Groundwater Workshop

JANUARY 23, 2024

DIXON Resource Conservation District

SOLANO Resource Conservation District

USDA NRCS U.S. Department of Agriculture Natural Resources Conservation Service

Solano GSA

Luhdorff & Scalmanini Consulting Engineers

UCDAVIS UNIVERSITY OF CALIFORNIA

Chris Lee

SOLANO COUNTY WATER AGENCY

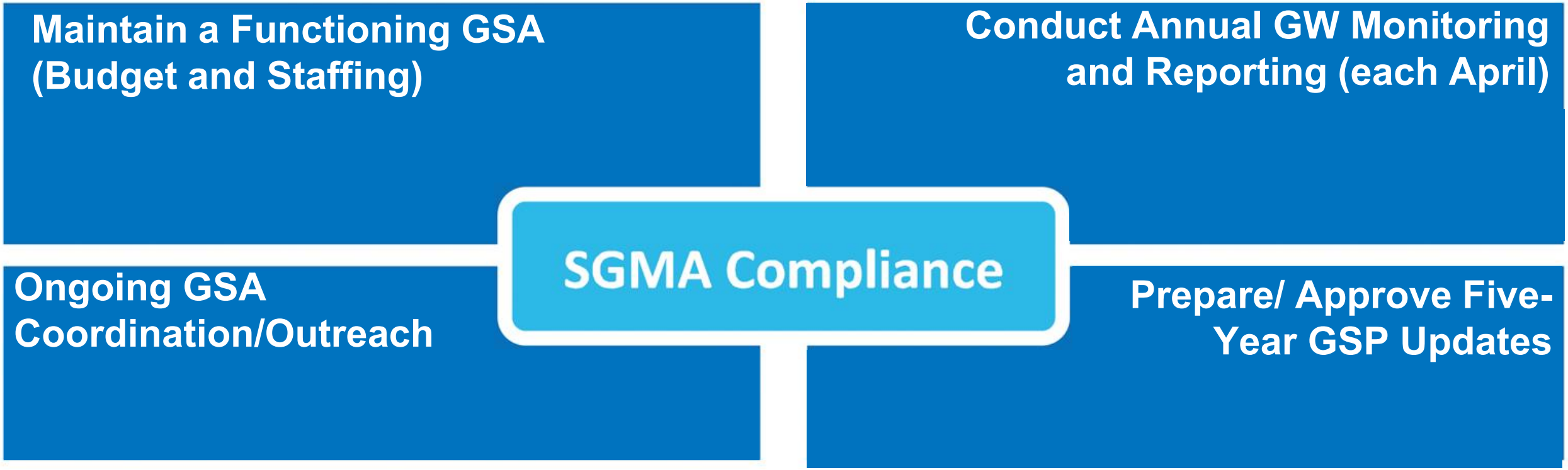
Groundwater Workshop

January 24, 2023

Welcome to the Solano Subbasin

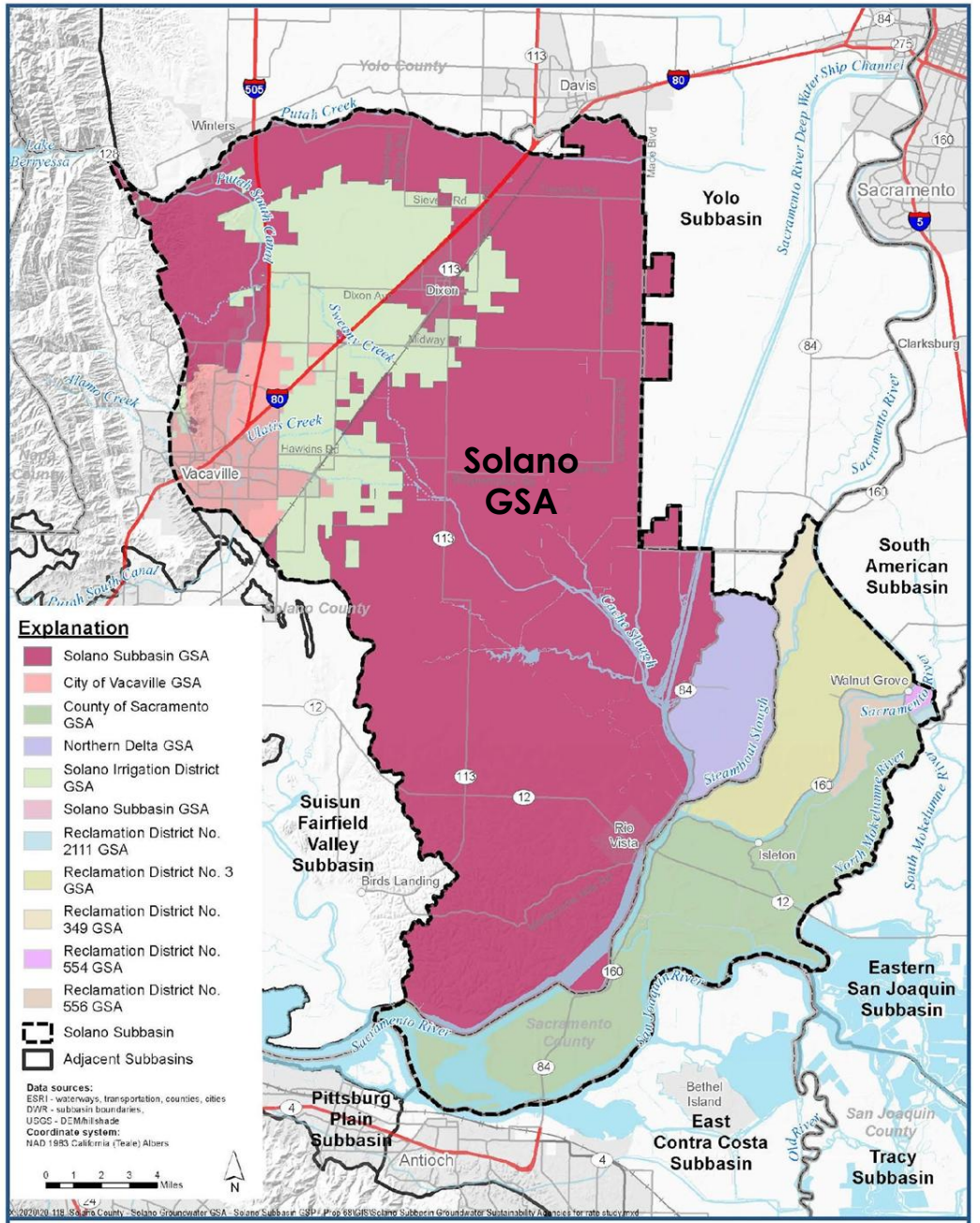
Chris Lee
Solano County Water Agency/Solano Groundwater Sustainability Agency

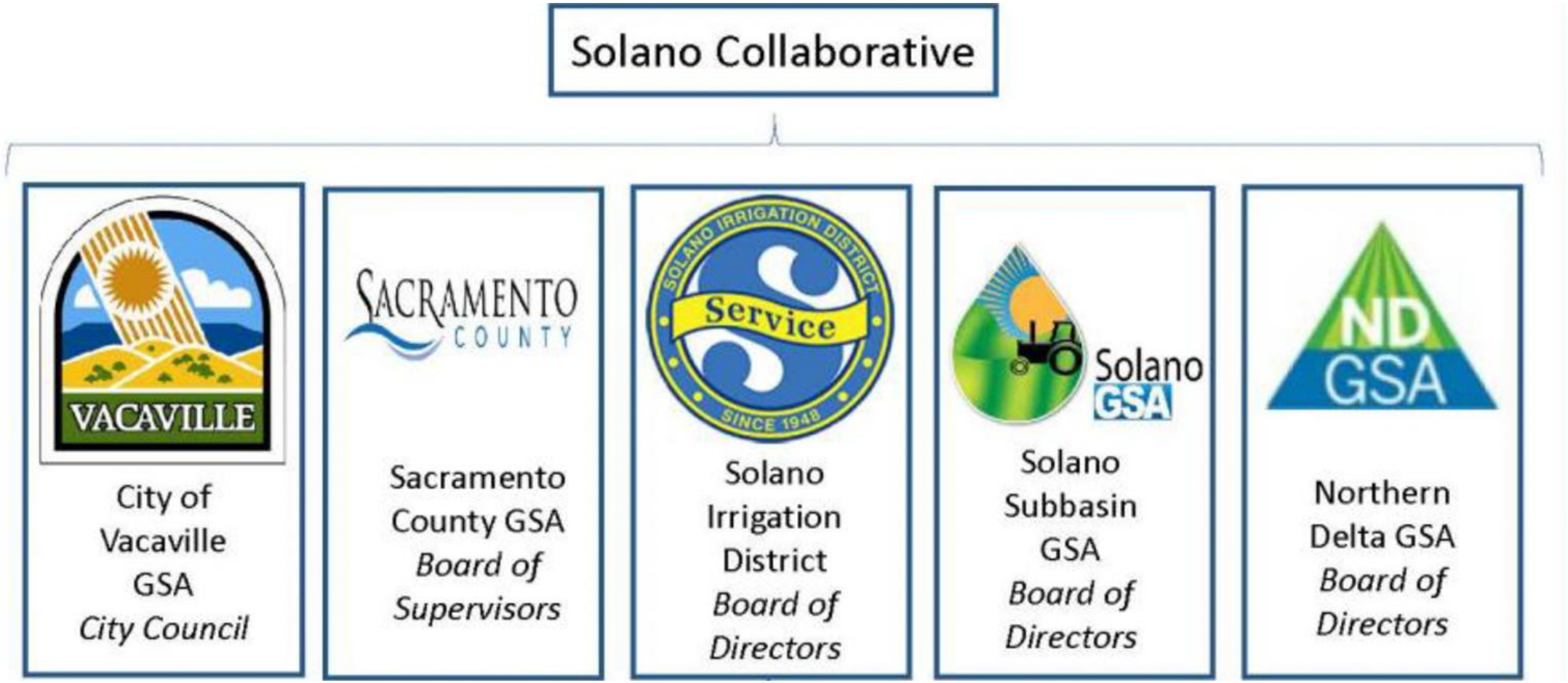
California SGMA Requirements



Solano Subbasin is Comprised of Multiple GSAs

- Groundwater Sustainability Plan (Plan Area)
- Find out if you are located in the Solano Subbasin: **solanogsp.com/solano-subbasin/**

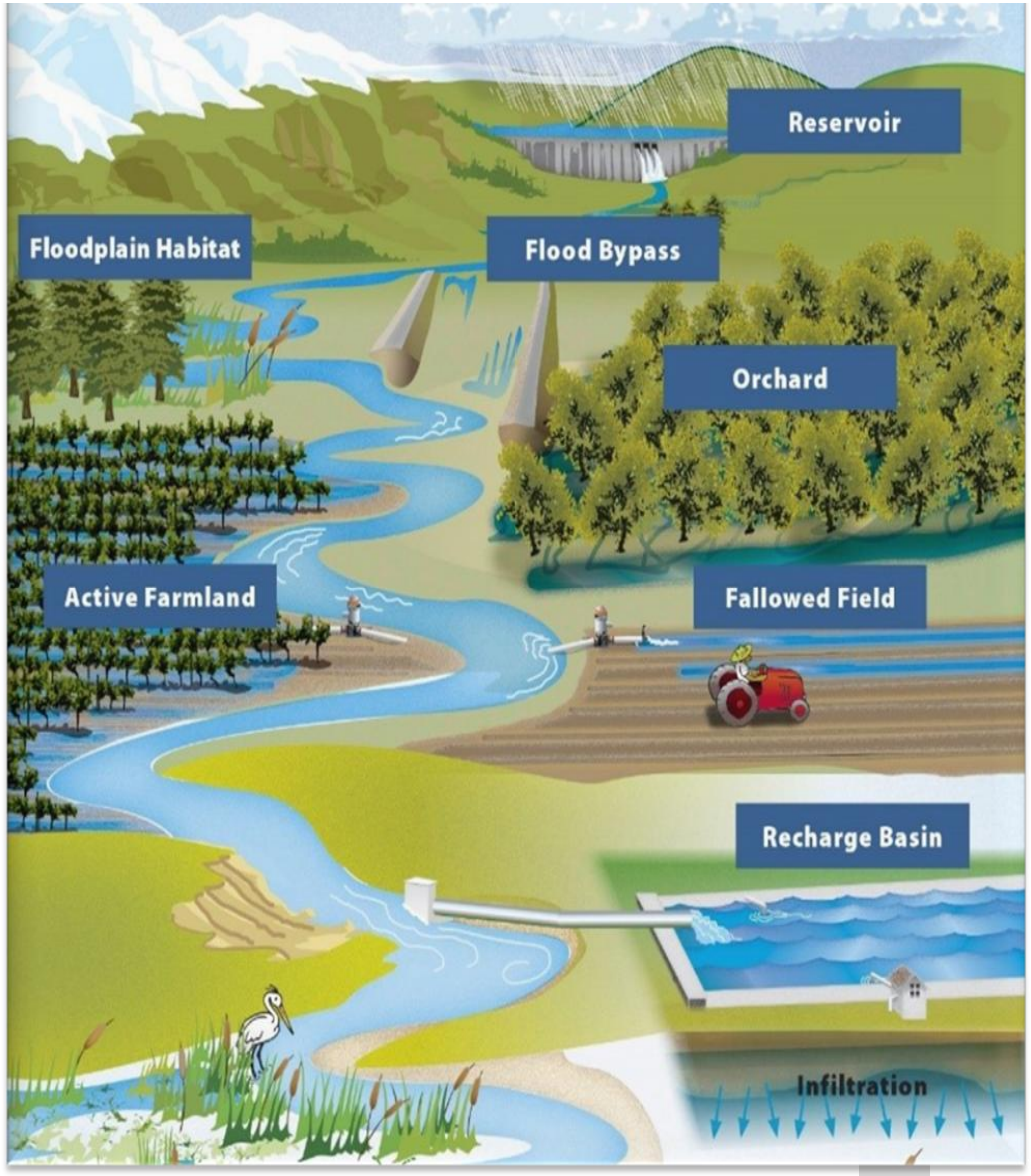




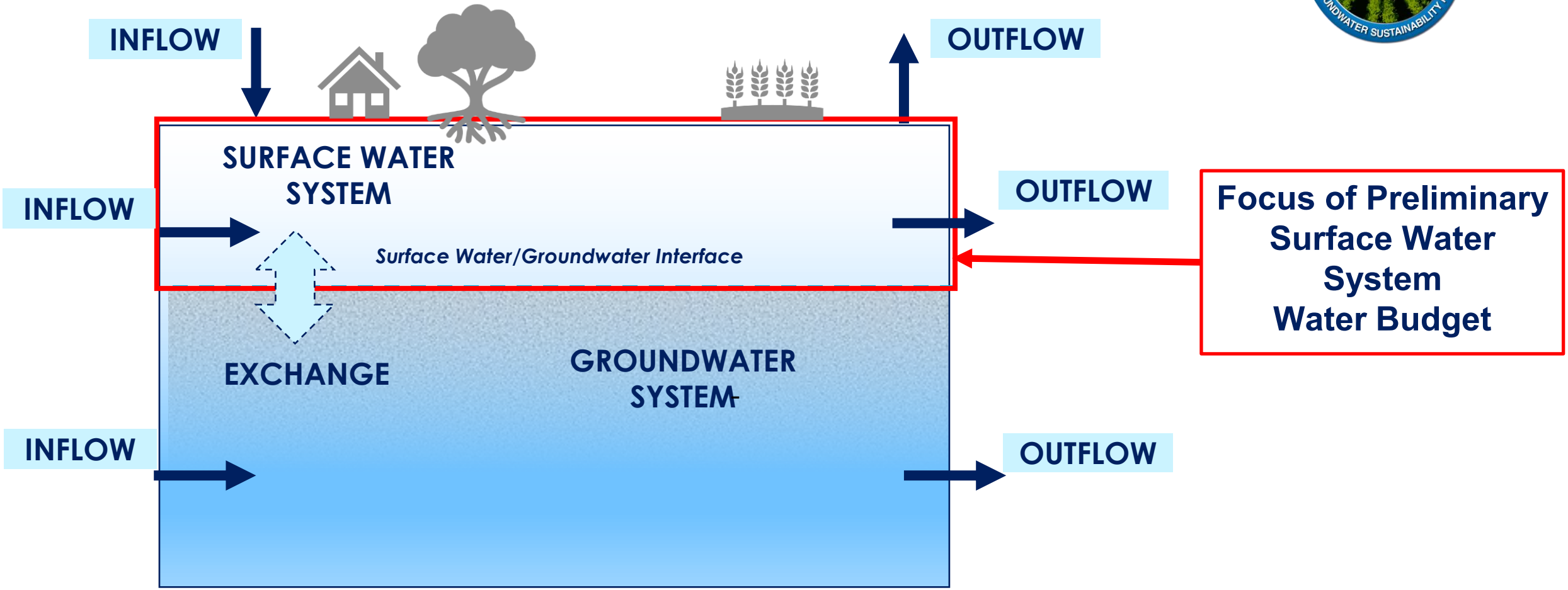
Independent Reclamation District (RD) GSAs; RD 3, RD 349, RD 555, RD 556, RD 2111, RD 317

GSP Implementation: Ongoing Activities

- Annual Reports and Five-Year Updates
- Tracking Groundwater Conditions
- Projects and Management Actions
- Outreach
- Grant Opportunities



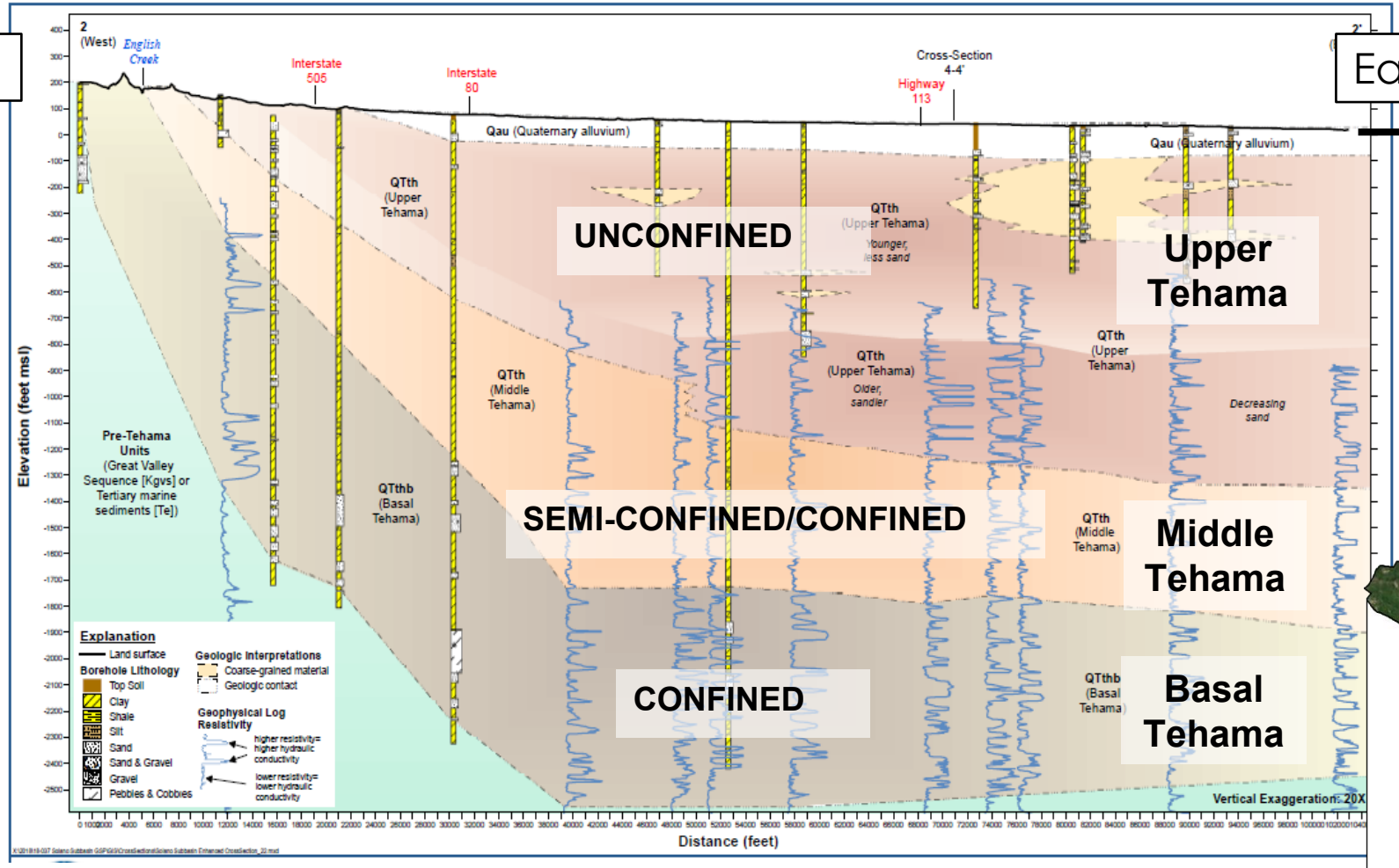
Water Budget Schematic: Preliminary Surface Water System Water Budget

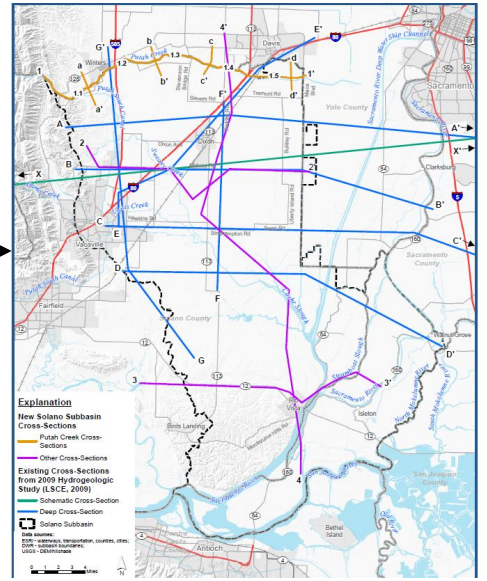


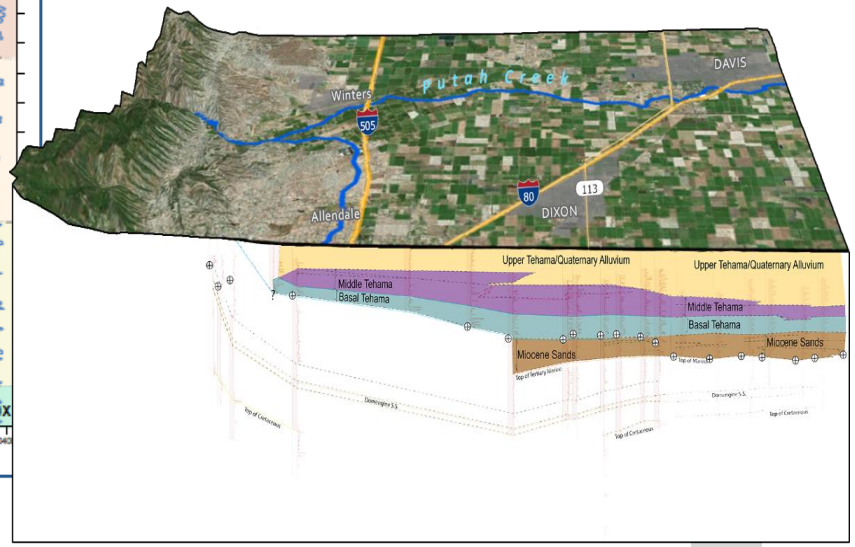
Geologic Cross Section-2-2’

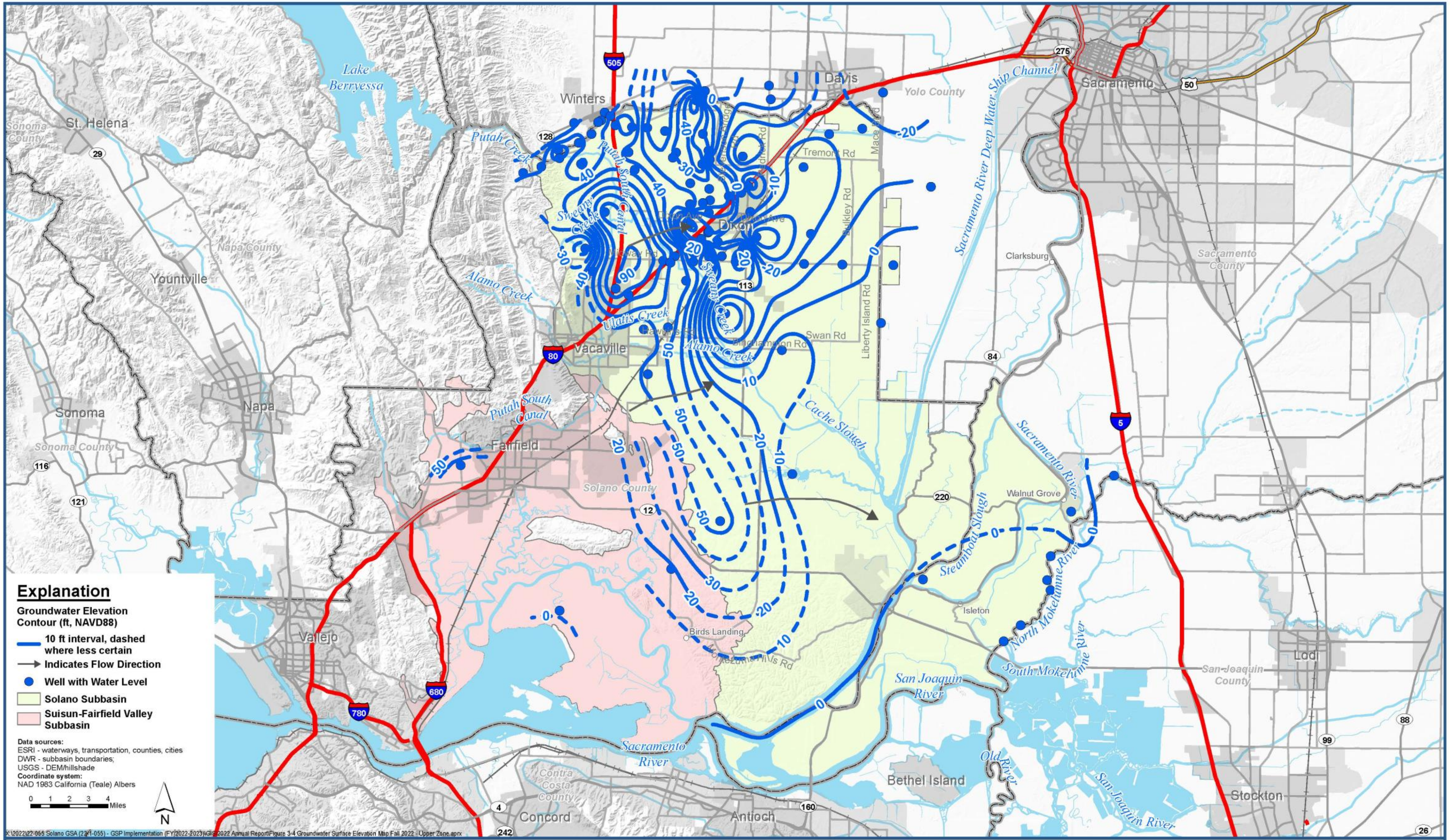
West

East







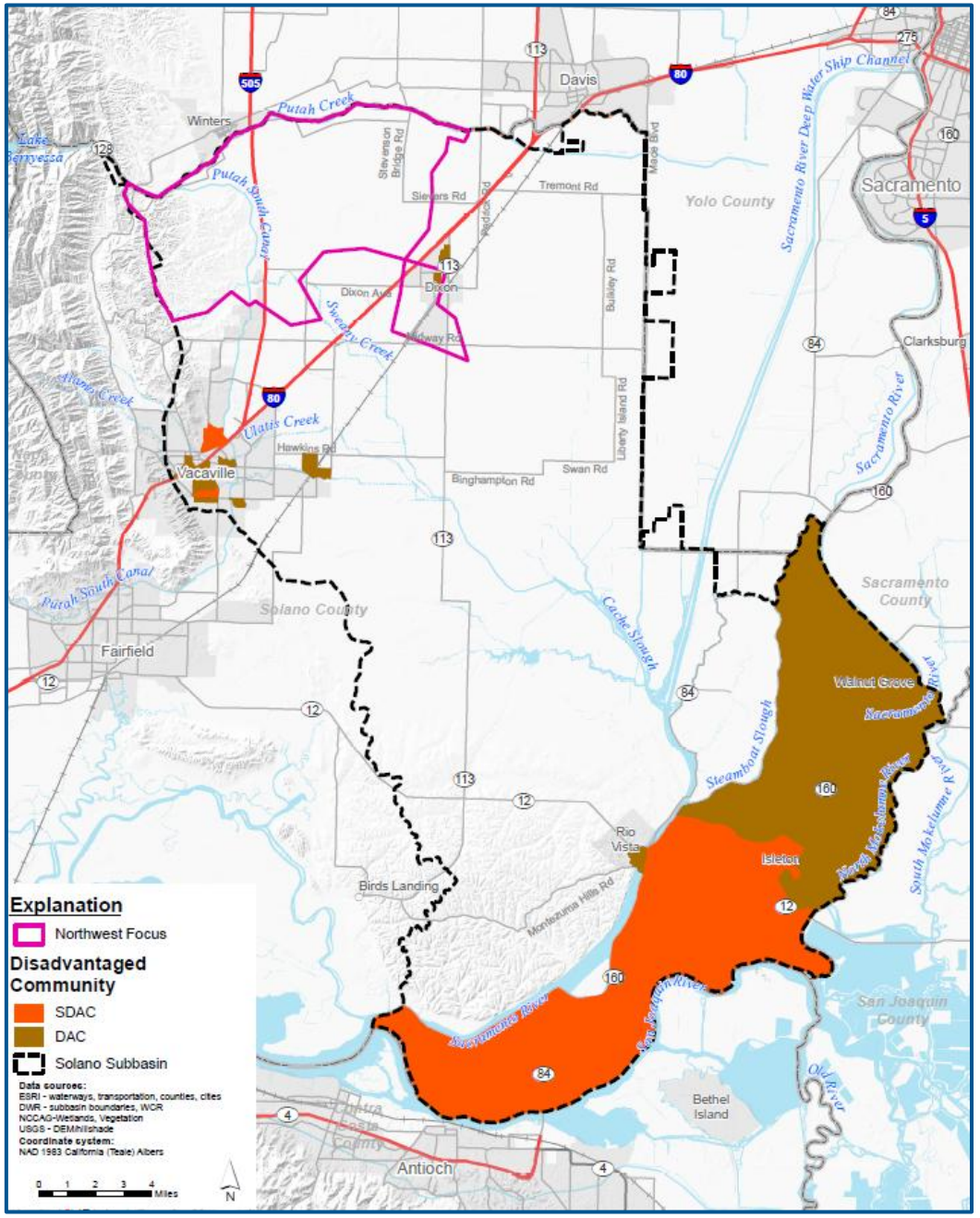


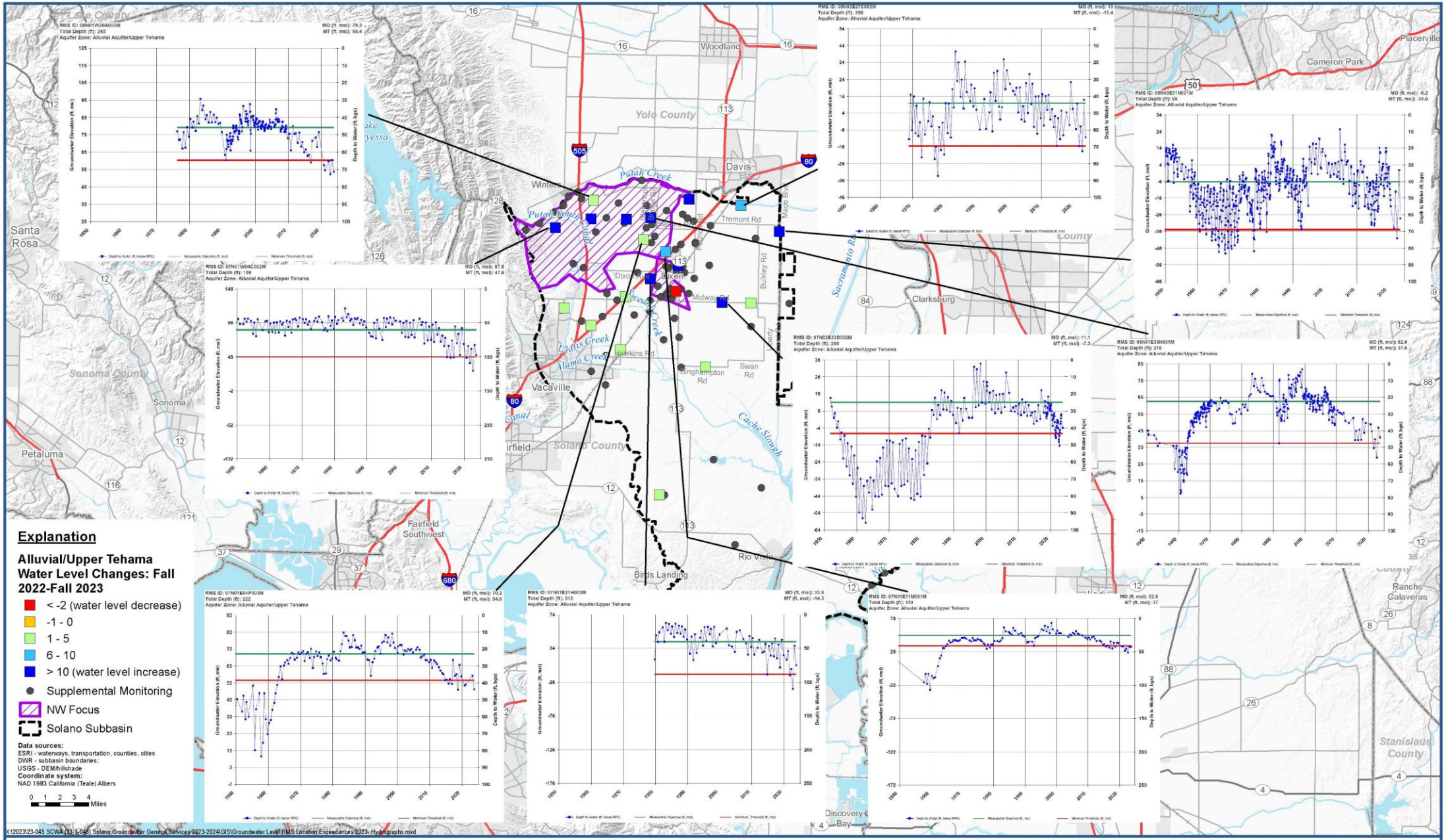
Groundwater Level: Alluvial Aquifer and Upper Tehama Zone - Fall 2022

Solano County and Subbasin
Annual Report - Water Year 2022

Figure 3-4

Northwest Focus Area





Luhdorff & Scalmanini Consulting Engineers

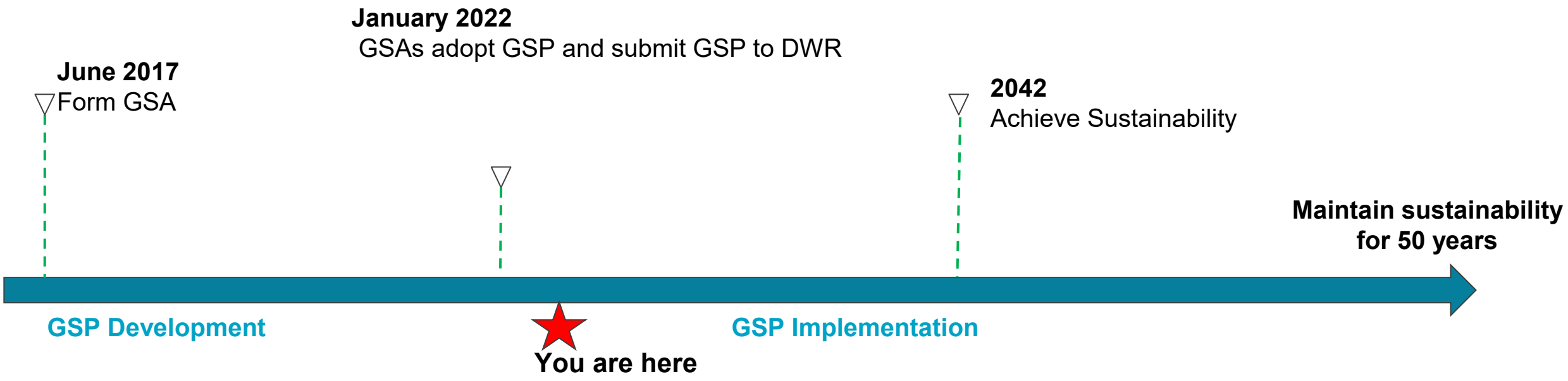
Groundwater Level Hydrographs: Alluvial Aquifer

Groundwater Sustainability Plan
Solano Subbasin

Figure X-X

Solano Subbasin – Long-Term Funding Strategy

SGMA Timeline



Occurring throughout:
- Outreach & Engagement
- Monitoring & Adaptive Management
- Annual reports and 5-year updates

Proposition 68 Grant-Awaiting Final Grant Agreement

Grant Funding Requests			
Project Title	Cost	Component Ranking	Comments
Component 1- Grant Administration	$391,000	5	Currently assumes maximum allowable at 10%
Component 2- GSP Monitoring and Data Management Enhancements	$970,000	2	
Task 1: Monitoring Enhancements and Addressing Monitoring Data Gaps	$340,000		
Task 2: Data Management System Enhancements	$250,000		
Task 3: Interconnected Surface Water (ISW) and Groundwater Dependent Ecosystems (GDEs) and Putah Creek Projects	$380,000		
Component 3- Supporting Groundwater Use Management Actions	$1,075,000	3	
Task 1: Improving Understanding of Basin Water Use	$375,000		
Task 2: Local Water Conservation and Management	$400,000		
Task 3: Groundwater Management Policy- Positioning for the Future	$300,000		
Component 4- Water Supply Replenishment and Reliability Projects	$900,000	4	
Task 1- Recharge Study – Targeted Augmentation	$600,000		
Task 2- Localized Groundwater Conditions Evaluation (near Lake Solano)	$150,000		
Task 3- City of Vacaville Recycled Water Planning	$150,000		
Component 5- GSP Implementation, Outreach, and Compliance Activities	$965,000	1	
Task 1- Prepare Annual Reports	$400,000		Annual reports WY 2022-2025
Task 2- Modify GSP in Response to DWR Determination	$15,000		
Task 3- Five-Year GSP Update	$325,000		Due January 2027, grant funding expires April 2026; approx. 50% of total cost included
Task 4- Stakeholder Engagement and Community Outreach	$225,000		
Total Funds Requested	$4,301,000		

Multiple ways to stay involved

Ongoing outreach via:

- Website: SolanoGSP.com
- Newsletters
- Press Releases
- Town Halls
- Events in partnership with RCDs
- Individual GSA Board meetings

Work with beneficial user groups includes:

- Projects and Management Actions
- Inter-basin Coordination
- Intra-basin Coordination
- Tribes
- Disadvantaged Communities

GSP Monitoring Webmap

- Initial tool to support stakeholder communications
- No sensitive well information included, limitation on zooming capability to obfuscate well locations
- Further enhancements planned in grant application
- Letter to landowners in early February
  - Link to webmap
  - No action required

THANK YOU

Nick Watterson

LUHDORFF & SCALMANINI CONSULTING ENGINEERS

Solano Subbasin Groundwater Conditions

Groundwater Workshop

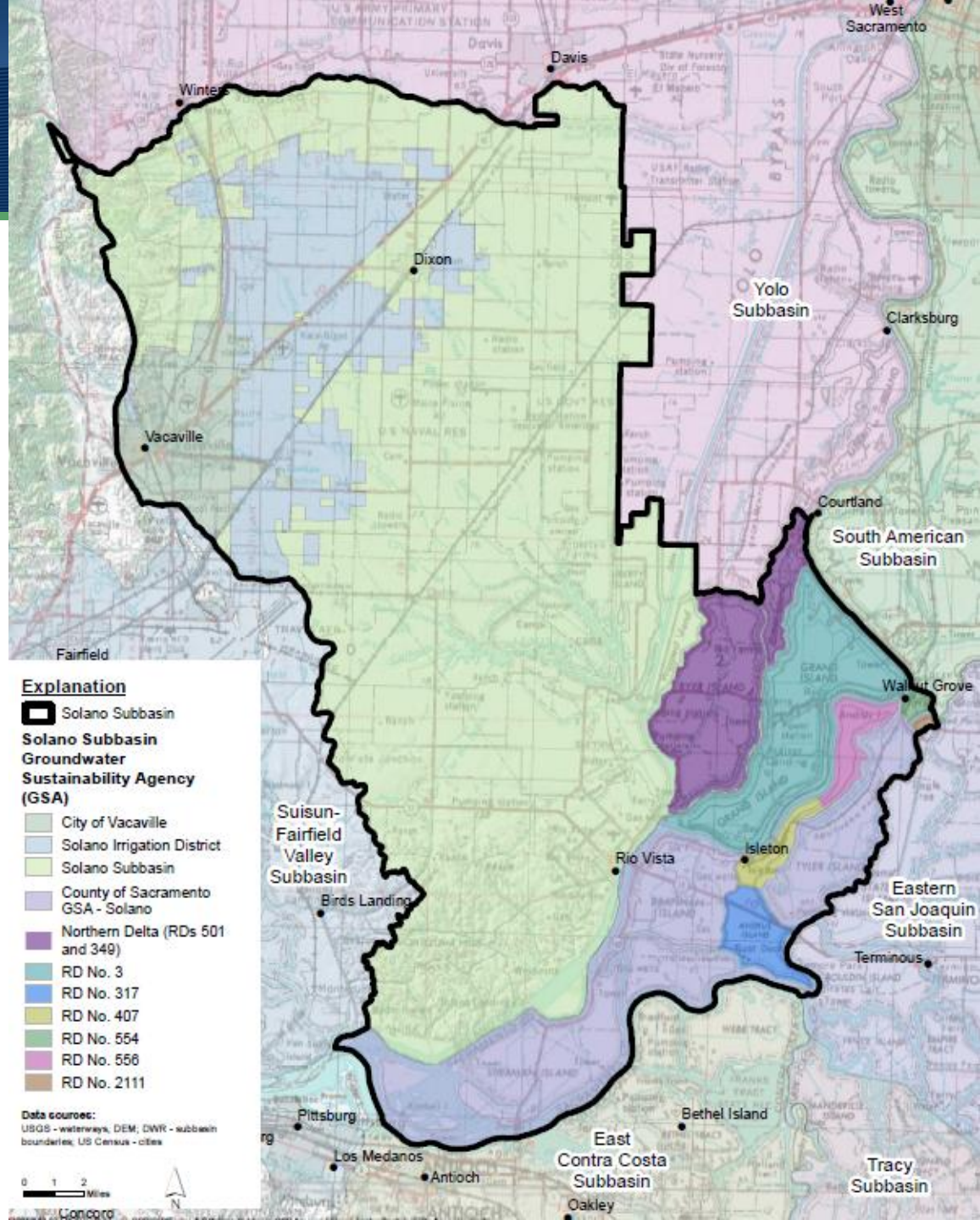
January 23, 2024

Nick Watterson

Luhdorff & Scalmanini
Consulting Engineers

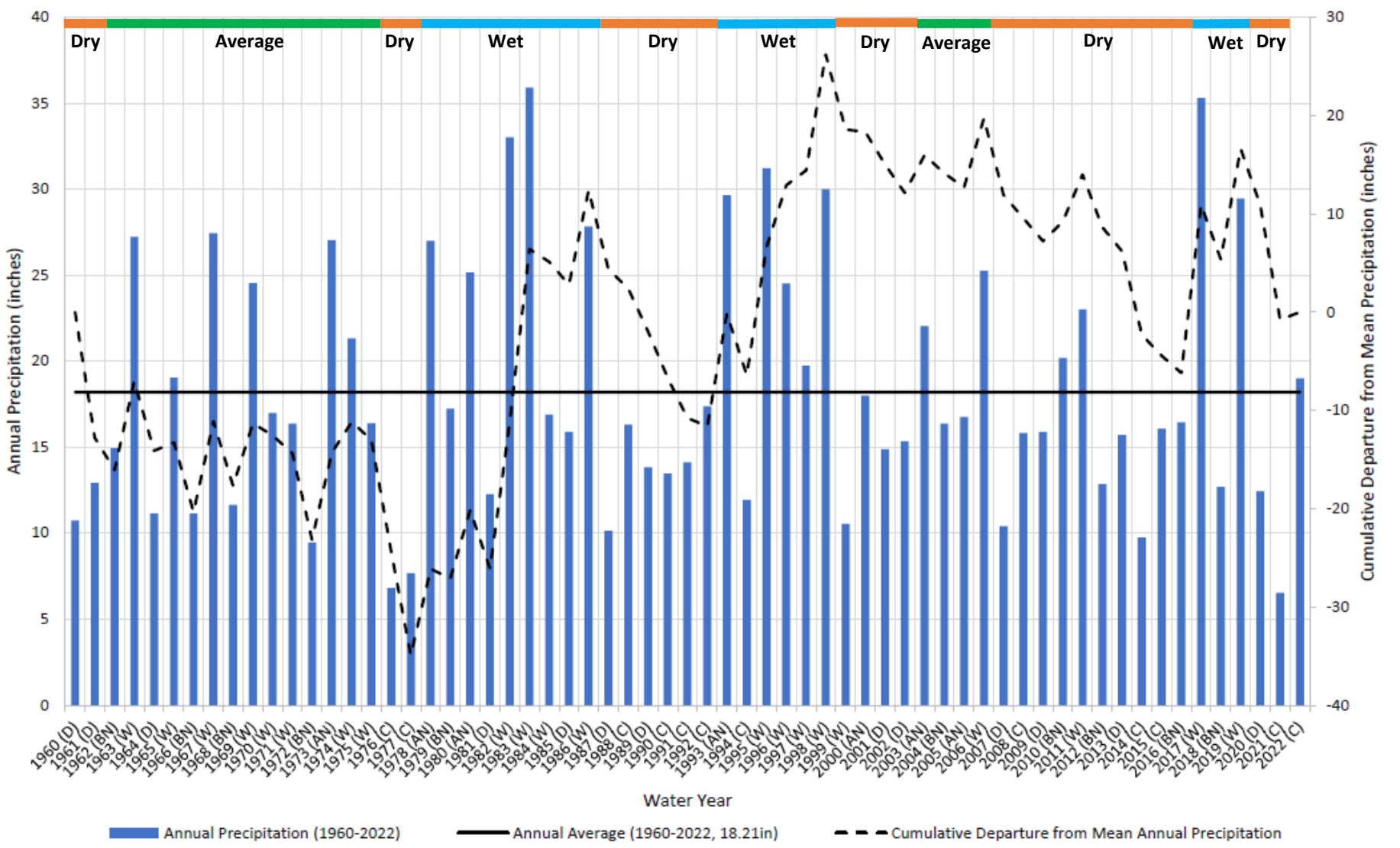
Outline

- Groundwater Levels in the Solano Subbasin
- Solano Subbasin Interactive Web Map
- Recent Groundwater Quality – Nitrate
- Sac Valley Water Quality Coalition High Vulnerability Area (HVA) Update
- Solano Subbasin Groundwater Recharge Interests and Considerations



Historical Precipitation

- Drier than average in recent years
- Since 1999:
  - 17 below avg years
  - 9 above avg years
- 2023:
  - 28.49 inches
  - >10 inches above avg

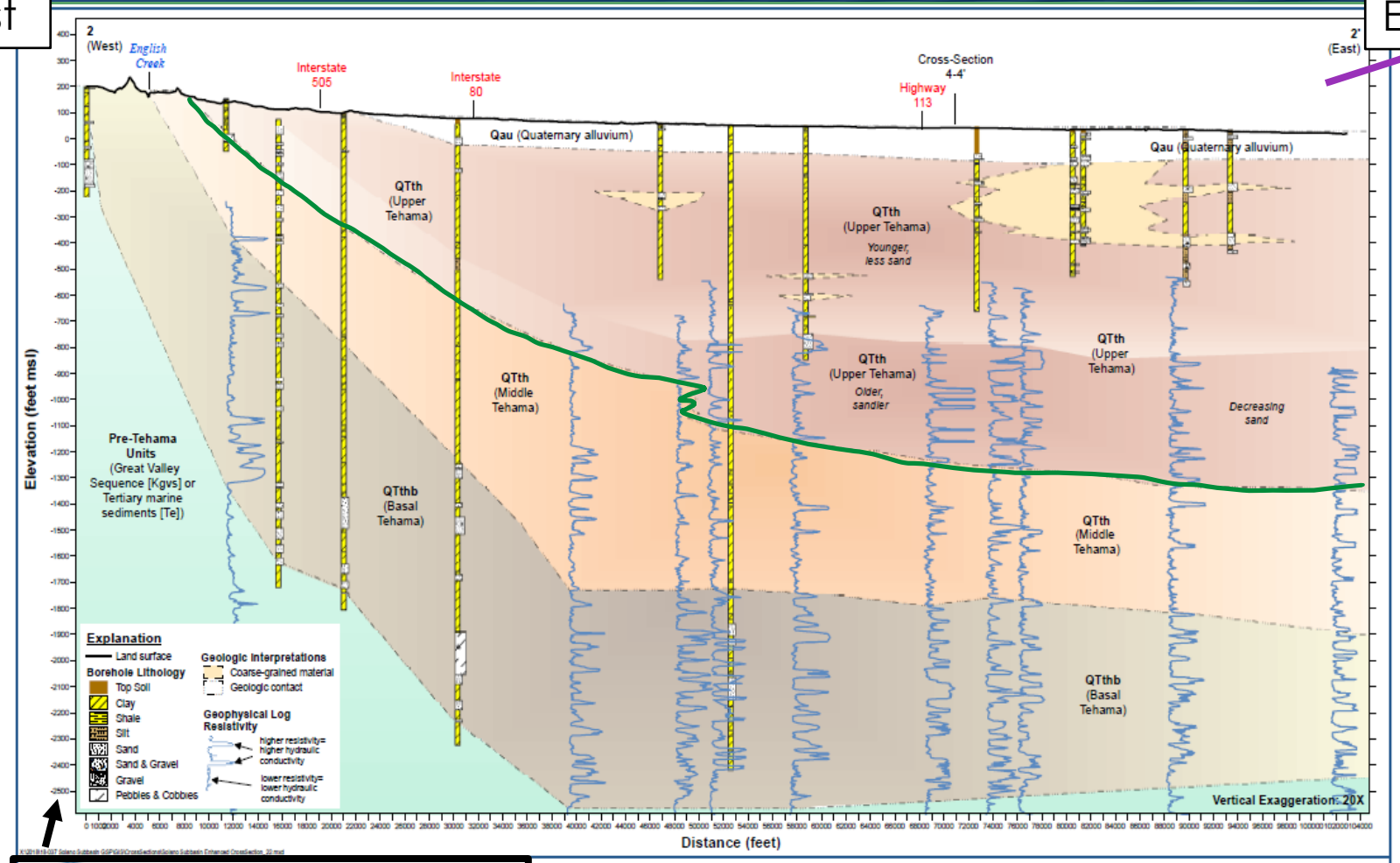


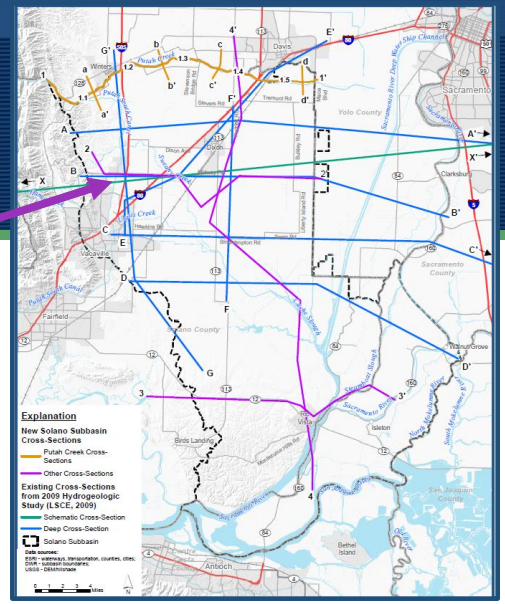
Precipitation measured at Davis Exp. Farm Station

Hydrogeology

West

East





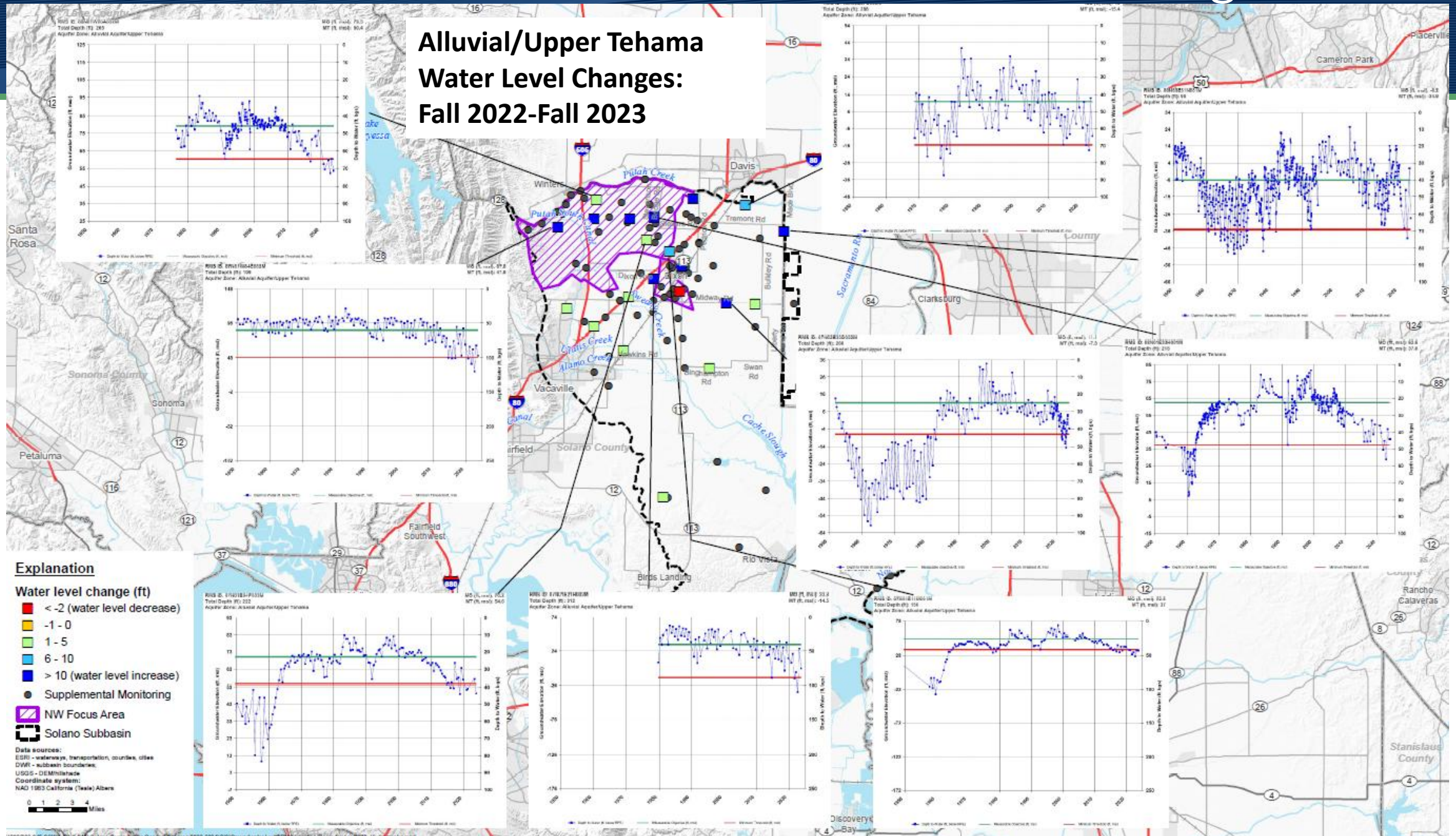
Alluvial/Upper Tehama Zone is primary aquifer for agricultural and small domestic wells

-2500 Ft Elev.;~2,700 Ft. Deep

LSCE

Solano Subbasin Groundwater Levels – 2023 changes

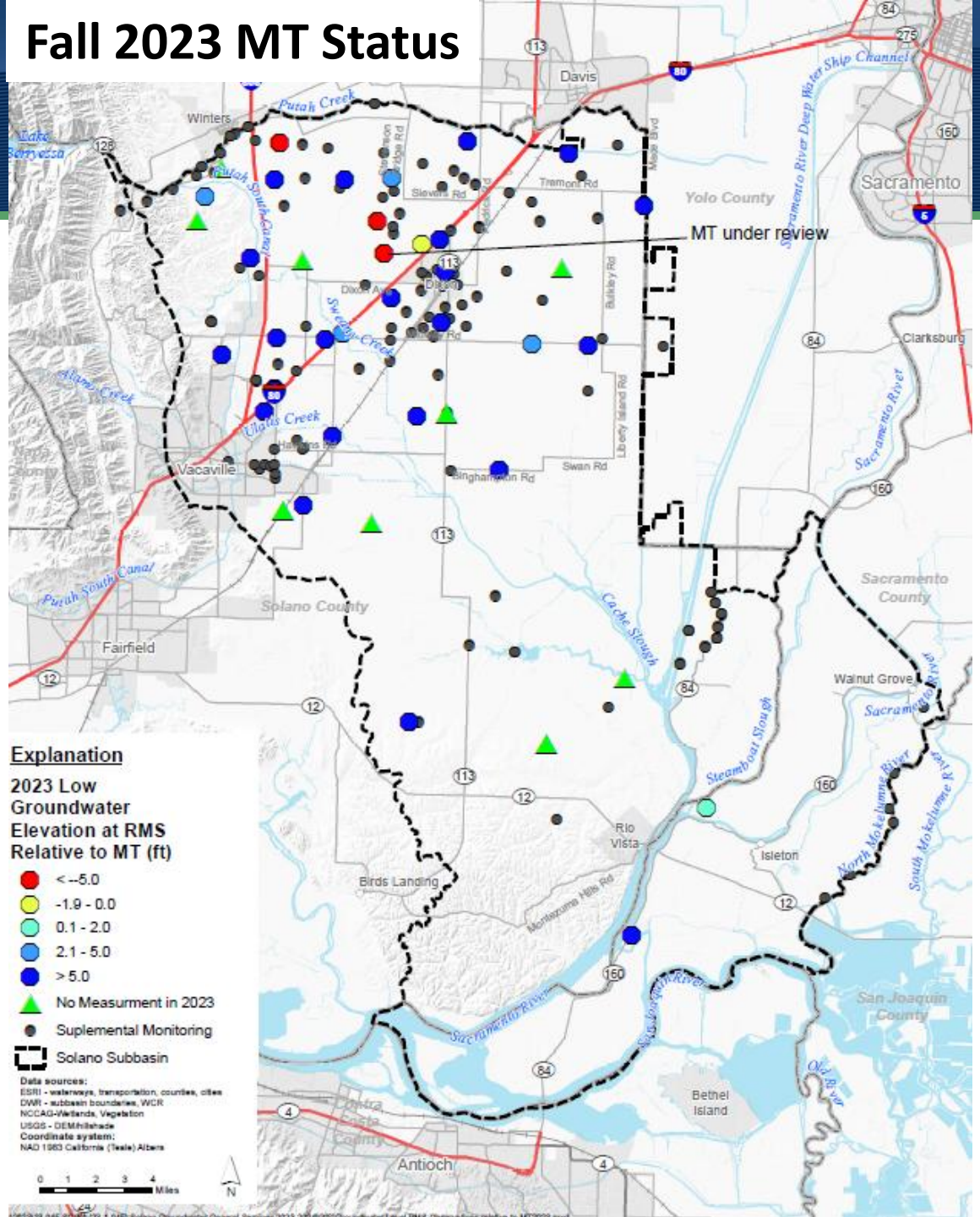
Alluvial/Upper Tehama Water Level Changes: Fall 2022-Fall 2023



Fall 2023 Groundwater Level Update

- Four Minimum Threshold (MT) exceedances in Fall 2023
- 10 MT exceedances in 2022
- One exceedance under review

Fall 2023 MT Status



Water Level Summary

- Recent declining water levels in some areas of Solano Subbasin
- Some water level recovery evident in wells as a result of wet 2023
  - Increased groundwater recharge from precipitation
  - Decreased groundwater demand
  - WY 2023 annual report to be completed by April 1
  - Full benefit to deeper groundwater system from recharge may be delayed
- Northwest Focus Area remains area of special attention, including for opportunities to enhance recharge

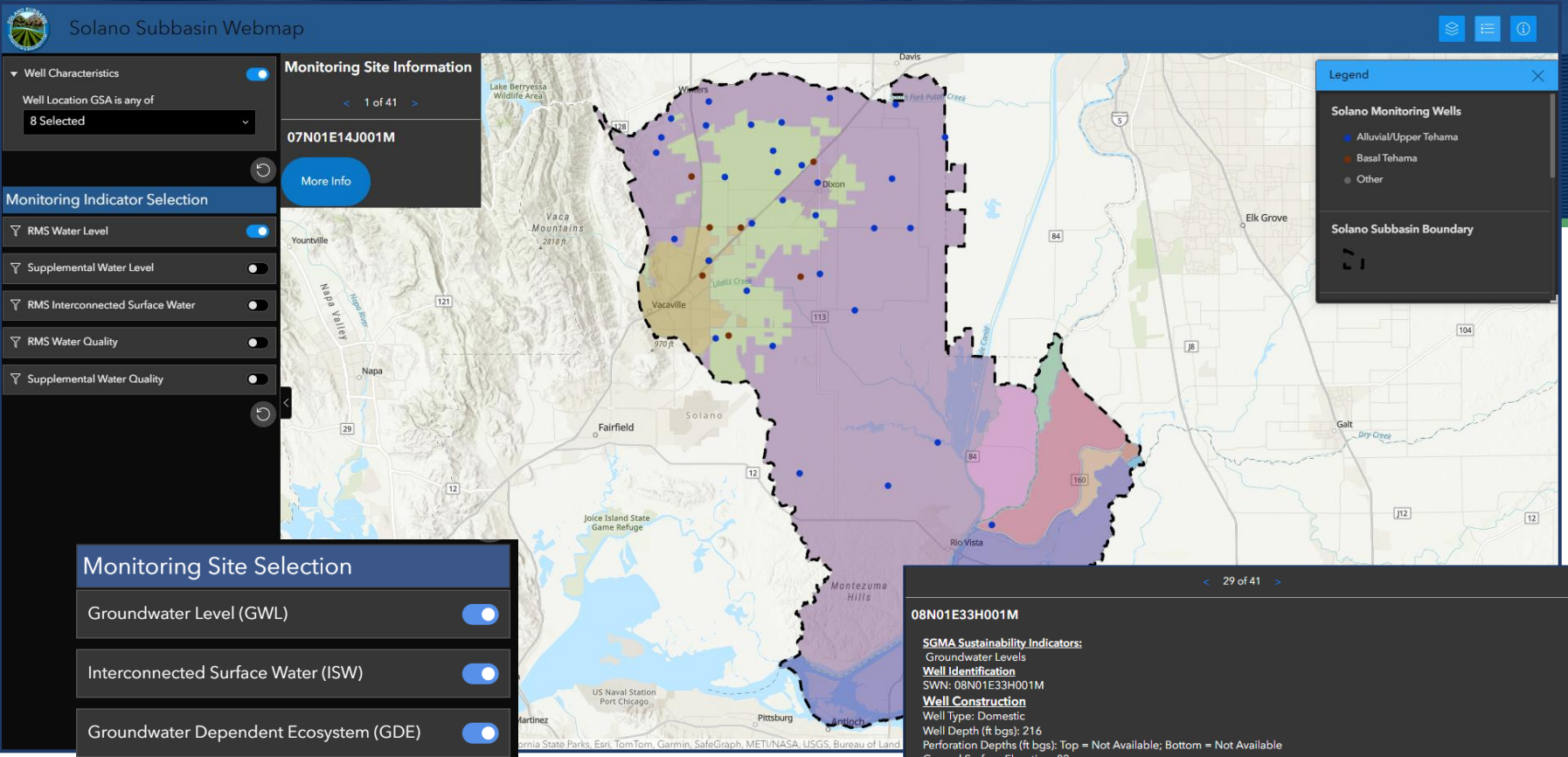
LSCE

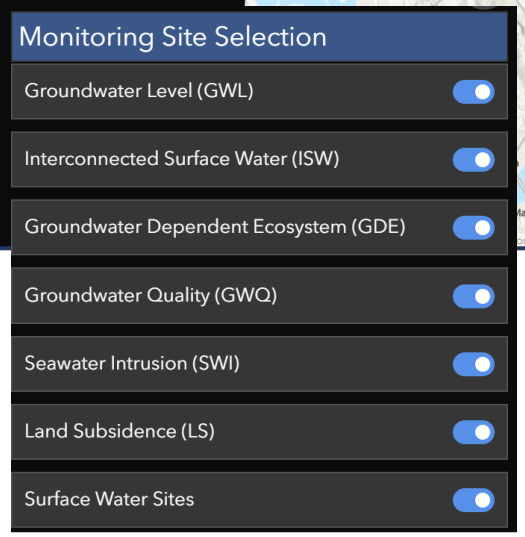
Solano Subbasin Interactive Monitoring Web Map

- Tool for keeping water users/managers updated on Subbasin conditions
- Avenue for disseminating information more frequently than GSP Annual Reports
  - New measurements
  - Monitoring network changes
  - Relationship of conditions to GSP Sustainable Management Criteria
- Focus on GSP Representative Monitoring Sites (RMS) - groundwater levels and quality
- No private well information presented - precise well locations not shown
- Planned public release in February at SolanoGSP.com

LSCE

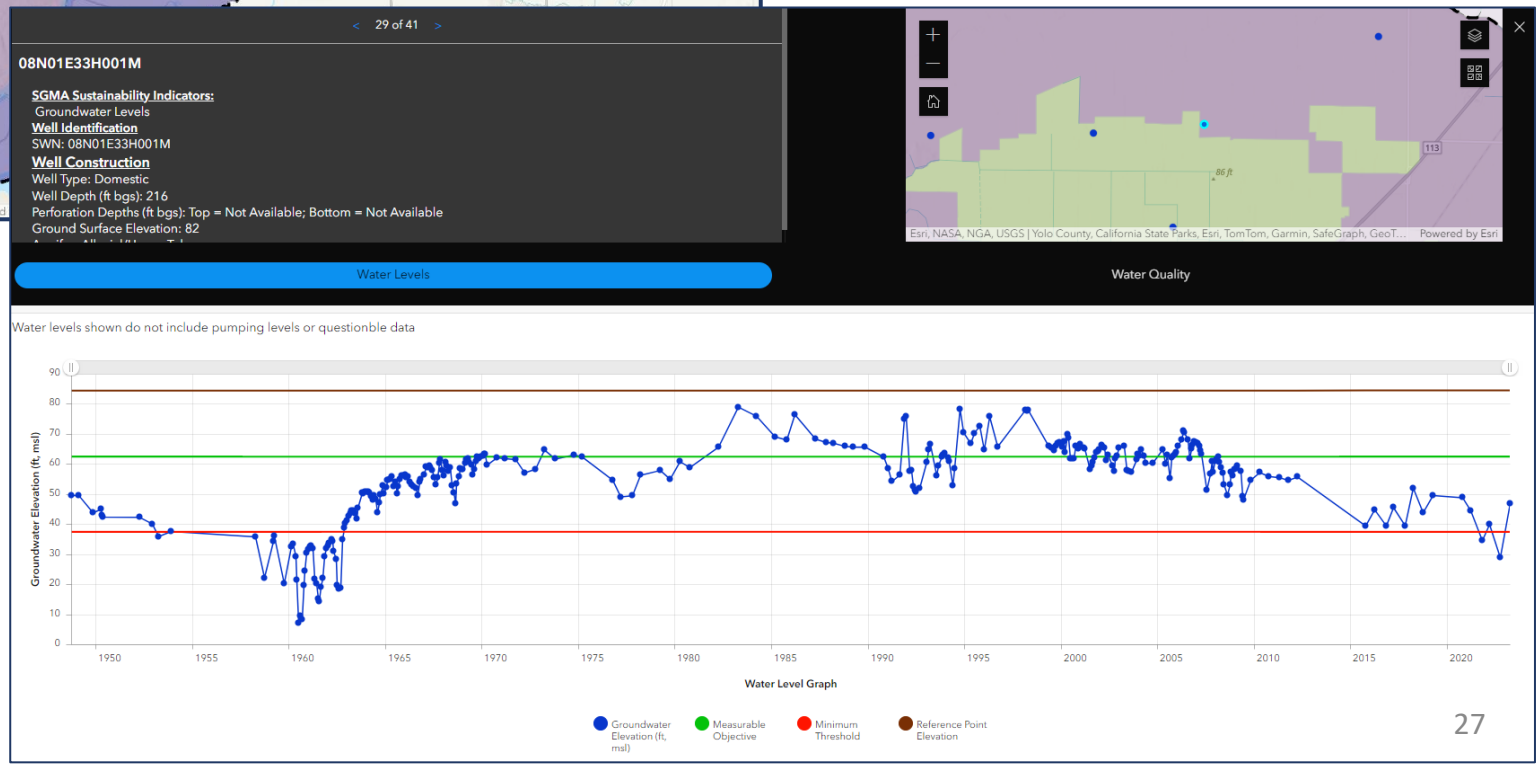
Web map highlights





Filter by Monitoring Entity and Sustainability Indicator

Monitoring Site Details & Time-Series Data



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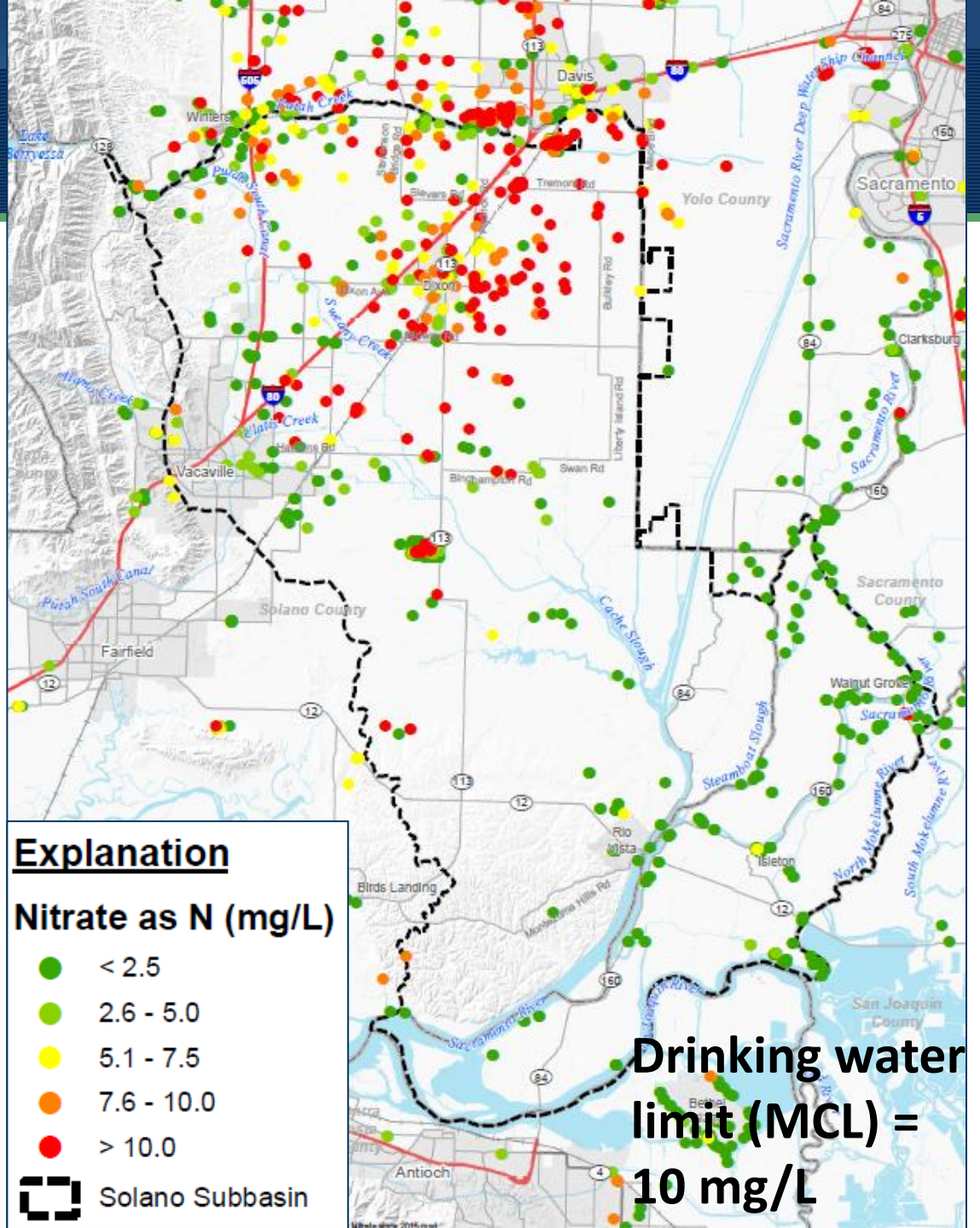
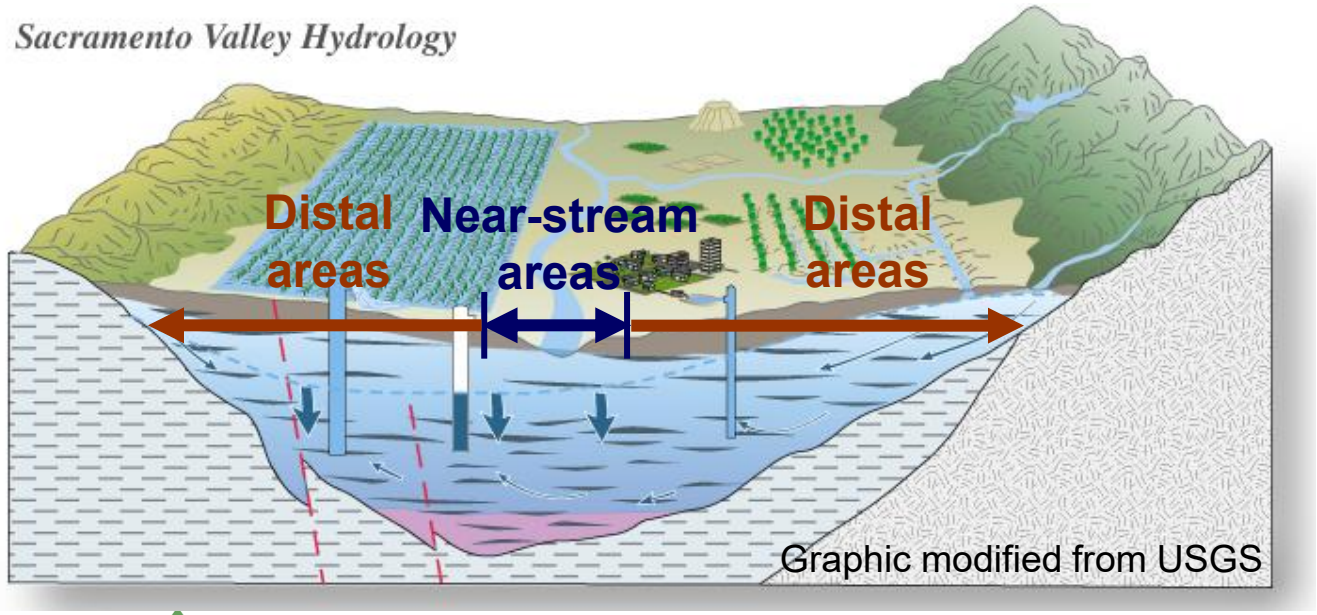
Groundwater Quality

- Recent monitoring suggests broader occurrence of elevated nitrate in GW
- Upper Zone nitrate conditions:
  - 119 wells with historical exceedance, many on ag land
  - Statistically significant trends in concentrations
    - 28 wells increasing
    - 16 decreasing
    - 23 neutral
- Management challenges:
  - Shallow GW conditions
  - Historical loading/residual nitrogen

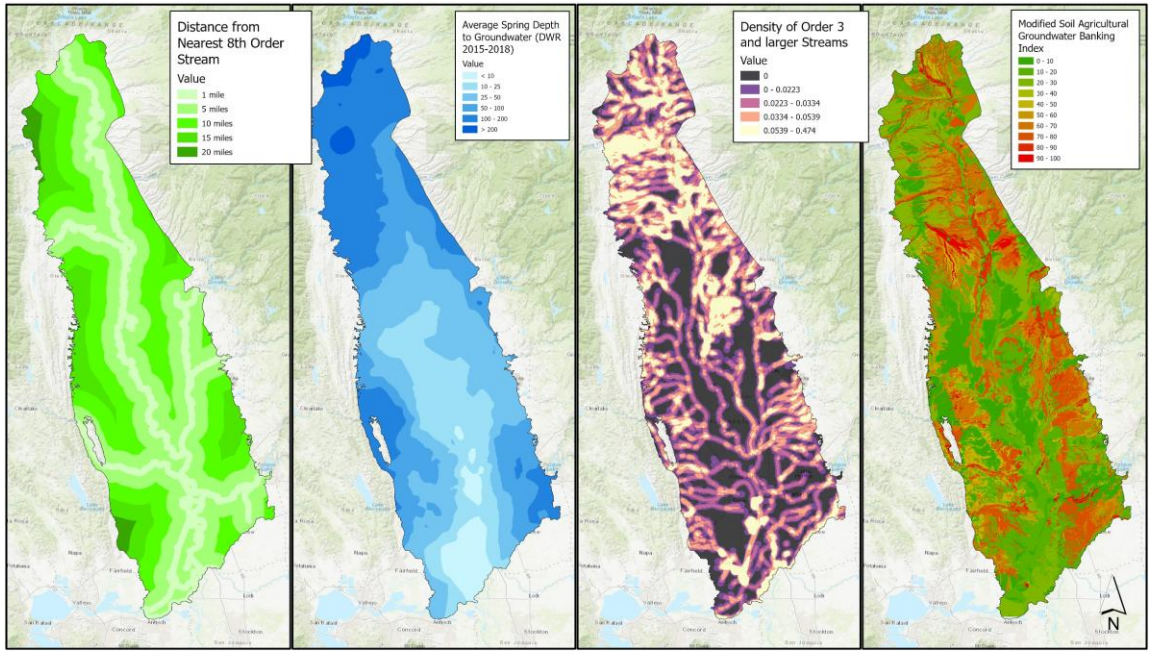


High Vulnerability Area (HVA) Update

- HVA updated as part of Five-Year GAR Update requirement
- Delineated Hydrogeologically Sensitive Area (HSA) based on important hydrogeologic factors
- Irrigated areas overlapping HSA are HVA



Distance from large stream | Depth to Groundwater | Density of Streams | SAGBI Soil Recharge Potential



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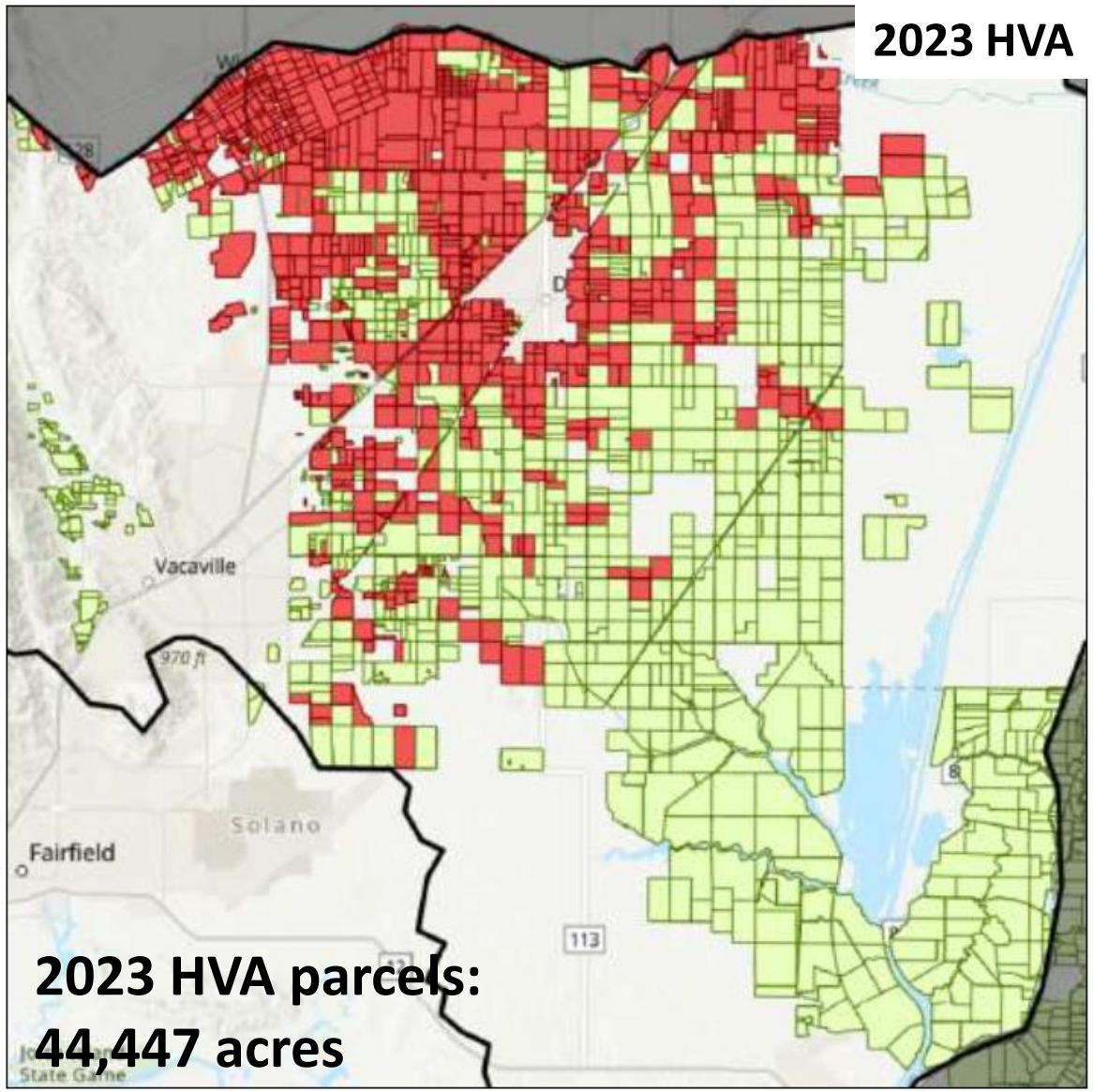
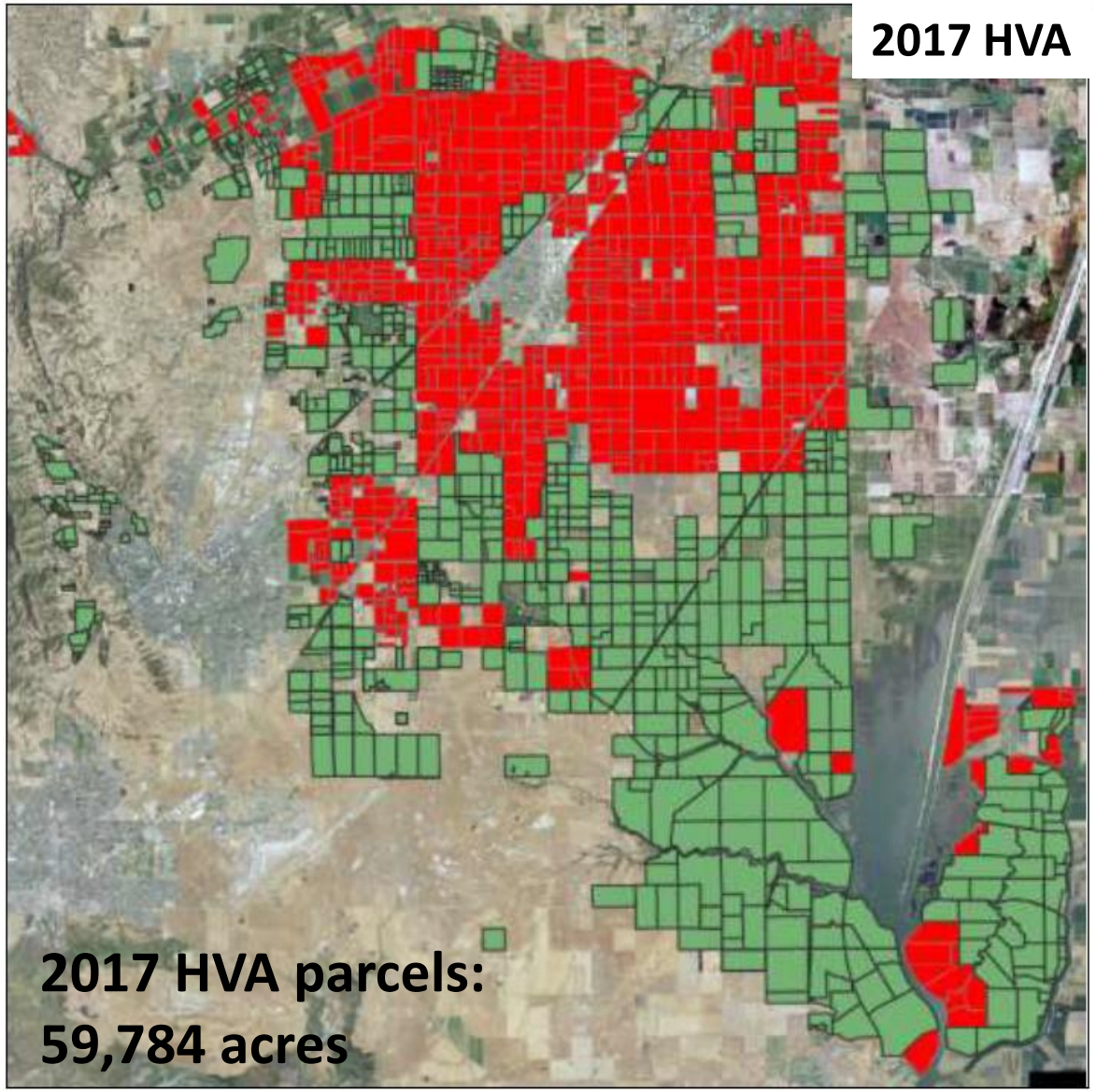
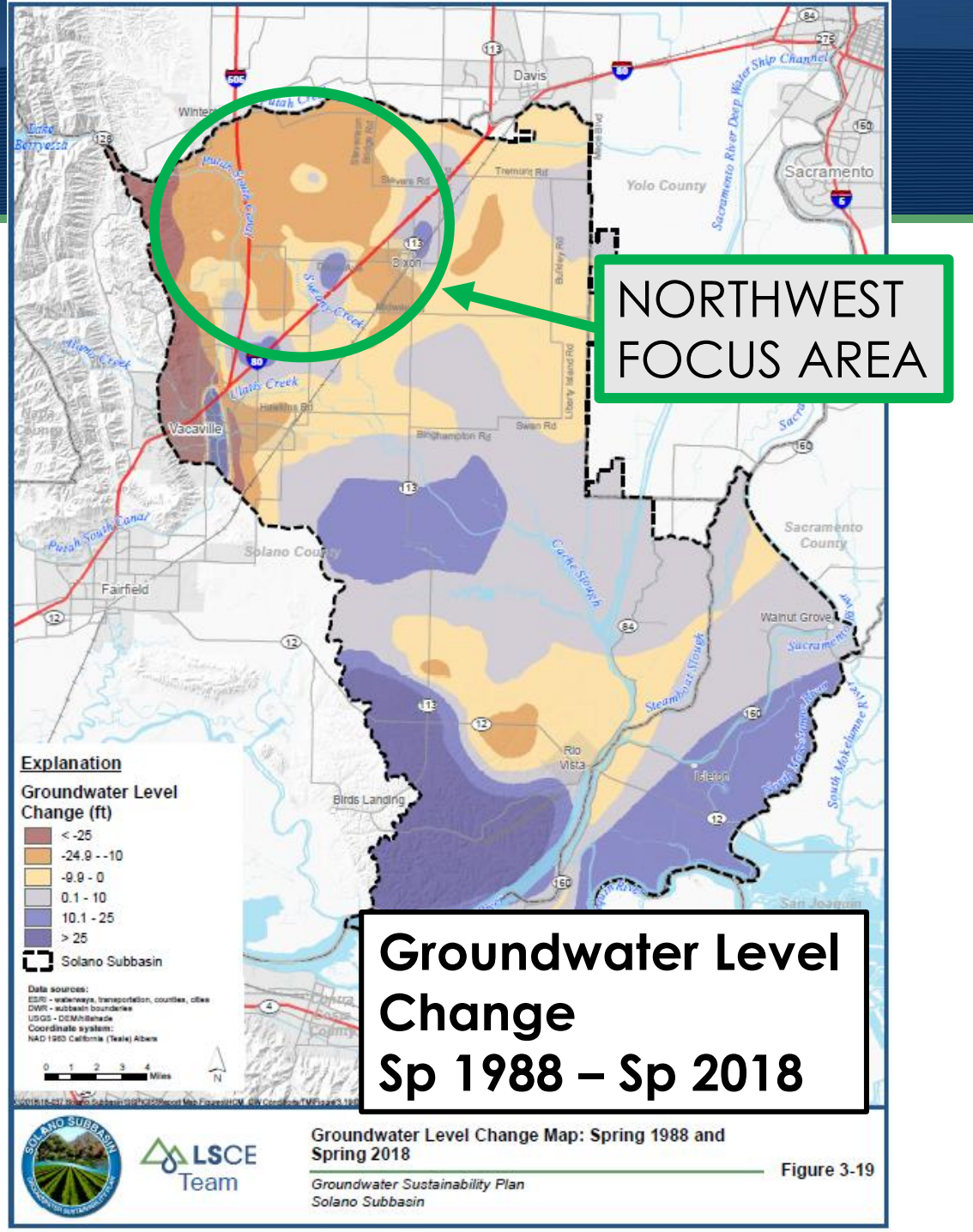
High Vulnerability Area (HVA) Update



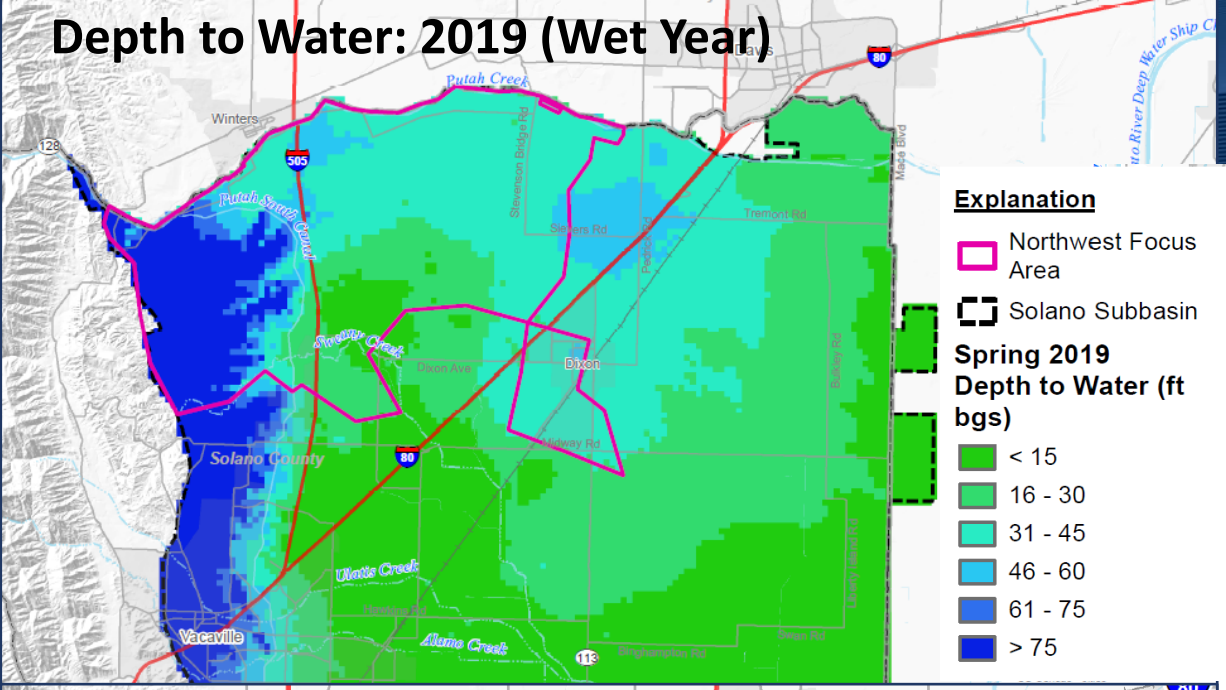


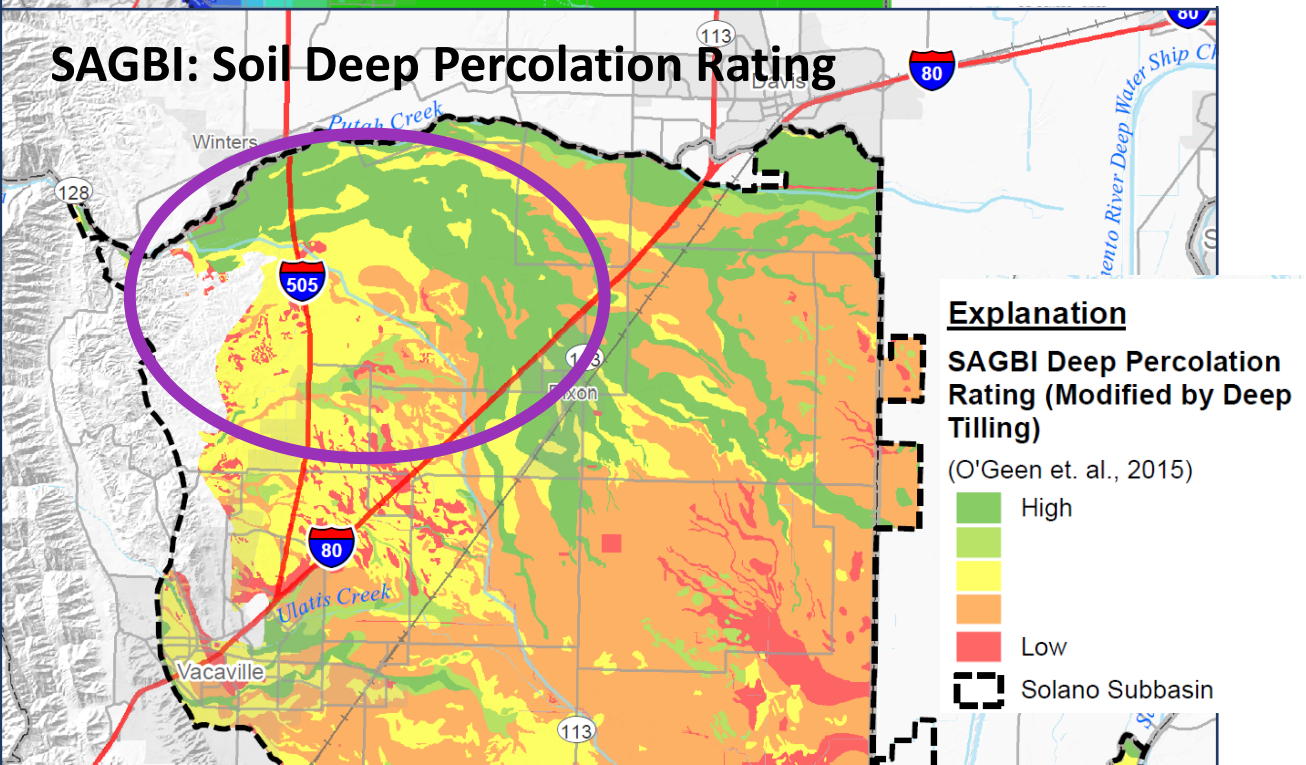
Groundwater Recharge

- NW Focus Area has recent groundwater level declines
- GSP implementation includes exploring ways to enhance groundwater recharge
  - Retain stormwater on agricultural lands
  - Use flood flows from creeks in this area (wet year average inflow ~ 24,000 AF, excluding Putah Creek)
- Achieve multiple benefits: increase groundwater recharge in NW Focus Area and improve stormwater management



Groundwater Recharge Considerations





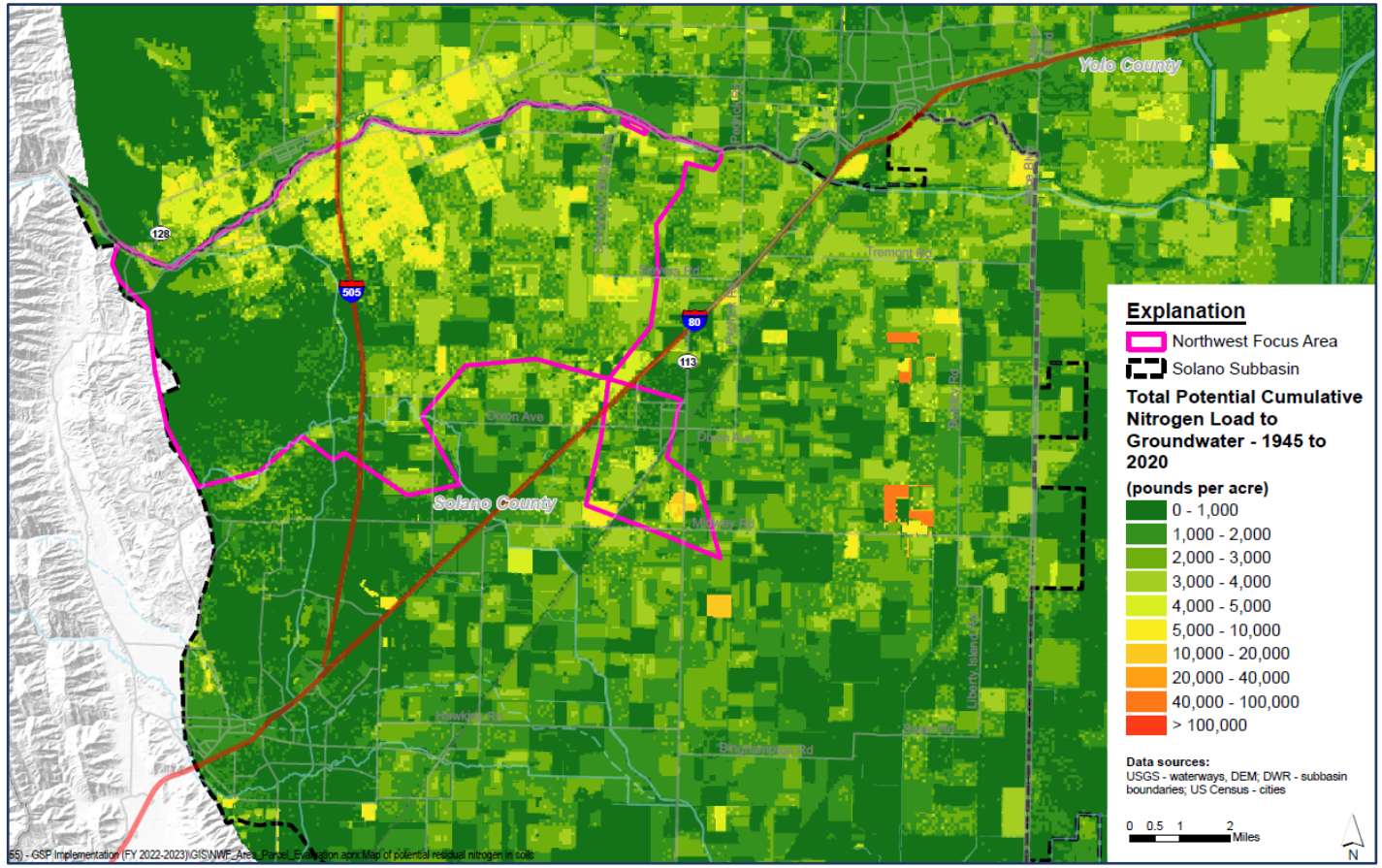
- Different methods of recharge involve unique considerations
- Hydrogeology
  - Soils (surface infiltration)
  - Deeper sediments within unsaturated zone (potential to transmit and store water)
  - Depth to water (storage potential during wet and dry years)
  - Fate of recharge water
- Infrastructure/water conveyance

Groundwater Recharge Considerations

- Other site characteristics
  - Field/crop management
  - Potential for leaching or mobilizing chemicals/nutrients
  - Nearby drinking water sources
  - Monitoring needs
- Benefits and adverse impacts from enhanced recharge on groundwater quality
- Solano Subbasin characteristics align with multi-benefit opportunities

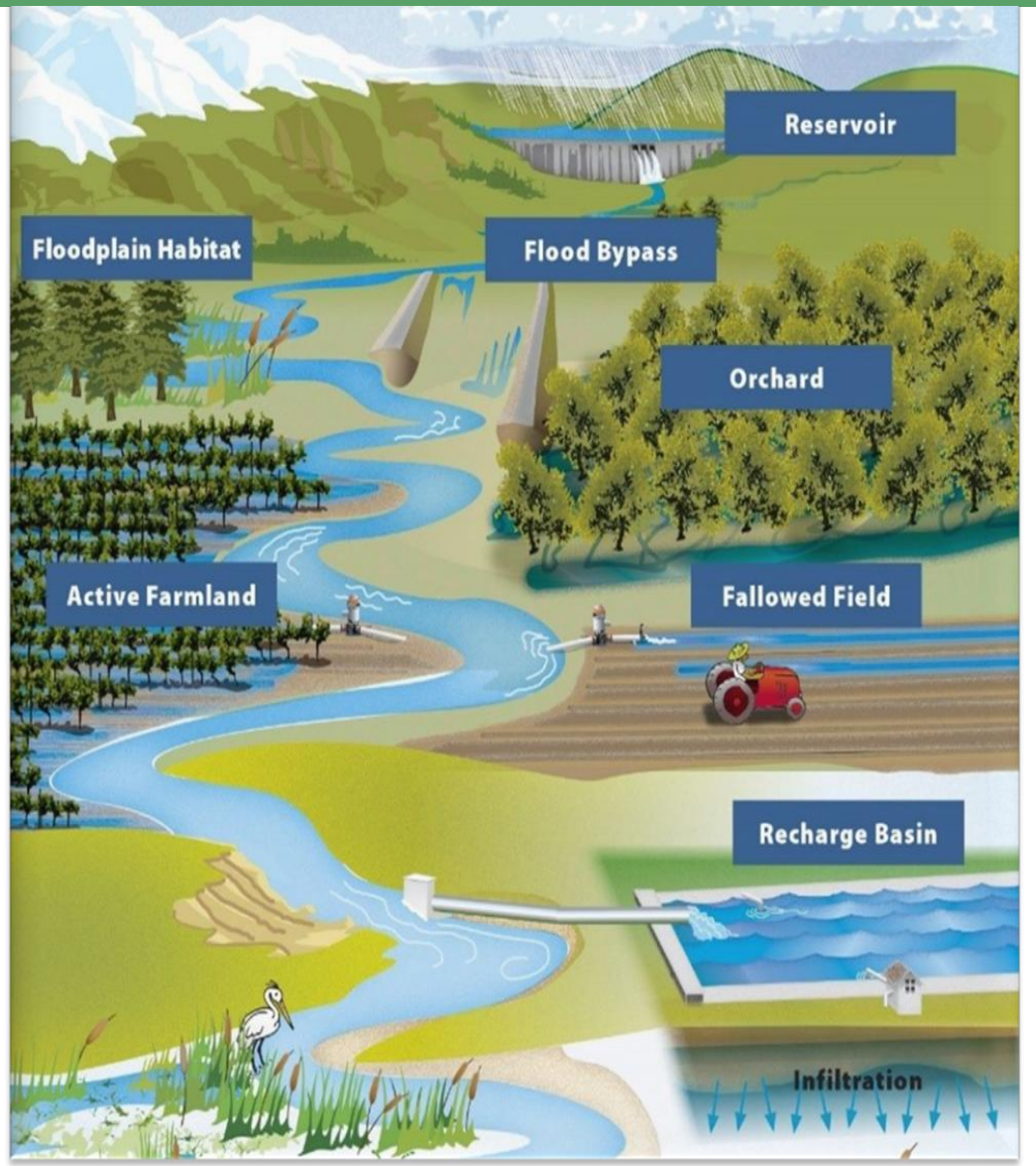
Estimates of historical nitrogen loading: since 1945

(from Harter et al., 2017)



Interest in Conducting Groundwater Recharge

- Have received interest from land owners/managers during GSP preparation and early implementation
- DWR GSP Implementation Grant will support some initial efforts
  - Education and outreach on management practices to enhance recharge
  - Pilot studies
- Planning future discussions with interested land owners/managers



LSCE

Thank you!

Nick Watterson

Luhdorff & Scalmanini
Consulting Engineers

Wendy Rash

NATURAL RESOURCE CONSERVATION SERVICES

Dixon-Solano Water Quality Coalition

January 23, 2024

Wendy Rash, Water Quality Specialist, NRCS

On-Farm Groundwater Recharge

Lessons from NRCS's Pilot Program

United States Department of Agriculture

Natural Resources Conservation Service

In a big water year…

- Does your soil infiltrate heavy rains or does it pond and evaporate or run off?
- Can you take flood water after your ground is saturated?
- Where can you put it?

Types of farm recharge practices

- Developing soil that can absorb and infiltrate water
  - Capturing rainfall
- Intentional flooding of fields for infiltration
  - On-Farm Recharge or Managed Aquifer Recharge
- Utilize surface water instead of groundwater
  - “In-lieu” recharge
- Put flood flows in dedicated non-crop areas to recharge
  - Groundwater Recharge Basin or Trench

Two recharge interim practice options

Recharge trench or basin

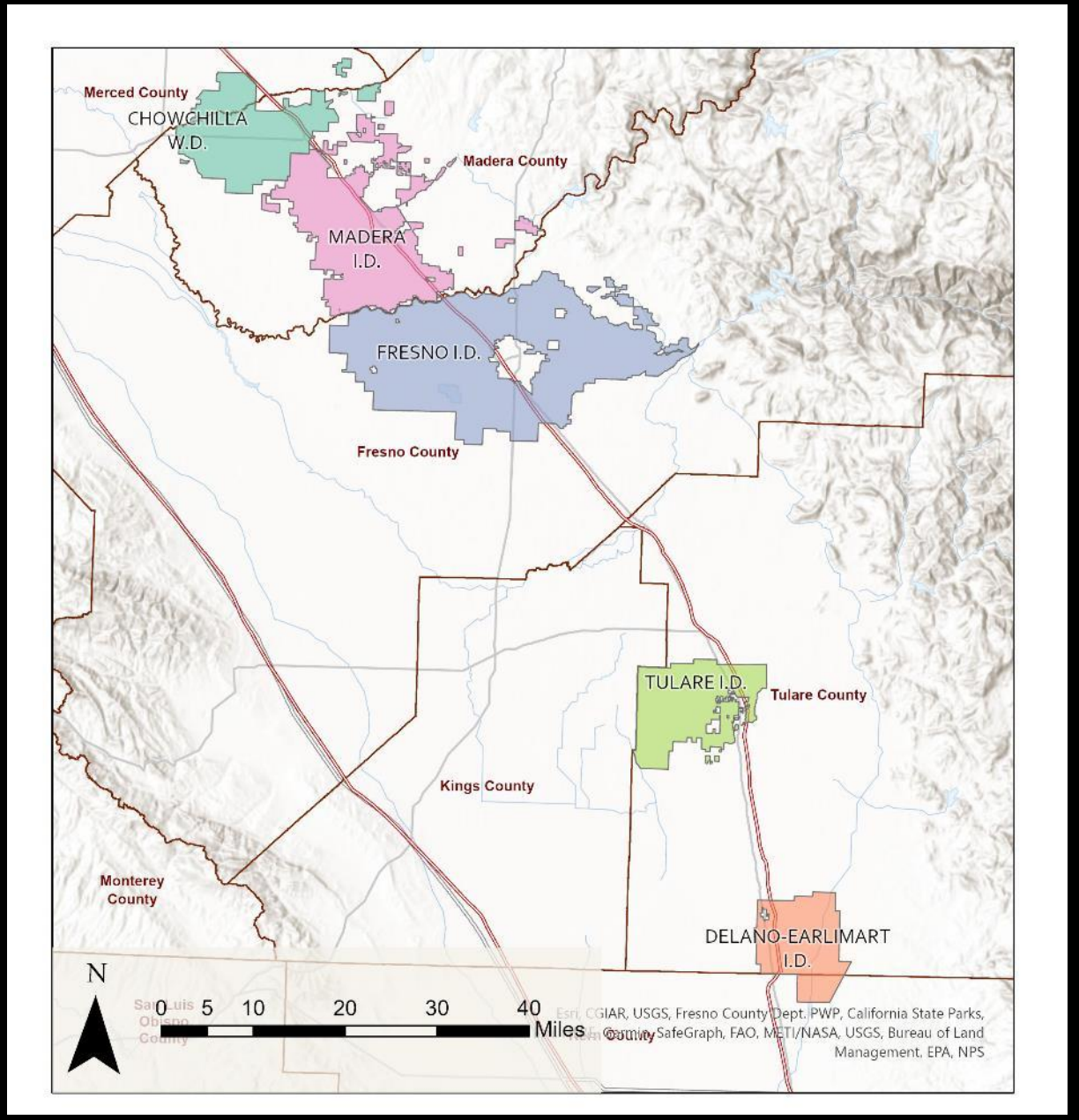
- Permanent feature (15 years) – land dedicated to recharge

On-farm recharge

- Management practice in tandem with agriculture

USDA-NRCS Recharge Pilot

Part of the Environmental Quality Incentives Program



Recharge Pilot program

- Goal: Field test the interim practices
- $1.4 million in Fiscal Year 2022, $1.5 M in Fiscal 2023
- Limited area
- Extra requirements on pilot projects
  - Monitoring well
  - Water source and rights

Site selection factors

- Soil Agricultural Groundwater Banking Index (SAGBI)
  - Soil properties, to 60 inch depth
- Groundwater Recharge Assessment Tool (GRAT)
  - Factors for shallow geology, to 120 ft depth
- Saturated hydraulic conductivity (Ksat) for basins

BI | Soil Agricultural Groundwater Banking Index

Factors | Map Settings

This App

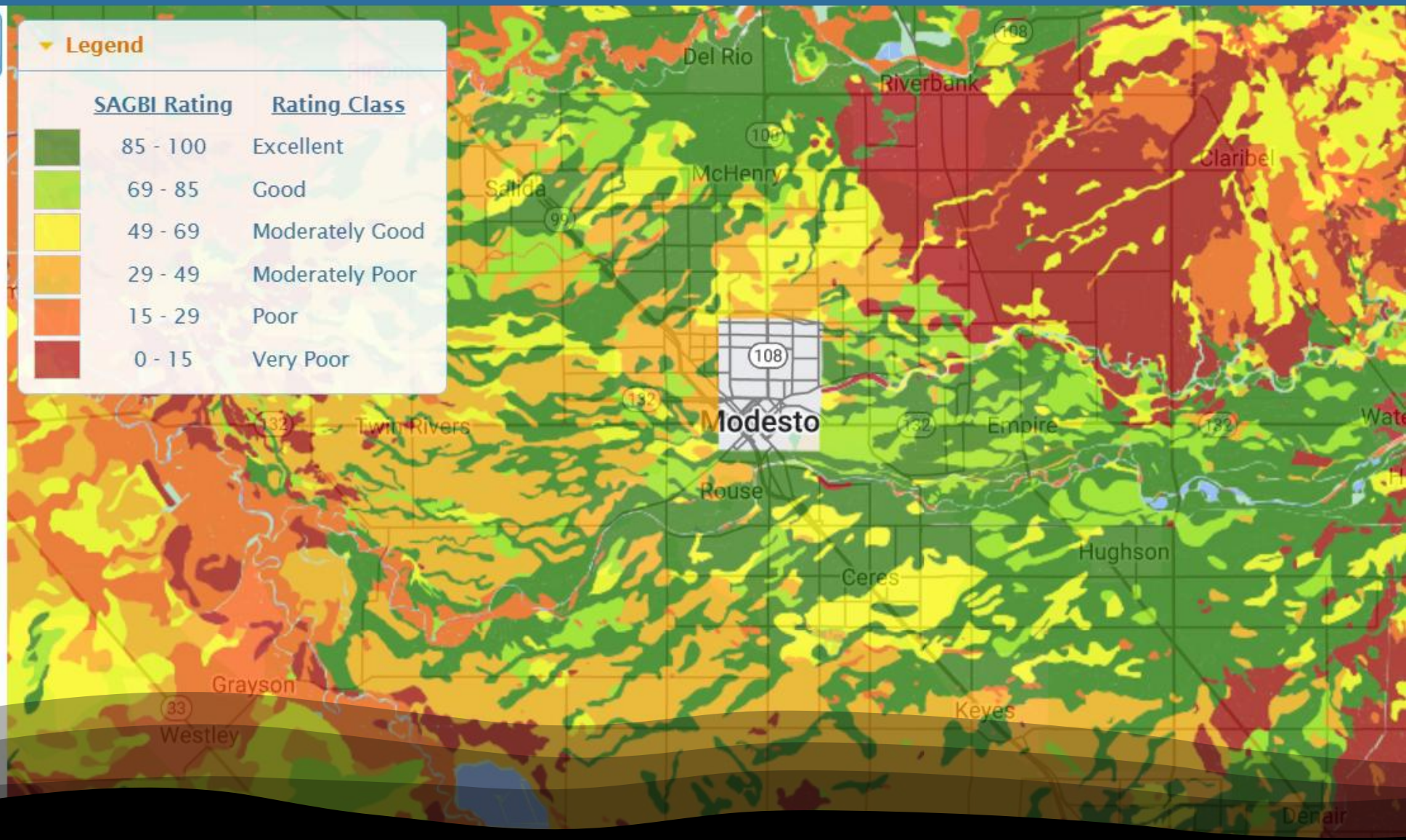
und

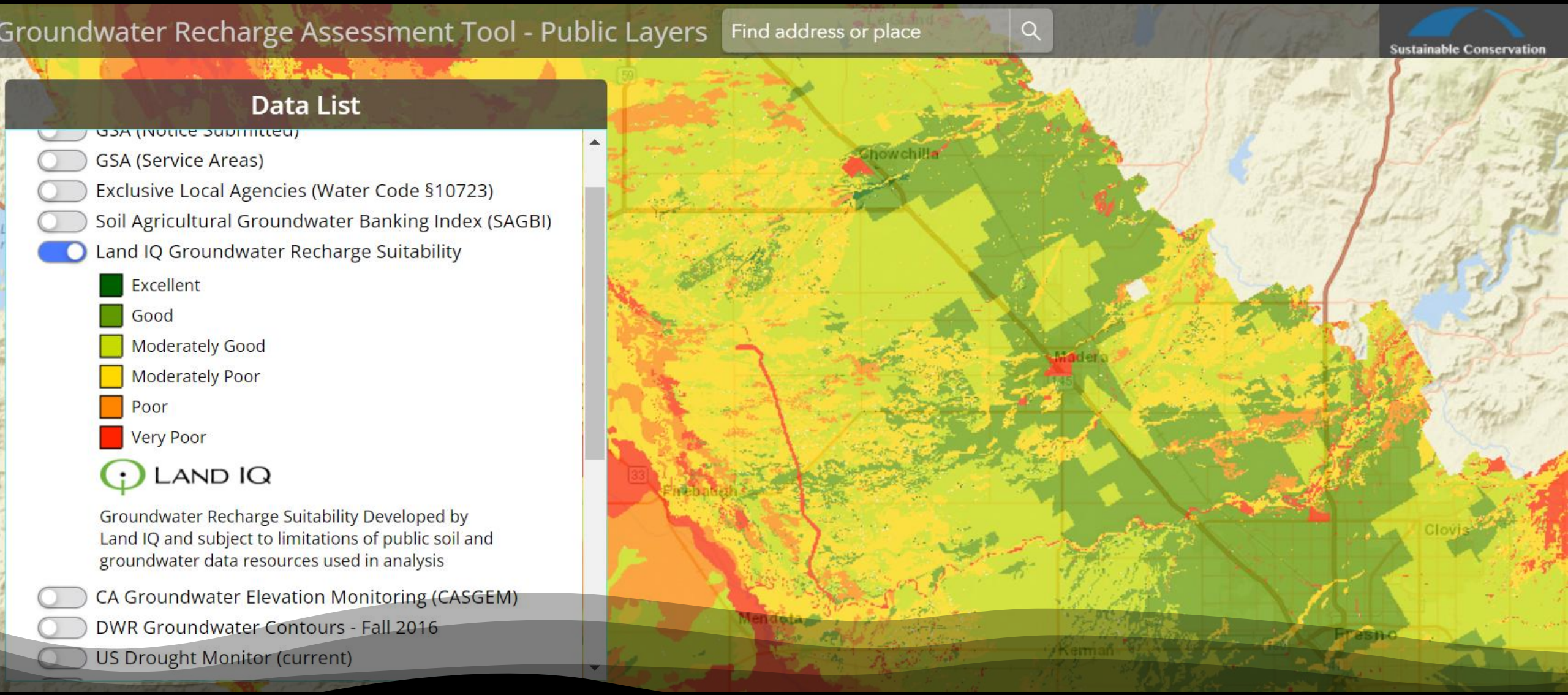
Agricultural Groundwater Banking
GBI) is a suitability index for
ater recharge on agricultural land.
I is based on five major factors
ritical to successful agricultural
ater banking: deep percolation,
e residence time, topography,
limitations, and soil surface
. More details can be found in the
icle in *California Agriculture*.

e app

the map to view specific SAGBI
s at that location.
more about each SAGBI factor on
actors' tab.
e 'Map Settings' tab to change the
overlay transparency, or to zoom
pecific area of interest.

was developed by the California
Lab at UC Davis and



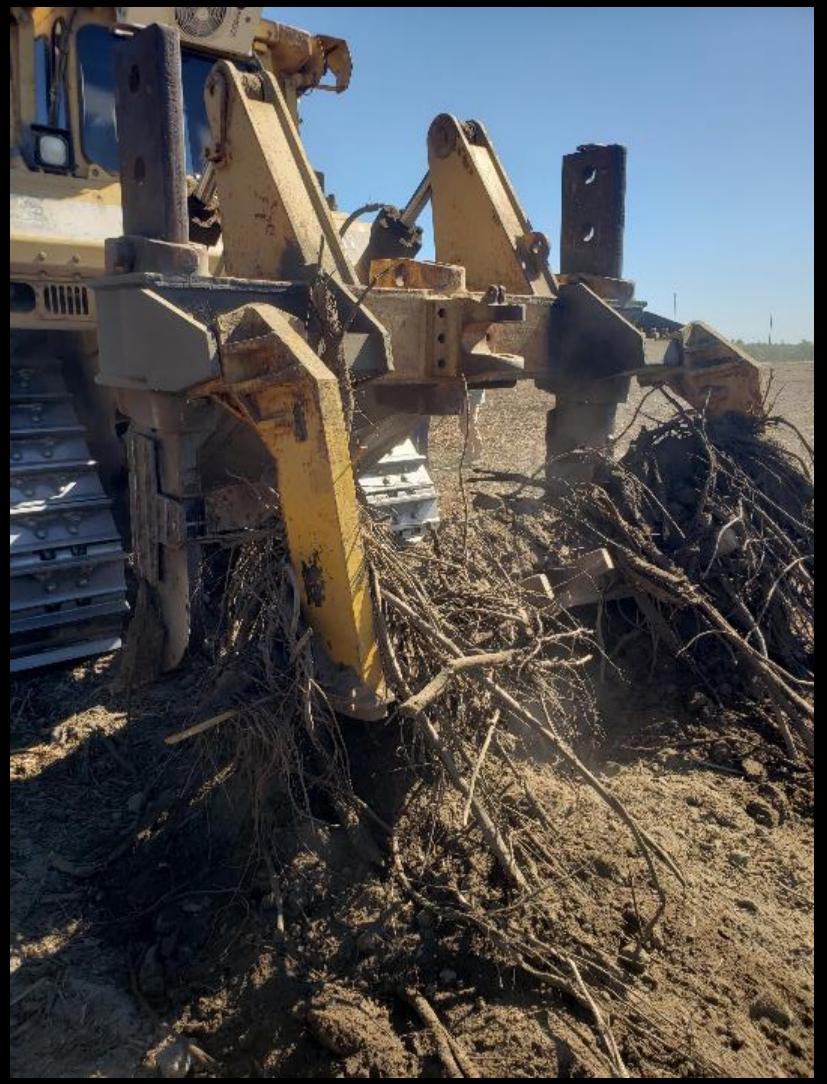

Groundwater Recharge Assessment Tool - Public Layers
Find address or place
Sustainable Conservation
Data List
GSA (Service Areas)
Exclusive Local Agencies (Water Code §10723)
Soil Agricultural Groundwater Banking Index (SAGBI)
Land IQ Groundwater Recharge Suitability
Excellent
Good
Moderately Good
Moderately Poor
Poor
Very Poor
LAND IQ
Groundwater Recharge Suitability Developed by Land IQ and subject to limitations of public soil and groundwater data resources used in analysis
CA Groundwater Elevation Monitoring (CASGEM)
DWR Groundwater Contours - Fall 2016
US Drought Monitor (current)
Chowchilla
Madera
Firebaugh
Mendota
Kerman
Clovis
Fresno

Site selection factors

- Water availability- District delivery or water rights for recharge
- Water quality considerations
  - Source water
  - Nutrient management
  - Pest management

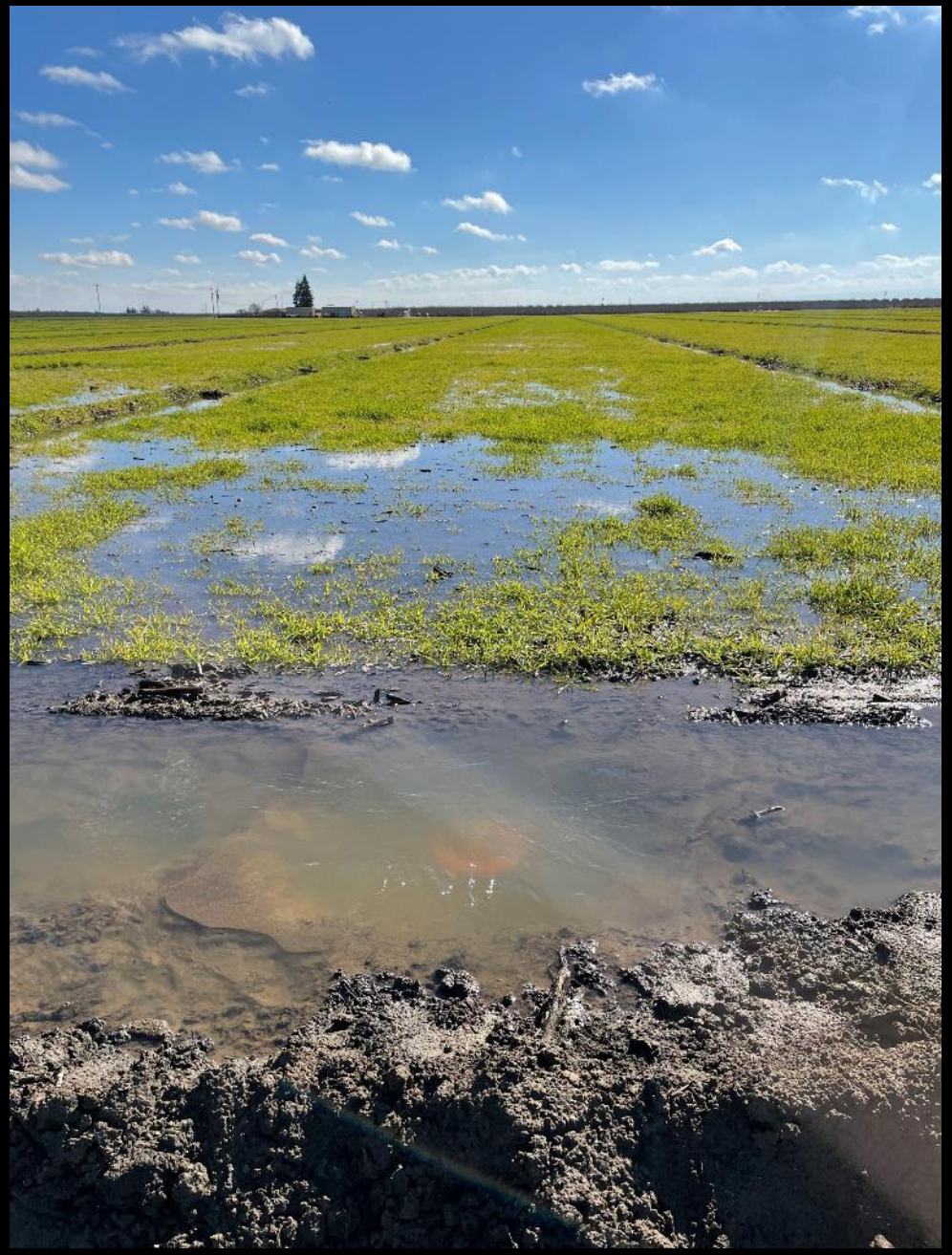
On-Farm Recharge: Walnut replant example

- Before: Walnut orchard, could not flood irrigate effectively
- Plan: Keep open 2+ years before replanting, design for recharge
- Orchard removal; land leveling, pump, pipe, gated pipe; cover crop
- Apply on-farm recharge water during fallow (annual crop) and after re-planting



Photos courtesy of Mark Hutson

Photos courtesy of Mark Hutson



- Barley and cover crop planted
- Applied recharge water Jan-Feb 2023
- 88.6 ac-ft recharged on about 40 acres

Photo by Wendy Rash, USDA

What did producers do for on-farm recharge?

- Nutrient management plan review
- Pesticide Use Reports for risk assessment
- Field setup plan for flood
- Consider: flood impacts to crops, cultural practices
- Put water on at least once a year when available:
  1 or 2 years in a 3-year contract

What did producers do for basins?

- Review site history
- Need appropriative water rights or recharge water right
- Only Cropland and Associated land, no pasture or range
- Discuss how water would get to the field: need pipe, turnout or flow meters?
- Basins are paid per ac-ft of storage capacity

Monitoring for pilot projects

- Nearby well to monitor for response
- Well Monitoring:
  - NRCS and Sustainable Conservation staff
  - Nov – Dec pre-recharge, 2022 and 2023
  - March 2023 post-recharge
  - water level measurements
  - water analysis for Nitrate and Total Dissolved Solids

Risk management for water quality

- High-risk sites ruled out
- Source water quality
- Pre-treatment for sediment

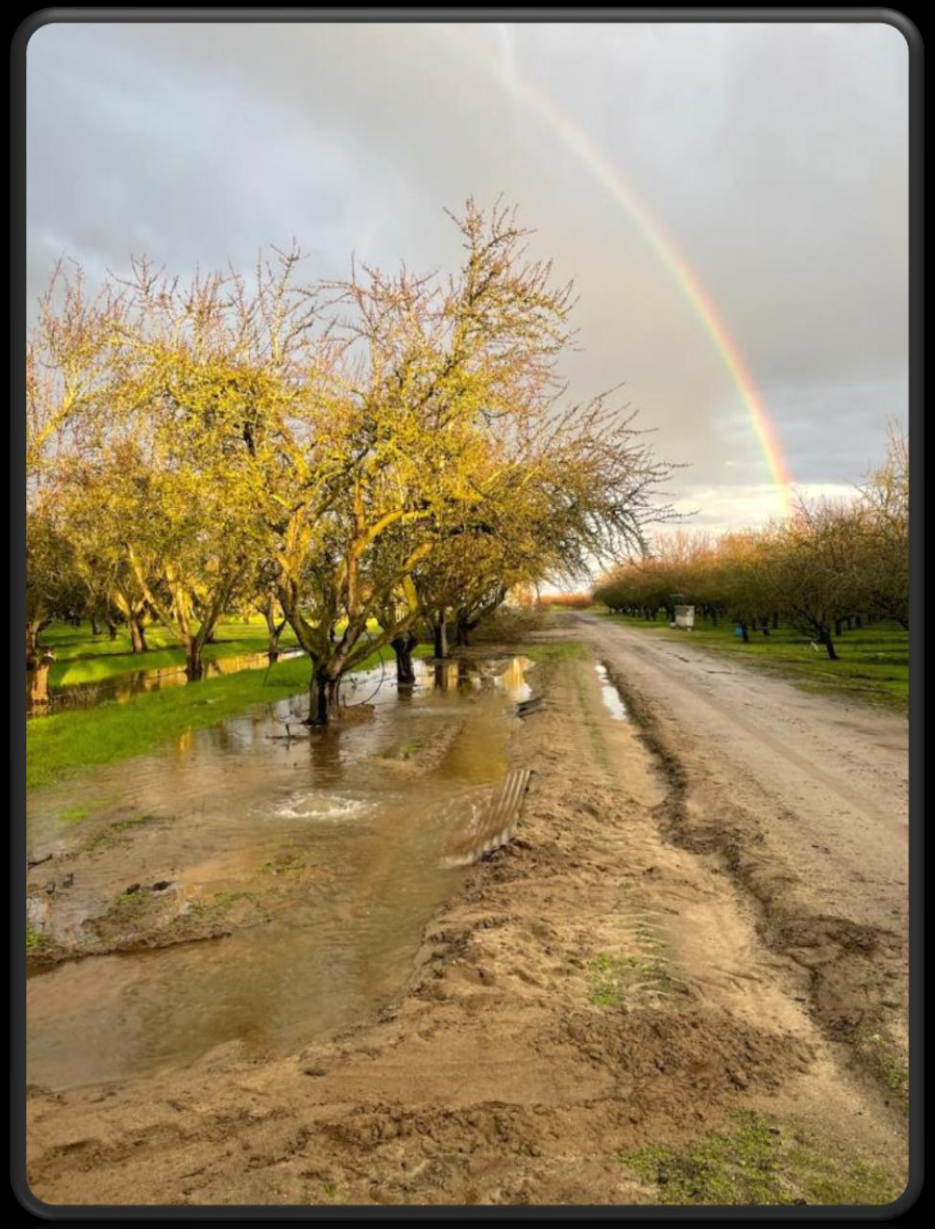
Goal: protect or improve groundwater quality

- Pest management
  - Pesticide leaching risk
  - State regulation- “No-Recharge” List
- Nutrient management
  - Nitrate leaching risk
  - Residual nitrate in soil
  - Nitrogen management

Agronomic considerations for crops

Annuals

- Damage to winter crops
- Flooding impacts to soil biology
- Loss of yield



Agronomic considerations for crops

Perennials

- Dormant season field work
- Root or fungal disease
- Loss of yield
- Wind-throws- loss of trees
- Weed pressure
- Root stock flooding tolerance

Farm setup considerations

- Water delivery and conveyance to the field
- Measuring applied water
- Irrigation system
- Field setup- Water spreading on the field
  - Slope and leveling
  - Checks and berms, furrows, flat fields
  - Water distribution plan (gated pipe, alfalfa valves, solid-set risers…)
  - Water management plan
- Seepage issues

Projects planned for 2022-23 in NRCS Pilot

Basin or Trench

- Design storage capacity ranged from 1 to 30 ac-ft

On-farm recharge

- Over 2,800 acres
- Vineyard
- Almonds
- Annuals or fallow

Outcomes for NRCS Pilot for 2022-23

Basin or Trench

- Built 1 on-farm basin
- 18 ac footprint, 60 ac-ft capacity
- >200 ac-ft recharged

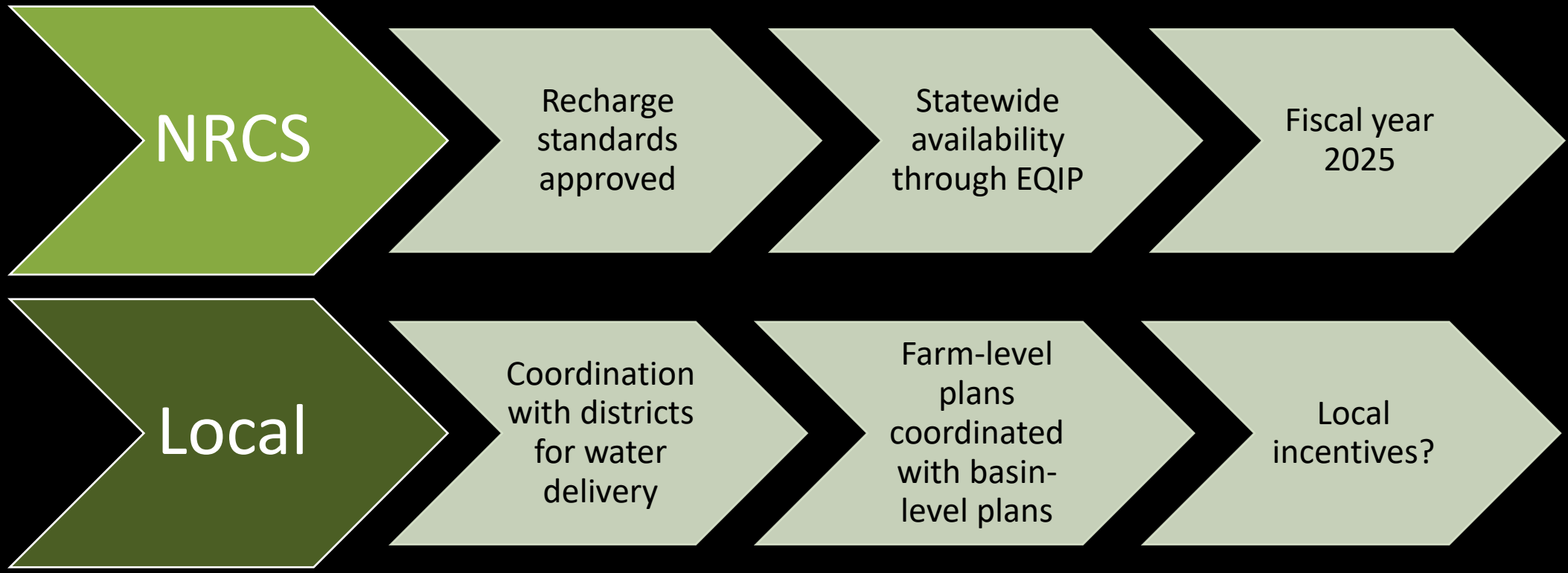
On-farm recharge

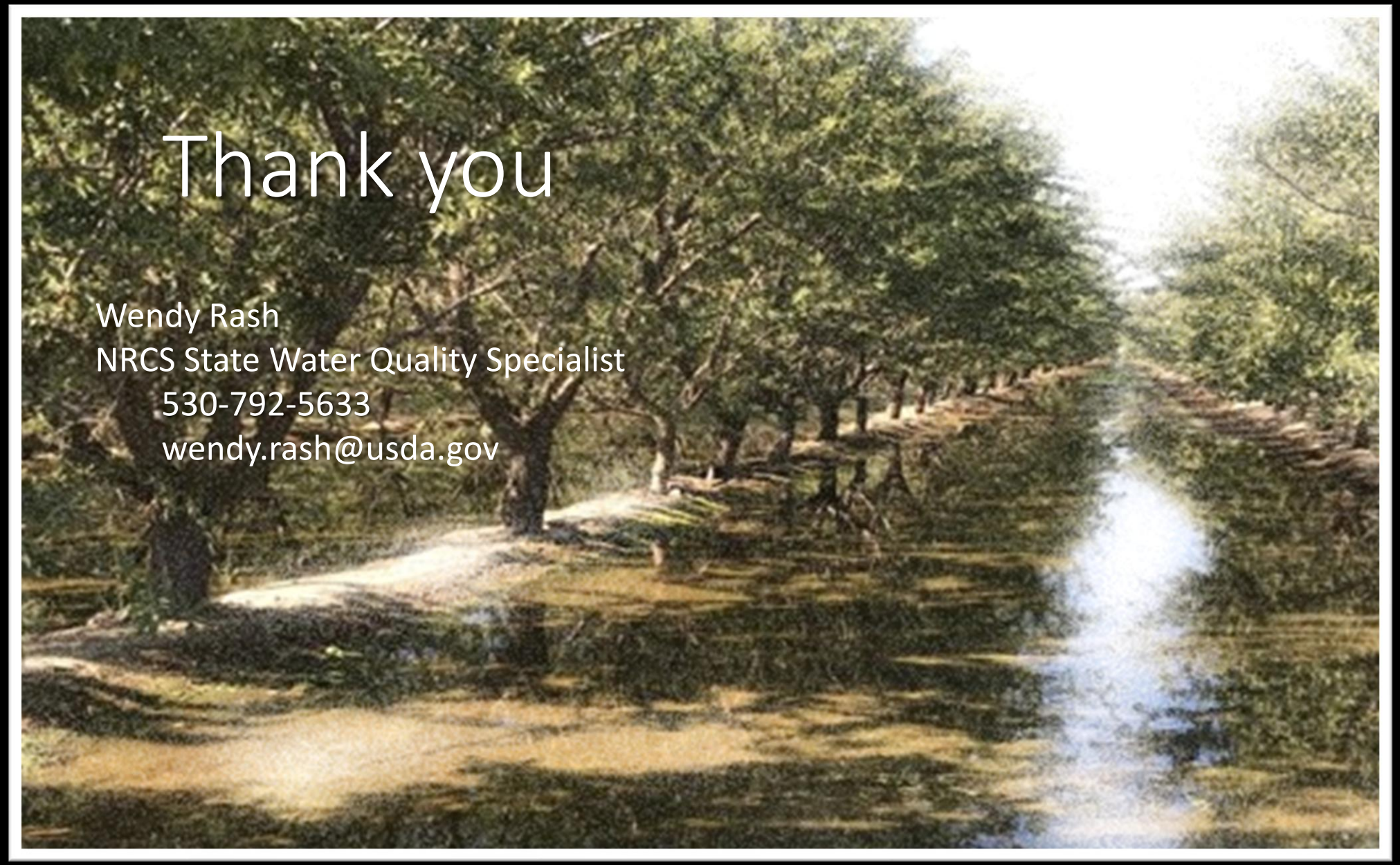
- Total recharge 4,680 ac-ft
- Averaged 1.7 ac-ft/ac
- Ranged from 0.5 – 3.25 ac-ft/ac

Observations

- Requires skilled management
- Labor costs
- Irrigation vs. Recharge: Minimum application
- Cooperation with agencies- water delivery, water rights
- Incentives
  - NRCS payment rates
  - GSA or ID incentives

Next steps


NRCS
Recharge standards approved
Statewide availability through EQIP
Fiscal year 2025
Local
Coordination with districts for water delivery
Farm-level plans coordinated with basin-level plans
Local incentives?


Thank you
Wendy Rash
NRCS State Water Quality Specialist
530-792-5633
wendy.rash@usda.gov

Local Growers and Kelly Huff

DIXON RESOURCE CONSERVATION DISTRICT

LOCAL GROWER PANEL

PRACTICES THAT BENEFIT GROUNDWATER

Thank You!

- *Thomas Bottoms, Tremont Farms*
- *Michael Barrett, Casbar Farms*
- *Craig Gnos, E&H Farms*
- *Nick Edsall, Bullseye Farms*
- *Spencer Bei, Robben Ranch*

LOCAL GROWER PANEL

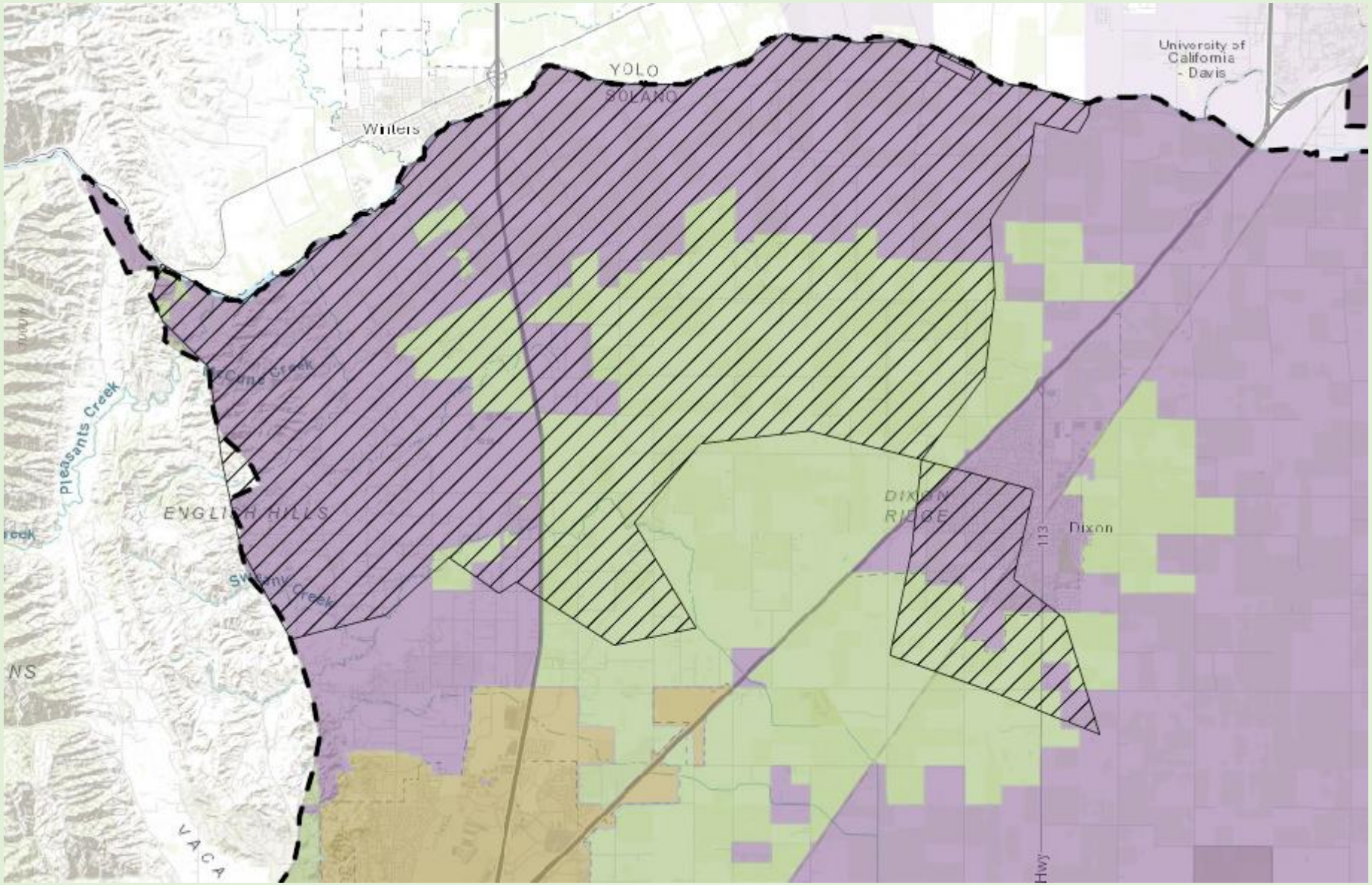
PRACTICES THAT BENEFIT GROUNDWATER

- Must provide benefits to and fit into overall system
- It is not all or nothing
- Can’t add significant new risks or complication to system
- Impacts can’t be evaluated in isolation

Existing standard practices that we should acknowledge have net benefits to groundwater quantity and/or quality?

Flooding of ag fields for recharge is working well in other areas of the state. What are some of the known limitations/concerns here and what are some alternatives that are more locally appropriate?

SOLANO SUBBASIN'S NORTHWEST FOCUS AREA



Solano GSA will be Recharge feasibility analyses in NW Focus Area and Tremont 3 Watershed. What practices and for what crops would you like to see more local information on quantified benefits to groundwater?

Break

VISIT THE REPRESENTATIVES FROM:

- SOLANO RCD-*IRRIGATION EFFICIENCY PROGRAM*
- SOLANO FARM BUREAU-*ONE WATER PROGRAM*
- NATURE CONSERVANCY-*BIRDS RETURN PROGRAM*
- SUSTAINABLE CONSERVATION-*RECHARGE PROGRAMS*

Amy King

SOLANO RESOURCE CONSERVATION DISTRICT

Dr. Helen E. Dahlke

UNIVERSITY OF CALIFORNIA, DAVIS

Q & A

Please take a moment to fill out the workshop evaluation.

Thank you for attending!