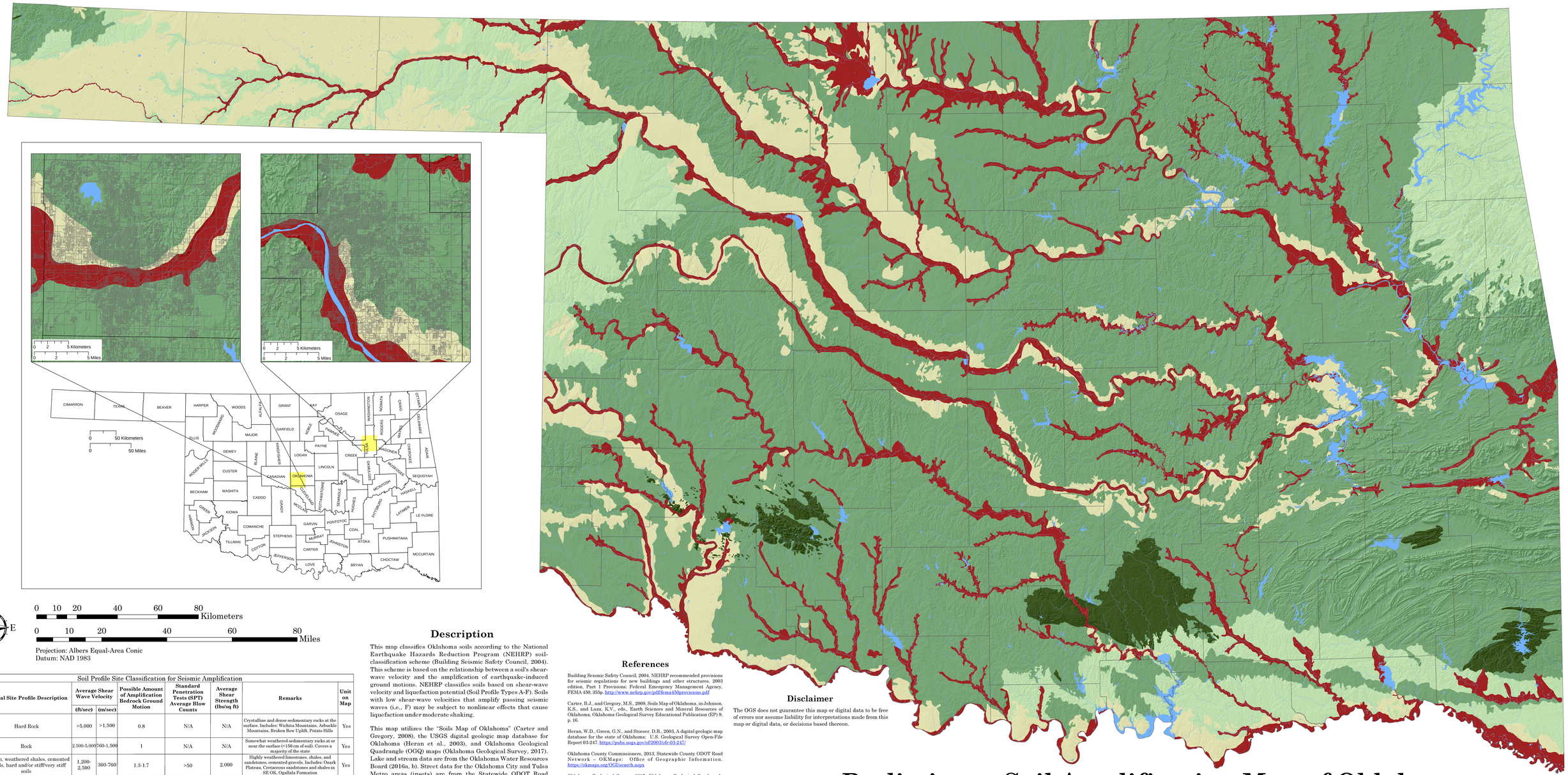
Oklahoma Geological Survey
Jeremy Boak, *Director*






N
W E
S

0 10 20 40 60 80 Kilometers

0 10 20 40 60 80 Miles

Projection: Albers Equal-Area Conic
Datum: NAD 1983

Soil Profile Site Classification for Seismic Amplification

| Soil Profile Type | General Site Profile Description | Average Shear Wave Velocity (ft/sec) | Average Shear Wave Velocity (m/sec) | Possible Amount of Amplification Bedrock Ground Motion | Standard Penetration Tests (SPT) Average Blow Counts | Average Shear Strength (lbs/sq ft) | Remarks | Unit on Map |
|---|---|---|---|---|---|---|---|---|
| A | Hard Rock | >5,000 | >1,500 | 0.8 | N/A | N/A | Crystalline and dense sedimentary rocks at the surface. Includes: Wichita Mountains, Arbuckle Mountains, Broken Bow Uplift, Potato Hills | Yes |
| B | Rock | 2,500-5,000 | 760-1,500 | 1 | N/A | N/A | Somewhat weathered sedimentary rocks at or near the surface (<150 cm of soil). Covers a majority of the state | Yes |
| C | Regolith, weathered shales, cemented gravels, hard and/or stiff/very stiff soils | 1,200-2,500 | 360-760 | 1.3-1.7 | >50 | 2,000 | Highly weathered limestones, shales, and sandstones, cemented gravels. Includes: Ozark Plateau, Cretaceous sandstones and shales in SE OK, Ogallala Formation | Yes |
| D | Sands, silts, and/or stiff/very stiff clays, loess, gravels | 6,000-1,200 | 180-360 | 1.5-2.4 | 15-50 | 1,000-2,000 | Sand that is generally not saturated with water. Includes: Panhandle cover and loess, Quaternary terrace deposits | Yes |
| E | Soil profile with more than 10 ft (3m) of soft clay defined as soil with Plasticity Index > 30, water content > 40 | <600 | <180 | 1.2-3.5 | <15 | <1,000 | Not mappable at this scale | No |
| F | Soils vulnerable to potential failure or collapse under seismic loading such as liquefiable soils, quick and highly sensitive clays, collapsible, weakly cemented soils | N/A | N/A | Site Specific Investigation should be conducted - can be < 1 to as high as 10 x | <15 | <1,000 | Any saturated or partially saturated sands. Includes: Quaternary alluvium | Yes |

## Description

This map classifies Oklahoma soils according to the National Earthquake Hazards Reduction Program (NEHRP) soil-classification scheme (Building Seismic Safety Council, 2004). This scheme is based on the relationship between a soil's shear-wave velocity and the amplification of earthquake-induced ground motions. NEHRP classifies soils based on shear-wave velocity and liquefaction potential (Soil Profile Types A-F). Soils with low shear-wave velocities that amplify passing seismic waves (i.e., F) may be subject to nonlinear effects that cause liquefaction under moderate shaking.

This map utilizes the "Soils Map of Oklahoma" (Carter and Gregory, 2008), the USGS digital geologic map database for Oklahoma (Heran et al., 2003), and Oklahoma Geological Quadrangle (OGQ) maps (Oklahoma Geological Survey, 2017). Lake and stream data are from the Oklahoma Water Resources Board (2016a, b). Street data for the Oklahoma City and Tulsa Metro areas (insets) are from the Statewide ODOT Road Network (Oklahoma County Commissioners, 2013). The underlying DEM is 30m resolution (U.S. Geological Survey, 2016).

The map was produced and drafted in ArcGIS 10.4 and reviewed by David Brown and Ted Satterfield. Russell Standridge assisted in drafting the map. Work was funded by a grant through the Oklahoma Governor's office. This map is for informational purposes only and should not be used to determine liquefaction potential for specific sites. Further mapping and geotechnical measurements should be conducted in areas of concern.

## References

Building Seismic Safety Council, 2004, NEHRP recommended provisions for seismic regulations for new buildings and other structures, 2003 edition, Part 1 Provisions: Federal Emergency Management Agency, FEMA 450, 355p. http://www.nehrp.gov/pdf/fema450provisions.pdf

Carter, B.J., and Gregory, M.S., 2008, Soils Map of Oklahoma, in Johnson, K.S., and Luza, K.V., eds., Earth Sciences and Mineral Resources of Oklahoma, Oklahoma Geological Survey Educational Publication (EP) 9, p. 16.

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Oklahoma Geological Survey, 2017, Oklahoma Geological Quadrangle maps 1-94 (1989-2017), http://www.ou.edu/content/ogs/maps/ogq.html

Oklahoma Water Resources Board, 2016a, OWRB – Lakes of Oklahoma – OWRB Surface Water Data: Oklahoma Water Resources Board, http://www.owrb.ok.gov/maps/PMG/owrbdata_SW.html

Oklahoma Water Resources Board, 2016b, OWRB – Major Streams – OWRB Surface Water Data: Oklahoma Water Resources Board, http://www.owrb.ok.gov/maps/PMG/owrbdata_SW.html

U.S. Geological Survey, 2016, 1 Arc-second Digital Elevation Models (DEMs) – USGS National Map 3DEP Downloadable Data Collection: U.S. Geological Survey. https://nationalmap.gov

## Disclaimer



# Preliminary Soil Amplification Map of Oklahoma

## According to the National Earthquake Hazard Reduction Program (NEHRP)

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2017

Scale 1:500,000