

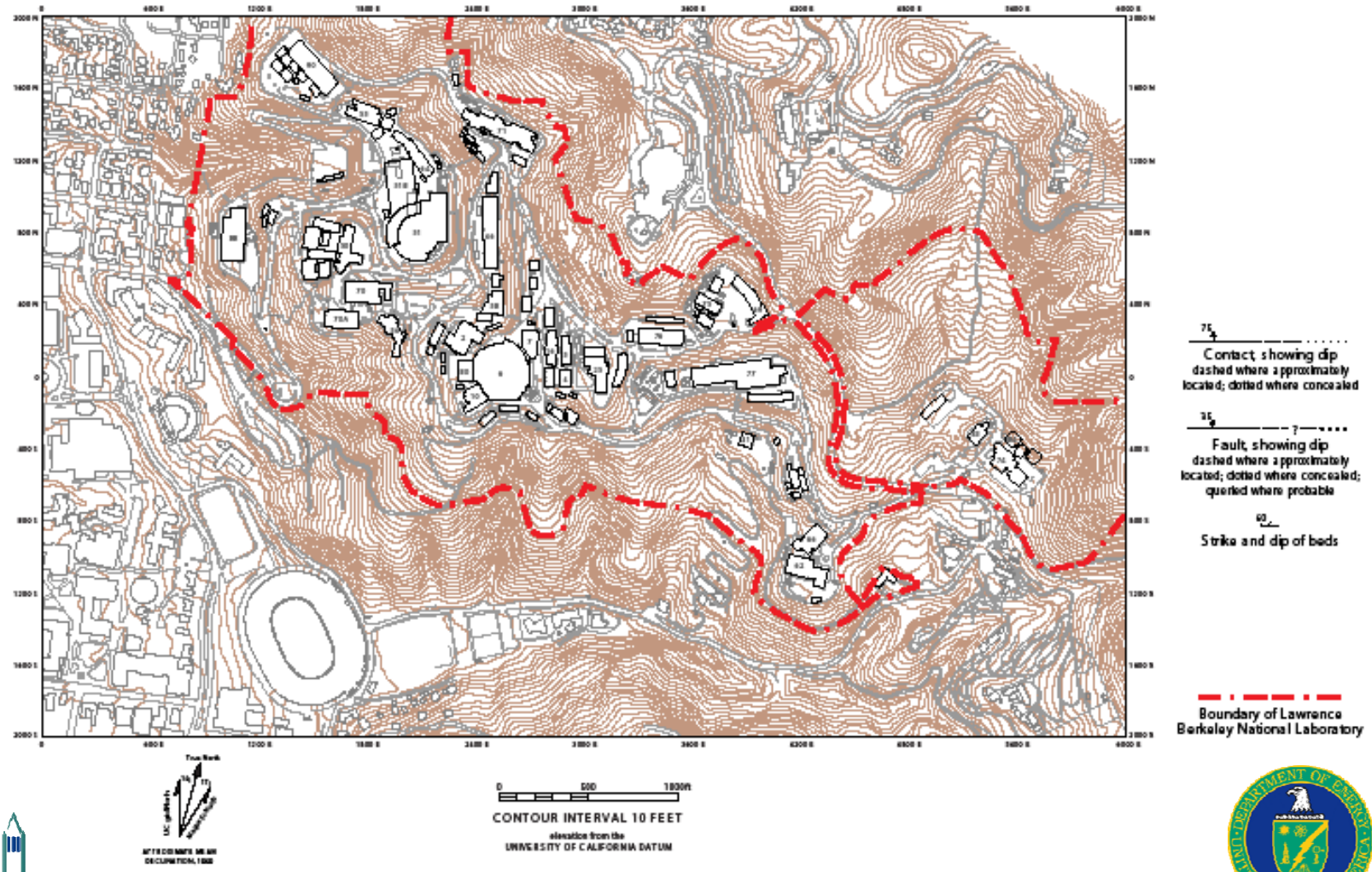
An Introduction to the Geology and Engineering Geology of Lawrence Berkeley National Laboratory

Preston Jordan

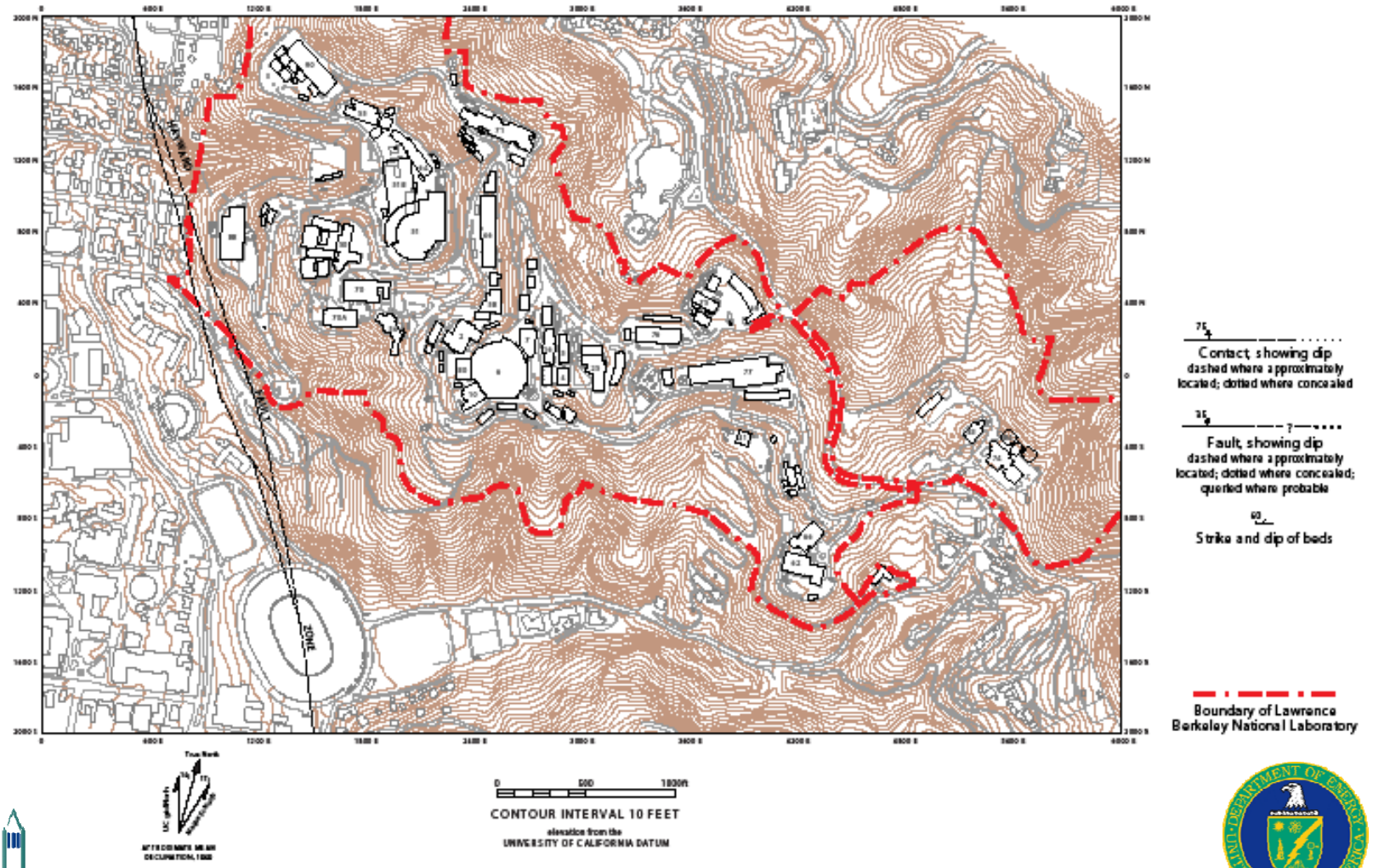
Earth Sciences Division
Lawrence Berkeley National Laboratory



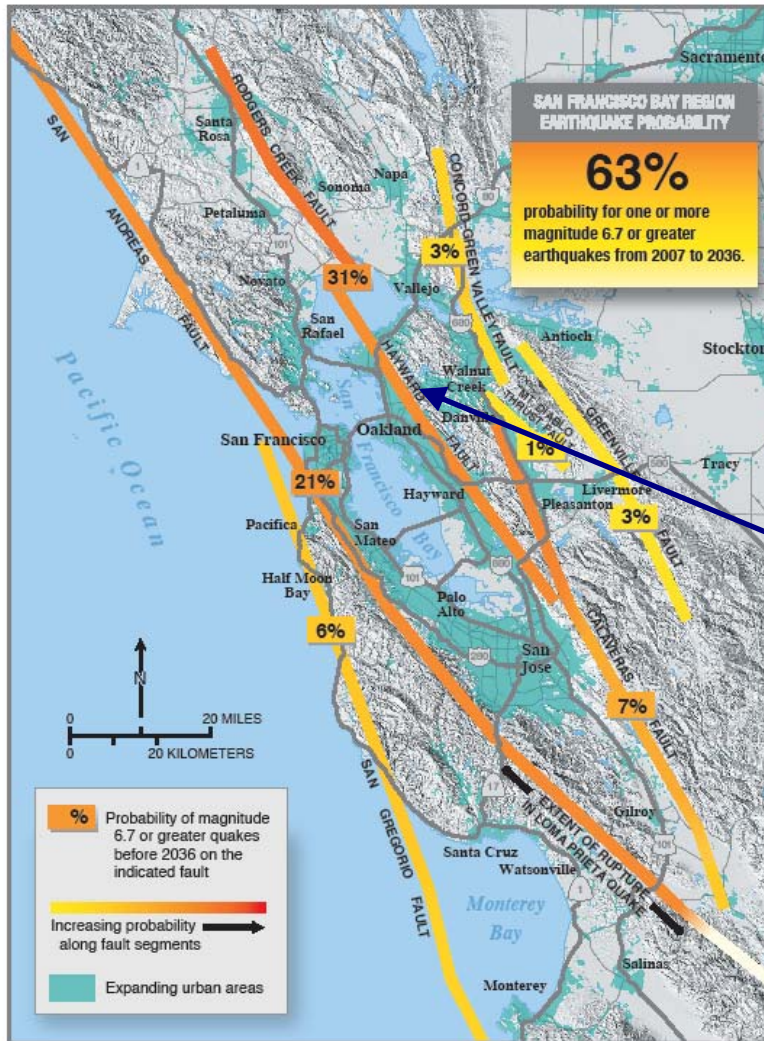
LBNL



Hayward Fault (Active)



Hayward Fault Earthquake Probability



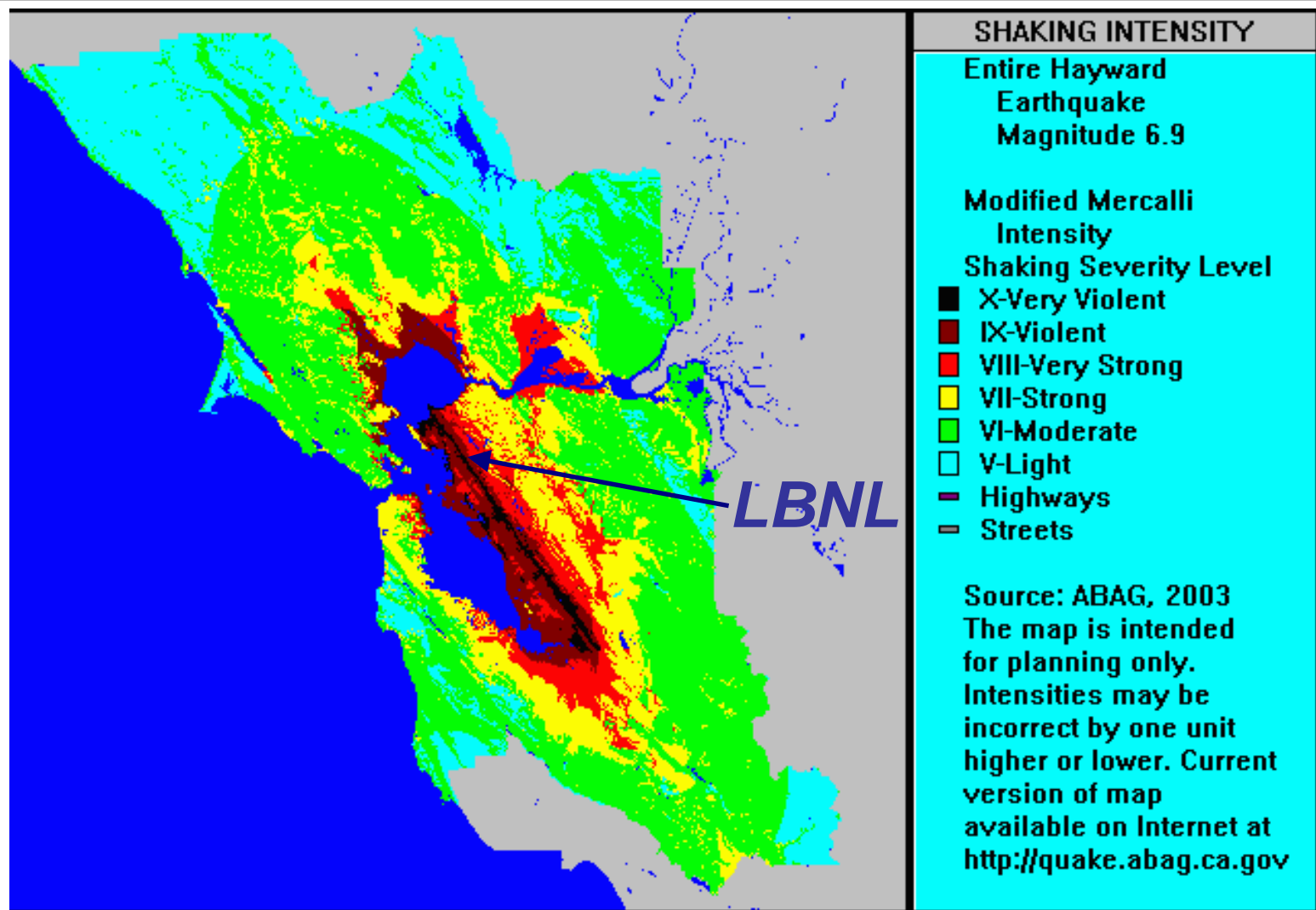
≥M6.7 probability estimate
for 2007-2036

63% for the Bay Area
31% for the Hayward/Rodgers
Creek Faults

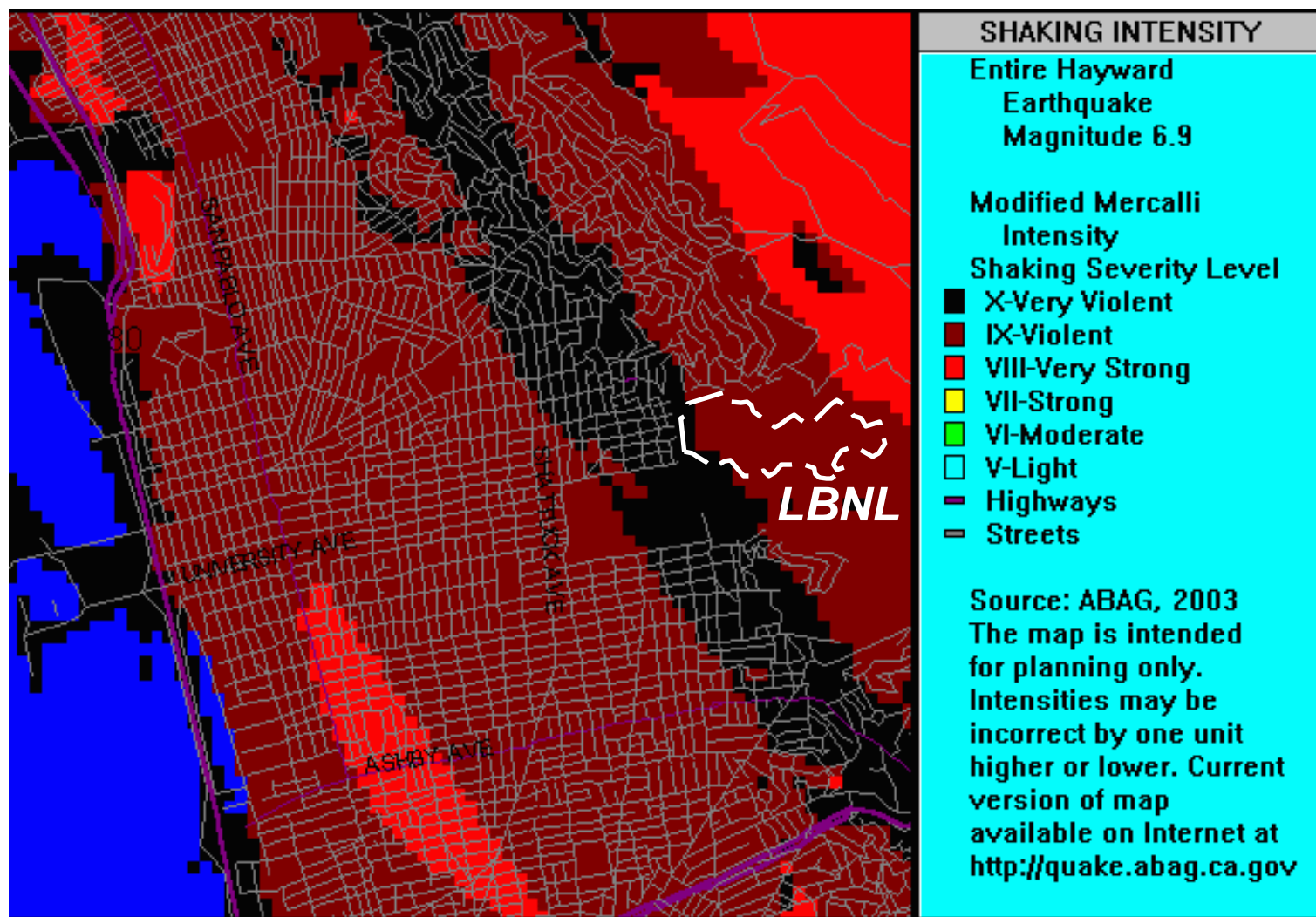
LBNL

Working Group on California Earthquake Probabilities, 2008. The uniform California earthquake forecast, version 2 (UCERF 2). USGS OFR 2007-1437.

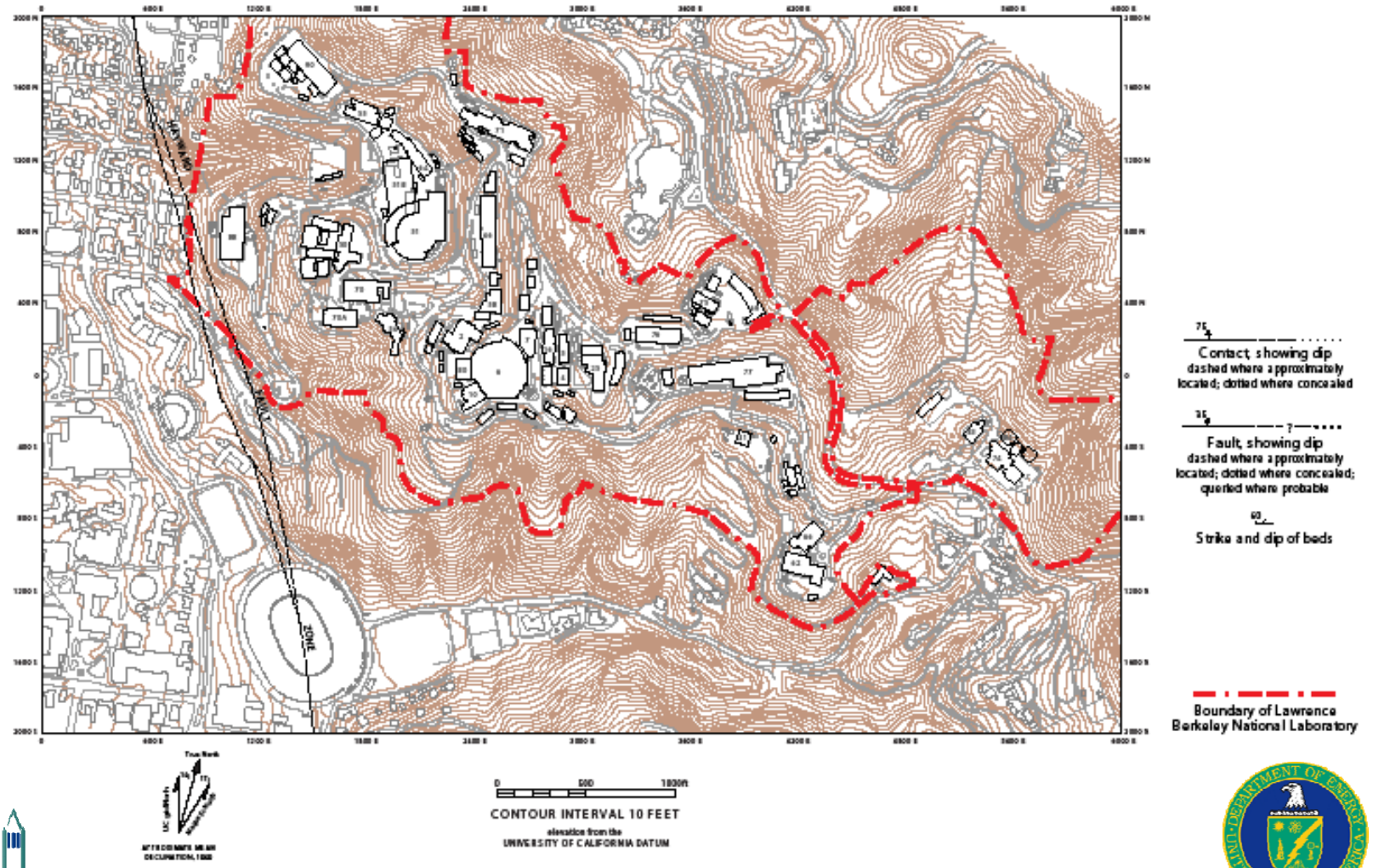
Hayward Fault Earthquake Shaking



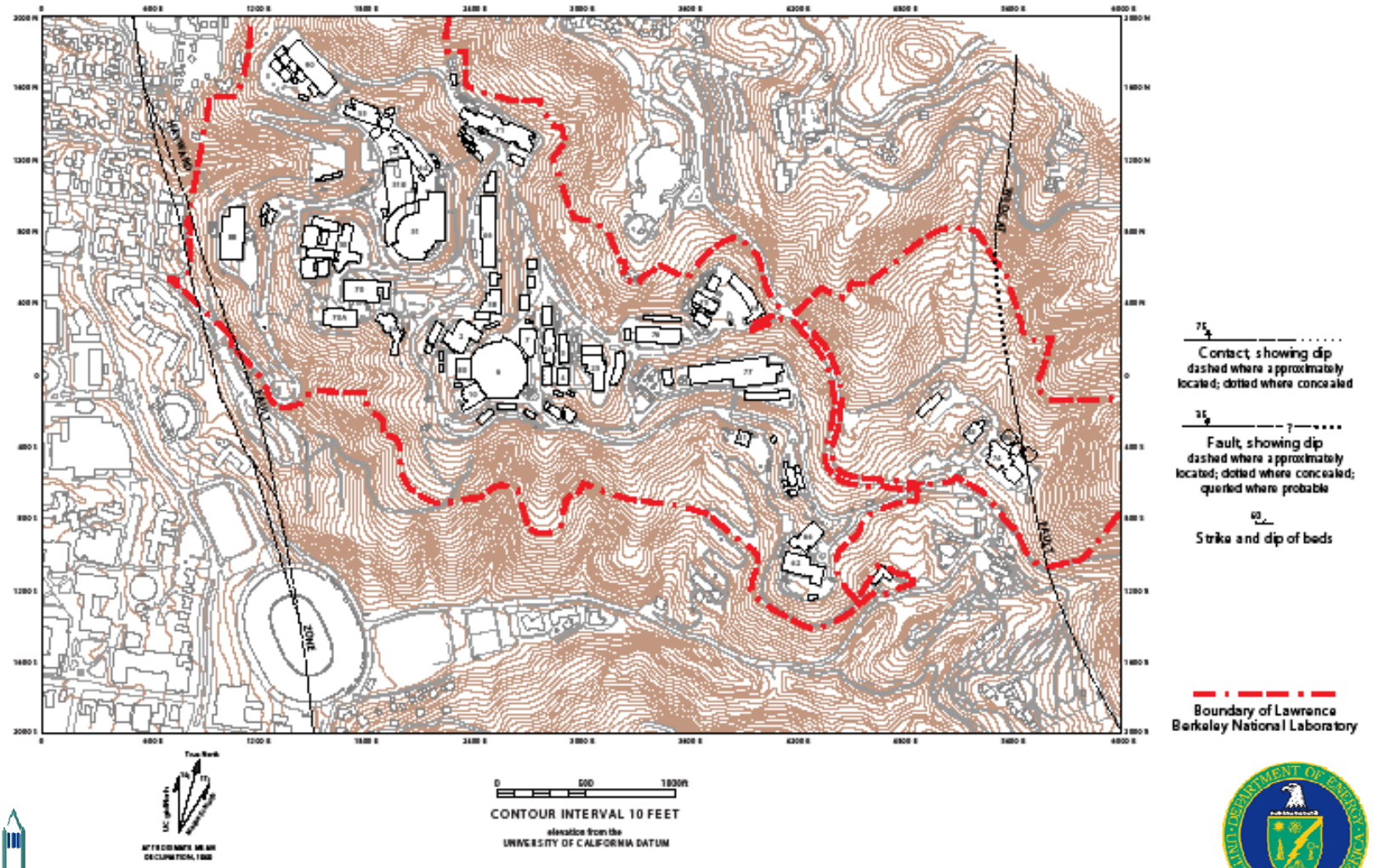
Hayward Fault Earthquake Shaking



Hayward Fault (Active)



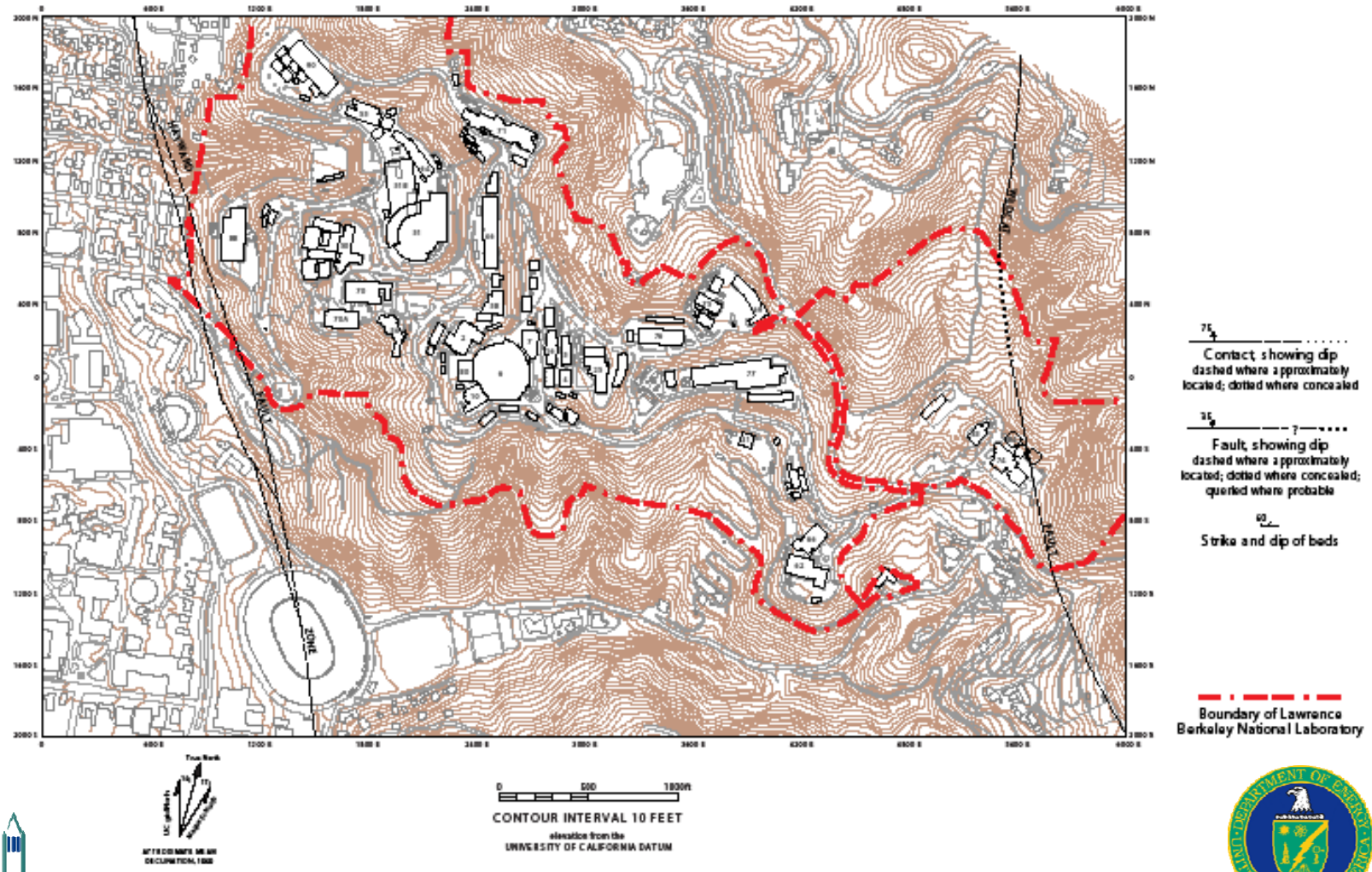
Wildcat Fault



Wildcat Fault (Inactive)



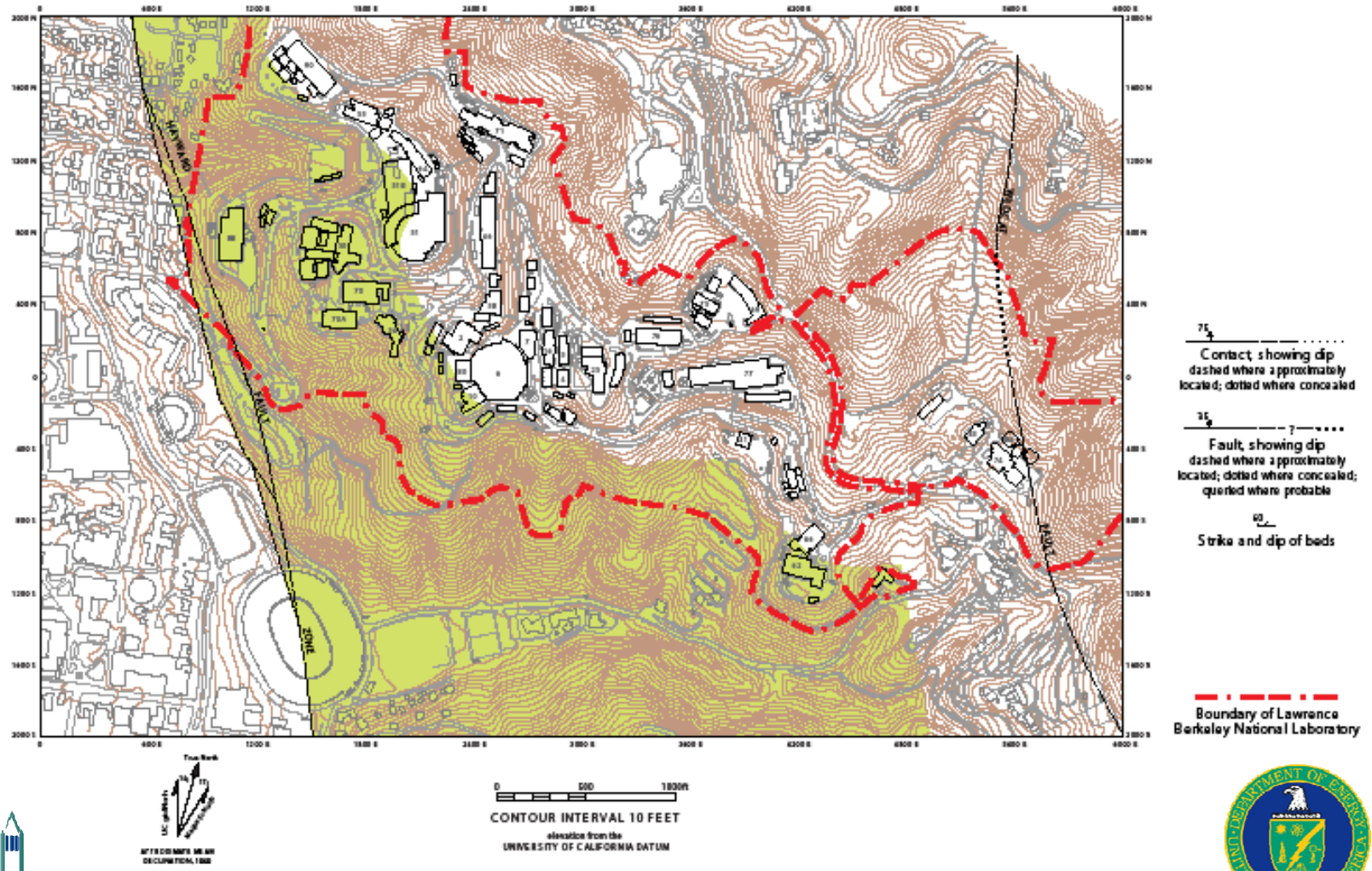
Wildcat Fault (Inactive)



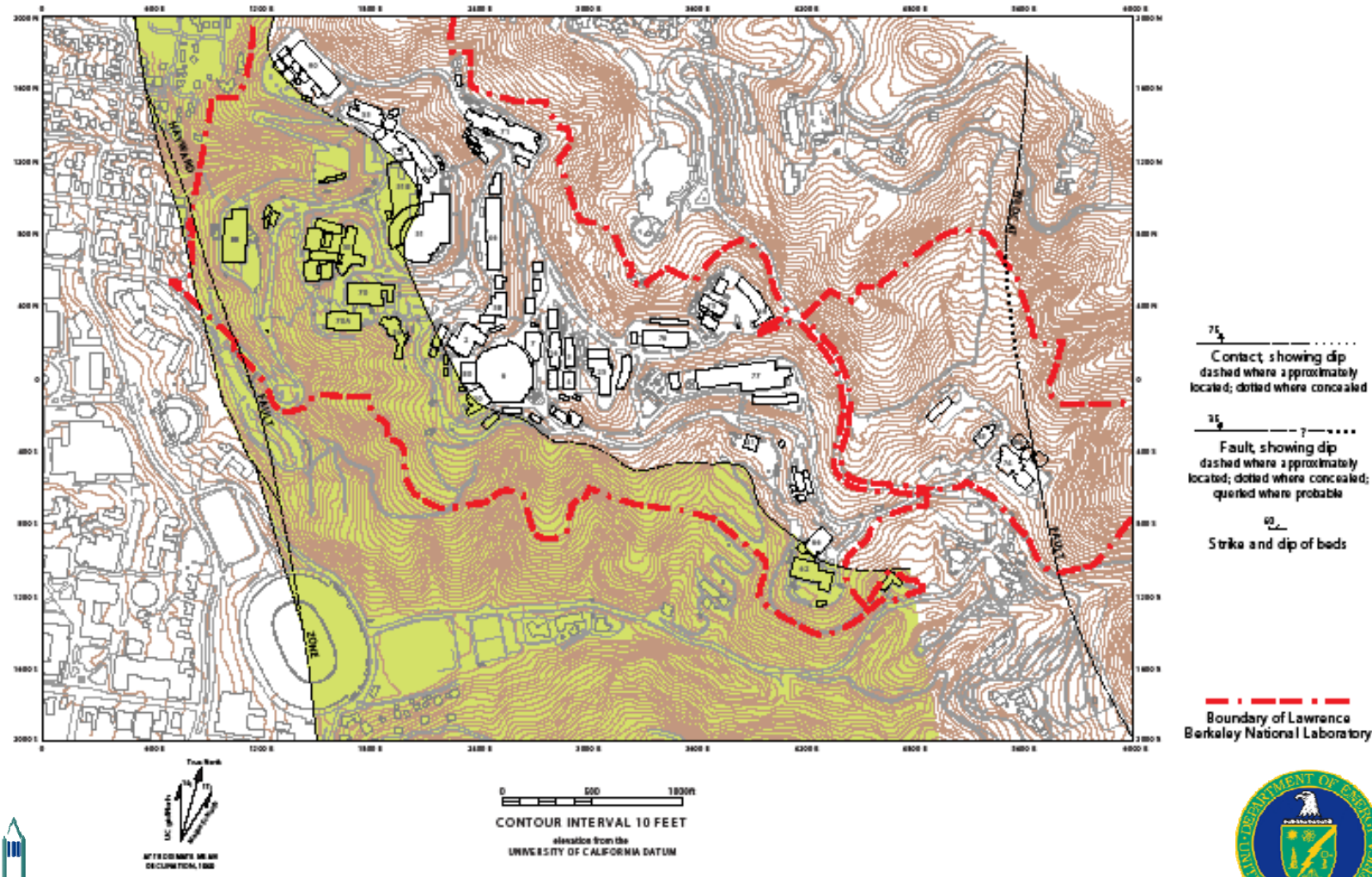
0 500 1000
CONTOUR INTERVAL 10 FEET
elevation from the
UNIVERSITY OF CALIFORNIA DATUM



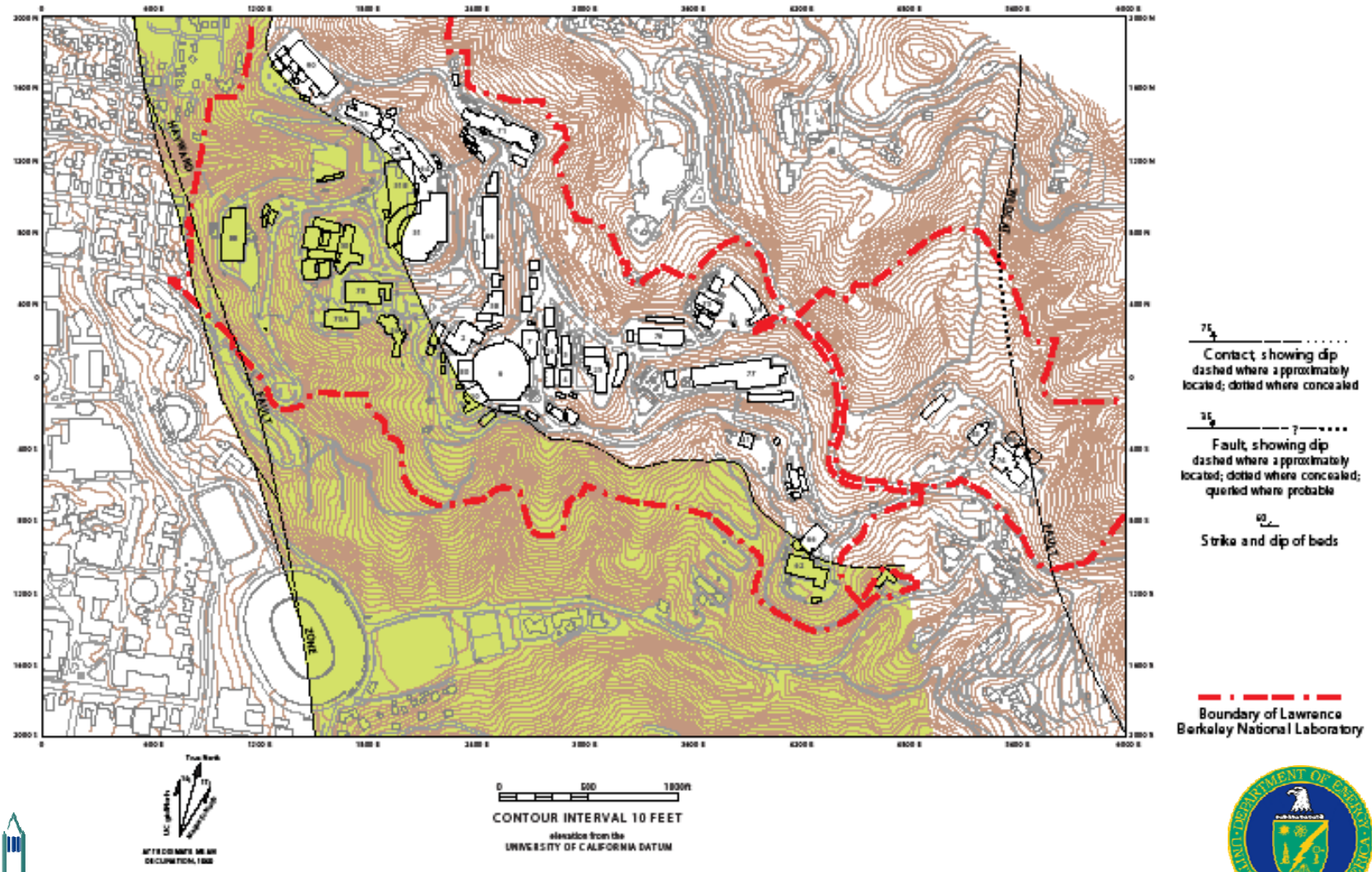
Great Valley Group



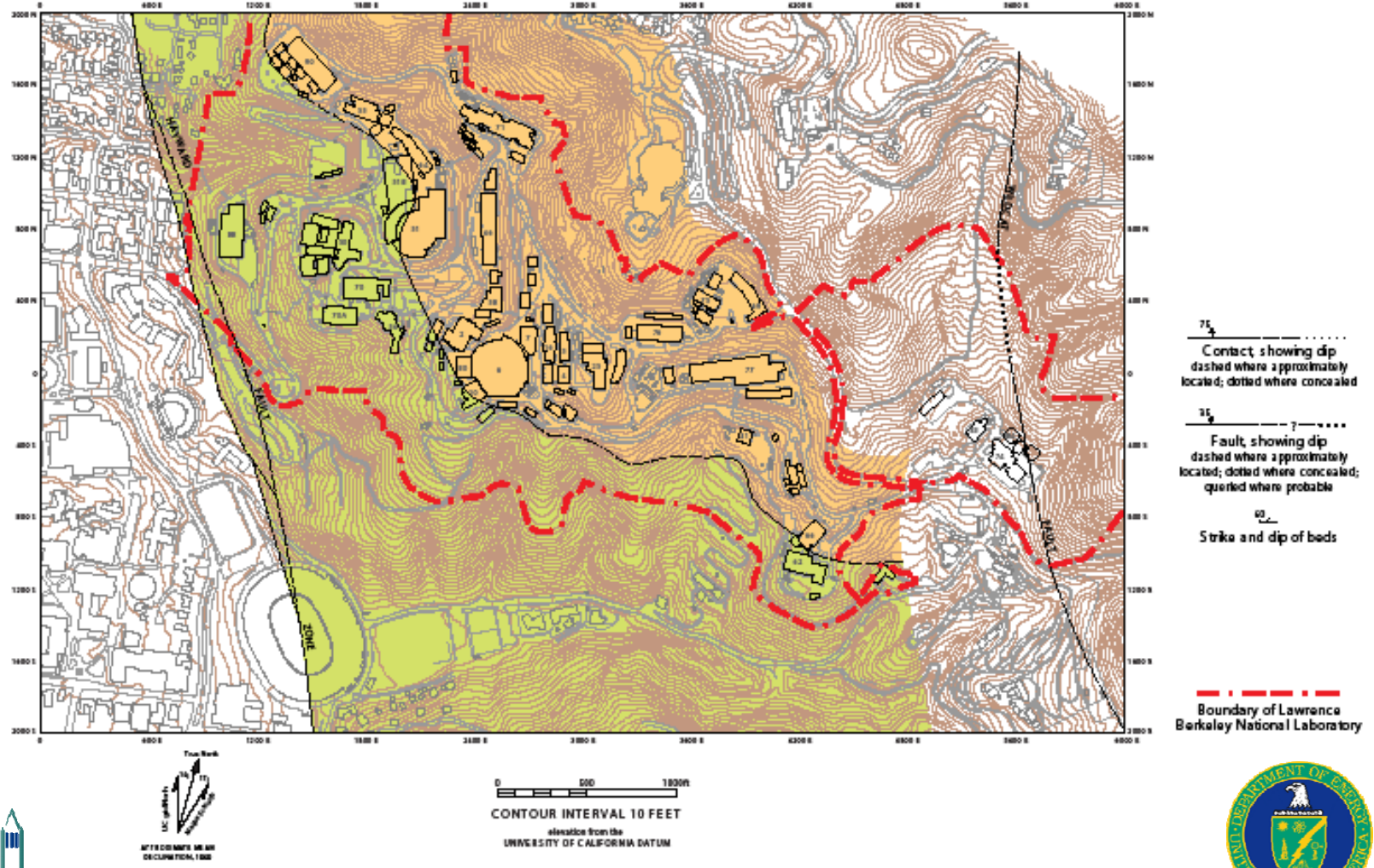
Unnamed Fault



Unnamed Fault (Inactive)



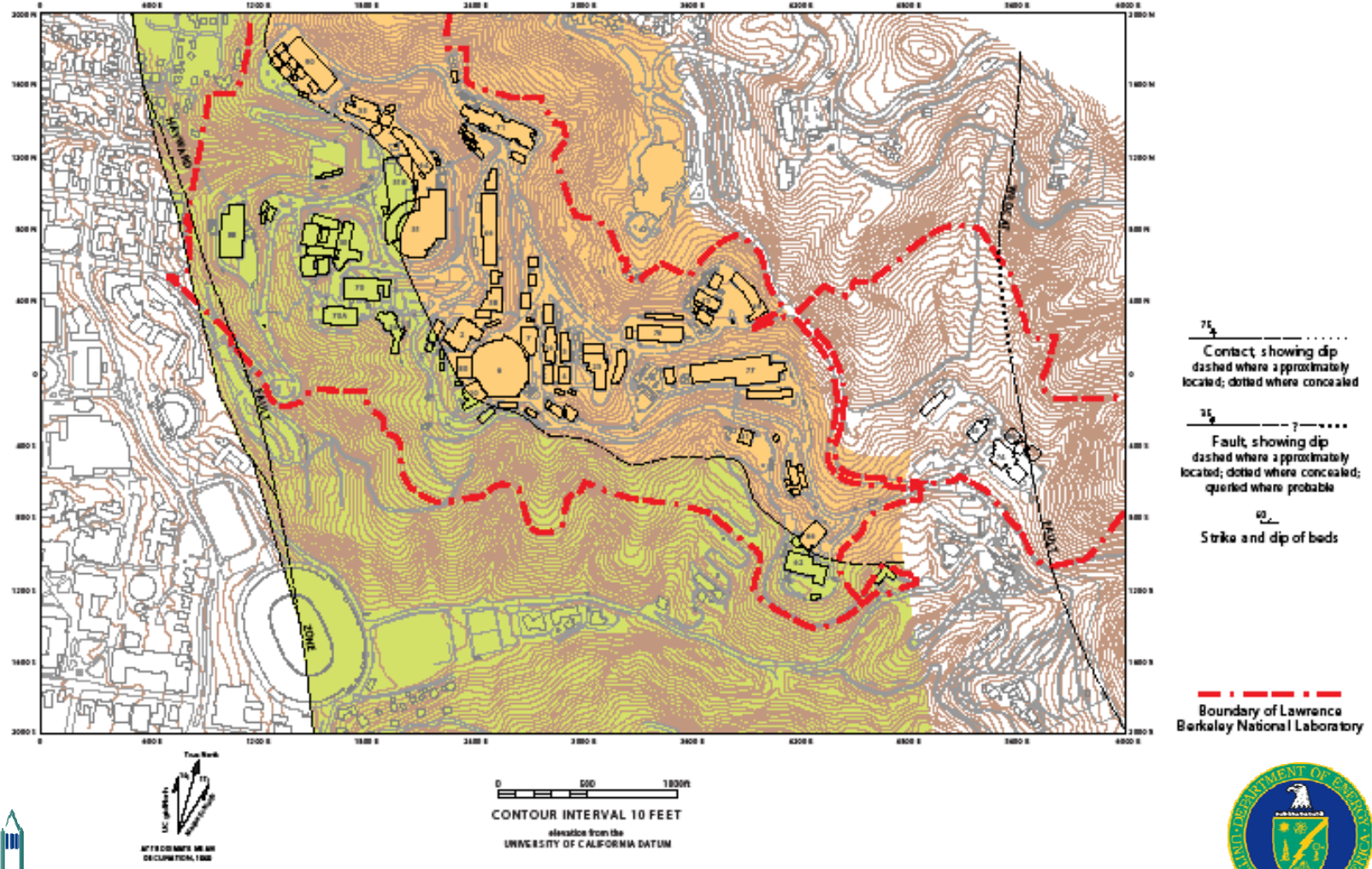
Orinda Formation



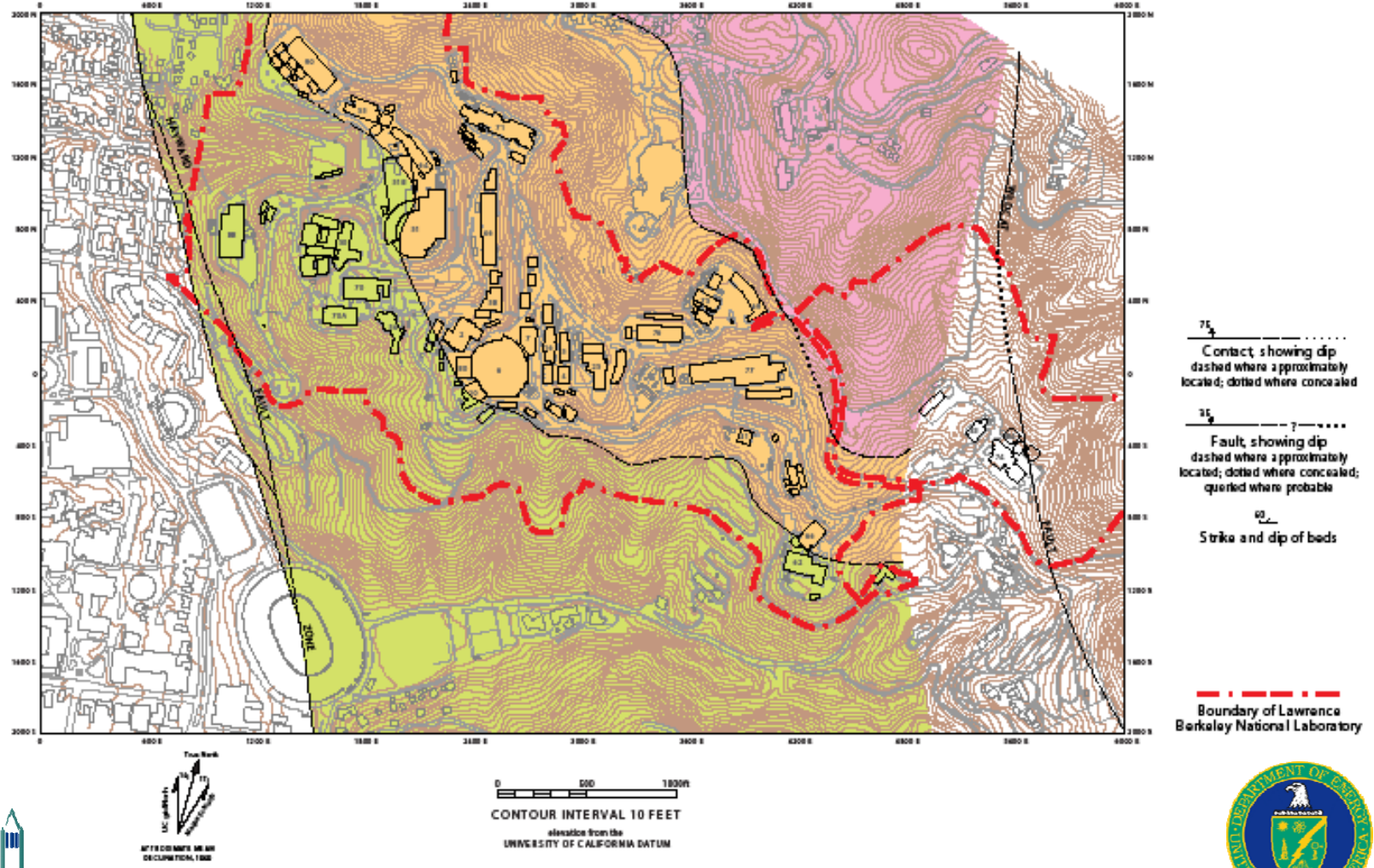
Orinda Formation Analog (Southern Owens Valley)



Orinda Formation



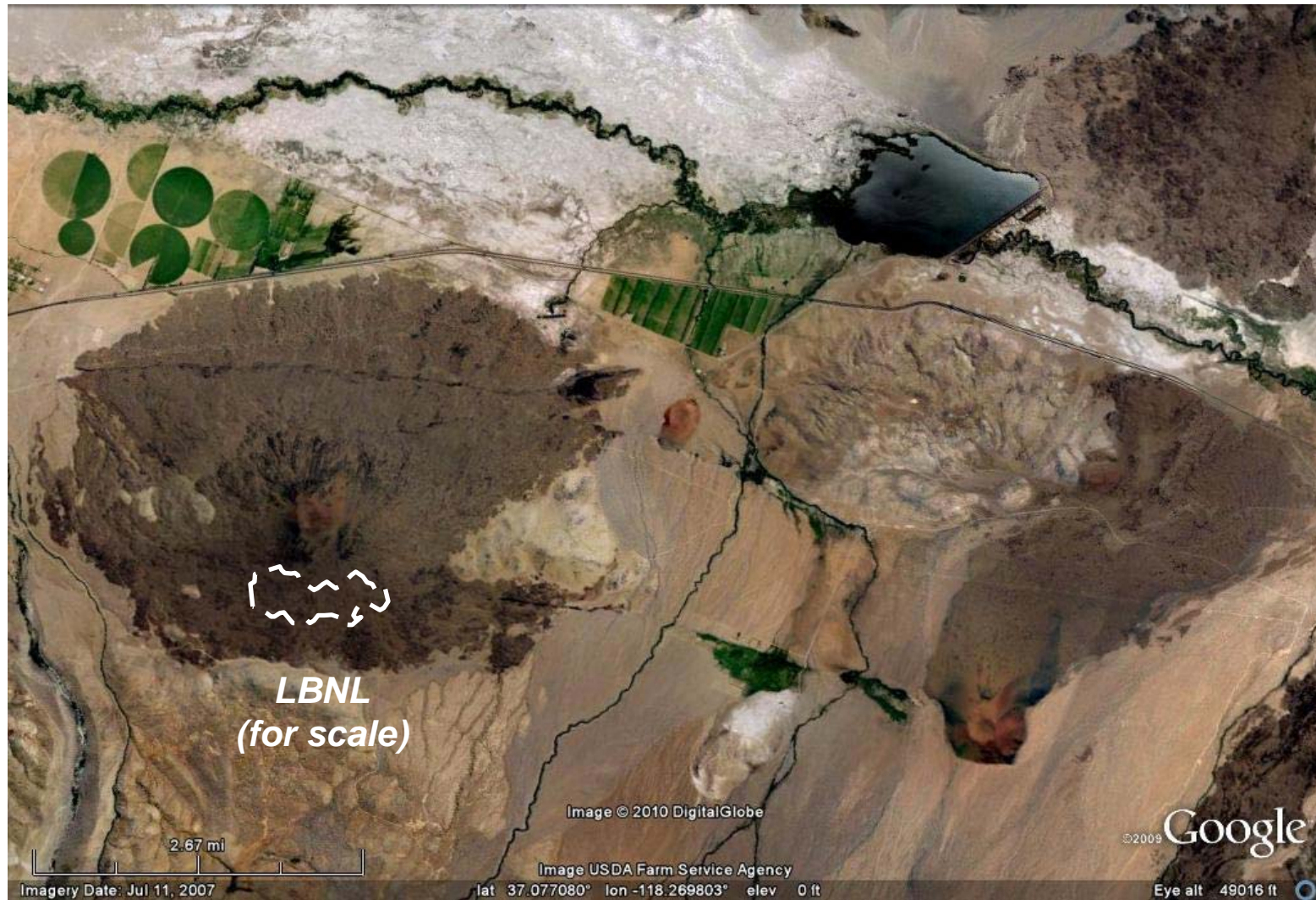
Moraga Formation



Moraga Formation Analog (Big Pine Volcanic Field In Southern Owens Valley)



Moraga Formation Analog (Big Pine Volcanic Field In Southern Owens Valley)



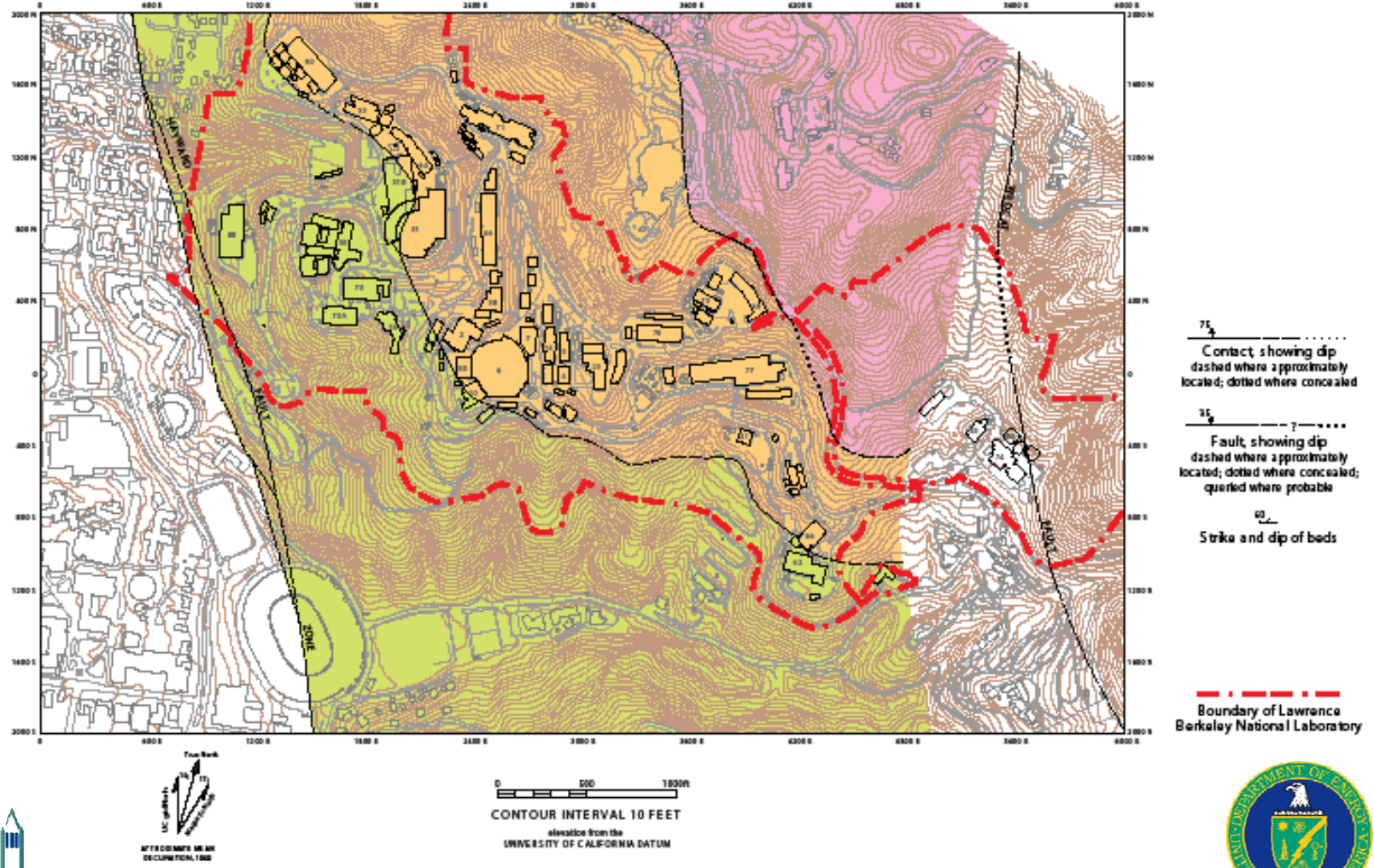
Moraga and Orinda Formation Tilted



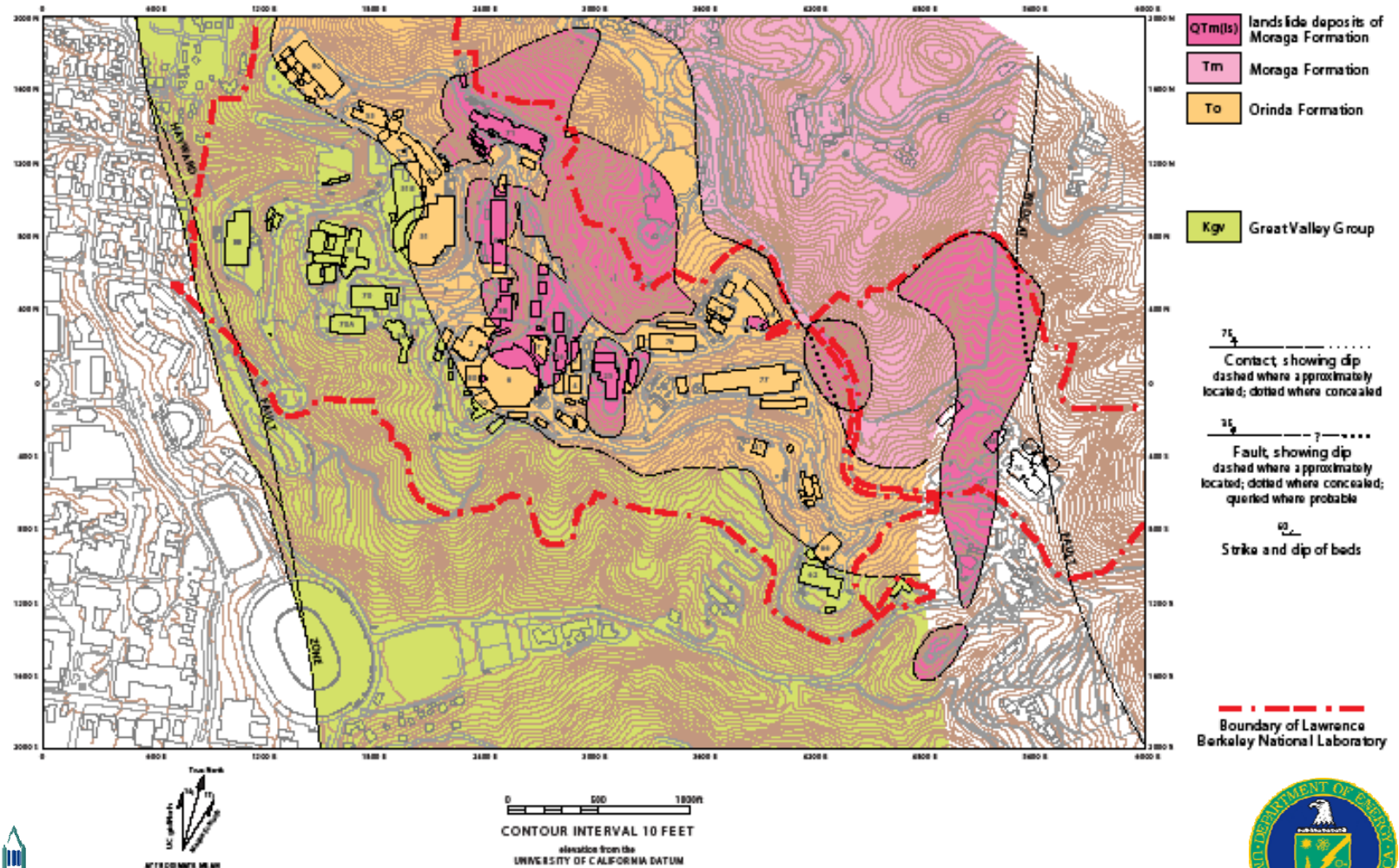
Southern road cut exposure of eastern approach to the Caldecott tunnels on Highway 24

From Steven Dutch via <http://www.uwsp.edu/geo/projects/geoweb/participants/dutch/Vtrips/CA24.HTM>

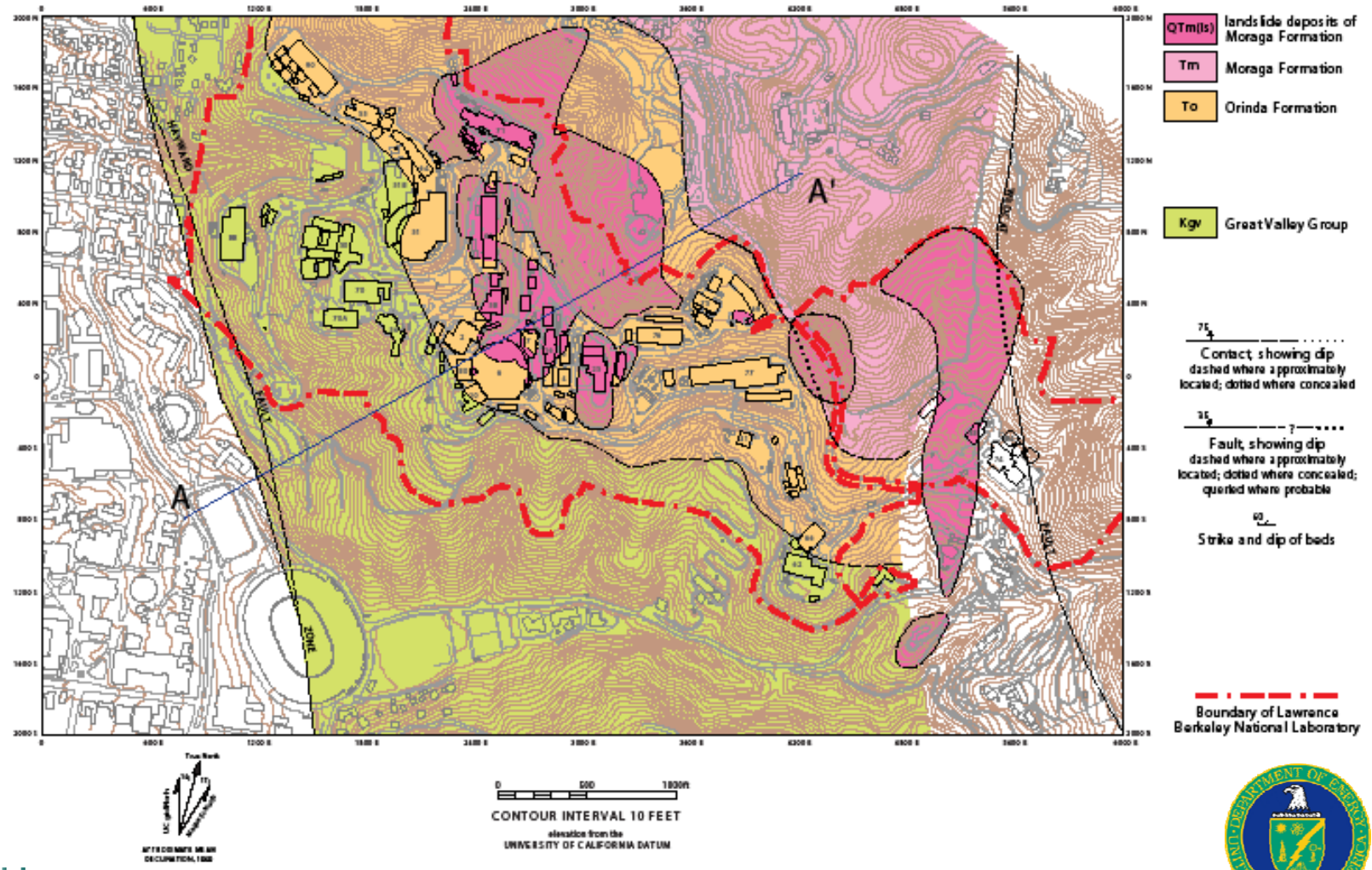
Moraga Formation



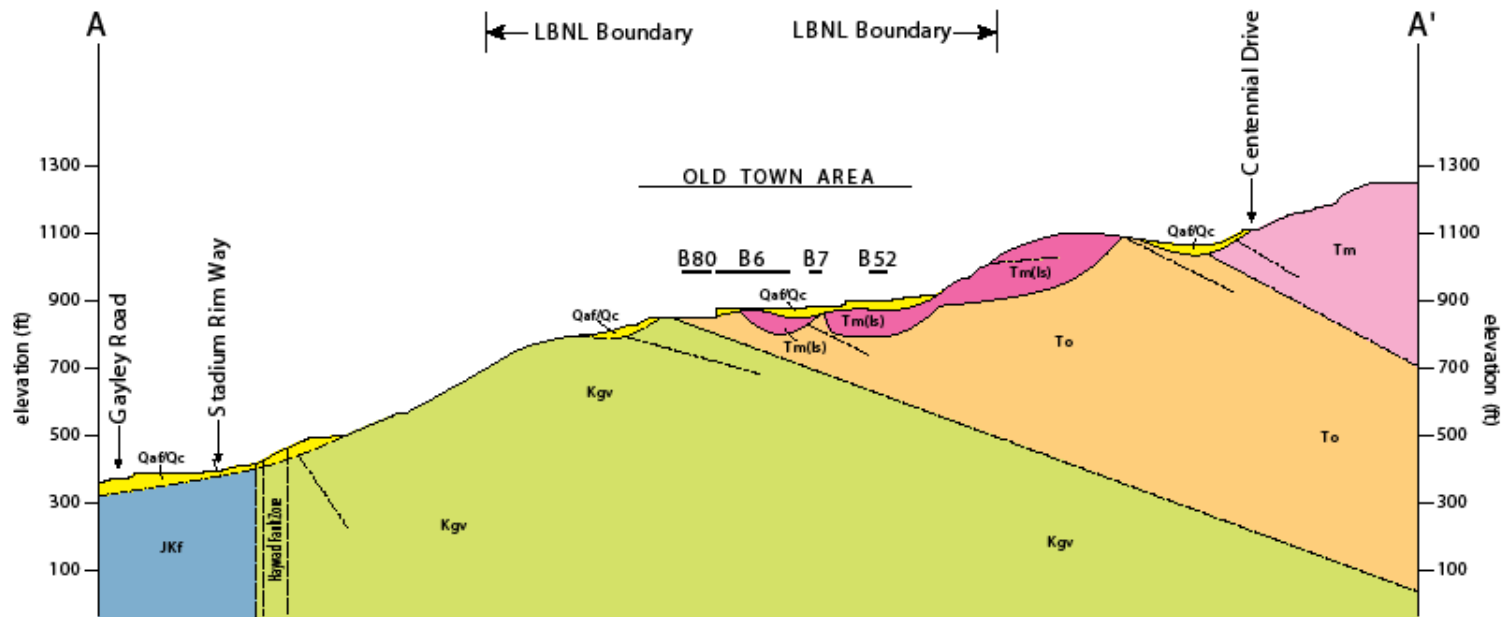
Surficial Masses of Moraga Volcanics



Lab-Wide Geologic Section



Lab-Wide Geologic Section



HORIZONTAL SCALE 1:4800



elevation from the UNIVERSITY OF CALIFORNIA DATUM

B58 approximate horizontal location of buildings on or near section



Qaf/Qc artificial fill/colluvium (may locally include alluvium)

lined box indicates unit appears in section

- Tm Moraga Formation (l) designates probable landslide deposits
- Tm(l)
- To Orinda Formation
- Tsp San Pablo Group

- Tc Claremont Formation
- Kgv Great Valley Group
- JKf Franciscan Complex

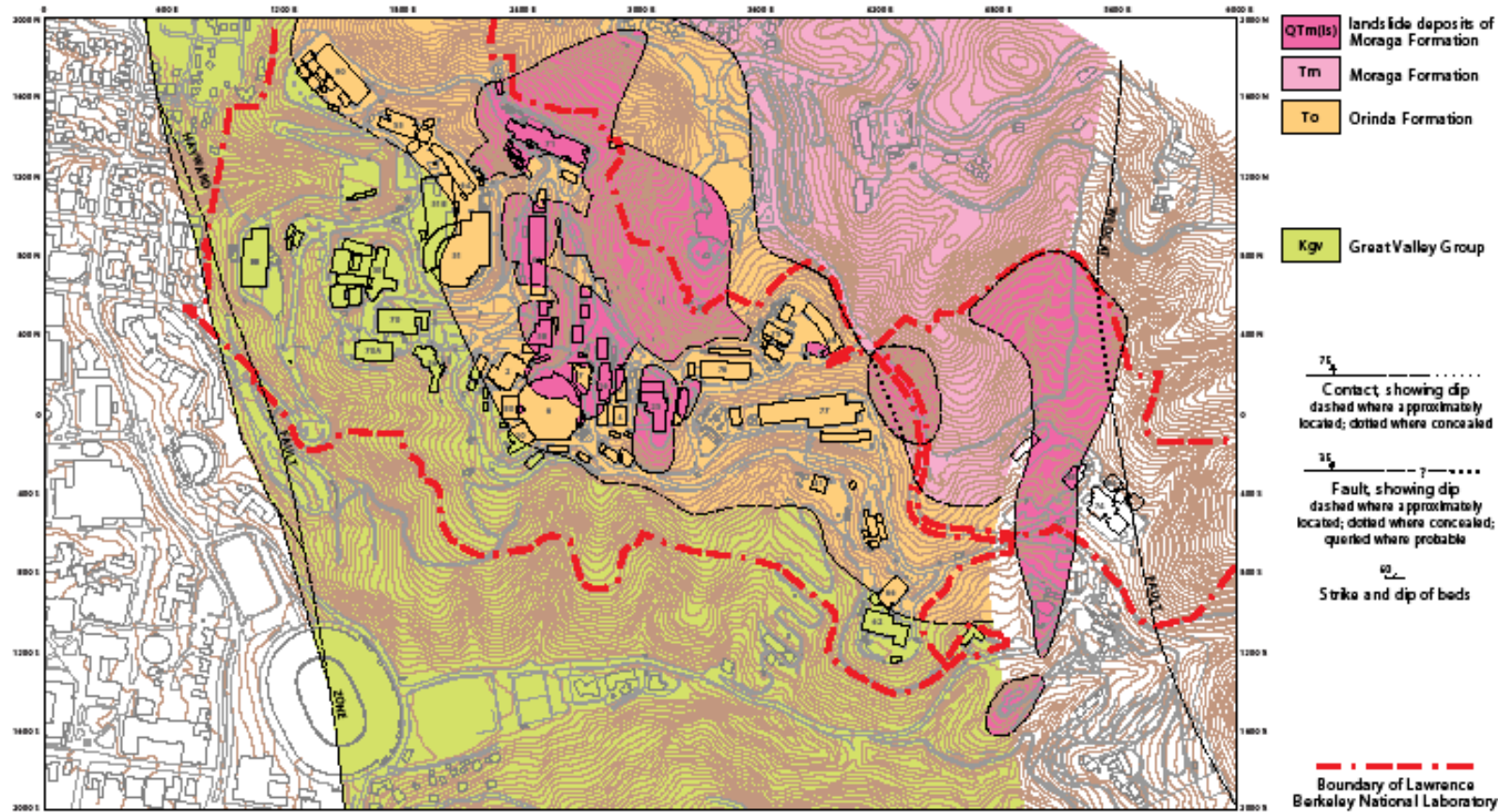
Contact dashed where approximately located

Fault dashed where approximately located; queried where probable

generalized a parent dip



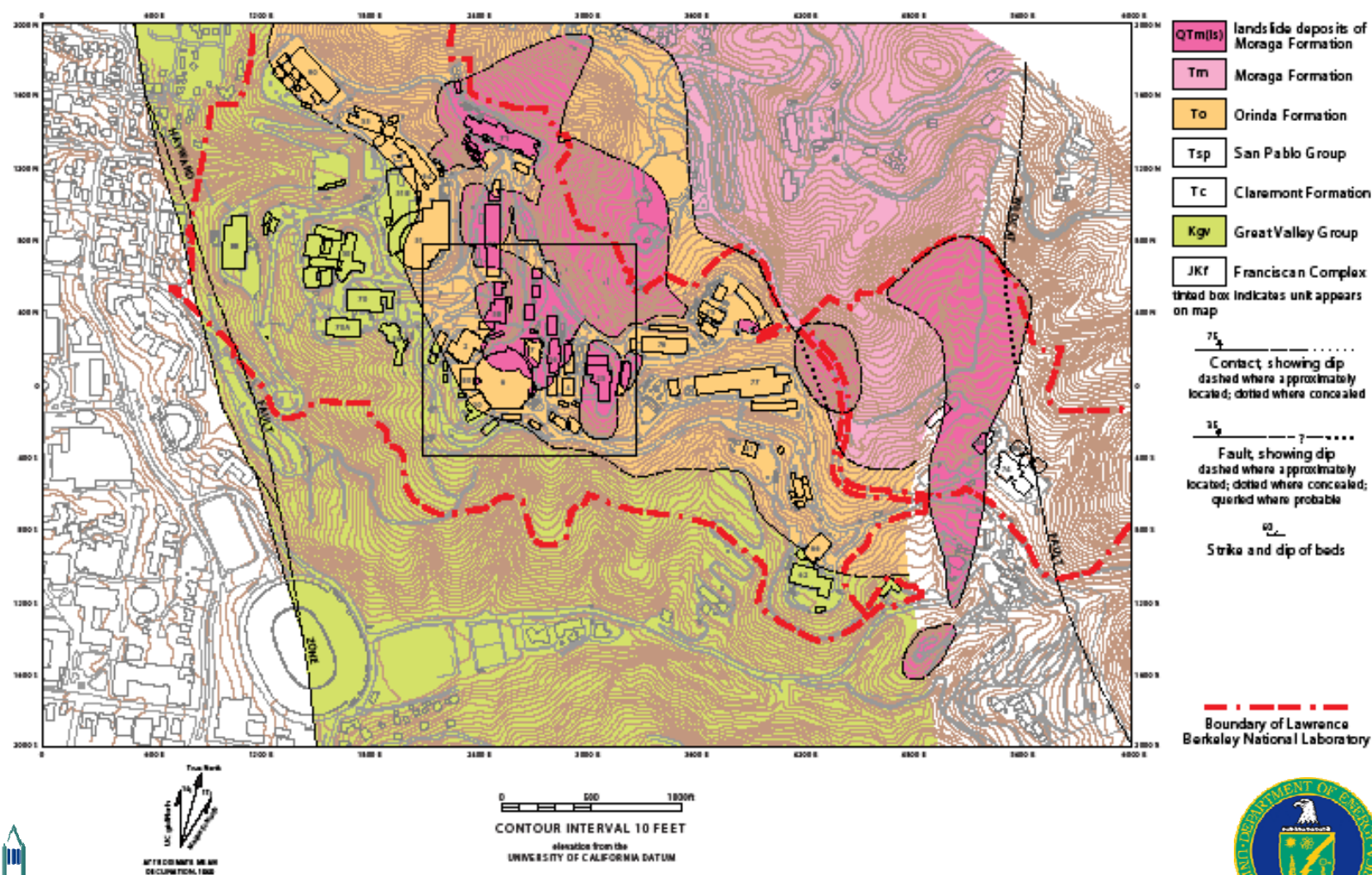
Where's The Data?



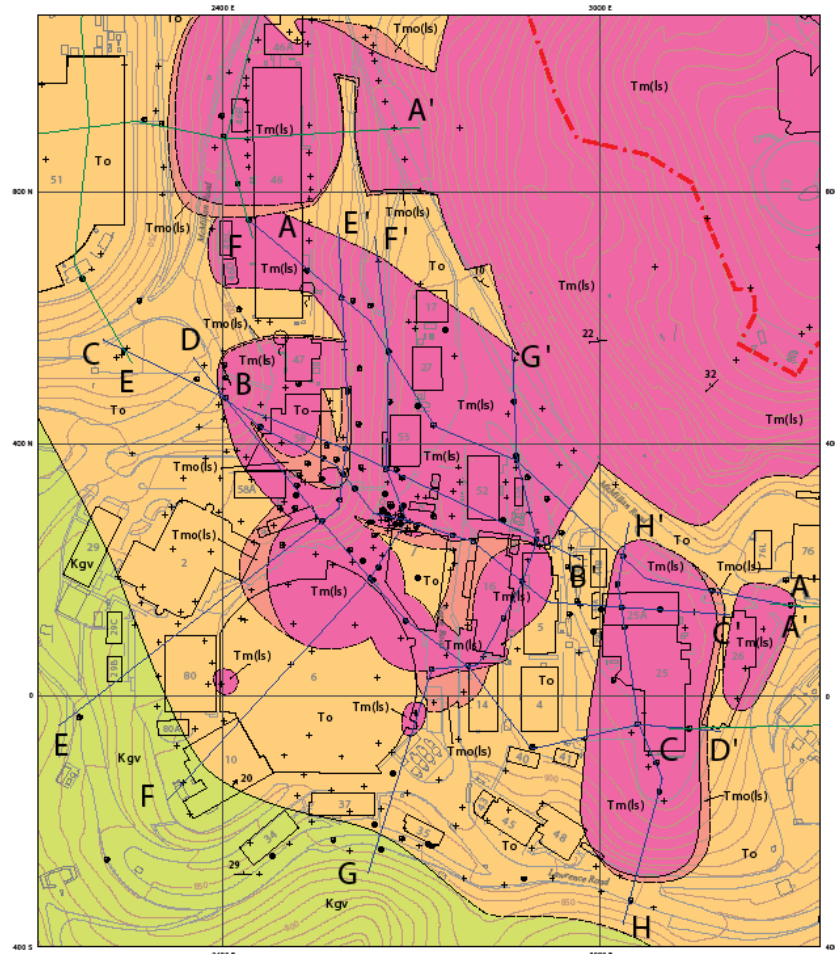
0 500 1000
 CONTOUR INTERVAL 10 FEET
 elevation from the
 UNIVERSITY OF CALIFORNIA DATUM



Old Town Area



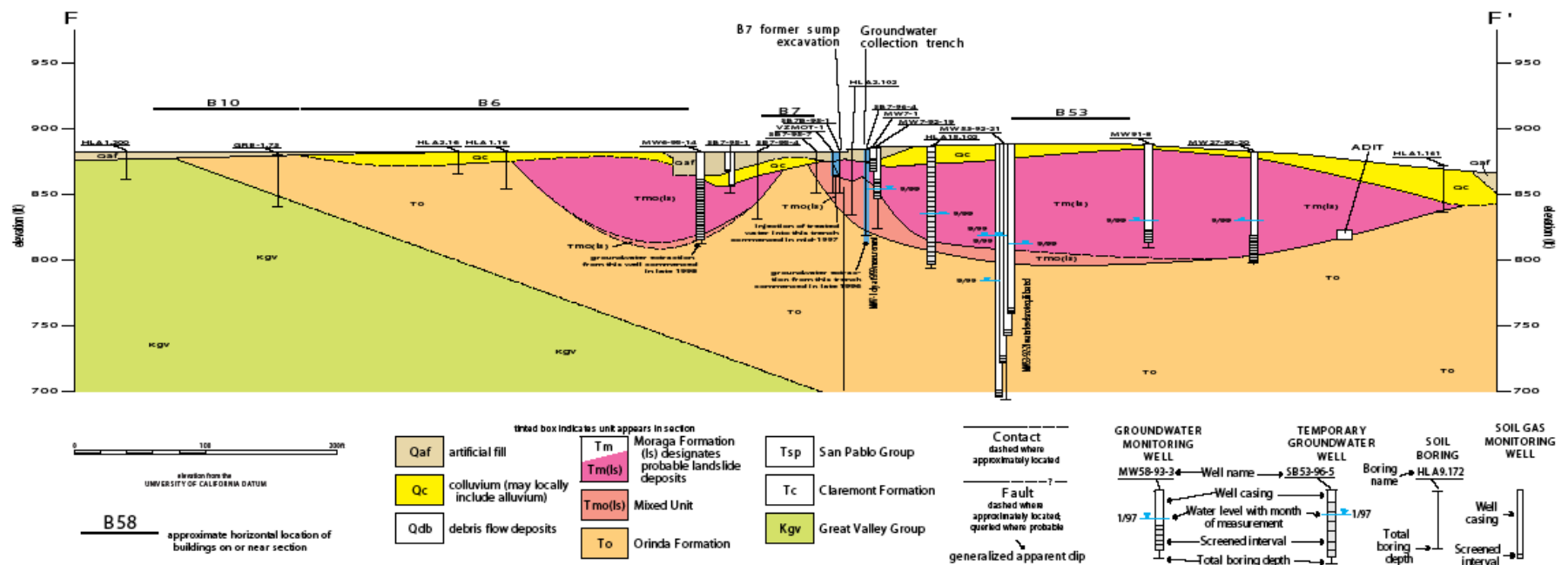
Old Town Area



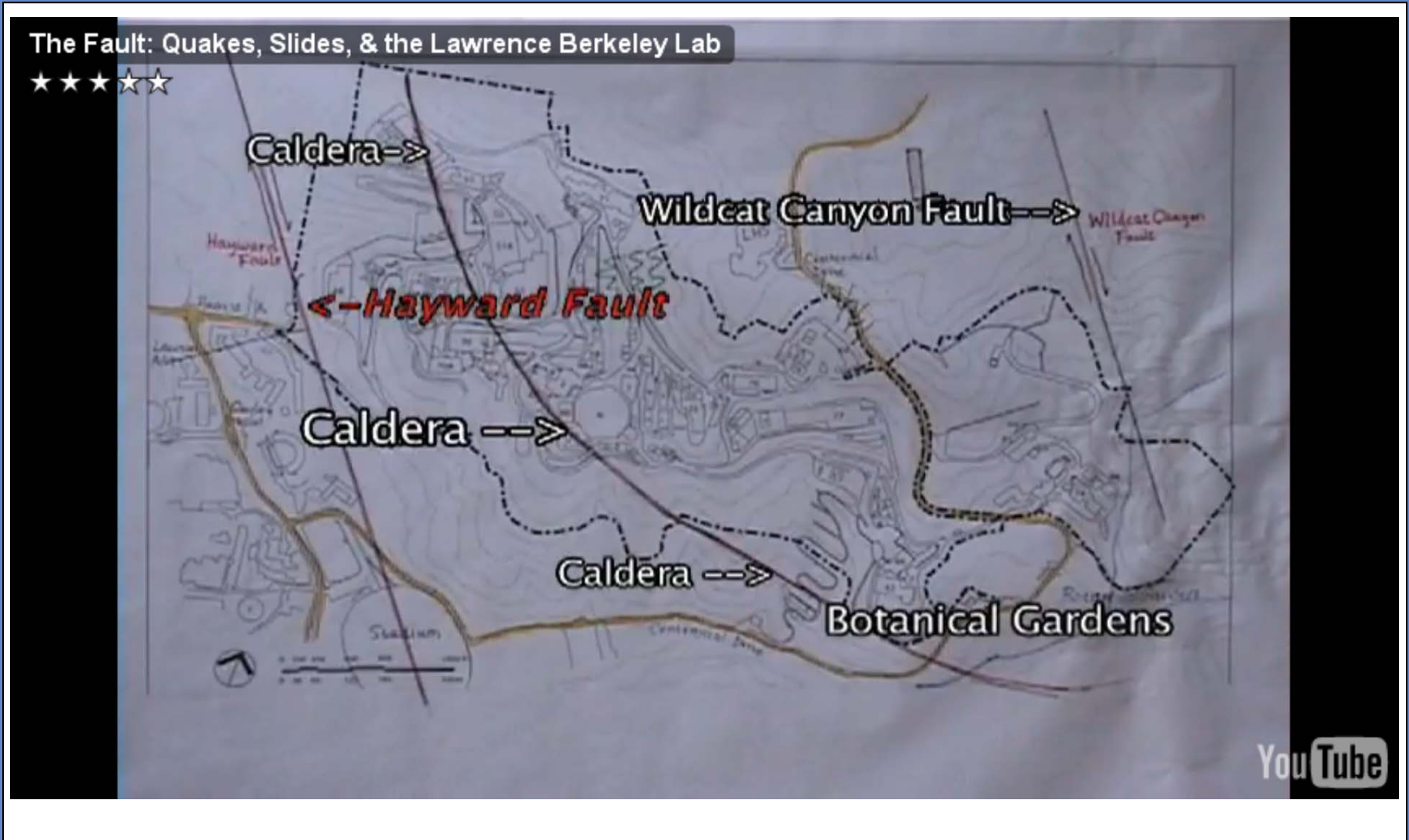
SCALE 1:1800
0 150 300ft
CONTOUR INTERVAL 10 FEET
UNIVERSITY OF CALIFORNIA DATUM



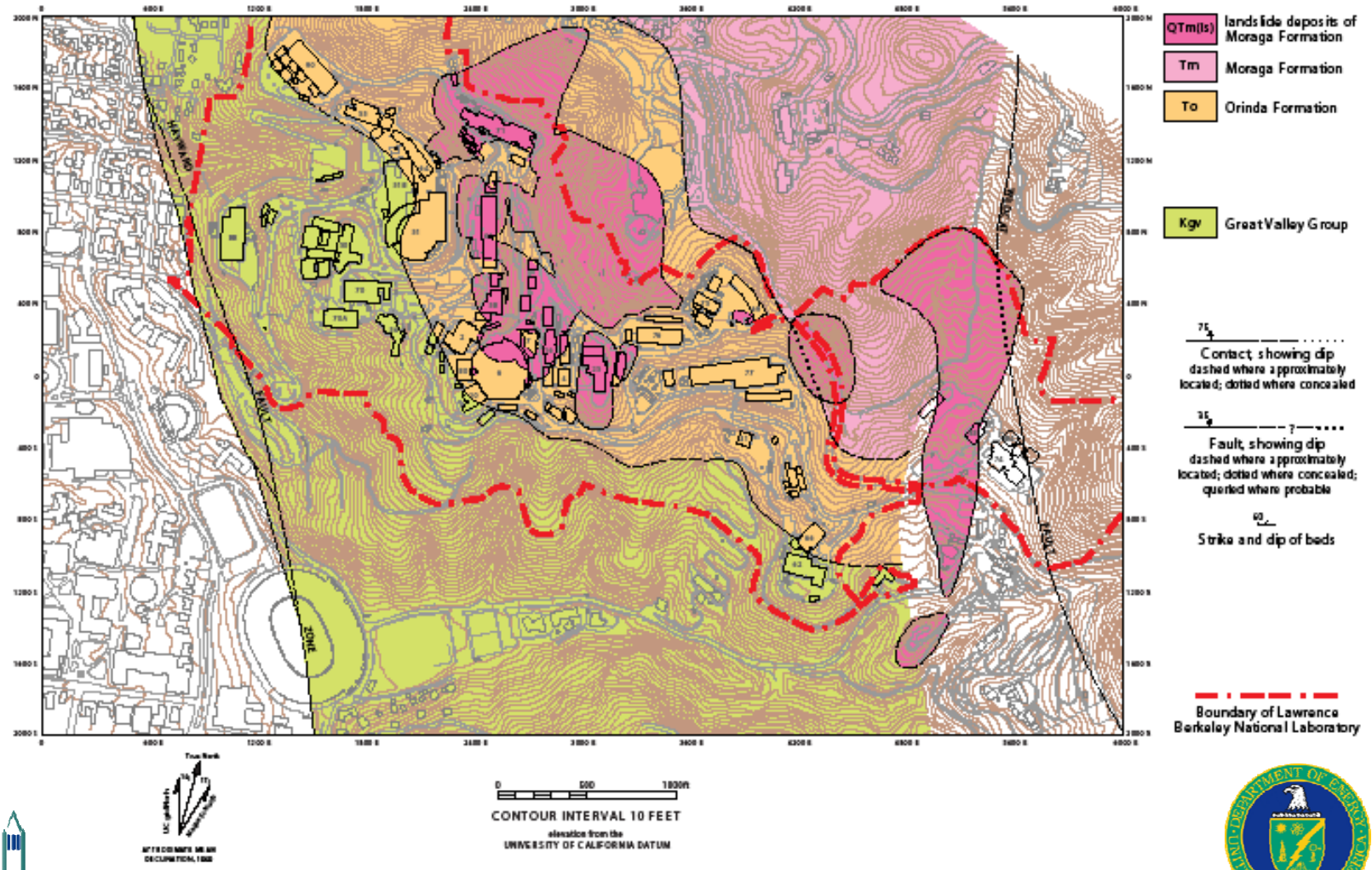
Old Town Area



Caldera Hypothesis Map



LBLN Bedrock Geology



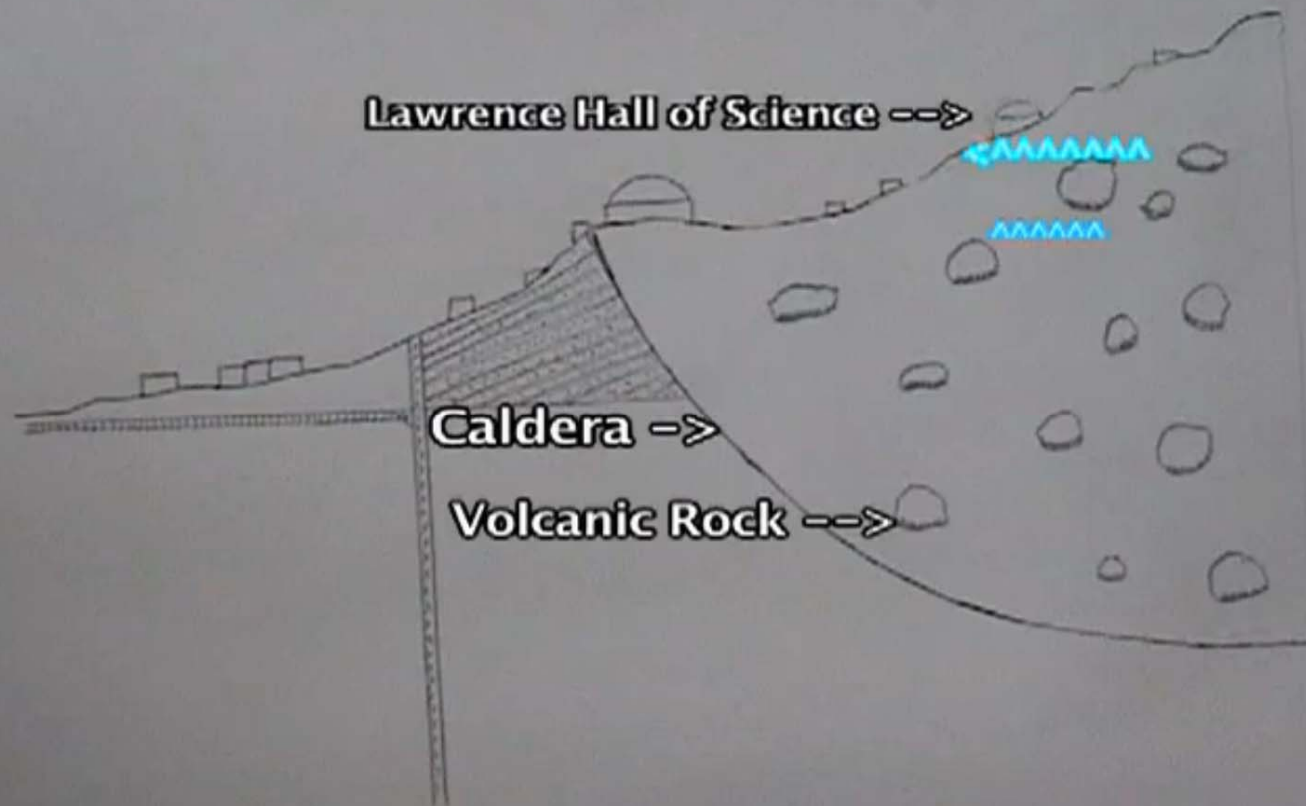
0 600 1800
 CONTOUR INTERVAL 10 FEET
 elevation from the
 UNIVERSITY OF CALIFORNIA DATUM



Caldera Hypothesis Map

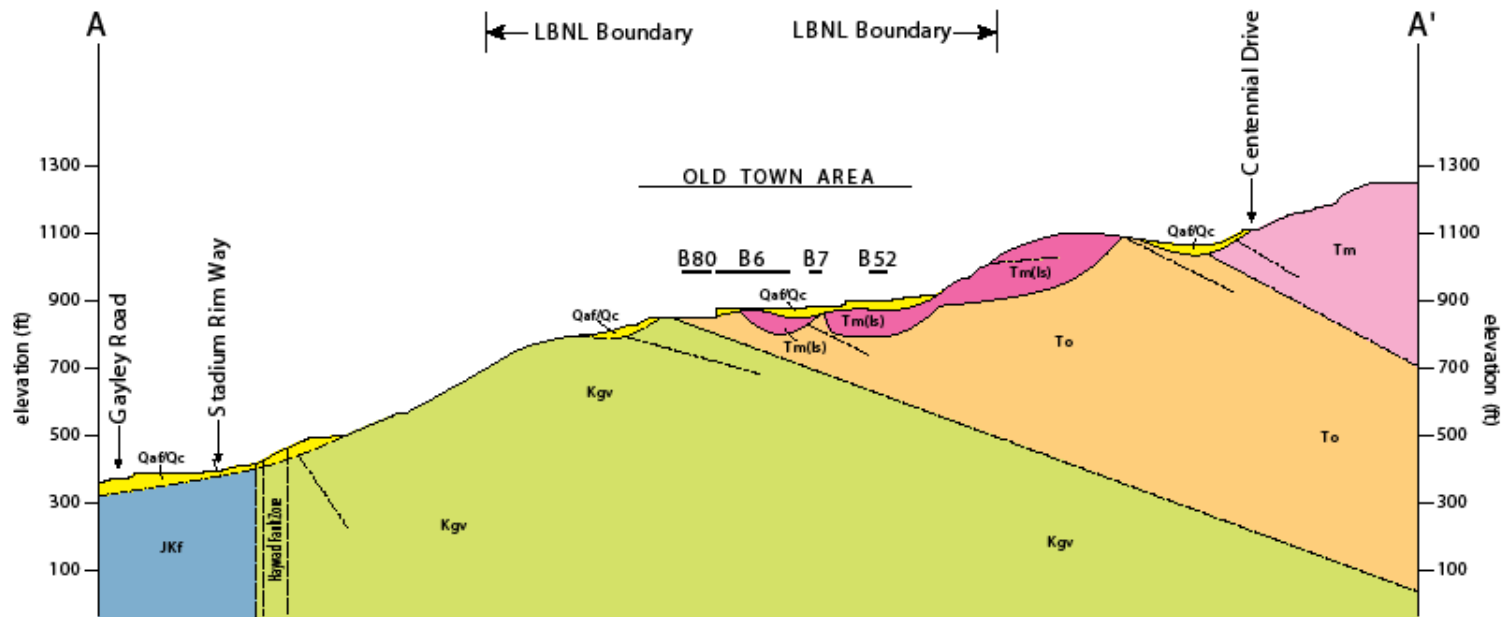
The Fault: Quakes, Slides, & the Lawrence Berkeley Lab

★★★★★



YouTube

Lab-Wide Geologic Section



HORIZONTAL SCALE 1:4800



elevation from the UNIVERSITY OF CALIFORNIA DATUM

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Tm(ls)	(ls) designates probable landslide deposits
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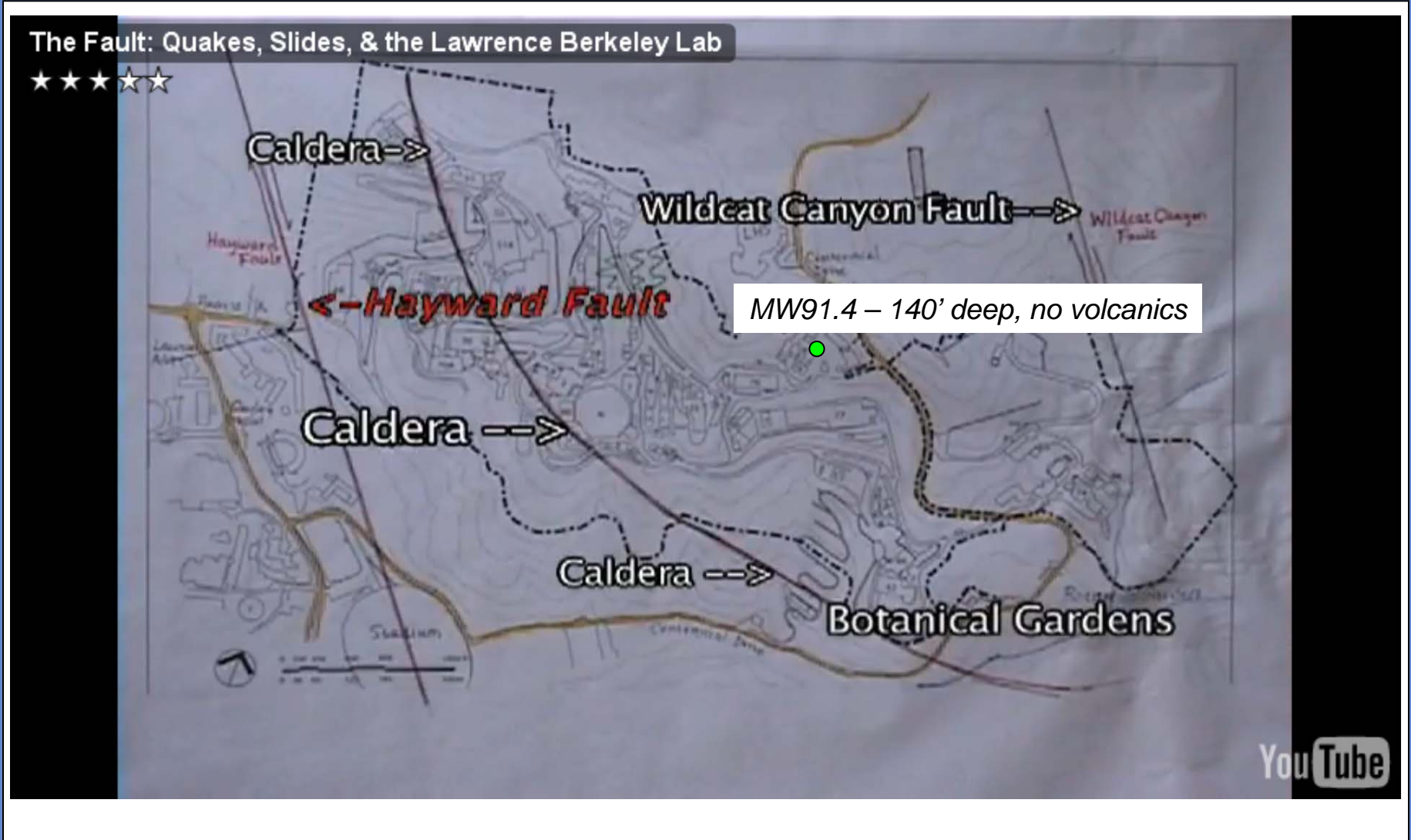
Contact dashed where approximately located

Fault dashed where approximately located; queried where probable

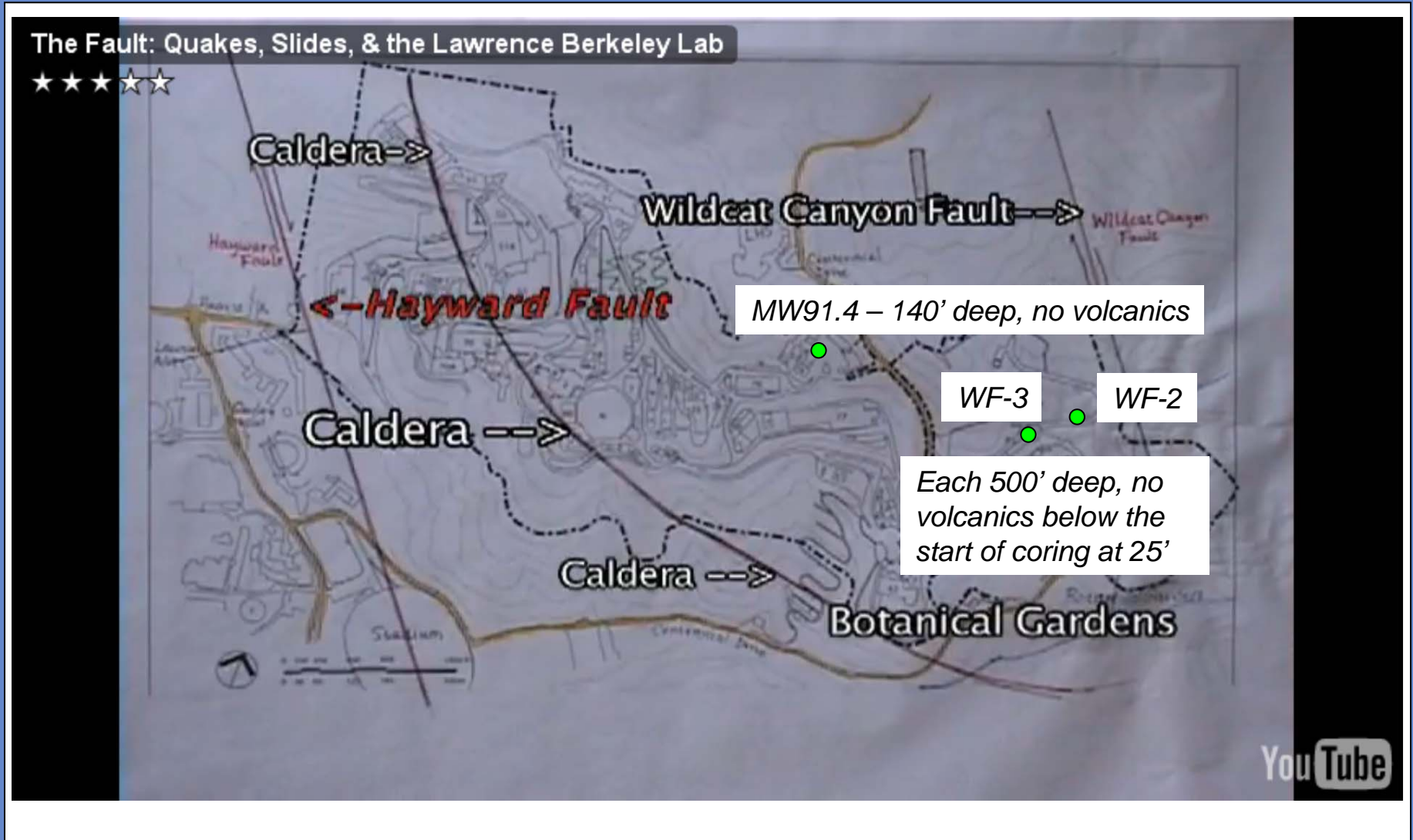
generalized a parent dip



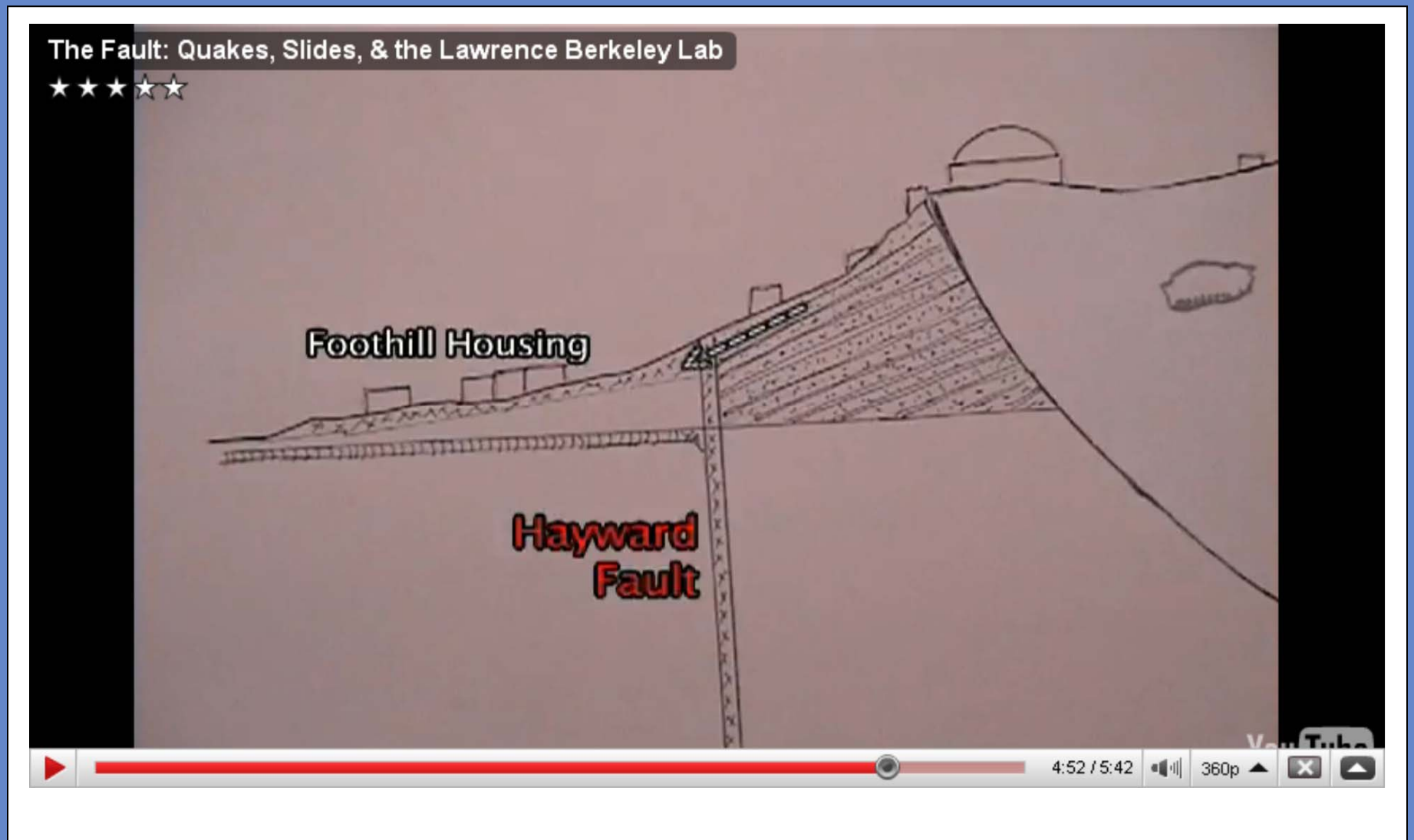
Caldera Hypothesis Map



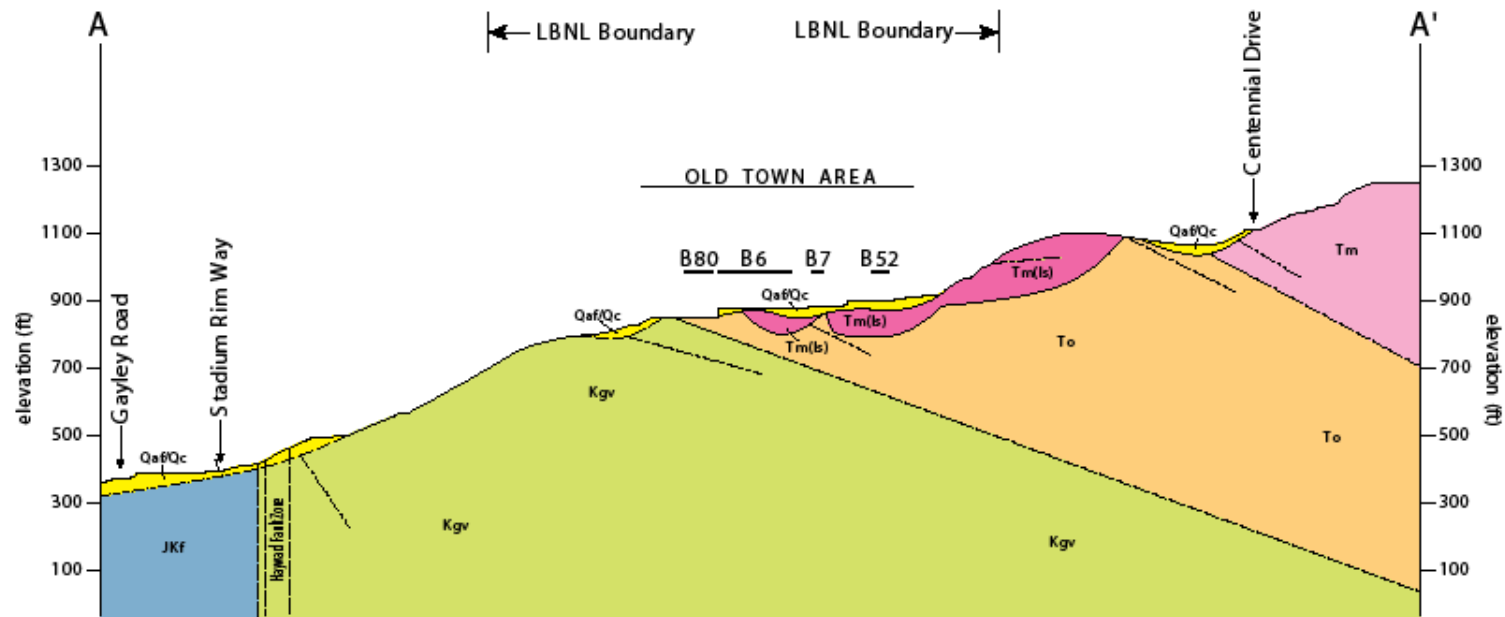
Caldera Hypothesis Map



Caldera Hypothesis Map



Lab-Wide Geologic Section



HORIZONTAL SCALE 1:4800



elevation from the UNIVERSITY OF CALIFORNIA DATUM

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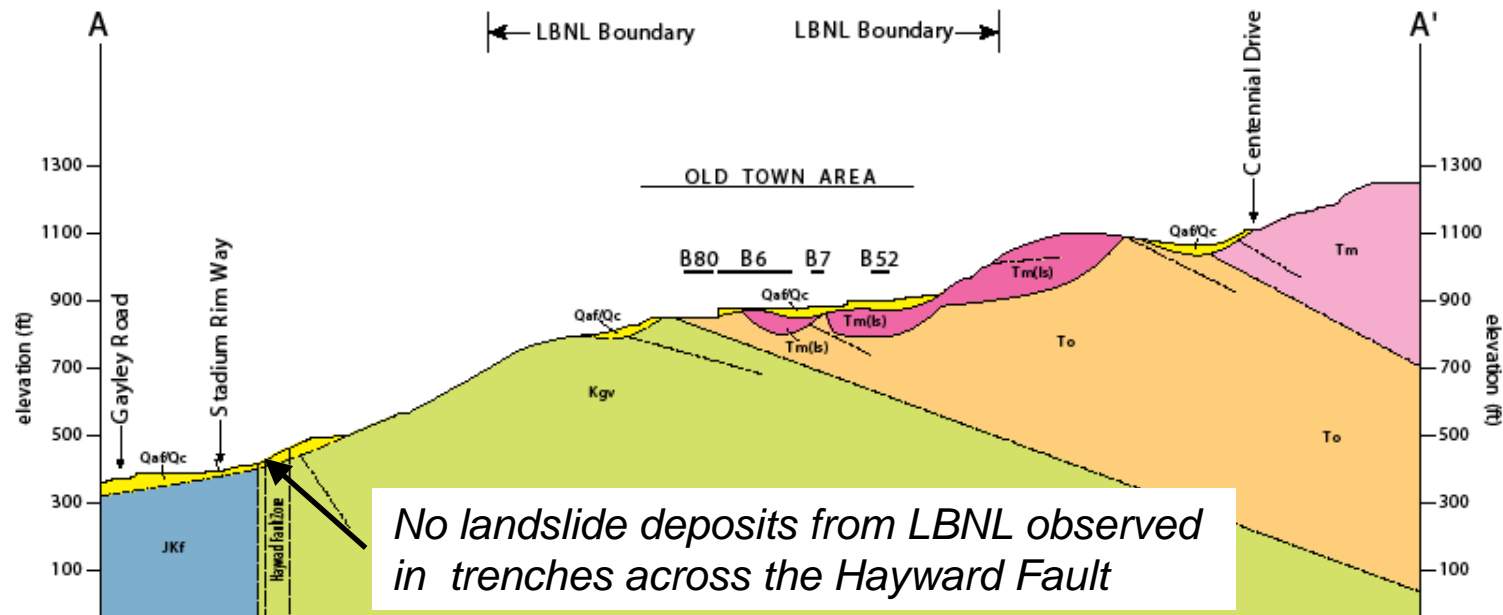
Contact dashed where approximately located

Fault dashed where approximately located; queried where probable

generalized a parent dip



Lab-Wide Geologic Section



No landslide deposits from LBNL observed in trenches across the Hayward Fault

HORIZONTAL SCALE 1:4800
 0 500 1000 1500 ft

elevation from the UNIVERSITY OF CALIFORNIA DATUM

B58 approximate horizontal location of buildings on or near section

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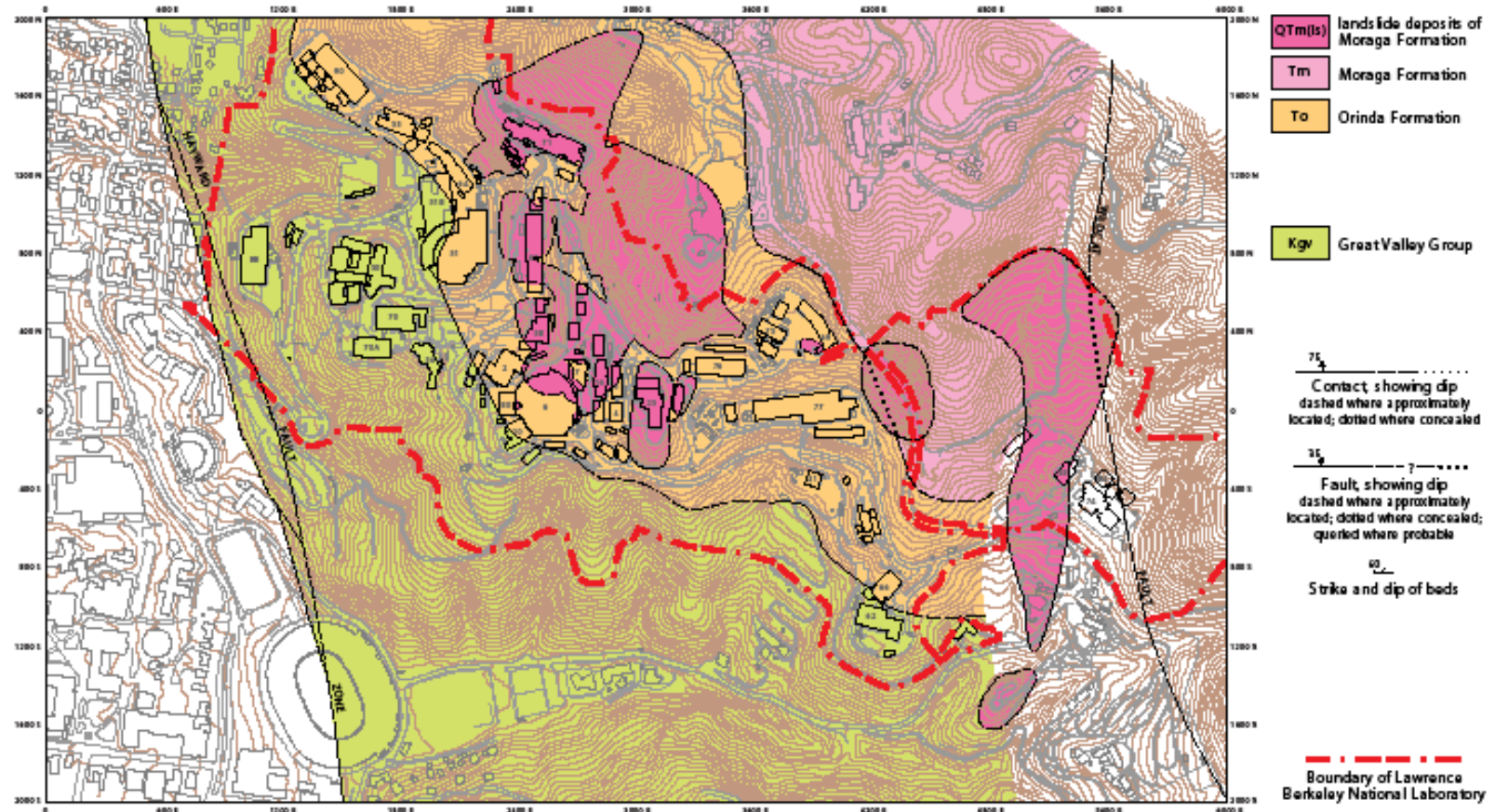
Contact dashed where approximately located

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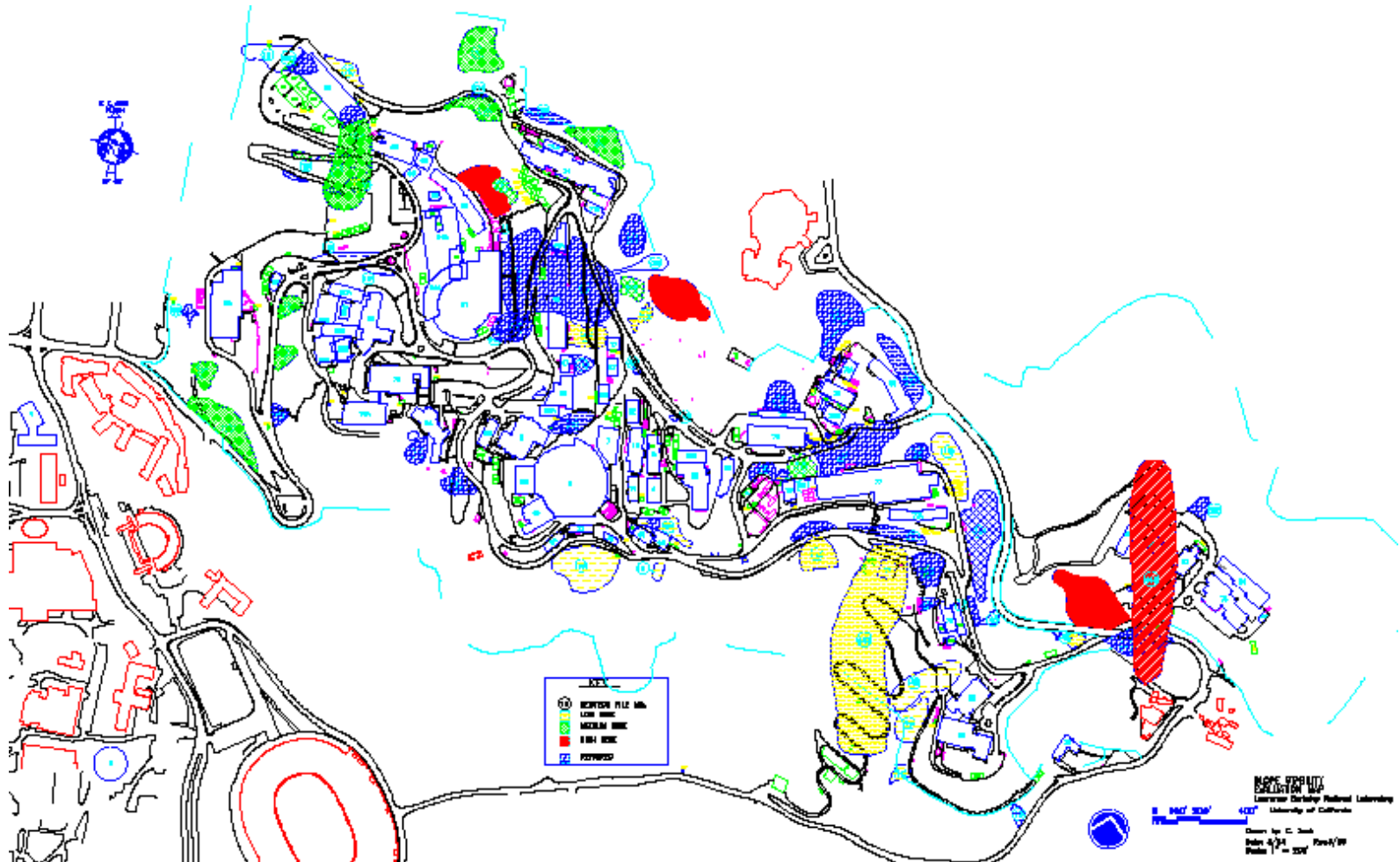
Surficial Volcanic Masses as Landslide Deposits



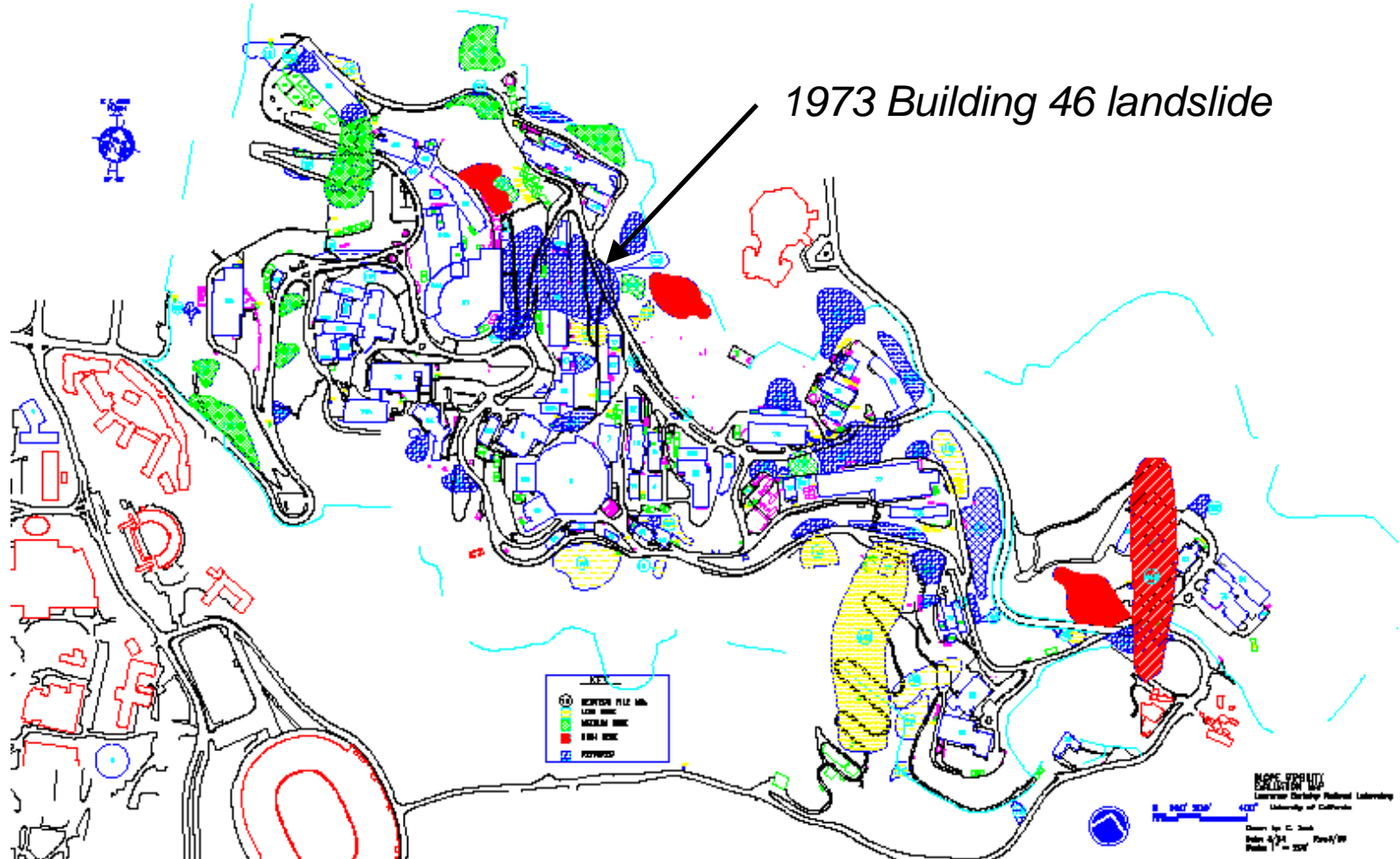
0 500 1000
 CONTOUR INTERVAL 10 FEET
 elevation from the
 UNIVERSITY OF CALIFORNIA DATUM



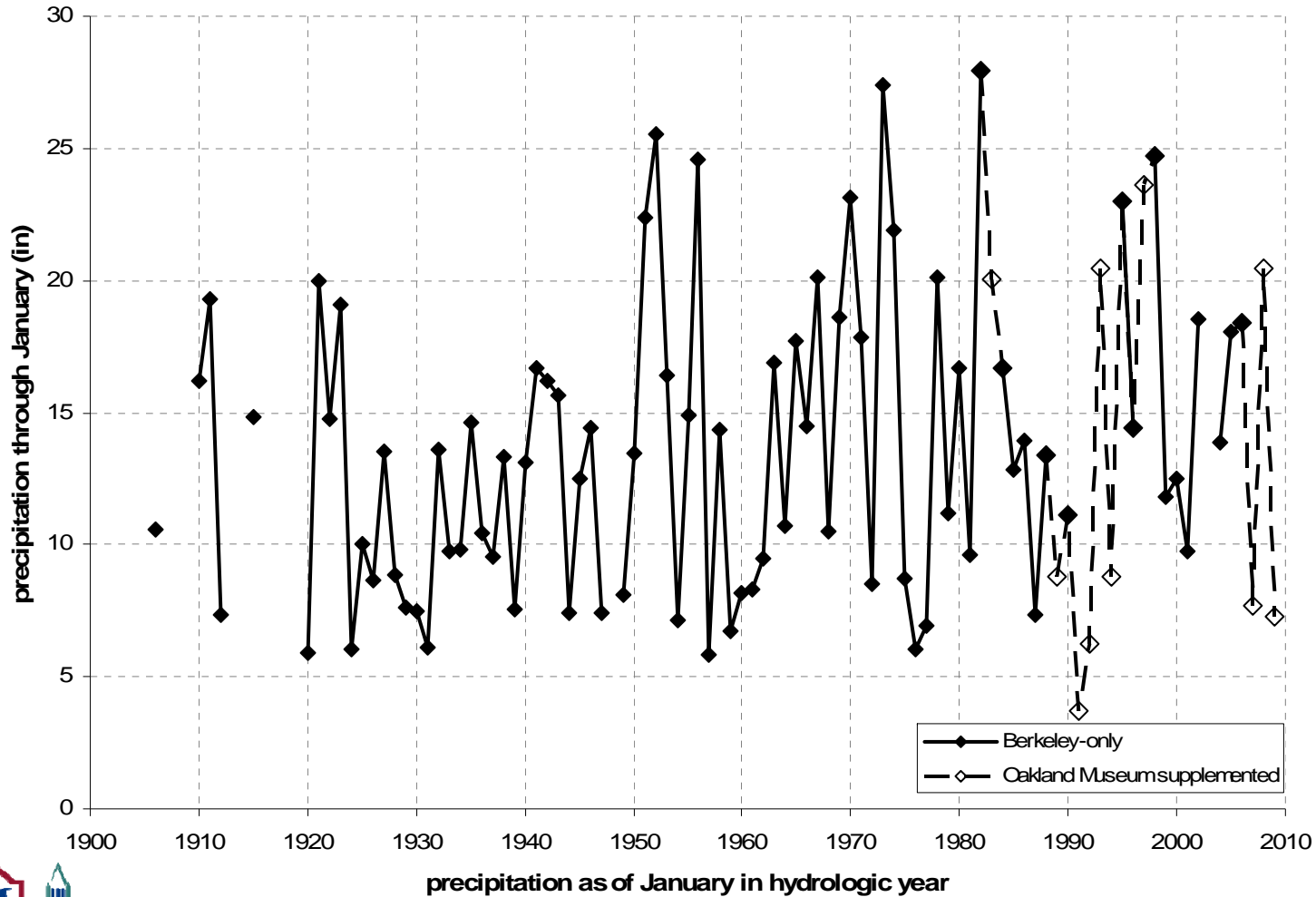
LBLN Landslide Map



LBLN Landslide Map



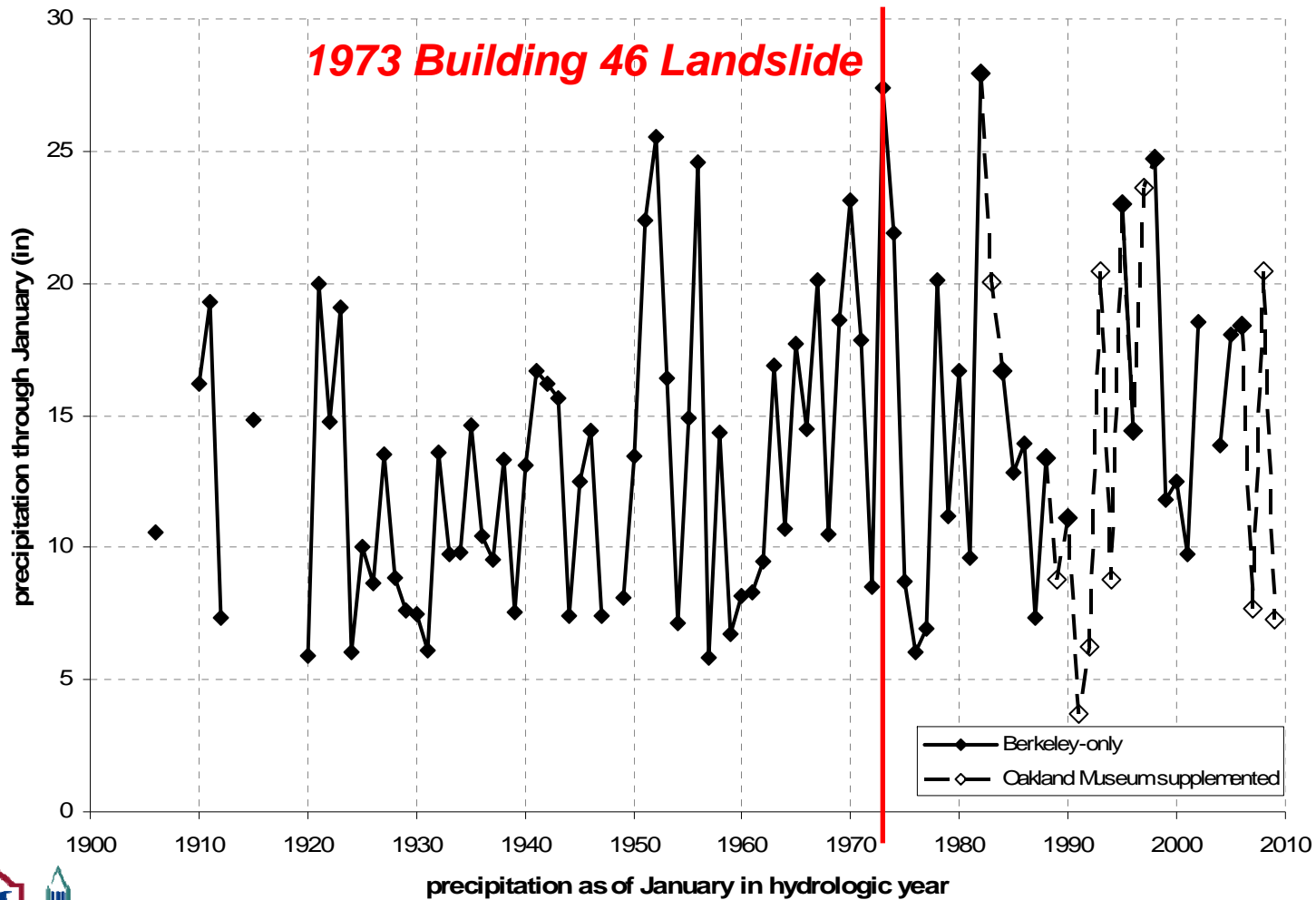
Precipitation Through January



data from <http://www.wrcc.dri.edu>



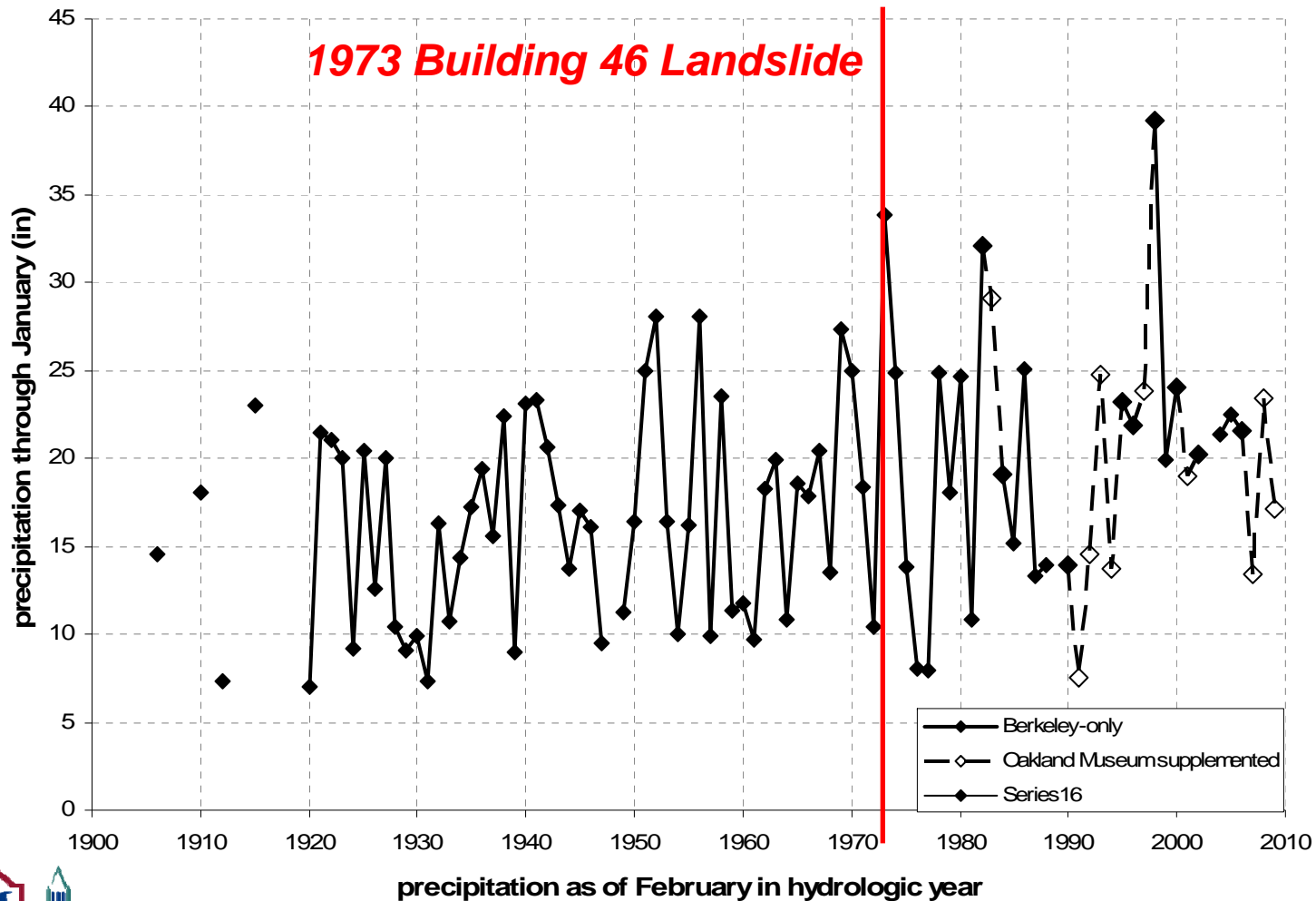
Precipitation Through January



data from <http://www.wrcc.dri.edu>



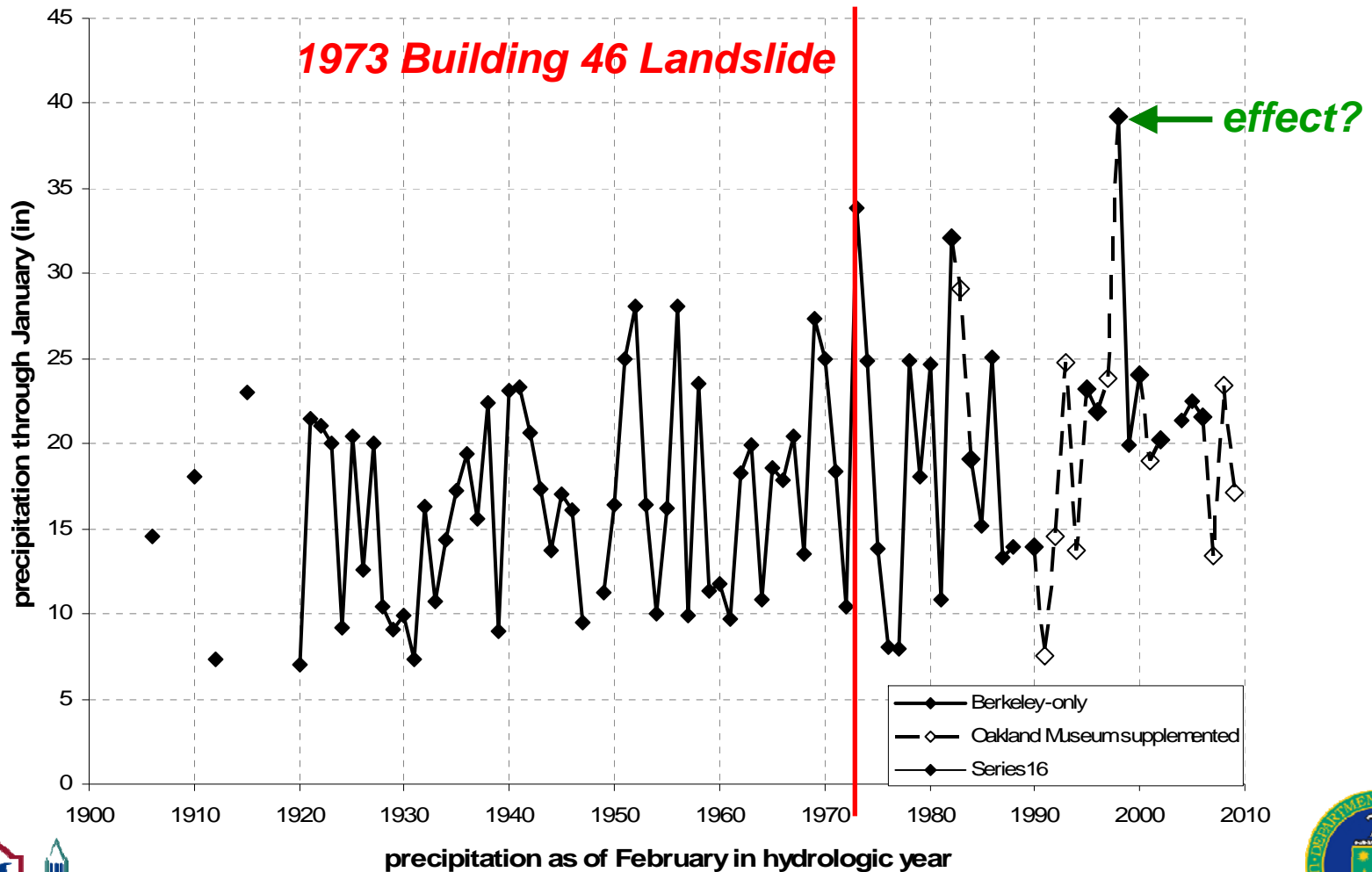
Precipitation Through February



data from <http://www.wrcc.dri>.



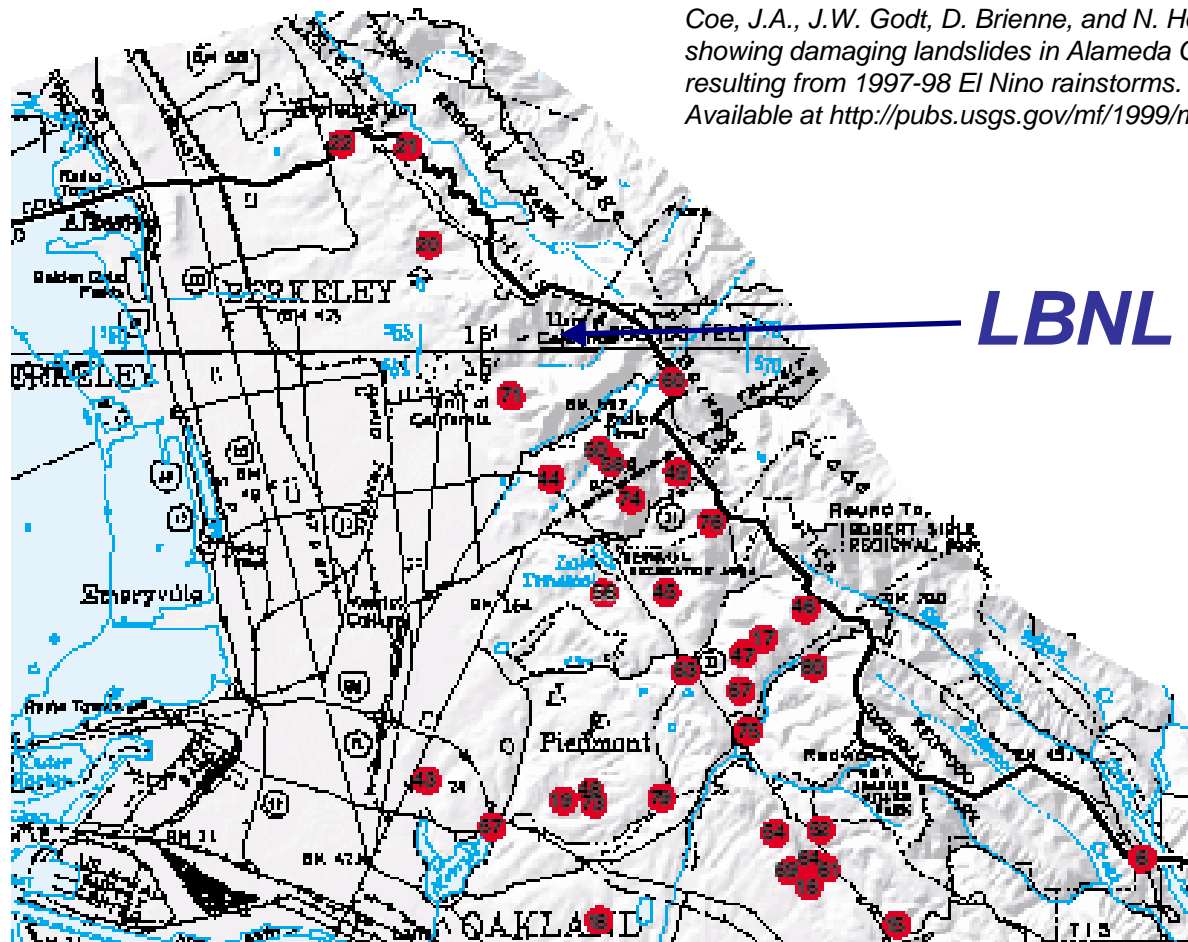
Precipitation Through February



data from <http://www.wrcc.dri>.



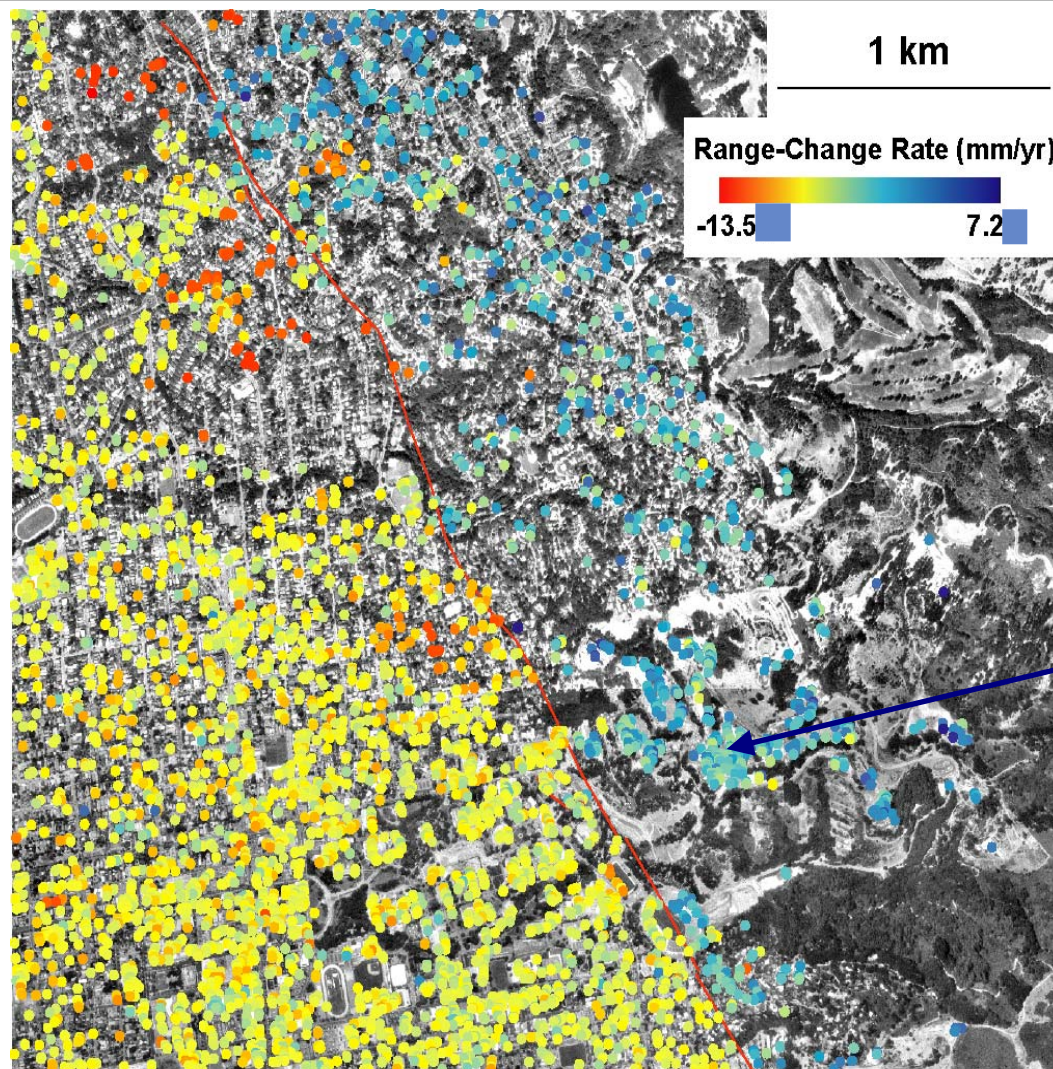
1997-98 Landslides



Coe, J.A., J.W. Godt, D. Brienne, and N. Houdre, 1999. Map showing damaging landslides in Alameda County, California, resulting from 1997-98 El Nino rainstorms. USGS MF-2325-B. Available at <http://pubs.usgs.gov/mf/1999/mf-2325-b/mf2325b.pdf>.



1992-2000 InSAR

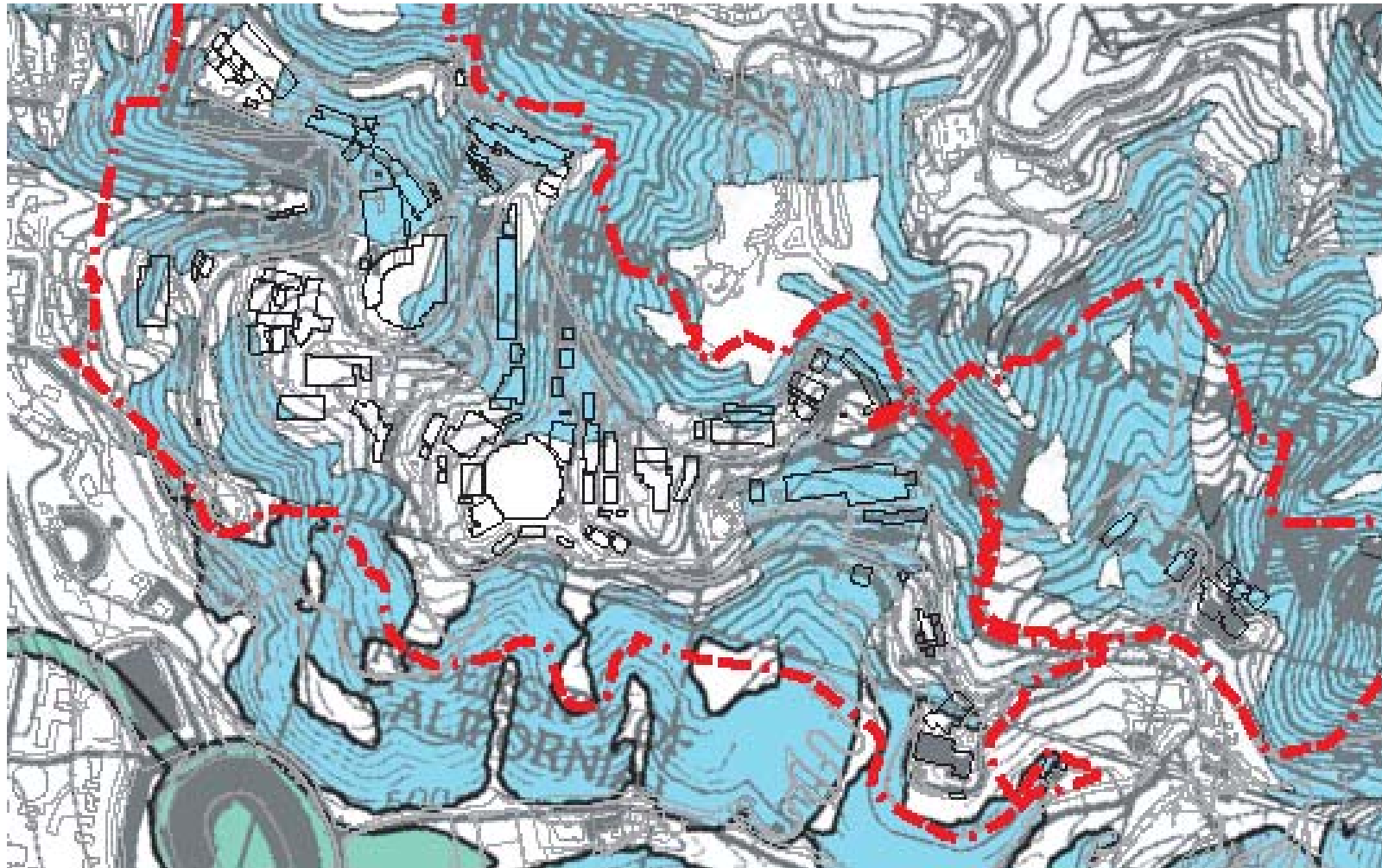


LBNL

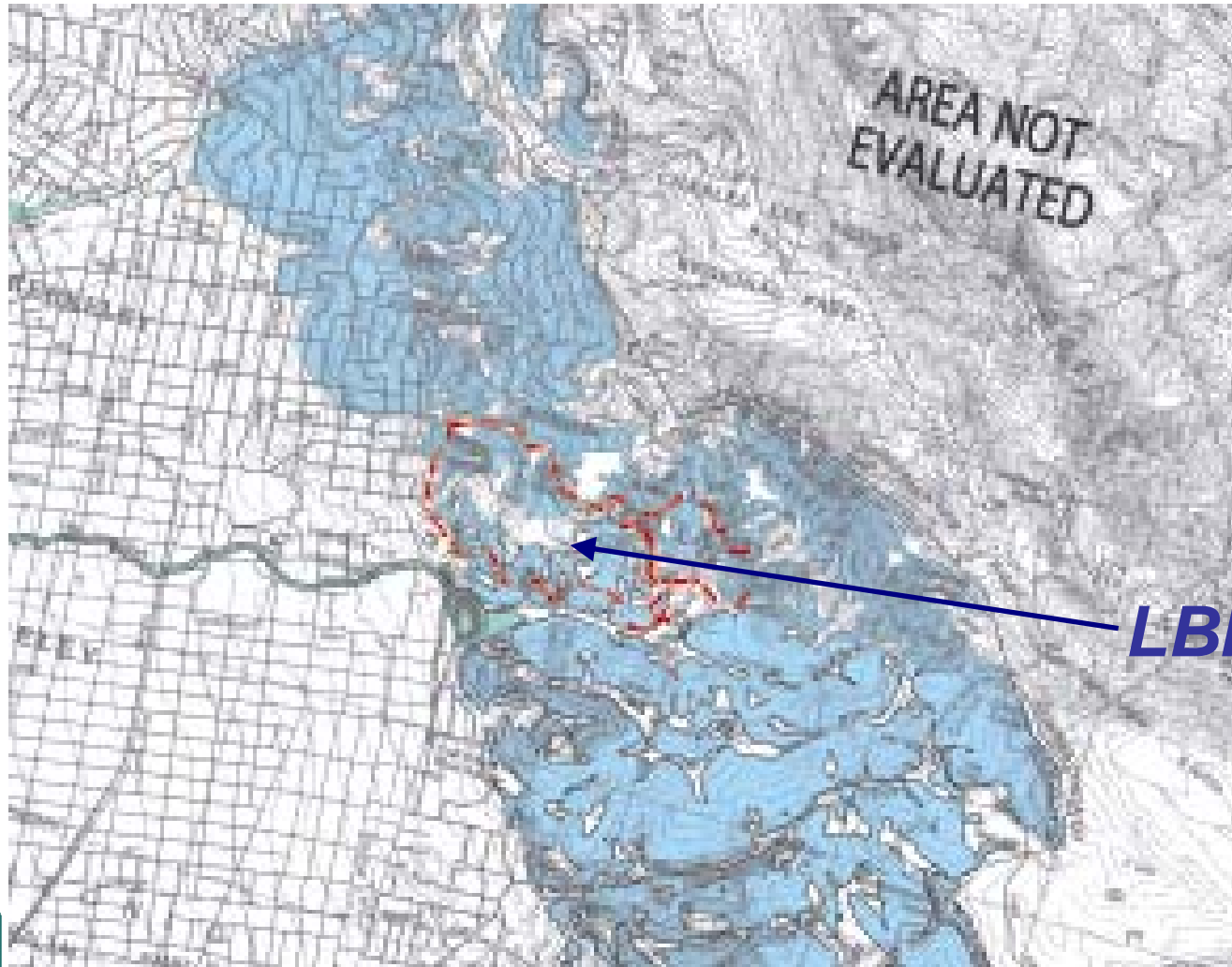
*Courtesy of Roland Burgmann, UCB
Professor of Earth and Planetary
Science*



Earthquake-Induced Landslide Study Zones



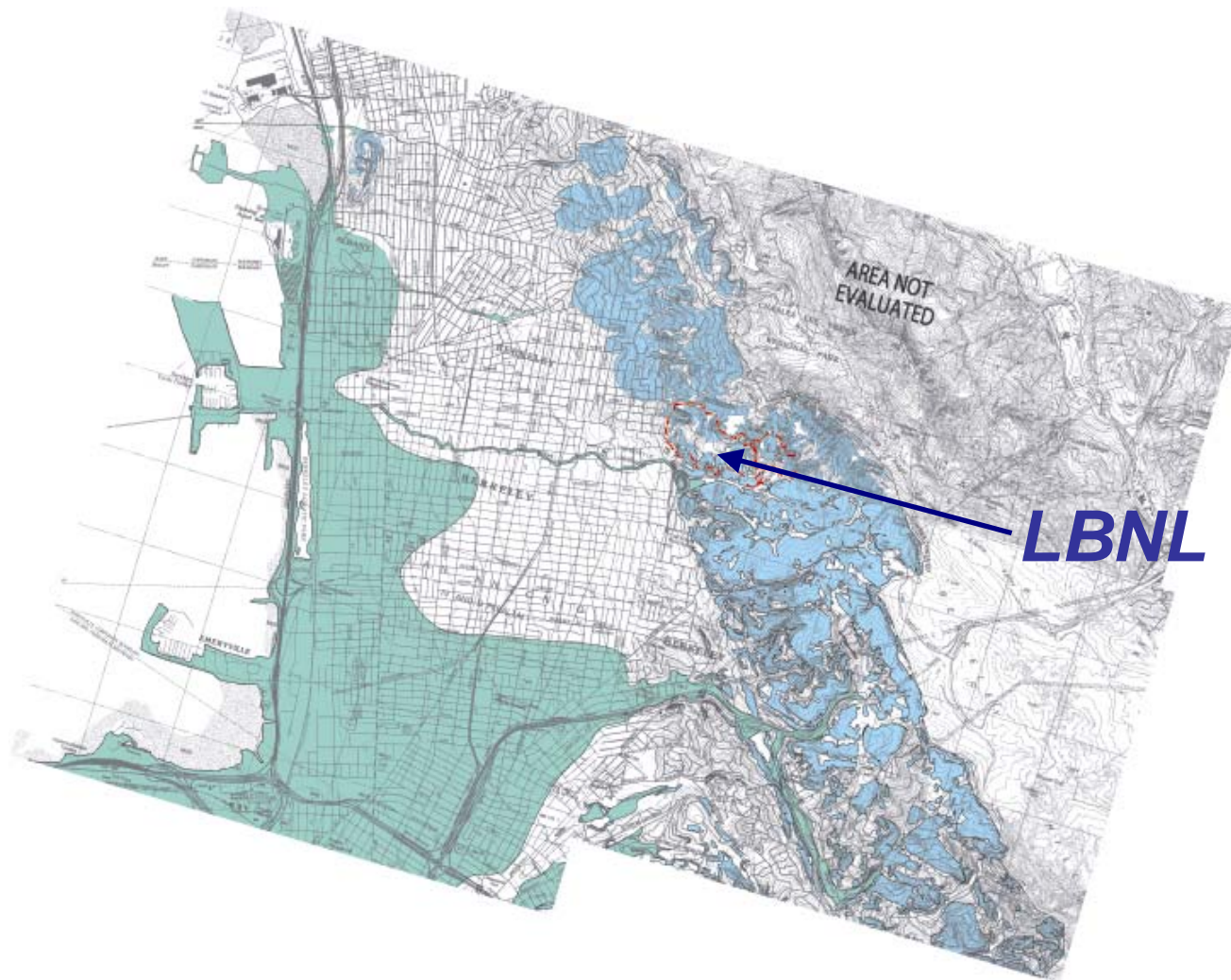
Earthquake-Induced Landslide Study Zones



LBNL



Earthquake-Induced Landslide Study Zones



In Conclusion

- There is no evidence of a caldera at LBNL
- The topography of LBNL suggests the volcanic rocks are stronger and more resistant to erosion than the other geologic units
- There is no evidence of a past landslide on the western slope of LBNL impacting the area below
- Slope stability is a concern at LBNL, as it is throughout the Berkeley Hills
- The LBNL site is on average more stable than the surrounding hills due to the initial site characteristics and the completed slope stability projects
- LBNL will continue to evaluate and improve slope stability

