STANISLAUS COUNTY
DEPARTMENT OF PUBLIC WORKS

Stanislaus Multi-Agency Regional Storm Water Resource Plan

Section 2. Planning Area Description

Prepared for:
State Water Resources Control Board
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Submitted by:
Stanislaus County, Department of Public Works

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Prepared by:

RMC water and environment
WOODARD &CURRAN

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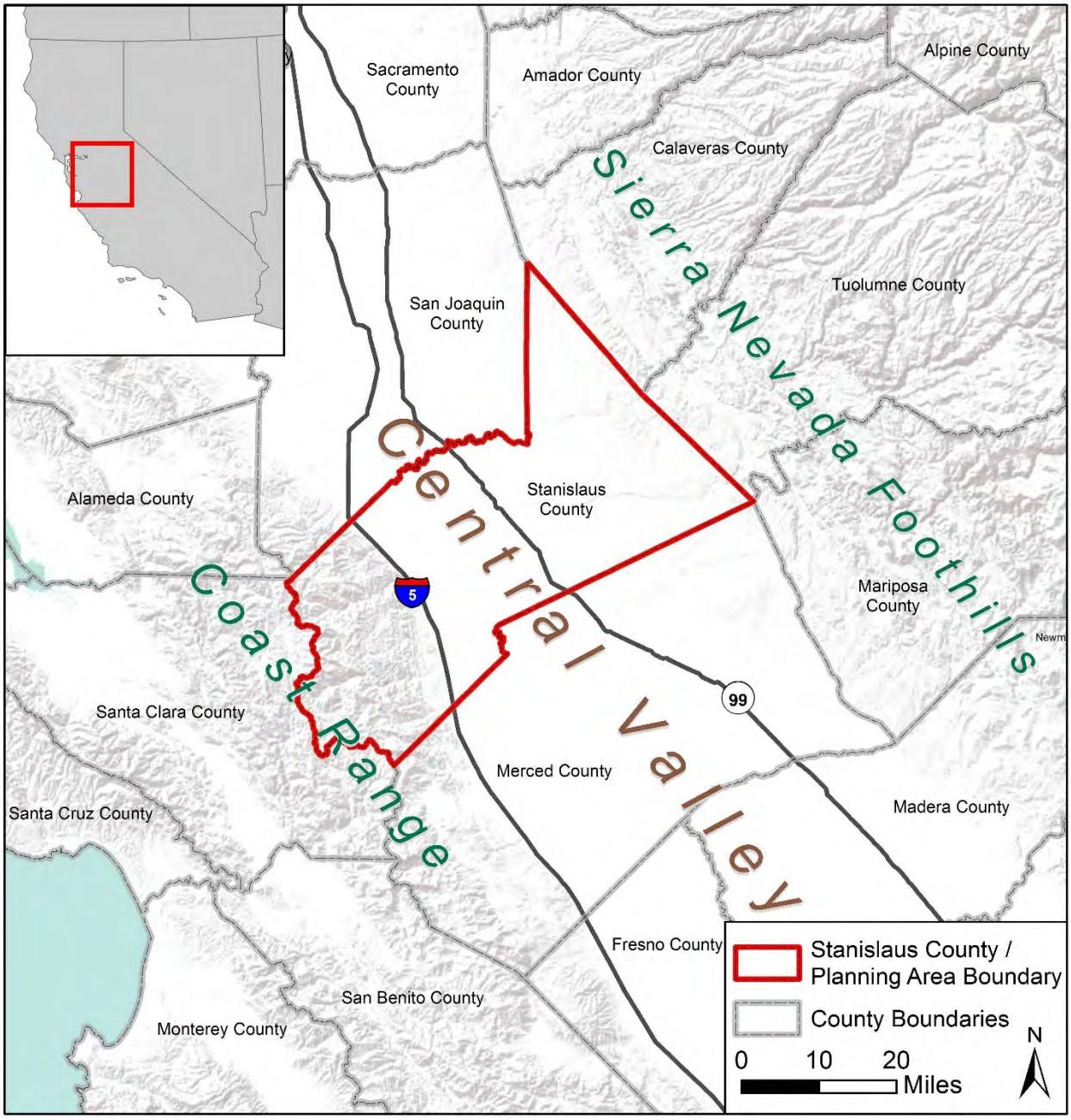
Section 2. Planning Area Description

Stanislaus County encompasses 1,515 square miles in California's Central Valley, with its western border in the Coast Range, southwest of the San Francisco Bay. The County extends to the Sierra Nevada foothills in the east (Figure 1). According to 2016 census estimates, Stanislaus County has a population of 541,560. The western portion of the County is mostly undeveloped rangeland. Outside of this area, agricultural land and rangeland constitute a major fraction of the County (45% and 36% respectively), with urban land of varying density constituting 13% of the area.

The Stanislaus Multi-Agency Regional SWRP (SWRP) planning area aligns with the Stanislaus County boundaries and includes the bulk of two major watersheds, the Middle San Joaquin-Lower Merced-Lower Stanislaus and the Panoche-San Luis Reservoir watersheds. This planning area was chosen to facilitate regional planning and evaluation based on significant overlap with the East Stanislaus and Westside San Joaquin Integrated Regional Water Management Plan (IRWMP) areas, as well as the Stanislaus and Tuolumne Rivers Groundwater Basin Association (STRGBA), Turlock Groundwater Basin Association (TGBA), and San Luis & Delta-Mendota Water Authority (SLDMWA) groundwater management planning areas. The SWRP planning area is entirely within the San Joaquin River Hydrologic Region. The County includes the cities of Modesto, Turlock, Hughson, Ceres, Oakdale, Newman, Waterford, Riverbank and Patterson. The County also includes 10 water and irrigation districts, and a number of Community Service Districts that deliver water to their constituents.

Figure 1. Area Overview



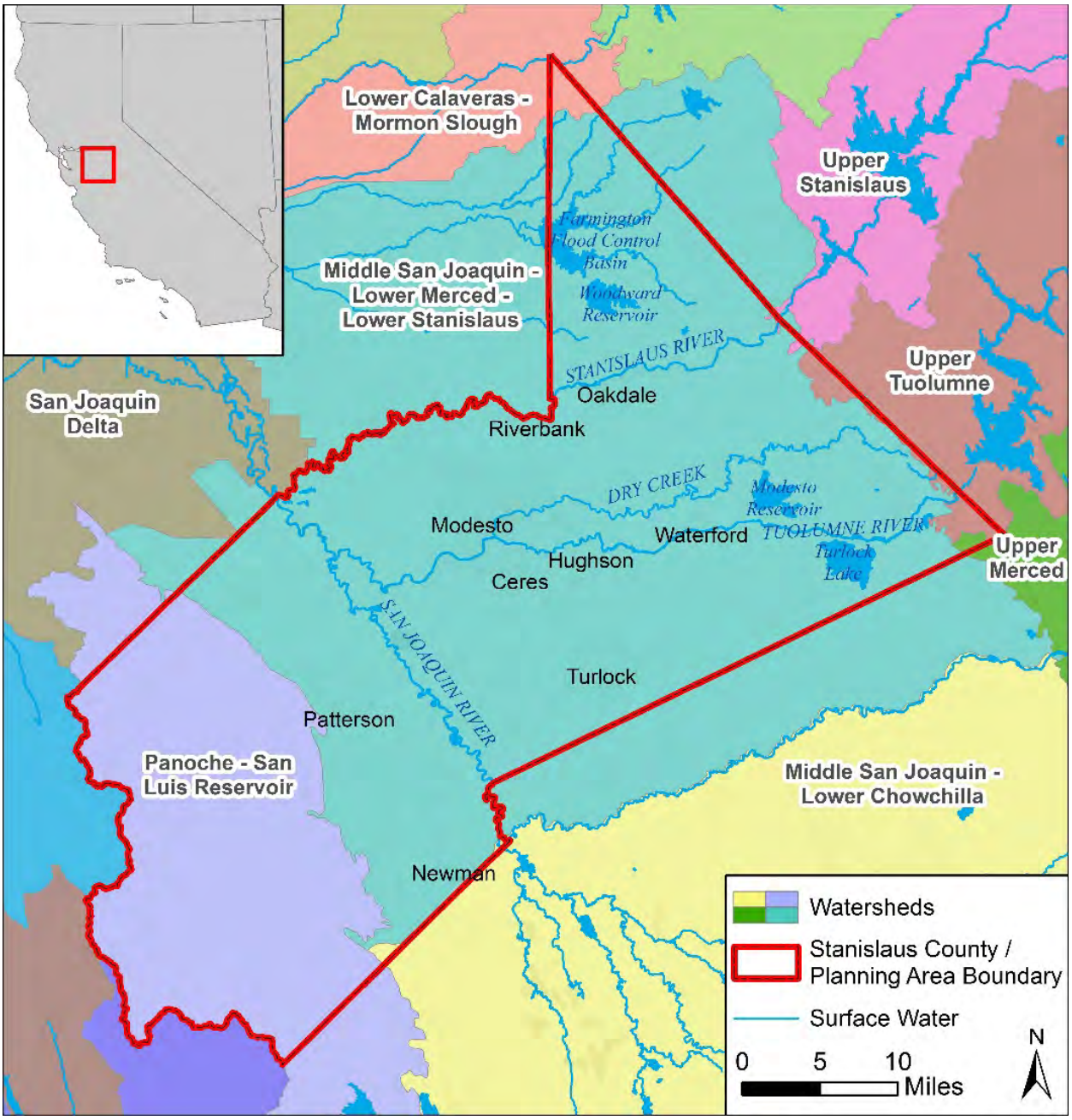
2.1 Description of Watersheds

The County includes two major watersheds (defined using USGS HUC 8 digit boundaries), the Middle San Joaquin-Lower Merced-Lower Stanislaus and the Panoche-San Luis Reservoir. The County also includes small portions of five additional watersheds. Together, these five watersheds make up less than 2% of the County (Table 1), with only a small portion of each watershed lying within the County boundary and are, therefore, not discussed individually in the SWRP.

Table 1. Watershed Areas Present in Stanislaus County

Watershed Name	Total Watershed Area (sqmi)	Watershed Area within Stanislaus County (sq mi)	% of Watershed within Stanislaus County	% of Stanislaus County Covered by Watershed
Middle San Joaquin-Lower Merced-Lower Stanislaus	1,767	1,102	62	72.7
Panoche-San Luis Reservoir	1,214	386	32	25.5
Upper Tuolumne	1,616	15	1	1.0
Lower Calaveras-Mormon Slough	199	6	3	0.4
Middle San Joaquin-Lower Chowchilla	2,494	2	0.1	0.1
Upper Merced	1,099	2	0.2	0.1
Upper Stanislaus	997	1	0.1	0.1

Figure 2. Watersheds in Stanislaus County



2.1.1 Middle San Joaquin-Lower Merced-Lower Stanislaus Description

The Middle San Joaquin-Lower Merced-Lower Stanislaus Watershed covers most of the County. The watershed encompasses over 1,700 square miles and extends into five counties in total. The majority of the watershed, approximately 1,100 square miles or 62%, is within the County. The watershed extends across the Central Valley from the foot of the Sierra Nevada in the east to the Coast Range and I-5 corridor in the west. The watershed is dominated by a plain which is composed of alluvial fan deposits and is part of the Great Valley geomorphic province. Three major rivers, the Stanislaus, Tuolumne, and San Joaquin, run through the Middle San Joaquin-Lower Merced-Lower Stanislaus Watershed. The watershed also contains several reservoirs used for water supply, flood control, and hydroelectric power production. All nine incorporated cities in the County are within the Middle San Joaquin-Lower Merced-Lower Stanislaus Watershed (Figure 2).

2.1.2 Panoche-San Luis Reservoir Description

The Panoche-San Luis Reservoir (PSLR) Watershed covers the westernmost portion of the County (Figure 2). It spans approximately 100 miles from north to south, beginning in San Joaquin County in the north, and extending to Fresno and San Benito Counties at its southern end. In total, the PSLR Watershed covers 1,214 square miles, with 386 square miles, or 32%, inside the County. The watershed includes the eastern portion of the Coast Range, which contains the highest point in the County (approximately 3,800 feet above sea level). The eastern edge of the watershed, at the foot of the Coast Range, is approximately 300 feet above sea level. No major water bodies are present in the PSLR Watershed, though there are several small intermittent creeks that flow from the mountains to the floor of the Central Valley within the watershed.

2.2 Jurisdictional Boundaries and Service Areas

The County contains nine incorporated cities, whose boundaries are depicted in Figure 3. The largest of these cities is Modesto, with a population of 212,175 as of 2016 (U.S. Census Bureau, 2017). A total of 24 water agencies serve water within the County. Service areas for the water purveyors in the County are shown in Figure 4.

Wastewater service in the County is provided by a number of entities, including the cities and water districts shown in Figure 5. The Cities of Modesto, Ceres, Turlock, Waterford, Hughson, Riverbank, Patterson, Newman and Oakdale provide wastewater services within their jurisdictions. Empire Sanitary District, Salida Sanitary District, Western Hills Water District, and the Community Services Districts (CSD) of Denair CSD, Grayson CSD, Keyes CSD, and Westley CSD also provide wastewater and sewer services within their service areas (ICF International, 2016). Septic systems are used widely throughout the County in areas where sanitary sewers have not been installed.

Land use agencies in the area include the East Stanislaus and West Stanislaus Resource Conservation Districts (RCDs). The East Stanislaus RCD includes the eastern portion of the County, with the western boundary at the San Joaquin River. The West Stanislaus RCD includes the remainder of the County, west of the San Joaquin River.

Additional internal boundaries within the County include the IRWM boundaries and groundwater basins. Groundwater basins are discussed in further detail in Section 2.5. The IRWM Regions within the County are the East Stanislaus IRWM Region and the Westside San Joaquin IRWM Region (Figure 6).

The East Stanislaus IRWM Region covers a total of 880 square miles. Most of this Region, 86%, lies within Stanislaus County, with the southern boundary extending in the Merced County. The Region covers half of the County and includes most cities within the County. The Westside San Joaquin Region lies along the western border of the East Stanislaus Region, and extends to the I-5 corridor in the east. The County's northern triangle, as well as the westernmost sections, roughly west of I-5, are not covered by IRWM regions at present.

Figure 3. Municipalities in Stanislaus County

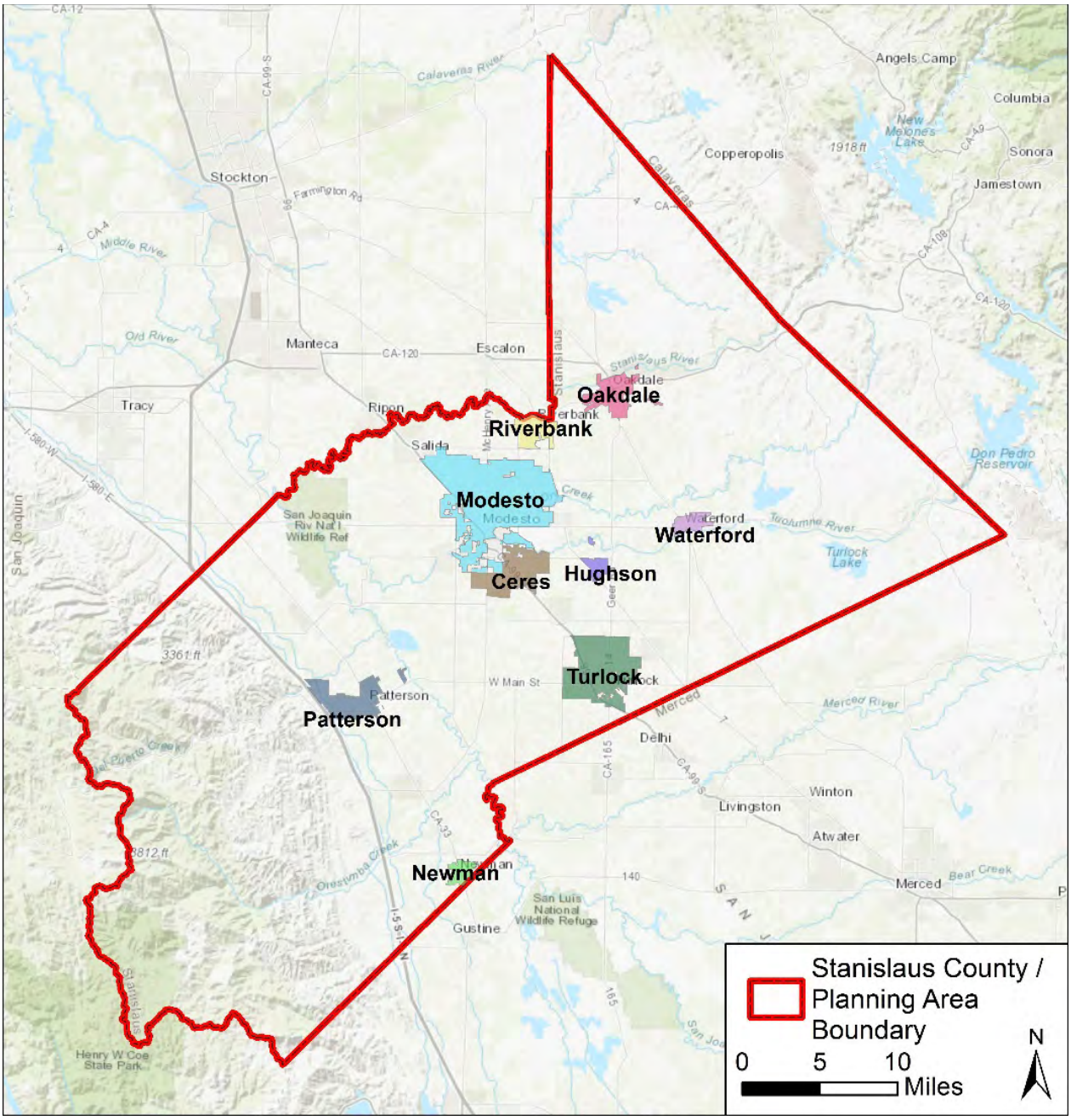
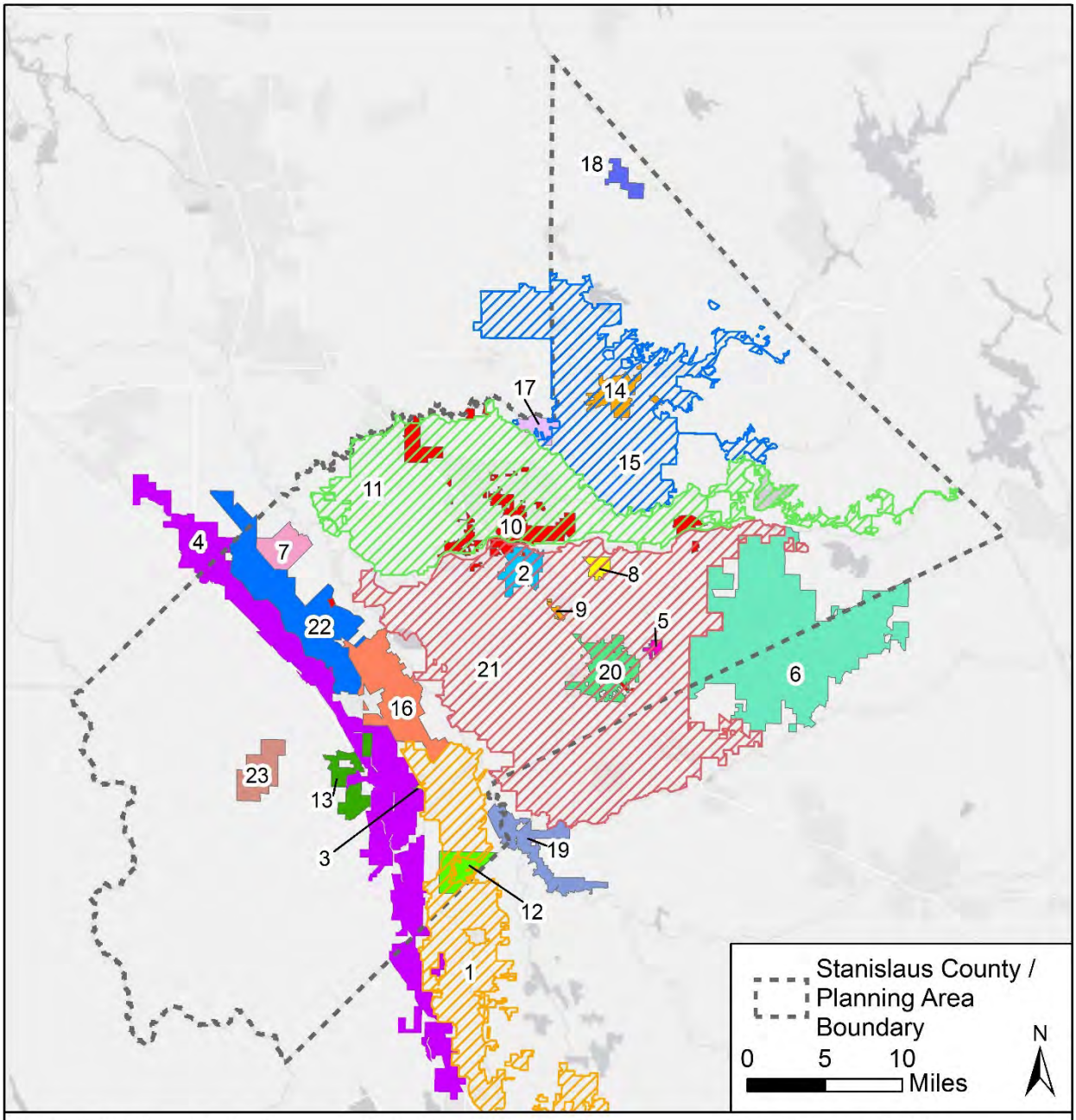


Figure 4. Water Purveyor Service Areas in Stanislaus County



1. Central California Irrigation District
2. Ceres, City Of
3. Crows Landing Community Service District
4. Del Puerto Water District
5. Denair Community Service District
6. Eastside Water District
7. El Solyo Water District
8. Hughson, City Of
9. Keyes Community Service District
10. Modesto, City Of
11. Modesto Irrigation District
12. Newman, City Of
13. Oak Flat Water District
14. Oakdale, City Of
15. Oakdale Irrigation District
16. Patterson, City Of
17. Riverbank, City Of
18. Rock Creek Water District
19. Stevinson Water District
20. Turlock, City Of
21. Turlock Irrigation District
22. West Stanislaus Irrigation District
23. Western Hills Water District

Figure 5. Wastewater Service Areas in Stanislaus County

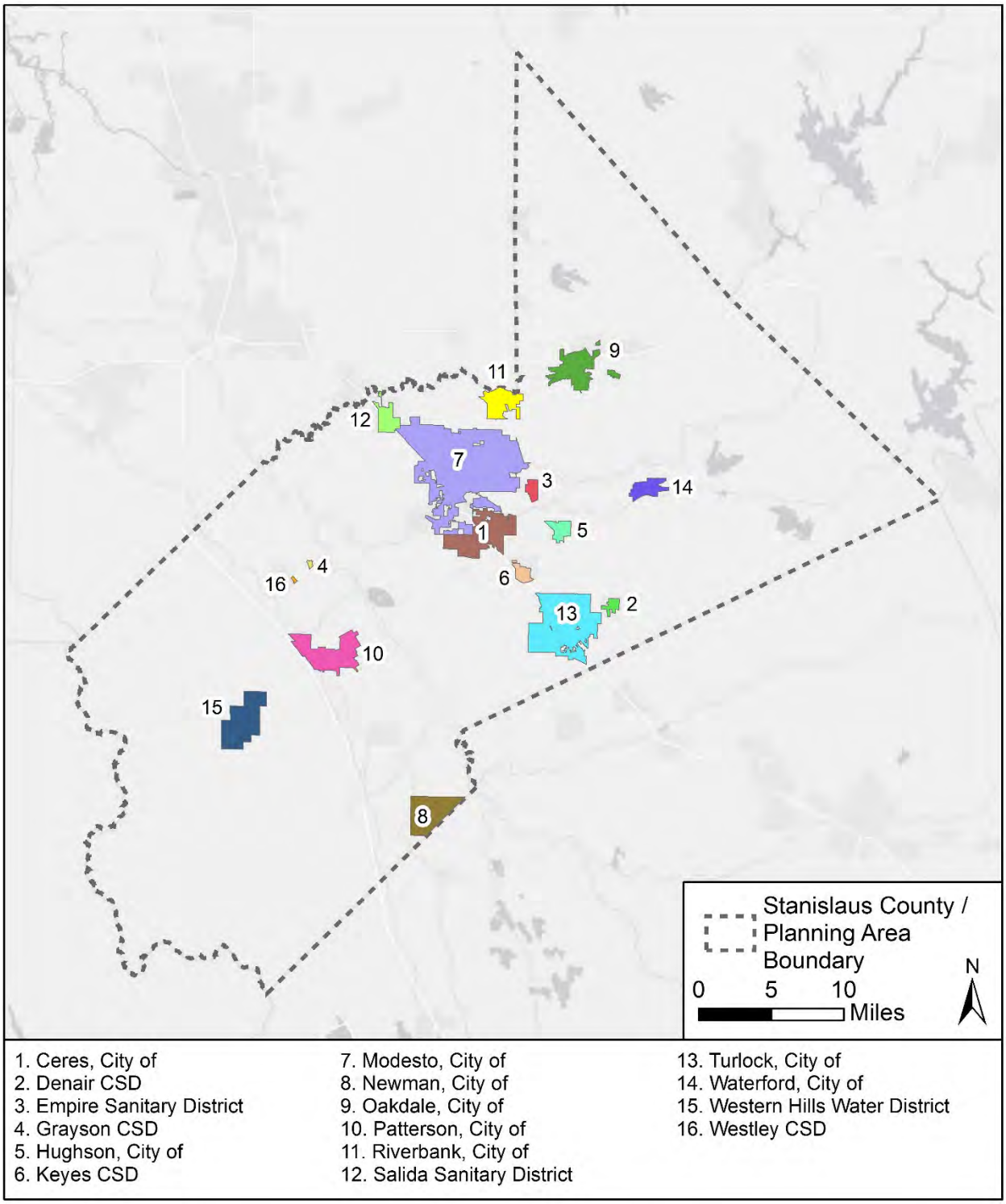
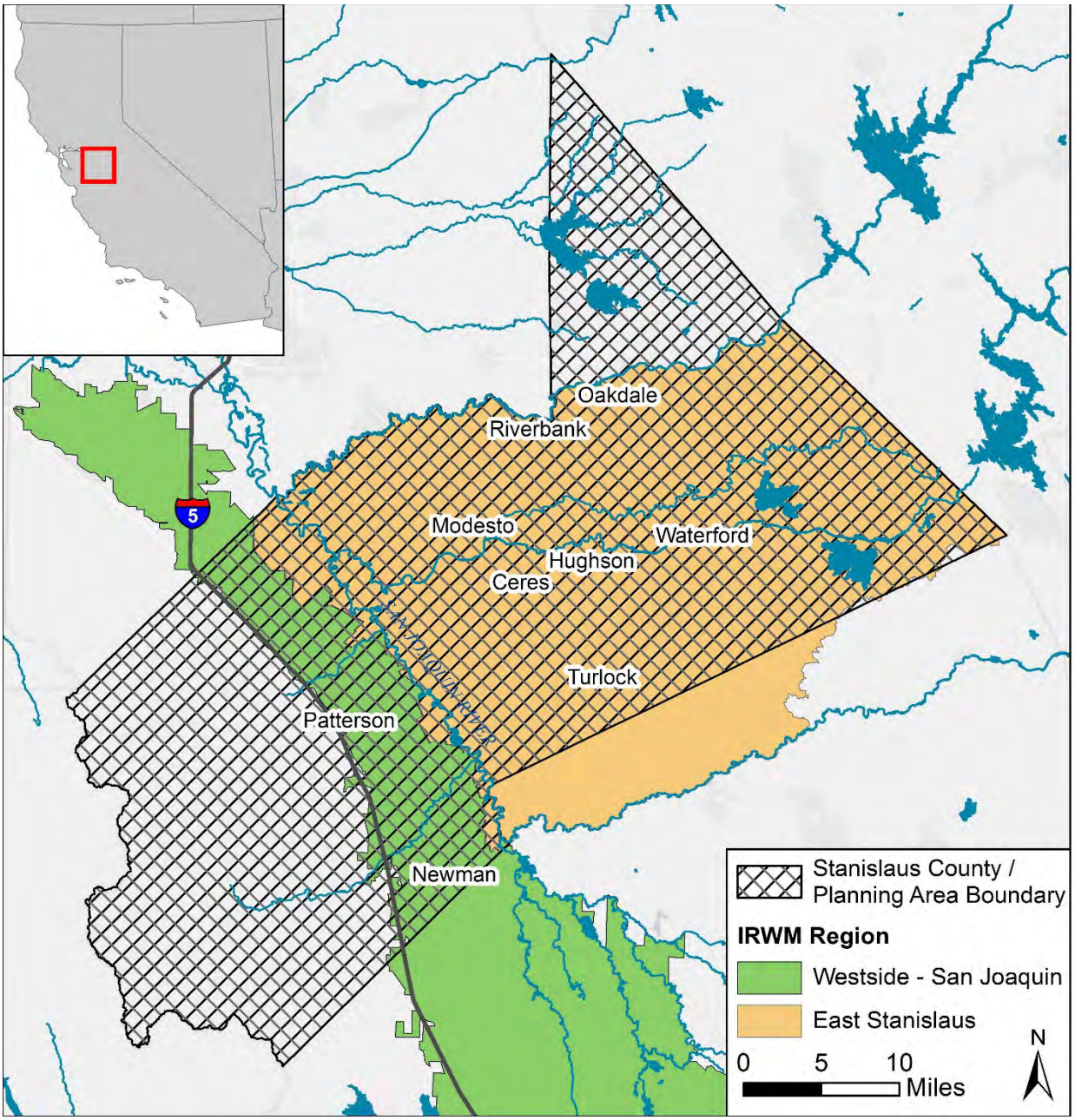


Figure 6. IRWM Regions in Stanislaus County



2.3 Watershed Processes

The County has a Mediterranean climate, with hot, dry summers and cool, wet winters. On average, the County receives 13 inches of rain annually. The major rivers in the County are the Stanislaus, Tuolumne, and San Joaquin Rivers. The San Joaquin River is the largest in the region, flowing from south to north through the Central Valley, with notable tributaries including the Cosumnes, Mokelumne, and Merced Rivers. The Tuolumne and Stanislaus Rivers are the two tributaries of the San Joaquin, which flow through the County. Both rivers begin in the Sierra Nevada and flow from east to west across the Central Valley, fed by snowmelt from the Sierra Nevada. After leaving the County, the San Joaquin River discharges to the Sacramento-San Joaquin Delta and the San Francisco Bay. Flowing from the western side of the County, Del Puerto Creek discharges into the San Joaquin River near Patterson, and Orestimba

Creek discharges into the San Joaquin River north of Newman. Salado Creek drains the eastern slopes of part of the Coast Range and ends north of Patterson without meeting the San Joaquin River. Little Salado Creek also drains portions of the Coast Range, ending south of Patterson and discharging through the Marshall Road Drain into the San Joaquin River.

Land use in the County is primarily agricultural, although localized urban areas exist, and are growing (Figure 7). These urbanized pockets cause an increase in impervious surfaces, which reduces the ability of stormwater to infiltrate to the subsurface. This urbanization has caused a major change to watershed processes in those areas of the County by increasing runoff and contributing to flooding and water quality issues.

The remainder of the County has been primarily developed for agriculture. In agricultural areas, impervious surfaces are less common, but natural watershed processes may be disrupted through groundwater use. Groundwater pumping can impact not only the groundwater levels, but also the overlying surface water bodies. Other agricultural practices can also affect groundwater. Historically, much of the agriculture in the County has been irrigated using unlined irrigation ditches and canals. This practice has facilitated groundwater recharge as irrigation water is transported between locations, and may encourage groundwater recharge in areas where it may not naturally occur (DWR, 2013). As some farmers move toward more precise irrigation methods, such as drip irrigation, groundwater recharge is expected to decline (Bookman-Edmonston, 2005).

Flooding in the County occurs naturally due to snowmelt and rainfall, and major flood events can occur regularly due to the topography and major river systems in the region (DWR, 2013). Some older areas of Stanislaus County have problems with flooding during storms that exceed ½-inch per hour due to inadequate drainage. In most rural parts of Stanislaus County, stormwater runoff is handled by field percolation or through roadside ditches which drain to Dry Creek, Tuolumne River, Stanislaus River, or San Joaquin River. There are few storm drain facilities constructed in rural areas. Cities in Stanislaus County use multiple types of infrastructure to reduce flooding, including storm drain systems, rock wells, and sanitary sewer cross-connections. Some developed areas of the County lack any stormwater management infrastructure.

Due to the agricultural nature of the County, there is a large amount of undeveloped area in the County, including privately-owned agricultural lands, parks, and open space. An overview of non-agricultural open space and natural areas is provided in Figure 8. These include city parks, regional parks, wildlife refuges, and state parks. Regional parks are valuable in preserving natural resources, such as river and riparian areas. River corridors and floodplains are some of the most ecologically valuable areas in the landscape, especially in an arid climate like the Central Valley of California. The rivers and floodplains are important for fish species, including anadromous species such as salmon and steelhead, and also provide wintering areas for migratory birds on the Pacific Flyway. The San Joaquin, Merced, Tuolumne, and Stanislaus Rivers are characterized as Critical Habitat for steelhead trout, as designated by the U.S. Fish and Wildlife Service. Other Critical Habitats in the Region include those for the vernal pool tadpole shrimp and vernal pool fairy shrimp. Riparian and wetland sensitive species within the San Joaquin River and the lower reaches of the Merced, Tuolumne, and Stanislaus Rivers include Delta button-celery, valley elderberry longhorn beetle, riparian woodrat, riparian brush rabbit, wading bird rookeries, least Bell's vireo, tricolored blackbirds, Swainson's hawk, pallid bat, and western red bat (ICF 2016).

Several notable natural areas exist within the County:

- **San Joaquin River National Wildlife Refuge (SJRNWR) –** The Refuge is located west of Modesto, within the historic floodplain of the confluences of the San Joaquin, Stanislaus, and Tuolumne Rivers. Refuge lands consist of oak-cottonwood-willow riparian forest, pastures, agricultural fields, and wetlands, with habitats for a diversity of wildlife including numerous special species such as Swainson's hawks, herons and cormorants, and the endangered riparian brush rabbits. The Refuge presently encompasses more than 6,500 acres. In January 2017, the U.S. Fish and Wildlife Service released a final plan authorizing the expansion of the refuge by up to 10,700 acres. This would link the refuge with the Grasslands Ecological Area, a mosaic of floodplain habitats that covers 160,000 acres.
- **Dos Rios Ranch –** Dos Rios Ranch is a 1,600-acre area adjacent to the SJRNWR managed by the Tuolumne River Trust and River Partners located at the confluence of the Tuolumne and the San Joaquin Rivers provides six miles of river frontage and is managed for habitat and attenuation of flood flows (ESA, 2014).
- **Henry W. Coe State Park –** Henry W. Coe State Park lies in the Diablo Mountains of the Coast Range and straddles Stanislaus and Santa Clara Counties. In total, it encompasses 87,000 acres of hills and mountains, offering hiking, biking, and equestrian trails. The park is home to native oaks as well as grassland and chaparral habitats (California State Parks, 2009)

Table 2. Land Use Area within Stanislaus County

Land Use Type	Area (sq mi)
Agriculture	625
Barren/Other	<1
Conifer Forest	2
Hardwood	164
Herbaceous	501
Shrub	102
Urban	105
Water	14
Wetland	4

Figure 7. Land Use in the Stanislaus County Area

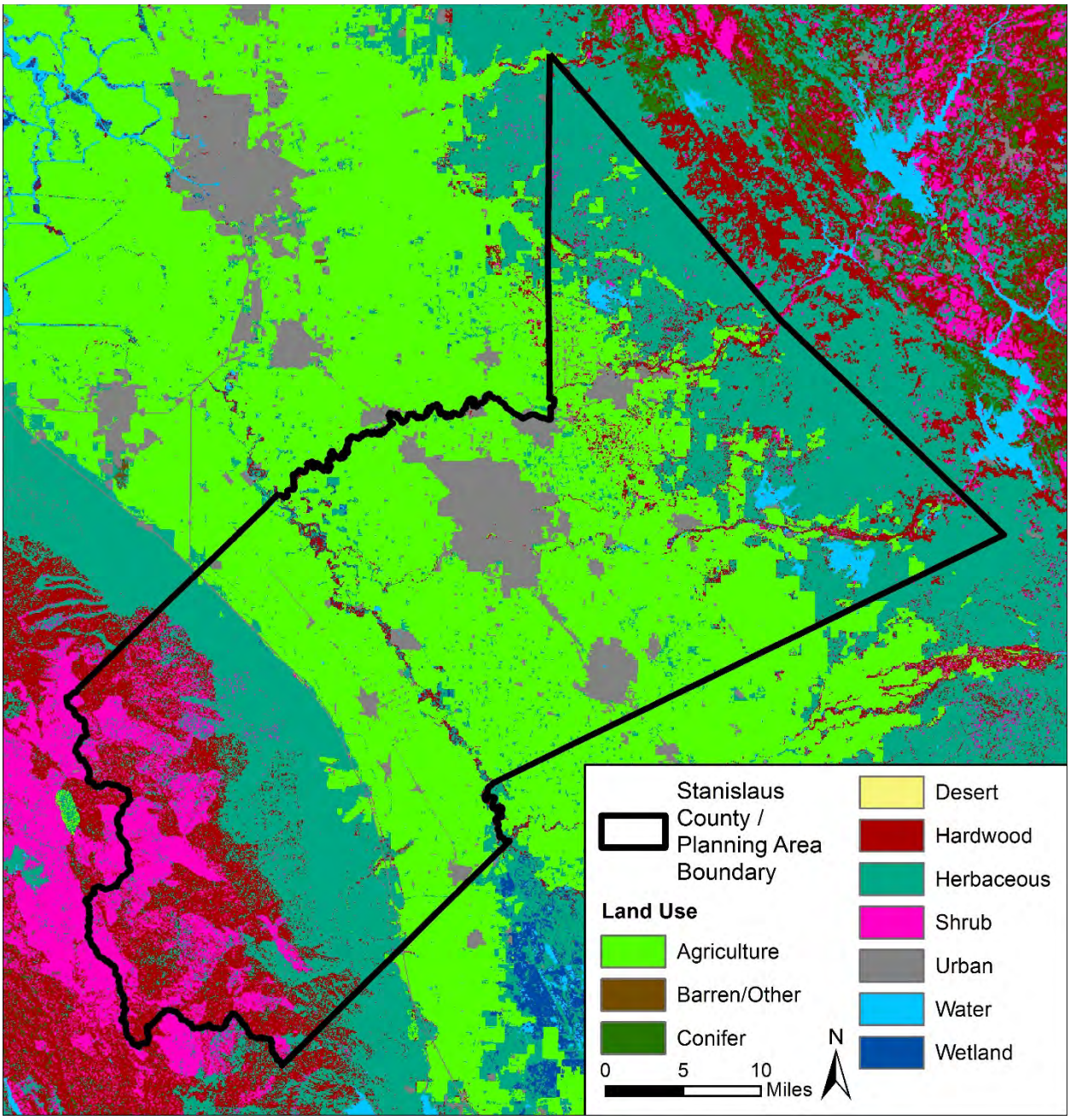
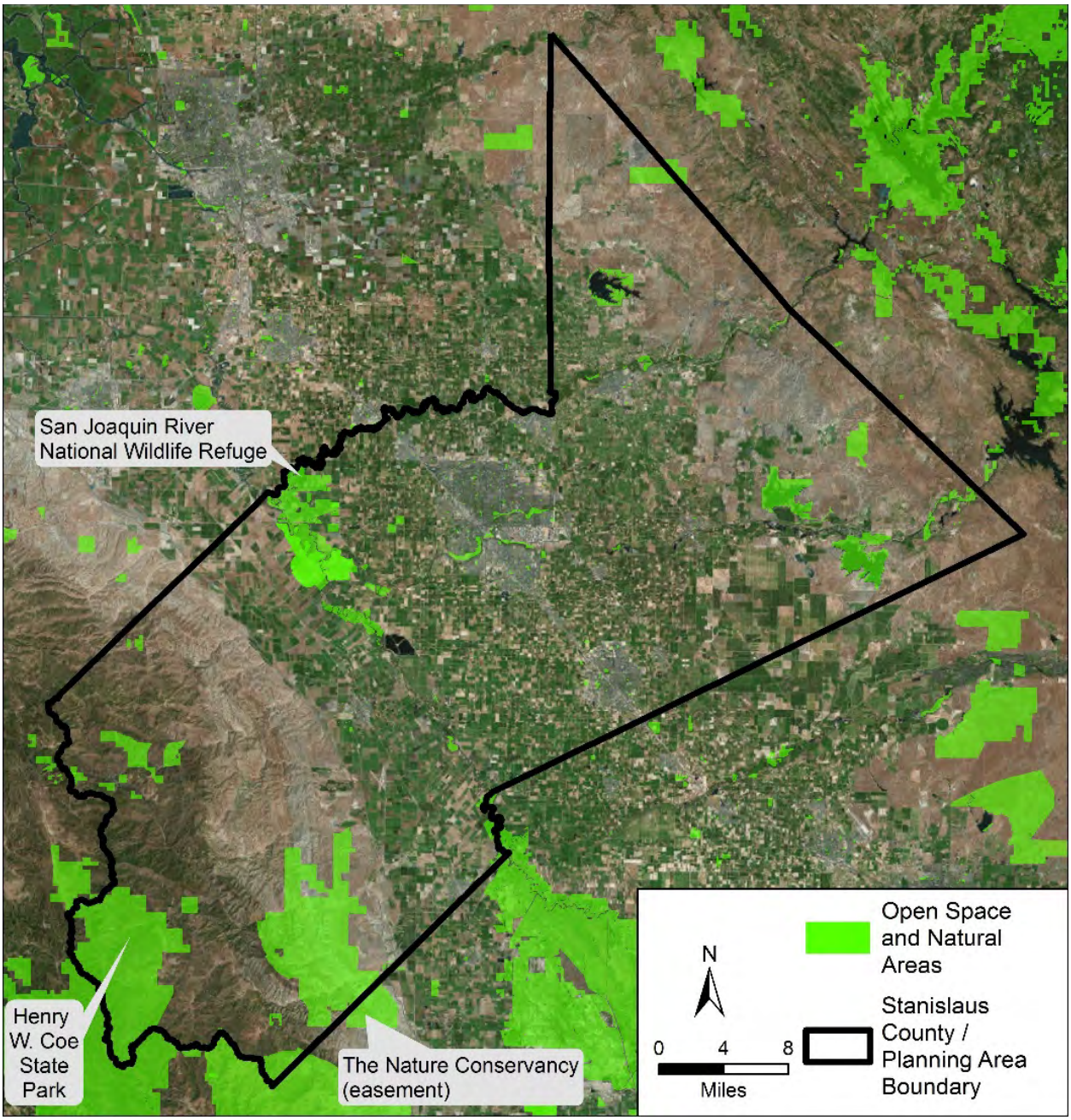


Figure 8. Open Space and Natural Areas within Stanislaus County



2.4 Surface Water Resources

2.4.1 Surface Water Bodies

Major surface water bodies in the County include the San Joaquin River, Tuolumne River, and Stanislaus River. An overview of these water bodies in a regional context is provided in Figure 9.

San Joaquin River

The San Joaquin River Basin covers approximately 32,000 square miles in the northern part of the San Joaquin Valley, roughly from Fresno to Stockton (San Joaquin River Group Authority, 1999). The primary sources of surface water to the San Joaquin River Basin are rivers that drain the western slope of the Sierra Nevada Range. The San Joaquin River is 330 miles in length, from its headwaters to its confluence with the Sacramento River. The San Joaquin River can be broken into Upper and Lower reaches. The Upper San Joaquin River extends from the headwaters to the Merced River; the Lower San Joaquin River runs from the River's confluence with the Merced River north to the Delta. Stanislaus County includes only the Lower San Joaquin River. The Lower San Joaquin River is characterized by the combination of flows from tributary streams, major rivers, groundwater accretions and agricultural drainage water (San Joaquin River Group Authority, 1999). The Lower San Joaquin River is located in the western portion of the County and runs roughly parallel to and approximately 6 miles east of the I-5 corridor. Within the County, the San Joaquin River has a shallow gradient; its elevation falls about 1 foot/mile in the County (ESA, 2014). It meanders through oxbow lakes, old slough channels, and wetlands. The river's major tributaries from the east are the Stanislaus and Tuolumne rivers (described in the following sections). Smaller creeks flow into the San Joaquin River from the Coast Range to the west, including Salado Creek and Little Salado Creek. Salado Creek is 20 miles long and drains 25 square miles; it terminates in Patterson prior to reaching the San Joaquin River. Little Salado Creek, just south of Salado Creek, empties into the Marshall Drain, which in turn discharges into the San Joaquin River.

Stanislaus River

The Stanislaus River Watershed is approximately 578,000 acres, located in the central Sierra Nevada, and is one of the largest tributaries to the San Joaquin River in the Central Valley. The Stanislaus River makes up a portion of the northern boundary of Stanislaus County, and meets the San Joaquin River along the County border. Snowmelt runoff contributes the largest portion of the flows in the Stanislaus River, with the highest monthly flows in May and June (San Joaquin River Group Authority, 1999). Flow control in the lower Stanislaus River is provided by the New Melones Reservoir (roughly 10 miles northeast of the County), which has a capacity of 2.4 million acre-feet (AF) and is operated by the U.S. Bureau of Reclamation (USBR). Releases from New Melones Reservoir are re-regulated downstream at Tulloch Reservoir (approximately 5 miles northeast of the County). The main water diversion point on the Stanislaus River is Goodwin Dam, which provides deliveries to Oakdale Irrigation District (OID) as well as water purveyors in San Joaquin County (San Joaquin River Group Authority, 1999).

Tuolumne River

The headwaters of the Tuolumne River begin in Yosemite National Park in the Sierra Nevada at an elevation of about 13,000 feet above sea level. The river descends 4,000 feet to the Hetch Hetchy Reservoir. At the reservoir, approximately 33% of the river's flow is diverted through Canyon Tunnel, and ultimately to the San Francisco Bay Area. The Tuolumne River and Dry Creek, a major tributary, are both within the County. Dry Creek is an ephemeral stream that originates north of the Modesto Reservoir, passes north of Waterford, and discharges into the Tuolumne River near downtown Modesto. Flows in the lower portion of the Tuolumne River are controlled primarily by the operation of New Don Pedro Dam, which lies just east of the County. The 2.03-million AF Don Pedro Reservoir, owned and operated by Modesto Irrigation District (MID) and Turlock Irrigation District (TID), stores water for irrigation, hydroelectric generation, fish and wildlife enhancement, recreation, and flood control purposes. MID and TID divert water to the Modesto Main Canal and the TID Main Canal a short distance downstream from New Don Pedro Dam at La Grange Dam, just west of the border of Stanislaus and Tuolumne Counties (San Joaquin River Group Authority, 1999). The water diverted by MID and TID serves both agricultural demands and drinking water demands (through agreements with urban water supplies such as the City of Modesto). The Tuolumne River discharges into the San Joaquin River within Stanislaus County west of Modesto, adjacent to the San Joaquin River National Wildlife Refuge.

2.4.2 Surface Water Quality

Pesticides have been found within the San Joaquin River at concentrations that are toxic to sensitive aquatic organisms. Two multi-year studies were conducted; the first study was conducted in the early 1990's and found a 43-mile reach of the San Joaquin River, between the confluence of the Merced and Stanislaus River, to be toxic about half of the time to invertebrate components of the U.S. Environmental Protection Agency (USEPA) three species test. This portion of the San Joaquin River is the portion within the East Stanislaus IRWM Region as the Stanislaus River coincides with the northern boundary and the Merced River coincides with the southern boundary of the IRWM Region. The toxicity in the river was caused by pesticides, specifically diazinon and chlorpyrifos, in storm and irrigation runoff from crops. A year later, follow-up study was conducted that found that water in the San Joaquin River was toxic to invertebrate species about 6% of the time. As with the first study, diazinon and chlorpyrifos in winter storm runoff from crops and summer irrigation return flows were identified as the primary source of the toxins. Urban runoff has also been identified as a significant source of these pollutants in and around the City of Modesto.

The SWRCB has found elevated levels of Group A Pesticides in fish in the Tuolumne, Merced, and Stanislaus Rivers and the main stem of the San Joaquin River. Group A Pesticides include chlordane, toxaphene, endosulfan, and other pesticides, many of which are no longer used or are heavily regulated. These chemicals tend to bind to sediment and move into water systems as sediment moves offsite (CVRWQCB, 2004). The San Joaquin, Merced, Tuolumne, and Stanislaus Rivers are all listed on the Clean Water Act (CWA) 303(d) list of impaired water bodies as being impaired by Group A pesticides and various other constituents.

The *Water Quality Control Plan for the Sacramento River Basin and the San Joaquin Basin* (Basin Plan) describes the beneficial uses, water quality objectives, and actions to be taken to meet those objectives for inland surface waters and groundwater in the San Joaquin Basin. The Basin Plan, last revised in 2016, describes the following water quality objectives within the San Joaquin Basin:

- **Bacteria** – In waters designated for contact recreation, the fecal coliform concentration shall not exceed a geometric mean of 200/100 milliliter (mL) from five samples over a 30-day period, nor shall more than 10% of the total number of samples taken during the 30-day period exceed 400/100 mL.
- **Chemical Constituents** – Water shall not contain chemical constituents in concentrations that adversely affect beneficial uses. For domestic and municipal water supply, the concentrations of chemical constituents must not be in excess of the maximum contaminant levels (MCLs) specified in the California Code of Regulations, and state and federal drinking water regulations.
- **Color** – Water shall be free of discoloration that adversely affects beneficial uses.
- **Floating Materials, Oil and Grease** – Water shall not contain floating materials, oils, greases, waxes or other materials that cause nuisance or affect beneficial uses.

Other water quality objectives were identified in the categories of biostimulatory substances, dissolved oxygen, mercury, methylmercury, pH, pesticides, radioactivity, salinity, sediment, settleable material, suspended material, tastes and odors, temperature, toxicity, and turbidity. A more comprehensive description of the water quality objectives is included in the Basin Plan (CVRWQCB, 2016).

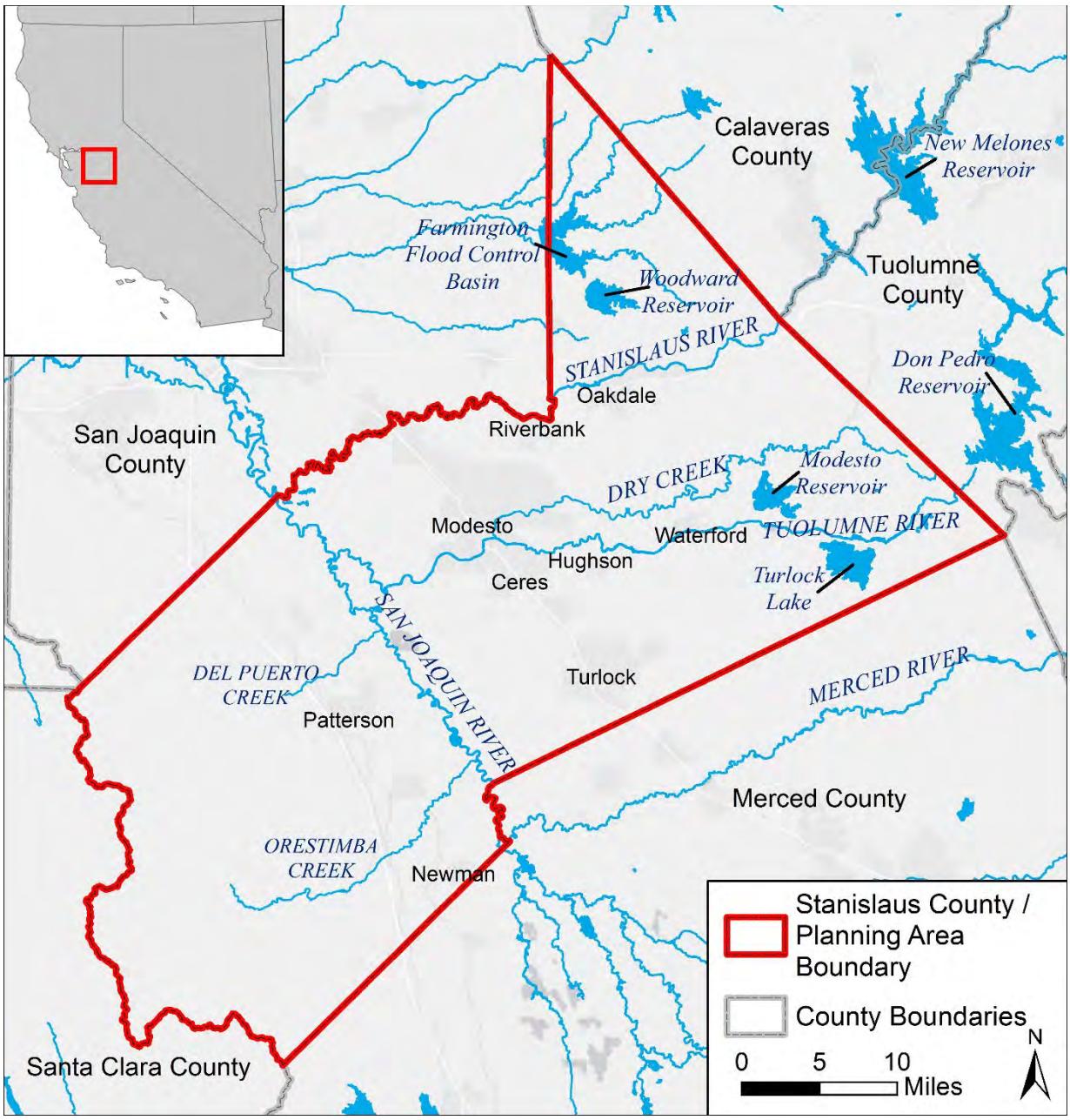
The SWRCB is also in the process of updating the *Water Quality Plan for the San Francisco Bay-Sacramento/San Joaquin Delta Estuary* (Bay-Delta Plan). The Bay-Delta Plan was developed in 2006 to protect water quality in the region and includes water quality objectives to protect municipal and industrial, agricultural, and fish and wildlife beneficial uses. The Delta Stewardship Council (DSC), as part of the Bay-Delta Plan, directed the SWRCB to adopt and implement updated flow objectives for the Sacramento–San Joaquin Delta (Delta) to achieve the coequal goals of ecosystem protection and a reliable water supply by June 2, 2014. To implement this policy, the Bay-Delta Plan is being updated by the

SWRCB through a phased process. As part of Phase 1, a draft Substitute Environmental Document (SED) was prepared in December 2012. The SED included support for potential changes to San Joaquin River flow and southern Delta water quality objectives, as well as an implementation program to be included in the Bay-Delta Plan. A revised draft was issued in 2016, and will be updated to a final draft before going to the SWRCB for approval. The SED proposes to balance the use of water for fishery protection against competing uses of water such as municipal, agricultural, and hydropower. Amendments to the 2006 Bay-Delta Plan will establish the following:

- **Flow Objectives** – New flow objectives on the Lower San Joaquin River (LSJR) and its three eastside tributaries (the Stanislaus, Tuolumne and Merced Rivers) for the protection of fish and wildlife beneficial uses.
- **Water Quality Objectives –** New water quality (salinity) objectives for the protection of agricultural beneficial uses in the southern portion of the Delta.
- **Implementation Program –** An implementation program to achieve those objectives

The amendments have the potential to impact the County, predominantly through reduced diversions from the Tuolumne River. As the SED and amendments progress forward, the County will track the flow objectives and water quality objectives that may be relevant to the area.

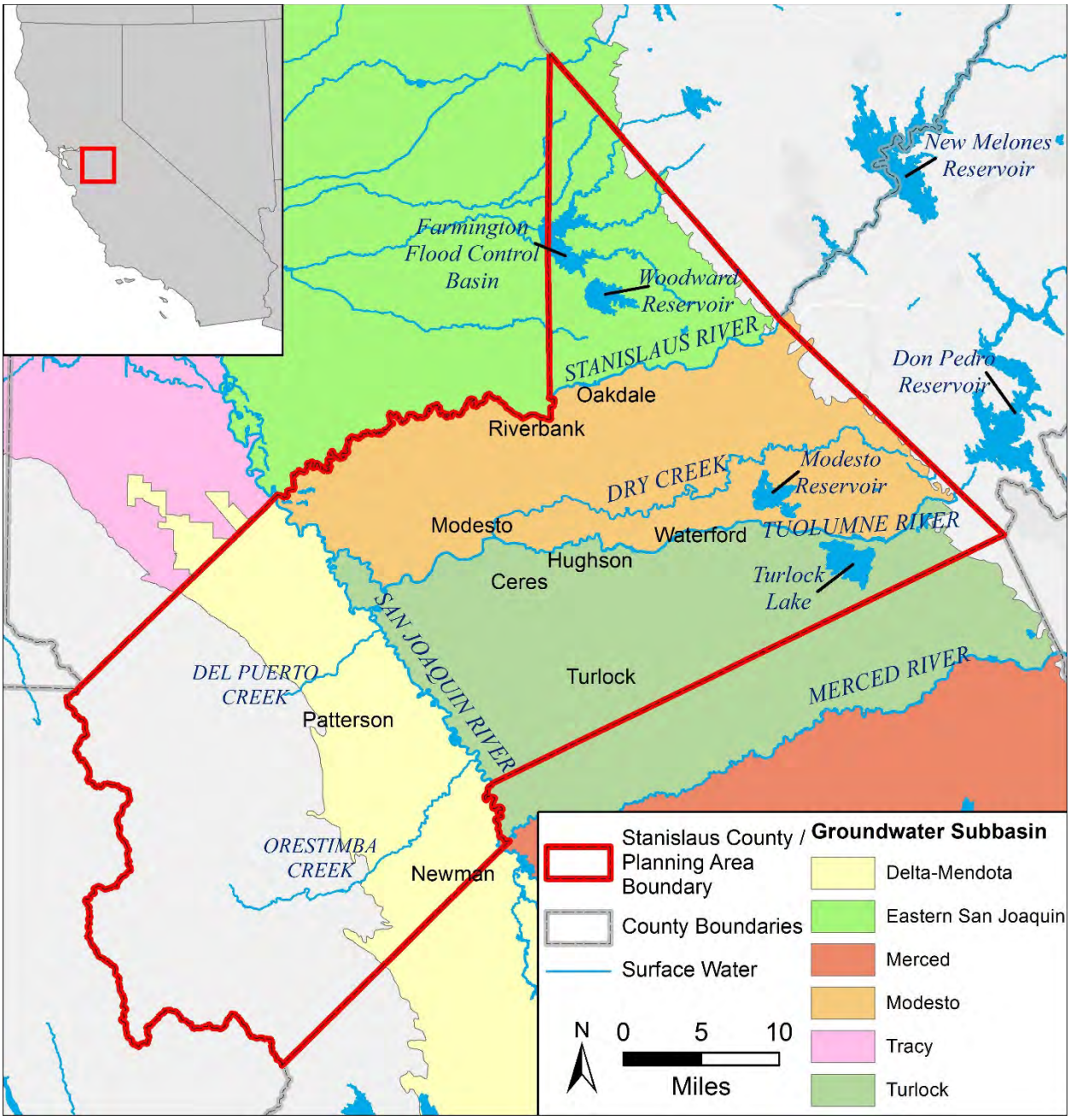
Figure 9. Major Surface Water Bodies in Stanislaus County



2.5 Groundwater Resources

Stanislaus County overlies the San Joaquin Valley Basin. Four individual groundwater subbasins underlie the County: the Eastern San Joaquin, Modesto, Turlock, and Delta-Mendota Subbasins (Figure 10). Consideration of groundwater supply and quality is crucial in Stanislaus County, due to the high reliance on groundwater for both domestic and agricultural use. These subbasins are described further in the sections that follow.

Figure 10. Groundwater Subbasins in Stanislaus County



2.5.1 Turlock Subbasin

The Turlock Subbasin covers approximately 542 square miles. Groundwater levels in the subbasin have fluctuated over the past few decades. DWR's Bulletin 118 estimated a 160,000 AF increase of groundwater overdraft in the Turlock Subbasin from 1990 to 1995, but from 1994 to 2000, groundwater water levels rose about seven feet. The rising groundwater levels suggested that the groundwater basin had started to recover, but again, beginning in 2000, groundwater production increased, reaching its peak in 2007 when 8.359 billion gallons were pumped. Combined with below average rainfall, increased agricultural pumping and urbanization, groundwater pumping for urban water has adversely impacted groundwater levels. Conservation efforts and increased rainfall have helped the groundwater basin to begin to recover once again. The groundwater basin is not currently on the list of critically overdrafted basins (DWR, 2016). The primary sources of groundwater recharge in the Turlock Subbasin are infiltration from the Tuolumne River and incidental recharge from applied irrigation water.

In terms of groundwater quality, shallow groundwater in the Turlock Subbasin does not meet drinking water standards due to the presence of constituents such as nitrate and arsenic. Additional treatment, blending, and well closures have all been used as strategies for addressing poor groundwater quality. Shallow groundwater is suitable for nonpotable uses and the groundwater from deeper aquifers is generally of high quality (TGBA, 2008).

2.5.2 Modesto Subbasin

The Modesto Subbasin encompasses 385 square miles, lying to the north of the Turlock Subbasin. Approximately the top 800 feet of the subbasin bears water suitable for potable uses (Bookman-Edmonston, 2005). Groundwater recharge in the subbasin occurs mainly from seepage from irrigation canals, including MID and OID channels. Natural recharge of the subbasin is estimated to be 33,000 acre-feet per year (AFY), while extraction is estimated to be roughly 450,000 AFY (DWR, 2004). Between 1970 and 2000 the average water level in the subbasin fell 15 feet (DWR, 2004). The subbasin has not been categorized as critically overdrafted (DWR, 2016).

Groundwater quality in the Modesto Subbasin ranges from mostly good in the unconfined aquifer to poor in some areas of the confined aquifer (MID, 2012). Total Dissolved Solids (TDS) in groundwater in the eastern two-thirds of the basin is generally less than 500 milligrams per liter (mg/L), with a range from 90 mg/L to 700 mg/L. High TDS (2,000 mg/L) groundwater is present beneath the MID service area at a depth of about 400 feet in the west to about 800 feet in the east. This degraded water originates in marine sediments underlying the San Joaquin Valley. The shallowest high TDS groundwater (TDS greater than 1,000 mg/L) occurs around 120 feet below ground within a 5- to 6-mile zone parallel to the San Joaquin River (MID, 2012).

2.5.3 Eastern San Joaquin Subbasin

The Eastern San Joaquin Subbasin includes the northernmost portion of Stanislaus County. In total, the subbasin covers 1,105 square miles (only a portion of which is within the County). Groundwater levels in the subbasin have been declining continuously over the past 40 years, resulting in the subbasin being designated as a critically overdrafted basin (DWR, 2016). In some locations, groundwater levels have fallen by as much as 100 feet (DWR, 2006b). The most depressed groundwater levels occur outside the County, near Stockton and Lodi (DWR, 2006b).

Groundwater quality in the subbasin is affected by the declining water levels and proximity to the Delta. Saltwater intrusion has been occurring east of the Delta, with the saline front moving eastward. Areas of elevated nitrate level also exist in the subbasin. Average TDS was found to be 463 mg/L, and mean specific conductance was 685 microsiemens per centimeter (µmhos/cm) (DWR, 2006b).

2.5.4 Delta Mendota Subbasin

The Delta-Mendota Subbasin includes portions of San Joaquin, Stanislaus, Merced, Fresno, and Madera Counties. Between 1970 and 2000, the subbasin water level increased by 2.2 feet (DWR, 2006a). Natural recharge into the subbasin is estimated at 8,000 AFY, with extraction over 500,000 AFY. Despite the gain in groundwater levels observed prior to 2000, the subbasin has been classified as critically overdrafted, and groundwater use will be managed closely in the future.

The groundwater in the northern portion of the subbasin is characterized by mixed sulfate to bicarbonate types. TDS ranges from 400 to 1,600 mg/L in the northern portion of the subbasin (DWR, 2006a). Average TDS in public supply wells is 770 mg/L (DWR, 2006a). Across a large portion of the subbasin, saline groundwater can be found within 10 feet below the ground surface. High iron, fluoride, nitrate, and boron are also present in localized areas in the subbasin (DWR, 2006a).

2.6 Water Supply

The water suppliers for the County are depicted in Figure 4. These include MID, TID, and the City of Modesto. Detailed information on the water supplied by urban and agricultural water suppliers can generally be found in the Urban Water Management Plan (UWMP) or Agricultural Water Management Plan (AWMP) for that agency. Overall, Stanislaus County's water use is approximately 1.6 million gallons per day (mgd) (USGS, 2010).

The primary urban water suppliers in the region are listed below, along with their supply sources. All suppliers providing at least 3,000 AFY or serving at least 3,000 connections are included. The remaining water service providers serve smaller populations or volumes each year and are not required to complete UWMPs.

- City of Modesto: The City of Modesto serves potable water to the City and several outlying communities in the County. The City's water sources include groundwater from the Modesto and Turlock Subbasins and surface water purchased from MID. In2015, the City served 47,459 AF of potable water, 67% of which was groundwater (West Yost, 2016a).
- City of Turlock: The City of Turlock provides potable and nonpotable water through 18,686 potable connections. Turlock also serves recycled water to a power plant and recreational field irrigation. The City currently relies entirely on groundwater from the Turlock Subbasin for potable use, and has some recycled water use. In the future, the City expects to purchase surface water from TID. In 2015, the City of Turlock provided approximately 17,415 AF of water for municipal purposes (West Yost, 2016b).
- City of Ceres: The City of Ceres delivers potable water through 11,625 connections within the City of Ceres limits. Groundwater from the Turlock Subbasin is the sole supply for the City, with 6,632 AF delivered in 2015. In the future, groundwater may be supplemented with surface water purchased from TID (Ceres, 2016).
- City of Riverbank: The City of Riverbank relies solely on groundwater from the Modesto Subbasin. In 2015, Riverbank served 3,878 AF through 6,743 connections (Kjeldsen, Sinnock, & Neudeck, Inc., 2016).
- City of Newman: The City of Newman serves just over 3,000 connections, and distributed approximately 1,900 AF of water in 2015. The City relies solely on groundwater from the Delta-Mendota Subbasin (Gouveia Engineering, 2016).
- City of Patterson: The City of Patterson serves potable water through 6,269 connections within the City. In 2015, the City delivered 3,216 AF (RMC, 2016). The City relies exclusively on groundwater from the Delta-Mendota Subbasin.

Agricultural water suppliers which have prepared AWMPs since 2012 (SBX 7-7 Plans) are listed below:

- MID: MID provides irrigation water to 57,000 acres and operates Don Pedro Reservoir together with TID.
- TID: TID serves 4,900 irrigation customers, covering a service area of 197,000 gross acres. TID operates Don Pedro Reservoir jointly with MID and delivers approximately 604,000 AFY, on average (TID, 2015).
- OID: OID serves 81,000 acres of cropland with surface water and groundwater in Stanislaus and San Joaquin Counties (Davids Engineering, 2016).
- Patterson Irrigation District (PID): PID serves approximately 13,000 acres, using both surface water and groundwater (PID, 2016).

Areas outside the service areas of the afore-mentioned public water agencies are primarily dependent on groundwater for their water supplies. Some small communities in the County get drinking water from small water providers, including the City of Hughson, Denair CSD, Keyes CSD, Monterey Park Tract CSD, Riverdale Park Tract CSD, and Stanislaus County Housing Authority. Outside these localized areas, privately-owned properties are managed by the individual property owner who also determines the water supply use, irrigation method, cropping patterns, and other issues related to their land. Unless a permit is acquired to install a building or well, modifications on the land are not part of a larger land use planning process. Privately-owned irrigation supply wells and domestic wells have been installed throughout the Modesto and Turlock Groundwater Subbasins to provide water for irrigation and supplies to rural homes and businesses.

Countywide water use is shown in Table 3. These high-level estimates are prepared every five years by the USGS California Water Science Center. Data from 2010 was the most recent available. Withdrawal and use estimates were calculated by the California Water Science Center using data from a range of sources, including the U.S. Environmental Protection Agency (USEPA) Safe Drinking Water Information System (SDWIS); U.S. Census Bureau; and the U.S. Department of Agriculture (USDA).

Table 3. Water Use in Stanislaus County as of 2010[1]

Water Source	Total Withdrawal (AFY)
Groundwater	1,199
Surface Water	444
Total	*1,643*
Water Use	**Total Use (AFY)**
Irrigation	1,500
Public Supply	104
All Other Categories	39
Total	*1643*

[1]Source: USGS California Water Science Center, 2017.

2.7 Water Quality Conditions

Water quality in Stanislaus County is regulated by the Central Valley Regional Water Quality Control Board (CVRWQCB). Each Regional Water Quality Control Board is required to prepare a Basin Plan to be used as a basis for regulatory actions to protect water quality. As described in Section2.4.2, Basin Plans describe beneficial uses, identify water quality objectives, and define an implementation program consisting of actions to be taken to meet those objectives. Region 5, the Central Valley Region, has two Basin Plans, one for Tulare Lake Basin and one for the Sacramento and San Joaquin River Basins. The latter Basin Plan is pertinent to the County and was originally adopted in 1975, then updated and revised in 1984, 1989, 1994, 1998, 2011, 2015, and 2016 (CVRWQCB, 2016).

Beneficial uses of water resources as identified in the Basin Plan are critical in water quality management. The use of a water body helps determine what water quality conditions are acceptable or unacceptable. The existing and potential beneficial uses of the surface waters within Stanislaus County, as defined in the Basin Plan, are shown in Table 4.

Table 4. Beneficial Uses of Surface Water in Stanislaus County

Surface Water Bodies			Tuolumne River (New Don Pedro Dam to San Joaquin River)	Stanislaus River (Goodwin Dam to San Joaquin River)	San Joaquin River (Mouth of Merced River to Vernalis)	Delta-Mendota Canal
Hydrologic Unit Number			535	535	535/541	541/543
	MUN	Municipal and Domestic Supply	P	P	P	E
Agriculture	AGR	Irrigation	E	E	E	E
		Stock Watering	E	E	E	E
Industry	PROC	Process		E	E	
	IND	Service Supply		E		
	POW	Power		E		
Recreation	REC-1	Contact	E	E	E	E
		Canoeing and Rafting	E	E	E	
	REC-2	Other Noncontact	E	E	E	E
Freshwater Habitat	WARM	Warm	E	E	E	E
	COLD	Cold	E	E		
Migration	MIGR	Warm			E	
		Cold	E	E	E	
Spawning	SPWN	Warm	E	E	E	
		Cold	E	E		
	WILD	Wildlife Habitat	E	E	E	E
	NAV	Navigation				

Legend: P = Potential beneficial use; E = Existing beneficial use

The Basin Plan does not identify beneficial uses of groundwater at the subbasin level. All groundwater in the Basin is assumed to be suitable for the following beneficial uses, at a minimum:

- Municipal and Domestic Supply
- Agricultural Supply
- Industrial Service Supply (e.g. cooling water supply)
- Industrial Process Supply

The CVRWQCB may also de-designate groundwater sites for any of the applicable beneficial uses, using criteria laid out in the Basin Plan.

Constituents that may impact water quality in the County include dissolved salts and nutrients in agricultural return flows, as well as residual pesticides and herbicides, and seepage from percolation ponds. Additionally, in areas with agriculture and cattle grazing, water can have elevated levels of nutrients, pathogens, and sediment. Urban runoff from industrial sites and roadways can carry pollutants such as petroleum hydrocarbons, metals and sediment that can also impact surface water quality.

Water quality concerns in the major rivers (Stanislaus, Tuolumne, and San Joaquin) within the County include organochlorine pesticides (diazinon and chlorpyrifos) and organic carbon, which contributes to low dissolved oxygen levels. These are managed and tracked through a Central Valley-wide Total Maximum Daily Load (TMDL) for pesticides, and a TMDL for the San Joaquin River in the Stockton Deep Water Shipping Channel (DWSC) for low dissolved oxygen.

Several additional water quality impairments are identified in the CVRWQCB's 303(d) list of impaired water bodies as causing impairments of the beneficial uses of water bodies in the County. These pollutants, listed in full in Table 5, include pesticides, mercury, and bacteria.

2.7.1 Applicable TMDLs and 303(d) Listed Impaired Waterbodies

Under CWA Section 303(d), States are required to develop a list of water quality limited segments. These waters on the list do not meet water quality standards, even after point sources of pollution have installed the minimum required levels of pollution control technology. The CWA requires the State to develop action plans, called TMDLs, to improve water quality. The 303(d) list of impaired water bodies within the Sacramento River and San Joaquin River Basins suffer significant water quality impairments from a variety of pollutants and must be addressed through the development of TMDLs. The Lower Stanislaus River, the Lower Tuolumne River (from Don Pedro Reservoir to the San Joaquin River), and the Lower Merced River (from McSwain Reservoir to the San Joaquin River) are included on this list. Irrigated agriculture has been identified as an anthropogenic source of pesticides, nitrate and sediment loading in surface water bodies. Additional sources of sediment loading include erosion, mining, and grazing, among others.

The EPA's 2016 303(d) list of impaired water bodies includes water body segments in Stanislaus County. Table 5 details the 303(d)-listed water bodies and the associated pollutants. Figure 11 displays the 303(d)-listed impaired water bodies in the County, as identified by the Final 2012 California Integrated Report (the latest year for which GIS data was available).

Table 5. 303(d)-listed Impaired Water Bodies in Stanislaus County

Water Body Name	Pollutant	Pollutant Category	TMDL Requirement Status
Del Puerto Creek	Pyrethroids	Pesticides	TMDL required
	Indicator Bacteria	Fecal Indicator Bacteria	TMDL required
	Dieldrin	Pesticides	TMDL required
	Bifenthrin	Pesticides	TMDL required
	Toxicity	Toxicity	TMDL required

Water Body Name	Pollutant	Pollutant Category	TMDL Requirement Status
	pH (high)	Miscellaneous	TMDL required
	Salinity	Salinity	TMDL required
	Chlorpyrifos	Pesticides	Being addressed by action other than a TMDL
	Diazinon	Pesticides	Being addressed by action other than a TMDL
	Diuron	Pesticides	Being addressed by action other than a TMDL
	Total Dissolved Solids	Salinity	TMDL required
	Cyfluthrin	Pesticides	TMDL required
	Cyhalothrin, Lambda	Pesticides	TMDL required
	Esfenvalerate/Fenvalerate	Pesticides	TMDL required
	Nitrate/Nitrite (Nitrite + Nitrate as N)	Nutrients	TMDL required
Dry Creek (tributary to Tuolumne River at Modesto, East Stanislaus County)	Chlorpyrifos	Pesticides	Being addressed by action other than a TMDL
	Indicator Bacteria	Fecal Indicator Bacteria	TMDL required
	Toxicity	Toxicity	TMDL required
	Oxygen, Dissolved	Nutrients	TMDL required
	Diuron	Pesticides	Being addressed by action other than a TMDL
Grayson Drain (at outfall)	Indicator Bacteria	Fecal Indicator Bacteria	TMDL required
	Toxicity	Toxicity	TMDL required
Harding Drain	Chlorpyrifos	Pesticides	Being addressed by action other than a TMDL
	alpha.-BHC (Benzenehexachloride or alpha-HCH)	Other Organics	TMDL required
	DDE (Dichlorodiphenyldichloroethylene)	Pesticides	TMDL required
	Indicator Bacteria	Fecal Indicator Bacteria	TMDL required
	Hexachlorobenzene/ HCB	Pesticides	TMDL required
	Lindane/gamma Hexachlorocyclohexane (gamma-HCH)	Pesticides	TMDL required

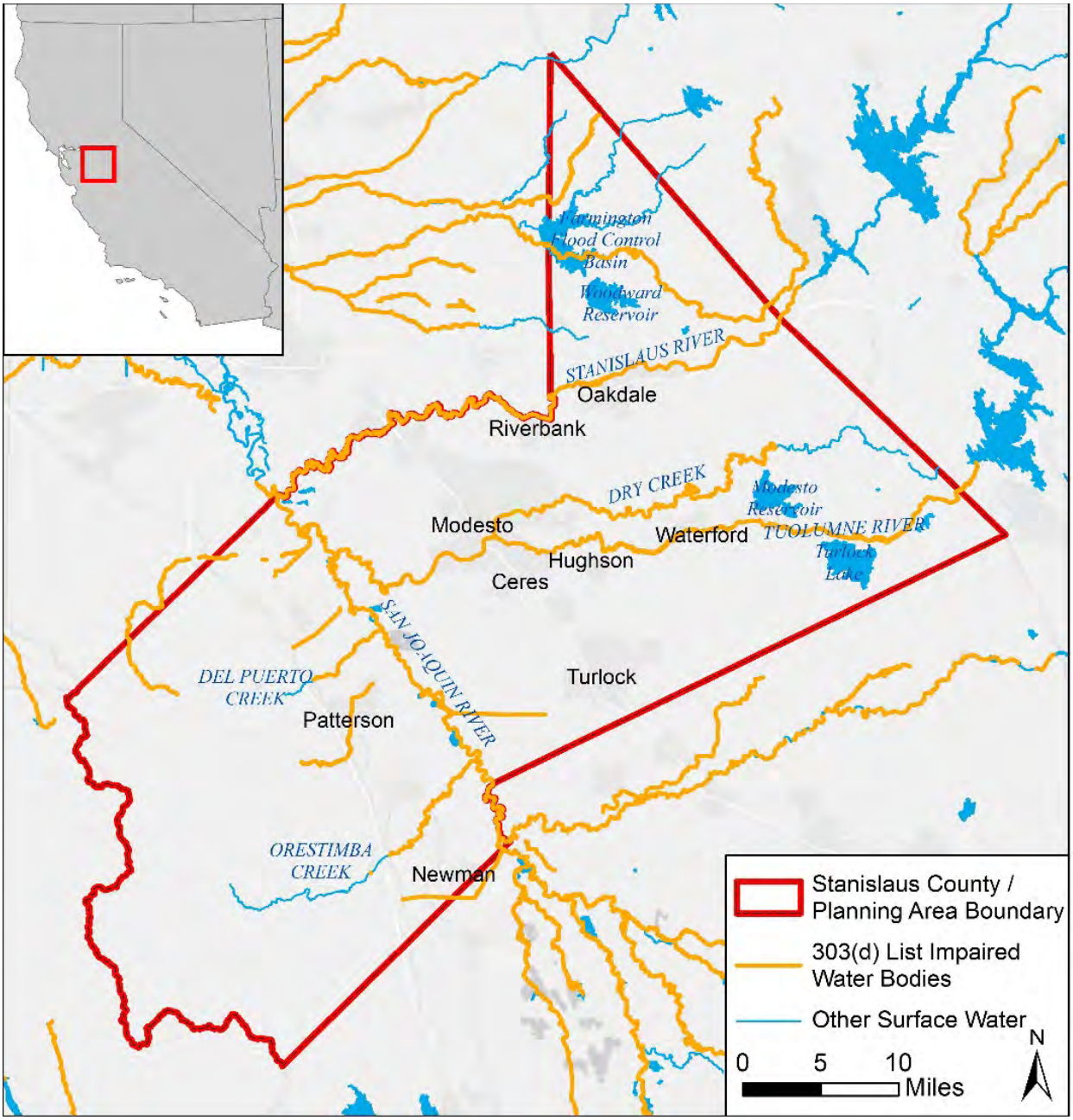
Water Body Name	Pollutant	Pollutant Category	TMDL Requirement Status
Highline Canal (from Mustang Creek to Lateral No 8, Merced and Stanislaus Counties)	Chlorpyrifos	Pesticides	Being addressed by action other than a TMDL
	Simazine	Pesticides	TMDL required
	Toxicity	Toxicity	TMDL required
Hospital Creek (San Joaquin and Stanislaus Counties)	Arsenic	Metals/Metalloids	TMDL required
	DDE (Dichlorodiphenyldichloroethylene)	Pesticides	TMDL required
	DDT (Dichlorodiphenyltrichloroethane)	Pesticides	TMDL required
	Dieldrin	Pesticides	TMDL required
	Pyrethroids	Pesticides	TMDL required
	Trifluralin	Pesticides	TMDL required
	Salinity	Salinity	TMDL required
	Toxicity	Toxicity	TMDL required
	Indicator Bacteria	Fecal Indicator Bacteria	TMDL required
	Chlorpyrifos	Pesticides	Being addressed by action other than a TMDL
	Methyl Parathion	Pesticides	Being addressed by action other than a TMDL
	Diuron	Pesticides	Being addressed by action other than a TMDL
	Total Dissolved Solids	Salinity	TMDL required
	Specific Conductivity	Salinity	TMDL required
Ingram Creek (from confluence with Hospital Creek to Hwy 33 crossing)	Pyrethroids	Pesticides	TMDL required
	Arsenic	Metals/Metalloids	TMDL required
	Toxicity	Toxicity	TMDL required
	Chlorpyrifos	Pesticides	Being addressed by action other than a TMDL
	Diuron	Pesticides	Being addressed by action other than a TMDL
	Nickel	Metals/Metalloids	TMDL required
	Nitrate/Nitrite (Nitrite + Nitrate as N)	Nutrients	TMDL required
	Simazine	Pesticides	TMDL required
	DDT (Dichlorodiphenyltrichloroethane)	Pesticides	TMDL required

Water Body Name	Pollutant	Pollutant Category	TMDL Requirement Status
	Indicator Bacteria	Fecal Indicator Bacteria	TMDL required
	Specific Conductivity	Salinity	TMDL required
	Total Dissolved Solids	Salinity	TMDL required
Ingram Creek (from confluence with San Joaquin River to confluence with Hospital Creek)	Salinity	Salinity	TMDL required
	Indicator Bacteria	Fecal Indicator Bacteria	TMDL required
	Toxicity	Toxicity	TMDL required
	DDE (Dichlorodiphenyldichloroethylene)	Pesticides	TMDL required
	Dieldrin	Pesticides	TMDL required
	DDT (Dichlorodiphenyltrichloroethane)	Pesticides	TMDL required
	Chlorpyrifos	Pesticides	Being addressed by action other than a TMDL
	Pyrethroids	Pesticides	TMDL required
Newman Wasteway	Simazine	Pesticides	TMDL required
	Salinity	Salinity	TMDL required
	Oxygen, Dissolved	Nutrients	TMDL required
	Indicator Bacteria	Fecal Indicator Bacteria	TMDL required
	Chlorpyrifos	Pesticides	Being addressed by action other than a TMDL
	DDE (Dichlorodiphenyldichloroethylene)	Pesticides	TMDL required
Orestimba Creek (above Kilburn Road)	Azinphos-methyl (Guthion)	Pesticides	TMDL required
	Toxicity	Toxicity	TMDL required
	Indicator Bacteria	Fecal Indicator Bacteria	TMDL required
	Chlorpyrifos	Pesticides	Being addressed by action other than a TMDL
	DDE (Dichlorodiphenyldichloroethylene)	Pesticides	TMDL required
	Dieldrin	Pesticides	TMDL required
	DDT (Dichlorodiphenyltrichloroethane)	Pesticides	TMDL required
	Diuron	Pesticides	Being addressed by action other than a TMDL
	Oxygen, Dissolved	Nutrients	TMDL required
	Specific Conductivity	Salinity	TMDL required

Water Body Name	Pollutant	Pollutant Category	TMDL Requirement Status
	Total Dissolved Solids	Salinity	TMDL required
	Diuron	Pesticides	Being addressed by action other than a TMDL
	Chlorpyrifos	Pesticides	Being addressed by action other than a TMDL
	Azinphos-methyl (Guthion)	Pesticides	TMDL required
	Indicator Bacteria	Fecal Indicator Bacteria	TMDL required
	Malathion	Pesticides	TMDL required
	DDD (Dichlorodiphenyldichloroethane)	Pesticides	TMDL required
	DDT (Dichlorodiphenyltrichloroethane)	Pesticides	TMDL required
	DDE (Dichlorodiphenyldichloroethylene)	Pesticides	TMDL required
	Toxicity	Toxicity	TMDL required
	Dieldrin	Pesticides	TMDL required
	Diazinon	Pesticides	Being addressed by action other than a TMDL
	Specific Conductivity	Salinity	TMDL required
	Total Dissolved Solids	Salinity	TMDL required
San Joaquin River (Merced River to Tuolumne River)	DDT (Dichlorodiphenyltrichloroethane)	Pesticides	TMDL required
	Mercury	Metals/Metalloids	TMDL required
	Group A Pesticides	Pesticides	TMDL required
	alpha.-BHC (Benzenehexachloride or alpha-HCH)	Other Organics	TMDL required
	Chlorpyrifos	Pesticides	Being addressed by USEPA-approved TMDL
	Toxicity	Toxicity	TMDL required
	DDE (Dichlorodiphenyldichloroethylene)	Pesticides	TMDL required
	Temperature, water	Miscellaneous	TMDL required
	Electrical Conductivity	Salinity	TMDL required
	Specific Conductivity	Salinity	TMDL required
	Total Dissolved Solids	Salinity	TMDL required
San Joaquin River	Group A Pesticides	Pesticides	TMDL required

Water Body Name	Pollutant	Pollutant Category	TMDL Requirement Status
(Tuolumne River to Stanislaus River)	DDT (Dichlorodiphenyltrichloroethane)	Pesticides	TMDL required
	Mercury	Metals/Metalloids	TMDL required
	Diazinon	Pesticides	Being addressed by USEPA-approved TMDL
	Chlorpyrifos	Pesticides	Being addressed by USEPA-approved TMDL
	Toxicity	Toxicity	TMDL required
	Electrical Conductivity	Salinity	TMDL required
	Temperature, water	Miscellaneous	TMDL required
Stanislaus River, Lower	Mercury	Metals/Metalloids	TMDL required
	Chlorpyrifos	Pesticides	Being addressed by action other than a TMDL
	Temperature, water	Miscellaneous	TMDL required
	Diazinon	Pesticides	Being addressed by action other than a TMDL
	Group A Pesticides	Pesticides	TMDL required
	Toxicity	Toxicity	TMDL required
Tuolumne River, Lower (Don Pedro Reservoir to San Joaquin River)	Chlorpyrifos	Pesticides	Being addressed by action other than a TMDL
	Group A Pesticides	Pesticides	TMDL required
	Mercury	Metals/Metalloids	TMDL required
	Diazinon	Pesticides	Being addressed by action other than a TMDL
	Toxicity	Toxicity	TMDL required
	Temperature, water	Miscellaneous	TMDL required
Westley Wasteway (Stanislaus County)	Chlorpyrifos	Pesticides	Being addressed by action other than a TMDL
	Indicator Bacteria	Fecal Indicator Bacteria	TMDL required
	Dimethoate	Pesticides	TMDL required

Figure 11. 303(d) Listed Impaired Water Bodies in Stanislaus County



Data source: SWRCB, 2012 California Integrated Report.

2.7.2 Stormwater Outfall Monitoring Results

Stormwater monitoring results are available from the City of Modesto, which conducts monitoring activities at four receiving water locations along the Tuolumne River and Dry Creek. A range of constituents are monitored at these locations, including nitrate, Total Suspended Solids (TSS), mercury, chlorpyrifos, and diazinon. The City is required to evaluate the monitoring results to determine whether the water quality objectives are being exceeded in the receiving water. In the 2014/2015 rainy season, exceedances occurred for fecal coliform bacteria, pH, aluminum, copper, zinc, and turbidity (Modesto, 2015).

Modesto also conducts monitoring at two urban discharge monitoring locations. Exceedances in 2014/2015 included fecal coliform bacteria, various metals, turbidity, dissolved oxygen, conductivity, and TDS (Modesto, 2015).

As part of the SWRP, additional stormwater monitoring will be conducted during the winter of 2017/2018 if adequate rainfall occurs. Samples will be collected at 10 key outfalls over three storm events during the wet season. Stormwater monitoring constituents were selected based on established TMDLs, 303(d) listed water body impairments, as well as the results of the stormwater quality monitoring sampling and analysis completed by the City of Modesto as required by their Municipal Separate Storm Sewer System (MS4) Permit R5-2015-0025 National Pollutant Discharge Elimination System (NPDES) No. CAS083526. A range of pollutants will be analyzed, including bacteria, metals, organics, nutrients, pesticides and general water chemistry parameters. This constituent list may be modified based on initial monitoring results or other relevant sampling data.

2.7.3 Water Quality Priorities

The County is part of the Central Valley Pesticide TMDL, with the lower Tuolumne River and the lower Stanislaus River identified as affected water bodies. This TMDL was adopted into the Central Valley Basin Plan in March 2014. The study area and cities within it are also subject to the following TMDLs:

- Sacramento-San Joaquin Delta – mercury/methylmercury;
- San Joaquin River, Merced River to Tuolumne River – boron and chlorpyrifos;
- Lower San Joaquin River – salt and boron;
- Lower San Joaquin River (below Tuolumne River) – diazinon and chlorpyrifos (both pesticides); and

MS4 permits that apply to the plan area include the following:

- City of Modesto (WDR No. R5-2008-0092; NPDES No. CAS083526); and
- Unincorporated urban areas, towns and cities in Stanislaus County (except the above) are covered by the General Permit for the Discharge of Storm Water from Small MS4s (WQ Order No. 2013-0001-DWQ). A Region-wide MS4 general permit is under development by the Regional Water Board, which is expected to be the umbrella permit in the future for all entities in this SWRP.

The SWRP will assist in compliance with the NPDES permits by supporting the elements of Public Education & Outreach, Public Participation, Water Quality and Habitat Enhancement in Flood Control Facilities.

2.7.4 Other Priorities

Other priorities for the region relate primarily to groundwater. Responsible groundwater management is critical to the economic and environmental health of the County. Therefore, one important priority is the identification of conjunctive use strategies to maximize the use of both surface water and groundwater. This would include groundwater recharge and the protection of groundwater quality. Issues beyond groundwater contamination from within the County include salinity, land subsidence, and overdraft. Additional water quality priorities may include goals such as maintaining favorable wildlife habitat and aesthetic value to the community.