

SUMMARY

From January through March, 1998, rainstorms driven by the 1997-98 El Niño Southern Oscillation triggered landslides* throughout the San Francisco Bay region of California. In March and April 1998, we conducted ground and air reconnaissance to assess landslide damage in Alameda County, located in the eastern part of the region. The initial sources for much of the damage data were the Alameda County Public Works Agency, municipal and County building, engineering, and seismic safety departments, private consultants, and the California Department of Transportation (Caltrans). After gathering damage data from these sources, we visited or flew over many of the sites. In all, we documented 87 sites that sustained damage from landslides. Total direct costs were about 20 million dollars, about 50 percent to roads and highways (18 sites), and 50 percent to private structures (houses, apartment buildings, garages, etc.; 69 sites). There were 17 private structures red-tagged and 7 yellow-tagged. "Tagged" structures are those that have been either condemned (red) or in need of significant repair (yellow). Municipal and county building inspection departments are commonly responsible for such determinations. Most of the losses occurred along the densely populated west flank of the Oakland hills. About half of the damage sites were within the cities of Oakland and Berkeley. On the basis of the sites we visited, most of the damage in these two cities was caused by relatively small translational or rotational slumps and slides (generally less than 10,000 m² in area and less than 5 m deep). Of the 87 sites documented, the time of occurrence was known at 23 sites, about 80 percent of which were in the first two weeks of February. All four damaging debris flows* occurred over this time. The Mission Peak landslide, a large (about 0.3 km wide x 1.2 km long), deep-seated, complex earthflow near Fremont, started moving about March 22.

Although direct damage from debris flows was relatively minor (about \$400,000), we observed moderate to abundant debris-flow activity in two rural areas of the County. The first area is centered on Walpert Ridge, and is bounded roughly by the edge of the East Bay Hills on the west, Hayward on the north, Palomares Canyon on the east, and Highway 680 on the south. The second area is in the vicinity of Hollis, Eden, Norris, Crow, and Cull Canyons northeast of Castro Valley. Field reconnaissance and preliminary mapping (Coe and others, 1998) suggest that the geographic distribution of these debris flows, and the landslide-damage sites described above, are very similar to that caused by the January 3-5, 1982, rainstorm (Wieczorek and others, 1988), the last major storm to cause widespread landslide damage in the County and throughout the San Francisco Bay region. This similarity suggests that, at least in a general sense, the distribution of landslides caused by future storms in Alameda County may be somewhat predictable.

Coe, J.A., Godt, J.W., and Wilson, R.C., 1998, Distribution of debris flows in Alameda County, California, triggered by 1998 El Niño rainstorms: a repeat of January 1982?: EOS, Transactions of the American geophysical Union, v. 79, no. 45, p. 266.

Wieczorek, G.F., Harp, E.L., Mark, R.K., Bhattacharyya, A.K., 1988, Debris flows and other landslides in San Mateo, Santa Cruz, Contra Costa, Alameda, Napa, Solano, Sonoma, Lake, and Yolo Counties, and factors influencing debris-flow distribution, in Ellen, S.D., and Wieczorek, G.F. eds., Landslides, Floods, and Marine Effects of the Storm of January 3-5, 1982, in the San Francisco Bay Region, California: U.S. Geological Survey Professional Paper 1434, p. 133-162.

* We use the term "landslide" in a broad sense to describe all types of slope failure including the slow-moving slumps, slides, and earthflows, as well as the fast-moving debris flows. We use the term "debris flow" to describe fast-moving slurries of mud, gravel, and organic debris that often mobilize from slumps, slides, or earthflows.

EXPLANATION

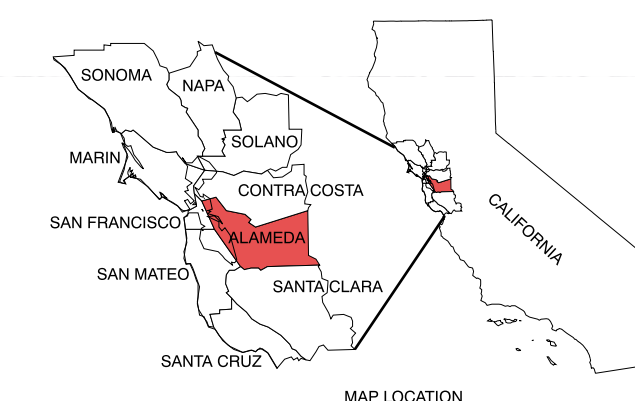
- Location of damaging landslide. The number identifies the landslide in the database. Data on file with authors, USGS, Menlo Park, California and Golden, Colorado.
- Approximate boundary of moderate to abundant (generally between 2 and 50 debris flows per 0.25 km²) debris flow activity. Debris flows were mapped from aerial photography furnished by Bruce Coffland of the NASA Ames Research Center, Aircraft Sensor Facility, Moffett Field, California.

MAP SHOWING LOCATIONS OF DAMAGING LANDSLIDES IN ALAMEDA COUNTY, CALIFORNIA, RESULTING FROM 1997-98 EL NIÑO RAINSTORMS

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Digital data prepared using ARC/INFO 7.1.2 running under Solaris 2.6 on a UNIX workstation. Map formatted using Adobe Illustrator 8.0 running under Mac OS 8.6.

Shaded relief base derived from Graham, S.E., and Pike, R.J., 1997, Shaded Relief Map of the San Francisco Bay Region, California, U.S. Geological Survey Open-File Report 97-745-B.

Any use of trade, product or firm names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

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This map was produced on request, directly from digital files, on an electronic plotter. It is also available as a PDF file at <http://greenwood.cr.usgs.gov>

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