Updated SMC for Water Levels and Water Quality
Tulare Lake Subbasin

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Agenda

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- Well Records Database
  - Problems with OSWCR
  - Compare DWR and USGS Well Record Databases
  - Combine USGS and Kings County Well Records
  - Assign Well Records to Aquifer Zones
- Water Level SMCs
  - Proposed Methodology for MO, MT
  - SMCs
- Water Quality SMCs
  - Proposed Methodology for MO, MT
  - SMCs
  - Sampling Analysis Plan

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Well Records Database



Problems with OSWCR

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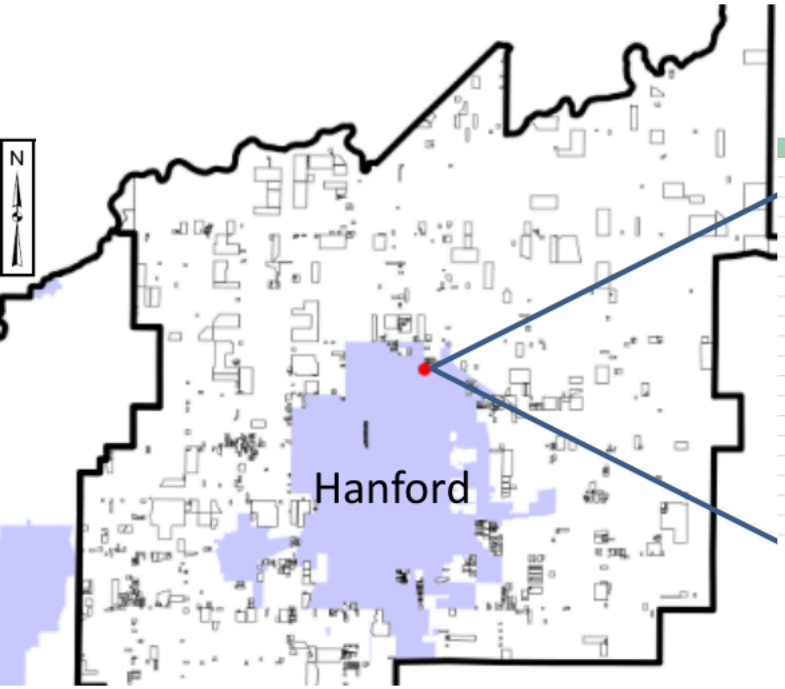
Orphan well hot spots: In this example, there are 18 wells located to center of section with no owner/address information, 15 Records are older than 1980



	D	I	J	L	N	P	Q	R	S	T	U
	WCRNumber	Address	City	APN	Activity	PlannedUse	DateWellComplete	YearWe	HoleDe	Comple	TopOfC
18	WCR1972-000948		HANFORD		New Well	Domestic	1/4/1972	1/1/1972	245	241	220
18	WCR1972-000915		HANFORD		New Well	Irrigation - Agriculture	8/3/1972	1/1/1972	336	330	210
18	WCR0319898				New Well	Domestic	10/12/1972	1/1/1972	615	610	260
18	WCR1975-000989				New Well	Domestic	4/30/1975	1/1/1975	205	200	180
18	WCR1975-001039				New Well	Domestic	9/18/1975	1/1/1975	202	200	180
18	WCR1975-001040				New Well	Domestic	9/19/1975	1/1/1975	202	200	180
18	WCR1975-001253				New Well	Domestic	11/4/1975	1/1/1975	220	214	154
18	WCR1976-001630				New Well	Domestic	5/4/1976	1/1/1976	205	200	180
18	WCR1976-001631				New Well	Domestic	5/5/1976	1/1/1976	205	200	160
18	WCR1976-001586				New Well	Domestic	9/1/1976	1/1/1976	243	240	200
18	WCR1976-001742				New Well	Domestic	12/8/1976	1/1/1976	205	200	180
18	WCR1976-001896				New Well	Domestic	12/9/1976	1/1/1976	205	200	180
18	WCR1977-003233				New Well	Domestic	11/18/1977	1/1/1977	263	260	200
18	WCR1978-002306				New Well	Domestic	2/22/1978	1/1/1978	210	200	160
18	WCR1979-002568				New Well	Domestic	7/1/1979	1/1/1979	190	180	160
18	WCR1985-007140				New Well	Irrigation - Agriculture	2/5/1985	1/1/1985	430	420	180
18	WCR1987-014430				New Well	Domestic	8/18/1987	1/1/1987	220	215	175
18	WCR1994-007360		HANFORD		New Well	Domestic	6/17/1994	1/1/1994	240	230	180

Problems with OSWCR

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Well records located at [property location redacted] :

-2013, installed a 60’ AG well

-2018, destroyed two domestic wells (220’ and 300’) and installed one domestic well (320’)

Activity	PlannedUse	DateWellComplete	YearWe	HoleDe	Comple	TopOfC	Numbe	Genera	StaticW
New Well	Domestic	4/11/2018	1/1/2018	330	320	300	1	Alluvial	178
Destroy	Domestic	4/13/2018	1/1/2018		300				190
Destroy	Water Supply	4/13/2018	1/1/2018		220				157
New Well	Irrigation - Agriculture	3/7/2013	1/1/2013	68	60	40	1	Alluvial	11

- Beneficial use may change over time due to change of ownership and use of the property
- At a single property exists both A and B zone wells

Compare DWR and USGS databases

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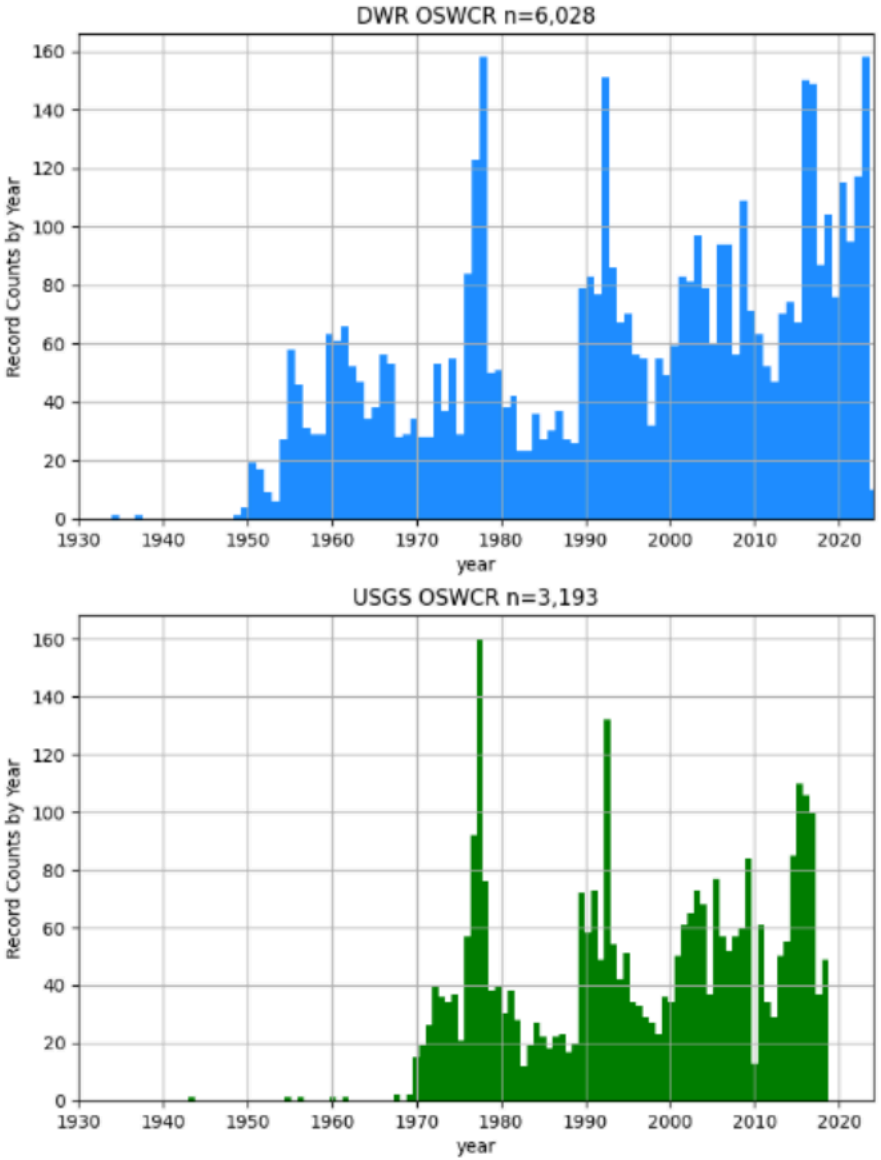
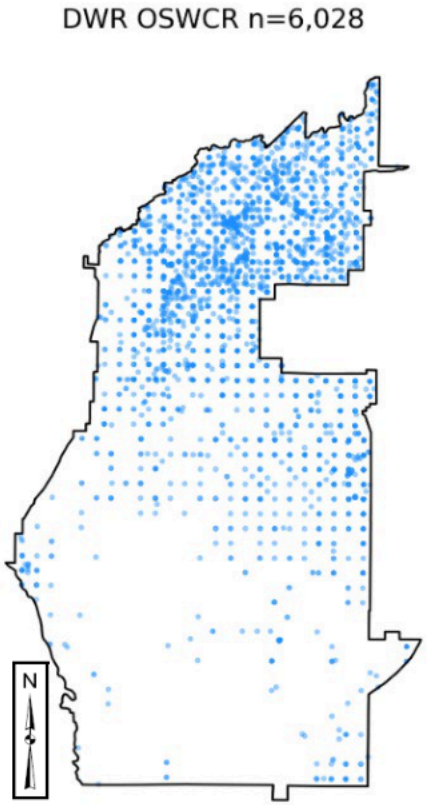
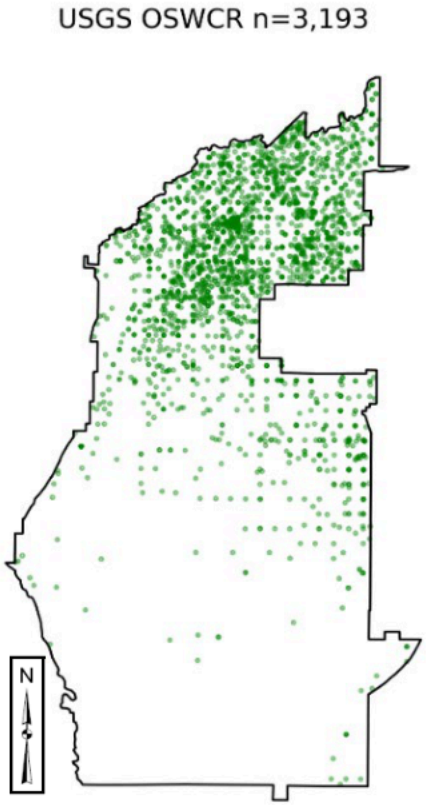


Number of well records with a depth in TLSb

By database:



DWR record coordinates



USGS record coordinates

Combined USGS and Kings County Well Records Database

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A best-available well records database is necessary to evaluate the groundwater infrastructure

- DWR OSWCR beneficial use wells with a depth: n= 4,166 (Mostly located to center of a section)
- USGS OSWCR beneficial use wells with a depth: n= 2,987 (Mostly located to a specific point)
- Kings County Well Records Database beneficial use wells with a depth: n = 2,298 (Additional wells)

Creating a Combined Well Records Database from USGS and Kings County Sources:

Step 1: Match County records to USGS records on permit number (verify using well construction information)

Step 2: County records that could not be matched to a USGS well record are appended to the well records list:

Result: Records that have a beneficial use and a depth: n = 4,443 well records

After removing the well destruction records, the count of records in the combined County + USGS database is: n = 4,308

Count by Zone

- A-Zone, n = 870 well records
- B-Zone, n = 2,077 well records
- C-Zone, n = 1,361 well records

Count by Well Type

- Agriculture wells, n = 2,208
- Stock watering wells, n = 20
- Domestic wells, n = 2,000
- Industrial wells, n = 40
- Public wells, n = 40

*Well record counts may change following the discovery of new wells or the issuance of database updates.

Assign Well Records to Aquifer Zones

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Well records from the combined database must be assigned to aquifer zones in order to develop SMCs.

Aquifer definitions:

- A-Zone: well records screened above the A-Clay
- B-Zone: Well records not screen above the A-Clay or below the C-Clay.
- C-Zone: Well records screened below the C-Clay

Methodology:

- Assign well records to aquifer zones based on raster interpolated A-Clay and E-Clay surfaces derived from USGS Reports

Assign Well Records to Aquifer Zones

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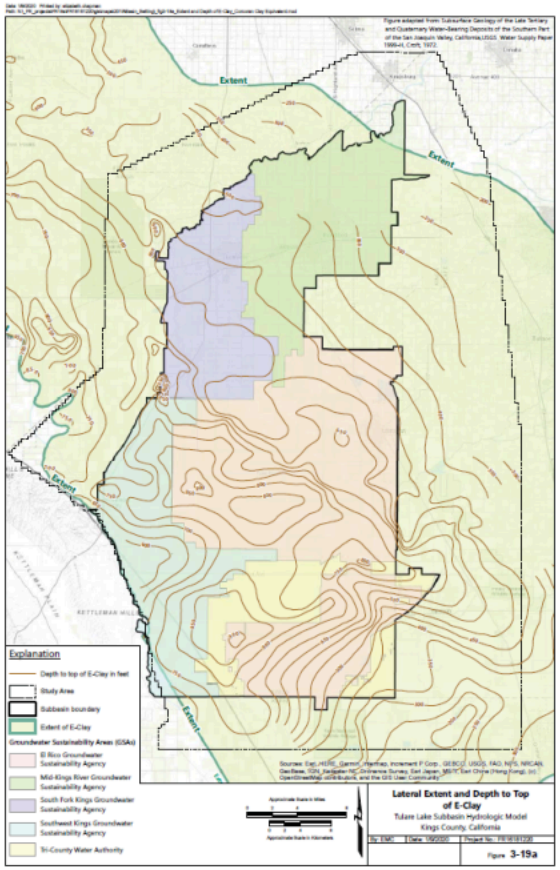
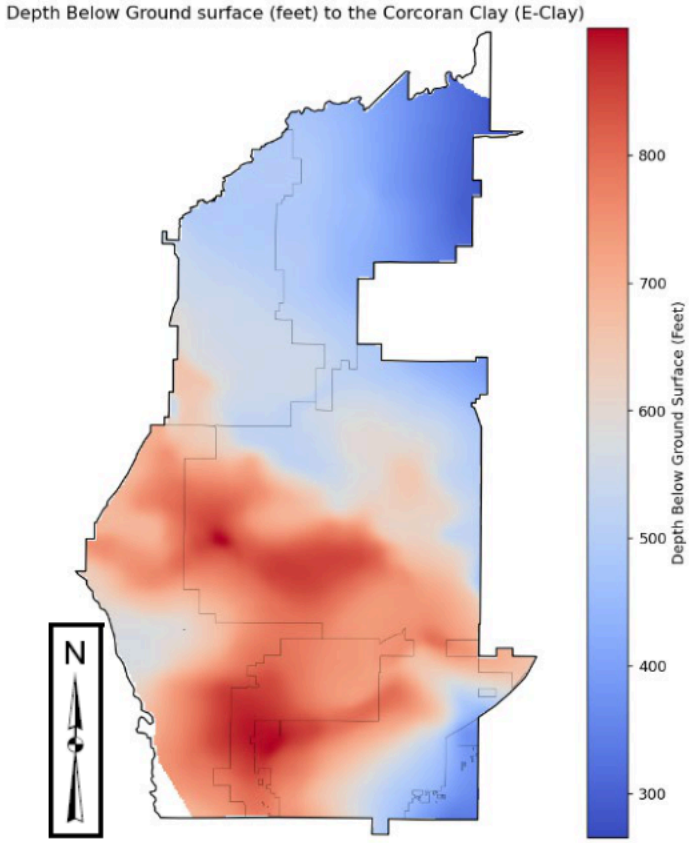
Corcoran Clay (E-Clay) contours from USGS

2020 TLSb GSP



Digitized E-Clay surface defines the C-Zone aquifer extent and is compared to well screens



- B-Zone wells are not screened above the A-Clay or below the E-Clay.
- C-Zone wells are screened below the E-Clay.

Assign Well Records to Aquifer Zones

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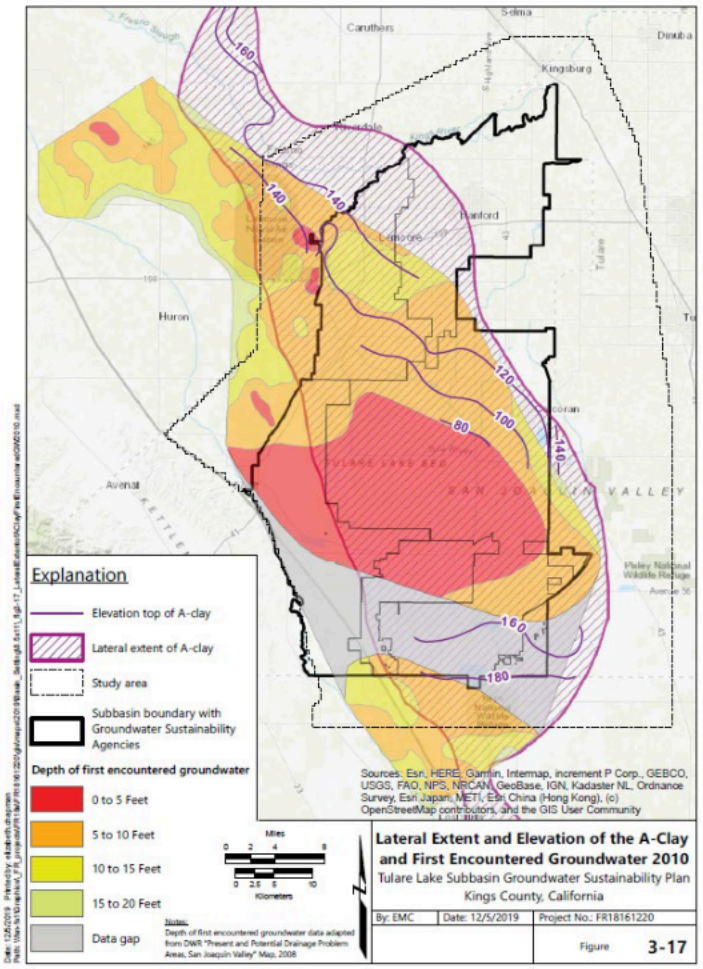
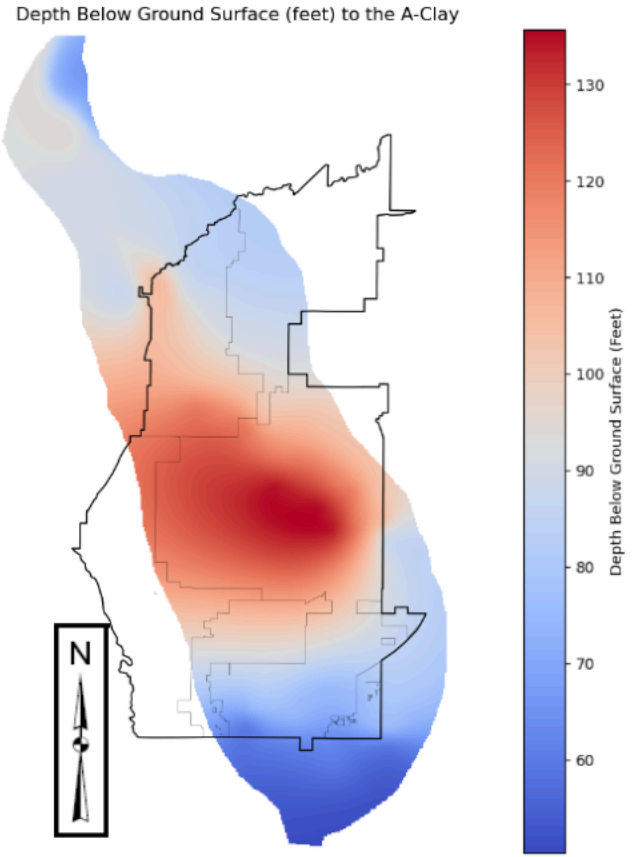
A-Clay Contours from USGS

2020 TLSb GSP



Digitized E-Clay surface defines the A-Zone aquifer extent and is compared to well depth



- A-Zone wells are screened above the A-Clay

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Water Level SMCs



Proposed Methodology for MO, MT

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- Overview of the A- and B-Zone MO and MT to be presented
- The C-Zone MO and MT will be handled separately and is not discussed here
- Methodology for A and B Zone MO/MT are being reviewed against water quality to ensure they are protective

Proposed Methodology for MO, MT

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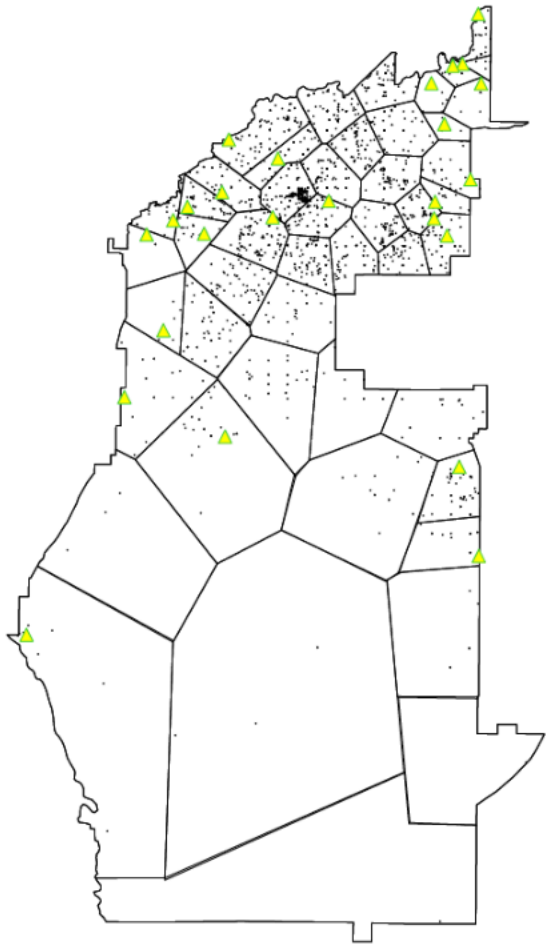
B-Zone MO and MT:

- B-Zone Well records grouped into Representative Monitoring Areas (~50 wells per area)
- Thiessen Polygons developed around well clusters (RMS monitoring areas)
- One RMS well per RMS monitoring area (if RMS well available)
- B-Zone well density (smaller polygons where well density is greater, larger polygons where well density is lower
- Well depth statics calculated for each representative monitoring area based on wells within each area

Minimum Threshold = 90th percentile of well depth
Measurable Objective = 20 feet below the 2015 water surface elevation

B-Zone Representative Monitoring Areas



Proposed Methodology for MO, MT

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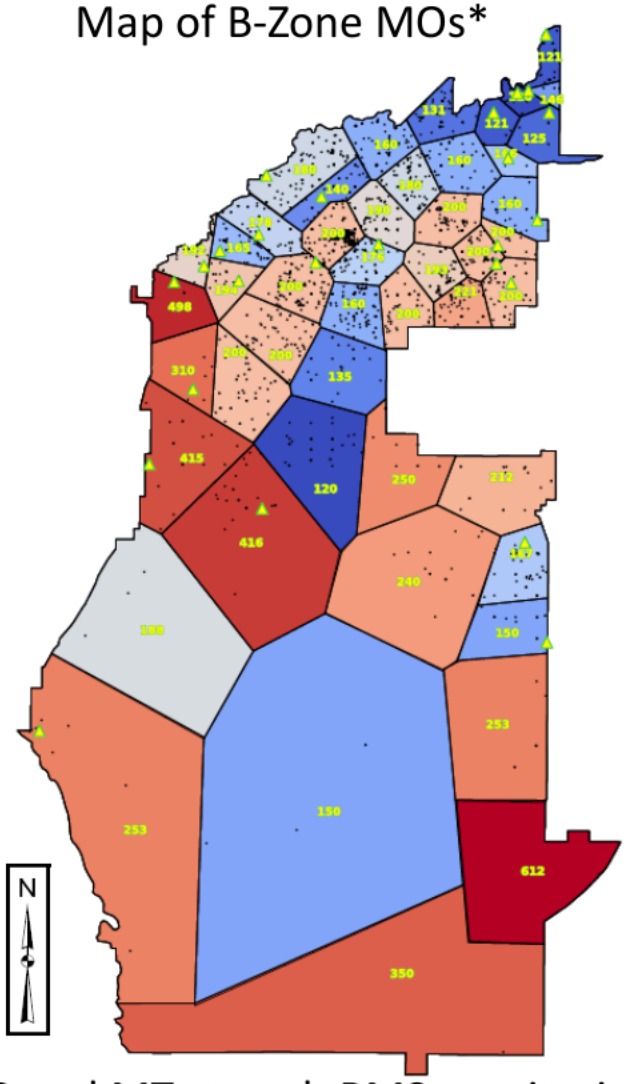
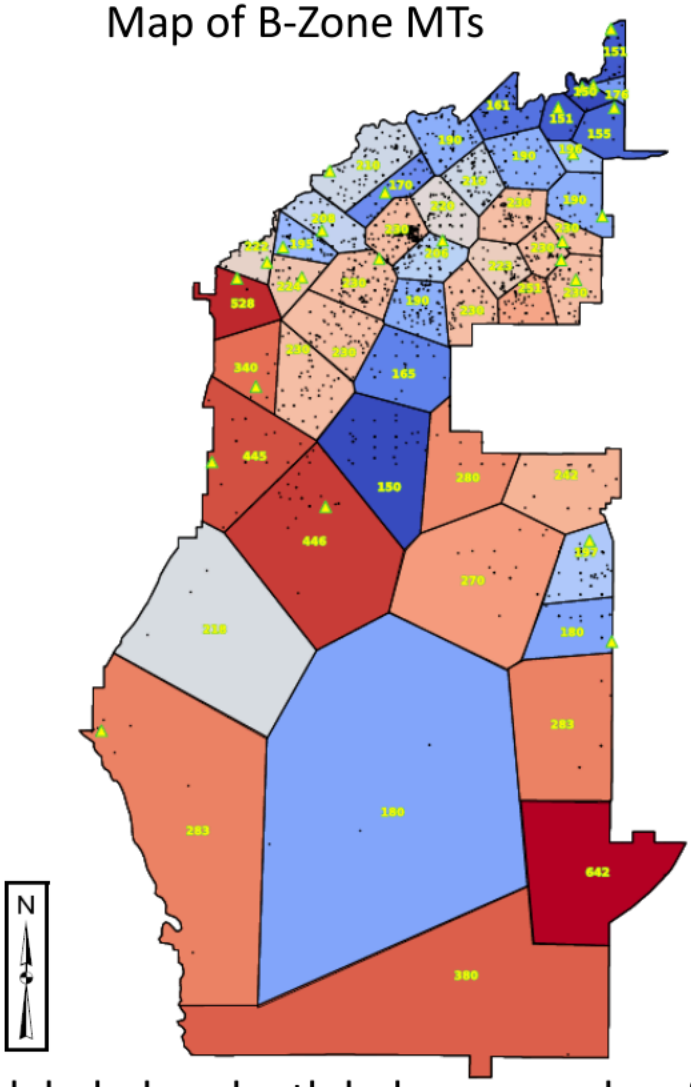
Map of B-Zone MOs*



Map of B-Zone MTs



*MO and MT at each RMS monitoring area are labeled as depth below ground surface

Proposed Methodology for MO, MT

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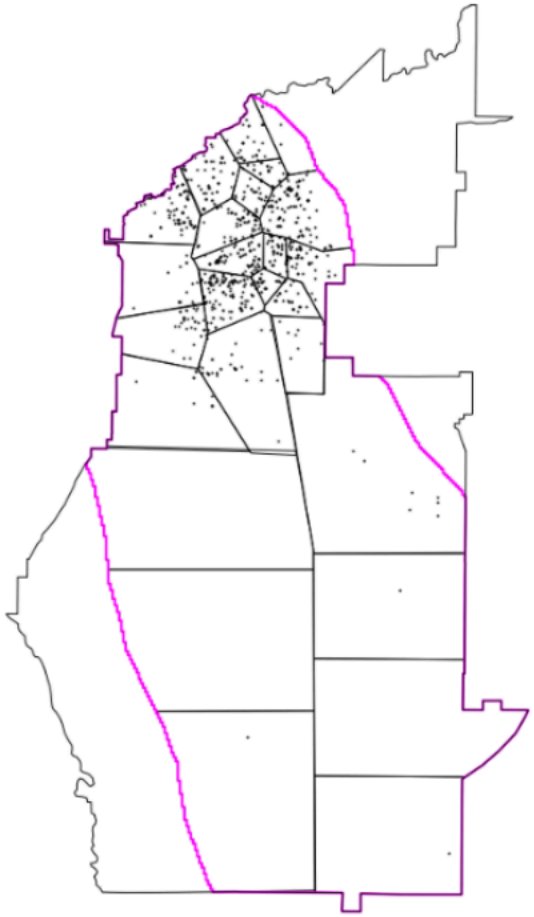
A-Zone MO and MT:

- A-Zone well records grouped into Representative Monitoring Areas (up to 25 wells per area)
- Thiessen Polygons developed around well clusters (RMS monitoring areas)
- One RMS well per RMS monitoring area (if RMS well available)
- A-Zone well density (smaller polygons where well density is greater, larger polygons where well density is lower
- Well depth statics calculated for each representative monitoring area based on wells within each area

*All A-Zone MO/MT set well above top of the A-Clay

Minimum Threshold = 90th percentile of well depth
Measurable Objective = 10 feet below the 2015 water surface elevation

A-Zone Representative Monitoring Areas



Proposed Methodology for MO, MT

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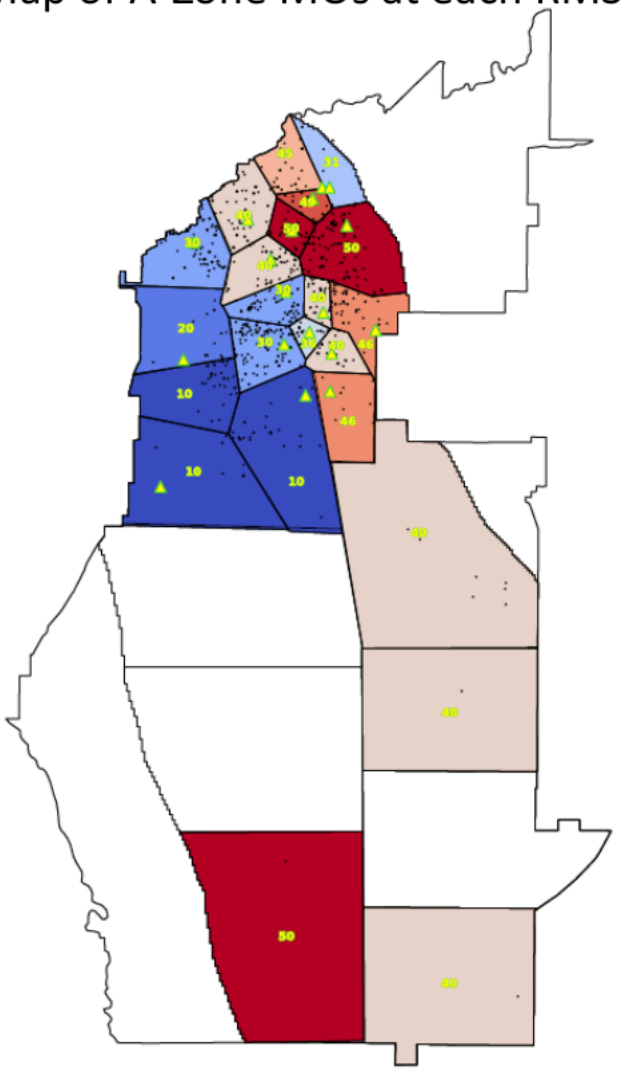
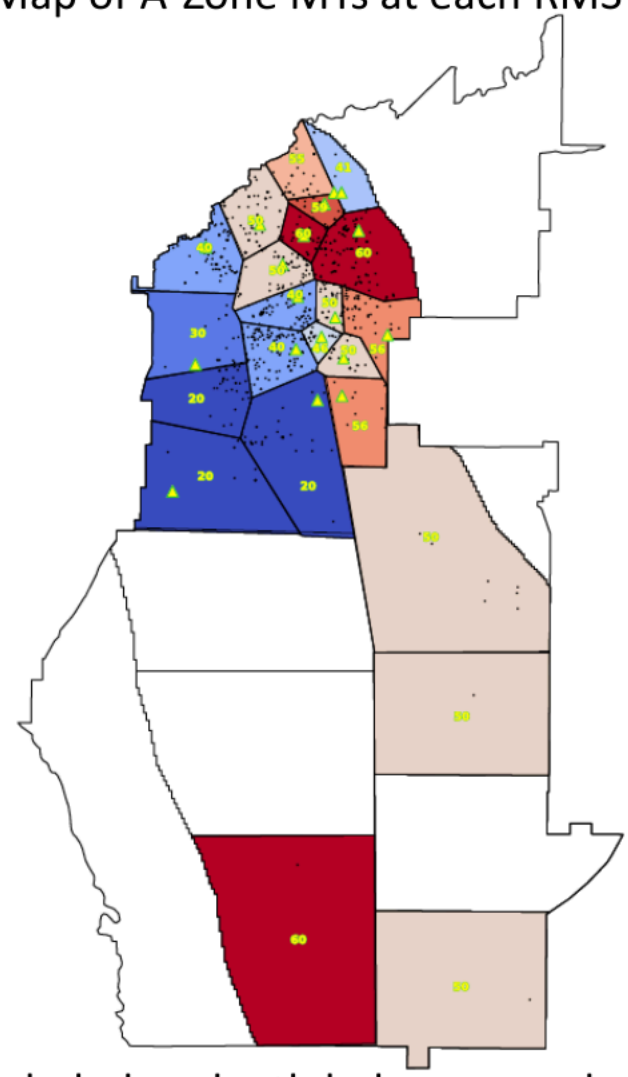
Map of A-Zone MOs at each RMS area*



Map of A-Zone MTs at each RMS area *



*MO and MT at each RMS monitoring area are labeled as depth below ground surface

Proposed Methodology for MO, MT

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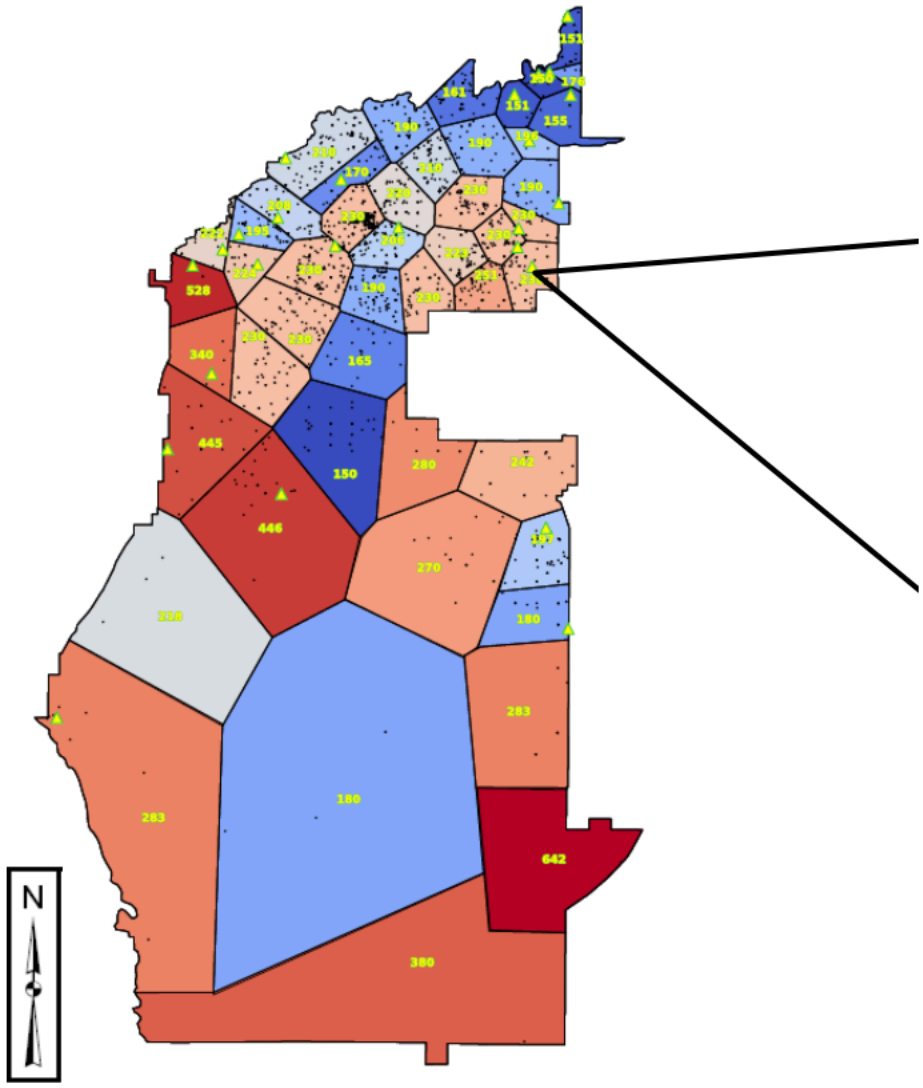
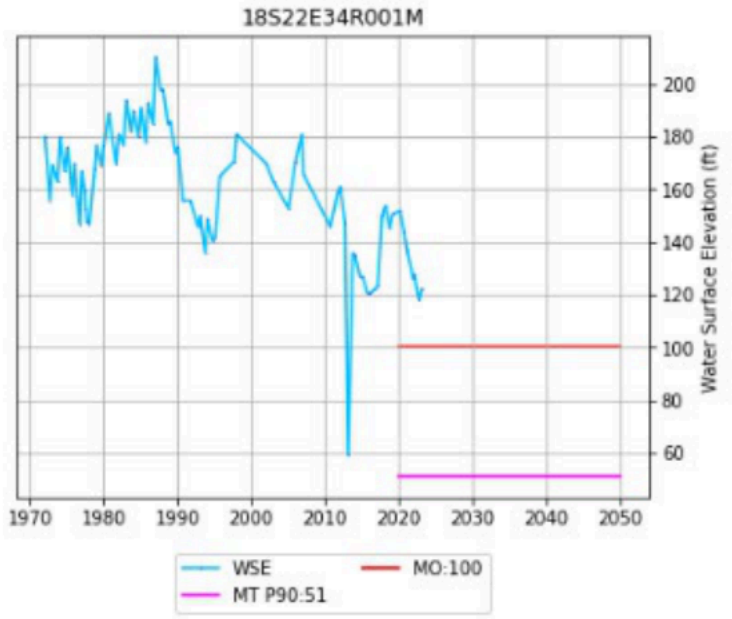


B-Zone Representative Monitoring Areas



Proposed Methodology for MO, MT

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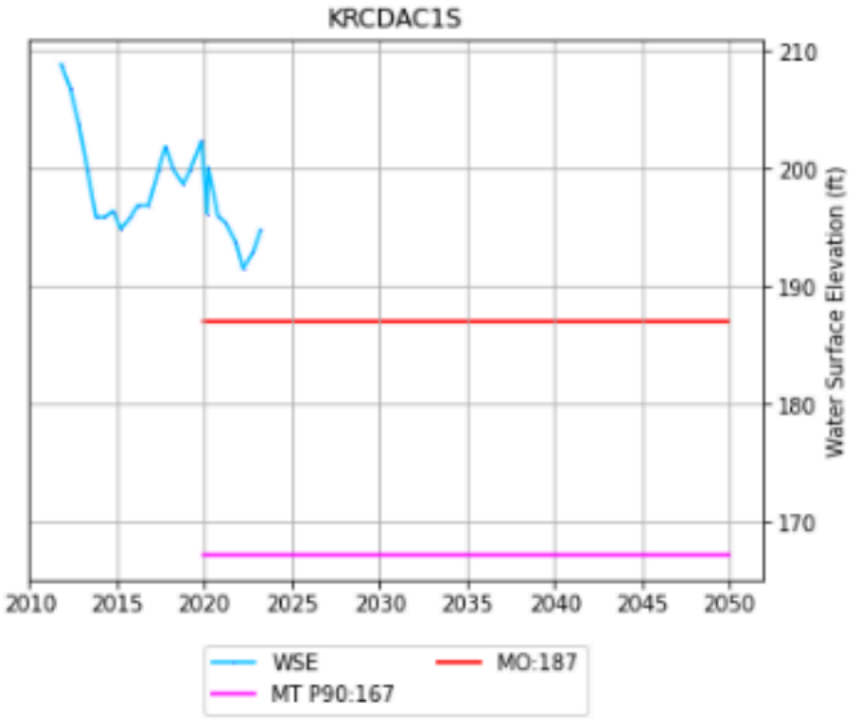
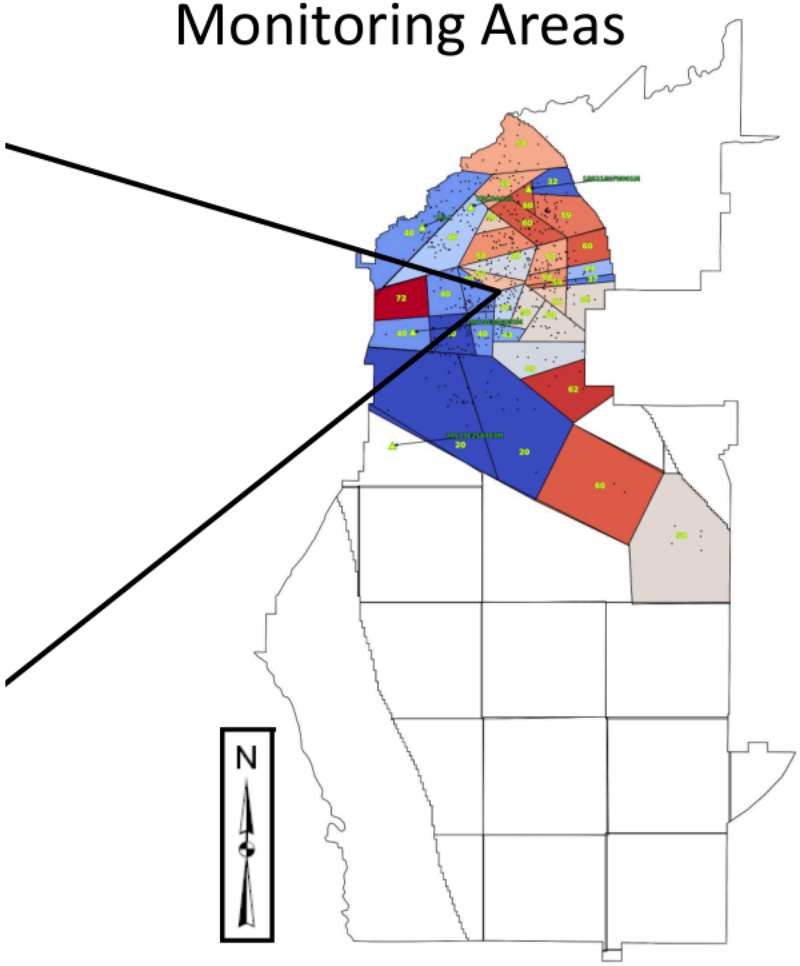


A-Zone Representative Monitoring Areas



Proposed Methodology for MO, MT

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Potential Quantified Impact to Beneficial Use Wells by Aquifer Zone (A or B):

-Calculated by counting the number of well completions with screen intervals at or less than the MO or MT level

-Calculated for each RMS monitoring area (Thiessen Polygon) and summed at the end

A-Zone Impacts (total = 870 Records)
MO: 28 (3%)
MT: 60 (7%)
B-Zone Impacts (total = 2,077 Records)
MO: 79 (4%)
MT: 184 (9%)

SMC

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B-Zone SMC

Sustainability Indicator	Monitoring Network	Undesirable Result	MT	MO
Chronic Lowering of Groundwater Levels	30 B-Zone RMS wells monitored at least 2 times annually	10% (3 of 30) RMS wells fall below their MT during one monitoring event	The elevation corresponding to the 90th percentile of all beneficial-use well depthss in the Thiessen polygons	The elevation corressponding to 20 feet below the 2015 elevation

The Early warning response when a water level approaches the MT includes:

- Additional monitoring in nearby RMS wells
- Public outreach to well owners in the surrounding monitoring areas to understand conditions at the local level

If the Undesirable Result is triggered:

- Increased frequency of monitoring at RMS well (quarterly)
- Monitor water levels at private wells in the monitoring area and adjacent monitoring areas
- Conduct a well survey to understand all potential impacts
- Execute well mitigation plan for qualifying conditions
- Set pumping limits in the monitoring area and adjacent monitoring areas

SMC

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A-Zone SMC

Sustainability Indicator	Monitoring Network	Undesirable Result	MT	MO
Chronic Lowering of Groundwater Levels	18 A-Zone RMS wells monitored at least 2 times annually	10% (2 of 18) RMS wells fall below their MT during one monitoring event	The elevation corresponding to the 90th percentile of all beneficial-use well depthss in the Thiessen polygons	The elevation corressponding to 10 feet below the 2015 elevation

The Early warning response when a water level approaches the MT includes:

- Additional monitoring in nearby RMS wells
- Public outreach to well owners in the surrounding monitoring areas to understand conditions at the local level

If the Undesirable Result is triggered:

- Increased frequency of monitoring at RMS well (quarterly)
- Monitor water levels at private wells in the monitoring area and adjacent monitoring areas
- Conduct a well survey to understand all potential impacts
- Execute well mitigation plan for qualifying conditions
- Set pumping limits in the monitoring area and adjacent monitoring areas

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Water Quality SMCs



Proposed Methodology for MO, MT

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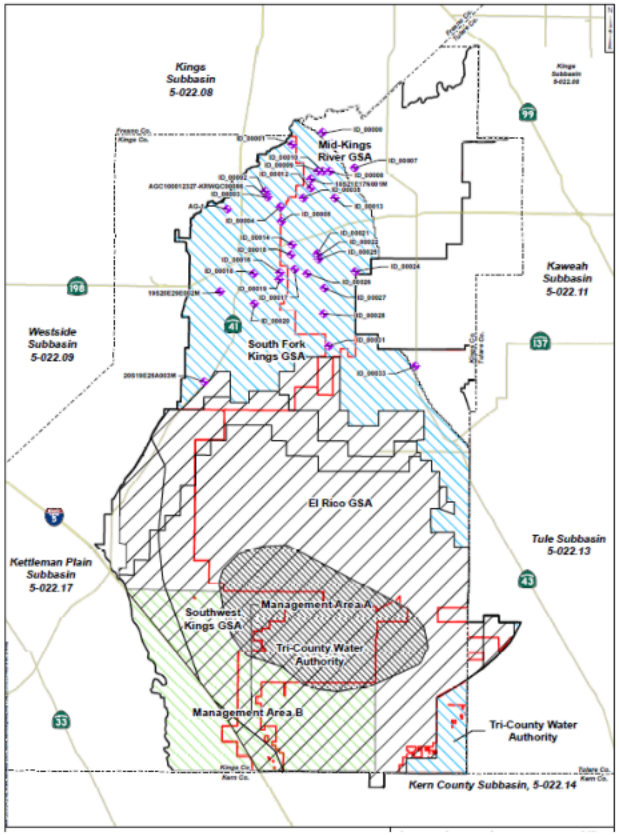
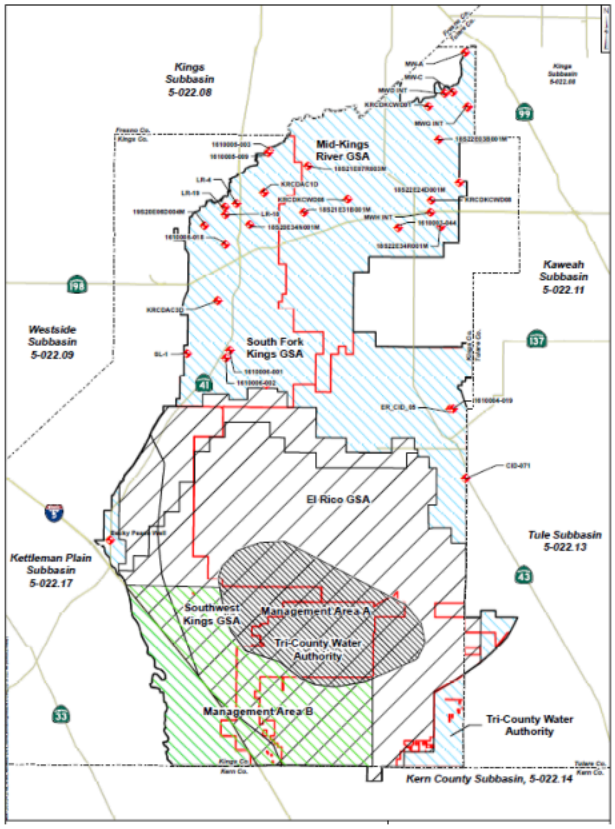
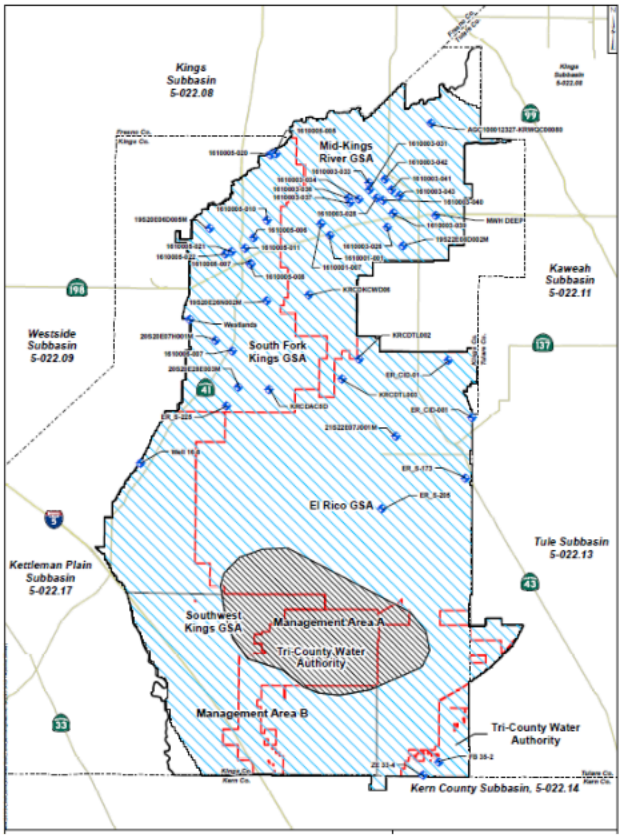
Primary Aquifer Areas with DE-Designated Areas



Primary Aquifer Zone A
Approximate Area: 218 Square Miles



Primary Aquifer Zone B
Approximate Area: 396 Square Miles



Primary Aquifer Zone C
Approximate Area: 837 Square Miles

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Selection of RMS Wells

- Within each Primary Aquifer – Area for RMS wells will be drawn following the Thiessen Polygon Method.
- Wells will be selected to cover an area approximating a circle with a radius of 3 to 4 miles or 28 square miles to 50 square miles.
- Polygons larger than this will be identified as data gaps where additional wells are needed.
- Using this method – approximate number of RMS wells needed per Primary Aquifer shown below.

Primary Aquifer	Area (Square Miles)	Number of RMS Wells
A	218	4 to 8
B	396	8 to 14
C	837	16 to 30

Proposed Methodology for MO, MT

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Minimum Thresholds

Minimum Thresholds (MTs) will be set at levels protective of human health (MCLs/SMCLs). For predominantly agricultural areas MTs will be set at Water Quality Objectives or MCLs/SMCLs) which ever is lower.

Constituent	Units	MCL	SMCL (Upper)	AQ WQO
TDS	mg/L	NA	1,000	450
Specific Conductance	µS/cm	NA	1,600	810
Nitrate as N	mg/L	10	NA	NA
Arsenic	µg/L	10	NA	100
Uranium	pCi/L	20	NA	NA
Sulfate	mg/L	NA	500	NA
Chloride	mg/L	NA	500	106

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Definition of Undesirable Result

- For wells with recent historic levels below MCLs/SMCLs/AQWQOs.
- The occurrence of undesirable result will be defined when MT exceeded for two consecutive samples
- For wells with recent historic levels above MCLs/SMCLs/AQWQOs.
- The occurrence of undesirable result will be defined when the level in excess of 20 percent greater than the recent historic concentration for two consecutive samples

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Measurable Objective

- For wells where concentrations of COCs are historically below MCLs/SMCLs/AWQOs, the measurable objective is to maintain water quality at the existing potable water levels with no observable upward trends.
- For wells with recent historical concentrations above MCLs/SMCLs/AWQOs the measurable objective is for wells to maintain stable or improving groundwater quality trends.