San Joaquin Valley

REAP

REGIONAL EARLY ACTION PLANNING

San Joaquin Valley
Regional Early Action
Planning (REAP) Program

Technical Assistance - Water Supply Study

January 2024

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ACRONYMS AND ABBREVIATIONS

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AFY - acre-feet per year

CAG - County Association of Government

COG - Council of Government

CTC - County Transportation Commissions

CVP - Central Valley Project

DWR - Department of Water Resources

GSA - Groundwater Sustainability Agency

GSP - Groundwater Sustainability Plan

HCD - Department of Housing and Community Development

HR - hydrologic region

M&I - municipal and industrial

MAF - million acre-feet per year

MPO - Metropolitan Planning Operations

REAP - Regional Early Action Planning

RHNA - Regional Housing Needs Allocation

RTPA - Regional Transportation Planning Agencies

RWQCB - Regional Water Quality Control Board

SGMA - Sustainable Groundwater Management Act

SJVGWB - San Joaquin Valley Groundwater Basin

SJVRPA - San Joaquin Valley Regional Planning Agencies

SWP - State Water Project

SWRCB - State Water Resources Control Board

USBR - U.S. Bureau of Reclamation

UWMP - Urban Water Management Plans

ES.

EXECUTIVE SUMMARY

California's watersheds are experiencing increased pressure from climate-driven events such as extreme heat, drought, and wildfire. Groundwater is a critical component for local and regional water resource management. While natural climactic pressures mount, sustainable management of groundwater basins is balancing the competing priorities of regulators, water suppliers, municipal, industrial and agriculture users, tribes, and environmental interests.

Rincon Consultants, Inc. (Rincon) has prepared this Water Supply Study as technical assistance under the San Joaquin Valley Regional Early Action Planning (REAP) Program, to support San Joaquin Valley Metropolitan Planning Organizations (MPO) with assessment of the state-mandated Regional Housing Needs Allocation (RHNA). The goal of this Water Supply Study is to assess linkages between land use planning and water management in San Joaquin Valley and evaluate the adequacy of water supply identified in water management plans to accommodate projected RHNA growth. Ultimately, the study seeks to determine how state regulations related to sustainable groundwater management, as implemented at the regional scale, may impact future housing production in the San Joaquin Valley and what strategies are available to meet the sixth-cycle RHNA numbers within a constrained water supply.

To estimate the expected increase in water demand that would be created by additional housing due to state regulations, Rincon estimated a population increase associated with the RHNA allocations across each groundwater subbasin in the San Joaquin Valley. From this estimated population increase, estimated per capita water use from local water districts were used to predict an associated water demand increase for this population growth.

After determining an estimated demand increase associated with projected RHNA growth, Rincon assessed water management and sustainability plans across the San Joaquin Valley to determine if their local water demand forecasts and related water budgets were inclusive of RHNA growth. The methods used by regional water suppliers to forecast urban water demand and associated supply were evaluated to determine whether they were adequate to accommodate RHNA growth.

This study determined that a majority of water supply projections from agencies throughout San Joaquin Valley were not adequate to supply the projected water demands consequent to RHNA-driven housing growth. Based on the findings in its groundwater sustainability plans as of the time of study publication, Kern County was determined to be the area of greatest concern for water supply availability. Overall, a total of $4.4 billion was estimated to be needed for projects identified in the groundwater sustainability plans to increase water supply. A significant investment in water supply acquisition, conveyance, recharge, and storage projects is needed to enable local water suppliers to meet projected water demands. Rincon recommends that MPOs approach the State regarding funding for these projects.

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1. INTRODUCTION

This Water Supply Study has been prepared as technical assistance under the San Joaquin Valley Regional Early Action Planning (REAP) Program, to support San Joaquin Valley Metropolitan Planning Organizations (MPO) with the state-mandated Regional Housing Needs Allocation (RHNA). MPOs include Council of Governments (COG), Regional Transportation Authorities (RTA), County Associations of Government (CAG), and County Transportation Commissions (CTC), as well as Regional Transportation Planning Agencies (RTPA), which consist of COGs, CAGs, and CTCs.

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BACKGROUND

The State of California's Department of Housing and Community Development (HCD) projects future housing needs and assigns unit quantities for development to MPOs throughout the state, including COGs, RTAs, CAGs, and CTCs. As noted above, MPOs also include the San Joaquin Valley RTPAs, which consist of each of the aforementioned organization types (see ***Table 1***).

State law (Government Code Section 65584) requires local governments to plan for enough housing to meet the respective regions' needs identified in the housing elements of their general plans, as informed by the RHNA. The San Joaquin Valley RTPAs have completed their sixth-cycle RHNAs and have been tasked with identifying land that can accommodate 280,517 new housing units between 2023 and 2031 to meet housing needs associated with anticipated population growth throughout the San Joaquin Valley (HCD 2021). Refer to ***Table 3*** in ***Chapter 2***, Demand Projections for a summary of RHNA units by MPO. Each MPO was responsible for developing region-specific methodology for distributing new housing in its respective jurisdiction, including with consideration to potential constraints and opportunities.

State law (Water Code Section 10720) also requires local governments to comply with the Sustainable Groundwater Management Act (SGMA) through localized planning and management efforts designed to create and maintain sustainable groundwater conditions, meaning conditions where basin outflow and inflow are balanced and where overdraft is not present. In accordance with SGMA, all groundwater basins defined and prioritized by the California Department of Water Resources (DWR) must be managed in accordance with a DWR-approved Groundwater Sustainability Plan (GSP), which is developed and implemented by a DWR-approved Groundwater Sustainability Agency (GSA). Refer to ***Table 8*** in ***Chapter 3, Water Supply Scenario*** for a summary of the region's groundwater basins and SGMA status. The San Joaquin Valley is underlain by numerous subbasins to the expansive San Joaquin Valley Groundwater Basin (SJVGWB), many of which are designated by DWR as "high priority" due to ongoing and historic overdraft conditions. Per SGMA requirements, the SJVGWB must achieve its sustainability goals by 2040.

As detailed in the following sections, the San Joaquin Valley MPOs are responsible for RHNA allocations to jurisdictions and for coordinating housing planning. Some MPOs also partner with agencies or water districts in support of groundwater management activities. This Water Supply Study supports the MPOs and their member agencies' decision-making processes related to housing development by assessing the water supply available to serve the housing projected by the RHNA.

PURPOSE

The San Joaquin Valley Regional Planning Agencies (SJVRPA), with assistance from the State-funded grant program, REAP, is conducting a series of regional planning studies to help inform decisions regarding housing development opportunities in the San Joaquin Valley. This Water Supply Study is part of this regional effort and is being conducted as technical assistance under the REAP program. The goal of this Water Supply Study is to assess linkages between land use planning and water management in San Joaquin Valley and evaluate the adequacy of water supply identified in water management plans to accommodate projected RHNA growth. Ultimately, the study seeks to determine how state regulations related to sustainable groundwater management, as implemented at the regional scale, may impact future housing production in the San Joaquin Valley and what strategies are available to meet the sixth-cycle RHNA numbers within a constrained water supply.

STUDY AREA

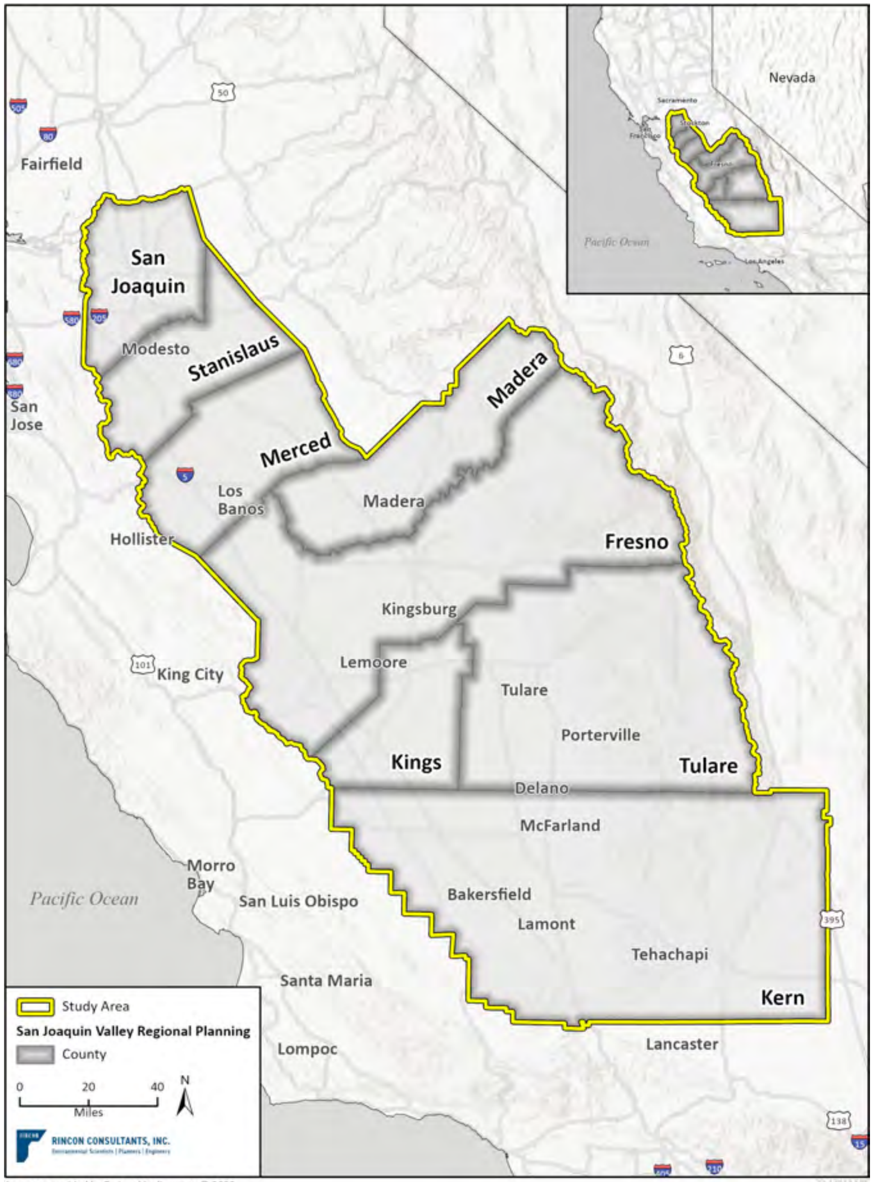
The study area for this Water Supply Study is the geographic area encompassed by the eight San Joaquin Valley MPOs, as identified in ***Table 1*** below and shown on ***Figure 1***. This is an appropriate extent of analysis for the study because it includes all MPO jurisdictions tasked with providing housing in accordance with the RHNA, as well as the groundwater basins that are relied upon as a water source for development in this area. The study area also encompasses the jurisdictions of urban water purveyors, GSAs, and other local agencies responsible for managing water resources.

Table 1. Study Area Overview - San Joaquin Valley MPOs

MPO	Member Agencies
Fresno COG	16 member agencies including Fresno County and the cities of Clovis, Coalinga, Firebaugh, Fowler, Fresno, Huron, Kerman, Kingsburg, Mendota, Orange Cove, Parlier, Reedley, San Joaquin, Sanger, and Selma
Kern COG	12 member agencies including Kern County and the cities of Arvin, Bakersfield, California City, Delano, Maricopa, McFarland, Ridgecrest, Shafter, Taft, Tehachapi, and Wasco
Kings CAG	5 member agencies including Kings County and the cities of Avenal, Corcoran, Hanford, and Lemoore
Madera CTC	3 member agencies including Madera County and the cities of Chowchilla and Madera
Merced CAG	7 member agencies including Merced County and the cities of Atwater, Dos Palos, Gustine, Livingston, Los Banos, and Merced
San Joaquin COG	8 member agencies including San Joaquin County and the cities of Escalon, Lathrop, Lodi, Manteca, Ripon, Stockton, and Tracy
Stanislaus COG	10 member agencies including Stanislaus County and the cities of Ceres, Hughson, Modesto, Newman, Oakdale, Patterson, Riverbank, Turlock, and Waterford
Tulare CAG	9 member agencies including Tulare County and the cities of Dinuba, Exeter, Farmersville, Lindsay, Porterville, Tulare, Visalia, and Woodlake

MPO = Metropolitan Planning Organization; COG = Council of Governments; CAG = County Association of Governments; CTC = County Transportation Commission
Source: San Joaquin Valley Regional Planning Agencies 2022a

Figure 1. Study Area



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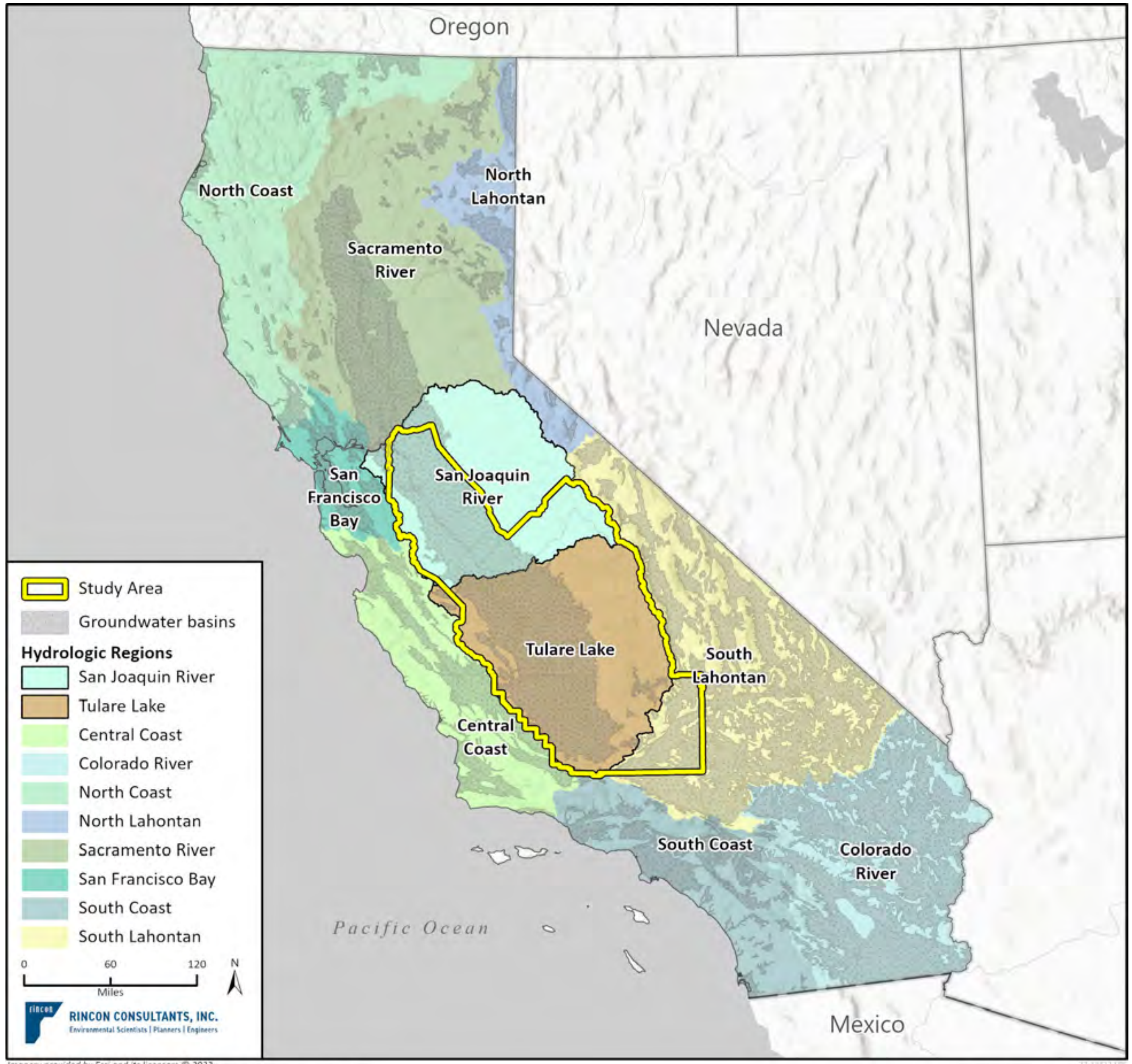
While ***Figure 1*** above shows political boundaries within the study area, ***Figure 2*** below shows natural boundaries of three separate hydrologic regions (HR), which are areas with similar characteristics of hydrology and/or geology. The California State Water Resources Control Board (SWRCB) uses HR boundaries to conduct basin planning through region-specific water quality control plans (basin plans) administered by respective regional water quality control boards (RWQCB). The basin plans inform this Water Supply Study as related to water quality challenges that may affect SGMA compliance and RHNA development potential.

Following ***Figure 2***, below, ***Table 2*** identifies the study area, HRs, and groundwater basins subject to SGMA and assessed for this Water Supply Study, including 15 subbasins to the SJVGWB.

Figure 2. Hydrologic Regions



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Additional data provided by the California Department of Water Resources (DWR) 2020.

Table 2. Hydrologic Regions and Groundwater Basins within the Study Area

Hydrologic Region	Counties	Groundwater Basins1 (DWR No.2)
San Joaquin River HR	• San Joaquin County • Stanislaus County • Merced County • Madera County • Fresno County	San Joaquin Valley Groundwater Basin (5-22): • Cosumnes Subbasin (5-22.16)[3] • East Contra Costa Subbasin (5-22.19)[3] • Eastern San Joaquin Subbasin (5-22.01) • Modesto Subbasin (5-22.02) • Turlock Subbasin (5-22.03) • Merced Subbasin (5-22.04) • Chowchilla Subbasin (5-22.05) • Madera Subbasin (5-22.06) • Delta-Mendota Subbasin (5-22.07) • Tracy Subbasin (5-22.15)
Tulare Lake HR	• Fresno County • Kings County • Tulare County • Kern County	San Joaquin Valley Groundwater Basin (5-22): • Kings Subbasin (5-22.08) • Westside Subbasin (5-22.09) • Pleasant Valley Subbasin (5-22.10) • Kettleman Plan Subbasin (5-22.17) • Kaweah Subbasin (5-22.11) • Tulare Lake Subbasin (5-22.12) • Tule Subbasin (5-22.13) • Kern County Subbasin (5-22.14) • White Wolf Subbasin (5-22.18) • Cummings Valley Groundwater Basin (5-27)[4] • Brite Valley Groundwater Basin (5-80)[4] • Tehachapi Valley West Groundwater Basin (5-28)[4]
South Lahontan HR	• Kern County	• Kerns River Valley Groundwater Basin (5-25)[5] • Indian Wells Valley Groundwater Basin (6-54)[5] • Walker Basin Creek Valley Groundwater Basin (5-26)[5] • Kelso Lander Valley Groundwater Basin (6-69)[5] • Fremont Valley Groundwater Basin (6-46)[5] • Tehachapi Valley East Groundwater Basin (6-45)[4] • Antelope Valley Groundwater Basin (6-44)[4]

Table Notes:

[1] Italicized basins/subbasin identified in this table are not further addressed in this Water Supply Study for the reasons described in the footnotes below.

[2] DWR identification numbers are provided to demonstrate how the groundwater basins underlying the Study Area are classified as subbasins to the larger San Joaquin Valley Groundwater Basin. Subbasins are also groundwater basins in their own right, and the terminology "subbasin" and "basin" is used inter-changeably throughout this report.

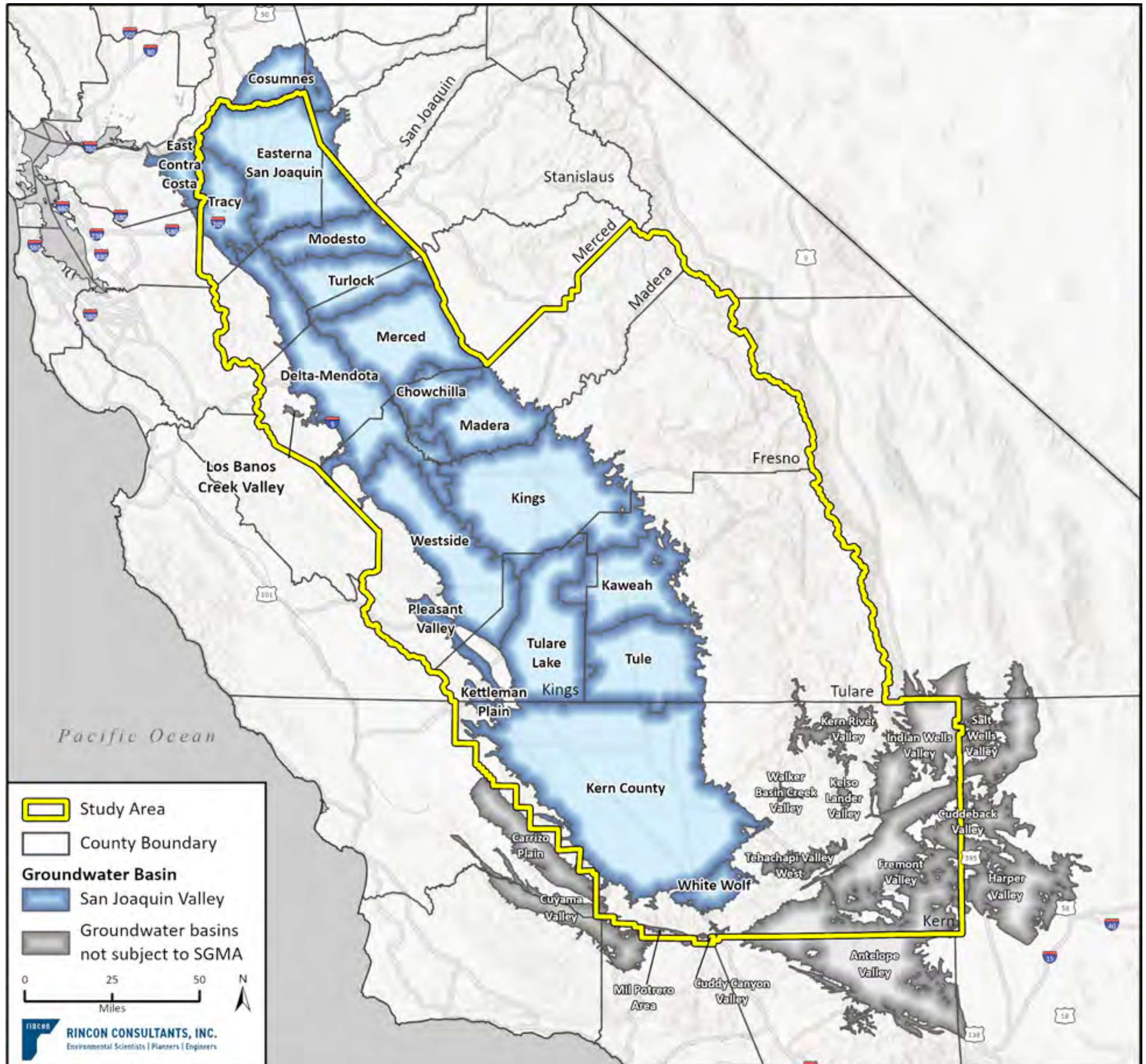
[3] Consumnes Subbasin and East Contra Costa Subbasin are located within the San Joaquin Valley Groundwater Basin but not within our Study Area; therefore, they are not addressed further in this report.

[4] Adjudicated groundwater basins are excluded from this Water Supply Study because they are exempt from SGMA due to being managed in accordance with respective Adjudication Judgements. Antelope Valley, Brite Valley, Cummings Valley, and Tehachapi Valley Groundwater Basins are not addressed further in this report.

[5] Groundwater basins identified in DWR's Bulletin 118 that are not subject to SGMA include Kerns River Valley, Indian Wells Valley, Walker Basin Creek Valley, Kelso Lander Valley, and Fremont Valley Groundwater Basins. These basins have no GSPs and are not addressed further in this report.

The study area encompasses the groundwater basins that are relied upon as a primary water source for urban development in the San Joaquin Valley. These basins are primarily subbasins of the larger SJVGWB. There are some areas where groundwater basins extend beyond the study area, due to discrepancies between natural and political boundaries. Such discrepancies do not affect this analysis, as it is focused on basins specific to the San Joaquin Valley and informed by basin-specific planning documents that address the entire extent of respective basins. There are also groundwater basins that are located within the study area, but not subject to SGMA due to low-priority DWR designations that do not require development of a GSP. These low-priority groundwater basins are shown in grey on ***Figure 3***, Groundwater Basins Subject to SGMA.

Figure 3. Groundwater Basins Subject to SGMA



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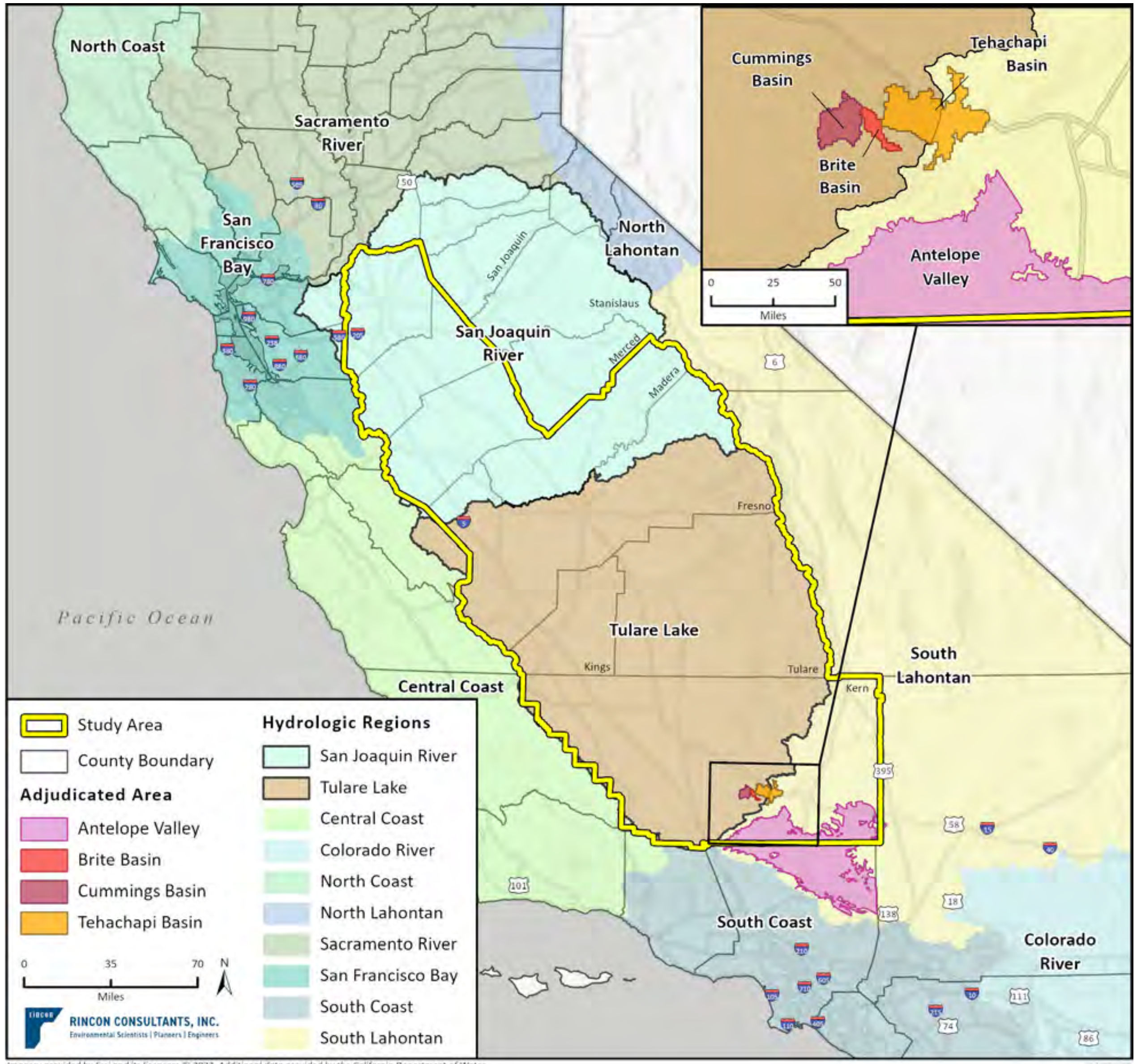
Additional data provided by the California Department of Water Resources (DWR) 2020.

Figure 4, presented below ***Figure 3***, shows that the study area primarily overlies the San Joaquin River HR and the Tulare Lake HR; these HRs are both addressed in the Central Valley RWQCB's Basin Plan for the Central Valley Region (Region 5) (Central Valley RWQCB 2016). The South Lahontan HR, which underlies the south-eastern-most portion of the study area, is addressed in the Lahontan RWQCB's Basin Plan for the Lahontan Region (Region 6) (Lahontan RWQCB 2021) and is hydrologically separated from the San Joaquin Valley by the southern portion of the Sierra Nevada mountains. Groundwater in this portion of the South Lahontan HR is largely managed through adjudication; see ***Figure 4***. Adjudicated basins are exempt from SGMA because the adjudication provides a management structure that meets SGMA's intent to create and maintain sustainable groundwater conditions. Therefore, because South Lahontan groundwater is hydrologically separate from San Joaquin Valley groundwater, as well as being exempt from SGMA due to adjudication, it is excluded from analysis in this Water Supply Study.

Figure 4. Adjudicated Areas (Exempt from SGMA)



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2.

DEMAND PROJECTIONS

This section provides an overview of the new housing units required by the sixth-cycle RHNA assessment and estimates water demands that will occur once the new housing units are occupied. This section also describes some of the constraints that may affect new housing construction.

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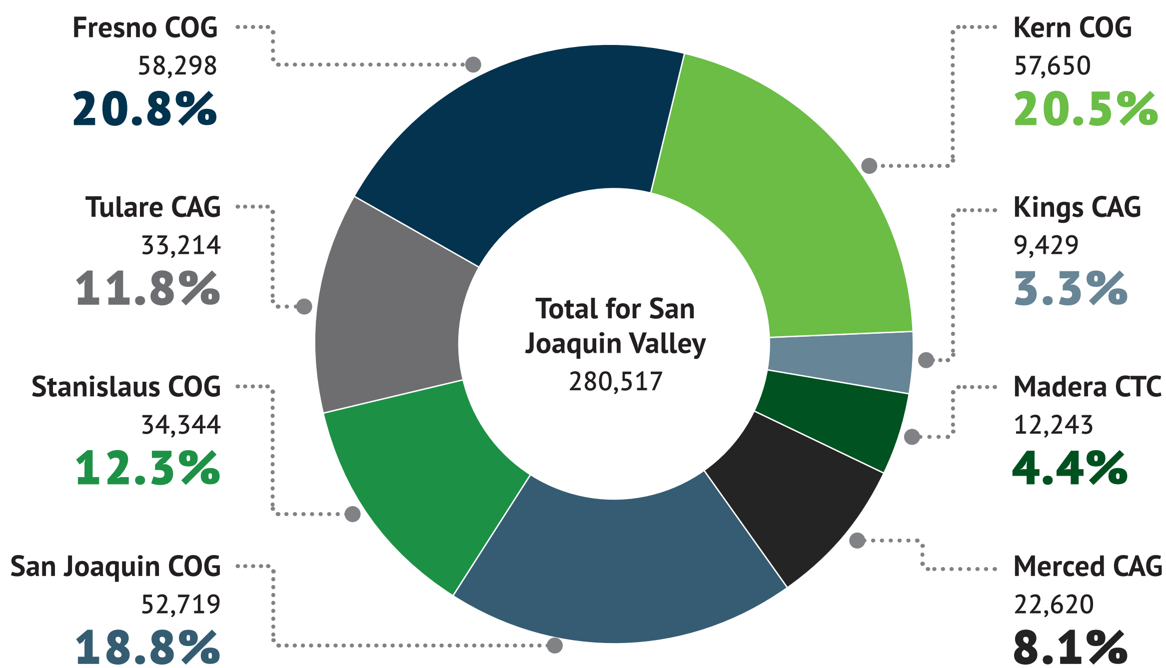
RHNA ALLOCATION BY COG

The RHNA is a minimum projection of additional housing units required to accommodate projected growth by the end of a community's housing element statutory planning period. Planning periods for the sixth cycle vary across the San Joaquin Valley but generally run from early 2023 through early 2031. HCD determines the regional housing needs for each COG. HCD consults with each COG regarding demographic trends and housing conditions such as future population, household growth, overcrowding, cost burden, vacancy rates, and jobs-housing imbalances.

After HCD issues the final regional housing need numbers, COGs allocate the housing needs for each of their jurisdictions. Following resolution of any appeals by HCD or local governments, HCD finalizes the RHNA allocations. Local governments are then required to update their housing elements to demonstrate that land is suitable and available to accommodate future residential development and that supportive policies and programs are in place. ***Figure 5*** shows the RHNA numbers allocated to each COG in the study area.

Figure 5. Sixth-Cycle RHNA Housing Units for San Joaquin Valley COGs



The RHNA has five statutory objectives that it is required to meet:

1. **Increase housing supply and mix of housing types, with the goal of improving housing affordability and equity in all cities and counties within the region**
2. **Promote infill development and socioeconomic equity; protect environmental and agricultural resources; encourage efficient development patterns; and achieve greenhouse gas reduction targets**
3. **Improve intraregional jobs-to-housing relationship, including the balance between low-wage jobs and affordable housing units for low-wage workers in each jurisdiction**
4. **Balance disproportionate household income distributions (more high-income allocation to lower-income areas, and vice-versa)**
5. **Affirmatively further fair housing**

To improve the efficacy and fairness of the sixth-cycle RHNA per these statutory objectives, the State has passed several pieces of legislation. These laws are in California Government Code, Title 7 Planning and Land Use, Article 10.6 Housing Elements (Section 65580 – 65589.11). Article 10.6 attempts to address the housing shortage in California by increasing the number of housing units that local governments are required to plan for.

Table 3 illustrates the difference between the planned housing units required by the fifth- and sixth-cycle RHNA. This table demonstrates that most counties in the study area have seen a substantial increase in housing units required by the sixth-cycle RHNA assessment. Some of this is due to inceases in expected housing needs from population growth, but current housing needs have also increased due to overcrowding and low vacancy rates.

Table 3. Fifth- and Sixth-Cycle RHNA – Housing Needs Change

MPO	Fifth-Cycle RHNA Housing Units	Sixth-Cycle RHNA Housing Units	Percent Change
Fresno COG	41,470	58,298	41%
Kern COG	67,675	57,650	-15%
Kings CAG	10,220	9,429	-8%
Madera CTC	12,895	12,243	-5%
Merced CAG	15,850	22,620	43%
San Joaquin COG	40,360	52,719	31%
Stanislaus COG	21,330	34,344	61%
Tulare CAG	26,910	33,214	23%
Total for San Joaquin Valley	**236,710**	**280,517**	**19%**

MPO = Metropolitan Planning Organization; COG = Council of Governments; CAG = County Association of Governments; CTC = County Transportation Commission; RHNA = Regional Housing Needs Allocation

Table 4 illustrates the estimated housing increase from the 2022 housing estimates for each county needed to accommodate the required housing units. The housing increases show in *Table 5* were estimated using the 2022 housing estimate from the 2020 U.S. Census. In total, the San Joaquin Valley counties would need to increase housing production by about 20 percent to achieve the additional units mandated by HCD.

Table 4. 2022 Housing Estimates and Sixth Cycle RHNA – Projected Increase

MPO	Estimated Households 2022	Estimated Households 2030	Percent Increase
Fresno COG	343,513	401,811	17%
Kern COG	305,853	315,282	19%
Kings CAG	46,729	104,379	20%
Madera CTC	50,368	62,611	49%
Merced CAG	90,309	112,929	25%
San Joaquin COG	258,566	311,285	20%
Stanislaus COG	184,513	218,857	19%
Tulare CAG	153,389	186,603	22%
Total for San Joaquin Valley	1,433,240	1,713,757	20%

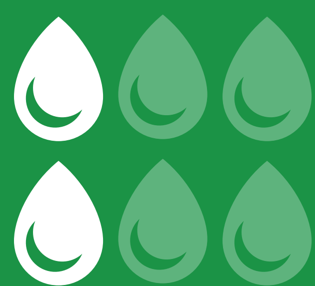
MPO = Metropolitan Planning Organization; COG = Council of Governments; CAG = County Association of Governments; CTC = County Transportation Commission; RHNA = Regional Housing Needs Allocation

WATER DEMAND FORECAST

Water demands are calculated by all urban water suppliers for their respective jurisdictions. Urban water suppliers are defined by the State as water purveyors with greater than 3,000 connections or serving greater than 3,000 acre-feet per year (AFY) of water, in Urban Water Management Plans (UWMP) prepared every 5 years. These plans are prepared to ensure that adequate water supplies are available to meet existing and future water demands. UWMPs must forecast water demands and assess water source reliability over a 20-year timeframe, as well as report progress on demand management and reduced water consumption. In UWMPs prepared in accordance with DWR's guidance, urban water suppliers report on historical and current average water use in gallons per capita per day.

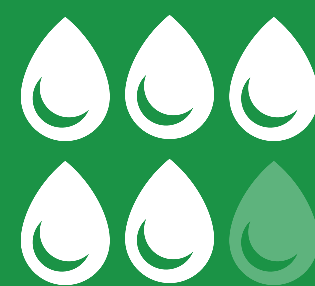
To determine the water demand associated with the additional housing required by the RHNA, data in the 2020 UWMPs for urban water suppliers throughout the San Joaquin Valley were used. Per capita demands were calculated using two different methods, presented below.

1. **Low Demand Scenario.** A low-end forecast was determined by calculating residential water use per capita based on each jurisdiction's projected 2030 residential water use and projected 2030 population, as reported in the 2020 UWMPs. This method estimates residential water demand and is assumed to be low-end because it does not account for increased commercial or industrial use based on the population and housing growth. Additionally, this estimate uses UWMP projections for the year 2030, when per capita water demand is expected to decrease due to water conservation efforts and improved infrastructure.



Low Demand Scenario (residential only)

2. **High Demand Scenario.** A high-end forecast was determined by using the total water use per capita for each water supplier in 2020, as reported in the 2020 UWMPs. This value was calculated in the UWMPs based on total service area water use. This estimate projects total demands on a per capita basis for the supplier's service area, including commercial, industrial and institutional and landscape demands. Using the 2020 total per capita demand value considers ancillary water use that occurs to support housing over time. Using 2020 rather than 2030 estimates for this scenario allows for a more conservative estimate that is calculated prior to implementation of future water conservation practices in residential areas.



High Demand Scenario (residential and associated CII)

Once per capita water demand was estimated for all urban water suppliers for each scenario, an average per capita demand factor was estimated for each COG by averaging the demand factors for suppliers within each jurisdiction. For unincorporated areas and municipalities whose water suppliers are not required to submit a UWMP, this average demand factor was used to forecast water demands.

Once residential and total per capita demands were estimated for each jurisdiction, these values were then applied to 95 percent of the forecasted RHNA units per jurisdiction, assuming household size as estimated by the 2020 U.S. Census. Projected water demand associated with the sixth-cycle RHNA assumes a 5 percent vacancy rate, the minimum vacancy rate for a healthy rental market per Article 10.6.

Appendix A, attached to this Water Supply Study, shows the estimated low (residential) and high (total) demands calculated for each urban water supplier within San Joaquin Valley.

Table 5 shows the estimated low- and high-water demand scenarios for each COG, followed by ***Figure 6***, which illustrates the additional water supply needed to serve the forecast RHNA housing units.

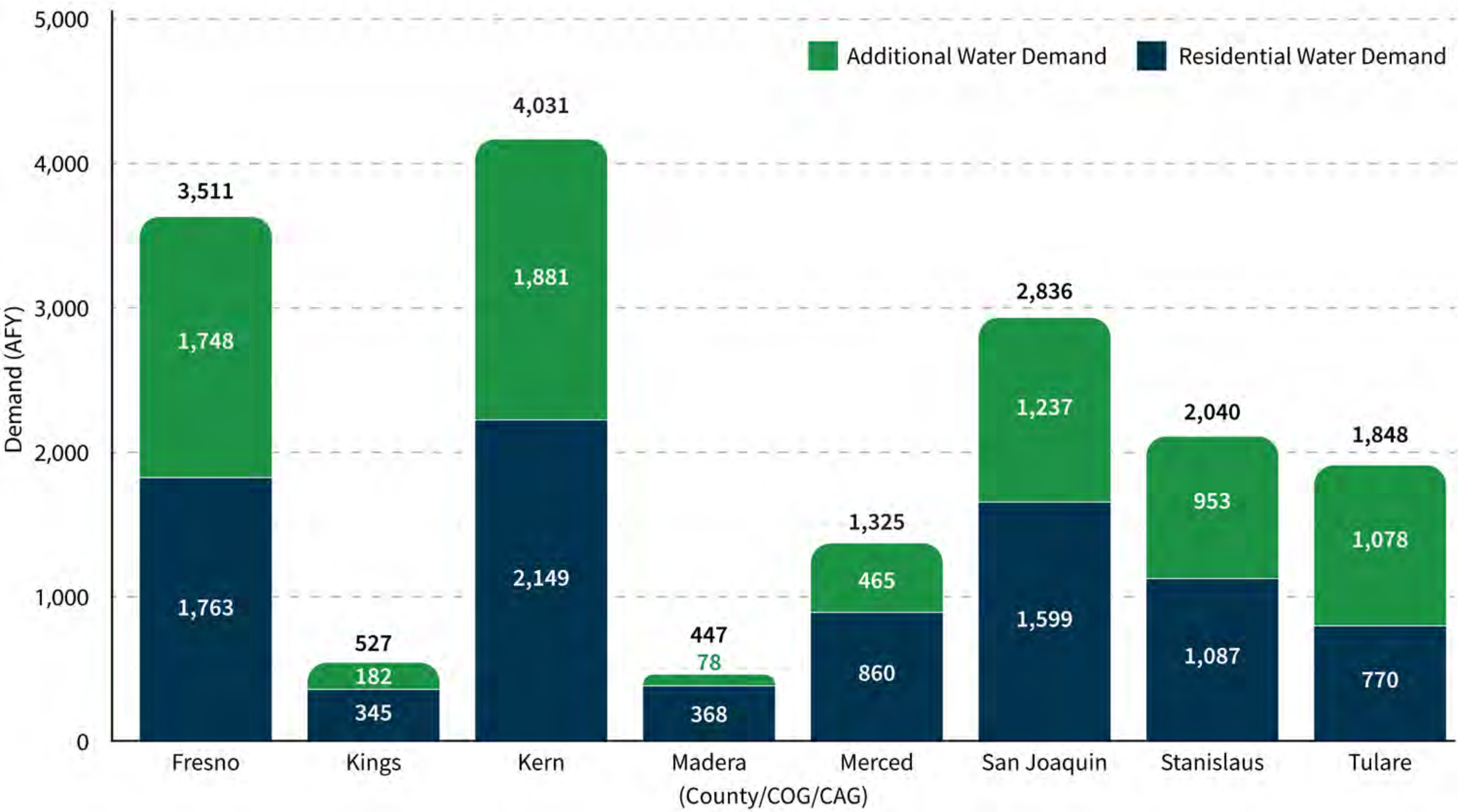
Table 5. Projected Water Demand for RHNA Units

MPO	Sixth-Cycle RHNA Housing Units	Average Population per Household[1]	Low Demand Scenario: Projected Residential Demand (AFY)	High Demand Scenario: Projected Total Demand (AFY)
Fresno COG	58,298	3.14	1,763	3,511
Kern COG	57,650	3.19	2,149	4,031
Kings CAG	9,429	3.17	345	527
Madera CTC	12,243	3.4	368	447
Merced CAG	22,620	3.35	860	1,325
San Joaquin COG	52,719	3.21	1,599	2,836
Stanislaus COG	34,344	3.12	1,087	2,040
Tulare CAG	33,214	3.33	770	1,848
Total for San Joaquin Valley	**280,517**		**8,943**	**16,564**

AFY = acre-feet per year; MPO = Metropolitan Planning Organization; COG = Council of Governments; CAG = County Association of Governments; CTC = County Transportation Commission; RHNA = Regional Housing Needs Allocation
Source: US Department of Finances, 2023

Figure 6 illustrates the additional water supply needed to serve the forecast RHNA housing units. The projected water demands shown in these tables and figures do not reflect redistribution of water demands that may occur as a result of intercity movement, or residents moving from areas that are currently overcrowded to areas with more available housing units.

Figure 6. Projected Water Demand for RHNA Units



CONSTRAINTS ON HOUSING DEVELOPMENT

A survey of City and County planners conducted for the San Joaquin Valley REAP Report asked about constraints to building new housing, including specific questions on infrastructure. The survey asked, "In your opinion, what are the three most critical housing issues facing your city or county?" Inadequate infrastructure was one of the top three responses (37.5 percent of respondents).

The survey also asked, "Which are the key physical constraints on the production of housing in your city or county?" The highest rated response, on a scale of 1 to 5, was water infrastructure (4.94), followed by sewer capacity infrastructure (4.91), and water supply (4.72). Infrastructure limitation was identified by 43.7 percent of respondents as limiting their ability to annex land.

In San Joaquin, Merced, and Tulare counties, older water and wastewater systems may not be able to accommodate the higher density nature of infill development prioritized by the RHNA objectives. In Stanislaus County, the capacity of the water systems and finite water sources are a constraint.

Water quality is an additional constraint for Merced County, and both Stanislaus and Merced counties have wastewater system capacity and service area limitations. These limitations may impact whether the housing unit allocations for the counties can be achieved.

3.

WATER SUPPLY SCENARIOS

The "water supply scenario" refers to current conditions related to water supply availability, including the existing sources of water, existing and anticipated uses, and major storage and conveyance infrastructure.

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SURFACE WATER

Two major river systems drain and define the Central Valley. North of the Sacramento-San Joaquin River/San Francisco Bay Delta (Delta), the Sacramento River flows south through the Sacramento Valley for 450 miles, consolidating tributaries, including the Feather River and American River. South of the Delta, the San Joaquin River flows northwest for 360 miles, merging tributaries, including the Merced River, Tuolumne River, Stanislaus River, and Mokelumne River. Although this study focuses on the San Joaquin Valley, the major water conveyance systems in the state cross both river basins and are summarized in the sections below.

In the south part of the San Joaquin Valley, the alluvial fan of the Kings River and other streams flow from four major Sierra Nevada rivers—the Kings, Kaweah, Tule, and Kern Rivers—into the Tulare Lake basin. This basin, historically filled during heavy snowmelt and hydrologically connected to the San Joaquin River, has been mostly dry since the early 1900s, because the rivers feeding it were diverted for agricultural purposes. However, the lake occasionally reappears following an extremely wet winter, such as in 1983, 1997, and 2023.

Central Valley Project

The Central Valley Project (CVP) is a complex, 400-mile network of dams, reservoirs, canals, hydroelectric powerplants, and other facilities both north and south of the Delta. The CVP extends from the Cascade Mountains near Redding in the north to the Tehachapi Mountains near Bakersfield in the south. The CVP supplies water for domestic and agricultural uses and reduces flood risk for adjacent lands. Secondary CVP benefits include hydroelectric production, water-based recreation, habitat protection, and water quality enhancement.

The U.S. Bureau of Reclamation (USBR) operates the CVP and has long-term agreements to supply water to more than 250 contractors. CVP construction began in 1938 with the Shasta Dam on the Sacramento River. Over the next five decades, the CVP was expanded into a system of 20 dams and reservoirs, 11 power plants, and 500 miles of major canals that together can hold nearly 12-million-acre feet per year (MAF) of water. Annual average CVP deliveries include seven MAF for agricultural, municipal, and industrial uses, along with water for wildlife refuges and water quality in the Sacramento-San Joaquin Delta.

The CVP regulates Sacramento River Basin (north of the Delta) and San Joaquin River Basin (south of the Delta) runoff to meet water demands in the Sacramento Valley, San Francisco Bay Area, San Joaquin Valley, and Tulare Lake Basin (USBR 2008, 2020). CVP water north of the Delta is controlled by Shasta Dam on the Sacramento River and Folsom Dam on the American River. CVP water south of the Delta is controlled by New Melones Dam on the Stanislaus River and Friant Dam on the San Joaquin River.

The Madera Canal and Friant-Kern Canals divert San Joaquin River supply to agricultural users in the southern portion of the basin. The Delta-Mendota Canal intercepts north of Delta water and conveys it southward through San Joaquin Valley, supplying the off-channel San Luis Reservoir and the San Joaquin River at Mendota Pool located downstream of Friant Dam. ***Table 6***, below, and the following ***Table 7*** summarize major CVP facilities.

Table 6. Major CVP Facilities

Facility	In Study Area?	Description	Storage Capacity
Shasta Dam and Reservoir	No	Constructed 1937-1945 on the Sacramento River	4,552,000 AF
Trinity Dam and Reservoir	No	Constructed 1956-1961 on the Trinity River	2,448,000 AF
Folsom Dam and Reservoir	No	Constructed 1951-1955 on the American River	977,000 AF
New Melones Dam and Reservoir	Yes	Constructed 1970-1980 on the Stanislaus River	2,420,000 AF
Friant Dam and Millerton Reservoir	Yes	Constructed 1937-1942 on the San Joaquin River Supplies the 152-mi Friant-Kern Canal which ends at Kern River Supplies the 36-mi Madera Canal which ends at Chowchilla River	520,000 AF
San Luis Dam and Reservoir	Yes	Constructed 1963-1968, off-stream in Diablo Range Stores north of Delta water diverted through Delta-Mendota Canal	966,000 AF (federal share)
Delta-Mendota Canal	Yes	Constructed 1946-1951 117-mile canal carries north of Delta water south to replenish San Joaquin River water diverted to Friant-Kern Canal and Madera Canal Intake at Clifton Court Forebay near Tracy Supplies San Luis Reservoir	
CVP/SWP Intertie	Yes	Constructed in 2012 Connects the state-managed California Aqueduct and the federally managed Delta-Mendota Canal	

AF = acre-feet

Project Deliveries

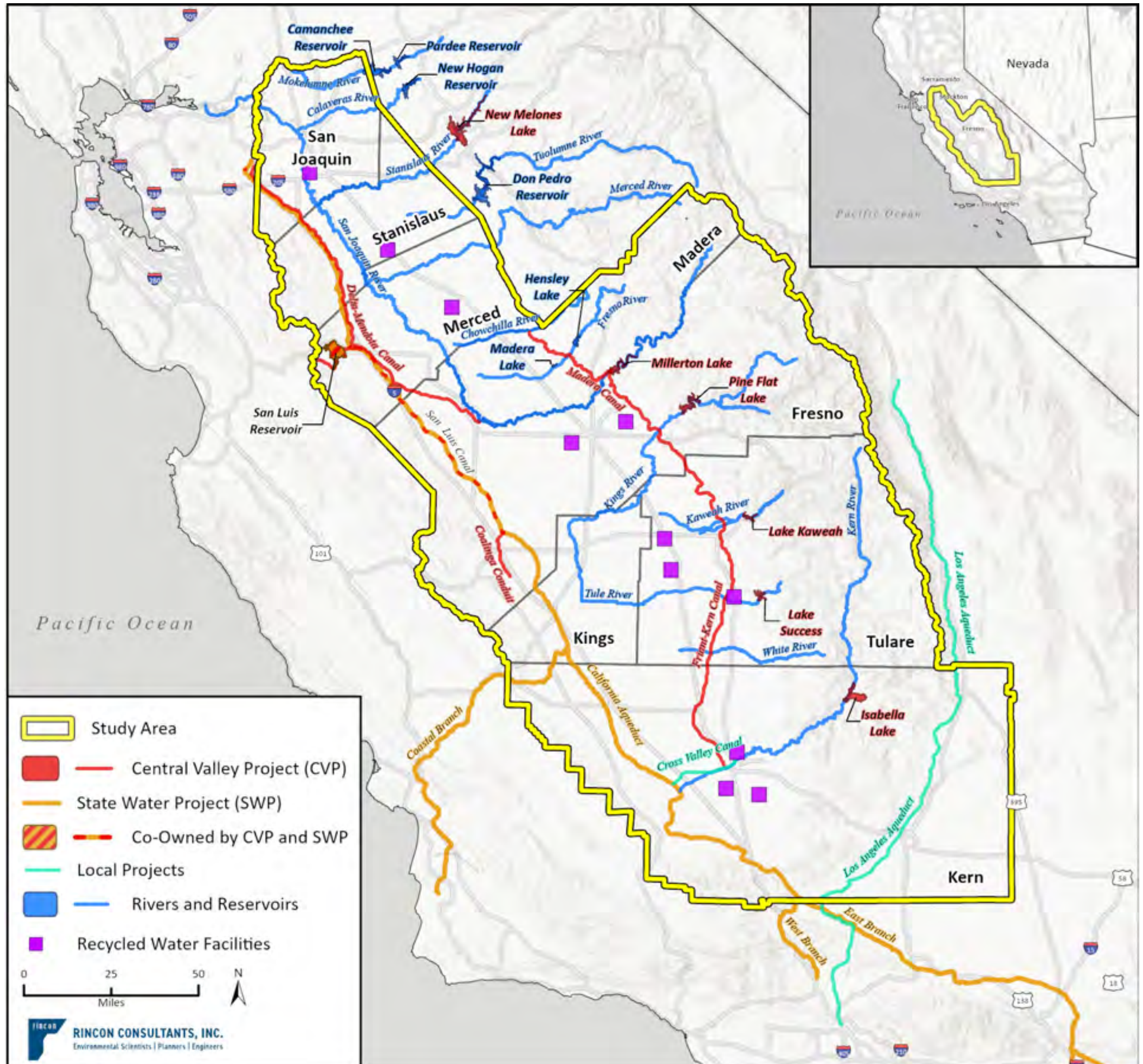
The CVP has water service contracts to deliver about 6.275 MAF per year. CVP contractors include the Sacramento River Settlement Contractors (Settlement Contractors), the San Joaquin River Exchange Contractors (Exchange Contractors), municipal and industrial (M&I) contractors (urban users), agricultural contractors in the San Joaquin and Tulare basins, and wildlife refuges. Each CVP contract type has a different priority for water delivery.

The Settlement Contractors and Exchange Contractors have the highest priority based on senior California water rights. The next highest priority for deliveries belongs to M&I contractors. During drought conditions, agricultural contractors, who have the lowest priority, bear the greatest reductions. The priority of refuge water supplies varies compared to other project deliveries. The average water supply required to maintain refuge wetlands, called "Level 2" water, has a priority comparable to the Settlement Contractors and Exchange Contractors, providing a perennially reliable water source. The water supply needed for ideal refuge habitat management, called "Incremental Level 4" water, is purchased annually from willing sellers and takes on the priority of its prepurchase source (USBR 2008). Historical CVP deliveries varied from year to year depending on water year type and available water supply, pumping restrictions, and environmental demands.

CVP Use in San Joaquin Valley

Twelve of the subbasins (Eastern San Joaquin, Madera, Delta-Mendota, Kings, Westside, Pleasant Valley, Kaweah, Tulare Lake, Tule, Kern, Tracy, and White Wolf Subbasins) in the San Joaquin Valley receive CVP deliveries. Appendix A summarizes the water supplies by subbasin across the San Joaquin Valley.

Figure 7. Surface Water Supply Infrastructure



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Additional data provided by CDFW 2022 and DWR 2022.

State Water Project

The State Water Project (SWP) is a multi-purpose network of reservoirs, aqueducts, power plants, pumping plants, and conveyance that extends more than 600 miles through California. The SWP was built to provide water for the growing metropolitan region in arid Southern California. To reach Southern California users, the water must be pumped 2,880 feet over the Tehachapi Mountains. Today, the SWP provides municipal and agricultural water supply, power generation, recreation, and habitat protection. Seventy percent of the over 4 MAF in contracts for SWP water is for urban use, serving more than 27 million people, while the remaining 30 percent serves agriculture.

The California DWR operates the SWP, which serves 29 water contractors. The SWP was authorized by the California Legislature in 1959 and began construction in 1960. The SWP systems includes 21 dams and more than 700 miles of canals, pipelines, and tunnels to convey water from the Sierra Nevada to urban and agricultural users across the state. The SWP serves agricultural users in the Tulare Lake Basin and urban users in the San Francisco Bay Area, Central Coast, and Southern California. ***Table 7***, below, and ***Figure 7***, presented above, summarize major SWP facilities.

Table 7. Major SWP Facilities

Facility	In Study Area?	Description	Storage Capacity
Oroville Dam and Reservoir	No	Constructed 1961-1968 on the Feather River	3,500,000 AF
California Aqueduct	Yes	Constructed 1963-1968 400-mile aqueduct serves as principal feature of SWP Intake at Clifton Court Forebay near Tracy	
San Luis Dam and Reservoir	Yes	Constructed 1963-1968, off-stream in Diablo Range Stores north of Delta water diverted through California Aqueduct	1,075,000 AF (State share)
East Branch	No	Construction completed in 1973 Ends at Lake Perris in Riverside County	
West Branch	No	Construction completed in 1973 Ends at Castaic Lake in Los Angeles County	
Coastal Branch	No	Constructed 1968 and 1994-1997 116-mi canal ends at Lake Cachuma in Santa Barbara County	

AF = acre-feet; SWP = State Water Project

Project Deliveries

The SWP delivers water to two primary contractor groups: agricultural and M&I (urban). Each SWP contract has a Table A amount, which represents the annual maximum amount of water each contractor may request. Contractors' Table A amounts total 4.173 MAF per year. Nearly all SWP deliveries occur south of the Delta for a total Delta Table A amount of 4.133 MAF per year (USBR 2008). However, similar to the CVP, SWP supplies can vary greatly from year to year depending on water year type and available water supply, pumping restrictions, and environmental demands.

SWP Use in San Joaquin Valley

Five of the subbasins (Pleasant Valley, Delta-Mendota, Tulare Lake, Kern County, and Tule) in the San Joaquin Valley receive SWP deliveries.

Other Surface Resources

Other surface water resources include rivers, streams, and springs within the San Joaquin Valley (refer to ***Figure 7***). Surface water is used to meet water demands and to recharge the groundwater systems via conjunctive use programs, discussed in ***Groundwater***, below.

- Calaveras River (Eastern San Joaquin Subbasin)
- Stanislaus River (Modesto, Turlock, Tracy Subbasins)
- Tuolumne River (Modesto, Turlock Subbasins)
- Merced River (Turlock Subbasin)
- San Joaquin River (Turlock, Madera, Delta-Mendota, Kings, Westside Subbasins)
- Chowchilla River (Chowchilla Subbasin)
- Fresno River (Madera Subbasin)
- Kings River (Kings, Tulare Lake, Tule Subbasins)
- Kaweah River (Kaweah, Tulare Lake Subbasins)
- Tule River (Tulare Lake, Tule Subbasins)
- White River (Tule Subbasin)
- Kern River (Tulare Lake, Kern, White Wolf Subbasin Subbasins)

GROUNDWATER

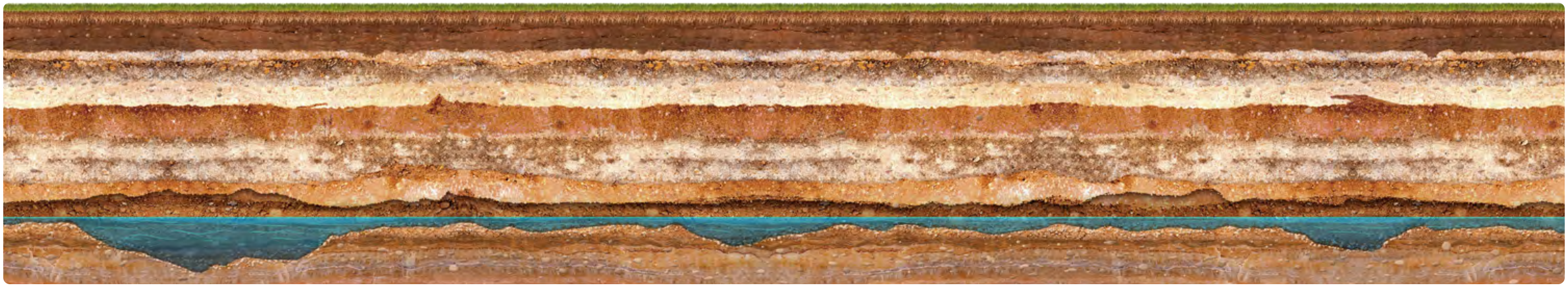
Groundwater is used to meet an estimated 40 percent of California's total water demands in an average year, and nearly 60 percent in dry years. Groundwater in California, however, has historically been withdrawn at a faster rate than it is replenished, resulting in overdraft conditions. In California's Groundwater (Bulletin 118), DWR estimated statewide groundwater overdraft at 2 MAF per year (DWR 2020). DWR further identified 20 groundwater basins in a state of critical overdraft, 11 of which are in the SJVGWB. Withdrawn groundwater volumes are compounded annually and has resulted in significant groundwater depletion over time.

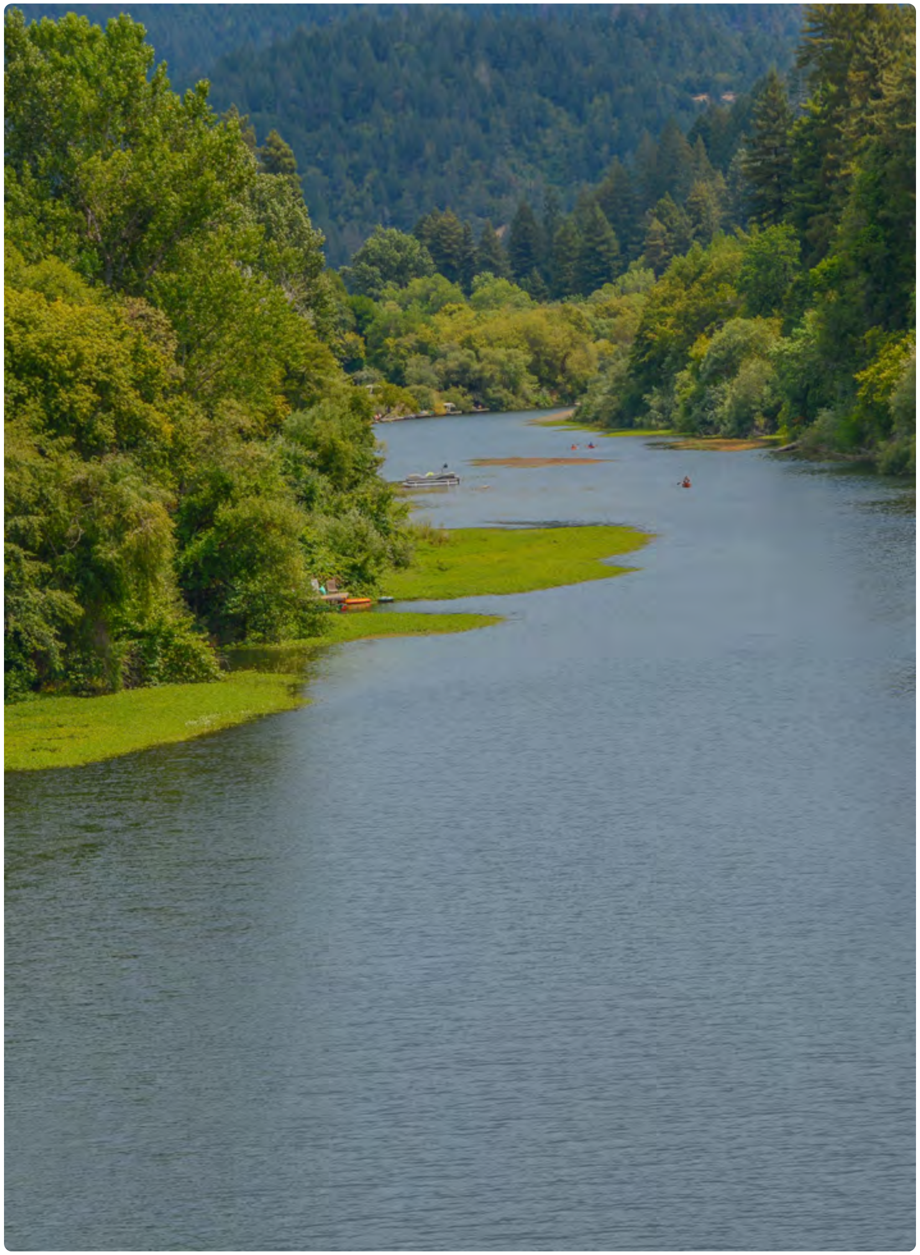
California's non-basin areas are defined as any area outside of a defined groundwater basin or subbasin and consisting of impermeable granitic, metamorphic, volcanic, or consolidated rocks (carbonates), with groundwater stored within fractures or other voids. The connectivity of these fractured rock systems is often limited and difficult to predict and characterize. These areas are typically found in the mountains and foothills upgradient of, or adjacent to, groundwater basins and include many of California's national parks, forests, and other wildland areas. A majority of the state's land area and domestic wells are located in non-basin areas, but groundwater extraction in non-basin areas comprises a small fraction (6 percent) of total pumping statewide (DWR 2020).

Management approaches, such as conjunctive use, allow surface water supplies and groundwater supplies to be managed collaboratively. Across the San Joaquin Valley, groundwater is banked when surface water supplies are most plentiful, and then extracted and used during droughts.

Conjunctive Use

Conjunctive use refers to the coordinated management of surface water and groundwater resources and is conducted both passively and actively. Conjunctive use is critical to water supply reliability planning in California, and to achieving and maintaining sustainable groundwater conditions for existing and anticipated end use demands. In its passive form, referred to as "in-lieu conjunctive use," surface water is used in wet years and groundwater is used in dry years. In its active form, referred to as groundwater banking, surface water is used to replenish groundwater basins through direct injection or recharge using infiltration ponds, such as stormwater catch basins (Water Education Foundation 2022). Groundwater banking is widely used by water agencies throughout San Joaquin Valley to store excess surface water supply when it is available during wet years, and use that supply in dry years, in combination with groundwater resources.





SGMA Status

For each of the state's medium- or high-priority subbasins, DWR-approved GSAs are responsible for preparing GSPs for their respective groundwater basins and submitting those plans to DWR for review and approval. The GSPs provide a roadmap for how local groundwater basins and subbasins will reach long-term sustainability. DWR has reviewed or is reviewing each of the GSPs submitted in 2020 and 2022 to determine whether its technical analysis and findings correctly conclude that the subject groundwater basin can be sustainable by the year 2045.

DWR's GSP review process has issued the following range of findings:

Approved. The GSP has been determined to comply with SGMA and is likely to achieve the basin's sustainability goal.

Incomplete. DWR has identified deficiencies that were significant enough to preclude its approval. The GSA has 180 days to address the deficiencies and resubmit the plan.

Inadequate. Following resubmittal and reevaluation, DWR (in collaboration with SWRCB) has determined that the corrected GSP did not sufficiently address the identified deficiencies. The SWRCB can now engage in State intervention.

DWR acknowledges the substantial effort put forth by local agencies to develop these initial GSPs. These plans represent significant local investment in defining and changing how groundwater is monitored, managed, and used. As shown in ***Table 8*** most GSPs in the San Joaquin Valley have been deemed incomplete or inadequate (if resubmitted). This means DWR has reviewed the technical analysis in the GSPs and determined that, as currently drafted, they do not comply with SGMA and would not achieve long-term sustainability for the basin.

Table 8. SGMA Status for SJVGWB Subbasins

Subbasins in SJVGWB	County(ies)	SGMA Basin Prioritization	GSP Status (as of April 2023)
Eastern San Joaquin Subbasin No. 5-022.01	• San Joaquin County	High, Critically Overdrafted	Incomplete
Modesto Subbasin No. 5-022.02	• Stanislaus County	High	Review in progress
Turlock Subbasin No. 5-022.03	• Stanislaus County • Merced County	High	Review in progress
Merced Subbasin No. 5-022.04	• Merced County	High, Critically Overdrafted	Incomplete
Chowchilla Subbasin No. 5-022.05	• Merced County • Madera County	High, Critically Overdrafted	Inadequate
Madera Subbasin No. 5-022.06	• Madera County	High, Critically Overdrafted	Incomplete
Delta-Mendota Subbasin No. 5-022.07	• San Joaquin County • Stanislaus County • Merced County • Madera County • Fresno County	High, Critically Overdrafted	Inadequate
Kings Subbasin No. 5-022.08	• Fresno County • Kings County • Tulare County	High, Critically Overdrafted	Incomplete
Westside Subbasin No. 5-022.09	• Fresno County • Kings County	High, Critically Overdrafted	Incomplete
Pleasant Valley Subbasin No. 5-022.10	• Fresno County	Medium	Review in progress
Kaweah Subbasin No. 5-022.11	• Tulare County	High, Critically Overdrafted	Inadequate
Tulare Lake Subbasin No. 5-022.12	• Kings County • Tulare County	High, Critically Overdrafted	Inadequate
Tule Subbasin No. 5-022.13	• Tulare County • Kern County	High, Critically Overdrafted	Inadequate
Kern County Subbasin No. 5-022.14	• Kern County	High, Critically Overdrafted	Inadequate
Tracy Subbasin No. 5-022.15	• San Joaquin County	Medium	Review in progress
Kettleman Plain Subbasin No. 5-022.17	• Kings County • Kern County	Low	N/A
White Wolf Subbasin No. 5-022.18	• Kern County	Medium	Review in progress

GSP = Groundwater Sustainability Plan; SGMA = Sustainable Groundwater Management Act; SJVGWB = San Joaquin Valley Groundwater Basin

Adjudicated Basins

There are five adjudicated groundwater basins within the Study Area, as shown in ***Figure 7*** and ***Table 9***. All of these basins were designated as Very Low priority in DWR's basin prioritization.

Table 9. Adjudicated Subbasins in the Study Area

Adjudicated Basins in the Study Area	County(ies)	SGMA Basin Prioritization	Watermaster
Cummings Valley Basin No. 5-027	• Kern County	Very Low	Tehachapi-Cummings County Watermaster
Tehachapi Valley-West Basin No. 5-028	• Kern County	Very Low	Tehachapi-Cummings County Watermaster
Brite Valley Basin No. 5-080	• Kern County	Very Low	Tehachapi-Cummings County Watermaster
Tehachapi Valley-East Basin No. 6-045	• Kern County	Very Low	Tehachapi-Cummings County Watermaster
Antelope Valley Basin No. 6-044	• Kern County • Los Angeles County • San Bernardino County	Very Low	Antelope Valley Watermaster

SGMA = Sustainable Groundwater Management Act

RECYCLED WATER

All of the wastewater treatment plants within the San Joaquin Valley percolate their treated effluent in infiltration ponds, which returns to groundwater. Several of the plants across the San Joaquin Valley deliver either secondary or tertiary treated effluent for agricultural and municipal irrigation (such as golf courses). The water reclamation plants that produce recycled water for direct use are listed below and shown in *Figure 5* above.

- Turlock Regional Water Pollution Control Facility (Turlock Subbasin)
- Merced WWTP (Merced Subbasin)
- Clovis Water Reuse Facility (Kings Subbasin)
- Fresno-Clovis Regional Wastewater Reclamation Facility (Kings Subbasin)
- Visalia Water Conservation Plant (Kaweah Subbasin)
- Tulare Water Pollution Control Plant (Kaweah Subbasin)
- Porterville Wastewater Treatment Facility (Tule Subbasin)
- Bakersfield Wastewater Treatment Plant #3 (Kern Subbasin)
- North of the River (NOR) Sanitary District No. 1 (Kern Subbasin)
- Lamont Public Utilities District WWTP (Kern Subbasin)
- City of Lathrop Consolidated Treatment Facility (Tracy Subbasin)

4.

WATER SUPPLY AVAILABILITY

San Joaquin Valley REAP
REGIONAL EARLY ACTION PLANNING

This section describes the availability of water supply for each groundwater basin in the San Joaquin Valley, based upon estimations of cumulative water demands for each basin and comparison of those estimates to the water budgets presented in the GSPs. Furthermore, this section examines the projects proposed to provide additional water supplies and characterizes the feasibility of acquiring water supplies necessary to meet projected demands associated with the sixth-cycle RHNA.

Each of the GSPs in the study area includes a water budget that accounts for inflows and outflows to the groundwater basin. Water budgets are important for understanding the historical, current, and projected amount of water going into (from mountain-front runoff, streambed percolation, return flows, recharge basins) and out of (from pumping, subsurface discharge) a basin. This process of accounting for inflows and outflows allows the GSAs to define changes in groundwater storage, which is an indicator of groundwater sustainability. For example, maintaining a net positive inflow means that groundwater storage and associated groundwater elevation is increasing. Because most of the groundwater basins in San Joaquin Valley are overdrafted, gradual increases in groundwater storage and elevation over time would reflect a positive outcome, or recovery from overdraft.

CUMULATIVE WATER DEMANDS

To determine cumulative water demands for each basin in the study area, Rincon compared the average urban water demand estimated for the proposed RHNA housing (see ***Chapter 3, Water Supply Scenario***) to the urban water demand estimated for 2030 in each of the GSPs. Any difference between these values (RHNA demand vs. GSP demand) represents a gap between the forecasted water demands associated with mandated housing and the urban water supply being planned for within each basin. This is the additional amount of water needed to accommodate demands associated with RHNA growth, which is not accounted for in the GSPs. Based on our review of the GSPs, their water demands were generally based on 2020 UWMPs and fifth-cycle RHNA, which were notably increased in the sixth cycle (see ***Table 4*** in ***Chapter 2, Demand Projections***).

In demand forecasting, projected urban water demand typically accounts for decreases in agricultural demand due to ag-to-urban conversion. Agricultural demand projections were assessed separately as part of a review of the GSP water budgets, described in ***Projected Water Budgets*** below.

While the concept of the water budgets is consistent across the SGMA basins, each GSP calculates its water budget differently. Urban water demand is generally determined by population increase, which is typically projected based on historical growth rates. For GSPs where urban demand was based on population projections, Rincon calculated a housing estimate difference by comparing the GSP population projections to the RHNA housing forecast and associated populations. This housing estimate difference was applied to the average water demand estimated for each basin (see ***Chapter 3, Water Supply Scenario***).

Table 10 shows the expected urban water demand associated with RHNA growth in addition to demand already planned for in the GSP, calculated for the Low-End Demand and High-End Demand scenarios introduced in ***Chapter 3, Water Supply Scenario***. This table shows that the total additional demand associated with housing that is not accounted for in the subbasin GSPs is approximately 6,082 AFY.

Table 10. Expected Urban Water Demand Increase from RHNA Allocations by Subbasin

Subbasins in SJVGWB[1]	Low-End Scenario: Water Demand Increase Estimate[2] (AFY)	High-End Scenario: Water Demand Increase Estimate[2] (AFY)
Eastern San Joaquin	614	1,062
Modesto	438	569
Turlock	0	0
Merced	705	991
Chowchilla	0	0
Madera	499	450
Delta-Mendota	335	509
Kings	81	121
Westside	15	23
Pleasant Valley	0	0
Kaweah	107	217
Tulare Lake	371	566
Tule	0	0
Kern County	1,038	1,417
Tracy	90	159
White Wolf	0	0
Total	**4,293**	**6,082**

AF = acre-feet; SJVGWB = San Joaquin Valley Groundwater Basin
[1] Excludes Kettleman Plain Subbasin because it is designated low priority and does not currently have a Groundwater Sustainability Plan
*[2] Low and High-End Scenarios are described in **Chapter 2** of this report.*

PROJECTED WATER BUDGETS

Under SGMA, each GSA is required to develop projected future water budgets as part of their GSPs. In these water budgets, estimated inflows to the basin are compared to estimated outflows from the basin to determine whether the basins are expected to be in balance, deficit (overdraft), or surplus. Inflows to the basins include percolation from streambeds, recharge basins, and precipitation, along with subsurface inflow and irrigation return flows. Outflows include groundwater pumping, subsurface outflow, and surfacing groundwater discharged through stream and river channels to adjacent areas. All groundwater pumping from agriculture, urban and municipal, and recreational uses is included in the estimated outflows.

To assess water supply availability within the study area, the water budget from each GSP was considered. Most of the GSPs had more than one scenario modeled for future water budgets, including different time periods and/or climate scenarios. For the purposes of this study, water budgets closest to year 2030 were used, to be nearest to the final year of implementation for the current RHNA cycle. Additionally, climate change was considered where possible, depending on data availability in the GSPs. These future water budgets are summarized in *Table 11*. This table shows that most basins within the San Joaquin Valley estimate that their year 2030 groundwater budgets will be negative, or contributing to overdraft. With Tracy as the notable exception, whose water budget has signifiacntly more inflow than outflow, the SJVGWB subbasins are projecting a negative change in storage in their GSP water budgets.

Table 11. Summary of Future Water Budgets

Subbasins in SJVGWB[1]	Estimated Inflows	Estimated Outflows	Estimated Change in Storage
Eastern San Joaquin	939,000	973,000	-34,000
Modesto	428,000	438,000	-10,000
Turlock	557,800	565,400	-7,600
Merced	743,000	873,000	-130,000
Chowchilla	256,100	297,800	-41,700
Madera	466,200	667,200	-201,000
Delta-Mendota	2,219,993	1,789,444	430,549
Kings	3,686,945	4,219,835	-532,890
Westside	421,000	426,000	-5,000
Pleasant Valley	24,260	25,036	-776
Kaweah	625,000	1,105,000	-480,000
Tulare Lake	320,538	465,721	-145,183
Tule	462,000	498,000	-36,000
Kern County	924,621	954,232	-29,611
Tracy	427,338	422,533	4,805
White Wolf	451,000	496,000	-45,000
Total	**–**	**–**	**-1,195,406**

SJVGWB = San Joaquin Valley Groundwater Basin
[1] Excludes Kettleman Plain Subbasin because it is designated low priority and does not currently have a Groundwater Sustainability Plan

PLANNED WATER SUPPLY PROJECTS

Each GSP identifies projects designed to provide additional water supplies to meet projected demand for the respective basin. These projects generally fall into two categories: demand reduction projects and supply increase projects.

Demand reduction projects are designed to promote conservation, increase water use efficiency, and reduce groundwater pumping. For example, the Madera Subbasin GSA proposes to offset estimated overdraft by significant reductions in groundwater pumping; the GSA plans to achieve a cumulative reduction in pumping of 10 percent by 2025 and eventually estimates an average savings of 90,000 AFY. Tule Subbasin proposes to offset overdraft by fallowing (or not sowing) approximately 20,000 acres of agricultural land to reduce demand, an expected benefit of 73,700 AFY.

Supply increase projects are designed in several ways. Most of the large-scale supply increases in the San Joaquin Valley are expected to come from increased capacity for storing surface water runoff. For example, the Tulare Lake Project in Kern Subbasin, proposed by the Kern Groundwater Authority GSA, expects to provide an additional 70,000 AFY to the subbasin through new conveyance facilities to divert flood flows from the Kings River to recharge basins. Surface water treatment for reuse can also increase basin water supplies. The North Kings GSA plans to increase surface water supply by approximately 82,240 AFY with construction of the Southeast Surface Water Treatment Facility, which will allow for surface water use from the Kings River to offset pumping in the basin.

In accordance with DWR's guidance, the GSAs identified water supply, water quality, and groundwater dependent ecosystem projects that support groundwater sustainability. Rincon reviewed each GSP's list of projects and assessed their future water budgets to identify each basin as either in balanced (sustainable) conditions; projected to be in balance after the addition of water supply projects detailed in ***Planned Water Supply Projects***, below; or not in balance (i.e., in overdraft).

Table 12 portrays these findings. This table shows that most GSAs expect to be able to acquire additional supply for their respective basins to be in balance in the future, with the exception of basins in Kern County (KGA Umbrella GSP and Henry Miller GSPs). Appendix A details these findings by GSP.

Table 12. Projected Water Budget Findings

Subbasins in SJVGWB1	Water Budgets Determination
Eastern San Joaquin	In balance with projects
Modesto	In balance with projects
Turlock	In balance with projects
Merced	In balance with projects
Chowchilla	In balance with projects
Madera	In balance with projects
Delta-Mendota	In balance with projects
Kings	In balance with projects
Westside	In balance with projects
Pleasant Valley	In balance with projects
Kaweah	In balance with projects
Tulare Lake	In balance with projects
Tule	In balance with projects
Kern County	Not in balance
Tracy	In balance
White Wolf	In balance with projects

SJVGWB = San Joaquin Valley Groundwater Basin
1 Excludes Kettleman Plain Subbasin because it is designated low priority and does not currently have a Groundwater Sustainability Plan

Depending on data availability, the GSPs also estimated an anticipated cost and expected benefit in AFY for each of the identified water supply projects. For many of the projects, these numbers could not be estimated, usually due to a long timeline or insufficient details for the project.

Table 13 shows the anticipated cost and expected benefit of all proposed projects in each of the subbasins. The expected benefit is the amount of additional supply in AFY the project is anticipated to provide at full implementation. Not all of the projects will be at full implementation by 2030, but many of the projects will have some expected benefit prior to the full implementation date.

Table 13. Summary of Proposed Implementation Projects

Subbasins in SJVGWB[1]	Average Annual Benefit at Full Implementation (AFY)	Estimated Project Costs (U.S. Dollars)
Eastern San Joaquin	88,637	$23 million
Modesto	81,748	$253 million
Turlock	20,756	NA
Merced	NA	$16 million
Chowchilla	134,414	$434 million
Madera	204,501	$285 million
Delta-Mendota	112,045	$782 million
Kings	577,698	$1.302 billion
Westside	77,300	$2 million
Pleasant Valley	39295	$28 million
Kaweah	77,375	$85 million
Tulare Lake	181,344	$407 million
Tule	324,839	$118 million
Kern County	673,609	$619 million
Tracy	13,500	$6 million
White Wolf	196,105	$33 million
Total	**2,803,166**	**$4.390 billion**

AF = acre-feet; SJVGWB = San Joaquin Valley Groundwater Basin
[1] Excludes Kettleman Plain Subbasin because it is designated low priority and does not currently have a Groundwater Sustainability Plan

The proposed implementation projects were compiled and broken down into the following categories: Conservation and Efficiency, Pumping Reduction, Surface Storage, Direct Recharge, Surface Water Treatment, Conveyance and Distribution, Recycled/Reclaimed Water, and Surface Water Trading. ***Table 14*** shows this compilation of the project types that each of the San Joaquin Valley basins is proposing to implement to achieve groundwater sustainability.

Table 14. Summary of Proposed Implementation Projects by Type

Subbasins in SJVGWB[1]	Conveyance & Distribution	Direct Recharge	Conservation & Efficiency	Surface Water Treatment	Recycled/ Reclaimed Water	Surface Water Trading	Surface Storage	Pumping Reduction	Other
Eastern San Joaquin	✓	✓	✓	✓	✓	✓			
Modesto	✓	✓	✓				✓	✓	✓
Turlock	✓	✓	✓		✓				
Merced	✓	✓	✓				✓	✓	✓
Chowchilla	✓	✓				✓	✓	✓	
Madera	✓	✓	✓			✓		✓	
Delta-Mendota	✓	✓	✓		✓		✓	✓	✓
Kings	✓	✓	✓	✓	✓			✓	✓
Westside		✓				✓		✓	
Pleasant Valley	✓	✓	✓		✓		✓	✓	✓
Kaweah	✓	✓	✓			✓	✓	✓	✓
Tulare Lake	✓	✓	✓				✓	✓	
Tule	✓	✓	✓		✓	✓	✓	✓	
Kern County	✓	✓	✓		✓	✓	✓	✓	✓
Tracy	✓						✓		
White Wolf	✓	✓	✓		✓		✓	✓	✓

SJVGWB = San Joaquin Valley Groundwater Basin

[1] Excludes Kettleman Plain Subbasin because it is designated low priority and does not currently have a Groundwater Sustainability Plan

5.

FEASIBILITY FINDINGS

This section provides overall findings about the availability of water supply to meet sixth-cycle RHNA housing demands, as well as suggested opportunities and constraints related to water supply infrastructure.

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OVERALL FINDINGS

Based on the existing water supply scenarios presented in the GSPs for groundwater basins across the San Joaquin Valley, there is purported to be adequate available water supplies to meet both GSP- and sixth-cycle RHNA-forecasted water demands. All the GSPs, with the exception of the Kern County Subbasin, claim to have identified demand reduction and supply acquisition projects enough to meet forecasted demands. However, the reviews conducted for this Water Supply Study indicate the following overall findings.

RHNA Water Demands

The housing units anticipated as part of the sixth-cycle RHNA are forecasted to require 9,000 to 16,000 AFY to serve new residential and associated commercial, industrial, and institutional demands. These demands were generally not included in the San Joaquin Valley GSPs as part of regional demand projections. In the Kern County and Eastern San Joaquin subbasins, the GSPs substantially under-projected the necessary demands associated with new state-mandated housing.

Most of the water demands in the San Joaquin Valley are associated with agricultural production, with urban water use comprising of less than 10 percent of overall applied water use (DWR 2018). The RHNA demands, as forecast for this Water Supply Study, represent less than one percent of the overall water demands in most groundwater basins.

To serve future housing and meet estimated water demands, an additional 4,000 to 6,000 AFY of supply is needed, above the amount of water projected to be available in local GSPs. This was determined to be the "RHNA demand gap" throughout the San Joaquin Valley, based on sixth-cycle RHNA units allocated across the region's jurisdictions. While this is a relatively small demand gap, given the scale of total water demand across the San Joaquin Valley, it is critical that 5-year GSP updates and RHNA cycles come into alignment so that water supply is appropriately coordinated with urban growth.

Water Supply Acquisition

To meet their forecasted water budgets and bring their subbasins into sustainable conditions, San Joaquin Valley GSAs must acquire additional water supplies and/or reduce demands by 1,266,800 AFY by 2030. Most of the basins identify a multitude of projects to achieve sustainability and expect to reduce groundwater pumping, increase surface water use, and improve water use efficiency.

To meet the forecasted sixth-cycle RHNA demands, 4,000 to 6,000 AFY in additional water supply is needed. Eleven out of 16 subbasins within the SJVGWB must pursue additional water supply acquisition to meet their projected growth plus these additional RHNA demands.

This is a significant amount of new water involving nearly $4.4 billion in new investment over the next several decades. The ability of all SJVGWB GSAs to make such significant financial investments will determine the region's success in providing adequate water supply for new residential growth. State grant programs for water supply development should be aligned with RHNA-mandated housing development to support the state's housing goals.

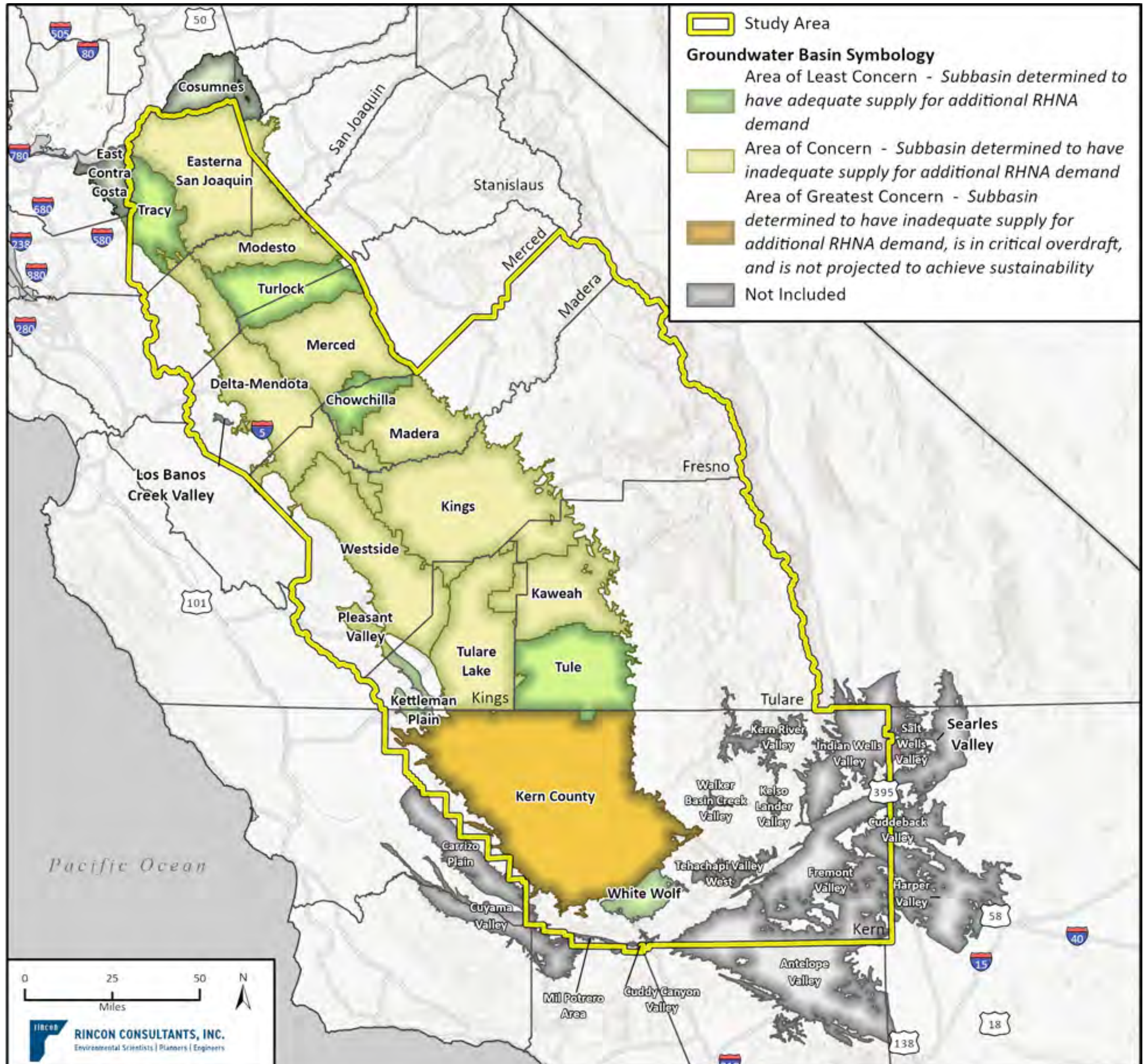
Areas of Concern

By assessing the subbasin water budgets, DWR plan determinations, and RHNA demand gaps, Rincon has categorized the subbasins into areas of varying concern, shown in ***Figure 8***. Tracy, Turlock, Chowchilla, and Tule Subbasins were found to have adequate supply to accommodate RHNA demand and were designated "Areas of Least Concern". These subbasins were found to have adequate supply to accommodate RHNA demand either due to the GSP estimates of urban water use (inclusive of the estimated increase from RHNA described previously in ***Chapter 2***), or, in the case of Tracy Subbasin, the projected water budget surplus estimated in the GSP being adequate to accommodate the additional estimated urban supply.

As not all GSPs within Kern County Subbasin were found to be in balance, even with future water supply acquisition and demand reduction projects, and the subbasin was not found to have adequate supply to accommodate RHNA demand, the Kern Subbasin was designated an "Area of Greatest Concern".

All other subbasins within San Joaquin Valley were designated "Areas of Concern" as their GSP water budgets underestimated urban water demands for new state-mandated housing, and they were not determined to have adequate supply without the implementation of additional projects. The GSPs did not include RHNA sixth-cycle housing counts as they were released after local GSPs were developed, but it is important to acknowledge that the demands associated with this housing are not currently being planned for.

Figure 8. Areas of Concern



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Additional data provided by the California Department of Water Resources (DWR) 2020.

PURVEYOR CONSTRAINTS AND OPPORTUNITIES

In addition to these preliminary conclusions regarding each identified purveyor's ability to provide water supply for the planned housing production, Rincon has identified constraints and opportunities related to both volumes of supplies as well as existing infrastructure capacity.

Conveyance and Storage Infrastructure

While urban demand in the San Joaquin Valley is small relative to agricultural demand, it is firm and requires more specific infrastructure compared to agricultural deliveries. Therefore, the need to plan new and expanded infrastructure—conveyance, storage, treatment—for new urban users may not scale directly in comparison to decreases in agricultural demand.

As shown in the San Joaquin Valley REAP survey described in Constraints on Housing Development, older water and wastewater systems in San Joaquin, Merced, and Tulare counties may not be able to accommodate the higher density nature of infill development resulting from RHNA growth. In Stanislaus County, the capacity of the water systems and finite water sources are a concern.

Water Quality and Treatment

Water quality can affect the GSAs' ability to use groundwater for urban and agricultural demands. Groundwater quality concerns raised in the GSPs included nitrate, total dissolved solids, arsenic, uranium, and hexavalent chromium. While some of these constituents are caused by human activity, several are naturally occurring. Each of the GSPs includes a groundwater monitoring program to better understand and track groundwater quality, as well as projects that address treatment needs for constituents of concern.

Many of the water supply projects in the San Joaquin Valley GSPs address additional capture and treatment of surface and storm water, such as City of Fresno's proposed Southeast Surface Water Treatment Facility and Fresno North Surface Water Treatment Facility in the North Kings GSP. These treatment projects must address the water quality concerns raised by the region's Basin Plans to adequately serve new urban demands.

Wastewater Treatment

While wastewater treatment and recycled water delivery are potential new supplies to meet projected demands, this water may already be accounted for in projected water budgets in the GSPs. Depending on how current effluent from wastewater treatment plants is disposed of and accounted for in the GSPs, wastewater effluent may be a necessary water budget component for percolation (i.e., groundwater recharge) and not available as new recycled water supply for surface application. If diverted for recycled water use, groundwater levels may be subsequently affected.

As reported in the San Joaquin Valley REAP survey, both Stanislaus and Merced counties have wastewater system capacity and service area limitations. These limitations may further impact whether the housing unit allocations for the counties can be achieved.

Cost of Supply Acquisition

To acquire the water supplies identified in the GSPs, approximately $4.4 billion will need to be invested by San Joaquin Valley GSAs to construct identified projects. This level of investment requires support from both state and federal funding sources, as local agency budgets are not sufficient to feasibly accomplish the projects.

In particular, it is important to leverage statewide funding and efforts to build wet-weather flow capture and recharge facilities. This 2023 wet season demonstrated that many local water facilities are incapable of storing and recharging high flows during a particularly rainy year.

RECOMMENDATIONS

Ultimately, these findings demonstrate that the future of water supply in the San Joaquin Valley may impact state-mandated housing development. To address this, Rincon recommends the following:

- Alignment between the 5-year GSP updates and RHNA cycles to ensure that new housing growth is planned for within groundwater and water supply management plans.
- Coordination between local GSAs and MPOs to incorporate the goals, actions, and projects discussed in the local GSPs into the jurisdiction's general plan updates and implementation measures. For example, many GSPs identify low-impact development standards as key best practices for increasing groundwater recharge in urban areas.
- Facilitate improved coordination between the GSPs to improve the groundwater planning process. Eash subbasin should employ coordinated groundwater modeling and methodologies to establish sustainability criteria and associated need for projects.
- Communication with the State regarding the RHNA demand gap, and the necessity of funding for water supply projects to serve projected growth.
- Leverage state and local efforts to build wet-weather flow capture and recharge facilities to facilitate groundwater management.

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A.

APPENDICES

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APPENDIX A

Table 15. Per Capita Demand Estimates by Urban Retail Water Supplier

Jurisdiction	Urban Retail Water Supplier	Residential Water Demand (AFY)	Total Water Demand (AFY)
Fresno COG			
Clovis	Clovis City of	0.14	0.20
Coalinga	Coalinga City of	0.10	0.23
Fresno	Bakman Water Company	0.16	0.19
	Fresno City of	0.15	0.22
Kerman	Kerman City of	0.12	0.19
Reedley	Reedley City of	0.08	0.19
Sanger	Sanger City of	0.14	0.19
Selma	California Water Service Company Selma	0.12	0.17
Kern COG			
Arvin	Arvin Community Service District	0.11	0.12
Bakersfield	Bakersfield City of	0.20	0.28
	California Water Service Company Bakersfield	0.13	0.20
	East Niles Community Services District	0.17	0.24
	Greenfield County Water District	0.19	0.22
	Oildale Mutual Water Company	0.22	0.25
	Vaughn Water Company	0.32	0.35
Delano	Delano City of	0.07	0.16
Kern	California Water Service Company Kern River Valley	0.09	0.14
Maricopa	West Kern Water District	0.12	0.20
McFarland	McFaland City of	0.09	0.09
Shafter	Shafter City of	0.17	0.24
Taft	West Kern Water District	0.12	0.20

Jurisdiction	Urban Retail Water Supplier	Residential Water Demand (AFY)	Total Water Demand (AFY)
Wasco	Wasco City of	0.10	0.14
Kings COG			
Hanford	Hanford City of	0.12	0.19
Madera COG			
Chowchilla City	Chowchilla, City of Water Department	0.10	0.13
Madera City	Madera City of	0.14	0.13
Atwater	Atwater City of	0.16	0.26
Livingston	Livingston City of	0.13	0.18
Los Banos	Los Banos City of	0.11	0.19
Merced	Merced City of	0.15	0.20
San Joaquin			
Lathrop	Lathrop City of	0.10	0.20
Lodi	Lodi City of	0.14	0.20
Stockton	California Water Service Company Stockton	0.08	0.14
	Stockton City of	0.10	0.17
Tracy	Tracy City of	0.11	0.20
Stanislaus COG			
Ceres	Ceres City of	0.12	0.13
Modesto	Modesto City of	0.14	0.19
Newman	Newman City of	0.12	0.19
Oakdale	Oakdale City of	0.13	0.22
Patterson	Patterson City of	0.11	0.16
Riverbank	Riverbank City of	0.14	0.17
Turlock	Turlock City of	0.15	0.27
Tulare COG			
Dinuba	Dinuba City of	0.13	0.18
Porterville	Porterville City of	0.13	0.15
Tulare	Tulare City of	0.12	0.24

Jurisdiction	Urban Retail Water Supplier	Residential Water Demand (AFY)	Total Water Demand (AFY)
Visalia	California Water Service Company Visalia	0.14	0.20

APPENDIX B

Table 16. San Joaquin Valley Water Supplies by Subbasin

SGMA GSPs	Plan Area Hydrology	Central Valley Project (CVP)	Surface Water (Used for Supply)	Imported Water (not CVP)	Groundwater	Recycled
Eastern San Joaquin Subbasin | No. 5-022.01						
Eastern San Joaquin Subbasin GSP	• Calaveras and Stanislaus River	• New Melones Unit	• Calaveras River to the New Hogan Reservoir (USBR)	• Agricultural and urban uses	• Used for agricultural and urban supply	• Planned – PMAs for City of Lodi White Slough WPCF; City of Manteca WWQCF; North San Joaquin Water Conservation District Winery wastewater; City of Escalon WWTP
Modesto Subbasin | No. 5-022.02						
Modesto Subbasin GSP	• Bounded by rivers on three sides: Stanislaus, Tuolumne, and San Joaquin Rivers	• N/A	• Stanislaus River • Tuolumne River	• None	• Oakdale ID pumps groundwater from 13 wells to supplement Stanislaus River deliveries • Agricultural pumping supplemented by private wells	• None
Turlock Subbasin | No. 5-022.03						
Turlock Subbasin GSP	• Bounded by rivers on three sides: Tuolumne, Merced, and San Joaquin Rivers	• N/A	• Agricultural: Tuolumne River, Merced River, and San Joaquin River • Dry Creek, Rouse Lake, and Mustang Creek	• None	• Extracted for agricultural use and potable water	• Turlock Regional Water Pollution Control Facility

SGMA GSPs	Plan Area Hydrology	Central Valley Project (CVP)	Surface Water (Used for Supply)	Imported Water (not CVP)	Groundwater	Recycled
Merced Subbasin | No. 5-022.04						
Merced Subbasin GSP	• Bounded by the Merced, San Joaquin, and Chowchilla Rivers. • Merced River dammed forming Lake McClure. • Chowchilla River drains into watershed regulated by Buchanan Dam. • San Joaquin River regulated by Millerton and other upstream reservoirs	• N/A	• Local surface water is used for agricultural irrigation.	• None	• Discharge primarily from groundwater production wells	• Merced Wastewater Treatment Plant
Chowchilla Subbasin | No. 5-022.05						
Chowchilla Subbasin GSP	• Chowchilla River, Ash Slough, Berenda Slough, Eastside Bypass and San Joaquin River	• N/A	• Buchanan Dam—Chowchilla River. • Millerton Reservoir—Madera Canal	• None	• Used for agricultural and urban supply	• None
Madera Subbasin | No. 5-022.06						
Multiple GSPs: Madera Subbasin Joint GSP	• Berenda Creek, Dry Creek, Fresno River, Cottonwood Creek, San Joaquin River, and Madera Lake • Major reservoirs upstream of Madera Subbasin: Hensley Lake and Millerton Lake	• Millerton Reservoir via Madera Canal • Hidden Dam via Fresno River • San Joaquin River	• Millerton Reservoir and Hensley Lake • Policies encourage grower use of surface water when available	• None	• Extracted for municipal and industrial use* • Private wells pumped for agricultural irrigation* ** Within city limits*	• None
Gravelly Ford Water District GSP	• San Joaquin River, Cottonwood Creek drains into the foothills, Chowchilla Canal Bypass is a major flood control channel	• Farming reliant on USBR Class 2 water	• Agricultural: Cottonwood Creek when foothill runoff can be diverted	• Friant Dam via San Joaquin River	• Within GSA, upper and lower aquifers used for irrigation and domestic use	• None
New Stone Water District GSP	• Bounded on east by the Chowchilla Bypass	• Friant Division via San Joaquin River	• Not consistently used for irrigation (only in wet years)	• None	• Pumping for agriculture	• None

SGMA GSPs	Plan Area Hydrology	Central Valley Project (CVP)	Surface Water (Used for Supply)	Imported Water (not CVP)	Groundwater	Recycled
Root Creek Water District GSP	• San Joaquin River	• Westside Mutual Water Company via Friant Division	• Two diversions along the San Joaquin River used for agriculture	• Madera Irrigation District, USBR, and CVP via pipeline	• Supplemented for surface water	• None
Delta-Mendota Subbasin | No. 5-022.07						
Multiple GSPs: Northern & Central Delta-Mendota GSP	• Surface waters from Fresno, Merced, Tuolumne, and Stanislaus rivers to San Joaquin River, which drains to Sacramento-San Joaquin Delta	• Delta-Mendota Canal meant to replace Friant Dam water via San Joaquin River	• Water deliveries from CVP, SWP, California Aqueduct, Delta-Mendota Canal, and San Joaquin River	• SWP to Oak Flat Water District	• Irrigation use supplements surface water deliveries • Municipal and domestic water	• Planned – PMAs for North Valley Regional Recycled Water Program (NVRRWP); Kaljian Drainwater Reuse Project
Farmers Water District GSP	• No natural surface water features in FWD.	• Groundwater put into Mendota Pool in exchange for CVP water delivered to Westside Subbasin	• Not used for agriculture	• Surface water adjacent to FWD used for agriculture	• 3 domestic and 17 agricultural wells • Agriculture uses max amount of surface water	• None
Aliso Water District GSP	• San Joaquin River	• Imported from the CVP	• Some landowners have access to San Joaquin River and the Chowchilla Bypass	• None	• Groundwater is the main water supply in the basin • Private landowners monitor their own well water levels	• None

SGMA GSPs	Plan Area Hydrology	Central Valley Project (CVP)	Surface Water (Used for Supply)	Imported Water (not CVP)	Groundwater	Recycled
Grassland GSP	• Streams west side: dammed San Luis and Los Banos Creeks, and Garzas and Ortigalita Creek. • Major upslope canals: Delta-Mendota Canal and CCID's Main and Outside Canals • Other important canals: Santa Fe and San Luis—San Luis Drain designed to carry storm water and surface and subsurface agricultural drainage flow	• Imported an average of 150,000 AFY of refuge water supplies from DMC for associated delivery	• GGSA surface water from USBR (CVP Refuge Level 2) and voluntary sources (Refuge Incremental Level 4) • Used in private, state, and federal wetlands • Mainly used by agriculture, with additional usage for municipal, domestic, and industrial	• None	• GGSA supplements Level 4 supply with groundwater when surface water is insufficient • Groundwater sourced from private wells	• None
San Joaquin River Exchange Contractors GSP	• San Joaquin River	• Primary supply to CCID, SLCC, FCWD and CCC	• Primary water source • SJREC hold senior water rights on San Joaquin River • SJREC GSA manages a sustainable interaction of surface water supplies and groundwater extraction	• None	• Used to meet peak demand, provide operational flexibility and additional supply during dry years	• None
Fresno County GSP	• San Joaquin River, Fresno Slough, Mendota Pool, and several canals (Chowchilla Bypass, Delta-Mendota Canal, Firebaugh Intake Canal, Columbia Canal, Central California Irrigation District (CCID) Main Canal, and CCID Outside Canal) • FCMA consists of MAA Meyers Water Bank and MAB Terra Linda Recharge Canal	• MPG exchanges groundwater into Fresno Slough for USBR use • USBR gives CVP water to MPG-owned lands in San Luis and Westlands Water District	• Sierra Nevada runoff to SJR tributaries • Flows to Millerton Reservoir • Millerton discharge to SJR • SJR west to Mendota Pool • Bifurcation at Chowchilla Bypass before Pool	• None	• Groundwater is used for irrigation purposes and extracted to the Mendota Pool	• None

SGMA GSPs	Plan Area Hydrology	Central Valley Project (CVP)	Surface Water (Used for Supply)	Imported Water (not CVP)	Groundwater	Recycled
Kings Subbasin | No. 5-022.08						
Multiple GSPs: McMullin Area GSP	• San Joaquin and King's Rivers are two principal rivers within/ bordering subbasin • Fresno Slough and James Bypass are along west edge and connect King's and San Joaquin Rivers	• For projects with connection to FID or Mendota Pool, CVP Friant Division Section 215, or contracted, CVP supplies may be available as subbasin is in CVP Place of USE	• Flood water drawn from north fork of the Kings River and/or James Bypass segment of the Kings River that is diverted and conveyed to land. • MVWD may receive USBR 214 water when available	• Water delivered via Dry Creek Canal and James Bypass when needed	• Used for residential and agricultural purposes	• None
North Fork Kings GSP	• King's River is the primary source of surface water for agriculture	• A small amount of Friant CVP water may be available for purchase in above average years	• Kings River suppliers vary by year depending on hydrologic conditions and amount carried into storage. • Pine Flat water diverted from King's River for distribution through canals	• None	• Meets domestic demands • Agricultural demands met through a combination of surface and groundwater	• None
Kings River East GSP	• San Joaquin River and Kings River	• Imported from the Friant Division	• Used for irrigation, M&I, and recharge. Pine Flat Dam and Reservoir, Wahtoke Creek, Travers Creek, Wooten Creek, Sand Creek, and Cottonwood Creek.	• None	• Used for irrigation, M&I, and dairies.	• None

SGMA GSPs	Plan Area Hydrology	Central Valley Project (CVP)	Surface Water (Used for Supply)	Imported Water (not CVP)	Groundwater	Recycled
North Kings GSP	• San Joaquin River and Kings River	• Imported from the Friant Division	• Supply comes from several intermittent stream channels flowing west from the foothills • Stormwater from ephemeral creeks diverted and conveyed to detention and recharge or used directly for irrigation	• None	• Used in agriculture, domestic and municipal wells, public water systems, local land use planning agencies, Native American Tribes, and disadvantaged communities	• City of Clovis Water Reuse Facility; Fresno-Clovis Regional Wastewater Reclamation Facility • Planned – PMA for City of Fresno Southeast Reclamation Facility
James GSP	• San Joaquin River and Kings River	• Imported from the Friant Division • USBR uses Mendota Pool (delivered by Delta-Mendota Canal) to make deliveries to James GSA entities	• Used solely for agricultural uses in James Irrigation District and Reclamation District No. 1606.	• Small amount from Friant-Kern Canal and McMullin GSA groundwater	• Used in James Irrigation District along with surface water • City of Jan Joaquin relies solely on groundwater for residential, commercial, and industrial services	• None
South Kings GSP	• San Joaquin River and Kings River	• Friant Division water can be several types of CVP water	• From San Joaquin and Kings River • Several CID canals run through/ near member agencies—used to deliver surface water for recharge	• None	• Solely relied on for deliveries from plan participants to their customers (residential, commercial, and industrial)	• None
Central Kings GSP	• Kings River and stored water within Pine Flat Reservoir	• None	• Diverted from Kings River and stored in Pine Flat • Agricultural, commercial, industrial, and urban use • Used for irrigation in 95,000 acres and supplemented by groundwater	• None	• Agricultural areas using surface water must be supplemented by groundwater. • All remaining areas rely solely on groundwater.	• None

SGMA GSPs	Plan Area Hydrology	Central Valley Project (CVP)	Surface Water (Used for Supply)	Imported Water (not CVP)	Groundwater	Recycled
Westside Subbasin | No. 5-022.09						
Westside Subbasin GSP	• None (all is imported from CVP via San Luis Canal)	• Receives surface water from CVP through Delta facilities and takes delivery from San Luis Canal	• Used for agricultural purposes for approximately 960,000 AF and must be supplemented by groundwater	• None	• Supplements surface water	• None
Pleasant Valley Subbasin | No. 5-022.10						
Pleasant Valley GSP	• None (all is imported from CVP via San Luis Canal)	• Receives surface water supplies from the CVP via San Luis Canal	• Agencies and water companies with access use it when available. • City of Coalinga uses water from CVP for agricultural, municipal, residential, commercial, and industrial	• None	• Primary water source since 1900s	• Treated wastewater from SCDR prison facility is used by private landowners for agricultural irrigation
Kaweah Subbasin | No. 5-022.11						
Multiple GSPs: Greater Kaweah GSP	• Kaweah River, Terminus Reservoir, Dry Creek, Yokohl Creek, Tulare Lake, St. Johns River	• Kaweah River system and Friant Unit of the CVP	• Kaweah River System, Friant Unit of the CVP, and Lake Kaweah	• Kings River Basin	• Groundwater is primarily extracted for agricultural use.	• None
East Kaweah GSP	• Kaweah River, Terminus Reservoir, Dry Creek, Yokohl Creek, Tulare Lake, St. Johns River	• Main Intake Canal conveys Kaweah River and CVP waters • TID uses water from Cameron and Packwood Creeks • Delivery below Tagus Evans Ditch	• Ditch companies get water from Lower Kaweah and St. Johns Rivers	• Kings River Basin	• Groundwater is primarily extracted for agricultural use.	• Citrus processing wastewater is recycled for crop irrigation near the City of Lindsay

SGMA GSPs	Plan Area Hydrology	Central Valley Project (CVP)	Surface Water (Used for Supply)	Imported Water (not CVP)	Groundwater	Recycled
Mid-Kaweah GSP	• Kaweah River, Terminus Reservoir, Dry Creek, Yokohl Creek, Tulare Lake, St. Johns River	• Main Intake Canal conveys Kaweah River and CVP waters • TID uses water from Cameron and Packwood Creeks • Delivery below Tagus Evans Ditch	• Consists of local Kaweah River system, Cameron and Packwood Creeks. • Kawaeah River delivered via Pre-1914 water rights		• Groundwater is primarily extracted for agricultural use.	• Visalia Water Conservation Plant • Tulare Water Pollution Control Plant (secondary for agricultural irrigation)
Tulare Lake Subbasin | No. 5-022.12						
Tulare Lake GSP	• None	• Is utilized but regulatory monitoring and management has reduced CVP delivery amounts per the 1992 CVPIA	• Diverted from Kings, Kaweh, Tule, and Kern Rivers via conveyance systems	• Imported using facilities of western SWP	• Used for agriculture or piped into municipal or agricultural delivery systems	• Multiple small to mid-size WWTPs where treated water is discharged into seepage ponds, used as recycled water, or used for irrigation

SGMA GSPs	Plan Area Hydrology	Central Valley Project (CVP)	Surface Water (Used for Supply)	Imported Water (not CVP)	Groundwater	Recycled
Tule Subbasin | No. 5-022.13						
Multiple GSPs: Pixley Irrigation District GSP	• Tule River, Deer Creek, and White River	• Most imports are from the CVP via the Friant-Kern Canal	• Agricultural demand met via Deer Creek (local)	• Angiola Water District imports from other sources including King's River and SWP	• Used by municipalities, public water systems, and domestic and industrial users	• City of Porterville Wastewater Treatment Facility
Alpaugh GSP	• None	• None	• During precipitation where Deer Creek exceeds its banks, stormwater is captured and pumped into storage reservoirs (Reservoirs 1, 2, and 3), and • Also distributed via canals in the GSA to supplement groundwater supply	• From Alpaugh ID and Atwell Island WD	• Agricultural water extracted from 13 AID agricultural wells into gravity-driven canal system on as-needed basis and distributed in the GSA • Municipal water extracted from a water-supply well (Well #1) with a designated backup well (Well #10)	• None
DEID GSA GSP	• White River	• Imported from the CVP via Friant-Kern Canal	• Surface and imported water is discharged to crops and municipal deliveries via wells	• From Friant-Kern Canal via pipelines and White River channel	• Recharged within stream channels, managed recharge basins, and areas with irrigated agriculture	• None
LTRID GSP	• Tule River, Deer Creek, and White River	• Imported from the CVP via Friant-Kern Canal	• Agricultural demand met via Tule River (local) and Friant-Kern Canal (imported)	• Angiola Water District imports from other sources including King's River and SWP	• Relied on by municipalities, public water systems, and domestic and industrial users	• City of Porterville Wastewater Treatment Facility

SGMA GSPs	Plan Area Hydrology	Central Valley Project (CVP)	Surface Water (Used for Supply)	Imported Water (not CVP)	Groundwater	Recycled
Eastern Tule GSA GSP	• Tule River, Deer Creek, and White River (used for distribution of imported water)	• Imported from the CVP via Friant-Kern Canal	• Used to recharge and supplement groundwater for agriculture when possible • Residents of Terra Bella in the Water Quality Improvement Program boundary of Terra Bella Irrigation District receive surface water as primary drinking water	• From Friant-Kern Canal and distributed using local water entities	• Relied on by most communities for municipal and industrial needs, except residents within Terra Bella Irrigation District who primarily use surface water supplied by USBR contract	• City of Porterville Wastewater Treatment Facility
TCWA – Tule Subbasin GSP	• District receives water from the CVP via the Fresno Slough Water District and Mercy Springs Water District Transfer	• Kings and Tule Rivers, Deer Creek, White River	• Kings and Tule Rivers, Deer Creek, White River, and flood waters when available • North Management Area lands receive a supply from Angiola Water District • Southeast Management Area lands do not have a surface water supply	• CVP via the Friant-Kern Canal • Angiola Water District imports from other sources including King's River and SWP	• The primary water supply • Angiola Water District operates two well fields • 10 active in East Well Field, and 18 active in West Well Field	• City of Porterville Wastewater Treatment Facility

SGMA GSPs	Plan Area Hydrology	Central Valley Project (CVP)	Surface Water (Used for Supply)	Imported Water (not CVP)	Groundwater	Recycled
Kern Subbasin | No. 5-022.14						
Multiple GSPs: KGA Umbrella GSP	• Kern River, regulated by the Isabella Dam and Reservoir	• Imported from the CVP--used for groundwater recharge	• Kern River, via the Sierra Nevada, used to recharge and supplement groundwater for agriculture when possible • Other sources of recharge: Poso and Caliente Creek, and ephemeral sources	• SWP via California Aqueduct (from CVP Delta Division) • CVP via Friant-Kern Canal	• Used in combination with surface water within service area • Conjunctive use programs capture and transport wet year surface water to recharge and offset pumping	• None
BVWSD GSA GSP	• Kern River, regulated by the Isabella Dam and Reservoir	• Imported from the CVP	• Used to meet demands and recharge principal aquifer system via conjunctive use program	• Kern River and SWP to BMA via CA Aqueduct • CVP Friant-Kern Unit via either East Side Canal or CA Aqueduct	• Used for agricultural, municipal, domestic, and industrial use.	• None
Kern River GSA GSP	• Kern River	• No direct CVP contractors • CVP available for purchase in wet years (Section 215 water)	• Kern River consists of releases from Lake Isabella, ~25 miles upstream of Plan Area • Mainly used for agriculture and drinking water • Actively recharge and bank surface water supplies, including Kern River and imported supplies	• From SWP via Cross Valley Canal and Federal CVP	• Vital source of agricultural, domestic, and municipal supply • Managed conjunctively with numerous surface water supplies	• City of Bakersfield Wastewater Treatment Plant #3 • North of the River (NOR) Sanitary District No. 1 • Lamont Public Utilities District Wastewater Treatment Plant (secondary for agriculture)

SGMA GSPs	Plan Area Hydrology	Central Valley Project (CVP)	Surface Water (Used for Supply)	Imported Water (not CVP)	Groundwater	Recycled
Olcese Water District GSP	• Kern River and Cottonwood Creek	• None	• Kern River fed from Sierra Nevada before discharge into Isabella Lake, receives additional runoff from 234 square miles of watersheds • Used for irrigation mainly and supplemented by groundwater when necessary. • ~79% surface water to 21% groundwater	• None	• Irrigated lands supplied by groundwater and Kern River water • Canyon View Ranch Well used by the Anne Sippi Clinic as raw source for domestic supply; only known potable consumption in Plan Area.	• None
Henry Miller Water District GSP	• California Aqueduct (SWP) and federal Friant-Kern Canal (CVP), Kern River, Poso Creek, Caliente Creek	• Imported water supplied by CVP's Friant-Kern Canal	• Kern River, Poso Creek, Caliente Creek, and significant ephemeral streams, spring, and seeps, are sources of recharge	• CVP's Friant-Kern Canal. • SWP via CA Aqueduct with CVP from Delta Division. • Treated, produced water used	• Due to natural, poorer quality in some areas of HMWD, it is generally not suitable for agriculture or domestic beneficial uses without treatment	• None
SOKR GSA GSP	• Kern River	• AEWSD contract with USBR for 40,000 AFY of Class 1 water and 311,675 AFY of Class 2 water from Friant Division of CVP	• Agricultural demands met by conjunctive use with groundwater depending on location	• SWP, Westside CVP, and Kern, Kings, Kaweah and St. John's Rivers	• Meets demands for urban potable water in the City of Arvin and Mettler • Agricultural demands met in combination with imported surface water	• None

SGMA GSPs	Plan Area Hydrology	Central Valley Project (CVP)	Surface Water (Used for Supply)	Imported Water (not CVP)	Groundwater	Recycled
Tracy Subbasin | No. 5-022.15						
Tracy Subbasin GSP		• USBR M&I contract for delivery of CVP water via Delta-Mendota Canal	• Purchase of Stanislaus River water from South San Joaquin Irrigation District (SSJID) via South County Water Supply Project (SCWSP)	• None	• City owns and operates nine wells (drilled below Corcoran Clay)	• City of Lathrop Consolidated Treatment Facility • Planned – PMA for Tracy Wastewater Treatment Plant
White Wolf Subbasin | 5-022.18						
White Wolf Subbasin GSP	• Kern River	• Imported from the CVP	• Used as irrigation water in combination with groundwater via conjunctive use programs	• SWP, CVP, Kern Water Bank, Kern River	• Supplies agriculture • Potable use includes domestic well owners and public water systems (TCWD, Tut Brothers Farm #95, and Cuyama Orchards)	• None

San Joaquin Valley

REAP

REGIONAL EARLY ACTION PLANNING

San Joaquin Valley Regional Early Action Planning (REAP) Program

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