

Agenda Item: 7A
Meeting Date: July 27, 2020

Sonoma Valley Groundwater Sustainability Agency

Action Item

TO: BOARD OF DIRECTORS
FROM: Jay Jasperse, Plan Manager, and Marcus Trotta, Technical Project Manager
SUBJECT: Draft Sustainable Management Criteria – Land Subsidence

Summary: The Groundwater Sustainability Plan (GSP) is due January 31, 2022. As part of the GSP, Sustainable Management Criteria (SMC) must be developed for six sustainability indicators as defined by the Sustainable Groundwater Management Act. This item requests Board direction regarding the proposed draft SMC for land subsidence developed by staff with input and concurrence from the Advisory Committee. The proposed SMC is described below and consists of a technical methodology to evaluate minimum thresholds and measurable objectives, a description of significant and unreasonable conditions, and definition of Undesirable Results. The item presents three options for Board consideration regarding how to define an Undesirable Result with a recommendation from the Advisory Committee.

Background

The Sustainable Groundwater Management Act (SGMA) requires Groundwater Sustainability Agencies (GSAs) in high- and medium-priority basins to develop and submit Groundwater Sustainability Plans (GSPs) to the California Department of Water Resources by January 31, 2022. GSPs are detailed road maps for how groundwater basins will reach and maintain long term sustainability.

Sustainable Management Criteria – General Overview

A central aspect of the GSP is to develop Sustainable Management Criteria (SMC) for each of the six sustainability indicators listed below:

1. Chronic **lowering of groundwater levels** indicating a significant and unreasonable depletion of supply if continued over the planning and implementation horizon.
2. Significant and unreasonable **reduction of groundwater storage**
3. Significant and unreasonable **seawater intrusion**
4. Significant and unreasonable **degraded water quality**, including the migration of contaminant plumes that impair water supplies
5. Significant and unreasonable **land subsidence** that substantially interferes with surface land uses

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6. **Depletions of interconnected surface water** that have significant and unreasonable adverse impacts on beneficial uses of the surface water (e.g. water in streams or wetlands).

As discussed at the June 1, 2020 Board meeting, an important requirement of the GSP is the development of SMCs which include: (1) quantitative minimum thresholds (MT); (2) quantitative measurable objectives (MO); (3) a qualitative description of significant and unreasonable conditions; and (4) a definition of what constitutes an undesirable result for the basin. A “cheat sheet” that defines these terms for the six sustainability indicators can be found as Attachment 1, Item 6A.

The initial draft SMCs for each of these indicators will be presented to the GSA Board for consideration as they are each developed over the next few months. Once draft SMCs are developed for the six sustainability indicators, the GSA will evaluate whether any management programs or projects are necessary to avoid undesirable results as defined by the SMC for both current and future (through 2072) conditions. It is important to recognize that the GSP and the implementation process is adaptive and provides opportunities for continued refinement and improvement throughout the process. For example, if any of the draft SMCs are found to require management programs or projects that are deemed by the Board to be infeasible (e.g., technical or cost considerations), the draft SMC will be revised accordingly. For these reasons, the SMCs are considered draft until the completion of the GSP. In addition, it is anticipated that during GSP implementation, some SMCs will be refined or modified based on new information.

Process for SMC Development for Land Subsidence

The general process for SMC development was presented to the Board on June 1, 2020. As part of that briefing, staff stated that the goal will be to vet technical aspects of the SMC (e.g., technical methodology, minimum thresholds, measurable objectives) with the AC and also to work with the AC to develop policy options for determination of basin-wide undesirable results for Board consideration. Since that time, staff have worked closely with the AC to develop a draft SMC proposal for land subsidence for Board consideration.

The land subsidence SMC was discussed at the May 12, June 6, and July 14 AC meetings. In addition, written materials presenting technical information and requests for additional input were also sent to the AC. After much evaluation of existing data/information and discussions among the technical staff and the AC, a draft SMC proposal has been developed for Board consideration, including three options for defining what constitutes the determination of an undesirable result for land subsidence.

Key Considerations

There are several key factors to be considered when developing SMC for land subsidence, including the GSA’s ability to determine when subsidence is permanent -- and related to groundwater pumping. Some of these considerations are summarized below.

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GSA Responsibilities Limited to Inelastic Subsidence Caused by Groundwater Pumping: SGMA is clear that GSAs are responsible for only managing “inelastic” (unrecoverable) subsidence caused by groundwater pumping. *The GSA does not manage short-term “elastic” (recoverable) subsidence, nor does it manage inelastic subsidence caused by something other than groundwater pumping, such as tectonic activity.*

Existing Subsidence Data do not Indicate Issues Regarding Subsidence: Available subbasin wide datasets (while limited to recent time periods) do not indicate the occurrence of inelastic land surface subsidence due to groundwater pumping within the Subbasin and problems that could occur related to historical inelastic subsidence (e.g., damage to infrastructure or modified drainage patterns) have not been reported by subbasin stakeholders. However, the risk of future potential inelastic subsidence exists due to the occurrence of chronic declines of groundwater levels within clay-rich portions of the subbasin’s aquifer system.

Total Subsidence Metric: The defined metric from the GSP regulations for measuring total subsidence is the rate of change in ground surface elevation. This can be measured with extensometers, continuous GPS stations, levelling surveys, or Interferometric Synthetic-Aperture Radar (InSAR) data.

Methodology for Measurement of Total Subsidence: To support the implementation of SGMA, monthly measurements of total subsidence are currently reported by DWR using InSAR data. This data is free and is planned to be provided into the future. The InSAR data are spatially extensive (covering the majority of the subbasin), but more limited temporally (with data available monthly going back to 2015). A limitation of InSAR data is that it measures total subsidence and does not distinguish whether such subsidence is inelastic and due to groundwater pumping.

Future Considerations: Setting a minimum threshold of anything greater than zero sets as policy that 20 years from now, it is acceptable for the Subbasin to be experiencing irreversible subsidence caused by groundwater pumping at some measurable rate.

Proposed Draft SMC for Land Subsidence

The key components of the proposed draft SMC for land subsidence are as follows:

Definition of Significant and Unreasonable Conditions

Any inelastic subsidence caused by groundwater pumping is a significant and unreasonable condition, everywhere in the subbasin and regardless of the beneficial uses and users.

Minimum Threshold (MT)

In general, the MT represents conditions that are to be avoided to ensure sustainable groundwater conditions. GSP Regulations § 354.28 (c)(5) lays out how subsidence MTs shall be defined. It states, “The minimum threshold for land subsidence shall be the rate and extent of

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subsidence that substantially interferes with surface land uses and may lead to undesirable results.”

While zero inelastic subsidence due to pumping is the desire, in order to account for measurement error, the proposed annual MT is 0.1 feet per year of total subsidence (elastic and inelastic) measured by InSAR for each 100 meters by 100 meters (~2.5 acre) grid (or pixel). The InSAR pixels serve as the Representative Monitoring Points (RMPs). The 0.1 feet per year value accounts for the inherent error in the InSAR technology. The reported total subsidence value is an average many individual measurements within each InSAR pixel. InSAR is proposed for use given the spatial coverage, accuracy, and no cost to the GSA (state funded program for SGMA). Disadvantages of InSAR are that it measures total subsidence rather than inelastic subsidence and the data record only extends to 2015.

Measurable Objective (MO)

The MO is the aspirational goal to achieve optimal protection of groundwater conditions. The proposed MO is the same as the MT given that zero subsidence related to groundwater pumping is the significant and unreasonable condition. In other words, there is not a more stringent condition for land subsidence than the MT.

Undesirable Results

Staff and the AC worked to developed options for what conditions should constitute an undesirable result. (Note: If an undesirable result occurs, the GSA must take steps to either regain or achieve sustainability, including possible projects and management actions.) All options would require: (1) an exceedance of the MT (0.1 feet per year of total subsidence); and (2) subsidence must be determined to be correlated to groundwater level declines due to groundwater pumping. The options considered the following variables:

- *Magnitude of subsidence:* A cumulative allowable cap of total subsidence measured by InSAR to account for the risk of cumulative small amounts of annual total subsidence less than 0.1 adding up to a more significant level of subsidence.
- *Timeframe of subsidence:* A consecutive time period during which any total subsidence measured by InSAR constitutes an undesirable result to also account for the risk of cumulative small amounts of annual total subsidence less than 0.1 adding up to a more significant level of subsidence.
- *Geographic extent of subsidence:* The spatial extent and land uses over which total subsidence is measured by InSAR to reduce the likelihood that a very small area could result in subbasin-wide undesirable results

Based on the above-described factors, the AC during its July 14, 2020 meeting considered the following options for Board consideration:

Option 1 – An undesirable result will occur if: (1) the MT is exceeded, OR (2) five continuous years of subsidence in any area even if each year’s annual subsidence rate is less than the MT,

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AND subsidence is determined to be correlated with groundwater level declines due to groundwater pumping.

Option 2 – An undesirable result will occur if: (1) the MT is exceeded, OR (2) within any five year period cumulative total subsidence exceeds 0.2 feet¹ in any area (even if each year's annual subsidence rate is less than the MT), AND subsidence is determined to be correlated with groundwater level declines due to groundwater pumping.

Option 3 – An undesirable result will occur if: (1) the MT is exceeded, OR (2) five continuous years of subsidence occurring over 25 contiguous acres (~10 InSAR pixels), including developed land or infrastructure facilities (even if each year's annual subsidence rate is less than the MT), AND subsidence is determined to be correlated with groundwater level declines due to groundwater pumping.

It is apparent that the determination of whether total subsidence measured by InSAR is correlated to groundwater level declines caused by pumping is an important aspect of the draft SMC. The GSP will detail the methodology for this assessment. In general, the following lists some of the activities that will be part of the evaluation:

- Review of related land surface elevation data from InSAR and other sources
- Review of groundwater elevation measurements and trends in RMPs (established as part of the declining groundwater level SMC) and other nearby wells being monitored, including an assessment as to whether groundwater levels are below historical lows
- Review of seismic related data and records
- Evaluation of time series plots of groundwater-levels and land subsidence from nearby monitoring wells
- Evaluation of known or estimated groundwater pumping patterns within the vicinity of any observed potential land subsidence
- Compilation of pertinent data including continuous global positioning stations and assessment of any data gaps

Advisory Committee Recommendation

Although the AC agreed that all the three options provided a reasonable range of decision criteria, as described below, the general consensus of the AC was to favor Option 2. Staff is most comfortable with Options 2 and 3. At the July 14, the AC agreed that Option 1 brings greater risk of false exceedances because any measurement of total subsidence, even at extremely low levels within the error of InSAR, could spur a potential determination of an undesirable result. Additionally, the risk of small amounts of

¹ The 0.2 feet cumulative total represents an estimated minimum limit for elastic subsidence due to groundwater pumping from the Santa Rosa Plain (an area with similar clay-rich geologic materials and a historical pattern of groundwater-level decline and subsequent recovery), while maintaining protections to avoid the potential for future inelastic subsidence.

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annual total subsidence below the MT adding up to a significant cumulative amount of subsidence is more effectively addressed through the cumulative cap proposed for Option 2.

Options 2 and 3 both would protect the basin from inelastic groundwater subsidence but would not be triggered by extremely small subsidence events. Option 2 and 3 differ in that with Option 2, an undesirable result would occur if over five years, small but significantly cumulative amounts of subsidence occurred in a localized area (2.5 acres). For Option 3 to be triggered by small amounts of subsidence, the subsidence would need to occur in 25 acres or more, and the land must include infrastructure or development. For this reason, Option 2 is more protective of groundwater resources.

Advisory Committee Process and Input

Attachment 2 provides a summary of the AC meetings during which the land subsidence SMC was discussed. In addition, information packets were also sent to AC members via email between meetings. The memo also summarizes the input received from the AC regarding various components of the SMC, including the development of undesirable result options.

Requested Board Action

Provide feedback to staff on the overall approach to the draft SMC for land subsidence, and consider approval of one of the three draft options presented, with the understanding that all of the SMCs will be revisited in total prior to final adoption.

Fiscal Information

None.

Vote Required

Majority vote required.

List of Attachments

1. Summary of Advisory Committee activities and input provided

Contact

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Technical Memorandum

July 21, 2020

To: Ann DuBay, Administrator, Sonoma Valley Groundwater Sustainability Agency
Jay Jasperse, Director of Groundwater Management, Sonoma Water

From: Timothy K. Parker, Senior Facilitator

Subject: Sonoma Valley Advisory Committee Process and Input on Land Subsidence Sustainable Management Criteria

The purpose of this memo is to summarize the Sonoma Valley Groundwater Sustainability Agency Advisory Committee (AC) process and input on the land subsidence sustainable management criteria (SMC) discussion and recommendations to the Sonoma Valley Groundwater Sustainability Agency Board (Board).

The current Staff analysis of the baseline, which has been conveyed to the AC, is that no measurable subsidence has been recorded in the Sonoma Valley groundwater subbasin.

On the dates below in 2020, the AC met covering the following **subsidence SMC** topics:

- **May 12 – General Topics: SGMA consideration and background information:** Staff suggested an approach to describing significant and unreasonable conditions, metrics and measurement/monitoring, a technical methodology for evaluating minimum thresholds and measurable objectives, and defining undesirable results.
- **June 6 – General Topics: Key points and consideration reminders, range of options for Board consider for defining undesirable results:** The AC discussed concerns, preferences, and additional proposed modifications and other possible options.
- **Post June 6 AC Follow up Documents and Questionnaire:** The AC was asked about proposed groundwater level/pumping correlation methodology, *and responded with support*. The AC also indicated that the span of *three options for definition of undesirable results seemed reasonable for Board consideration. The majority of responses preferred Option Two with one preference for Option Three (see below)*. *Other responses indicated* that the proposed area in Option Three may be too large and the inclusion of developed land may be inappropriate. Six responses received from the AC.
- **July 14 – Recap of past information and summary of input:** The AC expressed unanimous support to send the *three subsidence SMC options* to Board with a recommendation from the AC for **Option Two**. Seven AC Members present at AC meeting.

Final undesirable results options were presented at July 14 AC meeting. The undesirable result is triggered:

1. If the annual minimum threshold (0.1 feet total subsidence per year, measured at on InSAR pixel equivalent to 2.5 acres) is exceeded **or** five continuous years of subsidence ***in any area*** even if each year's annual subsidence rate is less than the minimum threshold
AND subsidence is determined to be correlated with groundwater level declines due to groundwater pumping.
2. If the annual minimum threshold is exceeded (0.1 feet total subsidence per year measured at one InSAR pixel equivalent to 2.5 acres) **or** within any five-year period the ***cumulative subsidence exceeds 0.2 feet total in any area*** (even if each year's annual subsidence rate is less than minimum threshold)
AND subsidence is determined to be correlated with groundwater level declines due to groundwater pumping.
3. If the annual minimum threshold is exceeded (0.1 feet total subsidence) **or** there are five continuous years of subsidence ***occurring over 25 contiguous acres (10 InSAR pixels) including developed land or infrastructure facilities***, even if each year's annual subsidence rate is less than the minimum threshold
AND subsidence is determined to be correlated with groundwater level declines due to groundwater pumping.

For all three options, the **Measurable Objective** is *Zero Subsidence* correlated with groundwater pumping based on hydrogeologic analysis.