# Recommendations for Water Year 2024 Groundwater Allocation

GREATER KAWEAH GSA

TAC PRESENTATION SEPTEMBER 21, 2023

# Measuring Groundwater Usage
## *Pumped (meters) vs. Consumption (ET)*

### MEASURING GROUNDWATER PUMPED

Pros:

- Isolates groundwater usage from other sources of applied water
- Better understanding of location and level physical water is pumped (if well information available)

Cons:

- Groundwater usage relies on estimations of net pumped water which includes:
  - Evaporation of Pumped Water
  - Return flows NOT consumed by a crop
- Expensive and heavy administrative lift to implement and track, and meters can be manipulated

### MEASURING GROUNDWATER CONSUMED (ET)

Pros:

- Removes return flow and evaporation assumptions
- Cost effective and easily implemented over a large area

Cons:

- Requires additional accounting of other applied water sources received by a crop to determine groundwater usage, BUT surface water and precip data is measured and readily available

## Core Principles of ET Based Groundwater usage Measurement:

1. ET measures Total Consumption including all sources of water received by a crop and cannot directly measure Groundwater Consumed

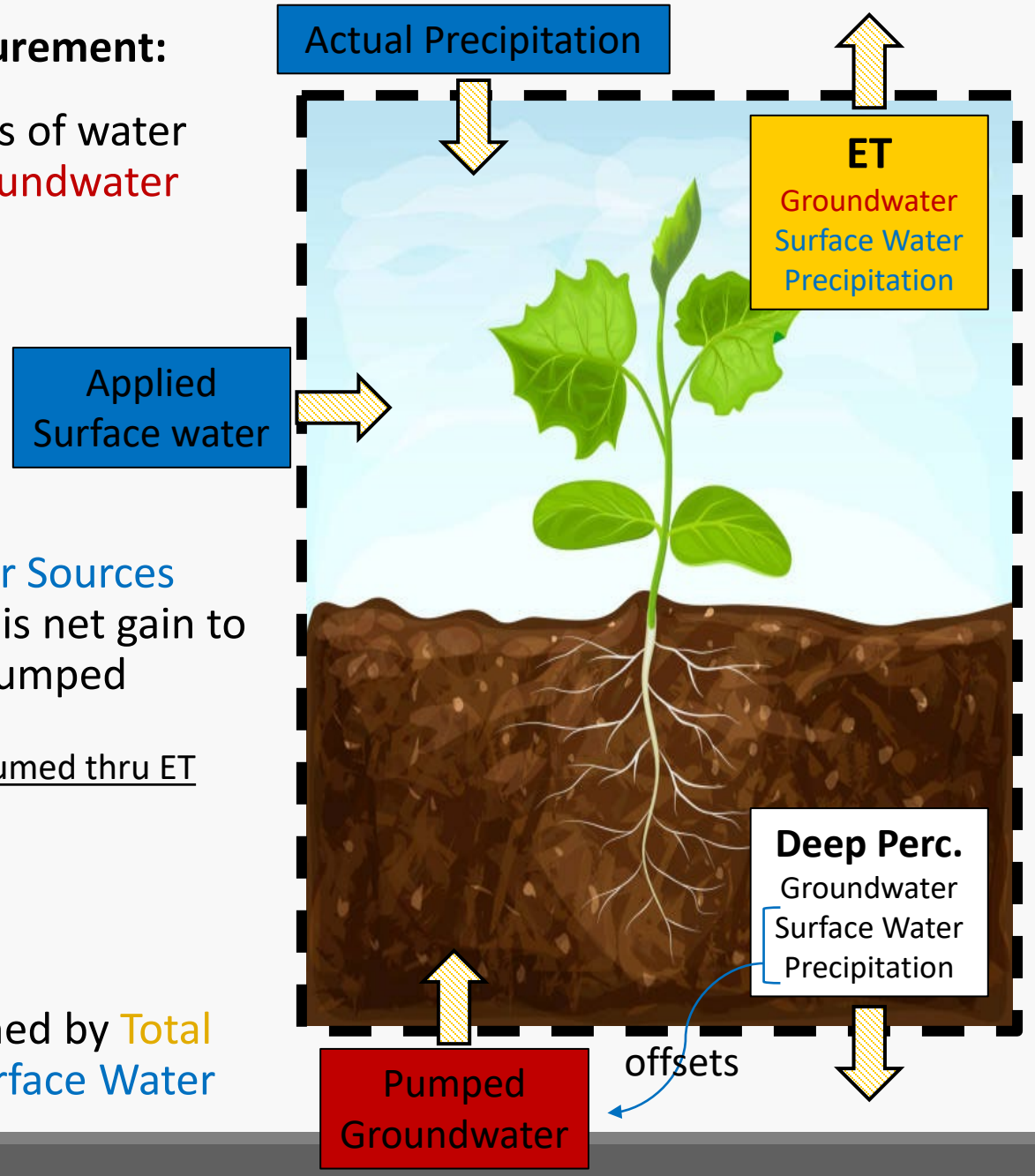
   Sources of received water
   - Actual Precipitation
   - Applied Surface Water
   - Pumped Groundwater

2. It can be reasonably assumed that Non-groundwater Sources received by a crop that is not consumed through ET is net gain to the groundwater budget and offsets groundwater pumped

   Portion of non-groundwater sources received by water not consumed thru ET

   **Deep Percolation of:**
   - Actual Precipitation
   - Applied Surface Water

3. Therefore, Consumed groundwater can be determined by Total Consumption less Actual Precipitation & Applied Surface Water



## Determining Groundwater Consumption Using ET

1. Start with **Total ET Consumption**

**ET**
Groundwater
Surface Water
Precipitation

2. Credit **Non- Groundwater Sources** Received by Crops

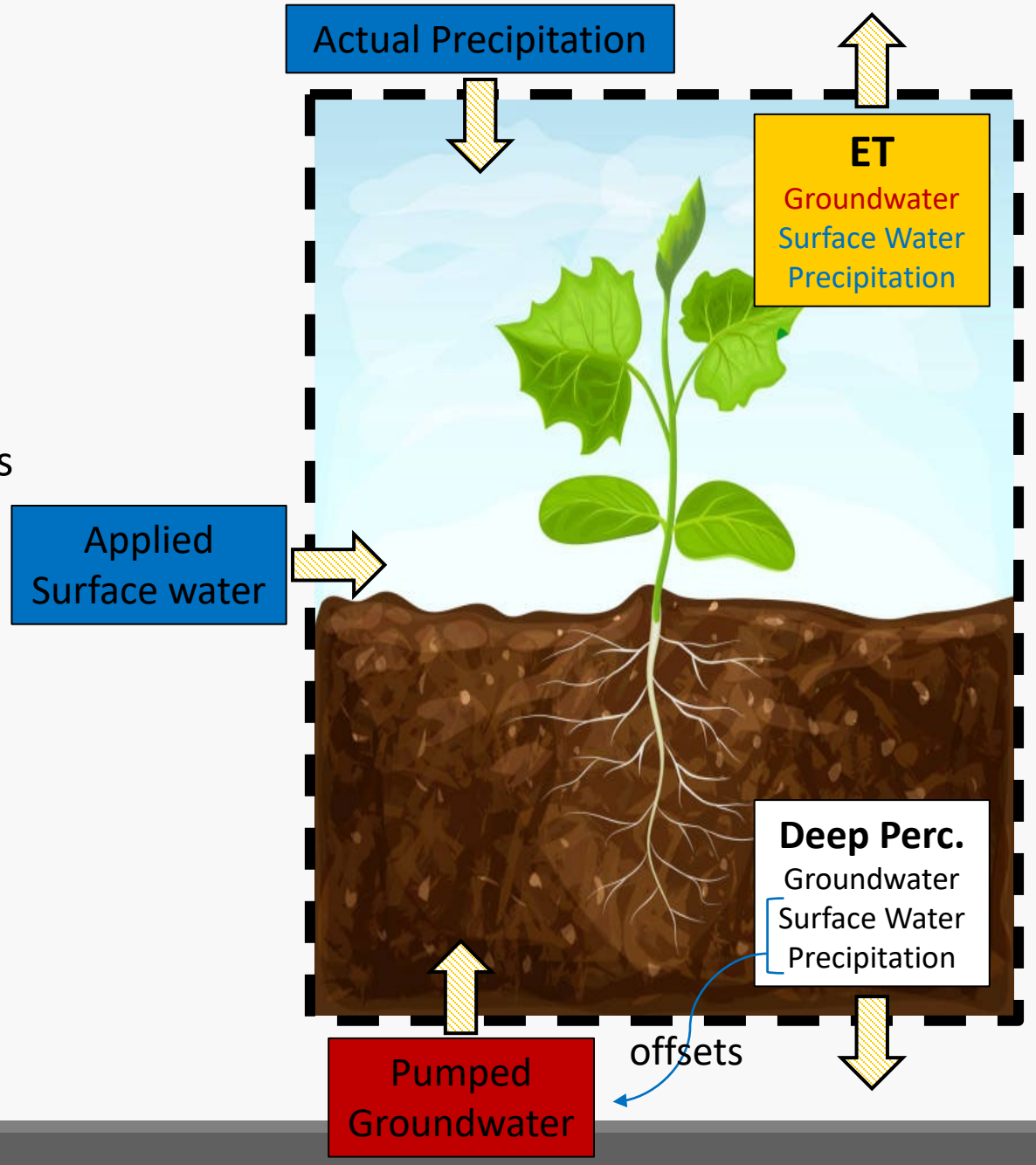
Actual Precipitation

Applied
Surface water

3. Remaining ET Consumption equals Groundwater Consumed

**Groundwater Consumed** =

**Total ET** – **Actual Precipitation** – **Applied Surface Water**



# Basis for Groundwater Allocations

**Native Sustainable Yield [*GKGSA R&Rs Section 4.03(a)1(A)*]**

*"Long-term average natural channel loss within the natural tributaries of the Kaweah River and the calculated underflow from the Sierra Nevada Mountains"*

**Total Precipitation [*GKGSA R&Rs Section 4.03(a)1(B)*]**

*"Actual precipitation to have occurred within the Water Year allocation year, to be calculated and reported one calendar month after actual rainfall occurs"*

**Temporary Tier 1 & Tier 2 [*GKGSA R&Rs Section 4.03(b)*]**

*"..will ramp-down pumping overtime calculated by a percentage of total overdraft as follows"*

# Native Sustainable Yield

Native Sustainable Yield is derived from the Appendix 3- Water Accounting Framework of the Kaweah Subbasin Coordination Agreement.

The Total Native Sustainable Yield supply is allocated to the 219,440 gross acreage of the Greater Kaweah GSA.

Not all components of the Water Accounting Framework are consistent using an ET Computation Model.

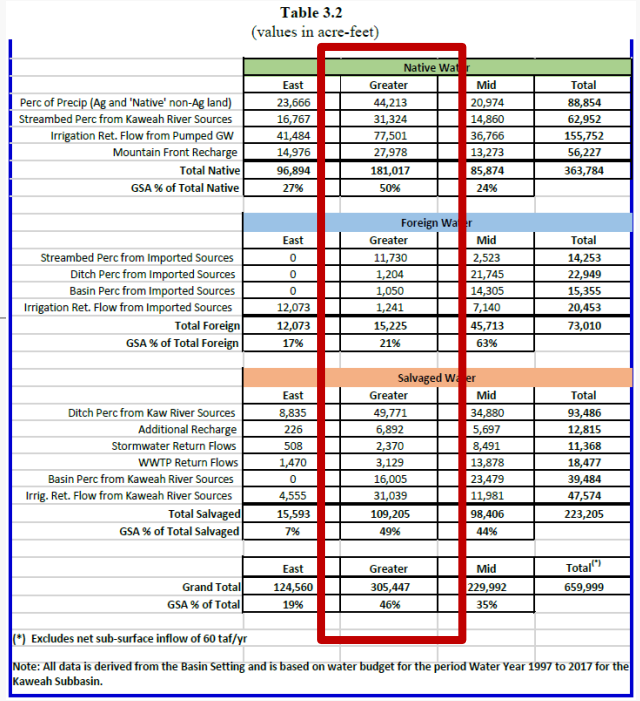


**Table 3.2**
(values in acre-feet)

| | Native Water | | | |
|---|---|---|---|---|
| | East | Greater | Mid | Total |
| Perc of Precip (Ag and 'Native' non-Ag land) | 23,666 | 44,213 | 20,974 | 88,854 |
| Streambed Perc from Kaweah River Sources | 16,767 | 31,324 | 14,860 | 62,952 |
| Irrigation Ret. Flow from Pumped GW | 41,484 | 77,501 | 36,766 | 155,752 |
| Mountain Front Recharge | 14,976 | 27,978 | 13,273 | 56,227 |
| **Total Native** | **96,894** | **181,017** | **85,874** | **363,784** |
| **GSA % of Total Native** | **27%** | **50%** | **24%** | |

| | Foreign Water | | | |
|---|---|---|---|---|
| | East | Greater | Mid | Total |
| Streambed Perc from Imported Sources | 0 | 11,730 | 2,523 | 14,253 |
| Ditch Perc from Imported Sources | 0 | 1,204 | 21,745 | 22,949 |
| Basin Perc from Imported Sources | 0 | 1,050 | 14,305 | 15,355 |
| Irrigation Ret. Flow from Imported Sources | 12,073 | 1,241 | 7,140 | 20,453 |
| **Total Foreign** | **12,073** | **15,225** | **45,713** | **73,010** |
| **GSA % of Total Foreign** | **17%** | **21%** | **63%** | |

| | Salvaged Water | | | |
|---|---|---|---|---|
| | East | Greater | Mid | Total |
| Ditch Perc from Kaw River Sources | 8,835 | 49,771 | 34,880 | 93,486 |
| Additional Recharge | 226 | 6,892 | 5,697 | 12,815 |
| Stormwater Return Flows | 508 | 2,370 | 8,491 | 11,368 |
| WWTP Return Flows | 1,470 | 3,129 | 13,878 | 18,477 |
| Basin Perc from Kaweah River Sources | 0 | 16,005 | 23,479 | 39,484 |
| Irrig. Ret. Flow from Kaweah River Sources | 4,555 | 31,039 | 11,981 | 47,574 |
| **Total Salvaged** | **15,593** | **109,205** | **98,406** | **223,205** |
| **GSA % of Total Salvaged** | **7%** | **49%** | **44%** | |

| | East | Greater | Mid | Total(*) |
|---|---|---|---|---|
| **Grand Total** | **124,560** | **305,447** | **229,992** | **659,999** |
| **GSA % of Total** | **19%** | **46%** | **35%** | |

(*) Excludes net sub-surface inflow of 60 taf/yr

Note: All data is derived from the Basin Setting and is based on water budget for the period Water Year 1997 to 2017 for the Kaweah Subbasin.

- **Percolation of Precipitation -** ET consumption only measures loses through evaporation or transpiration therefore actual precipitation is credited separately and the portion that is not consumed would offset groundwater pumping.

- **Imported** – Imported water is not native to the subbasin and is purchased and credited to owners separately from NSY.

- **Salvaged -** Salvaged water reflects return flows of previously appropriated surface water supplies that has been credited separately and the portion that is not consumed would represent return flows that offset groundwater pumping.

# Native Sustainable Yield

Components of Groundwater Inflow that are incorporated into Native Sustainable Yield Allocation include sources only from the Native category except for Percolation of Rainfall.

**Table 3.1**

Components of Groundwater Inflow

Native

- Percolation from rainfall
- Streambed percolation (natural channels) from Kaweah River watershed sources
- Agricultural land irrigation returns from pumped groundwater
- Mountain front recharge

Foreign

- Streambed percolation from imported sources
- Basin recharge from imported sources
- Ditch percolation from imported sources
- Agricultural land irrigation returns from imported sources

Salvaged

- Ditch percolation from previously appropriated Kaweah River sources
- Additional ditch/field recharge from over-irrigation
- Captured storm water returns
- Wastewater treatment plant returns
- Basin percolation from previously stored Kaweah River sources
- Agricultural land irrigation returns from Kaweah River watershed sources

*Except for mountain front recharge, sub-surface inflows in and out of the Subbasin are excluded from this accounting methodology and no ownership claims are asserted nor disavowed per this methodology.

# Applicable Components of the Water Accounting Framework under a Consumptive Model

Total Native Sustainable Yield Supply within the Greater Kaweah GSA

**136,803 AF**

Allocated over 219,440 gross acres of the GKGSA amounts to

**0.62 AF/acre**

| Native | Greater | Description |
|---|---|---|
| ~~Perc of Percip~~ | ~~44,213~~ | *Total Precip Credited Seperately* |
| Kaweah River Streambed Perc | 31,324 | *Native Supply* |
| Pump GW Return Flow | 77,501 | *Not debited in Consumptive Model* |
| Montain Front Recharge | 27,978 | *Native Supply* |
| **Native Total** | **136,803** | ***AF*** |

| Imported | Greater | Description |
|---|---|---|
| ~~Imported Streambed Perc~~ | ~~11,730~~ | *Non-native. Credit as SW to Owner* |
| ~~Imported Ditch Perc~~ | ~~1,204~~ | *Non-native. Credit as SW to Owner* |
| ~~Imported Basin Perc~~ | ~~1,050~~ | *Non-native. Credit as SW to Owner* |
| ~~Imported Irrigation Return Flow~~ | ~~1,241~~ | *Non-native. Credit as SW to Owner* |
| **Imported Total** | - | |

| Salavage | Greater | Description |
|---|---|---|
| ~~Kaweah River Ditch Perc~~ | ~~49,771~~ | *Previously appropiated Kaweah River Source* |
| ~~Additional Recharge~~ | ~~6,892~~ | *Originated as SW Credit to Owner* |
| ~~Stormwater Return Flow~~ | ~~2,370~~ | *Total Precip Credited Seperately* |
| ~~WWTP Return Flow~~ | ~~3,129~~ | *GW Origin* |
| ~~Kaweah River Basin Perc~~ | ~~16,005~~ | *Originated as SW Credit to Owner* |
| ~~Kaweah River Irrigation Return Flow~~ | ~~31,039~~ | *Originated as SW Credit to Owner* |
| **Salavage Total** | **-** | *AF* |

| | | |
|---|---|---|
| **Native Sustainable Yield Total** | **136,803** | ***AF*** |
| GKGSA Gross Acres | 219,440 | *Acres* |
| **Native Sustainable Yield Allocation** | **0.62** | ***AF/acre*** |

# Total Precipitation

- Total Precipitation is the actual precipitation to have occurred within the Water Year allocation year, to be calculated and reported one calendar month after actual rainfall occurs.

- Land IQ reports Actual Precipitation on a field-by-field basis. Actual Precipitation will be calculated and reported to Water Dashboard accounts monthly.

- The 1997-2017 Kaweah Subbasin 20-year average amounts to 9.7 inches or 0.81 Acre-Feet per Acre per the Kaweah Subbasin Setting.

# Temporary Tier 1 & Tier 2 Allocations

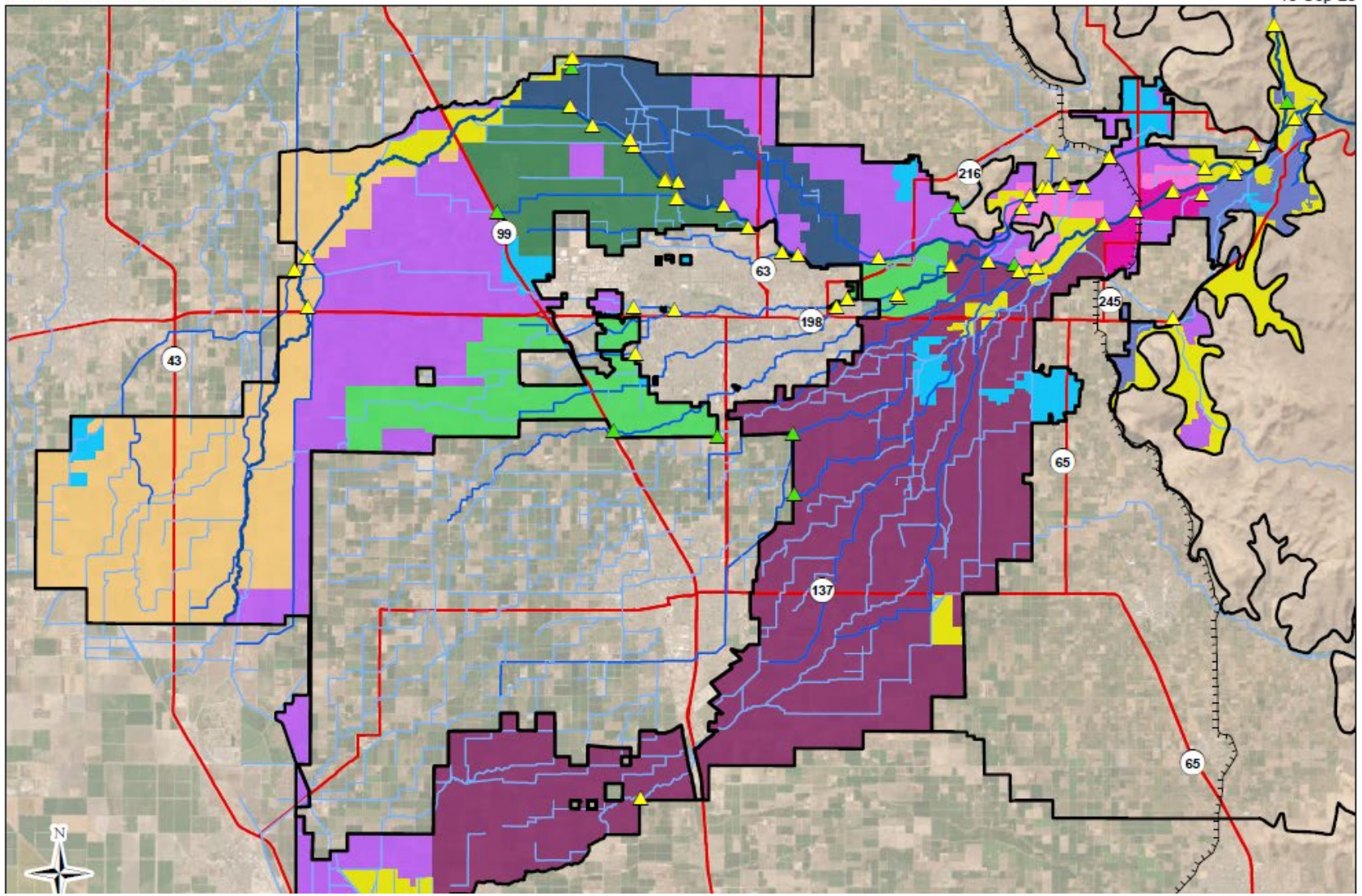
Temporary Tier 1 & Tier 2 ramp-downs allowable groundwater overdraft pumping overtime calculated by a percentage of total overdraft.

The allocations are only made available to 161,100 irrigated acres within the Greater Kaweah Management Area.

| Rampdown Schedule | | | |
|---|---|---|---|
| Water Years | Tier 1 | Tier 2 | Total Allowable |
| 2023-2025 | 40% | 50% | 90% |
| 2026-2030 | 40% | 30% | 70% |
| 2031-2035 | 20% | 20% | 40% |
| 2036-2040 | 20% | 0% | 20% |

## Greater Kaweah GSA

13-Sep-23




## Water Budget Analysis

### Map Features

Water Budget Subregion (WBS) Group

- Upper Kaweah River
- Upper Lower Kaweah River
- Upper St Johns River
- North of Lower St Johns River
- South of Lower St Johns River
- Downstream of Lower Kaweah River
- South of Lower Kaweah River
- Kings River / Cross Creek Area
- Groundwater Only
- Community
- Native
- Kaweah Subbasin GSA Boundary
- Diversion, Riparian Pump, or Gage
- Ungaged Outflow (Inter-GSA or Intra-GSA)
- Major River/Stream
- Major Surface Delivery Channel
- Minor Surface Delivery Channel
- Friant-Kern Canal
- State Highway

# Overdraft Scenarios for Temporary Water Allocation

To determining overdraft for the purpose of allocation Temporary Tier 1 & Tier 2 allocations, the Greater Kaweah GSA Board of Directors directed staff to calculate overdraft for the purpose of Temporary Water allocation independent of Surface Water Deliveries within the GSA.

Determining overdraft based on the circumstances of no surface water provides a better representation of overdraft that would occur on irrigated lands that do not have access to surface water, as well as overdraft that would occur on irrigated lands with access to surface water in a drought year when little to no surface water is available to offset crop demand.

The following calculation was used to determine overdraft for the purpose of Tier 1 & Tier 2 Temporary Water Allocations in the Greater Kaweah GSA:

$$[Overdraft_{\text{irr. acreage}}] = [Total\ Consumptive\ Use_{\text{irr. Acreage}}] - [NSY_{\text{irr. acreage}}] - [Total\ Precipitation_{\text{irr. acreage}}]$$

**The evaluation criteria was based the 24- year averages from the water year 1998/99 through water year 2021/22.*

# Overdraft Scenarios for Temporary Water Allocation

- **Irrigated Acreage that receives Temporary Allocation**
  - ✓ 161,100 acres
- **Total Consumption on Irr. Acreage**
  - *Average from 1998/99 to 2021/22*
  - ✓ 454,000 acre-feet
- **Native Sustainable Yield Allocation for Irr. Acreage**
  - *0.65 AF/acre * 161,100 acres*
  - ✓ 99,882 acre-feet
- **Total Precipitation for Irr. Acreage**
  - *0.81 AF/acre * 161,100 acres*
  - ✓ 130,230 acre-feet
- **Average Irr. Acreage Overdraft w/o Surface Water**
  - *[454,000 AF] – [99,882 AF] – [130,230 AF]*
  - ✓ 223,888 acre-feet

| Irrigated Acreage | Total Consumption (AF) | NSY (AF) | Total Precipitation (AF) | Overdraft (AF) |
|---|---|---|---|---|
| 161,100 | 454,000 | 99,882 | 130,230 | 223,888 |

| Water Year 2024 Allocatable Temporary Water | | | |
|---|---|---|---|
| **Tier** | **% Rampdown** | **Acre-Feet** | **AF/Acre** |
| Tier 1 | 40% | 89,555 | 0.56 |
| Tier 2 | 50% | 111,944 | 0.69 |
| **Total** | **90%** | **201,499** | **1.25** |

# Summary Water Year 2024 Allocation

| Category | 2024 WY Allocation | |
|---|---|---|
| NSY | 0.62 | AF/acre |
| Total Precip* | N/A | AF/acre |
| Tier 1 | 0.56 | AF/acre |
| Tier 2 | 0.69 | AF/acre |
| | | |
| **Total** | **1.87** | **AF/acre** |

*Total Precipitation is the **Actual Precipitation** to have occurred within the Water Year allocation year, to be calculated and reported one calendar month after actual rainfall occurs. Credits to offset ET Consumption during the Water Year can be estimated from the 1997/98 through 2017/18 water years 20-year average amounting to **0.81 AF/acre**.