







Sustainable Management Criteria

- Overview
- Sustainability Goal
- Undesirable Results
- Representative Monitoring
- Approach to Develop Minimum Thresholds, Measurable Objectives, and Interim Milestones
 - Levels
 - Storage
 - Quality
 - Subsidence
 - Surface Water Depletions

Relationship of SGMA Terms



For Each:

					
Lowering GW Levels	Reduction of Storage	Degraded Quality	Seawater Intrusion	Land Subsidence	Surface Water Depletion

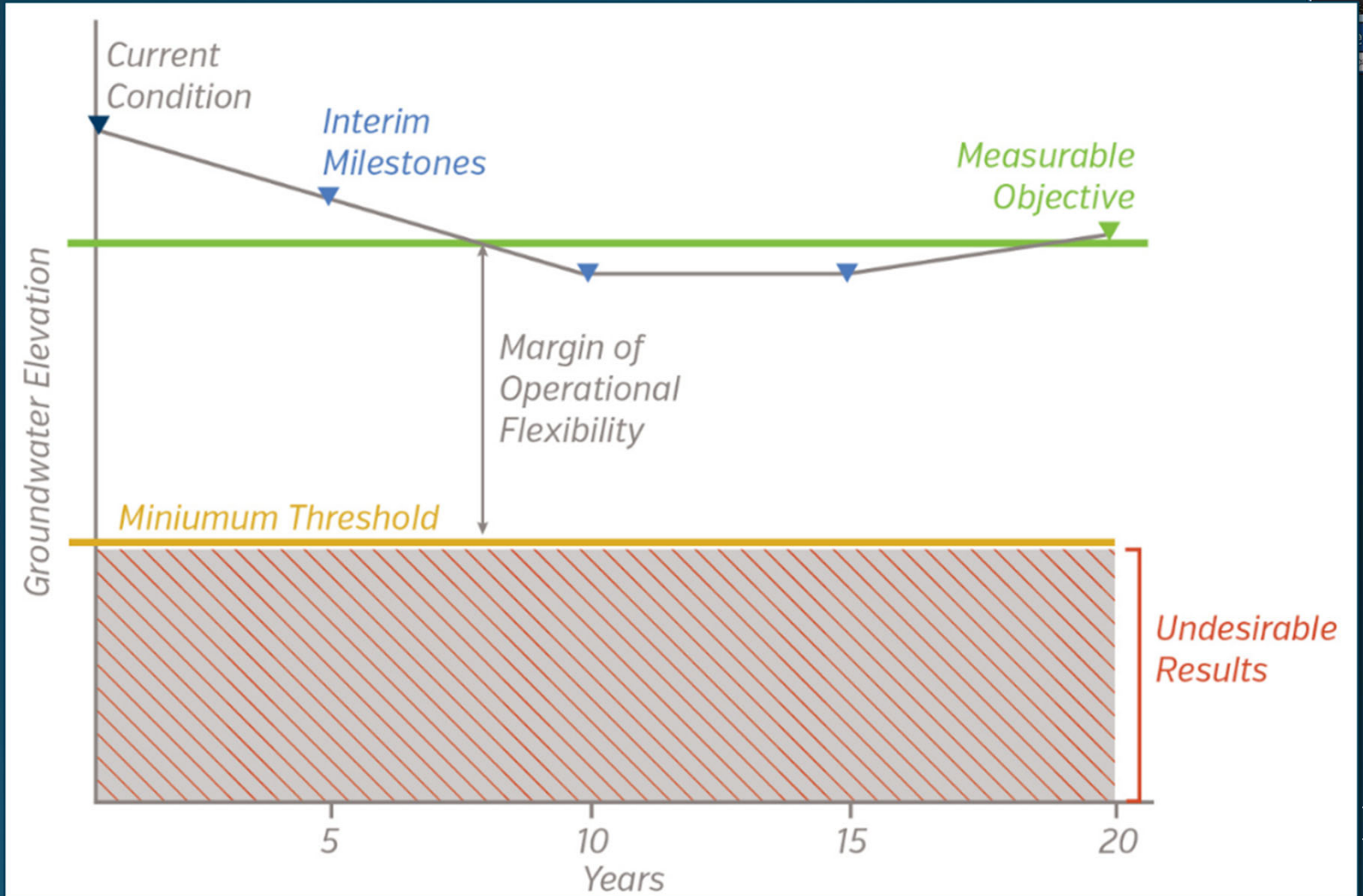
Sustainable Groundwater Management Act Terms

Acronyms

- UR = Undesirable Result
- MT = Minimum Threshold
- MoOF = Margin of Operational Flexibility
- MO = Measurable Objective
- SI = Sustainability Indicator
- bgs = below ground surface
- IM = Interim Milestone
- PMAs = Projects and Management Actions

Example:

(Current Conditions Sustainable)



Sustainable Management Criteria Development Approach

- Set Sustainability goal and undesirable results statements (complete)
- Select representative monitoring network for each sustainability indicator
- Develop minimum thresholds for each sustainability indicator
- Develop measurable objectives for each sustainability indicator
- Interim milestones likely not need in Butte Subbasin

Sustainability Goal Review

Sustainability Goal

- The sustainability goal for the Butte Subbasin GSP is to maintain, through a cooperative and partnered approach, locally managed sustainable groundwater resources to preserve and enhance the economic viability, social well-being and culture of all Beneficial Uses and Users without experiencing undesirable results.
- From: <https://www.buttebasingsgroundwater.org/>

Undesirable Results Statements Review

Undesirable Results Statements

- **Levels**
 - The undesirable result for the chronic lowering of groundwater levels is a result that would cause significant and unreasonable reduction in the long-term viability of Beneficial Uses and Users over the planning and implementation horizon of this GSP.
- **Storage**
 - The undesirable result for the reduction of groundwater in storage is a result that would cause significant and unreasonable reduction in the long-term viability of Beneficial Uses and Users over the planning and implementation horizon of this GSP.
- **Seawater Intrusion**
 - Seawater intrusion is not an applicable sustainability indicator, because seawater intrusion is not present and is not likely to occur in the Butte Subbasin due to the distance from the Pacific Ocean, bays, deltas, or inlets.
- **Quality**
 - The undesirable result for degraded water quality is a result stemming from a causal nexus between groundwater quantity related activities, such as groundwater extraction or groundwater recharge, and groundwater quality that causes significant and unreasonable effects to Beneficial Uses and Users including reduction in the long-term viability of these uses over the planning and implementation horizon of this GSP.
- **Land Subsidence**
 - The undesirable result for land subsidence is a result due to groundwater extraction that causes a significant and unreasonable reduction in the viability of the use of water conveyance and flood control infrastructure over the planning and implementation horizon of this GSP.
- **Depletion of Interconnected Surface Water**
 - The undesirable result for depletions of interconnected surface water is a result that causes significant and unreasonable adverse effects on Beneficial Uses and Users of interconnected surface water within the Butte Subbasin over the planning and implementation horizon of this GSP.

Monitoring Networks

Representative Monitoring

Overview: Sustainability Indicators and Monitoring Metrics

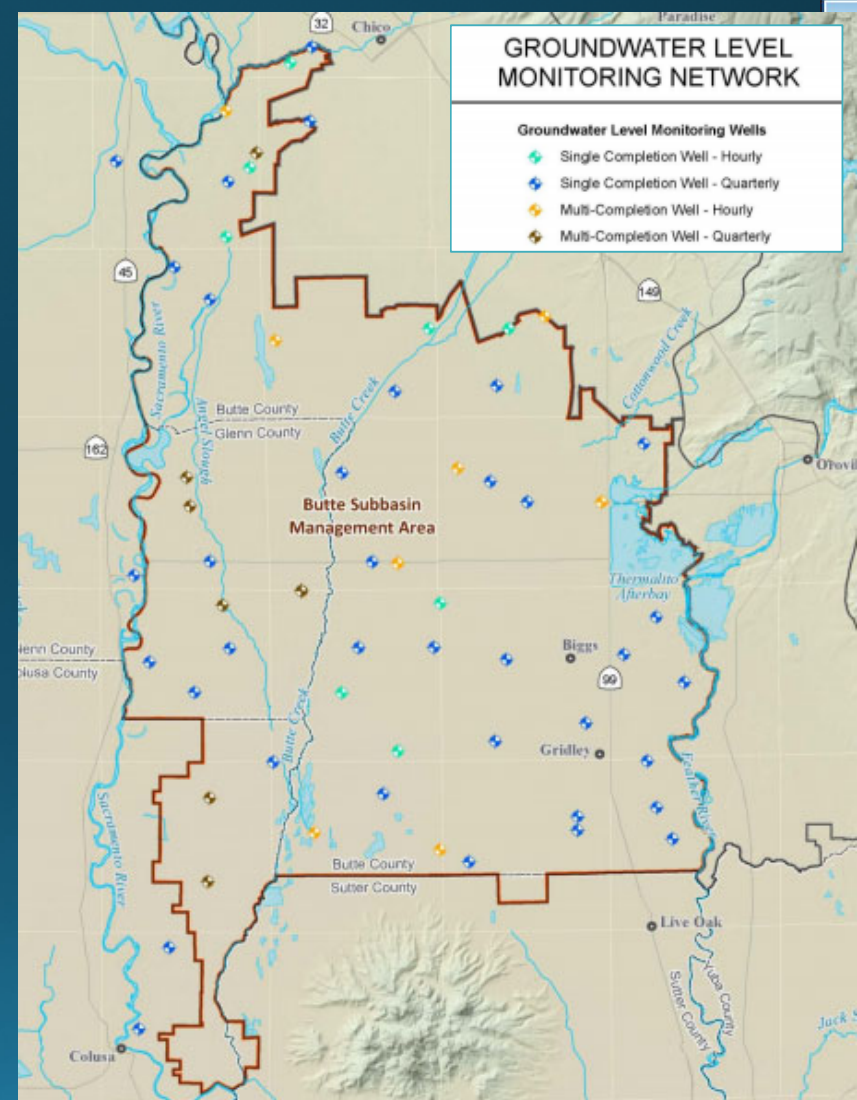
Sustainability Indicator	Monitoring Metric
Groundwater Levels	Groundwater Levels
Groundwater Storage	Groundwater Levels (proxy)
Groundwater Quality	Constituent Concentration(s)
Seawater Intrusion	NA
Subsidence	Subsidence Monitoring
Surface Water Depletion	Groundwater Levels (proxy)

Monitoring Networks

- Monitors wells that have been specifically designated for monitoring by the GSA
- Does not include all wells in the basin (uses a small percentage of wells)
- Need to be monitored for levels, quality or subsidence consistently
- Monitored by Agencies, Districts, Counties, GSA, or in-basin stakeholders after agreement with the GSAs
- Only monitors production wells (e.g., irrigation, domestic) for levels or quality if an agreement is present between well owner and GSAs for use of that particular well as a monitoring well.
- Well production volumes and how to measure or estimate pumping are addressed in the Projects and Management Actions portion of the GSP and are not used for sustainability directly

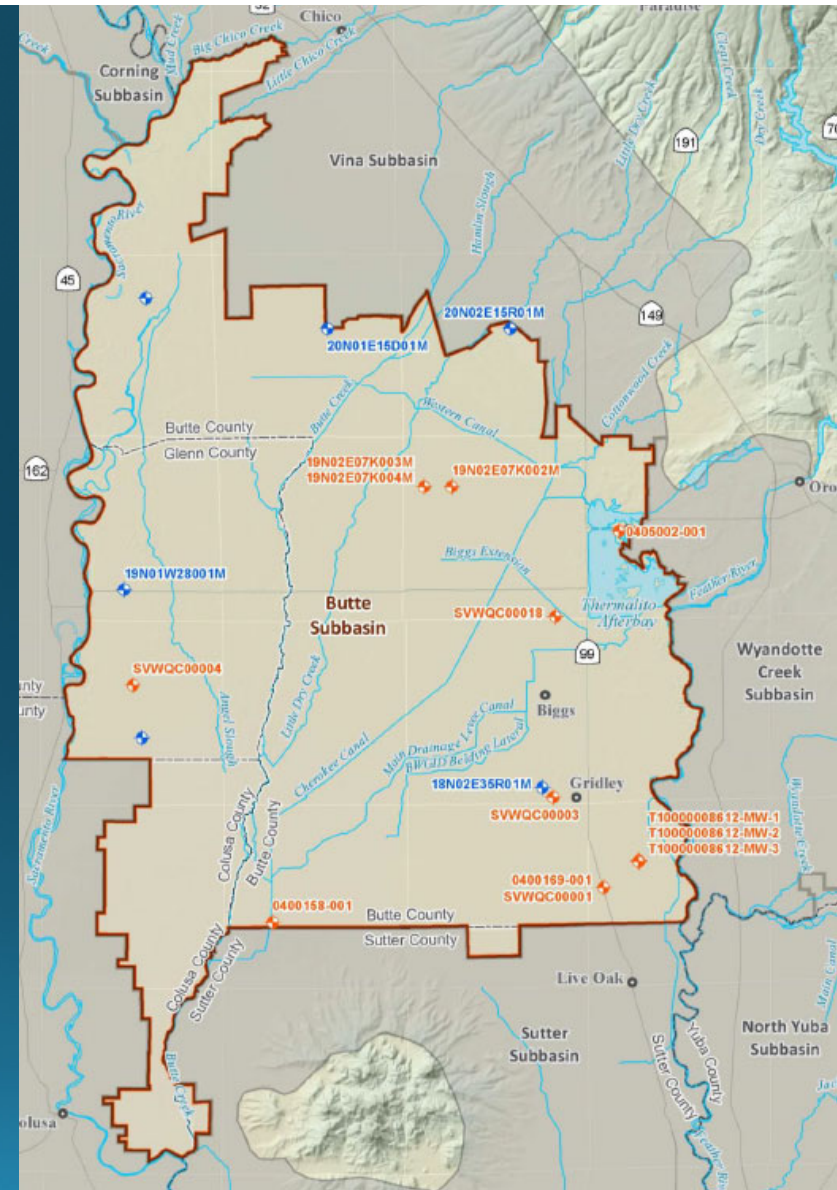
Groundwater Levels Monitoring Network

- Need to refine to a representative network by shallow and deep aquifer
- Select 1 completion per cluster well for shallow aquifer
- Select 1 completion per cluster well for deep aquifer
- Prepare levels representative network for shallow aquifer
- Prepare levels representative network for deep aquifer



Groundwater Quality

- Select representative monitoring networks for shallow and deep aquifer if needed in both aquifers
- Consider:
 - Monitoring well depth
 - Spatial coverage
 - Constituents currently monitored



Groundwater Levels and Surface Water Depletion

Minimum Threshold Approach

Measurable Objective Approach

Minimum Thresholds

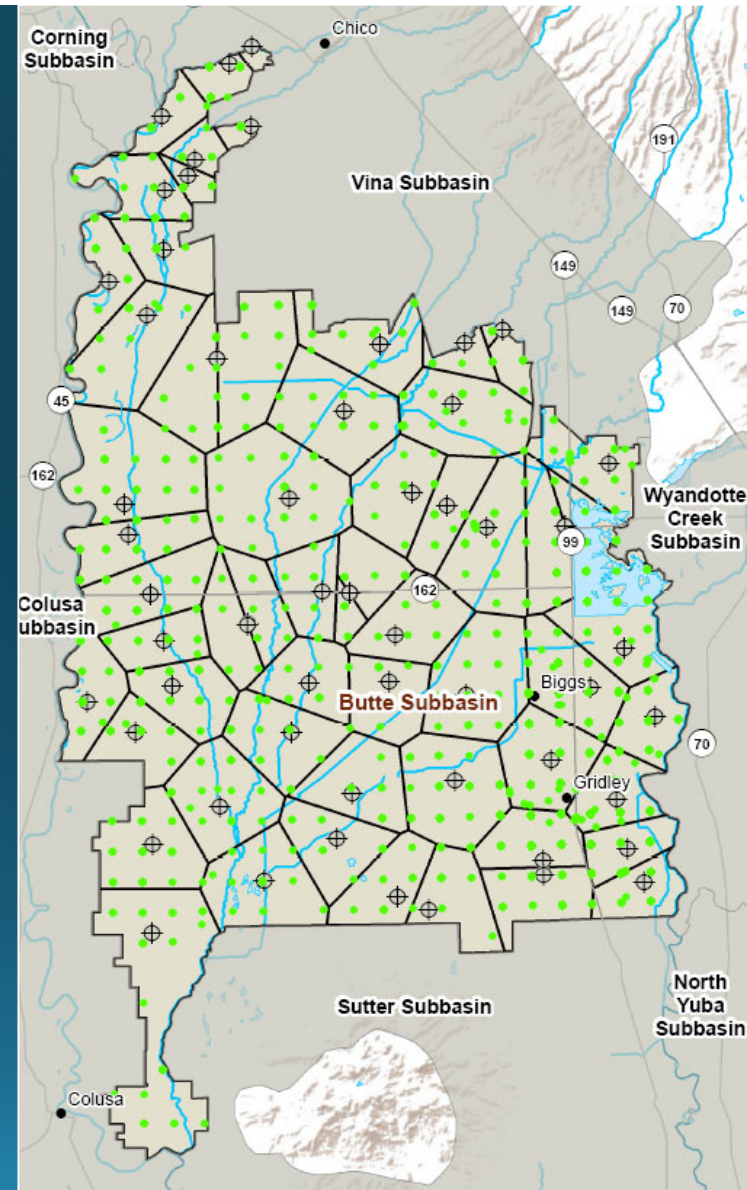
- §351 (t): “Minimum threshold” refers to a numeric value for each sustainability indicator used to define undesirable results”
- Elevation set at a monitoring well so that when conditions are worse than that elevation in a % of the network, it indicates an undesirable result is occurring
- Are set at each point in a representative monitoring network for each sustainability indicator using a consistent methodology – actual values will vary by location to match local conditions

Minimum Thresholds

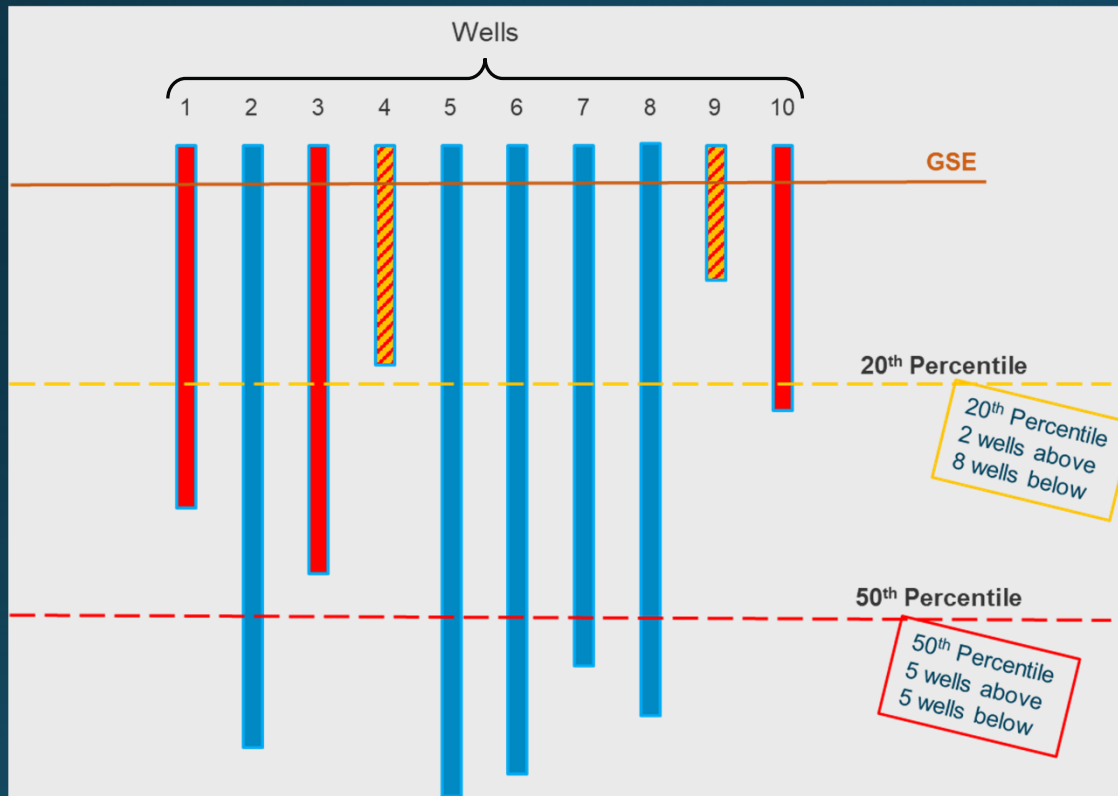
- Are set using a specific methodology that is applied to each monitoring well.
- Are set to represent a rationale for why the threshold is at the cusp of 'significant and unreasonable'
- Methodology includes consideration of spatial location and changing conditions across the Subbasin.

Groundwater Levels Threshold Considerations

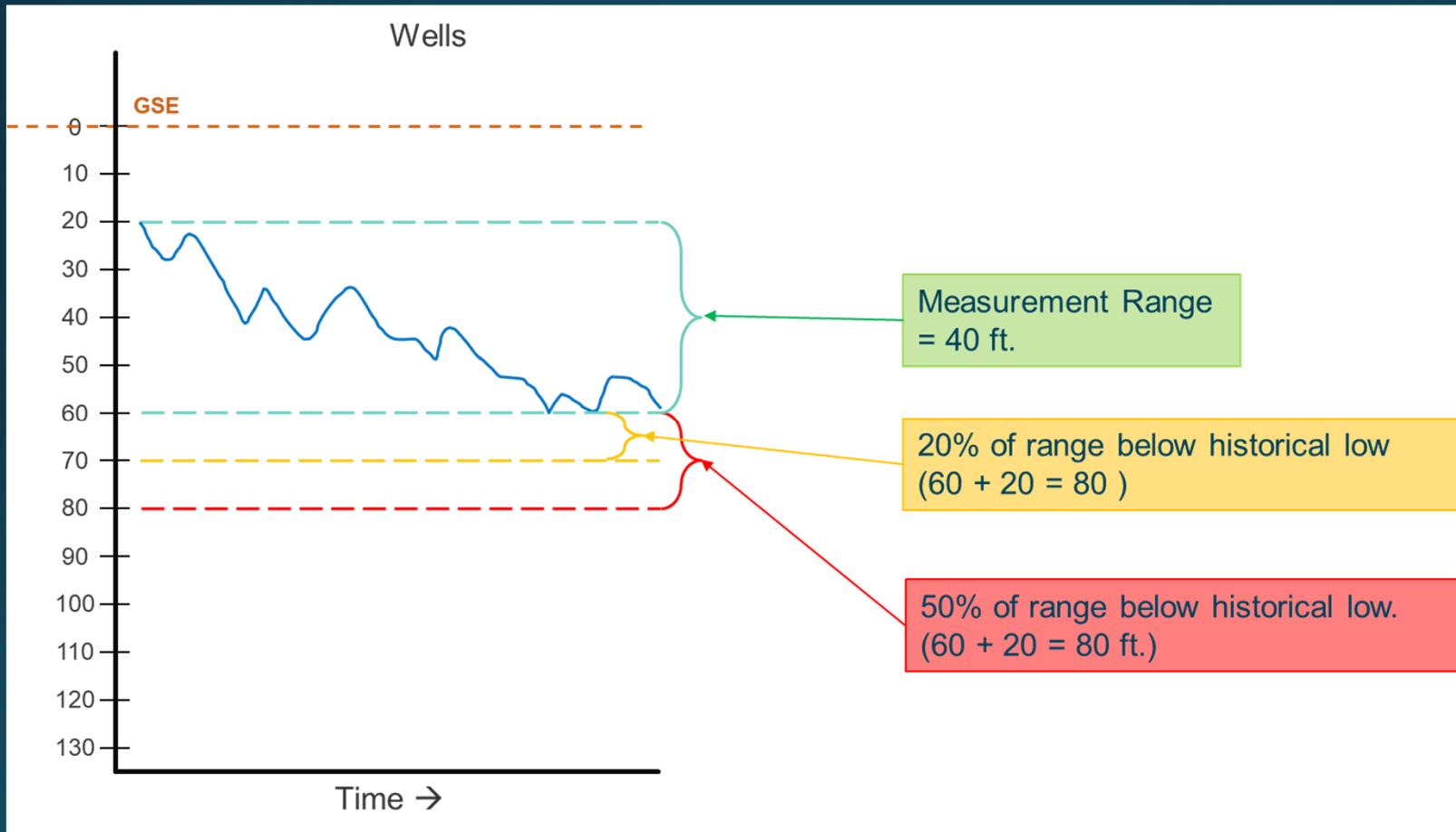
- Potential Approaches:
 - Well construction infrastructure
 - DWR Well Completion Database
 - Selected by Township Range Section Centroid (green dot)
 - Shallowest nearby well
 - Shallowest well, 5th, 10th, 20th, Percentile of nearby wells (100%, 95%, 90%, 80% of wells deeper than threshold)
 - Historical low on monitoring well
 - Percent of range of measurements (20%, 50%, 100%)
 - Locations of Groundwater Dependent Ecosystems – 30 feet rooting depth?



Understanding Well Depth Percentiles Groundwater Levels

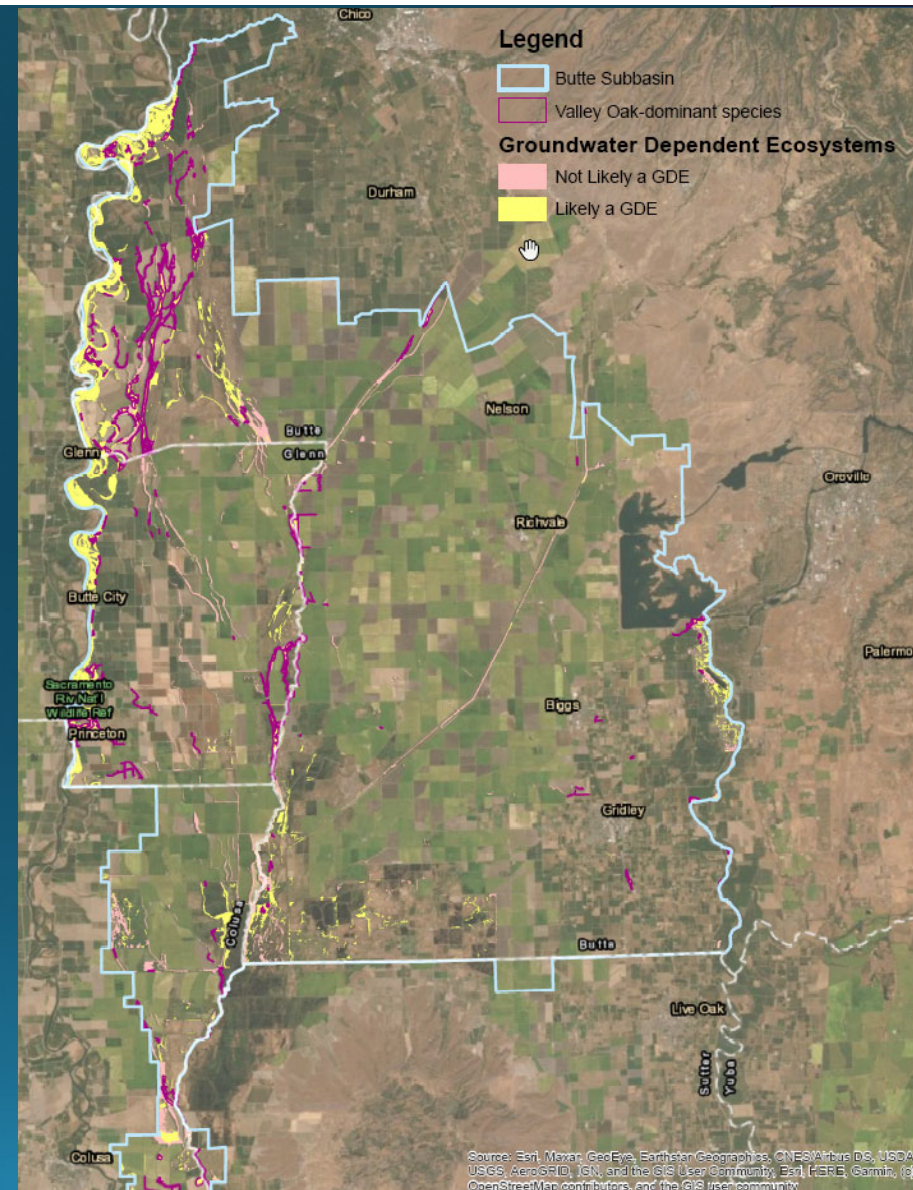


Percent of Range Groundwater Levels

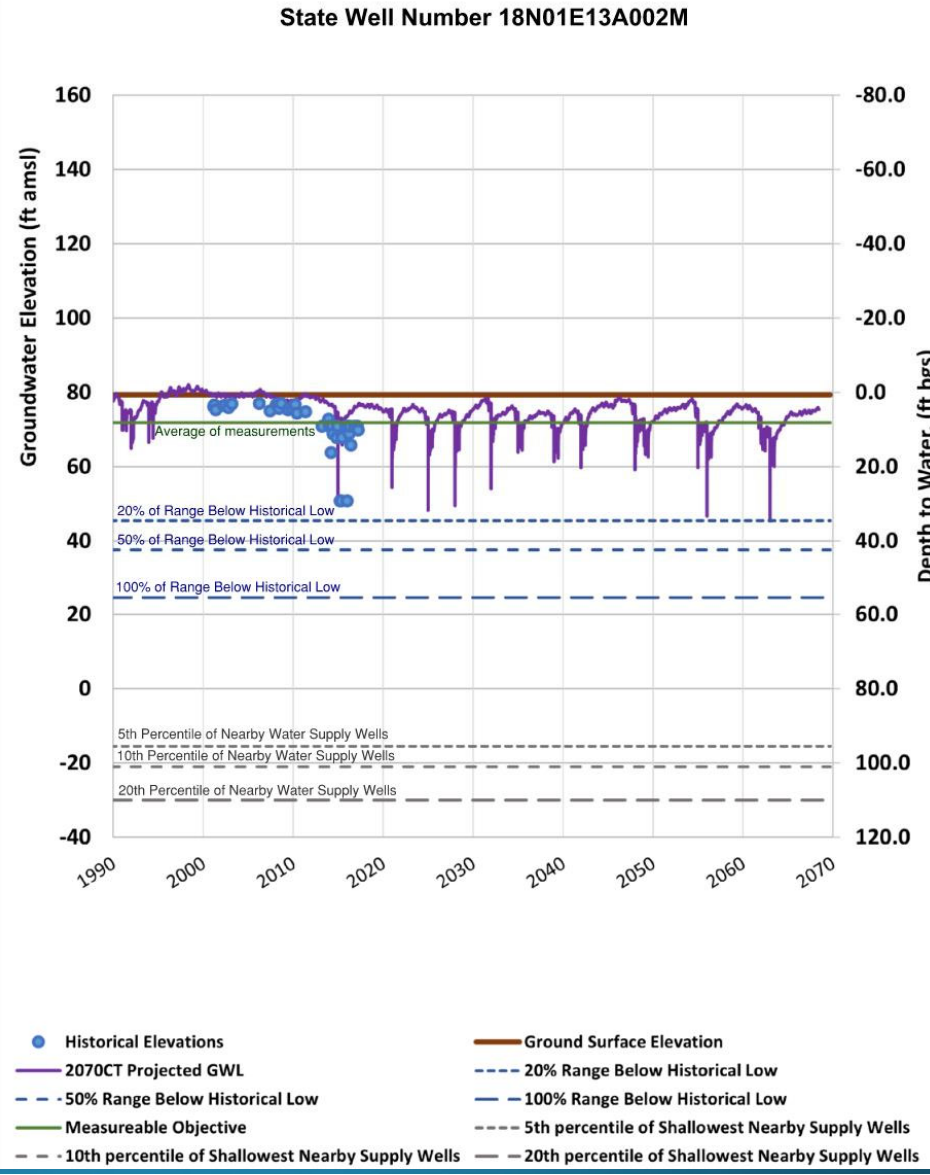
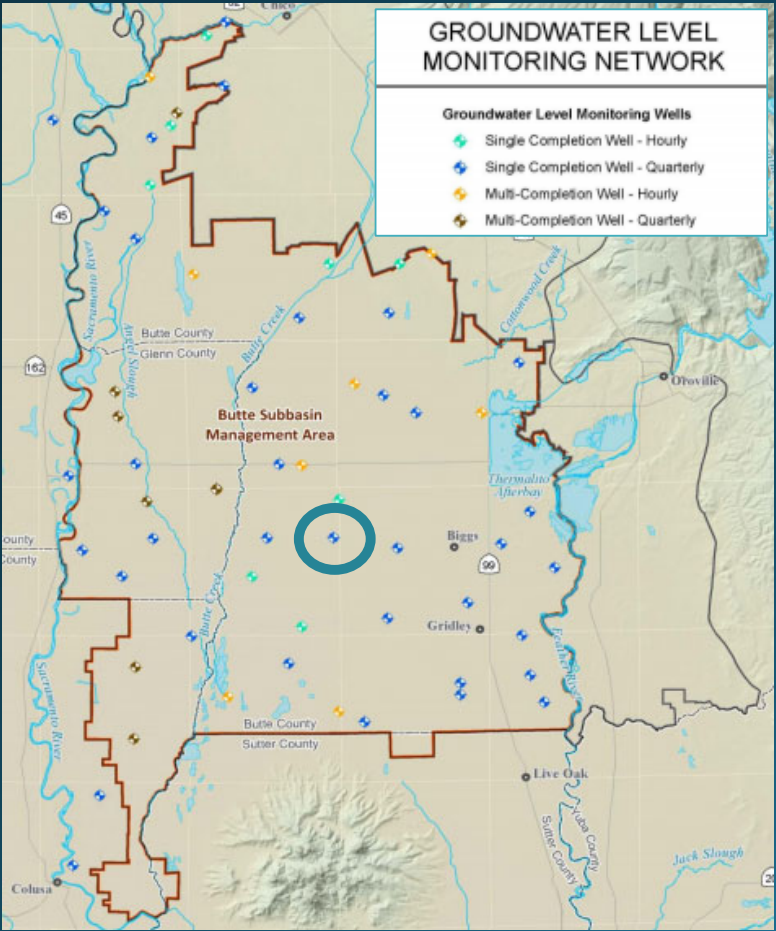


Groundwater Dependent Ecosystems

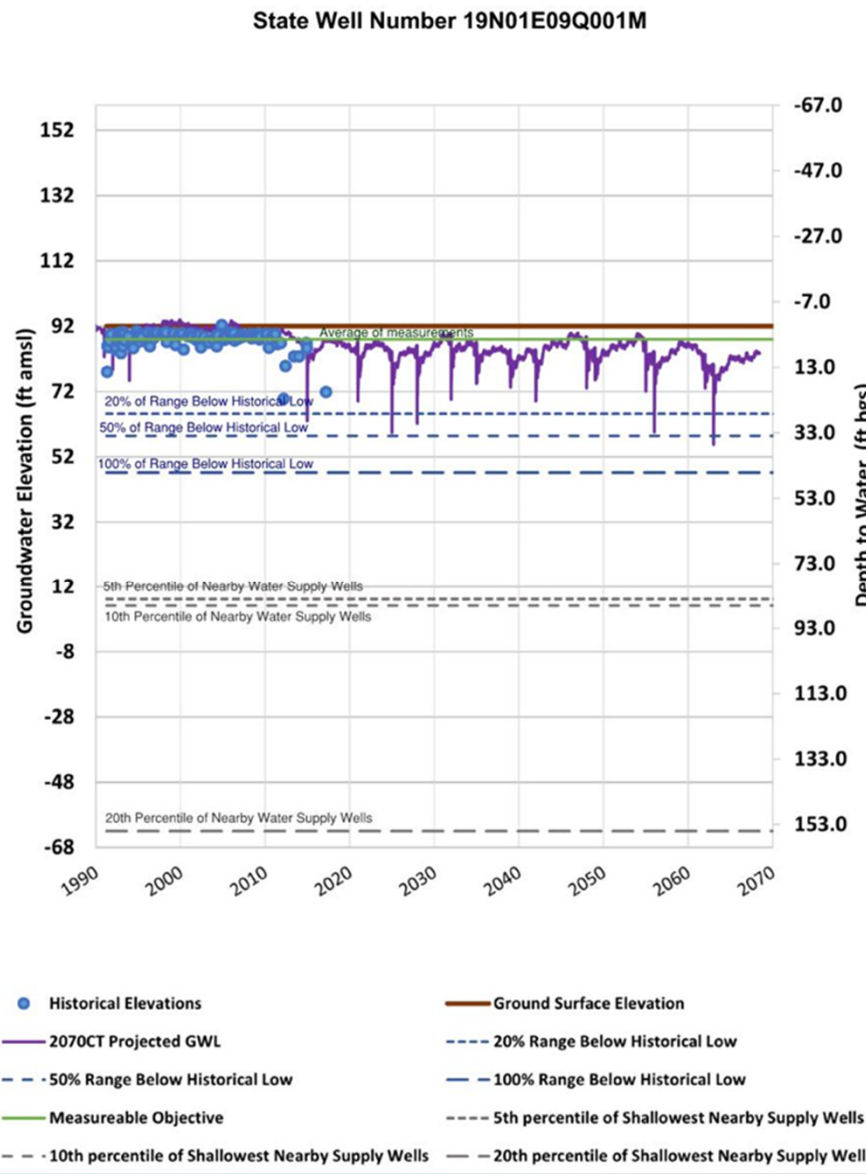
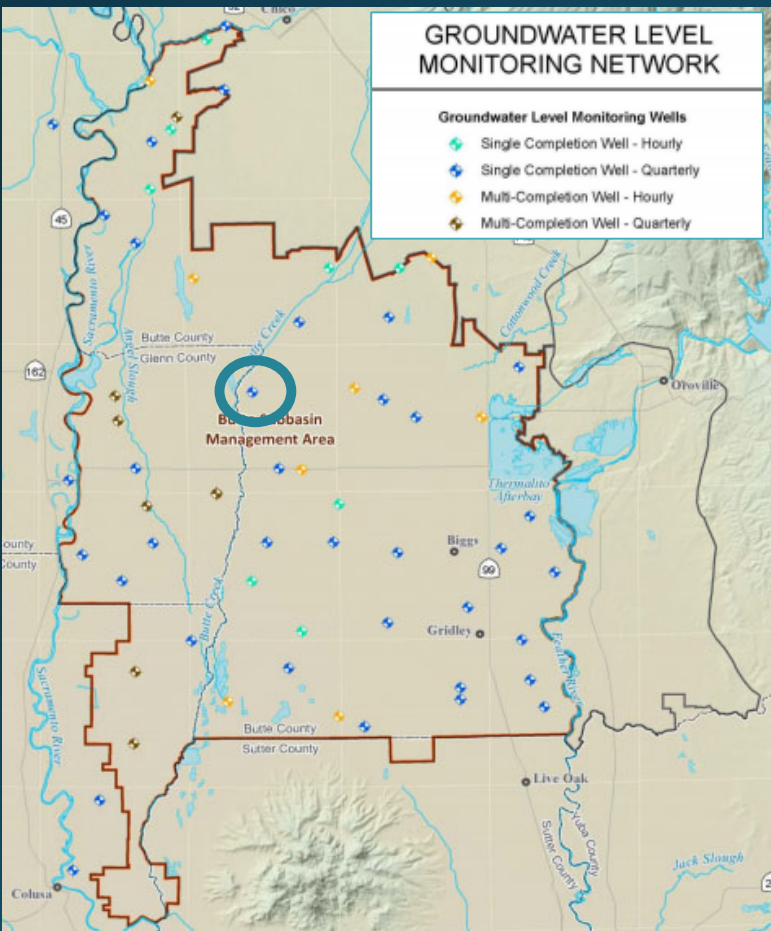
- Rooting depth of Valley Oaks = 30 feet
- Monitor with existing shallow wells near GDE locations if possible
- May use separate network of very shallow (<50 foot depth) wells, would require installation of new monitoring



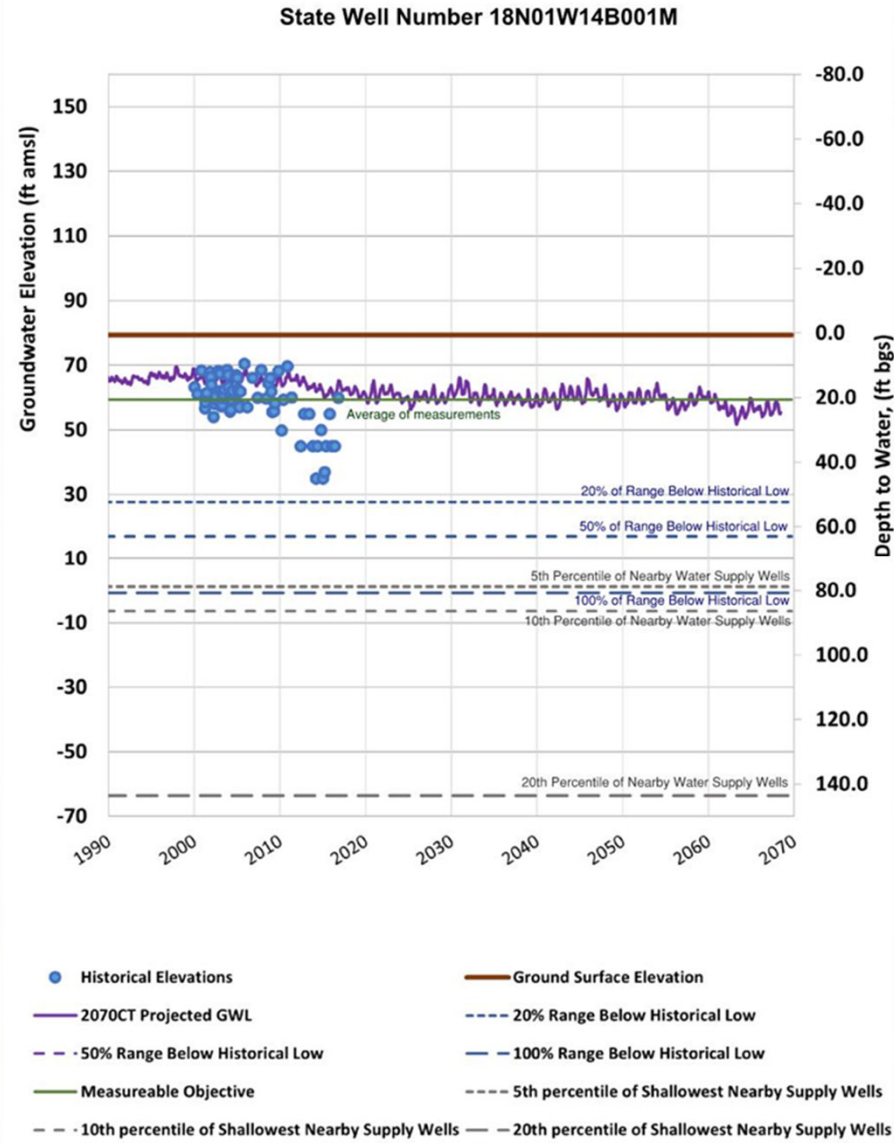
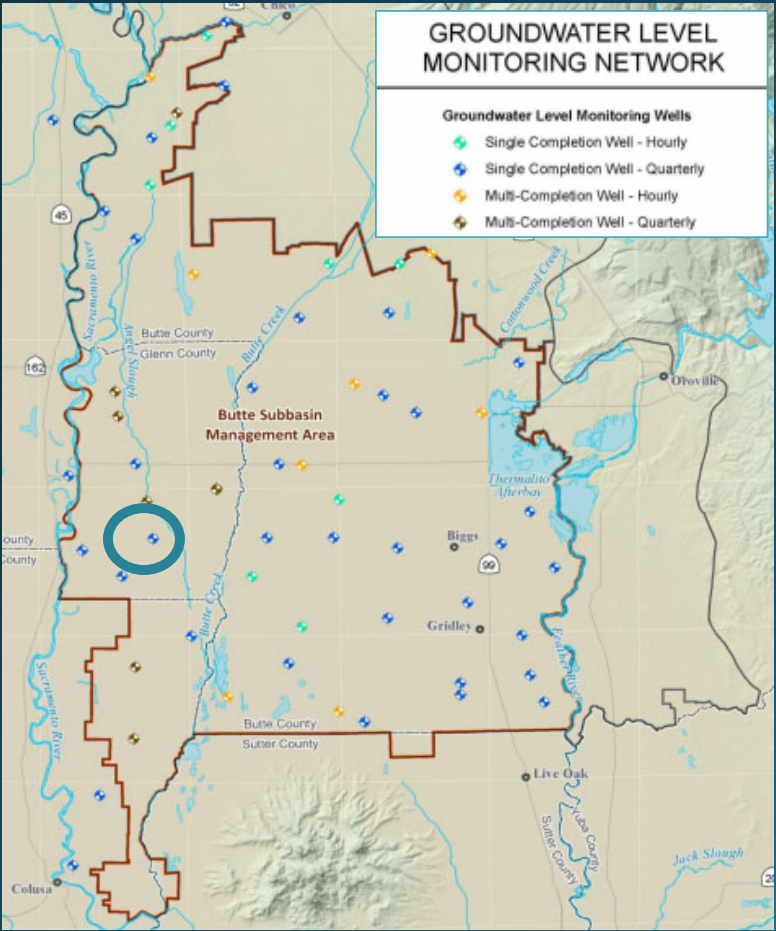
Example Hydrographs and Minimum Threshold Considerations



Example Hydrographs and Minimum Threshold Considerations



Example Hydrographs and Minimum Threshold Considerations

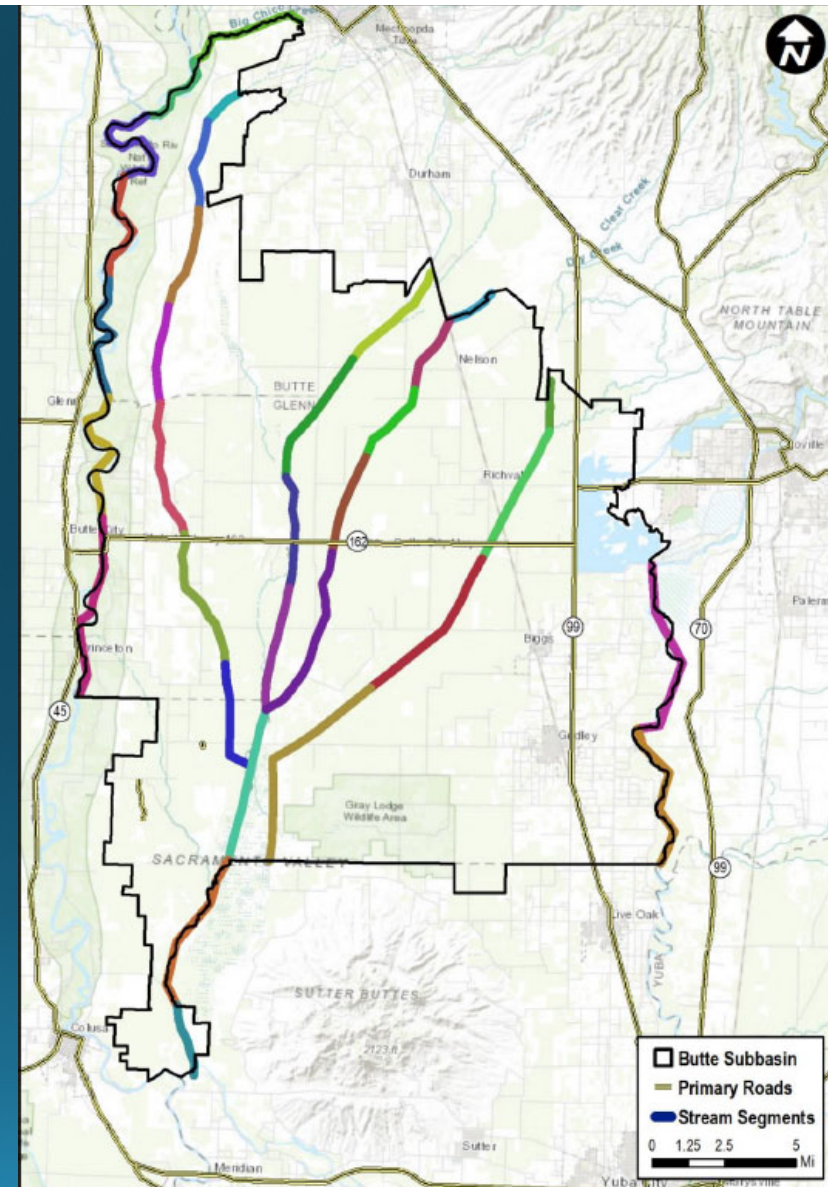


Groundwater Levels Thresholds Summary and Key Questions

- Set thresholds considering:
 - Historical monitoring (% Range)
 - Nearby well infrastructure (percentile of nearby wells)
 - Groundwater Dependent Ecosystems where present and near shallow wells
- Preliminary Recommendation from Technical Team:
 - Minimum Threshold: Use the lower of 100% of range below the historical low or the shallowest 5% of nearby wells.
 - Measurable Objective: Use the average of measurements
 - Establish new GDE monitoring network with new shallow wells during GSP implementation
- Key Questions:
 - What percentile of wells 'feels' reasonable?
 - What is 'significant and unreasonable'?
 - Slurry wall on the Feather River consideration?

Depletions of Interconnected Surface Water Recommendations

- Focus on key water bodies:
 - Sacramento River
 - Feather River
 - Butte Creek
 - Little Dry Creek, Dry Creek, Angel Slough
- Two options available

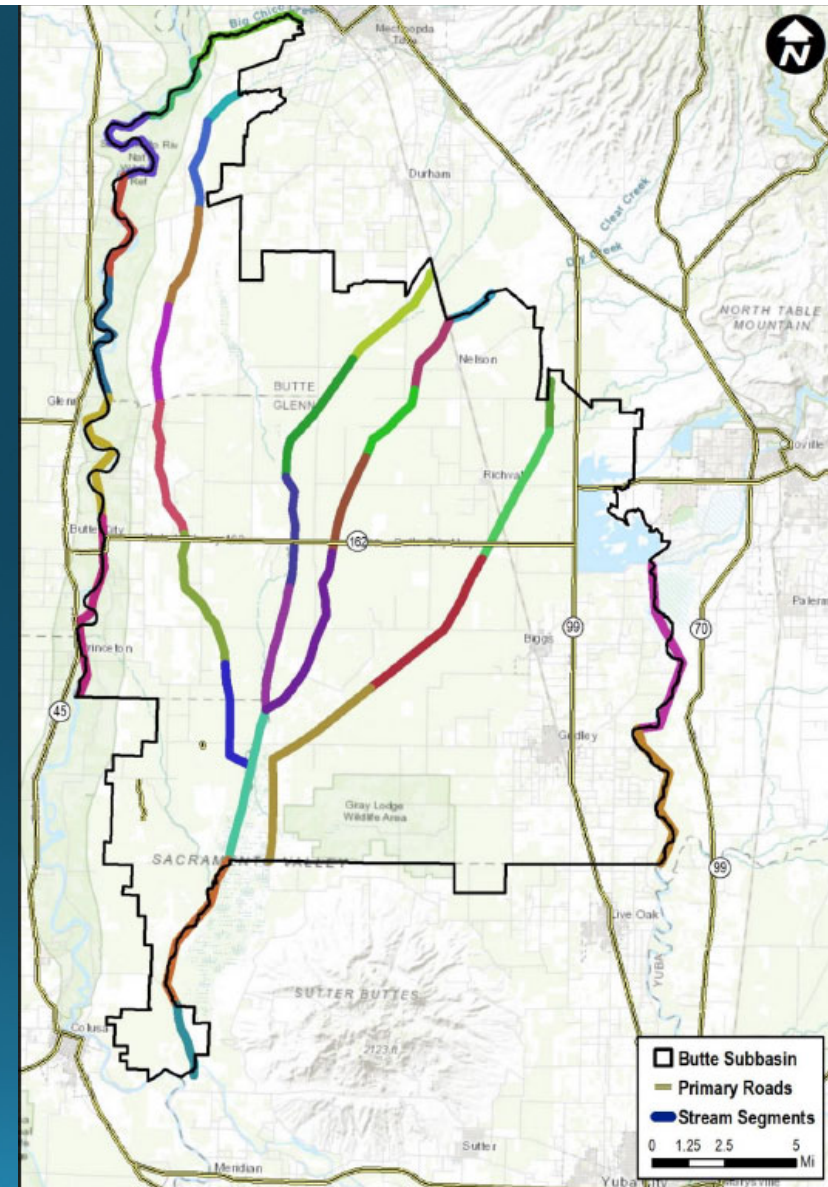


Depletion of Interconnected Surface Water

- Option 1: Monitoring for Depletions of Interconnected Surface Waters using levels as a proxy
 - Use numerical model to estimate depletions from key water bodies at existing and forecast groundwater levels
 - May lead to shallower minimum thresholds than levels thresholds in wells near key water bodies to be protective of depletions
 - Discuss what 'significant and unreasonable' means in terms of depletions in Butte Subbasin
 - Discuss what 'significant and unreasonable' means in terms of depletions outside Butte Subbasin

Depletions of Interconnected Surface Water

- Option 2: Do not set SW depletion thresholds for 2022 GSP and plan to establish at 5 year update
- Establish stronger shallow well monitoring network (may overlap with shallow wells for GDEs, reducing cost)



Depletions of Interconnected Surface Water Summary and Key Questions

- Key Questions for Consideration:
 - Interest in Option 1 (existing monitoring and shallow thresholds)
 - Interest in Option 2 (develop new shallow network, establish thresholds in 2027)
 - What amount of depletion ‘feels’ reasonable?
 - What is ‘significant and unreasonable’?
 - Slurry wall on the Feather River consideration?

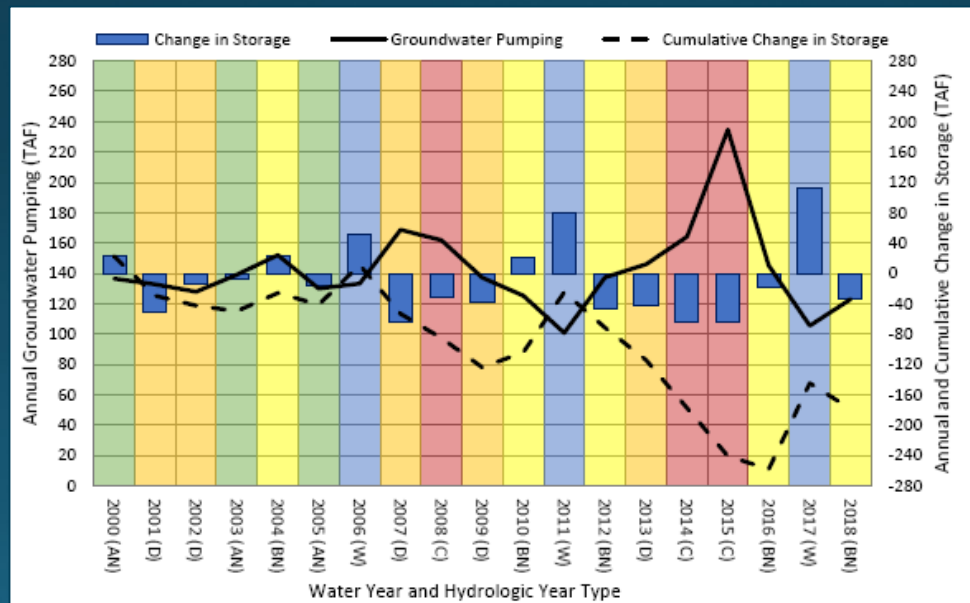
Manage to Most Restrictive Threshold

- One set of minimum thresholds for levels
- One set of minimum thresholds for surface water depletions
- One set of thresholds for monitoring wells near GDEs
- Shallowest threshold at each monitoring well is the threshold that should be managed to

Groundwater Storage

Groundwater Storage

- Recommend using levels as a proxy
- Change in storage that has occurred is a small portion of available storage.
- Limiting factor to storage use is existing well infrastructure and near surface conditions, not the amount of volume storage
- Therefore: levels threshold are protective against significant and unreasonable changes in storage



Seawater Intrusion

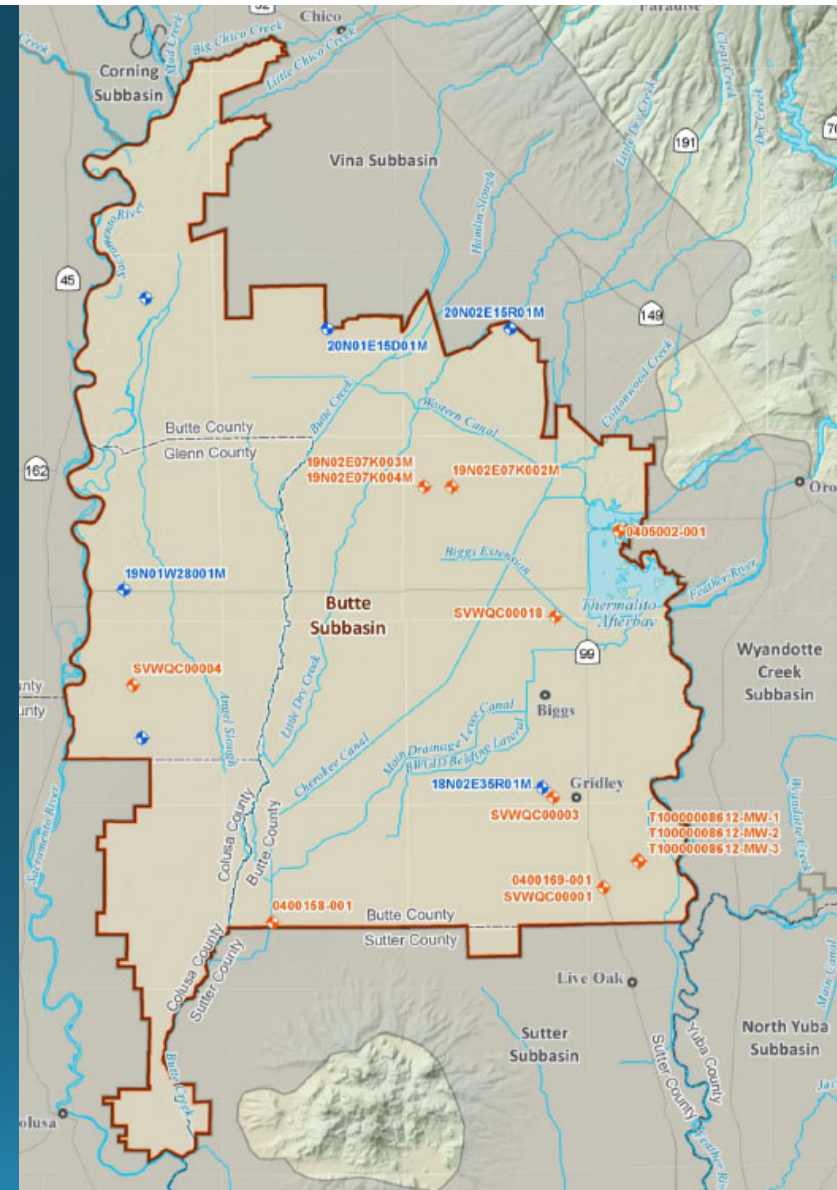
Seawater Intrusion Recommendations

- Not Applicable in the Butte Subbasin
- Seawater intrusion is not an applicable sustainability indicator because seawater intrusion is not present and is not likely to occur in the Butte Subbasin due to the distance between the Subbasin and the Pacific Ocean, bays, deltas, or inlets. Therefore, there is no possibility of an undesirable result due to seawater intrusion.

Groundwater Quality

Groundwater Quality

- Development Process:
 - Select Representative monitoring network
 - Select constituents of concern
 - Establish Minimum Threshold
 - Establish Measurable Objective
- Consider:
 - MCLs
 - Historical concentrations
 - Agricultural requirements



Groundwater Quality

- Total Dissolved Solids (TDS) considerations for thresholds
 - Drinking water standards (500 – 1,500 TDS)
 - Agricultural quality requirements (450 – 1,500 TDS depending on crop?)
 - Historical Measurements

Groundwater Quality

- What is the concern being managed by the GSA within its authorities?
 - Upwelling of saline water
- Technical Team Recommendation:
 - Monitor with deepest completions
 - Monitor deep aquifer
 - Include monitoring near Sutter Buttes
 - Set thresholds with deep production well uses considered

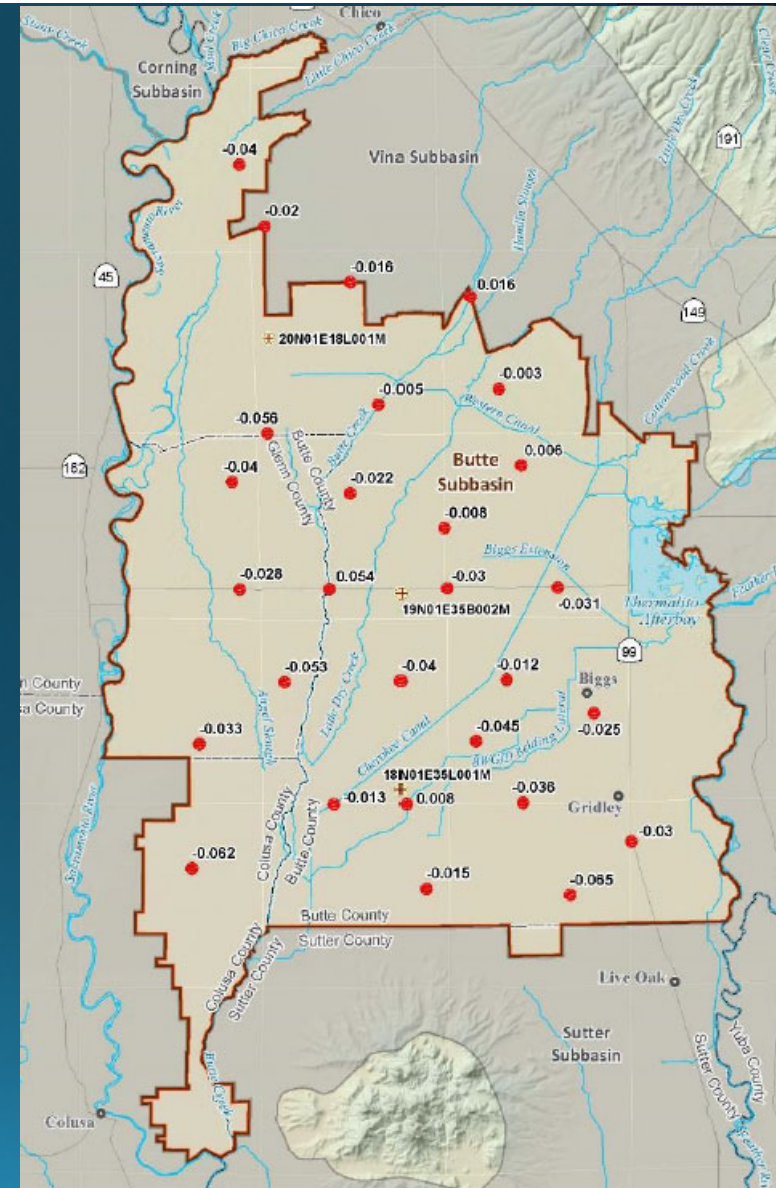
Groundwater Quality Summary and Key Questions

- Is monitoring only the deep aquifer acceptable?
- Is limiting constituents to TDS acceptable?
- Set thresholds considering:
 - MCLs
 - Agricultural requirements
- Key Questions:
 - Do we need to monitor and manage the shallow aquifer for SGMA?
 - Are there any other constituents of concern to discuss?

Inelastic Land Subsidence

Subsidence

- Historical subsidence is small
 - Less than 0.0325 feet per 5 years
- Recommend continued use of the DWR Sacramento Valley Subsidence Network
- Set MT at: 0.5 feet per 5 years (Consistent with Yuba GSP)
- Set MO at: 0.25 feet per 5 years (Consistent with Yuba GSP)



Subsidence

Summary and Key Questions

- Subsidence is not occurring in the Butte Subbasin
- Continue monitoring and review during 5-year update
- Key Questions:
 - What subsidence rate would be significant and unreasonable in Butte Subbasin?
 - Vulnerability of local infrastructure?

Next Steps

- Levels:
 - Develop draft groundwater level Minimum Thresholds
 - Develop approach for Measurable Objectives
- Depletions of Interconnected Surface Water:
 - Analyze depletions using numerical model
- Quality:
 - Develop representative monitoring network
 - Select constituents to be monitored
 - Select thresholds for each constituent selected
- Subsidence:
 - Review Minimum Thresholds and Measurable Objectives