Public Meeting Series

September 9-11, 2025

Best Management Practices of the Sustainable Management of Groundwater

DRAFT

Land Subsidence

BMP

Public Meeting Series

September 9, 2025
3:00 PM
Clovis

Best Management Practices of the Sustainable Management of Groundwater

DRAFT
Land Subsidence

BMP

Interpretation in Punjabi Available

Grab a headset if you want to hear this presentation in Punjabi.

Interpreters are in the sound booth if you have any questions.

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Housekeeping

- Bathrooms and water are in the lobby.
- Printed materials are available.
- Safety moment:
  - Identify your closest emergency exit.
- This meeting is being recorded and may be made available to the public.

Welcome and Introductions

Ground Rules

- Use conversational courtesy
- Hold **clarifying questions** until the questions portion of the agenda
- Please share your **public comments** during the public comment portion of the agenda
  - Both written and verbal comments will be included in the public record

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Today's Agenda

- Welcome and Introductions
- Opening Remarks
- Presentation on Draft BMP
- Clarifying Questions
- Public Comment

Today's Speakers

Keith Wallace
Assistant Deputy Director
Sustainable Water Management

Paul Gosselin
Deputy Director
Sustainable Water Management

Ben Brezing
Supervising Engineer
Sustainable Groundwater Management Office

Shane Edmunds
Supervising Engineering Geologist
Sustainable Groundwater Management Office

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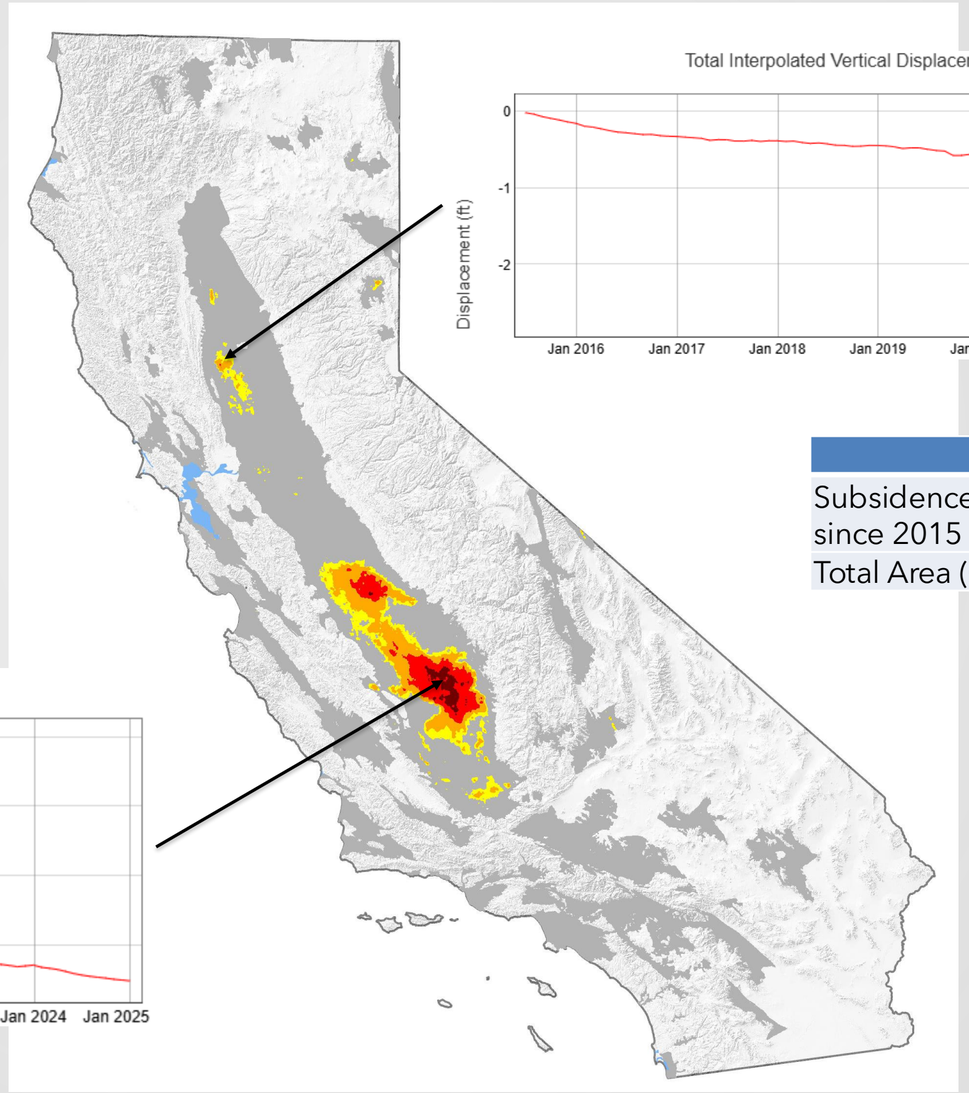
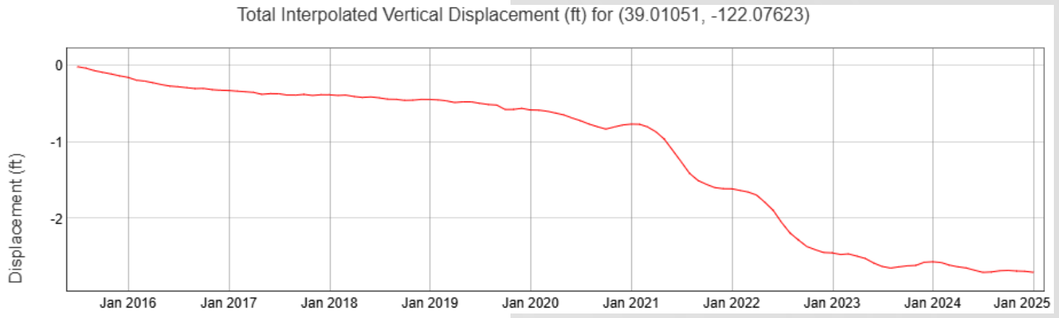
Subsidence BMP

9/09/2025 – 9/11/2025

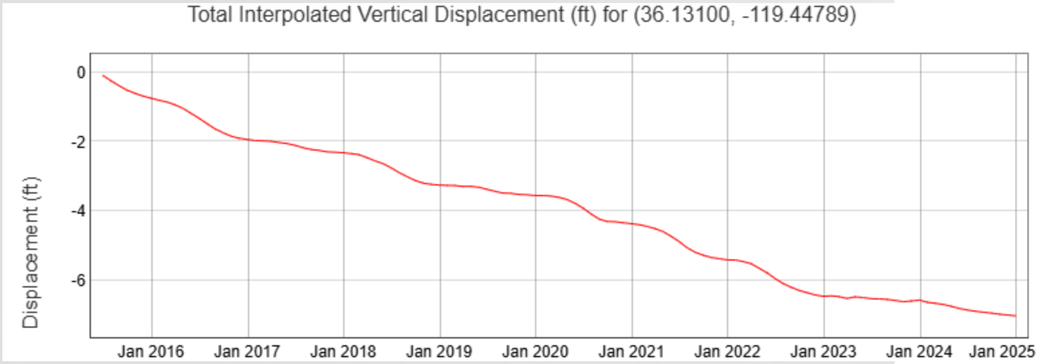
Recent Subsidence Data

- Recurring increases in subsidence during dry years
- Minimum Threshold exceedances





Subsidence (ft) since 2015	>0.5	>1	>2.5	>5
Total Area (sq mi)	4,959	3,256	1,384	258



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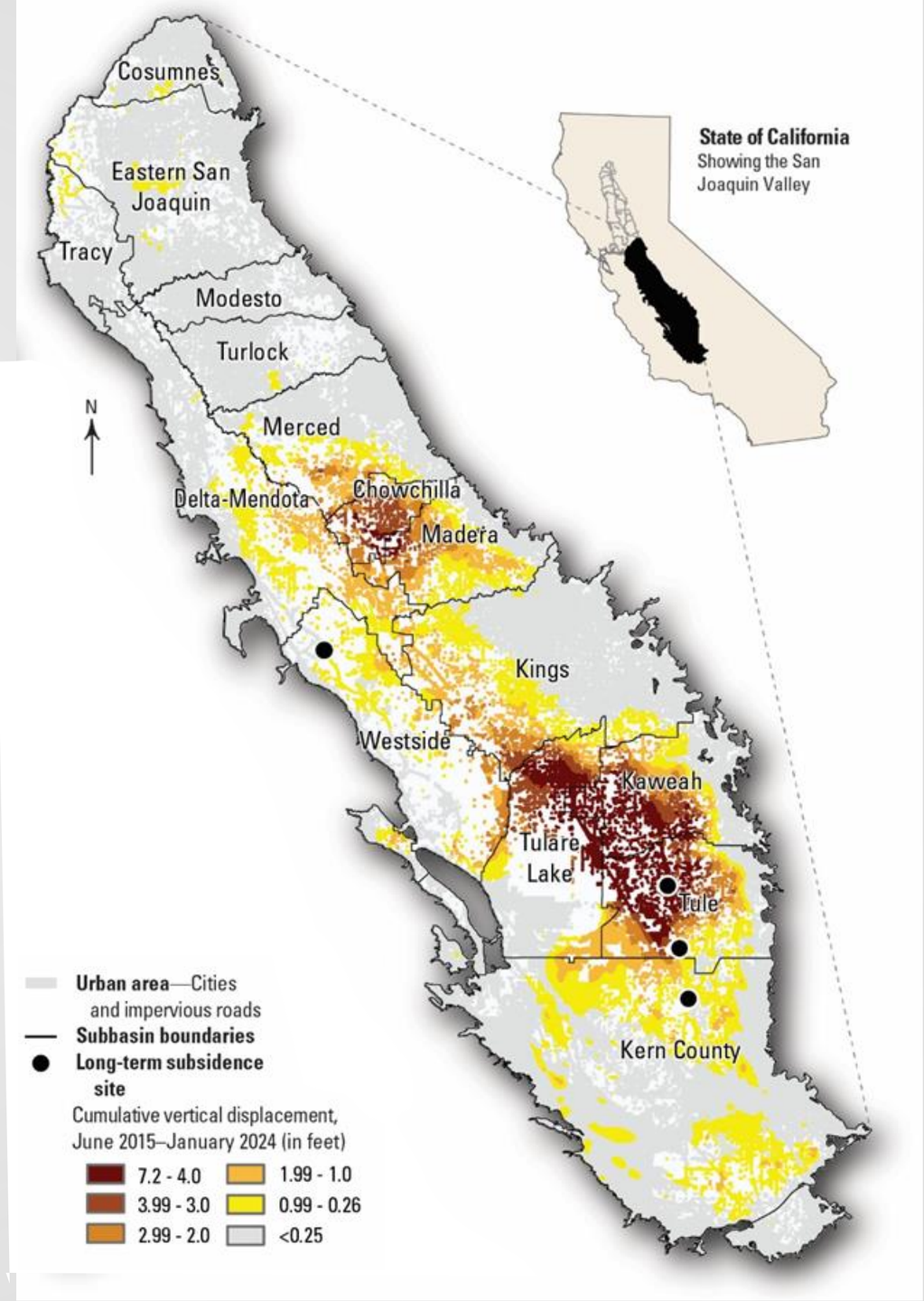
San Joaquin Valley Subsidence Conditions

- Two large merging areas
  - Chowchilla, Madera
  - Tule, Kaweah, Tulare Lake
- Impacts to infrastructure
  - Canals: Federal, State, Local
  - Flood protection
  - Wells, road, etc.



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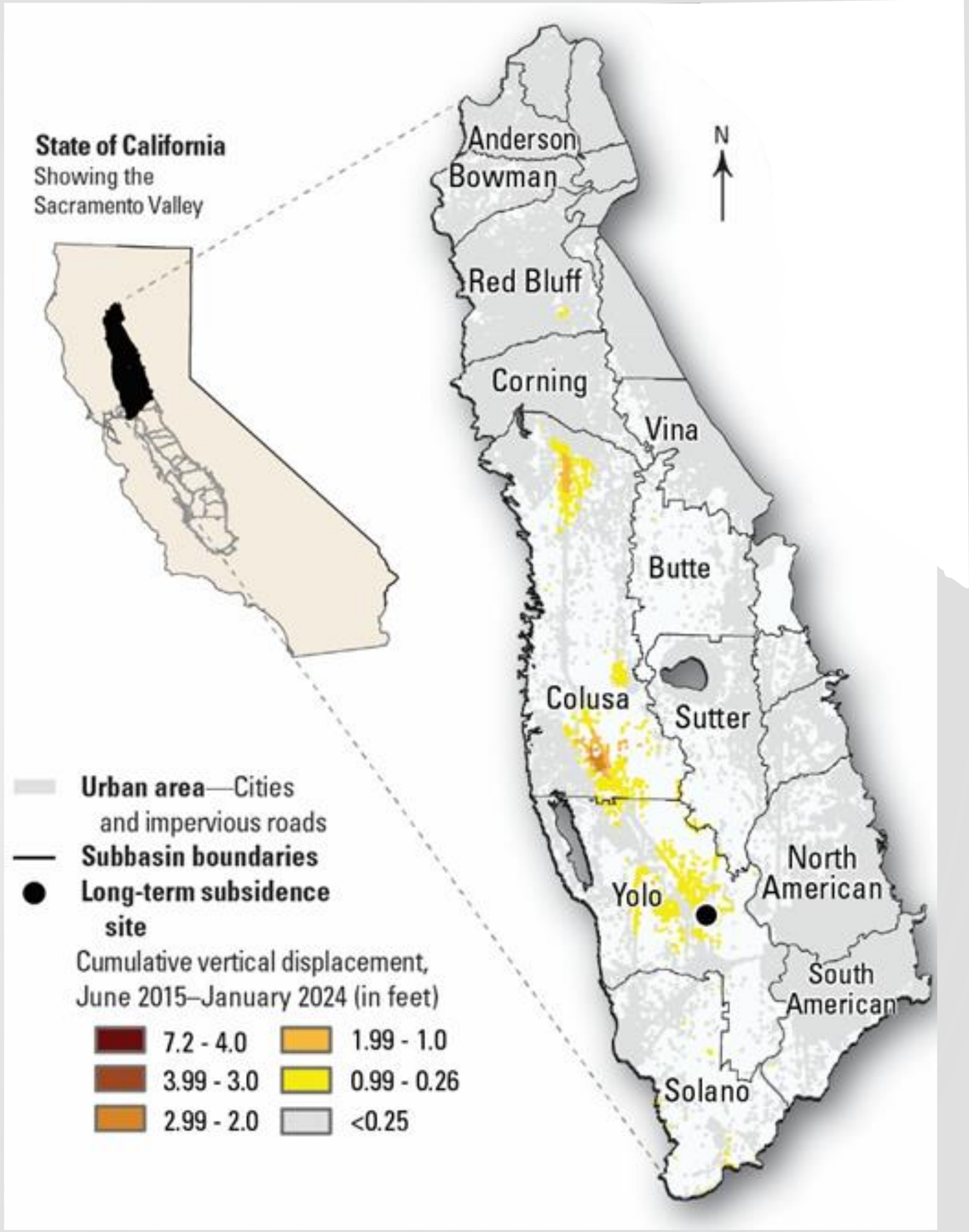
Sacramento Valley Subsidence Conditions

- Three currently isolated areas
  - Woodland / Yolo County
  - Arbuckle
  - Artois / Orland
- Impacts to infrastructure
  - Canals: Federal
  - Flood Levee / Bypasses
  - Wells, Roads, Etc.



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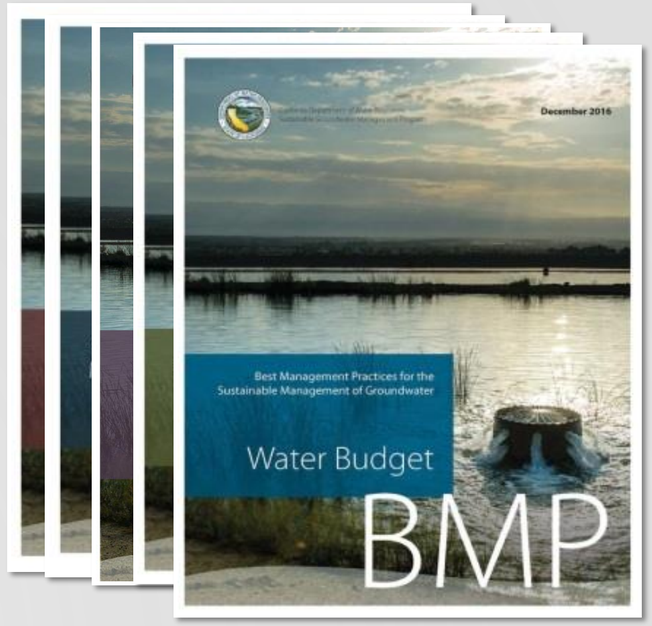
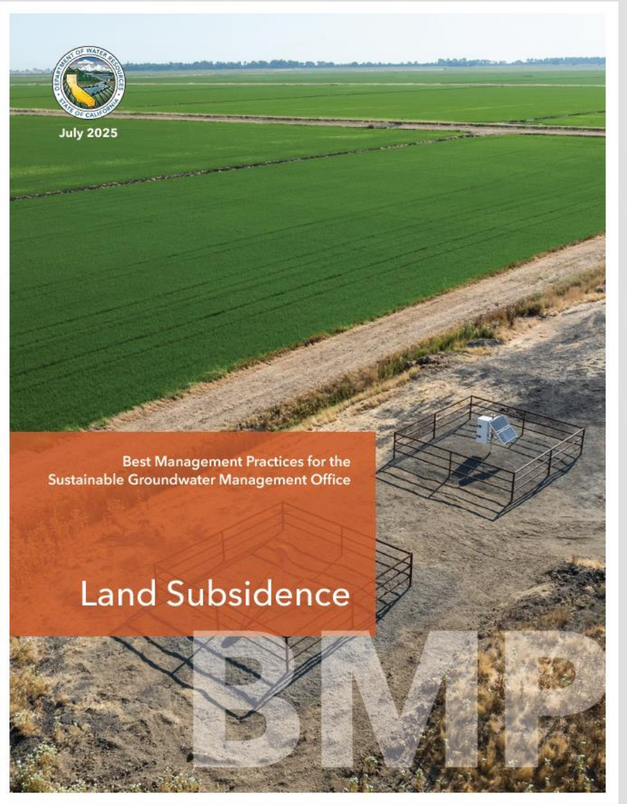
BMPs for SGMA

- Identify best practices to assist GSAs with SGMA implementation
- Can be incorporated into future regulation updates
- SGMO has now released 7 BMPs
  - Monitoring Protocols, Monitoring Network, Hydrogeologic Conceptual Model, Water Budget, Modeling, and DRAFT Sustainable Management Criteria, and Land Subsidence.



Subsidence BMP

- Goals of Subsidence BMP
  - Applicable to every SGMA basin, whether it has or hasn't experienced subsidence
  - Provide multiple pathways to manage subsidence



BMP Contents

Seven Chapters plus Six Appendices

- Objective
- Uses and Limitations
- Relationship to other BMPs
- Fundamentals of Subsidence
- Technical Assistance
- Land Subsidence and SGMA
- Land Subsidence Management

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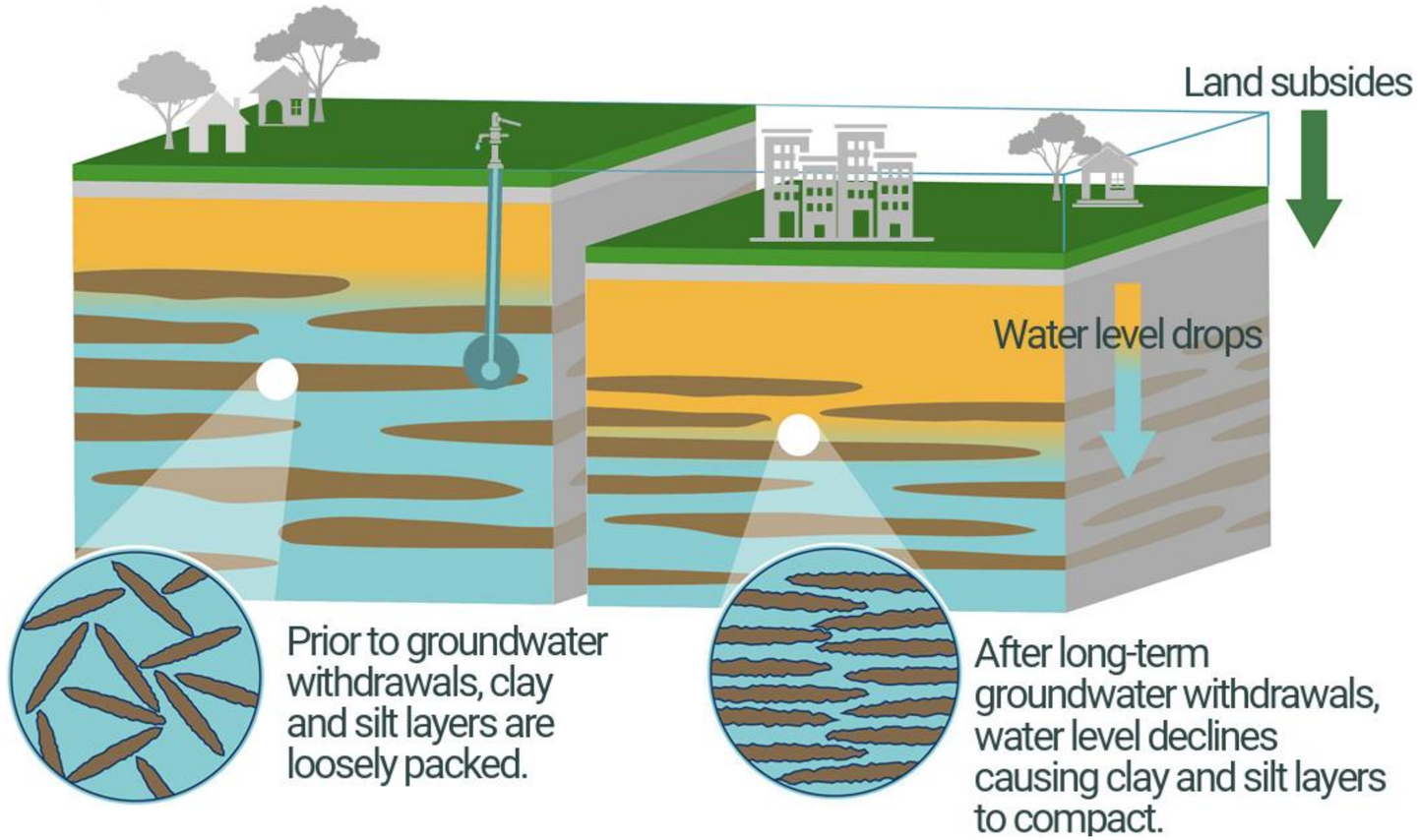
Fundamentals Chapter

- Technical content which answers key questions including:
  - What is subsidence?
  - What causes subsidence?
  - How do you stop subsidence?
  - Is subsidence reversible or permanent?
  - How does groundwater level management affect subsidence?
  - Is there a water level threshold where subsidence will not occur?

Fundamentals Chapter: Key Concepts

- **Compaction** – Vertical decreases in aquifer-system thickness.

- **Causes:**
  - Groundwater Extraction
  - Oil and Gas Extraction
  - Peat Oxidation
  - Tectonic Activity



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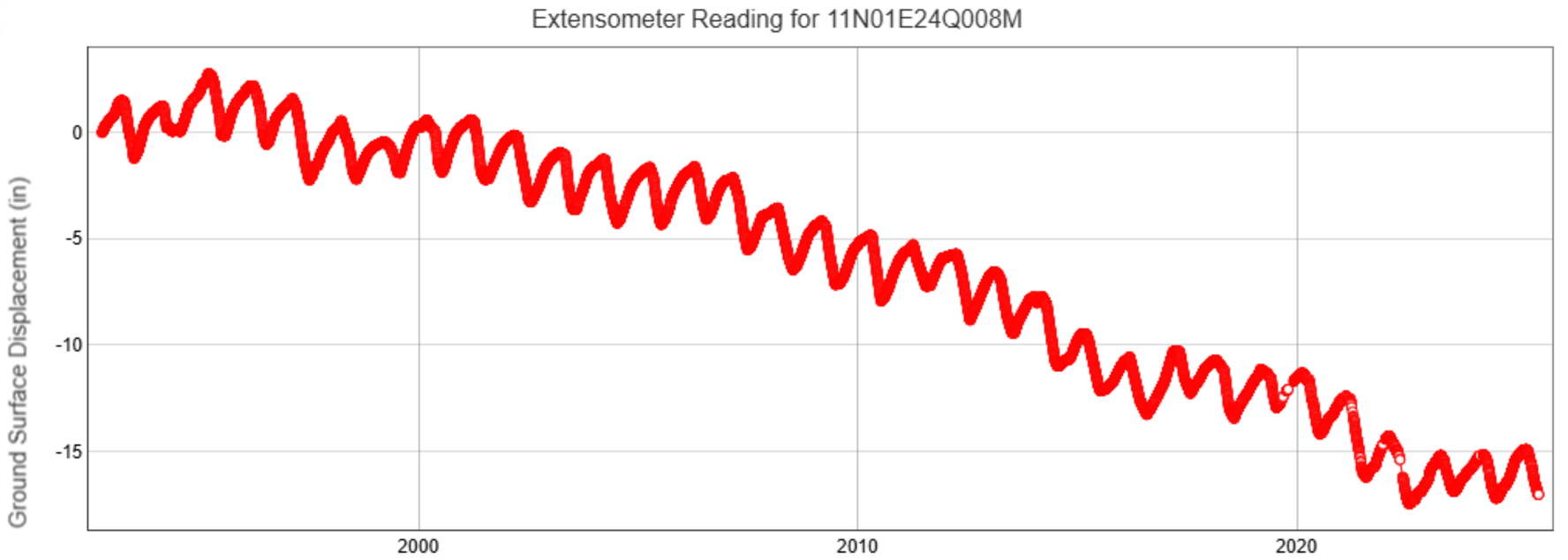
Fundamentals Chapter: Types of Subsidence

- **Elastic (reversible) Subsidence –** small changes in land surface elevation that can be reversed if groundwater levels are raised
- **Inelastic (irreversible) subsidence –** changes in land surface elevation that are permanent due to the restructuring of fine-grained sediment



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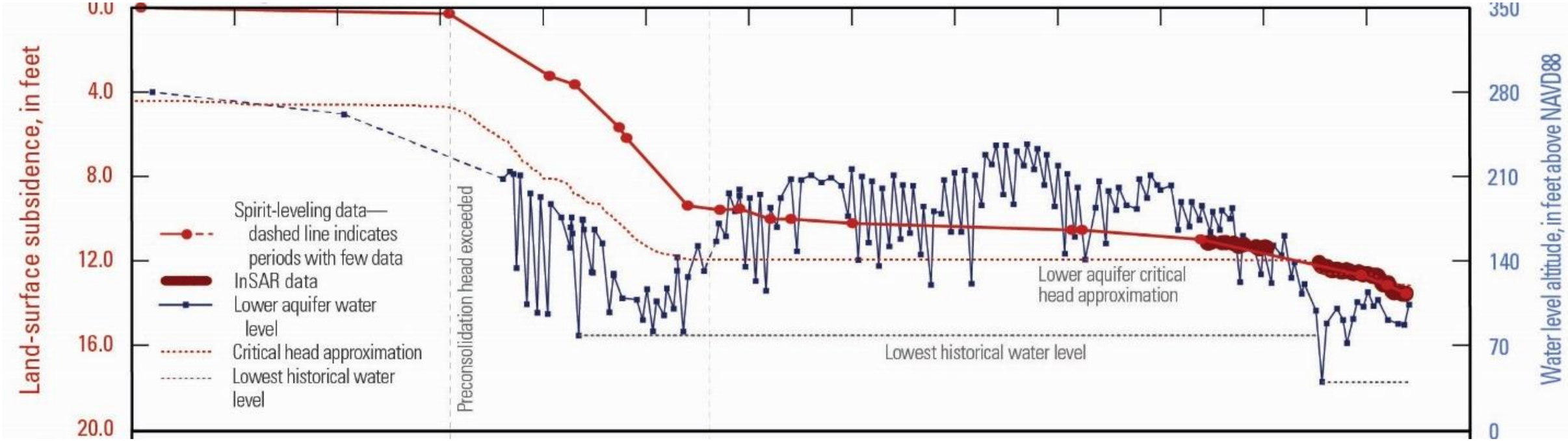
Fundamentals Chapter - Critical Head

- **Critical Head:** Groundwater level below which inelastic subsidence is caused. Varies over time as groundwater levels decline. Can be estimated in multiple ways and varies by location.



Source: Draft BMP

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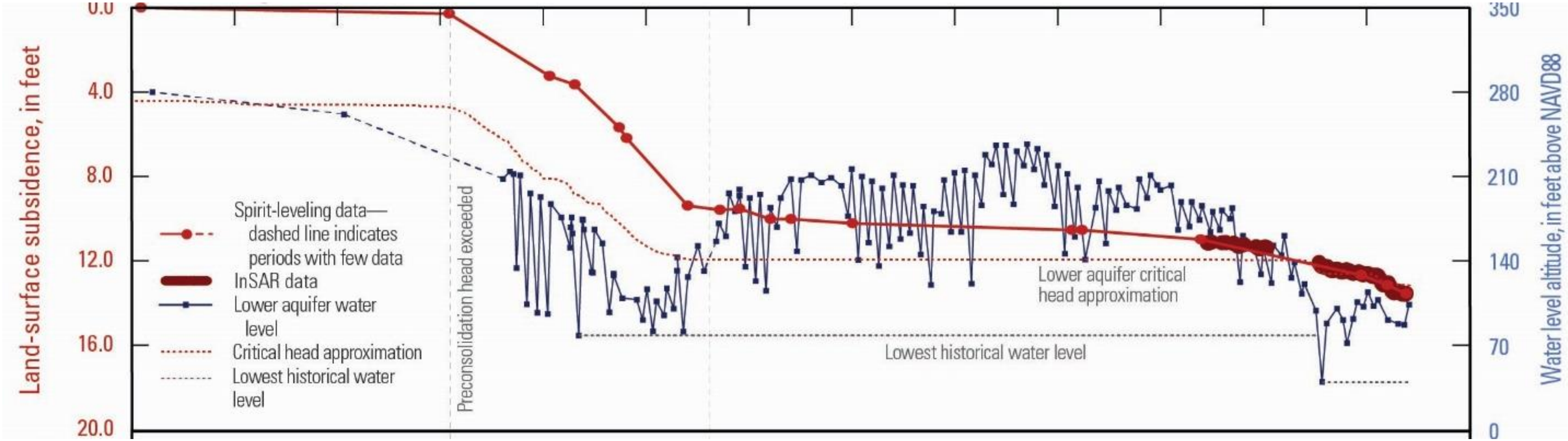
Fundamentals Chapter – Residual Subsidence

- **Residual Subsidence**: the continued decrease in land surface elevation even after the groundwater levels have stabilized or are recovering



Source: Draft BMP

Fundamentals Chapter - Key takeaways

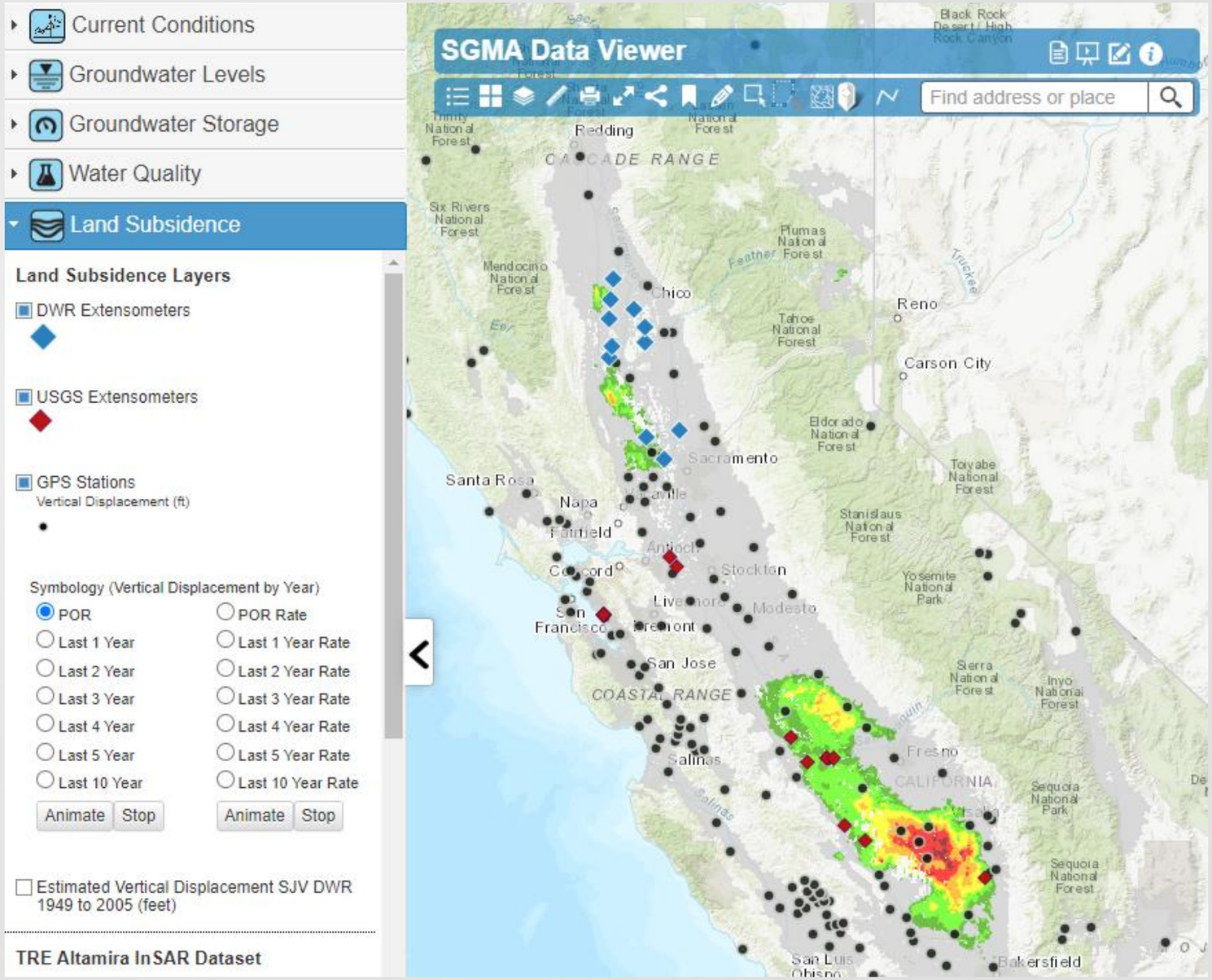
- Subsidence is effectively minimized only when groundwater levels are allowed to rise as rapidly and as much as possible above groundwater levels at which subsidence can occur
- Groundwater levels have to be managed adaptively to make subsidence targets achievable

Technical Assistance Chapter

- Technical content which answers key questions including:
  - How do you measure subsidence?
  - What is infrastructure and how to coordinate with entities responsible for the operation and maintenance of it?
  - How do you calculate critical head?
  - How do you model subsidence?

Technical Assistance: Monitoring Methods

- InSAR (remote sensing)
- Continuous Global Positioning Stations (GPS)
- Spirit Leveling
- Extensometers



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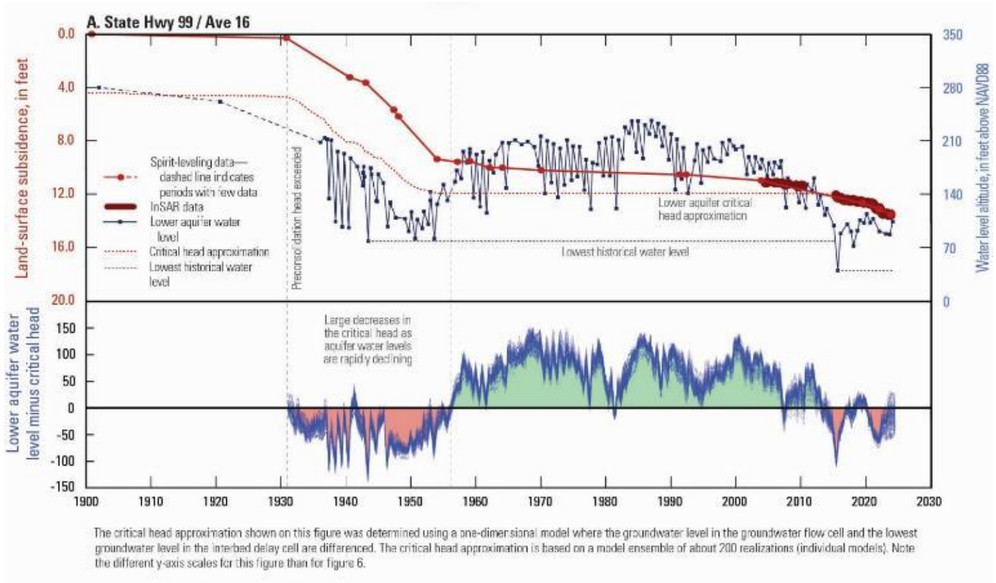
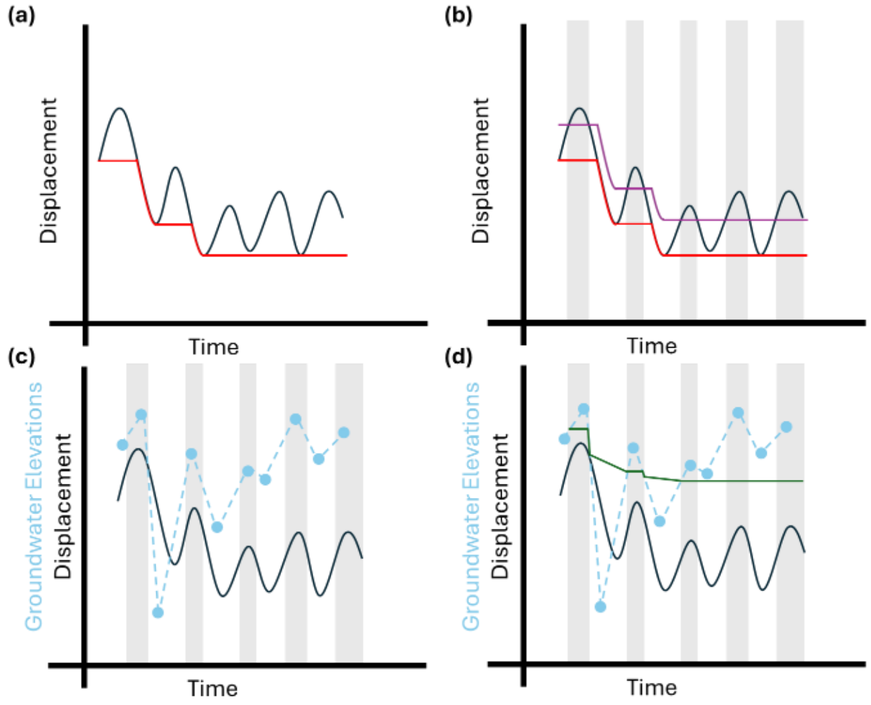
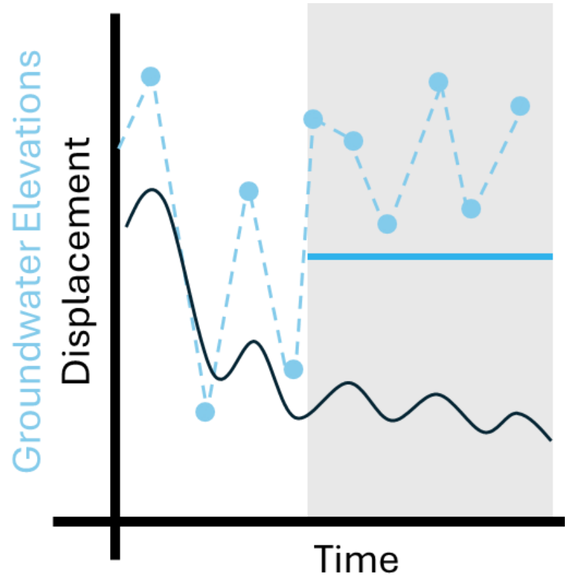
Technical Assistance: Estimating Critical Head

- Methods to estimate critical head







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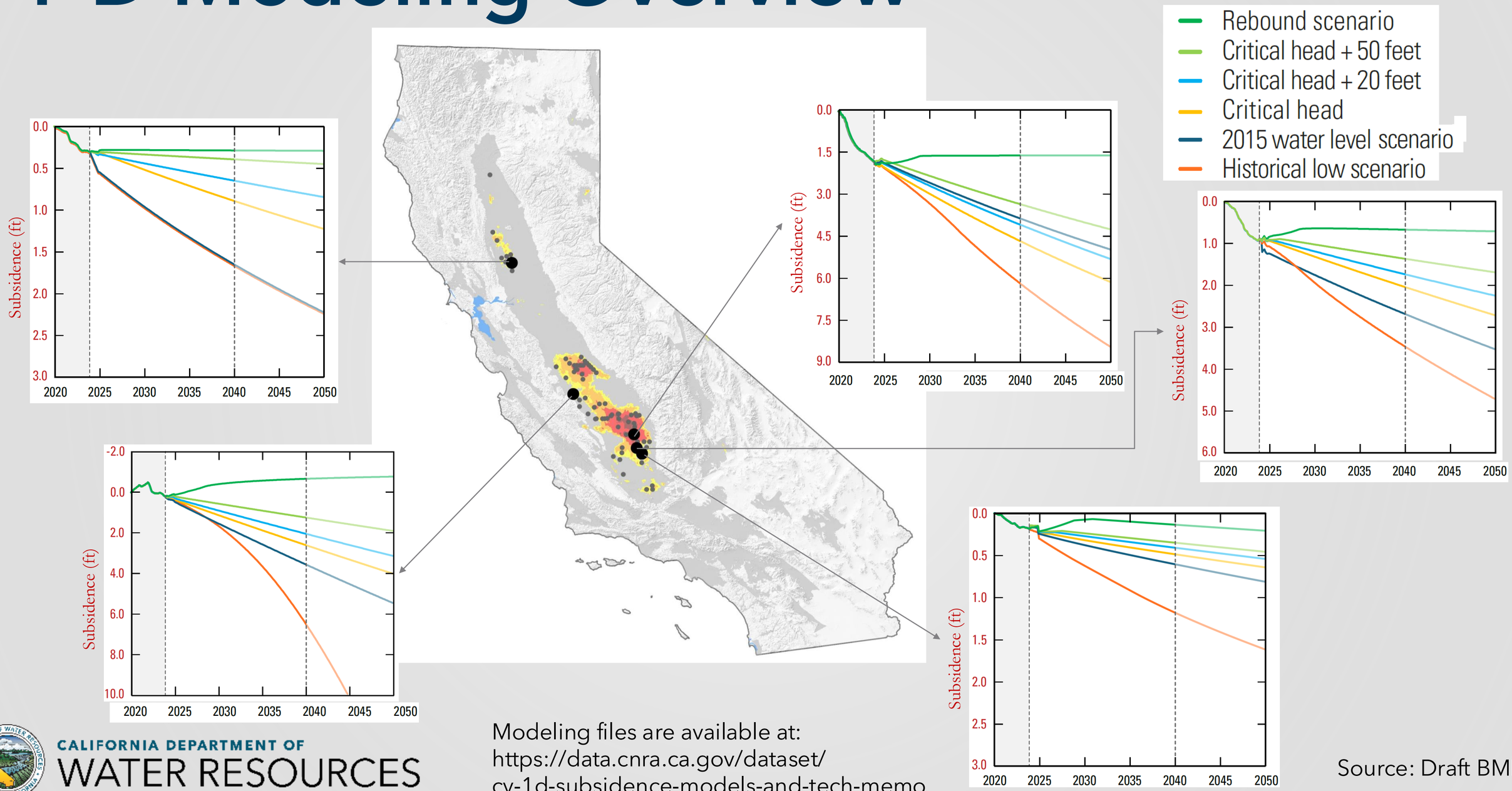
Technical Assistance: Identifying Infrastructure

- Any land use or property interest that has been or is likely to be affected by land subsidence
- When identifying infrastructure, groundwater managers should
  - assess specific impact criteria that may limit functionality or performance
  - consider that groundwater pumping in areas susceptible to subsidence may cause subsidence not only near extraction but in the surrounding areas as well

1-D Modeling Overview

Subsidence Simulation Groundwater Level Scenario Examples



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Modeling files are available at:
https://data.cnra.ca.gov/dataset/cv-1d-subsidence-models-and-tech-memo

Source: Draft BMP

Technical Assistance Chapter - Key takeaways

- Subsidence is measured with multiple methods, and considerable amounts of subsidence data are available
- Future subsidence can be modeled based on groundwater levels, but there is uncertainty
- Critical head can be estimated, but it also involves uncertainty

Land Subsidence Management Chapters

- **Mix of policy and technical content designed to answer key questions including:**
  - What are the best practices to manage subsidence under SGMA?
  - How should I adapt my groundwater level management with consideration of subsidence?
  - What are some general best practices to manage subsidence?
  - How do I engage interested parties and adjacent basins to discuss subsidence?
  - How should I consider managing my basin given its history of subsidence and my chosen thresholds for groundwater levels?

Management Chapters: SMC Recommendations

- Undesirable results should be based on impacts to surface land uses.

- Continuously evaluate whether undesirable results are occurring based on qualitative and quantitative definitions.

- Adaptively manage sustainable management criteria for land subsidence and provide updates in annual reports and periodic evaluations.

Management Chapters: SMC Recommendations

- Minimum thresholds (MTs) should be developed to avoid significant and unreasonable impacts to surface land uses and developed in conjunction with the entities responsible for infrastructure.

- MTs should include a cumulative amount of subsidence that would lead to undesirable results based on impacts, not based on a model result.

- MTs should be set to zero in areas that have not experienced subsidence.

Management Chapters: Monitoring under SGMA

- Subsidence monitoring networks should use all available data.

- Monitoring for subsidence and groundwater levels should be developed throughout all subsiding areas at a distribution and density to understand the cause, rate, and extent of the subsiding areas.

- Monitoring site distribution and frequency should be increased in areas where infrastructure is present.

Management Chapters: GWLs and Subsidence

- Groundwater Sustainability Agencies (GSAs) must evaluate the relationship between groundwater levels and subsidence.

- GSAs are required to provide evidence that groundwater level management has not and will not lead to undesirable results for subsidence.

- Sustainable management criteria for groundwater levels should be adaptively managed during implementation if more subsidence than estimated is occurring and as conditions change.

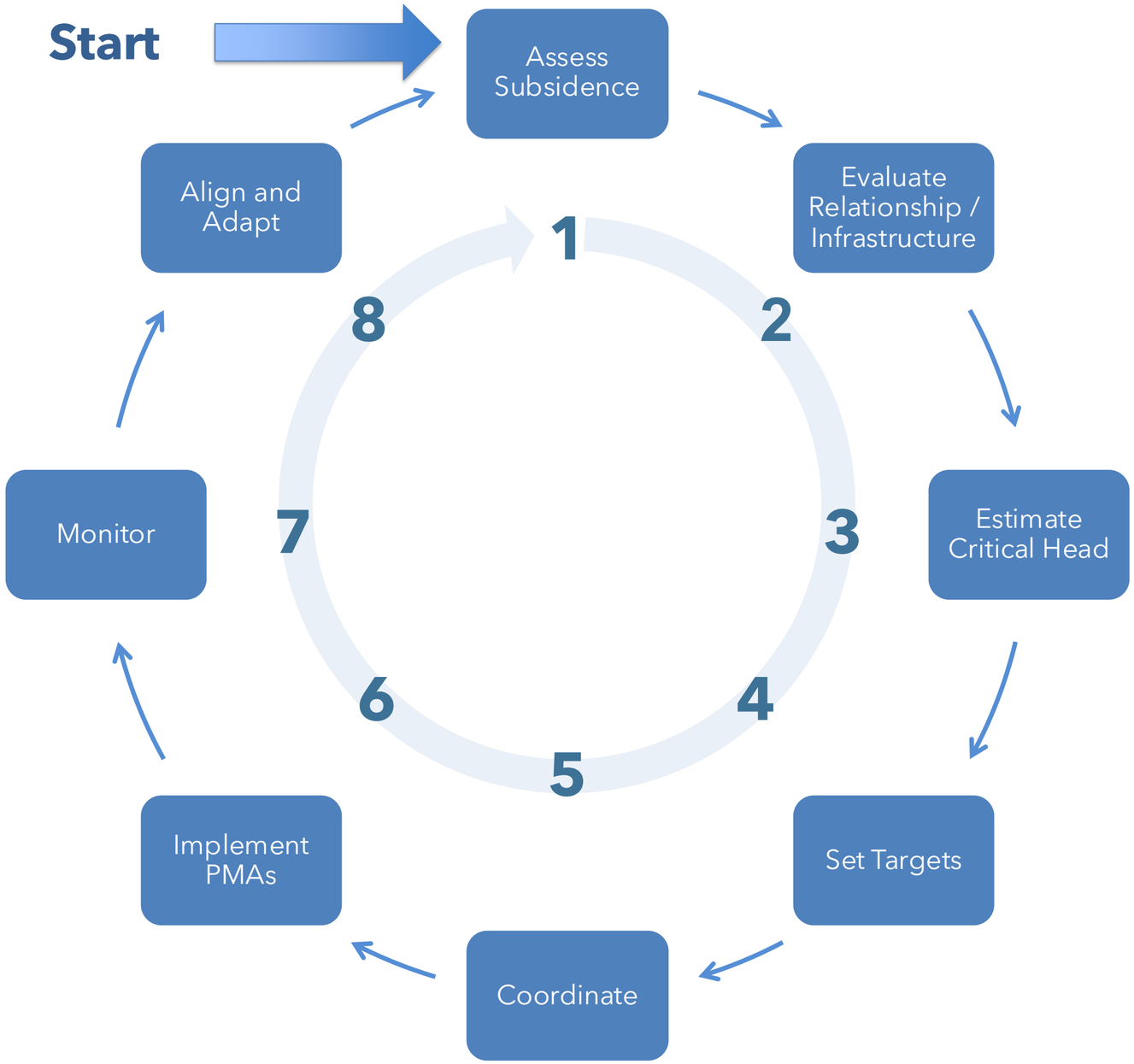
Management Chapters: Coordination

- Coordination is critical for successful subsidence management.

- Intra-basin coordination should be led by the GSAs with infrastructure managers, groundwater users, and interested parties to develop goals for subsidence management.

- Inter-basin coordination with GSAs and infrastructure managers is important to ensure individual basin management is not causing undesirable results in an adjacent basin.

Management: General Best Practices



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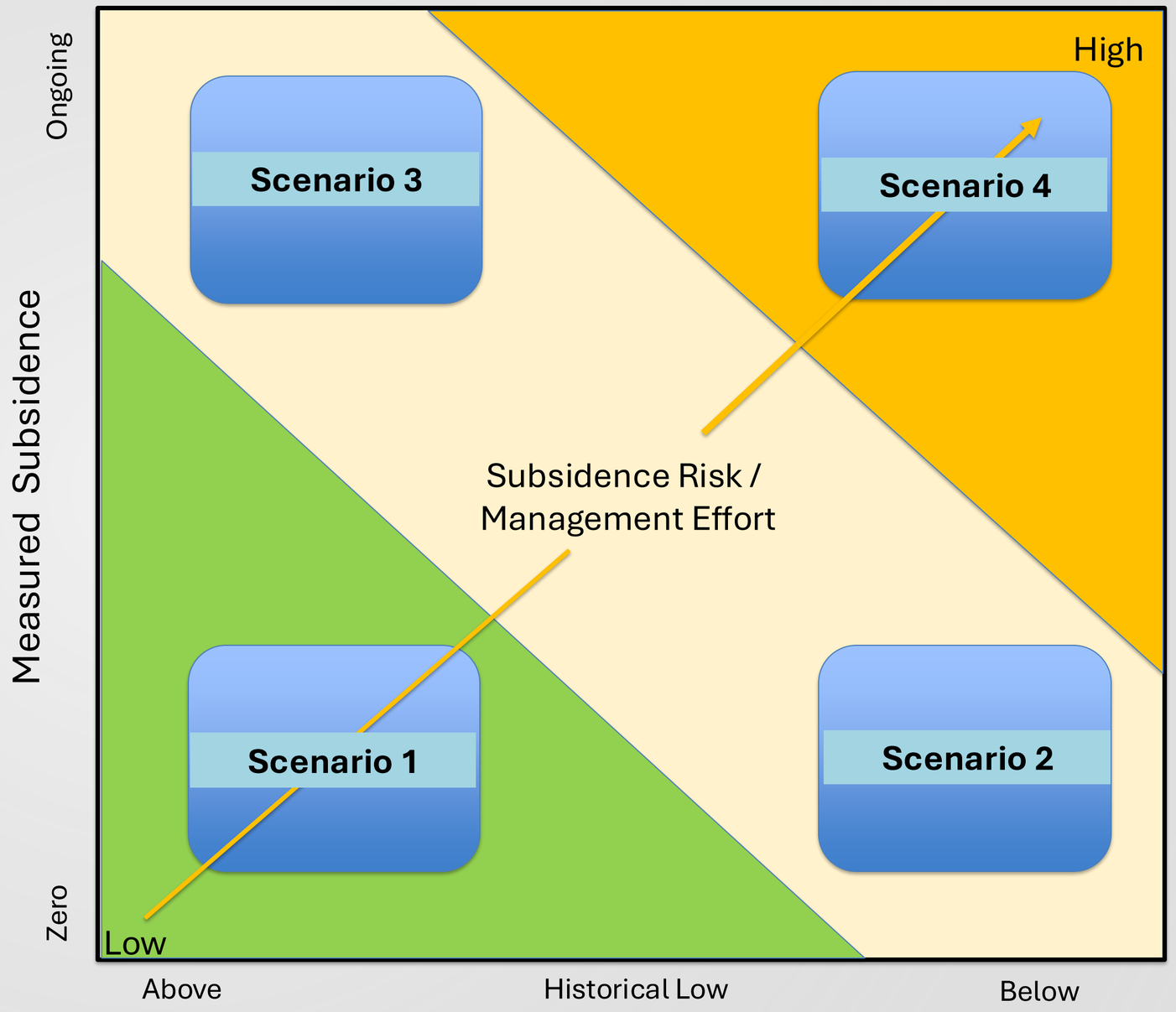
Management Scenarios

Scenarios help guide level of effort and expectations based on subsidence risk



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Management Scenario 1

No history of subsidence, managing water levels above historical low

Recommendations:

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

Management Scenario 2

No history of subsidence, managing water levels <u>below historical low</u>

Recommendations:

- Review the lithology of the aquifer.
- Utilize all available monitoring data to evaluate whether land subsidence is occurring.
- Set sustainable management criteria for land subsidence.
- Coordinate with the managers of infrastructure to understand the potential impacts of subsidence.
- Stop declines and raise water levels upon the onset of subsidence.

Management Scenario 3

History of subsidence, managing water levels above historical low

Recommendations:

- Utilize all available monitoring data and increase the frequency of monitoring.
- Determine critical head level.
- Set thresholds based on the tolerance of infrastructure to residual subsidence.
- Coordinate with the managers of infrastructure to understand impacts and associated repair costs due to subsidence.
- Set triggers to implement specific projects or management actions to limit residual subsidence if impacts to infrastructure occur.

Management Scenario 4

History of subsidence, managing water levels <u>below historical low</u>

Recommendations:

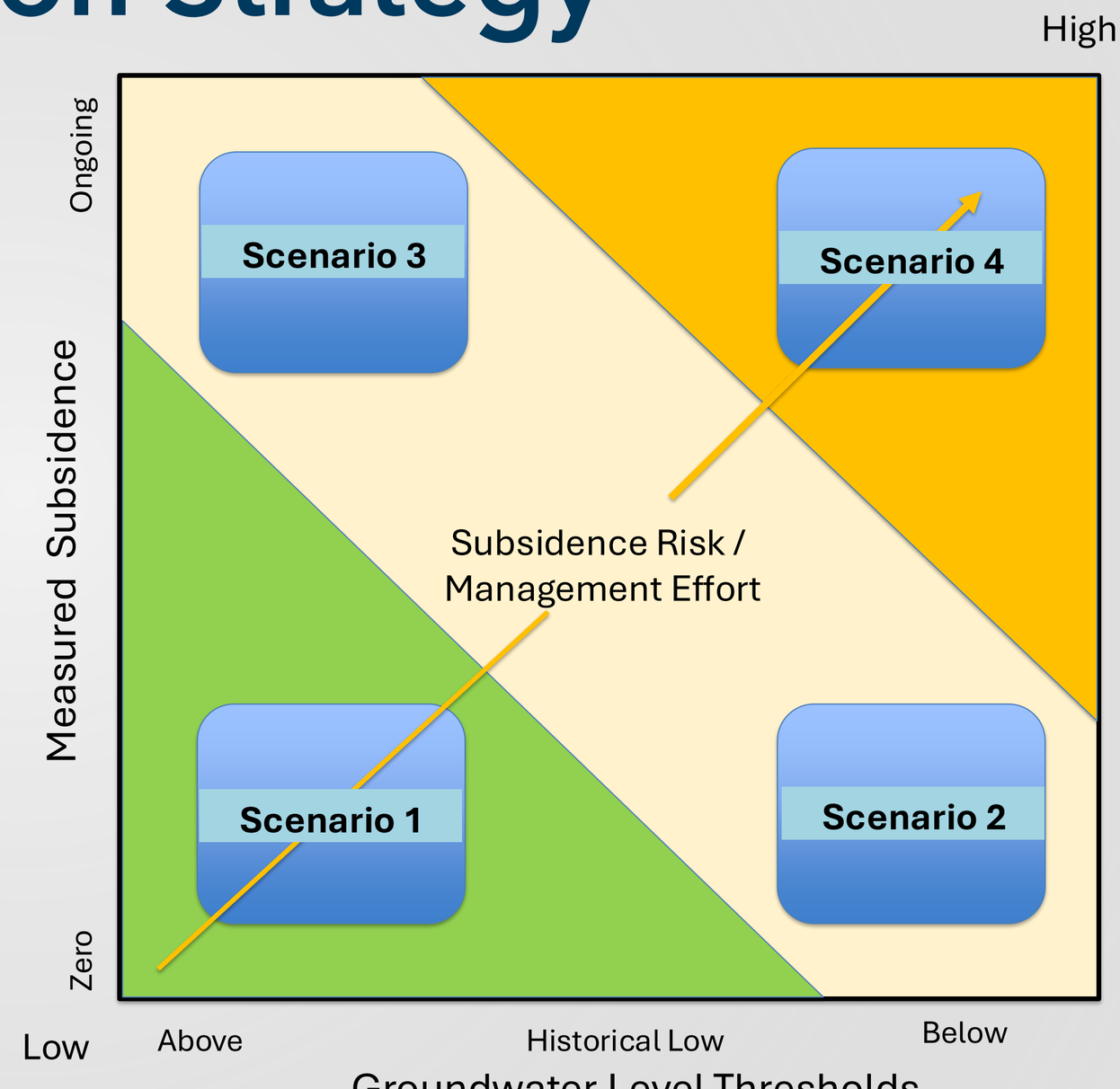
- Utilize all available monitoring data and increase the distribution and frequency of groundwater level, groundwater extraction, and land subsidence monitoring.
- Determine critical head level.
- Coordinate with the managers of infrastructure to estimate impacts and potential costs to repair infrastructure from land subsidence.
- Set thresholds based on the tolerance of infrastructure.
- Stop declines and raise water levels above critical head.
- Initiate projects and management actions to reduce demand and shift pumping away from subsiding areas.

Management Chapter - Key takeaways

- Subsidence can be managed, but it is difficult as it requires a stop to overdraft.
- Due to uncertainty and consequence, it is best to set conservative goals.
- Variable management strategies exist based on local conditions and regional coordination.

BMP Implementation Strategy

- Establish Expectations and Schedule
- Offer Assistance and Engagement
- Gauge Basin Response
- Evaluate Acceptability



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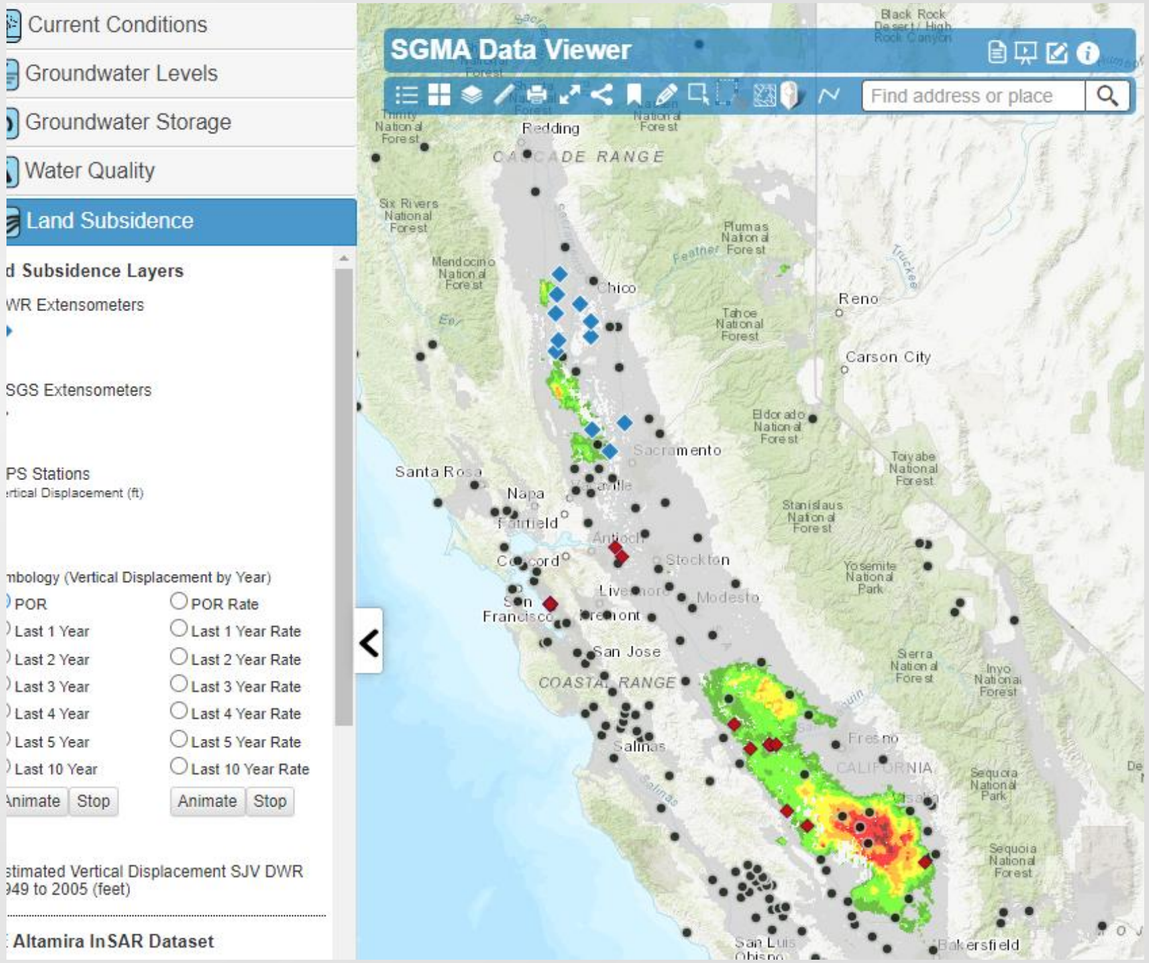
BMP Implementation Strategy

- **DWR Assistance**
  - Quarterly InSAR Data
  - Facilitation Support Services
  - Technical Support Services
  - Statewide GW Monitoring
  - Modeling
- **Facilitate Regional Implementation**



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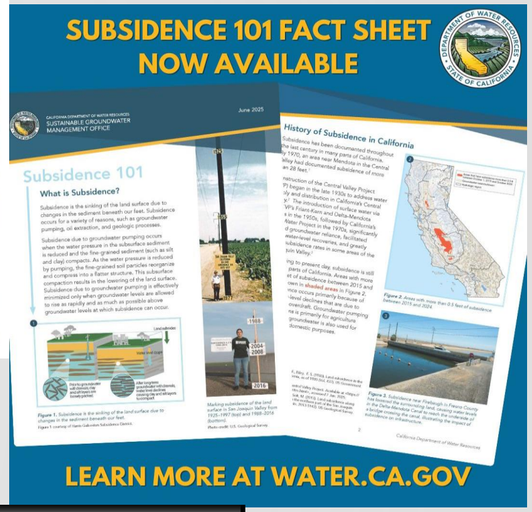
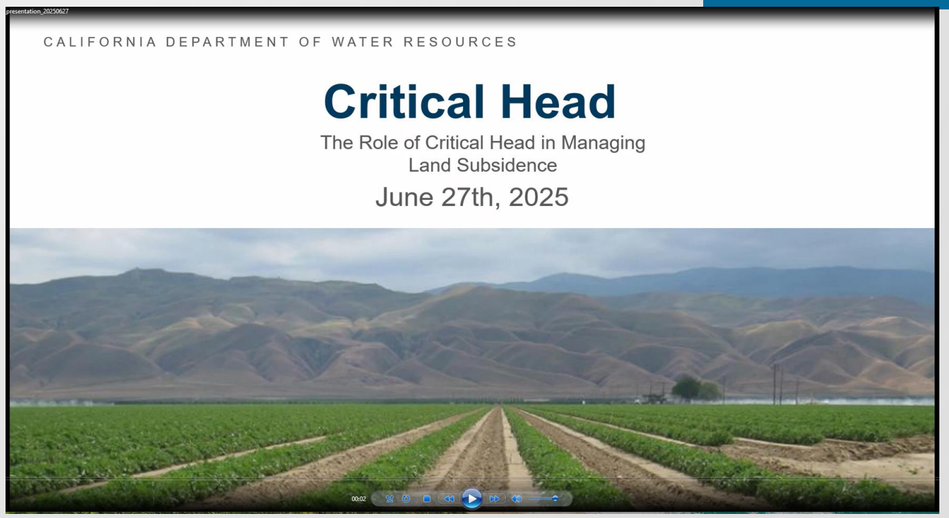
Education Campaign

- New website
- Social media posts
- Videos
- Factsheets for public audience
- Technical materials for practitioners





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Schedule

- Release of Draft BMP + Press Release – July 24
  - 60-day public comment period
- CA Water Commission Meeting – August 20
- Public meetings:
  - September 9: Clovis
  - September 10: Delano
  - September 11: Willows
- Final BMP – End of 2025

Questions

Turn the **blue card** in with your clarifying questions

Question Card

Date: _____

_____

_____

_____

_____

_____

Please select your preference for how your question is shared:

☐ I would like the facilitator to read my question aloud

☐ I would like to read my own question (please share your name below):

Name: _____

Questions will be directed to the appropriate DWR team member

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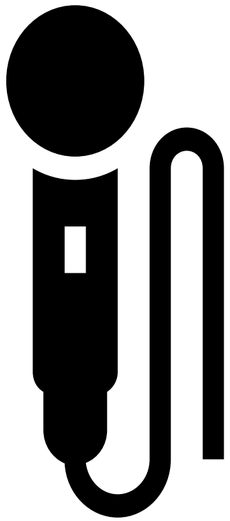
Public Comments

- Write your comments on the **pink card**
- Choose if you would like to verbally share your comment
- Comments will be recorded for the public record



Comment Card

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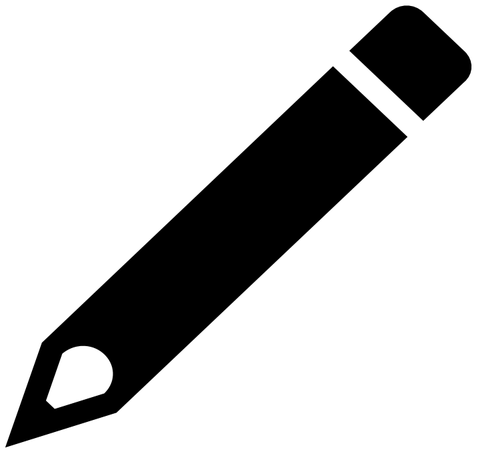
☐ I would like my comment to be a part of the public record but not read aloud



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Public Comment Process

Public comments due **September 22nd**

DWR reviews comments and makes revisions

DWR releases final Subsidence BMPs

To submit written comment:

Email Submittal

Letters should be submitted to **sgmps@water.ca.gov**

Electronic files should be PDF or Microsoft Word compatible.

Hard Copy via U.S. Mail

Letters should be addressed to:

Department of Water Resources
Sustainable Groundwater Management Office
ATTN: Subsidence BMP
P.O. Box 942836
Sacramento, CA 94236-0001

QR Codes

Subsidence 101 Factsheet

DWR Subsidence Webpage

Sustainable Groundwater Management Newsletter Signup

Draft Subsidence BMP

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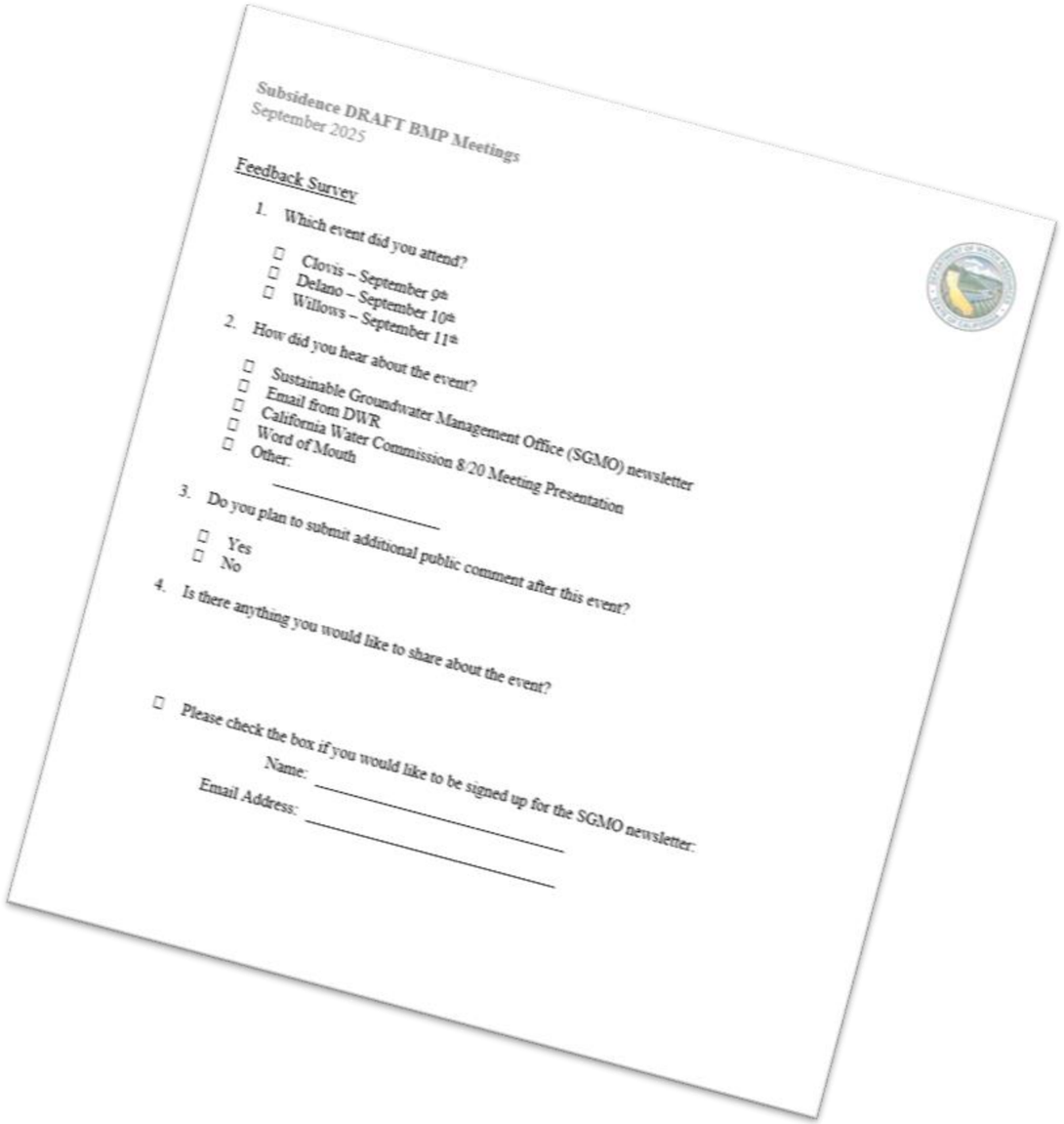
Don't forget to fill out the event survey!



Subsidence DRAFT BMP Meetings
September 2025

Feedback Survey

1. Which event did you attend?
   - ☐ Clovis – September 9th
   - ☐ Delano – September 10th
   - ☐ Willows – September 11th
2. How did you hear about the event?
   - ☐ Sustainable Groundwater Management Office (SGMO) newsletter
   - ☐ Email from DWR
   - ☐ California Water Commission 8/20 Meeting Presentation
   - ☐ Word of Mouth
   - ☐ Other: _____
3. Do you plan to submit additional public comment after this event?
   - ☐ Yes
   - ☐ No
4. Is there anything you would like to share about the event?

☐ Please check the box if you would like to be signed up for the SGMO newsletter:

Name: _____

Email Address: _____

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