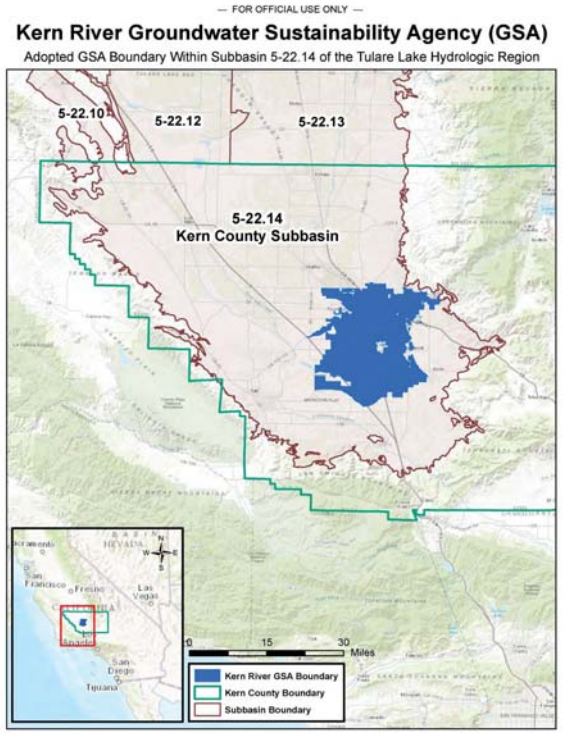
# Kern River GSA Formation Process

- Member agencies held hearings and approved formation of the KRGSA in March 2016.
- April 12 – GSA formation notification was submitted to DWR
  - ✓ GSA boundary maps
  - ✓ GSA forming resolutions
  - ✓ Public hearing notifications
  - ✓ MOU
  - ✓ Supporting documentation from other entities joining the KRGSA
  - ✓ List of interested parties
  - ✓ List and map of disadvantaged communities
- April 21 – DWR posted KRGSA notification
- 90-day notification period ends July 20, 2016

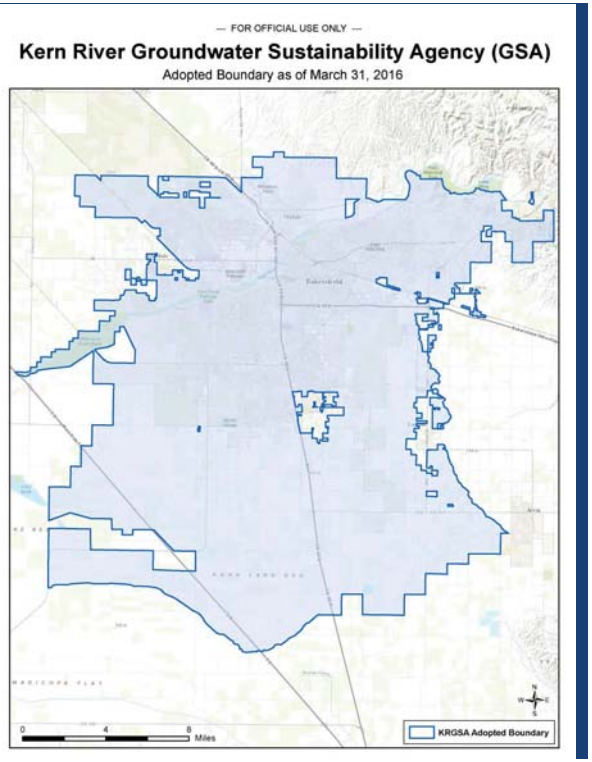
# Kern River GSA



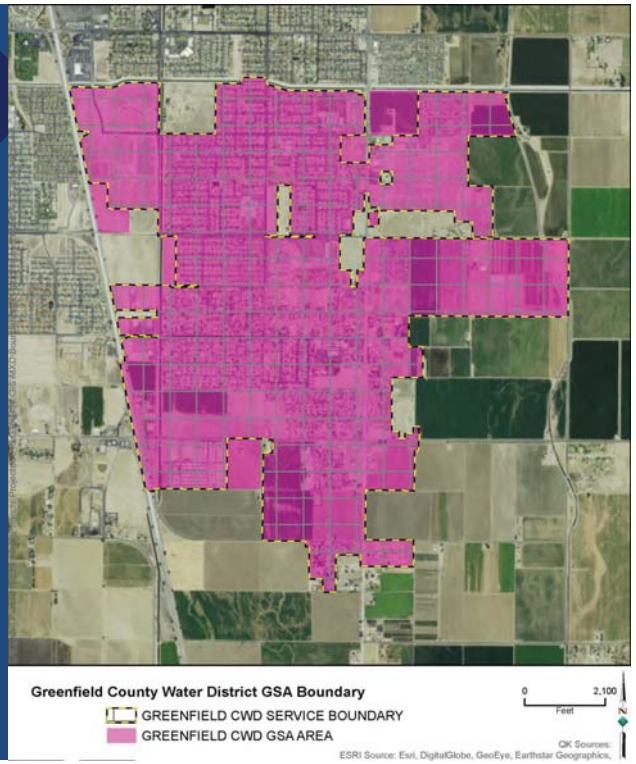

# SGMA – No Overlapping GSAs

- A key issue for SGMA and DWR is that there are not overlapping areas between and among various GSAs.
- GSA areas need to be discreet and unique – without overlap. This is an ongoing issue, there are several basins with overlapping GSAs
- http://www.water.ca.gov/groundwater/sgm/gsa_table.cfm

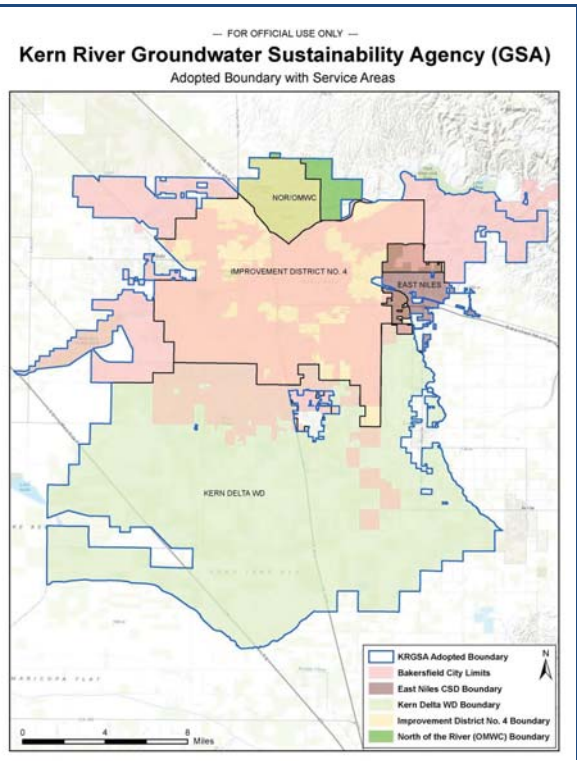
# Kern River GSA



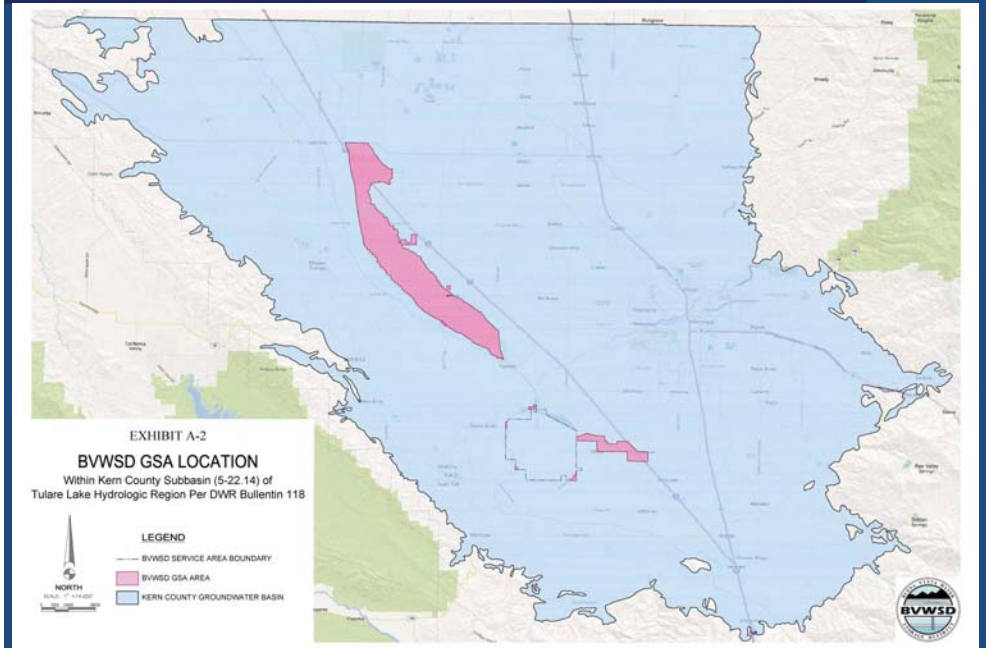
# Greenfield CWD GSA




# Kern River GSA




# Buena Vista WSD GSA




# KRGSA Status is Pending

| GSA Name | Basin Name | Basin Number | County(s) the GSA is Located | Date Notice Posted | Status or 90-day Period |
|---|---|---|---|---|---|
| County of Kern | Kern County | 5-22.14 | Kern | 06/17/2016 | Overlap |
| Greenfield County Water District | Kern County | 5-22.14 | Kern | 04/21/2016 | 07/20/2016 |
| Kern River Groundwater Sustainability Agency | Kern County | 5-22.14 | Kern | 04/21/2016 | 07/20/2016 |
| Buena Vista Water Storage District | Kern County | 5-22.14 | Kern | 03/10/2016 | Overlap |

## Groundwater Sustainability Plan

- Kern River GSA now poised to prepare a GSP for its GSA area
- SGMA requires that GSPs for critically overdrafted basins are developed by January 31, 2020.
- DWR recently published emergency regulations regarding the objectives and content of an acceptable GSP.

## GSP – Plan Contents

1. Administrative Information
2. Basin Setting
3. Sustainable Management Criteria
4. Monitoring Networks
5. Projects and Management Actions

## Importance of Coordinated Plan

- The GSP regulations focus on coordination and agreement across GSAs within a basin or subbasins.
- Kern River GSA will continue to meet with neighboring GSAs and interested parties to develop a coordinated plan within the overall basin.

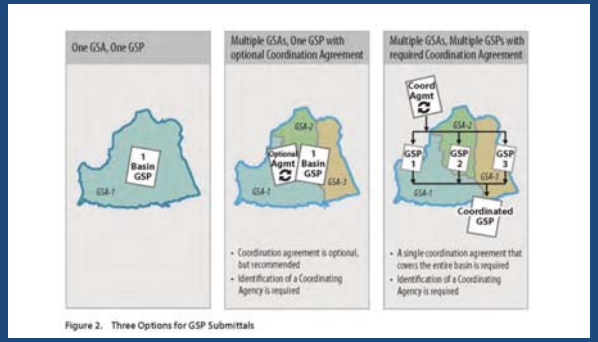


Figure 2. Three Options for GSP Submittals

GSP – Plan Contents

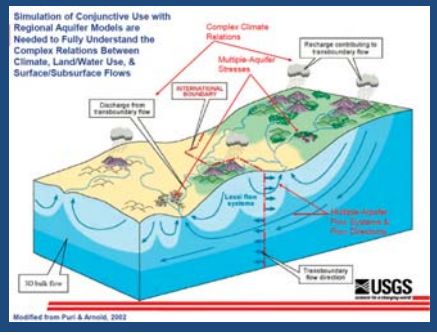
## 1. Administrative Information

- Introduction to Administrative Information
- Executive Summary + References
- Agency Information
- Description of Plan Area
- Notice and Communication

GSP – Plan Contents

## 2. Basin Setting

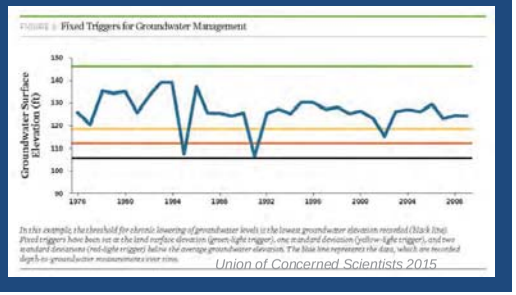
- ❑ Introduction
- ❑ Hydrologic Conceptual Model
- ❑ Groundwater Conditions
- ❑ Water Budget
- ❑ Management Areas




GSP – Plan Contents

## 3. Sustainable Management Criteria

- ❑ Introduction
- ❑ Sustainability Goal
- ❑ Undesirable Results
- ❑ Minimum Thresholds
- ❑ Measurable Objectives




Union of Concerned Scientists 2015

GSP – Plan Contents

## 4. Monitoring Networks

- ❑ Introduction
- ❑ Monitoring Network
- ❑ Representative Monitoring
- ❑ Assessment and Improvement
- ❑ Reporting to DWR

GSP – Plan Contents

## 5. Projects and Management Actions

- ❑ Introduction
- ❑ Projects and Management Actions

Groundwater Sustainability Plan

## Consultant Workplan

Two consultant teams

- Horizon / QK – program management, schedule tracking, plan development and review, community outreach and communication, DWR coordination
- Todd GW – technical groundwater analysis for plan development, lead author on technical plan components

Groundwater Sustainability Plan

## Tentative Schedule

| | Task | Start | End |
|---|---|---|---|
| 1 | Final GSP Regulations and Confirm Consultant Workplan | June 2016 | August 2016 |
| 2 | Basin Coordination | June 2016 | December 2019 |
| 3 | GSP: Peer Review Draft Chapters | July 2016 | October 2017 |
| 4 | GSP: Communication Plan | July 2016 | November 2016 |
| 5 | GSP: Projects and Management Actions | April 2018 | March 2019 |
| 6 | GSP: Plan Refinement and Finalization | April 2019 | July 2019 |
| 7 | GSP Approval and Submittal to DWR | September 2019 | December 2019 |
| 8 | General Program Communications and Meetings | June 2016 | January 2020 |

Groundwater Sustainability Plan

## Horizon Workplan

1. Confirm Workplan – develop GSP outline/approach based on final DWR GSP guidelines
2. Support Basin Coordination
3. Peer Review Draft GSP Sections
4. Communication and Outreach
5. GSP Projects and Management Actions
6. GSP Plan Refinement
7. GSP Plan Approval and DWR Submittal

Horizon Water and Environment

## Firm Description and Qualifications

- Interdisciplinary environmental consulting firm specializing in California water resources
- Public agency focus – water supply districts, flood control agencies, cities, counties, State agencies (DGS, DWR, CDFW, CDFA, CPUC)
- Planning documents - EIRs, river and watershed mgmt plans, gw mgmt plans, ws evaluations, O&M manuals, permit applications, GPUs, grant applications, CIP manuals, storwmwater mgmt plans, restoration and mitigation, monitoring plans, etc.

Horizon Water and Environment

## Ken Schwarz - Qualifications

- BA - UC Berkeley; MA/Ph.D. - UCLA
- 23 yrs. consulting experience
- Director at Philip Williams & Associates
- Principal at Jones & Stokes Associates
- Founded Horizon in 2008

Quad Knopf

## Firm Description and Qualifications

- 40-year presence in Central Valley
- Local Bakersfield Office
  - Planning
  - GIS
  - Engineering, survey, urban design, and biology
- Steve Esselman – local project manager with many years of Bakersfield experience

Horizon Water and Environment

## Ken Schwarz – Relevant Experience

- State Board Testimony on Kern River Flows
- Kern River Flow and Municipal Water Program EIR
- Kern River USACE Levee Inspection Compliance
- Expert Witness and Legal Proceedings Support
- Program Manager for SCWA, SJWC, SM County, CC County, SCVWD on past/current projects

Quad Knopf

## Firm Description and Qualifications

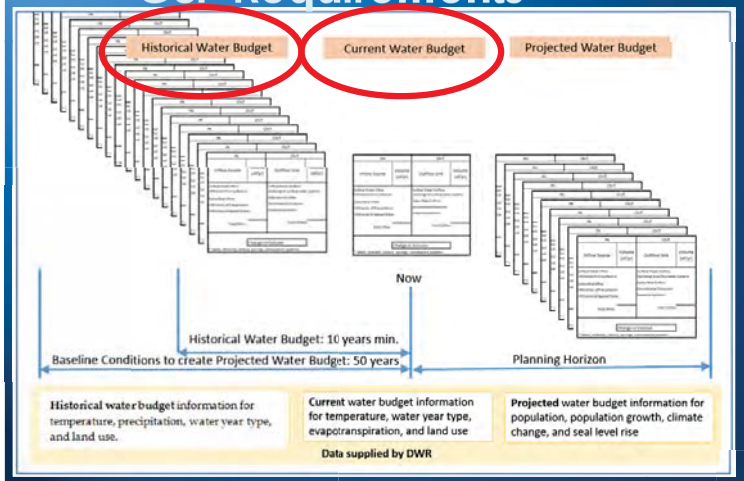
- Public outreach and coordination
- Strong knowledge of program area, communities, and local priorities
- Supported KRGSA application and notification
- Local research and spatial analysis
- QK staff live and work in Kern County, share a desire for a successful community outcome

# Questions

# Modeling Approach for GSP-Required Water Budgets

**KERN COUNTY GROUNDWATER SUBBASIN**

## GSP Requirements




Focus on Current and historical budgets first

Must cover entire subbasin!

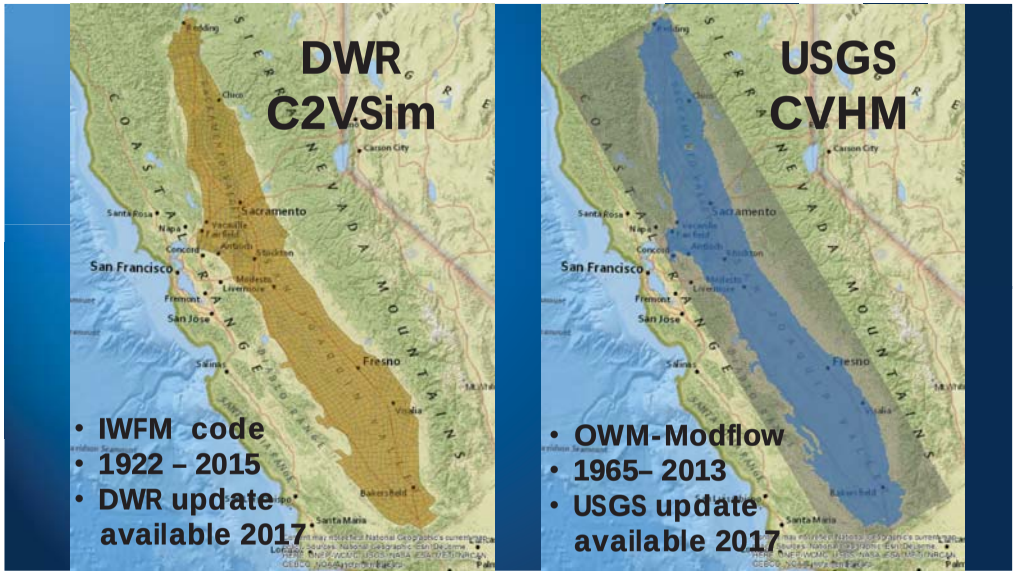
## KRGSA requested modeling approach to comply with GSP regulations

- Historical and Current Water Budgets
- Cover entire subbasin
- Quantify annual overdraft over average conditions
- Meet GSP deadlines
  - Model is not the end zone; water budgets are the **basis** for the plan and sustainability indicators
  - Lot to do AFTER model water budgets are available
  - Need a tool that is close to being DONE!

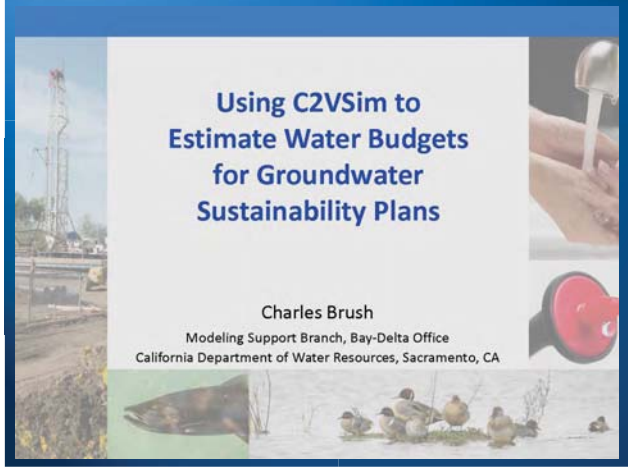
## Potential GSP Modeling Tools


- 2 Regional Models
- 3 Local Models
- Additional Agency local models
- More than one model may be beneficial for various GSP tasks
- Use the right tool for the job

Item 2




## DWR 2016 Presentation




- DWR Technical Assistance with C2VSim for GSPs
- §354.18(f) "The Department shall provide…C2VSIM… for use…in developing the water budget."

TODD GROUNDWATER

## Application to Water Budgets

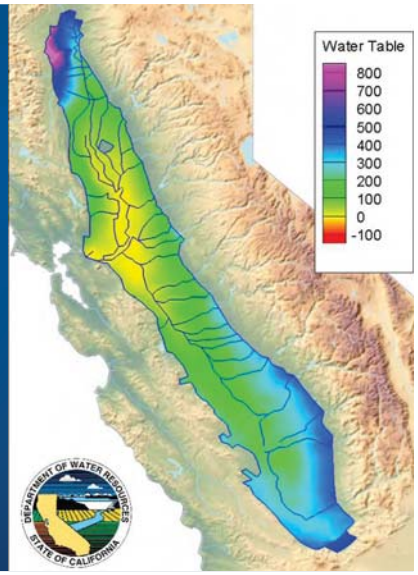
| Model | Advantages | Disadvantages |
|---|---|---|
| Local Models | • Hydrogeology<br>• Water Budgets<br>• Calibrations | • Don't cover entire subbasin<br>• Don't "talk" to each other<br>• Most not updated |
| CVHM | • Regional Model<br>• Hydrogeology | • Not yet updated<br>• No banking/recharge<br>• Calibration<br>• Lack of modeling tools |
| C2VSIM | • Regional Model<br>• Focus on Water Budgets<br>• Update in progress<br>• DWR-approved for SGMA | • Hydrogeology?<br>• Calibration?<br>• Improvements in progress |

GROUNDWATER

## C2VSim Model focus on Water Budgets

- DWR use for surface water and groundwater budgets
- Supports statewide applications for Bay-Delta office, CalSim 3, CWP
- Facilitate local zone budgets

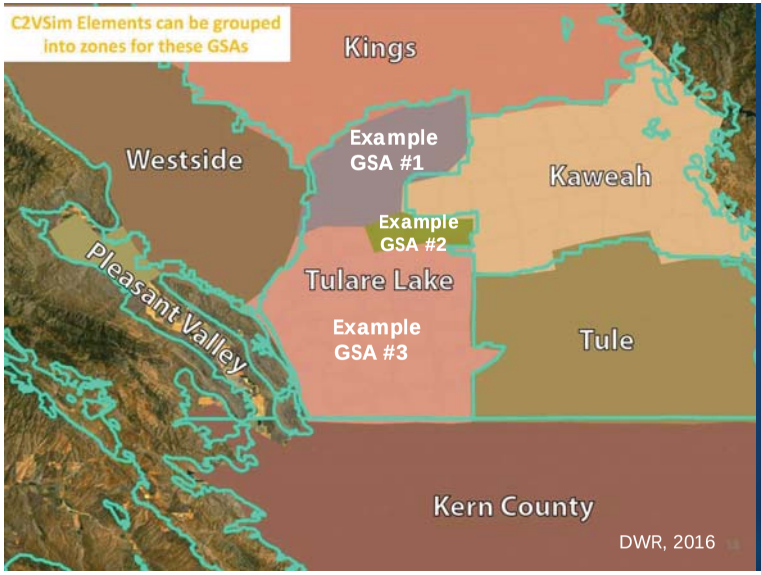
TODD GROUNDWATER




## C2VSim Regional Model

- Monthly streamflow, surface water diversions, precipitation, land use (crop acreages)
- Dynamically calculates crop water demands, allocates precipitation, soil moisture, and surface water
- Calculates groundwater demand
- 1922 – 2009 WY
- Calibrated 1976-2003 WY
- Update through 2015 in progress

TODD GROUNDWATER

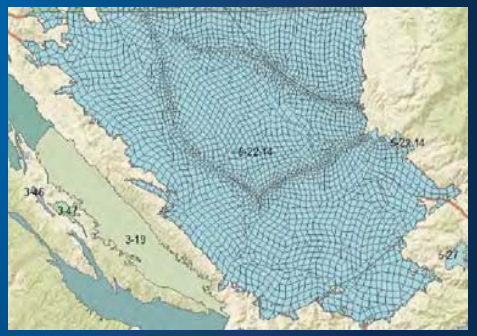



## Creating C2VSim Zones around Districts or GSAs

TODD GROUNDWATER

## Coarse-grid v. Fine-grid Model

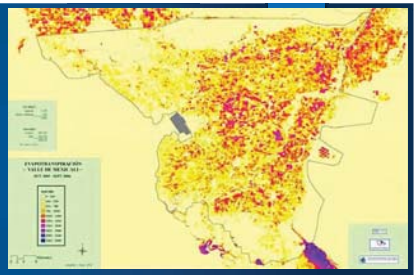
Average Element Area:
14.4 square miles



Average Element Area:
0.64 square miles

TODD GROUNDWATER

## Proposed C2VSim Revisions



- METRIC data from ITRC
  - Processing in progress
  - Final format? Monthly ET Zones? 20 years?
  - Acceptance of ET data?
  - ET zones v. crop coefficients
- Kern Fan Banking Operations
- Local GSA/District areas with accurate data

TODD GROUNDWATER

## Steps for Model Revision

- Get C2VSIM update inputs from DWR NOW
- Work with DWR on updated features in new model
- Review METRIC data and develop method for model input
- Parse model into zone budgets matching GSA/District boundaries
- GSAs provide input for water budget modifications in local area
- Update banking operations
- Revise C2VSim – use fine-grid if available; coarse-grid if not; update to fine-grid when available.
- Develop current and historical water budgets for the entire subbasin
- GSAs can use local models or regional model for analyzing projects
- Hydrogeologic Conceptual Models from the GSPs can be used for recommendations of future model improvements

## GSP Modeling Approach Advantages

- C2VSIM developed by DWR for water budgets
- Sanctioned by DWR and incorporated into GSP regulations
- Existing tool
- Covers entire subbasin
- Update and improvements available
- Relatively straightforward to check and revise local Agency data

## Criteria for Historical Water Budget Time Period

- Sufficiently long to approximate average hydrologic conditions (Kern River, precipitation)
- Recent time periods - current operations, widely-available and higher-quality data
- Initial conditions of stable (low) water levels
- Proposed:
  - Current water budget – WY 2015
  - Historical water budget – WY 1995 – WY 2014
  - Kern Fan Banking – back through WY 1978
- Also compile data through WY 2016

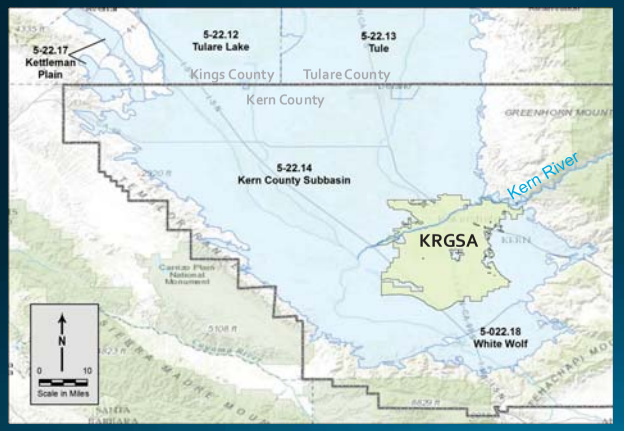
## Discussion

Kern River Groundwater Sustainability Agency (KRGSA)

# Groundwater Supply Workshop
# Groundwater Sustainability Plan (GSP)

July 13, 2017

## KRGSA and Groundwater Basins




- Located in Kern County Subbasin
- DWR critically-overdrafted basin
- KRGSA
  - 357 square miles
  - Kern River

## Workshop Presentation

- KRGSA Formation
- Contents of a Groundwater Sustainability Plan (GSP)
- Sustainability Criteria
- KRGSA Planning Area
- Request for information on groundwater supply and demand
- Schedule

## GSAs in Kern County Subbasin


- GSAs cover entire subbasin
- KRGSA Exclusive GSA December 2016
- Others recently formed

Exclusive GSA

GSA Notice Submitted

Item 3

# GSAs in Kern County Subbasin


- GSAs must form ***Groundwater Sustainability Plans (GSP)*** by 2020
- Achieve sustainability by 2040

Exclusive GSA

GSA Notice Submitted

# Sustainability Indicators

- Chronic lowering of water levels
- Depletion of groundwater in storage
- Degradation of groundwater quality
- Land subsidence from groundwater pumping
- Depletion of interconnected surface water affecting beneficial uses

An indicator is an undesirable result if determined to be "significant and unreasonable"

# What is in a Groundwater GSP?

Data Compilation / Data Management System

Institutional Setting – Water Supply / Plan Area

Workshop

Hydrogeologic Conceptual Model / Groundwater

Water Budget (Current and Historical)

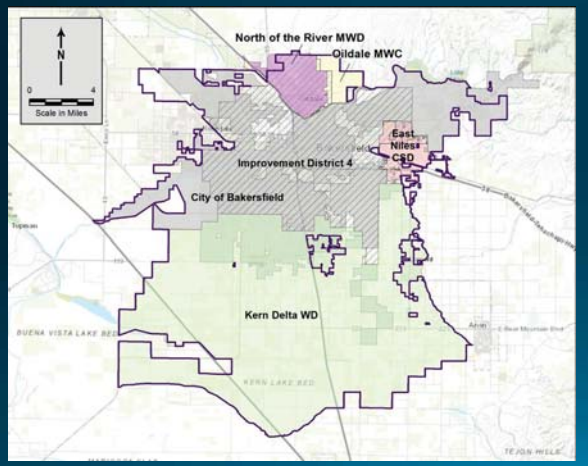
Sustainability Goals and Criteria

Management Scenarios Projected Water Budget

Monitoring Networks

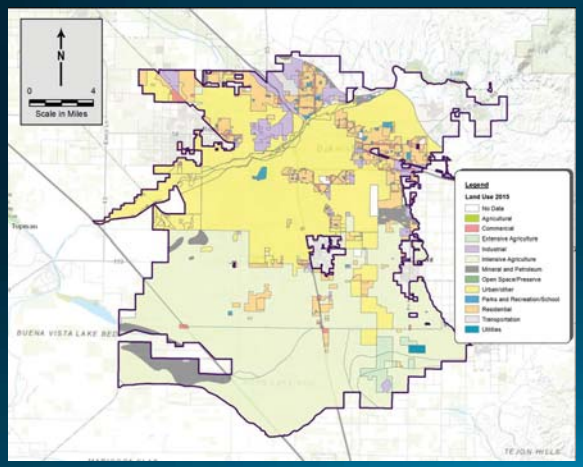
Plan Development

# KRGSA and Member Agencies



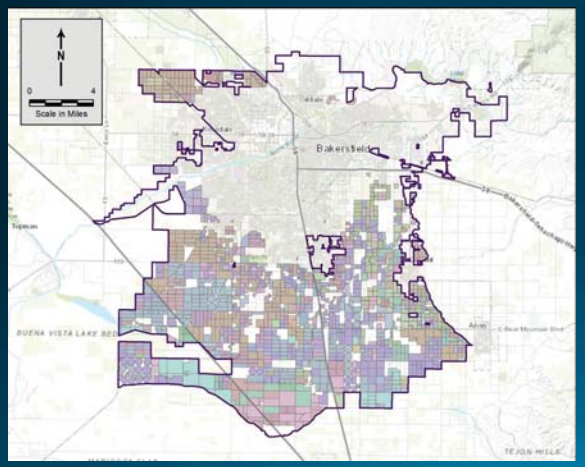

- BOARD/MANAGEMENT:
  - City of Bakersfield
  - Kern County Water Agency, Improvement District 4 (ID4)
  - Kern Delta Water District
- PARTICIPATING AGENCIES:
  - East Niles Community Services District (CSD)
  - North of the River Municipal Water District (MWD) / Oildale Mutual Water Company (MWC)
  - CA Water Service Company
  - Vaughn Water Company

## Land Use



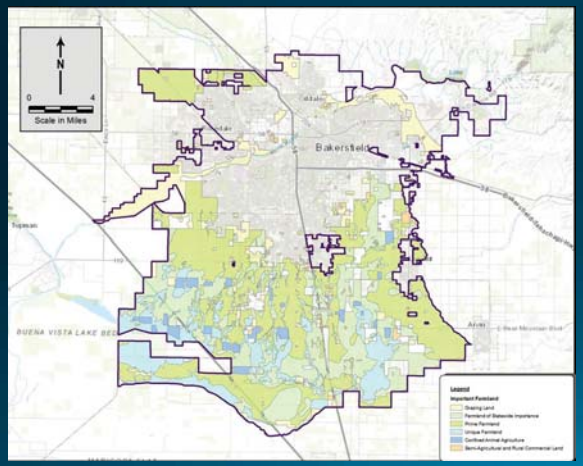

- Mix of Land Uses
- Large urban center
- Residential and industrial
- Large agricultural area
- Some petroleum resources

## Agricultural Crops



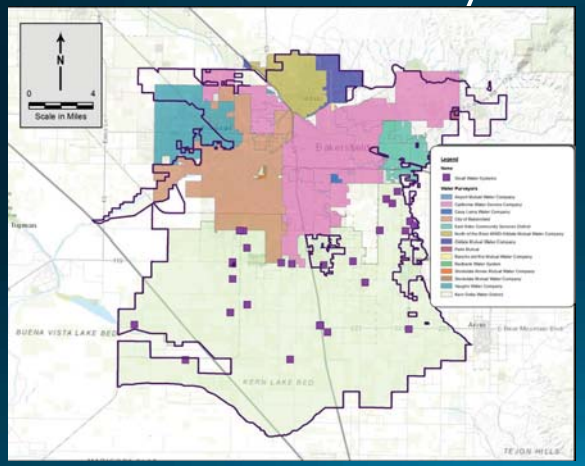

- Mix of agricultural crops
- Increasing permanent crops

## Farmland of State Importance



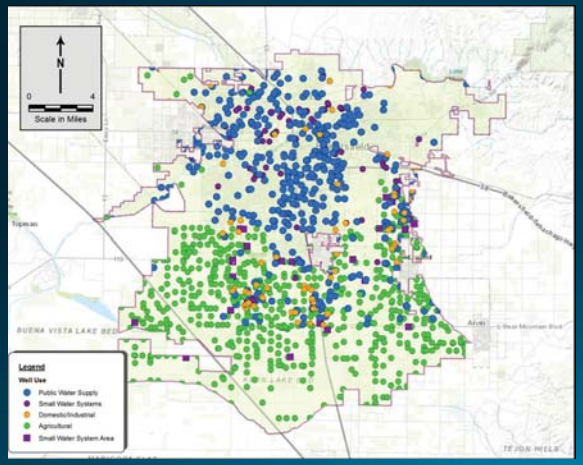

- Prime and unique Farmland
- Some Grazing Lands
- Dairies

## Local Water Purveyors



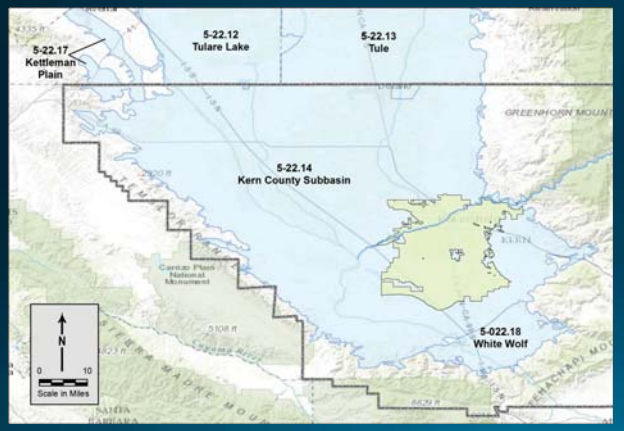

- 46 water suppliers in the KRGSA
- Includes 32+ small water systems
- Most of these systems rely on groundwater for part of supply

# Active Wells in the KRGSA >1,100



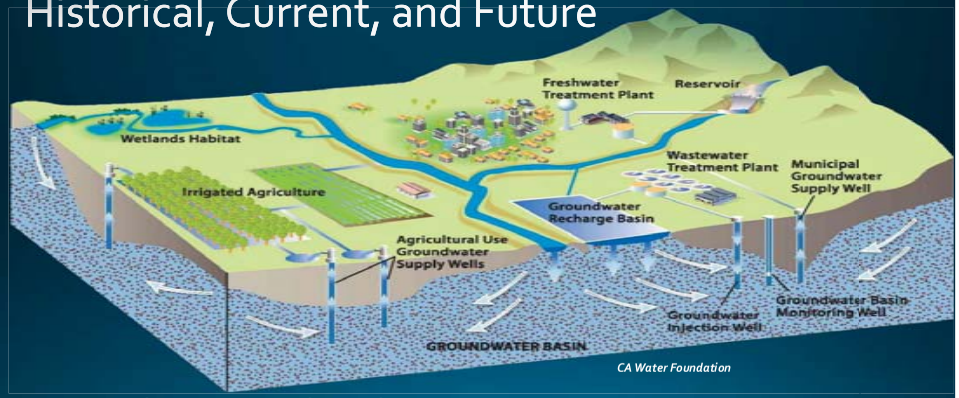

- 300+ municipal water supply wells
- 93+ small water system wells
- 106 domestic / industrial wells
- 642 agricultural wells
- GSP regulations require well identification and mapping

# GSP Basin-wide Water Budgets



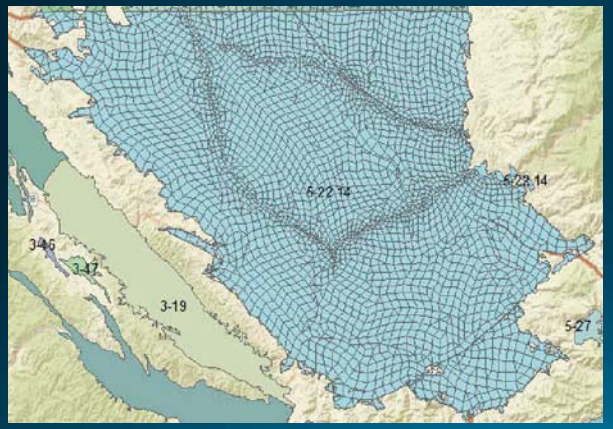

- Account for all inflows, outflows, and change in storage (groundwater and surface water)
- Current, Historical, and Projected water budgets
- Must cover the entire subbasin (>3,000 mi²)

# GSP Requires Detailed Water Budgets: Historical, Current, and Future




Tabulate inflows and outflows for the KRGSA groundwater system
Document surface water entering and leaving the GSA

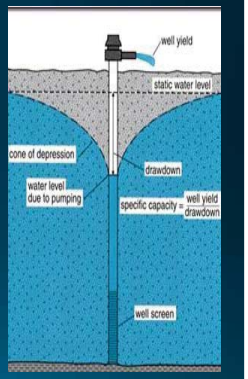
# DWR Basin-wide Groundwater Model




- C2VSim numerical computer model
- Regional model with incomplete local data
- Modify local water budgets for KRGSA in model
- Model Study Period: WY 1994 – WY 2015

# Well and Production Data Needed

- Wells
  - Number of wells and location (lat/long, coordinates)
  - Depth, screen interval, casing diameter and materials
  - Surface elevation / reference elevation
  - Capacity and use (active, standby, etc.)
  - Water use
- Monthly pumping (by well): October 1994 – Present
- If monthly data unavailable, will estimate from annual production
- Other water sources and use




TODD GROUNDWATER

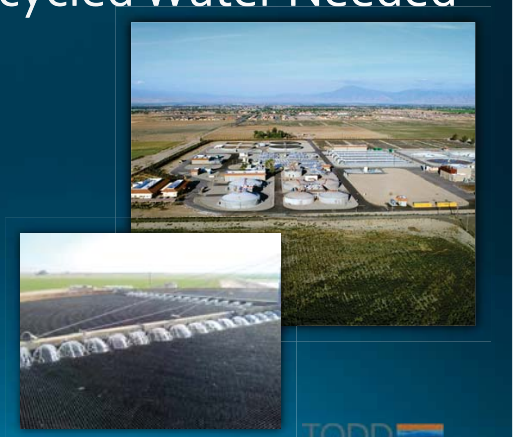
# Schedule


- GSP must be completed by 2020
- 2017
  - Describe Plan Area
  - Evaluate hydrogeology and groundwater conditions
  - Develop and analyze water budgets
  - Evaluate sustainability indicators for undesirable results
- 2018
  - Determine Sustainability Criteria
  - Identify and analyze management actions
  - Develop Plan
- 2019
  - Coordinate with other GSPs in the subbasin
  - Develop Monitoring networks
  - Prepare data for plan submittal to DWR

TODD GROUNDWATER

# Wastewater and Recycled Water Needed

- City of Bakersfield
  - WWTP #2 and #3
  - Recharge ponds
  - Irrigation with recycled water
- Kern Sanitation Authority
- NOR Sanitary District No. 1
- Kern County Service Area 71
- Septic systems – where?



TODD GROUNDWATER

# Get Involved

- GSP will contain information on the shared groundwater supply in the KRGSA
- GSP regulations require management and reporting of groundwater extractions
- Monthly Board meetings
- Quarterly information meetings

http://kernrivergsa.org

TODD GROUNDWATER

# Discussion and Questions

TODD GROUNDWATER

# Kern River Groundwater Sustainability Agency

**Public Meeting:**

**Introduction to the KRGSA and Developing a Groundwater Sustainability Plan**

**September 14, 2017**



## Meeting Agenda

- SGMA Overview
- KRGSA Background
- KRGSA Groundwater Sustainability Plan Overview
- GSP Components and Activities
- GSP Timeline
- How to Get Involved
- Feedback, Questions, and Comments



## SGMA Overview

- Requires Groundwater Sustainability Agencies to be formed in high or medium priority basins by June 2017
- GSAs are to develop a Groundwater Sustainability Plan (GSP).
- Basins can have a single GSP or multiple coordinated GSPs.
- Kern County GSP(s) due January 31, 2020.


Source: Department of Water Resources



## SGMA Key Steps and Timeline

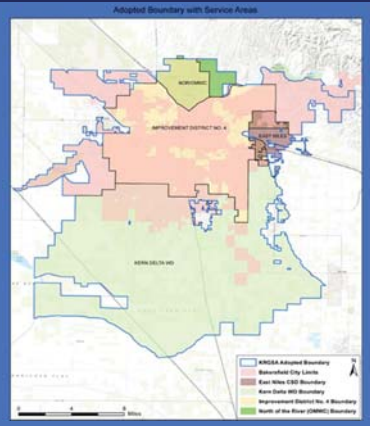
**Step One**
Local agencies must form Groundwater Sustainability Agencies by June 30, 2017

**Step Two**
Local GSAs must adopt a Groundwater Sustainability Plan (GSP) by Jan. 31, 2020.

**Step Three**
Once GSP is in place, local agencies must achieve sustainability by 2040.

Item 4

# Kern River Groundwater Sustainability Agency




Source: Kern River Groundwater Sustainability Agency

Core Agencies
- City of Bakersfield
- Kern County Water Agency Improvement District 4 (ID4)
- Kern Delta Water District (KDWD)

Participating Agencies
- East Niles Community Services District (CSD)
- North of the River Municipal Water District (MWD)/Oildale Mutual Water Company (MWC)
- California Water Service Co.
- Vaughn Water Company



# KRGSA and Kern County Subbasin

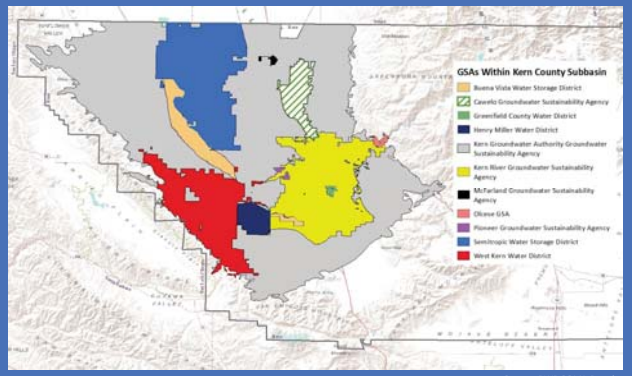

Source: Kern River Groundwater Sustainability Agency

- KRGSA located in the Kern County Subbasin
- Critically-overdrafted Basin
- KRGSA - 357 sq. mi.



# Coordination with other GSAs in Kern County Subbasin

Eleven GSAs Within Kern County Subbasin

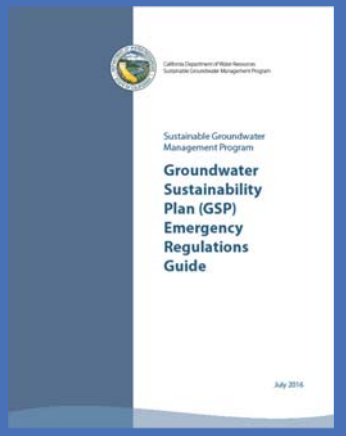



Source: DWR SGMA Portal



# GSP Requirements and Goals

- Manage groundwater without causing undesirable results.
- Don't adversely affect an adjacent basin.
- Describe basin-wide governance and coordination to reach sustainability.
- Establish timeline to fill data gaps.
- Use adaptive management.
- Achieve sustainability goal for basin by 2040.



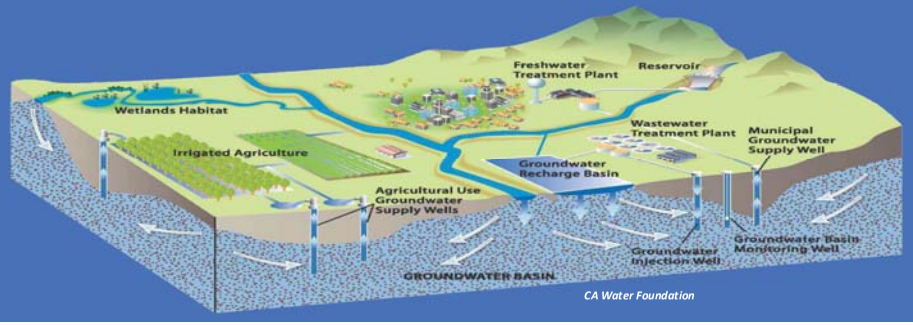
# Prevent Undesirable Results

- Chronic lowering of water levels.
- Depletion of groundwater.
- Degradation of groundwater quality.
- Land subsidence from groundwater pumping.
- Depletion of interconnected surface water affecting beneficial uses.



# Understanding the Basin

- GSP requires conceptual model/understanding of basin.
- GSP must describe basin water budget.
- GSP includes management actions to achieve sustainability.




*CA Water Foundation*



# Developing the GSP

Todd Groundwater is the technical consultant for the KRGSA, developing the groundwater analysis and modeling

1. Conduct Data Compilation/Management.
2. Establish Water Supply/Plan Area.
3. Develop a Hydrogeologic Conceptual Model and Conceptual Groundwater Budget.
4. Develop Water Budget for Current and Historic Conditions.
5. Establish Sustainability Goals and Criteria.
6. Establish Management Scenarios and Projected Water Budget for Future Conditions.
7. Actively Monitor Networks and GSP Development.

Kern County Groundwater Model

Source: Todd Groundwater

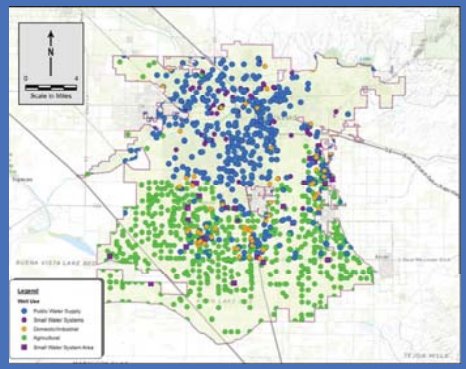


# Importance of Community Participation

Public Input is Essential:

- Data
- Feedback on GSP
- Feedback on potential management actions
- Implementation and monitoring
- Reflects community ideas and concerns

Active Wells in KRGSA Territory

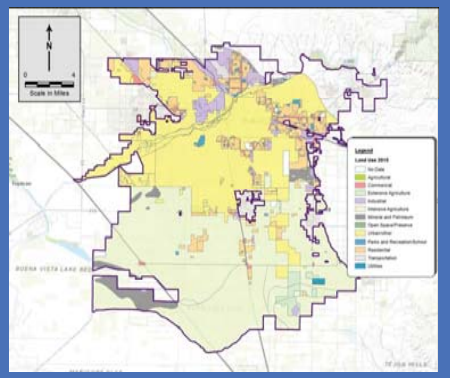


Source: Todd Groundwater

# Stakeholders and Community Participation

- KRGSA to engage a broad range of stakeholders within the KRGSA and the Kern County Subbasin, prior to making any local decisions.
- Stakeholders (Interested Parties) include:
  - Water Providers
  - Public Agencies
  - Disadvantaged Communities
  - Environmental Groups
  - Agricultural Entities
  - Industrial Users
  - Other GSAs
  - Parties Requesting Contact
  - Any Other Beneficial Uses and Users

Land Uses Within KRGSA Territory



Source: Kern River Groundwater Sustainability Agency



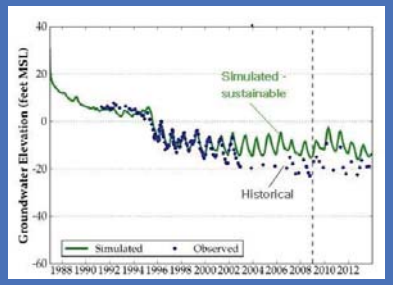
# KRGSA Timeline 2017-2020




# KRGSA Activities Moving Forward

- Continue GSP Development.
- Develop water budget to evaluate scenarios.
- Coordinate with other agencies in Kern County Subbasin.
- Conduct outreach to interested parties.
- Provide GSP status updates & meetings.
- Conduct targeted meetings and public workshops.

Simulated Sustainable Groundwater Model




Source: Todd Groundwater



# How to Get Involved

- Tracking on Website
- Quarterly Public Meetings and Workshops
- Monthly Board Meetings
- Upcoming Targeted Meetings
- Request a Meeting with KRGSA Staff
- Sign Up Sheet (to be added to contact list)

http://kernrivergsa.org


Source: Kern River Groundwater Sustainability Agency

# Feedback and Questions

Source: Kern River Groundwater Sustainability Agency



# Thank you!

Please contact us with any questions or concerns.

For more information, please visit our website at:

http://kernrivergsa.org

Phone: (661) 326-3767

Email: krgsa@kernrivergsa.org

Kern River Groundwater Sustainability Agency (KRGSA)

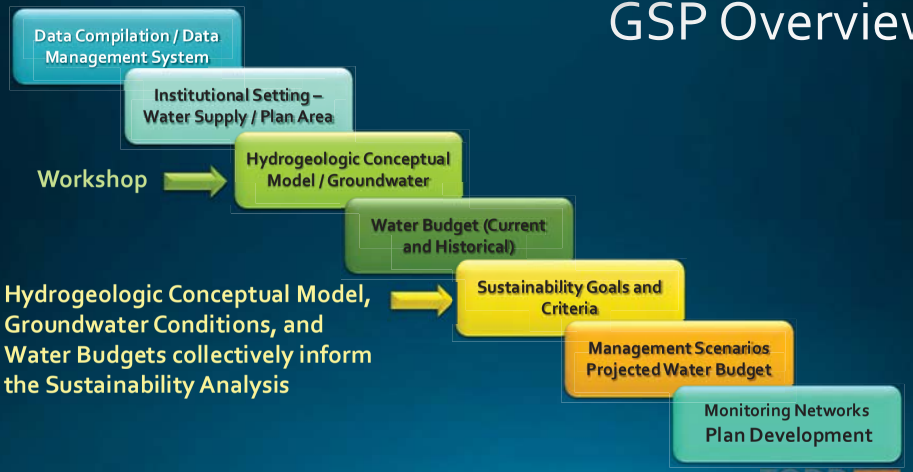
# Hydrogeologic Conceptual Model and Groundwater Conditions

## Groundwater Sustainability Plan (GSP)

April 5, 2018

TODD GROUNDWATER

# GSP Overview

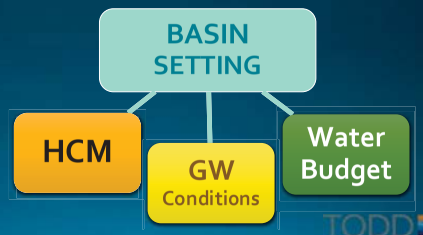



DRAFT

TODD GROUNDWATER

# Workshop Presentation

- Groundwater Sustainability Plan (GSP) Requirements
- Hydrogeologic Conceptual Model (HCM)
- Groundwater Conditions
- Next Steps




DRAFT

TODD GROUNDWATER

# Hydrogeologic Conceptual Model Regulatory Requirements

***What does the groundwater basin look like?***

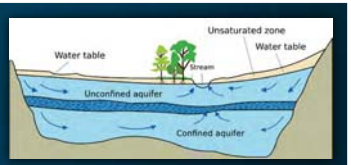
- Physical Setting
  - Topography
  - Geologic and structural setting
  - Surface geology, soils
  - Hydrology
- Groundwater Basin and Aquifers
  - Basin geometry, lateral boundaries and bottom
  - Principal aquifers and aquitards and properties
  - Stratigraphic and structural changes

DRAFT

TODD GROUNDWATER

Item 5

# Groundwater Conditions Regulatory Requirements

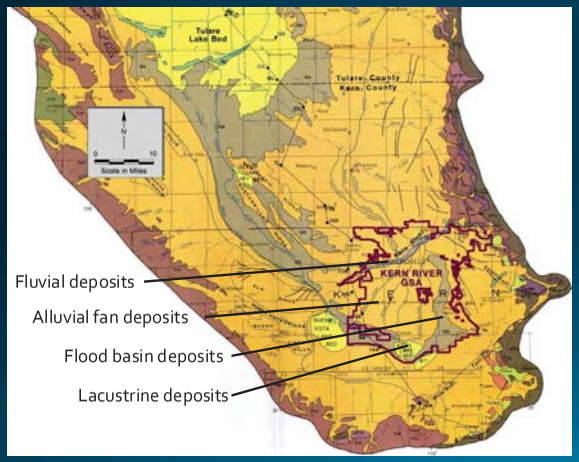



***What are the current and historical groundwater conditions?***

- Hydrographs (changes in groundwater levels over time)
- Groundwater elevation contour maps
- Changes in groundwater in storage (between seasonal highs)
- Groundwater quality
- Land subsidence
- Groundwater Dependent Ecosystems (if applicable)

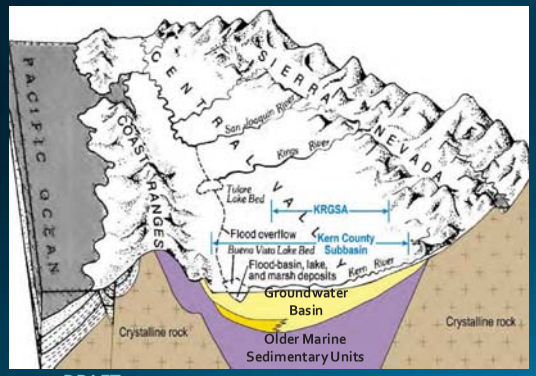
DRAFT

# Regional Geology and Depositional Environments




- Coarse-grain fluvial deposits along the Kern River in the KRGSA
- Coarse-grain alluvial fan
- Fine-grain flood basin deposits along fan edges
- Fine-grain lacustrine deposits in the old lake beds

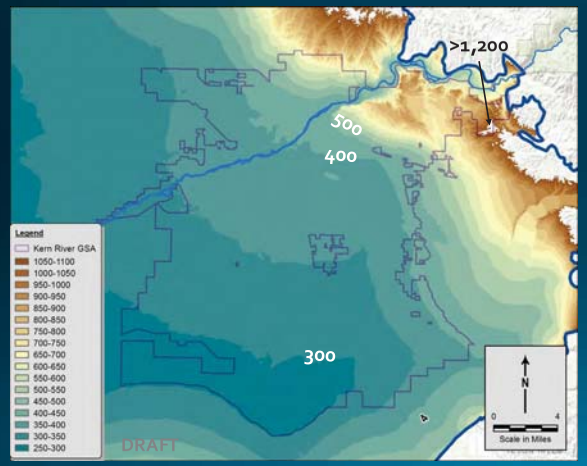
# Conceptual Hydrogeologic Setting Kern County Subbasin




- Alluvial-filled trough between the Sierra Nevada and Coast Ranges
- Underlain by older marine sedimentary units
- Flanked by crystalline bedrock

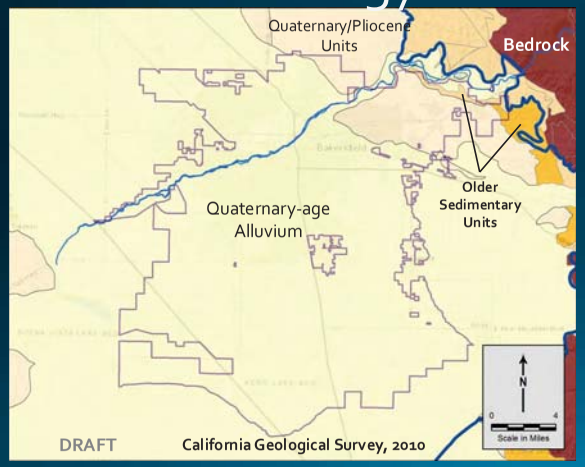
DRAFT

# Ground Surface Elevations - KRGSA



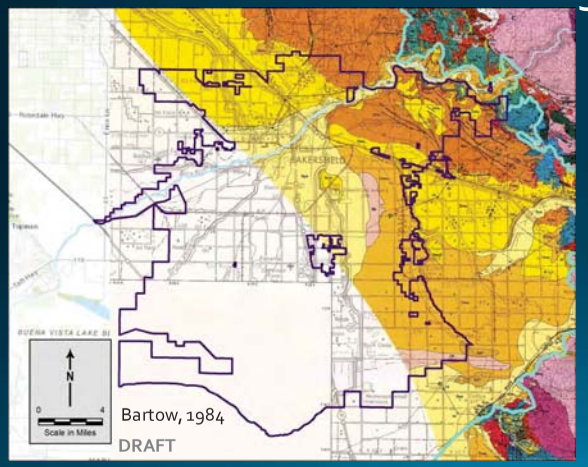

- Ground surface elevations vary >900 feet over the KRGSA
- Highest elevation in the northeast > 1,200 ft msl
- Lowest elevation in the south of about 280 ft msl
- Most of the KRGSA between 300 ft msl and 400 ft msl

# Surface Geology – Statewide Maps



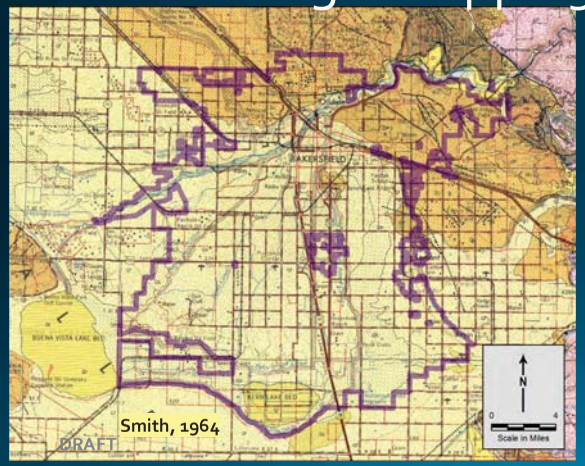

- KRGSA mostly overlain by Quaternary age alluvial deposits
- Rimmed by older units on the northwest in upper surface elevations
- Quaternary- and Pliocene-age units begin around 500 feet msl
- Miocene units at higher elevations (above about 800 ft msl)

# Additional USGS Geology Map



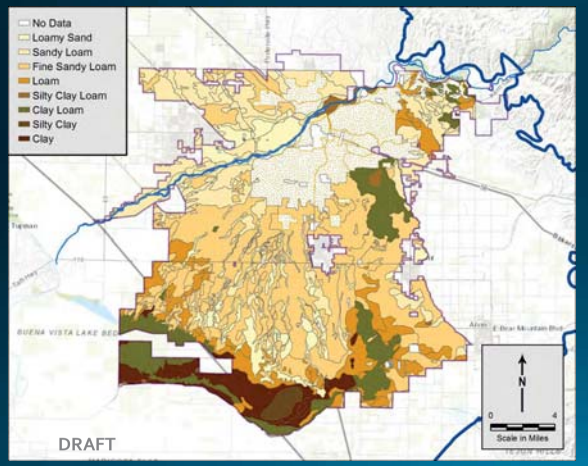

- Additional compilation and modifications provided by USGS, 1984
- Focus on the Tertiary geology
- General agreement with other maps with additional modifications

# Local Geologic Mapping



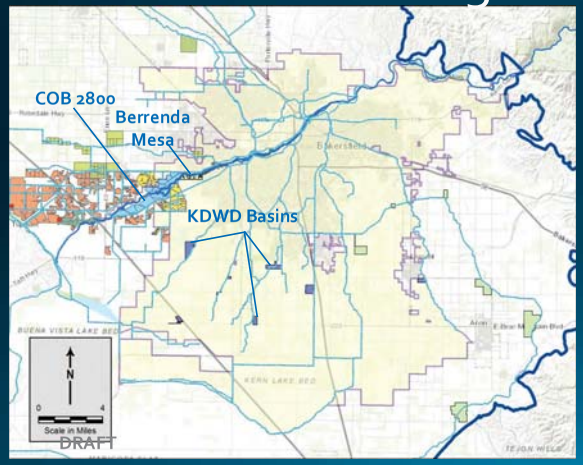

- Older local geologic maps provide more detail in the northeast
- Local maps for the Bakersfield Quadrangle compiled by Division of Mines and Geology 1964
- Contain structural information required by GSP regulations such as geologic faults and folds

# Soil Textures



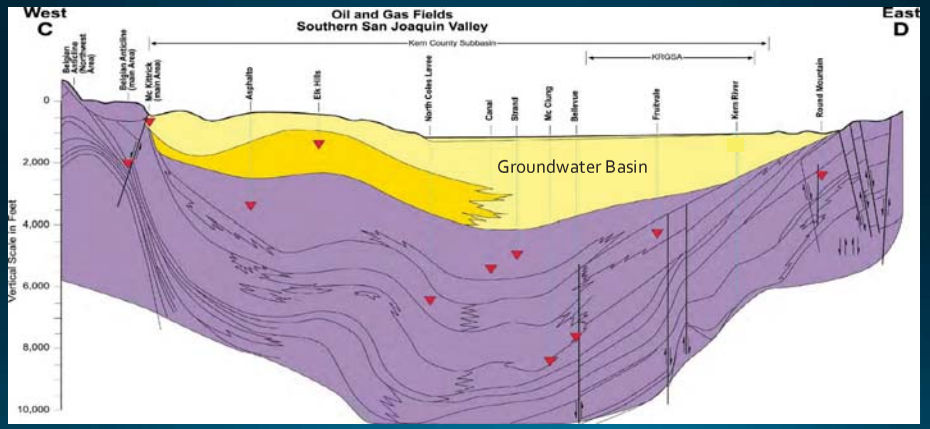

- More permeable textures indicated by lighter colors (white, yellow, light orange)
- Lower permeability textures indicated by dark orange, green and brown
- Soil textures agree well with geologic framework

# Canals and Recharge Basins



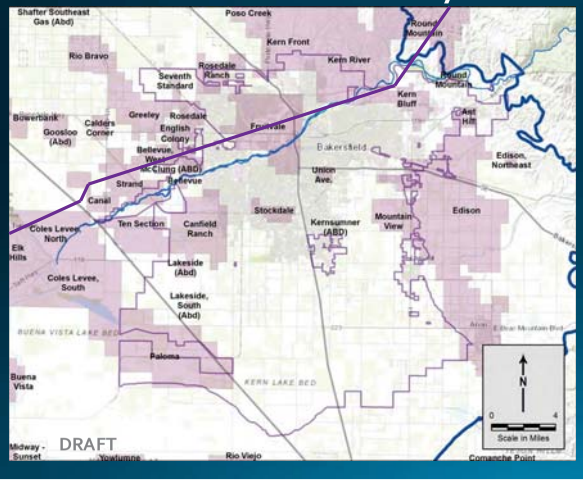

- Managed recharge in river channel, unlined canals, and basins
- KRGSA groundwater banking projects:
  - COB 2800 Acres
  - KCWA Berrenda Mesa
  - KDWD Metropolitan Project
- Numerous additional banking projects nearby

# Regional Cross Section and Oil Fields



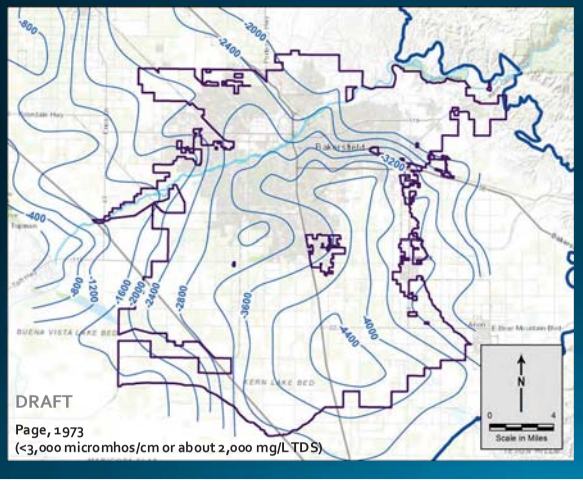

DRAFT

# Oilfields in Vicinity of KRGSA



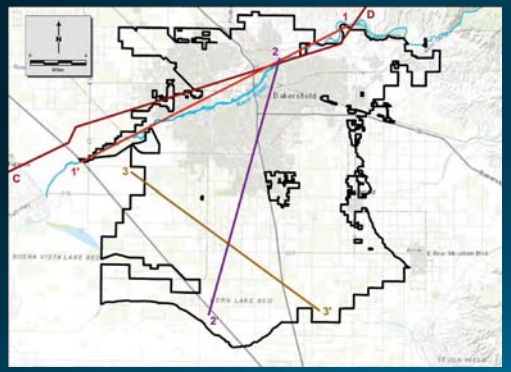

- KRGSA underlain by numerous oilfields at depth
- Cross section through northern GSA illustrates relationship to the groundwater basin

# Basin Bottom – Base of Fresh Water




- USGS mapped the base of fresh water in 1973
- Provide depths to define the groundwater basin bottom
- Operationally, the basin is limited by elevated metals and other constituents at depth (almost all wells <1,100 feet deep)

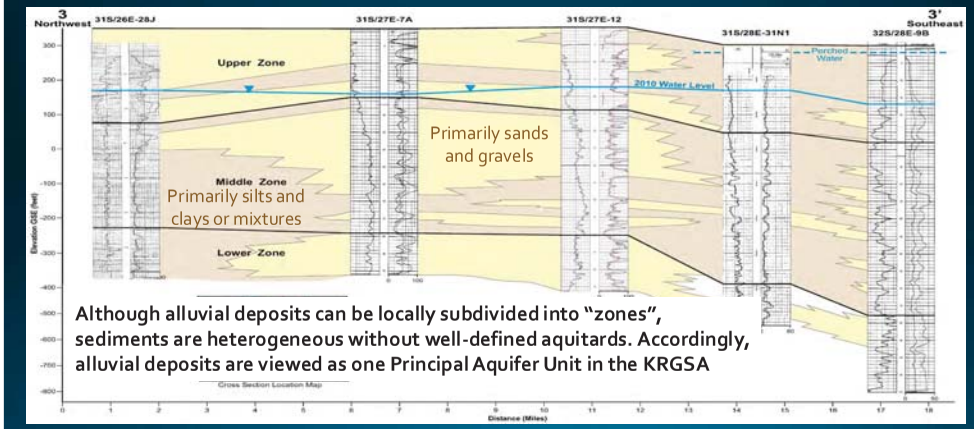
# Cross Section Location Map



- Numerous working cross sections developed across KRGSA
- Illustrate principal aquifer and subsurface textures
- Developed using geophysical logs at large scale; reduced for convenience in report

DRAFT

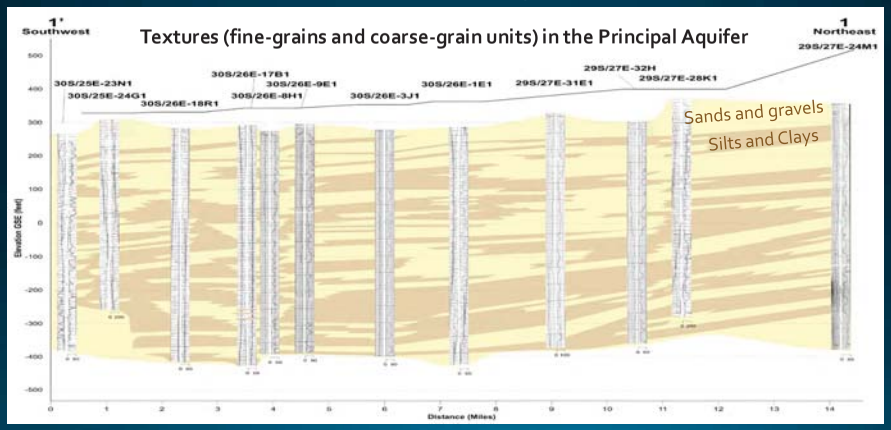
# 19-mile Cross Section in southern KRGSA




Although alluvial deposits can be locally subdivided into "zones", sediments are heterogeneous without well-defined aquitards. Accordingly, alluvial deposits are viewed as one Principal Aquifer Unit in the KRGSA

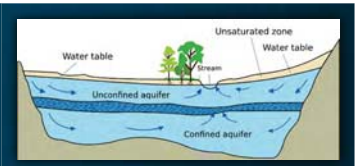
DRAFT

# 15-mile Cross Section along the Kern River




DRAFT

# Groundwater Conditions Regulatory Requirements

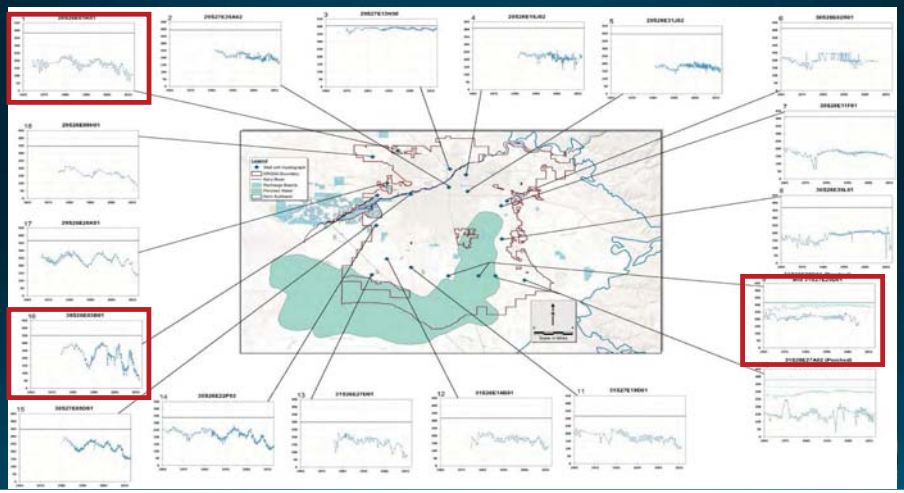



***What are the current and historical groundwater conditions?***

- Hydrographs (changes in groundwater levels over time)
- Groundwater Elevation Contour Maps
- Changes in groundwater in storage (between seasonal highs)
- Groundwater quality
- Land subsidence
- Groundwater Dependent Ecosystems

DRAFT

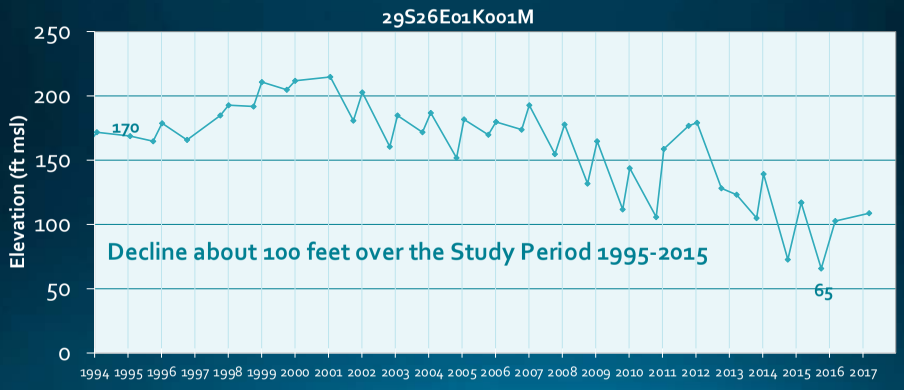
# KRGSA Water Level Hydrographs 1965-2017



# Western KRGSA (Banking Area)

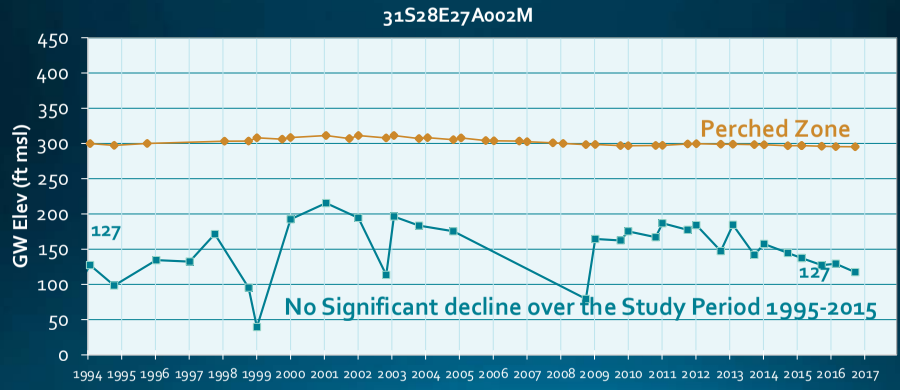

DRAFT

# Northern Border KRGSA



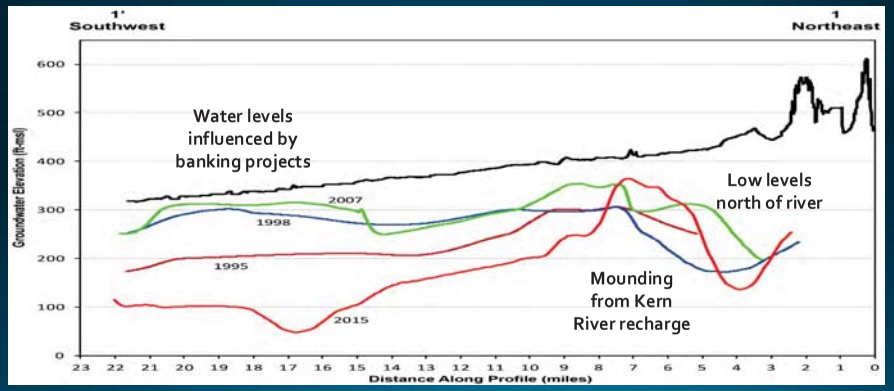

DRAFT

# Southeastern KRGSA



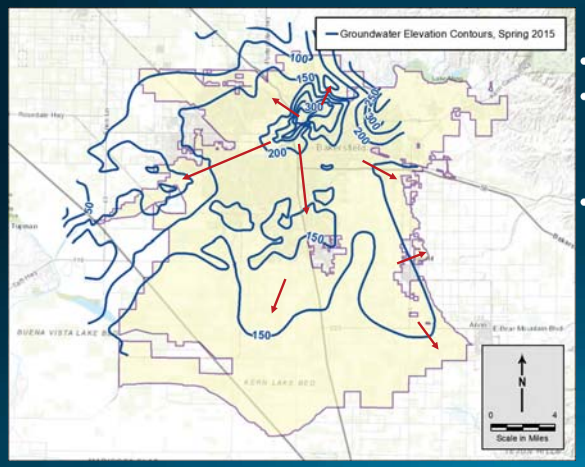

DRAFT

## Hydrologic Profiles beneath the Kern River



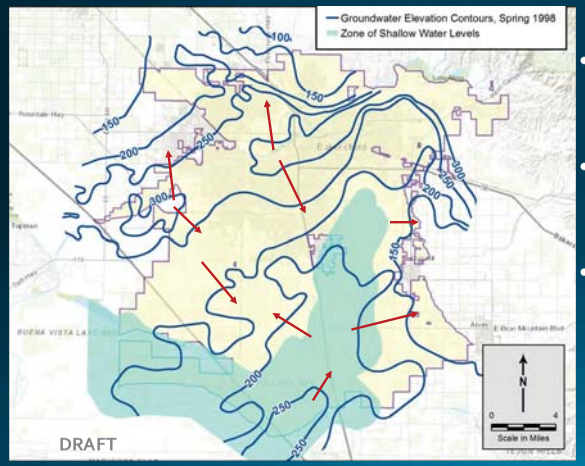

DRAFT

## Groundwater Elevation Contours 2015




- Severe Drought year
- In general, higher water levels than surrounding areas
- Except for the river, groundwater is flowing out of the KRGSA

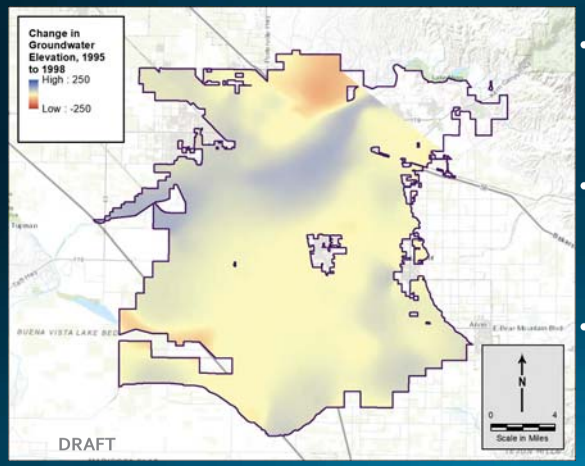
## Groundwater Elevation Contours 1998




DRAFT

- 20 groundwater elevation contour maps (Spring data)
- Examined maps and data for perched layers (zone of shallow water levels)
- Example for wet year - Spring 1998

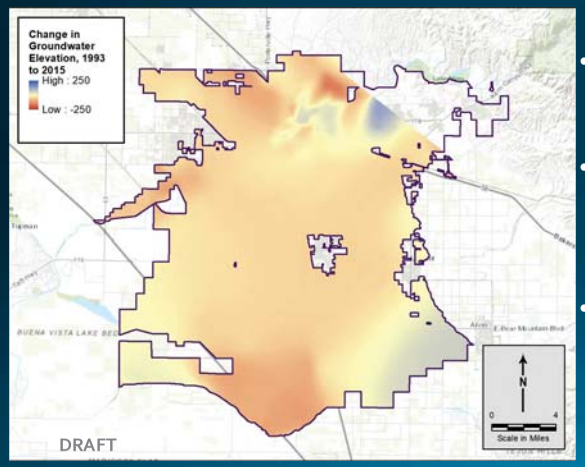
## Change in Groundwater in Storage, 1995 to 1998




DRAFT

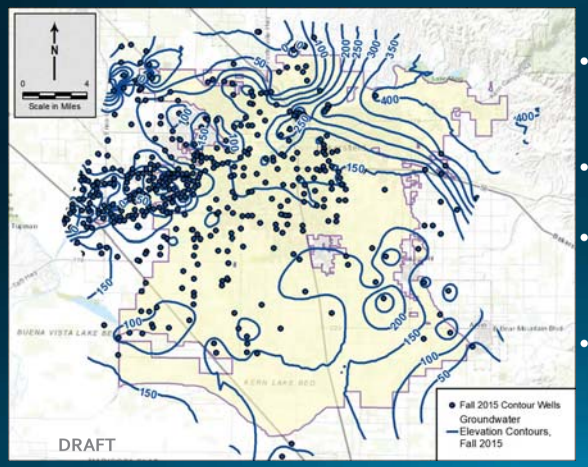
- Created 20 annual water levels change maps using KCWA Spring water level contour maps
- Blues areas indicate water level rise; red areas indicate water level declines
- Limited data create uncertainty for some areas and time periods

## Change in Groundwater in Storage, 1993 to 2015



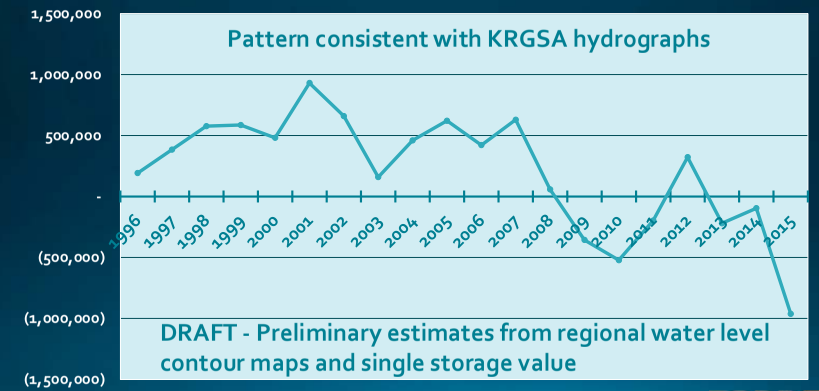

- Change in water levels over the entire study period
- Impacts of the recent drought result in water level declines over most of the KRGSA
- Some areas of uncertainty due to limited data

## Minimum Groundwater Elevation Contours, Fall 2015



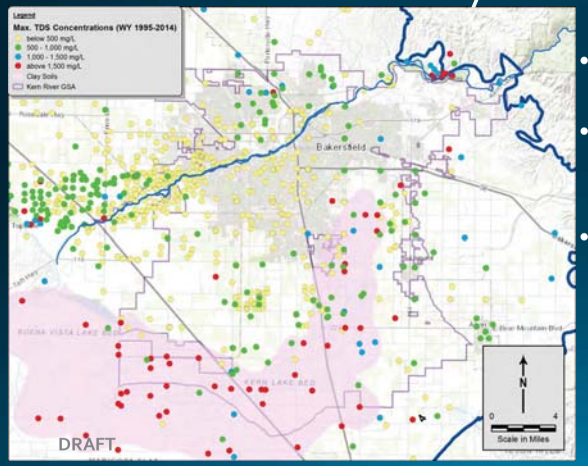

- Generated a groundwater elevation contour map for Fall 2015
- Represents minimum water levels in KRGSA
- Potential application to sustainability analysis and criteria
- Subsidence and other(?) undesirable results

## Cumulative Change in Storage from Annual Spring Water Level Contour Maps



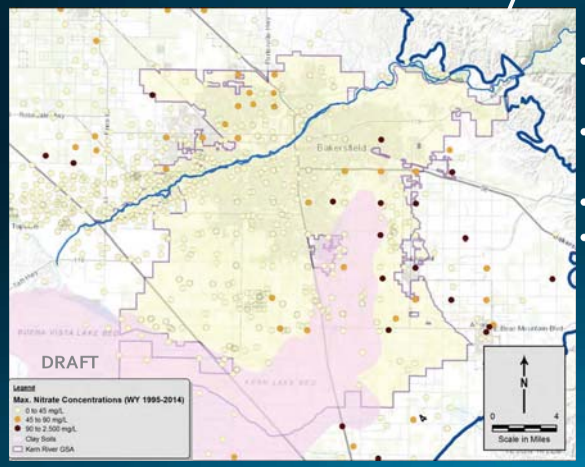

DRAFT

## Groundwater Quality - Distribution of TDS



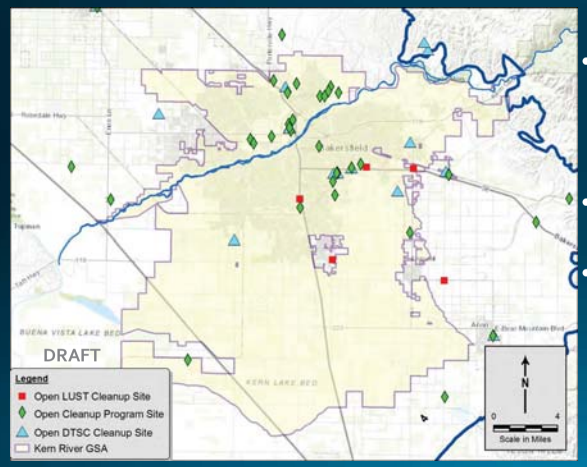

- Water quality database 1995 – 2014
- Total Dissolved Solids (TDS) below 1,000 mg/L over most of the KRGSA
- Elevated TDS values associated with clay-rich sediments and areas of perched groundwater

# Groundwater Quality – Nitrate ($NO_3$)



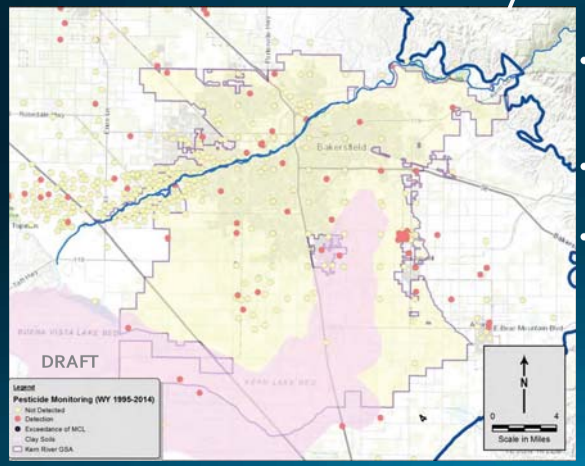

- Most of the area has concentrations below MCL
- Localized areas of elevated nitrate exceeding the MCL
- Areas of limited data
- Additional water quality data from Cal Water

# Groundwater Quality – Environmental Cleanup Sites



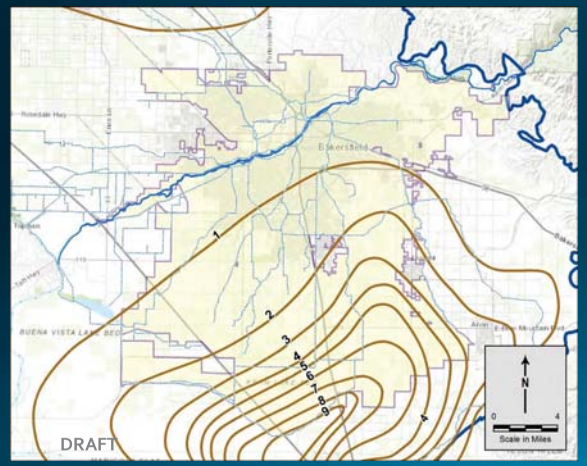

- Environmental Cleanup sites under the regulation of the Central Valley Water Board
- Data available from GeoTracker (state website)
- Only active (open) sites are included

# Groundwater Quality - Pesticides



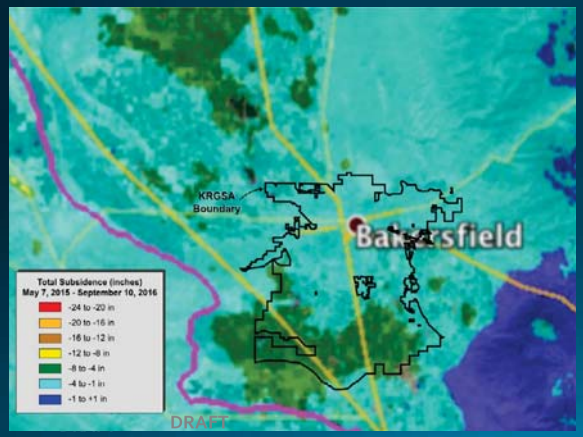

- Localized areas of pesticides detected in groundwater
- No concentrations exceeding MCLs
- Additional water quality data available from Cal Water

# KRGSA Historical Subsidence 1926-1970




- Historical subsidence mapped by USGS (in feet)
- Associated with clay sediments in the southern portion of the KRGSA

# Recent Subsidence 2015 - 2016

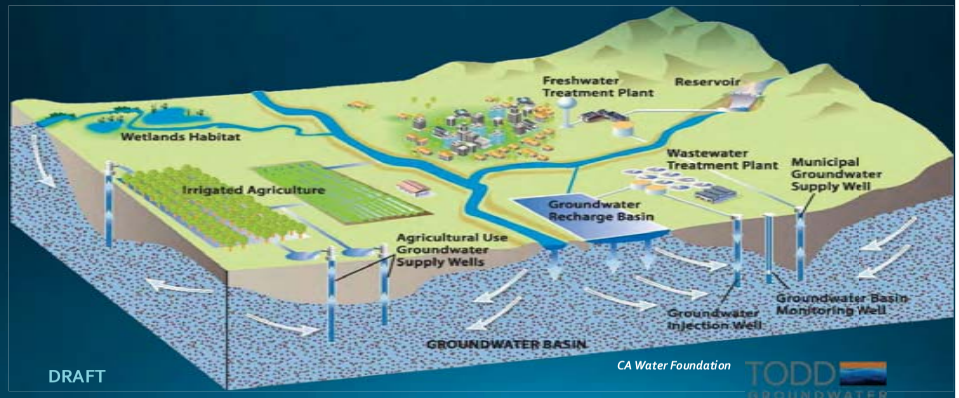



- Analyzed by Jet Propulsion Laboratory
- 4 to 8 inches of recent subsidence indicated in the southern KRGSA.

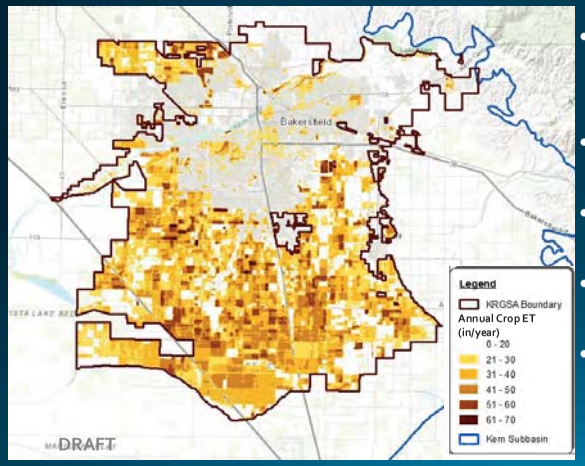
# Incorporate KRGSA data into the Basin-wide Groundwater Model


- Received early release of C2VSim model
- Model runs successfully; working on pre-processing
- Involving former DWR modeler who built the current version as a subconsultant
- On-call advisor to expedite schedule

# Next Step – Finalize KRGSA Water Budget




# METRIC Data Processing




- 240 METRIC maps covering the entire Kern Subbasin
- ET data for each 30m x 30m pixel (1/4 acre)
- More than 800,000 pixels in KRGSA
- Processing to limit data to agricultural areas
- Reconcile with water budgets

# Discussion and Questions

TODD GROUNDWATER

Item 6

# SGMA Discussion Meeting

July 17, 2018

| Name | Company | Email |
|---|---|---|
| WYATT SHIPLEY | VAQUERO ENERGY | WSHIPLEY@VAQUEROENERGY.COM |
| Mark Yarlot | Hathaway LLC | myarbt@hathawayllc.com |
| David Chapin | Aera Energy LLC | dcchapin@aeraenergy.com |
| RANDY HORNE | NAFTEX | RHORNE@NAFTEX.COM |
| B Joe Ashley | CRC | joe.ashley@crc.com |
| Abby Auffant | Chevron | AmAuffant@chevron.com |
| Diana Martin | Chevron | martindp@kernrk.com |
| Jeff Johnson | Chevron | jojw@chevron.com |
| STEVE LEWIS | E+B | slewis@ebresources.com |
| Trent Rosenlieb | Berry | trosenlieb@bry.com |
| Christina Halley | Sentinel Peak Resources | challey@sentinelpeakresources.com |
| Tim Loukey | Macpherson | TLoukey@MacphersonEnergy.com |
| Christine Zimmerman | WSPA | christine@wspa.org |
| Willie Rivera | CIPA | willie@cipa.org |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

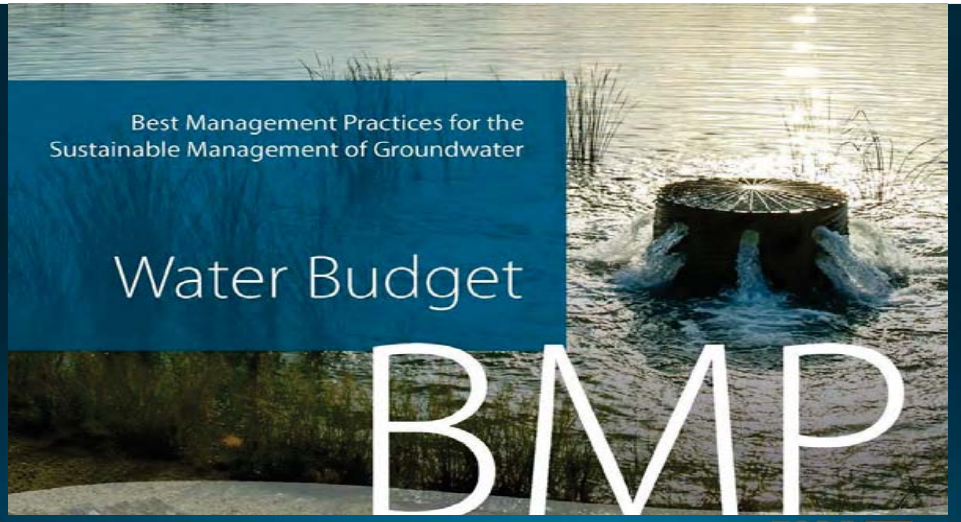
Kern River Groundwater Sustainability Agency (KRGSA)

DRAFT

# Water Budget Workshop
# KGA Coordination Committee Meeting

August 6, 2018

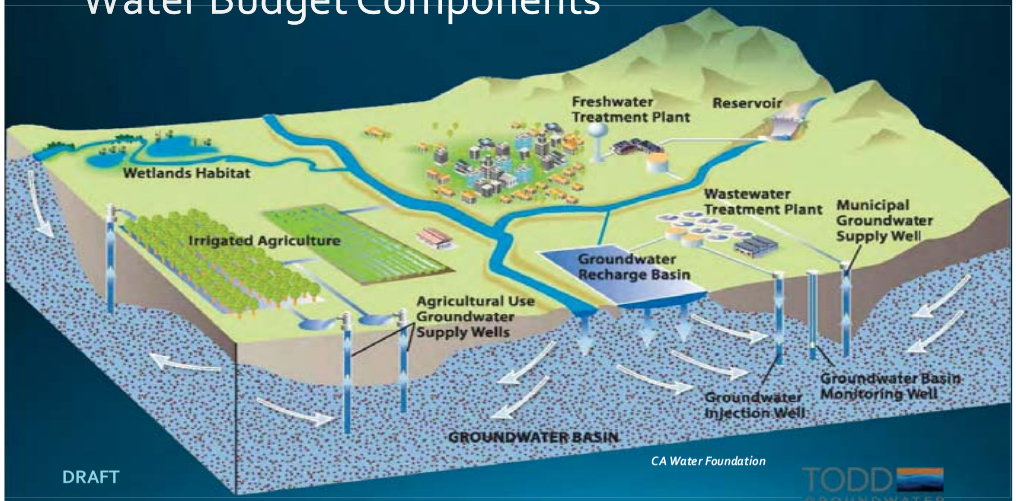
TODD GROUNDWATER




DRAFT

TODD GROUNDWATER

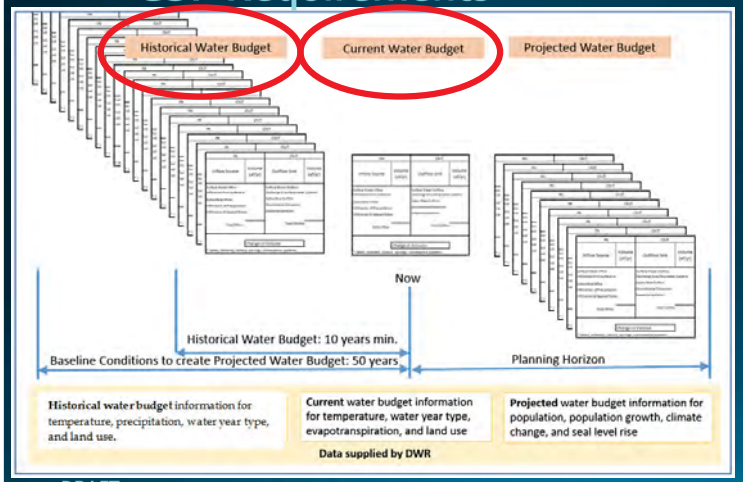
## Water Budget Components




DRAFT

TODD GROUNDWATER

## GSP Requirements



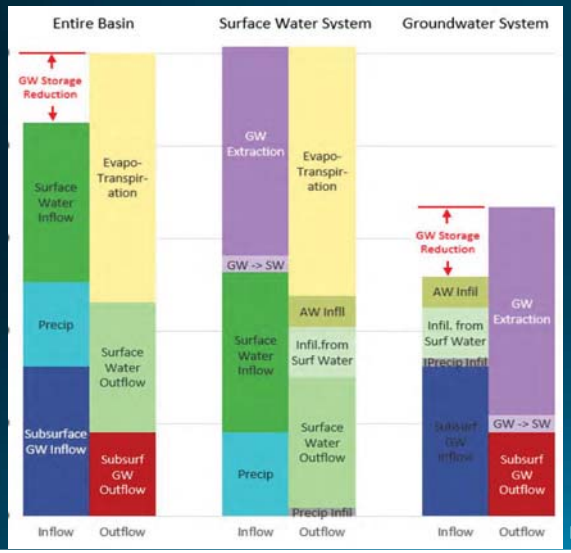

Focus on current and historical budgets first

Must cover entire subbasin

DRAFT

TODD GROUNDWATER

Item 7




## Water Budgets BMP Example

- Separate water budgets for groundwater and surface water
- Combine for GSA and Subbasin budgets
- Graphical representation required by regulations

DRAFT

## KRGSA Water Budgets - Approach

- Conduct analysis at the agency level
  - KCWA Improvement District No. 4 (ID4)
  - City of Bakersfield Water Resources
  - Kern Delta Water District
- Incorporate additional agencies/areas:
  - Cal Water, Greenfield County WD, East Niles CSD, NOR/OMWC, Berrenda Mesa, Rosedale Ranch ID, Vaughn MWC, Lamont CSD
- Combine for a KRGSA Water Budget
  - Groundwater and Surface Water
  - Document space and time
- How to handle "white areas" within KRGSA?


DRAFT

## KRGSA Water Budgets

**KRGSA Water Budgets – KRGSA GSP**

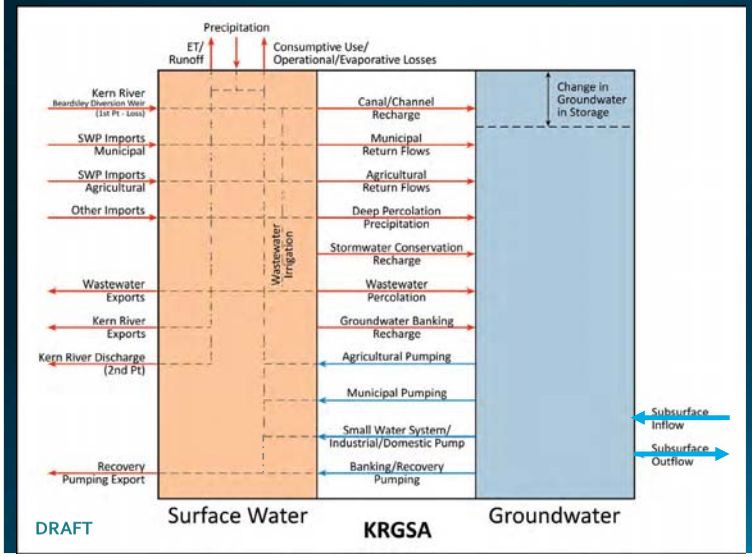
- Develop Water Budgets for KRGSA agencies (without subsurface inflows and outflows)
- Scale up to a KRGSA Water Budget for the GSP

**Subbasin Water Budgets – Groundwater Model**

- Incorporate water budgets into the Subbasin groundwater model
- Combine with other subbasin water budget data
- Use model for Subbasin Water Budget and subsurface inflows and outflows

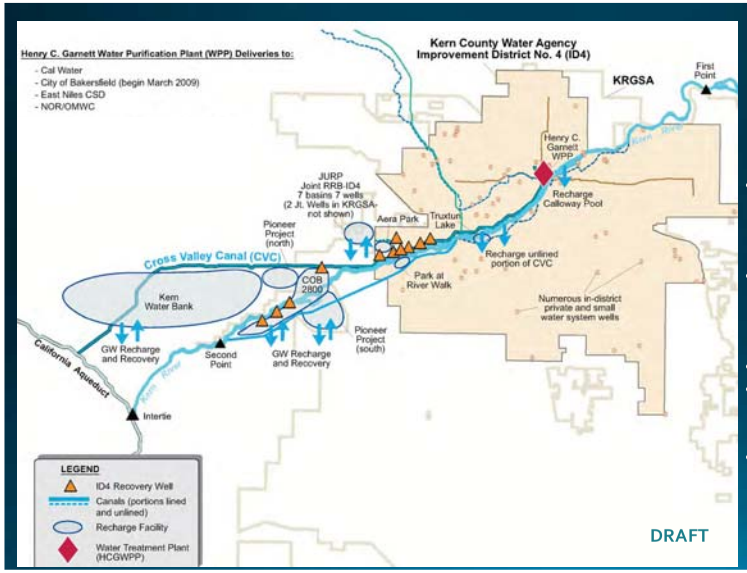

DRAFT

## KRGSA Combined Water Budget Components




DRAFT

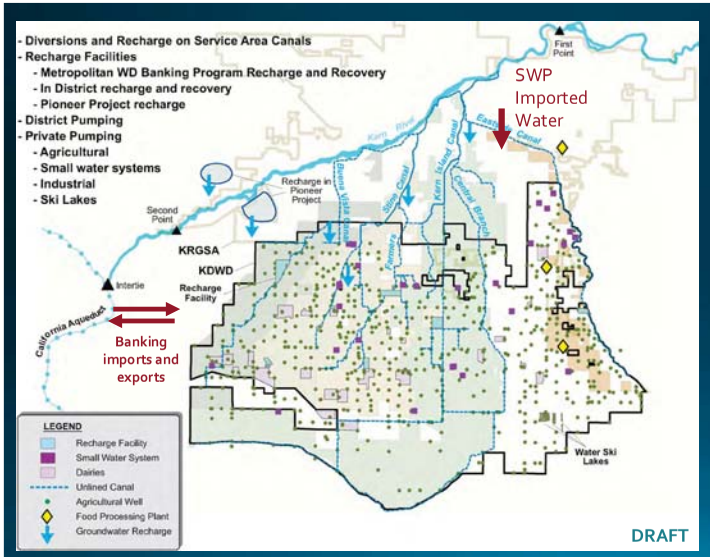
# Schematic Diagram ID4




DRAFT

- Monthly inflows to the WPP including SWP, groundwater, and other water sources by exchange
- Recharge in Calloway pool, unlined CVC, and banking projects (supplemental data from KR Annual Reports)
- ID4 recovery pumping
- Private in-district pumping (except City, Cal Water, other agencies)
- Treated surface water deliveries other KRGSA agencies

# Schematic Diagram KDWD



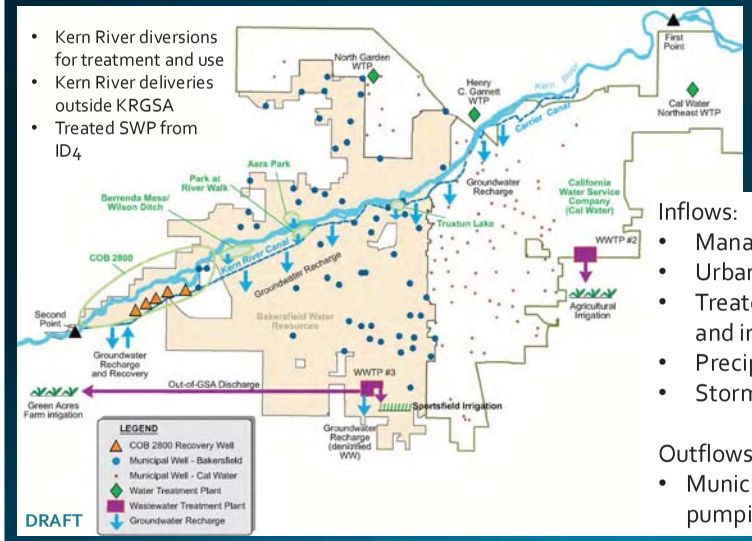

DRAFT

- Agricultural ET demand from METRIC ET data
- Diversions and managed recharge from District and KR Annual Reports
- ET demand not met by surface water assumed pumped from groundwater
- Dairies and food processing pump groundwater, consume small amounts, then recirculate for irrigation and recharge

- Kern River diversions for treatment and use
- Kern River deliveries outside KRGSA
- Treated SWP from ID4

# Schematic Diagram Bakersfield

## Water Resources




DRAFT

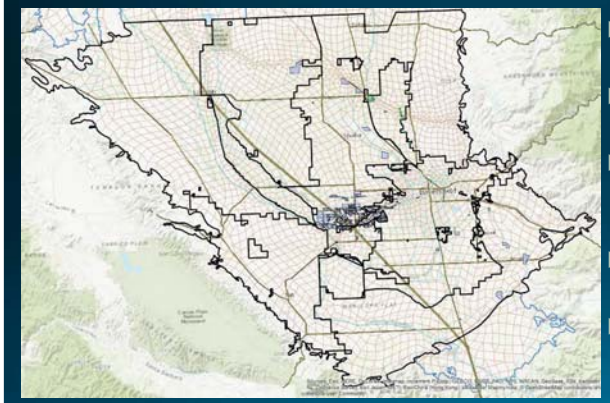
Inflows:

- Managed Recharge
- Urban Return Flows
- Treated wastewater recharge and irrigation return flows
- Precipitation infiltration
- Stormwater conservation

Outflows

- Municipal and Recovery pumping

# Subbasin Water Budget - C2VSim Update

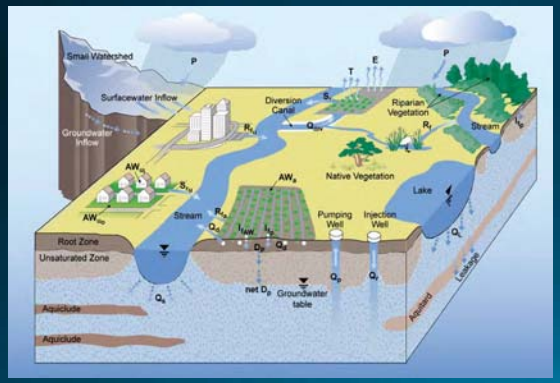


- C2VSim – DWR regional planning model released May 2018
- Use C2VSim model for subbasin water budget analysis
- Revise managed water supply and demand data with local subbasin data
- Maintain current model structure (layers and properties)
- Incorporate other existing data already in the C2VSim (e.g., soils)

DRAFT

# Subbasin Water Budget - Approach

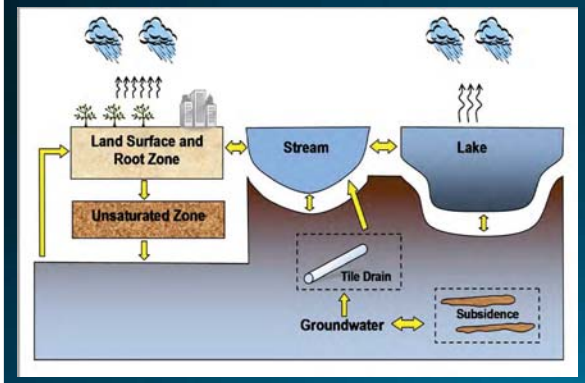
## Update Managed Water Supply and Demand Data




- Surface water diversions by water district
- Groundwater banking and recharge programs
- Groundwater banking recovery for in-basin use and export
- M&I water use
- Locally important water budget components
- Crop demand based on METRIC ET data

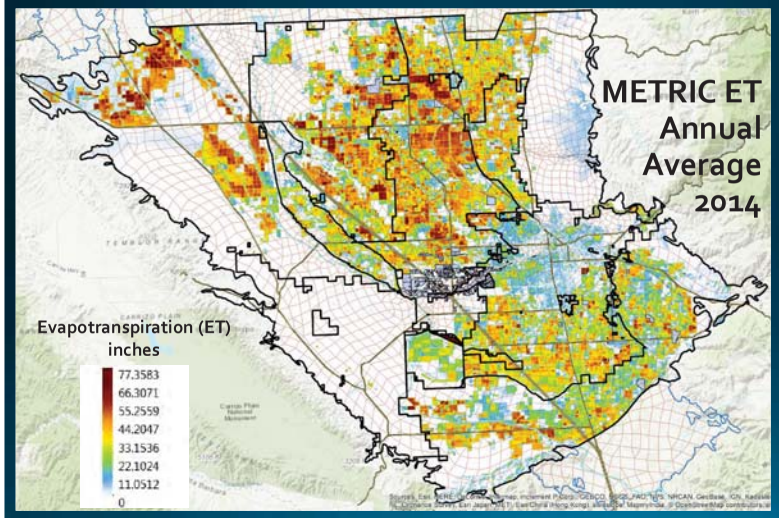
DRAFT

# IWFM – Integrated Process-Based Model




- Model simulates key hydrological processes
  - Surface Land Use, Root Zone, and Unsaturated Zone
  - Surface water deliveries from rivers and canals
  - Groundwater flow
- Focus on physical water
  - Where does the "wet water" go? (not paper exchanges)
  - Prevent "double-counting"

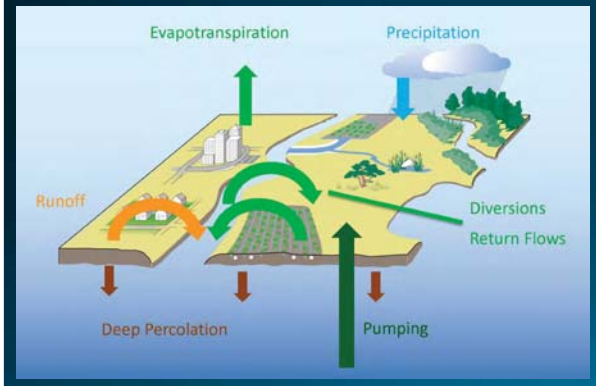
DRAFT




- Monthly data 1994-2015 (except 2012)
- Use for Irrigated Agriculture
- Approximate cutoff of 20 inches per year to exclude urban areas

DRAFT

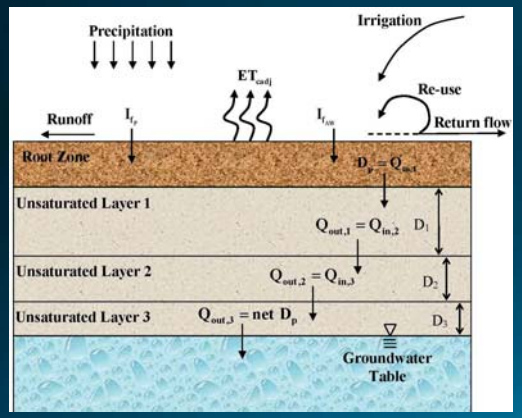
# Land Surface and Root Zone Processes




- Automatically adjusts diversions and pumping to meet demands following user-defined rules
  - Uses surface water, groundwater, and precipitation to meet water demand for different land uses
- Root Zone water budget tracks:
  - Surface runoff
  - Consumptive use
  - Deep percolation to groundwater

DRAFT

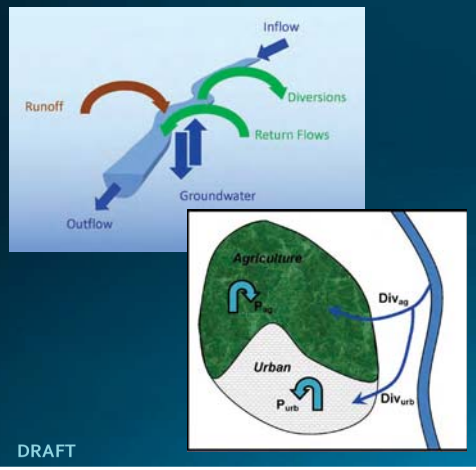
# IWFM Independent Demand Calculator (IDC)




- Calculates agricultural demand based on soil moisture budget
  - Monthly METRIC data used to generate crop ET time series to determine crop demand
  - Tracks change in soil moisture content throughout simulation
  - If soil moisture falls below minimum level (wilting point), irrigation water added to reach target level (field capacity) to cover ET, deep percolation and runoff

DRAFT

# Surface Water Process




- Tracks surface water delivered for agricultural and urban use
  - Directs diversions to designated subareas
  - Each subarea provides for spatial distribution of agricultural and urban use
- Surface Water budget tracks:
  - Diversions
  - River and canal seepage
  - Groundwater-surface water interactions
  - Natural inflows and outflows

DRAFT

# Example Water Budget Output for Each Process Module

## Land and Water Use Budget

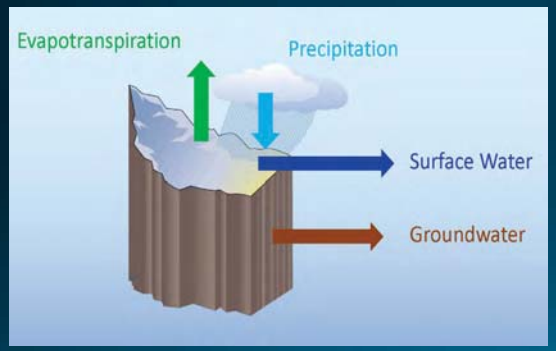
| | Column | Flow | 08/31/2004 | Source |
|---|---|---|---|---|
| Agricultural | Area (AC) | | 6,604,404 | |
| | Potential CUAW | | 2,586,635 | |
| | Supply Requirement | OUT | 3,294,699 | |
| | Pumping | IN | 1,601,200 | GW |
| | Diversion | IN | 1,693,677 | SW |
| | Shortage | (IN) | -177 | |
| | Re-use | | 67,228 | |
| Urban | Area (AC) | | 1,147,412 | |
| | Supply Requirement | OUT | 249,902 | |
| | Pumping | IN | 162,716 | GW |
| | Diversion | IN | 91,371 | SW |
| | Shortage | (IN) | -4,185 | |
| | Re-use | | 0 | |

## Root Zone Moisture Budget

| | Column | Flow | 08/31/2004 | Process |
|---|---|---|---|---|
| Agricultural | Area (AC) | | 6,604,404 | |
| | Precipitation | IN | 92 | |
| | Runoff | OUT | 0 | SW |
| | Prime Applied Water | | 3,294,876 | |
| | Reused Water | | 67,228 | |
| | Total Applied Water | IN | 3,362,104 | GW/SW |
| | Return Flow | OUT | 99,094 | SW |
| | Beginning Storage | | 4,100,673 | |
| | Net Gain from Land Expansion (+) | +/- | 0 | |
| | Infiltration (+) | IN | 3,195,874 | |
| | Actual ET (-) | OUT | 3,051,486 | |
| | Deep Percolation (-) | OUT | 166,381 | GW |
| | Ending Storage (=) | | 4,078,680 | |

DRAFT

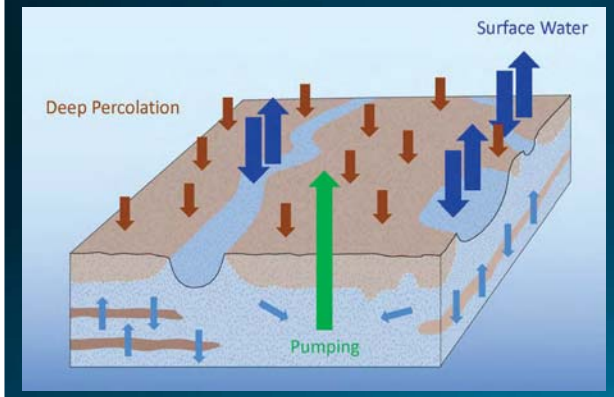
# Small Watershed Process




- Calculates runoff and inflow from adjacent small watersheds
  - Uses Soil Conservation Service methods for estimating runoff
  - Systematic method to track inflow from unmeasured watersheds
- Small Watershed budget tracks
  - Surface water runoff into basin
  - Infiltration of runoff to groundwater
  - Subsurface inflow into basin

DRAFT

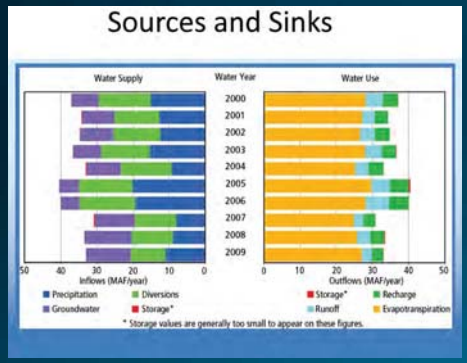
# Groundwater Process

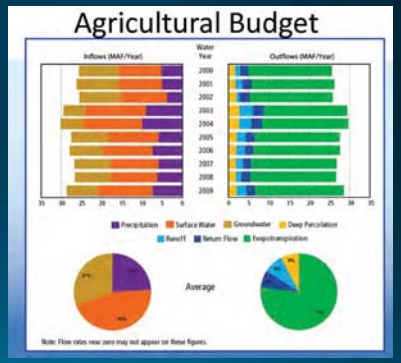



- Groundwater process integrates the inflows and outflows from other processes and simulates
  - Flow through aquifers
  - Groundwater pumping (unless designated)
  - Subsidence
- Groundwater budget tracks:
  - Volume for each inflow and outflow component
  - Storage change over time
  - Change in groundwater levels

DRAFT

# Water Budget Data can be Presented Graphically




DRAFT

# Groundwater Budgets List Inflow and Outflow of All Components for Each Time Step

**Groundwater Budget**
**Subregion 12**

| Column | Flow | 08/31/2004 | Process |
|---|---|---|---|
| Deep Percolation | IN | 2,880 | RZ |
| Beginning Storage (+) | | 42,057,306 | |
| Ending Storage (-) | | 42,064,339 | |
| Net Deep Percolation (+) | IN | 8,203 | UZ |
| Gain from Stream (+) | +/- | -11,243 | SW |
| Recharge (+) | IN | 21,179 | LS |
| Gain from Lake (+) | +/- | 0 | SW |
| Boundary Inflow (+) | IN | 0 | SWS |
| Subsidence (+) | | -62 | |
| Subsurface Irrigation (+) | IN | 0 | LS |
| Tile Drain Outflow (-) | OUT | 0 | SW |
| Pumping (-) | OUT | 7,200 | LS |
| Net Subsurface Inflow (+) | +/- | -3,844 | GW |
| Discrepancy (=) | | 0.00 | |
| Cumulative Subsidence | | 977 | |

**Z-Budget**
**Subregion 12, 8/31/2008**

| Column | Flow | IN | OUT | Process |
|---|---|---|---|---|
| GW Storage | | 8,766 | 15,838 | |
| Streams | +/- | 6,253 | 17,491 | SW |
| Tile Drains | OUT | 0 | 0 | SW |
| Subsidence | | 18 | 80 | |
| Net Deep Percolation | IN | 8,203 | 0 | LS |
| Small Watershed Baseflow | IN | 0 | 0 | SWS |
| Small Watershed Percolation | IN | 0 | 0 | SWS |
| Diversion Recoverable Loss | IN | 21,179 | 0 | SW |
| Bypass Recoverable Loss | IN | 0 | 0 | SW |
| Lakes | +/- | 0 | 0 | SW |
| Pumping by Element | OUT | 0 | 0 | LS |
| Pumping by Well | OUT | 0 | 7,200 | LS |
| Zones 12 and 10 | +/- | 397 | 2,248 | |
| Zones 12 and 11 | +/- | 2,952 | 2,619 | |
| Zones 12 and 13 | +/- | 713 | 3,005 | |
| Overall Zone Error | | 0.00 | | |

DRAFT

# Model Results will only be as good as the input data provided

- C2VSim Kern County Subbasin revisions focus on managed water supply and demand data of regional or local significance during the hydraulic period
- Data need to be consistent with data and databases that will be included in each GSP
- If data are unavailable, the DWR data set in C2VSim is used as the default

DRAFT

# Modeling Schedule

- NOW: completing initial model runs with priority components
- Late August: provide model to peer reviewer
- August – Sept: Internal QA/QC
- Sept – Oct: Identify, compile, and incorporate the lower-priority budget items and make corrections to existing data, as needed
- Early November – share results

DRAFT

TODD GROUNDWATER

# KERN DELTA WATER DISTRICT

## WELCOME

CSDA

September 13, 2018

Good afternoon – thank you for choosing to spend some time with us here at Kern Delta, we welcome the opportunity to tell you a little about ourselves.
So I'm going to give you a cursory history of how we came to be – and then we'll jump into who and where we are now, and what we do on a daily basis. I'm absolutely not a historian, so, please, if you are better-versed in these historical details, shout them out

# HISTORY

- MILLER AND LUX
  - Late 1800's
  - Cattle ranchers from San Francisco
  - Purchased swamp lands SJ Valley
    - Federal Swamp Act (1851)
      - Pennies/acre
      - Promise to improve lands

Henry Miller

1827-1916

Source: Wikipedia

1823-1887

Source: The Miller Red Barn Association

Charles Lux

Source: Kern County Museum

So, land, San Joaquin Valley, 1800s – Henry Miller and Charles Lux (both of whom had immigrated from German) were a couple of prosperous butchers from San Francisco, they decided to jump into cattle ranching in the SJ Valley…they were savvy,

# HISTORY

- HAGGIN, TEVIS, CARR
  - Wealthy capitalists
    - Invested in county lands
    - Purchased water rights and systems created by early farmers
- DROUGHT 1877
  - Haggin et al began draining the Kern River channeling water to their lands
    - Tens of thousands of Miller & Lux cattle perished

Dreadful Effects of Drought in California.

It is estimated that from one half to two-thirds of the sheep in the State have perished from starvation. The loss of cattle is not so great, as they were taken to the mountains in time. Dr. Hester, of Watsonville, recently started for the mountains from Fresno, with over three thousand sheep, and the lifeless carcasses of over twenty-five hundred of them now mark the route taken. The doctor says that unclaimed dead and dying sheep cover the plains, and huge flocks of sheep and lambs fall into line behind the wagons of the traveller, and follow, in the hope of getting a morsel of hay. One man from the San Joaquin Valley lost every sheep he had—eleven thousand—during a storm, and went home a penniless man. Another, an Italian, thought he could save the rest of forcing his sheep across the Tuolumne River by swimming them, and eight hundred were drowned in the attempt. Another man, near Visalia, despairing of ever getting his sheep to where there was feed, turned twelve thousand out to starve. If he undertook to drive them to the mountains many of them would die on the way; and if he left them because there is no feed on the way; and then, when the mountains are reached, all the good feed is already taken up by men who hold possession, shot gun in hand, and who are desperate enough to fight to the death. There will probably be a good many cases of bloodshed and death in the mountains this summer, and many stockmen will misfortunately disappear to return no more.—Watsonville (California) Transcript.

Not too long after Miller and Lux purchased their lands

# HISTORY

- LAWSUIT
  - Miller & Lux v. Haggin et al, M&L win
- WRIGHT IRRIGATION ACT 1887
  - Farmers can work together
  - Tax themselves
  - Appropriate water rights
    - Bring water to their own farms via irrigation districts

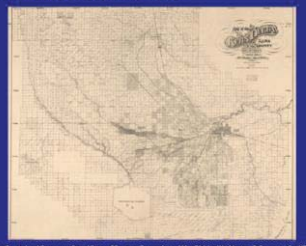
Source:
Photo by Carleton Watkin circa 1880-1890, courtesy: Kern County Museum

Miller & Lux won, critical importance because out of that came the Wright Irrigation Act

Item 8

# HISTORY

- KERN LAND COMPANY FORMS
  - Deliver Kern River water to lands south of the river
  - Five Canal Companies
    - Buena Vista
    - Stine
    - Farmers
    - Kern Island
    - Eastside

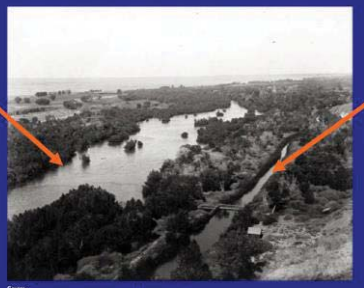


Source: Kern County Land Company, 1891 - Library of Congress Geography and Map Division Washington, D.C. 20540-4650 USA dcu

These canals, from the late 1800s, are the canals & the systems we use today in 2018

# HISTORY

Kern River



Kern Island Canal

Source:
Photo by Carleton Watkin circa 1888, courtesy: Kern County Museum

So this is a look at the construction of the Kern Island Canal, one of, and the biggest, of our 5 canal system - but let's move ahead to find out how Kern Delta Water District got here

# HISTORY

*FAST FORWARD →*

1965 Kern Delta Water Districts forms
1976 Kern Delta acquires Kern River water rights and facilities

Kern Island Canal today

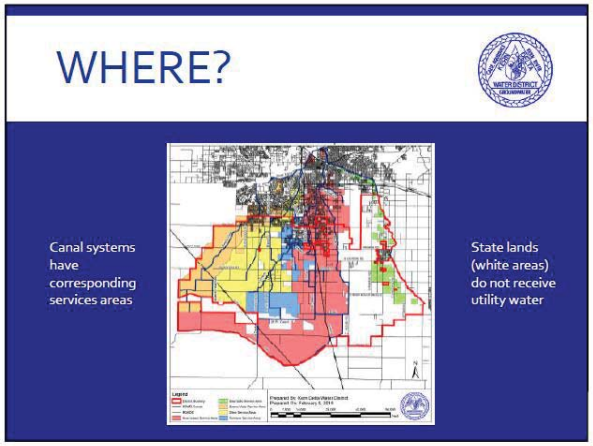
Fast forward to the color pictures
1965 KDWD forms for exactly 2 reasons: 1) to contract for state water and 2) to protect existing landowner water rights

# KERN ISLAND

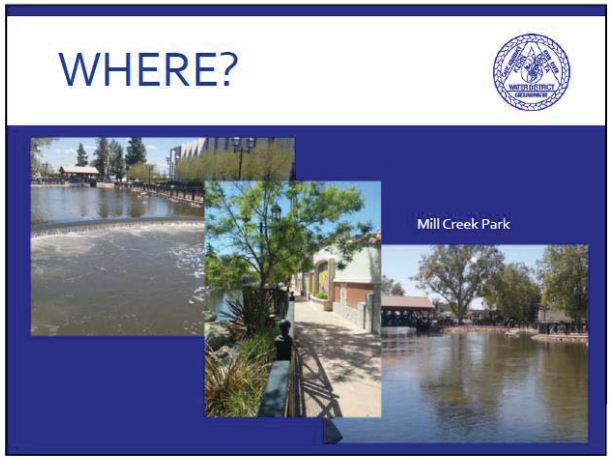
Kern Island Canal today

And here again, the Kern Island Canal, approximately 130 years later and still at peak performance.
Tidbit of information: when the Kern Island canal is running at full capacity it is capable of running at 475 cfs – 213,195 gallons per minute (448.83 conversion unit)


So now that we know how and why Kern Delta came to be, let's look at where we are: We stretch from west of the I-5 to the Buena Vista Lake bed, then all the way east past Weedpatch Highway, into Arvin. We have over 128,000 acres within our boundaries, with approximately 80,000 acres being irrigated agriculture – the irrigated acreage number change with the growing seasons as well as with the continued residential and commercial development that takes farmland out of production.

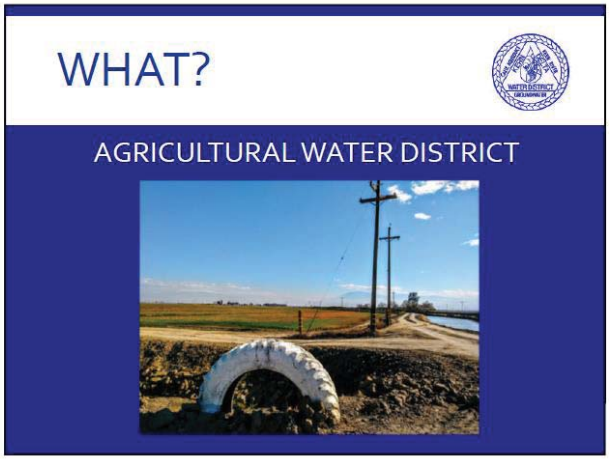



So here's another look at out District – the shaded colors indicate our different service areas – each canal system has a designated service area – the areas correspond to the canal locations, it's pretty much just logistics. So why aren't there any canals in the white area? Those are what we call state lands, and from what I know (???) Back when the canals were being constructed, the landowners in these areas chose not to pitch in any $, thus, no canals were constructed for them (in these area)

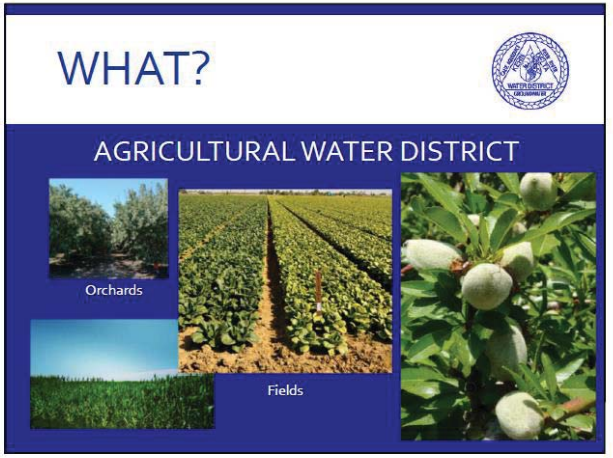



We are kind of everywhere. We are in developed beautiful locations like Mill Creek Park,

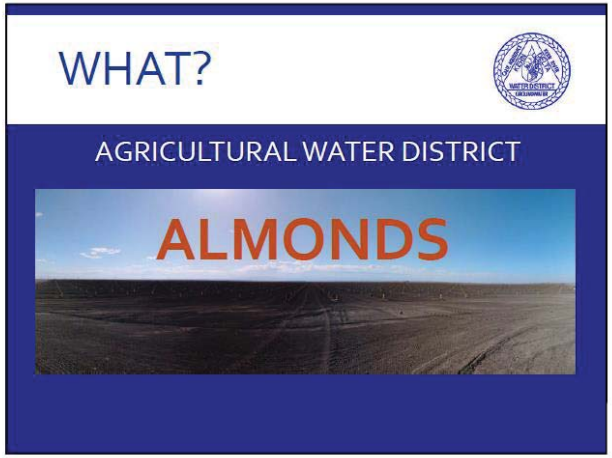

We are also in places you might not even know about – we were here long before the major thoroughfares



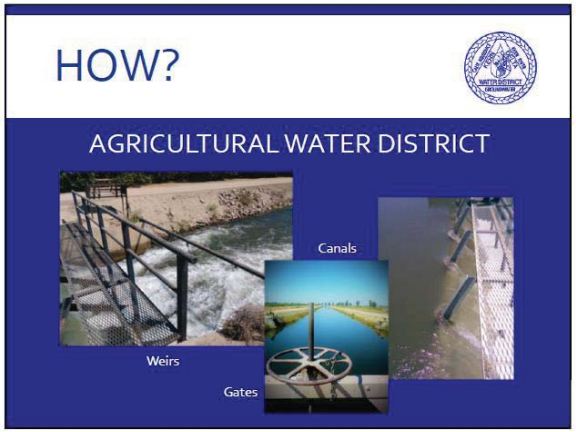

I guess I should slow down after showing you where we are and all those nice pictures of the canals and tell you exactly WHAT we are – so, we're an agricultural water (you probably already knew that), and we sell and deliver Kern River water and to a lesser extent, California State Aqueduct water, to growers... so that




this can happen!




And this!




How is this done? Old school. Canals, weirs, gates – all tended to by hand, gates opened and closed by a team of canal tenders – up and down the canals all day long every day. It's the grower's responsibility, their choice, to decide what to do with the water once it leaves our canal – some may channel it into a reservoir where it's piped out into sprinklers in their fields, some may have field that directly abuts the canal and choose to let the water flow right onto the field – but they place the order, they pay, and we deliver.

# FACT

## WATER RIGHTS

KERN DELTA WATER DISTRICT
HAS
THE
1ST
WATER
RIGHTS
ON
THE
KERN RIVER

***FIRST 300 CFS OF FLOW → KERN DELTA***

134,649 GALLONS/MINUTE

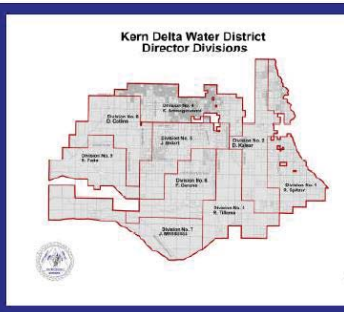
# ACCESSIBILITY

Directors are accessible to their constituents (growers)

Constituents not happy?

↓

elect alternate




Public meetings every month per Brown Act

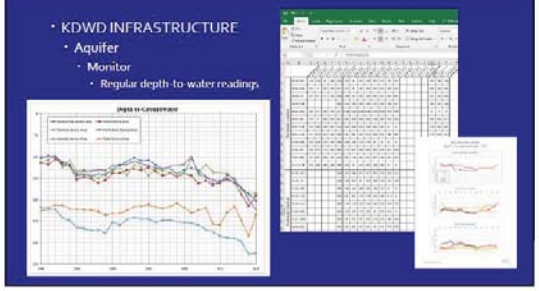
Public records

Kern Delta is governed by a Board of Directors – these Directors/members have a division – the growers know who the Director for their division is – don't like him vote him out

As an independent Special District because we get our funding in 2 ways: direct water sales, and property assessments.

# SUSTAINABILITY

- KDWD INFRASTRUCTURE
  - Aquifer
    - Monitor
      - Regular depth-to-water readings



How do we sustain our infrastructure? Our infrastructure sustains agriculture, the service we provide out here is the only water-delivery service the growers have (aside from a grower utilizing his own well)– our canals, weirs, gates, are part of our infrastructure, but also our aquifer, the aquifer below, is critical (DISCUSS SGMA: sustainability requirements, avoiding deadly sins, what we do and plan to do, etc.)– and that is one of the very important things we do – monitor it. We monitor depth to groundwater levels throughout our entire district on a continual basis: we measure monthly for our Board/in-house purposes to keep track of trends, groundwater declines as well as hopefully rebounds. We also measure depth to water levels and share the data with various state agencies to comply with various regulations (CASGEM, SGMA).

# SUSTAINABILITY

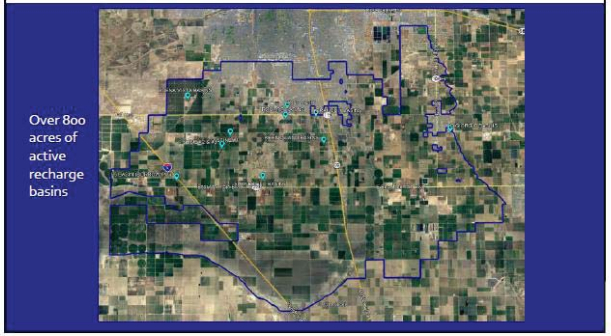
- KDWD INFRASTRUCTURE
  - Recharge Basins (spreading basin, recharge pond)
    - Over 800 active acres
    - Purchasing more property, constructing more

Kern Island Basin

I-5 Borrow Pit Basin

We currently have over 800 acres of active recharge ponds, and we are in the process of purchasing additional lands to construct more. Actively recharging the aquifer, which is critically overdraft in the San Joaquin Valley is not only good stewardship, it helps us with our SGMA goal attainment (not critically overdrafting it anymore, avoiding subsidence), etc (mention benefits)

# SUSTAINABILITY




Over 800 acres spread throughout the District…..perched water table area where there are none

# WORK


One of the great things here at Kern Delta is that we do all of our own maintenance, we do a lot of our own construction work, (describe soil borings for basin, tie into sustainability)

# CHALLENGES


Caliente creek perpendicular to Eastside canal, excess waters dump into our canal, runs high, soils become super saturated and give way - we work together as a team and we inevitably find solutions – and by and large as I mentioned, we do all of the work ourselves.

# CHALLENGES


Protection for public safety


'cause sometimes.....critters


Other challenges? Well.....we do the best we can

Item 9

# ARVIN-EDISON WATER STORAGE DISTRICT & ARVIN COMMUNITY SERVICES DISTRICT

INVITES YOU TO AN…

INFORMATIONAL WORKSHOP ON

SUSTAINABLE GROUNDWATER PLAN & COMPLIANCE

## TUESDAY, OCTOBER 2, 2018

THREE SEPARATE WORKSHOPS

TIMES: 8:00 A.M. 1:00 P.M. & 5:00 P.M.

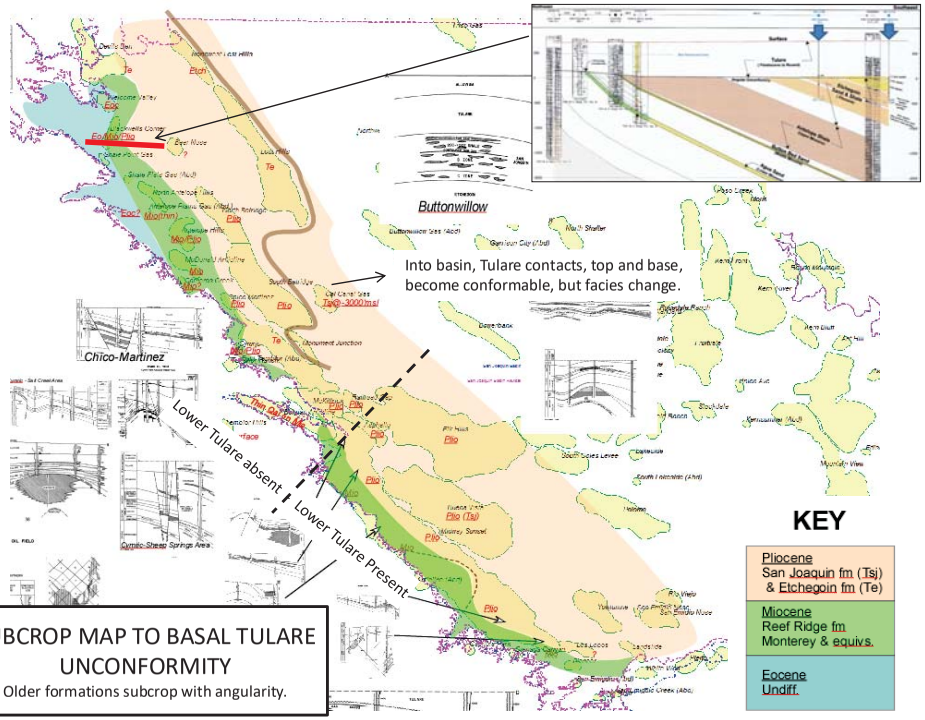
LOCATION: ARVIN VETERAN'S HALL

414 4th STREET

ARVIN, CALIFORNIA

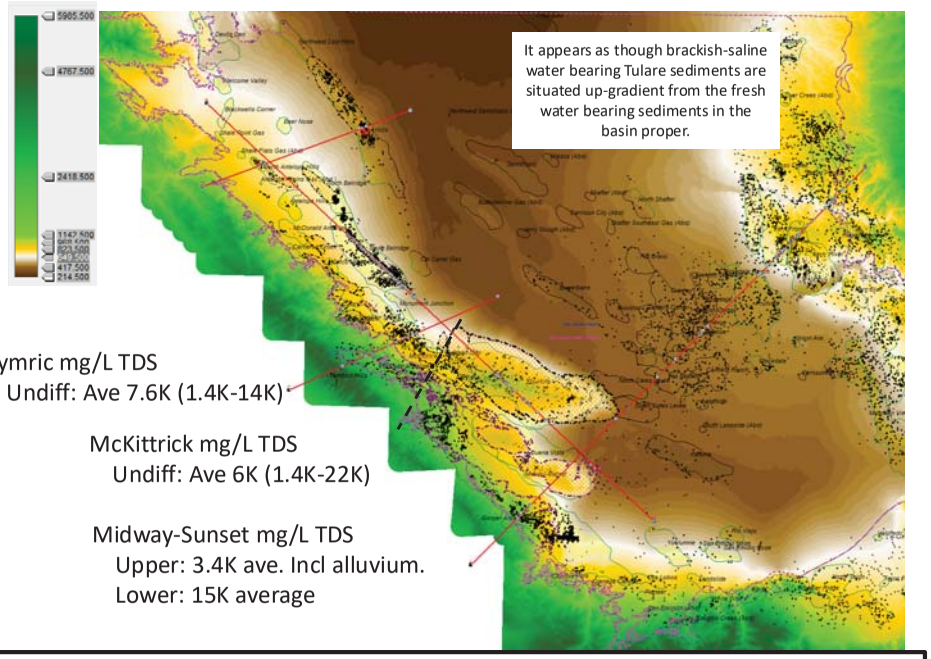
Self-Help Enterprises

ARVIN COMMUNITY SERVICES DISTRICT




SUBCROP MAP TO BASAL TULARE UNCONFORMITY

Older formations subcrop with angularity.

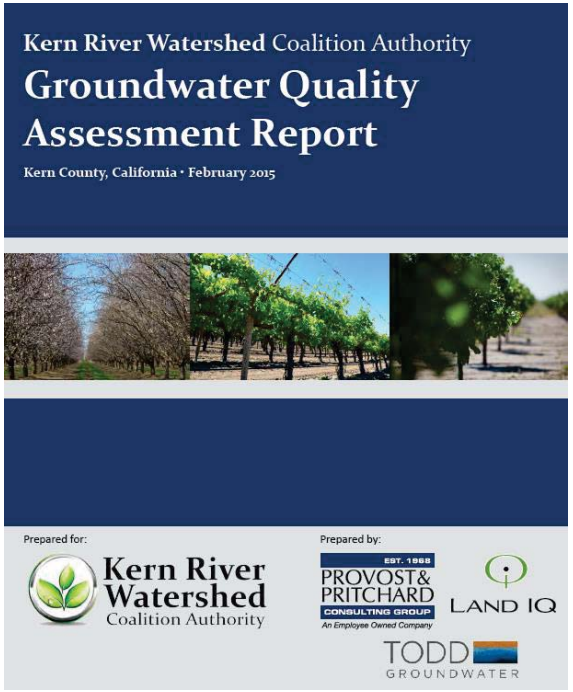


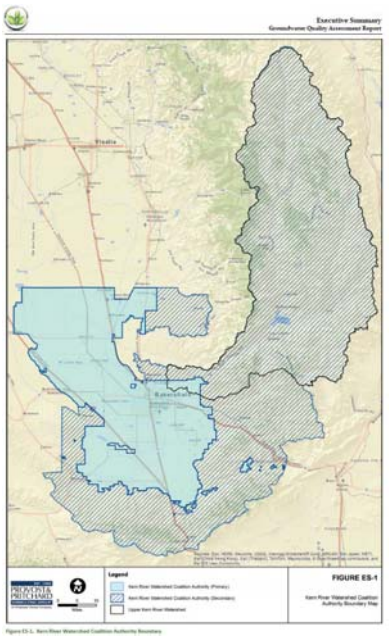

Cymric mg/L TDS
Undiff: Ave 7.6K (1.4K-14K)

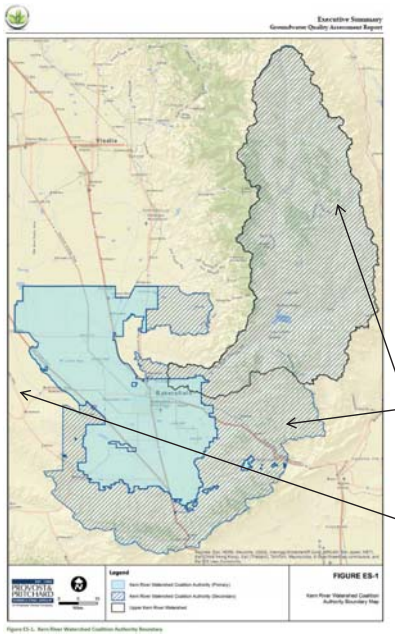
McKittrick mg/L TDS
Undiff: Ave 6K (1.4K-22K)

Midway-Sunset mg/L TDS
Upper: 3.4K ave. Incl alluvium.
Lower: 15K average

GROUND ELEVATION WITH TULARE FM OUTCROPS & WATER QUALITY





8.2 Significant Recharge Areas and Rates

8.2.1 Natural Recharge

Natural recharge is a function of precipitation, ET, and soil moisture holding capacity, as noted above. Precipitation and ET records for the primary KRWCA area are available from the California Irrigation Management Information System (CIMIS) Station. Average annual precipitation from the Shafter Station (No. 5) is 6.3 inches, which is relatively low compared to an annual potential evapotranspiration (ET) of 57 inches. As a consequence, deep percolation of precipitation past the root zone occurs infrequently or not at all. A daily soil moisture balance was completed for the Kern Fan (Todd, 2012) using the Thornthwaite and Mather method (1955 and 1957). This soil moisture balance showed that precipitation is generally consumed by evapotranspiration within a few days of a rainfall event, and there is no excess available water for recharge to groundwater.

In the secondary area where precipitation volumes are higher and evapotranspiration is generally lower, natural recharge is likely the primary source of recharge to groundwater. However, precipitation and runoff varies greatly, estimates of ET from vegetation are more difficult (due to the wide variety of vegetation and little research to support estimates), and there is little unconsolidated material in this area, as indicated in Section 5. The variations in precipitation and runoff, difficulty of estimating ET, limited extent of unconsolidated material, and predominance of fractured bedrock groundwater makes estimation of natural recharge in these areas infeasible.

Basin groundwater supply comes from here:
1)immense watersheds
2)sandy media for infiltration and recharge

Not here:
1)limited watershed area
2)Eto>>precip conditions dominate
3)Fractured Miocene shales capture rainwater

Item 10a

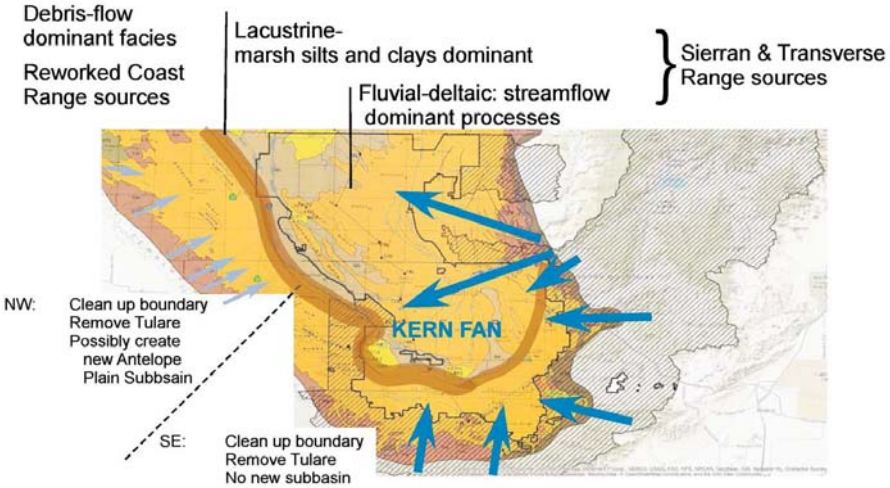
## EXPLAINING AIR SANDS

THE PROBLEM OF PRECIPITATION AND EVAPORATION – CALCULATING THE DEFICIT AND EXPLAINING THE PERMANENT PRESENCE OF AIR SANDS


CIMIS STATIONS
#205 Coalinga
#54 Blackwells Corner
#146 Belridge

infrequently or not at all. A daily soil moisture balance was completed for the Kern Fan (Todd, 2012) using the Thornthwaite and Mather method (1955 and 1957). This soil moisture balance showed that precipitation is generally consumed by evapotranspiration within a few days of a rainfall event, and

Thornwaite & Mather method to be applied to data from these three CIMIS stations



Item 10b

# *CIPA/WSPA Meeting with KGA*
# *1/9/19*

| Name | Company/Agency | Email |
|---|---|---|
| CHAD HATHAWAY | HATHAWAY LLC | CHATHAWAY@HATHAWAYLLC.COM |
| Matt Mayry | GEI | MMayry@geiconsultants.com |
| LARRY RODRIGUEZ | GEI | lrodriguez@geiconsultants.com |
| Jim Voyles | Chevron | jamesvoyles@chevron.com |
| Janie Moehnke | Chevron | JMoehnke@chevron.com |
| Diana Martin | HAK | martindp@HunterAk.com |
| Jeff Johnson | Chevron | johnsjw@chevron.com |
| KEVIN MALAMMA | STANTEC/CHEVRON | Kevin.malamma@STANTEC.com |
| Megan Schwartz | Catalyst | mschwartz@ce.solutions |
| AMY ROTH | E+B NATURAL RES. | AROTH@ebresources.com |
| David Chapin | Aera | dchapin@aeraenergy.com |
| Julie GLAVIN | AERA | jaglavin@aeraenergy.com |
| Christine Zimmerman | WSPA | christine@wspa.org |
| HARRY STARKEY | WKWD | harry@wkwd |
| MARK SMITH | EOC | eoc1911@gmail.com |
| STEVE LEWIS | E-B | slewis@ebresources.com |
| Rebecca Smith | WSPA/DowneyBrand | rsmith@downeybrand.com |
| Chris Reedy | VWM | Creedy@valleywatermanagement.org |
| Tim Lorley | MacPherson | TLorley@MacPhersonEnergy.com |
| RANDY HORNE | NAFTEX OP. CO. | RHORNE@NAFTEX.COM |
| Christin Faber | Aera Energy | CJfaber@aeraenergy.com |

***CIPA/WSPA Meeting with KGA***
***1/9/19***

| Name | Company/Agency | Email |
|---|---|---|
| Christina Dixon | Sentinel Peak Resources | cdixon@sentinelpeakresources.com |
| Megan Silva | Aera | mesilva@aeraenergy.com |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

Item 10c

| Comments | Response | Edits Made | Notes |
|---|---|---|---|
| General Comments | Additional edits have been made; however, additional sources and references to back up all changes are pending before the document can be considered a final draft.<br><br>All exempted aquifers and primacy productive limits that were reasonably accessible in the public domain have been excluded from discussion as aquifer for beneficial use. **It is requested that WSPA members review the list of Exemptions, Primacy Productive Limits with depths to Hydrocarbons, and provide additional comments to maintain appropriate accuracy.**<br><br>A Conceptual Profile was added in response to Exhibit A recommendation.<br><br>The Definable bottom of the Basin has been updated. Additional data will likely be considered to further refine the Base of Fresh Water and the Base of USDW. | A Conceptual Profile was added in response to Exhibit A recommendation.<br><br>The Definable bottom of the Basin has been updated. Additional data will likely be considered to further refine the Base of Fresh Water and the Base of USDW. | General Comments |
| 2.1.2.1 | Corcoran Clay extents and updates are pending for the west side and southwest side including Lost Hills and Midway Sunset area. Additional feedback coordination with WSPA members may be helpful for GEI regarding this comment. | | Corcoran Clay |
| 2.1.3 | Lateral and vertical boundaries of formations may not be possible to fully address for the 2020 GSP due to time constraints in completing the GSP in time for public review, unless WSPA members have very specific input to expedite this process; rather, the 2020 GSP is focusing on extent of known groundwater use, groundwater quality, depth to freshwater, depth to non-USDW, and exempted aquifers. | Revisions have been made in the text to better clarify the lateral boundaries as it relates to groundwater quality, depth to freshwater, depth to non-USDW, and exempted aquifers | Lateral and Vertical boundaries of formations. |
| 2.1.5 | Bottom of Basin has been updated with discussion of depth to freshwater, depth to non-USDW, and exempted aquifers. | Bottom of Basin has been updated with discussion of depth to freshwater, depth to non-USDW, and exempted aquifers.<br><br>Due to time constraints, the Umbrella GSP may not present all structure and differing depths of hydrocarbons within Productive Limits and Exemptions. **At this time, the shallowest hydrocarbon depth was used for presentation within the Productive limits and exempted aquifers.** A Data Gap will be acknowledged regarding the mapping of non-USDW and exempted aquifers associated with Oil and Gas activities. based on generalization as described above. | Bottom of Basin |
| 2.1.6 | Updates to aquifer descriptions have been made; however, this section is very much in draft form. | | Principal Aquifers. |
| 2.1.6.3 | Beneficial use or affects of activities are pending for the Umbrella Chapter.<br><br>Once chapter GSPs, are available, additional data on water quality and use of aquifers across the subbasin can be documented in the Umbrella Setting. | | Water Quality of Principal Aquifers. |
| 2.1.8 | GEI respectfully requests that WSPA members provide USGS researchers with approval to allow the use of USGS pp1713 3-D Geologic model layers 11 to 15 (Temblor to TOPO), in order to better develop acceptable cross sections with respect to Oil and Gas fields, at a subbasin-wide scale. | In the interim, the conceptual profile provides details of the current understanding of the subbasin from west to east.<br><br>Final Cross sections will delineate Base of Freshwater data, non-USDW data by Gillespie et. al., and any data from depth to Hydrocarbons in Primacy Productive limits, as well as depth to and lateral extents of exempted aquifers that intersect the cross section lines. | Cross Sections |
| 2.1.9.3 | No comment at this time | | |
| 2.1.9.6 | Revision made as recommended | | Produced water as an imported source of water. |
| 2.2.5 | **UICs have been removed.**<br><br>**WSPA member input is requested to clarify which Produced Water Ponds should remain in this section to satisfy SGMA requirements.**<br><br>It is not the intent of this section to evaluate or confirm whether any or all of these sites as listed by regulatory agencies are significantly impacting groundwater with beneficial use. This section presents cases as were listed from the regulatory databases, and labels them as potential groundwater contamination sites and plumes. | | GW Quality |
| 2.2.5.1 | GW quality section has been modified substantially, but it may not better address comments provided. This section will likely be a work in progress for the next few months. | Added brief paragraph on naturally occurring hydrocarbon deposits. | GW Quality |
| 2.2.6 | Added recommended comment | Added recommended comment | Land Subsidence |
| 2.2.8 | Potential GDEs<br><br>A new map of the KCS with neighboring subbasins will be added; similar to Exhibit B that was provided | New NCCAG figures are provided in Appendix, and revised discussion has been added accordingly. | Potential GDEs |
| 2.4 | *pending* | | MA, Mgmt zones |

Item 11a

**Kern Groundwater Authority & Kern County Farm Bureau**

**invites you to the...**

# SGMA Open House

## Sustainable Groundwater Management Act

A "One-Stop-Shop" for groundwater users with interests throughout the Kern Subbasin to meet with representatives from subbasin GSAs and water/irrigation districts, and from the State Water Resources Control Board & California Department of Water Resources to discuss the Kern Subbasin Groundwater Sustainability Plans and future SGMA implementation.

## Tuesday, May 14, 2019 from 5:30 to 7:30 p.m.

**Location: Kern Ag Pavilion** (3300 E. Belle Terrace, Bakersfield, CA 93307)

Participating groundwater sustainability agencies (GSAs) and water/irrigation districts that will have tables at the event:

Kern Groundwater Authority

- Arvin Community Services District (ACSD)
- Arvin-Edison Water Storage District (AEWSD)
- Cawelo Water District (CWD)
- City of Shafter
- County of Kern
- Kern County Water Agency (KCWA)
- Kern-Tulare Water District (KTWD)
- Kern Water Bank Authority (KWBA)
- North Kern Water Storage District (NKWSD)
- Rosedale-Rio Bravo Water Storage District (RRBWSD)
- Semitropic Water Storage District (SWSD)
- Shafter-Wasco Irrigation District (SWID)
- Southern San Joaquin Municipal Utility District (SSJMUD)
- Tejon-Castaic Water District (TCWD)
- West Kern Water District (WKWD)
- Westside District Water Authority (WDWA)
- Wheeler Ridge-Maricopa Water Storage District (WRMWSD)

Henry Miller Water District GSA

Buena Vista Water Storage District GSA

Olcese Water District GSA

Kern River GSA

- Kern Delta Water District
- City of Bakersfield
- Improvement District No. 4

*Co-hosted by:*

KERN GROUNDWATER AUTHORITY

KERN COUNTY FARM BUREAU

For questions about the event, email ppoire@kerngwa.com or call the Kern County Farm Bureau at (661) 397-9635.

# Kern County SGMA Open House

**May 14, 2019, Kern Ag Pavilion**

Item 11b

| Name | Mailing Address | Telephone | Email |
|---|---|---|---|
| Jasmene del Aguila | 1527 19th St. Suite 212 Bakersfield, CA 93301 | 661-843-7677 | jdelaguila@leadershipcounsel.org |
| David Ansolabehere | 17207 Industrial Farm | 661 393-6072 | |
| Lawrence D'Lang | on file | 619 840 3622 | lawrence@mottech.com |
| Max Palmer | 1717 W Park Ave, Redlands, CA 92373 | 909-292-6296 | max.palmer@geinc.com |
| Marko Zaninovich | 1999 Road 152 Delano 93215 | 661 792 3151 | |
| David Nixon | | | DANAEWSD@AOL.COM |
| Michelle Anderson | | | manderson@kcwa.com |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

# Kern County SGMA Open House

## May 14, 2019, Kern Ag Pavilion

| Name | Mailing Address | Telephone | Email |
|---|---|---|---|
| Karen Anderson | | 661 747-7835 | KAnderson@kernmanagementservices.com |
| Marcos Perez | 5080 California Ave | 661 336 0967 | marcos.perez@usda.gov |
| Rick Iger | | 661 303 6607 | riger@pprg.com |
| Dominic Fucinelli | 16460 E | 559-930-5767 | dominic@powwowenergy.com |
| Pres Bertuzzi | 4831 Calloway #102/Bksfd 93312 | 661-301-1708 | Pres@prh2o.com |
| Dennis Mullins | | 328-5358 | |
| Dan Hoekstra | 7122 Heatherwood Dr 93313 | 805 839 8292 | dan@hoekstraassociates.com |
| Tim Haltermann | P.O. Box 507 | (661) 340-3201 | tims@haltermann-ag.com |
| Jeff Giumarra | P.O. Bin 1969 Bakersfield 93303 | 661-395-7000 | jeffe@grapeking.com |
| | | | |
| | | | |
| | | | |

# Kern County SGMA Open House

**May 14, 2019, Kern Ag Pavilion**

| Name | Mailing Address | Telephone | Email |
|---|---|---|---|
| Paul Nugent | Bakersfield CA 93312<br>4831 Calloway Dr. Ste. 102 | 829-5109 | nugentag@gmail.com |
| Rod Stiefvater | " | " | rod@rtsag.com |
| DAN RAYTIS | | 444 5770 | dan@bbr.law |
| Jason Selvidge | | | jselvidge@aol.com |
| Gabriela Gonzaga | 2600 F St 93301 | 661 421 3515 | gabriela@provconsult.com |
| SATYA CALA | GEI | 916 388 4166 | SCALA@GEICONSULTANTS.COM |
| KENT H. STEPHENS | 1998 Rd 152 DELANO, CA 93215 | 661 792-3151 | |
| KLEN BOLLSTEDT | | 661 616 4600 | KLBollstedt@PPENG.COM |
| Aaron Wilson (Wilson Ag) | P.O. Box 130 Shafter 93263 | 661 746 2623 | wilsonag@atginternet.com |
| Alan Christiansen | Kern County | 661 817-0443 | achristiansen@kerncounty.com |
| DEE JASPAR | DJA | 661 393 4796 | djaspar@djacivil.com |
| | | | |

# Kern County SGMA Open House

**May 14, 2019, Kern Ag Pavilion**

| Name | Mailing Address | Telephone | Email |
|---|---|---|---|
| Don Wright | 11465 Tollhouse Rd Clovis CA 93619 | 559/355-2389 | don@waterwrights.net |
| Ron Bock | 283 N. Caesar Ave CLOVIS CA 93612 | 559/435-4333 | morethankful@aol.com |
| Geoff VandenHeuvel | 1407 Monaco St Tulare, CA | 209-730-1240 | geoff@milkproducers.org |
| MARK VALPREDO | 5279 FALLGATTER ST BKFLD CA 93308 | 661-747-2056 | MBVALPREDO@GMAIL.COM |
| Reilly Hossner | 2023 Regis Dr. Davis, CA 95618 | 925 464 0399 | reilly@bachandassociates.com |
| WALT FISHER | PO Box 68 Edison CA 93220 | 661. 805-5797 | IBCATTLE@AOL.COM |
| Rob Goff | 13654 Hwy 33, Lost Hills, CA 93249 | 661-203-9660 | rob.goff@wonderful.com |
| Javi Higuera Jr | 2231 Orphens Ct 93308 | 661-300-0229 | javi@trilogyplm.com |
| MARTY BARNES | 133 EASY ST 93308 | 661 809-5612 | gmc2001cb@gmail.com |
| Ruth F. Kelley | PO Box 455 | 6612136754 | KCR@ATGINTERNET.COM |
| Desirea Lawrence | 11200 River Run Blvd. #101 | 4106026 | lawrenced@missionbank.com |
| Mike Martens | " | 410.6021 | martensm@missionbank.com |

# Kern County SGMA Open House

## May 14, 2019, Kern Ag Pavilion

| Name | Mailing Address | Telephone | Email |
|---|---|---|---|
| Warren Plaskett | 11638 S. Granite Rd Bak 93308 | 661 979 5445 | papaplaskett@yahoo.com |
| Bill Dewey | 985 W. Millbrook Hanford CA 93230 | 559-904-6959 | bill.dewey@olcmnet.com |
| Juan Ramos | 930 18th Bakersfield CA 93301 | 661 979-8542 | juanr@zbfarminginc.com |
| MEL JOHNSON | 551 TAFT HWY BAK. CAL 93307 | 661-333-3914 | greenfield water@hotmail.com |
| TIM RUIZ | P.O. BOX 6038 BAK, CA 93306 | 661-871-2011 | truiz@eastnilescsd.org |
| ALAN TRAN | 12000 Vista Del Mar, Playa Del Rey, CA 90293 | 310-648-5995 | ALAN.TRAN@Lacity.org. |
| LEE WADDLE | 31492 APPALOOSA VISALIA 93292 | 559-368-3514 | LWADDLE@Tcag.com |
| BEN KING | P.O. BOX 29 COLUSA CA 95932 | 530-723-3119 | bking@pacgoldag.com |
| Mark Tomlinson | PO Box 2205 | 661-322-4004 | mtomlinson@kuhsparkerlaw.com |
| Shulamit Shrader | 1031 S. Mt. Vernon | 661-868-6218 | sashrader@ucanr.edu |
| Jose A Gomez R | 930 18 Th Bakerfield | 661 201-9052 | pepe@zbfarminginc.com |
| Julio Ramos | 930 8th st Bakersfield 93301 | 661 344-6599 | julio@zbfarminginc.com |

# Kern County SGMA Open House

## May 14, 2019, Kern Ag Pavilion

| Name | Mailing Address | Telephone | Email |
|---|---|---|---|
| Tom Watson | | 323 823 2324 | tomwatson@equilogix.com |
| Don Burfiel | 2910 CLUB DR LOS ANGELES, CA 90064 | 310 497-3117 | DBURF@AOL.COM |
| Anona Dutton | — | 650-292-9100 | adutton@ekiconsult.com |
| Ella Kelsey | PO Box 455, McFarland 93250 | 661-792-3604 | lkr@atg internet.com |
| Matt Thomson | 19407 Wildwood Rd Buttonwillow, CA 93206 | 661 549-3088 | mjthomson1@gmail.com |
| Christine Lutte Zimmerman | 901 Tower Way, Ste 300 Bakersfield, CA | 661-343-5753 | christine@wspa.org |
| Dan Bartel | 849 Allen Rd Bakersfield CA 93312 | 661 589 6045 | dbartel@rrbwsd.com |
| Eric Averett | " | " | eaverett@rrbwsd.com |
| Tom Bracken | 441 VINELAND RD BKS 93307 | 661 549 8123 | tom@sridge.net |
| Doug Gosling | | • | dgosling@stroupgosling.com |
| John Karwat | | 661 808 0766 | TECTA.1976@GMAIL.COM |
| Vincent Sorena | | 661-340-0848 | vincent.sorena@ac-foods.com |

# Kern County SGMA Open House

**May 14, 2019, Kern Ag Pavilion**

| Name | Mailing Address | Telephone | Email |
|---|---|---|---|
| Stacie Ann Silva | — | — | SSILVA@NEWCURRENTWATER.COM |
| Mohammad Goraya | 1508 Fieldspring Dr Bkf 93311 | 661-398-5500 | MGoraya@[illegible].com |
| Jake Cauzza | 1600 Corn Camp Rd Bottonwillow 93201 | 661-331-0760 | Jakecauzza@gmail.com |
| Rebecca Smith | 621 Capitol Mall, 18th Floor Sacramento CA | 916-520-5281 | rsmith@downeybrand.com |
| Joe Eller | 4300 Midway Rd, Taft, CA 93268 | 661-763-1537 | jeller@holmeswestern.com |
| Micah Eggleton | — | — | eggleton@woodardcarran.com |
| Jeff Looker | 1998 Rd 152, Delano, CA 93215 | (661) 792-3151 | jlooker@sunviewvineyards.com |
| Randy Womble | 8660 Indian Clover Ct. Bakersfield 93311 | 213 216 4114 | randywomble57@gmail.com |
| Scott Hamilton | 7718 Davis Park Dr 93308 | 661 3031540 | scott@resourceecon.solutions |
| John Allen | 9301 Shafter Rd 93311 | 661.332.2038 | allenalmonds@gmail.com |
| Jeff Johnson | 7812 Calle Espada 93309 | 661-412-7059 | jojw@chevron.com |
| Sam Blue | | | SBLUE@BAKERSFIELDCITY.US |

# Kern County SGMA Open House

**May 14, 2019, Kern Ag Pavilion**

| Name | Mailing Address | Telephone | Email |
|---|---|---|---|
| Andy Gordus | 1234 East Shaw Ave Fresno, CA DFish+Wildlife | 559 243-4014 x239 | Andy.gordus@wildlife.ca.gov |
| Chris Bellue | Kern Delta Water Dist. | 661834-4656 | chris@kerndelta.org |
| Kate Melberg | 1149 South Broadway St. Los Angles, CA 90015 | 213-847-5188 | sarah.melberg@lacity.org |
| Christina Jones | " | 213 847 5179 | Christina.jones@lacity.org |
| GARY MORRIS | 24886 HWY 33 FELLOWS CA 93224 | 661-332-5280 | GJMORRIS45@HOTMAIL.COM |
| STEVE LEWIS | 1600 NORRIS RD BAK CA 93306 | 661-912-2604 | slewis@cbresources.com |
| John Battistoni | 1234 E Shaw Ave Fresno ICA 93710 CaDept. of Fish & Wildlife | 559-243-4014 | John.Battistoni@wildlife.ca.gov |
| Don Nelson | 5330 office Centre Ct #34 Bakersfield, CA 93309 | 661-378-8652 | don.bakersfield@yahoo.com |
| Matthew Hurdon | 2106 Lone Tree ct 93312 | 661-747 3967 | matthew.supremealmond.com |
| Tom Regan | 300 N. Lake Ave, Ste 400 Pasadena, CA 91101 | (626)568-6044 | thomas.regan@stantec.com |
| Eric Vogler | 300 N LAKE PASADENA | 626 2985009 | eric.vogler@stantec.com |
| KRIS LAWRENCE | 1405 Commercial way, suite 125 Bakersfield, CA, 93309 | 661-666-1095 | klawrence@lhwd.org |

# Kern County SGMA Open House

## May 14, 2019, Kern Ag Pavilion

| Name | Mailing Address | Telephone | Email |
|---|---|---|---|
| Martin Milobar | 154 E White Ln 93307 | 661-302-7457 | mmilobar@kcwa.com |
| Mark Sheriff | 4200 Truxtun Ave suite 101 93309 | 661-858-3016 | msheriff@farmmanagementservices.com |
| Steve Johnson | 5405 peppertree Ln 93309 | 909-476-2247 | steve.johnson@qcinc.com |
| Frank Guzman | 711 Pine Cone St 93220 | 661 742 5725 | Frank.Guzman@olannet.com |
| Robert Kuhs | P. O. Box 2205 BAK 93303 | | |
| Kelly Cecil | 3647 Piccini St. | 661-330-7071 | Kelly-384@outlook.com |
| Kevin Pascoe | 9400 Etchart Rd. Bak. 93314 | 661-805-6331 | KPascoe@onemain.com. |
| Everett McGhee | 8520 Fuller Dr. 93307 | 661-319-5008 | fulleracresw@yahoo.com |
| Frances Alcorn | 8520 Fuller Dr. 93307 | 661-319-5008 | |
| Ben Tatt | POBox 445 Edison, CA 93220 | 661 978-9044 | ben@calfruitcrop.com |
| Mohammad Yaghmour | 1081 S. Mt Vernon Ave Bakersfield 93307 | 661-868-6211 | mayaghmour@ucanr.edu |
| Leroy Ellinghouse | 1416 9th St Sac Ca 95814 | 916 653-7168 | leroye@waterca.gov |

Item 12

# ARVIN-EDISON WATER STORAGE DISTRICT & ARVIN COMMUNITY SERVICES DISTRICT

INVITES YOU TO AN

INFORMATIONAL WORKSHOP ON

SUSTAINABLE GROUNDWATER PLAN & COMPLIANCE

## THURSDAY, MAY 30, 2019

THREE SEPARATE WORKSHOPS

TIMES: 8:00 A.M. 1:00 P.M. & 5:00 P.M.

LOCATION: ARVIN VETERAN'S HALL

414 4th STREET

ARVIN, CALIFORNIA

Self-Help Enterprises

ARVIN COMMUNITY SERVICES DISTRICT

# ARVIN-EDISON WATER STORAGE DISTRICT & ARVIN COMMUNITY SERVICES DISTRICT

Te invita a un taller informativo sobre el

plan de agua subterranea

sustentable y cumplimeniento

## Jueves 30 Mayo del 2019

tres talleres a las

Horarios: 8:00 A.M. 1:00 P.M. y 5:00 P.M.

Ubicación: Salon de veteranos de Arvin

414 4th Street

ARVIN, CALIFORNIA

Self-Help Enterprises

ARVIN COMMUNITY SERVICES DISTRICT

Kern River Groundwater Sustainability Agency (KRGSA)

# Review Draft KRGSA Groundwater Sustainability Plan (GSP)

Special Board Meeting
August 21, 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.

TODD GROUNDWATER

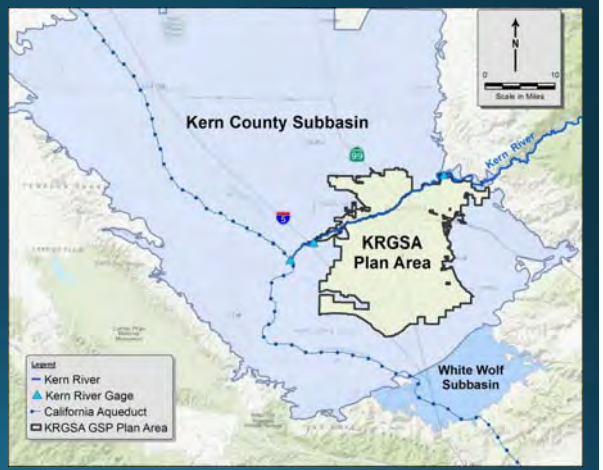
## KRGSA GSP Organization

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


TODD GROUNDWATER

## 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

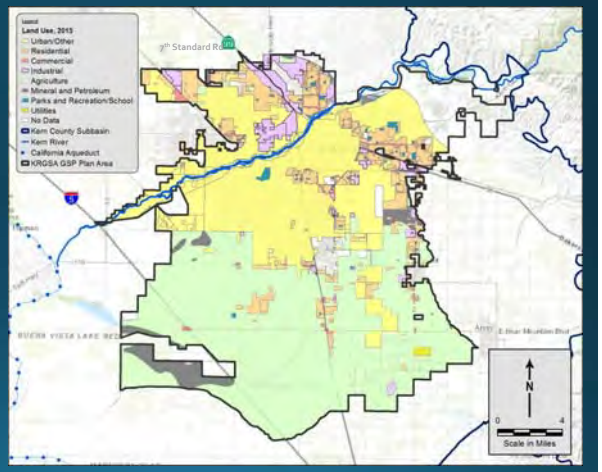



DRAFT

TODD GROUNDWATER

# Land Use in the KRGSA Plan Area

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

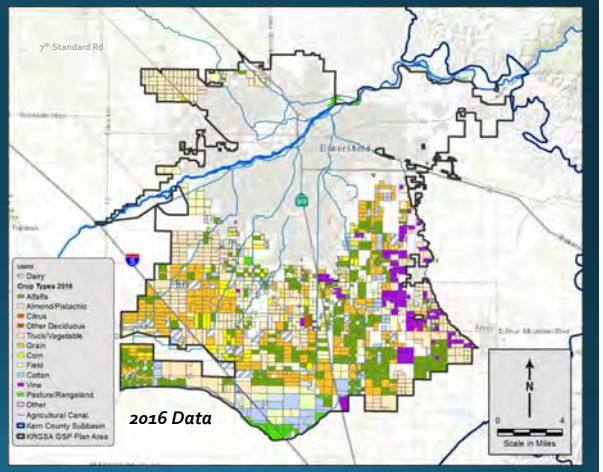



DRAFT

TODD GROUNDWATER

# Agricultural Lands in the KRGSA

- 90,000 acres irrigated agriculture in southern Plan Area
- 16,000 acres irrigated lands in northern Plan Area
- 20 Dairies in southern Plan Area

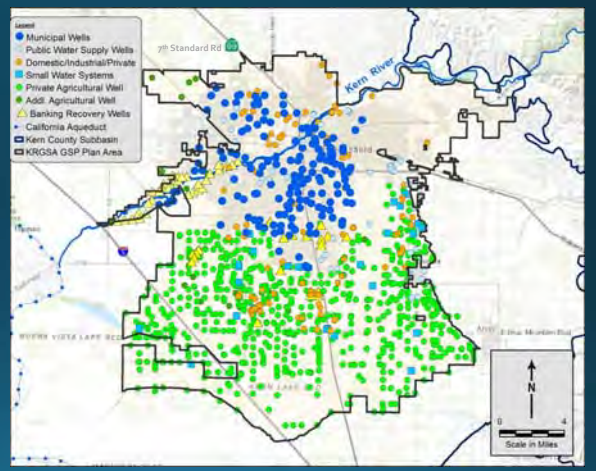



DRAFT

TODD GROUNDWATER

# 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

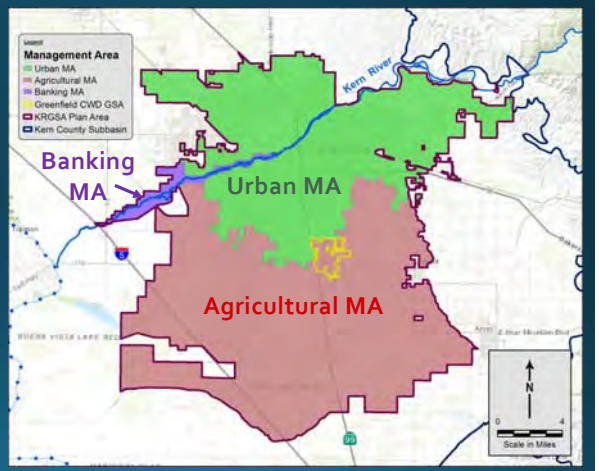



DRAFT

TODD GROUNDWATER

# Preliminary Management Areas (MA)

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




DRAFT

TODD GROUNDWATER

# 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

DRAFT

TODD GROUNDWATER

# Chronic Lowering of Water Levels

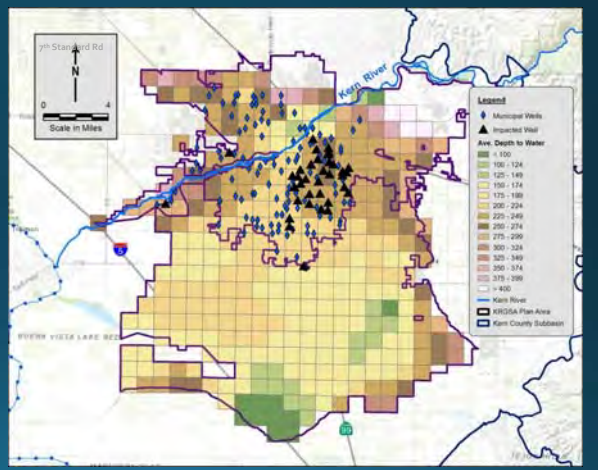
- Undesirable results: when significant and unreasonable impacts occur over the implementation/planning horizon, as determined by depth/elevation of water, affect the reasonable and beneficial use of, and access to, groundwater by overlying users.
- Impacts focus on groundwater wells
- Balance the need for:
  - higher water levels in municipal wells
  - lower water levels in irrigation and banking wells, primarily to provide critical supplies during multi-year droughts.

DRAFT

TODD GROUNDWATER

# Historic Low WLs Impacts to Wells

- Comparison of depth to water and top of municipal well screens
- During 2015, water levels were below the top of screens in more than 40 municipal wells
- Significant expenditures for lowering pumps, wells offline, securing supplemental supplies

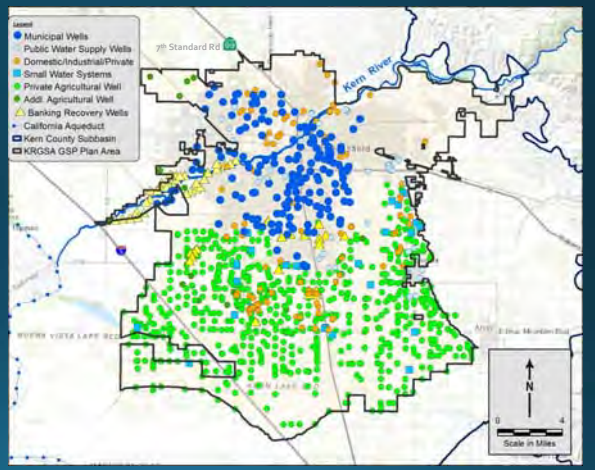



DRAFT

TODD GROUNDWATER

# Concentrated pumping in banking and ag wells

- More than 150 municipal wells intermingled with more than 50 banking recovery wells
- 642 Agricultural wells, mostly southern Plan Area
- Urban wells extend into the south-central Plan Area




DRAFT

TODD GROUNDWATER

# Reduction of Groundwater in Storage

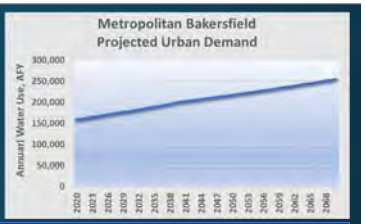
- 3 Independent Methods
- Relatively good agreement
- Minimal deficits; sustainable budget
- Deficit for banking adjustments

| 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 |

TODD GROUNDWATER

# 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



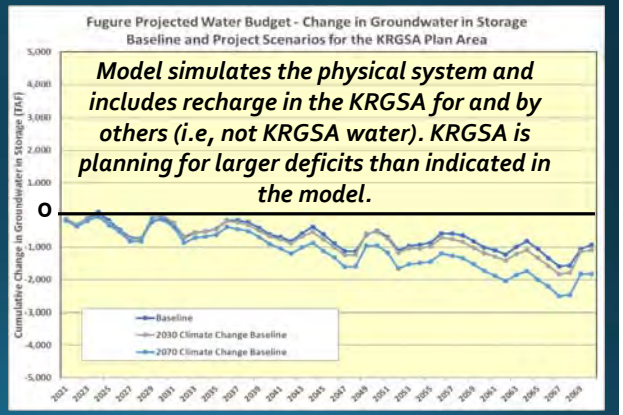

| Water Budget Component | Historical Average Annual Amounts (AFY) | Baseline Conditions (AFY) | 2030 Climate Change Conditions (AFY) | 2070 Climate Change Conditions (AFY) |
|---|---|---|---|---|
| SWP[1] – ID4 | 74,035 | 52,758 | 51,182 | 48,759 |
| SWP - KDWD | 18,655 | 15,765 | 15,294 | 14,537 |
| **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** |

DRAFT

TODD GROUNDWATER

# 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

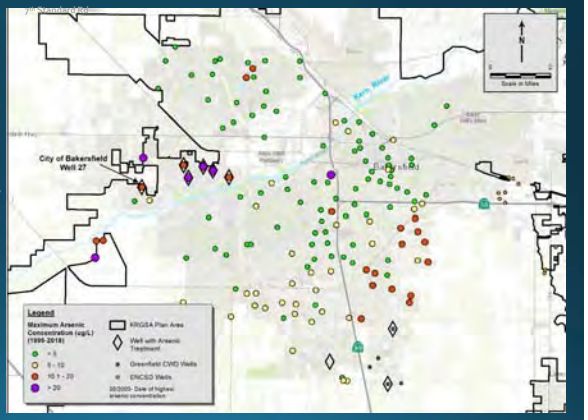



DRAFT

TODD GROUNDWATER

# 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

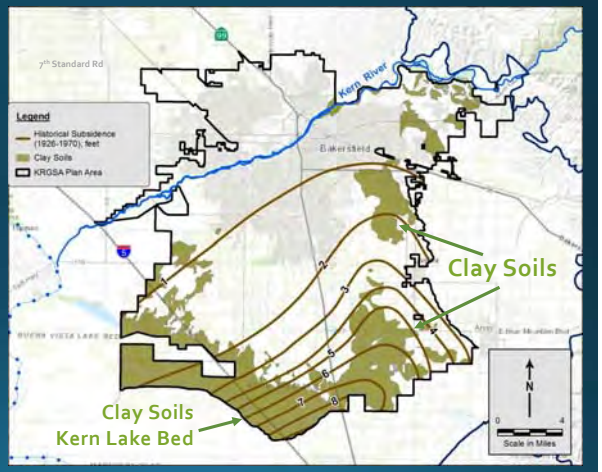



DRAFT

TODD GROUNDWATER

# 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 south and east Plan Area

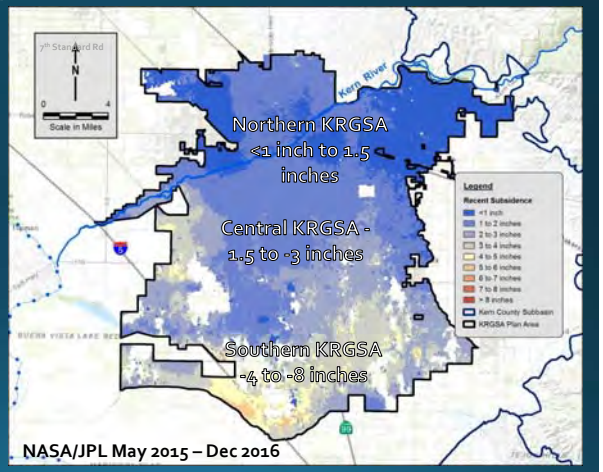



DRAFT

TODD GROUNDWATER

# Recent Drought Subsidence

- Recent subsidence May 2015 – Dec 2016 from NASA/JPL data
- Minimal subsidence in northern Plan Area
- -4 to -8 inches in southern Plan Area
- Recent subsidence in same areas as historical subsidence

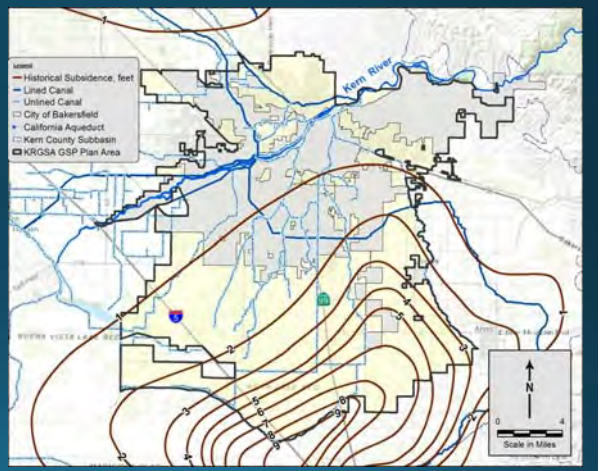



DRAFT

TODD GROUNDWATER

# 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




DRAFT

TODD GROUNDWATER

# Analysis of Interconnected Surface Water

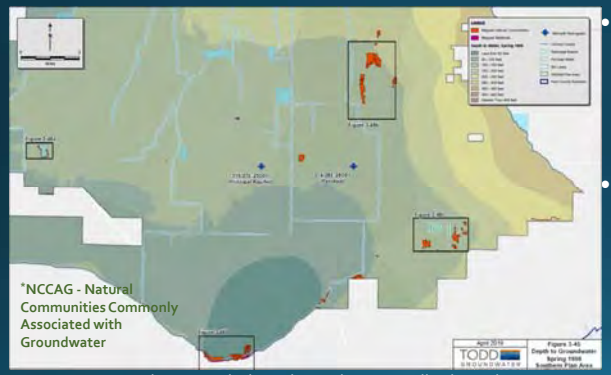

- Evaluated groundwater conditions using local NCCAG* maps along Kern River
- Kern River is actively managed through regulated releases, diversions, and managed aquifer recharge

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

DRAFT

TODD GROUNDWATER

# 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

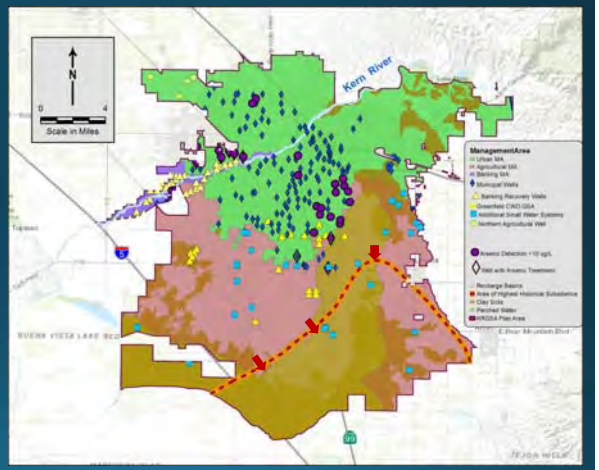
Mapped areas include recharge basins, spills along the rim canal, artificially-constructed ski lakes. Local irrigation and perched water conditions throughout the area.

DRAFT

TODD GROUNDWATER

# Sustainability Considerations

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




DRAFT

TODD GROUNDWATER

# 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/Northeast | Municipal wellfields | Historic Low WL | Historic Low WL | Historic Low WL | 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 |
| | Northwest | Agricultural and recovery wells | 50' below Historic Low WL | 50' below Historic Low WL | 50' below Historic Low WL | 50' below Historic Low WL |
| | South and East | Subsidence potential | 50' below Historic Low WL | 50' below Historic Low WL | 50' below Historic Low WL | 20' below Historic Low WL |
| KRGSA Banking MA | Kern River Channel | ID4/KCWA 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.*

- 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.

TODD GROUNDWATER

# Approach to Minimum Thresholds

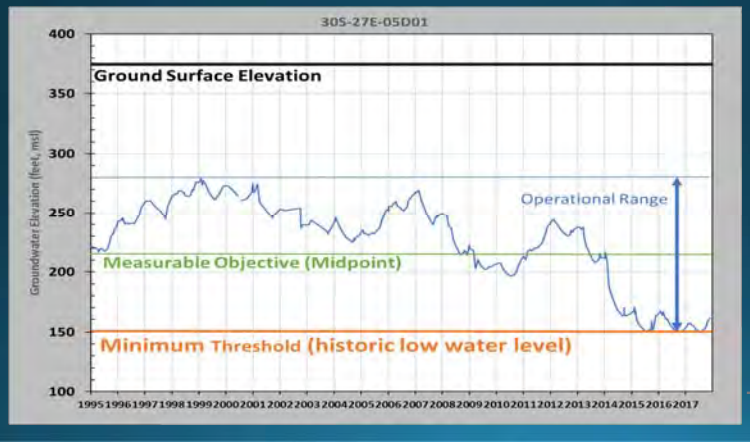
| KRGSA Management Area (MA) | MA Subarea and Considerations for Management | | Undesirable Results for Controlling Sustainability Indicators | | | |
|---|---|---|---|---|---|---|
| | | | Controlling Indicator | Minimum Threshold (MT) | Percent of Wells <MT | Duration of MT Exceedance |
| KRGSA Urban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

TODD GROUNDWATER

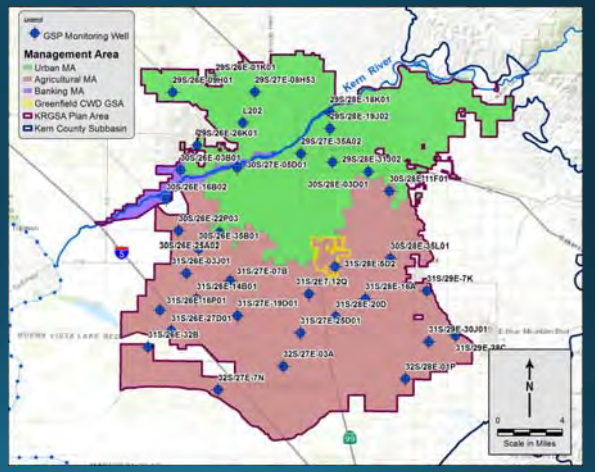
# Assignment of MT, MO, and Operational Range




TODD GROUNDWATER

# Preliminary GSP Monitoring Wells

- 36 wells identified
- Currently monitored in other WL programs:
  - Kern Fan Monitoring Comm
  - KCWA/ID4 WL Program
  - City Monitoring Wells
  - KDWD Monitoring Programs
- Possible additional Urban MA wells from Cal Water and ENCSD

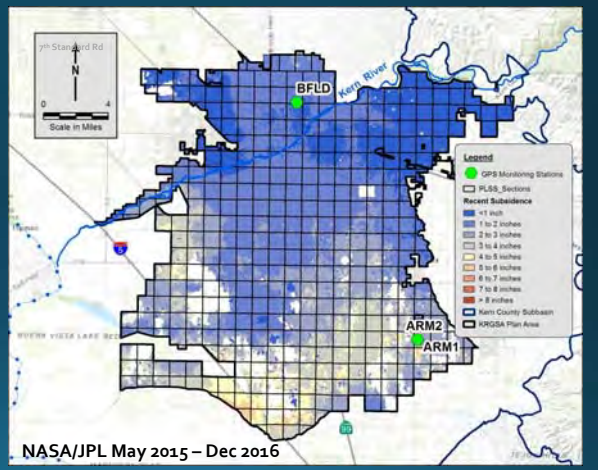



DRAFT

TODD GROUNDWATER

# 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




NASA/JPL May 2015 – Dec 2016

DRAFT

TODD GROUNDWATER

# Key Management 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

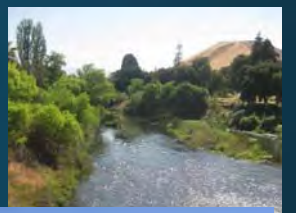
DRAFT

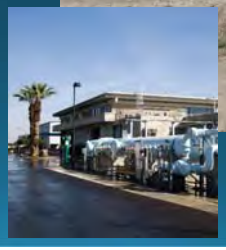
TODD GROUNDWATER

# Key Management 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





DRAFT

TODD GROUNDWATER

# Key Management 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*

DRAFT

TODD GROUNDWATER

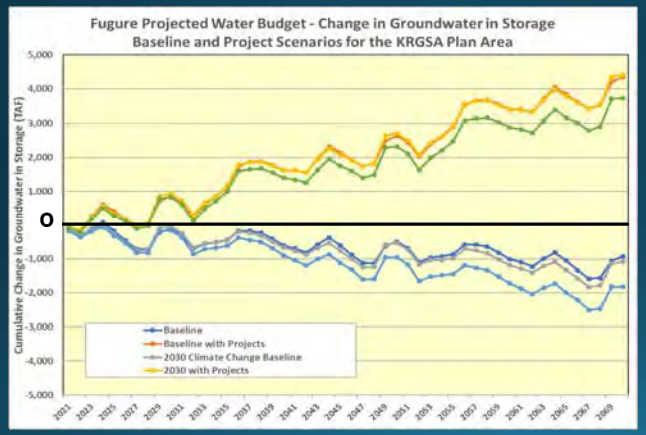
# Management Actions

- 5-Step Action Plan if Minimum Thresholds are exceeded
- Implement well metering in the Agricultural MA (KDWD)
- Program for reporting groundwater extractions in the KRGSA
- Conserve recycled water in the KRGSA Plan Area (City)
- Support Delta Conveyance to preserve imported supplies
- Incorporate Climate Change Adaptation Stratgies (ID4)
- Improve monitoring program
- Coordinate water quality analysis with existing programs

DRAFT

TODD GROUNDWATER

# Projected Water Budgets with Projects




Collectively, these projects and management actions address current and projected groundwater deficits to achieve sustainable management.

DRAFT

TODD GROUNDWATER

# 90-Review Period and Outreach

- Communication and outreach with Stakeholders for GSP input
- Outreach accomplished at many levels:
  - Agency Board Meetings and Workshops
  - Targeted community meetings
  - Coordinate with other GSAs on Open House
- GSP is a draft document and can be revised based on input:
  - Working to improve monitoring program
  - Incorporate details on how GSP implementation can be achieved
- KRGSA supports collaborative efforts and internal coordination to achieve sustainable management for the Subbasin shared groundwater resources



Item 14a

**Kern Groundwater Authority & Kern County Farm Bureau**

**invites you to the...**

# GSP Public Review Open House

## Sustainable Groundwater Management Act & Groundwater Sustainability Plan (GSP)

A "One-Stop-Shop" for groundwater users with interests throughout the Kern Subbasin to meet with representatives from subbasin GSAs and water/irrigation districts to discuss the Kern Subbasin Groundwater Sustainability Plans during the 90-day public review period.

## Thursday, September 26, 2019 from 5:30 to 7 p.m.

### Location: Kern Ag Pavilion (3300 E. Belle Terrace, Bakersfield, CA 93307)

**Participating groundwater sustainability agencies (GSAs) and water/irrigation districts that will have tables at the event:**

**Kern Groundwater Authority**

- Arvin Community Services District (ACSD)
- Arvin-Edison Water Storage District (AEWSD)
- Cawelo Water District (CWD)
- City of Shafter
- County of Kern
- Kern County Water Agency (KCWA)
- Kern-Tulare Water District (KTWD)
- Kern Water Bank Authority (KWBA)
- North Kern Water Storage District (NKWSD)
- Rosedale-Rio Bravo Water Storage District (RRBWSD)
- Semitropic Water Storage District (SWSD)
- Shafter-Wasco Irrigation District (SWID)
- Southern San Joaquin Municipal Utility District (SSJMUD)
- Tejon-Castaic Water District (TCWD)
- West Kern Water District (WKWD)
- Westside District Water Authority (WDWA)
- Wheeler Ridge-Maricopa Water Storage District (WRMWSD)

**Henry Miller Water District GSA**

**Buena Vista Water Storage District GSA**

**Olcese Water District GSA**

**Kern River GSA**

- Kern Delta Water District
- City of Bakersfield
- Improvement District No. 4

*Co-hosted by:*

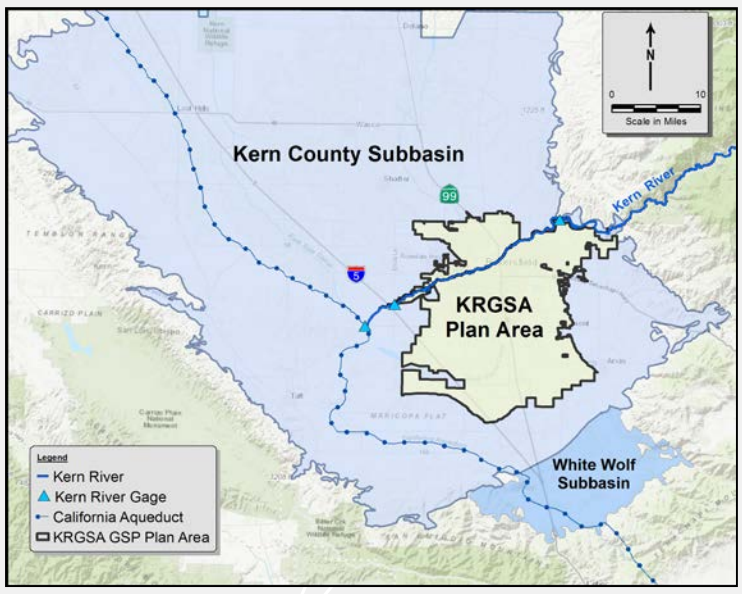
KERN GROUNDWATER AUTHORITY

KERN COUNTY FARM BUREAU

For questions about the event, email ppoire@kerngwa.com or call the Kern County Farm Bureau at (661) 397-9635.

KERN RIVER GROUNDWATER SUSTAINABILITY AGENCY

# Groundwater Sustainability Plan (GSP)



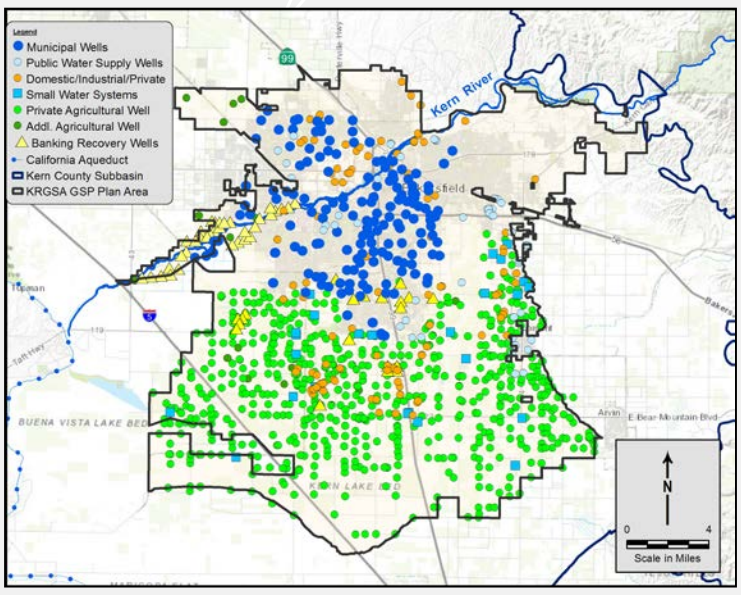

**Kern River Groundwater Sustainability Agency (KRGSA)**

**Groundwater Sustainability Plan (GSP) Plan Area**

The GSP Plan Area is located in the Kern County Subbasin, the largest groundwater basin in California. Covering about 2,834 square miles, the Subbasin extends from the Tehachapi/San Emigdio Mountains in the south to the northern Kern County line.

The KRGSA Plan Area covers 361 square miles, about 13 percent of the Subbasin. The area includes most of the Bakersfield city limits and extends from 7th Standard Road in the northwest to near Copus Road in the south. Both Highway 99 and I-5 cross the Plan Area. The area contains about 16 miles of the Kern River from the foothills on the northeast to the 2nd Point measuring station near I-5 in the southwest.

KRGSA member agencies include the City of Bakersfield (City), Kern County Water Agency – Improvement District No. 4 (ID4), Kern Delta Water District (KDWD), and other agencies. The City, ID4, and KDWD serve as the GSP Plan Managers.

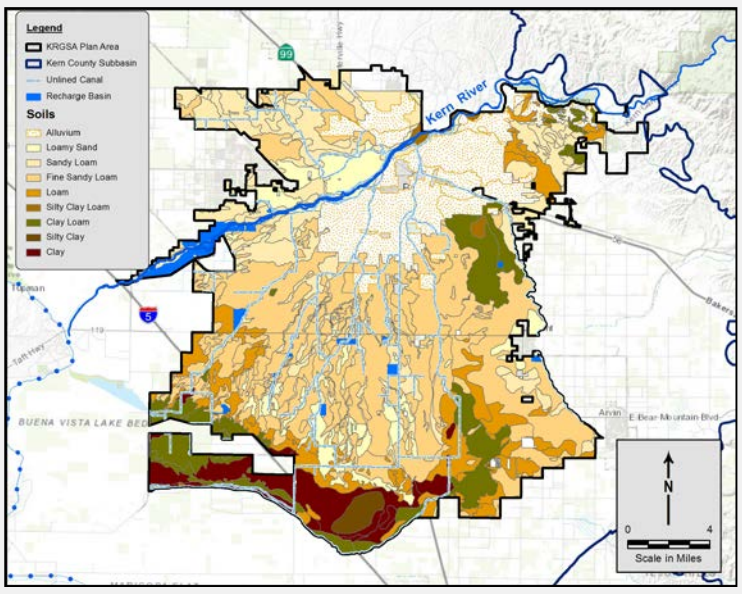



**Land Use and Groundwater Wells in KRGSA Plan Area**

Most of the northern KRGSA Plan Area is urban with sparsely populated or undeveloped areas in the northeast. The primary land use in the southern KRGSA Plan Area is agriculture. The west-central Plan Area is dominated by recharge basins and groundwater banking projects, mostly along the Kern River. Land use in the Plan Area is approximated as follows:

- 41% Agricultural
- 33% Urban
- 26% Undeveloped

The KRGSA relies heavily on groundwater with more than 1,000 active wells (see map at left). Most northern wells are municipal (blue dots) and banking recovery wells (yellow triangles). Southern wells are mostly agricultural (green dots). Additional private and public wells are distributed throughout the Plan Area.

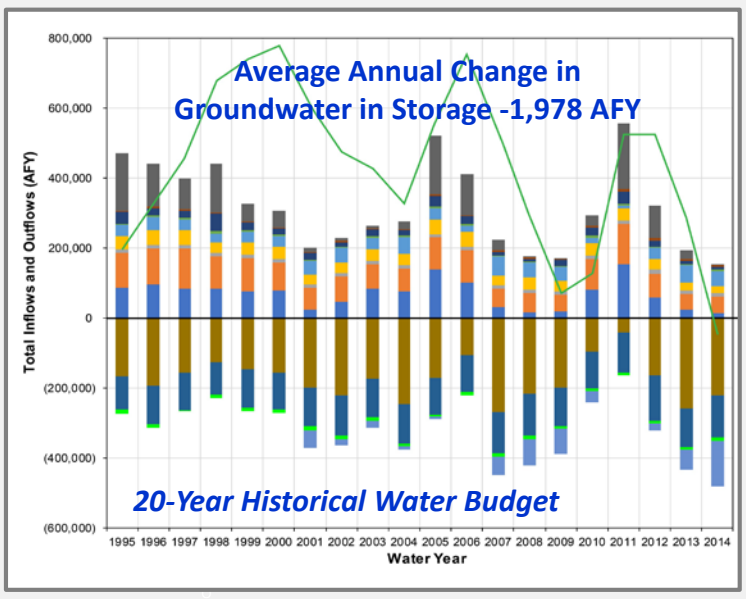



**Conjunctive Use and Managed Recharge**

Three primary water sources support beneficial uses in the Plan Area.

- Imported Water – ID4 manages and treats water from the State Water Project (SWP) to provide drinking water to much of the northern Plan Area. KDWD manages SWP water for agricultural irrigation in the southern Plan Area.
- Kern River Water – The City manages the Kern River on behalf of the Kern River Watermaster to provide drinking water, agricultural irrigation, and other uses.
- Groundwater – Public and private wells supplement surface water supplies.

These three sources are managed conjunctively in the KRGSA to optimize water supply. Both imported water and Kern River water are also recharged for replenishment and/or recovery in recharge basins, the river channel and along unlined canals. Areas of managed and natural recharge are indicated on the map.




**Basin Setting**

The GSP evaluates the Basin Setting of the Plan Area and addresses the following topics:

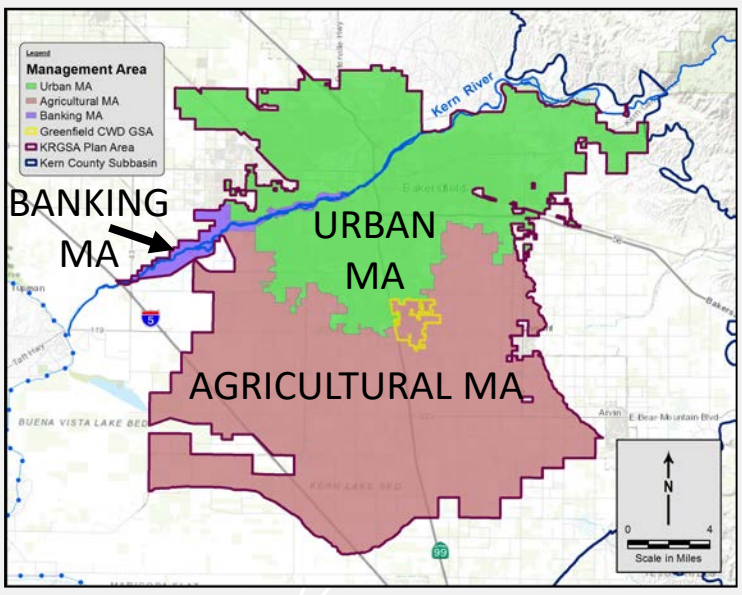
- **Hydrogeologic Conceptual Model -** describes the physical conditions of the groundwater basin including geology, topography, soils, hydrology, basin geometry and the aquifers and aquitards that control groundwater recharge, storage, and movement.
- **Groundwater Conditions –** evaluates groundwater occurrence and flow, groundwater levels and quality, inelastic land subsidence due to groundwater withdrawal, and interconnected surface water, if any.
- **Water Budgets -** provide an accounting of inflows and outflows of the groundwater system including an analysis of historical, current, and projected future conditions. Annual Change of Groundwater in Storage from the historical water budget is shown at left, indicating minimal depletion over 20 years.



TODD GROUNDWATER

KERN RIVER GROUNDWATER SUSTAINABILITY AGENCY

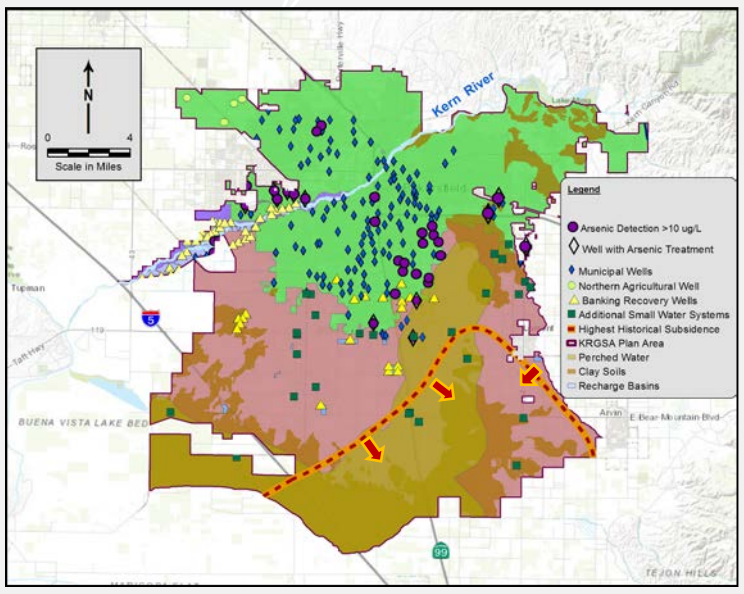
# Groundwater Sustainability Plan (GSP)




## Management Areas (MAs) and Sustainability Indicators

Three Management Areas (MAs) have been delineated to accommodate different sustainable management criteria, to facilitate management actions, and to align management responsibilities with agency jurisdictional boundaries. The GSP evaluates the six sustainability indicators listed below for each MA. *Undesirable results* are defined as any sustainability indicator determined by the KRGSA to be significant and unreasonable.

- **Chronic Lowering of Water Levels**
- **Reduction of Groundwater in Storage**
- **Degraded Water Quality**
- **Inelastic Land Subsidence**
- **Interconnected Surface Water (not identified in KRGSA)**
- **Seawater Intrusion (Not applicable to KRGSA)**



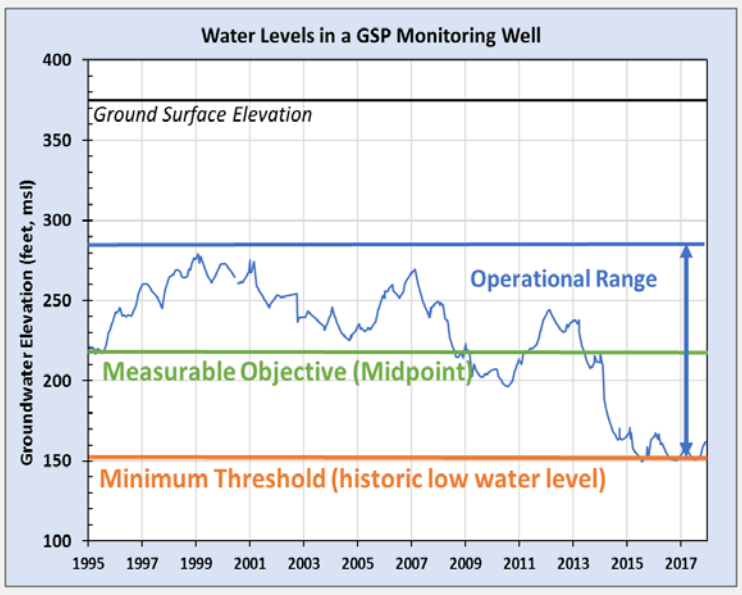

## KRGSA GSP Sustainability Considerations

During the recent drought, water levels fell below the top of screens in more than 40 municipal wells (blue diamonds on map), creating significant expenditures for well modifications and leaving other wells at risk if water levels are lowered. This need for higher water levels in the Urban MA is balanced with the need for banking recovery wells and irrigation wells to lower water levels during drought for provision of critical supplies.

Projected water budgets identified future deficits with decreases in supply and increases in demands. Projects were identified to meet these deficits.

Arsenic concentrations increased in municipal wells during historic low water levels (purple dots). Although wellhead treatment managed the issue during the drought, numerous wells remain at risk if water levels decline further.

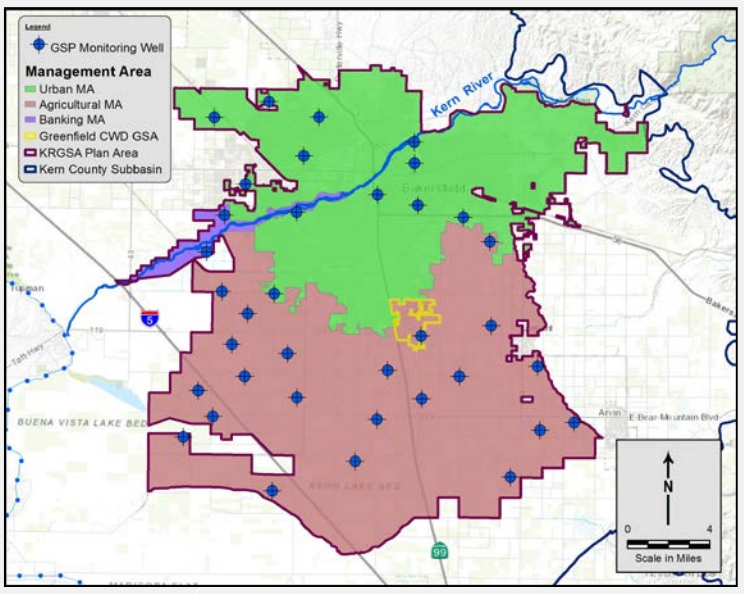
Historical land subsidence has occurred in the southern Plan Area. Although no infrastructure damage has been identified, subsidence remains a concern.




## KRGSA GSP Minimum Thresholds (MTs) and Measurable Objectives (MOs)

Based on the sustainability considerations above, undesirable results were determined to have occurred at the historic low water levels for the Water Level and Water Quality indicators for most of the Urban MA. Accordingly, minimum thresholds (MTs) are set at historic low water levels. MTs are lower in the Agricultural MA and Banking MA where well screens and arsenic are of lesser concerns. This allows operational flexibility for banking and irrigation wells, especially during drought. Water levels are also maintained relatively high in areas of historical subsidence.

Measurable Objectives (MOs) are selected as the midpoint between the MT and the historical high water level to set a reasonable operational range for water levels beneath the KRGSA Plan Area. These designations allow for all sustainability indicators to be monitored by water levels only, providing a relatively simple construct to facilitate GSP monitoring and sustainable management.




## KRGSA GSP Monitoring Network

Approximately 36 monitoring wells have been selected for the KRGSA GSP monitoring network. Wells were included based on long water level records and ease of use. Additional wells are being evaluated for possible inclusion in the program. Monitoring objectives are listed as follows:

- Demonstrate progress toward achieving MOs.
- Monitor impacts to the beneficial uses or users of groundwater.
- Monitor changes in groundwater conditions relative to MOs and MTs.
- Quantify annual changes in water budget components.
- Document performance of GSP projects and management actions.
- Ensure that management actions do not cause undesirable results.
- Demonstrate ability to achieve the KRGSA Sustainability Goal (see next page).

This monitoring program is supplemented by data from other monitoring programs in the Plan Area, such as the Irrigated Lands Program and drinking water programs.



TODD GROUNDWATER

KERN RIVER GROUNDWATER SUSTAINABILITY AGENCY

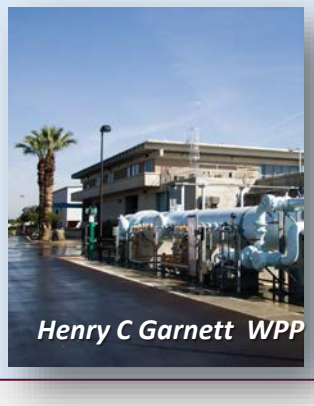
# Groundwater Sustainability Plan (GSP)

***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.

***Imported water is critical to sustainability in the KRGSA Plan Area***



*Henry C Garnett WPP*

## Summary of Undesirable Results and Minimum Thresholds for Each Management Area

| 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/Northeast | Municipal wellfields | Water Levels/Quality | 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 |
| | South and East | Subsidence potential | Subsidence | 20' below Historic Low WL | 40% in Agricultural MA | >2 Consecutive Years |
| KRGSA Banking MA | Kern River Channel | ID4/KCWA 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.*

### GSP PROJECT – KDWD Water Allocation Plan

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

*Recharge in unlined canals*

*TCP Treatment*

### GSP PROJECT – North Weedpatch Consolidation

- Consolidates up to 6 small water systems with East Niles CSD to address water quality concerns
- Provides for 1,2,3-TCP and arsenic treatment to improve drinking water for disadvantaged communities

### GSP PROJECT – City of Bakersfield Optimized Conjunctive Use

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

*Managed Recharge in the COB 2800 Facility*

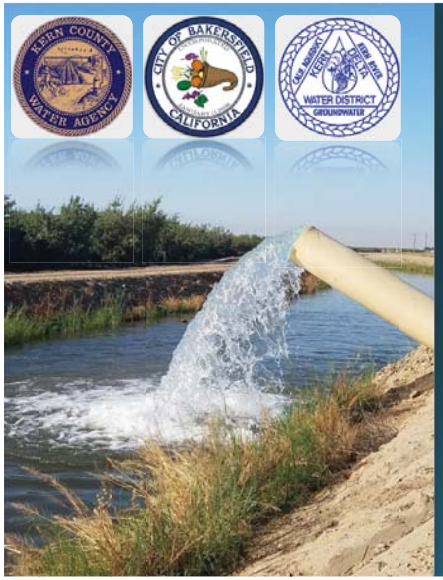
### Additional GSP Projects and Management Actions

- 5-Step Action Plan if Minimum Thresholds are exceeded
- Implement a Well Metering Program
- Implement a Groundwater Extraction Reporting Program
- Conserve recycled water in the KRGSA Plan Area
- Support Delta Conveyance to preserve imported supplies
- Incorporate Climate Change Adaptation Strategies
- Improve the GSP Monitoring Program
- Coordinate water quality analysis with existing programs
- Track urbanization of agricultural lands
- Consider water exchanges for water quality improvement

*Managed Recharge and Conjunctive Use - the Foundation of Sustainable Management in the Plan Area*



TODD GROUNDWATER



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:

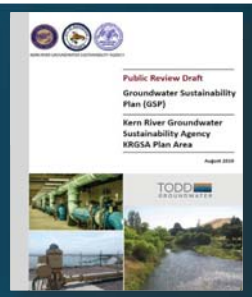
- support current and future beneficial uses of groundwater including municipal, agricultural, industrial, domestic, public supply, and environmental uses
- optimize conjunctive use of surface water and groundwater
- avoid or eliminate undesirable results over the implementation and planning horizon.

DRAFT

TODD GROUNDWATER

## 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

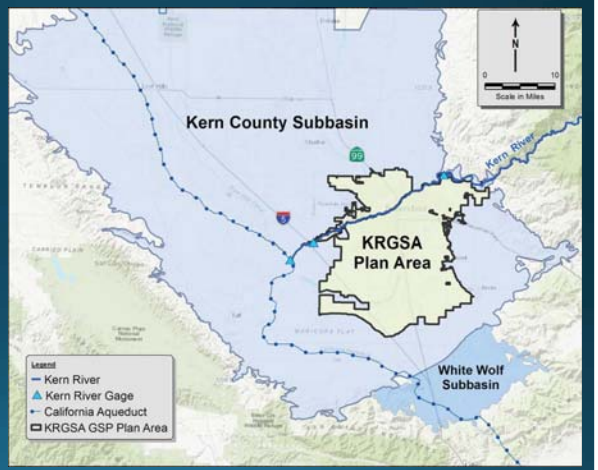



DRAFT

TODD GROUNDWATER

## 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



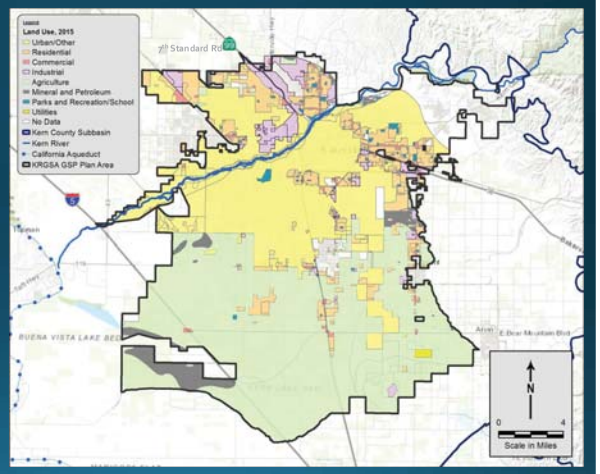

DRAFT

TODD GROUNDWATER

Item 15

## Land Use in the KRGSA Plan Area

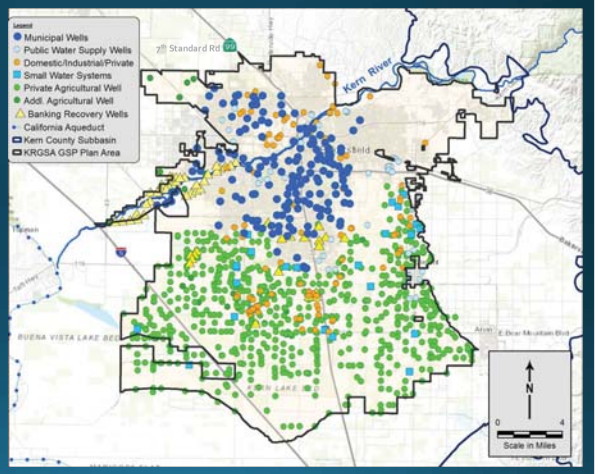
- North – Urban
- South – Agricultural
- 2015 Land Use
  - 41% - Agricultural
  - 33% - Urban
  - 26% - Undeveloped




DRAFT

## Active Wells in the KRGSA

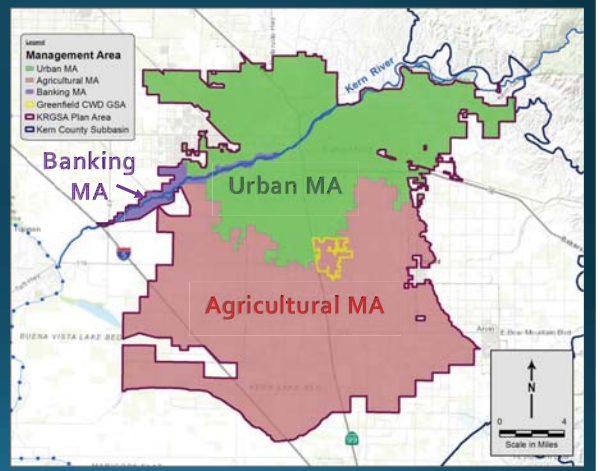
- 162 Municipal wells
- 67 Public Supply and Small Water System wells
- 151 Industrial, Domestic, and other Private wells
- 642 Agricultural wells
- 54 Banking recovery wells




DRAFT

## Preliminary Management Areas (MA)

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




DRAFT

## Sustainability Indicators

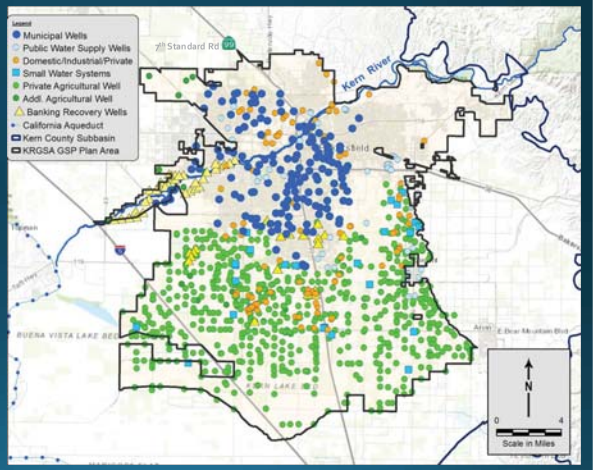
- Chronic Lowering of Water Levels
- Reduction of Groundwater Storage
- Degradation of Water Quality caused by management actions
- Land subsidence affecting land use
- Depletion of Interconnected Surface Water affecting beneficial use

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

DRAFT

# 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




DRAFT

# Reduction of Groundwater in Storage

- 3 Independent Methods
- Relatively good agreement
- Minimal deficits; sustainable budget
- Deficit for banking adjustments

| 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 |

# Projected Water Budgets Future Deficits

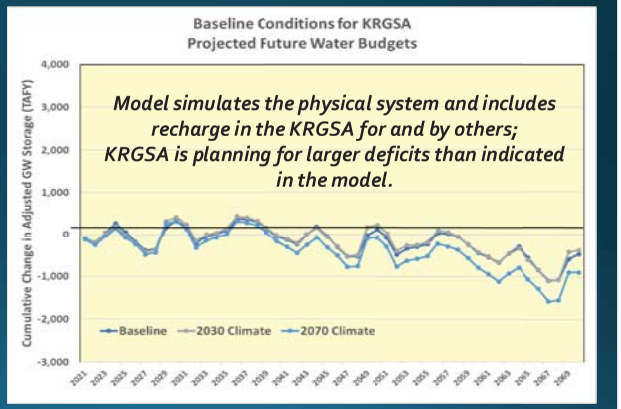
- Increase urban demand
- Decrease SWP supply
- Increase agricultural demand (climate changes factors )
- Potential Future Water Budget Deficits
- Plus Historical Adjusted deficit of -29,000 AFY

| 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** |

DRAFT

# Projected Water Budgets C2VSimFG-Kern Model

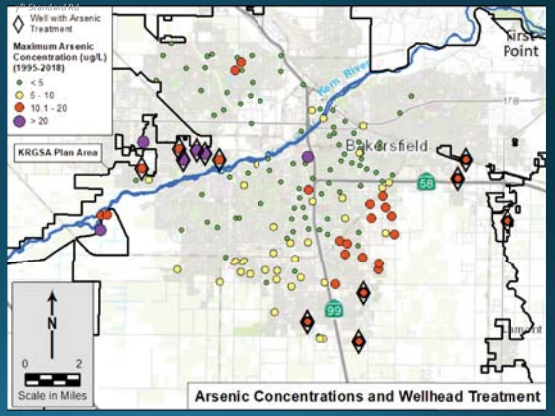
- Baseline - current land use and projected water supply and demand
- 2030 Climate Change Scenario with increases in agricultural demand and decreased supply
- 2070 Climate Change Scenario with further increase in demand and decrease in supply




DRAFT

# 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

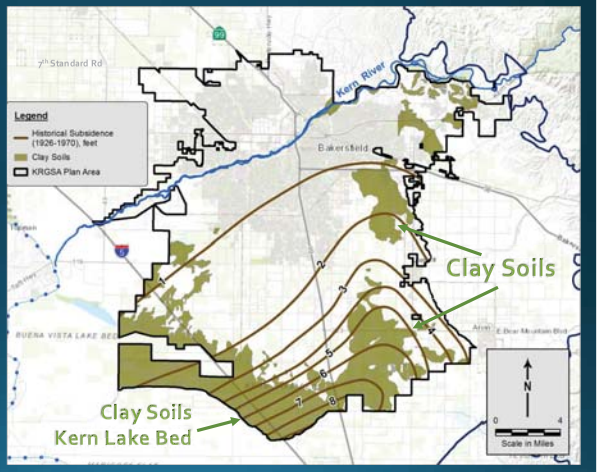


Arsenic Concentrations and Wellhead Treatment

DRAFT

# Inelastic Land Subsidence

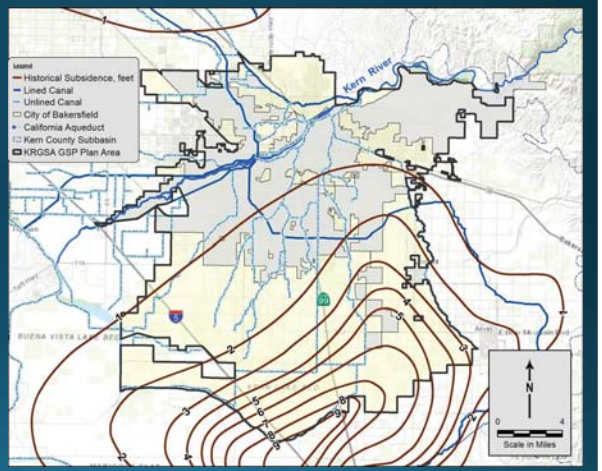
- Historical Subsidence from 1926 – 1970 mapped by USGS
- Up to 9 feet in southern Plan Area
- Correlates to areas of clay soils and subsurface clay sediments in southeast Plan Area




DRAFT

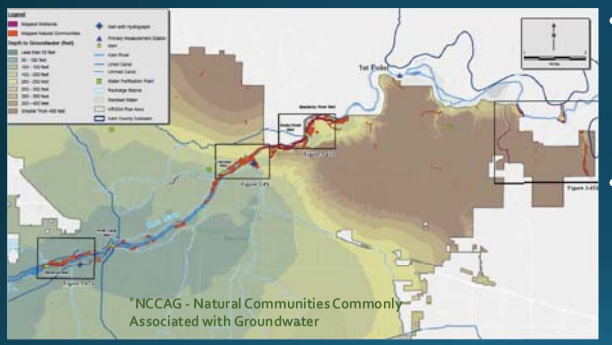
# Subsidence and Critical Infrastructure

- 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




DRAFT

# Analysis of Interconnected Surface Water

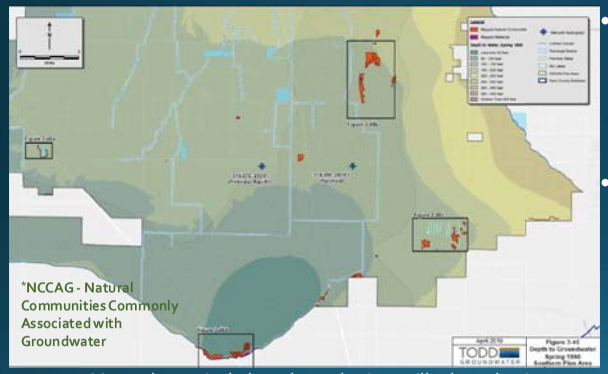



- Evaluated groundwater conditions using local NCCAG* maps along Kern River
- Kern River is actively managed through regulated releases, diversions, and managed aquifer recharge

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

DRAFT

# Analysis of Interconnected Surface Water



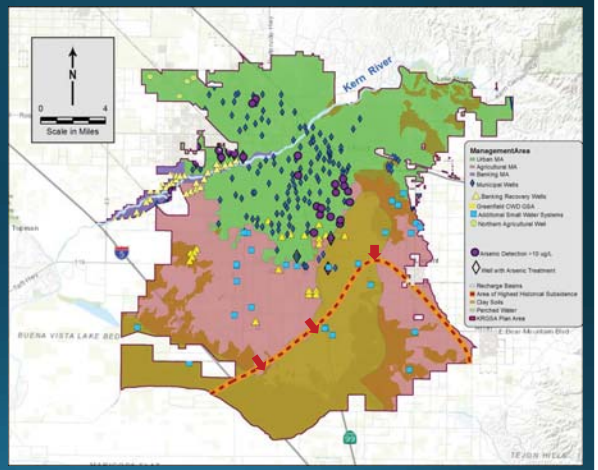

- Evaluated groundwater conditions at local NCCAG areas in southern Plan Area
- Analysis indicates that local vegetation and wetlands are not supported by groundwater in the Principal Aquifer

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

DRAFT

# 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




DRAFT

# 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.*

DRAFT

- 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.

# Approach to Undesirable Results

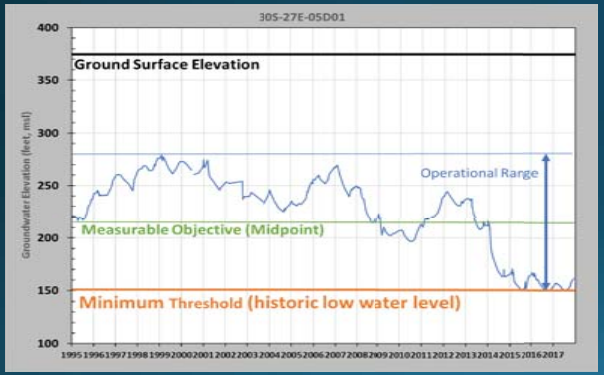
| KRGSA Management Area (MA) | MA Subarea and Considerations for Management | | Undesirable Results for Controlling Sustainability Indicators | | | |
|---|---|---|---|---|---|---|
| | | | Controlling Indicator | Minimum Threshold (MT) | Percent of Wells <MT | Duration of MT Exceedance |
| KRGSA Urban 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.

DRAFT

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

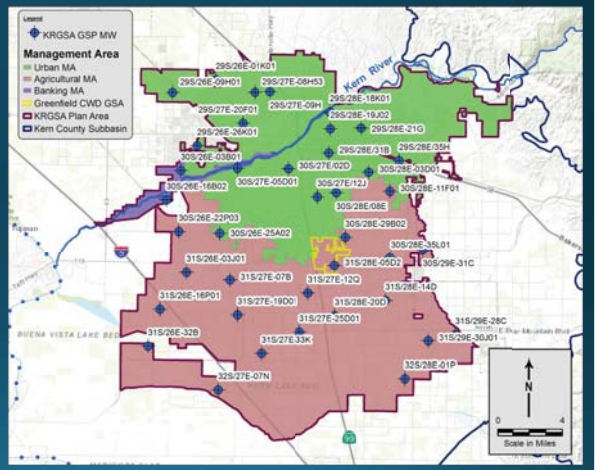



- Example hydrograph from monitoring well
- In Urban MA, MT is set at the historic low water level
- The MO is the average between the high level and the MT

DRAFT

# Improved GSP Monitoring Network

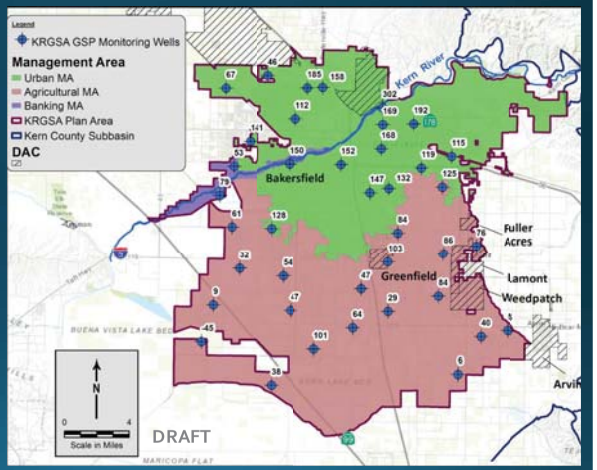
- 39 wells identified
- Improved well selection
- Added inactive wells to replace production wells
- Water level monitoring only
- Best use of other WL programs
- Incorporates water quality data from numerous existing programs




DRAFT

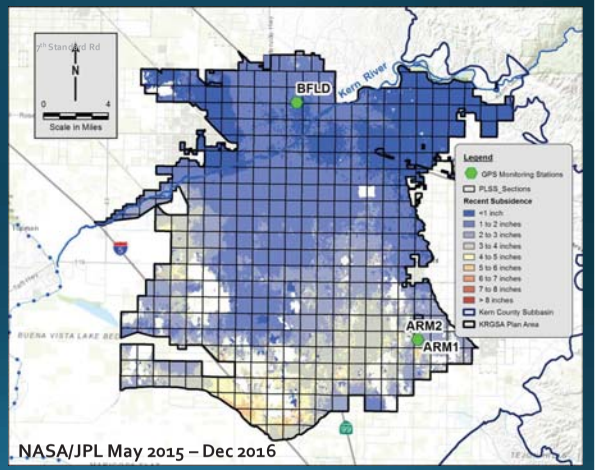
# Adjustments to MTs: Input from Small Water Systems

- 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




DRAFT

| 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

DRAFT

# 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

DRAFT

# 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

DRAFT

# Key GSP Projects

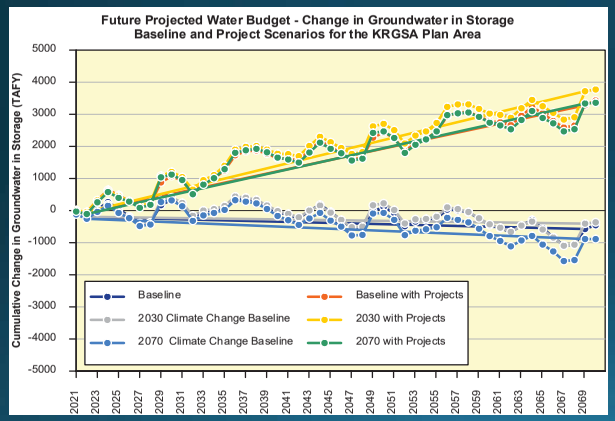
## East Niles Community Services District North Weedpatch Highway Consolidation

- 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*

DRAFT

# Projected Water Budgets with GSP Projects




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

DRAFT

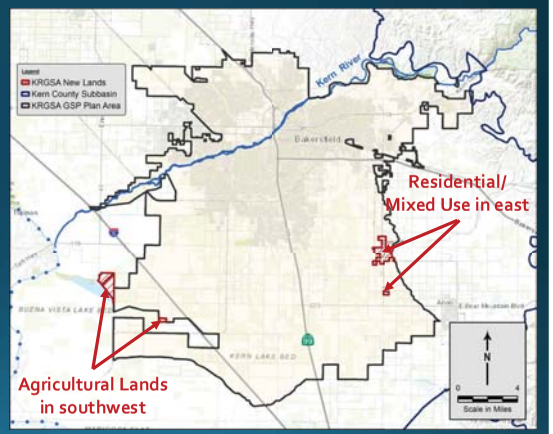
# Management Actions – KRGSA Policies

- 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

DRAFT

# 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




DRAFT

# 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

DRAFT

# 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

DRAFT

# 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)

DRAFT

# 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)

DRAFT

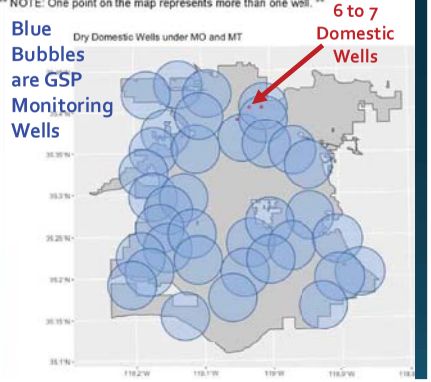
# Public Comments –
# Dry Well Analysis
# Leadership Counsel

- 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

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. **




DRAFT

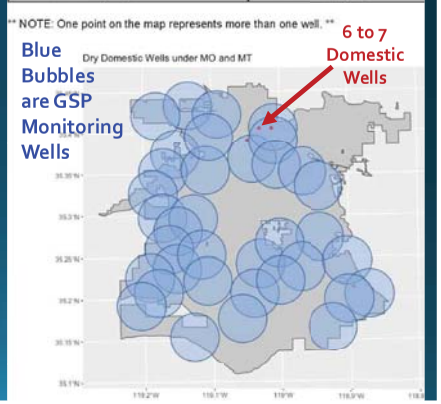
## Response to Public Comments – Dry Well Analysis Leadership Counsel

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.

| 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. **




DRAFT

## 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

DRAFT

## 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 current 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)

DRAFT

## 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

DRAFT


Questions?
TODD
GROUNDWATER

# ATTACHMENT F.5
# TARGETED WORKSHOP MATERIALS

## Attachment F.5 List of Materials

| Item | Document | Date |
|---|---|---|
| 1a | KRGSA Groundwater Workshop Materials (flyer, fact sheet, agenda – English/Spanish) | 8/20/18 |
| 1b | KRGSA Groundwater Workshop Presentation – English | 8/20/18 |
| 1c | KRGSA Groundwater Workshop Presentation – Spanish | 8/20/18 |
| 2 | Kern County Subbasin C2VSim Modeling Update (Todd Groundwater) | 10/26/18 |
| 3a | KRGSA Groundwater Workshop Materials (flyer, agenda – English/Spanish; sign-in sheet) | 11/13/18 |
| 3b | KRGSA Groundwater Workshop Presentation – English | 11/13/18 |
| 3c | KRGSA Groundwater Workshop Presentation – Spanish | 11/13/18 |
| 4 | Kern County Subbasin Draft C2VSim Modeling Results (Todd Groundwater) | 1/11/19 |
| 5 | Kern County Subbasin Revised C2VSim Historical Water Budgets (Todd Groundwater) | 3/22/19 |
| 6 | Leadership Counsel for Justice and Accountability – letter to KRGSA and response from KRGSA | 7/10/19<br>8/13/19 |
| 7a | KRGSA GSP Review Workshop Materials (flyer – English/Spanish; agenda) | 10/15/19 |
| 7b | KRGSA GSP Review Workshop Presentation – English | 10/15/19 |
| 7c | KRGSA GSP Review Workshop Presentation – Spanish | 10/15/19 |
| 7d | KRGSA GSP Review Workshop Summary, Meeting Notes, Sign-in Sheet | 10/15/19 |
| 8a | KRGSA GSP Review Workshop Materials (flyer – English/Spanish; agenda) | 11/6/19 |
| 8b | KRGSA GSP Review Workshop Presentation – English | 11/6/19 |
| 8c | KRGSA GSP Review Workshop Presentation – Spanish | 11/6/19 |
| 8d | KRGSA GSP Review Workshop Summary, Meeting Notes, Sign-in Sheet | 11/6/19 |
| 9 | Kern Delta Grower Outreach Meeting Materials (flyer, presentation, sign-in sheets) | 11/19/19<br>11/20/19 |

Item 1a

# You're Invited!

# GROUNDWATER WORKSHOP

**THIS WORKSHOP WILL COVER:**

- California's New Groundwater Law — the Sustainable Groundwater Management Act (SGMA) of 2014
- Your Groundwater Sustainability Agency (GSA)
- Your Groundwater Sustainability Plan (GSP)
- How to participate!

**Workshop**

**DATE: Monday, August 20, 2018**

**TIME:** 5:30 - 7 p.m.

**WHERE:** Fruitvale-Norris Park Recreation Room,

6221 Norris Road, Bakersfield, CA, 93308

**For more information**

Call or email Eva Dominguez (559) 802-1634, EvaD@SelfHelpEnterprises.org or Maria Herrera (559) 802-1676, MariaH@SelfHelpEnterprises.org

*Translation services will be available*

Self-Help Enterprises

KRGSA

KERN COUNTY WATER AGENCY

CITY OF BAKERSFIELD CALIFORNIA

KERN RIVER GROUNDWATER WATER DISTRICT

KERN RIVER GROUNDWATER SUSTAINABILITY AGENCY

# Estas Invitado: TALLER SOBRE EL AGUA SUBTERRÁNEA

**TEMAS DEL TALLER:**

- Nueva ley estatal del agua subterráne: la Ley del Manejo Sostenible del Agua Subterránea (SGMA, por sus siglas en ingles) de 2014
- Su Agencia de Manejo Sostenible de Agua Subterránea (GSA, por sus siglas en ingles) y Plan de Manejo Sostenible del Agua Subterránea
- Como participar!

**Taller**

**FECHA: Lunes, 20 de Agosto de 2018**

**HORA:** 5:30 - 7 de la tarde

**DÓNDE:** Sala de recreación Fruitvale-Norris Park

6221 Norris Road, Bakersfield, CA 93308

Llame o envié un correo electrónico a
Eva Dominguez (559) 802-1634, EvaD@SelfHelpEnterprises.org o
Maria Herrera (559) 802-1676, MariaH@SelfHelpEnterprises.org

*Servicios de traducción estarán disponibles*

Self-Help Enterprises

KRGSA

KERN RIVER GROUNDWATER SUSTAINABILITY AGENCY

# Kern River Groundwater Sustainability Agency
# Groundwater Workshop

Monday, August 20, 2018 5:30 p.m.
Fruitvale-Norris Park Recreation Room
6221 Norris Road, Bakersfield, CA 93308

# AGENDA

| | |
|---|---|
| 5:30 p.m. – 5:40 p.m. | Welcome & Introductions |
| 5:40 p.m. – 6:10 p.m. | California's New Groundwater Law and Groundwater Sustainability Plans |
| 6:10 p.m. – 6:30p.m. | Local Efforts to Comply with SGMA - Kern River Groundwater Sustainability Agency GSP Development Efforts |
| 6:30 p.m. – 6:50 p.m. | Share your Thoughts – Stakeholder Survey |
| 6:50 p.m. – 7:00 p.m. | Next Steps and Closing Remarks |

# Agencia de Sostenibilidad de Aguas Subterráneas de Kern River
# Taller de Agua Subterránea

Lunes, 20 de agosto 2018 5:30 p.m.
Fruitvale-Norris Park Recreation Room
6221 Norris Road, Bakersfield, CA 93308

# AGENDA

| | |
|---|---|
| 5:30 p.m. – 5:40 p.m. | Bienvenida y Introducciones |
| 5:40 p.m. – 6:10 p.m. | Nueva Ley de Aguas Subterráneas de California y Planes de Sostenibilidad de Aguas Subterráneas |
| 6:10 p.m. – 6:30p.m. | Esfuerzos Locales para Cumplir con SGMA - Esfuerzos para Desarrollar el GSP de Kern River GSA |
| 6:30 p.m. – 6:50 p.m. | Comparta sus Pensamientos - Encuesta de Partes Interesadas |
| 6:50 p.m. – 7:00 p.m. | Próximos Pasos y Comentarios de Cierre |

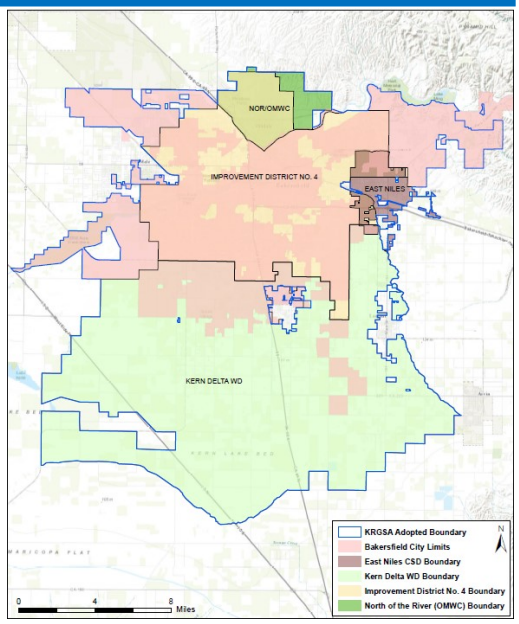
# Conozcan su Agencia del Manejo Sostenible de Agua Subterránea:

## Agencia de Manejo Sostenible de Agua Subterránea de Kern River

## RESUMEN

La Ley del Manejo Sostenible del Agua Subterránea (SGMA por sus siglas en inglés) es una nueva ley que, una vez plenamente implementada, cambiará la manera en que usamos y regulamos el uso del agua subterránea en California. Áreas que dependen mucho más del agua subterránea para consumo humano, agricultura, y otros usos deben cumplir con esta Ley. La Ley requiere que agencias locales dentro de esas áreas formen Agencias de Manejo Sostenible de Agua Subterránea (GSAs por las siglas en inglés) para manejar y regular el uso del agua subterránea. Una vez formadas, estas agencias tendrán nuevos poderes y funciones, incluso el poder de limitar o suspender el bombeo de agua subterránea y cobrar tarifas por la extracción de agua subterránea. Para el año 2040, cada agencia debe asegurar que la condición del agua subterránea en su área se mejore.

Para tal fin, las agencias tendrán que desarrollar e implementar Planes de Manejo Sostenible de Agua Subterránea (GSPs por sus siglas en ingles). Estos Planes deben documentar las condiciones del agua subterránea en el área; establecer metas para prevenir los impactos negativos; e identificar proyectos y acciones de manejo que mejoraran las condiciones de agua subterránea.




## SU GSA A SIMPLE VISTA

| | |
|---|---|
| **NOMBRE DE GSA** | Agencia del Manejo Sostenible del Agua Subterránea de Kern River |
| **FECHA FORMADA** | 30 de marzo 2017 |
| **TIPO DE AGENCIA** | Autoridad de Poderes Conjunta (Una autoridad de poderes conjunta es una entidad que consiste en dos o más agencias públicas que ejercen conjuntamente poderes, limitadas por las jurisdicciones territoriales combinadas de las agencias individuales). |
| **AGENCIAS MIEMBROS DE LA GSA** | Cuidad de Bakersfield, Agencia de Agua del Condado de Kern, Distrito de Agua de Kern Delta—Distrito de Mejora No. 4 (ID4) |
| **ÁREA DE LA GSA** | Edison, Fuller Acres, Lamont (pequeña porción del norte solamente), Oildale, Oil Junction, Rexland Acres, Weedpatch |
| **MESA DIRECTIVA** | Presidente—Rodney Palla, Distrito de Agua de Kern Delta<br>Miembro de la Mesa—Gene Lundquist, Distrito de Agua de Kern Delta —ID4<br>Miembro de la Mesa—Bob Smith, Cuidad de Bakersfield |
| **JUNTAS DE LA GSA** | Las juntas se llevan acabo cada primer jueves del mes a las 10:00 a.m. en 1600 Truxton Ave, Bakersfield, CA 93301, salon de conferencia A en el primer piso |

## ¡INVOLUCRARSE!

*La mayoría de las comunidades no incorporadas en el Valle de San Joaquín dependen únicamente en el agua subterránea para el agua potable. Muchos residentes más utilizan pozos privados. SGMA tiene la intención de reunir a diferentes usuarios de agua para que juntos decidan cómo usar y manejar el agua subterránea. Como resultado, las decisiones tomadas por los GSA afectarán a los residentes en las comunidades rurales.*

**Involúcrate y AYUDA a tu GSA a:**

- **Entender los desafíos del agua subterránea que afectan las comunidades no incorporadas y / o los pozos privados.**
- **Identificar y desarrollar proyectos que mejoren las condiciones del agua subterránea en su comunidad.**
- **Identificar maneras de mantener tarifas de SGMA económicas.**

**Como Participar:**

- Para recibir notificaciones sobre las juntas de la GSA e información importante sobre el desarrollo del GSP, registrarse como persona interesada de la GSA.
- Asista a las juntas de la Mesa Directiva y/o del comité de la GSA. Proporcione comentarios públicos o haga preguntas sobre el trabajo de la GSA.
- **Solicite servir en un comité.**

Juntos, podemos asegurarnos de que las necesidades de agua potable estén bien representadas en este importante proceso!

## INFORMACION DE CONTACTO

**Agencia del Manejo Sostenible del Agua Subterránea de Kern River**
Rodney Palla, (661) 326-3767, Krgsa@kernrivergsa.org

**Self-Help Enterprises:**
Maria Herrera, (559) 802-1676, MariaH@selfhelpenterprises.org

**Departamento de Recursos Hidricos, Coordinador Regional de SGMA:**
Matt Owens, (559) 230-3335, Matthew.Owens@water.ca.gov

Hoja informativa desarrollada por:

Self-Help Enterprises
COMMUNITY WATER CENTER
EL CENTRO COMUNITARIO POR EL AGUA
LEADERSHIP COUNSEL FOR JUSTICE & ACCOUNTABILITY
CLEAN WATER FUND

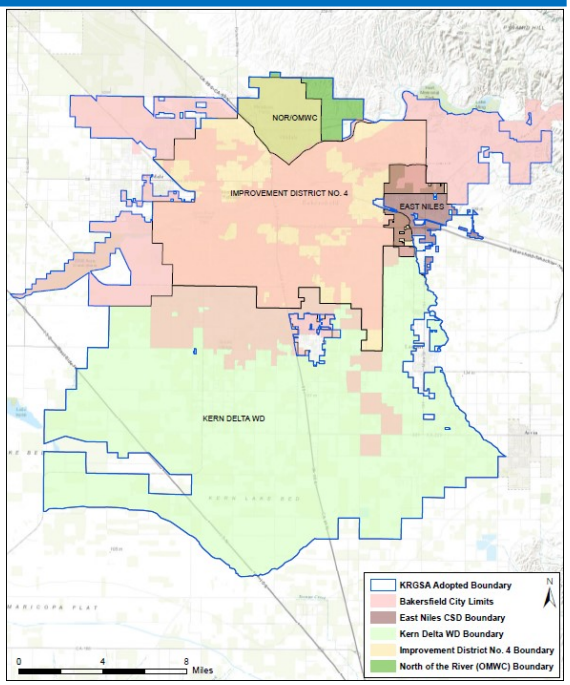
Updated July 2017

# Get to Know Your Groundwater Sustainability Agency: Kern River Groundwater Sustainability Agency

## OVERVIEW

The Sustainable Groundwater Management Act (SGMA) is a new law that, once fully implemented, will fundamentally change the way we use and manage groundwater in California. The Act applies to areas that rely heavily on groundwater. The Act requires local agencies to form Groundwater Sustainability Agencies (GSAs) to manage and regulate groundwater. Once formed, these GSAs have new powers, including the ability to limit or suspend groundwater pumping and charge fees for groundwater extraction and will be responsible for ensuring that groundwater conditions improve by 2040.

To do so, GSAs will need to develop and implement Groundwater Sustainability Plans (GSPs). GSPs will need to document the groundwater conditions in the area; establish goals to prevent negative impacts; and identify projects and management actions that improve groundwater conditions.




## YOUR GSA AT A GLANCE

| | |
|---|---|
| **GSA NAME** | Kern River Groundwater Sustainability Agency |
| **FORMED** | March 30, 2016 |
| **AGENCY TYPE** | Joint Powers Authority (A joint powers authority is an entity which consists of two or more public agencies jointly exercising powers, limited by the combined territorial jurisdictions of the individual agencies.) |
| **GSA MEMBER AGENCIES** | City of Bakersfield, Kern County Water Agency, Kern Delta Water District—Improvement District No. 4 (ID4) |
| **GSA BOUNDARIES** | Edison, Fuller Acres, Lamont (small northern portion only), Oildale, Oil Junction, Rexland Acres, Weedpatch |
| **BOARD OF DIRECTORS** | Chair—Rodney Palla, President, Kern Delta Water District<br>Board Member—Gene Lundquist, Kern Delta Water District—ID4<br>Board Member—Bob Smith, City of Bakersfield |
| **GSA MEETINGS** | Meetings are held on the first Thursday of each month at 10:00 a.m. at 1600 Truxtun Ave, Bakersfield, CA 93301, first floor conference room A |

## GET INVOLVED!

*Most unincorporated communities in the San Joaquin Valley are solely reliant on groundwater for drinking water. Many more residents rely on private wells. SGMA intends to bring different water users together to decide how to use and manage groundwater. As a result, decisions made by the GSAs will affect residents in rural communities.*

**Get involved and HELP your GSA:**

- **Understand the groundwater challenges affecting rural unincorporated communities and/or private wells.**
- **Identify and develop projects that improve groundwater conditions in your community.**
- **Identify ways to keep rates affordable.**

**Ways to Get Involved:**

- Register as an interested party for the GSA to receive notices of meetings and important information about Groundwater Sustainability Plan (GSP) development.
- Attend the GSA board meetings. Give public comment or ask questions about their work.

Together, we can make sure that drinking-water needs are well represented in this important process!

## CONTACT INFORMATION

**Kern River Groundwater Sustainability Agency:**
Rodney Palla, (661) 326-3767, Krgsa@kernrivergsa.org

**Self-Help Enterprises:**
Maria Herrera, (559) 802-1676, MariaH@selfhelpenterprises.org

**Department of Water Resources (DWR) Regional SGMA Coordinator:**
Matt Owens, (559) 230-3335, Matthew.Owens@water.ca.gov

Factsheet developed by:

Self-Help Enterprises
COMMUNITY WATER CENTER
EL CENTRO COMUNITARIO POR EL AGUA
LEADERSHIP COUNSEL FOR JUSTICE & ACCOUNTABILITY
CLEAN WATER FUND

Updated July 2018

# Kern River Groundwater Sustainability Agency

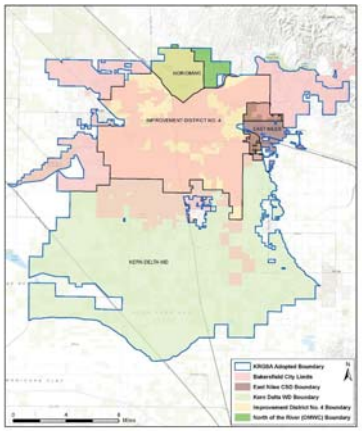
# Groundwater Workshop

August 20, 2018

## SELF-HELP ENTERPRISES (SHE)

- SHE is a nationally-recognized non-profit housing and community development organization whose mission is to work together with low-income families to build and sustain healthy homes and communities.
- Community Development Program provides technical assistance and leadership development in rural communities who face clean water, sanitary sewer and other infrastructure challenges.
- Community Engagement and Planning Team supports community participation in regional water management and groundwater sustainability planning as well as building water management capacity and expertise in rural communities.


## KERN RIVER GROUNDWATER SUSTAINABILITY AGENCY



Members of the Kern River GSA

- City of Bakersfield
- Kern County Water Agency – Improvement District #4 (ID4)
- Kern Delta Water District

Communities within the GSA

- Edison
- Fuller Acres
- Oildale
- Oil Junction
- Rexland Acres
- Weedpatch
- Lamont (small northern portion only)

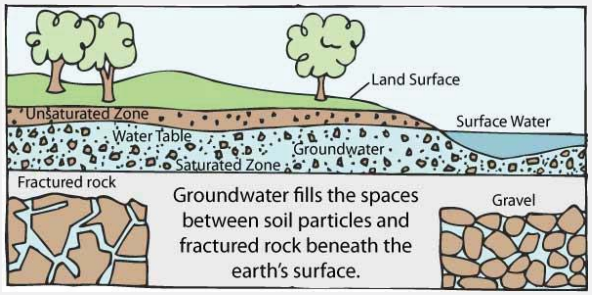
## WORKSHOP OVERVIEW

- California's New Groundwater Law – The Sustainable Groundwater Management Act (SGMA)
- Groundwater Sustainability Plans (GSPs)
- KRGSA's GSP Development Efforts
- Share Your Thoughts – Stakeholder Survey
- Wrap Up and Closing Remarks

Item 1b

## GROUNDWATER MATTERS

On average Californians get 40% of their water from groundwater. During droughts, that number can go up to 60%.




- In the Central Valley, we are even more dependent on groundwater than the state as a whole
- 90% of Central Valley residents rely on groundwater for at least part of their drinking water supply
- Most unincorporated communities are 100% reliant on groundwater – includes many of our small school districts

## HISTORICAL GROUNDWATER MANAGEMENT

- Previously, groundwater management was voluntary in certain areas of the state
- Groundwater levels have been declining due to over-pumping, less surface water, and not enough recharge
- The drought (2012-2016) had an unprecedented impact on our state
- Dry wells (i.e., Arvin, Lamont area, and many others)
- Subsidence

## HOW COMMUNITIES AND SCHOOLS USE GROUNDWATER

## CALIFORNIA'S SUSTAINABLE GROUNDWATER MANAGEMENT ACT (SGMA)

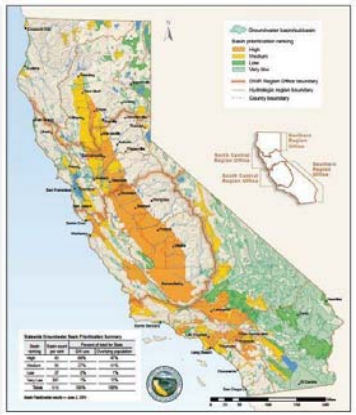
- Three-bill package: SB 1168 (Pavley), AB 1739 (Dickinson), SB 1319 (Pavley)
- Signed by Governor Brown on September 16, 2014
- Objective: Ensure the long-term reliability of our groundwater resources and connected surface water resources requiring "sustainable" management
- Core Principle: Local control

## PREVENT UNDESIRABLE RESULTS

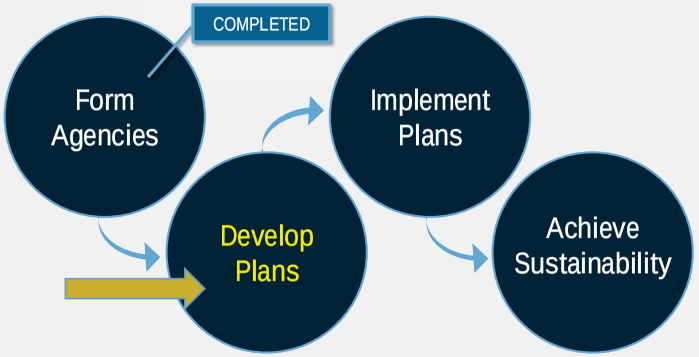

## WHOSE INTERESTS ARE AT STAKE?

- Holders of overlying groundwater rights (agricultural and domestic)
- Public water systems
- Local land use planning agencies
- Environmental users of groundwater
- Surface water users
- California Native American tribes
- Disadvantaged communities, including, but not limited to, those served by private domestic wells or small community water systems

## WHO MUST COMPLY WITH SGMA?



## SGMA DESIGN



## MULTIPLE GSAs IN A SUBBASIN

- More than one GSA can be formed in a sub-basin
- If there are multiple GSAs in a sub-basin, the GSAs can collaborate to write one single plan, or each GSA can write its own plan so long as the GSAs establish a coordination agreement for implementing multiple plans.
- However, GSAs must cover the entire area of the sub-basin, leaving no areas unmanaged
- All GSAs were approved in July 2017

## DEVELOPMENT OF GROUNDWATER SUSTAINABILITY PLANS

- GSPs must contain important information:
  - Description of plan area & basin setting
  - Sustainability criteria
  - Monitoring program and projects
- GSPs will serve as the roadmap to achieve sustainability
- GSAs will need to develop GSPs with stakeholder input

## POWERS AND RESPONSIBILITIES OF A GSA


## GSP SUBMITTAL AND APPROVAL BY DWR

- GSPs must be written by January 31, 2020 (or January 31, 2022 if the basin is not critically overdrafted)
- DWR determinations
  - Adequate
  - Inadequate
  - Incomplete
- If the Department of Water Resources decides that a GSP will not sustainably manage groundwater by 2040 (or 2042 if not in critically overdrafted basins)…

  → The State may step in and manage the sub-basin itself!
  Much more expensive
  Less local control

## GSP IMPLEMENTATION AND ACHIEVING SUSTAINABILITY

- After submitting its GSP, a GSA has 20 years to reach sustainability
  - Sustainability must be reached by 2040 (2042 for areas not in critical overdraft)
- DWR will review all plans every five years to assess progress and recommend corrective actions as needed
- Annual Reporting

## GROUNDWATER SUSTAINABILITY PLANS

1. **Description of the plan area and basin setting:** Groundwater conditions, water budget, hydrogeological conceptual model, management areas
2. **Sustainability criteria:** set sustainability goal, set minimum thresholds for undesirable results, set measurable objectives
3. **Projects and management actions:** projects, management actions, mitigation measures, monitoring plan

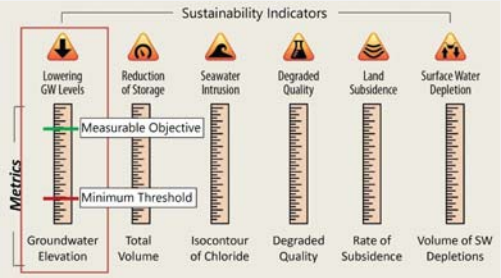
## QUESTIONS & ANSWERS

## WATER BUDGETS

## SUSTAINABILITY CRITERIA MEASUREABLE OBJECTIVES AND MINIMUM THRESHOLDS

Prevent "Undesirable results that are significant and unreasonable"

At this time, the only undesirable result that we can be certain doesn't apply to the Kern River GSA area is Seawater intrusion




## GENERAL PRINCIPLES – MEASURABLE OBJECTIVES AND MINIMUM THRESHOLDS

- Cannot harm sustainability in a neighboring basin
- Cannot continue to be in long-term overdraft
- Cannot deplete surface water

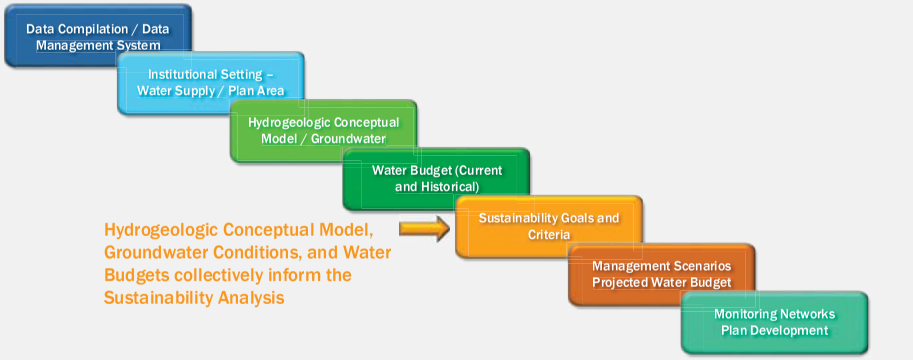
## SUSTAINABILITY IS DEFINED LOCALLY

- SGMA requires GSAs to define sustainability using two concepts:
  - Measurable objectives are aspirational goals. Technically, you should achieve them by 2040 (or 2042 if not critically overdrafted).
  - Minimum thresholds are to be avoided. If they are crossed, you may be out of compliance with your plan and violating the obligation to reach sustainability.

## MANAGEMENT ACTIONS AND PROJECTS

# KRGSA's GSP DEVELOPMENT EFFORTS

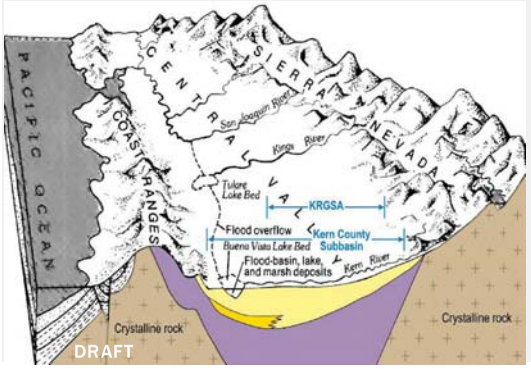
## GSP OVERVIEW




## GSAs AND GSPs IN KERN SUBBASIN
(AS OF APRIL 2018)

- GSAs Preparing Their Own GSPs:
  - Kern River GSA
  - Kern Groundwater Authority
  - Buena Vista Water Service District GSA
  - Henry Miller Water District GSA
  - Olcese Water District GSA
- GSAs That Have Not Formalized GSP Preparation Plans:
  - City of McFarland GSA
  - Greenfield County Water District GSA

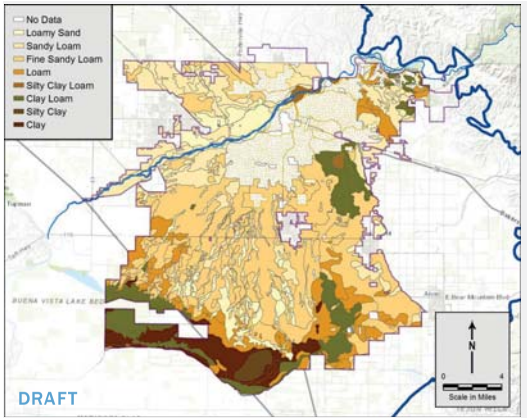
## CONCEPTUAL HYDROGEOLOGIC SETTING KERN COUNTY SUBBASIN




- Alluvial-filled trough between the Sierra Nevada and Coast Ranges
- Underlain by older marine sedimentary units
- Flanked by crystalline bedrock

TODD GROUNDWATER

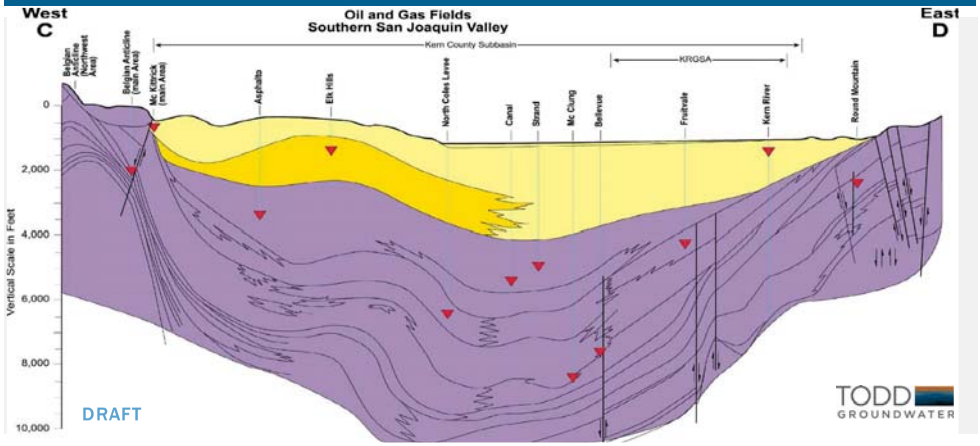
## SOIL TEXTURES




- More permeable textures indicated by lighter colors (white, yellow, light orange)
- Lower permeability textures indicated by dark orange, green and brown
- Soil textures agree well with geologic framework

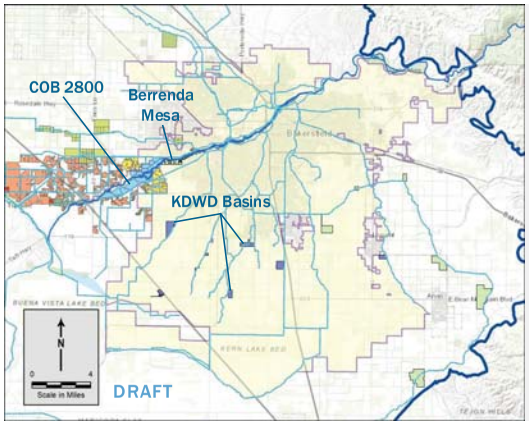
TODD GROUNDWATER

## REGIONAL CROSS SECTION AND OIL FIELDS




TODD GROUNDWATER

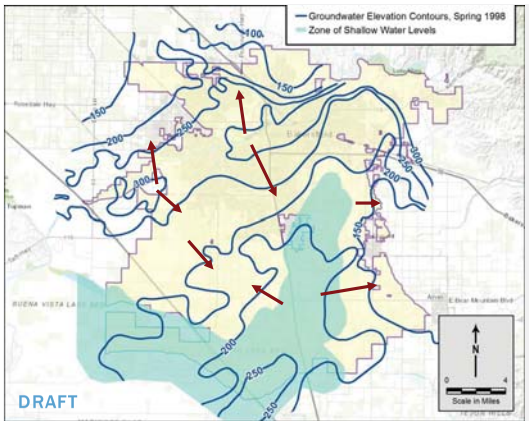
## CANALS AND RECHARGE BASINS




- Managed recharge in river channel, unlined canals, and basins
- KRGSA groundwater banking projects:
  - COB 2800 Acres
  - KCWA Berrenda Mesa
  - KDWD Metropolitan Project
- Numerous additional banking projects nearby

TODD GROUNDWATER

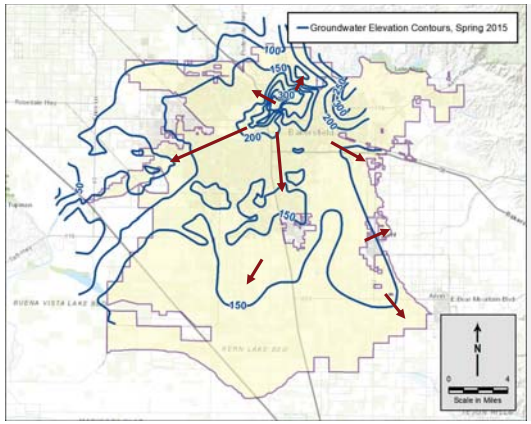
## GROUNDWATER ELEVATION CONTOURS 1998




- 20 groundwater elevation contour maps (Spring data)
- Examined maps and data for perched layers (zone of shallow water levels)
- Example for wet year - Spring 1998

TODD GROUNDWATER

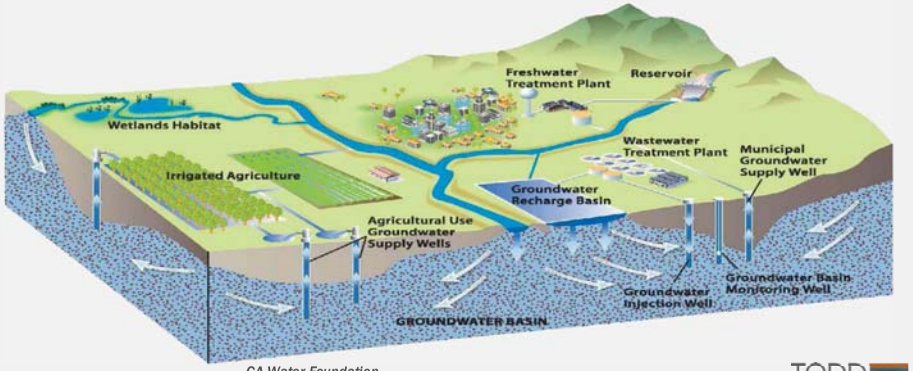
## GROUNDWATER ELEVATION CONTOURS 2015




- Severe Drought year
- In general, higher water levels than surrounding areas
- Except for the river, groundwater is flowing out of the KRGSA area

TODD GROUNDWATER

## FINALIZING THE KRGSA WATER BUDGET

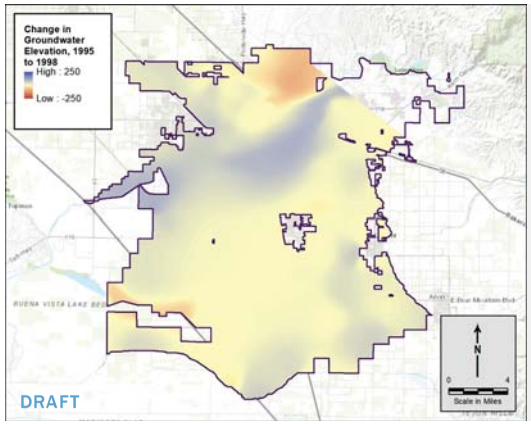



*CA Water Foundation*

DRAFT

TODD GROUNDWATER

## CHANGE IN GROUNDWATER IN STORAGE, 1995-1998




- Created 20 annual water level change maps using KCWA Spring water level contour maps
- Blue areas indicate water level rise; red areas indicate water level declines
- Limited data create uncertainty for some areas and time periods

DRAFT

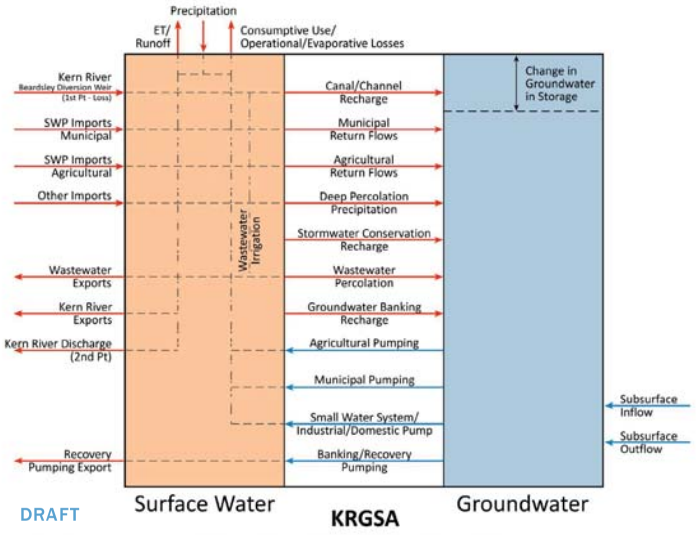
TODD GROUNDWATER

## KRGSA WATER BUDGETS – APPROACH

- Kern County water managed in real time for optimal use
- Provides flexibility and optimization of water but results in complex accounting of physical molecules
  - Focus on the physical system
    - Where does the "wet water" go? (not paper exchanges)
    - Water budget process follows the molecules – does not assign "ownership" of the water
    - Prevent "double-counting"


DRAFT

TODD GROUNDWATER




## KRGSA COMBINED WATER BUDGET COMPONENTS

TODD GROUNDWATER

## QUESTIONS & ANSWERS

## NEXT STEPS

- Work with agencies to reconcile data and local water budgets
- Compile for KRGSA
- Format data sets for model

Horizon WATER and ENVIRONMENT

TODD GROUNDWATER

## PARTICIPATE IN GSP DEVELOPMENT

You can help shape what is included in the plan by:

- Providing information about your past or present groundwater challenges
- Sharing information about your water usage and/or water well
- Sharing your vision for sustainability
- Identifying projects that can help address the groundwater conditions
- Completing the Stakeholder Survey

## STAKEHOLDER SURVEY

We want to hear from you!

- What do you know about SGMA?
- How do you use water?
- What else should we know?


## ADDITIONAL INFORMATION AND RESOURCES

- Technical Assistance for Severely Disadvantaged Communities
  - Self-Help Enterprises: https://www.selfhelpenterprises.org
    - Eva Dominguez, 559-802-1634, EvaD@selfhelpenterprises.org
    - Maria Herrera, 559-802-1676, MariaH@selfhelpenterprises.org
- Local Information – Kern River GSA: https://kernrivergsa.org
  - Art Chianello, 661-326-3715, AChianel@bakersfieldcity.us
- Statewide Information
  - Department of Water Resources: https://sgma.water.ca.gov/portal/
  - State Water Resources Control Board: https://www.waterboards.ca.gov/water_issues/programs/gmp/sgma.html

## STAY INVOLVED

- Attend GSA Meetings
  - KRGSA Board Meetings are held the last Wednesday of each month at 8 a.m. at 1600 Truxtun Avenue, Bakersfield, CA 93301
- Get on the "interested parties" list to receive correspondence and information from the KRGSA
- Visit the website to learn more: http://www.kernrivergsa.org/
- Attend future workshops

## UPCOMING REGIONAL WORKSHOPS

- Groundwater Quality Roundtable – October 3, 2018
- Groundwater Workshop 2.0 – October 27, 2018

Sponsored by Self Help Enterprises, Leadership Counsel for Justice and Accountability, Community Water Center, and Union of Concerned Scientists

*More information is available at the back table*

# THANK YOU!

# Agencia de Manejo Sostenible de Agua Subterránea de Kern River

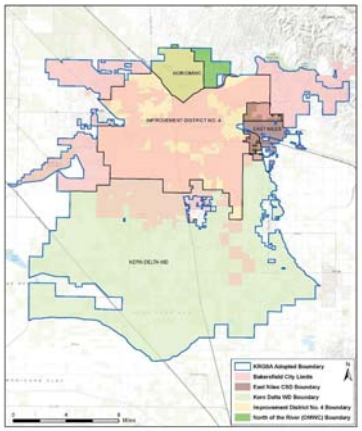
# Taller de Agua Subterránea

20 de Agosto 2018

## SELF-HELP ENTERPRISES (SHE)

- SHE es una organización de vivienda y desarrollo comunitario reconocida a nivel nacional (organización sin fines de lucro) cuya misión es trabajar junto con familias de bajos ingresos para construir y mantener hogares y comunidades saludables.
- El Programa de Desarrollo Comunitario brinda asistencia técnica y desarrollo de liderazgo en comunidades rurales que enfrentan desafíos para proporcionar agua limpia, alcantarillado sanitario y otra infraestructura.
- El Equipo de Planeación y Participación de la Comunidad apoya la participación de la comunidad en la gestión regional del agua y la planificación de la sostenibilidad del agua subterránea, así como la capacidad y experiencia en la gestión del agua en las comunidades rurales.


## AGENCIA DE MANEJO SOSTENIBLE DE AGUA SUBTERRÁNEA DE KERN RIVER (KRGSA)



Miembros de la Kern River GSA

- Cuidad de Bakersfield
- Agencia de Agua del Condado de Kern – Distrito de Mejora No. 4
- Distrito de Agua de Kern Delta

Comunidades dentro de la GSA

- Edison
- Fuller Acres
- Oildale
- Oil Junction
- Rexland Acres
- Weedpatch
- Lamont (pequeña porción del norte solamente)

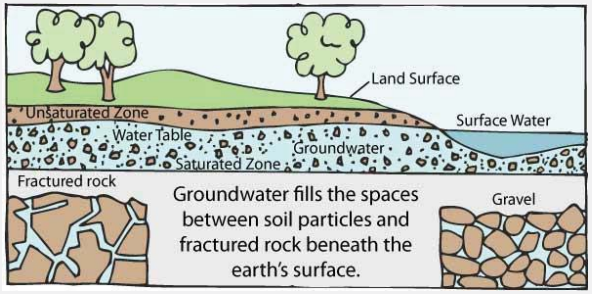
## DESCRIPCIÓN GENERAL DEL TALLER

- Nueva Ley Estatal del Agua Subterránea: Ley del Manejo Sostenible del Agua Subterránea (SGMA)
- Planes de Sostenibilidad de Aguas Subterráneas (GSPs)
- Esfuerzos para Desarrollar el GSP de la KRGSA
- Comparta sus Pensamientos – Encuesta para las Partes Interesadas
- Palabras de Finalización y Cierre

Item 1c

## IMPORTANCIA DE AGUA SUBTERRÁNEA

En promedio, California obtienen el 40% de su agua del agua subterránea. Durante las sequías, ese número puede llegar hasta el 60%.




- En el Valle Central, somos aún más dependientes del agua subterránea que el estado en general
- El 90% de los residentes de Central Valley dependen del agua subterránea para al menos parte de su suministro de agua potable
- La mayoría de las comunidades no incorporadas dependen en un 100% de las aguas subterráneas, e incluyen muchos de nuestros distritos escolares pequeños.

## DESAFÍOS DEL AGUA SUBTERRÁNEA: ¿POR QUÉ LA LEY DEL MANEJO SOSTENIBLE DEL AGUA SUBTERRÁNEA?

- Anteriormente, el manejo del agua subterránea era voluntaria en ciertas áreas del estado
- Los niveles de agua subterránea han disminuido debido al exceso de bombeo, las restricciones excesivas en las importaciones de agua de superficie y la falta de recarga
- La sequía (2012-2016) tuvo un impacto sin precedentes en nuestro estado.
- Pozos secos (por ejemplo: Arvin, área de Lamont y muchos otros)
- Hundimiento

## CÓMO LAS COMUNIDADES & LAS ESCUELAS UTILIZAN EL AGUA SUBTERRÁNEA

## LEY DEL MANEJO SOSTENIBLE DEL AGUA SUBTERRÁNEA DE CALIFORNIA (SGMA)

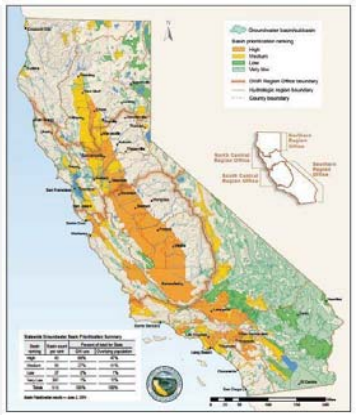
- Paquete de tres leyes: SB 1168 (Pavley), AB 1739 (Dickinson), SB 1319 (Pavley)
- Firmado por el Gobernador Brown el 16 de Septiembre de 2014
- Objetivo: Asegurar la confiabilidad a largo plazo de nuestros recursos de agua subterránea y los recursos hídricos superficiales conectados que requieren manejo "sostenible"
- Principio central: control local

## PREVENIR LOS RESULTADOS INDESEABLES

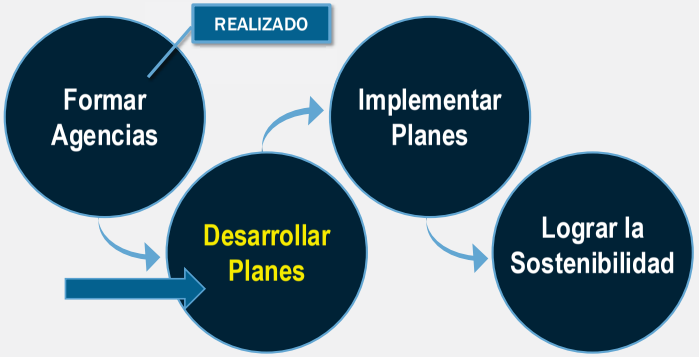

## ¿CUÁLES SON LOS INTERESES EN JUEGO?

- Titulares de derechos de aprovechamiento de agua subterránea (agricultura y doméstico)
- Sistemas de agua públicos
- Agencias locales de planificación del uso de la tierra
- Usuarios del agua subterránea para uso ambientales
- Usuarios de agua superficial
- Tribus de Nativos Americanos de California
- Comunidades de bajo ingresos, incluso las que reciben agua de pozos domésticos privados o pequeños sistemas de agua comunitarios

## ¿QUIÉN DEBE CUMPLIR CON SGMA?



## DISEÑO DE SGMA



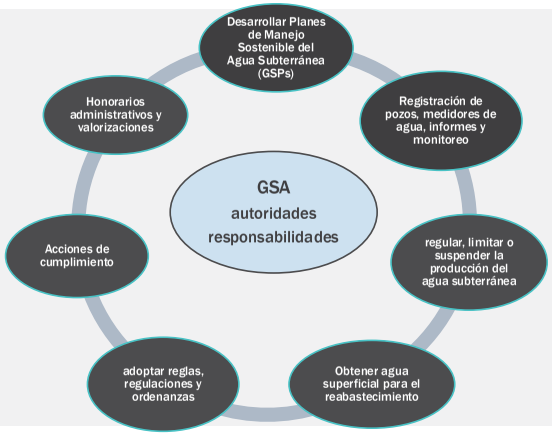
## MÚLTIPLES GSAS EN UNA SUBCUENCA

- Mas de una GSA se puede formar en una subcuenca
- Si existen múltiples GSAs en una subcuenca, las GSAs pueden colaborar para crear un plan único, o cada GSA puede crear su propio plan solo que las GSAs establecen un acuerdo de coordinación para implementar múltiples planes.
- Sin embargo, las GSAs deben cubrir toda el área de la subcuenca, sin dejar áreas sin gestionar
- Todas las GSAs fueron aprobadas en Julio 2018

## DESARROLLO DEL PLAN DEL MANEJO SOSTENIBLE DEL AGUA SUBTERRÁNEA

- Los GSPs deben incluir información importante:
  - Descripción del área del plan y la colocación del cuenca
  - Criterios de sostenibilidad de la cuenca
  - Programa de monitoreo y proyectos
- Los GSP servirán como una hoja de ruta para lograr la sostenibilidad dentro de 20 años
- Las GSAs deben desarrollar los GSPs con la participación de las partes interesadas

## ¿QUÉ PUEDE HACER UNA GSA?




## ENVÍO DE GSP Y APROBACIÓN POR DWR

- Los GSPs deben ser escritos antes del **31 de enero 2020 (o 31 de enero 2022 si la cuenca no esta críticamente en exceso)**
- Determinaciones de DWR (Departamento de Recursos Hídricos)
  - Adecuado
  - No Adecuado
  - No Completo
- Si el Departamento de Recursos Hídricos decide que el GSP **no gestionara de forma sostenible las aguas subterráneas antes del 2040 (o 2042 si la cuenca no esta críticamente en exceso)**…

  → **El Estado puede intervenir y administrar la subcuenca en sí!**

  Mucho mas costoso
  Menos control local

## IMPLEMENTACIÓN DE GSP Y LOGRO DE SOSTENIBILIDAD

- Después de presentar su GSP, una GSA tiene 20 años para alcanzar la sostenibilidad
  - **La sostenibilidad debe alcanzarse para 2040 (2042 para áreas que no están críticamente en exceso)**
- DWR revisará todos los planes cada cinco años para evaluar el progreso y recomendar acciones correctivas según sea necesario
- Reportes Anuales

## PLANES DE SOSTENIBILIDAD DE AGUAS SUBTERRÁNEAS

1. **Descripción del área del plan y la configuración de la cuenca:** Aguas subterráneas, presupuesto hídrico, modelo conceptual hidrogeológico, áreas de manejo
2. **Criterios de sostenibilidad:** establecer un objetivo de sostenibilidad, establecer umbrales mínimos para resultados indeseables, establecer objetivos medibles
3. **Proyectos y acciones de gestión:** proyectos, acciones de manejo, medidas de mitigación, plan de monitoreo

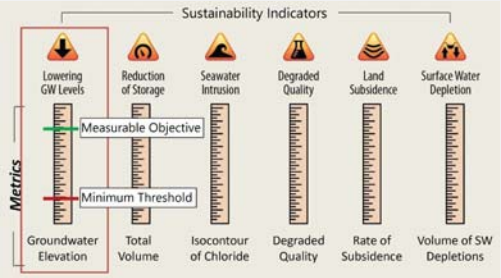
## PREGUNTAS Y RESPUESTAS

## PRESUPUESTOS DE AGUA

## CRITERIOS DE SOSTENIBILIDAD OBJETIVOS MEDIBLES Y UMBRALES MÍNIMOS

Prevenir "resultados indeseables que son significativos e irrazonables“

En este momento, el único resultado indeseable del que podemos estar seguros no se aplica al área de Kern River GSA es la intrusión de agua de mar




## PRINCIPIOS GENERALES - OBJETIVOS MEDIBLES Y UMBRALES MÍNIMOS

- No se puede dañar la sostenibilidad en una cuenca vecina
- No puede seguir estando en exceso a largo plazo
- No se puede agotar el agua superficial

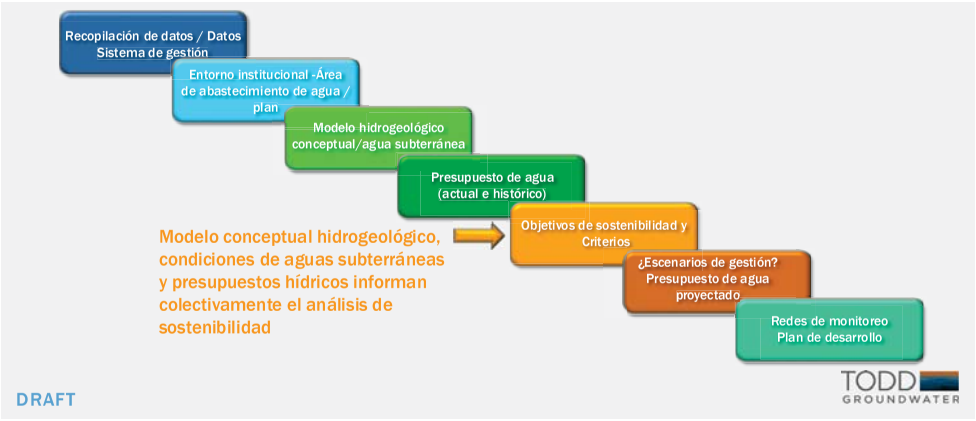
## LA SOSTENIBILIDAD SE DEFINE LOCALMENTE

- SGMA requiere que la GSA define la sostenibilidad utilizando dos conceptos:
  - **Objetivos Medibles** son metas aspiracionales. Técnicamente, deberías alcanzarlos para 2040 (o 2042 si no es cuenca críticamente en exceso).
  - **Umbrales Minimos** deben ser evitados Si se cruzan, puede estar fuera del cumplimiento de su plan y violar la obligación de alcanzar la sostenibilidad.

## ACCIONES Y PROYECTOS DE GESTIÓN

# ESFUERZOS DE DESARROLLO PARA EL GSP DE KRGSA

## GSP VISION EN CONJUNTO

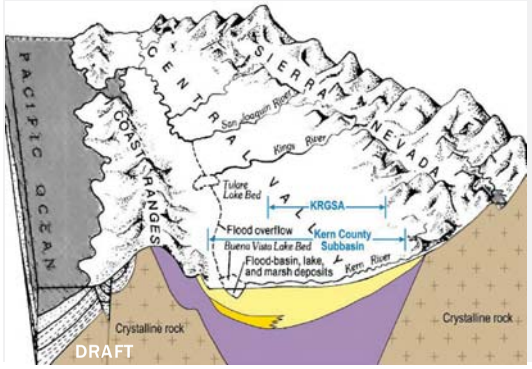



## GSAs Y GSPs EN LA SUBCUENCA KERN
(DESDE ABRIL 2018)

- **GSAs Que Prepararan su Propio GSP:**
  - Kern River GSA
  - Kern Groundwater Authority
  - Buena Vista Water Service District GSA
  - Henry Miller Water District GSA
  - Olcese Water District GSA

- **GSAs Que No Han Formalizado Sus Planes Para Preparar Su GSP:**
  - City of McFarland GSA
  - Greenfield County Water District GSA

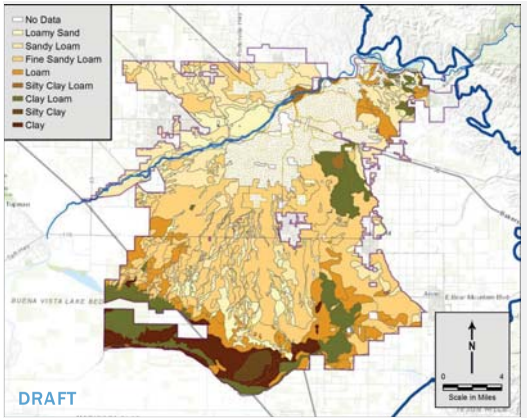
## CONFIGURACIÓN HIDROGEOLÓGICA CONCEPTUAL SUBCUENCA DEL CONDADO DE KERN




- Canal lleno de aluviones entre Sierra Nevada y Coast Ranges
- Subyacente por unidades sedimentarias marinas más antiguas
- Flanqueado por un lecho de roca cristalino

TODD GROUNDWATER

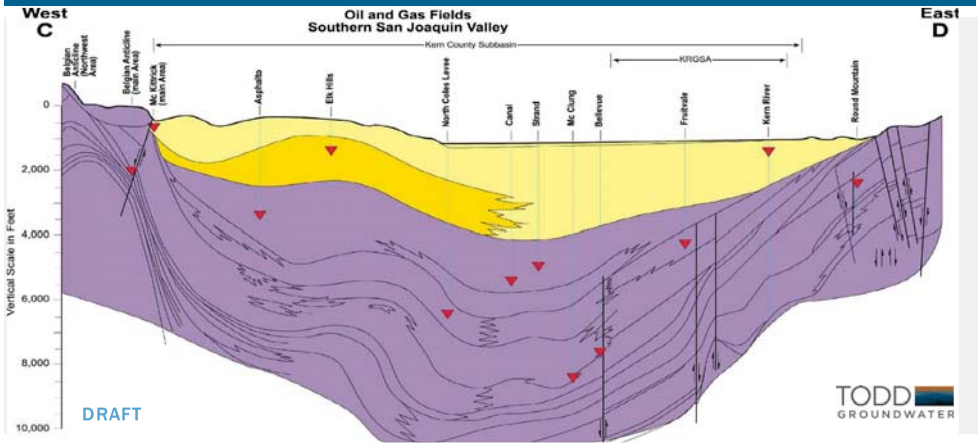
## TEXTURAS DEL TIERRA




- Texturas más permeables indicadas por colores más claros (blanco, amarillo, naranja claro)
- Las texturas de baja permeabilidad indicadas por naranja oscuro, verde y marrón
- Las texturas del suelo concuerdan bien con el marco geológico

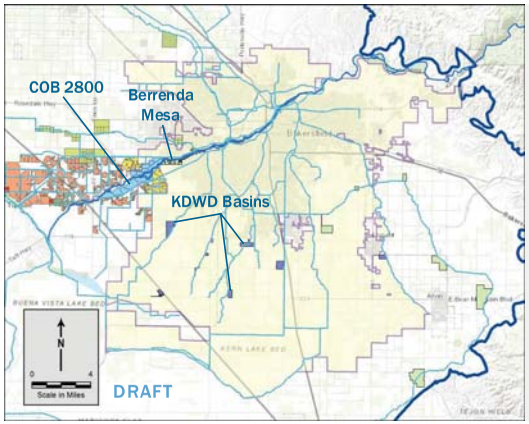
TODD GROUNDWATER

## SECCIÓN REGIONAL Y YACIMIENTOS PETROLÍFEROS




TODD GROUNDWATER

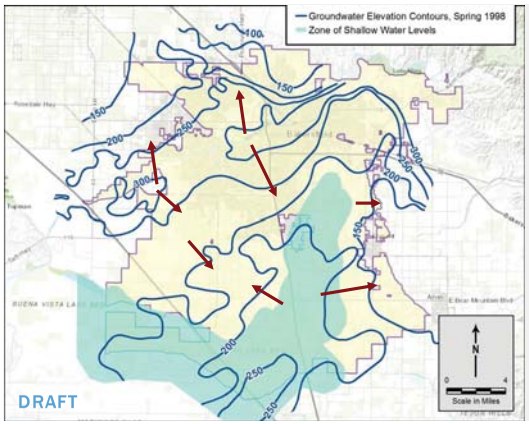
## CANALES Y CUENCAS DE RECARGA




- Recarga administrada en el canal del río, canales sin revestimiento y cuencas
- Proyectos de banca de aguas subterráneas KRGSA:
  - COB 2800 Acres
  - KCWA Berrenda Mesa
  - KDWD Proyecto Metropolitano
- Numerosos proyectos bancarios adicionales cerca

TODD GROUNDWATER

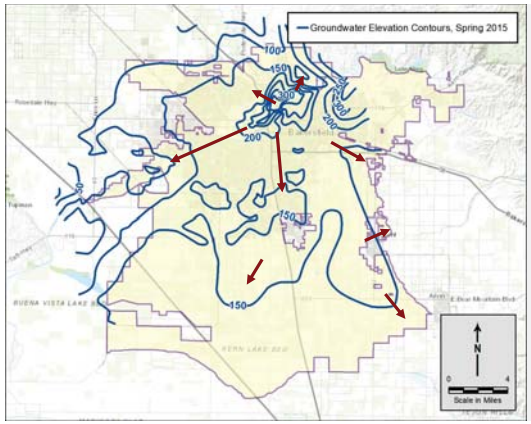
## CONTORNOS DE ELEVACIÓN DEL AGUA SUBTERRÁNEA 1998




- 20 mapas de contorno de elevación del agua subterránea (datos de primavera)
- Mapas y datos examinados para capas encaramadas (zona de niveles de aguas poco profundas)
- Ejemplo para el año lluvioso - Primavera de 1998

TODD GROUNDWATER

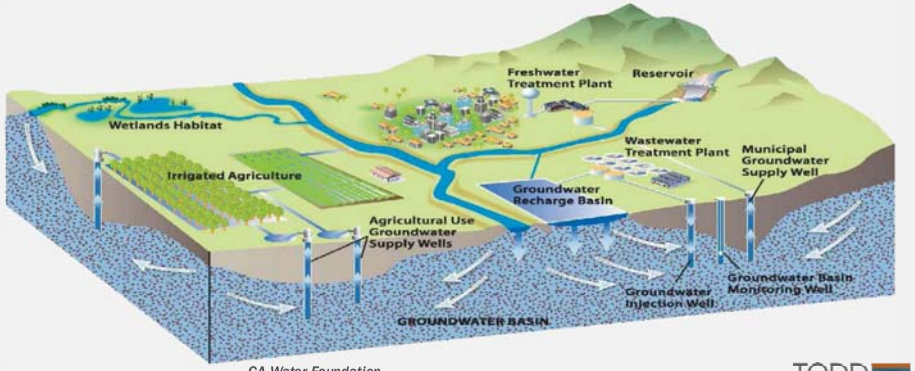
## CONTORNOS DE ELEVACIÓN DE AGUA SUBTERRÁNEA 2015




- Año de sequía severa
- En general, niveles de agua más altos que las áreas circundantes
- Excepto por el río, el agua subterránea fluye fuera del área de KRGSA

TODD GROUNDWATER

## FINALIZANDO EL PRESUPUESTO DE AGUA DE KRGSA

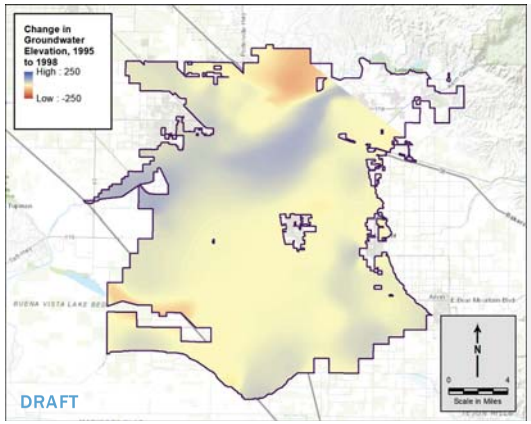



*CA Water Foundation*

DRAFT

TODD GROUNDWATER

## CAMBIO EN LAS AGUAS SUBTERRÁNEAS EN EL ALMACENAMIENTO, 1995-1998




- Se crearon 20 mapas anuales de cambio de nivel de agua utilizando los mapas de contorno de nivel de agua de KCWA Spring
- Las áreas azules indican un aumento en el nivel del agua; las áreas rojas indican una disminución del nivel de agua
- Los datos limitados crean incertidumbre para algunas áreas y períodos de tiempo

DRAFT

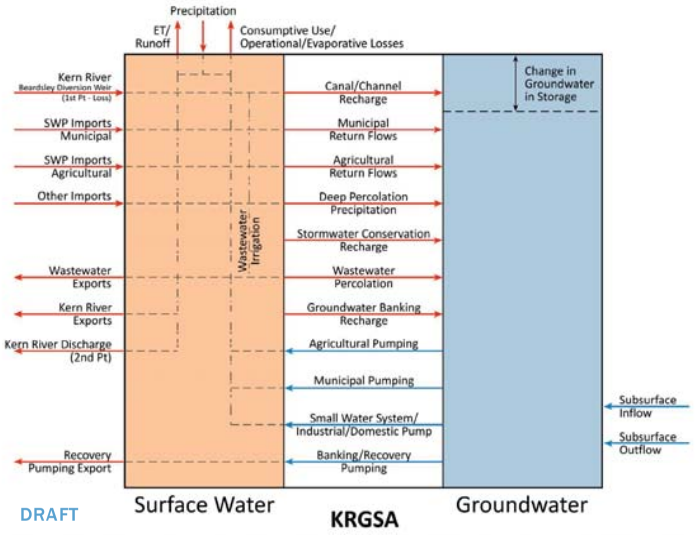
TODD GROUNDWATER

## PRESUPUESTOS DE AGUA KRGSA - ENFOQUE

- El agua del Condado de Kern se administra en tiempo real para un uso óptimo
- Proporciona flexibilidad y optimización de agua, pero da como resultado una contabilidad compleja de moléculas físicas
  - Enfoque en el sistema físico
    - ¿A dónde va el "agua mojada"? (no intercambios de papel)
    - El proceso presupuestario del agua sigue las "moléculas": ¿no se le asigna "propiedad" al agua?
    - Evitar el "doble conteo"


DRAFT

TODD GROUNDWATER




## COMPONENTES DE PRESUPUESTO COMBINADO DE AGUA DE KRGSA

TODD GROUNDWATER

## PREGUNTAS Y RESPUESTAS

## PROXIMOS PASOS

- Trabajar con agencias para conciliar datos y presupuestos locales de agua
- Compilar para KRGSA
- Formato de conjuntos de datos para el modelo

Horizon WATER and ENVIRONMENT

TODD GROUNDWATER

## PARTICIPE EN EL DESARROLLO DEL GSP

Puede ayudar a dar forma a lo que está incluido en el planificar por :

- Proporcionar información sobre sus desafíos de agua subterránea pasados o presentes
- Compartir información sobre su consumo de agua y / o pozo
- Compartiendo su visión para la sostenibilidad
- Identificar proyectos que pueden ayudar a abordar las condiciones del agua subterránea
- Completando la Encuesta de Parte Interesada

## ENCUESTA DE PARTES INTERESADAS

Queremos escuchar de ti!

- ¿Qué sabes sobre SGMA?
- ¿Cómo se usa el agua?
- ¿Qué más deberíamos saber?


## INFORMACIÓN ADICIONAL Y RECURSOS

- Asistencia técnica para comunidades severamente desfavorecidas
  - Self-Help Enterprises: https://www.selfhelpenterprises.org
    - Eva Dominguez, 559-802-1634, EvaD@selfhelpenterprises.org
    - Maria Herrera, 559-802-1676, MariaH@selfhelpenterprises.org
- Información Local– Kern River GSA: https://kernrivergsa.org
  - Art Chianello, 661-326-3715, AChianel@bakersfieldcity.us
- Información Estatal
  - Department of Water Resources: https://sgma.water.ca.gov/portal/
  - State Water Resources Control Board: https://www.waterboards.ca.gov/water_issues/programs/gmp/sgma.html

## MANTENTE INVOLUCRADO

- Asista a las reuniones de GSA
  - Las reuniones de la Mesa Directiva de KRGSA se llevan a cabo el último miércoles de cada mes a las 8 a.m. en 1600 Truxtun Avenue, Bakersfield, CA 93301.
- Ingrese en la lista de "partes interesadas" para recibir correspondencia e información de KRGSA
- Visita el sitio web para saber más: http://www.kernrivergsa.org/
- Asiste a talleres futuros

## PRÓXIMOS TALLERES REGIONALES

- Discusión Sobre la Calidad de Agua Subterránea y la Ley de Manejo Sostenible del Agua Subterránea– October 10, 2018
- Taller Sobre el Plan del Manejo Sostenible del Agua Subterránea– October 27, 2018

Patrocinado por Self Help Enterprises, Leadership Counsel for Justice and Accountability, Community Water Center, y Union of Concerned Scientists

*Más información está disponible en la mesa de atrás*

# GRACIAS!

Kern River Groundwater Sustainability Agency

KERN GROUNDWATER AUTHORITY

DRAFT

# Kern County Subbasin C2VSim Modeling Update

October 26, 2018

TODD GROUNDWATER

## Acknowledgements


- C2VSim Model Team
  - Mike Maley – Todd Groundwater
  - Charlie Brush – Hydrolytics LLC (formerly with DWR)
- Peer Review Team
  - Saquib Najmus and Frank Qian, Woodard & Curran
- Data Gatherers
  - GEI compiled surface water data for KGA and others
  - Todd GW compiled data for KRGSA, Kern River and past modeling efforts
- KRGSA and KGA
  - Water Districts and Consultants
  - Terry Erlewine and Patty Poire


DRAFT

TODD GROUNDWATER

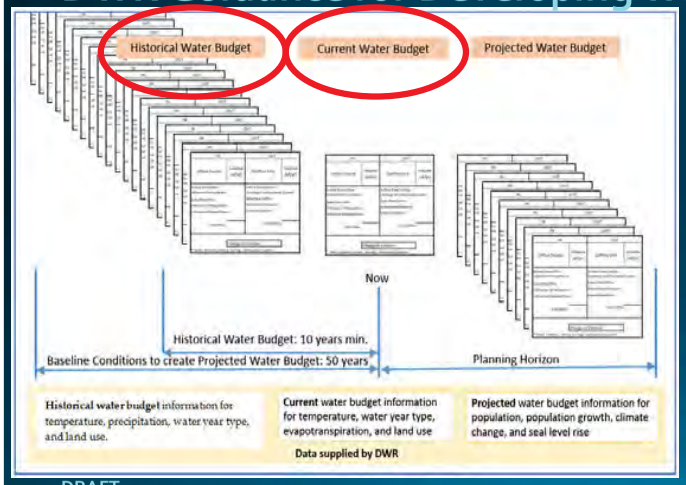
## Presentation Outline

- Objectives and Background
- Moving Data into the Model
- Current Model Performance
- Next Steps for Historical/Current Water budgets
- Proposed Projected Future Water Budgets

DRAFT

TODD GROUNDWATER

## DWR Guidance for Developing Water Budgets




- Separate groundwater and surface water budget
- Consistent approach for all GSAs in the Subbasin
- For entire Subbasin with interactions with adjoining subbasins
- Tabular and graphical representation required by regulations

DRAFT

TODD GROUNDWATER

Item 2

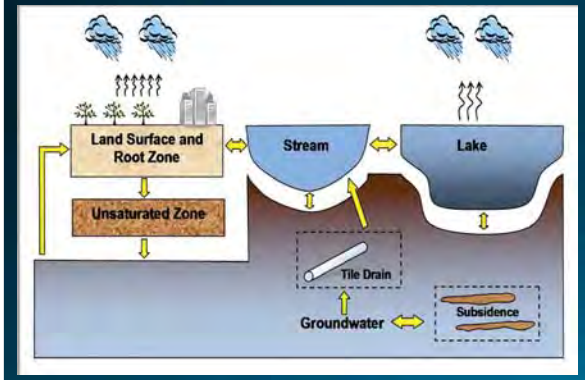
# Keeping up with Summer Schedule

- NOW: completing initial model runs with priority components
- Late August: provide model to peer reviewer
- August – Sept: Internal QA/QC
- Sept – Oct: Identify, compile, and incorporate the lower-priority budget items; make corrections to existing data, as needed
- Early November – share results

DRAFT

TODD GROUNDWATER

# IWFM – Integrated Process-Based Model




- Model simulates key hydrological processes
  - Land Surface, Root Zone, and Unsaturated Zone
  - Surface water deliveries from rivers and canals
  - Groundwater flow
- Demand-driven model
  - Many control points
- Tracks water throughout the system
  - Need to understand water consumption and losses

DRAFT

TODD GROUNDWATER

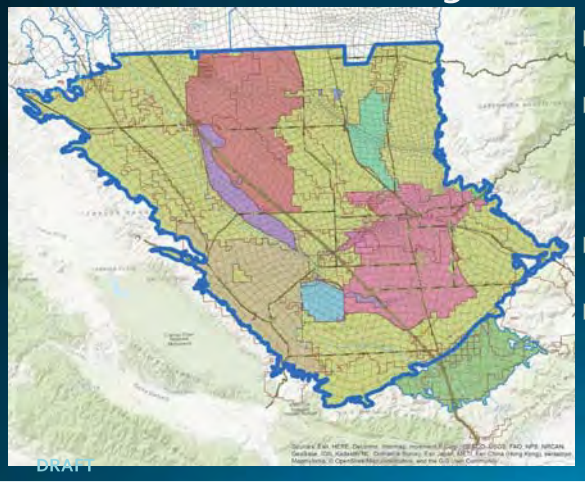
# C2VSim is a Regional Planning Model

DRAFT

- C2VSim
  - Covers Entire Central Valley
  - Focus to support CVP/SWP Planning
  - Beta-Version released May to support SGMA
- Regional Planning Model for DWR
  - Regionalized data application and assumptions
- Kern County was not original focus
  - Lacks key data for groundwater banking and local water use

TODD GROUNDWATER

# Subbasin Water Budget - C2VSim Update



DRAFT

- Use C2VSim model for subbasin water budget analysis
- Update Managed Water Supply and Demand Data
  - Use local subbasin data
  - Focus on physical water
- Maintain current model structure (layers and properties)
- Retain general C2VSim data structure with Kern County Updates

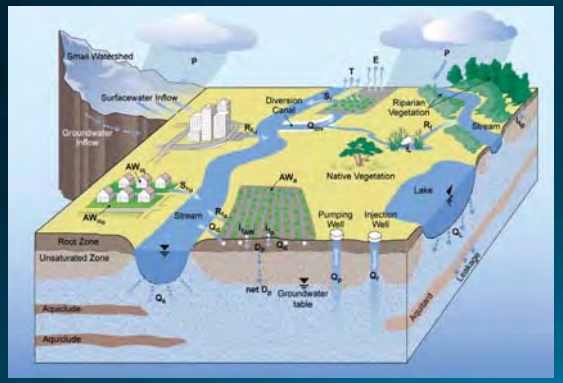
TODD GROUNDWATER

# Phased Approach to Model Revisions

- Phase 1 – Data Input
  - Restructure model to incorporate new data
- Phase 2 – Updates and Beta-Version Revisions
  - Review and update new data - QA/QC
  - Revise Beta-version parameters affecting model performance
- Phase 3 – Local Revisions
  - Incorporate locally-significant data
  - Continue to improve model performance
- Draft Historical and Current Water Budgets for District Review
- Phase 4 – Revisions and Refinements
  - Provide water budget updates
  - Final water budgets for GSP

DRAFT

# Managed Water Supply and Demand Data




- Surface water diversions by water district
- Groundwater banking and recharge programs
- Groundwater banking recovery for in-basin use and export
- Crop demand based on METRIC ET data
- Urban M&I water use
- Locally important water budget components

DRAFT

# Working Collaboratively with Peer Reviewers

- Regular Meetings to Discuss Model Progress
  - Vet approach with experienced modelers
  - Working to resolve issues
- W&C reviewing data consistency and application in the model

DRAFT

# Surface Water Conveyance and Service Areas

- Separate diversion for:
  - Each surface water source
  - Each district service area
  - Groundwater banking projects
  - Urban use
- Surface Water Data Sources
  - GEI compiled surface water data for KGA and others
  - Todd GW compiled surface water data for KRGSA and Kern River

DRAFT

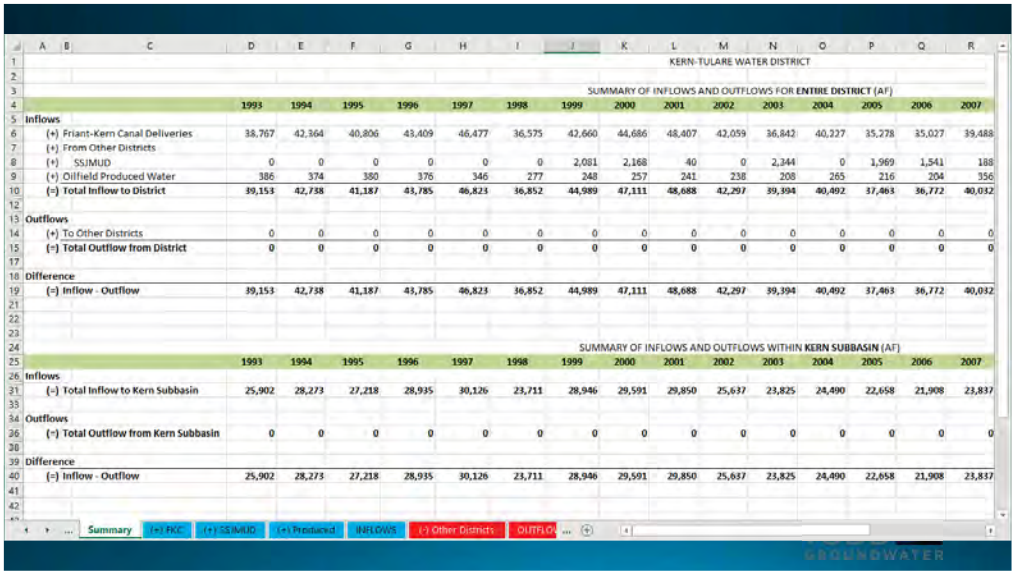
# Surface Water Conveyance and Service Areas

| | | | |
|---|---|---|---|
| Arvin Edison WSD | Cawelo WD | Lost Hills WD | Shafter-Wasco ID |
| Belridge WSD | Henry Miller WD | North Kern WSD | Semitropic WSD |
| Berrenda Mesa WD | Kern Delta WD (5 SAs) | Rosedale Ranch ID | SSJMUD |
| Buena Vista WSD (2 SAs) | Kern-Tulare WD | Rosedale-Rio Bravo WSD | Wheeler Ridge-Maricopa WSD |

| | | | |
|---|---|---|---|
| 2800 Acres | Buena Vista WSD | Kern Water Bank | Semitropic WSD |
| Arvin-Edison WSD | Cawelo WD | North Kern WSD | West Kern WD |
| Berrenda Mesa WSD | Kern Delta WD | Pioneer Project | |

| | |
|---|---|
| City of Bakersfield | Kern NWR |
| KCWA ID 4 | |
| Lost Hills UD | |

DRAFT



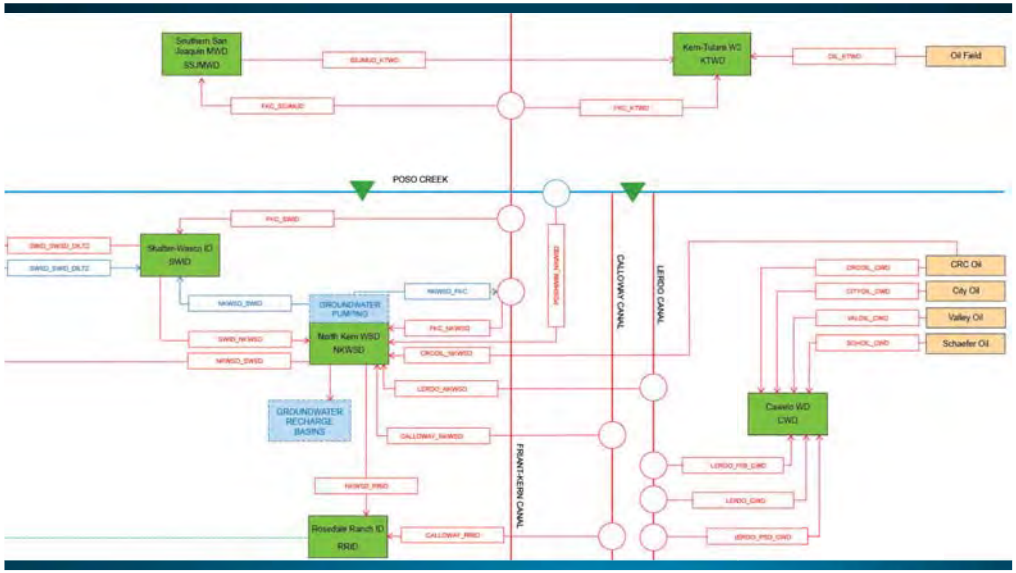
KERN-TULARE WATER DISTRICT

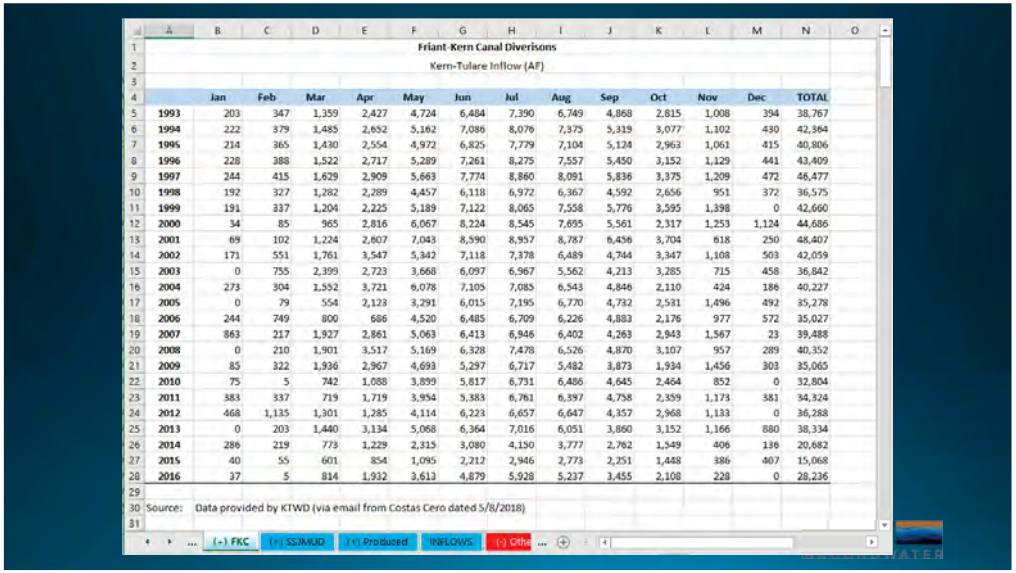
SUMMARY OF INFLOWS AND OUTFLOWS FOR **ENTIRE DISTRICT** (AF)

| | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Inflows** | | | | | | | | | | | | | | | |
| (+) Friant-Kern Canal Deliveries | 38,767 | 42,364 | 40,806 | 43,409 | 46,477 | 36,575 | 42,660 | 44,686 | 48,407 | 42,059 | 36,842 | 40,227 | 35,278 | 35,027 | 39,488 |
| (+) From Other Districts | | | | | | | | | | | | | | | |
| (+) SSJMUD | 0 | 0 | 0 | 0 | 0 | 0 | 2,081 | 2,168 | 40 | 0 | 2,344 | 0 | 1,969 | 1,541 | 188 |
| (+) Oilfield Produced Water | 386 | 374 | 380 | 376 | 346 | 277 | 248 | 257 | 241 | 238 | 208 | 265 | 216 | 204 | 356 |
| **(=) Total Inflow to District** | **39,153** | **42,738** | **41,187** | **43,785** | **46,823** | **36,852** | **44,989** | **47,111** | **48,688** | **42,297** | **39,394** | **40,492** | **37,463** | **36,772** | **40,032** |
| **Outflows** | | | | | | | | | | | | | | | |
| (+) To Other Districts | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **(=) Total Outflow from District** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **Difference** | | | | | | | | | | | | | | | |
| **(=) Inflow - Outflow** | **39,153** | **42,738** | **41,187** | **43,785** | **46,823** | **36,852** | **44,989** | **47,111** | **48,688** | **42,297** | **39,394** | **40,492** | **37,463** | **36,772** | **40,032** |

SUMMARY OF INFLOWS AND OUTFLOWS WITHIN **KERN SUBBASIN** (AF)

| | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Inflows** | | | | | | | | | | | | | | | |
| **(=) Total Inflow to Kern Subbasin** | **25,902** | **28,273** | **27,218** | **28,935** | **30,126** | **23,711** | **28,946** | **29,591** | **29,850** | **25,637** | **23,825** | **24,490** | **22,658** | **21,908** | **23,837** |
| **Outflows** | | | | | | | | | | | | | | | |
| **(=) Total Outflow from Kern Subbasin** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **Difference** | | | | | | | | | | | | | | | |
| **(=) Inflow - Outflow** | **25,902** | **28,273** | **27,218** | **28,935** | **30,126** | **23,711** | **28,946** | **29,591** | **29,850** | **25,637** | **23,825** | **24,490** | **22,658** | **21,908** | **23,837** |



Friant-Kern Canal Diversions

Kern-Tulare Inflow (AF)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1993 | 203 | 347 | 1,359 | 2,427 | 4,724 | 6,484 | 7,390 | 6,749 | 4,868 | 2,815 | 1,008 | 394 | 38,767 |
| 1994 | 222 | 379 | 1,485 | 2,652 | 5,162 | 7,086 | 8,076 | 7,375 | 5,319 | 3,077 | 1,102 | 430 | 42,364 |
| 1995 | 214 | 365 | 1,430 | 2,554 | 4,972 | 6,825 | 7,779 | 7,104 | 5,124 | 2,963 | 1,061 | 415 | 40,806 |
| 1996 | 228 | 388 | 1,522 | 2,717 | 5,289 | 7,261 | 8,275 | 7,557 | 5,450 | 3,152 | 1,129 | 441 | 43,409 |
| 1997 | 244 | 415 | 1,629 | 2,909 | 5,663 | 7,774 | 8,860 | 8,091 | 5,836 | 3,375 | 1,209 | 472 | 46,477 |
| 1998 | 192 | 327 | 1,282 | 2,289 | 4,457 | 6,118 | 6,972 | 6,367 | 4,592 | 2,656 | 951 | 372 | 36,575 |
| 1999 | 191 | 337 | 1,204 | 2,225 | 5,189 | 7,122 | 8,065 | 7,558 | 5,776 | 3,595 | 1,398 | 0 | 42,660 |
| 2000 | 34 | 85 | 965 | 2,816 | 6,067 | 8,224 | 8,545 | 7,695 | 5,561 | 2,317 | 1,253 | 1,124 | 44,686 |
| 2001 | 69 | 102 | 1,224 | 2,607 | 7,043 | 8,590 | 8,957 | 8,787 | 6,456 | 3,704 | 618 | 250 | 48,407 |
| 2002 | 171 | 551 | 1,761 | 3,547 | 5,342 | 7,118 | 7,378 | 6,489 | 4,744 | 3,347 | 1,108 | 503 | 42,059 |
| 2003 | 0 | 755 | 2,399 | 2,723 | 3,668 | 6,097 | 6,967 | 5,562 | 4,213 | 3,285 | 715 | 458 | 36,842 |
| 2004 | 273 | 304 | 1,552 | 3,721 | 6,078 | 7,105 | 7,085 | 6,543 | 4,846 | 2,110 | 424 | 186 | 40,227 |
| 2005 | 0 | 79 | 554 | 2,123 | 3,291 | 6,015 | 7,195 | 6,770 | 4,732 | 2,531 | 1,496 | 492 | 35,278 |
| 2006 | 244 | 749 | 800 | 686 | 4,520 | 6,485 | 6,709 | 6,226 | 4,883 | 2,176 | 977 | 572 | 35,027 |
| 2007 | 863 | 217 | 1,927 | 2,861 | 5,063 | 6,413 | 6,946 | 6,402 | 4,263 | 2,943 | 1,567 | 23 | 39,488 |
| 2008 | 0 | 210 | 1,901 | 3,517 | 5,169 | 6,328 | 7,478 | 6,526 | 4,870 | 3,107 | 957 | 289 | 40,352 |
| 2009 | 85 | 322 | 1,936 | 2,967 | 4,693 | 5,297 | 6,717 | 5,482 | 3,873 | 1,934 | 1,456 | 303 | 35,065 |
| 2010 | 75 | 5 | 742 | 1,088 | 3,899 | 5,817 | 6,731 | 6,486 | 4,645 | 2,464 | 852 | 0 | 32,804 |
| 2011 | 383 | 337 | 719 | 1,719 | 3,954 | 5,383 | 6,761 | 6,397 | 4,758 | 2,359 | 1,173 | 381 | 34,324 |
| 2012 | 468 | 1,135 | 1,301 | 1,285 | 4,114 | 6,223 | 6,657 | 6,647 | 4,357 | 2,968 | 1,133 | 0 | 36,288 |
| 2013 | 0 | 203 | 1,440 | 3,134 | 5,068 | 6,364 | 7,016 | 6,051 | 3,860 | 3,152 | 1,166 | 880 | 38,334 |
| 2014 | 286 | 219 | 773 | 1,229 | 2,315 | 3,080 | 4,150 | 3,777 | 2,762 | 1,549 | 406 | 136 | 20,682 |
| 2015 | 40 | 55 | 601 | 854 | 1,095 | 2,212 | 2,946 | 2,773 | 2,251 | 1,448 | 386 | 407 | 15,068 |
| 2016 | 37 | 5 | 814 | 1,932 | 3,613 | 4,879 | 5,928 | 5,237 | 3,455 | 2,108 | 228 | 0 | 28,236 |

Source: Data provided by KTWD (via email from Costas Cero dated 5/8/2018)

# Kern-Tulare Water District

Kern-Tulare WD from Friant-Kern Canal

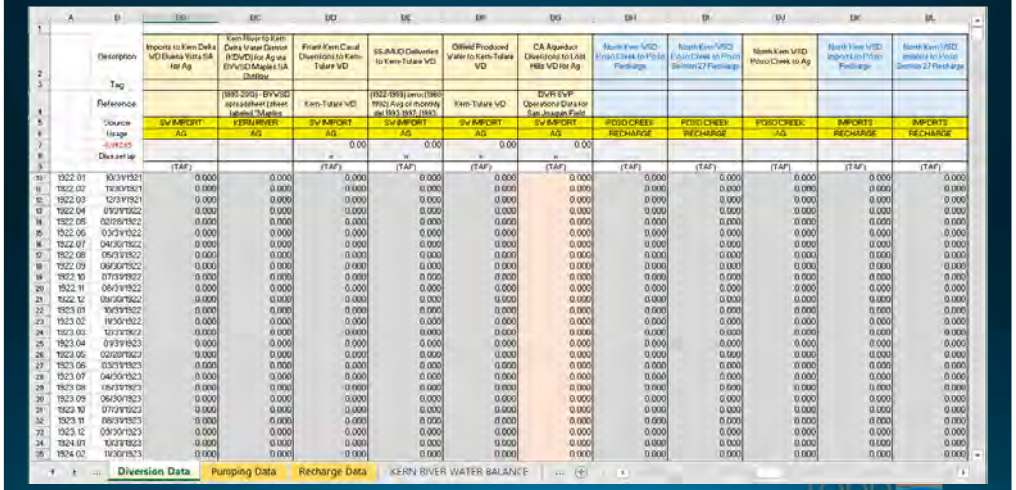
| | |
|---|---|
| 1922-1960 | Zero |
| 1961-1992 | Estimated: Monthly average of 1993-97 |
| 1993-2015 | District data |

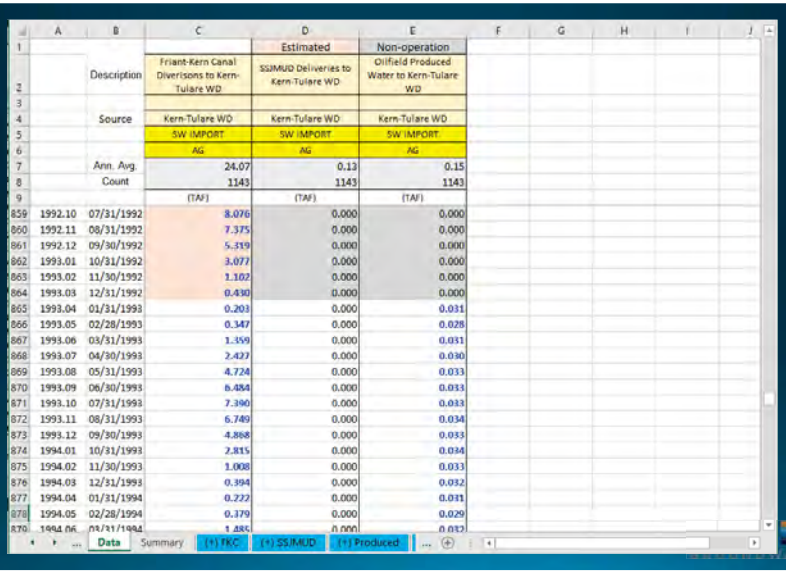
Kern-Tulare WD from SSJMUD

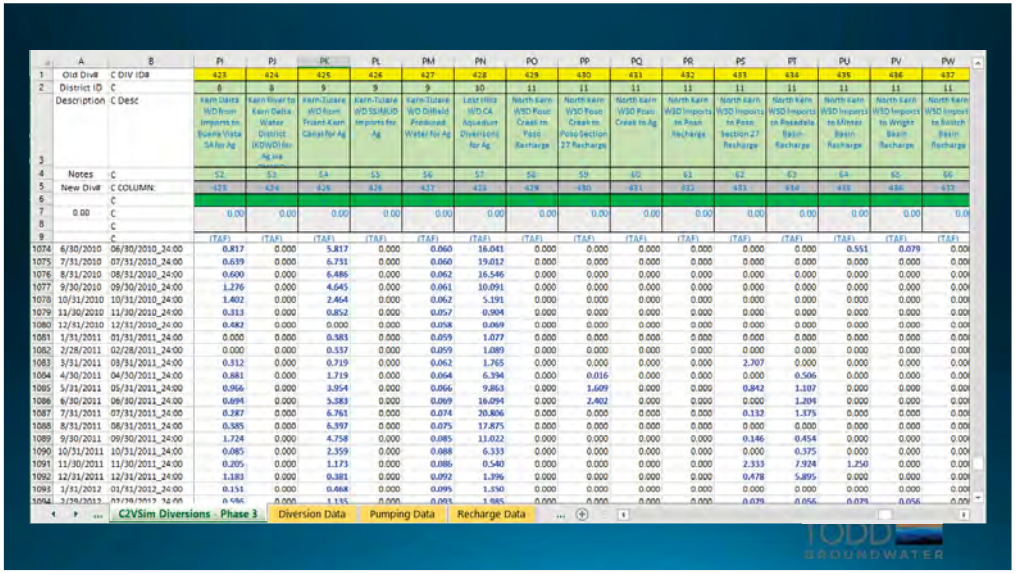
| | |
|---|---|
| 1922-1992 | Zero |
| 1993-2015 | District data |

Kern-Tulare WD from Oilfield produced water

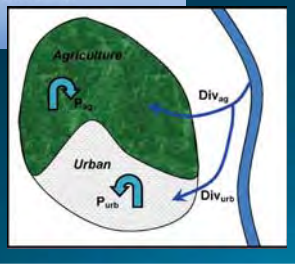
| | |
|---|---|
| 1922-1992 | Zero |
| 1993-2015 | District data |



## Surface Water Process


- Tracks surface water delivered for agricultural and urban use
  - Directs diversions to designated subareas
  - Each subarea provides for spatial distribution of agricultural and urban use
- Surface Water budget tracks:
  - Diversions
  - River and canal seepage
  - Groundwater-surface water interactions
  - Natural inflows and outflows

DRAFT

## Groundwater Banking and Recharge Locations

- Data Sources
  - Directly from local districts
  - Published reports or other sources
  - Historic data back to 1960's
- Facilities Include:
  - Groundwater Banks
  - Managed Aquifer Recharge
  - Recovery Wells

DRAFT

## Kern-Tulare Water District

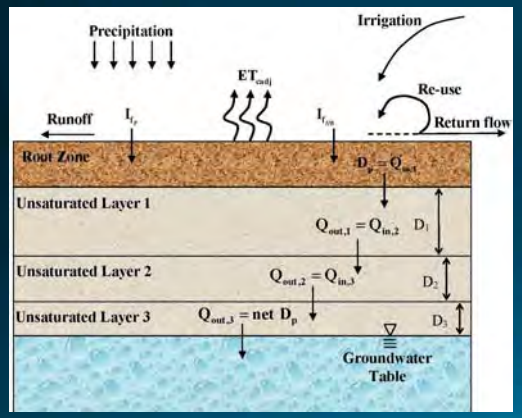
| Diversion | Leakage | Evap. | Delivery |
|---|---|---|---|
| Kern-Tulare WD from Friant-Kern Canal | 1% | 1% | 98% |
| Kern-Tulare WD from SSJMUD | 1% | 1% | 98% |
| Kern-Tulare WD from Oilfield produced water | 1% | 1% | 98% |

## Assigned C2VSim Elements to GW Banks

- Data Sources
  - Directly from local districts
  - Published reports or other sources
  - Historic data back to 1960's
- Facilities Include:
  - Groundwater Banks
  - Managed Aquifer Recharge
  - Recovery Wells

DRAFT

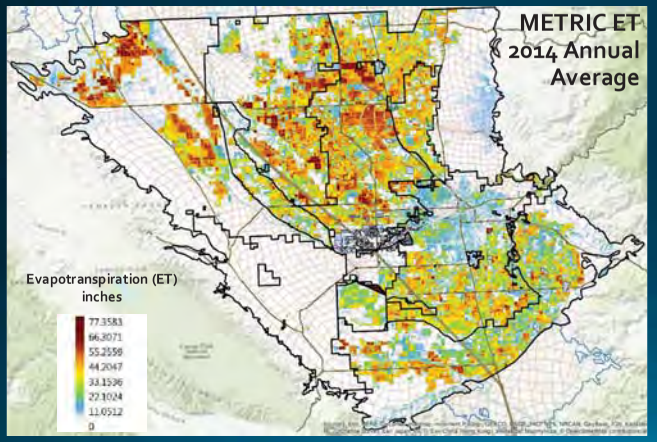
# IWFM Demand Calculator (IDC)




- Calculates agricultural demand based on soil moisture budget
  - Monthly crop ET time series
  - Tracks soil moisture content throughout simulation
  - If soil moisture falls below minimum level (wilting point), irrigation water added to reach target level (field capacity) to cover ET, deep percolation and runoff

DRAFT

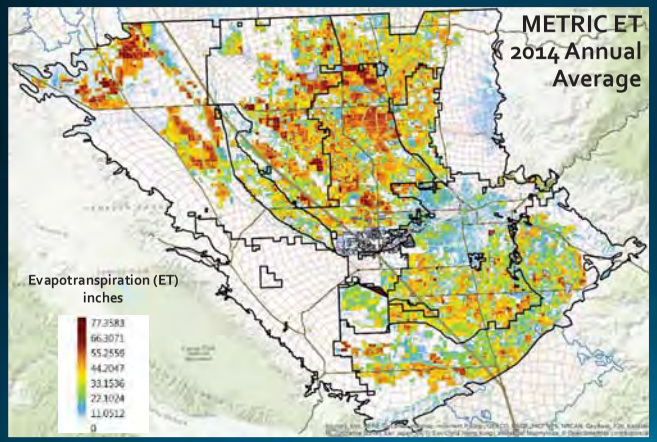
# Mapping METRIC ET Data to C2VSim




- METRIC ET Processing
  - Correlate METRIC ET and land use at 30 m pixel level
  - Average up pixel ET rate to C2VSim crop type or land use
  - Monthly Average ET for each C2VSim crop type
  - Maintain Volumetric Consistency

DRAFT

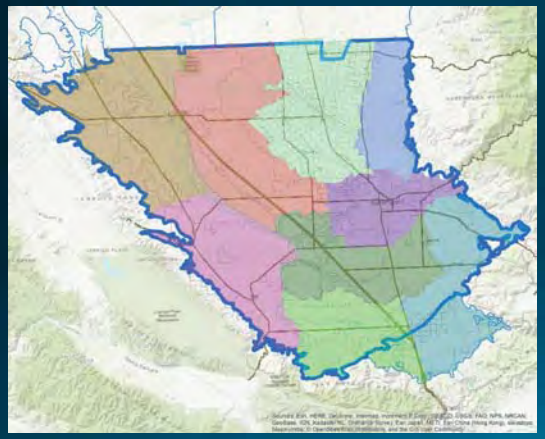
# ITRC METRIC ET Data




- Monthly data from ITRC
  - 1994-2015 (no 2012)
  - 30 m pixel
- Calculated METRIC ET rates for:
  - Irrigated Agriculture
  - Other land use

DRAFT

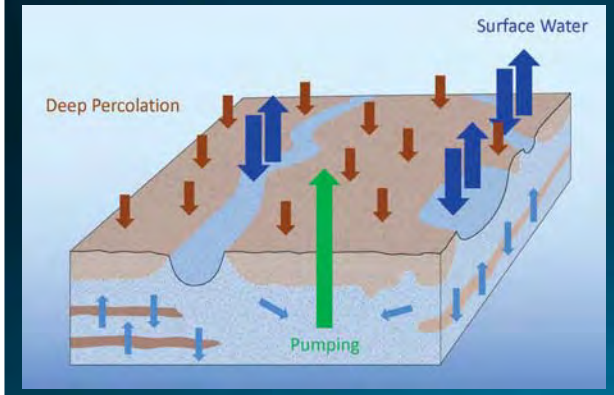
# C2VSim Applies Urban Demand over Zone



- Urban Demand Data
  - Surface water deliveries
  - Groundwater pumping volumes from major water purveyors
- C2VSim uses Urban Zones
  - Applied to urban land use areas
  - Population and Per Capita Use for M&I
- Kern County Updates
  - Defined new Metro Bakersfield Zone
  - Updated population data
  - Revised Per Capita Rates to reflect actual water use

DRAFT

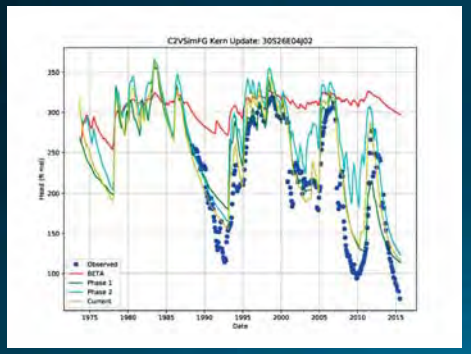
# Groundwater Process

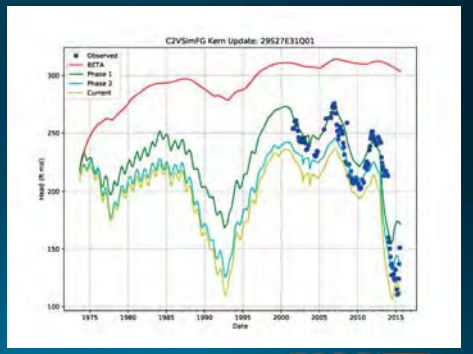



- Groundwater process integrates the inflows and outflows from other processes
- Groundwater budget tracks:
  - Volume for each inflow and outflow component
  - Storage change over time
- Change in groundwater levels
  - Hydrographs

DRAFT

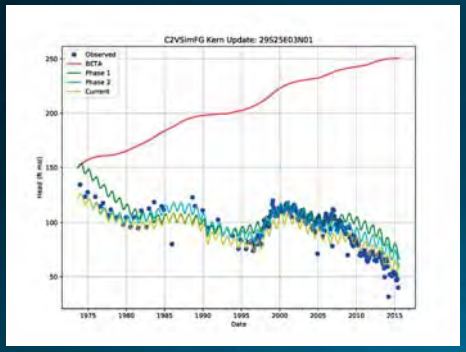
# Examples of Model Performance City of Bakersfield

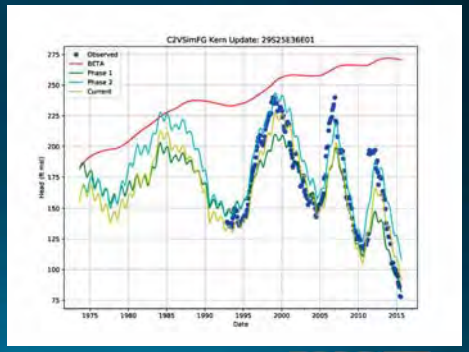




DRAFT

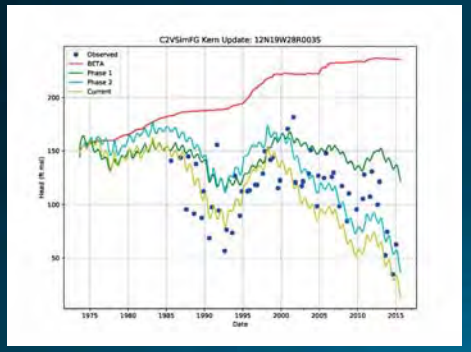
# Examples of Model Performance Rosedale-Rio Bravo Area

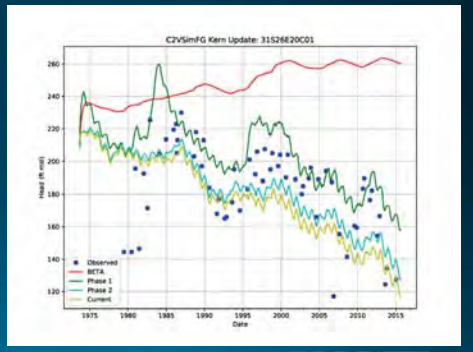




DRAFT

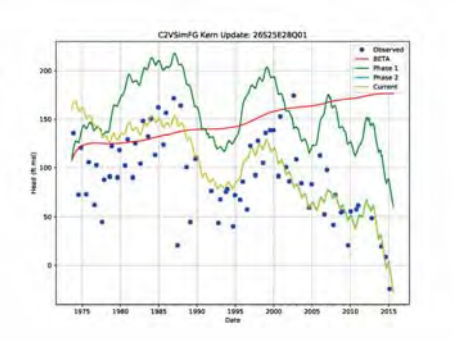
# Examples of Model Performance Arvin-Edison WSD and Kern Delta WD

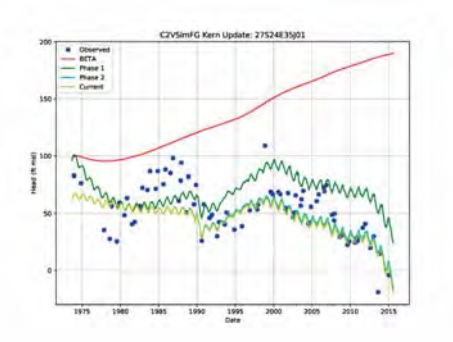




DRAFT

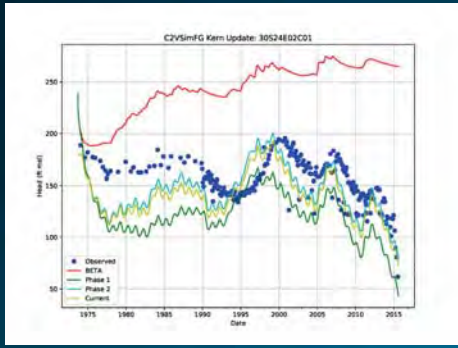
# Examples of Model Performance
# North Kern WSD and Shafter-Wasco ID

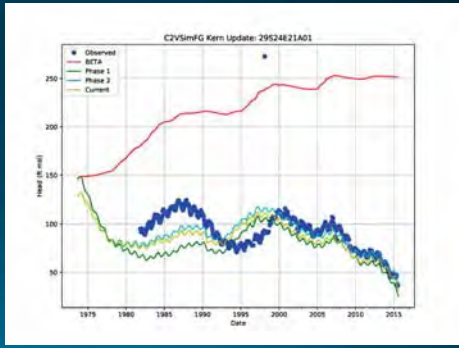



DRAFT

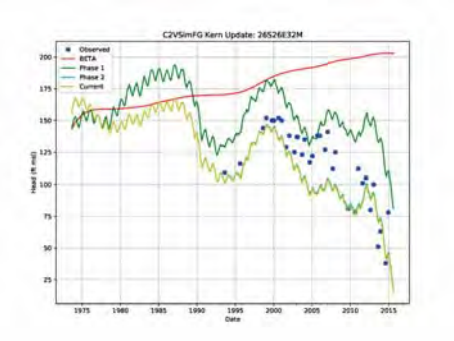
# Examples of Model Performance
# Buena Vista WSD and Semitropic WSD

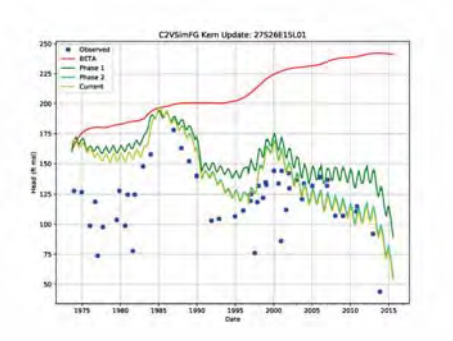



DRAFT

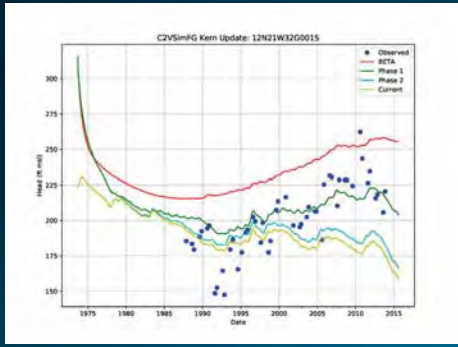
# Examples of Model Performance
# Cawelo WD and Kern-Tulare WD

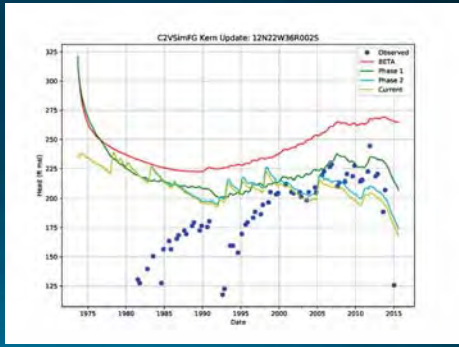



DRAFT

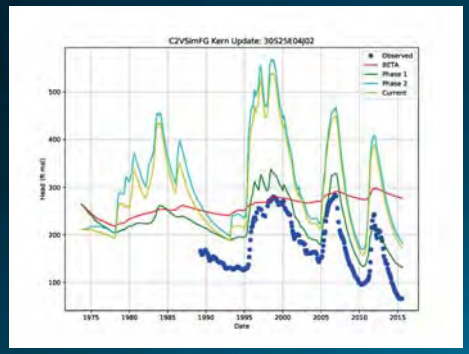
# Examples of Remaining Model Issues – Initial Condition Affecting Results

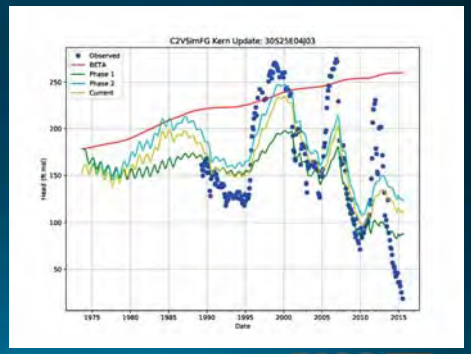



DRAFT

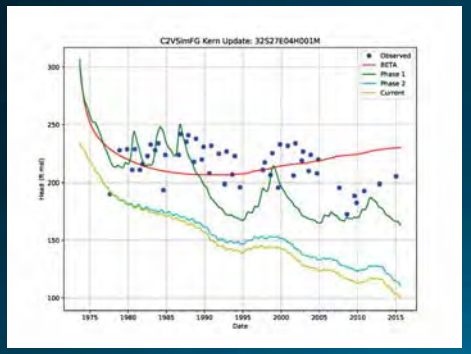
# Examples of Remaining Model Issues – Excess Recharge Retention in Layer 1

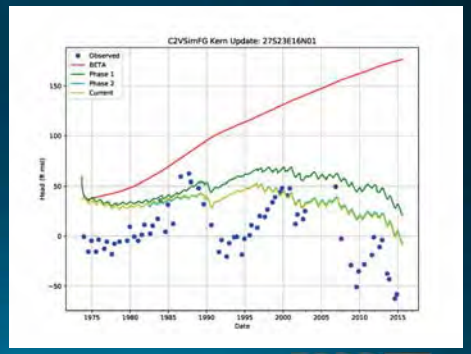



DRAFT

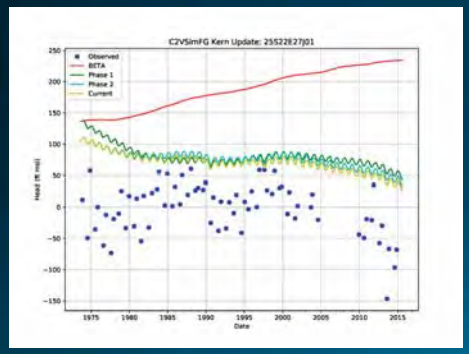
# Examples of Remaining Model Issues – Local Areas of Poor Correlation

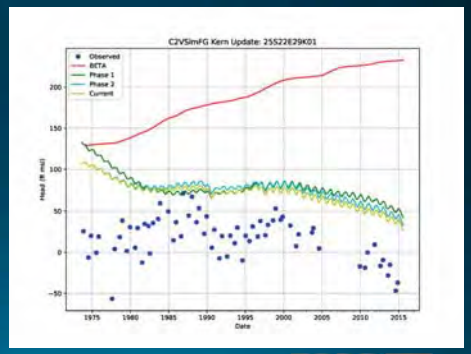



DRAFT

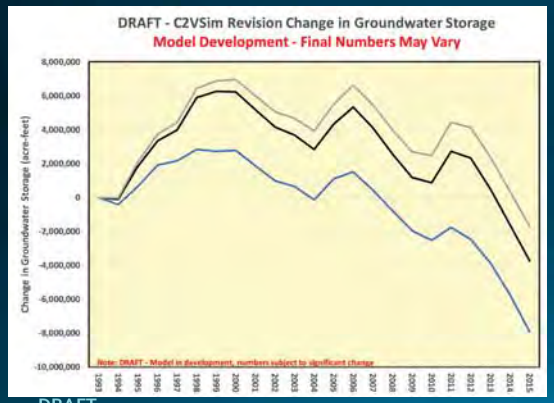
# Examples of Remaining Model Issues – Unwarranted Stream Recharge in Northwest




DRAFT

# Model Status – Groundwater Storage Change




- Current range gives a guide to final results
  - Anticipate lower storage as remaining issues are resolved
  - Reconcile Draft Model Results with Local water budgets
- Model does not account for Groundwater Banking Accounts
  - Water stored in basin for use by others

DRAFT

# Current Model Status

- Phase 1 - Data Input Complete
  - Primary Managed Water Data is Entered
  - Some local data additions are left to do
- Phase 2 and 3 - Working to Improve Model Performance
  - QA/QC of new data input structure still ongoing
  - Reconciling Beta-version issues
  - Limited adjustment to model parameters
- Develop Draft Historical and Current Water Budgets
  - Follow DWR Guidance for Water Budgets
  - Tabular and graphical results
  - Basinwide and Local GSA

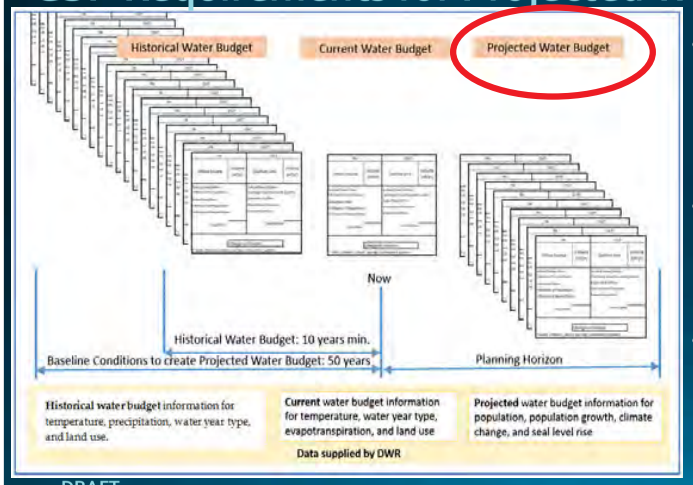
# Projected Future Water Budgets

# Next Steps for Model

- Early November – working to improve model performance
- Nov 13 – Submit for Peer Review
- Nov 22 – Share Draft results
- Early December – Model Update
- Phase 4 – Periodic Model updates as new information is available
- December – Transition to Projected Future Water Budgets

DRAFT

# GSP Requirements for Projected Water Budget




- Baseline
  - Project current land and water use
  - 50-years Historic hydrologic period
- Climate Change
  - DWR Guidance
  - 2030 and 2070 projected climate change
- Projected Sustainability Assessment
  - Test sustainability approach for

DRAFT

# Projected Future Modeling Baseline Development

- Projected Baseline Development
  - Current land use and historic hydrology over 50 year planning horizon
- Climate Change Baseline Development
  - Follow DWR Climate Change Guidance to modify Baseline Condition

DRAFT

# Projected Future Modeling Sustainability Assessment

- Sustainability Alternatives Screening Analysis
  - Early test of potential sustainability alternatives to support GSAs
  - Addresses DWR Uncertainty Analysis requirement
- Projected Future Sustainability Assessment
  - GSAs provide proposed sustainability alternatives
  - Develop basinwide scenarios
- Preferred Sustainability Alternative
  - Finalize scenarios for use in GSPs

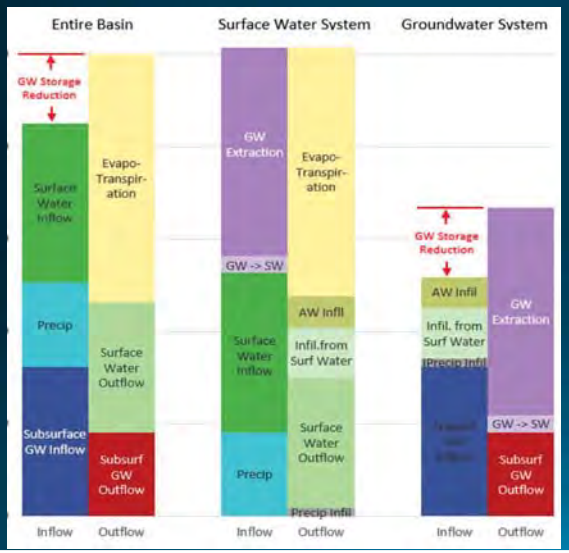
DRAFT

# Projected Future Sustainability Assessment

*CA Water Foundation*

- Supply-Side Project
  - Recharge projects
  - Operational changes
  - Recycled Water
- Demand Reduction
  - Urban water reduction
  - Changes in Ag operations
- Variable Changes
  - Imported Water Delivery

DRAFT




# Projected Future Water Budgets

- Evaluate baseline conditions
- Viability of Proposed Sustainability Plans
- How may Climate Change affect Proposed Sustainability Plan

DRAFT


Discussion
and
Questions

Item 3a

# You're Invited!
# GROUNDWATER WORKSHOP

## THIS WORKSHOP WILL COVER:

- California's New Groundwater Law — the Sustainable Groundwater Management Act (SGMA) of 2014
- Your Groundwater Sustainability Agency (GSA)
- Your Groundwater Sustainability Plan (GSP)
- How to participate!

**DATE: Tuesday, November 13, 2018**

**TIME:** 6:00 - 7:30 p.m.

**WHERE:** Bear Mountain Recreation David Head Center

10300 San Diego St., Lamont, CA 93241

**For more information, please contact:**

Eva Dominguez (559) 802-1634, EvaD@SelfHelpEnterprises.org or
Maria Herrera (559) 802-1676, MariaH@SelfHelpEnterprises.org

*Translation services will be available*

Self-Help Enterprises

KRGSA

KERN RIVER GROUNDWATER SUSTAINABILITY AGENCY

# ¡Estás Invitado!
# TALLER DE AGUA SUBTERRÁNEA

## TEMAS DEL TALLER:

- **Nueva ley estatal del agua subterránea: la Ley del Manejo Sostenible del Agua Subterránea (SGMA) de 2014**
- **Su Agencia de Manejo Sostenible de Agua Subterránea**
- **Su Plan de Manejo Sostenible del Agua Subterránea**
- **Como participar!**

**FECHA: Martes, 13 de noviembre 2018**

**HORA:** 6:00 - 7:30 p.m.

**DÓNDE:** Bear Mountain Recreation David Head Center

10300 San Diego St., Lamont, CA 93241

**Para mas información, póngase en contacto con:**

Eva Dominguez (559) 802-1634, EvaD@SelfHelpEnterprises.org o
Maria Herrera (559) 802-1676, MariaH@SelfHelpEnterprises.org

*Servicios de traducción estarán disponibles*

Self-Help Enterprises

KRGSA

KERN RIVER GROUNDWATER SUSTAINABILITY AGENCY

# Kern River Groundwater Sustainability Agency
# Groundwater Workshop

Tuesday, November 13, 2018 at 6:00 p.m.
Bear Mountain Recreation David Head Center
10300 San Diego St., Lamont, CA 93241

# AGENDA

| | |
|---|---|
| 6:00 p.m. – 6:05 p.m. | Welcome & Introductions |
| 6:05 p.m. – 6:25 p.m. | California's New Groundwater Law and Groundwater Sustainability Plans (GSP) |
| 6:25 p.m. – 6:45 p.m. | Local Efforts to Comply with SGMA - Kern River Groundwater Sustainability Agency GSP Development Efforts |
| 6:45 p.m. – 7:20 p.m. | Share your Thoughts – Stakeholder Discussion |
| 7:20 p.m. – 7:30 p.m. | Next Steps and Closing Remarks |

# Agencia de Sostenibilidad de Aguas Subterráneas de Kern River
# Taller de Agua Subterránea

Martes, 13 de noviembre, 2018 at 6:00 p.m.
Bear Mountain Recreation David Head Center
10300 San Diego St., Lamont, CA 93241

# AGENDA

| | |
|---|---|
| 6:00 p.m. – 6:05 p.m. | Bienvenida y Presentaciones |
| 6:05 p.m. – 6:25 p.m. | Nueva Ley de Aguas Subterráneas de California y Planes de Sostenibilidad de Aguas Subterráneas (GSP) |
| 6:25 p.m. – 6:45 p.m. | Esfuerzos Locales para Cumplir con SGMA - Esfuerzos de Desarrollo del GSP de la Agencia de Sostenibilidad de Aguas Subterráneas de Kern River |
| 6:45 p.m. – 7:20 p.m. | Comparta sus pensamientos - Discusión de las partes interesadas |
| 7:20 p.m. – 7:30 p.m. | Próximos Pasos y Clausura |

**Kern River GSA Groundwater Workshop**
**Tuesday, November 13, 2018, 6:00 p.m. - 7:30 p.m.**
**Bear Mountain Recreation David Head Center, 10300 San Diego St., Lamont, CA 93241**

| | Name/Nombre | Agency/Agencia | Phone/Telefono | Email/Correo Electrónico | Would you like to be notified of future meetings? ¿Desea que le avisemos sobre futuras reuniones? |
|---|---|---|---|---|---|
| 1 | ANTONE MATTEOS | ELADOS | 661-428-9650 | T.MATTEOS@TEJONRANCH.COM | X |
| 2 | Jana Marquez | KDWD | 661 834 4656 | jana@kerndelta.org | |
| 3 | Patty Poss | RCA | | | |
| 4 | David Beard | KCWA IDA | 661 634 1400 | dbeard@kcwa.com | |
| 5 | Debra Lilly | Horizon | 916 465 8074 | debra@horizonh2o.com | |
| 6 | Pete Kaiser | KDWD | | | |
| 7 | Ken Schwarz | Horizon Water & Environment | 510-986-1851 | ken@horizonh2o.com | |
| 8 | Mark Mulkay | KDWD | 661-834-4656 | | |
| 9 | ART Chianello | City of Bakersfield | 661-326-3715 | achianel@bakersfieldcity.us | |
| 10 | Jeevan Muhar | Arvin-Edison WSD | 661-854-5573 | jmuhar@aewsd.org. | X |
| 11 | Jasmene del Aguila | LCJA | cell-843-7677 | jdelaguila@leadershipcounsel.org | X |
| 12 | David Hampton | CWD | 661-831-6990 | dhampton@cawelaw.org | |
| 13 | Ramon Zavala | Lamont | 661- 845-213 (casc) | 661-332-7090 | |
| 14 | | | | | |
| 15 | | | | | |
| 16 | | | | | |

# Kern River Groundwater Sustainability Agency

# Groundwater Workshop

November 13, 2018

## WORKSHOP OVERVIEW

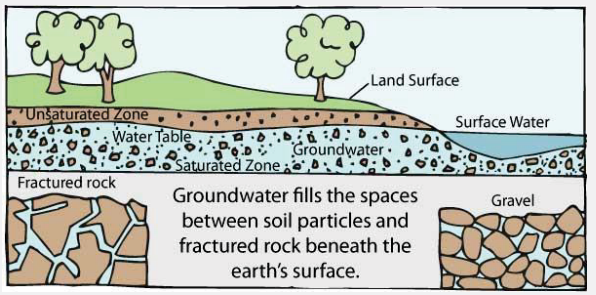
- California's New Groundwater Law – The Sustainable Groundwater Management Act (SGMA)
- Groundwater Sustainability Plans (GSPs)
- KRGSA's GSP Development Efforts
- Stakeholder Discussion
- Wrap Up and Closing Remarks

## SELF-HELP ENTERPRISES (SHE)

- SHE is a nationally-recognized non-profit housing and community development organization whose mission is to work together with low-income families to build and sustain healthy homes and communities.
- Community Development Program provides technical assistance and leadership development in rural communities who face clean water, sanitary sewer and other infrastructure challenges.
- Community Engagement and Planning Team supports community participation in regional water management and groundwater sustainability planning as well as building water management capacity and expertise in rural communities.


## GROUNDWATER MATTERS

On average Californians get **40%** of their water from groundwater. During droughts, that number can go up to **60%.**




- In the Central Valley, we are even more dependent on groundwater than the state as a whole
- **90%** of Central Valley residents rely on groundwater for at least part of their drinking water supply
- Most unincorporated communities are **100%** reliant on groundwater – includes many of our small school districts

Item 3b

## HOW COMMUNITIES AND SCHOOLS USE GROUNDWATER



## CALIFORNIA'S SUSTAINABLE GROUNDWATER MANAGEMENT ACT (SGMA)

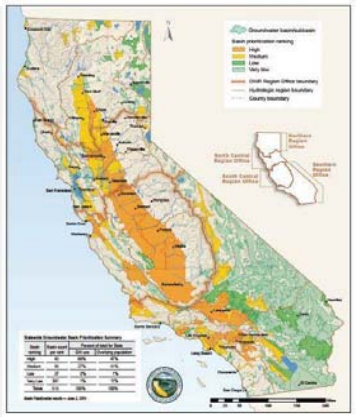
- Three-bill package: SB 1168 (Pavley), AB 1739 (Dickinson), SB 1319 (Pavley)
- Signed by Governor Brown on September 16, 2014
- Objective: Ensure the long-term reliability of our groundwater resources and connected surface water resources requiring "sustainable" management
- Core Principle: Local control

## HISTORICAL GROUNDWATER MANAGEMENT

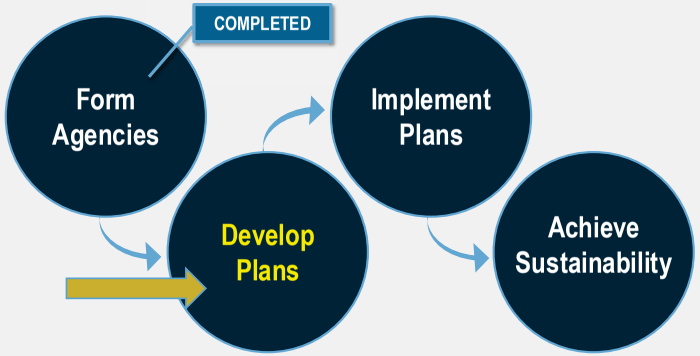
- Previously, groundwater management was voluntary in certain areas of the state
- Groundwater levels have been declining due to over-pumping, less surface water, and not enough recharge
- The drought (2012-2016) had an unprecedented impact on our state
- Dry wells (i.e., Arvin, Lamont area, and many others)
- Subsidence


## PREVENT UNDESIRABLE RESULTS

## WHO MUST COMPLY WITH SGMA?



## SGMA DESIGN



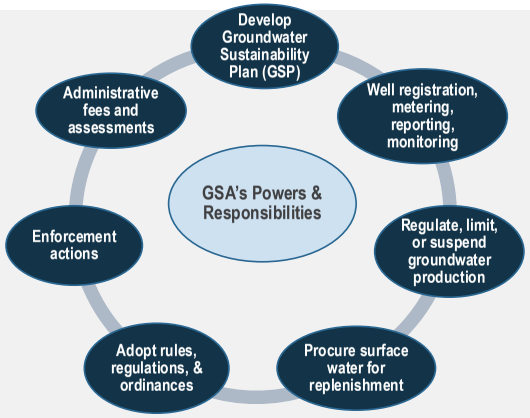

## WHOSE INTERESTS ARE AT STAKE?

- Holders of overlying groundwater rights (agricultural and domestic)
- Public water systems
- Local land use planning agencies
- Environmental users of groundwater
- Surface water users
- California Native American tribes
- Disadvantaged communities, including, but not limited to, those served by private domestic wells or small community water systems

## MULTIPLE GSAs IN A SUBBASIN

- More than one GSA can be formed in a sub-basin
- If there are multiple GSAs in a sub-basin, the GSAs can collaborate to write one single plan, or each GSA can write its own plan so long as the GSAs establish a coordination agreement for implementing multiple plans.
- However, GSAs must cover the entire area of the sub-basin, leaving no areas unmanaged
- All GSAs were approved in July 2017

## POWERS AND RESPONSIBILITIES OF A GSA




## GSP SUBMITTAL AND APPROVAL BY DWR

- GSPs must be written by **January 31, 2020 (or January 31, 2022 if the basin is not critically overdrafted)**
- DWR determinations
  - Adequate
  - Conditionally Adequate (minor deficiencies that can be corrected within 180 days)
  - Inadequate
- If the Department of Water Resources decides that a GSP **will not sustainably manage groundwater by 2040 (or 2042 if not in critically overdrafted basins)**…

  → **The State may step in and manage the sub-basin itself!**
  Much more expensive
  Less local control

## DEVELOPMENT OF GROUNDWATER SUSTAINABILITY PLANS

- GSPs must contain important information:
  - Description of plan area & basin setting
  - Sustainability criteria
  - Monitoring program and projects
- GSPs will serve as the roadmap to achieve sustainability
- GSAs will need to develop GSPs with stakeholder input

## GSP IMPLEMENTATION AND ACHIEVING SUSTAINABILITY

- After submitting its GSP, a GSA has 20 years to reach sustainability
  - **Sustainability must be reached by 2040 (2042 for areas not in critical overdraft)**
- DWR will review all plans every five years to assess progress and recommend corrective actions as needed
- Annual Reporting

## QUESTIONS & ANSWERS

## WATER BUDGETS

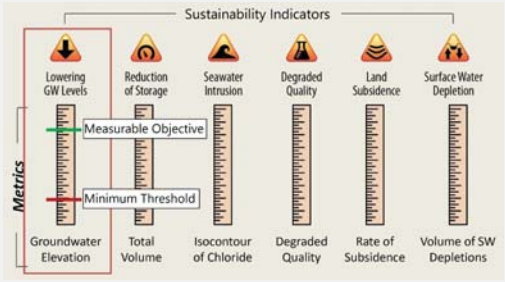

## GROUNDWATER SUSTAINABILITY PLANS

1. **Description of the plan area and basin setting:** Groundwater conditions, water budget, hydrogeological conceptual model, management areas
2. **Sustainability criteria:** set sustainability goal, set minimum thresholds for undesirable results, set measurable objectives
3. **Projects and management actions:** projects, management actions, mitigation measures, monitoring plan

## SUSTAINABILITY CRITERIA MEASUREABLE OBJECTIVES AND MINIMUM THRESHOLDS

Prevent "Undesirable results that are significant and unreasonable"

At this time, the only undesirable result that we can be certain doesn't apply to the Kern River GSA area is Seawater intrusion



## SUSTAINABILITY IS DEFINED LOCALLY

- SGMA requires GSAs to define sustainability using two concepts:
  - **Measurable objectives** are aspirational goals. Technically, you should achieve them by 2040 (or 2042 if not critically overdrafted).
  - **Minimum thresholds** are to be avoided. If they are crossed, you may be out of compliance with your plan and violating the obligation to reach sustainability.

## MANAGEMENT ACTIONS AND PROJECTS

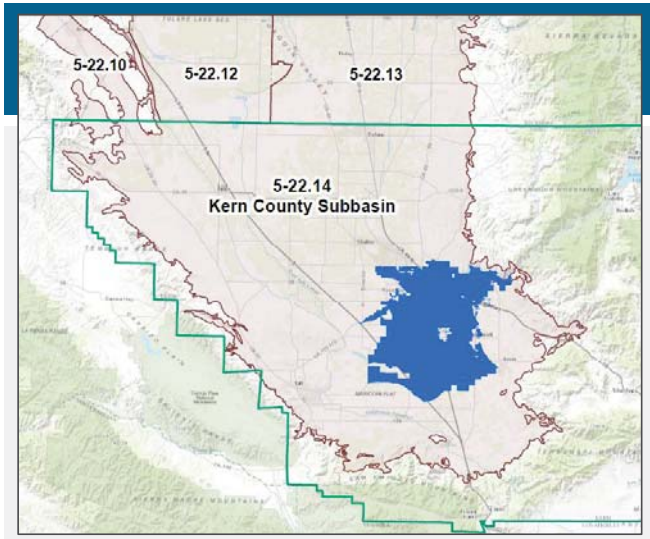


## GENERAL PRINCIPLES – MEASURABLE OBJECTIVES AND MINIMUM THRESHOLDS

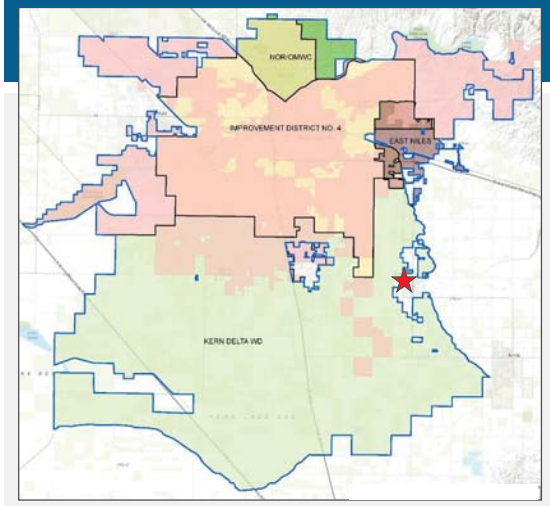
- Cannot harm sustainability in a neighboring basin
- Cannot continue to be in long-term overdraft
- Cannot deplete surface water

## KRGSA's GSP DEVELOPMENT EFFORTS

## KERN COUNTY SUBBASIN




## KERN RIVER GROUNDWATER SUSTAINABILITY AGENCY




Members of the Kern River GSA

- City of Bakersfield
- Kern County Water Agency – Improvement District #4 (ID4)
- Kern Delta Water District

Communities in the GSA

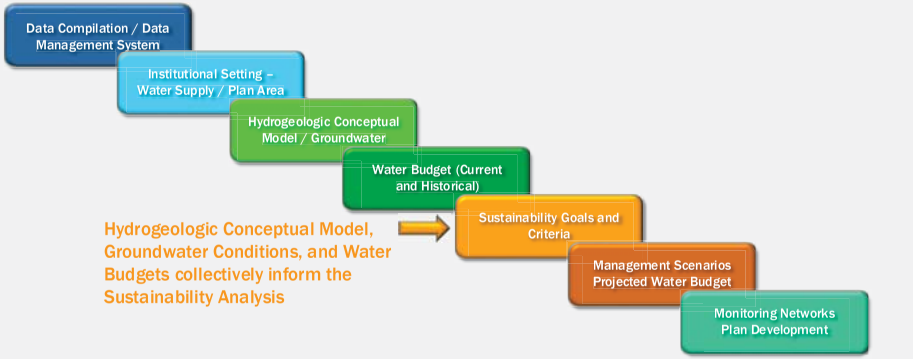
- Edison
- Fuller Acres
- Oildale
- Oil Junction
- Rexland Acres
- Weedpatch
- Lamont (small northern portion only)

## GSAs AND GSPs IN KERN SUBBASIN

(AS OF OCTOBER 2018)

- **GSAs Preparing Their Own GSPs:**
  - Kern River GSA
  - Kern Groundwater Authority GSA
  - Buena Vista Water Service District GSA
  - Cawelo Water District GSA
  - City of McFarland GSA
  - Greenfield County Water District GSA
  - Henry Miller Water District GSA
  - Olcese Water District GSA
  - Pioneer GSA
  - Semitropic Water Storage District GSA
  - West Kern Water District GSA
  - White Wolf GSA

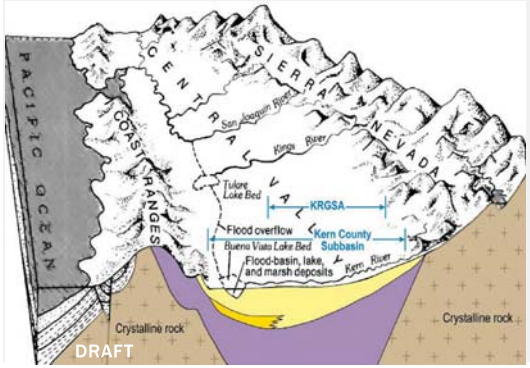
## GSP OVERVIEW




DRAFT

TODD GROUNDWATER

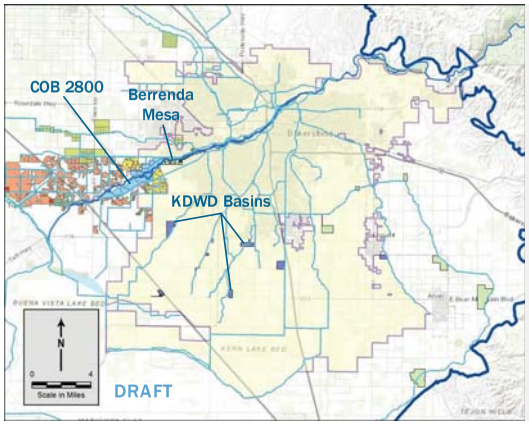
## CONCEPTUAL HYDROGEOLOGIC SETTING KERN COUNTY SUBBASIN




- Alluvial-filled trough between the Sierra Nevada and Coast Ranges
- Underlain by older marine sedimentary units
- Flanked by crystalline bedrock

TODD GROUNDWATER

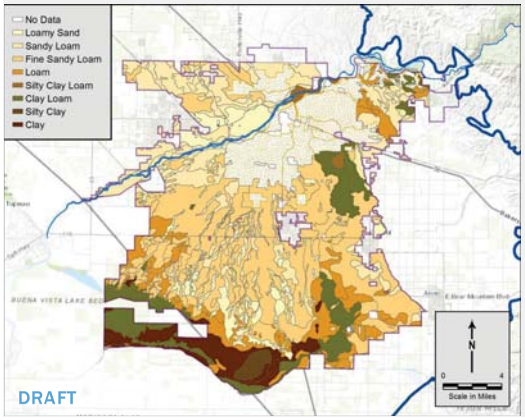
## CANALS AND RECHARGE BASINS




- Managed recharge in river channel, unlined canals, and basins
- KRGSA groundwater banking projects:
  - COB 2800 Acres
  - KCWA Berrenda Mesa
  - KDWD Metropolitan Project
- Numerous additional banking projects nearby

TODD GROUNDWATER

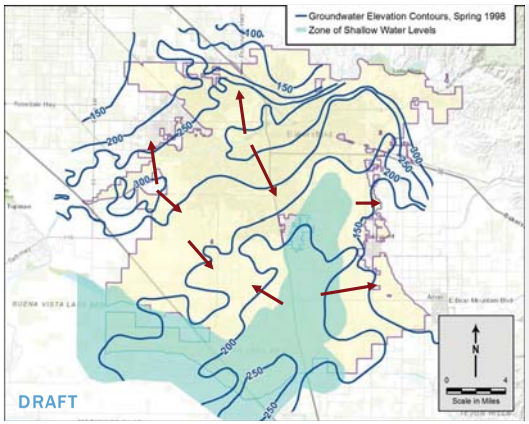
## SOIL TEXTURES




- More permeable textures indicated by lighter colors (white, yellow, light orange)
- Lower permeability textures indicated by dark orange, green and brown
- Soil textures agree well with geologic framework

TODD GROUNDWATER

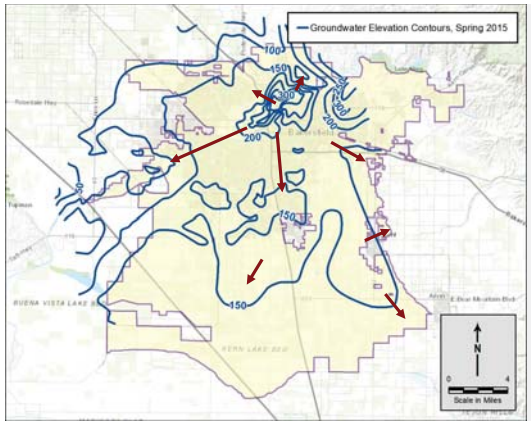
## GROUNDWATER ELEVATION CONTOURS 1998




- 20 groundwater elevation contour maps (Spring data)
- Examined maps and data for perched layers (zone of shallow water levels)
- Example for wet year - Spring 1998

TODD GROUNDWATER

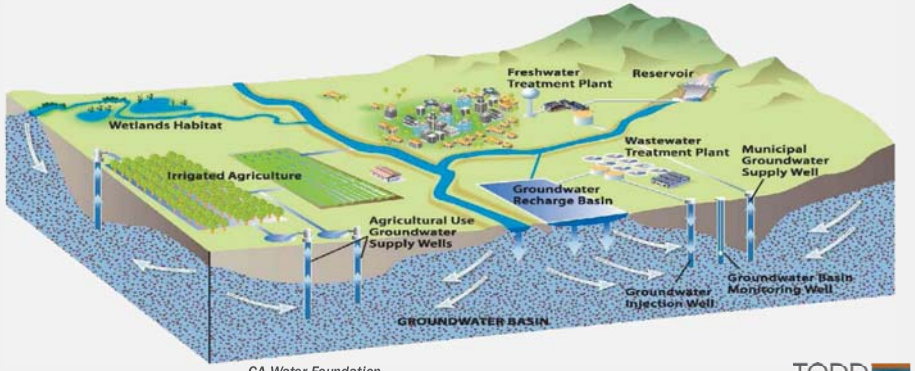
## GROUNDWATER ELEVATION CONTOURS 2015




- Severe Drought year
- In general, higher water levels than surrounding areas
- Except for the river, groundwater is flowing out of the KRGSA area

TODD GROUNDWATER

## FINALIZING THE KRGSA WATER BUDGET

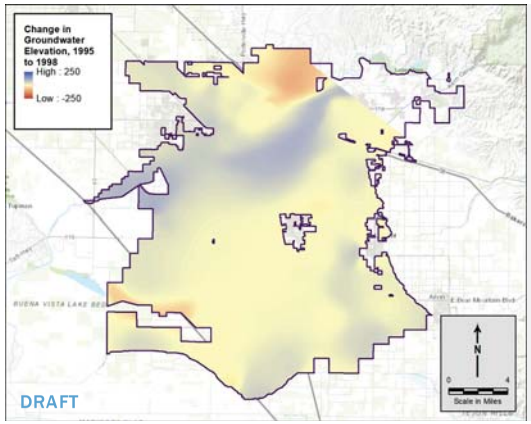



*CA Water Foundation*

DRAFT

TODD GROUNDWATER

## CHANGE IN GROUNDWATER IN STORAGE, 1995-1998



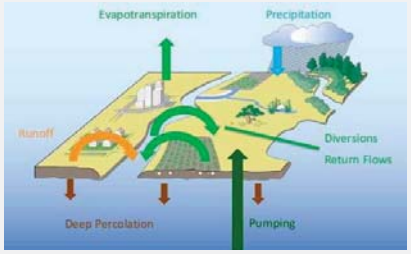

- Created 20 annual water level change maps using KCWA Spring water level contour maps
- Blue areas indicate water level rise; red areas indicate water level declines
- Limited data create uncertainty for some areas and time periods

DRAFT

TODD GROUNDWATER

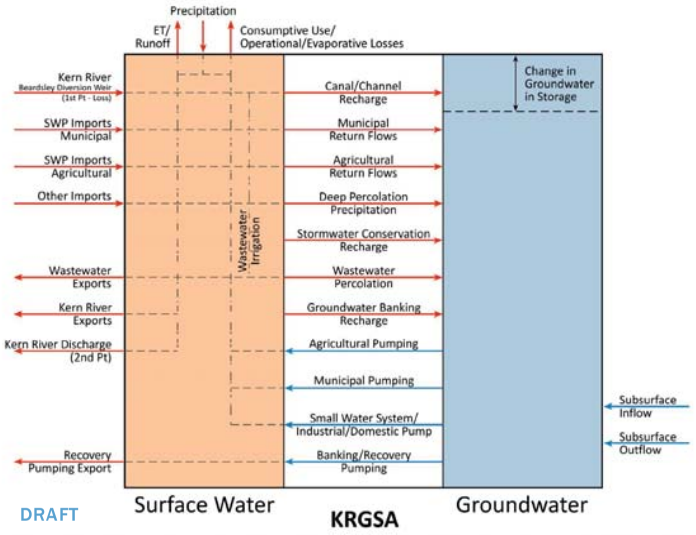
## KRGSA WATER BUDGETS – APPROACH

- Kern County water managed in real time for optimal use
- Provides flexibility and optimization of water but results in complex accounting of physical molecules
  - Focus on the physical system
    - Where does the "wet water" go? (not paper exchanges)
    - Water budget process follows the molecules – does not assign "ownership" of the water
    - Prevent "double-counting"




DRAFT

TODD GROUNDWATER




## KRGSA COMBINED WATER BUDGET COMPONENTS

TODD GROUNDWATER

## QUESTIONS & ANSWERS

## NEXT STEPS

- Work with agencies to reconcile data and local water budgets
- Compile for KRGSA
- Format data sets for model

Horizon WATER and ENVIRONMENT

TODD GROUNDWATER

## PARTICIPATE IN GSP DEVELOPMENT

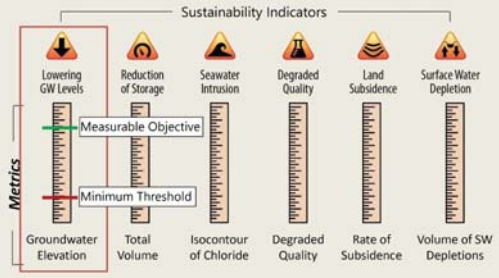
You can help shape what is included in the plan by:

- Providing information about your past or present groundwater challenges
- Sharing information about your water usage and/or water well
- Sharing your vision for sustainability
- Identifying projects that can help address the groundwater conditions
- Completing the Stakeholder Survey

## STAKEHOLDER DISCUSSION– UNDESIRABLE RESULTS

Undesirable Results are categorized as:

- Lowered Groundwater Levels
- Reduction of Storage
- Seawater Intrusion (not a factor in Kern County Sub-basin)
- Degraded Water Quality
- Land Subsidence
- Surface Water Depletion




## STAY INVOLVED

- Attend GSA Meetings
  - KRGSA Board Meetings are held the last Wednesday of each month at 8 a.m. at 1600 Truxtun Avenue, Bakersfield, CA 93301
- Get on the "interested parties" list to receive correspondence and information from the KRGSA
- Visit the website to learn more: http://www.kernrivergsa.org/
- Attend future workshops

## STAKEHOLDER DISCUSSION– UNDESIRABLE RESULTS

We want to hear from you!

- Have you, your community, or your business been affected by any of the undesirable results?
- Which of the undesirable results are the most important to you and why? Are there any more important than others?
- What improvements would you like to see happen in the next twenty years?

## ADDITIONAL INFORMATION AND RESOURCES

- Technical Assistance for Severely Disadvantaged Communities
  - Self-Help Enterprises: https://www.selfhelpenterprises.org
    - Eva Dominguez, 559-802-1634, EvaD@selfhelpenterprises.org
    - Maria Herrera, 559-802-1676, MariaH@selfhelpenterprises.org
- Local Information – Kern River GSA: https://kernrivergsa.org
  - Art Chianello, 661-326-3715, AChianel@bakersfieldcity.us
- Statewide Information
  - Department of Water Resources: https://sgma.water.ca.gov/portal/
  - State Water Resources Control Board: https://www.waterboards.ca.gov/water_issues/programs/gmp/sgma.html

# THANK YOU!

# Agencia de Manejo Sostenible de Agua Subterránea de Kern River

## Taller de Agua Subterránea

13 de Noviembre 2018

## DESCRIPCIÓN GENERAL DEL TALLER

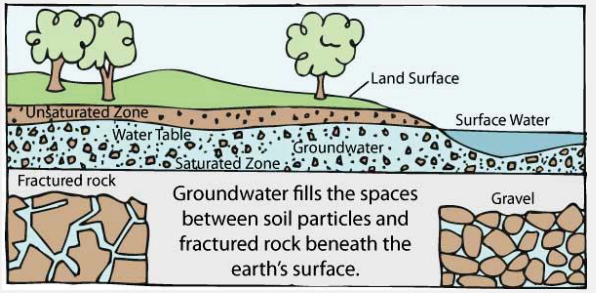
- Nueva Ley Estatal del Agua Subterránea: Ley del Manejo Sostenible del Agua Subterránea (SGMA)
- Planes de Sostenibilidad de Aguas Subterráneas (GSPs)
- Esfuerzos para Desarrollar el GSP de la KRGSA
- Discusión de las Partes Interesadas
- Palabras de Finalización y Cierre

## SELF-HELP ENTERPRISES (SHE)

- SHE es una organización de vivienda y desarrollo comunitario reconocida a nivel nacional (organización sin fines de lucro) cuya misión es trabajar junto con familias de bajos ingresos para construir y mantener hogares y comunidades saludables.
- El Programa de Desarrollo Comunitario brinda asistencia técnica y desarrollo de liderazgo en comunidades rurales que enfrentan desafíos para proporcionar agua limpia, alcantarillado sanitario y otra infraestructura.
- El Equipo de Planeación y Participación de la Comunidad apoya la participación de la comunidad en la gestión regional del agua y la planificación de la sostenibilidad del agua subterránea, así como la capacidad y experiencia en la gestión del agua en las comunidades rurales.


## IMPORTANCIA DE AGUA SUBTERRÁNEA

En promedio, California obtienen el 40% de su agua del agua subterránea. Durante las sequías, ese número puede llegar hasta el 60%.




- En el Valle Central, somos aún más dependientes del agua subterránea que el estado en general
- El 90% de los residentes de Central Valley dependen del agua subterránea para al menos parte de su suministro de agua potable
- La mayoría de las comunidades no incorporadas dependen en un 100% de las aguas subterráneas, e incluyen muchos de nuestros distritos escolares pequeños.

Item 3c

## CÓMO LAS COMUNIDADES & LAS ESCUELAS UTILIZAN EL AGUA SUBTERRÁNEA



## LEY DEL MANEJO SOSTENIBLE DEL AGUA SUBTERRÁNEA DE CALIFORNIA (SGMA)

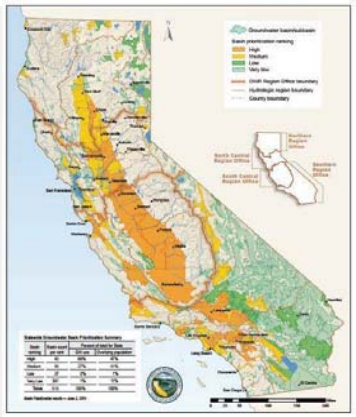
- Paquete de tres leyes: SB 1168 (Pavley), AB 1739 (Dickinson), SB 1319 (Pavley)
- Firmado por el Gobernador Brown el 16 de Septiembre de 2014
- Objetivo: Asegurar la confiabilidad a largo plazo de nuestros recursos de agua subterránea y los recursos hídricos superficiales conectados que requieren manejo "sostenible"
- Principio central: control local

## DESAFÍOS DEL AGUA SUBTERRÁNEA: ¿POR QUÉ LA LEY DEL MANEJO SOSTENIBLE DEL AGUA SUBTERRÁNEA?

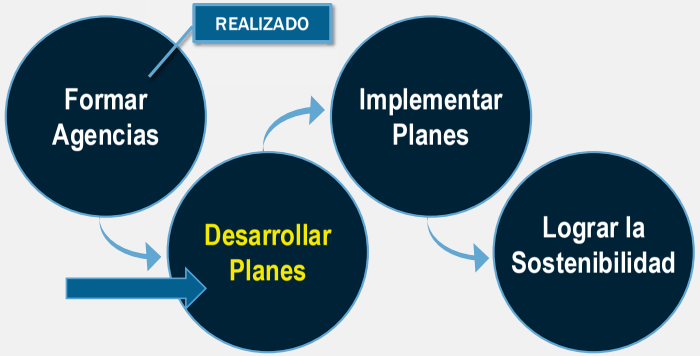
- Anteriormente, el manejo del agua subterránea era voluntaria en ciertas áreas del estado
- Los niveles de agua subterránea han disminuido debido al exceso de bombeo, las restricciones excesivas en las importaciones de agua de superficie y la falta de recarga
- La sequía (2012-2016) tuvo un impacto sin precedentes en nuestro estado.
- Pozos secos (por ejemplo: Arvin, área de Lamont y muchos otros)
- Hundimiento

## PREVENIR LOS RESULTADOS INDESEABLES

## ¿QUIÉN DEBE CUMPLIR CON SGMA?



## DISEÑO DE SGMA



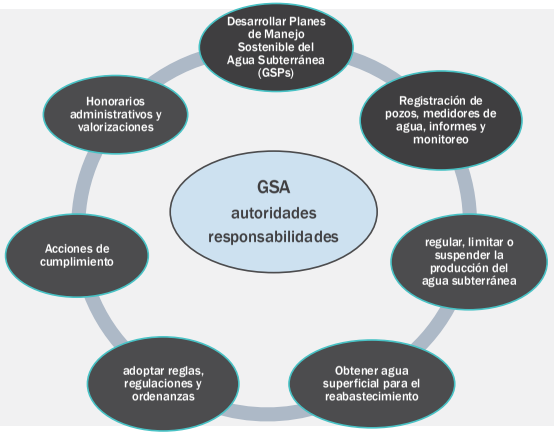

## ¿CUÁLES SON LOS INTERESES EN JUEGO?

- Titulares de derechos de aprovechamiento de agua subterránea (agricultura y doméstico)
- Sistemas de agua públicos
- Agencias locales de planificación del uso de la tierra
- Usuarios del agua subterránea para uso ambientales
- Usuarios de agua superficial
- Tribus de Nativos Americanos de California
- Comunidades de bajo ingresos, incluso las que reciben agua de pozos domésticos privados o pequeños sistemas de agua comunitarios

## MÚLTIPLES GSAS EN UNA SUBCUENCA

- Mas de una GSA se puede formar en una subcuenca
- Si existen múltiples GSAs en una subcuenca, las GSAs pueden colaborar para crear un plan único, o cada GSA puede crear su propio plan solo que las GSAs establecen un acuerdo de coordinación para implementar múltiples planes.
- Sin embargo, las GSAs deben cubrir toda el área de la subcuenca, sin dejar áreas sin gestionar
- Todas las GSAs fueron aprobadas en Julio 2018

## ¿QUÉ PUEDE HACER UNA GSA?




## ENVÍO DE GSP Y APROBACIÓN POR DWR

- Los GSPs deben ser escritos antes del **31 de enero 2020 (o 31 de enero 2022 si la cuenca no esta críticamente en exceso)**
- Determinaciones de DWR (Departamento de Recursos Hídricos)
  - Adecuado
  - Condicionalmente Adecuado (deficiencias menores que pueden corregirse dentro de los 180 días)
  - No Adecuado
- Si el Departamento de Recursos Hídricos decide que el GSP **no gestionara de forma sostenible las aguas subterráneas antes del 2040 (o 2042 si la cuenca no esta críticamente en exceso)**...

  → **El Estado puede intervenir y administrar la subcuenca en sí!**

  Mucho mas costoso

## DESARROLLO DEL PLAN DEL MANEJO SOSTENIBLE DEL AGUA SUBTERRÁNEA

- Los GSPs deben incluir información importante:
  - Descripción del área del plan y la colocación del cuenca
  - Criterios de sostenibilidad de la cuenca
  - Programa de monitoreo y proyectos
- Los GSP servirán como una hoja de ruta para lograr la sostenibilidad dentro de 20 años
- Las GSAs deben desarrollar los GSPs con la participación de las partes interesadas

## IMPLEMENTACIÓN DE GSP Y LOGRO DE SOSTENIBILIDAD

- Después de presentar su GSP, una GSA tiene 20 años para alcanzar la sostenibilidad
  - **La sostenibilidad debe alcanzarse para 2040 (2042 para áreas que no están críticamente en exceso)**
- DWR revisará todos los planes cada cinco años para evaluar el progreso y recomendar acciones correctivas según sea necesario
- Reportes Anuales

## PREGUNTAS Y RESPUESTAS

## PRESUPUESTOS DE AGUA

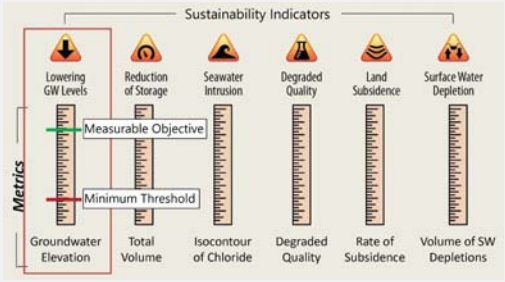

## PLANES DE SOSTENIBILIDAD DE AGUAS SUBTERRÁNEAS

1. **Descripción del área del plan y la configuración de la cuenca:** Aguas subterráneas, presupuesto hídrico, modelo conceptual hidrogeológico, áreas de manejo
2. **Criterios de sostenibilidad:** establecer un objetivo de sostenibilidad, establecer umbrales mínimos para resultados indeseables, establecer objetivos medibles
3. **Proyectos y acciones de gestión:** proyectos, acciones de manejo, medidas de mitigación, plan de monitoreo

## CRITERIOS DE SOSTENIBILIDAD OBJETIVOS MEDIBLES Y UMBRALES MÍNIMOS

Prevenir "resultados indeseables que son significativos e irrazonables“

En este momento, el único resultado indeseable del que podemos estar seguros no se aplica al área de Kern River GSA es la intrusión de agua de mar



## LA SOSTENIBILIDAD SE DEFINE LOCALMENTE

- SGMA requiere que la GSA define la sostenibilidad utilizando dos conceptos:
  - **Objetivos Medibles** son metas aspiracionales. Técnicamente, deberías alcanzarlos para 2040 (o 2042 si no es cuenca críticamente en exceso).
  - **Umbrales Minimos** deben ser evitados Si se cruzan, puede estar fuera del cumplimiento de su plan y violar la obligación de alcanzar la sostenibilidad.

## ACCIONES Y PROYECTOS DE GESTIÓN

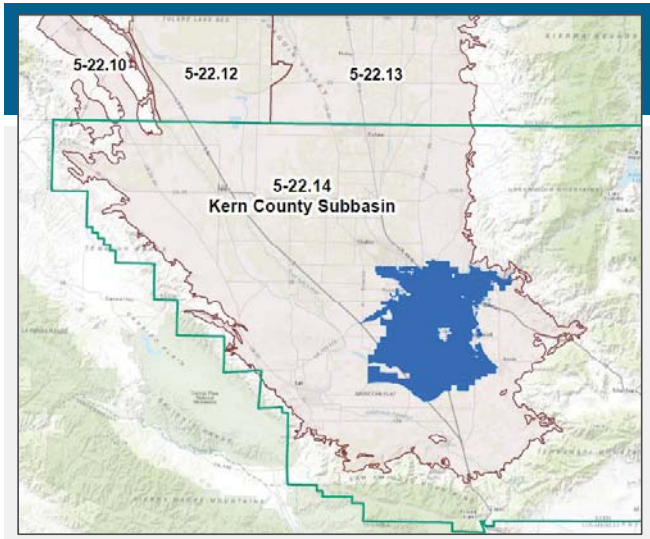


## PRINCIPIOS GENERALES - OBJETIVOS MEDIBLES Y UMBRALES MÍNIMOS

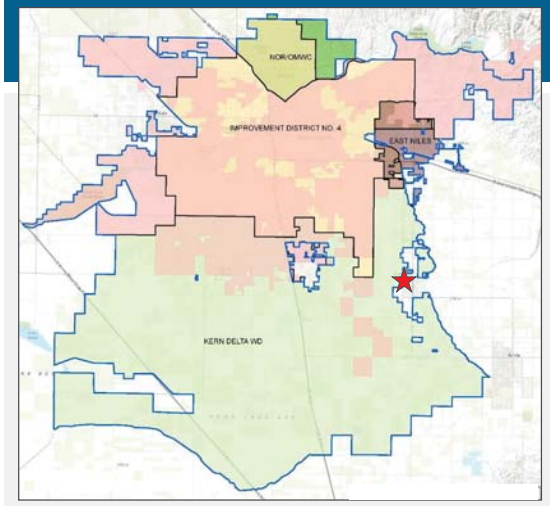
- No se puede dañar la sostenibilidad en una cuenca vecina
- No puede seguir estando en exceso a largo plazo
- No se puede agotar el agua superficial

## ESFUERZOS DE DESARROLLO PARA EL GSP DE KRGSA

## SUBCUENCA DEL CONDADO KERN




## AGENCIA DE SOSTENIBILIDAD DE AGUAS SUBTERRÁNEAS KERN RIVER (KERN RIVER GSA)




Miembros del Kern River GSA

- Cuidad de Bakersfield
- Agencia de Agua del Condado Kern – Distrito de Mejora #4 (ID4)
- Distrito de Agua Kern Delta

Comunidades en el GSA

- Edison
- Fuller Acres
- Oildale
- Oil Junction
- Rexland Acres
- Weedpatch
- Lamont (parte pequeña al norte)

## GSAs AND GSPs EN LA SUBCUENCA KERN
(A PARTIR DE 2018)

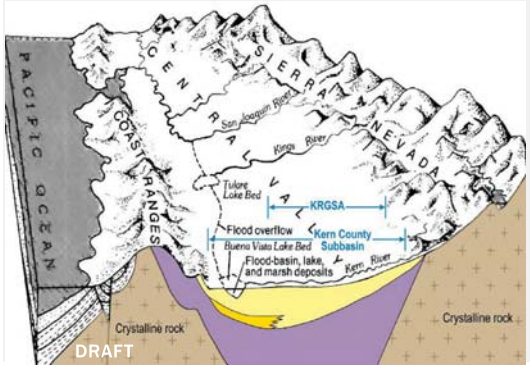
- **GSAs Preparando sus Propios GSPs:**
  - Kern River GSA
  - Kern Groundwater Authority GSA
  - Buena Vista Water Service District GSA
  - Cawelo Water District GSA
  - City of McFarland GSA
  - Greenfield County Water District GSA
  - Henry Miller Water District GSA
  - Olcese Water District GSA
  - Pioneer GSA
  - Semitropic Water Storage District GSA
  - West Kern Water District GSA
  - White Wolf GSA

## GSP VISION EN CONJUNTO


DRAFT

TODD GROUNDWATER

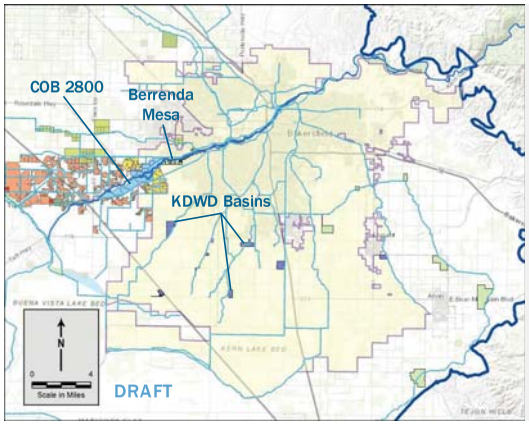
## CONFIGURACIÓN HIDROGEOLÓGICA CONCEPTUAL SUBCUENCA DEL CONDADO DE KERN




- Canal lleno de aluviones entre Sierra Nevada y Coast Ranges
- Subyacente por unidades sedimentarias marinas más antiguas
- Flanqueado por un lecho de roca cristalino

TODD GROUNDWATER

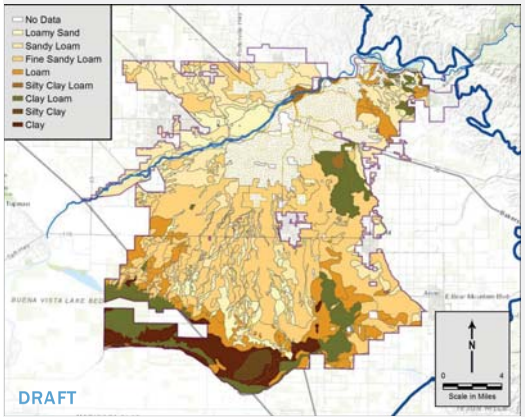
## CANALES Y CUENCAS DE RECARGA




- Recarga administrada en el canal del río, canales sin revestimiento y cuencas
- Proyectos de banca de aguas subterráneas KRGSA:
  - COB 2800 Acres
  - KCWA Berrenda Mesa
  - KDWD Proyecto Metropolitano
- Numerosos proyectos bancarios adicionales cerca

TODD GROUNDWATER

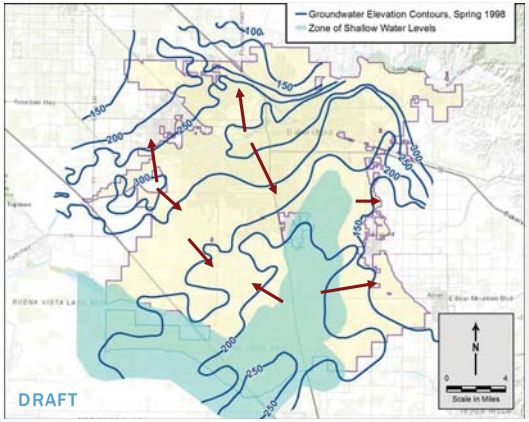
## TEXTURAS DEL TIERRA




- Texturas más permeables indicadas por colores más claros (blanco, amarillo, naranja claro)
- Las texturas de baja permeabilidad indicadas por naranja oscuro, verde y marrón
- Las texturas del suelo concuerdan bien con el marco geológico

TODD GROUNDWATER

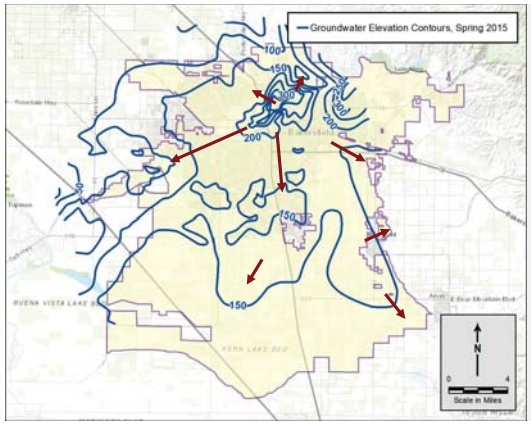
## CONTORNOS DE ELEVACIÓN DEL AGUA SUBTERRÁNEA 1998




- 20 mapas de contorno de elevación del agua subterránea (datos de primavera)
- Mapas y datos examinados para capas encaramadas (zona de niveles de aguas poco profundas)
- Ejemplo para el año lluvioso - Primavera de 1998

TODD GROUNDWATER

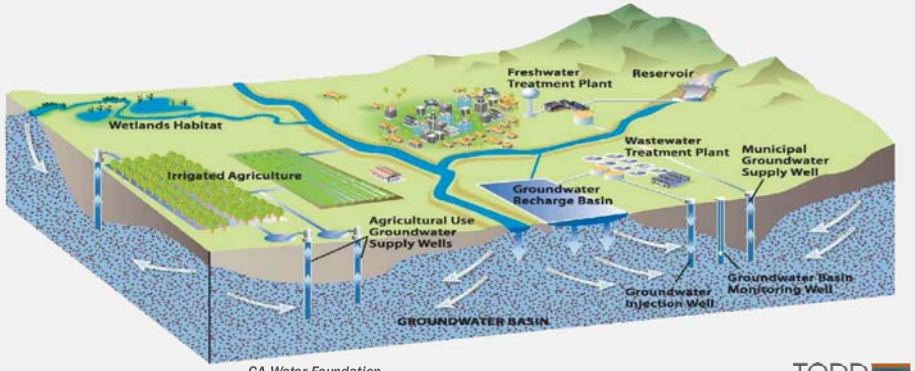
## CONTORNOS DE ELEVACIÓN DE AGUA SUBTERRÁNEA 2015




- Año de sequía severa
- En general, niveles de agua más altos que las áreas circundantes
- Excepto por el río, el agua subterránea fluye fuera del área de KRGSA

TODD GROUNDWATER

## FINALIZANDO EL PRESUPUESTO DE AGUA DE KRGSA

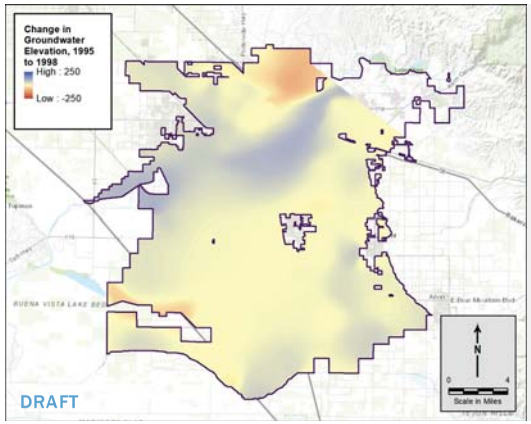



*CA Water Foundation*

DRAFT

TODD GROUNDWATER

## CAMBIO EN LAS AGUAS SUBTERRÁNEAS EN EL ALMACENAMIENTO, 1995-1998




- Se crearon 20 mapas anuales de cambio de nivel de agua utilizando los mapas de contorno de nivel de agua de KCWA Spring
- Las áreas azules indican un aumento en el nivel del agua; las áreas rojas indican una disminución del nivel de agua
- Los datos limitados crean incertidumbre para algunas áreas y períodos de tiempo

DRAFT

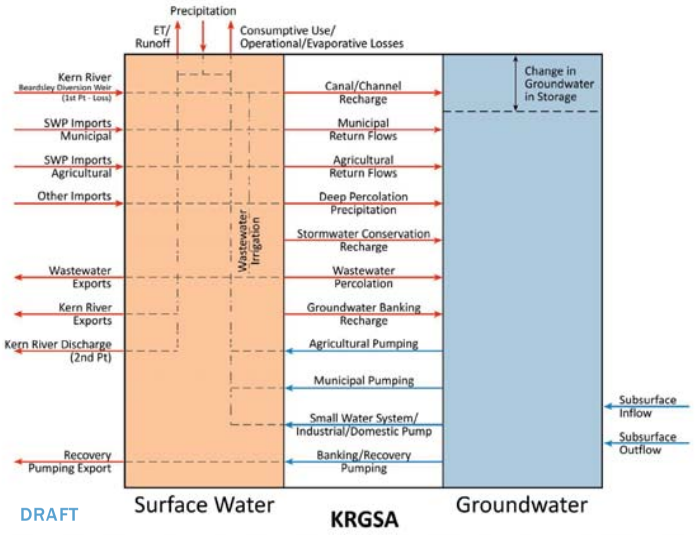
TODD GROUNDWATER

## PRESUPUESTOS DE AGUA KRGSA - ENFOQUE

- El agua del Condado de Kern se administra en tiempo real para un uso óptimo
- Proporciona flexibilidad y optimización de agua, pero da como resultado una contabilidad compleja de moléculas físicas
  - Enfoque en el sistema físico
    - ¿A dónde va el "agua mojada"? (no intercambios de papel)
    - El proceso presupuestario del agua sigue las "moléculas": ¿no se le asigna "propiedad" al agua?
    - Evitar el "doble conteo"


DRAFT

TODD GROUNDWATER




## COMPONENTES DE PRESUPUESTO COMBINADO DE AGUA DE KRGSA

TODD GROUNDWATER

## PREGUNTAS Y RESPUESTAS

## PROXIMOS PASOS

- Trabajar con agencias para conciliar datos y presupuestos locales de agua
- Compilar para KRGSA
- Formato de conjuntos de datos para el modelo

Horizon WATER and ENVIRONMENT

TODD GROUNDWATER

## PARTICIPE EN EL DESARROLLO DEL GSP

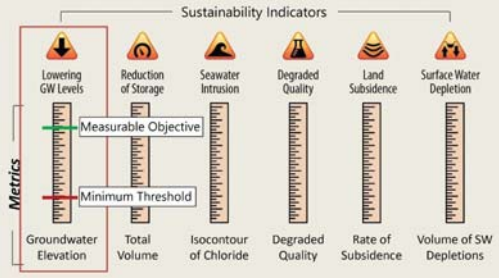
Puede ayudar a dar forma a lo que está incluido en el planificar por :

- Proporcionar información sobre sus desafíos de agua subterránea pasados o presentes
- Compartir información sobre su consumo de agua y / o pozo
- Compartiendo su visión para la sostenibilidad
- Identificar proyectos que pueden ayudar a abordar las condiciones del agua subterránea
- Completando la Encuesta de Parte Interesada

## DISCUSIÓN DE LAS PARTES INTERESADAS- RESULTADOS INDESEABLES

Los resultados indeseables se categorizan como :

- Niveles de Agua Subterránea Más Bajos
- Reducción de Almacenamiento
- Intrusión de Agua de Mar (no un factor en la subcuenca del condado de Kern)
- Calidad del Agua Degradada
- Hundimiento de la Tierra
- Agotamiento de Agua Superficial




## MANTENTE INVOLUCRADO

- Asista a las reuniones de GSA
  - Las reuniones de la Mesa Directiva de KRGSA se llevan a cabo el último miércoles de cada mes a las 8 a.m. en 1600 Truxtun Avenue, Bakersfield, CA 93301.
- Ingrese en la lista de "partes interesadas" para recibir correspondencia e información de KRGSA
- Visita el sitio web para saber más: http://www.kernrivergsa.org/
- Asiste a talleres futuros

## DISCUSIÓN DE LAS PARTES INTERESADAS- RESULTADOS INDESEABLES

¡Queremos escuchar de ti!

- ¿Usted, su comunidad o su negocio han sido afectados por alguno de los resultados indeseables?
- ¿Cuál de los resultados indeseables es el más importante para usted y por qué? ¿Hay algo más importante que otros?
- ¿Qué mejoras le gustaría ver que sucedan en los próximos veinte años?

## INFORMACIÓN ADICIONAL Y RECURSOS

- Asistencia técnica para comunidades severamente desfavorecidas
  - Self-Help Enterprises: https://www.selfhelpenterprises.org
    - Eva Dominguez, 559-802-1634, EvaD@selfhelpenterprises.org
    - Maria Herrera, 559-802-1676, MariaH@selfhelpenterprises.org
- Información Local– Kern River GSA: https://kernrivergsa.org
  - Art Chianello, 661-326-3715, AChianel@bakersfieldcity.us
- Información Estatal
  - Department of Water Resources: https://sgma.water.ca.gov/portal/
  - State Water Resources Control Board: https://www.waterboards.ca.gov/water_issues/programs/gmp/sgma.html

# GRACIAS!

Kern River Groundwater Sustainability Agency

KERN GROUNDWATER AUTHORITY

DRAFT

# Kern County Subbasin
# DRAFT C2VSim Modeling Results

January 11, 2019

TODD GROUNDWATER

## Use C2VSim for Water Budget Analysis


- C2VSim
  - Covers Entire Central Valley
  - Focus to support CVP/SWP Planning
  - Beta-Version released May to support SGMA
- Beta Version
  - DWR has provided the Beta version to support GSP water budget development

TODD GROUNDWATER

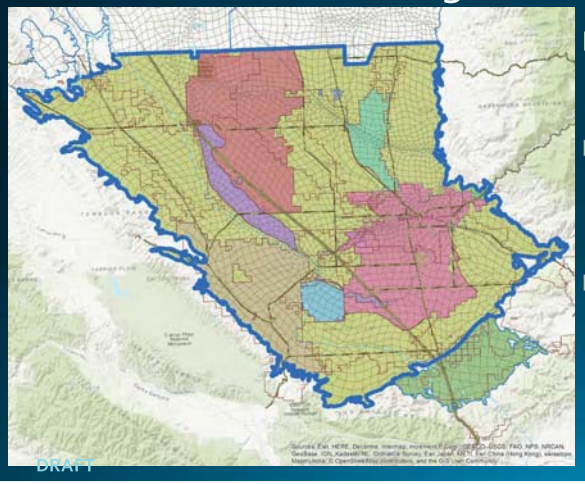
## Presentation Outline

- Background
- Model Results Summary
- Peer Review Report by Woodard & Curran
- Model Performance
- Next Steps

DRAFT

TODD GROUNDWATER

## Subbasin Water Budget - C2VSim Update

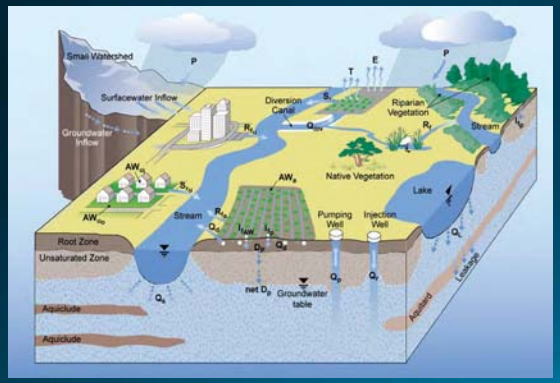



- Kern County Update
  - Update managed water data
  - Localize water distribution
- Update Managed Water Supply and Demand Data
  - Use local subbasin data
  - Focus on physical water
- Retain general C2VSim data structure with Kern County Updates
  - Maintain current model structure (layers and properties)

TODD GROUNDWATER

Item 4

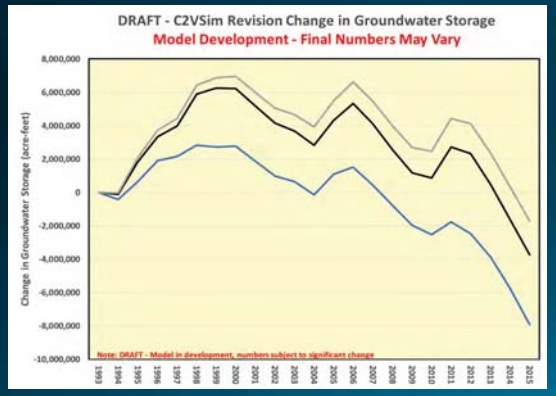
# Managed Water Supply and Demand Data




- Surface water diversions by water district
- Groundwater banking and recharge programs
- Groundwater banking recovery for in-basin use and export
- Crop demand based on METRIC ET data
- Urban M&I water use
- Locally important water budget components

DRAFT

# Where We Left Off



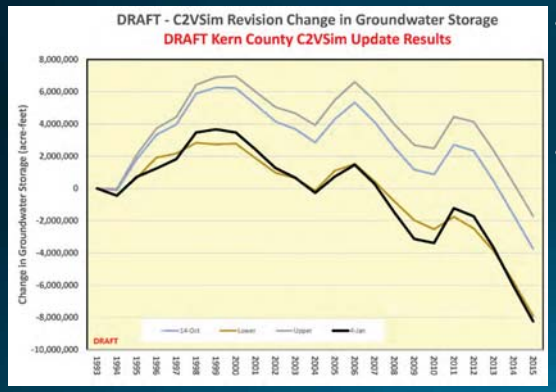

- Primary Managed Water Data was complete
- Ongoing QA/QC of data input
- Reconciling Beta-version issues

DRAFT

# Current Model Status

- Work on model performance
  - Kern River
  - QA of managed water data input
  - Address Beta Version issues
  - Revise Initial Condition
- DRAFT Model Results
  - Develop Draft Historical and Current Water Budgets
  - Basin-wide and Local GSA
- Left to Do
  - Address Questions and Comments
  - Make Final QA and Peer Review Revisions
  - Documentation

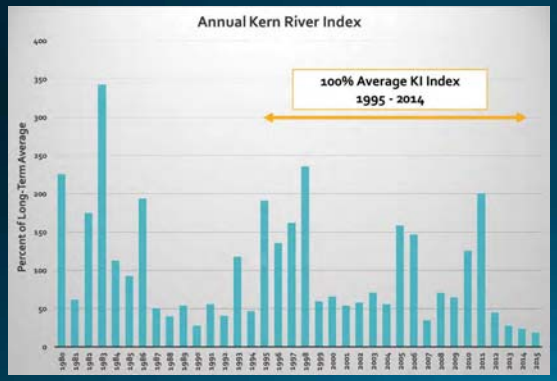
# DRAFT Results – Groundwater Storage Change




- DRAFT Groundwater Storage
  - Groundwater storage did end up at lower range as remaining issues were resolved
- Data Period Results
  - This graph shows the results over the period of data collection

DRAFT

# Historical Water Budget Time Period




- Sufficiently long to approximate average hydrologic conditions (Kern River, precipitation)
- Recent time periods - current operations, widely-available and higher-quality data
- Initial conditions of stable (low) water levels

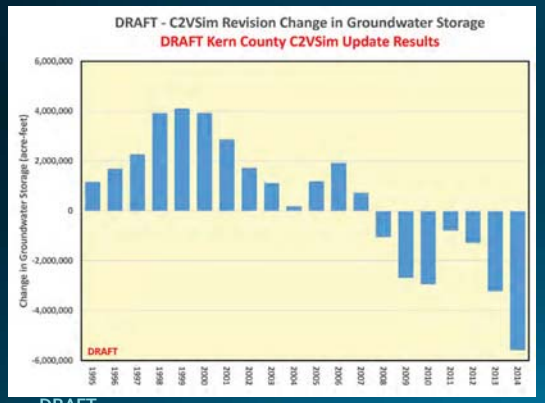
TODD GROUNDWATER

# Peer Review Report by Woodard & Curran

DRAFT

TODD GROUNDWATER

# DRAFT Results – Groundwater Storage Change



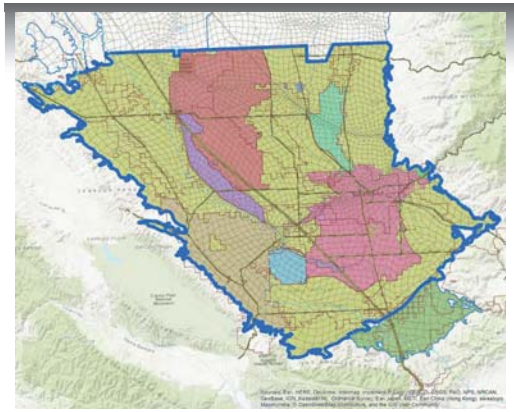

- 20-Year Assessment Period Results
  - **5,600,000** Acre-foot decline over 20-year Assessment Period
  - **280,000** Average Annual Water Storage Decline
- Model does not account for Groundwater Banking Accounts
  - Water stored in basin for use by others

DRAFT

TODD GROUNDWATER

WOODARD &CURRAN

## Kern C2VSim Peer Review Report



Prepared by

Saquib Najmus
&
Frank Qian

Woodard & Curran

January 11, 2019

COMMITMENT & INTEGRITY DRIVE RESULTS

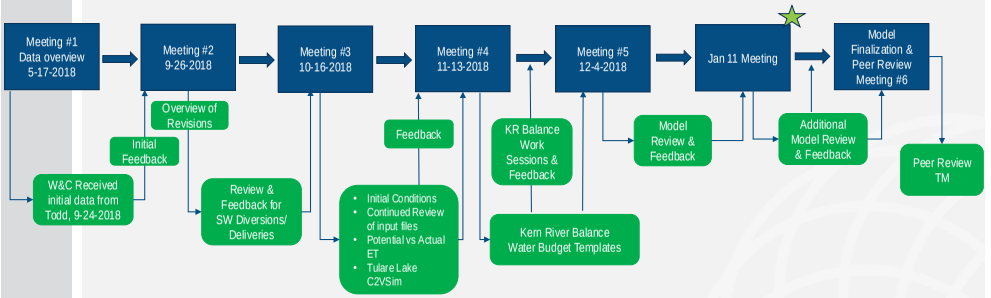
# Peer Review – Scope of Work

Scope was limited to input data review only

- Task 2.3 - Review of documentation of C2VSim data updates and verification and revisions (as needed) of the following sets of C2VSim input data:
  1. Pumping Data
  2. New Groundwater banking input data
  3. New Managed water Supply data
  4. METRIC data and other land use data, including changes to agricultural water demand
  5. Boundary inflows with updated data
  6. Urban demand data

- ~~Task 2.4 - Review Current and Historical Water Budgets for Kern County Subbasin~~

# Peer Review – Process

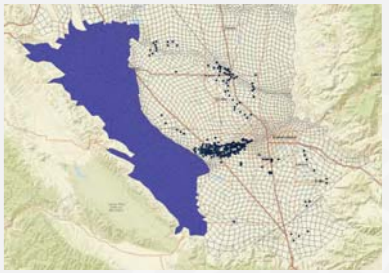



# Peer Review - Purpose

- To verify that the input data update for the Kern Subbasin of the C2VSim Beta version were made correctly and are consistent with model structure requirements

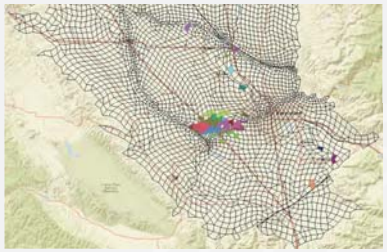
# Peer Review - Pumping Data

- Pumping turned off for select elements to represent field data
  - *Checked element pumping spec file in GIS*
- Wells added for extraction
  - *Confirmed locations in GIS*
- Pumping input files changed to reflect data from locals
  - *Checked model timeseries against local data in spreadsheets*
  - *Identified and resolved formatting issues in timeseries files*



## Groundwater Banking

- Delivery and extraction data were incorporated from local data
  - *Checked delivery elements in GIS*
  - *Checked model diversion timeseries against spreadsheet data*
  - *Checked pumping well locations in GIS*
  - *Checked model pumping timeseries against spreadsheet data*

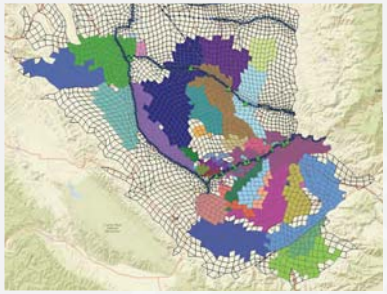


## METRIC data and Land Use

- ET data updated for 1993-2015
  - *Verified approach for mapping METRIC data to model subregions was valid*
- Land use data interpolated between 1993 and 2015
  - *Checked element level ag acreages by year in GIS*
  - *Checked subregion scale ag acreage by crop type*


## Managed Water Supply

- Pumping records where available
  - *Checked new well locations in GIS and verified timeseries data from spreadsheets*
- Surface water delivery records
  - *Checked delivery elements in GIS*
  - *Checked model diversion timeseries against spreadsheet data*
  - *Worked with Todd GW to develop a modified approach for deliveries to simulate as import/exports to resolve Kern River shortages reported by the model*

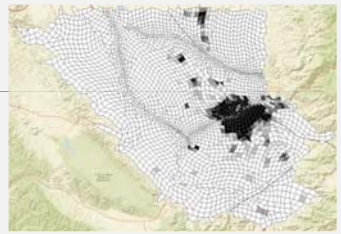


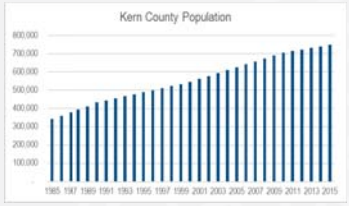
## Boundary Inflows

- Small Watersheds
  - *Checked small watershed parameters*
- Flow barrier at White Wolf
  - *Checked aquifer parameters in elements along fault*

# Urban Demand

- Urban areas
  - *Checked urban acreage in elements in GIS*
- Urban water use fractions
  - *Verified updates to water use fractions by subregion*
- Urban populations
  - *Checked urban population data in model against spreadsheet data*
- Urban per capita demand
  - *Checked GPCD spreadsheet calculations and implementation into model*






# Review of Model Results - Ongoing

- Evaluation of water budgets for input data verification
- Water Budget Templates from model results for ease of understanding

**Land and Water Use Budget (1990-2015 Average)**

| Zone | Zone Name | Total Area | Ag Area | Ag Supply Requirement | Ag Water Duty | Ag Pumping | Ag SW Delivery | Total Ag Supply | Urban Area | Urban Supply Requirement | Urban Water Duty | Urban Pumping | Urban SW Delivery |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Units --> | Acres | Acres | Acre-feet | Acre-feet /Acre | Acre-feet | Acre-feet | Acre-feet | Acres | Acre-feet | Acre-feet /Acre | Acre-feet | Acre-feet |

**Groundwater Budget (1990-2015 Average)**

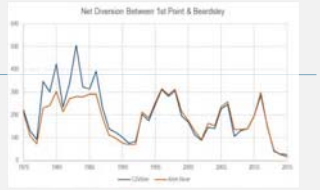
| Zone | Zone Name | Total Area | Deep Percolation Inflow (+) | Boundary Condition Inflow (+)/ Outflow (-) | Subsurface Inflow (+)/ Outflow (-) | Gain (+) from Stream or Loss (-) to Stream | Small Watershed Inflow(+)/ Outflow (-) | Tile Drain Inflow(+)/ Outflow (-) | Bank Recharge PLUS Canal Seepage Inflow (+) | GW Pumping Outflow (-) Including Bank Pumping | Model Reported Change in Storage (-) or (-) | Calculated Change in Storage (+) or (-) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Units --> | Acres | Acre-feet | Acre-feet | Acre-feet | Acre-feet | Acre-feet | Acre-feet | Acre-feet | Acre-feet | Acre-feet | Acre-feet |

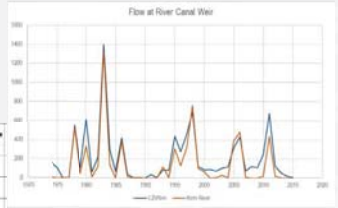
**Stream Reach Budget (1990-2015 Average)**

| Zone | Zone Name | Upstream Inflow (+) | Downstream Outflow (-) | Tributary Inflow (+) | Tile Drain (+) | Runoff (+) | Return Flow (+) | Gain from Groundwater (+) | Gain from Lake (+) | Riparian ET (-) | Diversion (-) | By-pass Flow (-) | Discrepancy (+) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Units --> | Acre-feet | Acre-feet | Acre-feet | Acre-feet | Acre-feet | Acre-feet | Acre-feet | Acre-feet | Acre-feet | Acre-feet | Acre-feet | Acre-feet |

# Kern River Deliveries

- *Complex setup & operation*
- *Model generated diversion shortages at stream nodes due to model structure, uncalibrated parameters, and other factors*
- *Worked with Todd GW to identify significance of model reported shortages and developed approach to ensure surface water delivery data provided by locals are properly incorporated*

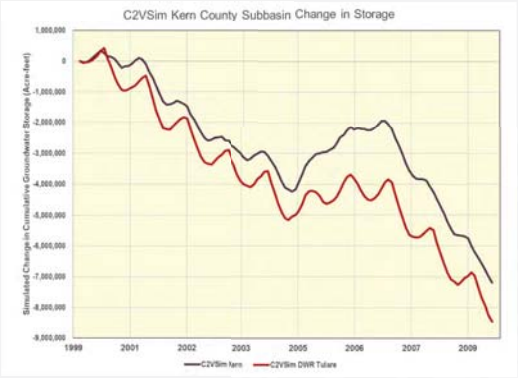



| Diversion ID | Diversion Name | Source Stream Node | Source Stream Name | Average Diversion (TAF/Mo) | Average Shortage (TAF/Mo) | Average Diversion (TAF/Year) | Average Shortage (TAF/Year) | |
|---|---|---|---|---|---|---|---|---|
| 416 | Kern Delta WD from Kern River at Calloway Weir to Wine SA for Ag | 37 | KERN RIVER | 1.158 | 0.003 | 13.896 | 0.041 | |
| 417 | Kern Delta WD from Kern River at Calloway Weir to Farmers SA for Ag | 37 | KERN RIVER | 0.345 | 0.000 | 4.141 | 0.006 | |
| 452 | North Kern WSD Kern River (Calloway) to Ag | 37 | KERN RIVER | 1.999 | 0.013 | 23.982 | 0.158 | |
| 497 | City of Bakersfield & IDA from Kern River (Calloway) for Urban Use | 37 | KERN RIVER | 0.736 | 0.012 | 8.836 | 0.144 | 6.0 |

# Review of Model Results - Ongoing

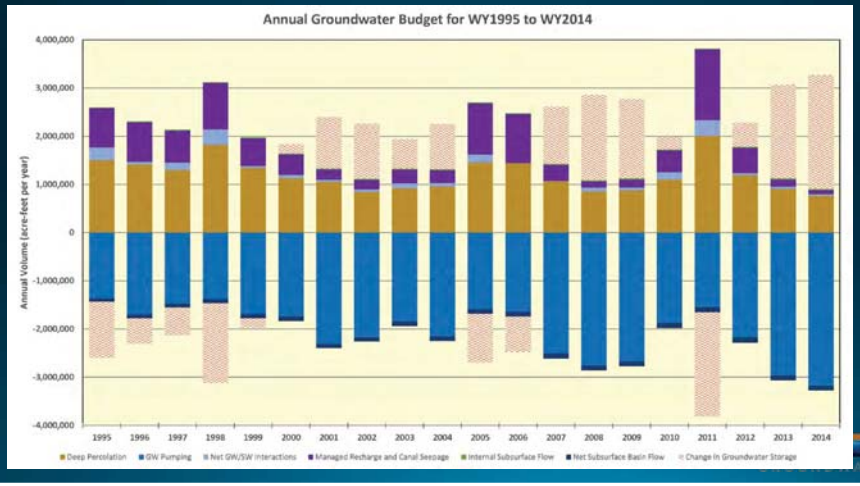
- Change in storage trends
- Comparison with Tulare Lake Pilot Study C2VSim



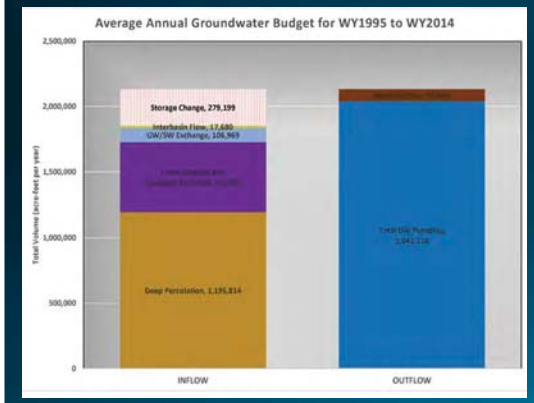
## Next Steps

- Additional Model review following this meeting and local feedback
- Final set of feedback to Todd GW
- Peer Review Technical Memorandum

## Annual Groundwater Budget



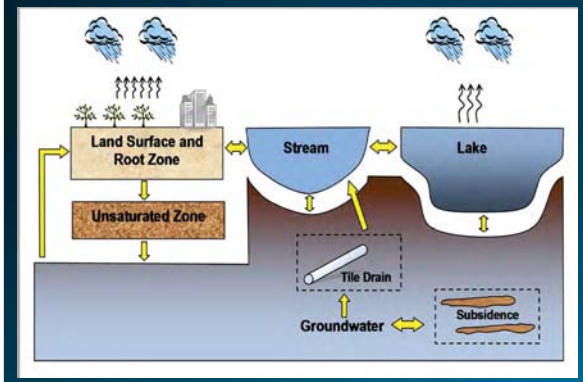

## Basin-Wide Historical Groundwater Budgets




- Inflow
  - Deep Percolation
  - Managed Aquifer Recharge (MAR) and Conveyance Seepage
  - GW/SW Interactions
  - Intra-basin Flow
- Outflow
  - Groundwater Pumping
  - Basin Outflow
- Storage Change
  - Difference of Inflow and Outflow

DRAFT

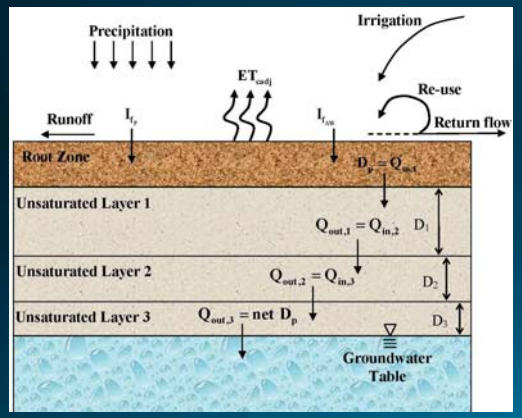
## C2VSim Provides Integrated Process-Based Methodology to Develop Water Budgets




- IWFM Model simulates key hydrological processes
  - Land Surface, Root Zone, and Unsaturated Zone
  - Surface water deliveries from rivers and canals
  - Groundwater flow

DRAFT

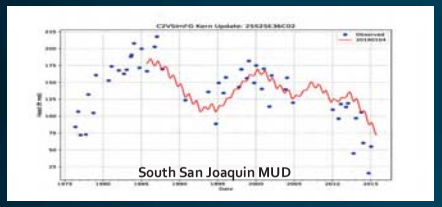
# IWFM Demand Calculator (IDC)

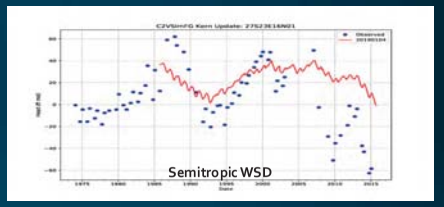


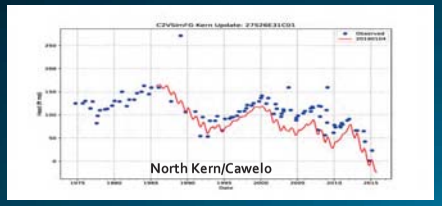

- Calculates agricultural demand based on soil moisture budget
  - Monthly crop ET time series
  - Tracks soil moisture content throughout simulation
  - If soil moisture falls below minimum level (wilting point), irrigation water added to reach target level (field capacity) to cover ET, deep percolation and runoff

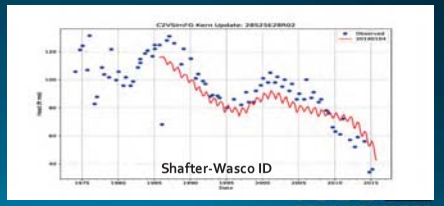
DRAFT

# Examples of Model Performance North of the River



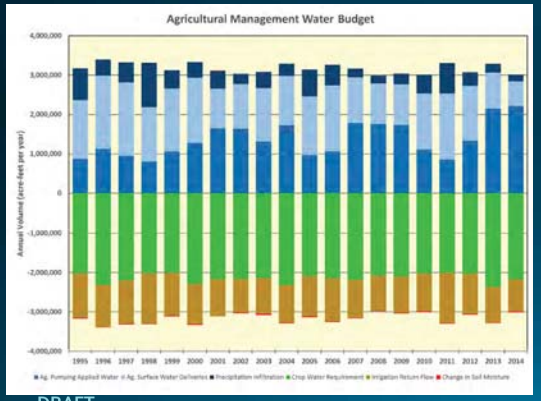




GROUNDWATER

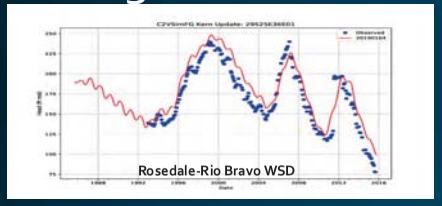
# C2VSim Provides Framework to Determine Water Supply and Demand Requirements

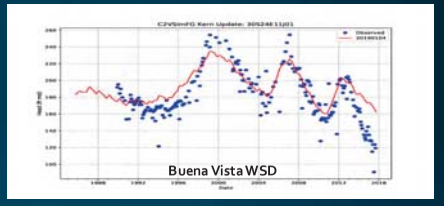


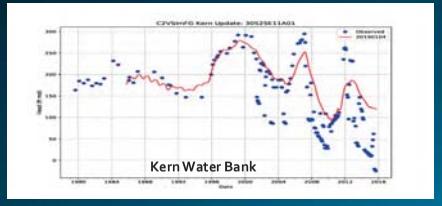

- Surface Water Deliveries are based on local data
- Ag Demand and Pumping based on METRIC data and soil moisture budget
- Effective Precipitation and Return Flow based on soil moisture

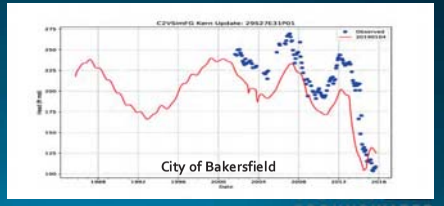
DRAFT

# Examples of Model Performance Along the River



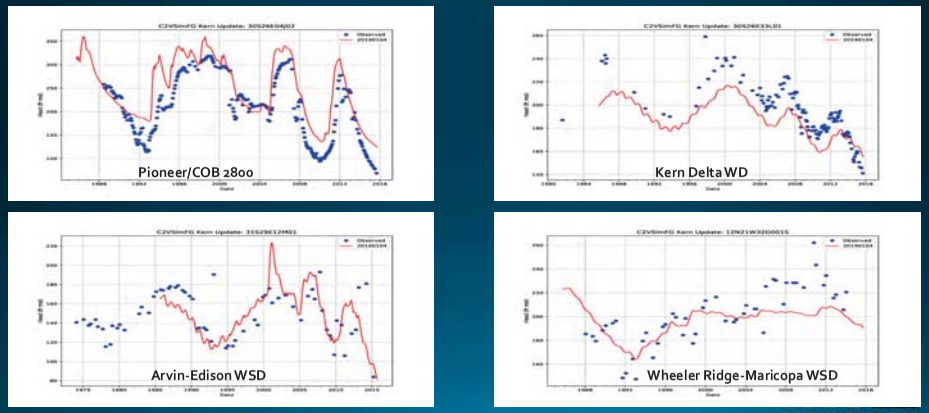



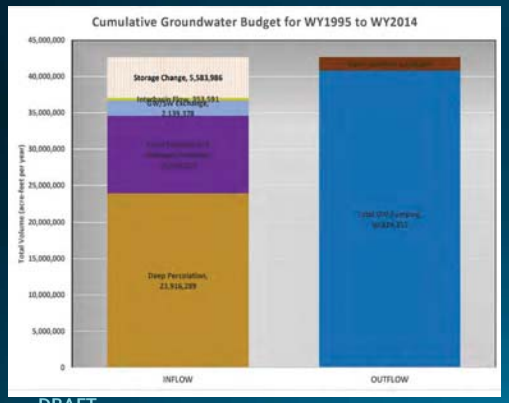




GROUNDWATER

# Examples of Model Performance North Kern WSD and Shafter-Wasco ID




# Basin-wide Historical Water Budgets




- Managed Water Components are generally well defined
  - largest part of water budget
- Groundwater Flow Components have higher uncertainty
  - smaller portion of the water budget
- Model does not account for Groundwater Banking Accounts
  - Water stored in basin for use by others

DRAFT

# C2VSim-Beta updated for Kern County Provides Appropriate SGMA Water Budget

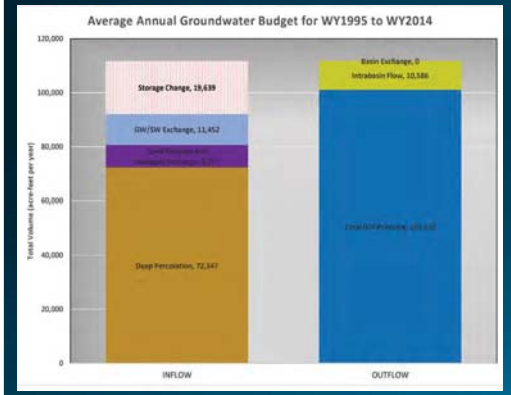
Groundwater Flow Equation

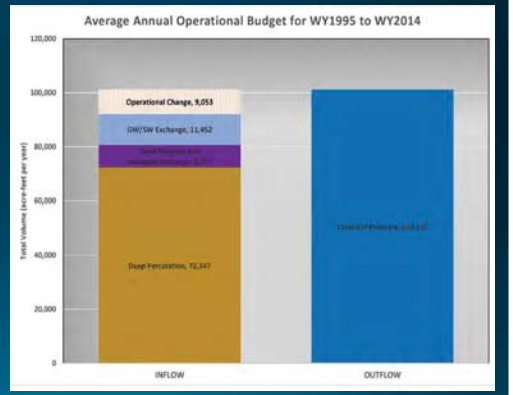
$$\frac{\partial}{\partial x}\left(T_x \frac{\partial h}{\partial x}\right)+\frac{\partial}{\partial y}\left(T_y \frac{\partial h}{\partial y}\right)+W=S\frac{\partial h}{\partial t}$$

Groundwater Flow Darcy Law | Inflows & Outflows - Checkbook | Change in Storage

- Kern County Subbasin is Highly Managed System
  - Inflows and Outflows (W) dominate the groundwater budget
  - Flow component is small in comparison
- Significant portion of water budget is derived from measured, locally-derived data

# Operational Water Budget does not include Subsurface Flow




DRAFT

# Defensibility of Water Budgets

- C2VSim utilizes Same Data and Methods across the Subbasin
  - Uses measured, locally-derived data
  - Applies consistent methodology across the subbasin
- Managed Water Supply and Demand Dominate the Subbasin Water Budget
- Model simulation provides reasonable representation of groundwater conditions
- DWR Provided C2VSim Beta-Version Specifically for Development of SGMA Water Budgets

TODD GROUNDWATER

# Discussion and Questions

# Next Steps for Model

- Historical Water Budgets
  - Coordination with Districts to Address questions and comments
  - Finalize Peer Review
  - Update model results
- Projected Future Water Budgets
  - Finalize hydraulic period
  - Setup Baseline Scenario
  - Update data request
  - Setup Climate Change Scenario

DRAFT

TODD GROUNDWATER

Kern River Groundwater Sustainability Agency

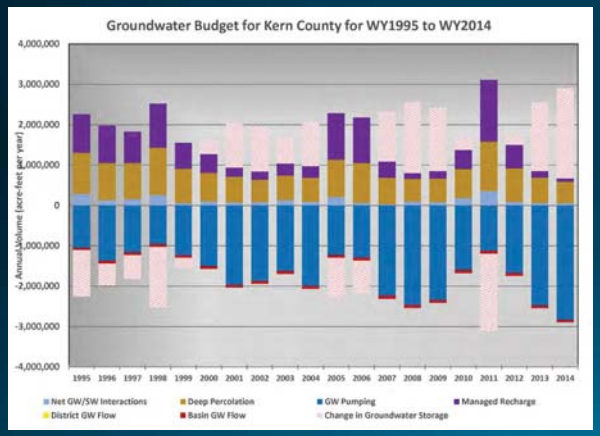
KERN GROUNDWATER AUTHORITY

# DRAFT
# Kern County Subbasin
# REVISED C2VSim Historical Water Budgets

March 22, 2019

TODD GROUNDWATER

## What was done for the revision?




- Improved Spreadsheet Documentation
  - Added column descriptions
  - Expanded and Improved Tables and Charts
- Addressed Comments and Model Issues
  - Addressed Regional Issues
  - Reconciled district issues and comments

DRAFT

TODD GROUNDWATER

## Revised Historical Groundwater Budget

Kern County Subbasin C2VSim Update - Groundwater Budget
Historical Hydrologic Period from WY1995 to WY2014
March 15, 2019 C2VSim Version
REVISED RESULTS For District Review

TABLE 1: Groundwater Budget for Kern County for WY1995 to WY2014

| Water Year | Deep Percolation | Managed Recharge and Canal Seepage | Net GW/SW Interactions | GW Pumping | Subsurface Flow within GW Basin | Subsurface Flow with Adjacent GW Basins | Change in Groundwater Storage |
|---|---|---|---|---|---|---|---|
| Units | Acre-ft | Acre-ft | Acre-ft | Acre-ft | Acre-ft | Acre-ft | Acre-ft |
| 1995 | 1,016,255 | 944,786 | 291,898 | -1,050,380 | 0 | -57,192 | 1,145,367 |
| 1996 | 919,089 | 926,517 | 130,236 | -1,375,387 | 0 | -66,362 | 534,092 |
| 1997 | 888,099 | 771,492 | 162,118 | -1,162,635 | 0 | -69,167 | 589,907 |
| 1998 | 1,163,881 | 1,097,173 | 261,886 | -959,859 | 0 | -69,065 | 1,494,017 |
| 1999 | 847,653 | 643,210 | 55,360 | -1,234,768 | 0 | -66,803 | 244,655 |
| 2000 | 707,355 | 466,772 | 99,916 | -1,506,021 | 0 | -63,161 | -297,140 |
| 2001 | 638,113 | 223,096 | 74,202 | -1,970,675 | 0 | -63,346 | -1,098,610 |
| 2002 | 556,073 | 209,605 | 76,750 | -1,874,097 | 0 | -65,355 | -1,097,024 |
| 2003 | 604,092 | 297,667 | 135,215 | -1,628,453 | 0 | -66,985 | -658,463 |
| 2004 | 589,227 | 285,056 | 94,817 | -1,993,485 | 0 | -70,698 | -1,095,083 |
| 2005 | 923,495 | 1,147,344 | 208,115 | -1,231,940 | 0 | -71,271 | 975,740 |
| 2006 | 984,355 | 1,125,521 | 64,651 | -1,290,643 | 0 | -77,926 | 805,958 |
| 2007 | 657,218 | 403,463 | 25,786 | -2,241,430 | 0 | -72,906 | -1,227,873 |
| 2008 | 557,643 | 146,937 | 97,235 | -2,470,751 | 0 | -67,540 | -1,736,477 |
| 2009 | 585,651 | 185,948 | 77,822 | -2,342,792 | 0 | -66,981 | -1,560,358 |
| 2010 | 719,510 | 467,676 | 182,389 | -1,600,706 | 0 | -75,737 | -306,870 |
| 2011 | 1,217,635 | 1,530,095 | 361,915 | -1,125,876 | 0 | -75,776 | 1,907,994 |
| 2012 | 828,196 | 580,250 | 89,545 | -1,666,675 | 0 | -73,943 | -242,635 |
| 2013 | 629,761 | 157,351 | 60,811 | -2,478,882 | 0 | -64,627 | -1,695,600 |
| 2014 | 531,345 | 84,816 | 51,048 | -2,834,025 | 0 | -62,170 | -2,228,995 |
| Total | 15,564,646 | 11,694,773 | 2,601,715 | -34,039,480 | 0 | -1,369,009 | -5,547,400 |
| Average | 778,232 | 584,739 | 130,086 | -1,701,974 | 0 | -68,450 | -277,370 |

DRAFT

TODD GROUNDWATER

Kern County Subbasin C2VSim Update - Groundwater Budget
Historical Hydrologic Period from WY1995 to WY2014
March 15, 2019 C2VSim Version
REVISED RESULTS For District Review

TABLE 1: Groundwater Budget for Kern County for WY1995 to WY2014

| Water Year | Deep Percolation | Managed Recharge and Canal Seepage | Net GW/SW Interactions | GW Pumping | Subsurface Flow within GW Basin | Subsurface Flow with Adjacent GW Basins | Change in Groundwater Storage |
|---|---|---|---|---|---|---|---|
| Units | Acre-ft | Acre-ft | Acre-ft | Acre-ft | Acre-ft | Acre-ft | Acre-ft |
| 1995 | 1,016,255 | 944,786 | 291,898 | -1,050,380 | 0 | -57,192 | 1,145,367 |
| 1996 | 919,089 | 926,517 | 130,236 | -1,375,387 | 0 | -66,362 | 534,092 |
| 1997 | 888,099 | 771,492 | 162,118 | -1,162,635 | 0 | -69,167 | 589,907 |
| 1998 | 1,163,881 | 1,097,173 | 261,886 | -959,859 | 0 | -69,065 | 1,494,017 |
| 1999 | 847,653 | 643,210 | 55,360 | -1,234,768 | 0 | -66,803 | 244,655 |
| 2000 | 707,355 | 466,772 | 99,916 | -1,506,021 | 0 | -63,161 | -297,140 |
| 2001 | 638,113 | 223,096 | 74,202 | -1,970,675 | 0 | -63,346 | -1,098,610 |
| 2002 | 556,073 | 209,605 | 76,750 | -1,874,097 | 0 | -65,355 | -1,097,024 |
| 2003 | 604,092 | 297,667 | 135,215 | -1,628,453 | 0 | -66,985 | -658,463 |
| 2004 | 589,227 | 285,056 | 94,817 | -1,993,485 | 0 | -70,698 | -1,095,083 |
| 2005 | 923,495 | 1,147,344 | 208,115 | -1,231,940 | 0 | -71,271 | 975,740 |
| 2006 | 984,355 | 1,125,521 | 64,651 | -1,290,643 | 0 | -77,926 | 805,958 |
| 2007 | 657,218 | 403,463 | 25,786 | -2,241,430 | 0 | -72,906 | -1,227,873 |
| 2008 | 557,643 | 146,937 | 97,235 | -2,470,751 | 0 | -67,540 | -1,736,477 |
| 2009 | 585,651 | 185,948 | 77,822 | -2,342,792 | 0 | -66,981 | -1,560,358 |
| 2010 | 719,510 | 467,676 | 182,389 | -1,600,706 | 0 | -75,737 | -306,870 |
| 2011 | 1,217,635 | 1,530,095 | 361,915 | -1,125,876 | 0 | -75,776 | 1,907,994 |
| 2012 | 828,196 | 580,250 | 89,545 | -1,666,675 | 0 | -73,943 | -242,635 |
| 2013 | 629,761 | 157,351 | 60,811 | -2,478,882 | 0 | -64,627 | -1,695,600 |
| 2014 | 531,345 | 84,816 | 51,048 | -2,834,025 | 0 | -62,170 | -2,228,995 |
| Total | 15,564,646 | 11,694,773 | 2,601,715 | -34,039,480 | 0 | -1,369,009 | -5,547,400 |
| Average | 778,232 | 584,739 | 130,086 | -1,701,974 | 0 | -68,450 | -277,370 |

NOTES:

| | |
|---|---|
| Deep Percolation | Precipitation and applied water that reaches the groundwater after simulated transport across the unsaturated zone |
| Managed Recharge and Canal Seepage | Combined groundwater recharge from managed aquifer recharge operations, groundwater banking, and seepage from canals and other conveyance |
| Net GW/SW Interactions | Net volumetric exchange of surface water and groundwater from streams: Positive represents a net groundwater recharge, and negative represents a net groundwater discharge to the stream |
| GW Pumping | Total groundwater pumping by wells. Groundwater banking recovery pumping is specified input whereas agricultural and municipal pumping is calculated by C2VSim based on demand |
| Subsurface Flow within GW Basin | Net subsurface groundwater flow into a neighboring water district or area within the Kern County Subbasin: negative is a net flow out of the district and positive is a net flow into the district |
| Subsurface Flow with Adjacent GW Basins | Net subsurface groundwater flow from the Kern County Subbasin with an adjoining groundwater basin: negative is a net flow out of the basin and positive is a net flow into the basin |
| Change in Groundwater Storage | Sum of the inflow components (positive numbers) plus the outflow components (negative numbers): positive is an increase in storage typified by a rise in GW levels whereas a negative is a decrease in storage typified by a decline in GW levels |

## Added descriptions of each table column

TODD GROUNDWATER

Item 5

# Modified Existing Tables to be more Useful

Kern County Subbasin C2VSim Update - Agricultural Management Water Budget
Historical Hydrologic Period from WY1995 to WY2014
March 15, 2019 C2VSim Version
REVISED RESULTS For District Review

TABLE 3: Agricultural Management Water Budget for Kern County for WY1995 to WY2014

| | | Water Supply | | | | | Water Demand | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Water Year | Irrigated Ag. Area | Effective Precipitation | Ag. Pumping Applied Water | Ag. Surface Water Deliveries | Effective Precipitation per Acre | Total Applied Water Per Acre | Crop Water Requirement | Percolation to Groundwater | Crop Water Demand Per Acre | Percolation to Groundwater per Acre |
| Units | Acres | Acre-ft | Acre-ft | Acre-ft | ft/acre | ft/acre | Acre-ft | Acre-ft | ft/acre | ft/acre |
| 1995 | 780,803 | 511,997 | 875,865 | 1,339,629 | 0.66 | 2.84 | 2,031,481 | 720,791 | 2.60 | 0.92 |
| 1996 | 798,735 | 339,242 | 1,189,242 | 1,646,089 | 0.42 | 3.55 | 2,334,047 | 679,718 | 2.92 | 0.85 |
| 1997 | 801,583 | 345,633 | 984,027 | 1,650,210 | 0.43 | 3.29 | 2,204,613 | 710,430 | 2.75 | 0.89 |
| 1998 | 799,230 | 652,085 | 790,716 | 1,200,974 | 0.82 | 2.49 | 2,018,992 | 774,769 | 2.53 | 0.97 |
| 1999 | 803,474 | 385,355 | 1,036,793 | 1,425,118 | 0.48 | 3.06 | 2,031,604 | 665,434 | 2.53 | 0.83 |
| 2000 | 835,206 | 345,364 | 1,302,650 | 1,461,846 | 0.41 | 3.31 | 2,306,622 | 621,846 | 2.76 | 0.74 |
| 2001 | 799,553 | 344,404 | 1,584,161 | 961,988 | 0.43 | 3.18 | 2,184,209 | 630,138 | 2.73 | 0.79 |
| 2002 | 738,420 | 230,039 | 1,584,845 | 1,056,901 | 0.30 | 3.58 | 2,168,362 | 555,304 | 2.94 | 0.75 |
| 2003 | 757,372 | 321,790 | 1,315,884 | 1,200,620 | 0.42 | 3.32 | 2,143,420 | 580,622 | 2.83 | 0.77 |
| 2004 | 769,162 | 266,231 | 1,707,768 | 1,147,322 | 0.35 | 3.71 | 2,337,414 | 594,258 | 3.04 | 0.77 |
| 2005 | 766,330 | 473,158 | 963,245 | 1,335,575 | 0.62 | 3.00 | 2,099,570 | 666,353 | 2.74 | 0.87 |
| 2006 | 816,721 | 433,899 | 1,065,518 | 1,468,445 | 0.53 | 3.10 | 2,154,851 | 661,919 | 2.64 | 0.81 |
| 2007 | 792,925 | 219,383 | 1,714,978 | 1,116,832 | 0.28 | 3.57 | 2,220,358 | 624,419 | 2.80 | 0.79 |
| 2008 | 762,593 | 165,218 | 1,704,923 | 991,935 | 0.22 | 3.54 | 2,100,362 | 612,113 | 2.75 | 0.80 |
| 2009 | 763,660 | 214,825 | 1,666,516 | 991,067 | 0.28 | 3.48 | 2,119,806 | 617,048 | 2.78 | 0.81 |
| 2010 | 755,415 | 337,579 | 1,114,858 | 1,265,554 | 0.45 | 3.15 | 2,030,995 | 632,526 | 2.69 | 0.84 |
| 2011 | 782,699 | 431,876 | 871,649 | 1,490,115 | 0.55 | 3.02 | 2,029,020 | 784,354 | 2.59 | 1.00 |
| 2012 | 790,395 | 289,340 | 1,326,877 | 1,278,762 | 0.37 | 3.30 | 2,054,992 | 672,386 | 2.60 | 0.85 |
| 2013 | 759,168 | 195,450 | 2,061,513 | 921,249 | 0.26 | 3.93 | 2,387,861 | 607,323 | 3.15 | 0.80 |
| 2014 | 723,000 | 148,116 | 2,132,157 | 663,077 | 0.20 | 3.87 | 2,195,110 | 582,580 | 3.04 | 0.81 |
| Total | 15,596,443 | 6,640,985 | 26,994,184 | 24,613,306 | | | 43,153,687 | 12,994,330 | | |
| Average | 779,822 | 332,049 | 1,349,709 | 1,230,665 | 0.42 | 3.31 | 2,157,684 | 649,716 | 2.77 | 0.83 |
| Percent | | 11% | 46% | 42% | | | 77% | 23% | | |

DRAFT

# Revision Focused on Addressing District Comments

- Addressed regional issues
  - Overly high pumping and deep percolation
  - Kern River Recharge
- Reconciled local issues and comments
  - Better aligned Water Budget Areas with district operations
  - Incorporated new or updated data
  - Fixed local data input errors

# Added New Tables and Graphs to Provide Additional Water Budget Information

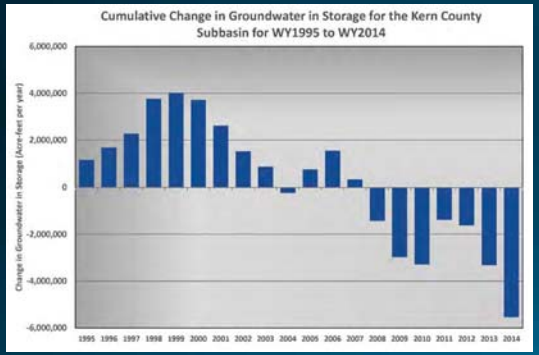
Kern County Subbasin C2VSim Update - Land and Water Use Summary
Historical Hydrologic Period from WY1995 to WY2014
March 15, 2019 C2VSim Version
REVISED RESULTS For District Review

TABLE 4: Land Use and Groundwater Recharge for Kern County for WY1995 to WY2014

| | Land Use Summary | | | | Groundwater Pumping Summary | | | | Surface Water Use Summary | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Water Year | Irrigated Agricultural Area | Urban Area | Native, Undeveloped or Fallow Area | Total Area | Agricultural Pumping | Urban Pumping | GW Banking, Exchanges and "Pump-Ins" | Total Pumping | Agricultural Surface Water Deliveries | Urban Surface Water Deliveries | Other Surface Water Deliveries | Total Surface Water Deliveries |
| Units | Acres | Acres | Acres | Acres | Acre-ft | Acre-ft | Acre-ft | Acre-ft | Acre-ft | Acre-ft | Acre-ft | Acre-ft |
| 1995 | 780,803 | 58,394 | 963,756 | 1,802,952 | 875,865 | 163,498 | 11,017 | 1,050,380 | 1,339,629 | 26,158 | 11,953 | 1,377,740 |
| 1996 | 798,735 | 71,339 | 931,951 | 1,802,025 | 1,189,242 | 173,962 | 12,184 | 1,375,387 | 1,646,089 | 27,131 | 14,181 | 1,687,400 |
| 1997 | 801,583 | 86,428 | 914,941 | 1,802,951 | 984,027 | 166,720 | 11,882 | 1,162,635 | 1,650,210 | 18,447 | 18,033 | 1,686,690 |
| 1998 | 799,230 | 94,070 | 909,652 | 1,802,951 | 790,716 | 159,223 | 9,919 | 959,859 | 1,200,974 | 10,595 | 41,895 | 1,253,465 |
| 1999 | 803,474 | 85,993 | 913,484 | 1,802,951 | 1,036,793 | 186,101 | 11,874 | 1,234,768 | 1,425,118 | 25,916 | 12,053 | 1,463,086 |
| 2000 | 835,206 | 85,863 | 881,882 | 1,802,951 | 1,302,650 | 188,030 | 15,341 | 1,506,021 | 1,461,846 | 29,107 | 6,073 | 1,497,026 |
| 2001 | 799,553 | 84,609 | 918,789 | 1,802,951 | 1,584,161 | 201,110 | 185,403 | 1,970,675 | 961,988 | 26,723 | 11,359 | 1,000,069 |
| 2002 | 738,420 | 87,611 | 976,921 | 1,802,951 | 1,584,845 | 203,989 | 85,264 | 1,874,097 | 1,056,901 | 28,216 | 16,859 | 1,101,976 |
| 2003 | 757,372 | 92,311 | 953,269 | 1,802,951 | 1,315,884 | 210,673 | 101,896 | 1,628,453 | 1,200,620 | 30,171 | 15,075 | 1,245,865 |
| 2004 | 769,162 | 95,981 | 937,809 | 1,802,951 | 1,707,768 | 207,608 | 78,110 | 1,993,485 | 1,147,322 | 53,794 | 19,412 | 1,220,528 |
| 2005 | 766,330 | 101,332 | 935,290 | 1,802,951 | 963,245 | 182,149 | 86,546 | 1,231,940 | 1,335,575 | 41,246 | 18,466 | 1,395,288 |
| 2006 | 816,721 | 112,056 | 874,174 | 1,802,951 | 1,065,518 | 205,577 | 19,548 | 1,290,643 | 1,468,445 | 37,939 | 18,441 | 1,524,825 |
| 2007 | 792,925 | 106,463 | 903,563 | 1,802,951 | 1,714,978 | 223,167 | 303,285 | 2,241,430 | 1,116,832 | 52,332 | 17,019 | 1,186,184 |
| 2008 | 762,593 | 103,540 | 936,819 | 1,802,951 | 1,704,923 | 217,072 | 548,757 | 2,470,751 | 991,935 | 53,289 | 14,880 | 1,060,103 |
| 2009 | 763,660 | 103,826 | 935,466 | 1,802,953 | 1,666,516 | 208,473 | 467,802 | 2,342,792 | 991,067 | 55,707 | 16,276 | 1,063,049 |
| 2010 | 755,415 | 106,423 | 941,113 | 1,802,951 | 1,114,858 | 202,412 | 283,436 | 1,600,706 | 1,265,554 | 58,175 | 19,425 | 1,343,153 |
| 2011 | 782,699 | 107,810 | 912,442 | 1,802,951 | 871,649 | 219,432 | 34,794 | 1,125,876 | 1,490,115 | 61,185 | 20,310 | 1,571,610 |
| 2012 | 790,395 | 110,511 | 902,046 | 1,802,951 | 1,326,877 | 237,461 | 102,396 | 1,666,675 | 1,278,762 | 64,536 | 15,464 | 1,358,761 |
| 2013 | 759,168 | 104,354 | 939,430 | 1,802,951 | 2,061,513 | 211,687 | 205,683 | 2,478,882 | 921,249 | 63,531 | 20,333 | 1,005,113 |
| 2014 | 723,000 | 111,830 | 968,121 | 1,802,951 | 2,132,157 | 215,499 | 486,370 | 2,834,025 | 663,077 | 52,704 | 13,044 | 728,826 |
| Total | | | | | 26,994,184 | 3,983,850 | 3,061,446 | 34,039,480 | 24,613,306 | 816,901 | 340,550 | 25,770,756 |
| Average | 779,822 | 95,537 | 927,546 | 1,802,905 | 1,349,709 | 199,192 | 153,072 | 1,701,974 | 1,230,665 | 40,845 | 17,027 | 1,288,538 |
| Percent | 43% | 5% | 51% | 100% | 79% | 12% | 9% | 100% | 96% | 3% | 1% | 100% |

DRAFT

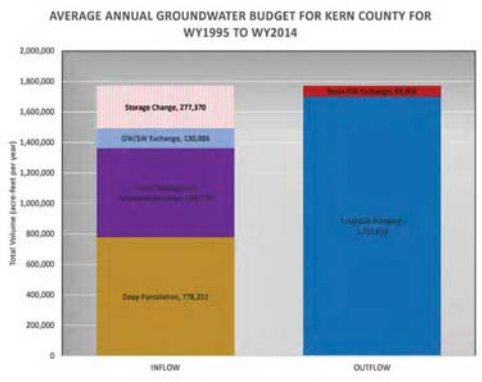
# Revision Provided Minor Difference in Groundwater Storage Change




- 20-Year Assessment Period
  - **5,550,000** Acre-foot decline over 20-year Assessment Period
  - **277,000** Average Annual Water Storage Decline
- Model does not account for Groundwater Banking Accounts
  - Water stored in basin for use by others

DRAFT

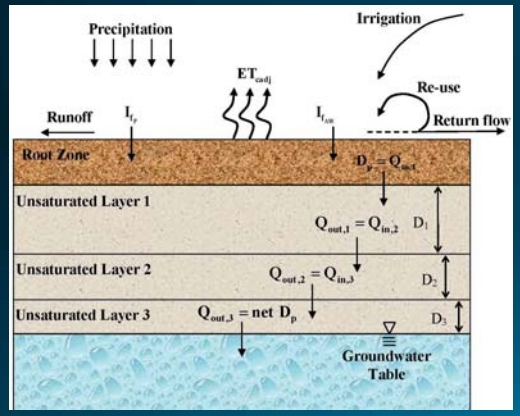
# What Changed in this Revision




- Inflow
  - Deep Percolation (-15%)
  - Canal Seepage and Recharge (+10%)
  - GW/SW Interactions (+22%)
- Outflow
  - Groundwater Pumping (-15%)
  - Basin Outflow (-25%)
- Storage Change (-1%)

DRAFT

# IWFM Demand Calculator (IDC)




- Calculates agricultural demand based on soil moisture budget
  - Monthly crop ET time series
  - Tracks soil moisture content throughout simulation
  - If soil moisture falls below minimum level (wilting point), irrigation water added to reach target level (field capacity) to cover ET, deep percolation and runoff

DRAFT

# Several Comments Noted Overly-High Pumping and Deep Percolation

- High Soil Hydraulic Conductivity
  - Used soil parameters from Beta Version
  - Found that Soil Hydraulic Conductivity is a Sensitive Parameter
  - Several area in Kern County had overly high values
- Caused Model to Overapply Pumping
  - Model calculates pumping based on crop demand and percolation rate
  - High percolation triggered additional pumping
  - The extra pumpage went back to the groundwater
- Incorrect Setting in a Pumping File Added to the Problem

DRAFT

# Model Crop Demand Correlates Well to ITRC ETc Assessment

Comparison of Annual ETc Volume for Kern County by ITRC (2017) and Revised C2VSim Model (2019)

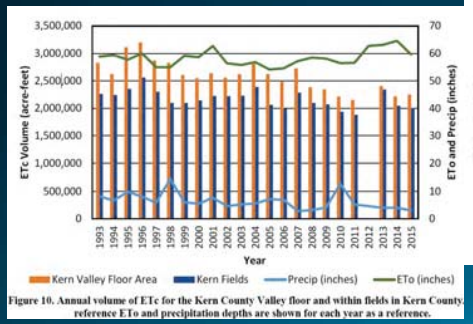



Figure 10. Annual volume of ETc for the Kern County Valley floor and within fields in Kern County. reference ETo and precipitation depths are shown for each year as a reference.

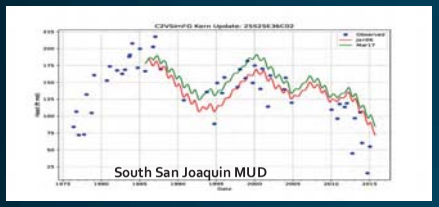
# Worked to Improve Kern River Flow Conditions

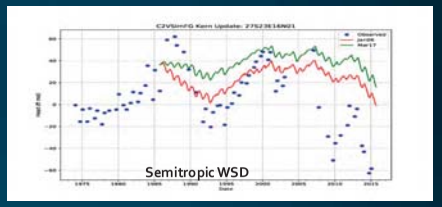
- Modified Aquifer and Stream Parameters
  - Applied aquifer parameters from existing local models
  - Adjusted streambed parameters to allow more upstream seepage
- Achieved significant improvement
  - Seepage rates from River are more inline with measured data
  - Reduced mounding under Kern Fan Banks
  - Decreased outflows to lower Kern River

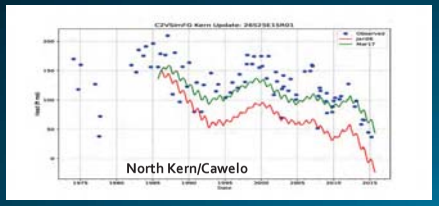
DRAFT

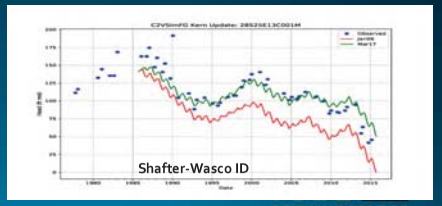
TODD GROUNDWATER

# Examples of Model Performance North of the River




GROUNDWATER

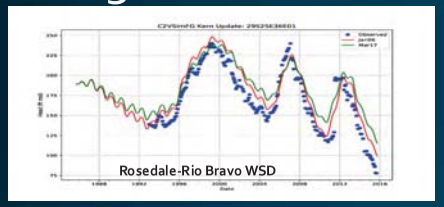
# Revised Water Budget Areas

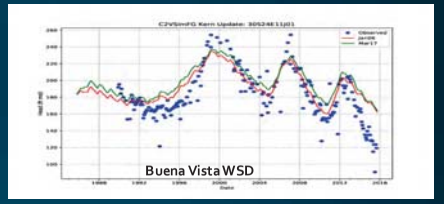

- ▶ Aligned with current GSA or district boundaries
  - ▶ Update managed water data
  - ▶ Localize water distribution
- ▶ Included local water management operations
  - ▶ Surface water delivery areas
  - ▶ Pumping
  - ▶ Managed recharge operations

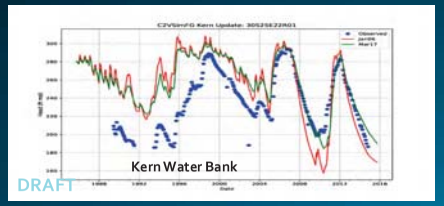
DRAFT

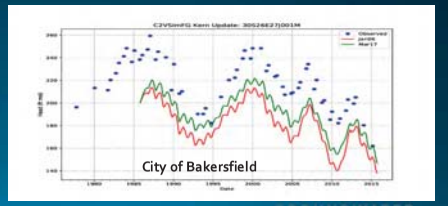
TODD GROUNDWATER

# Examples of Model Performance Along the River



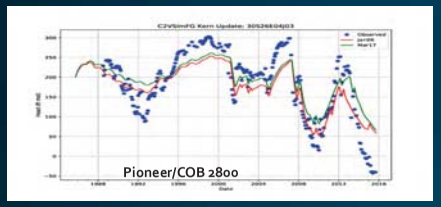



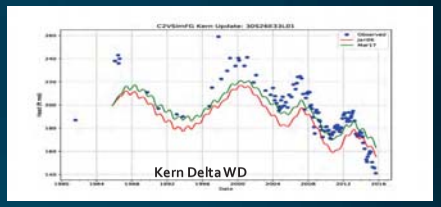



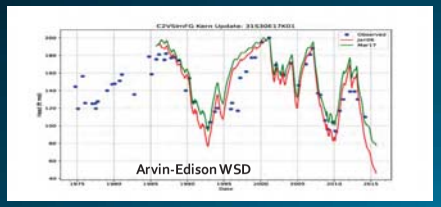

DRAFT

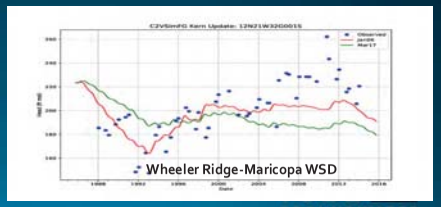
GROUNDWATER

# Examples of Model Performance North Kern WSD and Shafter-Wasco ID




# Defensibility of Water Budgets

- C2VSim utilizes Same Data and Methods across the Subbasin
  - Uses measured, locally-derived data
  - Applies consistent methodology across the subbasin
- Managed Water Supply and Demand Dominate the Subbasin Water Budget
- Model simulation provides reasonable representation of groundwater conditions
- DWR Provided C2VSim Beta-Version Specifically for Development of SGMA Water Budgets

**Kern County Subbasin C2VSim Update - Basin Yield Analysis**
**Historical Hydrologic Period from WY1995 to WY2014**
**March 15, 2019 C2VSim Version**
**REVISED RESULTS For District Review**

**TABLE 6: Sustainable and Native Yield Analysis for Kern County for WY1995 to WY2014 Base Pe**

| Water Year | Total Average Annual Volume | Agricultural Average Annual Volume | Agricultural Average Annual Volume per Ag Acre | Urban Average Annual Volume |
|---|---|---|---|---|
| Units | Acre-ft | Acre-ft | ft/acre | Acre-ft |
| **Groundwater-Pumping-Based Basin Yield** | | | | |
| Groundwater Pumping | 1,548,902 | 1,349,709 | 1.73 | 199,192 |
| Percentage of Pumping | | 87% | | 13% |
| Change in Groundwater in Storage | -277,370 | -219,962 | -0.28 | -32,462 |
| Percentage of Pumping | | -16% | | -16% |
| **Sustainable Yield** | **1,271,532** | **1,129,748** | **1.45** | **166,730** |
| **Recharge-Based Basin Yield** | | | | |
| **Native Yield based on Natural Recharge** | | | | |
| Precipitation Recharge | 192,337 | 167,602 | 0.21 | 24,735 |
| Small Watershed Recharge | 48,760 | 42,489 | 0.05 | 8,271 |
| Basin Inflow | 50,946 | 44,394 | 0.06 | 6,552 |
| Subtotal | 292,043 | 254,486 | 0.33 | 37,557 |
| **Natural or Basin Derived Operational Recharge** | | | | |
| Ag Return Flow - Pumped GW | 301,099 | 301,099 | 0.39 | 0 |
| Urban Stormwater and Wastewater | 57,534 | 0 | 0.00 | 57,534 |
| Urban Return Flow - Pumped GW | 44,899 | 0 | 0.00 | 44,899 |
| Subtotal | 403,532 | 301,099 | 0.39 | 102,433 |
| **Imported or Allocated Recharge** | | | | |
| Ag Return Flow - Surface Water | 274,542 | 274,542 | 0.35 | 0 |
| Urban Return Flow - Surface Water | 11,225 | 0 | 0.00 | 11,225 |
| Banking/Canal Seepage | 321,606 | 307,162 | 0.39 | 10,195 |
| Stream Recharge | 99,047 | 86,310 | 0.11 | 12,738 |
| Subtotal | 706,421 | 668,014 | 0.86 | 34,157 |
| **Groundwater Outflow from Basin** | | | | |
| Basin Outflow | -137,118 | -108,738 | -0.14 | -16,048 |
| Subtotal | -137,118 | -108,738 | -0.14 | -16,048 |
| **Total** | **1,264,877** | **1,114,360** | **1.43** | **158,099** |
| **Natural Native Yield** | **292,043** | **254,486** | **0.33** | **37,557** |
| **Operational Native Yield** | **695,575** | **555,585** | **0.71** | **139,990** |
| **Sustainable Yield** | **558,457** | **446,847** | **1.43** | **123,942** |

# Basin Yield Analysis

- Applied two different approaches
  - Groundwater Pumping Based
  - Recharge Based
- Compiled model data to support Basin Yield Analysis
- Model results are in line with other estimates

# Discussion and Questions

Item 6

LEADERSHIP COUNSEL FOR JUSTICE & ACCOUNTABILITY

[Sent via email]

Kern River GSA
krgsa@kernrivergsa.org

July 10th, 2019

**Re: Concerns and Recommendations to Ensure that Kern River GSA GSP Protects Vulnerable Drinking Water Users**

Dear members of the Kern River Groundwater Sustainability Agency,

Our organization works alongside low income communities of color in the San Joaquin Valley and the Eastern Coachella Valley to advocate for local, regional and state government entities to address their communities' needs for the basic elements that make up a safe and healthy community, including clean, safe, reliable and affordable drinking water, affordable housing, effective and safe transportation, efficient and affordable energy, green spaces, clean air, and more. We have been engaged in the Sustainable Groundwater Management Act (SGMA) implementation process because many of the communities with whom we work are dependent on groundwater for their drinking water supplies, and often have already experienced groundwater quality and supply issues.

Historically, communities we work with have not been included in decision-making about their previous water resources, and their needs have not been at the forefront of such decisions. In 2012, California recognized the Human Right to Drinking Water as a statewide goal. Now, because of SGMA's requirements for a transparent and inclusive process, groundwater management under the new law has the opportunity to include disadvantaged communities in decision-making and create groundwater management plans that understand their unique vulnerabilities and are sensitive to their drinking water needs.

We are concerned that drinking water impacts and disadvantaged community input have not been adequately analyzed and incorporated into the draft GSP, and recommend the following actions to ensure that drinking water is protected, especially for the communities whose drinking water is severely at risk from groundwater management activities, and who are the least able to pay for solutions for clean and reliable drinking water.

**Development of Sustainable Management Criteria**

In order to "consider the interests of" disadvantaged communities in developing sustainable management criteria, GSAs must address the impacts of the six sustainability indicators by reaching out

to all disadvantaged communities within the Kern Subbasin to understand their groundwater needs and incorporate their input prior to developing and adopting sustainable management criteria and analyzing the impact of preliminary minimum thresholds on drinking water users before proposing or approving alternatives. Under SGMA, ***all sustainable management criteria must be based on the GSA's determination of what will cause a "significant and unreasonable" impact on each of the six sustainability indicators.***[1] The determination of what is "significant and unreasonable" must be based on the needs of all beneficial users.[2] Therefore, without meaningfully consulting beneficial users within disadvantaged communities to understand what groundwater impacts those individuals want to avoid, the GSA cannot make a valid determination of what is "significant and unreasonable", and thus cannot set valid sustainable management criteria. As a result of the unique tiered structure that the Kern Subasin has decided to follow to address the creation of a GSP under SGMA, Kern River GSA, among other GSAs within the Kern Basin, have created and approved very broad undesirable results that will encompass the diverse terrain that exists within the Kern Basin. These undesirable results, however are intentionally difficult to trigger in order to avoid state intervention. We have suggested and continue to recommend that Kern River GSA consult with all types of beneficial users on what they consider to be "significant and unreasonable" impacts from each of the sustainability indicators before making decisions about sustainable management criteria. .

***In order to effectively "consider the interests of" all beneficial users, GSA committees must analyze how preliminary sustainable management criteria will affect drinking water users before reaching proposed final sustainable management criteria.***[3] Before deciding on proposed minimum thresholds, board members must be equipped with information about how potential minimum thresholds will impact access to drinking water for domestic well owners and communities on small community water systems. To the best of our knowledge, there has been no analysis of drinking water impacts incorporated into the process for determining minimum thresholds at the GSA or water district level. Kern River GSA must ensure that minimum thresholds are protecting drinking water, either by doing a drinking water impacts analysis of the minimum thresholds proposed by water districts, or by requiring water districts to conduct a drinking water impact analysis before finalizing their draft minimum thresholds.

The GSP development process ***must be representative of the interests of all beneficial users named in the Act***. To this end, it is imperative for the GSAs and water districts to reach out to disadvantaged community members for input before making key decisions such as recommending or proposing draft sustainable management criteria. We understand that under the Kern Basin's approach to SGMA, the responsibility for community engagement lies with the local water districts where more

[1] CCR sec. 352.28(a), 354.30(b), 354.26(a)

[2] CCR sec. 352.28(b)(4)

[3] California Department of Water Resources, Sustainable Management Criteria Best Management Practices, p. 9. The GSP must discuss how groundwater conditions at a selected minimum threshold could affect beneficial uses and users. This information should be supported by a description of the beneficial uses [of] groundwater and identification of beneficial uses, which should be developed through communication, outreach, and/or engagement with parties representing those beneficial uses and users, along with any additional information the GSA used when developing the minimum threshold.

detailed decisions will be made. To ensure that water districts are doing robust outreach and receiving substantial input from water users, we recommend that the GSA require water districts to conduct outreach to all types of beneficial users and incorporate feedback from all types of beneficial users into their decisions about sustainable management criteria. The GSA should also require water districts to report back on a regular basis in public GSA meetingsWe also recommend the GSA and the water districts engage with community based organizations that can help enhance outreach efforts and outcome.

Another obstacle to ensuring that all beneficial users' needs are incorporated into decisions about sustainable management criteria is the format in which the GSA will be making decisions that impact small communities, when those small communities have no representation on the GSA board. We know this situation is mainly due to the County of Kern's decision to waive its participation in SGMA, and that Kern River GSA reached this format after exploring several options to cover white areas. However, small water agencies like Lamont Public Utilities District will now be regulated by the Kern River GSA, but will have no voting power. The GSA board has never represented the needs of the individuals in Lamont, and is not familiar with their needs. Therefore the need for effective community engagement is imperative in cases like Lamont, as well as Greenfield and other communities that are not directly represented on the GSA board.

**Groundwater Quality Minimum Threshold Recommendation**

In determining how they will set their sustainable management criteria for groundwater quality, GSAs must consider many factors, including the state Maximum Contaminant Levels (MCLs), collaborating with other agencies currently monitoring and regulating groundwater contaminants in the region, analysis of areas where MCLs are already exceeded, and ways that groundwater management (i.e. pumping and recharge projects) could impact the concentration and movement of groundwater contaminants. We understand the complexity of setting groundwater quality Sustainable Management Criteria (SMC) that are accurate, attainable and measurable, and are eager to work with Central Kings GSA to ensure that groundwater management does not increase groundwater contamination, especially where groundwater is being used as a drinking water source.

*Recommendation for Water Quality Minimum Thresholds*

Given the need for a concrete minimum threshold that strongly protects the human right to drinking water and to ensure groundwater management actions do not impact drinking water, we recommend that Kern River GSA implement the following minimum thresholds:

- Minimum thresholds for water quality should be set at the best water quality since 2015 for each constituent, or at the Maximum Contaminant Level (MCL), whichever of the two reflects the better quality of water (lower contamination level).

- Where the minimum threshold exceeds the public health goal for any constituent, the GSP should, at a minimum, include a policy to strive for improvements to water quality to the point of meeting the relevant public health goal(s).
- The scope of minimum thresholds for water quality should include all potential water contaminants in order to prioritize ensuring access to safe drinking water.

The reasoning behind these minimum thresholds is that the GSAs are tasked with avoiding any undesirable results, and contamination of groundwater and other drinking water sources is a "significant and unreasonable" impact to the resource that we all need to drink, cook, bathe, grow food, and more. Accordingly, minimum thresholds must ensure protection from and prevention of contamination of groundwater and other drinking water sources. DWR instructs GSAs to look to existing groundwater regulatory programs and water quality standards.[4] Many GSAs have proposed incorporating the existing MCLs into their minimum thresholds, however reliance on an MCL is not sufficiently protective of drinking water sources, and does not prevent contamination of our critical resources.

An appropriate standard in the context of groundwater protections is the state's anti-degradation policy, which is used by the SWRCB and regional water boards, and does not allow for further contamination of groundwater based on the best quality of the water since 1968[5] the year the anti-degradation policy became effective. Given that SGMA became law in 2015, the GSA should, at a minimum ensure the better of highest quality of water achieved since 2015, or the MCL, whichever reflects a lower level of water contamination. Additionally, GSAs must ensure that the project and management actions they are proposing do not cause or exacerbate groundwater contamination, and in fact improve drinking water quality for the near and long term. For example, it is our understanding that GSAs within the Madera Subbasin Joint GSP plan to rely on on-farm recharge. Our organization has expressed concern that recharge on current or retired farmland where toxic pesticides and fertilizers have been applied threaten to significantly contaminate groundwater.

Another rule commonly used in environmental law is the precautionary principle, which prohibits activities that could cause harm when the amount of potential harm is unknown. We urge the GSAs to use these two rules, combined with seeking to remediate groundwater to the public health goal, as laid out above, to ensure that groundwater management does not cause degradation of groundwater quality.

*Contaminants to Include in Minimum Threshold*

[4]California Department of Water Resources, Sustainable Management Criteria Best Management Practices, p. 15.
[5] *Asociacion de Gente Unida por el Agua v. Central Valley Regional Water Quality Control Bd.* (2012) 210 Cal.App.4th 1255, 1268.

GSAs should monitor all primary drinking water contaminants, as well as chrome-6[6], which is known has significant health effects but is undergoing a new process to set the MCL because of procedural flaws. It is widely known that the San Joaquin Valley experiences widespread water quality issues from nitrates[7], DBCP[8][9], 123-TCP[10] and other contaminants, and the GSA's groundwater management activities could impact the concentration and location of those contaminants. Where relevant, GSAs should also consider monitoring for PFOA and PFOS as the EPA has established a Lifetime Health Advisory for them due to their potential impacts on drinking water systems.[11] Furthermore, GSAs should also monitor contaminants that are proven to increase from groundwater management, such as arsenic and uranium,[12] and closely examine the movement of contaminant plumes from recharge[13] and other groundwater management activities.

*Other Considerations for Groundwater Quality Minimum Threshold*

GSAs should monitor for contaminant concentrations quarterly, and increase monitoring to every month if a water quality test detects higher contamination concentration than the previous water quality test.

To establish causality between groundwater management activities and groundwater contamination, GSAs should look to (1) whether there has been a correlation in groundwater management pumping and an increase in contamination that could result from groundwater management activities, (2) relevant scientific studies that show proven mechanisms by which causation can be established between groundwater management activities and groundwater contamination, and (3) data and samples collected showing a causal nexus in the case at hand.

---

[6] Hausladen, Debra M., et al. "Hexavalent chromium sources and distribution in California groundwater." *Environmental science & technology* 52.15 (2018): 8242-8251.

[7] *Addressing Nitrate in California's Drinking Water: With a Focus on Tulare Lake Basin and Salinas Valley Groundwater: Report for the State Water Resources Control Board Report to the Legislature*. Center for Watershed Sciences, University of California, Davis, 2012.

[8] Peoples, S. A., et al. "A study of samples of well water collected from selected areas in California to determine the presence of DBCP and certain other pesticide residues." *Bulletin of environmental contamination and toxicology* 24.1 (1980): 611-618.

[9] Loague, Keith, et al. "A case study simulation of DBCP groundwater contamination in Fresno County, California 2. Transport in the saturated subsurface." *Journal of Contaminant Hydrology* 29.2 (1998): 137-163.

[10] Burow, Karen R., Walter D. Floyd, and Matthew K. Landon. "Factors affecting 1, 2, 3-trichloropropane contamination in groundwater in California." *Science of The Total Environment* 672 (2019): 324-334.

[11] "Drinking Water Health Advisories for PFOA and PFOS." *EPA*, Environmental Protection Agency, www.epa.gov/ground-water-and-drinking-water/drinking-water-health-advisories-pfoa-and-pfos.

[12] Jurgens, Bryant C., et al. "Effects of groundwater development on uranium: Central Valley, California, USA." Groundwater48.6 (2010): 913-928.; *also see* "Groundwater Quality in the Sustainable Groundwater Management Act (SGMA): Scientific Factsheet on Arsenic, Uranium, and Chromium," found at https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328800/Groundwater_Quality_in_SGMA_Scientific_factsheet_on_arsenic__uranium__and_chromium.pdf?1559328800

[13] Ground Water Recharge Using Waters of Impaired Quality (1994) https://www.nap.edu/read/4780/chapter/3

Finally, in order to effectively protect drinking water resources, GSAs should establish Management Areas in areas that are more vulnerable to groundwater contamination, such as communities with many shallow wells and communities that cannot afford to install drinking water filters or treatment facilities. Kern River GSA has decided to take a different approach to management areas, and has instead defined management areas based on the boundaries of local water districts. This approach does not highlight the importance of monitoring to ensure and protect safe groundwater for folks who depend on small water systems or private water wells. Kern River GSA should form management areas that protect groundwater users who are more vulnerable to contamination, such as homes on private wells and communities with shallow wells.

**Groundwater Levels Recommendations**

The California legislature has stated that the use of water for domestic purposes is the highest use of water,"[14] and passed the Human Right to Drinking Water in 2012.[15] After the passage of SGMA, GSAs now have the responsibility to protect drinking water through groundwater management. If they choose to allow individuals to keep pumping at the expense of severe drinking water impacts, that is a groundwater management decision that violates their obligation to protect drinking water resources. GSAs must therefore have strong minimum thresholds that protect all drinking water wells from dewatering.

Minimum thresholds are the most pivotal measure for how a GSA will prevent impacts on the sustainability indicators required to be monitored by SGMA. Minimum thresholds are also the point that a GSA must avoid, and could necessitate state intervention. There is some flexibility, however; for groundwater levels, DWR shows in its Sustainable Management Criteria Best Management Practices guide that it will allow a GSA to dip below its minimum threshold for groundwater levels in some cases, as long as its GSP will ensure that it comes back up and towards its measurable objective. Therefore, GSAs should strive to set minimum thresholds at levels that they seek to avoid.

*Recommendation for Groundwater Levels Minimum Thresholds*

We request that all GSAs set all groundwater levels minimum thresholds at a level to provide a buffer above the depth of the top of the screen of the shallowest well. The buffer must be adequate to ensure that the shallowest well does not go dry due to a short or medium-term exceedance of the minimum threshold. The GSAs should only disregard wells that they can prove are not in use. If GSAs choose not to do so, they must take on the responsibility for the wells that do go dry from this policy choice. impact analysis to evaluate how many drinking water wells will go dry, set management areas for shallower minimum thresholds where there are more concentrated shallow domestic wells, and ensure that drinking water is protected by implementing preventive actions such as digging deeper wells and

[14] Water Code sec. 106.
[15] Water Code sec. 106.3

assisting with consolidation projects. It is important to note that prevention, not mitigation, is the only way to effectively protect drinking water resources.

We have not seen Kern River GSA take any steps in protecting wells that serve individuals and communities. Under SGMA, Kern River GSA has the responsibility to ensure that groundwater management serves the interests of all of the beneficial groundwater users in its service area, including homes on private wells as well as small community water systems. It is important for minimum thresholds to be placed at a level that ensures access to water to the most vulnerable populations who most often rely on private wells or small water districts that tend to have more shallow wells than those used for agriculture purposes.

*Other Considerations for Groundwater Levels Minimum Thresholds*

In setting groundwater levels minimum thresholds, GSAs should also set minimum thresholds high enough as to avoid groundwater contamination from over pumping. They should also set minimum thresholds that ensure that rural communities have equitable access to groundwater resources, and have enough for current needs and future growth. GSAs must also factor in the increased costs of pumping and installing new wells if groundwater levels decrease, and avoid additional costs in groundwater access for low income communities dependent on groundwater for drinking water resources. GSAs should also set minimum thresholds for groundwater levels that will prevent subsidence from occurring and disrupting infrastructure that is critical to the health and safety of vulnerable communities, such as private wells, roads, and homes.

**Monitoring Network**

Broadly, GSAs must develop actionable steps to fill data gaps and monitor groundwater levels and groundwater quality. In order to protect drinking water resources, monitoring networks should be closely monitoring impacts on drinking water. In particular to water quality, GSAs should monitor for contaminant concentrations quarterly, and increase monitoring to every month if a water quality test detects higher contamination concentration than the previous water quality test. Testing should also robustly monitor plume migration especially given the high number of groundwater users in the Kings subbasin. The GSA should place monitoring wells near DACs and clusters of domestic wells.

We look forward to providing further recommendations on the monitoring network in the future.

**Transparency and Inclusivity**

As public agencies, GSAs are subject to the requirements of the Brown Act, which requires transparency of public agencies through notice of meetings and prior posting of agendas, posting of meeting minutes after meetings, and public access to meeting materials upon request by a member of the public. In addition to Brown Act requirements, GSAs must also adhere to the specific public participation

and inclusivity requirements for GSP development laid out in SGMA. SGMA expands the public participation requirements of GSAs to also "*encourage the active involvement of diverse social, cultural, and economic elements of the population within the groundwater basin prior to and during the development and implementation of the groundwater sustainability plan.*" (Water Code sec. 10727.8) To assist in GSAs complying with this requirement, DWR has published guidance on public notice and engagement, highlighting good practices for effective engagement. Both the letter and spirit of SGMA communicate that GSAs must conduct GSP development in an open and inclusive way.

In order to comply with the requirements for transparency and inclusivity under the Brown Act and SGMA, ***GSA agendas should contain specific information about the topics to be reviewed, and any action to be taken at the upcoming meeting.*** Additionally, ***meeting minutes should be sufficiently detailed to accurately show what transpired at meetings.*** We acknowledge that Kern River provides interested parties an agenda for the upcoming meeting via email and online via there Kern River GSA website, however these agendas are overly broad, making it difficult for the public to prepare to effectively participate in the meeting. This approach transfers over to the way that the minutes are recorded: minutes are also overly broad; for example, one entry in the meeting minutes from June 20th, 2019 states "Policy Coordination Meeting Update (M. Mulkay) Mark Mulkay, General Manager of Kern Delta Water District, provided update."[16] The minimal way in which meeting minutes are recorded hinders the opportunity for individuals who missed a meeting to understand what was discussed at the meeting. In order to comply with the requirements for transparency and inclusivity under the Brown Act and SGMA, we recommend that Kern River GSA develop more specific agendas and minutes. This will allow the public to effectively participate in the GSP development process and encourage the members of the public to continue to be engaged even if they cannot attend every meeting. to improve.

***A best practice to ensure authentic, meaningful input as required by SGMA is to post meeting materials before the meeting***, so that these materials are available to the public for feedback and engagement. The Brown Act requires these materials to be made available after the meeting upon written request of the public. Paired with SGMA's requirements for robust community engagement, the most effective way to ensure that the public is aware of what will be discussed and acted upon at meetings, and to access critical GSP development information despite not being able to attend one meeting, is to post all meeting materials online before the meeting. However, GSAs would facilitate more effective public engagement at the meetings if they were to post meeting presentations ahead of time, so that attendees could view the discussion items and data before the meeting. We are aware that Kern River GSA has a dedicated website in which they upload agendas, minutes, and presentations for public access. We request that Kern River GSA make all meeting materials available before each meeting by posting them on their website and sending them out via the interested parties email listserv.

[16] The agenda and minutes from this conversation can be found here: https://www.kerncog.org/wp-content/uploads/2019/06/COG_agenda_20190620.pdf

GSAs should also ***dedicate sufficient funding to ensure meaningful, effective, and accessible engagement of the public***. We, along with Self-Help Enterprises and Community Water Center, have worked with many GSAs' consultants to improve outreach to disadvantaged communities. With other GSAs, we have helped give input on workshops, and have helped conduct outreach for those workshops. We have also kept community residents informed about GSP developments at community meetings. We recommend that Kern River GSA host inclusive community workshops at times and locations that are accessible for a variety of stakeholders, work with organizations like ours and Self-Help Enteprises to host workshops and conduct outreach to disadvantaged communities, and provide food and translation services at workshops. Given the type of outreach that is necessary in order to engage disadvantaged communities, GSAs should also hire bilingual staff or consultants who can help conduct door-to-door outreach, attend community meetings, translate materials, and interpret at all GSA meetings. In creating annual operating budgets, GSAs should prioritize funding for these necessary outreach activities.

Lastly, GSAs ***must make GSP development decisions at public meetings***, and must not make decisions behind closed doors. Making substantive GSP development decisions outside of public meetings goes against the requirements of the Brown Act, as well as SGMA's requirements for "*consideration of all interests*" and "*encourage[ment] of active involvement*" of the public "*during the development...of the groundwater sustainability plan.*" (Water Code sec. 10723.2 and 10727.8) We are aware that Kern River GSA conducts 'manager meetings' as well as 'stakeholder meetings.' However, it has come to our attention that by the time items come to the stakeholder meeting, decisions have already been discussed extensively within manager meetings and are only presented in the stakeholder meetings as informational items, which then go to the board for approval. We encourage and recommend Kern River GSA to be more transparent about what is talked about at Manager meetings, and allow stakeholders at the stakeholder meetings to weigh in on decisions.

***Water districts must also adhere to the requirements of the Brown Act in their SGMA-related activities that have been delegated to them by Kern River GSA.*** The requirement under the Brown Act for legislative agencies like Kern River GSA to only "take action" at public meetings also applies to the water districts to whom the GSA has delegated decision-making power over sustainable management criteria.[17] Water districts are making those decisions at meetings that are not open to the public and are not noticed and agendized in compliance with the Brown Act or the requirements under SGMA for transparency and inclusivity. We recommend that the GSA require all water districts to notice and agendize their meetings, and only make SGMA decisions in public fora where members of the public can attend and participate.

**Projects and Management Actions**

[17] Gov. Code sec. 54952(c)(1)(A): As used in this chapter, "legislative body" means: A board, commission, committee, or other multimember body that governs a private corporation, limited liability company, or other entity that either: Is created by the elected legislative body in order to exercise authority that may lawfully be delegated by the elected governing body to a private corporation, limited liability company, or other entity.

Projects and Management Actions are a crucial part of the GSP, since they demonstrate how the GSA plans on attaining the sustainability goals that they have set out. Therefore, GSAs should also set specific timelines and triggers for specific projects. In addition, GSAs should include projects to prevent domestic drinking water impacts from lack of protection of domestic and community wells, particularly in disadvantaged communities that are unable to afford the high cost of replacing drinking water infrastructure.

We look forward to presenting more comments on the GSA's projects and management actions in the future.

**Groundwater Markets**

We have engaged in many discussions around the state about groundwater markets, and continue to warn against them. Commoditizing precious drinking water resources is dangerous and inequitable, since it lets those with more purchasing power have access to more water, and more likely than not will lead to concentrations of over-pumping by large agribusinesses, leaving nearby communities without drinking water. Furthermore, given all GSAs' severe lack of data on domestic wells and water use in their service areas, and our region's lack of understanding of how a market could impact groundwater use and subsurface groundwater flows, implementing groundwater markets now would be precipitous and foolish.

We strongly discourage and oppose the idea of putting groundwater markets into place where communities have already been exhausted of their resources and already carry financial burden to attain basic necessities. Water markets will increase the monetary value of water, hence perpetuating the idea that the wealthy will continue to have access to water leaving the most vulnerable, disadvantaged communities with an uncertainty to their access to water, which is a human right in the state of California. The power of what water markets are able to become, goes against California's declaration of water as a human right in of itself.

We look forward to giving more feedback in the future on the impact of groundwater market on drinking water resources in the GSA area.

~~~~~~~

We look forward to speaking more in depth with consultants, staff, stakeholder committee members and the Board of Directors about our recommendations. We hope that Kern River GSA will consider and incorporate the above recommendations, and hope to collaborate with the GSA to ensure that the GSP protects the subbasin's most vulnerable drinking water users. We are also in communication with the Department of Water Resources about current GSP development activities in the San Joaquin Valley, and hope to successfully work with Kern River GSA and DWR to ensure that groundwater management is equitable and sufficiently protective of vital drinking water resources.
~~~~~~~


Sincerely,

Jasmene Del Aguila and Amanda Monaco
Leadership Counsel for Justice and Accountability

NEW YORK
LONDON
SINGAPORE
PHILADELPHIA
CHICAGO
WASHINGTON, DC
SAN FRANCISCO
SILICON VALLEY
SAN DIEGO
LOS ANGELES
TAIWAN
BOSTON
HOUSTON
AUSTIN
HANOI
HO CHI MINH CITY

DuaneMorris®

FIRM and AFFILIATE OFFICES

COLIN L. PEARCE
DIRECT DIAL: +1 415 957 3015
PERSONAL FAX: +1 415 704 3098
E-MAIL: CLPearce@duanemorris.com

www.duanemorris.com

SHANGHAI
ATLANTA
BALTIMORE
WILMINGTON
MIAMI
BOCA RATON
PITTSBURGH
NEWARK
LAS VEGAS
CHERRY HILL
LAKE TAHOE
MYANMAR
OMAN
A GCC REPRESENTATIVE OFFICE OF DUANE MORRIS

ALLIANCES IN MEXICO
AND SRI LANKA

August 13, 2019

**VIA EMAIL AND U.S. MAIL**

Jasmene del Aguila
Amanda Monaco
Leadership Counsel for Justice and Accountability
1527 19th Street, Suite 212
Bakersfield CA 93301

**Re: July 10, 2019 Letter to Kern Delta Water District and KRGSA**

Dear Ms. del Aguila and Ms. Monaco:

This letter responds to the July 10, 2019, letter from the Leadership Counsel for Justice and Accountability ("Counsel") which you delivered to the Kern River Groundwater Sustainability Agency ("KRGSA") at its July 11, 2019 regular meeting, in Bakersfield, California. I understand you also emailed the letter to the Kern Delta Water District ("Kern Delta") prior to the KRGSA meeting.

I am special water counsel for the City of Bakersfield ("City"). The KRGSA consists of the City, Kern Delta and Improvement District No. 4 ("ID 4") of the Kern County Water Agency. The City authorized me to respond to your letter on behalf of the KRGSA and its member agencies.

Your letter states that the Counsel is involved in the Sustainable Groundwater Management Act ("SGMA") implementation process. The letter states that the Counsel is "concerned that drinking water impacts and disadvantaged community input have not been adequately analyzed and incorporated into the draft GSP." The letter also refers to an "umbrella approach that Kern basin GSAs are using to create GSPs in collaboration with local water districts," and further refers to "local GSP chapters" that are being created by water districts for "their particular service areas."

We are not sure what "draft GSP" your letter references. The KRGSA has not yet disseminated a draft Groundwater Sustainability Plan ("GSP") for public review. The KRGSA further does not intend to have its members utilize an "umbrella approach" to GSP preparation, or have its members prepare separate or distinct "GSP chapters" for their service areas. The KRGSA instead intends to prepare and distribute for public review a single GSP for the entire KRGSA service area. The KRGSA's GSP will thereafter be coordinated with GSPs prepared by other GSAs within the Kern Subbasin, to produce "a single plan covering the entire basin developed and implemented by multiple groundwater sustainability agencies." (Water Code §10727.)

Your letter also recommends that the KRGSA take a number of "actions" to "ensure that drinking water is protected, especially for the communities whose drinking water is severely at risk from groundwater management activities." (P. 1.) Your letter contends that these actions are required by SGMA as part of the process of developing sustainable management criteria.

Although we appreciate your suggestions and recommendations with regard to the contents of a GSP, we do not believe your letter accurately states or represents the requirements of SGMA, or the obligations of GSAs in connection with water quality issues.

In particular, we do not agree that "GSAs now have the responsibility to protect drinking water through groundwater management." (P. 5.) Enhancement or protection of water quality is not listed as one of the purposes or goals of SGMA. SGMA instead was intended to (1) provide for the sustainable management of groundwater basins, (2) enhance local management of groundwater consistent while preserving the security of water rights in the state, (3) establish minimum standards for sustainable groundwater management, (4) provide local agencies with the authority and technical and financial assistance necessary to sustainably manage groundwater, (5) avoid or minimize subsidence, (6) improve data collection and understanding about groundwater, (7) increase groundwater storage and remove impediments to recharge, (8) manage groundwater basins locally while minimizing state intervention, and (9) provide a more efficient and cost-effective groundwater adjudication process. (Water Code §10720.1.)

Federal, State and local agencies still have primary responsibility for protecting drinking water, and water quality. SGMA did not authorize or direct GSAs to assume authority or responsibility for the regulation of water quality. SGMA was not intended to limit or alter the authority of the State Water Resources Control Board, the Department of Water Resources, the State Department of Public Health, or any other regulatory agency. (Water Code §10726.8(c).) SGMA does not supersede "the land use authority of cities and counties." (Water Code §10726.8(f).) SGMA additionally was not intended to and does not determine or alter surface water rights or groundwater rights. (Water Code §10720.5(b).)

We do recognize that GSPs should "discuss how groundwater conditions at a selected minimum threshold could affect beneficial uses and users." (P. 2, n. 4.) We understand that GSPs should, "as applicable to the basin," address the "monitoring and management of

groundwater quality, groundwater quality degradation, inelastic land surface subsidence, and changes in surface flow and surface water quality that directly affect groundwater levels or quality or are caused by groundwater extraction in the basin." (Water Code §10727.2(d)(2).) We also acknowledge that GSPs should avoid "undesirable results," which are defined to include "significant and unreasonable degraded water quality, including the migration of contaminant plumes that impair water supplies." (Water Code §10721(x)(4).)

We do not agree, however, that GSAs must establish Maximum Contaminant Levels (MCLs) for groundwater contaminants, or set "minimum thresholds for water quality." We further do not agree that GSPs should direct or authorize its members to assume responsibility for "monitoring groundwater quality under the Kern River/ Kern Groundwater Authority GSA's Groundwater Sustainability Plans," or to "monitor all primary drinking water contaminants, as well as chrome-6." (P. 4.)

SGMA does not require member agencies to monitor or test for drinking water contaminants, as part of the GSP process or in connection with the implementation of a GSP. SGMA does not expand or increase existing monitoring and testing requirements for water quality conditions. SGMA does not require GSAs to address or include water quality conditions in their regular reports to the State following adoption of a GSP. (Water Code §10728.)

GSPs instead are only required to address, in connection with water quality issues, "migration of contaminated groundwater," and "measures addressing groundwater contamination cleanup, groundwater recharge, in-lieu use, diversions to storage, conservation, water recycling, conveyance, and extraction projects." (Water Code §10727.4.) Those matters, moreover, need only be addressed in a GSP "where appropriate and in collaboration with the appropriate local agencies." (*Id.*)

SGMA further does not require GSAs or members of GSAs, as part of the GSP process, to "establish" or consider any alleged causality between management and contamination, as you claim at page 5 of your letter. GSAs are additionally not required to "place management areas around areas where there are a high number of vulnerable private well owners and community water systems." (P. 5.)

We still welcome comments and input from members of the public and interested organizations, including the Counsel, in the SGMA process. The KRGSA will take the comments in your letter, which are relevant and applicable to SGMA and the preparation of GSPs into consideration in the course of preparing and implementing the GSP for the KRGSA.

We also acknowledge and appreciate your suggestions and comments regarding engagement of the public in the SGMA and GSP planning process. The KRGSA has undertaken many of the steps proposed in your letter in order to engage and inform the public during the SGMA and GSP process. The KRGSA conducted or participated in a number of community meetings and forums, and has made direct outreach to members of the community, including to

disadvantaged communities. The KRGSA has also complied with the requirements of the Brown Act, and otherwise made decisions and had discussions regarding the GSP and SGMA at properly noticed public meetings.

The KRGSA has considered, and intends to continue to consider, "the interests of all beneficial uses and users of groundwater," including, but not limited to, domestic well owners, public water systems, and "[d]isadvantaged communities, including, but not limited to, those served by private domestic wells or small community water systems." (Water Code §10723.2.) Through its education and outreach efforts, the KRGSA, and its members, have "actively engag[ed] with all types of beneficial users and encouraging the participation of local grassroots organizations as GSP chapters are being developed," as you recommend in your letter.

We thank you for your comments and suggestions. We look forward to working with you and other members of the public through the process of preparing, adopting and implementing the GSP for the KRGSA, and coordinating GSPs for the entire subbasin.

Sincerely,

Colin L. Pearce

CLP:bah

cc: City of Bakersfield,
Kern Delta Water District
Improvement District No. 4 of the Kern County Water Agency

Item 7a

## Kern River Groundwater Sustainability Agency (GSA)

# GROUNDWATER SUSTAINABILITY PLAN (GSP) REVIEW WORKSHOP

To comply with the Sustainable Groundwater Management Act (SGMA), the Kern River GSA developed a Groundwater Sustainability Plan (GSP) that will serve as a roadmap for how groundwater will be sustainably managed for years to come.

The draft GSP is now available for a 90-day public review period that will end on November 27, 2019. The Kern River GSA will host two workshops to review the plan and allow members of the local community to provide comments. **These workshops will discuss important issues that can affect the water you use in your home. Your comments on this plan are vital to helping address water quality and water supply challenges in your community.**

**DISCUSSION TOPICS:**

- What is the Sustainable Groundwater Management Act (SGMA)?
- Your local Groundwater Sustainability Agency (GSA)
- How can SGMA affect me and my community?
- **Review the Groundwater Sustainability Plan**

**Workshop #1:**
**Date:** Tuesday, October 15, 2019
**Time:** 5:30 – 7:30 p.m.
**Location:** Stan Keasling Community Room
601 Douglas St.
Bakersfield, CA 93308

**Workshop #2:**
**Date:** Wednesday, November 6, 2019
**Time:** 5:30 – 7:30 p.m.
**Location:** David Head Center
10300 San Diego St.
Lamont, CA 93241

**Community residents, private well owners, residents on community water systems, and water and school board members are encouraged to attend.**

**Spanish translation service is available.**

**To RSVP for either workshop (not required), please visit http://bit.ly/KRGSAReview or contact Eva Dominguez at (559) 802-1634 or EvaD@SelfHelpEnterpises.org.**

KRGSA

KERN RIVER GROUNDWATER SUSTAINABILITY AGENCY