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Salinas Valley: Valley-Wide Integrated Groundwater Sustainability Plan Chapters 1-3

Prepared for:
Salinas Valley Basin Groundwater Sustainability Agency

1-10-19 Draft Release

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ABBREVIATIONS AND ACRONYMS

AFY .... Acre-Feet per Year
AMBAG .... Association of Monterey Bay Area Governments
CASGEM .... California Statewide Groundwater Elevation Monitoring
CCR .... California Code of Regulations
CCRWQCB .... Central Coast Regional Water Quality Control Board
CIFP .... Capital Improvement and Financing Plan
CSD .... Community Services District
CSIP .... Castroville Seawater Intrusion Project
DDW .... Division of Drinking Water
DWR .... Department of Water Resources
GAMA .... Groundwater Ambient Monitoring and Assessment
GRC .... General Rate Case
GMP .... Groundwater Management Plan
GSA .... Groundwater Sustainability Agency
GSP .... Groundwater Sustainability Plan
ILRP .... Irrigated Lands Regulatory Program
IRWM .... Integrated Regional Water Management
JPA .... Joint Powers Authority
MCL .... Maximum Contaminant Level
MCWD .... Marina Coast Water District
MCWRA .... Monterey County Water Resources Association
MPWSP .... Monterey Peninsula Water Supply Project
NPDES .... National Pollutant Discharge Elimination System

RWMG..Regional Water Management Group
SB..Senate Bill
SGMA ....Sustainable Groundwater Management Act
SRDF ....Salinas River Diversion Facility
SVBGSA...Salinas Valley Basin Groundwater Sustainability Agency
SVWP...Salinas Valley Water Project
SWQCB..State Water Quality Control Board
UWMP ....Urban Water Management Plan
USGS..United States Geological Survey
WDR...Waste Discharge Requirements

SECTION 1
INTRODUCTION TO SALINAS VALLEY GROUNDWATER SUSTAINABILITY PLAN

1.1 PURPOSE OF THE VALLEY-WIDE GROUNDWATER SUSTAINABILITY PLAN

In 2014, the State of California enacted the Sustainable Groundwater Management Act (SGMA). This law requires groundwater basins or subbasins that are designated as medium or high priority to be managed sustainably.

Satisfying the requirements of SGMA generally requires four activities:
1. Forming one or more Groundwater Sustainability Agency(s) (GSAs) in the basin
2. Developing a Groundwater Sustainability Plan (GSP)
3. Implementing the GSP and managing to measurable, quantifiable objectives
4. Regular reporting to the California Department of Water Resources (DWR)

A Groundwater Sustainability Agency (GSA) is a local agency responsible for developing the GSP in its area of responsibility. The Salinas Valley Basin Groundwater Sustainability Agency (SVBGSA) is a GSA that was formed in 2017. The SVBGSA represents agriculture, public utility, municipal, county, and environmental stakeholders and is responsible for developing GSPs in much of the Salinas Valley.

The SVBGSA is currently developing GSPs for all or part of six subbasins in the Salinas Valley Groundwater Basin (Valley) including: the 180/400 Foot Aquifer Subbasin (3-004.01), the East Side Aquifer Subbasin (3-004.02), the Forebay Aquifer Subbasin (3-004.04), the Upper Valley Aquifer Subbasin (3-004.05), the Langley Area Subbasin (3-004.09) and the Monterey Subbasin (3-004.10). Although SGMA requirements dictate the development of a stand-alone GSP for each Subbasin, groundwater management is a valley-wide challenge. Projects and actions implemented in one subbasin have the potential to affect other subbasins in the Valley. Recognizing, the interdependence among the subbasins, the SVBGSA has developed this Salinas Valley Integrated r Sustainability Plan (ISP) which:

- Describes the ISP area
- Establishes local sustainable management criteria
- Provides projects and programs for reaching sustainability throughout ISP area by 2040

- Includes monitoring and reporting protocols to document long-term sustainable management in the ISP area.

The projects and programs presented in this ISP constitute a cohesive set of projects and programs designed to achieve sustainability throughout the entire ISP area. Each of the six subbasin GSPs developed by the SVBGSA is a subset of this ISP. This ISP includes all of the sustainable management criteria, projects and actions, and monitoring protocols included in each of the six subbasin GSPs. This ISP serves as the overarching document that guides groundwater management throughout the Valley.

1.2 Description of the Salinas Valley Integrated Groundwater Sustainability Plan area

The Salinas Valley is a southeast to northeast trending valley in coastal Central California that drains into the Salinas River. The ISP area extends from the Pacific Ocean to the San Luis Obispo County line. The ISP area includes parts of the urban areas of Salinas, Marina, Seaside, Castroville, Moss Landing, Chualar, Gonzales, Soledad, Greenfield, and King City (Figure 1-1).

A part of the ISP's northern boundary is shared with the Corralitos - Pajaro Valley Basin. The two basins are not considered to be hydraulically connected; the boundary coincides with the inland projection of a clay-filled paleodrainage of the Salinas River buried beneath Elkhorn Slough (DWR, 2004). A part of the ISP's southern boundary is shared with the adjudicated Seaside Subbasin. More information about this subbasin is included in Section 3.2 of this ISP.

The ISP area is bounded on the northeast by the Gabilan mountain range and on the southwest by the Santa Lucia Mountains. The SVBGSA has proposed a basin boundary adjustment for the Salinas Valley Groundwater Basin that extends the Upper Valley subbasin to the Monterey County / San Luis Obispo County line (Figure 1-1). This ISP assumes that the basin boundary modification will be accepted.

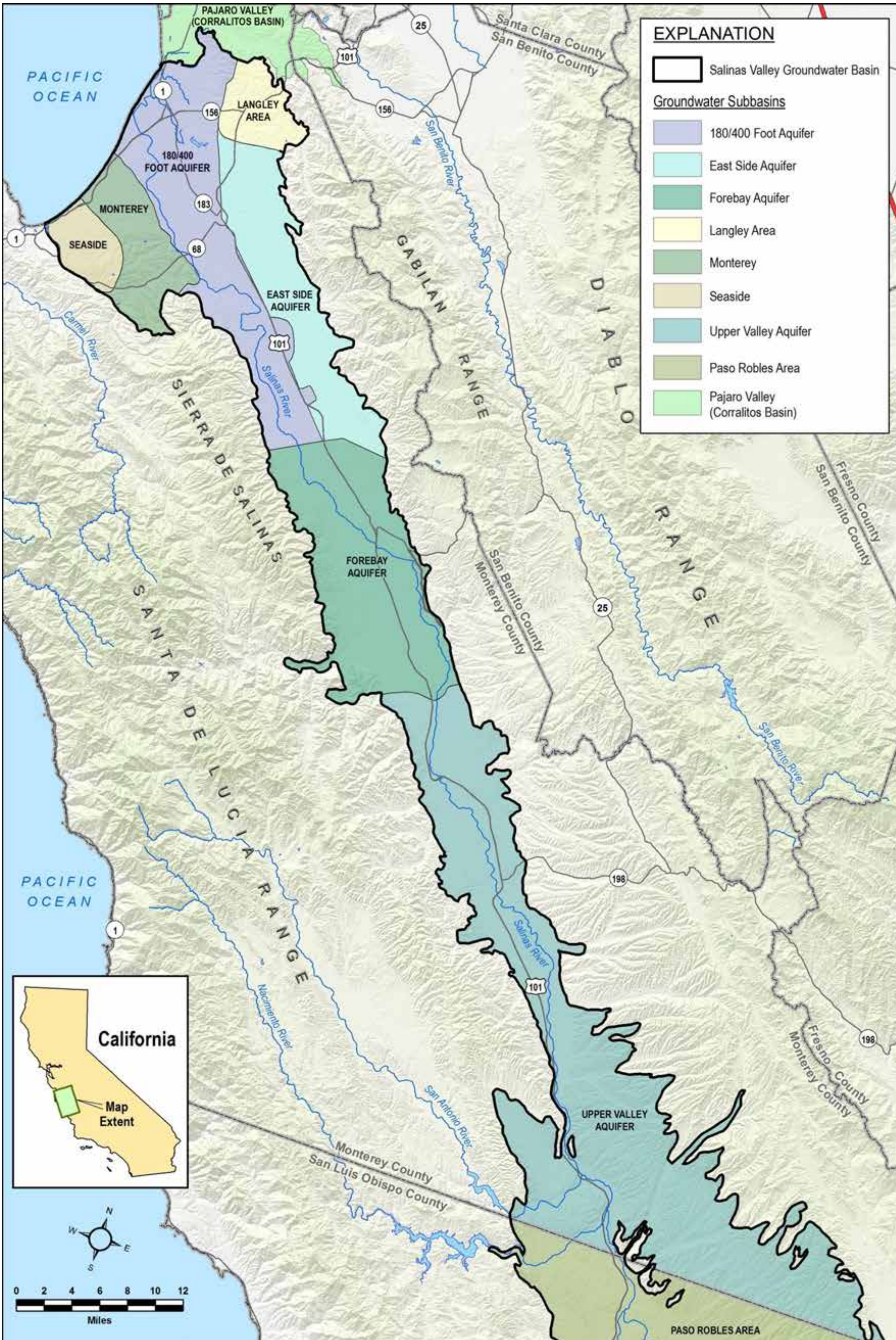

Figure 1-1: Salinas Valley Integrated Groundwater Sustainability Plan Area

SECTION 2
AGENCY INFORMATION (§ 354.6)

Groundwater management in the Valley under SGMA is implemented by four GSAs: the SVBGSA, the Marina Coast Water District (MCWD) GSA, the City of Marina GSA, and the Arroyo Seco GSA. The areas covered by the four GSAs are shown on Figure 2-1. Areas on Figure 2-1 associated with more than one GSA are areas that have overlapping claims regarding which GSA manages the area. These overlapping claims must be rectified under SGMA. Successful Valley wide groundwater management requires integrated and cooperative management by all four agencies.

2.1 CONTACT INFORMATION FOR GSA PLAN MANAGERS

Salinas Valley Groundwater Sustainability Agency
Attn.: Gary Petersen, General Manager
1441 Schilling Place
Salinas, CA 93901
https://svbgsa.org

Marina Coast Water District
Attn.: Keith Van Der Maaten, General Manager
11 Reservation Road
Marina, CA 93933
http://www.mcwd.org

City of Marina Groundwater Sustainability Agency
Attn.: Brian McMinn, Public Works Director
211 Hillcrest Ave.
Marina, CA 93933
ci.marina.ca.us

Arroyo Seco Groundwater Sustainability Agency
Attn.: Curtis Weeks, General Manager
599 El Camino Real
Greenfield, CA 93927
https://arroyosecogsa.org

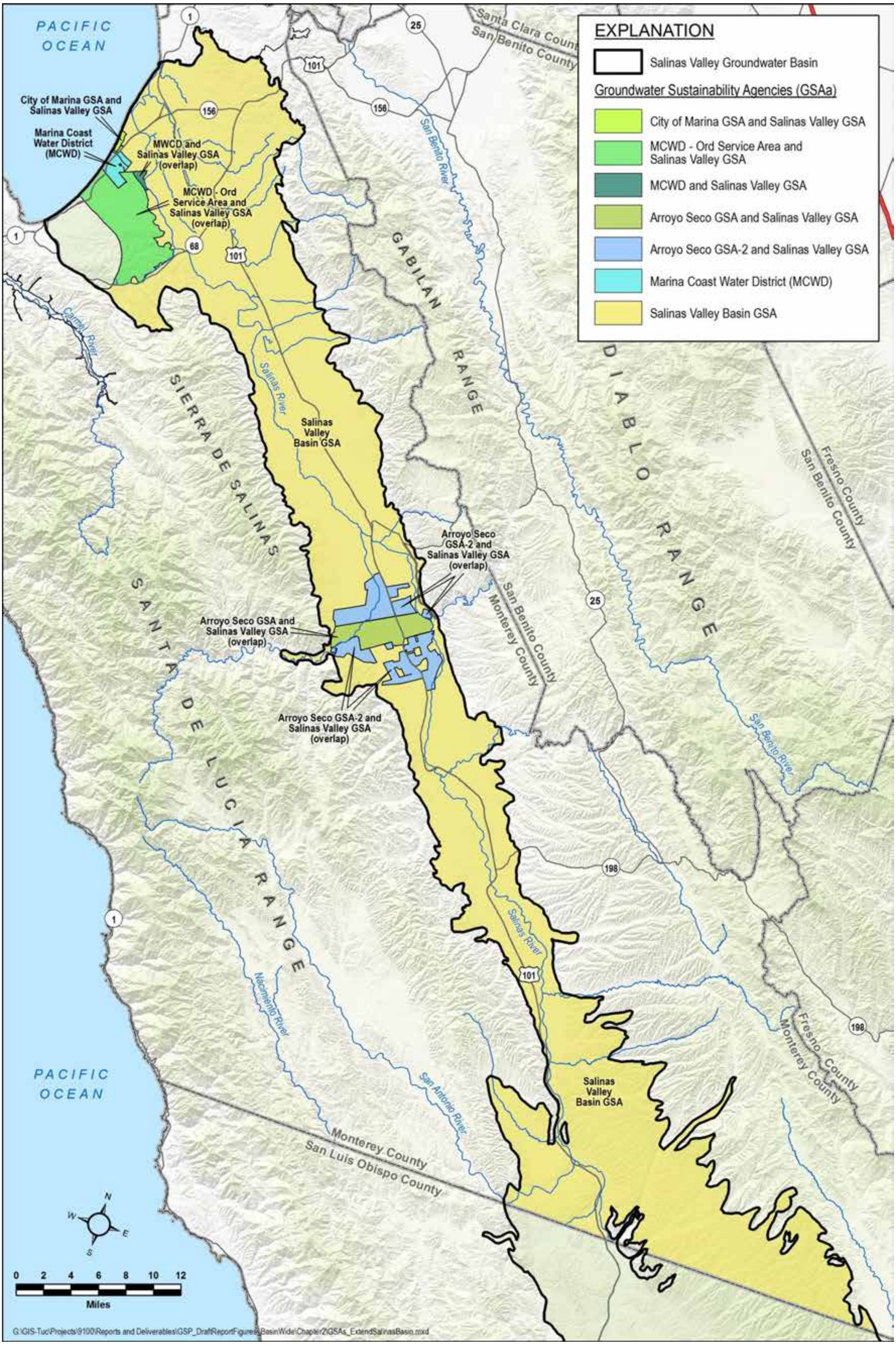

Figure 2-1: Map of Area Covered by GSAs

SECTION 3
DESCRIPTION OF PLAN AREA (§ 354.8)

3.1 INTRODUCTION

The extent of the area covered by this ISP is shown on Figure 3-1. The ISP area lies in northwestern Monterey County and includes the northern end of the Salinas River Valley. The ISP area covers an area of 527,634 acres (824 square miles) (DWR, 2004).

The Salinas River drains the Salinas Valley, discharging into Monterey Bay. The ISP area contains the municipalities of Salinas, Gonzales, Marina, Soledad, Greenfield, and King City and the census-designated places of Castroville, Moss Landing, Elkhorn, Boronda, Spreckels, Chualar, Pine Canyon, San Lucas, San Ardo, and Bradley. United States Highway 101 runs north-south through the entire ISP area. State Highways 1, 156, 146, 198, 183, and 68 also cross the ISP area. Rivers and streams, urban areas, and major roads are shown on Figure 3-1.

3.2 ADJUDICATED AREAS, OTHER GSAS, AND ALTERNATIVES

No part of the ISP area is adjudicated. An adjudicated basin is one in which, through legal action, groundwater rights have been quantified and the basin has certain requirements placed on it by the Court. Those requirements are normally administered and enforced by a watermaster that is appointed by the Court.

The only adjudicated subbasin in the Salinas Valley Basin is the Seaside Subbasin (DWR number 3-004.08). The Seaside Subbasin is shown as the highlighted area on Figure 3-2. The Seaside Subbasin Watermaster was appointed through the Decision filed February 9, 2007 by the Superior Court in Monterey County under Case No. M66343 - California American Water v. City of Seaside *et al*. The Seaside Basin Watermaster has 10 members, including several cities on the Monterey Peninsula, representatives from certain subareas with that basin, the Monterey Peninsula Water Management District, the Monterey County Water Resources Agency, and California American Water Company.

No alternative plans have been submitted for any part of the ISP area.

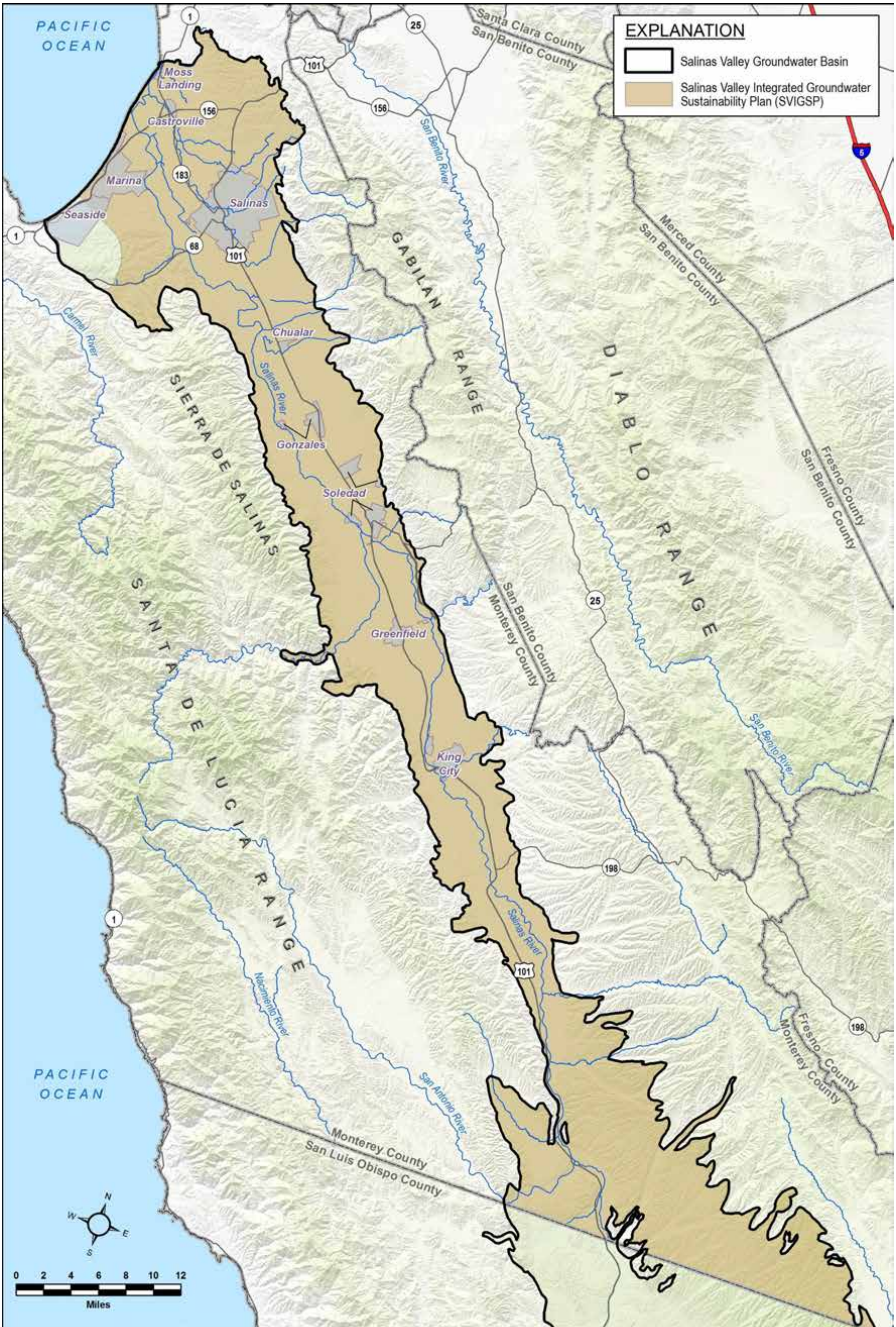

Figure 3-1: Area Covered by ISP

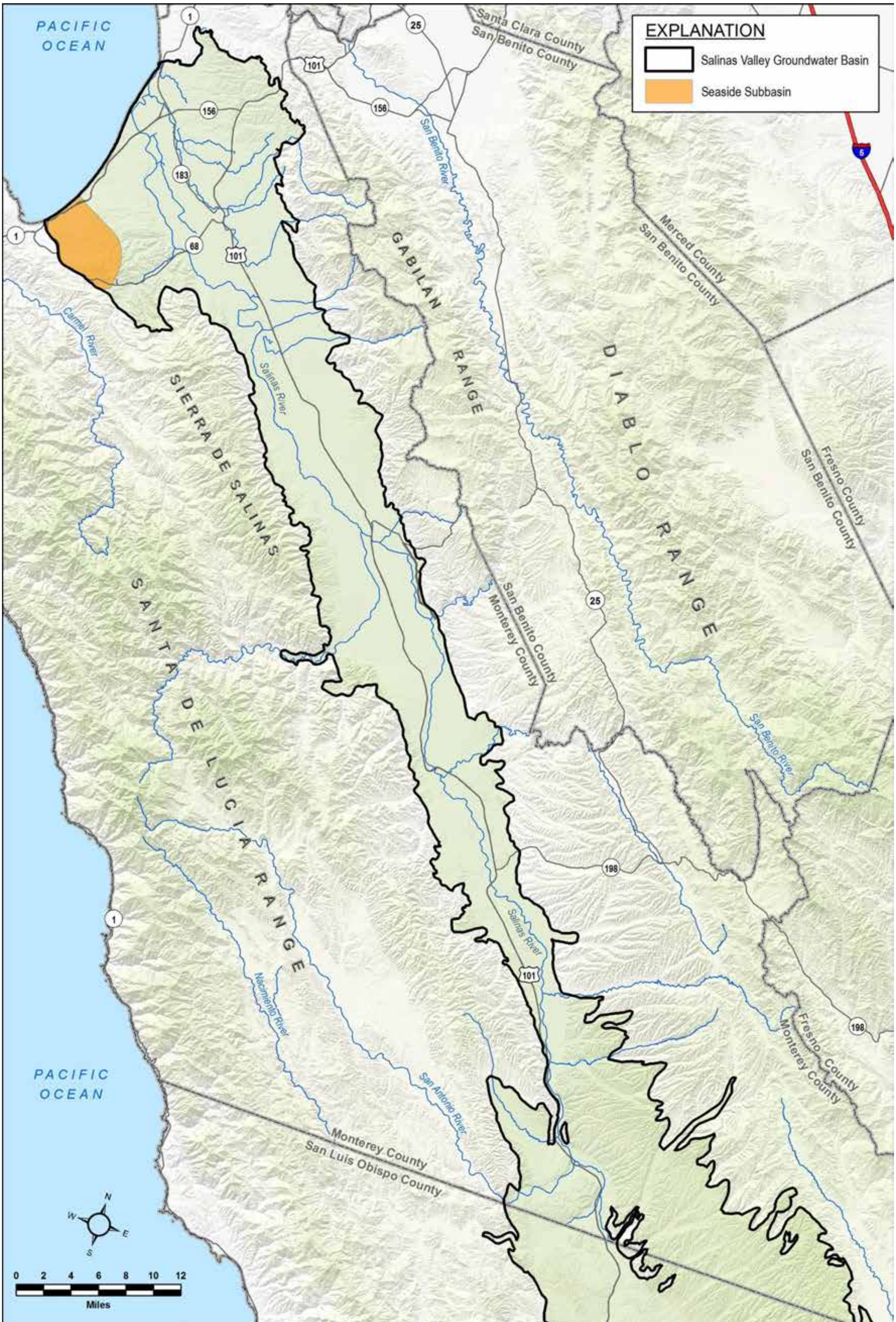

Figure 3-2: Adjudicated Areas

3.3 JURISDICTIONAL AREAS

There are several federal, state, and local agencies with water management authority in the ISP area.

3.3.1 FEDERAL JURISDICTION

A portion of the Fort Ord former Army base lies in the ISP area. The United States Department of Defense manages this part of Fort Ord. The United States Department of Fish and Wildlife manages the Salinas River National Wildlife Refuge. The United States Bureau of Land Management (BLM) manages a 27.5-acre parcel in the Salinas River floodplain approximately 3.5 miles north of Greenfield. The BLM additionally owns several parcels of land approximately 5.5 miles southwest of Soledad; a portion of these are within the ISP area. The BLM also owns land contiguous with Fort Ord. Areas under federal jurisdiction are shown on Figure 3-3.

3.3.2 STATE JURISDICTION

The California Army National Guard operates Camp Roberts, a military training facility located in both Monterey and San Luis Obispo counties. The California Department of Corrections and Rehabilitation manages the Salinas Valley State Prison and the adjacent Correctional Training Facility; both located 5 miles north of Soledad. The California Department of Fish and Wildlife owns and operates the Elkhorn Slough and Moro Cojo ecological reserves; and the Big Sandy and Moss Landing Wildlife Areas. The California Department of Parks and Recreation manages several areas in the ISP area near Moss Landing: Moss Landing State Beach, Salinas River Dunes Natural Preserve, Salinas River State Beach, and Salinas River Mouth Natural Preserve. Areas under State jurisdiction are shown on Figure 3-3.

3.3.3 COUNTY JURISDICTION

The entire ISP area lies in Monterey County. The Monterey County Water Resources agency has been responsible for water management in Monterey County since 1947. Specific lands managed by the County include Royal Oaks Park, Manzanita Regional Park, Toro Regional Park, and San Lorenzo Park. Areas under County jurisdiction are shown on Figure 3-3.

3.3.4 CITY AND LOCAL JURISDICTION

The cities of Salinas, Gonzales, Marina, Soledad, Greenfield, Seaside, and King City have water management authority in their incorporated areas. The Castroville Community Service District provides services in the town of Castroville. The Marina Coast Water District provides water and sewer collection services within its jurisdictional boundaries and within its Ord Community service area, which consists of the former Fort Ord. As a county water district, MCWD has water management authority over those areas. MCWD has filed an application with the Local Agency Formation Commission (LAFCO) to include all of the Ord Community service parcels that currently receive potable water or that have received final land use development approvals by the applicable land use jurisdiction. The jurisdictional boundaries of these areas are shown on Figure 3-4.

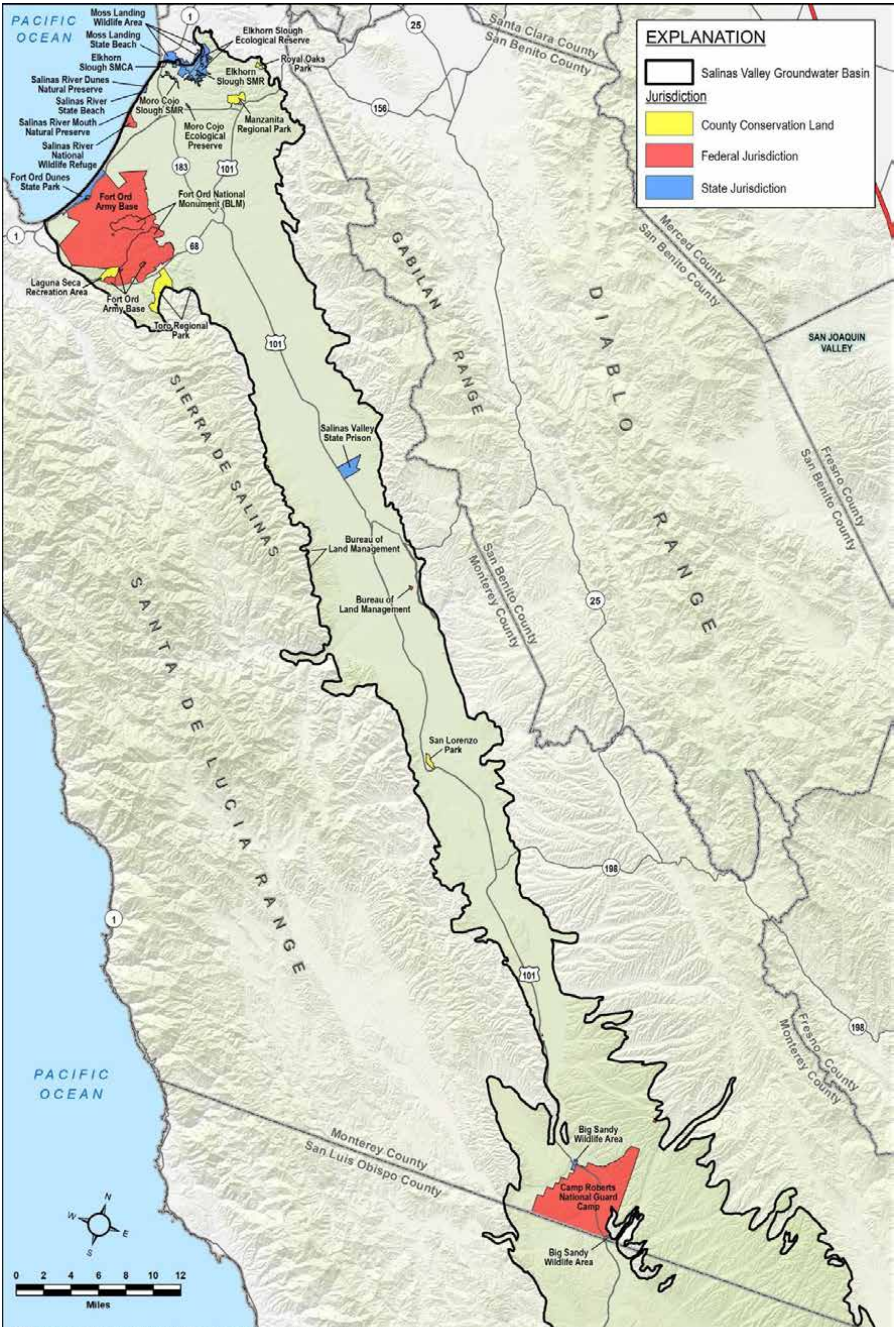

Figure 3-3: Jurisdictional Boundaries of Federal, State, and County Land

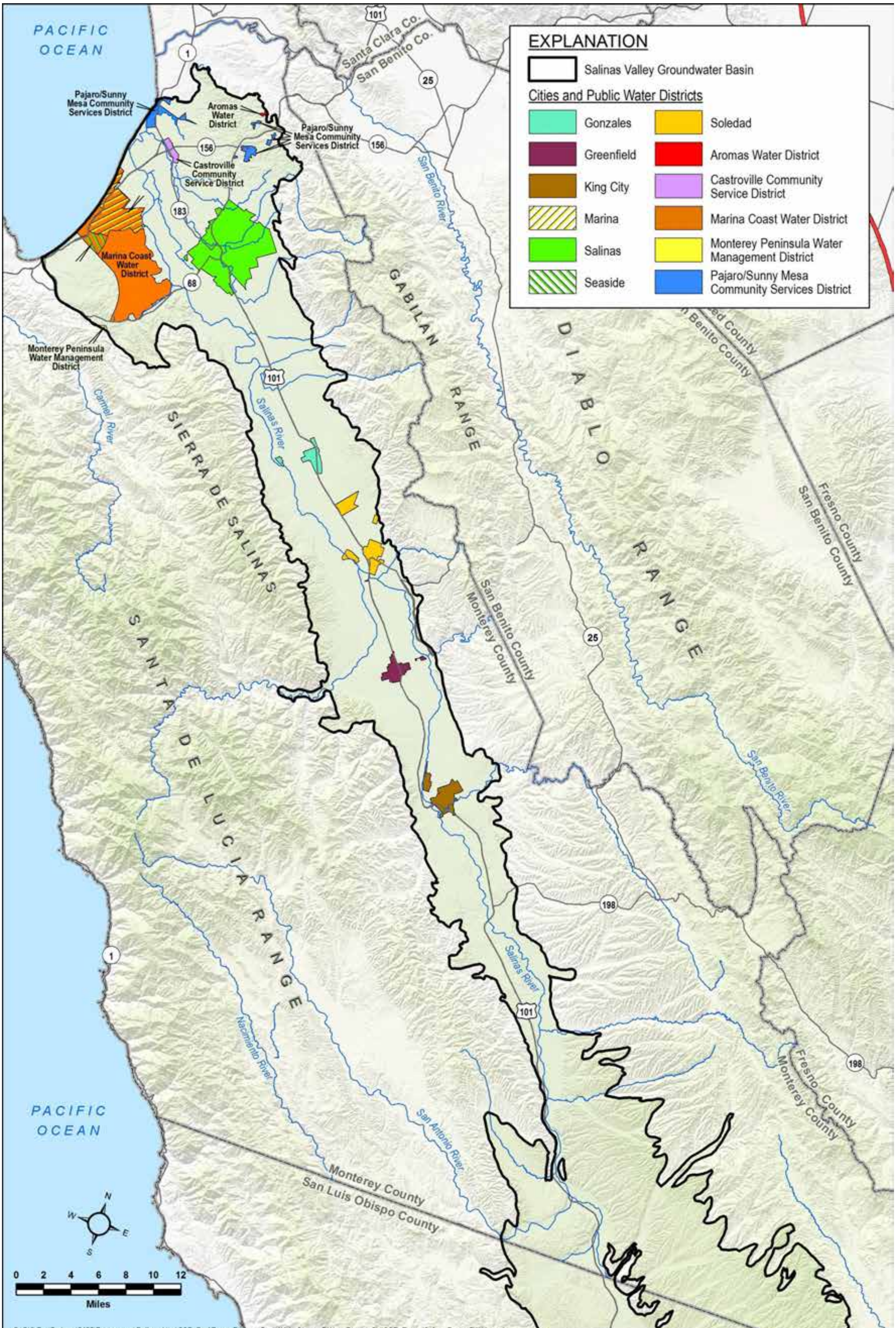

Figure 3-4: City and Local Jurisdictional Boundaries

3.4 Land Use

The County of Monterey and incorporated areas are the major land use authorities in the ISP area. Current land use in the ISP area is shown on Figure 3-5 and summarized by major category in Table 3-1 (DWR, 2014). These data were obtained from a 2014 statewide crop mapping study conducted by LandIQ and provided by DWR for GSAs to use in their GSPs (DWR, 2017). The majority of land in the ISP area is used for agriculture, pasture, and grazing. The top three crops, by value, in Monterey County in 2017 were lettuce, strawberries, and broccoli (Monterey County Agriculture Commissioner, 2018). Vineyards are also a major crop in Monterey County.

Table 3-1: Existing Land Use Summary

Category	Area in ISP area (acres)
Permanent Agriculture	50,903
Non-Permanent Agriculture	145,393
Non-categorized Agriculture	73,949
Commercial and Services	5,235
Residential	39,352
Industrial	2,928
Mining	5,325
Mixed Use	1,519
Public/Quasi-Public	29,071
Pasture and Grazing	147,214
Conservation	23,494
Recreation	2,781
Other	470
Total	**527,634**

Source: DWR, 2017
https://gis.water.ca.gov/app/CADWRLandUseViewer

3.4.1 Water Source Types

Groundwater is the primary water source for all water use sectors in the ISP area. Municipal and rural residential areas, small community systems, and small commercial operations such as golf courses and schools that depend on groundwater are shown in green on Figure 3-6.

The coastal farmland surrounding Castroville receives recycled water from a combination of the Castroville Seawater Intrusion Project (CSIP) and the Salinas Valley Water Project (SVWP). Reclaimed water is additionally used for irrigation in the Las Palmas Ranch development. Under CSIP, recycled urban wastewater is treated and applied to agricultural land shown by the green area on Figure 3-6. The SVWP provides additional water to the

CSIP system though the Salinas River Diversion Facility (SRDF). The SRDF is a rubber dam on the Salinas River near Marina, which diverts water into CSIP pipelines (Brown and Caldwell, 2015).

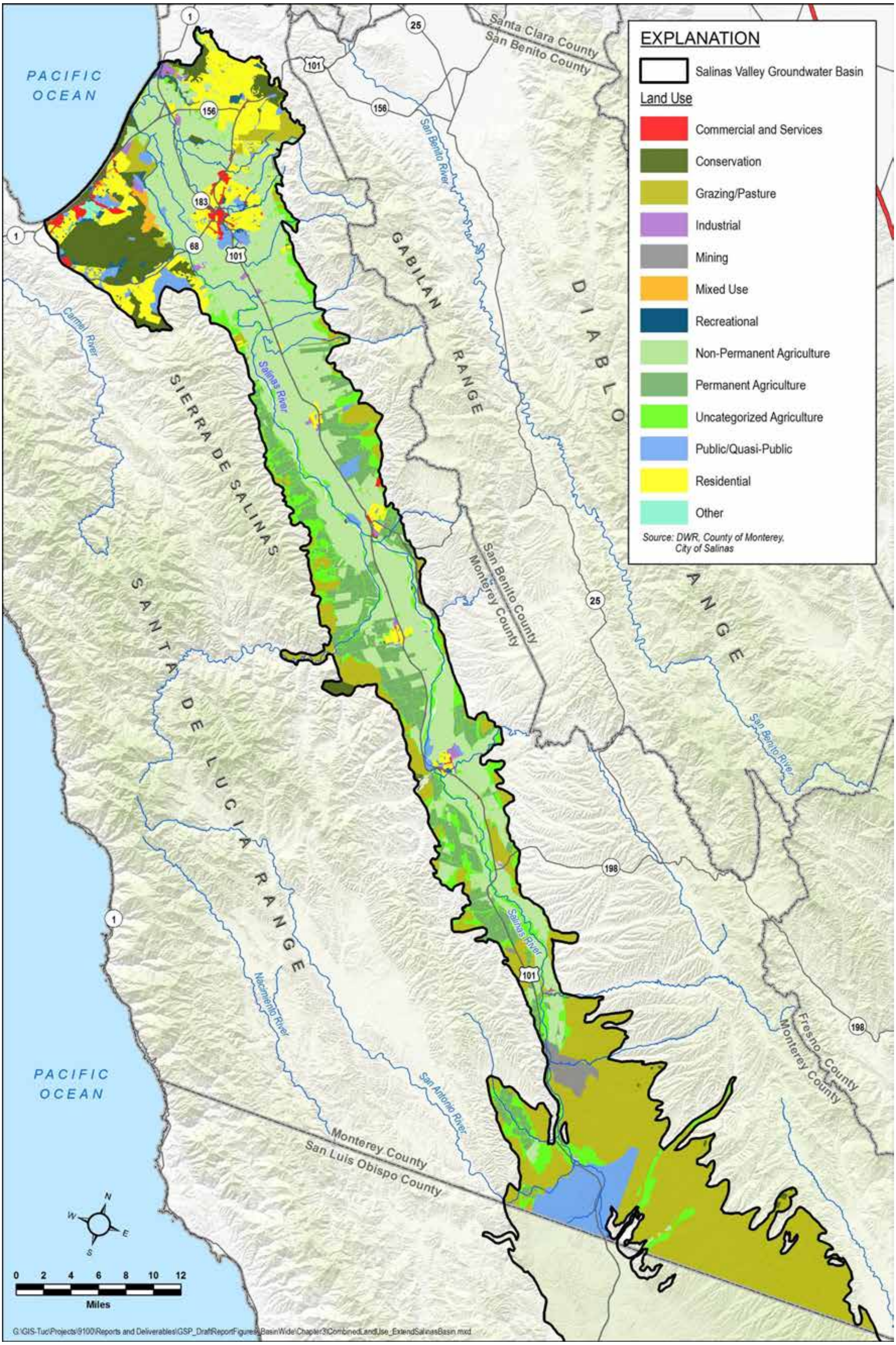

Figure 3-5: Existing Land Use

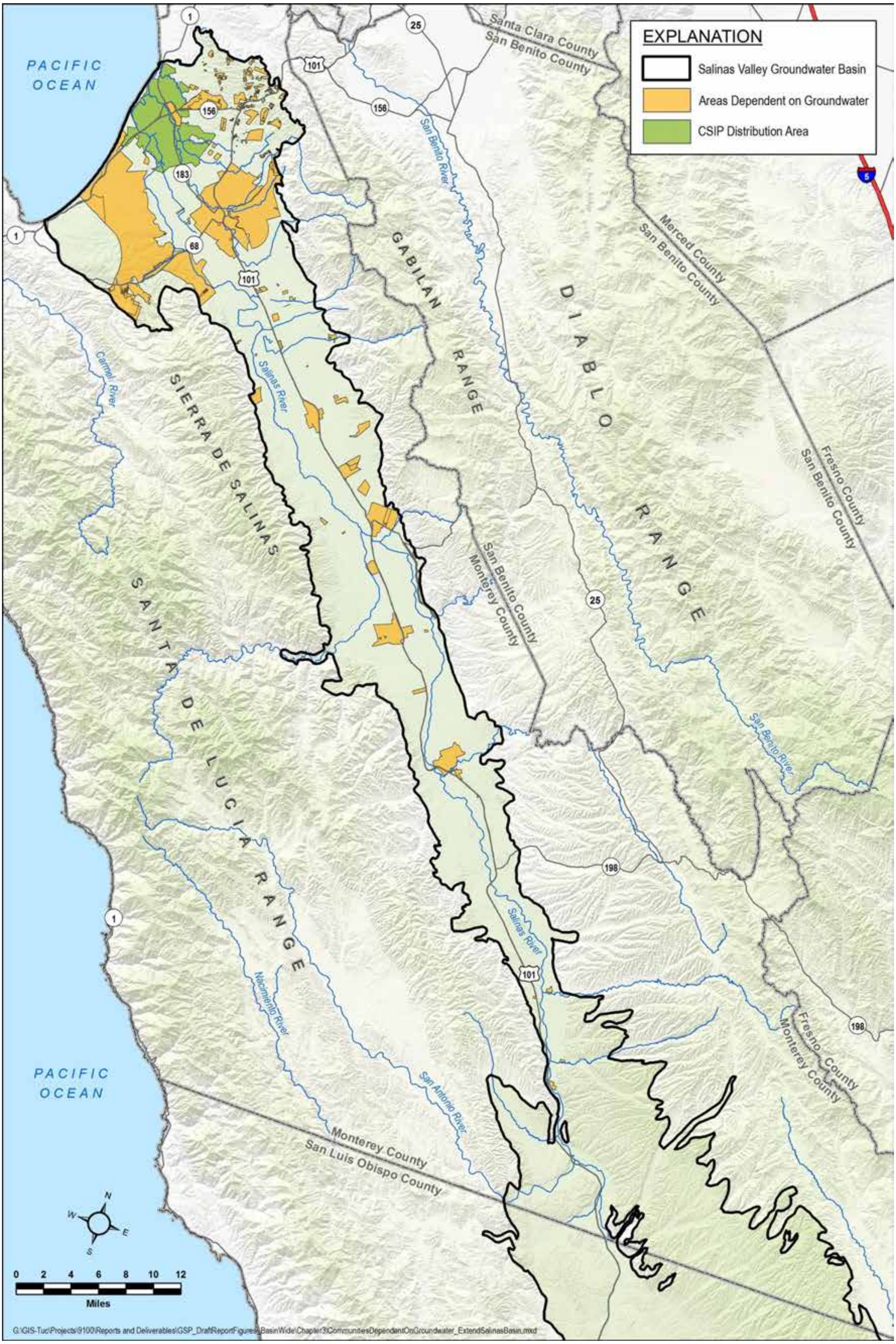

Figure 3-6: Municipal Areas Dependent on Groundwater and the CSIP Distribution Area

3.4.2 WATER USE SECTORS

Groundwater demands in the ISP area are organized into the six water use sectors identified in the GSP emergency regulations. Groundwater extraction data are reported by MCWRA for the Zones 2, 2A, and 2B, which do not correspond exactly with the area covered by this ISP. The extent of these zones is depicted in Figure 3-7. The MCWRA's groundwater extraction data is therefore likely an underestimate of the total pumping in the Valley. Groundwater demand categories include:

- **Urban**. Urban water use is assigned to non-agricultural water uses in the cities and census-designated places. Domestic use outside of census-designated places is not considered urban use. For the years 2010-2015, urban water use averaged 42,896 ac-ft and accounted for an average of 9% of the groundwater pumped in Zones 2, 2A, and 2B (MCWRA, 2016).
- **Industrial**. There is limited industrial use in the ISP area. DWR does not have any records of wells in the ISP area that are specifically categorized as industrial use wells. MCWRA records lump Industrial use and Urban use together as a single type of water use.
- **Agricultural**. This is the largest water use sector in Zones 2, 2A, and 2B; with an annual average use of 448,049 ac-ft between 2010 and 2015 (MCWRA, 2016). Agricultural water use accounted for an average of 91% of the groundwater pumped (MCWRA, 2016).
- **Managed wetlands**. DWR land use records indicate that there is one managed wetland in the ISP area; an 11.2-acre wetland owned by the State of California and located northeast of the Monte De Lago neighborhood, between state highway 156 and Castroville Boulevard.
- **Managed recharge**. There is no managed recharge in the ISP area. Wastewater treated by the Monterey One Water is distributed by the CSIP distribution system and used to offset agricultural groundwater pumping within the CSIP service area.
- **Native vegetation.** Approximately 43% of the ISP area is composed of agricultural, urban, or vineyard land uses. Native vegetation is largely present on the remaining 57% of the land; identified as pasture and grazing, federal land, conservation/recreation, or other. Although not a native species, water use by the invasive *Arundo donax* is estimated at between 32,000 and 64,000 AFY in the Salinas Valley (California Invasive Plan Council, 2011); an unknown quantity occurs within the ISP area.

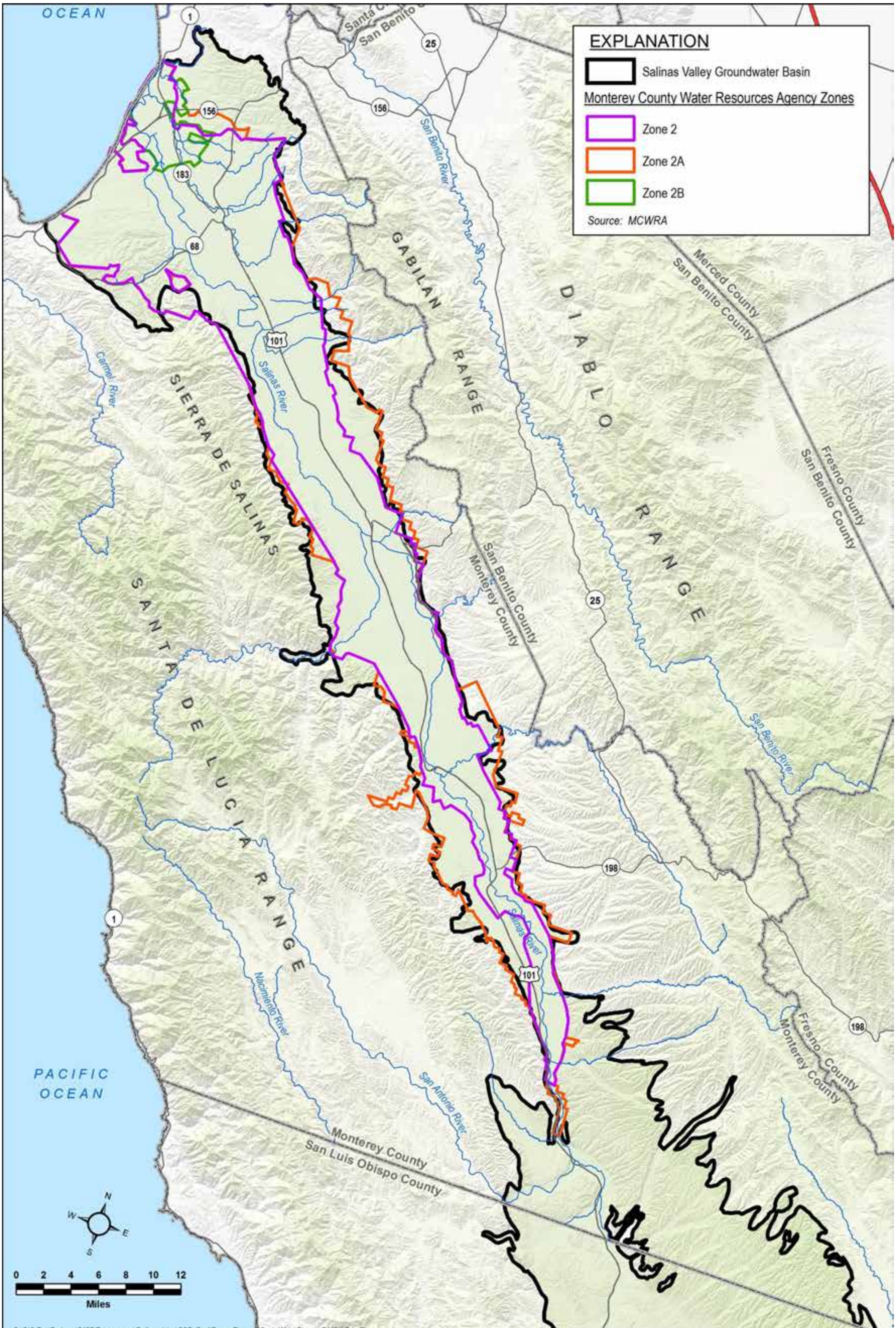

Figure 3-7: Extent of MCWRA Zones 2, 2A, and 2B

3.5 DENSITY OF WELLS

Groundwater in the ISP area is used for agricultural, municipal, and domestic purposes. Well density data for this GSP were derived from the database of wells that DWR specifically developed for use in GSPs. Other data sources are available from MCWRA or other sources; and they may have different data. The DWR data were used for simplicity and consistency with other DWR data in this report.

Based on data available from DWR, more than half of the wells in the DWR dataset are used for production; all production wells are assumed to be used for agricultural irrigation. Domestic use accounts for most of the remaining wells. DWR's well counts in the ISP area are summarized in Table 3-2.

Figure 3-8 Figure 3-8and Figure 3-9 show the density of domestic and production wells, respectively, per square mile in the ISP area.

Approximately 3% of wells in the ISP area are classified as public supply wells. Groundwater is the primary water source for urban and rural communities in the ISP area. Figure 3-10 shows the density of municipal wells per square mile.

Table 3-2: Well count summary

Category	Number of wells
Domestic	2,508
Production	1,997
Public Supply	157
Total	**4,662**

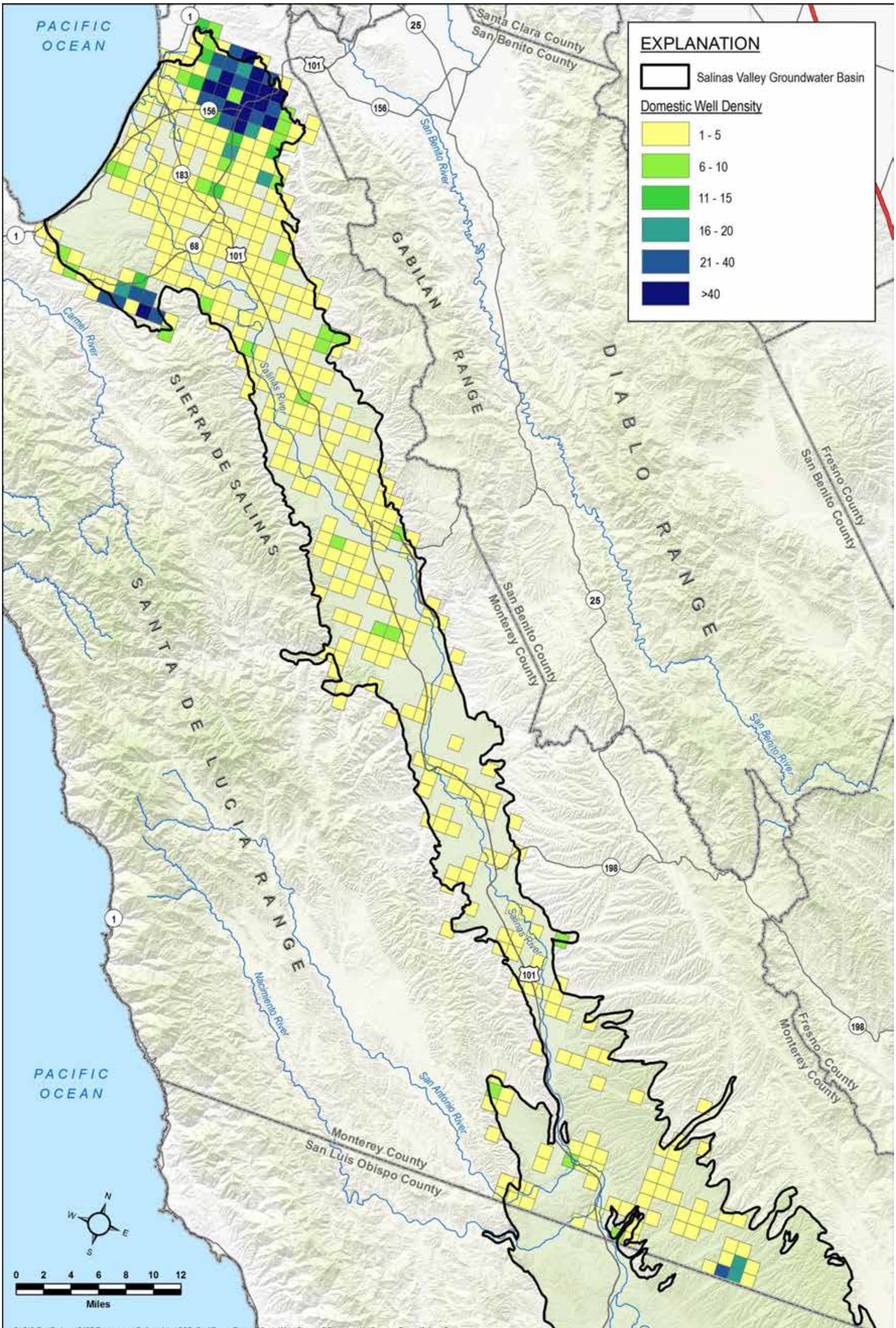

Figure 3-8: Map of Density of Domestic Wells per Square Mile

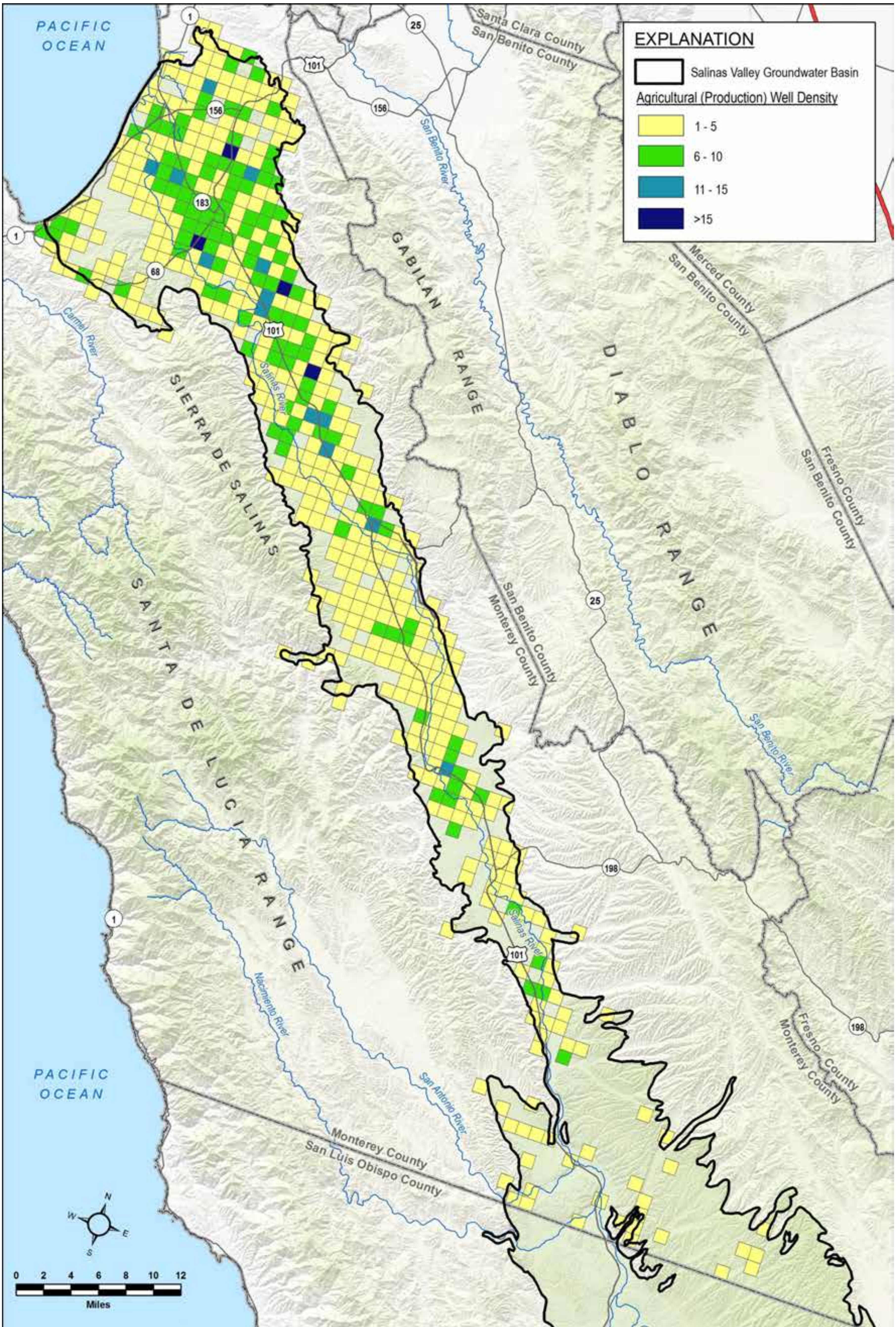

Figure 3-9: Map of Density of Production (Agricultural) Wells per Square Mile

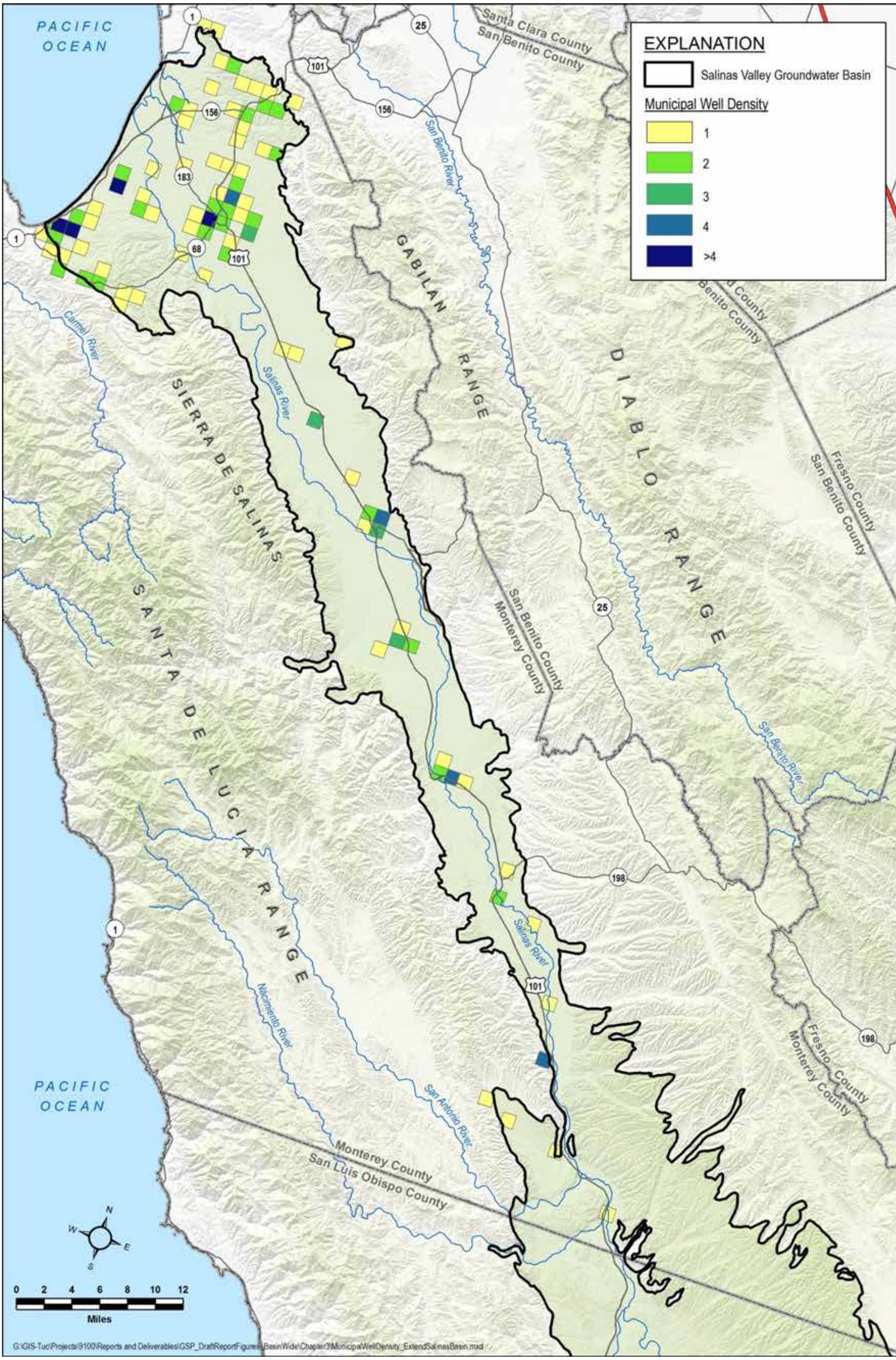

Figure 3-10: Map of Density of Municipal Wells per Square Mile

3.6 EXISTING MONITORING AND MANAGEMENT PROGRAMS

3.6.1 GROUNDWATER LEVEL MONITORING

3.6.1.1 MCWRA MONTHLY GROUNDWATER LEVEL MONITORING

MCWRA collects monthly groundwater level measurement from approximately 100 wells throughout the Salinas Valley. MCWRA processes these monthly measurements to develop a computed average depth to water for each Subbasin.

3.6.1.2 MCWRA ANNUAL FALL GROUNDWATER LEVEL MONITORING

Each fall, MCWRA collects annual groundwater level measurements from over 400 wells in the Salinas Valley. MCWRA uses these annual measurements to develop contour maps depicting the groundwater table elevation.

3.6.1.3 MCWRA AUGUST GROUNDWATER LEVEL MONITORING

MCWRA collects approximately 100 groundwater level measurements every August to establish the location and extent of groundwater pumping depressions that drive seawater intrusion. The August measurements usually coincides with the end of the irrigation season, and groundwater levels at this time reflect low groundwater elevations prior to the onset of seasonal winter recharge. These pumping depressions occur in the 180-Foot and 400-Foot Aquifers between the City of Salinas and the coast. Changes in pumping stress and recharge conditions cause the troughs to vary in location and depth from year to year. MCWRA uses the August groundwater elevation data to develop groundwater contour maps of the coastal pumping depressions in odd-numbered years.

3.6.1.4 CALIFORNIA STATEWIDE GROUNDWATER ELEVATION MONITORING (CASGEM)

MCWRA is the responsible agency for CASGEM monitoring in Monterey County. The monitoring network comprises 51 wells throughout the Salinas Valley. Some of the CASGEM monitoring wells are owned by MCWRA and others are privately owned by owners who have volunteered the well for inclusion in the CASGEM program. MCWRA collects quarterly groundwater elevation data from the CASGM wells and reports the groundwater elevation data to DWR twice per year.

The Monterey Peninsula Water Management District (MPWMD) is also a CASGEM monitoring entity within the Monterey Subbasin and is responsible for areas within the former Seaside Subbasin prior to the2016 basin boundary modification
Locations of CASGEM monitoring wells are shown on Figure 3-11.

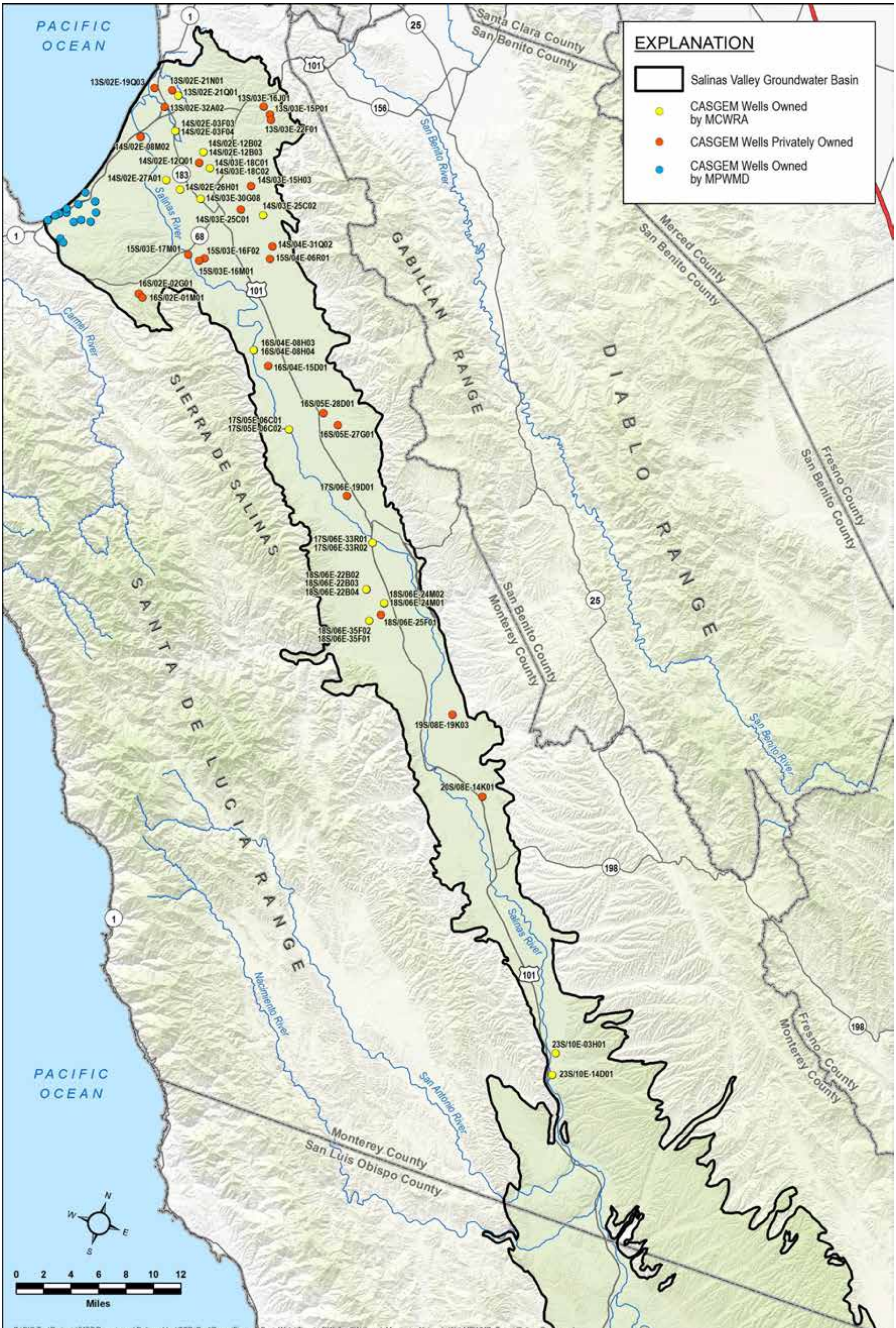

Figure 3-11: Locations of CASGEM Wells in the ISP Area

3.6.1.5 SEASIDE BASIN WATERMASTER GROUNDWATER MONITORING

The Seaside Basin Watermaster monitors groundwater levels in 23 wells on a monthly basis and 34 wells on a quarterly basis. California American Water Company and the City of Seaside provide monthly groundwater levels and annual water quality analysis results for their production wells. Additionally, all producers are required to report monthly production and injection to the Watermaster.

The Watermaster collects water samples from 17 wells on an annual basis and 6 wells on a quarterly basis. Water samples analysis results are used to prepare time-series plots of chloride concentrations and chloride/sodium molar ratios. Water quality analysis results are also used to develop Piper and Stiff diagrams, which are used to assess changes in geochemical signatures which may indicate advancing seawater. Downhole geophysical logging is also conducted to evaluate vertical changes in groundwater characteristics in four deep coastal sentinel wells.

3.6.2 GROUNDWATER EXTRACTION MONITORING

MCWRA collects groundwater extraction information from all wells that have discharge pipes of three inches or greater in diameter. These data have been collected since 1993. Extraction is self-reported by well owners.

3.6.3 GROUNDWATER QUALITY MONITORING

3.6.3.1 MCWRA SEAWATER INTRUSION MONITORING

MCWRA monitors seawater intrusion in the Salinas Valley with a network of 121 monitoring wells located in the 180/400-Foot Aquifer Subbasin. Of these 121 well, 96 are agricultural production wells that are sampled annually in June and August: timed to occur during peak pumping. 25 wells in the network are dedicated monitoring wells that are maintained by MCWRA and/or the Monterey Peninsula Water Supply Project (MPWSP).

Water quality samples from the wells are analyzed for major constituents, including anions and cations, conductivity, etc. The data are used to develop time-series plots of chloride and conductivity trends, Stiff and Piper diagrams, and to compute molar ratios of chloride to sodium.

The data are used to prepare maps of seawater intrusion in the 180/400-Foot Aquifer in odd-numbered years. Additional information about the occurrence and extent of seawater intrusion in both the 180- and 400-Foot Aquifers is provided in Section 5.

3.6.3.2 OTHER

Groundwater quality is monitored under several different programs and by different agencies including:

- Muncipal and community water purveyors must collect water quality samples on a routine basis for compliance monitoring and reporting to the California Division of Drinking Water.

- The USGS collects water quality data on a routine basis under the Groundwater Ambient Monitoring and Assessment (GAMA) program. These data are stored in the State's GAMA/Geotracker system. Figure 3-12 shows the location of wells in the State's GAMA Geotracker database that are in Monterey County.

- There are multiple sites that are monitoring groundwater quality as part of investigation or compliance monitoring programs through the Cedntral Coast Regional Water Quality Control Board.

- Required CalAm and MCWRA monitoring wells for CalAm's proposed source wells for the MPWSP.

- MCWD and the United States Army monitor groundwater levels and quality at the former Fort Ord for control of groudnwater contaminiation.

3.6.4 SURFACE WATER MONITORING

Streamflow gages operated by the USGS within the ISP area include:

- Arroyo Seco near Soledad (USGS Site #11152000)
- Arroyo Seco below Reliz Creek near Soledad (USGS Site #11152050)
- Salinas River near Bradley (USGS Site #11150500)
- Salinas River near Chualar (USGS Site #11152300)
- Salinas River near Spreckels (USGS Site #11152500)
- Reclamation Ditch near Salinas (USGS Site #11152650)
- Salinas River near Soledad (USGS Site #11151700)
- Gabilan Creek near Salinas (USGS Site # 11152600)

Water levels (stage) in the Salinas River Lagoon are measured at Monte Road and near the slide gate to the Old Salinas River. The locations of the surface-water monitoring facilities are depicted on Figure 3-13.

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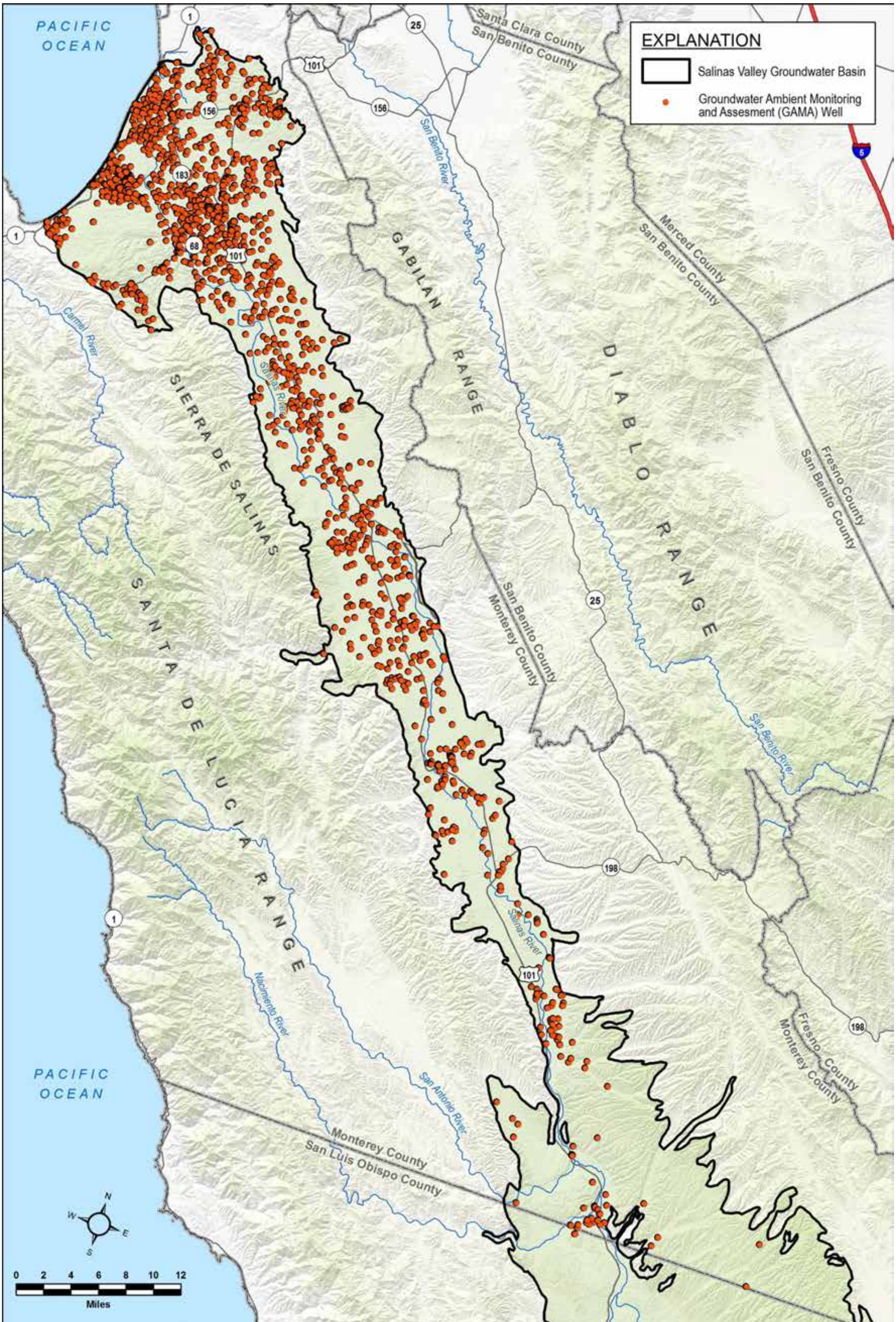

Figure 3-12: Locations of GAMA Wells in the ISP Area

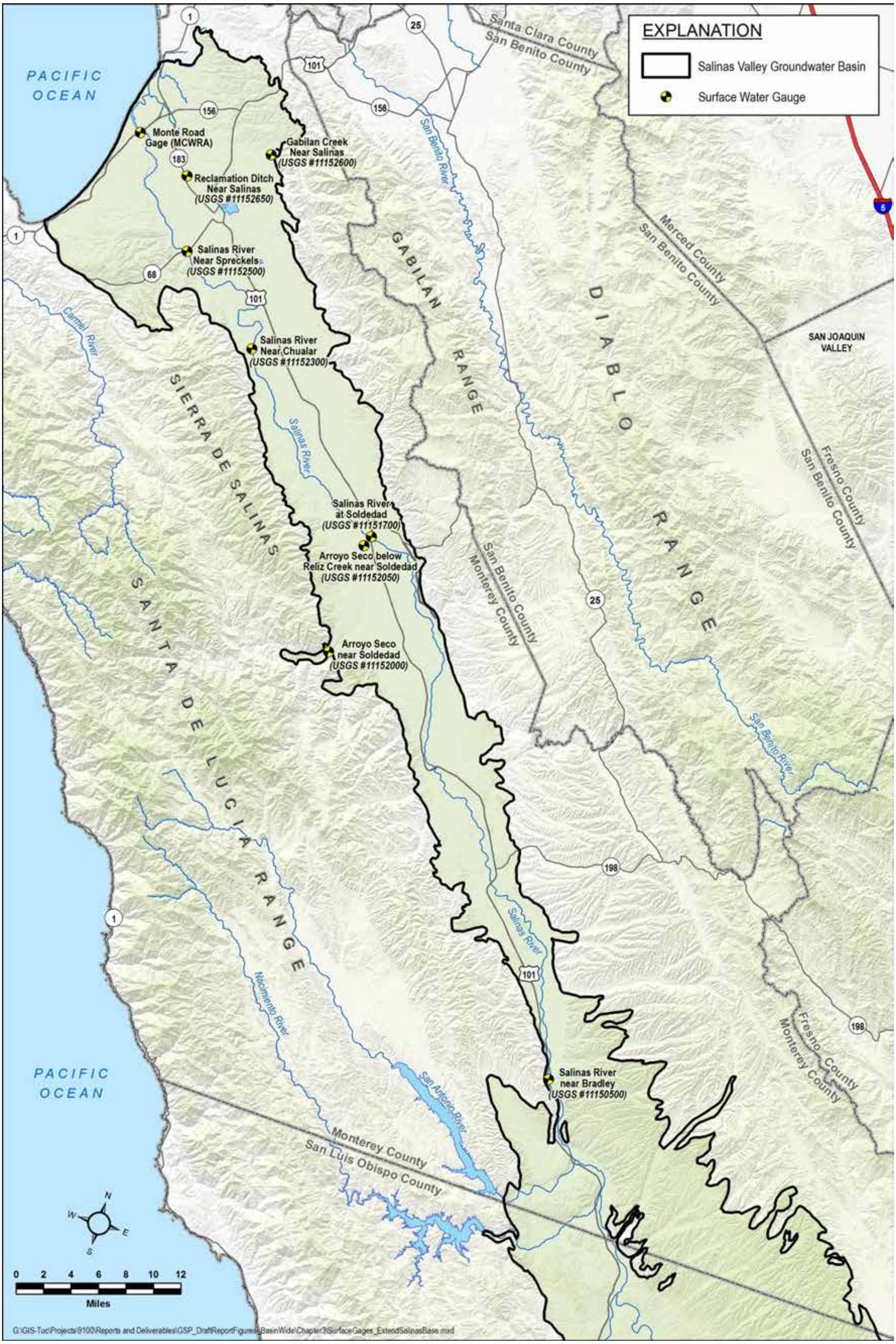

Figure 3-13: Surface Water Gaging Locations

3.6.5 Incorporating Existing Monitoring Programs Into the ISP

The existing monitoring programs and monitoring networks constitute a well-developed and broadly distributed system that provides representative data throughout the ISP area. The groundwater elevation monitoring programs are operated by an existing member of the SVBGSA, and therefore will be incorporated into the ISP monitoring plan. The existing groundwater level monitoring programs will be updated and improved to document the avoidance of undesirable results in each significant aquifer in the Valley.

The current water quality monitoring program from the production wells will be incorporated into this GSP to demonstrate that groundwater quality undesirable results do not occur based on data from a representative number of production wells. The existing stream gauges will also be incorporated into this ISP monitoring plan to validate our projections of surface water depletions from pumping.

This section to be completed after GSP is complete.

3.6.6 Limits to Operational Flexibility

The existing monitoring programs are not anticipated to limit the operational flexibility of this ISP.

3.7 Existing Management Plans

3.7.1 Monterey County Groundwater Management Plan

MCWRA developed a Groundwater Management Plan (GMP) that is compliant with AB3030 and SB1938 legislation (MCWRA, 2006). This GMP exclusively covered the Salinas Valley in Monterey County.

The GMP identified three objectives for groundwater management:

Objective 1: Development of Integrated Water Supplies to Meet Existing and Projected Water Requirements
Objective 2: Determination of Sustainable Yield and Avoidance of Overdraft
Objective 3: Preservation of Groundwater Quality for Beneficial Use

To meet these three objectives, the plan identified 14 elements that should be implemented by MCWRA:

Plan Element 1: Monitoring of Groundwater Levels, Quality, Production, and Subsidence
Plan Element 2: Monitoring of Surface Water Storage, Flow, and Quality

Plan Element 3: Determination of Basin Yield and Avoidance of Overdraft
Plan Element 4: Development of Regular and Dry Year Water Supply
Plan Element 5: Continuation of Conjunctive Use Operations
Plan Element 6: Short-Term and Long-Term Water Quality Management
Plan Element 7: Continued Integration of Recycled Water
Plan Element 8: Identification and Mitigation of Groundwater Contamination
Plan Element 9: Identification and Management of Recharge Areas and Wellhead Protection Areas
Plan Element 10: Identification of Well Construction, Abandonment, and Destruction Policies
Plan Element 11: Continuation of Local, State and Federal Agency Relationships
Plan Element 12: Continuation of Public Education and Water Conservation Programs
Plan Element 13: Groundwater Management Reports
Plan Element 14: Provisions to Update the Groundwater Management Plan

3.7.2 INTEGRATED REGIONAL WATER MANAGEMENT PLAN

The Greater Monterey County Integrated Regional Water Management (IRWM) Plan was developed by the Greater Monterey County Regional Water Management Group (RWMG), which consists of government agencies, nonprofit organizations, educational organizations, water service districts, private water companies, and organizations representing agricultural, environmental, and community interests, including:

- Big Sur Land Trust
- California State University Monterey Bay
- California Water Service Company
- Castroville Community Services District
- City of Salinas
- City of Soledad
- Elkhorn Slough National Estuarine Research Reserve
- Environmental Justice Coalition for Water
- Garrapata Creek Watershed Council
- Marina Coast Water District
- Monterey Bay National Marine Sanctuary
- Monterey County Agricultural Commissioner's Office
- Monterey County Water Resources Agency
- Monterey Regional Water Pollution Control Agency
- Moss Landing Marine Laboratories
- Resource Conservation District of Monterey County
- Rural Community Assistance Corporation
- San Jerardo Cooperative, Inc

The extent of the IRWM Plan area is shown on Figure 3-14. The IRWM Plan consists of a set of goals and objectives that were identified by the RWMG as being critical to address water resource issues within the planning area in the areas of:

- Water Supply
- Water Quality
- Flood Protection and Floodplain Management
- Environment
- Regional Communication and Cooperation
- Disadvantaged Communities
- Climate Change

The IRWM Plan includes more than 25 projects that could assist regional groundwater management.

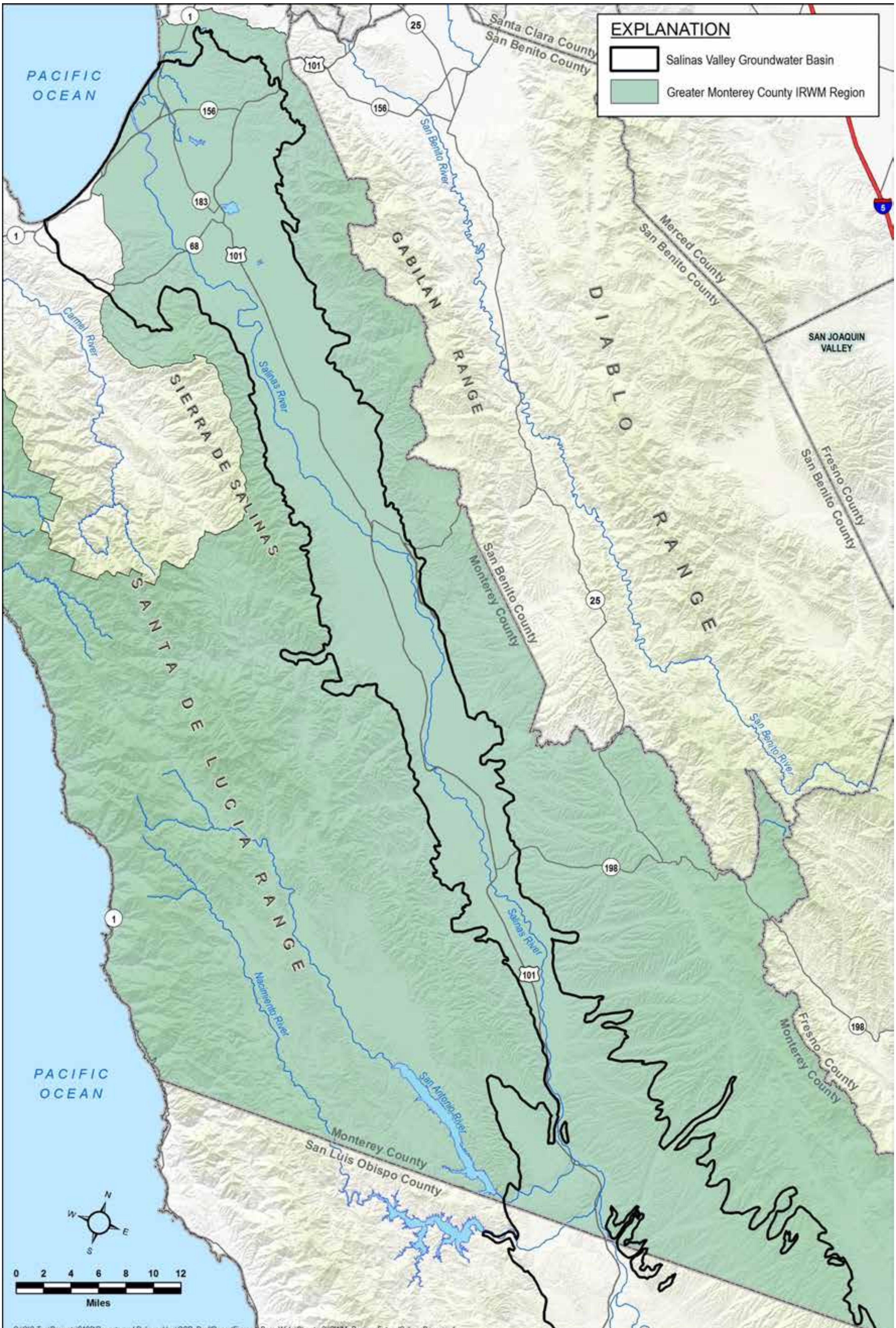

Figure 3-14: Greater Monterey County Integrated Regional Water Management Plan Extent

3.7.3 Urban Water Management Plans

3.7.3.1 California Water Service (Salinas District) Urban Water Management Plan

California Water Service serves the City of Salinas. Its 2015 Urban Water Management Plan (UWMP) (CA Water Service, 2016) describes the service area; reports historic and projected population; identifies historic and projected water demand by category (single-family, multi-family, commercial, industrial, institutional/government, and other); and describes the distribution system and identifies losses.

The UWMP describes the system's reliance on groundwater and California Water Service's support for efforts to avoid overdraft, including working cooperatively with MCWRA and participation in the development of this GSP. Specific activities that California Water Service intends to conduct include:

- Outreach to public agencies to ensure that the Company's presence, rights and interests, as well as historical and current resource management concerns are honored/incorporated within the GSA and GSP formulation process(es).
- Outreach to applicable local and regulatory agencies to ensure that the Company is at full participation, while also meeting the requirements and expectations set forth by SGMA.
- The enhanced use of digital/electronic groundwater monitoring equipment and other new technology aimed at measuring withdrawal rates, pumping water levels, and key water quality parameters within the context of day-to-day operations.
- Full participation in the development of GSP's and formulation of groundwater models being constructed in basins where the Company has an operating presence.
- Full participation in individual and/or joint projects aimed at mitigating seawater intrusion and other "undesirable results".
- Inclusion of sound groundwater management principles and data in all applicable technical reports, studies, facility master plans, and urban water management plans (including this 2015 update), particularly as these undertakings relate or pertain to water resource adequacy and reliability.
- Inclusion of sound groundwater management principles and data in all general rate case (GRC) filings and grant applications to ensure that resource management objectives remain visible and central to Cal Water's long-term planning/budgeting efforts.

The UMWP also addresses California Water Service's position on alternative supplies currently being developed for the Salinas Valley. California Water Service is evaluating possibility of utilizing up to 10,000 AFY (or more) of water from the proposed Deep Water Desal LLC desalination plant at Moss Landing.

The UWMP addresses the need for California Water Service to implement a well replacement program to mitigate water quality impacts from nitrates, uranium, MTBE, and sand contamination.

California Water Service's UWMP notes that it is expected that groundwater will continue to remain as its sole supply source due to uncertainties regarding the cost and implementation other options, such as surface water diversion or desalination. However, the UWMP recognizes that it would be beneficial for California Water Service to diversify its supply portfolio.

California Water Service evaluated the impact of climate change on its water supply. The study found that climate change could result in a supply reduction of 6% to 7% by the end of the century.

3.7.3.2 California Water Service (King City District) Urban Water Management Plan

California Water Service serves King City and the surrounding area. Its 2015 Urban Water Management Plan (UWMP) (CA Water Service, 2016) describes the service area; reports historic and projected population; identifies historic and projected water demand by category (single-family, multi-family, commercial, industrial, institutional/government, and other); and describes the distribution system and identifies losses. The UWMP for the King City district notes that groundwater levels have been relatively stable during the past 25 years, except for drought periods; however, these were followed by prompt water-level recoveries.

The UWMP notes that nitrate contamination is a concern in the King City District and that six wells have been removed from service due to nitrate levels in excess of the United States Environmental Protection Agency (USEPA) maximum contaminant level (MCL).

The UWMP describes the system's reliance on groundwater and California Water Service's support for efforts to avoid overdraft, including working cooperatively with MCWRA and participation in the development of this GSP. Specific activities that California Water Service intends to conduct in the King City district are identical to those proposed for the Salinas district, which are summarized in Section 3.7.3.1.

Given King City's inland location, the UWMP notes that desalination is not expected to be a viable future water supply source. Use of recycled water is not expected to be economically viable. The UWMP assumes that future water demands in the King City District will be met by groundwater. The UWMP includes sections on water shortage contingency planning and demand reduction efforts to address reductions in groundwater supplies.

3.7.3.3 City of Marina Urban Water Management Plan

The City of Marina most recently updated its UWMP in 2015 (Schaff & Wheeler, 2016). The UWMP describes the service area; reports historic and projected population; identifies historic and projected water demand by category (single-family, multi-family, commercial, industrial, institutional/government, and other); and describes the distribution system and identifies losses.

The City of Marina currently relies solely on groundwater, although the UWMP notes that, "The District is located along the Salinas River, and MCWD Board of Directors has considered purchasing surface water rights in the Salinas River Basin as a means of meeting long-term (beyond 2030) demands." The UWMP further notes that, "…the total Ord Community groundwater supply of 6,600 afy falls short of the total 2030 Ord Community demand of 8,293 afy by 1,693 afy. [and] …the Central Marina service area is not projected to exceed its current SVGB groundwater allocation within the planning period."

The City of Marina UWMP includes a number of demand management measures including:

- Water Waste Prevention Ordinances
- Metering
- Conservation Pricing
- Public Education and Outreach
- Programs to Assess and Manage Distribution System Real Loss
- Water Conservation Program Coordination and Staffing Support
- Water Survey Programs for Residential Customers
- Residential Plumbing Retrofits
- Residential Ultra-Low Flow Toilet Replacement Programs
- High-Efficiency Washing Machine Rebate Programs
- Commercial, Industrial, and Institutional Accounts
- Landscape Conservation Programs and Incentives

3.7.3.4 City of Soledad Urban Water Management Plan

The City of Soledad UWMP was updated in 2011 (Schaff & Wheeler, 2011). The UWMP describes the service area; reports historic and projected population; identifies historic and projected water demand by category (single-family, multi-family, commercial, industrial, institutional/government, and other); and describes the distribution system. Groundwater is the sole supply source for the City of Soledad, and the UWMP notes that several of its wells are out of service due to nitrate contamination. The City of Soledad UWMP indicates that it does not plan to develop alternative sources of water; rather it will focus on maintaining and expanding its existing infrastructure to meet demand. Desalination was not deemed a viable option due to the City's inland location. The City's wastewater treatment system was recently upgraded and recycled wastewater can be used to offset demand.

Soledad is located near the confluence of the Salinas and Arroyo Seco rivers, and that overdraft conditions have not been identified in this area by MCWRA, according to the UWMP. It is expected that groundwater will continue to be a reliable supply for the City of Soledad. The UWMP includes sections on water conservation, demand management, and emergency supply contingencies.

3.7.3.5 CALIFORNIA AMERICAN WATER COMPANY (CHUALAR)

The California American (Cal Am) Water Company operates a satellite water system serving approximately 1,000 residents near Chualar. The operation of this system is described in Cal-Am's 2010 UWMP. The Cal Am UWMP provides a description of the system, historic and projected water demands, and an assessment of current and future water supplies. Although the Cal Am UWMP discusses future water supply options such as desalination, aquifer storage and recovery, and recycled water; none of these are applicable to the Chualar satellite system.

The Chualar system is entirely dependent on groundwater from the 180-Foot Aquifer, and is far enough inland that it is not considered susceptible to seawater intrusion. The UWMP reports that water quality from the Chualar system wells is generally good.

3.7.3.6 MARINA COAST WATER DISTRICT URBAN WATER MANAGEMENT PLAN

The MCWD most recently updated its UWMP in 2015 (Schaff & Wheeler, 2016). The UWMP describes the service area; reports historic and projected population; identifies historic and projected water demand by category (single-family, multi-family, commercial, industrial, institutional/government, and other); and describes the distribution system and identifies losses.

The MCWD currently relies solely on groundwater, although the UWMP notes that, "The District is located along the Salinas River, and MCWD Board of Directors has considered purchasing surface water rights in the Salinas River Basin as a means of meeting long-term (beyond 2030) demands." The UWMP further notes that, "…the total Ord Community groundwater supply of 6,600 afy falls short of the total 2030 Ord Community demand of 8,293 afy by 1,693 afy. [and] …the Central Marina service area is not projected to exceed its current SVGB groundwater allocation from the Fort Ord Reuse Authority (FORA) within the planning period."

The MCWD UWMP includes a number of demand management measures including:

- Water Waste Prevention Ordinances
- Metering
- Conservation Pricing
- Public Education and Outreach
- Programs to Assess and Manage Distribution System Real Loss
- Water Conservation Program Coordination and Staffing Support
- Water Survey Programs for Residential Customers
- Residential Plumbing Retrofits
- Residential Ultra-Low Flow Toilet Replacement Programs
- High-Efficiency Washing Machine Rebate Programs
- Commercial, Industrial, and Institutional Accounts
- Landscape Conservation Programs and Incentives

3.7.3.7 ALCO WATER SERVICE COMPANY URBAN WATER MANAGEMENT PLAN

The Alco Water Service Company has not submitted a UWMP.

3.8 EXISTING GROUNDWATER REGULATORY PROGRAMS

3.8.1 GROUNDWATER EXPORT PROHIBITION

The Monterey County Water Resources Agency Act, § 52.21 prohibits the export of groundwater from any part of the Salinas Valley Groundwater Basin. In particular, the Act states:

> *For the purpose of preserving [the balance between extraction and recharge], no groundwater from that basin may be exported for any use outside the basin, except that use of water from the basin on any part of Fort Ord shall not be deemed such an export. If any export of water from the basin is attempted, the Agency may obtain from the superior court, and the court shall grant, injunctive relief prohibiting that exportation of groundwater.*

3.8.2 AGRICULTURAL ORDER

In 2017 the Central Coast Regional Water Quality Control Board (CCRWQCB) issued Agricultural Order No. R3-2017-0002, a Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands (Agricultural Order). The permit requires that growers implement practices to reduce nitrate leaching into groundwater and improve surface receiving water quality. Specific requirements for individual growers are structured into three tiers based on the relative risk their operations pose to water quality.

Growers must enroll, pay fees, and meet various monitoring and reporting requirements according to the tier to which they are assigned. All growers are required to implement groundwater monitoring, either individually or as part of a cooperative regional monitoring program. Growers electing to implement individual monitoring (i.e., not participating in the regional monitoring program implemented by the Central Coast Groundwater Coalition or CCGC) are required to test all on-farm domestic wells and the primary irrigation supply well for nitrate or nitrate plus nitrite, and general minerals (including, but not limited to, TDS, sodium, chloride and sulfate).

Negotiations with the Central Coast Regional Water Quality Control Board staff and Board Members for the next iteration of the Agricultural Order are on-going, expected to conclude in March 2020 with the adoption of a new Irrigated Lands Regulatory Program (ILRP) Waste Discharge Requirements (WDR) for farming operations in the Salinas Valley Groundwater Basin area (and the entire Central Coast region). As mandated by the State Water Resources Control Board, specific reporting requirements for nitrogen applications and removal, irrigation and surface water discharge management, and groundwater quality monitoring will be included with quantifiable milestones. While the outcome is not certain, the expectation is that the next Agricultural Order will be more complex with additional compliance reporting measures for all growers.

3.8.3 WATER QUALITY CONTROL PLAN FOR THE CENTRAL COAST BASINS

The Water Quality Control Plan for the Central Coastal Basin (Basin Plan) was most recently updated in September 2017. The objective of the Basin Plan is to outline how the quality of the surface water and groundwater in the Central Coast Region should be managed to provide the highest water quality reasonably possible.

The Basin Plan lists benceficial users, describes the water quality which must be maintained to allow those uses, provides an implementation plan, details State Water Resources Control Board (SWRCB) and CCRWQCB plans and polices to protect water quality and a statewide survelliance and monitoring program as well as regional surveillance and monitoring programs.

Present and potential future beneficial uses for inland waters in the Basin are: surface water and groundwater as municipal supply (water for community, military or individual water supplies); agricultural; groundwater recharge; recreational water contact and non-contact;

sport fishing; warm fresh water habitat; wildlife habitat; rare, threatened or endangered species; and, spawning, reproduction, and/or early development of fish.

Water Quality Objectives for both groundwater (drinking water and irrigation) and surface water are provided in the Basin Plan.

3.8.4 Requirements for New Wells

In October, 2017, Governor Brown signed Senate Bill (SB) 252 which became effective on January 1, 2018. SB 252 requires well permit applicants in critically overdrafted basins to include information about the proposed well, such as location, depth, and pumping capacity. The bill also requires the permitting agency to make the information easily accessible to the public and the GSAs.

3.8.5 Title 22 Drinking Water Program

The SWRCB Division of Drinking Water (DDW) regulates public water systems in the State to ensure the delivery of safe drinking water to the public. A public water system is defined as a system for the provision of water for human consumption through pipes or other constructed conveyances that has 15 or more service connections or regularly serves at least 25 individuals daily at least 60 days out of the year. Private domestic wells, wells associated with drinking water systems with less than 15 residential service connections, industrial and irrigation wells are not regulated by the DDW.

The DDW enforces the monitoring requirements established in Title 22 of the California Code of Regulations (CCR) for public water system wells, and all the data collected must be reported to the DDW. Title 22 also designates the Maximum Contaminant Levels (MCLs) for various waterborne contaminants, including volatile organic compounds, non-volatile synthetic organic compounds, inorganic chemicals, radionuclides, disinfection byproducts, general physical constituents, and other parameters.

3.8.6 Incorporating Regulatory Programs Into the GSP

Information in these various plans have been incorporated into this GSP and used during the preparation of Sustainability Goals, when setting Minimum Thresholds and Measurable Objectives and were considered during development of Projects and Management Actions.

This section to be completed after GSP is complete.

3.8.7 Limits to Operational Flexibility

Some of the existing management plans and ordinances will limit operational flexibility. These limits to operational flexibility have already been incorporated into the sustainability projects and programs included in this GSP. Examples of limits on operational flexibility include:

- The groundwater export prohibition included in the Monterey County Water Resources Agency Act prevents export of water out of the Subbasin. This prohibition is not expected to adversely affect our ability to reach sustainability.
- The Basin Plan and the Title 22 Drinking Water Program restrict the quality of water that can be recharged into the Subbasin.

This section to be completed after GSP is complete.

3.9 Conjunctive Use Programs

3.9.1 Monterey County Water Recycling Projects

One conjunctive use project operates in the ISP area. This project uses recycled water from the Salinas Valley Reclamation Project and distributes it through the CSIP distribution system. This project serves approximately 12,000 acres of farmland. The extent of the current CSIP distribution area is shown in Figure 3-6. The recycled water in the CSIP is supplemented with groundwater and surface water diverted from the SRDF. When river water is available and the SRDF is operating, grower groundwater pumping has been reduced by about 80% during peak irrigation demand periods. However, currently, it is necessary to conjunctively manage all three water sources to match irrigation demands with water supplies.

3.9.2 Regional Urban Water Augmentation Project

MCWD is currently installing pipelines for the Regional Urban Water Augmentation Project (RUWAP). This project includes a recycled water transmission and distribution system that will provide up to 1,427 ac-ft per year of recycled water to offset groundwater pumping in the Monterey Subbasin. The initial phase of the project will deliver 600 ac-ft per year of water to customers in Marina and Fort Ord.

3.10 LAND USE PLANS

Monterey County and the cities of Salinas, Gonzales, Marina, Soledad, Greenfield, and King City have land use authority over all or portions of the SVBGSA area. Land use is an important factor in water management as described below. The following sections provide a general description of these land use plans and how implementation may affect groundwater in the ISP area. The following descriptions were taken from publicly-available general plans at the time of the GSP preparation.

3.10.1 MONTEREY COUNTY GENERAL PLAN

Relevant elements of the Monterey County General Plan (Monterey County, 2010) are summarized in Table 3-3.

Table 3-3: Monterey County General Plan Summary

Element	Goal / Policy	
Land Use	LU-1.4	Growth areas shall be designated only where an adequate level of services and facilities such as water, sewerage, fire and police protection, transportation, and schools exists or can be assured concurrent with growth and development. Phasing of development shall be required as necessary in growth areas in order to provide a basis for long-range services and facilities planning
Open Space	OS-3.8	The County shall cooperate with appropriate regional, state and federal agencies to provide public education/outreach and technical assistance programs on erosion and sediment control, efficient water use, water conservation and re-use, and groundwater management. This cooperative effort shall be centered through the Monterey County Water Resources Agency.
Public Services	GOAL PS-2	**ASSURE AN ADEQUATE AND SAFE WATER SUPPLY TO MEET THE COUNTY'S CURRENT AND LONG-TERM NEEDS.**
	PS-2.1	Coordination among, and consolidation with, those public water service providers drawing from a common water table to prevent overdrawing the water table is encouraged.
	PS-2.2	The County of Monterey shall assure adequate monitoring of wells in those areas experiencing rapid growth provided adequate funding mechanisms for monitoring are established in the CIFP.
	PS-2.3	New development shall be required to connect to existing water service providers where feasible. Connection to public utilities is preferable to other providers.

Element	Goal / Policy	
	PS-2.4	Regulations for installing any new domestic well located in consolidated materials (e.g., hard rock areas) shall be enacted by the County.
	PS-2.5	Regulations shall be developed for water quality testing for new individual domestic wells on a single lot of record to identify: a. Water quality testing parameters for a one-time required water quality test for individual wells at the time of well construction. b. A process that allows the required one-time water quality test results to be available to future owners of the well. Regulations pursuant to this policy shall not establish criteria that will prevent the use of the well in the development of the property. Agricultural wells shall be exempt from the regulation.
	GOAL PS-3	**ENSURE THAT NEW DEVELOPMENT IS ASSURED A LONG-TERM SUSTAINABLE WATER SUPPLY.**
	PS-3.1	Except as specifically set forth[in the General Plan], new development for which a discretionary permit is required, and that will use or require the use of water, shall be prohibited without proof, based on specific findings and supported by evidence, that there is a long-term, sustainable water supply, both in quality and quantity to serve the development.
	PS-3.2	Specific criteria for proof of a Long Term Sustainable Water Supply and an Adequate Water Supply System for new development requiring a discretionary permit, including but not limited to residential or commercial subdivisions, shall be developed by ordinance with the advice of the General Manager of the Water Resources Agency and the Director of the Environmental Health Bureau. A determination of a Long Term Sustainable Water Supply shall be made upon the advice of the General Manager of the Water Resources Agency.
	PS-3.3	Specific criteria shall be developed by ordinance for use in the evaluation and approval of adequacy of all domestic wells.
	PS-3.4	The County shall request an assessment of impacts on adjacent wells and instream flows for new high-capacity wells, including high-capacity urban and agricultural production wells, where there may be a potential to affect existing adjacent domestic or water system wells adversely or in-stream flows, as determined by the Monterey County Water Resources Agency. In the case of new high-capacity wells for which an assessment shows the potential for significant adverse well interference, the County shall require that the proposed well site be relocated or otherwise mitigated to avoid significant interference. The following factors shall be used in developing criteria by ordinance for use in the evaluation and approval of adequacy of all such high-capacity wells, including but not limited to: a. Effect on wells in the immediate vicinity as required by the Monterey County Water Resources Agency or Environmental

Element	Goal / Policy	
		Health Bureau. b. Effects of additional extractions or diversion of water on in-stream flows necessary to support riparian vegetation, wetlands, fish, and other aquatic life including migration potential for steelhead, for the purpose of minimizing impacts to those resources and species. This policy is not intended to apply to replacement wells.
	PS-3.5	The Monterey County Health Department shall not allow construction of any new wells in known areas of saltwater intrusion as identified by Monterey County Water Resources Agency or other applicable water management agencies: a. Until such time as a program has been approved and funded that will minimize or avoid expansion of salt water intrusion into useable groundwater supplies in that area; or b. Unless approved by the applicable water resource agency. This policy shall not apply to deepening or replacement of existing wells, or wells used in conjunction with a desalination project.
	PS-3.6	The County shall coordinate and collaborate with all agencies responsible for the management of existing and new water resources
	PS-3.7	A program to eliminate overdraft of water basins shall be developed as part of the Capital Improvement and Financing Plan (CIFP) for this Plan using a variety of strategies, which may include but are not limited to: a. Water banking; b. Groundwater and aquifer recharge and recovery; c. Desalination; d. Pipelines to new supplies; and/or e. A variety of conjunctive use techniques. The CIFP shall be reviewed every five (5) years in order to evaluate the effectiveness of meeting the strategies noted in this policy. Areas identified to be at or near overdraft shall be a high priority for funding.
	PS-3.8	Developments that use gray water and cisterns for multi-family residential and commercial landscaping shall be encouraged, subject to a discretionary permit.
	PS-3.9	A tentative subdivision map and/or vesting tentative subdivision map application for either a standard or minor subdivision shall not be approved until the applicant provides evidence of a long-term sustainable water supply in terms of yield and quality for all lots that are to be created through subdivision.
	PS-3.10	In order to maximize agricultural water conservation measures to improve water use efficiency and reduce overall water demand, the County shall establish an ordinance identifying conservation measures that reduce agricultural water demand.

Element	Goal / Policy	
	PS-3.11	In order to maximize urban water conservation measures to improve water use efficiency and reduce overall water demand, the County shall establish an ordinance identifying conservation measures that reduce potable water demand
	PS-3.12	The County shall maximize the use of recycled water as a potable water offset to manage water demands and meet regulatory requirements for wastewater discharge, by employing strategies including, but not limited to, the following: a. Increase the use of treated water where the quality of recycled water is maintained, meets all applicable regulatory standards, is appropriate for the intended use, and re-use will not significantly impact beneficial uses of other water resources. b. Work with the agricultural community to develop new uses for tertiary recycled water and increase the use of tertiary recycled water for irrigation of lands currently being irrigated by groundwater pumping. c. Work with urban water providers to emphasize use of tertiary recycled water for irrigation of parks, playfields, schools, golf courses, and other landscape areas to reduce potable water demand. d. Work with urban water providers to convert existing potable water customers to tertiary recycled water as infrastructure and water supply become available.
	PS-3.13	To ensure accuracy and consistency in the evaluation of water supply availability, the Monterey County Health Department, in coordination with the MCWRA, shall develop guidelines and procedures for conducting water supply assessments and determining water availability. Adequate availability and provision of water supply, treatment, and conveyance facilities shall be assured to the satisfaction of the County prior to approval of final subdivision maps or any changes in the General Plan Land Use or Zoning designations.
	PS-3.14	The County will participate in regional coalitions for the purpose of identifying and supporting a variety of new water supply projects, water management programs, and multiple agency agreements that will provide additional domestic water supplies for the Monterey Peninsula and Seaside basin, while continuing to protect the Salinas and Pajaro River groundwater basins from saltwater intrusion. The County will also participate in regional groups including representatives of the Pajaro Valley Water Management Agency and the County of Santa Cruz to identify and support a variety of new water supply, water management and multiple agency agreement that will provide additional domestic water supplies for the Pajaro Groundwater Basin. The County's general objective, while recognizing that timeframes will be dependent on the dynamics

Element	Goal / Policy	
		of each of the regional groups, will be to complete the cooperative planning of these water supply alternatives within five years of the adoption of the General Plan and to implement the selected alternatives within five (5) years after that time.
	PS-3.15	The County will pursue expansion of the Salinas Valley Water Project (SVWP) by investigating expansion of the capacity for the Salinas River water storage and distribution system. This shall also include, but not be limited to, investigations of expanded conjunctive use, use of recycled water for groundwater recharge and seawater intrusion barrier, and changes in operations of the reservoirs. The County's overall objective is to have an expansion planned and in service by the date that the extractions from the Salinas Valley groundwater basin are predicted to reach the levels estimated for 2030 in the EIR for the Salinas Valley Water Project. The County shall review these extraction data trends at five-year intervals. The County shall also assess the degree to which the Salinas Valley Groundwater Basin (Zone 2C) has responded with respect to water supply and the reversal of seawater intrusion based upon the modeling protocol utilized in the Salinas Valley Water Project EIR. If the examination indicates that the growth in extractions predicted for 2030 are likely to be attained within ten years of the date of the review, or the groundwater basin has not responded with respect to water supply and reversal of seawater intrusion as predicted by the model, then the County shall convene and coordinate a working group made up of the Salinas Valley cities, the MCWRA, and other affected entities. The purpose will be to identify new water supply projects, water management programs, and multiple agency agreements that will provide additional domestic water supplies for the Salinas Valley. These may include, but not be limited to, expanded conjunctive use programs, further improvements to the upriver reservoirs, additional pipelines to provide more efficient distribution, and expanded use of recycled water to reinforce the hydraulic barrier against seawater intrusion. The county's objective will be to complete the cooperative planning of these water supply alternatives within five years and to have the projects on-line five years following identification of water supply alternatives.

The Monterey County General Plan does not include population projections; however, the Association of Monterey Bay Area Governments (AMBAG) has developed population projections through 2050, which are presented in Table 3-4.

Table 3-4: Monterey County Population Projections

Table 8: Subregional Population Forecast

Geography	2015	2020	2025	2030	2035	2040	Change 2015-2040 Numeric	Change 2015-2040 Percent
AMBAG Region	**762,676**	**791,600**	**816,900**	**840,100**	**862,200**	**883,300**	**120,624**	**16%**
Monterey County	**432,637**	**448,211**	**462,678**	**476,588**	**489,451**	**501,751**	**69,114**	**16%**
Carmel-By-The-Sea	3,824	3,833	3,843	3,857	3,869	3,876	52	1%
Del Rey Oaks	1,655	1,949	2,268	2,591	2,835	2,987	1,332	80%
Gonzales	8,411	8,827	10,592	13,006	15,942	18,756	10,345	123%
Greenfield	16,947	18,192	19,425	20,424	21,362	22,327	5,380	32%
King City	14,008	14,957	15,574	15,806	15,959	16,063	2,055	15%
Marina	20,496	23,470	26,188	28,515	29,554	30,510	10,014	49%
Marina balance	19,476	20,957	22,205	22,957	23,621	24,202	4,726	24%
CSUMB (portion)	1,020	2,513	3,983	5,558	5,933	6,308	5,288	518%
Monterey	28,576	28,726	29,328	29,881	30,460	30,976	2,400	8%
Monterey balance	24,572	24,722	25,324	25,877	26,456	26,972	2,400	10%
DLI & Naval Postgrad	4,004	4,004	4,004	4,004	4,004	4,004	0	0%
Pacific Grove	15,251	15,349	15,468	15,598	15,808	16,138	887	6%
Salinas	159,486	166,303	170,824	175,442	180,072	184,599	25,113	16%
Sand City	376	544	710	891	1,190	1,494	1,118	297%
Seaside	34,185	34,301	35,242	36,285	37,056	37,802	3,617	11%
Seaside balance	26,799	27,003	27,264	27,632	28,078	28,529	1,730	6%
Fort Ord (portion)	4,450	4,290	4,340	4,490	4,690	4,860	410	9%
CSUMB (portion)	2,936	3,008	3,638	4,163	4,288	4,413	1,477	86%
Soledad	24,809	26,399	27,534	28,285	29,021	29,805	4,996	20%
Soledad balance	16,510	18,100	19,235	19,986	20,722	21,506	4,996	30%
SVSP & CTF	8,299	8,299	8,299	8,299	8,299	8,299	0	0%
Balance Of County	104,613	105,361	105,682	106,007	106,323	106,418	1,805	2%
San Benito County	**56,445**	**62,242**	**66,522**	**69,274**	**72,064**	**74,668**	**18,223**	**32%**
Hollister	36,291	39,862	41,685	43,247	44,747	46,222	9,931	27%
San Juan Bautista	1,846	2,020	2,092	2,148	2,201	2,251	405	22%
Balance Of County	18,308	20,360	22,745	23,879	25,116	26,195	7,887	43%
Santa Cruz County	**273,594**	**281,147**	**287,700**	**294,238**	**300,685**	**306,881**	**33,287**	**12%**
Capitola	10,087	10,194	10,312	10,451	10,622	10,809	722	7%
Santa Cruz	63,830	68,381	72,091	75,571	79,027	82,266	18,436	29%
Santa Cruz balance	46,554	49,331	51,091	52,571	54,027	55,266	8,712	19%
UCSC	17,276	19,050	21,000	23,000	25,000	27,000	9,724	56%
Scotts Valley	12,073	12,145	12,214	12,282	12,348	12,418	345	3%
Watsonville	52,562	53,536	55,187	56,829	58,332	59,743	7,181	14%
Balance Of County	135,042	136,891	137,896	139,105	140,356	141,645	6,603	5%

Sources: Data for 2015 are from the U.S. Census Bureau and California Department of Finance. Forecast years were prepared by AMBAG and PRB.

3.10.2 City of Salinas General Plan

The Land Use and Conservation/Open Space Elements of the City of Salinas General Plan (City of Salinas, 2002) are relevant to water-resources within the 180/400-Foot Subbasin, and are summarized in Table 3-5.

Table 3-5: City of Salinas General Plan Summary

Element	Goal / Policy	
Land Use	Goal LU-6	Work with water suppliers and distributors such as Cal

Element	Goal / Policy	
		Water and Alco to continue to provide quality water supply and treatment capacity to meet community needs.
	Policy LU-6.1	Actively work with Cal Water and Alco, as well as regional water suppliers and distributors, to ensure that high quality water is available for the community.
	Policy LU-6.2	Review development proposals to ensure that adequate water supplies, treatment, and distribution capacity is available to meet the needs of the development without negatively impacting the existing community,
	Policy LU-6.3	Participate in and support regional programs and projects that target the improvement and conservation of the region's groundwater and surface water supply.
	Policy LU-6.4	Actively promote water conservation by City residents, businesses, and surrounding agricultural producers.
	Policy LU-6.5	Review projects subject, such as residential projects with 500 or more units, for compliance with Section 10910-10915 of the California Water Code.
Conservation	Goal COS-1	Provide a safe and adequate water supply for community uses.
	Policy COS-1.1	Work with regional and local water providers to ensure that adequate supplies of water are available to meet existing and future demand.
	Policy COS-1.2	Cooperate with local, regional, and state water agencies to develop new water sources.
	Policy COS-1.3	Work with local and regional water providers to increase the production, distribution, and use of recycled water,
	Policy COS-1.4	Maintain and restore natural watersheds to recharge the aquifers and ensure the viability of the ground water resources.
	Policy COS-1.5	Cooperate with the Monterey County Water Resources Agency, the State Water Resources Control Board and the Regional Water Quality Control Board to implement programs that address the two primary causes of poor water quality in the planning area: salt water intrusion and nitrate contamination.
	Policy COS-1.6	Enforce national (NPDES) requirements and participate in regional efforts to protect and enhance water quality.
	Goal COS-2	Encourage the conservation of water resources.
	Policy COS-	Participate in and implement local and regional programs

Element	Goal / Policy	
	2.1	that promote water conservation.
	Policy COS-2.2	Work with water providers to institute conservation programs to address water supply problems caused by groundwater overdrafting,
	Policy COS-2.3	Apply standards that promote water conservation in agricultural, residential and non-residential uses.
	Policy COS-2.4	Enforce the City's Water Conservation Ordinance.

3.10.3 City of Gonzales General Plan

Relevant elements of the City of Gonzales General Plan (City of Gonzales, 2011) are summarized Table 3-6.

Table 3-6: City of Gonzales General Plan Summary

Element	Goal / Policy	
Land Use	LU-1.2.2	New developments must have adequate water supplies.
	LU-8.3.1:	Modify proposed designs for industrial development to reduce adverse environmental impacts, particularly nose, air, and water pollution, odor, soil, and groundwater contamination, traffic, and visual blight to the degree practicable.
	LU-8.3.2	Plan for Sewer and Water Expansion. Ensure that adequate water and sewer capacity is available to support all areas designated for industrial development
Housing	HE-9.2	Promote Water Conservation Promote the use of water-saving devices, drought-tolerant landscaping, and other water conservation measures to achieve a reduction in home water bills for residential customers
	HE-9.4.1	Water Conservation. The City will continue to promote ways to reduce monthly home water bills. Such measures already include: (a) requiring new houses to utilize low-flow toilets, low-flow shower heads, and low flow faucets consistent with the requirements of the Monterey County Water Resources Agency, and (b) requiring the use of drought-tolerant landscaping within new developments (as specified in the State Model Landscape Ordinance). The City will also support new water retrofitting programs undertaken by the Monterey County Water

Element	Goal / Policy	
		Resources Agency, such as providing free low-flow plumbing fixtures to existing customers in Gonzales. Responsibility: Building Department, Public Works Department, Planning Department Timing: Ongoing
Community Health and Safety	Paragraph H Water Quality	Groundwater and surface water quality both affect the health of Gonzales residents. Because groundwater is the sole source of domestic water in Gonzales, a healthful supply is essential to the city's future. Surface water pollution creates negative aesthetic and environmental impacts, as well as creating potential health hazards locally and downstream. The Community Health and Safety Element includes policies to reduce the extent of water pollution that could occur from urban development in Gonzales, as well as policies to minimize potential risks if contamination does occur. The groundwater beneath Gonzales is vulnerable to contamination from lawn fertilizer, leaking underground storage tanks, failing septic systems, animal waste, and naturally occurring minerals. High nitrate levels are a persistent problem in the Salinas Valley, with about half of the 58 wells sampled exceeding the State water standard over a testing period of about 30 years. Nitrate problems around Gonzales are most prevalent on the northeast side of the Planning Area, where former greenhouse and dairy operations and the existing feed lot are probably the primary contaminant sources. Elsewhere in the Planning Area, groundwater quality is generally acceptable and meets all water quality standards. The Gonzales Public Works Department conducts regular measurements of water quality for city wells and takes corrective actions if nitrate levels exceed acceptable standards. In the past, well water quality problems have been addressed with special seals which block nitrates from entering the water supply. If activities and land uses around the wells are not properly managed in the future, contamination could result. This would require that wells be relocated or that well-head treatment be introduced.

3.10.4 CITY OF MARINA GENERAL PLAN

The City of Marina General Plan (City of Marina, 2010) recognizes that future water demands will require changes in the management of water resources in the area. The City of Marina's 2020 water demand is projected to be 7,720 acre-feet. [Section 3.44]. The General Plan includes the following measures related to water-supply planning.

- New developments must have identified water sources. [3.45]
- A 15-percent reserve will be maintained between demand and supply. When demand exceeds 85% of the available supply, no new development will be allowed until supplemental water sources are identified. [3.47]

3.10.5 CITY OF GREENFIELD GENERAL PLAN

Relevant elements of the City of Greenfield General Plan (City of Greenfield, 2005) are summarized in the Table 3-7.

Table 3-7: City of Greenfield General Plan Summary

Element	Goal / Policy	
Land Use	Policy 2.1.14	Program 2.1.E. The City shall develop a capital improvements plan for the extension of sewer, water, and other municipal services.
Growth Management	Goal 4.10	Assure that potable water supplies are available in quantities sufficient to serve the community and to develop supplies and facilities to meet future water needs.
	Policy 4.10.1	Manage future development so that facilities are available for proper water supply.
	Policy 4.10.2	Support water conservation throughout the City.
	Policy 4.10.3	New development shall pay the costs related to the need for increased water system capacity.
	Policy 4.10.4	Water service systems shall meet regulatory standards for water delivery, water storage, and

Element	Goal / Policy	
		emergency water supplies.
	Policy 4.10.5	Rural residences currently served by private well water shall connect to municipal water service when it becomes available. Upon connection to municipal water service, any private water well(s) may be maintained for irrigation purposes only and non-irrigation wells shall be capped and properly abandoned per Monterey County Division of Environmental Health standards.
	Policy 4.10.6	Identify and develop opportunities for use of non-potable water, including ground water, reclaimed water, and untreated surface water, for other than domestic use.
	Policy 4.10.7	Identify, monitor, and regulate land uses and activities that could result in contamination of groundwater supplies to minimize the risk of such contamination.
	Policy 4.10.8	Reduce the need for water system improvements by encouraging new development to incorporate water conservation measures to decrease peak water use.
	Policy 4.10.9	The City will support the Salinas Valley Water Project at a policy level toward maintaining long-term groundwater supply and quality.
	Program 4.10.A	Prior to project approval, new development shall demonstrate that adequate water quantity and quality can be provided. The City shall determine whether 1) capacity exists within the water system if a development project is built within a set period of time, or 2) capacity shall be provided by a funded program or other mechanism. This finding will be based on information furnished or made available to the City from consultations with the Public Works Department, the applicant, or other sources.
	Program 4.10.B	Cooperate with other regulatory agencies to control point and non-point water pollution sources to protect water resources.
	Program 4.10.C	Periodically update the City's drought contingency plan.
	Program	All new water and other service systems shall be

Element	Goal / Policy	
	4.10.D	placed within roads and existing easements whenever feasible to minimize environmental impact.
Housing	Objective 6.6	Provide adequate water, sewer, and storm drainage utilities, and adequate fire and police services, to accommodate projected residential development.
	Policy 6.7.1	Promote energy and water efficiency in new houses and rehabilitated houses to reduce ongoing homeowner costs.

3.10.6 CITY OF SOLEDAD GENERAL PLAN

The City of Soledad General Plan (City of Soledad, 2005) notes that water-supply wells "are taxed during the dry season with some existing wells exhibiting evidence of reduced production." Relevant elements of the City of Soledad General Plan are summarized in Table 3-8.

Table 3-8: City of Soledad General Plan Summary

Element	Goal / Policy	
Land Use	L7	Master plans for sewer, water, roads, drainage and other public improvements shall be required for new development on large undeveloped parcels and may be included in the specific plan required by policy L3, and as determined by the City.
Public Services and Facilities	S-2	The City shall plan for the expansion of needed water and sewer infrastructure including, but not limited to, the expansion of water production, storage and distribution facilities, the expansion of wastewater collection and treatment capacity, and storm drainage facility expansion.

Element	Goal / Policy	
	S-8	The City shall promote the efficient use of water and reduced water demand by: a. Requiring water conserving design and equipment in new construction; b. Encouraging water conserving landscaping and other conservation measures; c. Encouraging the retrofitting of existing fixtures with water conserving fixtures;
	S-9	The City will explore the potential for use of reclaimed water for landscape irrigation or other appropriate use.
	S-10	The City will manage the increase in water demand from new development to help insure groundwater resources are not overdrafted. The City will work with Monterey County and public and private water entities to plan for the efficient, long term management of groundwater resources.
Conservation / Open Space	8.6	The City, in cooperation with other water purveyors and water management agencies and landowners, shall participate in efforts to provide for comprehensive groundwater management to ensure the long-term maintenance and protection of groundwater resources within and surrounding Soledad.

3.10.7 King City General Plan

The King City General Plan (King City, 1998) indicates that the water system is adequate for current use, but that a new well site would be needed for future development. Relevant elements of the King City General Plan are summarized in Table 3-9.

Table 3-9: King City General Plan Summary

Element	Goal / Policy	
Housing	Policy 1.8	Regulate land uses and housing design to minimize the consumption of water and energy usage and encourage the design and construction of high-quality housing products.

3.10.8 Well Permitting

3.10.8.1 Monterey County Moratorium on Accepting and Processing New Well Permits.

On May 22, 2018, the Monterey County Board of Supervisors adopted Ordinance No. 5302 pursuant to Government Code Section 65858. The ordinance imposed a moratorium on the County Health Department accepting and processing new well permits; it was not a moratorium on additional groundwater pumping from existing wells. The ordinance was an Interim Urgency Ordinance, which took effect immediately upon adoption. The ordinance prohibits the acceptance or processing of any applications for new wells in the defined Area of Impact in the 180/400-Foot Aquifer Subbasin, with stated exceptions including municipal wells and replacement wells. Pursuant to Section 65858, the ordinance was originally only effective for 45 days to July 5, 2018, but at the June 26 Board meeting, the Board of Supervisors on a 4-1 vote extended the ordinance to May 21, 2020, by adoption of Ordinance No. 5303. During the moratorium, the County has stated that it will conduct further studies.

3.10.8.2 Monterey County General Plan

The Public Service element of the Monterey County General Plan addresses permitting of individual wells in rural or suburban areas. New residential or commercial lots in rural or suburban areas with limited utility services must have a minimum area of 2.5 acres if a well is the water source. Existing lots of any size can use an on-site well if they are outside of a water system service area. Existing lots within an established water system service area can use wells if they are greater than 2.5 acres or have a connection to a public sewage system. Table 3-10 summarizes the Monterey County General Plan's water supply guidelines for new lots. Table 3-11 depicts the decision matrix from the Monterey County General Plan for permitting new wells for existing lots.

3.10.8.3 Monterey County Ordinance Prohibiting Drilling of New Wells at Fort Ord

Monterey County Ordinance No. 04011, adopted April 27, 1999, prohibits the construction of water wells in areas impacted by contamination plumes on the former Fort Ord site.

3.10.8.4 Marina Coast Water District Water Well Permitting

Chapter 3.32 of the Marina Coast Water District Municipal Code requires a permit for the construction of shallow (less than 100 feet deep) wells for non-potable (landscape irrigation) use. All other well construction is prohibited within the MCWD jurisdictional area, except for wells constructed by the MCWD.

3.10.8.5 City of Salinas Well Permitting

Article IX, Chapter 16, of the City of Salinas Code of Ordinances requires a permit for all new wells.

Table 3-10: Monterey County Water Supply Guidelines for New Lots

Major Land Groups	*Maximum Emergency Response Time for Fire, Sheriff, and Ambulance*	*Road Intersection Level of Service, Improvements*	*Water*	*Sanitation*	*Solid Waste*	*Park Schools*[6]	*Stormwater and drainage*
Rural Standards							
Public Lands	45 min. [1]	LOS D	Individual Wells Permitted in Areas with Proven Long Term Water Supply [2,5]	Septic on Lots 1 acre or greater [2]	On-site Garbage and Recycling Pick	N/A	No Net Increase in harmful Run-off from parcel
Agriculture Lands	45 min. [1]	LOS D	Individual Wells Permitted in Areas with Proven Long Term Water Supply [2,5]	Septic on Lots 1 acre or greater [2]	On-site Garbage and Recycling Pick	Consult with local school district	No Net Increase in harmful Run-off from parcel
Rural Lands	45 min. [1]	LOS D	Individual Wells Permitted in Areas with Proven Long Term Water Supply [2,5]	Septic on Lots 1 acre or greater [2]	On-site Garbage and Recycling Pick	Consult with local school district	No Net Increase in harmful Run-off from parcel
Suburban Standards (limited array of public services)							
Rural Centers	12 min. [1] Structural Coverage	LOS D [4]	Public System; Individual Wells Allowed in limited situations [2,5]	Public System; Septic on Lots 1 acre or greater [2]	On-site Garbage and Recycling Pick Up	Neighbor-hood Parks/ Consult with local school district	Drainage Plan Required
Urban Standards (Full array of public facilities, including schools, libraries, parks, childcare, emergency service stations, community centers, transit, storm drainage, curbs, and sidewalks)							
Community Areas	5-8 min. Structural Coverage	LOS D - curb, gutters, sidewalks [3]	Public System	Public System [2]	On-site Garbage and Recycling Pick Up	Neighbor-hood Parks/ Consult with local school district	Drainage Plan Required

Table 3-11: Monterey County Well Permitting Guidelines for Existing Lots

Characteristics of Property	Water Connection Existing or Available from the Water System	Not within a Water System or a Water Connection Unavailable
Greater than or equal to 2.5 Acres connected to a Public Sewage System or an on-site wastewater treatment system.	Process Water Well Permit	Process Water Well Permit
Less than 2.5 Acres and connected to a Public Sewage System	Process Water Well Permit	Process Water Well Permit
Less than 2.5 Acres and connected to an on-site wastewater treatment system.	Do not Process Water Well Permit	Process Water Well Permit

3.10.9 Plan Implementation Effects on Existing Land Use

This section to be completed after GSP is complete.

3.10.10 Plan Implementation Effects on Water Supply

This section to be completed after GSP is complete.

DRAFT Chapter 4

Salinas Valley Basin Integrated Sustainability Plan

Prepared for:
SVBGSA

3 January 2019

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CHAPTER 4 HYDROGEOLOGIC CONCEPTUAL MODEL

4.1 Basin Setting

The Salinas Valley Groundwater Basin is an approximately 90-mile long alluvial basin underlying the elongated, intermountain valley of the Salinas River. The Basin is oriented southeast to northwest, with the Salinas River draining towards the northwest into the Pacific Ocean at Monterey Bay (Figure 4-1).

The Salinas River drains a watershed area of approximately 4,410 square miles, including the highlands of the Sierra de Salinas and Santa Lucia Range to the west and the Gabilan and Diablo Ranges to the east (Tetra Tech, 2015). The valley floor is approximately 10 miles wide in the north near the City of Salinas and narrows to about 2 miles wide in the south near San Ardo. The valley floor slopes at an average grade of approximately 5 feet/mile to the northwest, dropping from 400 feet above mean sea level (msl) near San Ardo to sea level at Monterey Bay. The colored bands on Figure 4-1 show the topography of the Salinas Valley. This topography was derived from the United States Geological Survey (USGS) Digital Elevation Model (DEM) of the area.

4.2 Basin Geology

The Salinas Valley Basin was formed through periods of structural deformation and periods of marine and terrestrial sedimentation in a tectonically active area on the eastern edge of the Pacific Plate. Figure 4-2 presents a geologic map of the study area, illustrating both the locations of faults and the geologic formations present at ground surface (California Geologic Survey, 1977). The legend in Figure 4-2 presents the age sequence of the geologic materials from the youngest unconsolidated Quaternary sediments to the oldest pre-Cambrian basement rock.

4.2.1 Basin Structure and Development

The Salinas Valley is underlain by the Salinian tectonic block, a geologic basement terrane consisting of metamorphic and granitic rock of Paleozoic to Mesozoic age. The Salinian Block is bordered on both east and west by tectonic blocks of the Franciscan Complex (Figure 4-3). The boundaries between these tectonic blocks are large scale strike-slip faults: the San Andreas fault zone on the east, and the Sur-Nacimiento fault zone on the west (Figure 4-3).

The combination of tectonically driven land movement and sea level changes has influenced the depositional environment in the Salinas Valley. Over time, the Salinas Valley has been filled with 10,000 to 15,000 feet of both marine and continental sediments. A major marine transgression in middle to late Miocene epoch, between approximately 16 and 6 million years ago (Ma), resulted in thick accumulations of fine-grained marine sediments that became the Monterey Formation.

Following the Monterey Formation deposition, gravels, sands, silts, and clays were eroded from the surrounding mountain ranges and deposited by the ancestral Salinas River and its tributaries. These continental deposits include stream-borne (fluvial) deposits as well as the alluvial fans that border portions of the Basin. The alluvial fans coalesce with fluvial deposits near the main stem of the ancestral river.

The uppermost 500 to 1500 feet of this sequence of marine and continental deposits constitute the freshwater aquifer system of the Salinas Valley Groundwater Basin. As described above, transitions between marine and terrestrial depositional environments led to complex layering of coarse and fine-grained marine and continental materials. This process creates variable hydrogeologic conditions throughout the Basin. No single definition of aquifers and aquitards is applicable to the entire Basin.

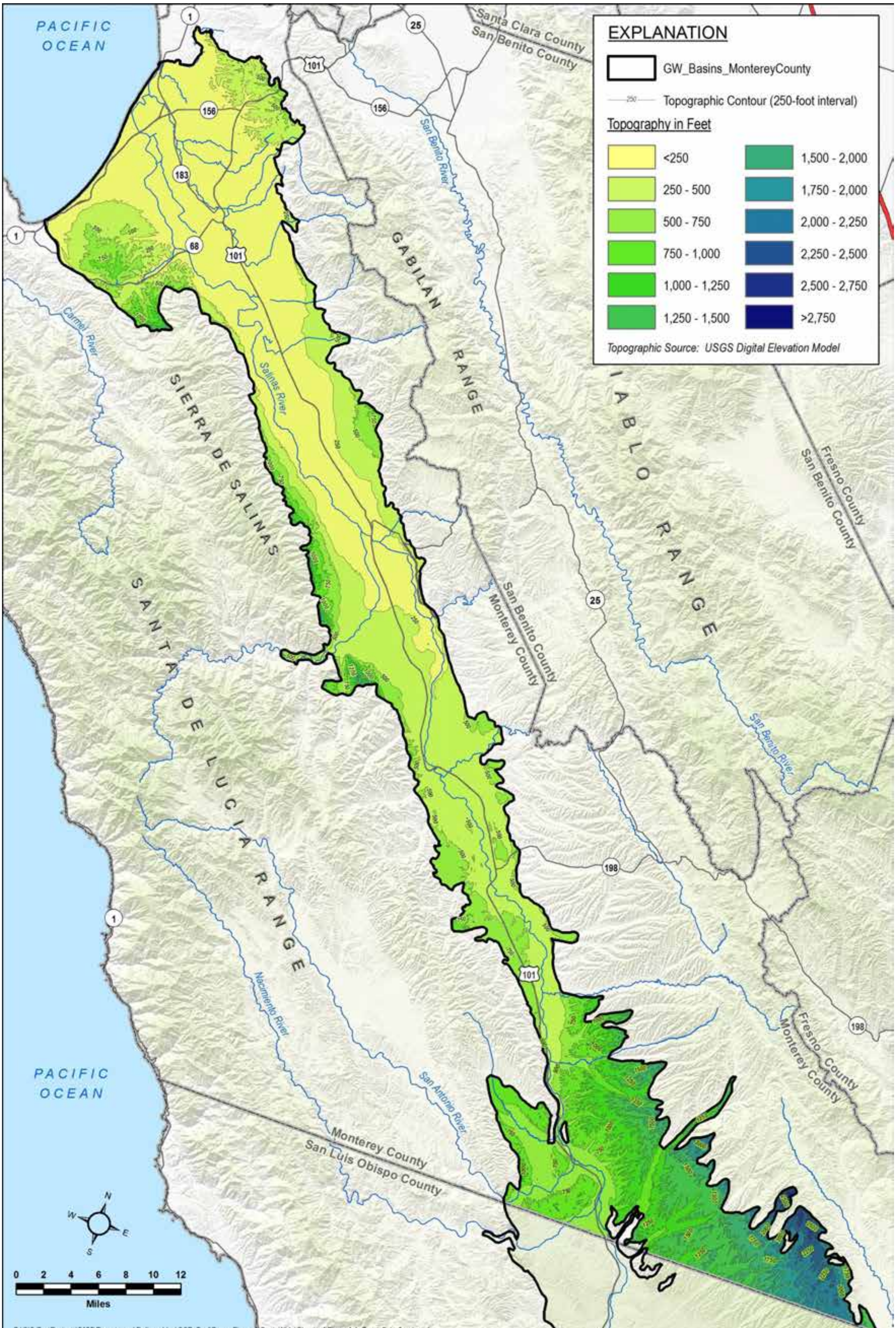

Figure 4-1: Salinas Valley Topography

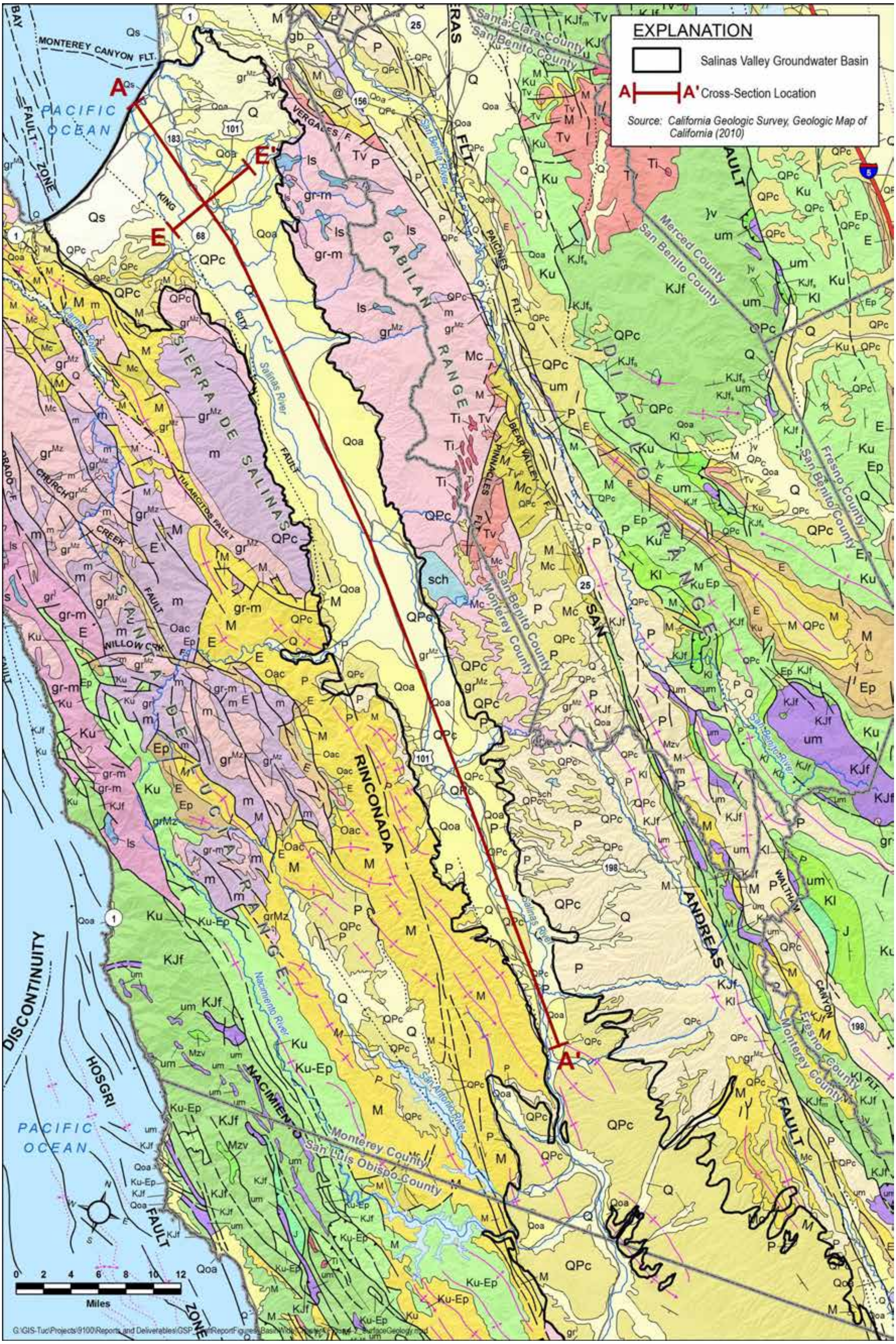

Figure 4-2: Geology

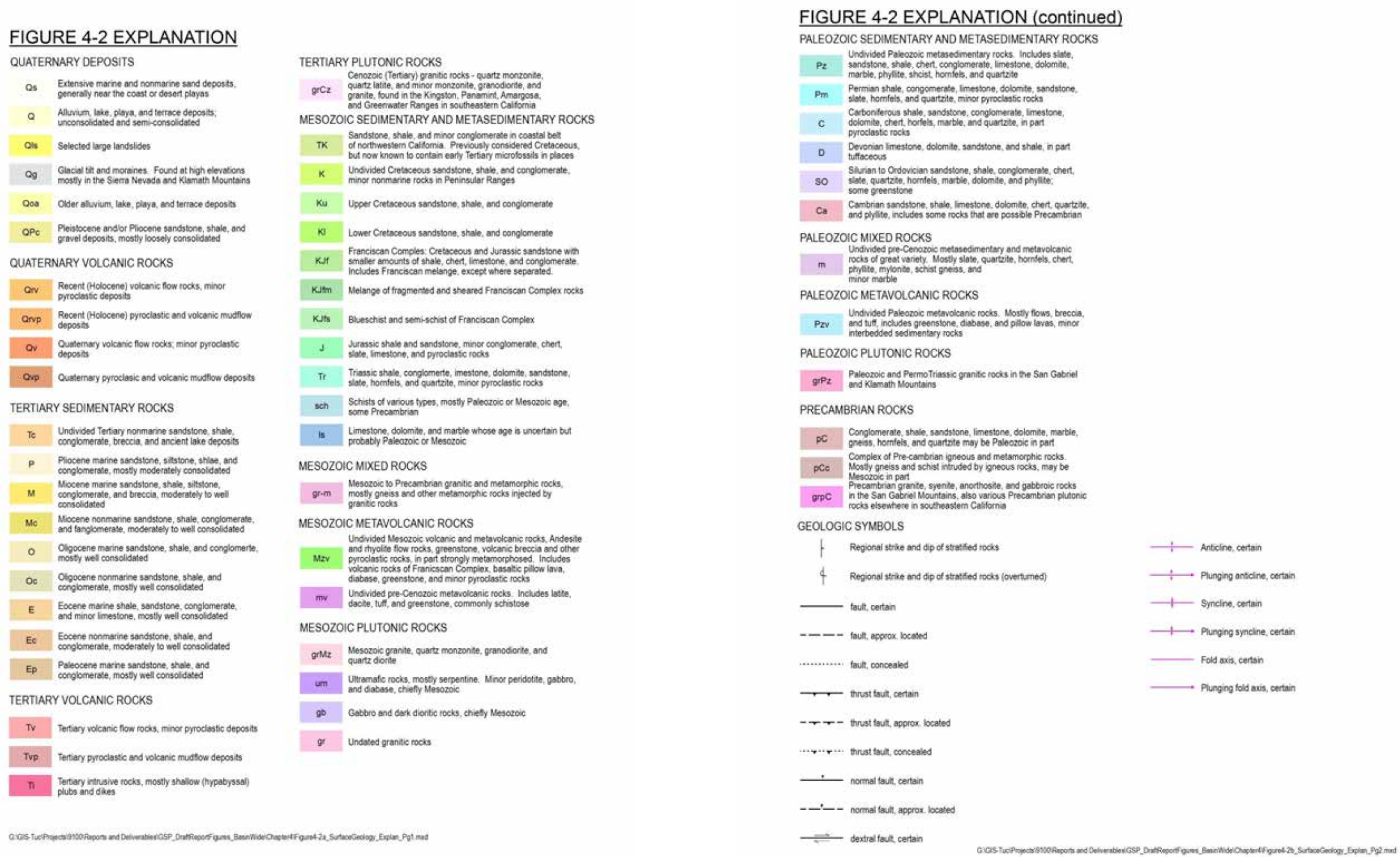

Figure 4-2 Explanation

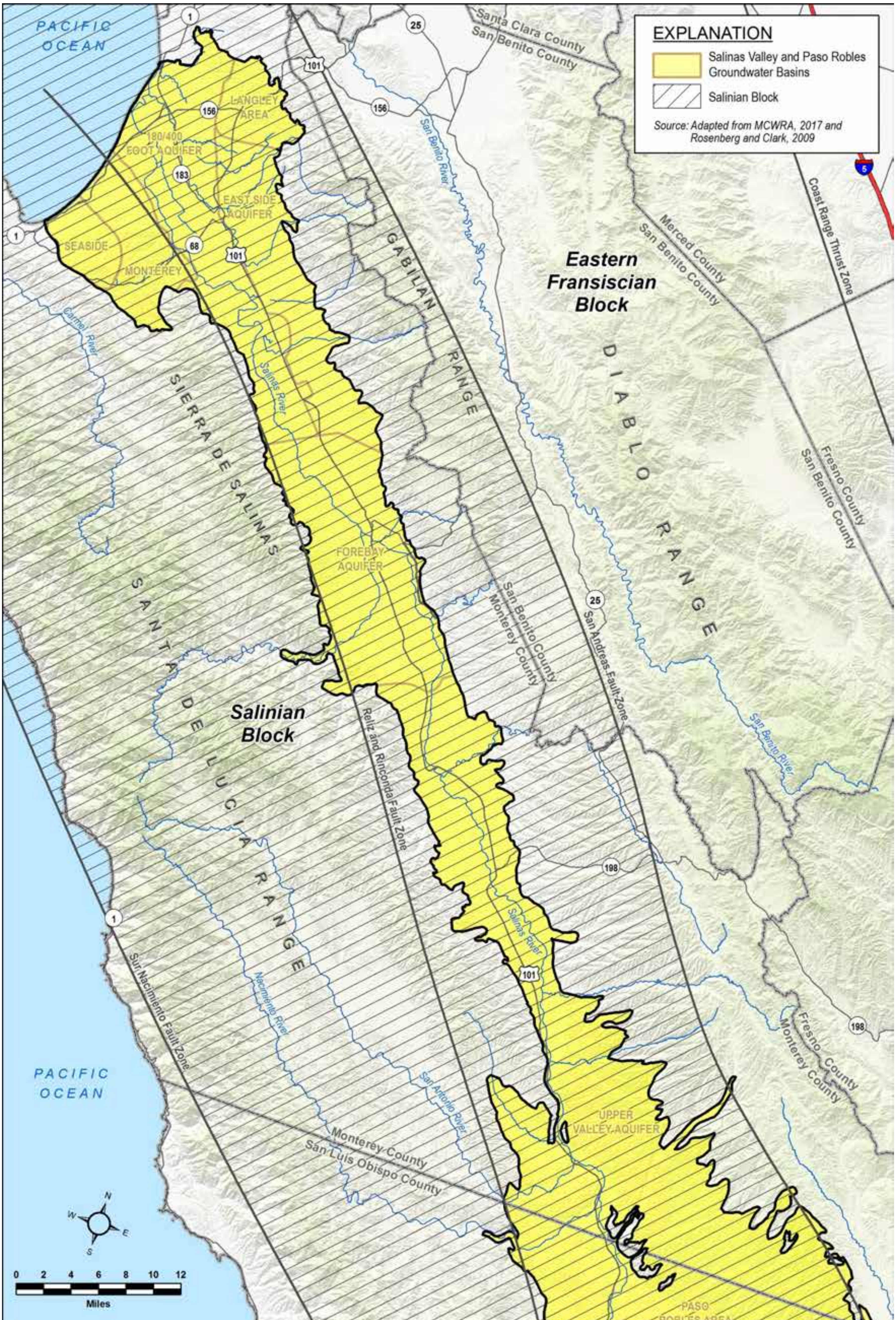

Figure 4-3: Salinas Valley Structural Geology

4.2.2 Geologic Formations

Major geologic units present in the Salinas Valley Basin are described below starting at the surface and moving through the strata from youngest to oldest. The corresponding designation on the Figure 4-2 geologic map is provided in parenthesis.

- *Alluvium (Qa)* – This Holocene unit predominately consists of unconsolidated layers of mixed sand, gravel, silt, and clay that were deposited in a fluvial environment by the Salinas River and its tributaries. In the northern portion of the basin, this unit also includes extensive laterally-continuous clay layers that were deposited in a shallow marine to brackish-water estuarine environment during periods when sea level rise caused submergence of the northern portion of the basin (Durham, 1974). The estuarine deposits extend from Monterey Bay to approximately Gonzales. This unit covers nearly the entire valley floor and was deposited by precursors to current geomorphic features. Therefore, its distribution is approximately coincident with current geography. The thickness is not well established because the alluvium is difficult to distinguish from underlying units, but it is likely 100 to 300 feet thick along the axis of the valley (Durham, 1974).

  In some reports, (e.g., Harding ESE 2001, and Kennedy-Jenks, 2004), the Qal is limited to the shallowest deposits overlying the first estuarine clay layer, and the remaining thickness of Qal described herein is combined with the underlying Older Alluvium (Qoa) to form a unit called Valley Fill Deposits (Qvf). These alternate geologic descriptions have not been adopted in this ISP, and do not have a bearing on the hydrostratigraphic nomenclature (Chapter 4.4.2) that forms the basis for the ISP and GSPs.

- *Older Alluvium (Qoa)* – This Pleistocene unit is composed of alternating, interconnected beds of fine-grained and coarse-grained deposits predominately associated with alluvial fan depositional environments. Older than, and underlying the Alluvium (Qa), the Older Alluvium is found throughout the Basin and is exposed at the ground surface on the alluvial fans along the margins of the basin and on terraces and other areas of uplift where it has not been covered by the more recent Alluvium. The alluvial fan deposits have an estimated maximum saturated thickness of 500 feet (Durham, 1974).

- *Aromas Sand (QPc)* – This Pleistocene unit is composed of cross-bedded sand containing some clayey layers (Harding ESE, 2001). The Aromas Sands are distinguishable at the surface based the presence of red sands and cemented erosion-resistant cap rocks in the Fort Ord area. This unit was deposited in a combination of eolian, high-energy alluvial, alluvial fan, and shoreline environments (Harding ESE, 2001; Greene, 1970; and Dupre, 1990). The Aromas Sand may be up to 300 feet thick (Harding ESE, 2001) in the Monterey Subbasin (Harding ESE, 2001) and likely extends into the northern portion of the 180-400 Foot Aquifer Subbasin (MCWRA, 2017a), but is not found in other portions of the basin.

- *Paso Robles Formation (Tc)* – This Pliocene to lower Pleistocene unit is composed of lenticular beds of sand, gravel, silt, and clay from terrestrial deposition (Thorup, 1976, Durbin, 1978). The depositional environment is largely fluvial (Durbin, 1973) but also includes alluvial fan, lake and floodplain deposition (Harding ESE, 2001; Thorup, 1976; Greene, 1970). The alternating beds of fine and coarse materials typically have bed thicknesses of 20 to 60 feet (Durbin, 1978). The Paso Robles Formation overlies the Purisima and Pancho Rico Formations and underlies most of the Salinas Valley but is rarely exposed at the surface. Durham (1974) reports that the thickness is variable due to erosion of the upper part of the unit and that approximately 500 ft remains near King City, 1,500 feet remains near Spreckels, and 1,000 feet remains near Salinas. Through most of the basin, this is the deepest unit containing fresh water. The underlying marine deposits typically do not yield high rates of fresh water. Information on the depths of the occurrence of fresh-water can be found in Section 4.3.1

- *Purisima Formation/ Pancho Rico Formation (P)* – These Pliocene units consists of intercalated siltstone, sandstone, conglomerate (Greene, 1977), clay and shale (Harding ESE, 2001) deposited in a shallow marine environment. The Purisima Formation is found in the subsurface in the northern portion of the basin and ranges from 500 to 1,000 feet in thickness (WRIME, 2003). The Pancho Rico Formation is found underlying the southern portion of the basin and crops out northeast of the Salinas River (Durham, 1974). They are the youngest consolidated sedimentary units encountered in the basin vicinity and for the most part they underlie the basin.

- *Santa Margarita Sandstone and Monterey Formation (M)* – These Miocene units consist of friable arkosic sandstone (Santa Margarita) and shale/mudstone (Monterey) deposited in a shallow marine environment (Harding ESE, 2001; Greene, 1977). In some areas the Santa Margarita Sandstone directly underlies the Paso Robles Formation where the Purisima Formation is absent (Greene, 1977). These units typically underlie the basin.

4.2.3 STRUCTURAL RESTRICTIONS TO FLOW

There are no known structural features that restrict groundwater flow inside the Salinas Valley Groundwater Basin. However, lack of stratigraphic continuity associated with contrasting geologic depositional environments may restrict groundwater flow between various subbasins, including:

- The transition from relatively layered fluvial and marine deposits in the 180/400-Foot Aquifer Subbasin to the alluvial fan deposits in the Eastside Subbasin likely restrict groundwater flow between the two subbasins
- The transition from a relatively homogeneous aquifer in the Forebay Subbasin to the structured and layered aquifers in the 180/400-Foot Aquifer Subbasin may restrict some amount of groundwater flow between the two subbasins

4.2.4 SOILS

The soils of the basin are derived from the underlying geologic formations and influenced by the historical and current patterns of climate and hydrology. Productive agriculture of the Salinas Valley is supported by deep, dark, fertile soils. The arable soils of Salinas Valley historically were classified into four groups (Carpenter and Cosby 1925): residual soils, old valley-filling soils, young valley-filling soils, and recent-alluvial soils. In addition, five classes of miscellaneous soils were mapped that included tidal marsh, peat, coastal beach and dune sands.

More recent surveys classify the soils into categories based on detailed soil taxonomy (U.S. Department of Agriculture, 2018). Figure 4-4 is a composite soil map of the Salinas Valley Basin from the USDA Natural Resources Conservation Service (NRCS) and the Gridded Soil Survey Geographic (gSSURGO) Database that is produced by the National Cooperative Soil Survey (NCSS).

The basin is dominated by four soil orders: mollisols, entisols, vertisols, and alfisols. Minor soils include histosols and isceptisols. The four major soil orders are described below.

- <u>Mollisols</u> are the most widespread soil order in the Salinas Valley. Mollisols are characterized by a dark surface horizon, indicative of high organic content. The organic content often originates from roots of surficial grasses or similar vegetation. They are highly fertile and often alkaline rich (calcium and magnesium). Mollisols can have any moisture regime, but enough available moisture to support perennial grasses is typical.

- Entisols are the predominant soil order along the river corridor. Entisols are mineral soils without distinct soil horizons because they have not been in place long enough for distinct horizons to develop. These soils are often found in areas of recent deposition such as active flood plains, river basins, and areas prone to landslides. Nearly all the soils along active river corridor are entisols.
- Vertisols are present over large areas on the valley lowlands in the central and northern Salinas Valley. Vertisols are predominantly clayey soils with high shrink-swell potential. Vertisols are present in climates that have distinct wet and dry seasons. During the dry season these soils commonly have deep, wide cracks. During the wet season these soils trend to have water pooling on the surface due to the high clay content.
- Alfisols are present along portions of the margin of the management area. Alfisols are known to have natural fertility both from clay acumination in the subsurface horizons and from leaf litter when under forested conditions. This order of soils is commonly associated with high base minerals such as calcium, magnesium, sodium, and potassium.

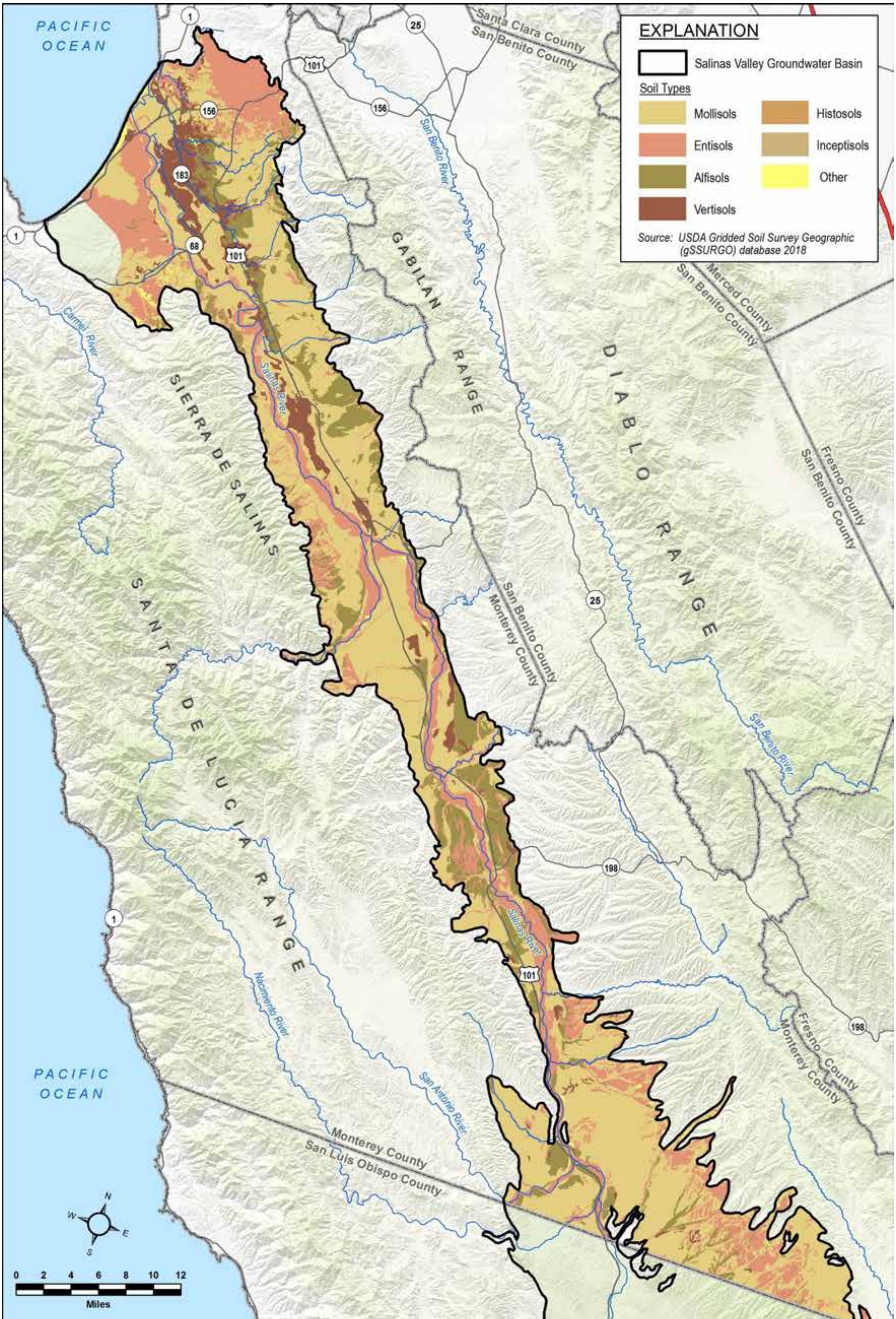

Figure 4-4: Composite Soils Map

4.3 BASIN AND SUBBASIN EXTENTS

4.3.1 BASIN BOUNDARIES

Groundwater in the basin occurs in alluvial sediments that fill the structural trough described in Chapter 4.2.1 . The boundaries of the basin are largely coincident with the contact between the alluvium and surrounding geologic formations as shown on Figure 4-2. Based on the geologic contacts, the basin boundaries and Subbasin boundaries are shown on Figure 1-1.

The southwestern and northeastern basin boundaries along the length of the basin correspond to the contact between the Quaternary deposits and the low-permeability granitic and metamorphic basement rock of the Sierra de Salinas and Gabilan Range. This geologic contact creates a groundwater flow barrier and a hydrogeologic boundary.

The southwestern boundary roughly follows the trace of the King City fault, also known as the Rinconda-Reliz fault, for most the length of the basin. In the northern portion of the basin, however, Quaternary deposits occur on both sides of the fault. In this area, the King City fault is not a barrier to groundwater flow and the groundwater basin extends southwest of the structural trough, such that the fault becomes a subbasin boundary instead of a basin boundary, as described further below.

The northwestern basin boundary is defined by the Pacific Ocean. The Basin aquifers extend across this boundary and continue into the subsurface underlying Monterey Bay; there no hydrogeologic barriers limiting groundwater flow across this coastal boundary.

The northern boundary separates the Salinas Valley Groundwater Basin from the Pajaro Valley Groundwater Basin. The boundary follows the current course of Elkhorn Slough that corresponds to a paleo-drainage of the Salinas River (DWR, 2003). The paleo-drainage is a 400-foot deep, buried, clay-filled layer that limits groundwater flow between these basins (Durbin, *et al.*, 1978).

The southern end of the portion of the Salinas Valley covered by this ISP is defined by the line dividing Monterey County from San Luis Obispo County (Figure 4-1). This boundary is administrative; not hydrogeological, and there is no barrier to groundwater flow across this boundary.

The base of the basin is not a sharp interface between permeable sediments and lower-permeability basement rock. As described in Chapter 4.2.1 , the sedimentary sequence in the Salinas Valley structural trough is 10,000 to 15,000 feet thick. However, the productive fresh water aquifers are only at shallower depths, with the effective thickness of the groundwater basin ranging from approximately 500 feet near the Monterey-San Luis Obispo County line to approximately 1,500 feet near the Monterey Bay shoreline. With increasing depth, two factors limit the viability of the sediments as productive aquifers:

1. Increased consolidation and cementation of the sediments decreases the well yield, and
2. Deeper strata contain poor-quality brackish water unsuitable for most uses.

Because these factors gradually change with depth, there is not a sharp well-defined base to the basin. This ISP has adopted the base of the aquifer that was defined by the USGS (Durbin et al., 1978). Figure 4-5 shows a map of elevation contours of the base of the basin. Figure 4-6 shows a contour map of depth to base of the basin based on the base elevation and ground surface elevation.

4.3.2 SUBBASINS

DWR designates eight subbasins in the Salinas Groundwater Basin (DWR, 2016). Six of these subbasins are being managed in part or in whole by SVBGSA and are therefore included in this ISP. Figure 1-1 illustrates the location of the subbasins.

The subbasins were originally defined in the *Salinas Valley Investigation Summary Report: Bulletin 52* (DWR, 1946). DWR divided the Basin into five areas for analytical purposes. DWR defined subbasins for purposes of resource management, using a combination of geographic, administrative, land use, and physical features. The boundaries do not represent hydrologic barriers and the subbasins are hydrologically connected to each other; although the hydrogeologic connection may be limited between some adjacent basins.

The following boundaries between subbasins have relatively clear hydrologic and geographic origins that are recognized by DWR's Bulletin 118 (2016):

- The boundary between the 180/400-Foot Aquifer Subbasin and the East Side Subbasin generally coincides with the eastern limit of the confining conditions and the location of State Highway 101

- The boundary between the Forebay Aquifer Subbasin and the two down-gradient subbasins, the 180/400-Foot Aquifer Subbasin and East Side Subbasin, generally coincides with southern limit of confining conditions
- The boundary between 180/400-Foot Aquifer Subbasin and the Monterey Subbasin coincides with the Reliz and Rinconada fault zone and a groundwater divide
- The boundary between the Upper Valley Subbasin and the Forebay Subbasin evolved from the boundary designated by DWR in the 1946 study (Bulletin 52) to separate the portion of the valley upgradient from influence of Arroyo Seco recharge.
- The boundary between the Langley Subbasin and the East Side Subbasin approximately coincides with topographic change from dissected upland (Langley) to terrace (East Side).

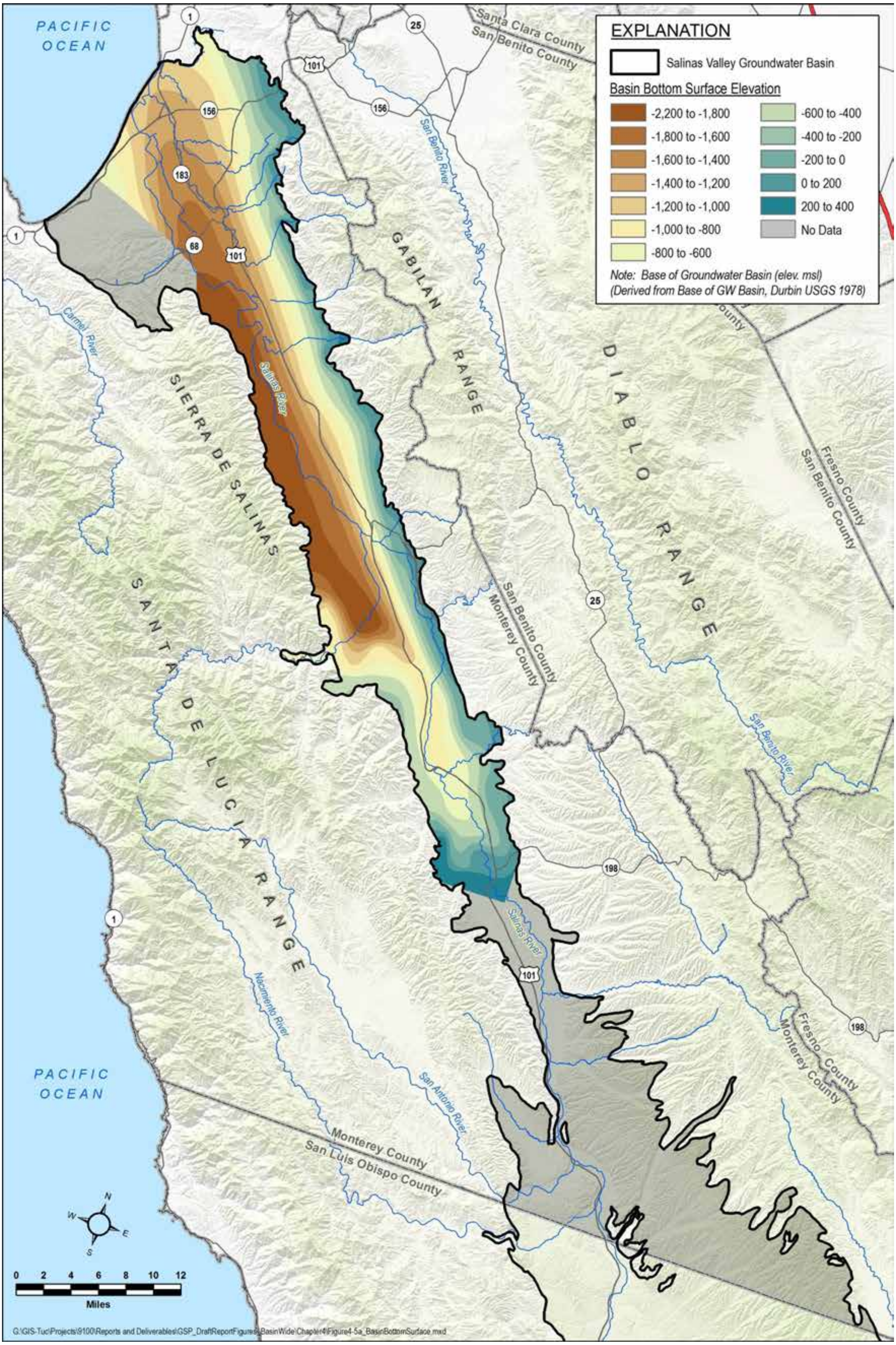

Figure 4-5: Elevation of the Base of the Basin

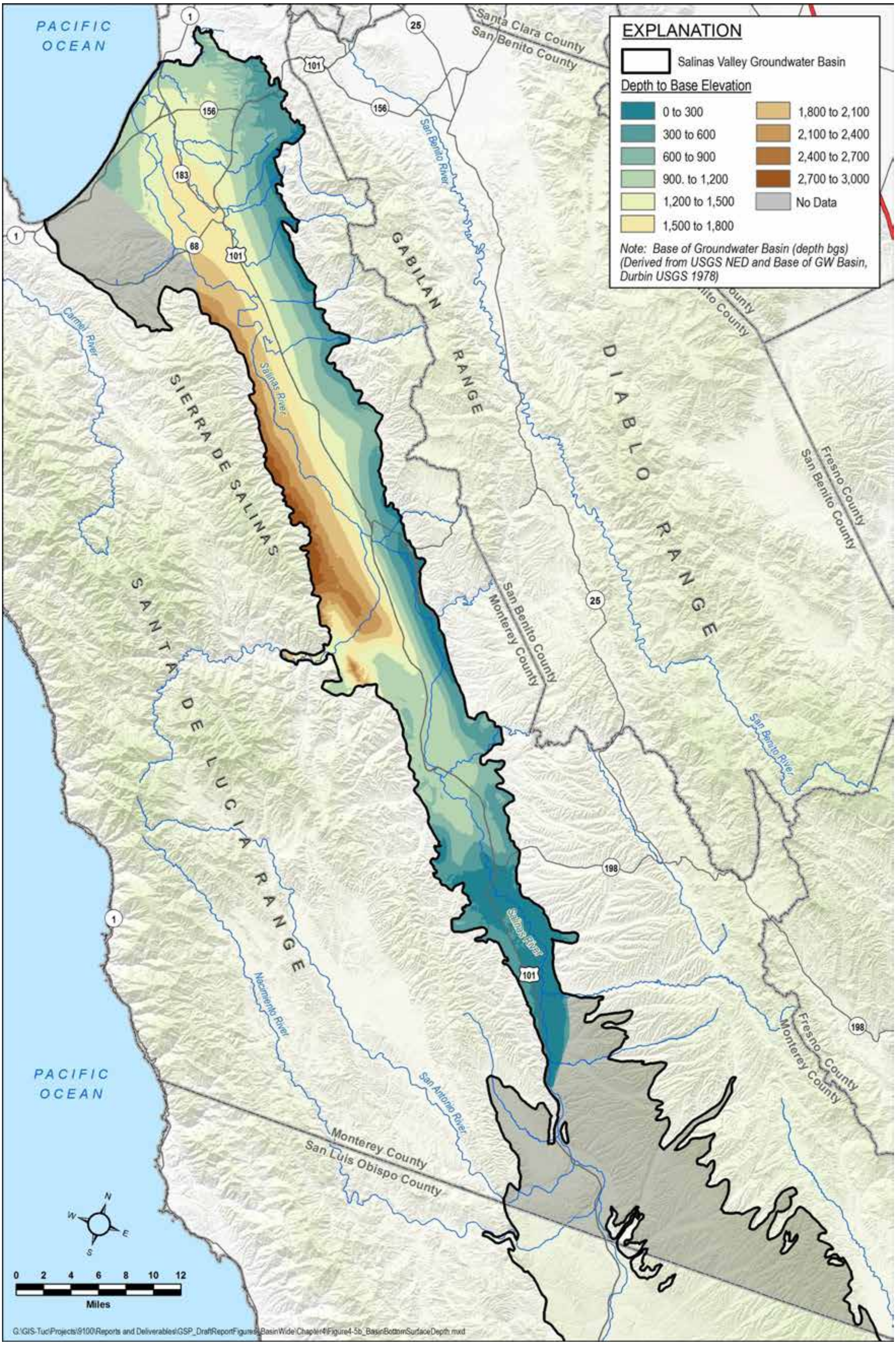

Figure 4-6: Depth to Base of the Basin

4.4 GROUNDWATER HYDROLOGY

Groundwater production is primarily from the alluvium that fills the Salinas Valley structural trough. Throughout most of the basin, the alluvium does not include laterally continuous clay layers to restrict vertical flow and divide the alluvium into distinguishable aquifers. Rather, the alluvium is undifferentiated and groundwater production wells are screened in the shallowest productive sand and gravel intervals.

The presence of laterally continuous clay layers distinguishes the northern subbains including the 180/400-Foot Aquifer Subbasin and the Monterey Subbasin from the other subbasins in the Valley. As described in the following two subsections, the presence of continuous clay layers affects the following aspects of the basin hydrogeology:

- A near-surface clay layer creates relatively shallow confined conditions in the 180/400-Foot Aquifer Subbasin, in contrast to the unconfined conditions over most of the basin
- Deeper clay layers create definable aquifers in the 180/400-Foot Aquifer Subbasin, whereas most of the basin includes only a single undifferentiated aquifer.

4.4.1 CONFINED AND UNCONFINED AREAS OF THE BASIN

Groundwater occurs in unconfined, semi-confined, and confined conditions in the Basin. Throughout most of the southern two-thirds of the Basin, the groundwater system is unconfined, meaning that there is no laterally continuous clay layer capping the productive aquifers. At the northern end of the basin, between approximately Gonzales and Monterey Bay, a laterally continuous shallow blue clay layer, named the Salinas Valley Aquitard, caps the most productive aquifers and separates the aquifers from the Salinas River and other local surface water features (DWR, 1946). While this clay layer is relatively continuous in the northern portion of the Valley, it is not monolithic. The clay layer is missing in some areas and pinches out in certain areas. DWR named the confined area the Pressure Area; and that term is used extensively in reports and in the MCWRA management area designations. The 180/400-Foot Aquifer Subbasin generally corresponds to the Pressure Area.

The other subbasins are predominately in unconfined conditions, with no extensive confining layers. Wells in the Eastside Subbasin are often under semi-confined conditions due to the presence of multiple discontinuous clay and silt layers.

4.4.2 PRINCIPAL AQUIFERS AND AQUITARDS

Groundwater production in the Salinas Valley basin is primarily from alluvial deposits belonging to three geologic units: the Holocene Alluvium (Qa), the Quaternary Older Alluvium (Qoa), and Pliocene Paso Robles Formation. Although these three geologic formations differ in age, they have similar distributions of sediment type and layering and in practice are difficult to distinguish during drilling.

For purposes of groundwater development in the Basin, these geologic units are not recognized as separate and individual aquifers. The principal aquifer in the Basin is simply referred to as alluvium, extending from the ground surface to the base of the groundwater basin. Other terminology, such as "Valley Fill" (Kennedy-Jenks, 2004) have also been assigned to the combined geologic units.

The local definition of multiple aquifers within the alluvium is more a matter of practical resource development than of scientific analysis. The alluvium is split into two or more aquifers only where there is either a laterally continuous aquitard or a laterally continuous high-yield aquifer over a large area such that:

- The aquitard or aquifer is clearly recognized in many wells at approximately the same depth interval,
- The aquitard or aquifer has an observable impact on the groundwater hydrology – typically by a difference in water levels or water quality above and below the aquitard, or noticeably high well yields in an aquifer, and
- There is practical value to well owners in recognizing the presence of the aquitard or aquifer in making well construction decisions based on that knowledge.

Aquitards and high-yield aquifers are recognized by local well owners throughout the Salinas Valley Basin. Although these local aquitards and aquifers may have practical importance to well owners over a square mile or more, most of the local aquitards and aquifers do not influence groundwater flow in the basin at a scale of significance to this ISP. The GSPs for each subbasin (based on the overview provided in this ISP), will include a more detailed description of the local hydrostratigraphy, including aquitards and aquifers that may be of local importance to the subbasin.

A cross-section along the valley length is shown in Figure 4-7. This cross-section is copied from on the most recent published hydrostratigraphic analysis (Brown and Caldwell, 2015). Figure 4-8 shows a southwest to northeast cross-section in the northern portion of the basin. This cross-section is copied from the *Hydrostratigraphic Analysis of the Northern Salinas Valley* (Kennedy/Jenks Consultants, 2004). The hydrogeologic cross-sections are based on geologic logs provided in California Department of Water Resources Water Well Drillers Reports (DWR-188 forms) filed by the well drillers. Because of the limited data regarding the deep aquifers, these are not shown on the Figure 4-7 cross-section. No high-quality cross-sections are available for the southern portion of the Salinas Valley.

As shown on the Figure 4-7 and Figure 4-8 cross-sections, fine-grained layers (aquitards) occur throughout the basin, but in the northern third of the basin there are two aquitards that are laterally continuous from the Monterey Bay coastline to approximately Chualar. The presence of these two extensive aquitards is important to the ISP for the following reasons:

- The shallow aquitard, named the Salinas Valley Aquitard creates a hydraulic separation between the Salinas River and the groundwater system
- The Salinas Valley Aquitard creates a relatively shallow confined groundwater regime, unlike other parts of the basin (Chapter 4.4.1)
- The deeper aquitard has been recognized for nearly a century and led to naming the productive aquifers above and below this aquitard as the 180-foot aquifer and the 400-foot aquifer
- The subbasin boundaries in the northern portion of the basin are largely defined to coincide with the mapped extent of these named aquitards.

As a result, the following aquitards and aquifers have been identified in the 180/400-Foot Aquifer Subbasin and Monterey Subbasin.

- Shallow Aquifer
- Salinas Valley Aquitard
- 180-Foot Aquifer
- 180/400-Foot Aquitard
- 400-Foot Aquifer
- 400-Foot/Deep Aquitard
- Deep Aquifers

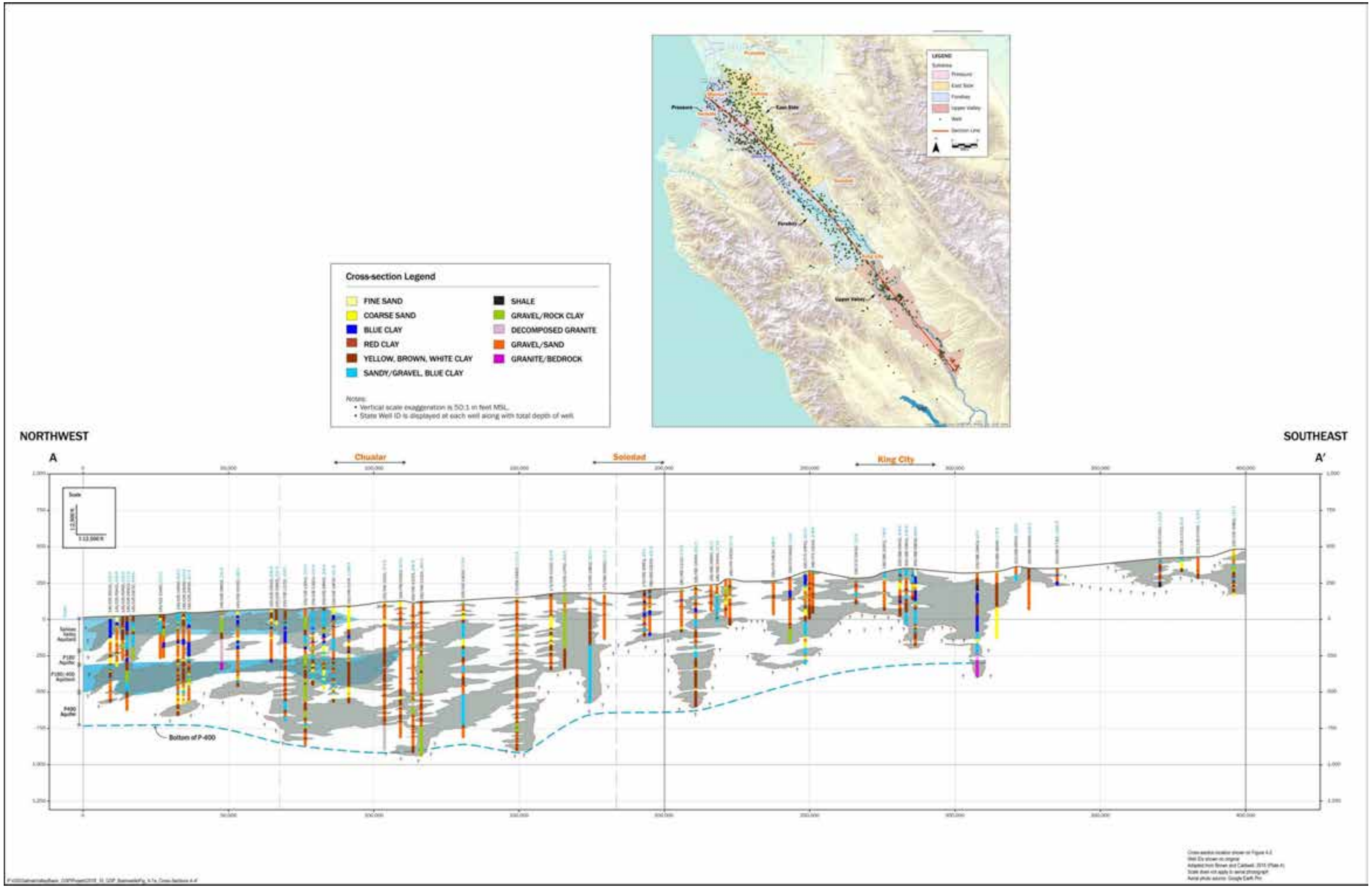

Figure 4-7: Cross-Section A to A′ Showing Principal Aquifers and Aquitards

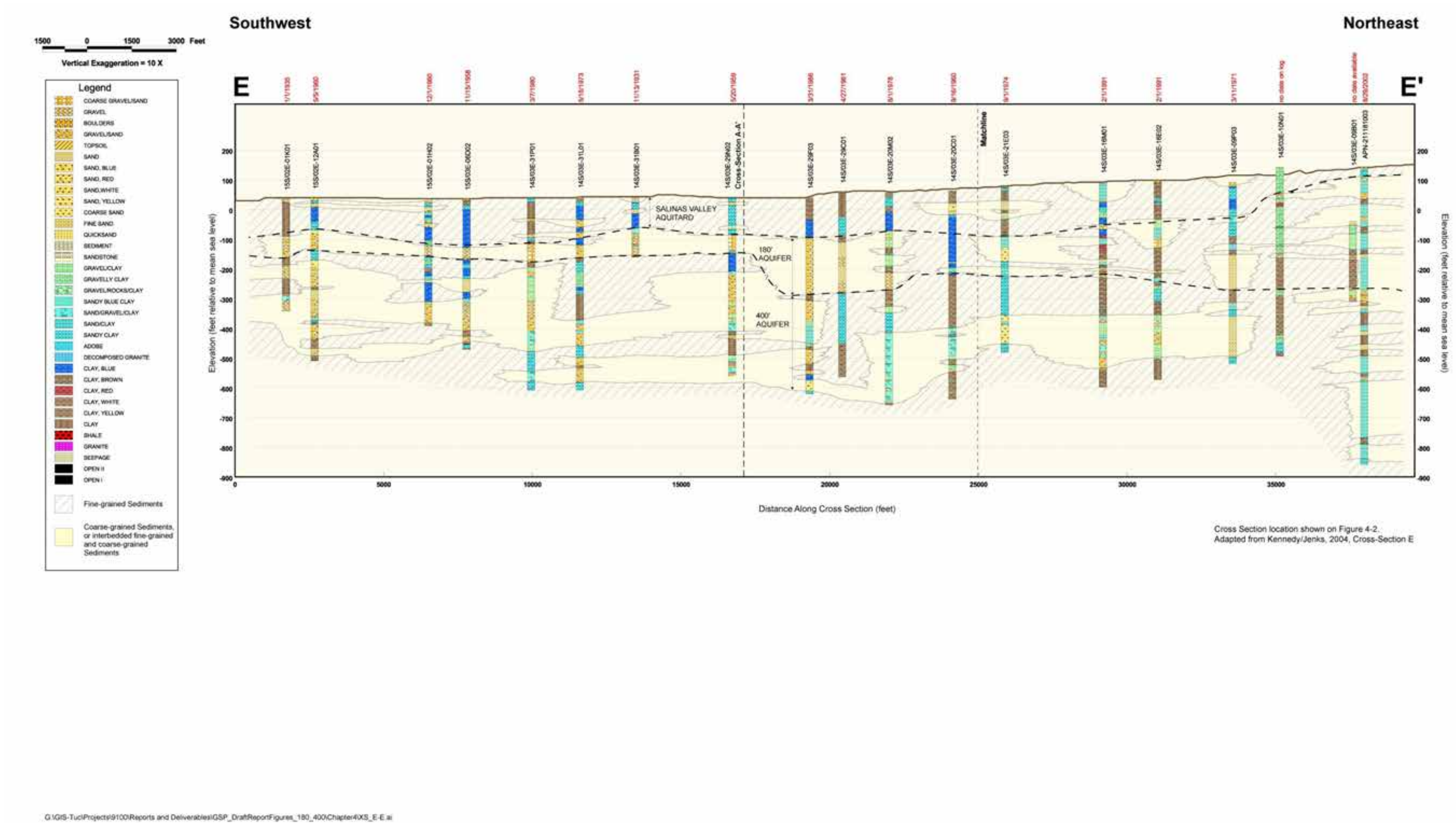

Figure 4-8: Cross Section E-E′ Showing Principal Aquifers and Aquitards

4.4.3 AQUIFER PROPERTIES

The values and distribution of aquifer properties in the Basin have not been well characterized and documented. The relatively sparse amount of measured aquifer properties throughout the Basin is considered a data gap that can be addressed during implementation of the GSPs.

Although hydrogeologic properties have not been measured at many specific locations in the Basin, the aquifer properties have been estimated through the process of model calibration. Aquifer property calibration has completed for numerous published modeling studies including studies by Durbin (1974); Yates (1987); WRIME (2003); and the unpublished Salinas Valley Integrated Hydrologic Model (SVIHM) developed by USGS that is being used in this ISP.

There are two general types of aquifer properties relevant to groundwater management:

- Aquifer storage properties: these properties control the relationship between the volume of groundwater stored in the aquifer and the water level measured in the aquifer, and
- Groundwater transmission properties: these properties control the relationship between hydraulic gradients and the rate of groundwater.

4.4.3.1 AQUIFER STORAGE PROPERTIES

The aquifer properties that characterize the relation between water level and aquifer storage volume are specific yield for unconfined aquifers and either storativity or specific storage for confined aquifers.

- Specific yield is the amount of water that drains from pores when an unconfined aquifer is dewatered. Often specific yield values range from 8% to 20%.
- Specific storage is the amount of water derived from a cubic foot of confined aquifer due to a one-foot decrease in the hydraulic head. Often specific storage values are on the order of $1x10^{-5}$ /ft.
- Storativity is the specific storage of a confined aquifer times the thickness of the aquifer. Because storativity depends on the thickness of the aquifer, a common range of values is not available.

Estimates of specific yield, compiled by DWR for Bulletin 118 are summarized in the middle column of Table 4-1. Estimates of storativity and specific storage are listed in the right-hand column of Table 4-1. The values for the 180/400-Foot Aquifer are specific storage values from the USGS. All other values are storativity values from DWR.

Table 4-1: Aquifer Storage Properties

Subbasin	Specific Yield (ft^3/ft^3)	Storativity (ft^3/ft^3) or Specific Storage (1/ft)
180/400-Foot Aquifer	0.06 – 0.16	0.00012 - 0.00029
East Side	0.06 – 0.16	0.03
Forebay	0.12	0.18 – 0.31
Upper Valley	0.10	0.08 – 0.15
Langley	N/A	N/A
Monterey	N/A	N/A

4.4.3.2 GROUNDWATER TRANSMISSION PROPERTIES

Hydraulic conductivity measures the ability of an aquifer to transmit water. Hydraulic conductivity is measured in units of feet per day. Units with higher hydraulic conductivities, such as sands and gravels, transmit groundwater more easily than units with lower hydraulic conductivities. Another common measurement of the ability of an aquifer to transmit water is transmissivity. Transmissivity is equivalent to the hydraulic conductivity of an aquifer times the thickness of an aquifer. Unfortunately, very few estimates of hydraulic conductivity or transmissivity exist for the Basin.

Potential well yields are sometimes used as a surrogate for aquifer transmissivity. The potential well yields are characterized by the specific capacity of a well. The specific capacity of a well is the ratio between the well production rate in gallons per minute (gpm) and the water level drawdown in the well during pumping, measured in feet (ft).

Specific capacity is relatively well correlated, and approximately proportional to, aquifer transmissivity. Durbin (1978) reported the following well yields and specific capacity estimates:

- Fluvial deposits that constitute the shallowest productive zones in most of the basin, including the 180-Foot Aquifer, have well yields of 500 to 4,000 gpm, decreasing from south to north, and specific capacities averaging 70 gpm/ft and 100 gpm/ft in the northwestern and southeastern portions of the basin, respectively.

- The alluvial fan deposits that are found along the margins of the basin and underlying the fluvial deposits have significantly different properties on the northeastern and southwestern sides of the basin. Alluvium from the Gabilan Range on the northeast (e.g., in the Forebay Subbasin) is relatively clay rich and low permeability, with an average specific capacity of 20 gpm/ft, while alluvium from the Sierra de Salinas has less clay and is more permeable, with an average specific capacity on the Arroyo Seco fan of 100 gpm/ft.
- In the 400-foot aquifer and equivalent units in the southeastern portions of the basin, well yields range from 300 to 4,000 gpm and average 1,200 gpm, with specific capacity averaging about 30 gpm/ft in the northwest and 60 gpm/ft in the southeast.

4.4.3.3 Aquifer Property Estimates in the SVIHM Model

For the SVIHM, the USGS adopted a textural analysis approach to estimating the distribution of hydraulic properties in the aquifers and aquitards of the basin. The USGS assigned coarse-grained material such as sand and gravel one hydraulic conductivity; and assigned fine-grained material such as clay and silt a separate hydraulic conductivity. By assessing the relative ratios of coarse and fine grained material, USGS could generate estimated hydraulic conductivity values at each point in the model. The USGS used a similar textural analysis to determine the specific storage (Ss) using a more complex set of parameters.

4.4.4 Natural Recharge Areas

Areas of significant, natural, areal recharge and discharge within the Salinas Valley Basin are discussed below. Quantitative information about all natural and anthropogenic recharge and discharge is provided in Chapter 6: Water Budgets. Natural groundwater recharge occurs through the following processes:

- Infiltration of surface water from the Salinas River, Arroyo Seco and tributary channels
- Deep percolation of excess applied irrigation water
- Deep percolation of infiltrating precipitation

The capacity for groundwater recharge is a dependent on a combination of factors, including steepness of grade, soil surface condition such as paving or compaction, and the ability of soil to transmit water past the root zone. To assist agricultural communities in California with assessing groundwater recharge potential, a consortium of researchers at UC Davis developed a Soil Agricultural Groundwater Banking Index

(SAGBI) and generated maps of recharge potential in agricultural areas of California (O'Geen et al., 2015). Figure 4-9presents the SAGBI index map for the Plan area. This map ranks soil suitability to accommodate groundwater recharge based on five major factors that affect recharge potential including: deep percolation, root zone residence time, topography, chemical limitations, and soil surface condition. Areas with excellent recharge properties are shown in green. Areas with poor recharge properties are shown in red. Not all land is classified, but this map provides good guidance on where natural recharge likely occurs.

Although Figure 4-9 shows some areas of good potential recharge in the 180/400-Foot Aquifer Subbasin, recharge to the productive zones of the Subbasin is very limited because of the low permeability Salinas Valley Aquitard. It is unlikely that any significant surficial recharge in the 180/400-Foot Aquifer Subbasin reaches the productive 180-Foot Aquifer or the 400-Foot Aquifer. This demonstrates the limited utility of potential recharge maps that are based on soil properties. This map should not be used to identify recharge areas that will directly benefit the extensive aquifers in the 180/400-Foot Aquifer Subbasin.

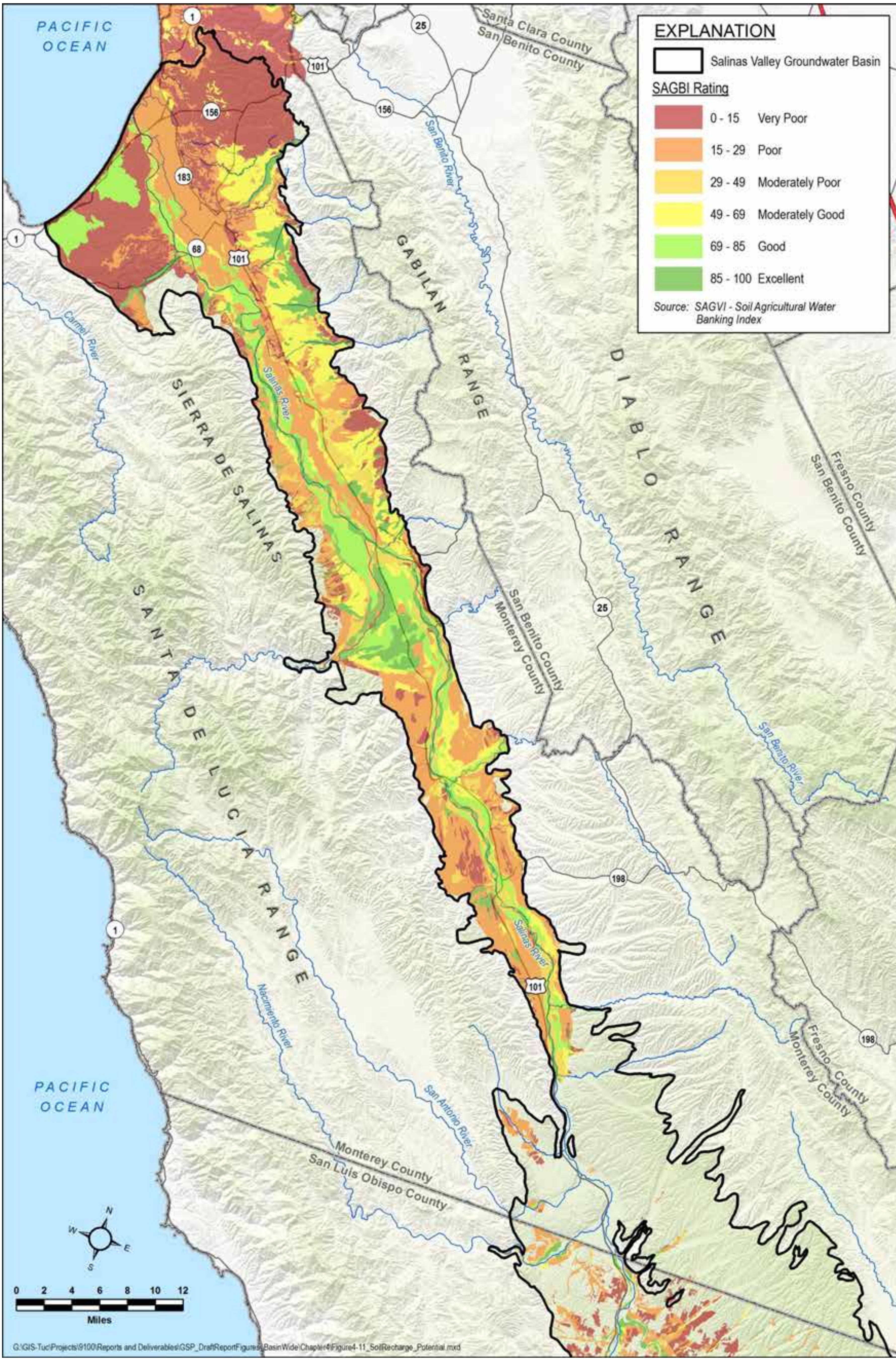

Figure 4-9: SAGBI Soils Map

4.4.5 NATURAL DISCHARGE AREAS

Natural groundwater discharge occurs as springs and seeps. Figure 4-10 presents the locations of springs/seeps mapped by the National Hydrographic Data Set. As shown in Figure 4-10, the springs and seeps occur near the basin boundaries. These areas are typically in relatively steep portions of alluvial fans and where the alluvium is in contact with adjacent bedrock of the Gabilan and Santa Lucia Ranges. With respect to the basin hydrology, the springs and seeps represent a negligible portion of the total basin discharge. Furthermore, they occur in the recharge areas of the basin, upgradient from production wells, and therefore will not be affected by groundwater management under this ISP.

Figure 4-11 shows the distribution of potential groundwater-dependent ecosystems (GDEs) and Natural Communities Commonly Associated with Groundwater (NCCAG) within the basin area. In areas where the water table is sufficiently high, groundwater discharge may occur as ET from phreatophyte vegetation within these GDEs. Appendix 4A describes methods used to determine the extent and type of potential GDEs. Figure 4-11 shows only potential GDEs. There has been no verification that the locations shown on this map constitute groundwater dependent ecosystems. Additional field reconnaissance is necessary to verify the existence of these potential GDEs. Figure 4-11 may include temporary constructed wetlands (*e.g.* San Ardo Oil Field treatment wetlands) which do not impose a demand on the groundwater basin.

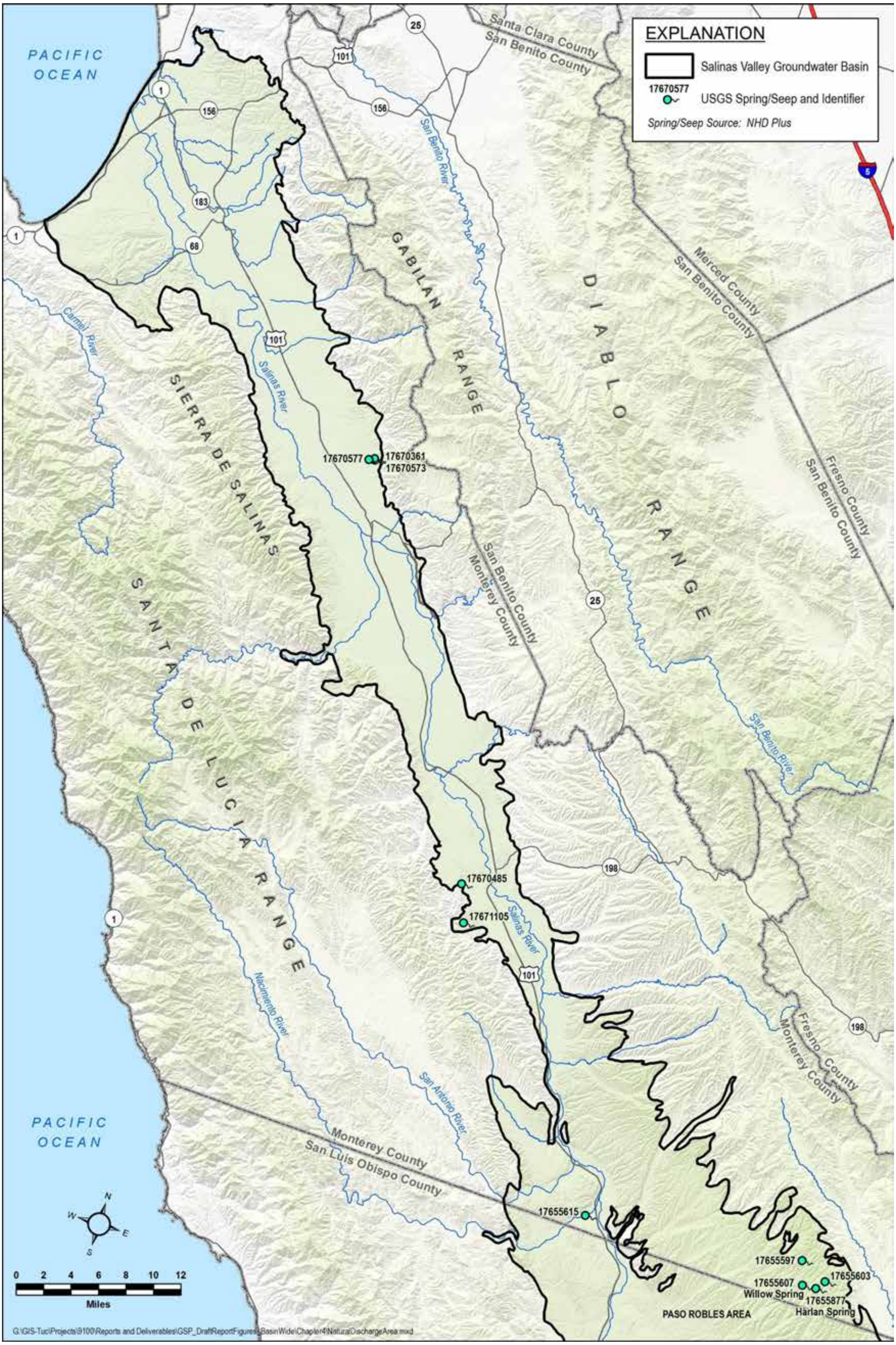

Figure 4-10: Natural Discharge Areas

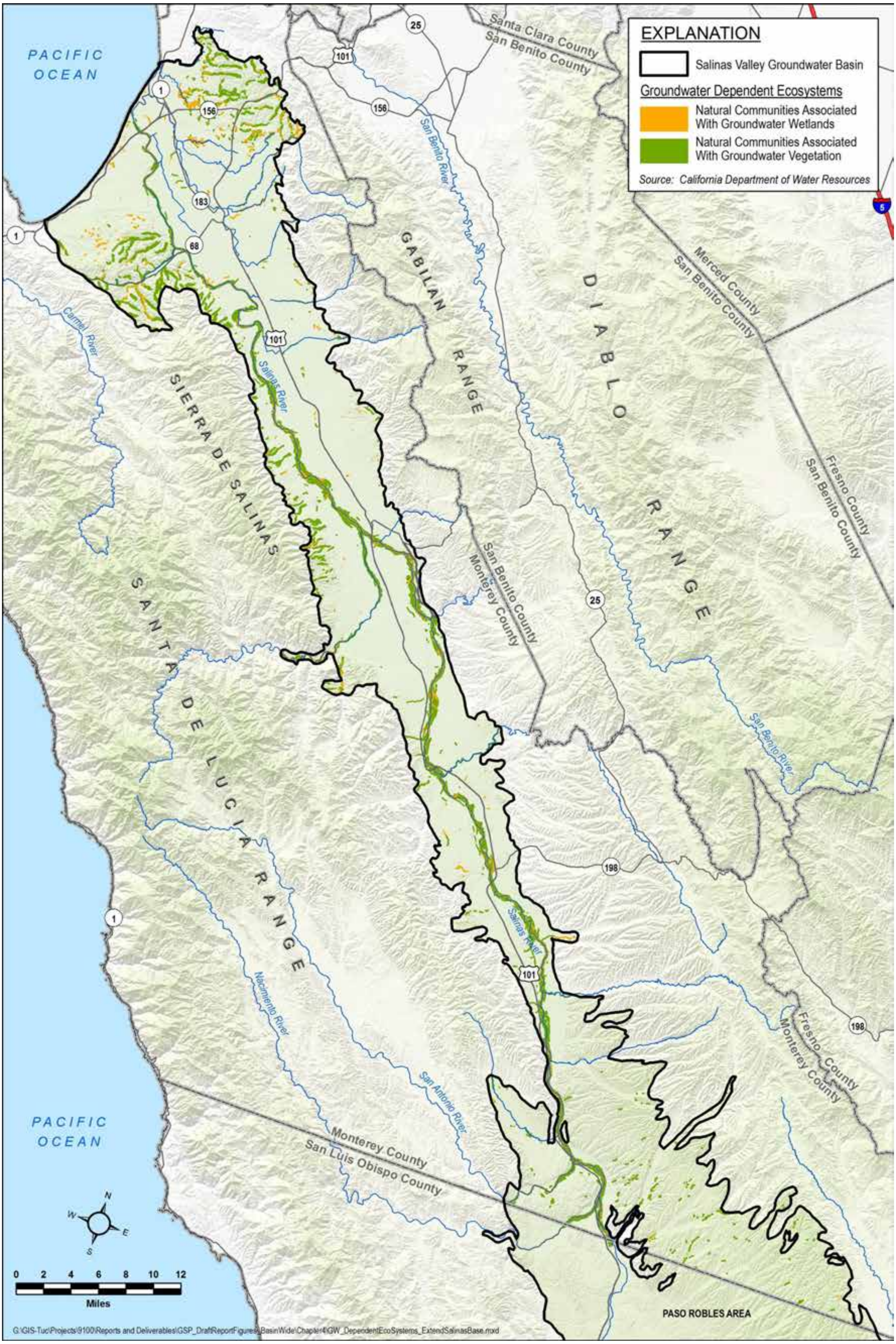

Figure 4-11: Potential Groundwater Dependent Ecosystems

4.5 SURFACE WATER BODIES

The primary surface water body in the Basin is the Salinas River. This river runs the entire length of the Basin (Figure 4-12**)**. As shown on Figure 4-12, the Salinas River is fed by the following main tributary systems. The three systems and the associated tributaries include:

- From Santa Lucia Range and Sierra de Salinas:
  - Arroyo Seco
  - San Antonio River
  - Nacimiento River
  - El Toro Creek
  - Hames Creek
- From Gabilan Range:
  - San Lorenzo Creek
  - Chalone Creek
  - Stonewall Creek
  - Pancho Rico Creek
  - Sargent Creek
- Valley Floor:
  - Blanco Drain
  - Reclamation Ditch #1665 (Rec Ditch)

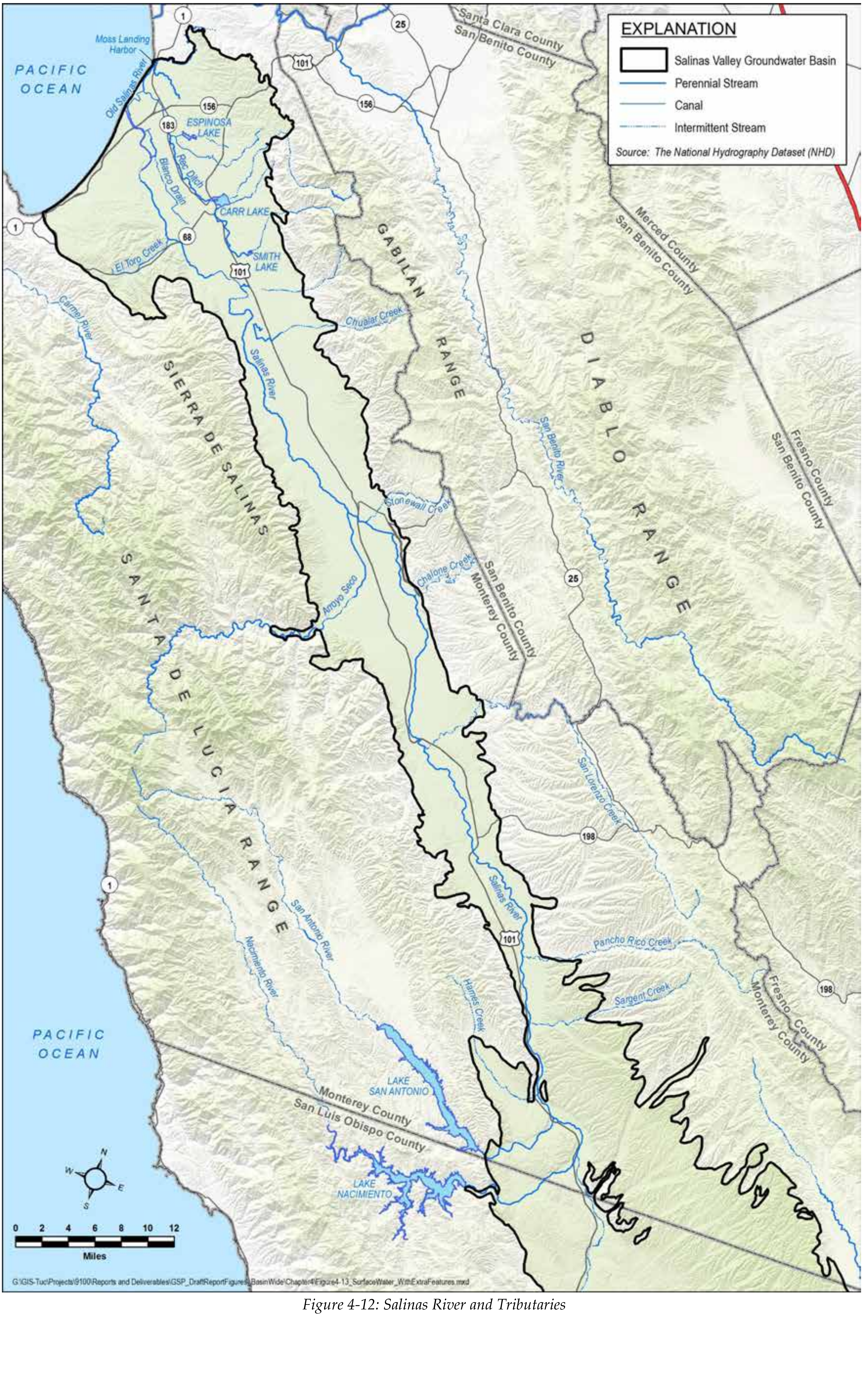

Figure 4-12: Salinas River and Tributaries

Releases to the Salinas River are controlled by two surface-water reservoirs: Lake Nacimiento and Lake San Antonio. Lake Nacimiento, in San Luis Obispo County, was constructed in 1957 and has a storage capacity of 335,00 acre-feet (MCWRA, 2018). Lake San Antonio, in Monterey County, was constructed in 1967 and has a storage capacity of 377,900 acre-feet. The locations of these reservoirs are depicted on Figure 4-12. The primary purposes of these reservoirs are to control flooding and to increase groundwater recharge from Salinas River. Although these two reservoirs are located outside of the SVIGSP area, they provide surface water storage in the upper watershed of the Salinas River and are important controls on the rate and timing of surface water flows in the Salinas River.

After the flow contribution from the San Antonio and Nacimiento Rivers and their associated reservoirs, the next largest contribution to flow comes from the Arroyo Seco, with a 275 square mile drainage area. With no dams in its drainage basin, flow of the Arroyo Seco is characterized by both very high flood flows and extended dry periods.

In the northern portion of the basin, two constructed canals convey surface water across the valley floor. The Rec Ditch was originally constructed in 1917 and is operated in part by MCWRA for flood management. The ditch flows southeast to northwest and drains the stormwater detention from Smith Lake and Carr Lake before flowing northwest towards Castroville and discharging first into Tembladero Slough and then into the Old Salinas River Channel and ultimately into Moss Landing Harbor (MCWRA Website). Blanco Drain, also known as Storm Maintenance District No. 2, is a drainage system that covers approximately 6.400 acres of farmland, predominately receiving agricultural return flow from tile drains in the dry season and stormwater runoff in the wet season. Blanco drain discharges into the Salinas River (Figure 4-12).

Near the Pacific Ocean, the Salinas River forms a lagoon and its outflow to Monterey Bay is blocked by sand dunes except during winter high-water flows. MCWRA operates a slide gate to transfer water through a culvert from the lagoon into Old Salinas River during the wet season for flood control (MCWRA, 1994).

4.6 Imported Water Supplies

No water is imported into the Salinas Valley Basin.

4.7 Water Quality

This section presents a general discussion of the natural groundwater quality in the Basin, focusing on general minerals. This discussion is based on data from previous reports. Discussion of the distribution and concentrations of specific constituents is presented in Chapter 5: Current Conditions.

4.7.1 General Mineral Chemistry

The major ion chemistry of Salinas Basin groundwater was characterized in a report prepared for the Central Coast Groundwater Coalition (CCGC) titled *Distribution of Groundwater Nitrate Concentrations, Salinas Valley, California* (LSCE, 2015). The purpose of the report was to respond to the Regional Board requirement for monitoring elevated nitrate concentrations near drinking water supply wells. The report included the results of extensive groundwater quality sampling and thus provided a good characterization of the general mineral water quality.

Figure 4-13 presents four Piper diagrams from the CCGC report that plot major ion data from subareas of the Salinas Valley Basin. The diagrams provide a means of representing the proportions of major anions and cations in water samples and thereby can be used to illustrate spatial trends in the character of the water quality.

Because groundwater flows southeast to northwest, the characterization of water chemistry from the subbasins can be viewed as a progressive evolution of groundwater chemistry from the Upper Valley Subbasin to the Forebay Subbasin to the 180/400-Foot Aquifer Subbasin to the Eastside Aquifer Subbasin. When viewed in this sequence, the following general pattern has been recognized and reported (LSCE, 2016, Boyle et al., 2012):

- A gradational shift along the flow direction from calcium/magnesium-chloride/sulfate groundwater towards calcium/magnesium-bicarbonate/carbonate groundwater (upper diamond-shaped diagram).
- A gradational shift in the anion diagram (lower right triangle) from chloride and sulfate to bicarbonate/carbonate.
- A gradational shift in the cation diagram (lower left triangle) from calcium to sodium.

Previous investigators have hypothesized that the progressive change in water chemistry results from cation exchange in clays and dissolution of carbonate minerals leading to the increase in bicarbonate/carbonate (Boyle et al., 2012, LSCE, 2016).

Although these changes in major-ion water chemistry may have some impact to specific water uses, they do not cause impacts to the beneficial uses of the groundwater.

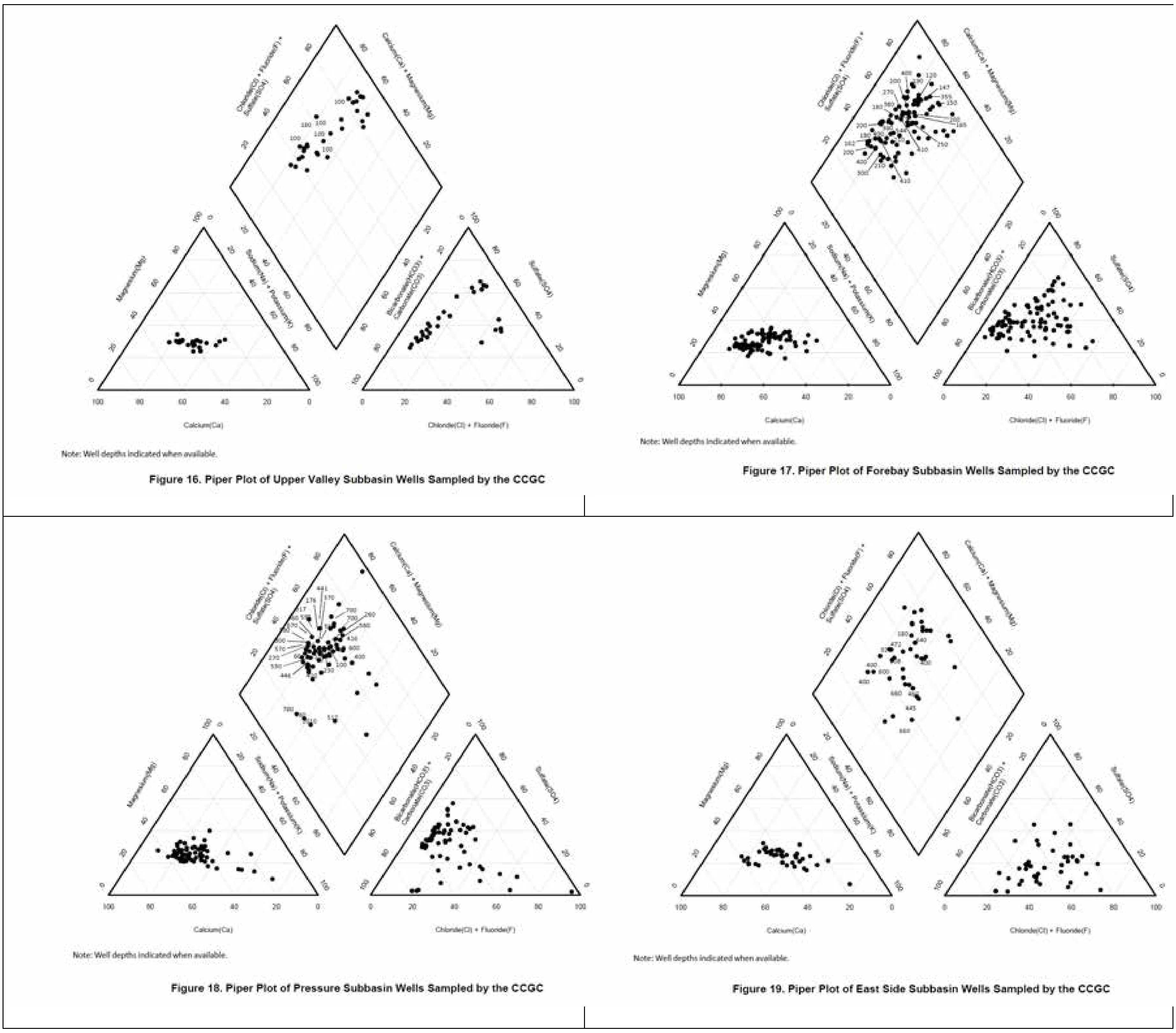

Figure 4-13: Piper Diagrams

4.7.2 SEAWATER INTRUSION

Groundwater pumping has reduced groundwater levels below sea level and caused seawater to flow into the basin from the Monterey Bay. Increased salt concentrations, measured as TDS or chloride concentration, are considered a nuisance rather than a health or toxicity concern. Increased salt concentrations impact the ability to use water for applications such as irrigation.

The impact of seawater intrusion on the practical use of groundwater occurs at concentrations much lower than that of seawater. TDS concentration in seawater is approximately 35,000 mg/L. The State of California has adopted a recommended Secondary Maximum Contaminant Level (SMCL) for TDS of 500 mg/L, and a short term maximum SMCL of 1,500 mg/L. These recommendations are based on taste rather than health impacts. The TDS limit for agricultural use is crop dependent: a 10% loss of yield in lettuce crops has been observed at a TDS of 750 mg/L; a 10% loss of yield in tomatoes has been observed at a TDS of 1,150 mg/L (FAO Irrigation and Drainage Paper 29, 1985).

The current seawater intrusion conditions are described more fully in Chapter 5.

4.8 DATA GAPS

Due to decades of extensive study and groundwater development, the structure and boundaries of the hydrogeologic conceptual model is relatively well-developed. However, there are a few notable data gaps including:

- There are very few measured aquifer parameters in the Basin.
- The hydrostratigraphy, vertical and horizontal extents, and potential recharge areas of the deep aquifers are poorly known.

Therefore, the ISP and related GSPs should include actions to reduce this data gap and thereby improve the quantification associated with this hydrogeologic conceptual model.

As described in Chapter 8, the ISP will include ongoing data collection and monitoring that will allow continued refinement and quantification of the groundwater system. However, the proposed data collection is not expected to alter the conceptual model as described above.