

SUMMARY

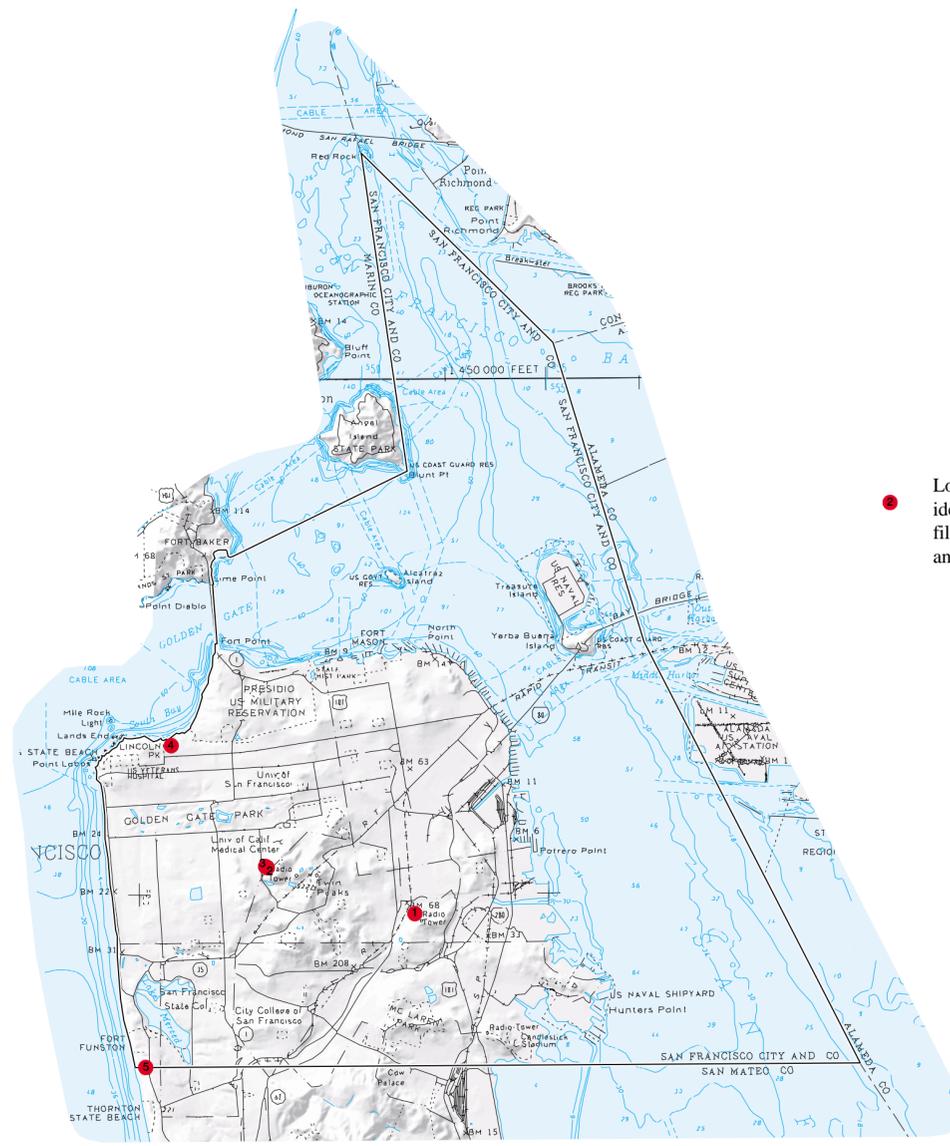
Landslides in the city and county of San Francisco caused an estimated \$4.1 million, including three red-tagged homes, extensive damage to the Olympic golf course, and minor damage to several residential properties. "Tagged" structures are those that have been either condemned (red) or in need of significant repair (yellow). Municipal and county building inspection departments are commonly responsible for such determinations. According to a report from the San Francisco Chief Building Inspector, the damage mostly occurred on steep slopes near Mount Sutro, Twin Peaks, Mount Davidson, Diamond Heights, Potrero Hill, and the Seacliff area. Most of the damage was reported between February 2 and February 26, 1998, although a few slides occurred in January, the earliest being reported January 8. A reconnaissance survey was conducted on May 1, 1998, with brief visits to all but a few of the affected areas. Sources of information included a San Francisco Department of Building Inspection memorandum, dated 2/27/98, and various news reports. No reports assessing road damage in the county were obtained.

A large rotational slump damaged three adjacent homes on the cliff above Phelan Beach in the Seacliff district. At the time of the survey, the houses were closed to occupants and one house foundation was being stabilized. The slump reportedly began on February 8 after a week of heavy rain. The earth movement caused the seaward sections of the houses to settle, resulting in tilting and cracking of the structures. The houses were built on unconsolidated dune sand and alluvium that overlies graywacke, chert, and basalt of the Franciscan Formation.

On Warren Drive near Mount Sutro, the driveway behind an apartment building was severely damaged by an earth slump. The movement mainly occurred February 11-13, requiring evacuation of the multi-car parking garage and closure of the driveway. The head scarp was approximately 1.5 m high and 25 m in length. Mud and debris had flowed downslope, piling against the back walls of several houses below.

Approximately 30 minor debris flows were reported in the hilly areas of San Francisco. Upon inspection, many of these slides were found to have occurred on very steep slopes veneered by colluvium of Franciscan Formation rocks, especially red chert debris. Damages usually were confined to cracked retaining walls and debris piles against homes. City inspectors cited some homeowners, requiring them to remove the fallen rock and to stabilize slopes on their properties.

Extensive fracturing and settling of earth occurred at a seaside golf course on both sides of the San Francisco-San Mateo County boundary. The major rotational slump, which is several kilometers long and hundreds of meters deep, occurred within a previously mapped landslide complex in the coastal bluffs.



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.

Scale 1:125,000



Universal Transverse Mercator Projection
Zone 10

MAP SHOWING LOCATIONS OF DAMAGING LANDSLIDES IN SAN FRANCISCO CITY AND 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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