

Corning Subbasin Groundwater Sustainability Plan

Technical Presentation

**Presented to Corning Subbasin Advisory Board
03/03/2020 | Teleconference**

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& ASSOCIATES**



Today's Meeting

- ▶ Review Chronic Lowering of Groundwater Levels SMC
 - ▶ Potential recommendations
- ▶ Introduction to Land Subsidence data and SMC
 - ▶ Potential recommendations
- ▶ Review Streamflow Depletion SMC Options
- ▶ Draft GSP Completion Process and Adoption Timeline
 - ▶ Recommendations to GSAs

Locally Defined Significant and Unreasonable Conditions for Each Sustainability Indicator Identify Problems that Need to be Resolved to Attain and Maintain Sustainability

Chronic Lowering of Groundwater Levels

- Domestic well users
- Ag well users

Land Subsidence

- Pumping
- Local geology

Degraded Groundwater Quality

- Movement of constituents of concern
- Existing programs


Depletion of Interconnected Surface Water

- Protection of Groundwater Dependent Ecosystems
- Beneficial users

Decreased Storage

- Water budgets
- Sustainable yield
- Pumping

- All are related to groundwater pumping
- Most can be linked back to declining groundwater levels one way or another
- That is why we start with groundwater levels SMC
- All SMC are interrelated
- Conjunctive use of both surface water and groundwater is key
- Projects and actions need to focus on sustainability of the Subbasin **as a whole**



Chronic Lowering of Groundwater Levels SMC

Review Proposed SMC

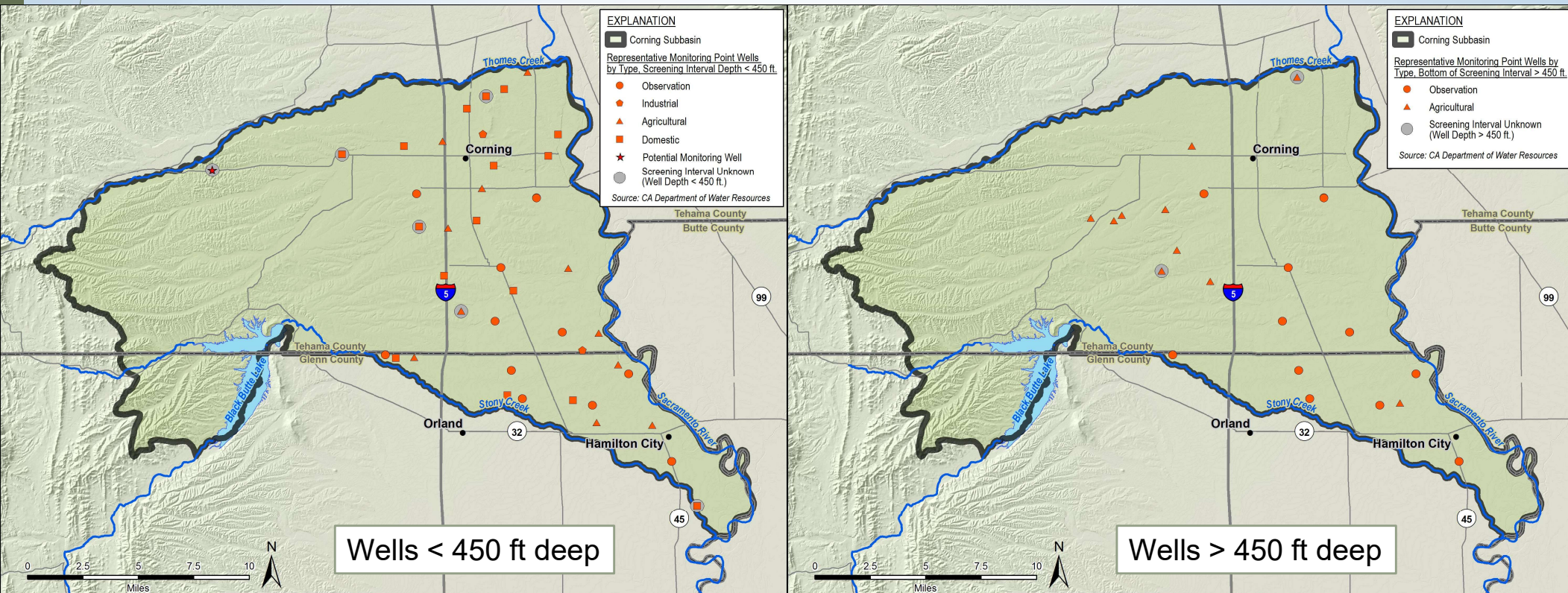


Significant and Unreasonable Conditions

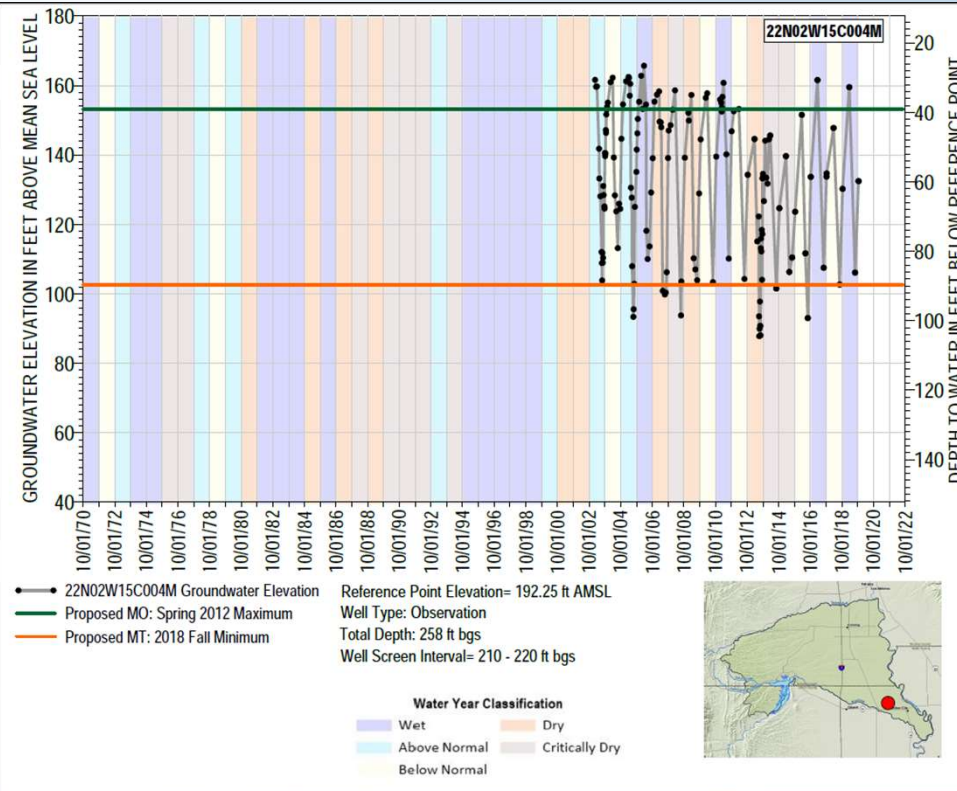
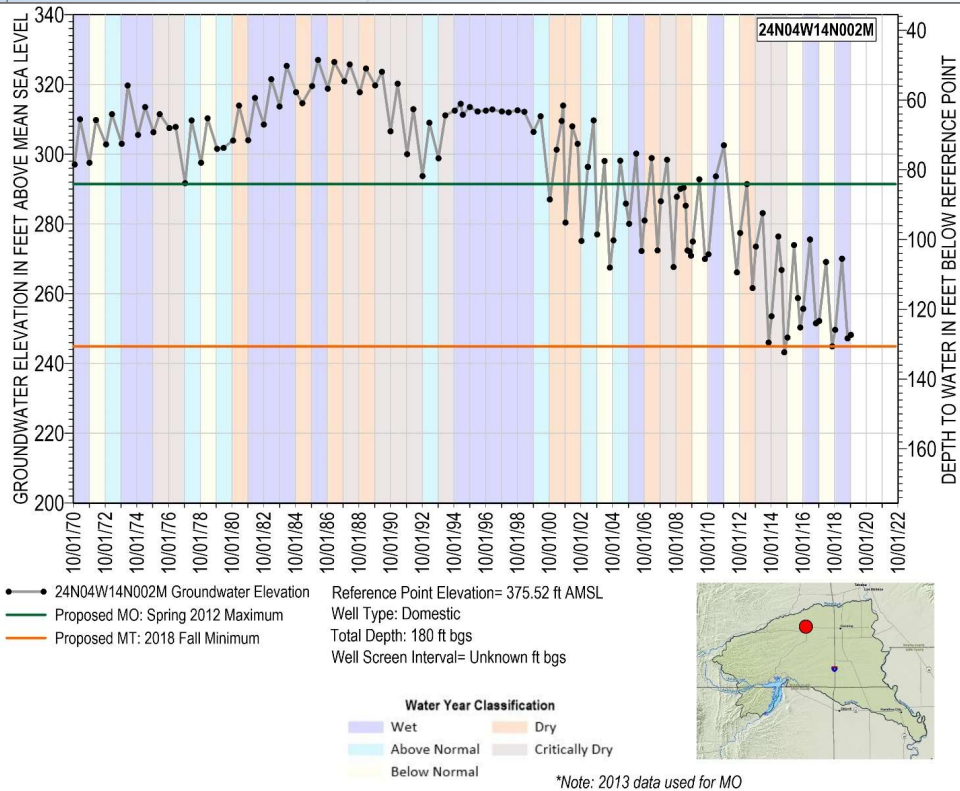
- ▶ Initial draft statement proposed and discussed at the October 2020 CSAB meeting:
- ▶ *Chronic lowering of groundwater levels is considered to be locally significant and unreasonable if it results in untenable financial burden or insufficient water supply to meet the needs of beneficial users in the Subbasin. Examples of untenable financial burden are significant and unreasonable costs for replacement of dry wells as well as pump lowering and additional energy costs for accessing groundwater at greater depths.*

Feedback from CSAB?

Groundwater Level Monitoring Network



Recent Trends in Water Level Declines and the Desire to Protect all Beneficial Users Guided Initial Development of Groundwater Minimum Thresholds (Fall 2018) and Measurable Objectives (Spring 2012)

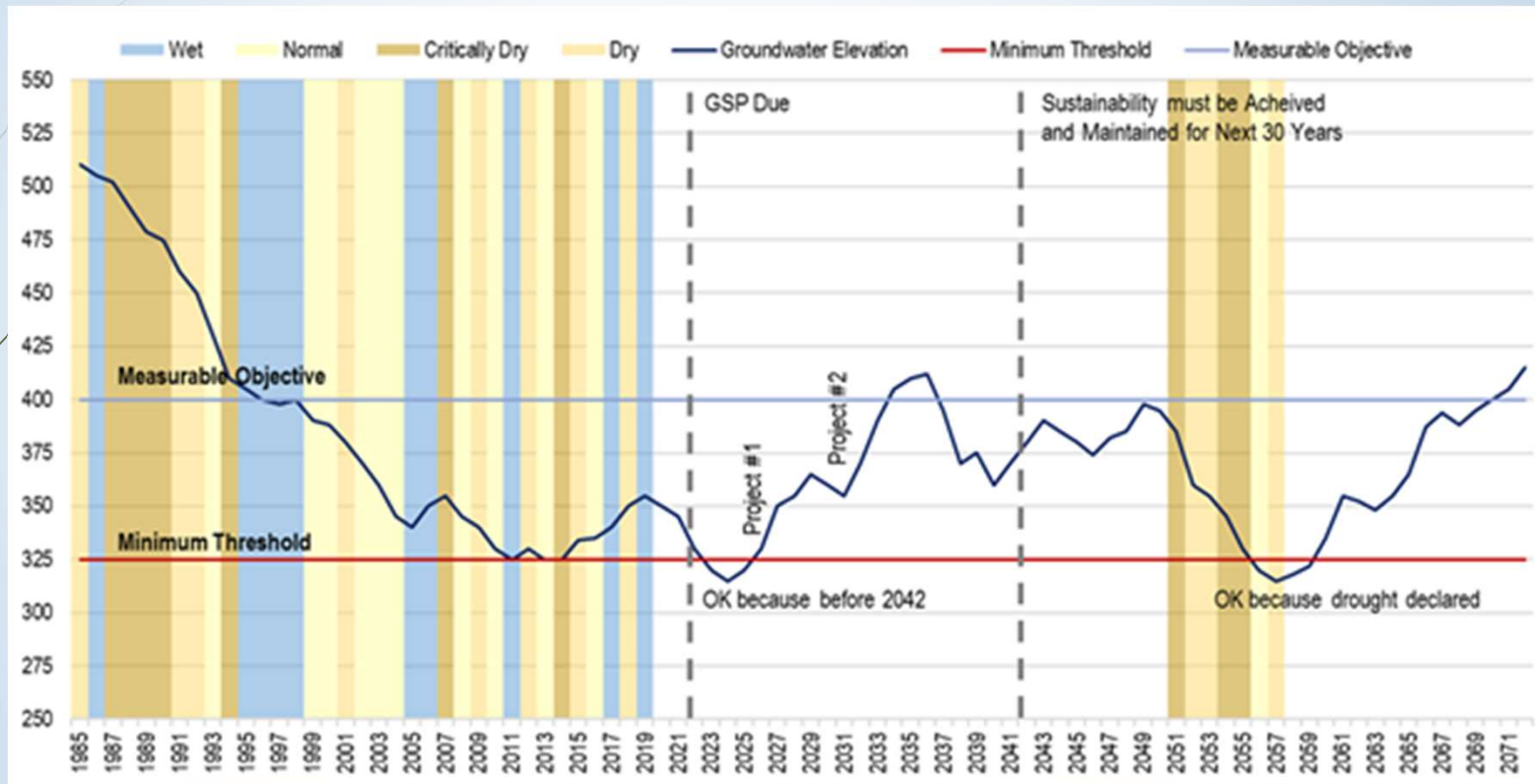


We have until 2042 to address any URs that may occur – SMC can be revised until 2042, based on monitoring and additional data and projects and actions

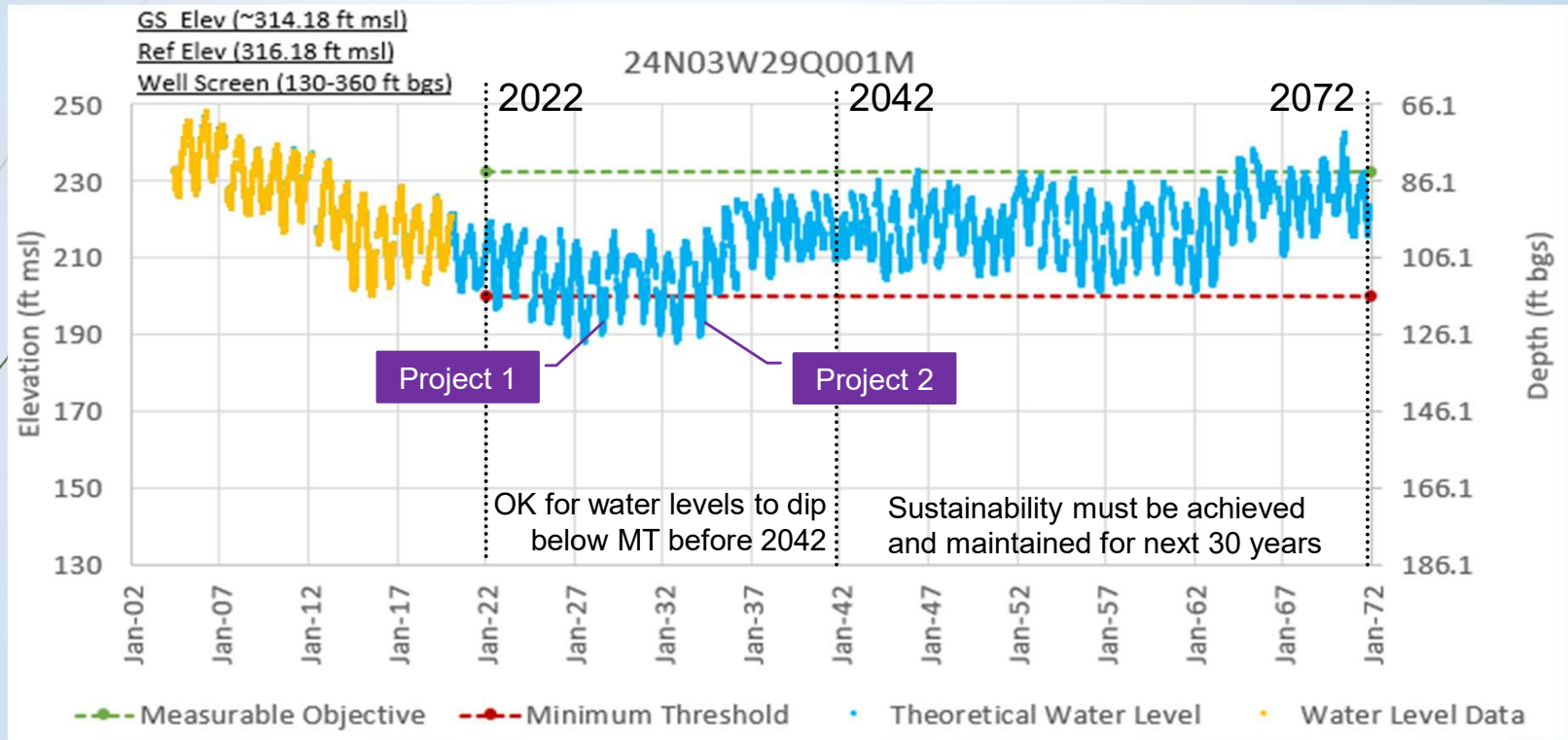
Undesirable Results - Options to Consider

- ▶ For the Subbasin, the groundwater elevation undesirable result is:
 - An undesirable result occurs when more than **10%** of groundwater elevations measured at RMP wells, drops below the associated minimum thresholds during **three consecutive years**. *[7 wells exceeding MTs 3 years in a row]*
 - An undesirable result occurs when more than **20%** of groundwater elevations measured at RMP wells, drops below the associated minimum threshold during **two consecutive years**. *[13 wells exceeding MTs 2 years in a row]*
 - In addition: if the water year type is dry or critically dry then levels below the minimum threshold are not undesirable as long as groundwater management allows for recovery in average or better years.

Example Water Levels and Drought Situation




Groundwater Level SMC Framework





Recap and Potential Action Item

- ▶ Recommendation to the GSA Boards on Chronic Lowering of Groundwater Levels SMC:
 1. **Significant and unreasonable** Conditions Statement – *any revisions?*
 2. **Minimum thresholds** at each representative monitoring point to reflect what locally is significant and unreasonable – **Fall 2018 water levels**
 3. **Measurable objectives** with safety factor on minimum thresholds – **Spring 2012 water levels**
 4. **Undesirable results**, as a combination of minimum thresholds – *pick a combination of MT exceedances*



Introduction to Land Subsidence

Data, Regs, SMC





What is Subsidence and how does it happen?

- ▶ Land subsidence is a gradual settling or sudden sinking of the Earth's surface
- ▶ Causes of subsidence
 - ▶ GW Level Decline - dewateres or depressurizes the porous media/aquifer skeleton
 - ▶ Geology – Subsidence is more pronounced where layers of fine-grained sediments exist
- ▶ Aquifer-system compaction may be seasonal or otherwise non-permanent (elastic), or permanent and irreversible (inelastic).



Potential Impacts from Inelastic Subsidence

- Damage to surface and subsurface infrastructure (eg, canals, roads, buildings, pipelines, etc.)
- Drainage issues
- Some permanent loss in aquifer storage



GSP Regulations - Subsidence

- ▶ Section 354.28(c)(5) of the Regulations states that “The minimum threshold for land subsidence shall be the rate and extent of subsidence that substantially interferes with surface land uses and may lead to undesirable results”
- ▶ 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.



Considerations for Significant and Unreasonable Conditions Description

- ▶ Who or what is impacted?
 - ▶ Ag or Developed Infrastructure?
- ▶ What type of impact constitutes significant and unreasonable?
 - ▶ GSP should consider the amount of subsidence that substantially interferes with surface land uses.
 - ▶ The impact must be due to groundwater use
 - ▶ Only applies to inelastic (irreversible) subsidence

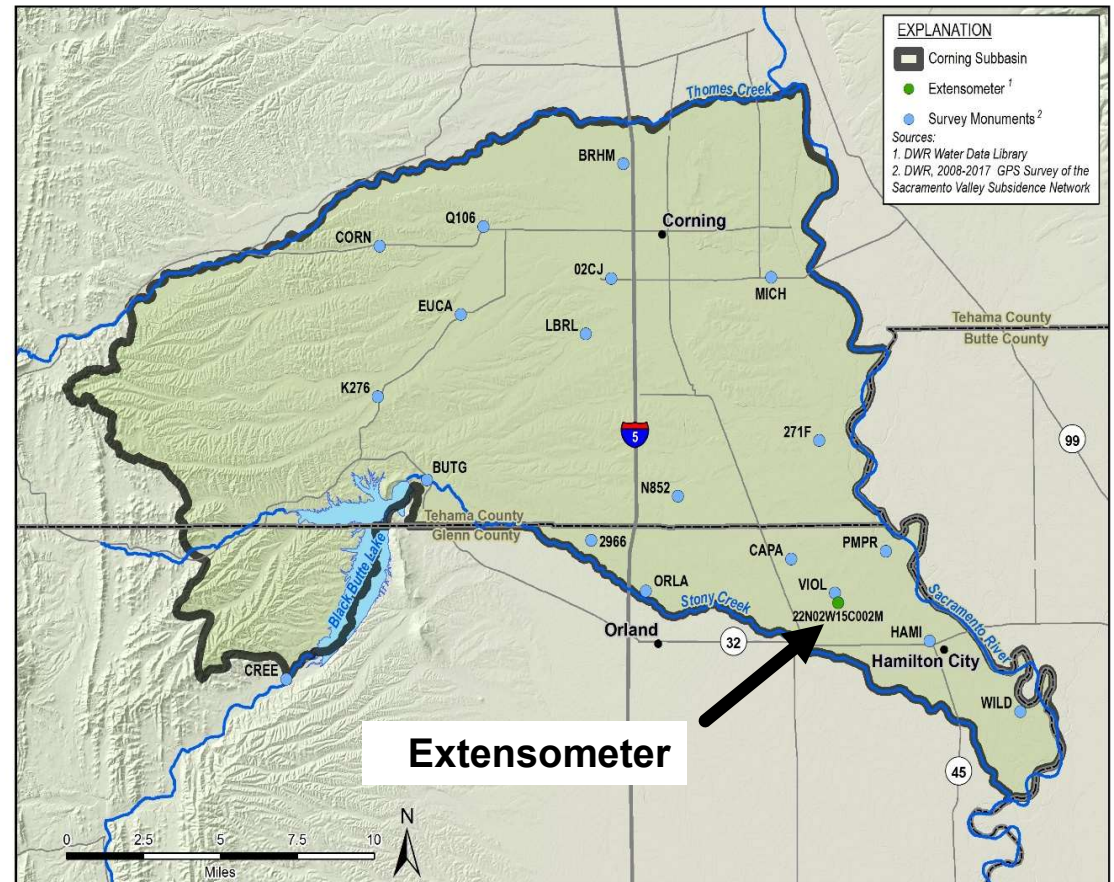
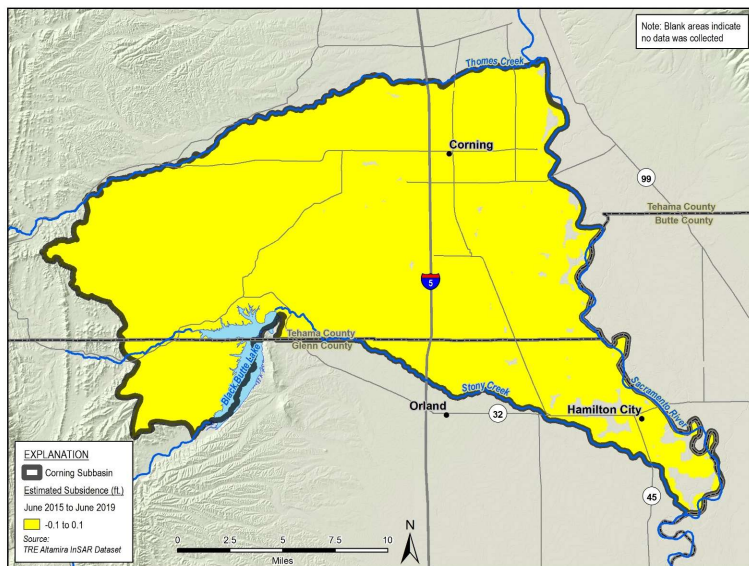


Overview of Subbasin Conditions

- ▶ To date there has been little to no inelastic subsidence observed in Corning Subbasin
- ▶ There is geology potentially conducive to inelastic subsidence if groundwater levels continue to decline
- ▶ Noted area of subsidence mostly to south of Subbasin could spread in future
- ▶ Maintaining water levels at current levels will be crucial in preventing future subsidence

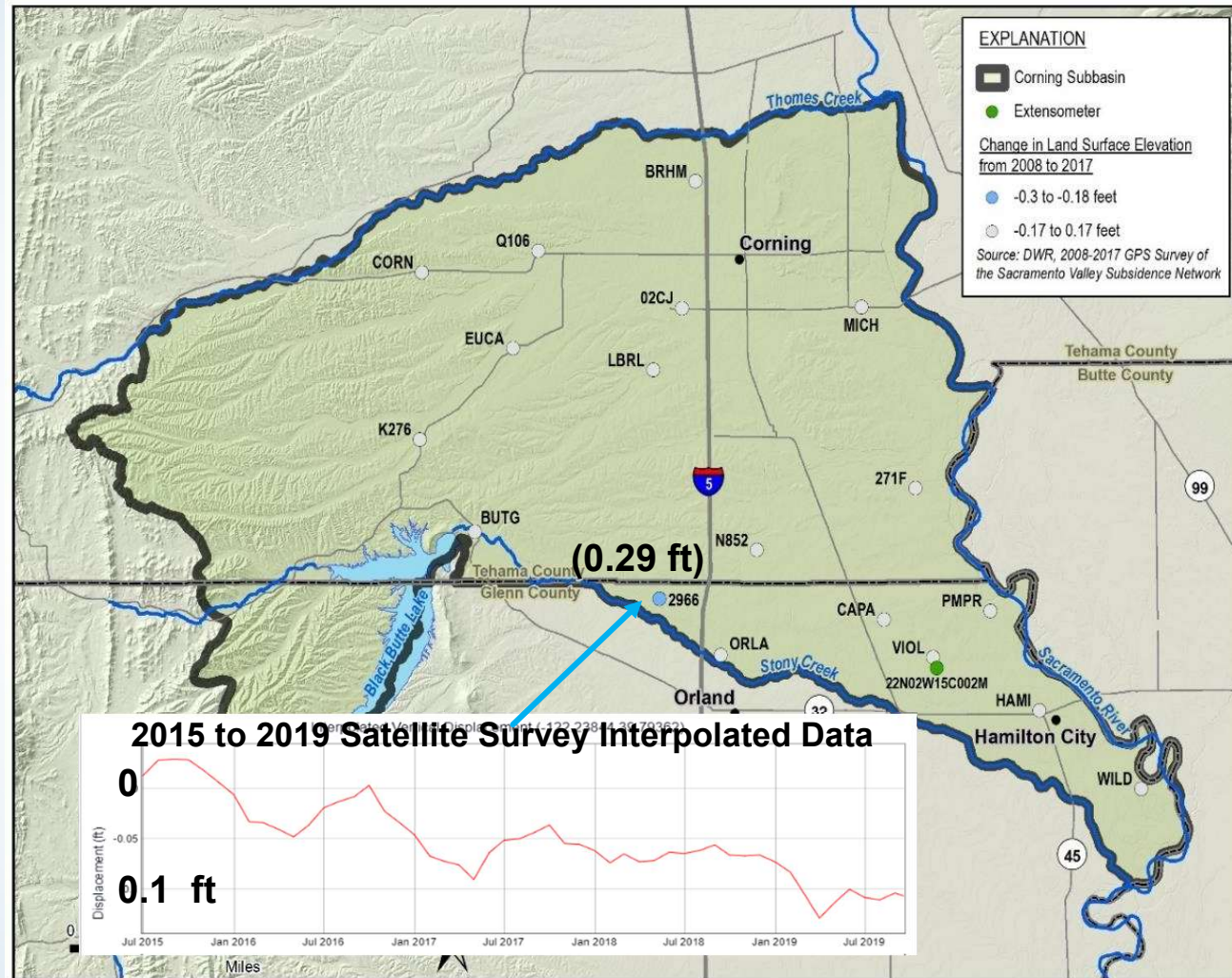
DWR Subsidence Monitoring Network

- 20 survey monuments
- 1 extensometer
- Comprehensive In-SAR satellite data



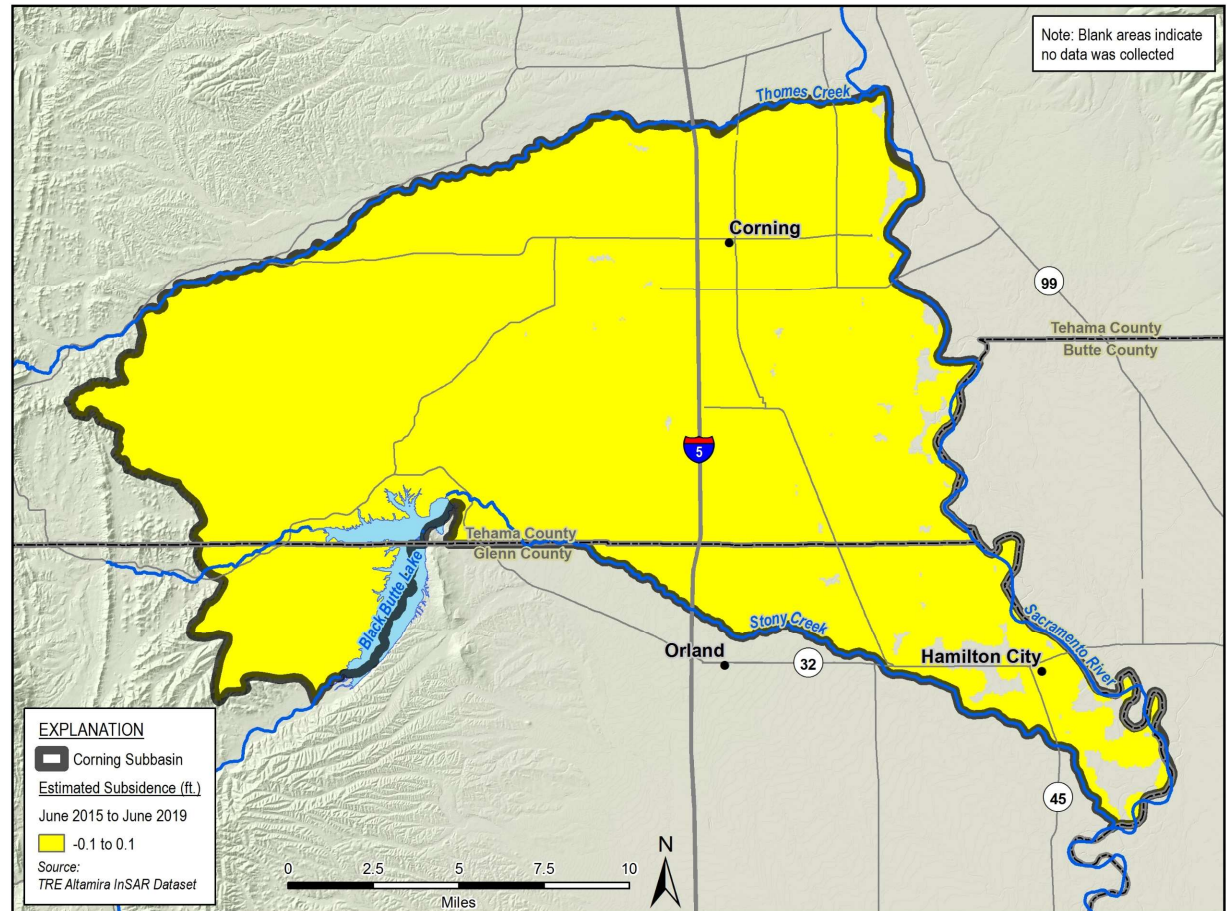
Subsidence Background - Elevation Surveys

Max subsidence in Subbasin at location near Orland is 0.29 ft between 2008 and 2017



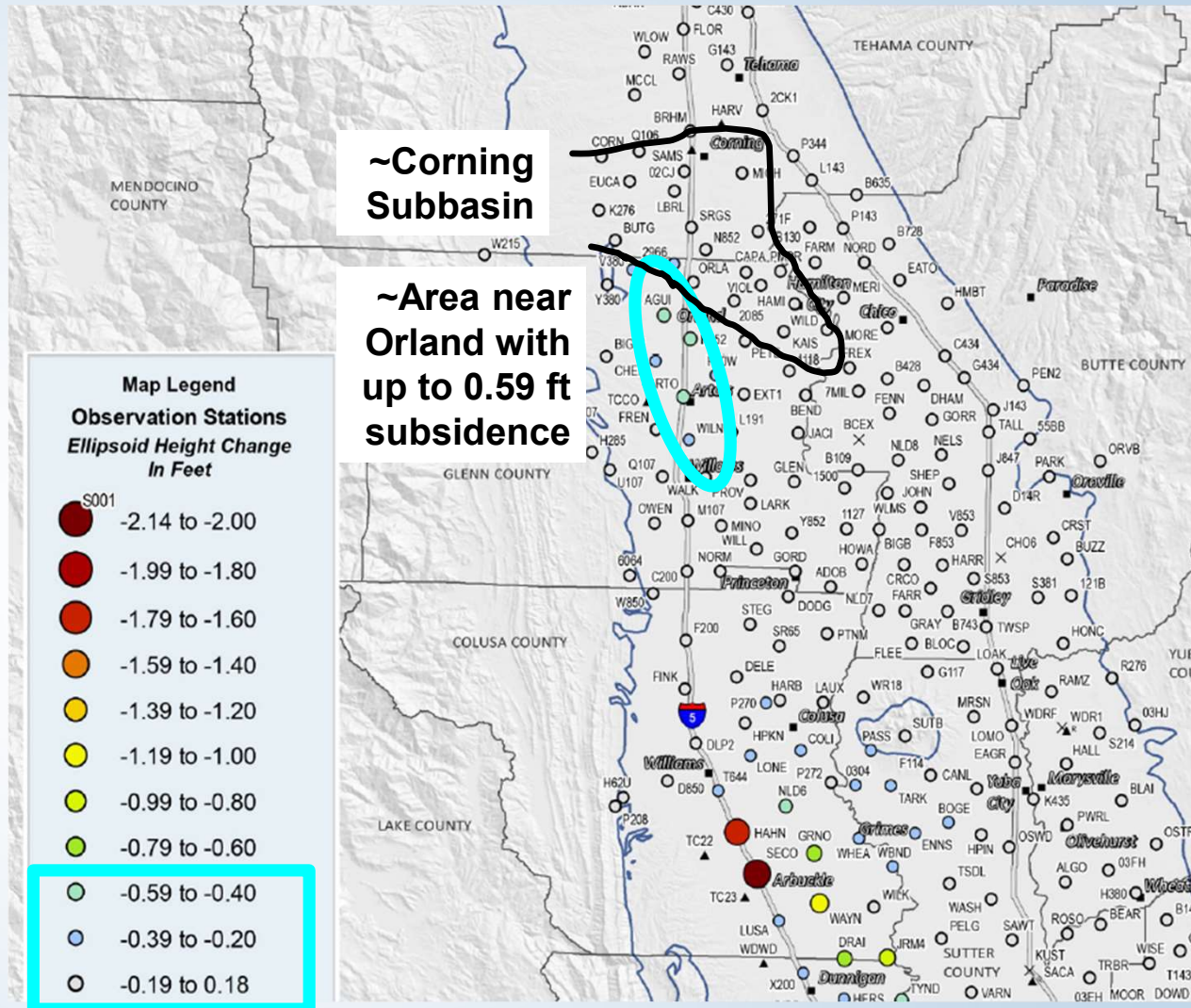
Subsidence Background – In-SAR

➤ Essentially no subsidence (± 0.1 ft) measured by satellite in Subbasin between 2015 and 2019



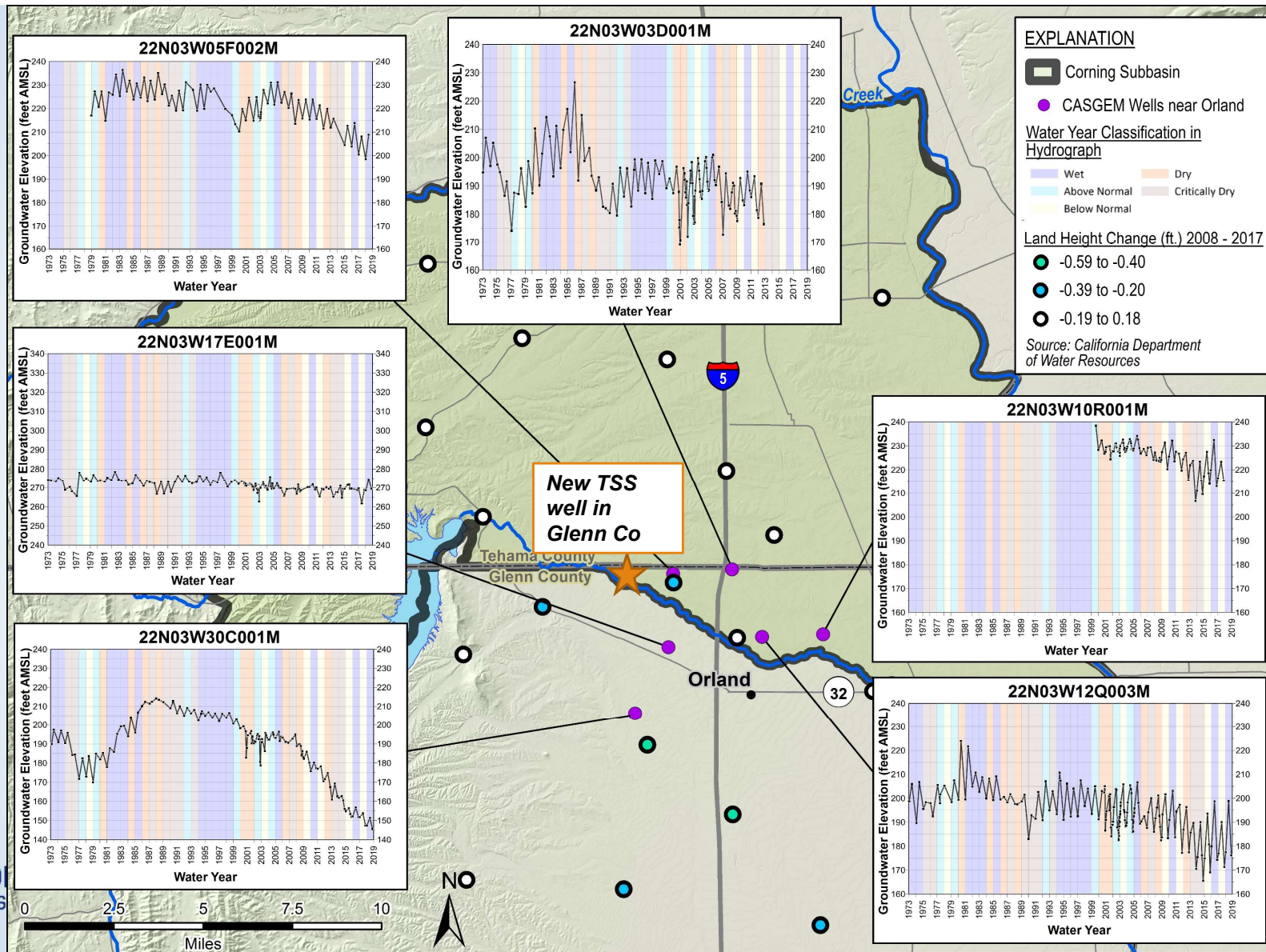
Regional Subsidence Overview

Area mostly adjacent to Corning Subbasin with subsidence (up to 0.59 ft or 7 inches) between 2008 and 2017 elevation surveys



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Regional Subsidence Compared to Water Levels





DISCUSSION: Develop a description of what is significant and unreasonable

- ▶ **Draft Significant and Unreasonable Conditions Statement:**

- ▶ *Any inelastic land subsidence that impacts infrastructure and is caused by lowering of groundwater levels occurring in the subbasin is significant and unreasonable.*

**Feedback on Significant and Unreasonable
Statement Considerations for Land Subsidence**

DISCUSSION: Set Minimum Thresholds

The value you do not want to cross

- ▶ Quantitative value that is used to define an undesirable result at each representative monitoring point (e.g., InSAR subsidence monitoring grid)
- ▶ **Minimum Thresholds based on what is Significant and Unreasonable**
- ▶ Example minimum threshold:
 - ▶ *The minimum threshold for inelastic subsidence due to lowered groundwater elevations is zero throughout the subbasin. To account for error in the InSAR data, the annual minimum threshold is set to 0.1 feet of subsidence per year, while maintaining no subsidence.*
 - ▶ *Measurable Objectives could be set at the same level, since you cannot do better than “no subsidence”.*



DISCUSSION: Undesirable Results are a Combination of Minimum Thresholds

Example:

Any exceedance of a minimum threshold is an undesirable result, if the exceedance is irreversible and caused by lowering groundwater elevations. It is furthermore an undesirable result if any area experiences five continuous years of subsidence due to lowered groundwater levels, even if each year's annual subsidence rate is less than the minimum threshold.

Subsidence SMC Additional Considerations

- Subsidence in the Corning Subbasin appears to only be an issue near Black Butte Lake and Orland
- Draft chronic lowering of water level minimum thresholds are set at the 2018 fall minimum water level.
- If water levels are maintained at equal to or greater levels than the past, no additional subsidence should occur
- Coordination w/ Colusa Subbasin is needed regarding subsidence area mostly to south of Corning Subbasin



Subsidence Discussion

- CSAB comments
- Public comments
- Potential Action Item



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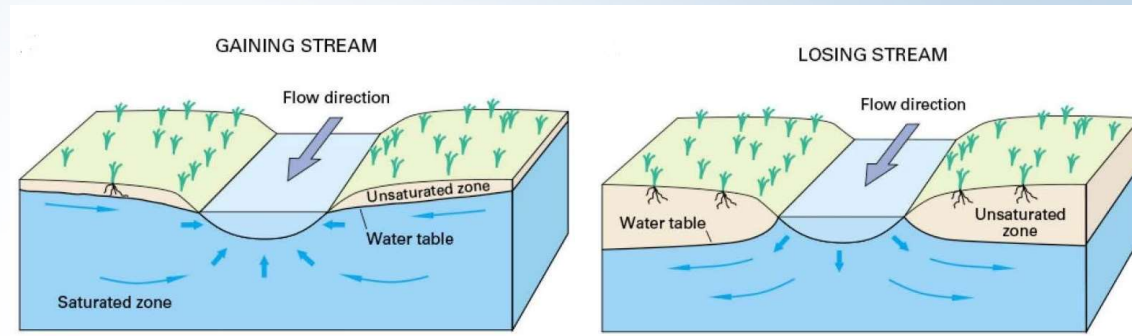


Depletion of Interconnected Surface Water

SMC Options

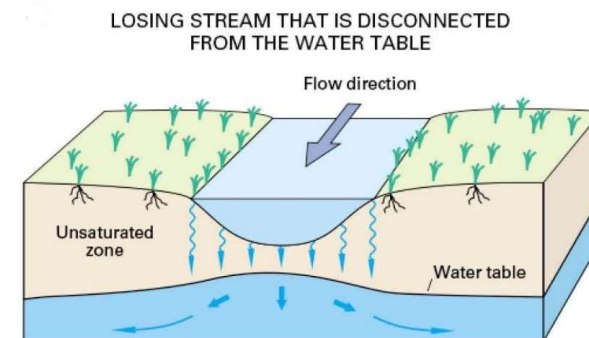
Interconnected Surface Water and Groundwater

➤ Many surface water bodies are **interconnected** with groundwater (i.e. there is exchange of water between the stream and the aquifer)



➤ Some surface water systems can be completely **disconnected** from groundwater.

➤ A surface water body may be connected to groundwater during some periods and disconnected during other periods.

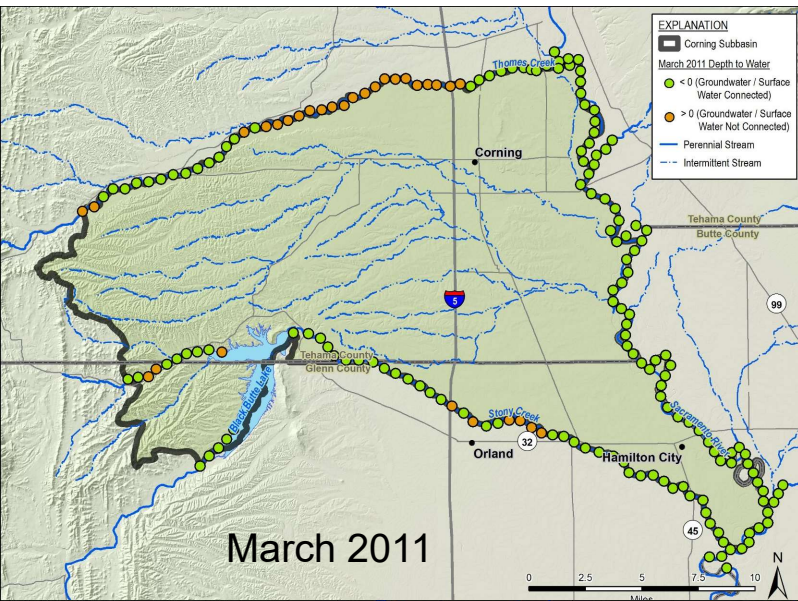


(USGS)

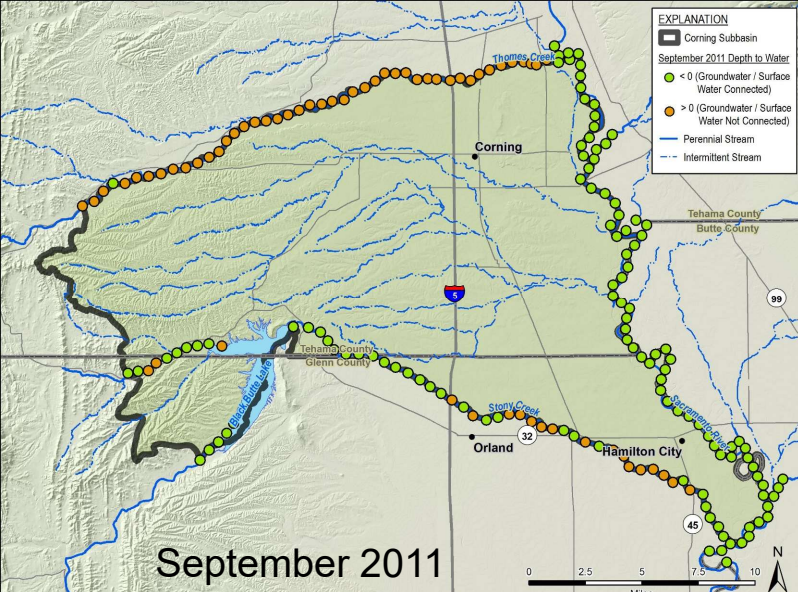


Brief Recap from 2/3 Meeting Discussion

- Reviewed GSP Regulations
- Identified areas that have interconnected surface water in the Subbasin
 - Sacramento River is fully connected to groundwater and mostly gaining water from groundwater
 - Thomes Creek is mostly disconnected from groundwater and mostly losing water to groundwater
 - Stony Creek is likely partially or seasonally connected to groundwater and may gain or lose water depending on water year type and seasons
 - Ephemeral streams are likely disconnected from groundwater.
- Identified beneficial users, including areas that support potential GDEs
- Reviewed areas that have shallow groundwater pumping along streams



March 2011



September 2011

Stream-aquifer Connection

Simulated depth to water at stream nodes:

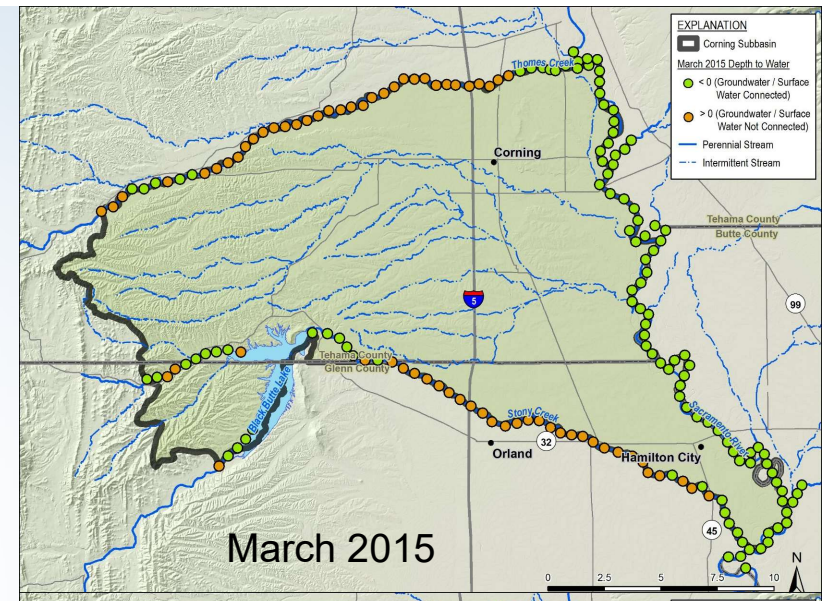
● < 0 (Groundwater / Surface Water Connected)

● > 0 (Groundwater / Surface Water Not Connected)

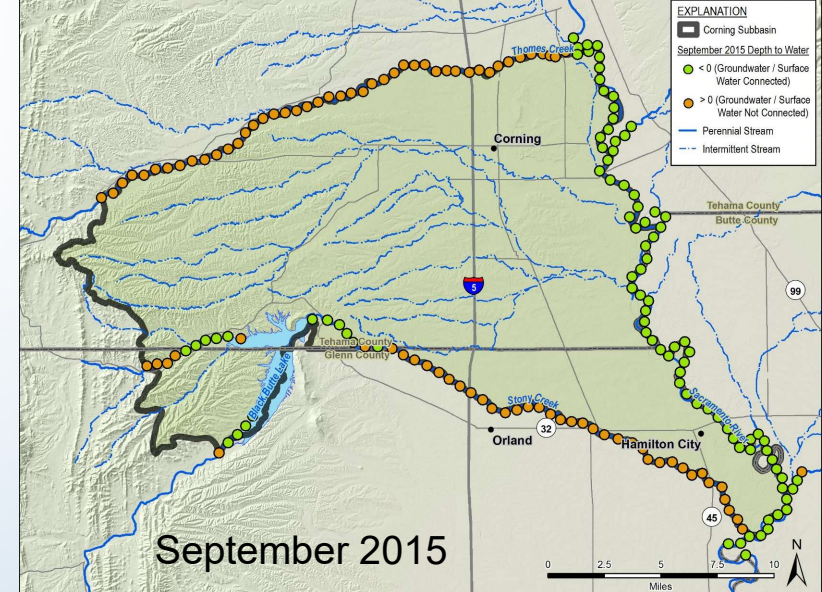
— Perennial Stream

- - - Intermittent Stream

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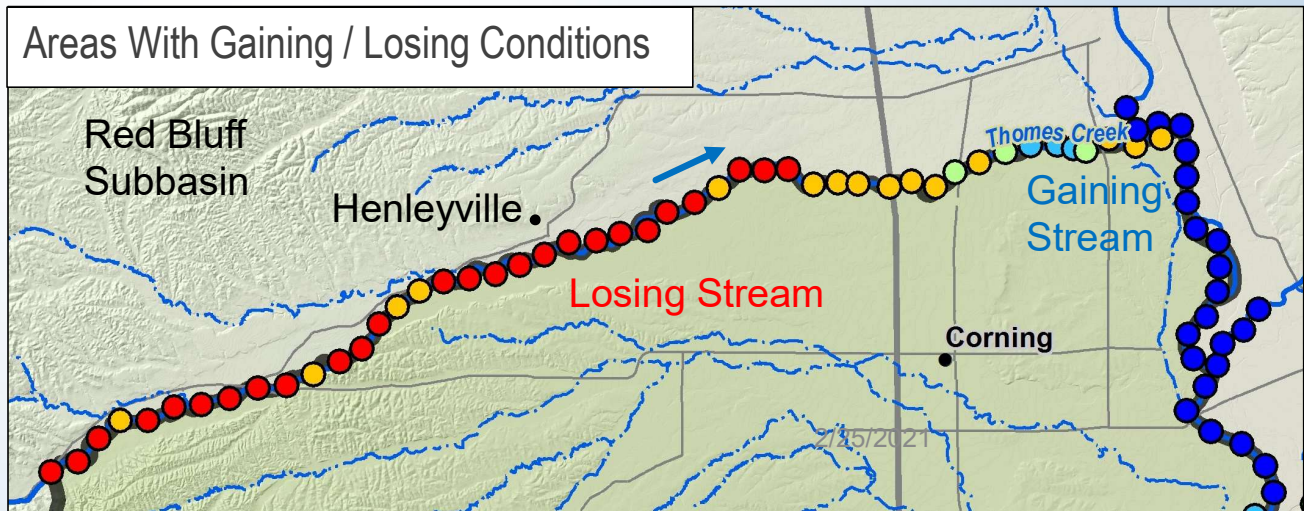
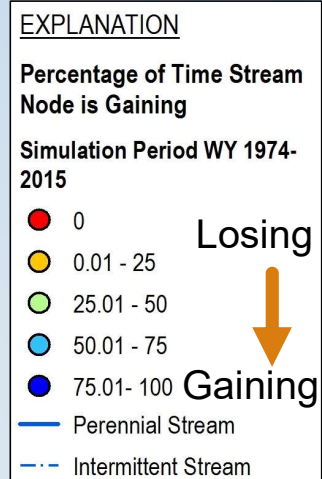
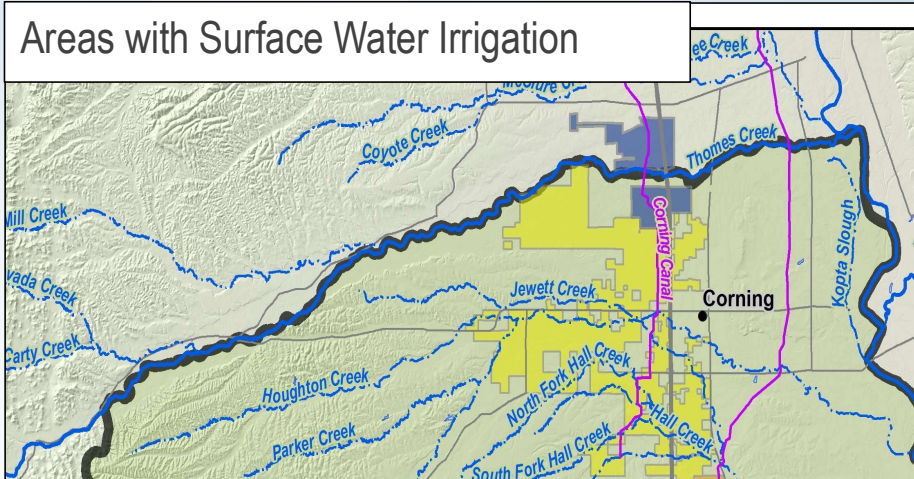
March 2015



September 2015

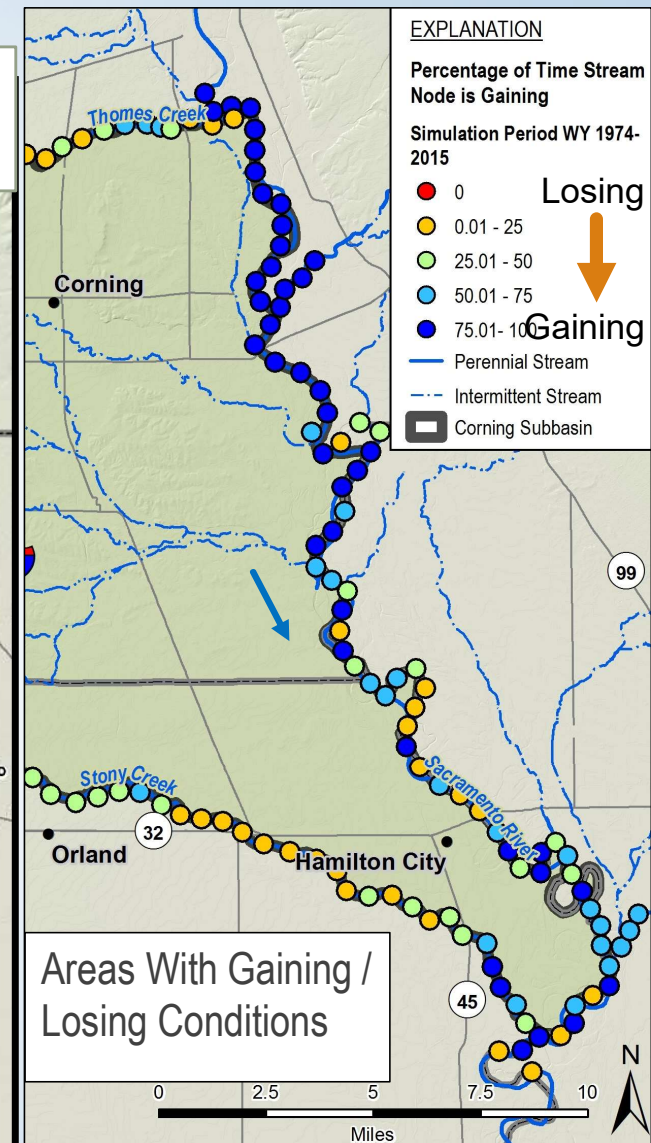
Thomes Creek Summary

- ▶ Likely mostly disconnected from groundwater due to deeper groundwater levels
- ▶ Often runs dry seasonally east of Henleyville
- ▶ Mainly losing reaches in Subbasin
- ▶ Some water was diverted for irrigation by riparian users, but now mainly pump groundwater for irrigation



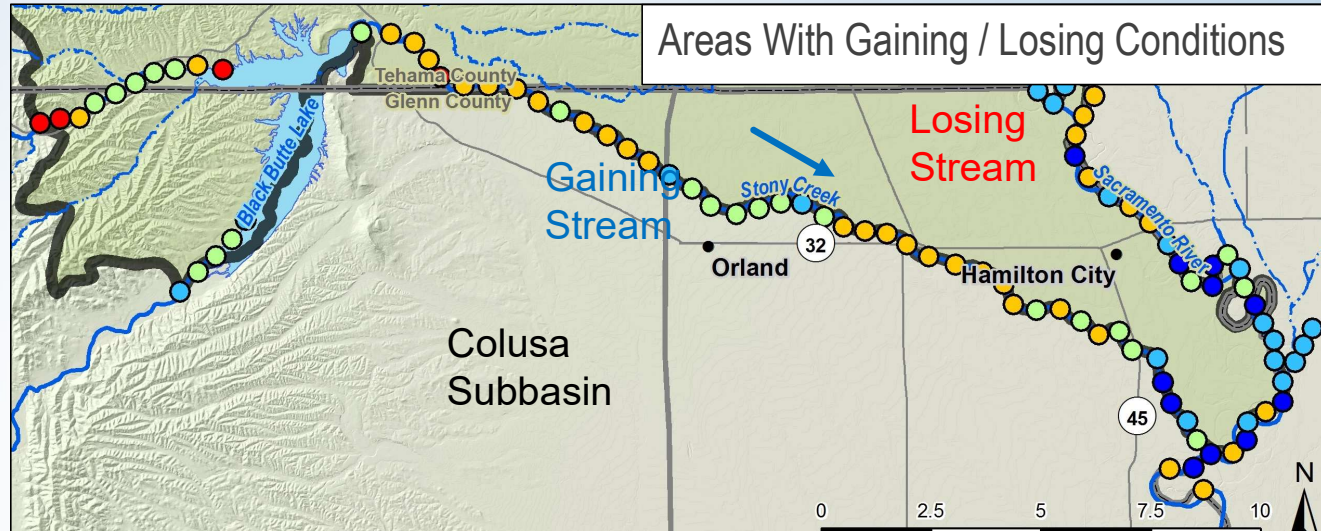
Sacramento River Summary

- River flow controlled upstream at Shasta Dam
- TCCA Diversion to TCC and Corning Canal
- Diversion at Glenn Colusa Canal
- Reaches in Subbasin are connected to groundwater and generally gaining
- River supports potential GDEs and multiple salmon runs across the Northern Sacramento Valley
- Multiple protected riparian habitat areas (parks, recreation, vegetation, restoration projects, flood control)
- Generally, not as much pumping near the stream

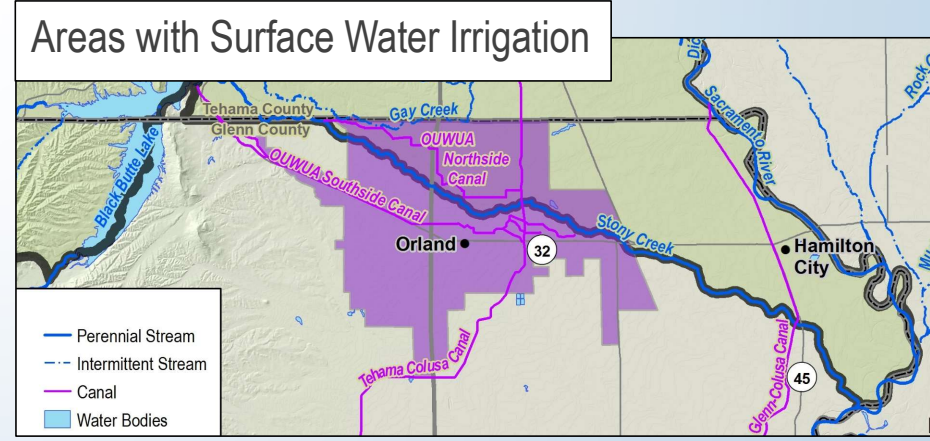


Stony Creek Summary

- Creek flow regulated at Black Butte Dam for flood control and irrigation
- Fully adjudicated and only diversions now occur at Northside Canal intake
- Creek connected to shallow groundwater
 - Alluvium fan surrounding Stony Creek is very transmissive, and Stony Creek is known as a significant source of direct groundwater recharge
- Creek is typically gaining upstream where surface water is used for irrigation and generally losing downstream where groundwater is used
- Creek does not reach Sacramento River without flow releases

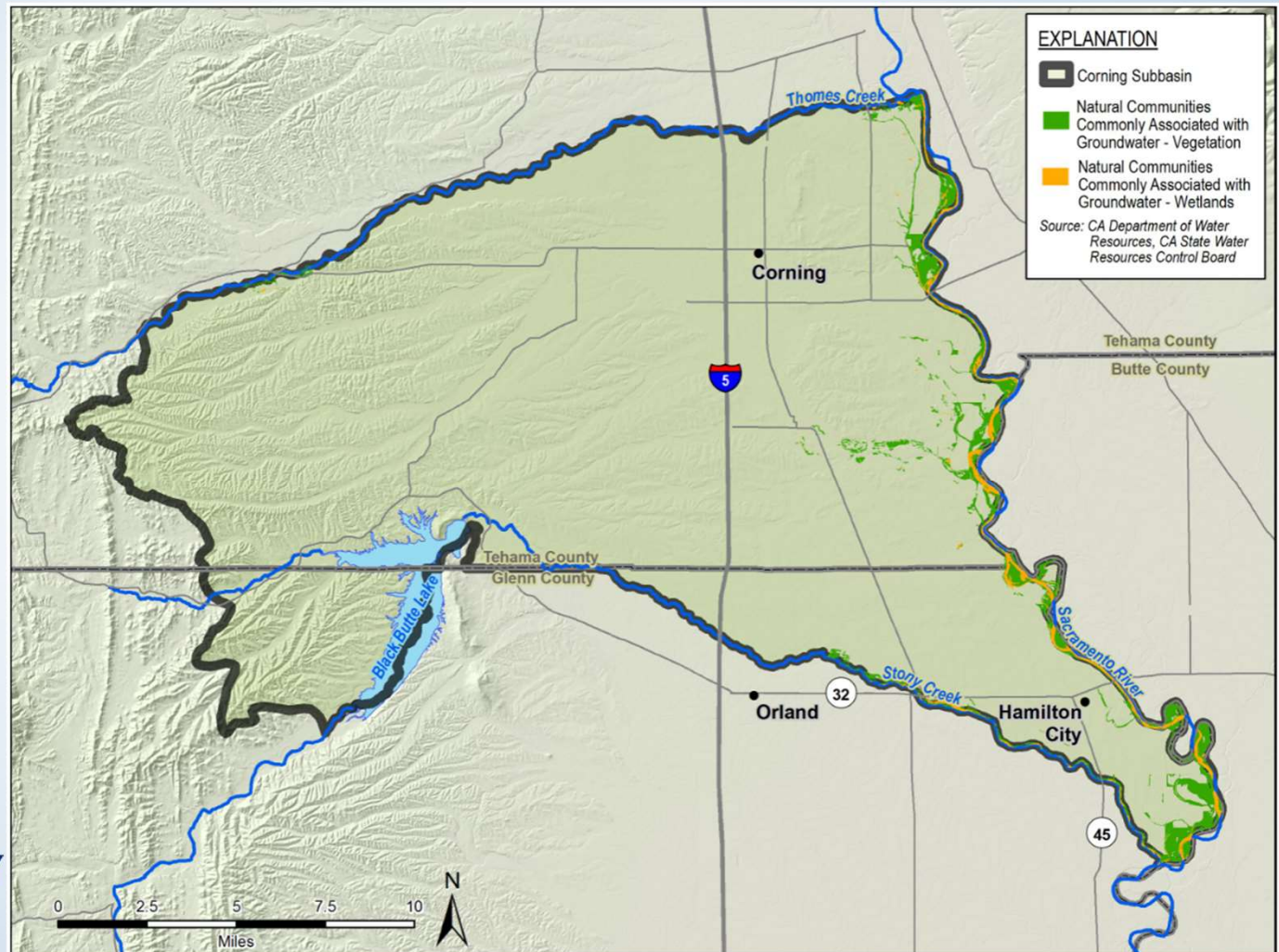


EXPLANATION	
Percentage of Time Stream Node is Gaining	
Simulation Period WY 1974-2015	
● 0	Losing
● 0.01 - 25	↓
● 25.01 - 50	
● 50.01 - 75	Gaining
● 75.01 - 100	
— Perennial Stream	
- - - Intermittent Stream	



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Potential GDEs Identified in the Subbasin



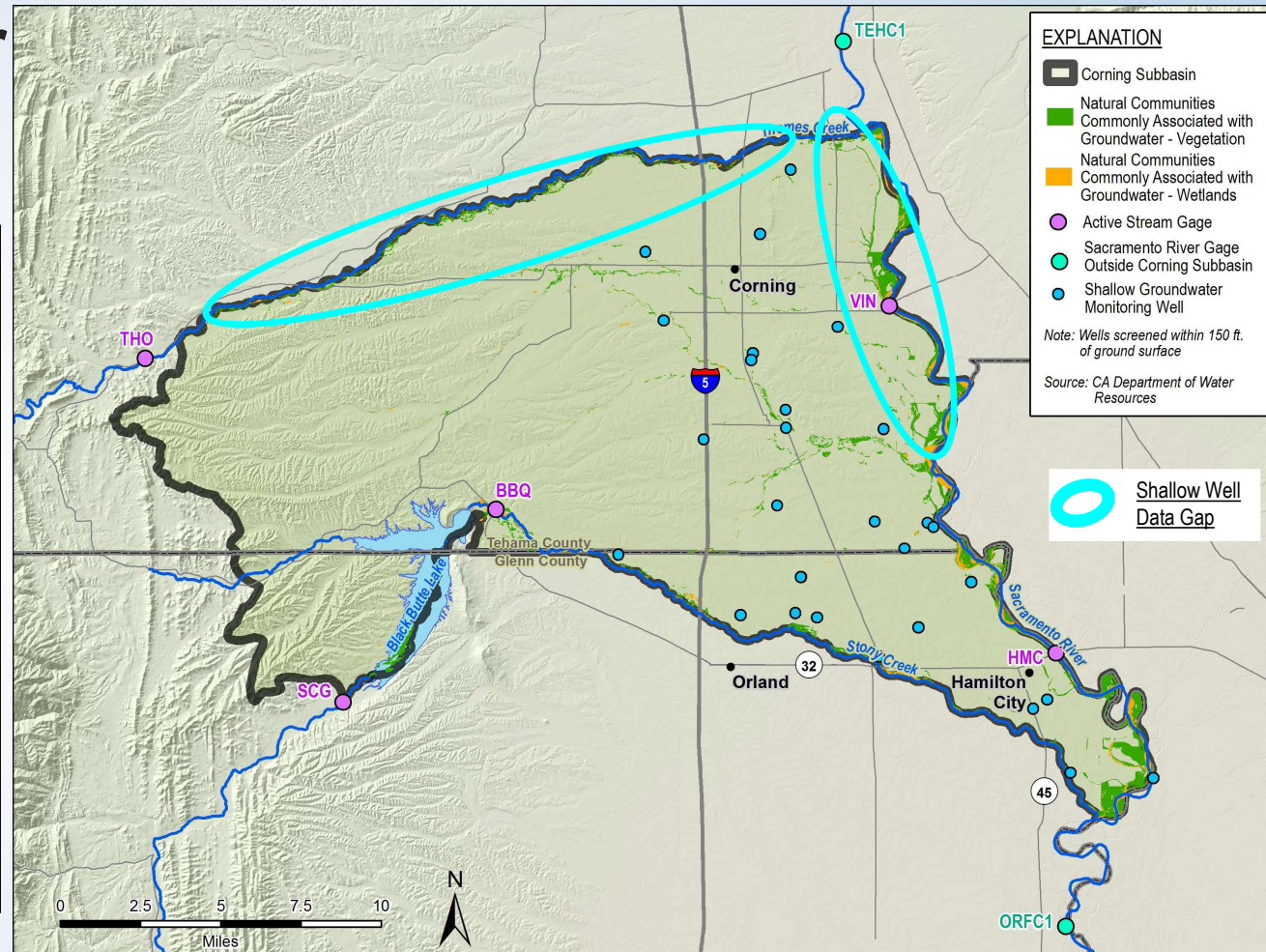


Monitoring Network Overview

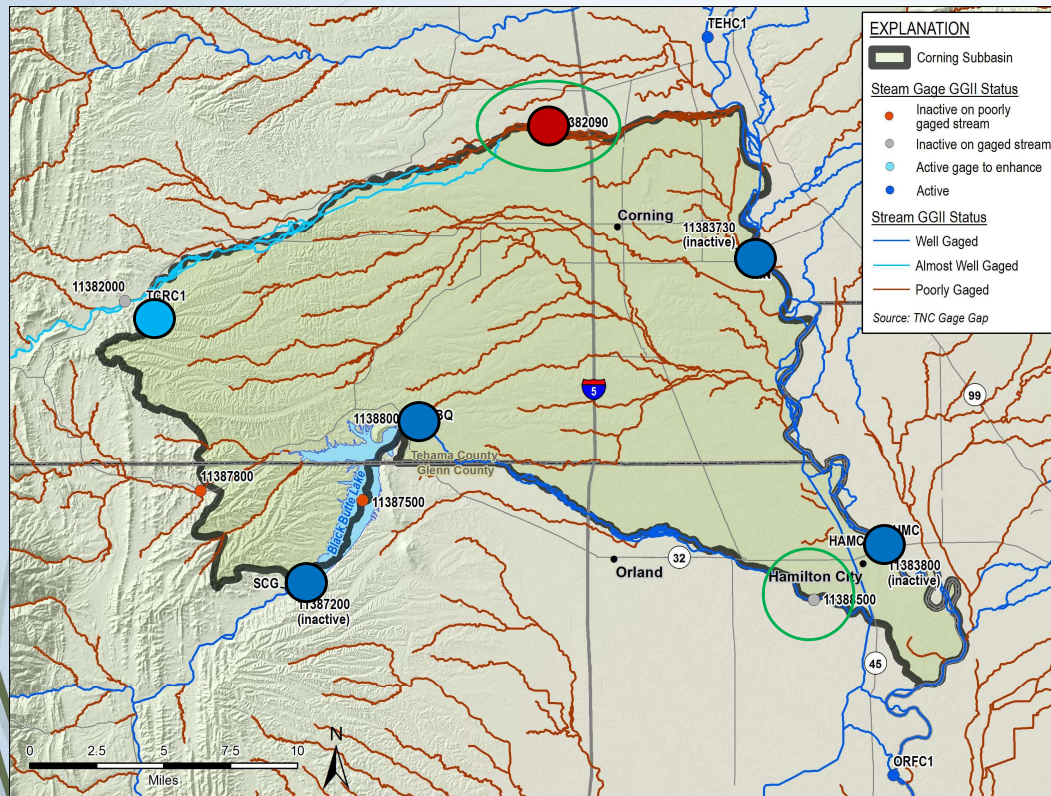
- ▶ Need to consider both streamflow monitoring and shallow groundwater monitoring to assess whether and how much streams are losing or gaining water
- ▶ Currently we identified:
 - ▶ 33 Shallow groundwater wells
 - ▶ 5 Stream gages

Shallow Groundwater Wells and Data Gaps

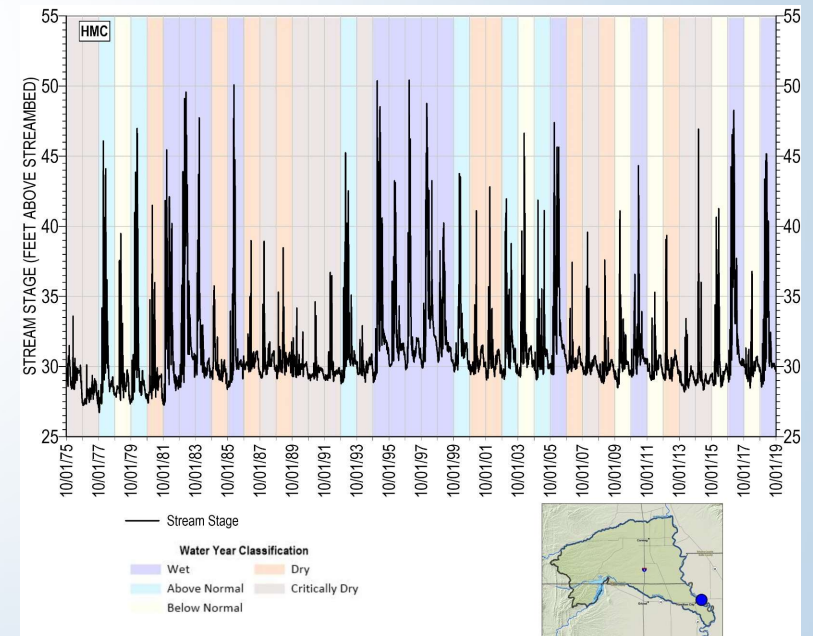
- ▶ 10 observations well clusters with continuous water level measurements
- ▶ 23 other shallow wells near potential GDEs with semi or tri-annual water level measurements
- ▶ Data gaps: Not enough shallow wells near Thomes Creek and northern portion of Sacramento River corridor




Surface Water Monitoring Stations and Data Gaps



- 5 active stream gages in Subbasin
- Data gaps:
 - Lower reach of Thomes Creek and ephemeral streams in center of Subbasin are not gaged.
 - Gage on upper reach of Thomes Creek only measures stream stage greater than a few feet





GSP Regulations

Depletion of Interconnected Surface Water

- ▶ SGMA requires the identification of **interconnected surface waters**, and of **Groundwater Dependent Ecosystems (GDEs)** (§354.16 (f)(g))
 - ▶ Assess the location, quantity, and timing of depletion and if the depletion of surface water is causing a **Significant and Unreasonable** impact
 - ▶ **If conditions are significant and unreasonable, they cannot get worse than they were on January 1, 2015**
- ▶ GSA must set **Minimum Thresholds** and **Measurable Objectives** to prevent further significant and unreasonable impacts
- ▶ GSA must define **Undesirable Results** based on a combination of minimum threshold exceedances

Surface Water Depletion SMC Metrics

- ▶ Section 354.28(c)(6) of the Regulations states that “The minimum threshold for depletions of interconnected surface water shall be the **rate or volume of surface water depletions caused by groundwater use** that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results.”
- ▶ The SGMA regulations allow for the use of **groundwater elevations as a proxy** for volume or rate of surface water depletion if a significant correlation exists between groundwater elevations and surface water depletions.
- ▶ Minimum thresholds should only apply to the interconnected stream reaches.



Significant and Unreasonable Statement Considerations

Statement of **Significant & Unreasonable** is a qualitative statement, describing groundwater conditions unacceptable to beneficial uses and users of water in the basin. These describe what conditions are to be avoided and serve as an initial framework around which the quantitative SMC are developed.

- **Who or what is impacted by significant and unreasonable conditions,**
- **What kind of impact constitutes significant and unreasonable,**
- **Over what time period are conditions significant and unreasonable, and**
- **Over what geographic area are conditions evaluated.**

Development of Significant and Unreasonable Conditions Statement

- ▶ Significant and unreasonable conditions for surface water depletion common elements:
 - ▶ *(Common GSP theme) – Causing significant adverse impact to beneficial uses and users of surface water within the Subbasin*
 - ▶ *(EDF Guidance) – No further depletion of surface flows, beyond the level of depletion that occurred prior to 2015*
 - ▶ *(Other Considerations) – The GSA does not have authority to manage reservoir releases*

Draft Significant and Unreasonable Conditions Statement

➤ Sacramento River:

- *Significant and unreasonable depletion of interconnected surface water on the Sacramento River occurs if surface water beneficial users are impacted, such as surface water diverters, riparian habitat, and potential GDEs. The GSAs do not have authority to manage Shasta reservoir releases and are not required to manage surface waters. In addition, impacts on the Sacramento River occurring in Subbasins upstream or adjacent to the Corning Subbasin are not the responsibility of the Corning Subbasin GSAs. Interbasin coordination will be necessary to assess overall impacts, should they occur.*
- *Significant and unreasonable streamflow depletion on the Sacramento River within the Corning Subbasin does not currently occur.*

Draft Significant and Unreasonable Conditions Statement

▶ **Stony Creek:**

- ▶ *Significant and unreasonable depletion of interconnected surface water on Stony Creek occurs if groundwater pumping affects streamflow and impacts any beneficial users (except invasive species) beyond depletions observed in 2015.*
- ▶ *Stony Creek is fully adjudicated, and the GSAs do not have authority to manage Black Butte Dam releases and are not required to manage surface waters.*
- ▶ *Stony Creek does not provide extensive riparian habitat beyond invasive species (*Arundo*), which is not a protected species and should not be considered a beneficial user.*

▶ **Thomes Creek**

- ▶ *Significant and unreasonable depletion of interconnected surface water on Thomes Creek occurs if groundwater pumping affects streamflow beyond depletions observed in 2015.*
- ▶ *Thomes Creek is mostly a disconnected stream for a good portion of the year, and does not support significant surface water diversions; invasive species are also prevalent on Thomes Creek and should not be considered beneficial users.*

Approach to MTs, MOs and URs

- ▶ Use water levels as a proxy - based on basic concept that as water levels drop, it increases the vertical gradient at streams and leads to potential streamflow depletion (conceptual method proposed by EDF, which is an approach being considered in Sacramento Valley GSPs)
- ▶ Using shallow groundwater levels of 2015 as Minimum Thresholds has regulatory backing; but if 2018 levels (which are often lower than 2015 and used for groundwater elevation SMC) are still not considered significant and unreasonable, can use 2018 levels for consistency
- ▶ Measurable Objectives could be set at a bit higher than Minimum Thresholds
- ▶ Undesirable Results could be:
 - ▶ ***If shallow groundwater levels drop below 2018 levels in years outside of drought years, it is considered an undesirable result.***



Interconnected Surface Water SMC Discussion: Questions and Comments?

- CSAB comments
- Public comments



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Draft GSP Completion and Adoption Timeline

Upcoming CSAB Meetings and Proposed Topics

Date	Key Meeting Topics	CSAB Meeting Objectives
Mar 3	<ul style="list-style-type: none"> • Depletion of interconnected surface water SMC discussion #2 – review SMC approaches • Land subsidence SMC discussion #1 – review SMC approaches 	<ul style="list-style-type: none"> • Input on proposed approaches for MT and MO development • Discussion of undesirable results • Potential recommendations to GSA Boards for Lowering of GWLs and Subsidence SMC
Apr 7	<ul style="list-style-type: none"> • Discussions and development of SMCs for Groundwater Quality and Reduction in Storage – Meeting #1 • Background on basin conditions, review water budgets, and GSP requirements • Initial discussion on potential projects and management actions 	<ul style="list-style-type: none"> • Input on significant and unreasonable conditions and initial discussion on MT development • Potential recommendations to GSA Boards for depletion of interconnected surface water SMC • Input on potential projects and management actions
May 5	<ul style="list-style-type: none"> • Discussions and development of SMCs for Groundwater Quality and Reduction in Storage – Meeting #2 • Review SMC approaches 	<ul style="list-style-type: none"> • Input on proposed approaches for MT and MO development • Potential recommendations to GSA Boards on water quality and storage SMC
June 2	<ul style="list-style-type: none"> • Revised List of Projects & Management Actions • Introduction to funding mechanisms 	<ul style="list-style-type: none"> • Input on final list of Projects & Management Actions • Input on funding mechanisms
July 7	<ul style="list-style-type: none"> • Present predicted impacts to groundwater conditions based on projects and management actions. • Compare against draft MT and MO for all Sustainability Indicators 	<ul style="list-style-type: none"> • Input on revisions of draft projects and management actions based on predicted impacts and comparison for all sustainability indicators
Aug 4	<ul style="list-style-type: none"> • Review Projects & Management Actions and effects on Sustainable Management Criteria • Re-evaluate funding mechanisms • Discuss priority actions for plan implementation • Review data gaps 	<ul style="list-style-type: none"> • Potential recommendations to GSA Boards on Projects and Management Actions to reach and maintain sustainability • Recommendations on funding mechanisms • Input on Plan Implementation and addressing data gaps

Receive public comments at each meeting

GSP Section Reviews

GSP Section	Status	Review Schedule
1 - Introduction	Draft complete, incorporating comments	Public review draft, Sept. 2021
2 - Plan Area	Draft complete, incorporating comments	Public review draft, Sept. 2021
3 - Basin Setting	Draft complete, incorporating comments	Public review draft, Sept. 2021
4 – Water Budgets	Draft developed, in review by GSA staff	CSAB review in March
5 - Monitoring Network	Draft almost complete	CSAB review in April
6 – Sustainable Management Criteria	Draft of groundwater levels section developed	Complete draft for CSAB review in May
7 - Projects and Management Actions	Draft list of projects and management actions developed	Review list at April 7 meeting; complete draft for CSAB review in June or July
8 – Plan Implementation	Assembling data gaps; reviewing options for funding mechanisms	Discussion at August meeting; include in Public review draft, Sept. 2021

Proposed GSP Completion and Adoption Timeline

- ▶ **August 5, 2021: 90-day notice to Cities and Counties, prior to public hearing**
 - ▶ *link to website with current draft sections (note: GSP does not need to be complete to post the notice)*
- ▶ **September 10, 2021: Public Release of Complete Draft GSP**
 - ▶ At August GSA meetings, authorize the CSAB to release the Public Draft GSP
 - ▶ At Sept. 1 CSAB meeting, recommend release of draft GSP for public review
 - ▶ *post full draft for 45-day public review (note: public review timeframe does not need to correspond to 90-day noticing)*
- ▶ **October 22, 2021: Draft GSP Public Review Ends**
 - ▶ *No CSAB meeting in October*
- ▶ **November 2021: incorporate public comments and finalize GSP**
 - ▶ November 3rd : at regularly scheduled CSAB meeting hold a public meeting to hear public comments on draft GSP
 - ▶ November 17th: reschedule the CSAB meeting to this date to review public comments incorporation and for CSAB to vote on recommendation to adopt
- ▶ **December 2021: hold GSA Board public hearings for GSP adoption**
 - ▶ *Tehama GSA GW Commission meets Dec 8 to consider adoption and could make a recommendation to the Tehama GSA Board which meets Dec 20 and could adopt GSP at that meeting*
 - ▶ *CSGSA needs to schedule a special meeting for early December. Last scheduled meeting date is 11/10/21*
- ▶ **January 2022: submit final adopted GSP to DWR**



CSAB Action Items

1. Agree to the full adoption schedule and Make Recommendation to GSAs
2. Incorporation of Draft GSP Comments, GSP Finalization and Recommendation to Adopt
 - a) Agree to move Nov 3rd CSAB meeting to Nov 17th (week before Thanksgiving)
 - ▶ *We still plan to have a public meeting on November 3rd to receive comments on draft GSP (CSAB members are welcome to attend, but are not required)*



End of Meeting