



# Land Subsidence Best Management Practices Management Scenarios

The Department of Water Resources’ (DWR) Land Subsidence Best Management Practices<sup>1</sup> (BMP) outlines **four management scenarios** to assist groundwater sustainability agencies (GSAs) manage land subsidence.

This fact sheet summarizes each of the scenarios to provide a quick reference for GSAs and the groundwater community.

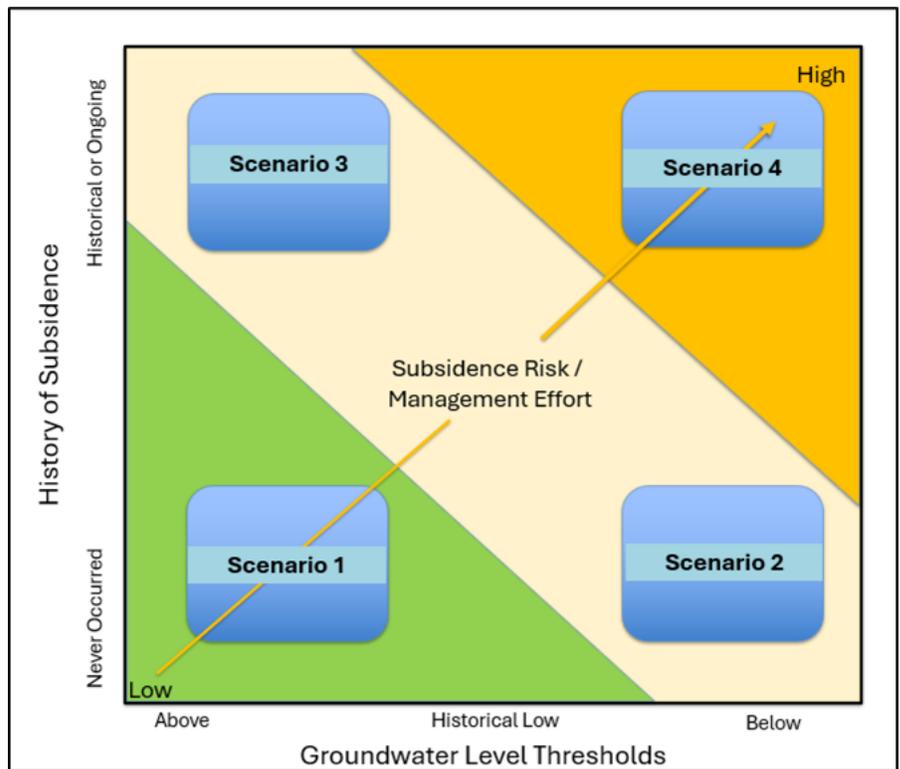
Each scenario is **based on two factors**:

1. Whether the area has experienced subsidence (historically or currently)
2. How the GSA has locally chosen to manage groundwater levels in its Groundwater Sustainability Plan (GSP). Specifically, how the GSA has established the Minimum Thresholds for groundwater levels to be above or below the historical low measurement. The four hypothetical subsidence management scenarios and

corresponding subsidence risk are shown in **Figure 1**.

The Scenario that applies to a basin may change over time as basin conditions and/or management approaches change.

For example, a **Scenario 2** basin will become a **Scenario 4** basin once subsidence is observed, and the basin manager should begin considering the actions under **Scenario 4** to manage land subsidence.



**Figure 1. Subsidence Management Scenarios**

<sup>1</sup> DWR. 2025b. Best Management Practices of the Sustainable Management of Groundwater. <https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents>

Similarly, a **Scenario 4** basin could become a **Scenario 3** basin if the basin manager revises groundwater level minimum thresholds to be above historical low.

The risk of subsidence and the management effort required by a GSA related to subsidence increases from a **Scenario 1** to a **Scenario 4**. In general, the farther groundwater levels are allowed to decline, the greater the risk of subsidence.

## Scenario 1

### No History of Subsidence, Groundwater Levels Above Historical Low

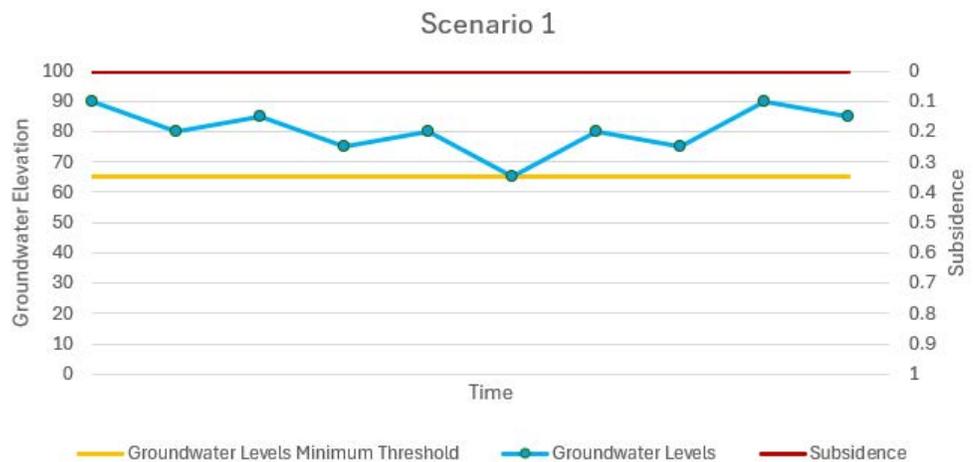
**Scenario 1** applies to areas within a basin that have no history of land subsidence, and the groundwater manager has set minimum thresholds that do not allow groundwater levels to drop below the historical low. The likelihood of land subsidence in this scenario is low.

Management in **Scenario 1** focuses on using readily available land subsidence data as part of monitoring basin conditions to ensure they do not change. Given the low likelihood of land subsidence and the availability of public monitoring sources such as Interferometric Synthetic Aperture Radar (InSAR) data, devoting significant resources to develop a locally maintained, dedicated land subsidence monitoring network and/or performing modeling related to future land subsidence is likely not warranted.

*The groundwater manager may consider the following actions to manage subsidence in this scenario:*

- Utilize all available monitoring data to evaluate whether land subsidence is occurring.
- Continue to manage groundwater levels at or above recent groundwater levels.

**Figure 2.**  
Example Scenario 1 showing no history of subsidence and management of groundwater levels above the historical low



## Scenario 2

### Area with No History of Subsidence, Managing Groundwater Levels Below Historical Low

**Scenario 2** applies to areas within a basin that have not experienced land subsidence, and the groundwater manager has set thresholds that may allow groundwater levels to fall below the historical lows.

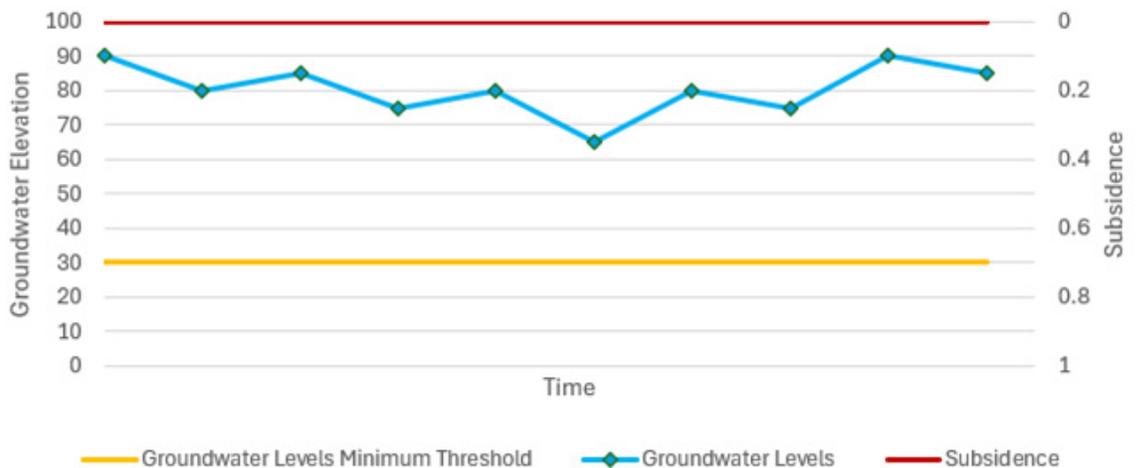
In this scenario, the likelihood that land subsidence will occur is increased by the decline of basin groundwater levels and the amount of fine-grained units present.

*The groundwater manager may consider the following actions to manage subsidence in this scenario:*

- Review the lithology of the aquifer and identify where the presence of fine-grained sediments and declining groundwater levels increases susceptibility to subsidence.

- Monitor basin conditions using readily available land subsidence data.
- Utilize all available monitoring data and increase the frequency of monitoring data (groundwater levels and subsidence) to evaluate whether land subsidence is occurring.
- Be aware of infrastructure in the area that could be impacted by land subsidence.
- Coordinate with the managers of infrastructure to understand the potential impacts of subsidence.
- Establish sustainable management criteria to identify the onset of land subsidence.
- Cease further groundwater level declines if land subsidence is observed.
- Raise groundwater levels to the critical head level if land subsidence is observed.

**Figure 3.**  
Example Scenario 2 showing no history of subsidence and management of groundwater levels below the historical low

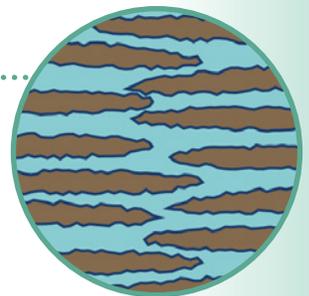


## Did You Know?

➤ **DWR is actively supporting GSAs with the installation of subsidence monitoring stations through the Technical Assistance Program.**<sup>2</sup> So far, this program has successfully installed over 30 monitoring stations throughout California which assist local GSAs with understanding subsidence conditions in their area. Pictured right is a new continuous GPS station and corner reflector installed in the Sacramento Valley by this program in 2025. DWR also provides InSAR monitoring of subsidence, which is updated four times each year, and is available on DWR's webpage: <https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer#landsub>.



➤ **Land subsidence can happen where fine-grained sediments are present below ground.** Fine-grained sediments like clays and silts are made of tiny, flat, plate-like particles. Water sits in the small spaces between these "plates" and separates them. When groundwater is pumped, and the groundwater level declines, the support for the "plates" decreases, and they become packed closer together, causing the layer to become thinner and the ground above it to sink. The further groundwater levels decline, the greater the chance fine-grained particles will be dewatered and the greater risk for subsidence. More information on this process is available in the Subsidence BMP.<sup>3</sup>



➤ **Subsidence has already impacted the ability of water supply systems in California.** Water Conveyance facilities such as the California Aqueduct and Friant-Kern Canal have lost up to 46% and 60% of their respective conveyance capacities in certain areas due to subsidence.<sup>4</sup> When parts of canals in subsiding areas sink, the canals must be operated at a lower flow-stage to ensure that water doesn't overflow canal embankments.



➤ **Subsidence impacts and costs are not just limited to infrastructure.** Home sale prices in areas classified as having high subsidence rates were 5.38 percent lower compared to areas of no subsidence based on a recent analysis.<sup>5</sup>



2 <https://water.ca.gov/Work-With-Us/Technical-Assistance>.

3 California Department of Water Resources (DWR). 2025b. Best Management Practices of the Sustainable Management of Groundwater. <https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents>

4 California Department of Water Resources (DWR). 2025b. Best Management Practices of the Sustainable Management of Groundwater. <https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents>

5 California Department of Water Resources. (2025). Appendix I: Update on Land Subsidence in California. In: California's Groundwater: Bulletin 118 – Update 2025 (CalGW Update 2025). Sacramento, CA: California Department of Water Resources. Available at: <https://water.ca.gov/programs/groundwater-management/bulletin-118>

## Scenario 3

### Area with Subsidence, Managing Groundwater Levels Above Historical Low

**Scenario 3** applies to areas within the basin that have experienced, or are currently experiencing, land subsidence, and the groundwater manager has set minimum thresholds at or above the historical low. Subsidence will be minimized once groundwater level declines cease, and so stabilizing and raising groundwater levels should be the first step in managing subsidence.

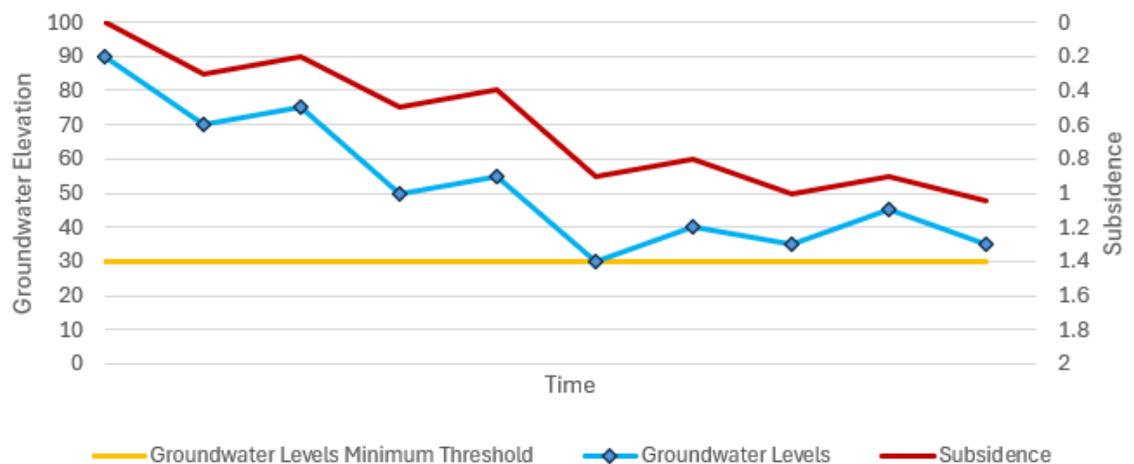
Once groundwater levels are stabilized, residual subsidence may continue to occur at a rate dependent on how high and how quickly groundwater levels are raised above the critical head level by the groundwater manager.

*The groundwater manager may consider the following actions to manage subsidence in this scenario:*

- Utilize all available monitoring data and increase the frequency of monitoring data.

- Determine the critical head level and model future residual subsidence.
- Be aware of infrastructure in the area that could be impacted by land subsidence.
- Coordinate with infrastructure managers to understand the potential impacts of subsidence.
- Set and reevaluate sustainable management criteria to identify the amount of land subsidence that would be significant and unreasonable for surface land uses.
- Cease further groundwater level declines if land subsidence is observed.
- Set triggers to implement specific projects and management actions to limit residual subsidence if impacts to infrastructure occur.
- If the subsidence is occurring in adjacent basins, coordinate with groundwater managers in adjacent basins to understand regional subsidence management strategies.

**Figure 4.**  
Example Scenario 3 showing an area with subsidence and management of groundwater levels above the historical low



## Scenario 4

### Area with Subsidence, Managing Groundwater Levels Below Historical Low

**Scenario 4** applies to areas within a basin that have experienced, or are currently experiencing, land subsidence, and the groundwater manager has set minimum thresholds that **allow groundwater levels to continue to decline below historical lows**. In this scenario, subsidence is likely to continue and is not being minimized by the groundwater manager, presenting the **highest risk for subsidence** of all four scenarios.

*The groundwater manager may consider the following actions to manage subsidence in this scenario:*

- Utilize all available monitoring data and increase the frequency of monitoring data.
- Calculate the critical head level and how much future subsidence could occur based on the allowable groundwater level declines.
- Increase frequency and distribution of monitoring and measure extraction near infrastructure.

- Ensure significant and unreasonable land subsidence is not occurring.
- Reevaluate sustainable management criteria at each periodic evaluation.
- Be aware of infrastructure in the area that could be impacted by land subsidence.
- Coordinate with the managers of infrastructure to understand recent and projected impacts as well as realized and anticipated costs to repair infrastructure from land subsidence.
- Coordinate with local land use and well permitting agencies.
- Initiate projects and management actions to raise groundwater levels to the critical head level. The schedule, scope and initiation of the PMA's should occur as soon as possible.
- Immediately reduce groundwater demand in areas experiencing land subsidence.
- Shift pumping from an area susceptible to subsidence to areas not susceptible to subsidence.
- If the subsidence is occurring in adjacent basins, coordinate with groundwater managers in adjacent basins to understand regional subsidence management strategies.

**Figure 5.**  
Example Scenario 4 showing an area with subsidence and management of groundwater levels below the historical low

