

## README\_Liquefaction

### Liquefaction Susceptibility Maps for the Idaho Falls-Rexburg Areas Idaho

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#### WHAT IS LIQUEFACTION?

Liquefaction occurs during strong earthquake ground shaking when saturated, cohesionless earth materials lose strength due to high excess pore-water pressure. The consequences of liquefaction can be catastrophic, including destruction of railways, roads, bridge abutments, and building foundations. Liquefaction susceptibility is highest in artificial fills and loose, sandy deposits that are saturated with water. Such deposits may occur adjacent to rivers, streams, and lakes, even in a semi-arid region like southern Idaho. Irrigation may also increase liquefaction susceptibility by saturating deposits.

#### HOW THESE MAPS WERE PRODUCED

Liquefaction susceptibility maps were produced for the following 7.5-minute U.S. Geological Survey quadrangles:

Ammon  
Firth  
Goshen  
Idaho Falls North  
Idaho Falls South  
Lewisville  
Menan Butte  
Rexburg  
Rigby  
Ririe  
Ucon  
Woodville

These maps were produced using a standard methodology that relates deposit age, texture, and environment of deposition to liquefaction susceptibility (Federal Emergency Management Administration, 2009, Table 4-10, p. 4-22; Youd and Perkins, 1978). The classification process was similar to that employed in Washington State (Palmer and others, 2004).

Earth materials within about 100 ft (30 m) of the surface were classified using 1:24,000-scale geologic maps for each of the quadrangles (Phillips and Welhan, in preparation). For each map unit, a score was assigned to each classifying factor then summed to give the classification. Symbols, scores, and the classification scheme used are provided in the spreadsheets listed at the end of this file. Bedrock does not liquefact, so only unconsolidated units were assigned a liquefaction susceptibility. Areas of bedrock overlain by >10 feet of unconsolidated materials were identified with water well records (IDWR, 2010) and classified on the basis of the unconsolidated deposits.

#### EXPLANATION OF LIQUEFACTION SUSCEPTIBILITY CLASSES

**High Liquefaction Susceptibility:** Holocene sandy alluvium of meandering streams and dunes; modern artificial fill.

**Moderate Liquefaction Susceptibility:** Holocene coarse alluvium of meandering streams, fine alluvial fans, and coarse colluvium; younger Pleistocene sandy alluvium of meandering streams.

Low Liquefaction Susceptibility: Younger to Older Pleistocene coarse alluvium of braided streams; Younger Pleistocene loess and loess >10 ft thick over bedrock.

## SEASONALLY SATURATED SOILS

Liquefaction susceptibility is strongly increased by a shallow groundwater table. To highlight areas with high water tables, seasonally saturated (aquic) soils within 5 ft (1.5 m) of the surface were indicated using data from county soil maps (Jorgensen, 1979; Noe, 1981; Miles, 1981; Salzmann and Harwood, 1973). These soils have redoximorphic features characteristic of transient saturation. In most of these soils, saturation occurs only during spring runoff and the irrigation season. Changes in irrigation practices and field draining alter local water tables so areas of saturation may have changed since collection of soil data. These data are shown on the digital map pdf files; they are also available in the ArcGIS Personal Geodatabase listed at the end of this file.

## DEPTH TO WATER TABLE

Contours showing average depth-to-water are used to further identify regions with potentially saturated conditions. The contours were created using data obtained from wells drilled into the Eastern Snake River Plain (ESRP) aquifer. This aquifer underlies the lowlands of the ESRP. The paucity of wells in upland areas required the contours to end at the ESRP boundary. In the ESRP, water tables experience large seasonal fluctuations. Multi-year droughts or wet cycles also influence water table levels. Local pumping, and irrigation practices are other important factors controlling the depth-to-water. These factors make it difficult to precisely estimate water table depths. Therefore, the depth-to-water contours should be viewed as guidelines to focus further investigation of liquefaction susceptibility rather than definitive measures of the depth-to-water. Details of how the water table contours were generated are given in Welhan (in preparation). The contours are shown on digital map pdf files; they are also available in the ArcGIS Personal Geodatabase listed at the end of this file.

## HOW TO USE THESE MAPS

Map users should use both the susceptibility class and indicators of water table depth when evaluating liquefaction susceptibility. The highest liquefaction hazards are in areas underlain by young, sandy sediments with high water tables. Artificial fills that have not been properly compacted are especially hazardous.

## LIMITATIONS ON THE USE OF THESE MAPS

These maps are a general guide to outline areas with the potential for liquefaction. Because this map is based on regional geological and hydrological mapping, detailed geotechnical investigation is required to determine actual ground conditions for specific building sites.

The maps are intended to be used at a scale of 1:24,000. As with all maps, users should not apply this map, either digitally or on paper, at more detailed scales.

## OBTAINING DIGITAL AND PAPER COPIES OF THESE MAPS

The maps and the data used to make them are available in digital format for free download at the website of the Idaho Geological Survey ([www.idahogeology.org](http://www.idahogeology.org)).

## REFERENCES CITED

Federal Emergency Management Agency, 2009, Multi-Hazard Loss Estimation Methodology Earthquake Model, HAZUS-MH MR4, Technical Manual (available at <http://www.fema.gov/library/viewRecord.do?id=3731>).

IDWR, 2010, Water well logs: Idaho Department of Water Resources, Boise. [Available at <http://www.idwr.idaho.gov/GeographicInfo/GISdata/wells.htm>]

Jorgensen, W., 1979, Soil survey of Jefferson County, Idaho: U.S. Department of Agriculture, Soil Conservation Service, 219 p. 66 map plates, scale, 1:20,000. [Available at <http://soildatamart.nrcs.usda.gov/>]

Noe, H.R., 1981, Soil survey of Madison County area, Idaho: U.S. Department of Agriculture, Soil Conservation Service, 128 p., 29 map plates, scale 1:24,000. [Available at <http://soildatamart.nrcs.usda.gov/>]

Miles, R.L., 1981, Soil survey of Bonneville County area, Idaho: U.S. Department of Agriculture, Soil Conservation Service, 108 p., 58 plates, scale 1:24,000. [Available at <http://soildatamart.nrcs.usda.gov/>]

Palmer, S.P. and others, 2004, Liquefaction susceptibility and site class maps of Washington State by county: Washington Department of Natural Resources, Division of Geology and Earth Resources Open File Report 2004-20 (available at <http://198.187.344/geology/pubs/ofr04-20/>).

Phillips, W.M. and J.A. Welhan, in preparation, Geologic maps of the Ammon, Firth, Goshen, Idaho Falls North, Idaho Falls South, Lewisville, Menan Butte, Rexburg, Rigby, Ririe, Ucon, and Woodville quadrangles, Idaho: Idaho Geological Survey Digital Web Maps, scale 1:24,000 (available at [www.idahogeology.org](http://www.idahogeology.org)).

Salzmann, R.A. and J.O. Harwood, 1973, Soil survey of Bingham area, Idaho: U.S. Department of Agriculture, Soil Conservation Service, 123 p., 120 plates, scale 1:24,000. [Available at <http://soildatamart.nrcs.usda.gov/>]

Welhan, J.A., in preparation, Water table model for use in liquefaction susceptibility mapping in the Idaho Falls-Rexburg area: Idaho Geological Survey Staff Report.

Youd, T.L. and M. Perkins, 1978, Mapping liquefaction-induced ground failure potential: Journal of the Geotechnical Engineering Division-ASCE, v. 104(4), pp. 433-446.

#### ACKNOWLEDGMENTS

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#### SPREADSHEETS

IF\_Rex\_Geounits.xls

Deposit Age, Texture, Environment, and Classification Scores for each geologic unit from each quadrangle in the study area

IF\_Rex\_Age\_symbols.xls

Symbols used for Age classes

IF\_Rex\_Texture\_symbols.xls

Symbols used for Texture classes

IF\_Rex\_Enviro\_symbols.xls

Symbols used for Depositional Environment classes

IF\_Rex\_Score\_Classes.xls

Classification scheme for geological units

ARCGIS PERSONAL GEODATABASE (version 1.2020.7)

\\GIS\_DATA\IDFall\_NEHRP\_LQ\_GIS.mdb (start with IdahoFalls\_NEHRP\_and\_Liquefaction.mxd)

Feature classes:

-->IDFalls\_H2Otable\_IDTM27-----Depth to water table

-->IDFalls\_LQ\_classIDTM27-----Liquifaction susceptibility data

-->IDFalls\_sat\_soil\_IDTM27-----Saturated soils data  
-->IDFalls\_SiteClass\_IDTM27-----NEHRP site class data  
-->Proj\_area\_quad\_indexIDTM27--Quadrangle index overlay