

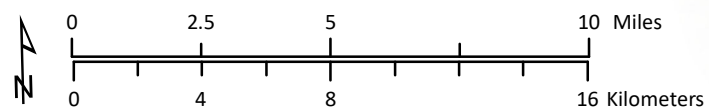
WASHINGTON STATE DEPT OF
**NATURAL
RESOURCES**
WASHINGTON
GEOLOGICAL SURVEY

Permanent Residents

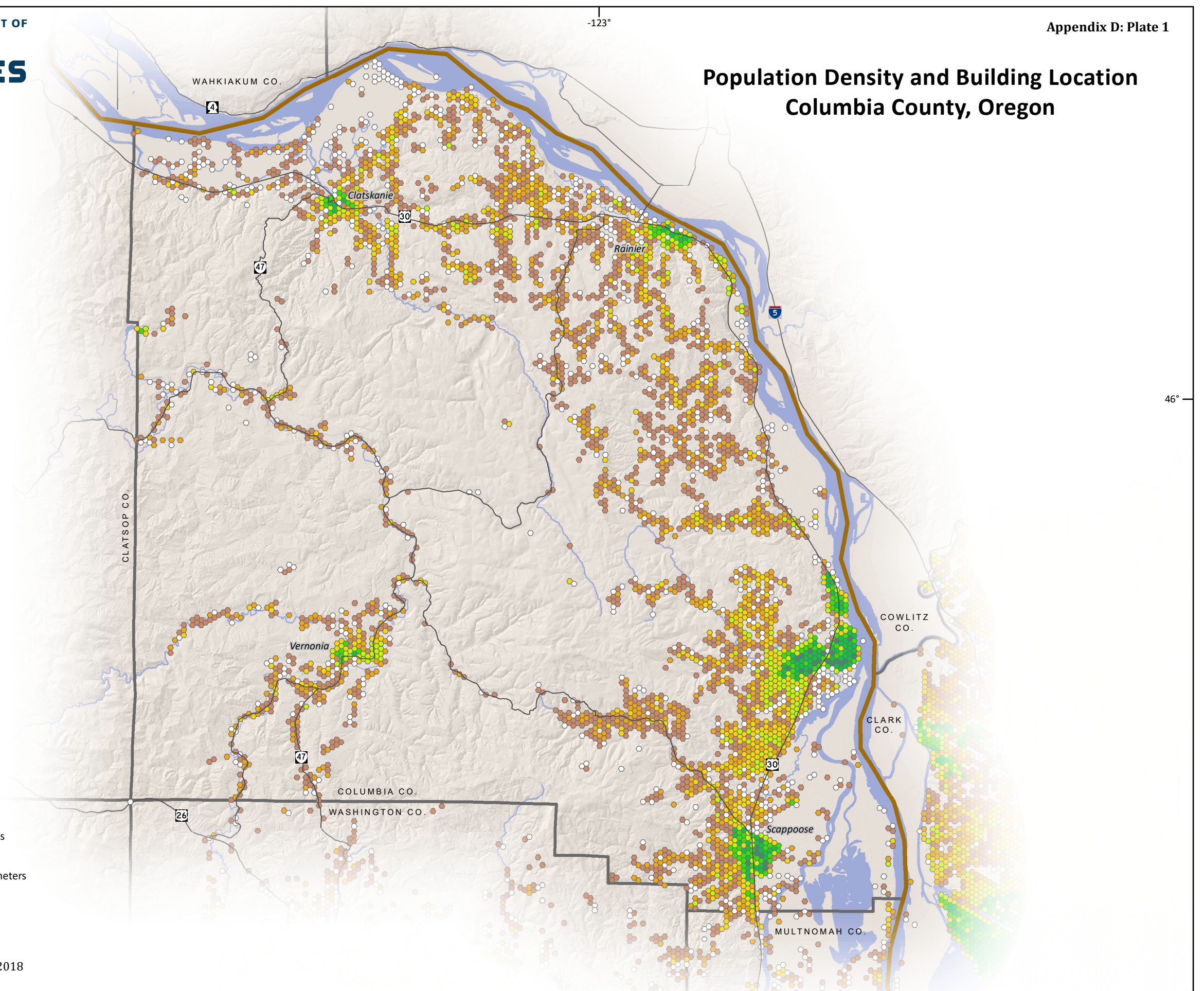
Per 20-Acre Cell

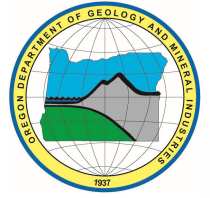
- 0 (Building(s) present, no permanent residents)
- 1–5
- 6–10
- 11–20
- 21–50
- 51–100
- 101–200
- 201–500
- 501–1,000
- 1,001–2,000

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



Source Data:
Hydrography: National Hydrography Dataset, 2018
Arterial network: Washington Dept. of Transportation, 2019;
Oregon Dept. of Transportation, 2018
Washington, Multnomah County population density: Bauer and others, 2018
Projection: Lambert Conformal Conic, EPSG 2913.





WASHINGTON STATE DEPT OF
**NATURAL
RESOURCES**
WASHINGTON
GEOLOGICAL SURVEY

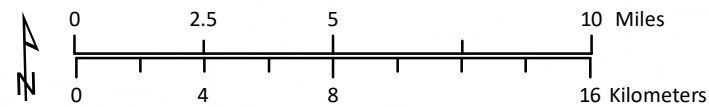
Population Density and Building Location Clark County, Washington

Appendix D: Plate 2

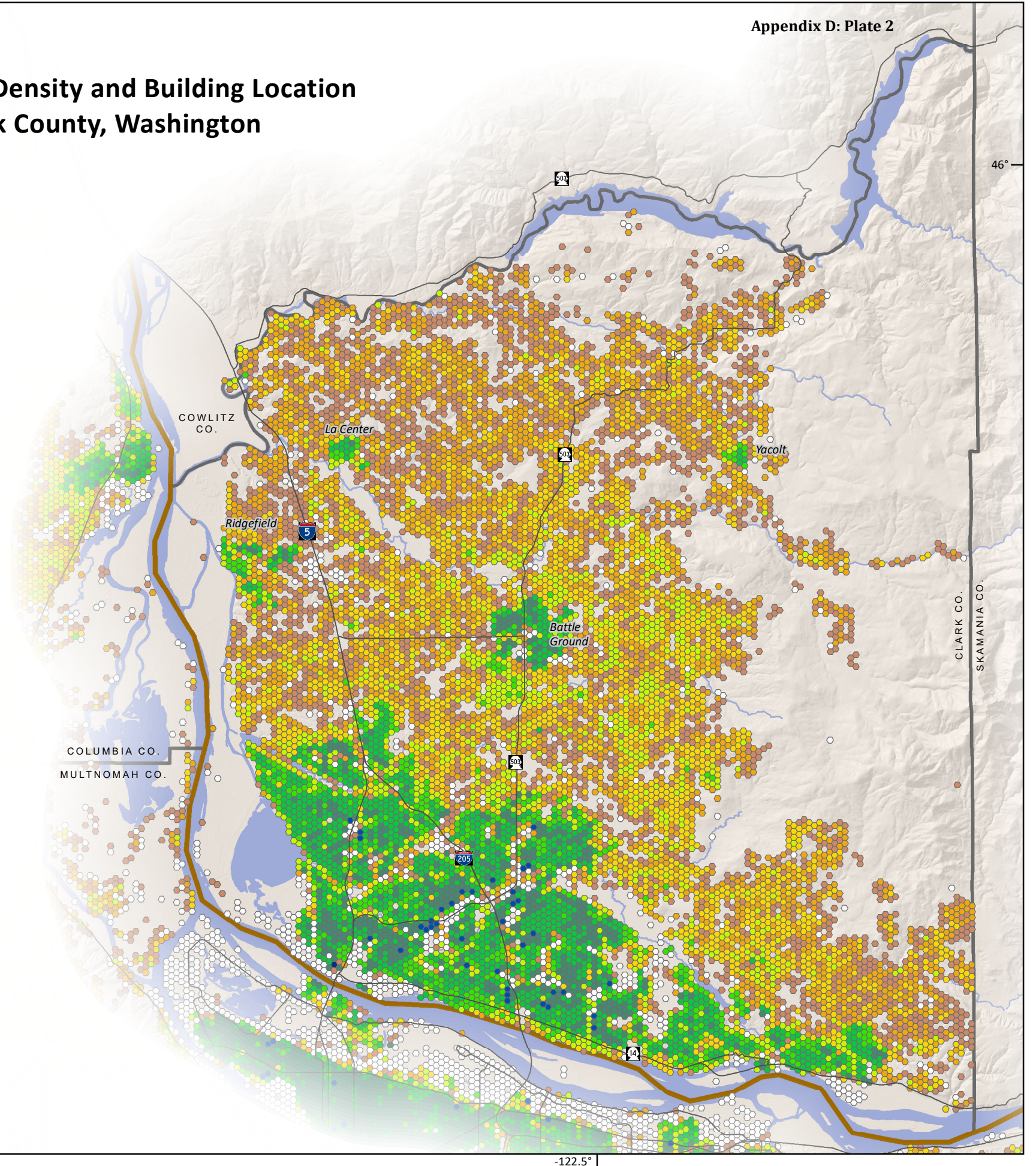
Permanent Residents Per 20-Acre Cell

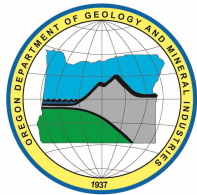
- 0 (Building(s) present,
no permanent residents)
- 1–5
- 6–10
- 11–20
- 21–50
- 51–100
- 101–200
- 201–500
- 501–1,000
- 1,001–2,000

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



Source Data:
Hydrography: National Hydrography Dataset, 2018
Arterial network: Washington Dept. of Transportation, 2019;
Oregon Dept. of Transportation, 2018
Multnomah County population density: Bauer and others, 2018
Projection: Lambert Conformal Conic, EPSG 2913.



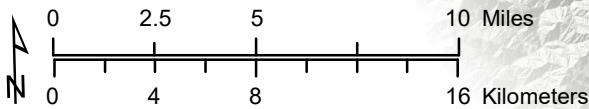


WASHINGTON STATE DEPT OF
**NATURAL
RESOURCES**
WASHINGTON
GEOLOGICAL SURVEY

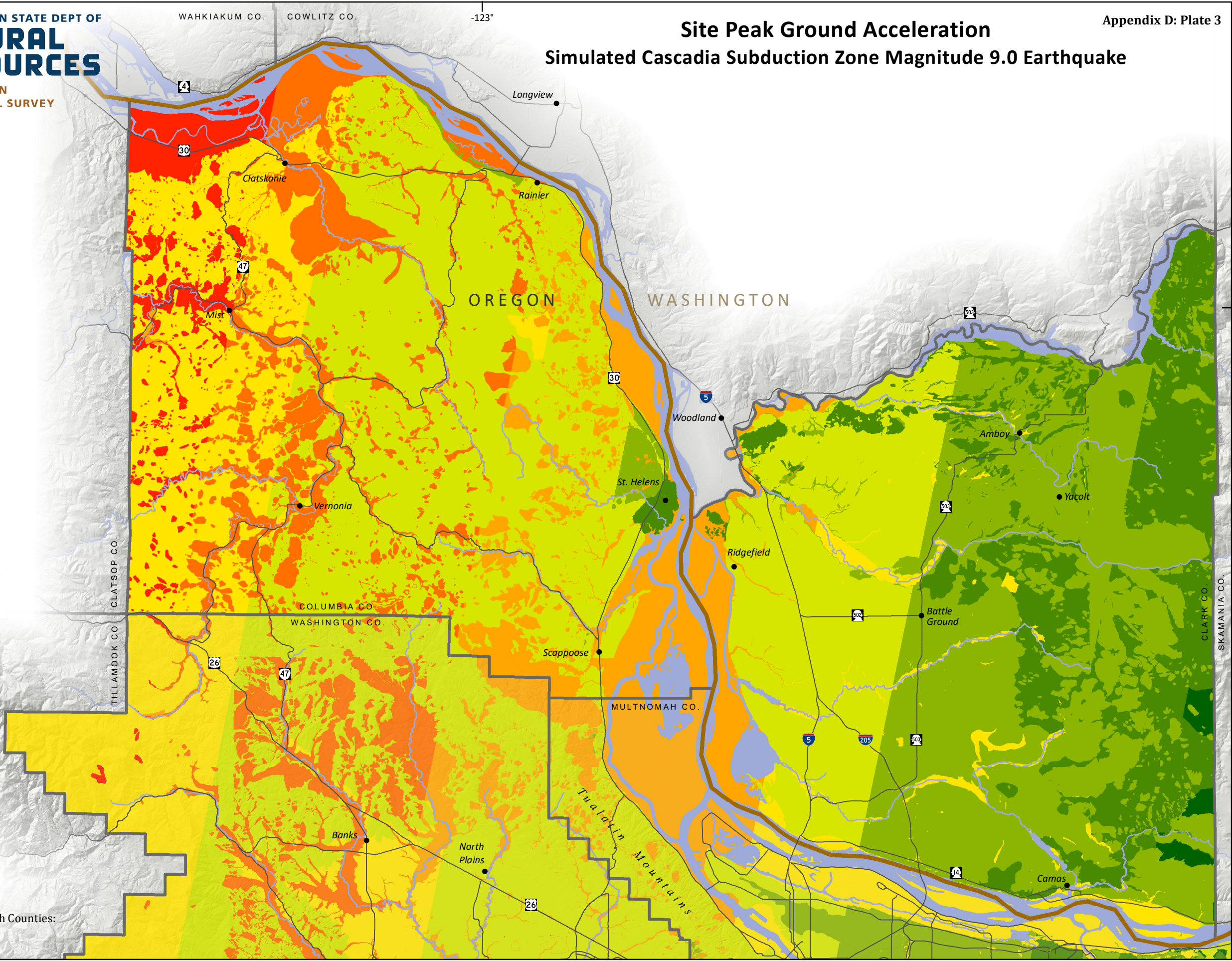
Site Peak Ground Acceleration Simulated Cascadia Subduction Zone Magnitude 9.0 Earthquake

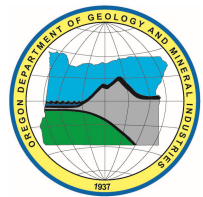
Appendix D: Plate 3

Site Peak Ground
Acceleration (g)
(fraction of standard gravity)



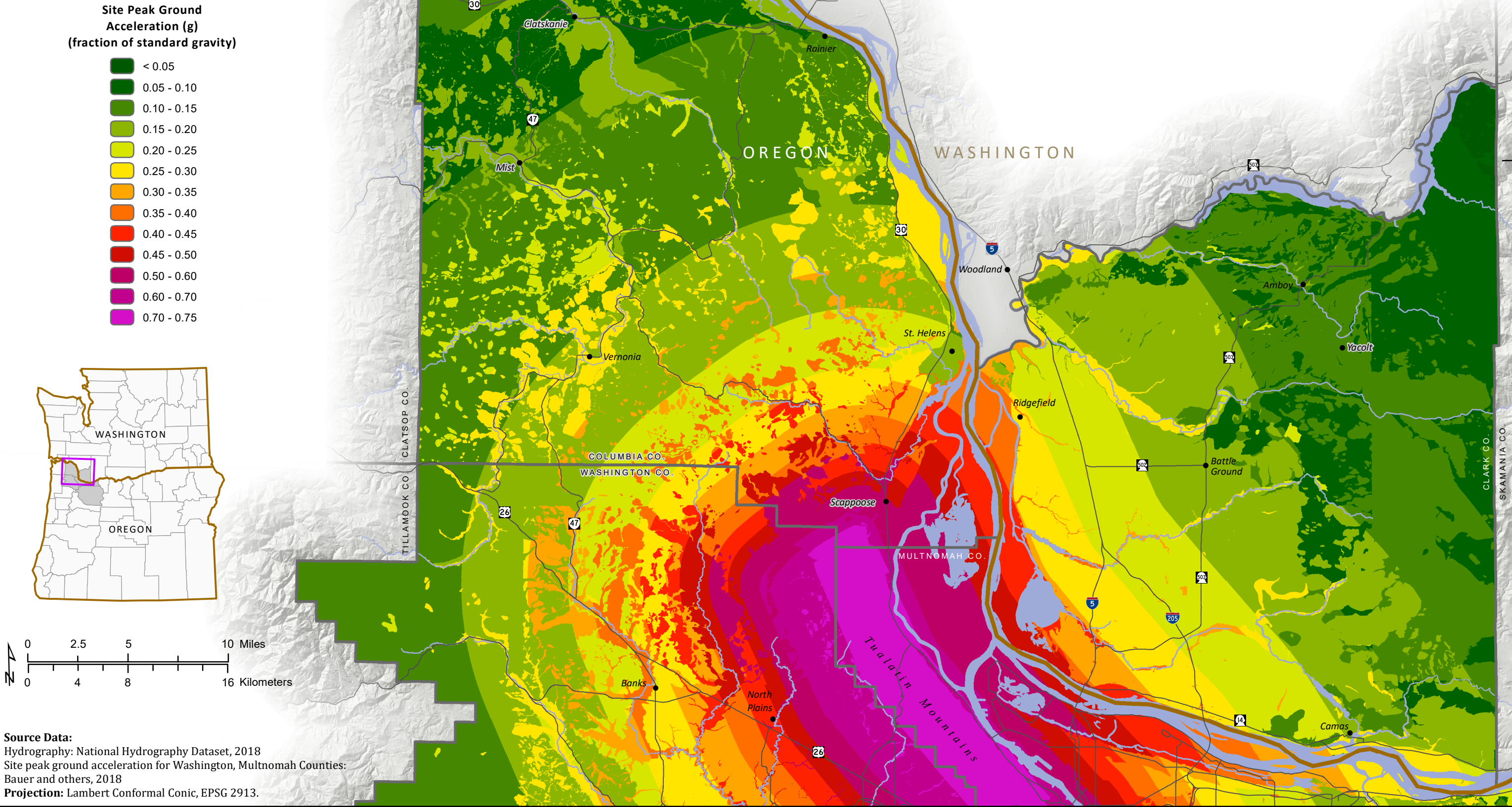
Source Data:
Hydrography: National Hydrography Dataset, 2018
Site peak ground acceleration for Washington, Multnomah Counties:
Bauer and others, 2018
Projection: Lambert Conformal Conic, EPSG 2913.

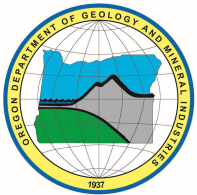




WASHINGTON STATE DEPT OF
**NATURAL
RESOURCES**
WASHINGTON
GEOLOGICAL SURVEY

Site Peak Ground Acceleration Simulated Portland Hills Fault Magnitude 6.8 Earthquake





WASHINGTON STATE DEPT OF
**NATURAL
RESOURCES**
WASHINGTON
GEOLOGICAL SURVEY

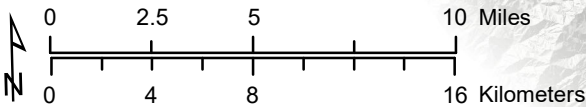
Perceived Shaking and Damage Potential

Simulated Cascadia Subduction Zone Magnitude 9.0 Earthquake

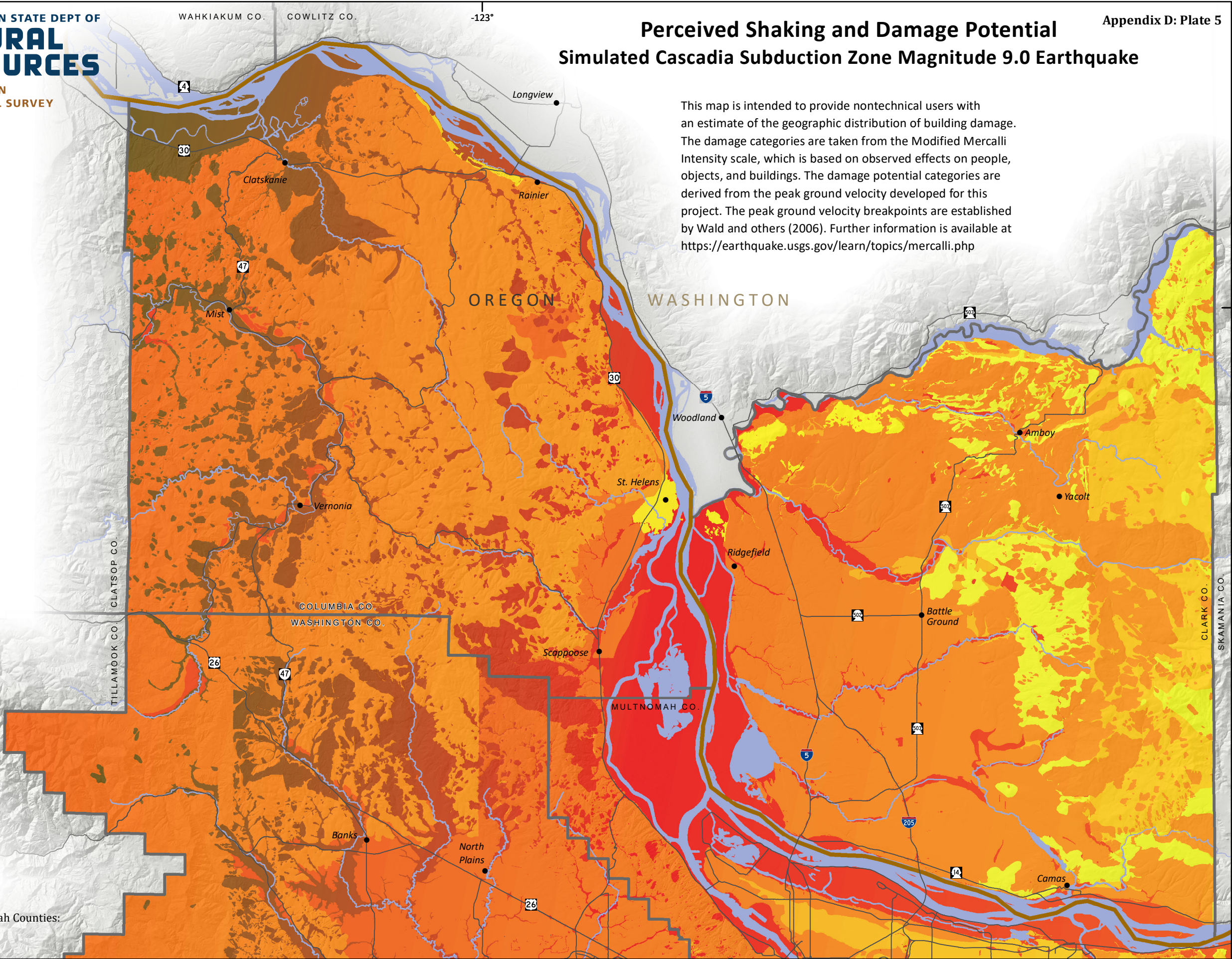
Appendix D: Plate 5

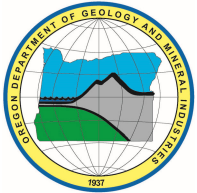
This map is intended to provide nontechnical users with an estimate of the geographic distribution of building damage. The damage categories are taken from the Modified Mercalli Intensity scale, which is based on observed effects on people, objects, and buildings. The damage potential categories are 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>

Modified Mercalli Intensity Scale	Perceived Shaking	Damage Potential
IV	Light	None
V	Moderate	Very light
VI	Strong	Light
VII	Very Strong	Moderate
VIII	Severe	Moderate/ Heavy
IX	Violent	Heavy



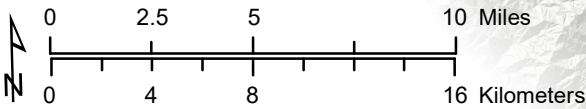
Source Data:
Hydrography: National Hydrography Dataset, 2018
Modified Mercalli Intensity for Washington and Multnomah Counties:
Bauer and others, 2018
Projection: Lambert Conformal Conic, EPSG 2913.





WASHINGTON STATE DEPT OF
**NATURAL
RESOURCES**
WASHINGTON
GEOLOGICAL SURVEY

Modified Mercalli Intensity Scale	Perceived Shaking	Damage Potential
IV	Light	None
V	Moderate	Very light
VI	Strong	Light
VII	Very Strong	Moderate
VIII	Severe	Moderate/ Heavy
IX	Violent	Heavy

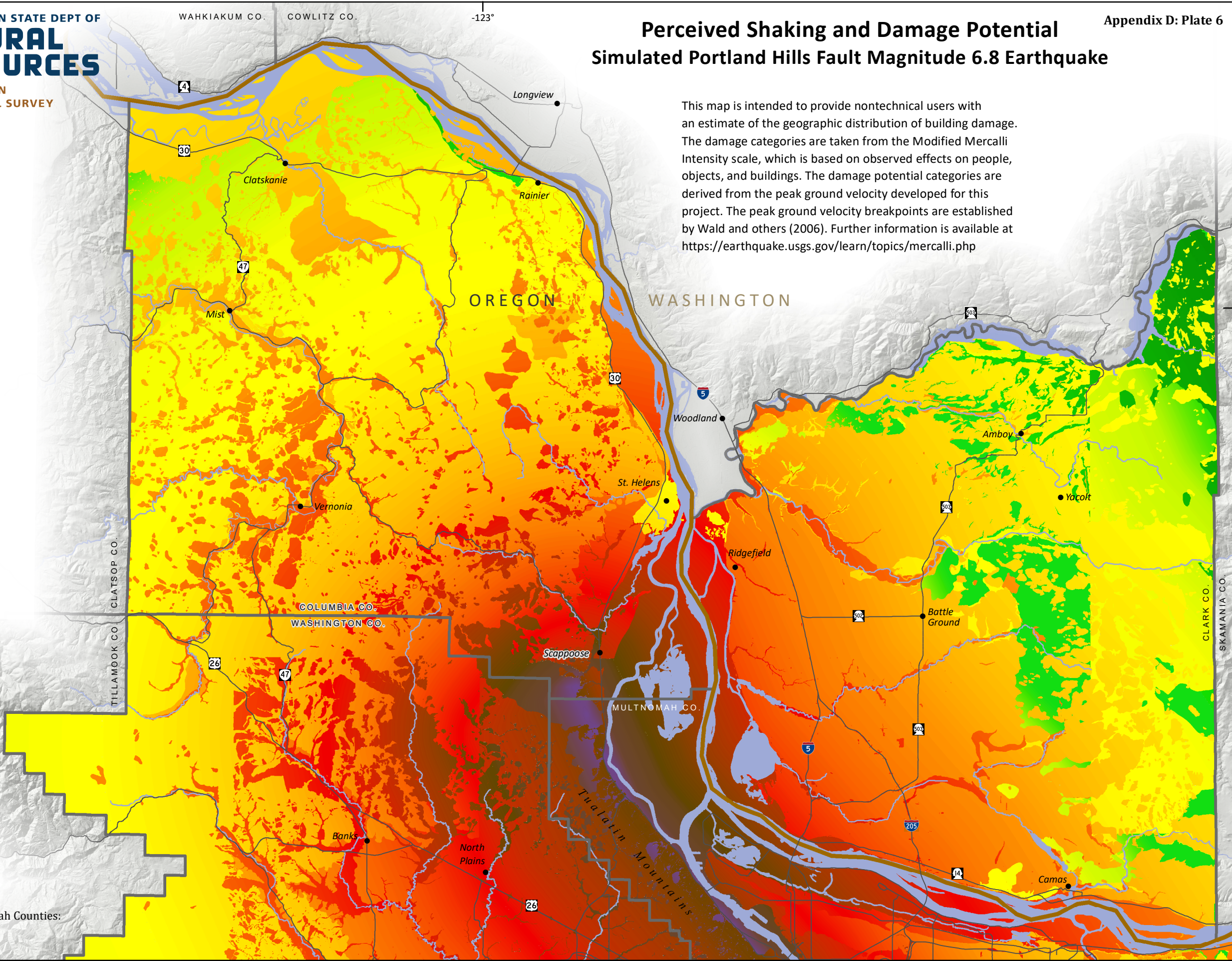


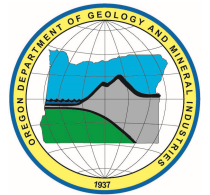
Source Data:
Hydrography: National Hydrography Dataset, 2018
Modified Mercalli Intensity for Washington and Multnomah Counties:
Bauer and others, 2018
Projection: Lambert Conformal Conic, EPSG 2913.

Perceived Shaking and Damage Potential

Simulated Portland Hills Fault Magnitude 6.8 Earthquake

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>



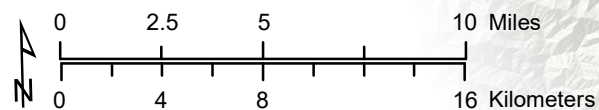


WASHINGTON STATE DEPT OF
**NATURAL
RESOURCES**
WASHINGTON
GEOLOGICAL SURVEY

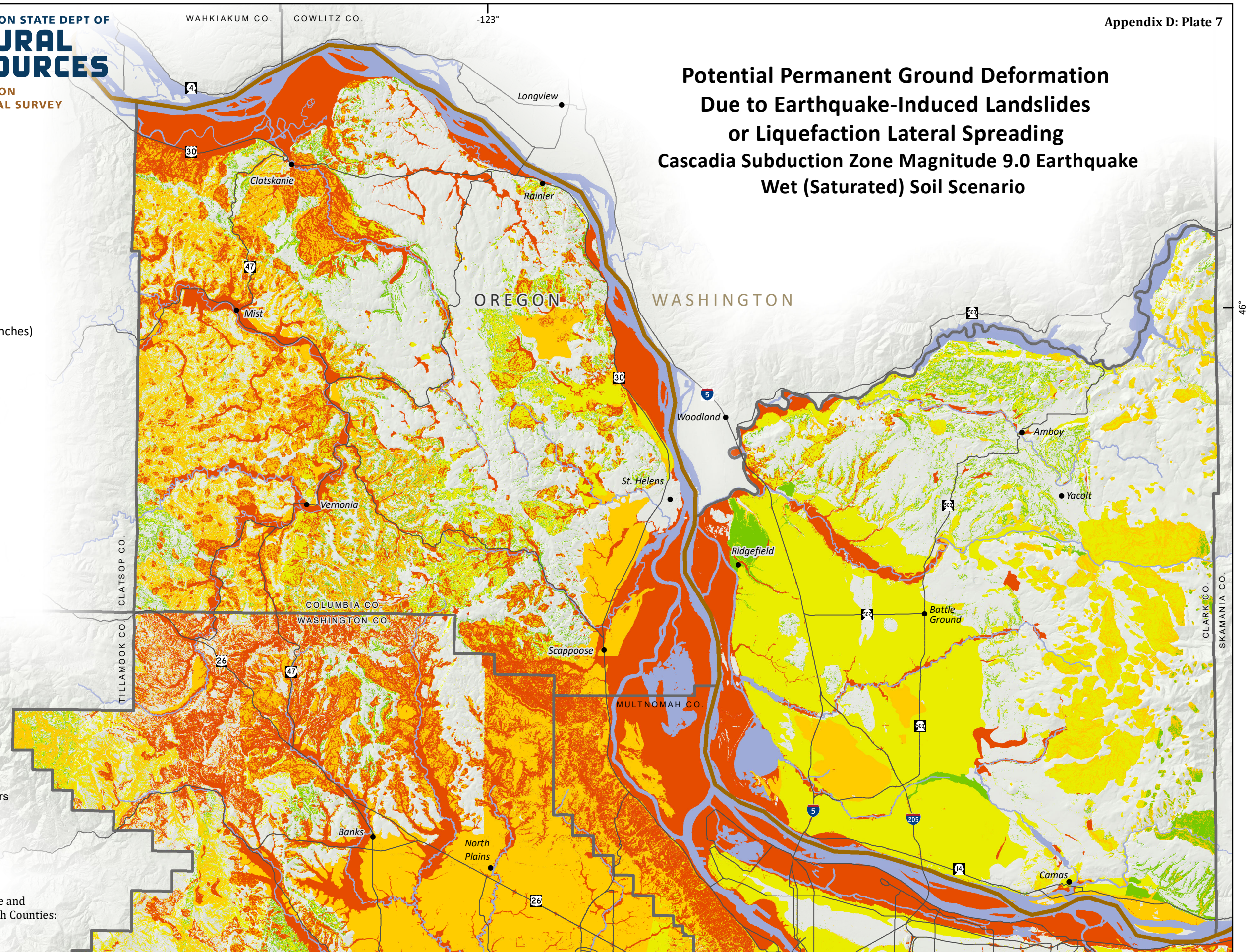
**Potential Permanent Ground Deformation
Due to Earthquake-Induced Landslides
or Liquefaction Lateral Spreading
Cascadia Subduction Zone Magnitude 9.0 Earthquake
Wet (Saturated) Soil Scenario**

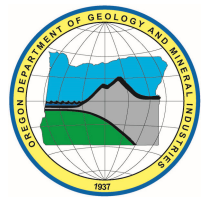
Permanent Ground Deformation

- 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: National Hydrography Dataset, 2018
Ground deformation from earthquake-induced landslide and
liquefaction lateral spreading in Washington, Multnomah Counties:
Bauer and others, 2018
Projection: Lambert Conformal Conic, EPSG 2913.





WASHINGTON STATE DEPT OF
**NATURAL
RESOURCES**
WASHINGTON
GEOLOGICAL SURVEY

WAHKIAKUM CO.

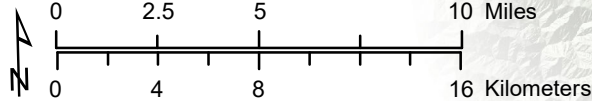
COWLITZ CO.

-123°

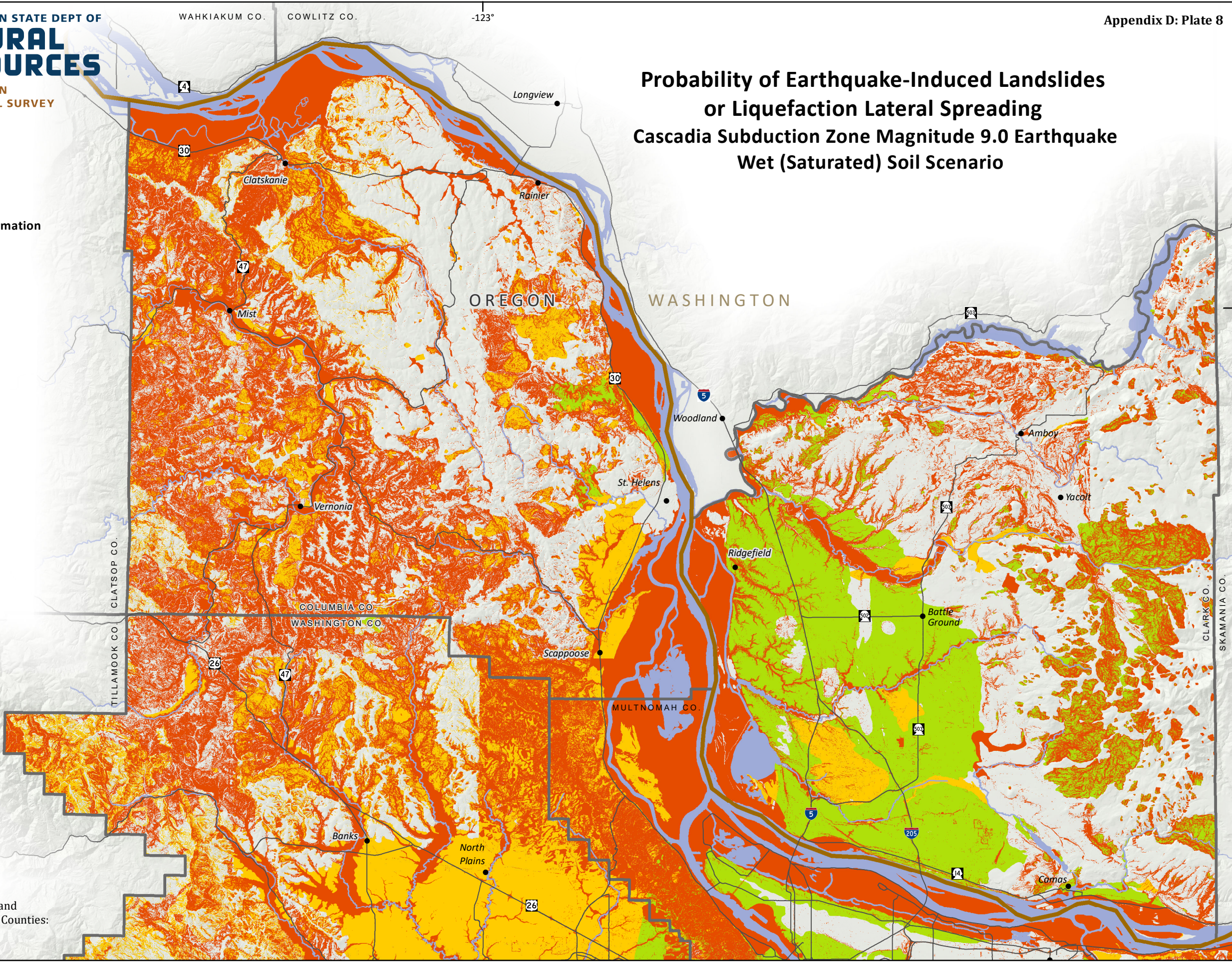
**Probability of Earthquake-Induced Landslides
or Liquefaction Lateral Spreading
Cascadia Subduction Zone Magnitude 9.0 Earthquake
Wet (Saturated) Soil Scenario**

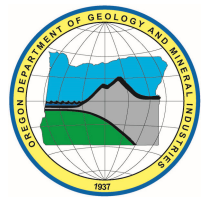
Probability of Permanent Ground Deformation

- None
- Low (1%–5%)
- Moderate (6%–15%)
- High (16%–30%)



Source Data:
Hydrography: National Hydrography Dataset, 2018
Ground deformation from earthquake-induced landslide and
liquefaction lateral spreading in Washington, Multnomah Counties:
Bauer and others, 2018
Projection: Lambert Conformal Conic, EPSG 2913.





WASHINGTON STATE DEPT OF
**NATURAL
RESOURCES**
WASHINGTON
GEOLOGICAL SURVEY

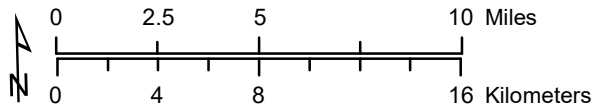
Potential Impact of Permanent Ground Deformation
to Portland, Oregon/Vancouver, Washington Regional Area
Emergency Transportation Route Segments
Cascadia Subduction Zone Magnitude 9.0 Earthquake
Wet (Saturated) Soil Scenario

Maximum Potential Permanent
Ground Deformation Within Segment

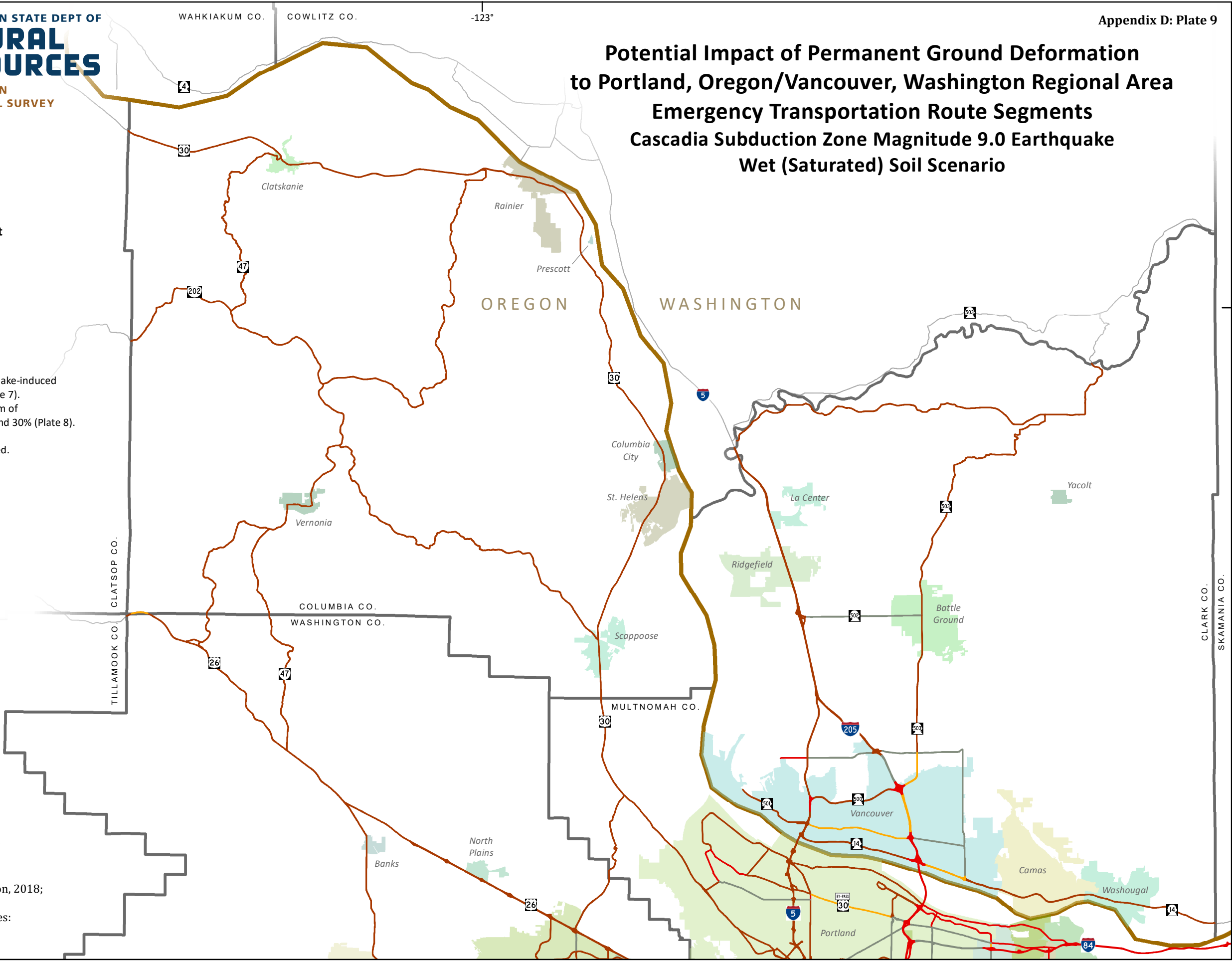
- < 0.5 meters
- 0.5–1.0 meters
- 1.0–2.0 meters
- > 2.0 meters

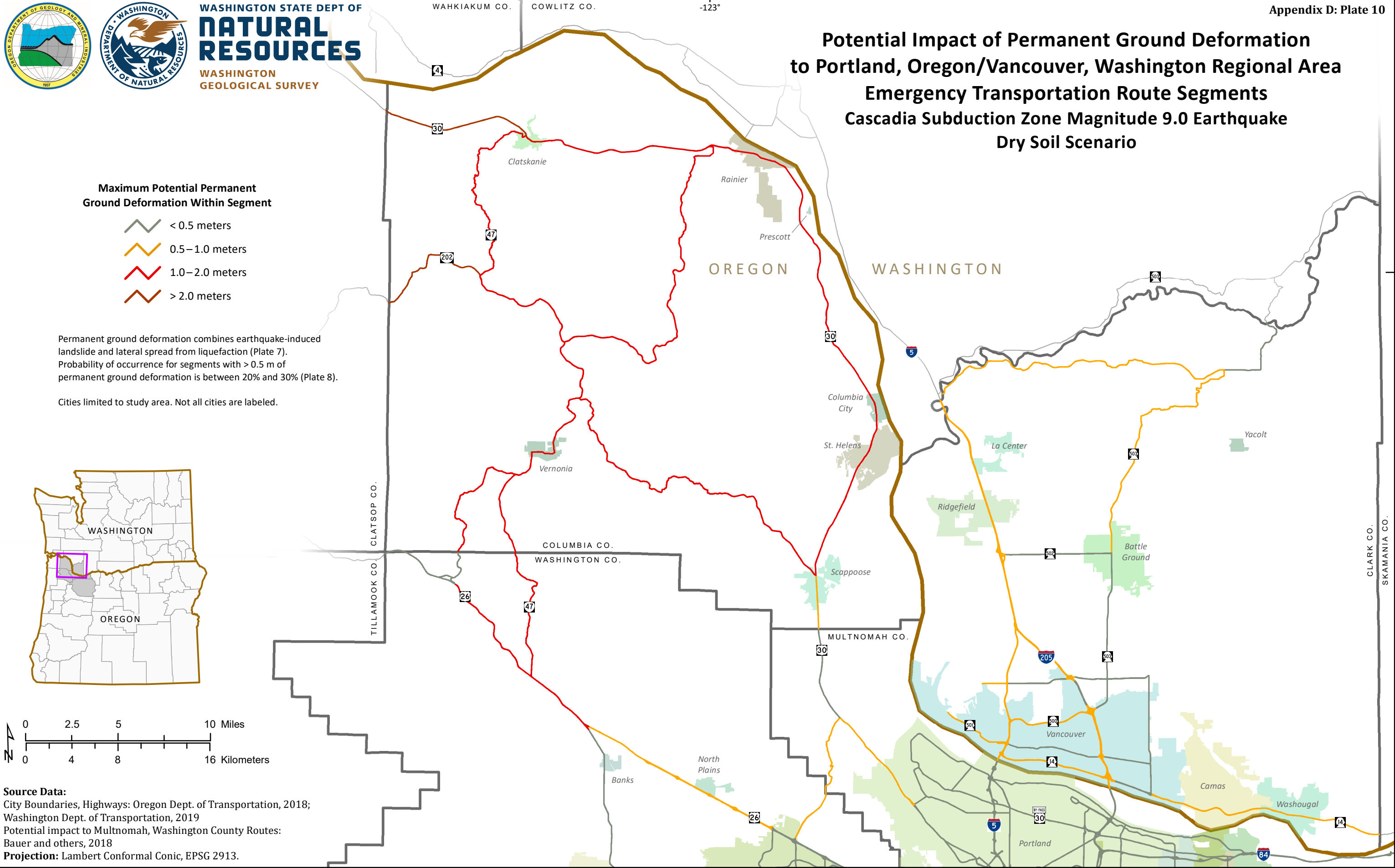
Permanent ground deformation combines earthquake-induced landslide and lateral spread from liquefaction (Plate 7). Probability of occurrence for segments with > 0.5 m of permanent ground deformation is between 20% and 30% (Plate 8).

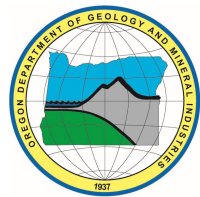
Cities limited to study area. Not all cities are labeled.



Source Data:
City boundaries, highways: Oregon Dept. of Transportation, 2018;
Washington Dept. of Transportation, 2019
Potential impact to Multnomah, Washington County routes:
Bauer and others, 2018
Projection: Lambert Conformal Conic, EPSG 2913.







WASHINGTON STATE DEPT OF
**NATURAL
RESOURCES**
WASHINGTON
GEOLOGICAL SURVEY

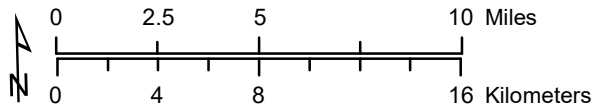
Potential Impact of Permanent Ground Deformation
to Portland, Oregon/Vancouver, Washington Regional Area
Emergency Transportation Routes
Cascadia Subduction Zone Magnitude 9.0 Earthquake
Wet (Saturated) Soil Scenario

Maximum Potential Permanent
Ground Deformation Within Segment

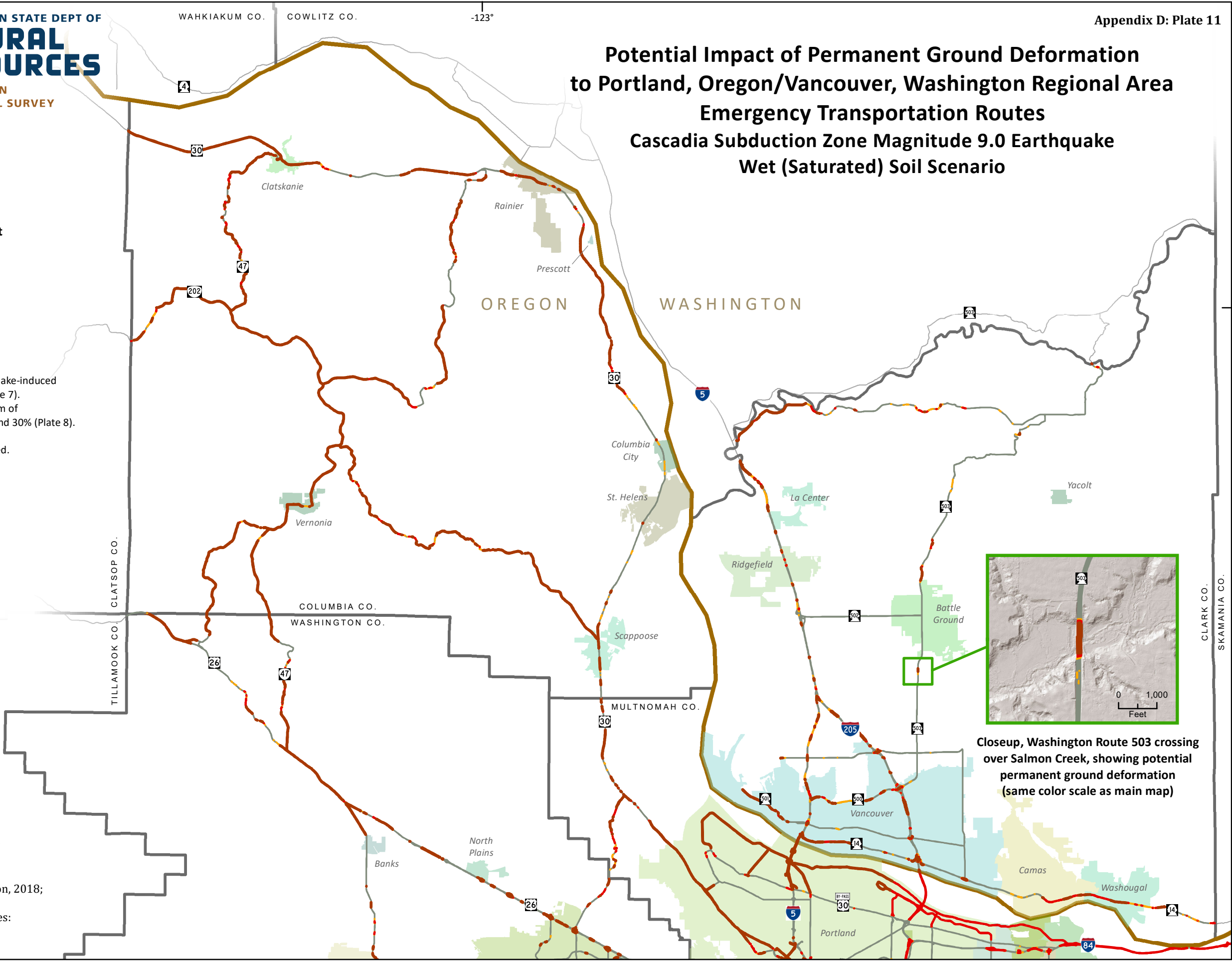
- < 0.5 meters
- 0.5–1.0 meters
- 1.0–2.0 meters
- > 2.0 meters

Permanent ground deformation combines earthquake-induced landslide and lateral spread from liquefaction (Plate 7). Probability of occurrence for segments with > 0.5 m of permanent ground deformation is between 20% and 30% (Plate 8).

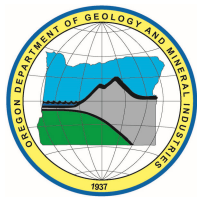
Cities limited to study area. Not all cities are labeled.



Source Data:
City boundaries, highways: Oregon Dept. of Transportation, 2018;
Washington Dept. of Transportation, 2019
Potential impact to Multnomah, Washington County routes:
Bauer and others, 2018
Projection: Lambert Conformal Conic, EPSG 2913.



Closeup, Washington Route 503 crossing
over Salmon Creek, showing potential
permanent ground deformation
(same color scale as main map)



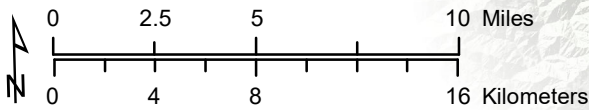
WASHINGTON STATE DEPT OF
**NATURAL
RESOURCES**
WASHINGTON
GEOLOGICAL SURVEY

**Potential Impact of Permanent Ground Deformation
to Electrical Transmission Structures**
**Cascadia Subduction Zone Magnitude 9.0 Earthquake,
Wet (Saturated) Soil Scenario**

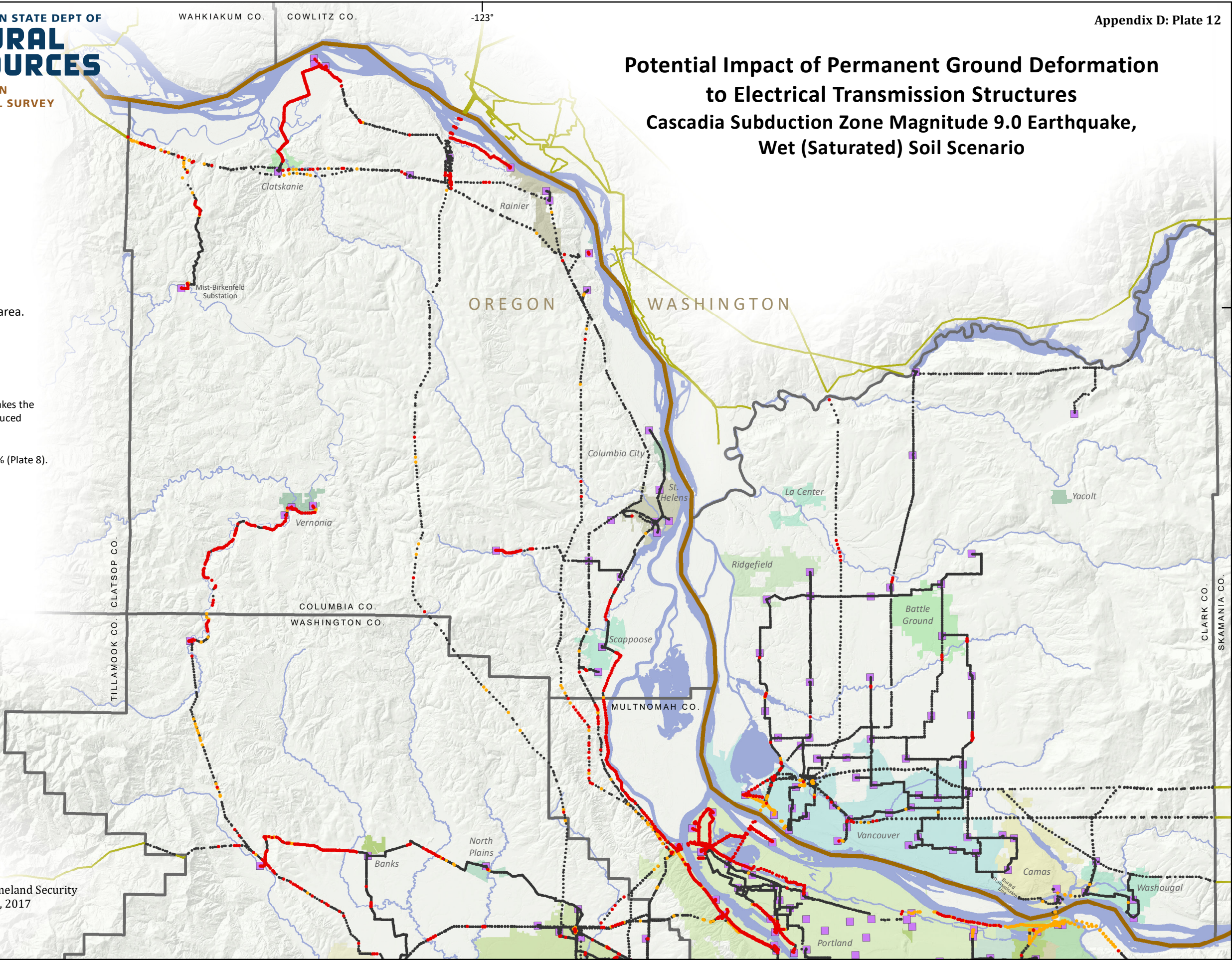
**Potential Permanent Ground Deformation at
Electrical Transmission Pole/Tower**

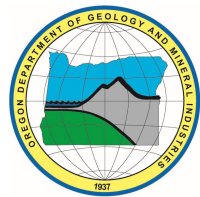
- < 1.0 meter
- 1.0–2.0 meters
- > 2.0 meters
- Substation (limited to study area.
Not all substations shown)
- Transmission Line Corridor
(outside of study area)

Permanent ground deformation at the pole/tower site takes the maximum of ground deformation due to earthquake-induced landslides and lateral spread from liquefaction (Plate 7). Probability of occurrence for structures with > 1 meter permanent ground deformation is between 20% and 30% (Plate 8).



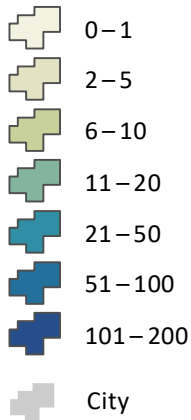
Source Data:
Hydrography: National Hydrography Dataset, 2018
Substations and transmission line corridors: Dept. of Homeland Security Homeland Infrastructure Foundation-Level Data (HIFLD), 2017
Cities and towns: Oregon Dept. of Transportation, 2018;
Washington Dept. of Transportation, 2019
Projection: Lambert Conformal Conic, EPSG 2913.



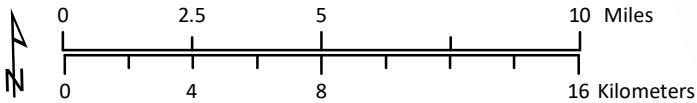


WASHINGTON STATE DEPT OF
**NATURAL
RESOURCES**
WASHINGTON
GEOLOGICAL SURVEY

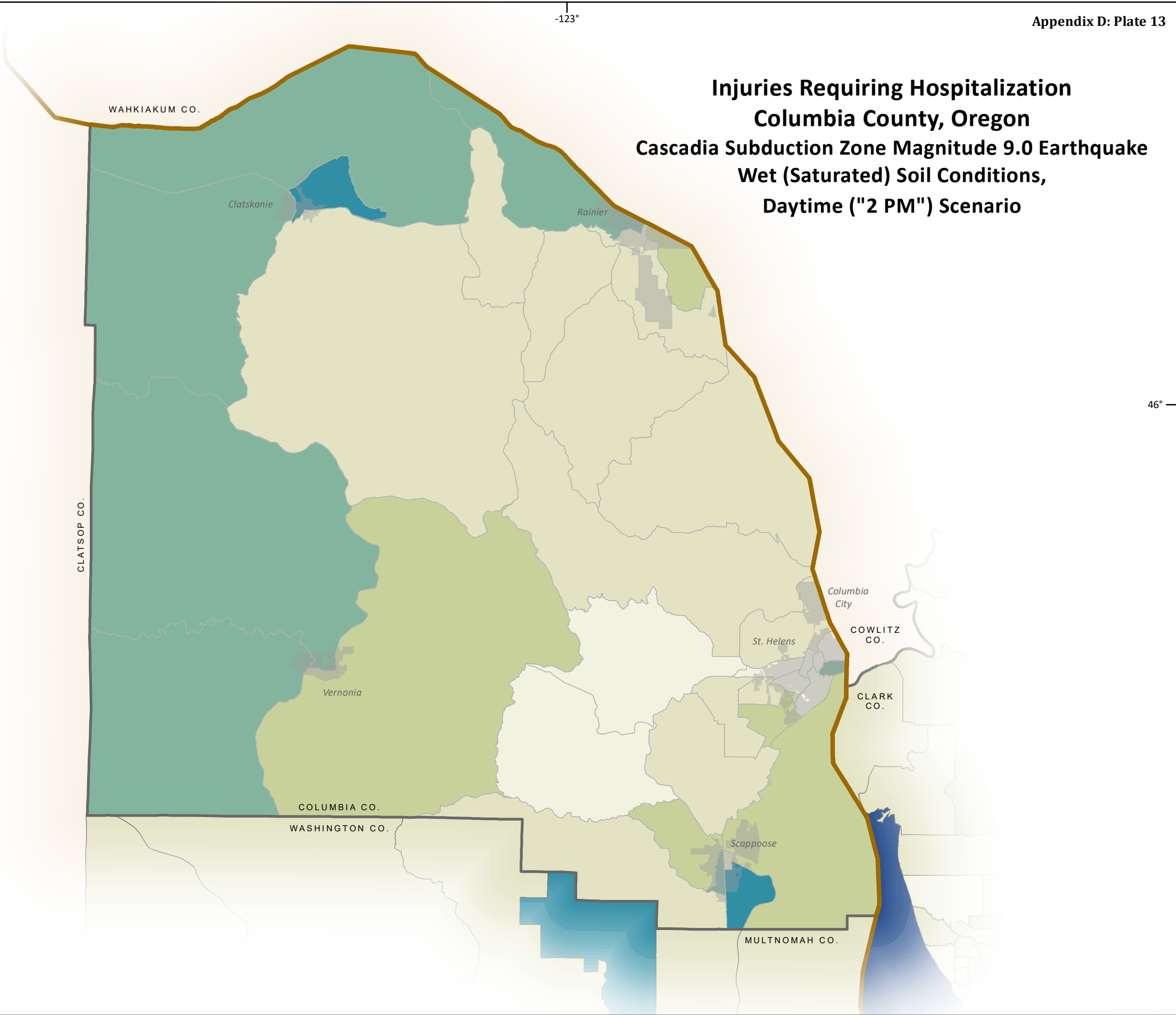
Injuries Requiring Hospitalization
per Neighborhood Unit

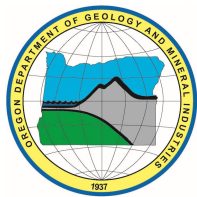


No hospitals exist in Columbia County.
Hospitals outside of Columbia County not shown.
"Injuries requiring hospitalization" combines
Hazus casualty levels 2 and 3 (Table 4-1).



Source Data:
Neighborhood units: Adapted from U.S. Census Bureau 2010 census block groups
Cities and towns: Oregon Dept. of Transportation, 2018
Casualties in Washington and Multnomah Counties: Bauer and others, 2018
Projection: Lambert Conformal Conic, EPSG 2913.



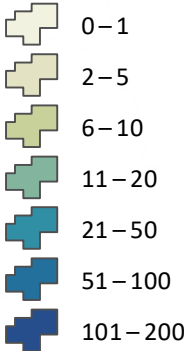


WASHINGTON STATE DEPT OF
**NATURAL
RESOURCES**
WASHINGTON
GEOLOGICAL SURVEY

Appendix D: Plate 14

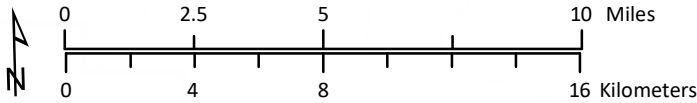
Injuries Requiring Hospitalization
Clark County, Washington
Cascadia Subduction Zone Magnitude 9.0 Earthquake
Wet (Saturated) Soil Conditions, Daytime ("2 PM") Scenario

**Injuries Requiring Hospitalization
per Neighborhood Unit**



Hospital
 City or Town

Hospitals outside of Clark County not shown.
Not all Clark County cities are shown in light grey.
"Injuries requiring hospitalization" combines
Hazard casualty levels 2 and 3 (Table 4-1).



Source Data:
Neighborhood units: Adapted from U.S. Census Bureau 2010 Census block groups
Hospitals: Metro Regional Land Information System (RLIS), January 2019
Cities and towns: Washington Dept. of Transportation, 2019
Casualties in Multnomah County: Bauer and others, 2018
Projection: Lambert Conformal Conic, EPSG 2913.

