Development and Implementation of an Annual Net Groundwater Impact Accounting Framework

Proposed Methodology

ZANJERO
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Agenda

- Scope of Work - Overview
- Purpose of framework
- Proposed methodology
- Discussion

ZANJERO Scope of Work: Overview

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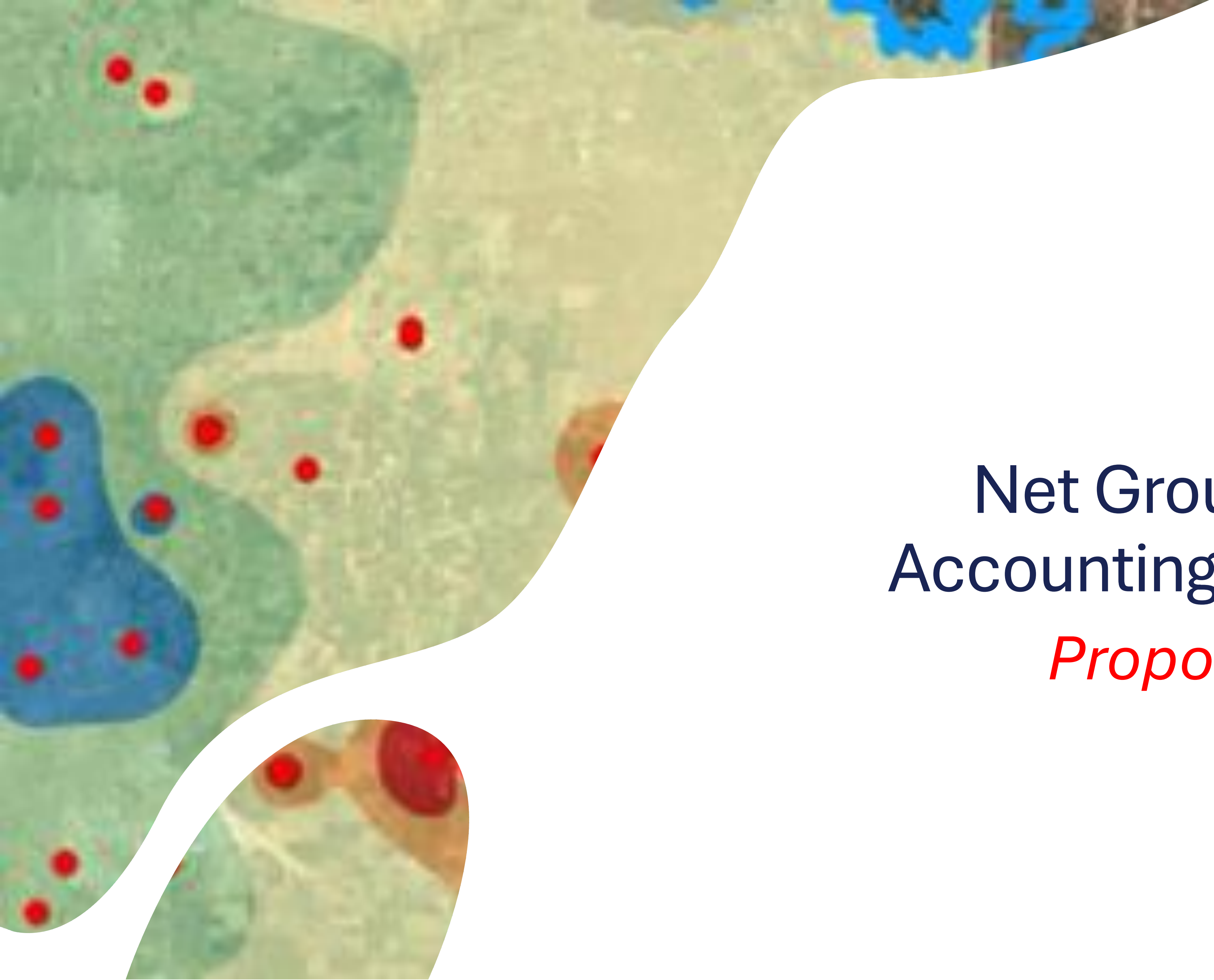
- Task 1 - Finalize Net Groundwater Impact Methodology (Q3 2026)
- Task 2 - Data Collection and Annual Net Groundwater Impact Calculations (Q3 2026)
- Task 3-Reporting (Q4 2026-Q1 2027)
  - By December 1, 2026: Final report calculating Net Groundwater Impact for Water Years 2024 and 2025
  - By March 1, 2027: Final report calculating Net Groundwater Impact for Water Year 2026
- Task 4-Coordination and Meetings (Q2 2026-Q1 2027)



Net Groundwater Accounting Framework

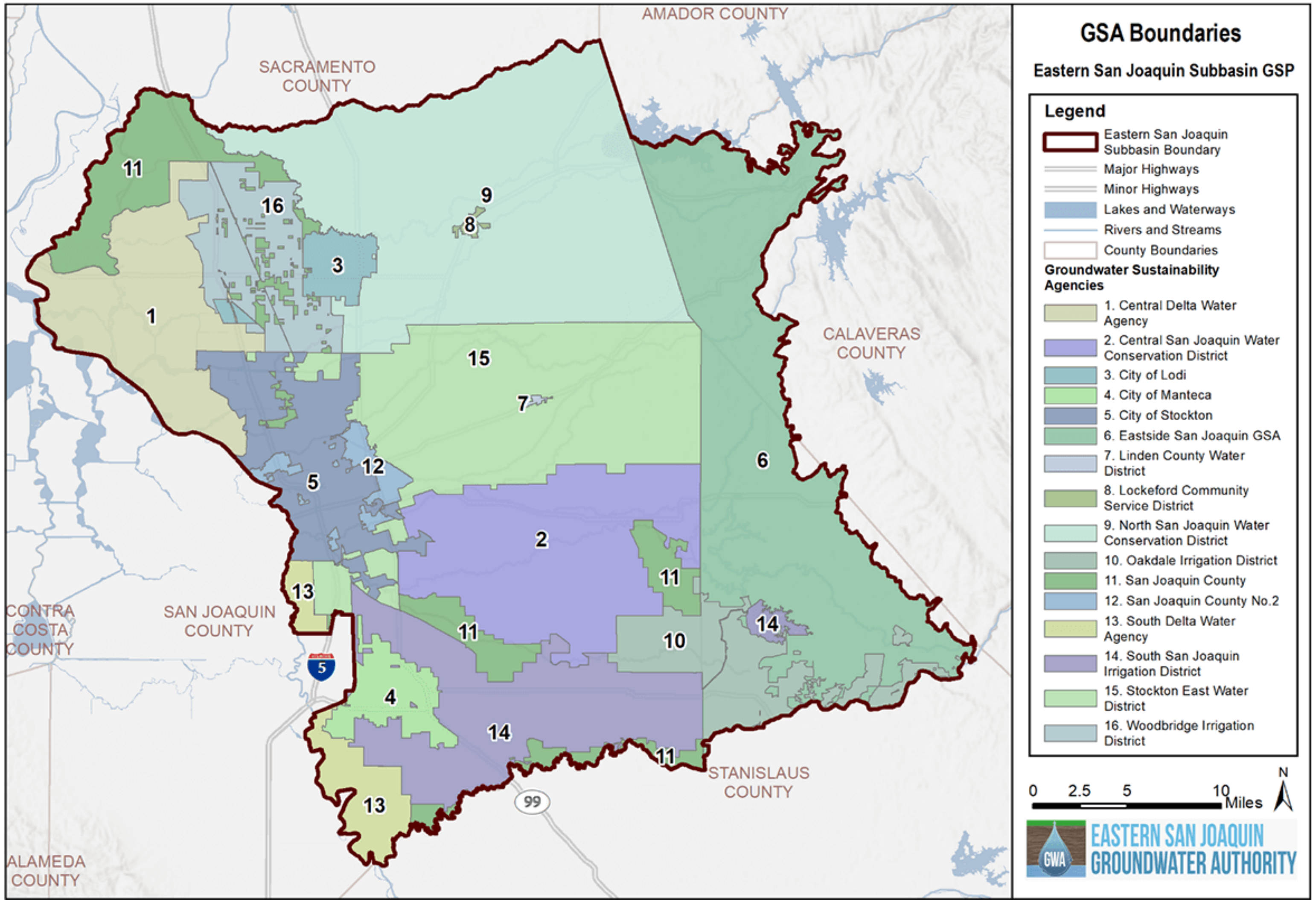
Proposed

Methodology Objective

- Reasonably estimate annual **consumptive use of groundwater pumping** to provide a proxy of each GSA's progress toward Subbasin-wide demand management
- Establish a baseline from which to measure progress in a consistent manner to allow for apple-to-apple evaluation of GSA efforts compared to each other
- Maintain simplicity and repeatability
- Use readily available data from GSAs or public sources
- Assure alignment with measured groundwater level changes

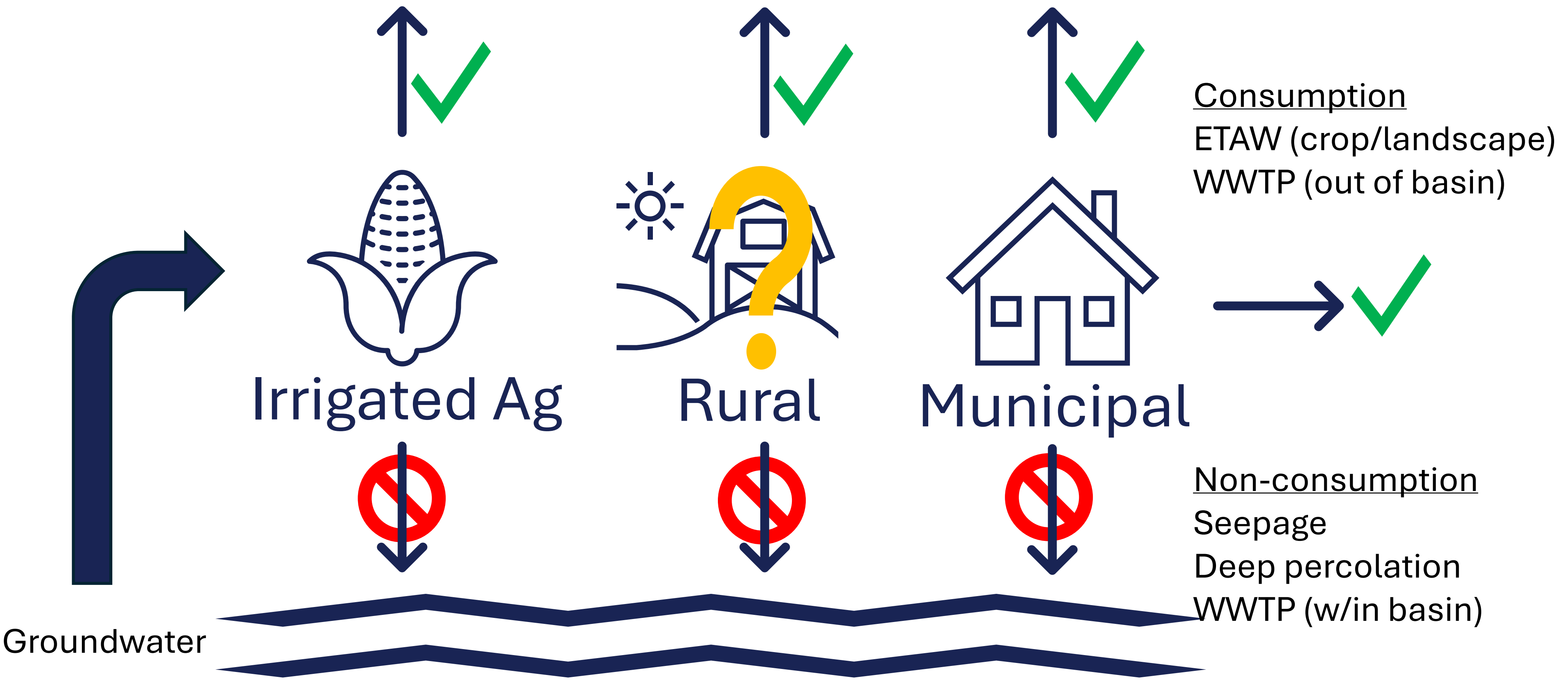
We have 16 (maybe 17) unique GSAs and need to have a method that treats all in a similar fashion

- Varied hydrologic and land use conditions
- Varied responsibilities for demand reduction
- Varied data collection and availability



What do we care about for the framework?

3 primary users of groundwater



Methodology by user group

- Irrigated agriculture
  - GW Consumption = ET – Eff Precip – Surface Water
  - Convert surface water records to ETAW using general efficiency

- Municipal
  - GW Consumption = GW discharge from WWTP + GW from outdoor use
  - Req’d factors (to be estimated based on available data):
    - Ratio of indoor use to outdoor use for year
    - Efficiency of outdoor use

- Rural domestic and self-supplied industry – Do we need this group?
  - Generally, very little change since 2015 SGMA baseline and limited overall volumetric impact on basin
  - Industrial use (e.g. wineries) is relatively low compared to overall use

Annual data needs by user group

- Irrigated agriculture
  - Total ET from Remote Sensing (use OpenET)
  - Effective Precipitation
  - Surface water deliveries
  - Groundwater pumping from previously stored surface water
- Municipal
  - Groundwater production into potable system
  - Surface water diversions into potable system
  - Wastewater inflow (for ratio) for WWTP with surface discharge

Effective Precipitation

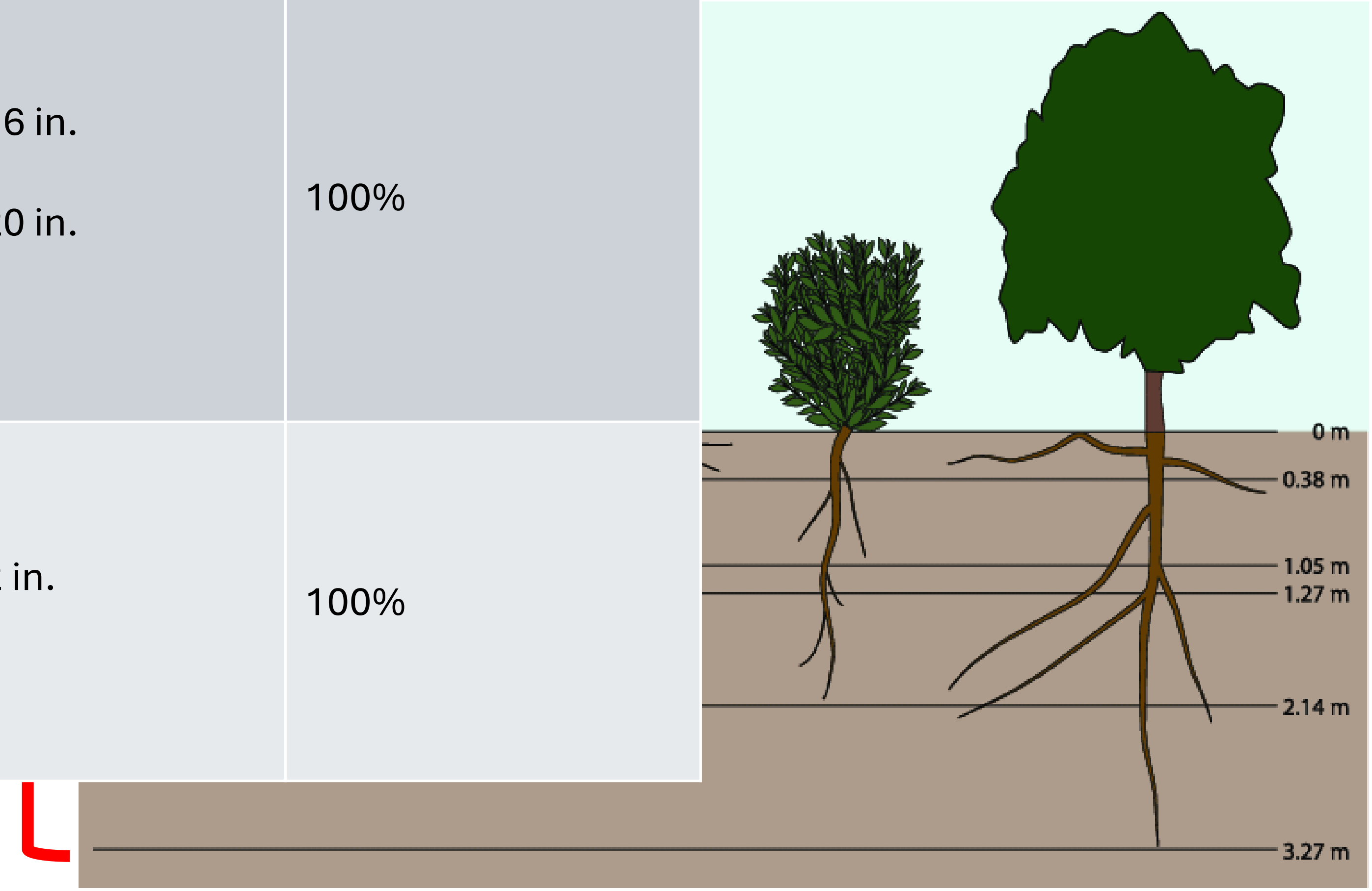
For irrigated agriculture users

Effective Precipitation (P_{eff})

- Formula: *GW Consumption = ET –* P_{eff} *– Surface Water*
- P_{eff} benefits crops and meets a portion of ET
  - The benefit can vary by crop type, management practice, time of year and overall quantity
- For this framework:
  - One rainfall value will be used for each year's calculation (with wet/dry season rule)
  - Separate P_{eff} values will be used for "permanent" vs "annual" crop
- Objective is to err on the side of "too much" effective precipitation for this framework. Individual GSAs may use more localized data for purposes of GSA-specific demand management program implementation

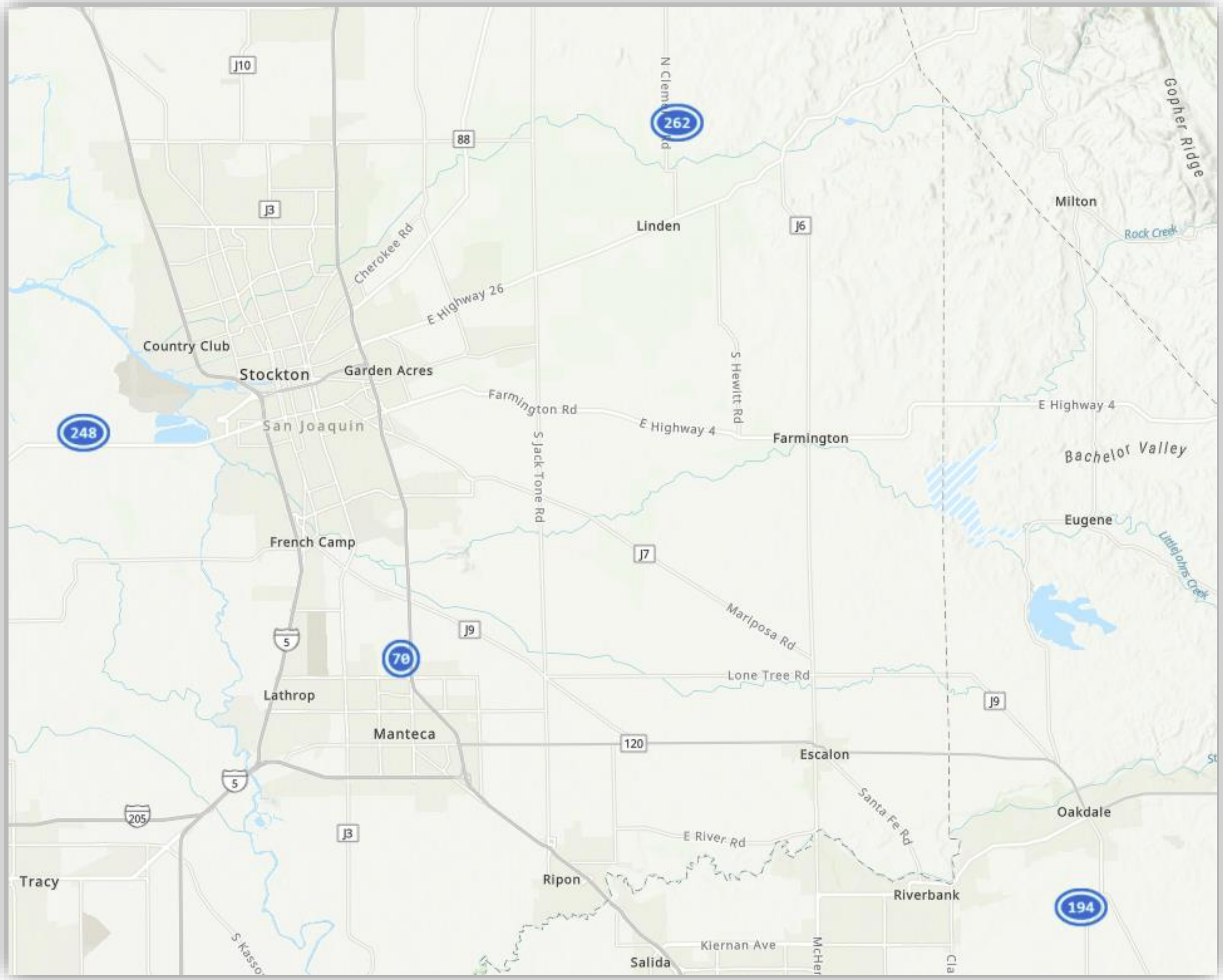
Concept for Effective Precipitation Rules

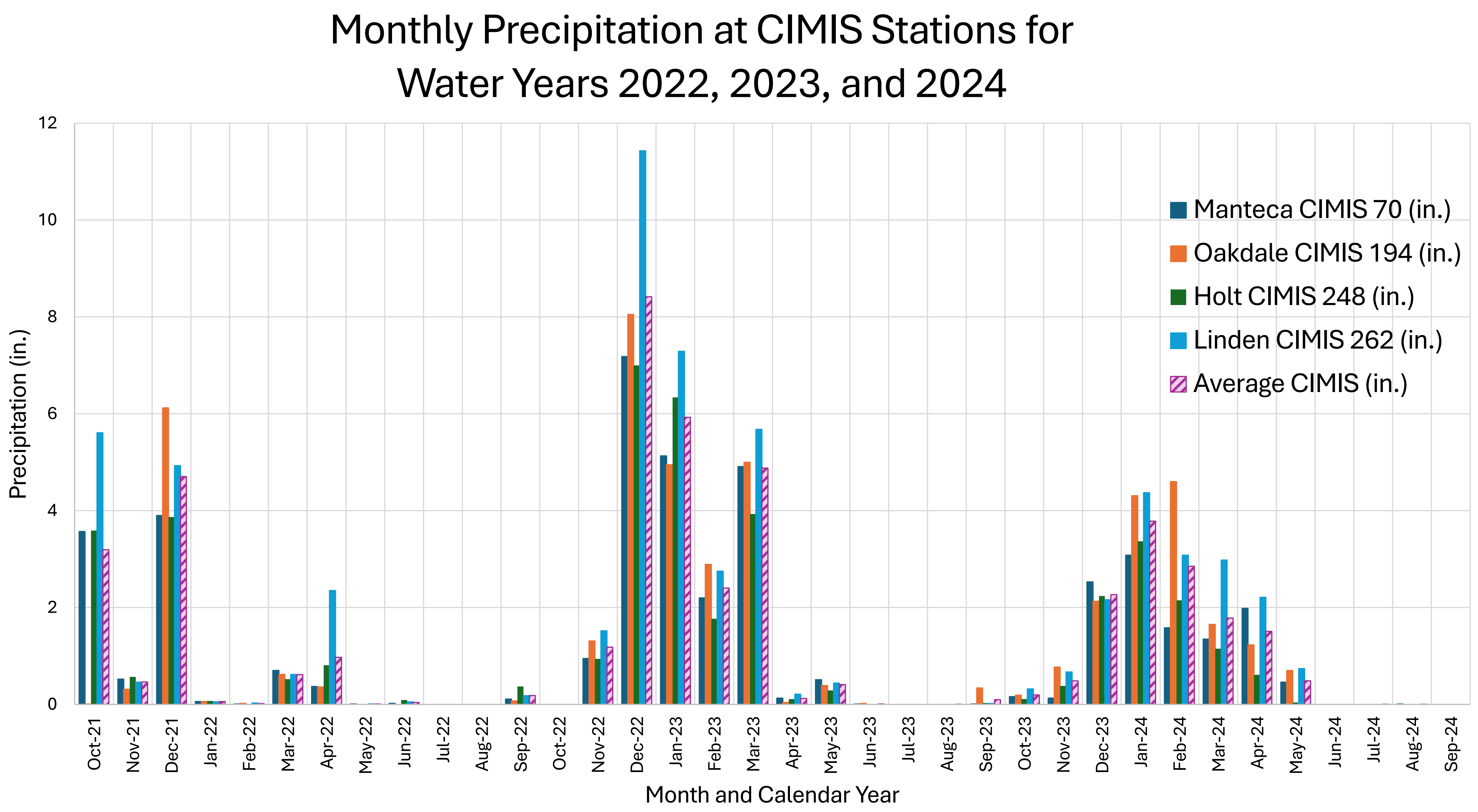
Category	Wet Season (October – March)	Dry Season (April – September)
Permanent Crops	• Precipitation up to 10 in. ○ 100% • Precipitation between 10 in. and 16 in. ○ 75% • Precipitation between 16 in. and 20 in. ○ 50% • Precipitation above 20 in. ○ 0%	100%
Annual Crops	• Precipitation up to 8 in. ○ 100% • Precipitation between 8 in. and 12 in. ○ 50% • Precipitation above 12 in. ○ 0%	100%



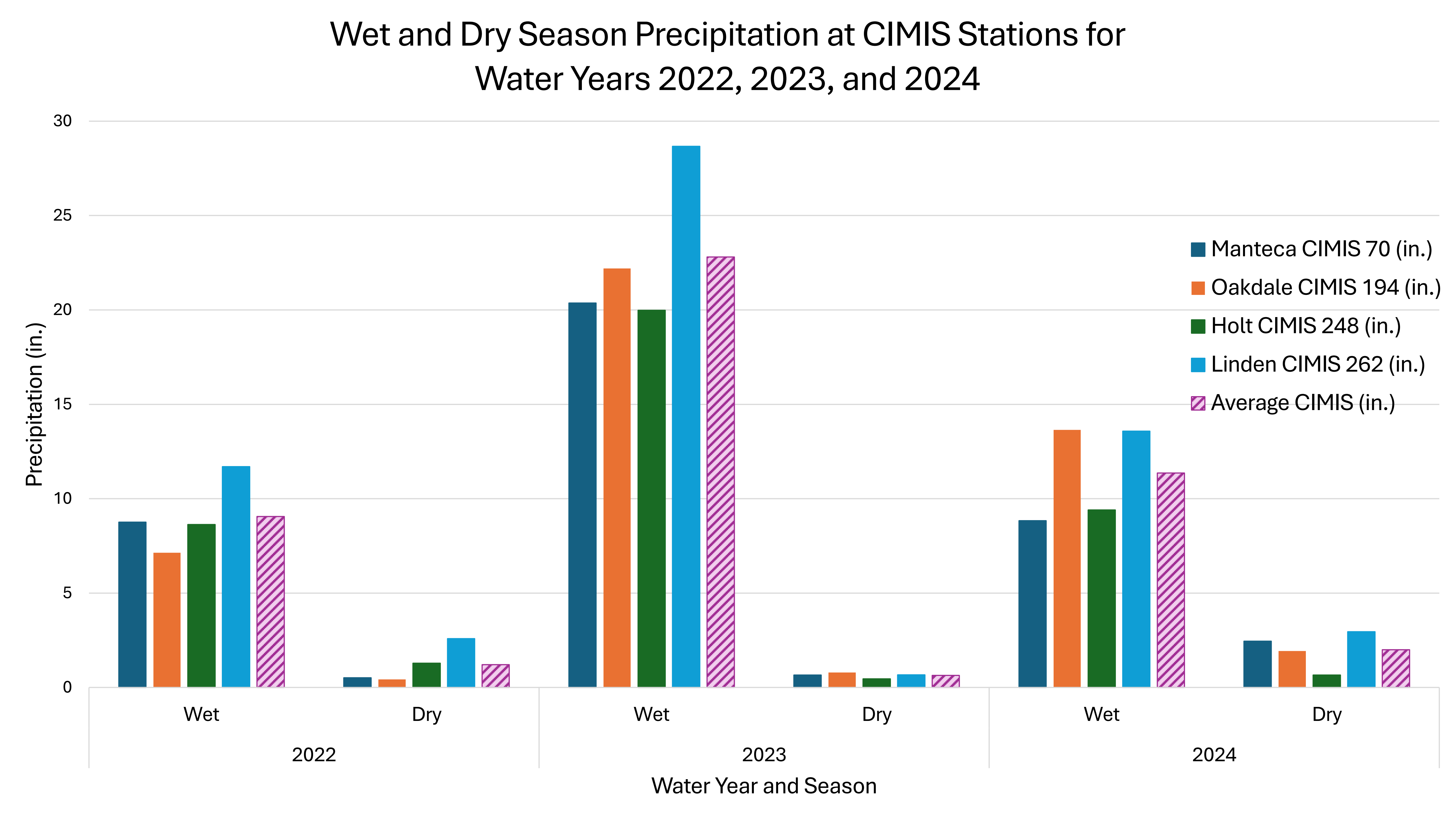
Proposed CIMIS Stations

- 70: Manteca
- 194: Oakdale
- 248: Holt
- 262: Linden





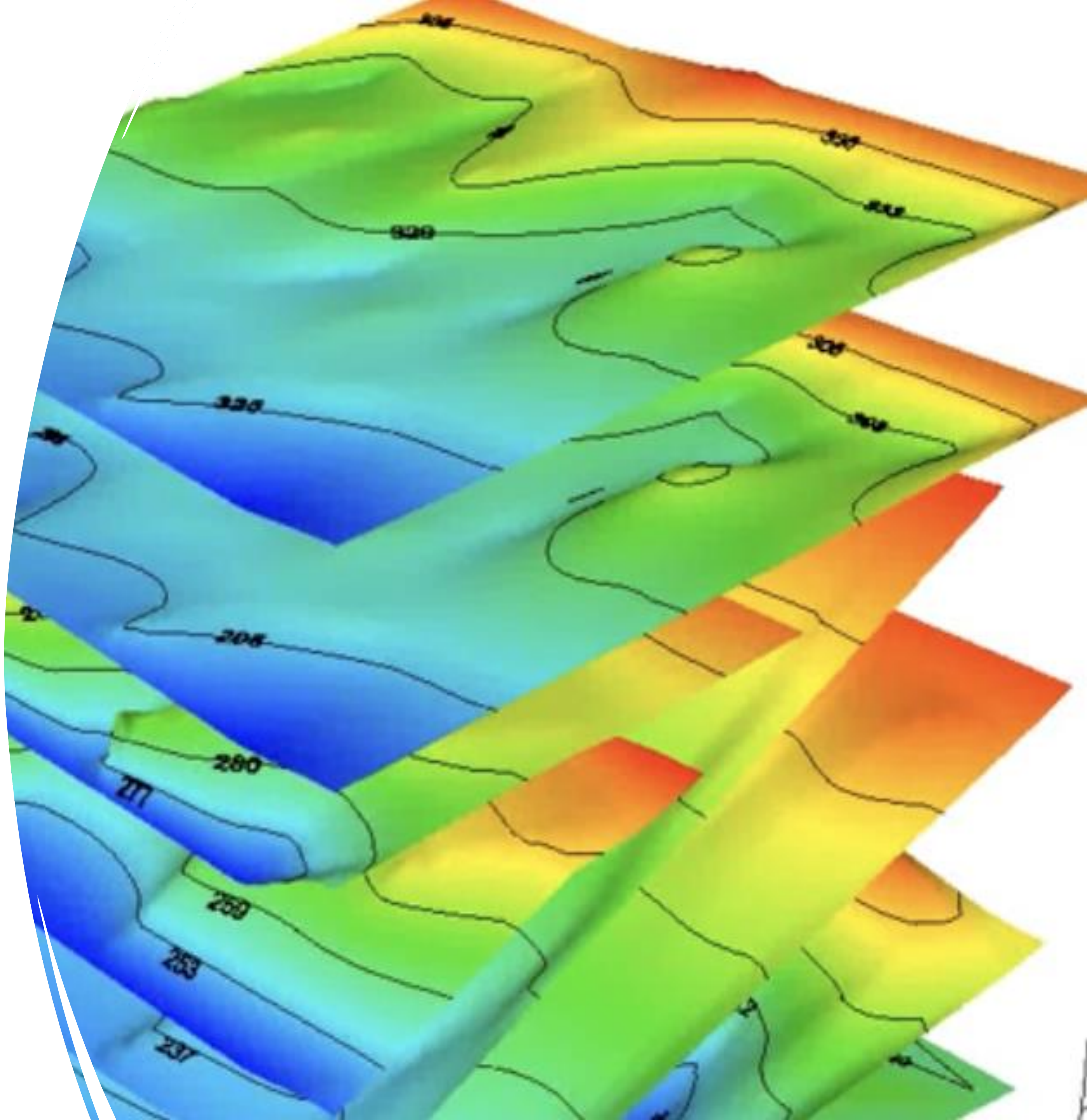
Monthly Precipitation at CIMIS Stations for Water Years 2022, 2023, and 2024
Precipitation (in.)
Month and Calendar Year
0
2
4
6
8
10
12
Oct-21
Nov-21
Dec-21
Jan-22
Feb-22
Mar-22
Apr-22
May-22
Jun-22
Jul-22
Aug-22
Sep-22
Oct-22
Nov-22
Dec-22
Jan-23
Feb-23
Mar-23
Apr-23
May-23
Jun-23
Jul-23
Aug-23
Sep-23
Oct-23
Nov-23
Dec-23
Jan-24
Feb-24
Mar-24
Apr-24
May-24
Jun-24
Jul-24
Aug-24
Sep-24
Manteca CIMIS 70 (in.)
Oakdale CIMIS 194 (in.)
Holt CIMIS 248 (in.)
Linden CIMIS 262 (in.)
Average CIMIS (in.)


Wet and Dry Season Precipitation at CIMIS Stations for Water Years 2022, 2023, and 2024
Precipitation (in.)
0
5
10
15
20
25
30
Manteca CIMIS 70 (in.)
Oakdale CIMIS 194 (in.)
Holt CIMIS 248 (in.)
Linden CIMIS 262 (in.)
Average CIMIS (in.)
Wet
Dry
2022
Wet
Dry
2023
Wet
Dry
2024
Water Year and Season

Example Results for P_{eff}

Water Year	Season	Precipitation (in.)	Permanent Crops (in.)	Annual Crops (in.)
2022	Wet	9.1	9.1 x 100% = 9.1	(8 x 100%) + (1.1 x 50%) = 8.6
	Dry	1.2	1.2 x 100% = 1.2	1.2 x 100% = 1.2
	Total	***10.3***	***10.3***	***9.8***
2023	Wet	22.8	(10 x 100%) + (6 x 75%) + (4 x 50%) + (2.8 x 0%) = 16.4	(8 x 100%) + (4 x 50%) + (12.8 x 0%) = 10.0
	Dry	0.6	0.6 x 100% = 0.6	0.6 x 100% = 0.6
	Total	***24.5***	***17.0***	***10.6***
2024	Wet	11.4	(10 x 100%) + (1.4 x 75%) = 11.1	(8 x 100%) + (4 x 50%) + (1.4 x 0%) = 10.0
	Dry	2.0	2.0 x 100% = 2.0	2.0 x 100% = 2.0
	Total	***13.4***	***13.1***	***12.0***

Example of Methodology that would be used for 2024, 2025 and 2026 framework baseline



Example results

- Irrigated agriculture:
    - ET from OpenET = **10,000 ac-ft** (for 3,000 acres in GSA irrigated field footprint)
    - 2,000 acres is permanent and 1,000 acres is annual
    - Calculate Peff = (2,000 ac X 17 in.) + (1,000 ac X 10 in.) = 2,833 + 833 = 3,666 ac-ft
    - Surface water = 2,000 ac-ft at 80% avg efficiency = 1,600 ac-ft
    - GW Consumption = 10,000 – 3,666 – 1,600 = **4,734 ac-ft**
- Municipal:
    - Total pumping = **2,000 ac-ft** GW + 6,000 ac-ft SW = 8,000 ac-ft (ratio of 25/75)
    - WWTP inflow = 4,000 ac-ft = 1,000 ac-ft from groundwater
    - Indoor/outdoor use ratio: 50/50 = 4,000 ac-ft indoor and 4,000 ac-ft outdoor
        - 60% Outdoor efficiency: 4,000 ac-ft X 60% = 2,400 ac-ft
        - GW outdoor = 25% X 2,400 ac-ft = 600 ac-ft
    - GW Consumption = 1,000 ac-ft + 600 ac-ft = **1,600 ac-ft**

Discussion and Next Steps