

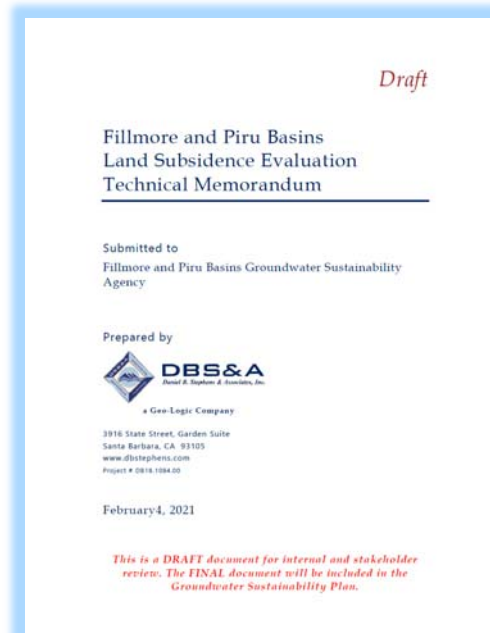
Item 5B - Sustainable Management Criteria

- Subsidence
- SW Depletion from GW Pumping - Stream Flow Cross Over Analyses
- SMC Matrix



Land Subsidence Evaluation

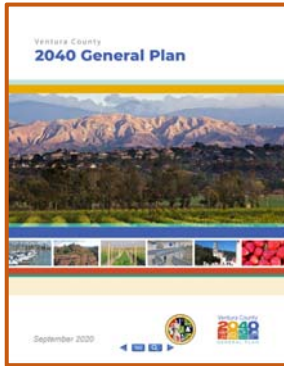
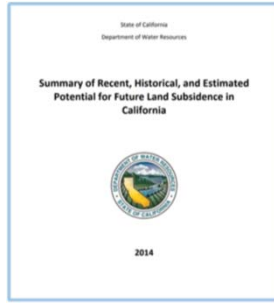
- Previous investigations and reports;
- Geodetic surveys;
- Interferometric Synthetic Aperture Radar (InSAR) data;
- Subsidence evaluations / potentials.



Previous Investigations

- **DWR 2014**

- ✓ Fillmore basin = low potential
- ✓ Piru basin = insufficient data

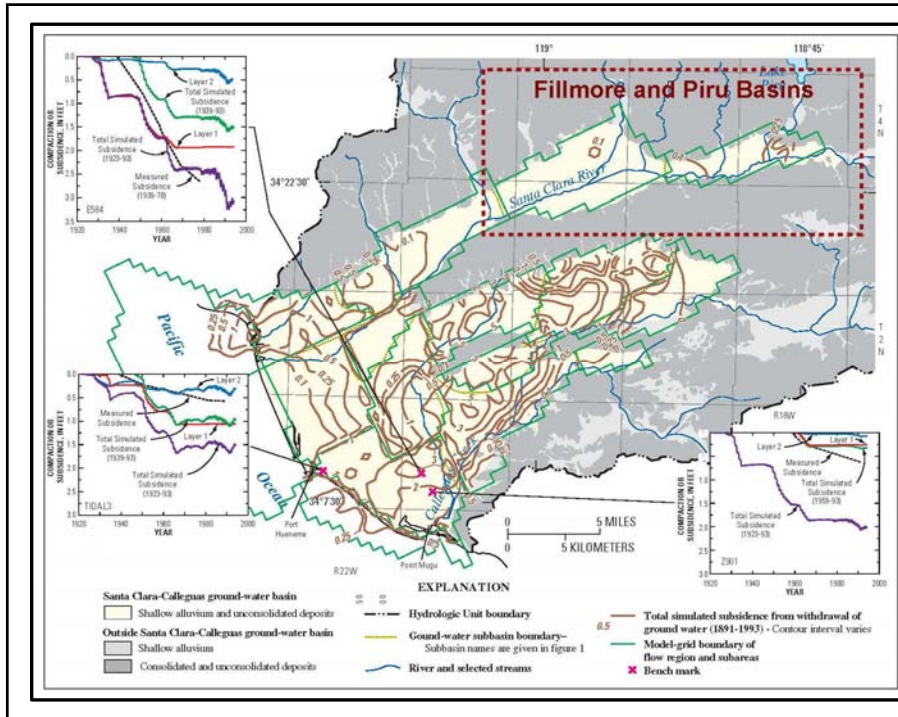


- **Ventura County General Plan 2013**

- ✓ Hazards Appendix largely reproduces 1973 General Plan map (not updated due to lack of geodetic data) - no technical data

- **Ventura County General Plan 2020**

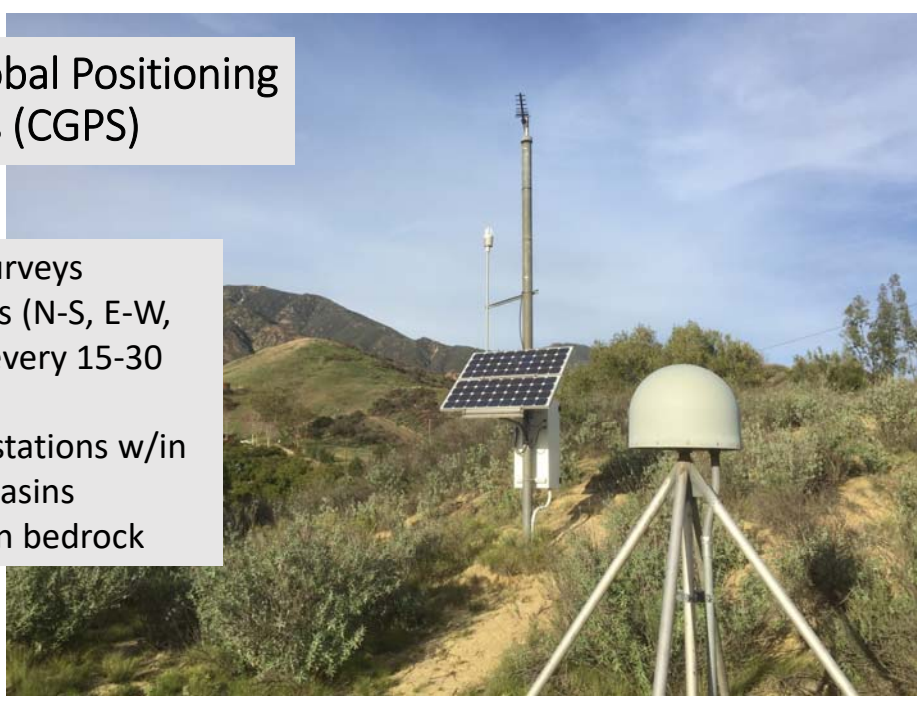
- ✓ Hazards Appendix - sediment loading & GW decline along SCR could lead to hydrocompaction (subsidence?), but does not present technical data



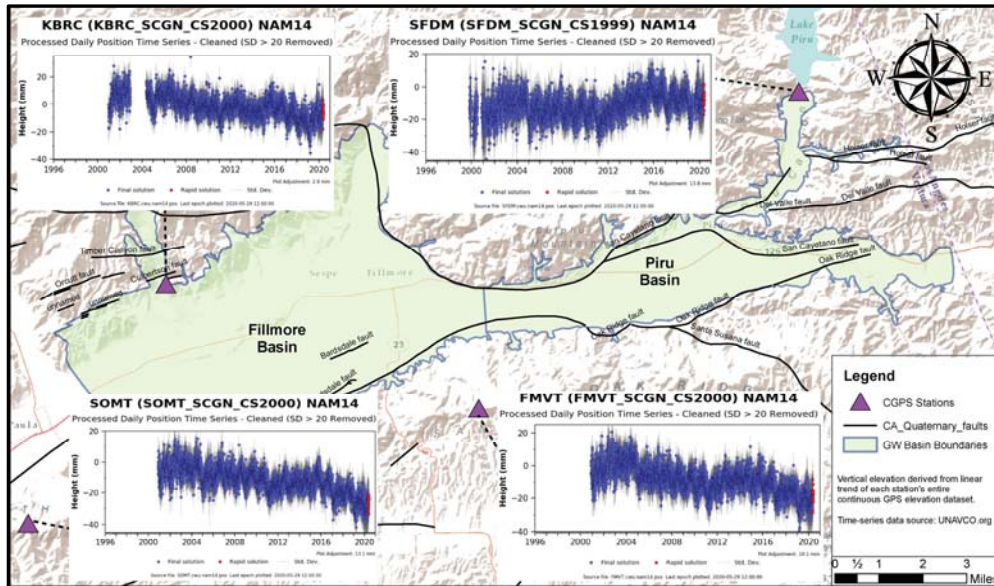
Simulated Subsidence due to Groundwater Withdrawal from 1981 to 1993 (Hanson et al 2003)

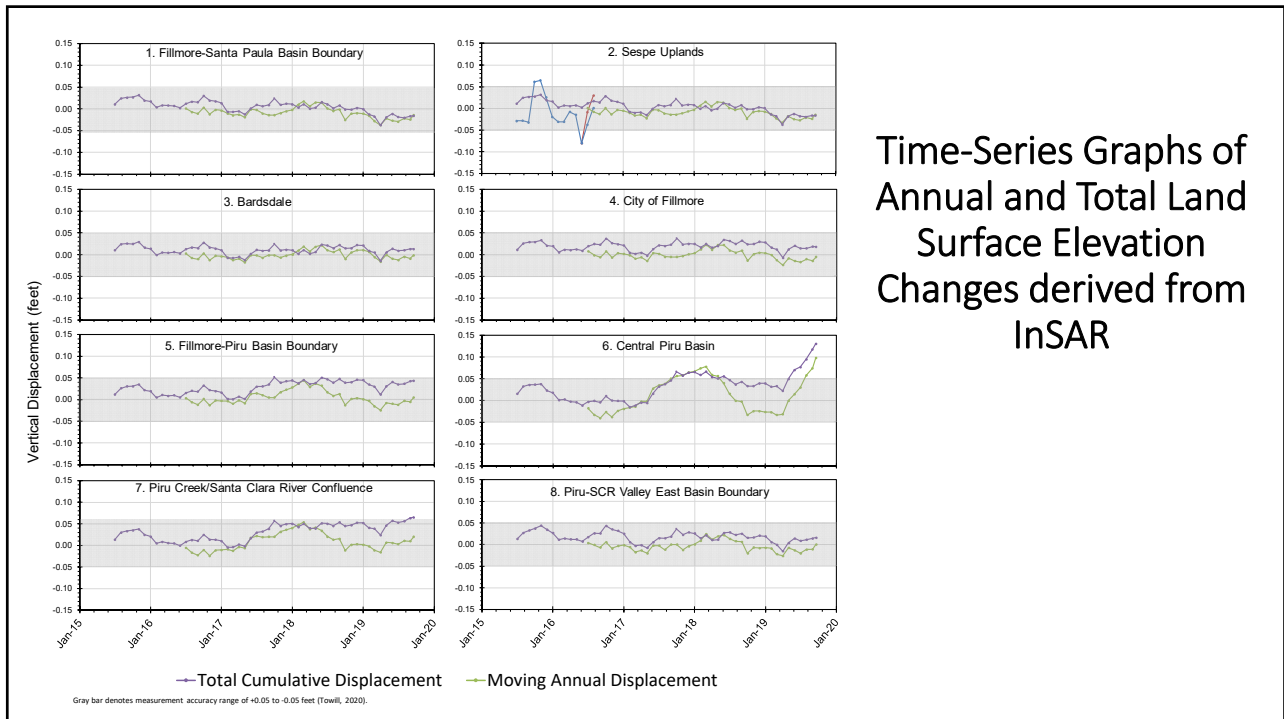
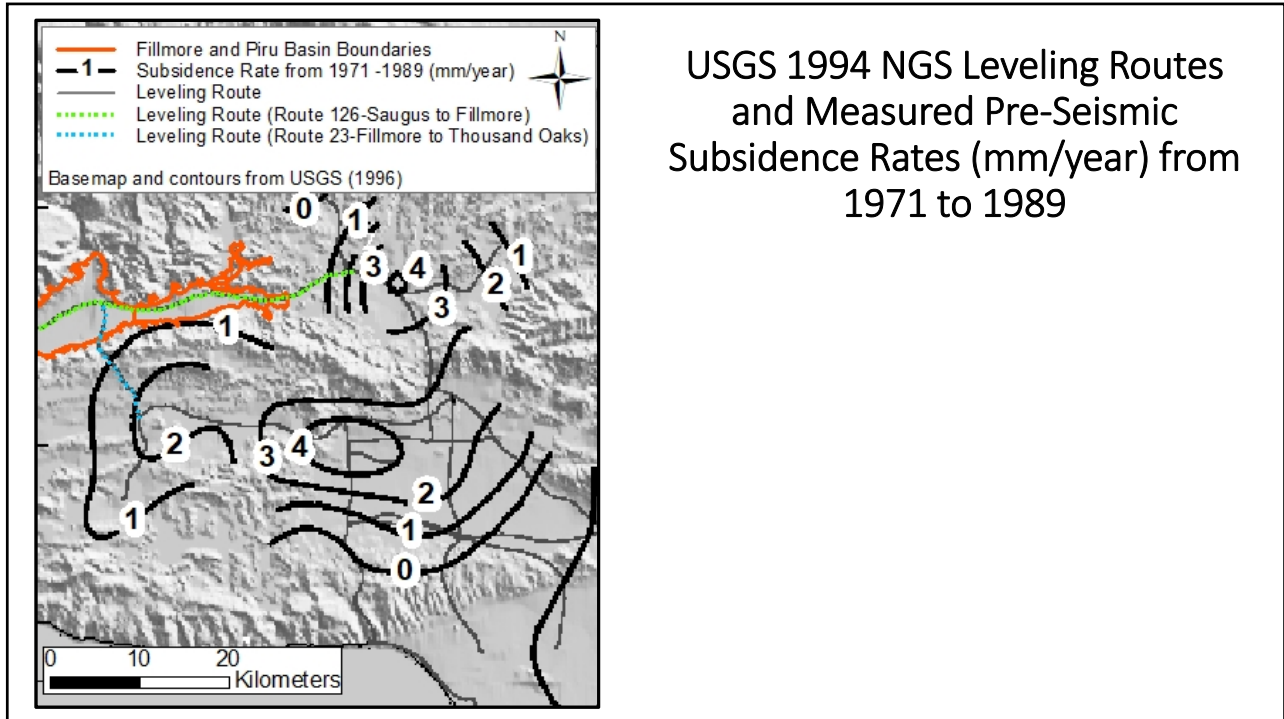
Continuous Global Positioning Systems (CGPS)

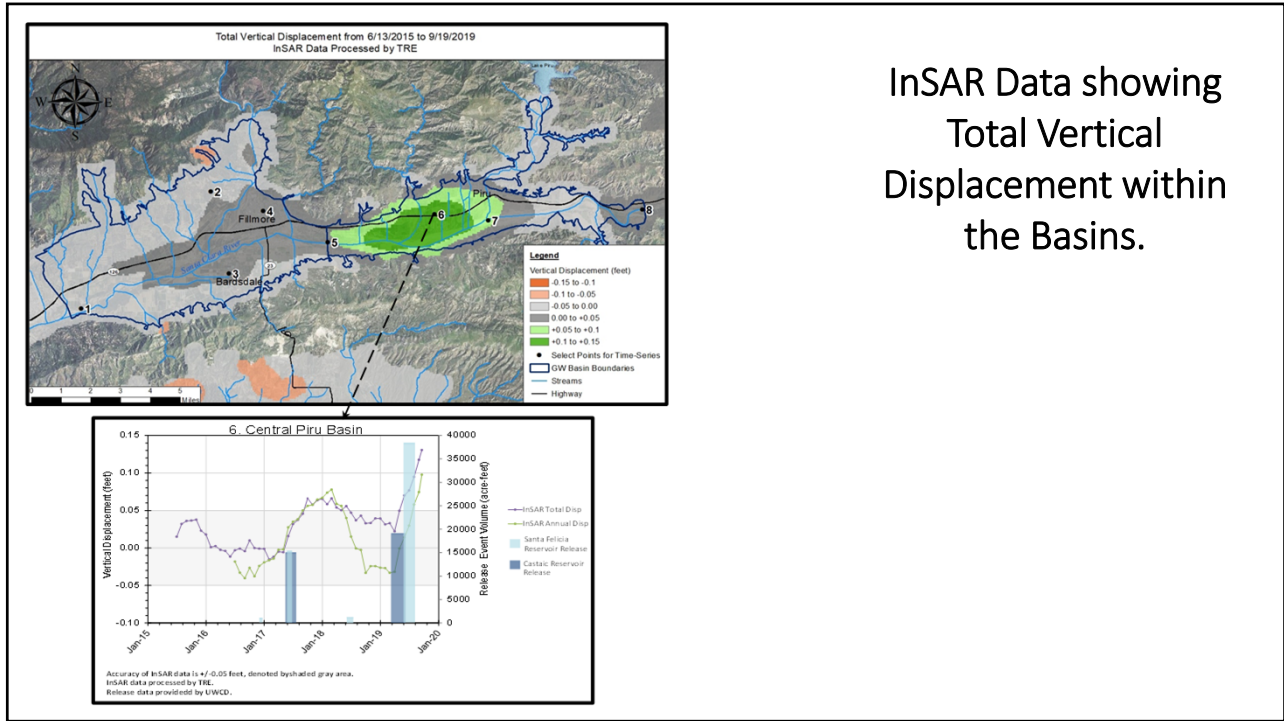
- Geodetic surveys
- 3D positions (N-S, E-W, Elevation) every 15-30 seconds
- Four CGPS stations w/in 5 miles of basins
- Mounted on bedrock



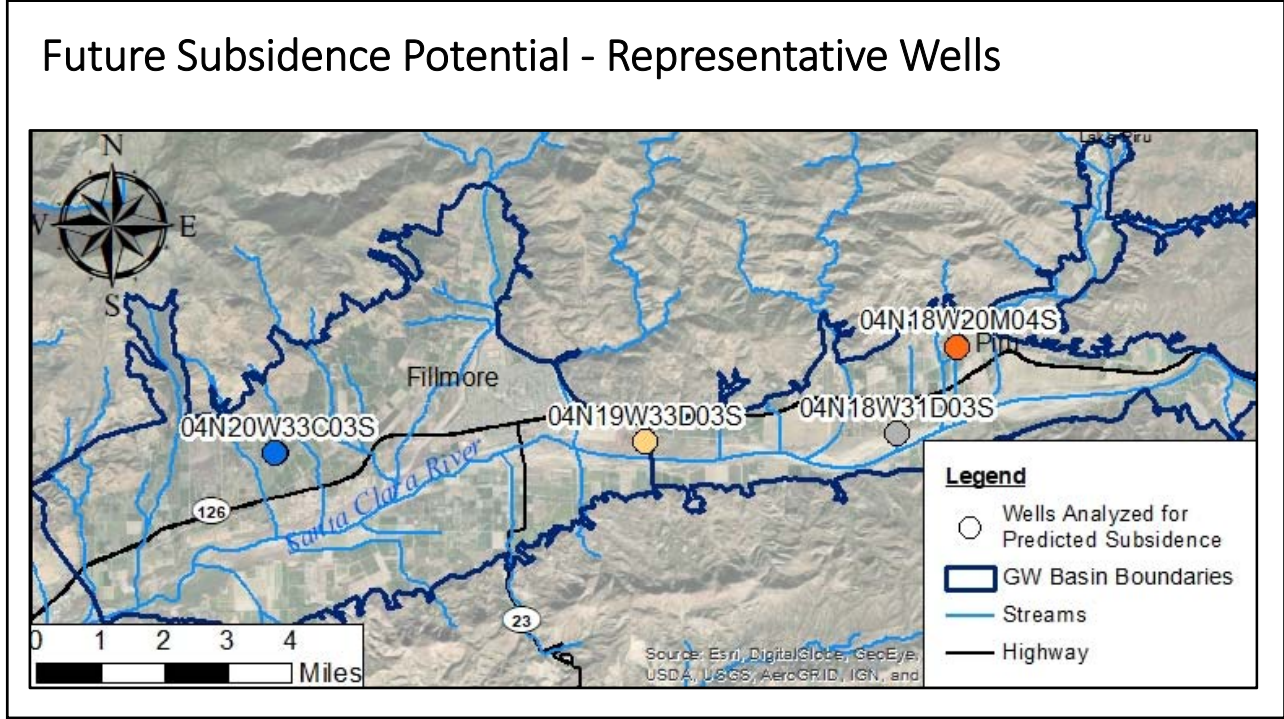
CGPS Locations and Vertical Movement Time-Series (UNAVCO)

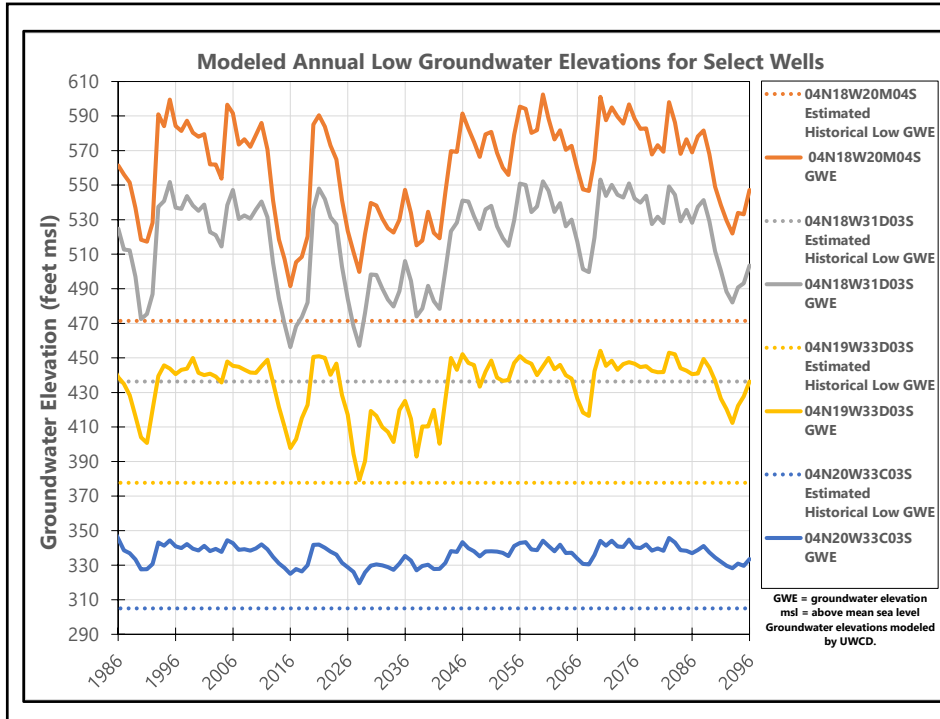




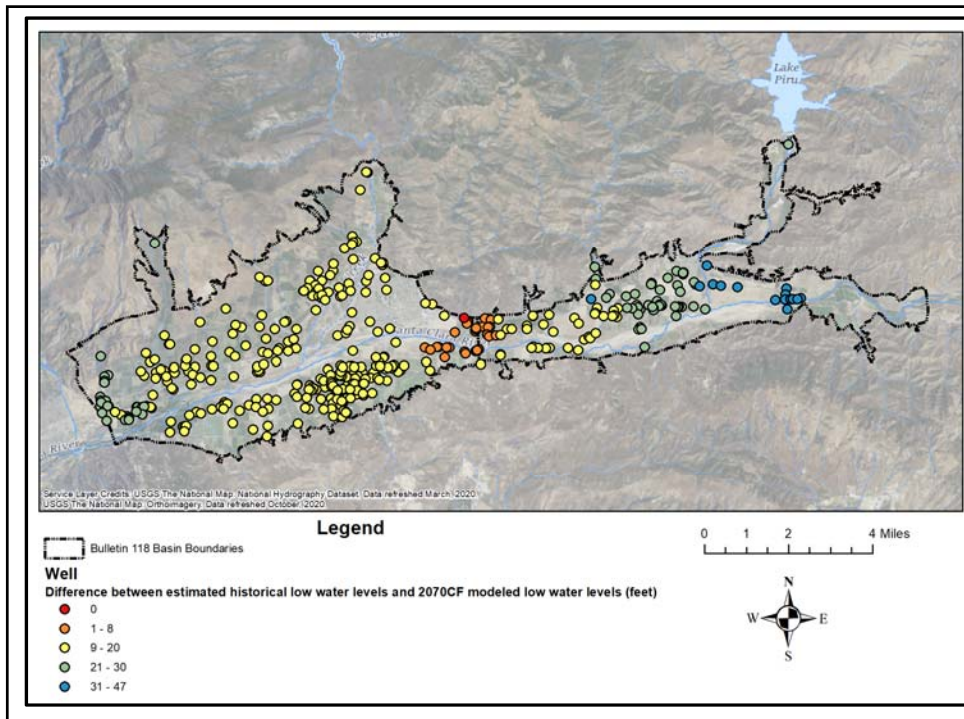


InSAR Data showing Total Vertical Displacement within the Basins.





2070CF
Modeled Water
Levels v.
Estimated
Historical Low
Water Level at
Representative
Wells



Difference
between
Estimated
Historical Low
Water Levels
and 2070CF
Modeled Low
Water Level

Summary of Subsidence Evaluations

Study / Investigator	Fillmore Basin	Piru Basin	Comments
USGS, 1996	maximum subsidence of 0.03 feet (8 mm, 0.6 mm/yr) near City of Fillmore	maximum subsidence zone up to 0.05 feet (15 mm, ~1 mm/year) around the Town of Piru	1975-1989 study period
Hanson, 2003	maximum value of just over 0.1 feet (0.00098 ft/yr) of subsidence	0.25 feet (0.0024 ft/yr) in the eastern portion of Piru Basin	1891 to 1993 study period
Ventura County, 2013 and 2020	Lies within subsidence hazard zone	Lies within subsidence hazard zone	No technical analyses conducted.
DWR, 2014	Low potential	Insufficient data	
InSAR	Less than +/-0.05 ft	Generally, less than +/-0.05 ft except during periods of artificial recharge, then up to +0.14 ft of rebound in Piru basin	June 2015 – Sept 2019 study period
2070 Climate Change Modeling by UWCD	No subsidence anticipated	No subsidence anticipated	1986 to 2096 model timeframe

Summary of (Inelastic) Subsidence Potential

Basin	Hydro-stratigraphic Setting Susceptibility	Chronic Declines in Groundwater Levels	Geodetic / Extensometer / Tiltmeter Evidence of Subsidence	InSAR Evidence of Subsidence	Subsidence Susceptibility Ranking
Fillmore	Low to Moderate	No	No	No	Low
Piru	Low	No	No	No	Low

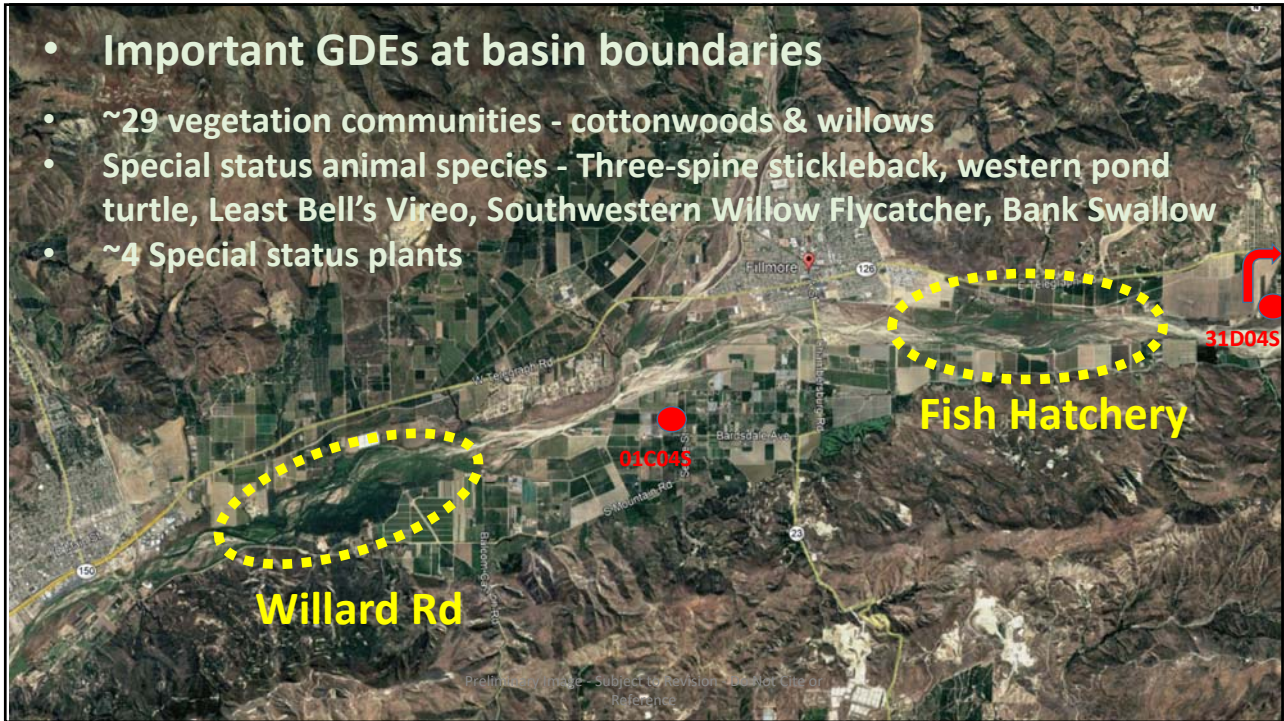
Item 5B - Sustainable Management Criteria

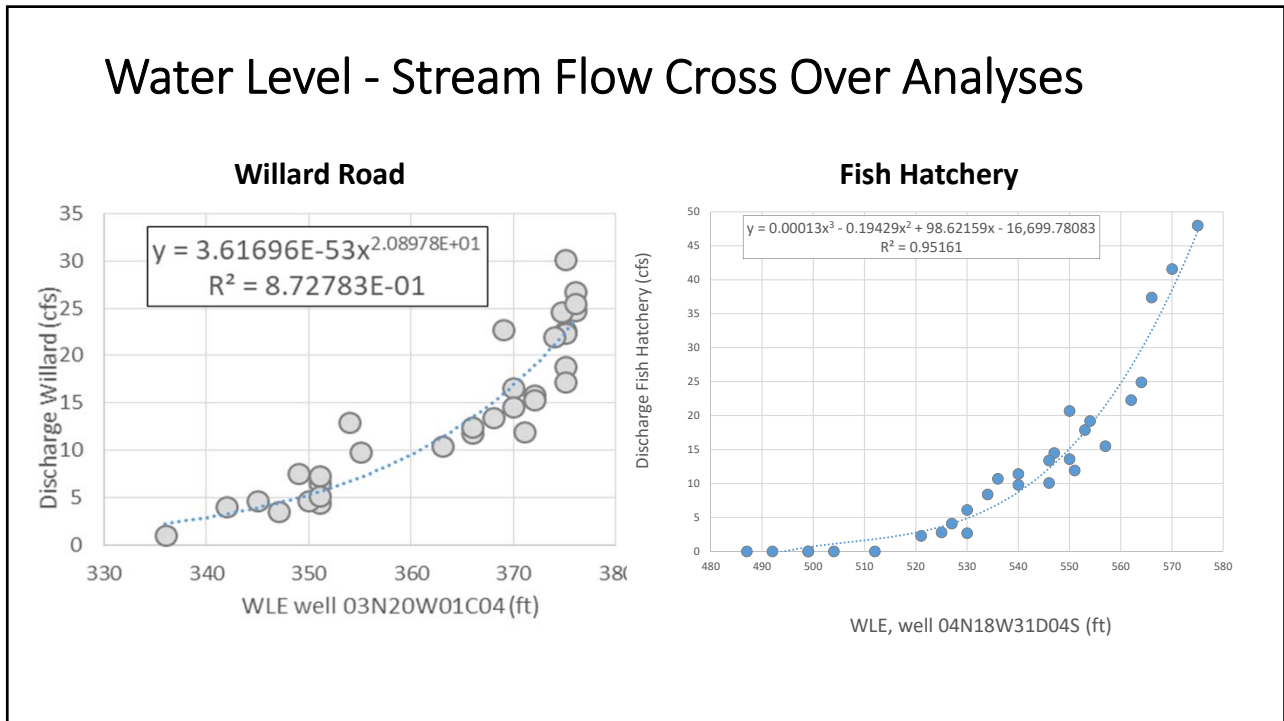
Water Level - Stream Flow Cross Over Analyses

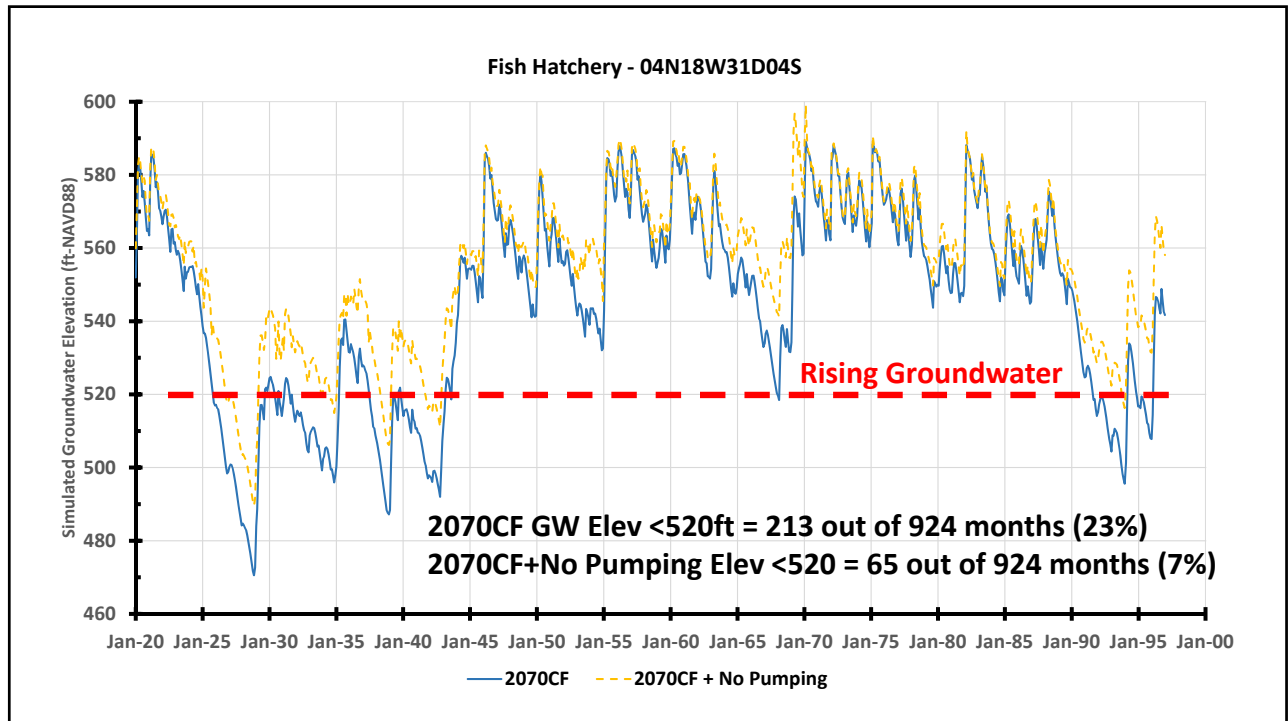
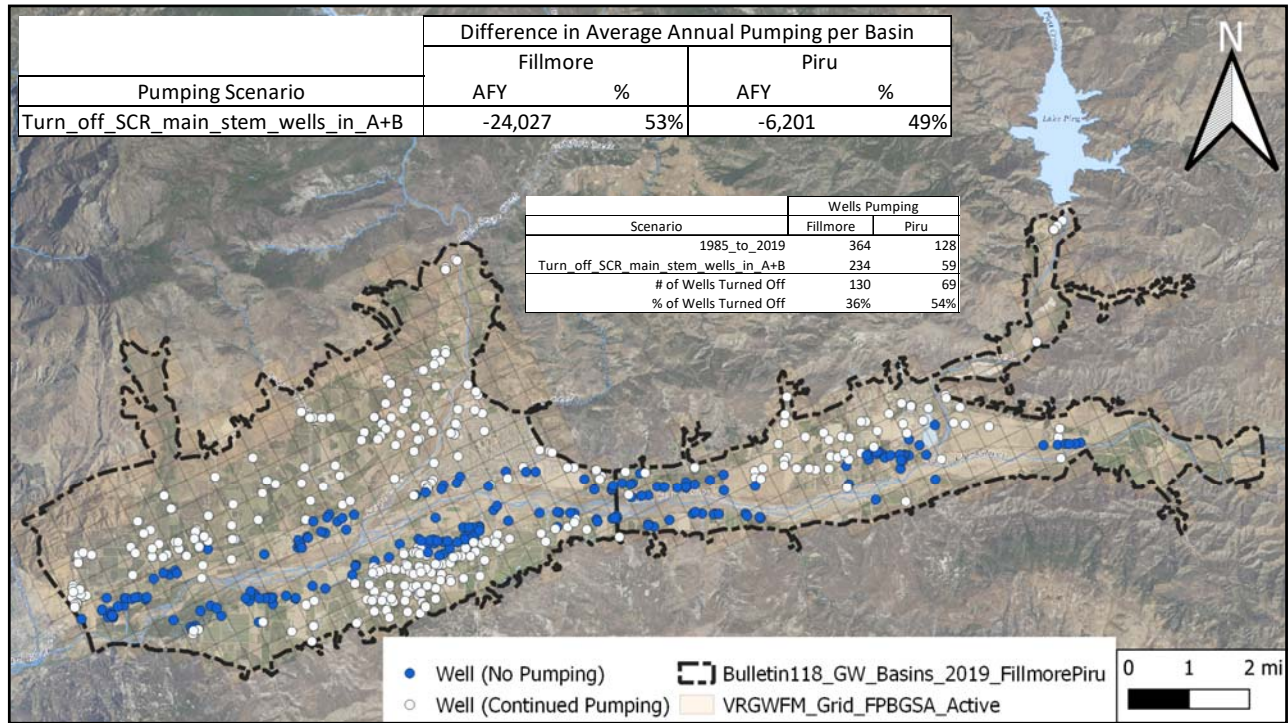
- Updated relationship(s) between WLs in wells near rising GW areas and measured SW flow
- Impact of climate change on SW flows

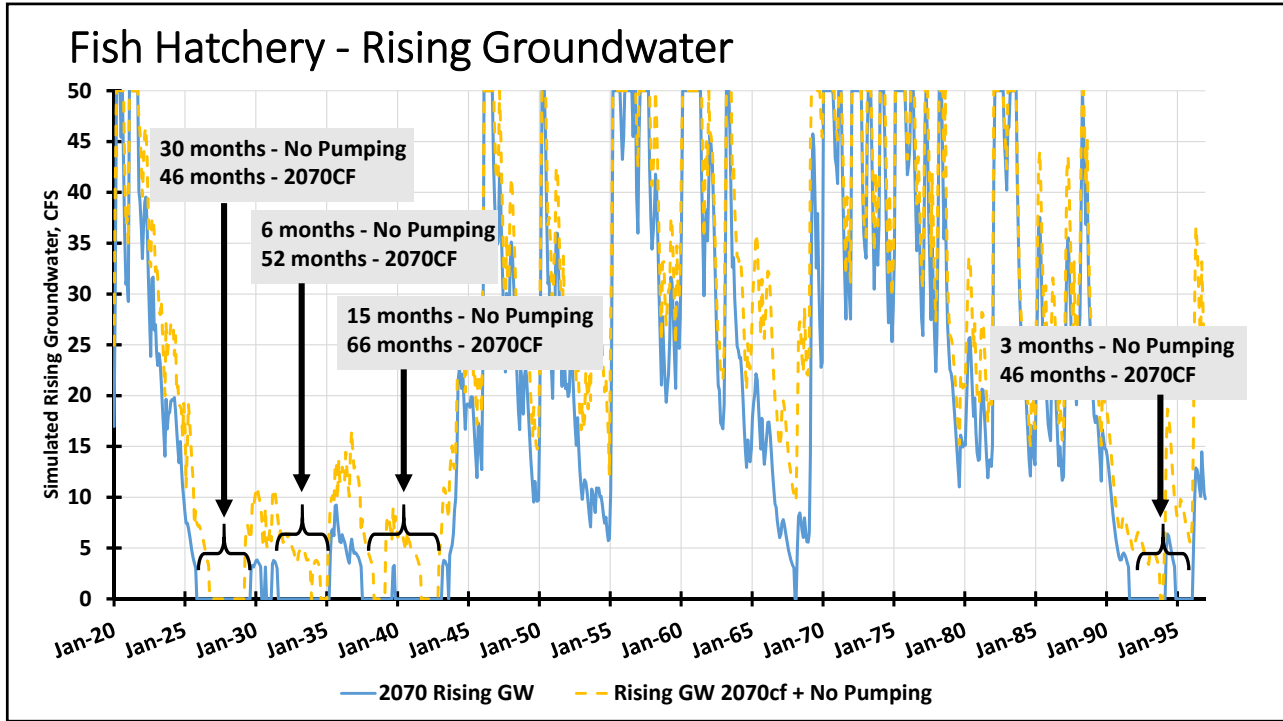


- Important GDEs at basin boundaries
- ~29 vegetation communities - cottonwoods & willows
- Special status animal species - Three-spine stickleback, western pond turtle, Least Bell's Vireo, Southwestern Willow Flycatcher, Bank Swallow
- ~4 Special status plants







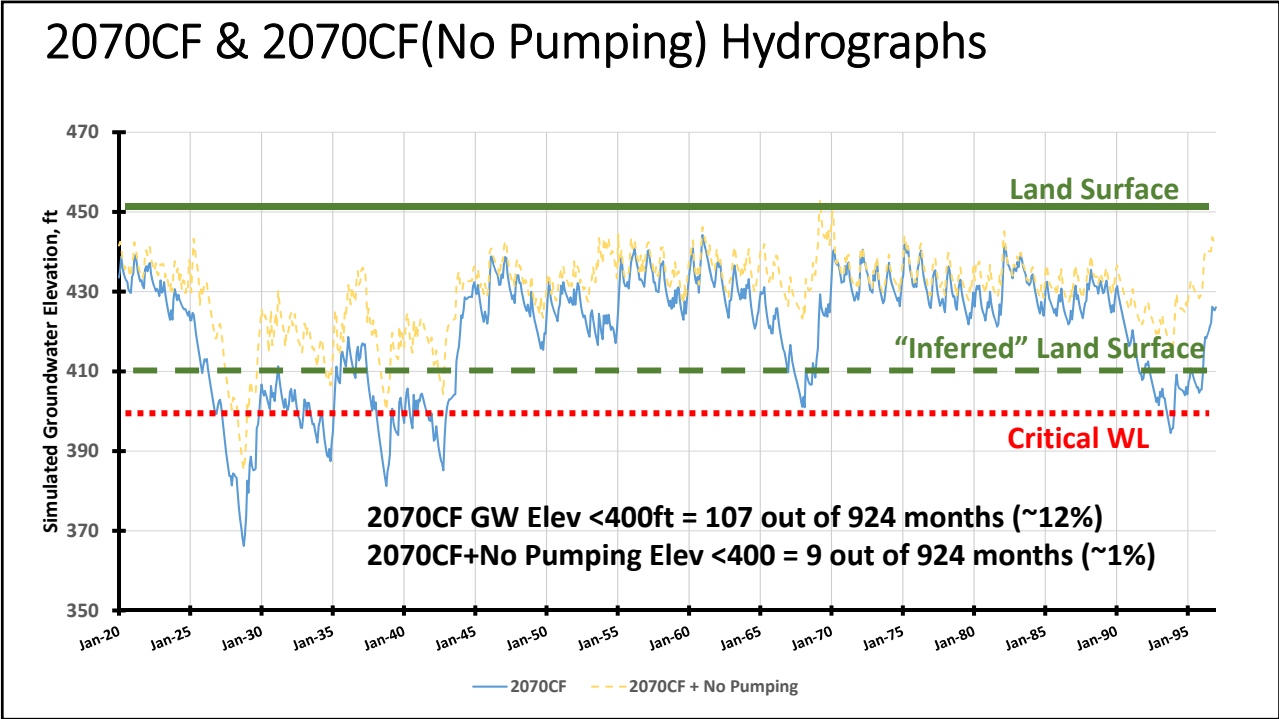


Item 5B - Sustainable Management Criteria

Groundwater Level - Rising Groundwater

- Updated relationship(s) between simulated WLs near the Fish Hatchery under the 2070CF conditions
- Impact of groundwater pumping on groundwater levels





Item 5B - Sustainable Management Criteria

Minimum Thresholds & Measurable Objectives

- Updated SMC matrices

SMCs - General Framework



- **Lowering GW Levels** - no chronic decline in water levels
- **Reduction of GW Storage** - no chronic decline in GW storage
- **Seawater Intrusion** - not applicable
- **Degraded Water Quality** - no regulatory authority over WQ / work with existing agencies with appropriate regulatory authority
- **Land Subsidence** - not anticipated during future climate & pumping conditions
- **Surface Water Depletion** - no chronic decline in SW flows (rising GW areas); GDEs - in droughts multi-month periods with zero rising GW with or w/o pumping & GW levels below critical WL in severe droughts

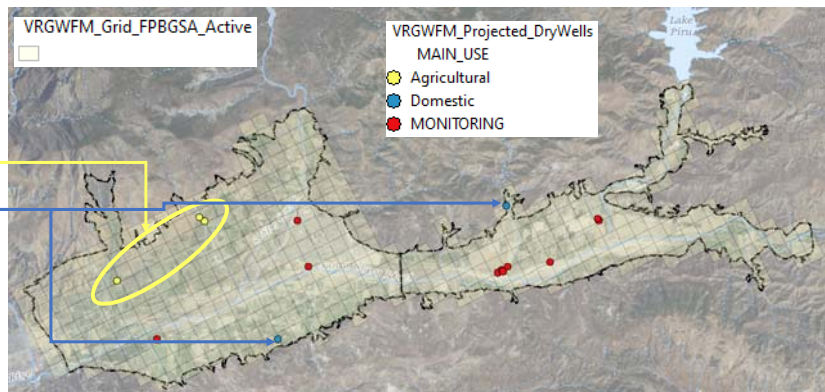
Lowering of Groundwater Levels

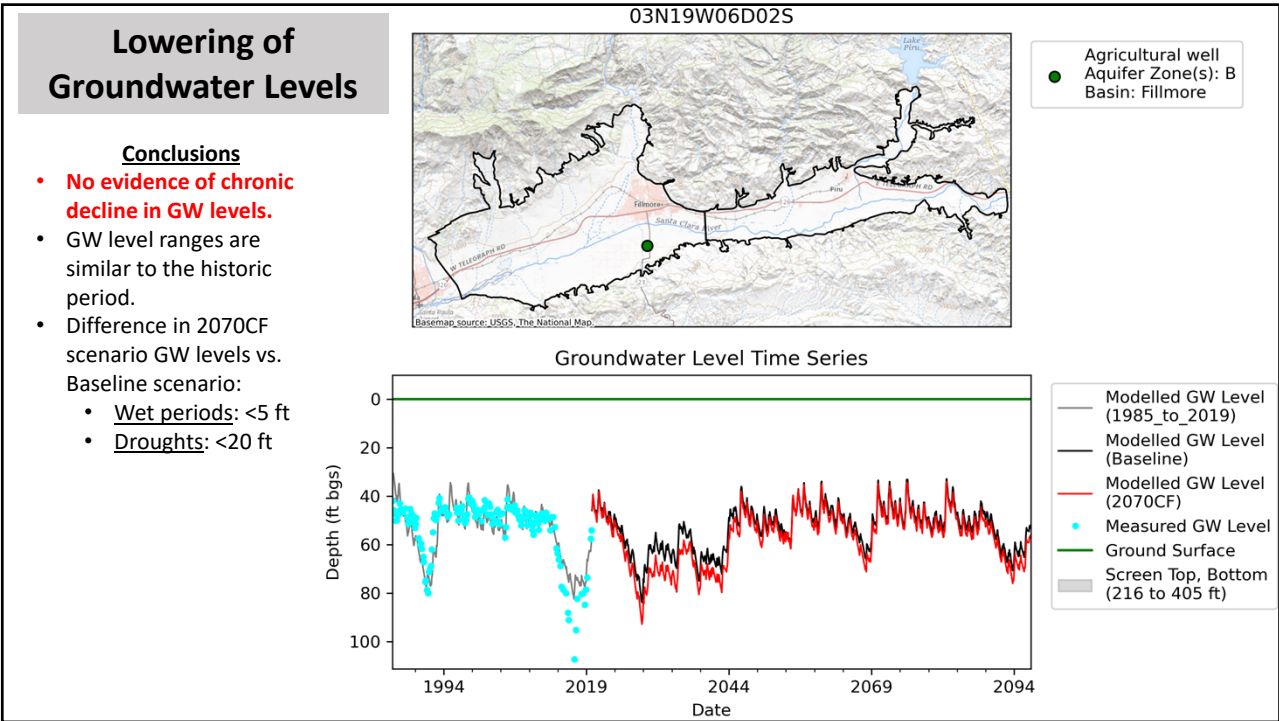
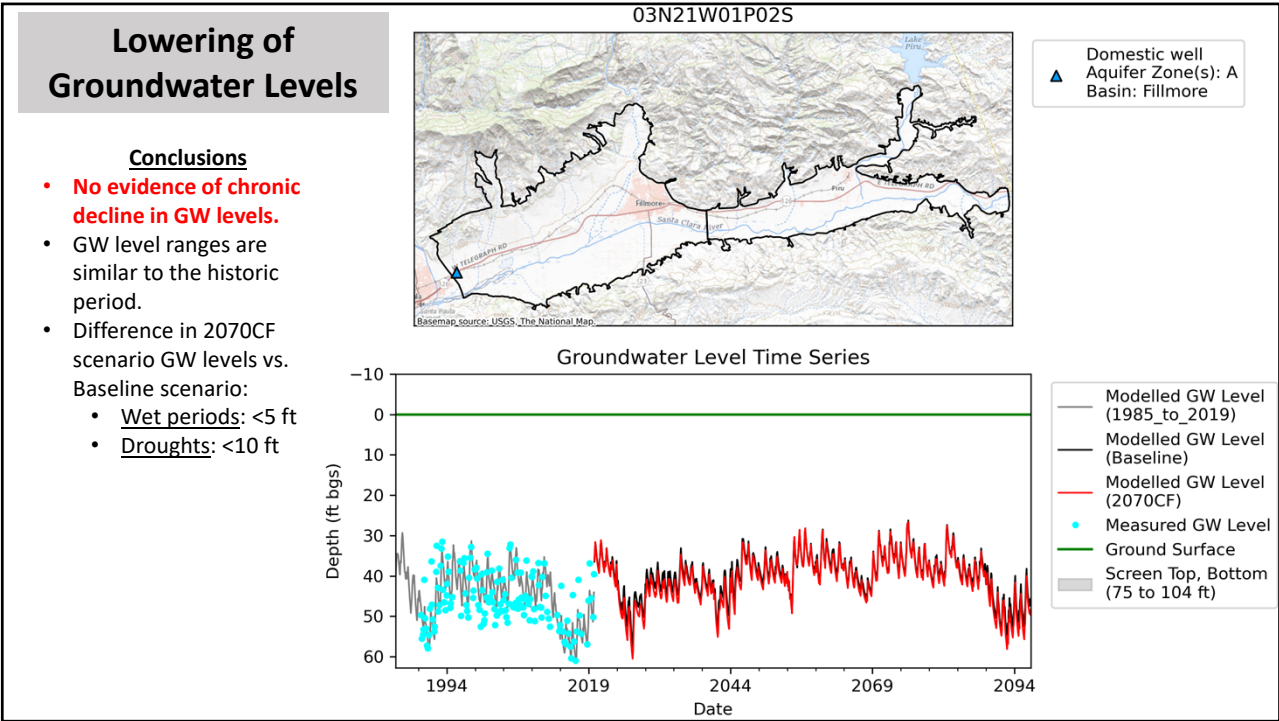
Dry Wells Evaluation (2070CF Future Scenario)

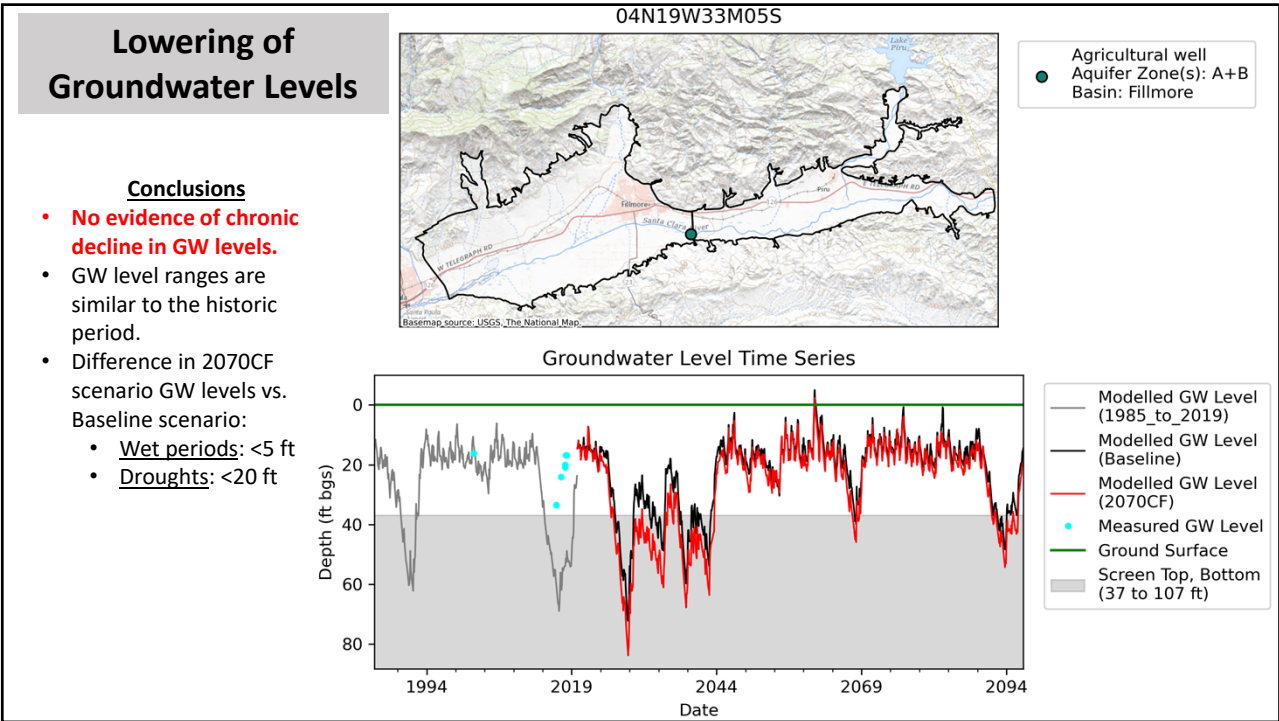
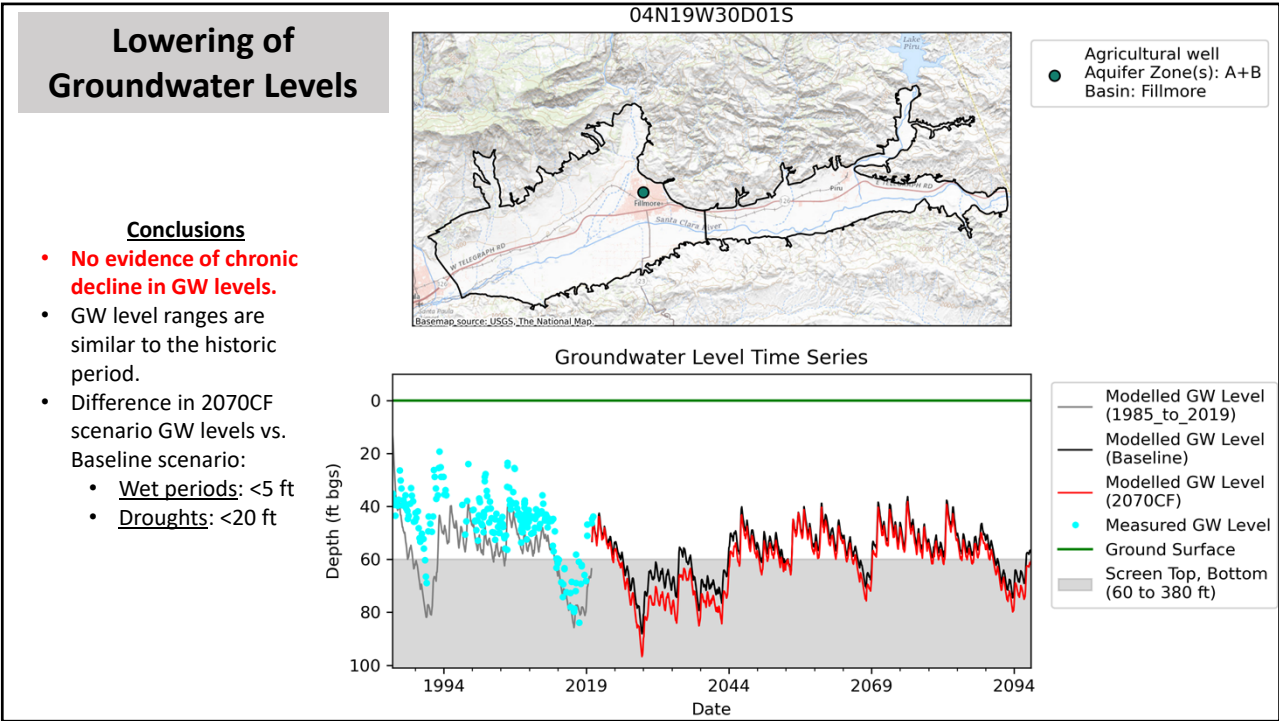
Bottom line: No potable water production wells & minimal number of Ag wells are predicted to go dry based on GW model

Notes:

- Based on comparison of modelled GW levels vs. bottom of screen...
- Some shallow monitoring wells (with screen <100 ft deep) will go dry during droughts.
- Manually inspected 3 agricultural wells and 2 domestic wells that modelled GW levels indicate would go dry:
 - Unlikely to go dry based on measured GW levels.
- Biases in modelled GW levels tends to underestimate measured GW levels - making this a cautious/conservative evaluation.





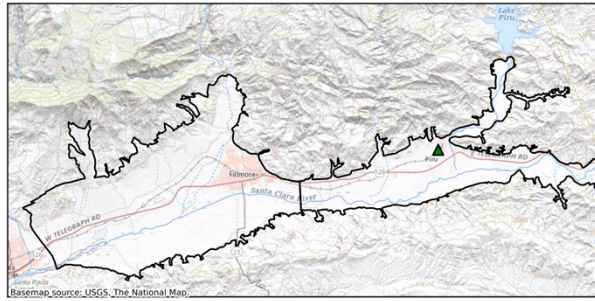


Lowering of Groundwater Levels

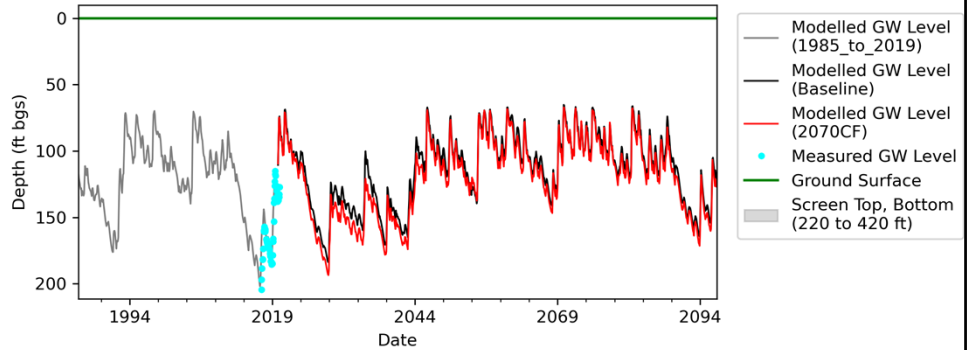
Conclusions

- **No evidence of chronic decline in GW levels.**
- GW level ranges are similar to the historic period.
- Difference in 2070CF scenario GW levels vs. Baseline scenario:
 - Wet periods: <5 ft
 - Droughts: <20 ft

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Groundwater Level Time Series

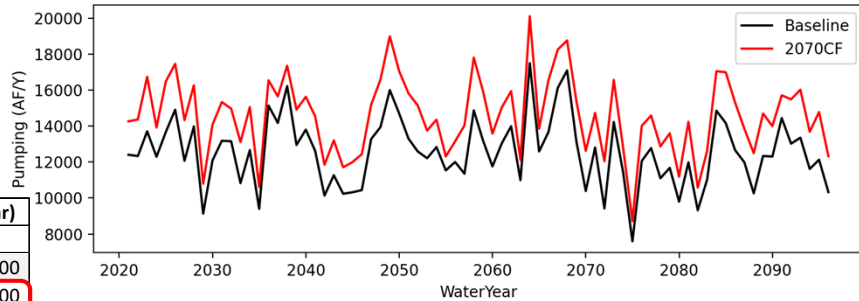


Reduction in Groundwater Storage

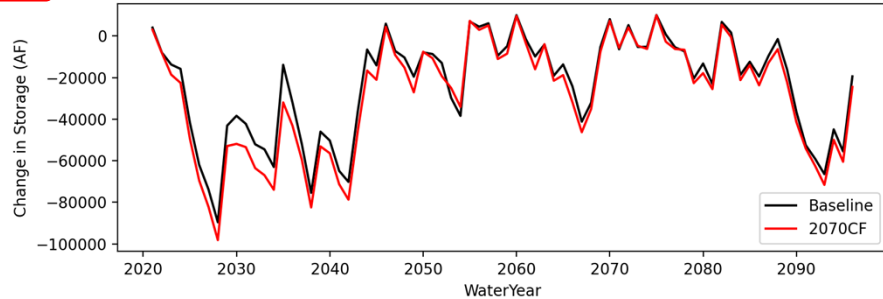
Scenario	Average Pumping (Acre-Feet/Year)	
	Fillmore	Piru
Historical	46,800	11,400
Baseline	44,800	12,600
2070CF	49,800	14,600

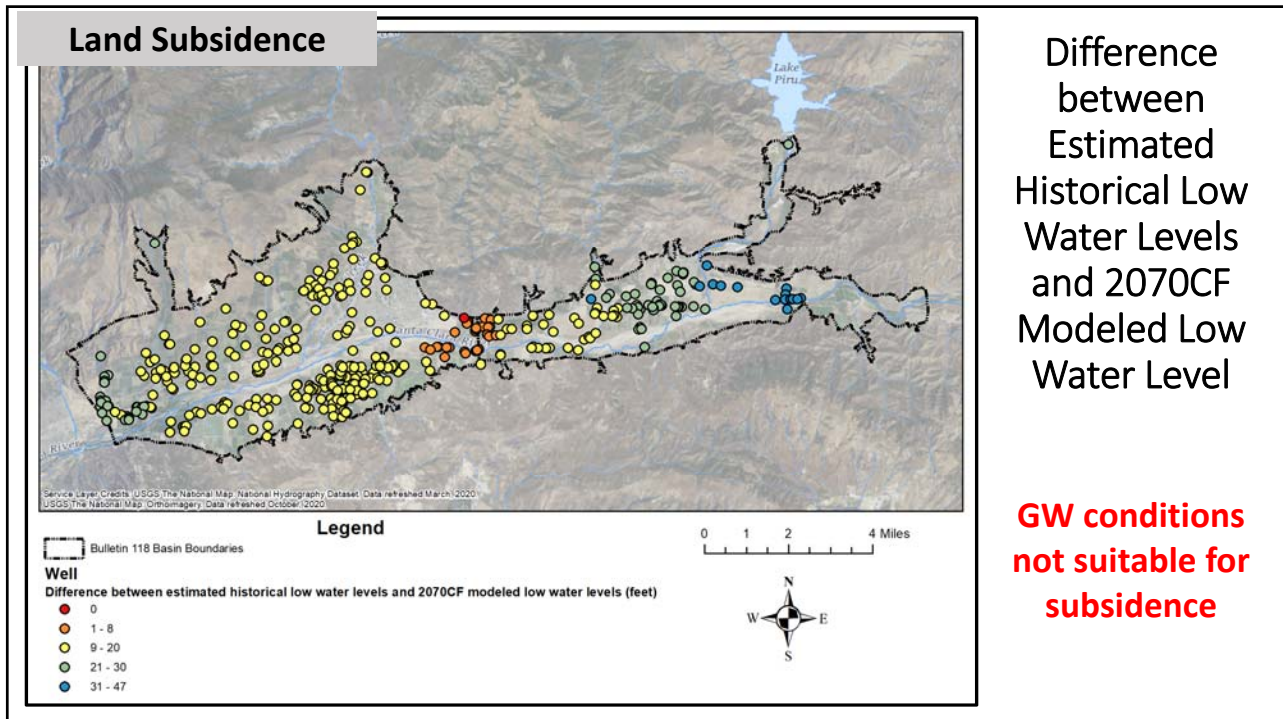
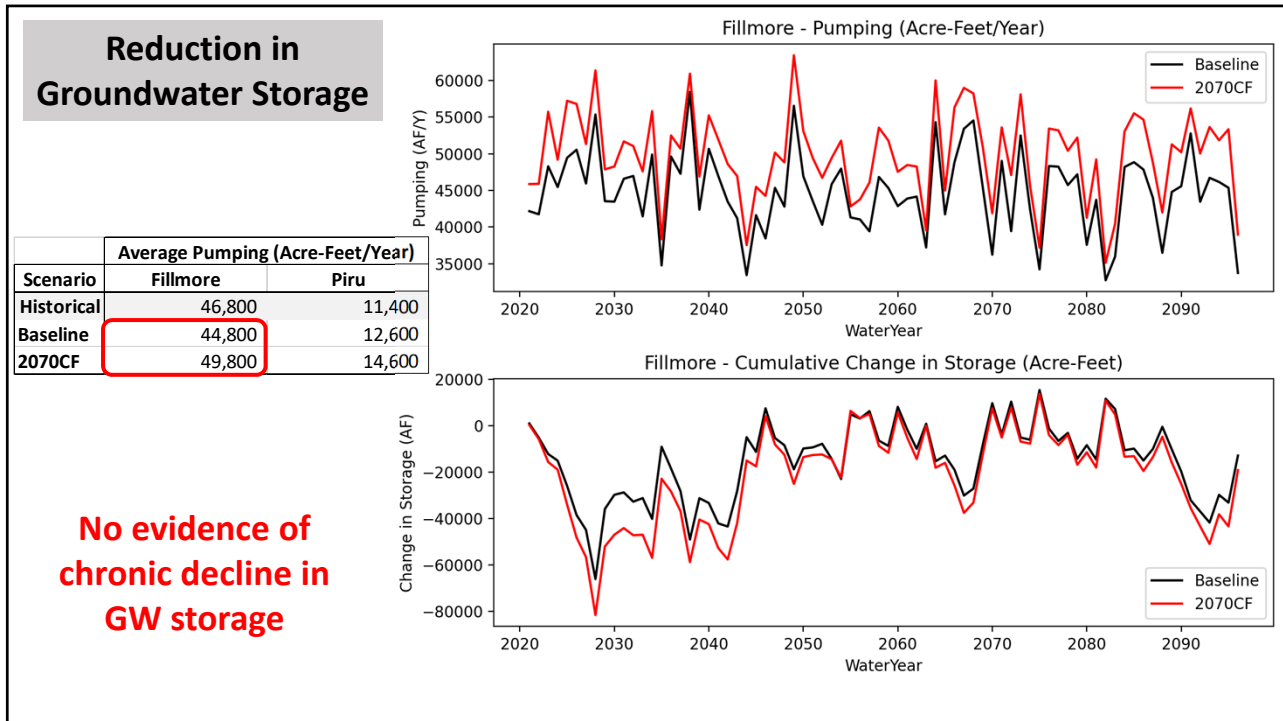
No evidence of chronic decline in GW storage

Piru - Pumping (Acre-Feet/Year)



Piru - Cumulative Change in Storage (Acre-Feet)



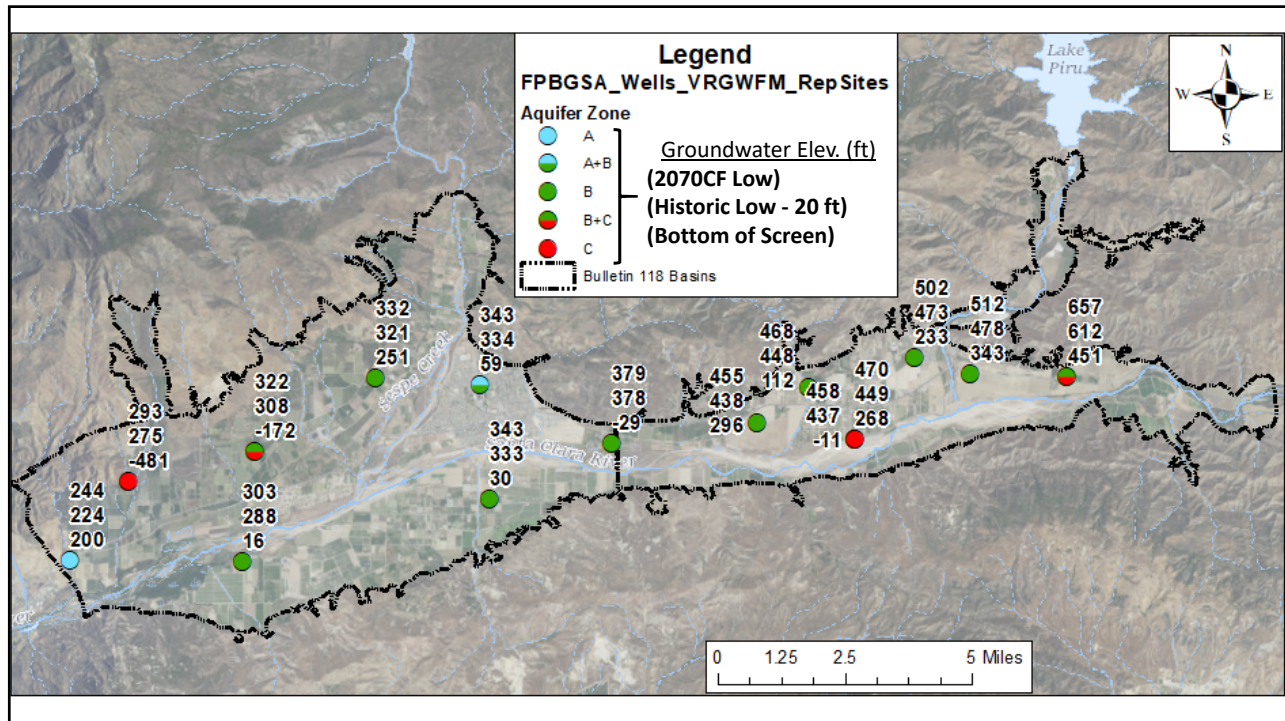
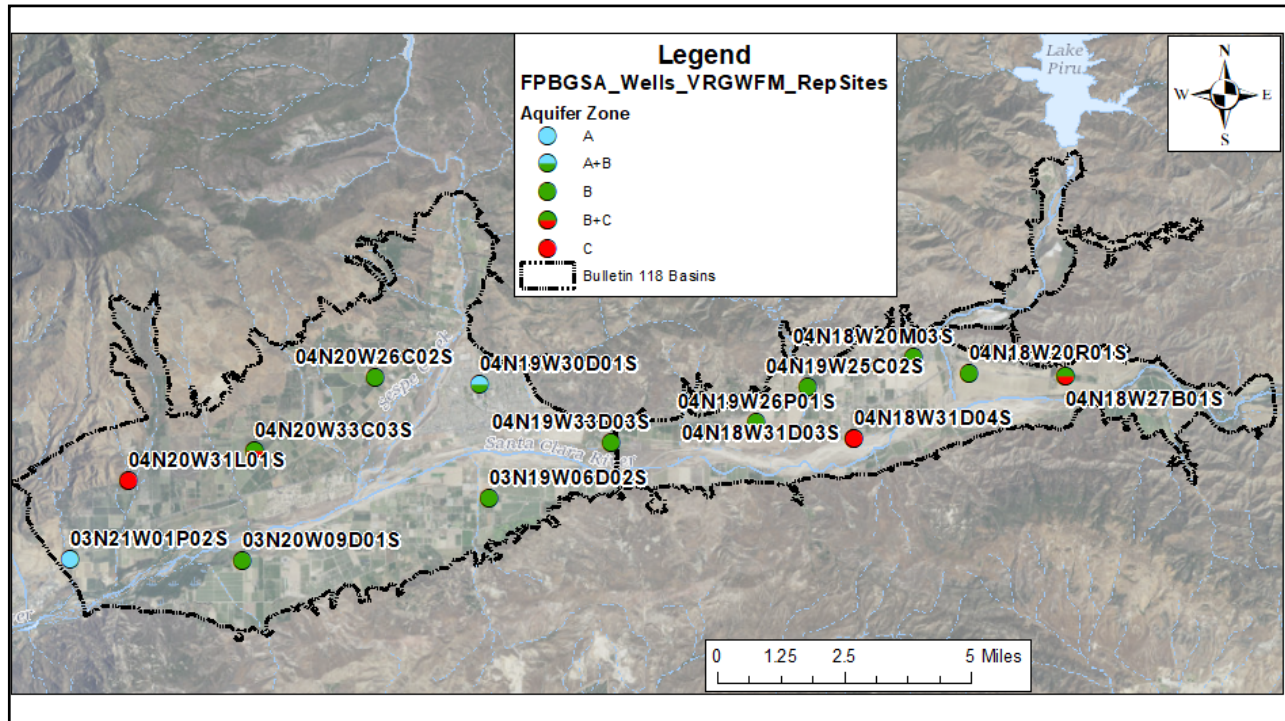



Surface Water - Groundwater Interaction / SW Depletion

- SMC focused on reaches of the Santa Clara River at the F-P & SP-F basin boundaries with rising GW
- No or limited beneficial uses and users of the SW in these areas
- GDEs present along those reaches → Birds - Amphibians - Vegetation
 - ✓ Drought periods create multi-month sequences with no rising GW with or without GW pumping
 - ✓ Drought periods create multi-month sequences with GW level declines greater than the critical water level decline of ~10 ft

Does the FPBGSA have a responsibility to mitigate drought impacts if those impacts are not any more severe than pre-Jan 2015 impacts?

SMC	Undesirable Results	Metric	MT	MO	Comments
GW Elevation	loss of ability to pump GW	GW elevation	WL declines below the base of well screens in more than 25% of representative wells	GW levels at 2011 high WL	maximizes range between MT and MO
GW Storage Reduction	inadequate GW storage to last through multi-year drought without GW extraction limitations	GW elevation	WLs equivalent to the 2070CF low	GW levels at 2011 high WL	maximizes range between MT and MO
SW Depletion	surface water flow declines due to GSP implementation that interfere with the beneficial use and users	Rising GW rates at the Fillmore-Piru basin boundary (Fish Hatchery) / Depth to GW at the Fillmore - Piru basin boundary	The GSP does not propose projects or management actions that would change the operational regime of the basins. Therefore, implementation of the GSP does not cause significant and unreasonable effects. No beneficial users or uses are impacted by implementation of the GSP.		
Land Subsidence	land subsidence amounts that interfere (total inelastic subsidence of 0.5ft/yr or 0.5ft over 5 yrs) with infrastructure operations	GW elevation	GW elevation lower than the estimated historical low	GW levels at 2011 high WL	maximizes range between MT and MO; Monitor subsidence amount - InSAR data from DWR
Degraded WQ	water quality degradation that impairs the beneficial use of the resource	WQ values	Water quality parameters established in existing or future regulations	FPBGSA is not a water purveyor and lacks regulatory authority for WQ compliance, but will cooperate with appropriately empowered entities	
Seawater Intrusion	NA	NA	NA	NA	





Questions

