



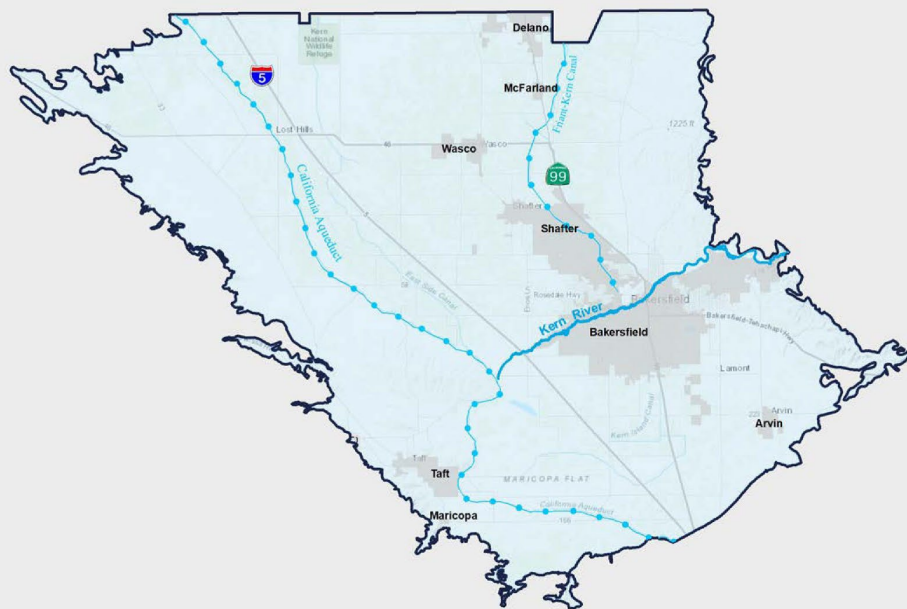
Kern River Groundwater Sustainability Agency (KRGSA)

KRGSA 5TH GSP ANNUAL REPORT WATER YEAR 2023

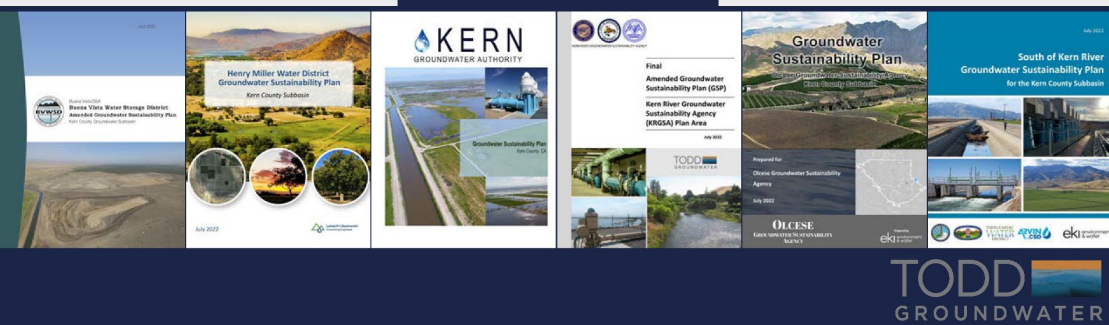
KRGSA BOARD MEETING
JUNE 6, 2024

Kern County Subbasin Groundwater Sustainability Plans

Fifth Annual Report



Water Year 2023

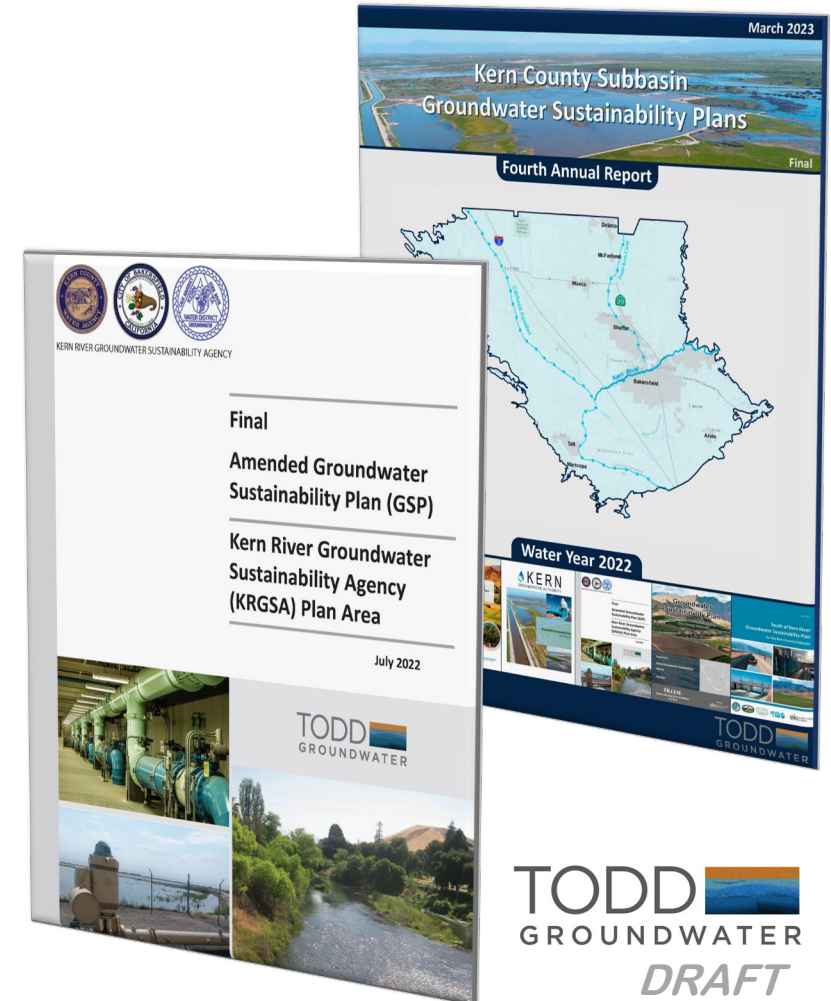


PRESENTATION OUTLINE

- Coordination with Kern County Subbasin 5th GSP Annual Report
- KRGSA Monitoring and Implementation Activities – WY 2023
 - Water Levels
 - Water Quality
 - Subsidence
 - Groundwater Budget
 - Progress on GSP Implementation

Coordination with Subbasin 5th GSP ANNUAL REPORT

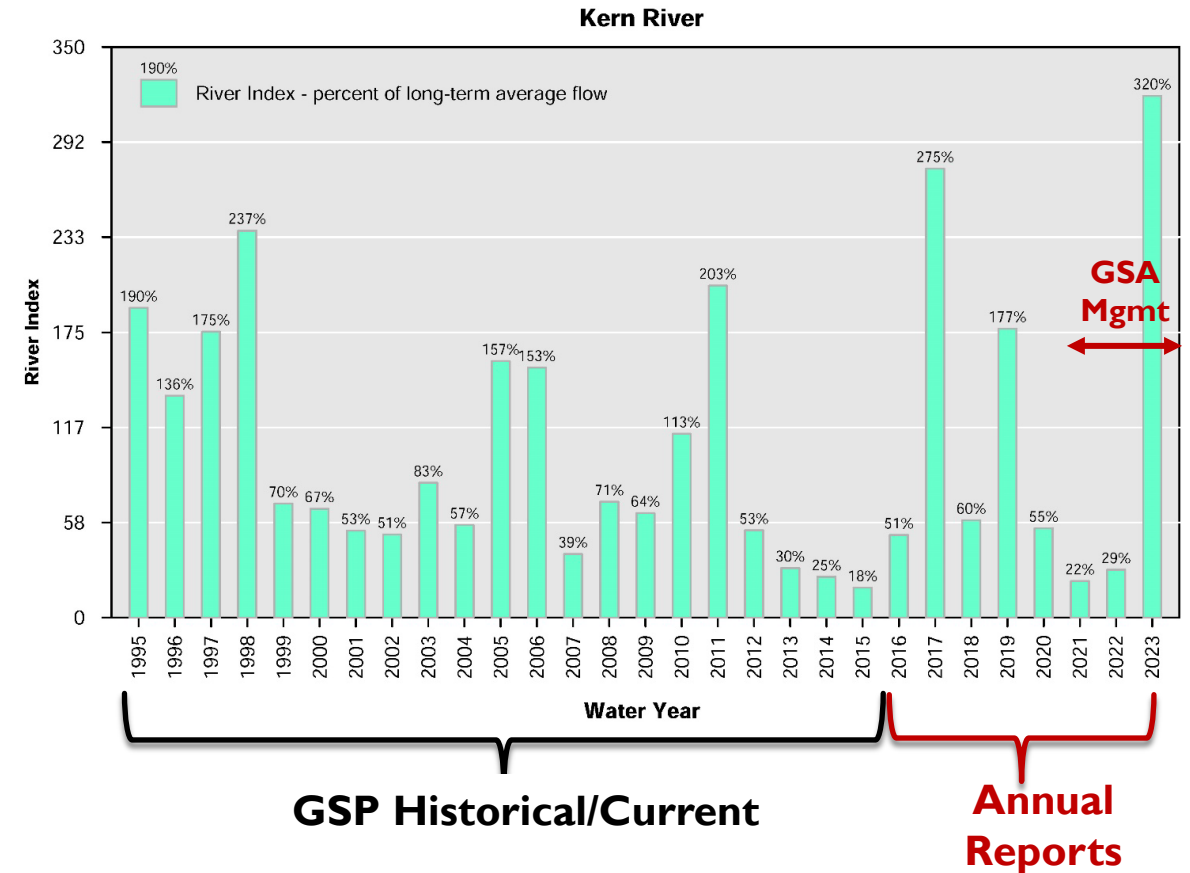
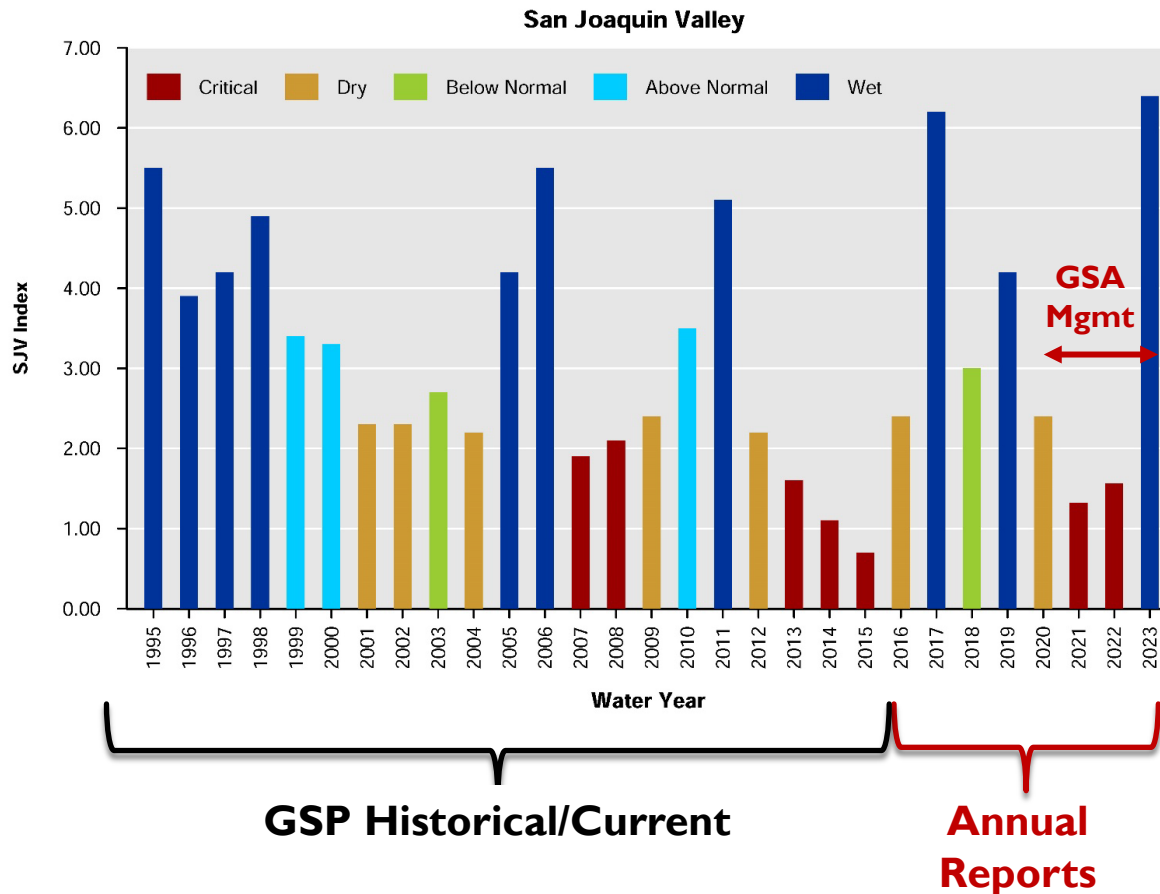
- All GSAs coordinated on one comprehensive annual report for 6 GSPs in Subbasin
- KRGSA provided data and information for:
 - Basin-wide update of numerical model
 - Water level mapping and hydrographs
 - GSAs Progress Report on GSP Implementation
- Submitted to DWR April 1, 2024
- Provided update at KRGSA April Board meeting



HYDROLOGY - WATER SUPPLY INDICES

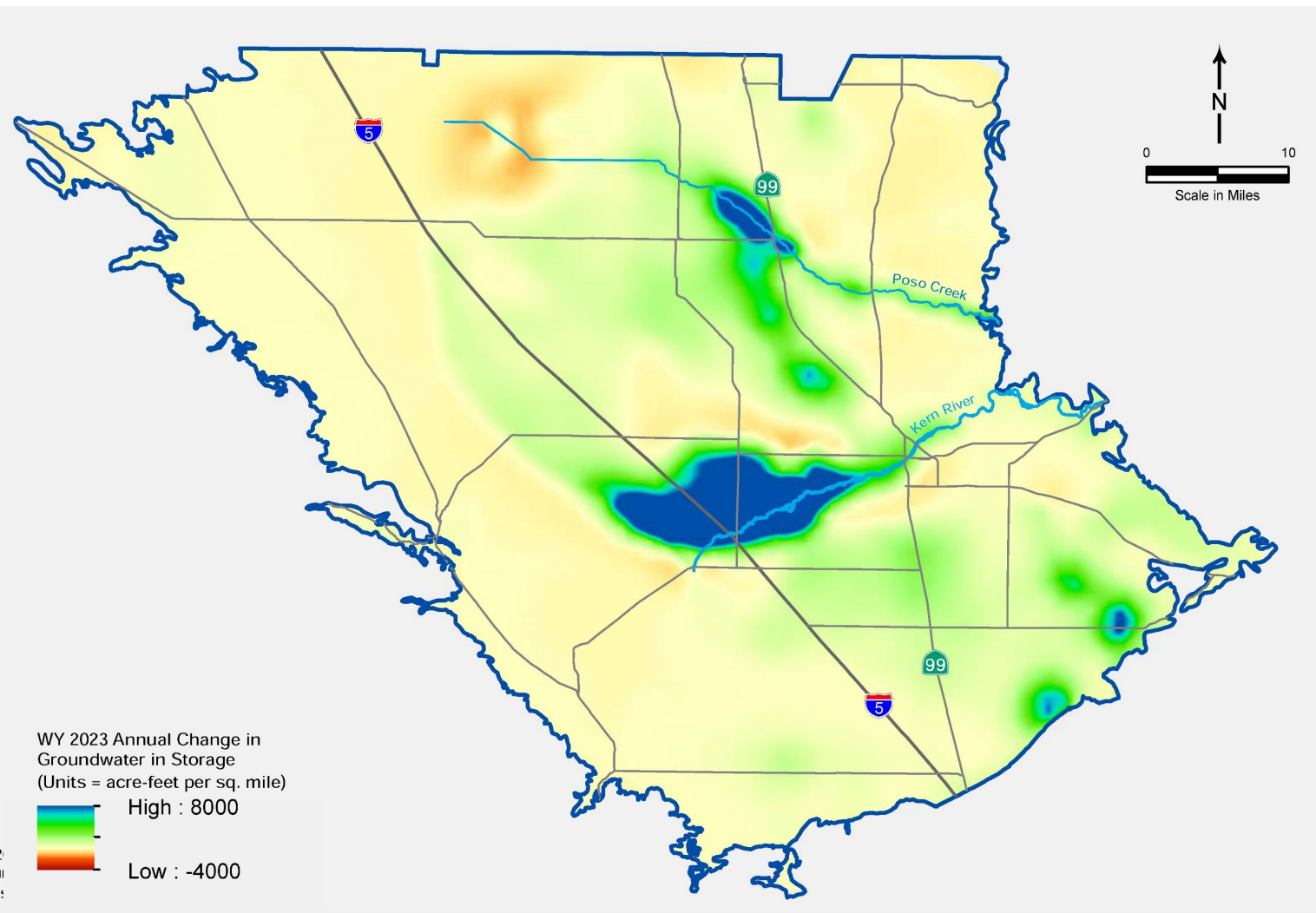
WY 2023 – SECOND CONSECUTIVE CRITICALLY DRY YEAR

WY 2023 KR Flow 320% of long-term average



WY 2023 MODEL RESULTS

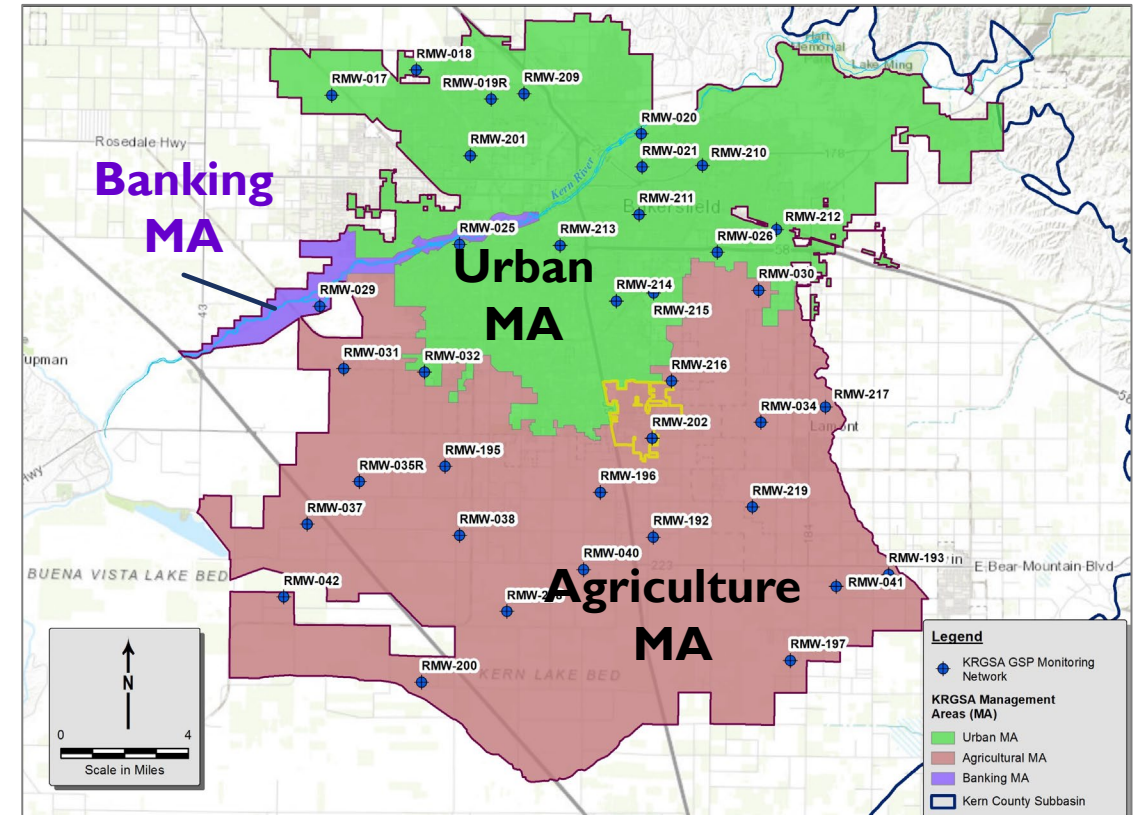
CHANGE in GROUNDWATER in STORAGE



- WY 2023 Storage Change +2,239,354 AFY
- Widespread low-level declines across the Subbasin
- Larger increases from banking operations
- Demonstrates that the Subbasin is dominated by groundwater banking and storage

KRGSA GSP WATER LEVEL MONITORING NETWORK

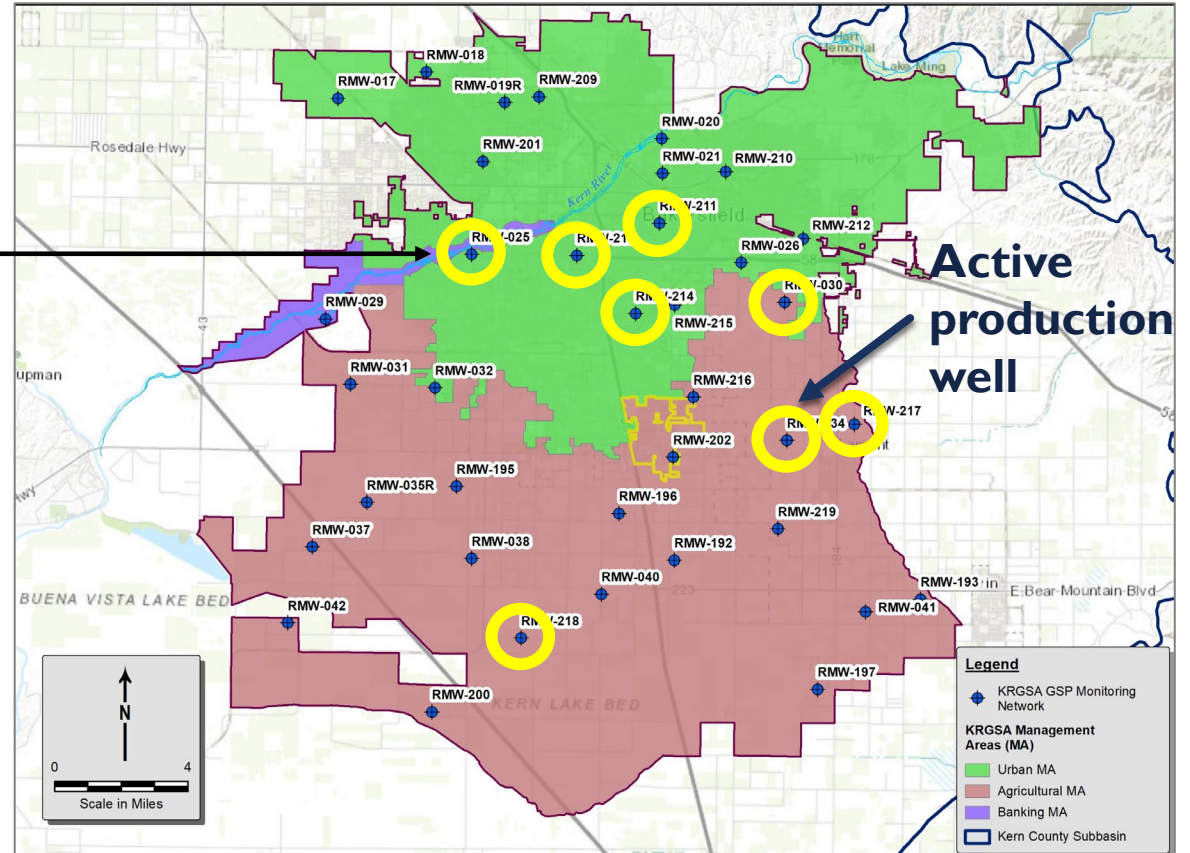
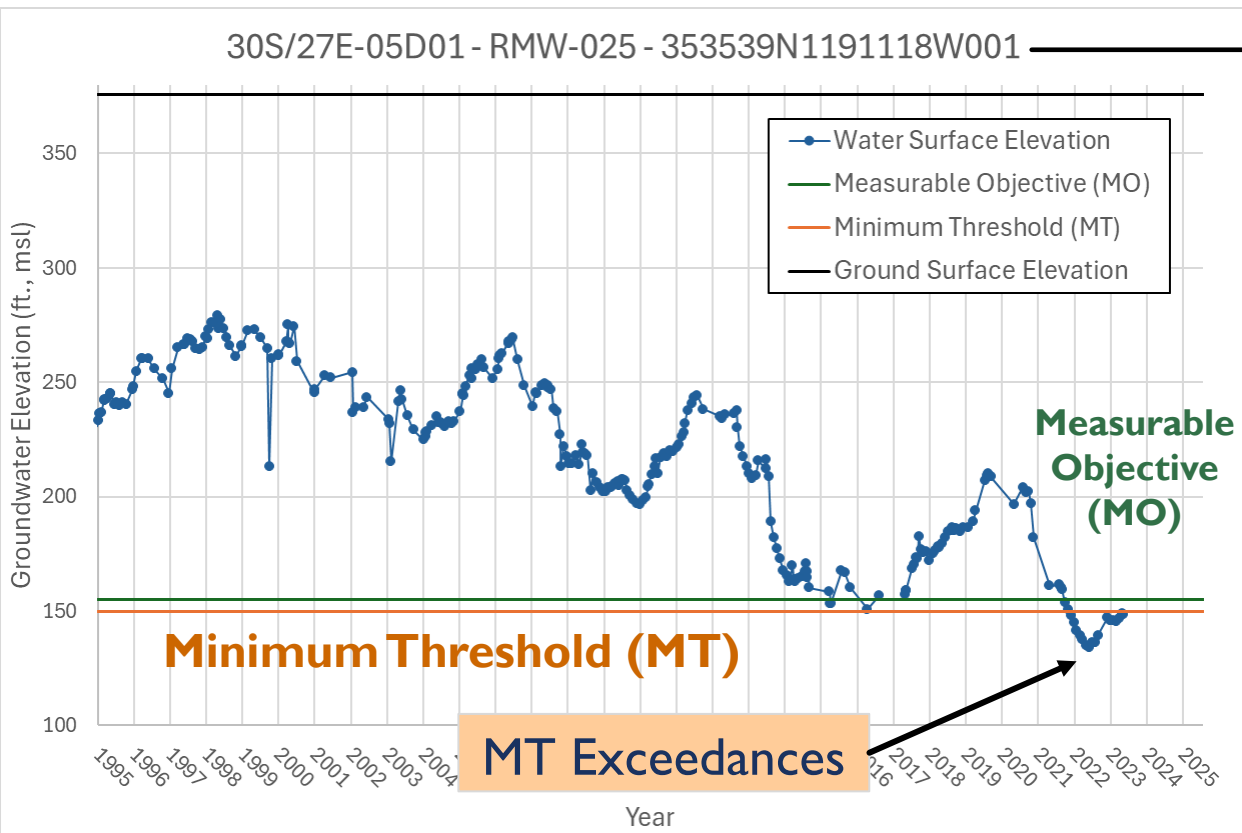
- 3 Management Areas (MAs) based on primary land and water use
- 37 wells - GSP Monitoring Network
- Developed minimum thresholds (MTs) and measurable objectives (MOs) for each well to track sustainable management
- Report semi-annual water level data to the DWR online SGMA portal (coordinated by the Subbasin Plan Manager)



37 wells in 3 Management Areas
Urban (16-green), Banking (1-purple),
Agricultural (20-red)

GROUNDWATER ELEVATION HYDROGRAPHS COMPARE TO MTs AND MOs

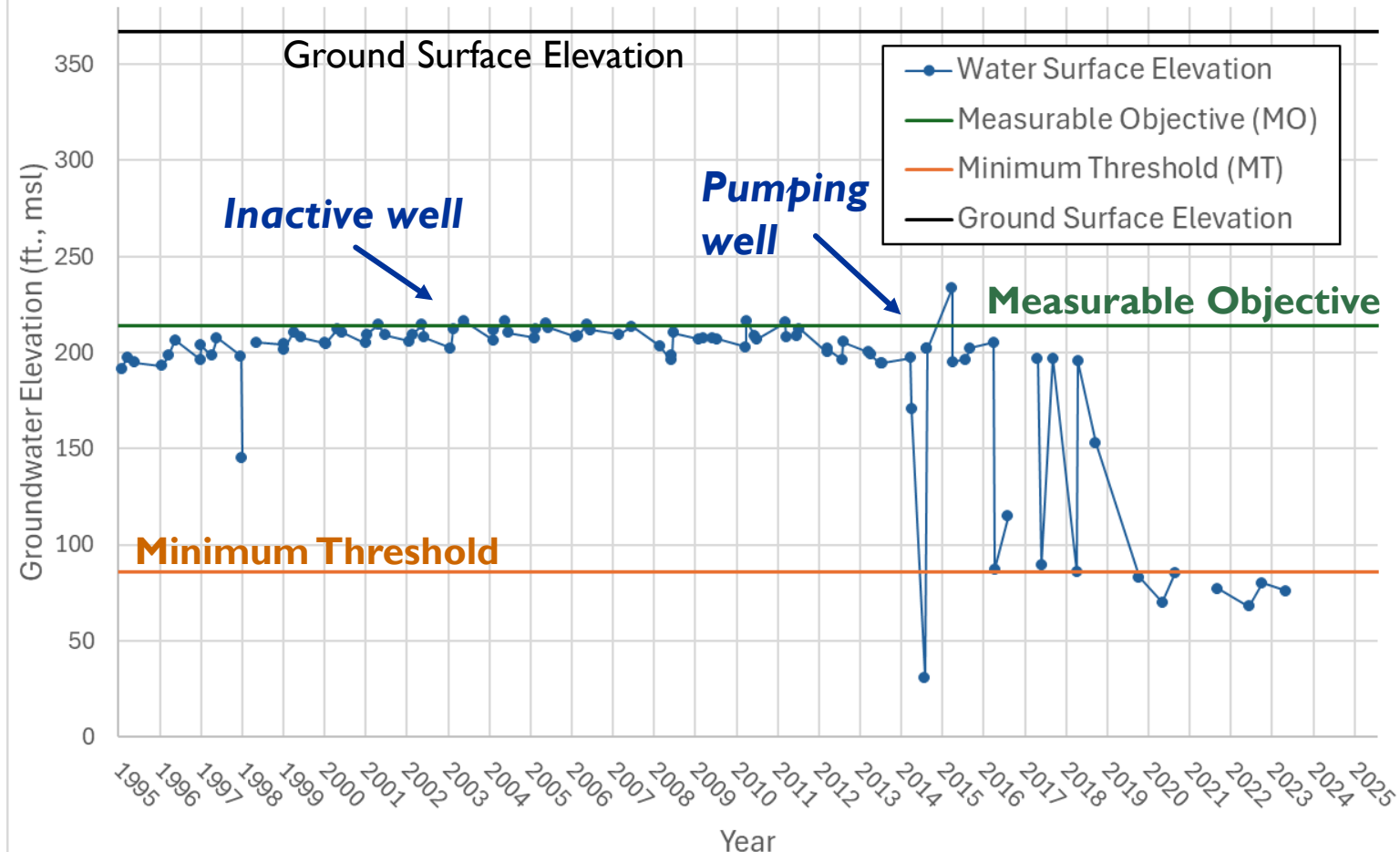
- Compare current water levels to (MTs)
- 8 of 37 wells exceeded MTs in WY 2023



MT Exceedance WY 2023

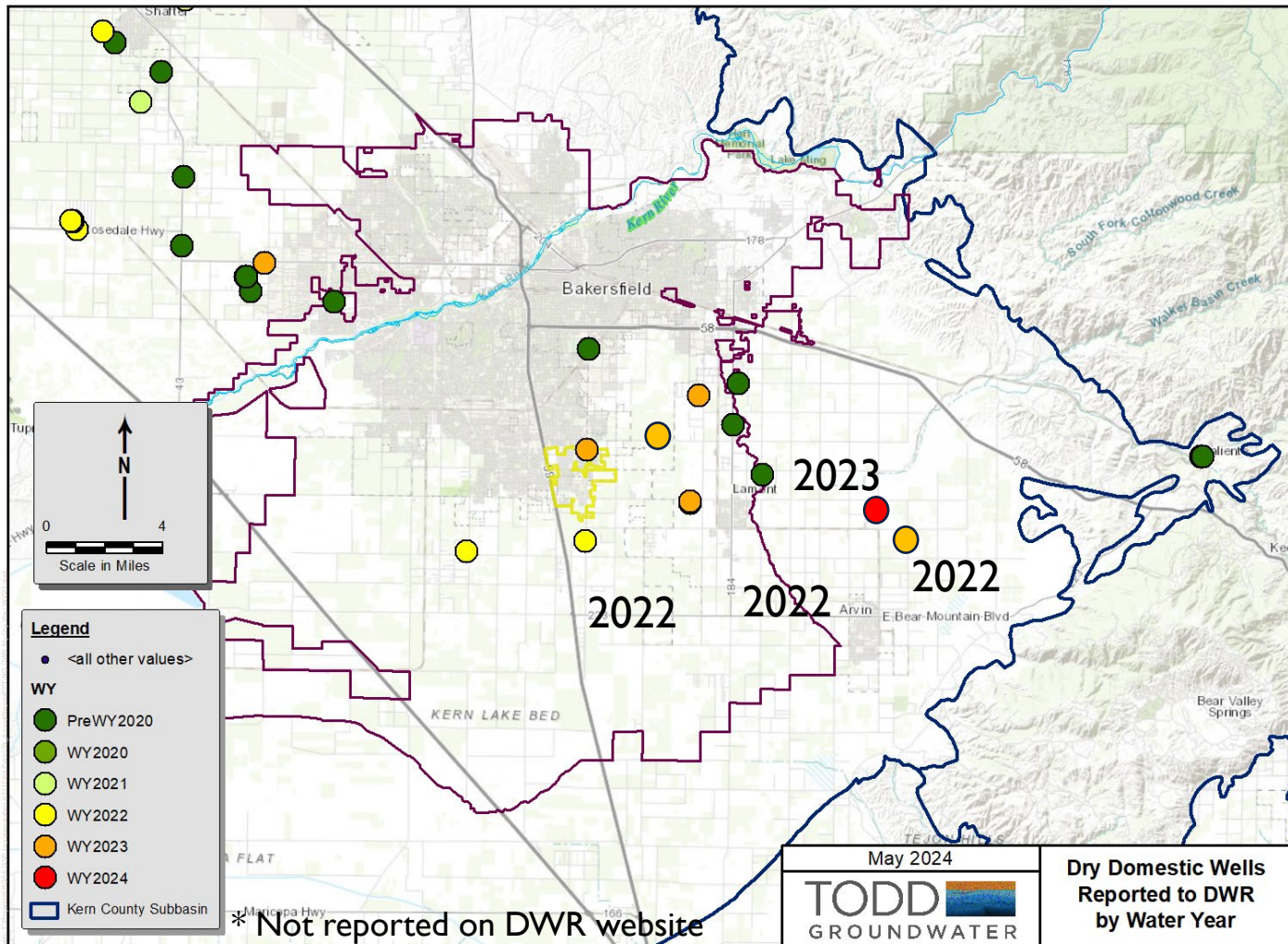
SOME MT EXCEEDANCES IN ACTIVE PRODUCTION WELLS

RMW-034 - KRGSA - 352747N1189435W001



- SGMA assumes measurements of static groundwater levels, not pumping water levels in the well
- Some MT exceedances occur inadvertently when RMWs are active pumping wells
- Can be problematic for SGMA compliance if pump is not turned off long enough to allow water levels to return to static conditions

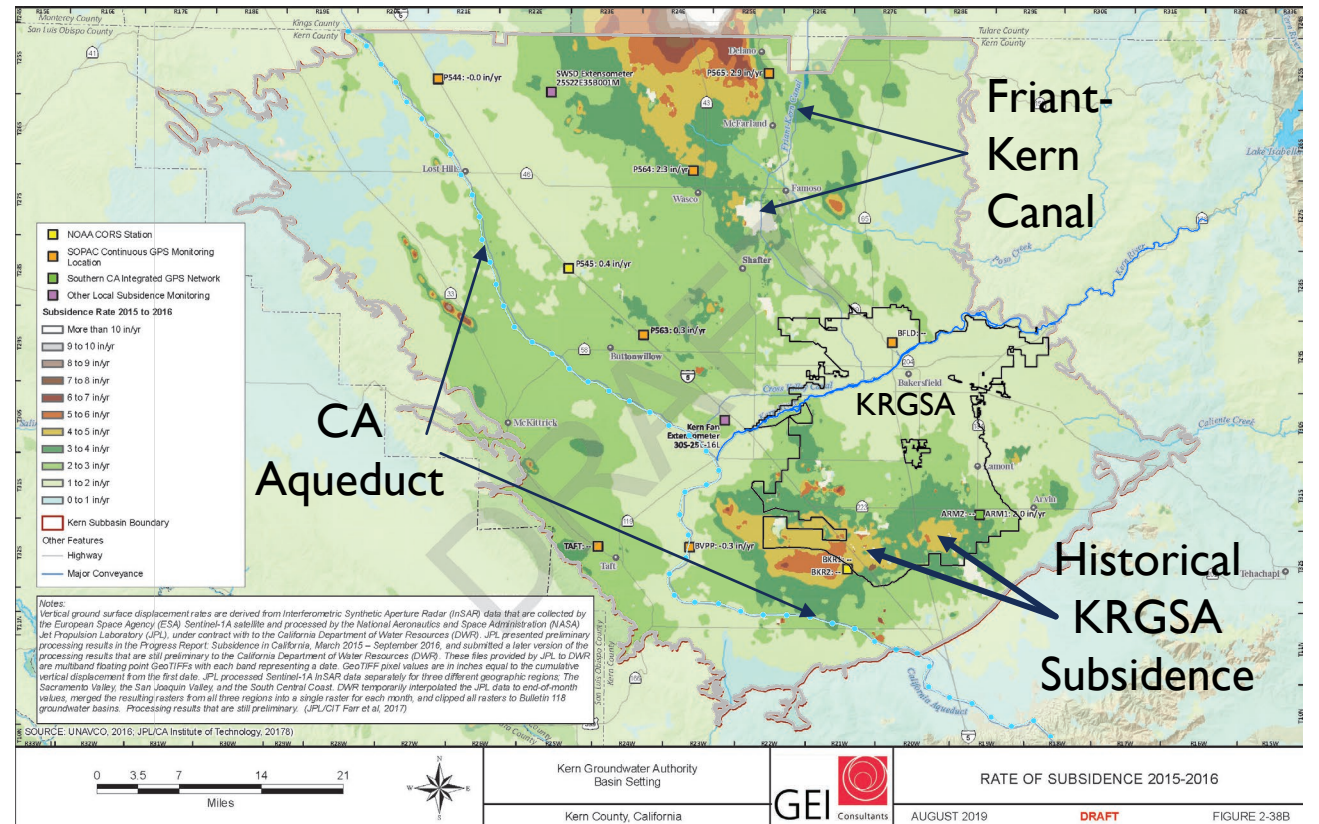
DRY DOMESTIC WELLS IN THE KRGSA SINCE 2016



- Eight dry domestic wells in the KRGSA in WY 2023
- Additional dry well reported in KRGSA in Spring 2024
- *Domestic Well Mitigation Management Action* in GSP to track active domestic wells and avoid widespread impacts

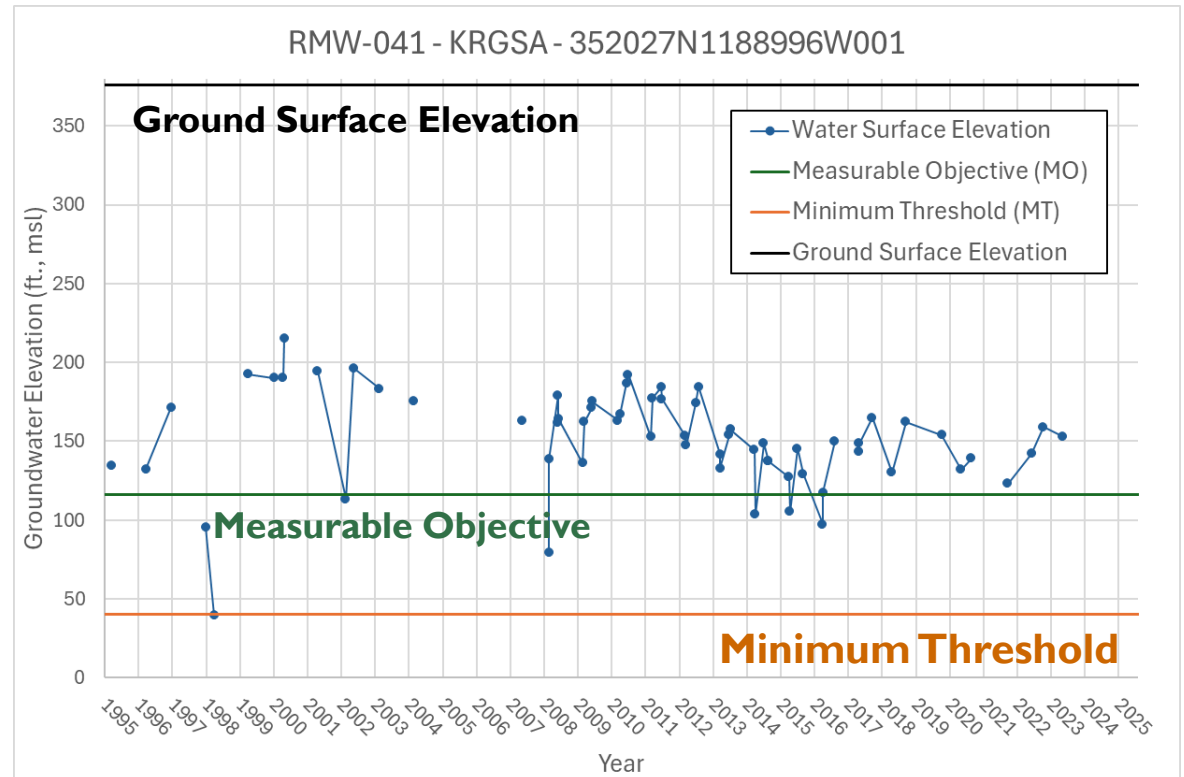
MULTI-FACETED APPROACH TO SUBSIDENCE MONITORING KRGSA GSP

- Historical land subsidence in southern KRGSA and adjacent districts
- Thick clay deposits associated with paleo-lake beds in the southern Kern County Subbasin
- No adverse impacts to critical infrastructure in KRGSA to date – no “undesirable results”
- Subbasin-wide monitoring to target CA Aqueduct and Friant-Kern Canal
- KRGSA monitoring – water levels, local GPS station, regional InSAR data



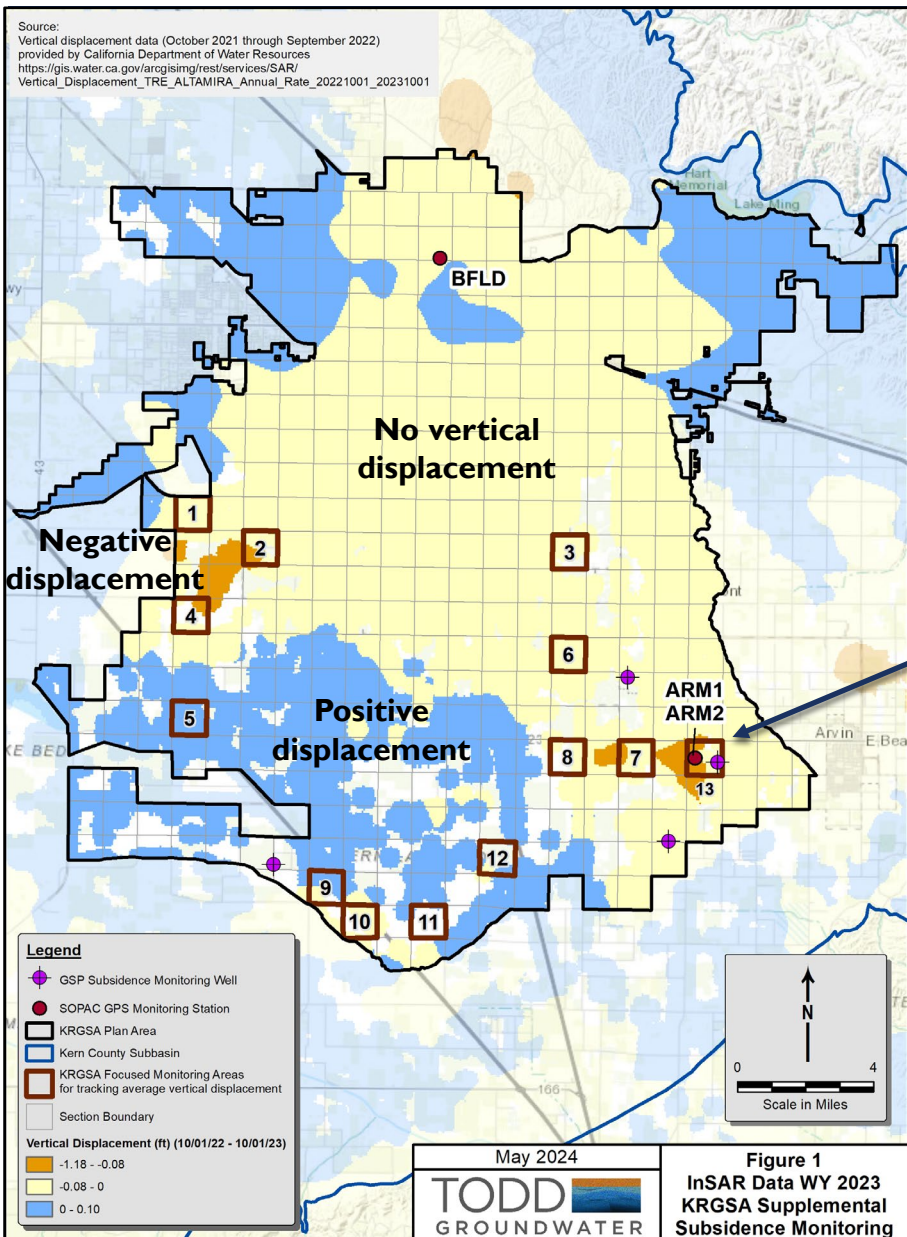
KRGSA WATER LEVEL MONITORING FOR LAND SUBSIDENCE

- Maintain water levels close to or above historical low levels to prevent exacerbation of future land subsidence and to avoid “undesirable results”
- Water levels in areas of larger subsidence rates in the KRGSA are currently above historic low water levels
- Time lag expected between groundwater recovery and cessation of land subsidence; recent drought of record triggered regional increase in land subsidence
- Some subsidence expected to continue into the future



Water Year 1995 - 2023

DWR InSAR DATA WY 2023



- Supplemental Subsidence Monitoring – 13 locations both inside and outside historically impacted areas

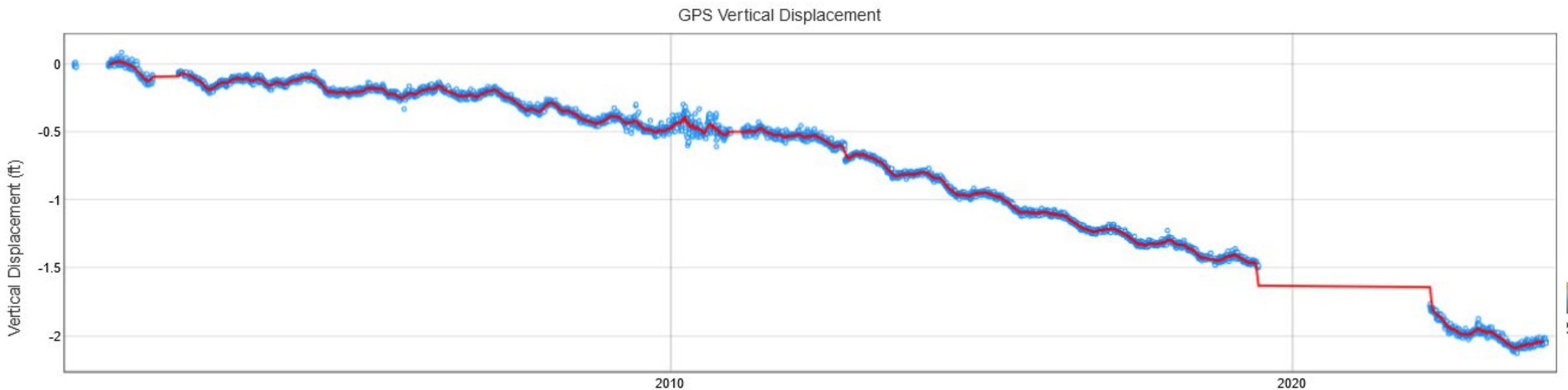
GPS Station in KRGSA

InSAR Cell ID	Average Vertical Displacement WY 2023 (inches)
1	-0.059
2	-0.074
3	-0.069
4	-0.079
5	0.072
6	-0.046
7	-0.075
8	-0.049
9	0.015
10	-0.012
11	0.041
12	0.014
13	-0.077

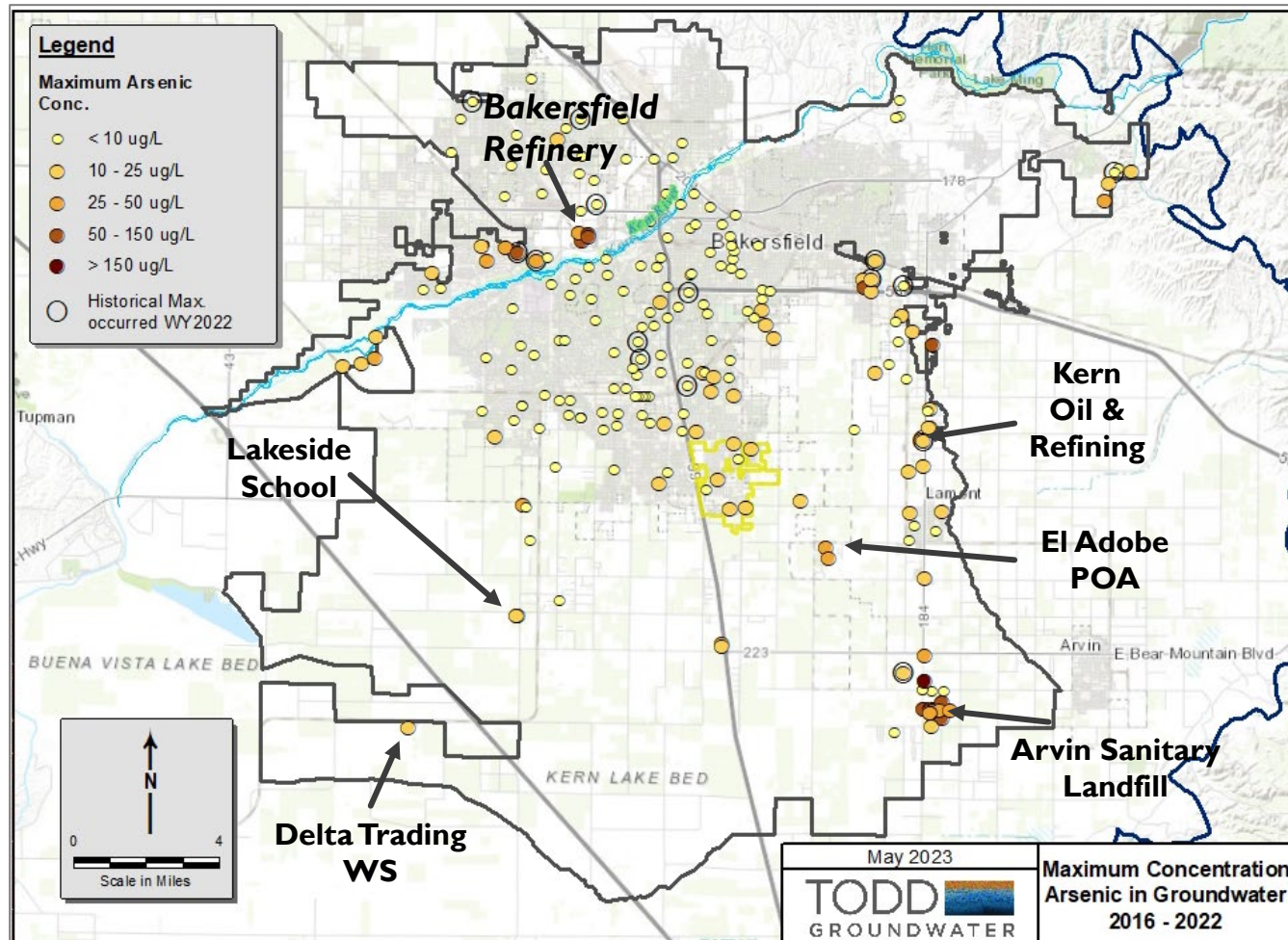
- WY 2023 Subsidence rates in target areas: -0.08 in/year to +0.08 in/year
- Minimal change
- Method error: ± 0.12 inches/year
- Rates increase in droughts and decrease during wet periods

HIGH RESOLUTION GPS STATION IN KRGSA

- Station in area of largest historical subsidence
- Vertical displacement of -2.05 feet over 22 years
- Average 1.1 inch per year, 0.08 in WY 2023
- Stanford study indicates compaction of subsurface clays will continue even if water levels are maintained above historic lows



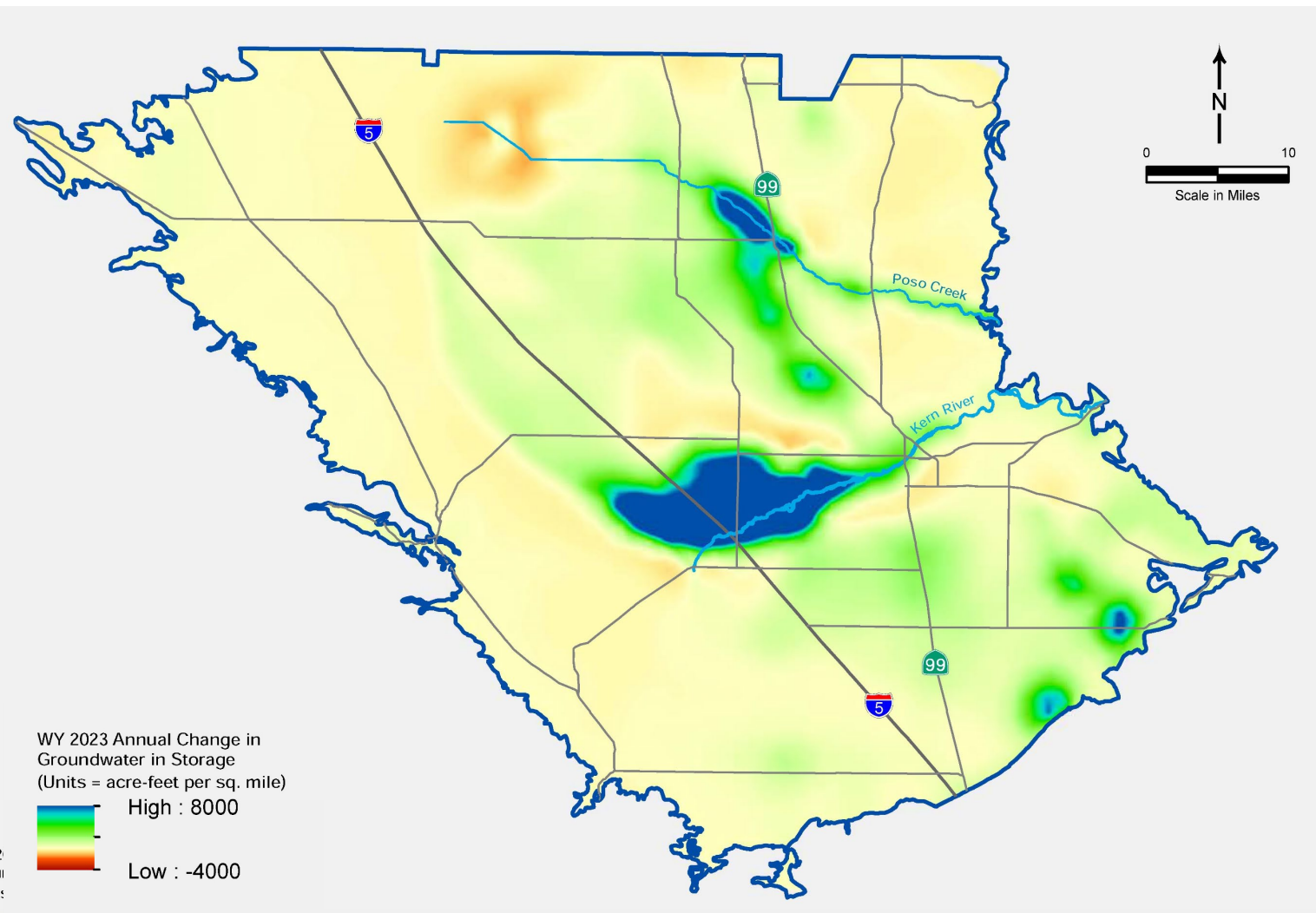
ARSENIC CONCENTRATIONS IN GROUNDWATER



- Most drinking water supply wells with elevated concentration have arsenic wellhead treatment
- Naturally occurring
- Several environmental contamination sites with elevated arsenic concentrations
 - Bakersfield Refinery
 - Kern Oil & Refining
 - Arvin Sanitary Landfill

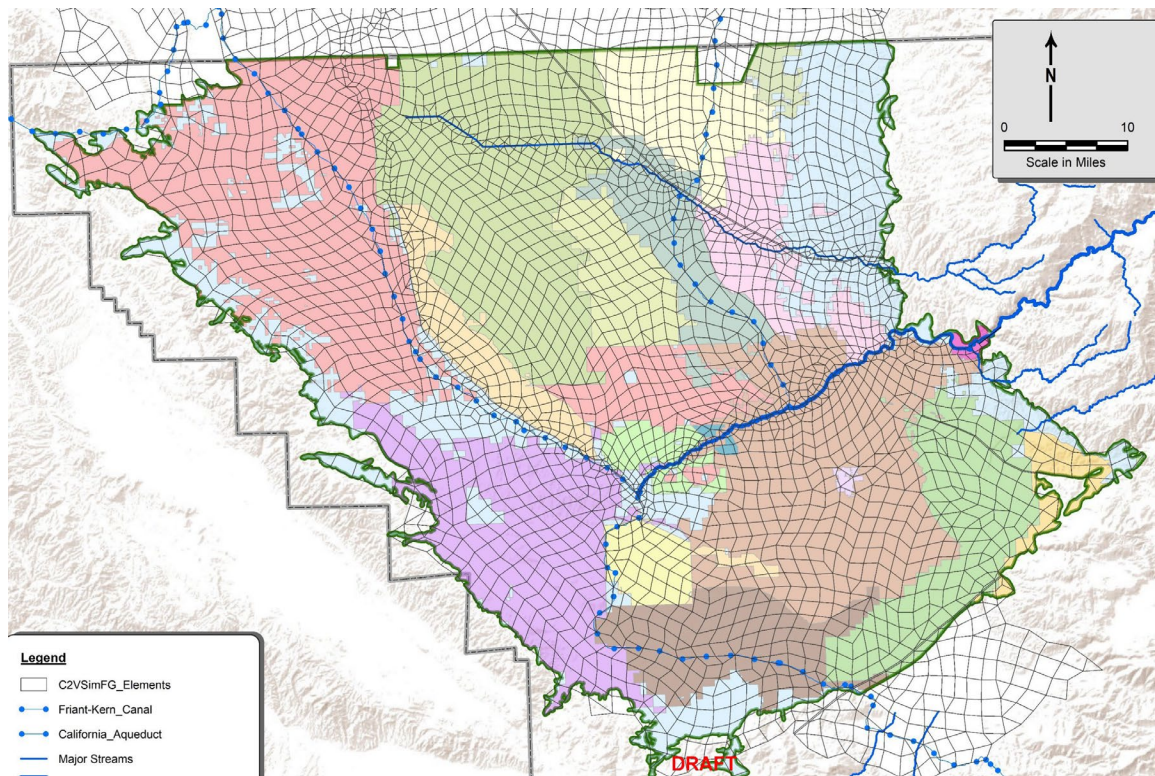
WY 2023 MODEL RESULTS

CHANGE in GROUNDWATER in STORAGE



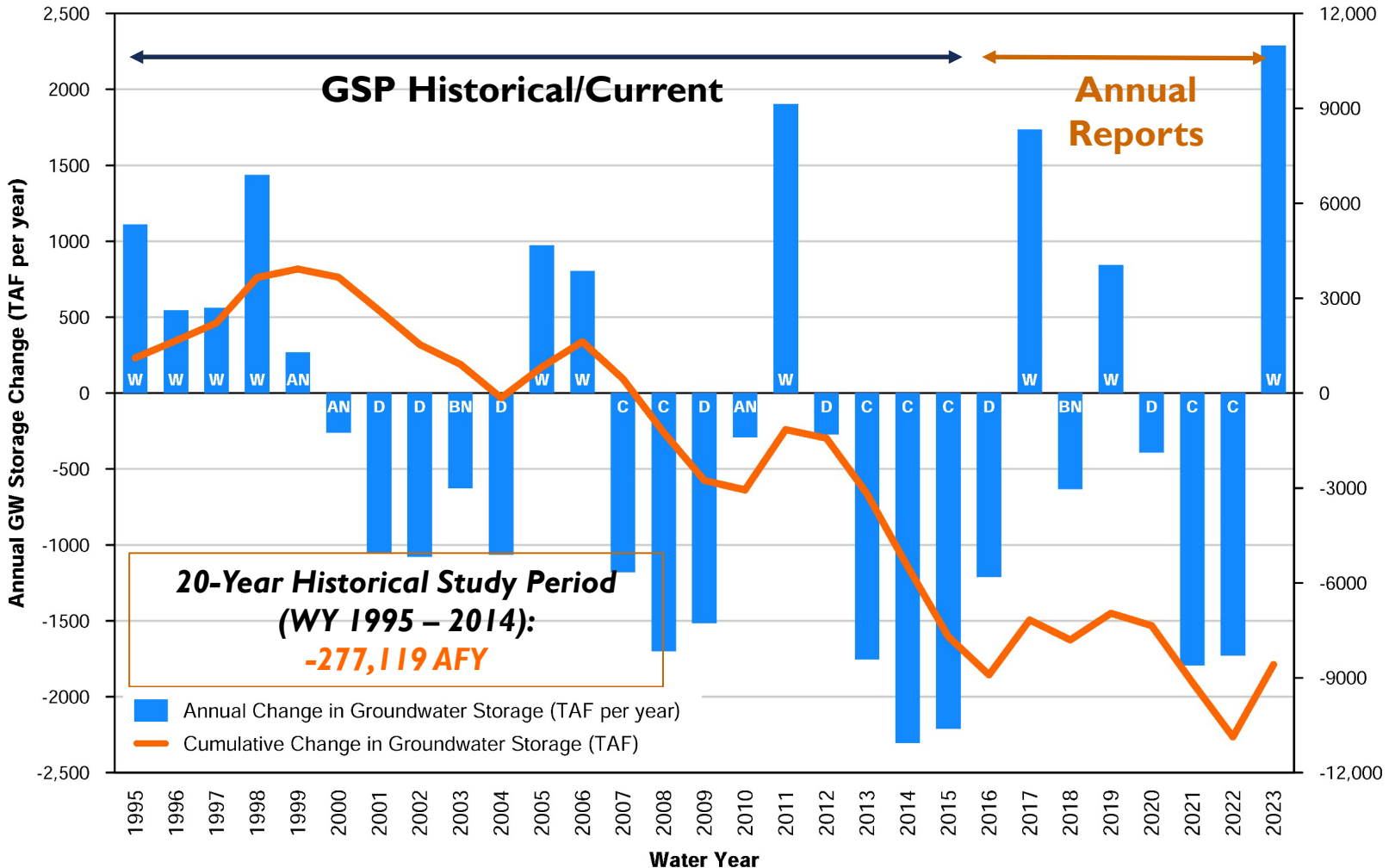
- WY 2023 Storage Change +2,239,354 AFY
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WATER BUDGETS



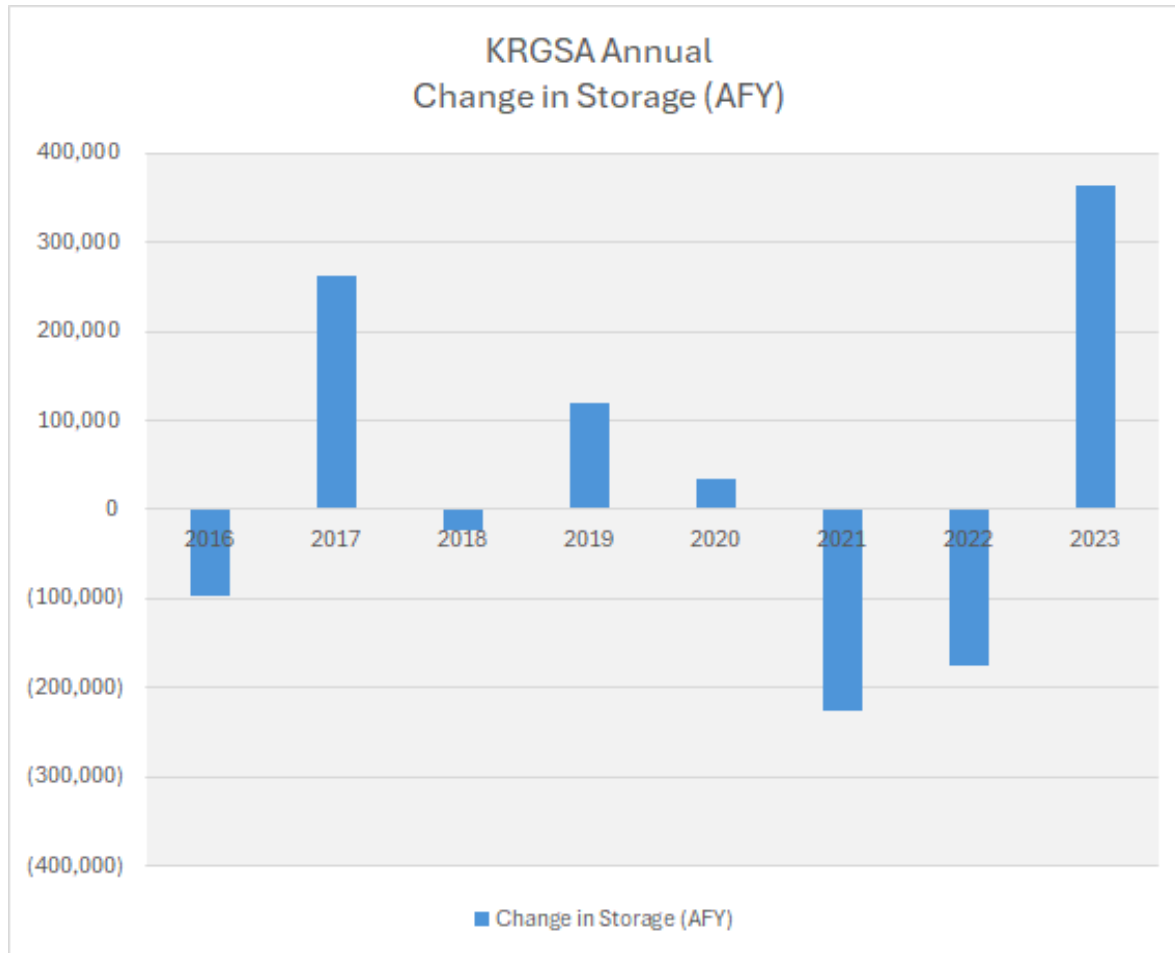
- Zone budget from C2VSim Subbasin Model
 - Simulated, Physical water only (no ownership)
 - Existing model zones not GSA based
- GSP Checkbook
 - KRGSA inflows/outflows
 - Includes non-KRGSA flows
 - 2010-2019
- KRGSA Water Budget
 - Detailed by entity
 - Simulated and Observed Data

WY 2023 CHANGE in GROUNDWATER in STORAGE DECLINES CONTINUE during PROLONGED DROUGHT



- WY 2023 Storage Change
- +2,239,354 AFY
- Water Budget Storage Change
- Average WY 2015 – WY 2023:
- -110,741 AFY
- Average WY 2019 – WY 2023:
- -155,989 AFY

KRGSA WATER BUDGET



- Zone budget from C2VSim Subbasin Model
- Increase in groundwater during wet years
- Decrease of groundwater during droughts
- Average 1994 – 2015 (KR Index 94%):
 - -21,000 AFY
- Average 2016 – 2023 (KR Index 124%):
 - +32,000 AFY
- *Budget appears balanced for average hydrologic conditions*

KRGSA ADJUSTED WATER BUDGET

<i>All values in acre-feet/ Water Year (AFY)</i>	2016	2017	2018	2019	2020	2021	2022	2023	AVERAGE 1994-2015	AVERAGE 2016-2023
INFLOWS										
Water Zone Budget 1 (Improvement District 4)	19,589	32,810	24,209	25,979	18,104	7,905	2,659	9,099	46,894	39,068
Water Zone Budget 2 (City of Bakersfield)	48,637	248,243	77,745	151,881	104,941	35,536	38,656	282,164	71,123	85,083
Water Zone Budget 3 (Kern Delta Water District)	121,818	208,194	165,925	187,931	125,869	95,372	98,724	244,901	121,571	130,776
Water Zone Budget 5 (Additional Pumping - Return Flows)	11,750	11,129	12,179	11,425	12,986	12,815	13,431	14,276	12,042	12,164
	201,795	500,376	280,058	377,216	261,899	151,627	180,686	550,441	309,606	310,514
OUTFLOWS										
Water Zone Budget 1 (Improvement District 4)	12,454	7,197	5,531	5,461	10,708	20,766	47,220	7,765	14,275	14,372
Water Zone Budget 2 (City of Bakersfield)	65,551	56,954	53,843	54,989	61,016	71,124	82,166	54,100	77,479	73,476
Water Zone Budget 3 (Kern Delta Water District)	183,527	137,921	201,423	160,590	117,526	241,917	178,653	76,304	163,563	163,208
Water Zone Budget 5 (Additional Pumping)	38,211	34,928	41,638	36,127	38,190	43,905	47,184	47,486	55,832	51,866
	299,743	237,000	302,435	257,167	227,440	377,712	355,223	185,657	330,776	317,315
INFLOWS - OUTFLOWS	(97,949)	263,376	(22,377)	120,049	34,459	(226,085)	(174,537)	364,785	(21,170)	32,715
Kern River Annual Index	51%	275%	60%	177%	55%	22%	29%	320%	94%	124%

Checkbook adjusts water budget to remove recharge and recovery pumping by/for non-KRGSA parties. Checkbook consistent with model results: KRGSA balanced water budget for ave. hydrologic conditions.

KRGSA GSP PROJECT IMPLEMENTATION PROGRESS IN WY 2023

- The **City** recharged 232,532 AF within the City-owned properties from canals, Kern River, City facilities, and 2,800 Acre Groundwater Recharge Facility as part of its *Optimized Conjunctive Use Program*. This amount was even more than in WY 2021 even in drought conditions.
- **KDWD** as a result of its *WAP* GSP Project, an additional 56,000 AF of transfer water was retained for active management – a supply that would have been previously unavailable without the project. In addition, the District was able to run water down the Eastside Canal longer (123 days extra) than usual operations to partially mitigate local groundwater declines. The fully operational AEWSD intertie brought an additional 12,311 acre feet of water to Kern Delta’s eastside service area.
- **ID4** continues to implement their 2020 UWMP by improving water efficiency. They completed the construction of its *Cross Valley Canal Extension Lining Project* (Pool No. 8) to increase reliability of surface water supply during dry conditions.
- Numerous other GSP projects and management actions are also underway including consolidation of numerous small water systems into existing water systems for improvements in drinking water quality in DAC areas. Lamont PUD, ENCSD, and the City all have consolidation projects in progress.



**Groundwater
Recharge
and
Conjunctive
Use**



QUESTIONS?

