Fillmore Basin Pumpers Association, Inc.
Piru Basin Pumpers Association, Inc.

March 9, 2021

Board of Directors, Staff, and Consultants
Fillmore and Piru Basins Groundwater Sustainability Agency
C/o Tony Emmert, Executive Director
United Water Conservation District
1701 N. Lombard St. Suite 200
Oxnard CA, 93030

Transmitted via email attachment to tonye@unitedwater.org

Re: Framework for Addressing Inelastic Land Subsidence in the GSP

Dear Directors and Staff:

As you know the Fillmore and Piru Pumpers Associations were formed to engage on behalf of agricultural landowners with the GSA concerning development of the Fillmore and Piru Groundwater Sustainability Plans (GSPs). The Pumper Associations desire to work cooperatively and collaboratively with the GSAs on planning issues that will impact sustainable management of the groundwater basin and our businesses. To this end, we are sending this letter to offer thoughts on a proposed framework for addressing the inelastic land subsidence sustainable management criteria (SMC) in the GSPs.

As you know, SMC are the GSP element where the "rubber meets the road." The SMC will ultimately control how much groundwater we as landowners can pump, how much we will pay to pump going forward, and what the impacts to our property values will be. The Pumper Associations desire to avoid undesirable results in a manner that provides the most flexibility to utilize the groundwater resource.

SGMA is clear that its chief goal is to avoid undesirable results (significant and unreasonable effects for applicable sustainability indicators). Therefore, we believe defining the significant and unreasonable effects that are to be avoided is key to developing the land subsidence (and other sustainability indicator) SMCs. For land subsidence this would be "the rate and extent of subsidence that substantially interferes with surface land uses and may lead to undesirable results" (GSP Emergency Regulations §354.28 (c)(5)).

During the February 28, 2021 FPGSA Board meeting, DBS&A proposed to address the land subsidence sustainability indicator by establishing minimum thresholds equivalent to estimated historical low groundwater levels. Given the SGMA definition of minimum thresholds, this means that *any* amount of inelastic subsidence would be considered to cause significant and unreasonable effects. However, it is very unlikely that significant and unreasonable effects would result from the first increment of inelastic subsidence that *might* occur if groundwater levels fall below the historical low levels. Therefore, the approach proposed on February 28 is inconsistent with the SGMA and creates an unnecessarily restrictive management framework.

Thus, the question remains – what would be a significant and unreasonable amount of inelastic subsidence and where? Unfortunately, this question is impossible to answer without detailed engineering evaluations of potentially sensitive infrastructure in the basins. Such evaluations are not available. However, subsidence case studies are available, and provide insight into subsidence amounts that have led to significant and unreasonable impacts in other groundwater basins. A summary of case studies from ten basins is presented in the table attached to this letter. As indicated below the table, the rates of subsidence in these basins ranged from approximately 1.2 to 4.5 inches per year (in/yr.). Reported cumulative subsidence ranged from 0.6 to 10 feet. One possible conclusion is that it may be reasonable to assume a threshold for potential significant and unreasonable effects based on the low end of the values reported from the case studies (i.e., 1.2 in/yr. or 0.6 feet of cumulative inelastic subsidence). These values could provide the basis for minimum thresholds in the initial GSP and could be revised later if basin-specific information becomes available.

A possible approach to establishing minimum thresholds for subsidence would be to identify sensitive receptors for subsidence in the basin (e.g., canals or gravity water systems, gravity sewer lines, 100-year floodplains, bridges, dams, etc.). Absent any specific information regarding the susceptibility of the sensitive receptors to land subsidence, 1.2 in/yr. or 0.6 feet of cumulative inelastic subsidence could be used for the initial minimum threshold at these locations. An envelope could be drawn around the sensitive receptors to establish the extent of subsidence, as required in GSP Emergency Regulations §354.28 (c)(5). The subsidence measurable objective could set at no measurable inelastic subsidence (for InSAR this would be no subsidence greater than 0.62-inch – the InSAR method accuracy). Going forward, engineering evaluations of the sensitive receptors could be undertaken to better understand that actual susceptibility to effects from land subsidence. The results of the engineering evaluations could be used to update the minimum thresholds.

Subsidence monitoring could be accomplished using InSAR data, assuming the State continues to fund data processing into the future, which appears likely, at least for the next several years. However, it may not be possible to determine whether land movement indicated by InSAR is the result of tectonic activity or inelastic land subsidence. This can be remedied by installing continuous global positioning system (GPS) stations in at least one key location per basin. The estimated capital cost per continuous GPS station is $60,000[1]. Annual operations and maintenance costs are approximately $3,000 per year[2].

If the GSA chooses an approach like that outlined in this letter (as opposed to a hard stop at historical low groundwater levels), a contingency plan should be developed to limit inelastic

[1] Cost estimate developed for Mound Basin Groundwater Sustainability Agency.
[2] Cost estimate developed for Mound Basin Groundwater Sustainability Agency.

subsidence to the selected minimum threshold values and to address any unexpected significant and unreasonable effects. Given that the groundwater modeling results indicate that groundwater levels will not likely fall below historical low levels, it seems appropriate that the contingency plan could be developed after GSP adoption for inclusion in the first 5-year GSP update.

Closing

Thank you for the opportunity to submit this framework for consideration. We look forward to further discussion of land subsidence and the other sustainability indicators.

Sincerely,

Gordon Kimball
Fillmore Pumpers Association, Inc.

Glen Pace
Piru Pumpers Association, Inc.

Attachment: Summary of Land Subsidence Case Studies

cc: Fillmore Pumpers Association, Inc. Members
Piru Pumpers Association, Inc. Members
Bryan Bondy, Bondy Groundwater Consulting, Inc.

Attachment
Summary of Land Subsidence Case Studies

Summary of Land Subsidence Case Studies

Reference	Title	Period of Observation	Subsidence Rate (in/yr)	Cumulative Subsidence (ft)	Reported Damage	Location
Leon et al., 2018	Land Subsidence and its Effects on the Urban Area of Tepic City, Mexico	2007 - 2011	2.4 - 2.8	Not reported	Surface cracking, sidewalks and planters; ruptured pipes and walls in houses. It is noted that the damage caused by this phenomenon has not been sufficiently noticeable to alarm governments or those affected.	Tepic City, Mexico
Dinary et al., 2020	Land Subsidence: The Forgotten Enigma of Groundwater (Over)Extraction	1950 - 1957 (through early 1970s)	1.2	0.7	Subsidence exacerbated the impact of sea level rise including, delta, erosion, shoreline retreat, and morphological changes to spits and lagoons. Land uses were impacted by the combined effects of subsidence and sea level rise.	Po River delta, Italy
Dinary et al., 2020	Land Subsidence: The Forgotten Enigma of Groundwater (Over)Extraction	1993 - 2004, 2004 - 2008	Not reported	0.6	300 building complaints and estimated damages of nearly 50 million euro. Groundwater use is now managed to prevent more than 2 cm (0.8 inch) of subsidence per year.	Murcia, Spain
Dinary et al., 2020	Land Subsidence: The Forgotten Enigma of Groundwater (Over)Extraction	1987 - 1995	3.1	2.2	Ground fissuring that resulted in damage to existing infrastructure.	Chino Basin, California
He et al., 2019	Land Subsidence Control Zone and Policy for the Environmental Protection of Shanghai	Since ~1986	2.3	8.0	Increased risk of coastal hazards such as marine flooding, storm surges, and tsunamis.	Shanghai, China
Lawrence Berkeley National Laboratory, 1979	Environmental and Economic Effects of Subsidence	1948 - 1967	4.5	7.5 - 10	Ground fissuring increased maintenance on highways and railroads, disrupted ditch irrigation systems, increased erosion (along fissues), embankment failure at Picacho Reservoir, and impacted aqueduct routing. Well damage was also reported.	Arizona
Lawrence Berkeley National Laboratory, 1979	Environmental and Economic Effects of Subsidence	1924 - 1964	3	10	Minor sidewalk cracks and well damages. Differential movement on pre-existing faults a dam failure.	Baldwin Hills, California
Lawrence Berkeley National Laboratory, 1979	Environmental and Economic Effects of Subsidence	1906 - 1973	1.5	8.5	Damage to structures and cracks in roads and sewer systems associated with differential movement along pre-existing faults. Subsidence also cause shoreline retreatment in coastal areas.	Houston-Galveston, Texas
Lawrence Berkeley National Laboratory, 1979	Environmental and Economic Effects of Subsidence	1935- 1974	1.5	5	Ground fissuring damaged wells, reservoirs, pipelines, homes, roads, and railroads.	Las Vegas Valley,
Lawrence Berkeley National Laboratory, 1979	Environmental and Economic Effects of Subsidence	1934 - 1967	2.9	8	Well sewer, and bridge damages. Aggravated flood hazard.	Santa Clara Valley, CA
		Range:	1.2 - 4.5 in/yr	0.6 - 10 feet		