



Levees prevent bay flooding at the Alviso Marina where the land sank more than six feet from subsidence between the early 20th century (top photo) and 1970s (bottom photo).

WHAT IS SUBSIDENCE?

Subsidence is a gradual settling or sudden sinking of the land surface due to the removal of earth materials like water or oil. Subsidence can be related to natural processes like sinkhole collapse, earthquakes, and volcanoes but is typically due to human activities. In California, the main cause of subsidence is groundwater overdraft, which occurs when pumping exceeds recharge in groundwater basins with substantial clay and silt. Unlike sinkholes, subsidence from pumping can affect broad areas.

IS SUBSIDENCE PERMANENT?

Subsidence can be permanent or temporary. When groundwater levels are very low for an extended time, subsurface compaction can permanently lower the land surface. In contrast, elastic subsidence is temporary and often seasonal, with the land sinking then rebounding as groundwater levels change.

WHAT PROBLEMS CAN SUBSIDENCE CAUSE?

Subsidence can cause seawater intrusion, increased flood risk in low-lying areas, infrastructure damage, economic loss, and lasting effects on groundwater aquifers and the ecosystems that depend on them. Sewer and storm systems, pumping stations, water supply wells and pipelines, and other critical infrastructure like levees, roads, bridges, and railroads are all susceptible to subsidence damage.

HAS THERE BEEN PERMANENT SUBSIDENCE IN SANTA CLARA COUNTY?

Yes, Santa Clara County was the first place in the United States where subsidence from groundwater overdraft was observed. Subsidence was first measured around 1915 and over time it affected more than 100 square miles of northern Santa Clara County. The largest subsidence occurred near the center of the valley in Sunnyvale, Santa Clara and San José, with maximum subsidence of about 14 feet in downtown San José. Subsidence has not been observed in southern Santa Clara County.

By about 1970, permanent subsidence was essentially halted due to Valley Water investments in reservoirs, diverse water supplies and groundwater recharge, along with management programs that allowed groundwater to recover.

WHAT ARE THE COSTS OF SUBSIDENCE?

The cost of addressing historical subsidence in Santa Clara County is estimated to be more than \$1 billion in today's dollars. Because of historical subsidence, some residential communities, major corporate campuses, and wastewater treatment facilities are now below sea level and protected from flooding by levees along San Francisco Bay.

WHAT IS VALLEY WATER DOING TO PREVENT SUBSIDENCE?

Because chronic groundwater overdraft caused historical subsidence, Valley Water works to maintain healthy groundwater levels and storage through:

- Managed aquifer recharge using local and imported surface water in nearly 300 acres of recharge ponds and 100 miles of streams, which helps replenish and balance water pumped from the ground.
- Surface water deliveries to water retailers from three water treatment plants, which reduce the need for groundwater pumping.
- Water conservation and recycling programs that reduce overall water demand and groundwater pumping.

The risk of subsidence is greatest during extended droughts, particularly if groundwater levels are substantially lowered. While subsidence and its impacts occur relatively gradually, they can be devastating in terms of infrastructure damage and increased flood risks. In a highly urban and vital region like Silicon Valley, the potential economic costs are enormous, so avoiding resumed, permanent land subsidence is a key driver for Valley Water.

Replenish
groundwater with
local & imported
surface water



Deliver surface
water to water
retailers



Lead water conservation and recycling programs

HOW DOES VALLEY WATER MONITOR SUBSIDENCE?

Valley Water has developed goals and metrics to ensure any changes in the land surface are within acceptable levels. To ensure a low risk of additional subsidence, Valley Water conducts extensive monitoring at:

- Two extensometers, which are special instruments that continuously monitor compaction to a depth of 1,000-feet in Sunnyvale and San Jose.
- Ten wells where Valley Water has established subsidence thresholds, or groundwater levels above which there is a low risk of permanent subsidence.
- Over 140 benchmarks measured annually to detect changes in the land surface across a wide area of the valley.

DID SUBSIDENCE OCCUR DURING THE MOST RECENT DROUGHTS?

No permanent subsidence occurred during the most recent droughts. Between 2012 and 2016, scarce surface water and higher groundwater pumping increased the risk of subsidence. Valley Water worked with water retailers to reduce groundwater pumping and overall water use, and increased recharge when surface water supplies improved. This led to a full and quick recovery of groundwater levels. A proactive drought response during the 2020-2022 drought helped maintain groundwater levels far above subsidence thresholds. The subsidence measured during both droughts was elastic, or temporary, with recovery of groundwater levels and the land surface to pre-drought conditions.

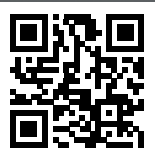
WHERE CAN I LEARN MORE?

Valley Water's Annual Groundwater Report has information on recent subsidence conditions and is available at valleywater.org/your-water/groundwater.

Subsidence monitoring, goals, and metrics are also described in Valley Water's Groundwater Management Plan, available at valleywater.org/your-water/where-your-water-comes/groundwater/sustainable.

CONTACT US

To find out the latest information on Valley Water projects or to submit questions or comments, use our **Access Valley Water** customer request system at access.valleywater.org.



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