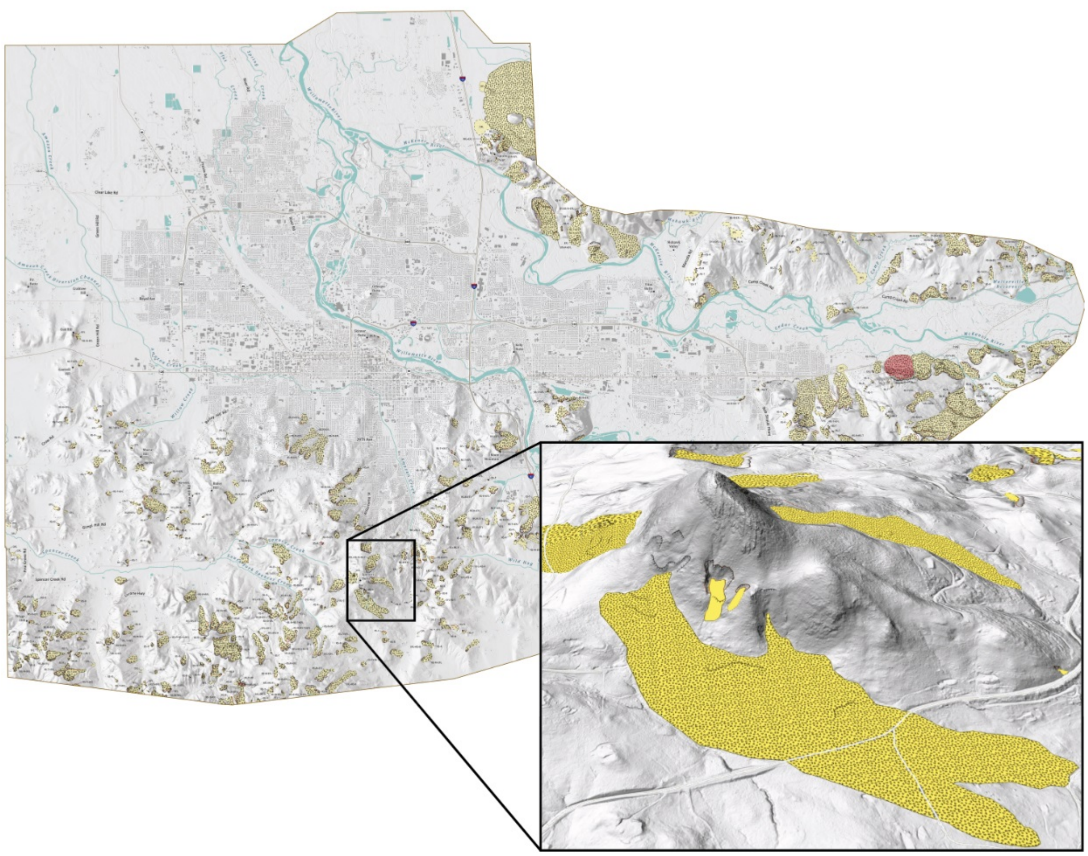
State of Oregon
Oregon Department of Geology and Mineral Industries
Brad Avy, State Geologist

INTERPRETIVE MAP 60

LANDSLIDE HAZARD AND RISK STUDY OF EUGENE-SPRINGFIELD AND LANE COUNTY, OREGON

by Nancy C. Calhoun[1], William J. Burns[1], Jon J. Franczyk[1], and Gustavo Monteverde[2]



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DISCLAIMER

Cover image: *Landslide inventory map of the Eugene-Springfield study area. Inset shows closeup of mapped landslides near Spencer Butte. See Plate 1 of this publication for more information.*

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GEOGRAPHIC INFORMATION SYSTEM (GIS) DATA

See the digital publication folder for files. Geodatabase is Esri® version 10.1 format. Metadata is embedded in the geodatabase and is also provided as separate .xml format files.

Eugene_Springfield_landslide_GIS_IMS_60.gdb:

Datasets:

- Buildings
  - building_footprints (polygons)
- Engineering_Geology
  - Eugene_Bedrock_Geo (polygons)
  - Eugene_Surficial_Geo (polygons)
- Landslide_Inventory
  - Deposits (polygons)
  - Historic_landslide_points (points)
  - Scarp_Flanks (polygons)
  - Scarps (polylines)
- Eugene_Deep_Susc (polygons)
- Eugene_Shallow_Susc (raster)

1.0 REPORT SUMMARY

This Eugene-Springfield landslide hazard and risk study was undertaken by the Oregon Department of Geology and Mineral Industries (DOGAMI) in order to create detailed, usable maps and analyses on the level and location of the landslide hazard and risk to infrastructure in the study area. This project was funded by the Federal Emergency Management Agency Risk MAP (Mapping, Assessment, and Planning) Program (EMW-2015-CA-00106). Lane County has experienced hundreds of landslides in the past 50 years. Many of these have been recorded in the Statewide Landslide Information Database for Oregon (SLIDO); however, no landslide hazard study has been conducted in the most populous portion of the county: the Eugene-Springfield metro area. The cities of Springfield and Eugene are growing at a rate of 5% to 7.7% annually (U.S. Census 2010) and, as this is the second most populated metro area in Oregon, understanding landslide hazards and risk from landslides is important for citizens and those addressing natural hazards in their organizations.

For this study we used the protocols established by DOGAMI for 1) making a landslide inventory; that is, mapping existing landslide deposits, 2) modeling deep and shallow landslide susceptibility in order to demonstrate where landslides may occur in the future, and 3) assessing landslide risk through exposure analysis and by using the FEMA Hazus-MH model. These established methods allow for a consistent scientific framework and comparison to other areas in Oregon to understand relative risk.

The study area is 230 mi^2 (595 km^2) centered on the Eugene-Springfield and Coburg urban growth boundaries with a buffer to include as much of the surrounding populated areas of Lane County as our project scope and available lidar coverage allowed. Our results include the following:

- There are over 700 existing landslides, including historic landslide points, covering 6% of the total study area.
- More than 4,500 residents live on existing deep-seated landslides.
- Approximately $476 M worth of buildings is located on existing deep landslides.

To better understand the results, we divided the study area into subsections, defined by communities. The landslide hazard is concentrated in a few communities. Notably, in the hills south of Eugene, southeast of Springfield, and throughout unincorporated Lane County, there is markedly more landslide hazard than in the dominantly flat, alluvial terrain in north-central and western Eugene, and in western Springfield along the McKenzie River and Willamette River.

The results led us to conclude that, overall, the study area experiences moderate landslide hazard and risk, with both concentrated in a few communities in the study area. We recommend:

- increasing private property owners' awareness of existing landslide hazards and taking precautions through risk reduction efforts at the individual lot level,
- incorporating landslide hazard maps and risk reduction strategies into community- and county-level planning efforts, and
- creating a landslide emergency response plan in order to best prepare and react in the case of a landslide occurrence.

The primary landslide hazard in the study area is exposure of existing structures to deep landslides. Substantive risk reduction activities for this type of landslide hazard include controlling the input of water onto slopes within the moderate and deep landslide susceptibility zones and on existing deep landslides, and avoiding adding material (weight) to the tops of susceptible slopes or, conversely, removing material from the bottoms of slopes (excavation or grading).

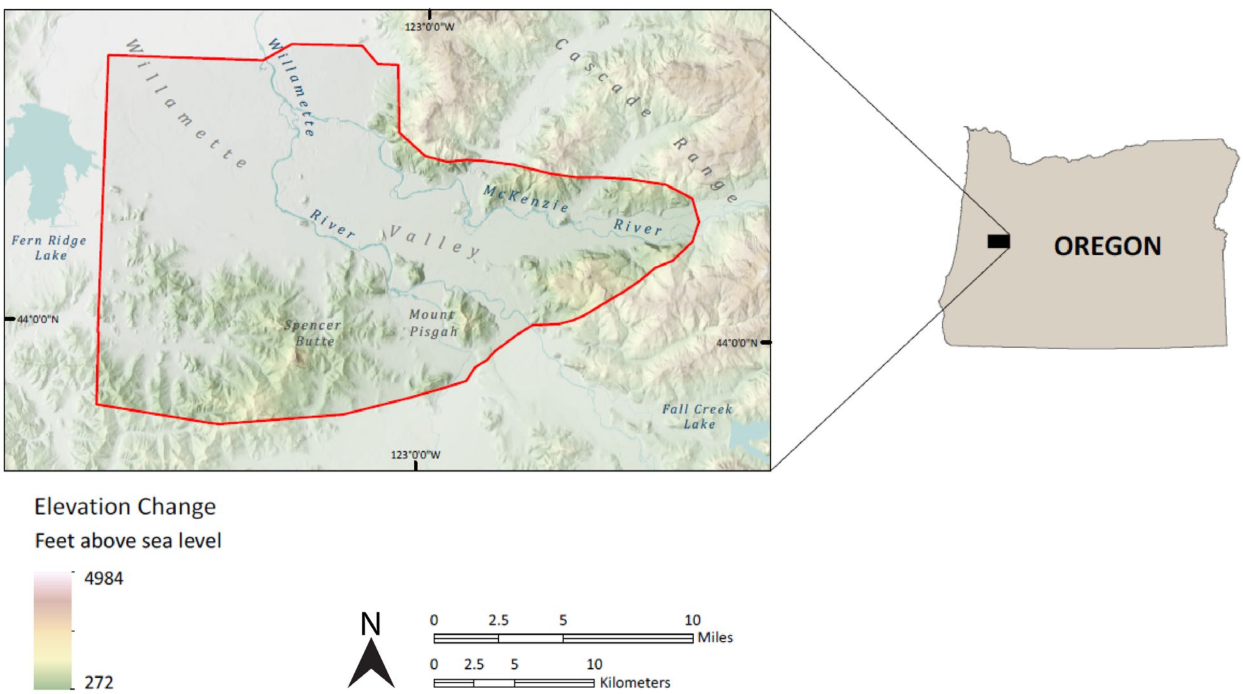
2.0 INTRODUCTION

Lane County has experienced many landslides in the last 50 years. Risk from landslides is not well-constrained for the most populated portions of the county. Assessing landslide risk is the primary reason for this study. In our work, we use DOGAMI protocols established by Burns and Madin (2009), Burns and others (2012), and Burns and Mickelson (2016). We also draw from the insights and results of Burns and others (2018).

2.1 The Study Area

The study area encompasses the population centers of the cities of Eugene and Springfield and includes within the project scope as much of the surrounding populated area as possible within available lidar-derived basemap coverage (**Figure 2-1**). We defined the southeastern boundary by available lidar coverage, and we used established quadrangle boundaries to define the western and northern boundaries.

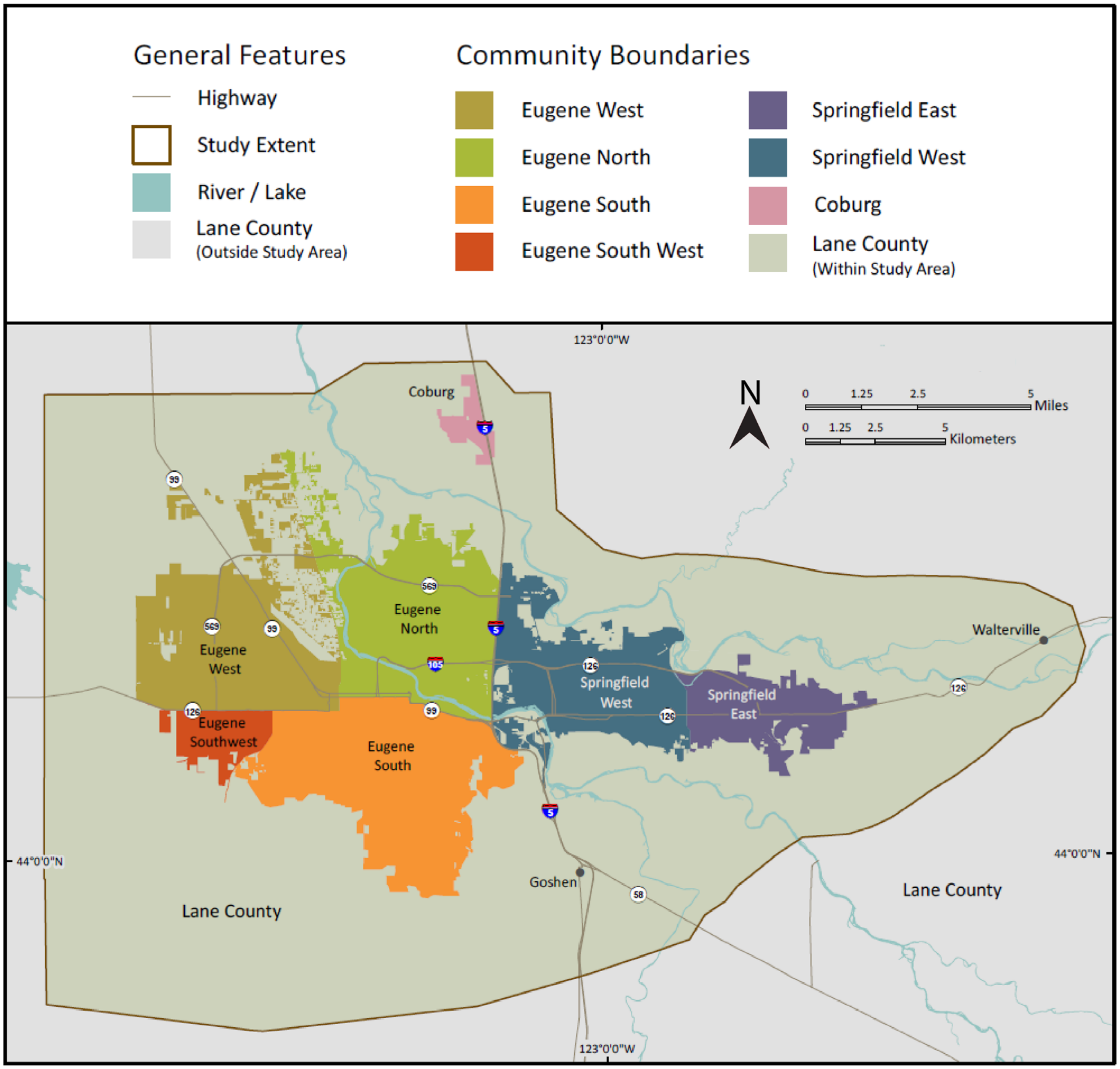
Figure 2-1. Map of the study area.



The study area includes the Cities of Eugene, Springfield, and Coburg, the unincorporated communities of Goshen and Walterville, and areas of unincorporated Lane County (**Figure 2-2**). The Cities of Eugene and City of Springfield are divided into risk reporting areas roughly defined by neighborhoods. The study area is the second most populous metro area in Oregon, with 256,278 people living within its boundaries (2010 U.S. Census, https://www.census.gov/2010census/data/).

The study area is centered on the southern terminus of the Willamette Valley, flanked by the Coast Range on the west and the Western Cascades on the east. The metro area includes the confluence of the Coastal Fork and Middle Fork of the Willamette River near Eugene's South Hills, as well as the confluence of the McKenzie River and the Willamette River just north of Eugene. These major rivers and the associated alluvial plains characterize the relatively flat topography along the valley floor. The subdued hills that comprise the South Hills of Eugene and more rugged mountains in the north and east of the study area define the terrain in the uplands surrounding the terminus of the Willamette Valley (Plate 1).

Figure 2-2. Map of risk reporting areas/communities in the study area.



The study area has a West Coast marine climate, with cool, wet winters and warm, dry summers. The precipitation is driven by a strong orographic effect associated with warmer moist air coming inland from the Pacific Ocean. As this moist air is driven up the Cascade Range, prolonged periods of precipitation result. The average annual precipitation ranges between 30 and 60 inches per year (Spatial Climate Analysis Service, 2000).

The region is subjected to small- to large-magnitude earthquakes from three primary sources: 1) Cascadia Subduction Zone, 2) intraplate, and 3) crustal. The Cascadia Subduction Zone is approximately 100 miles to the west, off the coast. The source for intraplate earthquakes is related to the subducting Juan de Fuca plate movement deep below the area. Shallow, crustal earthquakes occur from geologic structures near the surface, with a variety of potential sources in the greater Willamette Valley area (McClaughry and others, 2010).

2.2 Purpose

The purpose of this project is to help communities in this region become more aware of and resilient to landslide hazards by providing the communities with accurate, detailed, and up-to-date information about these hazards and community assets at risk.

The main objectives of this study are to:

- compile existing data including previous geologic hazard reports and natural hazard mitigation plans,
- create new geodatabase of landslide hazards including landslide inventory and susceptibility,
- compile or create a database of critical facilities and primary infrastructure, generalized land occupancy (land use/zoning), buildings, and population distribution data, and
- perform exposure and Hazus–based risk analyses.

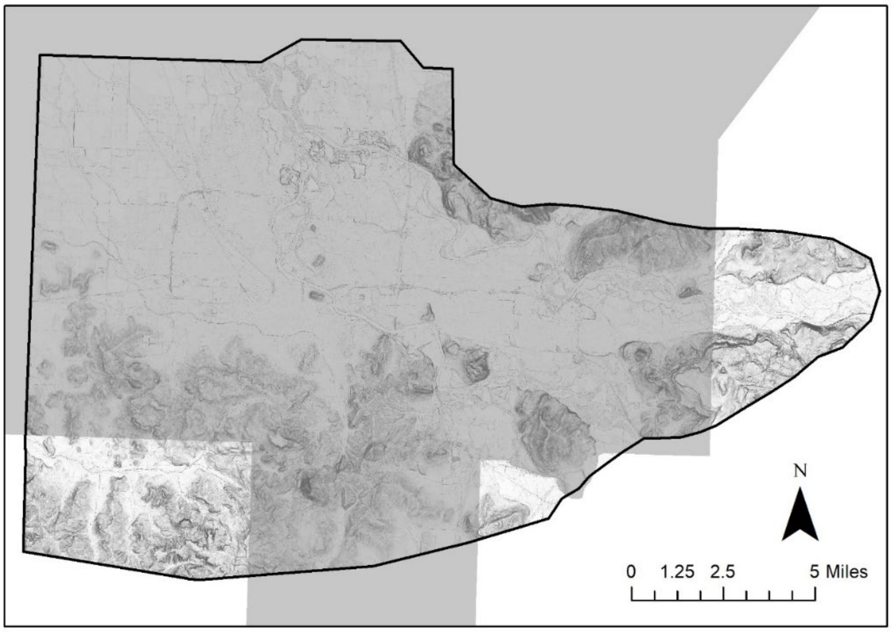
The body of this report describes the methods and results for these objectives. Throughout this report we use the engineering geology terms *hazard*, *susceptibility*, and *risk*. The term hazard is defined here as a possible source of danger, and in this report we are specifically referring to landslides as a hazard. The term susceptibility in this context is defined as a particular area being capable of slope failure or landsliding. The term risk is defined here as the possibility of loss or injury. In this report risk is the overlap of the hazard with assets (such as infrastructure) and their vulnerability to the hazard (Burns and others, 2015).

2.3 Adjacent Past Geologic or Related Studies

There have been no specific landslide hazard studies or risk studies in the Eugene metro area recently. There have been several landslide studies in northern Willamette Valley, including parts of Clackamas and Multnomah Counties (Burns and others, 2013; Burns and others, 2018), which we can use to compare relative risk.

Recent, in-depth geologic mapping in this area used lidar for analysis and included interpreted landslide deposits. The Southern Willamette Valley study (McClaughry and others, 2010) identified 26 landslide polygons within the current study area. However, as seen in **Figure 2-3**, some parts of our current study area are outside the study area of McClaughry and others (2010).

Figure 2-3. Southern Willamette Valley geologic map coverage shown in grey (McClaughry and others, 2010).



2.4 Engineering Geology

We created bedrock and surficial engineering geologic maps of the study area as input datasets for the deep and shallow landslide susceptibility models described later in this report. Engineering geology maps are commonly based on geotechnical properties and engineering behavior derived from a standard lithostratigraphic geologic map (Dobbs and others, 2012). Such maps are commonly divided into bedrock engineering geology and surficial engineering geology (Keaton and DeGraff, 1996).

In general, we followed the methods of Burns and others (2012) and Burns and Mickelson (2016) to create the surficial and bedrock engineering geology maps. A brief geologic history of the study area is provided below. For additional information on the bedrock and surficial geology, see McClaughry and others (2010) and the Oregon Geologic Data compilation (OGDC, release 6 [Smith and Roe, 2015]).

Three distinct physiographic provinces, the Coast Range, the Western Cascades, and the Willamette Valley (after Walker, 1977), coalesce in the study area. This means a diverse assemblage of rocks and sediment, as well as diverse topography, define the Eugene-Springfield metro and surrounding area. The highest buttes, peaks, ridgelines, and plateaus reach 1,800 ft above sea level, while the majority of the Eugene-Springfield metro area along the alluvial plains of the Willamette and McKenzie Rivers is between 400 and 450 ft above sea level.

The majority of geologic units in the study area are a result of deposition and deformation along the Juan de Fuca plate and North American plate boundary, which is an active subduction zone (Niem and Niem, 1984; Orr and Orr, 2012; McClaughry and others, 2010). The geologic setting is a complex forearc basin east of the Cascadia subduction zone, with accumulation of ~23,000 ft of volcanic and sedimentary strata during the Cenozoic (last 65 million years). A major structural feature, the Eugene-Denio lineament, strikes northwest to southeast through the southern terminus of the Willamette Valley. Rocks range from mid-Eocene sedimentary rocks to late Eocene and Oligocene volcanic and volcaniclastic rocks. These are overlain locally by Quaternary sediments including landslides, fans, and alluvial plain deposits (McClaughry and others, 2010).

The oldest rocks in the study area are exposed in the hills southwest of Eugene and include sedimentary rocks that are part of the middle Eocene Spencer Formation (~48 Ma). The Spencer Formation is overlain by younger sedimentary rocks of the Eugene Formation and interlayered tuffs and volcaniclastic rocks of the Fisher Formation. Early Western Cascade Volcanics define the northeastern portion of the study area, with an eruptive center, the Mohawk River caldera, defining the ridgeline of the Coburg Hills (McClaughry and others, 2010).

We simplified the geologic units in the study area into 11 bedrock engineering geologic units on the basis of similar geologic and geotechnical properties (**Figure 2-4**):

Late Pliocene and Quaternary units:

- Alluvium (Holocene to late Pleistocene)
- Older terrace alluvium (late Pliocene to Pleistocene)

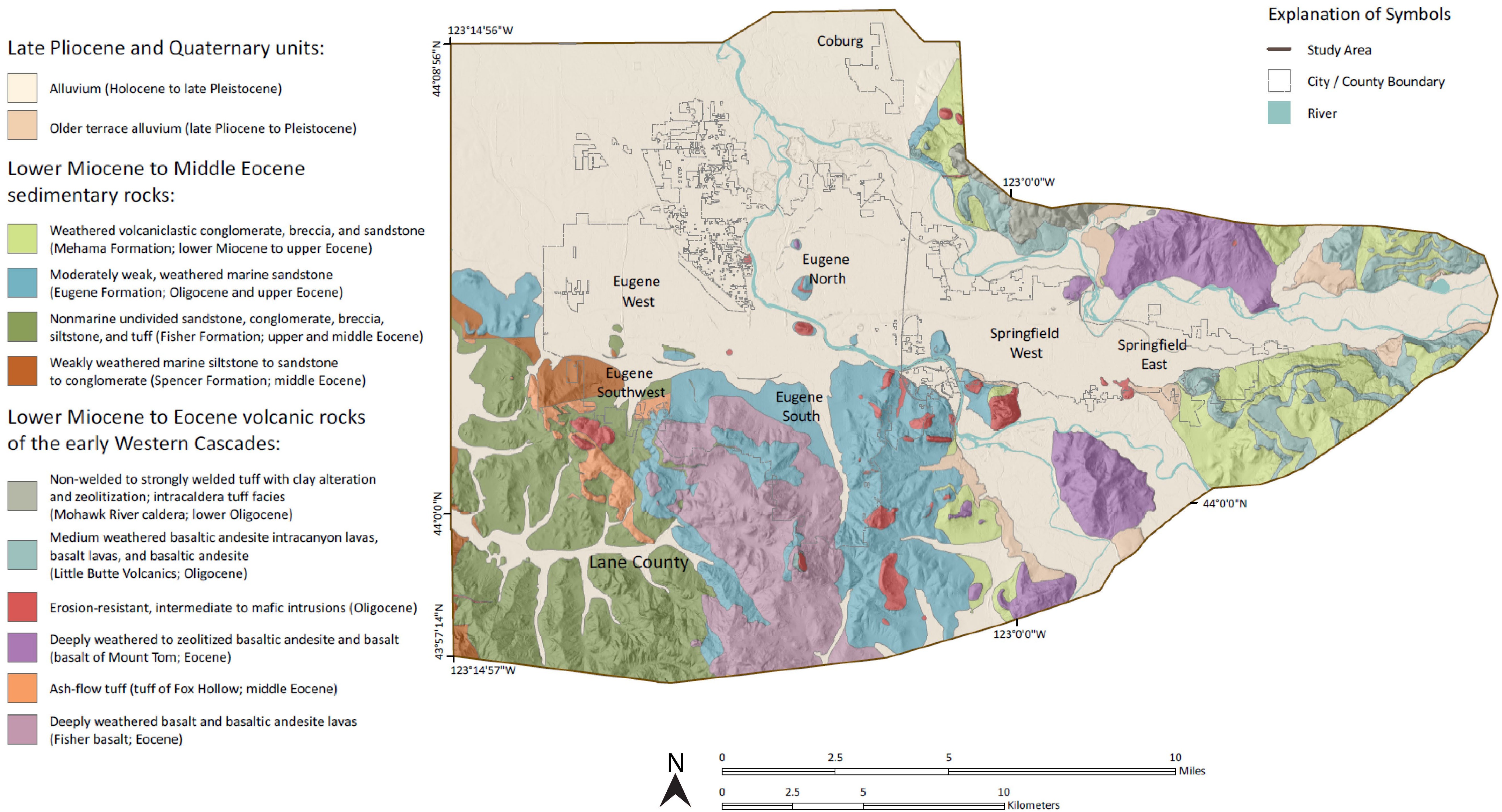
Lower Miocene to Middle Eocene sedimentary rocks:

- Weathered volcaniclastic conglomerate, breccia, and sandstone (Mehama Formation; lower Miocene to upper Eocene)
- Moderately weak, weathered marine sandstone (Eugene Formation; Oligocene and upper Eocene)
- Nonmarine undivided sandstone, conglomerate, breccia, siltstone, and tuff (Fisher Formation; upper and middle Eocene)
- Weakly weathered marine siltstone to sandstone to conglomerate (Spencer Formation; middle Eocene)

Lower Miocene to Eocene volcanic rocks of the early Western Cascades:

- Nonwelded to strongly welded tuff with clay alteration and zeolitization; intracaldera tuff facies (Mohawk River caldera; lower Oligocene)
- Medium weathered basaltic andesite intracanyon lavas, basalt lavas and basaltic andesite (Little Butte Volcanics; Oligocene)
- Erosion-resistant, intermediate to mafic intrusions (Oligocene)
- Deeply weathered to zeolitized basaltic andesite and basalt (basalt of Mount Tom; Eocene)
- Ash-flow tuff (tuff of Fox Hollow; middle Eocene)
- Deeply weathered basalt and basaltic andesite lavas (Fisher basalt; Eocene)

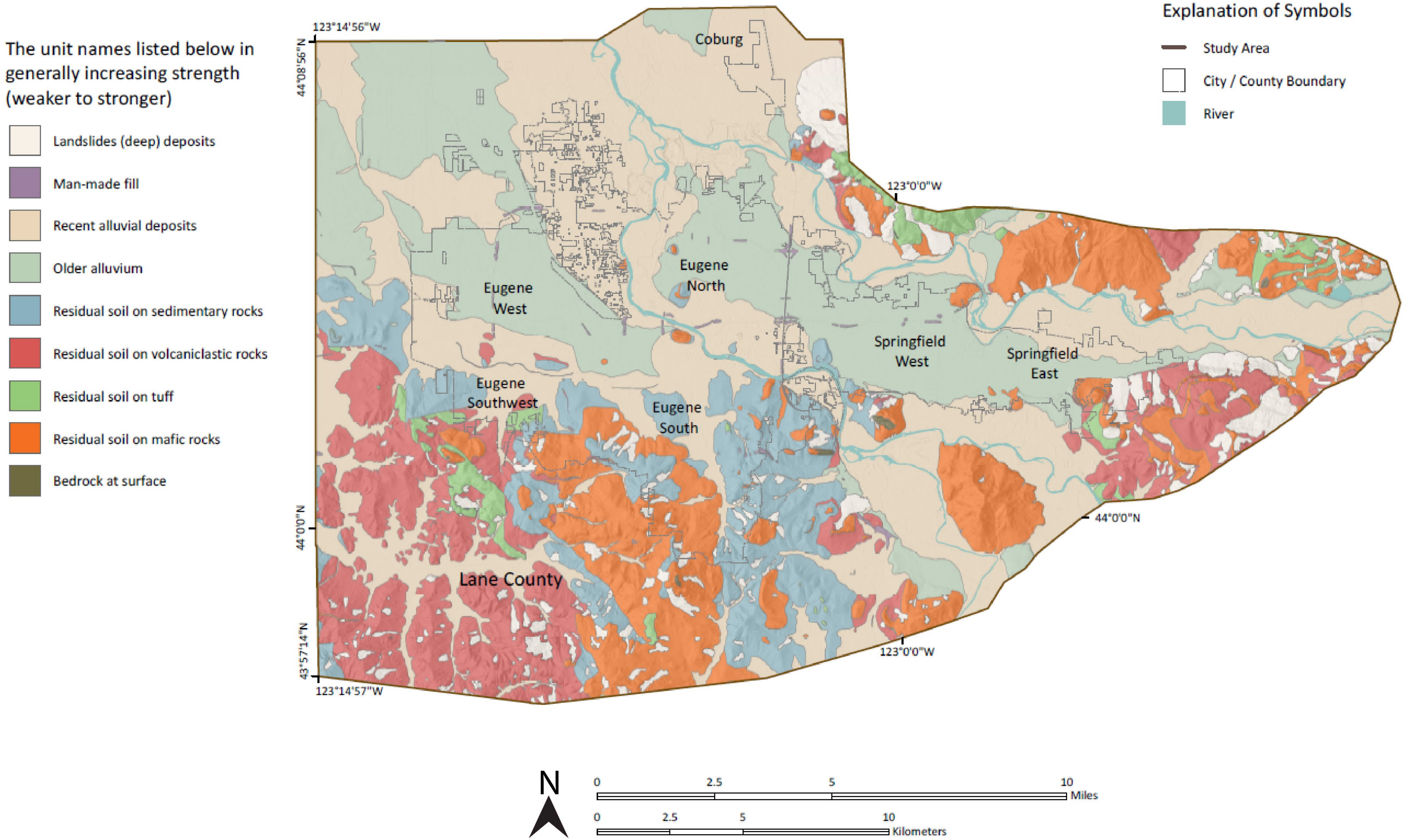
Figure 2-4. Map of generalized bedrock engineering geology in the study area.



We simplified the surficial geologic units in the study area into nine surficial engineering geologic units on the basis of similar geologic and geotechnical properties (**Figure 2-5**). The surficial engineering geologic map takes into consideration descriptions of soils and materials at the surface (Patching, 1987). The units are listed below in generally increasing strength (weaker to stronger):

- Landslide (deep) deposits
- Man-made fill
- Recent alluvial deposits
- Older alluvium
- Residual soil on sedimentary rocks
- Residual soil on volcaniclastic rocks
- Residual soil on tuff
- Residual soil on mafic rocks
- Bedrock at surface

Figure 2-5. Map of generalized surficial engineering geology in the study area.



2.5 Landslides

The Federal Emergency Management Agency (FEMA) issued 50 major disaster declarations for Oregon during the period 1953–2017 (https://www.fema.gov/disasters/grid/state-tribal-government/88?field_disaster_type_term_tid_1=All). Most of these disasters were related to storm events that caused flooding and commonly included landslides. During this time, 15 declared disasters affected Lane County (FEMA Disaster Declarations Summary [Excel spreadsheet], accessed via https://www.fema.gov/media-library/assets/documents/28318), including:

- 1964 – FEMA DR-184, Heavy Rains and Flooding
- 1972 – FEMA DR-319, Severe Storms and Flooding
- 1974 – FEMA DR-413, Severe Storms, Snowmelt, and Flooding
- 1994 – FEMA DR-1036, The El Nino (The Salmon Industry) Fishing Losses
- 1996 – FEMA DR-1099, High Winds, Severe Storms, and Flooding
- 1996 – FEMA DR-1107, Severe Storms and High Winds
- 1996 – FEMA DR-1149, Flooding, Land, Mud Slides, High Winds, Severe Storms
- 1997 – FEMA-DR 1160, Severe Winter Storms, Land and Mudslides, Flooding
- 2002 – FEMA-DR 1405, Severe Winter Storm with High Winds
- 2004 – FEMA-DR 1510, Severe Winter Storms
- 2005 – FEMA-DR 3228, Hurricane Katrina Evacuation (Coastal Storm)
- 2012 – FEMA-DR 4055, Severe Winter Storm, Flooding, Landslides, and Mudslides
- 2014 – FEMA-DR 4169, Severe Winter Storm
- 2015 – FEMA-DR 4258, Severe Winter Storms, Straight-Line Winds, Flooding, Landslides, and Mudslides
- 2016 – FEMA-DR 4296, Severe Winter Storm and Flooding
- 2017 – FEMA-DR-4328 Severe Winter Storms, Flooding, Landslides, and Mudslides

The increase in declared disasters in recent decades is likely due to a combination of 1) improved reporting, recording, and communications because of the onset of digital technology during this time period and 2) development in areas with relatively higher landslide hazards. Not all of the above declared disasters for Lane County included landslides or included the immediate study area for this project.

There are many historic (<150 years ago) and prehistoric (>150 years ago) landslides in the study area, which increase the current landslide risk. It is important to note that not all landslides that occurred in the past 150 years have been recorded or are accessible. For this study, DOGAMI mapped the existing landslides following the method outlined by Burns and Madin (2009). There are 634 landslides in the study area, covering 6% of the study area (Plate 1). There are 252 shallow and 335 deep landslides. These landslides were one of the primary inputs into the models used for the current project to create the shallow and deep landslide susceptibility maps.

One landslide was studied in more detail prior to this study. Known as the 67th Street landslide and labeled in our landslide inventory as Eugene_348, this landslide was mapped during geological mapping by Walker and Duncan (1989), Yeats and others (1996), Hladky and McCaslin (2006), and McClaughry and others (2010), with slightly different extents interpreted by the mappers. A geotechnical boring drilled and logged by DOGAMI in 1996 identified about 18 ft of breccia, interpreted to be landslide debris, overlying volcanic tuff, confirming the geological mapping interpretations (Oregon Water Resources Department well log LANE 51916, https://apps.wrd.state.or.us/apps/gw/well_log/Default.aspx).

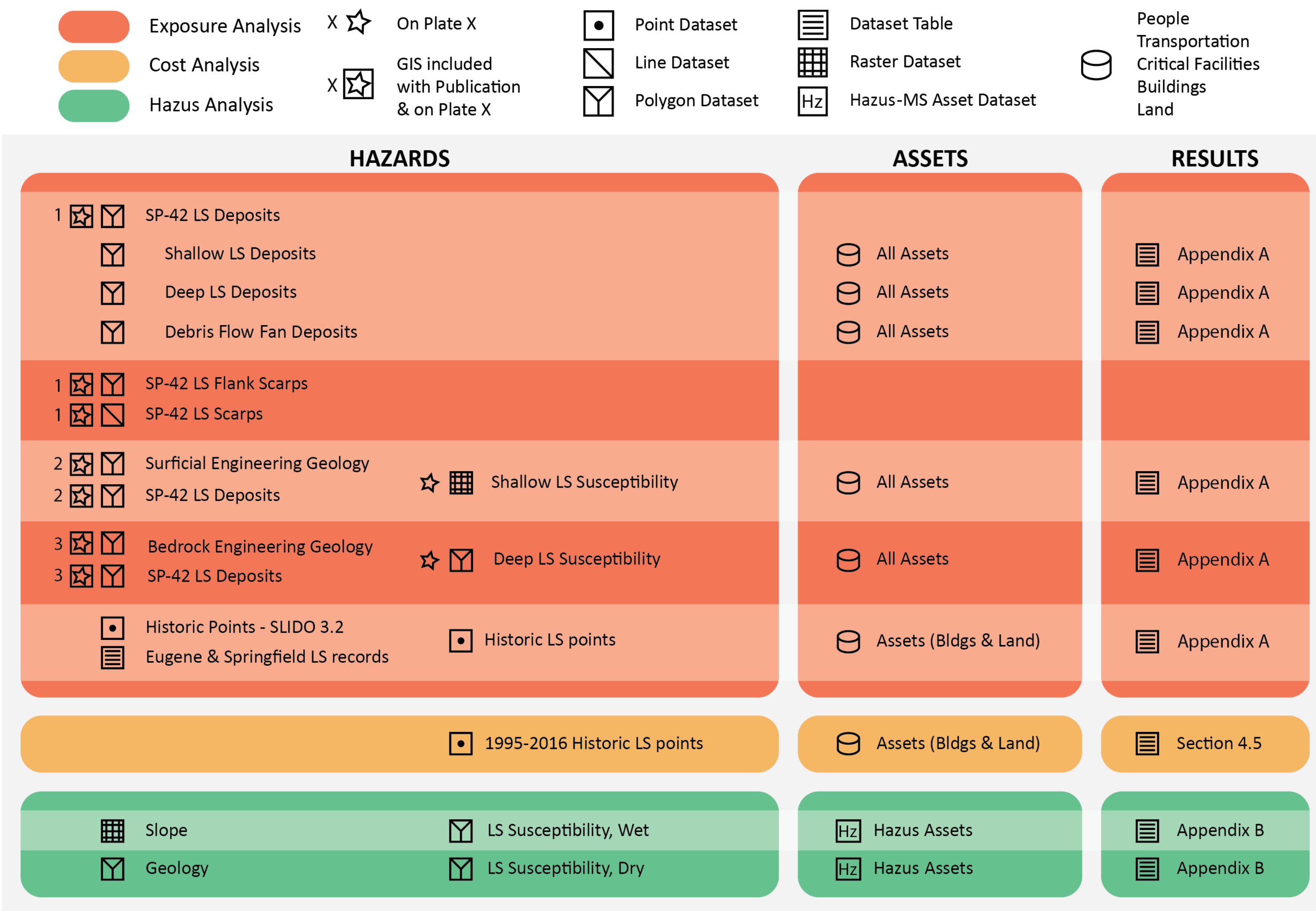
In the winters of 1996 and 1997 9,582 landslides (Hofmeister, 2000) were recorded across Oregon (FEMA Disaster Declarations 1099, 1107, 1149, and 1160). Lane County experienced 24% (2,280) of these 1996-1997 landslides.

The combination of FEMA declared disasters, hundreds of prehistoric landslides, and many historic landslides provides evidence of a moderate level of landslide hazard and risk in the study area. Therefore, these data attest to the practicality of continuing landslide risk reduction in this area.

3.0 METHODS

To evaluate the landslide hazard and risk for the study area, we performed three primary tasks: 1) compiled and created landslide hazard data including landslide inventory and susceptibility, 2) compiled and created asset data including critical facilities, roads, generalized land occupancy (land use/zoning), buildings, and population distribution data, and 3) performed risk analysis including exposure and Hazus-based risk analysis. **Figure 3-1** summarizes the hazard and asset datasets needed for the risk analyses and where the results of the analyses can be found in this publication.

Figure 3-1. Input datasets and results. SP-42 is Special Paper 42 (Burns and Madin, 2009). LS is landslide. SLIDO 3.2 is Statewide Landslide Information Database for Oregon, release 3.2 (Burns, 2014). Hazus-MH is Hazus-MH, version 2.1, loss estimation data (FEMA, 2011).



3.1 Landslide Hazard Evaluation Methods

First, we compiled the detailed lidar-based landslide inventory. Lidar data are from laser imaging of the ground surface from an airplane. Lidar data provide high-accuracy elevation imagery of the ground surface without vegetation and buildings, which makes mapping landslide scarps and morphology much easier (Burns, 2007). Then, we updated the historic landslide inventory within Eugene, Springfield, and areas of unincorporated Lane County within the study area. Because both of these datasets are landslide inventories but are different types of landslide inventories, we will refer to the lidar-based polygon inventory as the *SP-42 inventory* (**Figure 3-1**; DOGAMI Special Paper 42; Burns and Madin, 2009) and the historic point inventory as the *historic landslide point inventory* throughout this paper. Next, we used models to create shallow and deep landslide susceptibility. The methods we used to perform analysis with and create these datasets are described in detail in the following sections of this report and are the same methods DOGAMI uses for landslide hazard mapping projects throughout Oregon.

3.1.1 Landslide inventories

The SP-42 inventory was compiled from existing publications following the methodology of Burns and Madin (2009) to create the landslide inventory at a recommended use scale of 1:8,000. The data were extracted from the Statewide Landslide Information Database for Oregon (SLIDO), release 3.2 (Burns, 2014).

The historic landslide point dataset was created by compiling two existing datasets: 1) SLIDO-3.2 and 2) locally-held historic landslide records. We began the compilation by extracting historic landslide points from SLIDO-3.2. The City of Eugene and City of Springfield records were provided by several Bureau of Maintenance and Public Works staff members, in an open-format data gathering meeting. The final version of this dataset is included with this publication and is referred to as *historic landslide points* (**Figure 3-1)**.

Before this study, 51 historic landslide points had been recorded within the study area. Many of these records were from a post-1996 storm season damage survey carried out by FEMA and Oregon's Office of Emergency Management (FEMA, 1996). Others still were compiled by DOGAMI in the aftermath of the 1996 and 1997 winter storms (Hofmeister, 2000). In this compilation study, Lane County reported 24% of all landslides in Oregon recorded in the three 1996 and 1997 disaster declarations. Other historic landslide points were recorded by ODOT for failures along their roadways.

We identified 44 new historic landslides in this study on the basis of records gathered from City of Eugene and City of Springfield Public Works and Maintenance staff, as well as aerial photo surveys.

3.1.2 Shallow landslide susceptibility

We created the shallow landslide susceptibility map by following the shallow landslide susceptibility (**Figure 3-1**) mapping methodology of Burns and others (2012). The main components of the method include:

1) using a landslide inventory,
2) calculating regional slope stability factor of safety (FOS),
3) removing isolated small elevation changes (to reduce overprediction),
4) creating buffers to add susceptible areas missed in a grid-type analysis (to reduce underprediction), and
5) combining the four components into final susceptibility hazard zones.

The first component was taken directly from the landslide inventory created as part of this project. The calculation of the FOS requires several input datasets. One is a map of the surficial geology with geotechnical material properties. As discussed in section 2.4, we created a new surficial engineering geology map during this project. We created a table of material properties, based in part on local geotechnical reports and in part on existing, generalized statewide values (Burns and others, 2012, Table 3-2), for each of the primary surficial engineering geologic units in this specific study area (**Table 3-1**). Many of the values were based on local geotechnical reports submitted to the City of Eugene planning department as a part of the development requirements (Branch Engineering Inc., 1995; B2CC Construction Consulting, 2000; Professional Service Industries, Inc., 2000; Geomax, Inc., 2001; Redmond and Associates, 2003; Geoscience, Inc., 2006; Branch Engineering, Inc., 2012). Several reports included laboratory and/or field measurements of material strength. To calculate the FOS (component 2), we estimated new material properties from these local geotechnical reports and from past studies in the northern Willamette Valley including Clackamas, Multnomah County, and City of Portland (Burns and others, 2013, 2018), for geologic units that were not measured locally.

After we acquired the material property values either directly from past studies or through correlations for each surficial geologic unit, we averaged each set of values by geologic unit. DOGAMI staff then reviewed these ranges of values and the averaged values in order to decide the final material properties to be used for this study. These properties are listed in **Table 3-1** and were used to calculate the two slope thresholds that separate the three FOS ranges. The three FOS ranges are 1) values greater than 1.5 (generally considered stable), 2) values between 1.25 and 1.5 (generally considered potentially unstable), and 3) values below 1.25 (generally considered potentially unstable and unstable below 1.0).

Table 3-1. Summary of geotechnical material properties for primary surficial geologic engineering units in the study area, based on Burns and Mickelson, 2016.

Primary Surficial Geologic Engineering Unit	Angle of Internal Friction (degrees)	Cohesion (lb/ft^2)	Unit Weight (Saturated lb/ft^3)	Threshold* for Stable Slopes (FOS > 1.5) (degrees)	Threshold* for Potentially Unstable Slopes (FOS > 1.25) (degrees)
Landslide (deep) deposits	28	0	115	9.0	10.5
Man-made fill	30	0	115	9.5	11.5
Recent alluvial deposits	30	0	115	9.5	11.5
Older alluvium	34	0	115	11.5	13.5
Residual soil on sedimentary rock	30	250	115	15	18
Residual soil on volcaniclastic rocks	28	500	115	20	24
Residual soil on tuff	28	500	115	20	24
Residual soil on mafic rocks	28	500	115	20	24
Bedrock at surface	40	750	115	30	36

*Slope angle thresholds are the boundaries calculated for three FOS ranges: 1) values greater than 1.5 (generally considered stable), 2) values between 1.25 and 1.5 (generally considered potentially unstable), and 3) values below 1.25 (generally considered potentially unstable and unstable below 1.0).

To remove isolated small elevation changes (to reduce overprediction—component 3) and to add susceptible areas missed in a grid-type analysis (to reduce underprediction—component 4), we created buffers as described in detail by Burns and others (2012). When the FOS class map is prepared using a slope map with such high resolution, many areas with shallow landslide susceptibility are falsely classified as having moderate or high susceptibility (overprediction). This occurs because many fine-scale topographic features are represented in the lidar DEM that do not have sufficient vertical or lateral extent to pose a significant shallow landslide hazard. This could include features like road ditches. One disadvantage of a slope stability analysis using a raster or grid-type infinite slope equation is that the analysis looks at each raster cell independently. The FOS is calculated in the same way regardless of where the cell falls on a slope or where it sits in relation to important topographic features or changes. Because the location of a cell can have an important impact on the landslide susceptibility, DOGAMI developed these two buffers to help reduce underprediction.

3.1.3 Deep landslide susceptibility

We created the deep landslide susceptibility map by generally following the methodology of Burns and Mickelson (2016; **Figure 3-1**). Deep landslides were defined by Burns and Madin (2009) as having a failure surface greater than 15 feet in depth. The main components of the method include:

1) using a landslide inventory
2) creating buffers (hazard zone expansion areas)
3) combining the following four factors to determine the moderate susceptibility zone:
    a. susceptible geologic units
    b. susceptible geologic contacts
    c. susceptible slope angles for each engineering geology unit polygon
    d. susceptible direction of movement for each engineering geology unit polygon
4) combining components 1–3 into final susceptibility hazard zones

For each component and factor we made separate GIS data layers. The first component is taken directly from the landslide inventory created as part of this project. Because many deep landslides move repeatedly over hundreds or thousands of years and, commonly, the continued movement is through retrogressive failure or upslope failure of the head scarp, we applied a buffer (expanded the hazard zone) to all mapped deep landslide deposits.

Next, we used four factors to determine the moderate zone. The first factor, geologic units, has a relatively widespread correlation with surficial processes. For example, it is very common that certain rock formations or soil types are more or less prone to landslides. This is generally due to the properties of the rock or soil, such as the material strength or bedding planes.

The second factor, geologic contacts, is something we have noted in Oregon, especially since we began mapping landslide inventories using lidar (Burns and Mickelson, 2016). Many landslides occur along a contact, particularly when sedimentary or volcaniclastic rock is in contact with hard intrusive or volcanic rock. For example, large, deep landslides are located next to each other along the interlayered units of Mehama volcaniclastic rocks and basaltic andesite in the plateau area southeast of Springfield. It is more of a spatial relationship between the landslides and the contact surface trace in map view; this relationship is most likely caused by erosion or downcutting at the surface, which leads to exposure of the underlying weaker unit.

The third factor, slope angle, is very commonly correlated with landslide susceptibility. Most landslide susceptibility maps use slope as the primary factor or as at least one of the factors to predict future landslide locations. With regard to shallow landslides, it is very common to see more shallow landslides associated with steeper slopes. Deep landslides appear to have a less direct correlation with slope steepness, which is one reason to include the other three factors (geologic units, geologic contacts, and direction of movement).

Finally, the fourth factor is the direction of movement, which is recorded as an attribute for every landslide in our landslide inventory. A standard factor to examine during site-specific evaluations is the local bedding dip and dip direction because deep landslides tend to fail along those bedding planes and in the direction of the dip, especially where slope and dip are in the same direction. Unfortunately, we do not have extensive dip and dip direction measurements in the study area. Therefore we used the recorded direction of movement from the landslide inventory database as a proxy for dip direction or preferred direction of movement, and, where available, we included dip and dip direction measurements from digitized geologic maps (McClaughry and others, 2010).

We added together the four GIS data layers made from the factors to delineate the line between the moderate and low hazard zones (Plate 3). Then we combined the four component GIS layers to create the deep landslide susceptibility map with low, moderate, and high hazard zones.

In this particular study area, we observed several existing deep landslides along the southern valley wall of the McKenzie River (hills southeast of Springfield) whose toes protruded far onto the flat river valley bottom. The landslide "runout," or distance traveled from head scarp to final depositional zone, varies for different landslides, and some landslides exhibit long runouts that exceed the expected length of movement.

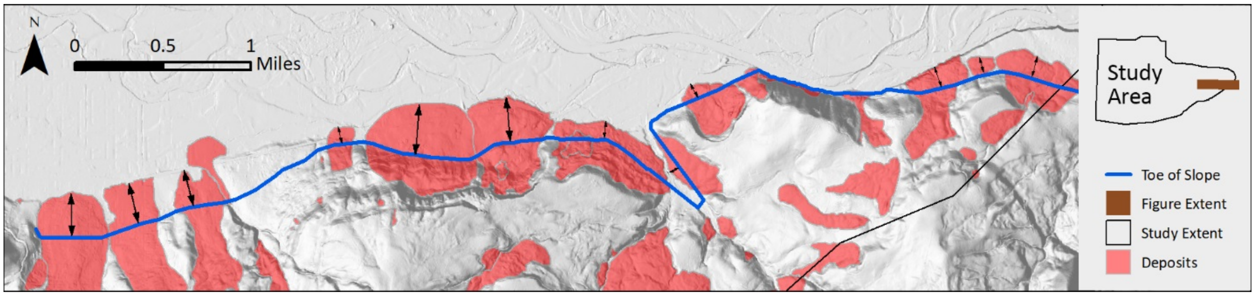
During landslide inventory mapping, we observed landslides that reached beyond the toe of the slope in the hills southeast of Springfield. This area more than any other in the study area exhibited many deep landslides along a relatively uniform slope with similar underlying geology and orientation. Using a simple method, we wanted to capture the area along similar, nearby slopes beyond the toe of slope that a landslide may be able to reach, based on what has occurred sometime in the past. We incorporated a mean runout length and added this area to the moderate deep landslide hazard zone.

In the hills to the southeast of Springfield (seen in study area inset map in **Figure 3-2**A), 13 deep landslides descend from the plateau onto the McKenzie River Valley. For each landslide, a polyline was drawn, estimating the toe of the slope, extrapolated beneath the landslide deposits, as shown in **Figure 3-2**A. The closest upslope bedrock slope angle was projected onto the river valley below, approximating where the toe of the slope might be without landslide or other surficial deposits obscuring the base of the slope. This was approximated along the north side of the plateau, beneath interbedded volcanic and volcaniclastic units forming distinct benches above the river plain. Unfortunately, recent precise geologic mapping is unavailable for the majority of this area of the study.

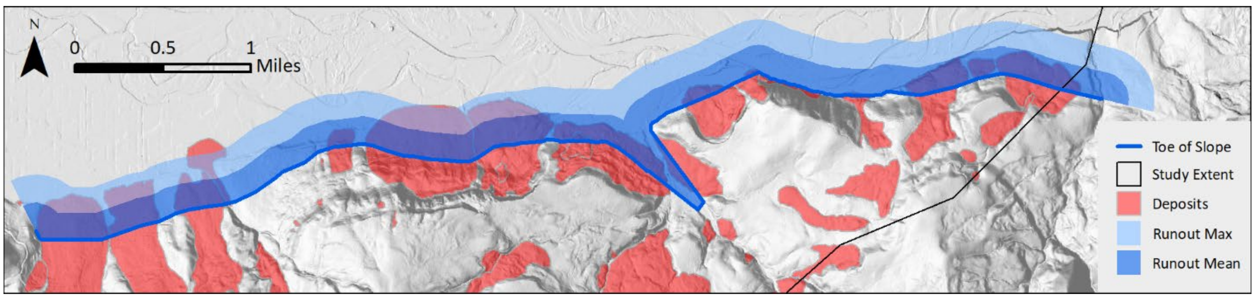
From this polyline, we measured the distance to the furthest extent of the landslide deposit (**Figure 3-2**A). We calculated the mean from these thirteen local landslides with varying runout distances, and found the mean runout of the landslide from the toe of the slope was 815 ft. We then buffered the polyline with this length (**Figure 3-2**B). This polygon was included in the moderate zone, extending the moderate hazard zone to include where landslides with extended runouts may occur. In instances along this valley-wall, existing landslide deposits extend farther than the mean runout distance, and the existing high and moderate hazard zones supersede this additional moderate zone factor (**Figure 3-2**C, D).

Figure 3-2. Method for determining mean runout along the southern wall of the McKenzie River valley.

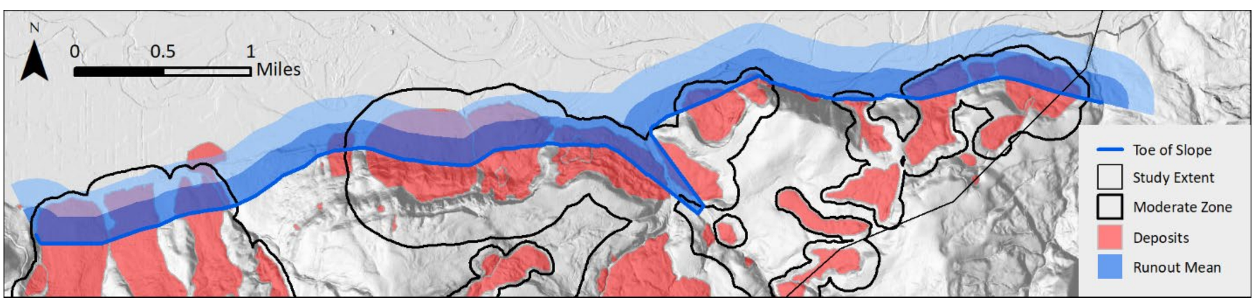
(A) Toe of slope in blue; horizontal runout length measurements shown via arrows, representing runout. Inset map depicting subset of study area for which this exercise was completed.



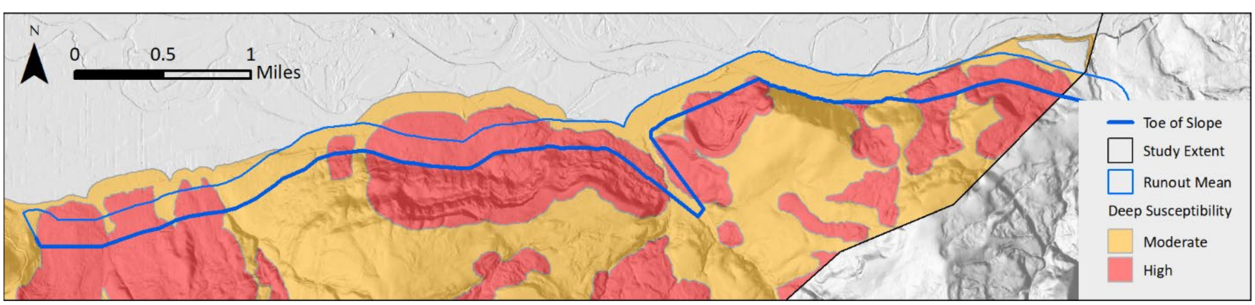
(B) Toe of slope line, with runout mean and runout max zones.



(C) Runout mean zone delineated and deep landslide deposits shown with a minimal moderate buffer, based on their head scarp heights (SP-48).



(D) Deep landslide susceptibility shown, with mean runout incorporated into the moderate zone.



Runout of landslides is not a well-constrained metric for deep landslides, and there are many different methods to map landslide runout, without scientific consensus. Coe and others (2016) pointed out the difficulty of inferring landslide velocity from existing landslide deposits. Long runout of landslides can be difficult to predict. We encourage more work on landslide runout that can be used for hazard mapping in the future.

3.2 Asset Data Compilation and Creation Methods

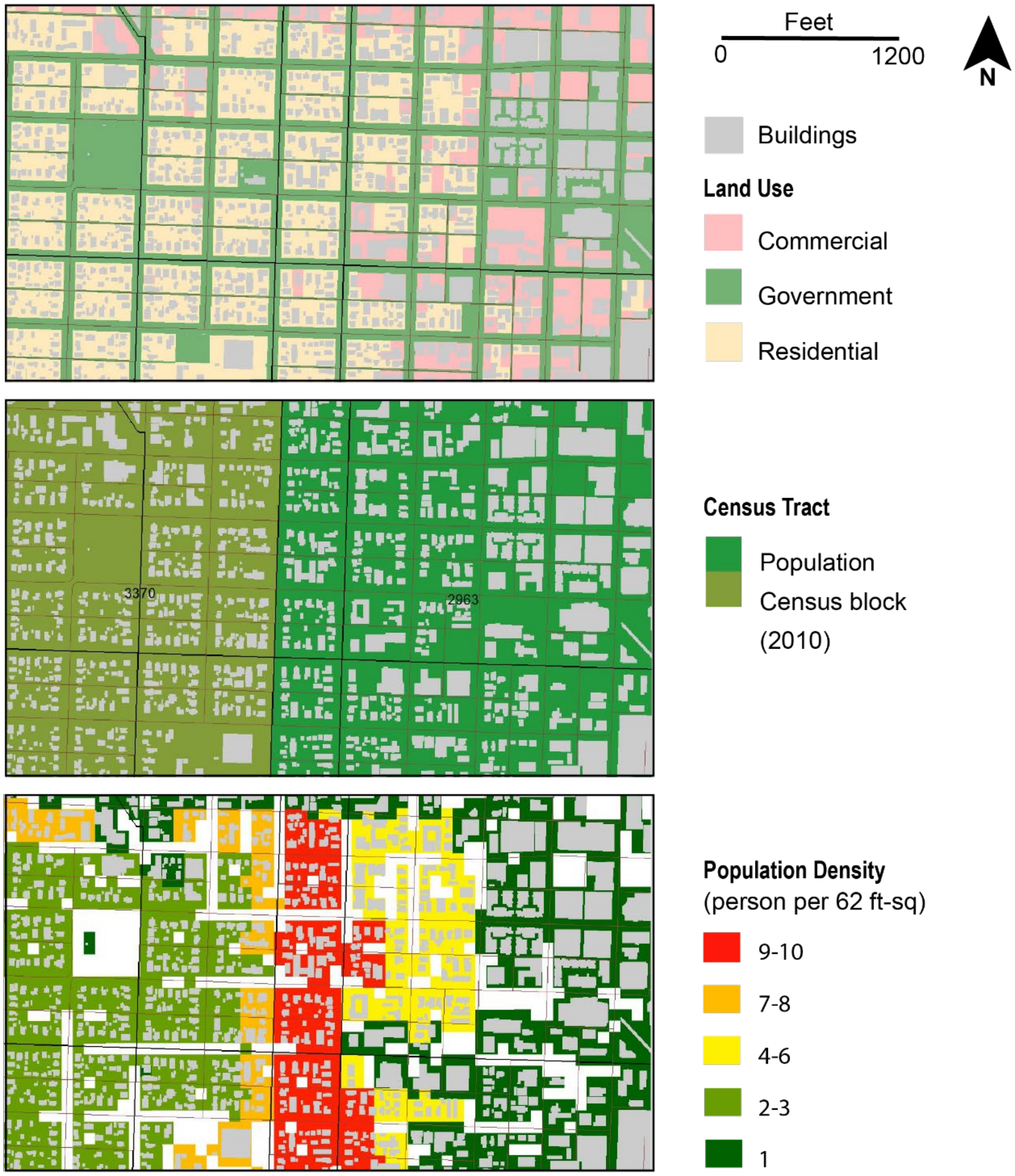
Next, we compiled and created asset datasets that included permanent population distribution, buildings and land, critical facilities, and roads. These asset datasets along with the SP-42 inventory and shallow and deep landslide susceptibility datasets were overlaid to evaluate exposure of the assets to the landslide hazard. We followed the same general methods to create and perform exposure outlined by Burns and others (2018) in Multnomah County.

3.2.1 Permanent population distribution dataset

Permanent population (resident) figures are needed to estimate accurately losses from disasters. However, it is challenging to map this asset because people tend to travel on yearly, seasonal, monthly, daily, and hourly bases.

In the study area, U.S. Census population data are organized in spatial units called census block-groups. Block-groups are statistical divisions of census tracts and generally contain between 600 and 3,000 people. Blocks can be as small as 125 acres (50 hectares) and are typically bounded by streets, roads, or creeks. In urban areas census blocks are small, usually defined by one city block, while in rural areas with fewer roads, blocks are larger and can be bound by other geographic and geomorphic features. Within each block-group the census provides no information on the spatial distribution of population. The census provides only one population number per block-group (**Figure 3-3**). To estimate the size and distribution of permanent population for most of the study area, we used the dasymetric mapping method developed by the U.S. Geological Survey (Sleeter and Gould, 2007). Dasymetric mapping is a process that allocates population data to residential units. Datasets like land cover and census data are used in the dasymetric process to map more precisely the population over an area. To assess and geographically distribute permanent population within the study area, we created a dasymetric population grid with 62 ft^2 cells. In order to make improvements to the population distribution we also used tax lots, which differentiate lots that generally have people living on them from those that do not, such as residential versus industrial. We also used building footprints to determine the likely locations of people within those tax lots designated as residential (**Figure 3-3**).

Figure 3-3. Dasymetric population distribution map input data and result examples from within the City of Eugene.



3.2.2 Buildings and land

DOGAMI acquired and edited previously digitized building footprints from LCOG, the Lane Council of Governments. Parts of the study area were not covered by the LCOG data, so DOGAMI staff digitized the buildings in those areas. To do this, we converted digital elevation models (DEMs, derived from lidar first returns) to hillshade imagery and used these together with orthophotos to identify building locations.

After we finalized the generalized land-use GIS layer, we transferred the improvement values and generalized land-use categories from the tax lot dataset into the building dataset (see Appendix C for more information).

Zoning refers to the permitted land use designation such as agricultural, industrial, residential, recreational, or other land-use purposes. Zoning data are commonly included in tax lot databases along with land-use designations. Data from tax lot databases also include information about the dollar value of the land and any improvements, such as houses. To evaluate land assets for this project, we combined county and city tax lot databases to create a layer that identifies generalized land use (residential, commercial, or public) information for each piece of property. While creating the generalized tax lot dataset, we noted the lack of dollar value for most public land and therefore recommend all public values be considered underestimates.

We created the generalized tax lot dataset with available property tax code data for Lane County acquired from LCOG. Starting with the generalized zoning dataset, we assigned each tax lot a generalized use of residential, commercial, or public. We classified generalized use classes from the parcel's defined chief zoning and land-use of the property. This methodology potentially introduces errors where the tax code for a parcel might not reflect real infrastructure or use at time of publication. We classified selected property that had no ownership information or property tax code according to occupancy class seen in or estimated from orthophotos. We classified government and education occupancy parcels from existing critical facility datasets. Community (generally jurisdictional) boundaries were manually populated, so that parcel counts were not duplicated during inventory/exposure analysis. In scenarios where parcels crossed multiple community boundaries, we selected the community to which the parcel appeared to be most appropriately associated.

3.2.3 Critical facilities

Critical facilities are typically defined as emergency facilities such as hospitals, fire stations, police stations, and school buildings (FEMA, http://www.fema.gov/national-flood-insurance-program-2/critical-facility). We used the definitions and data created for the DOGAMI Statewide Seismic Needs Assessment (SSNA; Lewis, 2007) to identify the critical facilities. The critical facilities included in this project are schools, police stations, fire stations, and hospitals. We extracted critical facilities as points from the SSNA. These points were buffered into polygons, which were used to complete the exposure analysis.

3.2.4 Roads

We acquired the road data from LCOG. Roads were divided into three categories:

- freeways, highways, and major arterials
- minor arterials and collectors/connectors
- local streets

3.3 Risk Analysis Methods

When landslides affect assets, landslides become natural hazards. Natural hazard risk assessment is the characterization of the overlap of natural hazards and assets. Risk analysis can range from simple to complicated. In this project we selected two types of regional risk analysis: 1) hazard and asset exposure, and 2) Hazus-MH analysis. Hazus-MH is a multi-hazard (MH) analysis program that estimates physical, economic, and social impacts of a disaster (FEMA, 2011). In order to understand better the risk, we also collected historic landslide data for the study area and estimated actual historic losses.

3.3.1 Exposure analysis

A building, or other asset, is considered to be exposed to a hazard if it is located within that particular hazard area. To find which community assets fell in which hazard zones, we performed exposure analysis with Esri ArcGIS software. We determined exposure through a series of spatial and tabular queries between hazards and assets. We then summarized the results by community (**Table 3-2**). Landslide hazard datasets used in the exposure analysis are:

- shallow landslides (inventory polygons; see section 3.1.1)
- deep landslides (inventory polygons; see section 3.1.1)
- debris flow fans (inventory polygons; see section 3.1.1)
- shallow landslide susceptibility (low, moderate, and high – see section 3.1.2)
- deep landslide susceptibility (low, moderate, and high – see section 3.1.3)

Asset data (section 3.2) used in the exposure analysis are:

- population (people per 62 ft^2)
- buildings and land in three generalized use classes: residential, commercial, and public
    - buildings reported by count, count percent of total, and value (dollars)
    - land reported by count, count percent of total, area (square feet and acres), area percent of total, value (dollars)
- critical facilities buildings: fire stations, police stations, hospitals, and school buildings
    - buildings reported by count, count percent of total, and value (dollars)
- roads: freeways, highways, and major arterials — lines
    - report by length (feet and miles), and percent of total

For example, we superimposed the buildings layer for the study area on the deep-landslide inventory layer to determine which buildings are exposed to that type of hazard, as demonstrated in **Figure 3-4**. The result of this analysis is both a map of the community assets exposed to the hazard and a table with the corresponding numbers of community assets exposed (full results in Appendix A).

Figure 3-4. Exposure examples from the study area: generalized land use (left), deep landslide deposit (center), and exposure of assets to a deep landslide (right).

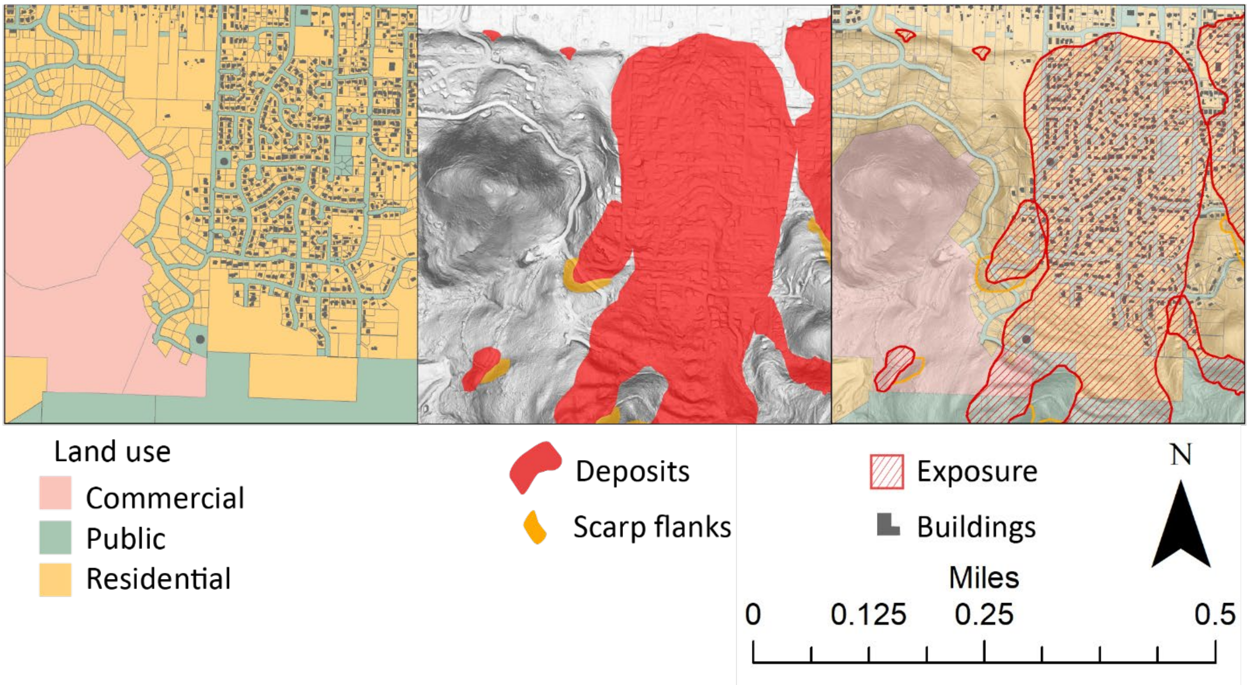


Table 3-2. Communities for exposure reporting. Community extents are shown in Figure 2-2.

Community	Area (mi^2)
Lane County	170
City of Springfield (East)	5.5
City of Springfield (West)	10.3
City of Coburg	1.0
City of Eugene neighborhoods	
Eugene North	13.2
Eugene South	15.4
Eugene Southwest	2.5
Eugene West	12.9
City of Eugene (total)	44

3.3.2 Hazus-MH analysis

We performed risk analysis with Hazus-MH, a risk modeling software package developed by FEMA (2011). Hazus requires a specific landslide susceptibility map, which is different than either the shallow or deep landslide susceptibility maps created as part of this project. The Hazus landslide susceptibility map (created for input into the Hazus earthquake module only) follows a specific method outlined in the Hazus technical manual (FEMA, 2011). We created both “dry” and “wet” Hazus landslide susceptibility maps for the study area, in which we used the surficial and bedrock engineering geologic information from **Figure 2-4** and **Figure 2-5** (**Table 3-3**).

Table 3-3. Landslide susceptibility of geologic groups (Hazus-MH 2.0, Table 4-15 [FEMA, 2011])

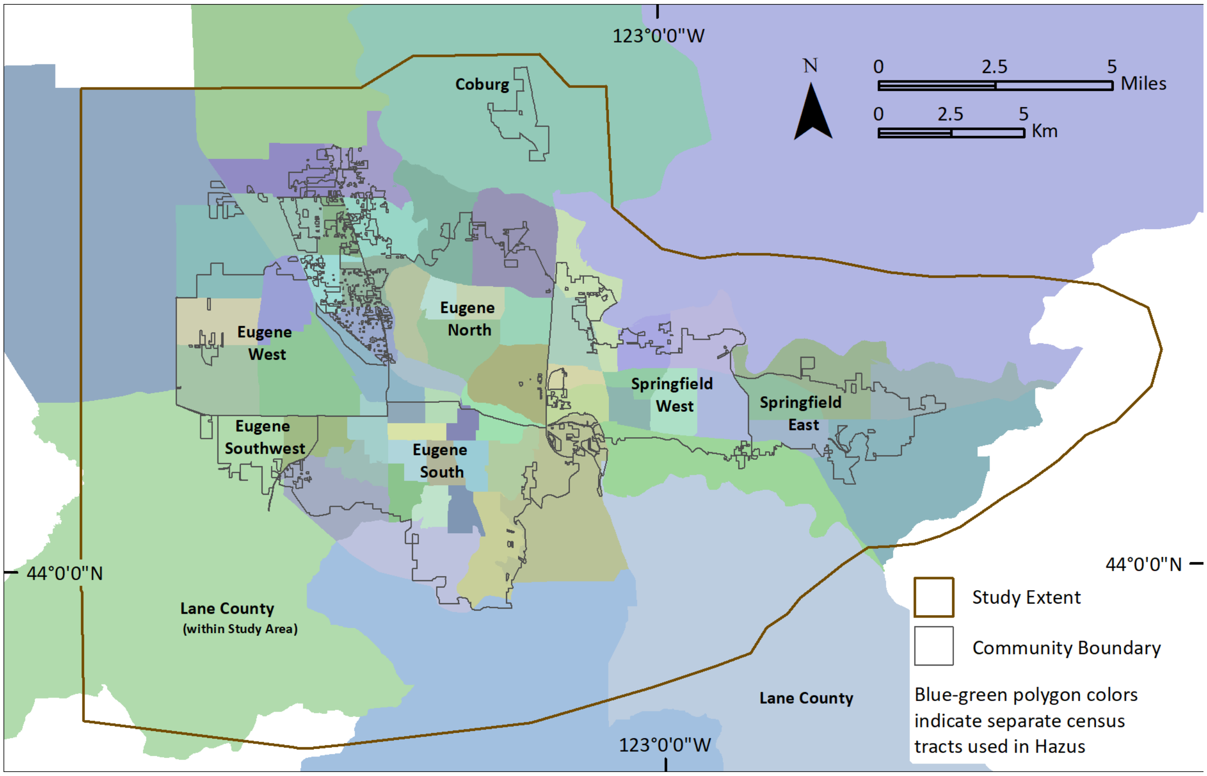
		Slope Angle, degrees					
	Geologic Group	**0–15**	**10–15**	**15–20**	**20–30**	**30–40**	**>40**
	(a) Dry (groundwater below level of sliding)						
A	Strongly Cemented Rocks (crystalline rocks and well-cemented sandstone, c' = 300 psf, ϕ' = 35°)	none	none	I	II	IV	VI
B	Weakly Cemented Rocks (sandy soils and poorly cemented sandstone, c' = 0, ϕ' = 35°)	none	III	IV	V	VI	VII
C	Argillaceous Rocks (shales, clayey soil, existing landslides, poorly compacted fills, c' = 0, ϕ' = 20°)	V	VI	VII	IX	IX	IX
	(b) Wet (groundwater level at ground surface)						
A	Strongly Cemented Rocks (crystalline rocks and well-cemented sandstone, c' = 300 psf, ϕ' = 35°)	none	III	VI	VII	VIII	VIII
B	Weakly Cemented Rocks (sandy soils and poorly cemented sandstone, c' = 0, ϕ' = 35°)	V	VIII	IX	IX	IX	X
C	Argillaceous Rocks (shales, clayey soil, existing landslides, poorly compacted fills, c' = 0, ϕ' = 20°)	VII	IX	X	X	X	X

Hazus software can be used to model a variety of earthquake, flood, and wind probabilistic hazards and/or hazard event scenarios. Although Hazus has limitations, we chose to use Hazus as part of our risk analysis because it is a widely and publicly available risk analysis program with data for the United States.

Default hazard and asset databases are included with the Hazus program. Most data are based on national-scale, general information that does not accurately reflect local conditions. We focused on loss ratios rather than absolute numbers, because we know that absolute numbers can be inaccurate at the local scale. For example, instead of examining the absolute count of buildings at various levels of damage, we looked at the ratio of the estimated damaged buildings to the total buildings in the Hazus database. Although the absolute numbers may be inaccurate, the ratios are very likely in the realistic range and could be applied to the much more accurate local database to obtain a realistic absolute number.

In the Hazus earthquake module, the census tract level is the smallest areal extent allowed for analysis. One limitation of Hazus is that census tract areas can be too coarse for small hazard zones. Although the extent of the 65 tracts is in some places larger than the study area and in some places the tracts are smaller, the chosen analysis extent, when constrained to census tracts, best represents the study area (**Figure 3-5**).

Figure 3-5. Map of the 65 census tracts used in Hazus analysis.



The goal for the Hazus analysis was to estimate damage and losses from two kinds of earthquakes (local crustal and Cascadia Subduction Zone), both with and without earthquake-induced landslides, so that we could examine the difference in damage and losses caused by just the earthquake-induced landslides. We subtracted the earthquake-without-landslides model results from the earthquake-with-landslides model results so that earthquake-induced landslide damage and losses results could be examined separately. We also analyzed landslides in dry and wet conditions (see **Table 3-2**) for each scenario to simulate the differences between an earthquake occurring when it is generally dry (summer) versus when it is generally wet (winter).

For the Cascadia Subduction Zone magnitude 9.0 earthquake scenario, Madin and Burns (2013) obtained synthetic bedrock ground motions from Arthur Frankel (U.S. Geological Survey, written communication, 2012); we used the same bedrock ground motion data for this project. We used the surficial engineering geology map from this study, created for the shallow landslide susceptibility, as the basis to create a seismic site class map, which was used to amplify the bedrock ground motions for the CSZ and the local crustal fault earthquake.

There is no known active mapped local crustal fault within 20 miles of the study area. Consequently, we examined the background seismicity in the U.S. Geological Survey deaggregation report for the Eugene-Springfield area (https://earthquake.usgs.gov/hazards/interactive/) and Burns and others (2008) to select an arbitrary fault with the potential to produce a magnitude 6.5 earthquake. We called this scenario the Arbitrary Eugene Fault.

While performing the Hazus analysis we discovered some software bugs associated with the Lane County data when using the CSZ ground motion input data. Hazus would not accept the tract (building) values we entered, so we were forced to analyze the tract data separately from the rest of the assets in

Hazus. The Hazus global reports provided in Appendix B include both sets of results, and we have obscured in each report the sections that should not be used.

These choices resulted in eight different Hazus analyses (Appendix B):

- M9 Cascadia Subduction Zone
  - No landslides
  - Landslides Dry – Tract results
  - Landslides Dry – Non-Tract results
  - Landslides Wet – Tract results
  - Landslides Wet – Non-Tract results
- M6.5 Arbitrary Eugene Fault
  - No landslides
  - Landslides Dry
  - Landslides Wet

In order to examine the coseismic landslide damage and loss only, we subtracted the "No Landslides" results from the dry and wet landslide results.

3.3.3 Annualized loss

To better understand the landslide risk, we used the historic landslide point inventory in conjunction with previous research related to landslide losses in Oregon (Burns and others, 2017). There are limited records of landslides in this study area, but landslide location points gathered from ODOT, Lane County Public Works, and damage survey reports from FEMA and OEM after the February 1996 storms and associated disasters (FEMA, 1996; Hofmeister, 2000), are recorded as historic landslide points in SLIDO. We identified other landslides by using aerial imagery and records from Lane County Public Works.

Six landslide-associated permits in the City of Eugene records cited landslides as reason for repairs to residential private property. These permits are associated with a known historic landslide in the vicinity. Repairs included foundation repairs, installation of helical piers, or replacing decks. The total cost of stated for work for landslide repairs was $67,500 for six unique landslide events, with a mean of $11,250 per landslide.

We combined these permit data with more data from other parts of Oregon. The best available data, gathered from a recent landslide study for western Multnomah County and the City of Portland (Burns and others, 2018), included dozens of landslides of a range of sizes and amounts of damage. When a permit is required to repair landslide damage, the City of Portland has a record of the monetary damage done to private infrastructure from landslide impact. A compilation of permits for landslide repairs, as well as loss estimates made immediately post-1996 on damage to public entity infrastructure, allowed an average landslide cost to be calculated from both public and private landslide loss data. The range of losses per landslide from these sources is $67,500 to $144,000 (Burns and others, 2017). These are our best available estimates for cost per landslide in the state of Oregon.

Our assumption is that damage from landslides in other places has similar economic loss impacts as calculated in the Burns and others (2017) study. We acknowledge that different landslide types in different geologic units may cause different amounts and types of damage and that differences in housing and property values may cause differences in damage and losses amounts. However, given the limited scope of this project, we were unable to factor in these differences.

A total of 75 landslide points from 1979 to 2016 are included. There may have been landslides in the past 150 years in the area that were not observed or recorded.

4.0 RESULTS

We produced three detailed hazard maps from data collected and analyzed in this study. Plate 1 is a landslide inventory, Plate 2 shows shallow landslide susceptibility, and Plate 3 shows deep landslide susceptibility. We combined the hazard maps with asset data to complete a landslide risk analysis.

4.1 Landslide Inventory Findings

Before the use of lidar to map existing landslides in the study area, 230 landslides areas (polygons) were mapped and included in SLIDO-3.4 (excluding talus/colluvium and fans; Burns and others, 2014). In contrast, the SP-42 inventory (method of Burns and Madin, 2009) created for the current project includes 634 landslides in the study area. The combined surface area of these landslides covers approximately 14.2 square miles (37 square kilometers), or approximately 6 percent of the study area (230.5 square miles; 595 square kilometers; Plate 1). These landslides range in size from 660 square feet (61 square meters) to more than 3 square miles (8 square kilometers). Of the 634 SP-42 inventory landslides, 252 are shallow and 335 are deep. The other 47 landslides are mostly debris flow fans (44) and rock fall talus. Inventories for each community are shown in **Table 4-1**.

The updated historic landslide point inventory contains 75 landslide records from 1979 to 2016. The historic landslide point dataset is displayed on Plate 1, and inventories for each community are shown in **Table 4-1**.

Table 4-1. Summary of landslide inventories for each community.

Community	SP-42 Inventory*	Historic Landslide Point Inventory
Lane County**	575	38
City of Springfield (East)	20	7
City of Springfield (West)	2	4
City of Coburg	0	0
City of Eugene neighborhoods		
Eugene North	1	1
Eugene South	63	24
Eugene Southwest	0	0
Eugene West	0	1
City of Eugene (total)	64	26

*Some landslides overlap community boundaries, so totals will not equal total landslides in study area.

**Unincorporated Lane County included in study.

4.2 Shallow Landslide Susceptibility Findings

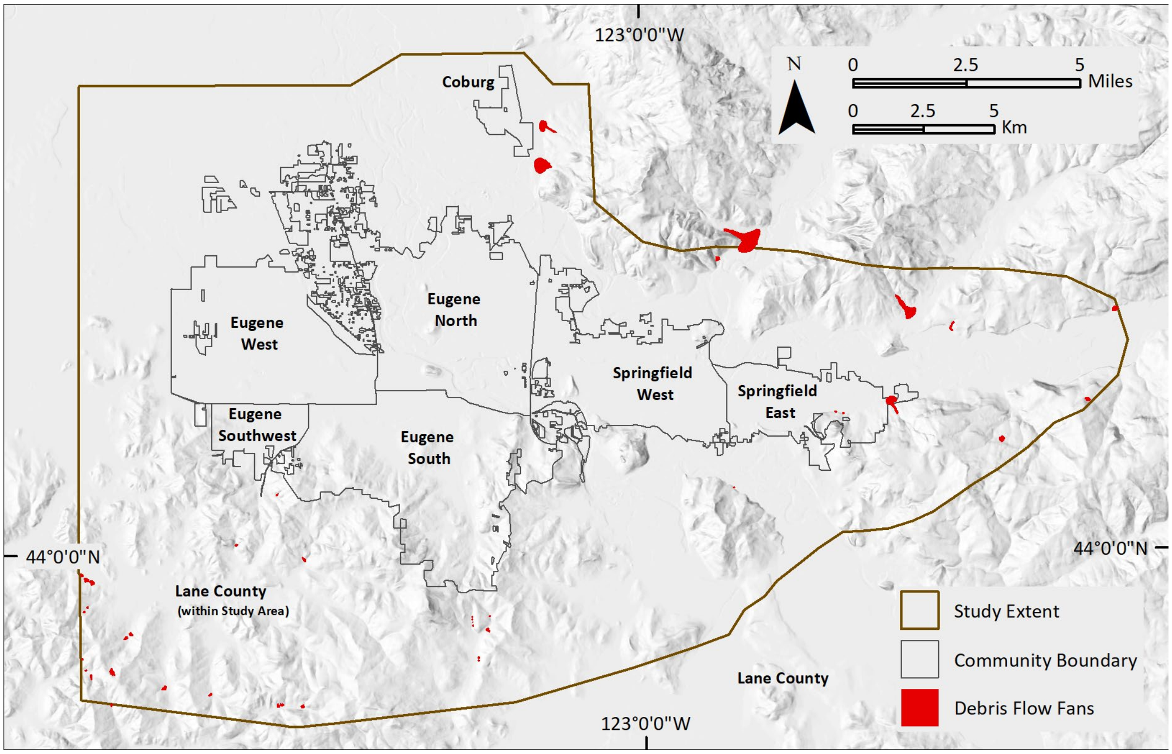
We classified the entire study area into zones of low, moderate, and high susceptibility to shallow landslides. Approximately 68% of the study area is classified as low, 24% as moderate, and 6.9% as high susceptibility (**Table 4-2**; Plate 2). It is important to remember that the shallow landslide susceptibility map can be thought of as a worst-case scenario. We produced the worst-case scenario by setting the groundwater table level to the ground surface throughout the study area. This worst-case scenario would be unlikely to occur everywhere at the same time. However, without better spatial and temporal information about groundwater this is a choice that we were forced to make. We chose a worst-case scenario as the best and most conservative approach. To further examine shallow landslide susceptibility, we examined the study area by the community (**Table 4-2**).

Table 4-2. Summary of shallow landslide susceptibility by community.

	Percentage by Zone		
Community	**Low**	**Moderate**	**High**
Lane County	65%	27%	8%
City of Springfield (East)	76%	18%	5%
City of Springfield (West)	89%	9%	2%
City of Coburg	93%	6%	0.7%
City of Eugene neighborhoods			
Eugene North	87%	10%	2%
Eugene South	63%	29%	7%
Eugene Southwest	88%	10%	1%
Eugene West	93%	5.6%	0.9%
City of Eugene (total)	77%	18%	4%
Total study area	68%	24%	6.9%

Although we did not model susceptibility to channelized debris flow transport and deposition, we did map 44 existing debris flow fans as part of the landslide inventory (**Figure 4-1**). Areas identified as highly susceptible to shallow landsliding are the most likely areas for initiation of debris flows (Plates 1 and 2). A possible method to identify whether or not a particular drainage is susceptible to debris flows is the presence of a fan at the mouth of the drainage developed by past debris flow events. The fan is usually formed by a sequence of debris flows depositing material where channel gradient is reduced and channel confinement is lost.

Figure 4-1. Map of channelized debris flow fans in the study area.



4.3 Deep Landslide Susceptibility Findings

We classified the entire study area into areas of low, moderate, and high susceptibility to deep landslides. Approximately 70% of the study area is classified as low, 23% as moderate, and 7% as high (**Table 4-3**; Plate 3). As previously mentioned, we noted that some historic deep landslides occurred within existing prehistoric landslides. It is important to remember that the susceptibility map is a conservative approach that can be thought of as a worst-case scenario. This is because we included all deep landslides that have been mapped in the high susceptibility zone. However, we do not expect all deep landslides to be active at the same time throughout the study area. This is the most conservative approach and therefore the worst-case scenario.

As with shallow landslide susceptibility, we calculated the area covered by deep landslide susceptibility within the communities (**Table 4-3**).

Table 4-3. Summary of deep landslide susceptibility by community.

	Percentage by Zone		
Community	**Low**	**Moderate**	**High**
Lane County	64%	27%	9%
City of Springfield (East)	80%	10%	9%
City of Springfield (West)	98%	1.3%	0.3%
City of Coburg	100%	0%	0%
City of Eugene Neighborhoods			
Eugene North	100%	0%	0%
Eugene South	68%	27%	5.7%
Eugene Southwest	100%	0%	0%
Eugene West	100%	0%	0%
City of Eugene (total)	85%	12.5%	3%
Total study area	70%	23%	7%

4.4 Risk Analysis and Loss Estimation Results

We performed two types of risk analysis: 1) hazard and asset exposure and 2) Hazus earthquake-triggered landslide risk analysis.

4.4.1 Exposure analysis results

We performed hazard and community asset exposure analysis on the nine hazard datasets/zones:

- shallow landslides (inventory polygons),
- deep landslides (inventory polygons),
- debris flow fans (inventory polygons),
- shallow landslide susceptibility (low, moderate, and high), and
- deep landslide susceptibility (low, moderate, and high)

and five asset datasets:

- buildings,
- land,
- transportation,
- critical facilities, and
- permanent population.

Tables showing the results of this analysis are provided in Appendix A.

As noted previously, while performing the exposure analysis we noticed the significant lack of dollar values for public land in the tax lot data. Therefore, for public land we consider the exposure analysis values as minimum values.

Table 4-4 is a summary of the exposure of select assets to the three landslide types. We found that about 4,600 people and approximately $1.13B in land and buildings are located on existing landslides.

Table 4-4. Summary of the exposure of select assets to three existing landslide types.

Landslide Type	Permanent Population	Buildings	Building Value	Land Parcels	Land Value	Roads (Miles)	Critical Facilities
Shallow landslides	33	31	$4.43M	316	$114M	0.37	0
Deep landslides	4,506	2,592	$476M	3,250	$493M	41.25	0
Debris flow fans	76	64	$9.40M	132	$30.3M	1.31	0

Table 4-5 is a summary of exposure of select assets to the six landslide susceptibility classes from the deep and shallow susceptibility maps. We found approximately $5.1B in land and buildings are located in the combined shallow and deep high susceptibility zones. More than 4,600 people live in the shallow landslide high susceptibility hazard zone, and more than 5,200 people live in the deep landslide high susceptibility zone.

Table 4-5. Summary of exposure of select assets to shallow and deep landslide susceptibility zones.

Susceptibility Class	Permanent Population	Buildings	Building Value	Land Parcels	Land Value	Roads (Miles)	Critical Facilities
			Shallow Landslide Susceptibility				
Low	220,560	100,246	$16,300M	83,430	$9,540M	1,218	84
Moderate	31,068	15,080	$3,880M	28,752	$1,740M	357	12
High	4,649	8,350	$4,560M	23,342	$361M	7	22
			Deep Landslide Susceptibility				
Low	231,433	111,213	$22,240M	76,888	$10,215M	1,350	117
Moderate	19,613	9,474	$1,925M	10,915	$1,122M	184	1
High	5,232	2,989	$561M	3,694	$308M	48	0

The amount of damage is concentrated in a few neighborhoods in the study area, as is clear from results in Appendix A. The damage from landslides is focused predominantly in Eugene South and Lane County communities, which are also the two largest communities by area. The unincorporated Lane County community makes up 74% of the total study area, some of which includes steep terrain with relatively weak rocks. Over 35% of Lane County is in the moderate to high susceptibility zones for both deep and shallow landslides, equaling 38,500 acres, the most of the communities included. Eugene South has a similar proportion of its area located in moderate to high susceptibility zones. Lane County also is the least densely populated of the communities, so has an associated 4,500 people living in moderate to high susceptibility zones, while Eugene South has between 18,000 and 20,000 people living in moderate to high susceptibility zones. Springfield East has the highest proportion of its buildings and land in the deep landslide high susceptibility zone (9% for each).

Several of the communities in this report have little to no exposure to existing landslides and have almost no land in the deep or shallow susceptibility zones. The communities of Eugene Southwest, Eugene West, Springfield West, Eugene North, and Coburg all have 0–10 cumulative percent of buildings exposed to any landslide hazard class, including existing landslides and moderate to high susceptibility zones, for both shallow and deep landslide susceptibility models.

4.4.2 Hazus analysis results

To examine the estimated damage and losses from future landslides triggered by an earthquake, we performed three different Hazus analyses on each of two earthquake scenarios (Appendix B):

Crustal M6.5 earthquake scenario: Arbitrary Eugene Fault

- No landslides
- Dry scenario landslides
- Wet scenario landslides

Subduction Zone M9.0 earthquake scenario: Cascadia Fault

- No landslides
- Dry scenario landslides
- Wet scenario landslides

These two scenarios were selected because the crustal M6.5 Arbitrary Eugene Fault earthquake represents a less likely but worst-case scenario and the M9.0 Cascadia Subduction Zone earthquake represents the more likely but less damaging scenario.

Hazus reports for each of the six analyses are provided in Appendix B. The results show that in a subduction zone event the earthquake-induced landslide hazard alone would result in economic loss to buildings of approximately $89.7M and in a local crustal earthquake approximately $454M. Hazus estimates a total replacement value for buildings at approximately $29B for both scenarios, which is more than the taxable improvements (building) value of $24.8B we derived from tax lot data (Appendix A). The reason for the difference in total building value between our database and the Hazus database is unclear and points to the need to update the Hazus general building stock inventory data with more accurate local data in future earthquake risk analysis studies. Another difference, in particular, between exposure results and Hazus results is apparent in the town of Coburg. There is little to no exposure calculated for Coburg's assets; however, due to the nature of the census tracts, the tract in which Coburg is situated has landslide deposits outside of the study area and town limits that are included in the Hazus results.

Total economic loss values are likely either over- or underestimates due to the low quality of the standard Hazus asset data, especially the critical facilities and infrastructure data. However, loss ratios are likely to be better estimates than the absolute numbers.

The analysis estimates damage by landslides alone triggered in a Cascadia or crustal earthquake will result in an estimated 2,770 buildings being moderately to completely damaged and more than 580 residents needing shelter (Appendix B). In Lane County, the loss ratio increased from 8% to 10% when landslides in a "wet" condition are used in the scenario. Overall, 1.5% of the damage of a Cascadia earthquake comes from landslides in the study area.

As can be seen in **Table 4-6**, Springfield East has 20% of total losses from a Cascadia-Subduction Zone earthquake damage occurring from landslides. Eugene South also has a high dollar value associated with coseismic landslide damage, with $34M worth of building damage estimated.

For the modeled damage for Cascadia – With Dry Landslides scenario, there was no additional damage compared to Cascadia – With No Landslides scenario. The ground motions from the Cascadia Subduction Zone earthquake alone did not overcome the Hazus-defined slope failure threshold within dry conditions. However, within wet ground conditions (Cascadia – With Landslides (Wet)), while ground motions were the same, slope failure was modeled to occur.

Table 4-6. Summary of Hazus analysis results for the Cascadia Subduction Zone M9.0 earthquake scenario: building dollar values only. Other results are included in Appendix B.

		Building Losses							
	Total Building Value ($)	Cascadia— No Landslide		Cascadia with Landslide (Dry)		Cascadia with Landslide (Wet)		Landslide (Wet) Only*	Percent of Total Losses from Landslides
		Loss ($)	Loss Ratio (%)	Loss ($)	Loss Ratio (%)	Loss ($)	Loss Ratio (%)	Difference in Losses ($)	
Coburg	$870M	$137M	16%	$137M	16%	$137M	16%	$0M	0%
Lane County	$4,990M	$421M	8%	$421M	10%	$516M	10%	$95M	1.5%
Springfield East	$2,357M	$163M	7%	$163	7%	$204M	9%	$41M	20%
Springfield West	$6,798M	$583M	9%	$583M	9%	$583M	9%	$0	0%
City of Eugene Neighborhoods									
Eugene North	$9,030M	$1,329M	15%	$1,329M	15%	$1,329M	15%	$0	0%
Eugene South	$13,760M	$1,998M	14%	$1,998M	14%	$2,032M	15%	$34.4M	1.7%
Eugene Southwest	$847M	$96M	11%	$96M	11%	$99M	12%	$2.77M	3%
Eugene West	$9,132M	$1,204M	13%	$1,204M	13%	$1,208M	13%	$3.79M	0%
City of Eugene total	$32,769M	$4,627M	14%	$4,627M	14%	$4,668M	14%	$40.9M	<1%
Total study area	$47,787M	$5,931M	12%	$5,931M	12%	$6,108M	13%	$177M	1.5%

* "Landslides (Wet) Only" is the difference between "Cascadia – No Landslide" and "Cascadia Landslide Wet" values.

4.5 Annualized Loss Results

On the basis of historical data, one to three landslides occur per year on average in the study area. Stormy, wet, or otherwise extreme landslide years, such as the 1996 winter, can cause hundreds of landslides and millions of dollars' worth of damage (Wang and others, 2002). The number of landslides multiplied by the average loss estimates provides a preliminary estimate of losses per year. In a previous study, Burns and others (2017, Table 4), found from exposure analysis for the City of Portland an average cost of $99,000 per landslide based on building permits, $144,000 exposed on private property per landslide, and $102,500 public property exposed per landslide. Although landslides in the Eugene-Springfield metro area may differ in type, style, and amount of damage as compared to landslides that have caused damage in the City of Portland, the Portland loss data are the best available and can be useful for landslide loss estimates in the Eugene-Springfield area.

A total of 75 landslide points from 1979 to 2016 are included in this study's historic landslide points. There may have been earlier historic landslides in the area; however, they were not recorded or were not recorded in a way that we were able to find. There are very few landslide records before 1996. From the years 1996 to 2016, there were 54 landslides; there are 15 landslides with unknown or undetermined years of occurrence and 6 records prior to 1995. Therefore, there are approximately 2-3 landslides per year on average, in the past 20 years; however, 37 of these 75 historic landslide points occurred in the record-setting rainy years of 1996 and 1997 winter. Omitting an extreme landslide occurrence year from the mean, there is approximately 1 landslide per typical year, although 37 were recorded in an exceptionally rainy year.

Therefore, based on the best available data the range of losses from landslides in a typical year is $99,000 to $306,000. The range of losses in an exceptional year, such as 1996, is $3.6M to $5.3M.

5.0 CONCLUSIONS, DISCUSSION, AND RECOMMENDATIONS

This study was initiated to alert communities in the study area of the need to be prepared for landslides. Although we cannot predict when landslide events will occur or how big they will be, we have provided a detailed understanding of landslide events in the past, the estimated scale of a potential disaster, the areas more or less susceptible to future landslides, and an estimate of what the damage and losses might be. We note that the portion of Oregon included in this study has high average annual precipitation as well as high 24-hour-duration precipitation related to storm events. The area also has a relatively moderate to high seismic hazard. Both high precipitation and large earthquakes are primary triggers for new landslides and the reactivation of existing landslides. Human activities can also trigger landslides. The main purpose of this project was to help communities in the study area become more resilient to landslide hazards by providing detailed, new digital databases locating the landslide hazards as well as community assets and the risk that exists where the two overlap.

A summary of findings includes:

- Lidar-based landslide inventory mapping (Plate 1) using the SP-42 method found 634 landslides, which cover approximately 6% (~14 square miles; 36 square kilometers) of the study area.
- About 4,500 people and land and buildings valued at approximately $1.1B are located on these existing landslides.
- Our new historic landslide point dataset has 75 records with dates ranging from 1979 to 2016 within the study area.
- Annual loss estimates from landslides in the study area are expected to be between $99,000 and $306,000 in a typical year; in extreme years (such as 1996), this increases to $3.6M to $5.3M.
- Almost 5,200 people live in the deep landslide high susceptibility zone and approximately 4,600 live in the shallow landslide high susceptibility zone.

Most of the existing historic landslide points are within both the deep and shallow moderate to high landslide susceptibility zones (Plate 3). Although we did not create a channelized debris flow susceptibility map, the combination of the shallow susceptibility map and the landslide inventory map showing debris flow fans could be used to identify where these types of landslides might initiate and where they might deposit. In addition, DOGAMI Interpretive Map 22 (Hofmeister and others, 2002) could be used with these other datasets to evaluate potential channelized debris flow hazards. In many cases, debris flow fan areas have the potential for life safety risk, and therefore we recommend extra caution is taken in these areas.

The main reason for the landslide hazard in the current study area appears to be the high relief and steep topography combined with susceptible geologic units and contacts in the northeast and southeast of the study area. The interpreted Mohawk River caldera rim northeast of the City of Eugene contains many large, deep landslides, many along contacts within the volcanic units. There are many more mapped to the north beyond this study area by McClaughry and others (2010), indicating there are widespread landslides within the Mohawk volcanic series.

An area only partly included in the McClaughry and others (2010) geologic study is the plateau southeast of Springfield. This area has susceptible geologic contacts and units, and nearby unfailed slopes with similar slope angles and direction of previous deep failures. There are 33 deep landslides with similar slope, direction, and underlying geology along the south wall of the McKenzie River valley. Within this area, we chose to add an extra deep landslide susceptibility buffer factor to accommodate the runout length typified by these 33 deep landslides. However, on the north side of this valley there are fewer and smaller deep landslides, though with similar geological makeup. This difference is likely due to underlying structural controls, such as dip direction, although we have limited structural geologic data in this particular area.

The other area with widespread moderate to high deep landslide susceptibility is in the South Hills area, south of Eugene. This area is characterized by weathered marine sedimentary and volcaniclastic rocks, with increased landslide susceptibility along contacts. Overall, the majority of the South Hills have a moderate susceptibility, with the existing landslides the likely place for reactivation of deep landslides. Shallow susceptibility, on the other hand, is strongly dictated by slope and strength of geologic material. The South Hills have some susceptibility to shallow landslides; however, susceptibility is concentrated along isolated steep slopes and narrow zones, particularly compared to the far southeast and northern hills with high concentrations of high susceptibility.

Compared to areas covered by previous studies that used the same methodologies, the Eugene-Springfield area as a whole has a low to moderate landslide hazard. This study area has a landslide density, or percent landslide inventory deposit coverage of the total area, of 5.2%, which is less than that of areas covered by previous studies using the same methodologies (**Table 5-1**). Some of these previous studies are centered in mountainous, entirely steep terrain, making a direct comparison to a mean landslide density slightly misleading, as the hazard locally can have a considerable range.

Table 5-1. Landslide density reported from past studies in Oregon.

	Percent Landslide Inventory Deposit Coverage	Relative Overall Hazard Classification Concluded in Report
Astoria (Burns and Mickelson, 2013)	27%	High
North Fork Siuslaw Watershed (Burns and others, 2012)	37%	High
Coastal Curry County (Burns and others, 2014)	25%	High
Bull Run Watershed (Burns and others, 2015)	15%	Moderate to High
Clatskanie (Mickelson and Burns, 2012)	25%	High

The deep landslide susceptibility of the Eugene-Springfield study is comparable to several other studies in Oregon, namely northwestern Clackamas County. The results for this study were also divided into communities, some with no (0%) deep landslide susceptibility, ranging to 8.2% of the areas of a community within the high deep landslide susceptibility. The City of Portland also exhibits a range by community, from 0% of some communities ranging to 14% of a community. Therefore, the Eugene-Springfield study area has a variable but significant deep landslide susceptibility range, comparable to that of northwestern Clackamas County.

We have discussed detailed study results in this report and have provided detailed data in appendices and on GIS-based map plates. Four primary conclusions of the project are:

- Large, deep landslides are a primary threat in the study area, and asset exposure to these landslides is significant. More than 4,500 residents, more than 2,500 buildings, and a combined building and land value of about $950 million are affected.
- 8,350 buildings are located in the high shallow landslide susceptibility zone, with close to $5B worth of land and buildings exposed.

- Annual historic landslide losses range from $99,000-$306,000; in extreme years (such as 1996), this increases to several million.
- Damage and losses from landslides alone, induced by a local crustal or a Cascadia Subduction Zone earthquake, may result in an estimated 2,770 buildings being moderately to completely damaged and close to 600 residents in need of shelter. In most communities, <5% of earthquake damage would come from landslides. However, in some communities, potential landslides triggered by the earthquakes could cause a 20% increase in damage and losses.

These data indicate moderate landslide hazard and risk in the study area. When we examined the hazard and risk at the community scale, we found Lane County, Eugene South, and Springfield East had consistently higher hazard and risk than the other, predominantly low-risk communities. This amount of landslide risk indicates an opportunity for proactive landslide risk management. Landslide risk can be managed in various ways. One way to conceptualize risk management components is illustrated in **Figure 5-1**.

Figure 5-1. Landslide risk management diagram (Y. Wang, written communication, 2010).

We provide the following recommendations to communities in the study area for continued work on landslide risk management. These recommendations are not comprehensive, but they should provide an adequate foundation for many of the risk management phases shown in **Figure 5-1**. The primary actions are related: awareness, regulations, and planning.

5.1 Awareness

Awareness of local hazards is crucial to understanding associated dangers and how to prepare for them. One of the main purposes of this report and maps is to help residents and landowners in the study area become aware of the parts they can play in readiness for hazardous events and risk reduction. Once the hazard is better understood, residents and landowners can work on risk reduction. To increase awareness, we will post this report and the map plates on the DOGAMI website. Helpful flyers can be linked from DOGAMI websites and/or distributed to help educate landowners of activities individuals can initiate to reduce landslide risk. Helpful flyers include the "Homeowners Guide to Landslides" (https://www

.oregongeology.org/Landslide/ger_homeowners_guide_landslides.pdf) and the DOGAMI fact sheet "Landslide Hazards in Oregon" (https://www.oregongeology.org/pubs/fs/landslide-factsheet.pdf).

City, county, neighborhood, and other local community leaders can implement awareness campaigns to educate neighborhoods, businesses, and individual homeowners about the locations of local hazards and how to reduce risk. For example, homeowners unintentionally increase their own risk through discharge of stormwater onto slopes that are susceptible to landslides. Landslides resulting from this type of discharge were observed after the 1996 events (Burns and others, 1998). Just knowing which slopes are susceptible can provide the impetus to switch from unknowingly increasing risk to actively reducing risk through cost-effective methods such as extending stormwater discharge pipes beyond the high hazard zone.

5.2 Warnings

Preparing for emergency situations such as storm events and earthquakes can be done in several ways. One can assess the level of readiness and preparedness to deal with a disaster before disaster occurs by estimating damage and losses from specific hazard events. This was done at a regional scale during this project. Another way to prepare is through the development of a landslide warning system, which would help better understand when these events might happen. Oregon has a general statewide landslide warning system; when the National Weather Service (NWS) initiates warnings, several Oregon state agencies (Oregon Emergency Management [OEM], Oregon Department of Transportation [ODOT], and DOGAMI) disseminate the warnings. The current warning system could be used by the communities in the study area. In the future, a monitoring system that tracks rainfall thresholds at which landslides can be expected to initiate could be developed by monitoring precipitation and resulting slide activity. Knowing when there will be periods of increased landslide potential will help communities prepare, respond, and recover, should landsliding occur. If known very high hazard areas, such as debris flow fans, with the potential for life safety issues are identified, evacuation could be considered, recommended, or required.

5.3 Development and Infrastructure Planning

Planning is an effective method to work on risk reduction and can be initiated in a variety of ways using the maps and data produced in this project. Two types of planning that engage leaders, residents, and landowners in planning are 1) focus on future development, and 2) focus on existing infrastructure.

These new hazard data should be used in long-term planning. The data should also be included in assessments when discussing expansion of urban growth boundaries. Another long-term planning tool is including data from this report in comprehensive plans, which most cities and counties use to identify community goals. Some planning could result in the avoidance of proposed development in high-hazard areas and even public buyouts in very high or life-threatening hazard areas. Additional planning can focus on maintenance of road-related grading, repeated asphalt overlays, or expanding roadways. Keeping specific records of maintenance practices is a good way to track risk reduction effects.

Stormwater runoff routing must be done carefully so that water is not directed onto or into unstable slope areas. Planning of the public stormwater system, for example, should include culvert outlets in order to evaluate any discharge onto highly susceptible zones. Planning could focus on private landowner education and awareness in order to gain landowner partnership in the control of stormwater.

5.4 Regulation

Connecting landslide inventory and susceptibility maps and data to regulations such as development codes and ordinances can be very effective. Such regulations use landslide hazard maps to identify proposed development and grading or other activities that may increase landslide risk in high hazard areas. These regulations typically have requirements to perform site-specific geotechnical analysis and mitigation design. Regulations can also reduce grading-related landslides. For example, relatively shallow grading activities can unintentionally cause slope failures, especially in conditions where existing landslides or slopes in high susceptibility zones may be only marginally stable. Placing debris or soil in the wrong location, for example, near the heads of existing landslides, can also unknowingly cause slope failure simply by adding more weight to the slope.

5.5 Large Deep Landslide Risk Reduction

Large, deep landslides are commonly harder and more expensive to mitigate because a single deep landslide may affect multiple landowners, including private, city, county, state, and federal landowners. Mitigation may require cooperating effort from public and private entities (generally, city or county and landowners) because the slides can span or even cross entire neighborhoods. This study accomplished parts one (hazard identification) and two (risk assessment) of landslide management illustrated in **Figure 5-1**. The critical next step is number three, engaging stakeholders (**Figure 5-1**). A public awareness campaign could be undertaken to educate homeowners and landowners about the landslide hazard and risk in their areas and prioritize future risk reduction actions. Residents on mapped landslide areas should participate in a neighborhood risk reduction program where all affected entities help reduce the overall risk.

There are many actions to reduce risk on large deep landslides. Risk reduction measures should include these as a minimum:

- Water
  - minimize or eliminate irrigation on landslide
  - intercept and collect surface water above landslide area to reduce natural water infiltration into the landslide
  - collect surface water runoff from within the landslide area from impervious surfaces, for example: roof downspouts, streets, and driveways, and
  - reduce any onsite storm water retention and inflation within the landslide area.
- Grading
  - Avoid grading within the landslide area unless a detailed geotechnical evaluation has been performed including recommendations on how and when to perform grading safely.
- Consult a geotechnical engineer and engineering geologist to conduct a site-specific evaluation to develop further site-specific risk reduction activities.

Some mitigation actions are more affordable and easier to accomplish than others. Large-scale mitigation activities for deep landslides commonly include engineered retaining structures and underground dewatering drainage systems. These activities will need to be prioritized by the community based on funding and acceptable level of risk for the community. A Geologic Hazard Abatement Districts (GHAD) designation may be a useful mechanism to fund and implement some landslide risk reduction actions (Curtin and Zovod, 2005). The report by Curtin and Zovod (2005) is a useful resource to understand GHADs specifically as they relate to landslide risk reduction.

5.6 Emergency Response

Finally, we recommend that neighborhoods and communities create landslide emergency response plans before the next disaster. One component of the plan should include identifying local engineering geologists and geotechnical engineers and establishing working relationships with them so they can be asked to evaluate landslides or areas during and directly after the next disaster. Their evaluations would help determine the immediate actions required following the disaster. For example, they would determine if a neighborhood should be evacuated or if the area is stable enough to perform an emergency response.

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8.0 APPENDICES

Appendices are available as separate documents in the digital file set.

Appendix A. Exposure Analysis Results (Microsoft® Excel® spreadsheet and Adobe® PDF formats)

Appendix B. Hazus Analysis Results (Adobe PDF format)

Eugene Crustal

Crustal M6.5 earthquake scenario: Arbitrary Eugene Fault

- No landslides (M6.5_Arbitrary_Eugene_acrustal2_no_ls.pdf)
- Dry scenario landslides (M6.5_Arbitrary_Eugene_acrustal3_dry_ls.pdf
- Wet scenario landslides (M6.5_Arbitrary_Eugene_acrustal4_wet_ls.pdf)

Subduction Zone M9.0 earthquake scenario: Cascadia Fault

- o No landslides (CSZ_no_ls.pdf)
- Detailed
  - o Dry scenario landslides (CSZ_ls_dry_non_tract_Redacted.pdf)
  - o Wet scenario landslides (CSZ_ls_wet_non_tract_Redacted.pdf)
- Tract
  - o Dry scenario landslides (CSZ_tract_ls_dry_Redacted.pdf)
  - o Wet scenario landslides (CSZ_tract_ls_wet_Redacted.pdf)

Appendix C. Building Digitization and Tax Lot Association Methods (Adobe PDF format)

Asset Inventory - Eugene & Springfield Neighborhoods

Buildings

	Residential			Commercial			Public			All Buildings		
COMMUNITIES	Single Family Count	Single Family (Count % of Total) (percent)	Single Family Value (dollars)	Commercial Count	Commercial (Count of Total) (percent)	Commercial Value (dollars)	Government Count	Government (Count of Total) (percent)	Government Value (dollars)	Total Count	Percent Total (Count of Total) (percent)	Total Value (dollars)
Lane County	25,364	23.28%	$2,417,885,541.66	5,877	45.99%	$739,643,803.18	414	21.15%	$299,180,800.57	31,655	25.59%	$3,456,710,145.41
Eugene South	23,508	21.58%	$4,851,688,738.15	1,070	8.37%	$1,146,192,172.12	607	31.02%	$1,626,903,447.50	25,185	20.36%	$7,624,784,357.77
Eugene Southwest	1,053	0.97%	$170,237,924.81	218	1.71%	$112,209,045.43	26	1.33%	$37,945,782.71	1,297	1.05%	$320,392,752.94
Springfield East	10,495	9.63%	$988,786,245.46	745	5.83%	$339,060,265.29	73	3.73%	$85,393,120.04	11,313	9.15%	$1,413,239,630.78
Eugene West	15,212	13.96%	$1,859,419,282.27	1,552	12.14%	$788,640,262.07	186	9.50%	$215,893,977.53	16,950	13.70%	$2,863,953,521.87
Springfield West	17,238	15.82%	$2,031,688,408.85	1,966	15.38%	$1,077,412,997.23	304	15.53%	$242,337,236.30	19,508	15.77%	$3,351,438,642.38
Coburg	551	0.51%	$57,117,914.95	167	1.31%	$111,959,363.84	13	0.66%	$6,593,195.45	731	0.59%	$175,670,474.25
Eugene North	15,537	14.26%	$3,272,141,659.96	1,184	9.27%	$1,176,935,290.88	334	17.07%	$1,098,183,337.36	17,055	13.79%	$5,547,260,288.20
Total (cities + county)	**108,958**	**100.00%**	**$15,648,965,716.11**	**12,779**	**100.00%**	**$5,492,053,200.04**	**1,957**	**100.00%**	**$3,612,430,897.46**	**123,694**	**100.00%**	**$24,753,449,813.60**

Land

	Residential						Commercial					
COMMUNITIES	Single Family Count	Single Family (Count % of Total) (percent)	Single Family Area (feet2)	Single Family Area (acres)	Single Family Area % of Total (percent)	Single Family Value (dollars)	Commercial Count	Commercial (Count % of Total) (percent)	Commercial Area (feet2)	Commercial Area (acres)	Commercial (Area % of Total) (percent)	Commercial Value (dollars)
Lane County	15,230	19.84%	887,764,093	20380.2599	55.06%	$1,460,990,859.69	3,432	43.69%	3,014,607,041	69,206	88.87%	$864,823,651.88
Eugene South	20,504	26.71%	249,842,962	5735.6054	15.50%	$2,110,245,938.00	997	12.69%	36,367,618	835	1.07%	$482,069,144.00
Eugene Southwest	749	0.98%	13,399,483	307.6098	0.83%	$60,020,701.00	168	2.14%	40,052,710	919	1.18%	$85,780,106.00
Springfield East	6,644	8.66%	76,443,617	1754.9040	4.74%	$399,693,803.00	184	2.34%	35,532,072	816	1.05%	$86,322,845.00
Eugene West	11,314	14.74%	122,807,187	2819.2652	7.62%	$733,805,397.00	1,043	13.28%	103,837,160	2,384	3.06%	$543,142,252.00
Springfield West	10,153	13.23%	106,216,109	2438.3864	6.59%	$717,137,136.00	1,041	13.25%	82,193,330	1,887	2.42%	$605,401,233.00
Coburg	382	0.50%	4,586,162	105.2838	0.28%	$33,932,423.00	85	1.08%	14,209,001	326	0.42%	$61,258,761.00
Eugene North	11,779	15.35%	151,319,182	3473.8105	9.38%	$1,356,301,589.00	906	11.53%	65,260,816	1,498	1.92%	$890,420,310.00
Total (cities + county)	**76,755**	**100.00%**	**1,612,378,796**	**37015.12508**	**100.00%**	**$6,872,127,846.69**	**7,856**	**100.00%**	**3,392,059,748**	**77,871**	**100.00%**	**$3,619,218,302.88**

	Public						All Land					
COMMUNITIES	Government Count	Government (Count % of Total) (percent)	Government Area (feet2)	Government Area (acres)	Government (Area % of Total) (percent)	Government Value (dollars)	Count	(Count % of Total) (percent)	Area (feet2)	Total Area (acres)	(Area % of Total) (percent)	Total Value (dollars)
Lane County	597	22.99%	927,975,659	21,303	65.07%	$138,209,389.51	19,259	22.08%	4,830,346,793	110,890	75.11%	$2,464,023,901.08
Eugene South	568	21.87%	289,293,294	6,641	20.28%	$426,959,927.00	22,069	25.31%	575,503,875	13,212	8.95%	$3,019,275,009.00
Eugene Southwest	29	1.12%	8,495,723	195	0.60%	$18,279,950.00	946	1.08%	61,947,916	1,422	0.96%	$164,080,757.00
Springfield East	128	4.93%	14,396,746	331	1.01%	$16,066,227.00	6,956	7.98%	126,372,435	2,901	1.97%	$502,082,875.00
Eugene West	399	15.36%	72,080,431	1,655	5.05%	$127,885,622.00	12,756	14.63%	298,724,778	6,858	4.65%	$1,404,833,271.00
Springfield West	375	14.44%	40,293,070	925	2.83%	$107,164,793.00	11,569	13.27%	228,702,508	5,250	3.56%	$1,429,703,162.00
Coburg	21	0.81%	4,143,688	95	0.29%	$3,870,585.00	488	0.56%	22,938,851	527	0.36%	$99,061,769.00
Eugene North	480	18.48%	69,548,148	1,597	4.88%	$315,597,062.00	13,165	15.10%	286,128,146	6,569	4.45%	$2,562,318,961.00
Total (cities + county)	**2,597**	**100.00%**	**1,426,226,758**	**32,742**	**100.00%**	**$1,154,033,555.51**	**87,208**	**100.00%**	**6,430,665,302**	**147,628**	**100.00%**	**$11,645,379,705.08**

Transportation

COMMUNITIES	Freeways, Highways & Major Arterials Length (feet)	Freeways, Highways & Major Arterials Length (miles)	Freeways, Highways & Major Arterials Percent of Total Length (%)	Freeways, Highways & Major Arterials Total Area (feet)	Freeways, Highways & Major Arterials Total Area (acres)	Minor Arterials & Collect/Connectors Length (feet)	Minor Arterials & Collect/Connectors Length (miles)	Minor Arterials & Collect/Connectors Percent of Total Length (%)	Minor Arterials & Collect/Connectors Total Area (feet)	Minor Arterials & Collect/Connectors Total Area (acres)
Lane County	269,825	51	30.59%	14,963,663	344	779,960	147.72	39.41%	31,051,647	344
Eugene South	44,231	8	5.02%	2,494,849	57	346,101	65.55	17.49%	13,672,570	57
Eugene Southwest	16,182	3	1.83%	970,543	22	40,566	7.68	2.05%	1,614,720	22
Springfield East	38,461	7	4.36%	2,289,664	53	84,638	16.03	4.28%	3,363,219	53
Eugene West	114,035	22	12.93%	6,442,453	148	211,678	40.09	10.70%	8,407,298	148
Springfield West	119,156	23	13.51%	6,382,111	147	282,136	53.43	14.26%	11,095,839	147
Coburg	9,846	2	1.12%	518,887	12	22,650	4.29	1.14%	896,000	12
Eugene North	270,237	51	30.64%	13,406,001	308	211,268	40.01	10.68%	8,366,826	308
Total (cities + county)	**881,973**	**167**	**100.00%**	**47,468,172**	**1,090**	**1,978,996**	**374.81**	**100.00%**	**78,468,119**	**1,090**

						All Roads				
COMMUNITIES	Local Streets Length (feet)	Local Streets Length (miles)	Local Streets Percent of Total Length %	Local Streets Total Area (feet)	Local Streets Total Area (acres)	Total Road Length (feet)	Total Road Length (miles)	Total Road Length (%)	Total Road Area (feet)	Total Road Area (acres)
Lane County	1,719,353	326	31.30%	51,055,116	1,172	2,769,138	524	33.15%	97,070,426	2,228
Eugene South	1,314,439	249	23.93%	38,444,906	883	1,704,771	323	20.41%	54,612,325	1,254
Eugene Southwest	73,467	14	1.34%	2,165,691	50	130,215	25	1.56%	4,750,954	109
Springfield East	322,872	61	5.88%	9,471,184	217	445,971	84	5.34%	15,124,067	347
Eugene West	702,977	133	12.80%	20,609,052	473	1,028,689	195	12.31%	35,458,802	814
Springfield West	539,615	102	9.82%	15,872,757	364	940,907	178	11.26%	33,350,708	766
Coburg	30,466	6	0.55%	896,028	21	62,963	12	0.75%	2,310,916	53
Eugene North	790,116	150	14.38%	23,132,153	531	1,271,621	241	15.22%	44,904,980	1,031
Total (cities + county)	**5,493,304**	**1,040**	**100.00%**	**161,646,887**	**3,711**	**8,354,274**	**1,582**	**100.00%**	**287,583,178**	**6,602**

Critical Facilities: Buildings

													All CFs		
COMMUNITIES	School Buildings Count	School Buildings (Count % of Total) (percent)	School Buildings Value (dollars)	Fire Buildings (count)	Fire Buildings (Count % of Total) (percent)	Fire Buildings Value (dollars)	Police Buildings (count)	Police Buildings (Count % of Total) (percent)	Police Buildings Value (dollars)	Hospital Buildings (count)	Hospital Buildings (Count % of Total) (percent)	Hospital Buildings Value (dollars)	Total Count	Percent Total (Count % of Total) (percent)	Total Value (dollars)
Lane County	16	18.82%	$172,421,962.25	6	28.57%	$1,322,064.56	3	30.00%	$1,635,298.75	0	0.00%	$0.00	25	21.19%	$175,379,325.56
Eugene South	17	20.00%	$112,526,852.25	3	14.29%	$7,420,292.31	2	20.00%	$1,303,937.50	1	50.00%	$178,312,416.00	23	19.49%	$299,563,498.06
Eugene Southwest	3	3.53%	$16,104,958.75	1	4.76%	$173,598.02	0	0.00%	$0.00	0	0.00%	$0.00	4	3.39%	$16,278,556.77
Springfield East	5	5.88%	$57,858,757.50	2	9.52%	$1,931,490.56	0	0.00%	$0.00	0	0.00%	$0.00	7	5.93%	$59,790,248.06
Eugene West	19	22.35%	$79,395,485.25	4	19.05%	$5,441,499.25	0	0.00%	$0.00	0	0.00%	$0.00	23	19.49%	$84,836,984.50
Springfield West	14	16.47%	$80,237,851.41	3	14.29%	$3,028,837.19	2	20.00%	$11,450,028.50	1	50.00%	$27,781,806.00	20	16.95%	$122,498,523.09
Coburg	1	1.18%	$2,780,004.75	0	0.00%	$0.00	2	20.00%	$884,061.80	0	0.00%	$0.00	3	2.54%	$3,664,066.55
Eugene North	10	11.76%	$113,932,687.47	2	9.52%	$2,093,267.75	1	10.00%	$263,482.00	0	0.00%	$0.00	13	11.02%	$116,289,437.22
Total (cities + county)	**85**	**100.00%**	**$635,258,559.63**	**21**	**100.00%**	**$21,411,049.64**	**10**	**100.00%**	**$15,536,808.55**	**2**	**100.00%**	**$206,094,222.00**	**118**	**100.00%**	**$878,300,639.82**

Social: Population

COMMUNITIES	Population Count	Population Exposed % of Total
Lane County	41,836	16.32%
Eugene South	70,373	27.46%
Eugene Southwest	3,020	1.18%
Springfield East	20,127	7.85%
Eugene West	38,515	15.03%
Springfield West	37,218	14.52%
Coburg	444	0.17%
Eugene North	44,744	17.46%
Total (cities + county)	**256,278**	**100.00%**

Landslide Inventory - Deep Landslide Deposits

Buildings

COMMUNITIES	Residential Single Family Count	Single Family (Count % of Total) (percent)	Single Family Value (dollars)	Commercial Commercial Count	Commercial (Count of Total) (percent)	Commercial Value (dollars)	Public Government Count	Government (Count of Total) (percent)	Government Value (dollars)	All Buildings Total Count	Percent Total (Count of Total) (percent)	Total Value (dollars)
Lane County	474	1.87%	$66,901,979.88	248	4.22%	$31,657,207.81	11	2.66%	$161,145.29	733	2.32%	$98,720,332.98
Eugene South	923	3.93%	$230,291,862.66	9	0.84%	$3,489,398.59	1	0.16%	$0.00	933	3.70%	$233,781,261.25
Eugene Southwest	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Springfield East	920	8.77%	$137,818,443.67	3	0.40%	$1,001,873.10	2	2.74%	$229,716.00	925	8.18%	$139,050,032.77
Eugene West	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Springfield West	0	0.00%	$0.00	0	0.00%	$0.00	1	0.33%	$4,027,491.00	1	0.01%	$4,027,491.00
Coburg	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Eugene North	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Total (cities + county)	**2,317**	**2.13%**	**$435,012,286.21**	**260**	**2.03%**	**$36,148,479.50**	**15**	**0.77%**	**$4,418,352.29**	**2,592**	**2.10%**	**$475,579,118.00**

Land

COMMUNITIES	Residential Single Family Count	Single Family (Count % of Total) (percent)	Single Family Area (feet2)	Single Family Area (acres)	Single Family Area % of Total (percent)	Single Family Value (dollars)	Commercial Commercial Count	Commercial (Count % of Total) (percent)	Commercial Area (feet2)	Commercial Area (acres)	Commercial (Area % of Total) (percent)	Commercial Value (dollars)
Lane County	482	3.16%	55,790,185	1,281	6.28%	$94,715,937.00	573	16.70%	201,158,299	4,618	6.67%	$159,453,936.00
Eugene South	1198	5.84%	14,835,659	341	5.94%	$120,148,116.00	9	0.90%	807,669	19	2.22%	$10,451,070.00
Eugene Southwest	0	0.00%	0	0	0.00%	$0.00	0	0.00%	0	0	0.00%	$0.00
Springfield East	880	13.25%	9,180,018	211	12.01%	$59,923,229.00	4	2.17%	444,773	10	1.25%	$790,916.00
Eugene West	0	0.00%	0	0	0.00%	$0.00	0	0.00%	0	0	0.00%	$0.00
Springfield West	1	0.01%	712	0	0.00%	$56,681.00	0	0.00%	0	0	0.00%	$0.00
Coburg	0	0.00%	0	0	0.00%	$0.00	0	0.00%	0	0	0.00%	$0.00
Eugene North	0	0.00%	0	0	0.00%	$0.00	0	0.00%	0	0	0.00%	$0.00
Total (cities + county)	**2,561**	**3.34%**	**79,806,574**	**1,832**	**4.95%**	**$274,843,963.00**	**586**	**7.46%**	**202,410,741**	**4,647**	**5.97%**	**$170,695,922.00**

COMMUNITIES	Public Government Count	Government (Count % of Total) (percent)	Government Area (feet2)	Government Area (acres)	Government (Area % of Total) (percent)	Government Value (dollars)	All Land Count	(Count % of Total) (percent)	Area (feet2)	Total Area (acres)	(Area % of Total) (percent)	Total Value (dollars)
Lane County	58	9.72%	46,299,725	1,063	4.99%	$27,158,463.00	1,113	34.25%	303,248,209	6,962	6.28%	$281,328,336.00
Eugene South	25	4.40%	8,136,468	187	2.81%	$15,149,318.00	1,232	37.91%	23,779,796	546	4.13%	$145,748,504.00
Eugene Southwest	0	0.00%	0	0	0.00%	$0.00	0	0.00%	0	0	0.00%	$0.00
Springfield East	17	13.28%	141,149	3	0.98%	$782,387.00	901	27.72%	9,765,940	224	7.73%	$61,496,532.00
Eugene West	0	0.00%	0	0	0.00%	$0.00	0	0.00%	0	0	0.00%	$0.00
Springfield West	3	0.80%	388,492	9	0.96%	$4,656,189.00	4	0.12%	389,204	9	0.17%	$4,712,870.00
Coburg	0	0.00%	0	0	0.00%	$0.00	0	0.00%	0	0	0.00%	$0.00
Eugene North	0	0.00%	0	0	0.00%	$0.00	0	0.00%	0	0	0.00%	$0.00
Total (cities + county)	**103**	**3.97%**	**54,965,834**	**1,262**	**3.85%**	**$47,746,357.00**	**3,250**	**3.73%**	**337,183,149**	**7,741**	**5.24%**	**$493,286,242.00**

Transportation

COMMUNITIES	Freeways, Highways & Major Arterials Length (feet)	Freeways, Highways & Major Arterials Length (miles)	Freeways, Highways & Major Arterials Percent of Total Length (%)	Freeways, Highways & Major Arterials Total Area (feet)	Freeways, Highways & Major Arterials Total Area (acres)	Minor Arterials & Collect/Connectors Length (feet)	Minor Arterials & Collect/Connectors Length (miles)	Minor Arterials & Collect/Connectors Percent of Total Length (%)	Minor Arterials & Collect/Connectors Total Area (feet)	Minor Arterials & Collect/Connectors Total Area (acres)	Local Streets Length (feet)	Local Streets Length (miles)	Local Streets Percent of Total Length %	Local Streets Total Area (feet)	Local Streets Total Area (acres)	All Roads Total Road Length (feet)	Total Road Length (miles)	Total Road Length (%)	Total Road Area (feet)	Total Road Area (acres)
Lane County	11,308	2.14	4.19%	631,165	14.49	24,599	4.66	3.15%	1,023,811	23.50	85,163	16.13	4.95%	2,743,268	62.98	121,070	22.93	4.37%	4,398,243	100.97
Eugene South	0	0.00	0.00%	0	0.00	5,702	1.08	1.65%	231,797	5.32	50,868	9.63	3.87%	1,525,490	35.02	56,569	10.71	3.32%	1,757,288	40.34
Eugene Southwest	0	0.00	0.00%	0	0.00	0	0.00	0.00%	0	0.00	0	0.00	0.00%	0	0.00	0	0.00	0.00%	0	0.00
Springfield East	94	0.02	0.24%	516	0.01	5,310	1.01	6.27%	217,261	4.99	34,740	6.58	10.76%	1,039,443	23.86	40,144	7.60	9.00%	1,257,219	28.86
Eugene West	0	0.00	0.00%	0	0.00	0	0.00	0.00%	0	0.00	0	0.00	0.00%	0	0.00	0	0.00	0.00%	0	0.00
Springfield West	0	0.00	0.00%	0	0.00	0	0.00	0.00%	0	0.00	0	0.00	0.00%	0	0.00	0	0.00	0.00%	0	0.00
Coburg	0	0.00	0.00%	0	0.00	0	0.00	0.00%	0	0.00	0	0.00	0.00%	0	0.00	0	0.00	0.00%	0	0.00
Eugene North	0	0.00	0.00%	0	0.00	0	0.00	0.00%	0	0.00	0	0.00	0.00%	0	0.00	0	0.00	0.00%	0	0.00
Total (cities + county)	**11,402**	**2.16**	**1.29%**	**631,681**	**14.50**	**35,610**	**6.74**	**1.80%**	**1,472,869**	**33.81**	**170,771**	**32.34**	**3.11%**	**5,308,201**	**121.86**	**217,783**	**41.25**	**2.61%**	**7,412,750**	**170.17**

Critical Facilities: Buildings

COMMUNITIES	School Buildings Count	School Buildings (Count % of Total) (percent)	School Buildings Value (dollars)	Fire Buildings (count)	Fire Buildings (Count % of Total) (percent)	Fire Buildings Value (dollars)	Police Buildings (count)	Police Buildings (Count % of Total) (percent)	Police Buildings Value (dollars)	Hospital Buildings (count)	Hospital Buildings (Count % of Total) (percent)	Hospital Buildings Value (dollars)	All CFs Total Count	Percent Total (Count % of Total) (percent)	Total Value (dollars)
Lane County	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Eugene South	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Eugene Southwest	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Springfield East	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Eugene West	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Springfield West	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Coburg	0	0.00%	$0.00	0	#DIV/0!	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Eugene North	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Total (cities + county)	**0**	**0.00%**	**$0.00**	**0**	**0.00%**	**$0.00**	**0**	**0.00%**	**$0.00**	**0**	**0.00%**	**$0.00**	**0**	**0.00%**	**$0.00**

Social: Population

COMMUNITIES	Population Count	Population Exposed % of Total
Lane County	590	1.41%
Eugene South	2,144	3.05%
Eugene Southwest	0	0.00%
Springfield East	1,772	8.81%
Eugene West	0	0.00%
Springfield West	0	0.00%
Coburg	0	0.00%
Eugene North	0	0.00%
Total (cities + county)	**4,506**	**1.76%**

Landslide Inventory - Shallow Landslide Deposits

Buildings

COMMUNITIES	Residential: Single Family Count	Single Family (Count % of Total) (percent)	Single Family Value (dollars)	Commercial: Commercial Count	Commercial (Count of Total) (percent)	Commercial Value (dollars)	Public: Government Count	Government (Count of Total) (percent)	Government Value (dollars)	All Buildings: Total Count	Percent Total (Count of Total) (percent)	Total Value (dollars)
Lane County	11	0.04%	$1,028,735.12	3	0.05%	$274,959.23	0	0.00%	$0.00	14	0.04%	$1,303,694.34
Eugene South	3	0.01%	$839,079.00	0	0.00%	$0.00	0	0.00%	$0.00	3	0.01%	$839,079.00
Eugene Southwest	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Springfield East	12	0.11%	$1,768,755.57	1	0.13%	$254,866.00	0	0.00%	$0.00	13	0.11%	$2,023,621.57
Eugene West	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Springfield West	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Coburg	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Eugene North	1	0.01%	$261,157.00	0	0.00%	$0.00	0	0.00%	$0.00	1	0.01%	$261,157.00
Total (cities + county)	**27**	**0.02%**	**$3,897,726.69**	**4**	**0.03%**	**$529,825.23**	**0**	**0.00%**	**$0.00**	**31**	**0.03%**	**$4,427,551.92**

Land

COMMUNITIES	Residential: Single Family Count	Single Family (Count % of Total) (percent)	Single Family Area (feet2)	Single Family Area (acres)	Single Family Area % of Total (percent)	Single Family Value (dollars)	Commercial: Commercial Count	Commercial (Count % of Total) (percent)	Commercial Area (feet2)	Commercial Area (acres)	Commercial (Area % of Total) (percent)	Commercial Value (dollars)
Lane County	52	0.34%	2,909,562	67	0.33%	$11,849,454.00	153	4.46%	14,179,123	326	0.47%	$56,378,069.00
Eugene South	35	0.17%	462,098	11	0.18%	$6,411,451.00	2	0.20%	204,726	5	0.56%	$2,744,176.00
Eugene Southwest	0	0.00%	0	0	0.00%	$0.00	0	0.00%	0	0	0.00%	$0.00
Springfield East	22	0.33%	281,041	6	0.37%	$2,234,469.00	3	1.63%	41,769	1	0.12%	$2,128,369.00
Eugene West	0	0.00%	0	0	0.00%	$0.00	0	0.00%	0	0	0.00%	$0.00
Springfield West	0	0.00%	0	0	0.00%	$0.00	0	0.00%	0	0	0.00%	$0.00
Coburg	0	0.00%	0	0	0.00%	$0.00	0	0.00%	0	0	0.00%	$0.00
Eugene North	1	0.01%	9,169	0	0.01%	$321,328.00	0	0.00%	0	0	0.00%	$0.00
Total (cities + county)	**110**	**0.14%**	**3,661,870**	**84**	**0.23%**	**$20,816,702.00**	**158**	**2.01%**	**14,425,618**	**331**	**0.43%**	**$61,250,614.00**

COMMUNITIES	Public: Government Count	Government (Count % of Total) (percent)	Government Area (feet2)	Government Area (acres)	Government (Area % of Total) (percent)	Government Value (dollars)	All Land: Count	(Count % of Total) (percent)	Area (feet2)	Total Area (acres)	(Area % of Total) (percent)	Total Value (dollars)
Lane County	43	7.20%	6,289,557	144	0.68%	$25,787,610.00	248	78.48%	23,378,242	537	92.72%	$94,015,133.00
Eugene South	5	0.88%	838,116	19	0.29%	$6,297,534.00	42	13.29%	1,504,940	35	5.97%	$15,453,161.00
Eugene Southwest	0	0.00%	0	0	0.00%	$0.00	0	0.00%	0	0	0.00%	$0.00
Springfield East	0	0.00%	0	0	0.00%	$0.00	25	7.91%	322,810	7	1.28%	$4,362,838.00
Eugene West	0	0.00%	0	0	0.00%	$0.00	0	0.00%	0	0	0.00%	$0.00
Springfield West	0	0.00%	0	0	0.00%	$0.00	0	0.00%	0	0	0.00%	$0.00
Coburg	0	0.00%	0	0	0.00%	$0.00	0	0.00%	0	0	0.00%	$0.00
Eugene North	0	0.00%	0	0	0.00%	$0.00	1	0.32%	9,169	0	0.04%	$321,328.00
Total (cities + county)	**48**	**1.85%**	**7,127,673**	**164**	**0.50%**	**$32,085,144.00**	**316**	**0.36%**	**25,215,161**	**579**	**0.39%**	**$114,152,460.00**

Transportation

COMMUNITIES	Freeways, Highways & Major Arterials Length (feet)	Freeways, Highways & Major Arterials Length (miles)	Freeways, Highways & Major Arterials Percent of Total Length (%)	Freeways, Highways & Major Arterials Total Area (feet)	Freeways, Highways & Major Arterials Total Area (acres)	Minor Arterials & Collect/Connectors Length (feet)	Minor Arterials & Collect/Connectors Length (miles)	Minor Arterials & Collect/Connectors Percent of Total Length (%)	Minor Arterials & Collect/Connectors Total Area (feet)	Minor Arterials & Collect/Connectors Total Area (acres)
Lane County	0	0.00	0.00%	0	0.00	1,030	0.20	0.13%	39,157	0.90
Eugene South	0	0.00	0.00%	0	0.00	111	0.02	0.03%	4,459	0.10
Eugene Southwest	0	0.00	0.00%	0	0.00	0	0.00	0.00%	0	0.00
Springfield East	0	0.00	0.00%	0	0.00	0	0.00	0.00%	0	0.00
Eugene West	0	0.00	0.00%	0	0.00	0	0.00	0.00%	0	0.00
Springfield West	0	0.00	0.00%	0	0.00	0	0.00	0.00%	0	0.00
Coburg	0	0.00	0.00%	0	0.00	0	0.00	0.00%	0	0.00
Eugene North	0	0.00	0.00%	0	0.00	0	0.00	0.00%	0	0.00
Total (cities + county)	**0**	**0.00**	**0.00%**	**0**	**0.00**	**1,141**	**0.22**	**0.06%**	**43,615**	**1.00**

COMMUNITIES	Local Streets Length (feet)	Local Streets Length (miles)	Local Streets Percent of Total Length %	Local Streets Total Area (feet)	Local Streets Total Area (acres)	All Roads: Total Road Length (feet)	Total Road Length (miles)	Total Road Length (%)	Total Road Area (feet)	Total Road Area (acres)
Lane County	49	0.01	0.00%	478	0.01	1,079	0.20	0.04%	39,634	0.91
Eugene South	94	0.02	0.01%	2,743	0.06	205	0.04	0.01%	7,202	0.17
Eugene Southwest	0	0.00	0.00%	0	0.00	0	0.00	0.00%	0	0.00
Springfield East	523	0.10	0.16%	15,797	0.36	523	0.10	0.12%	15,797	0.36
Eugene West	0	0.00	0.00%	0	0.00	0	0.00	0.00%	0	0.00
Springfield West	0	0.00	0.00%	0	0.00	0	0.00	0.00%	0	0.00
Coburg	0	0.00	0.00%	0	0.00	0	0.00	0.00%	0	0.00
Eugene North	170	0.03	0.02%	308	0.01	170	0.03	0.01%	308	0.01
Total (cities + county)	**836**	**0.16**	**0.02%**	**19,326**	**0.44**	**1,977**	**0.37**	**0.02%**	**62,942**	**1.44**

Critical Facilities: Buildings

COMMUNITIES	School Buildings Count	School Buildings (Count % of Total) (percent)	School Buildings Value (dollars)	Fire Buildings (count)	Fire Buildings (Count % of Total) (percent)	Fire Buildings Value (dollars)	Police Buildings (count)	Police Buildings (Count % of Total) (percent)	Police Buildings Value (dollars)	Hospital Buildings (count)	Hospital Buildings (Count % of Total) (percent)	Hospital Buildings Value (dollars)	All CFs: Total Count	Percent Total (Count % of Total) (percent)	Total Value (dollars)
Lane County	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Eugene South	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Eugene Southwest	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Springfield East	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Eugene West	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Springfield West	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Coburg	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Eugene North	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Total (cities + county)	**0**	**0.00%**	**$0.00**	**0**	**0.00%**	**$0.00**	**0**	**0.00%**	**$0.00**	**0**	**0.00%**	**$0.00**	**0**	**0.00%**	**$0.00**

Social: Population

COMMUNITIES	Population Count	Population Exposed % of Total
Lane County	3	0.01%
Eugene South	4	0.01%
Eugene Southwest	0	0.00%
Springfield East	26	0.13%
Eugene West	0	0.00%
Springfield West	0	0.00%
Coburg	0	0.00%
Eugene North	0	0.00%
Total (cities + county)	**33**	**0.01%**

Landslide Inventory - Debris Flow Fans

Buildings

COMMUNITIES	Residential: Single Family Count	Single Family (Count % of Total) (percent)	Single Family Value (dollars)	Commercial: Commercial Count	Commercial (Count of Total) (percent)	Commercial Value (dollars)	Public: Government Count	Government (Count of Total) (percent)	Government Value (dollars)	All Buildings: Total Count	Percent Total (Count of Total) (percent)	Total Value (dollars)
Lane County	21	0.08%	$1,856,686.13	17	0.29%	$1,564,187.94	0	0.00%	$0.00	38	0.12%	$3,420,874.07
Eugene South	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Eugene Southwest	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Springfield East	25	0.24%	$3,833,921.11	1	0.13%	$1,143,081.00	0	0.00%	$0.00	26	0.23%	$4,977,002.11
Eugene West	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Springfield West	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Coburg	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Eugene North	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Total (cities + county)	**46**	**0.04%**	**$5,690,607.24**	**18**	**0.14%**	**$2,707,268.94**	**0**	**0.00%**	**$0.00**	**64**	**0.05%**	**$8,397,876.18**

Land

COMMUNITIES	Residential: Single Family Count	Single Family (Count % of Total) (percent)	Single Family Area (feet2)	Single Family Area (acres)	Single Family Area % of Total (percent)	Single Family Value (dollars)	Commercial: Commercial Count	Commercial (Count % of Total) (percent)	Commercial Area (feet2)	Commercial Area (acres)	Commercial (Area % of Total) (percent)	Commercial Value (dollars)
Lane County	36	0.24%	1,176,252	27	0.13%	$7,377,822.00	55	1.60%	7,051,358	162	0.23%	$18,527,617.00
Eugene South	0	0.00%	0	0	0.00%	$0.00	0	0.00%	0	0	0.00%	$0.00
Eugene Southwest	0	0.00%	0	0	0.00%	$0.00	0	0.00%	0	0	0.00%	$0.00
Springfield East	30	0.45%	398,898	9	0.52%	$2,324,029.00	1	0.54%	305,460	7	0.86%	$492,842.00
Eugene West	0	0.00%	0	0	0.00%	$0.00	0	0.00%	0	0	0.00%	$0.00
Springfield West	0	0.00%	0	0	0.00%	$0.00	0	0.00%	0	0	0.00%	$0.00
Coburg	0	0.00%	0	0	0.00%	$0.00	0	0.00%	0	0	0.00%	$0.00
Eugene North	0	0.00%	0	0	0.00%	$0.00	0	0.00%	0	0	0.00%	$0.00
Total (cities + county)	**66**	**0.09%**	**1,575,150**	**36**	**0.10%**	**$9,701,851.00**	**56**	**0.71%**	**7,356,818**	**169**	**0.22%**	**$19,020,459.00**

COMMUNITIES	Public: Government Count	Government (Count % of Total) (percent)	Government Area (feet2)	Government Area (acres)	Government (Area % of Total) (percent)	Government Value (dollars)	All Land: Count	(Count % of Total) (percent)	Area (feet2)	Total Area (acres)	(Area % of Total) (percent)	Total Value (dollars)
Lane County	8	1.34%	687,277	16	0.07%	$1,601,957.00	99	75.00%	8,914,887	205	91.32%	$27,507,396.00
Eugene South	1	0.18%	143,185	3	0.05%	$0.00	1	0.76%	143,185	3	1.47%	$0.00
Eugene Southwest	0	0.00%	0	0	0.00%	$0.00	0	0.00%	0	0	0.00%	$0.00
Springfield East	1	0.78%	98	0	0.00%	$500.00	32	24.24%	704,456	16	7.22%	$2,817,371.00
Eugene West	0	0.00%	0	0	0.00%	$0.00	0	0.00%	0	0	0.00%	$0.00
Springfield West	0	0.00%	0	0	0.00%	$0.00	0	0.00%	0	0	0.00%	$0.00
Coburg	0	0.00%	0	0	0.00%	$0.00	0	0.00%	0	0	0.00%	$0.00
Eugene North	0	0.00%	0	0	0.00%	$0.00	0	0.00%	0	0	0.00%	$0.00
Total (cities + county)	**10**	**0.39%**	**830,560**	**19**	**0.06%**	**$1,602,457.00**	**132**	**0.15%**	**9,762,528**	**224**	**0.15%**	**$30,324,767.00**

Transportation

COMMUNITIES	Freeways, Highways & Major Arterials Length (feet)	Freeways, Highways & Major Arterials Length (miles)	Freeways, Highways & Major Arterials Percent of Total Length (%)	Freeways, Highways & Major Arterials Total Area (feet)	Freeways, Highways & Major Arterials Total Area (acres)	Minor Arterials & Collect/Connectors Length (feet)	Minor Arterials & Collect/Connectors Length (miles)	Minor Arterials & Collect/Connectors Percent of Total Length (%)	Minor Arterials & Collect/Connectors Total Area (feet)	Minor Arterials & Collect/Connectors Total Area (acres)
Lane County	0	0.00	0.00%	0	0.00	3,361	0.64	0.43%	134,780	3.09
Eugene South	0	0.00	0.00%	0	0.00	0	0.00	0.00%	0	0.00
Eugene Southwest	0	0.00	0.00%	0	0.00	0	0.00	0.00%	0	0.00
Springfield East	428	0.08	1.11%	26,317	0.60	0	0.00	0.00%	0	0.00
Eugene West	0	0.00	0.00%	0	0.00	0	0.00	0.00%	0	0.00
Springfield West	0	0.00	0.00%	0	0.00	0	0.00	0.00%	0	0.00
Coburg	0	0.00	0.00%	0	0.00	0	0.00	0.00%	0	0.00
Eugene North	0	0.00	0.00%	0	0.00	0	0.00	0.00%	0	0.00
Total (cities + county)	**428**	**0.08**	**0.05%**	**26,317**	**0.60**	**3,361**	**0.64**	**0.17%**	**134,780**	**3.09**

COMMUNITIES	Local Streets Length (feet)	Local Streets Length (miles)	Local Streets Percent of Total Length %	Local Streets Total Area (feet)	Local Streets Total Area (acres)	All Roads: Total Road Length (feet)	Total Road Length (miles)	Total Road Length (%)	Total Road Area (feet)	Total Road Area (acres)
Lane County	2,314	0.44	0.13%	69,933	1.61	5,675	1.07	0.20%	204,714	4.70
Eugene South	0	0.00	0.00%	0	0.00	0	0.00	0.00%	0	0.00
Eugene Southwest	0	0.00	0.00%	0	0.00	0	0.00	0.00%	0	0.00
Springfield East	798	0.15	0.25%	24,235	0.56	1,226	0.23	0.27%	50,552	1.16
Eugene West	0	0.00	0.00%	0	0.00	0	0.00	0.00%	0	0.00
Springfield West	0	0.00	0.00%	0	0.00	0	0.00	0.00%	0	0.00
Coburg	0	0.00	0.00%	0	0.00	0	0.00	0.00%	0	0.00
Eugene North	0	0.00	0.00%	0	0.00	0	0.00	0.00%	0	0.00
Total (cities + county)	**3,112**	**0.59**	**0.06%**	**94,168**	**2.16**	**6,901**	**1.31**	**0.08%**	**255,266**	**5.86**

Critical Facilities: Buildings

COMMUNITIES	School Buildings Count	School Buildings (Count % of Total) (percent)	School Buildings Value (dollars)	Fire Buildings (count)	Fire Buildings (Count % of Total) (percent)	Fire Buildings Value (dollars)	Police Buildings (count)	Police Buildings (Count % of Total) (percent)	Police Buildings Value (dollars)	Hospital Buildings (count)	Hospital Buildings (Count % of Total) (percent)	Hospital Buildings Value (dollars)	All CFs: Total Count	Percent Total (Count % of Total) (percent)	Total Value (dollars)
Lane County	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Eugene South	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Eugene Southwest	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Springfield East	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Eugene West	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Springfield West	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Coburg	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Eugene North	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Total (cities + county)	**0**	**0.00%**	**$0.00**	**0**	**0.00%**	**$0.00**	**0**	**0.00%**	**$0.00**	**0**	**0.00%**	**$0.00**	**0**	**0.00%**	**$0.00**

Social: Population

COMMUNITIES	Population Count	Population Exposed % of Total
Lane County	8	0.02%
Eugene South	0	0.00%
Eugene Southwest	0	0.00%
Springfield East	68	0.34%
Eugene West	0	0.00%
Springfield West	0	0.00%
Coburg	0	0.00%
Eugene North	0	0.00%
Total (cities + county)	**76**	**0.03%**

Shallow Landslide Susceptibility - Low

Buildings

COMMUNITIES	Residential Single Family Count	Single Family (Count % of Total) (percent)	Single Family Value (dollars)	Commercial Commercial Count	Commercial (Count of Total) (percent)	Commercial Value (dollars)	Public Government Count	Government (Count of Total) (percent)	Government Value (dollars)	All Buildings Total Count	Percent Total (Count of Total) (percent)	Total Value (dollars)
Lane County	21,303	83.99%	$1,910,350,510.10	4,118	70.07%	$413,080,636.56	311	75.12%	$94,821,456.20	25,732	81.29%	$2,418,252,602.85
Eugene South	12,234	52.04%	$2,030,357,899.15	875	81.78%	$652,533,057.39	421	69.36%	$692,462,534.00	13,530	53.72%	$3,375,353,490.54
Eugene Southwest	991	94.11%	$145,184,457.59	186	85.32%	$78,308,741.23	20	76.92%	$29,120,880.58	1,197	92.29%	$252,614,079.40
Springfield East	8,750	83.37%	$709,477,497.19	664	89.13%	$183,465,541.34	62	84.93%	$80,457,486.50	9,476	83.76%	$973,400,525.02
Eugene West	14,553	95.67%	$1,744,733,724.03	1,336	86.08%	$554,941,264.32	168	90.32%	$204,964,493.39	16,057	94.73%	$2,504,639,481.74
Springfield West	16,266	94.36%	$1,575,361,598.20	1,730	88.00%	$718,695,030.85	259	85.20%	$208,642,356.42	18,255	93.58%	$2,502,698,985.46
Coburg	511	92.74%	$48,545,435.92	145	86.83%	$89,287,203.75	12	92.31%	$6,322,988.30	668	91.38%	$144,155,627.97
Eugene North	14,051	90.44%	$2,808,901,970.94	1,035	87.42%	$810,452,232.12	245	73.35%	$496,087,627.79	15,331	89.89%	$4,115,441,830.85
Total (cities + county)	**88,659**	**81.37%**	**$10,972,913,093.12**	**10,089**	**78.95%**	**$3,500,763,707.55**	**1,498**	**76.55%**	**$1,812,879,823.16**	**100,246**	**81.04%**	**$16,286,556,623.83**

Land

COMMUNITIES	Residential Single Family Count	Single Family (Count % of Total) (percent)	Single Family Area (feet2)	Single Family Area (acres)	Single Family Area % of Total (percent)	Single Family Value (dollars)	Commercial Commercial Count	Commercial (Count % of Total) (percent)	Commercial Area (feet2)	Commercial Area (acres)	Commercial (Area % of Total) (percent)	Commercial Value (dollars)
Lane County	15,172	99.62%	621,789,252	14,274	70.04%	$1,207,125,933.25	3,387	98.69%	1,930,924,114	44,328	64.05%	$607,122,128.74
Eugene South	17,615	85.91%	120,121,326	2,758	48.08%	$1,211,748,352.83	993	99.60%	25,638,066	589	70.50%	$438,928,491.92
Eugene Southwest	749	100.00%	12,432,361	285	92.78%	$57,611,694.24	168	100.00%	34,778,975	798	86.83%	$76,669,028.45
Springfield East	6,333	95.32%	57,054,628	1,310	74.64%	$312,813,474.75	184	100.00%	27,469,127	631	77.31%	$77,779,832.77
Eugene West	11,313	99.99%	118,406,035	2,718	96.42%	$709,735,165.55	1,040	99.71%	96,543,717	2,216	92.98%	$516,652,418.44
Springfield West	9,972	98.22%	98,507,626	2,261	92.74%	$666,096,472.88	1,040	99.90%	74,042,233	1,700	90.08%	$570,482,758.98
Coburg	381	99.74%	4,228,225	97	92.20%	$31,451,667.40	85	100.00%	13,157,141	302	92.60%	$57,213,678.07
Eugene North	11,655	98.95%	137,527,519	3,157	90.89%	$1,256,851,493.27	905	99.89%	60,115,417	1,380	92.12%	$823,323,468.69
Total (cities + county)	**73,190**	**95.36%**	**1,170,066,972**	**26,861**	**72.57%**	**$5,453,434,254.16**	**7,802**	**99.31%**	**2,262,668,790**	**51,944**	**66.70%**	**$3,168,171,806.06**

COMMUNITIES	Public Government Count	Government (Count % of Total) (percent)	Government Area (feet2)	Government Area (acres)	Government (Area % of Total) (percent)	Government Value (dollars)	All Land Count	(Count % of Total) (percent)	Area (feet2)	Total Area (acres)	(Area % of Total) (percent)	Total Value (dollars)
Lane County	567	94.97%	584,782,991	13,425	63.02%	$93,627,608.83	19,126	99.31%	3,137,496,357	72,027	64.95%	$1,907,875,670.82
Eugene South	488	85.92%	218,911,218	5,026	75.67%	$348,596,411.42	19,096	86.53%	364,670,610	8,372	63.37%	$1,999,273,256.17
Eugene Southwest	28	96.55%	7,531,312	173	88.65%	$16,056,379.99	945	99.89%	54,742,648	1,257	88.37%	$150,337,102.67
Springfield East	119	92.97%	11,757,274	270	81.67%	$13,985,936.57	6,636	95.40%	96,281,030	2,210	76.19%	$404,579,244.09
Eugene West	388	97.24%	64,036,687	1,470	88.84%	$118,919,805.52	12,741	99.88%	278,986,439	6,405	93.39%	$1,345,307,389.52
Springfield West	364	97.07%	30,091,570	691	74.68%	$91,909,349.83	11,376	98.33%	202,641,428	4,652	88.60%	$1,328,488,581.69
Coburg	21	100.00%	3,892,491	89	93.94%	$3,496,758.92	487	99.80%	21,277,857	488	92.76%	$92,162,104.39
Eugene North	463	96.46%	52,015,725	1,194	74.79%	$236,246,345.15	13,023	98.92%	249,658,661	5,731	87.25%	$2,316,421,307.11
Total (cities + county)	**2,438**	**93.88%**	**973,019,267**	**22,337**	**68.22%**	**$922,838,596.23**	**83,430**	**95.67%**	**4,405,755,030**	**101,142**	**68.51%**	**$9,544,444,656.46**

Transportation

COMMUNITIES	Freeways, Highways & Major Arterials Length (feet)	Freeways, Highways & Major Arterials Length (miles)	Freeways, Highways & Major Arterials Percent of Total Length (%)	Freeways, Highways & Major Arterials Total Area (feet2)	Freeways, Highways & Major Arterials Total Area (acres)	Minor Arterials & Collect/Connectors Length (feet)	Minor Arterials & Collect/Connectors Length (miles)	Minor Arterials & Collect/Connectors Percent of Total Length (%)	Minor Arterials & Collect/Connectors Total Area (feet2)	Minor Arterials & Collect/Connectors Total Area (acres)
Lane County	195,902.01	37.10	72.60%	10,436,272.93	239.58	462,094.20	87.52	59.25%	18,840,008.20	432.51
Eugene South	32,680.37	6.19	73.89%	1,918,806.98	44.05	250,719.99	47.48	72.44%	10,011,991.60	229.84
Eugene Southwest	12,270.13	2.32	75.83%	758,618.55	17.42	30,740.93	5.82	75.78%	1,232,337.71	28.29
Springfield East	28,024.24	5.31	72.86%	1,689,320.74	38.78	68,019.45	12.88	80.37%	2,689,588.24	61.74
Eugene West	87,808.99	16.63	77.00%	4,929,465.47	113.16	191,868.34	36.34	90.64%	7,586,119.37	174.15
Springfield West	82,263.14	15.58	69.04%	4,526,842.28	103.92	258,867.45	49.03	91.75%	10,197,758.02	234.11
Coburg	8,794.36	1.67	89.32%	468,428.03	10.75	21,236.10	4.02	93.76%	841,701.25	19.32
Eugene North	200,553.79	37.98	74.21%	9,765,256.41	224.18	193,577.40	36.66	91.63%	7,628,218.41	175.12
Total (cities + county)	**648,297**	**122.78**	**73.51%**	**34,493,011**	**791.85**	**1,477,124**	**279.76**	**74.64%**	**59,027,723**	**1,355.09**

COMMUNITIES	Local Streets Length (feet)	Local Streets Length (miles)	Local Streets Percent of Total Length %	Local Streets Total Area (feet2)	Local Streets Total Area (acres)	All Roads Total Road Length (feet)	Total Road Length (miles)	Total Road Length (%)	Total Road Area (feet)	Total Road Area (acres)
Lane County	1,235,021.03	233.91	71.83%	37,298,063.30	856.25	1,893,017	358.53	68.36%	66,574,344	1,528.34
Eugene South	774,817.46	146.75	58.95%	23,165,114.93	531.80	1,058,218	200.42	62.07%	35,095,914	805.69
Eugene Southwest	65,761.53	12.45	89.51%	1,946,916.01	44.70	108,773	20.60	83.53%	3,937,872	90.40
Springfield East	264,201.69	50.04	81.83%	7,913,822.53	181.68	360,245	68.23	80.78%	12,292,732	282.20
Eugene West	690,654.39	130.81	98.25%	20,602,455.87	472.97	970,332	183.77	94.33%	33,118,041	760.29
Springfield West	499,441.79	94.59	92.56%	14,952,648.32	343.27	840,572	159.20	89.34%	29,677,249	681.30
Coburg	28,859.87	5.47	94.73%	868,352.64	19.93	58,890	11.15	93.53%	2,178,482	50.01
Eugene North	748,081.25	141.68	94.68%	22,249,523.48	510.78	1,142,212	216.33	89.82%	39,642,998	910.08
Total (cities + county)	**4,306,839**	**815.69**	**78.40%**	**128,996,897**	**2,961.36**	**6,432,260**	**1,218.23**	**76.99%**	**222,517,631**	**5,108.30**

Critical Facilities: Buildings

COMMUNITIES	School Buildings Count	School Buildings (Count % of Total) (percent)	School Buildings Value (dollars)	Fire Buildings (count)	Fire Buildings (Count % of Total) (percent)	Fire Buildings Value (dollars)	Police Buildings (count)	Police Buildings (Count % of Total) (percent)	Police Buildings Value (dollars)	Hospital Buildings (count)	Hospital Buildings (Count % of Total) (percent)	Hospital Buildings Value (dollars)	All CFs Total Count	Percent Total (Count % of Total) (percent)	Total Value (dollars)
Lane County	2	12.50%	$11,720,550.00	2	33.33%	$828,065.00	3	100.00%	$1,635,299.00	0	0.00%	$0.00	7	28.00%	$14,183,914.00
Eugene South	8	47.06%	$77,825,390.00	2	66.67%	$6,768,330.00	1	50.00%	$1,303,940.00	0	0.00%	$0.00	11	47.83%	$85,897,660.00
Eugene Southwest	2	66.67%	$11,420,114.00	1	100.00%	$173,598.00	0	0.00%	$0.00	0	0.00%	$0.00	3	75.00%	$11,593,712.00
Springfield East	5	100.00%	$57,858,790.00	2	100.00%	$1,931,494.00	0	0.00%	$0.00	0	0.00%	$0.00	7	100.00%	$59,790,284.00
Eugene West	19	100.00%	$79,395,474.00	4	100.00%	$5,441,500.00	0	0.00%	$0.00	0	0.00%	$0.00	23	100.00%	$84,836,974.00
Springfield West	14	100.00%	$80,237,828.00	3	100.00%	$3,028,835.00	1	50.00%	$10,109,100.00	0	0.00%	$0.00	18	90.00%	$93,375,763.00
Coburg	1	100.00%	$2,780,000.00	0	0.00%	$884,061.80	2	100.00%	$0.00	0	0.00%	$0.00	3	100.00%	$3,664,061.80
Eugene North	9	90.00%	$83,936,593.00	2	100.00%	$2,093,266.00	1	100.00%	$263,482.00	0	0.00%	$0.00	12	92.31%	$86,293,341.00
Total (cities + county)	**60**	**70.59%**	**$405,174,739.00**	**16**	**76.19%**	**$21,149,149.80**	**8**	**80.00%**	**$13,311,821.00**	**0**	**0.00%**	**$0.00**	**84**	**71.19%**	**$439,635,709.80**

Social: Population

COMMUNITIES	Population Count	Population Exposed % of Total
Lane County	37,186	88.88%
Eugene South	47,193	67.06%
Eugene Southwest	2,897	95.94%
Springfield East	17,413	86.52%
Eugene West	37,640	97.73%
Springfield West	35,656	95.80%
Coburg	422	94.95%
Eugene North	42,154	94.21%
Total (cities + county)	**220,560**	**86.06%**

Shallow Landslide Susceptibility - Moderate

Buildings

COMMUNITIES	Residential Single Family Count	Single Family (Count % of Total) (percent)	Single Family Value (dollars)	Commercial Commercial Count	Commercial (Count of Total) (percent)	Commercial Value (dollars)	Public Government Count	Government (Count of Total) (percent)	Government Value (dollars)	All Buildings Total Count	Percent Total (Count of Total) (percent)	Total Value (dollars)
Lane County	3,077	12.13%	$342,786,704.39	1,334	22.70%	$169,800,009.62	61	14.73%	$24,693,619.78	4,472	14.13%	$537,280,333.79
Eugene South	6,042	25.70%	$1,321,846,376.63	111	10.37%	$298,109,847.29	119	19.60%	$240,663,260.55	6,272	24.90%	$1,860,619,484.47
Eugene Southwest	52	4.94%	$19,305,022.70	25	11.47%	$12,426,636.03	2	7.69%	$730,331.00	79	6.09%	$32,461,989.73
Springfield East	1,196	11.40%	$167,050,067.48	54	7.25%	$107,196,904.90	9	12.33%	$672,762.00	1,259	11.13%	$274,919,734.38
Eugene West	619	4.07%	$92,468,116.37	133	8.57%	$100,751,527.66	16	8.60%	$6,893,797.30	768	4.53%	$200,113,441.34
Springfield West	681	3.95%	$178,764,977.04	170	8.65%	$182,370,862.67	35	11.51%	$28,210,380.45	886	4.54%	$389,346,220.16
Coburg	24	4.36%	$3,401,507.35	13	7.78%	$5,374,395.97	1	7.69%	$270,202.00	38	5.20%	$9,046,105.32
Eugene North	1,169	7.52%	$312,392,286.80	93	7.85%	$135,855,382.60	44	13.17%	$124,500,936.28	1,306	7.66%	$572,748,605.68
Total (cities + county)	**12,860**	**11.80%**	**$2,438,015,058.75**	**1,933**	**15.13%**	**$1,011,885,566.74**	**287**	**14.67%**	**$426,635,289.36**	**15,080**	**12.19%**	**$3,876,535,914.86**

Land

COMMUNITIES	Residential Single Family Count	Single Family (Count % of Total) (percent)	Single Family Area (feet2)	Single Family Area (acres)	Single Family Area % of Total (percent)	Single Family Value (dollars)	Commercial Commercial Count	Commercial (Count % of Total) (percent)	Commercial Area (feet2)	Commercial Area (acres)	Commercial (Area % of Total) (percent)	Commercial Value (dollars)	Public Government Count	Government (Count % of Total) (percent)	Government Area (feet2)	Government Area (acres)	Government (Area % of Total) (percent)	Government Value (dollars)	All Land Count	(Count % of Total) (percent)	Area (feet2)	Total Area (acres)	(Area % of Total) (percent)	Total Value (dollars)
Lane County	4,447	29.20%	216,577,730	4,972	24.40%	$212,121,968.43	2,874	83.74%	832,012,318	19,100	27.60%	$203,902,553.80	440	73.70%	256,831,936	5,896	27.68%	$32,220,366.55	7,761	40.30%	1,305,421,985	29,968	27.03%	$448,244,888.78
Eugene South	12,202	59.51%	104,970,593	2,410	42.01%	$751,487,501.78	218	21.87%	8,257,027	190	22.70%	$36,533,197.84	314	55.28%	57,042,426	1,310	19.72%	$64,564,420.87	12,734	57.70%	170,270,045	3,909	29.59%	$852,585,120.50
Eugene Southwest	93	12.42%	912,192	21	6.81%	$2,211,726.77	82	48.81%	4,611,309	106	11.51%	$7,805,425.73	21	72.41%	804,339	18	9.47%	$1,897,692.26	196	20.72%	6,327,841	145	10.21%	$11,914,844.76
Springfield East	2,111	31.77%	15,308,522	351	20.03%	$72,313,462.16	52	28.26%	6,138,180	141	17.28%	$6,490,971.68	57	44.53%	2,103,899	48	14.61%	$1,564,674.34	2,220	31.91%	23,550,601	541	18.64%	$80,369,108.18
Eugene West	1,226	10.84%	3,817,444	88	3.11%	$21,344,850.45	402	38.54%	6,366,585	146	6.13%	$23,659,095.21	208	52.13%	6,618,818	152	9.18%	$7,609,739.38	1,836	14.39%	16,802,848	386	5.62%	$52,613,685.05
Springfield West	1,065	10.49%	6,112,801	140	5.76%	$40,888,943.00	286	27.47%	6,786,435	156	8.26%	$30,752,267.99	152	40.53%	7,959,243	183	19.75%	$12,488,283.06	1,503	12.99%	20,858,478	479	9.12%	$84,129,494.05
Coburg	75	19.63%	325,173	7	7.09%	$2,267,054.67	39	45.88%	941,769	22	6.63%	$3,637,665.53	10	47.62%	226,523	5	5.47%	$344,930.46	124	25.41%	1,493,465	34	6.51%	$6,249,650.66
Eugene North	1,945	16.51%	11,517,363	264	7.61%	$84,055,596.78	225	24.83%	4,530,568	104	6.94%	$59,100,703.93	208	43.33%	13,772,732	316	19.80%	$60,881,164.33	2,378	18.06%	29,820,662	685	10.42%	$204,037,465.04
Total (cities + county)	**23,164**	**30.18%**	**359,541,818**	**8,254**	**22.30%**	**$1,186,691,104.04**	**4,178**	**53.18%**	**869,644,190**	**19,964**	**25.64%**	**$371,881,881.72**	**1,410**	**54.29%**	**345,359,917**	**7,928**	**24.21%**	**$181,571,271.26**	**28,752**	**32.97%**	**1,574,545,925**	**36,147**	**24.48%**	**$1,740,144,257.02**

Transportation

COMMUNITIES	Freeways, Highways & Major Arterials Length (feet)	Freeways, Highways & Major Arterials Length (miles)	Freeways, Highways & Major Arterials Percent of Total Length (%)	Freeways, Highways & Major Arterials Total Area (feet2)	Freeways, Highways & Major Arterials Total Area (acres)	Minor Arterials & Collect/Connectors Length (feet)	Minor Arterials & Collect/Connectors Length (miles)	Minor Arterials & Collect/Connectors Percent of Total Length (%)	Minor Arterials & Collect/Connectors Total Area (feet2)	Minor Arterials & Collect/Connectors Total Area (acres)	Local Streets Length (feet)	Local Streets Length (miles)	Local Streets Percent of Total Length %	Local Streets Total Area (feet2)	Local Streets Total Area (acres)	All Roads Total Road Length (feet)	Total Road Length (miles)	Total Road Length (%)	Total Road Area (feet)	Total Road Area (acres)
Lane County	70,316.70	13.32	26.06%	4,154,772.58	95.38	312,488.06	59.18	40.06%	11,543,348.13	265.00	472,985.28	89.58	27.51%	13,482,620.90	309.52	855,790	162.08	30.90%	29,180,742	669.90
Eugene South	11,314.80	2.14	25.58%	523,877.74	12.03	94,747.07	17.94	27.38%	3,581,205.59	82.21	534,054.37	101.15	40.63%	15,198,972.97	348.92	640,116	121.23	37.55%	19,304,056	443.16
Eugene Southwest	3,894.67	0.74	24.07%	196,547.60	4.51	9,812.55	1.86	24.19%	386,445.02	8.87	7,681.73	1.45	10.46%	250,831.01	5.76	21,389	4.05	16.43%	833,824	19.14
Springfield East	10,020.99	1.90	26.05%	564,992.92	12.97	16,591.50	3.14	19.60%	681,438.59	15.64	57,994.74	10.98	17.96%	1,689,537.05	38.79	84,607	16.02	18.97%	2,935,969	67.40
Eugene West	24,964.32	4.73	21.89%	1,371,226.53	31.48	19,018.53	3.60	8.98%	829,462.55	19.04	11,956.59	2.26	1.70%	362,379.84	8.32	55,939	10.59	5.44%	2,563,069	58.84
Springfield West	34,841.80	6.60	29.24%	1,613,155.29	37.03	22,446.91	4.25	7.96%	878,843.68	20.18	39,833.43	7.54	7.38%	1,126,094.06	25.85	97,122	18.39	10.32%	3,618,093	83.06
Coburg	1,048.48	0.20	10.65%	56,824.79	1.30	1,335.76	0.25	5.90%	57,051.75	1.31	1,597.75	0.30	5.24%	47,643.23	1.09	3,982	0.75	6.32%	161,520	3.71
Eugene North	65,768.10	12.46	24.34%	3,181,488.42	73.04	17,161.79	3.25	8.12%	747,303.73	17.16	41,762.05	7.91	5.29%	1,208,527.63	27.74	124,692	23.62	9.81%	5,137,320	117.94
Total (cities + county)	**222,170**	**42.08**	**25.19%**	**11,662,886**	**267.74**	**493,602**	**93.49**	**24.94%**	**18,705,099**	**429.41**	**1,167,866**	**221.19**	**21.26%**	**33,366,607**	**765.99**	**1,883,638**	**356.75**	**22.55%**	**63,734,592**	**1,463.14**

Critical Facilities: Buildings

COMMUNITIES	School Buildings Count	School Buildings (Count % of Total) (percent)	School Buildings Value (dollars)	Fire Buildings (count)	Fire Buildings (Count % of Total) (percent)	Fire Buildings Value (dollars)	Police Buildings (count)	Police Buildings (Count % of Total) (percent)	Police Buildings Value (dollars)	Hospital Buildings (count)	Hospital Buildings (Count % of Total) (percent)	Hospital Buildings Value (dollars)	All CFs Total Count	Percent Total (Count % of Total) (percent)	Total Value (dollars)
Lane County	2	12.50%	$10,726,340.00	2	33.33%	$141,288.00	0	0.00%	$0.00	0	0.00%	$0.00	4	16.00%	$10,867,628.00
Eugene South	4	23.53%	$14,046,150.00	0	0.00%	$0.00	1	50.00%	$0.00	1	100.00%	$178,312,000.00	6	26.09%	$192,358,150.00
Eugene Southwest	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Springfield East	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Eugene West	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Springfield West	0	0.00%	$0.00	1	33.33%	$1,340,890.00	0	0.00%	$0.00	0	0.00%	$0.00	1	5.00%	$1,340,890.00
Coburg	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Eugene North	1	10.00%	$29,996,200.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	1	7.69%	$29,996,200.00
Total (cities + county)	**7**	**8.24%**	**$54,768,690.00**	**3**	**14.29%**	**$1,482,178.00**	**1**	**10.00%**	**$0.00**	**1**	**50.00%**	**$178,312,000.00**	**12**	**10.17%**	**$234,562,868.00**

Social: Population

COMMUNITIES	Population Count	Population Exposed % of Total
Lane County	4,145	9.91%
Eugene South	20,083	28.54%
Eugene Southwest	98	3.25%
Springfield East	2,321	11.53%
Eugene West	806	2.09%
Springfield West	1,317	3.54%
Coburg	21	4.65%
Eugene North	2,278	5.09%
Total (cities + county)	**31,068**	**12.12%**

Shallow Landslide Susceptibility - High

Buildings

COMMUNITIES	Residential Single Family Count	Single Family (Count % of Total) (percent)	Single Family Value (dollars)	Commercial Commercial Count	Commercial (Count of Total) (percent)	Commercial Value (dollars)	Public Government Count	Government (Count of Total) (percent)	Government Value (dollars)	All Buildings Total Count	Percent Total (Count of Total) (percent)	Total Value (dollars)
Lane County	984	3.88%	$164,748,396.29	425	7.23%	$156,763,262.44	42	10.14%	$179,665,798.09	1,451	4.58%	$501,177,456.82
Eugene South	5,232	22.26%	$1,486,211,312.56	83	7.76%	$195,456,220.40	67	11.04%	$693,777,854.90	5,382	21.37%	$2,375,445,387.86
Eugene Southwest	9	0.85%	$5,501,284.00	7	3.21%	$21,473,735.90	4	15.38%	$8,094,562.70	20	1.54%	$35,069,582.60
Springfield East	549	5.23%	$108,796,875.82	24	3.22%	$44,818,865.66	1	1.37%	$0.00	574	5.07%	$153,615,741.48
Eugene West	40	0.26%	$22,217,422.80	74	4.77%	$132,947,430.60	1	0.54%	$4,035,660.00	115	0.68%	$159,200,513.40
Springfield West	291	1.69%	$277,561,328.68	66	3.36%	$176,347,289.49	10	3.29%	$5,484,448.82	367	1.88%	$459,393,066.99
Coburg	16	2.90%	$4,087,227.00	7	4.19%	$15,814,678.16	0	0.00%	$0.00	23	3.15%	$19,901,905.16
Eugene North	317	2.04%	$150,847,523.17	56	4.73%	$230,627,722.26	45	13.47%	$477,595,143.10	418	2.45%	$859,070,388.53
Total (cities + county)	**7,438**	**6.83%**	**$2,219,971,370.32**	**742**	**5.81%**	**$974,249,204.90**	**170**	**8.69%**	**$1,368,653,467.61**	**8,350**	**6.75%**	**$4,562,874,042.83**

Land

COMMUNITIES	Residential Single Family Count	Single Family (Count % of Total) (percent)	Single Family Area (feet2)	Single Family Area (acres)	Single Family Area % of Total (percent)	Single Family Value (dollars)	Commercial Commercial Count	Commercial (Count % of Total) (percent)	Commercial Area (feet2)	Commercial Area (acres)	Commercial (Area % of Total) (percent)	Commercial Value (dollars)	Public Government Count	Government (Count % of Total) (percent)	Government Area (feet2)	Government Area (acres)	Government (Area % of Total) (percent)	Government Value (dollars)	All Land Count	(Count % of Total) (percent)	Area (feet2)	Total Area (acres)	(Area % of Total) (percent)	Total Value (dollars)
Lane County	3,613	23.72%	48,824,259	1,121	5.50%	$41,733,415.09	2,609	76.02%	249,670,540	5,732	8.28%	$53,690,343.70	397	66.50%	85,760,305	1,969	9.24%	$12,360,811.03	6,619	34.37%	384,255,104	8,821	7.96%	$107,784,569.82
Eugene South	10,535	51.38%	24,590,591	565	9.84%	$147,010,136.89	167	16.75%	2,449,301	56	6.73%	$6,607,542.53	258	45.42%	13,157,645	302	4.55%	$13,798,836.50	10,960	49.66%	40,197,538	923	6.98%	$167,416,515.92
Eugene Southwest	44	5.87%	46,429	1	0.35%	$197,290.36	62	36.90%	637,056	15	1.59%	$1,305,637.32	17	58.62%	154,691	4	1.82%	$325,841.05	123	13.00%	838,176	19	1.35%	$1,828,768.73
Springfield East	1,661	25.00%	4,032,203	93	5.27%	$14,566,860.30	37	20.11%	1,902,472	44	5.35%	$2,052,027.30	45	35.16%	526,511	12	3.66%	$515,621.49	1,743	25.06%	6,461,186	148	5.11%	$17,134,509.09
Eugene West	609	5.38%	508,785	12	0.41%	$2,725,394.89	277	26.56%	862,490	20	0.83%	$2,830,829.38	171	42.86%	1,380,320	32	1.91%	$1,356,079.24	1,057	8.29%	2,751,595	63	0.92%	$6,912,303.51
Springfield West	761	7.50%	1,520,673	35	1.43%	$10,151,690.74	200	19.21%	1,313,425	30	1.60%	$4,166,244.40	128	34.13%	2,217,040	51	5.50%	$2,767,132.01	1,089	9.41%	5,051,137	116	2.21%	$17,085,067.15
Coburg	47	12.30%	30,103	1	0.66%	$213,701.15	32	37.65%	101,850	2	0.72%	$407,438.97	9	42.86%	22,299	1	0.54%	$28,897.56	88	18.03%	154,252	4	0.67%	$650,037.69
Eugene North	1,340	11.38%	2,181,984	50	1.44%	$15,394,484.76	156	17.22%	574,762	13	0.88%	$7,996,170.76	167	34.79%	3,716,729	85	5.34%	$18,469,591.71	1,663	12.63%	6,473,474	149	2.26%	$41,860,247.23
Total (cities + county)	**18,610**	**24.25%**	**81,735,028**	**1,876**	**5.07%**	**$231,992,974.19**	**3,540**	**45.06%**	**257,511,896**	**5,912**	**7.59%**	**$79,056,234.36**	**1,192**	**45.90%**	**106,935,539**	**2,455**	**7.50%**	**$49,622,810.60**	**23,342**	**26.77%**	**446,182,463**	**10,243**	**6.94%**	**$360,672,019.15**

Transportation

COMMUNITIES	Freeways, Highways & Major Arterials Length (feet)	Freeways, Highways & Major Arterials Length (miles)	Freeways, Highways & Major Arterials Percent of Total Length (%)	Freeways, Highways & Major Arterials Total Area (feet2)	Freeways, Highways & Major Arterials Total Area (acres)	Minor Arterials & Collect/Connectors Length (feet)	Minor Arterials & Collect/Connectors Length (miles)	Minor Arterials & Collect/Connectors Percent of Total Length (%)	Minor Arterials & Collect/Connectors Total Area (feet2)	Minor Arterials & Collect/Connectors Total Area (acres)	Local Streets Length (feet)	Local Streets Length (miles)	Local Streets Percent of Total Length %	Local Streets Total Area (feet2)	Local Streets Total Area (acres)	All Roads Total Road Length (feet)	Total Road Length (miles)	Total Road Length (%)	Total Road Area (feet)	Total Road Area (acres)
Lane County	3,603.53	0.68	1.34%	434,304.72	9.97	5,367.56	1.02	0.69%	768,332.61	17.64	11,333.90	2.15	0.66%	921,503.55	21.15	20,305	3.85	0.73%	2,124,141	48.76
Eugene South	221.86	0.04	0.50%	67,273.13	1.54	523.48	0.10	0.15%	108,853.50	2.50	5,146.31	0.97	0.39%	543,330.08	12.47	5,892	1.12	0.35%	719,457	16.52
Eugene Southwest	12.00	0.00	0.07%	17,954.46	0.41	0.00	0.00	0.00%	2,483.50	0.06	0.00	0.00	0.00%	3,006.82	0.07	12	0.00	0.01%	23,445	0.54
Springfield East	404.13	0.08	1.05%	46,781.67	1.07	0.00	0.00	0.00%	12,860.91	0.30	573.34	0.11	0.18%	36,455.70	0.84	977	0.19	0.22%	96,098	2.21
Eugene West	1,226.43	0.23	1.08%	164,881.15	3.79	725.60	0.14	0.34%	44,036.32	1.01	150.67	0.03	0.02%	8,795.96	0.20	2,103	0.40	0.20%	217,713	5.00
Springfield West	2,051.32	0.39	1.72%	272,318.64	6.25	821.38	0.16	0.29%	54,425.90	1.25	339.71	0.06	0.06%	47,280.60	1.09	3,212	0.61	0.34%	374,025	8.59
Coburg	0.00	0.00	0.00%	2,352.97	0.05	72.04	0.01	0.32%	3,367.53	0.08	0.00	0.00	0.00%	303.94	0.01	72	0.01	0.11%	6,024	0.14
Eugene North	3,915.17	0.74	1.45%	481,681.10	11.06	528.71	0.10	0.25%	36,498.13	0.84	273.20	0.05	0.03%	60,842.09	1.40	4,717	0.89	0.37%	579,021	13.29
Total (cities + county)	**11,434**	**2.17**	**1.30%**	**1,487,548**	**34.15**	**8,039**	**1.52**	**0.41%**	**1,030,858**	**23.67**	**17,817**	**3.37**	**0.32%**	**1,621,519**	**37.22**	**37,290**	**7.06**	**0.45%**	**4,139,925**	**95.04**

Critical Facilities: Buildings

COMMUNITIES	School Buildings Count	School Buildings (Count % of Total) (percent)	School Buildings Value (dollars)	Fire Buildings (count)	Fire Buildings (Count % of Total) (percent)	Fire Buildings Value (dollars)	Police Buildings (count)	Police Buildings (Count % of Total) (percent)	Police Buildings Value (dollars)	Hospital Buildings (count)	Hospital Buildings (Count % of Total) (percent)	Hospital Buildings Value (dollars)	All CFs Total Count	Percent Total (Count % of Total) (percent)	Total Value (dollars)
Lane County	12	75.00%	$149,975,080.00	2	33.33%	$352,711.00	0	0.00%	$0.00	0	0.00%	$0.00	14	56.00%	$150,327,791.00
Eugene South	5	29.41%	$20,655,292.00	1	33.33%	$651,965.00	0	0.00%	$0.00	0	0.00%	$0.00	6	26.09%	$21,307,257.00
Eugene Southwest	1	33.33%	$4,684,840.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	1	25.00%	$4,684,840.00
Springfield East	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Eugene West	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Springfield West	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	1	100.00%	$27,781,800.00	1	5.00%	$27,781,800.00
Coburg	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Eugene North	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Total (cities + county)	**18**	**21.18%**	**$175,315,212.00**	**3**	**14.29%**	**$1,004,676.00**	**0**	**0.00%**	**$0.00**	**1**	**50.00%**	**$27,781,800.00**	**22**	**18.64%**	**$204,101,688.00**

Social: Population

COMMUNITIES	Population Count	Population Exposed % of Total
Lane County	505	1.21%
Eugene South	3,097	4.40%
Eugene Southwest	25	0.82%
Springfield East	393	1.95%
Eugene West	69	0.18%
Springfield West	246	0.66%
Coburg	2	0.40%
Eugene North	313	0.70%
Total (cities + county)	**4,649**	**1.81%**

Deep Landslide Susceptibility - Low

Buildings

COMMUNITIES	Residential Single Family Count	Single Family (Count % of Total) (percent)	Single Family Value (dollars)	Commercial Commercial Count	Commercial (Count of Total) (percent)	Commercial Value (dollars)	Public Government Count	Government (Count of Total) (percent)	Government Value (dollars)	All Buildings Total Count	Percent Total (Count of Total) (percent)	Total Value (dollars)
Lane County	22,827	90.00%	$2,072,707,804.44	4571	77.78%	$568,930,327.25	388	93.72%	$298,212,485.80	27,786	87.78%	$2,939,850,617.49
Eugene South	16,612	70.67%	$3,161,557,188.46	1019	95.23%	$1,114,661,195.55	562	92.59%	$1,620,791,151.15	18,193	72.24%	$5,897,009,535.16
Eugene Southwest	1,052	99.91%	$169,990,764.29	218	100.00%	$112,209,113.16	26	100.00%	$37,945,774.28	1,296	99.92%	$320,145,651.73
Springfield East	9,035	86.09%	$749,747,740.49	735	98.66%	$333,219,082.70	68	93.15%	$80,900,532.50	9,838	86.96%	$1,163,867,355.68
Eugene West	15,212	100.00%	$1,859,419,263.20	1543	99.42%	$788,640,222.58	185	99.46%	$215,893,950.69	16,940	99.94%	$2,863,953,436.48
Springfield West	17,120	99.32%	$2,021,633,964.16	1963	99.85%	$1,072,972,473.00	293	96.38%	$238,213,406.46	19,376	99.32%	$3,332,819,843.63
Coburg	551	100.00%	$56,034,170.27	165	98.80%	$110,476,277.88	13	100.00%	$6,593,190.30	729	99.73%	$173,103,638.45
Eugene North	15,537	100.00%	$3,272,141,780.91	1184	100.00%	$1,176,935,336.97	334	100.00%	$1,098,183,707.17	17,055	100.00%	$5,547,260,825.05
Total (cities + county)	**97,946**	**89.89%**	**$13,363,232,676.22**	**11,398**	**89.19%**	**$5,278,044,029.10**	**1,869**	**95.50%**	**$3,596,734,198.34**	**111,213**	**89.91%**	**$22,238,010,903.67**

Land

COMMUNITIES	Residential Single Family Count	Single Family (Count % of Total) (percent)	Single Family Area (feet2)	Single Family Area (acres)	Single Family Area % of Total (percent)	Single Family Value (dollars)	Commercial Commercial Count	Commercial (Count % of Total) (percent)	Commercial Area (feet2)	Commercial Area (acres)	Commercial (Area % of Total) (percent)	Commercial Value (dollars)
Lane County	14,092	92.53%	585,465,319	13,440	65.95%	$1,199,890,073.72	2,533	73.81%	1,806,960,804	41,482	59.94%	$579,678,995.12
Eugene South	13,966	68.11%	133,356,122	3,061	53.38%	$1,420,745,341.04	980	98.29%	23,939,020	550	65.83%	$463,285,025.59
Eugene Southwest	749	100.00%	13,390,983	307	99.94%	$60,020,711.00	168	100.00%	40,027,338	919	99.94%	$85,780,089.00
Springfield East	5,264	79.23%	54,210,859	1,245	70.92%	$298,297,693.65	180	97.83%	34,222,266	786	96.31%	$84,995,854.86
Eugene West	11,314	100.00%	122,732,264	2,818	99.94%	$733,805,412.00	1,043	100.00%	103,772,791	2,382	99.94%	$543,142,342.00
Springfield West	10,061	99.09%	105,259,714	2,416	99.10%	$712,842,369.92	1,039	99.81%	82,021,475	1,883	99.79%	$604,697,849.59
Coburg	382	100.00%	4,583,502	105	99.94%	$33,932,423.00	85	100.00%	14,200,759	326	99.94%	$61,258,782.00
Eugene North	11,779	100.00%	151,226,865	3,472	99.94%	$1,356,301,581.00	906	100.00%	65,220,746	1,497	99.94%	$890,420,341.00
Total (cities + county)	**67,607**	**88.08%**	**1,170,225,629**	**26,865**	**72.58%**	**$5,815,835,605.33**	**6,934**	**88.26%**	**2,170,365,201**	**49,825**	**63.98%**	**$3,313,259,279.15**

COMMUNITIES	Public Government Count	Government (Count % of Total) (percent)	Government Area (feet2)	Government Area (acres)	Government (Area % of Total) (percent)	Government Value (dollars)	All Land Count	(Count % of Total) (percent)	Area (feet2)	Total Area (acres)	(Area % of Total) (percent)	Total Value (dollars)
Lane County	503	84.25%	718,249,709	16,489	77.40%	$101,985,364.90	17,128	88.94%	3,110,675,833	71,411	64.40%	$1,881,554,433.73
Eugene South	446	78.52%	231,872,251	5,323	80.15%	$399,074,480.85	15,392	69.74%	389,167,393	8,934	67.62%	$2,283,104,847.48
Eugene Southwest	29	100.00%	8,490,343	195	99.94%	$18,279,917.00	946	100.00%	61,908,664	1,421	99.94%	$164,080,717.00
Springfield East	101	78.91%	12,796,611	294	88.89%	$14,267,275.34	5,545	79.72%	101,229,737	2,324	80.10%	$397,560,823.84
Eugene West	399	100.00%	72,035,825	1,654	99.94%	$127,885,624.00	12,756	100.00%	298,540,881	6,854	99.94%	$1,404,833,378.00
Springfield West	368	98.13%	37,611,675	863	93.35%	$104,733,655.73	11,468	99.13%	224,892,864	5,163	98.33%	$1,422,273,875.23
Coburg	21	100.00%	4,141,313	95	99.94%	$3,870,587.00	488	100.00%	22,925,574	526	99.94%	$99,061,792.00
Eugene North	480	100.00%	69,505,186	1,596	99.94%	$315,597,094.00	13,165	100.00%	285,952,797	6,565	99.94%	$2,562,319,016.00
Total (cities + county)	**2,347**	**90.37%**	**1,154,702,913**	**26,508**	**80.96%**	**$1,085,693,998.81**	**76,888**	**88.17%**	**4,495,293,743**	**103,198**	**69.90%**	**$10,214,788,883.29**

Transportation

COMMUNITIES	Freeways, Highways & Major Arterials Length (feet)	Freeways, Highways & Major Arterials Length (miles)	Freeways, Highways & Major Arterials Percent of Total Length (%)	Freeways, Highways & Major Arterials Total Area (feet2)	Freeways, Highways & Major Arterials Total Area (acres)	Minor Arterials & Collect/Connectors Length (feet)	Minor Arterials & Collect/Connectors Length (miles)	Minor Arterials & Collect/Connectors Percent of Total Length (%)	Minor Arterials & Collect/Connectors Total Area (feet2)	Minor Arterials & Collect/Connectors Total Area (acres)
Lane County	238,502.96	45.17	88.39%	13,274,785.52	304.75	604,381.17	114.47	77.49%	24,149,008.09	554.38
Eugene South	41,270.42	7.82	93.31%	2,367,193.91	54.34	277,224.47	52.50	80.10%	10,963,173.53	251.68
Eugene Southwest	16,176.80	3.06	99.97%	973,121.72	22.34	39,792.66	7.54	98.09%	1,590,676.69	36.52
Springfield East	31,775.15	6.02	82.62%	1,899,749.86	43.61	71,446.52	13.53	84.41%	2,855,832.84	65.56
Eugene West	113,999.74	21.59	99.97%	6,465,574.64	148.43	211,612.46	40.08	99.97%	8,459,621.07	194.21
Springfield West	117,646.78	22.28	98.73%	6,326,133.54	145.23	277,628.11	52.58	98.40%	10,957,139.89	251.54
Coburg	9,842.84	1.86	99.97%	527,605.66	12.11	22,643.90	4.29	99.97%	902,120.55	20.71
Eugene North	270,237.05	51.18	100.00%	13,428,425.87	308.27	211,267.90	40.01	100.00%	8,412,021.40	193.11
Total (cities + county)	**839,452**	**158.99**	**95.18%**	**45,262,591**	**1,039.09**	**1,715,997**	**325.00**	**86.71%**	**68,289,594**	**1,567.71**

COMMUNITIES	Local Streets Length (feet)	Local Streets Length (miles)	Local Streets Percent of Total Length %	Local Streets Total Area (feet2)	Local Streets Total Area (acres)	All Roads Total Road Length (feet)	Total Road Length (miles)	Total Road Length (%)	Total Road Area (feet)	Total Road Area (acres)
Lane County	1,286,928.36	243.74	74.85%	38,717,157.66	888.82	2,129,812	403.37	76.91%	76,140,951	1,747.96
Eugene South	895,734.39	169.65	68.15%	26,435,392.31	606.87	1,214,229	229.97	71.23%	39,765,760	912.90
Eugene Southwest	72,877.72	13.80	99.20%	2,183,476.19	50.13	128,847	24.40	98.95%	4,747,275	108.98
Springfield East	260,285.75	49.30	80.62%	7,765,940.58	178.28	363,507	68.85	81.51%	12,521,523	287.45
Eugene West	702,761.66	133.10	99.97%	20,973,635.06	481.49	1,028,374	194.77	99.97%	35,898,831	824.12
Springfield West	531,738.86	100.71	98.54%	15,891,226.79	364.81	927,014	175.57	98.52%	33,174,500	761.58
Coburg	30,457.62	5.77	99.97%	916,299.81	21.04	62,944	11.92	99.97%	2,346,026	53.86
Eugene North	790,116.50	149.64	100.00%	23,518,896.79	539.92	1,271,621	240.84	100.00%	45,359,344	1,041.31
Total (cities + county)	**4,570,901**	**865.70**	**83.21%**	**136,402,025**	**3,131.36**	**7,126,350**	**1,349.69**	**85.30%**	**249,954,210**	**5,738.16**

Critical Facilities: Buildings

COMMUNITIES	School Buildings Count	School Buildings (Count % of Total) (percent)	School Buildings Value (dollars)	Fire Buildings (count)	Fire Buildings (Count % of Total) (percent)	Fire Buildings Value (dollars)	Police Buildings (count)	Police Buildings (Count % of Total) (percent)	Police Buildings Value (dollars)	Hospital Buildings (count)	Hospital Buildings (Count % of Total) (percent)	Hospital Buildings Value (dollars)	All CFs Total Count	Percent Total (Count % of Total) (percent)	Total Value (dollars)
Lane County	16	100.00%	172421970	5	83.33%	1,081,437.00	3	100.00%	$1,635,299.00	0	0.00%	$0.00	24	96.00%	$175,138,706.00
Eugene South	17	100.00%	112526832	3	100.00%	7,420,295.00	2	100.00%	$1,303,940.00	1	100.00%	$178,312,000.00	23	100.00%	$299,563,067.00
Eugene Southwest	3	100.00%	16104954	1	100.00%	173,598.00	0	0.00%	$0.00	0	0.00%	$0.00	4	100.00%	$16,278,552.00
Springfield East	5	100.00%	57858790	2	100.00%	1,931,494.00	0	0.00%	$0.00	0	0.00%	$0.00	7	100.00%	$59,790,284.00
Eugene West	19	100.00%	79395474	4	100.00%	5,441,500.00	0	0.00%	$0.00	0	0.00%	$0.00	23	100.00%	$84,836,974.00
Springfield West	14	100.00%	80237828	3	100.00%	3,028,835.00	2	100.00%	$11,449,990.00	1	100.00%	$27,781,800.00	20	100.00%	$122,498,453.00
Coburg	1	100.00%	2780000	0	0.00%	0.00	2	100.00%	$884,061.80	0	0.00%	$0.00	3	100.00%	$3,664,061.80
Eugene North	10	100.00%	113932793	2	100.00%	2,093,266.00	1	100.00%	$263,482.00	0	0.00%	$0.00	13	100.00%	$116,289,541.00
Total (cities + county)	**85**	**100.00%**	**$635,258,641.00**	**20**	**95.24%**	**$21,170,425.00**	**10**	**100.00%**	**$15,536,772.80**	**2**	**100.00%**	**$206,093,800.00**	**117**	**99.15%**	**$878,059,638.80**

Social: Population

COMMUNITIES	Population Count	Population Exposed % of Total
Lane County	37,424	89.45%
Eugene South	53,315	75.76%
Eugene Southwest	3,020	100.00%
Springfield East	16,965	84.29%
Eugene West	38,515	100.00%
Springfield West	37,006	99.43%
Coburg	444	100.00%
Eugene North	44,744	100.00%
Total (cities + county)	**231,433**	**90.31%**

Deep Landslide Susceptibility - Moderate

Buildings

COMMUNITIES	Residential Single Family Count	Single Family (Count % of Total) (percent)	Single Family Value (dollars)	Commercial Commercial Count	Commercial (Count of Total) (percent)	Commercial Value (dollars)	Public Government Count	Government (Count of Total) (percent)	Government Value (dollars)	All Buildings Total Count	Percent Total (Count of Total) (percent)	Total Value (dollars)
Lane County	1,957	7.72%	$256,420,549.22	982	16.71%	$125,659,456.53	15	3.62%	$807,243.00	2,954	9.33%	$382,887,248.75
Eugene South	5,826	24.78%	$1,404,487,285.48	37	3.46%	$27,653,524.73	42	6.92%	$6,112,498.30	5,905	23.45%	$1,438,253,308.51
Eugene Southwest	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Springfield East	482	4.59%	$89,143,894.17	4	0.54%	$1,260,356.20	2	2.74%	$0.00	488	4.31%	$90,404,250.37
Eugene West	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Springfield West	115	0.67%	$9,907,937.56	3	0.15%	$4,440,710.00	9	2.96%	$96,289.22	127	0.65%	$14,444,936.78
Coburg	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Eugene North	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Total (cities + county)	**8,380**	**7.69%**	**$1,759,959,666.43**	**1,026**	**8.03%**	**$159,014,047.46**	**68**	**3.47%**	**$7,016,030.52**	**9,474**	**7.66%**	**$1,925,989,744.41**

Land

COMMUNITIES	Residential Single Family Count	Single Family (Count % of Total) (percent)	Single Family Area (feet2)	Single Family Area (acres)	Single Family Area % of Total (percent)	Single Family Value (dollars)	Commercial Commercial Count	Commercial (Count % of Total) (percent)	Commercial Area (feet2)	Commercial Area (acres)	Commercial (Area % of Total) (percent)	Commercial Value (dollars)
Lane County	1,616	10.61%	232,442,673	5,336	26.18%	$204,822,857.01	1,423	41.46%	919,688,915	21,113	30.51%	$220,171,009.43
Eugene South	6,707	32.71%	96,323,104	2,211	38.55%	$583,809,000.84	35	3.51%	11,002,774	253	30.25%	$15,525,397.53
Eugene Southwest	0	0.00%	0	0	0.00%	$0.00	0	0.00%	0	0	0.00%	$0.00
Springfield East	680	10.23%	10,908,162	250	14.27%	$41,453,534.01	9	4.89%	779,250	18	2.19%	$951,893.88
Eugene West	0	0.00%	0	0	0.00%	$0.00	0	0.00%	0	0	0.00%	$0.00
Springfield West	98	0.97%	856,991	20	0.81%	$4,236,565.78	7	0.67%	120,617	3	0.15%	$703,419.43
Coburg	0	0.00%	0	0	0.00%	$0.00	0	0.00%	0	0	0.00%	$0.00
Eugene North	0	0.00%	0	0	0.00%	$0.00	0	0.00%	0	0	0.00%	$0.00
Total (cities + county)	**9,101**	**11.86%**	**340,530,930**	**7,818**	**21.12%**	**$834,321,957.64**	**1,474**	**18.76%**	**931,591,556**	**21,386**	**27.46%**	**$237,351,720.27**

COMMUNITIES	Public Government Count	Government (Count % of Total) (percent)	Government Area (feet2)	Government Area (acres)	Government (Area % of Total) (percent)	Government Value (dollars)	All Land Count	(Count % of Total) (percent)	Area (feet2)	Total Area (acres)	(Area % of Total) (percent)	Total Value (dollars)
Lane County	155	25.96%	137,662,680	3,160	14.83%	$23,995,777.72	3,194	16.58%	1,289,794,267	29,610	26.70%	$448,989,644.16
Eugene South	160	28.17%	45,789,680	1,051	15.83%	$23,571,540.32	6,902	31.27%	153,115,559	3,515	26.61%	$622,905,938.69
Eugene Southwest	0	0.00%	0	0	0.00%	$0.00	0	0.00%	0	0	0.00%	$0.00
Springfield East	17	13.28%	1,449,861	33	10.07%	$1,016,569.71	706	10.15%	13,137,274	302	10.40%	$43,421,997.60
Eugene West	0	0.00%	0	0	0.00%	$0.00	0	0.00%	0	0	0.00%	$0.00
Springfield West	8	2.13%	2,078,474	48	5.16%	$1,886,652.80	113	0.98%	3,056,081	70	1.34%	$6,826,638.00
Coburg	0	0.00%	0	0	0.00%	$0.00	0	0.00%	0	0	0.00%	$0.00
Eugene North	0	0.00%	0	0	0.00%	$0.00	0	0.00%	0	0	0.00%	$0.00
Total (cities + county)	**340**	**13.09%**	**186,980,695**	**4,292**	**13.11%**	**$50,470,540.55**	**10,915**	**12.52%**	**1,459,103,180**	**33,496**	**22.69%**	**$1,122,144,218.46**

Transportation

COMMUNITIES	Freeways, Highways & Major Arterials Length (feet)	Freeways, Highways & Major Arterials Length (miles)	Freeways, Highways & Major Arterials Percent of Total Length (%)	Freeways, Highways & Major Arterials Total Area (feet2)	Freeways, Highways & Major Arterials Total Area (acres)	Minor Arterials & Collect/Connectors Length (feet)	Minor Arterials & Collect/Connectors Length (miles)	Minor Arterials & Collect/Connectors Percent of Total Length (%)	Minor Arterials & Collect/Connectors Total Area (feet2)	Minor Arterials & Collect/Connectors Total Area (acres)	Local Streets Length (feet)	Local Streets Length (miles)	Local Streets Percent of Total Length %	Local Streets Total Area (feet2)	Local Streets Total Area (acres)	All Roads Total Road Length (feet)	Total Road Length (miles)	Total Road Length (%)	Total Road Area (feet)	Total Road Area (acres)
Lane County	20,013.87	3.79	7.42%	1,119,495.62	25.70	146,859.12	27.81	18.83%	5,854,026.31	134.39	329,506.74	62.41	19.16%	9,890,984.68	227.07	496,380	94.01	17.93%	16,864,507	387.16
Eugene South	2,946.60	0.56	6.66%	142,763.95	3.28	62,266.80	11.79	17.99%	2,475,103.84	56.82	359,137.04	68.02	27.32%	10,703,096.26	245.71	424,350	80.37	24.89%	13,320,964	305.81
Eugene Southwest	0.00	0.00	0.00%	0.00	0.00	760.82	0.14	1.88%	30,589.60	0.70	565.55	0.11	0.77%	17,278.57	0.40	1,326	0.25	1.02%	47,868	1.10
Springfield East	6,674.21	1.26	17.35%	400,830.21	9.20	7,854.62	1.49	9.28%	314,899.34	7.23	24,433.25	4.63	7.57%	737,000.50	16.92	38,962	7.38	8.74%	1,452,730	33.35
Eugene West	0.00	0.00	0.00%	0.00	0.00	0.00	0.00	0.00%	0.00	0.00	0.00	0.00	0.00%	0.00	0.00	0	0.00	0.00%	0	0.00
Springfield West	1,509.48	0.29	1.27%	86,183.36	1.98	4,507.63	0.85	1.60%	173,888.09	3.99	7,832.83	1.48	1.45%	233,011.44	5.35	13,850	2.62	1.47%	493,083	11.32
Coburg	0.00	0.00	0.00%	0.00	0.00	0.00	0.00	0.00%	0.00	0.00	0.00	0.00	0.00%	0.00	0.00	0	0.00	0.00%	0	0.00
Eugene North	0.00	0.00	0.00%	0.00	0.00	0.00	0.00	0.00%	0.00	0.00	0.00	0.00	0.00%	0.00	0.00	0	0.00	0.00%	0	0.00
Total (cities + county)	**31,144**	**5.90**	**3.53%**	**1,749,273**	**40.16**	**222,249**	**42.09**	**11.23%**	**8,848,507**	**203.13**	**721,475**	**136.64**	**13.13%**	**21,581,371**	**495.44**	**974,869**	**184.63**	**11.67%**	**32,179,152**	**738.73**

Critical Facilities: Buildings

COMMUNITIES	School Buildings Count	School Buildings (Count % of Total) (percent)	School Buildings Value (dollars)	Fire Buildings (count)	Fire Buildings (Count % of Total) (percent)	Fire Buildings Value (dollars)	Police Buildings (count)	Police Buildings (Count % of Total) (percent)	Police Buildings Value (dollars)	Hospital Buildings (count)	Hospital Buildings (Count % of Total) (percent)	Hospital Buildings Value (dollars)	All CFs Total Count	Percent Total (Count % of Total) (percent)	Total Value (dollars)
Lane County	0	0.00%	0	1	16.67%	$240,627.00	0	0.00%	$0.00	0	0.00%	$0.00	1	4.00%	$240,627.00
Eugene South	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Eugene Southwest	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Springfield East	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Eugene West	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Springfield West	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Coburg	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Eugene North	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Total (cities + county)	**0**	**0.00%**	**$0.00**	**1**	**4.76%**	**$240,627.00**	**0**	**0.00%**	**$0.00**	**0**	**0.00%**	**$0.00**	**1**	**0.85%**	**$240,627.00**

Social: Population

COMMUNITIES	Population Count	Population Exposed % of Total
Lane County	3,668.33	8.77%
Eugene South	14,477.81	20.57%
Eugene Southwest	0	0.00%
Springfield East	1,258.02	6.25%
Eugene West	0	0.00%
Springfield West	208.52	0.56%
Coburg	0	0.00%
Eugene North	0	0.00%
Total (cities + county)	**19,613**	**7.65%**

Deep Landslide Susceptibility - High

Buildings

COMMUNITIES	Residential Single Family Count	Single Family (Count % of Total) (percent)	Single Family Value (dollars)	Commercial Commercial Count	Commercial (Count of Total) (percent)	Commercial Value (dollars)	Public Government Count	Government (Count of Total) (percent)	Government Value (dollars)	All Buildings Total Count	Percent Total (Count of Total) (percent)	Total Value (dollars)
Lane County	580	2.29%	88,757,257.12	324	5.51%	45,054,124.84	11	2.66%	161,145.27	915	2.89%	$133,972,527.23
Eugene South	1,070	4.55%	272,371,114.40	13	1.21%	3,784,404.80	3	0.49%	0.00	1,086	4.31%	$276,155,519.20
Eugene Southwest	0	0.00%	0.00	0	0.00%	0.00	0	0.00%	0.00	0	0.00%	$0.00
Springfield East	978	9.32%	146,432,805.82	3	0.40%	1,001,873.00	2	2.74%	229,716.00	983	8.69%	$147,664,394.82
Eugene West	0	0.00%	0.00	0	0.00%	0.00	0	0.00%	0.00	0	0.00%	$0.00
Springfield West	3	0.02%	146,002.20	0	0.00%	0.00	2	0.66%	4,027,490.00	5	0.03%	$4,173,492.20
Coburg	0	0.00%	0.00	0	0.00%	0.00	0	0.00%	0.00	0	0.00%	$0.00
Eugene North	0	0.00%	0.00	0	0.00%	0.00	0	0.00%	0.00	0	0.00%	$0.00
Total (cities + county)	**2,631**	**2.41%**	**$507,707,179.54**	**340**	**2.66%**	**$49,840,402.64**	**18**	**0.92%**	**$4,418,351.27**	**2,989**	**2.42%**	**$561,965,933.45**

Land

COMMUNITIES	Residential Single Family Count	Single Family (Count % of Total) (percent)	Single Family Area (feet2)	Single Family Area (acres)	Single Family Area % of Total (percent)	Single Family Value (dollars)	Commercial Commercial Count	Commercial (Count % of Total) (percent)	Commercial Area (feet2)	Commercial Area (acres)	Commercial (Area % of Total) (percent)	Commercial Value (dollars)
Lane County	551	3.62%	69,291,652	1,591	7.81%	$56,277,938.05	670	19.52%	286,059,070	6,567	9.49%	$64,973,701.64
Eugene South	1,392	6.79%	20,003,285	459	8.01%	$105,691,657.77	11	1.10%	1,402,599	32	3.86%	$3,258,807.71
Eugene Southwest	0	0.00%	0	0	0.00%	$0.00	0	0.00%	0	0	0.00%	$0.00
Springfield East	944	14.21%	11,276,331	259	14.75%	$59,942,568.82	4	2.17%	508,264	12	1.43%	$375,083.33
Eugene West	0	0.00%	0	0	0.00%	$0.00	0	0.00%	0	0	0.00%	$0.00
Springfield West	2	0.02%	24,394	1	0.02%	$58,168.43	0	0.00%	0	0	0.00%	$0.00
Coburg	0	0.00%	0.00	0	0.00%	$0.00	0	0.00%	0	0	0.00%	$0.00
Eugene North	0	0.00%	0	0	0.00%	$0.00	0	0.00%	0	0	0.00%	$0.00
Total (cities + county)	**2,889**	**3.76%**	**100,595,662**	**2,309**	**6.24%**	**$221,970,333.07**	**685**	**8.72%**	**287,969,933**	**6,611**	**8.49%**	**$68,607,592.67**

COMMUNITIES	Public Government Count	Government (Count % of Total) (percent)	Government Area (feet2)	Government Area (acres)	Government (Area % of Total) (percent)	Government Value (dollars)	All Land Count	(Count % of Total) (percent)	Area (feet2)	Total Area (acres)	(Area % of Total) (percent)	Total Value (dollars)
Lane County	71	11.89%	71,480,526	1,641	7.70%	$12,228,215.23	1,292	6.71%	426,831,247	9,799	8.84%	$133,479,854.92
Eugene South	29	5.11%	11,449,563	263	3.96%	$4,313,653.97	1,432	6.49%	32,855,448	754	5.71%	$113,264,119.45
Eugene Southwest	0	0.00%	0	0	0.00%	$0.00	0	0.00%	0	0	0.00%	$0.00
Springfield East	17	13.28%	141,212	3	0.98%	$782,387.00	965	13.87%	11,925,807	274	9.44%	$61,100,039.14
Eugene West	0	0.00%	0	0	0.00%	$0.00	0	0.00%	0	0	0.00%	$0.00
Springfield West	3	0.80%	577,703	13	1.43%	$544,456.53	5	0.04%	602,097	14	0.26%	$602,624.96
Coburg	0	0.00%	0	0	0.00%	$0.00	0	0.00%	0	0	0.00%	$0.00
Eugene North	0	0.00%	0	0	0.00%	$0.00	0	0.00%	0	0	0.00%	$0.00
Total (cities + county)	**120**	**4.62%**	**83,649,004**	**1,920**	**5.87%**	**$17,868,712.74**	**3,694**	**4.24%**	**472,214,599**	**10,841**	**7.34%**	**$308,446,638.48**

Transportation

COMMUNITIES	Freeways, Highways & Major Arterials Length (feet)	Freeways, Highways & Major Arterials Length (miles)	Freeways, Highways & Major Arterials Percent of Total Length (%)	Freeways, Highways & Major Arterials Total Area (feet2)	Freeways, Highways & Major Arterials Total Area (acres)	Minor Arterials & Collect/Connectors Length (feet)	Minor Arterials & Collect/Connectors Length (miles)	Minor Arterials & Collect/Connectors Percent of Total Length (%)	Minor Arterials & Collect/Connectors Total Area (feet2)	Minor Arterials & Collect/Connectors Total Area (acres)
Lane County	11,308.21	2.14	4.19%	631,165.02	14.49	28,719.22	5.44	3.68%	1,148,720.84	26.37
Eugene South	0.00	0.00	0.00%	0.00	0.00	6,499.27	1.23	1.88%	263,774.80	6.06
Eugene Southwest	0.00	0.00	0.00%	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
Springfield East	0.00	0.00	0.00%	515.62	0.01	5,309.81	1.01	6.27%	213,156.57	4.89
Eugene West	0.00	0.00	0.00%	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
Springfield West	0.00	0.00	0.00%	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
Coburg	0.00	0.00	0.00%	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
Eugene North	0.00	0.00	0.00%	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
Total (cities + county)	**11,308**	**2.14**	**1.28%**	**631,681**	**14.50**	**40,528**	**7.68**	**2.05%**	**1,625,652**	**37.32**

COMMUNITIES	Local Streets Length (feet)	Local Streets Length (miles)	Local Streets Percent of Total Length %	Local Streets Total Area (feet2)	Local Streets Total Area (acres)	All Roads Total Road Length (feet)	Total Road Length (miles)	Total Road Length (%)	Total Road Area (feet)	Total Road Area (acres)
Lane County	102,917.87	19.49	5.99%	3,094,010.89	71.03	142,945	27.07	5.16%	4,873,897	111.89
Eugene South	59,146.71	11.20	4.50%	1,768,957.65	40.61	65,646	12.43	3.85%	2,032,732	46.67
Eugene Southwest	0.00	0.00	0.00%	0.00	0.00	0	0.00	0.00%	0	0.00
Springfield East	38,050.78	7.21	11.79%	1,136,877.63	26.10	43,361	8.21	9.72%	1,350,550	31.00
Eugene West	0.00	0.00	0.00%	0.00	0.00	0	0.00	0.00%	0	0.00
Springfield West	43.23	0.01	0.01%	1,787.35	0.04	43	0.01	0.00%	1,787	0.04
Coburg	0.00	0.00	0.00%	0.00	0.00	0	0.00	0.00%	0	0.00
Eugene North	0.00	0.00	0.00%	0.00	0.00	0	0.00	0.00%	0	0.00
Total (cities + county)	**200,159**	**37.91**	**3.64%**	**6,001,634**	**137.78**	**251,995**	**47.73**	**3.02%**	**8,258,966**	**189.60**

Critical Facilities: Buildings

COMMUNITIES	School Buildings Count	School Buildings (Count % of Total) (percent)	School Buildings Value (dollars)	Fire Buildings (count)	Fire Buildings (Count % of Total) (percent)	Fire Buildings Value (dollars)	Police Buildings (count)	Police Buildings (Count % of Total) (percent)	Police Buildings Value (dollars)	Hospital Buildings (count)	Hospital Buildings (Count % of Total) (percent)	Hospital Buildings Value (dollars)	All CFs Total Count	Percent Total (Count % of Total) (percent)	Total Value (dollars)
Lane County	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Eugene South	0	0.00%	0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Eugene Southwest	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Springfield East	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Eugene West	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Springfield West	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Coburg	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Eugene North	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00	0	0.00%	$0.00
Total (cities + county)	**0**	**0.00%**	**$0.00**	**0**	**0.00%**	**$0.00**	**0**	**0.00%**	**$0.00**	**0**	**0.00%**	**$0.00**	**0**	**0.00%**	**$0.00**

Social: Population

COMMUNITIES	Population Count	Population Exposed % of Total
Lane County	744	1.78%
Eugene South	2,580	3.67%
Eugene Southwest	0	0.00%
Springfield East	1,904	9.46%
Eugene West	0	0.00%
Springfield West	4	0.01%
Coburg	0	0.00%
Eugene North	0	0.00%
Total (cities + county)	**5,232**	**2.04%**

Hazus-MH: Earthquake Global Risk Report

Region Name: Eugene_ACrustal2

Earthquake Scenario: Abritary Eugene Fault

Print Date: May 02, 2018

Disclaimer:

This version of Hazus utilizes 2010 Census Data.

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

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.

HAZUS MH EARTHQUAKE • WIND • FLOOD

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Table of Contents

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):

Oregon

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

The geographical size of the region is 545.41 square miles and contains 65 census tracts. There are over 113 thousand households in the region which has a total population of 274,657 people (2010 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 101 thousand buildings in the region with a total building replacement value (excluding contents) of 28,781 (millions of dollars). Approximately 91.00 % of the buildings (and 75.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 3,834 and 419 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 101 thousand buildings in the region which have an aggregate total replacement value of 28,781 (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 83% 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 3 hospitals in the region with a total bed capacity of 565 beds. There are 108 schools, 21 fire stations, 7 police stations and 2 emergency operation facilities. With respect to high potential loss facilities (HPL), there are 0 dams identified within the inventory. Of these, 0 of the dams are classified as 'high hazard'. The inventory also includes 86 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 4,253.00 (millions of dollars). This inventory includes over 326 kilometers of highways, 72 bridges, 21,931 kilometers of pipes.

Table 1: Transportation System Lifeline Inventory

System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	72	1,926.00
	Segments	164	1,610.30
	Tunnels	0	0.00
		Subtotal	**3,536.30**
Railways	Bridges	0	0.00
	Facilities	6	16.00
	Segments	55	145.00
	Tunnels	0	0.00
		Subtotal	**161.00**
Light Rail	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
		Subtotal	**0.00**
Bus	Facilities	2	2.50
		Subtotal	**2.50**
Ferry	Facilities	0	0.00
		Subtotal	**0.00**
Port	Facilities	0	0.00
		Subtotal	**0.00**
Airport	Facilities	2	21.30
	Runways	3	113.90
		Subtotal	**135.20**
		Total	**3,835.00**

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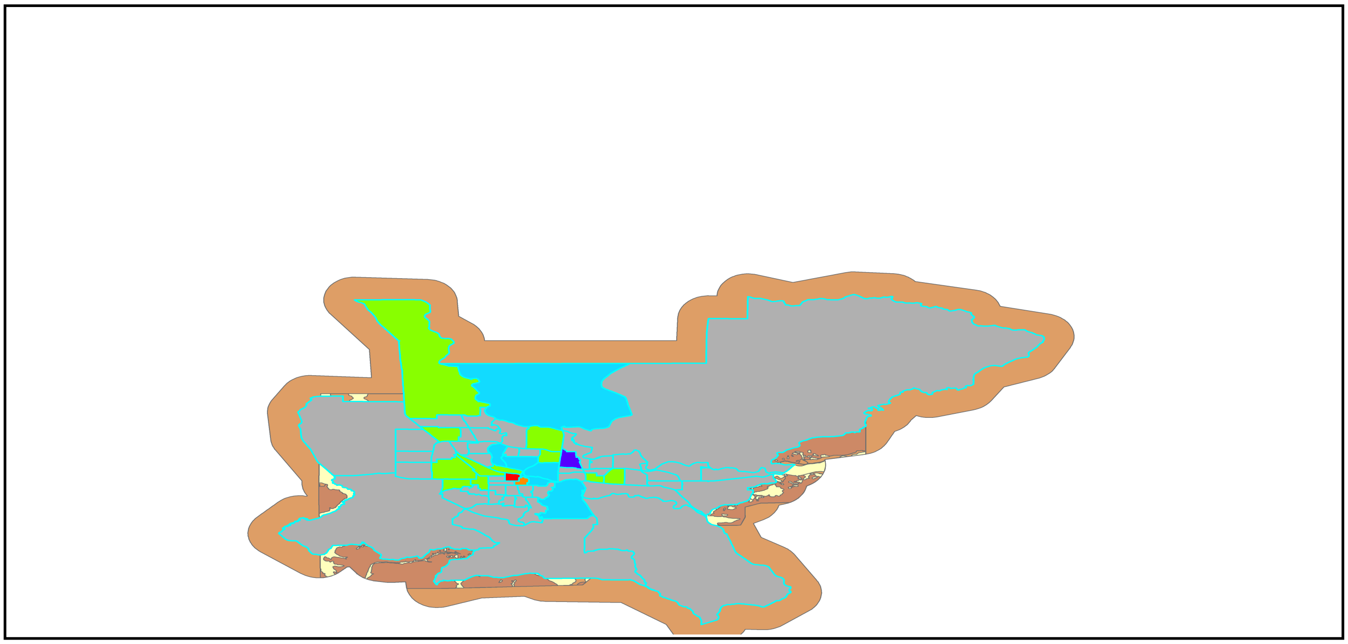
Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	219.30
	Facilities	3	112.90
	Pipelines	0	0.00
		Subtotal	**332.20**
Waste Water	Distribution Lines	NA	131.60
	Facilities	4	301.00
	Pipelines	0	0.00
		Subtotal	**432.60**
Natural Gas	Distribution Lines	NA	87.70
	Facilities	2	2.50
	Pipelines	0	0.00
		Subtotal	**90.20**
Oil Systems	Facilities	1	0.10
	Pipelines	0	0.00
		Subtotal	**0.10**
Electrical Power	Facilities	0	0.00
		Subtotal	**0.00**
Communication	Facilities	28	3.20
		Subtotal	**3.20**
		Total	**858.30**

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	Abritary Eugene Fault
Type of Earthquake	Arbitrary
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	NA
Longitude of Epicenter	-123.05
Latitude of Epicenter	44.08
Earthquake Magnitude	6.50
Depth (km)	10.00
Rupture Length (Km)	17.18
Rupture Orientation (degrees)	165.00
Attenuation Function	Pacific Northwest (PNW 2008) - Reverse

Building Damage

Building Damage

Hazus estimates that about 44,747 buildings will be at least moderately damaged. This is over 44.00 % of the buildings in the region. There are an estimated 7,773 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.

Damage categories by General Occupancy Type

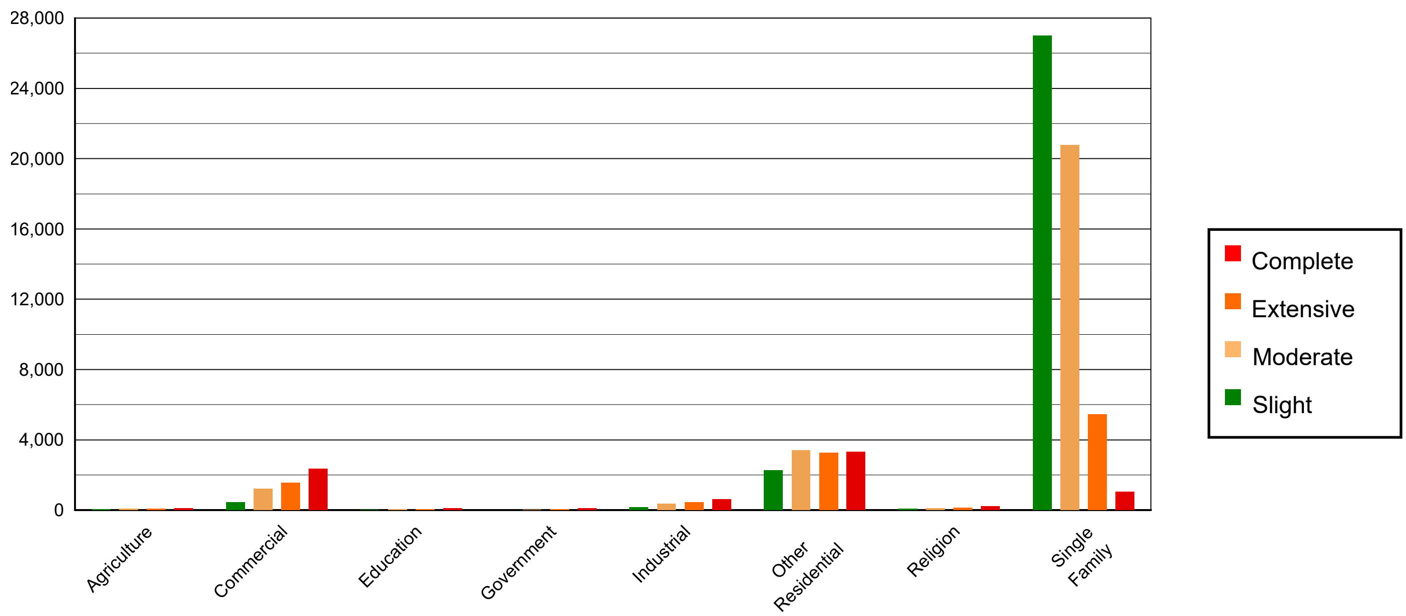


Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	67	0.25	65	0.22	77	0.30	68	0.62	96	1.23
Commercial	367	1.35	459	1.53	1,222	4.70	1,537	14.01	2,342	30.13
Education	28	0.10	30	0.10	48	0.18	55	0.50	85	1.10
Government	6	0.02	6	0.02	19	0.07	37	0.34	87	1.12
Industrial	155	0.57	147	0.49	373	1.44	452	4.12	627	8.06
Other Residential	1,666	6.14	2,267	7.55	3,385	13.02	3,247	29.60	3,296	42.41
Religion	62	0.23	73	0.24	114	0.44	126	1.15	195	2.51
Single Family	24,768	91.33	26,993	89.86	20,766	79.86	5,449	49.67	1,045	13.45
Total	**27,118**		**30,040**		**26,004**		**10,970**		**7,773**	

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

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	26,009	95.91	28646	95.36	22,360	85.99	6,009	54.77	1,157	14.89
Steel	118	0.43	89	0.29	306	1.18	564	5.15	1,007	12.95
Concrete	113	0.42	121	0.40	355	1.37	515	4.70	777	10.00
Precast	105	0.39	81	0.27	276	1.06	441	4.02	747	9.60
RM	15	0.06	10	0.03	35	0.13	56	0.51	84	1.08
URM	225	0.83	314	1.04	675	2.60	789	7.19	1,390	17.88
MH	533	1.97	780	2.60	1,996	7.68	2,595	23.66	2,611	33.59
Total	**27,118**		**30,040**		**26,004**		**10,970**		**7,773**	

*Note:
RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

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Essential Facility Damage

Before the earthquake, the region had 565 hospital beds available for use. On the day of the earthquake, the model estimates that only 4 hospital beds (1.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 4.00% of the beds will be back in service. By 30 days, 25.00% will be operational.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	**Total**	**At Least Moderate Damage > 50%**	**Complete Damage > 50%**	**With Functionality > 50% on day 1**
Hospitals	3	3	1	0
Schools	108	19	0	13
EOCs	2	0	0	0
PoliceStations	7	2	0	1
FireStations	21	4	0	6

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Transportation Lifeline Damage

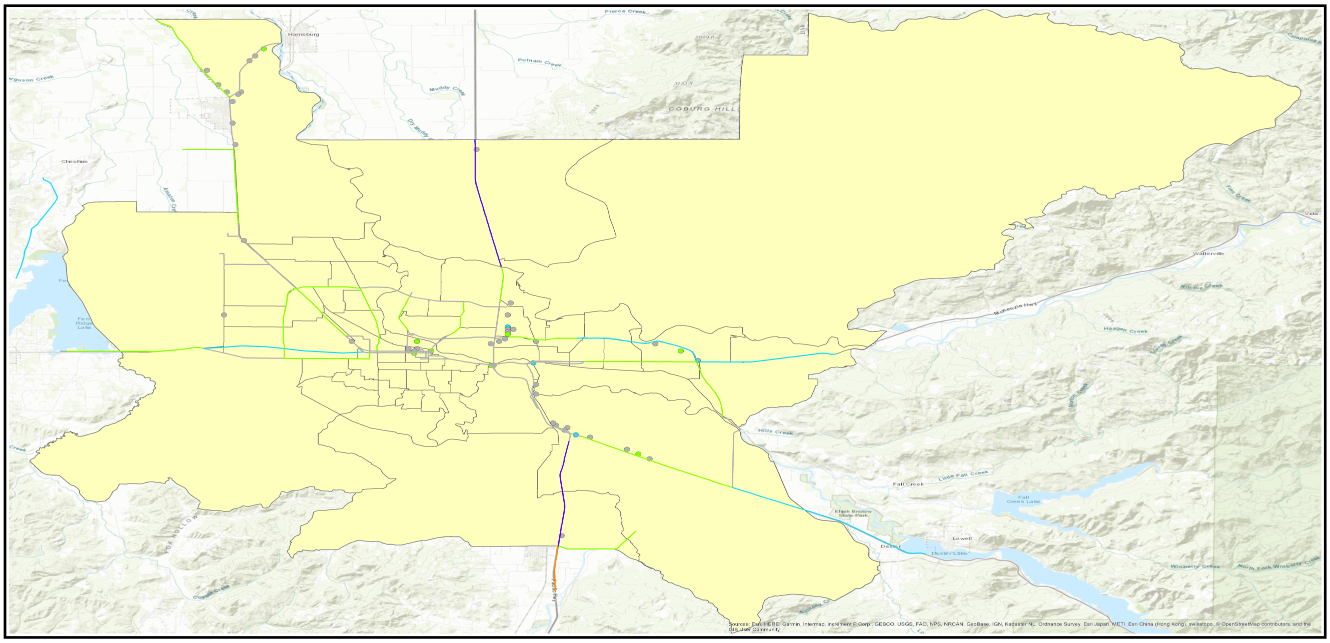

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Table 6: Expected Damage to the Transportation Systems

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	164	0	0	164	164
	Bridges	72	30	12	42	55
	Tunnels	0	0	0	0	0
Railways	Segments	55	0	0	55	55
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	6	1	0	5	6
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	2	1	0	1	2
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	2	1	0	2	2
	Runways	3	0	0	3	3

Table 6 provides damage estimates for the transportation system.

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	3	3	0	0	3
Waste Water	4	4	0	0	4
Natural Gas	2	2	0	0	2
Oil Systems	1	1	0	0	1
Electrical Power	0	0	0	0	0
Communication	28	27	0	19	28

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

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	10,966	4452	1113
Waste Water	6,580	3190	798
Natural Gas	4,386	915	229
Oil	0	0	0

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	113,685	56,418	53,910	48,550	10,995	0
Electric Power		58,225	35,898	14,757	2,885	81

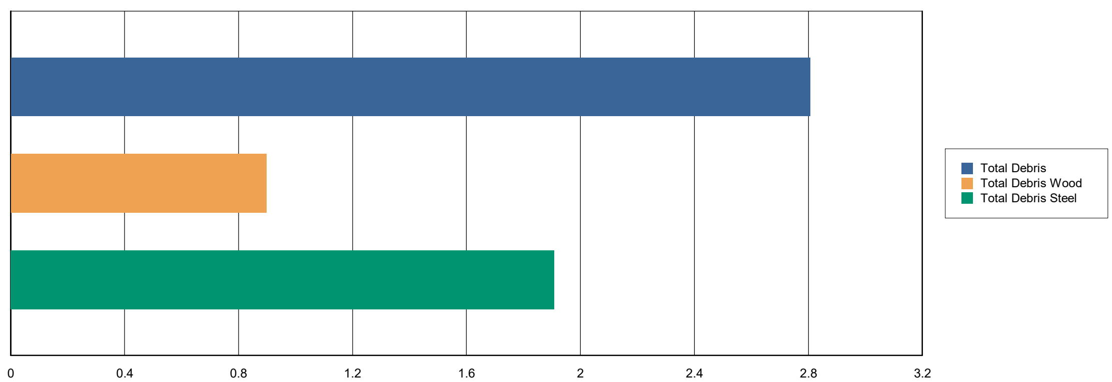
Induced Earthquake Damage

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 2.81 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 32.00% 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 112,240 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Earthquake Debris (millions of tons)



Brick/ Wood	Reinforced Concrete/Steel	Total Debris	Truck Load
0.90	1.91	2.81	112,240 (@25 tons/truck)

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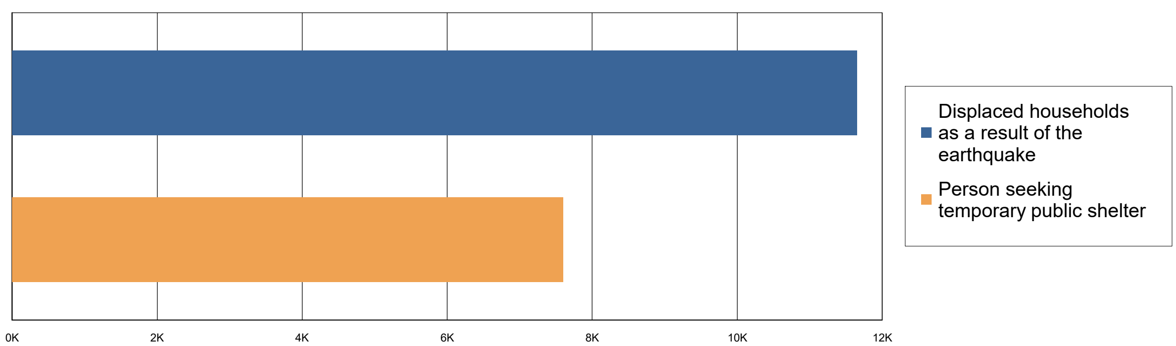
Social Impact

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 11,655 households to be displaced due to the earthquake. Of these, 7,601 people (out of a total population of 274,657) will seek temporary shelter in public shelters.

Displaced Households/ Persons Seeking Short Term Public Shelter



Displaced households as a result of the earthquake	Persons seeking temporary public shelter
11,655	7,601

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

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Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	69	22	4	7
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	85	27	4	9
	Other-Residential	1,327	378	52	101
	Single Family	512	92	7	14
	Total	**1,993**	**518**	**68**	**131**
2 PM	Commercial	3,983	1,254	210	413
	Commuting	1	1	2	0
	Educational	1,881	603	103	201
	Hotels	0	0	0	0
	Industrial	628	197	33	64
	Other-Residential	275	79	11	21
	Single Family	108	20	2	3
	Total	**6,876**	**2,154**	**361**	**701**
5 PM	Commercial	2,840	894	150	292
	Commuting	17	21	38	7
	Educational	500	161	28	54
	Hotels	0	0	0	0
	Industrial	392	123	20	40
	Other-Residential	509	146	21	39
	Single Family	202	37	3	6
	Total	**4,461**	**1,382**	**260**	**437**

Economic Loss

The total economic loss estimated for the earthquake is 10,682.71 (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.

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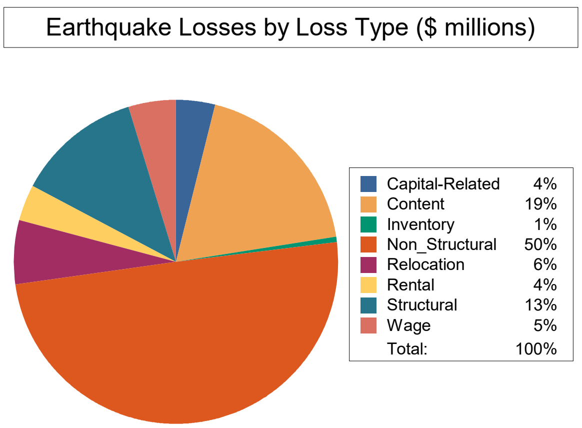
Building-Related Losses

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 10,176.10 (millions of dollars); 18 % 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 43 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.



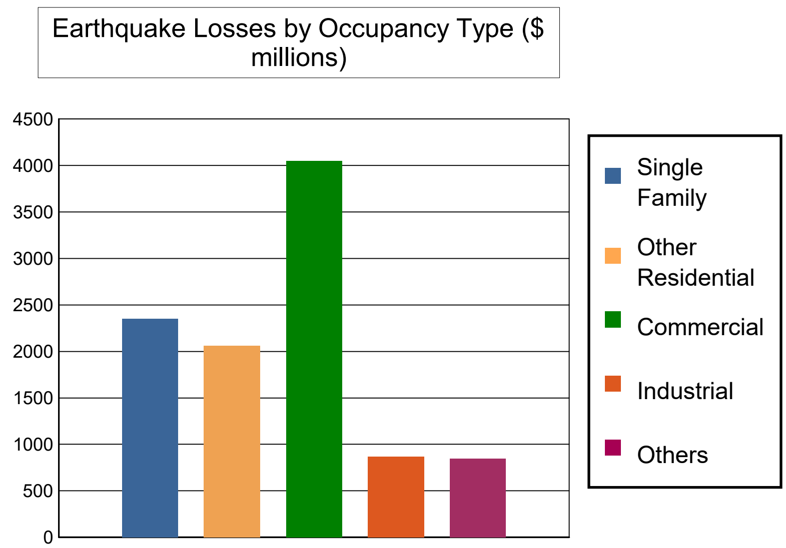


Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	41.15	397.10	15.81	24.12	478.19
	Capital-Related	0.00	17.56	348.14	9.42	6.89	382.01
	Rental	63.36	127.41	146.64	5.35	14.18	356.94
	Relocation	225.79	81.34	230.66	22.35	101.03	661.17
	Subtotal	**289.15**	**267.47**	**1,122.54**	**52.94**	**146.22**	**1,878.32**
Capital Stock Losses							
	Structural	302.28	256.91	499.44	107.72	115.74	1,282.08
	Non_Structural	1,352.61	1,257.32	1,642.37	403.28	393.32	5,048.90
	Content	407.82	278.82	766.41	258.25	189.48	1,900.79
	Inventory	0.00	0.00	16.84	46.97	2.20	66.01
	Subtotal	**2,062.71**	**1,793.04**	**2,925.07**	**816.22**	**700.74**	**8,297.78**
	Total	**2,351.86**	**2,060.51**	**4,047.61**	**869.16**	**846.96**	**10,176.10**

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.

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

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	1,610.29	$0.00	0.00
	Bridges	1,926.05	$329.24	17.09
	Tunnels	0.00	$0.00	0.00
	Subtotal	**3,536**	**329.20**	
Railways	Segments	145.03	$0.00	0.00
	Bridges	0.00	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	15.98	$4.90	30.66
	Subtotal	**161**	**4.90**	
Light Rail	Segments	0.00	$0.00	0.00
	Bridges	0.00	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**0**	**0.00**	
Bus	Facilities	2.46	$1.10	44.49
	Subtotal	**2**	**1.10**	
Ferry	Facilities	0.00	$0.00	0.00
	Subtotal	**0**	**0.00**	
Port	Facilities	0.00	$0.00	0.00
	Subtotal	**0**	**0.00**	
Airport	Facilities	21.30	$6.53	30.66
	Runways	113.89	$0.00	0.00
	Subtotal	**135**	**6.50**	
	Total	**3,835.00**	**341.80**	

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	112.90	$25.05	22.19
	Distribution Lines	219.30	$20.03	9.13
	Subtotal	**332.21**	**$45.08**	
Waste Water	Pipelines	0.00	$0.00	0.00
	Facilities	301.00	$99.40	33.02
	Distribution Lines	131.60	$14.36	10.91
	Subtotal	**432.62**	**$113.76**	
Natural Gas	Pipelines	0.00	$0.00	0.00
	Facilities	2.50	$1.07	43.38
	Distribution Lines	87.70	$4.12	4.69
	Subtotal	**90.19**	**$5.19**	
Oil Systems	Pipelines	0.00	$0.00	0.00
	Facilities	0.10	$0.02	20.88
	Subtotal	**0.11**	**$0.02**	
Electrical Power	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**$0.00**	
Communication	Facilities	3.20	$0.79	25.00
	Subtotal	**3.16**	**$0.79**	
	Total	**858.30**	**$164.84**	

Appendix A: County Listing for the Region

Lane,OR

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Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Oregon					
	Lane	274,657	21,614	7,166	28,781
Total State		**274,657**	**21,614**	**7,166**	**28,781**
Total Region		**274,657**	**21,614**	**7,166**	**28,781**

Hazus-MH: Earthquake Global Risk Report

Region Name: Eugene_ACrustal3

Earthquake Scenario: Arbitary Eugene Fault M6.5

Print Date: May 02, 2018

Disclaimer:

This version of Hazus utilizes 2010 Census Data.

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

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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Table of Contents

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):

Oregon

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

The geographical size of the region is 545.41 square miles and contains 65 census tracts. There are over 113 thousand households in the region which has a total population of 274,657 people (2010 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 101 thousand buildings in the region with a total building replacement value (excluding contents) of 28,781 (millions of dollars). Approximately 91.00 % of the buildings (and 75.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 3,834 and 419 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 101 thousand buildings in the region which have an aggregate total replacement value of 28,781 (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 83% 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 3 hospitals in the region with a total bed capacity of 565 beds. There are 108 schools, 21 fire stations, 7 police stations and 2 emergency operation facilities. With respect to high potential loss facilities (HPL), there are 0 dams identified within the inventory. Of these, 0 of the dams are classified as 'high hazard'. The inventory also includes 86 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 4,253.00 (millions of dollars). This inventory includes over 326 kilometers of highways, 72 bridges, 21,931 kilometers of pipes.

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Table 1: Transportation System Lifeline Inventory

System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	72	1,926.00
	Segments	164	1,610.30
	Tunnels	0	0.00
		Subtotal	**3,536.30**
Railways	Bridges	0	0.00
	Facilities	6	16.00
	Segments	55	145.00
	Tunnels	0	0.00
		Subtotal	**161.00**
Light Rail	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
		Subtotal	**0.00**
Bus	Facilities	2	2.50
		Subtotal	**2.50**
Ferry	Facilities	0	0.00
		Subtotal	**0.00**
Port	Facilities	0	0.00
		Subtotal	**0.00**
Airport	Facilities	2	21.30
	Runways	3	113.90
		Subtotal	**135.20**
		Total	**3,835.00**

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Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	219.30
	Facilities	3	112.90
	Pipelines	0	0.00
		Subtotal	**332.20**
Waste Water	Distribution Lines	NA	131.60
	Facilities	4	301.00
	Pipelines	0	0.00
		Subtotal	**432.60**
Natural Gas	Distribution Lines	NA	87.70
	Facilities	2	2.50
	Pipelines	0	0.00
		Subtotal	**90.20**
Oil Systems	Facilities	1	0.10
	Pipelines	0	0.00
		Subtotal	**0.10**
Electrical Power	Facilities	0	0.00
		Subtotal	**0.00**
Communication	Facilities	28	3.20
		Subtotal	**3.20**
		Total	**858.30**

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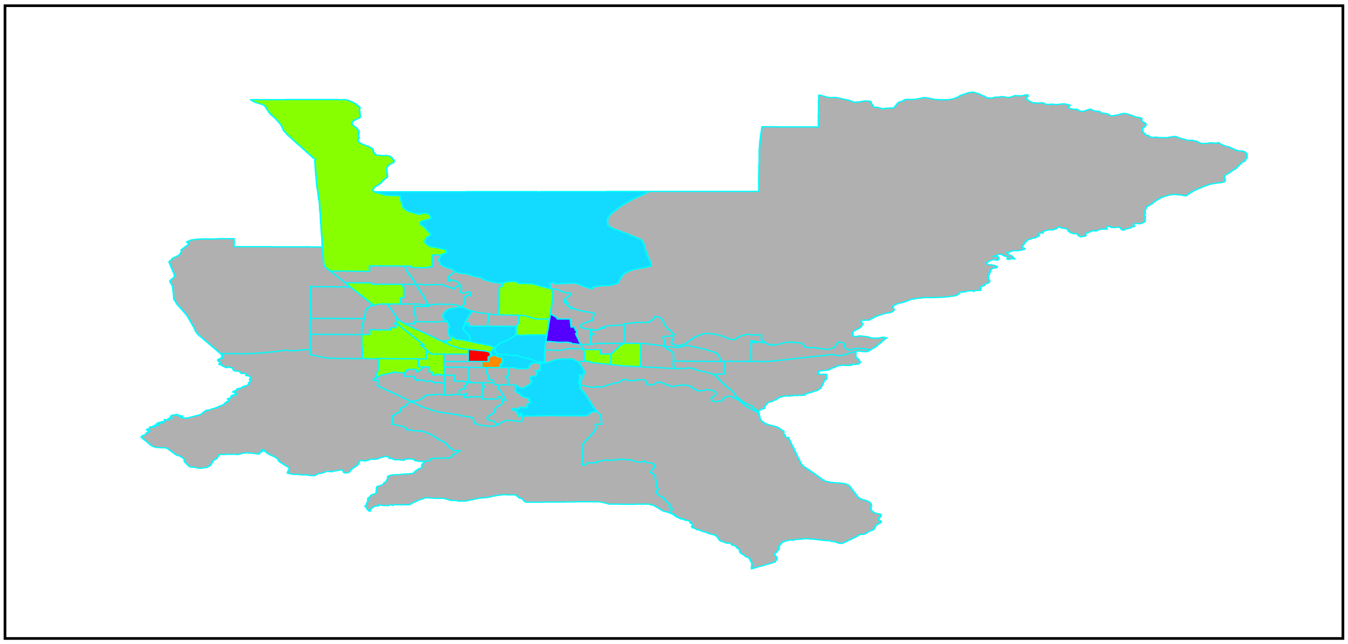
Earthquake Scenario

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



Scenario Name	Arbitary Eugene Fault M6.5
Type of Earthquake	Arbitrary
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	NA
Longitude of Epicenter	-123.05
Latitude of Epicenter	44.08
Earthquake Magnitude	6.50
Depth (km)	10.00
Rupture Length (Km)	17.18
Rupture Orientation (degrees)	165.00
Attenuation Function	Pacific Northwest (PNW 2008) - Reverse

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Building Damage

Building Damage

Hazus estimates that about 44,797 buildings will be at least moderately damaged. This is over 44.00 % of the buildings in the region. There are an estimated 7,792 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.

Damage categories by General Occupancy Type

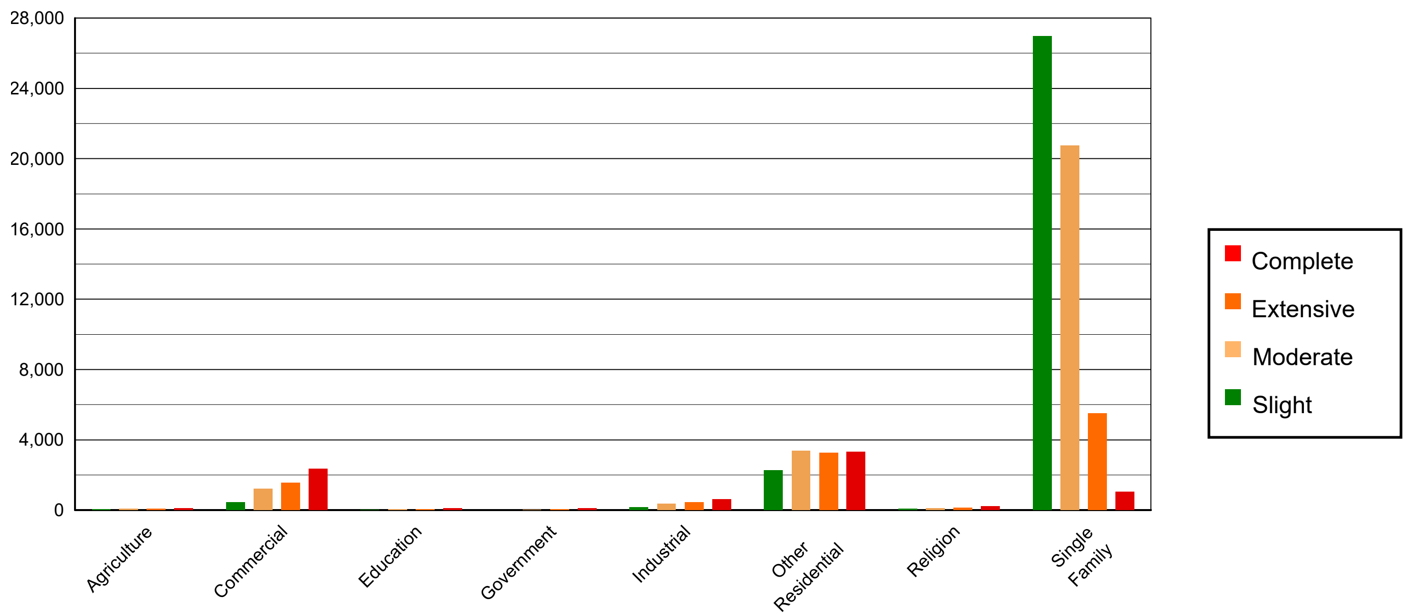

Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	67	0.25	65	0.22	77	0.30	68	0.61	96	1.23
Commercial	367	1.35	458	1.53	1,221	4.70	1,538	13.95	2,343	30.06
Education	28	0.10	30	0.10	48	0.18	55	0.50	85	1.10
Government	6	0.02	6	0.02	19	0.07	37	0.34	87	1.12
Industrial	155	0.57	147	0.49	373	1.44	452	4.10	627	8.04
Other Residential	1,666	6.15	2,265	7.55	3,383	13.02	3,250	29.47	3,298	42.33
Religion	62	0.23	73	0.24	114	0.44	126	1.14	195	2.50
Single Family	24,753	91.33	26,962	89.85	20,743	79.85	5,502	49.89	1,062	13.62
Total	**27,103**		**30,006**		**25,977**		**11,028**		**7,793**	

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

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	25,994	95.91	28614	95.36	22,336	85.99	6,064	54.99	1,174	15.07
Steel	118	0.43	88	0.29	306	1.18	565	5.12	1,007	12.93
Concrete	113	0.42	121	0.40	355	1.37	516	4.67	777	9.97
Precast	105	0.39	81	0.27	276	1.06	442	4.00	747	9.58
RM	15	0.06	10	0.03	35	0.13	56	0.51	84	1.08
URM	225	0.83	313	1.04	675	2.60	790	7.16	1,390	17.84
MH	533	1.97	779	2.60	1,994	7.68	2,597	23.55	2,613	33.53
Total	**27,103**		**30,006**		**25,977**		**11,028**		**7,793**	

*Note:

RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 565 hospital beds available for use. On the day of the earthquake, the model estimates that only 4 hospital beds (1.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 4.00% of the beds will be back in service. By 30 days, 25.00% 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	3	3	1	0
Schools	108	19	0	13
EOCs	2	0	0	0
PoliceStations	7	2	0	1
FireStations	21	4	0	6

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Transportation Lifeline Damage

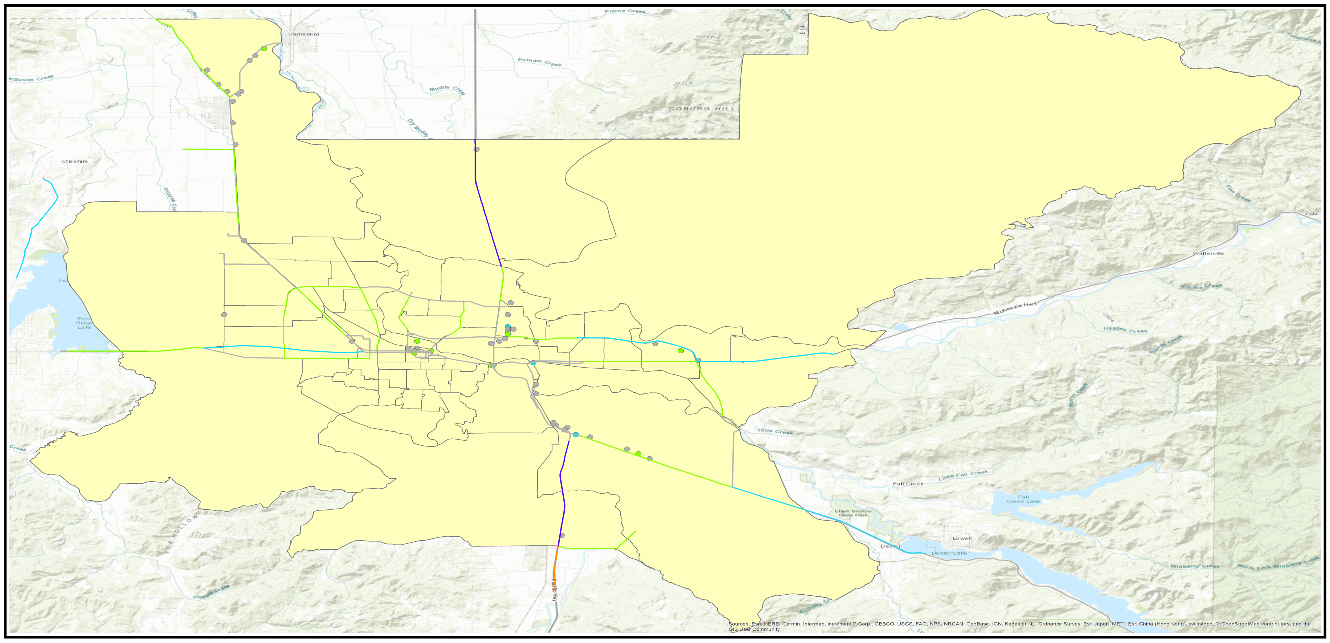

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Table 6: Expected Damage to the Transportation Systems

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	164	0	0	164	164
	Bridges	72	30	12	42	55
	Tunnels	0	0	0	0	0
Railways	Segments	55	0	0	55	55
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	6	1	0	5	6
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	2	1	0	1	2
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	2	1	0	2	2
	Runways	3	0	0	3	3

Table 6 provides damage estimates for the transportation system.

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.

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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	3	3	0	0	3
Waste Water	4	4	0	0	4
Natural Gas	2	2	0	0	2
Oil Systems	1	1	0	0	1
Electrical Power	0	0	0	0	0
Communication	28	27	0	19	28

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

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	10,966	4452	1113
Waste Water	6,580	3190	798
Natural Gas	4,386	915	229
Oil	0	0	0

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	113,685	56,418	53,910	48,550	10,995	0
Electric Power		58,225	35,900	14,762	2,888	81

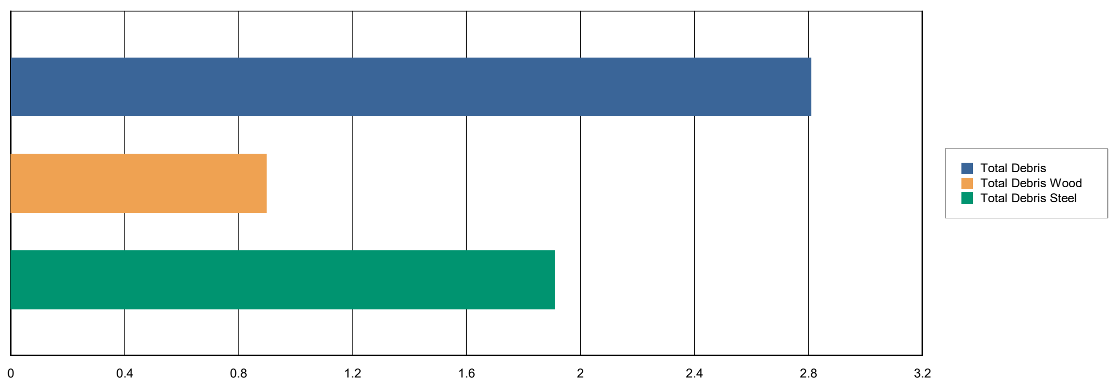
Induced Earthquake Damage

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 2.81 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 32.00% 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 112,360 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Earthquake Debris (millions of tons)



Brick/ Wood	Reinforced Concrete/Steel	Total Debris	Truck Load
0.90	1.91	2.81	112,360 (@25 tons/truck)

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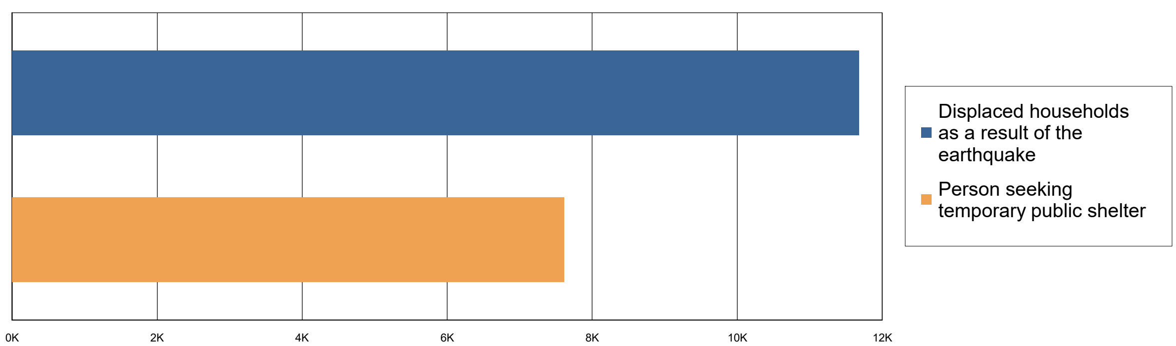
Social Impact

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 11,681 households to be displaced due to the earthquake. Of these, 7,615 people (out of a total population of 274,657) will seek temporary shelter in public shelters.

Displaced Households/ Persons Seeking Short Term Public Shelter



Displaced households as a result of the earthquake	Persons seeking temporary public shelter
11,681	7,615

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

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Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	69	22	4	7
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	85	27	4	9
	Other-Residential	1,328	378	52	101
	Single Family	516	92	8	14
	Total	**1,997**	**519**	**68**	**131**
2 PM	Commercial	3,985	1,255	210	413
	Commuting	1	1	2	0
	Educational	1,881	603	103	201
	Hotels	0	0	0	0
	Industrial	628	197	33	64
	Other-Residential	276	79	11	21
	Single Family	108	20	2	3
	Total	**6,879**	**2,155**	**361**	**702**
5 PM	Commercial	2,840	894	150	292
	Commuting	17	21	38	7
	Educational	500	161	28	54
	Hotels	0	0	0	0
	Industrial	393	123	20	40
	Other-Residential	509	146	21	39
	Single Family	204	37	3	6
	Total	**4,463**	**1,383**	**261**	**437**

Economic Loss

The total economic loss estimated for the earthquake is 10,702.80 (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.

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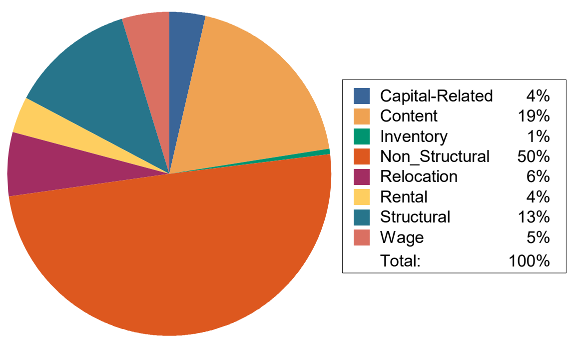
Building-Related Losses

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 10,193.42 (millions of dollars); 18 % 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 43 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Earthquake Losses by Loss Type ($ millions)



Earthquake Losses by Occupancy Type ($ millions)

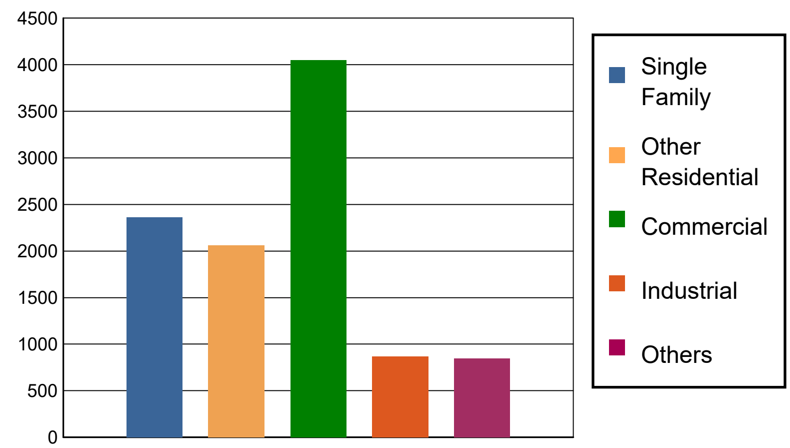


Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	41.19	397.19	15.82	24.15	478.35
	Capital-Related	0.00	17.58	348.24	9.42	6.90	382.14
	Rental	63.72	127.47	146.70	5.35	14.20	357.43
	Relocation	226.94	81.37	230.73	22.36	101.13	662.55
	Subtotal	**290.66**	**267.61**	**1,122.86**	**52.96**	**146.37**	**1,880.46**
Capital Stock Losses							
	Structural	304.60	257.00	499.68	107.78	115.83	1,284.89
	Non_Structural	1,359.00	1,257.78	1,643.35	403.86	393.84	5,057.83
	Content	409.47	278.96	767.06	258.74	189.87	1,904.11
	Inventory	0.00	0.00	16.87	47.07	2.20	66.14
	Subtotal	**2,073.07**	**1,793.74**	**2,926.96**	**817.46**	**701.74**	**8,312.96**
	Total	**2,363.73**	**2,061.34**	**4,049.81**	**870.42**	**848.11**	**10,193.42**

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.

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

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	1,610.29	$2.72	0.17
	Bridges	1,926.05	$329.24	17.09
	Tunnels	0.00	$0.00	0.00
	Subtotal	**3,536**	**332.00**	
Railways	Segments	145.03	$0.05	0.03
	Bridges	0.00	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	15.98	$4.90	30.66
	Subtotal	**161**	**4.90**	
Light Rail	Segments	0.00	$0.00	0.00
	Bridges	0.00	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**0**	**0.00**	
Bus	Facilities	2.46	$1.10	44.49
	Subtotal	**2**	**1.10**	
Ferry	Facilities	0.00	$0.00	0.00
	Subtotal	**0**	**0.00**	
Port	Facilities	0.00	$0.00	0.00
	Subtotal	**0**	**0.00**	
Airport	Facilities	21.30	$6.53	30.66
	Runways	113.89	$0.00	0.00
	Subtotal	**135**	**6.50**	
	Total	**3,835.00**	**344.50**	

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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	112.90	$25.05	22.19
	Distribution Lines	219.30	$20.03	9.13
	Subtotal	**332.21**	**$45.08**	
Waste Water	Pipelines	0.00	$0.00	0.00
	Facilities	301.00	$99.40	33.02
	Distribution Lines	131.60	$14.36	10.91
	Subtotal	**432.62**	**$113.76**	
Natural Gas	Pipelines	0.00	$0.00	0.00
	Facilities	2.50	$1.07	43.38
	Distribution Lines	87.70	$4.12	4.69
	Subtotal	**90.19**	**$5.19**	
Oil Systems	Pipelines	0.00	$0.00	0.00
	Facilities	0.10	$0.02	20.88
	Subtotal	**0.11**	**$0.02**	
Electrical Power	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**$0.00**	
Communication	Facilities	3.20	$0.79	25.00
	Subtotal	**3.16**	**$0.79**	
	Total	**858.30**	**$164.84**	

Appendix A: County Listing for the Region

Lane,OR

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Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Oregon					
	Lane	274,657	21,614	7,166	28,781
Total State		**274,657**	**21,614**	**7,166**	**28,781**
Total Region		**274,657**	**21,614**	**7,166**	**28,781**

Hazus-MH: Earthquake Global Risk Report

Region Name: Eugene_ACrustal4

Earthquake Scenario: Arbitary Eugene Fault M6.5

Print Date: May 02, 2018

Disclaimer:

This version of Hazus utilizes 2010 Census Data.

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

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.

Table of Contents

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):

Oregon

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

The geographical size of the region is 545.41 square miles and contains 65 census tracts. There are over 113 thousand households in the region which has a total population of 274,657 people (2010 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 101 thousand buildings in the region with a total building replacement value (excluding contents) of 28,781 (millions of dollars). Approximately 91.00 % of the buildings (and 75.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 3,834 and 419 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 101 thousand buildings in the region which have an aggregate total replacement value of 28,781 (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 83% 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 3 hospitals in the region with a total bed capacity of 565 beds. There are 108 schools, 21 fire stations, 7 police stations and 2 emergency operation facilities. With respect to high potential loss facilities (HPL), there are 0 dams identified within the inventory. Of these, 0 of the dams are classified as 'high hazard'. The inventory also includes 86 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 4,253.00 (millions of dollars). This inventory includes over 326 kilometers of highways, 72 bridges, 21,931 kilometers of pipes.

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Table 1: Transportation System Lifeline Inventory

System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	72	1,926.00
	Segments	164	1,610.30
	Tunnels	0	0.00
		Subtotal	**3,536.30**
Railways	Bridges	0	0.00
	Facilities	6	16.00
	Segments	55	145.00
	Tunnels	0	0.00
		Subtotal	**161.00**
Light Rail	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
		Subtotal	**0.00**
Bus	Facilities	2	2.50
		Subtotal	**2.50**
Ferry	Facilities	0	0.00
		Subtotal	**0.00**
Port	Facilities	0	0.00
		Subtotal	**0.00**
Airport	Facilities	2	21.30
	Runways	3	113.90
		Subtotal	**135.20**
		Total	**3,835.00**

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	219.30
	Facilities	3	112.90
	Pipelines	0	0.00
		Subtotal	**332.20**
Waste Water	Distribution Lines	NA	131.60
	Facilities	4	301.00
	Pipelines	0	0.00
		Subtotal	**432.60**
Natural Gas	Distribution Lines	NA	87.70
	Facilities	2	2.50
	Pipelines	0	0.00
		Subtotal	**90.20**
Oil Systems	Facilities	1	0.10
	Pipelines	0	0.00
		Subtotal	**0.10**
Electrical Power	Facilities	0	0.00
		Subtotal	**0.00**
Communication	Facilities	28	3.20
		Subtotal	**3.20**
		Total	**858.30**

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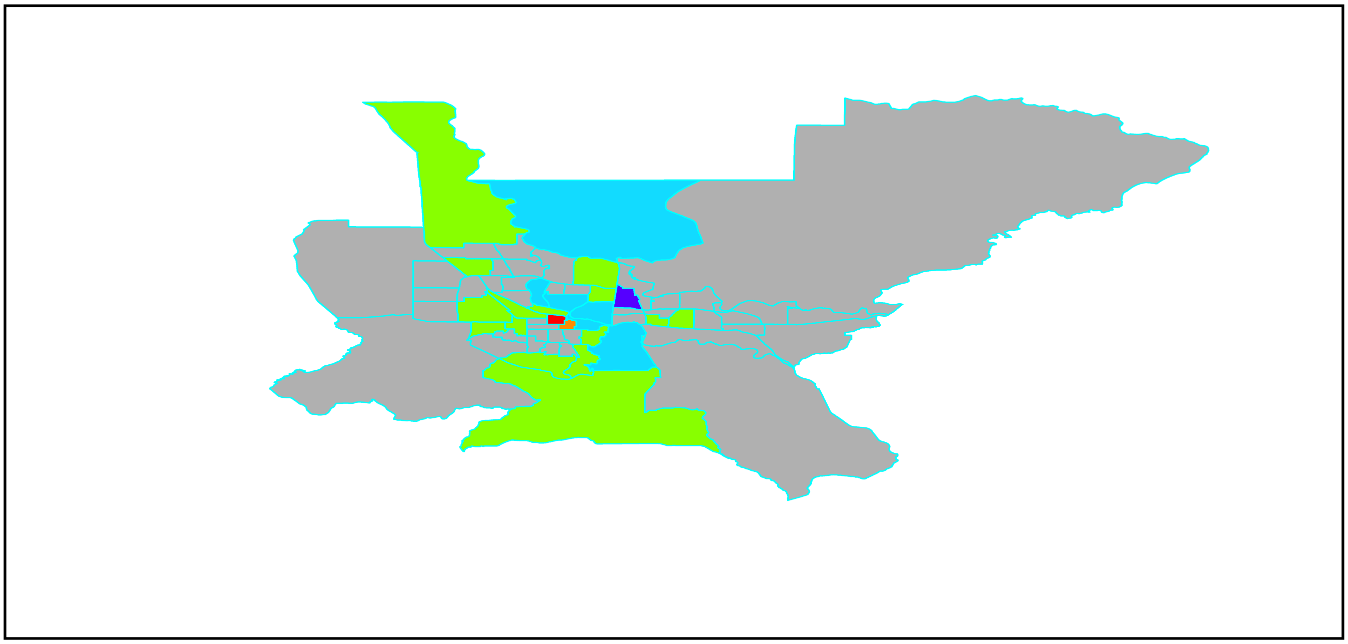
Earthquake Scenario

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



Scenario Name	Arbitary Eugene Fault M6.5
Type of Earthquake	Arbitrary
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	NA
Longitude of Epicenter	-123.05
Latitude of Epicenter	44.08
Earthquake Magnitude	6.50
Depth (km)	10.00
Rupture Length (Km)	17.18
Rupture Orientation (degrees)	165.00
Attenuation Function	Pacific Northwest (PNW 2008) - Reverse

Building Damage

Building Damage

Hazus estimates that about 46,543 buildings will be at least moderately damaged. This is over 46.00 % of the buildings in the region. There are an estimated 8,296 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.

Damage categories by General Occupancy Type

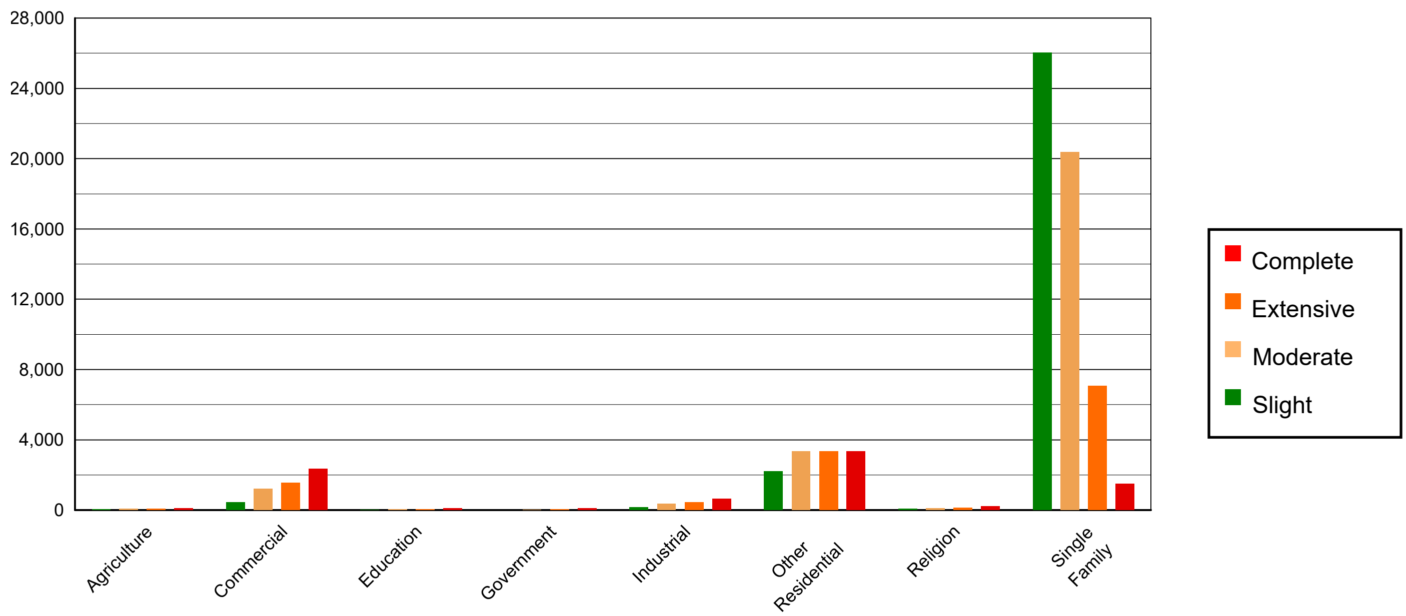


Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	66	0.25	63	0.22	75	0.30	71	0.56	97	1.17
Commercial	360	1.37	446	1.54	1,194	4.68	1,568	12.32	2,359	28.43
Education	27	0.10	29	0.10	46	0.18	57	0.45	86	1.04
Government	6	0.02	6	0.02	19	0.07	37	0.29	88	1.06
Industrial	153	0.58	144	0.50	366	1.43	460	3.61	631	7.61
Other Residential	1,637	6.21	2,218	7.64	3,331	13.05	3,337	26.21	3,340	40.25
Religion	61	0.23	72	0.25	112	0.44	129	1.02	196	2.37
Single Family	24,044	91.24	26,033	89.74	20,373	79.84	7,072	55.55	1,499	18.07
Total	**26,353**		**29,009**		**25,516**		**12,731**		**8,297**	

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

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	25,257	95.84	27644	95.29	21,943	86.00	7,706	60.53	1,633	19.68
Steel	116	0.44	87	0.30	299	1.17	570	4.48	1,012	12.20
Concrete	111	0.42	118	0.41	347	1.36	523	4.11	782	9.43
Precast	104	0.39	79	0.27	270	1.06	446	3.51	751	9.05
RM	15	0.06	9	0.03	34	0.13	57	0.45	85	1.02
URM	220	0.84	304	1.05	660	2.59	808	6.35	1,400	16.87
MH	531	2.01	768	2.65	1,962	7.69	2,621	20.58	2,634	31.75
Total	**26,353**		**29,009**		**25,516**		**12,731**		**8,297**	

*Note:

RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 565 hospital beds available for use. On the day of the earthquake, the model estimates that only 3 hospital beds (1.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 4.00% of the beds will be back in service. By 30 days, 23.00% will be operational.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	**Total**	**At Least Moderate Damage > 50%**	**Complete Damage > 50%**	**With Functionality > 50% on day 1**
Hospitals	3	3	2	0
Schools	108	24	0	13
EOCs	2	0	0	0
PoliceStations	7	2	0	1
FireStations	21	5	0	5

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Transportation Lifeline Damage

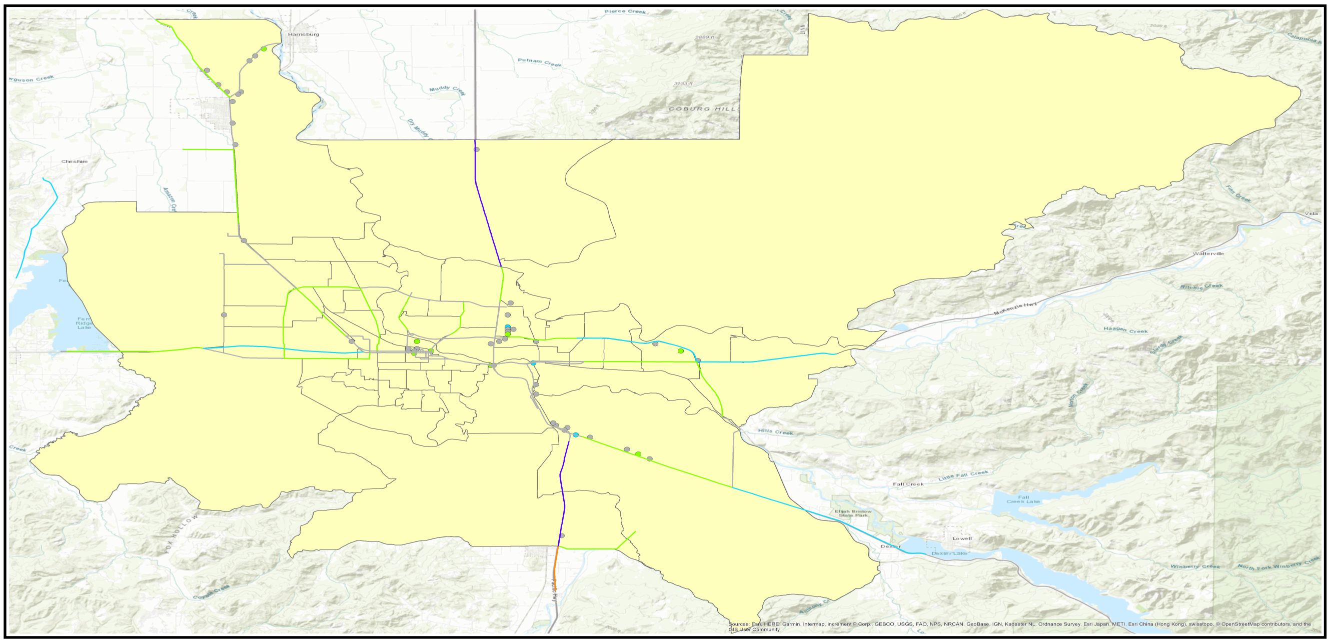

Table 6: Expected Damage to the Transportation Systems

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	164	0	0	164	164
	Bridges	72	30	12	42	55
	Tunnels	0	0	0	0	0
Railways	Segments	55	0	0	55	55
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	6	1	0	5	6
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	2	1	0	1	2
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	2	1	0	2	2
	Runways	3	0	0	3	3

Table 6 provides damage estimates for the transportation system.

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.

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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	3	3	0	0	3
Waste Water	4	4	0	0	4
Natural Gas	2	2	0	0	2
Oil Systems	1	1	0	0	1
Electrical Power	0	0	0	0	0
Communication	28	27	0	19	28

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

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	10,966	4452	1113
Waste Water	6,580	3190	798
Natural Gas	4,386	915	229
Oil	0	0	0

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	113,685	56,418	53,910	48,550	10,995	0
Electric Power		58,319	36,084	15,052	3,065	81

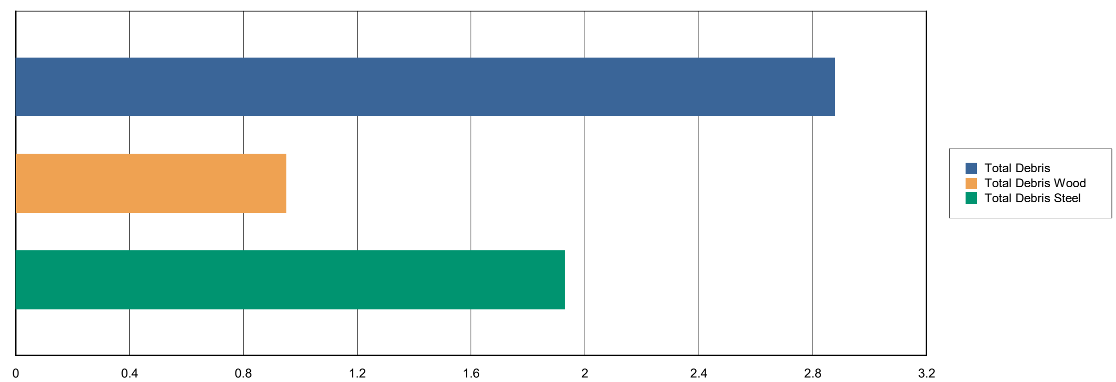
Induced Earthquake Damage

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 2.88 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 33.00% 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 115,160 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Earthquake Debris (millions of tons)



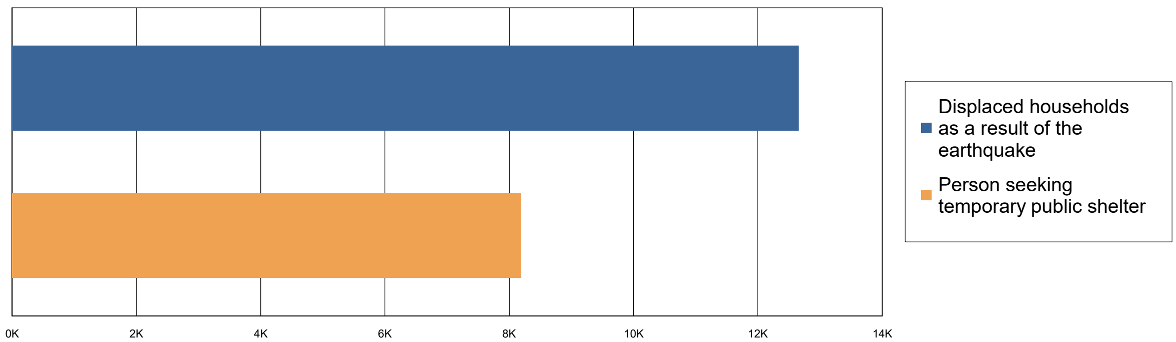
Brick/ Wood	Reinforced Concrete/Steel	Total Debris	Truck Load
0.95	1.93	2.88	115,160 (@25 tons/truck)

Social Impact

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 12,653 households to be displaced due to the earthquake. Of these, 8,184 people (out of a total population of 274,657) will seek temporary shelter in public shelters.

Displaced Households/ Persons Seeking Short Term Public Shelter



Displaced households as a result of the earthquake	Persons seeking temporary public shelter
12,653	8,184

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

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Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	69	22	4	7
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	86	27	4	9
	Other-Residential	1,345	382	53	102
	Single Family	615	113	9	16
	Total	**2,116**	**544**	**69**	**133**
2 PM	Commercial	4,025	1,266	212	416
	Commuting	1	1	2	0
	Educational	1,898	608	104	202
	Hotels	0	0	0	0
	Industrial	633	198	33	64
	Other-Residential	279	80	11	21
	Single Family	129	24	2	3
	Total	**6,965**	**2,177**	**364**	**707**
5 PM	Commercial	2,869	902	152	294
	Commuting	17	21	38	7
	Educational	503	162	28	54
	Hotels	0	0	0	0
	Industrial	395	124	20	40
	Other-Residential	516	148	21	39
	Single Family	244	45	4	6
	Total	**4,545**	**1,403**	**263**	**441**

Economic Loss

The total economic loss estimated for the earthquake is 11,139.75 (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.

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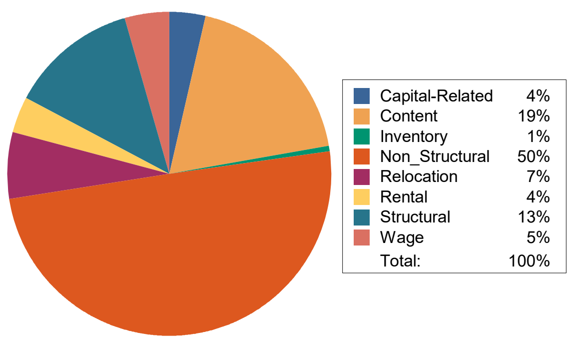
Building-Related Losses

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 10,630.58 (millions of dollars); 18 % 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 45 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Earthquake Losses by Loss Type ($ millions)



Earthquake Losses by Occupancy Type ($ millions)

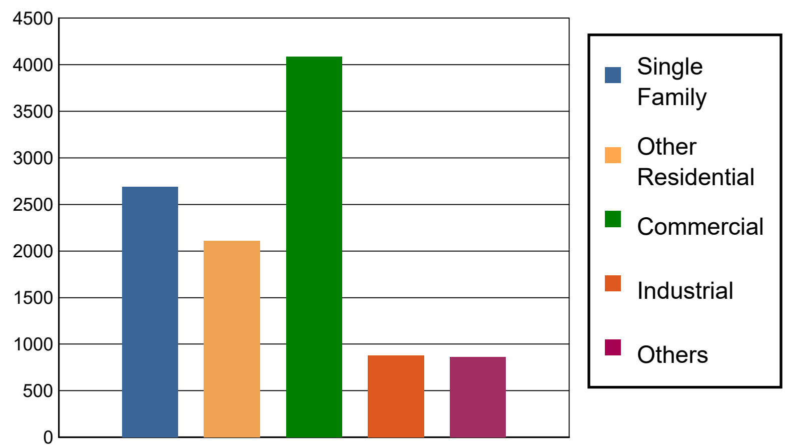


Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	42.39	399.46	15.89	24.38	482.13
	Capital-Related	0.00	18.09	350.45	9.47	6.99	385.00
	Rental	74.11	130.97	147.73	5.37	14.32	372.50
	Relocation	260.89	83.21	232.20	22.45	102.28	701.03
	Subtotal	**335.00**	**274.66**	**1,129.83**	**53.18**	**147.97**	**1,940.65**
Capital Stock Losses							
	Structural	367.69	262.73	503.16	108.28	117.16	1,359.02
	Non_Structural	1,535.26	1,286.91	1,659.96	407.38	399.70	5,289.21
	Content	454.85	286.55	778.05	261.52	193.84	1,974.81
	Inventory	0.00	0.00	17.08	47.56	2.24	66.89
	Subtotal	**2,357.80**	**1,836.20**	**2,958.27**	**824.75**	**712.93**	**8,689.93**
	Total	**2,692.80**	**2,110.86**	**4,088.10**	**877.93**	**860.90**	**10,630.58**

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.

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

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	1,610.29	$2.49	0.15
	Bridges	1,926.05	$329.24	17.09
	Tunnels	0.00	$0.00	0.00
	Subtotal	**3,536**	**331.70**	
Railways	Segments	145.03	$0.01	0.01
	Bridges	0.00	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	15.98	$4.90	30.67
	Subtotal	**161**	**4.90**	
Light Rail	Segments	0.00	$0.00	0.00
	Bridges	0.00	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**0**	**0.00**	
Bus	Facilities	2.46	$1.10	44.56
	Subtotal	**2**	**1.10**	
Ferry	Facilities	0.00	$0.00	0.00
	Subtotal	**0**	**0.00**	
Port	Facilities	0.00	$0.00	0.00
	Subtotal	**0**	**0.00**	
Airport	Facilities	21.30	$6.53	30.66
	Runways	113.89	$0.00	0.00
	Subtotal	**135**	**6.50**	
	Total	**3,835.00**	**344.30**	

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	112.90	$25.05	22.19
	Distribution Lines	219.30	$20.03	9.13
	Subtotal	**332.21**	**$45.08**	
Waste Water	Pipelines	0.00	$0.00	0.00
	Facilities	301.00	$99.45	33.04
	Distribution Lines	131.60	$14.36	10.91
	Subtotal	**432.62**	**$113.81**	
Natural Gas	Pipelines	0.00	$0.00	0.00
	Facilities	2.50	$1.07	43.51
	Distribution Lines	87.70	$4.12	4.69
	Subtotal	**90.19**	**$5.19**	
Oil Systems	Pipelines	0.00	$0.00	0.00
	Facilities	0.10	$0.02	20.88
	Subtotal	**0.11**	**$0.02**	
Electrical Power	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**$0.00**	
Communication	Facilities	3.20	$0.80	25.38
	Subtotal	**3.16**	**$0.80**	
	Total	**858.30**	**$164.91**	

Appendix A: County Listing for the Region

Lane,OR

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Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Oregon					
	Lane	274,657	21,614	7,166	28,781
Total State		**274,657**	**21,614**	**7,166**	**28,781**
Total Region		**274,657**	**21,614**	**7,166**	**28,781**

RiskMAP
Increasing Resilience Together

Hazus-MH: Earthquake Global Risk Report

Region Name: Lane_CSZ

Earthquake Scenario: Lane_EugeneRegion_CSZ_M9

Print Date: May 08, 2018

Disclaimer:
This version of Hazus utilizes 2010 Census Data.
Totals only reflect data for those census tracts/blocks included in the user's study region.

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):

Oregon

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

The geographical size of the region is 4,618.08 square miles and contains 86 census tracts. There are over 145 thousand households in the region which has a total population of 351,715 people (2010 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 138 thousand buildings in the region with a total building replacement value (excluding contents) of 35,999 (millions of dollars). Approximately 92.00 % of the buildings (and 76.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 6,841 and 1,941 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 138 thousand buildings in the region which have an aggregate total replacement value of 35,999 (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 81% 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 4 hospitals in the region with a total bed capacity of 586 beds. There are 157 schools, 50 fire stations, 11 police stations and 2 emergency operation facilities. With respect to high potential loss facilities (HPL), there are 0 dams identified within the inventory. Of these, 0 of the dams are classified as 'high hazard'. The inventory also includes 91 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 8,782.00 (millions of dollars). This inventory includes over 644 kilometers of highways, 199 bridges, 28,459 kilometers of pipes.

Table 1: Transportation System Lifeline Inventory

System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	199	3,407.20
	Segments	198	2,776.60
	Tunnels	2	10.40
		Subtotal	**6,194.20**
Railways	Bridges	0	0.00
	Facilities	6	16.00
	Segments	143	384.70
	Tunnels	0	0.00
		Subtotal	**400.70**
Light Rail	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
		Subtotal	**0.00**
Bus	Facilities	3	3.70
		Subtotal	**3.70**
Ferry	Facilities	0	0.00
		Subtotal	**0.00**
Port	Facilities	5	10.00
		Subtotal	**10.00**
Airport	Facilities	4	42.60
	Runways	5	189.80
		Subtotal	**232.40**
		Total	**6,841.00**

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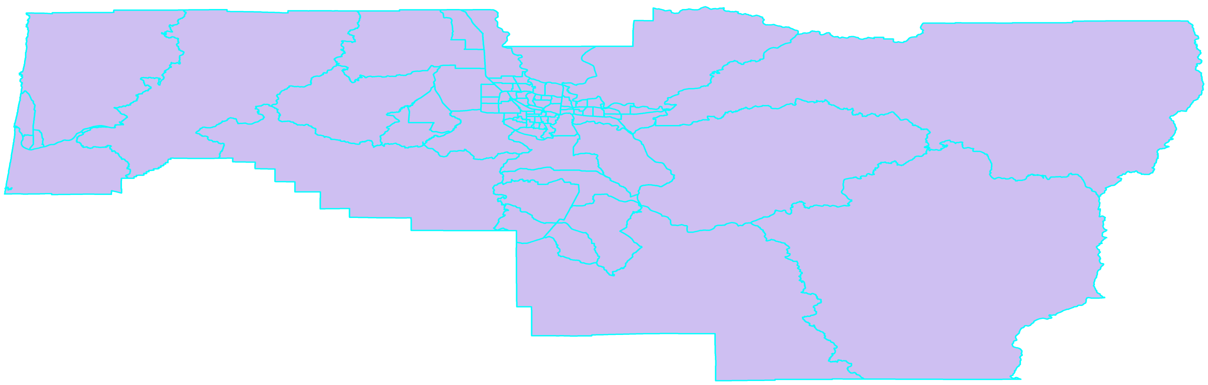
Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	284.60
	Facilities	7	263.40
	Pipelines	0	0.00
		Subtotal	**548.00**
Waste Water	Distribution Lines	NA	170.80
	Facilities	13	978.40
	Pipelines	0	0.00
		Subtotal	**1,149.10**
Natural Gas	Distribution Lines	NA	113.80
	Facilities	2	2.50
	Pipelines	0	0.00
		Subtotal	**116.30**
Oil Systems	Facilities	1	0.10
	Pipelines	0	0.00
		Subtotal	**0.10**
Electrical Power	Facilities	1	124.30
		Subtotal	**124.30**
Communication	Facilities	37	4.20
		Subtotal	**4.20**
		Total	**1,942.00**

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	Lane_EugeneRegion_CSZ_M9
Type of Earthquake	User-defined
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	NA
Longitude of Epicenter	NA
Latitude of Epicenter	NA
Earthquake Magnitude	9.00
Depth (km)	NA
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	NA

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Building Damage

Building Damage

Hazus estimates that about 23,757 buildings will be at least moderately damaged. This is over 17.00 % of the buildings in the region. There are an estimated 4,949 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.

Damage categories by General Occupancy Type

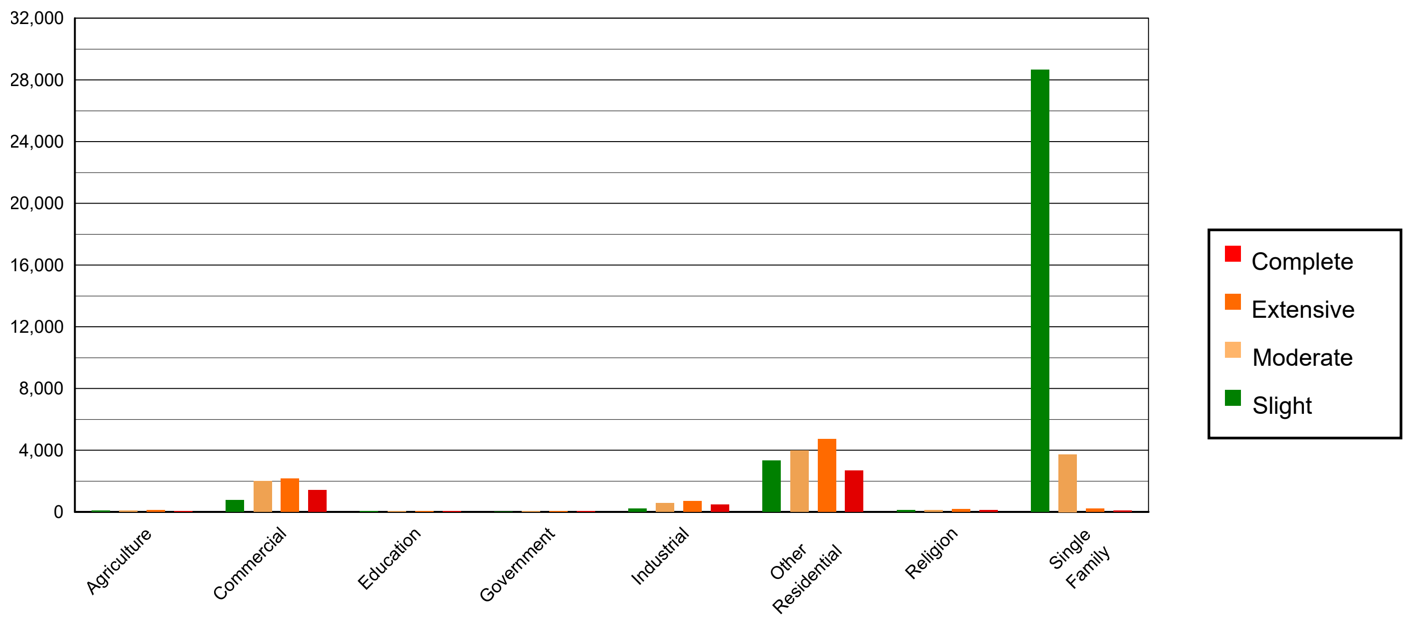

Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	237	0.29	89	0.27	80	0.76	103	1.26	69	1.40
Commercial	1,166	1.43	759	2.29	2,002	18.93	2,165	26.29	1,411	28.51
Education	90	0.11	40	0.12	56	0.53	76	0.92	55	1.11
Government	47	0.06	14	0.04	34	0.32	58	0.71	60	1.21
Industrial	428	0.52	202	0.61	563	5.33	712	8.65	456	9.21
Other Residential	6,338	7.76	3,338	10.05	3,967	37.52	4,737	57.53	2,685	54.24
Religion	211	0.26	99	0.30	131	1.24	180	2.19	124	2.50
Single Family	73,172	89.57	28,675	86.33	3,740	35.37	202	2.46	90	1.82
Total	**81,688**		**33,218**		**10,574**		**8,234**		**4,949**	

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

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	76,341	93.45	30417	91.57	4,592	43.43	450	5.47	72	1.46
Steel	351	0.43	97	0.29	399	3.78	947	11.50	875	17.68
Concrete	314	0.38	127	0.38	557	5.27	857	10.41	496	10.02
Precast	315	0.39	75	0.22	362	3.42	793	9.63	596	12.05
RM	39	0.05	9	0.03	55	0.52	101	1.23	48	0.98
URM	934	1.14	801	2.41	1,224	11.57	830	10.08	539	10.89
MH	3,393	4.15	1692	5.09	3,385	32.02	4,255	51.67	2,322	46.92
Total	**81,688**		**33,218**		**10,574**		**8,234**		**4,949**	

*Note:

RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 586 hospital beds available for use. On the day of the earthquake, the model estimates that only 138 hospital beds (24.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 30.00% of the beds will be back in service. By 30 days, 62.00% 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	4	3	0	1
Schools	157	0	0	111
EOCs	2	0	0	1
PoliceStations	11	0	0	6
FireStations	50	0	0	40

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Transportation Lifeline Damage

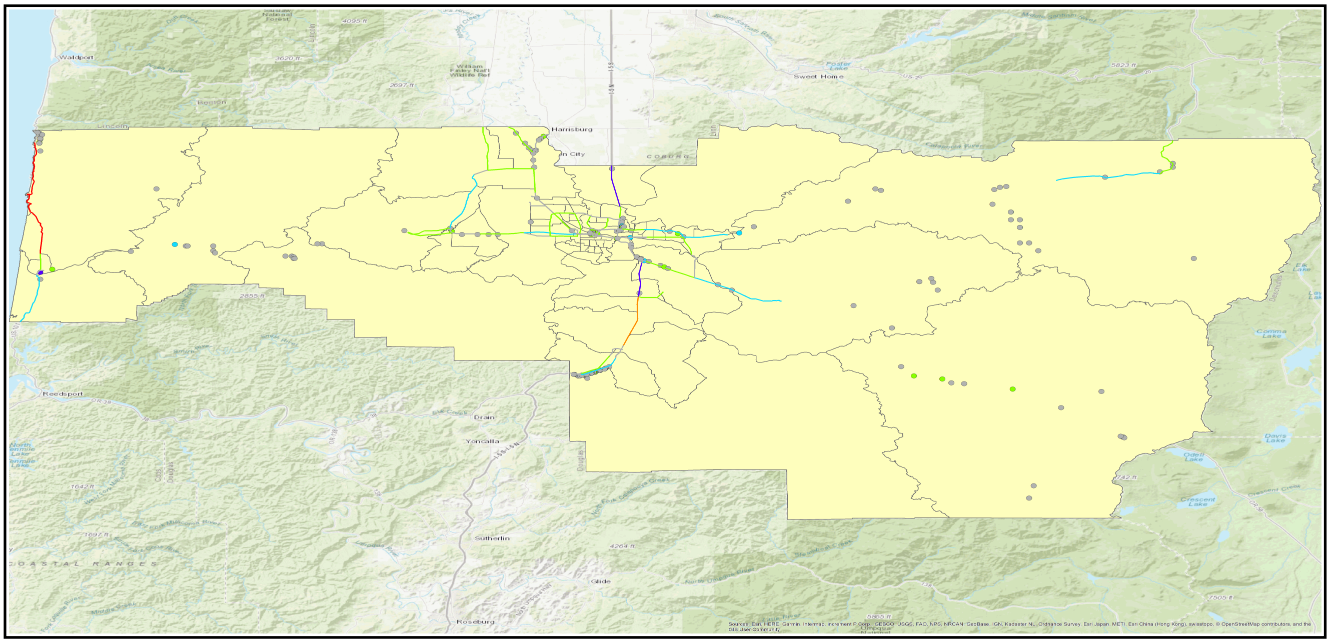

Table 6: Expected Damage to the Transportation Systems

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	198	0	0	198	198
	Bridges	199	18	0	181	189
	Tunnels	2	0	0	2	2
Railways	Segments	143	0	0	143	143
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	6	0	0	6	6
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	3	0	0	3	3
Ferry	Facilities	0	0	0	0	0
Port	Facilities	5	0	0	5	5
Airport	Facilities	4	0	0	4	4
	Runways	5	0	0	5	5

Table 6 provides damage estimates for the transportation system.

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.

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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	with Functionality > 50 % After Day 7
Potable Water	7	0	0	7	7
Waste Water	13	3	0	6	13
Natural Gas	2	0	0	2	2
Oil Systems	1	0	0	1	1
Electrical Power	1	0	0	0	1
Communication	37	6	0	37	37

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

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	14,230	1957	489
Waste Water	8,538	1403	351
Natural Gas	5,692	402	101
Oil	0	0	0

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	145,966	13,704	10,710	5,532	0	0
Electric Power		0	0	0	0	0

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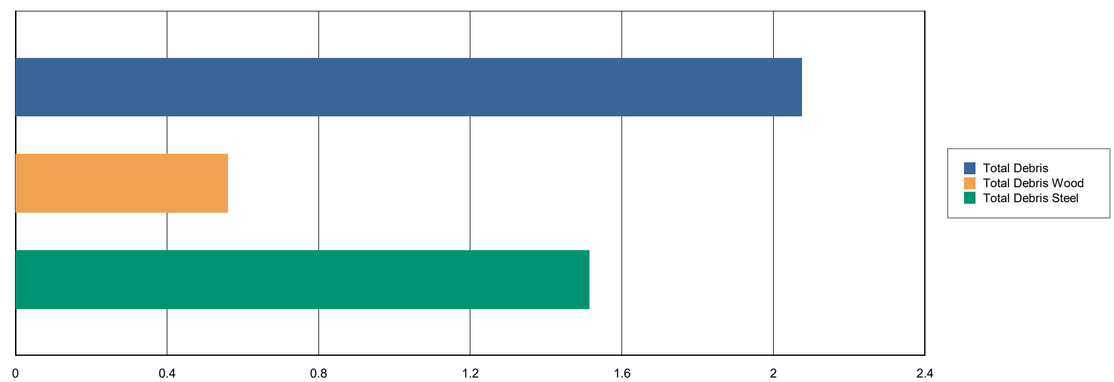
Induced Earthquake Damage

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 2.08 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 27.00% 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 83,000 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Earthquake Debris (millions of tons)



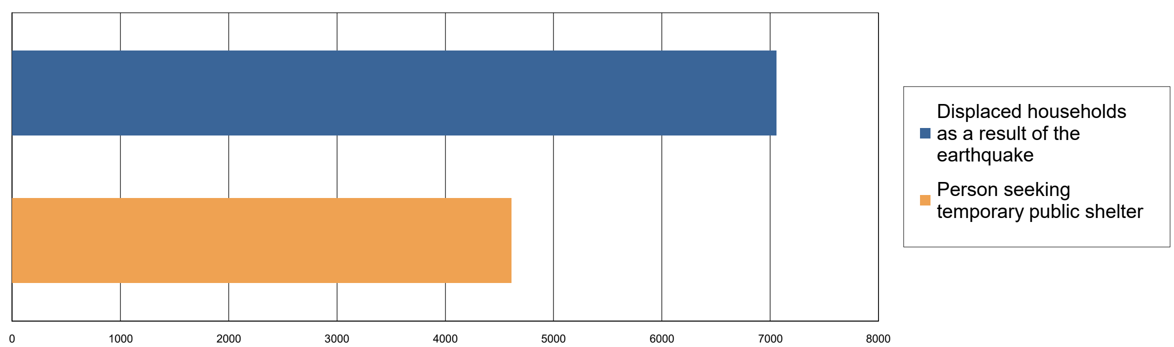
Brick/ Wood	Reinforced Concrete/Steel	Total Debris	Truck Load
0.56	1.51	2.08	83,000 (@25 tons/truck)

Social Impact

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 7,060 households to be displaced due to the earthquake. Of these, 4,606 people (out of a total population of 351,715) will seek temporary shelter in public shelters.

Displaced Households/ Persons Seeking Short Term Public Shelter



Displaced households as a result of the earthquake	Persons seeking temporary public shelter
7,060	4,606

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

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Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	44	13	2	4
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	69	20	3	6
	Other-Residential	866	226	28	54
	Single Family	106	16	2	4
	Total	**1,085**	**276**	**36**	**68**
2 PM	Commercial	2,544	754	125	245
	Commuting	0	0	1	0
	Educational	1,226	369	62	120
	Hotels	0	0	0	0
	Industrial	506	150	24	47
	Other-Residential	172	45	6	10
	Single Family	21	3	0	1
	Total	**4,471**	**1,321**	**217**	**424**
5 PM	Commercial	1,813	536	89	173
	Commuting	6	7	14	3
	Educational	307	93	16	31
	Hotels	0	0	0	0
	Industrial	317	94	15	29
	Other-Residential	325	86	11	20
	Single Family	41	7	1	2
	Total	**2,809**	**823**	**145**	**257**

Economic Loss

The total economic loss estimated for the earthquake is 6,421.04 (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.

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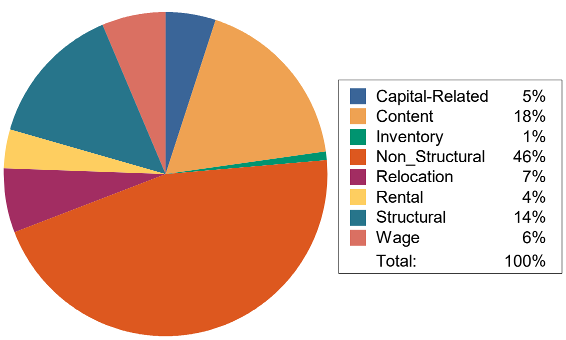
Building-Related Losses

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 6,124.66 (millions of dollars); 22 % 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 30 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Earthquake Losses by Loss Type ($ millions)



Earthquake Losses by Occupancy Type ($ millions)

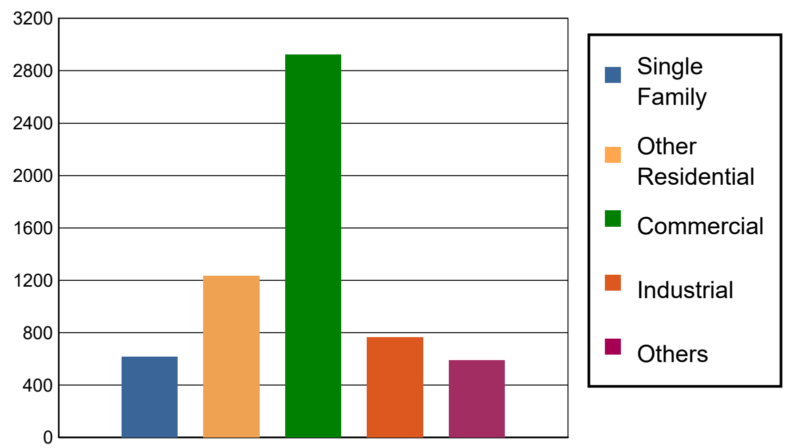


Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	23.29	325.66	17.18	20.01	386.14
	Capital-Related	0.00	9.94	283.85	10.27	5.33	309.39
	Rental	8.68	81.40	129.84	6.41	11.79	238.12
	Relocation	26.93	62.61	205.26	25.41	82.81	403.02
	Subtotal	**35.61**	**177.24**	**944.62**	**59.26**	**119.95**	**1,336.68**
Capital Stock Losses							
	Structural	55.51	183.50	414.06	116.22	96.85	866.14
	Non_Structural	360.87	726.52	1,098.04	342.61	260.43	2,788.47
	Content	165.74	145.52	453.67	209.81	109.66	1,084.41
	Inventory	0.00	0.00	11.36	36.13	1.48	48.96
	Subtotal	**582.12**	**1,055.54**	**1,977.13**	**704.77**	**468.42**	**4,787.98**
	Total	**617.73**	**1,232.78**	**2,921.75**	**764.02**	**588.37**	**6,124.66**

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.

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

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	2,776.60	$0.00	0.00
	Bridges	3,407.19	$153.80	4.51
	Tunnels	10.38	$0.00	0.03
	Subtotal	**6,194**	**153.80**	
Railways	Segments	384.74	$0.00	0.00
	Bridges	0.00	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	15.98	$3.13	19.61
	Subtotal	**401**	**3.10**	
Light Rail	Segments	0.00	$0.00	0.00
	Bridges	0.00	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**0**	**0.00**	
Bus	Facilities	3.70	$0.81	21.89
	Subtotal	**4**	**0.80**	
Ferry	Facilities	0.00	$0.00	0.00
	Subtotal	**0**	**0.00**	
Port	Facilities	9.99	$0.65	6.51
	Subtotal	**10**	**0.70**	
Airport	Facilities	42.60	$6.75	15.83
	Runways	189.82	$0.00	0.00
	Subtotal	**232**	**6.70**	
	Total	**6,841.00**	**165.10**	

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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	263.40	$11.26	4.28
	Distribution Lines	284.60	$8.81	3.09
	Subtotal	**547.99**	**$20.07**	
Waste Water	Pipelines	0.00	$0.00	0.00
	Facilities	978.40	$83.62	8.55
	Distribution Lines	170.80	$6.31	3.70
	Subtotal	**1,149.11**	**$89.93**	
Natural Gas	Pipelines	0.00	$0.00	0.00
	Facilities	2.50	$0.21	8.57
	Distribution Lines	113.80	$1.81	1.59
	Subtotal	**116.30**	**$2.02**	
Oil Systems	Pipelines	0.00	$0.00	0.00
	Facilities	0.10	$0.01	9.91
	Subtotal	**0.11**	**$0.01**	
Electrical Power	Facilities	124.30	$18.87	15.18
	Subtotal	**124.30**	**$18.87**	
Communication	Facilities	4.20	$0.33	7.83
	Subtotal	**4.18**	**$0.33**	
	Total	**1,942.00**	**$131.23**	

Appendix A: County Listing for the Region

Lane,OR

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Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Oregon					
	Lane	351,715	27,437	8,561	35,999
Total State		**351,715**	**27,437**	**8,561**	**35,999**
Total Region		**351,715**	**27,437**	**8,561**	**35,999**

Note to Readers:
While performing the Hazus analysis the authors of DOGAMI publication IMS-60 discovered some software bugs associated with the Lane County data when using the CSZ ground motion input data. Hazus would not accept the tract (building) values the authors entered, so the authors were forced to analyze the tract data separately from the rest of the assets in Hazus. The Hazus global reports provided in Appendix B of IMS-60 include both sets of results, but the sections in each report that should not be used have been obscured via redaction.

Hazus-MH: Earthquake Global Risk Report

Region Name: CSZ_Detailed_LSdry

Earthquake Scenario: Lane_CSZ_m9y

Print Date: May 09, 2018

Table of Contents

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):

Oregon

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

The geographical size of the region is 4,618.08 square miles and contains 86 census tracts. There are over 145 thousand households in the region which has a total population of 351,715 people (2010 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 138 thousand buildings in the region with a total building replacement value (excluding contents) of 35,999 (millions of dollars). Approximately 92.00 % of the buildings (and 76.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 6,841 and 1,941 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 138 thousand buildings in the region which have an aggregate total replacement value of 35,999 (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 81% 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 4 hospitals in the region with a total bed capacity of 586 beds. There are 157 schools, 50 fire stations, 11 police stations and 2 emergency operation facilities. With respect to high potential loss facilities (HPL), there are 0 dams identified within the inventory. Of these, 0 of the dams are classified as ‘high hazard’. The inventory also includes 91 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 8,782.00 (millions of dollars). This inventory includes over 644 kilometers of highways, 199 bridges, 28,459 kilometers of pipes.

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Table 1: Transportation System Lifeline Inventory

System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	199	3,407.20
	Segments	198	2,776.60
	Tunnels	2	10.40
		Subtotal	**6,194.20**
Railways	Bridges	0	0.00
	Facilities	6	16.00
	Segments	143	384.70
	Tunnels	0	0.00
		Subtotal	**400.70**
Light Rail	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
		Subtotal	**0.00**
Bus	Facilities	3	3.70
		Subtotal	**3.70**
Ferry	Facilities	0	0.00
		Subtotal	**0.00**
Port	Facilities	5	10.00
		Subtotal	**10.00**
Airport	Facilities	4	42.60
	Runways	5	189.80
		Subtotal	**232.40**
		Total	**6,841.00**

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Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	284.60
	Facilities	7	263.40
	Pipelines	0	0.00
		Subtotal	**548.00**
Waste Water	Distribution Lines	NA	170.80
	Facilities	13	978.40
	Pipelines	0	0.00
		Subtotal	**1,149.10**
Natural Gas	Distribution Lines	NA	113.80
	Facilities	2	2.50
	Pipelines	0	0.00
		Subtotal	**116.30**
Oil Systems	Facilities	1	0.10
	Pipelines	0	0.00
		Subtotal	**0.10**
Electrical Power	Facilities	1	124.30
		Subtotal	**124.30**
Communication	Facilities	37	4.20
		Subtotal	**4.20**
		Total	**1,942.00**

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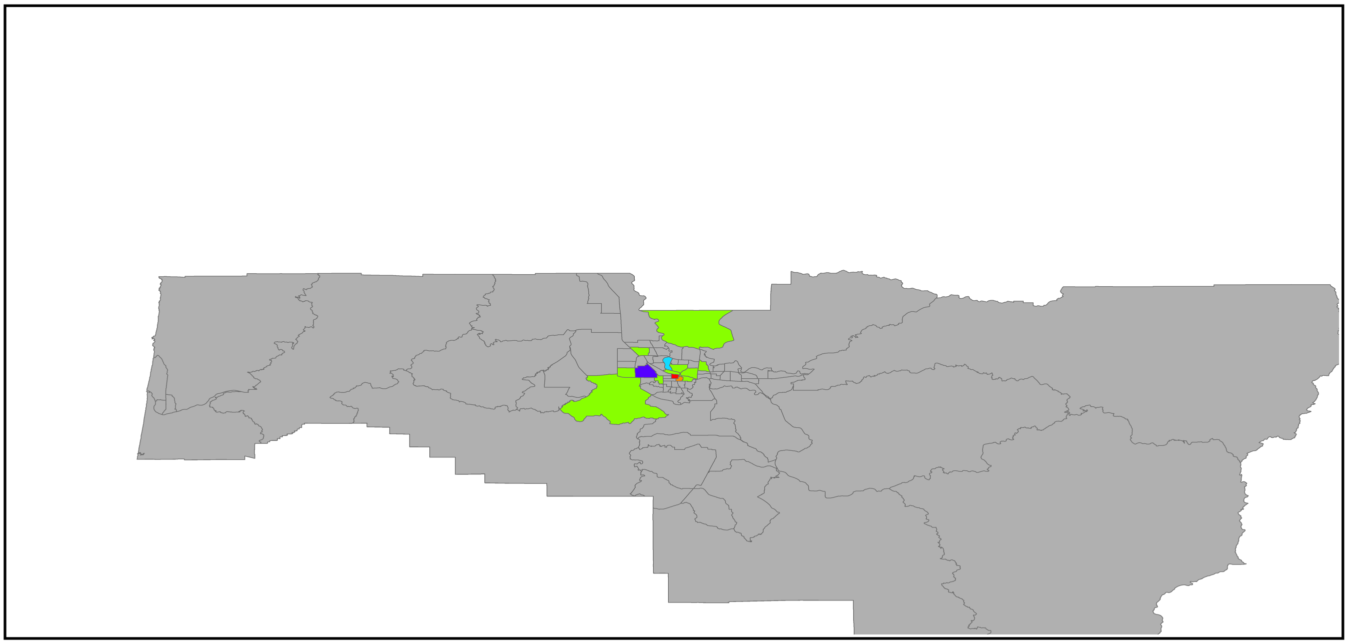
Earthquake Scenario

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



Scenario Name	Lane_CSZ_m9y
Type of Earthquake	User-defined
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	NA
Longitude of Epicenter	NA
Latitude of Epicenter	NA
Earthquake Magnitude	9.00
Depth (km)	NA
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	NA

Building Damage

Building Damage

Hazus estimates that about 23,757 buildings will be at least moderately damaged. This is over 17.00 % of the buildings in the region. There are an estimated 4,949 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.

Damage categories by General Occupancy Type

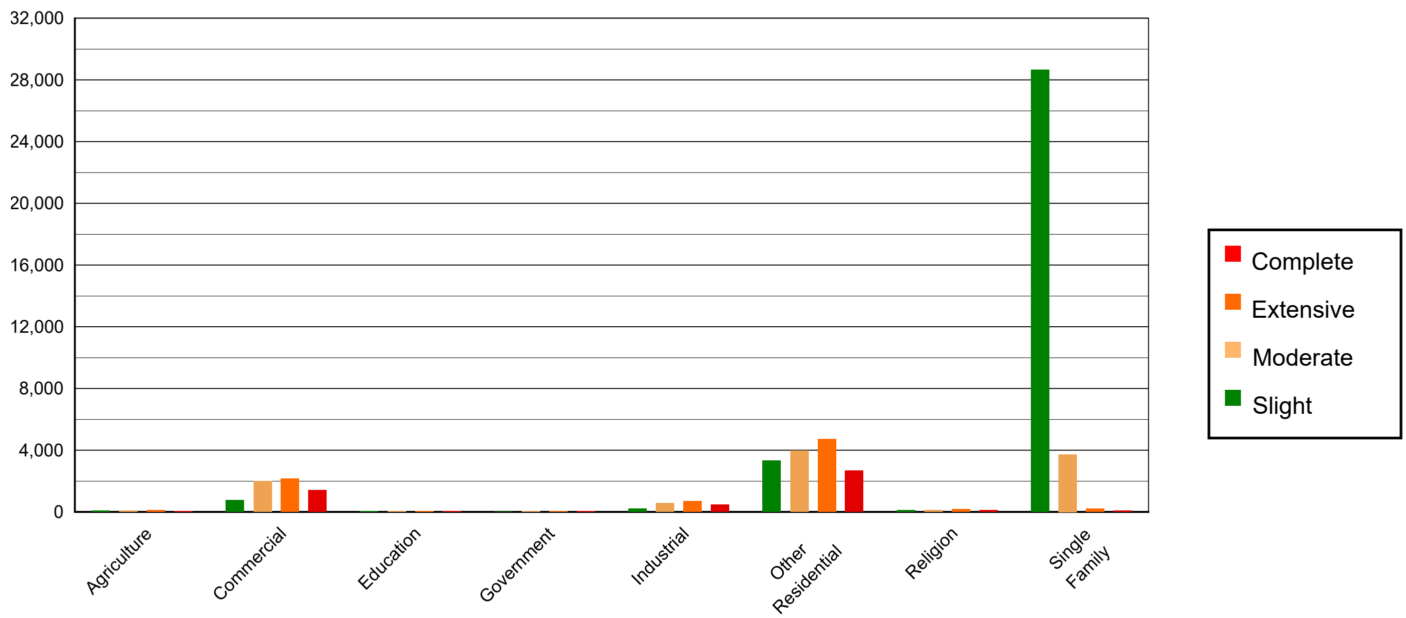


Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	237	0.29	89	0.27	80	0.76	103	1.26	69	1.40
Commercial	1,166	1.43	759	2.29	2,002	18.93	2,165	26.29	1,411	28.51
Education	90	0.11	40	0.12	56	0.53	76	0.92	55	1.11
Government	47	0.06	14	0.04	34	0.32	58	0.71	60	1.21
Industrial	428	0.52	202	0.61	563	5.33	712	8.65	456	9.21
Other Residential	6,338	7.76	3,338	10.05	3,967	37.52	4,737	57.53	2,685	54.24
Religion	211	0.26	99	0.30	131	1.24	180	2.19	124	2.50
Single Family	73,172	89.57	28,675	86.33	3,740	35.37	202	2.46	90	1.82
Total	**81,688**		**33,218**		**10,574**		**8,234**		**4,949**	

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[redacted]	81,688		33,218		10,574		8,234		4,949	

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Essential Facility Damage

Before the earthquake, the region had 586 hospital beds available for use. On the day of the earthquake, the model estimates that only 138 hospital beds (24.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 30.00% of the beds will be back in service. By 30 days, 62.00% will be operational.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	4	3	0	1
Schools	157	0	0	111
EOCs	2	0	0	1
PoliceStations	11	0	0	6
FireStations	50	0	0	40

Transportation Lifeline Damage

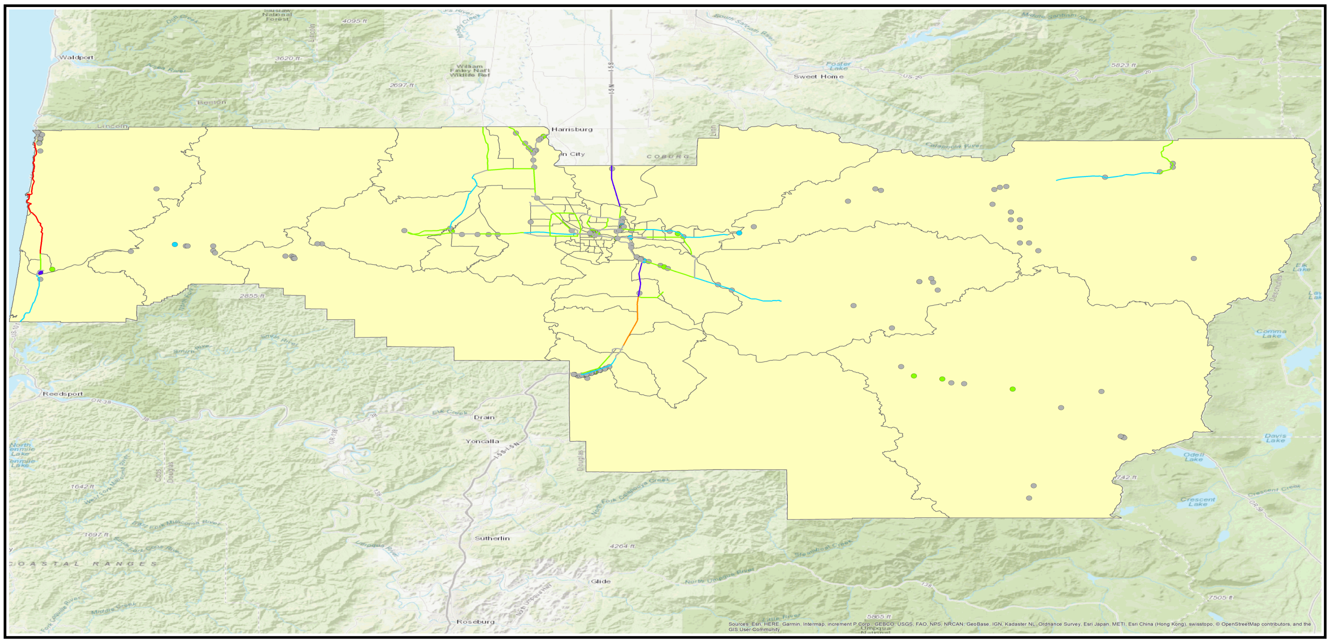

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Table 6: Expected Damage to the Transportation Systems

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	198	0	0	198	198
	Bridges	199	18	0	181	189
	Tunnels	2	0	0	2	2
Railways	Segments	143	0	0	143	143
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	6	0	0	6	6
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	3	0	0	3	3
Ferry	Facilities	0	0	0	0	0
Port	Facilities	5	0	0	5	5
Airport	Facilities	4	0	0	4	4
	Runways	5	0	0	5	5

Table 6 provides damage estimates for the transportation system.

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.

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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	7	0	0	7	7
Waste Water	13	3	0	6	13
Natural Gas	2	0	0	2	2
Oil Systems	1	0	0	1	1
Electrical Power	1	0	0	0	1
Communication	37	6	0	37	37

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

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	14,230	1957	489
Waste Water	8,538	1403	351
Natural Gas	5,692	402	101
Oil	0	0	0

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	145,966	13,704	10,710	5,532	0	0
Electric Power		0	0	0	0	0

Induced Earthquake Damage

Debris Generation

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Social Impact

Shelter Requirement

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Economic Loss

The total economic loss estimated for the earthquake is 6,424.38 (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

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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.

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

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	2,776.60	$3.32	0.12
	Bridges	3,407.19	$153.80	4.51
	Tunnels	10.38	$0.00	0.03
	Subtotal	**6,194**	**157.10**	
Railways	Segments	384.74	$0.02	0.01
	Bridges	0.00	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	15.98	$3.13	19.61
	Subtotal	**401**	**3.20**	
Light Rail	Segments	0.00	$0.00	0.00
	Bridges	0.00	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**0**	**0.00**	
Bus	Facilities	3.70	$0.81	21.89
	Subtotal	**4**	**0.80**	
Ferry	Facilities	0.00	$0.00	0.00
	Subtotal	**0**	**0.00**	
Port	Facilities	9.99	$0.65	6.51
	Subtotal	**10**	**0.70**	
Airport	Facilities	42.60	$6.75	15.83
	Runways	189.82	$0.00	0.00
	Subtotal	**232**	**6.70**	
	Total	**6,841.00**	**168.50**	

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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	263.40	$11.26	4.28
	Distribution Lines	284.60	$8.81	3.09
	Subtotal	**547.99**	**$20.07**	
Waste Water	Pipelines	0.00	$0.00	0.00
	Facilities	978.40	$83.62	8.55
	Distribution Lines	170.80	$6.31	3.70
	Subtotal	**1,149.11**	**$89.93**	
Natural Gas	Pipelines	0.00	$0.00	0.00
	Facilities	2.50	$0.21	8.57
	Distribution Lines	113.80	$1.81	1.59
	Subtotal	**116.30**	**$2.02**	
Oil Systems	Pipelines	0.00	$0.00	0.00
	Facilities	0.10	$0.01	9.91
	Subtotal	**0.11**	**$0.01**	
Electrical Power	Facilities	124.30	$18.87	15.18
	Subtotal	**124.30**	**$18.87**	
Communication	Facilities	4.20	$0.33	7.83
	Subtotal	**4.18**	**$0.33**	
	Total	**1,942.00**	**$131.23**	

Appendix A: County Listing for the Region

Lane,OR

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Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Oregon					
	Lane	351,715	27,437	8,561	35,999
Total State		**351,715**	**27,437**	**8,561**	**35,999**
Total Region		**351,715**	**27,437**	**8,561**	**35,999**

Note to Readers:
While performing the Hazus analysis the authors of DOGAMI publication IMS-60 discovered some software bugs associated with the Lane County data when using the CSZ ground motion input data. Hazus would not accept the tract (building) values the authors entered, so the authors were forced to analyze the tract data separately from the rest of the assets in Hazus. The Hazus global reports provided in Appendix B of IMS-60 include both sets of results, but the sections in each report that should not be used have been obscured via redaction.

Hazus-MH: Earthquake Global Risk Report

Region Name: Lane_CSZ_LSwet_det

Earthquake Scenario: Lane_CSZ_m9u

Print Date: May 09, 2018

Table of Contents

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):

Oregon

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

The geographical size of the region is 4,618.08 square miles and contains 86 census tracts. There are over 145 thousand households in the region which has a total population of 351,715 people (2010 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 138 thousand buildings in the region with a total building replacement value (excluding contents) of 35,999 (millions of dollars). Approximately 92.00 % of the buildings (and 76.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 6,841 and 1,941 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 138 thousand buildings in the region which have an aggregate total replacement value of 35,999 (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 81% 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 4 hospitals in the region with a total bed capacity of 586 beds. There are 157 schools, 50 fire stations, 11 police stations and 2 emergency operation facilities. With respect to high potential loss facilities (HPL), there are 0 dams identified within the inventory. Of these, 0 of the dams are classified as 'high hazard'. The inventory also includes 91 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 8,782.00 (millions of dollars). This inventory includes over 644 kilometers of highways, 199 bridges, 28,459 kilometers of pipes.

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Table 1: Transportation System Lifeline Inventory

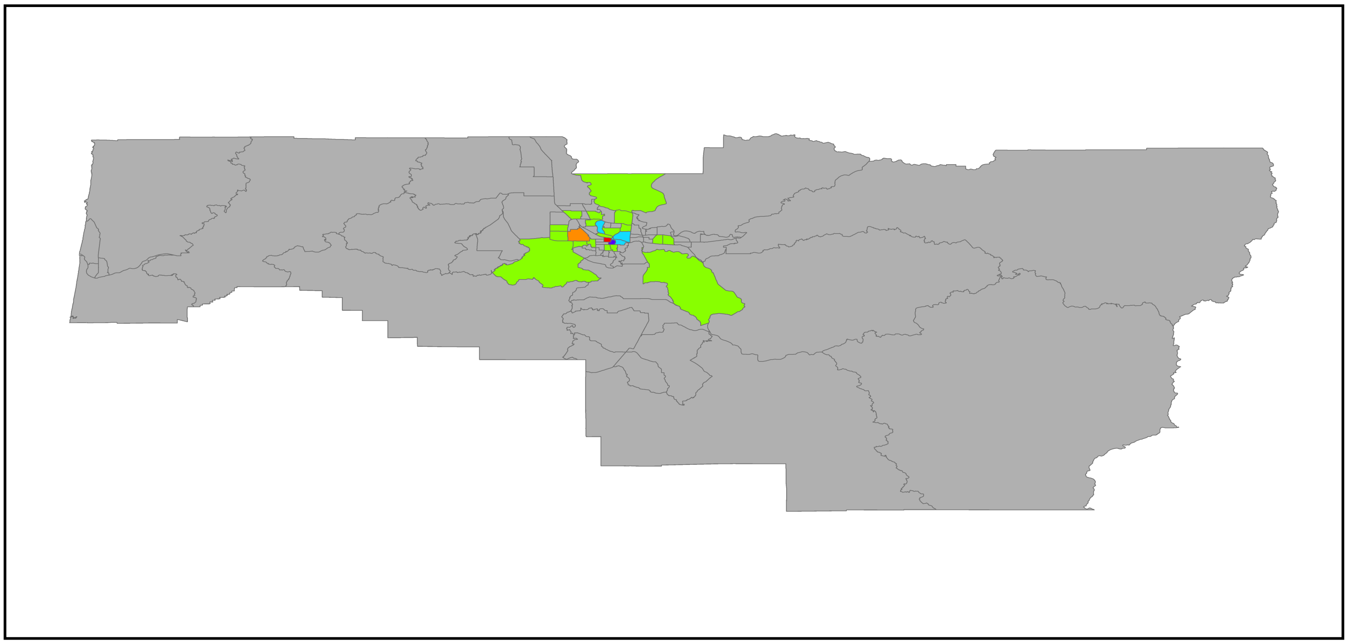
System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	199	3,407.20
	Segments	198	2,776.60
	Tunnels	2	10.40
		Subtotal	**6,194.20**
Railways	Bridges	0	0.00
	Facilities	6	16.00
	Segments	143	384.70
	Tunnels	0	0.00
		Subtotal	**400.70**
Light Rail	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
		Subtotal	**0.00**
Bus	Facilities	3	3.70
		Subtotal	**3.70**
Ferry	Facilities	0	0.00
		Subtotal	**0.00**
Port	Facilities	5	10.00
		Subtotal	**10.00**
Airport	Facilities	4	42.60
	Runways	5	189.80
		Subtotal	**232.40**
		Total	**6,841.00**

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	284.60
	Facilities	7	263.40
	Pipelines	0	0.00
		Subtotal	**548.00**
Waste Water	Distribution Lines	NA	170.80
	Facilities	13	978.40
	Pipelines	0	0.00
		Subtotal	**1,149.10**
Natural Gas	Distribution Lines	NA	113.80
	Facilities	2	2.50
	Pipelines	0	0.00
		Subtotal	**116.30**
Oil Systems	Facilities	1	0.10
	Pipelines	0	0.00
		Subtotal	**0.10**
Electrical Power	Facilities	1	124.30
		Subtotal	**124.30**
Communication	Facilities	37	4.20
		Subtotal	**4.20**
		Total	**1,942.00**

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	Lane_CSZ_m9u
Type of Earthquake	User-defined
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	NA
Longitude of Epicenter	NA
Latitude of Epicenter	NA
Earthquake Magnitude	9.00
Depth (km)	NA
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	NA

Building Damage

Building Damage

Hazus estimates that about 37,130 buildings will be at least moderately damaged. This is over 27.00 % of the buildings in the region. There are an estimated 7,631 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.

Damage categories by General Occupancy Type

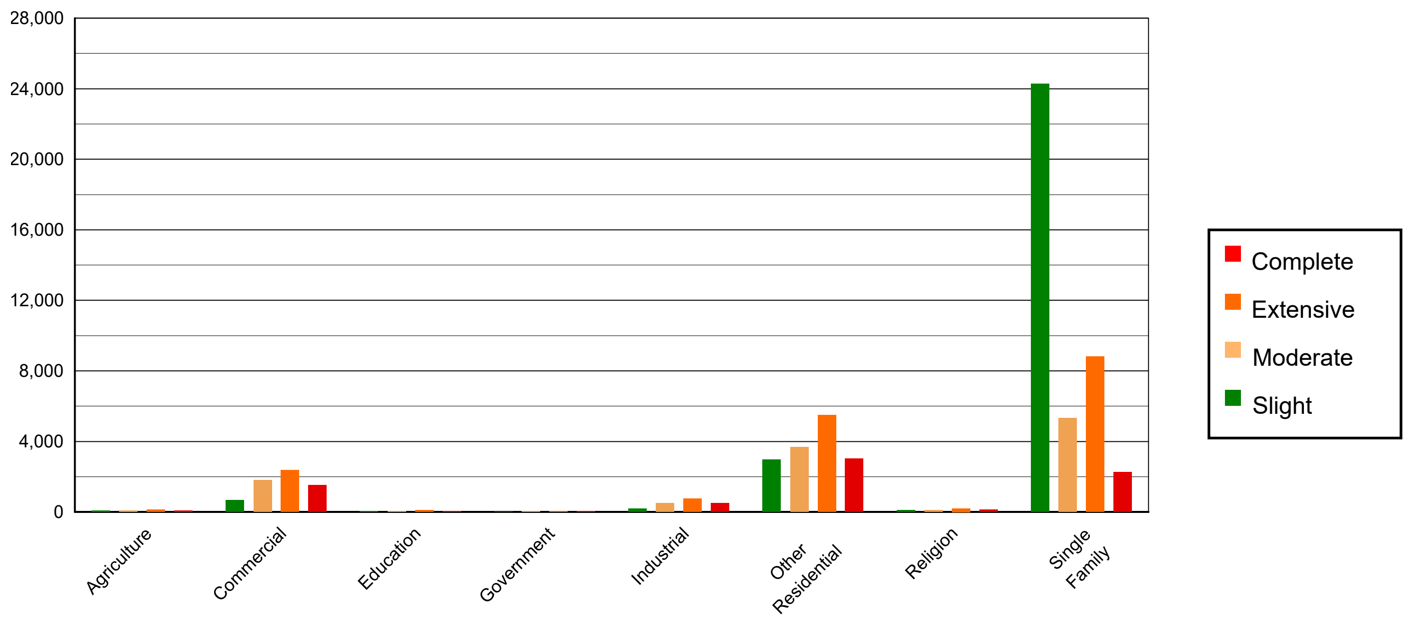


Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	223	0.30	80	0.28	78	0.67	122	0.68	77	1.01
Commercial	1,144	1.56	675	2.39	1,793	15.49	2,365	13.20	1,526	20.00
Education	86	0.12	36	0.13	51	0.44	84	0.47	60	0.78
Government	46	0.06	13	0.05	31	0.27	60	0.34	62	0.81
Industrial	423	0.58	183	0.65	504	4.36	760	4.24	490	6.43
Other Residential	5,893	8.05	2,959	10.46	3,683	31.81	5,498	30.68	3,032	39.73
Religion	197	0.27	86	0.30	121	1.04	206	1.15	136	1.78
Single Family	65,226	89.06	24,263	85.75	5,317	45.92	8,824	49.24	2,249	29.47
Total	**73,237**		**28,296**		**11,579**		**17,920**		**7,632**	

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[redacted]	73,237		28,296		11,579		17,920		7,632	

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See IMS-60 text report, section 3.3.2, regarding redacted material in this Hazus report.

Essential Facility Damage

Before the earthquake, the region had 586 hospital beds available for use. On the day of the earthquake, the model estimates that only 138 hospital beds (24.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 30.00% of the beds will be back in service. By 30 days, 62.00% 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	4	3	0	1
Schools	157	0	0	111
EOCs	2	0	0	1
PoliceStations	11	0	0	6
FireStations	50	0	0	40

Transportation Lifeline Damage

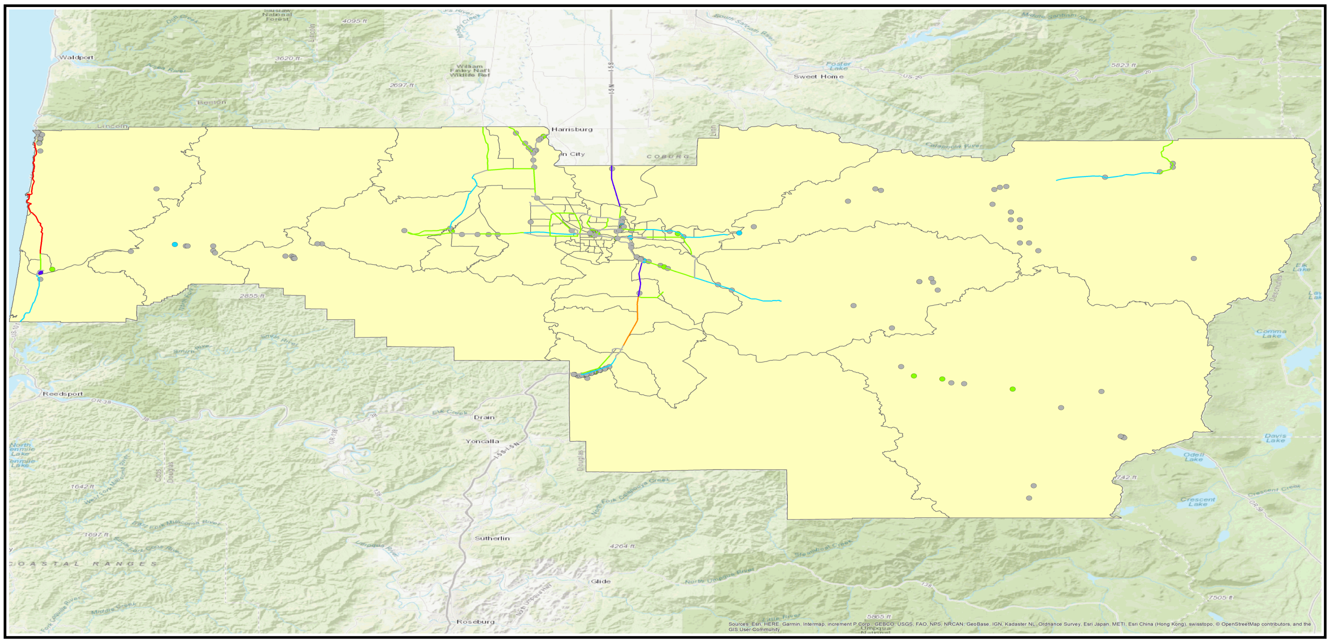

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Table 6: Expected Damage to the Transportation Systems

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	198	0	0	198	198
	Bridges	199	18	0	181	189
	Tunnels	2	0	0	2	2
Railways	Segments	143	0	0	143	143
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	6	0	0	6	6
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	3	0	0	3	3
Ferry	Facilities	0	0	0	0	0
Port	Facilities	5	0	0	5	5
Airport	Facilities	4	0	0	4	4
	Runways	5	0	0	5	5

Table 6 provides damage estimates for the transportation system.

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	7	0	0	7	7
Waste Water	13	3	0	6	13
Natural Gas	2	0	0	2	2
Oil Systems	1	0	0	1	1
Electrical Power	1	0	0	0	1
Communication	37	6	0	37	37

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

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	14,230	1957	489
Waste Water	8,538	1403	351
Natural Gas	5,692	402	101
Oil	0	0	0

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	145,966	13,704	10,710	5,532	0	0
Electric Power		0	0	0	0	0

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Induced Earthquake Damage

Debris Generation

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Social Impact

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Economic Loss

The total economic loss estimated for the earthquake is 9,089.68 (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.

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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.

Table 12: Transportation System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	2,776.60	$45.58	1.64
	Bridges	3,407.19	$153.80	4.51
	Tunnels	10.38	$0.00	0.03
	Subtotal	**6,194**	**199.40**	
Railways	Segments	384.74	$1.18	0.31
	Bridges	0.00	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	15.98	$3.13	19.61
	Subtotal	**401**	**4.30**	
Light Rail	Segments	0.00	$0.00	0.00
	Bridges	0.00	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**0**	**0.00**	
Bus	Facilities	3.70	$0.81	21.89
	Subtotal	**4**	**0.80**	
Ferry	Facilities	0.00	$0.00	0.00
	Subtotal	**0**	**0.00**	
Port	Facilities	9.99	$0.65	6.51
	Subtotal	**10**	**0.70**	
Airport	Facilities	42.60	$6.75	15.83
	Runways	189.82	$0.00	0.00
	Subtotal	**232**	**6.70**	
	Total	**6,841.00**	**211.90**	

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	263.40	$11.26	4.28
	Distribution Lines	284.60	$8.81	3.09
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	Facilities	0.10	$0.01	9.91
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	Subtotal	**124.30**	**$18.87**	
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Hazus-MH: Earthquake Global Risk Report

Region Name: Lane_CSZ_LSDry

Earthquake Scenario: Lane_CSZ9

Print Date: May 08, 2018

Disclaimer:
This version of Hazus utilizes 2010 Census Data.
Totals only reflect data for those census tracts/blocks included in the user's study region.

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

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Building and Lifeline Inventory

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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 8,782.00 (millions of dollars). This inventory includes over 644 kilometers of highways, 199 bridges, 28,459 kilometers of pipes.

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Table 1: Transportation System Lifeline Inventory

System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	199	3,407.20
	Segments	198	2,776.60
	Tunnels	2	10.40
		Subtotal	**6,194.20**
Railways	Bridges	0	0.00
	Facilities	6	16.00
	Segments	143	384.70
	Tunnels	0	0.00
		Subtotal	**400.70**
Light Rail	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
		Subtotal	**0.00**
Bus	Facilities	3	3.70
		Subtotal	**3.70**
Ferry	Facilities	0	0.00
		Subtotal	**0.00**
Port	Facilities	5	10.00
		Subtotal	**10.00**
Airport	Facilities	4	42.60
	Runways	5	189.80
		Subtotal	**232.40**
		Total	**6,841.00**

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	284.60
	Facilities	7	263.40
	Pipelines	0	0.00
		Subtotal	**548.00**
Waste Water	Distribution Lines	NA	170.80
	Facilities	13	978.40
	Pipelines	0	0.00
		Subtotal	**1,149.10**
Natural Gas	Distribution Lines	NA	113.80
	Facilities	2	2.50
	Pipelines	0	0.00
		Subtotal	**116.30**
Oil Systems	Facilities	1	0.10
	Pipelines	0	0.00
		Subtotal	**0.10**
Electrical Power	Facilities	1	124.30
		Subtotal	**124.30**
Communication	Facilities	37	4.20
		Subtotal	**4.20**
		Total	**1,942.00**

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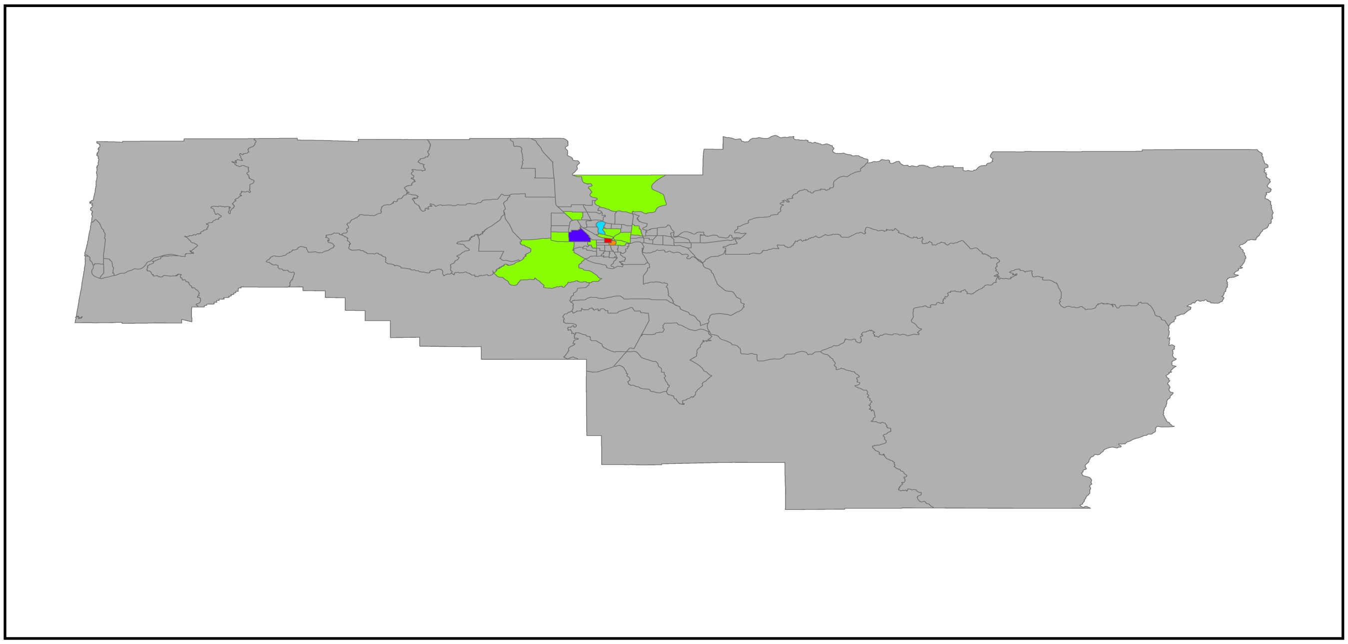
Earthquake Scenario

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



Scenario Name	Lane_CSZ9
Type of Earthquake	User-defined
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	NA
Longitude of Epicenter	NA
Latitude of Epicenter	NA
Earthquake Magnitude	9.00
Depth (km)	NA
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	NA

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Building Damage

Building Damage

Hazus estimates that about 23,757 buildings will be at least moderately damaged. This is over 17.00 % of the buildings in the region. There are an estimated 4,949 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.

Damage categories by General Occupancy Type

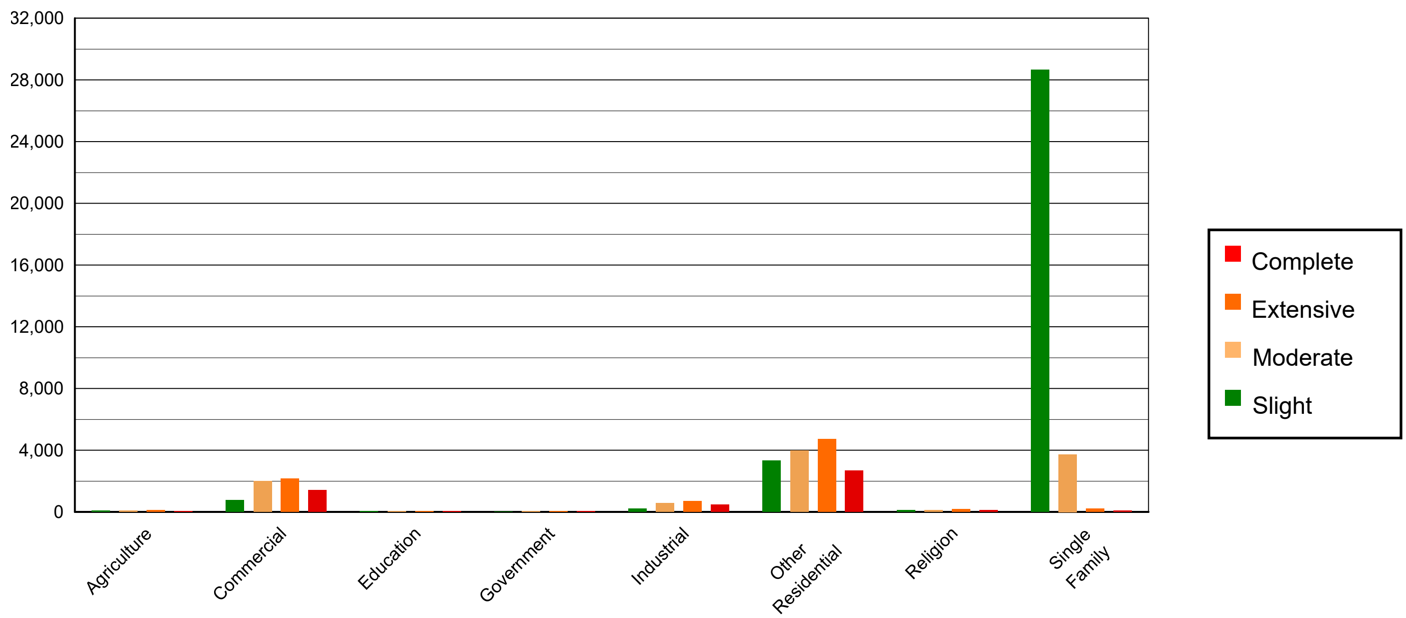

Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	237	0.29	89	0.27	80	0.76	103	1.26	69	1.40
Commercial	1,166	1.43	759	2.29	2,002	18.93	2,165	26.29	1,411	28.51
Education	90	0.11	40	0.12	56	0.53	76	0.92	55	1.11
Government	47	0.06	14	0.04	34	0.32	58	0.71	60	1.21
Industrial	428	0.52	202	0.61	563	5.33	712	8.65	456	9.21
Other Residential	6,338	7.76	3,338	10.05	3,967	37.52	4,737	57.53	2,685	54.24
Religion	211	0.26	99	0.30	131	1.24	180	2.19	124	2.50
Single Family	73,172	89.57	28,675	86.33	3,740	35.37	202	2.46	90	1.82
Total	**81,688**		**33,218**		**10,574**		**8,234**		**4,949**	

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

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	76,341	93.45	30417	91.57	4,592	43.43	450	5.47	72	1.46
Steel	351	0.43	97	0.29	399	3.78	947	11.50	875	17.68
Concrete	314	0.38	127	0.38	557	5.27	857	10.41	496	10.02
Precast	315	0.39	75	0.22	362	3.42	793	9.63	596	12.05
RM	39	0.05	9	0.03	55	0.52	101	1.23	48	0.98
URM	934	1.14	801	2.41	1,224	11.57	830	10.08	539	10.89
MH	3,393	4.15	1692	5.09	3,385	32.02	4,255	51.67	2,322	46.92
Total	**81,688**		**33,218**		**10,574**		**8,234**		**4,949**	

*Note:
RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

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See IMS-60 text report, section 3.3.2, regarding redacted material in this Hazus report.

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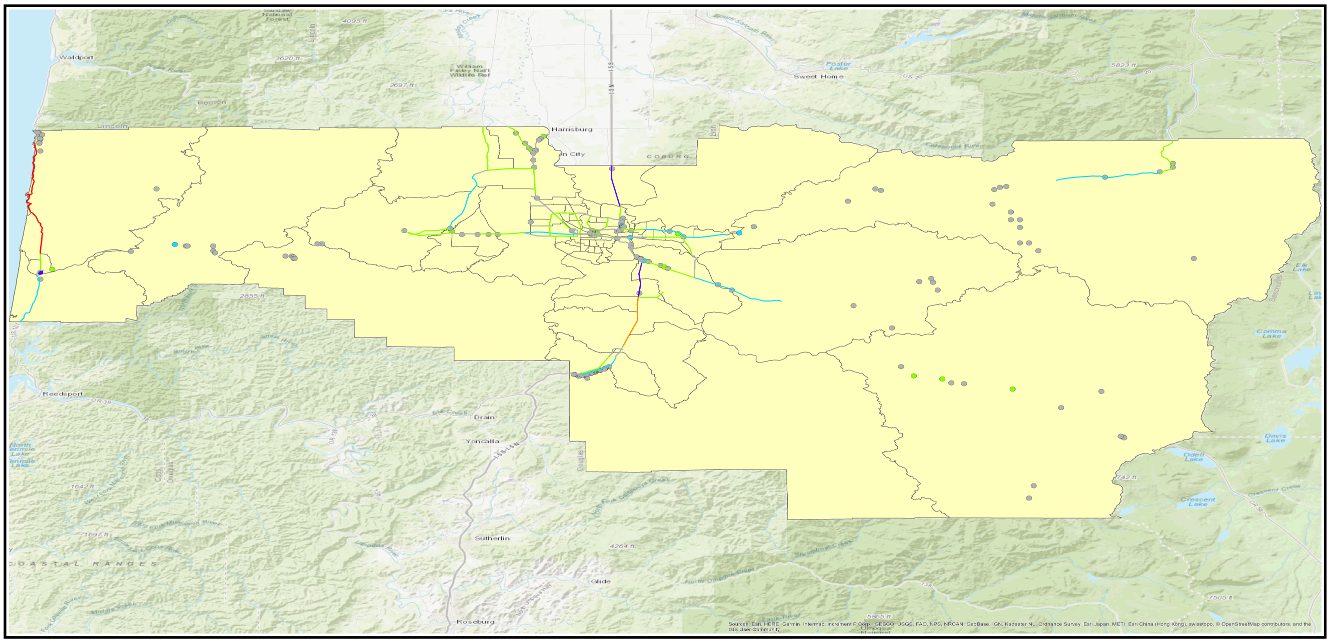
Transportation Lifeline Damage



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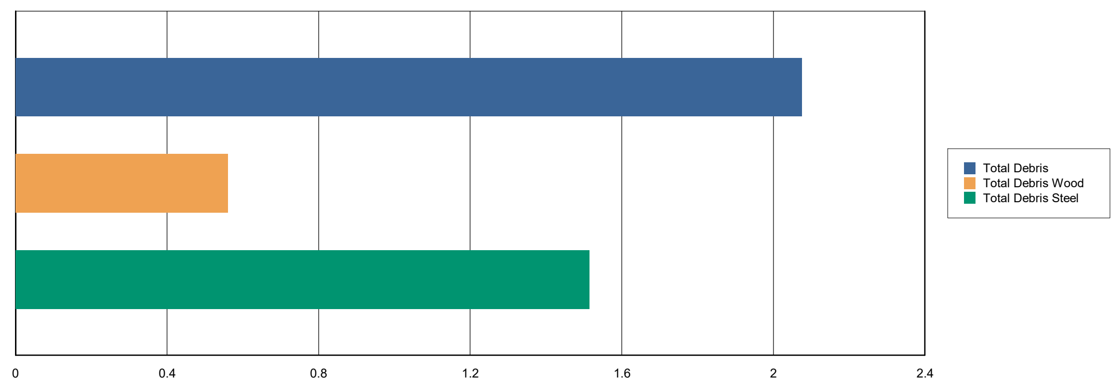
Induced Earthquake Damage

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 2.08 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 27.00% 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 83,000 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Earthquake Debris (millions of tons)



Brick/ Wood	Reinforced Concrete/Steel	Total Debris	Truck Load
0.56	1.51	2.08	83,000 (@25 tons/truck)

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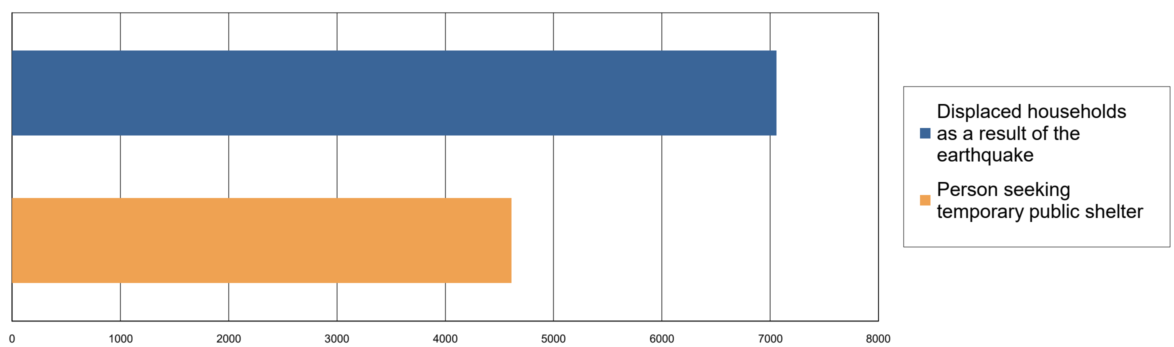
Social Impact

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 7,060 households to be displaced due to the earthquake. Of these, 4,606 people (out of a total population of 351,715) will seek temporary shelter in public shelters.

Displaced Households/ Persons Seeking Short Term Public Shelter



Displaced households as a result of the earthquake	Persons seeking temporary public shelter
7,060	4,606

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	44	13	2	4
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	69	20	3	6
	Other-Residential	866	226	28	54
	Single Family	106	16	2	4
	Total	**1,085**	**276**	**36**	**68**
2 PM	Commercial	2,544	754	125	245
	Commuting	0	0	1	0
	Educational	1,226	369	62	120
	Hotels	0	0	0	0
	Industrial	506	150	24	47
	Other-Residential	172	45	6	10
	Single Family	21	3	0	1
	Total	**4,471**	**1,321**	**217**	**424**
5 PM	Commercial	1,813	536	89	173
	Commuting	6	7	14	3
	Educational	307	93	16	31
	Hotels	0	0	0	0
	Industrial	317	94	15	29
	Other-Residential	325	86	11	20
	Single Family	41	7	1	2
	Total	**2,809**	**823**	**145**	**257**

Economic Loss

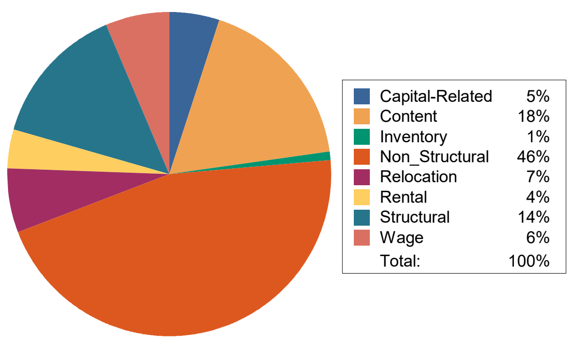
The total economic loss estimated for the earthquake is 6,421.04 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

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 6,124.66 (millions of dollars); 22 % 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 30 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Earthquake Losses by Loss Type ($ millions)



Earthquake Losses by Occupancy Type ($ millions)

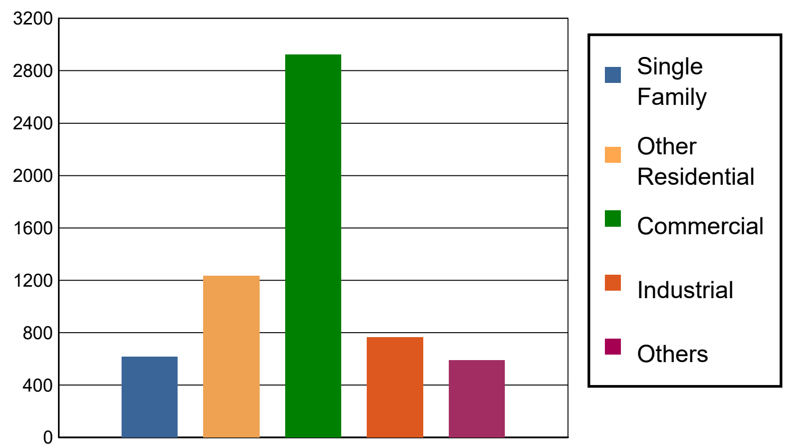


Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	23.29	325.66	17.18	20.01	386.14
	Capital-Related	0.00	9.94	283.85	10.27	5.33	309.39
	Rental	8.68	81.40	129.84	6.41	11.79	238.12
	Relocation	26.93	62.61	205.26	25.41	82.81	403.02
	Subtotal	**35.61**	**177.24**	**944.62**	**59.26**	**119.95**	**1,336.68**
Capital Stock Losses							
	Structural	55.51	183.50	414.06	116.22	96.85	866.14
	Non_Structural	360.87	726.52	1,098.04	342.61	260.43	2,788.47
	Content	165.74	145.52	453.67	209.81	109.66	1,084.41
	Inventory	0.00	0.00	11.36	36.13	1.48	48.96
	Subtotal	**582.12**	**1,055.54**	**1,977.13**	**704.77**	**468.42**	**4,787.98**
	Total	**617.73**	**1,232.78**	**2,921.75**	**764.02**	**588.37**	**6,124.66**

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Transportation and Utility Lifeline Losses

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Appendix A: County Listing for the Region

Lane,OR

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Oregon					
	Lane	351,715	27,437	8,561	35,999
Total State		**351,715**	**27,437**	**8,561**	**35,999**
Total Region		**351,715**	**27,437**	**8,561**	**35,999**

Note to Readers:
While performing the Hazus analysis the authors of DOGAMI publication IMS-60 discovered some software bugs associated with the Lane County data when using the CSZ ground motion input data. Hazus would not accept the tract (building) values the authors entered, so the authors were forced to analyze the tract data separately from the rest of the assets in Hazus. The Hazus global reports provided in Appendix B of IMS-60 include both sets of results, but the sections in each report that should not be used have been obscured via redaction.

Hazus-MH: Earthquake Global Risk Report

Region Name: Lane_CSZ_LSwet

Earthquake Scenario: Lane_CSZM9b

Print Date: May 08, 2018

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Table of Contents

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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):

Oregon

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

The geographical size of the region is 4,618.08 square miles and contains 86 census tracts. There are over 145 thousand households in the region which has a total population of 351,715 people (2010 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 138 thousand buildings in the region with a total building replacement value (excluding contents) of 35,999 (millions of dollars). Approximately 92.00 % of the buildings (and 76.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 6,841 and 1,941 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 138 thousand buildings in the region which have an aggregate total replacement value of 35,999 (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 81% 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 4 hospitals in the region with a total bed capacity of 586 beds. There are 157 schools, 50 fire stations, 11 police stations and 2 emergency operation facilities. With respect to high potential loss facilities (HPL), there are 0 dams identified within the inventory. Of these, 0 of the dams are classified as 'high hazard'. The inventory also includes 91 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 8,782.00 (millions of dollars). This inventory includes over 644 kilometers of highways, 199 bridges, 28,459 kilometers of pipes.

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System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
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	Segments	198	2,776.60
	Tunnels	2	10.40
		Subtotal	**6,194.20**
Railways	Bridges	0	0.00
	Facilities	6	16.00
	Segments	143	384.70
	Tunnels	0	0.00
		Subtotal	**400.70**
Light Rail	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
		Subtotal	**0.00**
Bus	Facilities	3	3.70
		Subtotal	**3.70**
Ferry	Facilities	0	0.00
		Subtotal	**0.00**
Port	Facilities	5	10.00
		Subtotal	**10.00**
Airport	Facilities	4	42.60
	Runways	5	189.80
		Subtotal	**232.40**
		Total	**6,841.00**

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	284.60
	Facilities	7	263.40
	Pipelines	0	0.00
		Subtotal	**548.00**
Waste Water	Distribution Lines	NA	170.80
	Facilities	13	978.40
	Pipelines	0	0.00
		Subtotal	**1,149.10**
Natural Gas	Distribution Lines	NA	113.80
	Facilities	2	2.50
	Pipelines	0	0.00
		Subtotal	**116.30**
Oil Systems	Facilities	1	0.10
	Pipelines	0	0.00
		Subtotal	**0.10**
Electrical Power	Facilities	1	124.30
		Subtotal	**124.30**
Communication	Facilities	37	4.20
		Subtotal	**4.20**
		Total	**1,942.00**

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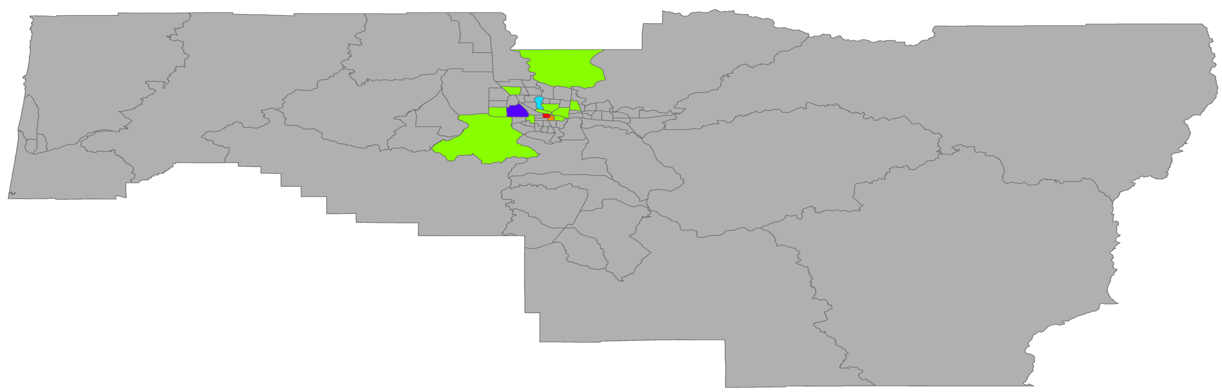
Earthquake Scenario

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



Scenario Name	Lane_CSZM9b
Type of Earthquake	User-defined
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	NA
Longitude of Epicenter	NA
Latitude of Epicenter	NA
Earthquake Magnitude	9.00
Depth (km)	NA
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	NA

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Building Damage

Building Damage

Hazus estimates that about 24,313 buildings will be at least moderately damaged. This is over 18.00 % of the buildings in the region. There are an estimated 5,053 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.

Damage categories by General Occupancy Type

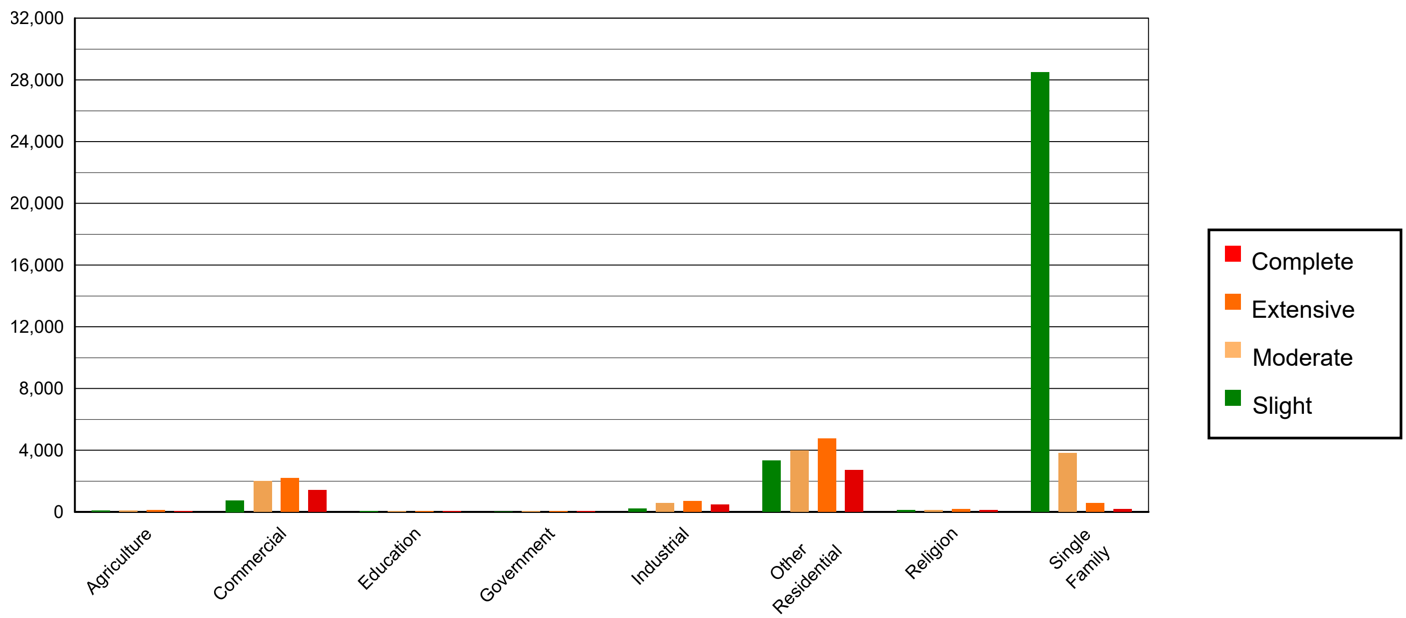

Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	236	0.29	89	0.27	80	0.75	104	1.21	70	1.38
Commercial	1,165	1.43	756	2.29	1,997	18.78	2,171	25.16	1,414	27.98
Education	90	0.11	40	0.12	56	0.52	76	0.88	55	1.09
Government	47	0.06	14	0.04	34	0.32	58	0.68	60	1.18
Industrial	427	0.53	201	0.61	561	5.28	714	8.27	457	9.04
Other Residential	6,331	7.78	3,334	10.09	3,961	37.26	4,748	55.04	2,691	53.25
Religion	211	0.26	99	0.30	131	1.23	181	2.10	124	2.46
Single Family	72,819	89.54	28,490	86.27	3,812	35.85	575	6.67	183	3.62
Total	**81,326**		**33,023**		**10,632**		**8,628**		**5,053**	

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

	None		Slight		Moderate		Extensive		Complete	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Wood	75,981	93.43	30229	91.54	4,664	43.87	832	9.64	167	3.31
Steel	351	0.43	96	0.29	398	3.74	948	10.99	876	17.33
Concrete	314	0.39	126	0.38	556	5.23	859	9.95	497	9.83
Precast	315	0.39	74	0.23	361	3.39	794	9.20	597	11.82
RM	39	0.05	9	0.03	54	0.51	101	1.17	48	0.96
URM	932	1.15	798	2.42	1,220	11.48	836	9.69	541	10.71
MH	3,393	4.17	1690	5.12	3,379	31.78	4,258	49.36	2,326	46.04
Total	**81,326**		**33,023**		**10,632**		**8,628**		**5,053**	

*Note:

RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

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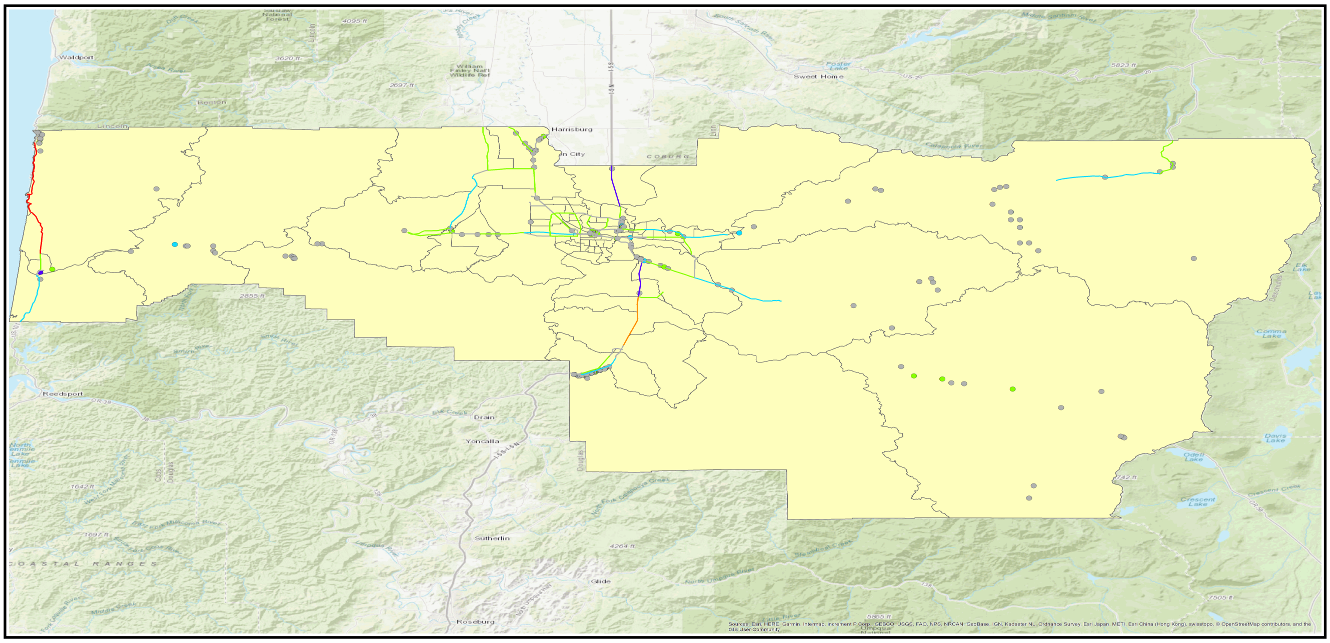
See IMS-60 text report, section 3.3.2, regarding redacted material in this Hazus report.

Transportation Lifeline Damage



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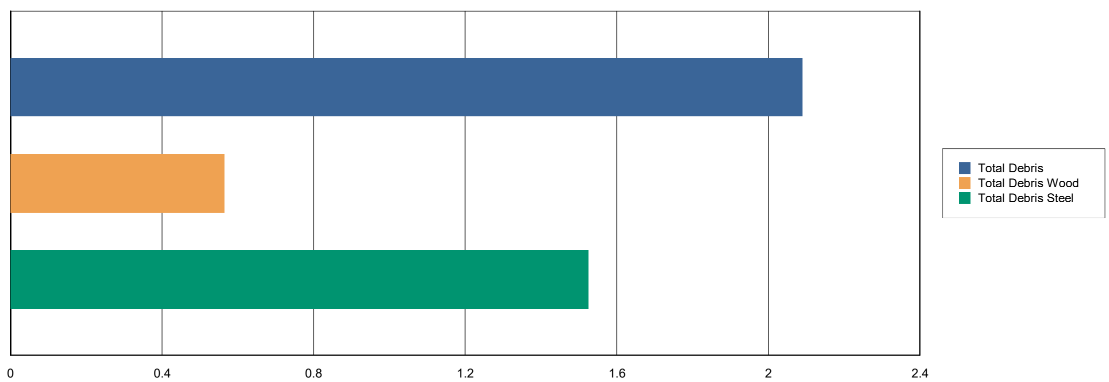
Induced Earthquake Damage

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 2.09 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 27.00% 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 83,560 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Earthquake Debris (millions of tons)



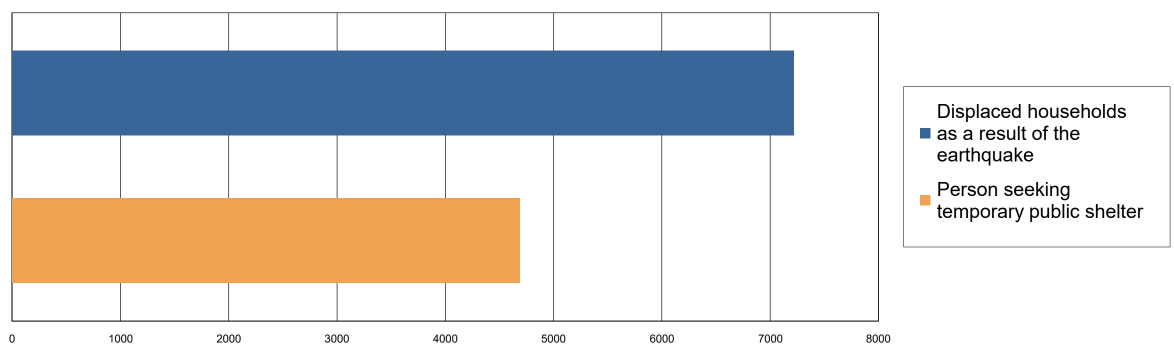
Brick/ Wood	Reinforced Concrete/Steel	Total Debris	Truck Load
0.56	1.52	2.09	83,560 (@25 tons/truck)

Social Impact

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 7,219 households to be displaced due to the earthquake. Of these, 4,690 people (out of a total population of 351,715) will seek temporary shelter in public shelters.

Displaced Households/ Persons Seeking Short Term Public Shelter



Displaced households as a result of the earthquake	Persons seeking temporary public shelter
7,219	4,690

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

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Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	44	13	2	4
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	69	20	3	6
	Other-Residential	868	227	28	54
	Single Family	130	21	2	4
	Total	**1,111**	**281**	**36**	**69**
2 PM	Commercial	2,554	757	125	246
	Commuting	0	0	1	0
	Educational	1,230	370	62	120
	Hotels	0	0	0	0
	Industrial	508	150	24	47
	Other-Residential	172	45	6	10
	Single Family	26	4	1	1
	Total	**4,490**	**1,326**	**218**	**425**
5 PM	Commercial	1,820	538	89	174
	Commuting	6	7	14	3
	Educational	308	93	16	31
	Hotels	0	0	0	0
	Industrial	317	94	15	29
	Other-Residential	326	86	11	20
	Single Family	50	8	1	2
	Total	**2,828**	**827**	**145**	**258**

Economic Loss

The total economic loss estimated for the earthquake is 6,519.41 (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.

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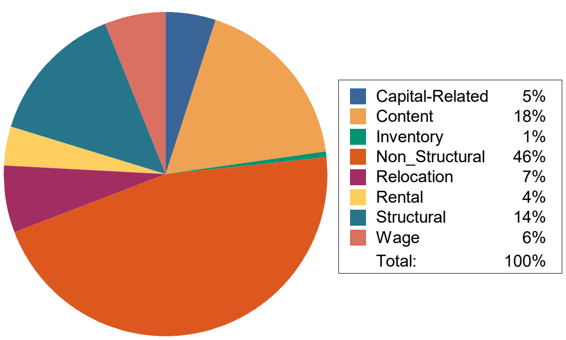
Building-Related Losses

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 6,214.33 (millions of dollars); 22 % 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 31 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Earthquake Losses by Loss Type ($ millions)



Earthquake Losses by Occupancy Type ($ millions)

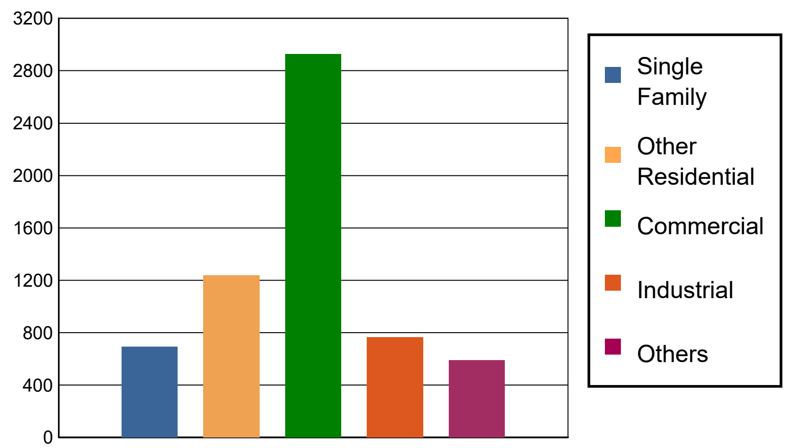


Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	23.40	325.94	17.19	20.03	386.57
	Capital-Related	0.00	9.99	284.22	10.28	5.34	309.82
	Rental	11.20	81.72	130.06	6.41	11.81	241.19
	Relocation	35.34	62.81	205.56	25.43	82.95	412.09
	Subtotal	**46.54**	**177.92**	**945.78**	**59.31**	**120.14**	**1,349.68**
Capital Stock Losses							
	Structural	69.26	184.02	414.69	116.34	97.10	881.40
	Non_Structural	400.73	729.31	1,100.84	343.53	261.22	2,835.64
	Content	176.05	146.28	455.42	210.55	110.17	1,098.47
	Inventory	0.00	0.00	11.39	36.26	1.49	49.14
	Subtotal	**646.04**	**1,059.61**	**1,982.33**	**706.68**	**469.98**	**4,864.66**
	Total	**692.58**	**1,237.53**	**2,928.11**	**765.98**	**590.12**	**6,214.33**

Transportation and Utility Lifeline Losses

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Appendix A: County Listing for the Region

Lane,OR

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Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Oregon					
	Lane	351,715	27,437	8,561	35,999
Total State		**351,715**	**27,437**	**8,561**	**35,999**
Total Region		**351,715**	**27,437**	**8,561**	**35,999**

Appendix C: Building Digitization and Tax Lot Association Methods

This appendix explains the data and general methods used in creating building footprints for the Eugene-Springfield and Lane County landslide hazard and risk study area. These methods included using lidar-derived hillshades, orthorectified imagery, and county tax lots to add to an existing building footprint dataset from LCOG and produce a complete building footprint dataset for the study area. All editing and analysis was performed using Esri® ArcMap®, version 10.4 software. This building footprint dataset and associated generalized tax lot information were used in exposure analysis. However, the generalized tax lot information was not included in the final building footprint delivery.

The Lane County Council of Governments (LCOG, https://www.lcog.org/) provided initial building footprints and tax lots in 2016. The most recent imagery datasets were used to increase the accuracy and precision of these building footprint polygons. These datasets are listed below:

- Lidar-derived, highest hit hillshades at 1-meter resolution. The lidar imagery used is from project areas "Lane County 2014" (collected in 2015) and "Willamette Valley 2009" (collected in 2009). Downloaded via: https://gis.dogami.oregon.gov/maps/lidarviewer/
- Orthoimages from the National Agriculture Imagery Program (NAIP) for 2014 at 1-meter resolution. Downloaded via: https://www.fsa.usda.gov/programs-and-services/aerial-photography/imagery-programs/naip-imagery/.
- Orthoimages from the National Agriculture Imagery Program (NAIP) for 2016 at 1-meter resolution. Downloaded via: https://www.fsa.usda.gov/programs-and-services/aerial-photography/imagery-programs/naip-imagery/.
- Esri® World Imagery service accessible via ArcMap software (https://www.arcgis.com/home/item.html?id=10df2279f9684e4a9f6a7f08febac2a9)
- Google Street View™ (https://www.google.com/streetview/) and Bing™ "Bird's eye view" imagery accessed using SIGGIS Street & Bird View Esri ArcGIS toolbar add-in (https://www.arcgis.com/home/item.html?id=ce579037a3e442a59d53ec3e4c322088).

The first step to creating a complete building footprint dataset was to assess and update the initial footprint polygons provided by LCOG. All digitizing was done at a 1:800 or larger scale; buildings under 400 square feet were not digitized or edited. During the editing process, footprints were assigned a lineage code as shown in the table below.

Lineage Domain

Code	Description
1	Original LCOG building footprint
2	Original LCOG—Does not exist in current imagery
3	Original LCOG—Modified by DOGAMI
4	Additions—building created by DOGAMI

Lidar-derived, highest hit hillshades were used for digitizing new footprints where buildings were visible in the lidar imagery. If a building did not appear in the lidar-derived data, e.g., was built after the lidar was collected, orthoimages were used (Esri® World Imagery or NAIP). When NAIP was needed, imagery collected in 2014 was used outside of the Eugene-Springfield city limits and imagery collected in 2016 was used within the city limits. After all additional building footprints were added to the overall dataset, topology checks were conducted to determine if there were any footprints that overlapped each other or were duplicates. Duplicate building polygons were deleted, except for original LCOG footprints not found in current imagery. These were marked as exceptions. Most small “sliver” errors were also marked as exceptions.

Finally, LCOG tax lots, with the aid of World Imagery and NAIP when necessary, were used to assign a generalized land use and improvement value to each building footprint. A building was assigned a generalized land use value based on the zoning value of the tax lot in which it was located. This step began with a visual scan to determine if any footprints (1) spanned multiple tax lots or (2) were not associated with a tax lot. For a building footprint that spanned two or more tax lots, either the building was split between two or more tax lots, or tax lots were merged. This was most common with large commercial buildings, condominiums, or apartments. When a building did not have an associated tax lot, tax lot boundaries were adjusted to include the corresponding building’s centroid. Topology checks were then run to ensure that there were no overlaps in tax lot boundaries. Final quality control checks were done to determine if there were either remaining tax lots with significant building value but no building, or building centroids not located within a tax lot.