Perspectives on Water in California

Moderated by:
Dr. Frank A. Gomez
Executive Director, STEM-NET
Office of the Chancellor &
Dr. Steve Blumenshine,
Executive Director, CSU-WATER

STEM-NET

The California State University
WATER ADVOCACY TOWARDS EDUCATION & RESEARCH

https://www2.calstate.edu/impact-of-the-csu/research/stem-net

Speakers

Karl Longley & Walter Mizuno & Sarge Green (Ret.), California Council on Science & Technology (CCST)
Water Salinity & Direct Air Capture Research: Salinity & Removing Carbon from Air

Erick Orellana, Community Water Center
Water Justice in Rural California Communities

Jon Reiter, Golden State Clean Energy
Valley Clean Infrastructure Plan

Larry Dale, Lawrence Berkeley National Laboratories (LBNL)
The Number and Location of Irrigation Wells in the Central Valley

Water Salinity & Direct Air Capture

Research: Salinity & Removing Carbon from Air

Karl Longley, PE, ScD, Professor Emeritus, CSU, Fresno
Walter Mizuno, Professor Emeritus, CSU, Fresno
Sarge Green, Research Scientist, CSU, Fresno

THE PROBLEM
Water-supply sustainability risk index in 2050

Source: U.S. Geological Survey (2017) *Brackish Groundwater in the United States.*

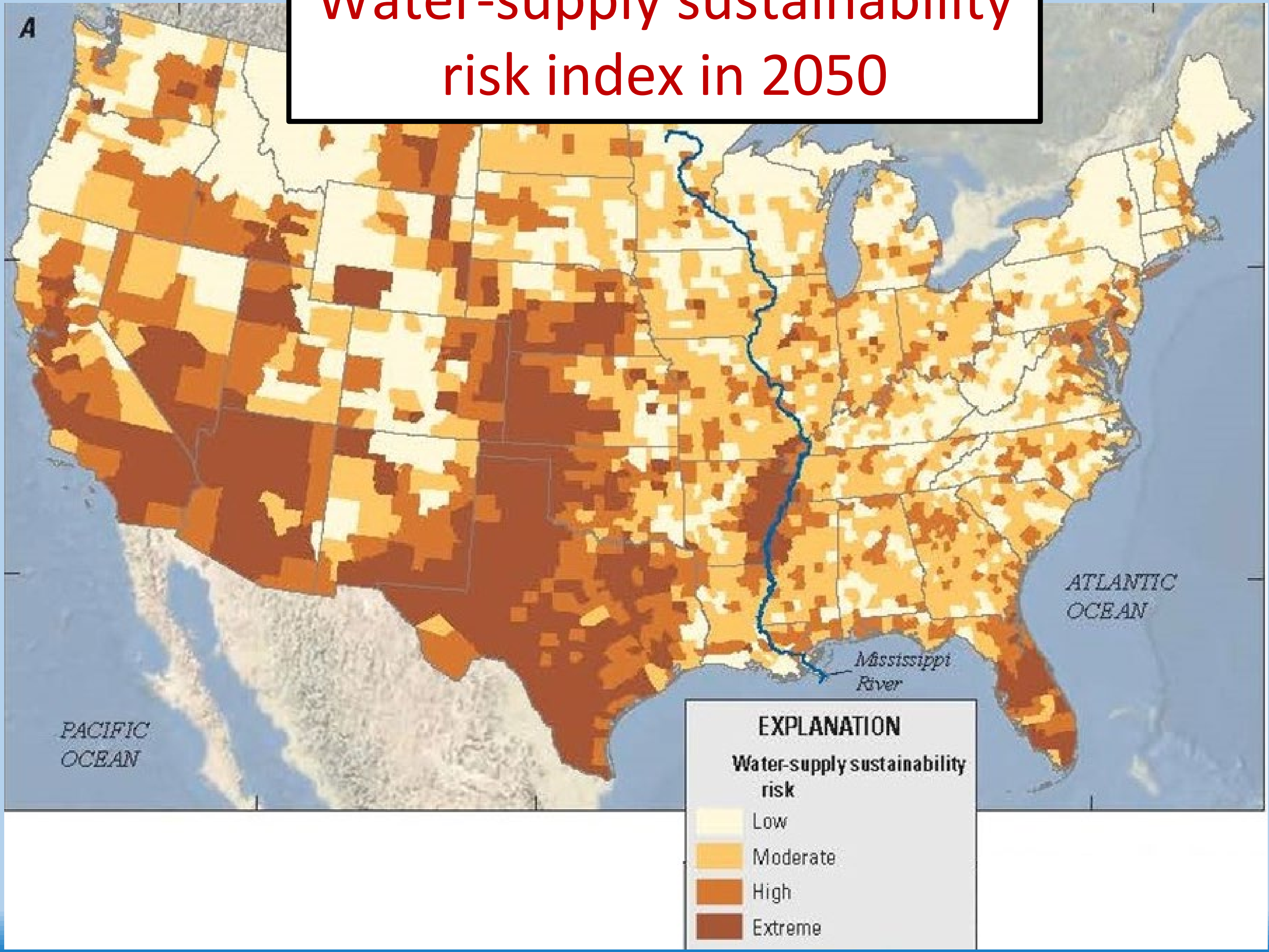
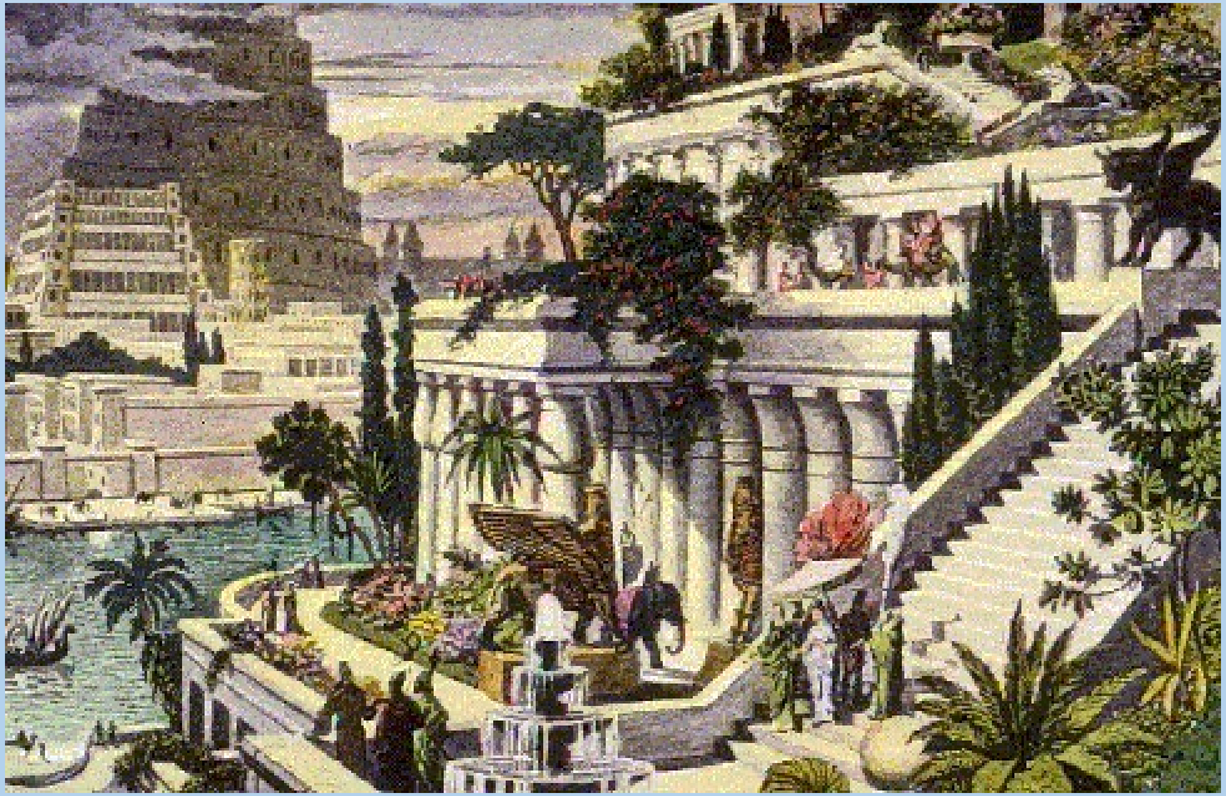
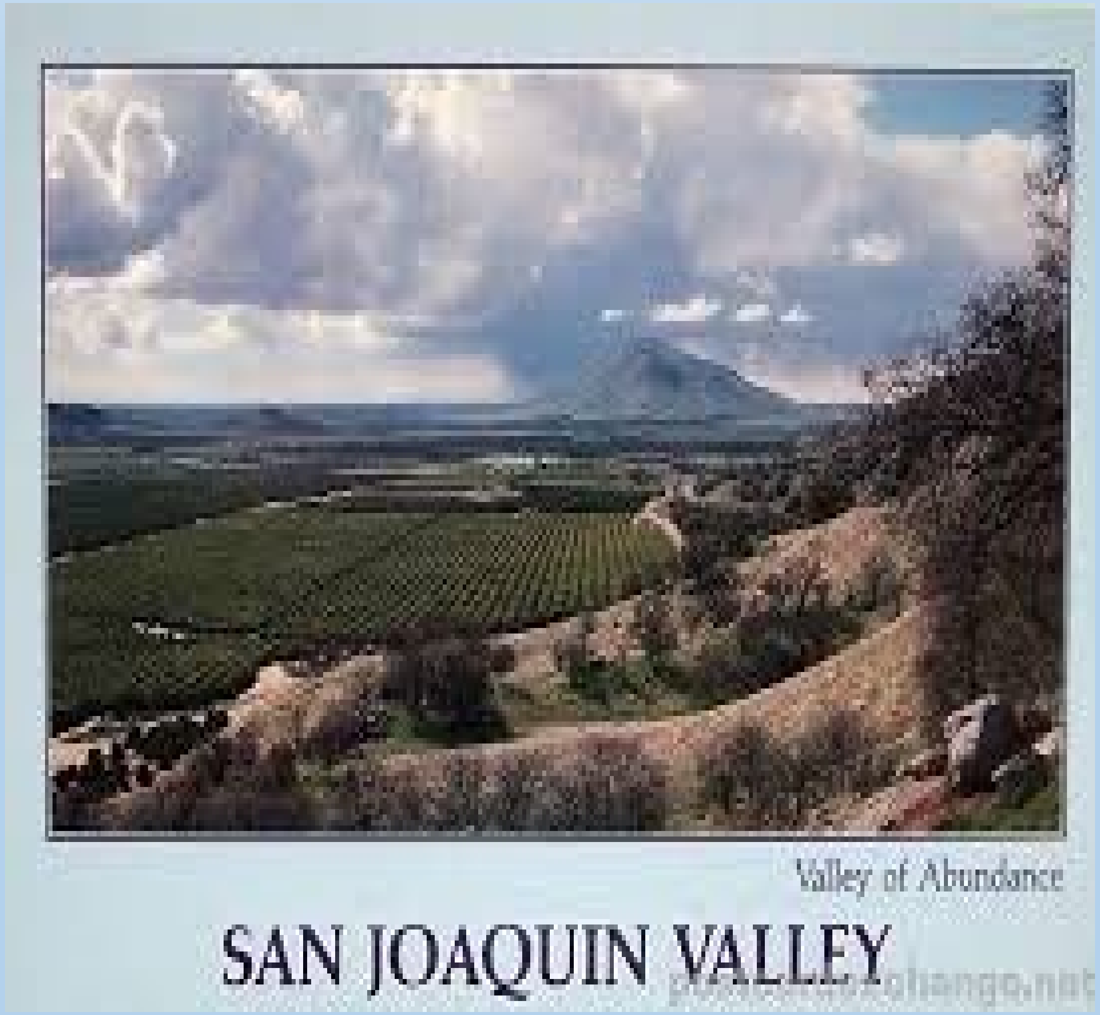


Fig A: Water-supply sustainability risk index for the conterminous United States in 2050 linking water demand to population growth, increases in power generation, and climate change Modified from Roy and others (2012).



The ancient Hanging Gardens of Babylon in the palace of Nebuchadnezzar II (604-562 BC), one of the ancient Seven Wonders of the World



San Joaquin Valley Agriculture, Currently A Wonder of the World

Technology & Application Challenge

Waste brine streams are produced by desalting projects.

What do you do with it?

Image: Saltworks (www.saltworkstech.com/articles/how-to-manage-brine-disposal-and-treatment/)

Ideal Desalination Process Model

Energy required minimized

Chemicals required minimized

Use of saline water sources maximized

Ideal System

Water recovery maximized

Valuable constituent recovery maximized

Waste generated minimized

Cost minimized

Carbon footprint minimized

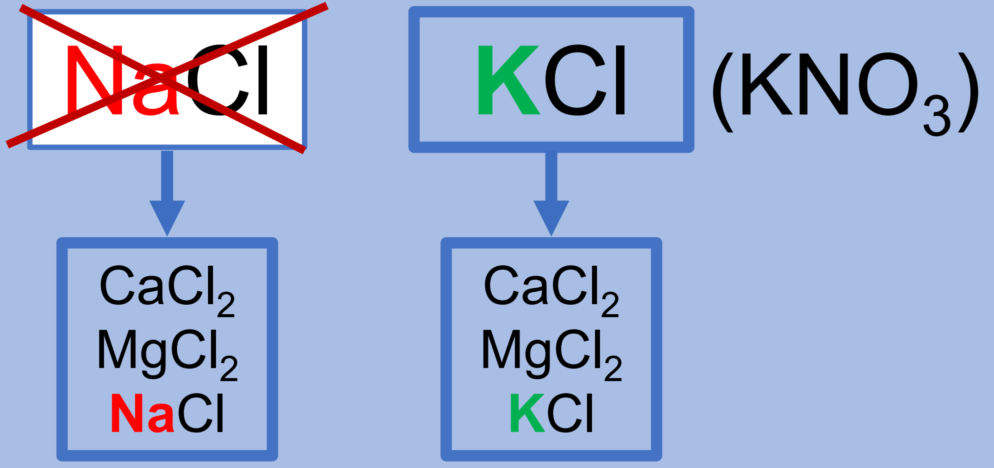
Reliability maximized

Complexity minimized

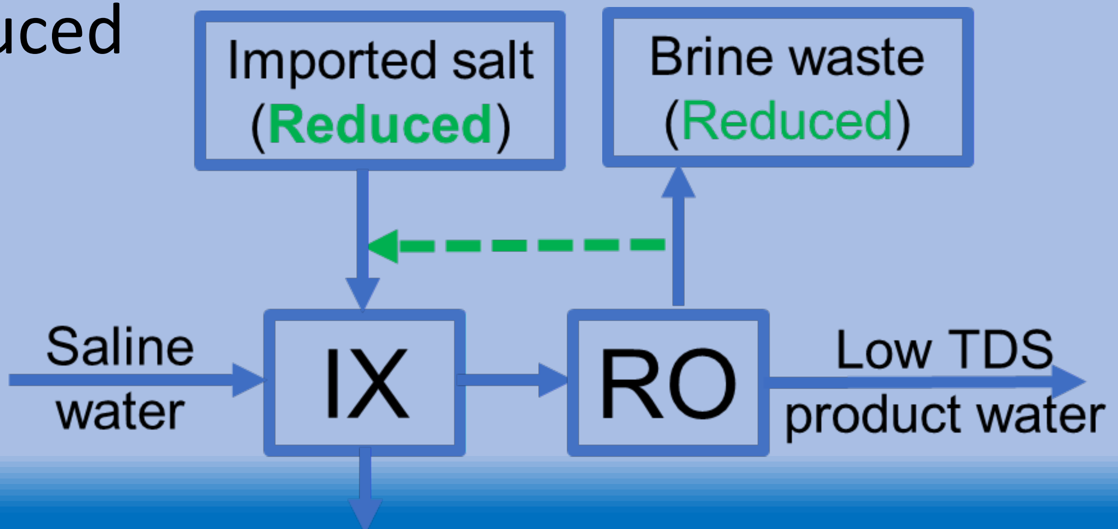
Current Project – DWR Prop 204

Objectives:

1. **Optimize IX operation** (see diagram on next slide):
   A. Use environmentally friendly KCl to regenerate the IX resin.
      - K is a plant nutrient
      - Eliminates adding Na to the waste stream.

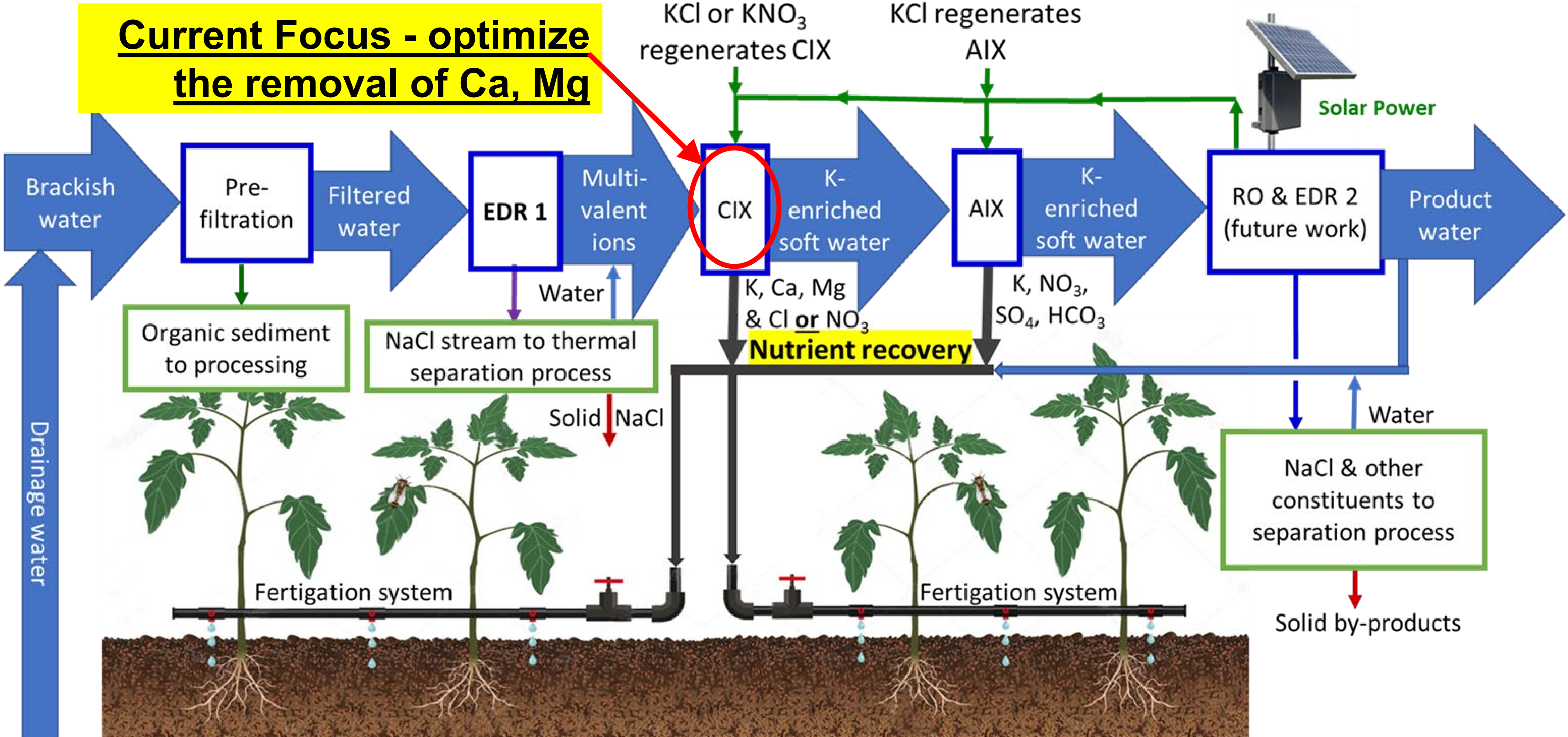


   B. Regenerate the resin using brine produced by the desalter, thereby reducing the amount of imported salt required and waste brine produced.



CSU The California State University Agricultural Research Institute | FRESNO STATE | California Water Institute Lyles College of Engineering | CALIFORNIA DEPARTMENT OF WATER RESOURCES | UCLA Samueli School of Engineering | S&A Stringfellow & Associates | Agua DB water to drink | Jordan Agricultural Research Center

Production of Agricultural Water and Nutrients from Saline Water Sources



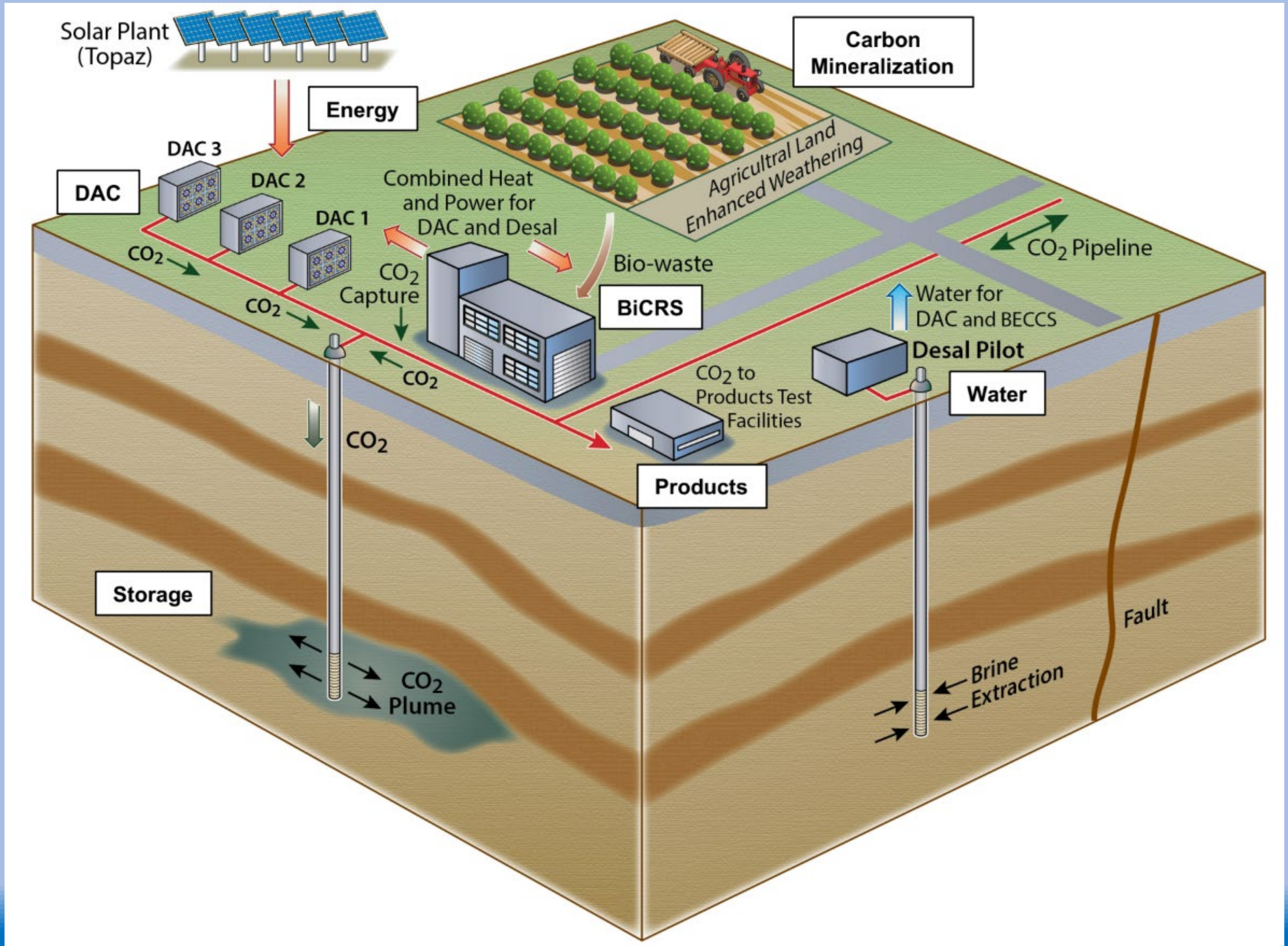
Regional Direct Air Capture HUB Proposal:

Community ALliance for Direct Air Capture (CALDAC)

Topic Area 1, Phase 0 Project: Feasibility Study

CALDAC Vision:

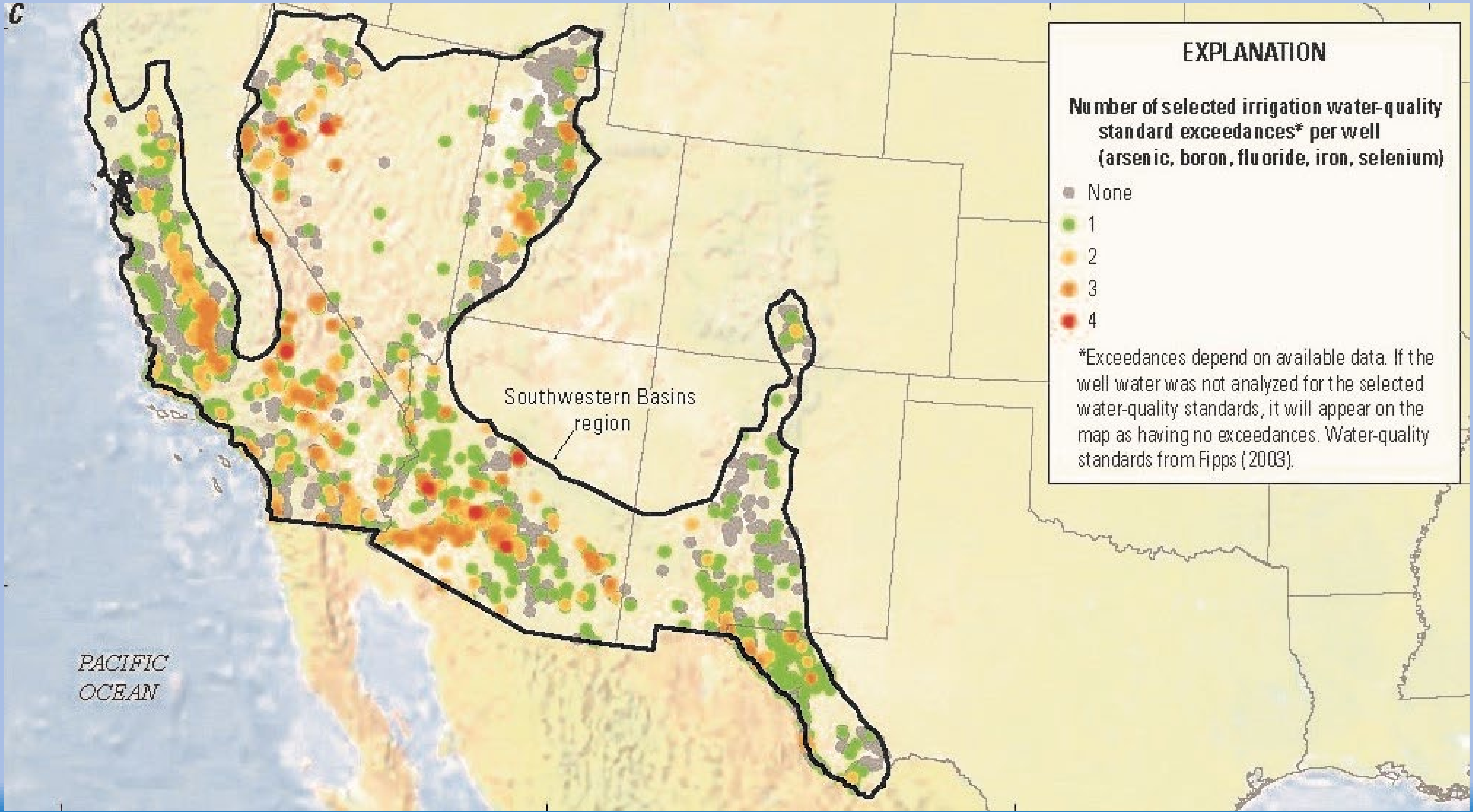
A connected hub that integrates multiple DAC technologies, other carbon removal approaches, carbon utilization solutions, carbon-free, clean energy providers and energy storage solutions, water management, as well as geologic storage providers.



CALDAC - Water Sources for CO_2 Stabilization, Process Waters & Other Uses

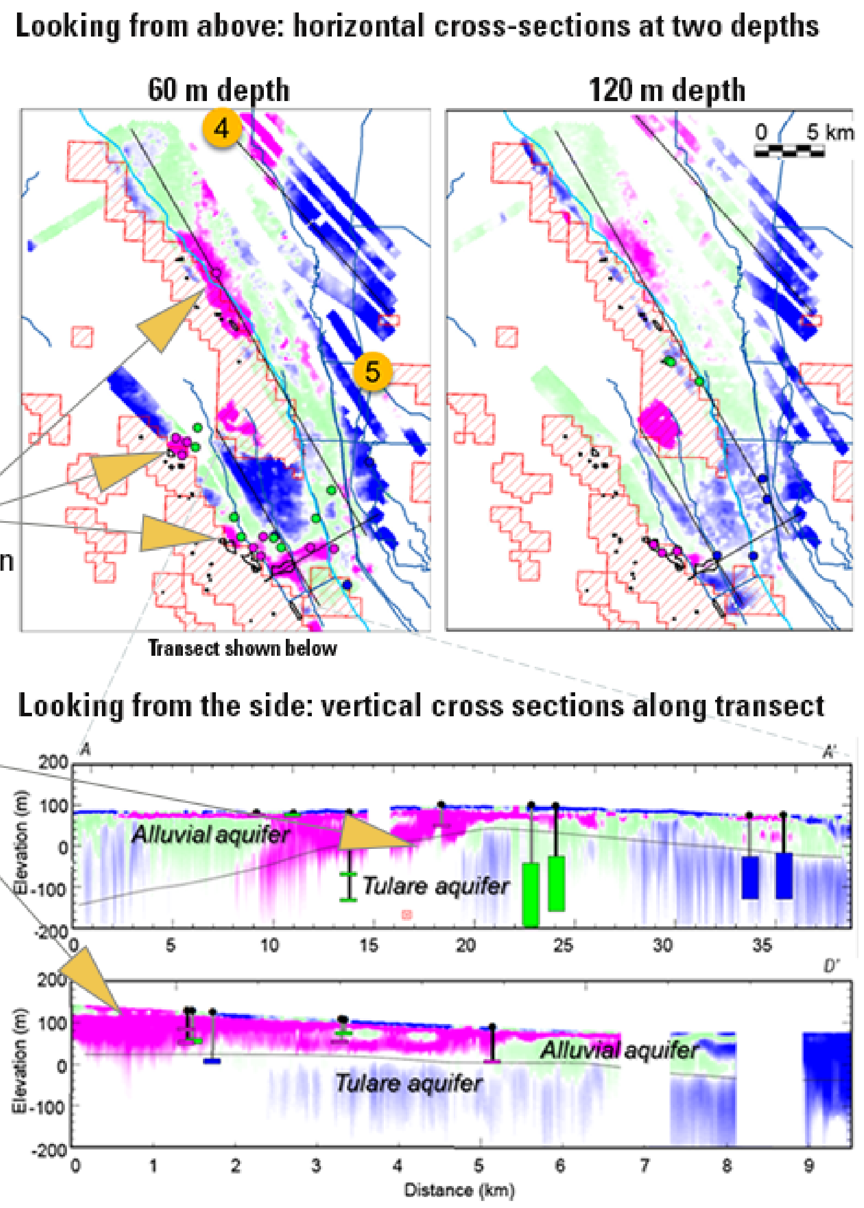
- Ag. drainage water
- Brackish groundwaters
- Brackish surface waters
- Produced water (oil & gas industry)
- Industrial wastewater
- Municipal wastewater

Fig. 36. Locations of wells producing brackish groundwater from 0 to 3,000 feet below land surface in the Southwestern Basins region.



Source: U.S. Geological Survey (2017) *Brackish Groundwater in the United States.*

Distribution of Shallow Groundwater Salinity in Western San Joaquin Valley



Higher salinity groundwater found in the alluvial aquifer near historical produced water disposal ponds

Source: USGS CA Water Science Center and CA Oil, Gas, and Groundwater Program

An interesting read on the California brackish water situation you can Google Mavens brackish water):

THANK YOU

Addressing Drinking Water Challenges in California Disadvantaged Communities

Erick Orellana

COMMUNITY WATER CENTER
EL CENTRO COMUNITARIO POR EL AGUA

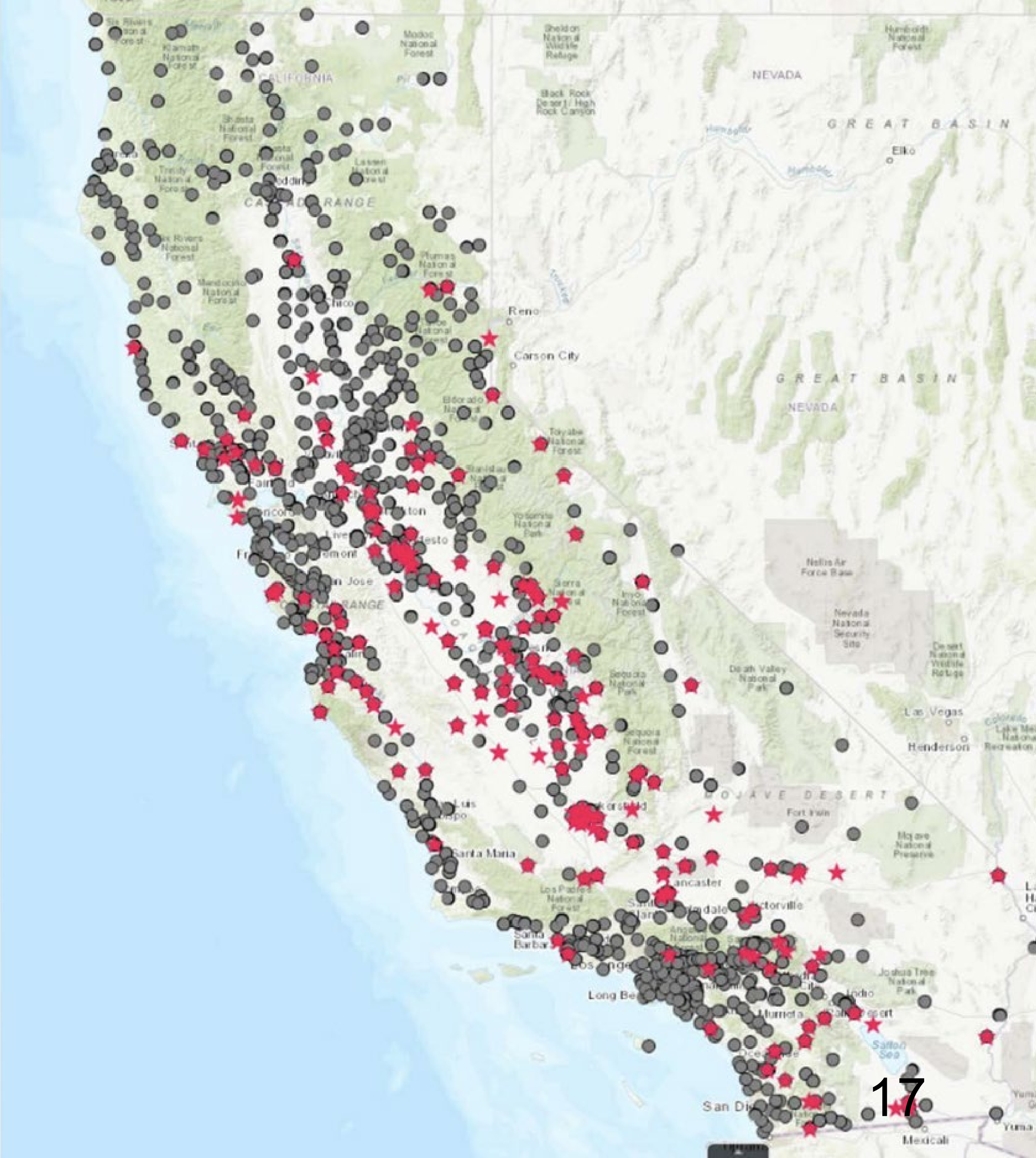
Our Mission

Act as a catalyst for community water solutions through organizing, education and advocacy in California.

Our Vision

Ensure that ALL Californians have access to safe, clean and affordable water.

Nearly 1M people in California are impacted by unsafe drinking water each year



Public water systems out of compliance with drinking water standards (as of Feb 2019) are denoted by a star.

Source: Human Right to Water Portal, CA State Water Resources Control Board

Communities

Water Quality

Infrastructure

Water Affordability

Climate Change

AGUA Coalition

Community-Driven Policy Advocacy

- Consult community to understand their priorities
- Educate communities about project funding and implementation process
- Policy for community, by community

CLEAN WATER ACTION

COMMUNITY WATER CENTER
EL CENTRO COMUNITARIO POR EL AGUA

LEADERSHIP COUNSEL FOR JUSTICE & ACCOUNTABILITY

June 1, 2021

Jeanine Townsend, Clerk to the Board
State Water Resources Control Board (SWRCB)
1001 I Street, 24th Floor
Sacramento, CA 95814
Sent via commentletters@waterboards.ca.gov

RE: Comment Letter, Drinking Water State Revolving Fund 21-22 Intended Use Plan

Dear SWRCB Board Members and Staff,

We are pleased to submit the following comments for the Drinking Water State Revolving Fund (DWSRF) 21-22 Intended Use Plan (IUP), on behalf of the undersigned Environmental Justice organizations. Our organizations work in and alongside communities that have experienced severe drinking water challenges for decades. We write our comments with a commitment to ensure State policies and processes are beneficial to such communities. As mentioned in the Intended Use Plan, the DWSRF's ultimate goal is to finance infrastructure improvements to support Californians' Human Right to Water (HR2W). We hope that our comments are received with significant consideration in light of the urgency and importance of addressing the problems which the Intended Use Plan seeks to resolve.

The 21-22 Intended Use Plan draft demonstrates that the SWRCB is poised to take commendable strides towards addressing the barriers to many Californians' lack of access to clean drinking water. In order to ensure that the SWRCB's efforts are efficient and effective, we recommend that the SWRCB take the following steps:

1. Develop a clear and consistent methodology for assessing financial need/eligibility for work conducted on private property
2. Reassess the current IUP per-connection funding target
3. Develop new metrics to assess project success and timeliness
4. Clarify the status of current project assistance to HR2W list systems
5. Identify how the needs of "at-risk" systems will be addressed

Technical Assistance Projects

- West Goshen, CA (Central Valley - Tulare County)
- East Orosi, CA (Central Valley - Tulare County)
- N of Moss Landing (Central Coast - Monterey County)
- Springfield (Central Coast - Monterey County)

San Joaquin Valley, West Goshen

Community Water Leaders Network

Safe and Affordable Drinking Water Fund (SB200)

- Signed into law by Governor Newsom in July 2019
- $1.4 billion over 11 years
- Provide universal access to safe drinking water focused on most vulnerable communities and households
- Includes funding for ~2M people not served by public water systems including domestic wells

Safe Water Resources

Questions?

- Sign-up to receive monthly newsletters on water justice: **CommunityWaterCenter.org**

- Follow us on social media!

Erick Orellana, Senior Policy Advocate
Erick.Orellana@communitywatercenter.org

VALLEY CLEAN
INFRASTRUCTURE PLAN

POWERING CALIFORNIA FORWARD

Speaker: Jon Reiter
Presented at the Lender Meeting
December 4, 2023

GOLDEN STATE
CLEAN ENERGY

VALLEY CLEAN INFRASTRUCTURE PLAN

What is the 'Valley Clean Infrastructure Plan'?

- Public-Private Collaboration between WWD and GSCE to develop solar and transmission assets on WWD-owned retired lands and privately-owned fallowed lands

- WWD will contribute land, serve as CEQA lead agency and have a right to co-invest

- GSCE will source private lands for scale, secure transmission corridors, permit solar generation , solar storage and transmission

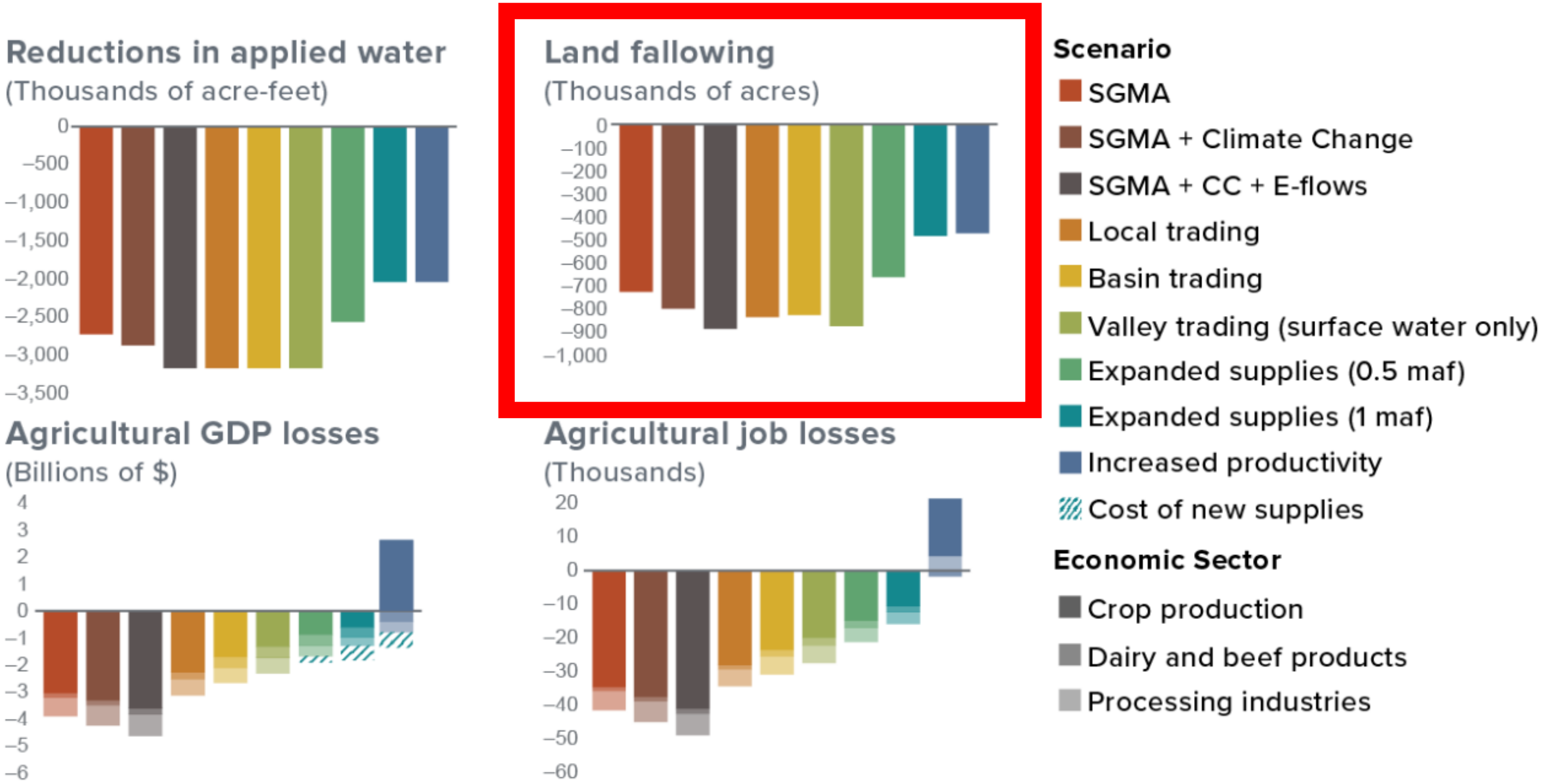
- GSCE will develop and build transmission to serve all lands in the VCIP program

GOLDEN STATE CLEAN ENERGY

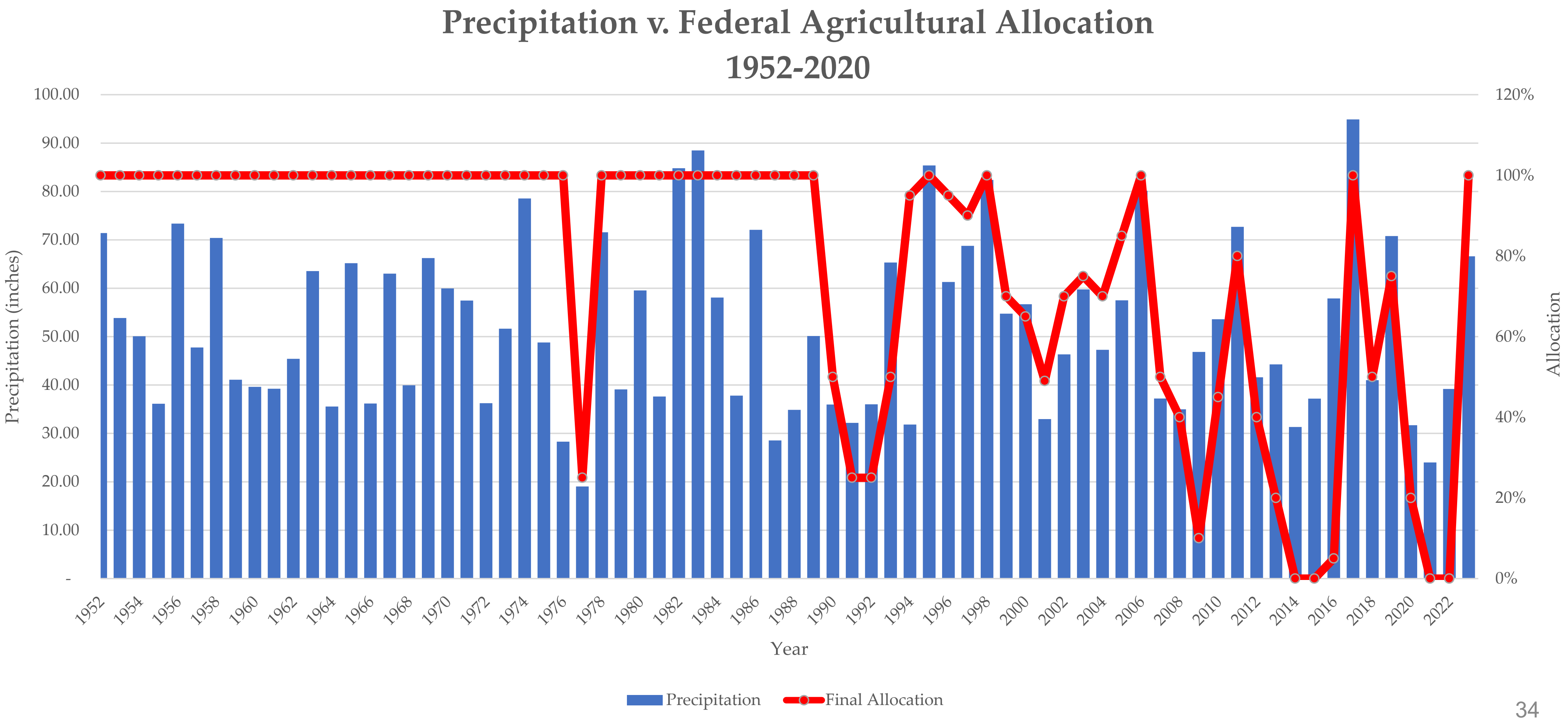
Westlands Water District

SGMA: Declining Groundwater Supplies

By 2040, water trading, new supplies, and increased productivity can temper the impacts of farm water reductions



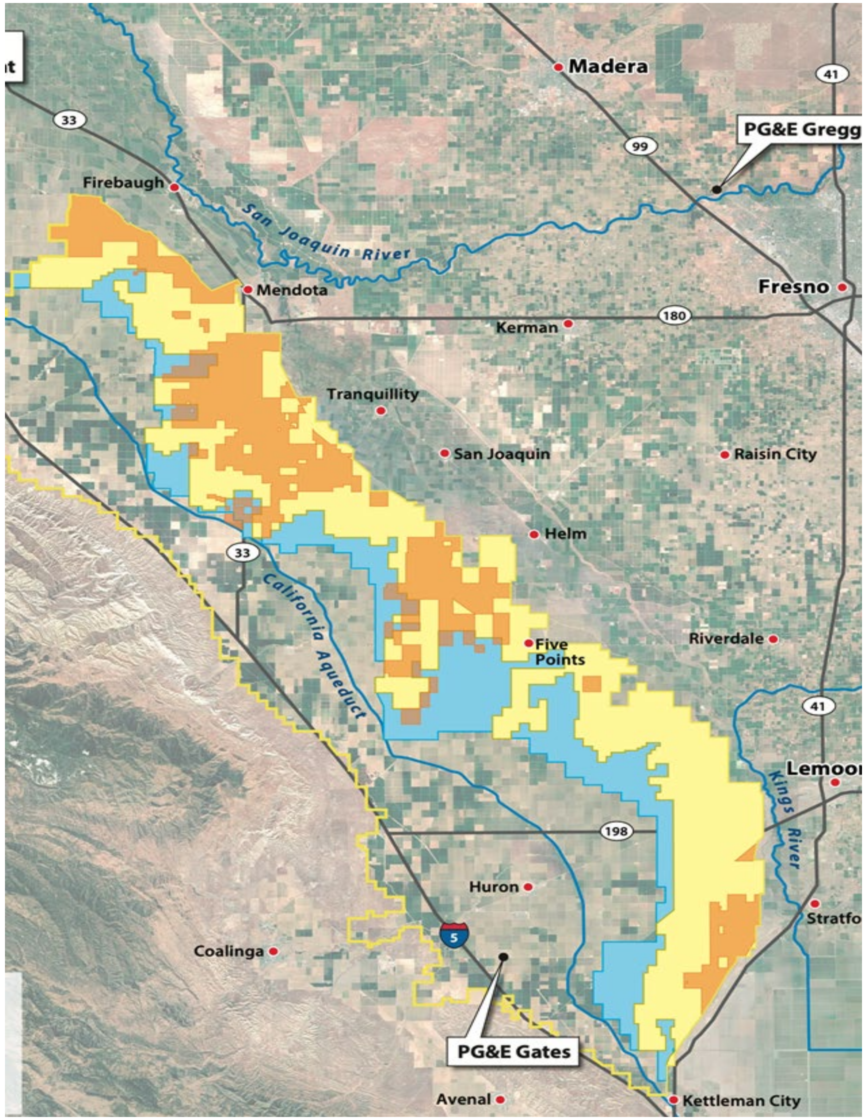
Volatile Surface Water in Westlands



Unique Opportunity and Timing for Westlands

- California has committed its utilities to **100% renewable energy by 2045**
  - Overlaps SGMA implementation period
  - DWR was added to the mandate in 2022
- California is **already behind** in developing renewable energy
  - Plans call for 6,000 -7,000 MWs of new generation and storage per year
  - CA in past decade has only succeeded in adding an average of 1,000 MWs of solar and 300 MWs of wind each year
- Studies show that **500,000 – 750,000 acres** of new solar energy may be needed between now and 2045; desert areas of California have habitat and species challenges

Size of Westlands Opportunity



- Westlands has **more contiguous retired and fallowed lands** in the San Joaquin Valley (SJV) than any other region

- Estimates show that that there are as much as-
  - **60,000+ acres** (*estimate*) of District owned lands that are fallowed or retired (approximately 10% of the District); plus
  - **200,000+ acres** (*estimate*) of similar privately owned lands

- Landowners can **unlock the value** in underutilized open lands
  - Retain water for farming
  - Generate non-water related revenue
  - Cost avoidance for the owner (taxes and maintenance)

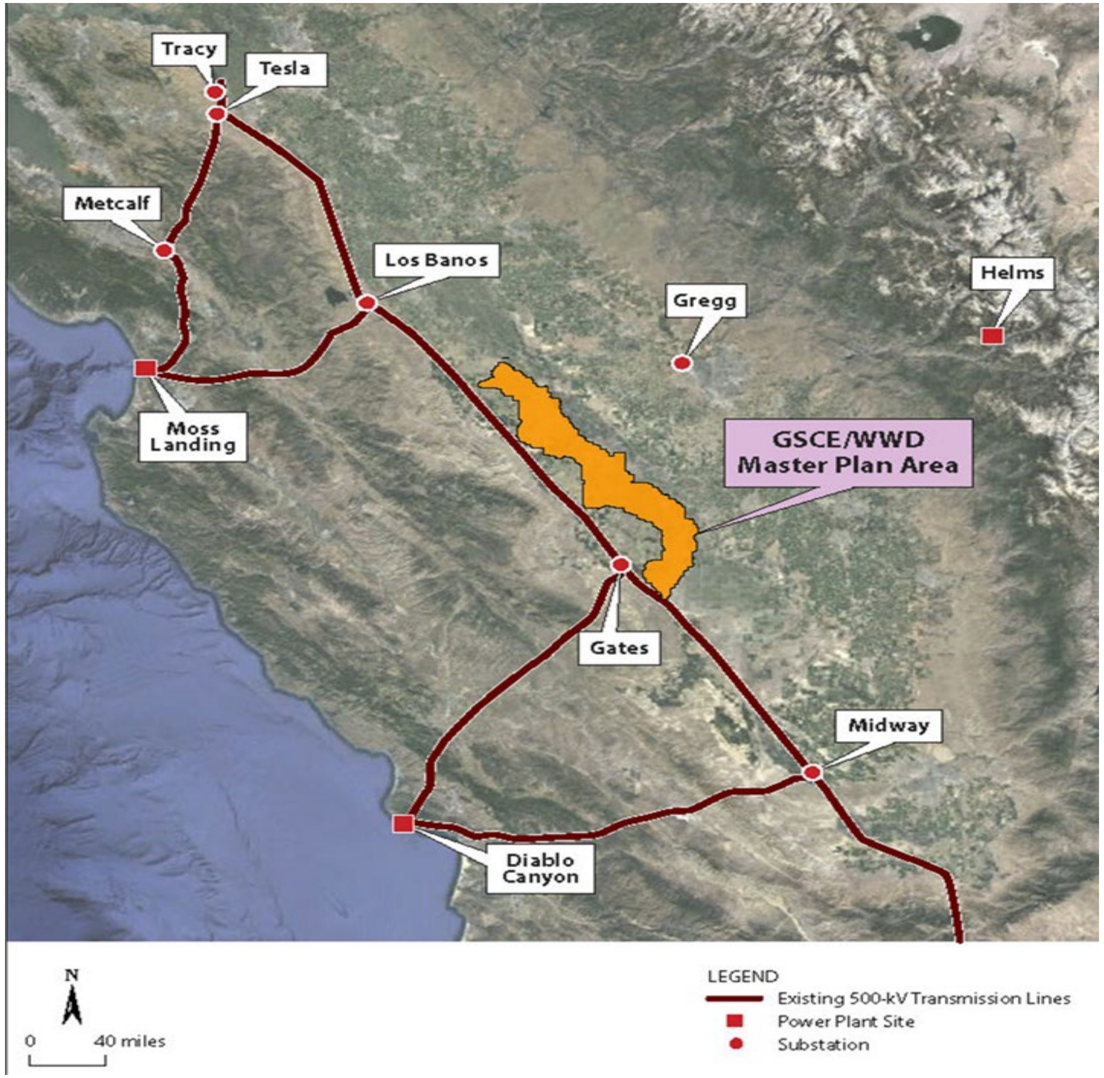
Westlands' Long-Term Liability has become a Valuable Asset

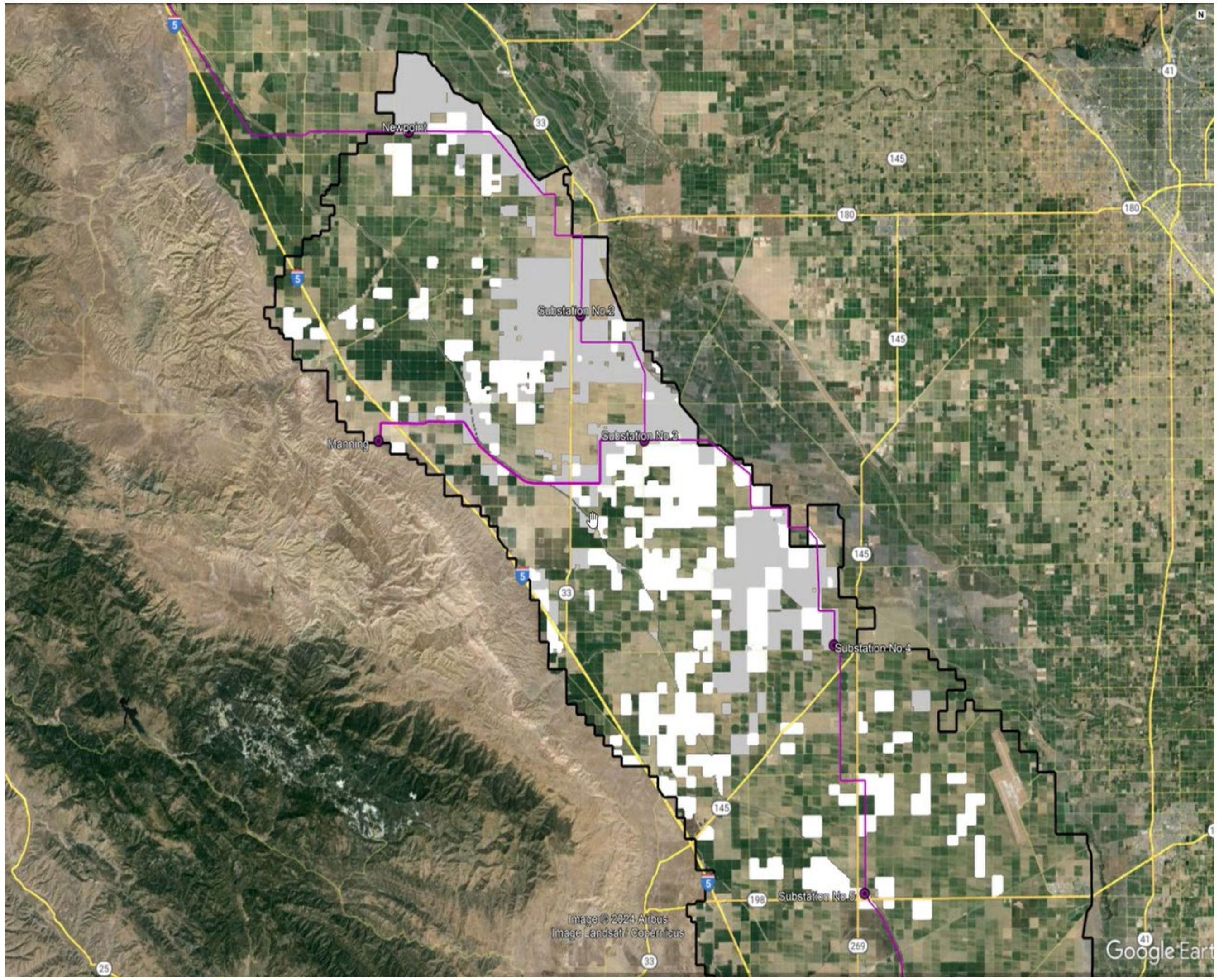
CAISO's Transmission Plans Run through Westlands

- CAISO (grid operator) and other CA regulatory agencies expect approximately **25% of renewable power needs in the SJV**
- 500,000-750,000 acres required for solar power will increase significantly if/when **hydrogen power** production becomes commercially viable
- As of 2022, **DWR** is subject to renewable power requirements

VALLEY CLEAN INFRASTRUCTURE PLAN

WWD is Strategically Located





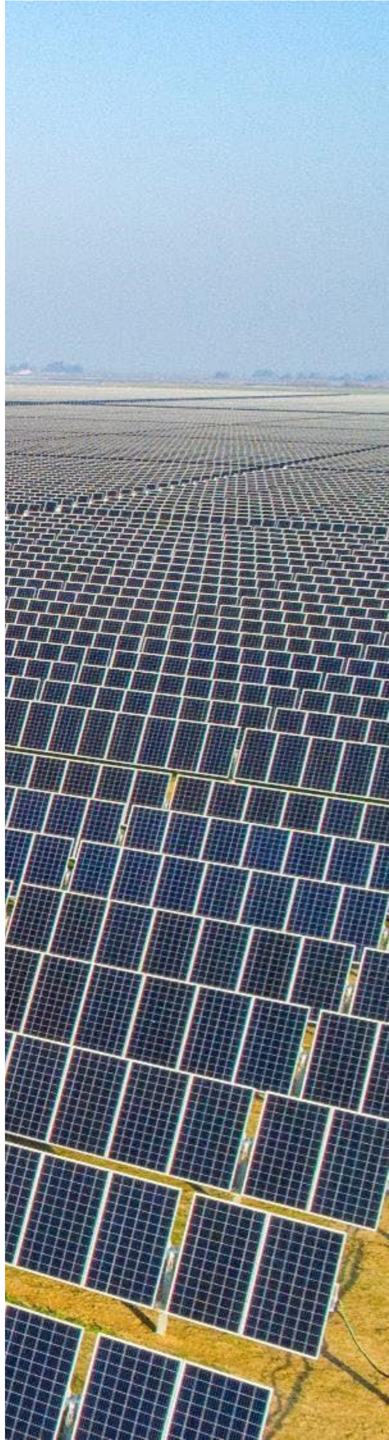
VCIP is an Innovative Approach to Creating Value for WWD, Energy Customers, Landowners, & Local Communities

SOLAR FOR THE CLEAN ENERGY FUTURE | Approximately 20,000 MW (PV) and hundred of miles of transmission lines to help meet California's future needs in an efficient and cost-effective manner

GARNERING BROAD SUPPORT | Strong support from a wide variety of parties, including environmental groups, labor, state and local governments, and agriculture groups

WATER BENEFITS | Saving water for productive farms while using less productive lands for solar provides a mutual benefit to the agricultural community

JOBS & ECONOMIC DEVELOPMENT | Potential for thousands of high paying jobs over the next 15+ years, plus economic development from opportunities for manufacturing, fabrication, assembly, and research and development.




Thank you

The Number of Irrigation Wells in the Central Valley

& Potential to Generate Electricity

Dr. Larry Dale, Scientist, Economist
Lawrence Berkeley National Laboratory, Ret.
larry.l.dale@gmail.com

Dr. Sarah Lewis MacDonald, GIS Consultant
Envision Geo
Dr. Damian Park, Economist
Santa Clara University

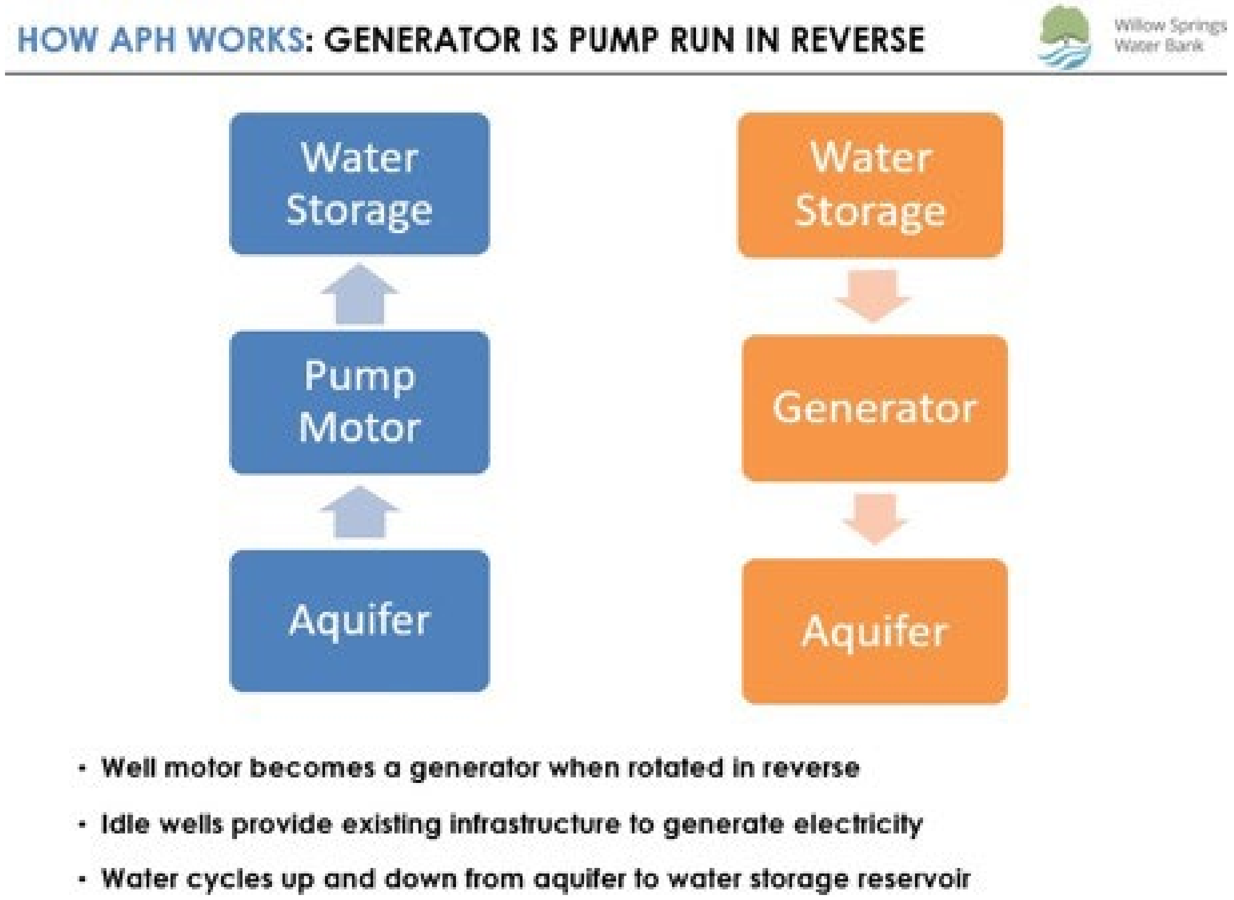
CEC Project to Evaluate New Technology: Aquifer Pumped Hydro (APH)

Two parts to APH project:

- Show how irrigation wells can generate electricity
  - using APH technology
- Count up the number of irrigation wells
  - showing the scope of APH technology

- Wells can generate electricity
  - Demonstration projects in Antelope Valley
    - Work out efficiency, cost, generation levels under different conditions
- The number of wells determines the scope (generation potential
  - No good State well inventory
  - Steps to obtain a better well inventory

Irrigation Wells Can Generate Electricity



APH cost competitive with Li batteries

- Retrofit equipment:
  - Surface storage or access to surface water.
  - A variable frequency drive (VFD) to start motor.
  - A VFD regeneration drive
  - Utility connection interface.
- Ongoing demonstration projects, preliminary evidence suggest:
  - Irrigation wells can generate between .05 and .5 MW
- Unit cost of APH in is competitive with Li batteries

APH potential and the number of irrigation wells

- USDA census
  - Individual raw survey data difficult/impossible to access.
  - Census undercounts farms (PPIC 2023 study)
- Electricity accounts
  - Data difficult/impossible to access
  - Diesel wells not counted
  - Not all agricultural wells included?
- Districts and GSA's
  - Data difficult/impossible to access
  - Reports rely on well completion reports
- Northern Regional Office (NRO) Well Counts
  - Limited coverage (Northern Sacramento Valley only)
  - Hard to replicate
- **Well completion reports (WCR) Well Counts:**
  - Cover entire Valley
  - Not all wells counted

Many wells aren't reported

- Compare municipal wells with municipal well completion reports
  - 2.4 municipal wells for every municipal well report
  - Similar ratio of irrigation wells to irrigation well reports?
    - Well survey can test that assumption

	Irrigation Wells[1,2]	Municipal Wells[1,4]
Commpletion Reports (DWR)	31,842	4,590
Operating Wells	NA	10,882
Wells per Completion Report		2.4

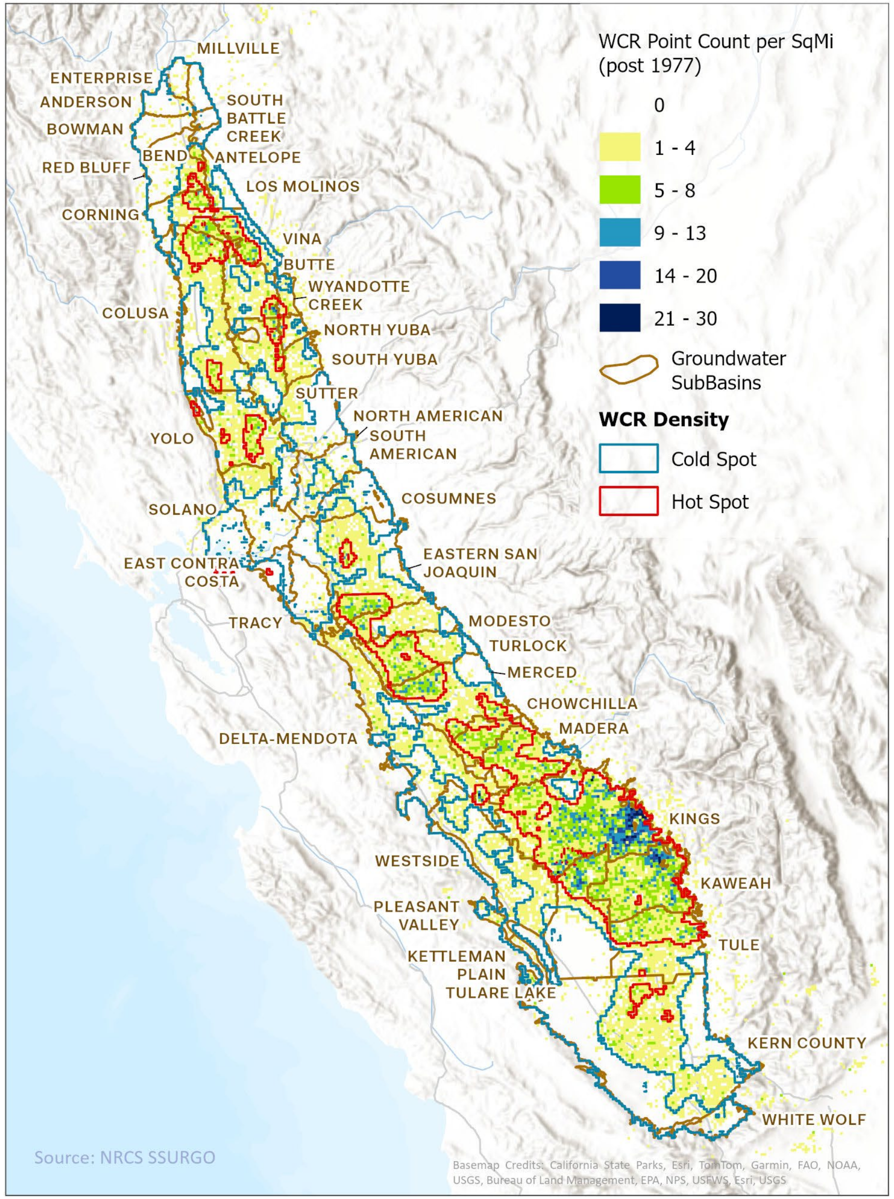
1. DWR Bulletin 118 (2020)
   https://www.arcgis.com/home/item.html?id=425b3d23264b45af8f1ca71017049bff
2. USGS Circular 1401-a (1991)
3. DWR Bulletin 118 (2020)
   https://www.arcgis.com/home/item.html?id=425b3d23264b45af8f1ca71017049bff
4. SWRCB GAMA. Div. Drinking Water 2023
   https://gamagroundwater.waterboards.ca.gov/gama/gamamap/public/

Options for Counting Irrigation Wells

1. Remote sensing
   - Satellite photo data
2. Count wells in the field
   - Drive or fly by counts
3. Farm or District level survey (combine steps 1-2)
   - Locate priority survey regions
     - Use WCR's and NRO's as well proxies
     - Minimize required sample size
   - Design Survey instrument
     - Simple, satellite maps for easy reference
   - Assess Accuracy: Follow up drive by to assess accuracy

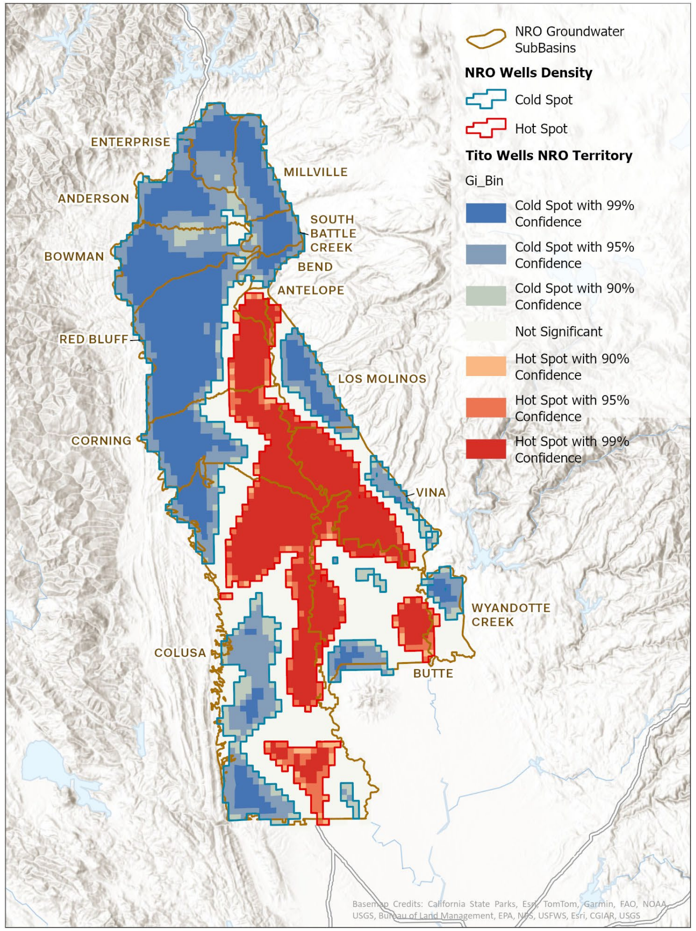
WCR density regions

- Total of 21,000 sections in the Central Valley proper
  - Mostly flat area outlined in the map on the right.
  - **Average of about 2 wells** (reported) per section
- About 30% of Valley has under 1 well per section
  - White areas on map (outlined in blue)
  - **Low Well Density**
- About 45% of Valley reports 1-4 wells per section
  - Yellow areas on map
  - **Medium Well Density**
- Remaining 25% reports > 5 wells per section
  - Green areas on map (outlined in red)
  - Some areas with over 20 wells per section)
  - **High Well Density**

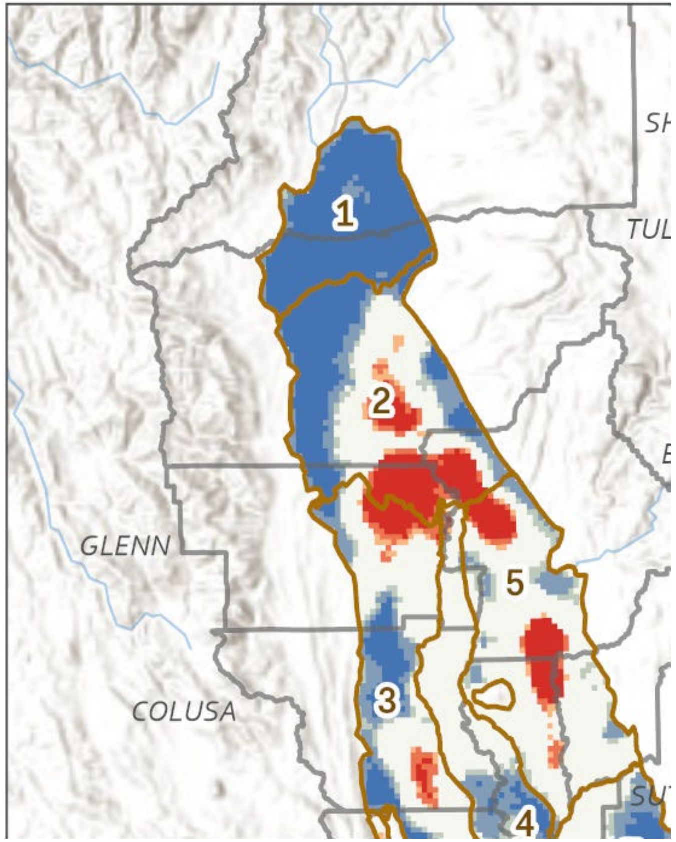


Note: WCR and NRO counts have similar well density regions

NRO Density Regions

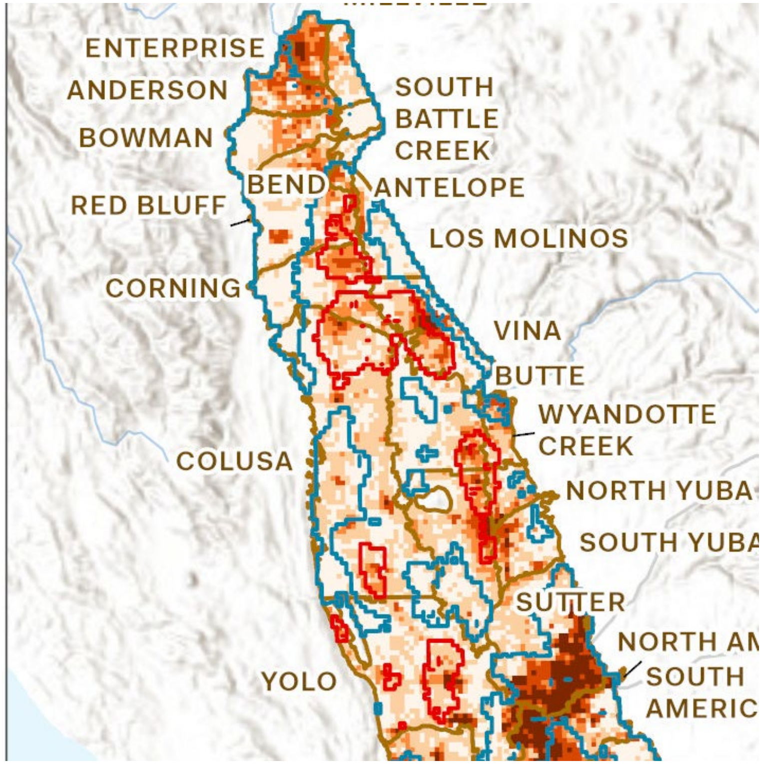


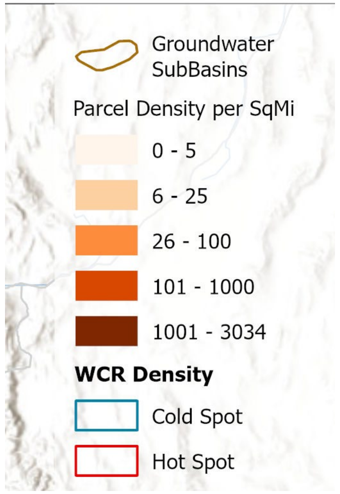
WCR Density Regions

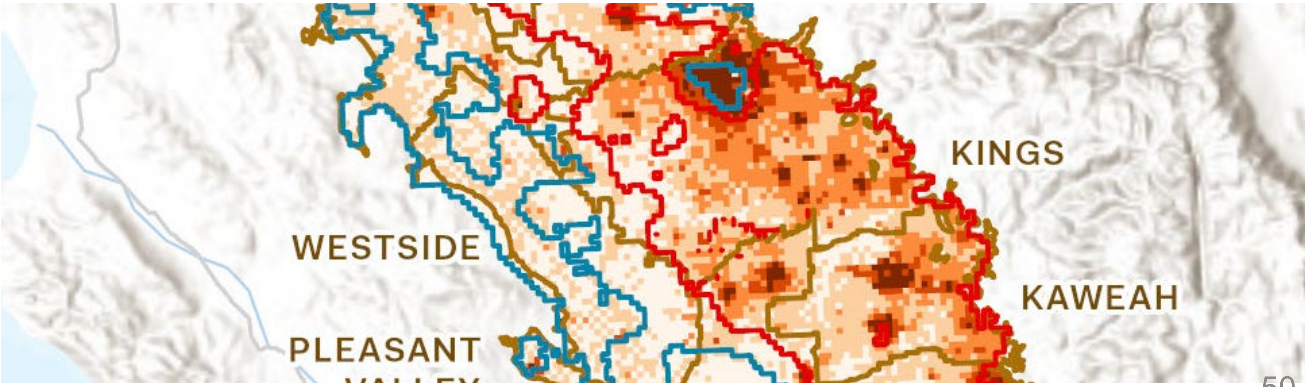


WCR Density Explanatory Variable:
Parcel Size

- Sacramento Valley
  - Low well density (white or pale orange)
    - Larger parcels <26 parcels per section)
    - Foothills west side: larger farms
  - High well density (red or brown)
    - Smaller parcels (<26 parcels per section)
    - Middle Valley, smaller farms or ranchettes
- San Joaquin Valley
  - High well density
    - East side, > 26 parcels
    - smaller farms, Orange Cove
  - Low well density
    - West side, < 26 parcels,
    - larger farms: Westlands

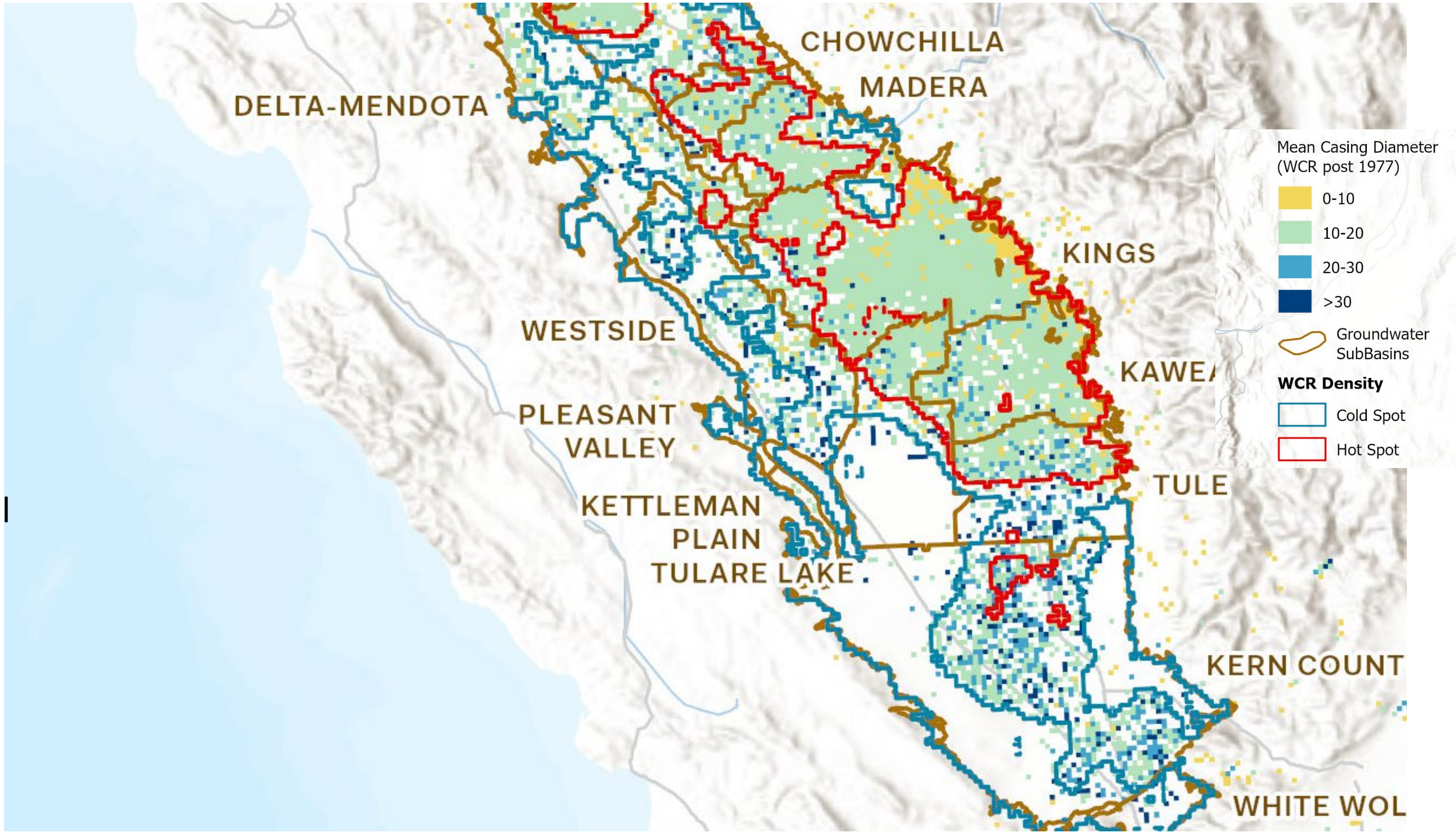






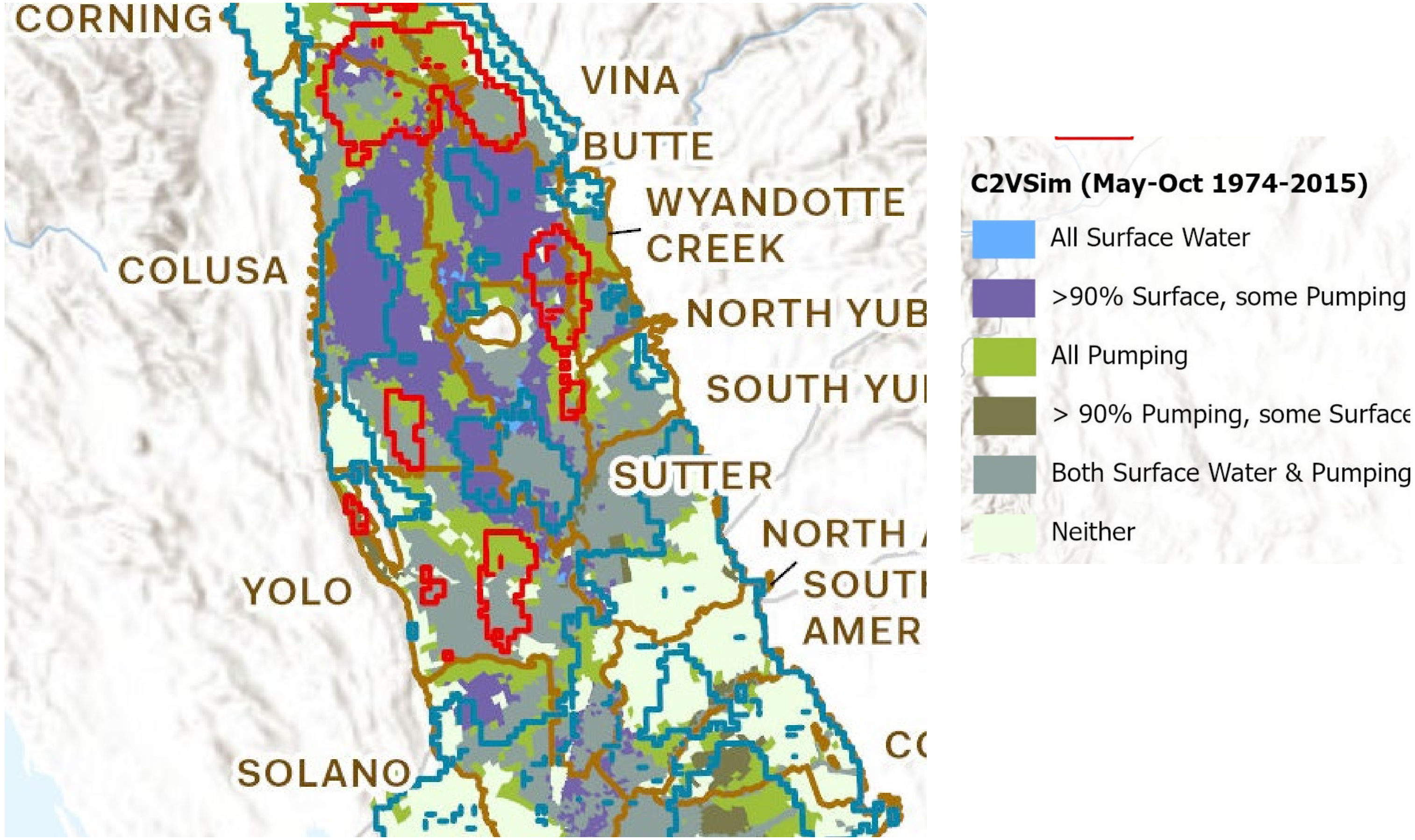
Explanatory Variable: **Well Size**

- Low Well Density (shaded blue)
  - Large wells (>20" casing)
  - East side San Joaquin Valley
- High Well density (shaded green)
  - Smaller wells (< 20" casing)
  - West side San Joaquin
- Inverse correlation between large well size and low well density



WCR Density Explanatory Variables: **Water Supply**

- High density regions
  - Largely groundwater (Green, olive, gray)
    - Orchard land
      - North, south and east of the Rice acreage
- Low density regions
  - Some areas mostly surface water (purple, blue)
    - Rice areas of Sacramento
  - No water supply (light green)
    - Foothills, rangeland, urban area



Summary: Variability of well density measures

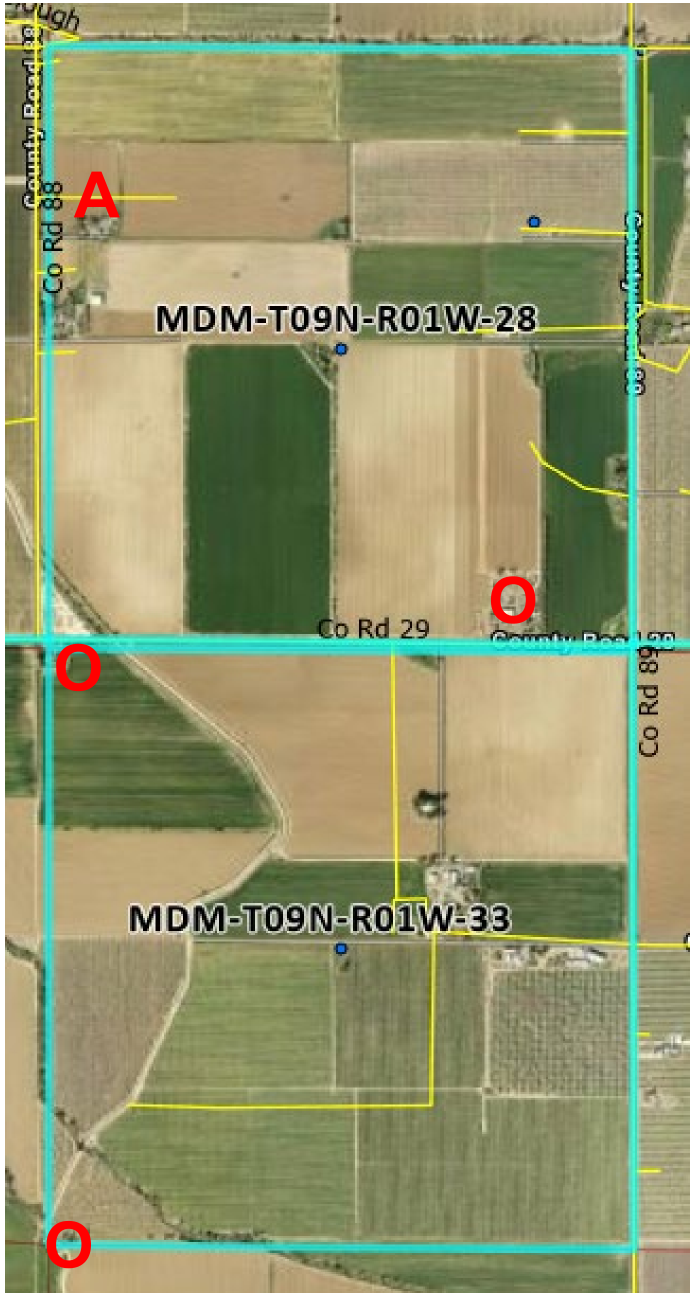
	Sections	Well Density (Wells/sec)	Stan. Dev	Well Ratio (Wells/WCR)	Stan. Dev
DWR North. Region	2714	1.92	2.70	1.27	**1.59**
Irrigated Region	703	3.67	2.96	1.47	**1.57**
Orchard Sub Region	219	4.53	3.36	1.32	**1.60**
Field, Other Sub Region	57	3.65	2.26	1.67	1.67
Rice Sub Region	61	2.25	1.83	1.79	**1.57**

1. Shows how measures of well density vary across land use regions.
   - Uses two measures: SD of well density and SD of well/WCR ratio
2. Well field data from DWR's northern office suggests we require less survey data than we thought to get a reliable well count.

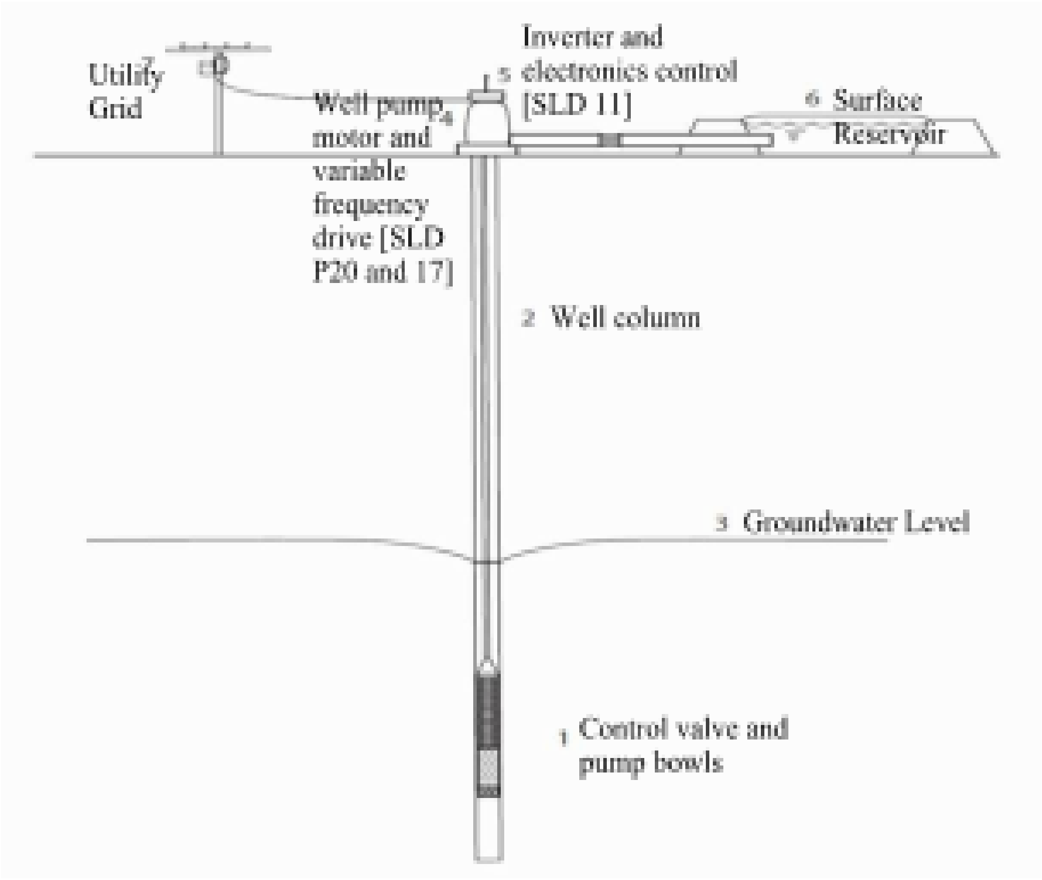
Survey Instrument

Key Issues:

- Who to Survey?:
  - Farm
  - District or GSA
- How to secure confidential data transfer
  - Internet log on
  - Simple (mark well location)
  - Test on focus groups
- Assess survey accuracy
  - Post survey drive by
- Provide APH follow up
  - Evaluate cost and benefits of APH



Questions?



Aquifer Pumped Hydro (APH) Schematic

Speakers Contacts

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Jon Reiter, Golden State Clean Energy
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Next Steps/Closing Remarks

Dr. Frank A. Gomez
Executive Director, STEM-NET
Office of the Chancellor

https://www2.calstate.edu/impact-of-the-csu/research/stem-net

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STEM-NET Community Events

STEM-NET April Webcast

Topic: Supporting Active Learning in Introductory STEM Courses with Extended Reality: the ALIS-XR Approach Date: Friday, April 12, 2024
Time: 11:00 AM - 12:00 PM

Register Here

2024 Spring SoCalGas STEM-NET Student Research Fellowship Virtual Research Café

Date: Friday, April 26, 2024
Time: 12:00 PM – 1:30 PM

Register Here

Join our CSU STEM-NET Community listserv

csustemnet@lists.calstate.edu

Begin a Conversation with Colleagues and Join our Private CSU STEM-NET Facebook Group

https://www.facebook.com/groups/2629611737269292

For more information about STEM-NET visit our website:

THANK YOU FOR JOINING US TODAY!

Frank A. Gomez *CSU Office of the Chancellor* *fgomez@calstate.edu*