The California Geological Survey (CGS), contracted by California Governor's Office of Emergency Services (Cal OES), completed eight-seven (87) HAZUS loss estimates for deterministic earthquake scenarios. This report documents the methodologies and tabular summaries as described in Section D of the contract.

D. I. HAZUS Methodology and Data Sources Used

Hazus is a program provided by FEMA to use as a standardized tool that estimates casualties, and damage and losses to building infrastructure and utility lifelines from natural hazards. The earthquake loss module uses inputs such as ground motion data to calculate the damage and losses from individual earthquake scenarios or to estimate annualized earthquake losses. These estimates provide useful information for regional and municipal disaster mitigation, planning, response, and reconstruction purposes.

The most recent version of Hazus at project implementation was Hazus 6.1. Notably, this release contains updates to the Earthquake Mapping Schemes and subsequent incorporation of additional seismic design levels for state's building inventory data, resulting in the use of up-to-date earthquake vulnerability attribution data for better identifying vulnerable areas and communities.

Eighty-seven scenarios in Table DII were analyzed. For each scenario, casualty, damage, and loss estimates were calculated at the census tract level for all counties experiencing 4% or greater USGS ShakeMap Peak Ground Acceleration (PGA) (Figure A).

Hazus-specific files for each scenario were downloaded from the 2014 Building Seismic Safety Council Earthquake Scenario Catalog
[https://earthquake.usgs.gov/scenarios/catalog/bssc2014/]
and imported into the Hazus Scenario Wizard as a User-defined Hazard (Figure B).

Ten scenarios lack Quick Assessment Reports as Hazus would produce a runtime error and crash during the production of the report. Consultation with the HAZUS programing team produced no resolution to the issue, however the data found in those reports (e.g., estimated economic loss, damage assessments, casualties and shelter needs) can be found in their respective detailed reports. The ten scenarios lacking the Quick Assessment Reports are: Almanor, Death Valley (No), Hilton Creek, Independence rev, Kern Canyon (South Kern), Klamath graben fault system (east), Likely, Mono Lake, Panamint Valley, and Warm Springs Valley fault zone.

Outputs of the individual analyses for each of the eighty-seven scenarios are incorporated into a variety of data products outlined in the Table A. Tabular summaries containing scenario information and results for all scenarios are indicated in Table B.

Table A

Product Type	Data
Maps	Scenario Intensity Map
	Total Building Related Economic Losses by Census Tract
	Loss Ratio by Census Tract
	Displaced Households by Census Tract
	Debris Generated by Census tract
Summary Reports	Direct Economic Losses for Buildings
	Direct Economic Losses for Transportation
	Direct Economic Losses for Utilities
	Casualties – All
	Shelter Requirements
	Global Summary Report
	Quick Assessment Report – 2AM
	Quick Assessment Report – 2PM
	Quick Assessment Report – 5PM
	Report Summary
Data Files	Results.shp
	hazard.shp
	damaged_facilities_points.shp
	damaged_facilities_lines.shp
	results.csv
	building_damage_by_occupancy.csv
	damaged_facilities.csv
	GeoJsonhazard.geojson
	StudyRegion.hpr

Table B

Table	Type of Data
DII	USGS Shakemap earthquake scenario name and magnitude
DIII	Individual scenario economic losses including: Total Building Related Losses, Transportation System Losses, and Utility System Losses
DIV	Individual scenario social impacts including: casualties by Hazus Severity Level for the 3 periods of 2AM, 2PM, and 5PM; Displaced Households; and Short Term Shelter Needs
DV	Individual scenario induced damages: Total Debris Generated
DVI	Individual scenario building losses by FEMA Preliminary Damage Assessment (PDA) categories of No Damage, Affected, Minor, Major, Destroyed

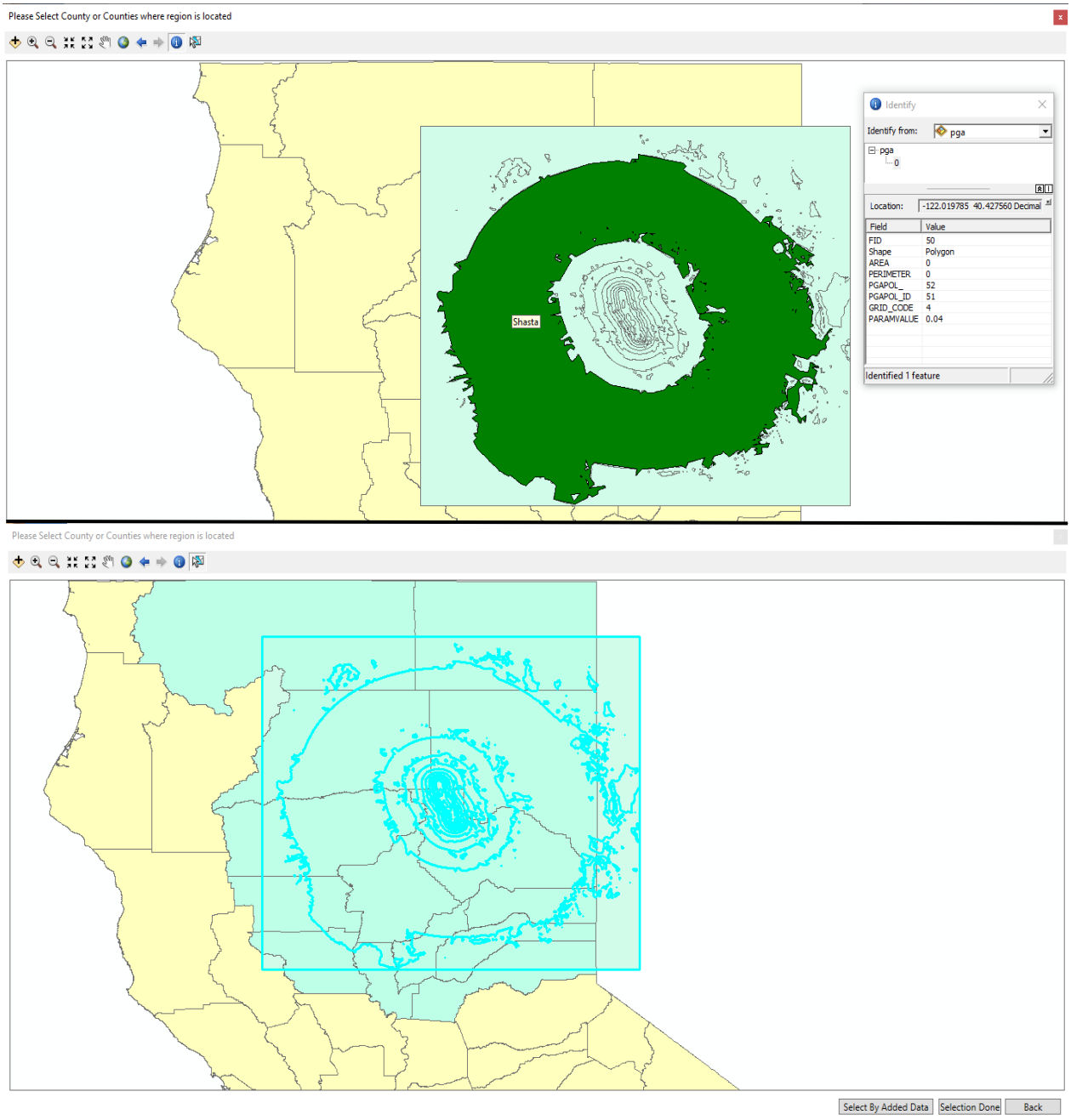

Figure A. Screenshot showing peak ground acceleration (PGA) polygons with the green polygon representing the area experiencing 4% - 8% PGA (top). Counties in light blue intersecting and within the outermost boundary of the green polygon were selected for analysis (bottom).

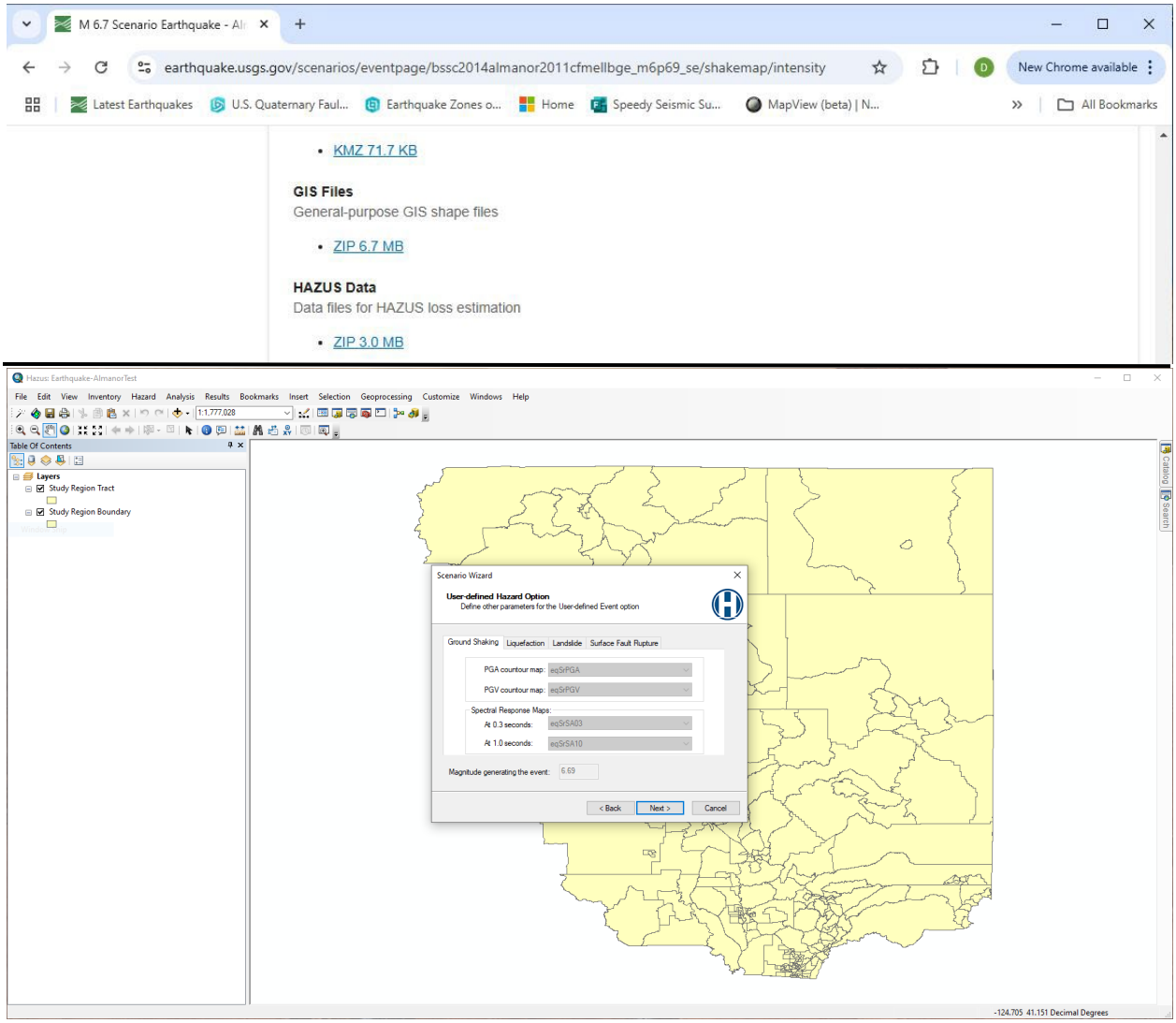

Figure B. Screenshot showing public website location where archived Hazus-specific files for an example scenario (Almanor M6.7) were obtained (top). Hazus User-defined scenario option GUI where archived files containing scenario-specific ground motion inputs, peak ground acceleration, peak ground velocity, and spectral accelerations at 1.0 and 3.0 seconds, were defined (bottom).

Table DII: earthquake scenario name and magnitude

Scenario Name	Magnitude
2016 Cascadia M 9 scenario	9.0
Almanor	6.69
Anacapa-Dume alt 1	7.2
Antelope Valley	7.03
Bartlett Springs	7.54
Big Lagoon - Bald Mtn	7.87
Calaveras: CC+CS+CE	7.26
Calaveras: CN+CC+CS	7.29
Calaveras: CN+CC+CS+CE	7.43
Carson Range-Kings Canyon fault	7.23
Cascadia Megathrust - whole CSZ Characteristic largest M branch	9.34
Cedar Mtn-Mahogany Mtn	7.13
Collayami	6.7
Compton	7.45
Coronado Bank alt2	7.38
Death Valley (No)	7.37
Eaton Roughs	7.36
Elsinore: CM+J+T+s+GI	7.69
Elsinore: CM+J+T+s+GI+W	7.77
Elsinore: J+T+s+GI+W	7.72
Great Valley 03 Mysterious Ridge	7.03
Great Valley 03a Dunnigan Hills	6.53
Great Valley 04a Trout Creek	6.6
Great Valley 04b Gordon Valley	6.77
Great Valley 06 (Midland)	7.27
Great Valley 06 Midland alt2	7.12
Great Valley 07 (Orestimba)	6.92
Great Valley 08 (Quinto)	6.59
Great Valley 09 (Laguna Seca)	6.57
Great Valley 13 (Coalinga)	7.03
Great Valley 14 (Kettleman Hills)	7.12
Hartley Springs	6.77
Hat Creek-McArthur-Mayfield	7.29
Hayward: HN+HS+HE	7.36
Hayward: RC+HN+HS	7.57
Hayward: RC+HN+HS+HE	7.58
Haywired M 7.05 scenarios (middle epicentral location)	7.05
Hilton Creek	6.92
Honey Lake	7.03
Hosgri	7.54
Hunting Creek - Berryessa	6.69
Independence rev	7.31
Kern Canyon (North Kern)	7.1
Kern Canyon (South Kern)	7.06
Klamath graben fault system (east)	7.36

Scenario Name	Magnitude
Likely	7.16
M 6.9 SD-TJ shakeout exercise scenario	6.9
Maacama	7.55
Mohawk Valley	7.13
Mono Lake	6.7
Monte Vista - Shannon	7.14
Monterey Bay-Tularcitos	7.26
N. San Andreas: SAN+SAP+SAS	7.88
N. San Andreas: SAO+SAN+SAP	7.94
N. San Andreas: SAO+SAN+SAP+SAS	8.04
Oak Ridge (Onshore)	7.16
Oceanic - West Huasna	7.21
Ortigalita (South)	7.01
Owens Valley	7.38
Panamint Valley	7.38
Pitas Point (Lower West)	7.21
Polaris	6.79
Puente Hills	7.08
Red Mountain	7.41
Reliz	7.44
Rose Canyon	6.99
Round Valley	7.02
S. San Andreas: CC+BB+NM+SM+NSB+SSB+BG+CO	8.1
S. San Andreas: CH+CC+BB+NM+SM+NSB+SSB+BG	8.1
S. San Andreas: CH+CC+BB+NM+SM+NSB+SSB+BG+CO	8.17
S. San Andreas: PK+CH+CC+BB+NM+SM+NSB+SSB+BG	8.11
S. San Andreas: PK+CH+CC+BB+NM+SM+NSB+SSB+BG+CO	8.18
San Cayetano	7.16
San Gregorio (North)	7.44
San Gregorio (South)	7.24
San Jacinto: SBV+SJV+s+A+CC+B	7.72
San Jacinto: SBV+SJV+s+A+CC+B+SM	7.76
San Luis Range (So Margin)	7.49
Santa Ynez (West)	7.11
Smith Valley fault	7.37
Southern California ShakeOut – M 7.8 on the Southern San Andreas Fault (2012 update)	7.8
Surprise Valley	7.2
Trinidad (alt1)	7.46
Warm Springs Valley fault zone	6.92
West Napa	6.97
White Mountains	7.38
Zayante-Vergeles	7.48

Table DIII: Total Building Related Losses, Transportation System Losses, and Utility System Losses

GSR=Global Summary Report.pdf

		GSR page 18	GSR page 19	GSR page 20
ECONOMIC LOSSES (in dollars)		**in dollars**	**in dollars**	**in dollars**
Scenario Name	**Magnitude**	**Total Building Related Losses**	**Total Transportation System Losses**	**Total Utility System Losses**
2016 Cascadia M 9 scenario	9.0	$5,630,090,000	$251,500,000	$4,007,740,000
Almanor	6.69	$82,870,000	$7,210,000	$714,880,000
Anacapa-Dume alt 1	7.2	$23,785,050,000	$718,610,000	$5,528,660,000
Antelope Valley	7.03	$35,930,000	$4,870,000	$116,270,000
Bartlett Springs	7.54	$2,084,800,000	$149,940,000	$1,831,720,000
Big Lagoon - Bald Mtn	7.87	$2,755,020,000	$82,720,000	$644,640,000
Calaveras: CC+CS+CE	7.26	$23,876,180,000	$790,420,000	$3,656,880,000
Calaveras: CN+CC+CS	7.29	$46,776,660,000	$1,416,430,000	$5,773,830,000
Calaveras: CN+CC+CS+CE	7.43	$54,097,220,000	$1,652,910,000	$7,220,170,000
Carson Range-Kings Canyon fault	7.23	$351,620,000	$20,620,000	$276,210,000
Cascadia Megathrust - whole CSZ Characteristic largest M branch	9.34	$14,623,140,000	$554,550,000	$10,407,890,000
Cedar Mtn-Mahogany Mtn	7.13	$57,000,000	$4,640,000	$185,900,000
Collayami	6.7	$884,800,000	$77,710,000	$3,896,300,000
Compton	7.45	$314,002,060,000	$6,709,680,000	$18,302,930,000
Coronado Bank alt2	7.38	$8,625,450,000	$532,520,000	$2,217,060,000
Death Valley (No)	7.37	$25,230,000	$6,420,000	$156,660,000
Eaton Roughs	7.36	$667,740,000	$35,530,000	$464,260,000
Elsinore: CM+J+T+s+GI	7.69	$54,088,330,000	$1,173,890,000	$10,099,440,000
Elsinore: CM+J+T+s+GI+W	7.77	$167,640,890,000	$3,139,430,000	$15,186,760,000
Elsinore: J+T+s+GI+W	7.72	$161,606,650,000	$2,947,280,000	$13,248,660,000
Great Valley 03 Mysterious Ridge	7.03	$4,232,450,000	$212,380,000	$2,545,780,000
Great Valley 03a Dunnigan Hills	6.53	$4,236,440,000	$211,160,000	$923,900,000
Great Valley 04a Trout Creek	6.6	$3,205,500,000	$164,340,000	$1,689,780,000
Great Valley 04b Gordon Valley	6.77	$9,644,510,000	$425,830,000	$4,211,960,000
Great Valley 06 (Midland)	7.27	$27,598,630,000	$981,980,000	$10,529,800,000
Great Valley 06 Midland alt2	7.12	$28,815,290,000	$954,290,000	$10,286,320,000
Great Valley 07 (Orestimba)	6.92	$11,754,570,000	$405,900,000	$4,554,200,000
Great Valley 08 (Quinto)	6.59	$1,453,990,000	$91,630,000	$3,325,470,000
Great Valley 09 (Laguna Seca)	6.57	$1,317,110,000	$61,650,000	$2,577,330,000
Great Valley 13 (Coalinga)	7.03	$1,489,430,000	$46,770,000	$1,881,690,000
Great Valley 14 (Kettleman Hills)	7.12	$1,747,640,000	$45,860,000	$2,281,540,000
Hartley Springs	6.77	$186,270,000	$5,810,000	$383,200,000
Hat Creek-McArthur-Mayfield	7.29	$245,780,000	$10,230,000	$1,150,580,000
Hayward: HN+HS+HE	7.36	$93,935,130,000	$2,722,060,000	$7,159,180,000
Hayward: RC+HN+HS	7.57	$145,173,450,000	$3,111,020,000	$9,631,920,000
Hayward: RC+HN+HS+HE	7.58	$150,150,190,000	$3,165,670,000	$10,470,450,000
Haywired M 7.05 scenarios (middle epicentral location)	7.05	$89,015,610,000	$2,482,760,000	$7,477,180,000
Hilton Creek	6.92	$105,030,000	$6,420,000	$623,380,000
Honey Lake	7.03	$269,570,000	$14,460,000	$317,390,000
Hosgri	7.54	$2,791,390,000	$125,120,000	$1,475,060,000
Hunting Creek - Berryessa	6.69	$2,274,760,000	$137,770,000	$1,732,510,000

		GSR page 18	GSR page 19	GSR page 20
ECONOMIC LOSSES (in dollars)		**in dollars**	**in dollars**	**in dollars**
Scenario Name	**Magnitude**	**Total Building Related Losses**	**Total Transportation System Losses**	**Total Utility System Losses**
Independence rev	7.31	$83,610,000	$13,510,000	$596,670,000
Kern Canyon (North Kern)	7.1	$69,550,000	$5,790,000	$291,520,000
Kern Canyon (South Kern)	7.06	$122,530,000	$7,670,000	$565,190,000
Klamath graben fault system (east)	7.36	$16,700,000	$5,480,000	$89,510,000
Likely	7.16	$47,030,000	$10,570,000	$124,610,000
M 6.9 SD-TJ shakeout exercise scenario	6.9	$26,397,090,000	$1,132,230,000	$2,686,540,000
Maacama	7.55	$11,687,410,000	$454,010,000	$5,742,200,000
Mohawk Valley	7.13	$380,850,000	$33,860,000	$792,710,000
Mono Lake	6.7	$13,620,000	$5,130,000	$132,060,000
Monte Vista - Shannon	7.14	$45,952,550,000	$1,362,370,000	$3,159,690,000
Monterey Bay-Tularcitos	7.26	$9,588,360,000	$266,130,000	$1,680,450,000
N. San Andreas: SAN+SAP+SAS	7.88	$119,210,410,000	$3,013,540,000	$7,785,690,000
N. San Andreas: SAO+SAN+SAP	7.94	$116,954,440,000	$3,069,340,000	$7,064,690,000
N. San Andreas: SAO+SAN+SAP+SAS	8.04	$132,775,440,000	$3,253,720,000	$8,954,510,000
Oak Ridge (Onshore)	7.16	$24,356,440,000	$637,080,000	$7,664,610,000
Oceanic - West Huasna	7.21	$5,219,600,000	$103,400,000	$1,615,190,000
Ortigalita (South)	7.01	$1,544,090,000	$105,910,000	$2,882,400,000
Owens Valley	7.38	$196,210,000	$19,270,000	$1,017,400,000
Panamint Valley	7.38	$91,940,000	$16,740,000	$593,110,000
Pitas Point (Lower West)	7.21	$8,430,980,000	$243,700,000	$1,192,770,000
Polaris	6.79	$917,610,000	$28,050,000	$310,210,000
Puente Hills	7.08	$180,808,120,000	$3,507,400,000	$9,935,180,000
Red Mountain	7.41	$15,572,230,000	$459,900,000	$3,333,790,000
Reliz	7.44	$12,982,150,000	$428,060,000	$2,394,720,000
Rose Canyon	6.99	$27,675,590,000	$1,199,430,000	$3,115,710,000
Round Valley	7.02	$178,380,000	$7,220,000	$1,272,320,000
S. San Andreas: CC+BB+NM+SM+NSB+SSB+BG+CO	8.1	$77,005,350,000	$1,886,870,000	$31,348,510,000
S. San Andreas: CH+CC+BB+NM+SM+NSB+SSB+BG	8.1	$76,255,110,000	$1,784,770,000	$30,133,500,000
S. San Andreas: CH+CC+BB+NM+SM+NSB+SSB+BG+CO	8.17	$82,978,770,000	$2,068,400,000	$33,320,330,000
S. San Andreas: PK+CH+CC+BB+NM+SM+NSB+SSB+BG	8.11	$79,737,450,000	$1,851,460,000	$31,453,560,000
S. San Andreas: PK+CH+CC+BB+NM+SM+NSB+SSB+BG+CO	8.18	$84,225,240,000	$2,114,850,000	$34,063,560,000
San Cayetano	7.16	$9,304,800,000	$323,130,000	$9,289,640,000
San Gregorio (North)	7.44	$26,196,860,000	$1,427,710,000	$2,857,280,000
San Gregorio (South)	7.24	$4,130,350,000	$171,450,000	$928,270,000
San Jacinto: SBV+SJV+s+A+CC+B	7.72	$52,468,570,000	$1,211,800,000	$12,363,710,000
San Jacinto: SBV+SJV+s+A+CC+B+SM	7.76	$54,990,570,000	$1,260,080,000	$14,257,460,000
San Luis Range (So Margin)	7.49	$10,012,420,000	$245,790,000	$2,395,560,000
Santa Ynez (West)	7.11	$4,017,280,000	$143,350,000	$912,270,000

		GSR page 18	GSR page 19	GSR page 20
ECONOMIC LOSSES (in dollars)		**in dollars**	**in dollars**	**in dollars**
Scenario Name	**Magnitude**	**Total Building Related Losses**	**Total Transportation System Losses**	**Total Utility System Losses**
Smith Valley fault	7.37	$30,140,000	$7,590,000	$157,430,000
Southern California ShakeOut – M 7.8 on the Southern San Andreas Fault (2012 update)	7.8	$115,185,560,000	$2,688,150,000	$43,118,060,000
Surprise Valley	7.2	$57,960,000	$6,630,000	$15,810,000
Trinidad (alt1)	7.46	$1,208,480,000	$55,080,000	$472,500,000
Warm Springs Valley fault zone	6.92	$17,510,000	$3,500,000	$66,830,000
West Napa	6.97	$11,705,240,000	$489,910,000	$2,630,300,000
White Mountains	7.38	$299,670,000	$12,590,000	$837,260,000
Zayante-Vergeles	7.48	$36,907,230,000	$848,170,000	$4,536,490,000

Table DIV: Casualties by Hazus Severity Level for the 3 periods of 2AM, 2PM, and 5PM; Displaced Households; Short Term Shelter Needs

GSR=Global Summary Report.pdf		GSR pg 16 table 10			GSR pg 15	GSR pg 15
SOCIAL IMPACTS		**Casualties by Hazus Severity Level**			**Displaced Households**	**Short Term Shelter Needs (# of people)**
Scenario Name	**Magnitude**	**2AM**	**2PM**	**5PM**		
2016 Cascadia M 9 scenario	9.0	361	643	450	1471	871
Almanor	6.69	1	1	1	1	0
Anacapa-Dume alt 1	7.2	1314	2004	1495	2590	1408
Antelope Valley	7.03	1	1	1	0	0
Bartlett Springs	7.54	162	157	119	165	96
Big Lagoon - Bald Mtn	7.87	237	321	231	977	591
Calaveras: CC+CS+CE	7.26	1393	2481	1938	2,678	1,562
Calaveras: CN+CC+CS	7.29	2798	5630	4327	11,033	5,730
Calaveras: CN+CC+CS+CE	7.43	3463	7130	5502	14,833	7,669
Carson Range-Kings Canyon fault	7.23	9	14	10	7	3
Cascadia Megathrust - whole CSZ Characteristic largest M branch	9.34	1170	2357	1668	4,933	2,886
Cedar Mtn-Mahogany Mtn	7.13	2	2	2	2	1
Collayami	6.7	43	43	34	46	25
Compton	7.45	46641	92742	67810	258750	145563
Coronado Bank alt2	7.38	380	554	405	256	117
Death Valley (No)	7.37	1	1	1	0	0
Eaton Roughs	7.36	27	35	27	72	42
Elsinore: CM+J+T+s+GI	7.69	4621	6190	4853	7589	4996
Elsinore: CM+J+T+s+GI+W	7.77	17976	40314	28948	80,580	49,800
Elsinore: J+T+s+GI+W	7.72	17140	38265	27518	76887	47544
Great Valley 03 Mysterious Ridge	7.03	167	274	188	121	70
Great Valley 03a Dunnigan Hills	6.53	239	529	355	868	483
Great Valley 04a Trout Creek	6.6	114	175	126	67	37
Great Valley 04b Gordon Valley	6.77	424	658	520	693	378
Great Valley 06 (Midland)	7.27	1452	2829	2311	2,587	1,480
Great Valley 06 Midland alt2	7.12	1650	3337	2667	3861	2175
Great Valley 07 (Orestimba)	6.92	717	903	735	1,090	658
Great Valley 08 (Quinto)	6.59	56	179	144	136	83
Great Valley 09 (Laguna Seca)	6.57	45	111	86	62	43
Great Valley 13 (Coalinga)	7.03	72	107	84	100	72
Great Valley 14 (Kettleman Hills)	7.12	88	115	93	69	52
Hartley Springs	6.77	5	8	5	16	5
Hat Creek-McArthur-Mayfield	7.29	8	12	8	10	5
Hayward: HN+HS+HE	7.36	10697	26430	19225	57220	29862
Hayward: RC+HN+HS	7.57	19166	51409	36368	114,713	58,122
Hayward: RC+HN+HS+HE	7.58	19476	52151	36944	115446	58644
Haywired M 7.05 scenarios (middle epicentral location)	7.05	8752	23578	17413	41036	23125
Hilton Creek	6.92	3	4	3	2	0
Honey Lake	7.03	19	26	20	67	37
Hosgri	7.54	177	244	187	395	209
Hunting Creek - Berryessa	6.69	82	126	86	74	36
Independence rev	7.31	3	4	5	3	1
Kern Canyon (North Kern)	7.1	2	2	1	0	0

		GSR pg 16 table 10			GSR pg 15	GSR pg 15
SOCIAL IMPACTS		**Casualties by Hazus Severity Level**			**Displaced Households**	**Short Term Shelter Needs (# of people)**
Scenario Name	**Magnitude**	**2AM**	**2PM**	**5PM**		
Kern Canyon (South Kern)	7.06	5	5	4	0	0
Klamath graben fault system (east)	7.36	0	0	0	0	0
Likely	7.16	2	2	1	0	0
M 6.9 SD-TJ shakeout exercise scenario	6.9	1719	3739	2777	8,589	3,874
Maacama	7.55	786	1796	1274	2560	1288
Mohawk Valley	7.13	7	13	10	11	4
Mono Lake	6.7	1	1	0	0	0
Monte Vista - Shannon	7.14	2830	5848	4457	12,564	5,889
Monterey Bay-Tularcitos	7.26	500	1191	844	2202	1083
N. San Andreas: SAN+SAP+SAS	7.88	18176	35398	25286	121,062	53,254
N. San Andreas: SAO+SAN+SAP	7.94	19550	36850	26345	129100	56169
N. San Andreas: SAO+SAN+SAP+SAS	8.04	21424	40654	29282	137,451	60,536
Oak Ridge (Onshore)	7.16	1735	2878	2275	4469	2631
Oceanic - West Huasna	7.21	386	582	462	806	494
Ortigalita (South)	7.01	45	112	84	55	34
Owens Valley	7.38	12	17	17	33	15
Panamint Valley	7.38	4	3	2	0	0
Pitas Point (Lower West)	7.21	771	1529	1133	4,527	2,715
Polaris	6.79	25	45	36	86	35
Puente Hills	7.08	26731	50158	36327	112174	66939
Red Mountain	7.41	1359	3031	2162	6,974	3,888
Reliz	7.44	878	2223	1641	3,158	1,867
Rose Canyon	6.99	1746	3687	2708	8225	3729
Round Valley	7.02	13	20	16	43	19
S. San Andreas: CC+BB+NM+SM+NSB+SSB+BG+CO	8.1	9108	11299	9097	27445	19097
S. San Andreas: CH+CC+BB+NM+SM+NSB+SSB+BG	8.1	8587	10849	8666	26,786	18,220
S. San Andreas: CH+CC+BB+NM+SM+NSB+SSB+BG+CO	8.17	9768	12233	9809	30275	20853
S. San Andreas: PK+CH+CC+BB+NM+SM+NSB+SSB+BG	8.11	8985	11449	9126	28,149	19,117
S. San Andreas: PK+CH+CC+BB+NM+SM+NSB+SSB+BG+CO	8.18	9887	12416	9952	30763	21148
San Cayetano	7.16	510	762	590	733	420
San Gregorio (North)	7.44	2345	3450	2580	20992	8795
San Gregorio (South)	7.24	160	298	209	384	185
San Jacinto: SBV+SJV+s+A+CC+B	7.72	6881	9227	7070	17466	12928
San Jacinto: SBV+SJV+s+A+CC+B+SM	7.76	7154	9593	7359	18,121	13,374
San Luis Range (So Margin)	7.49	964	1573	1250	2,327	1,305
Santa Ynez (West)	7.11	230	404	292	627	313
Smith Valley fault	7.37	1	1	1	0	0

		GSR pg 16 table 10			GSR pg 15	GSR pg 15
SOCIAL IMPACTS		**Casualties by Hazus Severity Level**			**Displaced Households**	**Short Term Shelter Needs (# of people)**
Scenario Name	**Magnitude**	**2AM**	**2PM**	**5PM**		
Southern California ShakeOut – M 7.8 on the Southern San Andreas Fault (2012 update)	7.8	13755	19017	14769	45376	30875
Surprise Valley	7.2	5	7	5	1	0
Trinidad (alt1)	7.46	72	93	78	236	135
Warm Springs Valley fault zone	6.92	1	1	0	1	1
West Napa	6.97	715	1574	1132	2,113	1,078
White Mountains	7.38	30	51	38	84	40
Zayante-Vergeles	7.48	3430	8503	6195	13,583	7,979

Table DV: Total Debris Generated

GSR=Global Summary Report.pdf

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INDUCED DAMAGES		
Scenario Name	**Magnitude**	**Total Debris Generated (tons)**
2016 Cascadia M 9 scenario	9.0	846,000
Almanor	6.69	4,000
Anacapa-Dume alt 1	7.2	2,223,000
Antelope Valley	7.03	1,000
Bartlett Springs	7.54	261,000
Big Lagoon - Bald Mtn	7.87	495,000
Calaveras: CC+CS+CE	7.26	2,210,000
Calaveras: CN+CC+CS	7.29	4,996,000
Calaveras: CN+CC+CS+CE	7.43	6,065,000
Carson Range-Kings Canyon fault	7.23	20,000
Cascadia Megathrust - whole CSZ Characteristic largest M branch	9.34	2,623,000
Cedar Mtn-Mahogany Mtn	7.13	5,000
Collayami	6.7	74,000
Compton	7.45	53,926,000
Coronado Bank alt2	7.38	531,000
Death Valley (No)	7.37	1,000
Eaton Roughs	7.36	76,000
Elsinore: CM+J+T+s+GI	7.69	5,874,000
Elsinore: CM+J+T+s+GI+W	7.77	27,945,000
Elsinore: J+T+s+GI+W	7.72	26,855,000
Great Valley 03 Mysterious Ridge	7.03	330,000
Great Valley 03a Dunnigan Hills	6.53	487,000
Great Valley 04a Trout Creek	6.6	219,000
Great Valley 04b Gordon Valley	6.77	799,000
Great Valley 06 (Midland)	7.27	2,607,000
Great Valley 06 Midland alt2	7.12	2,855,000
Great Valley 07 (Orestimba)	6.92	1,158,000
Great Valley 08 (Quinto)	6.59	179,000
Great Valley 09 (Laguna Seca)	6.57	140,000
Great Valley 13 (Coalinga)	7.03	119,000
Great Valley 14 (Kettleman Hills)	7.12	135,000
Hartley Springs	6.77	14,000
Hat Creek-McArthur-Mayfield	7.29	22,000
Hayward: HN+HS+HE	7.36	14,038,000
Hayward: RC+HN+HS	7.57	25,318,000
Hayward: RC+HN+HS+HE	7.58	25,879,000
Haywired M 7.05 scenarios (middle epicentral location)	7.05	12,080,000
Hilton Creek	6.92	6,000
Honey Lake	7.03	34,000
Hosgri	7.54	323,000
Hunting Creek - Berryessa	6.69	162,000
Independence rev	7.31	6,000

INDUCED DAMAGES		
Scenario Name	**Magnitude**	**Total Debris Generated (tons)**
Kern Canyon (North Kern)	7.1	3,000
Kern Canyon (South Kern)	7.06	7,000
Klamath graben fault system (east)	7.36	0
Likely	7.16	3,000
M 6.9 SD-TJ shakeout exercise scenario	6.9	2,681,000
Maacama	7.55	1,679,000
Mohawk Valley	7.13	26,000
Mono Lake	6.7	1,000
Monte Vista - Shannon	7.14	4,632,000
Monterey Bay-Tularcitos	7.26	1,075,000
N. San Andreas: SAN+SAP+SAS	7.88	20,173,000
N. San Andreas: SAO+SAN+SAP	7.94	19,910,000
N. San Andreas: SAO+SAN+SAP+SAS	8.04	22,741,000
Oak Ridge (Onshore)	7.16	2,666,000
Oceanic - West Huasna	7.21	633,000
Ortigalita (South)	7.01	142,000
Owens Valley	7.38	23,000
Panamint Valley	7.38	5,000
Pitas Point (Lower West)	7.21	1,106,000
Polaris	6.79	69,000
Puente Hills	7.08	29,405,000
Red Mountain	7.41	2,279,000
Reliz	7.44	1,655,000
Rose Canyon	6.99	2,725,000
Round Valley	7.02	24,000
S. San Andreas: CC+BB+NM+SM+NSB+SSB+BG+CO	8.1	10,470,000
S. San Andreas: CH+CC+BB+NM+SM+NSB+SSB+BG	8.1	10,218,000
S. San Andreas: . CH+CC+BB+NM+SM+NSB+SSB+BG+CO	8.17	11,343,000
S. San Andreas: PK+CH+CC+BB+NM+SM+NSB+SSB+BG	8.11	10,733,000
S. San Andreas: PK+CH+CC+BB+NM+SM+NSB+SSB+BG+CO	8.18	11,517,000
San Cayetano	7.16	827,000
San Gregorio (North)	7.44	3,422,000
San Gregorio (South)	7.24	350,000
San Jacinto: SBV+SJV+s+A+CC+B	7.72	7,048,000
San Jacinto: SBV+SJV+s+A+CC+B+SM	7.76	7,420,000
San Luis Range (So Margin)	7.49	1,394,000
Santa Ynez (West)	7.11	406,000
Smith Valley fault	7.37	1,000

INDUCED DAMAGES		
Scenario Name	**Magnitude**	**Total Debris Generated (tons)**
Southern California ShakeOut – M 7.8 on the Southern San Andreas Fault (2012 update)	7.8	16,284,000
Surprise Valley	7.2	10,000
Trinidad (alt1)	7.46	166,000
Warm Springs Valley fault zone	6.92	1,000
West Napa	6.97	1,391,000
White Mountains	7.38	52,000
Zayante-Vergeles	7.48	5,355,000

Table DVI: PDA categories of No Damage, Affected, Minor, Major, Destroyed

GSR=Global Summary Report.pdf

GSR page 9 Table 4

BUILDING LOSSES		FEMA Preliminary Damage Assessment (PDA) Categories				
Scenario Name	**Magnitude**	**No Damage**	**Affected**	**Minor**	**Major**	**Destroyed**
2016 Cascadia M 9 scenario	9.0	3,602,492	51,298	20,196	3,331	576
Almanor	6.69	546,665	1,648	138	4	0
Anacapa-Dume alt 1	7.2	6,289,780	365,572	42,559	3,360	293
Antelope Valley	7.03	1,830,505	678	29	0	0
Bartlett Springs	7.54	4,162,875	32,571	8,831	2,594	183
Big Lagoon - Bald Mtn	7.87	694,028	19,200	8,552	3,194	676
Calaveras: CC+CS+CE	7.26	4,680,517	318,033	40,287	4,558	709
Calaveras: CN+CC+CS	7.29	4,404,838	585,225	90,283	10,452	1,341
Calaveras: CN+CC+CS+CE	7.43	4,459,933	649,823	105,644	13,153	1,972
Carson Range-Kings Canyon fault	7.23	2,456,184	7,180	694	20	0
Cascadia Megathrust - whole CSZ Characteristic largest M branch	9.34	4,588,993	111,971	41,781	13,060	3,141
Cedar Mtn-Mahogany Mtn	7.13	241,904	847	217	36	1
Collayami	6.7	3,025,036	17,266	3,400	309	6
Compton	7.45	4,351,439	1,703,566	741,093	107,162	48,232
Coronado Bank alt2	7.38	6,455,925	163,525	10,500	541	23
Death Valley (No)	7.37	1,568,491	563	62	1	0
Eaton Roughs	7.36	1,637,088	12,863	1,736	153	7
Elsinore: CM+J+T+s+GI	7.69	5,775,405	823,596	134,683	20,725	4,744
Elsinore: CM+J+T+s+GI+W	7.77	4,947,216	1,540,545	375,681	66,823	21,227
Elsinore: J+T+s+GI+W	7.72	5,001,410	1,502,492	363,685	63,918	19,988
Great Valley 03 Mysterious Ridge	7.03	4,114,196	71,187	6,777	379	11
Great Valley 03a Dunnigan Hills	6.53	3,249,730	44,771	7,329	866	164
Great Valley 04a Trout Creek	6.6	3,811,587	54,904	3,600	129	5
Great Valley 04b Gordon Valley	6.77	3,822,296	152,600	16,939	1,095	89
Great Valley 06 (Midland)	7.27	4,102,411	389,457	53,158	4,235	1,019
Great Valley 06 Midland alt2	7.12	4,039,658	387,952	61,877	5,107	1,201
Great Valley 07 (Orestimba)	6.92	4,307,046	172,600	18,625	1,788	398
Great Valley 08 (Quinto)	6.59	3,818,067	18,684	2,483	347	80
Great Valley 09 (Laguna Seca)	6.57	3,607,781	18,235	2,479	297	22
Great Valley 13 (Coalinga)	7.03	6,181,973	21,478	2,473	202	25
Great Valley 14 (Kettleman Hills)	7.12	5,822,654	29,952	3,012	238	21
Hartley Springs	6.77	820,395	3,672	778	36	0
Hat Creek-McArthur-Mayfield	7.29	564,535	2,804	777	132	5
Hayward: HN+HS+HE	7.36	3,837,789	767,939	188,023	25,869	11,721
Hayward: RC+HN+HS	7.57	3,799,466	825,614	289,998	51,526	26,583
Hayward: RC+HN+HS+HE	7.58	4,031,898	862,039	307,067	53,421	27,108
Haywired M 7.05 scenarios (middle epicentral location)	7.05	3,448,103	762,428	160,272	18,167	10,204
Hilton Creek	6.92	894,926	2,810	331	8	0
Honey Lake	7.03	650,137	4,142	1,101	197	14
Hosgri	7.54	7,296,247	49,172	9,672	1,373	93
Hunting Creek - Berryessa	6.69	3,763,129	40,631	3,092	159	4
Independence rev	7.31	1,655,756	1,614	233	7	0
Kern Canyon (North Kern)	7.1	4,325,338	1,148	56	0	0
Kern Canyon (South Kern)	7.06	4,588,483	2,875	260	3	0

GSR page 9 Table 4

BUILDING LOSSES		FEMA Preliminary Damage Assessment (PDA) Categories				
Scenario Name	**Magnitude**	**No Damage**	**Affected**	**Minor**	**Major**	**Destroyed**
Klamath graben fault system (east)	7.36	215,086	324	43	1	0
Likely	7.16	475,409	1,190	214	3	0
M 6.9 SD-TJ shakeout exercise scenario	6.9	2,328,916	312,500	69,074	8,163	1,613
Maacama	7.55	4,217,105	119,662	27,596	6,073	1,236
Mohawk Valley	7.13	2,189,211	6,561	821	55	3
Mono Lake	6.7	973,493	360	57	1	0
Monte Vista - Shannon	7.14	3,927,140	458,908	109,268	11,001	1,791
Monterey Bay-Tularcitos	7.26	4,554,674	110,079	18,745	2,464	447
N. San Andreas: SAN+SAP+SAS	7.88	4,394,890	775,541	215,962	46,651	19,647
N. San Andreas: SAO+SAN+SAP	7.94	4,330,644	732,229	204,383	44,303	19,999
N. San Andreas: SAO+SAN+SAP+SAS	8.04	4,347,452	832,950	233,913	51,276	23,490
Oak Ridge (Onshore)	7.16	6,526,369	320,832	49,450	5,456	1,501
Oceanic - West Huasna	7.21	4,834,198	77,042	15,601	3,287	327
Ortigalita (South)	7.01	4,526,636	20,181	1,953	244	19
Owens Valley	7.38	4,756,687	3,132	873	139	6
Panamint Valley	7.38	5,959,879	1,911	197	4	0
Pitas Point (Lower West)	7.21	4,776,082	44,172	24,610	4,274	1,340
Polaris	6.79	1,489,218	13,132	3,168	287	22
Puente Hills	7.08	4,737,825	1,387,258	431,778	53,382	20,270
Red Mountain	7.41	7,184,340	113,764	37,718	7,535	2,383
Reliz	7.44	4,590,405	138,653	23,753	3,408	1,048
Rose Canyon	6.99	5,791,274	329,350	74,358	8,432	1,376
Round Valley	7.02	865,485	2,631	731	174	11
S. San Andreas: CC+BB+NM+SM+NSB+SSB+BG+CO	8.1	7,771,440	1,009,636	185,797	40,187	18,297
S. San Andreas: CH+CC+BB+NM+SM+NSB+SSB+BG	8.1	9,247,701	1,014,095	183,668	40,387	16,425
S. San Andreas: CH+CC+BB+NM+SM+NSB+SSB+BG+CO	8.17	9,491,080	1,082,993	198,630	42,920	19,419
S. San Andreas: PK+CH+CC+BB+NM+SM+NSB+SSB+BG	8.11	9,613,757	1,053,841	192,821	41,767	17,239
S. San Andreas: PK+CH+CC+BB+NM+SM+NSB+SSB+BG+CO	8.18	9,363,360	1,098,311	201,128	43,412	19,572
San Cayetano	7.16	7,156,678	156,308	13,357	1,256	231
San Gregorio (North)	7.44	4,271,426	326,588	50,389	7,446	763
San Gregorio (South)	7.24	4,570,820	61,838	6,488	498	50
San Jacinto: SBV+SJV+s+A+CC+B	7.72	6,125,349	613,158	131,334	25,591	11,910
San Jacinto: SBV+SJV+s+A+CC+B+SM	7.76	6,090,930	640,642	135,840	27,399	12,529
San Luis Range (So Margin)	7.49	6,981,659	102,712	26,211	5,745	2,089
Santa Ynez (West)	7.11	5,466,426	50,945	11,515	1,545	108
Smith Valley fault	7.37	2,455,455	512	31	0	0
Southern California ShakeOut – M 7.8 on the Southern San Andreas Fault (2012 update)	7.8	5,650,196	1,356,774	284,800	55,779	28,165
Surprise Valley	7.2	169,664	717	269	109	14
Trinidad (alt1)	7.46	399,586	17,273	3,723	814	77
Warm Springs Valley fault zone	6.92	619,572	421	54	2	0

GSR page 9 Table 4

BUILDING LOSSES		FEMA Preliminary Damage Assessment (PDA) Categories				
Scenario Name	**Magnitude**	**No Damage**	**Affected**	**Minor**	**Major**	**Destroyed**
West Napa	6.97	3,953,358	152,465	22,334	2,812	875
White Mountains	7.38	2,129,640	3,295	1,235	441	48
Zayante-Vergeles	7.48	4,725,183	266,198	73,219	10,608	6,813

Section E: Data Delivery

Project data will be delivered to Cal OES via SharePoint site. The files included:

1. Final Report file containing:
    a. The final report as described in Section D of the contract.
    b. An Excel file called CGS HAZUS Scenario Loss Estimates - Section D.xlsx which contains:
        i. data for all tables (DII, DIII, DIV, DV, DVI) documented in Section D of the contract;
        ii. Output comparisons from different reports due to rounding and or significant digits.
        iii. Runtime error stats – errors received when running Quick Assessment Report
        iv. Rerun Comparisons – difference documented when rerunning HAZUS due to script updates. These were document for Cal OES and the FEMA HAZUS team.
2. Eighty-seven zipped scenario folders containing the following folders:
    a. USGS ShakeMap Scenario Intensity Map
    b. Maps:
        i. Debris Generated by Census Tract.pdf
        ii. Displaced Households by Census Tract.pdf
        iii. Loss Ratio by Census Tract.pdf
        iv. Total Building Related Economic Loss by Census Tract.pdf
        v. ArcGIS Pro project
    c. Reports
        i. building damage count by general occupancy.pdf
        ii. casualties - all.pdf
        iii. debris generated.pdf
        iv. direct economic losses for buildings.pdf
        v. direct economic losses for transportation.pdf
        vi. direct economic losses for utilities.pdf
        vii. global summary report.pdf
        viii. shelter requirements.pdf
    d. HAZUS Export Tool exports
        i. Shapefile exports
        ii. Report Summary
        iii. CSVs: building_damage_by_occupancy, building_damage_by_type, damaged_facilities, and results
    e. Scenario Files
    f. Scenario.hpr