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Cone Penetration Tests and Soil Borings at Mason Road, Green Valley, Solano County, California

By Michael J. Bennett, Thomas E. Noce, and James J. Lienkaemper

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Conversion Factors

SI to Inch/Pound

Multiply	By	To obtain
	Length	
centimeter (cm)	0.3937	inch (in.)
millimeter (mm)	0.03937	inch (in.)
meter (m)	3.281	foot (ft)
kilometer (km)	0.6214	mile (mi)
kilometer (km)	0.5400	mile, nautical (nmi)
meter (m)	1.094	yard (yd)

Cone Penetration Tests and Soil Borings at Mason Road, Green Valley, Solano County, California

By Michael J. Bennett[1], Thomas E. Noce[1], and James J. Lienkaemper[1]

Abstract

In support of a study to investigate the history of the Green Valley Fault, 13 cone penetration test soundings and 3 auger borings were made at the Mason Road site in Green Valley, Solano County, California. Three borings were made at or near two of the cone penetration test soundings. The soils are mostly clayey with a few sandy layers or lenses. Fine-grained soils range from low plasticity sandy lean clay to very plastic fat clay. Lack of stratigraphic correlation in the subsurface prevented us from determining whether any channels had been offset at this site. Because the soils are generally very clayey and few sand layers or lenses are loose, the liquefaction potential at the site is very low.

Introduction

The data collected during this investigation are being used to support research into the fault history of the Green Valley Fault (fig. 1). To determine the late Pleistocene slip rate of the Green Valley Fault at the Mason Road site (fig.2) required matching subsurface channel deposits across the fault. The channel and local stratigraphy were defined using several geophysical methods including the cone penetration test (CPT), ground-penetration radar (GPR), and seismic refraction (Kimball, 2005; Craig and others, 2011). The U.S. Geological Survey (USGS) conducted 12 CPTs and one seismic CPT in 2004 and one CPT and two hollow-stem borings for sampling in 2007 (fig. 3). Another hollow-stem borehole was drilled in 2009 at stake 11 (near SNC003), also for sampling.

We drilled the borehole on the west side of the fault to sample and penetrate below a thin channel deposit inferred from the CPT to lie at about 12 m depth. This channel deposit on the west side of the fault was thought to match a channel deposit on the east side of the fault but which was laterally offset by about 500 m (Lienkaemper, personal communication). From the base of the borehole in the channel gravels we obtained radiocarbon ages of less than 15 ka. Therefore, these dates and the upper bound of plausible slip rate of the fault from regional geodesy of about 10 mm/year both suggest that actual channel offsets would be expected in the range of only 75 to 150 m, much less than previously assumed.

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Field and Laboratory Methods

Cone Penetration Test (CPT)

Thirteen CPT soundings were conducted at the Mason Road site to determine stratification, density, consistency, and penetration resistance of the soils and to evaluate the geology at depth. Two different cone penetrometers were used for the soundings. Digital cone 766tc was used for sounding SNC001 as a seismic cone and used without the seismic capability for soundings SNC002 through SNC012. Analog cone 329 was used for sounding SNC013. Cone 766tc is a Hogentogler 10-ton digital subtraction cone with a single-element strain gauge that eliminates mechanical coupling effects. The cone has internal electronic power amplification and regulation mounted directly behind the transducer, a design that eliminates the effect of cable resistance on the measurements. In addition, the cone is temperature-compensated to reduce errors due to temperature changes at depth. A strain gauge is located in a 3.6-cm-diameter housing, the tip of which is a 60° 10-cm^2 cone. Cone resistance (Q_C) is measured at the tip; side friction resistance (f_s) is measured along a 150 cm^2 sleeve located behind the cone. The cone is advanced into the soil at a rate of 2 cm/s. Recording channels include (1) tip resistance, (2) side friction resistance, (3) two channels of inclination, and (4) two channels to measure shear-wave velocity. Tip resistance and the ratio between side friction resistance and tip resistance (friction ratio, R_f, in percent) are used to infer soil type. The penetration resistance, which is digitized at depth intervals of 5 cm, permits detailed inferences about stratigraphy and lithology. The procedures and equipment meet the requirements of ASTM D3441-79 (American Society for Testing and Materials, 1983). The digital cone is advanced with the cone penetration truck; further information about the cone and the truck can be obtained at *http://pubs.usgs.gov/fs/2003/fs028-03/*. The analog cone follows the same procedures and equipment requirements as the cone 766tc except the analog cone measurements are digitized every 10 cm and the cone is advanced with a Mobile B-50 drill rig. The B-50 drill rig was used because of limited access for the CPT truck.

Measuring shear-wave velocity during soundings is faster and less expensive than standard cross-hole or downhole seismic tests. All of the electronics are in the cone, eliminating the need for drilling and casing boreholes. The cone itself is in direct contact with the soil and causes fewer disturbances of the in-situ conditions than drilling a hole to be cased. A shear wave is generated at the surface by horizontally striking a vertical steel plate (underneath a leveling pad of the truck) with a sledge hammer. The location of the seismic source on the ground surface and the orientation of the seismometer in the cone allow the shear waves to propagate down through the soil, rather than across the horizontal surface layer, which reduces the effect of refraction on the results. The resulting wave is recorded and transmitted to a computer in the truck. The arrival time of the shear wave can then be determined. The change in depth between any two tests is divided by the difference in the arrival times to determine the average shear-wave velocity for that depth interval.

The location of the thirteen CPT soundings is shown in figure 3. The CPT data can be downloaded in tabular format at the USGS web site found at *http://earthquake.usgs.gov/research/cpt/data/solano/*.

Continuous Hollow-Stem Auger Sampling

Two hollow-stem auger borings (fig. 3) were made 1.5 m east from sounding SNC007 to obtain samples for soil index tests and to obtain samples suitable for radiocarbon dating and for

optically stimulated luminescence dating (OSL). Continuous samples were taken with thin-walled, 7.6 cm x 91 cm, Shelby tubes used with hollow-stem augers (25.4 cm outside and 10.2 cm inside diameter). Tubes were slowly advanced into the soil past the end of the auger; the auger was then advanced the sampling length, the tube was then rotated to shear off the sample from the undisturbed soil. Following retrieval, the tubes were capped and sealed with tape; wax was not used for sealing the tubes. One borehole was also made at stake 11 (fig. 3), approximately 6 m south of SNC003, for the same purposes as the boring at SNC007.

Laboratory Testing

Index tests conducted in the laboratory include: grain size (D422-63, ASTM, 1983); Atterberg tests, liquid limit (D423-66, ASTM, 1983); plastic limit (D424-59, ASTM, 1983); and water content (D2216, ASTM, 1983). An important index property is the plasticity index (PI), computed as the difference between the liquid limit and the plastic limit. Samples were classified using the Unified Soil Classification (D2488-69, ASTM, 1983) as modified by Howard (1984). Fat and lean are terms used to describe clay types, fat clays have liquid limits greater than 50, lean clays have liquid limits less than 50. Shelby tube samples were cut into 15 cm lengths for bulk density and vane shear tests. The length of each subsample was measured and the tube and sample weighed for density measurements. A pocket penetrometer was used to measure unconfined compressive strength of the sample. Next, when the sample was still contained in the tube, shear strength was measured using a Wykeham Farrance laboratory vane shear device. The vane (12.7 x 12.7 mm) was pushed 4 cm into the sample and rotated at 90 degrees per minute. Peak strength, residual strength and remolded strength were measured; sensitivity was calculated from the ratio of peak strength to remolded strength. After the strength measurements were recorded, the vane was removed and a water content sample was taken from the area of the vane test. The sample was then extruded from the Shelby tube and described. The Munsell Soil Color Chart was used to describe color (Munsell, 1994). Results of the laboratory tests are shown in table 1 and table 2.

Liquefaction Susceptibility

We evaluated liquefaction susceptibility in several ways. Cone and friction resistance measurements from the cone penetrometer tests were used to calculate the liquefaction potential index (LPI). LPI assumes that the severity of liquefaction is proportional to three factors: (1) thickness of the liquefied layers, (2) how close are the liquefied layers to the ground surface, and (3) how much less than 1 is the factor of safety, where the “factor of safety” is the ratio of the soil’s capacity to resist liquefaction to the seismic demand imposed by the earthquake (Iwasaki and others 1978).

Toprak and Holzer (2003) independently correlated LPI with liquefaction effects in California earthquakes. Toprak and Holzer found that sand boils typically occur when LPI was equal to or greater than 5 and that lateral spreads occur when LPI was equal to or greater than 12.

Seed and Idriss (1982) suggest guidelines for determining the limits of liquefaction for clayey soils. They suggested that clayey soils are susceptible to liquefaction if: (1) clayey soils have less than 15 % clay (less than 0.005 mm), (2) the liquid limit is less than 35, and (3) the water content is greater than 90 % of the liquid limit. Bray and Sancio (2006) have suggested that a plasticity index (liquid limit –plastic limit) less than 12 is needed for soils to liquefy.

The liquefaction potential can be expressed graphically by using the liquefaction potential display (LPD). The LPD is a five-fold classification system that reflects the liquefaction factor of safety as determined by the CPT. Type 1 LPD represents soils that are not liquefiable

because the soils are either above the water table or the soils contain more than 15 percent clay and are not liquefiable. Type 2 LPD represents soils that are susceptible to liquefaction but their penetration resistance is high enough that the soils are not liquefiable under any seismic conditions. Type 3 LPD represents soils that have a factor of safety greater than 1.0 but could be liquefiable under more stressful conditions. Type 4 LPD represents soils that have a liquefaction factor of safety less than 1.0 but greater than 0.75. Type 5 LPD represents soils that have a liquefaction factor of safety less than 0.75. Examples of the LPD five-fold classification system for the geotechnical logs are shown in figures 4 through 21 and in a cross section (fig. 35).

Results

The geotechnical logs from the cone penetration tests (CPT) are shown in figures 4 through 21.The logs consist of 8 columns: (1) friction ratio (friction resistance/cone resistance, in percent) indicates soil type; a low number indicates coarse-grained soil type and a number greater than 2 indicates clayey soil type; (2) cone resistance indicates bearing capacity; (3) a 12-zone classification by Robertson (1990) indicates soil behavior type; (4) the Unified Soil Classification system (USC); (5) unit velocity in meters per section, only for SNC001; for all other geotechnical logs, the fines content (size fraction less than 0.075 mm) is shown; (6) the median grain size (D_{50}); (7) the liquefaction potential display (LPD), a 5-zone classification based on the liquefaction factor of safety; and (8) soil description.

The variations with depth in CPT, median grain size, Atterberg limits and water content, strength, liquidity index, and sensitivity and plasticity, are shown in figure 22 for the boring at SNC007. The variations with depth in CPT, median grain size, Atterberg limits and water content, strength, liquidity index, and sensitivity and plasticity, are shown in figure 23 for the boring at stake 11. The variation in plasticity with depth is shown in figure 24 for both of the borings to facilitate comparison of the stratification at the Mason Road site.

Grain size distributions are shown two ways. The first shows the distribution of grain size curves (fig. 25), with the cumulative percent finer plotted against the median grain size (D_{50}), in mm. The second shows the distribution of grain size in a ternary diagram (fig. 26); sand and gravel are plotted together and silt and clay separately. In both graphs, samples that are classified as “sensitive” in regards to soil strength are highlighted. Sensitivity is defined as the ratio of the peak strength to the remolded strength. Sensitive soils have sensitivity ratios between about 4 and 8.

The plasticity index of the samples is shown on the plasticity classification chart (fig. 27*A*, *B*) where sensitive samples are highlighted. The relation between median grain size, and liquid limit and clay content is shown in figure 28*A*, and relations between median grain size and plasticity index is shown in figure 28*B*. The effect of clay content on the plasticity index is shown in figure 29*A* and the effect of clay content on peak strength and remolded strength is shown in figure 29*B*. Figure 30 shows the relation between strength and plasticity index. Figure 31 shows the inverse relation between peak shear strength and the chroma of the samples. As the chroma value increases, the peak shear strength value decreases.

Figure 32 shows the relations between liquidity index and sensitivity (*A*), remolded strength (*B*), and plasticity index (*C*).

Three cross sections show the subsurface stratigraphy at the Mason Road site. The east-west profile is shown in figure 33. The north-south profile between SNC011 in the north and SNC005 in the south is shown in figure 34. A north-south profile that shows the soundings with velocity data and sample data is shown in figure 35. Also shown in figure 35 is the liquefaction potential display (LPD); LPD is a classification system that connotes the liquefaction potential

of the soil. We calculated the LPI at the Mason Road site based on the following: (1) a water table located at 3 m, (2) a **M6.5** earthquake, and (3) an acceleration of 0.3 g. Due to the high clay content of the soil and the relatively dense sand deposits at the Mason Road site, the liquefaction potential of the soil is very low. The graphic legend showing the UBC soil classification and the LPD liquefaction potential classification is shown in figure 36. The Unified Soil Classification legend is shown in figure 37.

Results of the grain size and Atterberg tests are shown in table 1. Results of strength and density measurements are shown in table 2. The arrival times of the shear waves and velocity calculations for the seismic tests at SNC001 are shown in table 3.

Discussion

Stratigraphy

The stratigraphy at the site is inferred from the layering recorded in the CPT soundings and in the two borings at sounding SNC007 and near SNC003 (stake 11). Four informal units have been identified, not all of which are found in all soundings. Unit A consists of sandy lean clay to fat clay with sand that is part of the disturbed-fill-plow zone. In some of the soundings, a high proportion of Unit A is classified as organic material of low plasticity (OL). Unit A is continuous throughout the site but varies in thickness from 1 m to about 1.5 m. The shear-wave velocity of Unit A is 137 m/s (measured in SNC001).

Unit B is composed of fat clay to sandy fat clay that is the finest grained and most plastic (average PI 38, minimum 14, maximum 52) of all the sediments in the profile, it is also the most recognizable in the CPT profile by its tip resistance and very high friction ratio. Except for sounding SNC005, Unit B occurs in all of the soundings. Unit B has an average shear wave velocity of about 181 m/s. The combined Units A and B have an average shear wave velocity of 169 m/s (as measured in SNC001).

Unit C is mostly fine grained but contains a few discontinuous sand layers or lenses less than 1 m thick. Unit C is divided into 2 parts; C_1 is the upper part (3-6 m thick); C_2 is the lower part of the unit and includes all soil to the bottom of the soundings. Subunit C_1 is composed of lean clay with sand to sandy lean clay. The boundary between C_1 and C_2 is identified, in general, by one of two occurrences. First, sand beds about 1 meter thick occur at the bottom of C_1 as in SNC007 and SNC011 (figs. 33, 34, 35), and second, an increase in the tip and side friction (hip pattern) like that found in SNC003 and SNC012.The shear wave velocity of Unit C is 278 m/s (as measured in SNC001). Excluding the well-developed sand layers in SNC007, the fine-grained soils in borings at SNC007 and stake 11are dissimilar. Almost half of the samples in the stake 11 boring are classified as CH or CHS soil (fig. 27), whereas none of the samples in the SNC007 boring are any type of CH soil.

Unit D is seen only in SNC005. Forty centimeters of disturbed Unit A soil rests directly on Unit D, which is about 0.9 m thick. Unit D is interpreted to be Pleistocene alluvium-colluviums based on the UBC soil types 11 and 12, the very high penetration resistance, and the resultant very limited penetration depth of 1.3 m. Based on field work conducted in Alameda County (Holzer and others, 2006) and Santa Clara County (Holzer and others, 2008), UBC soil types 11 and 12 have been found to be relatively accurate predictors of Pleistocene age soil.

Geotechnical Properties

Geotechnical properties such as plasticity and median grain size have a strong correlation to the high clay content of the soil. The most recognizable and continuous layer at the Mason Road site is the fat clay with varying amounts of sand in Unit B. In SNC007, the sandy lean clay to silty sand between 8.2 and 9.5 m displays a sensitivity of about 8. This sensitive zone is not a reflection of "classic" Scandinavian sensitive soils that were deposited in a marine environment and then leached of salt (Torrance, 1983). This sensitivity is simply a consequence of the loss of strength when remolded. The sensitivity is directly related to the high liquidity index of the soil, which is greater than 1 (fig. 32*A*), and the low remolded strength values (fig. 32*B*, and table 2). Highly plastic soils such as the fat (CH) clay in Unit B contain too much clay and are too "sticky" to develop a sensitive soil structure. However, the interval 8 to 9.5 m has a PI of 12 or less and a liquidity index greater than 1, which makes this interval susceptible to liquefaction.

The effect of soil aging and cementation on the relation between soil plasticity and shear strength can be seen in figure 29. The peak strength (fig. 29*A*) has a lower correlation coefficient than either the residual (fig. 29*B*) or the remolded strength (fig. 29*C*). Peak strength has a low correlation coefficient because it is influenced by cementation and aging. When remolding the sample during the strength test, cementation and aging effects are essentially removed and therefore the R2 value increases from peak to residual to finally remolded. In figure 29*C,* it can be seen that at a clay content of about 7 percent, the remolded strength and plasticity index approach zero.

Understanding how geotechnical properties relate to one another can be very helpful in fully interpreting the soil profile in a boring. For example, in figure 32, the liquidity index is plotted against the plasticity index, remolded strength, and sensitivity. Soils having high liquidity indexes generally are soils with low remolded strength and high sensitivity. These conditions can pose significant soil stability problems in engineering projects.

Liquefaction

The liquefaction potential estimated from soundings at the Mason Road site is very low. The controlling factor is the high clay content of the soil and the resistance of the dense sandy soils to liquefaction. The LPI ranges from 0 to 0.19. Within the dense sand between 10 m and 13 m, the only layers that generate LPI are on the rising or falling tip resistance of sandy interbeds. Nearly all of the soil samples have clay content greater than 15, and all samples have a plasticity index greater than 12 or a water-content liquid limit-ratio less than 0.9.

The LPI of the soil near SNC007 is very low (0.19). The LPI in the soil at the stake 11 boring is even lower (0.0). The liquefaction potential display for these soundings and borings is shown in the cross section shown in figure 35.

Conclusions

Sandy lean clay to fat clay predominates in the subsurface at the Mason Road site. There are few continuous sand layers. Lack of correlation of the subsurface across the fault made it difficult to determine any offset caused by the Green Valley Fault. The details of the fault offset study are discussed in Lienkaemper and others (unpublished data, 2011). The fine-grained nature of the soils and the presence of thin and dense sand layers at the Mason Road site results in a very low liquefaction potential (LPI<1).

Acknowledgments

Coyn Criley performed laboratory testing and assisted with the sounding at SNC013 and the boring at SNC007. Robert Sickler assisted with drilling and sampling at stake 11. Reviews by John Tinsley III and Ray Wilson were very helpful and are greatly appreciated.

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Figure 1. Map showing the location of the Mason Road site in northern California.

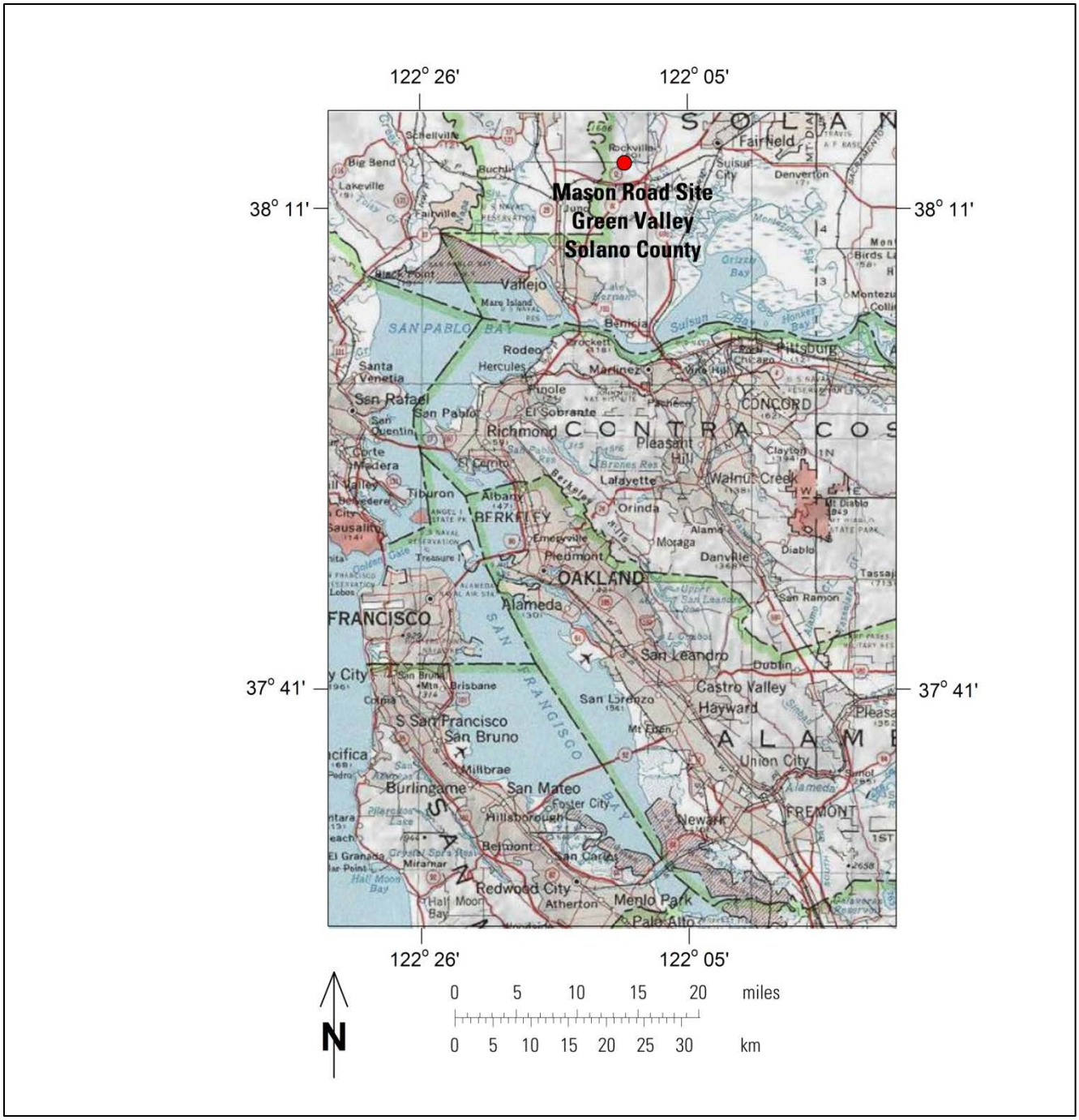


Figure 2. Map showing the location of the Mason Road site (red dot) in the San Francisco Bay area.

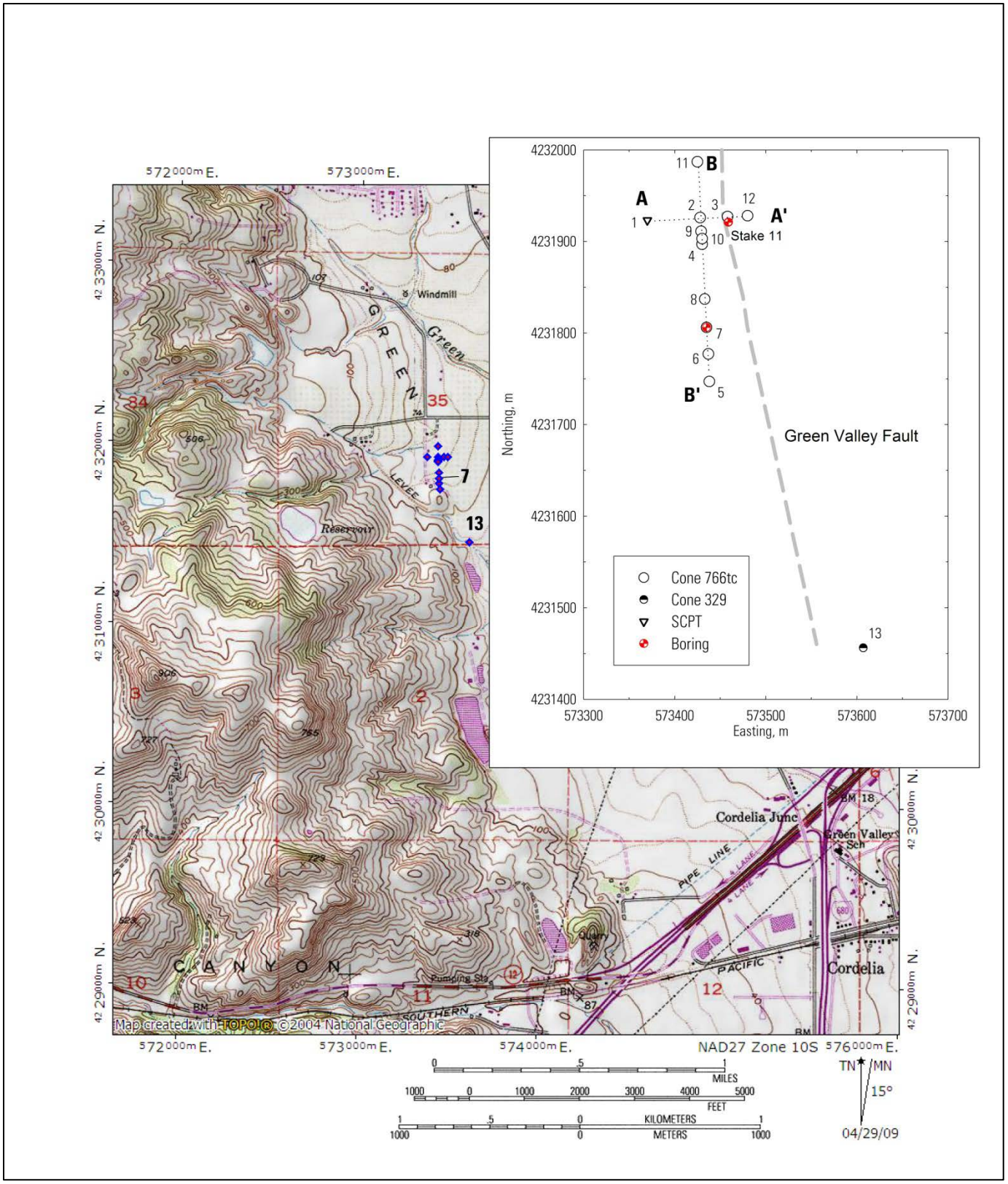


Figure 3. Map showing the Mason Road site in Green Valley, including locations of soundings and borings, and the Green Valley Fault.

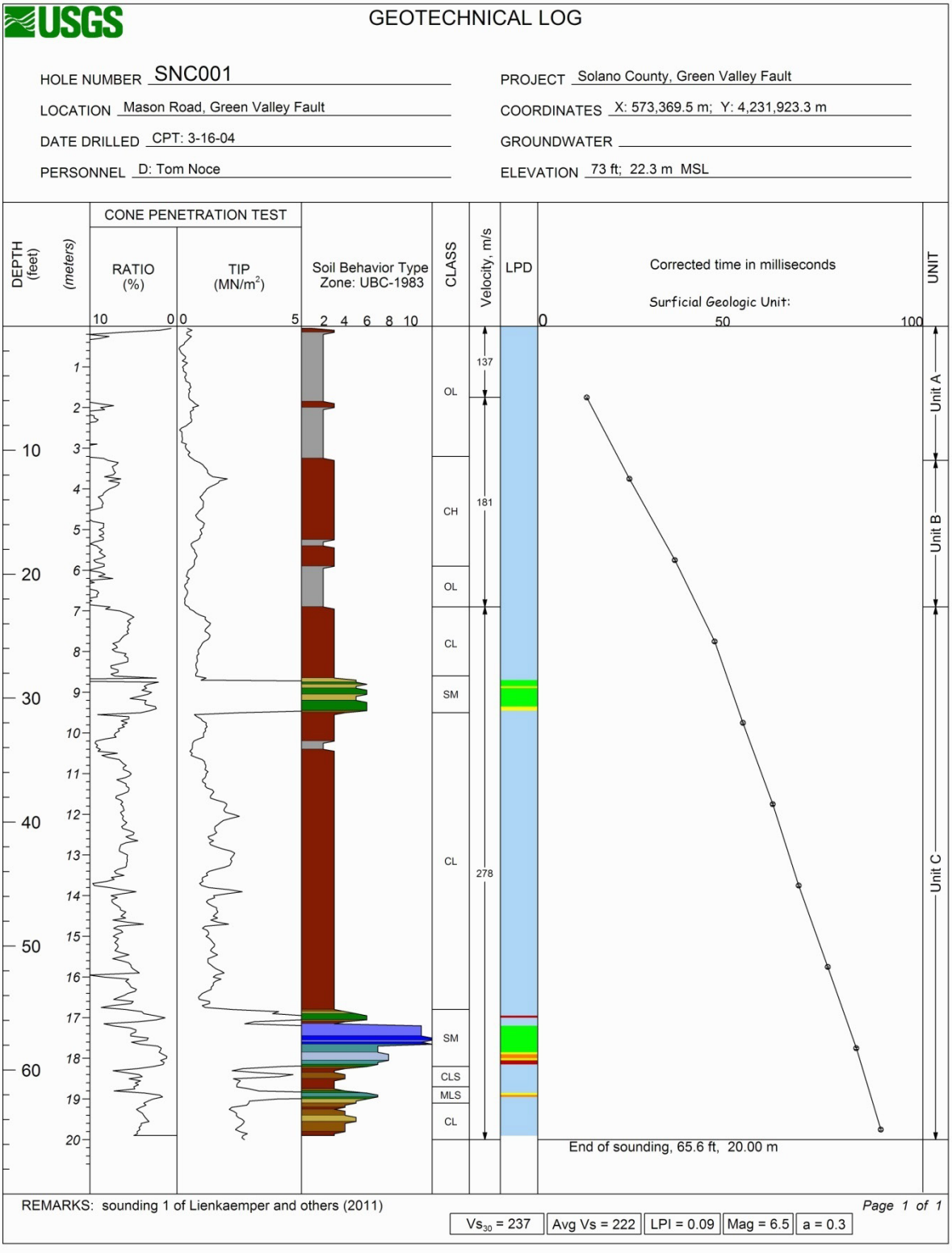


Figure 4. Log of SNC001 showing tip resistance, friction ratio, UBC soil behavior type, LPD, and seismic time picks.

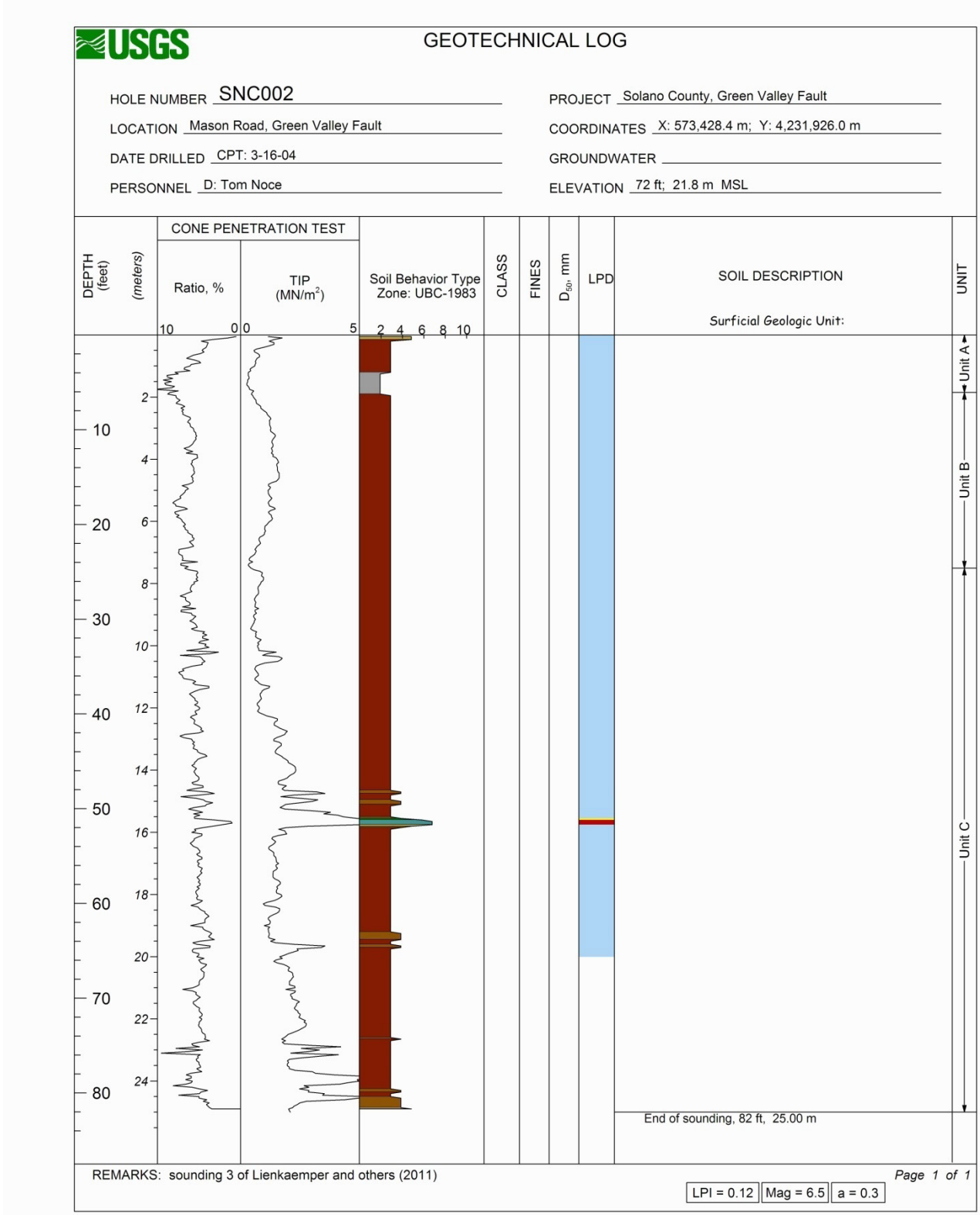


Figure 5. Log of SNC002 showing tip resistance, friction ratio, UBC soil behavior type, and liquefaction potential display.

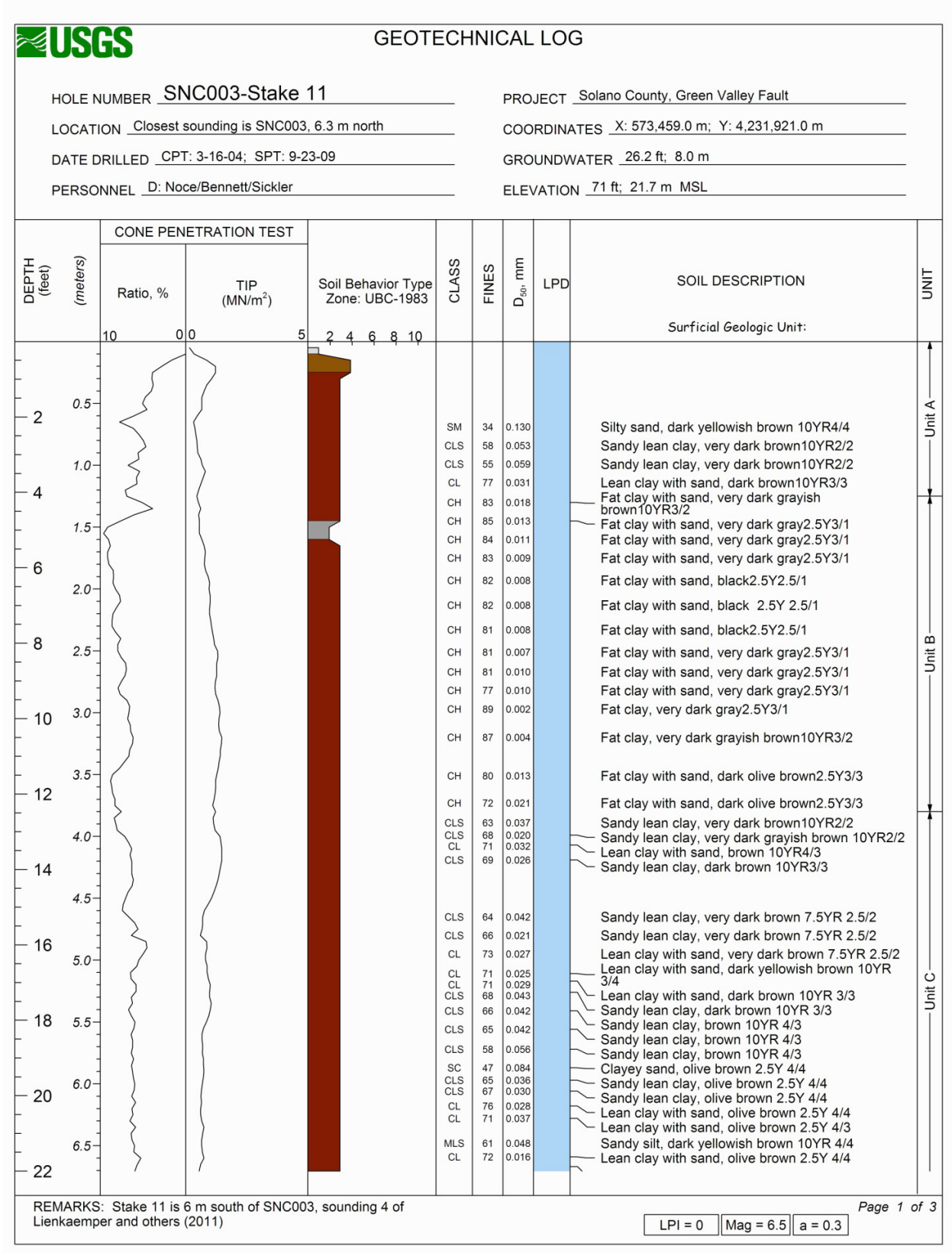


Figure 6. Log of SNC003a showing tip resistance, friction ratio, UBC soil behavior type, and liquefaction potential display.

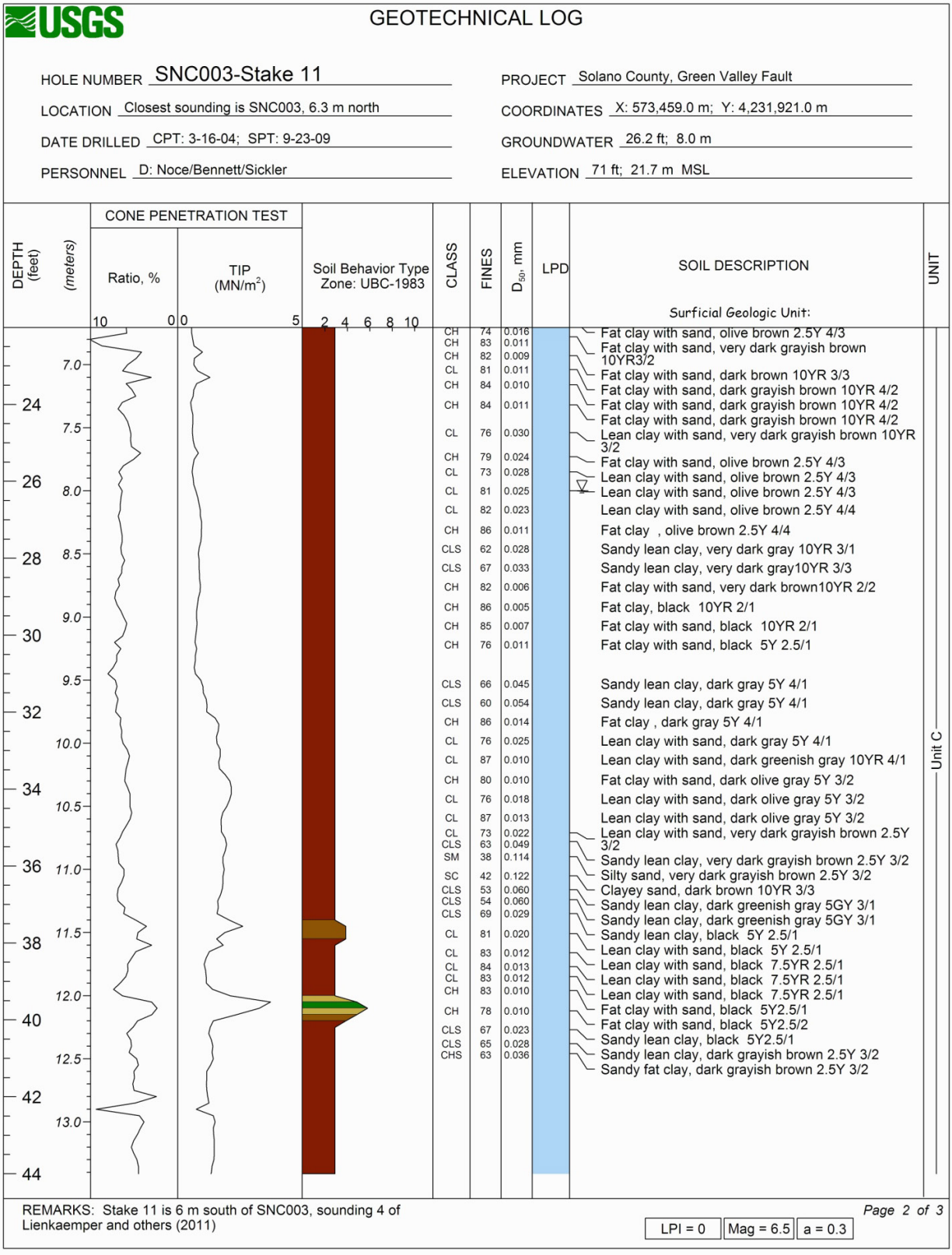


Figure 7. Log of SNC003b showing tip resistance, friction ratio, UBC soil behavior type, and liquefaction potential display.

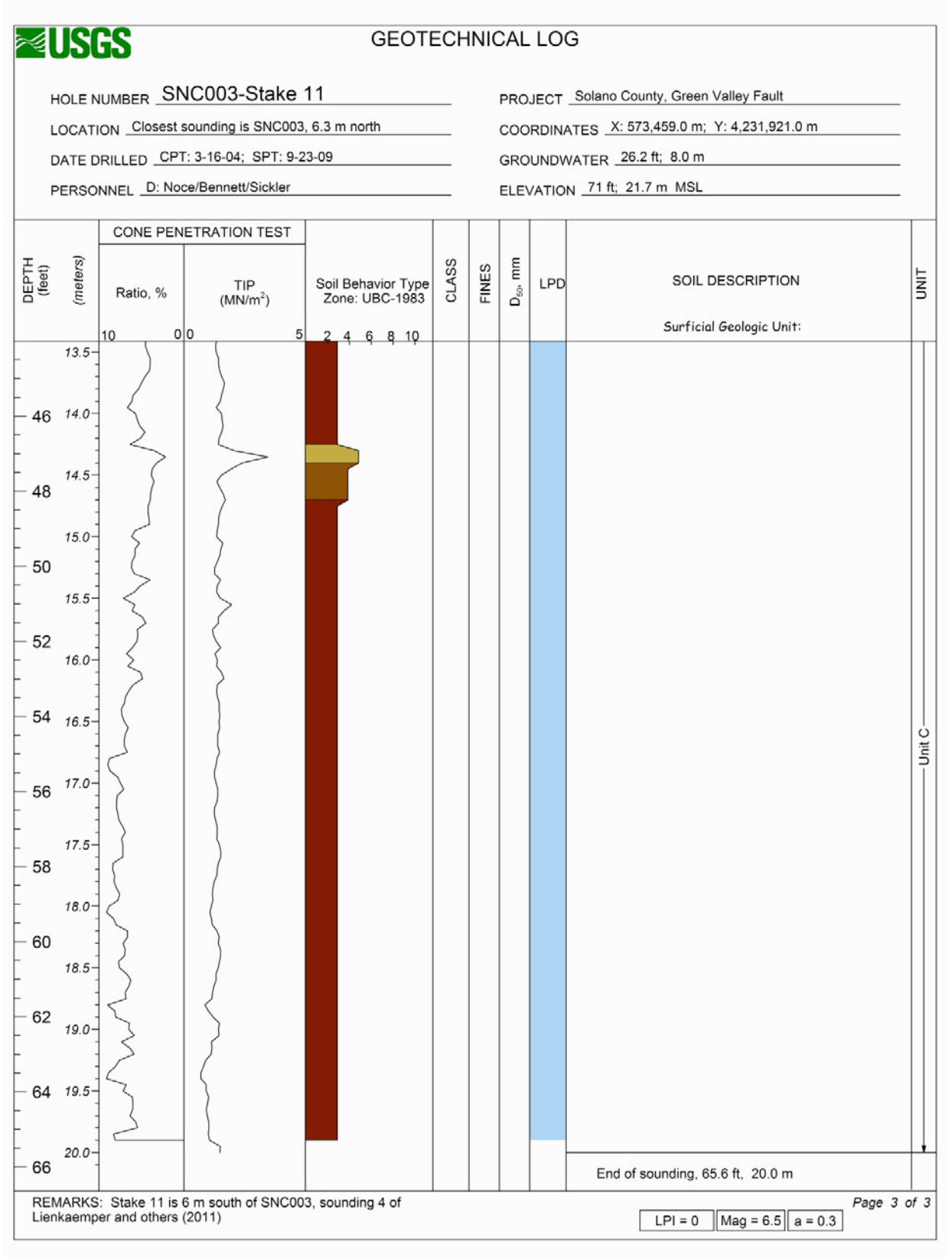


Figure 8. Log SNC003 showing tip resistance, friction ratio, UBC soil behavior type, and liquefaction potential display.

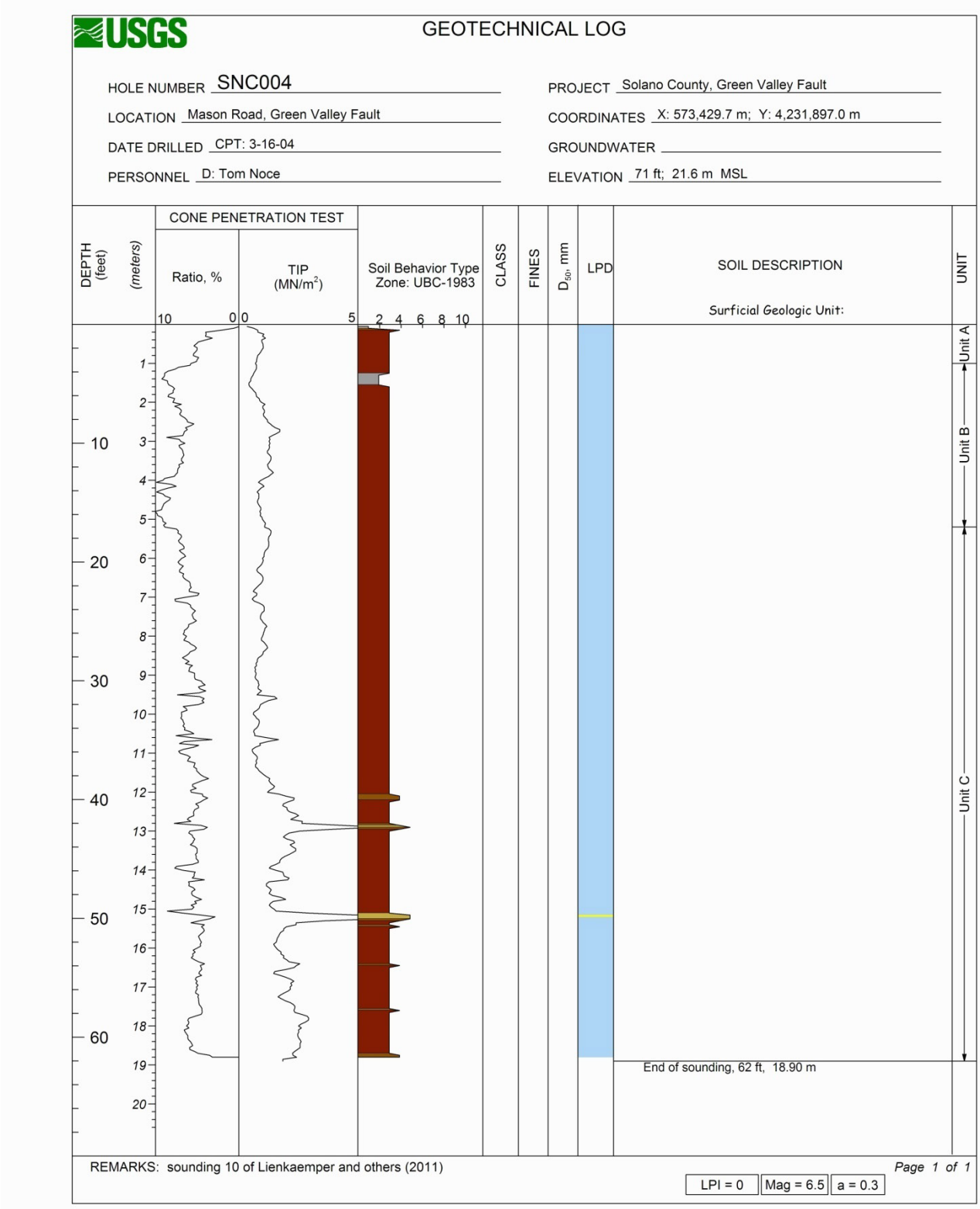


Figure 9. Log of SNC004 showing tip resistance, friction ratio, UBC soil behavior type, and liquefaction potential display.

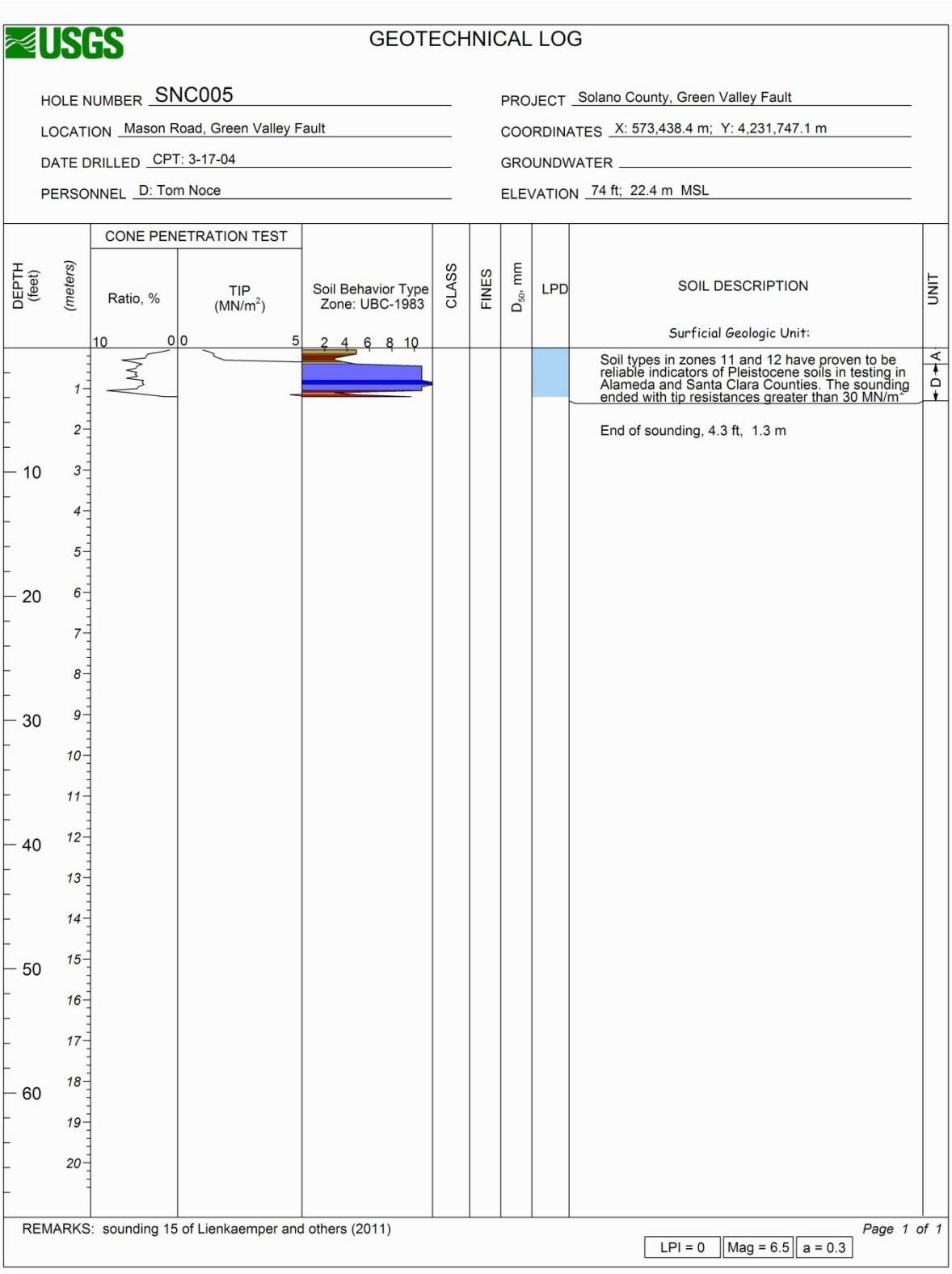


Figure 10. Log of SNC005 showing tip resistance, friction ratio, UBC soil behavior type, and liquefaction potential display.

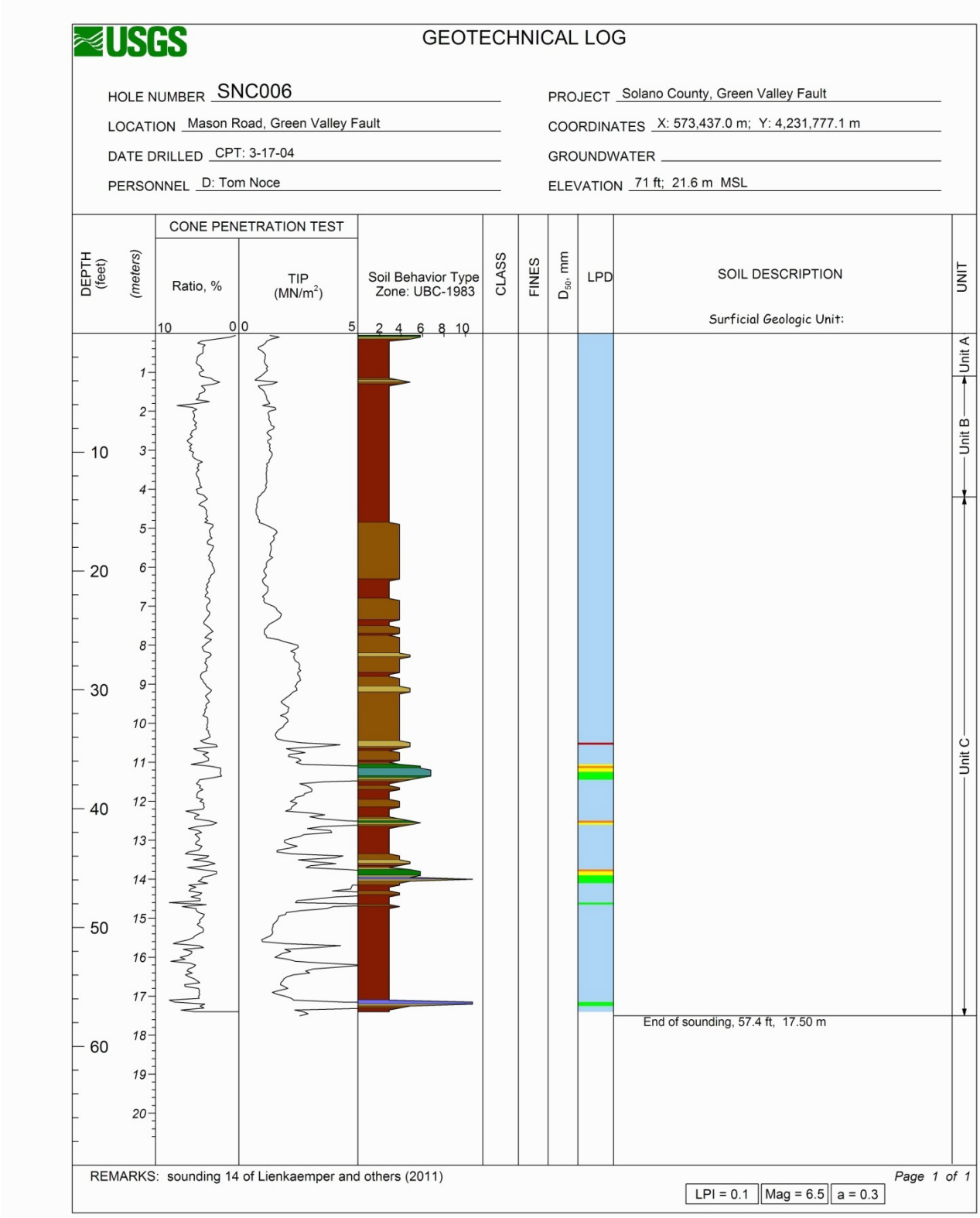


Figure 11. Log of SNC006 showing tip resistance, friction ratio, UBC soil behavior type, and liquefaction potential display.

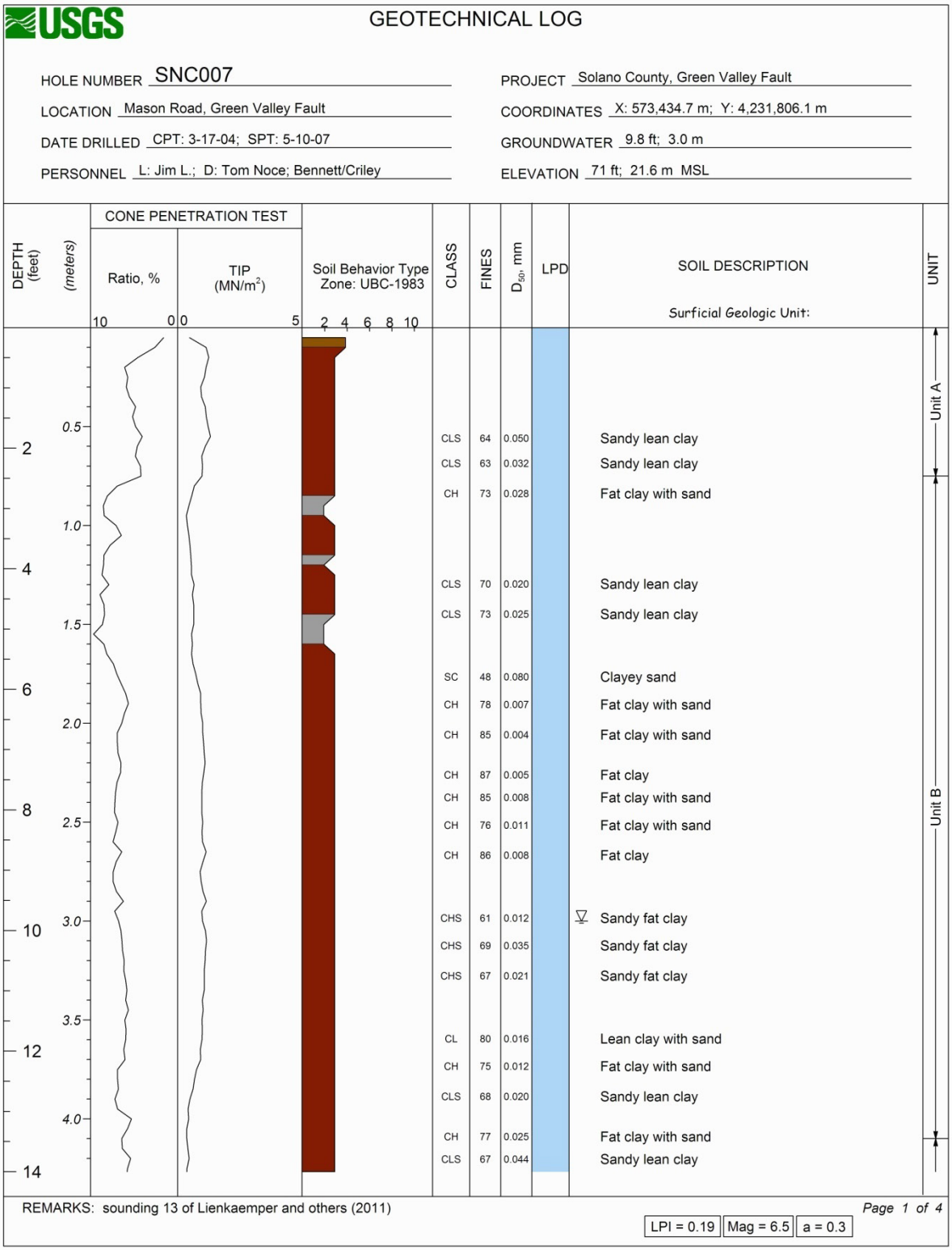


Figure 12. Log of SNC007a showing tip resistance, friction ratio, UBC soil behavior type, and liquefaction potential display.

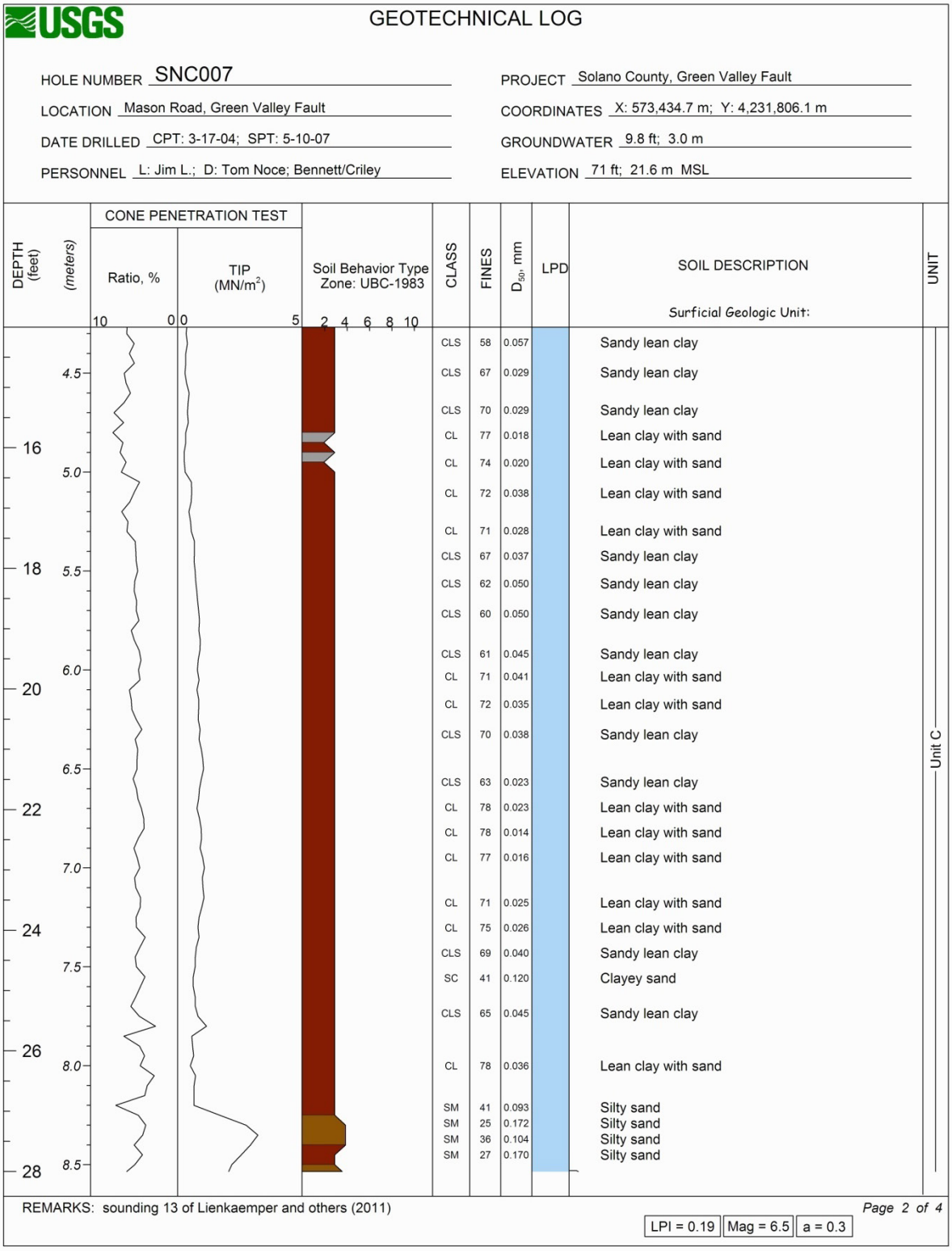


Figure 13. Log of SNC007b showing tip resistance, friction ratio, UBC soil behavior type, and liquefaction potential display.

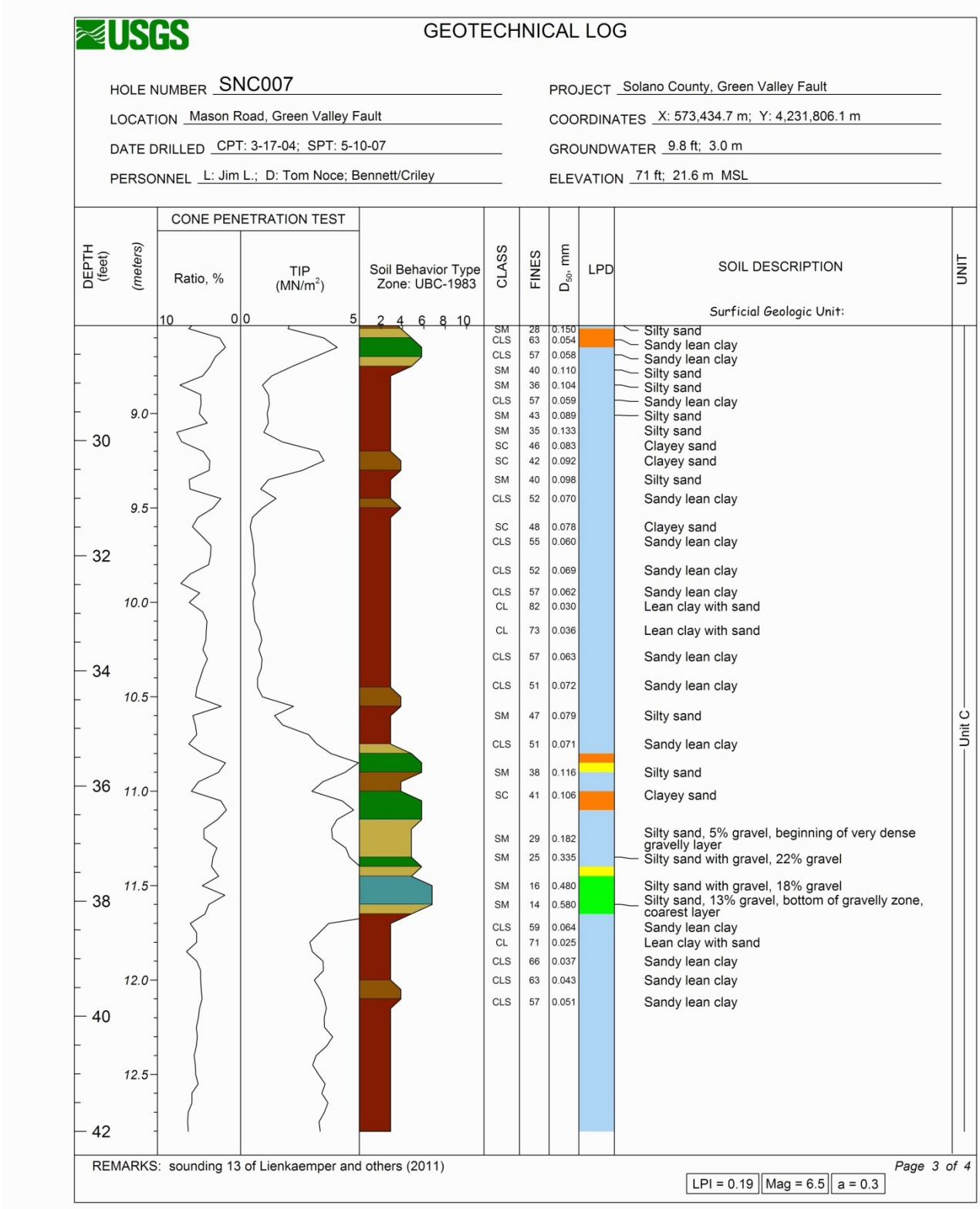


Figure 14. Log of SNC007c showing tip resistance, friction ratio, UBC soil behavior type, and liquefaction potential display.

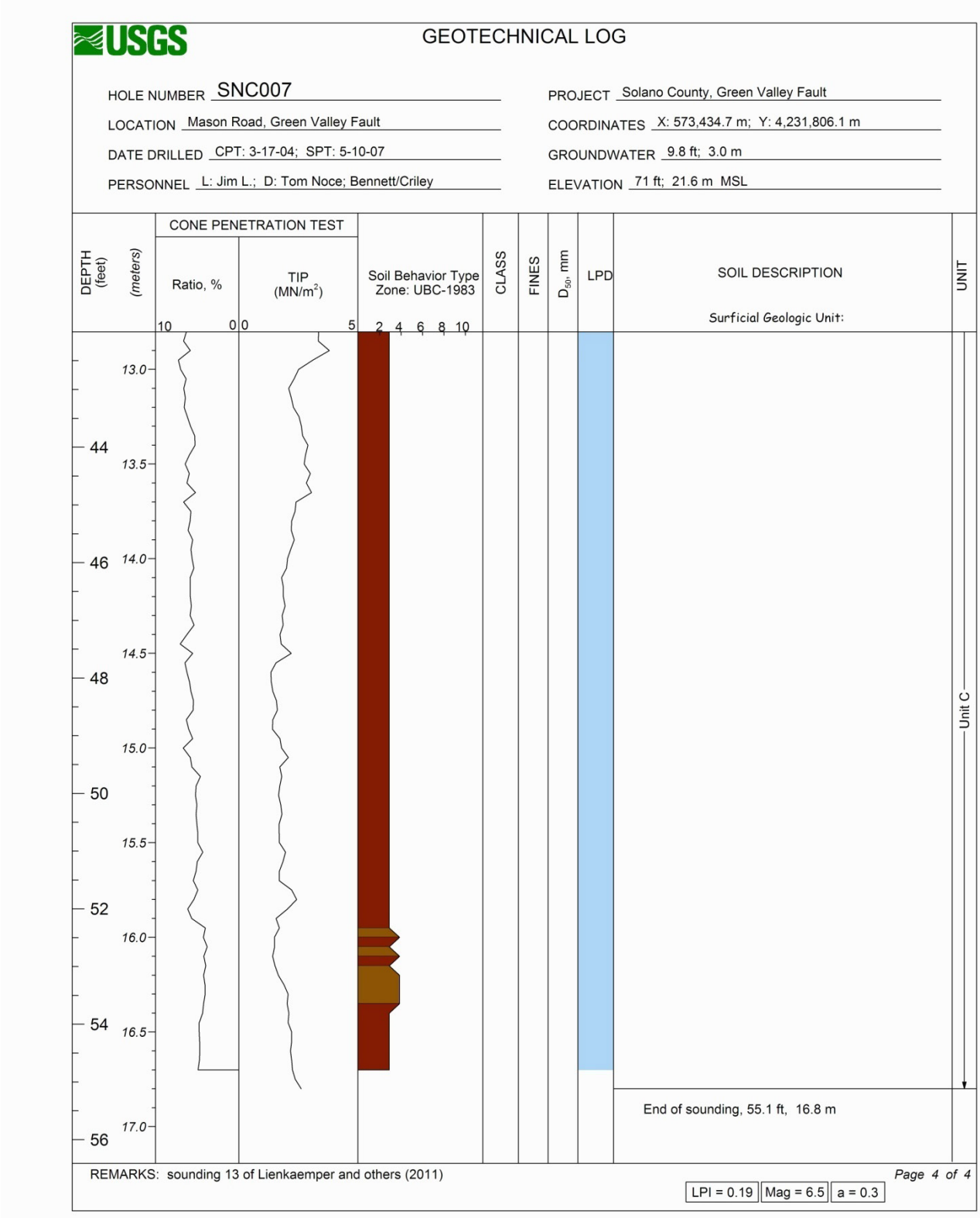


Figure 15. Log of SNC007d showing tip resistance, friction ratio, UBC soil behavior type, and liquefaction potential display.

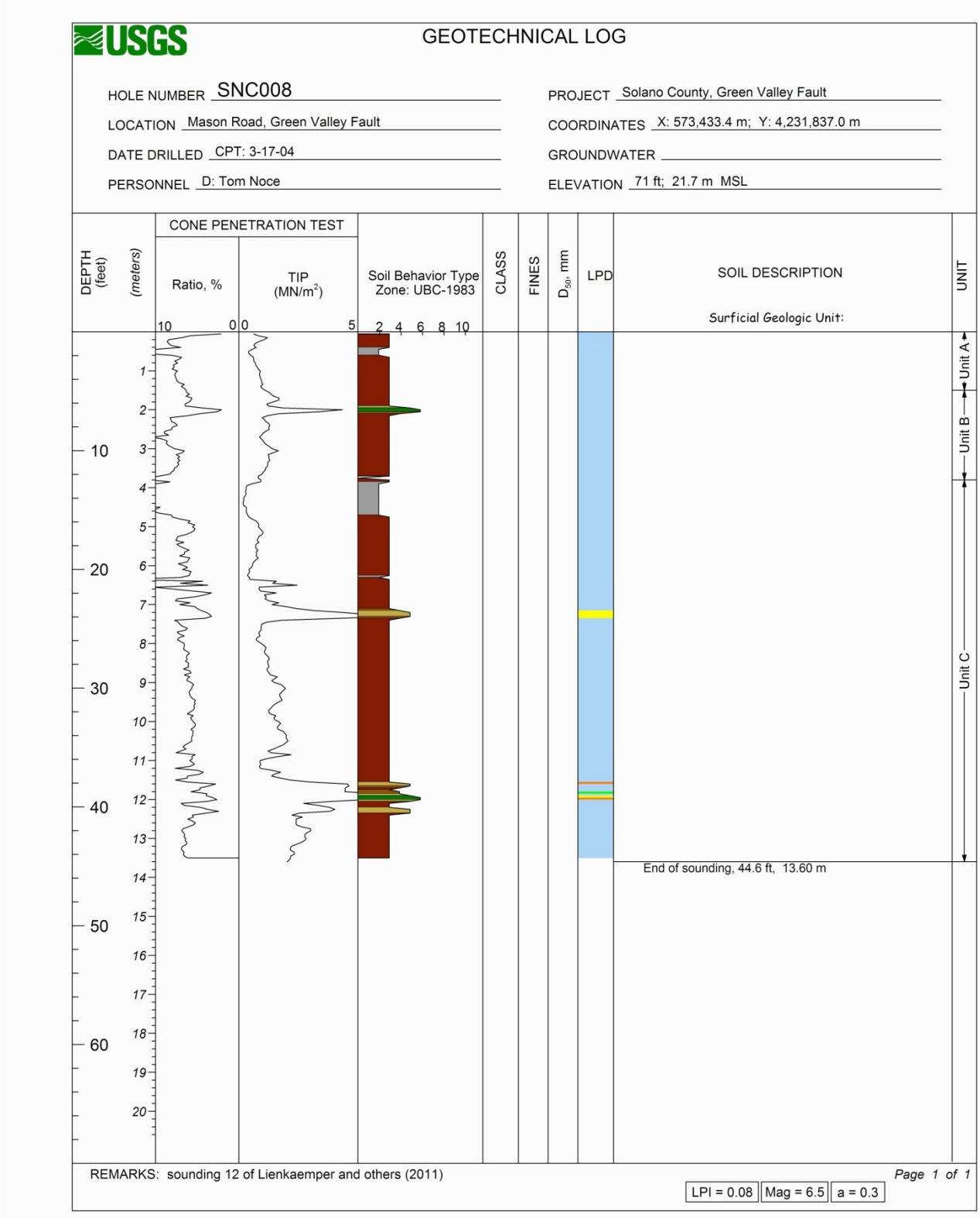


Figure 16. Log of SNC008 showing tip resistance, friction ratio, UBC soil behavior type, and liquefaction potential display.

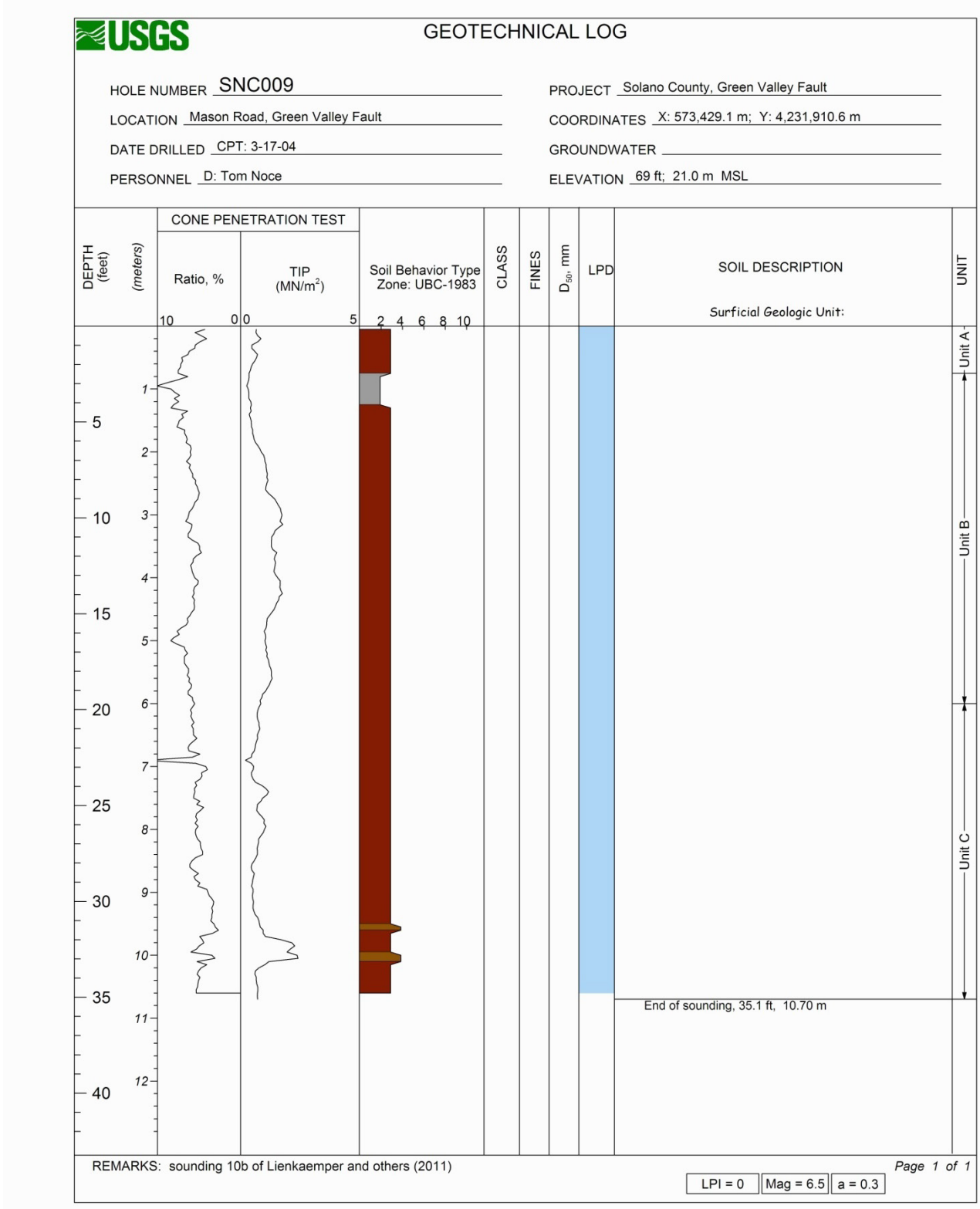


Figure 17. Log of SNC009 showing tip resistance, friction ratio, UBC soil behavior type, and liquefaction potential display.

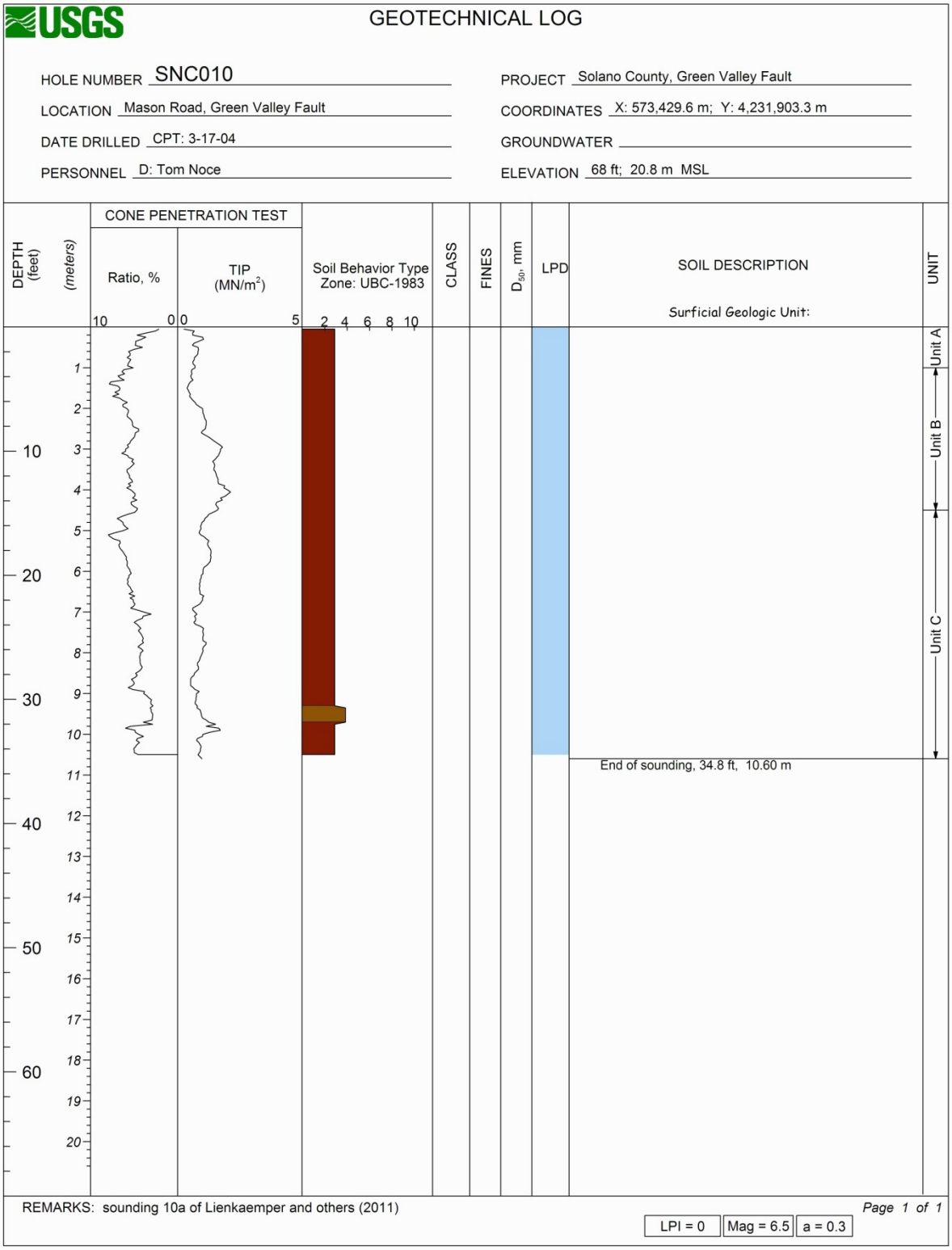


Figure 18. Log of SNC010 showing tip resistance, friction ratio, UBC soil behavior type, and liquefaction potential display.

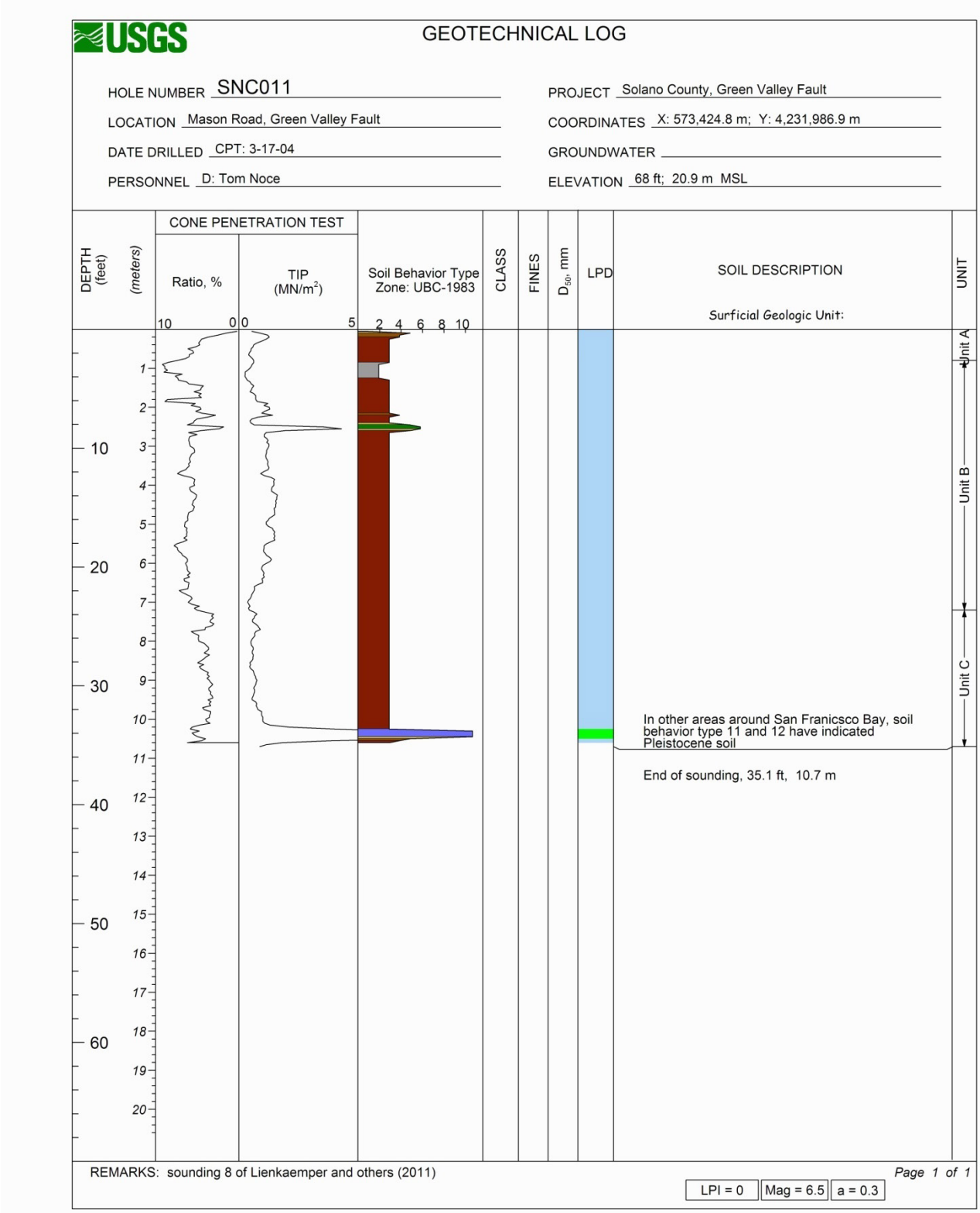


Figure 19. Log of SNC011 showing tip resistance, friction ratio, UBC soil behavior type, and liquefaction potential display.

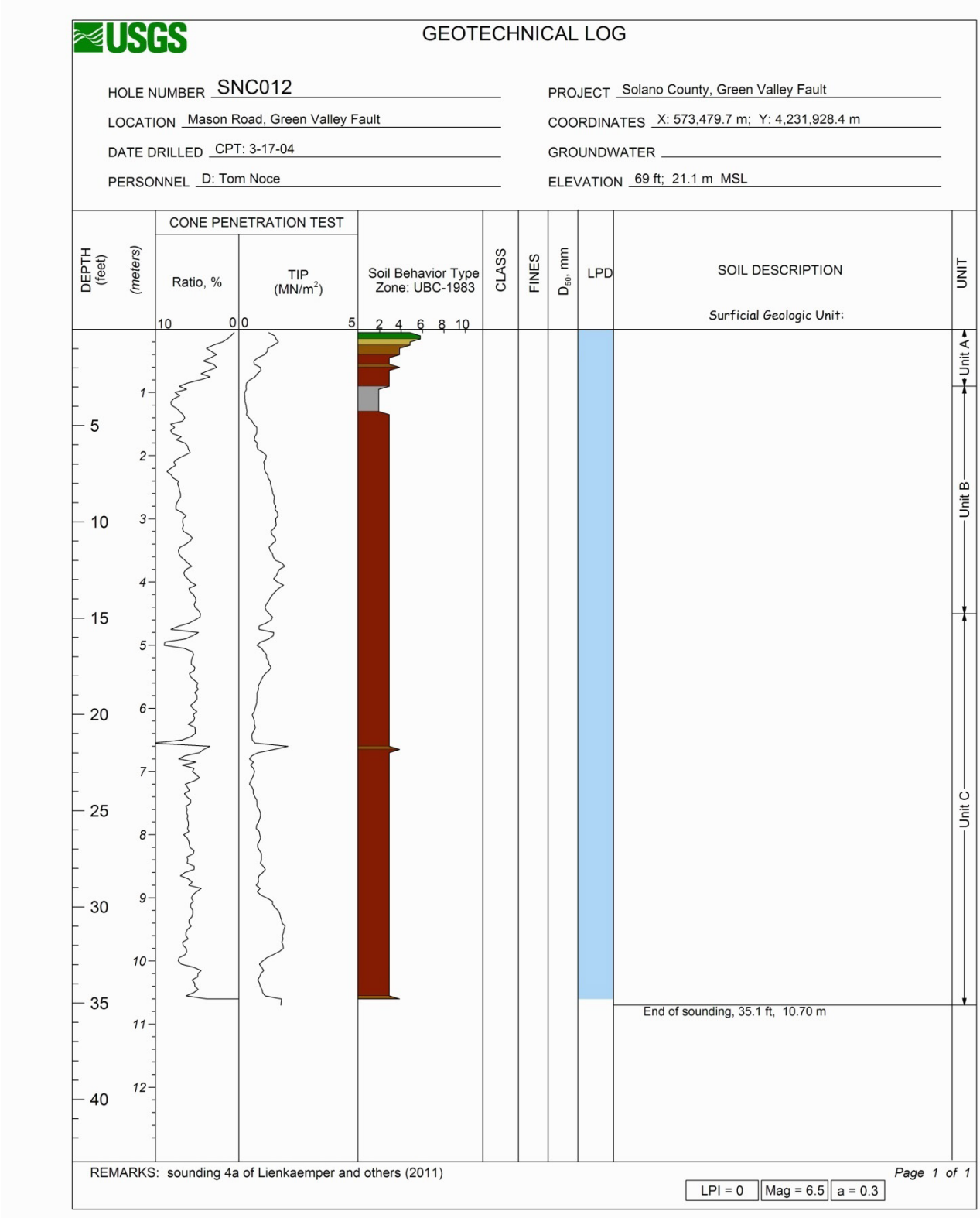


Figure 20. Log of SNC012 showing tip resistance, friction ratio, UBC soil behavior type, and liquefaction potential display.

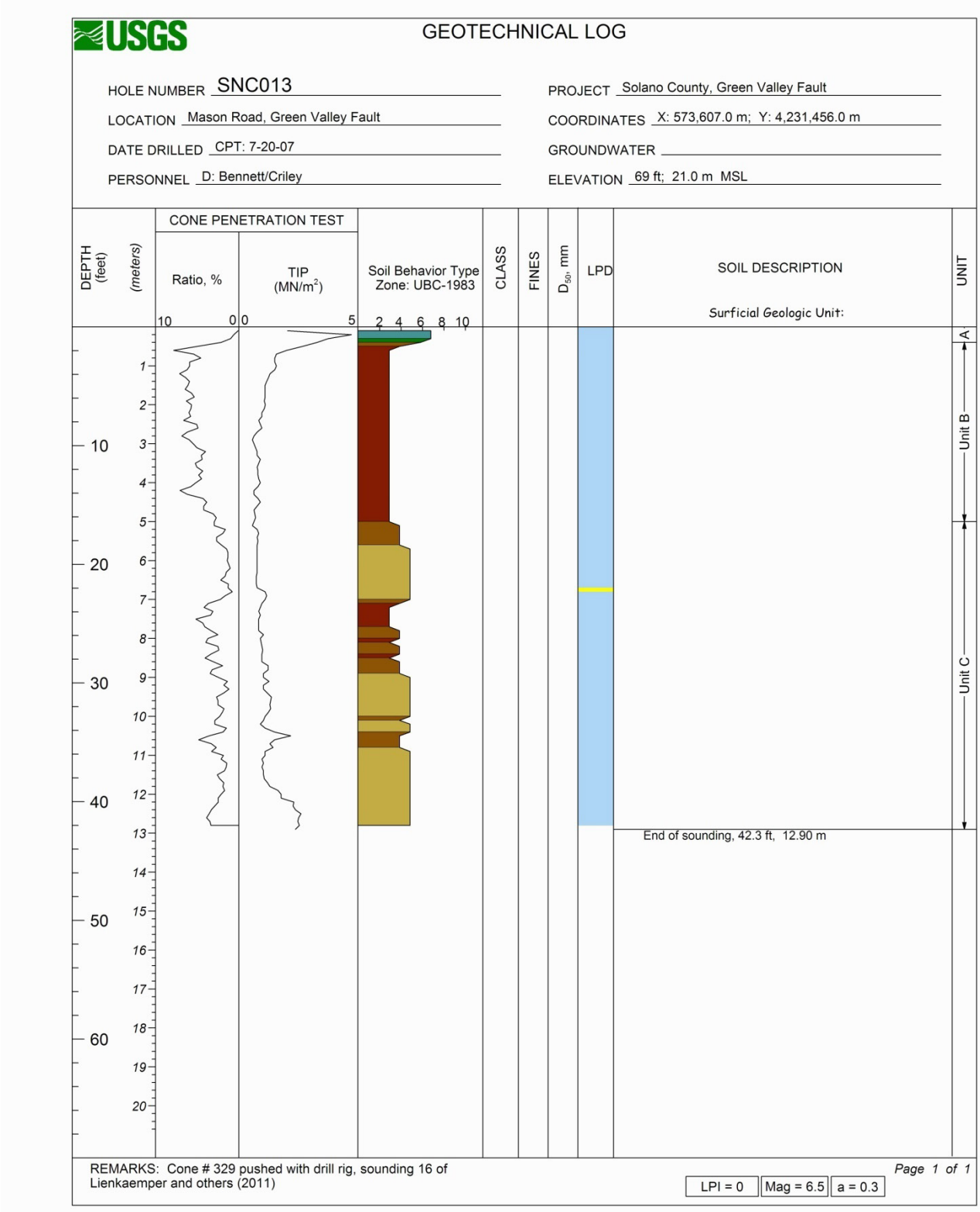


Figure 21. Log of SNC013 showing tip resistance, friction ratio, UBC soil behavior type, and liquefaction potential display.

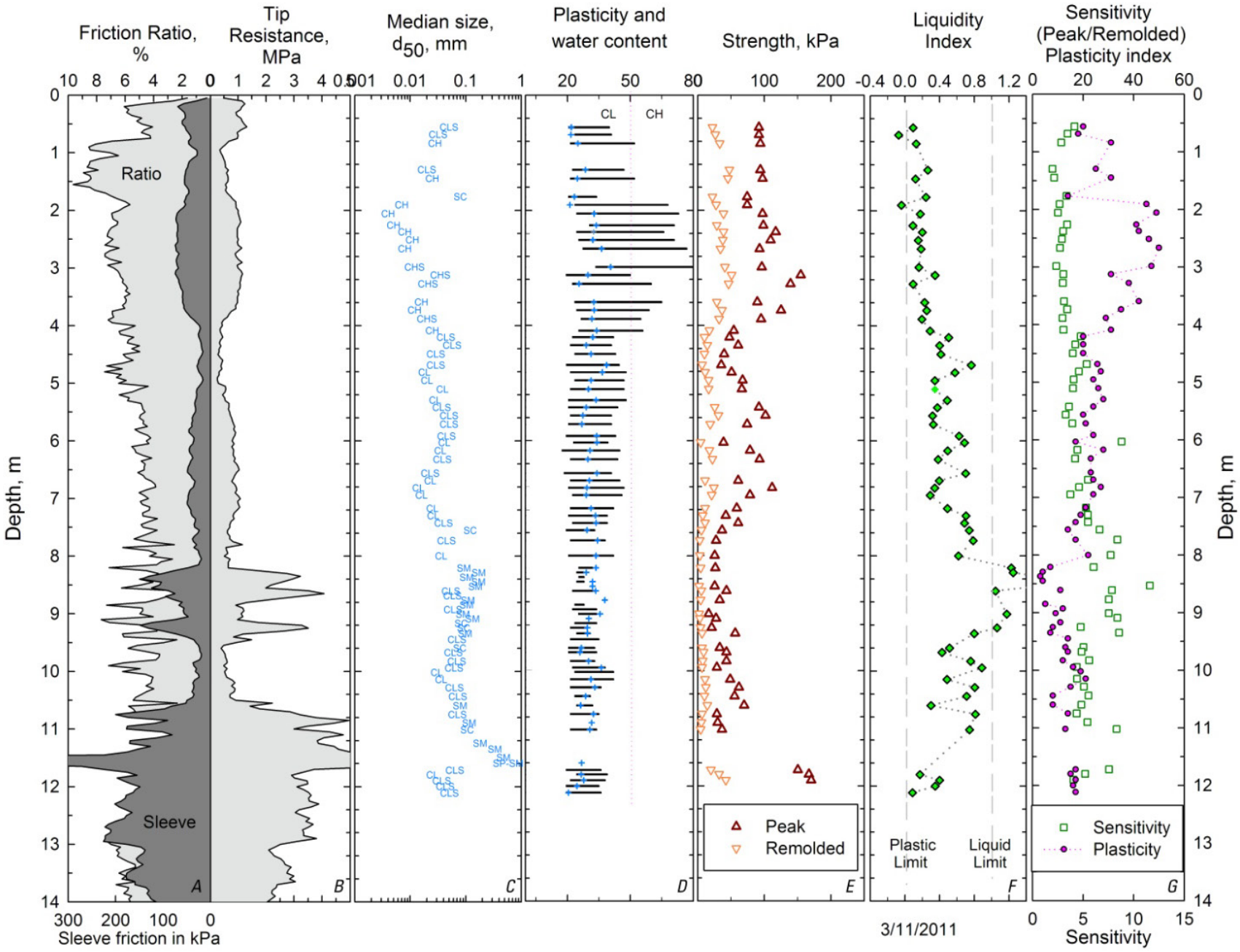


Figure 22. Graphs showing the relations among index properties for the boring at SNC007.

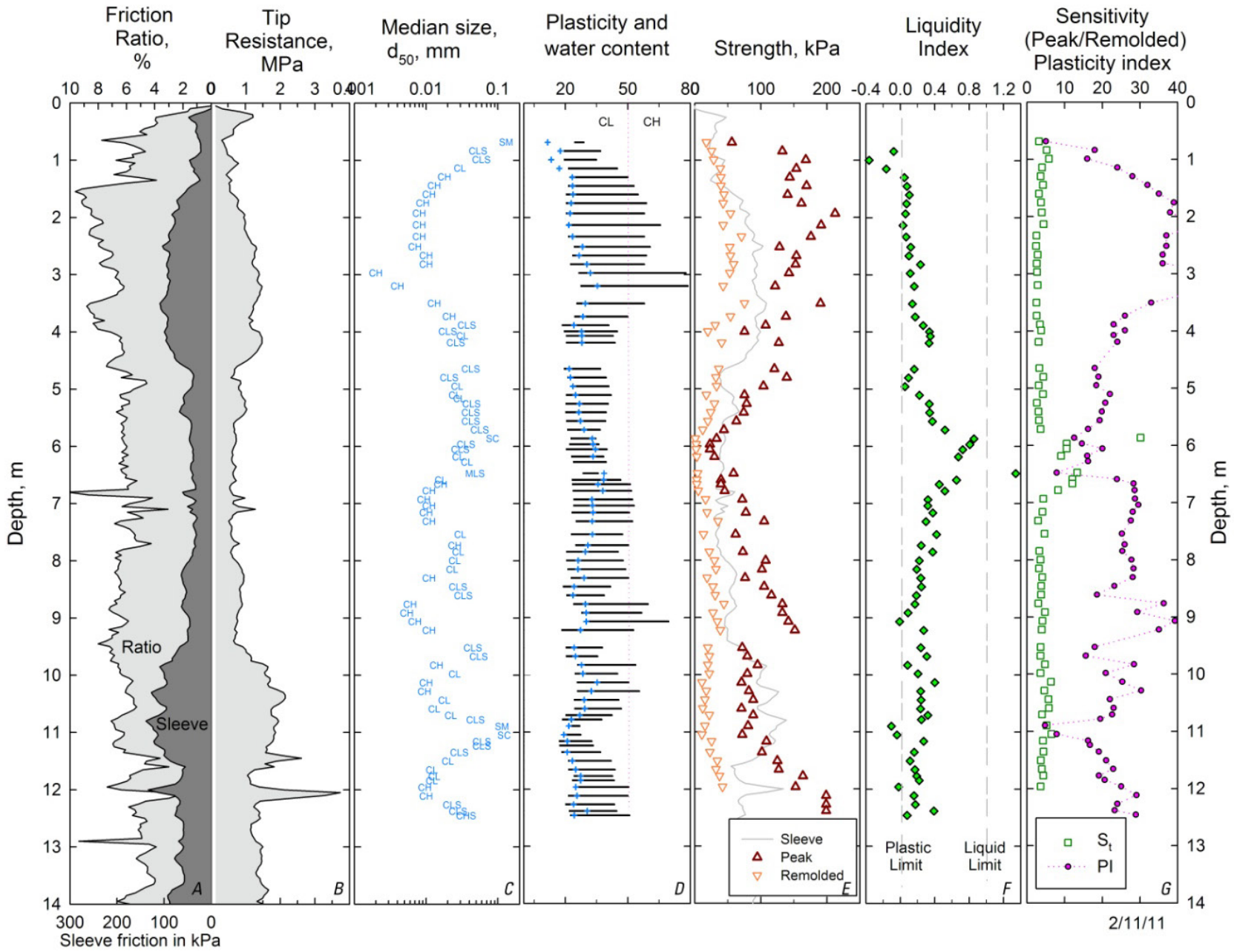


Figure 23. Graphs showing the relations among index properties (columns *A* through *G*) at stake 11 near sounding SNC003.

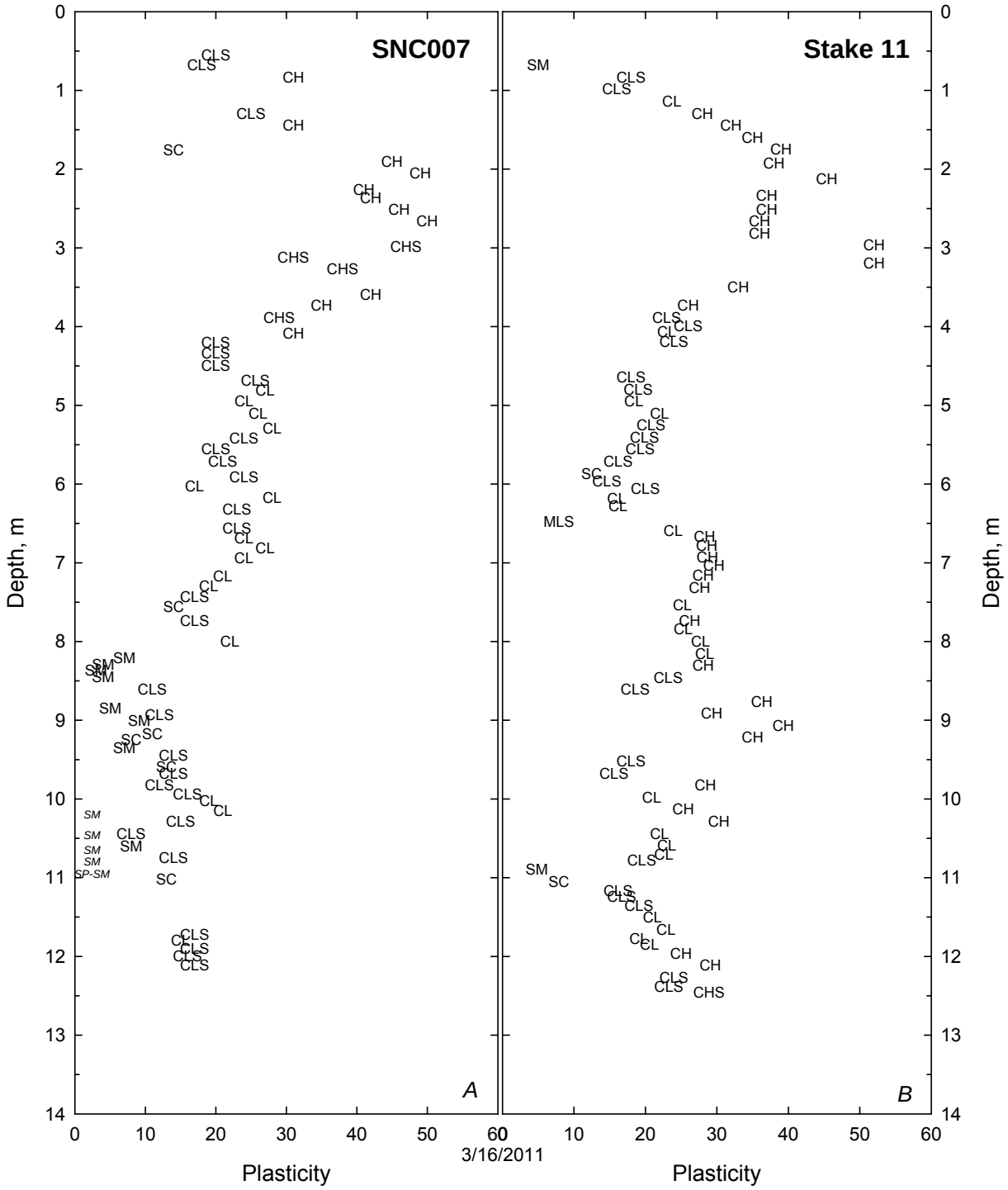


Figure 24. Graphs show the relation between plasticity at sounding SNC007 (*A*) and at stake 11near SNC003 (*B*).

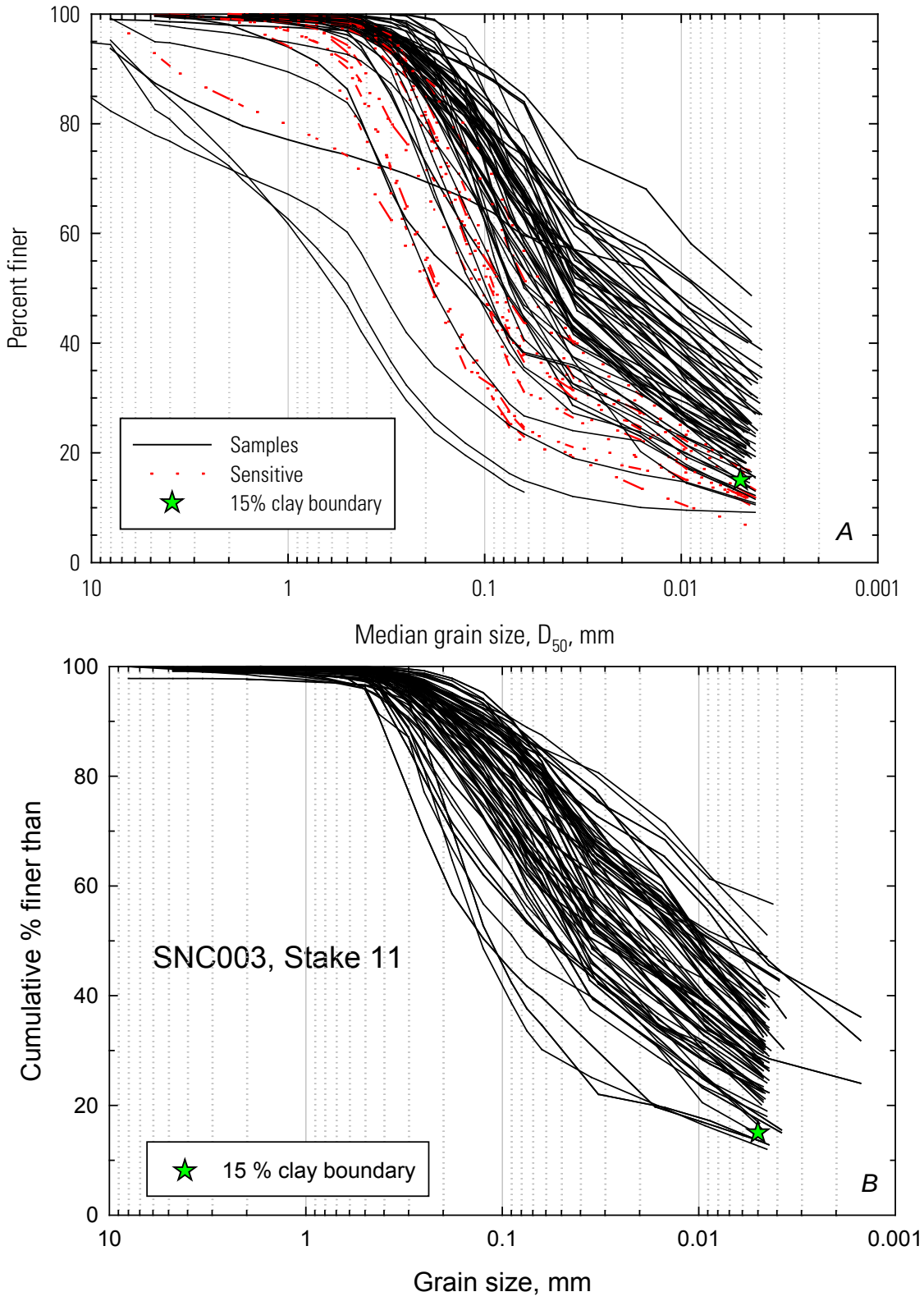


Figure 25. Graphs showing distribution of grain size curves, SNC003 (*A*) and SNC003 (*B*).

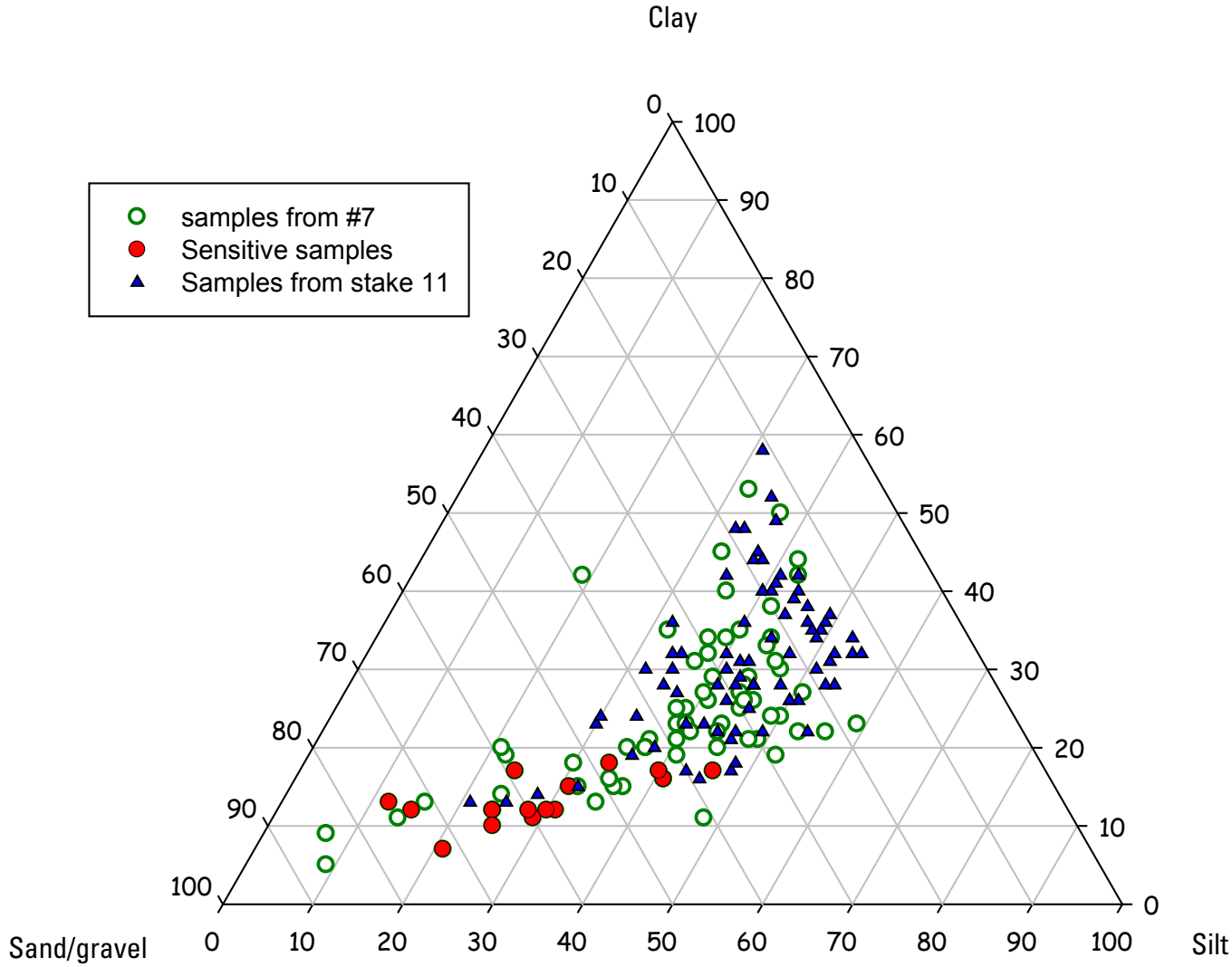


Figure 26. Ternary size classification chart for the samples from borings at SNC007 and stake 11.

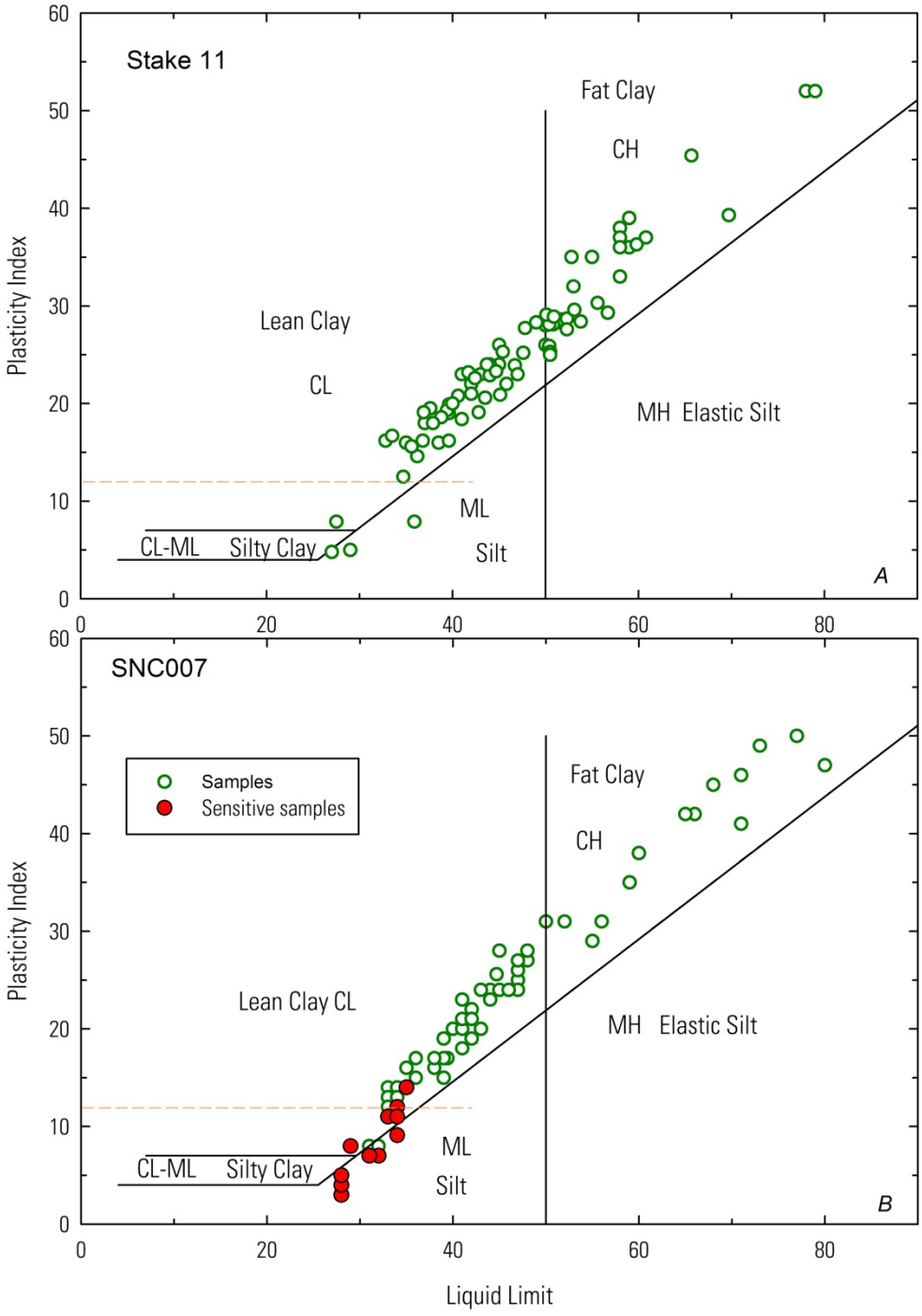


Figure 27. Plasticity charts showing the samples from borings at SNC007 and stake 11. The dotted red line represents a plasticity index of 12. This is a commonly used threshold above which liquefaction is unlikely to occur.

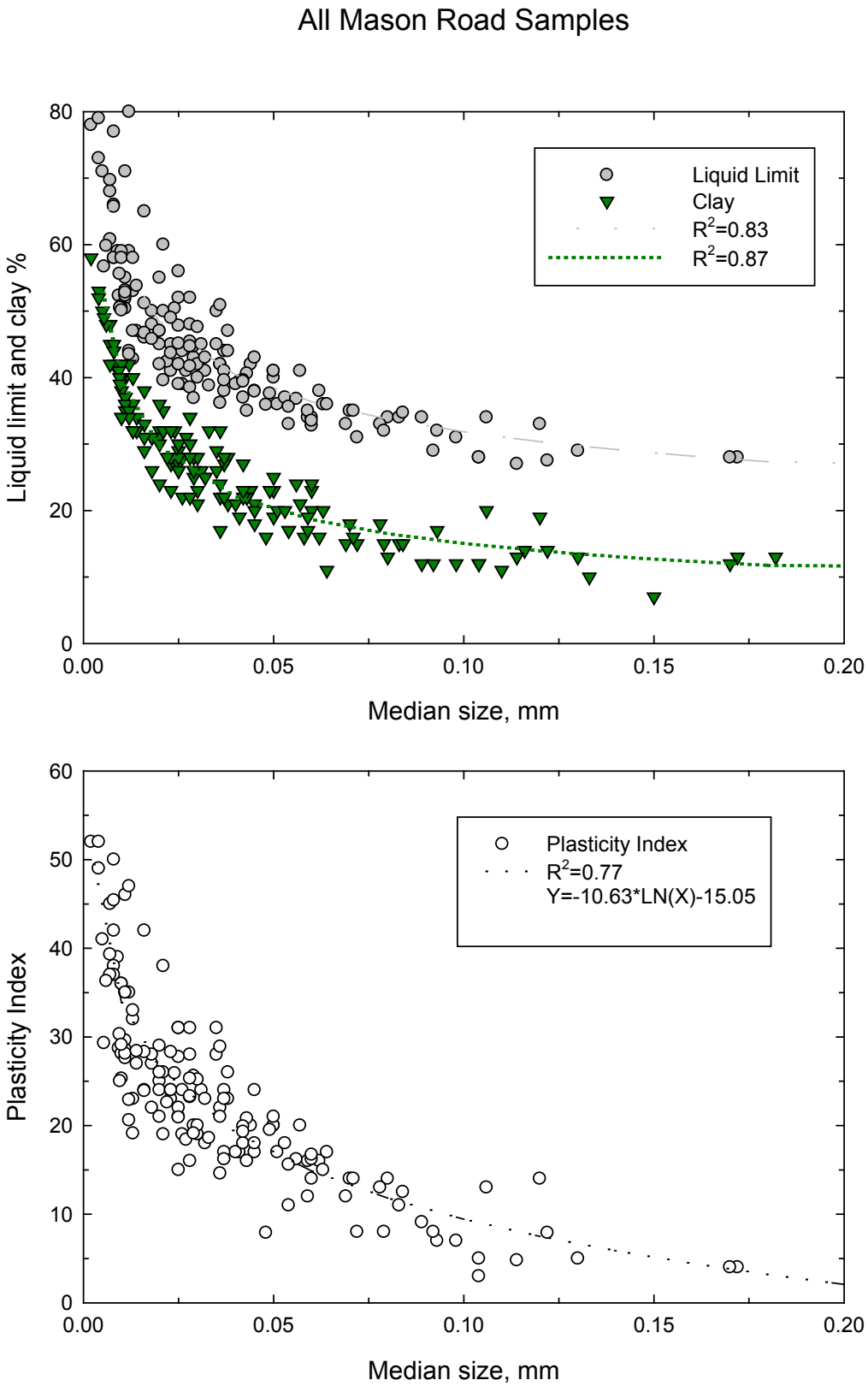


Figure 28. Graphs showing median size versus liquid limit and clay (*A*), and plasticity index (*B*) for all Mason Road samples.

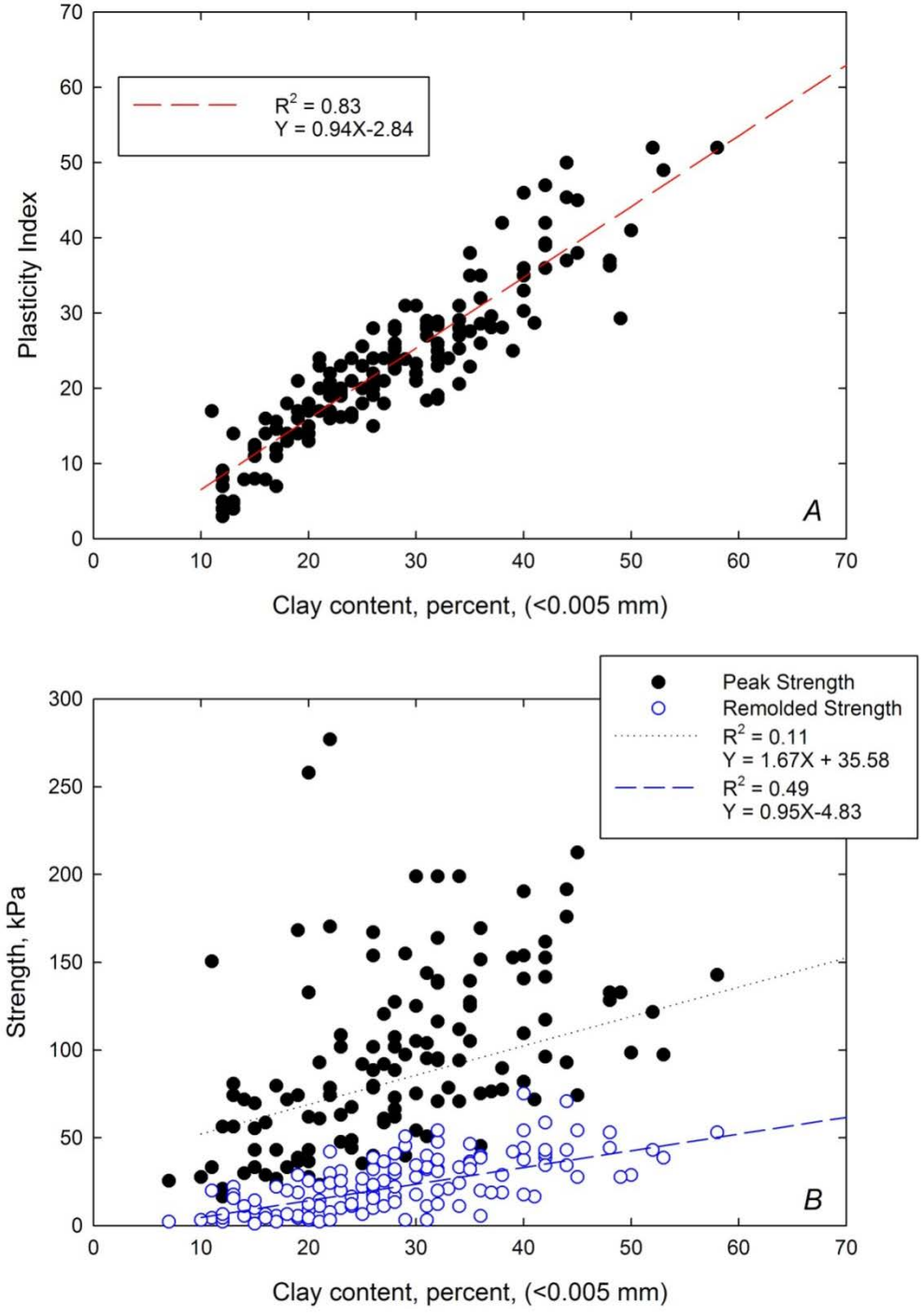


Figure 29. Graphs showing the relation between clay content and plasticity (A), and peak strength and remolded strength (B).

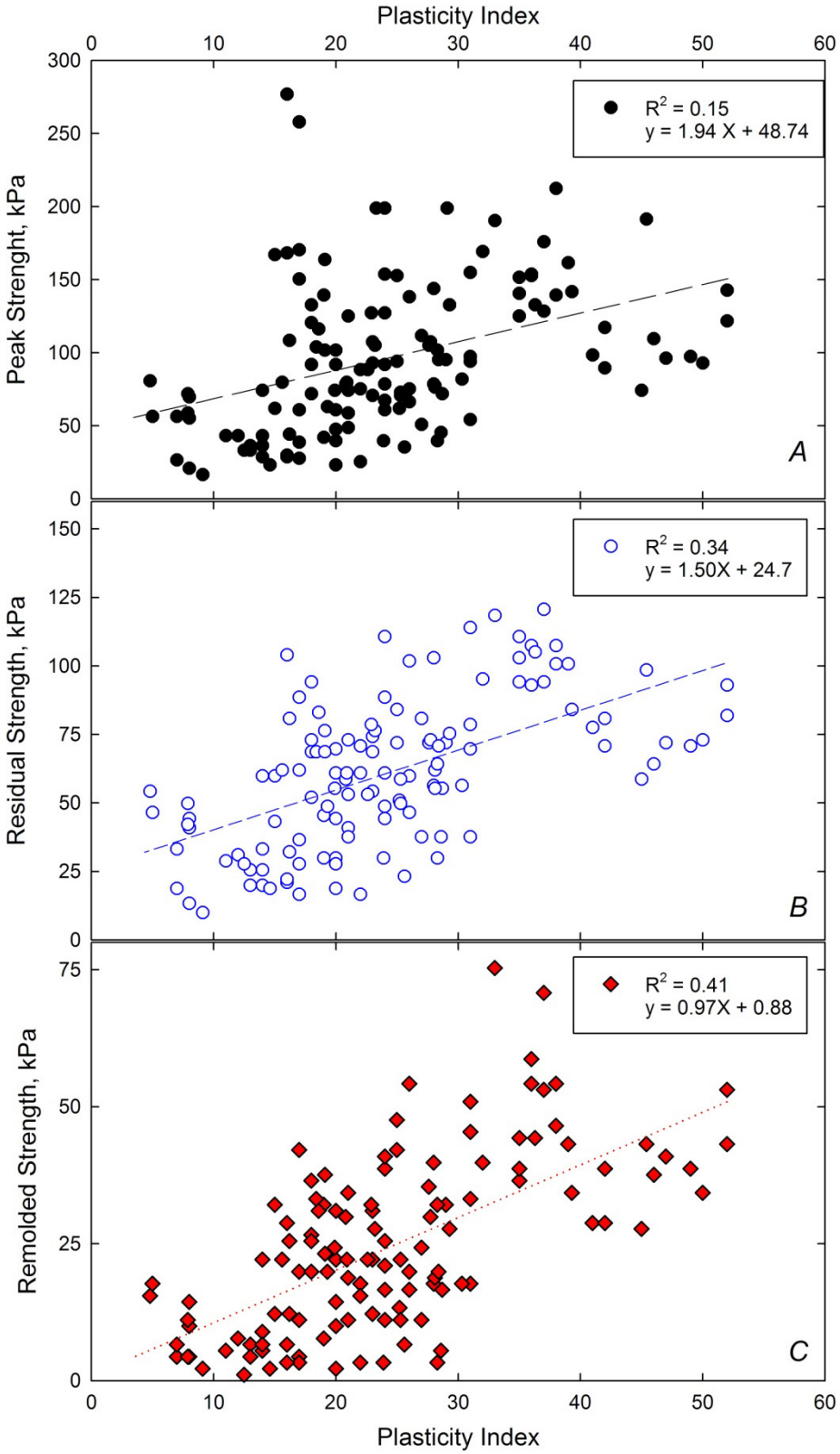


Figure 30. Graphs showing the relations between plasticity index and peak strength (A), residual strength (B), and remolded strength (C).

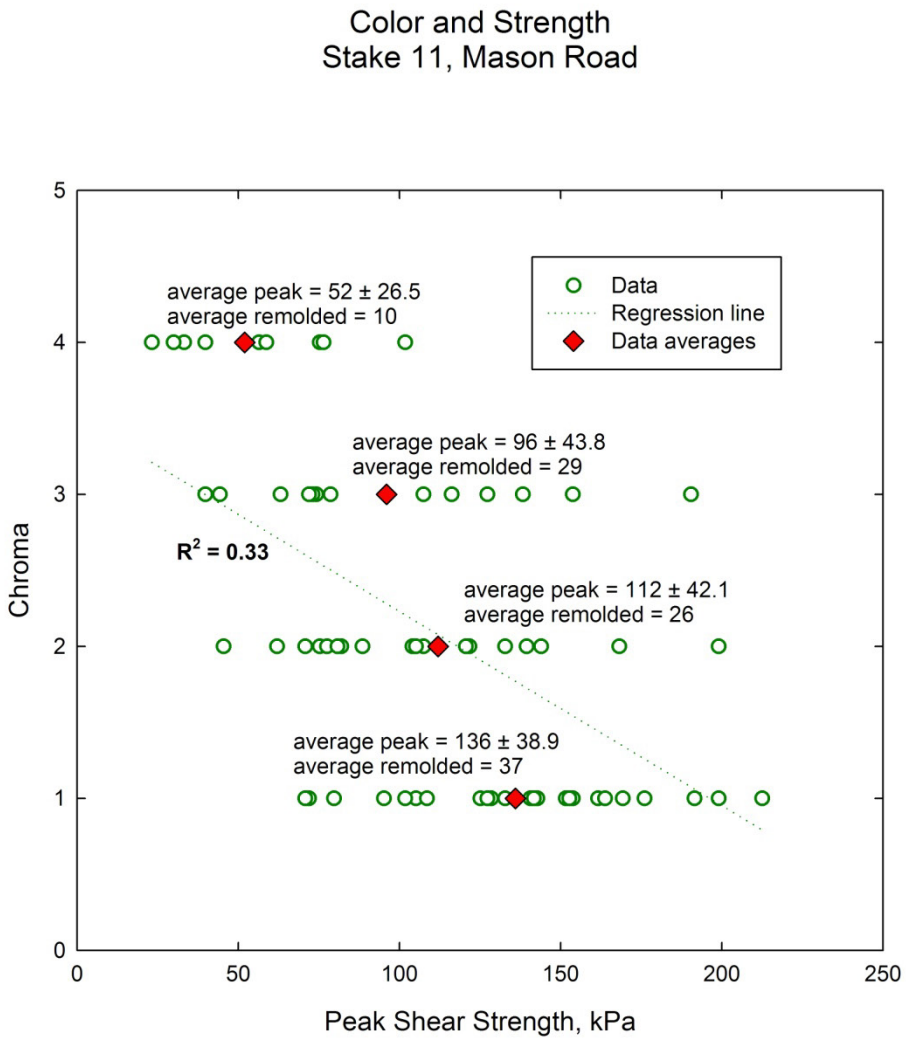


Figure 31. Graph showing the relation between peak shear strength and the chroma factor of color. In general, as the chroma increases the peak shear strength decreases.

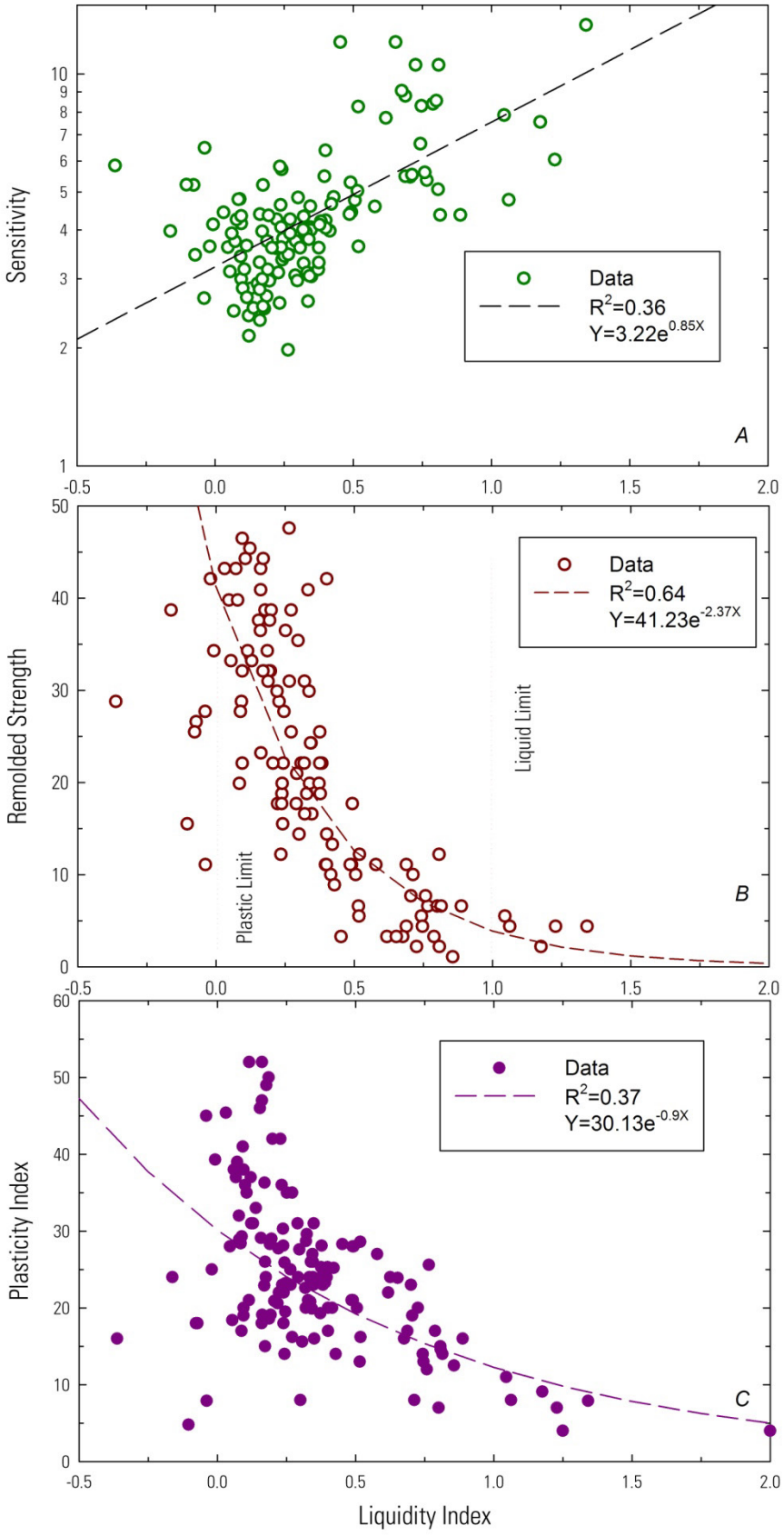


Figure 32. Graphs showing the relations among liquidity index and sensitivity (*A*), remolded strength (*B*), and plasticity index (*C*).

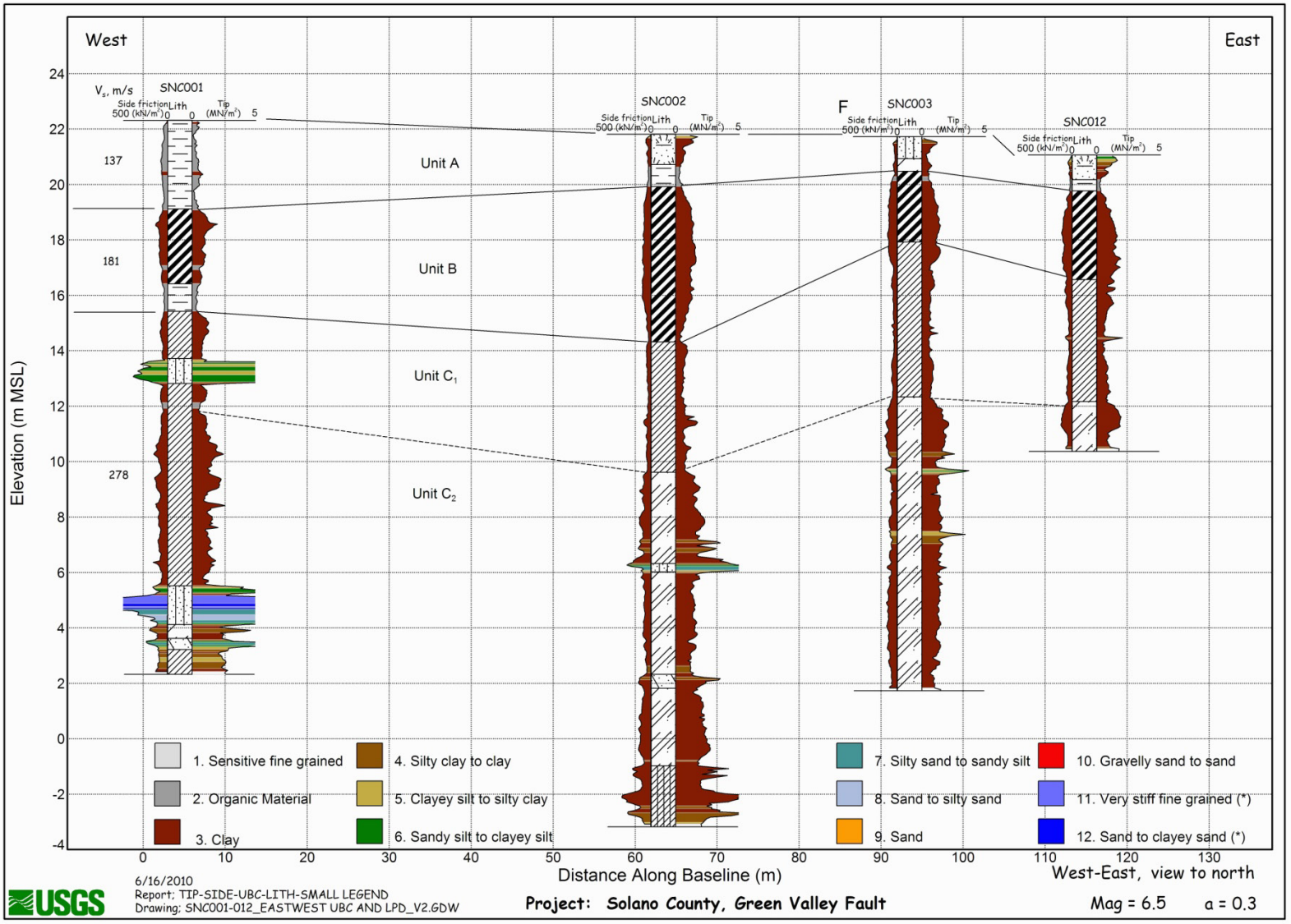


Figure 33. Cross section (view north) showing tip resistance, side friction, lithology, and UBC soil behavior type. The north-south trending Green Valley Fault would pass through this cross section at the position marked “F”, just west of SNC003.

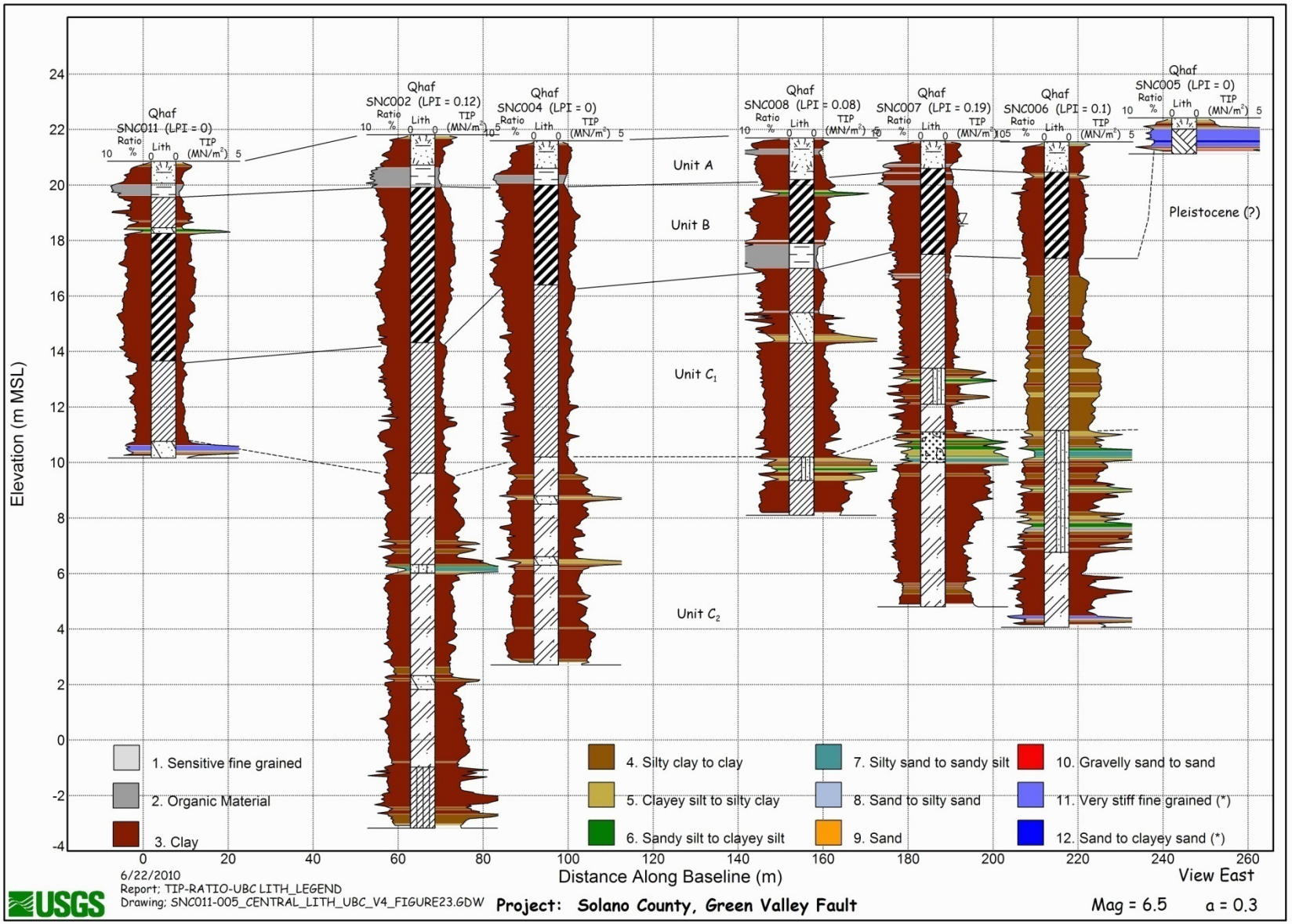


Figure 34. Cross section (north to south) showing tip resistance, friction ratio, lithology and UBC soil behavior type. The 7 soundings are west of the Green Valley Fault.

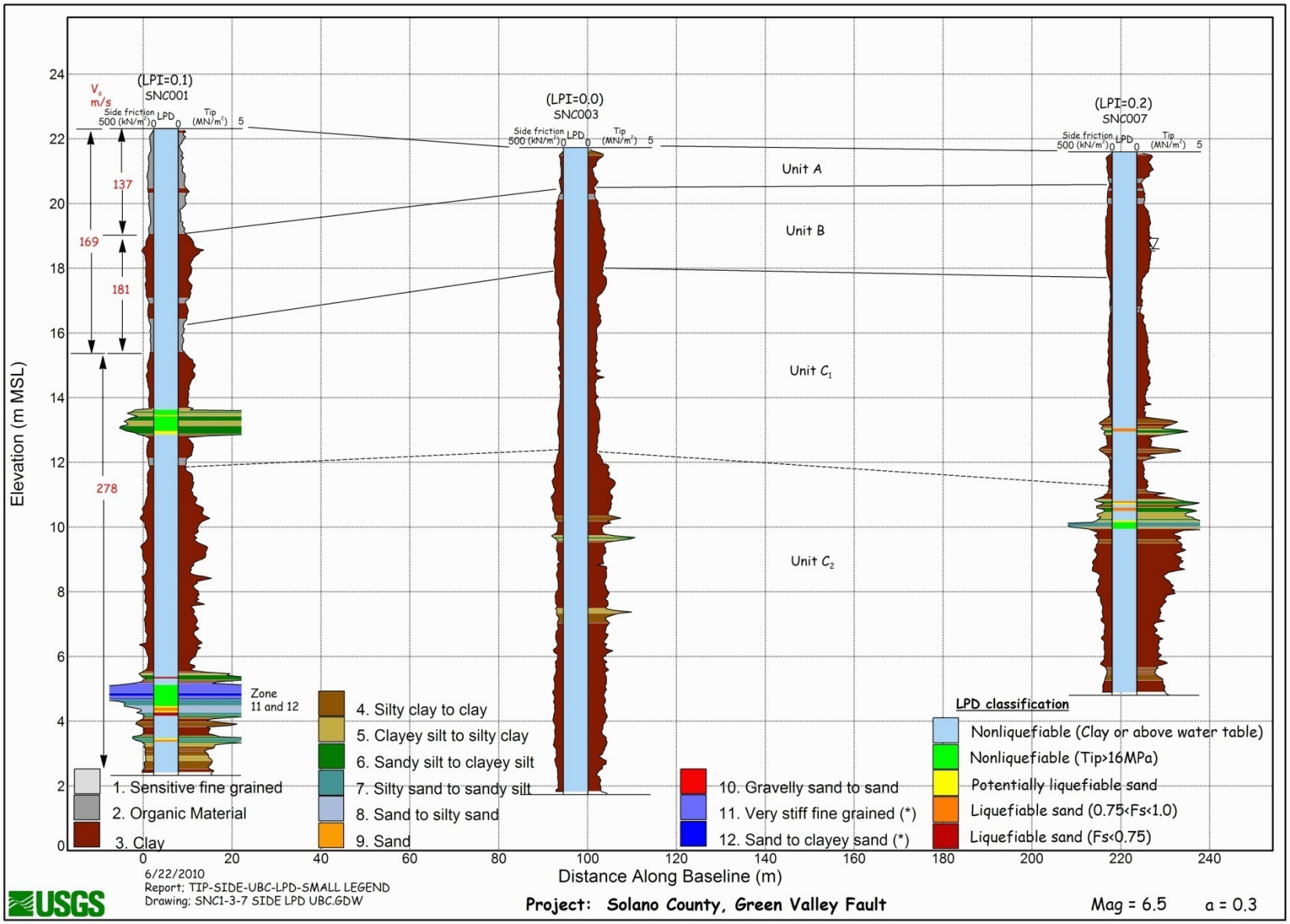


Figure 35. Cross section showing the sounding with the seismic cone (SNC001) and the 2 soundings associated with the borings. Also shown with the CPT tip and side resistance are the UBC soil type and LPD. The liquefaction potential at the site is very low.

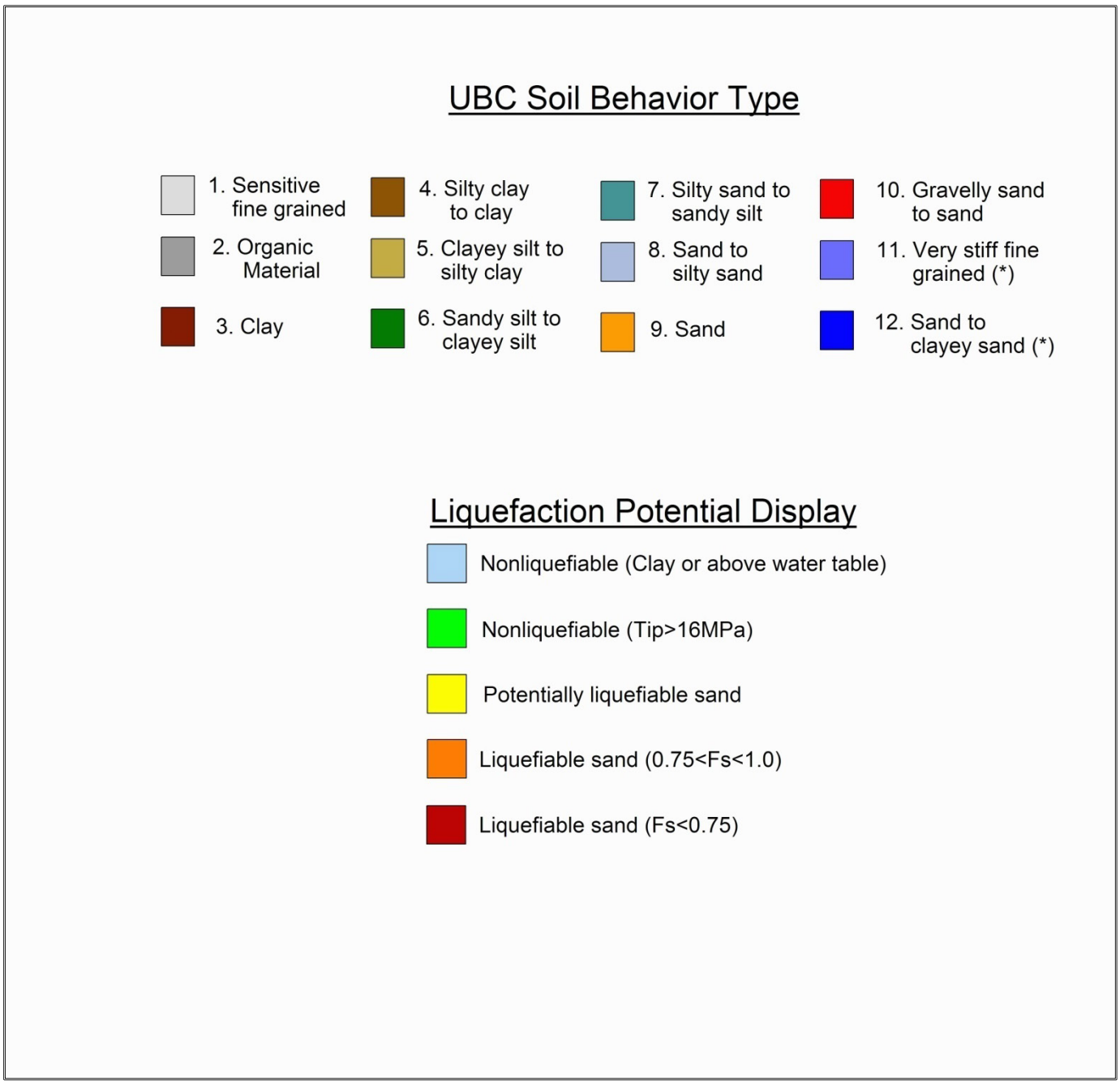


Figure 36. Legends showing the UBC 12-classification soil behavior types and the five Liquefaction Potential Display (LPD) zones.

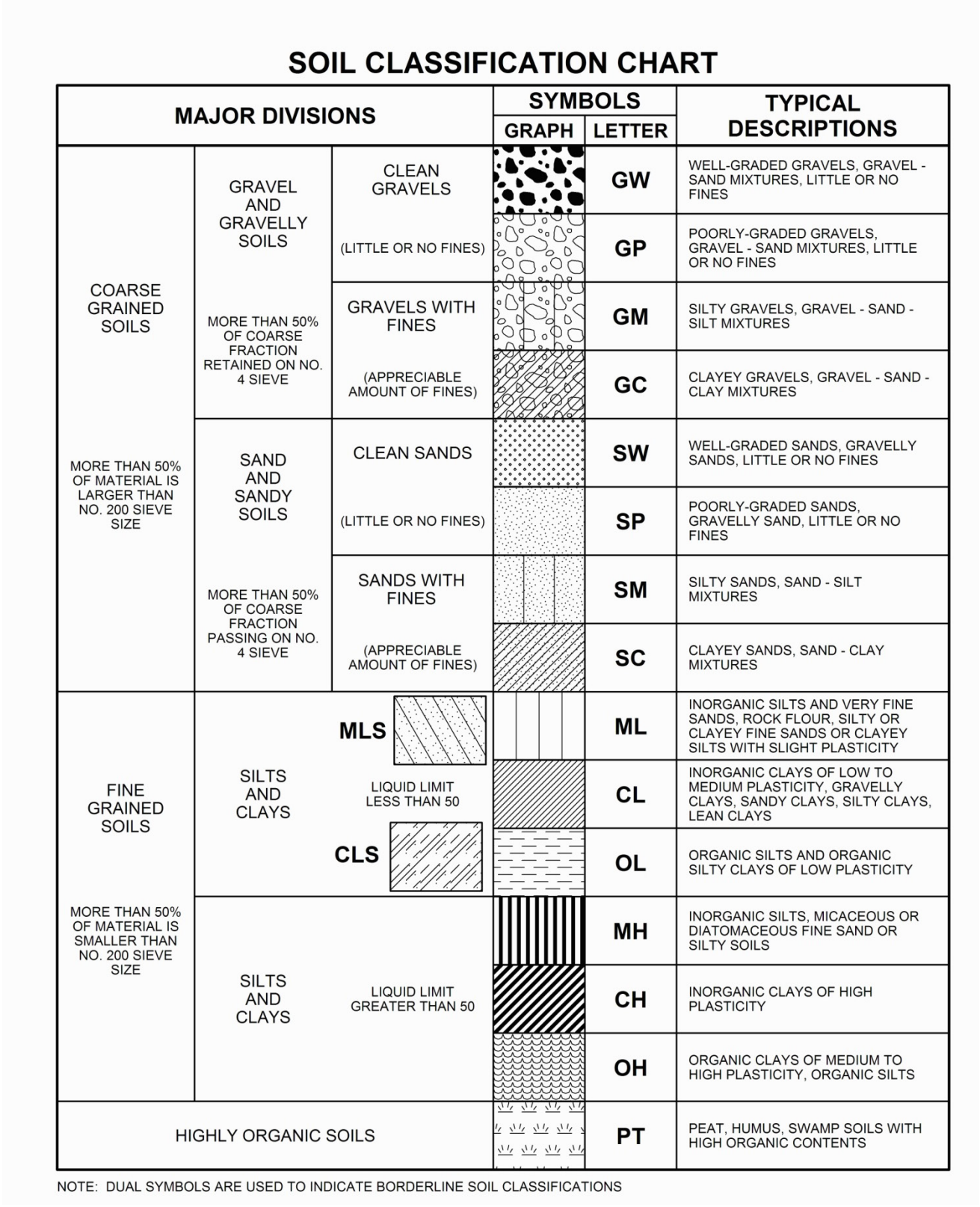


Figure 37. Graph showing the Unified Soil Classification (USC) chart.

Table 1. Grain size and Atterberg properties					Elevation, m =	21.6												
[The Unified Soil Classification symbols are defined in the description column]																		
Site	Sample depth range, ft	Depth interval, ft	Depth, m	Depth, ft	Elevation, m	Gravel >4.75 mm	Sand 4.75-0.075 mm	Silt 0.075-0.005 mm	Clay <0.005 mm	Median size, D_{50} mm	Fines, <0.075 mm	Sorting Cu D60/D10	Natural water content, %	Liquid limit	Plastic limit	Plasticity index	Liquidity index	Unified Soil Class	Description
SNC007-1a	1-3	1.67-2	0.56	1.83	21.04	0	36	39	25	0.050	64		21.9	40	20	20	0.09	CLS	Sandy lean CLAY
SNC007-1b	1-3	2-2.5	0.69	2.25	20.91	0	37	38	25	0.032	63		21.7	41	23	18	-0.07	CLS	Sandy lean CLAY
SNC007-1c	1-3	2.5-3	0.84	2.75	20.76	0	27	39	34	0.028	73		25.0	52	21	31	0.13	CH	Fat CLAY with sand
SNC007-2a	3-5	4-4.5	1.30	4.25	20.30	0	30	38	32	0.020	70		28.6	47	22	25	0.26	CLS	Sandy lean CLAY
SNC007-2b	3-5	4.5-5	1.45	4.75	20.15	0	27	44	29	0.025	73		24.8	52	21	31	0.12	CH	Fat CLAY with sand
SNC007-3a	5-7	5.56-6	1.77	5.79	19.83	0	52	35	13	0.080	48		23.4	34	20	14	0.24	SC	Clayey SAND
SNC007-3b	5-7	6-6.5	1.91	6.25	19.70	0	22	33	45	0.007	78		21.2	68	23	45	-0.04	CH	Fat CLAY with sand
SNC007-3c	5-7	6.5-7	2.06	6.75	19.54	1	14	32	53	0.004	85		32.7	73	24	49	0.18	CH	Fat CLAY with sand
SNC007-4a	7-9	7'3"-7'7"	2.26	7.42	19.34	0	13	37	50	0.005	87		33.8	71	30	41	0.09	CH	Fat CLAY
SNC007-4b	7-9	7'7"-8'	2.37	7.79	19.23	0	15	43	42	0.008	85		32.4	66	24	42	0.20	CH	Fat CLAY with sand
SNC007-4c	7-9	8-8.5	2.51	8.25	19.09	0	24	36	40	0.011	76		32.1	71	25	46	0.15	CH	Fat CLAY with sand
SNC007-4d	7-9	8.5-9	2.67	8.75	18.93	1	13	42	44	0.008	86		36.3	77	27	50	0.19	CH	Fat CLAY
SNC007-5a	9-11	9'7"-10'	2.98	9.79	18.62	13	26	19	42	0.012	61		40.6	80	33	47	0.16	CHS	Sandy fat CLAY
SNC007-5b	9-11	10'-10.5'	3.12	10.25	18.48	0	31	40	29	0.035	69		29.8	50	19	31	0.35	CHS	Sandy fat CLAY
SNC007-5c	9-11	10.5'-11'	3.28	10.75	18.32	0	33	32	35	0.021	67		25.6	60	22	38	0.09	CHS	Sandy fat CLAY
SNC007-6a	11-13	11'7"-12'	3.59	11.79	18.01	0	20	42	38	0.016	80		32.6	65	23	42	0.23	CH	Fat CLAY with sand
SNC007-6b	11-13	12-12.5'	3.73	12.25	17.87	0	25	40	35	0.012	75		32.8	59	24	35	0.25	CH	Fat CLAY with sand
SNC007-6c	11-13	12.5-13'	3.89	12.75	17.71	0	32	37	31	0.020	68		31.7	55	26	29	0.20	CHS	Sandy fat CLAY
SNC007-7a	13-15	13'3"-13'7"	4.09	13.42	17.51	0	23	47	30	0.025	77		34	56	25	31	0.29	CH	Fat CLAY with sand
SNC007-7b	13-15	13'7"-14'	4.20	13.79	17.40	0	33	44	23	0.044	67		32.1	42	22	20	0.51	CLS	Sandy lean CLAY
SNC007-7c	13-15	14-14.5'	4.34	14.25	17.26	0	42	37	21	0.057	58		29	41	21	20	0.40	CLS	Sandy lean CLAY
SNC007-7d	13-15	14.5-15'	4.50	14.75	17.10	0	33	41	26	0.029	67		31.3	43	23	20	0.42	CLS	Sandy lean CLAY
SNC007-8a	15-17	15'2"-15'7"	4.69	15.38	16.91	0	30	45	25	0.029	70		38.7	45	19	25.6	0.77	CLS	Sandy lean CLAY
SNC007-8b	15-17	15'7"-16'	4.81	15.79	16.79	0	23	46	31	0.018	77		36.6	48	21	27	0.58	CL	Lean CLAY with sand
SNC007-8c	15-17	16-16.5'	4.95	16.25	16.65	0	26	50	24	0.020	74		31.3	47	23	24	0.35	CL	Lean CLAY with sand
SNC007-8d	15-17	16.5-17'	5.11	16.75	16.49	0	28	44	28	0.038	72		30	47	21	26	0.35	CL	Lean CLAY with sand
SNC007-9a	17-19	17'2"-17'7"	5.30	17.38	16.30	0	29	37	34	0.028	71		33.7	48	20	28	0.49	CL	Lean CLAY with sand
SNC007-9b	17-19	17'7"-18'	5.42	17.79	16.18	0	33	40	27	0.037	67		29	44	20	24	0.38	CLS	Sandy lean CLAY
SNC007-9c	17-19	18-18.5'	5.56	18.25	16.04	0	38	39	23	0.050	62		27.4	41	21	20	0.32	CLS	Sandy lean CLAY
SNC007-9d	17-19	18.5-19'	5.72	18.75	15.89	0	40	41	19	0.050	60		26.9	41	20	21	0.33	CLS	Sandy lean CLAY
SNC007-10a	19-21	19'3.5"-19'7"	5.92	19.4	15.68	0	39	40	21	0.045	61		34	43	19	24	0.63	CLS	Sandy lean CLAY
SNC007-10b	19-21	19'7"-20'	6.03	19.8	15.57	0	29	52	19	0.041	71		34.1	39	22	17	0.69	CL	Lean CLAY with sand
SNC007-10c	19-21	20-20.5'	6.17	20.3	15.43	0	28	46	26	0.035	72		30.8	45	17	28	0.49	CL	Lean CLAY with sand
SNC007-10d	19-21	20.5-21'	6.32	20.8	15.28	0	30	49	21	0.038	70		29.8	44	21	23	0.38	CLS	Sandy lean CLAY
SNC007-11a	21-23	21'4"-21'9"	6.57	21.5	15.03	0	37	40	23	0.023	63		34.1	41	18	23	0.70	CLS	Sandy lean CLAY
SNC007-11b	21-23	21-9"-22'2"	6.69	22.0	14.91	0	22	51	27	0.023	78		30.5	45	21	24	0.40	CL	Lean CLAY with sand
SNC007-11c	21-23	22'2"-22'7"	6.82	22.4	14.78	0	22	44	34	0.014	78		29.3	47	20	27	0.34	CL	Lean CLAY with sand
SNC007-11d	21-23	22'7"-23'	6.95	22.8	14.65	0	23	44	33	0.016	77		29	46	22	24	0.29	CL	Lean CLAY with sand
SNC007-12a	23-25	23'4''-23'9"	7.18	23.5	14.42	0	29	44	27	0.025	71		31.3	42	21	21	0.49	CL	Lean CLAY with sand
SNC007-12b	23-25	23'9"-24'2"	7.30	24.0	14.30	0	25	53	22	0.026	75		33.4	39	20	19	0.71	CL	Lean CLAY with sand
SNC007-12c	23-25	24'2"-24'7"	7.43	24.4	14.17	0	31	48	21	0.040	69		33.7	39	22	17	0.69	CLS	Sandy lean CLAY
SNC007-12d	23-25	24'7"-25'	7.56	24.8	14.04	0	59	22	19	0.120	41		29.4	33	19	14	0.74	SC	Clayey SAND
SNC007-13a	25-27	25'2"-25'7"	7.73	25.4	13.87	0	35	45	20	0.045	65		34.4	38	21	17	0.79	CLS	Sandy lean CLAY

Site	Sample depth range, ft	Depth interval, ft	Depth, m	Depth, ft	Elevation, m	Gravel >4.75 mm	Sand 4.75-0.075 mm	Silt 0.075-0.005 mm	Clay <0.005 mm	Median size, D_{50} mm	Fines, <0.075 mm	Sorting Cu D60/D10	Natural water content, %	Liquid limit	Plastic limit	Plasticity index	Liquidity index	Unified Soil Class	Description
SNC007-13b	25-27	25'7"-26'	8.00	25.8	13.60	0	22	56	22	0.036	78		33.6	42	20	22	0.62	CL	Lean CLAY with sand
SNC007-13c1	25-27	26'-26'5"	8.21	26.2	13.39	0	59	24	17	0.093	41		33.6	32	25	7	1.23	SM	Silty SAND
SNC007-13c2	25-27	26'5"-26'9"	8.29	26.6	13.31	0	75	12	13	0.172	25		29	28	24	4	1.25	SM	Silty SAND
SNC007-13d	25-27	26'9"-27'	8.37	26.9	13.23	0	64	24	12	0.104	36			28	25	3		SM	Silty SAND
SNC007-14a	27-29	27'2.5"-27'6"	8.45	27.4	13.15	0	73	15	12	0.170	27		32	28	24	4	2.00	SM	Silty SAND
SNC007-14b1	27-29	27'6"-27'8"	8.53	27.6	13.07	0	72	21	7	0.150	28	17	32					SM	Silty SAND
SNC007-14b2	27-29	27'8"-28'2"	8.61	27.9	12.99	0	37	46	17	0.054	63		33.5	33	22	11	1.05	CLS	Sandy lean CLAY
SNC007-14c1	27-29	28'2"-28'4.5"	8.69	28.3	12.91	0	43	41	16	0.058	57							CLS	Sandy lean CLAY
SNC007-14c2	27-29	28'4.5"-28'7"	8.77	28.5	12.83	0	60	29	11	0.110	40		37.8					SM	Silty SAND
SNC007-14d1	27-29	28'7"-28'10"	8.85	28.7	12.75	0	64	24	12	0.104	36			28	23	5		SM	Silty SAND
SNC007-14d2	27-29	28'10"-29'	8.93	28.9	12.67	0	43	40	17	0.059	57			34	22	12		CLS	Sandy lean CLAY
SNC007-15a1	29-31	29'-29'4"	9.01	29.2	12.59	0	57	31	12	0.089	43		35.6	34	25	9	1.18	SM	Silty SAND
SNC007-15a2	29-31	29'4"-29'9"	9.09	29.5	12.51	3	62	25	10	0.133	35	40	30.2					SM	Silty SAND
SNC007-15b	29-31	29'9"-30'	9.17	29.9	12.43	0	54	31	15	0.083	46			34	23	11		SC	Clayey SAND
SNC007-15c	29-31	30'-30'6"	9.25	30.3	12.35	0	58	30	12	0.092	42		29.5	29	21	8	1.06	SC	Clayey SAND
SNC007-15d1	29-31	30'6"-30'9"	9.35	30.6	12.25	0	60	28	12	0.098	40		29.6	31	24	7	0.80	SM	Silty SAND
SNC007-15d2	29-31	30'9"-31'	9.45	30.9	12.15	0	48	34	18	0.070	52			35	21	14		CLS	Sandy lean CLAY
SNC007-16a	31-33	31'2"-31'6"	9.60	31.3	12.00	0	52	30	18	0.078	48		26.7	33	20	13	0.52	SC	Clayey SAND
SNC007-16b	31-33	31'6"-32'	9.68	31.8	11.92	0	45	35	20	0.060	55		26	34	20	14	0.43	CLS	Sandy lean CLAY
SNC007-16c	31-33	32'-32'6"	9.83	32.3	11.77	0	48	37	15	0.069	52		30.1	33	21	12	0.76	CLS	Sandy lean CLAY
SNC007-16d1	31-33	32'6"-32'9"	9.94	32.6	11.66	0	43	41	16	0.062	57		36.2	38	22	16	0.89	CLS	Sandy lean CLAY
SNC007-16d2	31-33	32'9"-33'	10.02	32.9	11.58	0	18	59	23	0.030	82			42	23	19		CL	Lean CLAY with sand
SNC007-17a	33-35	33'1"-33'6"	10.15	33.3	11.45	0	27	49	24	0.036	73		31.2	42	21	21	0.49	CL	Lean CLAY with sand
SNC007-17b	33-35	33'6"-34'	10.29	33.8	11.31	0	43	37	20	0.063	57		33.1	36	21	15	0.81	CLS	Sandy lean CLAY
SNC007-17c	33-35	34'-34'6"	10.44	34.3	11.16	0	49	36	15	0.072	51		28.7	31	23	8	0.71	CLS	Sandy lean CLAY
SNC007-17d	33-35	34'6"-35	10.60	34.8	11.00	0	53	32	15	0.079	47		26.4	32	24	8	0.30	SM	Silty SAND
SNC007-18b	35-37	35'5"-36'	10.75	35.7	10.85	0	49	35	16	0.071	51		32.4	35	21	14	0.81	CLS	Sandy lean CLAY
SNC007-18c1	35-37	36'-36'1.5"	10.90	36.1	10.70	0	62	24	14	0.116	38		31.6					SM	Silty SAND
SNC007-18c2	35-37	36'1.5"-36'4"	11.02	36.3	10.58	0	59	21	20	0.106	41		30.7	34	21	13	0.75	SC	Clayey SAND
SNC007-18d	35-37	36'4"-36'5.5"	11.25	36.4	10.35	5	66	16	13	0.182	29							SM	Silty SAND
SNC007-18e	35-37	36'5.5"-37"	11.35	36.7	10.25	22	53	14	11	0.335	25							SM	Silty SAND with gravel
SNC007-19a	37-39	37'2"-37'6"	11.50	37.3	10.10	18	66	7	9	0.480	16	103						SM	Silty SAND with gravel
SNC007-19b1	37-39	37'6"-37'10.5'	11.60	37.7	10.00	13	73			0.580	14	21	26.8					SP-SM	SAND with silt
SNC007-19b2	37-39	37'10.5"-38'1"	11.72	38.0	9.88	0	41	48	11	0.064	59	17		36	19	17		CLS	Sandy lean CLAY
SNC007-19c	37-39	38'1"-38'6"	11.80	38.3	9.80	0	29	45	26	0.025	71		26.6	39	24	15	0.17	CL	Lean CLAY with sand
SNC007-19d	37-39	38'6"-39'	11.90	38.8	9.70	0	34	44	22	0.037	66		27.8	38	21	17	0.40	CLS	Sandy lean CLAY
SNC007-20a	39-40	39'1"-39'6"	12.00	39.3	9.60	0	37	41	22	0.043	63		24.6	35	19	16	0.35	CLS	Sandy lean CLAY
SNC007-20b	39-40	39'6"-40"	12.12	39.8	9.48	2	41	37	20	0.051	57		20.5	36	19	17	0.09	CLS	Sandy lean CLAY
Stake 11-SNC003																			
Stake 11-1D	2-4	2-2.5	0.69	2.25	20.91	0	66	21	13	0.130	34		11.5	29	24	5		SM	Silty sand
Stake 11-1C	2-4	2.5-3	0.84	2.75	20.76	0	42	38	20	0.053	58		17.6	37	19	18	-0.08	CLS	Sandy lean clay
Stake 11-1B	2-4	3-3.5	0.99	3.25	20.61	0	45	36	19	0.059	55		13.2	35	19	16	-0.36	CLS	Sandy lean clay
Stake 11-1A	2-4	3.5-4	1.14	3.75	20.46	0	23	51	26	0.031	77		17.1	45	21	24	-0.16	CL	Lean clay with sand
Stake 11-2A	4-6	4-4.5	1.30	4.25	20.30	0	17	52	31	0.018	83		23.3	50	22	28	0.05	CH	Fat Clay with sand
Stake 11-2B	4-6	4.5-5	1.45	4.75	20.15	0	15	49	36	0.013	85		23.5	53	21	32	0.08	CH	Fat Clay with sand

Site	Sample depth range, ft	Depth interval, ft	Depth, m	Depth, ft	Elevation, m	Gravel >4.75 mm	Sand 4.75-0.075 mm	Silt 0.075-0.005 mm	Clay <0.005 mm	Median size, D_{50} mm	Fines, <0.075 mm	Sorting Cu D60/D10	Natural water content, %	Liquid limit	Plastic limit	Plasticity index	Liquidity index	Unified Soil Class	Description
Stake 11-2C	4-6	5-5.5	1.60	5.25	20.00	0	16	44	40	0.011	84		23.7	55	20	35	0.11	CH	Fat Clay with sand
Stake 11-2D	4-6	5.5-6	1.75	5.75	19.85	0	17	41	42	0.009	83		22.8	59	20	39	0.07	CH	Fat Clay with sand
Stake 11-3A	6-8	6-6.66	1.93	6.33	19.67	0	18	37	45	0.008	82		22.3	58	20	38	0.06	CH	Fat Clay with sand
Stake 11-3B	6-8	6.66-7.33	2.13	7.00	19.47	0	18	38	44	0.008	82		21.7	66	20	45	0.03	CH	Fat Clay with sand
Stake 11-3C	6-8	7.33-8.0	2.33	7.66	19.27	0	19	37	44	0.008	81		23.5	58	21	37	0.07	CH	Fat Clay with sand
Stake 11-4A	8-10	8-8.5	2.51	8.25	19.09	0	19	33	48	0.007	81		28.3	61	24	37	0.12	CH	Fat Clay with sand
Stake 11-4B	8-10	8.5-9	2.67	8.75	18.93	0	19	41	40	0.010	81		26.6	59	23	36	0.10	CH	Fat Clay with sand
Stake 11-4C	8-10	9-9.5	2.82	9.25	18.78	2	21	35	42	0.010	77		30.4	58	22	36	0.23	CH	Fat Clay with sand
Stake 11-4D	8-10	9.5-10	2.97	9.75	18.63	0	11	31	58	0.002	89		32	78	26	52	0.12	CH	Fat clay
Stake 11-5A	10-12	10.0-11.0	3.20	10.50	18.40	1	12	35	52	0.004	87		35.4	79	27	52	0.16	CH	Fat clay
Stake 11-5B	10-12	11.0-12.0	3.51	11.50	18.09	0	20	40	40	0.013	80		29.6	58	25	33	0.14	CH	Fat clay with sand
Stake 11-6A	12-14	12.0-12.5	3.73	12.25	17.87	0	28	40	32	0.021	72		28.5	50	24	26	0.17	CH	Fat clay with sand
Stake 11-6B	12-14	12.5-13.0	3.89	12.75	17.71	0	37	35	28	0.037	63		24.1	41	18	23	0.27	CLS	Sandy lean clay
Stake 11-6C1	12-14	13.0-13.21	3.99	13.10	17.61	0	32	32	36	0.020	68		27.8	45	19	26	0.34	CLS	Sandy lean clay
Stake 11-6C2	12-14	13.21-13.5	4.07	13.36	17.53	1	28	46	25	0.032	71		*28*	43	20	23	0.35	CL	Lean clay with sand
Stake 11-6D	12-14	13.5-14	4.19	13.75	17.41	0	31	41	28	0.026	69		28	44	20	24	0.33	CLS	Sandy lean clay
Stake 11-7A	15-17	15-15.5	4.65	15.25	16.95	0	36	37	27	0.042	64		21.9	37	19	18	0.16	CLS	Sandy lean clay
Stake 11-7B	15-17	15.5-16	4.80	15.75	16.80	0	34	34	32	0.021	66		22.4	39.6	20.6	19	0.09	CLS	Sandy lean clay
Stake 11-7C	15-17	16-16.5	4.95	16.25	16.65	0	27	42	31	0.027	73		23.6	41	22.6	18.4	0.05	CL	Lean clay with sand
Stake 11-7D1	15-17	16.5-16.92	5.11	16.75	16.49	0	29	41	30	0.025	71		24.9	42	20	22	0.22	CL	Lean clay with sand
Stake 11-7D2	15-17	16.92-17	5.17	16.96	16.43	0	29	43	28	0.029	71							CL	Lean clay with sand
Stake 11-8A	17-19	17-17.5	5.26	17.25	16.34	0	32	46	22	0.043	68		26.8	40.6	19.8	20.8	0.34	CLS	Sandy lean clay
Stake 11-8B	17-19	17.5-18	5.41	17.75	16.19	0	34	44	22	0.042	66		26.5	39.6	19.7	19.9	0.34	CLS	Sandy lean clay
Stake 11-8C	17-19	18-18.5	5.56	18.25	16.04	0	35	42	23	0.042	65		27.3	39.4	20.1	19.3	0.37	CLS	Sandy lean clay
Stake 11-8D	17-19	18.5-19	5.72	18.75	15.89	0	42	34	24	0.056	58		29	36.8	20.6	16.2	0.52	CLS	Sandy lean clay
Stake 11-9A	19-21	19-19.5	5.87	19.25	15.73	0	53	32	15	0.084	47		32.9	34.7	22.2	12.5	0.86	SC	Clayey sand
Stake 11-9B1	19-21	19.5-19.67	5.97	19.58	15.63	0	35	48	17	0.036	65		33.4	36.2	21.6	14.6	0.81	CLS	Sandy lean clay
Stake 11-9B2	19-21	19.67-20.08	6.06	19.87	15.54	0	33	46	21	0.030	67		34.5	40	20	20	0.73	CLS	Sandy lean clay
Stake 11-9C1	19-21	20.08-20.5	6.18	20.29	15.42	0	24	54	22	0.028	76		33.3	38.5	22.5	16	0.68	CL	Lean clay with sand
Stake 11-9C2	19-21	20.5-20.71	6.28	20.60	15.32	0	29	49	22	0.037	71			39.6	23.4	16.2		CL	Lean clay with sand
Stake 11-10A	21-23	21-21.5	6.48	21.25	15.12	0	39	45	16	0.048	61		38.6	35.9	28	7.9	1.34	MLS	Sandy silt
Stake 11-10B1	21-23	21.5-21.75	6.59	21.63	15.01	0	28	43	29	0.016	72		38.4	46.7	22.8	23.9	0.65	CL	Lean clay with sand
Stake 11-10B2	21-23	21.75-22	6.67	21.88	14.93	0	26	43	31	0.016	74		35.7	51.2	22.9	28.3	0.45	CH	Fat Clay with sand
Stake 11-10C	21-23	22-22.5	6.78	22.25	14.82	0	17	47	36	0.011	83		38.0	51.8	23.2	28.6	0.52	CH	Fat Clay with sand
Stake 11-10D	21-23	22.5-23	6.93	22.75	14.67	0	18	41	41	0.009	82		32.8	52.3	23.6	28.7	0.32	CH	Fat Clay with sand
Stake 11-11A	23-25.25	23-23.25	7.04	23.10	14.56	0	19	44	37	0.011	81		33.1	53.1	23.5	29.6	0.32	CH	Fat Clay with sand
Stake 11-11B	23-25.25	23.25-23.75	7.16	23.50	14.44	0	16	46	38	0.010	84		33.3	50.8	22.7	28.1	0.38	CH	Fat Clay with sand
Stake 11-11C	23-25.25	23.75-24.5	7.32	24.00	14.28	0	16	49	35	0.011	84		32.9	52.3	24.7	27.6	0.30	CH	Fat Clay with sand
Stake 11-11D	23-25.25	24.5-25.25	7.54	24.75	14.06	0	24	48	28	0.030	76		33	47.6	22.4	25.2	0.42	CL	Lean clay with sand
Stake 11-12A	25.25-27	25.25-25.5	7.73	25.38	13.87	0	21	47	32	0.024	79		30.8	50.4	24.5	25.9	0.24	CH	Fat Clay with sand
Stake 11-12B	25.25-27	25.5-26	7.85	25.75	13.75	0	27	45	28	0.028	73		29.6	45.4	20.1	25.3	0.38	CL	Lean clay with sand
Stake 11-12C	25.25-27	26-26.5	8.00	26.25	13.60	0	19	53	28	0.025	81		26.2	47.8	20.1	27.7	0.22	CL	Lean clay with sand

Site	Sample depth range, ft	Depth interval, ft	Depth, m	Depth, ft	Elevation, m	Gravel >4.75 mm	Sand 4.75-0.075 mm	Silt 0.075-0.005 mm	Clay <0.005 mm	Median size, D_{50} mm	Fines, <0.075 mm	Sorting Cu D60/D10	Natural water content, %	Liquid limit	Plastic limit	Plasticity index	Liquidity index	Unified Soil Class	Description
Stake 11-12D	25.25-27	26.5-27	8.15	26.75	13.45	0	18	54	28	0.023	82		26.1	49	20.7	28.3	0.19	CL	Lean clay with sand
Stake 11-13A	27-29	27-27.5	8.31	27.25	13.29	0	14	49	37	0.011	86		29	50.4	22.3	28.1	0.24	CH	Fat clay
Stake 11-13B	27-29	27.5-28	8.46	27.75	13.14	0	38	32	30	0.028	62		24.2	41.7	18.5	23.2	0.25	CLS	Sandy lean clay
Stake 11-13C	27-29	28-28.5	8.61	28.25	12.99	0	33	35	32	0.033	67		23.7	38.8	20.2	18.6	0.19	CLS	Sandy lean clay
Stake 11-13D	27-29	28.5-29	8.76	28.75	12.84	0	18	34	48	0.006	82		29.7	59.8	23.5	36.3	0.17	CH	Fat clay with sand
Stake 11-14A	29-31	29-29.5	8.92	29.25	12.68	0	14	37	49	0.005	86		30	56.7	27.4	29.3	0.09	CH	Fat clay
Stake 11-14B	29-31	29.5-30	9.07	29.75	12.53	0	15	43	42	0.007	85		30.1	69.7	30.4	39.3	-0.01	CH	Fat clay with sand
Stake 11-14C	29-31	30-30.5	9.22	30.25	12.38	0	24	40	36	0.011	76		27.3	52.8	17.8	35	0.27	CH	Fat Clay with sand
Stake 11-15A	31-33	31-31.5	9.53	31.25	12.08	0	34	48	18	0.045	66		24.2	37.9	19.9	18	0.24	CLS	Sandy lean clay
Stake 11-15B	31-33	31.5-32	9.68	31.75	11.92	0	40	43	17	0.054	60		24.8	35.6	20	15.6	0.31	CLS	Sandy lean clay
Stake 11-15C	31-33	32-32.5	9.83	32.25	11.77	0	14	54	32	0.014	86		27.8	53.8	25.4	28.4	0.08	CH	Fat clay
Stake 11-15D	31-33	32.5-33	9.98	32.75	11.62	0	24	50	26	0.025	76		28.5	45.1	24.2	20.9	0.21	CL	Lean clay with sand
Stake 11-16A	33-35	33-33.5	10.13	33.25	11.47	0	13	53	34	0.010	87		35.3	50.5	25.2	25.3	0.40	CH	Fat Clay with sand
Stake 11-16B	33-35	33.5-34	10.29	33.75	11.31	0	20	40	40	0.010	80		32.5	55.6	25.3	30.3	0.24	CH	Fat Clay with sand
Stake 11-16C	33-35	34-34.5	10.44	34.25	11.16	0	24	50	26	0.018	76		29.1	45.8	23.8	22	0.24	CL	Lean clay with sand
Stake 11-16D	33-35	34.5-35	10.59	34.75	11.01	0	13	55	32	0.013	87		29.4	47	24	23	0.23	CL	Lean clay with sand
Stake 11-17A1	35-37	35-35.25	10.71	35.13	10.89	0	27	45	28	0.022	73		27	42.4	19.8	22.6	0.32	CL	Lean clay with sand
Stake 11-17A2	35-37	35.25-35.5	10.78	35.38	10.82	0	37	40	23	0.049	63		22.9	37.6	18.1	19.5	0.25	CLS	Sandy lean clay
Stake 11-17B	35-37	35.5-36	10.90	35.75	10.70	0	62	25	13	0.114	38		21.7	27	22.2	4.8	-0.10	SM	Silty sand
Stake 11-17C	35-37	36-36.5	11.05	36.25	10.55	0	58	28	14	0.122	42		19.3	27.5	19.6	7.9	-0.04	SC	Clayey sand
Stake 11-17D1	35-37	36.5-36.75	11.16	36.63	10.44	0	47	30	23	0.060	53		21	32.8	16.6	16.2	0.27	CLS	Sandy lean clay
Stake 11-17D2	35-37	36.75-37	11.24	36.88	10.36	0	46	30	24	0.060	54			33.5	16.8	16.7		CLS	Sandy lean clay
Stake 11-18A	37-39	37-37.5	11.35	37.25	10.25	0	31	43	26	0.029	69		20.9	36.9	17.8	19.1	0.16	CLS	Sandy lean clay
Stake 11-18B	37-39	37.5-38	11.51	37.75	10.09	0	19	51	30	0.020	81		23.4	42	21	21	0.11	CL	Lean clay with sand
Stake 11-18C	37-39	38-38.5	11.66	38.25	9.94	0	17	48	35	0.012	83		25	44	21.1	22.9	0.17	CL	Lean clay with sand
Stake 11-18D1	37-39	38.5-38.75	11.77	38.63	9.83	0	16	52	32	0.013	84		27.4	42.8	23.7	19.1	0.19	CL	Lean clay with sand
Stake 11-18D2	37-39	38.75-39	11.85	38.88	9.75	0	17	49	34	0.012	83		27.4	43.5	22.9	20.6	0.22	CL	Lean clay with sand
Stake 11-19A	39-41	39-39.5	11.96	39.25	9.64	0	17	44	39	0.010	83		25	50.5	25.5	25	-0.02	CH	Fat Clay with sand
Stake 11-19B	39-41	39.5-40	12.12	39.75	9.48	0	22	44	34	0.010	78		25.6	50.1	21	29.1	0.16	CH	Fat Clay with sand
Stake 11-19C	39-41	40-40.5	12.27	40.25	9.33	0	33	35	32	0.023	67		23.9	43.7	19.7	24	0.18	CLS	Sandy lean clay
Stake 11-19D1	39-41	40.5-40.75	12.38	40.63	9.22	0	35	35	30	0.028	65		30.5	44.7	21.4	23.3	0.39	CLS	Sandy lean clay
Stake 11-19D2	39-41	40.75-41	12.46	40.88	9.14	0	34	34	32	0.036	66		24.3	50.9	22	28.9	0.08	CHS	Sandy fat clay

Table 2. Soil strength and density

[The Unified Soil Classification symbols are defined in the description column]

Site	Sample depth range, ft	Depth, m	Depth, ft	Unified Soil Class	Description	Peak Strength, kPa	Residual Strength, kpa	Remolded Strength, kPa	Sensitivity Peak/Remolded	Density, kg/cm^3
SNC007-1a	1-3	0.56	1.83	CLS	Sandy lean CLAY	91.9	60.9	22.1	4.2	1.87
SNC007-1b	1-3	0.69	2.25	CLS	Sandy lean CLAY	91.9	73	26.6	3.5	1.78
SNC007-1c	1-3	0.84	2.75	CH	Fat CLAY with sand	94.1	69.7	33.2	2.8	1.93
SNC007-2a	3-5	1.30	4.25	CLS	Sandy lean CLAY	94.1	71.9	47.6	2.0	1.93
SNC007-2b	3-5	1.45	4.75	CH	Fat CLAY with sand	97.4	78.6	45.4	2.1	1.98
SNC007-3a	5-7	1.77	5.79	SC	Clayey SAND	74.2	59.8	22.1	3.4	-
SNC007-3b	5-7	1.91	6.25	CH	Fat CLAY with sand	74.2	58.7	27.7	2.7	1.92
SNC007-3c	5-7	2.06	6.75	CH	Fat CLAY with sand	97.4	70.8	38.7	2.5	1.89
SNC007-4a	7-9	2.26	7.42	CH	Fat CLAY	98.5	77.5	28.8	3.4	1.76
SNC007-4b	7-9	2.37	7.79	CH	Fat CLAY with sand	117.3	80.8	38.7	3.0	1.89
SNC007-4c	7-9	2.51	8.25	CH	Fat CLAY with sand	109.6	64.2	37.6	2.9	1.93
SNC007-4d	7-9	2.67	8.75	CH	Fat CLAY	93	73	34.3	2.7	1.84
SNC007-5a	9-11	2.98	9.79	CHS	Sandy fat CLAY	96.3	71.9	40.9	2.4	1.84
SNC007-5b	9-11	3.12	10.25	CHS	Sandy fat CLAY	154.9	114	50.9	3.0	1.97
SNC007-5c	9-11	3.28	10.75	CHS	Sandy fat CLAY	139.4	100.7	46.5	3.0	1.93
SNC007-6a	11-13	3.59	11.79	CH	Fat CLAY with sand	89.6	70.8	28.8	3.1	1.87
SNC007-6b	11-13	3.73	12.25	CH	Fat CLAY with sand	125.1	102.9	36.5	3.4	1.88
SNC007-6c	11-13	3.89	12.75	CHS	Sandy fat CLAY	95.2	71.9	32.1	3.0	1.88
SNC007-7a	13-15	4.09	13.42	CH	Fat CLAY with sand	54.2	37.6	17.7	3.1	1.8
SNC007-7b	13-15	4.20	13.79	CLS	Sandy lean CLAY	47.6	29.9	10	4.8	1.86
SNC007-7c	13-15	4.34	14.25	CLS	Sandy lean CLAY	60.9	44.3	14.4	4.2	1.92
SNC007-7d	13-15	4.50	14.75	CLS	Sandy lean CLAY	39.8	27.7	10	4.0	1.92
SNC007-8a	15-17	4.69	15.38	CLS	Sandy lean CLAY	35.4	23.2	6.6	5.4	1.93
SNC007-8b	15-17	4.81	15.79	CL	Lean CLAY with sand	50.9	37.6	11.1	4.6	1.97
SNC007-8c	15-17	4.95	16.25	CL	Lean CLAY with sand	67.5	48.7	16.6	4.1	1.97
SNC007-8d	15-17	5.11	16.75	CL	Lean CLAY with sand	66.4	46.5	16.6	4.0	1.95
SNC007-9a	17-19	5.30	17.38	CL	Lean CLAY with sand	-	-	-	-	-
SNC007-9b	17-19	5.42	17.79	CLS	Sandy lean CLAY	91.9	60.9	25.5	3.6	1.93
SNC007-9c	17-19	5.56	18.25	CLS	Sandy lean CLAY	101.8	69.7	31	3.3	1.95
SNC007-9d	17-19	5.72	18.75	CLS	Sandy lean CLAY	74.2	53.1	18.8	3.9	1.95
SNC007-10a	19-21	5.92	19.4	CLS	Sandy lean CLAY	-	-	-	-	-
SNC007-10b	19-21	6.03	19.8	CL	Lean CLAY with sand	38.7	27.7	4.4	8.8	-
SNC007-10c	19-21	6.17	20.3	CL	Lean CLAY with sand	78.6	56.4	17.7	4.4	1.95
SNC007-10d	19-21	6.32	20.8	CLS	Sandy lean CLAY	93	68.6	22.1	4.2	1.91
SNC007-11a	21-23	6.57	21.5	CLS	Sandy lean CLAY	-	-	-	-	-
SNC007-11b	21-23	6.69	22.0	CL	Lean CLAY with sand	60.9	44.3	11.1	5.5	1.93
SNC007-11c	21-23	6.82	22.4	CL	Lean CLAY with sand	111.8	80.8	24.3	4.6	1.9
SNC007-11d	21-23	6.95	22.8	CL	Lean CLAY with sand	78.6	60.9	21	3.7	1.94
SNC007-12a	23-25	7.18	23.5	CL	Lean CLAY with sand	58.7	40.9	11.1	5.3	1.87
SNC007-12b	23-25	7.30	24.0	CL	Lean CLAY with sand	42.1	29.9	7.7	5.5	1.87
SNC007-12c	23-25	7.43	24.4	CLS	Sandy lean CLAY	60.9	36.5	11.1	5.5	1.9
SNC007-12d	23-25	7.56	24.8	SC	Clayey SAND	36.5	25.5	5.5	6.6	1.94
SNC007-13a	25-27	7.73	25.4	CLS	Sandy lean CLAY	27.7	16.6	3.3	8.4	1.95
SNC007-13b	25-27	8.00	25.8	CL	Lean CLAY with sand	25.5	16.6	3.3	7.7	1.91
SNC007-13c1	25-27	8.21	26.2	SM	Silty SAND	26.6	18.8	4.4	6.0	1.9
SNC007-13c2	25-27	8.29	26.6	SM	Silty SAND	-	-	-	-	1.93
SNC007-13d	25-27	8.37	26.9	SM	Silty SAND	-	-	-	-	1.93
SNC007-14a	27-29	8.45	27.4	SM	Silty SAND	-	-	-	-	-
SNC007-14b1	27-29	8.53	27.6	SM	Silty SAND	25.5	19.9	2.2	11.6	1.94
SNC007-14b2	27-29	8.61	27.9	CLS	Sandy lean CLAY	43.2	28.8	5.5	7.9	1.94
SNC007-14c1	27-29	8.69	28.3	SM	Silty SAND	-	-	-	-	1.85
SNC007-14c2	27-29	8.77	28.5	SM	Silty SAND	33.2	-	4.4	7.5	1.85
SNC007-14d1	27-29	8.85	28.7	SM	Silty SAND	-	-	-	-	1.92
SNC007-14d2	27-29	8.93	28.9	CLS	Sandy lean CLAY	-	-	-	-	1.92
SNC007-15a1	29-31	9.01	29.2	SM	Silty SAND	16.6	10	2.2	7.5	1.9

Site	Sample depth range, ft	Depth, m	Depth, ft	Unified Soil Class	Description	Peak Strength, kPa	Residual Strength, kpa	Remolded Strength, kPa	Sensitivity Peak/Remolded	Density, kg/cm^3
SNC007-15a2	29-31	9.09	29.5	SM	Silty SAND	27.7	15.5	3.3	8.4	1.92
SNC007-15b	29-31	9.17	29.9	SC	Clayey SAND	-	-	-	-	-
SNC007-15c	29-31	9.25	30.3	SC	Clayey SAND	21	13.3	4.4	4.8	1.94
SNC007-15d1	29-31	9.35	30.6	SM	Silty SAND	56.4	33.2	6.6	8.5	1.95
SNC007-15d2	29-31	9.45	30.9	CLS	Sandy lean CLAY	-	-	-	-	-
SNC007-16a	31-33	9.60	31.3	SC	Clayey SAND	33.2	19.9	6.6	5.0	1.89
SNC007-16b	31-33	9.68	31.8	CLS	Sandy lean CLAY	43.2	33.2	8.9	4.9	1.91
SNC007-16c	31-33	9.83	32.3	CLS	Sandy lean CLAY	43.2	31	7.7	5.6	1.9
SNC007-16d1	31-33	9.94	32.6	CLS	Sandy lean CLAY	28.8	21	6.6	4.4	1.88
SNC007-16d2	31-33	10.02	32.9	CL	Lean CLAY with sand	-	-	-	-	-
SNC007-17a	33-35	10.15	33.3	CL	Lean CLAY with sand	48.7	37.6	11.1	4.4	1.85
SNC007-17b	33-35	10.29	33.8	CLS	Sandy lean CLAY	62	43.2	12.2	5.1	1.93
SNC007-17c	33-35	10.44	34.3	CLS	Sandy lean CLAY	55.3	40.9	10	5.5	1.9
SNC007-17d	33-35	10.60	34.8	SM	Silty SAND	69.7	44.3	14.4	4.8	2.01
SNC007-18b	35-37	10.75	35.7	CLS	Sandy lean CLAY	28.8	19.9	6.6	4.4	-
SNC007-18c1	35-37	10.90	36.1	SM	Silty SAND	29.9	23.2	5.5	5.4	-
SNC007-18c2	35-37	11.02	36.3	SC	Clayey SAND	36.5	25.5	4.4	8.3	-
SNC007-18d	35-37	11.25	36.4	SM	Silty SAND	-	-	-	-	-
SNC007-18e	35-37	11.35	36.7	SM	Silty SAND with gravel	-	-	-	-	-
SNC007-19a	37-39	11.50	37.3	SM	Silty SAND with gravel	-	-	-	-	-
SNC007-19b1	37-39	11.60	37.7	SP-SM	SAND with silt	-	-	-	-	1.95
SNC007-19b2	37-39	11.72	38.0	CLS	Sandy lean CLAY	150.5	62	19.9	7.6	
SNC007-19c	37-39	11.80	38.3	CL	Lean CLAY with sand	167.1	59.8	32.1	5.2	2.00
SNC007-19d	37-39	11.90	38.8	CLS	Sandy lean CLAY	170.4	88.5	42.1	4.0	2.03
SNC007-20a	39-40	12.00	39.3	CLS	Sandy lean CLAY	277	-	-	-	2.2
SNC007-20b	39-40	12.12	39.8	CLS	Sandy lean CLAY	258	-	-	-	2.07
Stake 11										
Stake 11-1D	2-4	0.69	2.3	SM	Silty sand	56.4	46.5	17.7	3.2	1.61
Stake 11-1C	2-4	0.84	2.8	CLS	Sandy lean clay	132.8	94.1	25.5	5.2	1.63
Stake 11-1B	2-4	0.99	3.3	CLS	Sandy lean clay	168.2	104	28.8	5.8	1.69
Stake 11-1A	2-4	1.14	3.8	CL	Lean clay with sand	153.8	110.7	38.7	4.0	1.75
Stake 11-2A	4-6	1.30	4.3	CH	Fat Clay with sand	143.9	102.9	39.8	3.6	1.88
Stake 11-2B	4-6	1.45	4.8	CH	Fat Clay with sand	169.3	95.2	39.8	4.3	1.97
Stake 11-2C	4-6	1.60	5.3	CH	Fat Clay with sand	140.6	94.1	44.3	3.2	2.05
Stake 11-2D	4-6	1.75	5.8	CH	Fat Clay with sand	161.6	100.7	43.2	3.7	1.94
Stake 11-3A	6-8	1.93	6.3	CH	Fat Clay with sand	212.5	107.4	54.2	3.9	2.03
Stake 11-3B	6-8	2.13	7.0	CH	Fat Clay with sand	191.5	98.5	43.2	4.4	2.07
Stake 11-3C	6-8	2.33	7.7	CH	Fat Clay with sand	176	120.6	70.8	2.5	2.06
Stake 11-4A	8-10	2.51	8.3	CH	Fat Clay with sand	128.4	94.1	53.1	2.4	2.02
Stake 11-4B	8-10	2.67	8.8	CH	Fat Clay with sand	153.8	107.4	54.2	2.8	2.04
Stake 11-4C	8-10	2.82	9.3	CH	Fat Clay with sand	152.7	93	58.7	2.6	1.98
Stake 11-4D	8-10	2.97	9.8	CH	Fat clay	142.8	93	53.1	2.7	1.96
Stake 11-5A	10-12	3.20	10.5	CH	Fat clay	121.7	81.9	43.2	2.8	1.91
Stake 11-5B	10-12	3.51	11.5	CH	Fat clay with sand	190.4	118.4	75.3	2.5	2
Stake 11-6A	12-14	3.73	12.3	CH	Fat clay with sand	138.3	101.8	54.2	2.6	2.05
Stake 11-6B	12-14	3.89	12.8	CLS	Sandy lean clay	107.4	74.2	31	3.5	1.95
Stake 11-6C1	12-14	3.99	13.1	CLS	Sandy lean clay	75.3	59.8	19.9	3.8	2.01
Stake 11-6C2	12-14	4.07	13.4	CL	Lean clay with sand	-	-	-	-	-
Stake 11-6D	12-14	4.19	13.8	CLS	Sandy lean clay	127.3	88.5	40.9	3.1	2.04
Stake 11-7A	15-17	4.65	15.3	CLS	Sandy lean clay	120.6	68.6	36.5	3.3	1.76
Stake 11-7B	15-17	4.80	15.8	CLS	Sandy lean clay	139.4	45.4	32.1	4.3	1.91
Stake 11-7C	15-17	4.95	16.3	CL	Lean clay with sand	104	68.6	33.2	3.1	1.88
Stake 11-7D1	15-17	5.11	16.8	CL	Lean clay with sand	75.3	60.9	17.7	4.3	1.93
Stake 11-7D2	15-17	5.17	17.0	CL	Lean clay with sand	-	-	-	-	-
Stake 11-8A	17-19	5.26	17.3	CLS	Sandy lean clay	78.6	58.7	29.9	2.6	1.85
Stake 11-8B	17-19	5.41	17.8	CLS	Sandy lean clay	74.2	55.3	24.3	3.1	1.9

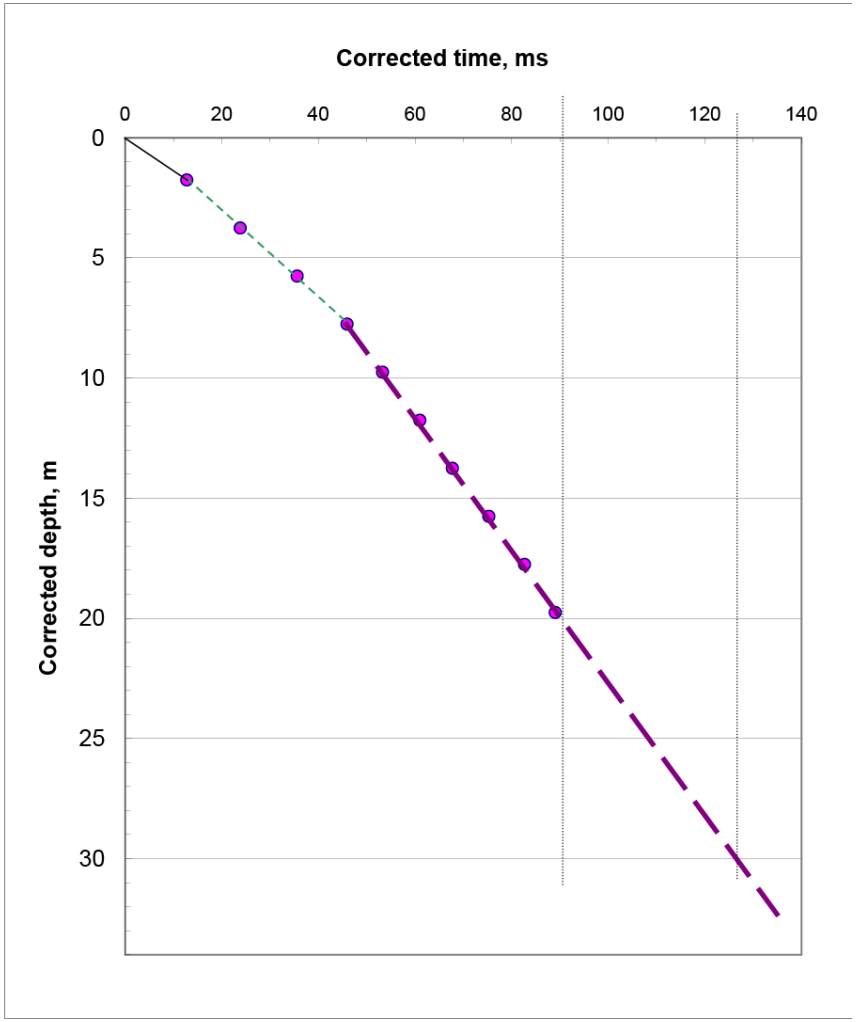
Site	Sample depth range, ft	Depth, m	Depth, ft	Unified Soil Class	Description	Peak Strength, kPa	Residual Strength, kpa	Remolded Strength, kPa	Sensitivity Peak/Remolded	Density, kg/cm^3
Stake 11-8C	17-19	5.56	18.3	CLS	Sandy lean clay	63.1	48.7	19.9	3.2	1.94
Stake 11-8D	17-19	5.72	18.8	CLS	Sandy lean clay	44.3	32.1	12.2	3.6	1.93
Stake 11-9A	19-21	5.87	19.3	SC	Clayey sand	33.2	27.7	1.1	30.2	1.92
Stake 11-9B1	19-21	5.97	19.6	CLS	Sandy lean clay	23.2	18.8	2.2	10.5	1.89
Stake 11-9B2	19-21	6.06	19.9	CLS	Sandy lean clay	23.2	18.8	2.2	10.5	1.89
Stake 11-9C1	19-21	6.18	20.3	CL	Lean clay with sand	29.9	22.1	3.3	9.1	1.9
Stake 11-9C2	19-21	6.28	20.6	CL	Lean clay with sand	-	-	-	-	-
Stake 11-10A	21-23	6.48	21.3	MLS	Sandy silt	58.7	42.1	4.4	13.3	1.86
Stake 11-10B1	21-23	6.59	21.6	CL	Lean clay with sand	39.8	29.9	3.3	12.1	1.84
Stake 11-10B2	21-23	6.67	21.9	CH	Fat Clay with sand	39.8	29.9	3.3	12.1	1.84
Stake 11-10C	21-23	6.78	22.3	CH	Fat Clay with sand	45.4	37.6	5.5	8.3	1.88
Stake 11-10D	21-23	6.93	22.8	CH	Fat Clay with sand	71.9	55.3	16.6	4.3	1.95
Stake 11-11A	23-25.25	7.04	23.1	CH	Fat Clay with sand	-	-	-	-	-
Stake 11-11B	23-25.25	7.16	23.5	CH	Fat Clay with sand	77.5	62	18.8	4.1	1.87
Stake 11-11C	23-25.25	7.32	24.0	CH	Fat Clay with sand	105.1	71.9	35.4	3.0	1.89
Stake 11-11D	23-25.25	7.54	24.8	CL	Lean clay with sand	62	50.9	13.3	4.7	1.85
Stake 11-12A	25.25-27	7.73	25.4	CH	Fat Clay with sand	-	-	-	-	1.85
Stake 11-12B	25.25-27	7.85	25.8	CL	Lean clay with sand	73	58.7	22.1	3.3	1.9
Stake 11-12C	25.25-27	8.00	26.3	CL	Lean clay with sand	107.4	73	29.9	3.6	1.94
Stake 11-12D	25.25-27	8.15	26.8	CL	Lean clay with sand	101.8	64.2	32.1	3.2	1.93
Stake 11-13A	27-29	8.31	27.3	CH	Fat clay	76.4	55.3	18.8	4.1	1.94
Stake 11-13B	27-29	8.46	27.8	CLS	Sandy lean clay	105.1	76.4	27.7	3.8	2
Stake 11-13C	27-29	8.61	28.3	CLS	Sandy lean clay	116.2	83	31	3.7	2.05
Stake 11-13D	27-29	8.76	28.8	CH	Fat clay with sand	132.8	105.1	44.3	3.0	2
Stake 11-14A	29-31	8.92	29.3	CH	Fat clay	132.8	75.3	27.7	4.8	1.95
Stake 11-14B	29-31	9.07	29.8	CH	Fat clay with sand	141.7	84.1	34.3	4.1	1.97
Stake 11-14C	29-31	9.22	30.3	CH	Fat Clay with sand	151.6	110.7	38.7	3.9	2.06
Stake 11-15A	31-33	9.53	31.3	CLS	Sandy lean clay	71.9	52	19.9	3.6	1.78
Stake 11-15B	31-33	9.68	31.8	CLS	Sandy lean clay	79.7	62	22.1	3.6	2.02
Stake 11-15C	31-33	9.83	32.3	CH	Fat clay	95.2	70.8	19.9	4.8	1.91
Stake 11-15D	31-33	9.98	32.8	CL	Lean clay with sand	79.7	60.9	22.1	3.6	2.03
Stake 11-16A	33-35	10.13	33.3	CH	Fat Clay with sand	70.8	49.8	11.1	6.4	-
Stake 11-16B	33-35	10.29	33.8	CH	Fat Clay with sand	81.9	56.4	17.7	4.6	1.90
Stake 11-16C	33-35	10.44	34.3	CL	Lean clay with sand	88.5	70.8	15.5	5.7	1.97
Stake 11-16D	33-35	10.59	34.8	CL	Lean clay with sand	70.8	54.2	12.2	5.8	1.92
Stake 11-17A1	35-37	10.71	35.1	CL	Lean clay with sand	88.5	53.1	22.1	4.0	2.04
Stake 11-17A2	35-37	10.78	35.4	CLS	Sandy lean clay	-	-	-	-	-
Stake 11-17B	35-37	10.90	35.8	SM	Silty sand	80.8	54.2	15.5	5.2	2.06
Stake 11-17C	35-37	11.05	36.3	SC	Clayey sand	71.9	49.8	11.1	6.5	2.07
Stake 11-17D1	35-37	11.16	36.6	CLS	Sandy lean clay	108.5	80.8	25.5	4.3	2.09
Stake 11-17D2	35-37	11.24	36.9	CLS	Sandy lean clay	-	-	-	-	-
Stake 11-18A	37-39	11.35	37.3	CLS	Sandy lean clay	101.8	68.6	23.2	4.4	2.04
Stake 11-18B	37-39	11.51	37.8	CL	Lean clay with sand	125.1	73	34.3	3.6	2.02
Stake 11-18C	37-39	11.66	38.3	CL	Lean clay with sand	127.3	78.6	32.1	4.0	2
Stake 11-18D1	37-39	11.77	38.6	CL	Lean clay with sand	163.8	76.4	37.6	4.4	1.95
Stake 11-18D2	37-39	11.85	38.9	CL	Lean clay with sand	-	-	-	-	-
Stake 11-19A	39-41	11.96	39.3	CH	Fat Clay with sand	152.7	84.1	42.1	3.6	2.06
Stake 11-19B	39-41	12.12	39.8	CH	Fat Clay with sand	199	-	-	-	2.1
Stake 11-19C	39-41	12.27	40.3	CLS	Sandy lean clay	199	-	-	-	2.12
Stake 11-19D1	39-41	12.38	40.6	CLS	Sandy lean clay	199	-	-	-	1.9
Stake 11-19D2	39-41	12.46	40.9	CHS	Sandy fat clay	-	-	-	-	-

Table 3. Time and velocity for SNC001.

CPT #	**SNC001**	Sounding #	1	Units: ms=milliseconds	Offset, generator, 0.70 m
Offset, source		0.96		m/s=meters per second	Offset, hammer, 0.96 m
Offset, seismometer		0.25			
Surficial Geology		Alluvial	Green Valley Fault		
Source		OLD hammer			
Vs20=	222 **m**	**Vs30=**	237 **m/s**		

Depth m	Corrected Depth m	Corrected Depth ft	Travel time ms	Corrected travel time ms	Average Velocity m/s	Interval Velocity m/s
2.00	1.75	5.7	14.54	**12.75**	137	137
4.00	3.75	12.3	24.59	**23.82**	157	181
6.00	5.75	18.9	36.09	**35.60**	162	170
8.00	7.75	25.4	46.28	**45.93**	169	194
10.00	9.75	32.0	53.53	**53.27**	183	272
12.00	11.75	38.6	61.20	**61.00**	193	259
14.00	13.75	45.1	67.90	**67.74**	203	297
16.00	15.75	51.7	75.42	**75.28**	209	265
18.00	17.75	58.2	82.79	**82.67**	215	271
20.00	19.75	64.8	89.14	**89.03**	222	314

Top, m	Bottom, m	Bottom Depth, ft	Top corrected time, ms	Bottom corrected time, ms	Interval velocity, m/s
0.00	7.75	25.43	0.00	45.93	169
7.75	19.75	64.80	45.93	89.03	278
0.00	1.75	5.74	0.00	12.75	137
1.75	7.75	25.43	12.75	45.93	181
7.75	19.75	64.80	45.93	89.03	278



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