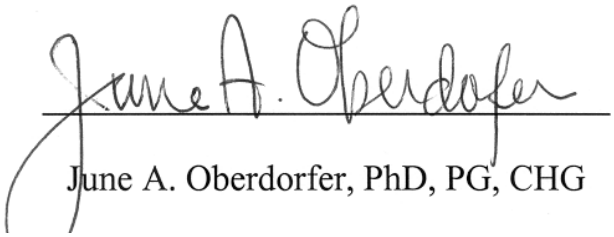
Amendment Number Two to Declaration of June A. Oberdorfer, July 2010 *Antelope Valley Groundwater Cases, Phase 3: Status of Aquifer and Issue of Overdraft*



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This second amendment to my July 2010 Declaration expands upon opinions provided in the concluding paragraph of that document with respect to evidence of and impacts of overdraft. The focus of the discussion is on land subsidence following 1992.

Land subsidence occurs in regions of water level declines where clay aquitards are present. There is clear evidence of a decline in water levels in many regions of the Antelope Valley (U.S. Geological Survey, National Water Information System, http://waterdata.usgs.gov/nwis; Carlson *et al.,* 1998; Beeby *et al.,* 2010, Figure E2-4). The extent of the thick, lacustrine (lake bed), clay aquitard over much of the Lancaster subbasin has also been documented by multiple investigators (Durbin, 1978; Leighton and Phillips, 2003; Beeby *et al.,* 2010, Figure 3-5 and Figure E2-2).

When water levels decline, water slowly drains out of the thick clay aquitard in response to the hydraulic head being lowered by pumping from the aquifers. As the water flows out of the aquitard, the tiny clay particles become more densely packed in a process called compaction. The denser packing of the clay particles causes the clay aquitard to become thinner in the vertical direction which in turn causes the land surface to subside. This process is essentially irreversible. Even if water levels recover in the adjacent aquifer(s), the clay aquitard does not expand.

An on-going consequence of groundwater overdraft is the land subsidence in the Lancaster sub-basin. Ikehara and Phillips (1994) documented land subsidence from 1930 to 1992 (figure showing magnitude of subsidence reproduced in modified form in Beeby *et al.,* 2010, Figure E2-16). Subsequent studies (Galloway *et al.,* 2000; Sneed *et al.,* 2005, Galloway and Hoffman, 2007) indicate that subsidence continued after 1992 over much of the same area, with a region with a particularly high rate of subsidence (about 25 mm per year) near Lancaster and another area with a similarly high rate of subsidence at Edwards Air Force Base (EAFB). The regional-scale data are available through 1999.

Data on land subsidence are available for much of the last decade for EAFB. Sneed *et al.,* (2005) showed subsidence rates at the Base for 1990 – 2004 that I calculated to be about 15 mm per year. More recent extensometer data provided by the U.S. Geological Survey (Michelle Sneed, personal communication) show subsidence that I have calculated to be about 11 mm/year at portions of EAFB for the period Sept. 2004 to Sept. 2009. Declining water levels have contributed to land subsidence, sink-like depressions, and playa-surface fissuring and has

accelerated playa-surface erosion impacting runways at the Base (Sneed and Galloway, 2000). The ongoing subsidence is evidence of both past and current overdraft.

References

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