Chapter 4
Environmental Setting

4.1 Overview

This chapter describes the environmental setting of the ILRP as it relates to surface water, groundwater, and agriculture. It briefly describes program boundaries and the watersheds and groundwater basins contained therein. It also summarizes the existing agricultural uses in the program area. The environmental setting, as it relates to specific resources, is presented in the sections of Chapter 5, Environmental Impacts and Mitigation Measures. A more detailed description of each watershed and groundwater basin can be found in the ECR. (ICF Jones & Stokes 2008).

4.2 Introduction

The connection between groundwater and surface water is important to address in the development of any program designed to protect water resources, because the movement of water from one hydrologic system to another can move pollutants between the two systems. Groundwater is recharged by seepage of water moving downward from the ground surface.

Today, many cities in the San Joaquin Valley that depend on groundwater for drinking water rely on surface water delivery facilities for groundwater recharge. In wet years, many agricultural water users are encouraged to forego pumping groundwater in exchange for applying surface water, and many irrigation districts and municipal water agencies recharge groundwater through spreading basins designed to enhance recharge. This recharged water can then be used in drier years when surface water supplies are less available. This interconnectedness both supports better utilization of water resources and provides pathways for contamination to occur.

4.3 Program Boundaries and Subdivisions

The jurisdiction of the Central Valley Water Board stretches from the Oregon border to the northern tip of Los Angeles County. Three major watersheds have been delineated within this region, namely the Sacramento River Basin, the San Joaquin River Basin, and the Tulare Lake Basin. The three basins cover approximately 40 percent of the total area of the state and include approximately 75 percent of the state's irrigated acreage (Central Valley Water Board 2002a).

The Central Valley is a large, flat, fertile valley that dominates the central portion of California. The northern half of the Central Valley is referred to as the Sacramento Valley. Its watershed extends out of the valley northward to the Oregon border; this entire watershed is included in the Central Valley Water Board's jurisdiction. The southern half of the Central Valley is referred to as the San Joaquin Valley. It includes both the San Joaquin River and Tulare Lake Basins. The Sacramento and San Joaquin Valleys meet at the shared delta of the Sacramento and San Joaquin Rivers, which flow through the northern (Sacramento Valley) and southern (San Joaquin Valley) halves of the valley, respectively.

The crests of the Sierra Nevada on the east and the Coast Ranges and Klamath Mountains on the west border the Sacramento and San Joaquin River Basins. The Sacramento and San Joaquin River Basins cover approximately one-fourth of the total area of the state and contain over 43 percent of the state's irrigable land. Surface waters from these two basins meet and form the Delta waterway system, which ultimately drains to San Francisco Bay. Major groundwater resources underlie both river valley floors. The Tulare Lake Basin is bounded on the east and south by the Sierra Nevada and on the west by the Coast Ranges. A low topographic rise in the floor of the San Joaquin Valley separates this basin from the San Joaquin River Basin to the north.

The Sacramento River Basin covers approximately 27,210 square miles. The principal streams in the basin are the Sacramento River and its larger tributaries: the Pit, Feather, Yuba, Bear, and American Rivers on the east; and Cottonwood, Stony, Cache, and Putah Creeks on the west. Major reservoirs include Shasta, Oroville, and Folsom.

The San Joaquin River Basin covers approximately 15,880 square miles. The principal streams in the basin are the San Joaquin River and its larger tributaries: the Cosumnes, Mokelumne, Calaveras, Stanislaus, Tuolumne, Merced, Chowchilla, and Fresno Rivers. Major reservoirs include Pardee, New Hogan, Comanche, Millerton, McClure, Don Pedro, and New Melones.

The Tulare Lake Basin comprises the drainage area of the San Joaquin Valley south of the San Joaquin River and encompasses approximately 17,650 square miles. The valley floor makes up slightly less than one-half the total basin land area. The Kings, Kaweah, Tule, and Kern Rivers, which drain the west face of the Sierra Nevada, provide the bulk of the surface water supply native to the basin. Major reservoirs are Pine Flat, Kaweah, Success, and Isabella. Imported surface water enters the Tulare Lake Basin through the San Luis Canal/California Aqueduct System, Friant-Kern Canal, and the Delta-Mendota Canal.

4.4 Surface Water

The Central Valley watershed is divided into three major hydrologic regions or surface water basins, which are described below and illustrated in Figures 2-2, 2-3, and 2-4. Each of the three basins is divided into subwatersheds delineated by DWR CalWater boundaries. The three surface water basins and their associated acreage, rivers/tributaries, and watersheds are described in detail in the ECR (ICF Jones & Stokes 2008).

4.4.1 Sacramento River Basin

The Sacramento River Basin contains the entire drainage area of the Sacramento River and its tributaries. It begins upstream of Shasta Lake near the Oregon border and extends south to the Delta, stretching roughly from the northeast corner of California to Sacramento County. The basin drains approximately one-third of total runoff in the state into the middle and lower reaches of the Sacramento River. For the purposes of this analysis, the Sacramento River Basin includes eight subwatersheds (Figure 2-2): the Pit River, Shasta-Tehama, Butte-Sutter-Yuba, Upper Feather River–Upper Yuba River, Lake-Napa, Colusa Basin, Solano-Yolo, and American River Subwatersheds.

Geologic provinces composing the Sacramento River Basin include the Sacramento Valley, the Coast Ranges, the Klamath Mountains, the Cascade Range, the Sierra Nevada, the Modoc Plateau, and the delta of the Sacramento River. Land uses in the Sacramento River Basin are principally forest and

range lands in the upper reaches, with urban development focused around the City of Sacramento. Agriculture is the dominant land use on the valley floor, followed by urban development.

Water quality concerns in the Sacramento River Basin are concentrated in the Sacramento Valley, in subwatersheds that are heavily agricultural. These include the Solano-Yolo, Colusa Basin, Butte-Sutter-Yuba Subwatersheds where agricultural land uses constitute 60, 37, and 36 percent of total acreage, respectively. Section 303(d) listings related to irrigated agriculture occur in all of these subwatersheds, as well as in the American River Subwatershed.

While some water bodies in other subwatersheds of the Sacramento River Basin are also Section 303(d) listed as impaired, these sources of impairment likely are caused by timber harvesting, grazing, and resource extraction, not irrigated agriculture. Elevated levels of diazinon in the Shasta-Tehama Subwatershed are related to pesticide use; however, water quality in this subwatershed generally meets or exceeds water quality objectives. To date, there is no associated Section 303(d) listing.

4.4.2 San Joaquin River Basin

The San Joaquin River Basin contains the entire drainage area of the San Joaquin River and its tributaries. It extends from the Delta and the Cosumnes River in the north to the southern reaches of the San Joaquin River watershed, encompassing the area from Sacramento County (including the southeast corner of the county itself) to Madera County (and portions of Fresno County). For the purposes of this analysis, the San Joaquin River Basin includes 12 subwatersheds (Figure 2-3): the Cosumnes River, Delta-Mendota Canal, San Joaquin River, San Joaquin Valley Floor, Delta-Carbona, Ahwahnee, Mariposa, Upper Mokelumne River–Upper Calaveras River, Merced River, North Valley Floor, Stanislaus River, and Tuolumne River Subwatersheds.

The San Joaquin River Basin encompasses approximately 9.8 million acres. In general, the basin is dominated by native vegetation. The primary tributaries in the basin are the Stanislaus River, Tuolumne River, and Merced River, which meet with the San Joaquin River in the valley floor at the basin's southern end. The basin is dominated by agriculture at the confluence of the San Joaquin and these various rivers. The San Joaquin River Basin includes most of the Delta as well as the Delta-Mendota Canal, a highly manipulated component of the Central Valley Project. Multiple canals in the Delta-Mendota Canal Subwatershed deliver water to agricultural operations and then back to the natural drainages. Many tributaries in the subwatershed that would otherwise be dry during the summer irrigation season flow year-round due to agricultural return flows.

The water quality of the San Joaquin River is of critical interest because it flows to the Delta, which is a primary source of drinking water, and supplies irrigation water to farms in the western San Joaquin Valley. One of the primary water quality concerns in the San Joaquin River Basin is the transport of pesticides by agricultural return flows to water bodies and transport of pesticides that are applied to orchards during the dormant growing season (November to January) that are transported to water bodies during rainfall events.

Water quality concerns in the San Joaquin River Basin are concentrated in the subwatersheds that are heavily agricultural—specifically, the Delta-Mendota Canal, San Joaquin Valley Floor, Delta-Carbona, and North Valley Floor Subwatersheds. Agricultural land constitutes one-third to one-half of the total land use in each of these subwatersheds. Correspondingly, all of these subwatersheds include water bodies impaired by Section 303(d)-listed pollutants that are associated with irrigated agriculture. Many of the rivers, creeks, and agricultural drainages in these subwatersheds contain

low dissolved oxygen (DO) (generally associated with agricultural return flows), fluctuating pH, and elevated levels of electrical conductivity (EC) (indicative of high salinity). Within each subwatershed, data indicate that chlorpyrifos, diazinon, permethrin, dieldrin, and DDT (and its breakdown products DDD and DDE) are frequently present in concentrations that exceed water quality objectives. Other pesticides are detected in these subwatersheds but not consistently in each subwatershed. In addition, elevated levels of naturally occurring metals that are mobilized and suspended in agricultural return flows are common in these subwatersheds—such as copper, arsenic, cadmium, boron, nickel, lead, and selenium.

4.4.3 Tulare Lake Basin

The Tulare Lake Basin includes the southern San Joaquin Valley and encompasses a drainage area from Fresno to the southern end of the Central Valley near the Grapevine (see Figure 2-4 for subwatershed boundaries). For the purposes of this analysis, the Tulare Lake Basin includes 10 subwatersheds: the Kings River, Kaweah River, Kern River, South Valley Floor, Grapevine, Coast Range, Fellows, Temblor Valley, Sunflower Valley, and Southern Sierra Subwatersheds.

Much of the topography within the upland portions of the Tulare Lake Basin is dominated by steep river canyons and large mountains, typical of the Sierra Nevada and Coast Ranges. The basin encompasses several significant land holdings, including Sequoia National Park, Sequoia National Forest, the Golden Trout Wilderness Area, and the Tule Indian Reservation. The basin also includes two Superfund cleanup sites, the Coalinga Asbestos Mine and the Atlas Asbestos Mine.

Due to the amount of land in the Tulare Lake Basin that is in the Sierra Nevada and the Coast Ranges, much of the basin is dominated by native vegetation and includes little urban development. In the upper watershed areas, irrigated agriculture accounts for less than 2 percent of land uses in the Kings River, Kaweah River, Kern River, Grapevine, Coast Range, Sunflower Valley, and Southern Sierra Subwatersheds—with just slightly more in the Temblor Subwatershed (3.3 percent). There is no agriculture in the Fellows Subwatershed.

In general, agricultural operations have a greater impact on surface water in the Central Valley between the Fresno area and the Tehachapi Mountains than other parts of the Valley. This is primarily due to the valley topography allowing for much larger agricultural operations.

Section 303d water quality concerns within the Tulare Lake Basin are limited to the South Valley Floor Subwatershed. None of the other subwatersheds include water bodies with Section 303(d)-listed pollutants; and all physical parameters such as EC, pH, temperature, and turbidity are generally within Basin Plan standards. Factors such as selenium and sedimentation are believed to be naturally occurring (with the exception of the South Valley Floor Subwatershed).

The South Valley Floor Subwatershed is the largest watershed within the Tulare Lake Basin, at approximately 5.3 million acres (approximately 8,280 square miles). The watershed is located in the southern Central Valley and is bounded to the north by the San Joaquin River, to the south by the Tehachapi Mountains, on the west by the Coast Ranges, and on the east by the Sierra Nevada. As noted, the South Valley Floor Subwatershed is relatively flat compared to the surrounding subwatersheds. Agriculture is the primary land use type in the subwatershed, encompassing approximately 66 percent (3.5 million acres) of the total land area.

Surface water in the South Valley Floor Subwatershed is not sufficient to support land uses in the subwatershed, resulting in a large proportion of water being imported from other locations. The Friant-Kern Canal, the San Luis Canal/California Aqueduct System, and the Cross-Valley Canal are

major water delivery facilities that have dramatically altered the way water is managed in the South Valley Floor Subwatershed; water is moved from one end of the valley to the next as needed. The Tulare Lake Basin is hydrologically closed except in extremely wet periods. Because of the intensive water development that has occurred in the basin, very few channels are not specifically maintained as water delivery features; there is very little monitoring or characterization of the basin's water quality.

4.5 Groundwater

California's groundwater is described by DWR as a "hidden resource." Management of groundwater resources is more complex than management of surface water because groundwater is not visible (DWR 2003). It is thought that California could not have achieved its agricultural economy, the fifth largest in the world, if it were not for the groundwater supply. Approximately 43 percent of the entire population of California obtains drinking water from groundwater aquifers (DWR 2003). In some areas, the use of groundwater is threatened by the high rates of extraction and inadequate recharge or contamination of aquifers from poor management practices.

The groundwater basins within the three major hydrologic regions (HRs) of the Central Valley watershed have been delineated using the boundaries in Bulletin 118 (DWR 2003), they are:

- Sacramento River Basin
- San Joaquin River Basin
- Tulare Lake Basin

Groundwater is one of California's most important natural resources, and our reliance on it continues to grow. Statewide, groundwater supplies account for approximately 30 percent of the total urban and agricultural water supply in average years, approximately 40 percent of the total water supply in dry years, and as much as 60 percent or more in some regions in dry years. Groundwater provides from 30 to 41 percent of the total water supply for urban and agricultural uses in the Sacramento River, San Joaquin River, and Tulare Lake Basins (see Table 4-1). More than 70 percent of the groundwater used in California is supplied from the Sacramento River, San Joaquin River, and Tulare Lake Basins. (DWR 2003.) With such a large amount of water coming from these basins, protection of their water resources is critical to ensure that future needs are met.

Table 4-1. Average Annual Groundwater Supply for the Sacramento River, San Joaquin River, and Tulare Lake Basins

Basin	Total Demand Volume (TAF)	Demand Met by Groundwater (TAF)	Demand Met by Groundwater (%)
Sacramento River	8,720	2,672	31
San Joaquin River	7,361	2,195	30
Tulare Lake	10,556	4,340	41

TAF = thousand acre-feet.
Source: DWR 2003.

The Sacramento River Basin consists of 90 basins and subbasins (Figure 4-1). The San Joaquin River Basin (Figure 4-2) includes nine subbasins, and the Tulare Lake Basin includes 19 basins and

subbasins (Figure 4-3). Detailed information on the quality of these groundwater basins is contained in the ECR (ICF Jones & Stokes 2008).

4.6 Agriculture

The lower elevations of the Central Valley have been dominated by agricultural activity for over 100 years. Over this period, crop types have changed and agricultural management practices have been altered, but intensive agriculture is still the principal land use adjacent to the valley's rivers and streams. The current status of agriculture in the three program area basins is briefly summarized below.

The Sacramento River Basin encompasses approximately 12.2 million acres. Of this amount, 2.4 million acres are classified as agricultural lands. The majority of these acres occur on the Valley floor, in the Solano-Yolo, Colusa Basin, and Butte-Sutter-Yuba Subwatersheds. Rice is the primary crop in the Sacramento River Basin, particularly in the Colusa and Butte-Sutter-Yuba Subwatersheds where poorly drained soils provide ideal conditions for this crop. Agricultural land uses account for less than 10 percent of total acreage in the Pit River, Shasta-Tehama, Upper Feather River–Upper Yuba River, American River, and Lake-Napa Subwatersheds.

The San Joaquin River Basin encompasses approximately 9.8 million acres. Of this total, approximately 2 million acres are classified as agricultural. Agricultural land uses in the basin are concentrated in the valley floor—specifically in the Delta-Mendota Canal, San Joaquin Valley Floor, Delta-Carbona, and North Valley Floor Subwatersheds. There is very little agriculture in the remaining subwatersheds—less than 1 percent in most cases. The primary crops that are produced in the San Joaquin River Basin include field crops, pasture, deciduous fruits and nuts, vineyards, and grain and hay.

The Tulare Lake Basin encompasses approximately 10.7 million acres. Of this amount, 3.6 million acres are classified as agricultural. The vast majority of this agricultural land is located in the South Valley Floor Subwatershed (3.5 million acres), largely due to topography. In comparison with other subwatersheds in the Tulare Lake Basin, the South Valley Floor Subwatershed is relatively flat. Consequently, the bulk of water quality concerns related to the Tulare Lake Basin involve agricultural operations and agricultural return flows in the South Valley Floor Subwatershed. The primary crop types within the Tulare Lake Basin as a whole are grain and hay crops, pasture, and deciduous fruits and nuts.

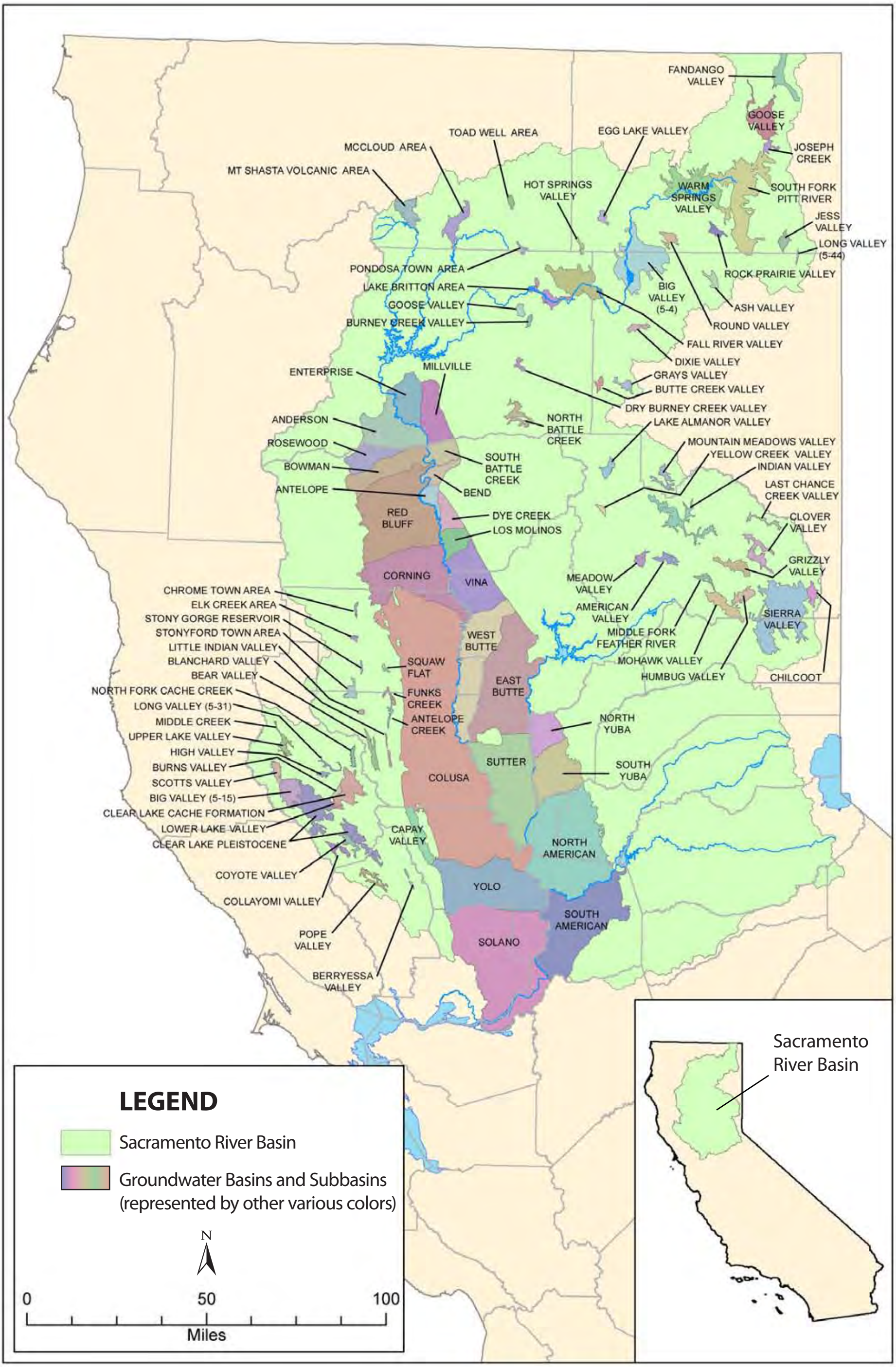

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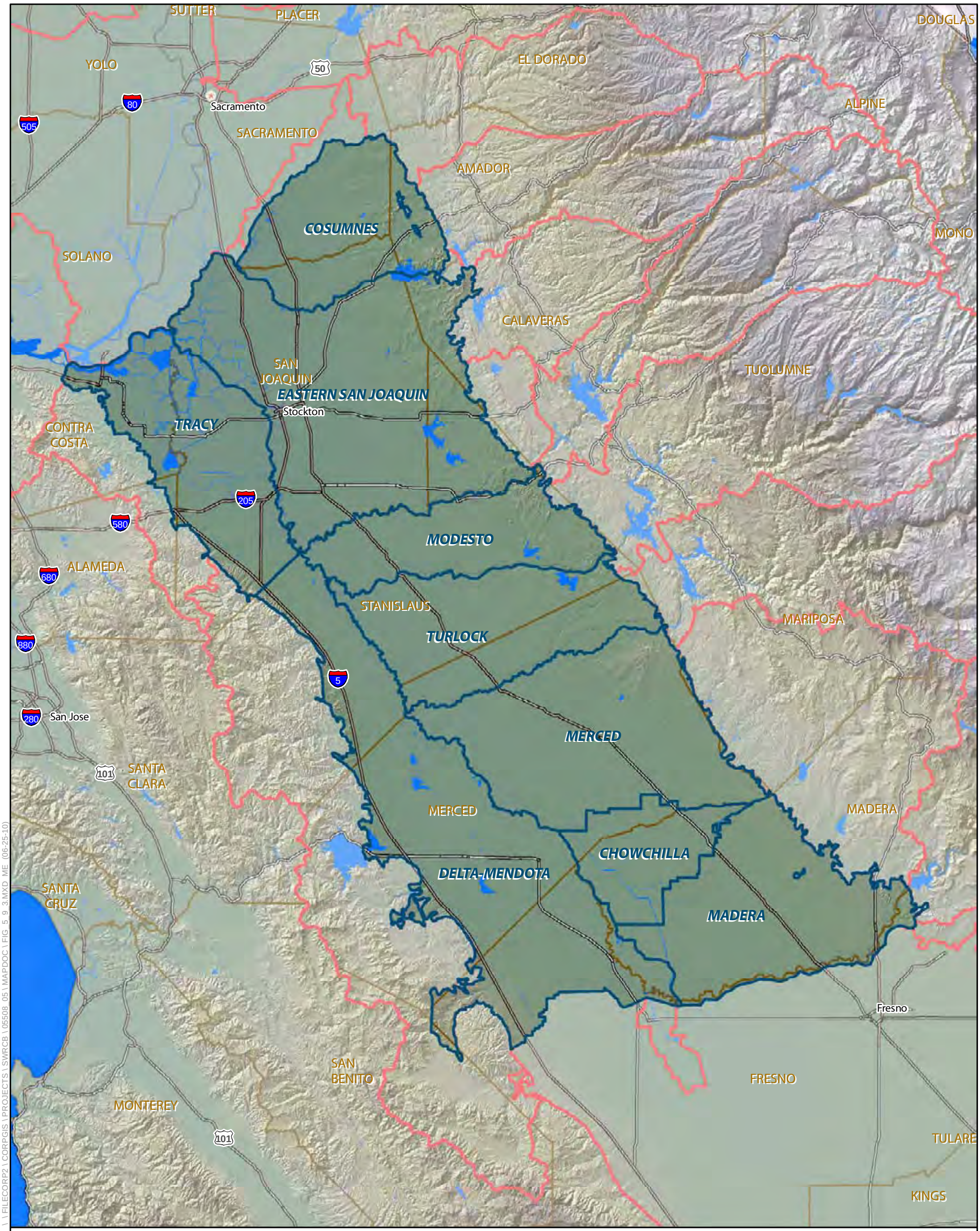
Figure 4-1
Sacramento River Basin Groundwater Basins and Subbasins



Legend

- Cities
- US Highway
- Interstate
- Groundwater Subbasin Boundaries
- Subwatershed Boundaries
- County Lines

0 7.5 15 30

Miles

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Figure 4-2
San Joaquin River Basin
Groundwater Subbasins

odesto

STANISLAUS

TUOLUMNE R

MERCED R

MARIPOSA

MONO

395

6

FRESNO

INYO

MADERA

SAN JOAQUIN R

MERCED

FRESNO R

CHOWCHILLA R

San Luis Reservoir

MADERA SUBBASIN 5-22.06

DELTA-MENDOTA SUBBASIN 5-22.07

PANOCHE VALLEY BASIN 5-23

5

Fresno

KINGS SUBBASIN 5-22.08

KINGS R

SAN BENITO

WESTSIDE SUBBASIN 5-22.09

Owens Lake

VALLECITOS CREEK VALLEY BASIN 5-71

MONTEREY

KAWEAH SUBBASIN 5-22.11

KINGS

TULARE LAKE SUBBASIN 5-22.12

PLEASANT VALLEY SUBBASIN 5-22.10

TULE SUBBASIN 5-22.13

TULARE

KERN RIVER VALLEY BASIN 5-25

Isabella Lake

SAN LUIS OBISPO

PASO ROBLES AREA SUBBASIN 3-4.06

KERN COUNTY SUBBASIN 5-22.14

WALKER BASIN CREEK VALLEY BASIN 5-26

CARRIZO PLAIN BASIN 3-19

Bakersfield

TEHACHAPI VALLEY WEST BASIN 5-28

101

TEHACHAPI VALLEY EAST BASIN 6-45

CARRIZO PLAIN BASIN 3-19

BRITE VALLEY BASIN 5

CUMMINGS VALLEY BASIN 5-27

CUYAMA VALLEY BASIN 3-13

KERN

Rosamond Lake

MIL POTRERO AREA BASIN 5-85

CASTAC LAKE VALLEY BASIN 5-29

CUDDY VALLEY BASIN 5-84

5

Lancaster

SANTA BARBARA

CUDDY RANCH AREA BASIN 5-83

CUDDY CANYON VALLEY BASIN 5-82

LOS ANGELES

VENTURA

Legend

- Cities
- US Highway
- Interstate
- Subwatershed Boundaries
- Groundwater Basin and Subbasin Boundaries
- County Lines

N

0 15 30

Miles

Tulare Lake Basin

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Figure 4-3
Tulare Lake Basin Groundwater Basins and Subbasins