COLUSA AND GLENN GROUNDWATER AUTHORITIES

Colusa Subbasin

Joint Technical Advisory Committee

GSP Development

January 8, 2021

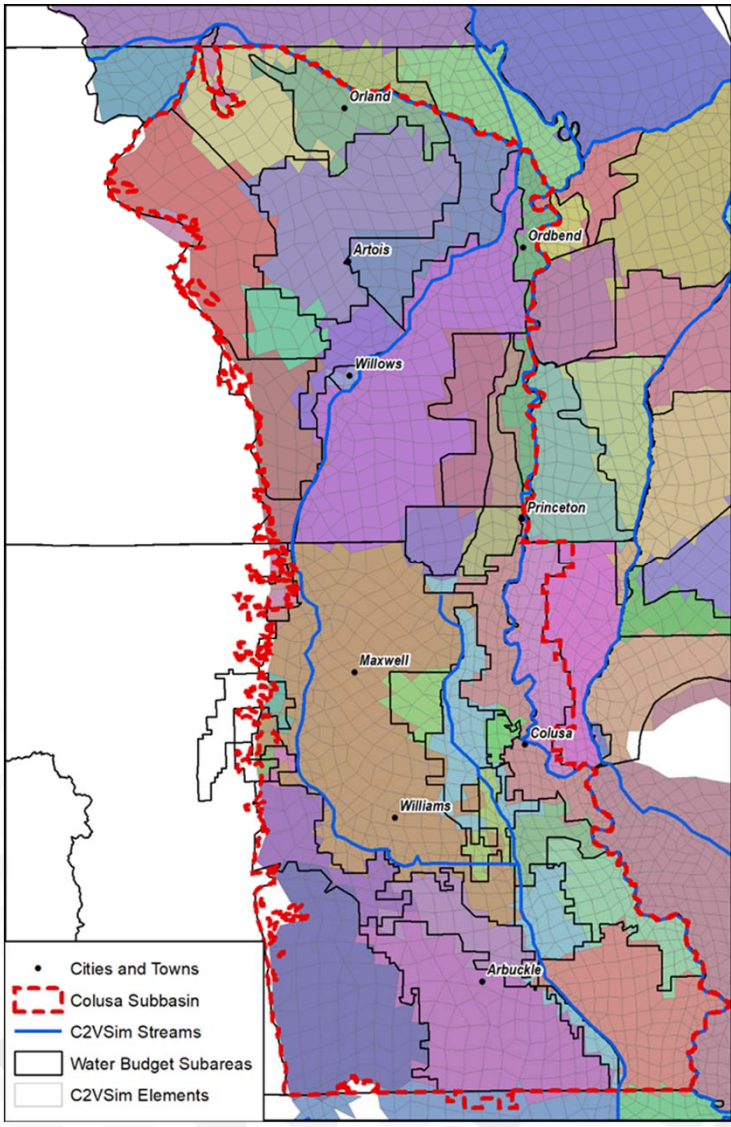
Discussion Topics

- Subarea Water Budgets
  - Davids Engineering
- Sustainable Management Criteria
  - Woodard & Curran, ERA Economics
- Management Area Considerations
  - Woodard & Curran, West Yost

4.a. Subarea Water Budgets

Water Budget Approach

- Estimated using DWR's Integrated Hydrologic Model (C2VSimFG Beta2), with local refinements
- 38 Subareas in Colusa Subbasin
  - Water Suppliers/ Diverters
  - Counties
  - GW-Only Areas
- Ability to Report Out Water Budgets to Support Intrabasin Discussions



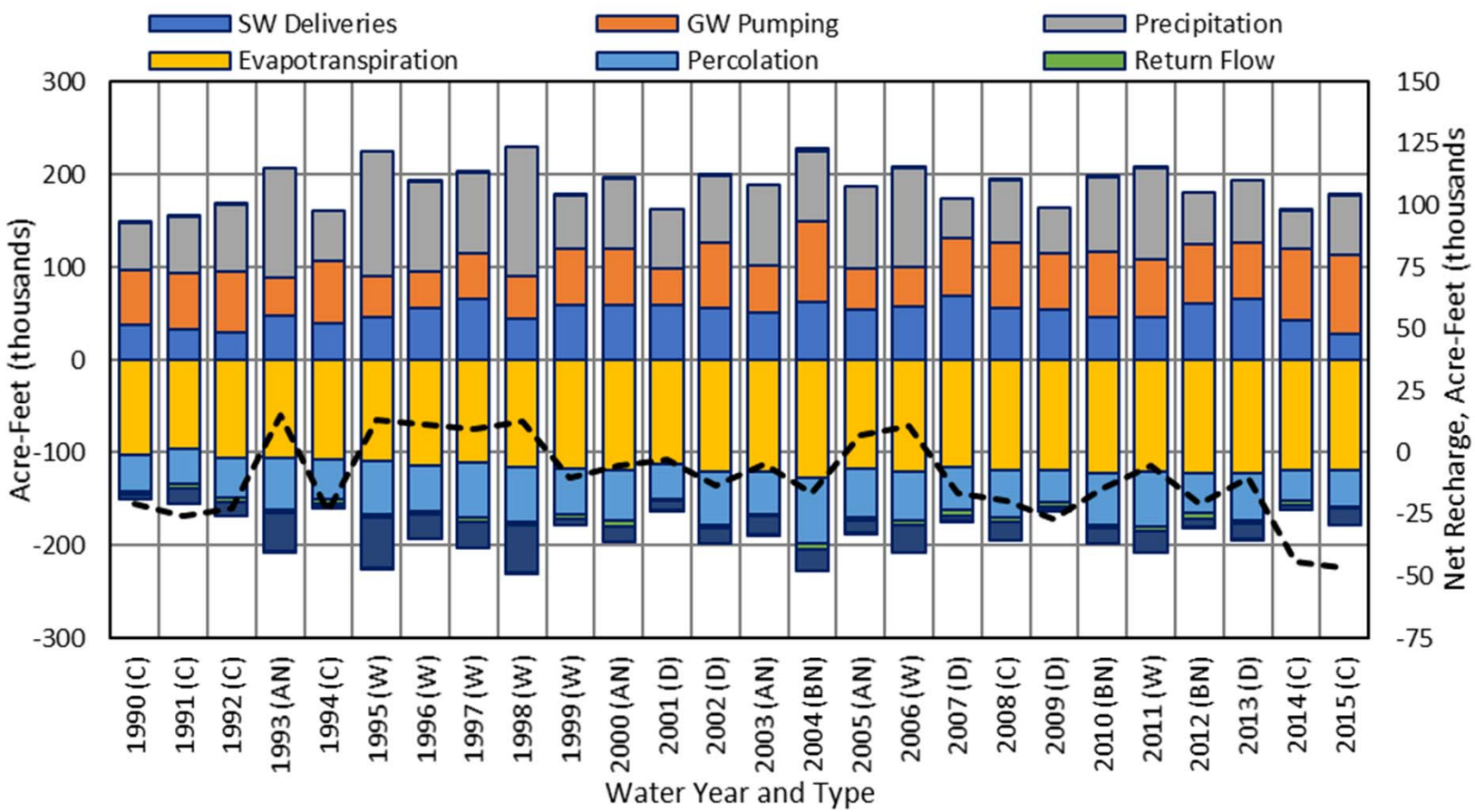
Surface System Water Budget Components

- Land Use
- Precipitation
- Surface Water Deliveries
- Groundwater Pumping
- Evapotranspiration
- Deep Percolation
- Stream/Canal Seepage
- Runoff from Precipitation and Applied Water

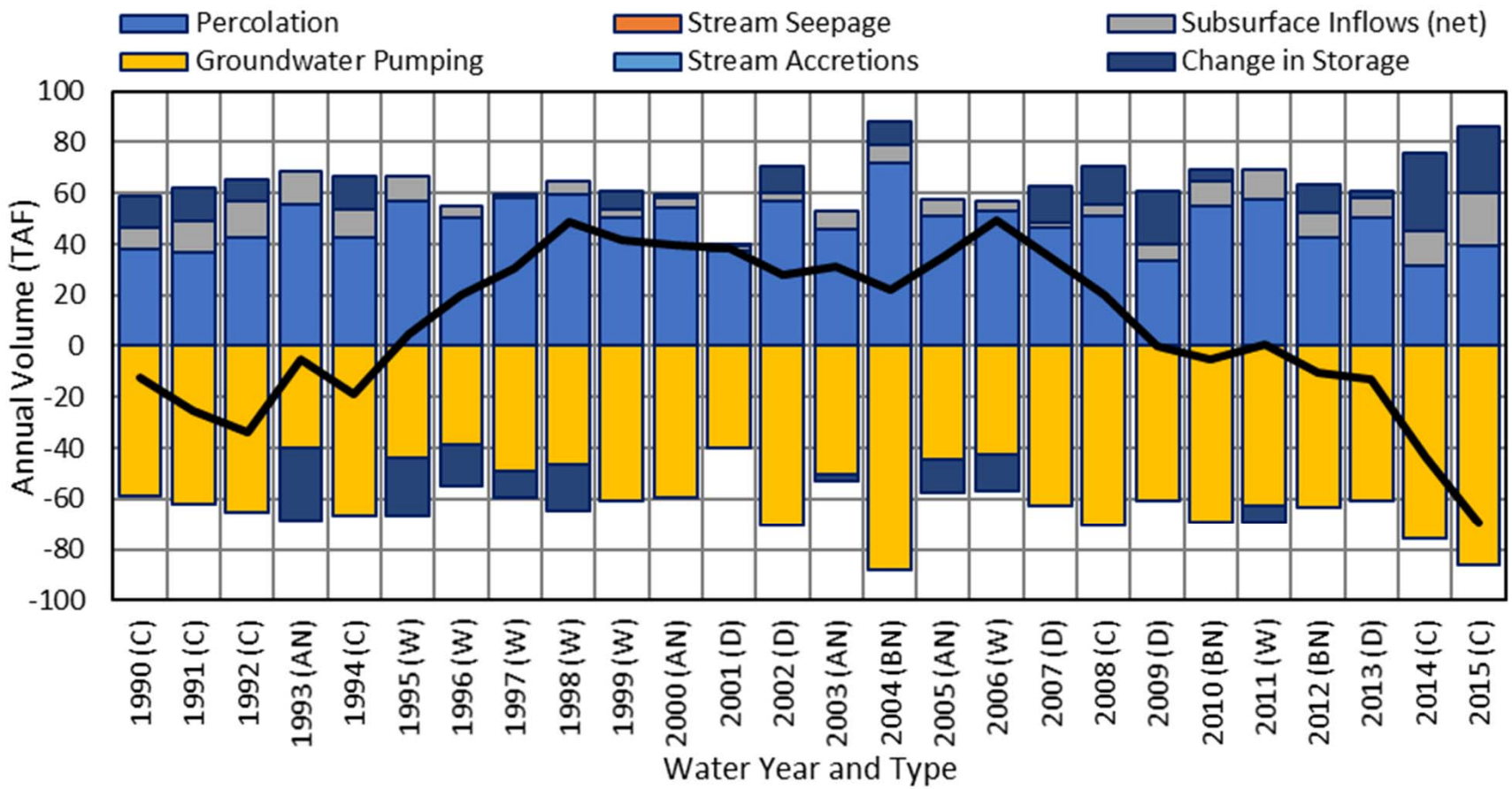
Groundwater System Water Budget Components

- Subsurface Flows
- Exchanges with Surface Layer
  - Groundwater Pumping
  - Recharge
- Change in Groundwater Storage

Example Surface Water Budget



Example Groundwater Budget



Next Steps

- Assemble Draft Water Budget Summaries by Subarea
- Distribute for Additional Input
- Support Intrabasin Discussions
  - Management Areas
  - Sustainable Management Criteria
  - Projects and Management Actions

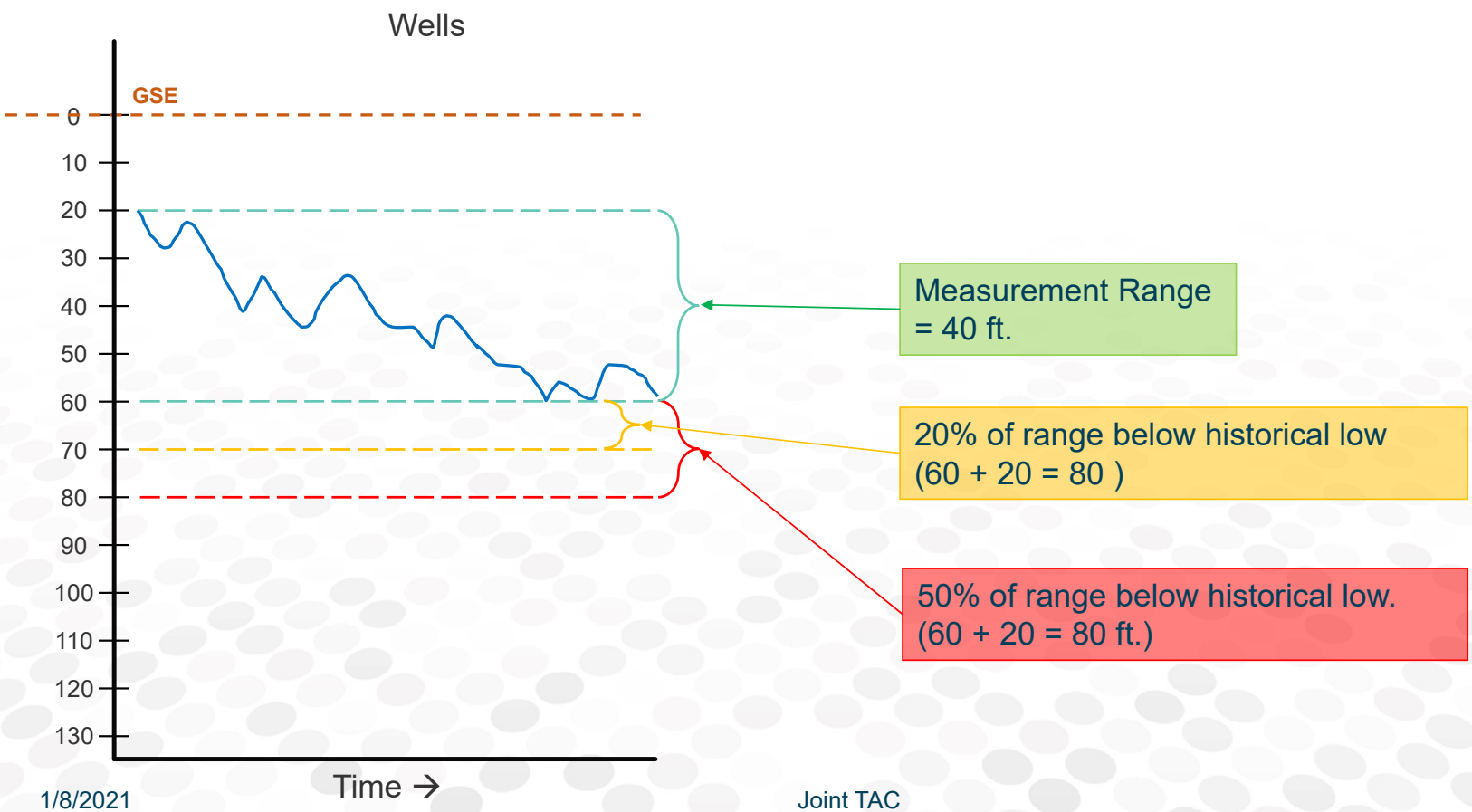
Discussion

4.b. Sustainable Management Criteria

Sustainable Management Criteria

- Considerations for groundwater level thresholds
  - Percent of range of measurements
  - Percentile of nearby wells depth
  - Percentile of nearby domestic wells depth
- Model use and forecasted surface water deliveries

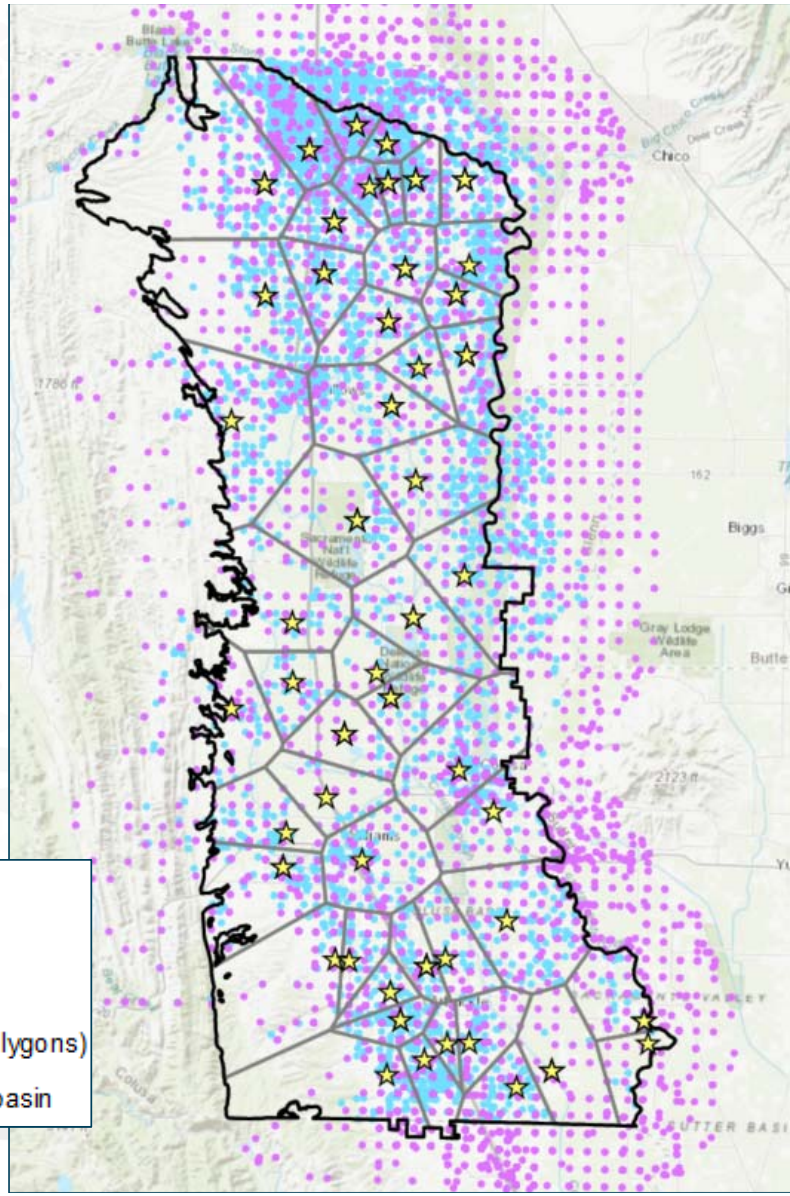
Percent of Range
Groundwater Levels



Thiessen Polygons and WCR database

Groundwater Levels

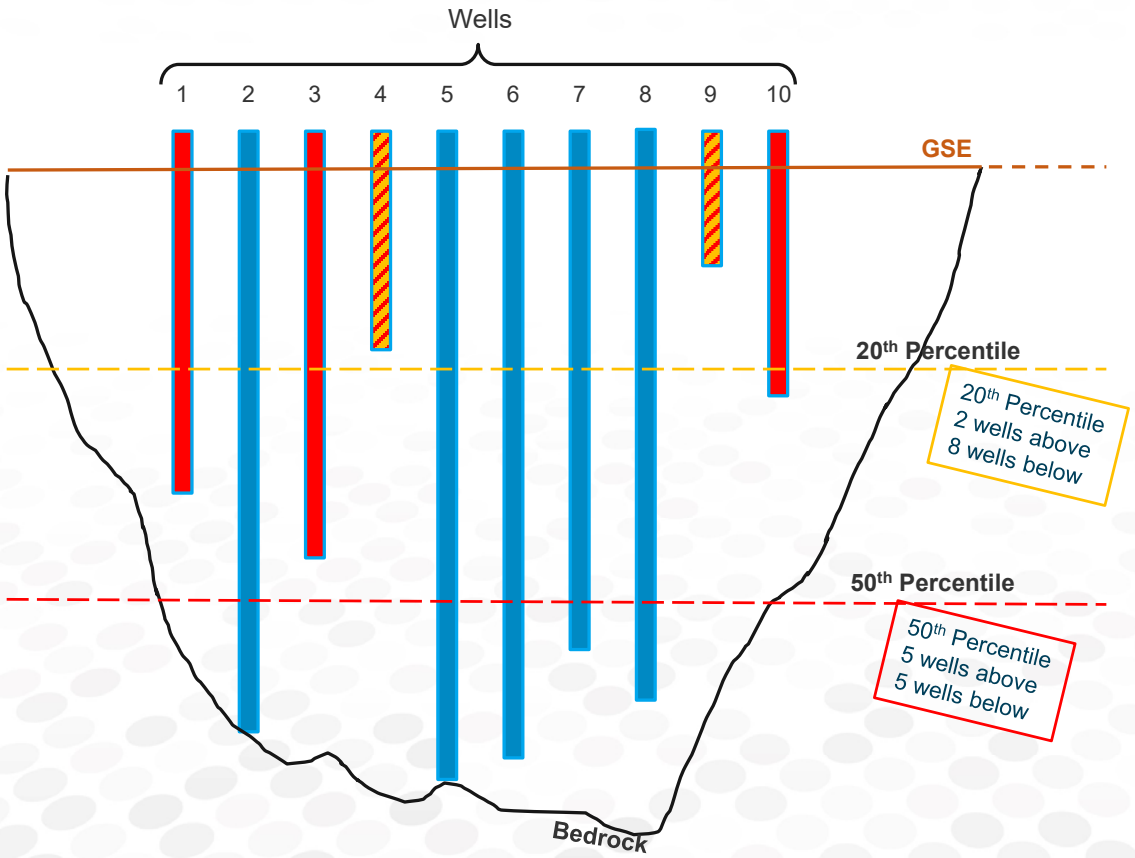
- Shows area that is nearest to each monitoring well
- Can be used to select Well Completion Reports to identify which WCRs are closest to which monitoring point



Monitoring Network
Glenn/Colusa County WCRs
OSWCRs Database
Monitoring Network (Thiessen Polygons)
Sacramento Valley - Colusa Subbasin

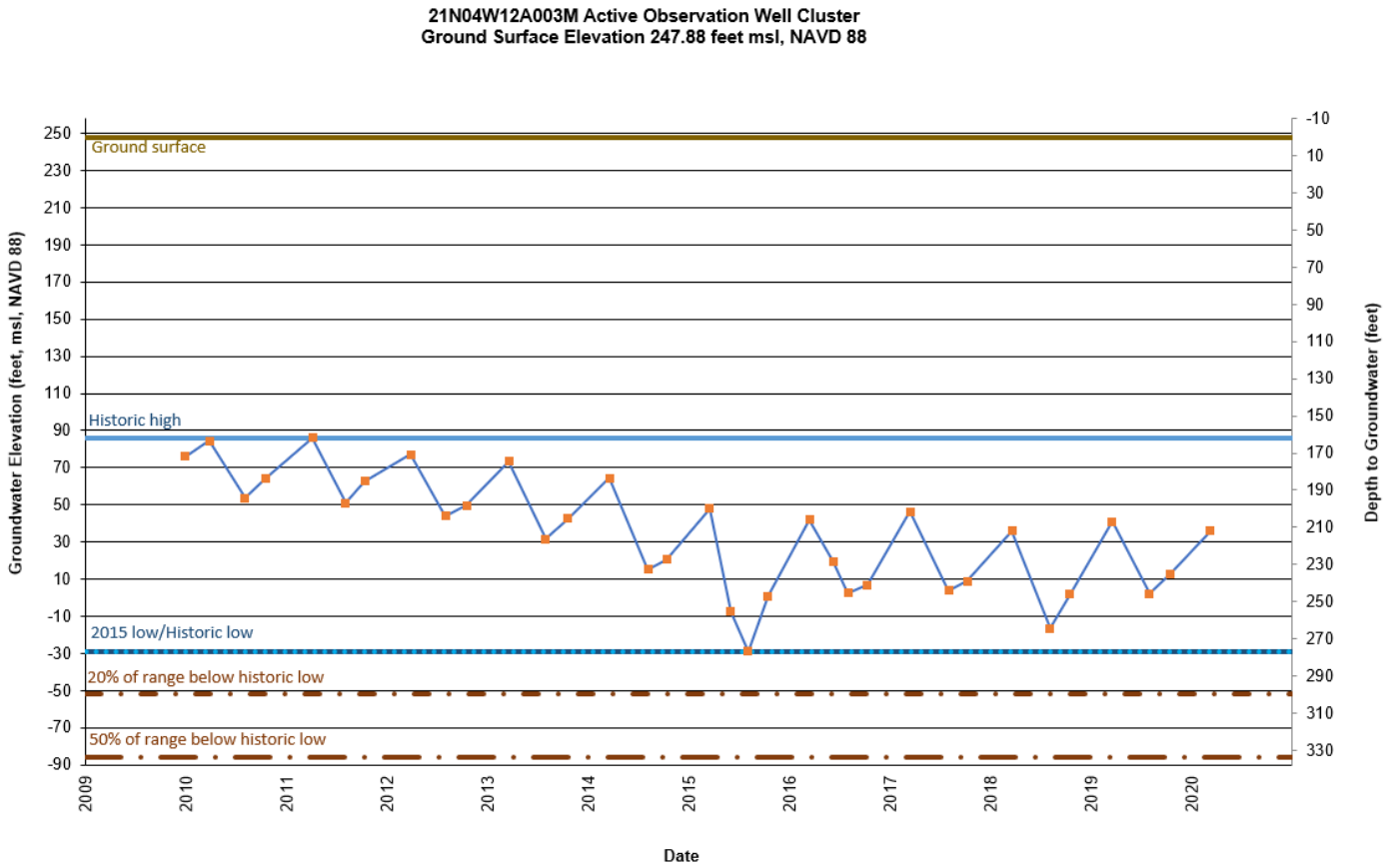
Understanding Well Depth Percentiles

Groundwater Levels



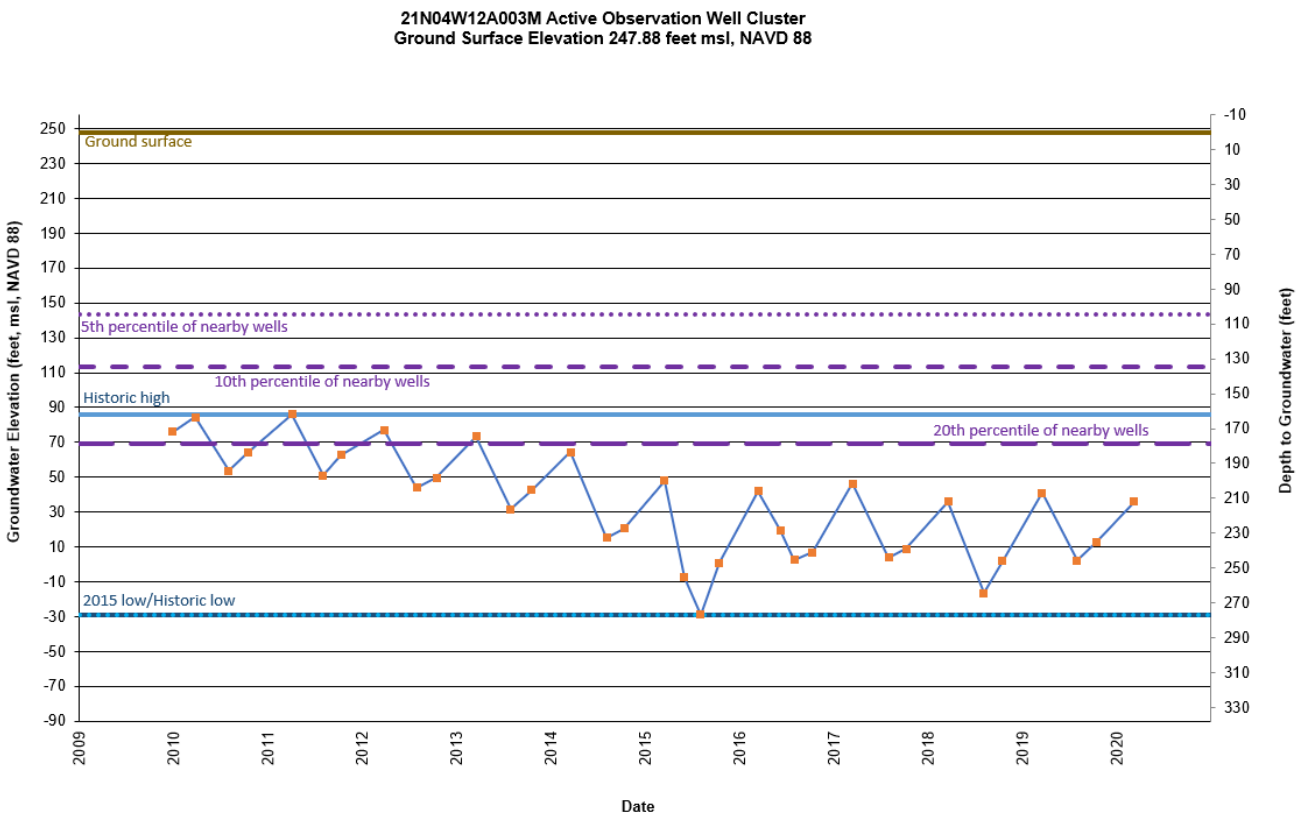
Period of Record

- 20%, 50% below historic low



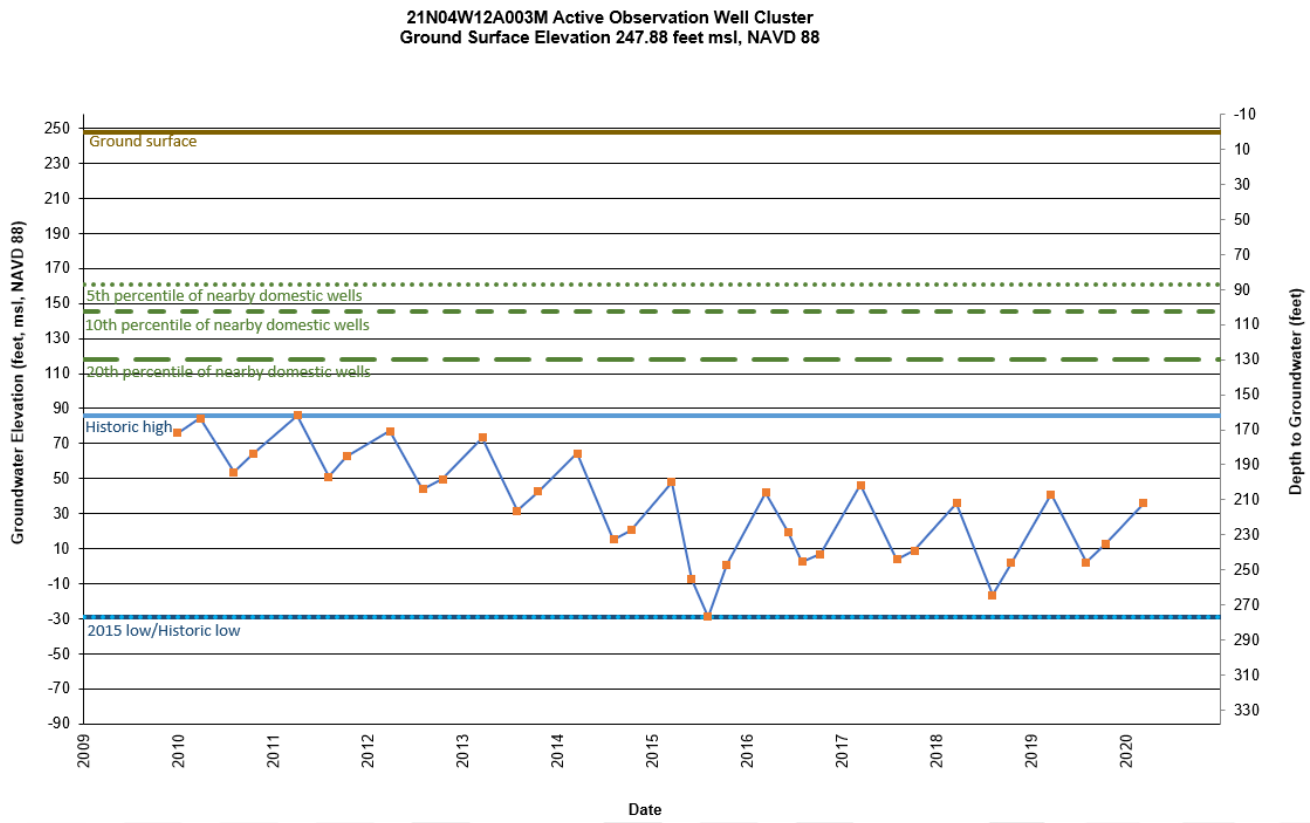
Percentile of All Nearby Wells

- 5th, 10th, 20th percentile
- Well types included:
  - Domestic
  - Industrial
  - Irrigation
  - Municipal
  - Public
  - Stock or Animal Watering



Percentile of Nearby Domestic Wells

- 5th, 10th, 20th percentile
- Well types included:
  - Domestic wells



Future Surface Water Availability

- Future surface water availability is uncertain
- Bay delta water quality control plan factors
- Need to be considered as part of minimum thresholds
- Will use numerical model under multiple scenarios to evaluate effects of reduced surface water deliveries on groundwater conditions
- Will use those scenarios to guide minimum threshold development

Model Use and Forecasted Surface Water Deliveries

- Model reductions in surface water supply and corresponding reductions in groundwater levels due to increased pumping
- Compare to domestic well infrastructure to evaluate potential effects
- Consider using local considerations (nearby well depths, range of measurements, etc.) to set Minimum Thresholds that are similar in elevation to groundwater conditions under reduced future surface water deliveries

Potential Economic Analysis to Support Selection of MT and MO

- Overview
- Economic analysis in other basins
  - Alternative PMA implementation timelines and associated Minimum Thresholds (MT) and Measurable Objectives (MO)
  - Tradeoff analysis: demand management and domestic well mitigation program
- Potential economic analysis
- Discussion

Overview

- MT and MO may be set based on modeled groundwater levels and SMC
  - Different percentiles; historic lows; modeled reductions in surface water supply and associated groundwater levels
- Economic analysis is a framework for comparing tradeoffs in alternative MT/MO in a consistent manner
  - Costs and benefits occurring at different points in time

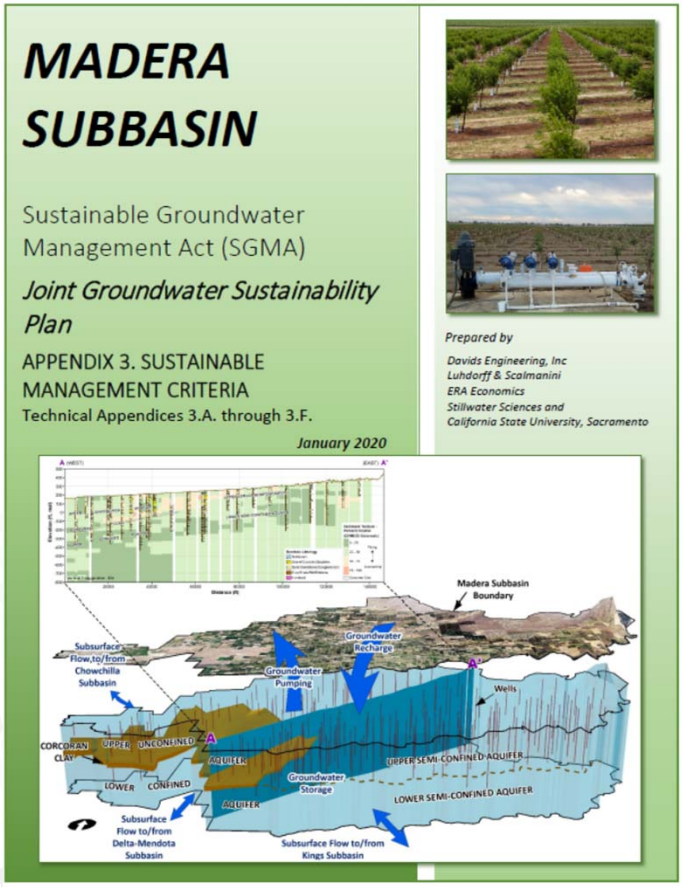
Example Tradeoffs in Setting MT/MO			
Set Higher MT/MO		**Set Lower MT/MO**	
Potential Benefits	**Potential Costs**	**Potential Benefits**	**Potential Costs**
• Lower pumping cost • Fewer affected domestic wells • Reduced subsidence • GDE and other SMC benefits	• Capital outlays for PMAs • May affect pumping in some years/regions • Increased monitoring and management • Risk of exceeding MT	• Delayed costs for PMAs • Greater flexibility to respond to surface water shortage • Greater management flexibility	• Greater pumping cost • Domestic well impacts • Subsidence, GDE, and other SMC

Example Analysis in Other Subbasins

- Madera Subbasin
  - Benefit-cost analysis of more rapid demand management (land idling) implementation
- Chowchilla Subbasin
  - Benefit-cost analysis of domestic well impacts

Madera Subbasin

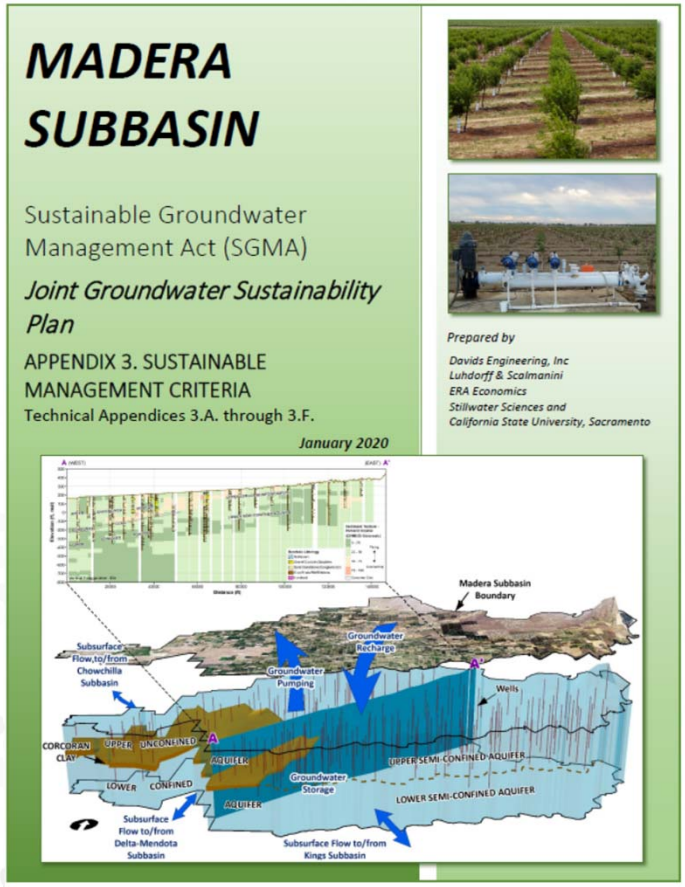
- Costs and benefits of reducing pumping to keep groundwater levels higher
  - Appendix 3.C Economic Impact Analysis of Accelerated Demand Reduction Program
- Method
  - Economic model of subbasin agriculture and water use
  - Projected groundwater elevation under GSP implementation



Madera Subbasin

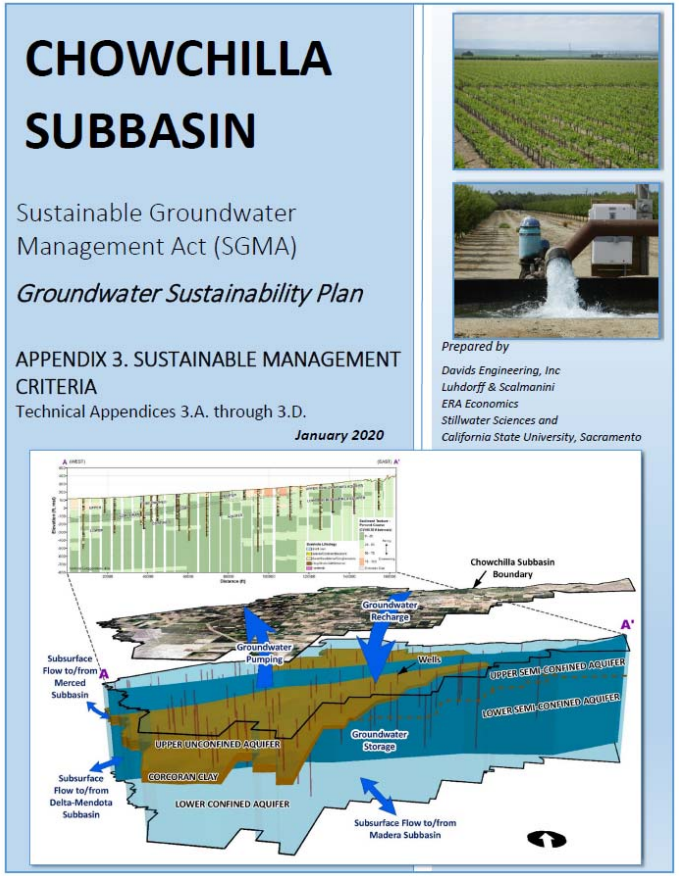
- Outcomes
  - Quantification of the economic contribution of agriculture to subbasin economy
  - Benefit-cost analysis of accelerated demand management (focus on irrigated agriculture)

Madera Benefit-Cost Analysis Summary	
Benefits	**Costs**
• Reduced pumping costs due to lesser lifts • SMCs including avoided domestic well replacement costs	• Loss of crop revenue due to fallowing • County tax revenue losses • Farm job losses and impacts to DACs



Chowchilla Subbasin

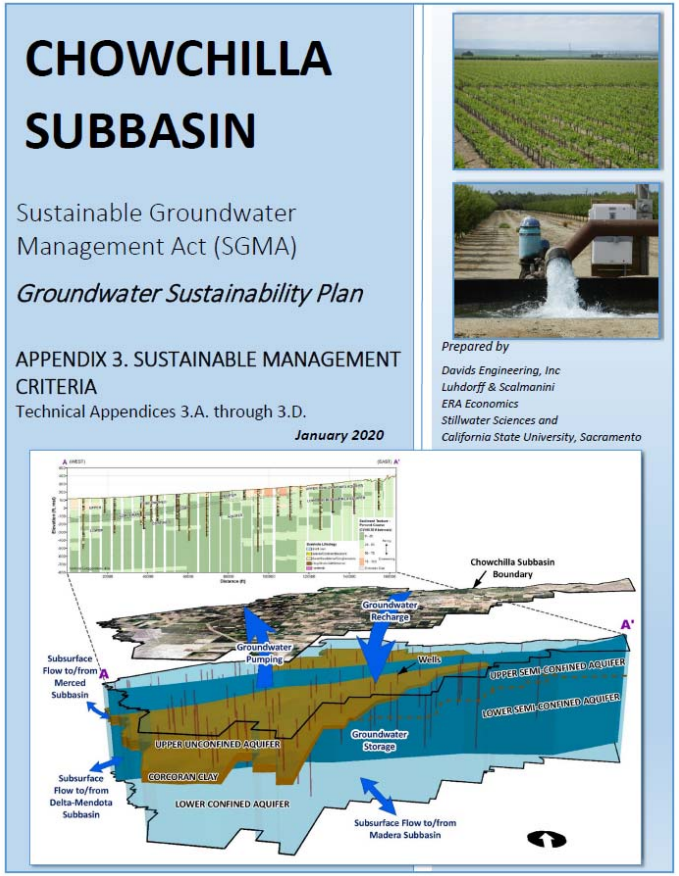
- Costs and benefits of a potential domestic well mitigation program
  - Appendix 3.C Economic Analysis and Framework for Potential Domestic Well Mitigation Program
- Method
  - Economic model of subbasin agriculture and water use
  - Projected groundwater elevation under GSP implementation
  - Preliminary domestic well inventory developed for the GSP from multiple sources



Chowchilla Subbasin

- Outcomes
  - Benefit-cost analysis of GSP implementation, accelerated demand management, and impacts to domestic wells
  - Review of existing mitigation programs
  - Quantification of potential program costs

Chowchilla Benefit-Cost Analysis Summary	
Benefits	**Costs**
• Economic activity with continued farming • Reduced pumping costs due to lesser lifts • Avoided domestic well replacement capital costs	• Loss of crop revenue due to fallowing • Well replacement mitigation program costs



Potential Economic Analysis Considerations

- Can provide a consistent framework for quantifying costs and benefits that occur over time
- Analysis can be scaled up or down to specific management areas if needed for future planning efforts
- Relation to funding mechanisms
  - Provides a basis for allocating project costs
  - Foundation for any benefits-based assessments
- Integrate with groundwater model projected levels under future land use and surface water availability

Discussion

4.c. Management Areas

Management Areas

- Regulations
- Potential boundaries
- Management areas and projects and management areas
- Management area examples

Management Area Regulations

§351 (r): "'Management area'" refers to an area within a basin for which the Plan may identify different minimum thresholds, measurable objectives, monitoring, or projects and management actions based on differences in water use sector, water source type, geology, aquifer characteristics, or other factors."

Management Area Regulations

§354.20 (a): “Each Agency may define one or more management areas within a basin if the Agency has determined that creation of management areas will facilitate implementation of the Plan. Management areas may define different minimum thresholds and be operated to different measurable objectives than the basin at large, provided that undesirable results are defined consistently throughout the basin.”

Management Area Regulations

GSPs that include management areas need to describe:

- Reason for creation of management area
- Sustainable management criteria and rationale
- Level of monitoring
- §354.20 (b) (4): "An explanation of **how the management area can operate under different minimum thresholds and measurable objectives without causing undesirable results outside the management area**, if applicable."

Summary of Regulations

- A management area can be used to”
  - Set different minimum thresholds
  - Set different measurable objectives
  - Set up different density and frequency of monitoring
  - Vary implementation of projects and management actions
- Management areas are optional but may be established at GSA’s discretion
- Management areas increase GSP complexity

Potential Management Area Uses

- Provided by regulation
  - Differentiate rationale for Minimum Thresholds and Measurable Objectives
  - Establish different concentration or types of monitoring

- At GSA Board's Discretion
  - At GSA's discretion, Management Areas *could* be used to:
    - Delegate authorities to other jurisdictions
    - Perform projects and management actions discretely by Management Area

Key Management Area Considerations

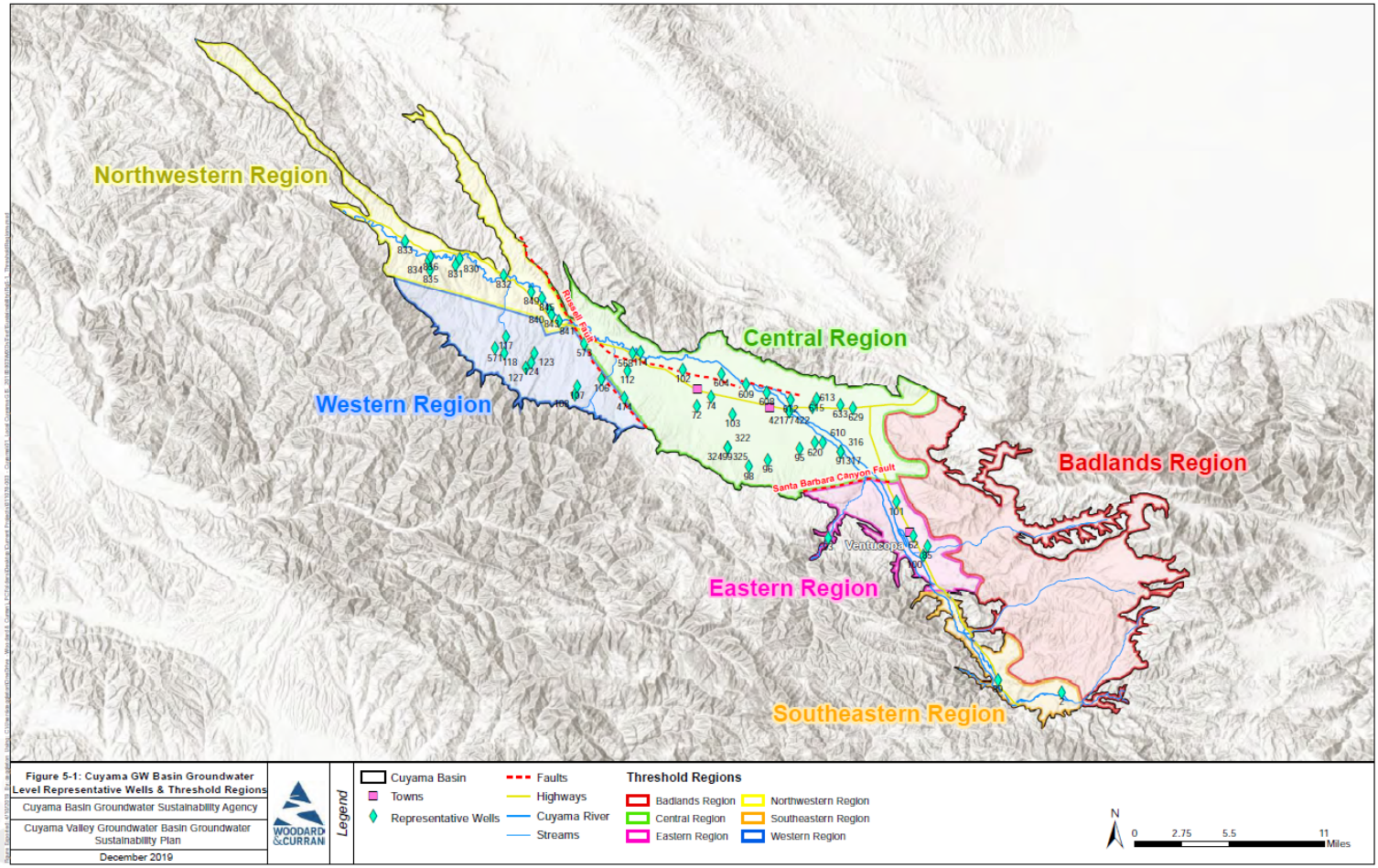
- The GSA Board may assign costs, allocations, and projects and management actions spatially throughout the Subbasin, regardless of management areas

- Management Areas should be considered based on:
  - Unique physical conditions requiring specific thresholds or monitoring
  - Efficiency of existing organizational structures (districts, cities) to assist and help manage projects and/or management actions within the area

Options for Management Area Boundaries

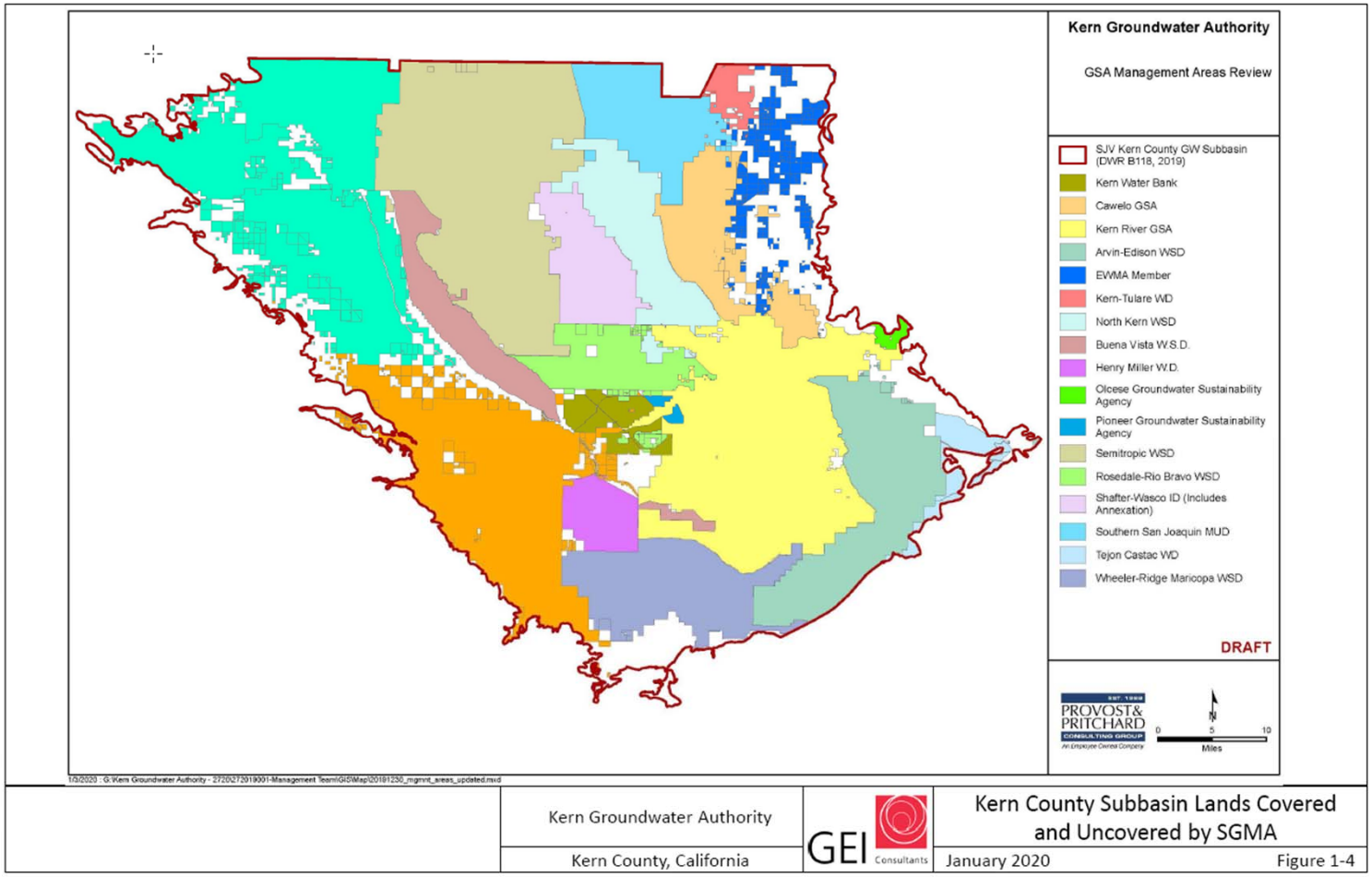
- Physical Boundaries
  - Canals
  - Streams
  - Watershed Divides
  - Isocontours
  - Groundwater contours
- Jurisdictional Boundaries
  - Districts
  - Cities/Towns
  - Counties

Cuyama GSP
Management Areas



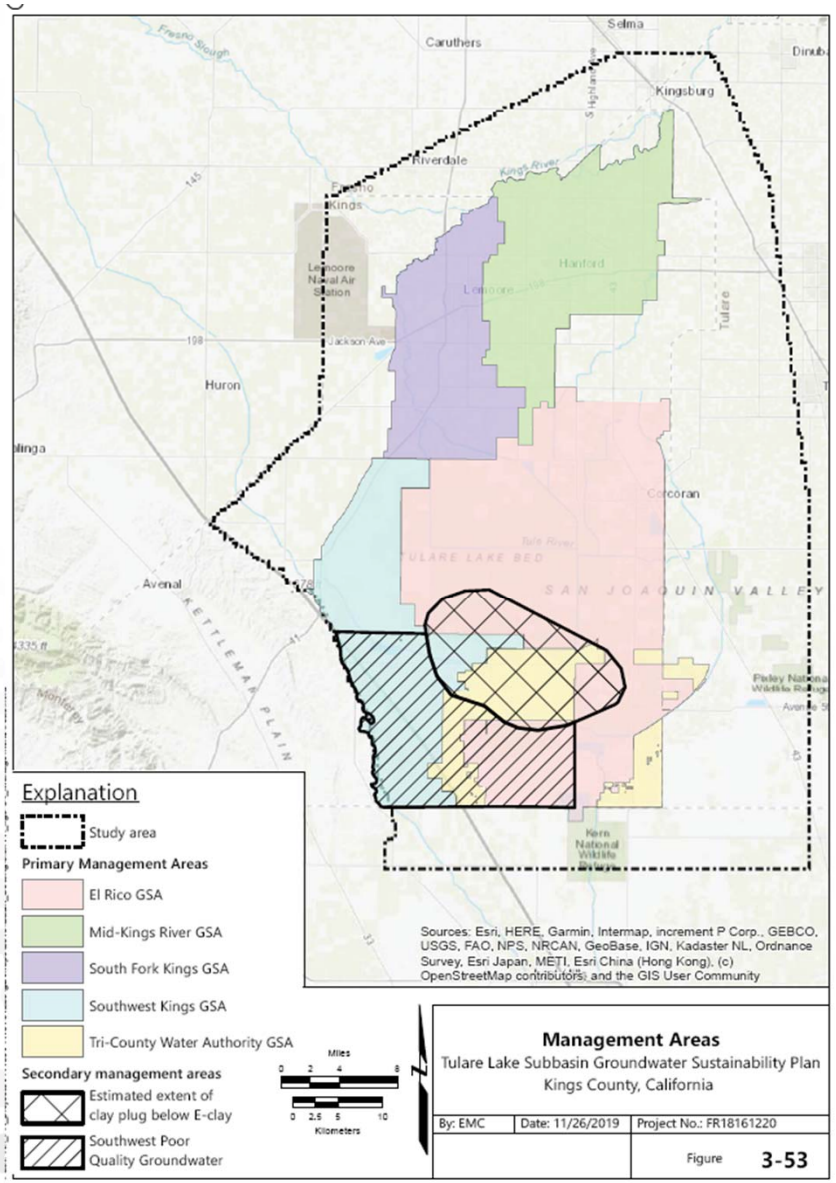
Kern Groundwater Authority GSP

Management Areas



Tulare Lake Subbasin GSP

Management Areas



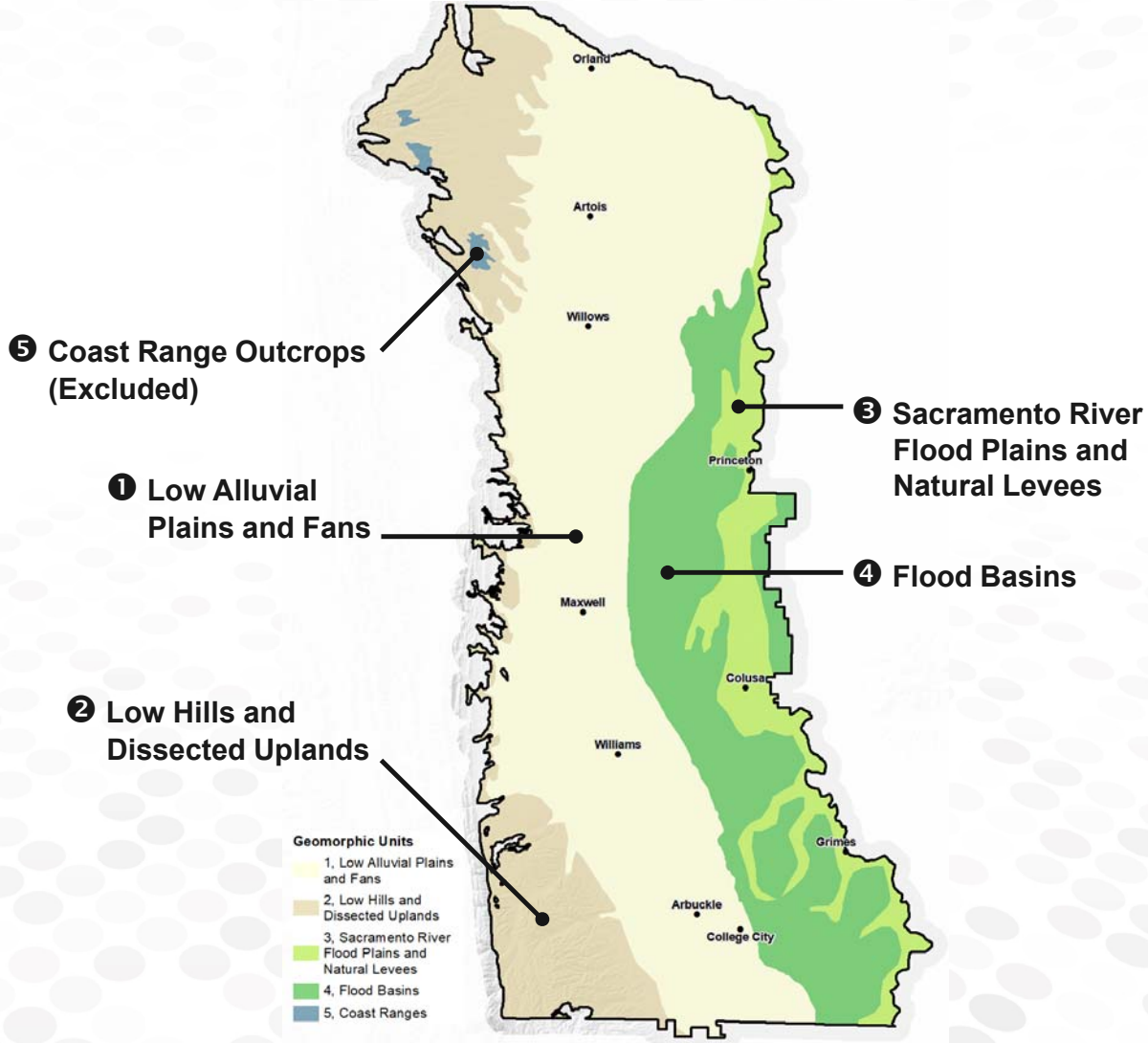
Potential Geographic Considerations for Management Areas

- Geomorphic Boundaries
- Topography
- Geology
- Streams
- Groundwater Levels
- Land Use
- Institutional Boundaries
- Groundwater Monitoring Network
- Groundwater Use
- Net Recharge

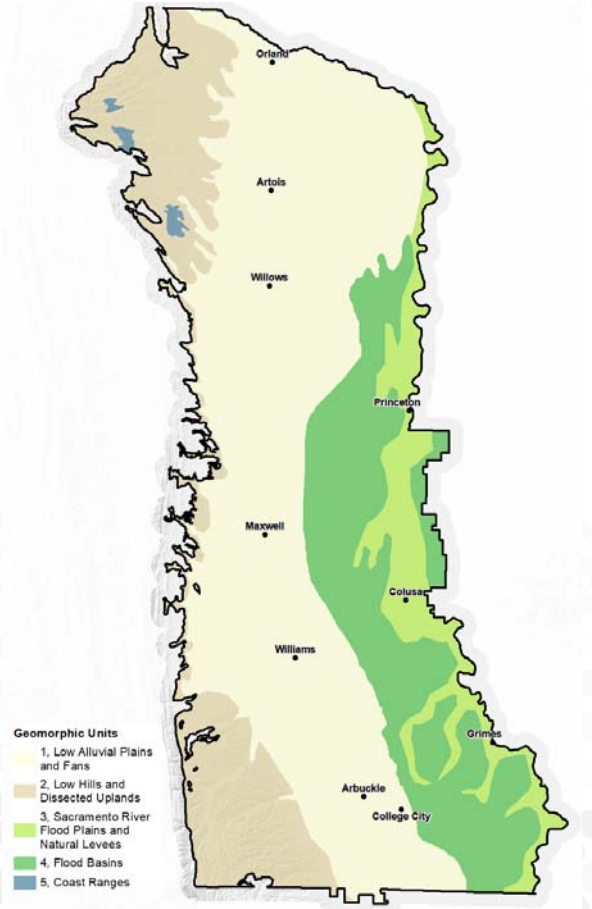
Established Geomorphic Boundaries

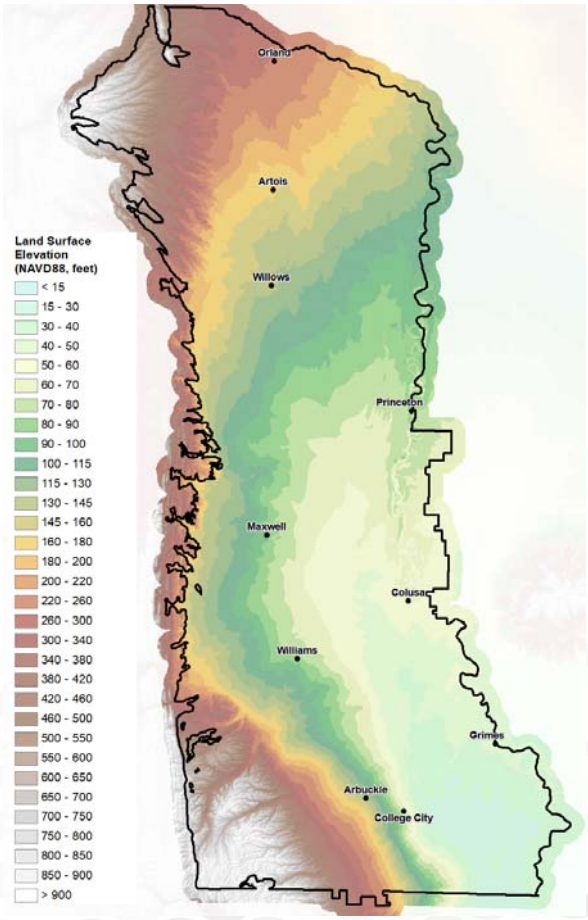
USGS Geomorphic Provinces

Revised USGS Delineation



Topography


Orland
Artois
Willows
Princeton
Maxwell
Colusa
Williams
Grimes
Arbuckle
College City
Geomorphic Units
1, Low Alluvial Plains and Fans
2, Low Hills and Dissected Uplands
3, Sacramento River Flood Plains and Natural Levees
4, Flood Basins
5, Coast Ranges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Williams
Grimes
Arbuckle
College City
Land Surface Elevation (NAVD88, feet)
< 15
15 - 30
30 - 40
40 - 50
50 - 60
60 - 70
70 - 80
80 - 90
90 - 100
100 - 115
115 - 130
130 - 145
145 - 160
160 - 180
180 - 200
200 - 220
220 - 260
260 - 300
300 - 340
340 - 380
380 - 420
420 - 460
460 - 500
500 - 550
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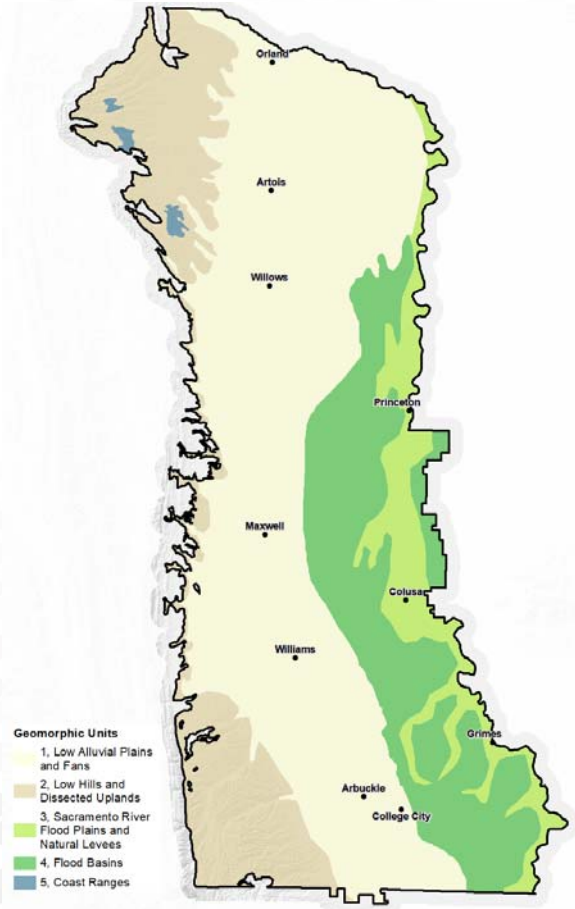
650 - 700
700 - 750
750 - 800
800 - 850
850 - 900
> 900

Geology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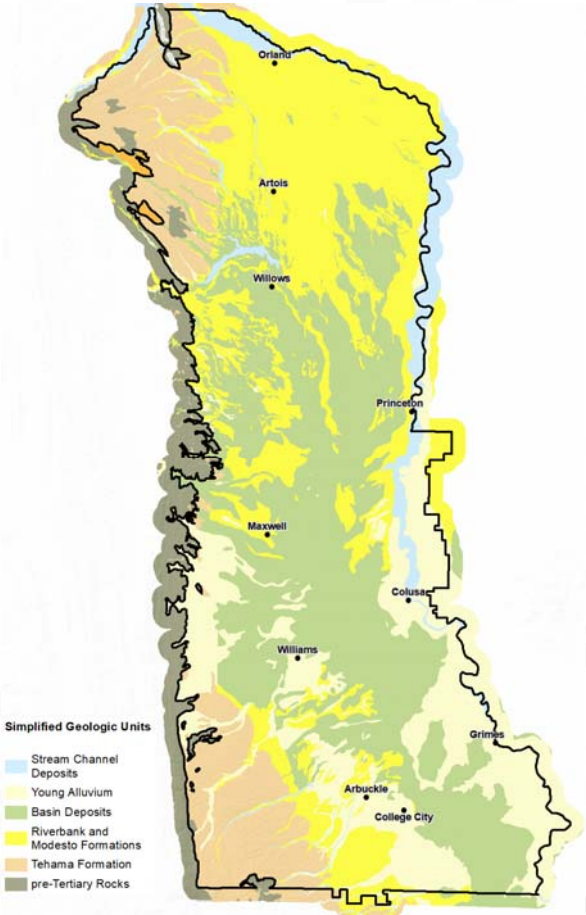
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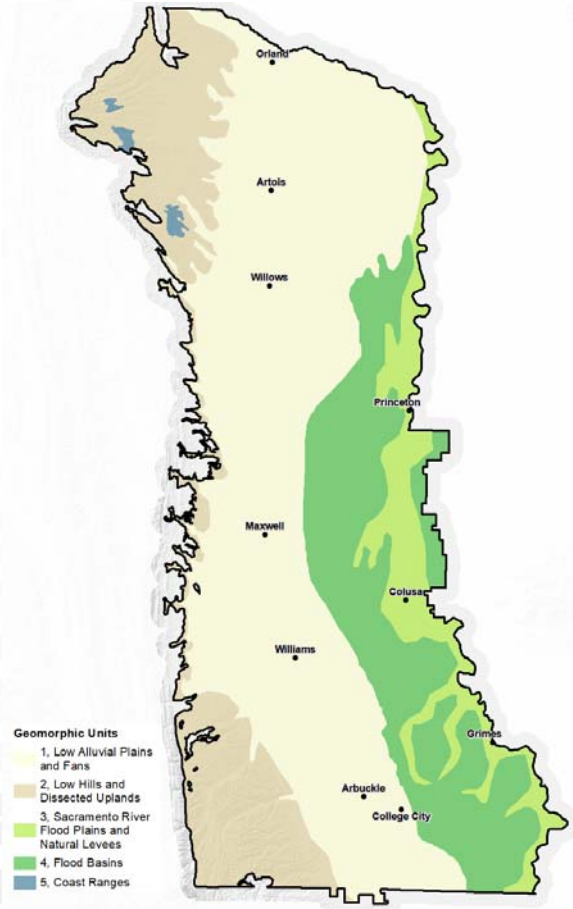
Princeton
Maxwell
Colusa
Williams
Grimes
Arbuckle
College City
Simplified Geologic Units
Stream Channel Deposits
Young Alluvium
Basin Deposits
Riverbank and Modesto Formations
Tehama Formation
pre-Tertiary Rocks

Streams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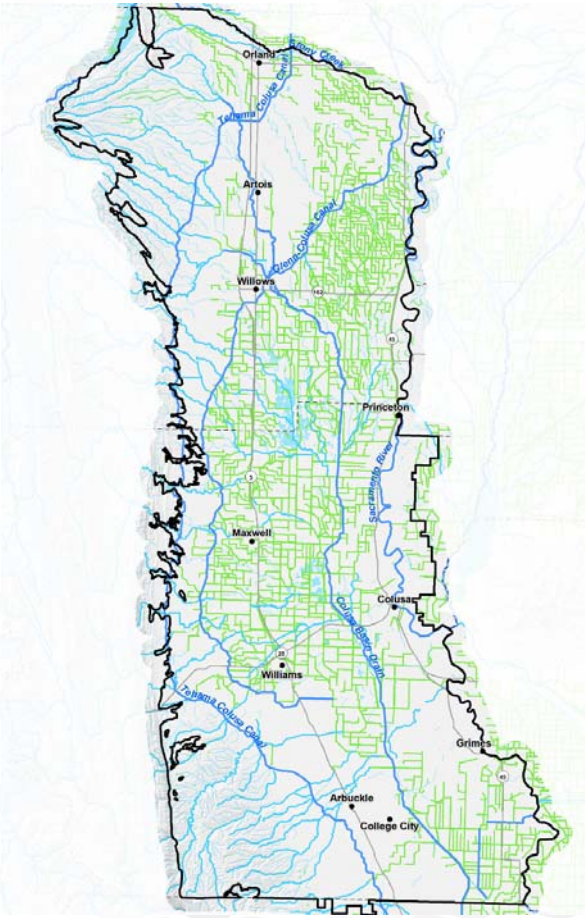
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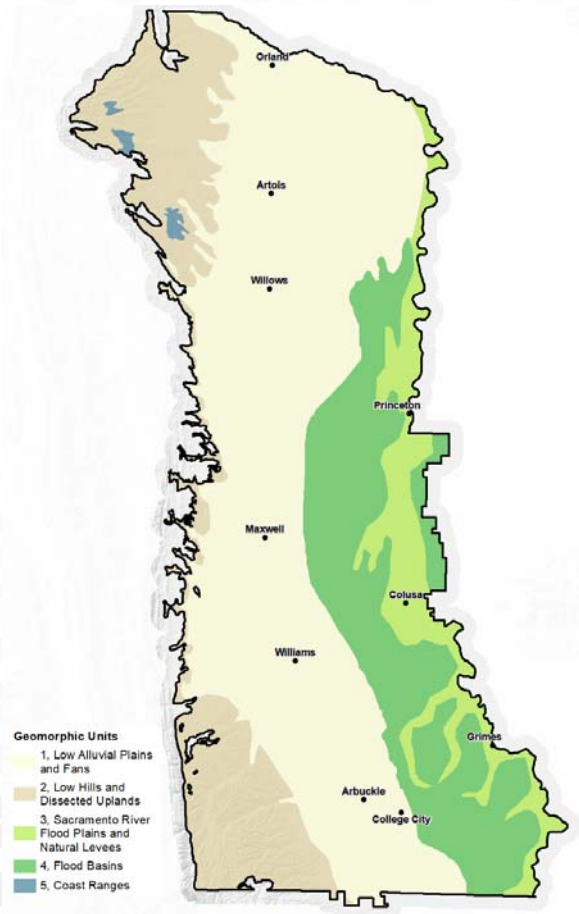
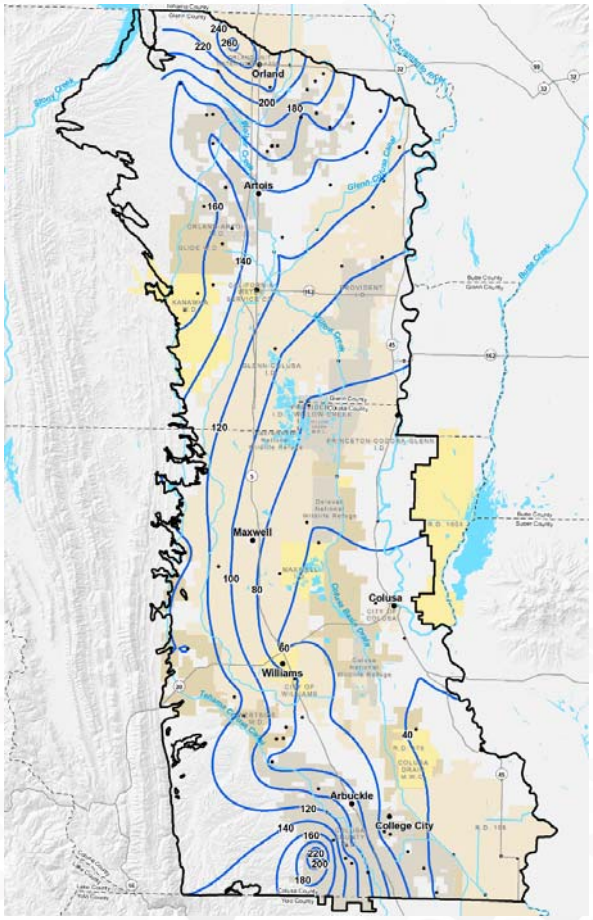
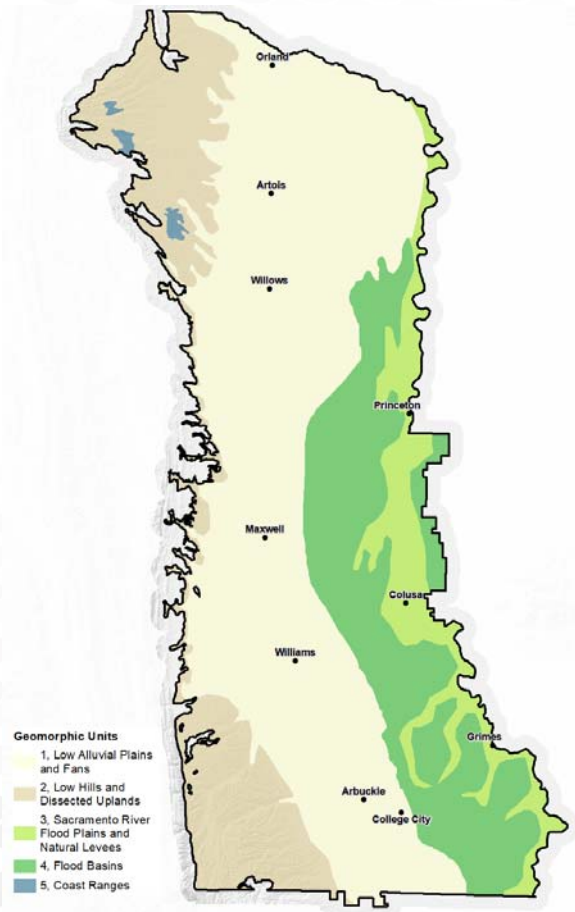
College City

Groundwater Levels





Land Use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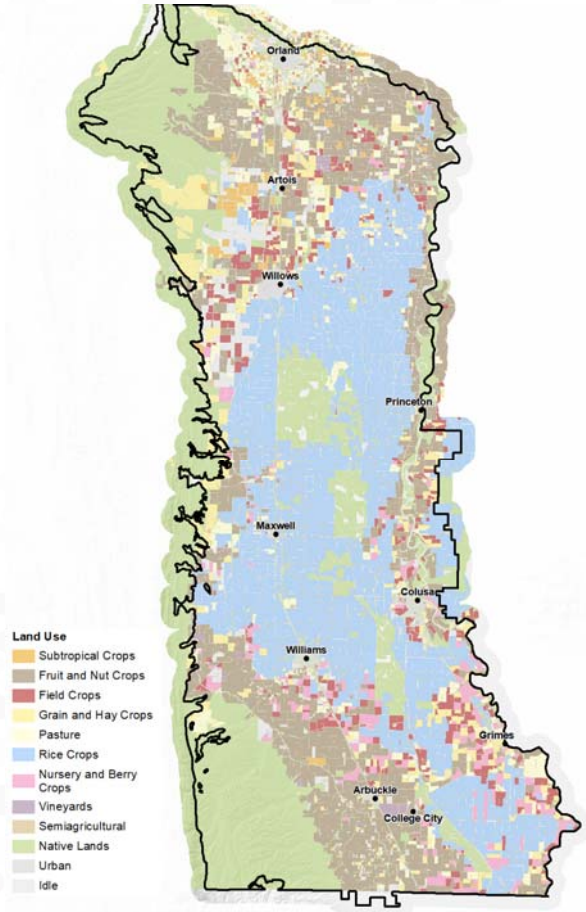
Orland
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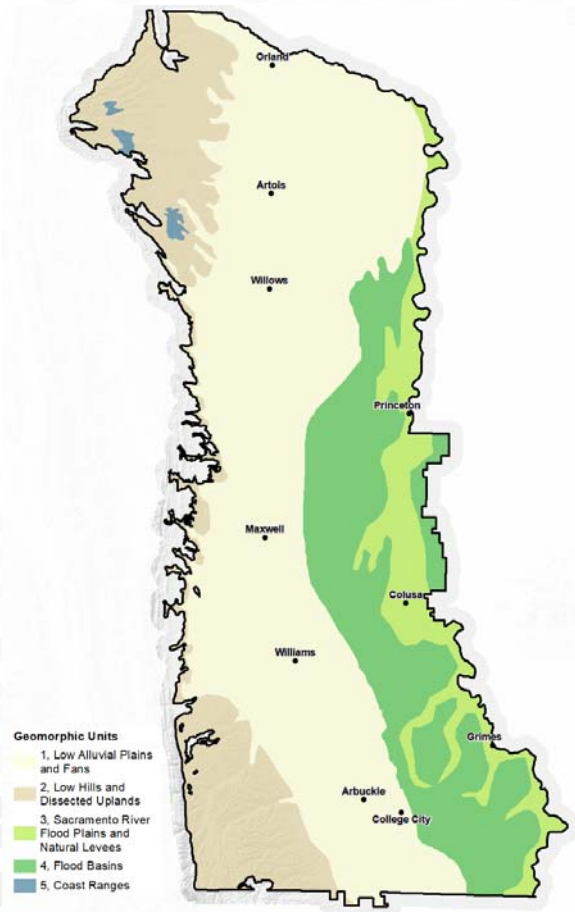
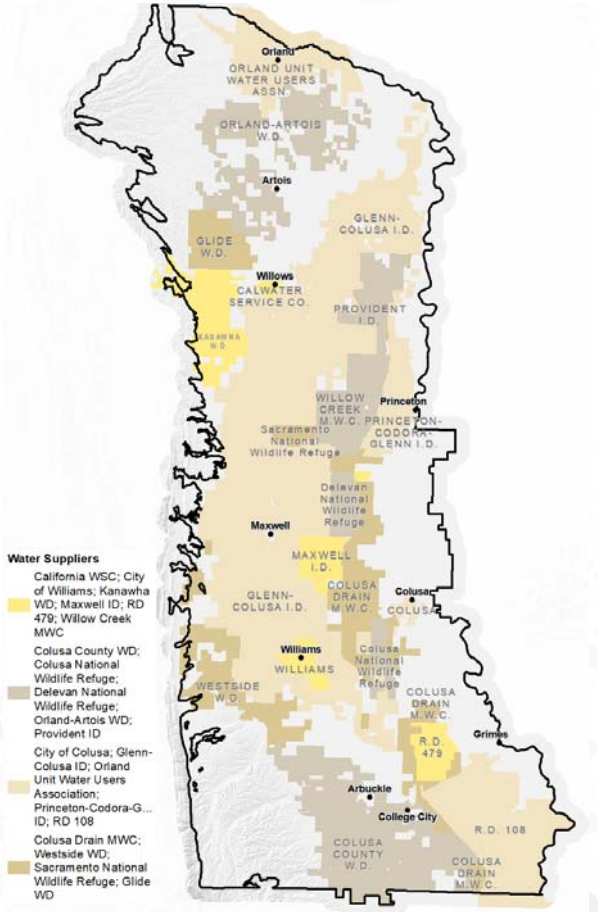
Princeton
Maxwell
Colusa
Williams
Grimes
Arbuckle
College City
Land Use
Subtropical Crops
Fruit and Nut Crops
Field Crops
Grain and Hay Crops
Pasture
Rice Crops
Nursery and Berry Crops
Vineyards
Semiagricultural
Native Lands
Urban
Idle

Institutional Boundaries

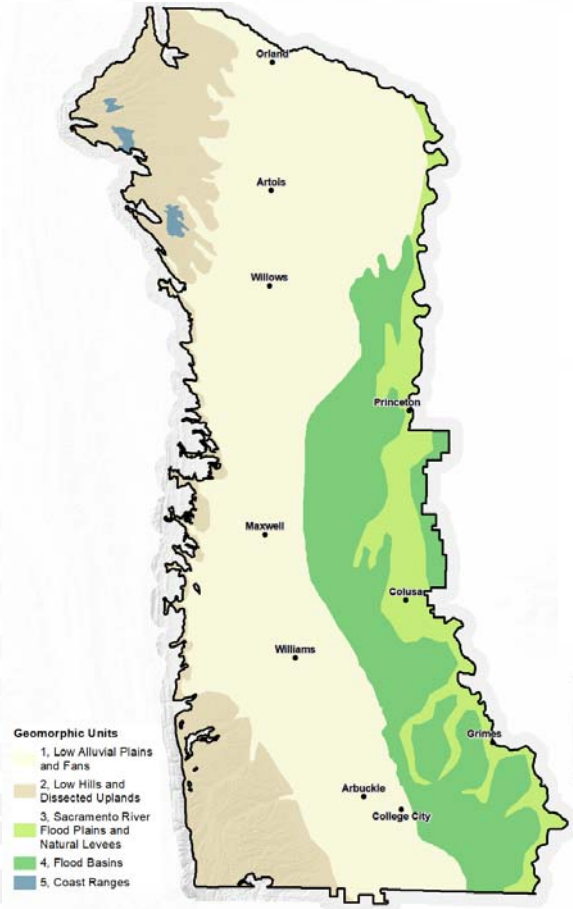
Local Agencies

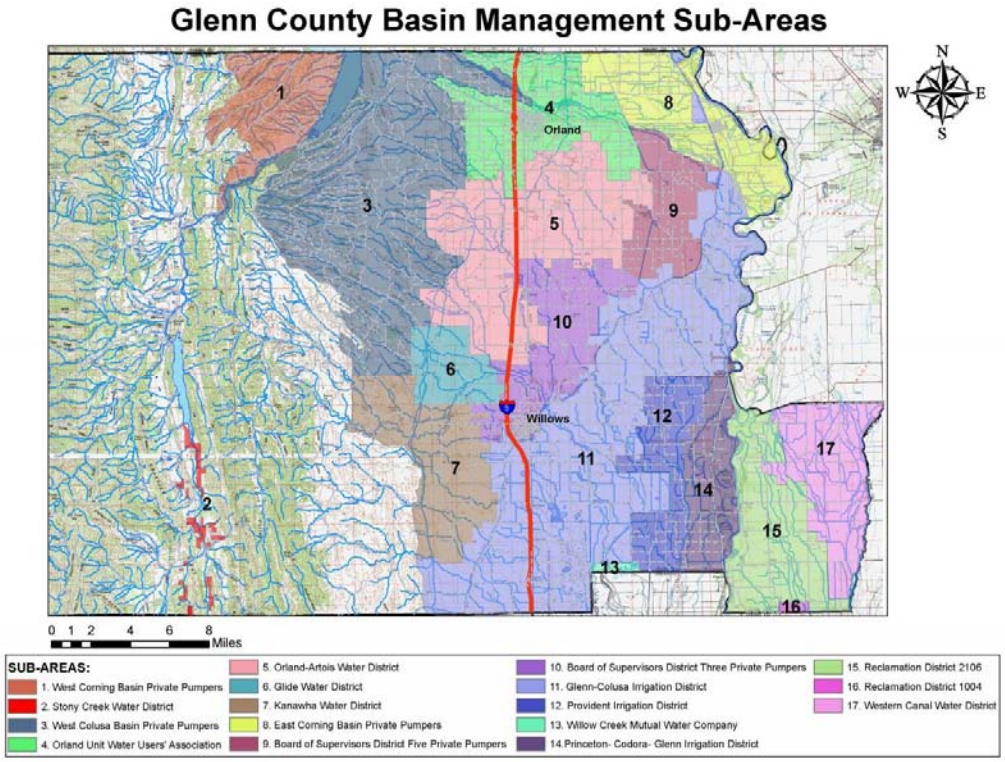




Institutional Boundaries

Glenn County BMO Areas





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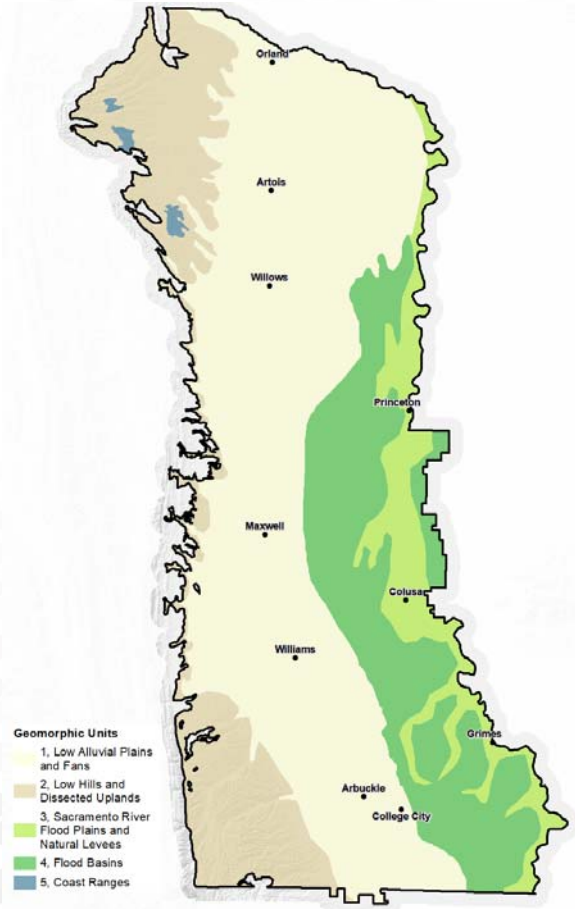
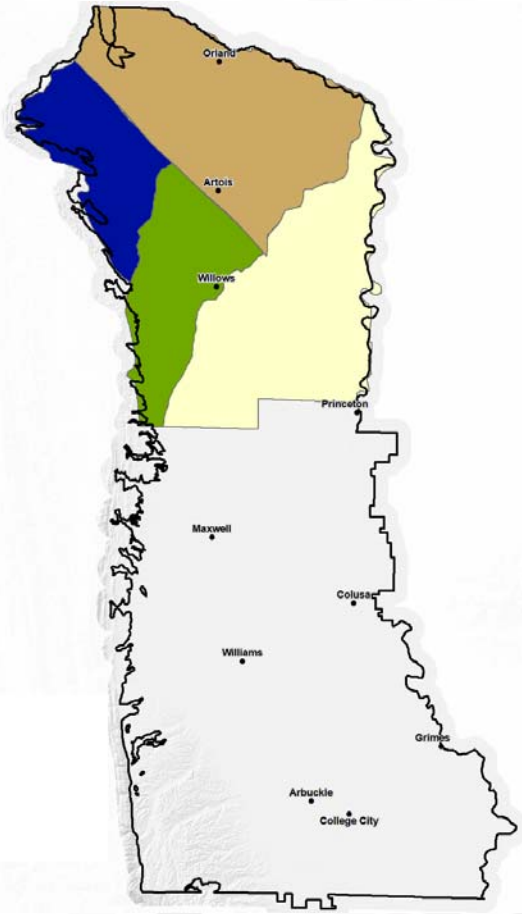
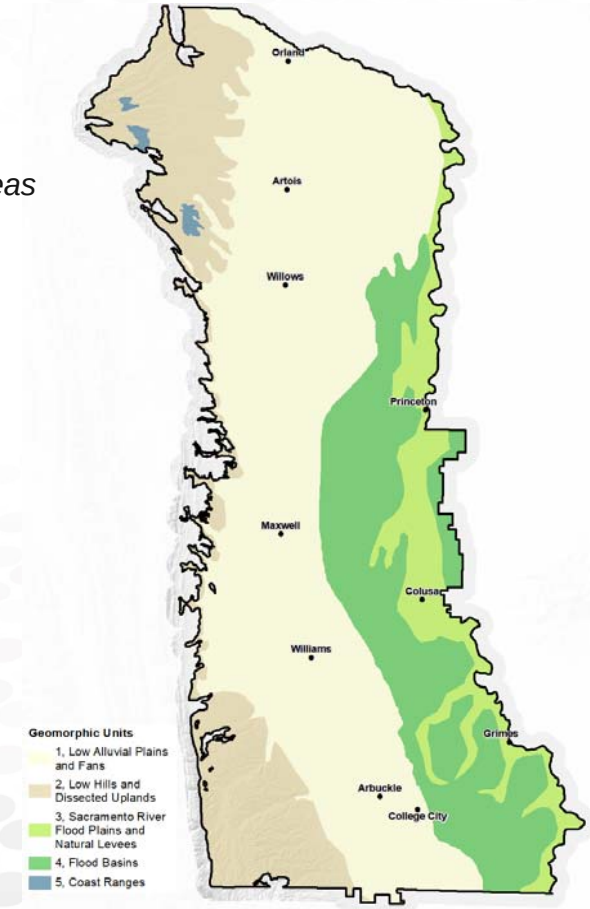
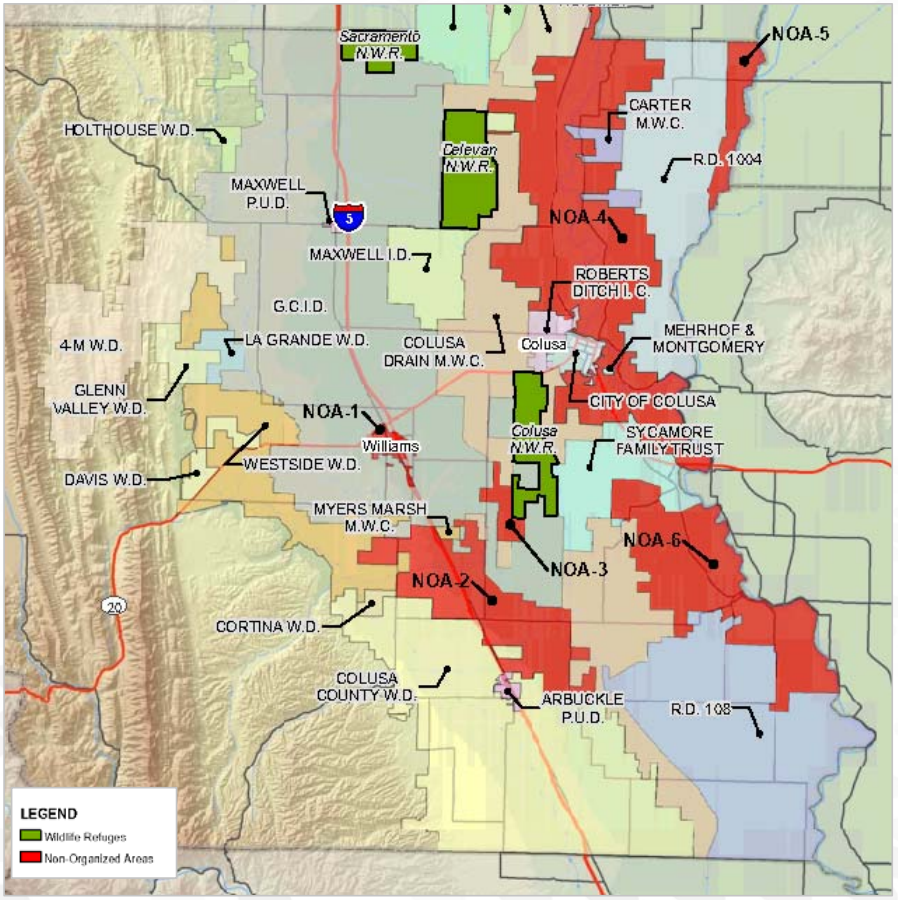




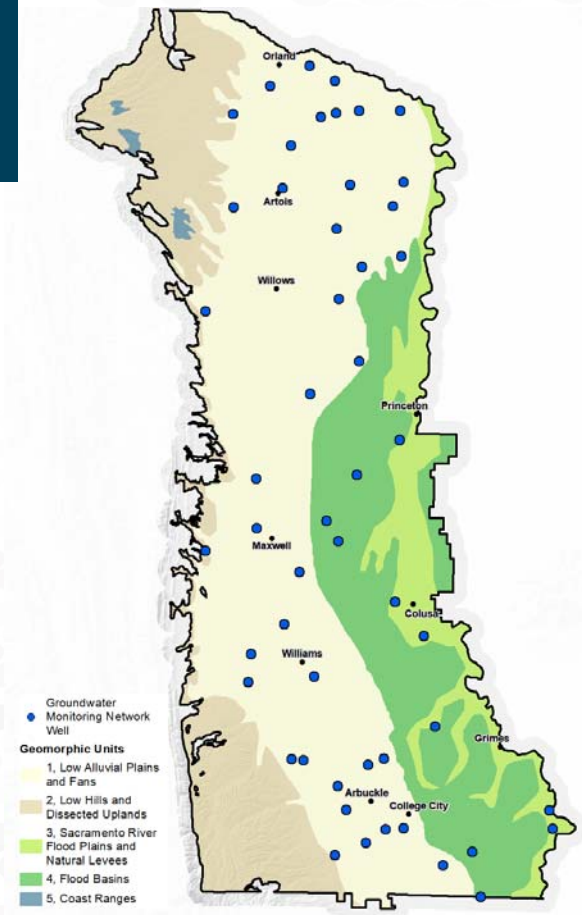
Institutional Boundaries

Colusa County Groundwater Management Plan Entities/Areas



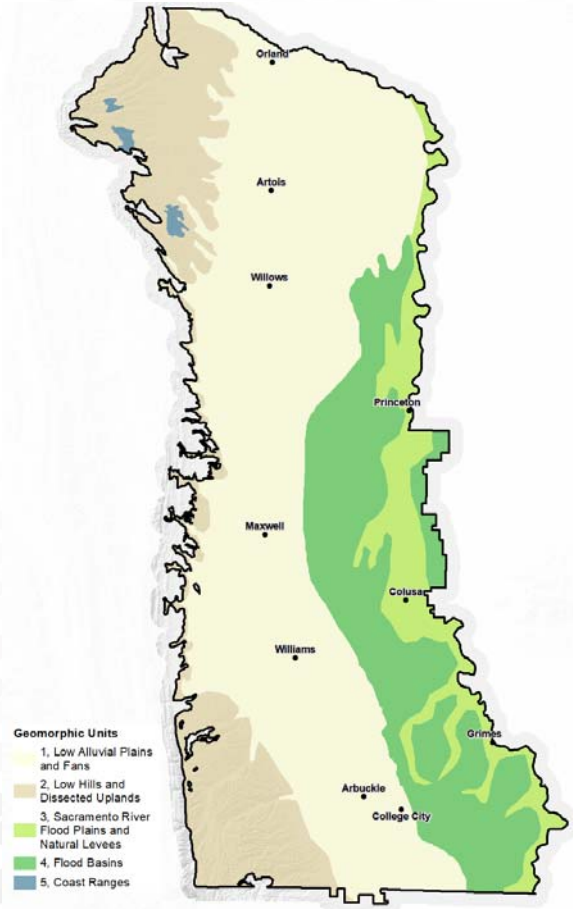


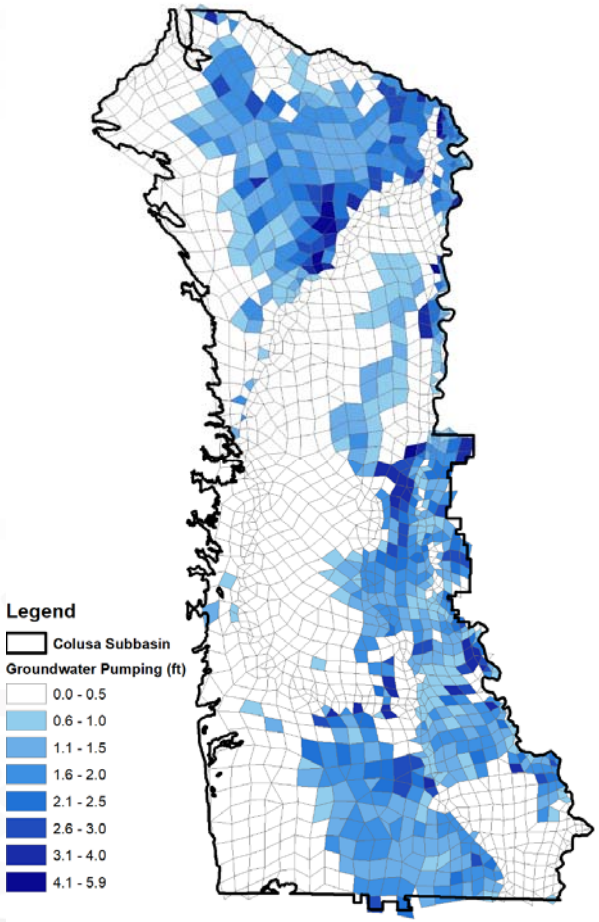
Groundwater Monitoring Network



Historical Groundwater Use

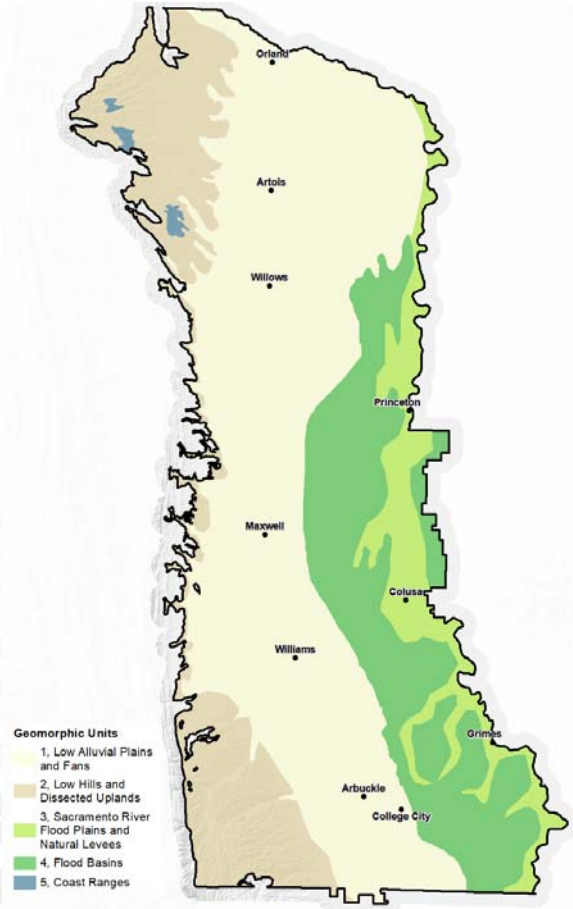
Estimated 1990 – 2015

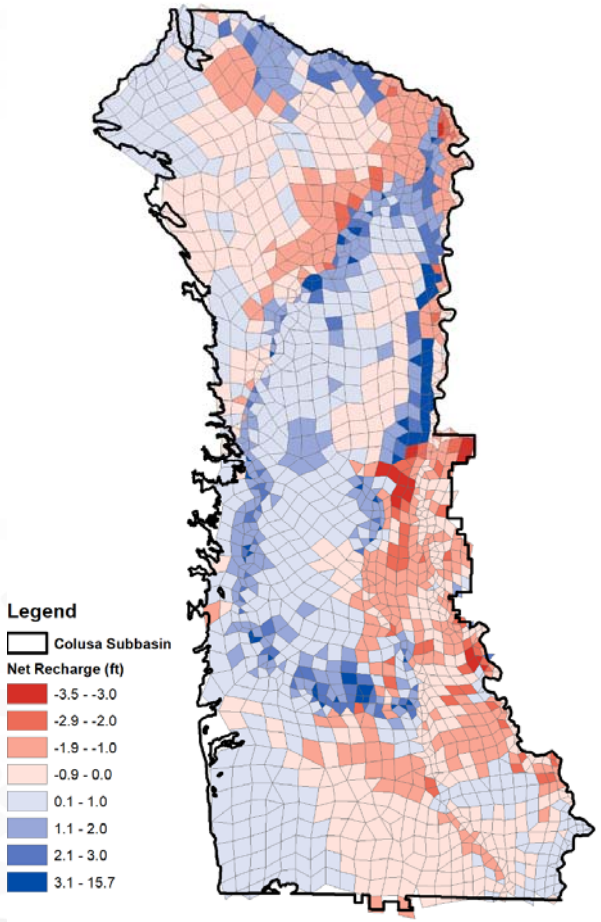




Historical Net Recharge

(Recharge – Pumping)
Estimated 1990 – 2015





Discussion