# SECTION 2

## 2.4. Water Budget

Detailed water budget information is documented in *Chapter 2.3* of the *Subbasin Setting*. These budgets are derived from the Tule Subbasin Groundwater Flow Model, covering the period from Water Year (WY) 1987 through WY2024.

This section summarizes inflows and outflows components for the Subbasin and the PID GSA. The water budgets for the Subbasin and PID are divided into a surface water system water budget and a groundwater system water budget. Water budget tables are highly detailed and identify inflow and outflow components by source of water (e.g., evapotranspiration (ET) and deep percolation from Tule River). Water budget results for the Subbasin are presented in *Tables 2-2* and 2-3 in the *Subbasin Setting*. PID water budget results in included in this document and presented in **Tables 2-5** through **2-7** with a schematic of the different inflow and outflow components for the PID water budget is presented in **Figure 2-38.**

### *2.4.1. Surface Water Budget*

The surface water budget for the Subbasin is described in *Chapter 2.3.1* of the *Tule Subbasin Setting*. Inflows to the surface water system include precipitation, applied imported surface water (irrigation), discharge from wells, and surface water inflows. Surface water budget for the Subbasin is presented in *Table 2-2a* in the *Subbasin Setting* and for PID is presented in **Table 2-5**. Surface water outflow includes recharge from precipitation, streambed infiltration and surface water outflows, canal losses, deep percolation of applied water, and evapotranspiration (ET). Surface water outflows for the Subbasin are presented in *Table 2-2b* for the Subbasin and for PID are presented in **Table 2-6**.  The surface water outflows are color coded to show different components that are included with the estimate for native yield.

- Blue: Groundwater inflows to be included in the native yield estimate
- Magenta: Groundwater inflows to be excluded from the native yield estimate
- Yellow: Surface water or groundwater outflows not included in the native yield estimate.

#### 2.4.1.1 Surface Water Inflows

Surface water inflows are for PID presented in **Table 2-5**.

##### *2.4.1.1.1 Precipitation*

The methodology used to determine annual average precipitation in the Subbasin is described in *Chapter 2.3.1.1.1* of the *Tule Subbasin Setting*. Annual precipitation values for the Subbasin were estimated based on the long-term average annual isohyetal map and using the annual precipitation data from the Porterville Station.

Across the Subbasin, the total annual precipitation ranged from 147,000 AF to 761,000 AF with an average of 361,000 AFY. The total annual precipitation within PID ranged from 4,300 AF to 28,100 AF between WY1987 to WY2024, with an average of 13,500 AFY.

### 2.4.1.1.2 Stream Inflows

Stream inflows into the Subbasin include inflows from the Tule River, Deer Creek and the White River. Flowing through PID is the Tule River. Flows in the Tule River are controlled through releases from Lake Success, which are documented in the TRA annual reports. During the historical water budget period, flows released from Lake Success ranged from 8,820 to 627,000 AF with an average value of 120,100 AFY. Both Deer Creek and the White River are located to the south of PID. Inflows from Deer Creek into the Subbasin are measured at Fountain Springs by the USGS. Over the historical water budget period, values have ranged from 2,000 to 88,000 AF with an average of 18,400 AFY. Flow measurements in the White River are based on the USGS stream gage station near Ducor. The estimated inflow into Subbasin from the White River ranged from 250 to 37,000 AF with an average of 6,000 AFY.

The Tule River first crosses the Tule East GSA (City of Porterville) before entering PID GSA. Flows into PID are estimated based on the calculated infiltration, evaporation, and diversions that occur prior to PID. Annual inflows into PID ranged from 300 to 487,100 AF with an average of 83,100 AFY.

### 2.4.1.1.3 Imported Water

Surface water is imported into the Subbasin and PID GSA via the FKC and the Tule River. Data from the USBR Central Valley Operation Annual Reports and Tule River Asociation Annual Reports were compiled to calculate the average amount of imported surface water, as described in *Chapter 2.3.1.1.3* of the *Tule Subbasin Setting.* PID holds a long-term contract for 15,000 AFY of Class 1 water and 30,000 AF of Class 2 water from the Friant Division. PID also manages a supply of Tule River water through agreements with four entities: the Porter Slough, Hubbs & Miner, Rhodes-Fine, and Gilliam-McGee Ditch Companies. Combined, these companies hold an average annual entitlement of approximately 12,900 AFY measured at Success Dam.

For the entire Subbasin, surface water deliveries ranged from 18,900 to 587,400 AF with an average of 352,900 AFY. Within PID, surface water deliveries ranged from 100 AF to 65,300 AF with an average of 15,400 AFY.

### 2.4.1.1.4 Discharge to Crops from Wells

Chapter 2.3.1.1.4 of the *Subbasin Setting* describes the water applied to crops from wells to be the total applied water minus imported surface water delivers and diverted streamflow. Estimates of crop ET were used to estimate total crop demand, with an assumed irrigation efficiency of 79 percent.

Across the Subbasin, the average groundwater pumping over the historical period was 651,000 AFY. Within PID, the simulated groundwater pumping ranged from 9,400 AF to 38,500 AF with an average of 23,300 AFY.

#### 2.4.1.1.5 Municipal Deliveries from Wells

Chapter 2.3.1.1.5 of the *Subbasin Setting* describes the methodology used to determine the average annual groundwater production for municipal use within the Subbasin for the historical period. Groundwater pumping for municipal supply is conducted by the City of Porterville and other local communities. The average municipal pumping across the Subbasin over the historical period was 19,600 AFY. For PID the average municipal pumping was 100 AFY.

### 2.4.1.2 Surface Water Outflows

Surface water outflows for PID are presented in **Table 2-6**.

#### 2.4.1.2.1 Areal Recharge from Precipitation

Areal recharge from precipitation on the Subbasin valley floor was estimated using the methodology developed by Williamson et al. (1989). As part of a regional hydrogeological study of the California Central Valley, Williamson et al. developed a monthly soil-moisture budget for the Sacramento and San Joaquin Valleys based on a 50-year period of record (1922–1971). This budget accounts for potential evapotranspiration, assumed plant root depth, soil moisture-holding capacity, and precipitation.

In this model, monthly precipitation that exceeds both potential evapotranspiration and soil-moisture storage is categorized as net infiltration to the groundwater system. These results were simplified into a linear regression model, known as the Williamson Method, to estimate net infiltration from annual precipitation:

$$PPT_{ex} = (0.64)\ PPT - 6.2$$

Where:

- $PPT_{ex}$: Excess Annual Precipitation (net infiltration/recharge) in ft/yr.
- PPT: Total Annual Precipitation in ft/yr.

For the Subbasin, groundwater recharge from precipitation ranged from 0 to 241,000 AF with an average of 33,000 AFY. For PID, the areal recharge from precipitation ranged between 0 to 10,000 AF, with an average of 1,700 AFY.

#### 2.4.1.2.2 Streambed Infiltration

As discussed in 2.4.1.2 of this GSP, the three primary surface water bodies in the Subbasin are the Tule River, Deerk Creek, and the White River. Streambed infiltration from each of these surface water bodies is discussed in full detail in 2.3.1.2.2 of the *Subbasin Setting.* Average recharge from the Tule River was 19,700. Average recharge from Deer Creek over the historical water budget period 11,500 AF. Average recharge from the White River was 5,800 AF. The average annual streambed infiltration before within PID for the historical period is estimated to be 4,500 AFY, ranging from 300 to 10,400 AF.

## *2.4.1.2.3 Canal Losses*

*Chapter 2.3.1.2.3* of the *Subbasin Setting* contains a detailed description and methodology to calculate canal losses for the entire Subbasin. Canal losses are attributed to three sources, water from the natural surface water bodies (Tule River and Deer Creek) diverted to unlined canals, and water losses from imported water from the FKC.

For the entire Subbasin, losses from Tule River water diversion were on average 23,300 AFY, losses from water from Deer Creek was on average 2,500 AFY, and losses from imported water was on average 52,800 AFY. There are no canal losses attributed to water from the White River within the Subbasin. For PID, canal losses attributed to imported water ranged from 0 to 500 AF with and average of 200 AFY. Canal losses attributed to Tule River water ranged from 0 to 6,900 AF with an average e of 1,600 AFY.

## *2.4.1.2.4 Deep Percolation of Applied Water*

The deep percolation of applied water for the entire Subbasin is described in detail in *Chapter 2.3.1.2.5* of the *Subbasin Setting*. Sources of water for irrigation include the Tule River, Deer Creek, imported water, recycled water, and groundwater. Sources of deep percolation within PID include imported water and agricultural irrigation from groundwater pumping.

Across the Subbasin, deep percolation from Tule River water on average 22,000 AFY. Deep percolation from water diverted off of Deer Creek was 1,100 AFY. Deep percolation of imported water was approximately 96,900 AFY. Groundwater pumping contributed the greatest amount of deep percolation with an annual average of 148,200 AFY. Within PID, sources of deep percolation include imported surface water, Tule River water, and groundwater. For imported water, annual values ranged from 0 to 14,200 AF with an annual average of 5,800 AFY. Deep percolation of Tule River water ranged from 0 to 25,700 AF with an average of 6,200 AFY. Deep percolation of applied groundwater for agricultural use ranged from 2,200 to 8,000 AF with an average 5,200 AFY.

## *2.4.1.2.5 Managed Recharge in Basins*

Over the historical water budget period for the entire Subbasin, imported surface water used for artificial recharge was on average 14,500 AFY. Within PID, there was a large increase in the recharge of imported water starting in 2017. From 2017 through 2024, recharge of imported surface water ranged from 0 AF during the dry years of WY2020 and WY2021 and was as high as 73,700 AF during WY2023.

## *2.4.1.2.6 Evapotranspiration*

Sources of ET for the entire Subbasin are described in detail in *Chapter 2.3.1.2.6* of the *Subbasin Setting*. Sources of ET within PID include precipitation from crops and native vegetation and agricultural consumptive use, including groundwater pumping and imported surface water.

### *Evapotranspiration of Precipitation from Crops and Native Vegetation*

ET of precipitation is estimated to be equal to total precipitation minus areal recharge and includes estimates for both crops and native vegetation.

Over the historical period, ET from precipitation for the entire Subbasin was on average 328,000 AFY. Within PID, ET from crops and native vegetation ranged from 4,300 to 18,000 AF with an average of 11,800 AFY.

*Agricultural Consumptive Use*

Agricultural consumptive for the entire subbasin includes all sources of irrigation excluding precipitation. The methodology used to estimate agricultural consumptive use within the Subbasin is described in *Chapter 2.3.1.2.6* of the *Subbasin Setting*. ET from agricultural consumptive use within PID is calculated separately for imported water, Tule River water, and groundwater (pumping) for the historical period.

For the entire Subbasin, the estimated average annual agricultural consumptive use was 724,000 AFY. Within PID, ET from agricultural consumptive use of imported water ranged from 100 to 12,600 AF with an average of 6,600 AFY. For ET from Tule River water, the annual ET values ranged from 0 to 15,400 AF with an average of 4,400 AFY. ET from groundwater pumping ranged from 6,700 to 30,500 AF with an average of 17,900 AFY.

### *2.4.1.2.7 Surface Water Outflows*

Surface water outflow within the Subbasin for Tule River is described in *Chapter 2.3.1.2.7* of the *Subbasin Setting.* Over the historical period, Tule River outflows ranged form 0 to 121,000 AF with an average of 12,000 AFY

Surface water outflows of PID were estimated based on the surface water inflows minus diversions and deep percolation. Surface water outflow through Tule River ranged from 0 to 477,600 AF with an average of 78,900 AFY. It should be noted that flows out of PID are greater than flows out of the Subbasin because of the additional infiltration that occurs in the GSAs to the west of PID within the Subbasin.

## *2.4.2. Groundwater Budget*

As shown in **Table 2-7**, the groundwater budget for the Tule Subbasin tracks all water entering and leaving the system. This balance is defined by the core equation:

$$Inflow - Outflow = \pm \Delta S$$

Inflows for the groundwater budget consists of areal recharge from precipitation, streambed infiltration, managed infiltration of water in basins for the purpose of groundwater storage, canal losses, return flows of applied irrigation water, and subsurface inflows. Groundwater outflows include all groundwater pumping (agricultural) and subsurface outflows. The subsurface inflow and outflow components in the groundwater budget are excluded when determining whether the water budget is balanced, and therefore, groundwater pumping is directly compared to all in-GSA recharge components.

Following the format of the surface water budget tables, the groundwater budget (**Table 2-7**) distinguishes between different water sources using specific colors:

- Blue: Groundwater inflows to be included in the native yield estimate

- Magenta: Groundwater inflows to be excluded from the native yield estimate
- Yellow: Surface water or groundwater outflows not included in the native yield estimate.

A chart describing the average annual values for each inflow and outflow component of the groundwater budget is presented in **Figure 2-39.** Average inflows were 45,100 AFY while the average outflows were 47,300 AFY. The average change in storage from WY1987 to WY2024 was a decline of -2,200 AFY. When excluding subsurface inflows and outflows, the average change in storage was an increase of 6,200 AFY.

## 2.4.2.1 Groundwater Inflows

Most of the groundwater inflow components are equal to the items described in the *Surface Water Outflow Section 2.4.1.2.* The only additional component to groundwater inflow is subsurface inflows.

### *2.4.2.1.1 Area Recharge from Precipitation*

Areal recharge for the Subbasin is described in *Chapter 2.3.2.1.1* of the *Subbasin Setting*. Additional details are provided in section 2.4.1.2.1 of this GSP. For PID, the areal recharge from precipitation ranged between 0 to 10,000 AF, with an average of 1,700 AFY.

### *2.4.2.1.2 Streambed Infiltration*

Streambed infiltration for Deer Creek across the Subbasin is discussed Chapter 2.3.2.1.3 of the *Subbasin Setting*. Additional details are provided in section 2.4.1.2.2 of this GSP. The average annual streambed infiltration before within PID for the historical period is estimated to be 4,500 AFY, ranging from 300 to 10,400 AF.

### *2.4.2.1.3 Canal Losses*

Canal losses for imported water across the Subbasin are discussed in Chapter 2.3.1.2.3 of the *Subbasin Setting*. Additional details are provided in section 2.4.1.2.3 of this GSP. Canal losses attributed to imported water ranged from 0 to 500 AF with an average of 200 AFY. Canal losses attributed to Tule River water ranged from 0 to 6,900 AF with an average e of 1,600 AFY.

### *2.4.2.1.4 Return Flows from Applied Water*

Return flows are from both applied surface water and groundwater. Groundwater recharge from applied groundwater is discussed in *Chapter 2.3.2.1.7* of the *Subbasin Setting*. Additional details are provided in section 2.4.1.2.4 Within PID, sources of deep percolation include imported surface water, Tule River water, and groundwater. For imported water, annual values ranged from 0 to 14,200 AF with an annual average of 5,800 AFY. Deep percolation of Tule River water ranged from 0 to 25,700 AF with an average of 6,200 AFY. Deep percolation of applied groundwater for agricultural use ranged from 2,200 to 8,000 AF with an average 5,200 AFY.

### *2.4.2.1.5 Managed Recharge in Basin*

Managed recharge in basis is discussed in *Chapter 2.3.1.2.4* of the *Subbasin Setting*. Additional details are provided in section 2.4.1.2.5 of this GSP. Within PID, there was a large increase in the recharge of imported water starting in 2017. From 2017 through 2024, recharge of imported surface water ranged from 0 AF during the dry years of WY2020 and WY2021 and was as high as 73,700 AF during WY2023.

#### *2.4.2.1.6 Subsurface Inflows*

*Chapter 2.3.2.1.9* of the *Subbasin Setting* describes subsurface inflow for the entire Subbasin. Average inflows into the Subbasin from adjacent subbasins was on average 75,000 AFY. This does not account for flows between GSAs within the Subbasin. For PID, subsurface inflow from other GSAs ranged between 10,900 and 20,100 AF with an average 15,200 AFY. As discussed in the *Groundwater Conditions* section of this GSP and presented in **Figures 2-20** through **2-23**, groundwater flow is generally east to west or northeast to southwest which would suggest that most of the water flowing out of PID is to the west where a cone of depression is located within the Subbasin.

### 2.4.2.2 Groundwater Outflows

#### *2.4.2.2.1 Agricultural Groundwater Pumping*

*Chapter 2.3.2.3.2* of the *Subbasin Setting* describes agricultural groundwater pumping throughout the entire Subbasin. Groundwater pumping for the entire subbasin was on average 651,000 AFY. Within PID agricultural groundwater pumping for the historical period ranged from 9,400 AF to 38,500 AF, with an average of 23,600 AFY. Average municipal pumping within PID was 100 AFY.

#### *2.4.2.2.2 Subsurface Outflows*

Subsurface outflows for the Subbasin are described in *Chapter 2.3.2.3.4* of the *Subbasin Setting*. For the entire Subbasin, the average subsurface outflow was approximately 82,000 AFY. This does not account for flow between GSAs within the Subbasin. Within PID, subsurface outflows into adjacent GSAs ranged from 19,000 to 29,100 AF, with an average of 23,700 AFY, which is greater than the average inflows of 15,200 AFY.

## ***2.4.3. Current Water Budget***

The current water budget for PID is presented in the historical water budget tables as the most recent water year (**Table 2-5** through **Table 2-7)**. In WY 2024, the total groundwater inflow into the GSA was approximately 77,400 AF and the total groundwater outflow was 46,700 AF. Change in storage was an increase of approximately 30,700 AF. When excluding for subsurface inflows and outflows, the change in storage was an increase of 38,300 AF.

## ***2.4.4. Projected Water Budget***

To achieve long-term sustainability, a projected water budget was developed for the Tule Subbasin, incorporating the specific projects and management actions proposed by each of the GSAs. The projected water budget is for the time period 2025 through 2070. Using a groundwater flow model for the 45-year projection period, the subbasin aimed to:

- Verify Sustainability: Assess whether planned actions successfully meet sustainability goals.

- Analyze GSA Interactions: Evaluate how groundwater levels in one GSA are affected by the actions of neighboring GSAs.
- Determine Sustainable Yield: Estimate the maximum amount of water that can be withdrawn annually without causing undesirable results.
- Climate Change Integration

The model accounts for future climate variability by adjusting baseline hydrology and water deliveries. These adjustments—derived from the DWR's CalSim-II model and recommendations from the Climate Change Technical Advisory Group—affect three primary water sources:

1. Tule River flows
2. Friant-Kern Canal deliveries
3. State Water Project (California Aqueduct) deliveries

Climate-related adjustments to hydrology and surface water deliveries were applied over two distinct planning horizons:

- 2030 Central Tendency: Provides near-term projections of climate impacts on hydrology, centered on the year 2030.
- 2070 Central Tendency: Provides long-term projections of potential climate impacts, centered on the year 2070. These adjustments were applied to the model projection for the period from 2050 to 2070.
- Imported Water Supply Adjustments

For supplies arriving via the Friant-Kern Canal, TH&Co utilized delivery schedules from the Friant Water Authority (2018). These projections account for two major factors:

1. San Joaquin River Restoration Project (SJRRP): Projected deliveries include adjustments associated with this restoration effort.
2. Implementation Timeline**:** Adjustments for climate change and the SJRRP begin in 2025.
    - Changes are applied incrementally between 2025 and 2030.
    - The full suite of adjustments reaches 100% implementation by 2030.

The projected groundwater budget for PID is presented in **Table 2-8.**

### *2.4.5. Sustainable Yield [PLACEHOLDER – will be updated as SMCs/PMAs are finalized]*

PID was previously a member of the ETGSA, which developed a groundwater accounting system to track groundwater use and implement a groundwater allocation program. This ETGSA program allowed for pumping in excess of the sustainable yield through 2035 (**Table 2-9**). These percentages allow for pumping in excess of the sustainable yield and are referred to as transitional pumping credits. In an effort to achieve sustainable conditions and address subsidence, PID has adopted resolution 2024-09-20, which eliminated all transitional pumping credits and permit pumping at the sustainable yield ten years sooner than what was originally agreed to by the ETGSA and the rest of the Tule Subbasin.

| Table 2-9. Percentage of Historical Annual Avg. Use Above Sustainable Limit (ETGSA GSP) | | | |
|---|---|---|---|
| 2021-2025 | 2026-2030 | 2031-2035 | 2035-2040 |
| 90% | 80% | 30% | 0% |

The sustainable yield for PID is 0.99 AF/acre. The historical average pumping for PID is 23,100 AF or 1.37 AF/acre. Although the ETGSA planned on having a glide path to achieve the sustainable yield allocation by 2035 as noted in **Table 2-9**, PID elected—through Resolution No. 2024-09-20—to disregard the glide path and achieve the sustainable yield pumping allocation by WY2025. This resolution also eliminated the ability of landowners within PID to use transition credits accumulated when pumping below the Table 5 target percentages and using those credits in future years to allow for increases in pumping above glide path target percentages. Sustainable yield for PID has been established at 0.99 AF/acre. For WY2025, by pumping at the sustainable yield limit and not allowing for any transitional pumping credits, PID has reduced pumping by approximately 6,400 AF/year or 27% of the historical average.