	3
100-year Total		32	\$219,530	\$109,765	\$329,295	\$82,324	3
500-year	Commercial	2	\$285,230	\$285,230	\$570,460	\$142,615	--
	Exempt	8	\$12,190	\$6,095	\$18,285	\$4,571	--

Flood Event	Parcel Type	Total Improved Parcels	Improved Value	Content Value	Total Value	Loss Estimate (25% of Total Value)	Population
	Residential	83	\$3,549,760	\$1,774,880	\$5,324,640	\$1,331,160	249
500-year Total		93	\$3,847,180	\$2,066,205	\$5,913,385	\$1,478,346	249
GRAND TOTAL		125	\$4,066,710	\$2,175,970	\$6,242,680	\$1,560,670	252

Source: Adams County GIS/Assessor's Office, Wood analysis.

Table B-14 City of Brighton Critical Facilities in Flood Zones

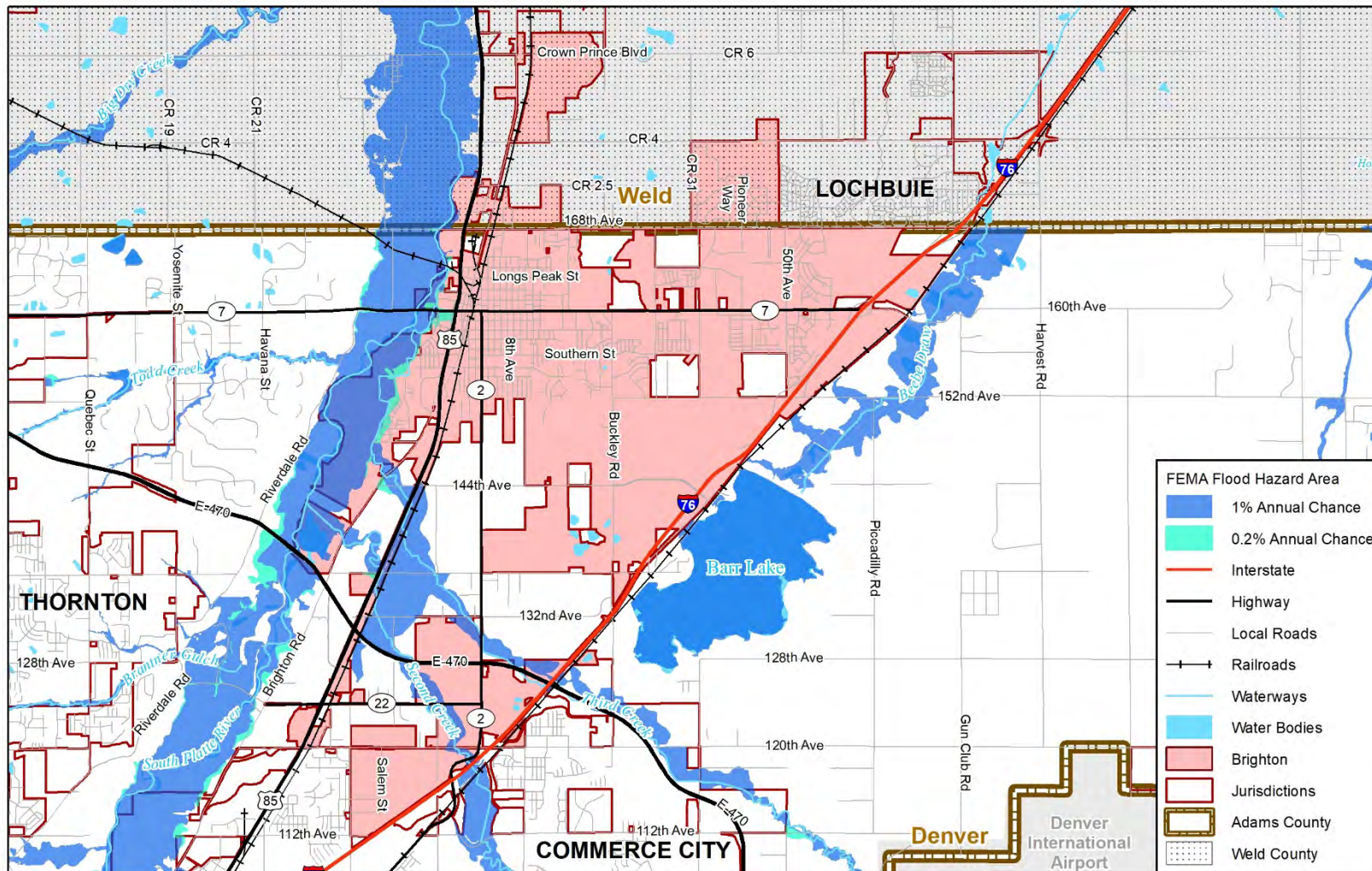
Flood Event	FEMA Lifeline	Critical Facility Type	Total
100-year	Food/Water/Shelter	Gravel Mines/Ponds	1
	Transportation	Minor Bridge	1
100-Year Total			2
500yr	---	---	-
500-Year Total			0
GRAND TOTAL			2

Source: Adams County GIS/Assessor's Office, Wood analysis.

National Flood Insurance Program Policy Analysis

Brighton has participated in the National Flood Insurance Program (NFIP) since November 16, 1977. NFIP insurance data shows that as of September 2019, there were 9 flood insurance policies in force in the City with \$2,224,000 of coverage. This is an increase of 8 policies since 2013. There have been two historical claims for flood losses totaling \$3,293. There are no repetitive or severe repetitive loss structures as defined by the NFIP as of September 2019. The City of Brighton does not participate in the Community Rating System (CRS) program.

Figure B-6 FEMA Special Flood Hazard Areas in the City of Brighton



Map compiled 2/2020;
intended for planning purposes only.
Data Source: Adams County GIS,
Colorado Information Marketplace, FEMA NFHL,
Weld County, ESRI World Terrain Map

0 3.5 7 Miles



B.4.4 Hazardous Materials Incident

The National Response Center (NRC) records 71 hazardous materials incidents in or near the City of Brighton from 1990 through 2018; as noted in Section 5.3.13 of the Base Plan, this likely excludes a large number of unreported minor spills. This constitutes 8.5% of the 832 hazardous materials incidents reported countywide during the same time frame, and averages out to roughly 2.4 incidents per year. As noted in Section 5.3.13, only around 6% of reported hazardous materials incidents result in injuries, fatalities, or evacuations.

As of January 2020, there are 15 EPA Tier II facilities and no Risk Management Plan (RMP) facilities located in the City.

B.4.5 Wildfire Vulnerability

Overall, the LPT felt Brighton's risk from wildfires is Medium, due to the prevalence of brush fires in the area.

Figure B-7 shows the Wildland Urban Interface (WUI) areas in and near the City of Brighton by medium and low density; the City does not have any high density WUI areas.

Table B-15 and Table B-16 calculate the people, property, and critical facilities located in the low and medium density WUI areas. Based on this analysis, there are 114 people, \$1.3M worth of property damage, and no critical facilities located in medium density WUI areas. Low density WUI areas include no people or potential property damage, but do include one critical facility.

Table B-15 City of Brighton Parcels and Exposure in Wildland Urban Interface (WUI) Zones

WUI Zone	Parcel Type	Improved Parcels	Improved Value	Content Value	Total Value	Population
Low Density	Exempt	2	\$0	--	\$0	--
Medium Density	Residential	38	\$878,560	\$439,280	\$1,317,840	114
TOTAL		40	\$878,560	\$439,280	\$1,317,840	114

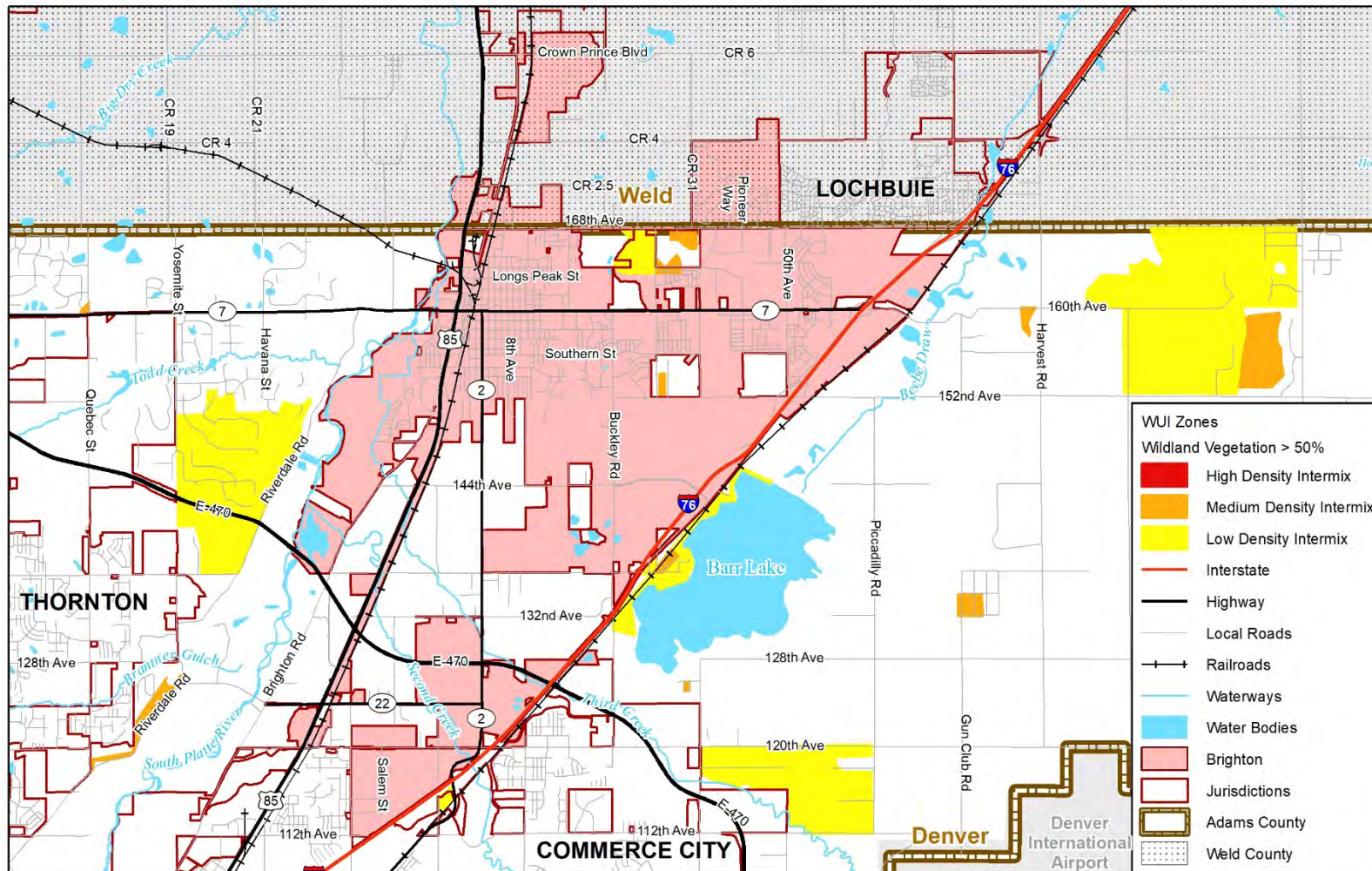
Source: Adams County GIS/Assessor's Office, Wood analysis.

Table B-16 City of Brighton Critical Facilities in Wildland Urban Interface (WUI) Zones

Wildfire	FEMA Lifeline	Critical Facility Type	Total
Low Density	Hazardous Material	HazMat EO Tier II Sites	1
TOTAL			1

Source: Adams County GIS/Assessor's Office, Wood analysis.

Figure B-7 Wildland Urban Interface (WUI) Intermix Areas in the City of Brighton



wood.
Map compiled 2/2020;
intended for planning purposes only.
Data Source: Adams County GIS,
Colorado Information Marketplace,
Weld County, ESRI World Terrain Map,
2012 Comprehensive Plan

B.4.6 Growth and Development Trends

Table B-17 lists the number of building permits issued by the City from 2010 through 2019. They illustrate the steady growth in development over the past decade.

Table B-17 City of Brighton Building Permits Issued 2010-2019

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Residential (# of Units)	50	57	391	114	203	205	523	366	265	500
Commercial	1	4	4	8	3	5	6	10	7	8
Industrial	4	1	0	35	2	1	0	1	3	5
Public Buildings	0	4	3	1	0	0	1	1	0	0
Total	55	66	398	158	208	211	530	378	275	513

Source: Brighton Community Development, www.brightonco.gov/214/Community-Development

B.5 Capability Assessment

This section profiles the programs and policies currently in use by the City of Brighton to reduce hazard impacts or that could be used to implement hazard mitigation activities. The capabilities assessment is divided into five sections: planning and regulatory mitigation capabilities, administrative and technical mitigation capabilities, fiscal mitigation capabilities, past and ongoing mitigation outreach, and other mitigation efforts.

B.5.1 Planning and Regulatory Mitigation Capabilities

Table B-18 lists planning and land management tools typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place in Brighton.

Table B-18 City of Brighton Planning and Regulatory Mitigation Capabilities

Regulatory Tool (ordinance, code, plans)	Yes/No	Comments
Comprehensive Plan	Yes	Brighton 2020 Comprehensive Plan
Zoning ordinance	Yes	
Subdivision ordinance	Yes	
Growth management ordinance	Yes	
Floodplain ordinance	Yes	Prevents certain types of development from occurring in the floodplain and floodway. This ordinance also sets requirements for any change to the regulatory floodplain and floodway.
Building codes	Yes	
Fire department ISO rating	Yes	
Erosion or sediment control program	No	This controls environmental pollution.
Storm water management program	Yes	This program is in place to reduce flooding in developed areas.
Site plan review requirements	Yes	
Capital improvement plan	Yes	
Economic development plan	Yes	
Local emergency operations plan	Yes	Updated on 2 year cycles and next update is in Nov 2020
Other special plans	Yes	Recovery, Alert and Warning, Shelter, Debris Management,

Regulatory Tool (ordinance, code, plans)	Yes/No	Comments
Flood insurance study or other engineering study for streams	Yes	This defines new floodplain areas and identifies capital improvement projects to reduce flood hazards.
Elevation certificates (for floodplain development)	Yes	This works to reduce flooding of any proposed development in the City.

Brighton 2020 Comprehensive Plan

The following are the overall goals that the City of Brighton established in their Comprehensive Plan: Brighton 2020: A Vision for Managing Change and Promoting Excellence. These goals are the foundation and guide to the public and private sector as decisions are made that “effect the future quality of life of existing and future residents and the natural and build environment in which they live, learn, work, and play.” The achievement of the following goals will depend largely on the City’s ability to successfully implement its hazard mitigation strategies and reduce risk to people and property from hazards.

- Preserve and enhance Brighton’s quality of life
- Preserve and enhance Brighton’s small town identity
- Promote and develop Brighton as a sustainable community
- Promote and protect Brighton’s “Free-Standing” community
- Maintain Brighton’s farming character
- Promote Brighton’s local history
- Promote community focal points
- Become an “inclusive” community
- Encourage interaction among residents

The majority of Brighton’s long-term planning goals and visions depend on fostering a safe, hazard resilient community.

Historic Splendid Valley District Plan

Historic Splendid Valley is an eclectic agricultural area established through a partnership with the City of Brighton and Adams County. The area is focused on preserving farmland and stimulating innovative opportunities that create closer connections between people, farming and nature. The District has been in a state of transition since E-470 opened in 2003, making the area more accessible and developable, threatening its farming heritage, the local food economy, and the buffer that farmland provides between Brighton and the Denver region.

The City of Brighton partnered with Adams County to draft the District Plan to study the feasibility of preserving farmland in southern Brighton that remains valuable for food production, while allowing for a range of development opportunities that consider the most efficient and sustainable use of the land. This plan helps decision-makers guide investment in the area for compatible residential, commercial, and industrial development, as well as farmland conservation, and local food and agritourism promotion.

Second Creek Major Drainageway Plan and Flood Hazard Area Delineation

Mile High Flood District is currently in the process of creating a master plan for Second Creek. This plan identifies capital improvement projects along the stream corridor and will also delineate a new regulatory floodplain. The City of Brighton is a sponsor of this study.

Third Creek Major Drainageway Plan and Flood Hazard Area Delineation

Mile High Flood District is currently in the process of creating a master plan for Third Creek. This plan identifies capital improvement projects along the stream corridor and will also delineate a new regulatory floodplain. The City of Brighton is a sponsor of this study.

South Platte River

Mile High Flood District is currently in the process of creating a master plan for the South Platte River. This plan identifies capital improvement projects along the stream corridor and will also delineate a new regulatory floodplain.

2006 Brighton Outfall System Plan

This plan identifies capital improvement projects to prevent or reduce flooding throughout the City. Mile High Flood District was a sponsor of this study.

2015 Brighton Stormwater Master Plan

This plan identifies capital improvement projects to prevent or reduce flooding throughout the City. Mile High Flood District was a sponsor of this study.

B.5.2 Administrative and Technical Mitigation Capabilities

Table B-19 identifies the personnel responsible for activities related to mitigation and loss prevention in Brighton.

Table B-19 City of Brighton Administrative and Technical Mitigation Capabilities

Personnel Resources	Yes/No	Department/Position
Planner/engineer with knowledge of land development/land management practices	Yes	Utilities/Assistant Director of Utilities
Engineer/professional trained in construction practices related to buildings and/or infrastructure	Yes	Utilities/Assistant Director of Utilities
Public Works/Public Works Engineering Manager		
Planner/engineer/scientist with an understanding of natural hazards	Yes	
Personnel skilled in GIS	Yes	Information Technology/Senior GIS Analyst Information Technology/GIS Technician Information Technology/GIS Administrator
Full time building official	Yes	Community Development/Chief Building Official
Floodplain manager	Yes	Infrastructure/Director of Infrastructure
Emergency manager	Yes	Emergency Management Coordinator

B.5.3 Fiscal Mitigation Capabilities

Table B-20 identifies financial tools or resources that Breckenridge could potentially use to help fund mitigation activities.

Table B-20 City of Brighton Fiscal Mitigation Capabilities

Financial Resources	Accessible / Eligible to Use	Has Been Used in the Past	Comments
Community Development Block Grant	Yes	No	This is accessible only to the extent the City has applied and been awarded funds for this purpose
Capital Improvements Project funding	Yes	Yes	
Authority to levy taxes for specific purposes	No	No	A levy for specific purposes requires a vote of residents
Fees for water, sewer, gas, or electric services	Yes	Yes	Only to the extent the mitigation is necessary for the operation of the water and sewer enterprise.
Impact fees for new development	Yes	Yes	
Incur debt through general obligation bonds	No	No	Debt requires a vote of residents
Incur debt through special tax bonds	No	No	Debt requires a vote of residents
Incur debt through private activities	No	No	Debt requires a vote of residents
Withhold spending in hazard prone areas	Yes	No	

B.5.4 Past and Ongoing Mitigation Efforts

In 2015 the city was able to utilize an HMPG grant to install additional outdoor warning sirens to better warn the public of all hazard events, particularly tornado activity within the city.

The City of Brighton provides the local community with information on local hazards through a variety of platforms:

- Citizen Policy Academy
- Community Emergency Response Team (CERT) training
- Participating in community events (City BBQs, public events, etc.)
- Weather Spotter courses offered to city staff and residents

Local Citizen Groups That Communicate Hazard Risks: the Brighton Community Emergency Response Team (CERT) provides an annual course that outlines the risks to our local community as well as individual, family and neighborhood action items to help mitigate risk. Additionally, team leadership responds to community requests for information by senior groups, faith based organizations, and city departments and integrates local hazard information into each of these formats. The City does not currently participate in Firewise or StormReady.

B.5.5 Opportunities for Enhancement

Based on the capability assessment, Brighton has several existing mechanisms in place that already help to mitigate hazards. There are also opportunities for the City to expand or improve on these policies and programs to further protect the community. Future improvements may include providing training for staff members related to hazards or hazard mitigation grant funding in partnership with the County and DHSEM. Additional training opportunities will help to inform City staff and City Council on how best to integrate hazard information and mitigation projects into the City policies and ongoing duties of the City. Continuing to train City staff on mitigation and the hazards that pose a risk to the City will lead to more

informed staff members who can better communicate this information to the public. Another capability enhancement would be to consider joining the CRS, which would require enhancements to the City's floodplain management program; however, the low number and value of flood insurance policies in Brighton means this would not significantly affect flood insurance affordability in the City.

B.6 Mitigation Goals and Objectives

The City of Brighton has adopted the hazard mitigation goals and objectives developed by the HMPC and described in Section 6.2 of the Base Plan.

B.7 Mitigation Actions

The local planning team identified and prioritized the following mitigation actions for the City of Brighton based on the risk assessment. Information on how each action will be implemented and administered, such as ideas for implementation, responsible agency, potential funding, estimated cost, and timeline also are included. These actions are also captured in Table 6-2 in the Base Plan.

Table B-21 City of Brighton 2020 Mitigation Action Plan

ID	Related Goal(s)	Hazard(s) Mitigated	Description / Background / Benefits	Lead Agency and Partners	Cost Estimate	Potential Funding	Priority	Timeline	Status / Implementation Notes
COB-1	1,2,4	Multi-Hazard: Drought, Earthquake, Subsidence, Flood, Winter Weather, Thunderstorm, Tornado, Wildfire, Hazmat	Integrate mitigation & preparedness planning into existing public education programs: Integrate in programs around the city to enhance resiliency of the community around all hazard vulnerabilities. Residents must be aware of local hazards and the mitigation & preparedness actions they can take to assist in protecting themselves and their families from the adverse effects, and to enhance community resiliency. Continued and additional community education and training to specifically address local hazards, containing detailed recommendations around potential community action items, which are crucial to continue to reinforce the need to take personal and individual action to mitigate risk related to local hazards. Add information about local hazards and mitigation strategies into existing citizen centered trainings and/or developed hazard and response specific training for citizens as needed to provide information to residents about mitigation/preparedness options in their community.	City of Brighton/ Brighton Fire Rescue District's OEM	\$5,000	HSGP, EMPG, local budgets	High	2021	In progress. Community education programs (CERT, Citizen Police Academy, Weather Spotter etc.) contain the most recent assessment of local hazards and mitigations actions that can be undertaken by community members to promote resiliency. This program is always in process as additional classes are hosted and hazards are evaluated.
COB-2	2	Multi-Hazard: Thunderstorm, Tornado,	Emergency Services Support Generator: Currently, the city maintains only a small generator at the Brighton Police Department, capable only of supporting minimal emergency lighting, the security of detention cells, and limited	City of Brighton	\$200,000	FEMA HMA funding, City of Brighton Capital	High	2022	Continue – Not Completed. A project to develop backup power for shelter sites was determined to be

ID	Related Goal(s)	Hazard(s) Mitigated	Description / Background / Benefits	Lead Agency and Partners	Cost Estimate	Potential Funding	Priority	Timeline	Status / Implementation Notes
		Winter Weather, Flood, Dam Failure, Hazardous Materials, Earthquake, Subsidence, Wildfire, Terrorism, Cyber	communication systems. The current generator cannot support the emergency coordination functions which take place at this location. Install a generator and associated wiring to support emergency functions during a short- or long-term power outage. The wiring and installation of a 500KVA generator and a 1200amp transfer switch would allow for a reliable back up power source at a critical city facility. This generator would support key city staff and services at this location and would allow for the relocation of staff and continuity of critical services. In addition, emergency support related services and functions are coordinated from this location. Critical emergency support functions such as operation of the Emergency Operations Center (EOC), location of the Policy Group meeting area and information center, the Joint Information Center (JIC) and local law enforcement operations are designated to take place at this location.			Improve ments budget			higher priority and has been underway since 2015.
COB-3	2	Multi-Hazard: Winter Weather, Thunderstorm, Tornado	Public/Emergency Shelter Generator for Eagle View Adult Center: Eagle View Adult Center is the main shelter location for the city. It does not have a generator nor is the building wired to accept a generator. Project would be purchasing a generator and wiring the building to setup the generator. Benefits: Ability to safely shelter residents during power loss.	City of Brighton OEM and Parks and Rec	\$250,000 - \$300,000	HMA grants and General Funds	High	2025-2030	New in 2020. UASI funding was secured in 2015 to wire the Eagle View Adult Center for receiving a generator, but due to an extreme overrun in expected construction costs, this project was never implemented,

ID	Related Goal(s)	Hazard(s) Mitigated	Description / Background / Benefits	Lead Agency and Partners	Cost Estimate	Potential Funding	Priority	Timeline	Status / Implementation Notes
									and funding was returned to UASI.
COB-4	2	Tornado	Expansion of Outdoor Warning System: Expand the City's siren system to cover portions of unincorporated Adams and Weld Counties. Several areas within the Brighton Fire Rescue District and the north area (Weld County) of the City of Brighton are without outdoor warning sirens. Installation of additional warning sirens in the locations lacking coverage to warn residents of potential hazards.	City of Brighton, Brighton Fire Rescue District	\$45,000 per unit	HMA funding	High	2021	In progress. Sirens scheduled to be installed at Great Rock and Todd Creek Fire Stations with HMP funds have been completed. Plans for an additional unit to be placed at Vestas have been put on hold pending the development of an easement for public safety facility.
COB-5	2	Flood	North Outfall Phase III: Complete engineering civil drawings and construct the outfall system. Design and construct a larger outfall system to convey flows to South Platte River. Add additional inlets and piping network to more efficiently collect storm runoff.	City of Brighton	\$4,800,000	Storm water impact fees, monthly fees and MHFD.	High	2021	In progress. City has 50-percent design plans. Will be under contract for 100-percent design plans in 2020.
COB-6	2	Flood	Master Drainage Plan: Comprehensive master planning efforts are needed to provide guidance to the City. The City needs to hire an engineering consulting firm to complete a comprehensive master drainage plan.	City of Brighton, MHFD	\$25,000	Already available stormwater funding	Medium	End of 2020	In progress. Project budgeted for end of 2020.
COB-7	2	Flood	Second and Egbert Drainage Improvements: An undersized drainage pipe and lack of inlet do not provide appropriate drainage at this intersection.	City of Brighton	\$250,000	Stormwater impact fees and	Low	2023	Continue – Not Completed.

ID	Related Goal(s)	Hazard(s) Mitigated	Description / Background / Benefits	Lead Agency and Partners	Cost Estimate	Potential Funding	Priority	Timeline	Status / Implementation Notes
			Design and construct drainage infrastructure to alleviate flooding at this intersection.			monthly fees.			
COB-8	2	Flood	Third Creek and Brighton Road: The Third Creek Crossing under Brighton Road has become silted and is not adequately sized to pass 100-year flows. Complete engineering civil drawings and construct a 100-year crossing under Brighton Road.	City of Brighton	\$4,000,000	Storm water impact fees, monthly fees and MHFD.	Low	2025	Continue – Not Completed.
COB-9	2	Flood	South Brighton Outfall: The far southern portion of the City needs drainage improvements to convey storm flows to the South Platte River. Design and construct an outfall system to convey flows to South Platte River. Complete engineering civil drawings and construct the outfall system.	City of Brighton	\$20,000,000	Storm water impact fees, monthly fees and MHFD.	Medium	2025	Continue – Not Completed.
COB-10	2	Flood	Recreation Center Tributary Outfall: Design and construct an outfall to serve the properties surrounding the intersection of Bridge and Telluride Street to prevent localized flooding of public roadways.	City of Brighton and MHFD	\$4,500,000	Storm water impact fees, monthly fees and MHFD.	High	2025	New in 2020.

B.7.1 Continued Compliance with the National Flood Insurance Program

Recognizing the importance of the National Flood Insurance Program (NFIP) in mitigating flood losses, the City of Brighton will place an emphasis on continued compliance with the NFIP. As an NFIP participant, the City has and will continue to make every effort to remain in good standing with NFIP. This includes continuing to comply with the NFIP's standards for updating and adopting floodplain maps and maintaining and updating the floodplain zoning ordinance as well as review of any potential development in special flood hazard areas.

B.8 Implementation and Maintenance

This section provides an overview of the City's strategy for plan implementation and maintenance, and outlines the method and schedule for monitoring, evaluating, and updating the plan. The section also discusses incorporating the plan into existing planning mechanisms and how to ensure continued public involvement in mitigation planning.

B.8.1 Incorporation into Existing Planning Mechanisms

The information contained within this plan, including results from the Vulnerability Assessment, and the Mitigation Strategy will be used by the City to help inform updates and the development of local plans, programs and policies, as described in Section 7.3 of the Base Plan. The following mitigation actions listed in Table B-21 specifically address development of local plans that will be informed by the information in this HMP:

- COB-1: Integrate mitigation & preparedness planning into existing public education programs
- COB-6: Master Drainage Plan

The City of Brighton was not included in the 2014 Adams County Hazard Mitigation Plan, and as such did not incorporate elements of that plan into other planning mechanisms.

B.8.2 Monitoring, Evaluation and Updating the Plan

The City Emergency Manager will be responsible for monitoring, evaluating, and updating this plan using the process outlined in Section 7 of the Base Plan. The City will continue to involve the public in mitigation, as described in Section 7.4 of the Base Plan. The City Emergency Manager will be responsible for representing the City on the Adams County HMPC, and for coordination with City staff and departments during plan updates. The City will review this annex regularly and will update it every five years in accordance with the Disaster Mitigation Act Requirements.

C City of Commerce City

This Annex consolidates information specific to Commerce City and goes into more detail about risk, capabilities, and mitigation strategies unique to that jurisdiction.

C.1 Mitigation Planning History and 2020 Update Process

The City of Commerce City is situated in western Adams County. Commerce City had previously participated in the 2010 Denver Regional Natural Hazard Mitigation Plan. The City committed to participating in the 2020 Adams County plan update and met all participation requirements. The City participated in the County's multi-jurisdictional Hazard Mitigation Planning Committee (HMPC), and also brought together a Local Planning Team (LPT) to help collect data, identify and prioritize City mitigation actions and implementation strategies, and review annex drafts.

Table C-1 Commerce City Local Planning Team

Department or Stakeholder	Title
Office of Emergency Management	Emergency Manager
Community Development	Planning Manager
Public Works	Flood Plain Administrator

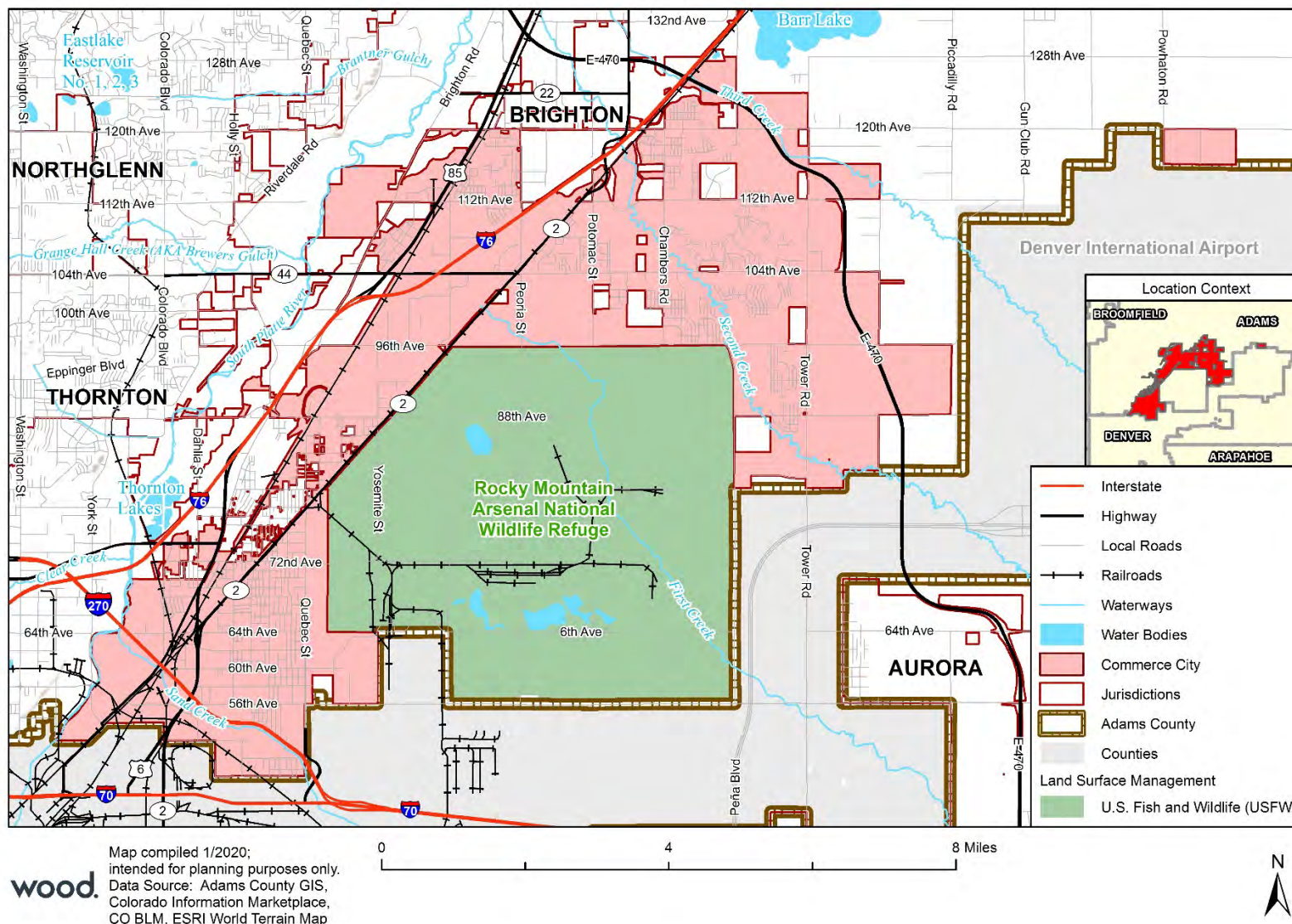
More details on the planning process and participating jurisdictions, service districts and stakeholders can be found in Section 3 of the Base Plan, along with the public's role during the 2020 update.

C.2 Community Profile

Commerce City is located in western Adams County. The City has a land area of 35.22 square miles and is bordered by the City of Denver to the south, the City of Thornton to the west, the Cities of Northglenn and Brighton to the north, and Denver International Airport to the east. Rocky Mountain Arsenal National Wildlife Refuge is bordered on its western, northern, and northeastern sides by Commerce City. The City was incorporated in 1952 and was officially named Commerce City in 1963 after the annexation of Derby and subsequent increase in population. Today, Commerce City is one of the fastest growing communities in the State.

Figure C-1 shows a map of the City of Commerce City and its location within Adams County.

Figure C-1 Map of the City of Commerce City



C.2.1 Demographics

This section was updated using data from the U.S. Census Bureau's 2012-2017 American Community Survey (ACS) 5-Year Estimates, and the Colorado State Demography Office.

As of 2017, the U.S. Census Bureau estimated Commerce City's total population at 52,905. This constitutes a 16% increase in population since 2012 (45,537). Table C-2 below lists population estimates for the City alongside those of Adams County and the State of Colorado, showing how they have changed in the last five years.

Table C-2 Commerce City Population Change, 2012-2017

Jurisdiction	2012	2013	2014	2015	2016	2017	Growth 2012-2017
Commerce City	45,537	47,239	48,792	50,346	51,731	52,905	16%
Adams County	442,996	452,030	461,558	471,206	479,977	487,850	10%
Colorado	5,042,853	5,119,329	5,197,580	5,278,906	5,359,295	5,436,519	8%

Source: U.S. Census Bureau American Community Survey, www.census.gov/.

Table C-3 and Table C-4 show several key demographic and social characteristics of Commerce City, how those characteristics have changed over the last five years, and how those characteristics compare to the rest of the County and the State.

Table C-3 Commerce City Demographic and Social Characteristics, 2012-2017

Commerce City	2012	2017	% Change
Population	45,537	52,905	16.2%
Median Age	30.2	30.7	1.7%
Total Housing Units	15,788	15,724	-0.4%
Housing Occupancy Rate	90.5%	96.9%	7.1%
% of Housing Units with no Vehicles Available	5.4%	5.3%	-1.9%
Median Home Value	\$188,400	\$258,500	37.2%
Unemployment	6.9%	3.1%	-55.1%
Mean Travel Time to Work (minutes)	29.1	29.1	0.0%
Median Household Income	\$60,963	\$69,268	13.6%
Per Capita Income	\$22,640	\$24,076	6.3%
% of Individuals Below Poverty Level	17.7%	12.2%	-31.1%
% Without Health Insurance	21.3%	9.6%	-54.9%
# of Households	14,294	15,240	6.6%
Average Household Size	3.16	3.45	9.2%
% of Population Over 25 with High School Diploma	76.4%	80.6%	5.5%
% of Population Over 25 with Bachelor's Degree or Higher	20.1%	22.7%	12.9%
% with Disability	10.2%	8.1%	-20.6%
% Speak English less than "Very Well"	16.2%	12.0%	-25.9%

Source: U.S. Census Bureau American Community Survey, www.census.gov/.

Table C-4 Demographic and Social Characteristics Compared to the County and State

Demographic & Social Characteristics (as of 2017)	Commerce City	County	Colorado
Median Age	30.7	33.4	36.5
Housing Occupancy Rate	96.90%	96.00%	89.80%
% of Housing Units with no Vehicles Available	5.30%	5.30%	5.30%
Median Home Value	\$258,500	\$241,900	\$286,100
Unemployment	3.10%	5.10%	5.20%
Mean Travel Time to Work (minutes)	29.1	29.2	25.2
Median Household Income	\$69,268	\$64,087	\$65,458
Per Capita Income	\$24,076	\$27,487	\$38,845
% of Individuals Below Poverty Level	12.20%	12.20%	11.50%
% Without Health Insurance	9.60%	13.40%	9.40%
Average Household Size	3.16	2.98	2.55
% of Population Over 25 with High School Diploma	76.40%	82.60%	91.10%
% of Population Over 25 with bachelor's degree or Higher	20.10%	23.10%	39.40%
% with Disability	10.20%	10.70%	10.60%
% Speak English less than "Very Well"	16.20%	11.50%	6.00%

Source: U.S. Census Bureau American Community Survey, www.census.gov/.

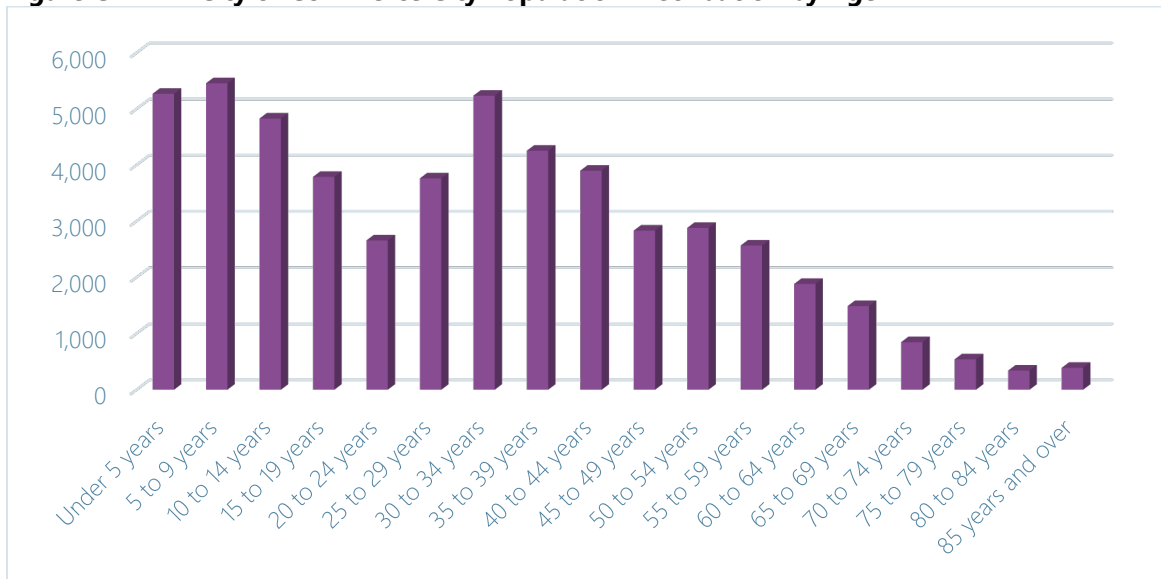
Table C-5 and Figure C-2 break down the demographics of the City by sex, race, and age.

Table C-5 Demographics by Race and Sex

Commerce City	Population	%
Total Population	52,905	
Male	26,393	49.9%
Female	26,512	50.1%
White, not Hispanic	23,595	44.6%
Hispanic or Latino	24,557	46.4%
Black	2,169	4.1%
Asian	1,065	2.0%
American Indian and Alaska Native	522	1.0%
Native Hawaiian and Other Pacific Islander	181	0.3%
Some other race	3,101	5.9%
Two or more races	1,975	3.7%

Source: U.S. Census Bureau American Community Survey, www.census.gov/.

Figure C-2 City of Commerce City Population Distribution by Age



Source: U.S. Census Bureau American Community Survey, www.census.gov/.

C.2.2 Housing and Economy

Table C-6 presents the 2017 American Community Survey estimates for types of housing units in the City.

Table C-6 Types and Total Amounts of Housing Units in Commerce City

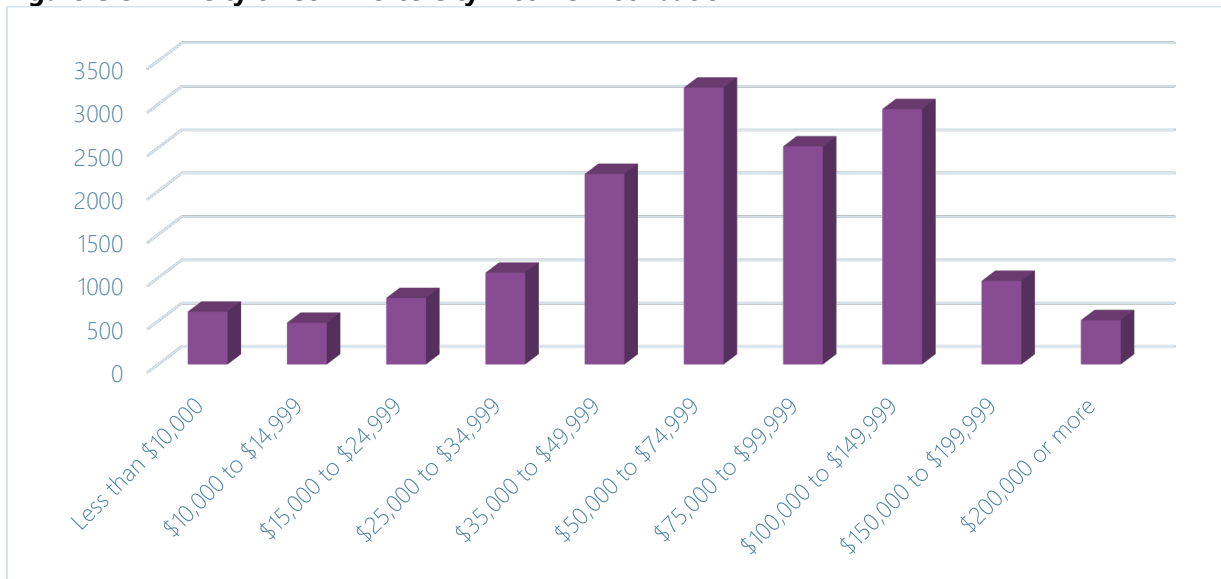
Type of housing units	Total	Percentage
Total housing units	15,724	
1-unit detached	12,066	76.74%
1-unit attached	1,168	7.43%
2 units	328	2.09%
3 or 4 units	296	1.88%
5 to 9 units	394	2.51%
10 to 19 units	603	3.83%
20 or more units	403	2.56%
Mobile home	449	2.86%
Boat, RV, van, etc.	17	0.11%

Source: U.S. Census Bureau American Community Survey, www.census.gov/.

As of 2017 the median home value in the City was \$258,500, a 37% increase since 2012. That value exceeds the average for Adams County (\$241,900) but remains slightly below the State average (\$286,100). Commerce City's housing occupancy rate is 96.9%, above the County and State averages.

The City's per capita income in 2017 was \$24,076, a 6.3% increase since 2012, showing that income has not kept up with rising housing costs. The City's per capita income is below that of Adams County as a whole (\$27,487) and well below the average for Colorado (\$38,845). Figure C-3 shows the distribution of income in the City. Unemployment in 2017 was 3.10%, well below the County average of 5.10%.

Figure C-3 City of Commerce City Income Distribution



Source: U.S. Census Bureau American Community Survey, www.census.gov/.

C.3 Hazard Identification and Profiles

The City of Commerce City's Local Planning Team (LPT) identified the hazards that affect the community and summarized their geographic location, probability of future occurrence, potential magnitude or severity, and overall significance specific to the City, as shown in Table C-7. Due to Commerce City's proximity to Denver International Airport, the City's LPT evaluated Plane Crash as a locally recognized hazard. However, the City considered plane crash to be of low overall significance, and it is not profiled further in this Plan.

Table C-7 City of Commerce City Hazard Significance

Hazard	Geographic Location	Probability of Future Occurrence	Magnitude/Severity (Extent)	Overall Significance
Hazardous Materials Incident	Significant	Highly Likely	Critical	High
Flood	Significant	Highly Likely	Limited	Medium
Winter Weather	Significant	Highly Likely	Limited	Medium
Thunderstorms	Significant	Highly Likely	Limited	Medium
Tornado/High Wind	Significant	Highly Likely	Limited	Medium
Lightning/Hail	Limited	Highly Likely	Negligible	Medium
Terrorism/Active Shooter	Limited	Likely	Negligible	Medium
Cyber Incident	Limited	Likely	Limited	Medium
Drought	Limited	Occasional	Negligible	Low
Earthquake	Limited	Occasional	Limited	Low
Subsidence	Limited	Likely	Negligible	Low
Wildfire	Limited	Occasional	Negligible	Low
Dam Failure/Incident	Limited	Occasional	Limited	Low
Plane Crash	Limited	Occasional	Catastrophic	Low

<p>Geographic Location Limited: Less than 10% of planning area Significant: 10-50% of planning area Extensive: 50-100% of planning area</p> <p>Probability of Future Occurrences Highly Likely: Near 100% chance of occurrence in next year or happens every year. Likely: Between 10 and 100% chance of occurrence in next year or has a recurrence interval of 10 years or less. Occasional: Between 1 and 10% chance of occurrence in the next year or has a recurrence interval of 11 to 100 years. Unlikely: Less than 1% chance of occurrence in next 100 years or has a recurrence interval of greater than every 100 years.</p>	<p>Magnitude/Severity (Extent) Catastrophic—More than 50% of property severely damaged; shutdown of facilities for more than 30 days; and/or multiple deaths Critical—25-50% of property severely damaged; shutdown of facilities for at least two weeks; and/or injuries and/or illnesses result in permanent disability Limited—10-25% of property severely damaged; shutdown of facilities for more than a week; and/or injuries/illnesses treatable do not result in permanent disability Negligible—Less than 10% of property severely damaged, shutdown of facilities and services for less than 24 hours; and/or injuries/illnesses treatable with first aid</p> <p>Significance Low: minimal potential impact Medium: moderate potential impact High: widespread potential impact</p>
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Information on past events can be found in in the hazard profiles in Section 4.3 of the Base Plan.

C.4 Vulnerability Assessment

The intent of this section is to assess Commerce City's vulnerability separate from that of the County as a whole, which has already been assessed in Section 4.3 Vulnerability Assessment of the Base Plan. For most of the hazards listed in Table C-7, hazard and vulnerability do not vary significantly from the County overall, or vulnerability data is difficult to compile or estimate below county level. As a result, only Dam Failure/Incident, Flood, Hazardous Materials Incidents, and Wildfire are profiled separately in this annex.

For more information about how hazards affect Adams County, see Section 4 (Risk Assessment) of the Base Plan.

C.4.1 Community Asset Inventory

Table C-8 shows the total number of improved parcels, properties, and their improvement and content values for the City of Commerce City. Only those parcels with improvement values greater than \$0 or those classified as "exempt" were counted here and in the vulnerability assessments to follow. Counts and values are based on the latest county assessor's data (as of September 2019), which was provided in GIS format. Content values were estimated as a percent of the improvement value here and under the hazard vulnerability assessment based on standard FEMA Hazus methodologies: 100% of the improvement value for commercial structures, and 50% for residential structures and exempt or vacant parcels.

Table C-8 City of Commerce City Property Exposure

Parcel Type	Improved Parcels	Improved Value	Content Value	Total Value
Agricultural	8	\$237,380	\$237,380	\$474,760
Commercial	774	\$192,343,440	\$192,343,440	\$384,686,880
Exempt	801	\$108,051,170	\$54,025,585	\$162,076,755
Industrial	146	\$45,032,900	\$67,549,350	\$112,582,250
Residential	16,129	\$307,626,510	\$153,813,255	\$461,439,765
State Assessed	100	\$0	\$0	\$0
TOTAL	17,958	\$653,291,400	\$467,969,010	\$1,121,260,410

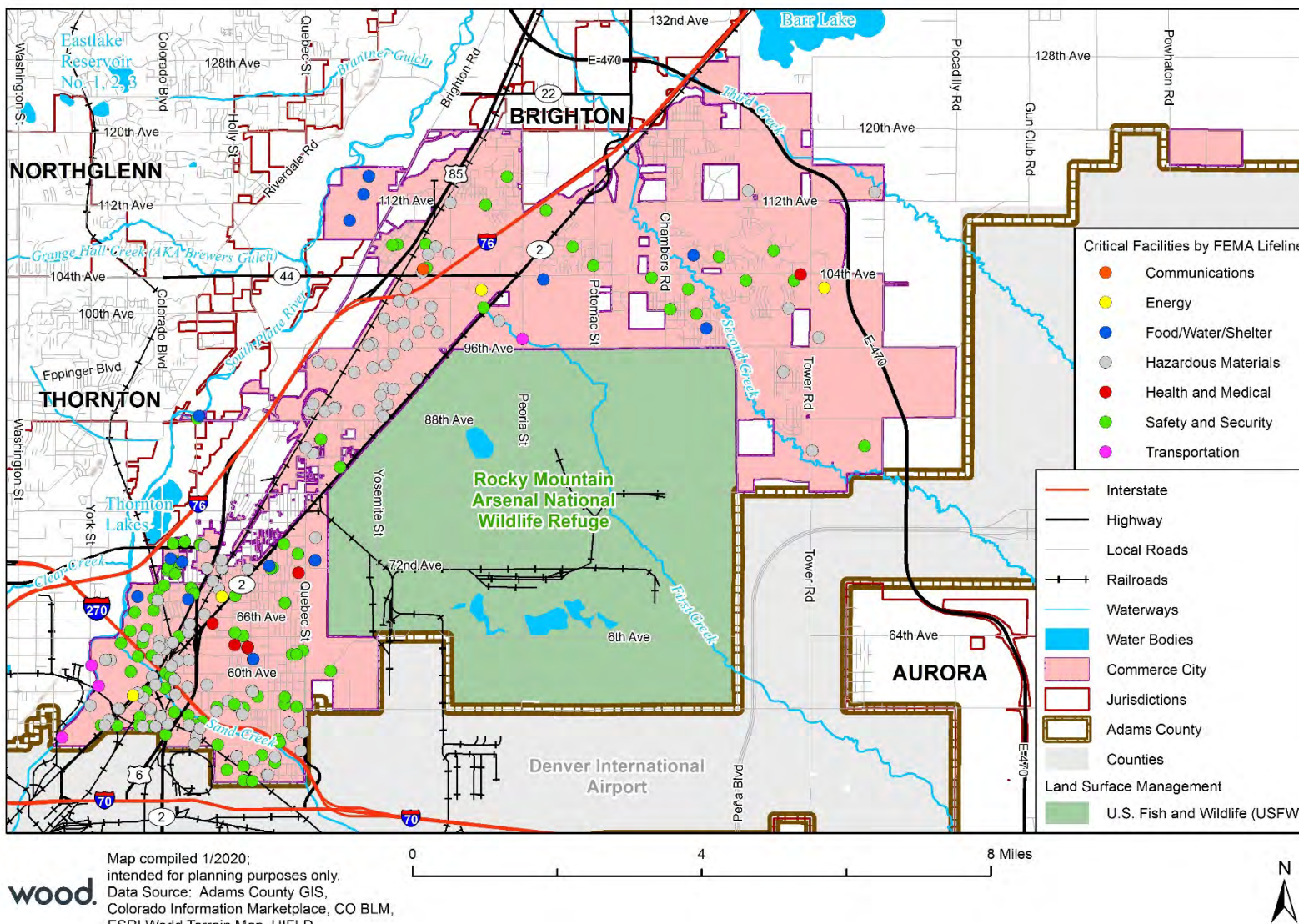
Source: Adams County GIS/Assessor's Office, Wood analysis.

Table C-9 lists summary information about the 273 critical facilities and other community assets identified by the City's LPT as important to protect or that provide critical services in the event of a disaster. These facilities are mapped in Figure C-4. For additional information on the definitions behind each critical facility category, source, and other details refer to Section 4.3.2 of the Base Plan.

Table C-9 City of Commerce City Critical Facilities and Infrastructure Summary

FEMA Lifeline	Critical Facility Type	Total
Communications	Communication Towers	1
Energy	Electric Substations	4
Food/Water/Shelter	Emergency Shelters	7
	Gravel Mines/Ponds	7
Hazardous Material	Environmental Hazard Superfund	58
	Environmental Hazard Toxic Site	13
	HazMat RMP Sites	7
	HazMat Tier II Sites	72
Health and Medical	Dialysis Center	1
	Nursing Home	2
	Senior Housing	2
	Urgent Care	1
Safety and Security	Fire Stations	8
	Government Facilities	4
	Landfills/Govt. Services	54
	Police Station	1
	Schools	27
Transportation	Minor Bridge	1
	Pedestrian Bridge	3
TOTAL		273

Source: Adams County GIS/Assessor's Office, Wood analysis.

Figure C-4 City of Commerce City Critical Facilities and Infrastructure

C.4.2 Dam Failure/Incident Vulnerability

The LPT felt the City's risk from a dam failure or incident is Low, despite the presence of high hazard dams and the exposure of numerous critical facilities to the dam inundation zones, due to the low probability of future events.

Table C-10 (excerpted from Table 4-13 in the Base Plan) lists the primary dams in and immediately upstream of the City of Commerce City. These dams, along with their potential dam inundation extents are mapped in Figure C-5.

Table C-10 Dams of Concern for the City of Commerce City

Dam Name	Waterway	Dam Type	Storage Capacity (Acre-Feet)	Emergency Action Plan?	Primary Purpose	Hazard Rating
Cherokee NW	South Platte-Os	Earth	157	Not Required	Other	Low
Derby	South Platte River-Os	Earth	1,230	Yes	Irrigation	Significant
Dunes	South Platte River-Os	Earth	5,644	Yes	Water Supply	High
Havana Street Dam	South Platte River-Tr	Earth	397	Not Required	Flood Control	Low
La Dore	South Platte River-Os	Earth	510	Not Required	Water Supply	Low
Miller	South Platte-Tr	Earth	2,262	Not Required	Water Supply	Low
South Tani Reservoir	South Platte River-Os	Earth	7,530	Yes	Water Supply	High
Tigers	South Platte River-Os	Earth	2,974	Not Required	Water Supply	Low
Upper Derby	South Platte River-Tr	Earth	620	Yes	Water Supply	Significant

Source: USACE National Inventory of Dams 2018, Wood analysis

Table C-11 and Table C-12 calculate the people, property, and critical facilities potentially at risk of dam inundation. Based on this analysis, there are 3,732 people and 154 critical facilities potentially at risk of inundation from a dam failure or incident. Projected losses total more than \$106.8M, although it is important to note that any single dam incident would be unlikely to affect all parcels potentially at risk. A major dam failure could also impact several major transportation corridors, including I-270 and I-76, potentially disrupting traffic in the area.

Table C-11 City of Commerce City Parcels and Exposure in Dam Inundation Zones

Parcel Type	Improved Parcels	Improved Value	Content Value	Total Value	Loss Estimate (50% of Total Value)	Population
Commercial	247	\$53,238,810	\$53,238,810	\$106,477,620	\$53,238,810	--
Exempt	159	\$23,907,880	\$11,953,940	\$35,861,820	\$17,930,910	--
Industrial	67	\$15,623,440	\$23,435,160	\$39,058,600	\$19,529,300	--
Residential	1,244	\$21,499,750	\$10,749,875	\$32,249,625	\$16,124,813	3,732
State Assessed	43	\$0	\$0	\$0	\$0	--
TOTAL	1,760	\$114,269,880	\$99,377,785	\$213,647,665	\$106,823,833	3,732

Source: Adams County GIS/Assessor's Office, Wood analysis.

Figure C-5 City of Commerce City Dams of Concern and Dam Inundation Zones

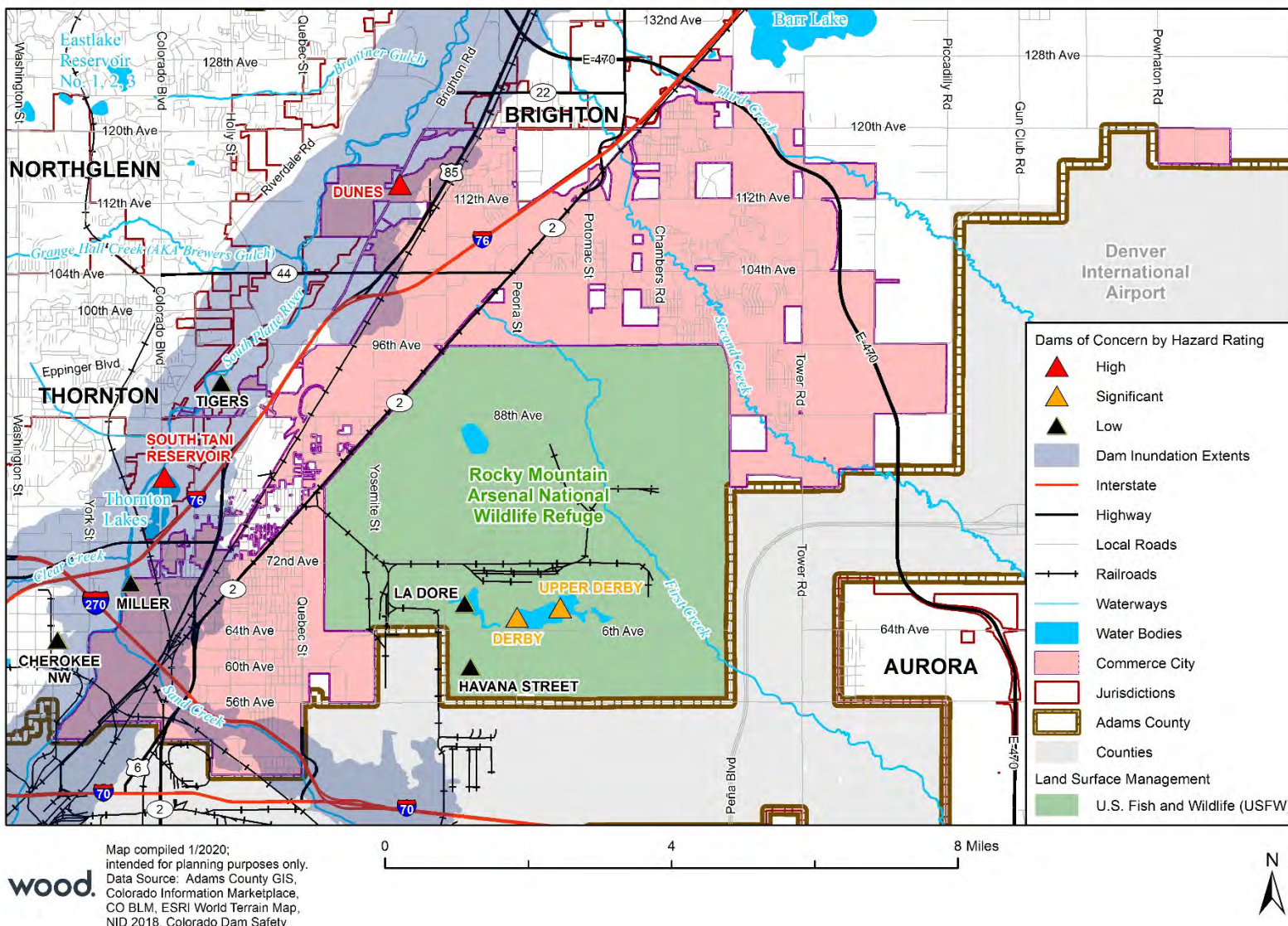


Table C-12 City of Commerce City Critical Facilities in Dam Inundation Zones

FEMA Lifeline	Critical Facility Type	Total
Energy	Electric Substations	2
Food/Water/Shelter	Emergency Shelters	3
	Gravel Mines/Ponds	5
Hazardous Material	Environmental Hazard Superfund	52
	Environmental Hazard Toxic Site	9
	HazMat RMP Sites	3
	HazMat Tier II Sites	27
Health and Medical	Nursing Home	1
Safety and Security	Fire Stations	1
	Government Facilities	3
	Landfills/Govt. Services	40
	Schools	5
Transportation	Pedestrian Bridge	3
TOTAL		154

Source: Adams County GIS/Assessor's Office, Wood analysis.

C.4.3 Flood Vulnerability

The LPC felt the City's flood risk is Medium, due to the lower numbers of people, property, and critical facilities potentially at risk compared to the County as a whole.

The major drainageway in the Commerce City area is the South Platte River, which runs along the City's west side. Major tributaries that cross through the City include Sand Creek, First Creek, Second Creek, and Third Creek. Thornton Lakes border the west side of the City.

Figure C-6 shows the mapped floodplains in the latest version of FEMA's National Flood Hazard Layer (NFHL). The NFHL maps both the 1% annual chance (100-year) and the 0.2% annual chance (500-year) flood events, as described in more detail in Section 4.3.5 of the Base Plan.

Table C-13 and Table C-14 summarize the people, property, and critical facilities located in the 100-year and 500-year floodplains. Based on this analysis, there are 9 people, 89 properties with a potential for \$3,086,443 worth of property damage, and 19 critical facilities potentially at risk of a 1% annual chance flood. For a 0.2% annual chance flood, that vulnerability increases by nearly \$760,000 worth of property damage and 10 critical facilities in addition to what would be affected by the 1% flood. As with Dam Failure/Incident above, several critical transportation corridors could be disrupted.

Table C-13 City of Commerce City Parcels and Exposure in Flood Zones

Flood Event	Parcel Type	Total Improved Parcels	Improved Value	Content Value	Total Value	Loss Estimate (25% of Total Value)	Population
100-year	Commercial	11	\$4,249,740	\$4,249,740	\$8,499,480	\$2,124,870	--
	Exempt	67	\$3,622,350	\$1,811,175	\$5,433,525	\$1,358,381	--
	Industrial	1	\$61,610	\$92,415	\$154,025	\$38,506	--
	Residential	3	\$46,610	\$23,305	\$69,915	\$17,479	9

Flood Event	Parcel Type	Total Improved Parcels	Improved Value	Content Value	Total Value	Loss Estimate (25% of Total Value)	Population
	State Assessed	7	\$0	\$0	\$0	\$0	--
100-year Total		89	\$7,980,310	\$6,176,635	\$14,156,945	\$3,539,236	9
500-year	Commercial	9	\$1,149,720	\$1,149,720	\$2,299,440	\$574,860	--
	Exempt	5	\$0	--	\$0	\$0	--
	Industrial	3	\$296,110	\$444,165	\$740,275	\$185,069	--
	State Assessed	1	\$0	\$0	\$0	\$0	--
500-year Total		18	\$1,445,830	\$1,593,885	\$3,039,715	\$759,929	--
GRAND TOTAL		107	\$9,426,140	\$7,770,520	\$17,196,660	\$4,229,165	9

Source: Adams County GIS/Assessor's Office, Wood analysis.

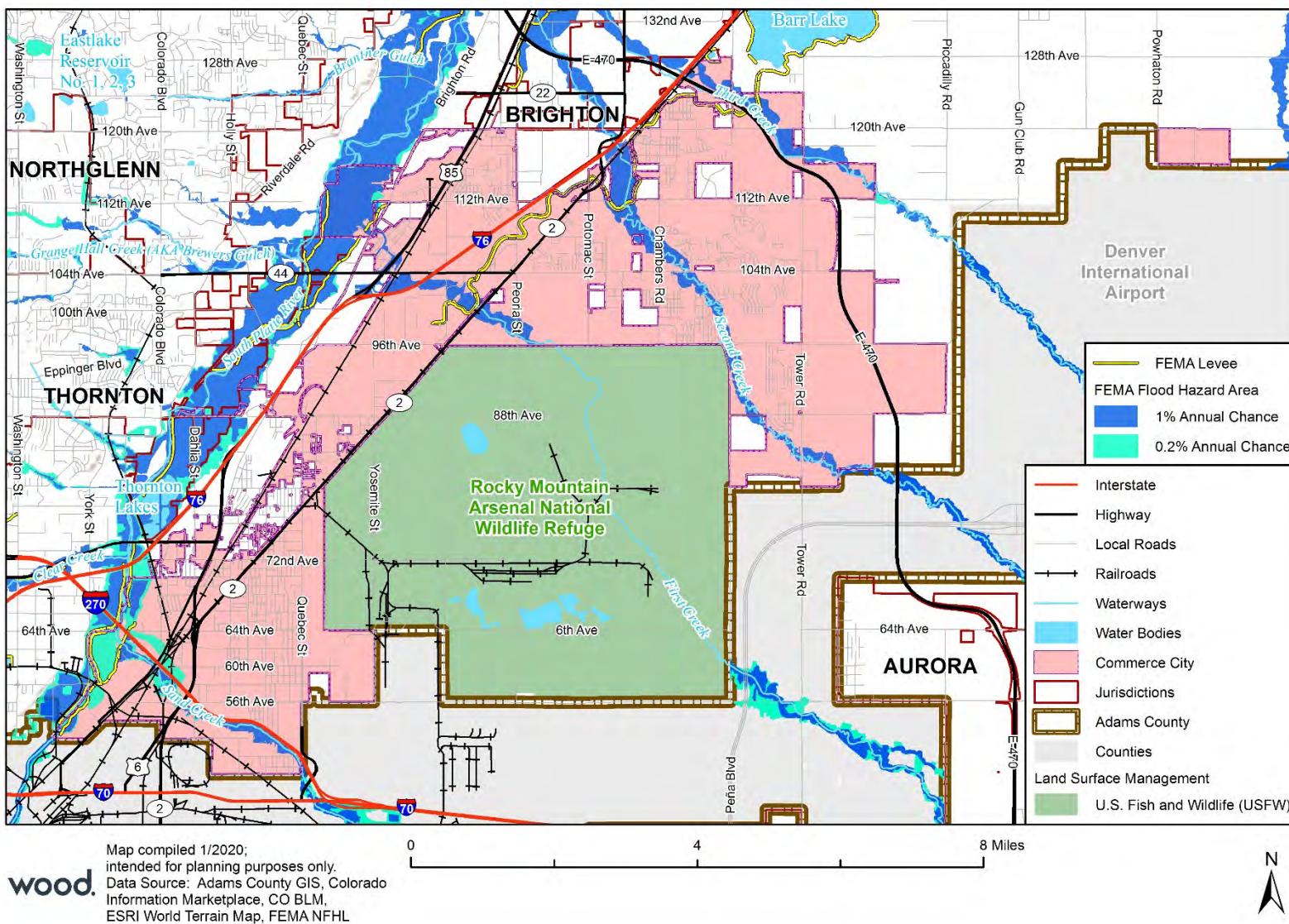
Table C-14 City of Brighton Critical Facilities in Flood Zones

Flood Event	FEMA Lifeline	Critical Facility Type	Total
100-year	Food/Water/Shelter	Gravel Mines/Ponds	5
	Hazardous Material	Environmental Hazard Toxic Site	1
		HazMat Tier II Sites	2
	Safety and Security	Landfills/Govt. Services	7
		Schools	1
	Transportation	Pedestrian Bridge	3
100-Year Total			19
500yr	Hazardous Material	Environmental Hazard Toxic Site	1
		HazMat RMP Sites	1
	Safety and Security	HazMat Tier II Sites	4
		Landfills/Govt. Services	4
500-Year Total			10
GRAND TOTAL			29

Source: Adams County GIS/Assessor's Office, Wood analysis.

National Flood Insurance Program Policy Analysis

Commerce City has participated in the National Flood Insurance Program (NFIP) since February 15, 1978. NFIP insurance data shows that as of September 2019, there were 20 flood insurance policies in force in the City with \$5,802,000 of coverage, but there have been no historical claims for flood losses. There are no repetitive or severe repetitive loss structures as defined by the NFIP as of September 2019. The Commerce City does not participate in the Community Rating System (CRS) program.

Figure C-6 FEMA Special Flood Hazard Areas in the City of Commerce City

C.4.4 Hazardous Materials Incident

The LPT felt Commerce City's risk from hazardous materials is High, due to the large number of hazardous materials facilities and transportation routes in the City.

The National Response Center (NRC) records 170 hazardous materials incidents in or near Commerce City from 1990 through 2018; as noted in Section 5.3.13 of the Base Plan, this likely excludes a large number of unreported minor spills. This constitutes 20% of the 832 hazardous materials incidents reported countywide during the same time frame, and averages out to roughly 5.9 incidents per year. As noted in Section 5.3.13, only around 6% of reported hazardous materials incidents result in injuries, fatalities, or evacuations.

As of January 2020, there are 72 EPA Tier II facilities and 7 Risk Management Plan (RMP) facilities located in the City.

C.4.5 Wildfire Vulnerability

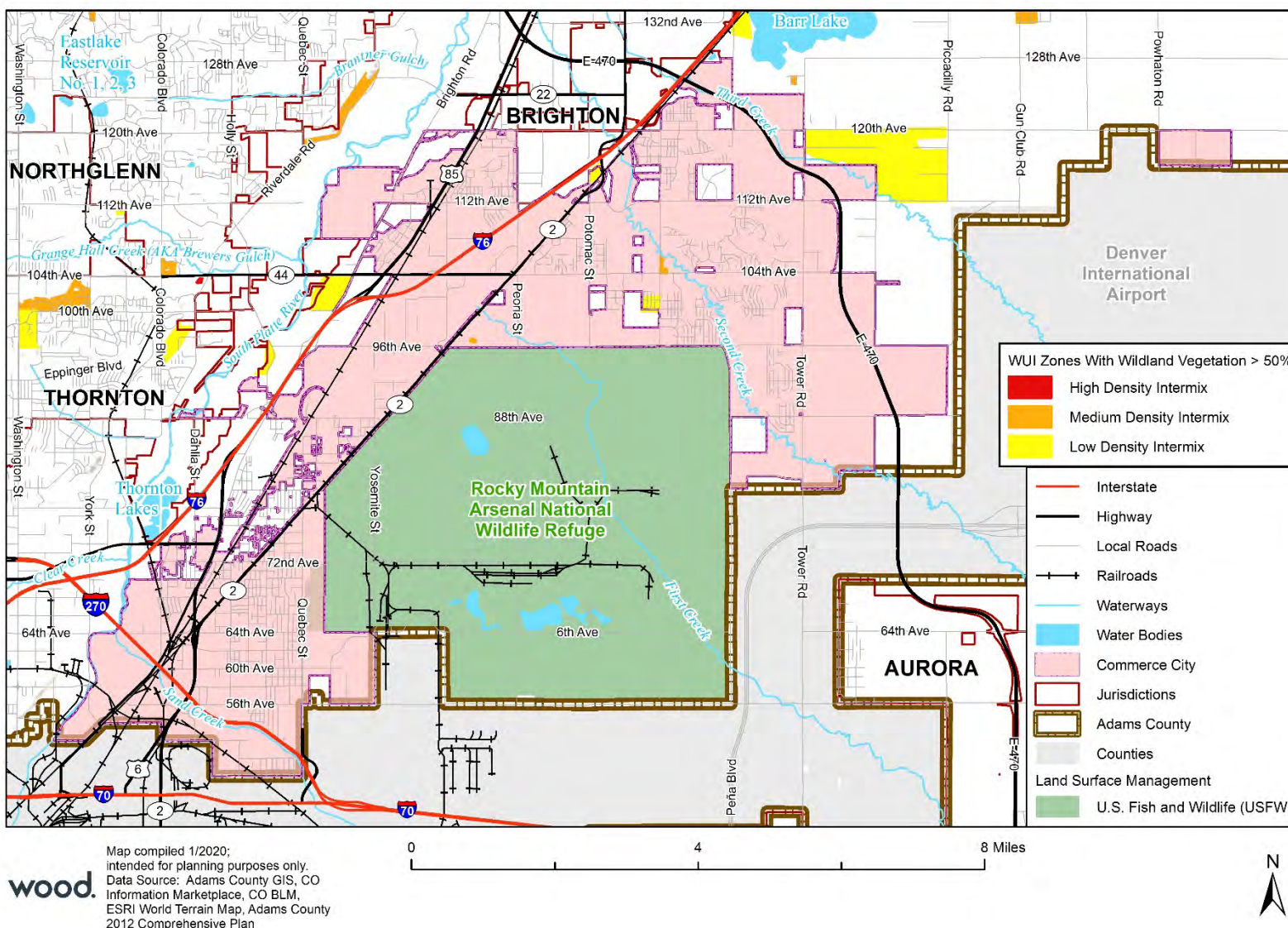
Figure C-7 shows the Wildland Urban Interface (WUI) areas in and near the City of Commerce City by medium and low density; the City does not have any high density WUI areas.

Table C-15 calculates the people and property located in the low and medium density WUI areas. There are no critical facilities exposed in the low or medium density WUI areas. Based on this analysis, there are 54 people and \$495,000 worth of property damage in medium density WUI areas. In low density WUI areas there are 306 people and \$3.3M worth potential property damage.

Table C-15 City of Commerce City Parcels and Exposure in Wildland Urban Interface (WUI) Zones

WUI Zone	Parcel Type	Improved Parcels	Improved Value	Content Value	Total Value	Population
Low Density	Exempt	3	\$0	--	\$0	--
	Residential	102	\$2,201,930	\$1,100,965	\$3,302,895	306
Medium Density	Residential	18	\$330,360	\$165,180	\$495,540	54
TOTAL		123	\$2,532,290	\$1,266,145	\$3,798,435	360

Source: Adams County GIS/Assessor's Office, Wood analysis.

Figure C-7 Wildland Urban Interface (WUI) Intermix Areas in the City of Commerce City

C.4.6 Growth and Development Trends

Commerce City is one of the fastest growing cities in Colorado. According to the Commerce City 2019 Economic Profile, the City is projected to reach a population of 78,655 by 2035.

C.5 Capability Assessment

This section profiles the programs and policies currently in use by the City of Commerce City to reduce hazard impacts or that could be used to implement hazard mitigation activities. The capabilities assessment is divided into five sections: planning and regulatory mitigation capabilities, administrative and technical mitigation capabilities, fiscal mitigation capabilities, past and ongoing mitigation outreach, and other mitigation efforts.

C.5.1 Planning and Regulatory Mitigation Capabilities

Table C-16 lists planning and land management tools typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place in Commerce City.

Table C-16 City of Commerce City Planning and Regulatory Mitigation Capabilities

Regulatory Tool (ordinance, code, plans)	Yes/No	Comments
Comprehensive Plan	Yes	
Zoning ordinance	Yes	Land Development Plan
Subdivision ordinance	Yes	
Growth management ordinance	Yes	Identifies boundaries where we can grow
Floodplain ordinance	Yes	
Other special purpose ordinance		Stormwater in Public Works
Building codes	Yes	IBC 2018 edition
Fire department ISO rating	Yes	Rating of 2, Fire District not city owned
Erosion or sediment control program	Yes	Public Works Department
Storm water management program	Yes	Public Works Department
Site plan review requirements	Yes	Community Development Department
Capital improvement plan	Yes	
Economic development plan	Yes	Economic Development Department
Local emergency operations plan	Yes	Chapter 24 of the municipal code
Other special plans	Yes	Master Parks Plan and Transportation Plan
Flood insurance study or other engineering study for streams	Yes	Partnership with Mile High Flood District
Elevation certificates (for floodplain development)	Yes	Public Works Department

City of Commerce City C3 Vision Comprehensive Plan

The C3 Vision Plan sets the policy foundation for the city's decision-making process and regulatory framework and address both current and long-term (2035 and beyond) needs. The plan is designed to guide the growth and development of the city and recommend programs for services and infrastructure. Following are the guiding principles that the City of Commerce City established in their Comprehensive Plan.



- **Land Use and Growth:** Grow Commerce City in a balanced and compact pattern of neighborhoods and commerce centers, where residents have access to employment, services, and shopping. Promote infill and phase new growth to avoid inefficient and costly leapfrog development.
- **Economic Development:** Maintain a strong employment base; help create a jobs/housing balance; define appropriate locations for a range of industry and businesses (including green businesses); and be a home for major corporations.
- **Fiscal Stability:** Continue as a fiscally stable city by fortifying revenues, while efficiently maintaining and providing services and infrastructure.
- **Housing/Neighborhoods:** Provide multiple types of housing serving a range of current and future residents and incomes in vibrant neighborhoods where people want to live.
- **Redevelopment/Reinvestment:** Promote new centers, while maintaining the integrity of existing districts by continually renewing and reinvesting.
- **Transportation:** Ensure a quality community by providing efficient, effective, and varied modes of transportation that integrate and connect neighborhoods, the community, and the region.
- **Safety and Wellness:** Increase the health and well-being of residents through healthy living, access to medical facilities, and public safety and hazard planning.
- **Parks, Open Space/Recreation:** Provide ample and well-distributed parks and recreation facilities, and a connected system of trails and open space, to provide for outdoor recreation, relaxation, and rejuvenation and to protect views.
- **Facilities and Infrastructure:** Ensure adequate and efficient public facilities and infrastructure for current and future residents and businesses.
- **Appearance and Design:** Enhance the positive image of the city at all gateways, along corridors, and in neighborhoods and commercial districts.
- **Cultural/Tourism:** Become a destination for tourism and visitors, drawing people and businesses to arts, history, culture, sports, commerce, and other attractions.
- **Environmental Conservation/Stewardship:** Increase recycling, conservation, and the use of renewable energy sources, while reducing energy and resource use overall.

Several of Commerce City's guiding principles, including Safety and Wellness, Facilities and Infrastructure, and Environmental Conservation/Stewardship, tie directly hazard mitigation and offer opportunities to integrate the goals of this hazard mitigation plan. Beyond these direct links, the majority of Commerce City's guiding principles and overall vision will be strengthened by ensuring the City is resilient to hazards.

Capital Improvement and Preservation Plan (CIPP)

The City of Commerce City's CIPP helps construct and maintain public assets that support the City's long-term vision. Capital projects include:

- **Traditional Projects:** Projects that add new or expanded assets to the city's inventory, such as city buildings, roads, parks, and recreation amenities.
- **Operational Projects:** Projects that add or improve needed public assets to address growth or deficiencies, such as traffic signals, bridge replacements, emergency warning towers, sidewalk connections, drainage and stormwater improvements, studies, or parks/road enhancements.
- **Preservation Projects:** Projects that ensure long-term asset maintenance, such as repaving or replacing roads, curbs and gutters, and repairing golf and park amenities.

Projects in the City of Commerce City's CIPP include investments that can also support the City's hazard mitigation goals, including drainage improvements, infrastructure maintenance, and critical facility enhancements.

C.5.2 Administrative and Technical Mitigation Capabilities

Table C-17 identifies the personnel responsible for activities related to mitigation and loss prevention in Commerce City.

Table C-17 City of Commerce City Administrative and Technical Mitigation Capabilities

Personnel Resources	Yes/No	Department/Position
Planner/engineer with knowledge of land development/land management practices	Yes	Community Development and Public Works Departments
Engineer/professional trained in construction practices related to buildings and/or infrastructure	Yes	Community Development and Public Works Departments
Planner/engineer/scientist with an understanding of natural hazards	No	
Personnel skilled in GIS	Yes	IT Department
Full time building official	Yes	Community Development Department
Floodplain manager	Yes	Public Works
Emergency manager	Yes	Police Department
Grant writer	No	
GIS Data Resources (Hazard areas, critical facilities, land use, building footprints, etc.)	Yes	In IT
Warning Systems/Services (Reverse 911, cable override, outdoor warning signals)	Yes	Adcom = CodeRed, Commerce City = Outdoor Warning System

C.5.3 Fiscal Mitigation Capabilities

Table C-18 identifies financial tools or resources that Commerce City could potentially use to help fund mitigation activities.

Table C-18 City of Commerce City Fiscal Mitigation Capabilities

Financial Resources	Accessible / Eligible to Use	Has Been Used in the Past	Comments
Community Development Block Grant	Yes	No	Commerce City began receiving CDBG funds directly around 2017; in 2020, the city received a CARES Act CDBG grant, which is largely being used for mortgage and rental assistance in response to COVID-19
Capital Improvements Project funding	Yes	No	
Authority to levy taxes for specific purposes	Yes	No	The city has healthy reserve levels to rely on and has not had to levy additional taxes or incur additional debt
Fees for water, sewer, gas, or electric services	Yes	No	The city does not provide water, sewer, gas, or electric services directly; thus, there are no fees charged by the city for these services
Impact fees for new development	Yes	No	
Incur debt through general obligation bonds	Yes	No	The city has healthy reserve levels to rely on and has not had to levy additional taxes or incur additional debt

Financial Resources	Accessible / Eligible to Use	Has Been Used in the Past	Comments
Incur debt through special tax bonds	Yes	No	The city has healthy reserve levels to rely on and has not had to levy additional taxes or incur additional debt
Incur debt through private activities	No	No	The city has healthy reserve levels to rely on and has not had to levy additional taxes or incur additional debt
Withhold spending in hazard prone areas	No	No	

C.5.4 Past and Ongoing Mitigation Efforts

The City is currently updating its Master Plan and Storm Water Standards with the Mile High Flood District.

Public Education and Outreach:

The City of Commerce City Emergency Manager conducts disaster preparedness training through the CERT program to encourage public awareness and preparedness and increase public involvement in emergency response. The CERT program supports local response capability by training community volunteers about the hazards they face and ways to prepare for them. Commerce City does not have any local citizen groups that communicate hazard risks. The City does not currently participate in Firewise or StormReady.

C.5.5 Opportunities for Enhancement

Based on the capability assessment, Commerce City has several existing mechanisms in place that already help to mitigate hazards, including numerous planning tools and many available funding mechanisms. There are also opportunities for the City to expand or improve on its capability to further protect the community. One capability enhancement would be to consider joining the CRS, which would require enhancements to the City's floodplain management program; however, the low number and value of flood insurance policies in Commerce City means this would not significantly affect flood insurance affordability in the City.

C.6 Mitigation Goals and Objectives

The City of Commerce City has adopted the hazard mitigation goals and objectives developed by the HMPC and described in Section 6.2 of the Base Plan.

C.7 Mitigation Actions

The local planning team identified and prioritized the following mitigation actions for Commerce City based on the risk assessment. Information on how each action will be implemented and administered, such as ideas for implementation, responsible agency, potential funding, estimated cost, and timeline also are included. These actions are also captured in Table 6-2 in the Base Plan.

Table C-19 City of Commerce City 2020 Mitigation Action Plan

ID	Related Goal(s)	Hazard(s) Mitigated	Description / Background / Benefits	Lead Agency and Partners	Cost Estimate	Potential Funding	Priority	Timeline	Status / Implementation Notes
C-C-1	2	Multi-Hazard: Winter Weather, Thunderstorm, Tornado, Flood, High Wind	Protect critical infrastructure from power outages with emergency generators: Retrofit public government buildings with back-up emergency generators. Commerce City has three critical buildings that don't have emergency back-up power supply. In the event of a power outages, these critical buildings will not be operational. The buildings are two recreation centers that have been designated as emergency shelters and the municipal service center which maintains the city's fleet vehicles and equipment. In the past, natural disasters such as blizzards created major power outages; therefore, the city could not use their designated emergency shelters facilities and also hinder fleet support services. The lack of capability of maintaining operational readiness of emergency shelters and fleet support services during power outages as the potential of creating hardships in providing emergency sheltering and fleet support services.	City of Commerce City Public Work / Commerce City OEM	\$500,000	HMA Grants with General Budget Funds	High	2021-2023	New in 2020. This project will help maintain operational readiness of critical infrastructure to perform mission essential functions such as emergency shelter operations and sustainment of Fleet services.
C-C-2	2	Multi-Hazard: Winter Weather, Thunderstorm, Tornado, Flood, High Wind	Sustain mobile fleet by providing internal fuel storage dispensing capability: Install a permanent fuel storage/dispensing facility. Commerce City doesn't have internal fuel storage/dispensing capability to maintain the city's fleet vehicles. Currently the city uses public retail vendors such as gas stations to provide fuel for its vehicles. In the events of blizzards, major flooding and power outages public gas stations maybe be closed or out of fuel which will severely decrease the city's capability in maintaining their fleet and	City of Commerce City Public Work / Commerce City OEM	\$225,000	HMA Grants with General Budget Funds	High	2021-2022	New in 2020. This project will help maintain operational readiness and sustainment of city's fleet and equipment.

ID	Related Goal(s)	Hazard(s) Mitigated	Description / Background / Benefits	Lead Agency and Partners	Cost Estimate	Potential Funding	Priority	Timeline	Status / Implementation Notes
			operational readiness. Two critical fleet sections are first responder vehicles and snowplow trucks which if these vehicles don't have fuel will create a public safety emergency.						
C C- 3		Flood	Fairfax Park Drainage Reconstruction: The first phase of this project is a study through Mile High Flood District to study the drainage for the Core part of the City and to determine what infrastructure improvements are needed to better drain the Fairfax Park/Regional Detention Pond. The next phase of the project will be to replace the outfall pipe from Fairfax Park to the South Platter River. We anticipate that this project will be done over a three-year period. The majority of the storm water from the historic portion of Commerce City drains to Fairfax Park. Fairfax Park functions as a regional drainage facility and as a regional park for the City. The outfall system from Fairfax Park to the South Platte is undersized, the pond frequently overtops, and the flooding negatively affects the surrounding neighborhood. In addition, during large storm events it takes several days for Fairfax to drain. This affects the use of the site as a regional park.	City of Commerce City Public Work / Commerce City OEM	\$4,350,000	Mitigation grant funds, Mile High Flood District funds with general budget funds	High	2021-2024	New in 2020. Benefits: Maintain operational readiness of critical infrastructure to perform mission essential functions such as maintaining emergency routes during major flood events and sustainment of storm sewer infrastructure.

C.7.1 Continued Compliance with the National Flood Insurance Program

Recognizing the importance of the National Flood Insurance Program (NFIP) in mitigating flood losses, the City of Commerce City will place an emphasis on continued compliance with the NFIP. As an NFIP participant, the City has and will continue to make every effort to remain in good standing with NFIP. This includes continuing to comply with the NFIP's standards for updating and adopting floodplain maps and maintaining and updating the floodplain zoning ordinance as well as review of any potential development in special flood hazard areas.

C.8 Implementation and Maintenance

This section provides an overview of the City's strategy for plan implementation and maintenance, and outlines the method and schedule for monitoring, evaluating, and updating the plan. The section also discusses incorporating the plan into existing planning mechanisms and how to ensure continued public involvement in mitigation planning.

C.8.1 Incorporation into Existing Planning Mechanisms

The information contained within this plan, including results from the Vulnerability Assessment, and the Mitigation Strategy will be used by the City to help inform updates and the development of local plans, programs and policies, as described in Section 7.3 of the Base Plan.

The City of Commerce City was not included in the 2014 Adams County Hazard Mitigation Plan, and as such did not incorporate elements of that plan into other planning mechanisms.

C.8.2 Monitoring, Evaluation and Updating the Plan

The City Emergency Manager will be responsible for monitoring, evaluating, and updating this plan using the process outlined in Section 7 of the Base Plan. The City will continue to involve the public in mitigation, as described in Section 7.4 of the Base Plan. The City Emergency Manager will be responsible for representing the City on the Adams County HMPC, and for coordination with City staff and departments during plan updates. The City will review this annex regularly and will update it every five years in accordance with the Disaster Mitigation Act Requirements.

D Denver Water

This Annex consolidates information specific to Denver Water and goes into more detail about risk, capabilities, and mitigation strategies unique to that jurisdiction.

D.1 Mitigation Planning History and 2020 Update Process

Denver Water is a new participant to the Adams County Hazard Mitigation Plan. Denver Water has several facilities located in Adams County and made an effort to be involved in the County's Plan update process in 2020. Denver Water is committed to participating in the 2020 Adams County plan update and met all participation requirements. Denver Water participated in the County's multi-jurisdictional Hazard Mitigation Planning Committee (HMPC), and also brought together a Local Planning Team (LPT) to help collect data, identify and prioritize Denver Water's mitigation actions and implementation strategies, and review annex drafts.

Table D.1 Denver Water Local Planning Team

Department or Stakeholder	Title
Operations	Manager of Emergency Management
Operations	Emergency Management Specialist
Engineering	Engineer

More details on the planning process and participating jurisdictions, service districts and stakeholders can be found in Section 3 of the Base Plan, along with the public's role during the 2020 update.

D.2 Community Profile

Denver Water provides water services to 1.4 million people in the City and County of Denver, Adams County and many surrounding suburbs. Established in 1918, it is Colorado's oldest and largest water utility, a public agency governed by a five-member Board of Water Commissioners, and funded by water rates and new tap fees, not taxes.

D.3 Hazard Identification and Profiles

Denver Water's Local Planning Team (LPT) identified the hazards that affect the community and summarized their geographic location, probability of future occurrence, potential magnitude or severity, and overall significance specific to Denver Water as shown in Table D.2. There are no hazards that are unique to Denver Water.

Table D.2 Denver Water Hazard Significance

Hazard	Geographic Location	Probability of Future Occurrence	Magnitude/Severity (Extent)	Overall Significance
Dam Failure/Incident	Limited	Unlikely	Critical	Medium
Wildfire	Extensive	Highly Likely	Limited	Medium
Flood	Limited	Likely	Limited	Medium
Terrorism/Active Shooter	Limited	Likely	Limited	Medium
Drought	Extensive	Likely	Negligible	Medium
Thunderstorms	Limited	Highly Likely	Limited	Low
Tornado/Damaging Wind	Limited	Highly Likely	Negligible	Low
Winter Weather	Limited	Highly Likely	Negligible	Low
Hazardous Materials Incident	Limited	Likely	Negligible	Low
Earthquake	Limited	Occasional	Limited	Low
Subsidence	Limited	Unlikely	Limited	Low
Cyber Incident	Limited	Likely	Limited	Low
Geographic Location Limited: Less than 10% of planning area Significant: 10-50% of planning area Extensive: 50-100% of planning area Probability of Future Occurrences Highly Likely: Near 100% chance of occurrence in next year or happens every year. Likely: Between 10 and 100% chance of occurrence in next year or has a recurrence interval of 10 years or less. Occasional: Between 1 and 10% chance of occurrence in the next year or has a recurrence interval of 11 to 100 years. Unlikely: Less than 1% chance of occurrence in next 100 years or has a recurrence interval of greater than every 100 years.		Magnitude/Severity (Extent) Catastrophic—More than 50% of property severely damaged; shutdown of facilities for more than 30 days; and/or multiple deaths Critical—25-50% of property severely damaged; shutdown of facilities for at least two weeks; and/or injuries and/or illnesses result in permanent disability Limited—10-25% of property severely damaged; shutdown of facilities for more than a week; and/or injuries/illnesses treatable do not result in permanent disability Negligible—Less than 10% of property severely damaged, shutdown of facilities and services for less than 24 hours; and/or injuries/illnesses treatable with first aid Significance Low: minimal potential impact Medium: moderate potential impact High: widespread potential impact		

Information on past events can be found in the hazard profiles in Section 4.3 of the Base Plan.

D.4 Vulnerability Assessment

The intent of this section is to assess Denver Water's vulnerability separate from that of the County as a whole, which has already been assessed in Section 4.3 Vulnerability Assessment of the Base Plan. For most of the hazards listed in Table D.2, hazard and vulnerability do not vary significantly from the County overall, or vulnerability data is difficult to compile or estimate below county level. As a result, only Dam Failure/Incident, Flood, and Drought are profiled separately in this annex. While wildfire is a medium significance this is due to the essential facilities Denver Water has in the high country. For the purpose of this plan, only Denver Water properties and facilities that lie specifically within Adams County have been assessed for vulnerability data.

For more information about how hazards affect Adams County, see Section 4 (Risk Assessment) of the Base Plan.

D.4.1 Community Asset Inventory

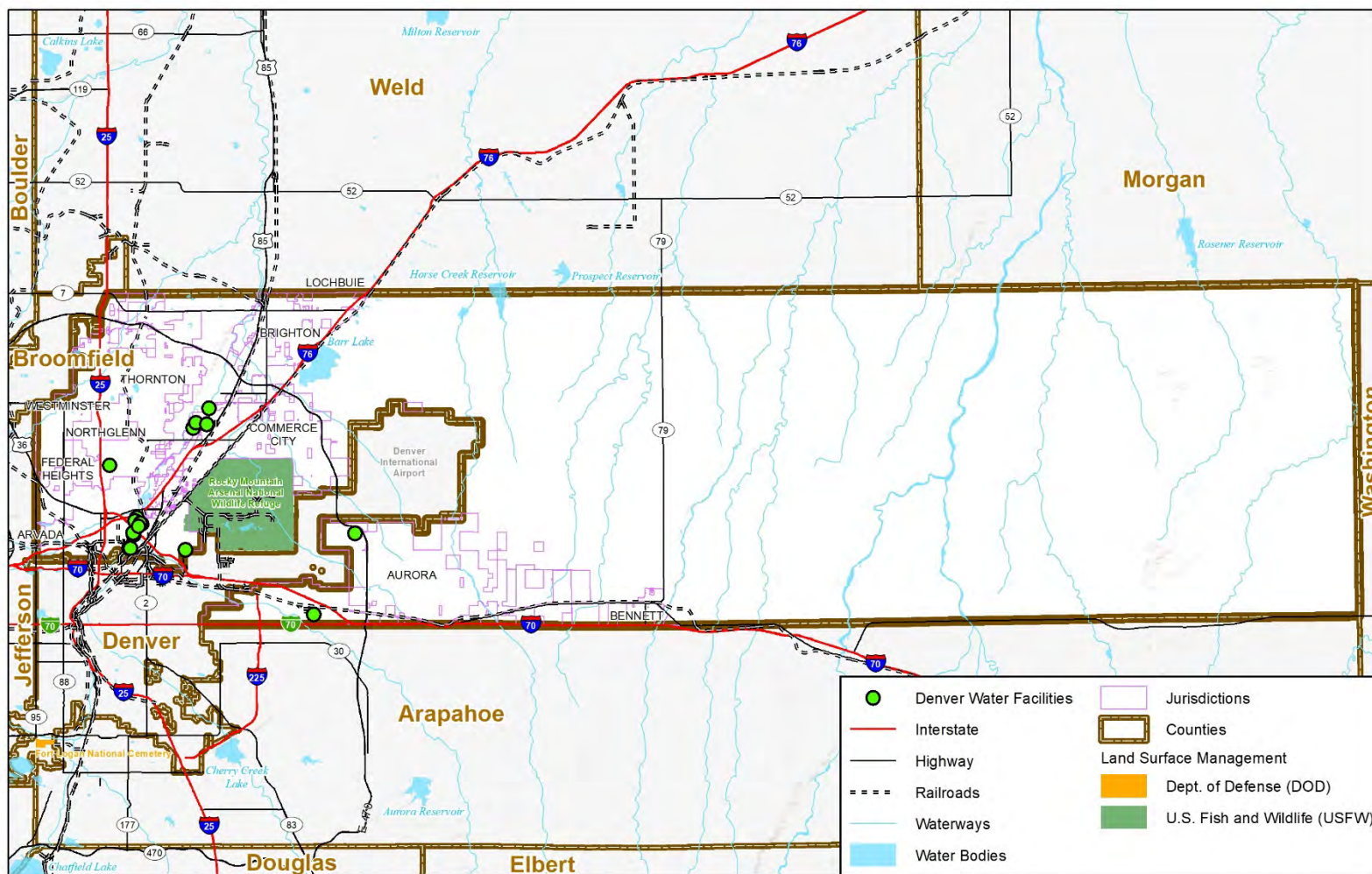
Table D.3 and Figure D.1 show critical facilities and other community assets identified by Denver Water as important to protect in the event of a disaster.

Table D.3 Denver Water – Critical Facilities and Other Community Assets

Type of Facility	Facility Name
Canal	High Line Canal Sand Creek
Dam and Res. 2,000 ac-ft.	Dunes Dam & Reservoir
	Miller Dam & Pond
Decentralization Station	64th Ave Decentralization Station
Pond House	Bambei-Walker (Miller) Pond House
Pump Station	56th Avenue Pump Station
	64th Ave Pump Station
	Broomfield Pump Station
	Metro Burlington Ditch Pump Station
	Recycling Plant Distribution Pump Station
	Recycling Plant Source Water Pump Station
	Welby Pump Station
Reservoir	Bambei-Walker (Miller) Reservoir
	Cat Reservoir
	Hazletine Reservoir
	Howe-Haller A Reservoir
	Howe-Haller B Reservoir
	Tanaube Reservoir
	Welby Reservoir
Treated Reservoir – 10MG	Broomfield Treated Reservoir
Treated Reservoir – 15MG	56th Avenue Treated Reservoir
	64th Ave Treated Reservoir
Treatment Plant	Recycling Plant

Source: Denver Water

Figure D.1 Denver Water Facilities in Adams County



wood.
Map compiled 8/2020;
intended for planning purposes only.
Data Source: Adams County GIS, Colorado
Information Marketplace, CO BLM, ESRI
World Terrain Map. Denver Water

D.4.2 Dam Failure/Incident Vulnerability

Denver Water Dams that Pose a Potential Risk to Adams County

Denver Water operates two dams in Adams County, detailed in the table below. Of the two dams only the Dunes dam is classified as a high hazard dam with the potential to impact the western portion of Adams County. The likelihood and impacts of an incident at Dunes Dam are discussed in Section 4.3.2. Failure of the dam is unlikely but would have extensive consequences both in terms of economic losses to Denver Water, as well as the loss of the water resource for a period of time. Outside of potential effects to Denver Water infrastructure, failure of the dam would also result in damage to downstream communities and property and potential loss of life.

Table D.4 Denver Water Dams Located in Adams County

Dam Name	Waterway	Dam Type	Storage Capacity (Acre-Feet)	Emergency Action Plan?	Primary Purpose	Hazard Rating
Dunes	South Platte River	Earth	5,644	Yes	Water Supply	High
Miller	South Platte-Tr	Earth	2,262	Not Required	Water Supply	Low

Source: USACE National Inventory of Dams 2018, Wood analysis

Denver Water Facilities Vulnerable to Dam Failure/Incidents in Adams County

In addition to the Dunes Dam posing a risk to other community facilities in the County, there are nine dams of concern located in or upstream of Adams County that pose a potential risk to Denver Water owned and operated facilities. Denver Water's Dunes Dam is one of the facilities that is vulnerable to a dam failure/incident event from other dams in the county. Depending on the type and severity of the incident, this could result in water quality impacts and possibly lead to spillway flows or concerns for the integrity of the Dunes Dam. The following tables (Table D.5 and Table D.6) provide details on the dams of concern for Denver Water facilities within Adams County and the specific facilities located within the potential inundation areas.

Table D.5 Dams of Concern for Denver Water Facilities within the Adams County

Dam Name	Waterway	Dam Type	Storage Capacity (Acre-Feet)	Emergency Action Plan?	Primary Purpose	Hazard Rating
Bear Creek	Bear Creek	Earth	75,000	Yes	Flood Control	High
Blunn	Ralston Creek	Earth	7,839	Yes	Recreation	High
Chatfield	South Platte River	Earth	355,000	Yes	Flood Control	High
Cherry Creek	Cherry Creek	Earth	134,470	Yes	Flood Control	High
Dunes	South Platte River	Earth	5,644	Yes	Water Supply	High
Quincy	West Toll Gate Creek	Earth	4,560	Yes	Recreation	High
Ralston	Ralston Creek	Earth	15,900	Yes	Water Supply	High
Spring Gulch	Spring Gulch	Earth	1,752	Yes	Irrigation	High
Westerly Creek	Westerly Creek	Earth	9,300	Yes	Flood Control	High

Source: USACE National Inventory of Dams 2018, Wood analysis

Table D.6 Denver Water Facilities within the Dam Inundation Areas

Type of Facility	Facility Name	Dams of Concern
Dam and Res. - 2000 ac-ft	Dunes Dam & Reservoir	Bear Creek, Chatfield, Cherry Creek
	Miller Dam & Pond	Bear Creek, Blunn, Chatfield, Cherry Creek, Quincy, Ralston, Spring Gulch, Westerly Creek
Pond House	Bambei-Walker (Miller) Pond House	Bear Creek, Blunn, Chatfield, Cherry Creek, Ralston
Pump Station	Metro Burlington Ditch Pump Station	Bear Creek, Chatfield, Cherry Creek, Quincy, Spring Gulch
	Recycling Plant Distribution Pump Station	Bear Creek, Chatfield, Cherry Creek, Quincy, Westerly Creek
	Recycling Plant Source Water Pump Station	Bear Creek, Chatfield, Cherry Creek, Spring Gulch
	Welby Pump Station	Bear Creek, Blunn, Chatfield, Cherry Creek, Quincy, Ralston, Spring Gulch
Reservoir	Bambei-Walker (Miller) Reservoir	Bear Creek, Blunn, Chatfield, Cherry Creek, Quincy, Ralston, Spring Gulch, Westerly Creek
	Cat Reservoir	Bear Creek, Chatfield, Cherry Creek, Quincy, Ralston, Spring Gulch
	Hazletine Reservoir	Bear Creek, Chatfield, Cherry Creek, Dunes, Quincy, Ralston, Spring Gulch
	Howe-Haller A Reservoir	Bear Creek, Chatfield, Cherry Creek, Quincy, Ralston, Spring Gulch
	Howe-Haller B Reservoir	Bear Creek, Chatfield, Cherry Creek, Dunes, Quincy, Ralston, Spring Gulch
	Tanaube Reservoir	Bear Creek, Chatfield, Cherry Creek
	Welby Reservoir	Bear Creek, Blunn, Chatfield, Cherry Creek, Quincy, Ralston, Spring Gulch
Treatment Plant	Recycling Plant	Bear Creek, Chatfield, Cherry Creek, Spring Gulch

Source: Denver Water and Wood Analysis

D.4.3 Flood Vulnerability

The LPT considered Denver Water's risk to flooding to be medium. According to the GIS analysis conducted for this planning process, there are 13 Denver Water Facilities located within areas with a 1% and 0.2% annual chance of flooding. Table D.7 shows the facilities vulnerable to flooding.

Table D.7 Denver Water Facilities Vulnerable to Flooding

Type of Facility	Facility Name
Facilities within 1% Annual Chance Flood Event	
Pump Station	Welby Pump Station
Reservoir	Bambei-Walker (Miller) Reservoir
	Cat Reservoir
	Hazletine Reservoir
	Howe-Haller A Reservoir
	Howe-Haller B Reservoir
	Welby Reservoir
Facilities within 0.2% Annual Chance Flood Event	
Dam and Res. - 5000 ac-ft	Miller Dam & Pond
Pond House	Bambei-Walker (Miller) Pond House
Pump Station	Metro Burlington Ditch Pump Station
	Recycling Plant Distribution Pump Station

Source: Denver Water and Wood Analysis

The area below the Dune Dam is prone to high flows along the rivers from heavy snowmelt runoff and intense rainfall. When significant runoff rain and events occur, Denver Water is responsible for managing Dunes Dam to maintain reservoir capacity, including releasing water to relieve pressure on the dam structure. This can result in high flows in communities such as Brighton, which have become highly developed in the floodplain downstream of Dunes Dam.

D.4.4 Drought Vulnerability

The most significant impacts associated with drought and water shortage for Denver Water are those related to water intensive activities such as wildfire protection and municipal usage. Denver Water will utilize their Water Shortage Response Plan during water shortage events. This plan contains progressive stages that can be enacted. These stages contain voluntary and mandatory conservation measures in addition to specific curtailments of water usage for specific industries. Denver Water uses various indicators when deciding to enact restrictions. These indicators include geographical, environmental and economic conditions on the western slope, where most of the Denver Water's most critical assets are located. However, restrictions and subsequent reductions in usage on the western slope do not increase water in streams and waterways in Denver Water's collection system. Revenue shortages, water quality issues and recycled water availability are all potential impacts during water shortage events. In addition, a lack of available water can also lower reservoir levels, which exposes more shoreline to erosion. This can result in increased water treatment costs. During an extraordinary, long-term water shortage event, hydropower availability may be at risk.

D.4.5 Erosion and Deposition Vulnerability

As noted in Section 4.1.1 of the Base Plan, the HMPC determined that soil erosion and deposition was not a significant hazard to Adams County as a whole. However, Denver Water has some of their facilities impacted by erosion: Howe-Haller A, Howe-Haller B, and Hazletine Reservoirs are vulnerable to wave run-up erosion. Mitigation action DW-3 was added to addresses this hazard.

D.4.6 Growth and Development Trends

Denver Water does not have authority to manage growth or development within its district outside of Denver Water property. As the population continues to grow in Adams County and throughout the Front

Range, so too will the demand for water growth and reliance on Denver Water assets, particularly during times of drought.

D.5 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.

D.5.1 Regulatory Mitigation Capabilities

Regulatory mitigation capabilities include the planning and land management tools typically used by local jurisdictions to implement hazard mitigation activities. Table D.8 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 D.8 Denver Water—Regulatory Mitigation Capabilities

Regulatory Tool (ordinances, codes, plans)	Yes/No	Comments
General or 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	
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	Denver Water Emergency Operations Plan developed in 2012, reviewed and updated on regular basis
Other special plans	Yes	Drought Response Plan Watershed Management Plan Crisis Communications Plan Climate Adaptation Plan Integrated Resource Plan FERC Emergency Action Plans (EAPs) on all dams. EPA Emergency Response Plans (ERPs) treatment and distribution plans. Continuity of Operations Plans

		Facility Security Plans
Flood insurance study or other engineering study for streams	N/A	
Elevation certificates (for floodplain development)	N/A	

D.5.2 Administrative/Technical Mitigation Capabilities

Table D.9 identifies the personnel responsible for activities related to mitigation and loss prevention in Denver Water.

Table D.9 Denver Water—Administrative and Technical Mitigation Capabilities

Personnel Resources	Yes/No	Department/Position	Comments
Planner/engineer with knowledge of land development/land management practices	yes	External Affairs	Watershed Scientist
Engineer/professional trained in construction practices related to buildings and/or infrastructure	Yes	Engineering	
Planner/engineer/scientist with an understanding of natural hazards	Yes	External Affairs	Drought planners Watershed Scientist
Personnel skilled in GIS	Yes	IT/GIS	
Full time building official	N/A		
Floodplain manager	N/A		
Emergency manager	Yes	Emergency Management Section	
Grant writer	No		
Other personnel	Yes	Water resource engineers and drought planners	
GIS Data Resources (Hazard areas, critical facilities, land use, building footprints, etc.)	Yes	IT/GIS	
Warning Systems/Services (Reverse 9-11, cable override, outdoor warning signals)	Yes	IT /Local Dispatch Centers	Internal Warning Systems/Services: Everbridge System Controls Denver Water is responsible for managing the water system and will notify first response agencies when emergencies arise External: Local Systems. First Response Agencies are responsible for notifying their populations of impacting emergencies

D.5.3 Fiscal Mitigation Capabilities

Table D.10 lists financial tools or resources that Denver Water could or already does use to help fund mitigation activities. Denver Water has received funding for forest management and watershed health improvements through the Colorado State Forest Service and U.S. Forest Service (USFS).

Table D.10 Denver Water Fiscal Mitigation Capabilities

Financial Resources	Accessible / Eligible to Use (Yes/No)	Has Been Used in the Past	Comments
Community Development Block Grant	No	N/A	
Capital Improvements Project funding	Yes	Yes	
Authority to levy taxes for specific purposes	Yes	Yes	For water rates only
Fees for water, sewer, gas, or electric services	Yes	Yes	
Impact fees for new development	Yes	Yes	Tapping Fees
Incur debt through general obligation bonds	Yes	Yes	
Incur debt through special tax bonds	No	No	
Incur debt through private activities	No	No	
Withhold spending in hazard prone areas	N/A	N/A	

D.5.4 Past Mitigation and Ongoing Efforts

Denver Water has partnered with local emergency management agencies to participate in local emergency management programs, including planning (i.e., hazard mitigation planning), training and exercises, response, recovery and mitigation efforts. Denver Water has incorporated the FEMA process for plan development including after-action reviews and improvement items all to enhance the planning, response and mitigation efforts in order to build a resilient utility.

Mitigation Outreach and Partnerships

Denver Water has various outreach and partnerships including 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. Denver does not currently participate in the Storm Ready or Firewise programs.

Coordination Efforts include:

- Denver Water's External Affairs division consists of Customer Relations, Communications & Marketing, Government & Stakeholder Relations, Conservation, Treated Water Planning, Demand Planning and Water Resources. This group provides a plethora of planning and outreach with local partners. They provide media relations, social media, marketing, publications, internal communication, stakeholder relations, government relations, community outreach, and website communications for both our combined service area of 1.4 million people and for the communities where Denver Water's watersheds and facilities are located.

- Denver Water’s Emergency Management, Safety & Security section partners with local OEMs, local law enforcement agencies to work closely on planning, response, recovery and mitigation efforts in order to build a resilient community that can respond to emergencies. to share public safety messages around flood/runoff safety, create a culture of preparedness and foster an understanding of Denver Water’s operations and constraints.

Denver Water uses the following communication and coordination methods to conduct public outreach:

- TAP stories, videos and infographics across all social media channels, which provide content and opportunities for local partners to adapt for use on their social media channels.
- Partnerships with County Emergency Management and offering content for their annual safety guide
- Presentations to community groups, the annual State of the River event, Emergency Manager’s Town Halls, etc.
- Expert interview(s) on local PATV station.
- Proactive media pitches to local publications and websites.

D.5.5 Opportunities for Enhancement

Based on the capability assessment, Denver Water has several existing mechanisms in place that already help to mitigate hazards. There are also opportunities for Denver Water to expand or improve on these policies and programs to further protect the community. Future improvements may include providing training for staff members related to hazards or hazard mitigation grant funding in partnership with the County and Colorado Division of Homeland Security and Emergency Management (DHSEM) or the Colorado Water Conservation Board (CWCB). Additional training opportunities will help to inform staff and board members on how best to integrate hazard information and mitigation projects into Denver Water policies and ongoing duties. Continuing to train Denver Water staff on mitigation and the hazards that pose a risk to the district will lead to more informed staff members who can better communicate this information to the public. Another opportunity for enhancement includes continued relationship building with county and local government staff to raise awareness of preparedness resources and mitigation techniques in the event of high-water flows.

D.6 Mitigation Goals and Objectives

Denver Water has adopted the hazard mitigation goals and objectives developed by the HMPC and described in Chapter 6 Mitigation Strategy.

D.7 Mitigation Actions

Denver Water identified and prioritized the following mitigation action based on the risk assessment. Background information on how each action will be implemented and administered, such as ideas for implementation, responsible agency, potential funding, estimated cost, and timeline also are included. These actions are also captured in Table 6-2 in the Base Plan.

Table D.11 Denver Water 2020 Mitigation Action Plan

ID	Related Goal(s)	Hazard(s) Mitigated	Description / Background / Benefits	Lead Agency and Partners	Cost Estimate	Potential Funding	Priority	Timeline	Status / Implementation Notes
DW-1	2	Flood	Slope armoring of reservoirs. Design and construct slope armoring to protect the west bank of Howe-Haller A, Howe-Haller B, and Hazeltine Reservoirs from erosion caused by flood events. This will protect the West Bank from damage, costly repairs, and regulatory disruption.	Denver Water	\$6,000,000	HMA grants and District Budget	Low	2023-2024	New in 2020. This project will protect the West Bank from damage, costly repairs, and regulatory disruption.
DW-2	2	Flood	Henderson Creek Improvement. Design and construct an improved drainage channel downstream of Dunes Reservoir spillway. Dunes' spillway is designed to pass the Probable Maximum Flood (PMF). The capacity and performance of the downstream channel is currently unknown, and Dunes Reservoir has a 1 foot storage restriction until the downstream channel is improved.	Denver Water and MHFD/County	\$48,840	HMA grants and District Budget	Low	2029	New in 2020. This project will allow Dunes Reservoir to be operated to its maximum capacity without restriction.
DW-3	2	Erosion	Downstream North Complex Reservoir Riprap. Design and construct a ribbon of riprap around the perimeter of Howe-Haller A, Howe-Haller B, and Hazeltine Reservoirs to protect the reservoir slopes from wave run-up erosion.	Denver Water	\$10,500,000	HMA grants and District Budget	Low	2025-2026	New in 2020. Protects the reservoir slopes from damage caused by wave erosion.
DW-4	2	Drought	Hazeltine Final Grading. Perform grading and construct a low-flow channel in Hazeltine Reservoir. Final grading is required prior to the construction of the Hazeltine Pump Station and operation of the reservoir.	Denver Water	\$3,900,000	HMA grants and District Budget	High	2020-2021	New in 2020. This project will allow operations of Hazeltine Reservoir, pump station construction, and ultimately, operation of the North Complex.
DW-5	2	Drought	North Complex Hazeltine Pump Station. Design and construct a pump station with up to 220 cfs capacity to	Denver Water	\$121,500,000	HMA grants and	High	2020-2026	New in 2020. This project will allow the North Complex to

ID	Related Goal(s)	Hazard(s) Mitigated	Description / Background / Benefits	Lead Agency and Partners	Cost Estimate	Potential Funding	Priority	Timeline	Status / Implementation Notes
			operate the DRWSP North Complex (Dunes, Tanabe, Howe-Haller A, Howe-Haller B, and Hazeltine).			District Budget			operate for water exchange and drought recovery.



D.8 Implementation and Maintenance

This section provides an overview of Denver Water’s strategy for plan implementation and maintenance, and outlines the method and schedule for monitoring, evaluating, and updating the plan. The section also discusses incorporating the plan into existing planning mechanisms and how to ensure continued public involvement in mitigation planning.

D.8.1 Incorporation into Existing Planning Mechanisms

The information contained within this plan, including results from the Vulnerability Assessment and the Mitigation Strategy, will be used by Denver Water to help inform updates and the development of District plans, programs and policies, to include future capital improvement planning for the Denver Water area in Adams County. As noted in Chapter 7 Implementation and Maintenance, the HMPC representatives from Denver Water will report on efforts to integrate the hazard mitigation plan into local plans, programs and policies and will report on these efforts at the annual HMPC plan review meeting.

Denver Water did not participate in the 2014 Adams County Hazard Mitigation Plan, and as such did not incorporate elements of that plan into other planning mechanisms.

D.8.2 Monitoring, Evaluation and Updating the Plan

Denver Water will follow the procedures to monitor, review, and update this plan in accordance with Adams County as outlined in Chapter 7 of the Base Plan. Denver Water will continue to involve the public in mitigation, as described in Section 7.4 of the Base Plan. Denver Water Manager of Emergency Management will be responsible for representing the District in the County HMPC, and for coordination with County staff and departments during plan updates. Denver Water realizes it is important to review the plan regularly and update it every five years in accordance with the Disaster Mitigation Act Requirements.

Adams County Hazard Mitigation Plan Update Kick Off Meeting Agenda

Date: Thursday, October 17, 2019
9:00 am-11:00 am MDT

Meeting at: Adams County Government Center
4430 S. Adams Government Center
Brighton, CO 80601

Project: Adams County Multi-Hazard Mitigation Plan Update

Subject/Purpose

The purpose of the meeting is to initiate the process for updating the County's Hazard Mitigation Plan (HMP), introduce the Disaster Mitigation Act of 2000, and summarize the hazard mitigation planning process. The HMP is intended to identify hazards, assets at risk, and ways to reduce impacts through long-term sustainable mitigation projects.

Attendees: Adams County Hazard Mitigation Planning Committee and Stakeholders

1. Introductions
2. Hazard Mitigation Overview
3. Mitigation Planning Process and Requirements
4. Overview of the 2012 Imagine Adams County Comprehensive Plan
5. Coordination with Other Agencies, Related Planning Efforts, and Recent Studies
6. Project Schedule and Next Steps
7. Questions

Adams County Multi-Jurisdictional Hazard Mitigation Plan 2019 Update

Kick-Off Meeting Summary

9-11 am

October 17, 2019

Adams County Government Center
4430 S. Adams County Parkway, Brighton, CO

Introductions and Opening Remarks

This document summarizes the kickoff meeting for the Adams County Hazard Mitigation Plan update for 2019. The meeting was facilitated by Wood Environment & Infrastructure Solutions, Inc. (Wood), the consulting firm hired to facilitate the planning process and develop the updated County plan. Scott Field, project manager at Wood, began the meeting with introductions. Scott first introduced the other members of the Wood team along with Mark Thompson of the Colorado Division of Homeland Security & Emergency Management (DHSEM). Scott then asked those at the meeting to introduce themselves. Twenty (20) persons representing a mix of county departments and the Town of Bennett as well as representatives from neighboring communities were present and documented on a sign-in sheet. County representatives included the County Manager's Office, Public Works, Finance, Community Development, Assessor, Parks, IT, and Human Services, as well as representatives from North Metro Fire Rescue and the Office of the Coroner.

The key discussion is summarized below; additional details can be found in the meeting PowerPoint presentation.

Hazard Mitigation Overview

Mark (DHSEM) outlined what hazard mitigation is and why mitigation it is important. Mark explained hazard mitigation should be an ongoing effort integrated into both day-to-day operations and long-term planning. Mark noted that FEMA is only concerned with natural hazards being profiled within these plans, but explained this does not preclude communities from including manmade hazards, which could help in having a one stop plan for all types of hazards that pose a risk to the community. Mark continued by explaining a hazard mitigation plan is not a regulatory document and is not a set-in-stone commitment of resources. The overall purpose of a local hazard mitigation plan is to prevent knowable hazards from having an impact on the community.

Mark stated there are two main types of benefits a community gains from having a FEMA approved hazard mitigation plan (HMP); (1) bringing people together in the community; (2) having an HMP approved by FEMA makes a community eligible for FEMA grants (Pre-Disaster Mitigation, Flood Mitigation Assistance, Hazard Mitigation Grant Program-Post-Disaster). He noted that any funding requests from FEMA needs to be based on the hazards and mitigation strategy in the HMP. He added that

information from the hazard mitigation plan, specifically the vulnerability assessment and mitigation strategy, can be used in other hazard related plans such as community wildfire protection plans.

FEMA will only fund mitigation projects that will reduce future demand for and the costs of disaster response and recovery, such as retrofitting a critical facility, enforcing building codes, land use planning, or removing a structure from a hazard area. Mitigation funding cannot be used for response actions such as purchasing vehicles for fire or police departments. Mark continued by briefly reviewing the benefit cost relationship of mitigation projects. He shared statistics from the 2017 National Institute of Building Science Report which showed that mitigation grants funded through select federal government agencies, on average, can save the nation \$6 in future disaster costs for every \$1 spent on hazard mitigation. Since 2011, Colorado has had 116 projects awarded FEMA funding for mitigation projects. Mark continued by sharing examples of Colorado communities that have successfully used mitigation grant funding through FEMA's Hazard Mitigation Assistance Program to complete projects that have mitigated their risks from existing hazards.

Currently, the Town of Bennett and the City of Commerce City are the only local government jurisdictions seeking to participate in the planning process in addition to the County. In order for Bennett and Commerce City to be considered a "participating" jurisdiction they cannot simply adopt the plan but have to also assess their unique risks and identify specific mitigation actions for their community. All the other communities in Adams County are already included in an existing hazard mitigation plan; while their information will be included in the Adams County plan, they will not be "participating jurisdictions" in accordance with FEMA guidelines.

Hazard Mitigation Planning Process and Requirements

Scott continued the meeting with the specific planning requirements the County will have to meet in order to have a FEMA approved plan. Scott reviewed the Disaster Mitigation Act (DMA) of 2000 Requirements and explained that the Adams County Multi-Jurisdictional Hazard Mitigation Plan (HMP) will be updated in accordance with these requirements. The planning process involves a 4 Phase approach with 9 tasks per FEMA guidance updated in 2013. The kickoff meeting is the first step in the process and also covers tasks 1-3 (Determine the planning area and resources; Build the planning team; Create an outreach strategy).

Role of the Hazard Mitigation Planning Committee (HMPC)

The first step in getting organized is to determine the hazard mitigation planning committee members, which has already started with those in attendance at the kickoff meeting. Scott gave those present additional recommendations of who could also be invited to be on the committee, starting with those who were on the committee for the 2015 planning process. Scott noted that special districts could also be considered jurisdictions and be eligible for FEMA funding on their own or have the option to participate as a stakeholder. As a stakeholder they do not need to adopt the plan but could not apply directly to FEMA for grant funding.

Scott emphasized that local input, and participation from the county, municipalities, and special districts is required for full approval from FEMA. Participation includes the following:

- Attend meetings and participate in the planning process
- Provide requested information to update or develop jurisdictional information
- Review drafts and provide comments
- Identify mitigation projects specific to jurisdiction, provide status
- Assist with and participate in the public input process
- Coordinate formal adoption

Stakeholders include other local, state and federal agencies with a stake in hazard mitigation in the County or may include academic institutions and local business and industry. State and federal stakeholders may include the Colorado Department of Transportation (CDOT), Colorado Department of Public Health (CDPHE), Colorado Water Conservation Board (CWCB), and Denver International Airport (DIA). The HMPC noted the Mile High Flood District (MHD), Denver Water, the school districts, and the Regional Transportation District (RTD) should also be included as stakeholders in their process. Neighboring counties as well as incorporated jurisdictions who will not be participating in this planning process will also be notified about the update and given an opportunity to provide input into the process. Stakeholders have various options and levels of participation including:

- Attend HMPC meetings or stay in loop via email list
- Provide data/information
- Partner on mitigation efforts
- Review draft plan

Plan Update Requirements, Key Elements and Schedule

Aspects of the planning process include:

- Engage the participants to take part in planning process and efforts
- Raise awareness and engage the public
- Update hazards and baseline development data to reflect current conditions
- Update the mitigation strategy
- Document progress and note changes in priorities

An important requirement of the hazard mitigation planning process is to involve the public in the process. FEMA requires the HMPC provide two opportunities for public involvement: once during the drafting stage and once more prior to plan approval. FEMA does not prescribe how to involve the public at either of these steps. There are several advantages to involving the public including developing solutions that fit local needs better, strengthening local support for the plan and ensuring a fair process in the development of the plan. Scott acknowledged that it can be challenging to get the public to attend meetings and shared that Wood has had success with using online surveys to receive good feedback. It is also recommended to “piggyback” public meeting with other related meetings. The HMPC noted the county is currently holding nightly “Pumpkin Nights” at the Riverdale Regional Park and that there will continue to be public outreach opportunities due to the upcoming holiday season.

Another requirement of the plan update process is performing a community capability assessment. This is an assessment of the communities existing plans, regulations, fiscal abilities, administrative and technical abilities. Identifying fiscal abilities early on is important because FEMA requires a 25% match of local

funds. Early identification will help to understand potential funding sources now that could be used to possibly match the federal funds.

Conducting a risk assessment is a key aspect of a hazard mitigation plan and involves two components: hazard identification (what can happen here) and the vulnerability assessment (what will be affected). The HMP update will be based on existing documents and studies, with the Adams County Hazard Mitigation Plan (2014) providing the baseline for identified hazards and the groundwork for goals, policies and actions for hazard mitigation.

The HMP will be updated over the next six months, with at least two more meetings with the Hazard Mitigation Planning Committee. Wood will be updating the Hazard Identification and Risk Assessment (HIRA) in the next couple of months, with input from the HMPC. Three drafts of the HMP will be created: the first for review by HMPC committee, a second for public review, and a third for state and FEMA review. The first draft for HMPC review is targeted for early January 2020, with a public review draft in late January followed by a review by Colorado DHSEM.

Review of Identified Hazards

The County's previous HMP was fully integrated into the Adams County Comprehensive Plan. Based on hazards from the previous plan, the list of potential hazards was reviewed. Amy Carr, Hazard Mitigation Planner at Wood, showed a slide that listed the hazards in the 2015 HMP.

- Thunderstorms (included lighting, hail and high wind)
- Winter Weather
- Tornadoes
- Flood (included dam failure)
- Drought
- Subsidence
- Earthquake
- Wildfire

Amy recommended profiling dam failure separately from flood. The group agreed and thought that the other hazards listed are still valid but did suggest the inclusion of the following human-caused hazards; cyber threats, hazardous materials, and terrorism/active shooters. Amy noted that the significance level of some hazards may vary across the County, and some hazards may not be applicable to all jurisdictions. Scott noted that every hazard profiled should have at least one mitigation action identified.

Amy asked the group to review the list of hazards and comment on how they could be enhanced or updated with:

- Historic incidents
- Incident logs
- Public perception
- Scientific studies
- Other plans and reports (e.g., flood and drainage studies, CWPPs, Internet databases)
- Recent disasters

Coordinating with Other Agencies\Related Planning Efforts\Recent Studies

A discussion on recent studies of hazards in other documents and reports followed the identified hazards discussion. Opportunities for coordinating and cross-referencing the HMP were discussed. Recent studies and related planning efforts included the completion of Drainage Master Plan, which resulted in the removal of thirty-eight (38) structures from the floodplain; a subarea plan is being developed for the Sheridan Corridor in conjunction with the City of Arvada. At this time the HMPC also shared aspects of the community that have seen substantial changes since the 2014 plan. These changes included the opening of the G-Line (commuter rail) and development beginning to occur around the rail stops.

Other considerations for the plan update should include vulnerable populations including the homeless community.

Initial Information Needs and Next steps

Scott discussed initial information needs and next steps. Scott encouraged the group to send by email information on:

- Recent hazard events (since 2014) – damages, incident logs, damage assessments, etc.
- Growth and development trends
- Recent updated plans and policies

Where available online, Wood will try to obtain the updated plans previously noted. Scott encouraged the group to send other information that might not be readily accessible online.

A Google Share Drive and website will be set up for the project to share large documents and general project milestones. A GIS needs list was provided to the County to assist with data collection, which is already in progress. The County will provide the meeting summary, handouts, presentation and sign in sheet by email so that other HMPC members that could not attend today's meeting could get up to speed. Scott noted that he will be in touch to followup on some of the previously identified data sources and plans.

Wood will begin work in the Hazard Identification and Risk Assessment update and develop a public survey that can be used online, with a hardcopy version for dissemination at local events. The next HMPC meeting will be in November or December following the update of the Hazard Identification and Risk Assessment section of the plan. The specific date will be shared when available.

Adjourn

The meeting adjourned at 11:00 am.

scott.field@woodplc.com

303-742-5320

2000 South Colorado Blvd, Denver, CO 80222



Hazard Mitigation Plan Kick-Off Meeting
 Adams County Government Center | Platte River D
 4430 South Adams Parkway, Brighton, CO 80601

October 17, 2019

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From: [Field, Scott](#) on behalf of [Ronald Sigman](#)
To: [Brislawn, Jeff P](#); [alex.jakubowski@elbertcounty.co.gov](#); [Alisha Reis](#); [Carr, Amy](#); [bdaley@jeffco.us](#); [Ben Dahlman](#); [blenderi@auroragov.org](#); [Brandy Foley](#); [Brian Dearth](#); [Byron Fanning](#); [cbbennet@auroragov.org](#); [Chris Kline](#); [Chris Laws](#); [christopher.hudak@state.co.us](#); [cmcmahill@suncor.com](#); [CoronerQuestions](#); [Cory Stark](#); [Crystal Elliott](#); [David Rausch](#); [Debbie Haines](#); [dross@sacfd.org](#); [earlcumley@bennettfirerescue.org](#); [ejanes@arvada.org](#); [Gabe Rodriguez](#); [gkgrove@co.jefferson.co.us](#); [gordie.olson@cityofthornton.net](#); [Greg Baca](#); [Greg Moser](#); [gscheidt@bennett.co.us](#); [Heidi M. Miller](#); [Herb C. Covey](#); [Josh Zygielbaum](#); [Juliana J. Archuleta](#); [Julie.Beyers@state.co.us](#); [Karsen M. Forsman](#); [kdavies@broomfield.org](#); [Ken Musso](#); [Kirk Dominic](#); [Kristin Sullivan](#); [kstewart@udfcd.org](#); [Kylin Mueller](#); [Linda Hawkins](#); [Lisa Culpepper](#); [Libby Tart](#); [Mark Bodane](#); [markw.thompson@state.co.us](#); [BlancoCastano, Marta](#); [Martin.Postma@cityofthornton.net](#); [Mary Hodge](#); [maskenazi@tchd.org](#); [Matt Chapman](#); [Matthew.Mueller@denvergov.org](#); [Michael Bean](#); [Mike Holub](#); [mnichols@adcom911.org](#); [mschuman@acfpd.org](#); [Nathan Fogg](#); [Paolo Diaz](#); [Ray Gonzales](#); [Rebecca Zamora](#); [Rebecca.franco@denverwater.org](#); [Rick Reigenborn](#); [Ron Osgood](#); [Ross Riley](#); [Ryan Doyle](#); [RYoung@crgov.com](#); [Sandra K. Dean](#); [Field, Scott](#); [solomon.rich@sablealturafire.org](#); [Stephanie Hackett](#); [Steve O'Dorisio](#); [tbeach@seweldfire.org](#); [Thomas Swingle](#); [TPatterson@acfpd.org](#); [Wayne Belohlavy](#)
Subject: FW: Hazard Mitigation Plan

-----Original Appointment-----

From: Ronald Sigman [mailto:RSigman@adcomgov.org]

Sent: Monday, November 18, 2019 2:22 PM

To: Ronald Sigman; [alex.jakubowski@elbertcounty.co.gov](#); [Alisha Reis](#); [Carr, Amy](#); [bdaley@jeffco.us](#); [Ben Dahlman](#); [blenderi@auroragov.org](#); [Brandy Foley](#); [Brian Dearth](#); [Byron Fanning](#); [cbbennet@auroragov.org](#); [Chris Kline](#); [Chris Laws](#); [christopher.hudak@state.co.us](#); [cmcmahill@suncor.com](#); [CoronerQuestions](#); [Cory Stark](#); [Crystal Elliott](#); [David Rausch](#); [Debbie Haines](#); [dross@sacfd.org](#); [earlcumley@bennettfirerescue.org](#); [ejanes@arvada.org](#); [Gabe Rodriguez](#); [gkgrove@co.jefferson.co.us](#); [gordie.olson@cityofthornton.net](#); [Greg Baca](#); [Greg Moser](#); [gscheidt@bennett.co.us](#); [Heidi M. Miller](#); [Herb C. Covey](#); [Josh Zygielbaum](#); [Juliana J. Archuleta](#); [Julie.Beyers@state.co.us](#); [Karsen M. Forsman](#); [kdavies@broomfield.org](#); [Ken Musso](#); [Kirk Dominic](#); [Kristin Sullivan](#); [kstewart@udfcd.org](#); [Kylin Mueller](#); [Linda Hawkins](#); [Lisa Culpepper](#); [Libby Tart](#); [Mark Bodane](#); [markw.thompson@state.co.us](#); [BlancoCastano, Marta](#); [Martin.Postma@cityofthornton.net](#); [Mary Hodge](#); [maskenazi@tchd.org](#); [Matt Chapman](#); [Matthew.Mueller@denvergov.org](#); [Michael Bean](#); [Mike Holub](#); [mnichols@adcom911.org](#); [mschuman@acfpd.org](#); [Nathan Fogg](#); [Paolo Diaz](#); [Ray Gonzales](#); [Rebecca Zamora](#); [Rebecca.franco@denverwater.org](#); [Rick Reigenborn](#); [Ron Osgood](#); [Ross Riley](#); [Ryan Doyle](#); [RYoung@crgov.com](#); [Sandra K. Dean](#); [Field, Scott](#); [solomon.rich@sablealturafire.org](#); [Stephanie Hackett](#); [Steve O'Dorisio](#); [tbeach@seweldfire.org](#); [Thomas Swingle](#); [TPatterson@acfpd.org](#); [Wayne Belohlavy](#)

Subject: Hazard Mitigation Plan

When: Thursday, December 12, 2019 1:00 PM-4:00 PM (UTC-07:00) Mountain Time (US & Canada).

Where: 4430 S. Adams County Parkway, Brighton, CO Platte River A conference room

You are invited to participate in the development of our County Hazard Mitigation Plan by attending our next Planning meeting being held on Thursday, December 12th, 1 -4 pm at the Adams County Government Center, 4430 S. Adams County Parkway, Platte River A conference room. During this meeting we will be discussing the top hazards faced by the County to be addressed in the Hazard Mitigation Plan. Your input and participation is appreciated.

Thank You,

**ADAMS COUNTY MULTI-JURISDICTIONAL
MULTI-JURISDICTIONAL MITIGATION PLAN**

2019 UPDATE

RISK ASSESSMENT MEETING

Thursday, December 12, 2019 1:00pm – 4:00pm

**Adams County Government Center, Platte River Room A
4430 S. Adams County Parkway, Brighton, CO**

- ❖ **Introductions**
- ❖ **Review of the Planning Process**
- ❖ **Review of Identified Hazards and Vulnerability Assessment Overview**
- ❖ **Capabilities Assessment Update**
- ❖ **Update on Public Involvement Activities/public meeting planning**
- ❖ **Next Steps**
- ❖ **Questions and Answers/Adjourn**

**Summary of the Adams County
Multi-Hazard Mitigation Plan Update
Risk Assessment Meeting**

December 12, 2019

1:00 pm – 4:00pm

**Adams County Government Center– Platte River Room A
4430 S. Adams County Parkway, Brighton, CO**

Introductions and Opening Remarks

Scott Field of Wood Environment and Infrastructure Solutions, the consulting firm hired to facilitate the plan development process, began the meeting with welcoming remarks. Twenty people were present and documented on a sign in sheet.

Review of Mitigation, Disaster Mitigation Act (DMA) Requirements, and the Planning Process

Following introductions, a PowerPoint presentation was presented by Scott Field and Amy Carr also of Wood. Amy reviewed the planning process being followed and discussed the project status.

Risk Assessment Presentation and Discussion

Amy outlined the general risk assessment requirements before turning it back to Scott for a detailed discussion of each hazard. He presented highlights on each hazard included in the updated risk assessment chapter of the plan. Refer to the Adams County HMP Risk Assessment PowerPoint presentation for specific details on each hazard and a handout summarizing hazard significance. Highlights of the discussion are noted by hazard in the table below.

Hazard or Topic	Meeting Discussion and Problem Statements
Severe Thunderstorms	<ul style="list-style-type: none"> • The HMPC concurred with moving lightning and hail into the Severe Thunderstorm profile. • HMPC noted that the hail crop and property damages seemed low. <ul style="list-style-type: none"> ◦ The total listed reflects only damages reported to NOAA's NCEI database, and typically do not include insured losses. ◦ Wood will review USDA Risk Management Agency's data in addition to the NCEI data to address insured crop damages also.
Tornado/High Wind	<ul style="list-style-type: none"> • Questions were received related to the inclusion of high winds in the tornado profile. <ul style="list-style-type: none"> ◦ Wood will review and consider moving the hazard under thunderstorms, and/or clarify the distinction between the two hazards. • Impacts from past high wind events have led to downed powerlines which was noted as having the potential of being a cascading event with power losses, which tend to impact vulnerable populations the most.
Severe Winter Weather	<ul style="list-style-type: none"> • The HMPC noted there has been an increase in the homeless population in the County, and suggested this be considered in the vulnerability assessment.

Hazard or Topic	Meeting Discussion and Problem Statements
	<ul style="list-style-type: none"> Wood has already received preliminary homeless figures and will follow up with the County Manager's Office. A connection was made that the 2003 blizzard that caused \$93M in damage followed on the heels of the 2003 drought.
Flood	<ul style="list-style-type: none"> Clarification was received on the NFIP and insured losses data.
Drought	<ul style="list-style-type: none"> Questions were received related to the connection between extreme heat and drought. <ul style="list-style-type: none"> Wood will clearly define the hazards and clarify the connections between the hazards.
Dam Failure/Incident	<ul style="list-style-type: none"> Mile High Flood District reported that they are currently updating dam inundation mapping for some of the dams in the County. HMPC noted the connection between cyber incidents and the risk of dam failure/incidents. Question was received related to the definition of dam failure and dam incidents. <ul style="list-style-type: none"> Wood will clearly define the two type of events in the HIRA.
Hazardous Materials	<ul style="list-style-type: none"> The HMPC discussed the increase in hazardous materials incidents in the 2000s, which matches statewide and national trends. It was suggested that the increase might be partly due to the increasing number of meth labs during that period. (Subsequent analysis of data indicates that only 13 of the 833 reported hazardous materials incidents involved meth labs.) Questions related to what spatial analysis has been completed and suggestions on further analysis to conduct: <ul style="list-style-type: none"> Map of pipelines in the County – Wood will include and highlight in the hazard profile and discussion and will consider mapping for the vulnerability assessment. Map of hazmat spills – Wood currently has the data in tabular form but will consider also including a map figure. Updated the zoning analysis in relation to Tier II facilities (included in the 2014 plan) – The HMPC suggested separating the incorporated jurisdictions from the County in the table. The HMPC added that the BOCC is interested in identifying the location of "invasive uses" in the county in relationship to what Zone District they are located within. The HMPC discussed whether or not airplane crashes should be added as a separate hazard profile, but concluded it was not needed.
Earthquake	<ul style="list-style-type: none"> No comments
Subsidence	<ul style="list-style-type: none"> No comments
Wildfire	<ul style="list-style-type: none"> No comments
Terrorism/Active Shooter	<ul style="list-style-type: none"> No comments
Cyber Incident	<ul style="list-style-type: none"> County experiences DDOS attacks daily. Adams County Fire noted being hit by a malware attack but were not impacted significant and did not have to pay a ransom. But added the 911 Center being impacted by a cyber attack could have serious cascading impacts. HMPC suggested increasing the extent rating from Negligible to Limited.
Capabilities	<ul style="list-style-type: none"> County and Tri County Health work together to report hazmat spills quickly Opportunities for enhancement were discussed including: <ul style="list-style-type: none"> Re-integrating the Hazard Mitigation Plan in the next Comprehensive Plan update

Update on Public Involvement Activities/public meeting.

Amy noted that a draft on-line public survey and had already received 68 responses. The HMPC is encouraged to share the link to the public survey through their respective channels:

<https://woodplc.surveymonkey.com/r/AdamsCountyHMP>

Plan Timeline/Next steps

The next HMPC planning meeting will be in mid-January (now scheduled for January 14th at 1pm). The purpose of this meeting is to review the goals and objectives from 2014 plan and develop goals for the 2020 plan. The meeting materials will also be shared electronically, including the presentation and handouts.

The meeting adjourned at 4:00 pm.

**ADAMS COUNTY MULTI-JURISDICTIONAL
HAZRD MITIGATION PLAN
2020 UPDATE**

MITIGATION STRATEGY MEETING

Tuesday, January 14, 2020 1:00pm – 3:00pm

**Adams County Government Center, Brantner Gulch A
4430 S. Adams County Parkway, Brighton, CO**

- ❖ **Introductions**
- ❖ **Review of the Planning Process**
- ❖ **Public Survey Results**
- ❖ **Mitigation Goals and Objectives**
- ❖ **Mitigation Actions**
- ❖ **Review of Progress on Existing Mitigation Actions**
- ❖ **Developing New Mitigation Actions**
- ❖ **Next Steps**
- ❖ **Questions and Answers/Adjourn**

Adams County Multi-Jurisdictional Hazard Mitigation Plan 2020 Update

Goals and Mitigation Strategy Meeting Summary

January 14, 2020, 1:00 – 3:00 pm
Adams County Government Center
4430 S. Adams County Parkway, Brighton, CO

Introductions

Ron Sigman, Adams County Office of Emergency Management (OEM) Director, kicked off the meeting and thanked everyone for their participation. Ron noted there was another County government meeting going on that had pulled away several planning team members. Scott Field (Wood E&IS) introduced the Wood team and prompted the attendees to say their names and what entity/department they represent. In attendance were staff from Adams County Government, City of Thornton, Town of Bennett, City of Brighton, Denver Water, Tri-County Health Department, Commerce City, and Colorado DHSEM.

Review of the Planning Process

The FEMA planning process steps were noted; Wood is currently wrapping up the Risk Assessment process and beginning the mitigation strategy portion. Today's meeting addressed mitigation strategizing and goal review/development aspects.

The Hazard Summary table was briefly reviewed, and Scott noted that the only major change was for the Cybersecurity hazard; the Magnitude rating was switched from "negligible" to "limited" based on previous Hazard Mitigation Planning Committee (HMPC) feedback.

The roles of the participating jurisdictions in the HMPC vs. Stakeholders were reviewed, as differentiated under FEMA's eyes. Unincorporated Adams County, the Town of Bennett, and the City of Commerce City are the participating jurisdictions in the plan update, while other entities (i.e. everyone else) were key stakeholders that would provide useful input and feedback as well as review the Hazard Mitigation Plan (HMP) drafts. Only the participating jurisdictions, however, will be specifically addressed in the plan and will be required to meet certain criteria such as attending planning meetings, identifying mitigation actions, and tracking other aspects in order to qualify for funding in the future.

The City of Brighton asked to become a participating jurisdiction in the 2020 Adams County Plan Update, since the majority of their population falls within Adams County boundaries. This will be discussed more offline.

The new high potential hazard dam grant by FEMA was introduced, and how a community needs to have existing dam related goals or objectives in order to qualify for grant funds. The State of Colorado was awarded two grant projects from this grant last year. This dam grant, however, cannot be applied towards federal dams or hydroelectric dams.

Public Survey Results

The process for obtaining feedback and opinions from the general public was introduced, then the key results and top answers about the mitigation plan and assessed hazards were discussed. The top three hazards of concern based on this public survey were: Severe Thunderstorms (including heavy rain, lightning, and hail), Severe Winter Weather, and Cyberthreats. Handouts showing the entire survey results were distributed to the meeting attendees. The HMPC and stakeholders were encouraged to review the survey results and take them into account when developing mitigation goals, objectives, and actions.

Mitigation Goals and Objectives

The existing goals from the current Adams County Comprehensive (Comp) Plan were reviewed so that the HMPC could decide whether to keep, edit, re-define, or remove what they think is appropriate moving forward with the HMP. Key differences between “goals,” “objectives” and “actions” were defined as described by FEMA: goals and objectives are usually more general and broad guidelines while actions are specific and project-driven. Projects submitted for grant funding will need to tie back to goals and objectives in the HMP. The attendees received copies of the 2014 Comprehensive Plan goals along with goals from related mitigation plans included the Colorado State Hazard Mitigation Plan, and several local HMPs from the surrounding area.

As reference, the 2014 Adams County Comp Plan Goals were:

- Goal 1: Promote coordinated and connected growth
- Goal 2: Protect the health, safety, and welfare of Adams County’s inhabitants
- Goal 3: Foster regional collaboration and partnerships
- Goal 4: Reduce the fiscal impact of growth
- Goal 5: Promote economic vitality
- Goal 6: Preserve the County’s natural resources

The Wood team engaged the attendees in discussing how to handle previous Comp Plan goals in the context of this mitigation plan, with the options to: keep/transfer current Comp Plan goals in the new HMP; create new mitigation goals that support the Comp Plan existing goals; or perhaps generate completely new goals. The attendees discussed whether the Comp Plan policies falling under the general goals perhaps translated more appropriately to mitigation plan objectives. Because the Comp Plan usually is very wide-ranging in terms of aspects addressed and the existing goals are not necessarily mitigation-oriented, certain policies more applicable to mitigation were pulled and are noted in the distributed Mitigation Strategy handouts.

The group agreed to develop mitigation focused goals for this plan, and then tie them in to the relevant Comp Plan goals. The Adams County Comp Plan is being updated in 2021, and will focus more on sustainability and corridors of interest. The goals developed for this HMP will be used to inform the Comp Plan update. Certain Adams County Comp Plan policies were suggested for keeping: these were Policies 2.4, 12.1, and 12.2.

Participating jurisdictions are free to come up with their own goals and objectives, or they can simply adopt the County’s.

The group discussed how to address, via mitigation actions or other methods, the increasing homeless population in the county, and how that ties to hazards such as flooding, since homeless populations tend to congregate in those types of hazard prone areas that may then distribute biohazards down the stream.

Ron from Adams County OEM suggested the attendees come up with 3 to 4 goals and perhaps add to current Comp Plan goals. He mentioned he would be sending out an email to request feedback from key entities/departments. The departments most involved with future goals and actions need to have a voice (e.g. public works, stormwater), since actions depend on priorities, but these change over time and by department.

Attendees mentioned some key themes currently set by the City of Westminster's HMP and that Adams County could use the same method for determining goals. The following goals were specifically mentioned as a starting point for developing updated goals for Adams County:

- Increase community awareness of Adams County's vulnerability to natural hazards.
- Reduce the vulnerability of people, property, and the environment to natural and human-caused hazards.
- Increase internal capabilities and coordination to reduce the impacts of natural and human-caused hazards.
- Strengthen communication and coordination among public agencies, NGOs, businesses, and residents.

Wood will work with Adams County OEM to flesh these out and send them to the HMPC for comments. Goals and objectives will be finalized at the February meeting.

Mitigation Actions

One way to think of mitigation actions is the four A's:

- Altering a hazard,
- Averting a hazard,
- Avoiding a hazard,
- Adapting to a hazard

FEMA suggests these four categories for mitigation actions:

- Plans and Regulations,
- Structure and Infrastructure Projects,
- Education and Awareness, and
- Natural Systems Protection.

Resources for more details on mitigation action types, categories, and example projects were provided, including a short discussion on climate change and adaptation considerations. Example hazard-specific mitigation projects were discussed including FEMA funding-eligible projects for winter weather, flood, and other hazards.

Mark from DHSEM reminded the crowd that FEMA looks at actions and goals as reducing risk long-term, and to keep that in mind as the HMPC considers new actions. Mark also suggested using the key term

“resiliency” as the HMPC considers mitigation actions, to push people and stakeholders to open up to additional types of grants or funding.

Review of Progress on Existing Mitigation Goals and Actions

The 2014 Adams County mitigation actions were reviewed amongst the meeting attendees with the following actions being discussed in more detail:

- Adams County Actions 13 (Hoffman Drainage Way) and 16 (Little Dry Creek Flood Mitigation) were noted as being Completed.
- The Town of Bennett asked if they should keep mitigation action 2015-28 Priority 9.5 since the town lacks a fire authority. Wood suggested they may keep it or reword it to emphasize coordination between appropriate agencies if desired.

Mark from DSHSEM covered some examples of “Deleted” actions due to lack of project applicability over time, or even inability to complete a project in an area where the community does not have control/jurisdiction (e.g. state owned vs. federal land).

Short-term ongoing projects or projects predicted to be completed this year may not need to be included in this HMP since they will be over with by the time of the HMP approval in 2020.

Developing New Mitigation Goals and Actions

Each participating jurisdiction needs to develop at least one new action. Ideally, jurisdictions should develop actions that address all the hazards addressed in the plan, or at least the High significance hazards, but FEMA Region VIII does not require this. All jurisdictions that participate in the National Flood Insurance Program (NFIP) will need to have a mitigation action addressing continued NMFIP compliance.

The following resources with ideas and examples of mitigation actions and implementation were reviewed:

- FEMA’s Mitigation Idea: <https://www.fema.gov/media-library/assets/documents/30627>
- Colorado Planning for Hazards Guide: <https://planningforhazards.com/home>

The new mitigation action worksheets were passed out and explained; and attendees were asked to fill out at least one mitigation action before leaving, to provide initial guidance and ideas. A digital version of the new mitigation action sheet will be sent out after the meeting to provide additional forms. Wood requested that all mitigation action development sheets be returned by January 31st.

Ron from Adams County Emergency Management stated that he would be sending out a meeting follow up meeting to Adams County Parks and Open Space, Public Works, and Stormwater Departments as well as the county managers and directors to request input on this mitigation strategy process as well as collect new mitigation action sheets.

Next Steps

The next steps in the HMP update process were briefly discussed and the project milestones and prospective timeline for task completions were presented. The Wood team mentioned that the next HMPC meeting would be focused on setting and prioritizing mitigation actions and that the specific day and time would be set soon.

Questions and Answers/Adjourn

The meeting adjourned around 3pm.

Points of Contact for this HMP update effort:

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ADAMS COUNTY HAZARD MITIGATION PLAN

2019 UPDATE

Updating the Mitigation Strategy

Mitigation Planning Goals, Objectives, and Actions - Definitions

Goals, objectives, and mitigation actions should be based on the information revealed in the Risk Assessment. Definitions are provided below:

Goals are general guidelines that explain what you want to achieve. Goals are defined before considering how to accomplish them so that the goals are not dependent on the means of achievement. They are usually broad policy-type statements, long term, and represent global visions, such as:

- Reduce exposure to hazard related losses
- Minimize the risk from natural disasters to existing facilities and proposed development.
- Reduce the impact of natural hazards to the citizens of the county.
- Provide protection for natural resources from hazard impacts
- Maintain and enhance existing mitigation measures.
- Increase public awareness of vulnerability to hazards and support and demand for hazard mitigation

Objectives define strategies or implementation steps to attain the identified goals. Unlike goals, objectives are specific and measurable, such as:

- Maintain the flood mitigation programs to provide 100-year flood protection
- Protect critical facilities to the 500 year flood
- Educate citizens about wildfire defensible space actions.
- Prepare plans and identify resources to facilitate reestablishing operations after a disaster.

Mitigation Actions are specific actions that help you achieve your goals and objectives. Some examples include:

- Elevate three historic structures located in the downtown district
- Sponsor a community fair to promote wildfire defensible space
- Retrofit the police department to withstand flood damage

The goals and objectives from the Adams County 2014 Comprehensive Plan are shown on the next page. The 2020 plan update presents an opportunity to review the goals and modify if desired. Use this handout to verify that they are still appropriate or suggest modifications to the planning committee and Wood (Scott.Field@woodplc.com).

Adams County 2014 Comprehensive Plan Goals

Goal 1: Promote Coordinated and Connected Growth

Goal 2: Protect the Health, Safety, and Welfare of Adams County's Inhabitants

Goal 3: Foster Regional Collaboration and Partnerships

Goal 4: Reduce the Fiscal Impact of Growth

Goal 5: Promote Economic Vitality

Goal 6: Preserve the County's Natural Resources

2014 Comprehensive Plan Policies Related to Mitigation

Policy 2.4: Promote Regional Cooperation

Policy 7.1: Boost Drainage and Flood Control Capacity

Policy 7.3: Protect Water Supplies

Policy 9.3: Preserve Water Corridors and Reservoirs

Policy 9.4: Protect Culturally and Historically Significant Resources

Policy 12.1: Reduce Risk and Effects of Natural Hazards

Policy 12.2: Increase Public Awareness of Hazard Risks

Policy 12.3: Limit Building in High-Risk Areas and Improve Disaster Prevention.

Other Related Plan Goals

It is also important to integrate the mitigation strategy with other existing goals to ensure consistency, efficiency, and effectiveness. This can help in identifying funding opportunities.

Adams County Open Space, Parks & Trail Plans Master Plan – Guiding Principles and Goals (2012)

Principal 3: Natural Resource and Wildlife Habitat Protection

- Protect and enhance important ecological and scenic resources such as riparian areas, wetlands, floodplains, prairie grasslands and unique land forms.

Principal 5: Water Resources Protection and Enhancement

- Improve water quantity and quality to assure a continuing quality of life in Adams County by implementing stormwater management best practices to minimize runoff and encourage infiltration, protecting and enhancing wetland habitats and riparian zones.
- Protect, in as natural a state as possible, floodplains and flood hazard areas for flood event conveyance and storage. Enhance these corridors with vegetation to reduce erosion and siltation.

Principal 7: Agricultural Conservation

- Preserve and protect the viability and character of high quality agricultural lands in the County.
- Consider agricultural lands and their viability to serve as natural area protection.

Principal 9: Disturbed Land Restoration

- Encourage existing and future mining operations to reclaim lands during and after mining in an effort to create habitat, restore vegetation, contribute to flood storage and provide recreational and educational opportunities.

The following goals are from jurisdictions in Adams County as well as some neighboring counties' hazard mitigation plans, and are also provided for reference purposes.

2017 Thornton, Federal Heights, & Northglenn Hazard Mitigation Plan

Thornton Goals

1. Protect people, property, and natural resources
2. Improve capability to prevent and reduce physical, economic, and social losses from disasters
3. Ensure that functionality of local critical facilities are maintained in the event of a disaster
4. Strengthen communication and coordination among public agencies, NGOs, businesses, and residents
5. Increase public awareness of natural hazard risks and mitigation options
6. Integrate hazard mitigation into other planning mechanisms
7. Ensure that Hazard Mitigation will be acknowledged and supported by the Thornton Comprehensive Plan and other local plans

Federal Heights Goals

1. Improve capability to reduce disaster losses
2. Strengthen communication and coordination among public agencies, NGOs, businesses, and citizens
3. Increase public awareness of natural hazards and mitigation options
4. Integrate hazard mitigation into other planning mechanisms
5. Increase the city's resilience to hazards during all phases of the Emergency Management Cycle
6. Increase individual resilience to hazards

Northglenn Goals

1. Protect people, property, and natural resources
2. Improve capability to reduce disaster losses
3. Strengthen communication and coordination among public agencies, NGOs, businesses, and citizens
4. Increase public awareness of natural hazards and mitigation options

City of Aurora Hazard Mitigation Plan 2016

Goal 1: Protect people, property, critical facilities, and natural resources from natural hazards through mitigation planning and activities.

Goal 2: Increase public awareness, preparedness, and education about localized natural hazards and actions that can be taken to reduce their impacts.

Goal 3: Establish and maintain relationships that strengthen hazard communication and coordination efforts with public agencies, non-governmental organizations (NGOs), businesses, and citizens.

Goal 4: Coordinate and integrate natural hazard mitigation with city planning, engineering, and development activities.

Goal 5: Maintain the momentum of hazard mitigation planning and preparedness efforts in Aurora

City of Westminster Hazard Mitigation Plan 2018

Goal 1: Increase community awareness of Westminster's vulnerability to natural hazards

Goal 2: Reduce vulnerability of people, property, and the environment to natural hazards

Goal 3: Increase internal capabilities and coordination to reduce the impacts of natural hazards

Arapahoe County Multi-Hazard Mitigation Plan 2015-2020

Goal 1: Prevent the loss of lives and injuries from hazards

Goal 2: Prevent and/or reduce damages to public and private property from hazards

Goal 3: Strengthen communication and coordination among public agencies, non-governmental organizations (NGOs), businesses and private citizens

Goal 4: Reduce the adverse economic and natural resource impacts of hazards

Goal 5: Improve local resiliency to hazard events

Jefferson County Multi-Hazard Mitigation Plan, 2016

Goal 1: Increase awareness about natural hazards

Goal 2: Reduce impacts of natural hazards on life, property, and the environment

Goal 3: Strengthen and develop partnerships in regard to mitigating hazard impacts

Weld County Multi-Jurisdictional Hazard Mitigation Plan, 2016

Goal 1: Reduce loss of life, property damages and economic impacts from disasters

Goal 2: Improve the County's and local jurisdictions' capabilities to reduce disaster losses

Goal 3: Increase community resilience through community engagement and preparedness education

Goal 4: Position Weld County communities to maintain eligibility for FEMA and other federal mitigation funding through active participation in mitigation planning.

STATE OF COLORADO 2018 MITIGATION GOALS

Minimize the loss of life and personal injuries from all-hazard events (I)
A, D, F, G, H
Reduce losses and damages to state, tribal, and local governments, as well as special districts and private assets, and support similar local efforts (II)
J, O
Reduce federal, state, tribal, local, and private costs of disaster response and recovery (III)
D, E, J, P, Q
Support mitigation initiatives and policies that promote disaster resiliency, nature-based solutions, cultural resources and historic preservation, and climate adaptation strategies (IV)
A, B, E, M, N
Minimize interruption of essential services and activities (V)
D, E, J, L, P, Q
Incorporate equity considerations into all mitigation strategies (VI)
A, E
Support improved coordination of risk mitigation between and among the public, private, and non-profit sectors (VII)
A, C, D, E, G, I, K, L, M, N, O, R
Create awareness and demand for mitigation as a standard of practice (VIII)
A, B, C, E, G, K, L, M, N, O

Mitigation Objectives:

- A. Support and empower local and regional mitigation strategies through statewide guiding principles, programs, and resources
- B. Promote activities that are climate neutral and supportive of appropriate renewable and alternative energy
- C. Strengthen hazard risk communication tools and procedures
- D. Strengthen continuity of operations at the federal, state, regional, tribal, and local levels of government to ensure the delivery of essential services
- E. Strengthen cross-sector connections across the state government
- F. Identify specific areas at risk to natural hazards and zones of vulnerability

- G. Expand public awareness, education, and information programs relating to hazards and mitigation methods and techniques
- H. Develop mitigation projects focused on preventing loss of life, injuries, and negative impacts to natural resources and reliant community sectors from natural, technological, and human-caused hazards
- I. Assist local government officials with construction, non-construction, and regulatory hazard mitigation activities
- J. Protect state critical, essential, and necessary assets located in natural hazard risk areas
- K. Improve state, tribal, and local government mitigation project monitoring and decision-making tools
- L. Strengthen connections between hazard mitigation activities and preparedness, response, and recovery activities
- M. Improve coordination of state government mitigation resources with federal, tribal, and local government and private nonprofit resources
- N. Increase state, tribal, and local government and private nonprofit participation in existing hazard mitigation programs
- O. Partner with local and tribal governments to develop projects, initiatives, and public resources that protect private property from hazards
- P. Reduce services interruptions and revenue losses, resulting from hazard events, to the state
- Q. Reduce downtime and revenue losses, resulting from hazard events, for local and tribal governments and private nonprofit organizations
- R. Through training, grants, and technical assistance, increase local government use of land use strategies that reduce risks to hazards

Example Mitigation Action Items

Alternative Mitigation Actions	Dam Failure	Floods	Hazardous Materials	Drought	Weather Extremes (hail, lightning, wind, temps, drought)	Earthquakes	Wildland Fires	Severe Winter Storm
PREVENTION								
Building codes and enforcement		■	■	■	■	■	■	■
Comprehensive Watershed Tax		■						
Density controls	■	■	■				■	
Design review standards		■	■	■		■	■	
Easements		■	■				■	
Environmental review standards		■	■			■	■	
Floodplain development regulations	■	■	■					
Hazard mapping	■	■	■				■	
Floodplain zoning	■	■	■					
Forest fire fuel reduction			■				■	
Housing/landlord codes			■	■	■			
Slide-prone area/grading/hillside development regulations							■	
Manufactured home guidelines/regulations		■			■	■		
Minimize hazardous materials waste generation			■					
Multi-Jurisdiction Cooperation within watershed	■	■		■				
Open space preservation	■	■					■	
Performance standards	■	■		■	■	■	■	■
Periodically contain/remove wastes for disposal			■					
Pesticide/herbicide management regulations			■					
Special use permits	■	■	■				■	
Stormwater management regulations		■	■					
Subdivision and development regulations	■	■	■	■		■	■	
Surge protectors and lightning protection					■			
Tree Management				■	■		■	■

Alternative Mitigation Actions	Dam Failure	Floods	Hazardous Materials	Drought	Weather Extremes (hail, lightning, wind, temps, drought)	Earthquakes	Wildland Fires	Severe Winter Storm
Transfer of development rights		■					■	
Utility location			■		■			■
PROPERTY PROTECTION								
Acquisition of hazard prone structures	■	■					■	
Facility inspections/reporting	■	■	■			■		
Construction of barriers around structures	■	■	■					
Elevation of structures	■	■						
Relocation out of hazard areas	■	■	■				■	
Structural retrofits (e.g., reinforcement, floodproofing, bracing, etc.)		■	■	■	■	■	■	■
PUBLIC EDUCATION AND AWARENESS						■		
Debris Control		■						
Flood Insurance	■	■						
Hazard information centers	■	■	■	■	■	■	■	■
Public education and outreach programs	■	■	■	■	■	■	■	■
Real estate disclosure	■	■	■		■	■	■	■
Crop Insurance				■	■	■		
Lightning detectors in public areas					■			
NATURAL RESOURCE PROTECTION								
Best Management Practices (BMPs)		■	■	■	■		■	
Forest and vegetation management	■	■		■	■		■	■
Hydrological Monitoring	■	■	■	■	■			
Sediment and erosion control regulations	■	■	■	■				
Stream corridor restoration		■						
Stream dumping regulations		■	■					
Urban forestry and landscape management		■		■	■		■	■
Wetlands development regulations		■	■				■	
EMERGENCY SERVICES								

Alternative Mitigation Actions	Dam Failure	Floods	Hazardous Materials	Drought	Weather Extremes (hail, lightning, wind, temps, drought)	Earthquakes	Wildland Fires	Severe Winter Storm
Critical facilities protection	■	■	■	■	■	■	■	■
Emergency response services	■	■	■		■	■	■	■
Facility employee safety training programs	■	■	■		■	■	■	■
Hazard threat recognition	■	■	■	■	■	■	■	■
Hazard warning systems (community sirens, NOAA weather radio)	■	■	■		■	■	■	■
Health and safety maintenance	■	■	■	■	■	■	■	■
Post-disaster mitigation	■	■	■	■	■	■	■	■
Evacuation planning	■	■	■				■	
STRUCTURAL PROJECTS								
Channel maintenance		■						
Dams/reservoirs (including maintenance)	■	■						
Isolate hazardous materials waste storage sties			■					
Levees and floodwalls (including maintenance)		■						
Safe room/shelter					■	■		■
Secondary containment system			■					
Site reclamation/restoration/revegetation		■	■	■				
Snow fences								■
Water supply augmentation				■	■			

Carr, Amy

From: Ronald Sigman <RSigman@adcogov.org>
Sent: Monday, February 03, 2020 7:14 AM
To: alex.jakubowski@elbertcounty.co.gov; Alisha Reis; Carr, Amy; Ben Dahlman; blenderi@auroragov.org; Brandy Foley; Brian Dearth; Byron Fanning; Chris Kline; Chris Laws; christopher.hudak@state.co.us; cmcmahill@suncor.com; CoronerQuestions; Cory Stark; Crystal Elliott; Dave Skuodas; David Rausch; Debbie Haines; dross@sacfd.org; earlcumley@bennettfirerescue.org; ejanes@arvada.org; Gabe Rodriguez; gkgrove@co.jefferson.co.us; gordie.olson@cityofthornton.net; Greg Baca; Greg Moser; gscheidt@bennett.co.us; Heidi M. Miller; Herb C. Covey; Josh Zygielbaum; Juliana J. Archuleta; Julie.Beyers@state.co.us; Karsen M. Forsman; kdavies@broomfield.org; Ken Musso; Kirk Dominic; Kristin Sullivan; kstewart@udfcd.org; Kurt Carlson; Kylin Mueller; Linda Hawkins; Lisa Culpepper; logan sand; Libby Tart; markw.thompson@state.co.us; BlancoCastano, Marta; Martin.Postma@cityofthornton.net; Mary Hodge; maskenazi@tchd.org; Matt Chapman; Matthew Newman (mnewman@tchd.org); Matthew.Mueller@denvergov.org; Michael Bean; Mike Holub; mnichols@adcom911.org; mschuman@acfpd.org; Nathan Fogg; Norm Brown; Paolo Diaz; Ray Gonzales; Rebecca Zamora; Rebecca.franco@denverwater.org; Rick Reigenborn; Ron Osgood; Ronald Sigman; Ross Riley; Ryan Doyle; RYoung@crgov.com; Sandra K. Dean; Field, Scott; solomon.rich@sablealturafire.org; Stephanie Caulk; Stephanie Hackett; Steve O'Dorisio; tbeach@seweldfire.org; Thomas Swingle; TPatterson@acfpd.org; Wayne Belohlavy
Subject: FW: Adams County draft HIRA for HMPC review

Planning Committee Members,

Please take a look at the first draft of the updated Hazard Identification and Risk Assessment (HIRA) section (link below) for the revised 2020 County Hazard Mitigation Plan. Our contractor, Scott Field has included some instruction below for providing comments.

Thank You,

From: Field, Scott <scott.field@woodplc.com>
Sent: Friday, January 31, 2020 6:38 PM
To: Ronald Sigman <RSigman@adcogov.org>
Cc: Carr, Amy <amy.carr@woodplc.com>; BlancoCastano, Marta <marta.blancocastano@woodplc.com>; Moore, Abigail <abigail.moore@woodplc.com>
Subject: RE: Adams County draft HIRA for HMPC review

Please be cautious: This email was sent from outside Adams County

Oh I forgot to add: if the file is too large for some folks' email programs, it can also be accessed through this Box folder:

<https://app.box.com/s/womtnitf0jg3wcmibgavhu4adde7f3g6>

W. Scott Field, CEM
Senior Emergency Management Specialist
Wood Environment & Infrastructure Solutions, Inc
Hazard Mitigation and Emergency Management Program
2000 South Colorado Blvd, Suite 2-1000, Denver, CO, 80222
Office: 303-742-5320
Mobile: 720-569-9266
scott.field@woodplc.com
www.woodplc.com

From: Field, Scott
Sent: Friday, January 31, 2020 6:34 PM
To: Ronald Sigman (RSigman@adcogov.org) <RSigman@adcogov.org>
Cc: 'Amy Carr (amy.carr@woodplc.com)' <amy.carr@woodplc.com>; BlancoCastano, Marta <marta.blancocastano@woodplc.com>; Moore, Abigail <abigail.moore@woodplc.com>
Subject: Adams Dounty draft HIRA for HMPC review

Ron,

Attached is the first draft of the updated Hazard Identification and Risk Assessment section of the Adams County Hazard Mitigation Plan. Please distribute to the HMPC for review and comment.

Anything **highlighted in yellow** is a specific question or note for the HMPC's attention.

Anything **highlighted in green** is a placeholder for Wood to add more material later.

We would like to get comments back **by February 14th** in order to turn around and deliver a draft of the complete plan by the end of February. Please have people send their comments to me, preferably either in track changes or as comments.

Thanks, and have a great weekend.

W. Scott Field, CEM
Senior Emergency Management Specialist
Wood Environment & Infrastructure Solutions, Inc
Hazard Mitigation and Emergency Management Program
2000 South Colorado Blvd, Suite 2-1000, Denver, CO, 80222
Office: 303-742-5320
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Carr, Amy

From: Ronald Sigman <RSigman@adcogov.org>
Sent: Wednesday, January 15, 2020 11:15 AM
To: Kristin Sullivan; Byron Fanning; Mike Holub
Cc: Libby Tart; David Rausch; Field, Scott
Subject: Comprehensive Plan Mitigation projects

Good Morning,

As we continue to move forward on the revision to the Hazard Mitigation Plan our contractor is seeking information on the status of mitigation projects that were identified in the 2012/2014 Comprehensive Plan. We are also seeking information on projects that may be proposed for the next few years that relate to mitigation. This information is an important piece of the Hazard Mitigation Plan which is an integral part of Comp Plan. If you have any information on past or proposed mitigation projects that we can include in our plan it would help us out moving forward. Again, our Hazard Mitigation Plan is a federal requirement for seeking Mitigation grant funding that can be used to support our County projects.

Thank You in advance for any information you can provide,



Ron Sigman, CO-CEM

Emergency Manager, *Office of Emergency Management*

ADAMS COUNTY, COLORADO

4430 South Adams County Parkway, 1st Floor, Suite C1900

Brighton, CO 80601

O: 720.523.6601 m: 720.988.4148 | rsigman@adcogov.org

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Carr, Amy

From: Ronald Sigman <RSigman@adcogov.org>
Sent: Monday, January 13, 2020 8:59 AM
To: alex.jakubowski@elbertcounty.co.gov; Alisha Reis; Carr, Amy; Ben Dahlman; blenderi@auroragov.org; Brandy Foley; Brian Dearth; Byron Fanning; Chris Kline; Chris Laws; christopher.hudak@state.co.us; cmcmahill@suncor.com; CoronerQuestions; Cory Stark; Crystal Elliott; Dave Skuodas; David Rausch; Debbie Haines; dross@sacfd.org; earlcumley@bennettfirerescue.org; ejanes@arvada.org; Gabe Rodriguez; gkgrove@co.jefferson.co.us; gordie.olson@cityofthornton.net; Greg Baca; Greg Moser; gscheidt@bennett.co.us; Heidi M. Miller; Herb C. Covey; Josh Zygielbaum; Juliana J. Archuleta; Julie.Beyers@state.co.us; Karsen M. Forsman; kdavies@broomfield.org; Ken Musso; Kirk Dominic; Kristin Sullivan; kstewart@udfcd.org; Kurt Carlson; Kylin Mueller; Linda Hawkins; Lisa Culpepper; logan sand; Libby Tart; Mark Bodane; markw.thompson@state.co.us; BlancoCastano, Marta; Martin.Postma@cityofthornton.net; Mary Hodge; maskenazi@tchd.org; Matt Chapman; Matthew Newman (mnewman@tchd.org); Matthew.Mueller@denvergov.org; Michael Bean; Mike Holub; mnichols@adcom911.org; mschuman@acfpd.org; Nathan Fogg; Norm Brown; Paolo Diaz; Ray Gonzales; Rebecca Zamora; Rebecca.franco@denverwater.org; Rick Reigenborn; Ron Osgood; Ronald Sigman; Ross Riley; Ryan Doyle; RYoung@crgov.com; Sandra K. Dean; Field, Scott; solomon.rich@sablealturafire.org; Stephanie Caulk; Stephanie Hackett; Steve O'Dorisio; tbeach@seweldfire.org; Thomas Swingle; TPatterson@acfpd.org; Wayne Belohlavy
Subject: Hazard Mitigation Plan meeting info
Attachments: Copy of Mitigation Action Tracker 1-6-20.xlsx; Mitigation Goals Worksheet_Adams2019.docx; Adams County HMP Mitigation Strategy Meeting Agenda -Final.docx
Follow Up Flag: Follow up
Flag Status: Completed

Our next Hazard Mitigation Plan meeting is scheduled for Jan 14th at 1:00 pm at the Adams County Government Center (4430 S. Adams County Parkway, Brighton) in the Brantner Gulch A conference room. I have attached the meeting agenda, mitigation action tracker spreadsheet, and mitigation goals worksheet for your review/comments. If you have information or comments regarding any of the items contained in the goals or action tracker worksheets please bring those notes to the meeting or you can email me that information so that we can include them in our Plan. Thank You in advance,



Ron Sigman, CO-CEM

Emergency Manager, *Office of Emergency Management*

ADAMS COUNTY, COLORADO

4430 South Adams County Parkway, 1st Floor, Suite C1900

Brighton, CO 80601

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Carr, Amy

From: Ronald Sigman <RSigman@adcogov.org>
Sent: Friday, March 6, 2020 10:46 AM
To: Alisha Reis; Carr, Amy; Andres M. Carrera; blenderi@auroragov.org; Brandy Foley; Brian Dearth; Byron Fanning; Chris Kline; Chris Laws; christopher.hudak@state.co.us; cmcmahill@suncor.com; Cory Stark; Crystal Elliott; Dave Skuodas; David Rausch; Debbie Haines; dross@sacfd.org; earlcumley@bennettfirerescue.org; ejanes@arvada.org; Gabe Rodriguez; gkgrove@co.jefferson.co.us; gordie.olson@cityofthornton.net; Greg Baca; Greg Moser; gscheidt@bennett.co.us; Heidi M. Miller; Juliana J. Archuleta; Julie.Beyers@state.co.us; Ken Musso; Kirk Dominic; kstewart@udfcd.org; Kurt Carlson; Kylin Mueller; Linda Hawkins; Lisa Culpepper; logan sand; Libby Tart; markw.thompson@state.co.us; BlancoCastano, Marta; Martin.Postma@cityofthornton.net; Michael Bean; Mike Holub; mnichols@adcom911.org; mschuman@acfpd.org; Paolo Diaz; Ray Gonzales; Rebecca Zamora; Rebecca.franco@denverwater.org; Ron Osgood; Ronald Sigman; Ross Riley; Ryan Doyle; RYoung@crgov.com; Sandra K. Dean; Field, Scott; solomon.rich@sablealturafire.org; Stephanie Caulk; Stephanie Hackett; Steve O'Dorisio; tbeach@seweldfire.org; Thomas Swingle; TPatterson@acfpd.org; Wayne Belohlavy
Subject: FW: Adams County Hazard Mitigation Plan - HMPC Review Draft

Please take a minute to look over the base draft of the Hazard Mitigation Plan <https://app.box.com/s/womtnitf0jg3wcmibgavhu4adde7f3g6> . Please submit any edits in the Word doc using track changes by Friday, March 20 so that we can keep our project on schedule.

Thank You,

From: Field, Scott <scott.field@woodplc.com>
Sent: Friday, March 6, 2020 10:35 AM
To: Ronald Sigman <RSigman@adcogov.org>
Cc: Carr, Amy <amy.carr@woodplc.com>
Subject: Adams County Hazard Mitigation Plan - HMPC Review Draft

Please be cautious: This email was sent from outside Adams County

Ron,

The draft Adams County Hazard Mitigation Plan is ready for HMPC review at:
<https://app.box.com/s/womtnitf0jg3wcmibgavhu4adde7f3g6>

Please pass this link on to all HMPC members. The document is available in both Word and pdf format. We would prefer comments & edits in the Word doc using track changes, but we'll take them any way we can get them. Note that for those who didn't have a chance to review and comment the on the draft HIRA – you get a second chance!

This is only the base plan: the jurisdictional annexes and the appendices will be completed once we have your feedback on the base plan.

We need comments back by **Friday March 20** in order to keep the project on schedule.

Thank you all for your involvement and for staying engaged throughout this process!

**ADAMS COUNTY MULTI-JURISDICTIONAL
HAZRD MITIGATION PLAN**

2020 UPDATE

MITIGATION STRATEGY MEETING

Wednesday, February 5, 2020 9:00am – 11:00am

**Adams County Government Center, Brantner Gulch C
4430 S. Adams County Parkway, Brighton, CO**

- ❖ **Introductions**
- ❖ **Review of the Planning Process**
- ❖ **Review of Mitigation Goals and Objectives**
- ❖ **Review of possible mitigation activities and alternatives**
- ❖ **Discuss criteria for mitigation action selection and prioritization**
- ❖ **Prioritize mitigation actions (group process)**
- ❖ **Next Steps**
- ❖ **Questions and Answers/Adjourn**

Adams County Multi-Jurisdictional Hazard Mitigation Plan 2020 Update

Mitigation Priorities Meeting Summary

February 5, 2020, 9:00 – 11:00 am
Adams County Government Center
4430 S. Adams County Parkway, Brighton, CO

Introductions

Ron Sigman, Adams County Office of Emergency Management (OEM) Director, kicked off the meeting and thanked everyone for their participation. In attendance were staff from Adams County Government, City of Northglenn, City of Westminster, Town of Bennett, Denver Water, Tri-County Health Department, and Colorado DHSEM.

Review of the Planning Process

The meeting began with a recap of the planning process and actions completed to date. The City of Brighton and Denver Water have officially been added as participating jurisdictions in the updated plan.

The first draft of the Hazard Identification and Risk Assessment (HIRA) was sent to HMPC members on January 31st; comments are due back to the Wood consultant team by February 14th. Attendees were specifically asked to review the hazard rankings, and comment if they agreed with them as listed. The data analysis suggests possible changes to the rankings for flood and dam incidents; however the HMPC is in no way bound to accept these changes as data is often incomplete and doesn't always tell the whole story.

Mitigation Goals and Objectives

The draft mitigation goals and objectives were reviewed and approved for inclusion in the draft plan.

Mitigation Action Prioritization

A total of 27 new mitigation actions were submitted by HMPC members. The HMPC reviewed and prioritized these actions using the STAPLEE criteria (Social, Technical, Administrative, Political, Legal, Economic, and Environmental). Participants then "voted" for which projects they thought the County should focus on; the number of votes was converted to a priority for each project (high, medium, or low). This prioritization will be reflected in the new Mitigation Actions Table in the draft plan.

Next Steps

Once HMPC comments on the draft HIRA have been received, Wood will prepare a draft of the base plan for HMPC review. This draft is anticipated by early March. A public review draft is expected by late March, with submission to the State and FEMA in April. This schedule would have the final plan ready for local adoption in June.

If Adams County OEM feels that another meeting is warranted to review the final plan, it will be scheduled; but there is not currently another face-to-face meeting of the HMPC planned.

Questions and Answers/Adjourn

The meeting adjourned at 11 am.

Points of Contact for this HMP update effort:

Scott Field

Wood E&IS Project Manager

scott.field@woodplc.com

303-742-5320

2000 South Colorado Blvd, Denver, CO 80222

Ronald Sigman

Adams County Emergency Manager

rsigman@adcogov.org

720-523-6601

4430 S. Adams County Pkwy, Brighton, CO 80601

**SIGN-IN SHEET
ADAMS COUNTY
LOCAL HAZARD MITIGATION PLAN UPDATE PROJECT
HMPC #4 – Mitigation Strategy**

Wednesday February 5, 2020 @ 9:00am-11:00am

Adams County Government Center, Branter Gulch C, 4430 S. Adams County Parkway Brighton 80601

Name	Jurisdiction/Organization/Citizen	Title	Phone	E-mail
Ron Osgood	Northglenn Police	Commander	303-450-8968	rosgood@northglenn.org
Geri Scheidt	Town of Bennett	Safety Officer	303-243-0833	gscheidt@bennett.co.us
Ron Symen	Adams OEM	E.M.	6601	rsymen@adco.org
Greg Moser	Westminster EMC	EMC	3/658-4550	gmoser@cityofwestminster.us
Mark Thompson	DASEM	Mitigation Planner	724-630-0770	mark.thompson@state.co.us
Rebecca Franco	Denver Water	EM Manager	303 250 1575	rebecca.franco@denverwater.org
Mark Schuman	Adams County Fire	Div. Chief EM	303-539-6872	mschuman@adcofire.org
David Rausch	ADCO	IT SW Manager	303 539 6840	drausch@adco.gov
Kurt Carlson	ADCO Parks & Rec	Parks Manager	303 687 8013	kcarlson@adco.gov
Michael Bean	ADCO OEM	EM Coord.	720-523-6603	mbean@adco.gov
Greg Baca	Adams IT	GIS Mgr	720-858-6844	gbaca@adco.gov
Sam Blum	TC HD	EM Manager	720-2001479	sblum@tchd.org
Steve Odoresio	Adams	Commissioner	720-333-1117	sodoresio@adco.gov

HMPC #4 – Mitigation Strategy

Wednesday February 5, 2020 @ 9:00am-11:00am

Adams County Government Center, Branter Gulch C, 4430 S. Adams County Parkway Brighton 80601

[illegible]

ADAMS COUNTY MITIGATION PLAN

2020 UPDATE

Updating the Mitigation Strategy

Revised and Updated Goals & Objectives

2014 Comprehensive Plan Goals

*plan scheduled for revision in 2020/21

- Goal 1: Promote coordinated and connected growth
- Goal 2: Protect the health, safety, and welfare of Adams County's inhabitants
- Goal 3: Foster regional collaboration and partnerships
- Goal 4: Reduce the fiscal impact of growth
- Goal 5: Promote economic vitality
- Goal 6: Preserve the County's natural resources

2020 Hazard Mitigation Plan Goals & Objectives

Goal 1: Increase community awareness of Adams County's vulnerability to natural hazards (comp plan goal #2 &3)

Objective 1.1: Inform and educate the community about the types of hazards Adams County is exposed to, where they occur, and recommended responses.

- Continue the OEM outreach programs
 - Coordinate public education preparedness programs and delivery
 - Maintain OEM social media (facebook, twitter, nextdoor, workplace) platforms
 - Coordinate with County Communications Department for internal & external messaging

Goal 2: Reduce vulnerability and protect people, property, and the environment to natural hazards (comp plan goal #2 & 6)

Objective 2.1: Provide mechanisms to enhance life safety

Objective 2.2: Reduce impacts to critical facilities and services

- Identify and protect critical facilities
- Protect hazardous materials facilities

Objective 2.3: Reduce impacts to existing buildings to the extent possible

Objective 2.4: Reduce impacts to future development to the extent possible

Objective 2.5: Reduce impacts to County natural resources

Objective 2.6: Reduce impacts to public health (natural health hazards, not bio-terrorism)

Goal 3: Increase internal capabilities and coordination to reduce the impacts to natural hazards (comp plan goal #1 &5)

Objective 3.1: Improve planning coordination

Objective 3.2: Improve funding coordination

Objective 3.3: Improve response coordination

Goal 4: Strengthen communication and coordination among public agencies, NGO's, businesses, and residents (comp plan goal 1 & 3)

Objective 4.1: Strengthen community and regional partnerships at all levels

Mitigation Action Selection and Prioritization Criteria

Does the proposed action protect lives or vulnerable populations?

Does the proposed action address hazards or areas with the highest risk?

Does the proposed action protect critical facilities, infrastructure, or community assets?

Does the proposed action meet multiple community objectives (multi-objective management)?

Is there a strong advocate for the action or project that will support the action's implementation?

STAPLE/E

Developed by FEMA, this method of applying evaluation criteria enables the planning team to consider in a systematic way the social, technical, administrative, political, legal, economic, and environmental opportunities and constraints of implementing a particular mitigation action. For each action, the HMPC should ask, and consider the answers to, the following questions:

Social - Does the measure treat people fairly (different groups, different generations)? Does it consider social equity, disadvantaged communities, or vulnerable populations?

Technical - Will it work? (Does it solve the problem? Is it feasible?)

Aministrative - Is there capacity to implement and manage project?

Political - Who are the stakeholders? Did they get to participate? Is there public support? Is political leadership willing to support it?

Legal - Does your organization have the authority to implement? Is it legal? Are there liability implications?

Economic - Is it cost-beneficial? Is there funding? Does it contribute to the local economy or economic development? Does it reduce direct property losses or indirect economic losses?

Environmental - Does it comply with environmental regulations or have adverse environmental impacts?

Review the new mitigation actions received and use the STAPLE/E criteria to begin prioritizing each action. Add a plus sign (+) or minus sign (-) under each STAPLE/E column if you think the actions fits that criteria or not

Action	Hazard	Type of Project	Social	Technical	Admin.	Legal	Economic	Environmental	Total + signs
Develop a public awareness brochure and make available in hard copy and electronically on the town's website *Town of Bennett specific*	Multi	Education and awareness							
Dam Safety Alerting System	Dam Failure	Local plans and regulations							
Develop an extreme heat plan	Extreme Heat	Local plans and regulations							
Review existing building codes and adopt latest version of IBC when published	Multi: Earthquake, strong winds, extreme temps, thunderstorm, winter storms	Local plans and regulations							
Major drainageway planning and flood hazard delineation: Little Dry Creek, Second Creek(downstream from DIA), Brantner Gulch, DFA0054	Flood	Local plans and regulations							

Action	Hazard	Type of Project	Social	Technical	Admin.	Legal	Economic	Environmental	Total + signs
Flood Hazard Delineation Studies: Grange Hall Creek, South Platte River, Clear Creek	Flood	Local plans and regulations							
Update Outfall Systems Plans: Basin 4100 & DFA 0056, Pecos & 54th, Third Creek	Flood	Local plans and regulations							
Acquire land for conservation; provide zoning and future land use guidance to map vulnerable populations and create a toolkit to assist and educate owners/developers on development concerns to particular areas on ways to mitigate existing concerns	Flooding	Structure and infrastructure; Local plans and regulations; education and awareness							
Sheltering Equipment Upgrades - Generators	Multi: Severe Weather (winter storm, tornado, high wind)	Structure and infrastructure							
Retrofit the City's public/emergency shelter, Eagle View Adult Center to be wired to accept a generator. Purchase a generator for the shelter *City of Brighton specific	Multi: Severe Weather (winter storm, tornado, high wind)	Structure and Infrastructure							

Action	Hazard	Type of Project	Social	Technical	Admin.	Legal	Economic	Environmental	Total + signs
Update and upgrade existing snow fences; increase snowplow equipment	Winter Weather	Structure and infrastructure							
Dahlia outfall system	Flooding	Structure and infrastructure							
Regional Park Sheltering	Multi: Severe Weather (thunderstorms, tornado, high wind)	Structure and infrastructure							
96th Avenue Bridge Repair Project	Multi: Flooding, Thunderstorms, Wildland Fire	Structure and infrastructure							
York Street Phase II (E. 78th -E. 88th Ave)	Flood	Structure and infrastructure							
York Street Phase III /Coordination with UPR on bridge replacement	Flood	Structure and infrastructure							
Dahlia Pond Improvements at southwest corner of I-76	Flood	Structure and infrastructure							
2019 Logan Court Drainage Basin Storm design	Flood	Structure and infrastructure							
ADA Five Areas Project	Multi	Structure and Infrastructure							

Action	Hazard	Type of Project	Social	Technical	Admin.	Legal	Economic	Environmental	Total + signs
E. 88 th Ave and Welby Road Intersection Improvements	Winter Storm, Flood, Thunderstorm	Structure and Infrastructure							
Steele Street Project	Winter Storm, Hazmat	Structure and Infrastructure							
Dahlia St Project	Flood, Thunderstorm,	Structure and Infrastructure							
2019 E 152 nd Ave and Imboden Drainage	Flood, Thunderstorm, Winter Storm	Structure and Infrastructure							
Broadway Intersection of 62 nd Ave (minor System)	Flood, Thunderstorm, Winter Storm	Structure and Infrastructure							
Broadway at 59 th Ave (major system)	Flood, Thunderstorm, Winter Storm	Structure and Infrastructure							
Clear Creek Drop Structure	Flood, Thunderstorm	Structure and Infrastructure							
Video Inspection and Maintenance of Stormwater Infrastructure	Flood, Thunderstorm, Winter Storm	Structure and Infrastructure							

Adams County Multi-Jurisdictional Hazard Mitigation Plan 2020 Update

Town of Bennett Meeting Summary

January 23, 2020, 1:00 – 3:00 pm
Town of Bennett Town Hall
207 Muegge Way, Bennett, CO

Introductions

Present were the Adams County Office of Emergency Management (OEM) Director; the Town Engineer; Community Development; Utilities; the Town Safety Officer, and three members of the Wood consultant team.

Mitigation Planning Process and Requirements

The Town of Bennett is participating for the first time in Adams County's HMP Update. They are currently included in the Arapahoe County's HMP, which is also beginning its update process.

Hazard Identification and Risk Assessment Overview

Bennett staff reviewed the critical facilities lists, and noted that some may be missing, such as water, recreation, government facilities, and parks/open spaces; the Town Safety Officer will send more information and locations. A new Public Works administrative building is currently being built. Water well sites may be missing from the current critical facilities list too. The Town inquired on the Hazmat Tier II site present in their boundaries.

Winter Weather: The Community Development representative inquired on whether livestock damages/losses are currently being included in the crop losses figures under the Winter Weather summary statistics. Wood mentioned it would look into that in more detail.

Flood: The Town Engineer mentioned that most of Bennett is found within Zones X according to FEMA, and hence most properties and a couple town bridges would be exposed to some flood hazards. A past event with a train wash out was brought up, noting that parts of the train were never found again ([perhaps this story is related to the information on the Town's history site](#)). Major flood hazard sources were discussed, and it was agreed that Kiowa Creek's floodplains post the highest concern with regards to flooding.

The Town staff asked what it would take to join the CRS program in the future. However, since no one in Bennett currently pays NFIP premiums, there would be little benefit to joining.

Stormwater hazards and related issues should be more addressed/analyzed within the Flood chapter. The Town wishes to continue working on and expanding their Stormwater Drainage Master Plan information, and the Town Board has adopted items within their Capital Asset inventory Master Plan ([CAMP](#)).

Drought: The Town has been looking at water storage, usage, and projections with regards to drought and general water availability.

Dam Incidents: The Town suggested looking into the Aurora Reservoir Dam (aka Senac Dam, a High significance hazard dam), as it could cause inundation into Bennett if it were to fail. The Arapahoe County HMP should contain more information on this dam.

Hazardous Materials: The train runs through Bennett parallel to Colfax Avenue; if it were to derail, that would be a serious issue impacting most of the Town.

Earthquake: Bennett rated this hazard as having an overall significance of High because it would potentially lead to the shutdown of critical facilities for more than 30 days. The Town Engineer is unsure of what earthquake preparedness the buildings/structures have that are key to the town.

Land Subsidence: There might be additional coal mine data available.

Wildfire: Bennett/Watkins Fire Authority should have a Fire Mitigation Plan.

Prairie fires are a big deal in rural communities and small fires take place all the time (usually around 2 acres in size). The Kevin Mitchell Fire and Smalley Fires have been largest in the local area, around 30-40 acres.

Bennett acquired a golf course that could pose issues in terms of vulnerability to fire. It's the area on the south side of the flagpole annexation (in Arapahoe County), called Antelope Hills.

Bennett/Watkins Fire and the Town Public Works departments are key for the Town. Strasburg has a fire entity as well that could assist with future efforts.

Terrorism: The Colorado Air and Space Port could be a potential target along with DIA. The Air and Space Port would also be used for relocation of afflicted populations after major disasters elsewhere in the country.

Development of Mitigation Actions

Bennett wants to look into raising community awareness about hazards as part of a general mitigation goal.

The Intermountain Rural Electric Association, or IREA, is a utility provider that is relocating into Bennett.

There is a new Public Works facility being built in the Town. The generator currently is very old and new well sites managed by Public Works will need generators.

With regards to Bennett's 2015 mitigation actions from the Arapahoe County HMP, some updates were noted:

- 2015-08 (to join the NFIP): Completed
- 2015-11 (participation and adoption of the UDFCD/MHFD master plans): In Progress?

- Bennett uses the Mile High Flood District's technical criteria and has adopted standards. The town is looking at a BCA for capital improvement projects and potentially joining the District in the future, but not quite yet.
- 2015-28 (wildfire mitigation planning): Progress is To Be Determined
 - The Town's Fire Chief is looking into additional funding to continue working on this action.
- 2015-29 (stormwater drainage master plan): In Progress
 - The Town has a short/few page conforming document already. They are seeking more funding to expand the document. It is a conceptual starting point included in the CAMP document.

Project Schedule and Next Steps

More mitigation actions be coming soon, maybe Flood or Dam Incidents related. These should be in by the end of January.

The action prioritization meeting will be held in the next couple of weeks.

Questions

The meeting adjourned around 3pm.

Points of Contact for this HMP update effort:

Scott Field

Wood E&IS Project Manager

scott.field@woodplc.com

303-742-5320

2000 South Colorado Blvd, Denver, CO 80222

Ronald Sigman

Adams County Emergency Manager

rsigman@adcogov.org

720-523-6601

4430 S. Adams County Pkwy, Brighton, CO 80601

SIGN-IN SHEET
ADAMS COUNTY
LOCAL HAZARD MITIGATION PLAN UPDATE PROJECT
Town of Bennett HMPC Meeting

Thursday January 23, 2020 @ 1:00pm-2:30pm
Town Hall, Lost Creek Conference Room 207 Muegge Way, Bennett, CO 801012

Name	Department/Organization	Title	Phone	E-mail
Dan Giroux	TOB	Town Engineer	3/929 3194	dangiroux@terramax.com
Deb Merkle	TOB-Comm Dev	Manager	3-644-3249	dmerkle@bennett.co.us
Ricky Martinez	TOB	Utilities Supervisor	303-644-3249	rmartinez@bennett.co.us
Gerilyn Scheidt	TOB	Safety Officer	3-243 0833	gscheidt@bennett.co.us
Ron Sigman	Adams OEM	Emergency Manager	720 523 6601	rsigman@adco.org
Amy Carr	Wood	Hazard Mit Planner		
Scott Field	Wood	PM		
Marta Blanco Castano	Wood	GIS Analyst/Planner		



**January 27, 2020
Adams County LEPC Meeting
Agenda**

Time: 9:00 a.m. - 11:00 a.m.

Place: Adams County Government Center: Conference Center– Brantner Gulch A
4430 South Adams County Parkway, Brighton, CO 80601

1. Call Meeting to Order/ Introductions ~ Glenn Grove
2. Approval of August 2019 Meeting Minutes ~ Glenn
3. Legislative / Regulatory Update ~ All
4. Partner Updates
 - Adams County ~ Adams County Representatives
 - Local Agencies ~ Agency Representatives
 - Local Chemical Facilities ~ Facility Representatives
 - Tri-County Health Dept. ~ TCHD Representatives
 - State of Colorado ~ State Representatives
 - Environmental Protection Agency ~ EPA Representatives
 - Others
5. Continuing Business
 - ESF 10 – Hazardous Material Response Plan Update
 - Spill Reporting - Update on Recent Spills, Compiled 2019 reports

Presentation: *Scott Field, Wood Environment & Infrastructure Solutions, Inc– Hazard Mitigation Plan Overview*

6. Old Business
7. New Business
 - Discussion of future strategic direction of LEPC – Ron Sigman
 - Board Membership terms and re-appointments
 - Discussion of date for next LEPC Meeting
 - Discussion of May meeting alternates
8. Additional Announcements ~ Chair
9. Adjournment ~ Glenn

Parking Instructions: Parking is available in the northwest lot which is outside of the Conference Center.

Pursuant to the Colorado Open Meetings Act, this agenda was posted in the following locations; Adams County Administration Building, main lobby, and the LEPC website on or before January 20, 2020.



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HAZARD MITIGATION PLAN

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Help the county prepare for natural and human-caused hazards.

Adams County is in the process of updating its Hazard Mitigation Plan. We're seeking information from the public and stakeholders to better understand our vulnerabilities, as well as opportunities to reduce the impacts of hazards before they occur.

The Hazard Mitigation Plan analyzes our vulnerabilities to natural and manmade hazards and identifies proactive mitigation actions the county, towns and cities can take to minimize impacts to people, property and critical facilities.

Hazard Mitigation Plan Survey

Please take this survey by Jan. 3, 2020.

Hazard Mitigation Plan Survey



We need your input! We're seeking information from the public and stakeholders to better understand our vulnerabilities, as well as opportunities to reduce the impacts of hazards before they occur. Please take our short, five-question [Hazard Mitigation Plan Survey](#). The deadline is Friday, Jan. 3.



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Adams County Government, CO

30 mins · 🌐

We need your input! We're seeking information from the public and stakeholders to better understand our vulnerabilities, as well as opportunities to reduce the impacts of hazards before they occur. Please take our short, five question Hazard Mitigation Plan Survey: <http://www.adcogov.org/hazard-mitigation-plan>. The deadline is January 3, 2020.



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@adamscountygov

With rich tradition and history, Adams County offers the best of rural & suburban life – vibrant cities, quiet towns & miles of recreation. #AdamsCo

📍 facebook.com/adamscountygov

🔗 adcogov.org

📅 Joined May 2012



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We're seeking information to better understand our vulnerabilities, as well as opportunities to reduce the impacts of hazards before they occur. Please take our short, five question Hazard Mitigation Plan Survey: adcogov.org/hazard-mitigat.... The deadline is January 3, 2020.



10:30 AM - 9 Dec 2019

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1



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Adams County Hazard Mitigation Plan Update Public Input Survey

Help the Town of Bennett prepare for natural and human-caused hazards.

Adams County is in the process of updating its Hazard Mitigation Plan. We're seeking information from the public and stakeholders to better understand our vulnerabilities, as well as opportunities to reduce the impacts of hazards before they occur.

The Town of Bennett is asking residents to participate in a [short survey](#). The deadline to answer is Jan. 3, 2020. The purpose of this survey is to collect information from the public and stakeholders to better understand the vulnerabilities within the County as well as solicit input on needs to best mitigate, or reduce, the impacts of hazards before they occur.

[PLEASE TAKE THE SURVEY ONLINE HERE.](#)

The Hazard Mitigation Plan analyzes our vulnerabilities to natural and man-made hazards and identifies proactive mitigation actions the County, Towns and Cities can take to minimize impacts to people, property and critical facilities.



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Town of Bennett · Bennett Park and Recreation District
Bennett School District · Morgan Community College
Bennett Community Market · Jamie Zerr-Lockwood
Communities that Care

Bennett Arts Council

The goal of the Bennett Arts Council is to emphasize the cultural and creativity happening in the Town of Bennett.

Links

State Services



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Quick Links for Town Forms



Community Links



Utilities



What's New

Adams County Hazard Mitigation Plan Update Public Input Survey

Help the Town of Bennett prepare for natural and human-caused hazards.

Potential Candidate Election Informational Meeting

The Town of Bennett will have an open house and informational meeting 6:00 pm, Tuesday, December 10, 2019.

Town Hall Closed Tuesday Nov. 26, 2019. Winter Weather Advisory until 5 p.m. November 26, 2019

The Blizzard Warning issued for Bennett has been downgraded to a Winter Weather Advisory and will last until 5 p.m. Tuesday, November 26, 2019.

[view all](#)



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Town of Bennett, C...

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Town of Bennett, Colorado



Requests for Proposals



CURRENT RFP

Current and past RFP's can be found [here](#).

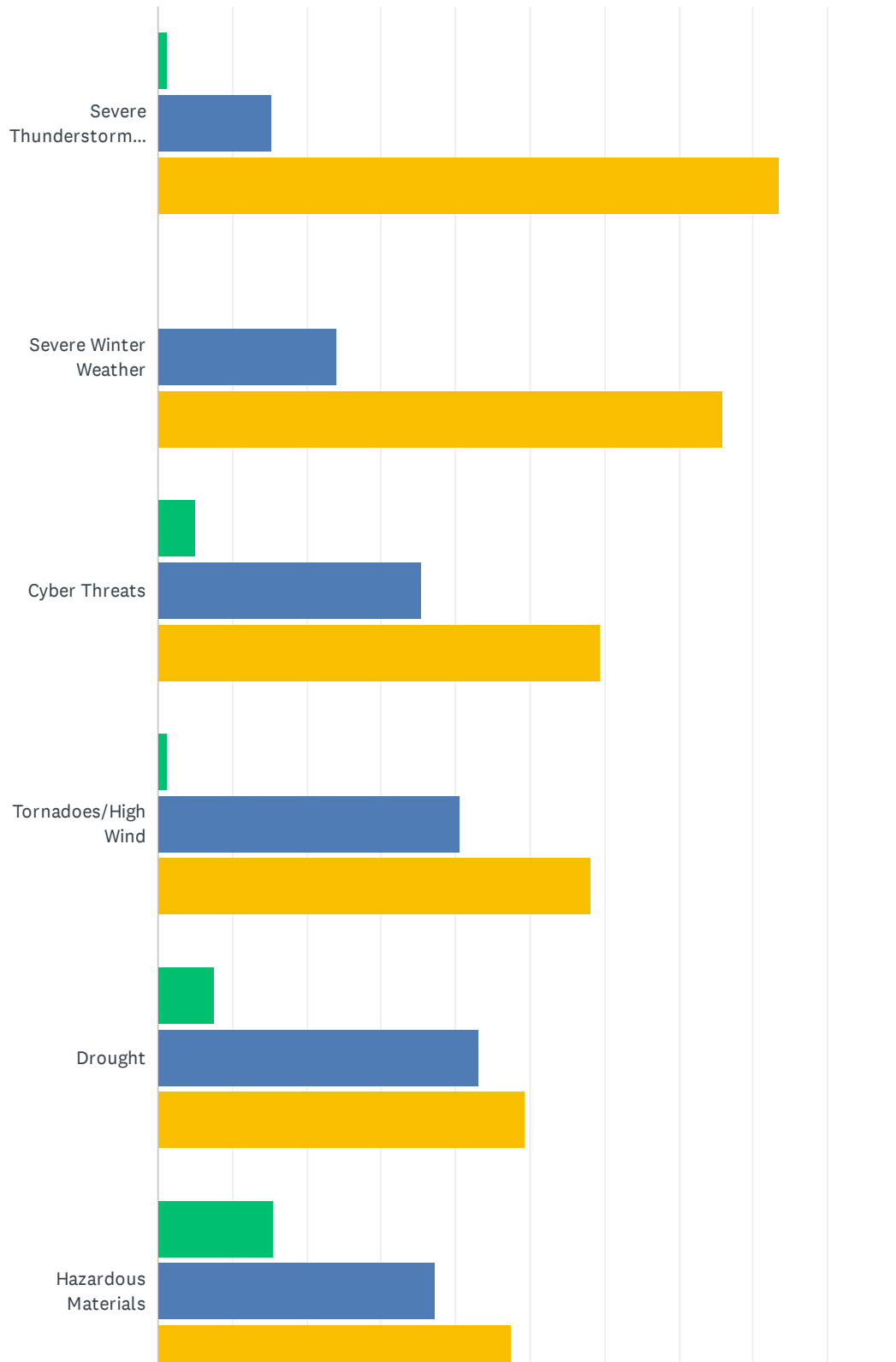
Animal Control

Lost a pet? Found a pet?

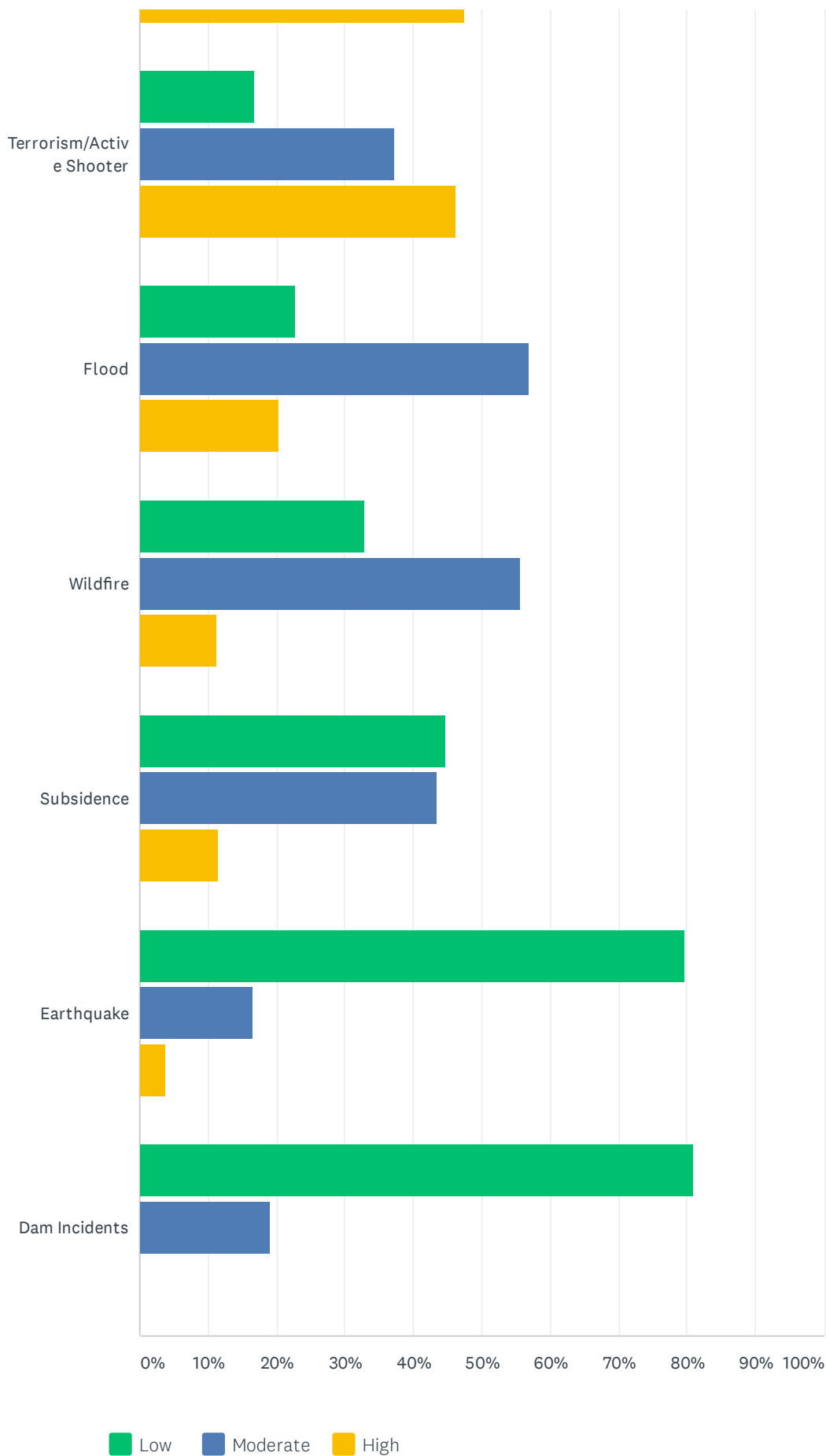
[CLICK HERE](#)

Q1 The hazards addressed in the Hazard Mitigation Plan update are listed below. Please indicate the level of significance in Adams County that you perceive for each hazard.

Answered: 79 Skipped: 0



Adams County Hazard Mitigation Plan Update Public Input Survey



Adams County Hazard Mitigation Plan Update Public Input Survey

	LOW	MODERATE	HIGH	TOTAL	WEIGHTED AVERAGE
Severe Thunderstorms (Includes: heavy rain, lighting and hail)	1.27% 1	15.19% 12	83.54% 66	79	2.82
Severe Winter Weather	0.00% 0	24.05% 19	75.95% 60	79	2.76
Cyber Threats	5.06% 4	35.44% 28	59.49% 47	79	2.54
Tornadoes/High Wind	1.27% 1	40.51% 32	58.23% 46	79	2.57
Drought	7.59% 6	43.04% 34	49.37% 39	79	2.42
Hazardous Materials	15.38% 12	37.18% 29	47.44% 37	78	2.32
Terrorism/Active Shooter	16.67% 13	37.18% 29	46.15% 36	78	2.29
Flood	22.78% 18	56.96% 45	20.25% 16	79	1.97
Wildfire	32.91% 26	55.70% 44	11.39% 9	79	1.78
Subsidence	44.87% 35	43.59% 34	11.54% 9	78	1.67
Earthquake	79.75% 63	16.46% 13	3.80% 3	79	1.24
Dam Incidents	81.01% 64	18.99% 15	0.00% 0	79	1.19

#	OTHER (PLEASE SPECIFY)	DATE
1	fracking and its impact on land, wells, people - high impact!	1/3/2020 2:15 PM
2	Bad roads	12/12/2019 9:21 AM
3	Mental health crisis	12/9/2019 11:44 PM
4	CPS taking children illegally and failure to protect by law	12/9/2019 5:18 PM
5	Oil and gas leaks from underground pipelines, water contamination and other oil and gas risks.	12/9/2019 1:17 PM
6	Solar EMP damaging electrical grid	12/9/2019 12:50 PM

Q2 Do you have information on specific hazard issues/problem areas that you would like the planning committee to consider? Note the jurisdiction to which it applies:

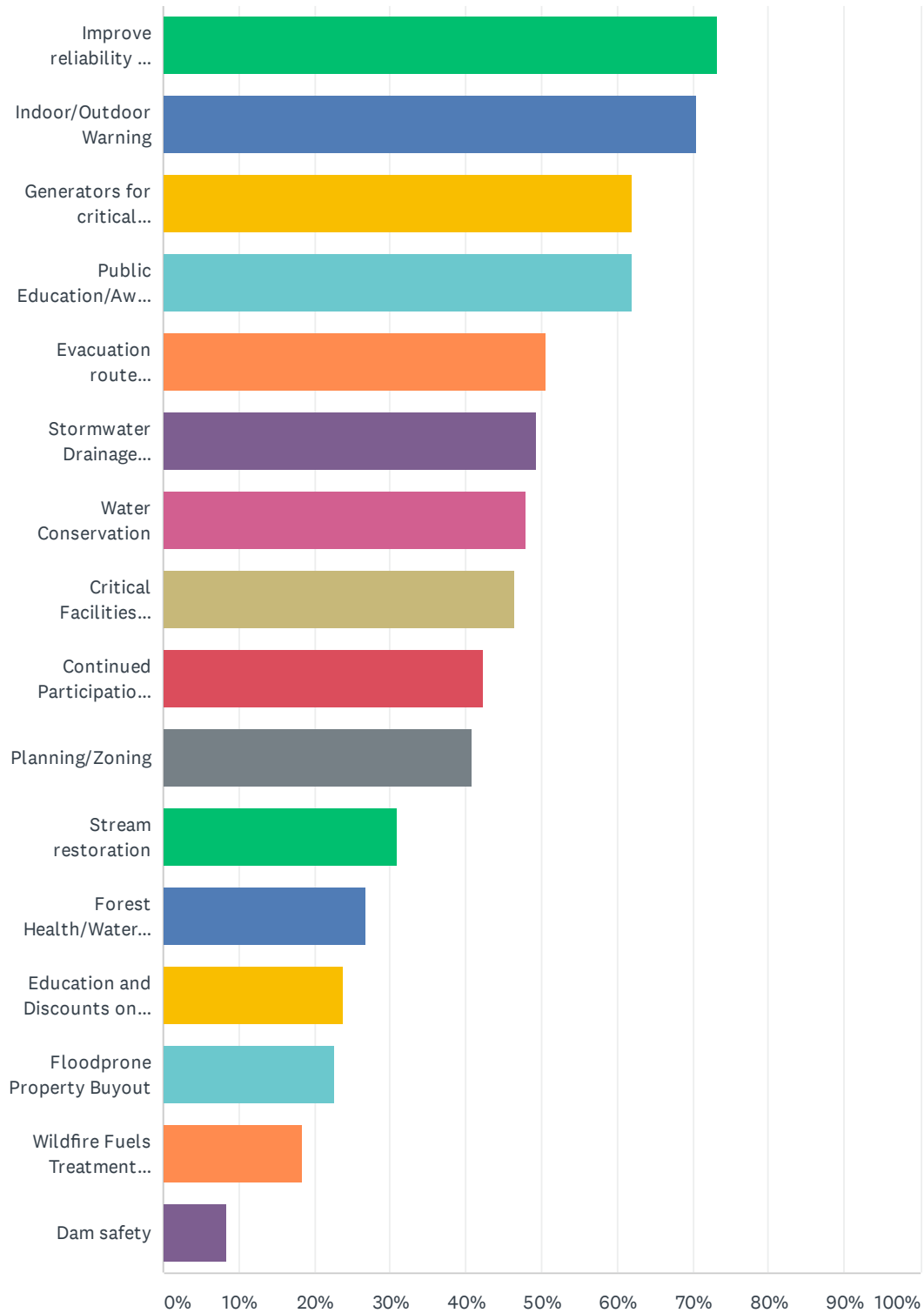
Answered: 21 Skipped: 58

#	RESPONSES	DATE
1	W 84th Ave floods a lot during rain storms, possibly due to how hilly it is? The water rushes and pools on the roads.	1/2/2020 5:01 PM
2	Mo	12/17/2019 4:11 PM
3	Suncor issues and plants in commerce city	12/17/2019 3:05 PM
4	None	12/12/2019 9:26 AM
5	Roads so bad sometimes impassable for emergency services	12/12/2019 9:21 AM
6	Gang and Organized Crime	12/10/2019 9:45 AM
7	I was shocked to learn that Adams County is at the top in the state for tornados, and we have no sirens.	12/10/2019 9:34 AM
8	No	12/10/2019 8:51 AM
9	No	12/9/2019 9:54 PM
10	Major freeways such as I-25 for chemical hazards	12/9/2019 9:04 PM
11	Tornado sirens can barely be heard in Thornton	12/9/2019 8:48 PM
12	N/A	12/9/2019 6:49 PM
13	No	12/9/2019 4:56 PM
14	Tornado sirens in Strasburg	12/9/2019 4:55 PM
15	No	12/9/2019 4:11 PM
16	Homeless encampments near Platte containing biohazardous such as human waste, needles and garbage	12/9/2019 4:06 PM
17	Oil and Gas be so close to highly populated areas.	12/9/2019 1:53 PM
18	Not yet	12/9/2019 1:17 PM
19	Read on Solar EMP's and Carrington Effect.	12/9/2019 12:50 PM
20	Railroad train accidents and semi trucks	12/9/2019 12:35 PM
21	Flooding is the city view neighborhood during sever storms	12/9/2019 11:41 AM

Q3 Mitigation is defined as actions that can be taken to reduce or eliminate the long-term risk to hazards, prior to an event occurring. The following types of mitigation actions may be considered in Adams County. Please indicate the types of mitigation actions that you think should have the highest priority in the Adams County Hazard Mitigation Plan.

Answered: 71 Skipped: 8

Adams County Hazard Mitigation Plan Update Public Input Survey



Adams County Hazard Mitigation Plan Update Public Input Survey

ANSWER CHOICES	RESPONSES	
Improve reliability of communications systems	73.24%	52
Indoor/Outdoor Warning	70.42%	50
Generators for critical facilities	61.97%	44
Public Education/Awareness	61.97%	44
Evacuation route development	50.70%	36
Stormwater Drainage Improvements	49.30%	35
Water Conservation	47.89%	34
Critical Facilities Protection	46.48%	33
Continued Participation in the National Flood Insurance Program	42.25%	30
Planning/Zoning	40.85%	29
Stream restoration	30.99%	22
Forest Health/Watershed Protection	26.76%	19
Education and Discounts on Flood Insurance	23.94%	17
Floodprone Property Buyout	22.54%	16
Wildfire Fuels Treatment projects	18.31%	13
Dam safety	8.45%	6
Total Respondents: 71		

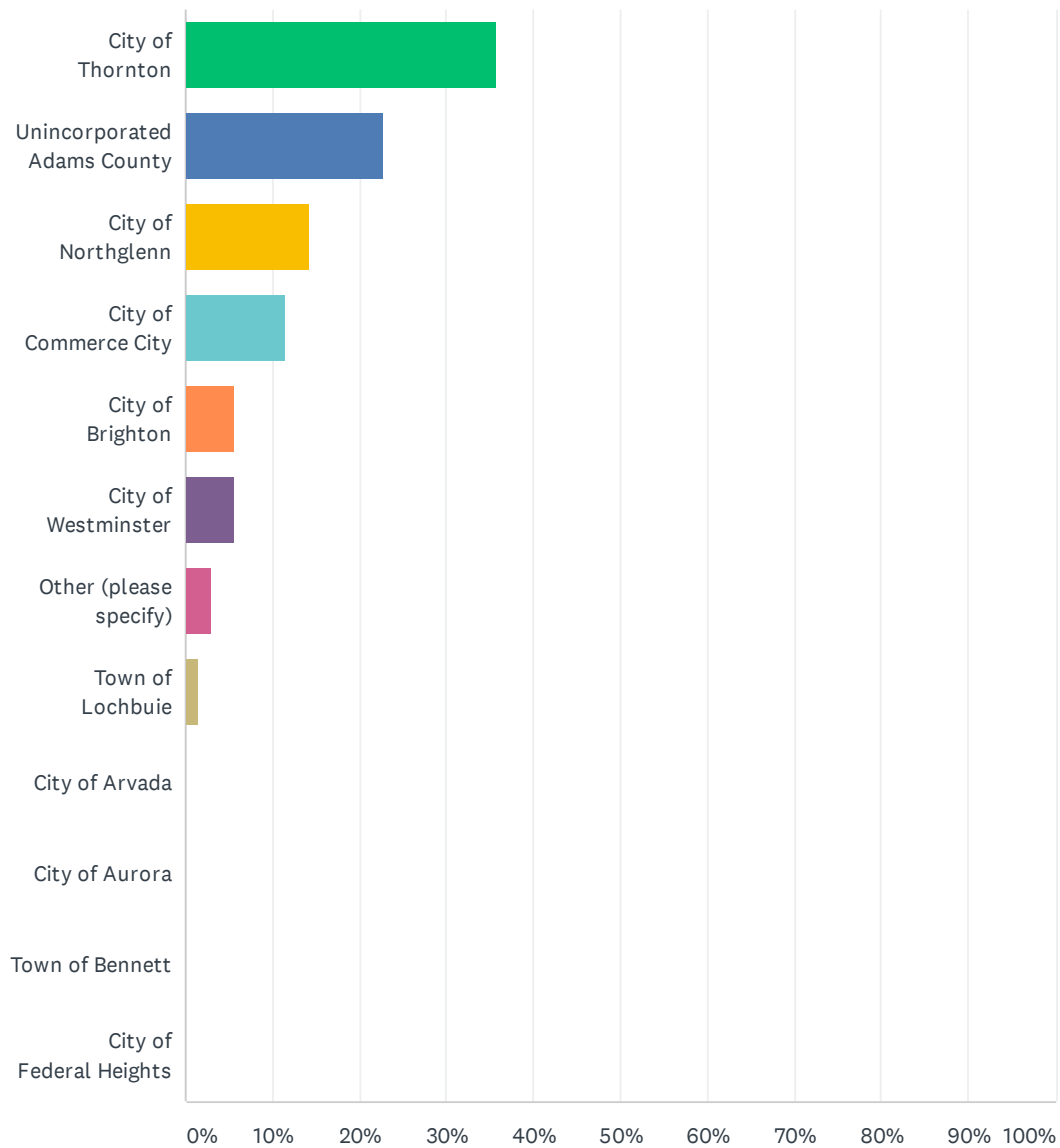
Q4 Please comment on any other pre-disaster mitigation actions that the planning committee should consider for reducing future losses caused by natural disasters:

Answered: 8 Skipped: 71

#	RESPONSES	DATE
1	Not having day to day law enforcement ems fire encrypted. The public can hear warnings quicker and better informed	12/17/2019 3:07 PM
2	Landscaped road medians and road sides in Thornton are notorious for irrigation systems that are broken and wasteccwater all over the roads. That seems like an easy target for water conservation. It's shocking..	12/10/2019 9:39 AM
3	Strong cybersecurity defense against ransomware	12/10/2019 6:07 AM
4	Another Dam downstream in the Platt.	12/9/2019 8:38 PM
5	I'm curious about hazardous materials. Maybe I'm not educated enough on the topic, but for having so many railways and farm land around I feel like the preparedness plan in the case of a spill should be better communicated.	12/9/2019 8:04 PM
6	N/A	12/9/2019 6:50 PM
7	Radon mitigation discounts	12/9/2019 4:56 PM
8	Only know specifically river run(west) subdivision needs one or two emergency routes to evacuate if a hazardous accident happens on the train tracks or hwy 85. It can be a dangerous situation if evacuation is necessary.	12/9/2019 12:40 PM

Q5 Indicate the community you live in

Answered: 70 Skipped: 9



Adams County Hazard Mitigation Plan Update Public Input Survey

ANSWER CHOICES	RESPONSES	
City of Thornton	35.71%	25
Unincorporated Adams County	22.86%	16
City of Northglenn	14.29%	10
City of Commerce City	11.43%	8
City of Brighton	5.71%	4
City of Westminster	5.71%	4
Other (please specify)	2.86%	2
Town of Lochbuie	1.43%	1
City of Arvada	0.00%	0
City of Aurora	0.00%	0
Town of Bennett	0.00%	0
City of Federal Heights	0.00%	0
TOTAL		70

#	OTHER (PLEASE SPECIFY)	DATE
1	Work in all but live elsewhere	12/10/2019 4:39 AM
2	Strasburg	12/9/2019 4:56 PM

Carr, Amy

From: Ronald Sigman <RSigman@adcogov.org>
Sent: Tuesday, December 17, 2019 4:36 PM
To: Field, Scott
Cc: Carr, Amy
Subject: Re: Neighboring counties

I have sent invites to all neighboring jurisdictions and county municipal agencies for all of our meetings. Thornton has attended and I've had a few others accept but not show up.

From: Field, Scott <scott.field@woodplc.com>
Sent: Tuesday, December 17, 2019 4:30:54 PM
To: Ronald Sigman <RSigman@adcogov.org>
Cc: Carr, Amy <amy.carr@woodplc.com>
Subject: Neighboring counties

Please be cautious: This email was sent from outside Adams County

Ron,
One thing I forgot to talk to you about last week is there's a FEMA requirement to invite/involve the neighboring jurisdictions in the planning process. Typically this just means inviting the EMs of the surrounding counties to review the draft. But it's also not a bad idea to send them a notice earlier in the process just to give them a heads up that there is a process. Maybe something along these lines:

This email is to advise you that Adams County has started the process of updating our Hazard Mitigation Plan to meet the requirements of the Disaster Mitigation Act of 2000 (DMA 2000). The County Office of Emergency Management is taking the lead on the project in coordination with the Hazard Mitigation Planning Committee (HMPC) comprised of various County departments and other stakeholders. Professional planning assistance is being provided by Wood Environment & Infrastructure Solutions, Inc.

As a neighboring jurisdiction, you are an important stakeholder in this process and we welcome your input! If you would like to be invited to HMPC meetings, please let me know and we will add you to our list. We will also be sending you a copy of the draft plan for your review and comment when it is ready. If you have any other comments or information you would like to share, please feel free to contact me by phone or email.

W. Scott Field, CEM
Senior Emergency Management Specialist
Wood Environment & Infrastructure Solutions, Inc
Hazard Mitigation and Emergency Management Program
2000 South Colorado Blvd, Suite 2-1000, Denver, CO, 80222
Office: 303-742-5320
Mobile: 720-569-9266
scott.field@woodplc.com
www.woodplc.com

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From: Ronald Sigman
To: Alisha Reis; Carr, Amy; Andres M. Carrera; blenderi@auroragov.org; Brandy Foley; Brian Dearth; Byron Fanning; Chris Kline; Chris Laws; christopher.hudak@state.co.us; cmcmahill@suncor.com; Cory Stark; Crystal Elliott; Dave Skuodas; David Rausch; Debbie Haines; dross@sacfd.org; earlcumley@bennettfirerescue.org; ejanes@arvada.org; Gabe Rodriguez; gkgrove@co.jefferson.co.us; gordie.olson@cityofthornton.net; Greg Baca; Greg Labrie; Greg Moser; Heidi M. Miller; Juliana J. Archuleta; Julie.Beyers@state.co.us; Ken Musso; Kirk Dominic; kstewart@udfcd.org; Kurt Carlson; Kylin Mueller; Linda Hawkins; Lisa Culpepper; logan sand; Libby Tart; markw.thompson@state.co.us; marta.blancocastano@woodplc.com; Martin.Postma@cityofthornton.net; Michael Bean; Mike Holub; mnichols@adcom911.org; mschuman@acfpd.org; Paolo Diaz; Ray Gonzales; Rebecca Zamora; Rebecca.franco@denverwater.org; Ron Osgood; Ronald Sigman; Ross Riley; Ryan Doyle; RYoung@crgov.com; Sandra K. Dean; Field, Scott; solomon.rich@sablealturafire.org; Stephanie Caulk; Stephanie Hackett; Steve O'Dorisio; tbeach@seweldfire.org; Thomas Swingle; TPatterson@acfpd.org; Wayne Belohlavy; gscheidt@bennett.co.us; Matt Rivera; Jim Siedlecki
Cc:
Subject: Draft Hazard Mitigation Plan to be posted for public review
Date: Wednesday, June 10, 2020 10:32:55 AM

CAUTION: External email. Please do not click on links/attachments unless you know the content is genuine and safe.

Good Morning,

I just wanted everyone to know that our draft Hazard Mitigation Plan is ready to be posted on our County webpage for public review. This is one of the final steps before we seek plan approval. I will be working with our Communications Dept to get it posted and it will probably be available for about two weeks.

You may review the draft at

https://drive.google.com/drive/folders/13tOrDluUPKQC9aIWL_IXNvJQsdD8LLJt?usp=sharing

There will also be a short public feedback collector posted with the plan

https://bit.ly/Adams_HMP_Public_Feedback_Survey

Thank You,

Ron Sigman, CO-CEM

Emergency Manager, *Office of Emergency Management*

ADAMS COUNTY, COLORADO

4430 South Adams County Parkway, 1st Floor, Suite C1900

Brighton, CO 80601

o: 720.523.6601 m: 720.988.4148 | rsigman@adcogov.org

www.adcogov.org



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2020 HAZARD MITIGATION PLAN DRAFT FOR PUBLIC REVIEW AND COMMENT

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- [July 2019](#)

Posted on: June 11, 2020

Adams County has developed an update to its 2015 Hazard Mitigation Plan in compliance with the Disaster Mitigation Act of 2000. The updated 2020 Hazard Mitigation Plan Draft is now available for public review and comment before it is finalized.

View the draft and the public comment page:

- [Adams County Mitigation Plan - Public Review Draft](#)
- [Feedback Survey for Adams County Mitigation Plan Update](#)

Adams County Hazard Mitigation Plan

Public Review Draft

May 2020

Adams County, Colorado

Feedback Survey for Adams County Hazard Mitigation Plan Update

2

Responses

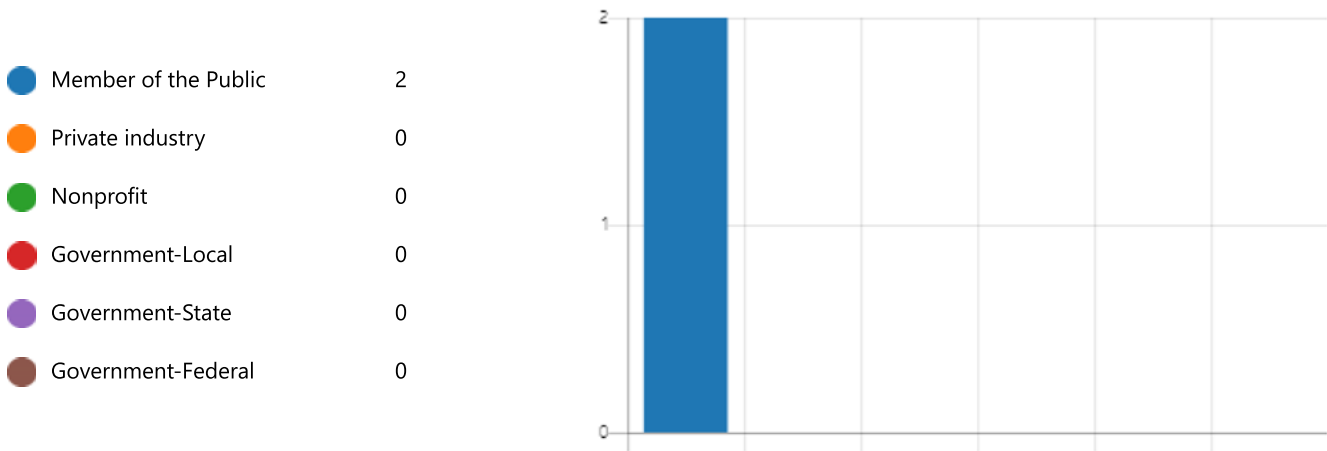
00:44

Average time to complete

Closed

Status

1. Select affiliation (select one):



2. Please provide comments regarding the Draft Update of the Adams County Hazard Mitigation Plan here:

1

Responses

Latest Responses

"Jrydzeski@msn.com"

3. Please provide your contact information (Name and email address)

0

Responses

Latest Responses

Adams County Planning Team Roster

LAST NAME	FIRST NAME	ORGANIZATION	ROLE	EMAIL	OFFICE PHONE	CELL PHONE	Invited to Participate?
Sigman	Ron	ADCO OEM	Emergency Manager	rsigman@adcogov.org	720-523-6601	720-988-4148	Y
Field	Scott	Wood E&IS	Consultant	scott.field@woodplc.com	303-742-5320	720-569-9266	Y
Carr	Amy	Wood E&IS	Consultant	amy.carr@woodplc.com	303-630-0796		Y
Blanco Castano	Marta	Wood E&IS	Consultant	marta.blancocastano@woodplc.com	303-630-0768		Y
Bean	Michael	ADCO OEM	EM Coordinator	mbean@adcogov.org	720-523-6602	720-548-8165	Y
Tart-Schoenfelder	Libby	ADCO - CED	Long-range Planner	LTart-Schoenfelder@adcogov.org	720-523-6858		y
Scheidt	Gerilynn	Town of Bennett	Public Works	gscheidt@bennett.co.us	(303) 644-3249 ext 1004		y
Miller	Heidi	ADCO CMO	County Attorney	HMiller@adcogov.org	720-523-6329		y
Culpepper	Lisa	ADCO Treasurer	Treasurer's office	LCulpepper@adcogov.org	720-523-6162		y
Forsman	Karson	ADCO Communications	Communications Specialist	KForsman@adcogov.org	720-523-6786		Y
Foley	Brandy	ADCO Public Works	Stormwater Inspector	BFoley@adcogov.org			y
Janes	Enessa	Arvada OEM	EM Coordinator	ejanes@arvada.org			Y
Fanning	Byron	ADCO Parks	Director	BFanning@adcogov.org	303-637-8006		y
Zygielbaum	Josh	ADCO Clerk & Recorder	Clerk & Recorder	JZygielbaum@adcogov.org			y
Musso	Ken	ADCO Assessor	County Assessor	KMusso@adcogov.org	720-523-6125		y
Dearth	Brian	ADCO CMO	Comm Specialist	BDearth@adcogov.org	720-523-6281		y
Schuman	Mark	ADCO Fire	Chief - Training	mschuman@acfpd.org			y
Rausch	David	ADCO Public Works	Infrastructure & Stormwater	DRausch@adcogov.org	720-523-6840		y
Ross	Derek	S. Adams Fire		dross@sacfd.org			y
Solomon	Rich	Sable Altura Fire	Chief	solomon.rich@sablealturafire.org			y
Doyle	Ryan	Thornton OEM	Emergency Manager	Ryan.Doyle@cityofthornton.net			y
Patterson	Troy	Adams County Fire	Chief	TPatterson@acfpd.org			y
Postma	Martin	City of Thornton	Long-range Planner	Martin.Postma@cityofthornton.net	303-538-7631		y
Archuleta	Juliana	ADCO Public Works	Stormwater	MJArchuleta@adcogov.org	720-523-6869		y
Mueller	Kylin	ADCO CMO	Management Analyst	KM Mueller@adcogov.org	720-523-6864		y
Lenderink	Brandon	Aurora OEM	Coordinator	blenderi@auroragov.org			y
O'Dorisio	Steve	ADCO Commissioner	Commissioner	SODorisio@adcogov.org	720-523-6100		y
Rodriguez	Gabe	ADCO CMO	Cultural Affairs Liaison	GRodriguez@adcogov.org	720-523-6846		y
Beach	Tom	SE Weld Fire	Chief	tbeach@seweldfire.org			y
Reis	Alisha	ADCO CMO	Dep. County Manager	AReis@adcogov.org	720-523-6293		y
Young	Rick		Adams County DA	RYoung@crgov.com			y
Hackett	Stephanie	Brighton OEM	Emergency Manager	shackett@brightonco.gov			y
Dean	Sandra	ADCO Treasurer	Treasurer's Office	SDean@adcogov.org			y
Chabra	Aman						y
Appleberry	Sheronda	ADCO Coroner	Coroner's Office	coronerquestions@adcogov.org	303-655-3533		y
Gonzales	Raymond	ADCO CMO	County Manager	RGonzales@adcogov.org	720-523-6829		y
Ostler	Bryan	ADCO CMO	Dep. County Manager	BOstler@adcogov.org	720-523-6792		y

Adams County Planning Team Roster

Kline	Chris	ADCO CMO	Dep. County Manager	CKline@adcogov.org	720-523-6188		y
Holub	Mike	ADCO Facilities	Director	MHolub@adcogov.org	720-523-6004		y
Dominic	Kirk	Commerce City OEM	Emergency Manager	kdominic@c3gov.com			y
Laws	Chris	ADCO Sheriff's Office	Commander	CLaws@adcogov.org			y
Gallamore	L.						y
Thompson	Mark	DHSEM	Mitigation Planner	markw.thompson@state.co.us			y
Bodane	Mark	Brighton Fire	Chief	mbodane@brightonfire.org			y
Askenazi	Michelle	Tri-County Health	Manager	maskenazi@tchd.org			y
Belohlavy	Wayne	North Metro Fire	LEPC co-chair	wbelohlavy@northmetrofire.org			y
Olson	Gordie	City of Thornton Fire	Chief	gordie.olson@cityofthornton.net			y
Baca	Greg	ADCO GIS	GIS Manager	GBaca@adcogov.org	720-523-6144		y
Nichols	Martha	ADCOM 911	Communications Specialist	mnichols@adcom911.org			y
Hawkins	Linda	ADCO CMO	Digital Media Specialist	LHawkins@adcogov.org	720-523-6104		y
Haines	Debbie	ADCO Retirement	Executive Director	DHaines@adcogov.org	720-523-6289		y
Hodge	Mary	ADCO Commissioner	Commissioner	MHodge@adcogov.org	720-523-6100		y
Bennett	Carrigan	Aurora OEM	Coordinator	cbbennet@auroragov.org			y
Diaz	Paulo	ADCO Poverty Reduction	Manager	PDiaz@adcogov.org	720-523-6815		y
Swingle	Thomas	ADCO Assessor	Appraisal Manager	TSwingle@adcogov.org	720-523-6732		y
Grove	Glenn	Adams/Jeffco Hazmat	LEPC Chair	gkgrove@co.jefferson.co.us			y
Reigenborn	Rick	ADCO Sheriff's Office	County Sheriff	RReigenborn@adcogov.org			Y
Moser	Greg	Westminster OEM	Emergency Manager	gmoser@cityofwestminster.us	303-653-4550		Y
Chapman	Matt	Aurora OEM	Emergency Manager	mchapman@auroragov.org			Y
Sullivan	Kristin	ADCO Public Works	Director Public Works	KSullivan@adcogov.org			Y
Elliot	Crystal	ADCO Poverty Reduction	Census Liaison	CElliott@adcogov.org	720-523-6816		Y
McMahill	Christopher	SunCor Fire	Chief	cmcmahill@suncor.com			Y
Stark	Cory	DHSEM	RFM-NCR	cory.stark@state.co.us			Y
Cumley	Earl	Bennett Fire	Chief	earlcumley@bennettfirerescue.org			Y
Osgood	Ron	Northglenn PD	Commander	rosgood@northglenn.org			y
Covey	Herb	ADCO Human Services	Dep Director	hcovey@adcogov.org			y
Hudak	Christopher	DHSEM	Mitigation Planner	christopher.hudak@state.co.us	303-877-8313		y
Beyers	Julie	DHSEM	Mitigation Planner	Julie.Beyers@state.co.us	720-454-6483		y
Zamora	Rebecca	ADCO CSWB	ADCO CMO-liaison	rzamora@adcogov.org	720-523-6991		Y
Dahlman	Ben	ADCO Finance	Director	bdahlman@adcogov.org	720-523-6280		y
Riley	Ross	North Metro Fire	Chief	rriley@northmetrofire.org	303-252-3500		y

APPENDIX B: HMPC MEMBERS

Department/Agency	Title	Name	Participating Jurisdiction	Stakeholder	Meetings ¹ Attended
Adams County					
Office of Emergency Management ²	Emergency Manager	Ron Sigman	X		Kickoff; Mtg#2; Mtg#3; 1/23/20; Mtg#4
Office of Emergency Management ²	Emergency Management Coordinator	Michael Bean	X		Kickoff; Mtg#2; Mtg#3; Mtg#4
Community & Economic Development ^{2,3}	Long-Range Planner	Libby Tart-Schoenfelder	X		Kickoff; Mtg #2; Mtg#3
Assessor	County Assessor	Ken Musso	X		Kickoff
Assessor	Appraisal Manager	Thomas Swingle	X		Kickoff; Mtg#2
County Managers Office ^{2,3}	Management Analyst	Kylin Mueller	X		Kickoff; Mtg#2
County Managers Office ^{2,3}	Dep. County Manager	Alisha Reis	X		Kickoff; Mtg#2
County Managers Office ^{2,3}	Neighborhood Liaison	Rebecca Zamora	X		Kickoff
County Managers Office ^{2,3}	Poverty Reduction and Neighborhood Outreach	Paolo Diaz	X		Mtg#2
Communications ²	Communication Specialist	Karson Forsman	X		
Coroner's Office	Chief Deputy Coroner	Sheronda Appleberry	X		Kickoff
Facilities & Fleet Management ²	Director	Mike Holub	X		Mtg#4
Finance ²	Director	Benjamin Dahlman	X		Kickoff
Information Technology & Innovation ²	GIS Manager	Greg Bacca	X		Kickoff; Mtg #3; Mtg #4
Parks, Open Space, and Cultural Arts ^{2,3}	Director	Byron Fanning	X		Kickoff
Parks, Open Space, and Cultural Arts ^{2,3}	Parks Manager	Kurt Carlson	X		Mtg#2; Mtg#4
Public Works ²	Infrastructure & Stormwater Manager	David Rausch	X		Kickoff; Mtg #2; Mtg #3; Mtg #4
Public Works ²	Stormwater Inspector	Brandy Foley	X		

¹ Those that are not listed as attending a meeting participated in the planning process in other ways such as emails, phone calls and face-to-face meetings with the County Project Manager and consultants.

² Local or Regional Agency involved in hazard mitigation activities.

³ Agency with authority to regulate development.

Department/Agency	Title	Name	Participating Jurisdiction	Stakeholder	Meetings ¹ Attended
Public Works ²	Stormwater Inspector	Juliana Archuleta	X		
Adams Fire Protection District ²	Chief-Training	Mark Schuman	X		Mtg#2;Mtg#4
Adams Fire Protection District ²	Chief	Troy Patterson	X		
Board of County Commissioners ^{2,3}	County Commissioner – District 4	Steve O'Dorisio	X		Mtg#4
Town of Bennett					
Public Works ²	Town Safety Officer	Gerilynn Scheidt	X		Kickoff; Mtg#2; Mtg#3; 1/23/20; Mtg#4
Public Works ²	Town Engineer	Dan Giroux	X		1/23/20
Public Works ²	Utilities Supervisor	Ricky Martinez	X		1/23/20
Community Development ^{2,3}	Manager	Deb Merkle	X		1/23/20
Bennett Fire Rescue ²	Chief	Earl Cumley	X		
City of Brighton					
Brighton Office of Emergency Management ²	Emergency Management Coordinator	Norman Brown	X		Mtg#2
Brighton Office of Emergency Management ²	Emergency Manager	Stephanie Hackett	X		Mtg#3
Brighton Fire ²	Chief	Mark Bodane	X		
City of Commerce City					
Office of Emergency Management ²	Emergency Manager	Kirk Dominic	X		Mtg#2;Mtg#3
Denver Water					
Administrative Services ²	Manager of Emergency Management	Rebecca Franco	X		Mtg#2; Mtg#4
Administrative Services ²	Emergency Management Specialist	Lisa Ciazza	X		Mtg#3
Stakeholders					
Southeast Weld Fire Protection District ²	Chief	Tom Beach		X	
Adams/Jeffco HazMat ²	LEPC Chair	Glenn Grove		X	
North Metro Fire Protection District ²	LEPC co-chair	Wayne Belohlavy		X	Mtg#2
North Metro Fire Protection District ²	Chief	Ross Riley		X	
City of Thornton ^{2,3}	Long-Range Planner	Martin Postma		X	Kickoff; Mtg#2; Mtg#3



Department/Agency	Title	Name	Participating Jurisdiction	Stakeholder	Meetings ¹ Attended
City of Thornton ²	Emergency Manager	Ryan Doyle		X	
City of Thornton ²	Fire Chief	Gordie Olson		X	
City of Westminster ²	Emergency Manager	Greg Moser		X	Kickoff; Mtg#4
City of Aurora ²	Emergency Management Coordinator	Brandon Lenderink		X	
City of Aurora ²	Emergency Management Coordinator	Carrigan Bennett		X	
City of Aurora ²	Emergency Manager	Matt Chapman		X	
Tri-County Health ²	Emergency Preparedness Planner	Matt Newman		X	Mtg#2; Mtg#3
Tri-County Health ²	Emergency Preparedness Coordinator	Sara Garrington		X	Mtg#4
Northglenn Police Department ²	Commander	Ron Osgood		X	Mtg#3
Mile High Flood District ^{2,3}	Watershed Manager	Dave Skudoas		X	Mtg#2
Mile High Flood District ^{2,3}	Planning Intern	Stephanie Caulk		X	Mtg#2
Mile High Flood District ^{2,3}	Program Manager, Flood Warning and Information Services	Kevin Stewart		X	Mtg#3; Mtg#4
City of Arvada Office of Emergency Management ²	Emergency Management Coordinator	Enessa Janes		X	
South Adams Fire Protection District ²	Battalion Chief	Derek Ross		X	
Sable Altura Fire ²	Chief	Rich Solomon		X	
Suncor Energy	Fire Chief	Christopher McMahill		X	
Colorado Department of Homeland Security and Emergency Management (DHSEM)	Mitigation Planning	Mark Thompson		X	Kickoff; Mtg#3; Mtg#4
DHSEM	Mitigation Planning	Christopher Hudak		X	Kickoff
DHSEM	Mitigation Planning	Julie Beyers		X	Kickoff
FEMA Region VIII	Community Planner	Logan Sand		X	Mtg#2
Wood Environment and Infrastructure Solutions, Inc. Planning Team					



Department/Agency	Title	Name	Participating Jurisdiction	Stakeholder	Meetings ¹ Attended
Wood	Project Manager	Scott Field			
Wood	Hazard Mitigation Planner	Amy Carr			
Wood	Hazard Mitigation Planner	Abby Moore			





APPENDIX C: PLAN ADOPTION

Note: The records of adoption will be incorporated as an electronic appendix. When the plan is adopted in 2020, the jurisdictions and adoption date will be noted here, but scanned versions of all adoption resolutions will be kept on file with Adams County Emergency Management. A sample adoption resolution is provided here.

Hazard Mitigation Plan Adoption Sample Resolution

Resolution # _____

**Adopting the Adams County
Hazard Mitigation Plan 2020**

Whereas, (name of county or community) recognizes the threat that natural hazards pose to people and property within our community; and

Whereas, undertaking hazard mitigation actions will reduce the potential for harm to people and property from future hazard occurrences; and

Whereas, an adopted Multi-Jurisdictional Hazard Mitigation Plan is required as a condition of future funding for mitigation projects under multiple FEMA pre- and post-disaster mitigation grant programs; and

Whereas, (name of county or community) resides within the Planning Area, and fully participated in the mitigation planning process to prepare this Hazard Mitigation Plan; and

Whereas, the Colorado Department of Homeland Security and Emergency Management and Federal Emergency Management Agency, Region VIII officials have reviewed the Adams County Hazard Mitigation Plan and approved it contingent upon this official adoption of the participating governing body; and

Now, therefore, be it resolved, that the (name of board or council), hereby adopts the Adams County Hazard Mitigation Plan, as an official plan; and

Be it further resolved, Adams County Emergency Management will submit this Adoption Resolution to the Colorado Department of Homeland Security and Emergency Management and Federal Emergency Management Agency, Region VIII officials to enable the Plan's final approval.

Passed: (date)

Certifying Official

Adams County Hazard Mitigation Plan 2020 Update New Mitigation Action Worksheet

Use this sheet to record new potential mitigation projects (1 form per project) identified during the planning process. Provide as much detail as possible and use additional pages as necessary. Complete and return to Amy Carr by **January 31, 2020**.

Mitigation Action/Project Title	Sheltering Equipment - upgrades - <i>Generators</i>
Hazard(s) Mitigated	Weather extremes, severe winter storm, severe tornado, high wind
Priority (High, Medium, Low)	
Project Description, Issue/Background	Outfit major shelters with designated as storm/or extreme weathering shelters with back-up generators.
Responsible Office/ Agency and partners	Adams City Union Partners (Housing Authority), Office of Emergency Mgmt (Adams City)
Timeline for Completion	1-2 yrs
Cost Estimate	unknown - dependant on # of shelters, etc
Benefits (Avoided Losses)	→ power losses, → need for increased power for power outages

Prepared by: Lisa Ciarra
 Jurisdiction: Power Water
 Title/Dept: EM Specialist
 Phone: 720-339-7457
 Email: lisa.ciarra@denverwater.org

Please return worksheets by email to:
 Amy Carr
 amy.carr@woodplc.com
 Phone: 303-630-0796

Adams County Hazard Mitigation Plan 2020 Update New Mitigation Action Worksheet

Use this sheet to record new potential mitigation projects (1 form per project) identified during the planning process. Provide as much detail as possible and use additional pages as necessary. Complete and return to Amy Carr by **January 31, 2020**.

Mitigation Action/Project Title	Dam Safety Alerting System
Hazard(s) Mitigated	Flooding Consequences
Priority (High, Medium, Low)	Med
Project Description, Issue/Background	Inventory of High Hazard Dams Status of " " " Rainfall thresholds to fill/spill. Process to notify ^{warning} decision makers Coordination w/ internal/external agencies (Fed/State/Regional)
Responsible Office/ Agency and partners	TBD Partner: MHFD
Timeline for Completion	2023
Cost Estimate	Est \$50k
Benefits (Avoided Losses)	Floodproofing measures implemented losses Life safety, Community Awareness elevated

Prepared by: Kevin Stewart
 Jurisdiction: MHFD (support agency)
 Title/Dept: Engineering Services Mgr / Flood Warning
 Phone: 303-455-6277
 Email: kstewart@mhfd.org a Info Services

Please return worksheets by email to:
 Amy Carr
 amy.carr@woodplc.com
 Phone: 303-630-0796

Adams County Hazard Mitigation Plan 2020 Update New Mitigation Action Worksheet

Use this sheet to record new potential mitigation projects (1 form per project) identified during the planning process. Provide as much detail as possible and use additional pages as necessary. Complete and return to Amy Carr by **January 31, 2020**.

Mitigation Action/Project Title	Public/Emergency Shelter Generator For Eagle View Adult Center
Hazard(s) Mitigated	multiple severe winter weather Severe Thunderstorms Tornado/High winds
Priority (High, Medium, Low)	High
Project Description, Issue/Background	main shelter location for the city does not have a generator nor is the building wired to accept a generator
Responsible Office/ Agency and partners	City of Brighton / oem / Parks & Rec.
Timeline for Completion	5-10 yrs.
Cost Estimate	\$250,000 - \$300,000 (construction, wiring, generator)
Benefits (Avoided Losses)	Ability to safely shelter residents during power loss

Prepared by: Stephanie Hackett
 Jurisdiction: City of Brighton/Brighton
 Title/Dept: em coordinator Fire
 Phone: 720-288-1008
 Email: shackett@brightonco.gov

Please return worksheets by email to:
 Amy Carr
 amy.carr@woodplc.com
 Phone: 303-630-0796

Adams County Hazard Mitigation Plan 2020 Update New Mitigation Action Worksheet

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Mitigation Action/Project Title	
Hazard(s) Mitigated	Extreme heat events.
Priority (High, Medium, Low)	
Project Description, Issue/Background	Develop an extreme heat plan that incorporates: → pre-identified cooling stations → increase awareness of public through outreach. → identify → identifies most vulnerable communities.
Responsible Office/ Agency and partners	Adams County
Timeline for Completion	
Cost Estimate	minimal
Benefits (Avoided Losses)	lives.

Prepared by: _____
 Jurisdiction: _____
 Title/Dept: _____
 Phone: _____
 Email: _____

Please return worksheets by email to:
 Amy Carr
 amy.carr@woodplc.com
 Phone: 303-630-0796

Adams County Hazard Mitigation Plan 2020 Update New Mitigation Action Worksheet

Use this sheet to record new potential mitigation projects (1 form per project) identified during the planning process. Provide as much detail as possible and use additional pages as necessary. Complete and return to Amy Carr by **January 31, 2020**.

Mitigation Action/Project Title	Limit development around floodplain/ways
Hazard(s) Mitigated	flooding, weather event concerns storming w/ flooding
Priority (High, Medium, Low)	High
Project Description, Issue/Background	provide zoning and future land use guidance to map vulnerable areas and create a toolkit to assist owners/developers and educate on development concerns to particular areas or ways to mitigate existing concerns acquire land for conservation
Responsible Office/ Agency and partners	Jurisdictions / FEMA / Flood Control District
Timeline for Completion	Ongoing — ID by 2023-25 (zoning code update possible for ADCC)
Cost Estimate	
Benefits (Avoided Losses)	acquisition of vulnerable properties by county to prevent development

Prepared by: Libby Tart
 Jurisdiction: Adams
 Title/Dept: Sr. Long Range Planner/CEDD
 Phone: 7-523-6858
 Email: Hart@adco.gov.org

Please return worksheets by email to:
 Amy Carr
 amy.carr@woodplc.com
 Phone: 303-630-0796

Adams County Hazard Mitigation Plan 2020 Update New Mitigation Action Worksheet

Use this sheet to record new potential mitigation projects (1 form per project) identified during the planning process. Provide as much detail as possible and use additional pages as necessary. Complete and return to Amy Carr by **January 31, 2020**.

Mitigation Action/Project Title	Update Building and construction codes to the most recent versions updates.
Hazard(s) Mitigated	Earth quakes, strong winds, Extreme temps, TS storms, winter storms, etc
Priority (High, Medium, Low)	High
Project Description, Issue/Background	International Building codes and related construction codes are updated every three years. The county should adopt the latest versions of all of these plans shortly after (within six months) of the publishing of the Plan updates.
Responsible Office/ Agency and partners	County building department
Timeline for Completion	2020 → ongoing
Cost Estimate	Still time
Benefits (Avoided Losses)	

Prepared by: Martin Postma
 Jurisdiction: City of Thornton
 Title/Dept: Long Range Planning
 Phone: 303-538-7631
 Email: martin.postma@thorntonco.org

Please return worksheets by email to:
 Amy Carr
 amy.carr@woodplc.com
 Phone: 303-630-0796

Adams County Hazard Mitigation Plan 2020 Update New Mitigation Action Worksheet

Use this sheet to record new potential mitigation projects (1 form per project) identified during the planning process. Provide as much detail as possible and use additional pages as necessary. Complete and return to Amy Carr by **January 31, 2020**.

Mitigation Action/Project Title	Public Awareness
Hazard(s) Mitigated	flood, tornado, natural hazards
Priority (High, Medium, Low)	Medium
Project Description, Issue/Background	Brochure to be made available to the public in hard copy, & placed on Town's website
Responsible Office/ Agency and partners	Town of Bennett
Timeline for Completion	December 2020
Cost Estimate	Not Sure
Benefits (Avoided Losses)	?

Prepared by: Gerilyn Scheidt
 Jurisdiction: Town of Bennett
 Title/Dept: Town Safety Officer
 Phone: 303-243-0833
 Email: gscheidt@bennett.co.us

Please return worksheets by email to:
 Amy Carr
 amy.carr@woodplc.com
 Phone: 303-630-0796

Adams County Hazard Mitigation Plan 2020 Update New Mitigation Action Worksheet

Use this sheet to record new potential mitigation projects (1 form per project) identified during the planning process. Provide as much detail as possible and use additional pages as necessary. Complete and return to Amy Carr by **January 31, 2020**.

Mitigation Action/Project Title	Dahlia Outfall system
Hazard(s) Mitigated	Flooding
Priority (High, Medium, Low)	Medium
Project Description, Issue/Background	Add trunkline for 1.5 miles Modify & enlarge detention basin Issues: cross irrigation ditch, through Construction Debris landfill, Have asphalt placed and/or hand scarp, traffic control Business access
Responsible Office/ Agency and partners	Public Works / MHFD (UDR II)
Timeline for Completion	Mid 2021
Cost Estimate	25 million
Benefits (Avoided Losses)	Local regulatory Flood damage losses Critical facilities protection Loss of life

Prepared by: David Rausch
 Jurisdiction: _____
 Title/Dept: Infrastructure & Stormwater
 Phone: 720 253 6540
 Email: drausch@adco.gov.org

Please return worksheets by email to:
 Amy Carr
 amy.carr@woodplc.com
 Phone: 303-630-0796

Adams County Hazard Mitigation Plan 2020 Update New Mitigation Action Worksheet

Use this sheet to record new potential mitigation projects (1 form per project) identified during the planning process. Provide as much detail as possible and use additional pages as necessary. Complete and return to Amy Carr by **January 31, 2020**.

Mitigation Action/Project Title	Reduce Impacts To Roadways
Hazard(s) Mitigated	Snow Drifts & Severe Winter Weather
Priority (High, Medium, Low)	Medium
Project Description, Issue/Background	<p>Snow Fences - update/upgrade</p> <ul style="list-style-type: none"> • Living - Vegetation • Snow Structures <p>Increase - Snowplow Equipment</p>
Responsible Office/ Agency and partners	Transportation
Timeline for Completion	2022
Cost Estimate	Requires Study
Benefits (Avoided Losses)	Avoid Loss of Life & Maintain Passability

Prepared by: Greg Baca
 Jurisdiction: _____
 Title/Dept: _____
 Phone: _____
 Email: _____

Please return worksheets by email to:
 Amy Carr
 amy.carr@woodplc.com
 Phone: 303-630-0796

Adams County Hazard Mitigation Plan 2020 Update New Mitigation Action Worksheet

Use this sheet to record new potential mitigation projects (1 form per project) identified during the planning process. Provide as much detail as possible and use additional pages as necessary. Complete and return to Amy Carr by **January 31, 2020**.

Mitigation Action/Project Title	Regional Park Sheltering
Hazard(s) Mitigated	Thunderstorms, Tornadoes, Hail, Flooding
Priority (High, Medium, Low)	Medium
Project Description, Issue/Background	<p>There is no safe room at the Adams County Regional Park. The park is the largest event center in unincorporated Adams County as well the secondary location for the Alternate Care Facility. Rapid egress of citizens from the park is not possible due to roadway issues.</p> <p>Action: Review funding options as well as storm shelter alternatives (retrofitting or new construction) to provide safe rooms at the Adams County Regional Park. Provide adequate sheltering for severe storms and tornados.</p>
Responsible Office/ Agency and partners	Adams County Parks *included in Regional Park Master Plan
Timeline for Completion	TBD
Cost Estimate	TBD
Benefits (Avoided Losses)	

Prepared by: Ron Sigman
Jurisdiction: Adams County
Title/Dept: OEM
Phone: 720.523.6601
Email: rsigman@adcogov.org

Please return worksheets by email to:
Amy Carr
amy.carr@woodplc.com
Phone: 303-630-0796

Adams County Hazard Mitigation Plan 2020 Update New Mitigation Action Worksheet

Use this sheet to record new potential mitigation projects (1 form per project) identified during the planning process. Provide as much detail as possible and use additional pages as necessary. Complete and return to Amy Carr by **January 31, 2020**.

Mitigation Action/Project Title	ADA Five Areas Project
Hazard(s) Mitigated	ADA access improvement. All-hazards
Priority (High, Medium, Low)	High
Project Description, Issue/Background	<p>Project will provide better access in compliance with Americans with Disabilities Act improvements (curb, gutter, and sidewalks) in the following areas:</p> <ul style="list-style-type: none"> • Area 1: 68th Ave – Washington St – York St • Area 2: E. 66th Ave – Washington St – York St • Area 3: Steele St – Niver Creek Tr – E. 86th Ave • Area 4: E 56th Ave – Lincoln St.- Washington St. • Area 5: E 55th Ave – Lincoln St. – Washington St.
Responsible Office/ Agency and partners	Adams County Public Works
Timeline for Completion	2021
Cost Estimate	<p>Areas 1-4: \$5,360,000</p> <p>Area 5: \$680,000</p>
Benefits (Avoided Losses)	Provide better ADA access

Prepared by:

Jurisdiction:

Adams County

Title/Dept:

Public Works

Phone:

720.523.6875

Email:

publicworks@adcogov.org

Please return worksheets by email to:

Amy Carr

amy.carr@woodplc.com

Phone: 303-630-0796

Adams County Hazard Mitigation Plan 2020 Update

New Mitigation Action Worksheet

Use this sheet to record new potential mitigation projects (1 form per project) identified during the planning process. Provide as much detail as possible and use additional pages as necessary. Complete and return to Amy Carr by **January 31, 2020**.

Mitigation Action/Project Title	ADA Five Areas Project
Hazard(s) Mitigated	ADA access improvement. All-hazards
Priority (High, Medium, Low)	High
Project Description, Issue/Background	<p>Project will provide better access in compliance with Americans with Disabilities Act improvements (curb, gutter, and sidewalks) in the following areas:</p> <ul style="list-style-type: none"> • Area 1: 68th Ave – Washington St – York St • Area 2: E. 66th Ave – Washington St – York St • Area 3: Steele St – Niver Creek Tr – E. 86th Ave • Area 4: E 56th Ave – Lincoln St.- Washington St. • Area 5: E 55th Ave – Lincoln St. – Washington St.
Responsible Office/ Agency and partners	Adams County Public Works
Timeline for Completion	2021
Cost Estimate	<p>Areas 1-4: \$5,360,000</p> <p>Area 5: \$680,000</p>
Benefits (Avoided Losses)	Provide better ADA access

Prepared by:

Jurisdiction:

Adams County

Title/Dept:

Public Works

Phone:

720.523.6875

Email:

publicworks@adcogov.org

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Mitigation Action/Project Title	96 th Avenue Bridge Repair Project
Hazard(s) Mitigated	Flooding, Thunderstorms, Wildland fire
Priority (High, Medium, Low)	Hlgh
Project Description, Issue/Background	Starting in November 2019, crews will repair the 96th Avenue bridge over Bijou Creek located approximately 2.3 miles west of Rector-Leader Road in unincorporated Adams County. This project will rehabilitate the existing bridge to address critical structural problems. Phase 1 work will include repairs to the abutments, piers, girders, and approach roadways.
Responsible Office/ Agency and partners	Adams County Public Woks
Timeline for Completion	2020 - 2021
Cost Estimate	\$662,000
Benefits (Avoided Losses)	

Prepared by:

Jurisdiction: Adams County

Title/Dept: Public Works

Phone: 303.317.2112

Email: 96thAvaeBridge@gmail.com

Please return worksheets by email to:
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amy.carr@woodplc.com
Phone: 303-630-0796

Adams County Hazard Mitigation Plan 2020 Update New Mitigation Action Worksheet

Use this sheet to record new potential mitigation projects (1 form per project) identified during the planning process. Provide as much detail as possible and use additional pages as necessary. Complete and return to Amy Carr by **January 31, 2020**.

Mitigation Action/Project Title	Dahlia Street Project
Hazard(s) Mitigated	Flood, Winter Storm, Thunderstorms
Priority (High, Medium, Low)	High
Project Description, Issue/Background	Dahlia Street from 74 th Ave to 78 th Ave. Install new curb, gutter, and sidewalk, turn lanes, and bike lanes. Add storm trunk line to Dahlia Pond.
Responsible Office/ Agency and partners	Adams County Public Works
Timeline for Completion	2021
Cost Estimate	\$9,000,000
Benefits (Avoided Losses)	

Prepared by:

Jurisdiction: Adams County

Title/Dept: Public Works

Phone: 720.523.6875

Email: publicworks@adcogov.org

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amy.carr@woodplc.com
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Mitigation Action/Project Title	E. 88 th Ave and Welby Road Intersection Improvements
Hazard(s) Mitigated	Winter Storm, Flood, Thunderstorm
Priority (High, Medium, Low)	Low
Project Description, Issue/Background	This project will make improvements to E. 88 th and Welby Road, including traffic signals and ADA-compliant curb ramps. Project on a temporary shutdown.
Responsible Office/ Agency and partners	Adams County Public Works
Timeline for Completion	Project on temporary shutdown
Cost Estimate	\$613,978
Benefits (Avoided Losses)	

Prepared by:

Jurisdiction: Adams County

Title/Dept: Public Works

Phone: 720.523.6961

Email: WelbyRd88thAveProject@gmail.com

Please return worksheets by email to:
Amy Carr
amy.carr@woodplc.com
Phone: 303-630-0796

Adams County Hazard Mitigation Plan 2020 Update New Mitigation Action Worksheet

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Mitigation Action/Project Title	Pecos Street Project
Hazard(s) Mitigated	Winter Storm, Flood
Priority (High, Medium, Low)	Med
Project Description, Issue/Background	Pecos St. from W. 52 nd Ave to W. 58 th Ave. Install new curb, gutter and sidewalks, turn lanes, bike lanes
Responsible Office/ Agency and partners	Adams County Public Works
Timeline for Completion	2021
Cost Estimate	\$8,000,000
Benefits (Avoided Losses)	

Prepared by:

Jurisdiction: Adams County

Title/Dept: Public Works

Phone: 720.523.6875

Email: publicworks@adcogov.org

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Amy Carr
amy.carr@woodplc.com
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Mitigation Action/Project Title	Steele Street Project
Hazard(s) Mitigated	Winter Storm, Hazmat
Priority (High, Medium, Low)	Med
Project Description, Issue/Background	Extension of Steele St north of 86 th Avenue to 88 th Avenue.
Responsible Office/ Agency and partners	Adams County Public Works
Timeline for Completion	2021
Cost Estimate	\$1,700,000
Benefits (Avoided Losses)	

Prepared by:

Jurisdiction: Adams County

Title/Dept: Public Works

Phone: 720.523.6875

Email: publicworks@adcogov.org

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amy.carr@woodplc.com

Phone: 303-630-0796

Adams County Hazard Mitigation Plan 2020 Update

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Use this sheet to record new potential mitigation projects (1 form per project) identified during the planning process. Provide as much detail as possible and use additional pages as necessary. Complete and return to Amy Carr by **January 31, 2020**.

Mitigation Action/Project Title	York Street Phase II (E. 78 th Ave – E. 88 th Ave)
Hazard(s) Mitigated	Flood, Winter Storm
Priority (High, Medium, Low)	Med
Project Description, Issue/Background	<p>York St. from E. 78th Ave to E. 88th Ave. This project includes roadway widening, including sidewalks, curbs, and gutter improvements. Project to include design of roadway improvements, structure replacement or modifications and construction of those improvements.</p> <p>The overall objective of this project is to improve roadway capacity, safety, mobility, pedestrian access facilities, multi-use trail, drainage system, structure replacement or modification, and median/landscaping amenity and street lighting.</p>
Responsible Office/ Agency and partners	Adams County Public Works
Timeline for Completion	2021
Cost Estimate	\$14,500,000
Benefits (Avoided Losses)	

Prepared by:

Jurisdiction: Adams County

Title/Dept: Public Works

Phone: 720.523.6875

Email: publicworks@adcogov.org

Please return worksheets by email to:

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amy.carr@woodplc.com

Phone: 303-630-0796

Adams County Hazard Mitigation Plan 2020 Update New Mitigation Action Worksheet

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Mitigation Action/Project Title	York Street Phase III (E. 58 th – SH 224)
Hazard(s) Mitigated	Flood, Winter Storm, Thunderstorm
Priority (High, Medium, Low)	High
Project Description, Issue/Background	The project is for roadway widening, including sidewalks, curbs, and gutters. Coordination with Union Pacific Railroad for railroad bridge replacement. Floodplain impacts.
Responsible Office/ Agency and partners	Adams County Public Works Union Pacific Railroad
Timeline for Completion	2021/2022
Cost Estimate	\$14,500,000 (total project)
Benefits (Avoided Losses)	

Prepared by:

Jurisdiction: Adams County

Title/Dept: Public Works

Phone: 720.523.6875

Email: publicworks@adcogov.org

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Mitigation Action/Project Title	Clear Creek Drop Structure
Hazard(s) Mitigated	Flood, Thunderstorm,
Priority (High, Medium, Low)	Med
Project Description, Issue/Background	
Responsible Office/ Agency and partners	Adams County Storm Water Utility
Timeline for Completion	2021
Cost Estimate	\$3,000,000
Benefits (Avoided Losses)	

Prepared by:

Jurisdiction: Adams County

Title/Dept: Storm Water Utility

Phone: 720.523.6840

Email: DRausch@adcogov.org

Please return worksheets by email to:
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 amy.carr@woodplc.com
 Phone: 303-630-0796

Adams County Hazard Mitigation Plan 2020 Update New Mitigation Action Worksheet

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Mitigation Action/Project Title	Dahlia St Project (Dahlia St from Hwy 224-I76.
Hazard(s) Mitigated	Flood, Thunderstorm,
Priority (High, Medium, Low)	Med
Project Description, Issue/Background	
Responsible Office/ Agency and partners	Adams County Storm Water Utility
Timeline for Completion	2021
Cost Estimate	\$8,000,000
Benefits (Avoided Losses)	

Prepared by:

Jurisdiction: Adams County

Title/Dept: Storm Water Utility

Phone: 720.523.6840

Email: DRausch@adcogov.org

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Mitigation Action/Project Title	2019 E 152 nd Ave and Imboden Drainage
Hazard(s) Mitigated	Flood, Thunderstorm, Winter Storm
Priority (High, Medium, Low)	Med
Project Description, Issue/Background	Improve storm water drainage, flood control.
Responsible Office/ Agency and partners	Adams County Storm Water Utility
Timeline for Completion	2020
Cost Estimate	\$500,000
Benefits (Avoided Losses)	

Prepared by:

Jurisdiction: Adams County

Title/Dept: Storm Water Utility

Phone: 720.523.6840

Email: DRausch@adcogov.org

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Phone: 303-630-0796

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Mitigation Action/Project Title	Dahlia Pond Improvements at southwest corner of I-76
Hazard(s) Mitigated	Flood, Thunderstorm, Winter Storm
Priority (High, Medium, Low)	Med
Project Description, Issue/Background	Improve storm water drainage, flood control.
Responsible Office/ Agency and partners	Adams County Storm Water Utility
Timeline for Completion	2020
Cost Estimate	\$3,000,000
Benefits (Avoided Losses)	

Prepared by: _____
Jurisdiction: Adams County
Title/Dept: Storm Water Utility
Phone: 720.523.6840
Email: DRausch@adcogov.org

Please return worksheets by email to:
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 amy.carr@woodplc.com
 Phone: 303-630-0796

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Mitigation Action/Project Title	2019 Logan Court Drainage Basin Storm design
Hazard(s) Mitigated	Flood, Thunderstorm, Winter Storm
Priority (High, Medium, Low)	Med
Project Description, Issue/Background	Improve storm water drainage, flood control.
Responsible Office/ Agency and partners	Adams County Storm Water Utility
Timeline for Completion	2021
Cost Estimate	\$100,000
Benefits (Avoided Losses)	

Prepared by: _____
Jurisdiction: Adams County
Title/Dept: Storm Water Utility
Phone: 720.523.6840
Email: DRausch@adcogov.org

Please return worksheets by email to:
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 amy.carr@woodplc.com
 Phone: 303-630-0796

Adams County Hazard Mitigation Plan 2020 Update New Mitigation Action Worksheet

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Mitigation Action/Project Title	Broadway Intersection of 62 nd Ave (minor system)
Hazard(s) Mitigated	Flood, Thunderstorm, Winter Storm
Priority (High, Medium, Low)	low
Project Description, Issue/Background	Improve storm water drainage, flood control.
Responsible Office/ Agency and partners	Adams County Storm Water Utility
Timeline for Completion	2022
Cost Estimate	\$500,000
Benefits (Avoided Losses)	

Prepared by: _____
Jurisdiction: Adams County
Title/Dept: Storm Water Utility
Phone: 720.523.6840
Email: DRausch@adcogov.org

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 amy.carr@woodplc.com
 Phone: 303-630-0796

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Mitigation Action/Project Title	Broadway at 59 th Ave (major system)
Hazard(s) Mitigated	Flood, Thunderstorm, Winter Storm
Priority (High, Medium, Low)	med
Project Description, Issue/Background	Improve storm water drainage, flood control.
Responsible Office/ Agency and partners	Adams County Storm Water Utility
Timeline for Completion	2023
Cost Estimate	\$8,000,000
Benefits (Avoided Losses)	

Prepared by: _____
Jurisdiction: Adams County
Title/Dept: Storm Water Utility
Phone: 720.523.6840
Email: DRausch@adcogov.org

Please return worksheets by email to:
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Mitigation Action/Project Title	Broadway at 59 th Ave (major system)
Hazard(s) Mitigated	Flood, Thunderstorm, Winter Storm
Priority (High, Medium, Low)	med
Project Description, Issue/Background	Improve storm water drainage, flood control.
Responsible Office/ Agency and partners	Adams County Storm Water Utility
Timeline for Completion	2023
Cost Estimate	\$8,000,000
Benefits (Avoided Losses)	

Prepared by: _____
Jurisdiction: Adams County
Title/Dept: Storm Water Utility
Phone: 720.523.6840
Email: DRausch@adcogov.org

Please return worksheets by email to:
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Mitigation Action/Project Title	Little Dry Creek – Major Drainageway Planning and Flood Hazard Delineation Study
Hazard(s) Mitigated	Flood, Thunderstorm, Winter Storm
Priority (High, Medium, Low)	med
Project Description, Issue/Background	Improve storm water drainage, flood control.
Responsible Office/ Agency and partners	Adams County Storm Water Utility
Timeline for Completion	2020
Cost Estimate	\$14,000
Benefits (Avoided Losses)	

Prepared by: _____
Jurisdiction: Adams County
Title/Dept: Storm Water Utility
Phone: 720.523.6840
Email: DRausch@adcogov.org

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 amy.carr@woodplc.com
 Phone: 303-630-0796

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Mitigation Action/Project Title	Grange Hall Creek-Flood Hazard Delineation Study
Hazard(s) Mitigated	Flood, Thunderstorm, Winter Storm
Priority (High, Medium, Low)	med
Project Description, Issue/Background	Improve storm water drainage, flood control.
Responsible Office/ Agency and partners	Adams County Storm Water Utility
Timeline for Completion	2020
Cost Estimate	\$8,000
Benefits (Avoided Losses)	

Prepared by: _____
Jurisdiction: Adams County
Title/Dept: Storm Water Utility
Phone: 720.523.6840
Email: DRausch@adcogov.org

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Phone: 303-630-0796

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Mitigation Action/Project Title	Basin 4100 & DFA 0056 Outfall Systems Plan (OSP) Update
Hazard(s) Mitigated	Flood, Thunderstorm, Winter Storm
Priority (High, Medium, Low)	med
Project Description, Issue/Background	Improve storm water drainage, flood control.
Responsible Office/ Agency and partners	Adams County Storm Water Utility
Timeline for Completion	2020
Cost Estimate	\$12,000
Benefits (Avoided Losses)	

Prepared by: _____
Jurisdiction: Adams County
Title/Dept: Storm Water Utility
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Email: DRausch@adcogov.org

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 Phone: 303-630-0796

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Mitigation Action/Project Title	Pecos & 54 th Ave Outfall Systems Plan (OSP) Update
Hazard(s) Mitigated	Flood, Thunderstorm, Winter Storm
Priority (High, Medium, Low)	med
Project Description, Issue/Background	Improve storm water drainage, flood control.
Responsible Office/ Agency and partners	Adams County Storm Water Utility
Timeline for Completion	2020
Cost Estimate	\$75,000
Benefits (Avoided Losses)	

Prepared by: _____
Jurisdiction: Adams County
Title/Dept: Storm Water Utility
Phone: 720.523.6840
Email: DRausch@adcogov.org

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amy.carr@woodplc.com
Phone: 303-630-0796

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Mitigation Action/Project Title	South Platte river FHAD
Hazard(s) Mitigated	Flood, Thunderstorm, Winter Storm
Priority (High, Medium, Low)	med
Project Description, Issue/Background	Improve storm water drainage, flood control.
Responsible Office/ Agency and partners	Adams County Storm Water Utility
Timeline for Completion	2020
Cost Estimate	\$18,000
Benefits (Avoided Losses)	

Prepared by:

Jurisdiction: Adams County

Title/Dept: Storm Water Utility

Phone: 720.523.6840

Email: DRausch@adcogov.org

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Mitigation Action/Project Title	Clear Creek FHAD
Hazard(s) Mitigated	Flood, Thunderstorm, Winter Storm
Priority (High, Medium, Low)	med
Project Description, Issue/Background	Improve storm water drainage, flood control.
Responsible Office/ Agency and partners	Adams County Storm Water Utility
Timeline for Completion	2020
Cost Estimate	\$20,000
Benefits (Avoided Losses)	

Prepared by: _____
Jurisdiction: Adams County
Title/Dept: Storm Water Utility
Phone: 720.523.6840
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Mitigation Action/Project Title	Third Creek Master Drainage Plan Outfall Systems Plan (OSP) Update
Hazard(s) Mitigated	Flood, Thunderstorm, Winter Storm
Priority (High, Medium, Low)	med
Project Description, Issue/Background	Improve storm water drainage, flood control.
Responsible Office/ Agency and partners	Adams County Storm Water Utility
Timeline for Completion	2020
Cost Estimate	\$50,000
Benefits (Avoided Losses)	

Prepared by: _____
Jurisdiction: Adams County
Title/Dept: Storm Water Utility
Phone: 720.523.6840
Email: DRausch@adcogov.org

Please return worksheets by email to:
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Mitigation Action/Project Title	Second Creek (downstream from DIA) Major Drainageway Planning and flood hazard delineation study
Hazard(s) Mitigated	Flood, Thunderstorm, Winter Storm
Priority (High, Medium, Low)	med
Project Description, Issue/Background	Improve storm water drainage, flood control.
Responsible Office/ Agency and partners	Adams County Storm Water Utility
Timeline for Completion	2020
Cost Estimate	\$20,000
Benefits (Avoided Losses)	

Prepared by: _____
Jurisdiction: Adams County
Title/Dept: Storm Water Utility
Phone: 720.523.6840
Email: DRausch@adcogov.org

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Mitigation Action/Project Title	Brantner Gulch major drainageway planning and flood hazard delineation update
Hazard(s) Mitigated	Flood, Thunderstorm, Winter Storm
Priority (High, Medium, Low)	med
Project Description, Issue/Background	Improve storm water drainage, flood control.
Responsible Office/ Agency and partners	Adams County Storm Water Utility
Timeline for Completion	2021
Cost Estimate	\$15,000
Benefits (Avoided Losses)	

Prepared by: _____
Jurisdiction: Adams County
Title/Dept: Storm Water Utility
Phone: 720.523.6840
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 amy.carr@woodplc.com
 Phone: 303-630-0796

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Use this sheet to record new potential mitigation projects (1 form per project) identified during the planning process. Provide as much detail as possible and use additional pages as necessary. Complete and return to Amy Carr by **January 31, 2020**.

Mitigation Action/Project Title	DFA 0054 major drainageway planning and flood hazard delineation update
Hazard(s) Mitigated	Flood, Thunderstorm, Winter Storm
Priority (High, Medium, Low)	med
Project Description, Issue/Background	Improve storm water drainage, flood control.
Responsible Office/ Agency and partners	Adams County Storm Water Utility
Timeline for Completion	2021
Cost Estimate	\$30,000
Benefits (Avoided Losses)	

Prepared by: _____
Jurisdiction: Adams County
Title/Dept: Storm Water Utility
Phone: 720.523.6840
Email: DRausch@adcogov.org

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 amy.carr@woodplc.com
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Mitigation Action/Project Title	Lost Creek major drainageway planning
Hazard(s) Mitigated	Flood, Thunderstorm, Winter Storm
Priority (High, Medium, Low)	med
Project Description, Issue/Background	Improve storm water drainage, flood control.
Responsible Office/ Agency and partners	Adams County Storm Water Utility
Timeline for Completion	2022
Cost Estimate	TBD
Benefits (Avoided Losses)	

Prepared by: _____
Jurisdiction: Adams County
Title/Dept: Storm Water Utility
Phone: 720.523.6840
Email: DRausch@adcogov.org

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 Phone: 303-630-0796

Adams County Hazard Mitigation Plan 2020 Update New Mitigation Action Worksheet

Use this sheet to record new potential mitigation projects (1 form per project) identified during the planning process. Provide as much detail as possible and use additional pages as necessary. Complete and return to Amy Carr by **January 31, 2020**.

Mitigation Action/Project Title	McKay Lake Watershed outfall systems plan (OSP)
Hazard(s) Mitigated	Flood, Thunderstorm, Winter Storm
Priority (High, Medium, Low)	med
Project Description, Issue/Background	Improve storm water drainage, flood control.
Responsible Office/ Agency and partners	Adams County Storm Water Utility
Timeline for Completion	2023
Cost Estimate	\$8,000
Benefits (Avoided Losses)	

Prepared by: _____
Jurisdiction: Adams County
Title/Dept: Storm Water Utility
Phone: 720.523.6840
Email: DRausch@adcogov.org

Please return worksheets by email to:
 Amy Carr
 amy.carr@woodplc.com
 Phone: 303-630-0796

Adams County Hazard Mitigation Plan 2020 Update New Mitigation Action Worksheet

Use this sheet to record new potential mitigation projects (1 form per project) identified during the planning process. Provide as much detail as possible and use additional pages as necessary. Complete and return to Amy Carr by **January 31, 2020**.

Mitigation Action/Project Title	Video Inspection and Maintenance of Stormwater Infrastructure
Hazard(s) Mitigated	Flood, Thunderstorm, Winter Storm
Priority (High, Medium, Low)	med
Project Description, Issue/Background	Improve storm water drainage, flood control.
Responsible Office/ Agency and partners	Adams County Storm Water Utility
Timeline for Completion	2020
Cost Estimate	\$800,000
Benefits (Avoided Losses)	

Prepared by: _____
Jurisdiction: Adams County
Title/Dept: Storm Water Utility
Phone: 720.523.6840
Email: DRausch@adcogov.org

Please return worksheets by email to:
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Mitigation Action/Project Title	Video Inspection and Maintenance of Stormwater Infrastructure
Hazard(s) Mitigated	Flood, Thunderstorm, Winter Storm
Priority (High, Medium, Low)	med
Project Description, Issue/Background	Improve storm water drainage, flood control.
Responsible Office/ Agency and partners	Adams County Storm Water Utility
Timeline for Completion	2021
Cost Estimate	\$850,000
Benefits (Avoided Losses)	

Prepared by: _____
Jurisdiction: Adams County
Title/Dept: Storm Water Utility
Phone: 720.523.6840
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Mitigation Action/Project Title	Video Inspection and Maintenance of Stormwater Infrastructure
Hazard(s) Mitigated	Flood, Thunderstorm, Winter Storm
Priority (High, Medium, Low)	med
Project Description, Issue/Background	Improve storm water drainage, flood control.
Responsible Office/ Agency and partners	Adams County Storm Water Utility
Timeline for Completion	2022
Cost Estimate	\$900,000
Benefits (Avoided Losses)	

Prepared by: _____
Jurisdiction: Adams County
Title/Dept: Storm Water Utility
Phone: 720.523.6840
Email: DRausch@adcogov.org

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Mitigation Action/Project Title	Video Inspection and Maintenance of Stormwater Infrastructure
Hazard(s) Mitigated	Flood, Thunderstorm, Winter Storm
Priority (High, Medium, Low)	med
Project Description, Issue/Background	Improve storm water drainage, flood control.
Responsible Office/ Agency and partners	Adams County Storm Water Utility
Timeline for Completion	2023
Cost Estimate	\$900,000
Benefits (Avoided Losses)	

Prepared by: _____
Jurisdiction: Adams County
Title/Dept: Storm Water Utility
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Email: DRausch@adcogov.org

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 amy.carr@woodplc.com
 Phone: 303-630-0796

Adams County Hazard Mitigation Plan 2020 Update New Mitigation Action Worksheet

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Mitigation Action/Project Title	Rec Center Tributary Outfall
Hazard(s) Mitigated	Flood
Priority (High, Medium, Low)	High
Project Description, Issue/Background	Design and construct an outfall to serve the properties surrounding the intersection of Bridge and Telluride Street.
Responsible Office/ Agency and partners	City of Brighton and Mile High Flood District.
Timeline for Completion	2025
Cost Estimate	\$4,500,000
Benefits (Avoided Losses)	Prevent localized flooding of public roadways.

prepared by: Scott Olsen
 jurisdiction: City of Brighton
 title/Dept: Stormwater and Environmental Division
 phone: 303-655-2136
 mail: solsen@brightonco.gov

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 amy.carr@woodplc.com
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Adams County Hazard Mitigation Plan 2020 Update New Mitigation Action Worksheet

Use this sheet to record new potential mitigation projects (1 form per project) identified during the planning process. Provide as much detail as possible and use additional pages as necessary.

Mitigation Action/Project Title	Emergency back-up generators.
Hazard(s) Mitigated	Severe winter weather, blizzards, high wind events, tornados, and floods.
Priority (High, Medium, Low)	High
Project Description, Issue/Background	<p>Description: Retrofit public government buildings with back-up emergency generators.</p> <p>Issues/Background: Commerce City has there three critical buildings that don't have emergency back-up power supply. In the event of a power outages, these critical buildings will not be operational. The buildings are two recreation centers that have been designated as emergency shelters and the municipal service center which maintains the city's fleet vehicles and equipment. In the past, natural disasters such as blizzards created major power outages; therefore the city could not use their designated emergency shelters facilities and also hinder fleet support services. The lack of capability of maintaining operational readiness of emergency shelters and fleet support services during power outages as the potential of creating hardships in providing emergency sheltering and fleet support services.</p>
Responsible Office/ Agency and partners	Commerce City Public Works Division with partnership from Emergency Management Division.
Timeline for Completion	1-3 years.
Cost Estimate	\$125,000/generator x 3 = \$375,000.
Potential Funding	Mitigation grant funds with general budget funds.
Benefits (Avoided Losses)	Maintain operational readiness of critical infrastructure to perform mission essential functions such as emergency shelter operations and sustainment of Fleet services.

Prepared by: Kirk Dominic
 Jurisdiction: Commerce City
 Title/Dept: Emergency Manager/Police Department
 Phone: 303-319-5482
 Email: kdominic@c3gov.com

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amy.carr@woodplc.com
Phone: 303-630-0796

Adams County Hazard Mitigation Plan 2020 Update New Mitigation Action Worksheet

Use this sheet to record new potential mitigation projects (1 form per project) identified during the planning process. Provide as much detail as possible and use additional pages as necessary.

Mitigation Action/Project Title	Fuel storage/dispensing facility.
Hazard(s) Mitigated	Severe winter weather, blizzards, high wind events, tornados, and floods.
Priority (High, Medium, Low)	High
Project Description, Issue/Background	<p><u>Description:</u> Installation of a permanent fuel storage/dispensing facility at the city yard.</p> <p><u>Issues/Background:</u> Commerce City doesn't have internal fuel storage/dispensing capability to maintain the city's fleet vehicles and equipment. Currently the city uses public retail vendors such as gas stations to provide fuel for its vehicles and equipment. In the past, natural disasters such as blizzards, flooding and tornados have caused major power outages and/or shortages of the retail fuel supply. The lack of capability to dispense fuel or shortages of retail fuel supply has severely decrease the city's capability in maintaining operational readiness of the city's fleet and equipment. Two critical fleet sections are first responders vehicles and snow plow trucks which if these vehicles don't have fuel will create a public safety emergency.</p>
Responsible Office/ Agency and partners	Commerce City Public Works Division with partnership from Emergency Management Division.
Timeline for Completion	1-2 years.
Cost Estimate	\$125,000.
Potential Funding	Mitigation grant funds with general budget funds.
Benefits (Avoided Losses)	Maintain operational readiness and sustainment of city's fleet and equipment.

Prepared by: Kirk Dominic
 Jurisdiction: Commerce City
 Title/Dept: Emergency Manager/Police Department
 Phone: 303-319-5482
 Email: kdominic@c3gov.com

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Phone: 303-630-0796

Adams County Hazard Mitigation Plan 2020 Update New Mitigation Action Worksheet

Use this sheet to record new potential mitigation projects (1 form per project) identified during the planning process. Provide as much detail as possible and use additional pages as necessary.

Mitigation Action/Project Title	Emergency back-up generators.
Hazard(s) Mitigated	Severe winter weather, blizzards, high wind events, tornados, and floods.
Priority (High, Medium, Low)	High
Project Description, Issue/Background	<p>Description: Retrofit public government buildings with back-up emergency generators.</p> <p>Issues/Background: Commerce City has there three critical buildings that don't have emergency back-up power supply. In the event of a power outages, these critical buildings will not be operational. The buildings are two recreation centers that have been designated as emergency shelters and the municipal service center which maintains the city's fleet vehicles and equipment. In the past, natural disasters such as blizzards created major power outages; therefore the city could not use their designated emergency shelters facilities and also hinder fleet support services. The lack of capability of maintaining operational readiness of emergency shelters and fleet support services during power outages as the potential of creating hardships in providing emergency sheltering and fleet support services.</p>
Responsible Office/ Agency and partners	Commerce City Public Works Division with partnership from Emergency Management Division.
Timeline for Completion	1-3 years.
Cost Estimate	\$166,666/generator x 3 = \$500,000.
Potential Funding	Mitigation grant funds with general budget funds.
Benefits (Avoided Losses)	Maintain operational readiness of critical infrastructure to perform mission essential functions such as emergency shelter operations and sustainment of Fleet services.

Prepared by: Kirk Dominic
 Jurisdiction: Commerce City
 Title/Dept: Emergency Manager/Police Department
 Phone: 303-319-5482
 Email: kdominic@c3gov.com

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amy.carr@woodplc.com
Phone: 303-630-0796

Adams County Hazard Mitigation Plan 2020 Update

New Mitigation Action Worksheet

Use this sheet to record new potential mitigation projects (1 form per project) identified during the planning process. Provide as much detail as possible and use additional pages as necessary.

Mitigation Action/Project Title	Fuel storage/dispensing facility.
Hazard(s) Mitigated	Severe winter weather, blizzards, high wind events, tornados, and floods.
Priority (High, Medium, Low)	High
Project Description, Issue/Background	<p><u>Description:</u> Installation of a permanent fuel storage/dispensing facility at the city yard.</p> <p><u>Issues/Background:</u> Commerce City doesn't have internal fuel storage/dispensing capability to maintain the city's fleet vehicles and equipment. Currently the city uses public retail vendors such as gas stations to provide fuel for its vehicles and equipment. In the past, natural disasters such as blizzards, flooding and tornados have caused major power outages and/or shortages of the retail fuel supply. The lack of capability to dispense fuel or shortages of retail fuel supply has severely decrease the city's capability in maintaining operational readiness of the city's fleet and equipment. Two critical fleet sections are first responders vehicles and snow plow trucks which if these vehicles don't have fuel will create a public safety emergency.</p>
Responsible Office/ Agency and partners	Commerce City Public Works Division with partnership from Emergency Management Division.
Timeline for Completion	1-2 years.
Cost Estimate	\$225,000.
Potential Funding	Mitigation grant funds with general budget funds.
Benefits (Avoided Losses)	Maintain operational readiness and sustainment of city's fleet and equipment.

Prepared by: Kirk Dominic

Jurisdiction: Commerce City

Title/Dept: Emergency Manager/Police Department

Phone: 303-319-5482

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Adams County Hazard Mitigation Plan 2020 Update New Mitigation Action Worksheet

Use this sheet to record new potential mitigation projects (1 form per project) identified during the planning process. Provide as much detail as possible and use additional pages as necessary.

Mitigation Action/Project Title	Fairfax Park Drainage Reconstruction
Hazard(s) Mitigated	Flooding
Priority (High, Medium, Low)	High
Project Description, Issue/Background	<p>Description: The first phase of this project is a study through Mile High Flood District to study the drainage for the Core part of the City and to determine what infrastructure improvements are needed to better drain the Fairfax Park/Regional Detention Pond. The next phase of the project will be to replace the outfall pipe from Fairfax Park to the South Platte River. We anticipate that this project will be done over a three-year period.</p> <p>Issues/Background: The majority of the storm water from the historic portion of Commerce City drains to Fairfax Park. Fairfax Park functions as a regional drainage facility and as a regional park for the City. The outfall system from Fairfax Park to the South Platte is undersized, the pond frequently overtops, and the flooding negatively affects the surrounding neighborhood. In addition, during large storm events it takes several days for Fairfax to drain. This affects the use of the site as a regional park.</p>
Responsible Office/ Agency and partners	Commerce City Public Works Division with partnership from Emergency Management Division.
Timeline for Completion	1-4 years.
Cost Estimate	Drainage Study - \$750,000 (2021) Outfall Improvements Phase 1: \$1,200,000 (2022) Outfall Improvements Phase 2: \$1,200,000 (2023) Outfall Improvements Phase 2: \$1,200,000 (2024) Total = \$4,350,000
Potential Funding	Mitigation grant funds, Mile High Flood District funds with general budget funds.
Benefits (Avoided Losses)	Maintain operational readiness of critical infrastructure to perform mission essential functions such as maintaining emergency routes during major flood events and sustainment of storm sewer infrastructure.

Prepared by: Kirk Dominic
Jurisdiction: Commerce City
Title/Dept: Emergency Manager/Police Department
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amy.carr@woodplc.com
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Adams County Hazard Mitigation Plan 2020 Update New Mitigation Action Worksheet

Use this sheet to record new potential mitigation projects (1 form per project) identified during the planning process. Provide as much detail as possible and use additional pages as necessary.

Mitigation Action/Project Title	Stoplight and intersection infrastructure at Marketplace Drive and Hwy 79
Hazard(s) Mitigated	Hazardous Materials
Priority (High, Medium, Low)	Medium
Project Description, Issue/Background	This is a high traffic intersection right off I-70 with multiple businesses including King Soopers, Love's Travel w/truck stop, McDonalds, and a Tractor Supply. Redesign and installation of a stoplight area will assist with traffic safety for commercial vehicles as well as residential vehicles.
Responsible Office/ Agency and partners	Town of Bennett - Public Works
Timeline for Completion	2022
Cost Estimate	\$1.2M
Potential Funding	CIP Budget
Benefits (Avoided Losses)	

Prepared by: _____
 Jurisdiction: _____
 Title/Dept: _____
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 Email: _____

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Adams County Hazard Mitigation Plan 2020 Update New Mitigation Action Worksheet

Use this sheet to record new potential mitigation projects (1 form per project) identified during the planning process. Provide as much detail as possible and use additional pages as necessary.

Mitigation Action/Project Title	Replacement of culverts of on Kiowa-Bennett Road and Hwy 36
Hazard(s) Mitigated	Flood, Winter Weather
Priority (High, Medium, Low)	High
Project Description, Issue/Background	When Bennett experiences heavy rains and/or snowfall in this area, the Kiowa-Bennett road has experienced flooding and erosion issues. Replacement of culverts is expected to reduce and/or eliminate the flooding and erosion.
Responsible Office/ Agency and partners	Town of Bennett - Public Works
Timeline for Completion	2021
Cost Estimate	\$500,000
Potential Funding	CIP Budget
Benefits (Avoided Losses)	

Prepared by: _____
 Jurisdiction: _____
 Title/Dept: _____
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amy.carr@woodplc.com
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Adams County Hazard Mitigation Plan 2020 Update New Mitigation Action Worksheet

Use this sheet to record new potential mitigation projects (1 form per project) identified during the planning process. Provide as much detail as possible and use additional pages as necessary.

Mitigation Action/Project Title	Design of expansion for wastewater treatment facility
Hazard(s) Mitigated	Flood
Priority (High, Medium, Low)	High
Project Description, Issue/Background	With the growth that the Town of Bennett is experiencing, it is necessary to begin the process for design of expansion of this facility to accommodate the growth. The site also experienced stormwater flooding in 2019.
Responsible Office/ Agency and partners	Town of Bennett - Public Works
Timeline for Completion	2021
Cost Estimate	\$350,000
Potential Funding	CIP Budget
Benefits (Avoided Losses)	

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 Title/Dept: _____
 Phone: _____
 Email: _____

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APPENDIX F: GLOSSARY



ACRONYMS

%g	Percentage of gravity
BRIC	Building Resilient Infrastructure and Communities grant program
CFR	Code of Federal Regulations
CO-WRAP	Colorado Wildfire Risk Assessment Program
CRS	Community Rating System
CWCB	Colorado Water Conservation Board
CWPP	Community Wildfire Protection Plan
DEM	Digital Elevation Model
DFIRM	Digital Flood Insurance Rate Maps
DHS	Department of Homeland Security
DMA	Disaster Mitigation Act
EAP	Emergency Action Plan
EF	Enhanced Fujita
EOP	Emergency Operations Plan
EPA	U.S. Environmental Protection Agency
EPR	Health Department Emergency Preparedness and Response
ESA	Endangered Species Act
ESF	Emergency Support Functions
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FIRM	Flood Insurance Rate Map
FMA	Flood Management Assistance grant program
FIS	Flood Insurance Study
GIS	Geographic Information System
Hazmat	Hazardous Materials
Hazus-MH	Hazards, United States-Multi Hazard
HMA	Hazard Mitigation Assistance grant program
HMGP	Hazard Mitigation Grant Program
MM	Modified Mercalli Scale
Mph	Miles per Hour

M _w	Moment Magnitude
NASA	National Aeronautics and Space Administration
NEHRP	National Earthquake Hazards Reduction Program
NFIP	National Flood Insurance Program
NOAA	National Oceanic and Atmospheric Administration
NWS	National Weather Service
PDM	Pre-Disaster Mitigation
PDI	Palmer Drought Index
PGA	Peak Ground Acceleration
PHDI	Palmer Hydrological Drought Index
SFHA	Special Flood Hazard Area
SPI	Standardized Precipitation Index
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USGS	U.S. Geological Survey
WUI	Wildland Urban Interface

DEFINITIONS

100-Year Flood: The term “100-year flood” can be misleading. The 100-year flood does not necessarily occur once every 100 years. Rather, it is the flood that has a 1% chance of being equaled or exceeded in any given year. Thus, the 100-year flood could occur more than once in a relatively short period of time. The Federal Emergency Management Agency (FEMA) defines it as the 1% annual chance flood, which is now the standard definition used by most federal and state agencies and by the National Flood Insurance Program (NFIP).

Acre-Foot: An acre-foot is the amount of water it takes to cover 1 acre to a depth of 1 foot. This measure is used to describe the quantity of storage in a water reservoir. An acre-foot is a unit of volume. One acre foot equals 7,758 barrels; 325,829 gallons; or 43,560 cubic feet. An average household of four will use approximately 1 acre-foot of water per year.

Asset: An asset is any man-made or natural feature that has value, including, but not limited to, people; buildings; infrastructure, such as bridges, roads, sewers, and water systems; lifelines, such as electricity and communication resources; and environmental, cultural, or recreational features such as parks, wetlands, and landmarks.

Base Flood: The flood having a 1% chance of being equaled or exceeded in any given year, also known as the “100-year” or “1% chance” flood. The base flood is a statistical concept used to ensure that all properties subject to the NFIP are protected to the same degree against flooding.

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Basin: A basin is the area within which all surface water—whether from rainfall, snowmelt, springs, or other sources—flows to a single water body or watercourse. The boundary of a river basin is defined by natural topography, such as hills, mountains, and ridges. Basins are also referred to as “watersheds” and “drainage basins.”

Benefit: A benefit is a net project outcome and is usually defined in monetary terms. Benefits may include direct and indirect effects. For the purposes of benefit/cost analysis of proposed mitigation measures, benefits are limited to specific, measurable risk reduction factors, including reduction in expected property losses (buildings, contents, and functions) and protection of human life.

Benefit/Cost Analysis: A benefit/cost analysis is a systematic, quantitative method of comparing projected benefits to projected costs of a project or policy. It is used as a measure of cost effectiveness.

Building: A building is defined as a structure that is walled and roofed, principally aboveground, and permanently fixed to a site. The term includes manufactured homes on permanent foundations on which the wheels and axles carry no weight.

Capability Assessment: A capability assessment provides a description and analysis of a community's current capacity to address threats associated with hazards. The assessment includes two components: an inventory of an agency's mission, programs, and policies, and an analysis of its capacity to carry them out. A capability assessment is an integral part of the planning process in which a community's actions to reduce losses are identified, reviewed, and analyzed, and the framework for implementation is identified. The following capabilities were reviewed under this assessment:

- Legal and regulatory capability
- Administrative and technical capability
- Fiscal capability

Community Rating System (CRS): The CRS is a voluntary program under the NFIP that rewards participating communities (provides incentives) for exceeding the minimum requirements of the NFIP and completing activities that reduce flood hazard risk by providing flood insurance premium discounts.

Critical Area: An area defined by state or local regulations as deserving special protection because of unique natural features or its value as habitat for a wide range of species of flora and fauna. A sensitive/critical area is usually subject to more restrictive development regulations.

Critical Facility: Facilities and infrastructure that are critical to the health and welfare of the population. These become especially important after any hazard event occurs. For the purposes of this plan, critical facilities include:

- Structures or facilities that produce, use, or store highly volatile, flammable, explosive, toxic or water reactive materials.
- Hospitals, nursing homes, and housing likely to contain occupants who may not be sufficiently mobile to avoid death or injury during a hazard event.
- Police stations, fire stations, vehicle and equipment storage facilities, and emergency operations centers that are needed for disaster response before, during, and after hazard events.
- Public and private utilities, facilities and infrastructure that are vital to maintaining or restoring normal services to areas damaged by hazard events.
- Government facilities.

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Dam: Any artificial barrier or controlling mechanism that can or does impound 10 acre-feet or more of water.

Dam Failure: Dam failure refers to a partial or complete breach in a dam (or levee) that impacts its integrity. Dam failures occur for a number of reasons, such as flash flooding, inadequate spillway size, mechanical failure of valves or other equipment, freezing and thawing cycles, earthquakes, and intentional destruction.

Disaster Mitigation Act of 2000 (DMA): The DMA is Public Law 106-390 and is the latest federal legislation enacted to encourage and promote proactive, pre-disaster planning as a condition of receiving financial assistance under the Robert T. Stafford Act. The DMA emphasizes planning for disasters before they occur. Under the DMA, a pre-disaster hazard mitigation program and new requirements for the national post-disaster Hazard Mitigation Grant Program (HMGP) were established.

Drainage Basin: A basin is the area within which all surface water—whether from rainfall, snowmelt, springs or other sources—flows to a single water body or watercourse. The boundary of a river basin is defined by natural topography, such as hills, mountains and ridges. Drainage basins are also referred to as **watersheds** or **basins**.

Drought: Drought is a period of time without substantial rainfall or snowfall from one year to the next. Drought can also be defined as the cumulative impacts of several dry years or a deficiency of precipitation over an extended period of time, which in turn results in water shortages for some activity, group, or environmental function. A hydrological drought is caused by deficiencies in surface and subsurface water supplies. A socioeconomic drought impacts the health, well-being, and quality of life or starts to have an adverse impact on a region. Drought is a normal, recurrent feature of climate and occurs almost everywhere.

Earthquake: An earthquake is defined as a sudden slip on a fault, volcanic or magmatic activity, and sudden stress changes in the earth that result in ground shaking and radiated seismic energy. Earthquakes can last from a few seconds to over 5 minutes, and have been known to occur as a series of tremors over a period of several days. The actual movement of the ground in an earthquake is seldom the direct cause of injury or death. Casualties may result from falling objects and debris as shocks shake, damage, or demolish buildings and other structures.

Exposure: Exposure is defined as the number and dollar value of assets considered to be at risk during the occurrence of a specific hazard.

Extent: The extent is the size of an area affected by a hazard.

Fire Behavior: Fire behavior refers to the physical characteristics of a fire and is a function of the interaction between the fuel characteristics (such as type of vegetation and structures that could burn), topography, and weather. Variables that affect fire behavior include the rate of spread, intensity, fuel consumption, and fire type (such as underbrush versus crown fire).

Fire Frequency: Fire frequency is the broad measure of the rate of fire occurrence in a particular area. An estimate of the areas most likely to burn is based on past fire history or fire rotation in the area, fuel conditions, weather, ignition sources (such as human or lightning), fire suppression response, and other factors.

Flash Flood: A flash flood occurs with little or no warning when water levels rise at an extremely fast rate

Flood Insurance Rate Map (FIRM): FIRMs are the official maps on which the Federal Emergency Management Agency (FEMA) has delineated the Special Flood Hazard Area (SFHA).

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Flood Insurance Study: A report published by the Federal Insurance and Mitigation Administration for a community in conjunction with the community's FIRM. The study contains such background data as the base flood discharges and water surface elevations that were used to prepare the FIRM. In most cases, a community FIRM with detailed mapping will have a corresponding flood insurance study.

Floodplain: Any land area susceptible to being inundated by flood waters from any source. A FIRM identifies most, but not necessarily all, of a community's floodplain as the SFHA.

Floodway: Floodways are areas within a floodplain that are reserved for the purpose of conveying flood discharge without increasing the base flood elevation more than 1 foot. Generally speaking, no development is allowed in floodways, as any structures located there would block the flow of floodwaters.

Floodway Fringe: Floodway fringe areas are located in the floodplain but outside of the floodway. Some development is generally allowed in these areas, with a variety of restrictions. On maps that have identified and delineated a floodway, this would be the area beyond the floodway boundary that can be subject to different regulations.

Freeboard: Freeboard is the margin of safety added to the base flood elevation.

Frequency: For the purposes of this plan, frequency refers to how often a hazard of specific magnitude, duration, or extent is expected to occur on average. Statistically, a hazard with a 100-year frequency is expected to occur about once every 100 years on average and has a 1% chance of occurring any given year. Frequency reliability varies depending on the type of hazard considered.

Fujita Scale of Tornado Intensity: Tornado wind speeds are sometimes estimated on the basis of wind speed and damage sustained using the Fujita Scale. The scale rates the intensity or severity of tornado events using numeric values from F0 to F5 based on tornado wind speed and damage. An F0 tornado (wind speed less than 73 miles per hour [mph]) indicates minimal damage (such as broken tree limbs), and an F5 tornado (wind speeds of 261 to 318 mph) indicates severe damage.

Goal: A goal is a general guideline that explains what is to be achieved. Goals are usually broad-based, long-term, policy-type statements and represent global visions. Goals help define the benefits that a plan is trying to achieve. The success of a hazard mitigation plan is measured by the degree to which its goals have been met (that is, by the actual benefits in terms of actual hazard mitigation).

Geographic Information System (GIS): GIS is a computer software application that relates data regarding physical and other features on the earth to a database for mapping and analysis.

Hazard: A hazard is a source of potential danger or adverse condition that could harm people or cause property damage.

Hazardous Material: A substance or combination of substances which, because of quantity, concentration, or physical, chemical, or infectious characteristics, may either cause or significantly contribute to, an increase in mortality or an increase in serious, irreversible, or incapacitating reversible, illness.

Hazard Mitigation Grant Program (HMGP): Authorized under Section 202 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, the HMGP is administered by FEMA and provides grants to states, tribes, and local governments to implement hazard mitigation actions after a major disaster declaration. The purpose of the program is to reduce the loss of life and property due to disasters and to enable mitigation activities to be implemented as a community recovers from a disaster

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Hazards U.S. Multi-Hazard (Hazus-MH) Loss Estimation Program: Hazus-MH is a GIS-based program used to support the development of risk assessments as required under the DMA. The Hazus-MH software program assesses risk in a quantitative manner to estimate damages and losses associated with natural hazards. Hazus-MH is FEMA's nationally applicable, standardized methodology and software program and contains modules for estimating potential losses from earthquakes, floods, and wind hazards. Hazus-MH has also been used to assess vulnerability (exposure) for other hazards.

Hydraulics: Hydraulics is the branch of science or engineering that addresses fluids (especially water) in motion in rivers or canals, works and machinery for conducting or raising water, the use of water as a prime mover, and other fluid-related areas.

Hydrology: Hydrology is the analysis of waters of the earth. For example, a flood discharge estimate is developed by conducting a hydrologic study.

Intensity: For the purposes of this plan, intensity refers to the measure of the effects of a hazard.

Inventory: The assets identified in a study region comprise an inventory. Inventories include assets that could be lost when a disaster occurs and community resources are at risk. Assets include people, buildings, transportation, and other valued community resources.

Lightning: Lightning is an electrical discharge resulting from the buildup of positive and negative charges within a thunderstorm. When the buildup becomes strong enough, lightning appears as a "bolt," usually within or between clouds and the ground. A bolt of lightning instantaneously reaches temperatures approaching 50,000°F. The rapid heating and cooling of air near lightning causes thunder. Lightning is a major threat during thunderstorms. In the United States, 75 to 100 Americans are struck and killed by lightning each year (see <http://www.fema.gov/hazard/thunderstorms/thunder.shtm>).

Liquefaction: Liquefaction is the complete failure of soils, occurring when soils lose shear strength and flow horizontally. It is most likely to occur in fine grain sands and silts, which behave like viscous fluids when liquefaction occurs. This situation is extremely hazardous to development on the soils that liquefy, and generally results in extreme property damage and threats to life and safety.

Local Government: Any county, municipality, city, town, township, public authority, school district, special district, intrastate district, council of governments (regardless of whether the council of governments is incorporated as a nonprofit corporation under State law), regional or interstate government entity, or agency or instrumentality of a local government; any Indian tribe or authorized tribal organization, or Alaska Native village or organization; and any rural community, unincorporated town or village, or other public entity.

Magnitude: Magnitude is the measure of the strength of an earthquake, and is typically measured by the Richter scale. As an estimate of energy, each whole number step in the magnitude scale corresponds to the release of about 31 times more energy than the amount associated with the preceding whole number value.

Mass movement: A collective term for landslides, mudflows, debris flows, sinkholes, and lahars.

Mitigation: A preventive action that can be taken in advance of an event that will reduce or eliminate the risk to life or property.

Mitigation Actions: Mitigation initiatives are specific actions to achieve goals and objectives that minimize the effects from a disaster and reduce the loss of life and property.

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Objective: For the purposes of this plan, an objective is defined as a short-term aim that, when combined with other objectives, forms a strategy or course of action to meet a goal.

Peak Ground Acceleration: Peak Ground Acceleration (PGA) is a measure of the highest amplitude of ground shaking that accompanies an earthquake, based on a percentage of the force of gravity.

Preparedness: Preparedness refers to actions that strengthen the capability of government, citizens, and communities to respond to disasters.

Presidential Disaster Declaration: These declarations are typically made for events that cause more damage than state and local governments and resources can handle without federal government assistance. Generally, no specific dollar loss threshold has been established for such declarations. A Presidential Disaster Declaration puts into motion long-term federal recovery programs, some of which are matched by state programs, designed to help disaster victims, businesses, and public entities.

Probability of Occurrence: The probability of occurrence is a statistical measure or estimate of the likelihood that a hazard will occur. This probability is generally based on past hazard events in the area and a forecast of events that could occur in the future. A probability factor based on yearly values of occurrence is used to estimate probability of occurrence.

Repetitive Loss Property: Any NFIP-insured property that, since 1978 and regardless of any changes of ownership during that period, has experienced:

- Four or more paid flood losses in excess of \$1000.00; or
- Two paid flood losses in excess of \$1000.00 within any 10-year period since 1978 or
- Three or more paid losses that equal or exceed the current value of the insured property.

Return Period (or Mean Return Period): This term refers to the average period of time in years between occurrences of a particular hazard (equal to the inverse of the annual frequency of occurrence).

Riverine: Of or produced by a river. Riverine floodplains have readily identifiable channels. Floodway maps can only be prepared for riverine floodplains.

Risk: Risk is the estimated impact that a hazard would have on people, services, facilities, and structures in a community. Risk measures the likelihood of a hazard occurring and resulting in an adverse condition that causes injury or damage. Risk is often expressed in relative terms such as a high, moderate, or low likelihood of sustaining damage above a particular threshold due to occurrence of a specific type of hazard. Risk also can be expressed in terms of potential monetary losses associated with the intensity of the hazard.

Risk Assessment: Risk assessment is the process of measuring potential loss of life, personal injury, economic injury, and property damage resulting from hazards. This process assesses the vulnerability of people, buildings, and infrastructure to hazards and focuses on (1) hazard identification; (2) impacts of hazards on physical, social, and economic assets; (3) vulnerability identification; and (4) estimates of the cost of damage or costs that could be avoided through mitigation.

Risk Ranking: This ranking serves two purposes, first to describe the probability that a hazard will occur, and second to describe the impact a hazard will have on people, property, and the economy. Risk estimates for the City are based on the methodology that the City used to prepare the risk assessment for this plan. The following equation shows the risk ranking calculation:

$$\text{Risk Ranking} = \text{Probability} + \text{Impact (people + property + economy)}$$

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Robert T. Stafford Act: The Robert T. Stafford Disaster Relief and Emergency Assistance Act, Public Law 100-107, was signed into law on November 23, 1988. This law amended the Disaster Relief Act of 1974, Public Law 93-288. The Stafford Act is the statutory authority for most federal disaster response activities, especially as they pertain to FEMA and its programs.

Special Flood Hazard Area: The base floodplain delineated on a FIRM. The SFHA is mapped as a Zone A in riverine situations. The SFHA may or may not encompass all of a community's flood problems

Stakeholder: Business leaders, civic groups, academia, non-profit organizations, major employers, managers of critical facilities, farmers, developers, special purpose districts, and others whose actions could impact hazard mitigation.

Thunderstorm: A thunderstorm is a storm with lightning and thunder produced by cumulonimbus clouds. Thunderstorms usually produce gusty winds, heavy rains, and sometimes hail. Thunderstorms are usually short in duration (seldom more than 2 hours). Heavy rains associated with thunderstorms can lead to flash flooding during the wet or dry seasons.

Tornado: A tornado is a violently rotating column of air extending between and in contact with a cloud and the surface of the earth. Tornadoes are often (but not always) visible as funnel clouds. On a local scale, tornadoes are the most intense of all atmospheric circulations, and winds can reach destructive speeds of more than 300 mph. A tornado's vortex is typically a few hundred meters in diameter, and damage paths can be up to 1 mile wide and 50 miles long.

Vulnerability: Vulnerability describes how exposed or susceptible an asset is to damage. Vulnerability depends on an asset's construction, contents, and the economic value of its functions. Like indirect damages, the vulnerability of one element of the community is often related to the vulnerability of another. For example, many businesses depend on uninterrupted electrical power. Flooding of an electric substation would affect not only the substation itself but businesses as well. Often, indirect effects can be much more widespread and damaging than direct effects.

Watershed: A watershed is an area that drains downgradient from areas of higher land to areas of lower land to the lowest point, a common drainage basin.

Wildfire: Wildfire refers to any uncontrolled fire occurring on undeveloped land that requires fire suppression. The potential for wildfire is influenced by three factors: the presence of fuel, topography, and air mass. Fuel can include living and dead vegetation on the ground, along the surface as brush and small trees, and in the air such as tree canopies. Topography includes both slope and elevation. Air mass includes temperature, relative humidity, wind speed and direction, cloud cover, precipitation amount, duration, and the stability of the atmosphere at the time of the fire. Wildfires can be ignited by lightning and, most frequently, by human activity including smoking, campfires, equipment use, and arson.

Windstorm: Windstorms are generally short-duration events involving straight-line winds or gusts exceeding 50 mph. These gusts can produce winds of sufficient strength to cause property damage. Windstorms are especially dangerous in areas with significant tree stands, exposed property, poorly constructed buildings, mobile homes (manufactured housing units), major infrastructure, and aboveground utility lines. A windstorm can topple trees and power lines; cause damage to residential, commercial, critical facilities; and leave tons of debris in its wake.

Zoning Ordinance: The zoning ordinance designates allowable land use and intensities for a local jurisdiction. Zoning ordinances consist of two components: a zoning text and a zoning map.