Kern River Groundwater Sustainability Agency (KRGSA)

KRGSA Groundwater Sustainability Plan (GSP) Final Draft

Public Hearing
KRGSA Board Meeting
December 5, 2019

TODD GROUNDWATER

KRGSA Sustainability Goal

Manage groundwater resources sustainably in the KRGSA Plan Area to:

- support current and future beneficial uses of groundwater including municipal, agricultural, industrial, domestic, public supply, and environmental uses
- optimize conjunctive use of surface water and groundwater
- avoid or eliminate undesirable results over the implementation and planning horizon.

KRGSA GSP Organization

1 Administrative Information

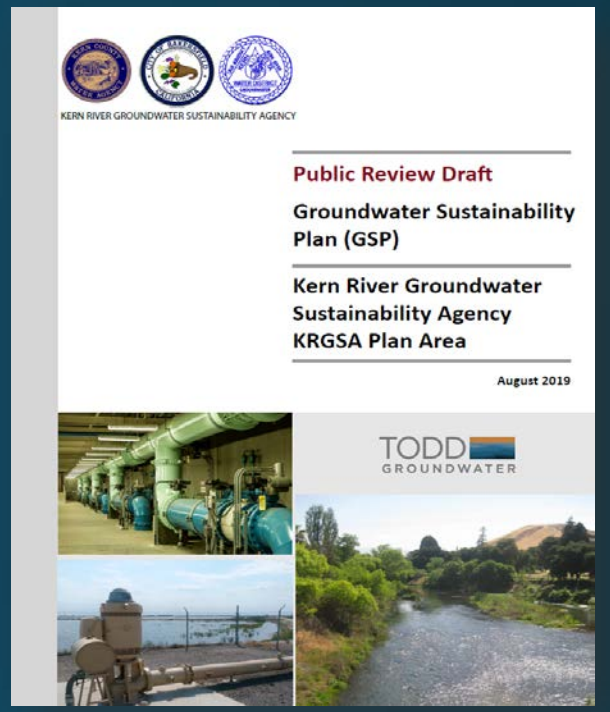
2 Plan Area

3 HCM/Groundwater Conditions

4 Water Budgets

5 Sustainable Management Criteria

6 Monitoring Networks



7 Projects and Management Actions

8 Implementation Plan

9 References and Technical Studies

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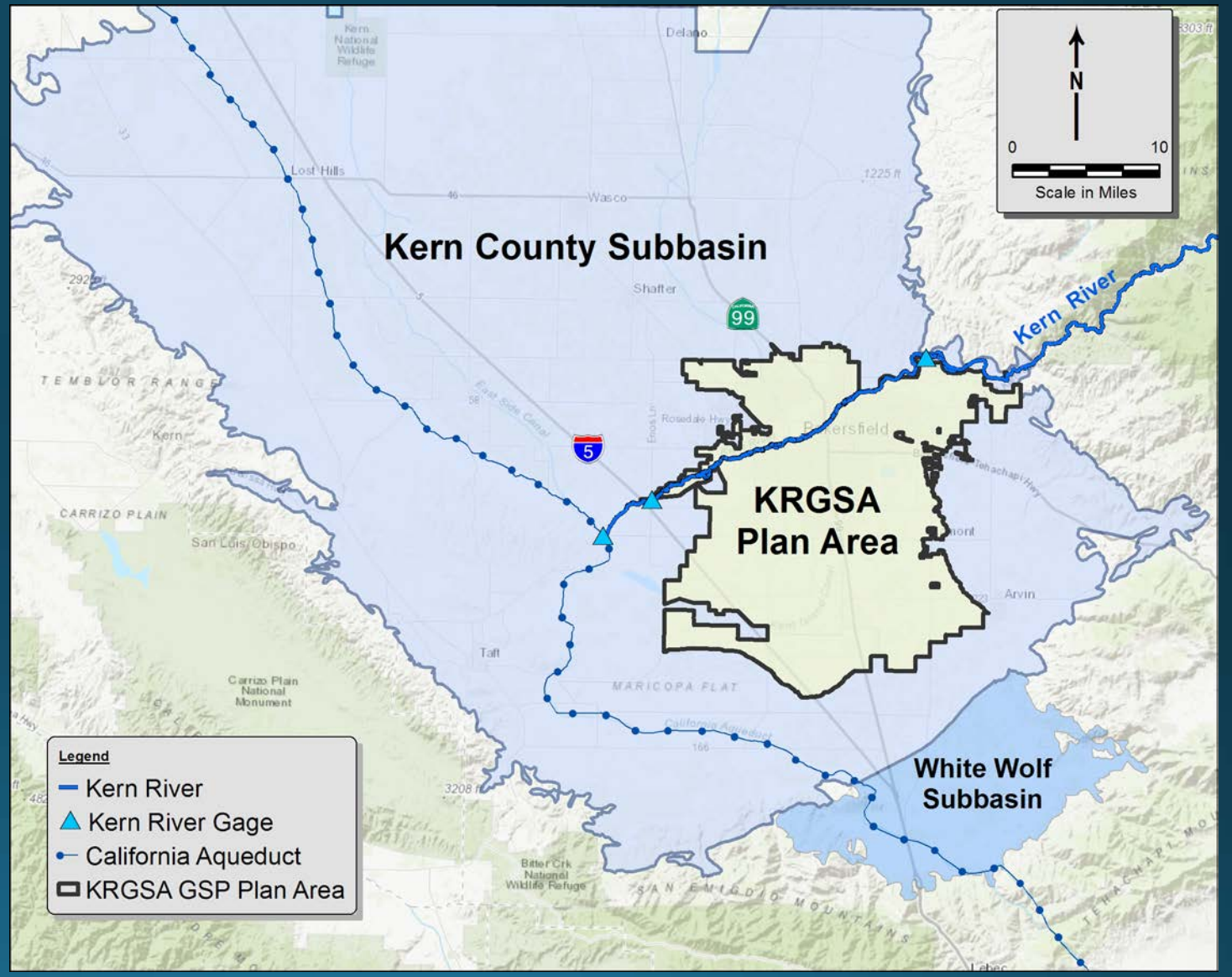
KRGSA GSP Plan Area

- 361 square miles
- 13% of the Kern County Subbasin
- Composed of:
  - City of Bakersfield
  - Improvement District No. 4 (KCWA)
  - Kern Delta Water District (KDWD)
  - Additional smaller agencies



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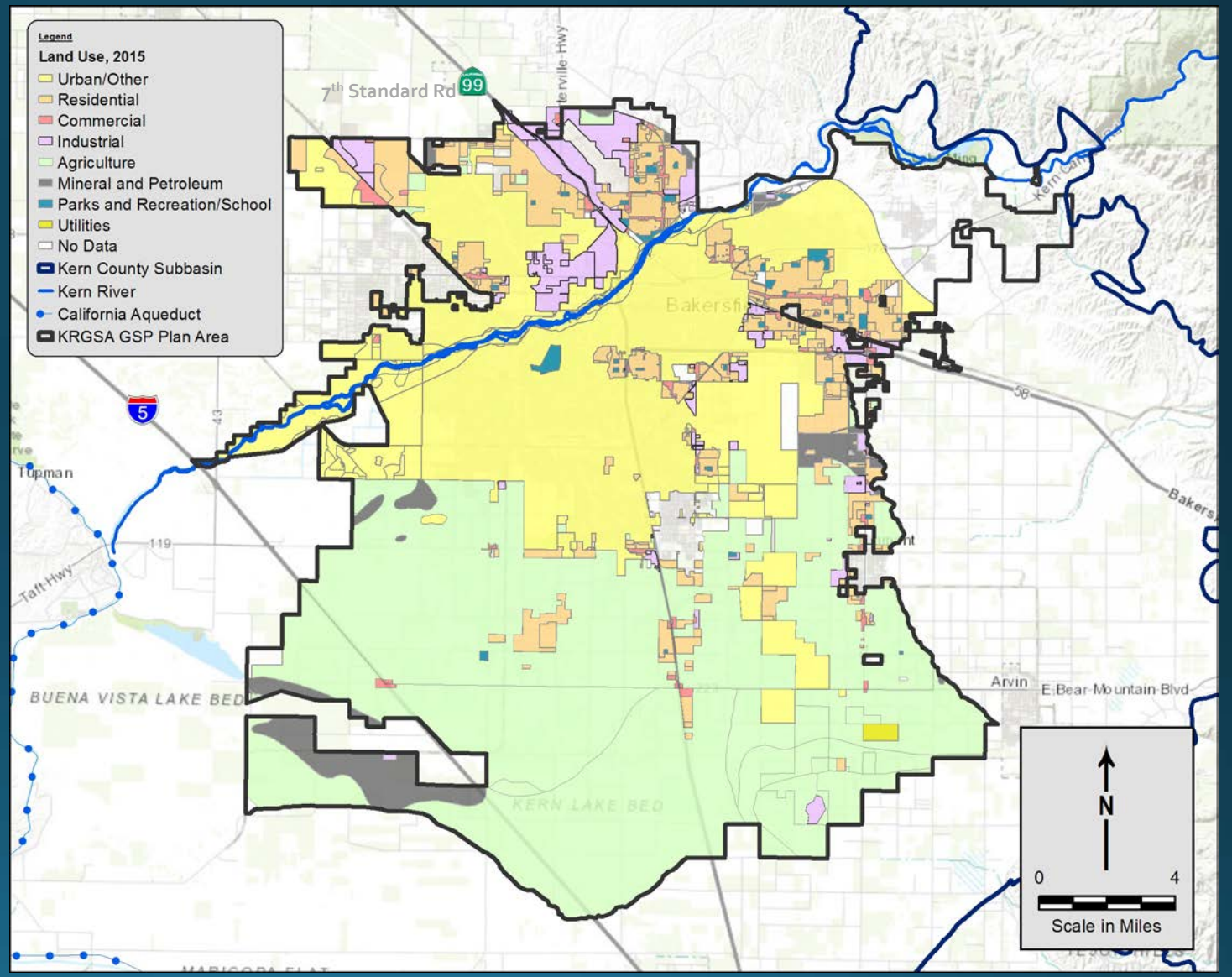
Land Use in the KRGSA Plan Area

- North – Urban
- South – Agricultural
- 2015 Land Use
  - 41% - Agricultural
  - 33% - Urban
  - 26% - Undeveloped



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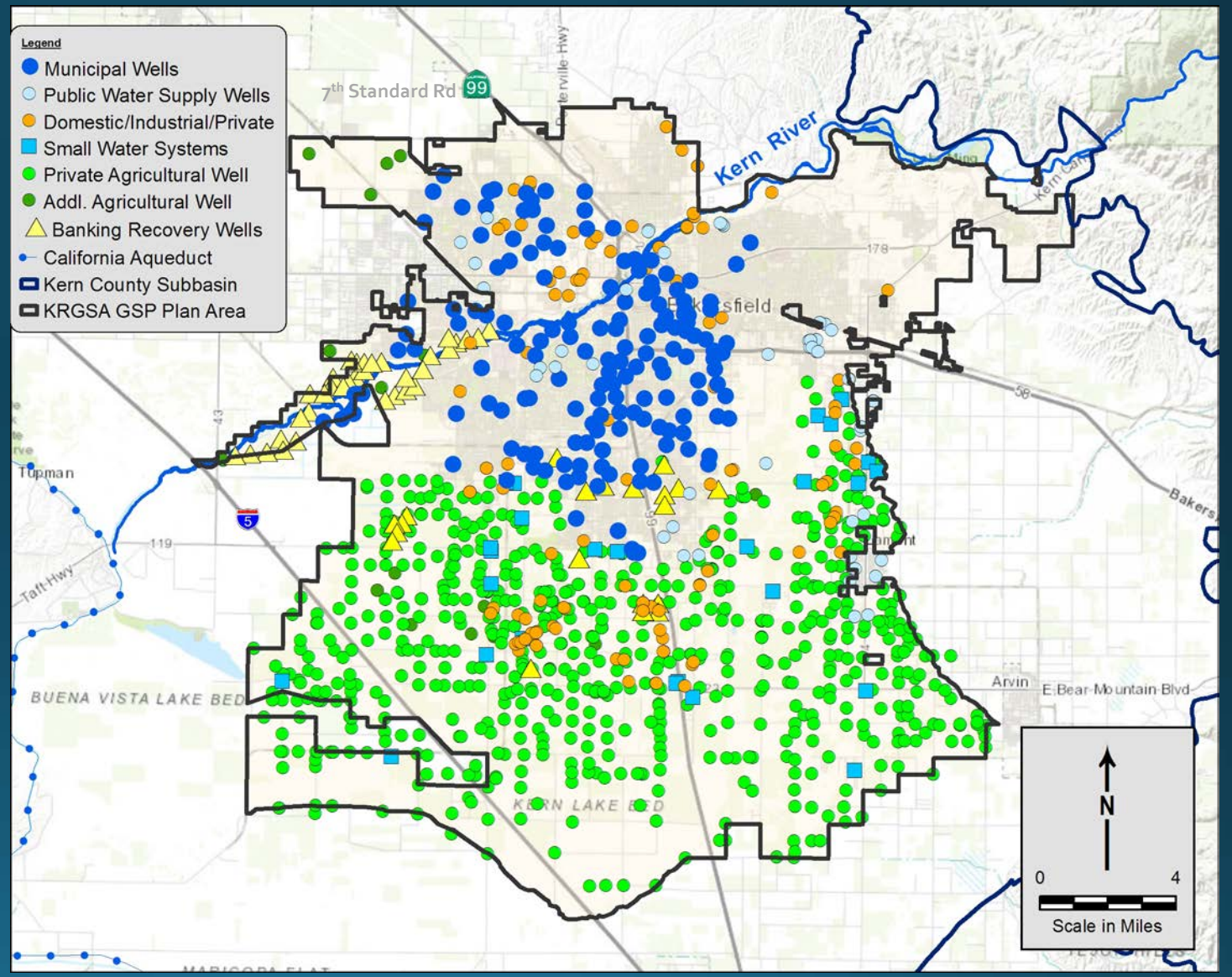
Active Wells in the KRGSA

- 162 Municipal wells
- 67 Public Supply and Small Water System wells
- 151 Industrial, Domestic, and other Private wells
- 642 Agricultural wells
- 54 Banking recovery wells



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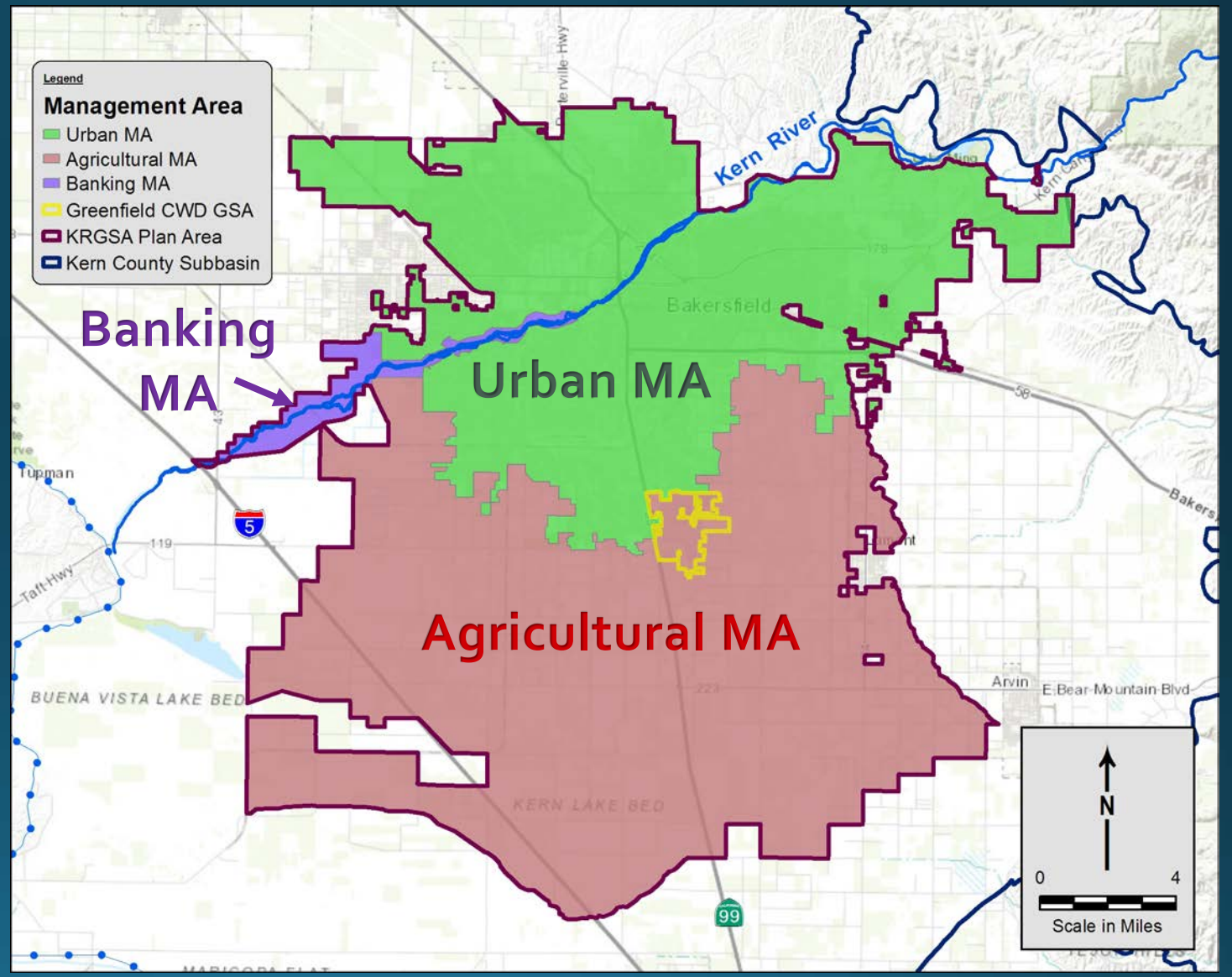
Preliminary Management Areas (MA)

- Based on land use and well use
  - Urban MA – 41%
  - Agricultural MA – 57%
  - Banking – 2%



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Sustainability Indicators

Chronic Lowering of Water Levels

Reduction of Groundwater Storage

Degradation of Water Quality caused by management actions

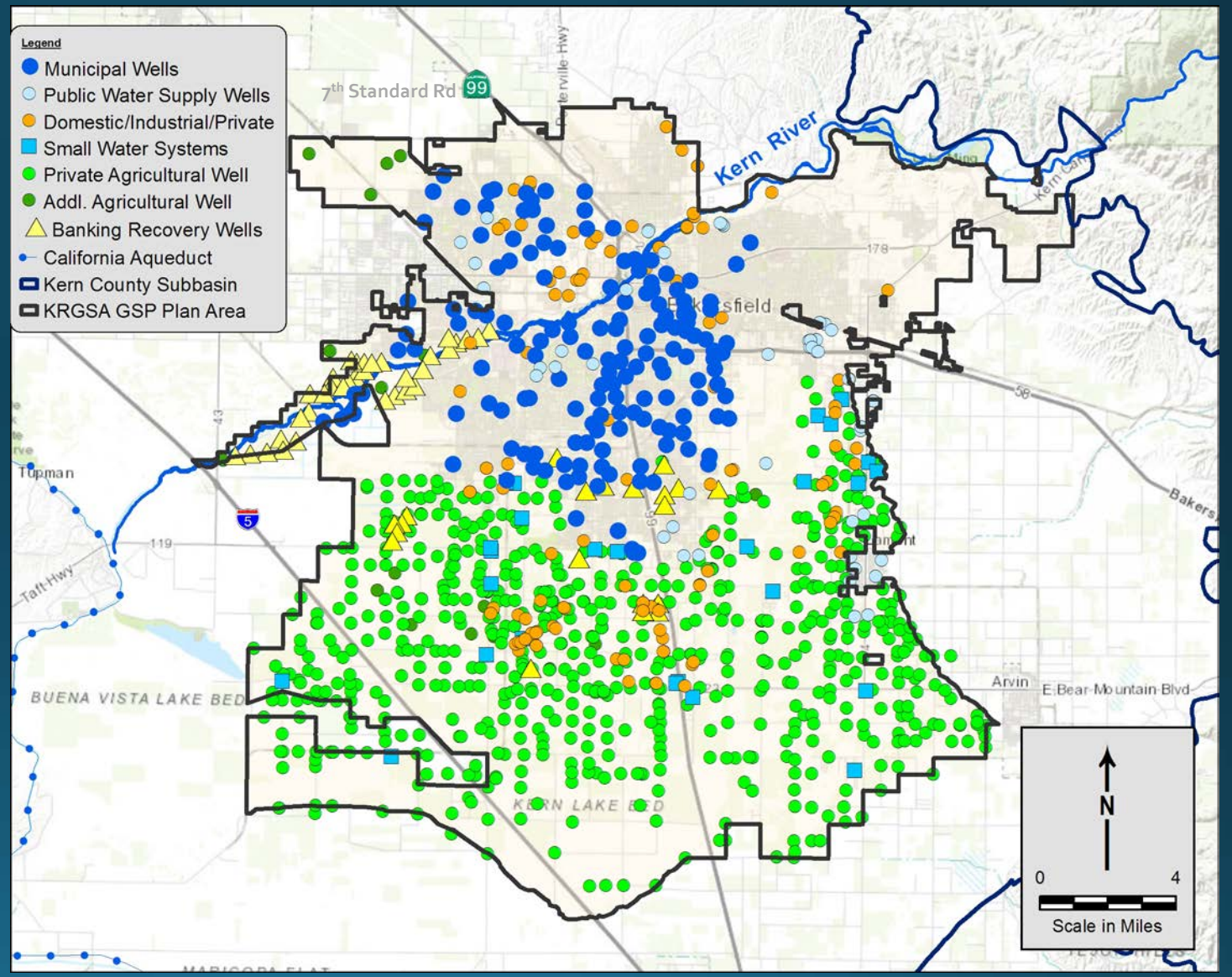
Land subsidence affecting land use

Depletion of Interconnected Surface Water affecting beneficial use

If a sustainability indicator is determined to be significant and unreasonable , then it is an Undesirable Result

Balance High and Low WLs

- Municipal wells went dry or experienced problems during drought – keep water levels above historic lows
- Agricultural and banking wells require lower water levels
- Balance needs of KRGSA wells



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Reduction of Groundwater in Storage

- 3 Independent Methods
- Relatively good agreement
- Minimal deficits; sustainable budget

Historical Water Budget Method	Change in Groundwater in Storage (AFY)[1]	Comments
Checkbook	-1,978 AFY	Tabulates recharge and pumping for the physical groundwater system beneath the KRGSA
C2VSimFG-Kern Model	4,055 AFY	Simulated inflows and outflows including subsurface flows
Groundwater Elevation Contour Maps	-2,912 AFY	Subtraction of spring groundwater elevation contour maps
Adjusted Checkbook	-29,153 AFY	Removes recharge and pumping attributable non-KRGSA parties. Adds banking outside of KRGSA attributable to KRGSA agencies

- Deficit for banking adjustments

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Projected Water Budgets Future Deficits

- Increase urban demand
- Decrease SWP supply
- Increase agricultural demand (climate changes factors)
- Potential Future Water Budget Deficits
- Plus Historical Adjusted deficit of -29,000 AFY

Water Budget Component	Historical Average Annual Amounts (AFY)	Baseline Conditions (AFY)	2030 Climate Change Conditions (AFY)	2070 Climate Change Conditions (AFY)
SWP[1] – ID4	74,035	52,758	51,182	48,759
SWP - KDWD	18,655	15,765	15,294	14,537
TOTAL SWP	92,690	68,523	66,476	63,296
Net decrease in SWP from historical:		**24,167**	**26,214**	**29,394**
Agriculture Demand	261,019	261,019	271,460	281,460
Urban Demand[2]	167,970	182,290	178,115	254,117
TOTAL DEMAND	428,989	443,309	449,575	535,577
Net increase in demand from historical:		**14,320**	**20,586**	**106,588**
Potential Future Water Budget Deficits:		**-38,487**	**-46,800**	**-135,982**

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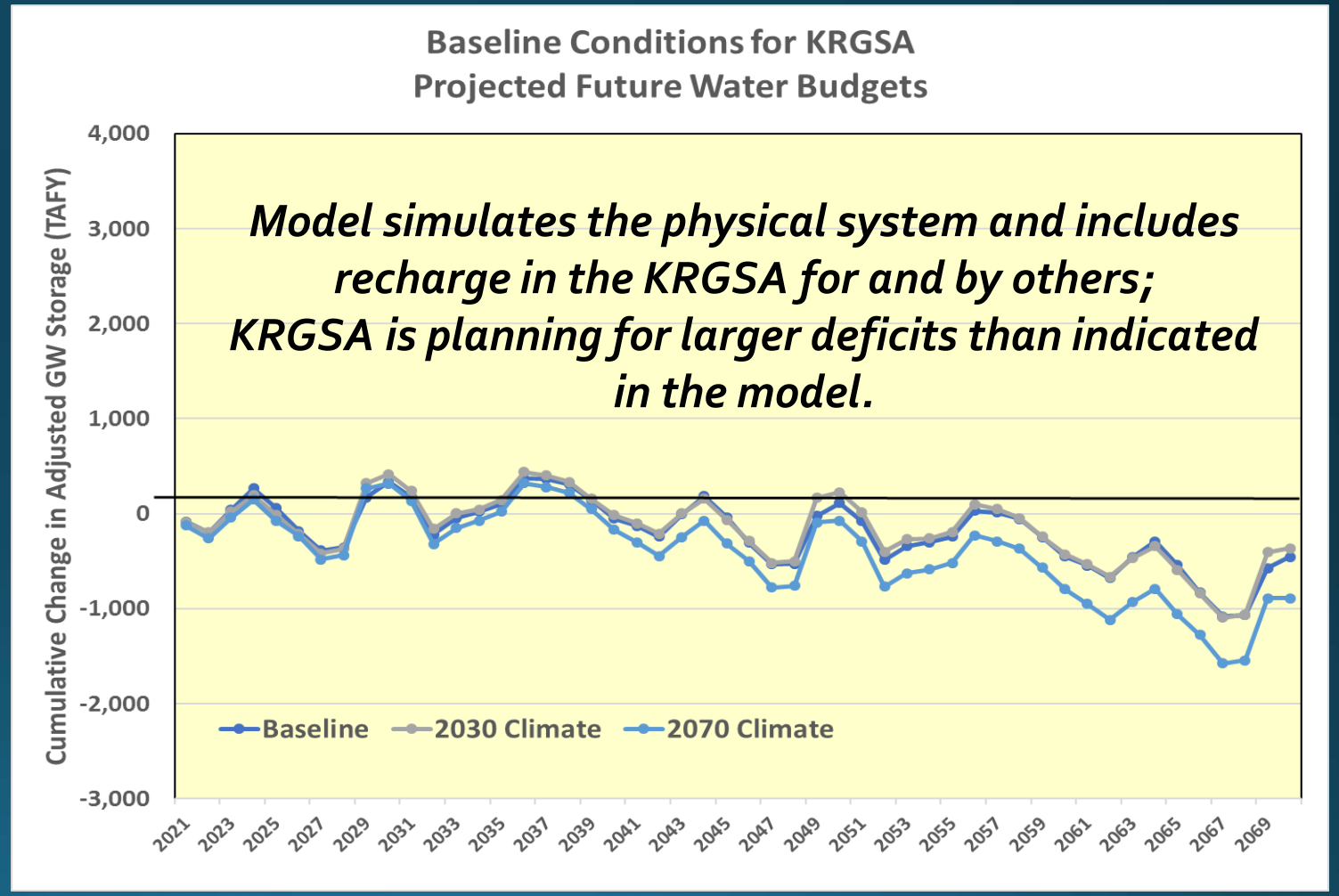
Projected Water Budgets C2VSimFG-Kern Model

- Baseline - current land use and projected water supply and demand
- 2030 Climate Change Scenario with increases in agricultural demand and decreased supply
- 2070 Climate Change Scenario with further increase in demand and decrease in supply



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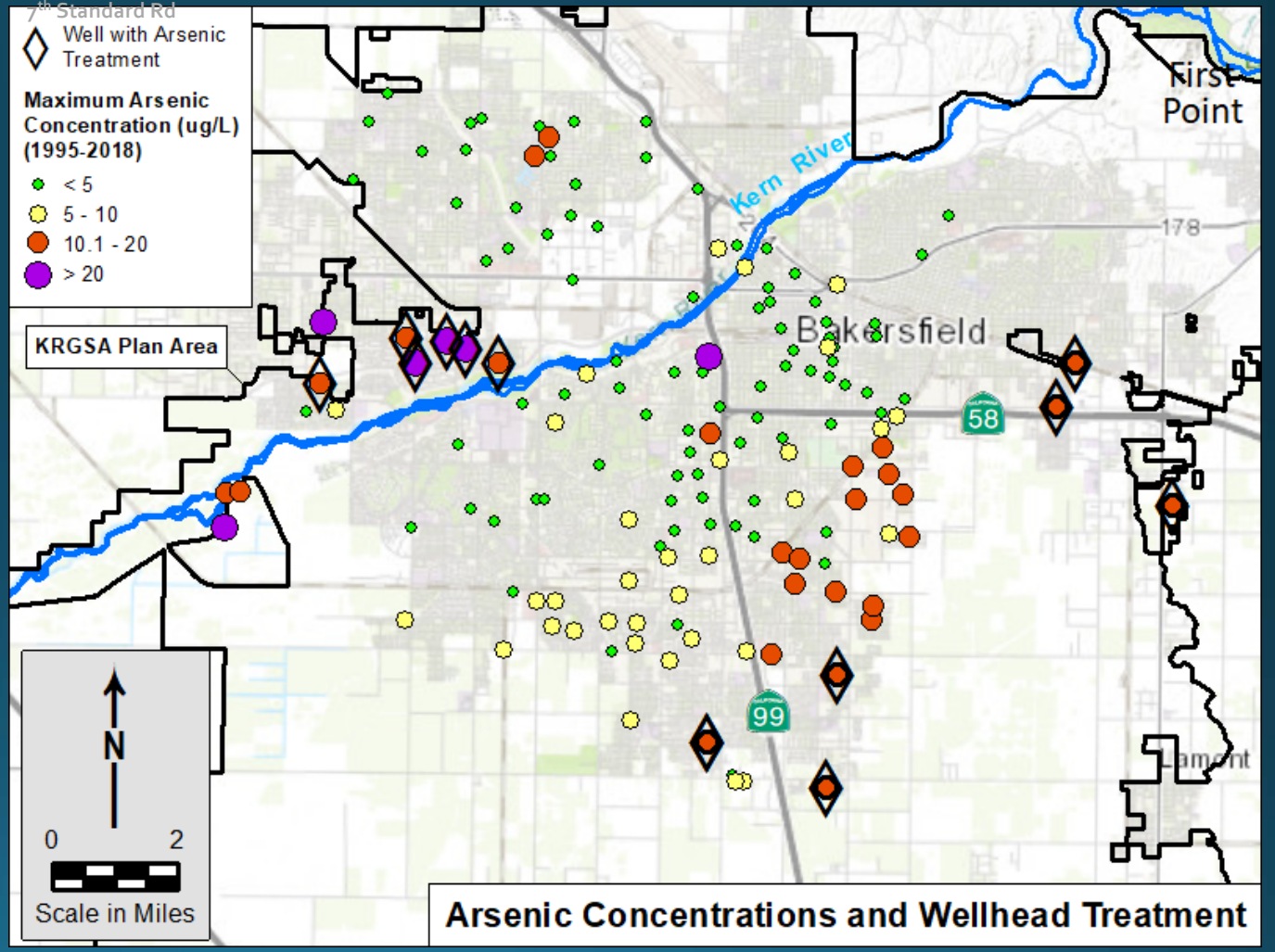
Constituent of Concern Arsenic

- Focus on constituents affected by management actions
- Arsenic concentrations increase with declining water levels
- More than 25 wells with detections above the MCL
- Widespread issue in the Plan Area



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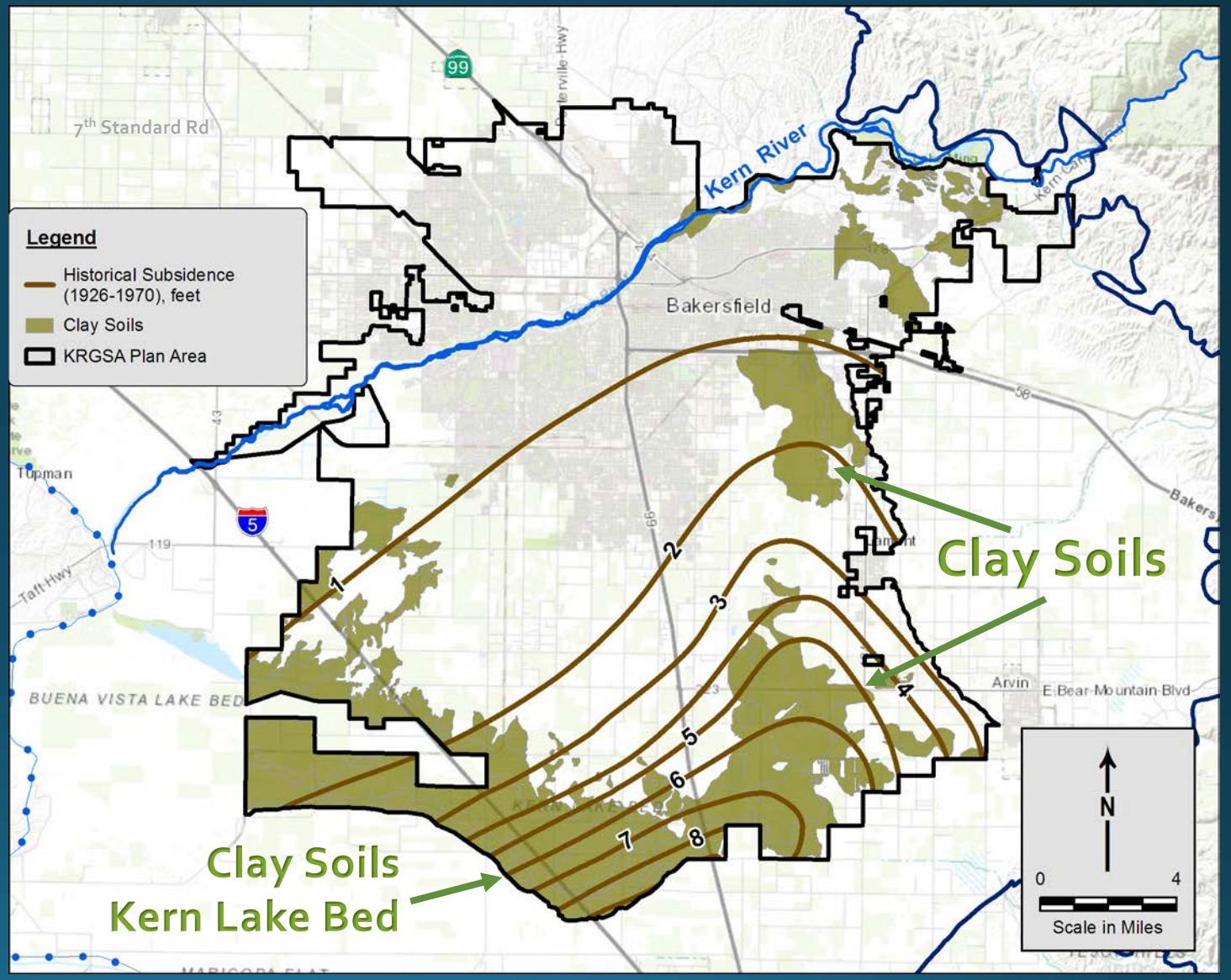
Inelastic Land Subsidence

- Historical Subsidence from 1926 – 1970 mapped by USGS
- Up to 9 feet in southern Plan Area
- Correlates to areas of clay soils and subsurface clay sediments in southeast Plan Area



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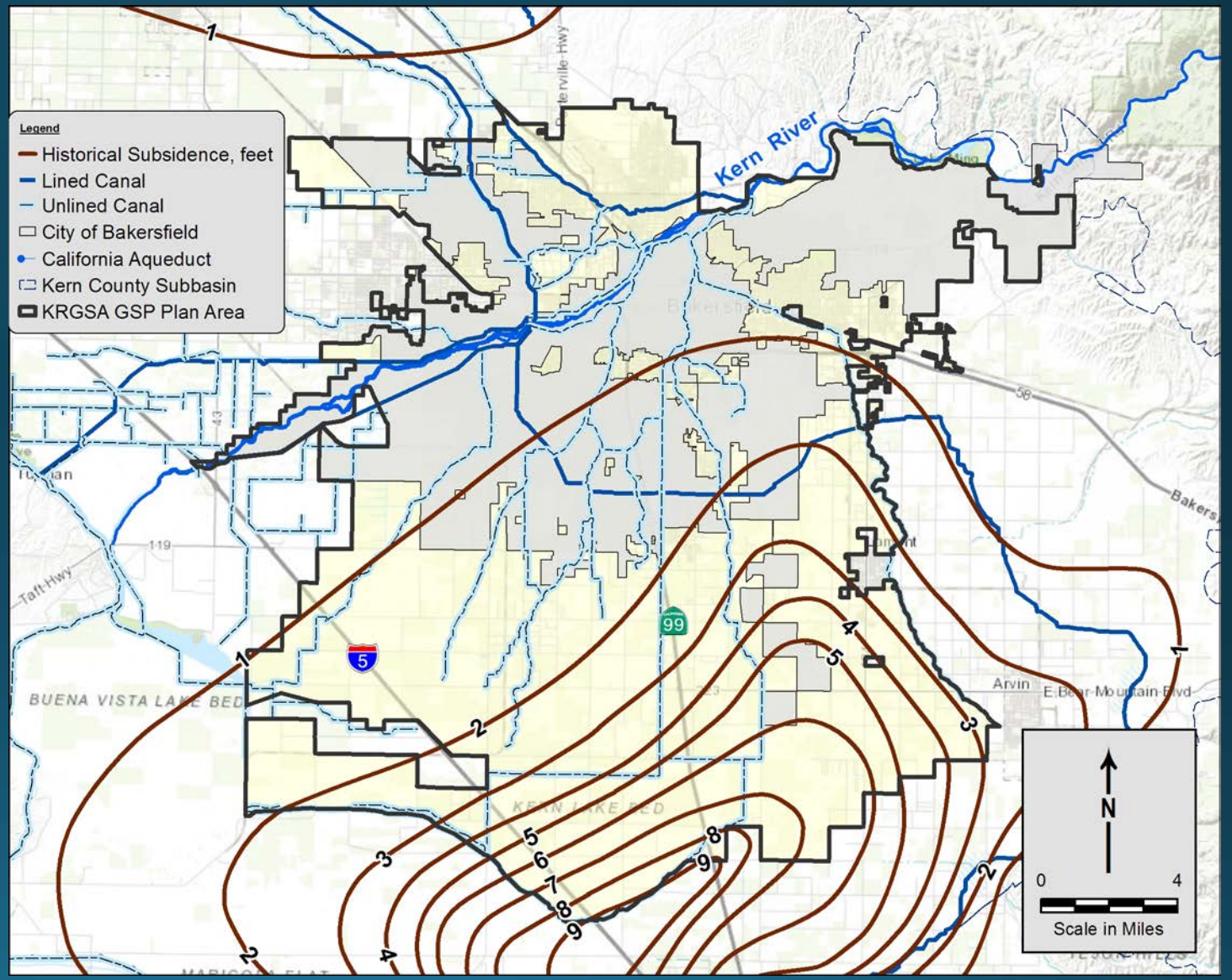
Subsidence and Critical Infrastructure

- Critical infrastructure includes pipelines, canals, utilities, structures, wells, transportation
- No damage to critical infrastructure in the Plan Area identified to date
- Set minimum thresholds to mitigate future subsidence



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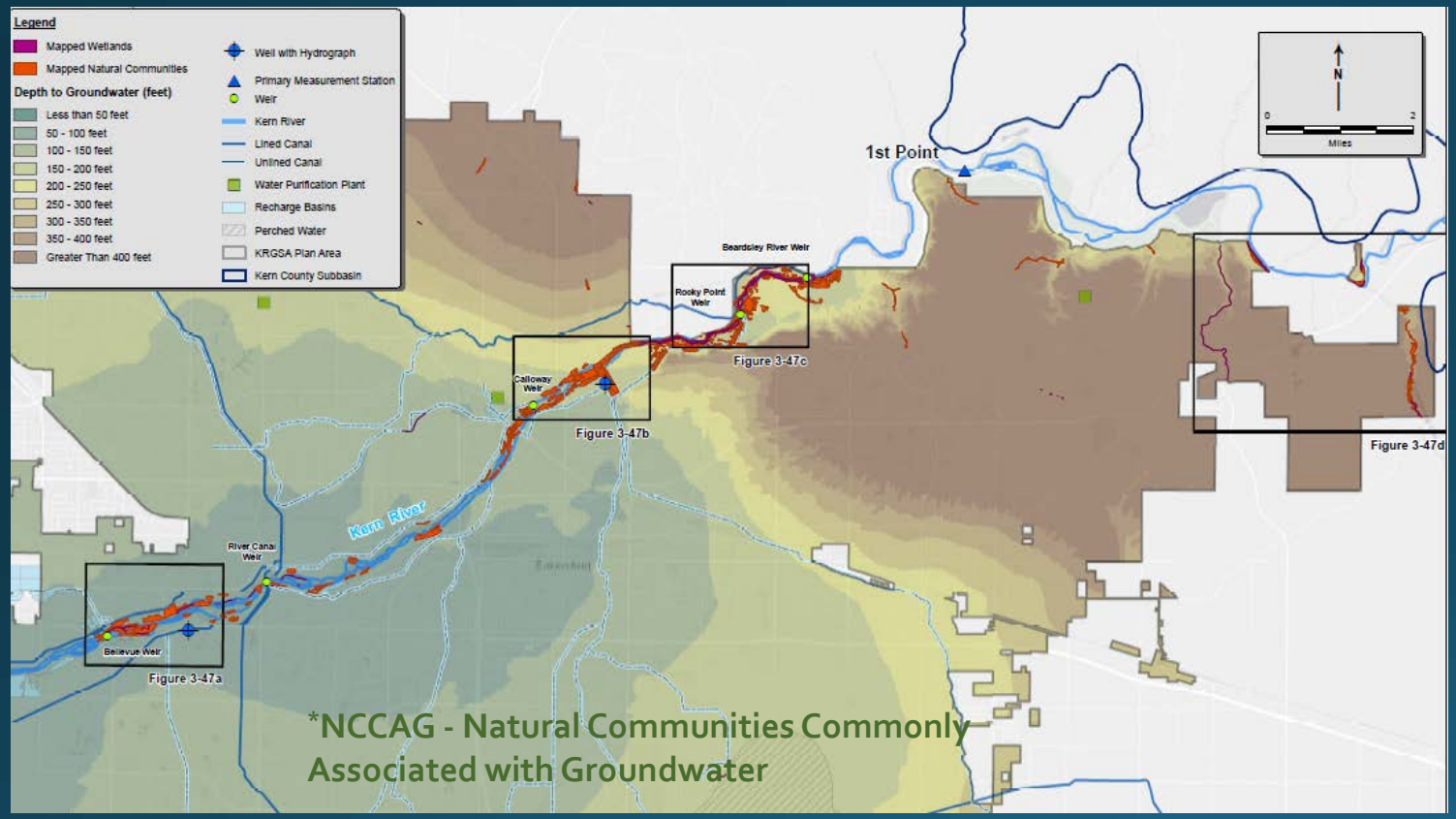
Analysis of Interconnected Surface Water



- Evaluated groundwater conditions using local NCCAG* maps along Kern River
- Kern River is actively managed through regulated releases, diversions, and managed aquifer recharge

More than 80% of the flow is diverted above the Calloway Weir
River was dry below the Calloway Weir more than 25 % of the time
Groundwater is deeper than 50' below the river throughout the entire KRGSA

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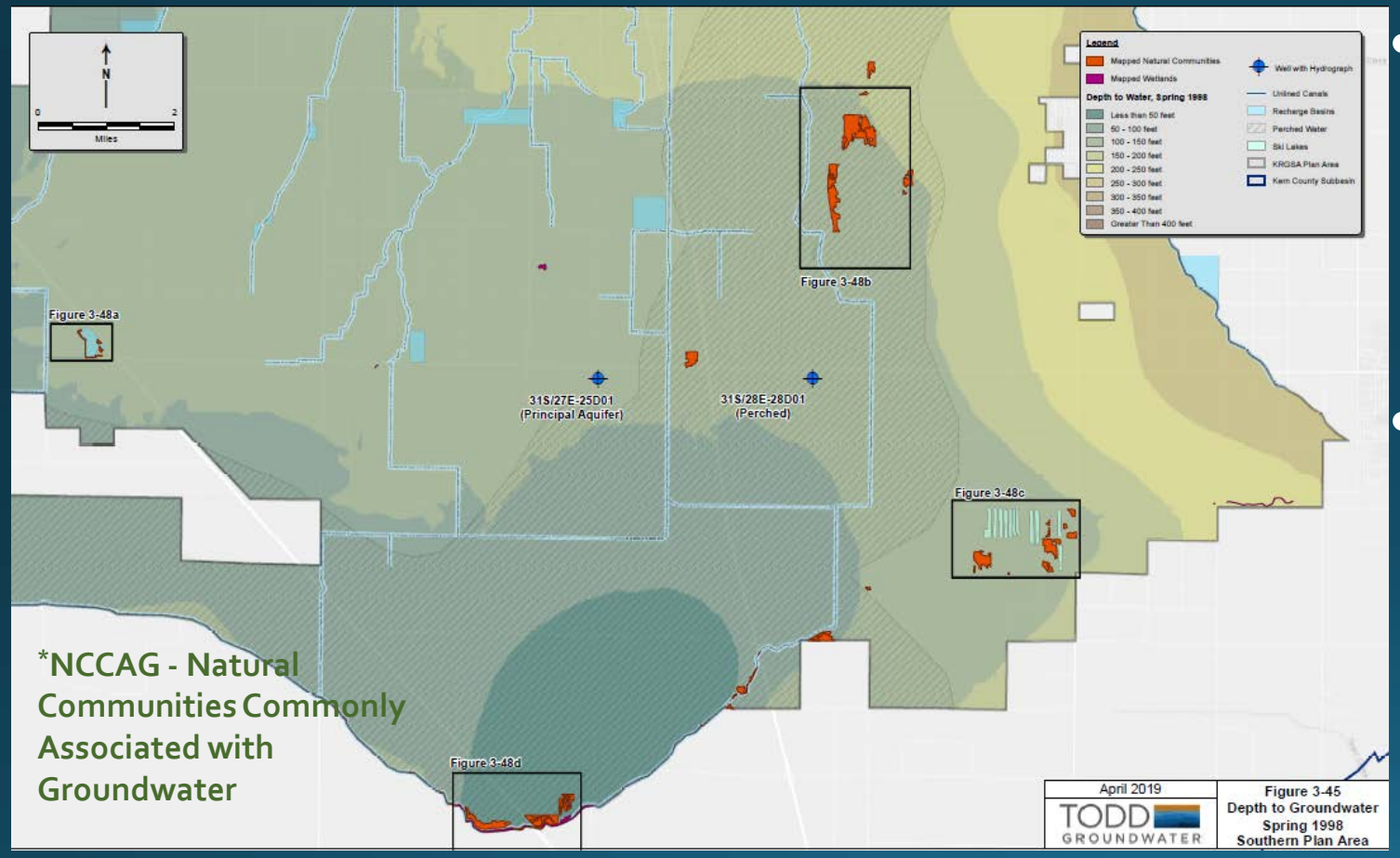
Analysis of Interconnected Surface Water



- Evaluated groundwater conditions at local NCCAG areas in southern Plan Area
- Analysis indicates that local vegetation and wetlands are not supported by groundwater in the Principal Aquifer

Mapped areas include recharge basins, spills along the rim canal, artificially-constructed ski lakes. Local irrigation and perched water conditions throughout the area.

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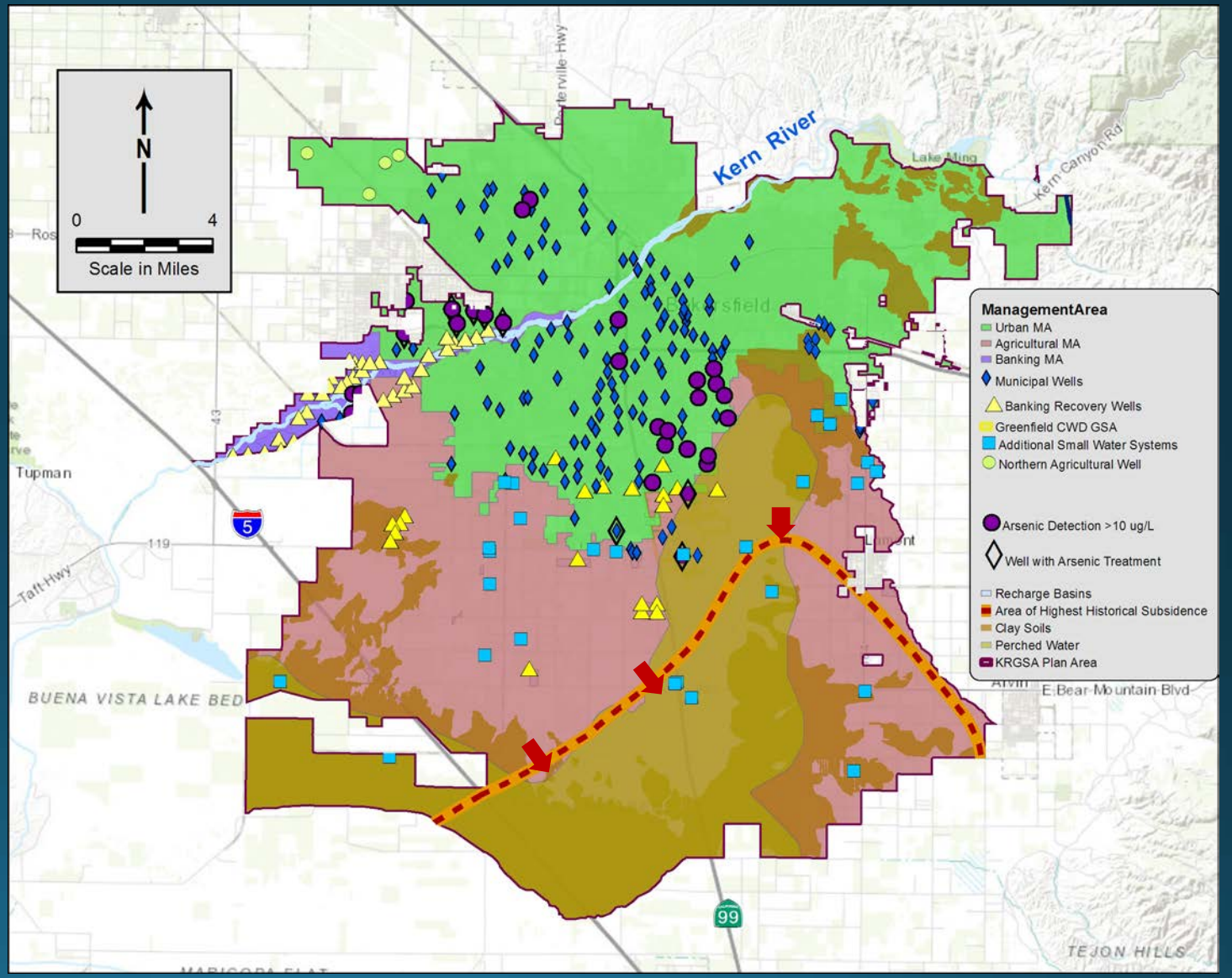
Sustainability Considerations

- WL below screens in Municipal Wells
- Ability of banking recovery wells to recover water
- Arsenic in Municipal Wells
- Deficits for Projected Water Budgets
- Historical subsidence



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Approach to Minimum Thresholds

KRGSA Management Area (MA)	MA Subarea and Considerations for Management		Sustainability Indicator and Minimum Threshold (MT)			
			Chronic Lowering of Water Levels	Reduction of Groundwater in Storage	Degraded Water Quality	Land Subsidence
KRGSA Urban MA	Central/South	Municipal wellfields	Historic Low WL	Historic Low WL	Historic Low WL	Historic Low WL
	Northeast	ENCSD wellfield	50' below Historic Low WL	50' below Historic Low WL	50' below Historic Low WL	50' below Historic Low WL
	Northwest corner	Transition to agricultural lands	20' below Historic Low WL	20' below Historic Low WL	20' below Historic Low WL	20' below Historic Low WL
KRGSA Agricultural MA	Along southern Urban MA	Transition with municipal wells	Historic Low WL	50' below Historic Low WL	Historic Low WL	50' below Historic Low WL
	North-Central	Greenfield CWD wells	Historic Low WL	50' below Historic Low WL	Historic Low WL	10' below Historic Low WL
	West	Agricultural and recovery wells	50' below Historic Low WL	50' below Historic Low WL	50' below Historic Low WL	50' below Historic Low WL
	Southeast	Subsidence potential	50' below Historic Low WL	50' below Historic Low WL	50' below Historic Low WL	20' below Historic Low WL
	East	Transition to small system wells	Historic Low WL	50' below Historic Low WL	Historic Low WL	50' below Historic Low WL
KRGSA Banking MA	Kern River Channel	ID4/KCWA/City recovery activities	20' below Historic Low WL	Not applicable	20' below Historic Low WL	50' below Historic Low WL
	Berrenda Mesa	KCWA operational area	Historic Low WL	Not applicable	Historic Low WL	50' below Historic Low WL
	COB 2800 Facility	City of Bakersfield municipal wells	Historic Low WL	Not applicable	Historic Low WL	50' below Historic Low WL

Historic low water level (WL) is the lowest level observed in an area during the recent drought of 2013-2016.
Measurable Objective (MO) for each sustainability indicator is the average of the MT and the historical high groundwater elevation during the historical Study Period.
Highlighted green cell indicates the controlling sustainability indicator(s) for that area in each MA.

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- Undesirable results relate historic low water levels; keep urban wells near historic lows.
- Allow operational flexibility for banking wells to recover critical supplies during drought.
- Measurable Objectives are selected as the midpoint for an operational range.
- Keep MTs and MOs SIMPLE to facilitate management.

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Approach to Undesirable Results

KRGSA Management Area (MA)	MA Subarea and Considerations for Management		Undesirable Results for Controlling Sustainability Indicators			
			Controlling Indicator	Minimum Threshold (MT)	Percent of Wells <MT	Duration of MT Exceedance
KRGSA Urban MA	Central/South	Municipal wellfields	Water Levels/Quality	Historic Low WL	Any well	>3 Consecutive Months
	Northeast	ENCSD wellfield	Water Levels	50' below Historic Low WL	Any well	>3 Consecutive Months
	Northwest corner	Transition to agricultural lands	Water Levels	20' below Historic Low WL	Any well	>3 Consecutive Months
KRGSA Agricultural MA	Along southern Urban MA	Transition with municipal wells	Water Levels/Quality	Historic Low WL	40% in Urban MA	>2 Consecutive Years
	North-Central	Greenfield CWD wells	Water Levels/Quality	Historic Low WL	Greenfield CWD MW	>2 Consecutive Years
	Northwest	Agricultural and recovery wells	Water Levels	50' below Historic Low WL	40% in Agricultural MA	>2 Consecutive Years
	Southeast	Subsidence potential	Subsidence	20' below Historic Low WL	40% in Agricultural MA	>2 Consecutive Years
	East	Transition to Small Water Systems	Water Levels/Quality	Historic Low WL	Lamont-north area MWs	>2 Consecutive Years
KRGSA Banking MA	Kern River Channel	ID4/KCWA/City recovery activities	Water Levels/Quality	20' below Historic Low WL	Any well	>3 Consecutive Months
	Berrenda Mesa	KCWA operational area	Water Levels/Quality	Historic Low WL	Any well	>3 Consecutive Months
	COB 2800 Facility	City of Bakersfield municipal wells	Water Levels/Quality	Historic Low WL	Any well	>3 Consecutive Months

Historic low water level (WL) is the lowest level observed in an area during the recent drought of 2013-2016.

- Add number of wells and duration to refine definition of undesirable results.

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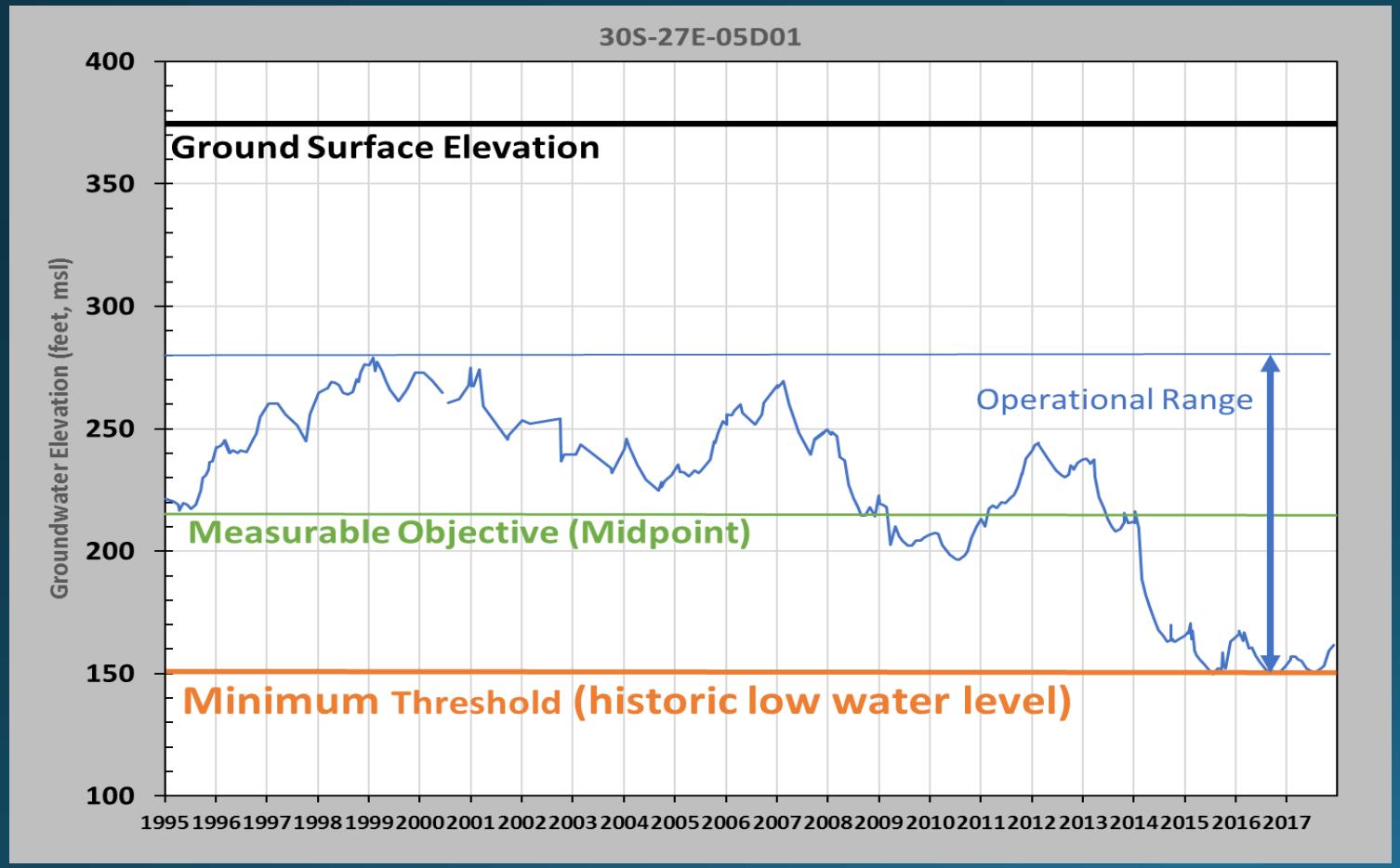
Assignment of Minimum Thresholds (MTs) and Measurable Objectives (MOs)



- Example hydrograph from monitoring well
- In Urban MA, MT is set at the historic low water level
- The MO is the average between the high level and the MT

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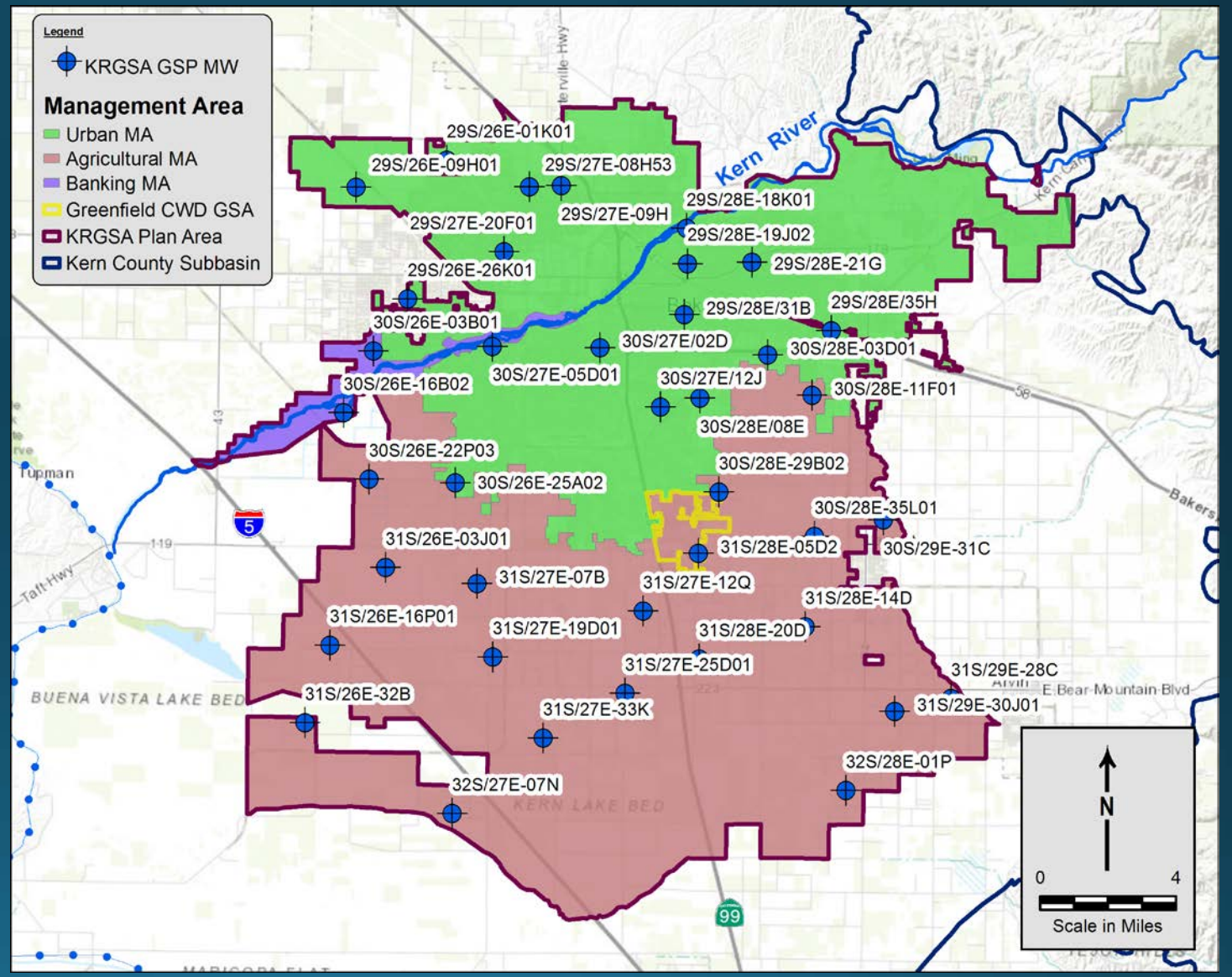
Improved GSP Monitoring Network

- 39 wells identified
- Improved well selection
- Added inactive wells to replace production wells
- Water level monitoring only
- Best use of other WL programs
- Incorporates water quality data from numerous existing programs



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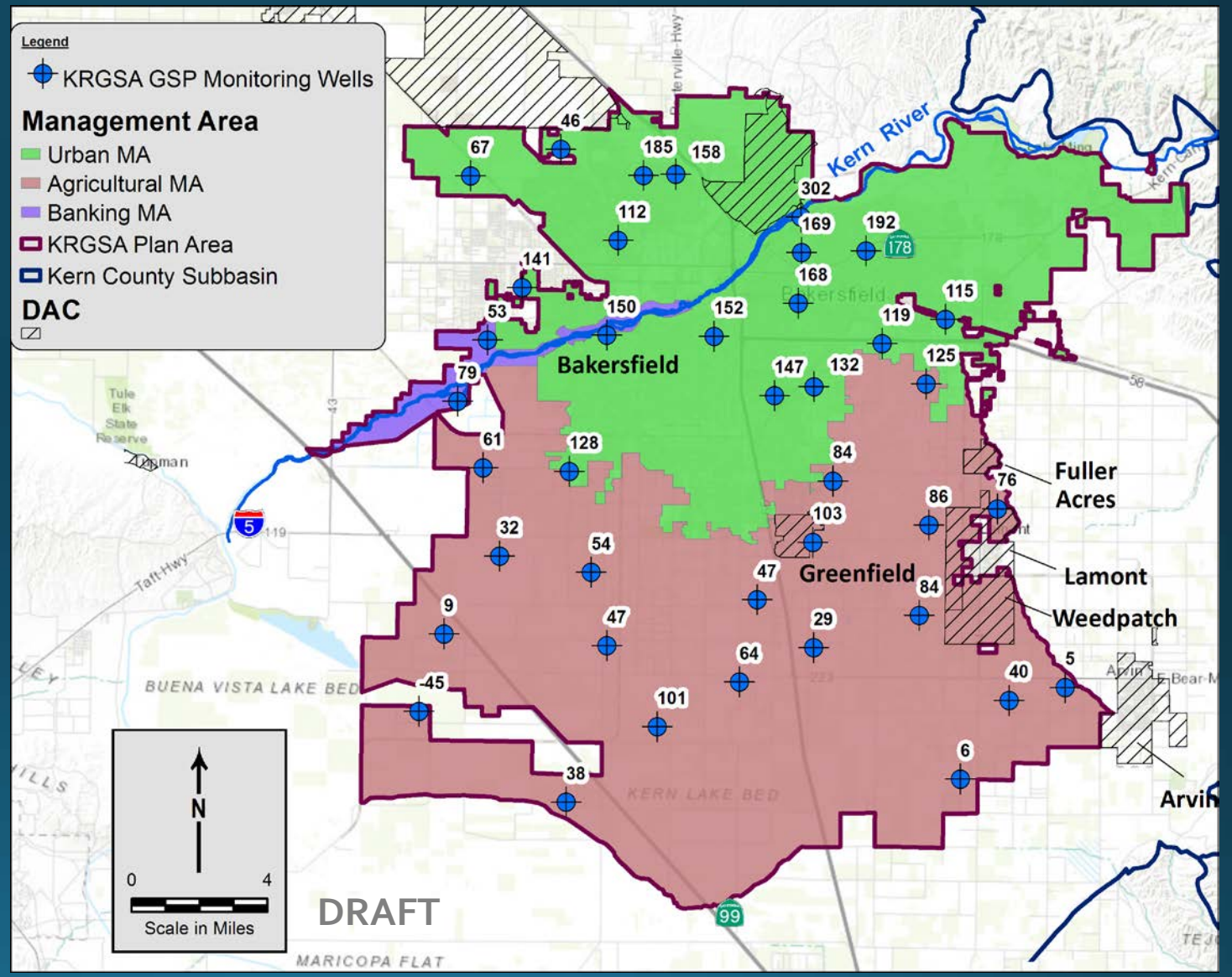
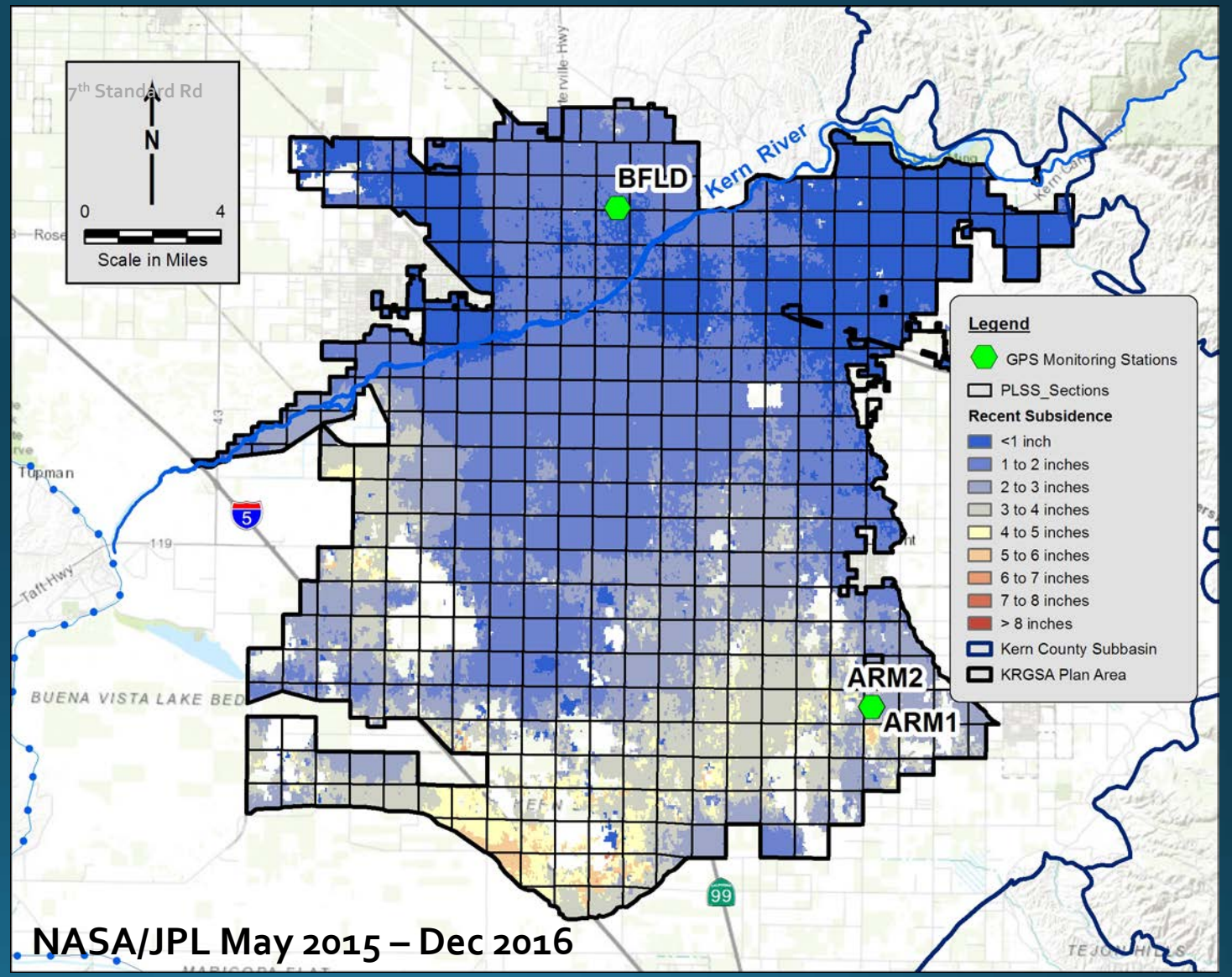
Adjustments to MTs: Input from Small Water Systems

- Modified Minimum Thresholds (MTs) at request of Lamont and Fuller Acres
- Consistent criteria with Urban MA
- Modified MTs in 3 separate areas as requested by 4 separate Small Water Systems



KRGSA Subsidence Monitoring

- Water level monitoring
- Three GPS stations for screening
- InSAR Subsidence available from DWR (on 1-mile grids)
- Coordinate with KGA and other GSAs for regional Subbasin-wide subsidence monitoring



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Project	Description	KRGSA Project Water
Water Allocation Plan	KDWD plans to use its full Kern River entitlement as prioritized in its Water Allocation Plan (WAP) for the Agricultural MA. The WAP total average supply has been corrected for planned sales to NKWSD.	20,797 AFY
Kern River Optimized Conjunctive Use	The City plans to use its full Kern River entitlement, less current obligations, to mitigate undesirable results for water levels and water quality in the Urban MA.	89,619 AFY
Expand Recycled Water Use in the KRGSA	The City will increase recycled water use inside of the KRGSA from its WWTP No. 3 in 2026 when a contract for use outside of the KRGSA expires (about 72% is currently used outside of the KRGSA).	11,556 to 13,407 AFY
Conversion of Agricultural Lands to Urban Use	Approximately 10,000 acres of current KRGSA agricultural lands is expected to be urbanized; this future urban demand is already included in the projected water budget, so 100% of this agricultural water use represents a demand reduction.	27,000 AFY
ENCSD North Weedpatch Highway Water System Consolidation	Up to six small water systems in the northeast KRGSA will be consolidated into the ENCSD system for benefits to drinking water quality, including to disadvantaged communities (DACs).	No new supply; improved water quality to DACs
Possible Water Exchange	KRGSA member agencies can perform exchanges of surface water and groundwater for benefits to water quality, including to DACs	No new supply; improved water quality to DACs

GSP Projects to Address Future Water Budget Deficits

Up to about 150,000 AFY of additional KRGSA supply

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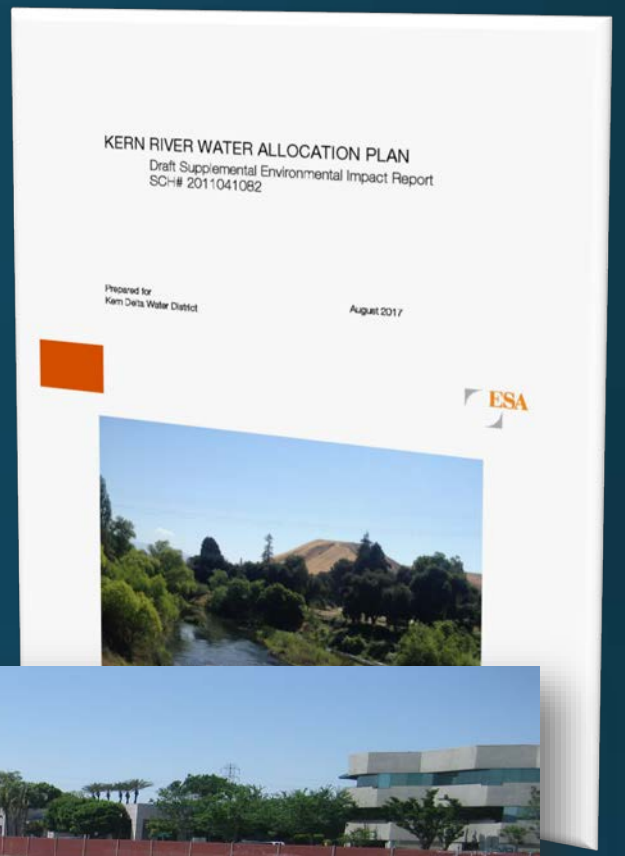
Key GSP Projects

KDWD Kern River Water Allocation Plan

- Optimizes Kern River recharge across the southern Plan Area
- Reduces groundwater pumping
- Allows local maintenance of water levels
- SEIR completed 2018 – implementation initiated



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Key GSP Projects

City of Bakersfield Optimized Conjunctive Use

- Prioritizes use of City's available Kern River water
- Increasing water availability over the implementation and planning horizon
- Allows municipal pumping to be reduced to avoid undesirable results
- Meets future projected water budget deficits for urban demand

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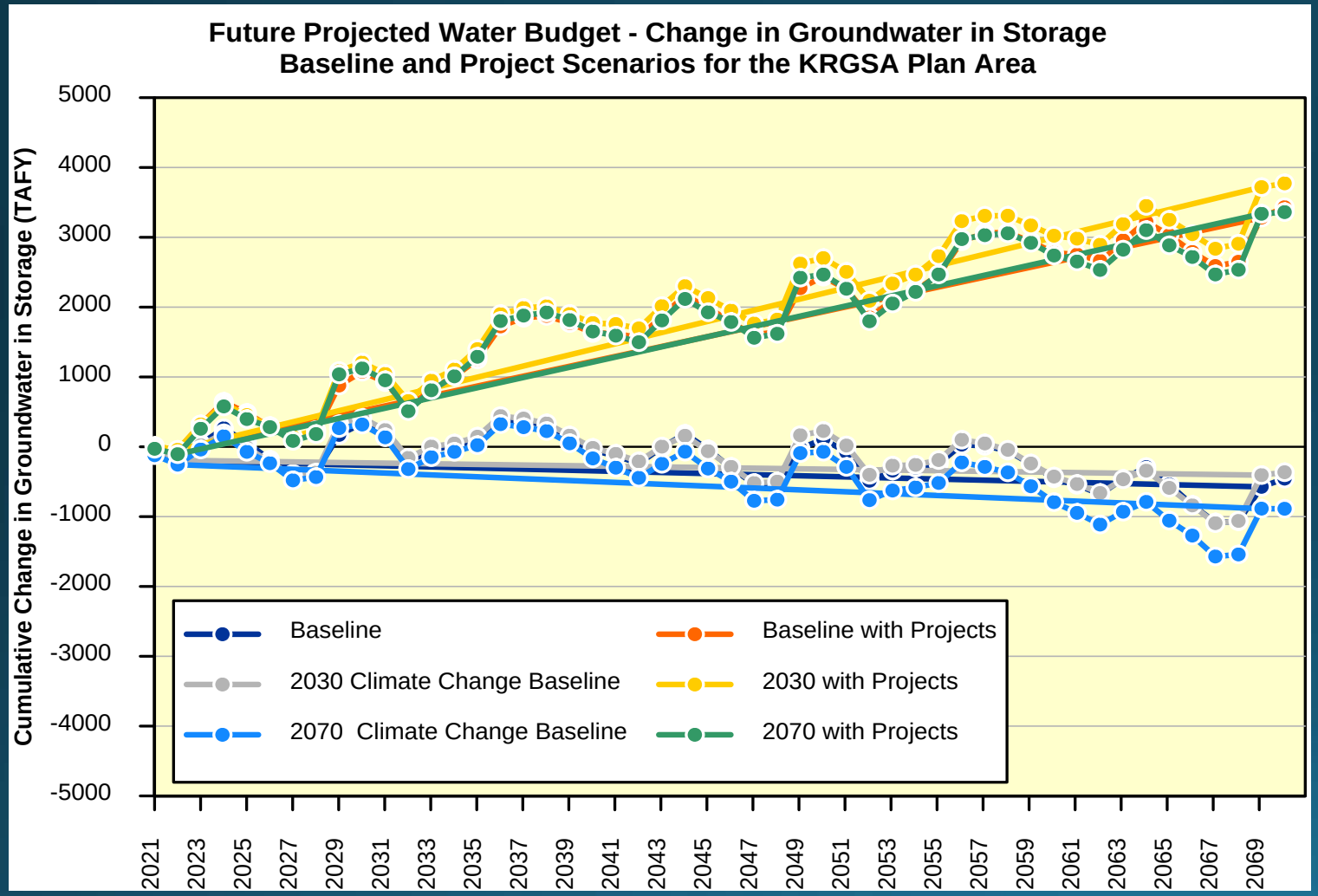
Key GSP Projects

East Niles Community Services District North Weedpatch Highway Consolidation

- Consolidation of up to six small water systems with ENCSD to address water quality concerns: nitrate, TCP, and arsenic
- Grant funding through the DWRSF program
- Improves drinking water quality for disadvantaged communities in the KRGSA

1,2,3-TCP Wellhead Treatment

Projected Water Budgets with GSP Projects



GSP projects and address current and projected water budget deficits to achieve sustainable management.

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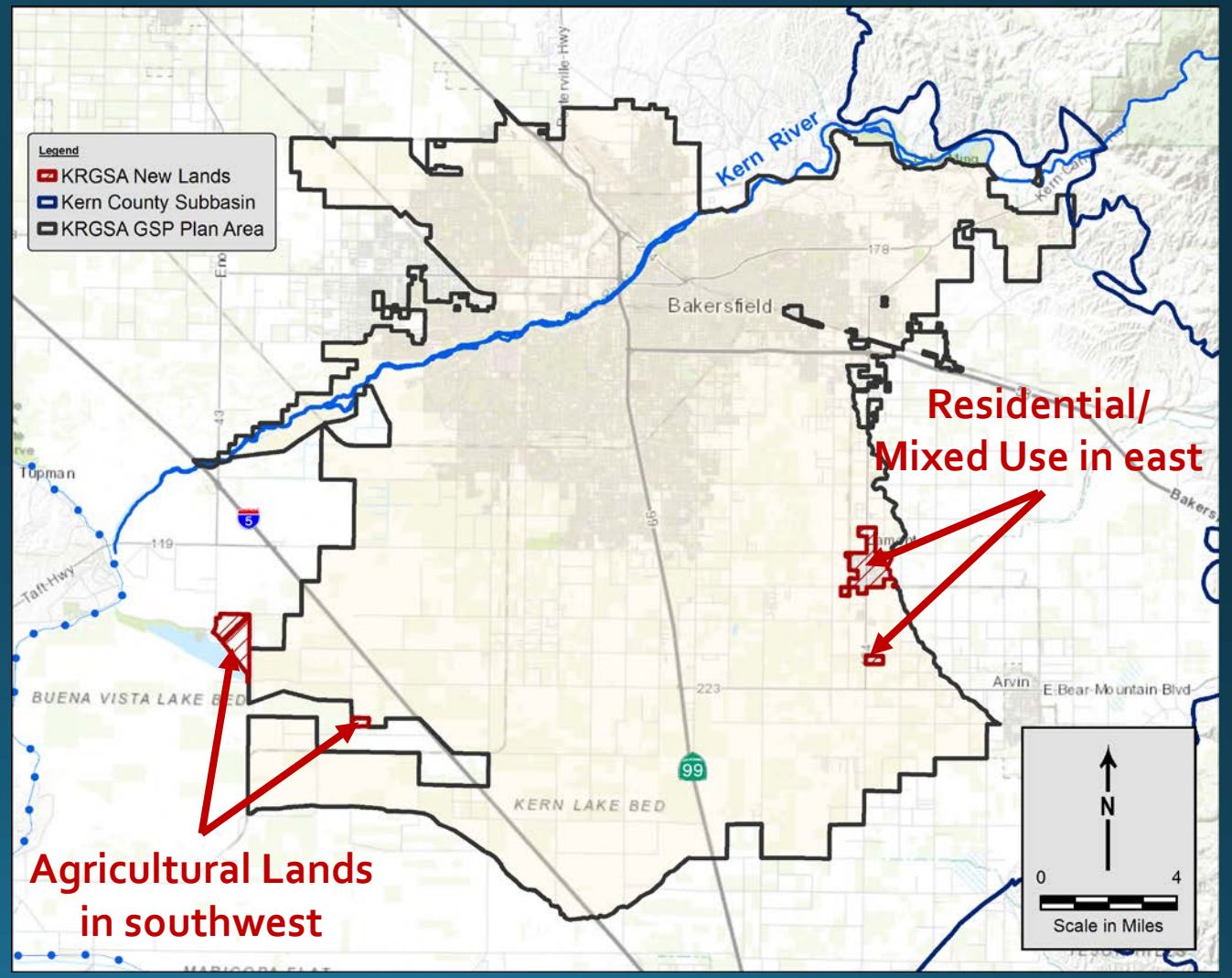
Management Actions – KRGSA Policies

- 5-Step Action Plan if Minimum Thresholds are exceeded
- Optimize Conjunctive Use in the KRGSA
- Implement a Well Metering Program
- Implement a groundwater extractions Program
- Support CA Delta Conveyance to Preserve Imported Supplies
- Incorporate Climate Change Adaptation Strategies
- Support Sustainable Groundwater Supplies for KRGSA DACs
- Improve Groundwater Monitoring Program
- Incorporate a Policy of Adaptive Management in the GSP Process

Additional Changes/Additions to Draft GSP
New Lands Added

- Agricultural lands in southwest
- Urban/Mixed land uses in southeast
- Total 1,847 acres (less than 1% of previous Plan Area)
- Eastern lands already in water budget; small water use in southwest (1,300 – 2,500 AFY)
- New Appendix K of the GSP



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Public Comments on the Draft GSP

- Chevron NA – meeting 2-14-19; email comments 8-5-19; 10-24-19
  - Response: All comments discussed and incorporated
- Leadership Counsel letter 7-10-19; letter 11-26-19
  - Response: Letter from KRGSA 8-13-19
  - Response: Reviewed comments; clarifications to GSP, as applicable
- California Department of Fish and Wildlife
  - Response: Reviewed comments; clarifications to GSP, as applicable
- City of Los Angeles
  - Response: Revised recycled water amounts on Table 2-1 (revised to 11,321 AFY)
  - Response: Modified discharge provided from February through September
  - Response: Provide notifications regarding any future GSA actions

Public Comments
Leadership Counsel for Justice & Accountability

- 23-page letter of perceived deficiencies/un-met requirements
- Numerous Comments Claim non-engagement of Small Water Systems and DACs
  - Response: 1st meeting with Small Water Suppliers July 2017; numerous outreach meetings and 2 Open Houses; ongoing relationships between GSA members and Small Water Systems; GSP projects and management actions target DACS; Adjusted MTs based on Small Systems input; many other activities
  - Response: Lamont PUD joined the KRGSA after the Draft GSP was prepared; edits and adjusted MTs based on their input; may add Lamont PUD MW to GSP program
- Attached technical analysis on 3 issues (responses on following slides):
  - Water Budget Checkbook and Future Water Budget Hydrology
  - Water Quality
  - Dry Well Analysis

Response to Public Comments – Water Budget Leadership Counsel for Justice & Accountability

- Comment: Checkbook doesn't account for subsurface outflows that could impact recharged water
- Response: Model analysis does account for subsurface outflows
  - Recharge used to maintain water levels; seasonal recovery with local wells (not all water is banked long-term)
  - Conditions are dynamic and will change over time
  - Water budget components and MTs/MOs monitored
- Comment: Projected Water Budget hydrology not variable
- Response: Contains both the wettest year and driest year in the 50-year period and period of largest water level fluctuations in most areas
  - Compares to rainfall and streamflow over a 50-year period
  - Explained in detail in the model documentation (Attachment 1)

Response to Public Comments – Water Quality Leadership Counsel for Justice & Accountability

- Comment: TDS, nitrates and arsenic are actively managed and programs are described adequately (no response required)
- Comment: Includes suggestions for Annual Report (noted)
- Comment: Pesticides not detected above MCLs (no response required)
- Comment: Suggest clarifying language on local management (considered)
- Comment: Questions on sources and impacts to wells (response – management actions and monitoring program will address these issues)
- Comment: Provide additional information on 1,2,3-TCP (response – noted in GSP that the KRGSA will be analyzing TCP water quality data)

Public Comments – Dry Well Analysis Leadership Counsel

- Provided a "Dry Well Analysis" of the Minimum Thresholds (MTs) and Measurable Objectives (MOs)
- Places a 2-mile blue-bubble radius around the monitoring wells
- Count number of wells going "dry" for each MO or MT bubble
- Out of 3,633 wells, predict six or seven domestic wells will go dry

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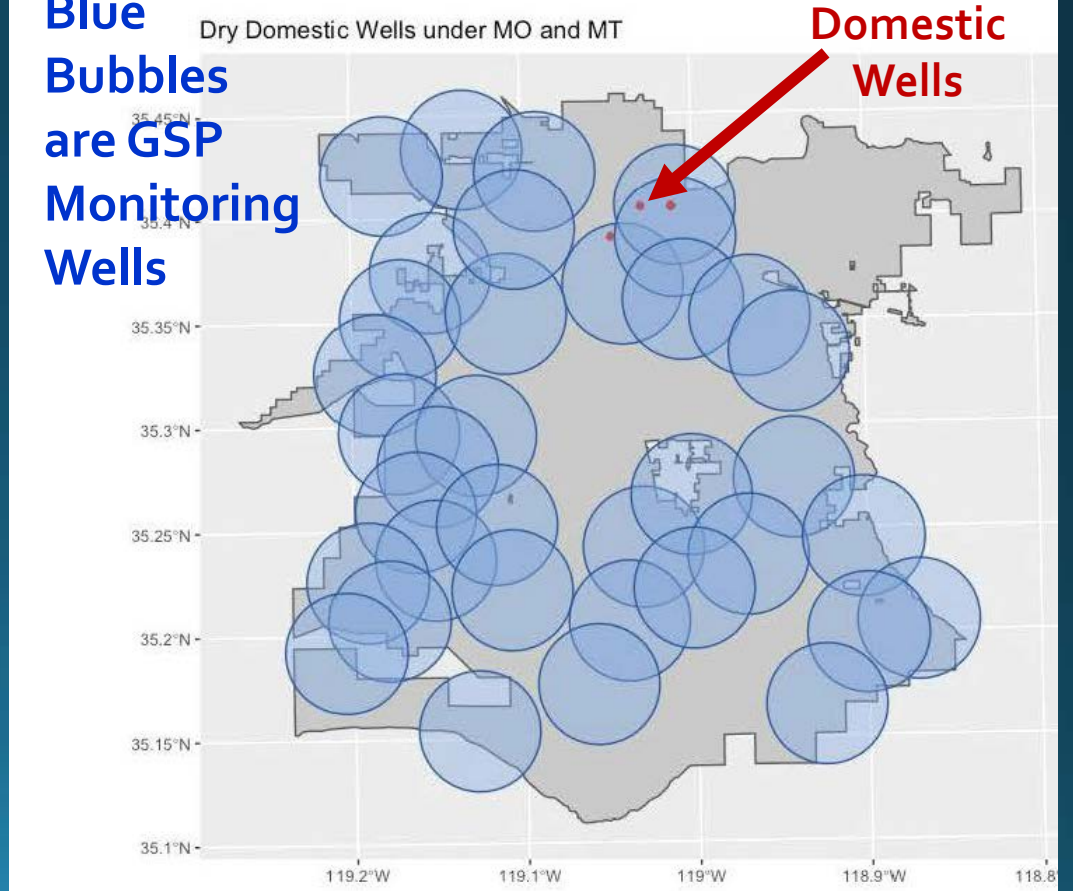
Larger no. of wells include monitoring, remediation, cathodic, test wells, etc.

If **Measurable Objective** is met..	If **Minimum Threshold** is met..
159 wells go dry	250 wells go dry
6 domestic wells go dry	7 domestic wells go dry

** NOTE: One point on the map represents more than one well. **



Response to Public Comments – Dry Well Analysis Leadership Counsel

1. All "dry wells" are in Urban MA where higher water levels are maintained
2. MO is average water level; if 159 wells go dry every time water levels are "average" or below, they have been dry for a long period of time (i.e., 1990s)
3. MT is historic low level – well would have been dry before any GSP action was taken
4. Located in City/Cal Water/OMWC service areas; pumping reported to ID4

Larger no. of wells include monitoring, remediation, cathodic, test wells, etc.

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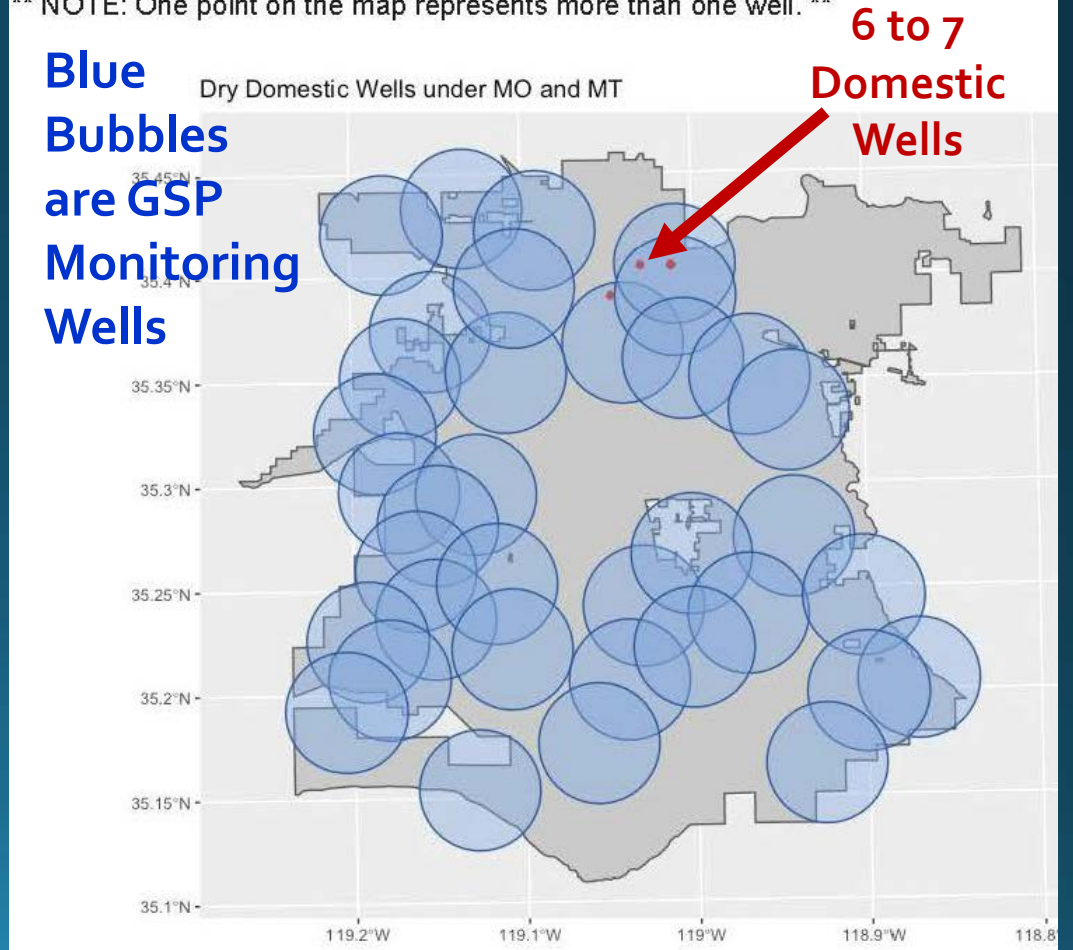

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Public Comments and Responses
California Department of Fish and Wildlife

1. No wells occur on certain CDFW lands in the Plan Area
   Response: Other nearby wells inform local groundwater conditions
2. Identify habitats and species that may depend on groundwater and identify monitoring to track environmental beneficial uses over time.
   Response: NCCAG maps (TNC/DWR) and species included in GSP Section 3.3.6
3. Analysis merits further investigation and recommends installation of shallow monitoring wells. Also recommends additional analysis.
   Response: Shallow GSP monitoring well at Calloway Pool; additional future analysis to be considered if conditions change
4. No consideration of environmental uses of groundwater in management criteria.
   Response: No interconnected surface water indicated; no environmental uses of groundwater identified; sustainability goal to protect any future identified environmental beneficial uses of groundwater

Additional Public Comments
California Department of Fish and Wildlife

- No consideration of environmental uses of groundwater in management criteria.

  Response: No interconnected surface water indicated; no environmental uses of groundwater identified; sustainability goal to protect any future identified environmental beneficial uses of groundwater

- Critically over-drafted basin should not allow MTs to lower water levels.

  Response: GSP brings KRGSA water budget into balance

- Groundwater elevations as a proxy for water quality is not supported by correlations between concentrations and elevation.

  Response: Yes it is; see Figure 3-14 Section 3.3.4.6

- Anticipates involvement in CEQA for GSP projects (no response required)

Next Steps

- Board Adoption of Final GSP 12-05-2019
- Additional minor revisions/cleanup of Draft GSP, as directed by the Board including clarifications in response to public comments, as needed
- Final document and data preparation
- Submit to DWR by January 31, 2020

Questions?

TODD GROUNDWATER