Appendix E: Plate 1

Earthquake Regional Impact Analysis for Clackamas, Multnomah, and Washington Counties, Oregon

Source Data:
Hydrography, Arterial Network: Metro Regional Land Information System (RLIS), 2016
Population: Derived from U.S. Census Bureau, 2010
Map Author: John M. Bauer
September 1, 2017

Oregon Department of Geology and Mineral Industries Open-File Report O-18-02
Population Density and Building Location
Multnomah County, Oregon

Source Data:
Hydrography, Arterial Network: Metro Regional Land Information System (RLIS), 2016
Population: Derived from U.S. Census Bureau, 2010
Projection: Lambert Conformal Conic, EPSG 2913. Unit: International Feet,
Horizontal Datum: NAD 1983
Map Author: John M. Bauer
September 1, 2017

Floating structures and buildings less than 400 square feet not included in building count

Permanent Residents Per 20-Acre Cell

0 (buildings present, no permanent residents)
1–5
6–10
11–20
21–50
51–100
101–200
201–500
501–1,000
1,001–2,000

Oregon Department of Geology and Mineral Industries Open-File Report O-18-02
Earthquake Regional Impact Analysis for Clackamas, Multnomah, and Washington Counties, Oregon
Appendix E: Plate 2
Population Density and Building Location
Washington County, Oregon

Permanent Residents Per 20-Acre Cell

- 0 (Building(s) present, no permanent residents)
- 1–5
- 6–10
- 11–20
- 21–50
- 51–100
- 101–200
- 201–500
- 501–1,000
- 1,001–2,000

Floating structures and buildings less than 400 square feet not included in building count

Source Data:
Hydrography, Arterial Network: Metro Regional Land Information System (RLIS), 2016
Population: Derived from U.S. Census Bureau, 2010
Map Author: John M. Bauer
September 1, 2017
Site Peak Ground Acceleration
Simulated Cascadia Subduction Zone Magnitude 9.0 Earthquake

Source Data:
Major Arterial Network: Metro Regional Land Information System (RLIS), 2016
Site ground motion: DOGAMI, 2018
Projection: Lambert Conformal Conic, EPSG 2913. Unit: International Feet,
Horizontal Datum: NAD 1983
Map Author: John M. Bauer
February 2, 2018

Appendix E: Plate 4
Earthquake Regional Impact Analysis for Clackamas, Multnomah, and Washington Counties, Oregon
Site Peak Ground Acceleration
Simulated Portland Hills Fault Magnitude 6.8 Earthquake

Source Data:
Major Arterial Network: Metro Regional Land Information System (RLIS), 2016
Site ground motion: DOGAMI, 2018
Projection: Lambert Conformal Conic, EPSG 2913. Unit: International Feet,
Horizontal Datum: NAD 1983
Map Author: John M. Bauer
February 2, 2018
This map is intended to provide nontechnical users with an estimate of the geographic distribution of building damage. The damage categories are taken from the Modified Mercalli Intensity scale, which is based on observed effects on people, objects, and buildings. The damage potential categories are derived from the peak ground velocity developed for this project. The peak ground velocity breakpoints are established by Wald and others (2006). Further information is available at https://earthquake.usgs.gov/learn/topics/mercalli.php

Source Data:
Hydrography, Major Arterial Network: Metro Regional Land Information System (RLIS), 2016
Site ground motion: DOGAMI, 2018
Map Author: John M. Bauer
February 12, 2018
This map is intended to provide nontechnical users with an estimate of the geographic distribution of building damage. The damage categories are taken from the Modified Mercalli Intensity scale, which is based on observed effects on people, objects, and buildings. The damage potential categories are derived from the peak ground velocity developed for this project. The peak ground velocity breakpoints are established by Wald and others (2006). Further information is available at https://earthquake.usgs.gov/learn/topics/mercalli.php.
Potential Permanent Ground Deformation Due to Earthquake-Induced Landslides or Liquefaction Lateral Spreading
Cascadia Subduction Zone Magnitude 9.0 Earthquake Wet (Saturated) Soil Scenario

Permanent Ground Deformation
- None
- Low (0–10 cm; 0–4 inches)
- Moderate (10–30 cm; 4–12 inches)
- High (30–100 cm; 12–39 inches)
- Very High (100–1180 cm; 39–173 inches)

Source Data:
Hydrography: Metro Regional Land Information System (RLIS), 2016
Probability of earthquake-induced landslide or liquefaction: DOGAMI, 2018, taking maximum ground deformation from earthquake-induced landslide and liquefaction lateral spreading.

Map Author: John M. Bauer
February 12, 2018

Appendix E: Plate 8
Earthquake Regional Impact Analysis for Clackamas, Multnomah, and Washington Counties, Oregon
Probability of Earthquake-Induced Landslides or Liquefaction
Cascadia Subduction Zone Magnitude 9.0 Earthquake
Wet (Saturated) Soil Scenario

Source Data:
- Hydrography: Metro Regional Land Information System (RLIS), 2016
- Probability of earthquake-induced landslide or liquefaction: DOGAMI, 2018, taking maximum probability from earthquake-induced landslide and liquefaction probabilities.

Map Author: John M. Bauer
February 12, 2018

Appendix E: Plate 9
Maximum Potential Permanent Ground Deformation Within Segment

- < 0.5 meters
- 0.5 – 1.0 meters
- 1.0 – 2.0 meters
- > 2.0 meters

Permanent ground deformation combines earthquake-indueed landslide and lateral spread from liquefaction (Plate 8).
Probability of occurrence for segments with > 0.5 m of permanent ground deformation is between 20% and 30% (Plate 9).

Emergency Transportation Routes in Columbia County (OR) and Clark County (WA) not analyzed nor fully represented in this map.

Not all cities are labeled.

Source Data:
City boundaries: Metro Regional Land Information System (RLIS), 2016
Emergency Transportation Routes: Metro, 2006
Map Author: John M. Bauer
September 1, 2017

Appendix E: Plate 10
Earthquake Regional Impact Analysis for Clackamas, Multnomah, and Washington Counties, Oregon
Potential Impact of Permanent Ground Deformation to Metro Emergency Transportation Route Segments
Cascadia Subduction Zone Magnitude 9.0 Earthquake
Dry Soil Scenario

Permanent ground deformation combines earthquake-induced landslide and lateral spread from liquefaction (Plate 8). Probability of occurrence for segments with > 0.5 m of permanent ground deformation is between 20% and 30% (Plate 9).

Emergency Transportation Routes in Columbia County (OR) and Clark County (WA) not analyzed nor fully represented in this map.

Not all cities are labeled.

Source Data:
City boundaries: Metro Regional Land Information System (RLIS), 2016
Emergency Transportation Routes: Metro, 2006
Map Author: John M. Bauer
September 1, 2017
Potential Impact of Permanent Ground Deformation to Metro Emergency Transportation Routes
Cascadia Subduction Zone Magnitude 9.0 Earthquake Wet (Saturated) Soil Scenario

Potential Permanent Ground Deformation

- < 0.5 meters
- 0.5 – 1.0 meters
- 1.0 – 2.0 meters
- > 2.0 meters

Permanent ground deformation takes the maximum of earthquake-induced landslide and lateral spread from liquefaction (Plate 8).

Probability of occurrence for road areas with > 0.5 m permanent ground deformation is between 20% and 30% (Plate 9).

Emergency Transportation Routes in Columbia County (OR) and Clark County (WA) not analyzed nor fully represented in this map.

Highway labels are placed on areas with minimal to no ground deformation (< 0.5 m).

Not all cities are labeled.
Potential Impact of Permanent Ground Deformation to Electrical Transmission Structures
Cascadia Subduction Zone Magnitude 9.0 Earthquake, Wet (Saturated) Soil Scenario

Potential Permanent Ground Deformation at Electrical Transmission Pole/Tower
- < 1.0 meter
- 1.0 – 2.0 meters
- > 2.0 meters

Substation
Transmission Line Corridor (outside of study area)

Permanent ground deformation at the pole/tower site takes the maximum of earthquake-induced landslide and lateral spread from Equation (Plate 8). Probability of occurrence for structures with >1 meter permanent ground deformation is between 20% and 30% (Plate 9).

Source Data:
Hydrography: Metro Regional Land Information System (RLIS), 2016
Transmission Structures: Compiled by DGAMI, 2017
Substations and Transmission Line Corridors: Dept. of Homeland Security
Homeland Infrastructure Foundation-Level Data (HIFLD), 2017
Projection: Lambert Conformal Conic, EPSG 2913. Unit: International Feet
Horizontal Datum: NAD 1983
Map Author: John M. Bauer
September 1, 2017
Injuries Requiring Hospitalization
Clackamas County, Oregon
Cascadia Subduction Zone Magnitude 9.0 Earthquake
Wet (Saturated) Soil Conditions, Daytime ("2 PM") Scenario

Injuries Requiring Hospitalization per Neighborhood Unit

0 – 1
2 – 5
6 – 10
11 – 20
21 – 50

H Hospitals outside of Clackamas County not shown.
"Injuries requiring hospitalization" combines Hazus casualty levels 2 and 3.

Source Data:
Neighborhood Units: Adapted from U.S. Census Bureau 2010 Census Block Groups
Hospitals: Metro Regional Land Information System (RLIS), May 2017
Map Author: John M. Bauer
February 12, 2018

Oregon Department of Geology and Mineral Industries Open-File Report O-18-02
Injuries Requiring Hospitalization
Multnomah County, Oregon
Cascadia Subduction Zone Magnitude 9.0 Earthquake
Wet (Saturated) Soil Conditions, Daytime ("2 PM") Scenario

Source Data:
Neighborhood Units: Adapted from U.S. Census Bureau 2010 Census Block Groups
Hospitals: Metro Regional Land Information System (RLIS), May 2017
Map Author: John M. Bauer
February 12, 2018

Hospitals outside of Multnomah County not shown.
"Injuries requiring hospitalization" combines Hazus casualty levels 2 and 3.
Injuries Requiring Hospitalization
Washington County, Oregon
Cascadia Subduction Zone Magnitude 9.0 Earthquake
Wet (Saturated) Soil Conditions, Daytime ("2 PM") Scenario

Injuries Requiring Hospitalization per Neighborhood Unit

0–1
2–5
6–10
11–20
21–50
51–100
101–200

Hospital

Hospitals outside of Washington County not shown.
"Injuries requiring hospitalization" combines Hazus casualty levels 2 and 3.

Source Data:
Neighborhood Units: Adapted from U.S. Census Bureau 2010 Census Block Groups
Hospitals: Metro Regional Land Information System (RLIS), May 2017
Projection: Lambert Conformal Conic, EPSG 2913, Unit: International Feet, Horizontal Datum: NAD 1983
Map Author: John M. Bauer
February 12, 2018

Oregon Department of Geology and Mineral Industries Open-File Report O-18-02