

Hazus-MH: Earthquake Event Report

Region Name: Arapahoe county Random fault 2010 Census

Earthquake Scenario: Random Arapahoe County

Print Date: March 25, 2013

Totals only reflect data for those census tracts/blocks included in the user's study region.

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Disclaimer:

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

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General Description of the Region

Hazus is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop earthquake losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from earthquakes and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 1 county(ies) from the following state(s):

Colorado

Note:

Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 804.43 square miles and contains 121 census tracts. There are over 224 thousand households in the region which has a total population of 572,179 people (2002 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 249 thousand buildings in the region with a total building replacement value (excluding contents) of 52,216 (millions of dollars). Approximately 94.00 % of the buildings (and 77.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 3,255 and 542 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 249 thousand buildings in the region which have an aggregate total replacement value of 52,216 (millions of dollars) . Appendix B provides a general distribution of the building value by State and County.

In terms of building construction types found in the region, wood frame construction makes up 71% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 8 hospitals in the region with a total bed capacity of 0 beds. There are 191 schools, 39 fire stations, 16 police stations and 9 emergency operation facilities. With respect to high potential loss facilities (HPL), there are 18 dams identified within the region. Of these, 6 of the dams are classified as 'high hazard'. The inventory also includes 22 hazardous material sites, 0 military installations and 0 nuclear power plants.

Transportation and Utility Lifeline Inventory

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 3,797.00 (millions of dollars). This inventory includes over 386 kilometers of highways, 290 bridges, 7,773 kilometers of pipes.

Table 1: Transportation System Lifeline Inventory

System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	290	392.20
	Segments	179	2,600.90
	Tunnels	1	0.30
	Subtotal		2,993.30
Railways	Bridges	10	1.90
	Facilities	0	0.00
	Segments	27	63.90
	Tunnels	0	0.00
	Subtotal		65.80
Light Rail	Bridges	0	0.00
	Facilities	5	13.30
	Segments	5	9.10
	Tunnels	0	0.00
	Subtotal		22.40
Bus	Facilities	1	1.10
	Subtotal		1.10
Ferry	Facilities	0	0.00
	Subtotal		0.00
Port	Facilities	0	0.00
	Subtotal		0.00
Airport	Facilities	2	21.30
	Runways	4	151.90
	Subtotal		173.20
		Total	3,255.80

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	87.40
	Facilities	1	32.30
	Pipelines	0	0.00
	Subtotal		119.70
Waste Water	Distribution Lines	NA	52.40
	Facilities	4	258.40
	Pipelines	0	0.00
	Subtotal		310.90
Natural Gas	Distribution Lines	NA	35.00
	Facilities	8	0.00
	Pipelines	493	184.40
	Subtotal		219.30
Oil Systems	Facilities	0	0.00
	Pipelines	54	66.40
	Subtotal		66.40
Electrical Power	Facilities	16	0.00
	Subtotal		0.00
Communication	Facilities	8	0.80
	Subtotal		0.80
		Total	717.10

Earthquake Scenario

Hazus uses the following set of information to define the earthquake parameters used for the earthquake loss estimate provided in this report.

Scenario Name	Random Arapahoe County
Type of Earthquake	Arbitrary
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	NA
Longitude of Epicenter	-104.38
Latitude of Epicenter	39.65
Earthquake Magnitude	6.50
Depth (Km)	10.00
Rupture Length (Km)	17.18
Rupture Orientation (degrees)	150.00
Attenuation Function	Central & East US (CEUS 2008)

Building Damage

Building Damage

Hazus estimates that about 66,314 buildings will be at least moderately damaged. This is over 27.00 % of the buildings in the region. There are an estimated 11,532 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	204	0.16	80	0.15	84	0.23	68	0.36	52	0.45
Commercial	3,179	2.47	1,444	2.65	2,312	6.45	1,916	10.11	1,354	11.74
Education	69	0.05	29	0.05	39	0.11	36	0.19	27	0.23
Government	65	0.05	27	0.05	41	0.11	37	0.20	27	0.24
Industrial	904	0.70	418	0.77	693	1.93	578	3.05	420	3.64
Other Residential	37,662	29.25	19,055	34.98	12,868	35.92	7,359	38.82	5,277	45.76
Religion	252	0.20	103	0.19	134	0.37	125	0.66	92	0.79
Single Family	86,442	67.13	33,317	61.16	19,656	54.87	8,837	46.62	4,284	37.15
Total	128,777		54,473		35,826		18,955		11,533	

Table 4: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	106,771	82.91	46,216	84.84	20,408	56.96	3,398	17.93	421	3.65
Steel	1,093	0.85	530	0.97	1,353	3.78	1,789	9.44	1,965	17.04
Concrete	1,837	1.43	985	1.81	1,859	5.19	1,907	10.06	1,431	12.41
Precast	854	0.66	306	0.56	652	1.82	740	3.91	663	5.75
RM	14,780	11.48	4,083	7.50	8,060	22.50	8,123	42.85	4,791	41.54
URM	2,338	1.82	1,461	2.68	1,789	4.99	1,189	6.28	827	7.17
MH	1,103	0.86	892	1.64	1,706	4.76	1,809	9.54	1,435	12.44
Total	128,777		54,473		35,826		18,955		11,533	

*Note:

RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 0 hospital beds available for use. On the day of the earthquake, the model estimates that only 0 hospital beds (7.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 24.00% of the beds will be back in service. By 30 days, 65.00% will be operational.

Table 5: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	8	7	0	0
Schools	191	121	2	37
EOCs	9	0	0	8
PoliceStations	16	0	0	15
FireStations	39	1	0	26

Transportation and Utility Lifeline Damage

Table 6 provides damage estimates for the transportation system.

Table 6: Expected Damage to the Transportation Systems

System	Component	Number of Locations_				
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	179	0	0	179	179
	Bridges	290	65	24	225	251
	Tunnels	1	0	0	1	1
Railways	Segments	27	0	0	27	27
	Bridges	10	0	0	10	10
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Light Rail	Segments	5	0	0	5	5
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	5	0	0	5	5
Bus	Facilities	1	0	0	1	1
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	2	0	0	2	2
	Runways	4	0	0	4	4

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, Hazus performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

Table 7 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	1	1	0	0	1
Waste Water	4	2	0	0	4
Natural Gas	8	7	0	1	6
Oil Systems	0	0	0	0	0
Electrical Power	16	7	0	6	15
Communication	8	3	0	8	8

Table 8 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	4,371	1087	272
Waste Water	2,622	546	136
Natural Gas	535	286	71
Oil	246	69	17

Table 9: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	224,104	56,152	38,958	8,529	0	0
Electric Power		144,771	81,606	35,312	8,452	224

Fire Following Earthquake

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 4 ignitions that will burn about 0.45 sq. mi 0.06 % of the region's total area.) The model also estimates that the fires will displace about 1,736 people and burn about 158 (millions of dollars) of building value.

Debris Generation

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 3.71 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 23.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 148,200 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 14,057 households to be displaced due to the earthquake. Of these, 8,914 people (out of a total population of 572,179) will seek temporary shelter in public shelters.

Casualties

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described 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 (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	55	17	3	6
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	12	3	1	1
	Industrial	34	10	2	3
	Other-Residential	862	241	35	68
	Single Family	1,319	376	63	125
	Total	2,281	647	104	203
2 PM	Commercial	3,061	928	156	308
	Commuting	1	1	2	0
	Educational	2,337	720	124	243
	Hotels	2	1	0	0
	Industrial	247	72	11	22
	Other-Residential	157	44	6	12
	Single Family	219	62	11	20
	Total	6,025	1,827	311	606
5 PM	Commercial	2,204	664	112	218
	Commuting	43	54	95	18
	Educational	336	103	18	35
	Hotels	3	1	0	0
	Industrial	155	45	7	14
	Other-Residential	327	91	13	25
	Single Family	512	144	24	47
	Total	3,579	1,102	270	357

Economic Loss

The total economic loss estimated for the earthquake is 8,642.69 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 8,535.09 (millions of dollars); 21 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 50 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	18.00	337.79	8.11	40.73	404.62
	Capital-Related	0.00	7.57	288.99	4.85	13.99	315.40
	Rental	65.25	104.71	145.56	2.32	14.29	332.13
	Relocation	232.01	70.64	246.69	11.38	168.80	729.52
	Subtotal	297.26	200.92	1,019.02	26.66	237.80	1,781.66
Capital Stock Losses							
	Structural	507.55	174.07	328.42	40.92	178.90	1,229.86
	Non_Structural	1,569.03	887.29	970.04	127.27	582.13	4,135.75
	Content	422.29	191.85	428.20	75.00	242.97	1,360.30
	Inventory	0.00	0.00	9.45	17.09	0.96	27.50
	Subtotal	2,498.87	1,253.21	1,736.11	260.28	1,004.96	6,753.42
	Total	2,796.13	1,454.13	2,755.14	286.94	1,242.75	8,535.09

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

Hazus estimates the long-term economic impacts to the region for 15 years after the earthquake. The model quantifies this information in terms of income and employment changes within the region. Table 14 presents the results of the region for the given earthquake.

Table 12: Transportation System Economic Losses
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	2,600.88	\$0.00	0.00
	Bridges	392.21	\$37.04	9.44
	Tunnels	0.26	\$0.00	1.66
	Subtotal	2993.30	37.00	
Railways	Segments	63.92	\$0.00	0.00
	Bridges	1.92	\$0.02	0.89
	Tunnels	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	65.80	0.00	
Light Rail	Segments	9.10	\$0.00	0.00
	Bridges	0.00	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	13.32	\$2.27	17.01
	Subtotal	22.40	2.30	
Bus	Facilities	1.06	\$0.23	22.22
	Subtotal	1.10	0.20	
Ferry	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Port	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Airport	Facilities	21.30	\$3.25	15.27
	Runways	151.86	\$0.00	0.00
	Subtotal	173.20	3.30	
	Total	3255.80	42.80	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	\$0.00	0.00
	Facilities	32.30	\$5.75	17.80
	Distribution Lines	87.40	\$4.89	5.59
	Subtotal	119.71	\$10.64	
Waste Water	Pipelines	0.00	\$0.00	0.00
	Facilities	258.40	\$49.93	19.32
	Distribution Lines	52.40	\$2.46	4.68
	Subtotal	310.85	\$52.39	
Natural Gas	Pipelines	184.40	\$0.65	0.35
	Facilities	0.00	\$0.00	0.00
	Distribution Lines	35.00	\$0.84	2.41
	Subtotal	219.34	\$1.49	
Oil Systems	Pipelines	66.40	\$0.16	0.24
	Facilities	0.00	\$0.00	0.00
	Subtotal	66.38	\$0.16	
Electrical Power	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
Communication	Facilities	0.80	\$0.12	15.35
	Subtotal	0.78	\$0.12	
	Total	717.07	\$64.79	

Table 14. Indirect Economic Impact with outside aid

(Employment as # of people and Income in millions of \$)

LOSS	Total	%

Appendix A: County Listing for the Region

Arapahoe, CO

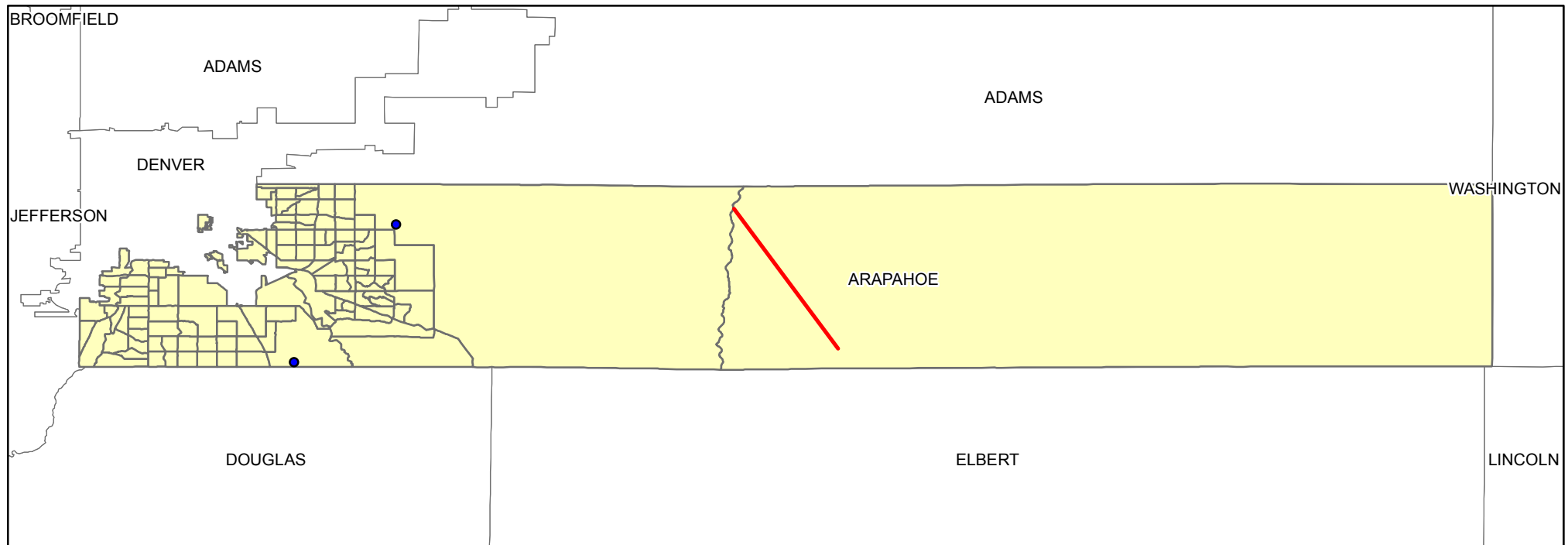
Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Colorado	Arapahoe	572,179	40,061	12,154	52,216
Total State		572,179	40,061	12,154	52,216
Total Region		572,179	40,061	12,154	52,216

Study Region: Arapahoe County

Hazard Scenario: Random Fault 6.5

Airports Map

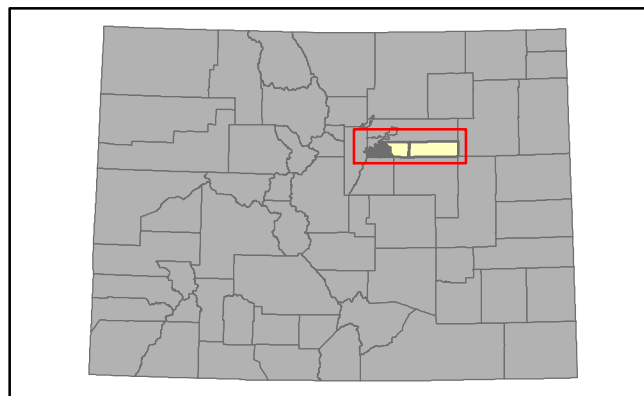


Legend

Airports
Probability Damage > Extensive



— Fault
— Study Region Tract
— Counties



Created by: Colorado Geological Survey
Team: Matt Morgan and Scot Fitzgerald
Date Created: March 2013
Location: Arapahoe County Colorado
Fault Parameters: arbitrary, magnitude 6.5, depth 10km
Data: Changed to CGS Landslides and CGS/FEMA Soils data
Projection: GCS North American 1983

0 5 10 20 Miles

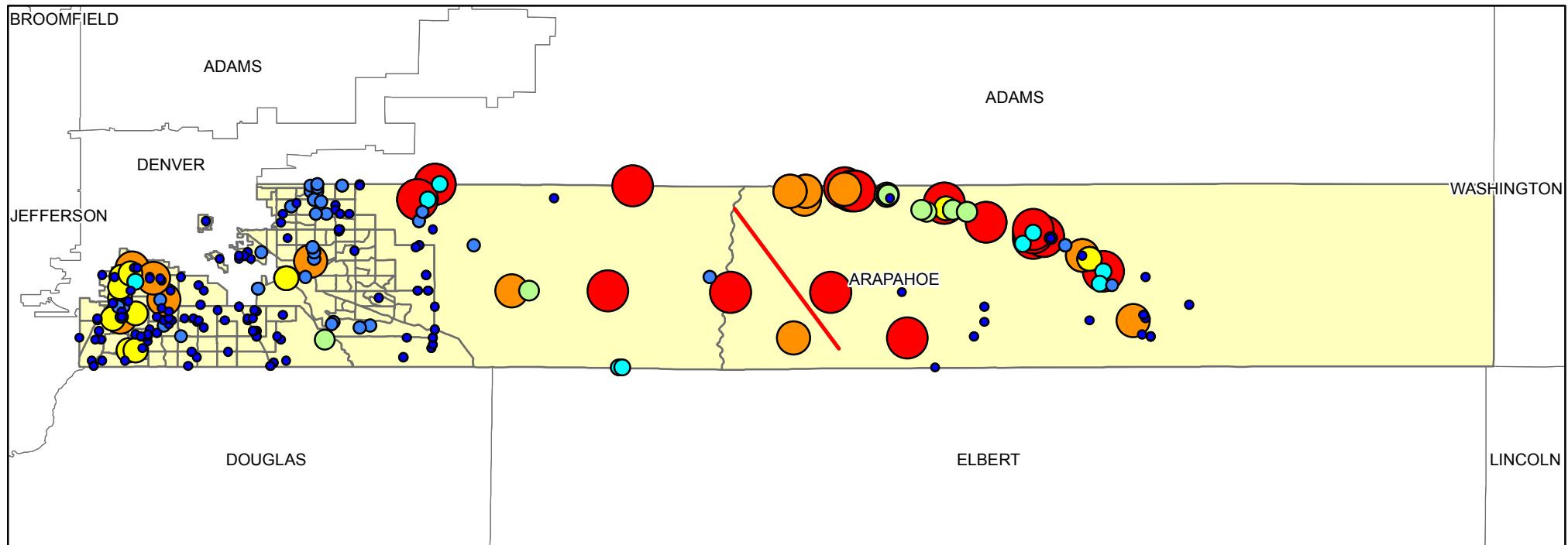


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Study Region: Arapahoe County

Hazard Scenario: Random Fault 6.5

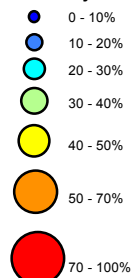
Bridges Map



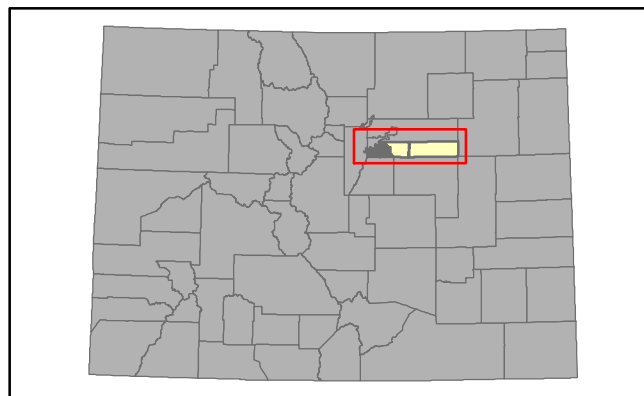
Legend

Bridges

Probability Damage > Extensive



— Fault
— Study Region Tract
— Counties



Created by: Colorado Geological Survey
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Date Created: March 2013
Location: Arapahoe County Colorado
Fault Parameters: arbitrary, magnitude 6.5, depth 10km
Data: Changed to CGS Landslides and CGS/FEMA Soils data
Projection: GCS North American 1983

0 5 10 20 Miles

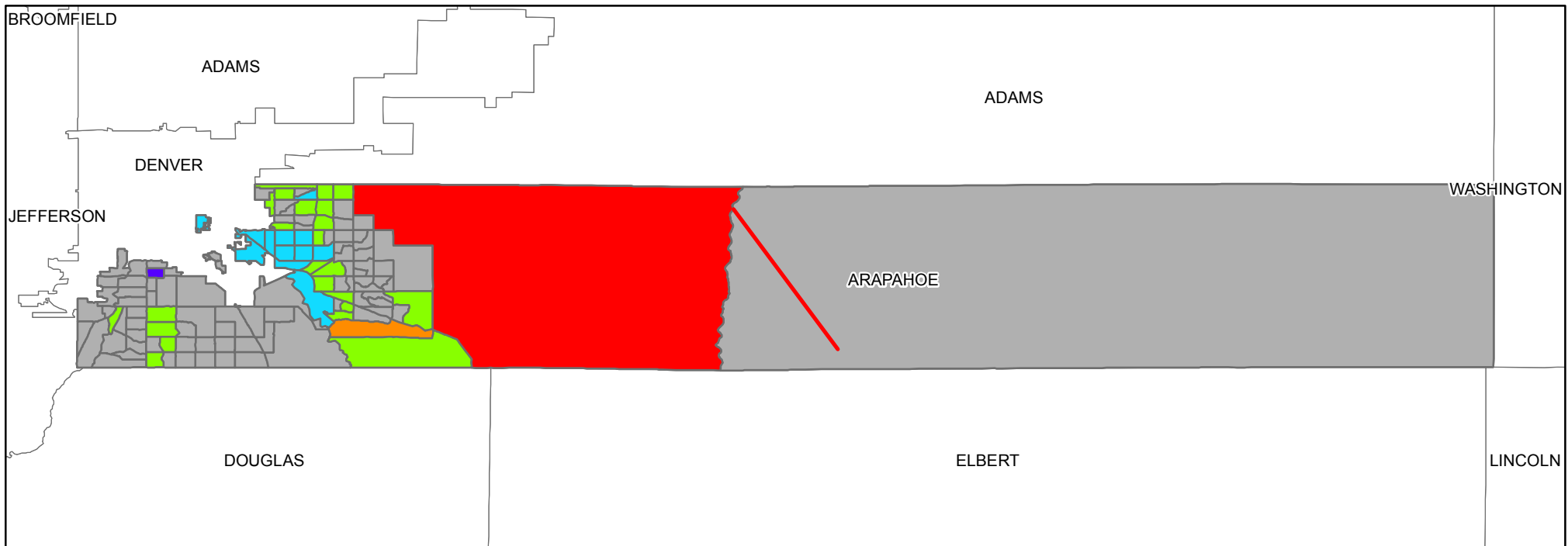


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Study Region: Arapahoe County

Hazard Scenario: Random Fault 6.5

Building Economic Loss Map

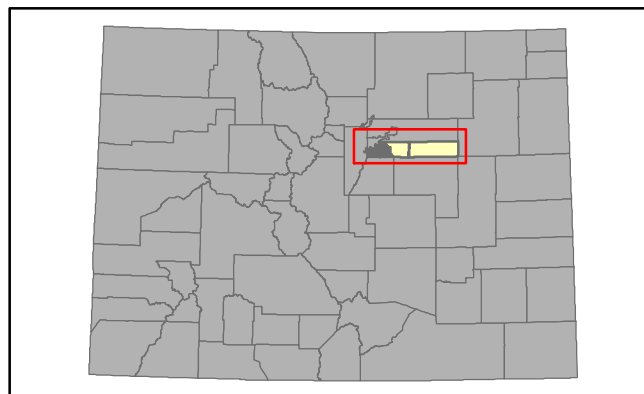


Legend

— Fault

Building Economic Loss in Thousands of Dollars

- 3357 - 80545
- 80545 - 157733
- 157733 - 234921
- 234921 - 312109
- 312109 - 389297
- 389297 - 466487
- Study Region Tract
- Counties



Created by: Colorado Geological Survey

Team: Matt Morgan and Scot Fitzgerald

Date Created: March 2013

Location: Arapahoe County Colorado

Fault Parameters: arbitrary, magnitude 6.5, depth 10km

Data: Changed to CGS Landslides and CGS/FEMA Soils data

Projection: GCS North American 1983

0 5 10 20 Miles

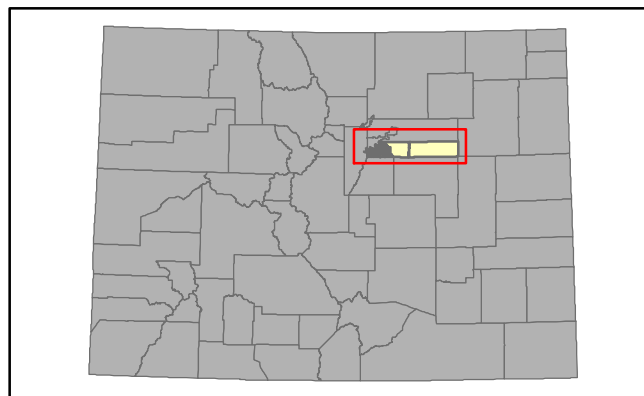
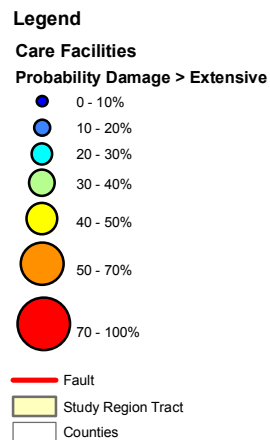
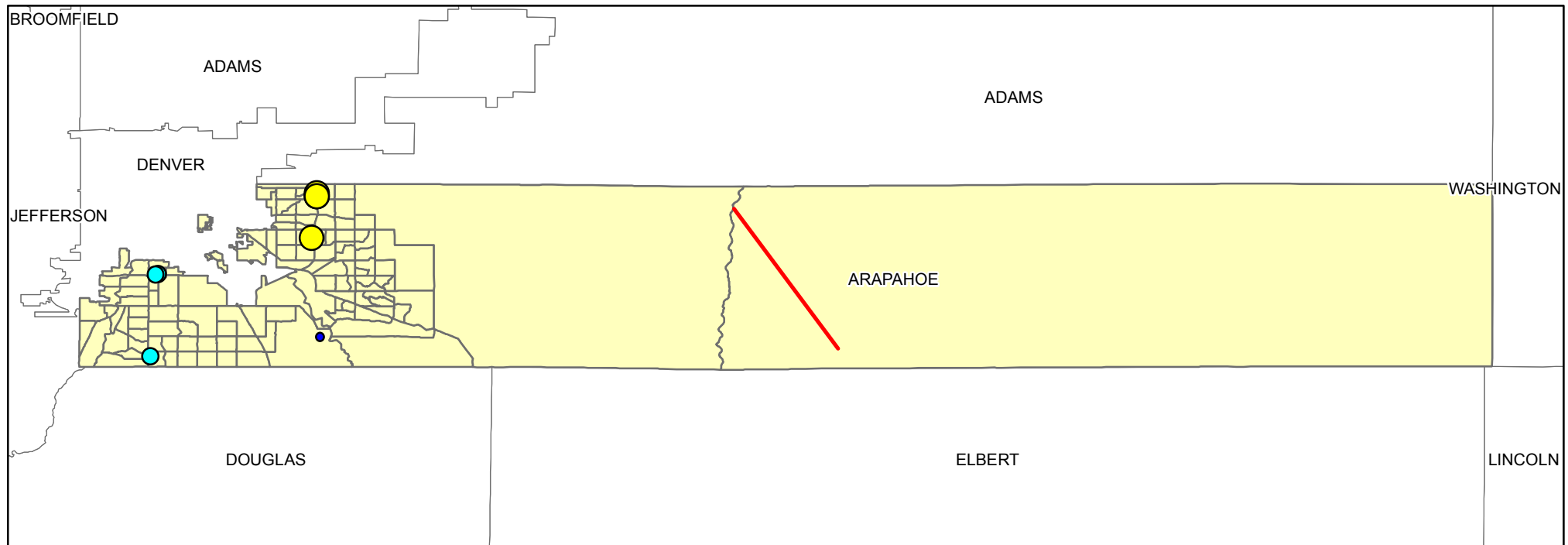


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Study Region: Arapahoe County

Hazard Scenario: Random Fault 6.5

Care Facilities Map



Created by: Colorado Geological Survey
Team: Matt Morgan and Scot Fitzgerald
Date Created: March 2013
Location: Arapahoe County Colorado
Fault Parameters: arbitrary, magnitude 6.5, depth 10km
Data: Changed to CGS Landslides and CGS/FEMA Soils data
Projection: GCS North American 1983

0 5 10 20 Miles

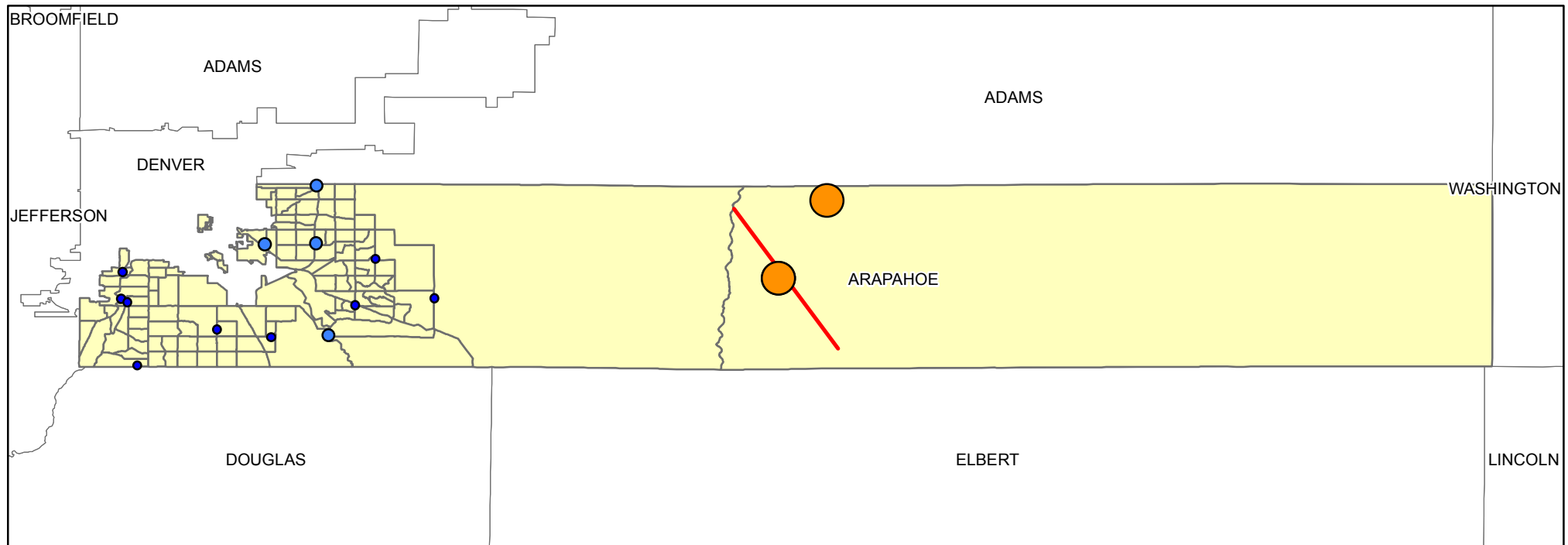


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Study Region: Arapahoe County

Hazard Scenario: Random Fault 6.5

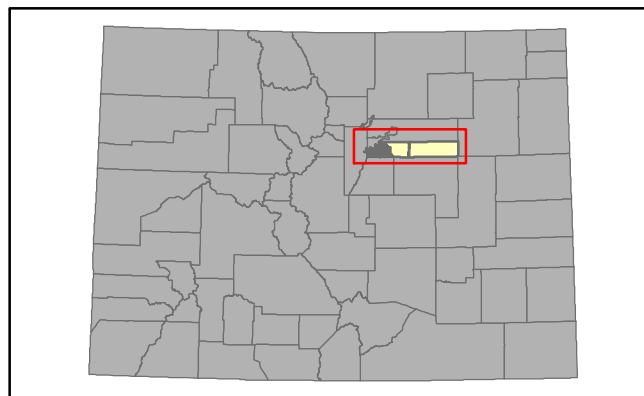
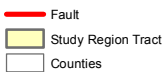
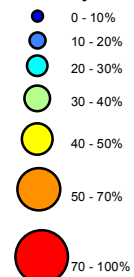
Electrical Facilities Map



Legend

Electrical Power Facilities

Probability Damage > Extensive



Created by: Colorado Geological Survey

Team: Matt Morgan and Scot Fitzgerald

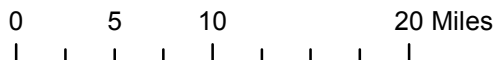
Date Created: March 2013

Location: Arapahoe County Colorado

Fault Parameters: arbitrary, magnitude 6.5, depth 10km

Data: Changed to CGS Landslides and CGS/FEMA Soils data

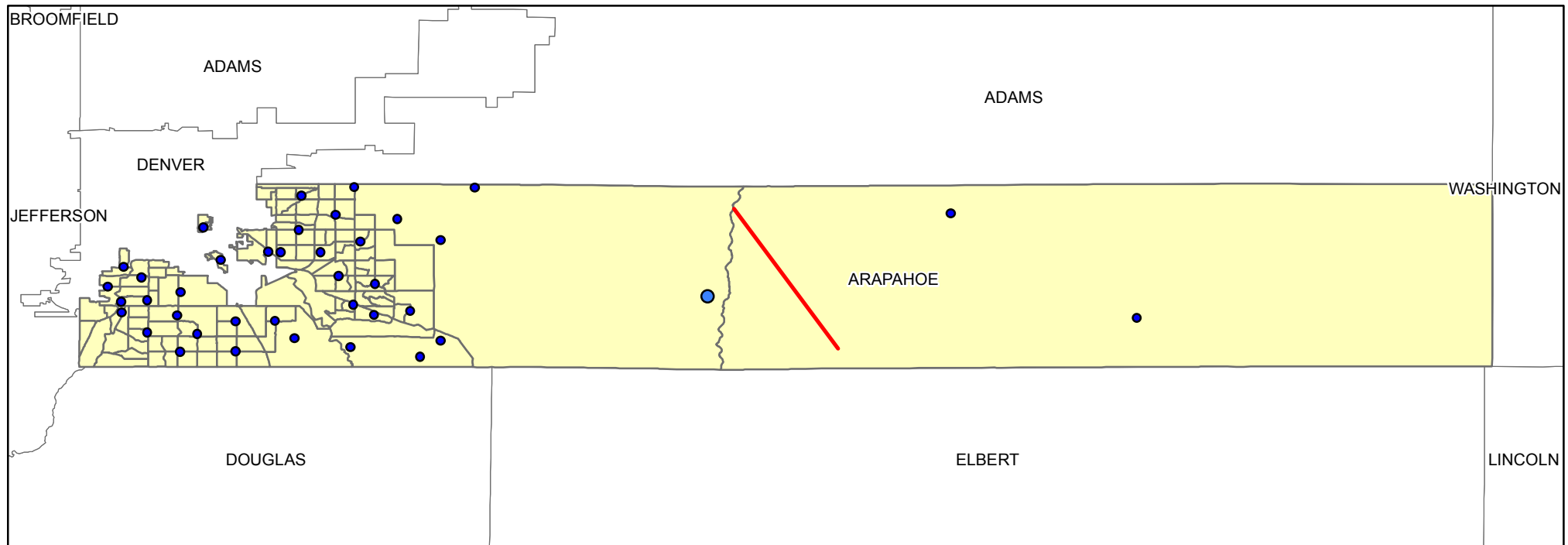
Projection: GCS North American 1983



Study Region: Arapahoe County

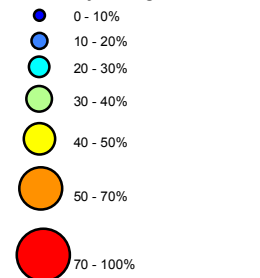
Hazard Scenario: Random Fault 6.5

Fire Stations Map

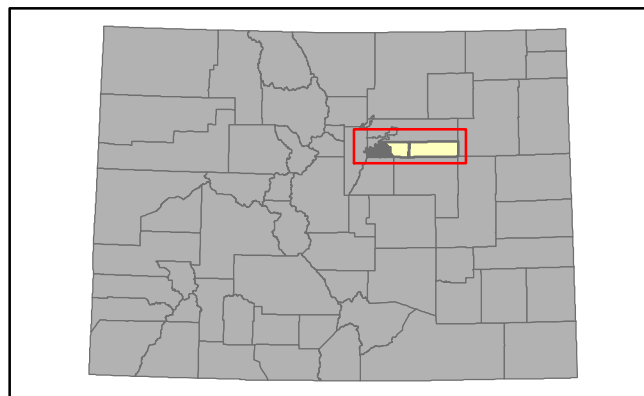


Legend

Fire Stations
Probability Damage > Extensive



— Fault
— Study Region Tract
— Counties



Created by: Colorado Geological Survey
Team: Matt Morgan and Scot Fitzgerald
Date Created: March 2013
Location: Arapahoe County Colorado
Fault Parameters: arbitrary, magnitude 6.5, depth 10km
Data: Changed to CGS Landslides and CGS/FEMA Soils data
Projection: GCS North American 1983

0 5 10 20 Miles

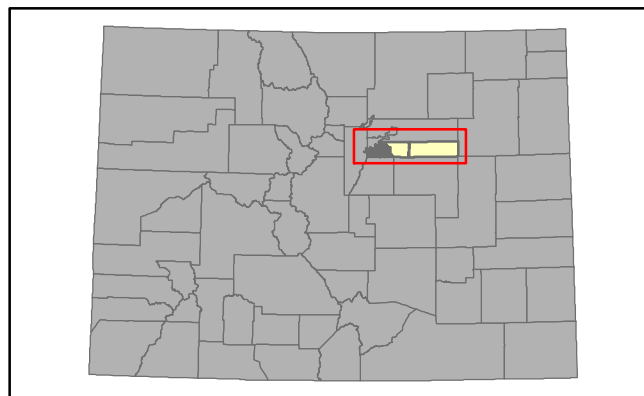
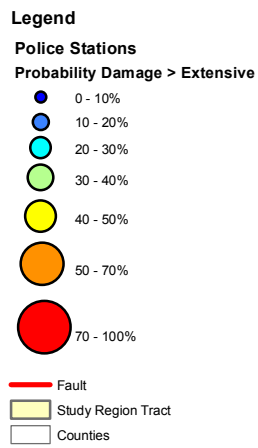
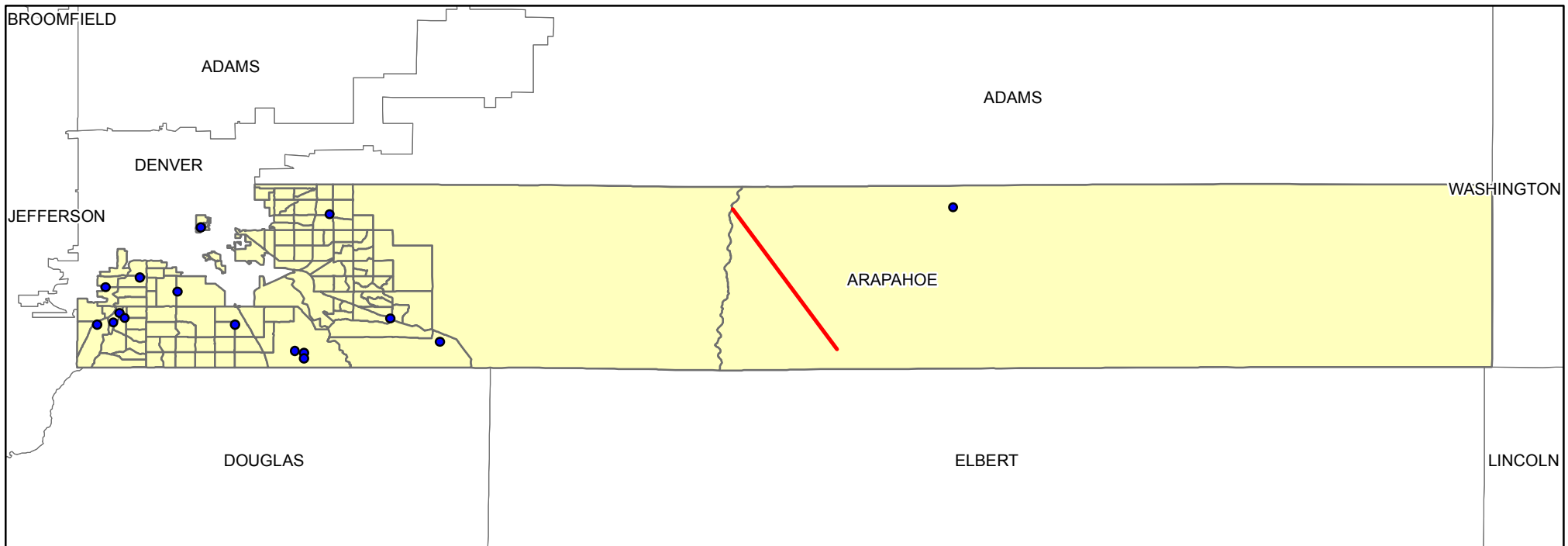


HAZUS
EARTHQUAKE • WIND • FLOOD

Study Region: Arapahoe County

Hazard Scenario: Random Fault 6.5

Police Stations Map



Created by: Colorado Geological Survey
Team: Matt Morgan and Scot Fitzgerald
Date Created: March 2013
Location: Arapahoe County Colorado
Fault Parameters: arbitrary, magnitude 6.5, depth 10km
Data: Changed to CGS Landslides and CGS/FEMA Soils data
Projection: GCS North American 1983

0 5 10 20 Miles

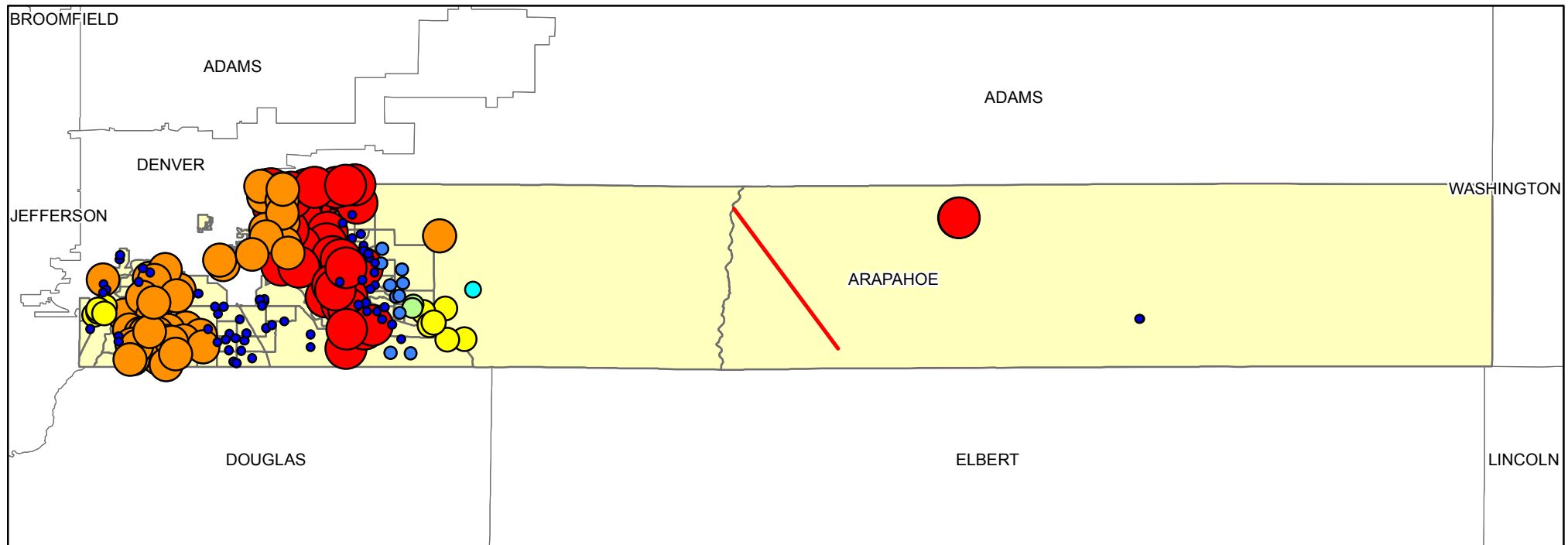


HAZUS
EARTHQUAKE • WIND • FLOOD

Study Region: Arapahoe County

Hazard Scenario: Random Fault 6.5

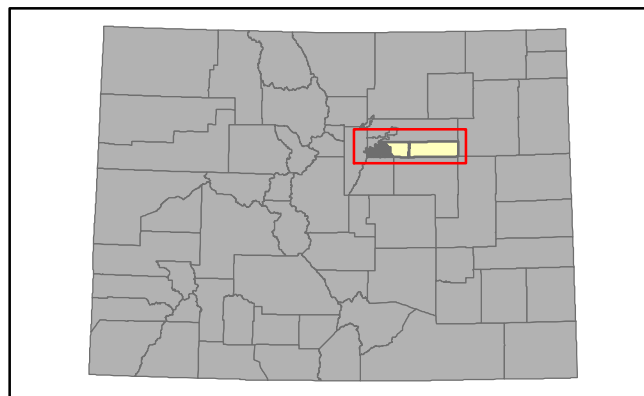
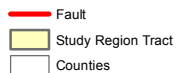
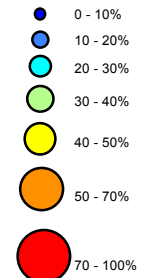
Schools Map



Legend

Schools

Probability Damage > Extensive



Created by: Colorado Geological Survey

Team: Matt Morgan and Scot Fitzgerald

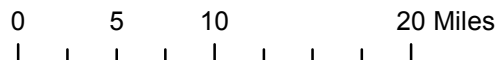
Date Created: March 2013

Location: Arapahoe County Colorado

Fault Parameters: arbitrary, magnitude 6.5, depth 10km

Data: Changed to CGS Landslides and CGS/FEMA Soils data

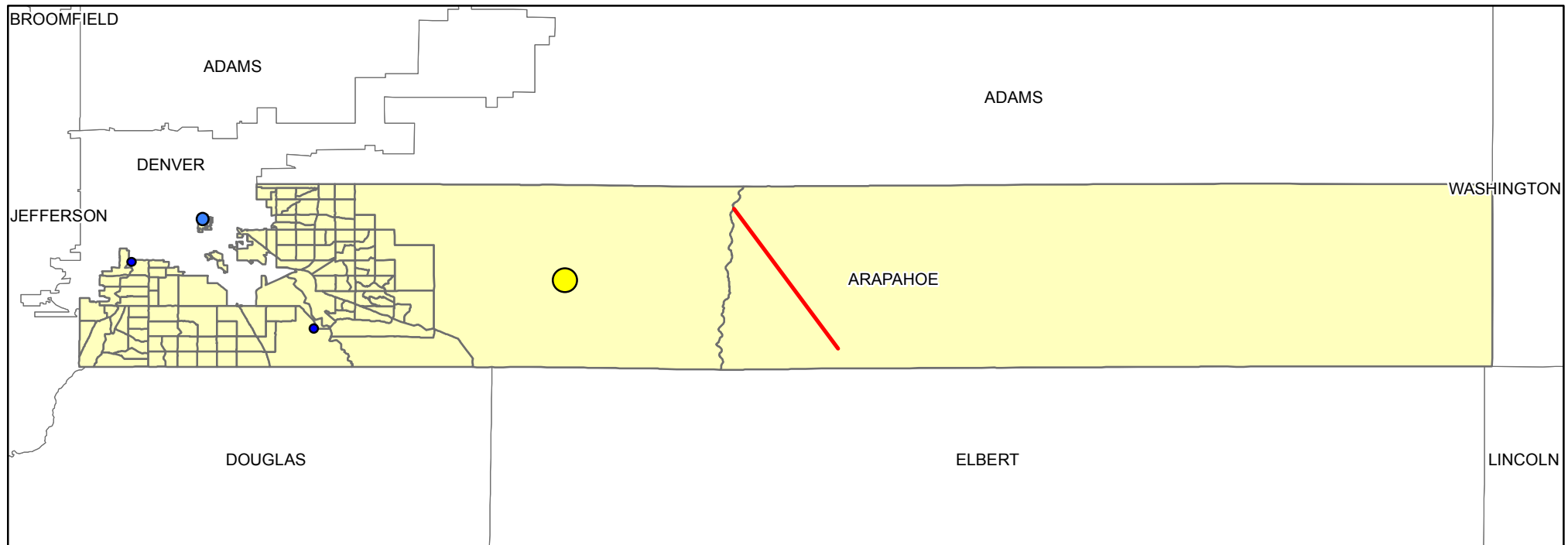
Projection: GCS North American 1983



Study Region: Arapahoe County

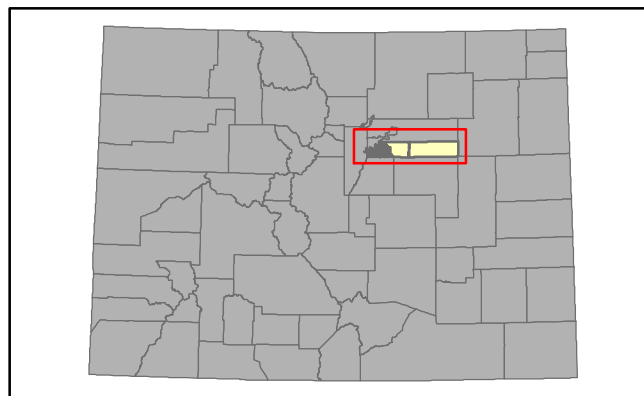
Hazard Scenario: Random Fault 6.5

Waste Water Facilities Map



Legend

- Waste Water Facilities**
Probability Damage > Extensive
- 0 - 10%
 - 10 - 20%
 - 20 - 30%
 - 30 - 40%
 - 40 - 50%
 - 50 - 70%
 - 70 - 100%
- Fault
— Study Region Tract
— Counties



Created by: Colorado Geological Survey
Team: Matt Morgan and Scot Fitzgerald
Date Created: March 2013
Location: Arapahoe County Colorado
Fault Parameters: arbitrary, magnitude 6.5, depth 10km
Data: Changed to CGS Landslides and CGS/FEMA Soils data
Projection: GCS North American 1983

0 5 10 20 Miles



HAZUS
EARTHQUAKE • WIND • FLOOD