MY JOB DEPENDS ON WATER

Farming in the SGMA Era

GREATER KAWEAH GROUNDWATER SUSTAINABILITY AGENCY

MID-KAWEAH GSA

EAST KAWEAH GROUNDWATER SUSTAINABILITY AGENCY

THANK YOU TO OUR EVENT SPONSORS & VENDORS!

MY JOB DEPENDS ON WATER

Farming in the SGMA Era

MY JOB DEPENDS ON WATER

Farming in the SGMA Era

Event Agenda

8:30 AM	**Welcome!**
8:35 – 9:45 AM	**Session 1: Your Water & SGMA** • Jason Phillips – CVP and Friant • Mark Larsen – Kaweah River • Aaron Fukuda, Michael Hagman, Mark Larsen – SGMA Updates • Kait Palys – Mitigation Program
9:45 – 11:00 AM	**Session 2: Farming in the SGMA Era – Tools and Funding for Success** • Joel Kimmelshue – Land IQ • Craig Hornung – Irrigation Practices • Amber Butland, Lurana Strong – Grant Funding
11:00 – 12:30 PM	**BBQ Lunch and Sponsor Presentations**
12:30 – 1:30 PM	**Vendor Fair**

MY JOB DEPENDS ON

WATER

Farming in the SGMA Era

SESSION 1

Your Water and SGMA

Jason Phillips

Title: CEO, Friant Water Authority

Topic: Friant Water Authority and the Central Valley Project

MY JOB DEPENDS ON WATER
Farming in the SGMA Era

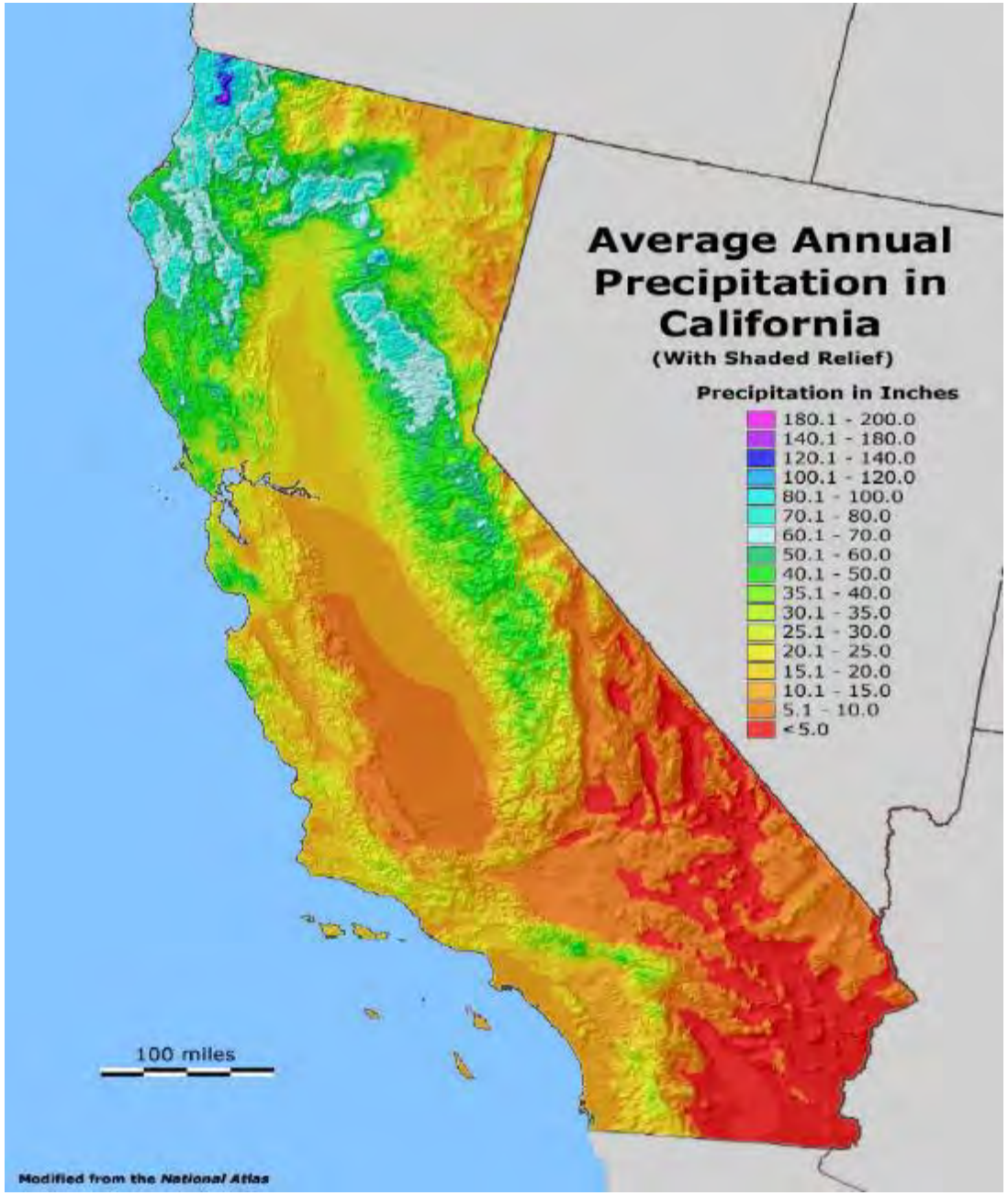
Friant
WATER AUTHORITY

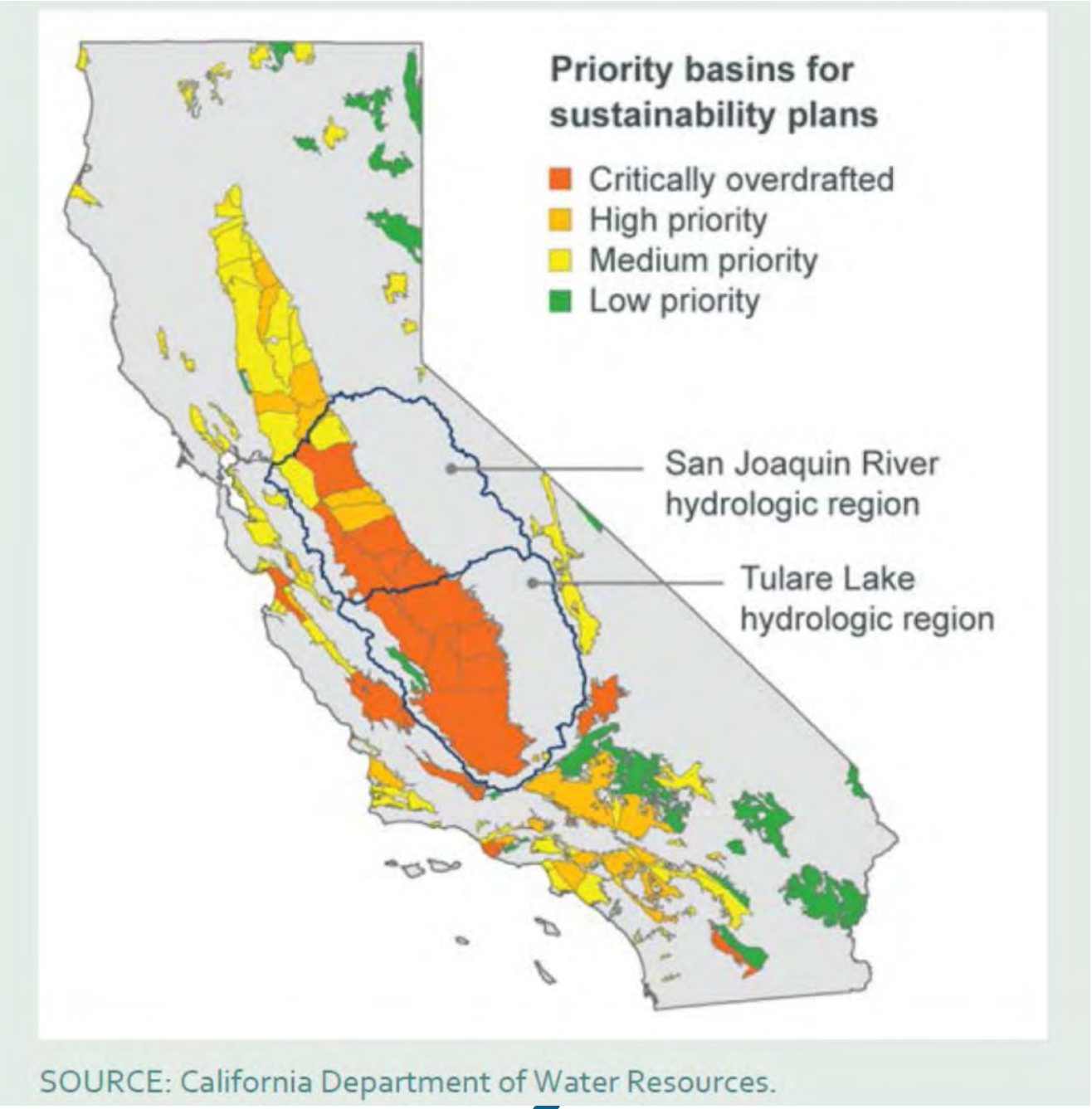
Kaweah Sub-basin Grower Event

July 13, 2023

California Water

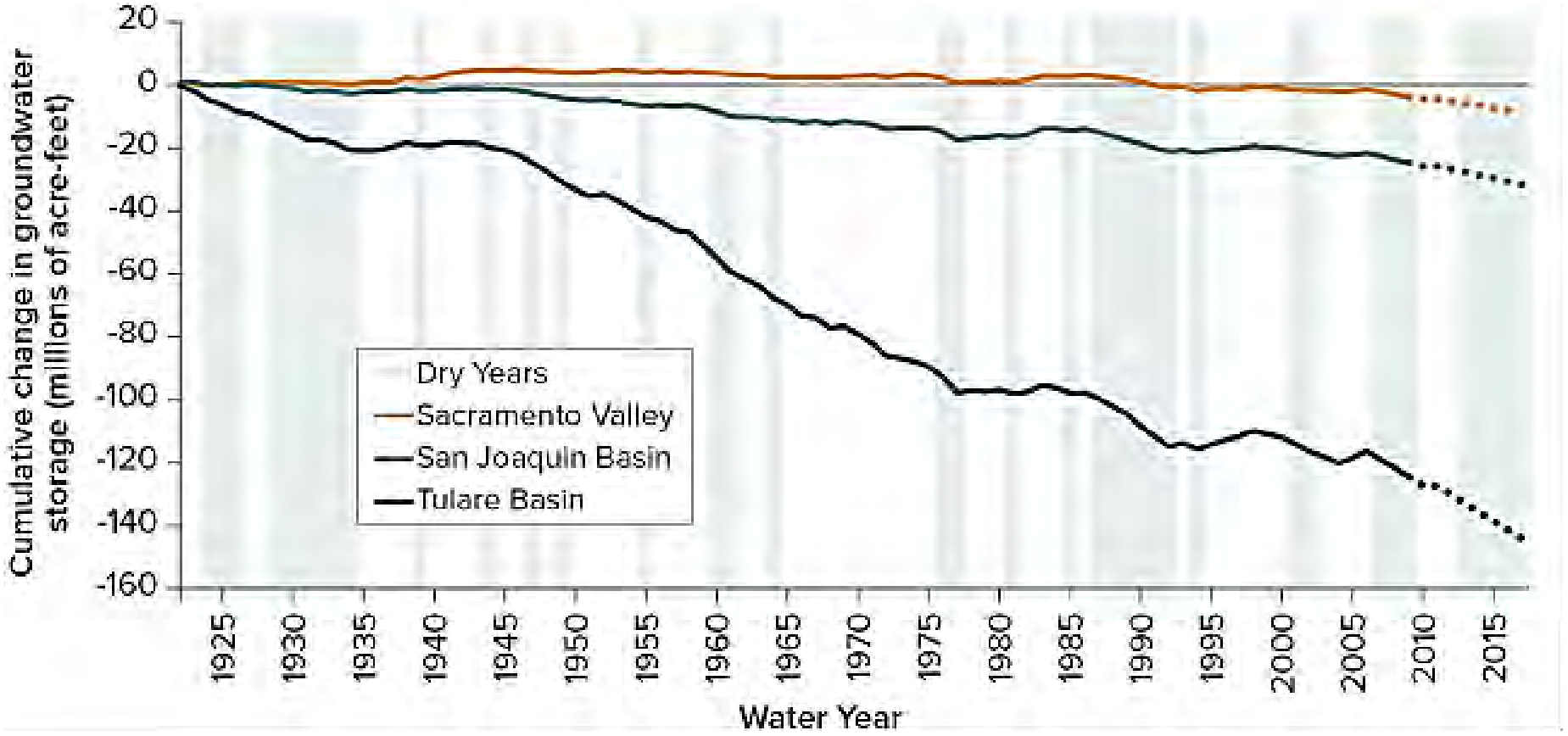
- Most precipitation falls in the north; most water demand is in the south.
- The wet season is winter and spring; water is needed more in the summer.
- Precipitation varies from year to year; demands don't vary much.





SOURCE: California Department of Water Resources.

SUSTAINED REGIONAL GROUNDWATER OVERDRAFT



SOURCE: Historical data through 2009 from the California Department of Water Resources; PPIC estimates after 2009. E. Hanak et al.

LAND SUBSIDENCE

IMPACTS OF GROUNDWATER OVERDRAFT

Central Valley Project

Major CVP Facilities

1940s – Construction of Shasta Dam, Friant Dam, Jones Pumping Plant, and Related Canals

1956 – Folsom Dam constructed

1961 – Trinity Division added to import water into the CVP from the Klamath.

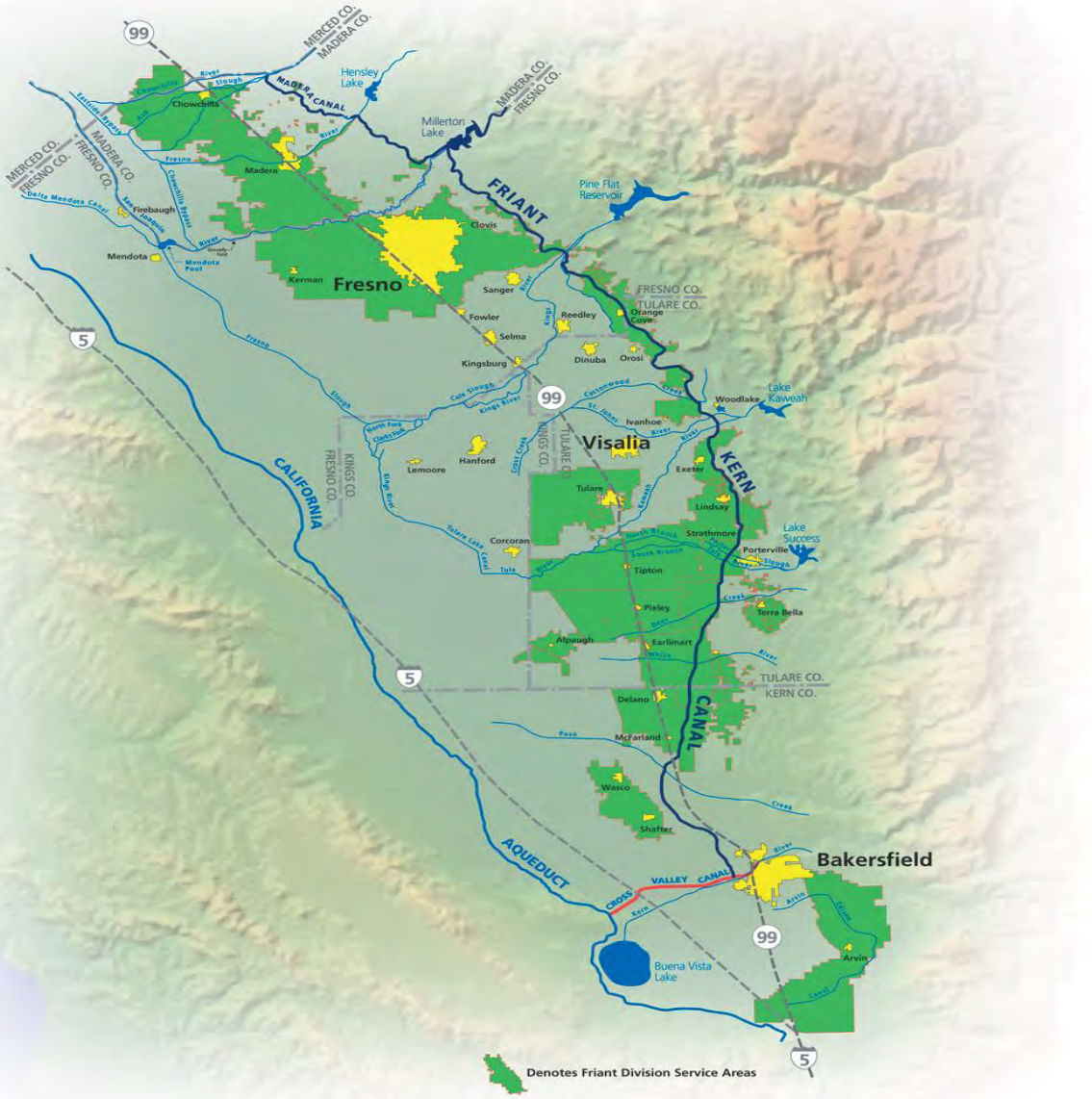
1967 – San Luis Unit and State Water Project

1968 – San Felipe Unit

1979 – New Melones Dam


FRIANT DAM

Friant Division Service Area



Friant Dam

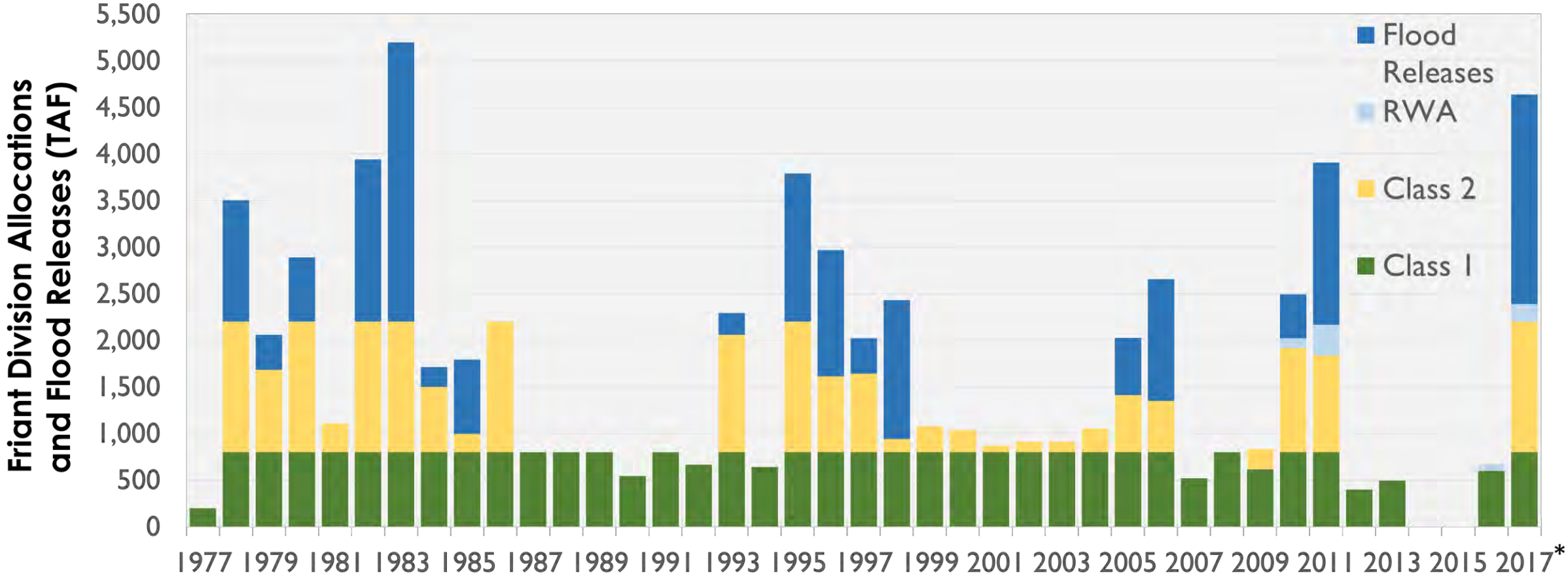
Inflow
1,750 TAF/yr

Millerton Lake
520 TAF capacity

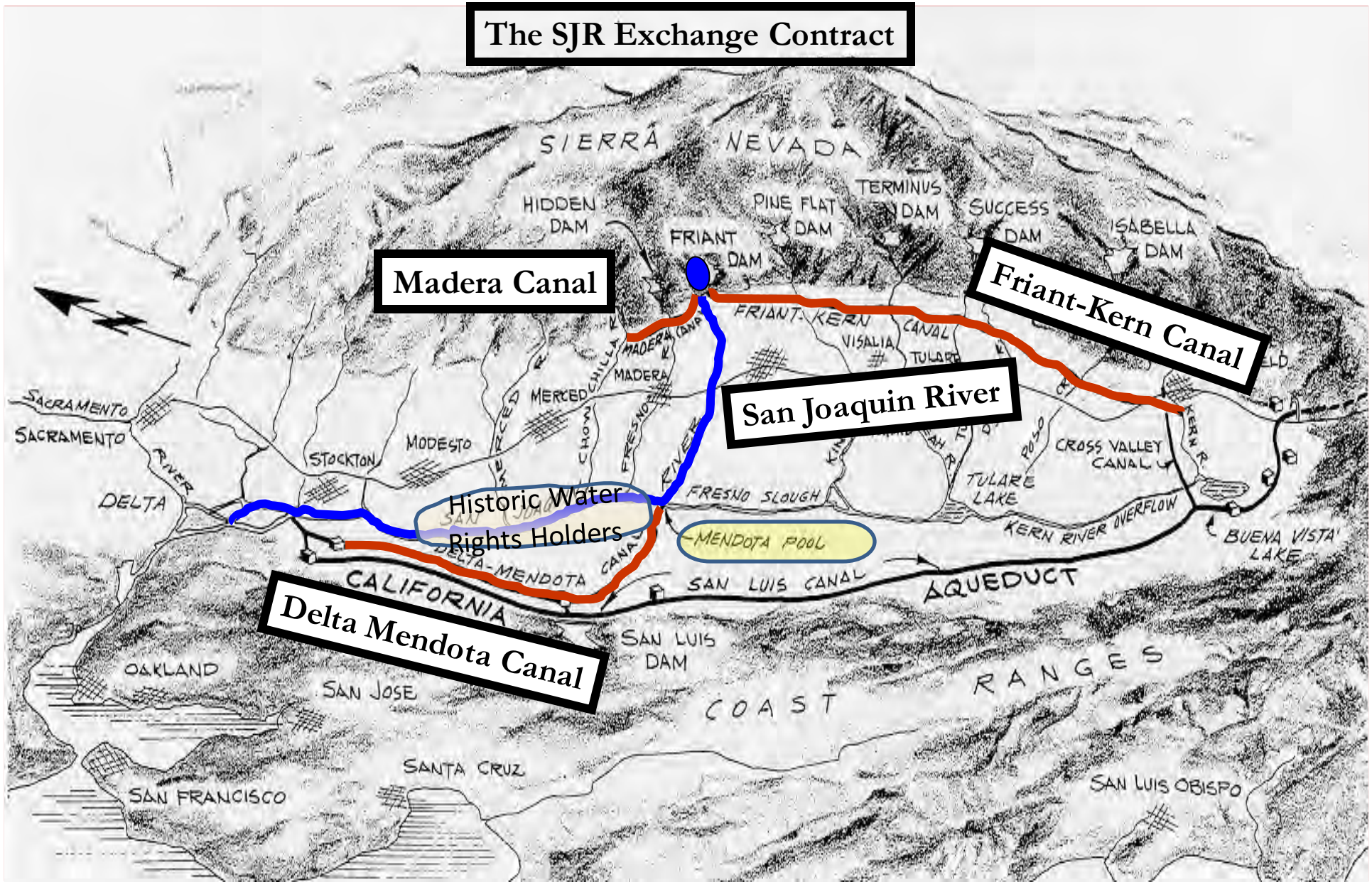
Average annual flood releases (prior to Settlement): 450 TAF/YR

Flood Releases To SJR reduced by Settlement. Flood releases exceed 100 TAF in 25% of years and 500 TAF in 10% of years

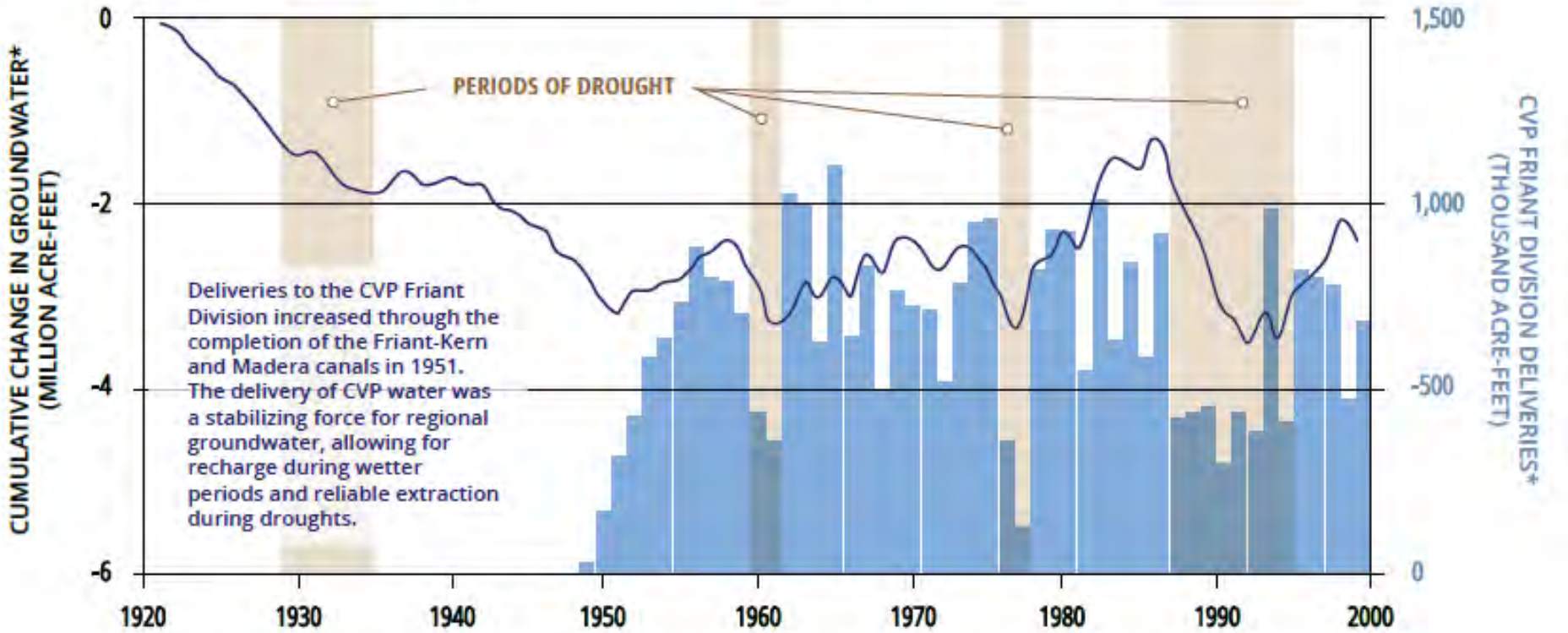
FRIANT DELIVERIES
Long-term average 1.2 MAF/YR



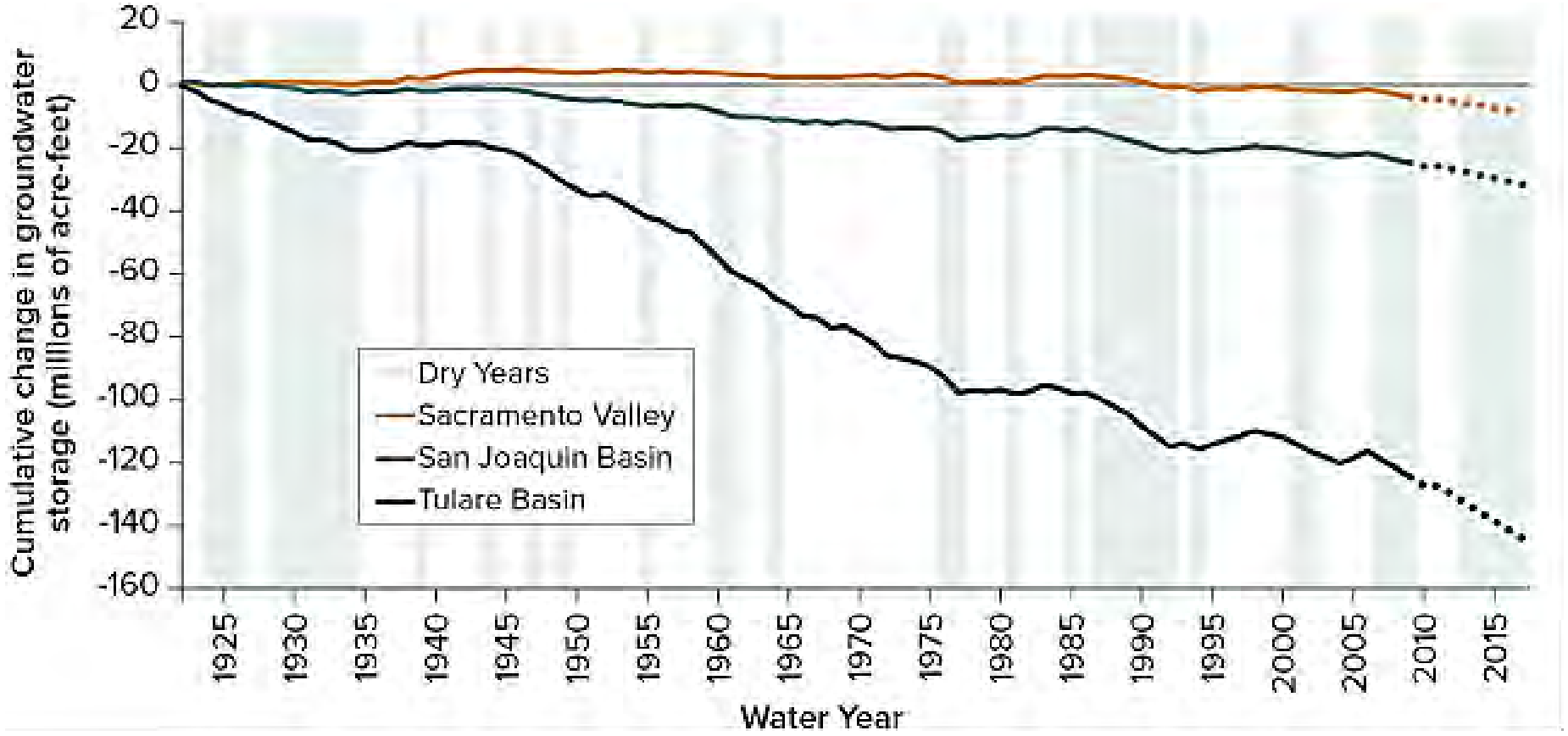
How The Friant Division Works



WATER DELIVERIES TO THE FRIANT DIVISION KEPT REGIONAL GROUNDWATER STABLE THROUGH MULTIPLE CYCLES OF DROUGHT

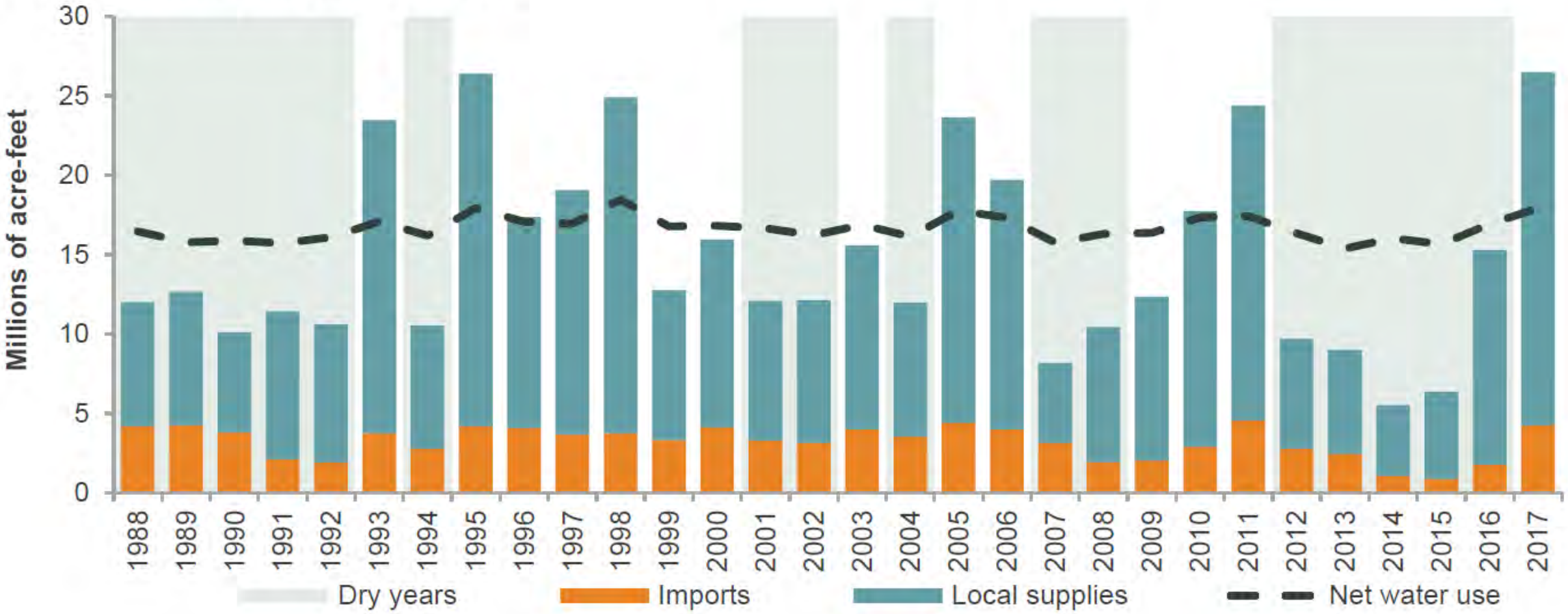


SUSTAINED REGIONAL GROUNDWATER OVERDRAFT

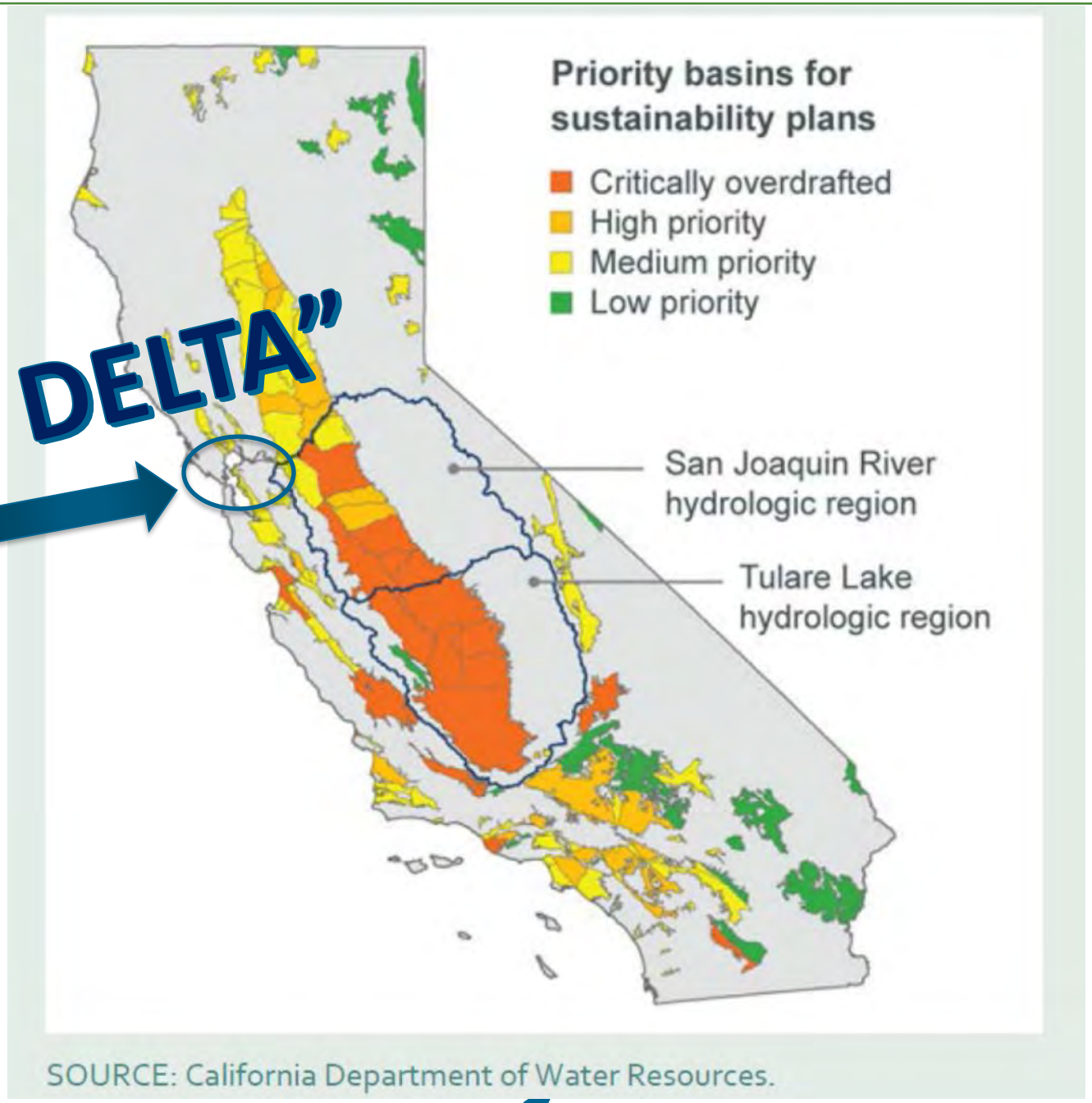


SOURCE: Historical data through 2009 from the California Department of Water Resources; PPIC estimates after 2009. E. Hanak et al.

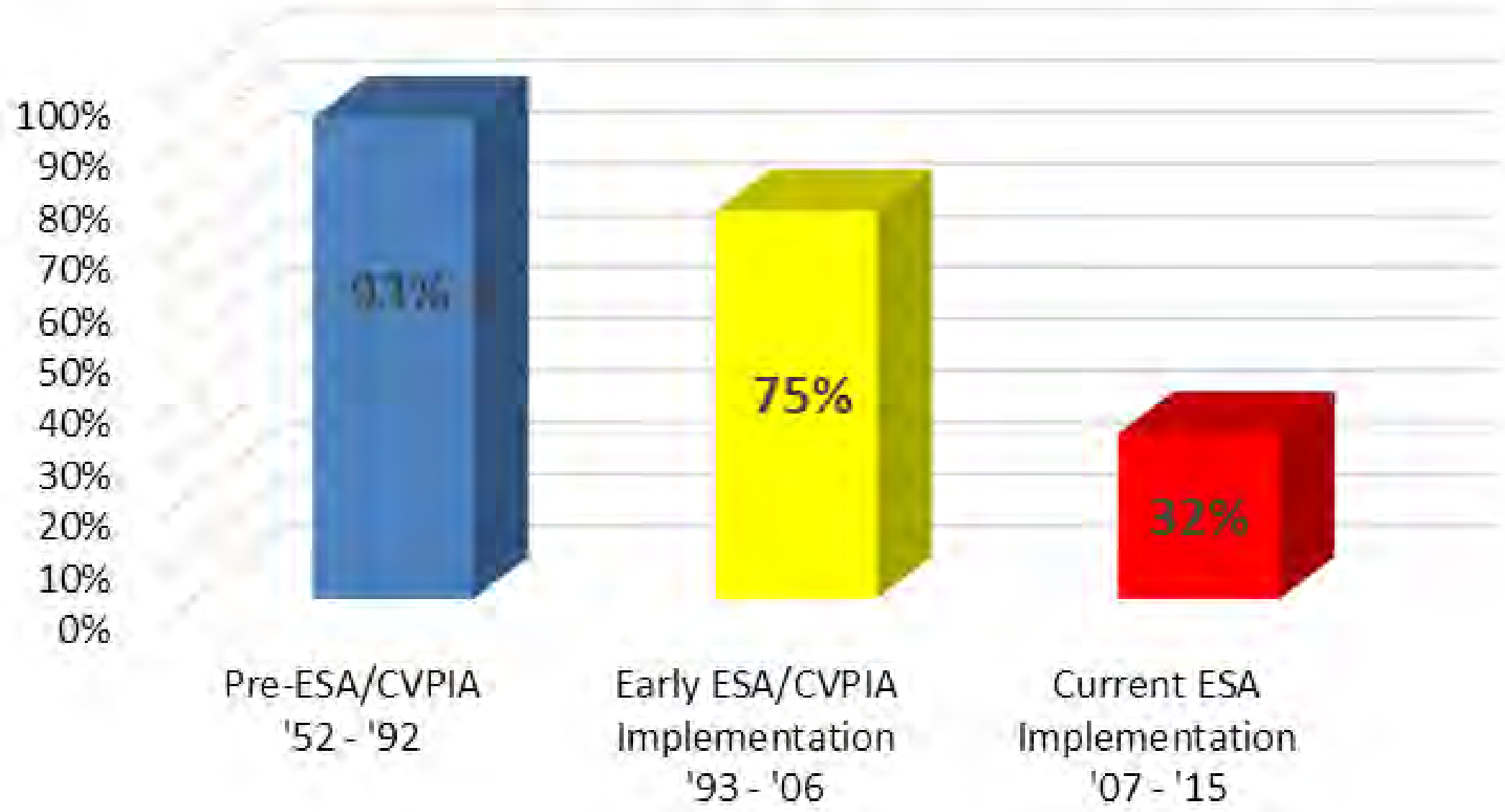
San Joaquin Valley Agricultural Water Use 1988 - 2017

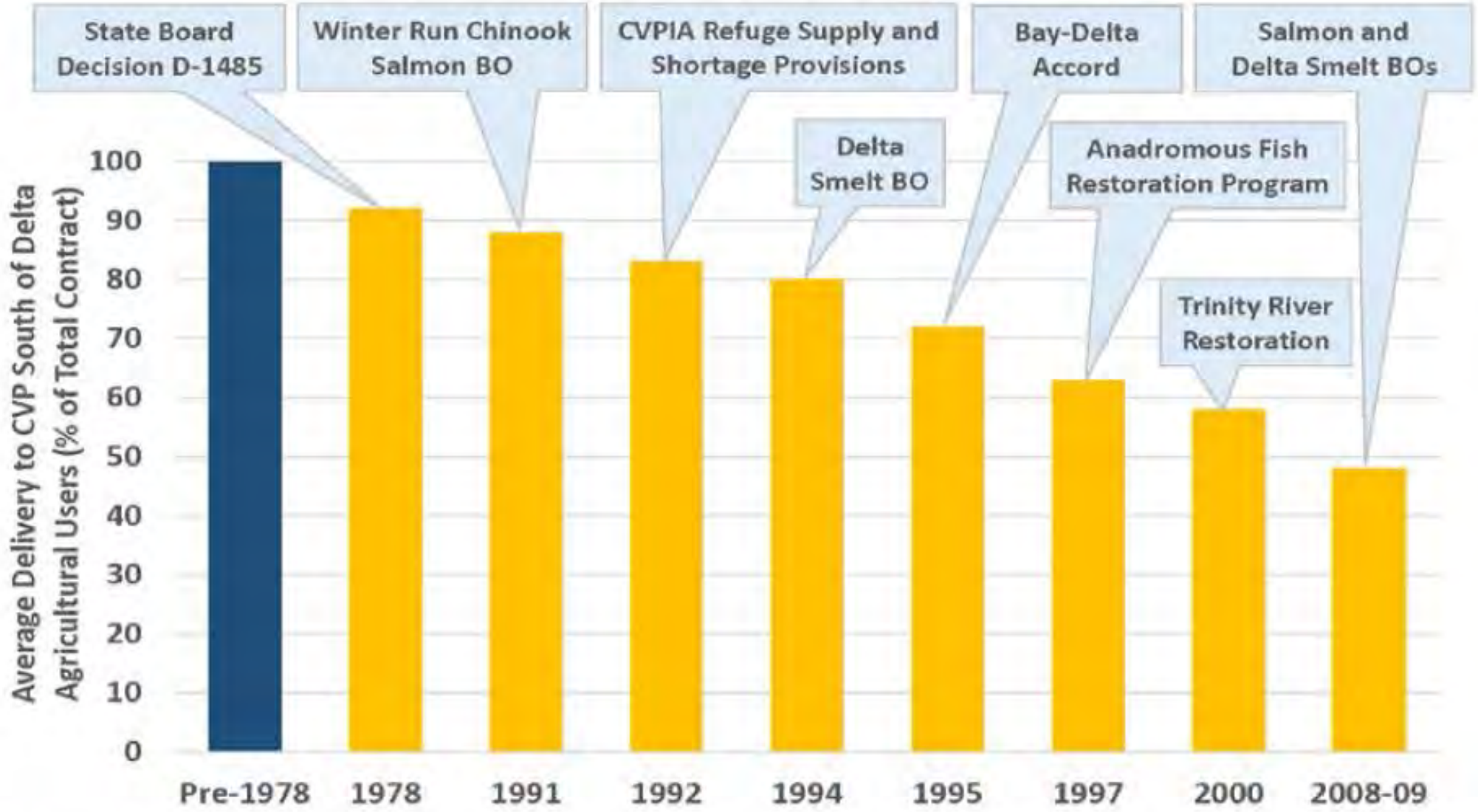


Source: *Water and the Future of the San Joaquin Valley*. PPIC, 2019


"THE DELTA"
Priority basins for sustainability plans
Critically overdrafted
High priority
Medium priority
Low priority
San Joaquin River hydrologic region
Tulare Lake hydrologic region
SOURCE: California Department of Water Resources.

South of Delta CVP Ag Allocations by Era





Sources: Pre-1978, CVP Water Delivery Records; 1978 – 2000, San Luis Delta Mendota Water Authority, extracted from various California Department of Water Resources (DWR) and U.S. Department of the Interior, Bureau of Reclamation (Reclamation) CalSim-II benchmark studies; 2008/2009, Reclamation & DWR CalSim-II Benchmark BO Study.

END

Mark Larsen

Title: General Manager, Greater Kaweah GSA

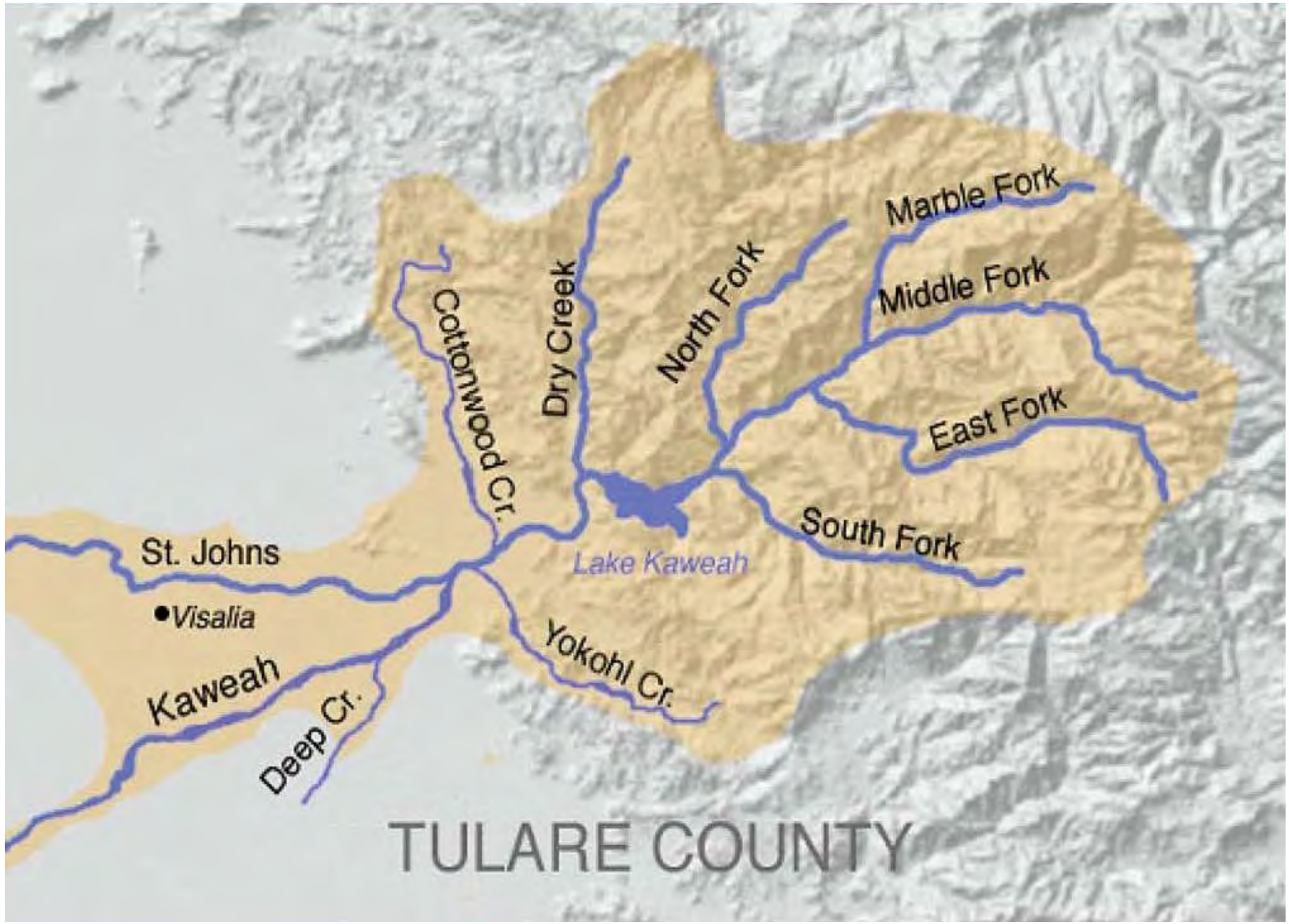
Watermaster, Kaweah and St. Johns rivers

Topic: Kaweah River System Water Mangement

MY JOB DEPENDS ON WATER
Farming in the SGMA Era

Water Supply and Flood Control in the KAWEAH BASIN

- River System
- Surface Water Supply
- Water Management Entities


Marble Fork
Middle Fork
North Fork
Dry Creek
Cottonwood Cr.
East Fork
South Fork
Lake Kaweah
St. Johns
Visalia
Kaweah
Deep Cr.
Yokohl Cr.
TULARE COUNTY

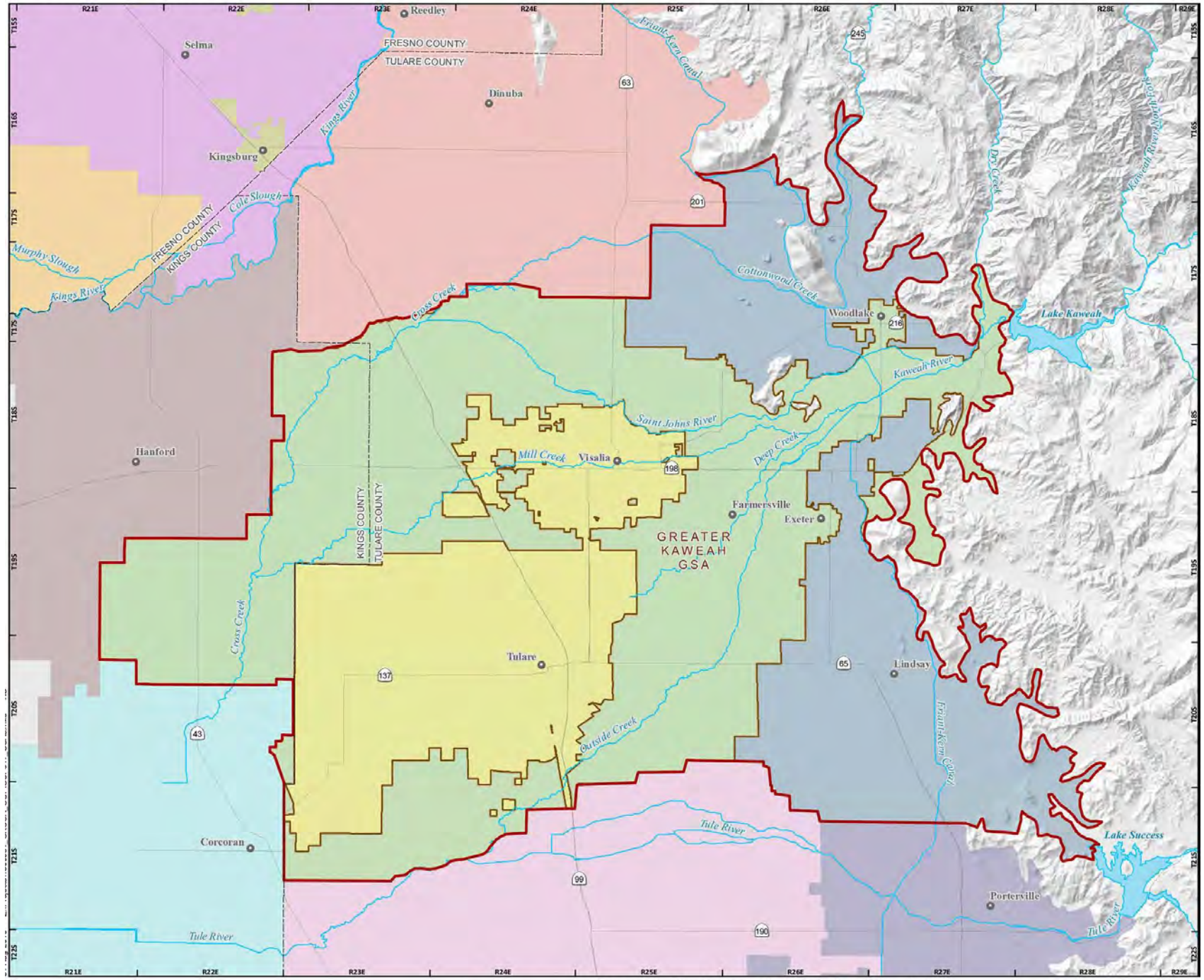


Figure 1-1: Greater Kaweah Jurisdictional Boundaries

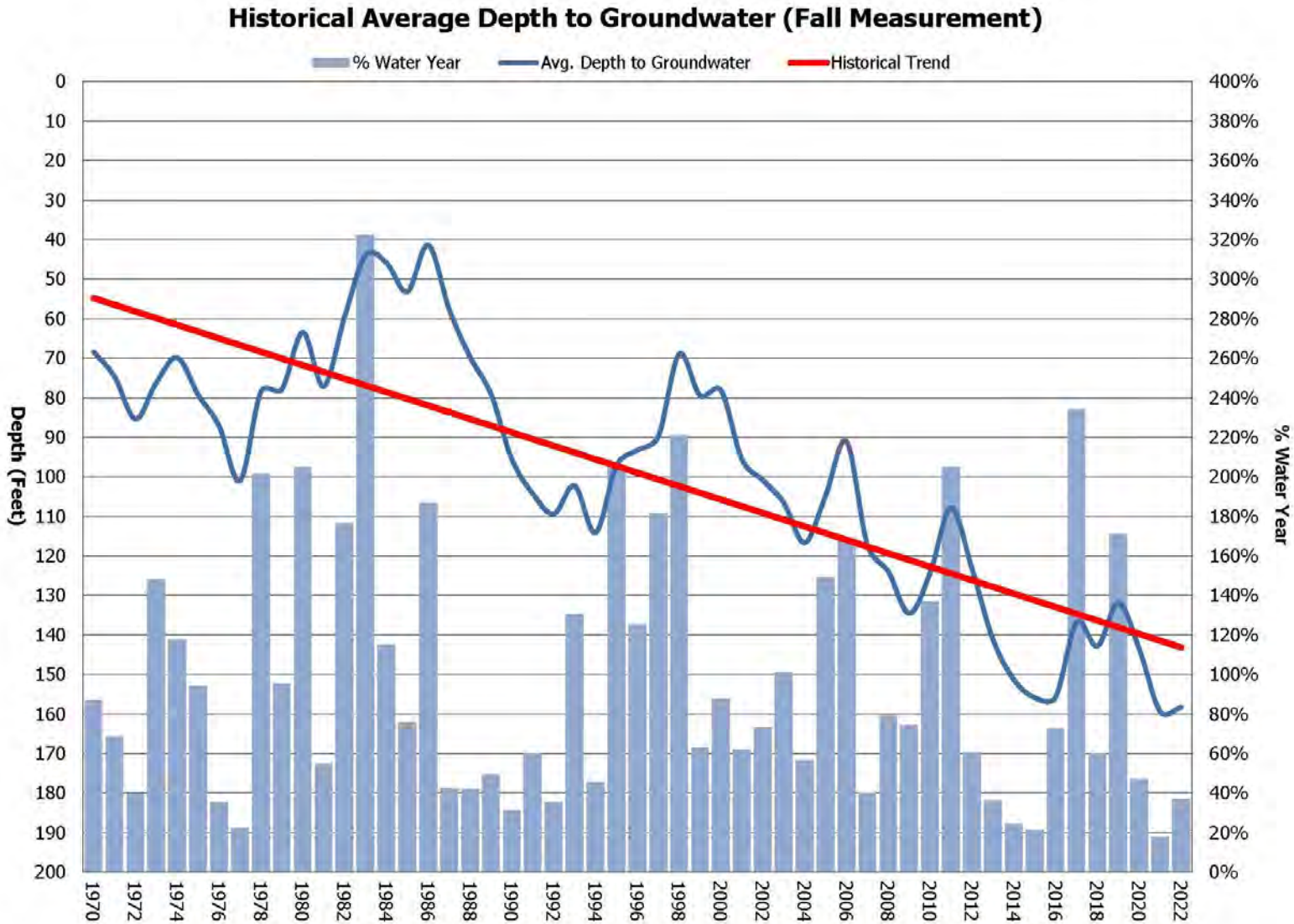
Annual Average Surface Water Supply

Kaweah River Supply	430,000 af	80%
CVP – Friant Kern	90,000	18%
Kings River	10,000	2%
State Water Project Water	~0	0%
Total	530,000	

* 1 Acre Foot = Annual Water for Family of 4

Kaweah - 2024 Water Year?

2014	24%
2015	21%
2016	72%
2017	238%
2018	61%
2019	174%
2020	48%
2021	19%
2022	37%
2023	~309%
2024	??


Historical Average Depth to Groundwater (Fall Measurement)
% Water Year
Avg. Depth to Groundwater
Historical Trend
Depth (Feet)
% Water Year
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
400%
380%
360%
340%
320%
300%
280%
260%
240%
220%
200%
180%
160%
140%
120%
100%
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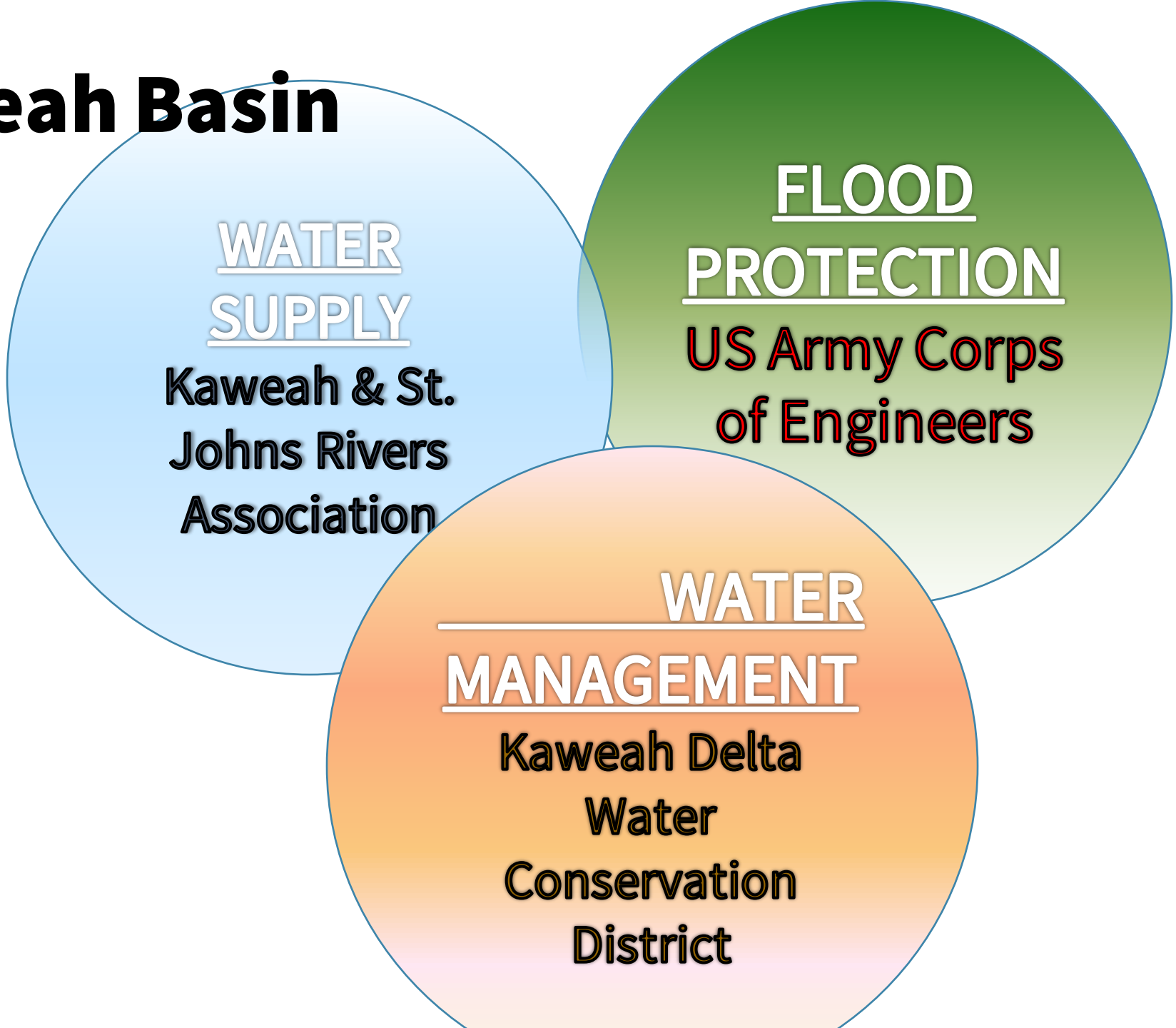
2022

Kaweah Basin



WATER MANAGEMENT

Kaweah Delta Water Conservation District

KAWEAH DELTA Water Conservation DISTRICT

Petition for Formation of "Kaweah Delta Water Conservation District"

Under the Provision of the "Water Conservation Act of 1927"

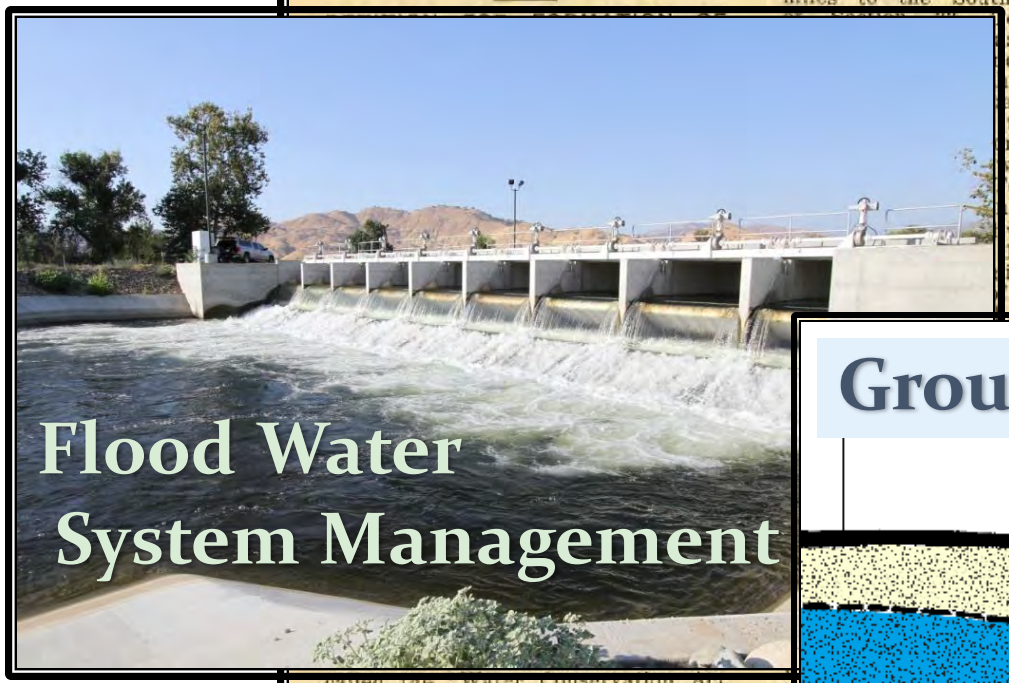
BEFORE THE BOARD OF SUPERVISORS OF THE COUNTY OF TULARE, STATE OF CALIFORNIA.

miles to the Northeast corner of the Northwest quarter of Section 29, said Township and Range, running thence West 3½ miles to the Southeast corner ownship 17 st, M. D. B. ce North ½ east corner arter of said thence West rthwest quarter rest quarter ownship and ce South ½ west corner 19, running iles to the Section 27,

& M., running thence West ½ mile to the Northwest corner of the Southeast quarter of said Section 12, running thence South ½ mile to the [illegible] west corner of the Southeast quarter of said Section 12, running thence West ¼ mile to the Northwest corner of the Northeast quarter of the Northwest quarter of Section 13, Township and Range, running thence South ¼ mile to the Southwest corner of the Northeast quarter of the Northwest quarter of said Section 13, running thence West ¼ mile to the Northwest corner of the Southwest quarter of the Northwest quarter of said Section 13,

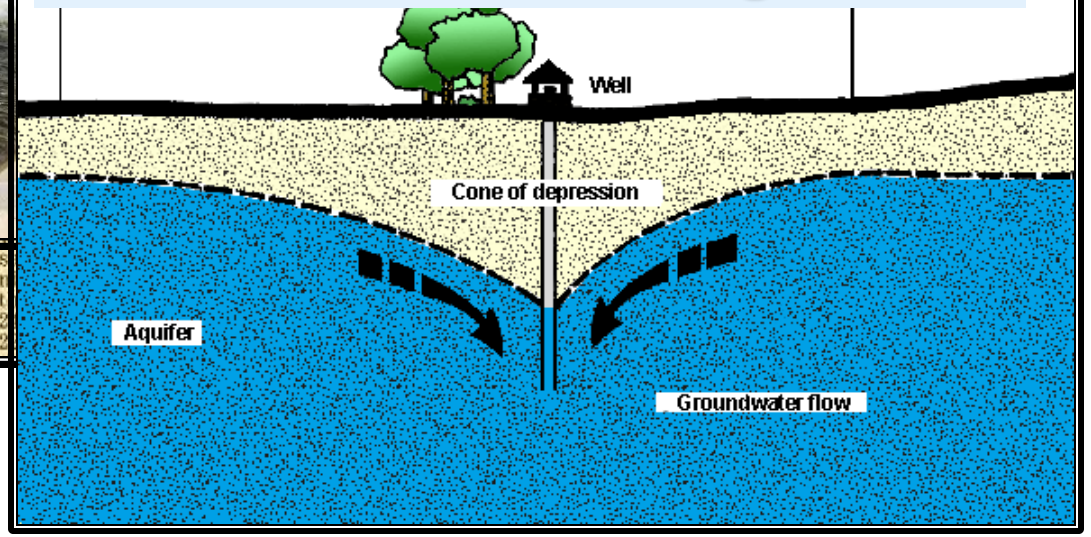
called the "Water Conservation Act of 1927", approved by the Governor April 11, 1927, and being Chapter 91, Statues of 1927, and further propose that said district be known as the "KAWEAH DELTA WATER

1927



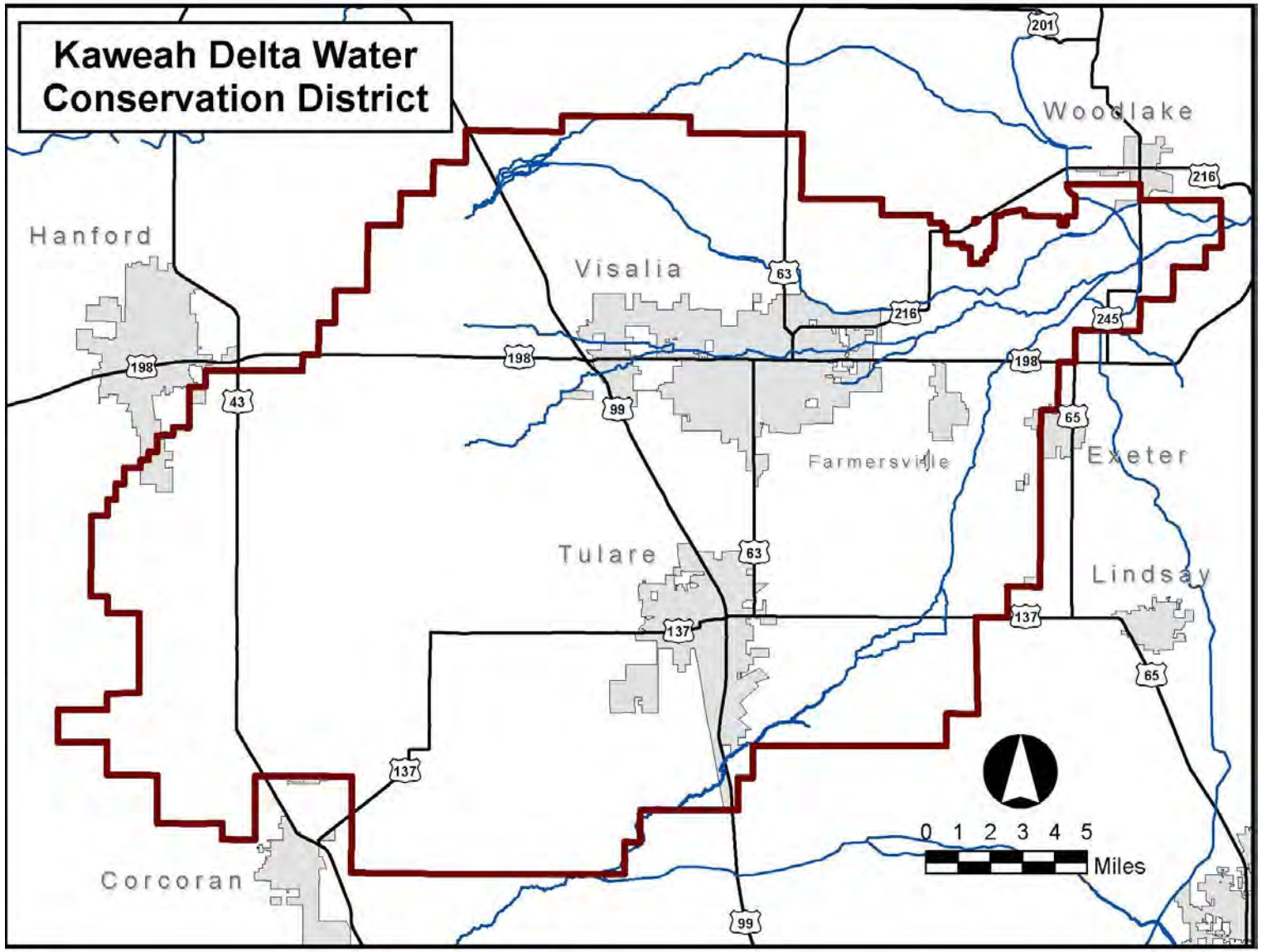
Flood Water System Management

Groundwater Management



Kaweah Delta Water Conservation District

- 340,000 Acres, +200 Miles of Channels, 2 Major Cities



1906

Channel Maintenance

Groundwater

FLOOD PROTECTION

US Army Corps of Engineers

FLOOD PROTECTION

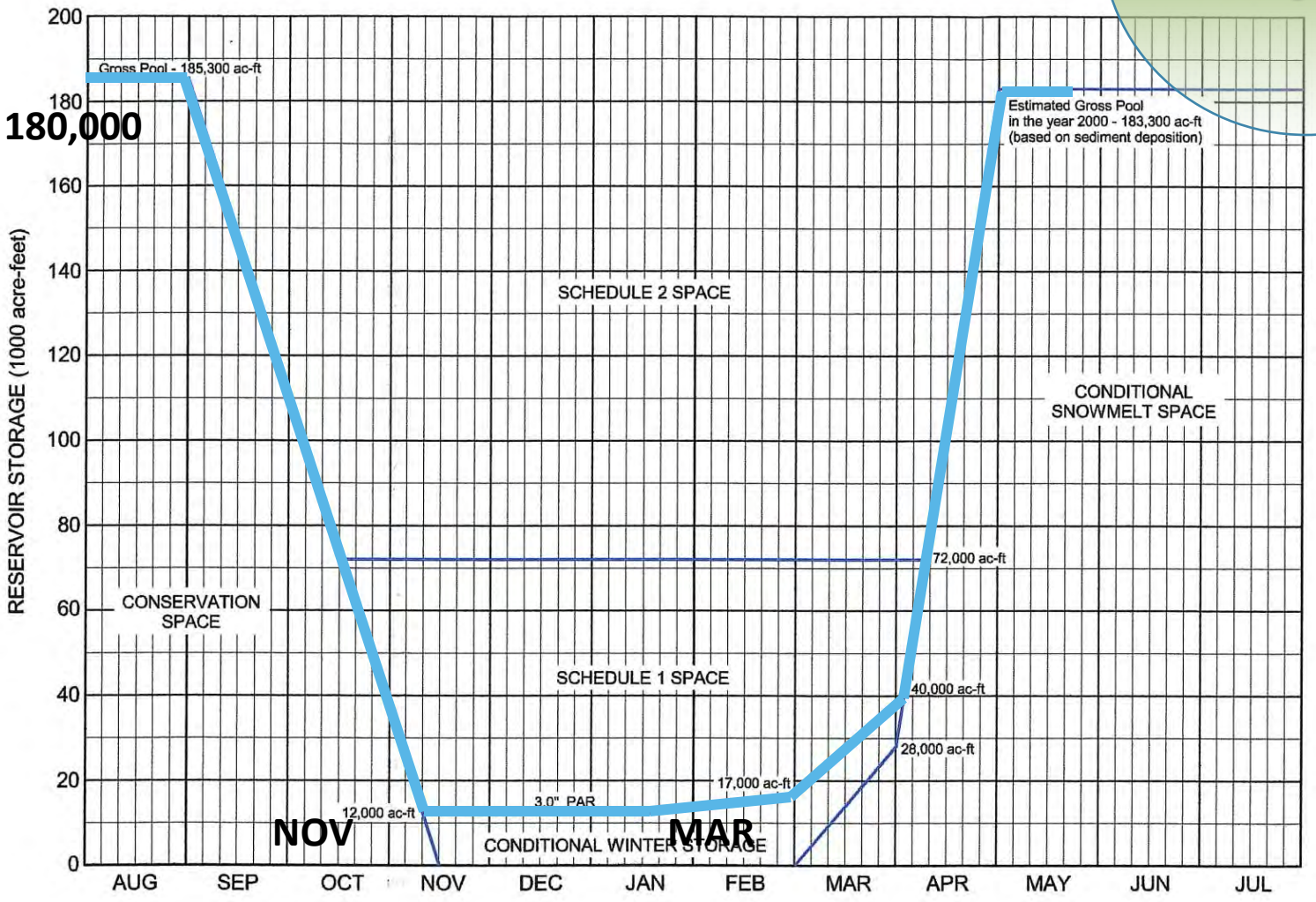
US Army Corps of Engineers

- Owns the Property
- Owns the Facilities
- Has Primary Use of Lake
  - FLOOD PROTECTION

  Controls Lake Storage from Nov 15 – April 15

Lake Kaweah Storage

FLOOD PROTECTION
US Army Corps of Engineers



WATER SUPPLY

Kaweah & St. Johns Rivers Association

K&SJRA

WATER SUPPLY

Kaweah & St. Johns Rivers Association

- Previously Two Separate Associations
- KSJRA Formed 1974
- 31 Units with water rights
- Some Ditch Co., Irrig. Districts, Riparian
- Private and Public Entities

WATER SUPPLY

Kaweah & St. Johns Rivers Association

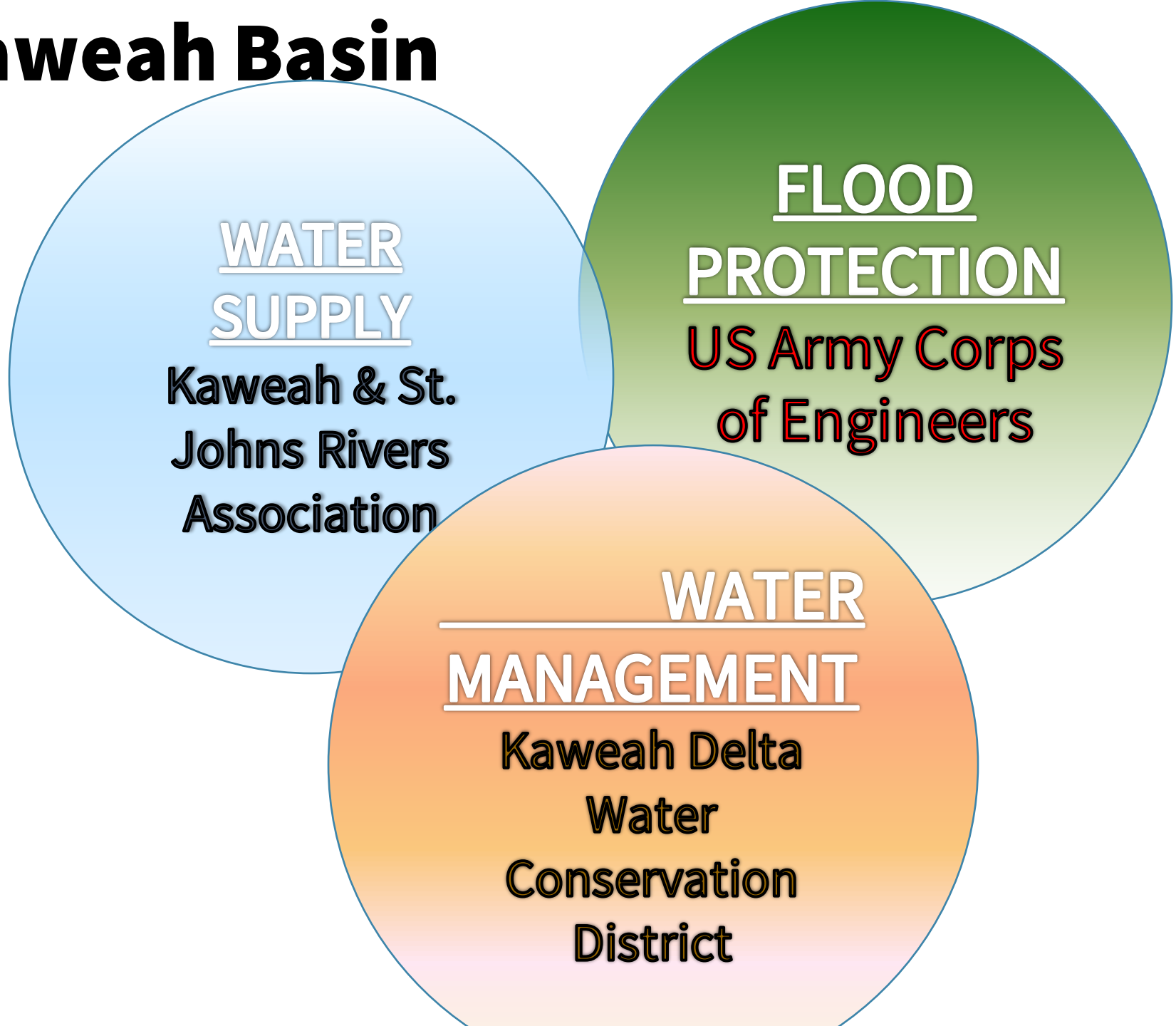
"Protect and preserve the diversionary rights of the Kaweah and St. Johns Rivers"

WATER SUPPLY

Kaweah & St. Johns Rivers Association

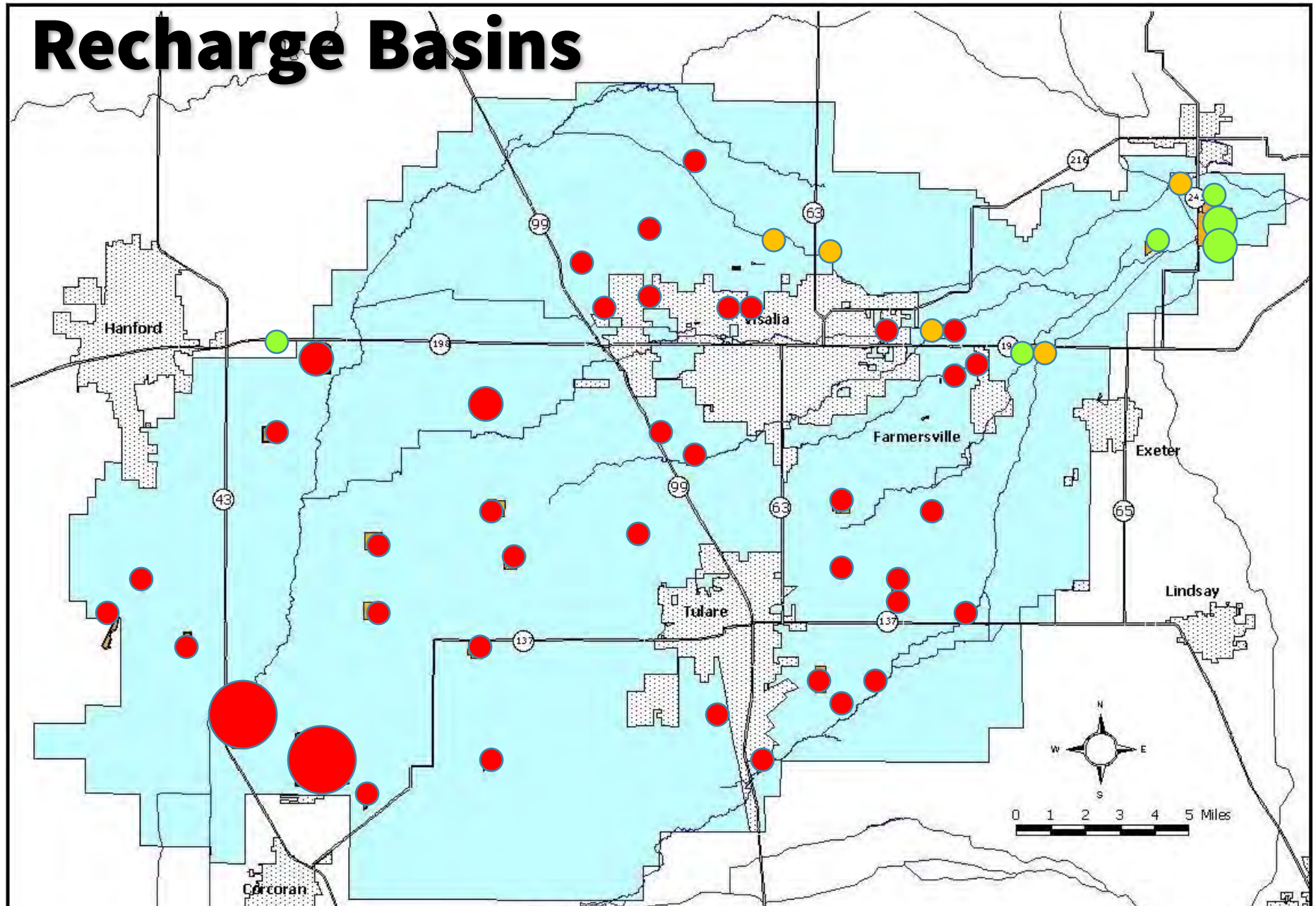
- Kaweah River is a “fully appropriated stream”
- Water is distributed to the member units from a schedule based on historical use
- They have a contract with KDWCD to store water in Lake Kaweah

Kaweah Basin



- Coordinate Flood Releases and Water Distribution
- Development and Utilization of Recharge Basin Facilities
- Water Importation

Recharge Basins



Lake Kaweah Enlargement Project

Lake Kaweah Enlargement Project

LAKE KAWEAH - Original

- Constructed 1962
- Original Capacity 143,000 Acre-Feet
- Protection 46 year

LAKE KAWEAH - Enlargement

- Construction 2004
- New Capacity 186,000 Acre-Feet
- Protection 70 year

Aaron Fukuda

Title: General Manager, Tulare ID

Interim General Manager, Mid-Kaweah GSA

Topic: GSP Determination & SGMA Update

MY JOB DEPENDS ON WATER
Farming in the SGMA Era

Michael Hagman

Title: General Manager, Lindmore ID

Executive Director, East Kaweah GSA

Topic: GSP Determination & SGMA Update

MY JOB DEPENDS ON WATER
Farming in the SGMA Era

Incomplete to Inadequate Determination

- DWR: 2-year Review ended in January 2020 with an “Inadequate”
  - Kaweah Subbasins did meet SGMA requirements of: deadline, completeness, coordination and subbasin coverage
  - Kaweah Subbasin GSAs given 180-days to revise GSP
- DWR: March 2023
  - Chronic Lowering of Groundwater Levels
    1. Set Sustainable Groundwater Management Criteria to avoid undesirable results
    2. Consider how MT for groundwater levels impact other undesirable results
    3. Mitigation Plan
  - Subsidence
    1. Better define undesirable result of channel capacity loss
    2. Describe MT for groundwater levels impact on inelastic subsidence

MKGSA Projects and Management Actions

Projects

- Visalia Tertiary Treatment Plant Upgrade – Exchange Agreement with Tulare ID – water used for irrigation Demand (Completed)
- City of Visalia Packwood Creek Linear Recharge Project (Completed)
- Tulare ID/City of Tulare 150-Acre Recharge Complex (Completed)
- Tulare ID 60-Acre Recharge Basin (Completed)
- Okieville Basin Recharge Project (Construction WY 2023)
- City of Visalia Cameron Creek Linear Recharge Project (In Design)
- City of Tulare Catron Basin Stormwater Capture and Recharge Basin (Grant Application Pending)
- Tulare ID Seaborn Reservoir – Reclamation of Mining operation for surface water storage and habitat restoration project (Pending Funding)
- Purchase and implementation of TowTEM Unit (Completed)

Management Actions

- 2022 MKGSA Emergency Ordinance – Groundwater Allocation & Cutback

EKGSA Projects

Project	Annual Benefit (AF)	Status	Total Cost	Grant	Local
Cottonwood Creek Recharge	1,800	In Progress	$750,000	$750,000	$0
Lewis Creek Recharge	3,000	In Progress	800,000	650,000	150,000
Lindmore ID 1st Avenue Recharge	800	In Progress	5,400,000	-	5,400,000
Lindmore ID 5th Avenue Recharge	2,000	Complete	8,000,000	-	8,000,000
Lindmore ID HRB Recharge	500	Complete	750,000	-	750,000
Mariposa Basin Recharge	180	Complete	725,000	525,000	200,000
Upper Lewis Creek Recharge	400	In Progress	425,000	375,000	50,000
Yokohl Creek Recharge	1,800	In Progress	500,000	500,000	-
Sentinel Butte Flood Capture	400	In Progress	375,000	375,000	-
Rancho de Kaweah	9,000	Study	12,500,000		12,500,000
Total Estimated Annual Benefit	19,880		$30,225,000	$3,175,000	$27,050,000

- Numerous private landowner projects, right sizing plantings, recharge basins, fallowing, etc. Substantial cost in total (in the millions).
- Lindmore ID HRB was installed in 2017 and by 2019 met the 10-year objective and has met the 20-year objective
- Lindmore ID 5th Avenue RB began operation June 6 and has already achieved the estimated average annual rate with four more months.
- Additional funded study to understand how Dry Wells can be used for recharge and what the effect is on groundwater quality ($200,000)

GKGSA Projects and Management Actions

Projects

- Kaweah Delta – Hannah Ranch Flood Control/Recharge (2020-2025)
- Kaweah Delta – Paregien Basin Expansion (2022-2023)
- Kaweah Delta – Paregien Basin Land Purchase (2024-2025)
- Kings County WD - Delta View (Feasibility Study 2024)
- Kaweah Delta – Kaweah Oaks Preserve Flood Control/Recharge (Design 2023)
- Consolidated Peoples DC – Shannon Basin Expansion (2022-2024)
- St. Johns WD – Vanderstelt Recharge Basin (Design 2023)
- Kaweah Delta – Flood Water Capture/Recharge Project (2023)

Management Actions

- Rules and Regulation
- Ongoing Demand Reduction Allocations & Penalties

Kait Palys

Title: Water Resources Specialist/Hydrogeologist, INTERA

Topic: Mitigation Program

MY JOB DEPENDS ON WATER
Farming in the SGMA Era

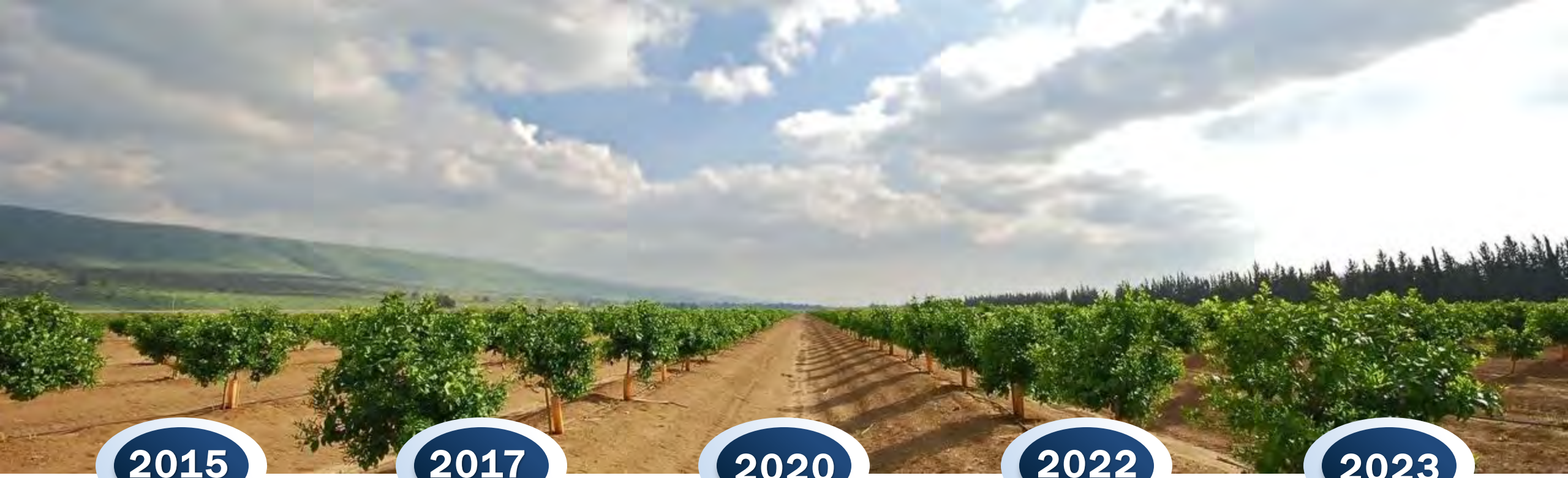
Kaweah Subbasin Mitigation Program

A Presentation to

My Job Depends on Water

2023 Grower Event

July 13, 2023



2015

SGMA goes into effect

2017

GSAs are formed

2020

First GSP is submitted

Implementation commences

2022

DWR sends 1st inadequate determination

GSAs submit Amended GSPs

2023

DWR sends 2nd inadequate determination

INTERA

2023

The GSAs are working to address DWR's comments to avoid SWRCB probation

DWR sends 2nd inadequate determination

INTERA

Why is SWRCB probation undesirable?

Landowner required annual reporting of monthly extractions

Metering requirements (paid for by landowner)

Fees for SWRCB to manage Basin

Sub

Fees can be raised at any point by SWRCB

Base Filing Fee	Volumetric Fee	Late Fee
• $300/well	• $40/ac-ft • $55/ac-ft if SWRCB develops interim plan	• 25% each month applicable

INTERA

DWR's recommendations:

Refine Water Level Sustainable Management Criteria

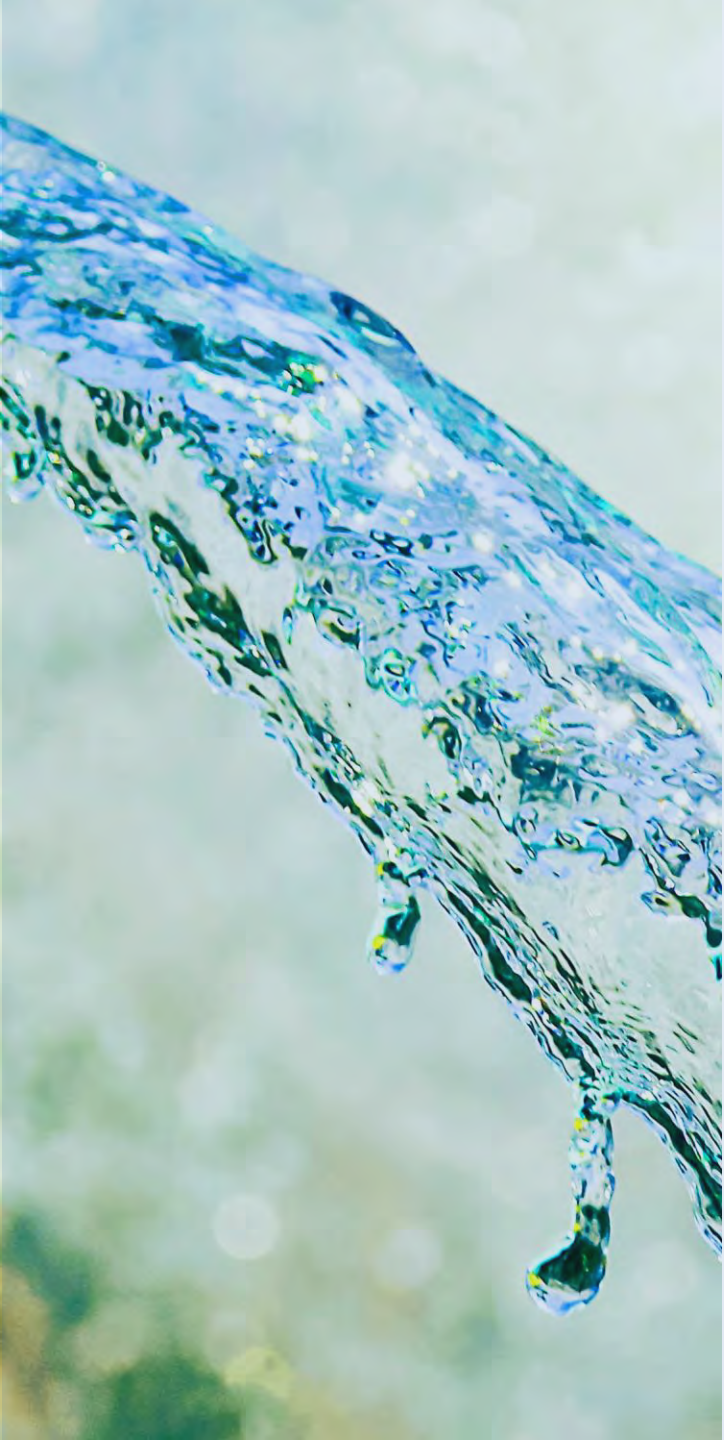
Refine Subsidence Sustainable Management Criteria

Develop a Mitigation Program

What does a Mitigation Plan do?

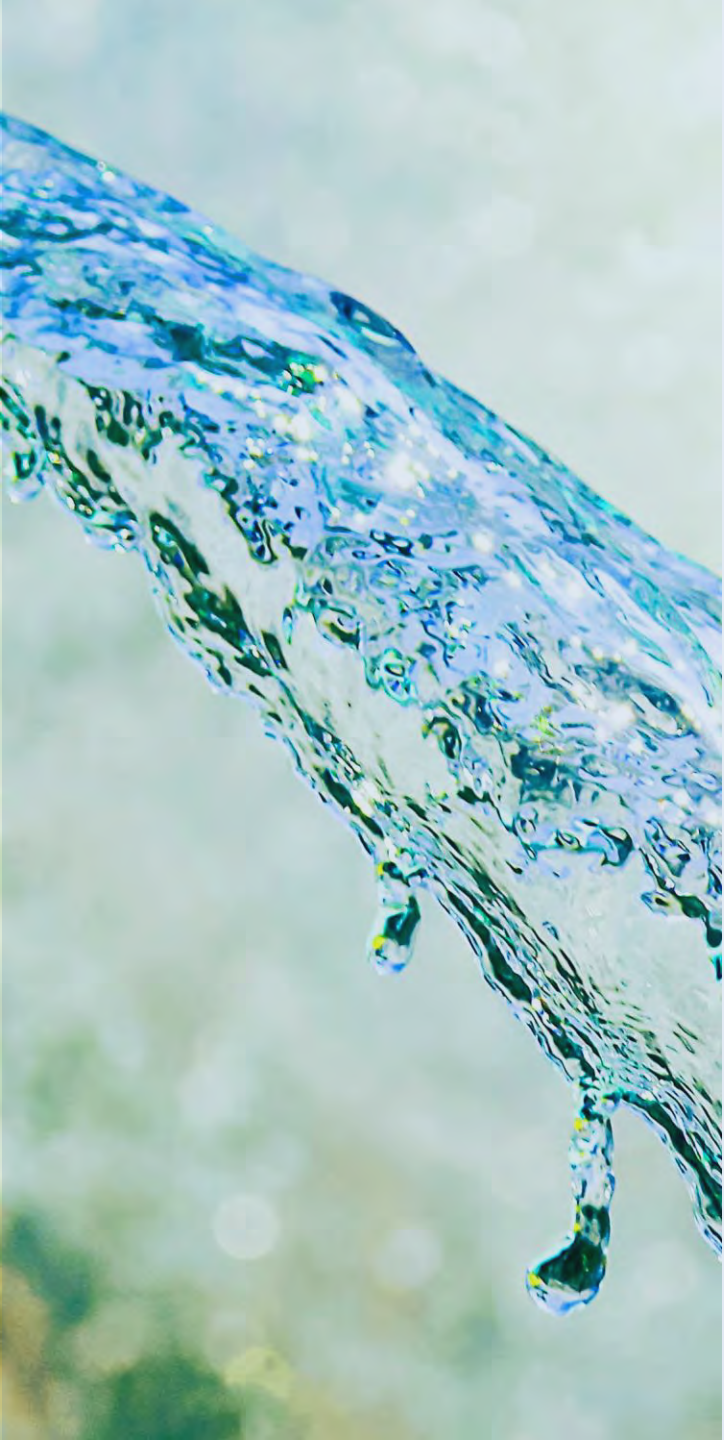
Outlines a process for impacted well owners to receive technical and/or financial assistance to mitigate

Impacts must be related to groundwater overdraft (post-GSP implementation) to qualify for assistance



Kaweah Subbasin Mitigation Program

- East Kaweah GSA Mitigation Plan
- Greater Kaweah Mitigation Plan
- Mid-Kaweah Mitigation Plan



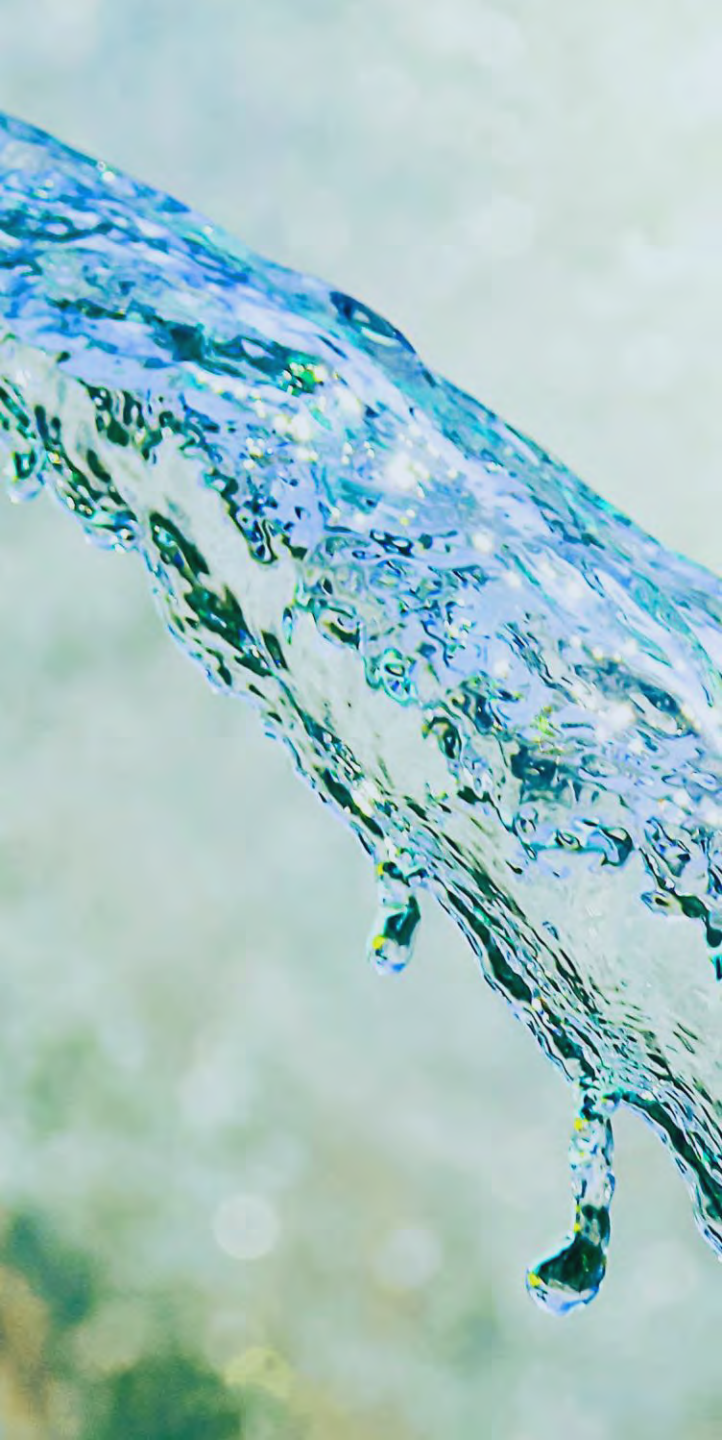
Kaweah Subbasin Mitigation Program

Coordinated framework that lays out the minimum requirements of the GSA-specific Mitigation Plans

East Kaweah GSA Mitigation Plan

Gre Mitigation Plan

Mitigation Plan



GSA Performs Initial Stakeholder Outreach

Claimant Identifies Need for Mitigation by Filing a Claim Application with GSA

GSA Performs Pre-Qualification Review

GSA or Contractor Performs Technical Investigation

Mitigation Qualification Evaluated by GSA's Technical Advisory Commitee (TAC). The TAC Shall Recommend a Mitigation Measure to the GSA Board for Consideration.

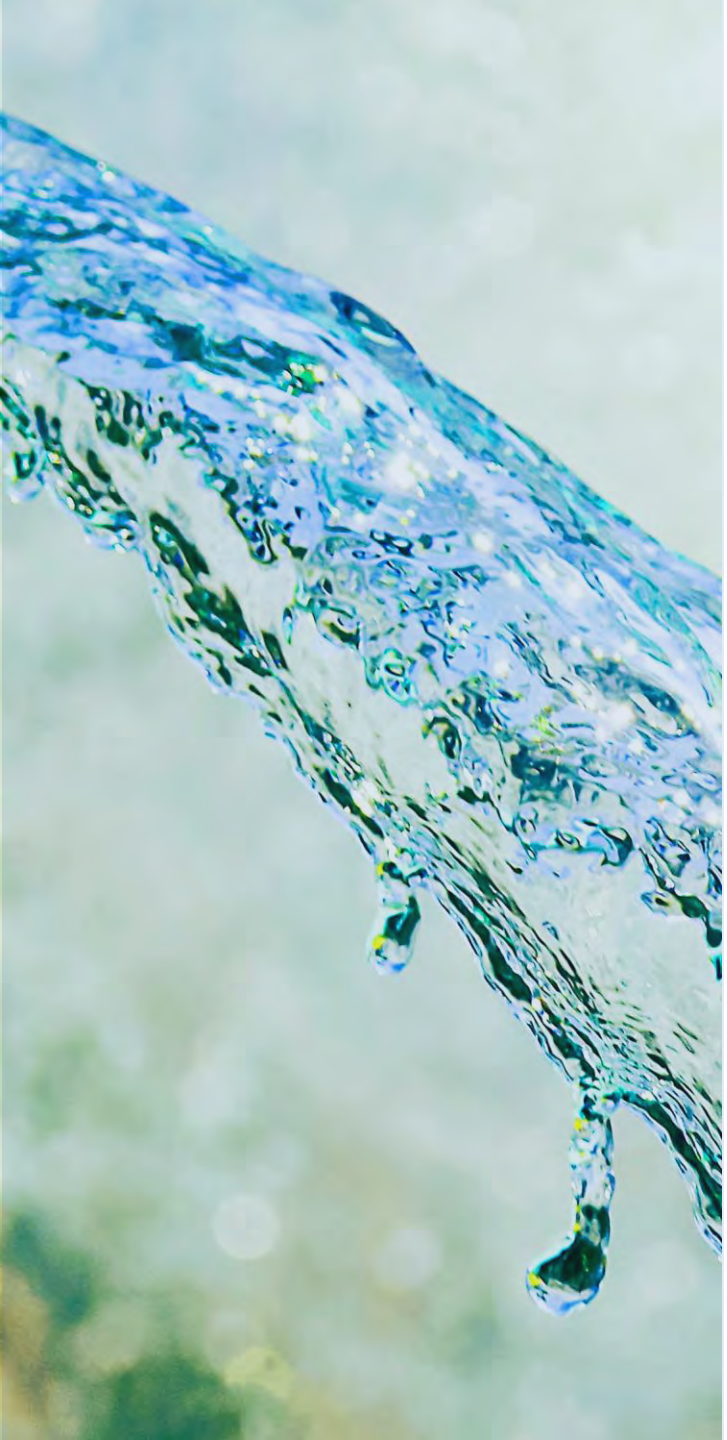
Appropriate Mitigation Determined by GSA and Claimant

Mitigation and Indemnification Agreement Signed by Claimant and GSA

GSA Awards Qualifying Claimant with Agreed Upon Mitigation Support

What is the process?

INTERA



Kaweah Subbasin Mitigation Program

- East Kaweah GSA Mitigation Plan
- Greater Kaweah Mitigation Plan
- Mid-Kaweah Mitigation Plan

Each GSA has developed a Mitigation Plan that identifies mitigation claims process, claim eligibility, and types of mitigation available.

Public Comment Period is Open!

EKGSA

https://ekgsa.org/mitigation

MKGSA

https://www.midkaweah.org/

GKGSA

https://greaterkaweahgsa.org/

MY JOB DEPENDS ON

WATER

Farming in the SGMA Era

SESSION 1

Speaker Panel

MY JOB DEPENDS ON WATER

Farming in the SGMA Era

SESSION 2

Farming in the SGMA Era – Tools and Funding for Success

Joel Kimmelshue

Title: Owner/Principal Soil & Agricultural Scientist, Land IQ

Topic: Land IQ – ET and groundwater management

MY JOB DEPENDS ON WATER
Farming in the SGMA Era

MY JOB DEPENDS ON WATER - FARMING IN THE SGMA ERA

MANAGEMENT OF GROUNDWATER RESOURCES THROUGH EVAPOTRANSPIRATION AND UNDERSTANDING CROP TYPE

EAST KAWEAH GROUNDWATER SUSTAINABILITY AGENCY

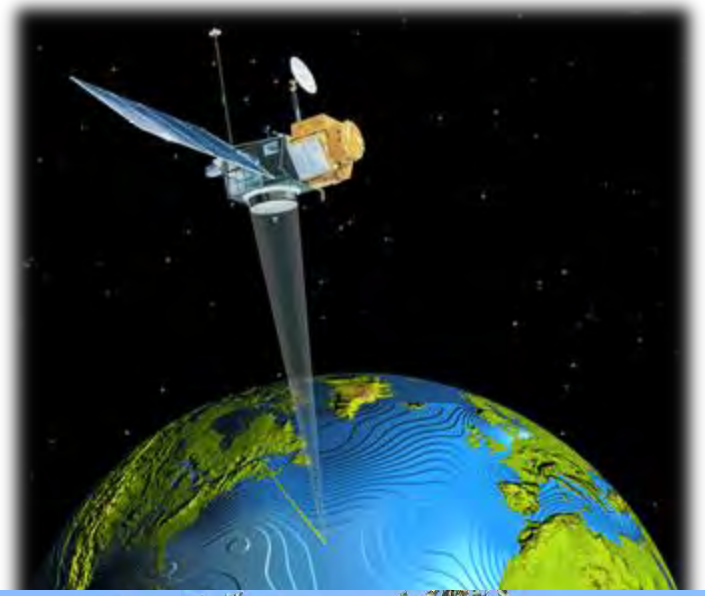
GREATER KAWEAH GROUNDWATER SUSTAINABILITY AGENCY

MID-KAWEAH GSA

LAND IQ

JULY 13, 2023

LAND IQ TECHNICAL DISCIPLINES



Land-Based Sciences: Land and Water Resources

- Agronomic assessments/soil science
- Water quality and supply evaluations
- Salinity and nutrient management
- Agricultural reuse
- Land stabilization and erosion control
- Soil reclamation and irrigation/drainage

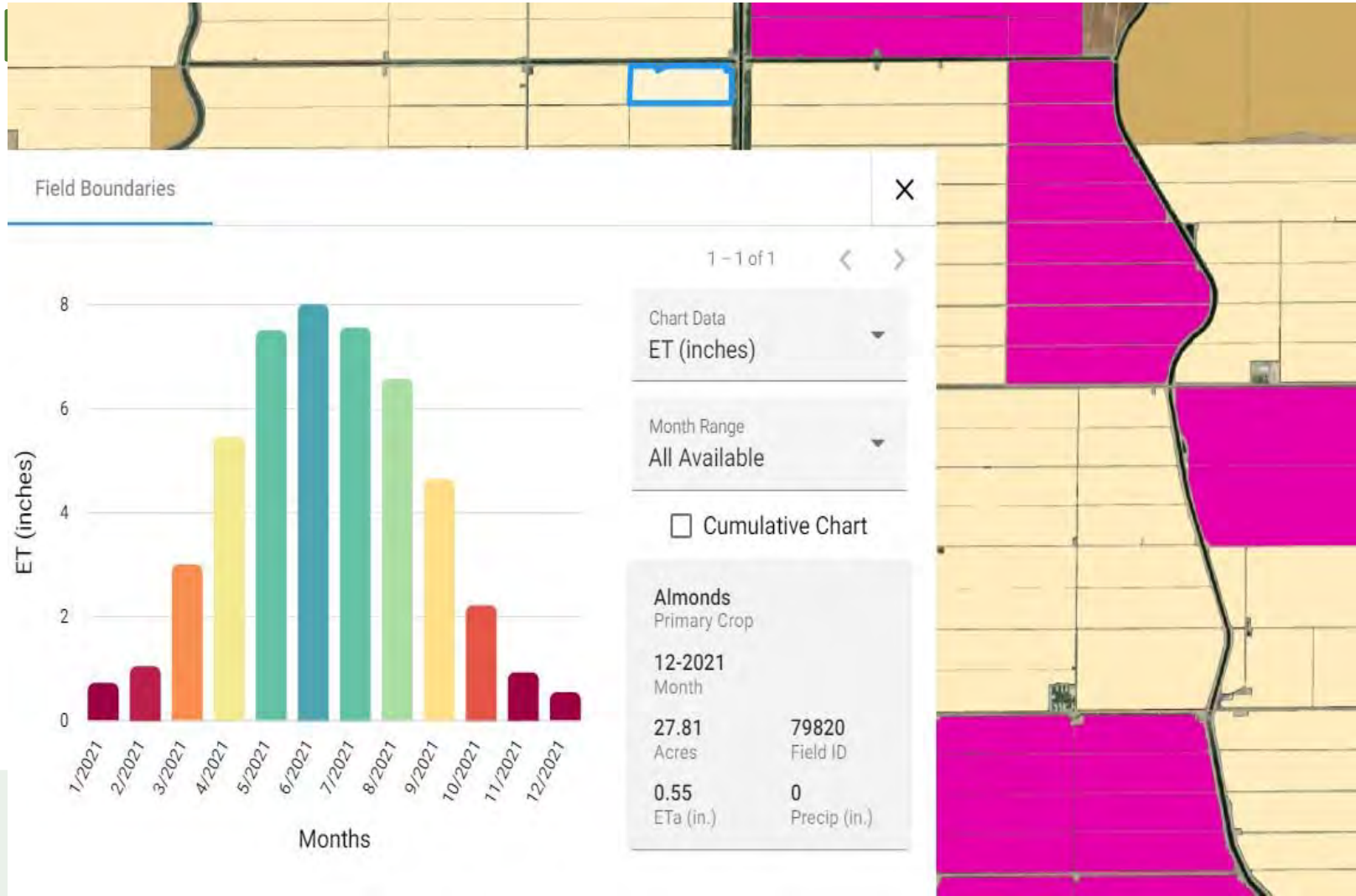
Spatial Sciences: Remote Sensing and GIS

- Consumptive use estimation and crop identification
- Large landscape evaluations
- Irrigation and drainage
- Production agriculture

Development

- Data management tools

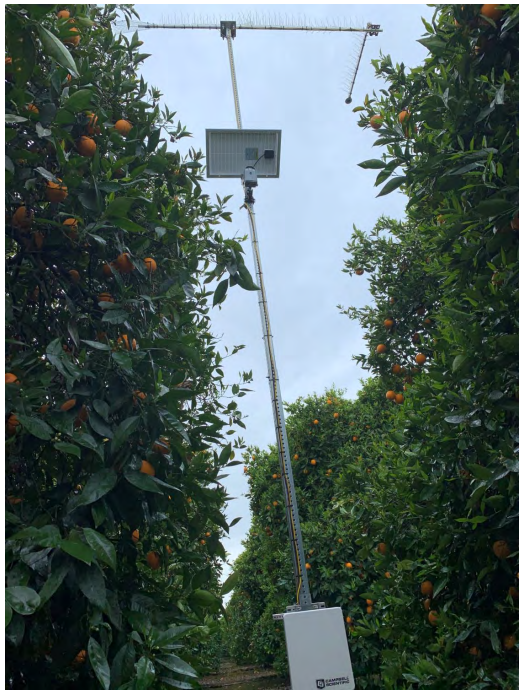
Evapotranspiration and Ground Truthing Cali and validation



GROUND TRUTHING – WHY?

Ground truthing quantification of ETa using specialized scientific instrumentation

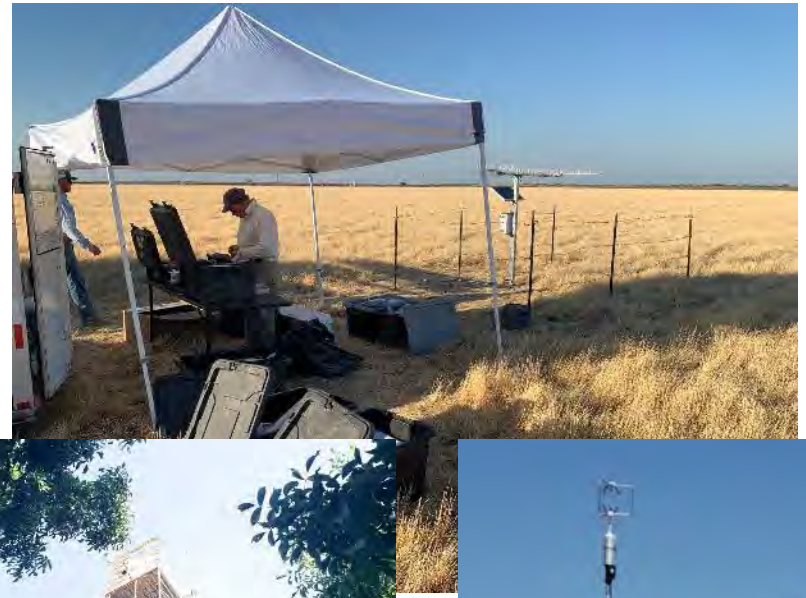
- Widely accepted, scientifically proven, methodologies for quantifying ETa
- Two station types employed
  - Eddy Covariance (Full)
  - Surface Renewal (Water IQ/H2Q)
- Strategically placed throughout AOI to characterize spectrum of water use conditions
  - Low water use environments are just as important as high use conditions
  - Minimum field size requirements based on crop type
- Built and maintained by Land IQ
  - Not possible without grower cooperators willing to grant permission to install and work around infrastructure
  - Require monthly visits to clean/maintain
  - Telemetered via cellular modems



LAND IQ

GROUND TRUTHING FOR CALIBRATION – WHY?

- Defensible
- Independent validation
- Calibration to actual conditions
- Avoiding interpolation during cloud and smoke cover
- Understanding specific field conditions and management
- Allows for continual improvement of models
- Allows for crop-specific modeling
- Stations used are a combination of eddy covariance and surface renewal approaches developed through collaboration with DWR (Delta) and UC Davis researchers
- A “ground up” approach

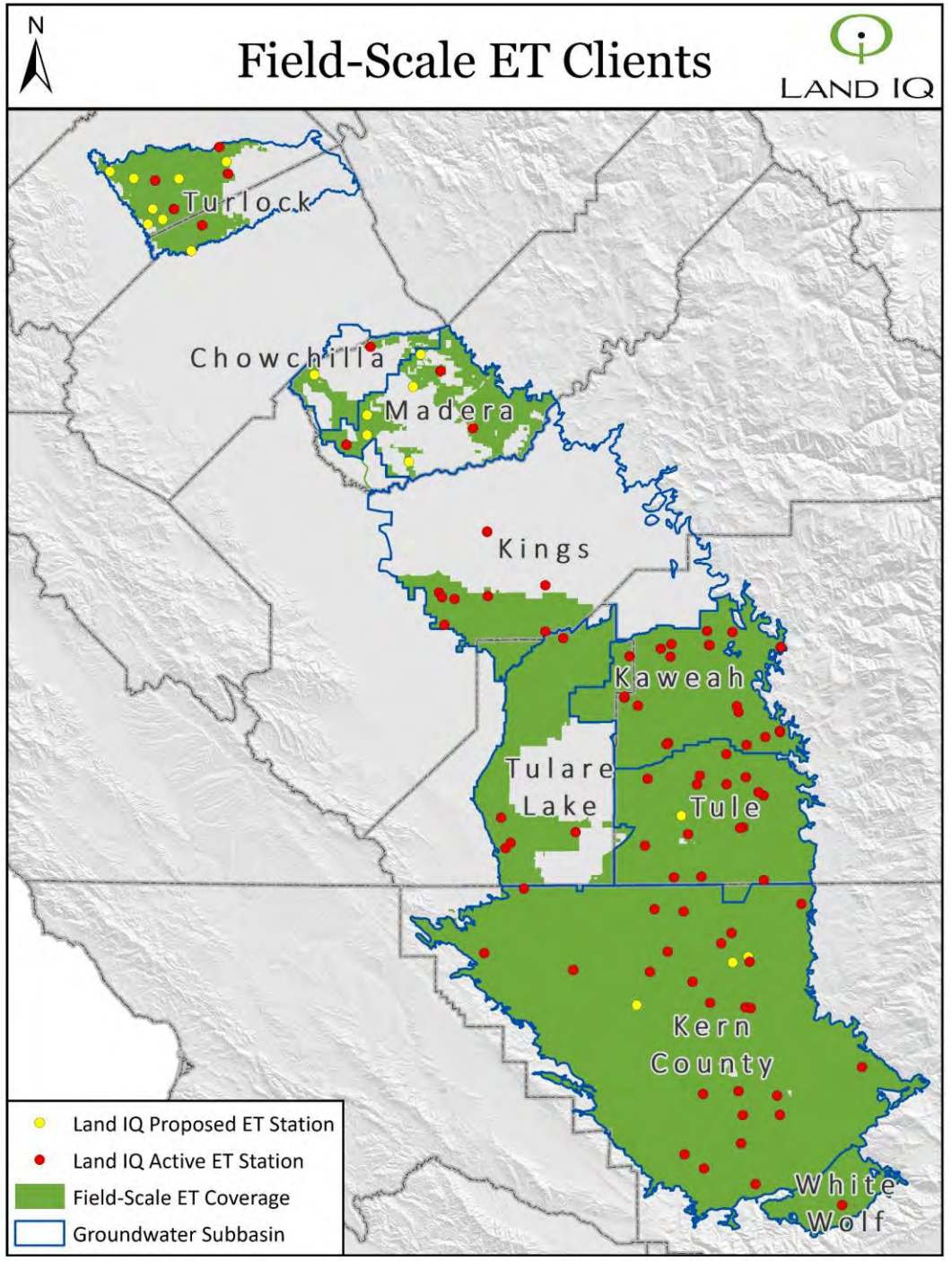


CURRENT ET WORK EFFORTS

Land IQ currently provides monthly, field by field consumptive use, land use, and precipitation results for:

- Approaching 100 ground truthing stations
- Approximately 40 GSAs or Districts
- 3.3 million acres
- 35-40 different crops
- Multiple water sources
- Supports various allocation methods and water management strategies
- Monthly reports with accuracies
- Delivery within about 30 days
- Integration to on-line platform results
- Collaboration with UC Davis, UC Cooperative Extension and USDA Agricultural Research Service

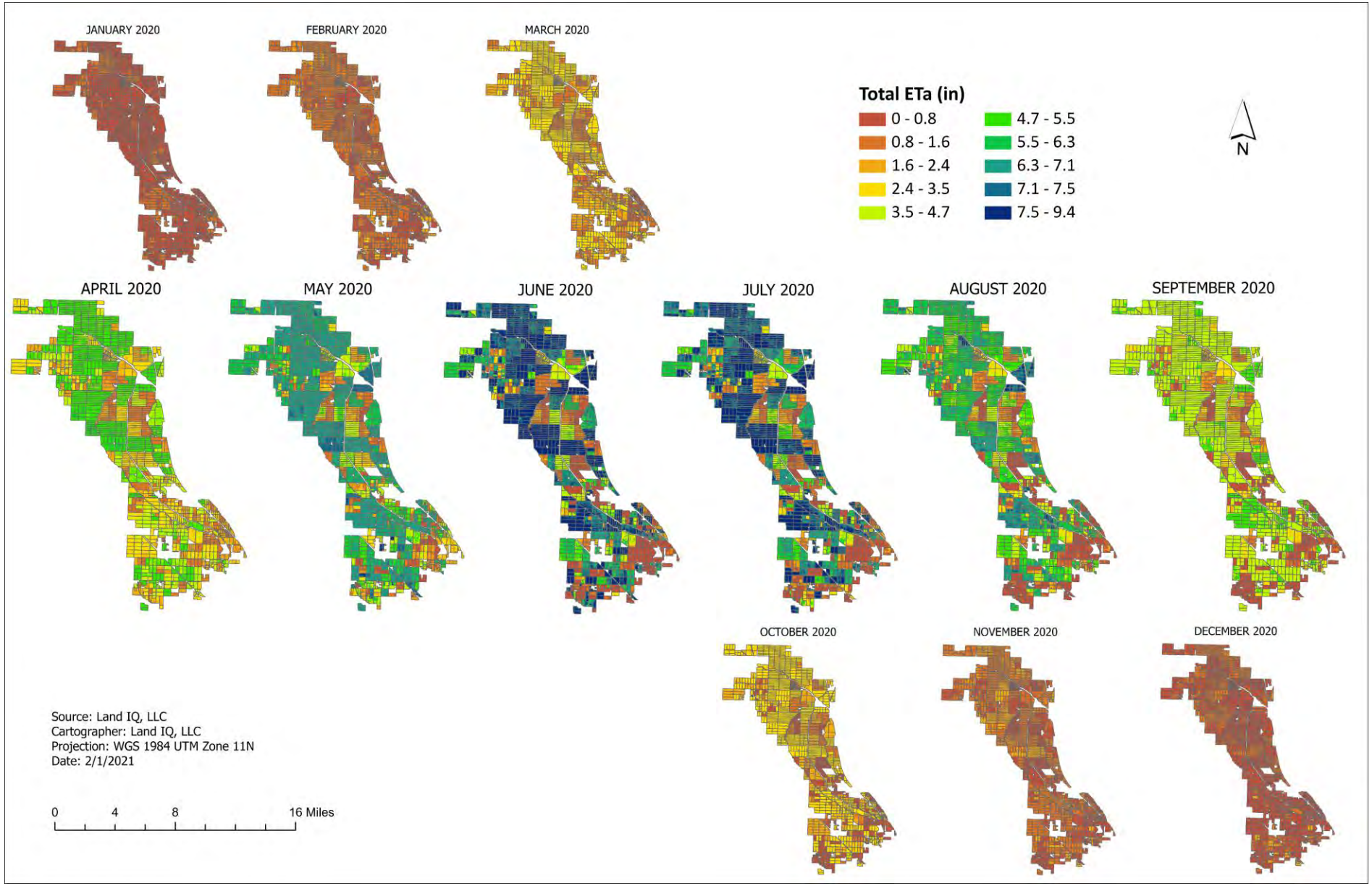
Necessary for more accurate estimation of consumed water in any water allocation/market approach



EVAPOTRANSPIRATION

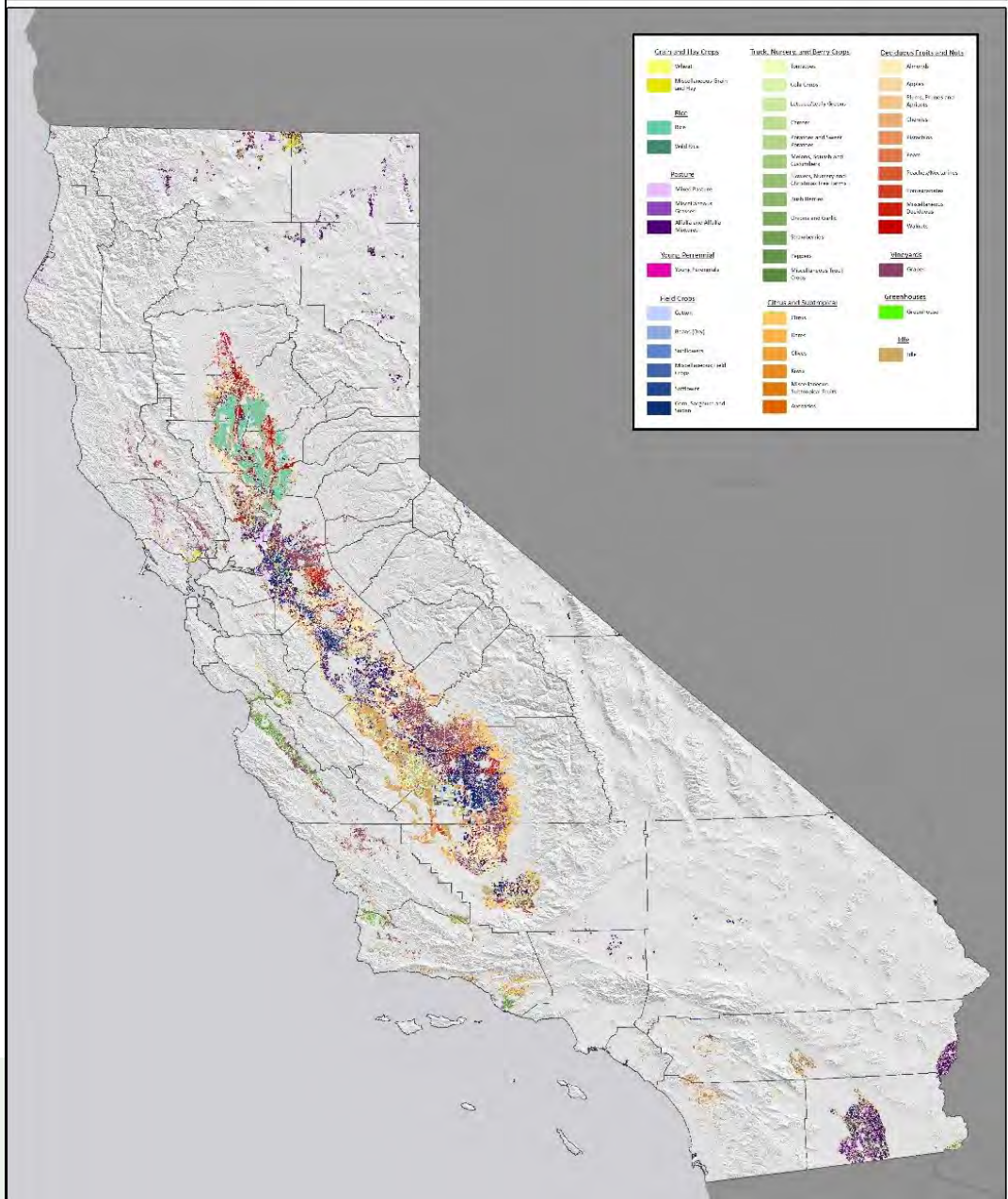
DELIVERABLE – FIELD BY FIELD ET

- Monthly results delivered to the GSA within 25 days of the previous month
- Calibrated and validated by ground truthing climatic stations
- Reviewed by independent advisors
- Used for tracking water use, water management, reporting, allocations, water markets, etc.



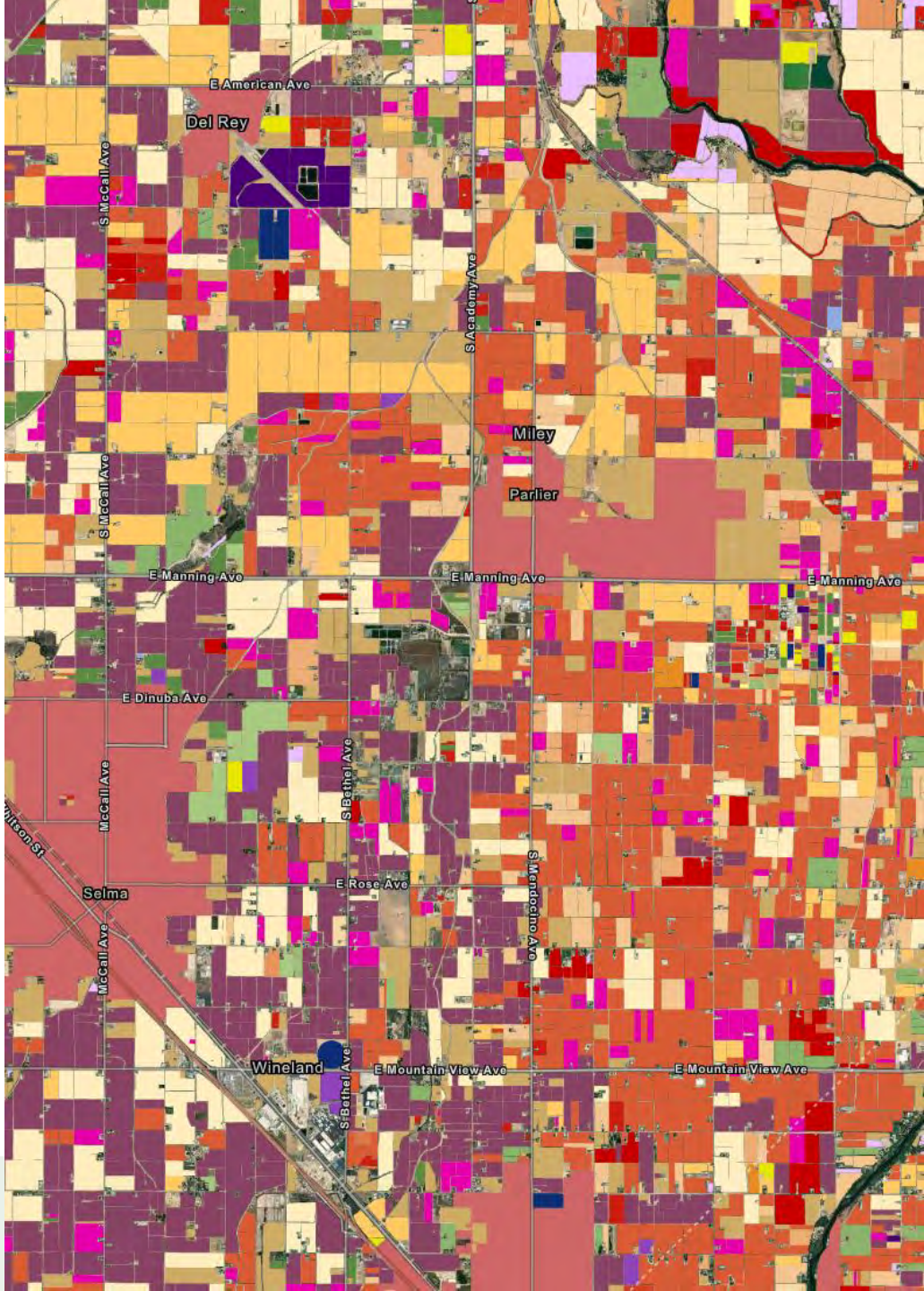
Crop Mapping

2021 DWR STATEWIDE LAND USE



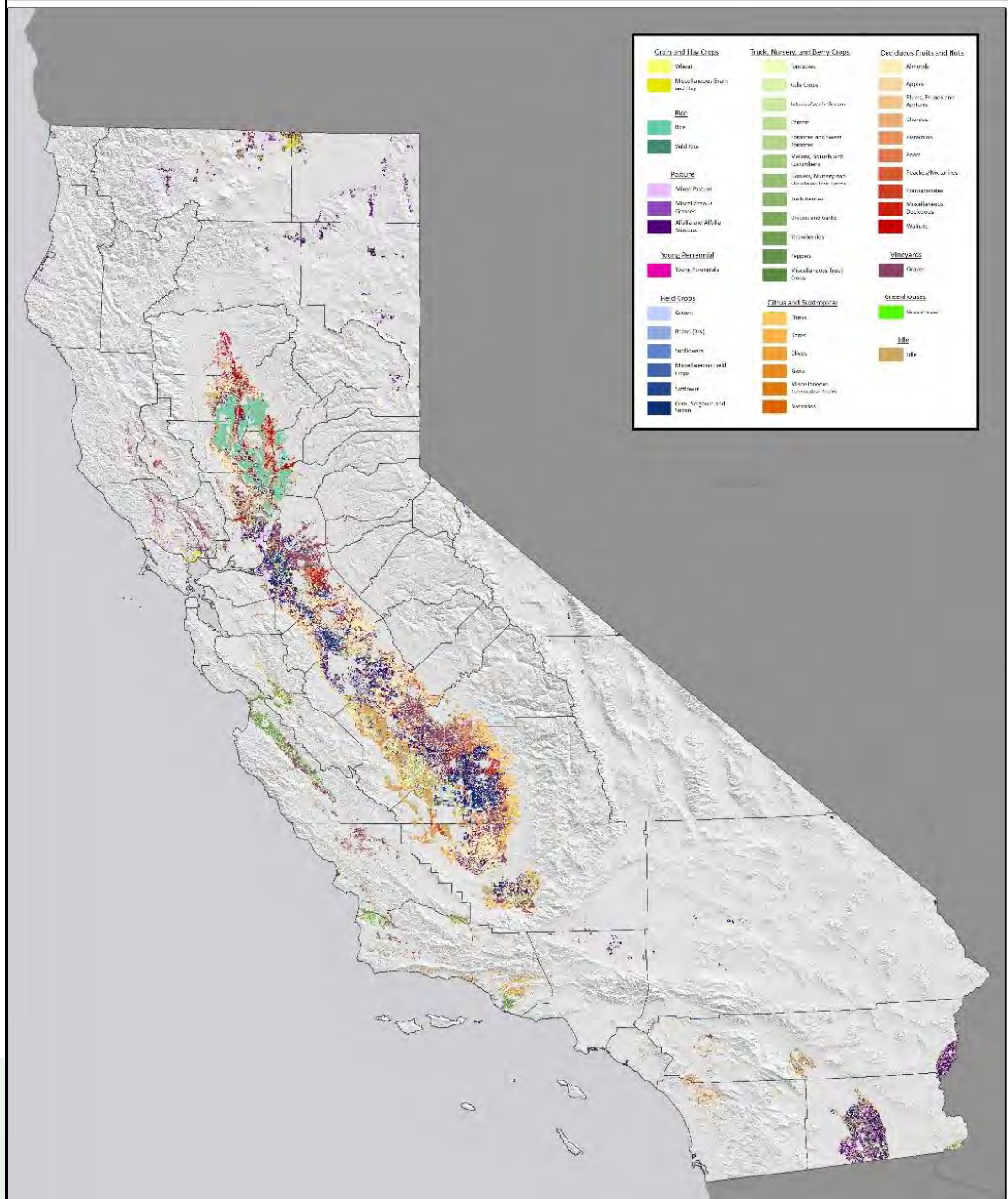
STATEWIDE LAND USE – ALL CROPS

- Minimum field size of 2.0 acres – many times less
- Overall accuracy of 97.6% based on independent ground-truth validation dataset
- Approximately 50 crop legend categories, which represent 98% of all irrigated lands
- Over 17,000 miles of ground truthing each year
- Fact: Urban is approximately 50% of ag footprint (4.7 million acres versus 9.6)



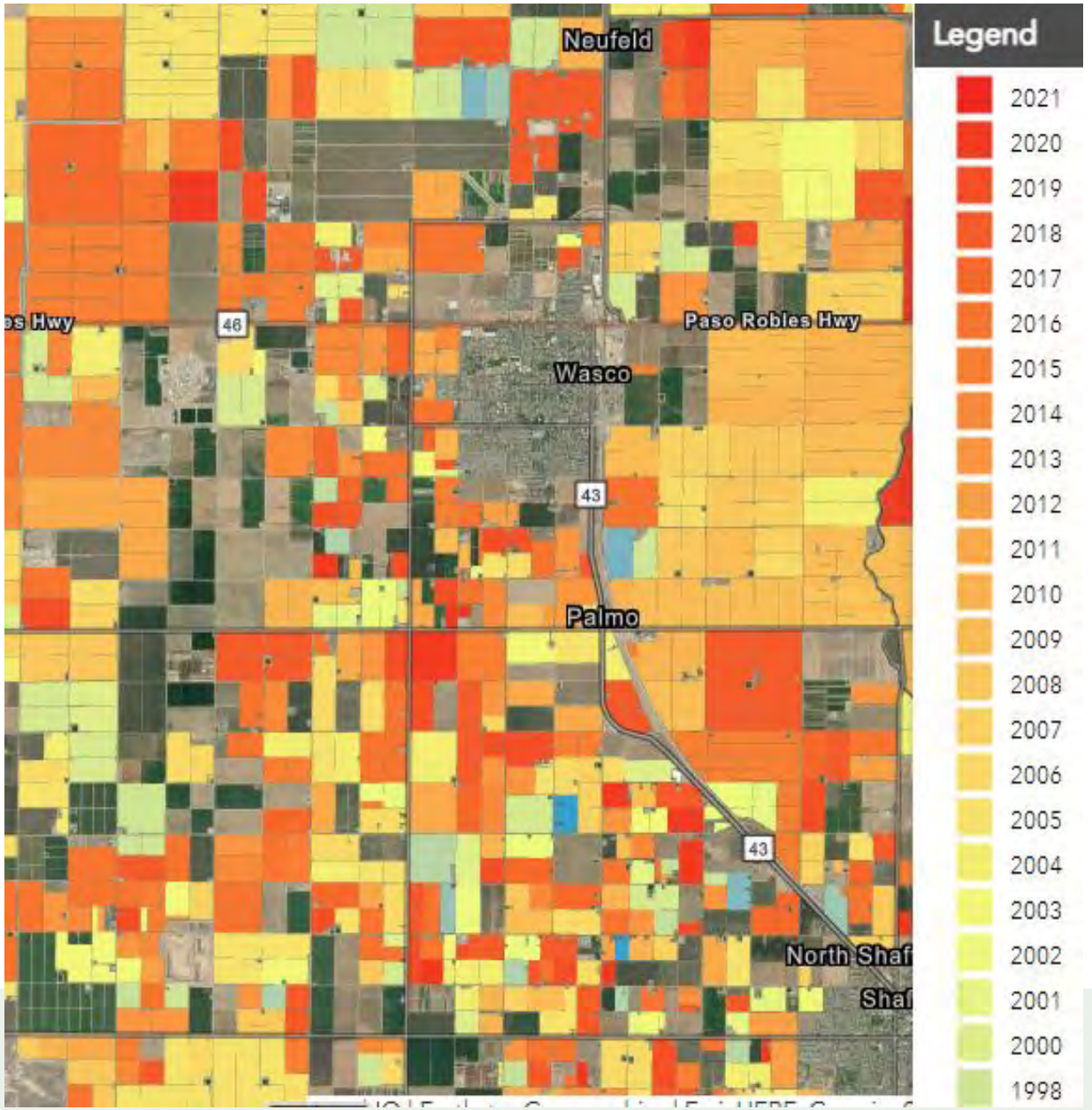
PERMANENT CROP AGE

2021 DWR STATEWIDE LAND USE

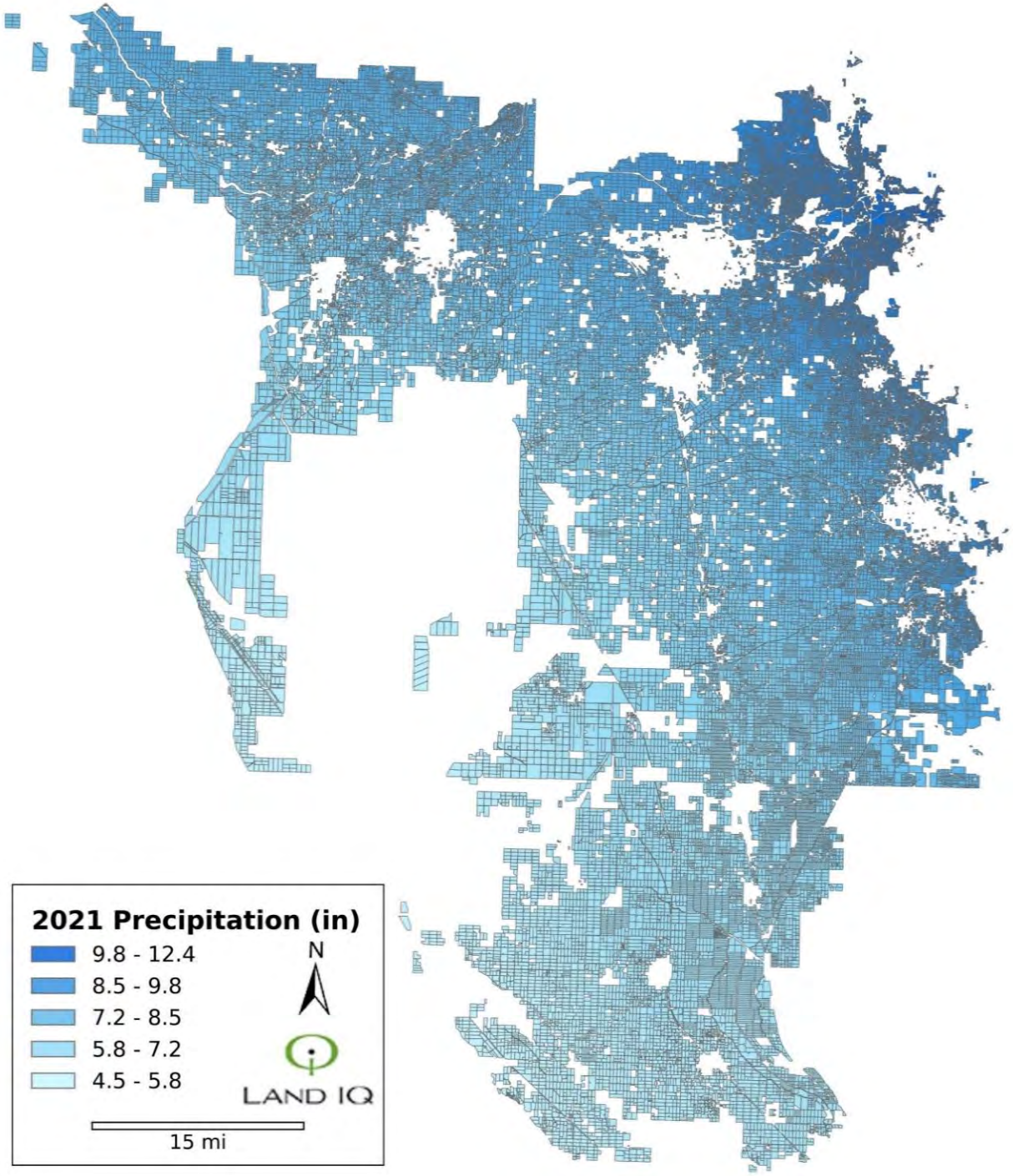


DELIVERABLE – PERMANENT CROP AGE

- Same methodology used to provide crop type to CA Dept of Water Resources as a requirement of SGMA
- Consistent with results for DWR
- Highly correlated to consumed water
- ETo x Kc = ETc (not true for trees)
- Yet another line of evidence that people can use to refine their water management allocations

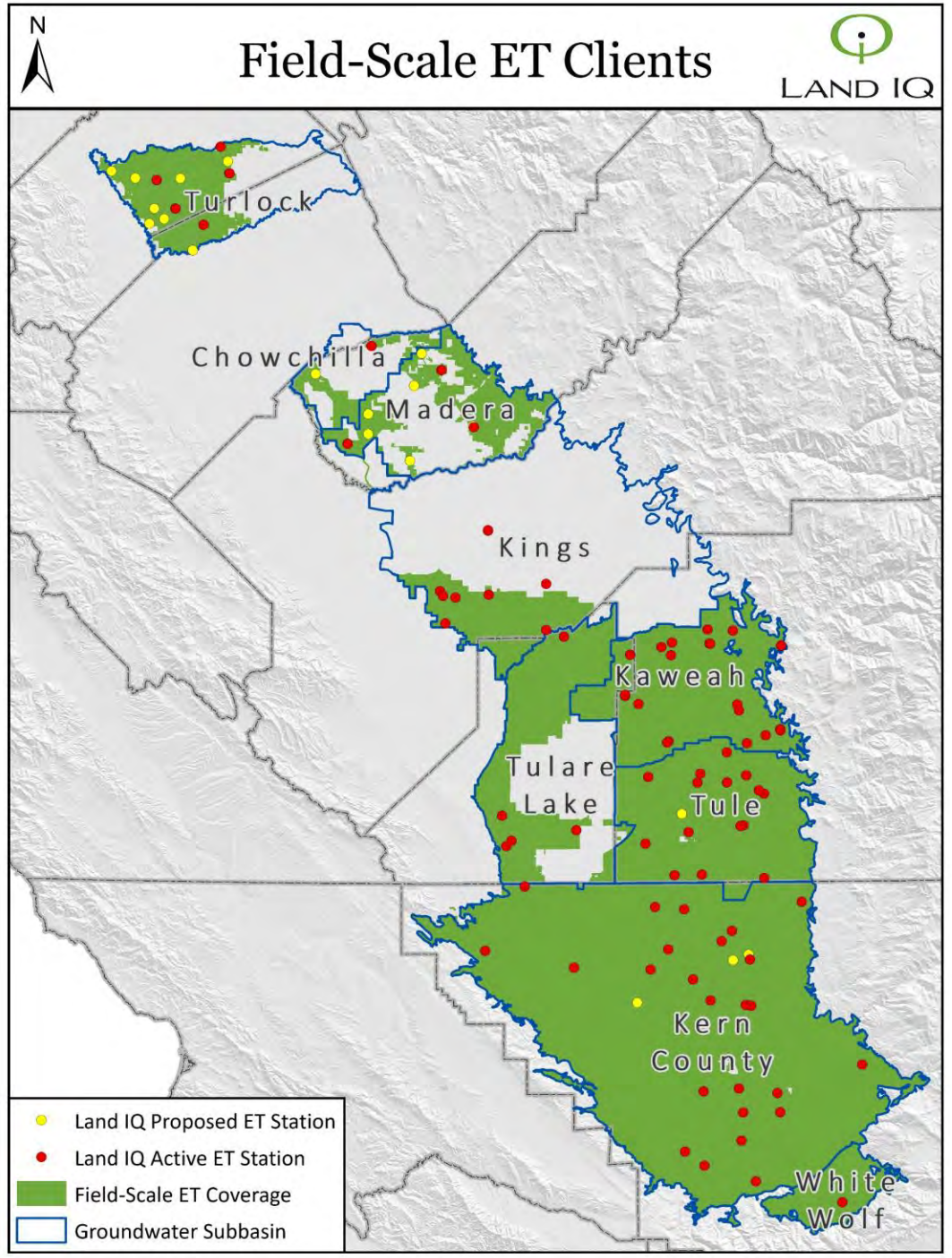


PRECIPITATION



DELIVERABLE – FIELD BY FIELD PRECIPITATION

- Results collected by rain gauges at ground truthing stations
- Incorporation of other public rain gauge results (e.g. CIMIS, airports, cities, etc.
- Conversion of point data into a spatial precipitation map by month and by year
- Assignment of a field-by-field precipitation for rainfall contribution to ET, water budget tracking, allocations, modeling, etc.



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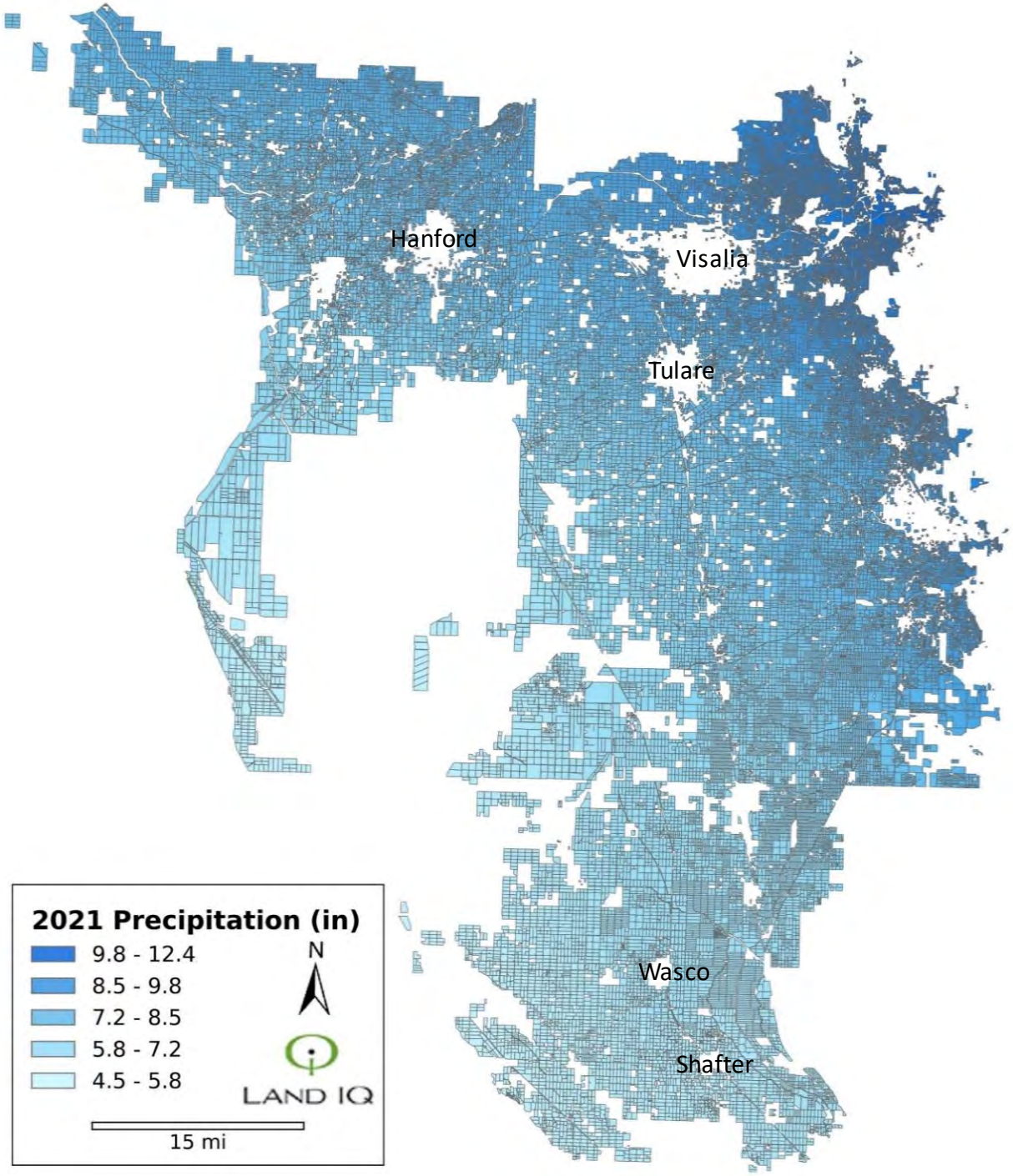
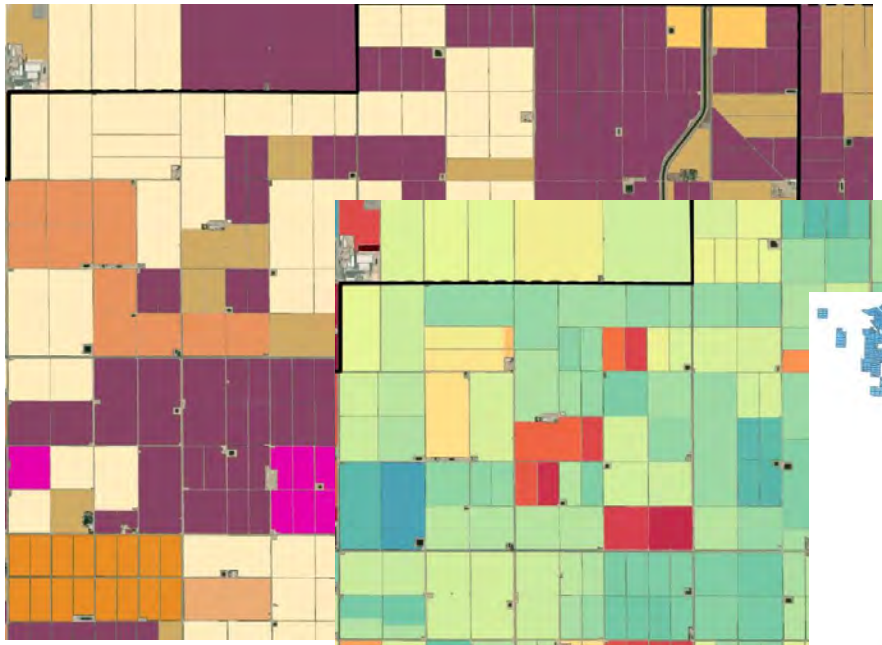
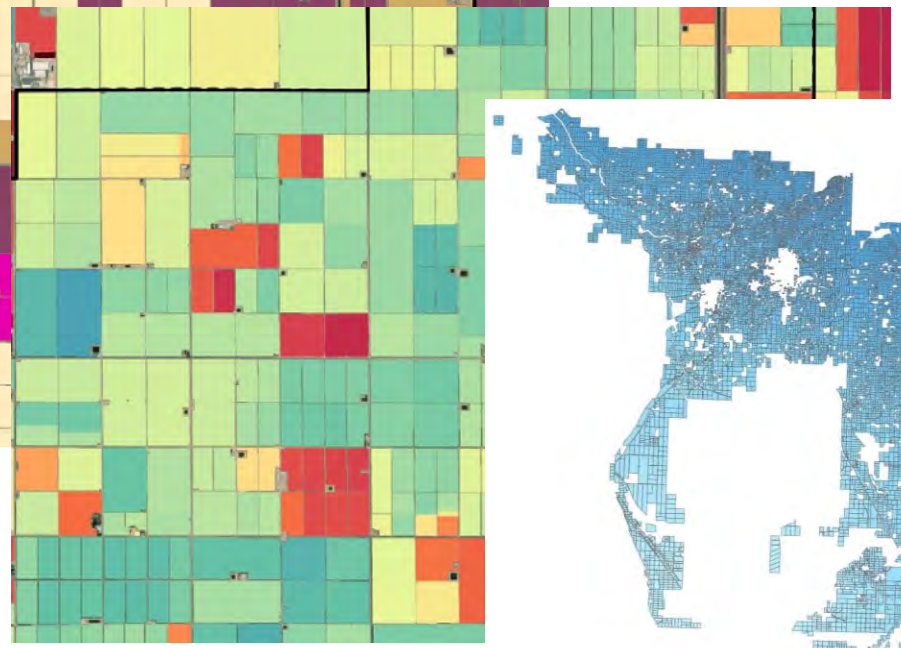


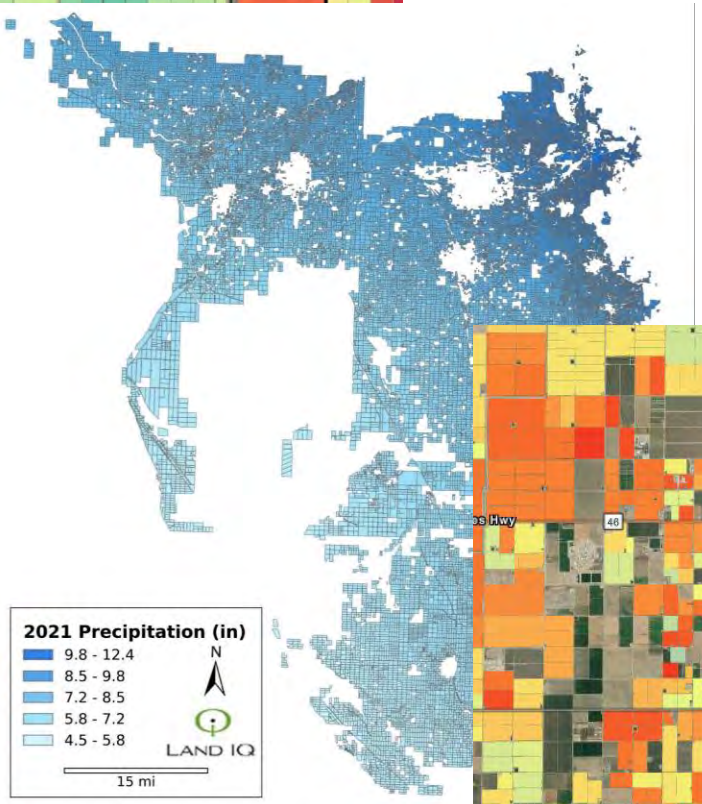
FIELD-BY-FIELD RESULTS



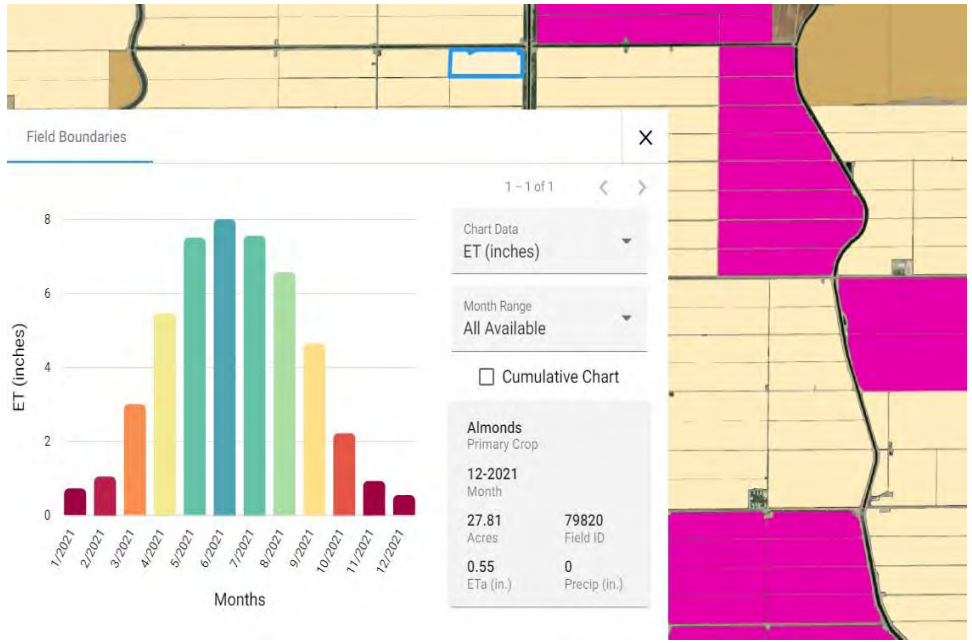
Land Use



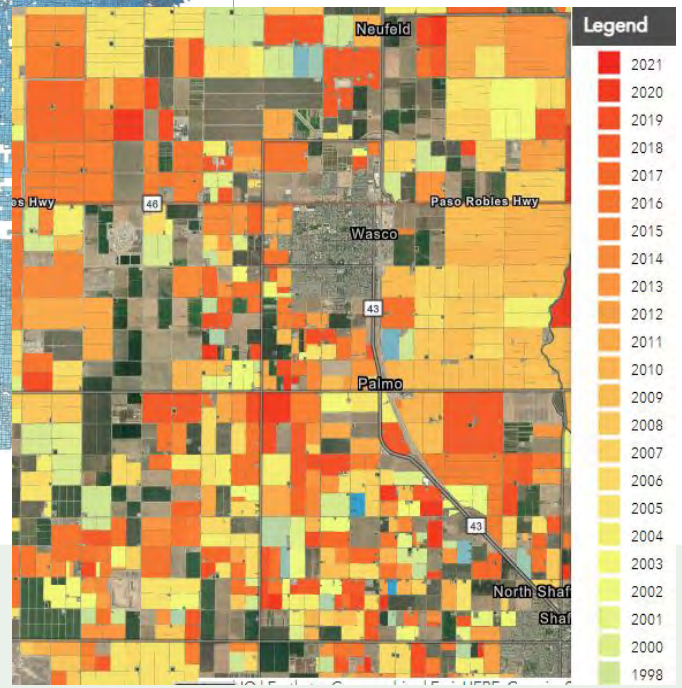
Monthly ET



Monthly Precipitation



Online Viewer and Data Download Tool

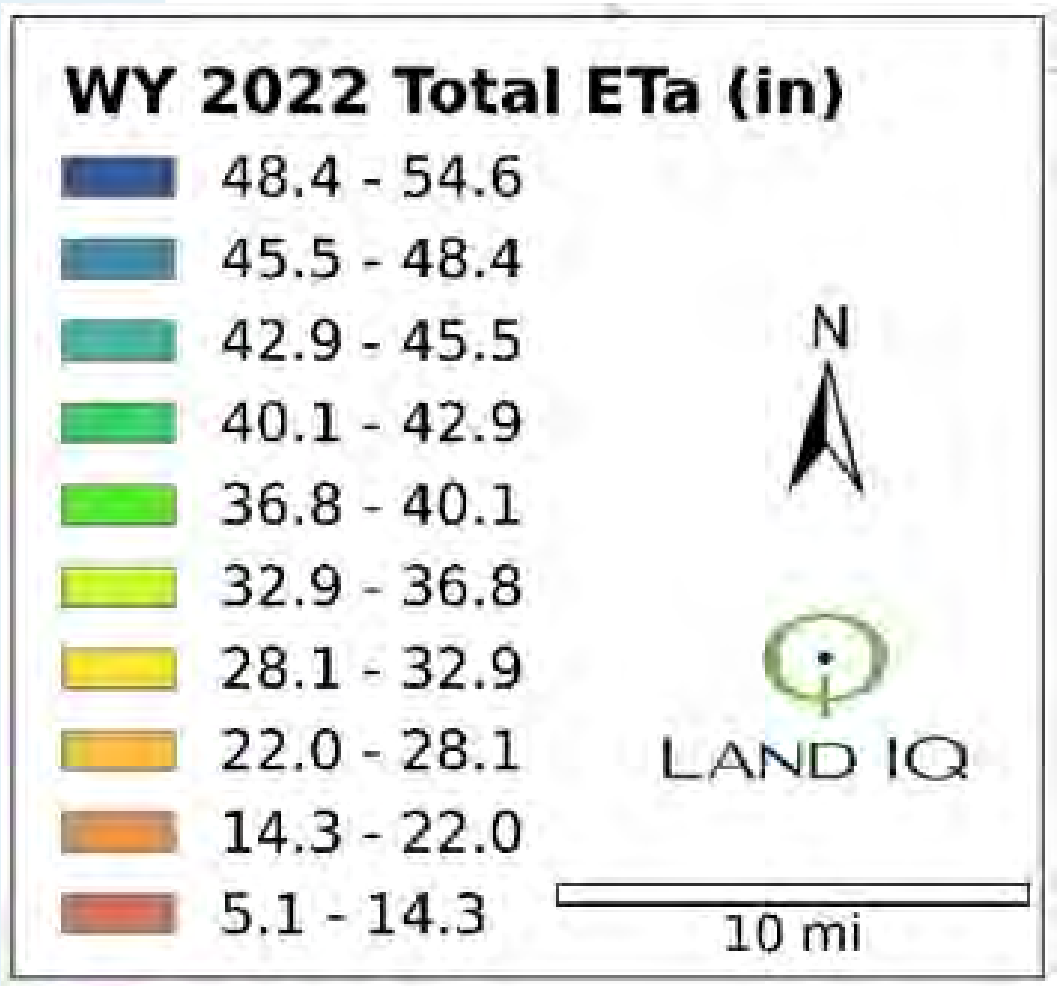


Age

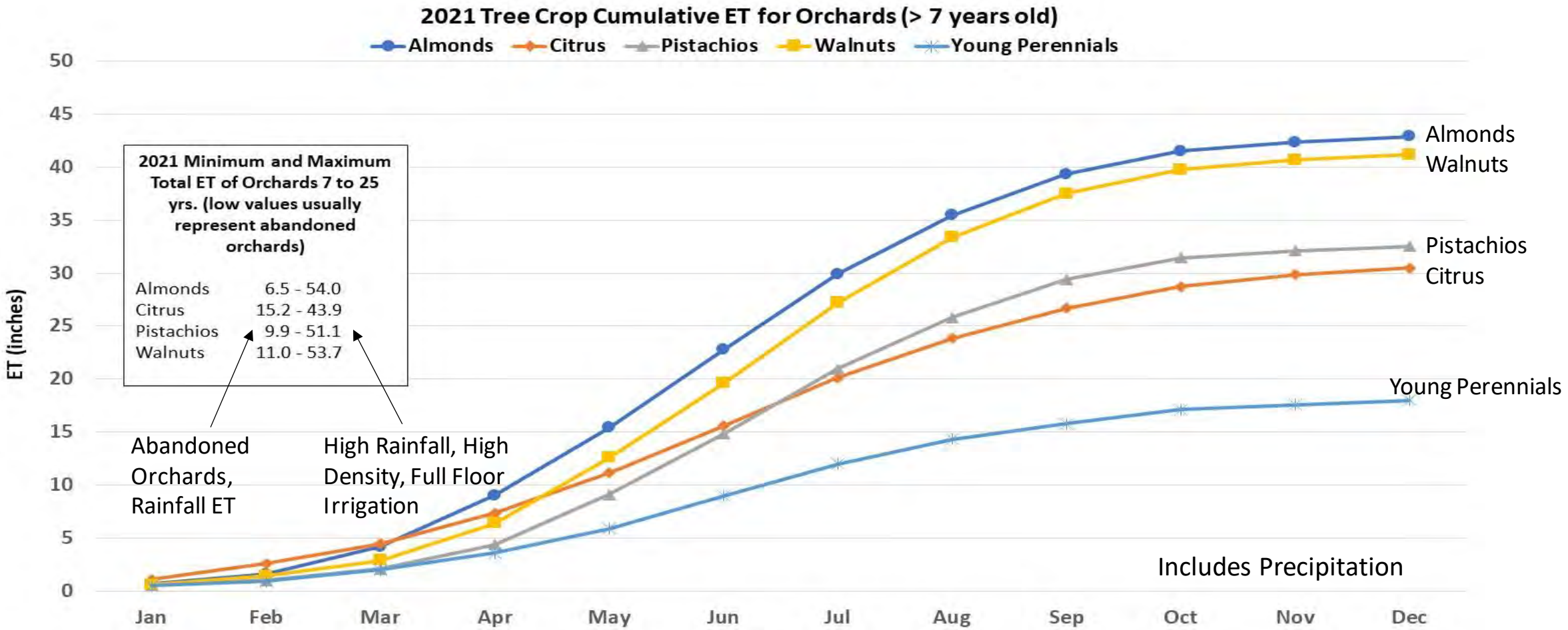
LAND IQ

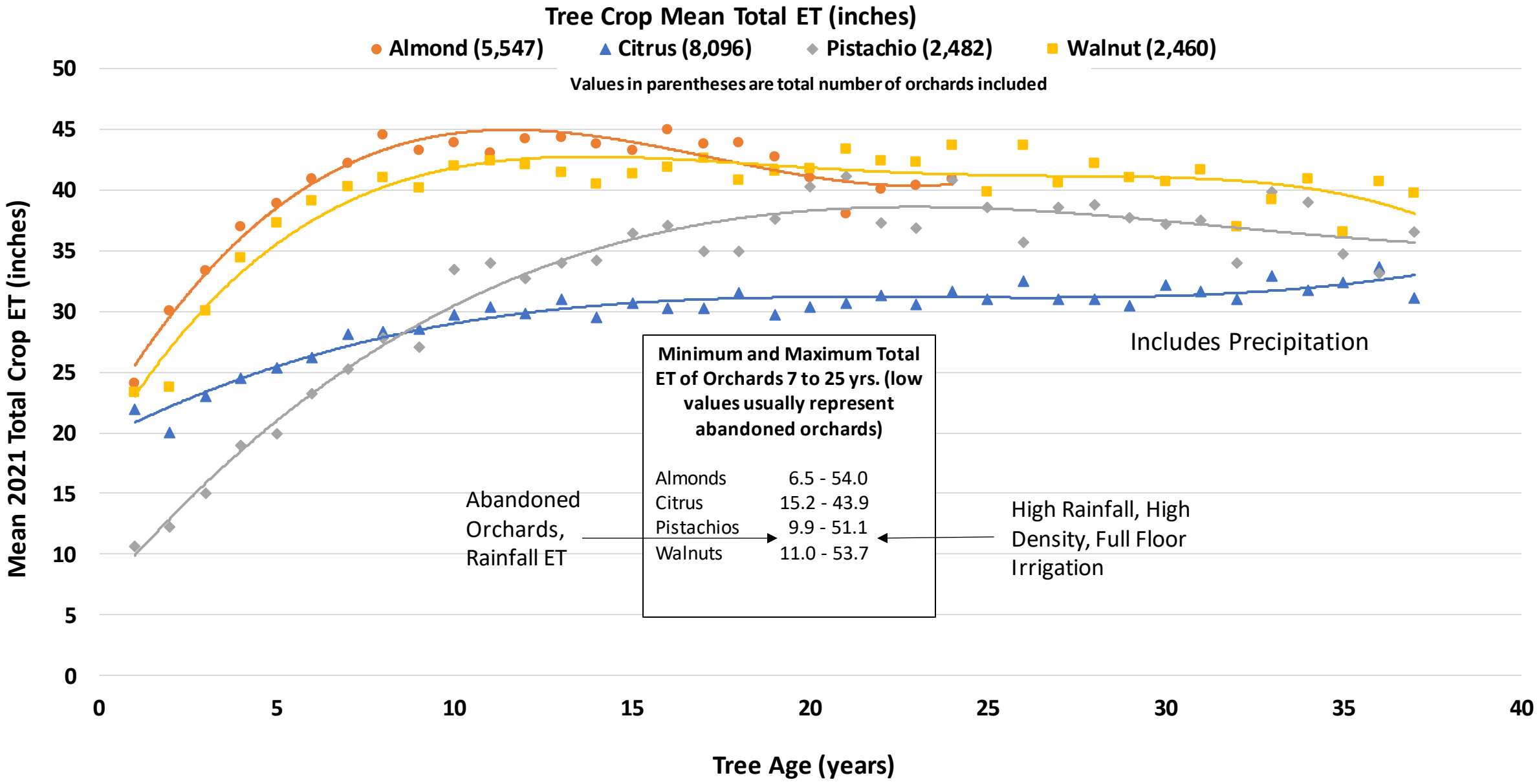
RESULTS

ALMOND ET – SPATIAL REPRESENTATION

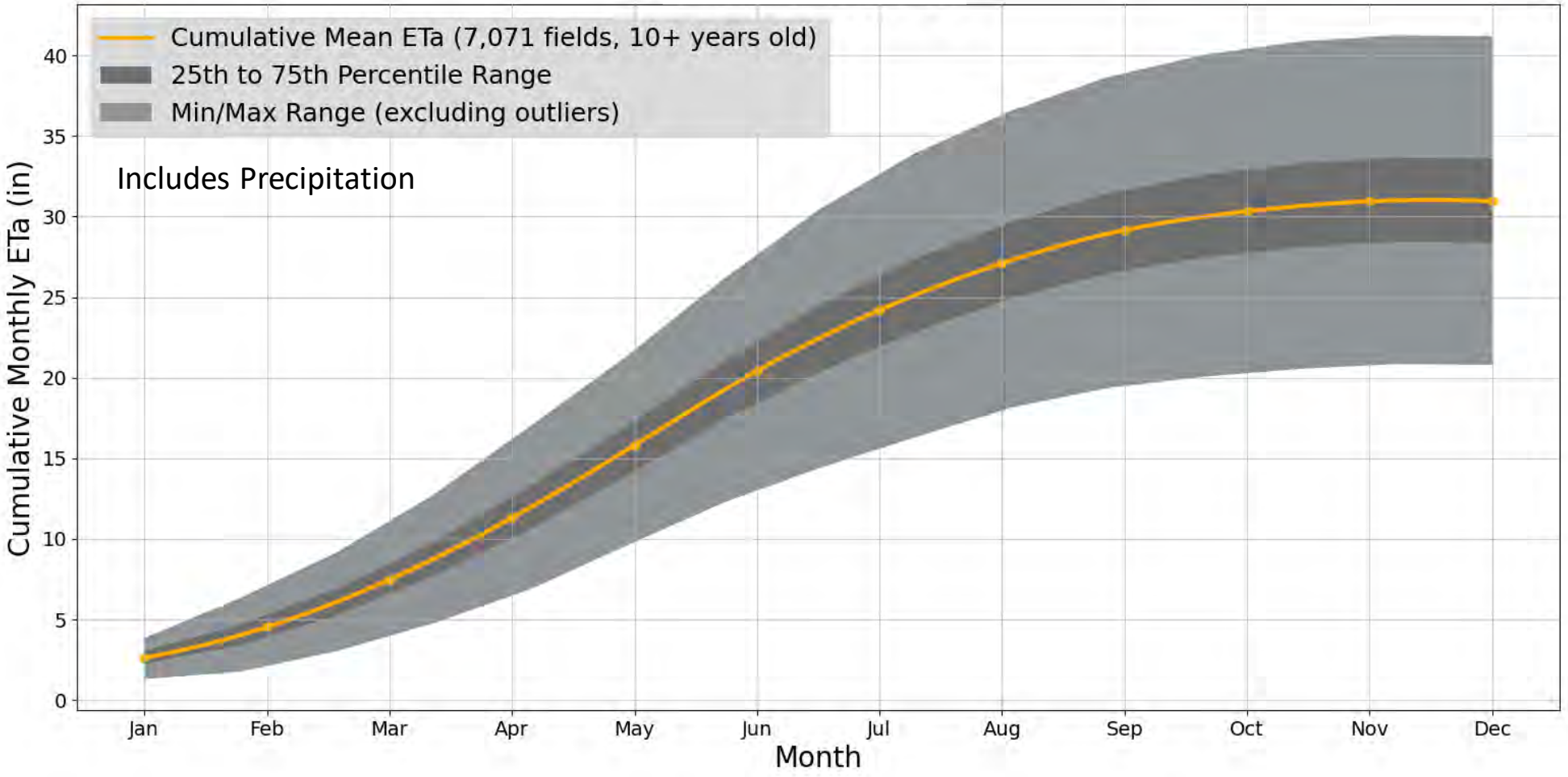


PERMANENT TREE CROP AVERAGE ANNUAL CONSUMPTIVE USE

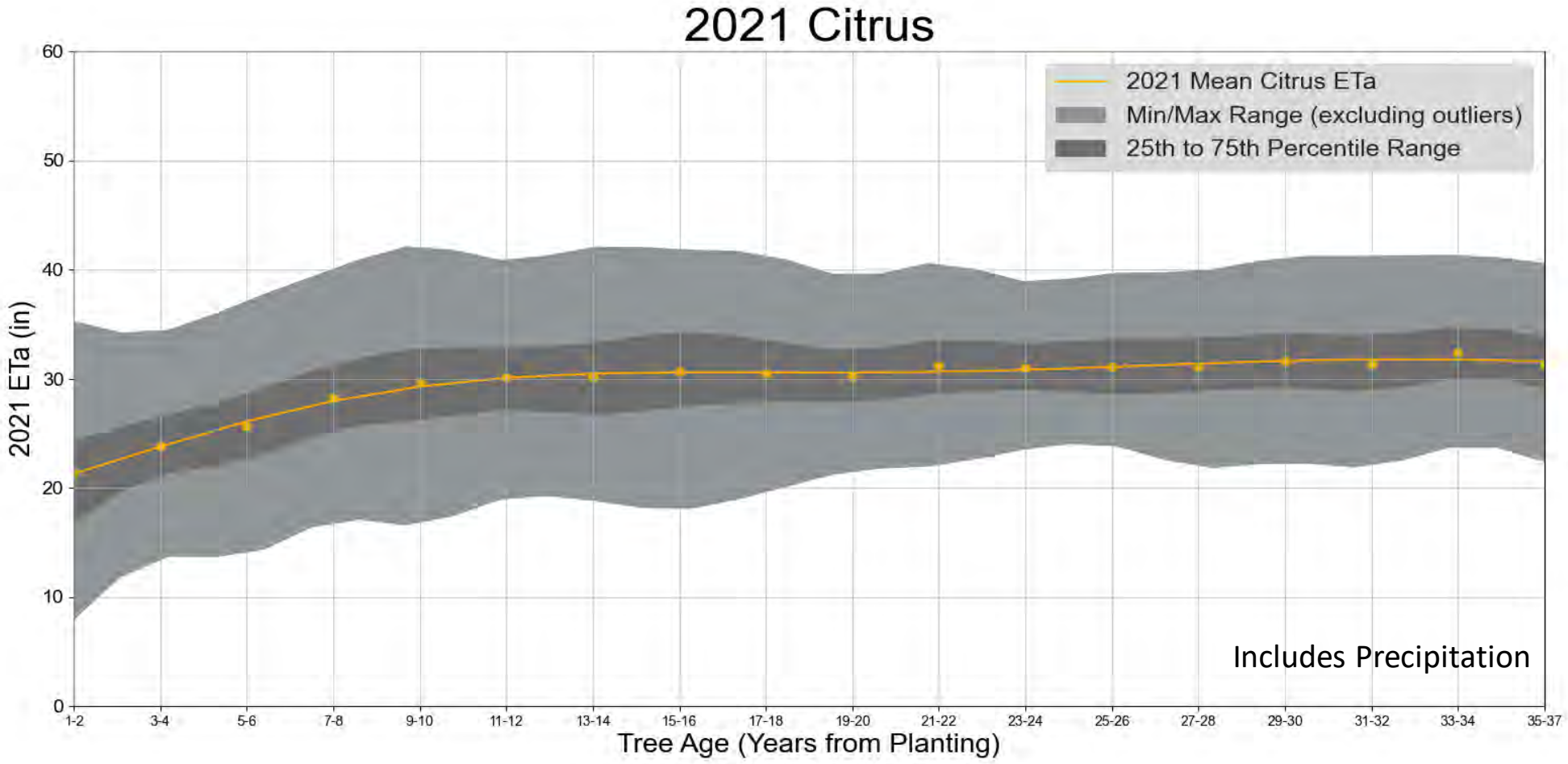



Tree Crop Mean Total ET (inches)
Almond (5,547)
Citrus (8,096)
Pistachio (2,482)
Walnut (2,460)
Values in parentheses are total number of orchards included
Mean 2021 Total Crop ET (inches)
Tree Age (years)
Minimum and Maximum Total ET of Orchards 7 to 25 yrs. (low values usually represent abandoned orchards)
Almonds 6.5 - 54.0
Citrus 15.2 - 43.9
Pistachios 9.9 - 51.1
Walnuts 11.0 - 53.7
Abandoned Orchards, Rainfall ET
High Rainfall, High Density, Full Floor Irrigation
Includes Precipitation

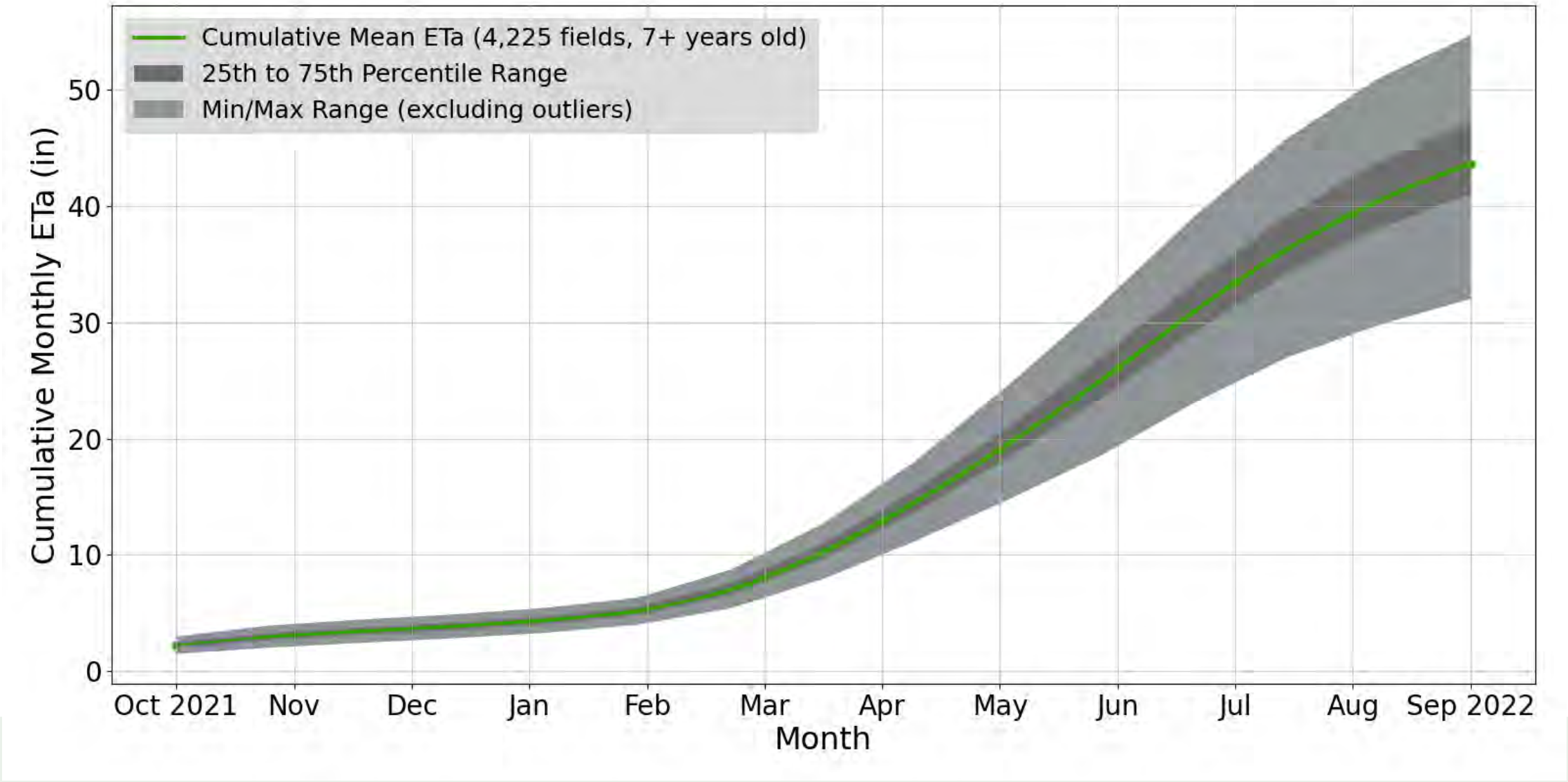
CITRUS CUMULATIVE ET



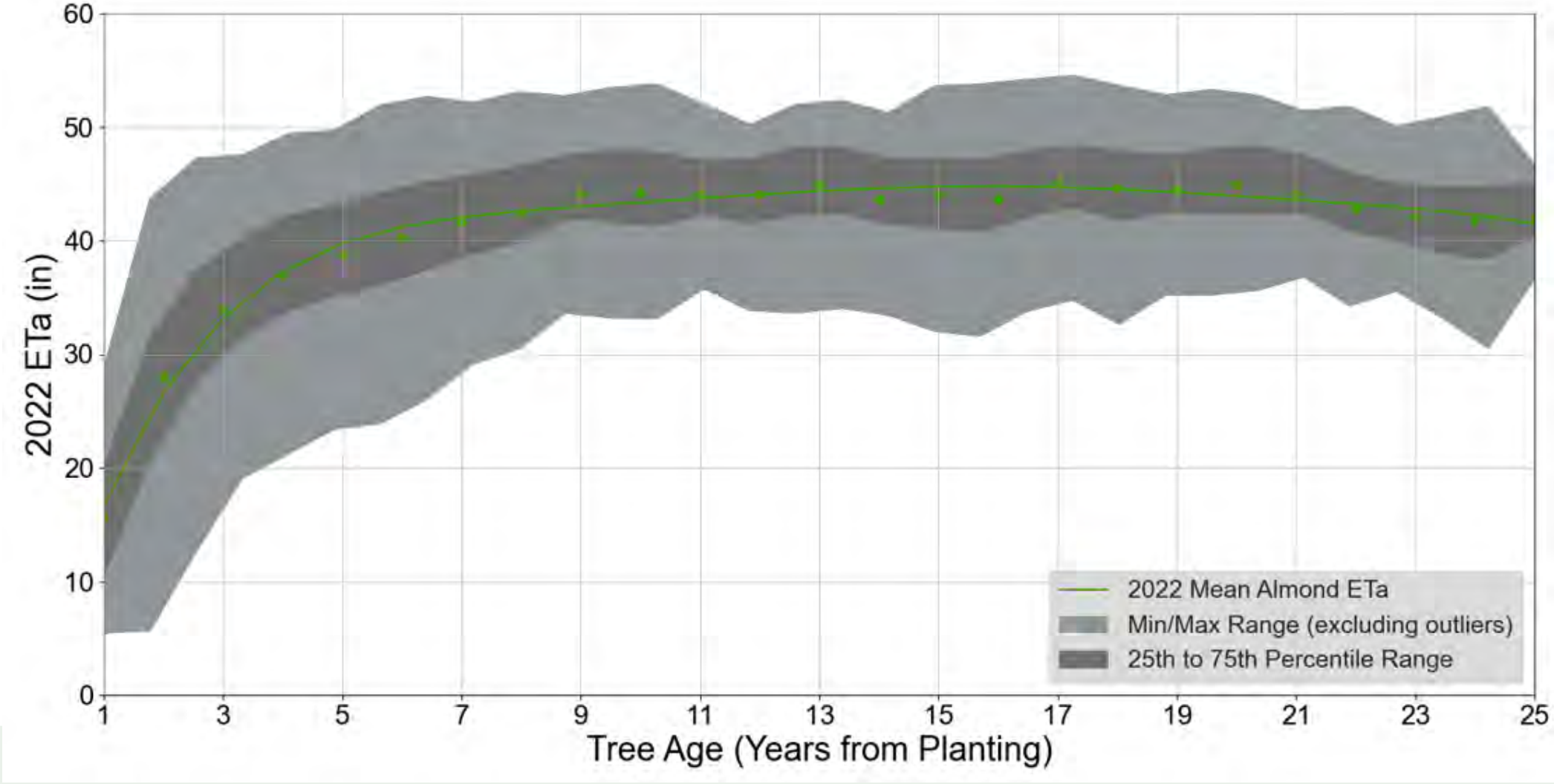
Citrus Evapotranspiration By Age



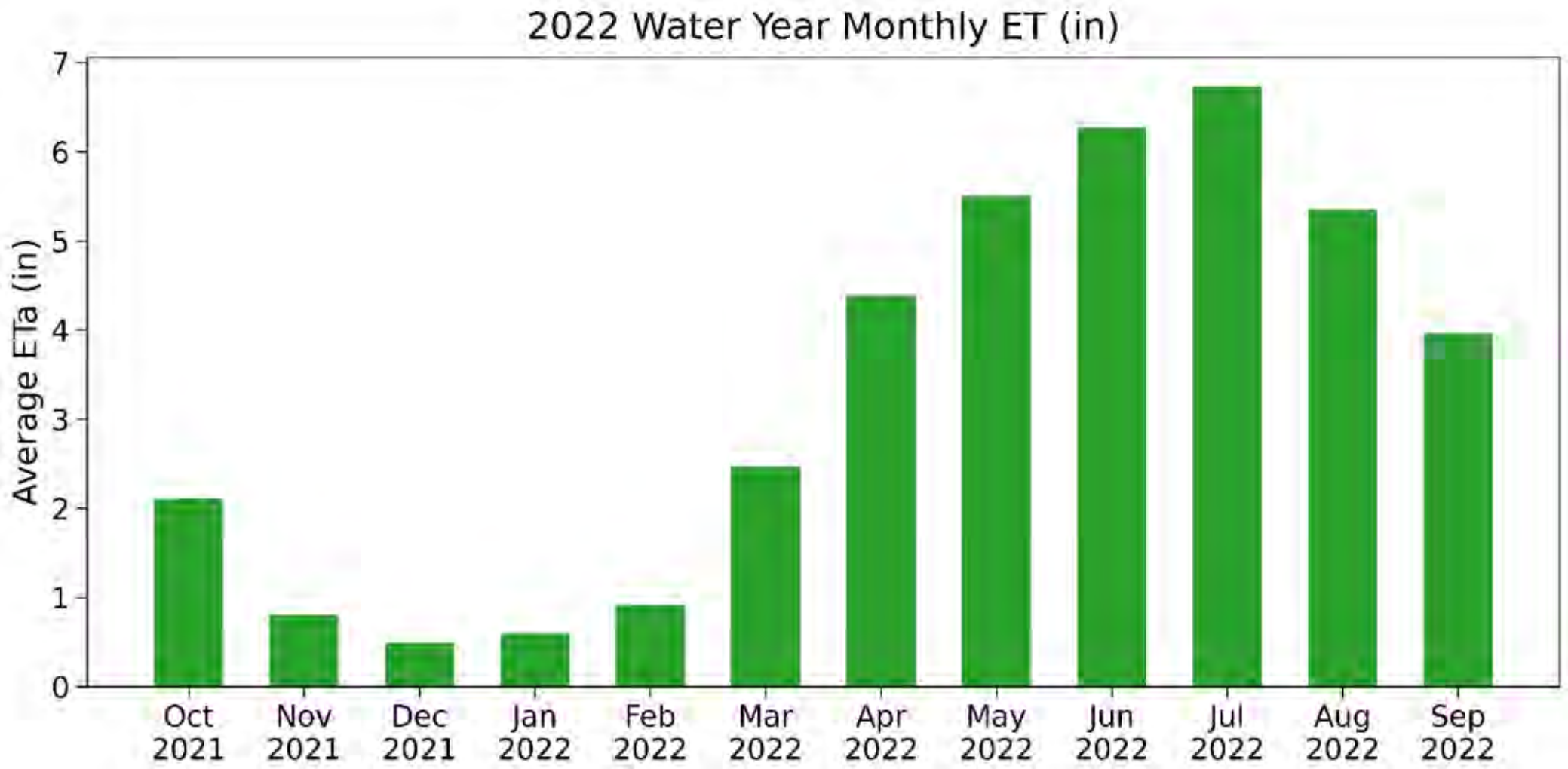
Almond Cumulative ET



Almond Evapotranspiration By Age



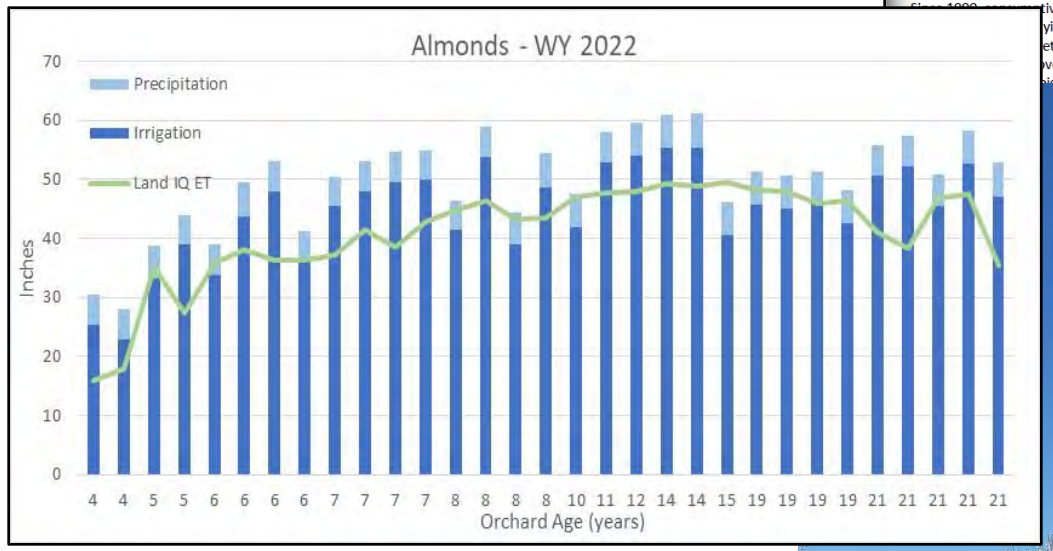
Almond Average Monthly ET

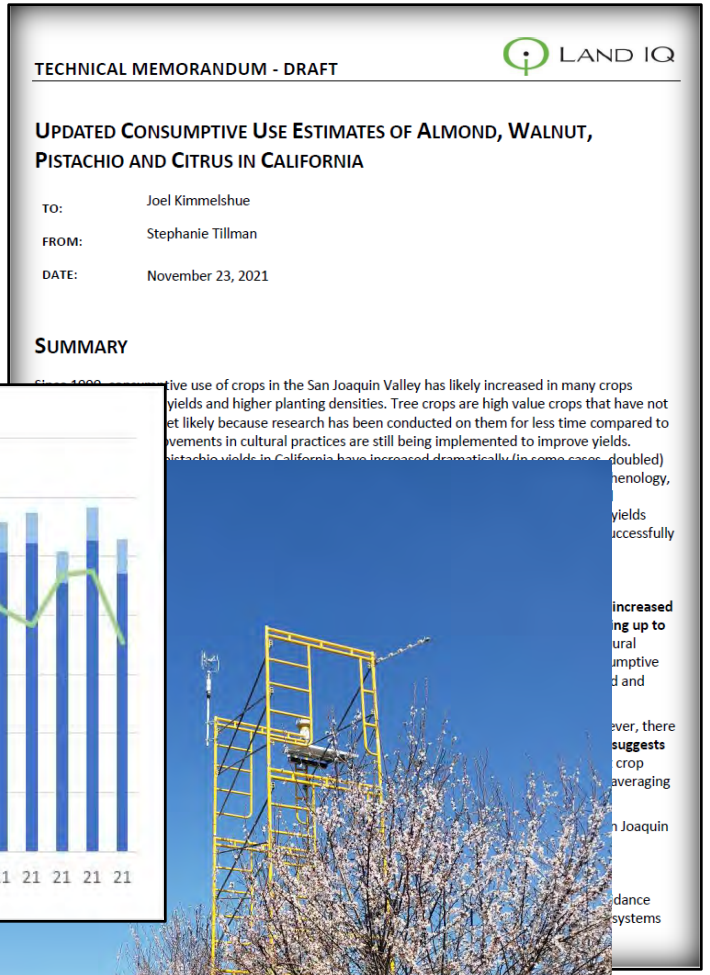


VALIDATION

MULTIPLE APPROACHES TO CALIBRATION AND VALIDATION

- Ground Truthing
  - Eddy Covariance
  - Surface Renewal
- Measured versus Predicted
- Applied Versus Consumed
- Literature Comparisons
- Independent Reviews (UC, ARS, and Cal Poly-ITRC)
- Agronomic Knowledge and Experience
- Grower Acceptance




TECHNICAL MEMORANDUM - DRAFT

LAND IQ

UPDATED CONSUMPTIVE USE ESTIMATES OF ALMOND, WALNUT, PISTACHIO AND CITRUS IN CALIFORNIA

TO: Joel Kimmelshue

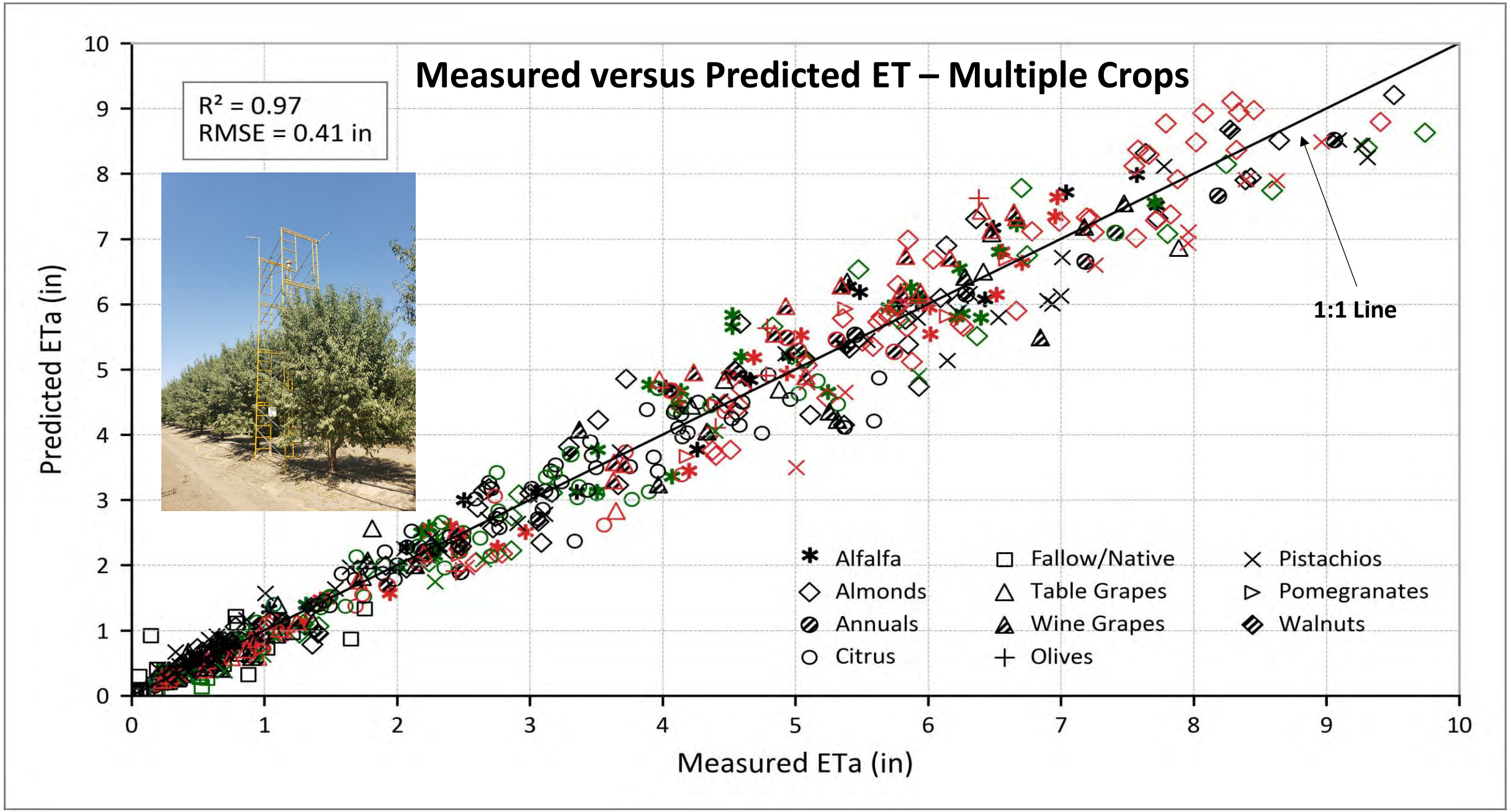
FROM: Stephanie Tillman

DATE: November 23, 2021

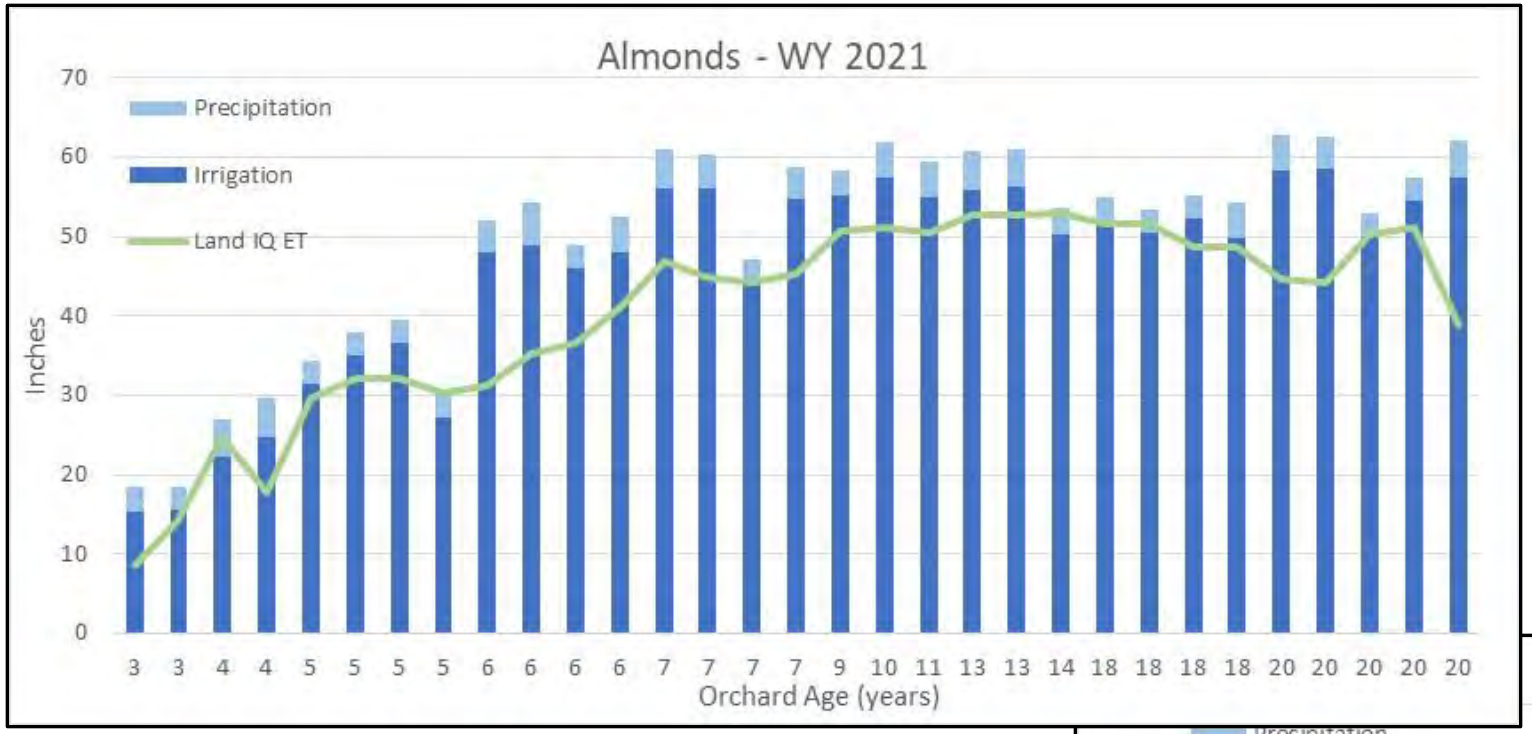
SUMMARY

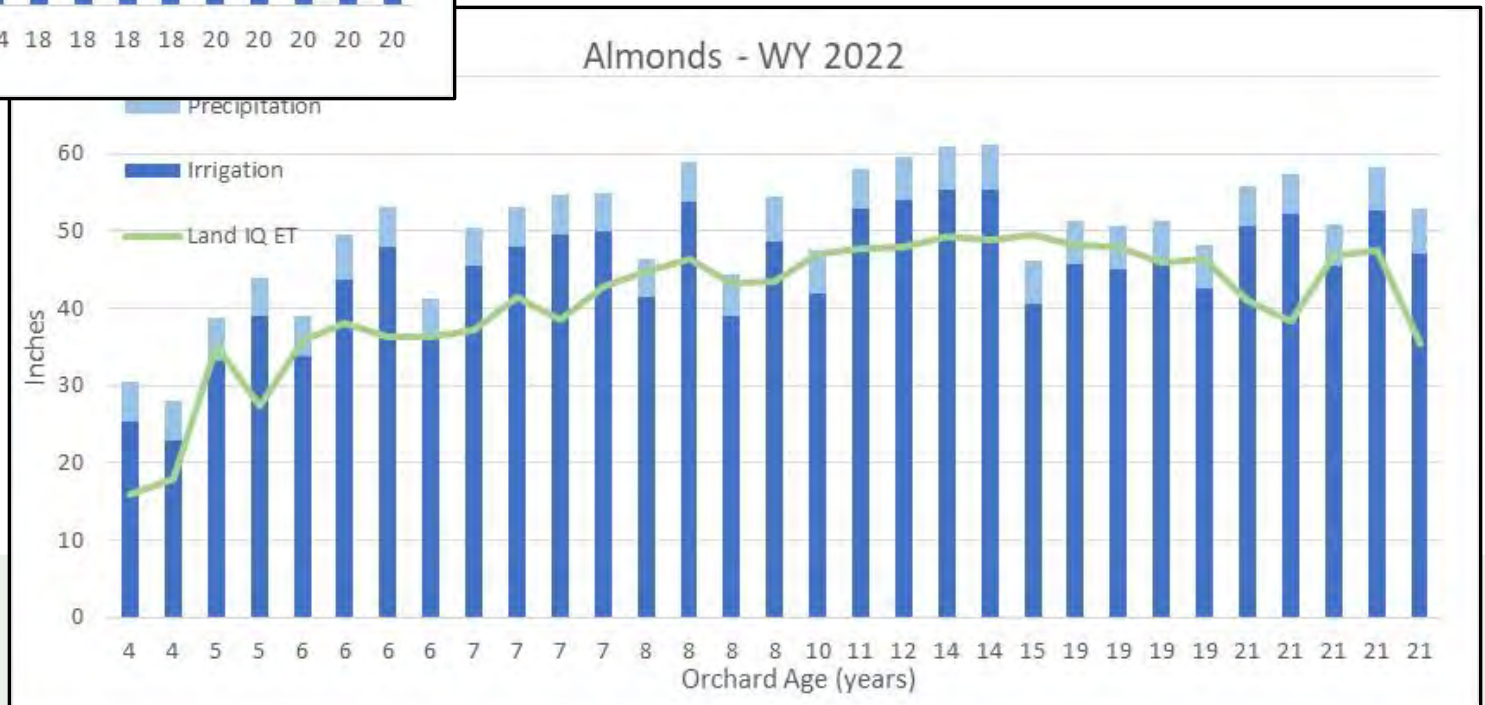
tive use of crops in the San Joaquin Valley has likely increased in many crops yields and higher planting densities. Tree crops are high value crops that have not et likely because research has been conducted on them for less time compared to vements in cultural practices are still being implemented to improve yields. doubled) henology, yields uccessfully increased ng up to ural umptive d and ever, there suggests crop averaging n Joaquin dance systems

Measured versus Predicted ET – Multiple Crops

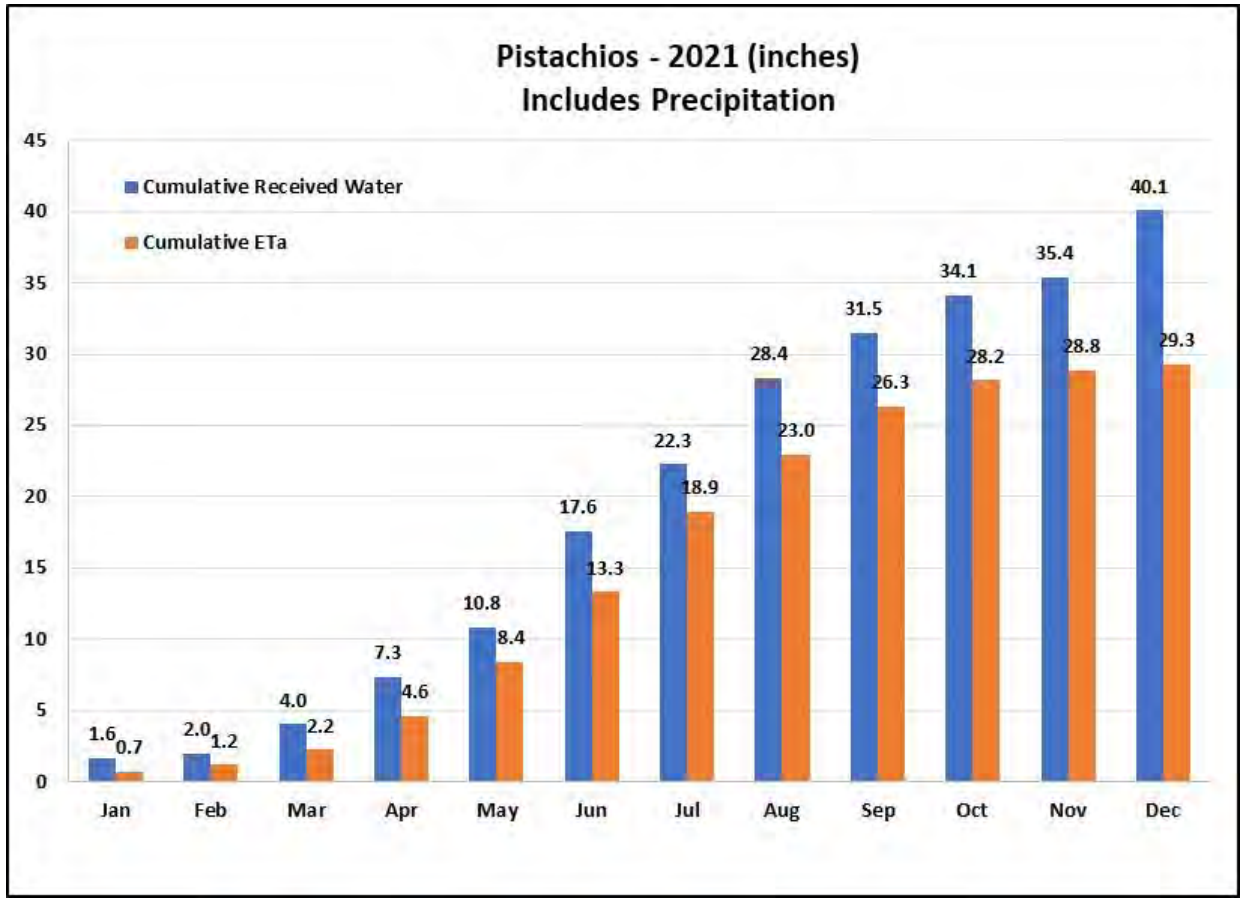


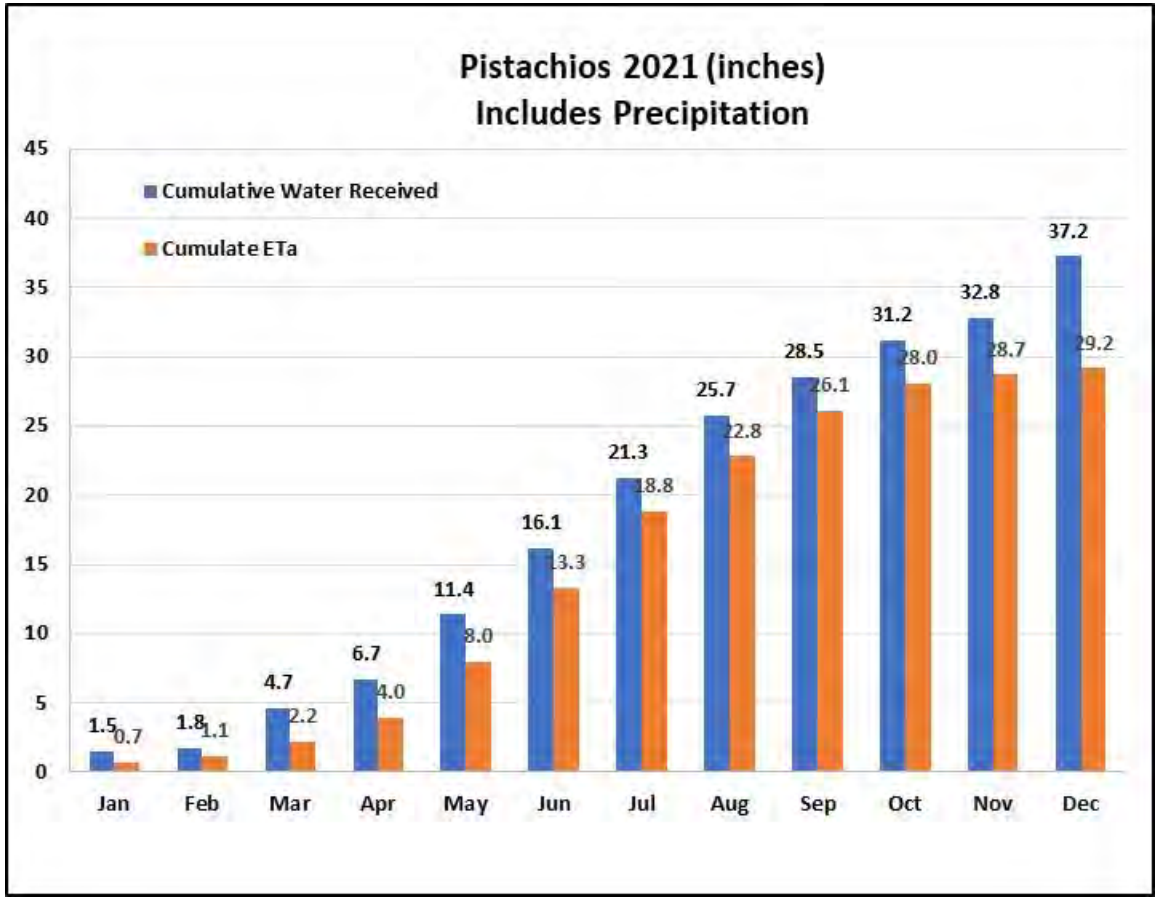
Water Received versus Consumed by Age - Almonds



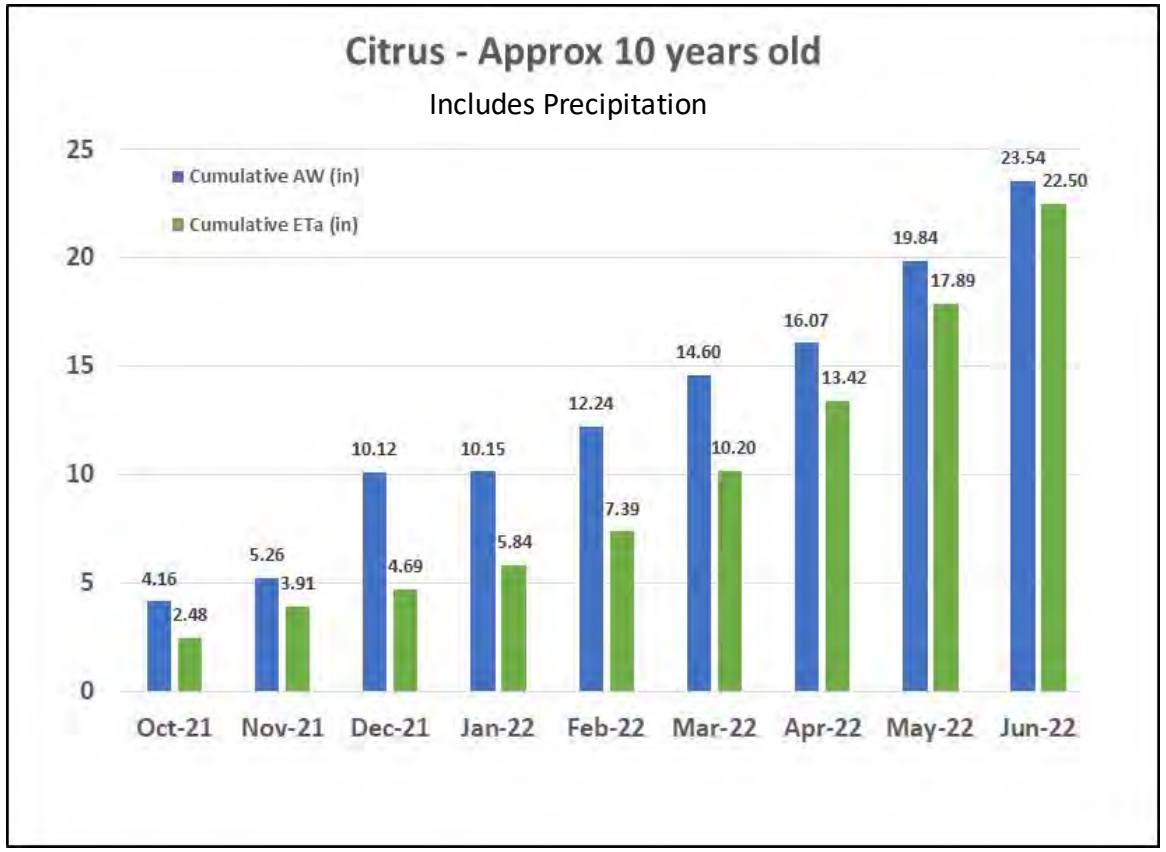


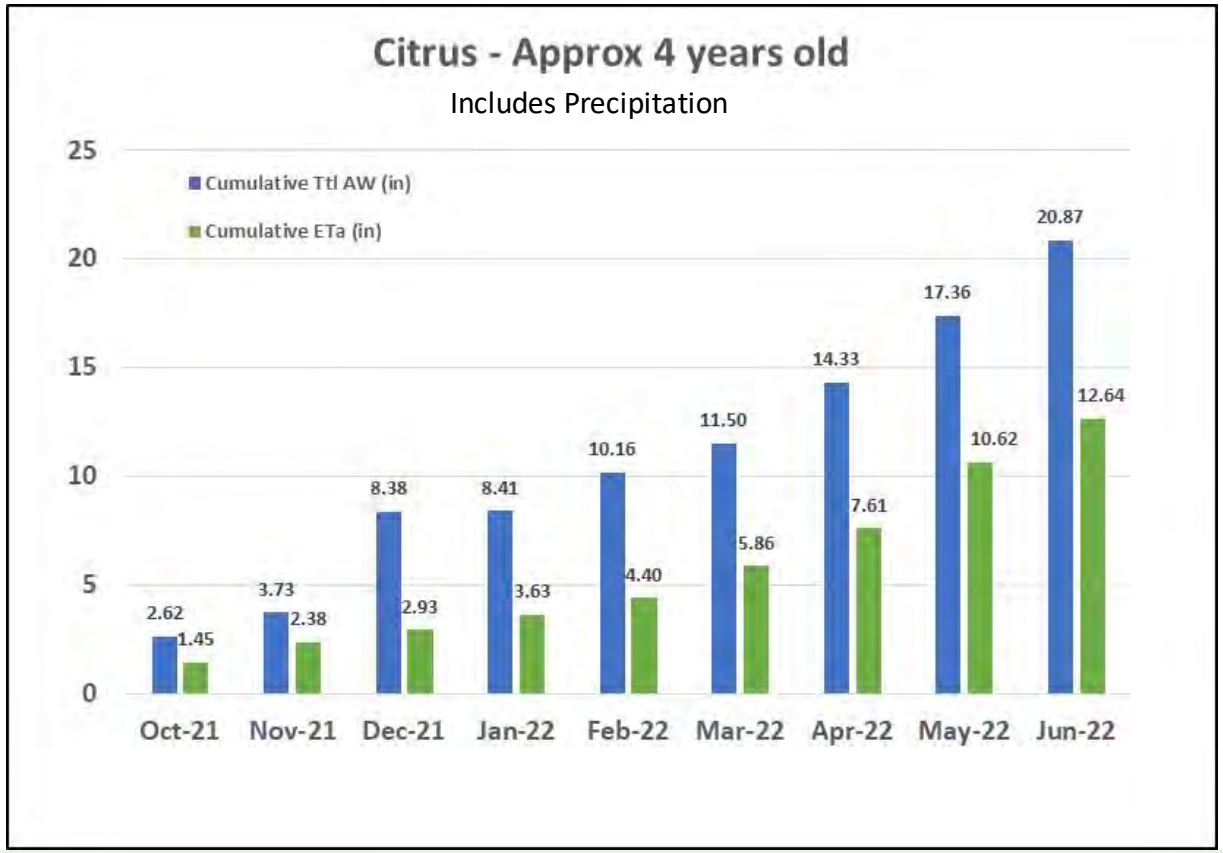
WATER RECEIVED VERSUS CONSUMED - PISTACHIOS



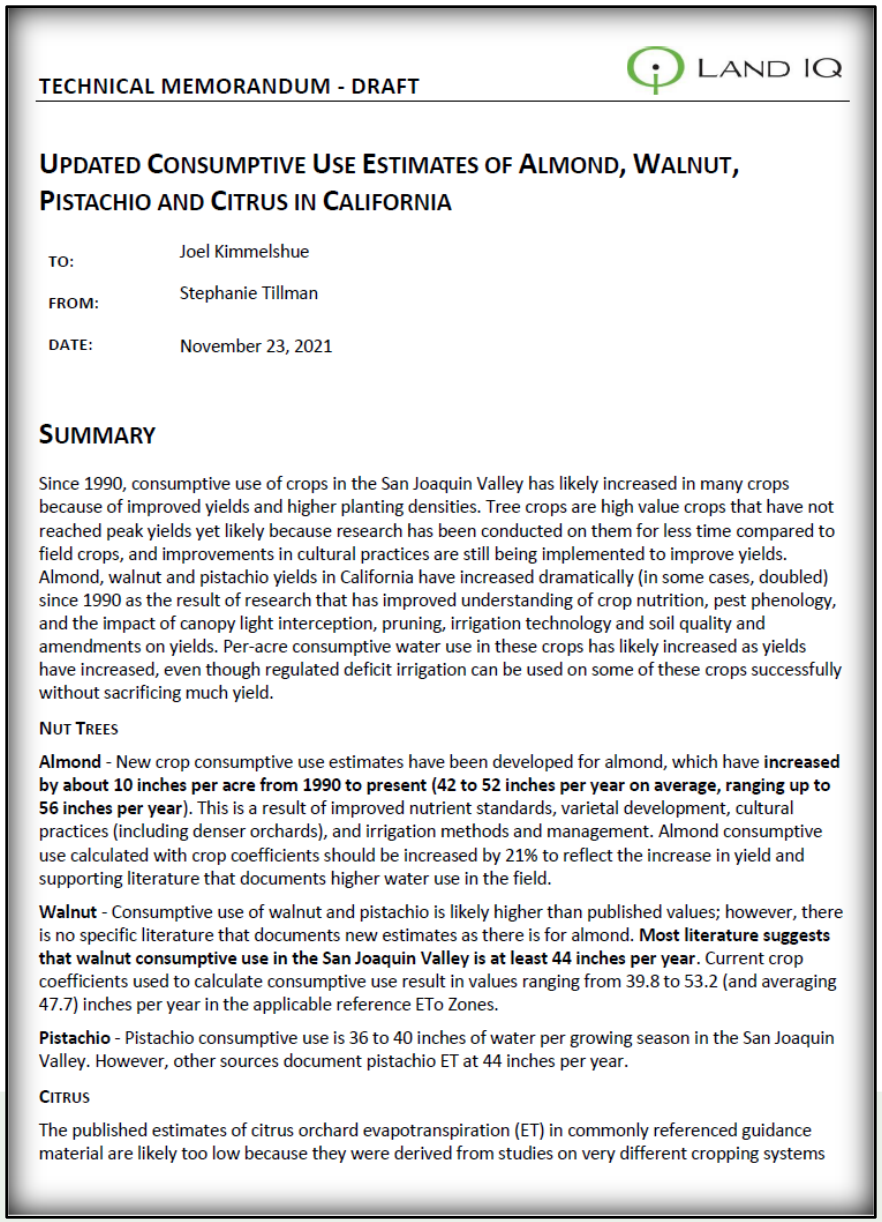


WATER RECEIVED VERSUS CONSUMED - CITRUS





LITERATURE COMPARISONS - ALMONDS



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FROM: Stephanie Tillman

DATE: November 23, 2021

SUMMARY

Since 1990, consumptive use of crops in the San Joaquin Valley has likely increased in many crops because of improved yields and higher planting densities. Tree crops are high value crops that have not reached peak yields yet likely because research has been conducted on them for less time compared to field crops, and improvements in cultural practices are still being implemented to improve yields. Almond, walnut and pistachio yields in California have increased dramatically (in some cases, doubled) since 1990 as the result of research that has improved understanding of crop nutrition, pest phenology, and the impact of canopy light interception, pruning, irrigation technology and soil quality and amendments on yields. Per-acre consumptive water use in these crops has likely increased as yields have increased, even though regulated deficit irrigation can be used on some of these crops successfully without sacrificing much yield.

NUT TREES

Almond - New crop consumptive use estimates have been developed for almond, which have **increased by about 10 inches per acre from 1990 to present (42 to 52 inches per year on average, ranging up to 56 inches per year)**. This is a result of improved nutrient standards, varietal development, cultural practices (including denser orchards), and irrigation methods and management. Almond consumptive use calculated with crop coefficients should be increased by 21% to reflect the increase in yield and supporting literature that documents higher water use in the field.

Walnut - Consumptive use of walnut and pistachio is likely higher than published values; however, there is no specific literature that documents new estimates as there is for almond. **Most literature suggests that walnut consumptive use in the San Joaquin Valley is at least 44 inches per year**. Current crop coefficients used to calculate consumptive use result in values ranging from 39.8 to 53.2 (and averaging 47.7) inches per year in the applicable reference ETo Zones.

Pistachio - Pistachio consumptive use is 36 to 40 inches of water per growing season in the San Joaquin Valley. However, other sources document pistachio ET at 44 inches per year.

CITRUS

The published estimates of citrus orchard evapotranspiration (ET) in commonly referenced guidance material are likely too low because they were derived from studies on very different cropping systems

Findings

- Highest measured literature value published = 55 inches, including precipitation
- Highest Land IQ result = 54 inches, including precipitation
- Production practices are changing faster than published research
  - Growers are using different water management strategies
  - Compliance with allocations and short water supplies

DEVELOPMENT OF INDEPENDENT ADVISORY GROUP

- Retired UC Cooperative Extension Agents and Farm Advisors:
  - Blake Sanden, MS – 26 years in Kern County
  - Allan Fulton, MS – 35 years in Kings, and Northern CA counties
  - Review results every month beginning in 2021 and offer suggestions for improvements
- Larger Advisory Group:
  - Blake Sanden, MS - Retired
  - Allan Fulton, MS - Retired
  - Daniele Zaccaria, PhD – UC Davis
  - Rick Snyder, PhD – UC Davis, Emeritus
  - Dan Howes, PhD – Cal Poly ITRC
  - Khaled Bali, PhD – UC ANR
  - Pasquale Steduto, PhD – UN-FAO

Agronomic Knowledge and Grower Acceptance

Agronomic Knowledge

- New discoveries with production practices related to:
  - Water use
  - Harvest
  - Irrigation management
  - Regional differences (Critically over-drafted versus not)

Grower Acceptance

- ET is being used to charge growers for their water
- ET is being used to determine pumping allocations
- ET is being integrated into long-term water management planning and decisions
- 3.3 million acres total

CONCLUSIONS

- Accuracy matters
- Ground truthing provides:
  - Calibration
  - Validation
  - Defensibility
  - Confidence
  - Independent analyses
  - A data-driven approach
- Goal is to continually reduce variability
- Impactful on decision-making, water management, orchard management, and allocation management

Questions

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916.517.2482

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GROUNDWATER SUSTAINABILITY AGENCY

GREATER KAWEAH
GROUNDWATER
SUSTAINABILITY
AGENCY

MID-KAWEAH GSA

LAND IQ

JULY 13, 2023

Craig Hornung

Title: Owner, Hornung Brothers Farming

Technical Services, AC-Foods

Topic: Smart Irrigation Practices

MY JOB DEPENDS ON WATER
Farming in the SGMA Era

Farming in the SGMA World Today, and Hopefully Tomorrow !!

Kaweah Sub-Basin

- Agriculture in the Kaweah Sub-Basin is very diverse
- Row Crops and Permanent Plantings
- Water supply:
    - River water
    - Irrigation District (CVP)
    - Groundwater
- How can Technology help us?
- What can we Do Now to address the issues ahead of us?

What do you want from your technology?

- Ability to gather information to make a Decision.
- You can gather a lot of cool information but is it useful?
- Too much data to analyze consumes too much time
- Information Platforms not well designed for growers.
- Reliable service from Distributor/ service provider.
- Solid Knowledge base from Manufacture/ Parent Company
- It has to work into your overall management practice.

HBF / Griffith Farms / AC Foods

Key points to Maximum use of our Resources-Water, soil, trees

Reservoirs (Most lined) for Irrigation Water Storage/Balancing irrigation water.

Efficient and affective Fertilizer and irrigation water applications. Active Scheduling.

Evaluation and testing of new applied technologies. Updated the Irrigation system-1/2 gph drippers, FanJets with pressure regulators (Varying patterns and combinations)

Water modification for good infiltration- Solution gypsum, acidification

Monitoring Soil Moisture probes daily. Weather stations around ranches as well.

Looking at Tree Stress and capturing all irrigation applications, Phytech.

Automation application where possible- simple to complex. Wiseconn/Phytech

R&D projects looking to the Future. Water Conservation Trial.

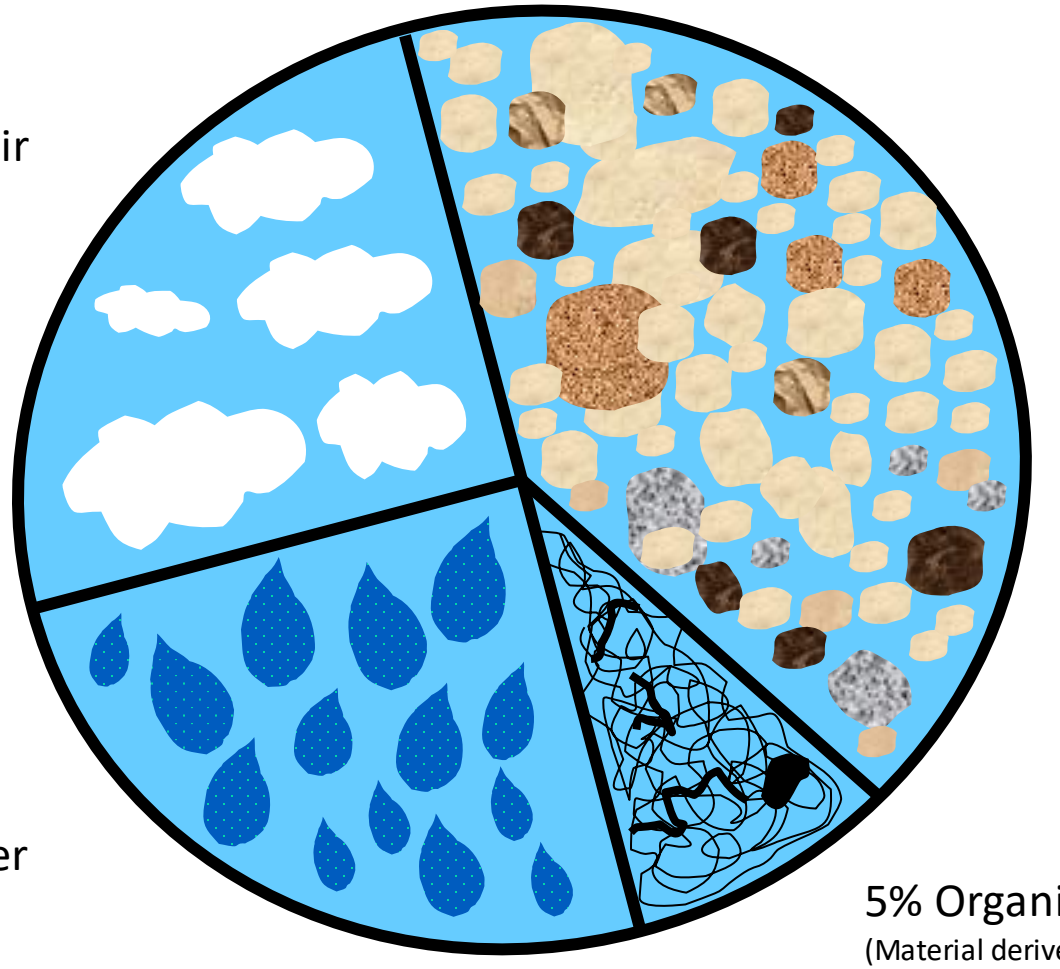
Water budget by block: Projected Vs Actual.

Water recharge basins- Dedicated Basins and fields in transition.

Systems evaluated over the past 30 years

- Cambell Scientific-Neutron Probe
- Sentek-RT-6 Logger and Enviroscan probe, Diviner
- T-Systems Crop Sense SMM and Weather
- Automata
- Adcon and C-Probe
- John Deere Field Connect-Metos (Pessel)
- Aquaspy
- Aquacheck
- Observant -Purchased by Jain
- Climate Minder-Rain Bird
- Pure Sense –Purchased by Jain
- Tensimeter based products
- Phytech
- Yara Technologies
- Wiseconn-Drop Control, SMM and Automation
- Altrac-addition of Soil Moisture Monitoring
- Ranch Systems

Soil – Plant – Water Relationship



25% Air

45% Minerals
(Clay, sand or silt particles)

25% Water

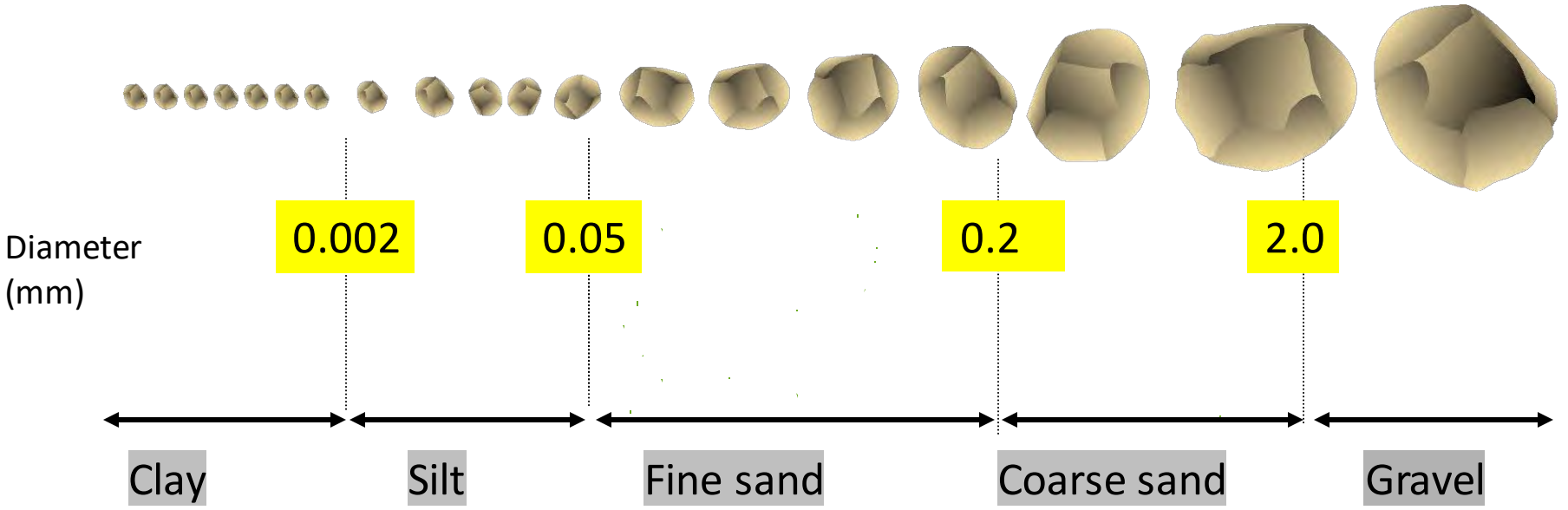
5% Organic Matter
(Material derived from the decay of plants and animals)

Volumetric content of the four principal components of soil at an ideal balance for plant growth.

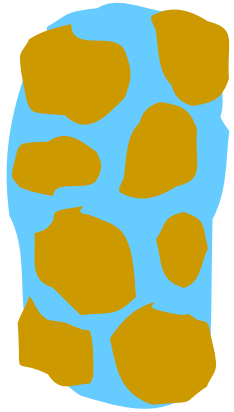
Source: Western Fertilizer Handbook

Soil Texture

Internationally agreed upon size fraction classification:

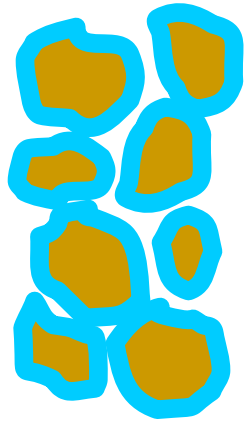


Different Water Contents of Soil



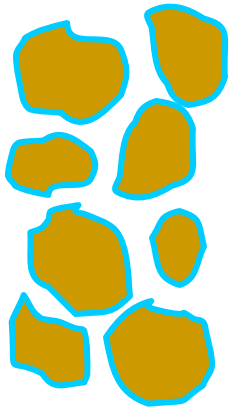
Saturation

All pores are filled with water - no air pockets



Field Capacity

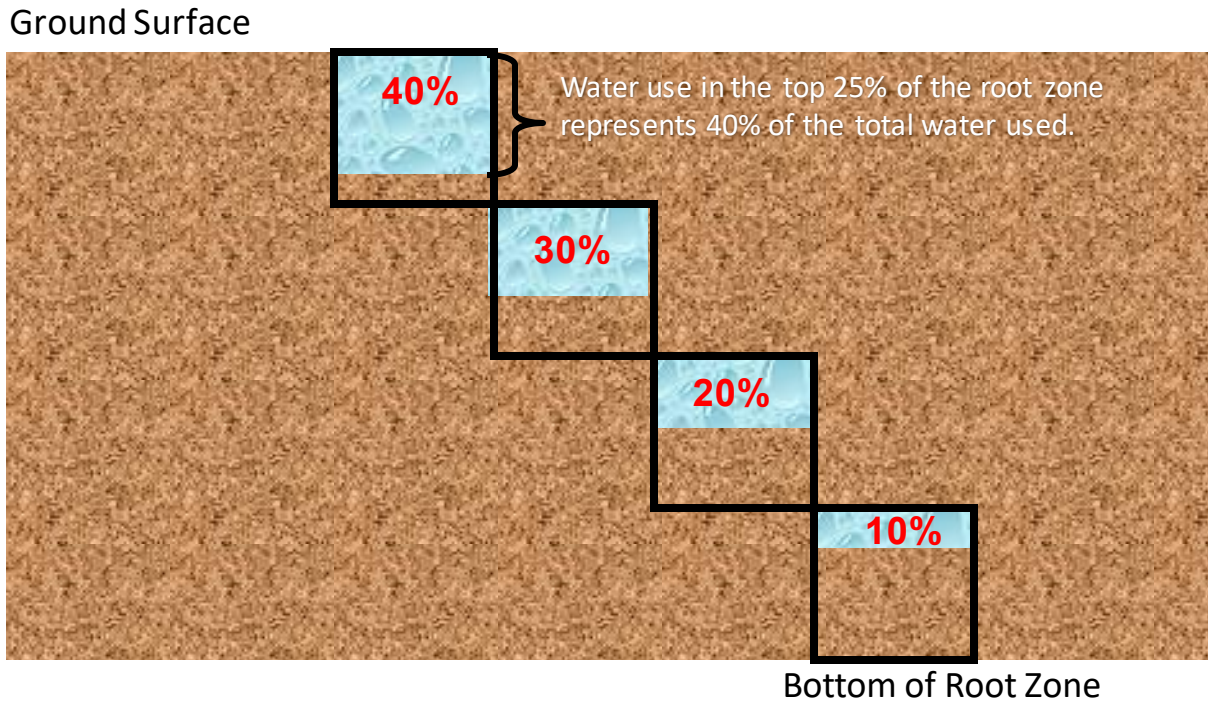
Large pores are drained by gravity. This is the upper limit of storable water in the soil.



Permanent Wilting Point

Plants cannot remove adequate water to survive.

Soil Water Extraction Pattern
Target area for fertilizer placement



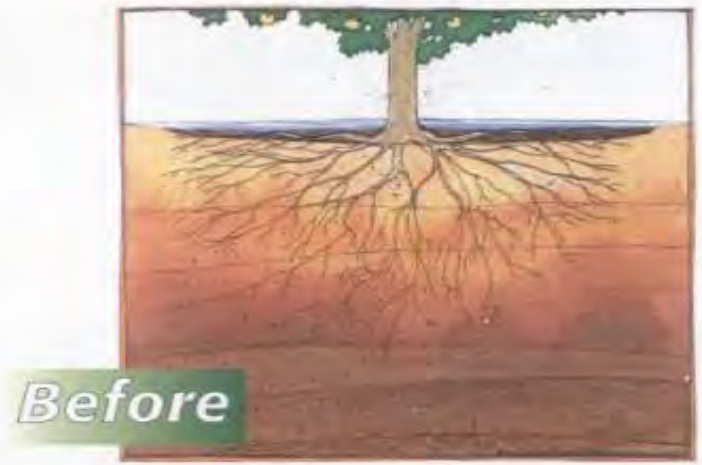
Water moves
on to the next deeper zone when each part of the soil reservoir is filled to capacity.

The largest percentage of water and nutrients are taken up in the top 12-20 inches of soil.

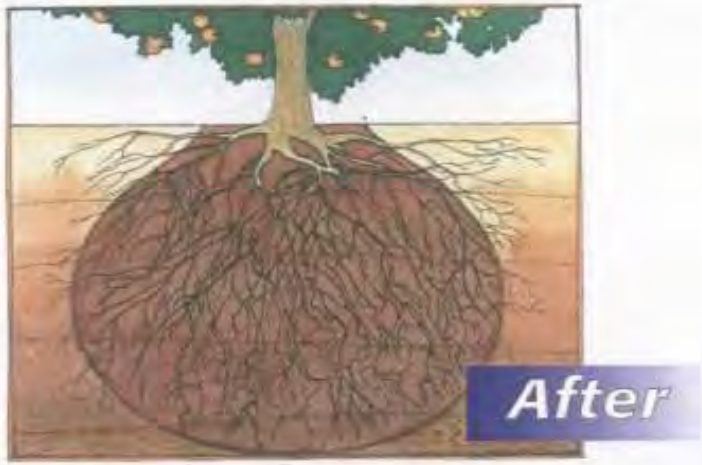
Sensor placement is matched to this water and nutrient uptake zone.

Soil water extraction pattern from the soil for many irrigated plants (adapted from Ames Co., 1967)

Low EC water causes Irrigation infiltration issues.

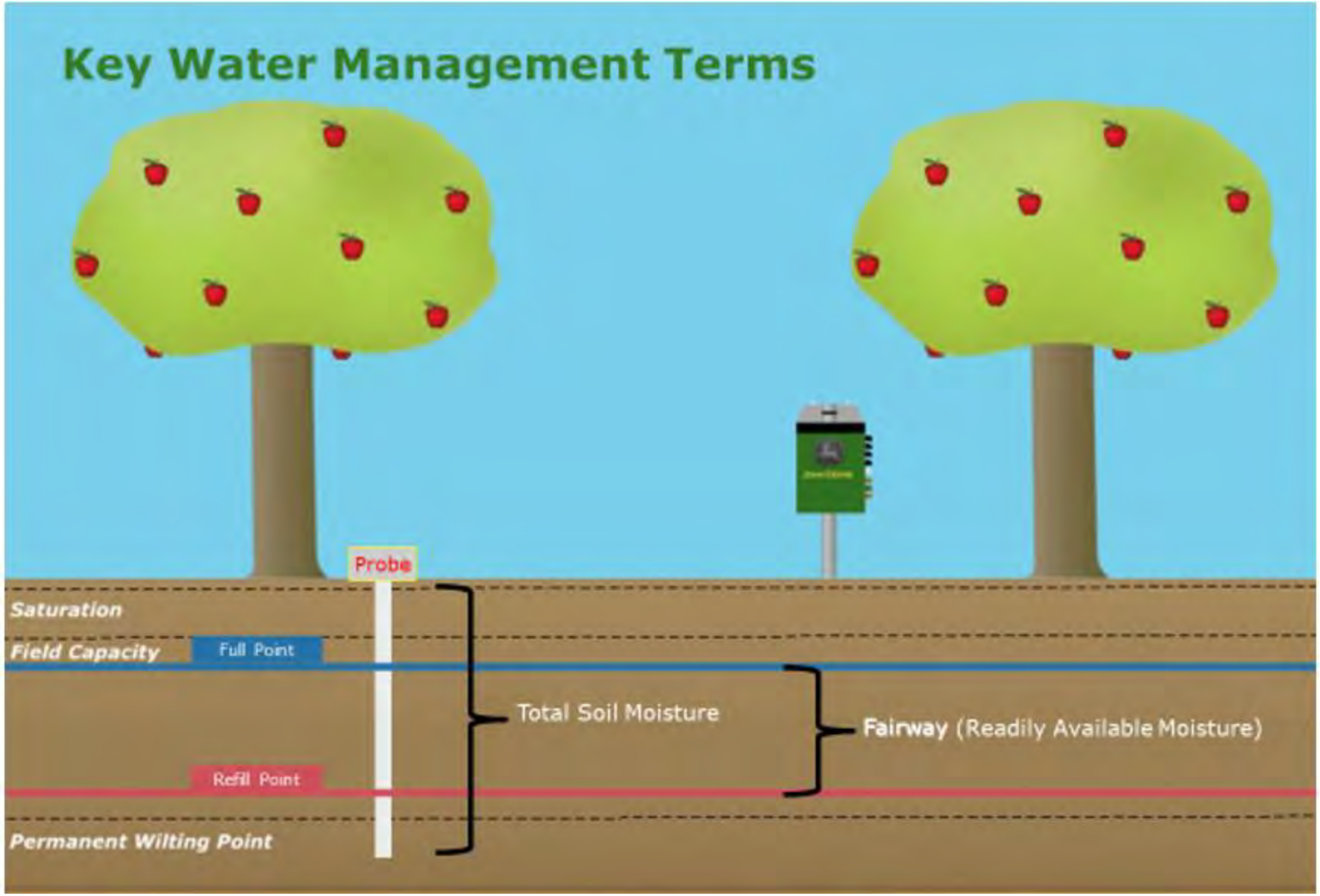


Shallow water penetration can be caused by calcium deficient irrigation water, tight soil or other related water and soil characteristics. These conditions result in a root zone with insufficient moisture to support normal plant growth. Premature heat stress is generally associated with inadequate soil moisture. Weed pressure is another indication of soil with poor water penetration.



Each Ag Solution Master gypsum application helps flocculate soil particles, opening up the soil to let water penetrate deeper into the root zone. The result is an expanded root zone and better root development – conditions that minimize heat stress and lead to higher plant quality and better production. Plants with less stress are more resistant to pests.

Soil Moisture Graphs-Capacitance probes



Soil Moisture Graph Options

As water is applied to the soil the graph line moves up. As water is removed from the profile the lines goes down.

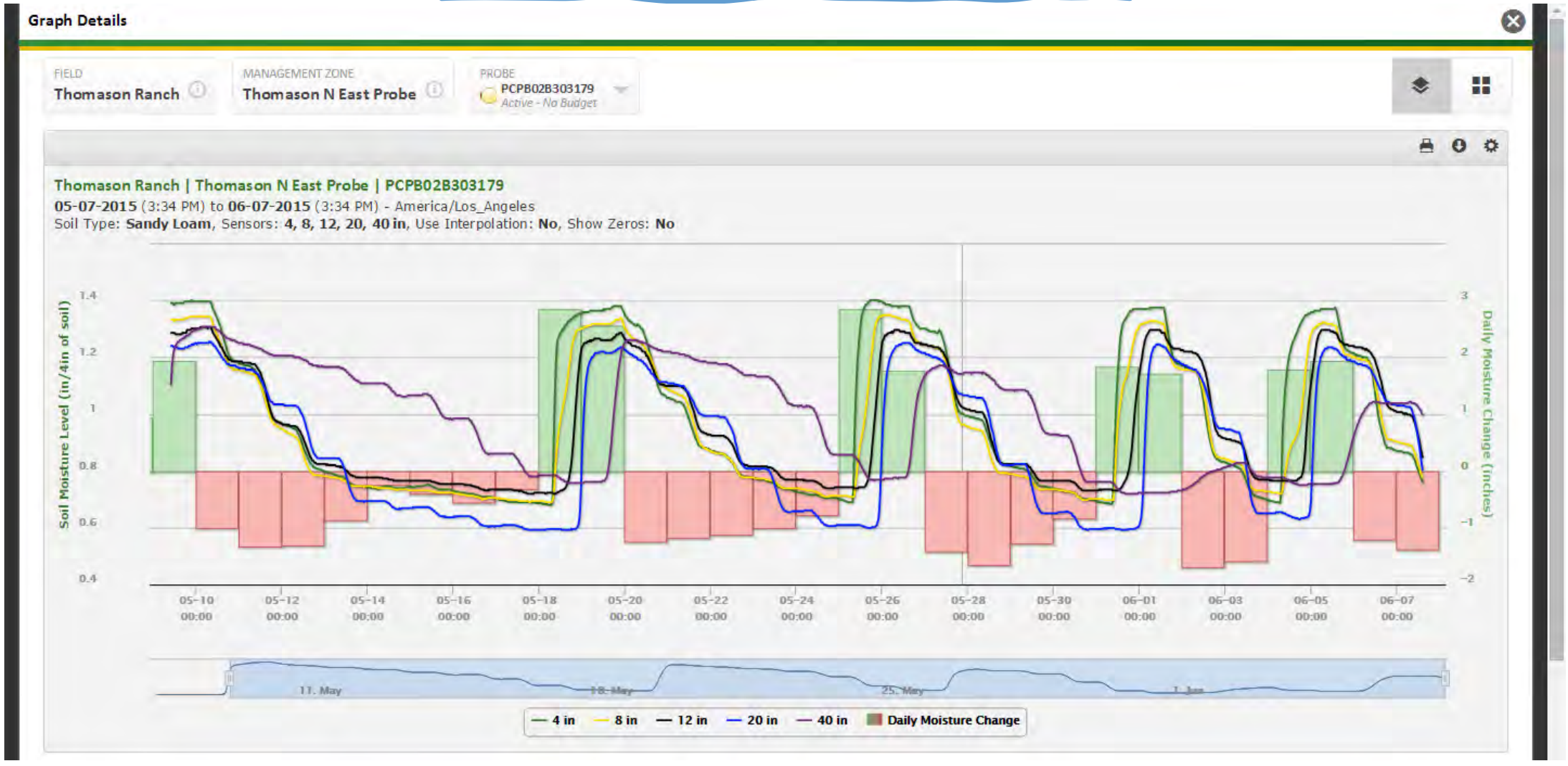
Sum Graph

Stacked Graph

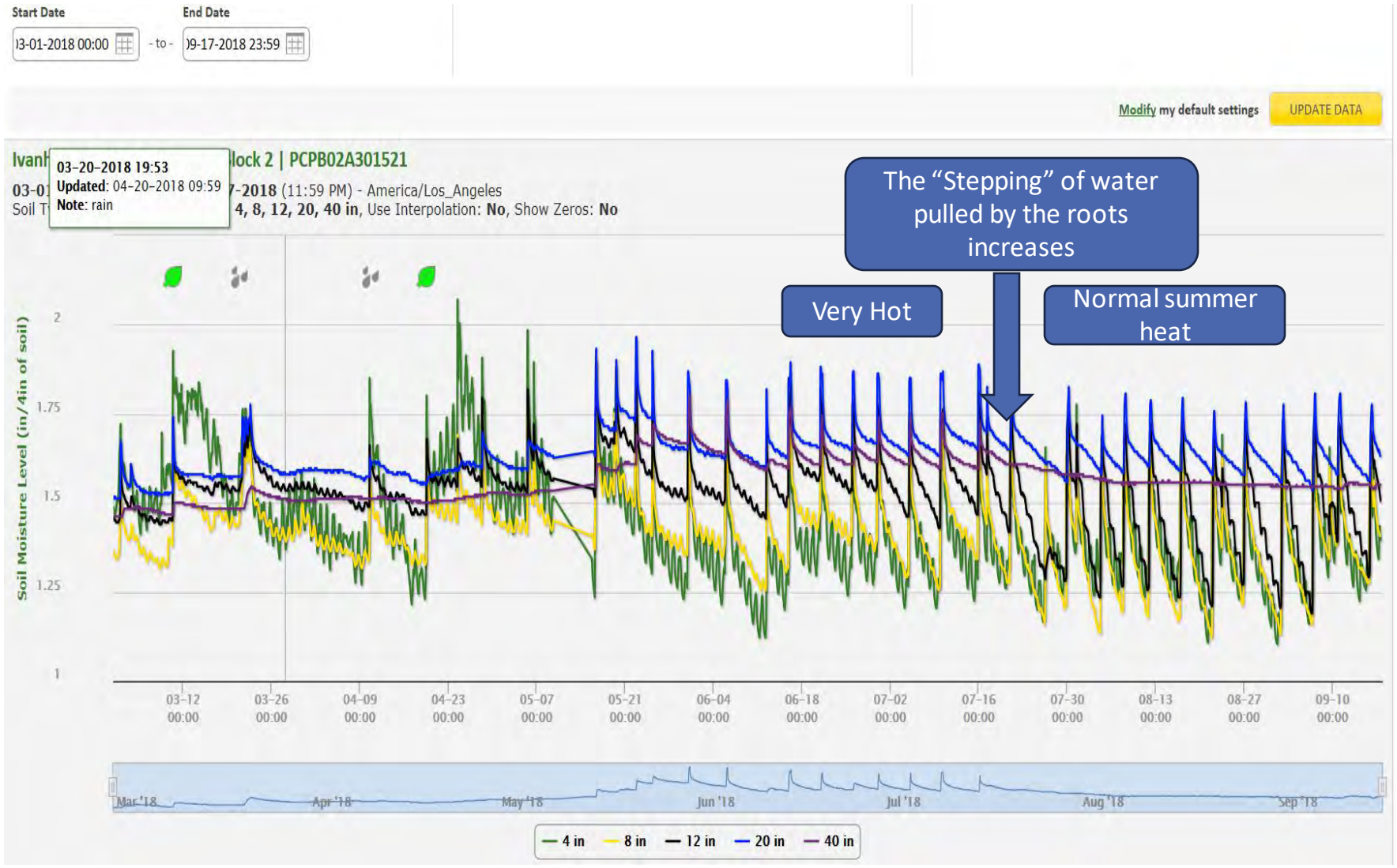
Line Graph

Soil Moisture Data-This is your "gas gauge" to what you have in your tank

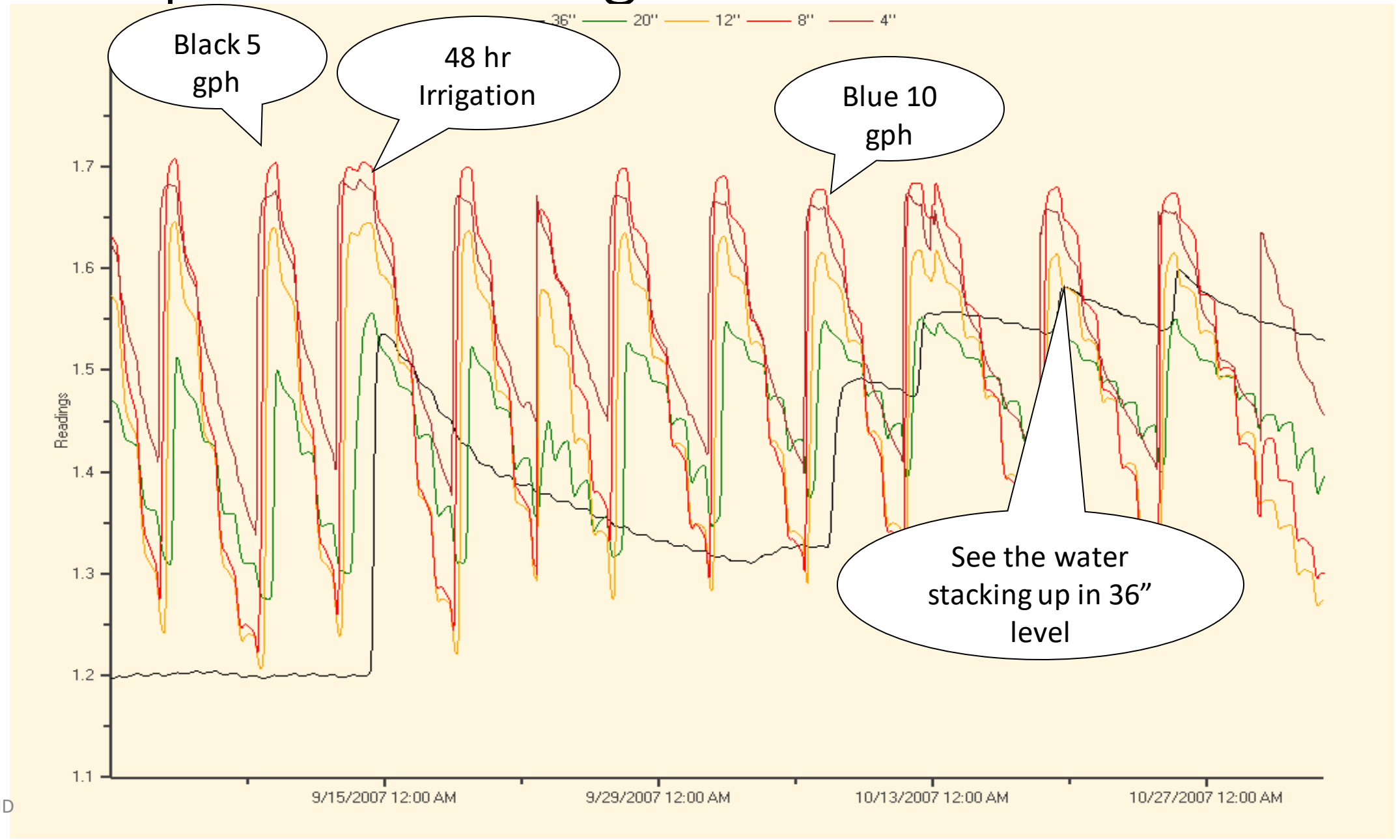
Almonds, Firebaugh, CA



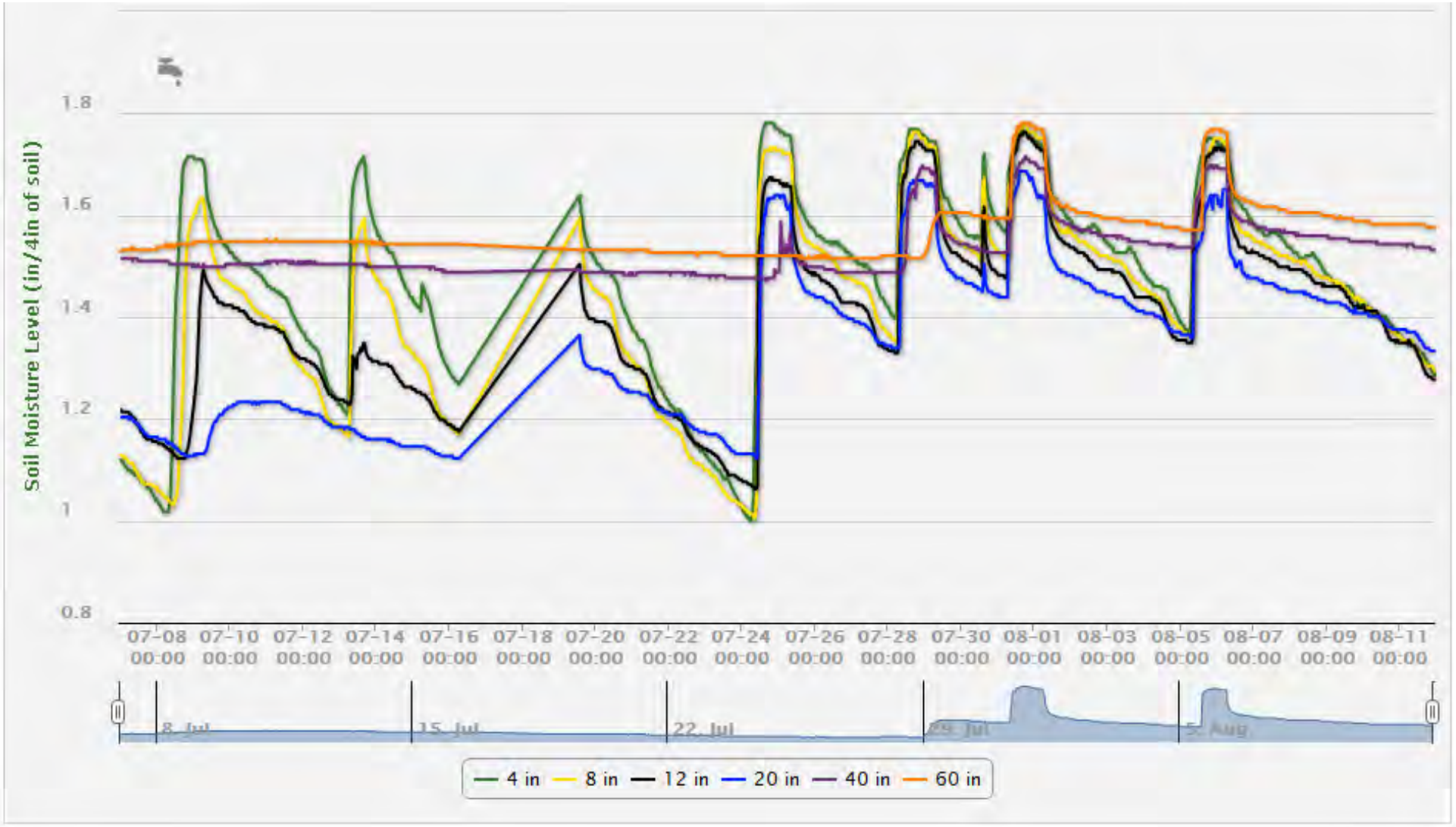
Very hot temps move into normal summer heat-root zone pulls more water.



Example of Over Irrigation in Citrus



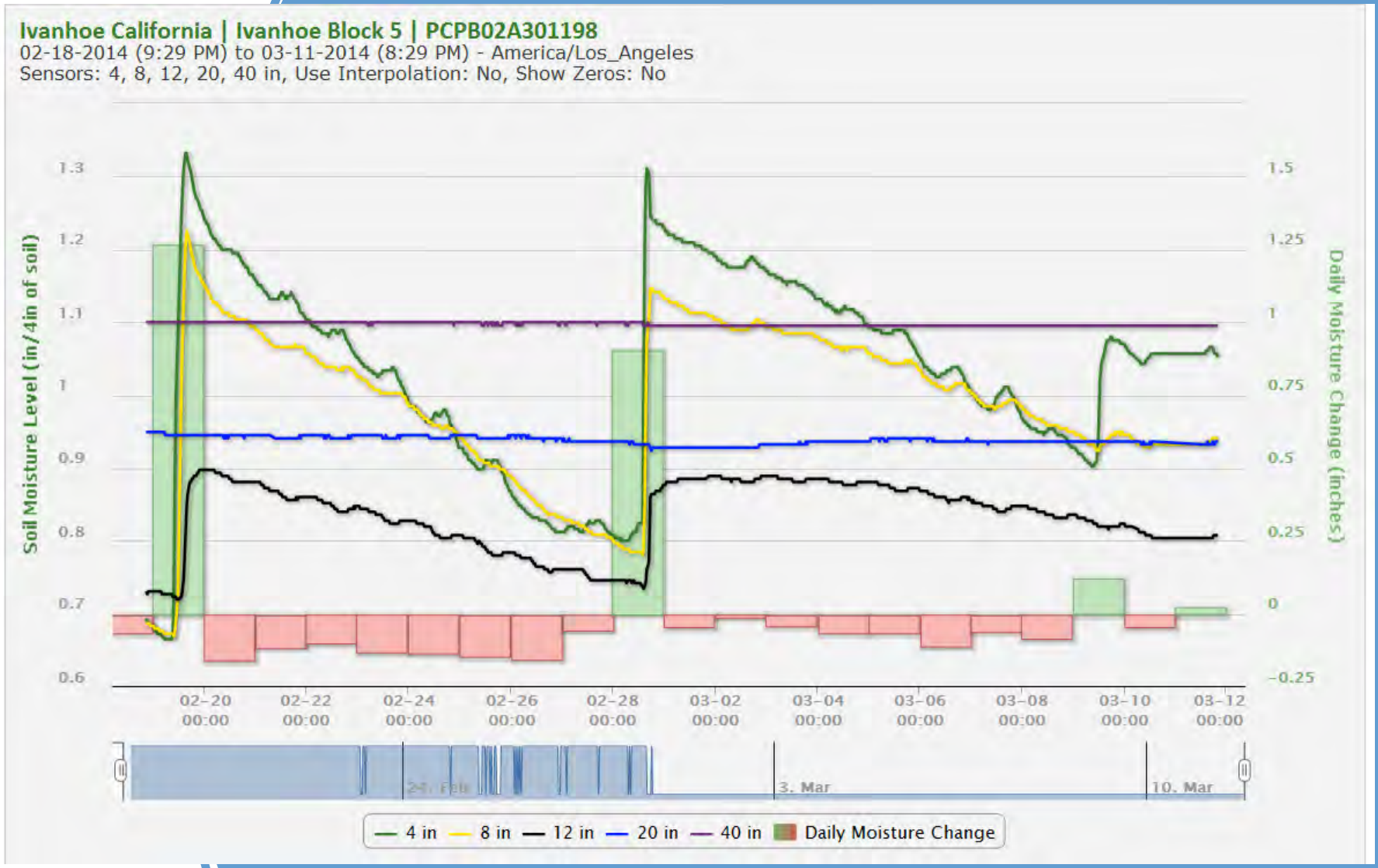
JD



Over Irrigation

Over Irrigation Sum Graph

Line Graph and Daily Moisture Change



Young Citrus Trees

FanJets R Black

What is your Game Plan for your operation?

Do you have ample water for this season? SGMA Restrictions??

Are you Dialed in to your Frequency and Duration of your Irrigation Cycles?

When running fertilizer through your irrigation system, where is your target area in the soil profile? How many hours of irrigation do you reach it?

Do you know the depth of your wetting front in the soil profile for varying amount of irrigation applications?

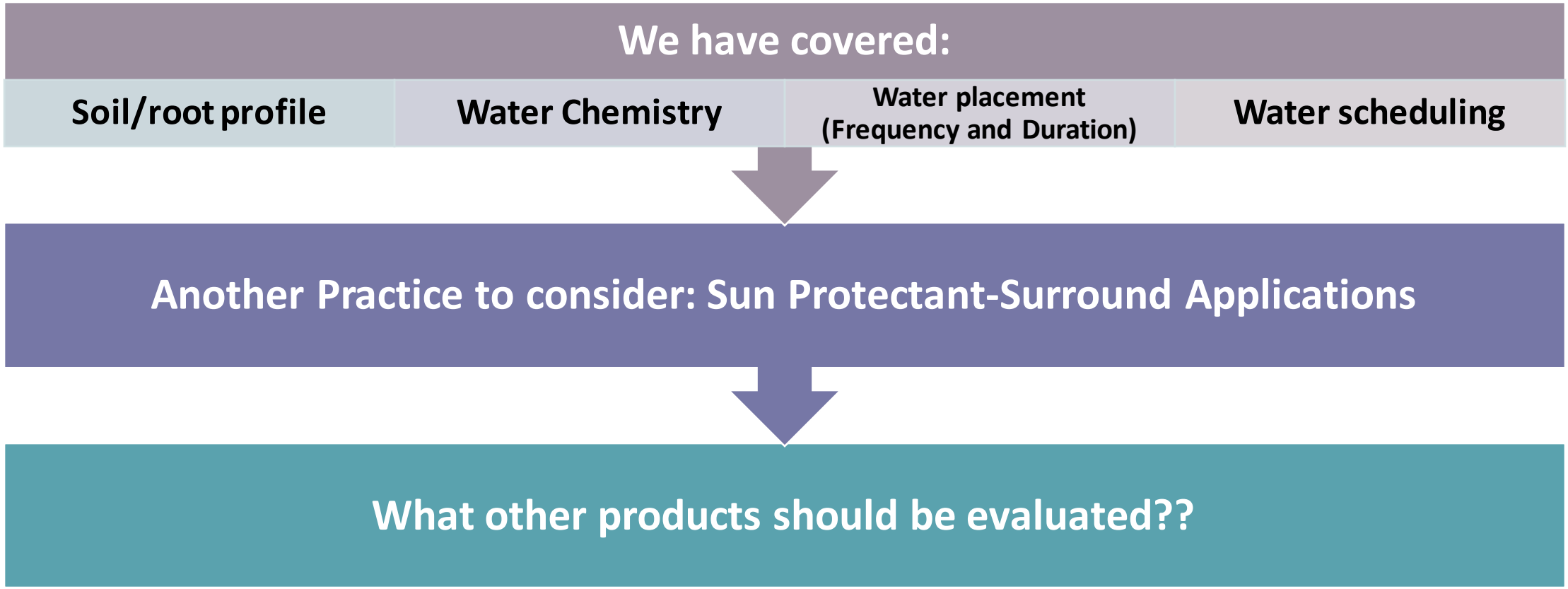
How does your Soil / Water Chemistry affect your irrigations? How much does your well water differ from your district water?

Is your irrigation system in good repair? Flushed regularly at the correct pressure and duration of time? Emitter rates tested?

Have you measured your uniformity in the field?

How are you scheduling your irrigations? Spring-Summer-Fall-Winter

What products can help you through a water short year? Do they work??

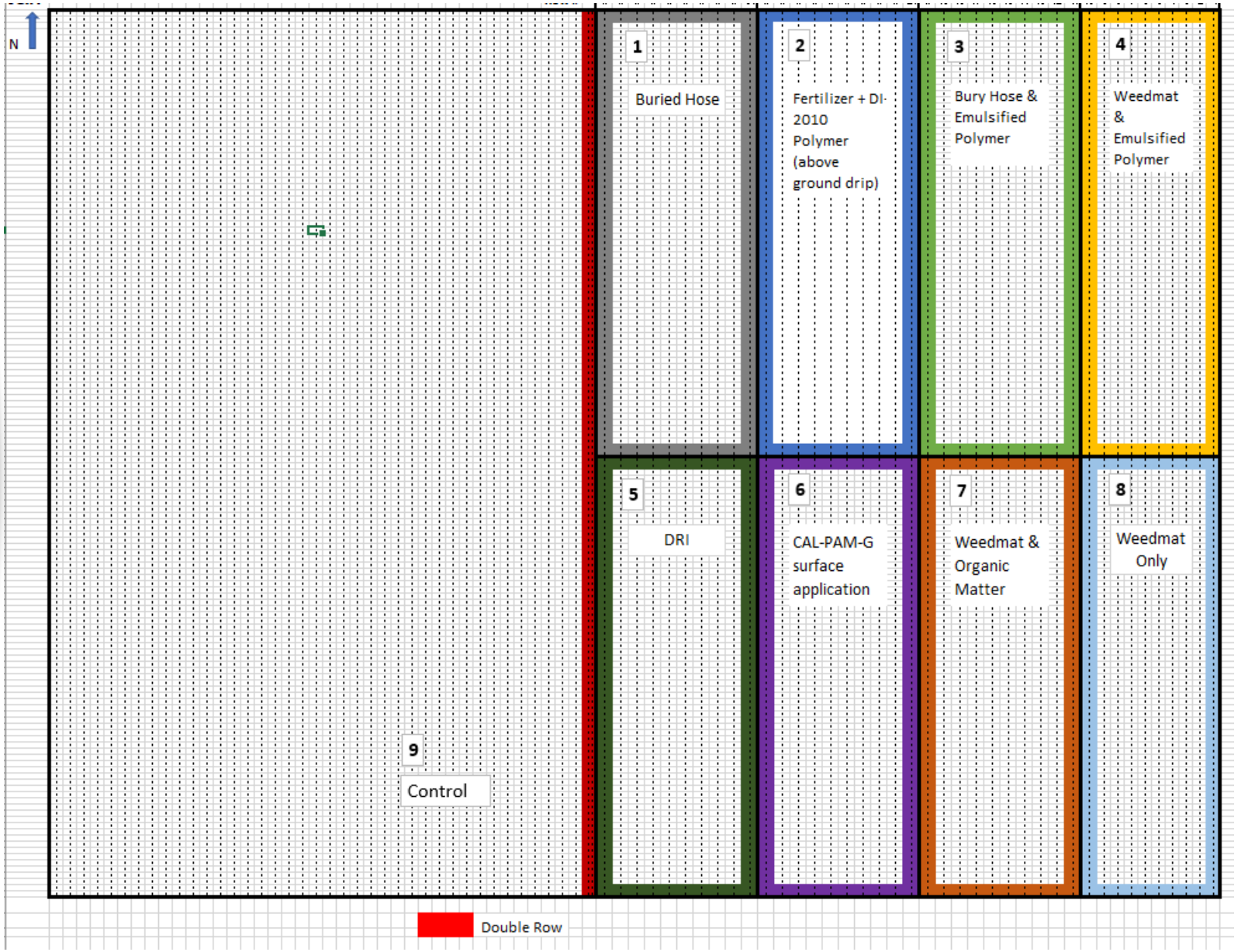


Water Conservation Trial, Strathmore CA

2.5-acre plots

Enviroscan probe in each plot.

Excavated cross section annually in October to evaluate moisture profile.



Water conservation Trial plots. Implemented 2019

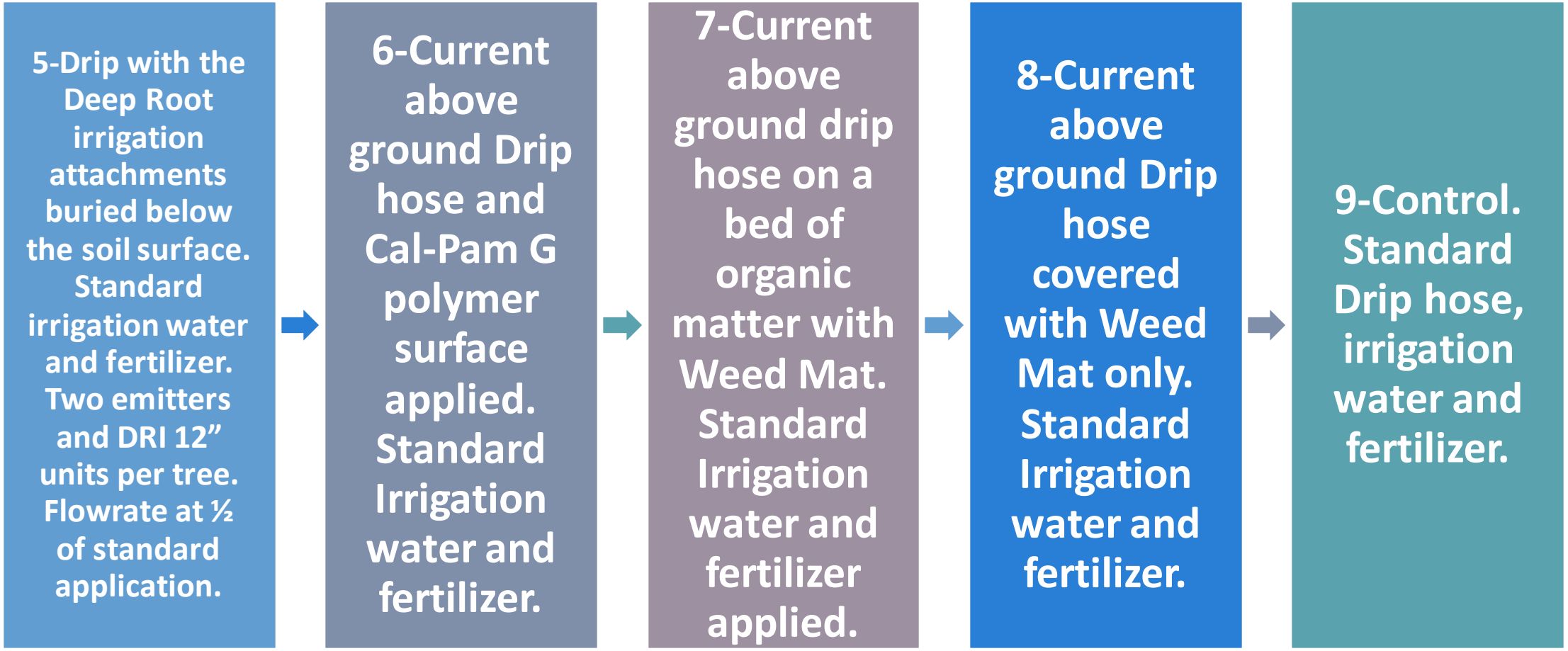
1-Current Drip hose buried below the berm surface about 6-8 inches. Standard irrigation water and fertilizer.

2-Current above ground Drip hose with a fertilizer compatible Polymer added into the irrigation water.

3-Current Drip hose buried below the berm surface about 4-6 inches and an emulsified polymer added to the irrigation water.

4-Current above ground Drip hose covered with a Weed mat and an emulsified Polymer added into the irrigation water.

Water conservation Trial plots. Implemented 2019



September/October each year each treatment area was excavated across the berm to evaluate root growth and moisture levels.

Inline drip hose injected into the side of the berm about 6-8 inches

Irrigation System Automation

- Requires a different level of management.
- Added control can help cut labor costs and increase irrigation efficiency and duration accuracy. Did each set run the correct amount of time.
- Flow meter summary of applied water
- Flow and pressure alerts.
- Different levels of Automation application.
- Fertilizer application and timing in that irrigation set.
- Works very well with a reservoir as the water source.

Automation at the pump Station/Electrical Panels

- **Main VFD Drive (1)**
- **Filters on VFD drive (2)**
- **Manual Time clock On Main VFD Drive (3)**
- **Small VFD Drive (4)**
- **Time clock for small VFD Drive. (5)**
- **WiseConn Monitoring X-1 Node. (6)**
- **Main Gutter Box**

Automation-Manual Timers

Easy to set for off time. Currently not used for an on start – only shut off.

No batteries to change.

Easy connection into most any electrical system HOA panel or VFD controller.

Downside is you need to be onsite to enable time clock.

Flow Meters-Good Data Collection

Electronic flow meters.

- Low Battery warning indicator.
- Seametrics flow meters installed on a cant. Not straight up.

Manual propeller driven flow meters

Electronic Flow meters require grounding to the system and the flowing water.

Some flow meters require a specific distance of pipe before and after the flow meter. Consult the manufacture's specifications.

All Flow meters require a full pipe to read the flow correctly.

Reservoirs with access to Surface water

District water-are you running a 24-hour set so you don't have to change water end of the day or at night? Even though you only needed 8-12 hours of water?

Water storage/Frost water

Pump station-switch from a gravity screen to Sand media filters.

Water Recharge with an unlined reservoir. Building water Credits.

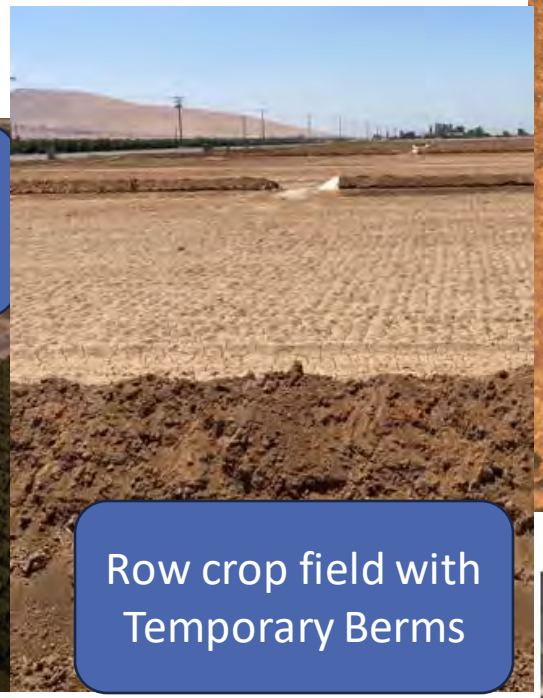
Lined Reservoir with a leach field using the reservoir footprint.

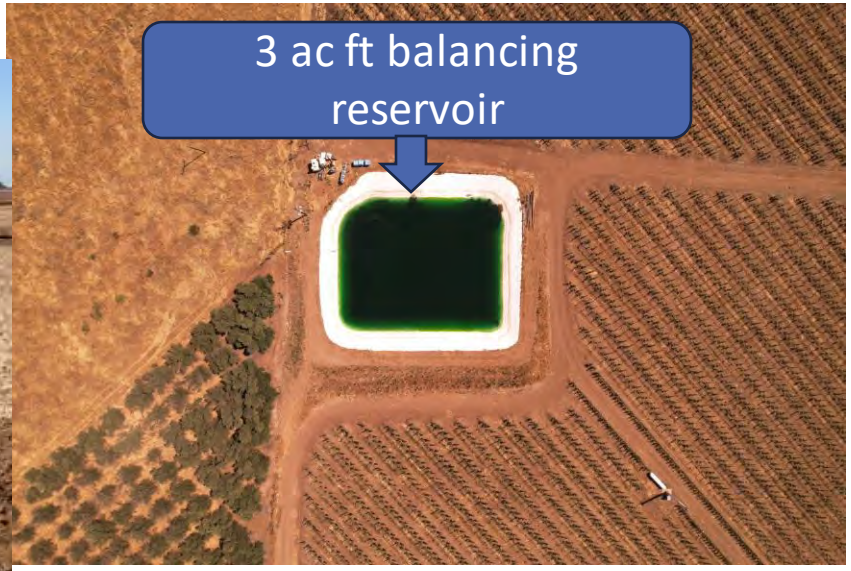
Large reservoir with a "tub" configuration for low water years.

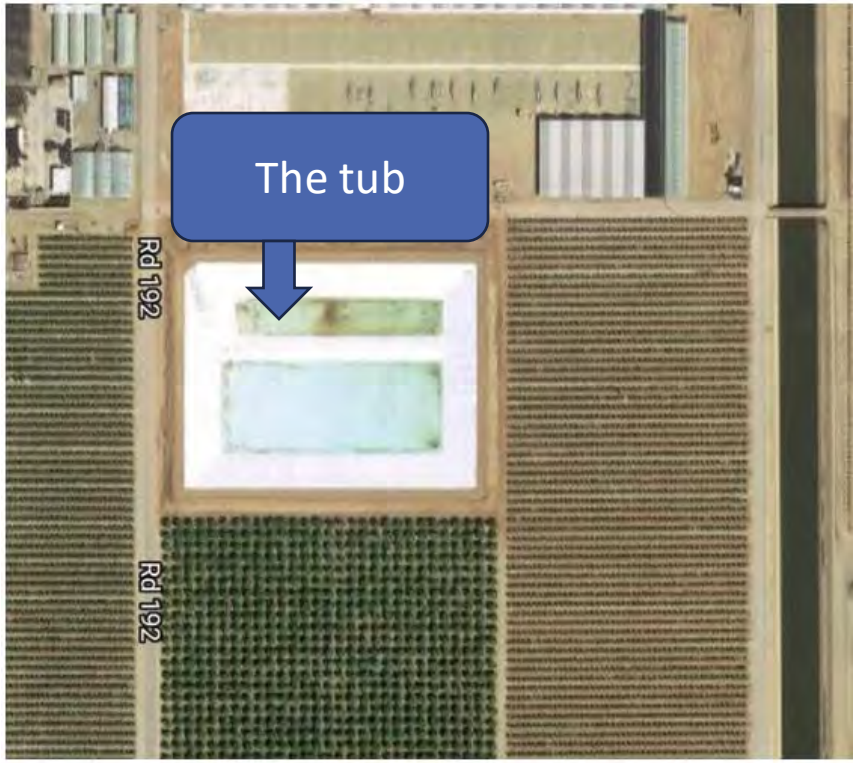
Water at the ready if the District has to shut down for repairs.

Water for the winter when the Friant Kern Canal is dewatered.

Reservoirs / Basins







Recharge opportunities

Leach lines/fields

Drip lines/standard irrigation system

Dry wells. EKGSA is working with USDA to formalize an acceptable and permittable procedure to put these into practice.

Unlined Basins.

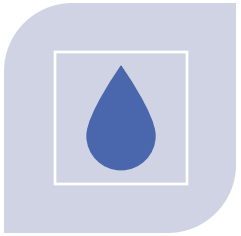
Fields in Transition- temporary berms to hold water in wet years

Furrow irrigation

Planning-when redeveloping a field consider all the options available for water efficiency and water recharge.

Evaluate all facets of your Irrigation operation

COLLECTION OF GOOD DATA TO SUPPORT YOUR IRRIGATION APPLICATIONS IS CRITICAL WHEN COMPARING YOUR OPERATION TO THE DATA COLLECTED BY LAND IQ IN THE WATER DASHBOARD.



BE CONSISTENT IN COLLECTION OF THIS WATER DATA.

EMPLOY GOOD EQUIPMENT.

ENGAGE THE SUPPORT STAFF AT YOUR GSA FOR HELP.

LOOK AT PAST RESEARCH. DAVID GOLDHAMER

Citrus Drought Irrigation

David A. Goldhamer
Consulting Water Management Specialist
dgoldhamer@sbcglobal.net
(559) 228-8775

Dealing with sand, dirt and debris in your district water and your gravity screen.

Motor driven wand rotation.

Larger wand nozzles, faster rotation

Wand water pressure can be increased by installing a small auxiliary booster pump.

Craig's Observations

1-Quality water supplies are critical to our future. Water is Everything.

2-Always Schedule your Irrigations to be as efficient as possible.

3-Maximum Fertility efficiency is only achieved with good water Management.

4-If you don't measure it… you don't know how to manage it.

5-Grow the Best Crop Possible (Not necessarily the biggest yield)

6-The Ag Industry and Grower's need to tell their story. "Re-invent the image of the American farmer as an 'environmental steward' and true American hero!"

7-The General Population has no concept of Farming or where their Food comes from.

8-America Grows the Safest and most abundant food supply in the world.

9-Farming is an "art" supported by science.

10-Elect Statesman not politicians.

Amber Butland

Title: Community Education Specialist, UC Cooperative Extension Fresno

Topic: Grant Funding for Growers

MY JOB DEPENDS ON WATER
Farming in the SGMA Era

State Water Efficiency & Enhancement Program (SWEEP) Funding

Amber Butland

Community Education Specialist

Climate Smart Agriculture Program

UCCE Fresno County

July 13, 2023

cdfa

UC CE

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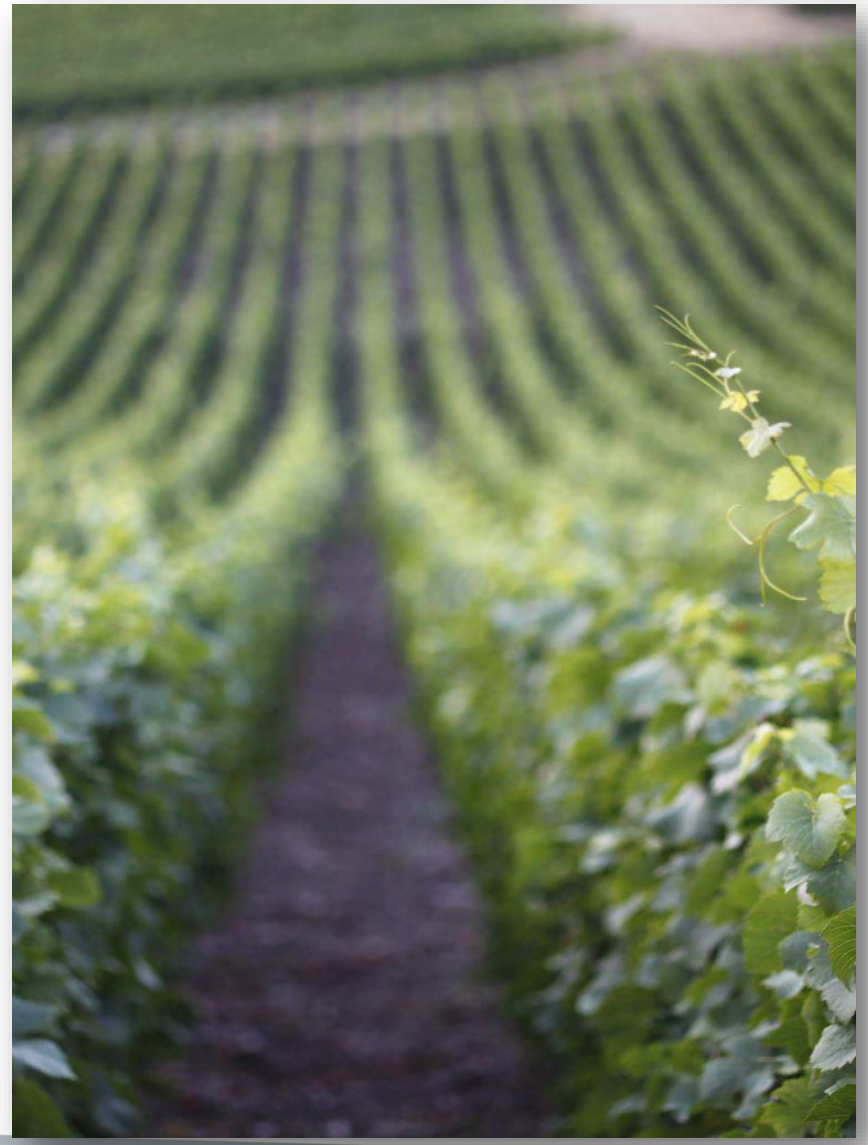
Agriculture and Natural Resources



Overview

- ❑ Climate Smart Ag CES
- ❑ State Water Efficiency & Enhancement Program
  - ✓ What is SWEEP?
  - ✓ SWEEP Projects
  - ✓ Benefits of SWEEP practices
  - ✓ SWEEP Resources
- ❑ Solicitation Changes of CDFA Grant Programs
- ❑ Questions

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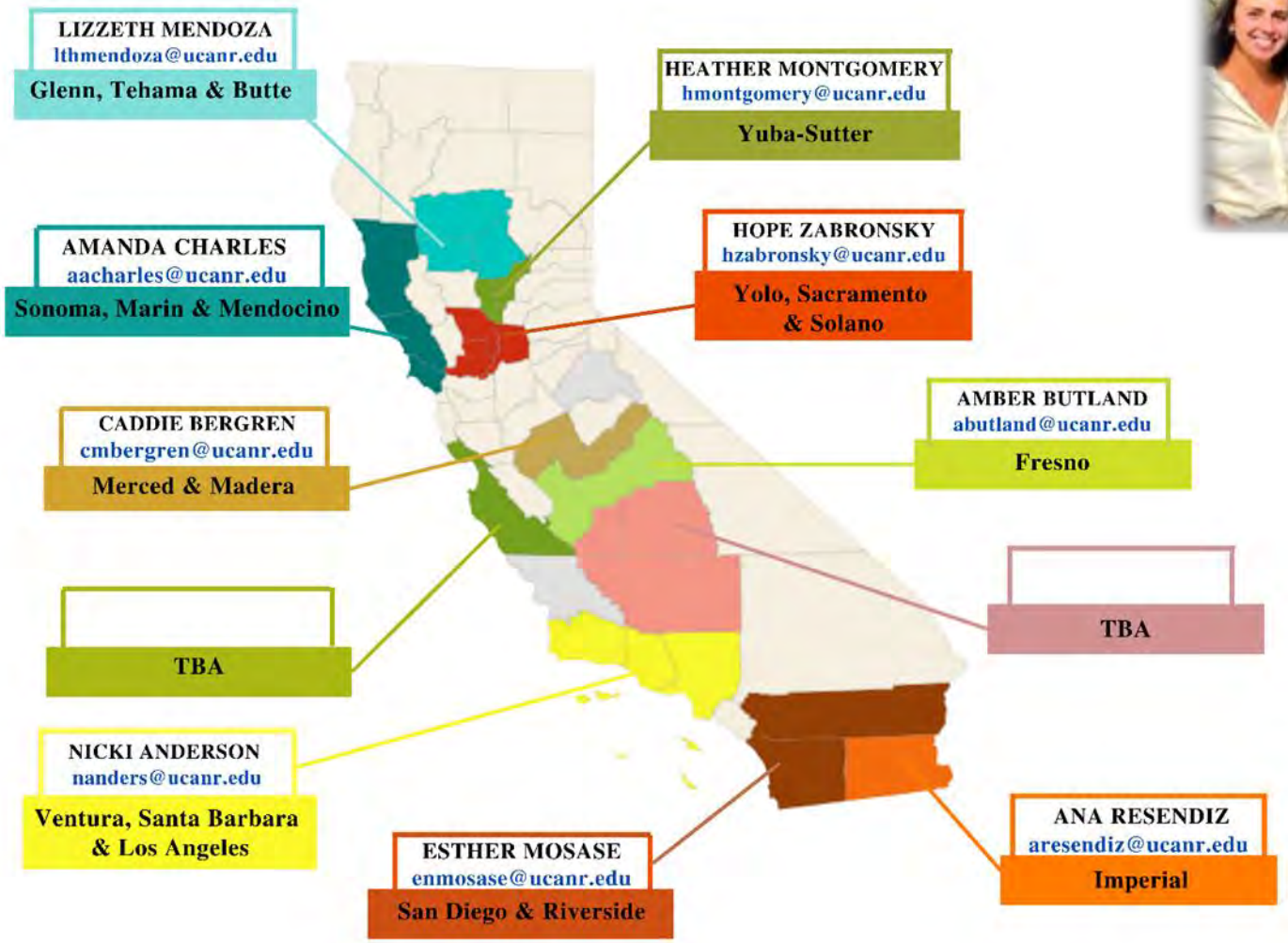
Climate Smart Agriculture Program



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What is State Water Efficiency and Enhancement Program?

cdfa CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

State Water Efficiency & Enhancement Program

Provides financial assistance to implement irrigation systems that reduce greenhouse gases and save water on California ag operations.

Started in 2014 – merit based or first come, first served

Up to $200,000 to implement the use of new irrigation systems on operating Agriculture Farms and Ranches

Funding and Duration

Application window expected 2023 fall/winter

- Max award amount: $200,000
- Max grant duration: 24 months
- Reimbursement
- An ag operation cannot receive a total cumulative SWEEP award greater than $600,000.
- Cannot build on a previously funded SWEEP project on the same APN.

Eligible System Components

- Soil, weather, plant sensor
- Drip Systems Components
- Pump retrofits or replacement
- Fuel conversion (diesel to electric)
- Variable Frequency Drives
- Installation of Renewable Energy

(solar)

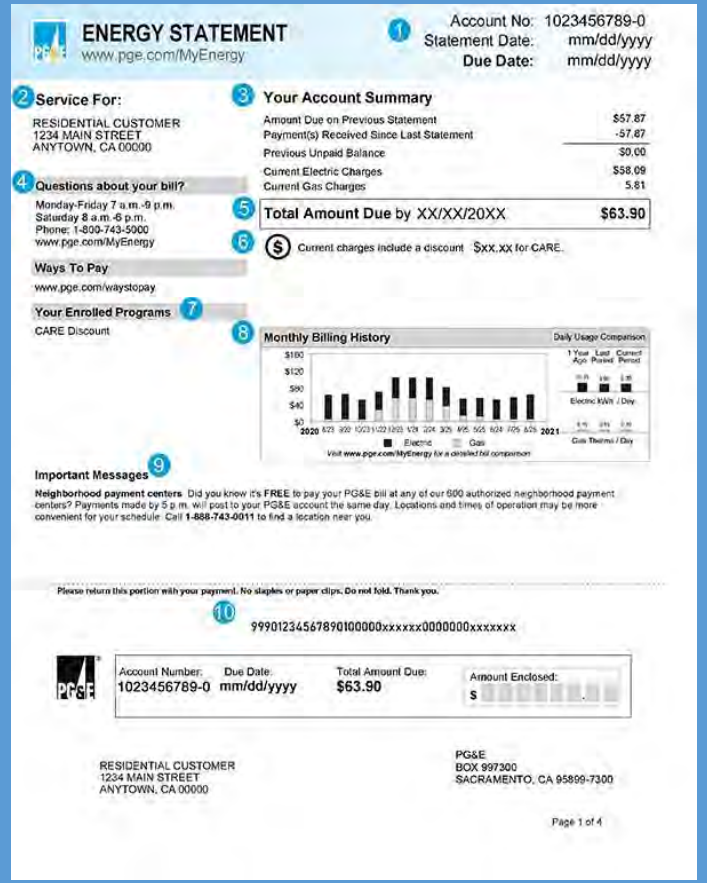
Not eligible:

- New/deeper wells
- Additional pumps
- Newly planted acreage

Allowable Costs

- All components of irrigation systems
- Sensor hardware and telemetry
- Software associated with sensors and weather stations
- Flow meters (required)
- Permits
- Electric connection fees
- Subscription services for project term

Pre-Application Preparation



ENERGY STATEMENT
www.pge.com/MyEnergy

1 Account No: 1023456789-0
Statement Date: mm/dd/yyyy
Due Date: mm/dd/yyyy

2 Service For:
RESIDENTIAL CUSTOMER
1234 MAIN STREET
ANYTOWN, CA 00000

3 Your Account Summary

Amount Due on Previous Statement	$57.87
Payment(s) Received Since Last Statement	-57.87
Previous Unpaid Balance	$0.00
Current Electric Charges	$58.09
Current Gas Charges	5.81
5 Total Amount Due by XX/XX/20XX	$63.90

4 Questions about your bill?
Monday-Friday 7 a.m.-9 p.m.
Saturday 8 a.m.-6 p.m.
Phone: 1-800-743-5000
www.pge.com/MyEnergy

6 Current charges include a discount $XX.XX for CARE.

Ways To Pay
www.pge.com/waystopay

Your Enrolled Programs 7
CARE Discount

8 Monthly Billing History
Daily Usage Comparison
Electric kWh / Day
Gas Therms / Day
Visit www.pge.com/MyEnergy for a detailed bill comparison

Important Messages 9
Neighborhood payment centers Did you know it's FREE to pay your PG&E bill at any of our 600 authorized neighborhood payment centers? Payments made by 5 p.m. will post to your PG&E account the same day. Locations and times of operation may be more convenient for your schedule. Call 1-888-743-0011 to find a location near you.

Please return this portion with your payment. No staples or paper clips. Do not fold. Thank you.

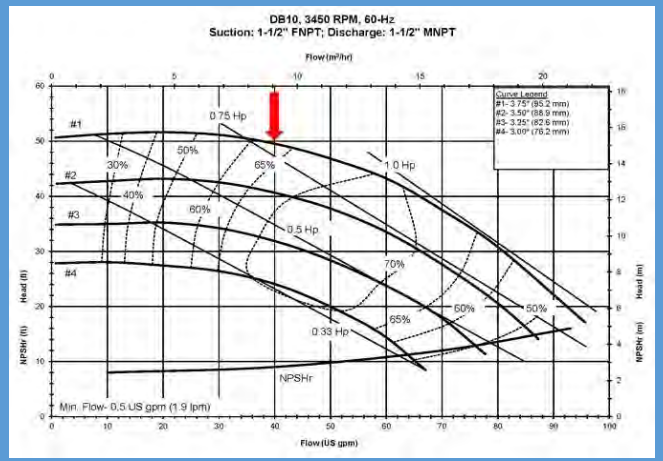
10 99901234567890100000xxxxxx0000000xxxxxxx

Account Number:	Due Date:	Total Amount Due:	Amount Enclosed:
1023456789-0	mm/dd/yyyy	$63.90	$

RESIDENTIAL CUSTOMER
1234 MAIN STREET
ANYTOWN, CA 00000

PG&E
BOX 997300
SACRAMENTO, CA 95899-7300

Page 1 of 4



What to collect if you are considering applying:

- ❑ Energy records from the past 12 months for all systems included in the project
- ❑ Pump Efficiency Tests (valid for up to 24 months prior to application opening) - cost is not covered in application
- ❑ Bids from vendors on desired project components (required for solar projects)

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Application Attachments

- Project Narrative
- Project Design
- Budget Worksheet
- Water Savings Tool
- GHG Calculator Tool

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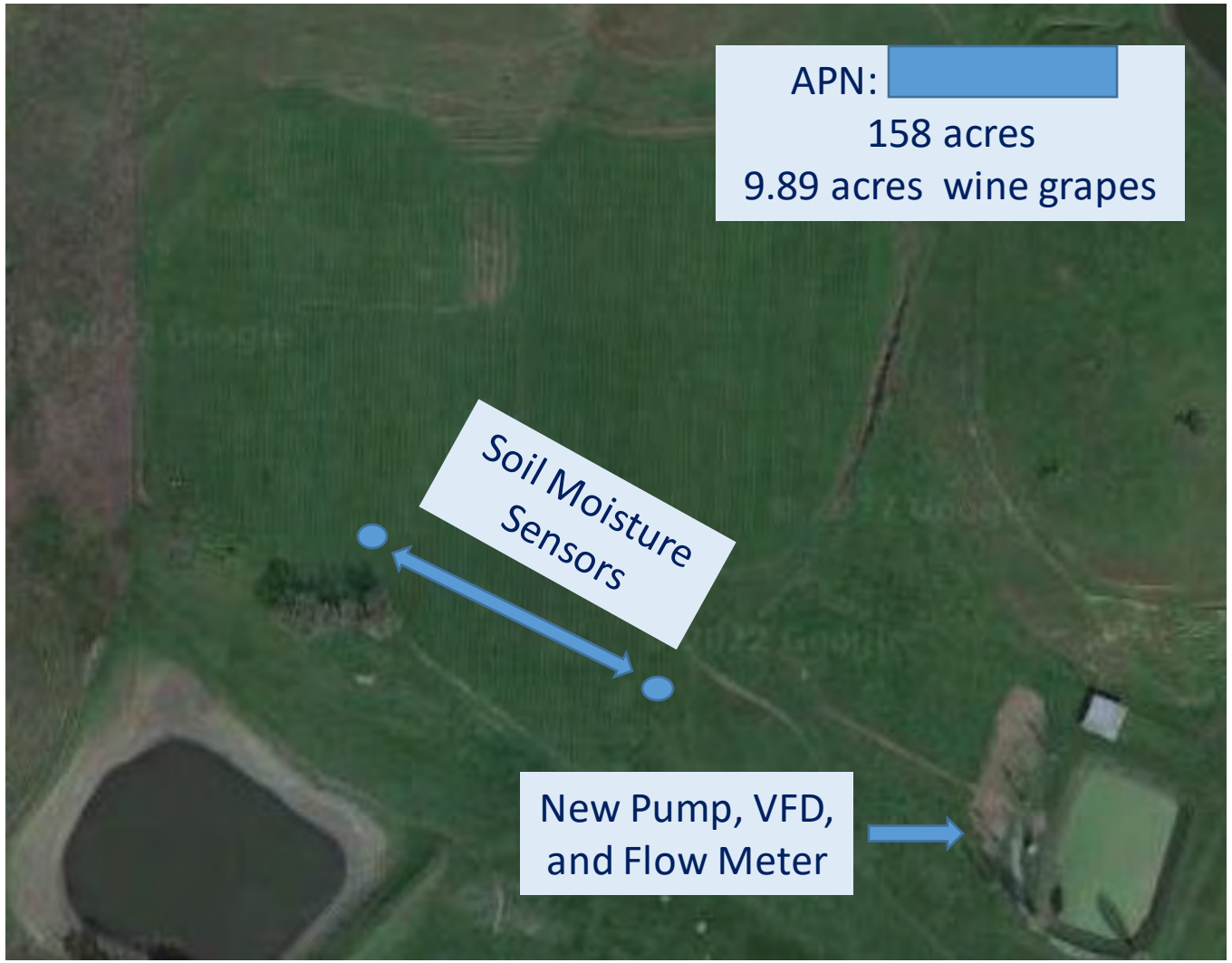
Project Design



Must Include:

- Labeled APN
- Detailed schematic of the location of proposed infrastructure
- Location of existing or proposed flowmeters
- Crop and water source
- Online Map

Post Award Activities

Yes, you will be required to have a flow meter.

- Pre-project Consultation (Phone)
- Post-project Verification by CDFA (Photos & Phone)
- Post-project Quantification by CDFA or third party rep (up to 3 years)
- Expectation to maintain the system for minimum of 10 years

SWEEP FAQ's

1. Is there a minimum amount required for matching funds?

No. Matching funds are encouraged, but not required.

2. Can applicants apply to both SWEEP and EQIP, and if awarded EQIP funding, withdraw their SWEEP application?

Yes, applicants may apply to both programs. If awarded EQIP funding, applicants would not be eligible to receive SWEEP funding on the same parcels for the same equipment. Applicants may indicate components funded by EQIP as matching funds.

SWEEP FAQ's

3. Is a pump efficiency test required even if changes to the pump(s) are not a part of the project?

Yes, applicants must determine pump efficiency for all the pumps (including booster pumps) that service the irrigation system in order to complete the required SWEEP GHG Calculator Tool. This cost is not covered by SWEEP.

4. Is there a minimum threshold for water savings and greenhouse gas (GHG) reductions?

No, there is not a minimum threshold for water savings and GHG emissions reductions as long as water savings can be estimated using the SWEEP Irrigation Water Saving Assessment Tool Page 2 and GHG reductions can be quantified using the Air Resource Board (ARB) quantification methodology.

SWEEP Website and Resources

Application Materials

- Priority Population Map Tool
- 2021 SWEEP Budget Worksheet
- SWEEP Irrigation Water Savings Calculator
- SWEEP GHG Calculator

Resources

- SWEEP flyer 2021
- 2021 SWEEP Public Comments
- 2021 SWEEP RGA Public Comment Summary
- Past Solicitations
- List of Agricultural Management Practices Incentivized by SWEEP
- Irrigation Technical Resources
- SWEEP Sub-Advisory Group

Sweep Videos

Climate Smart Agriculture: Rossow Farms

Episode 1: SWEEP has had a positive effect on Seth Rossow's family owned farm, Rossow Farms which is located in Merced, San Joaquin County. (4:06)

https://www.cdfa.ca.gov/oefi/sweep/

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Solicitation Changes

Block Grant Pilot Program Proposal:

Healthy Soils Program (HSP) and State Water Efficiency and Enhancement Program (SWEEP)

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CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

Presented by the CDFA during the Environmental Farming Act Science Advisory Panel on October 20,2022

Upcoming solicitations –

- Traditional Style & Block Grant Style
- Early 2023 Application Periods

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Agriculture and Natural Resources

Questions?

Contact me with any further questions!

Amber Butland

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550 E. Shaw Ave.

Suite 210-B

Fresno, CA 93710

UNIVERSITY OF CALIFORNIA
Agriculture and Natural Resources

Lurana Strong

Title: District Conservationist, USDA Natural Resources Conservation Service

Topic: Grant Funding for Growers

MY JOB DEPENDS ON WATER
Farming in the SGMA Era

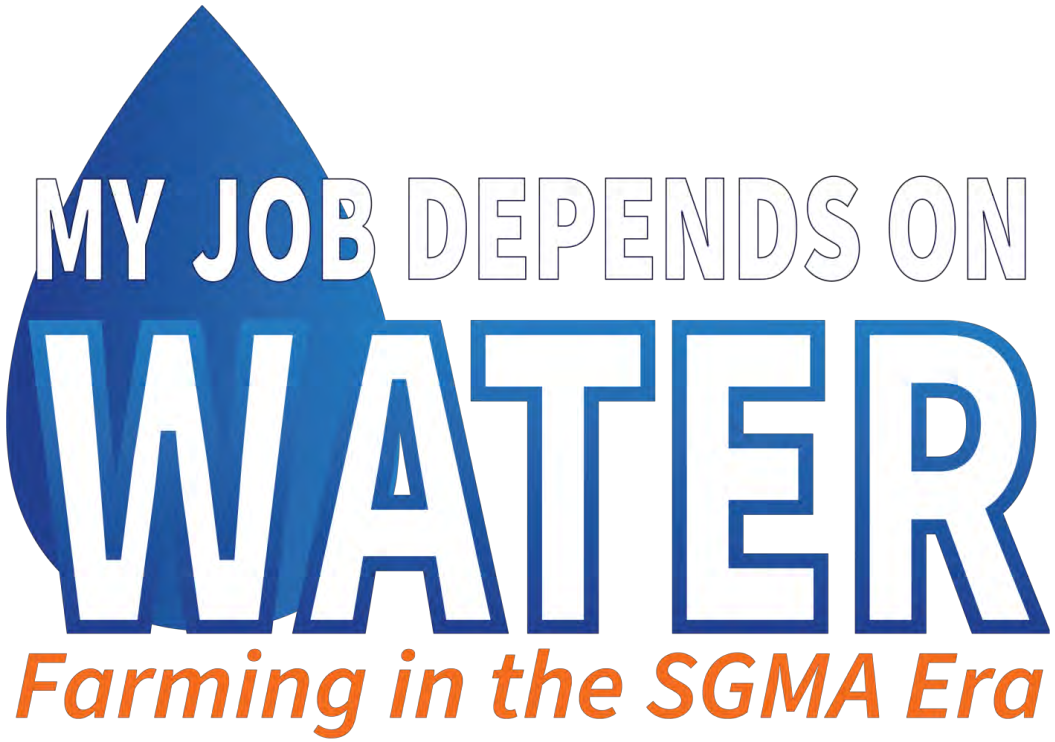
MY JOB DEPENDS ON

WATER

Farming in the SGMA Era

SESSION 2

Speaker Panel



BBQ LUNCH

Please wait to be excused!

MY JOB DEPENDS ON

WATER

Farming in the SGMA Era

SPONSOR PRESENTATIONS

MY JOB DEPENDS ON WATER

Farming in the SGMA Era

BRANDT INC.

AvidWater = AVI + IDC

- AvidWater was officially formed and announced April of 2023 but the legacy is much longer.
- Agri-Valley Irrigation was formed in 1983 and grew into a leading irrigation business across the Central Valley with 6 retail locations.
- Irrigation Design and Construction was founded in 2004 and quickly grew to 9 retail locations spanning the Central Valley to Northern and Coastal California markets.
- Today AvidWater's 15 retail locations and elite construction team no project is too big or small to help make your water go further.
- Our certifications include: **CCA, QAL, CID, CAIS, PASp, CA-NSp**

Agri-Valley Irrigation, LLC

IDC LLC
IRRIGATION DESIGN & CONSTRUCTION

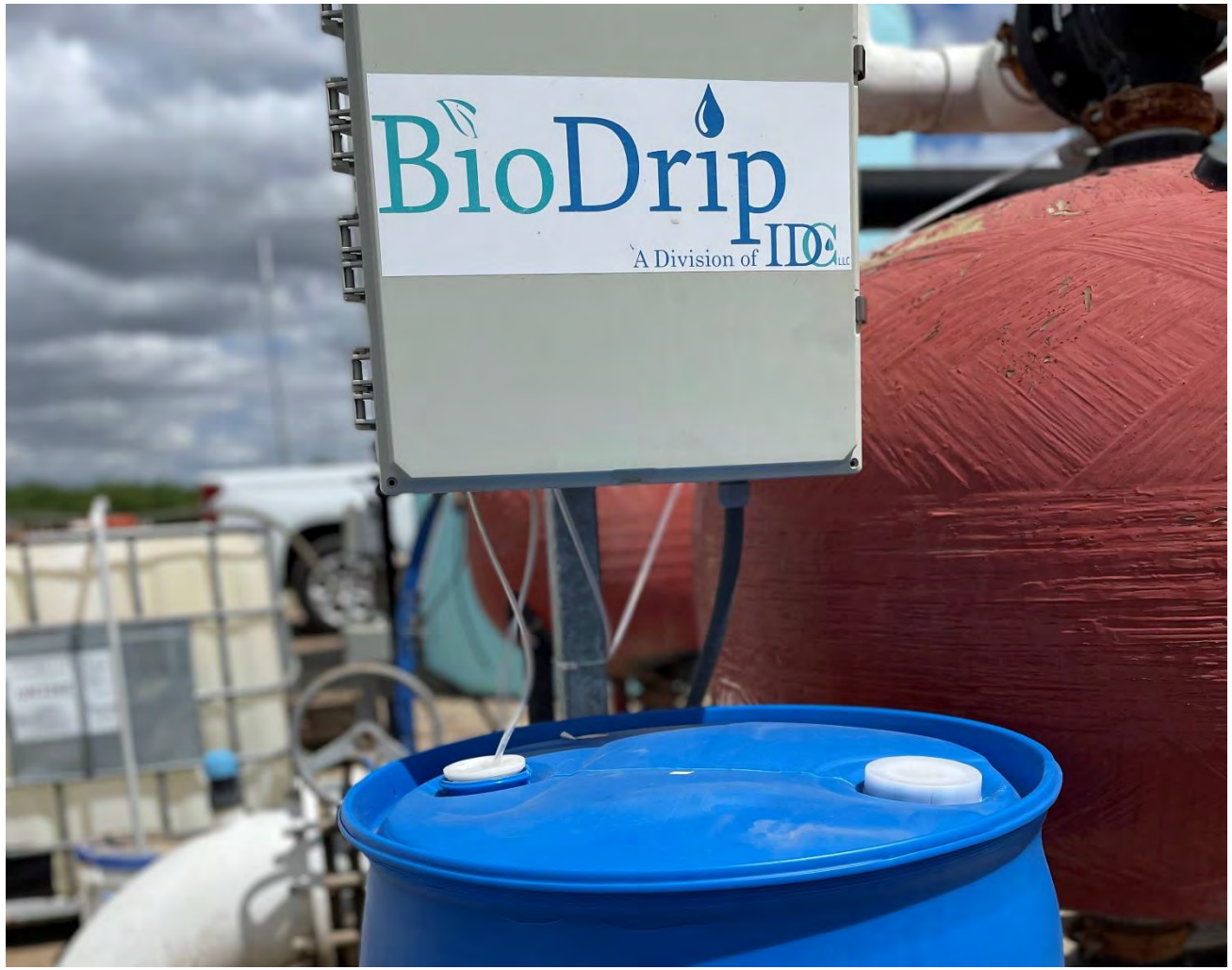
AVIDWATER

AvidWater Team

- AvidWater partners with long-term suppliers, such as Brandt, in the agricultural water treatment industry.
- AvidWater works to provide the best service and products available to solve a grower's particular issue.
- The water treatment team has experts with years of on-site treatment combined with certifications and education in agronomy, engineering, and chemistry.
- **Collin Scholl**, CAIS, Agronomic Sales Lead – Water Treatment
- **Blair Baker**, CCA, Account Manager
- **Tim Tauvar**, Operations Manager
- **Joe Roggio**, CAIS, Sales & Operations

Water Treatment Services

- At AvidWater we offer a full line of irrigation maintenance and remediation services and products to protect your system investment.
- Under the AvidWater banner our water treatment divisions are known as Micro-Pro (AVI) and BioDrip (IDC).
- With operations teams in place we inspect, deliver and treat your irrigation system/water on a continuous basis providing the grower/irrigator a worry-free experience.
- For questions or quotes reach out, water sample reports and consultations are always free.



AVIDWATER

Automation & Monitoring

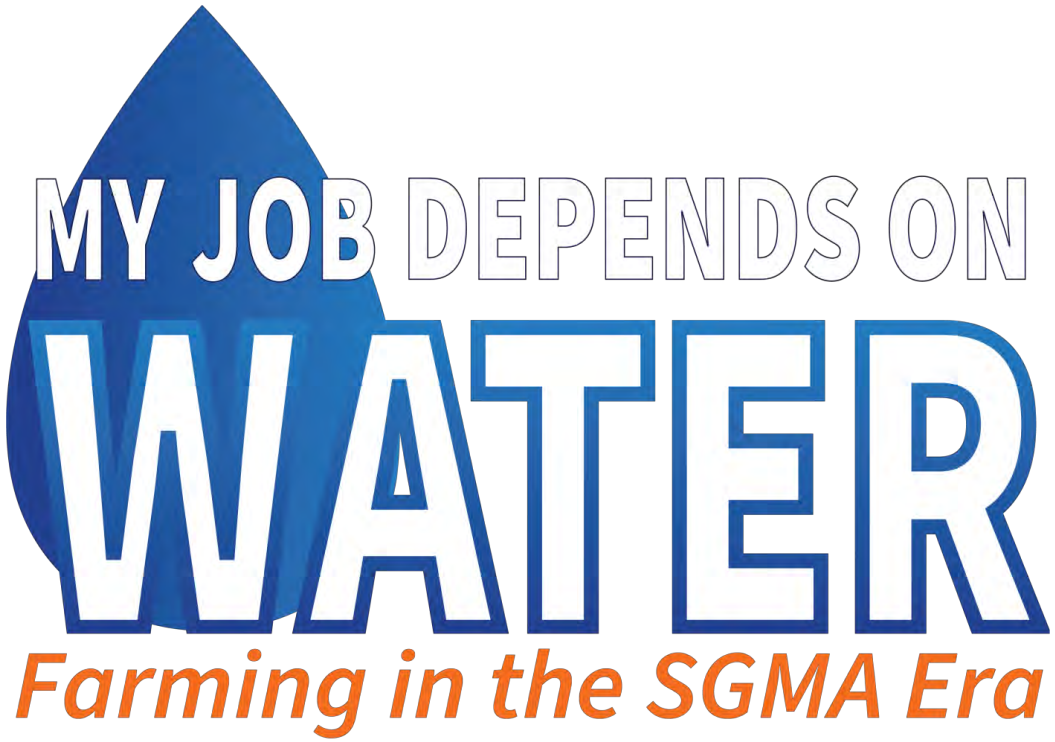
- Primary use partner is Jain Logic due to capability and familiarity with products and services.
- Soil moisture, weather, satellite imaging, flow meter monitoring, valve automation, pump automation, reservoir level monitoring.
- Pump control, valve/set automation, fertilizer injection.
- Jain Logic is the culmination industry leading software and field tested, in-house hardware packaged to provided the most reliable and insightful irrigation management platform.

AVIDWATER

Water Management Services

- 4,800 acres currently enrolled in Water Management Services program.
- Business was started in 2020 with an idea to help growers adopt technology without capital investment risk.
- WMS provides all the equipment necessary to provide precision irrigation scheduling and management coupled with expert advice / weekly report for a fee per acre annually.
- Grower does not own the equipment and has no capital risk enrolling in the program.

AVIDWATER



HORTAU

"This has been the most important agronomy tool we've used to date."

- Dave Gill, Golden Eagle Farms

IRRIGATION MANAGEMENT SERVICES

HORTAU

A team of Ag professionals

Hortau at a glance

- 22+ years in the industry
- 75 employees
- Local Offices in Modesto & San Luis Obispo
- More than 1,000 farms currently serviced
- 6500+ monitoring stations deployed
- Full-service irrigation management

For more on the entire Hortau team, visit hortau.com/staff

Services currently offered

Irrigation Management	Autonomous Irrigation	Weather	Flowmeter Monitoring
			
On-demand, tension-based, irrigation management service including • Equipment, Wireless, Data storage, Apps and access • Crop stress anticipation with forecasted schedule a week ahead • Field tech support • Grower support	Autonomous irrigation operation and control service including • Equipment, Wireless, Data storage, Apps and access • Three automation mode: remote start, schedule and fully autonomous • Field tech support • Grower support	Local weather monitoring service including • Equipment, Wireless, Data storage, Apps and access • Access to Hortau weather network (in development) • Field tech support • Grower support	Wireless flowmeter monitoring service including • Equipment, Wireless, Data storage, Apps and access • Remote access to flowmeter data from multiple locations • Field tech support • Grower support

Field Monitoring

Irrigation Managed with Soil Tension leads to multiple benefits

Better input efficiency

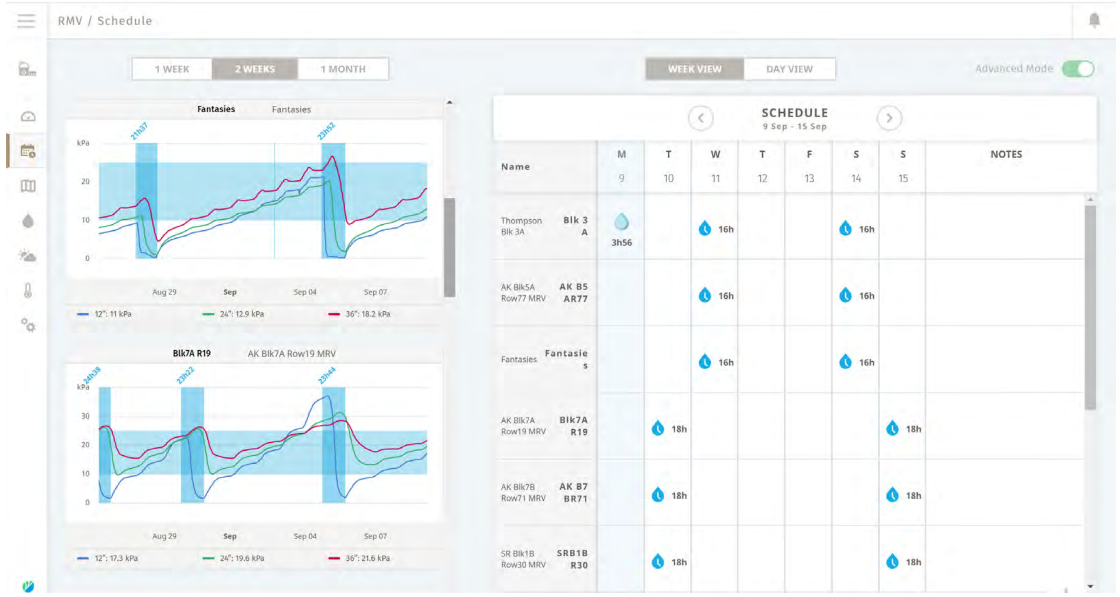
- Water
- Nutrients
- Pesticides

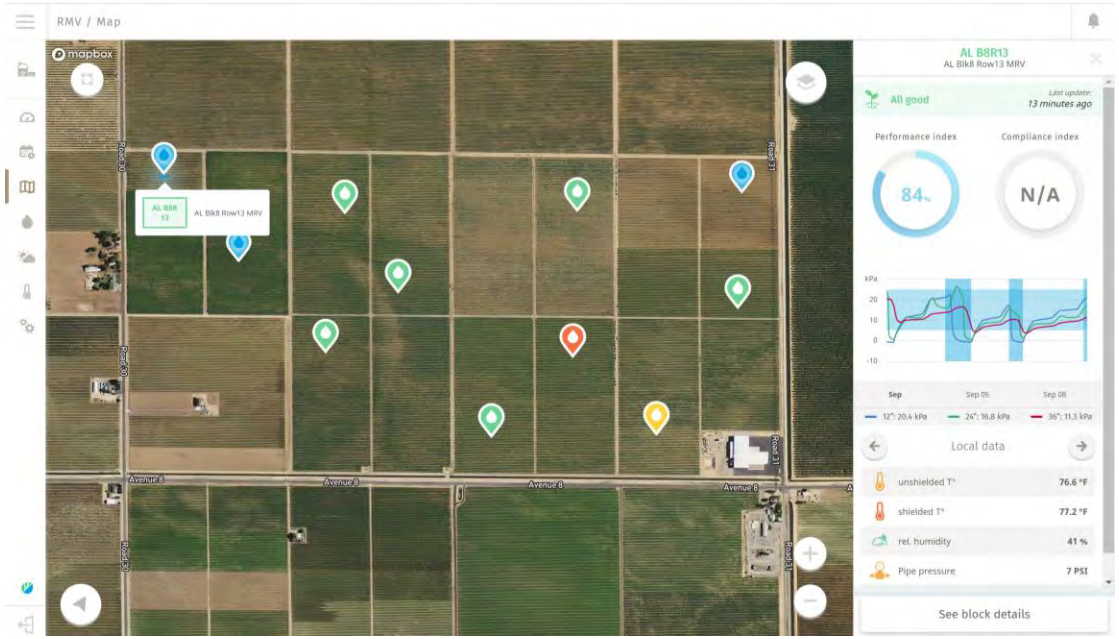
Increased crop health

- Better quality
- Better uniformity
- Better yields

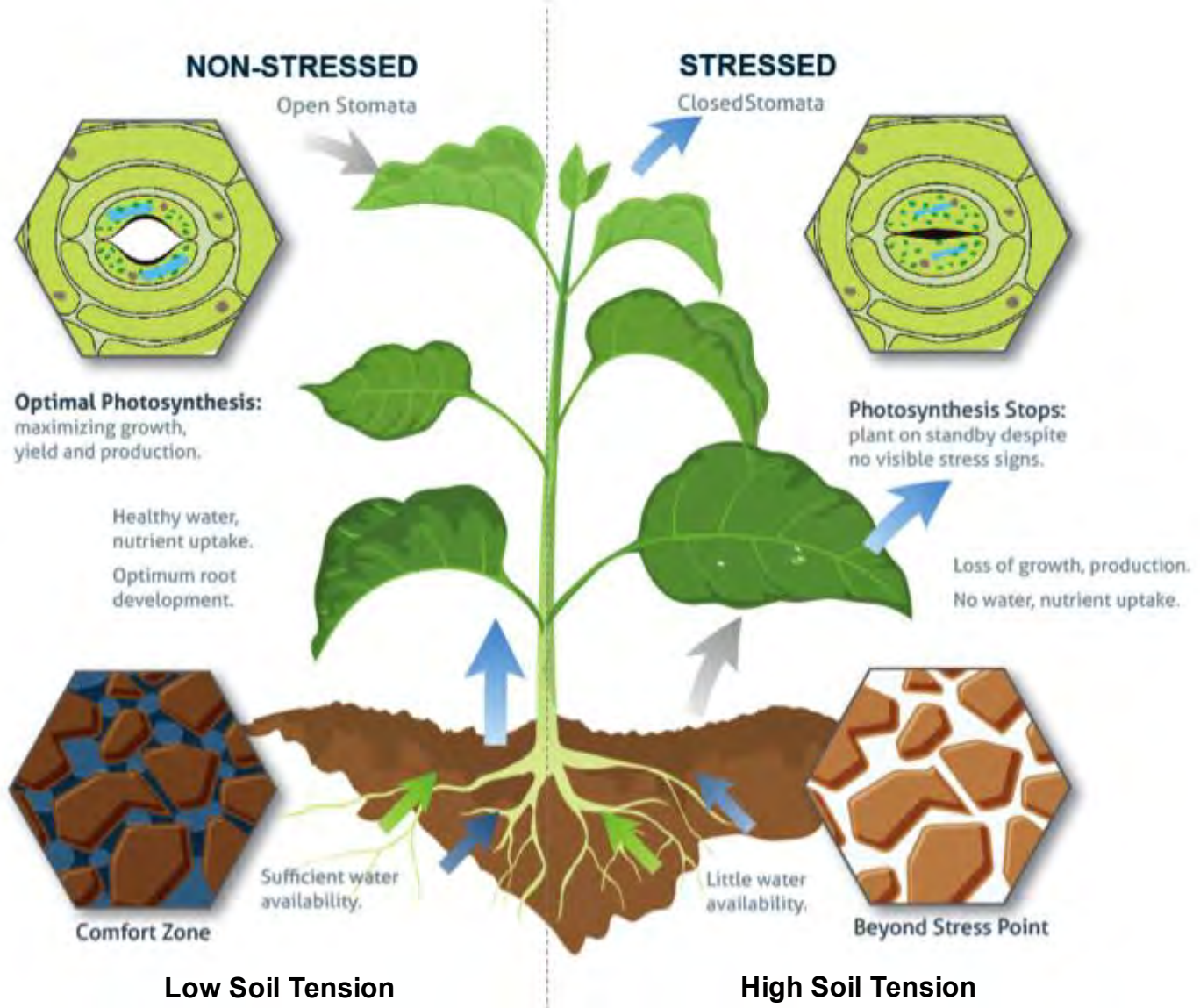
Better reporting and traceability

- SIGMA
- Repeatability of best results



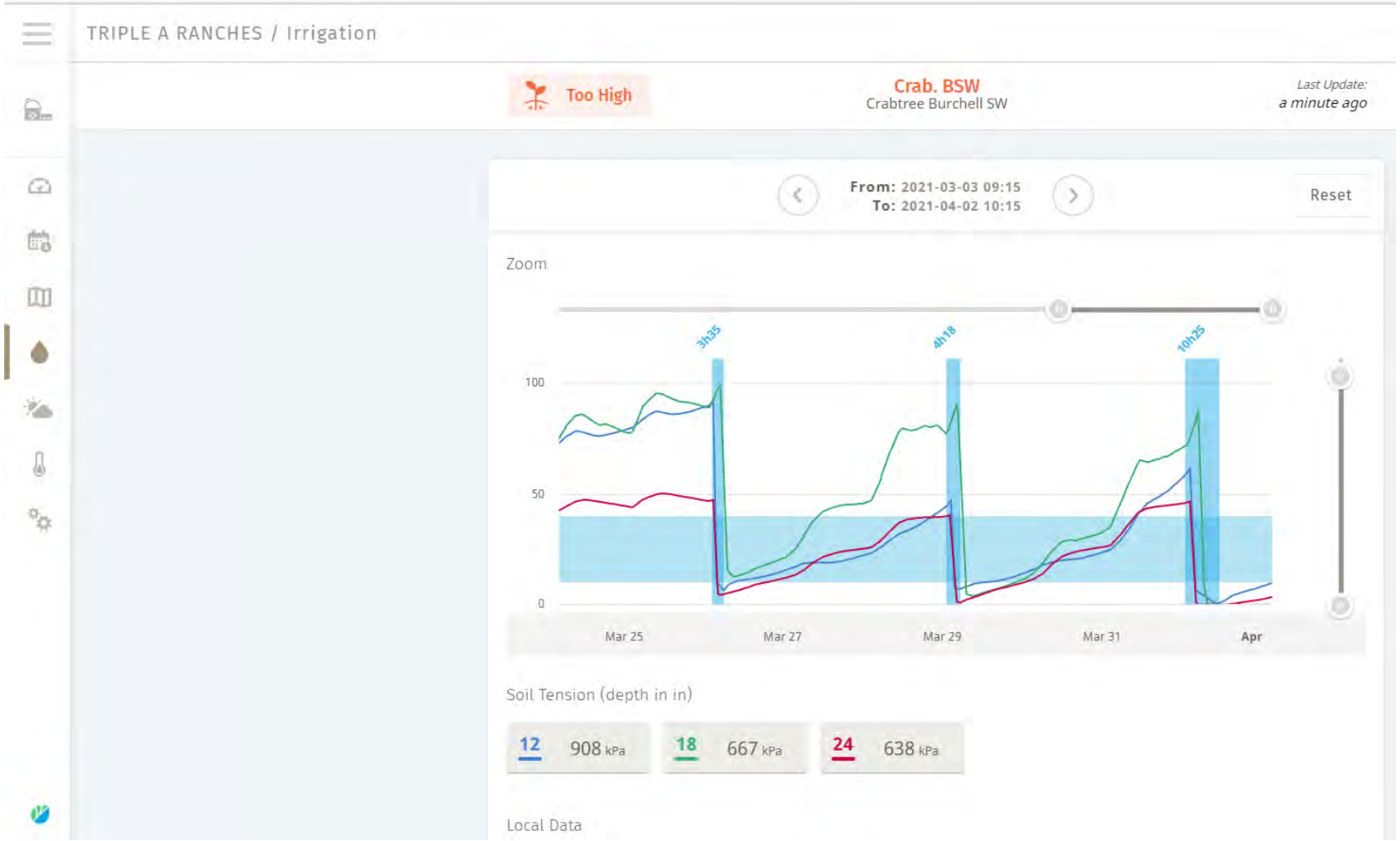


Plants regulate growth based on available water



Soil tension is the proven way to directly measure available water. Hortau's technology allows growers to **anticipate the water needs of their crop ensuring maximum photosynthesis**

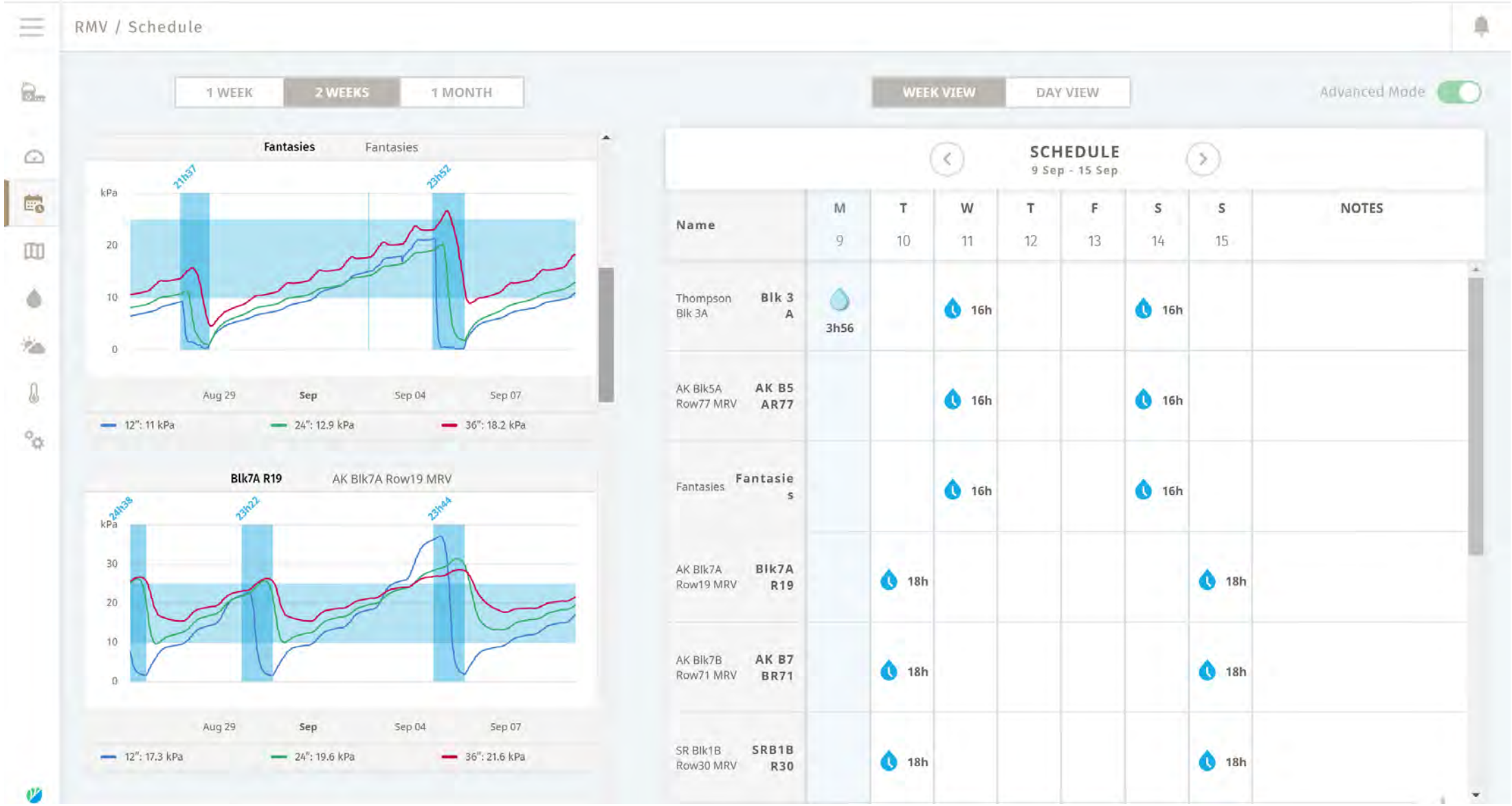
Field Monitoring Graphs



NDVI


RMV / Map
mapbox
Rd 29 1/2
Rd 30
AL 4.6 ac
AK
AK
103 New
AK
102 new
108 new
AK
AK
SCR
AK
SCR
WS
Ave 8
Ave 8
Ave 8
Legend
Barren areas, cloud, water, sand, snow
Very low photosynthetic activity
Low photosynthesis
Medium photosynthesis
High photosynthesis
Cultural artifact
NDVI FAQs
Image date: 2021-05-31
Activate Windows
Go to Settings to activate Windows.

Taking action: Easily turn field data into irrigation schedules



Hortau's Complete Solution

Sensing

Irrigation: Soil Tension
Patented 1000 kPa polymer tensiometer

In-Field weather and frost conditions
Temperature, humidity
leaf wetness

Irrigation system operating conditions
Pressure, run-time
Flowmeter

Weather
Weather Stations
Weather Forecast
Evapotranspiration
Pest models

IoT Network

Smart Wireless Devices

Over-the-air updates
Software updated remotely

Edge Computing
Ability to bring decision criteria in the device for fast and off-line reaction.

Solar Powered

Wireless connectivity
3G/4G LTE
Soon 5G with modular connectivity
Device-to-device communication

Cloud and Apps

AWS Cloud

React Native app development

Actionnable Output

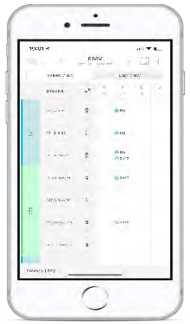
Operational
Focused on simplifying management decision

Management by-exception approach
Highlights areas where attention is needed

Irrigation scheduling and run time

Optional advanced agronomic advices

Alerts

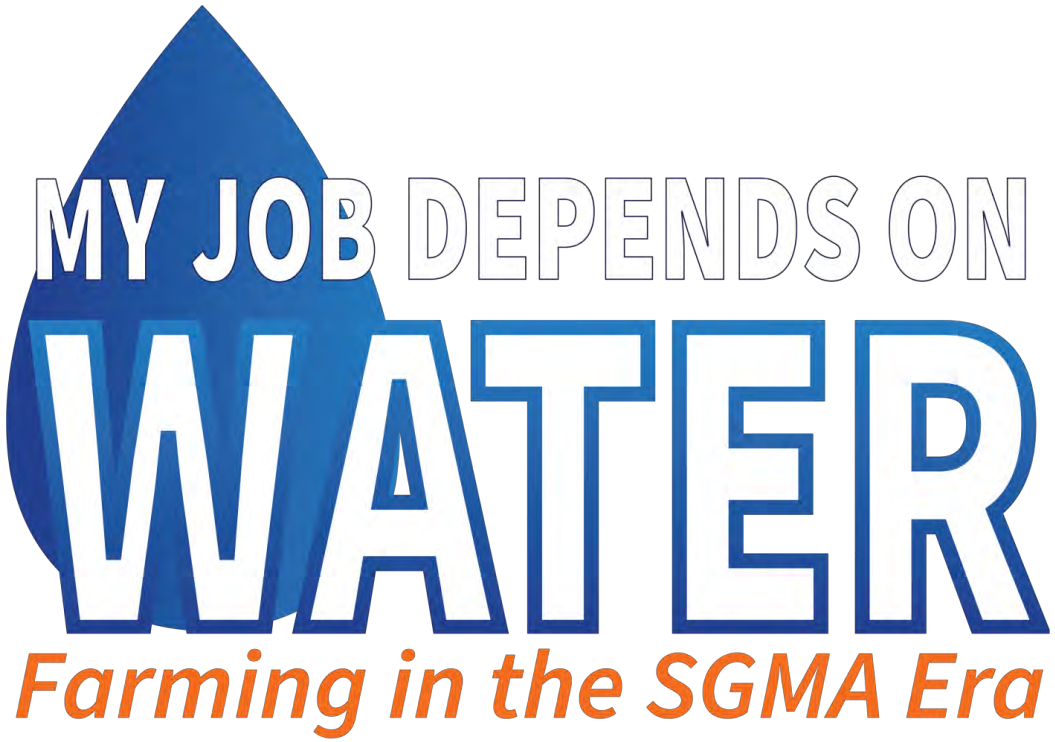


Automation

Based on plant demand

Based on forecast schedule

Remote control



HOTSPOT AG


HotSpot AG™
Farming in the SGMA Era
James Nichols

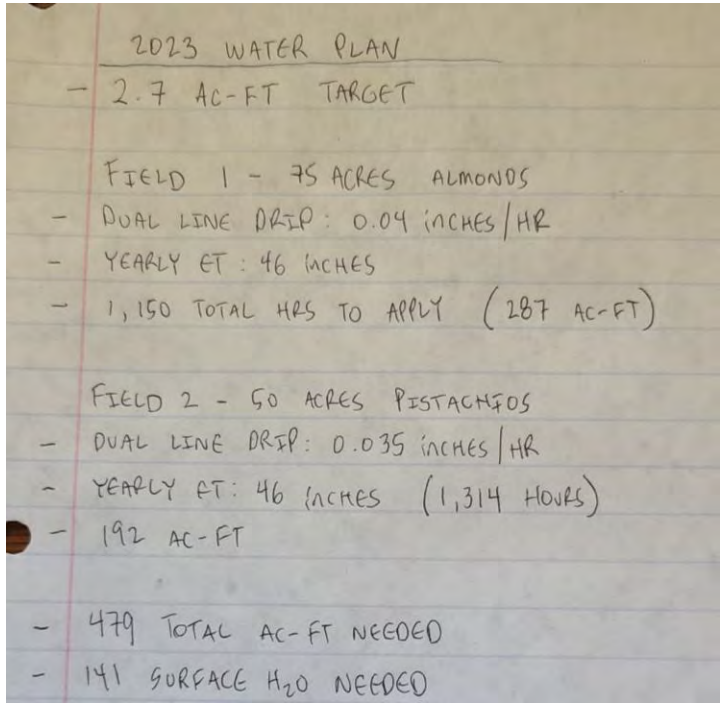
Farming in the SGMA Era

- SGMA has changed how we farm
  - The cost of groundwater can be up to $500/acre-ft
  - Additional costs include:
    - Electricity for groundwater pumping
    - Labor
    - Burden of technology adoption

Farming in the SGMA Era

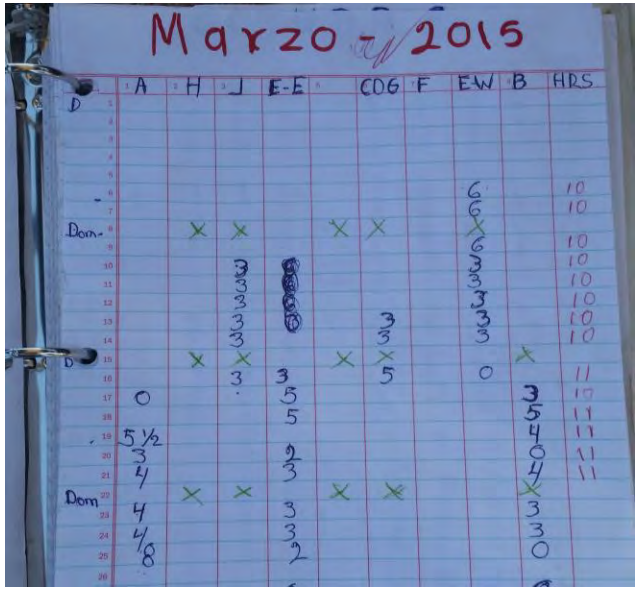
SGMA compliance poses many challenges

PLANNING
Developing an organizational water plan is difficult



EXECUTION
Water mismanagement can lead to costly yield and quality impacts for years

REPORTING
Water Accounting is tedious and time consuming



HotSpotAG™
See your farm in a new light

Pre-SGMA Era

- HotSpot AG began as a Nichols Farms project in 2013
- Originally scoped to monitor water applications
- Evolved into a tool to help growers plan, execute, and report irrigation and fertilizer applications

Nichols Farms Home HIJ

Challenges

- Lacked knowledge of crop water usage
- Weekly Target Irrigation Amounts Missed Due to:
  - System Complexity
  - High Labor Requirement
  - Delayed reporting

HotSpotAG™
See your farm in a new light

Nichols Farms Home HIJ

Solutions

- Confidence in irrigation plan
- Precise Irrigation Applications
  - Simplified Operations
  - High Labor Requirement
  - Realtime Reporting

Measures daily actual crop water usage (ETa), water stress, irrigation applied, and provides irrigation suggestions

Nichols Farms Home HIJ

Solutions

- Confidence in irrigation plan
- Precise Irrigation Applications
  - Simplified Operations
  - Efficient Labor Utilization
  - Realtime Reporting and Record Keeping

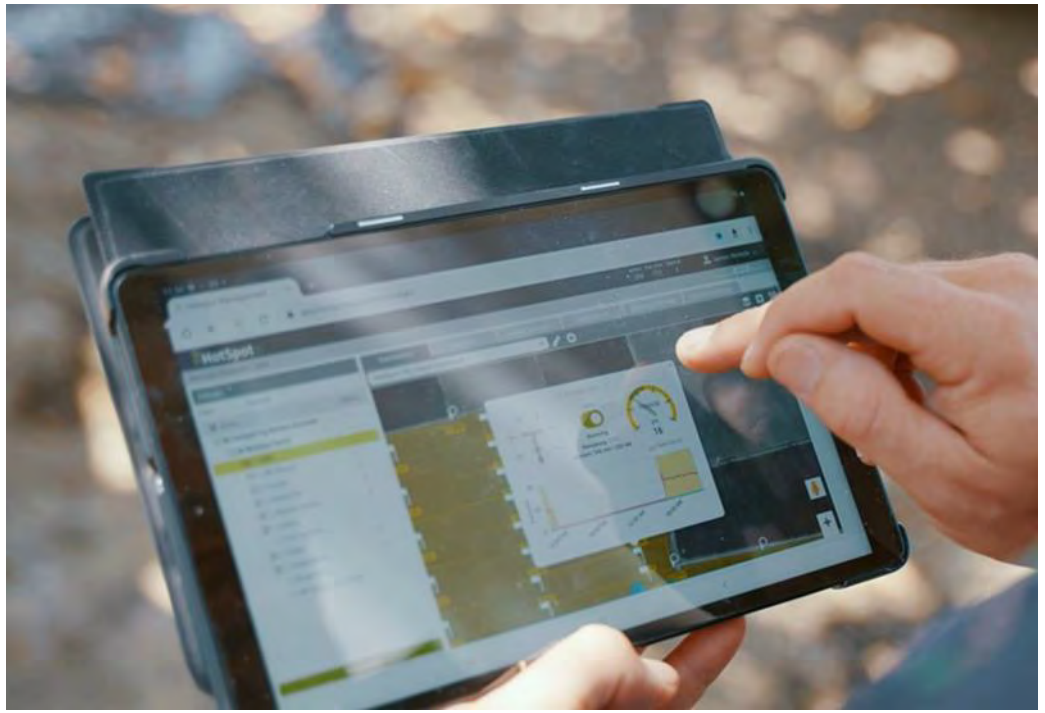
HotSpotAG™
See your farm in a new light

Nichols Farms Home HIJ

Solutions

- Confidence in irrigation plan
- Precise Irrigation Applications
  - Simplified Operations
  - Efficient Labor Utilization
  - Realtime Reporting and Record Keeping

Remote Irrigation Management



Accessible in UTVs, pickups, tractors and during a morning cup of coffee

HotSpot AG™
See your farm in a new light

Nichols Farms Home HIJ

Solutions

- Confidence in irrigation plan
- Precise Irrigation Applications
  - Simplified Operations
  - Efficient Labor Utilization
  - Realtime Reporting and Record Keeping

Irrigation Summary

Download CSV

Date	H North			J North		
	Actual (in)	Plan (in)	Difference	Actual (in)	Plan (in)	Difference
2023-06-05	0.00			0.00		
2023-06-06	0.30	0.31	-3%	0.30	0.31	-3%
2023-06-07	0.44	0.46	-5%	0.30	0.31	-3%
2023-06-08	0.31	0.31	1%	0.31	0.31	0%
2023-06-09	0.31	0.31	0%	0.31	0.31	0%
2023-06-10	0.00			0.15	0.15	0%
2023-06-11	0.00			0.00		
week 23 summary	**1.36**	**1.38**	**-2%**	**1.36**	**1.38**	**-1%**
2023-06-12	0.00			0.00		
2023-06-13	0.28	0.31	-8%	0.30	0.31	-3%
2023-06-14	0.59	0.61	-3%	0.30	0.31	-3%
2023-06-15	0.30	0.31	-3%	0.29	0.31	-6%
2023-06-16	0.30	0.31	-3%	0.59	0.61	-3%
2023-06-17	0.45	0.46	-3%	0.31	0.31	0%
2023-06-18	0.31	0.31	0%	0.31	0.31	0%
week 24 summary	**2.22**	**2.30**	**-3%**	**2.09**	**2.14**	**-2%**

HotSpotAG™
See your farm in a new light

Funding Opportunity

IAN VIETTI

Director of Conservation
Innovative AG Services

Phone 559-799-3285

Mail ivietti@innovativeag.net

Website www.innovativeag.net

Testimonials

Charlie Abee

AG Irrigation Professor
College of the Sequoias

"HotSpot AG is an automation and monitoring system developed by a farmer for farmers. The system gives you key pieces of information that are useful to you as a grower to help you make informed decisions that affect your bottom line."

Blake Mauritson

Partner
ANB Ranches

"Being able to monitor our total system remotely, gives me and our employees more time to focus on other ranch needs. I feel more comfortable now that our fields are receiving the water they need."

Larry Dotson

Senior Engineer
Kaweah Delta Water Conservation District

"The products and services supplied by HotSpot AG are timely and relevant solutions to acquiring remote data for productive improvements in operations and maintaining records."

Contact Steven Soares To Schedule Your Demo!

STEVEN SOARES

Senior Customer Success Manager

TRAINING CENTER

Located at 1502 Idaho Ave, Hanford, CA 93230

Phone: 559-415-5933 **E-Mail:** ssoares@hotspotag.com **Website:** www.hotspotag.com

HotSpotAG™

See your farm in a new light

MY JOB DEPENDS ON WATER

Farming in the SGMA Era

TECHNOFLO

TechnoFlo®

Your Flow Meter Source

Barrett Schortman

WHO WE ARE

- Your source for all things Flow Meter Related
- Central Valley Company. Based out of Porterville, CA.
- Family Owned and Operated
  - Experienced owners in the flow meter business since the 1970's
- Vast Product Line – Made in the USA
  - Full Bore Electromagnetic Meters, Traditional Propeller Meters, and Ultrasonic Meters & Sensors
- Service First Company – We Provide Solutions to help solve our clients' issues
- We Are All Locals Just Like You
  - The ever-changing agriculture industry in California can be tough, but we get it

OUR SOLUTIONS

- Full-Bore Magmeters
- Traditional Propeller Meters
- Ultrasonic Flow, Level and Volume Sensors
- Repair and Calibration Services

FULL-BORE ELECTROMAGNETIC (MAGMETERS)

- TechnoFlo is the Master Stocking Distributor for Seametrics
- Seametrics
  - Headquartered in Kent, WA
  - Since 1990
  - Nationwide leader for battery-powered magmeters installed
    - Around 20,000 within the State of California
- No Moving Parts – resistant to wear and tear
- AG3000 and AG90
  - Highly accurate
  - Telemetry-ready
  - 5-year battery life
  - 5-year warranty, longest in the industry

AG3000 FLANGED MAG METER

- Sizes 2 inches all the way up to 12 inches
- Requires minimal straight pipe run for installation
- Comes with an easy to read and navigate display
- Highly accurate up to 1% of flow
- Pulse Output standard for telemetry
- Comes in AC or DC powered versions with battery backup
- Straight pipe requirements of 2 diameters upstream and 1 diameter downstream from an elbow or discharge

AG90 INSERTION STYLE MAG METER

- Seametrics latest product
- Sizes 4 inches all the way up to 14 inches
- Great if you're looking to replace a propeller meter or for a new install
- Requires no routine maintenance
- Highly accurate up to 2% of actual flow
- Easily programmable
- Comes ready with pulse output for telemetry applications
- Straight pipe requirements of 5 diameters upstream and 2 downstream

TECHNOFLO PROPELLER METERS

- TechnoFlo Propeller Meters
  - Manufactured at our Porterville facility
- Workhorse of the Industry
- Sizes 4 inches all the way up to 72 inches
- Saddle Style, Open Flow, Vertical Flow, Flanged
- TechnoFlo Meters = Reliability & Performance
  - Long Life Water Lubricated Ceramic Bearings
- Telemetry-ready

TECHNOFLO PS32 SADDLE METER

- Extremely popular among current clients due to ease of use and reliability
- Easy to install and use
- Accuracy of +/- 2% of actual flow
- No Bounce LCD Graphic Display that has no fade of segments
- Pulse output standard for Telemetry
- Straight pipe requirements of 10 pipe diameters upstream, and 2 downstream.
- A full-pipe is always required for these as well as the Seametrics Mag meters

CONVERSION KITS

- Can provide direct drop-in replacement meters to replace old (6’ or larger) McCrometer or Water Specialties meters
  - Verification of your existing tube dimensions are needed for proper fitment of the new meter
  - Great option if unhappy with: Register, bearings, battery life, display quality, and difficulty of use of current meter
- TechnoFlo display conversions are also offered
  - Can be installed at our shop, or instructions can be provided to do the work at your own
  - Customers love the cost savings over having to buy a whole new meter

ULTRASONIC FLOW, VOLUME, AND LEVEL SENSORS

- Manufactures Rep for Pulsar/Greyline – based in Largo, FL
- Partial Pipe Applications for inside a pipe
  - AVFM 6.1
- Non-Contact Applications
  - DFM 6.1 – For "complex" fluids (gas bubbles, debris, etc)
  - TTFM 6.1 – For generally cleaner fluids
- Portable Versions Available
  - MantaRay, PDFM, PTFM
  - Popular for field testing/flow rate verifications

SERVICES

- Repairs of Mechanical Propeller Meters
  - Quick turnaround time
  - Large parts inventory of McCrometer & Water Specialties
  - Stock over 1000 meters to meet dealer and district SGMA needs
- Accuracy Testing
  - NIST Traceable flow lab
  - Calibration of McCrometer & Water Specialties meters
- High Level Tech Support
- Knowledgeable Team
  - Over 50 years of experience

THANK YOU

MY JOB DEPENDS ON WATER

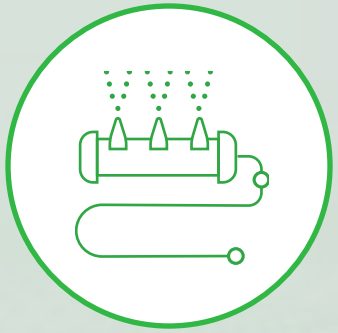
Farming in the SGMA Era

PHYTECH

Phytech

Control Every **Beat** of your Farm

Allowing growers to Monitor, Plan, Analyze and Control Every Beat of their Farm:



Irrigation

Nutrition

Pest and disease

*seamless API with leading providers:

The Weather Company An IBM Business

WiseConn

planet.

Suterra

NELSON

DAVIS

Phytech

How We Started

We wanted a technology that makes a difference

Knowing how the trees ACTUALLY FEEL

was the most crucial gap we identified so we started with it

Phytech

Listening To Trees' Heartbeats

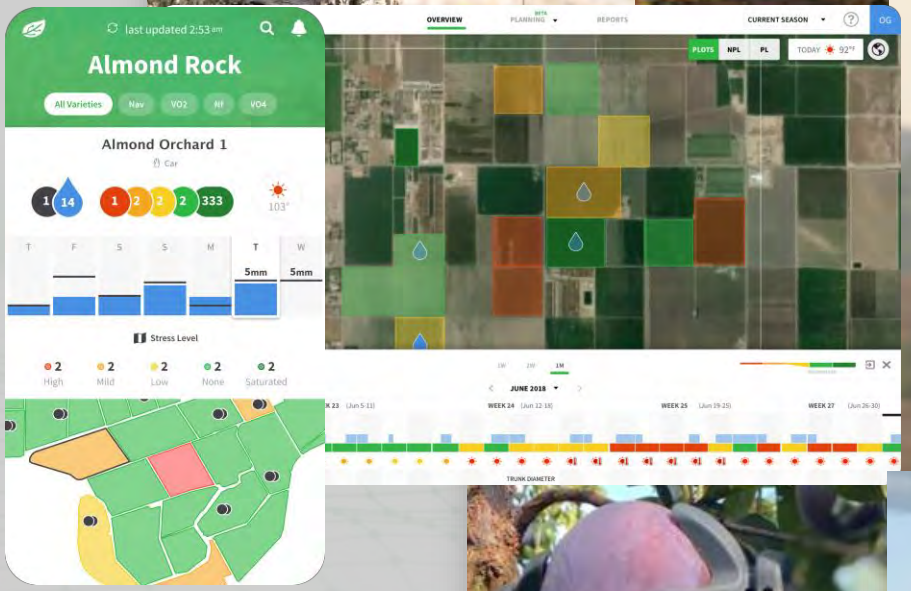
HIGH STRESS	MILD STRESS	LOW STRESS	NO STRESS	NO STRESS
Affecting plot yield	Slightly affecting plot yield	Not yet affecting plot yield	Optima yield	Far from yield affecting stress

Trees talk. Click to Learn how we listen>>

Phytech

Full Field Monitoring:

- Plant - 3 x Dendrometers
- Infrastructure - Water pressure sensors
- Soil - Full Soil Moisture (3ft)
- Fruit - 3 x fruit sensors (*optional)
- IOT Network - Data logger
- Optional: hydraulic system monitors, nutrition monitors, frost sensors, wind machine monitors



Phytech

Hydraulic System Monitoring

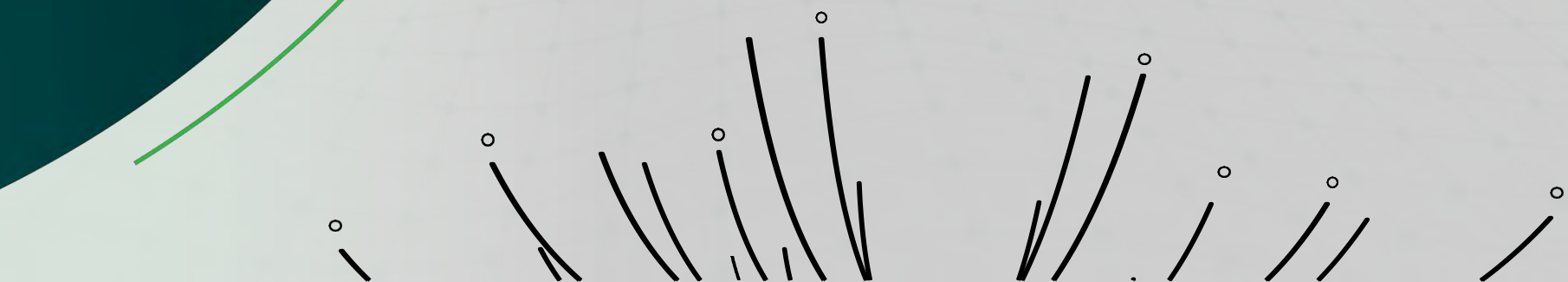
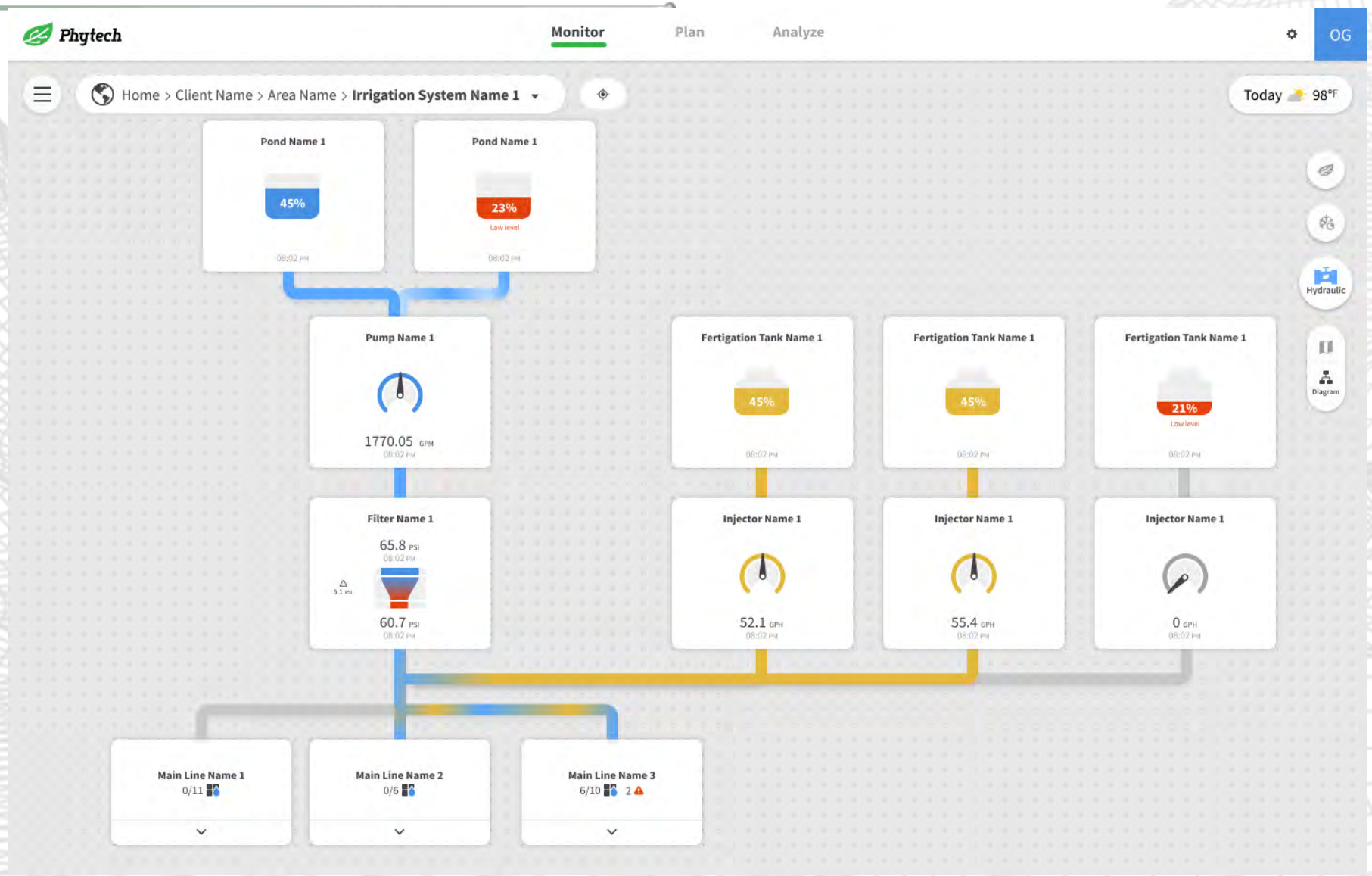
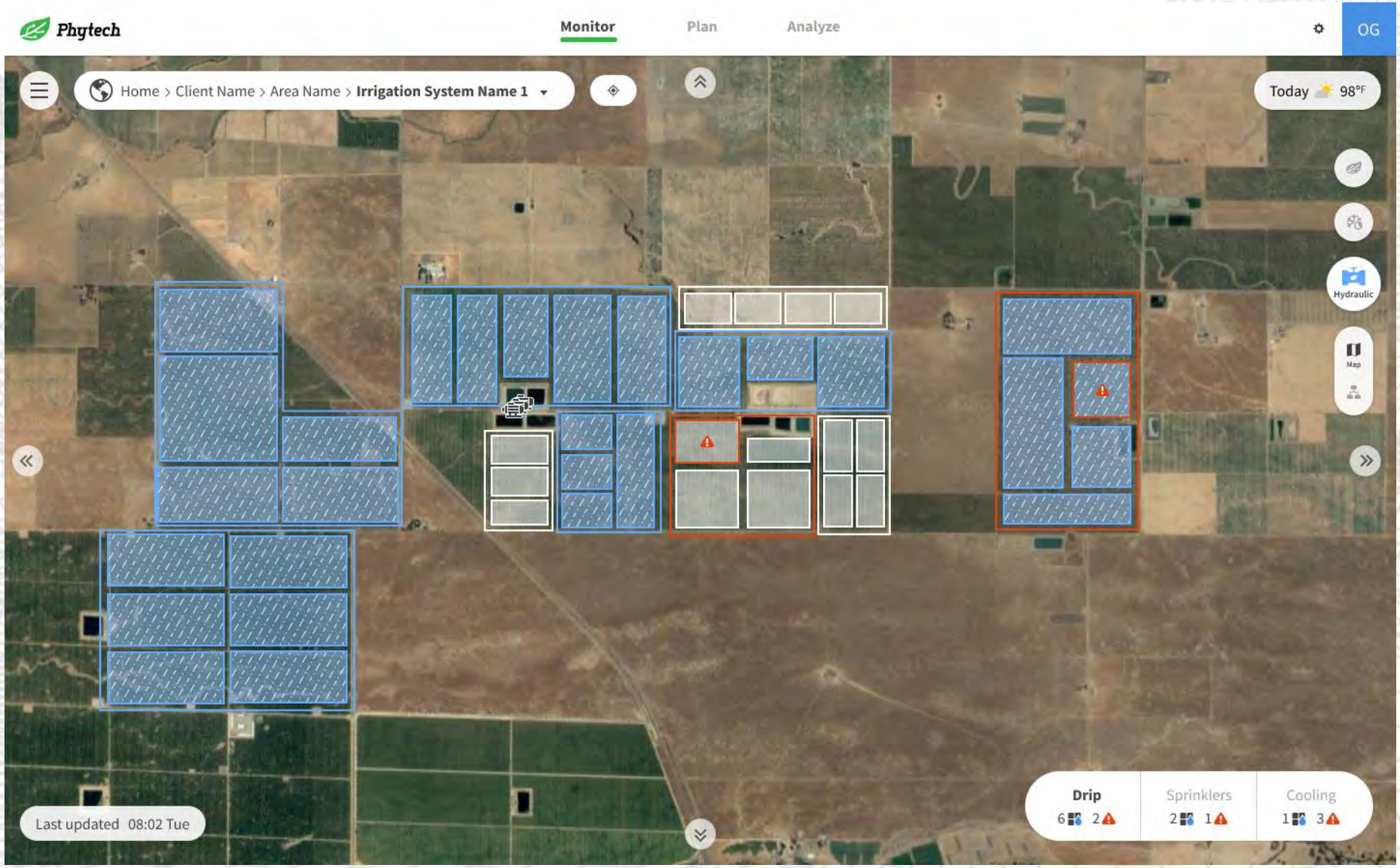


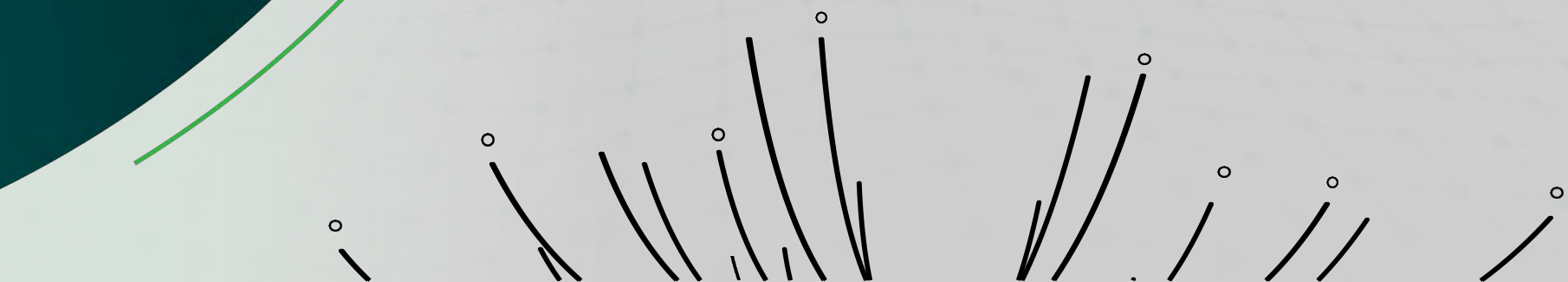
Diagram View



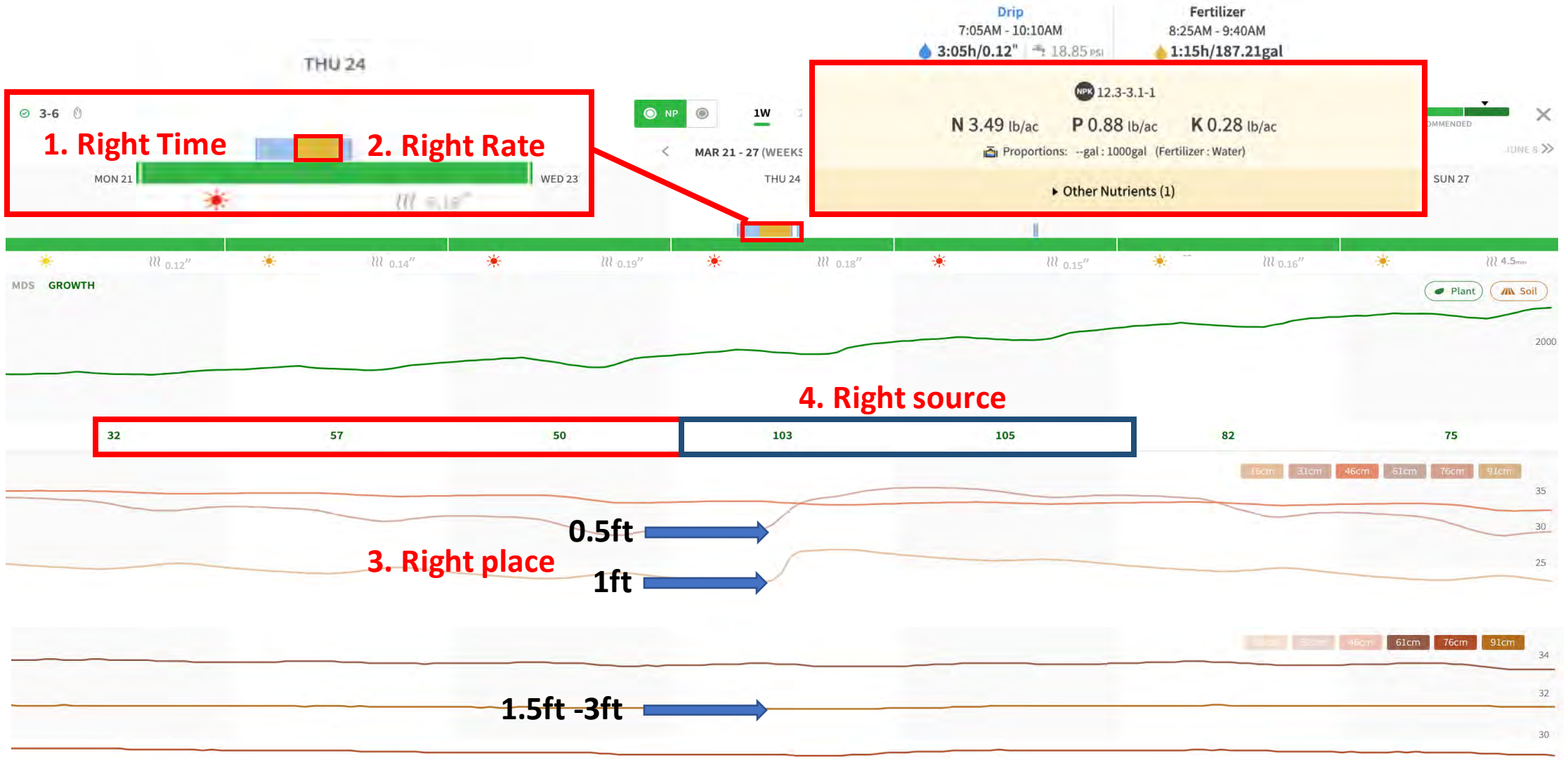
Zoom In: Deep-dive Into Alerts And Valves Performance



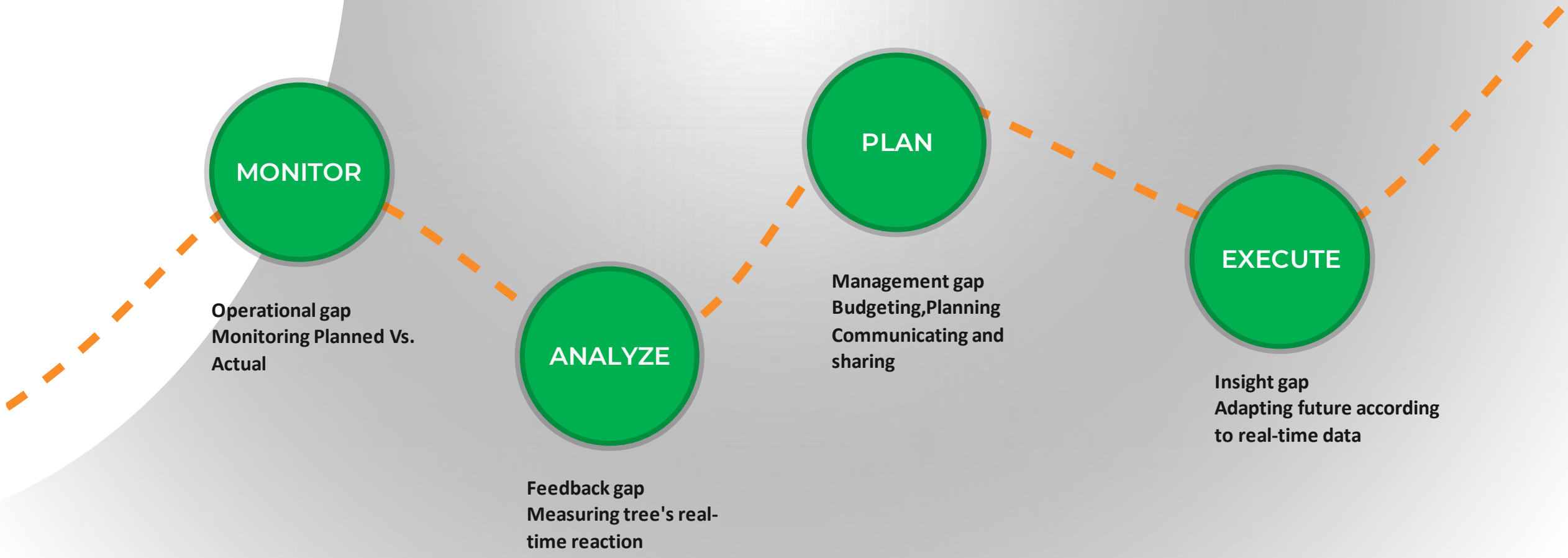
Nutrition



Monitoring And Controlling The 4R's



Bridging The Gaps, Connecting The Dots



Phytech

Phytech

Thank You

MY JOB DEPENDS ON

WATER

Farming in the SGMA Era

RANCH SYSTEMS

TECHNOLOGY FOR AG & WATER MANAGEMENT

Hylon Kaufmann
Vice President, Business Development & Customer Support
Ranch Systems, Inc.

TECHNOLOGY

Before you become too entranced with gorgeous gadgets and mesmerizing video displays, let me remind you that information is not knowledge, knowledge is not wisdom, and wisdom is not foresight. Each grows out of the other, and we need them all.

Arthur C. Clarke
(1917-2008) Author

PROBLEM

MOTHER NATURE

Agriculture is at the mercy of the environment. Variability from year to year can not be controlled.

CUSTOMERS

Marketing is driving a messaging to fill a perceived requirement from consumers forcing a traceability chain.

COSTS

Agriculture markets are global. Managing costs are an ongoing challenge.

REGULATORY

Agriculture is faced with more and more regulatory challenges. Data is both the defense and the offense strategy.

FINANCIALS

Funding institutions, processors, export contracts, etc. are all looking for data to validate and support future commitments.

WATER MANAGEMENT

Constraints from water availability, water quality and government regulation.

SOLUTION

CLOSE THE GAP

Technology documents events and actions required in today's production agriculture.

TARGET AUDIENCE

Growers, consultants, processors, consumers, regulators, water management institutions, financial and insurance institutions.

COST SAVINGS

Refining crop inputs, managing labor, maximizing equipment, water management and risk mitigation.

EASY TO USE

Remote monitoring and optional control solutions have evolved providing anytime, anywhere access and flexibility.

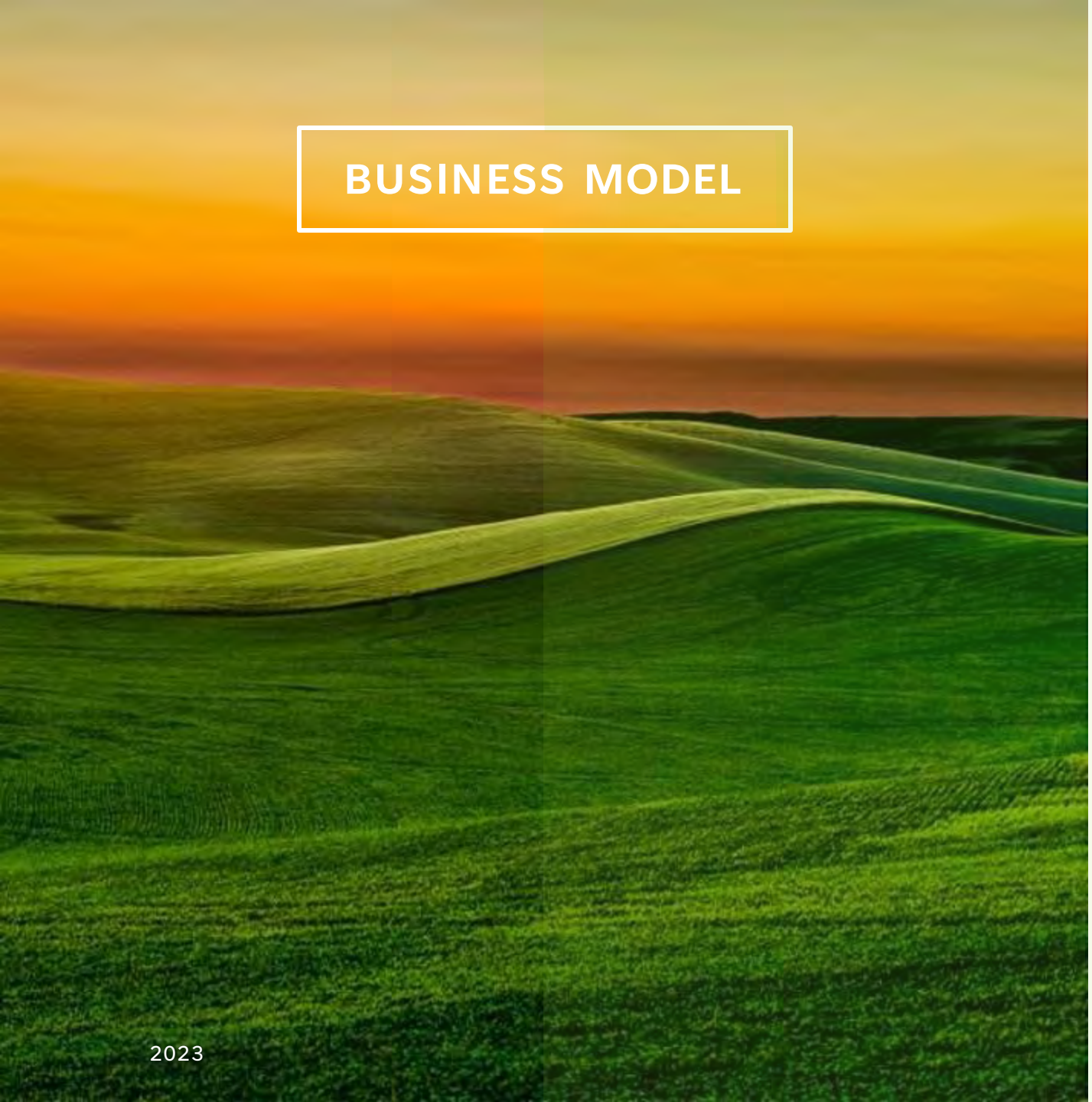
ROI VS RISK

par·a·digm shift

/ˈperəˌdīm SHift/

a fundamental change in approach or underlying assumptions.


IT IS TIME TO
CHANGE



BUSINESS MODEL

DOCUMENTATION

Automatically document events and activities.

IN-SEASON DECISIONS

Real time data provides the ability to adjust decisions and actions

KNOWLEDGE OVER TIME

Ability to review year over year to identify opportunities to adjust future in-season decisions.

SUMMARY

All sectors of agriculture production are facing new challenges. By adopting and using agriculture technology you will have the tools to help navigate the world we are now in.

HARDWARE KEY POINTS

Ruggedness!

- Enclosures – focus on metal for key wear parts
- Water Resistance – IP67 and GoreTex venting
- Cabling is burial grade
- Connectors are factory over-moulded

Minimal Downtime

- Solar Power
- Amble backup capacity in batteries
- Amble sensor data backup in flash storage

Serviceability

- Modular PCBs (e.g. modem boards) for ease of service and upgrade flexibility
- Firmware upgrades “over-the-air”
- Remote diagnosis and troubleshooting

Flexibility

- Support for customizing units to special sensors and controls
- Anytime, anywhere access with dashboard and reporting options and customizing ability.

PLATFORM KEY POINTS

Compatible Sensors

- Soil Moisture, Temperature, Salinity
- Weather – Sensors and Calculated Decision Values
- Water Management – Flow Meters, Pressure, Water Level

Serviceability

- Modular (e.g. modem boards) for ease of service and upgrade flexibility
- Firmware upgrades “over-the-air”
- Remote diagnosis and troubleshooting

Privacy and Security

- Unlimited Data Storage that YOU Own
- Storage is at redundant at geographically separated sites
- Data is not aggregated, shared or resold

Data You Need the Way You Want It

THANK YOU

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MY JOB DEPENDS ON WATER
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