

Land Subsidence in Las Vegas, Nevada, 1935-2000: New Geodetic Data Show Evolution, Revised Spatial Patterns, and Reduced Rates

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ABSTRACT

Subsidence in Las Vegas Valley has been geodetically monitored since 1935, and several generations of maps have depicted more than 1.5 m of total subsidence. This study presents new geodetic data that reveal insights into the spatial distribution and magnitude of subsidence through the year 2000. In particular, synthetic aperture radar interferometry (InSAR) and global positioning system (GPS) studies demonstrate that subsidence is localized within four bowls, each bounded by Quaternary faults. Conventional level line surveys across the faults further indicate that these spatial patterns have been present since at least 1978, and based on the new geodetic data a revised map showing subsidence between 1963 and 2000 has been developed. A comparison of the location of the subsidence bowls with the distribution of pumping in the valley indicates that subsidence is offset from the principal zones of pumping. Although the reasons for this offset are not well understood, it is likely the result of heavy pumping up-gradient from compressible deposits in the subsidence zones. A compilation of subsidence rates based on conventional, InSAR, and GPS data indicates that rates have significantly declined since 1991 because of an artificial recharge program. The rates in the northwest part of the valley have declined from more than 5-6 cm/year to about 2.5-3 cm/year, a reduction of 50 percent; in the central and southern parts of the valley, rates have declined from about 2.5 cm/year to only a few millimeters per year, a reduction of more than 80 percent.