2014 AND 2015 PIRU AND FILLMORE BASINS BIENNIAL GROUNDWATER CONDITIONS REPORT

Open-File Report 2016-01
June 2016

THIS REPORT IS PRELIMINARY AND IS SUBJECT TO MODIFICATION BASED UPON FUTURE ANALYSIS AND EVALUATION

PREPARED BY
GROUNDWATER
RESOURCES
DEPARTMENT

UNITED WATER
CONSERVATION
DISTRICT

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Cover Photo: Santa Clara River dry stream channel in the Fillmore groundwater basin looking downstream west of the Fillmore Fish Hatchery (downstream of the Piru/Fillmore basin boundary) on 10/28/2014.

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EXECUTIVE SUMMARY

This 2014 and 2015 Biennial Groundwater Conditions Report (previous reports in the series entitled AB 3030 Biennial Groundwater Conditions Report) was prepared by the United Water Conservation District (United Water or United) Groundwater Department. It contains recent and historical information and data on precipitation, groundwater recharge, surface water flows, groundwater extractions, groundwater levels, surface water and groundwater quality, and includes discussion regarding the proposed Upper Santa Clara River Chloride TMDL, wastewater treatment plants, the Toland Road Landfill and agricultural land use in the Piru and Fillmore basins.

This report serves to keep the interested parties current on the groundwater conditions of the Piru and Fillmore basins. The AB 3030 groundwater management program has been superseded by the Sustainable Groundwater Management Act enacted January 1, 2015 by the California Legislature. Representatives for the Piru and Fillmore basins have until January 31, 2022 to submit Groundwater Sustainability Plans for these basins to the California Department of Water Resources (CA DWR). Below is a summary of the information contained in this report.

Precipitation

Ventura County precipitation in water years 2014 and 2015 was low enough to be considered drought conditions; 2015 was the fourth consecutive year of drought. Piru basin precipitation for the 2014 and 2015 water years was 7.72 and 12.18 inches respectively, as recorded at the Piru-Temescal Guard Station at Lake Piru. For the period of record at this gage (1950 to 2015) the average water year precipitation is 20.01 inches and the median precipitation is 17.08 inches.

Fillmore basin precipitation for water years 2014 and 2015 was 7.49 and 11.36 inches, respectively, as recorded at the Fillmore Fish Hatchery near the Piru-Fillmore basin boundary. Precipitation in 2014 was 10.83 inches below the historical average precipitation of 18.32 inches (1957 to 2015). The median precipitation for this gage is 16.05 inches.

Conservation Releases

United Water's usual fall conservation releases from Lake Piru provide groundwater recharge to both the Piru and Fillmore basins (and other basins located further down-gradient) at a time when natural runoff into the Santa Clara River is limited. Below-average precipitation since 2012 and the subsequent low inflow into Lake Piru resulted in United Water's inability to perform a fall conservation release from Lake Piru in either 2014 or 2015.

Groundwater Extractions

In calendar year 2014 a total of 14,102 acre-feet of groundwater extraction from the Piru basin was reported to United Water, which is 1,699 acre-feet greater than the historical average (from 1980 to 2015). In calendar year 2015 a total of 14,139 acre-feet of groundwater extraction was reported for the Piru basin, totaling 1,736 acre-feet more than the historical average.

In calendar year 2014 a total of 50,327 acre-feet of groundwater extraction was reported for the Fillmore basin, which is 5,729 acre-feet greater than the historical average (from 1980 to 2015). In calendar year 2015 a total of 47,722 acre-feet of groundwater extraction was reported for the Fillmore basin, which is 3,124 acre-feet more than the historical average.

In 2014 and 2015 most well production was measured and reported to United by water meter, estimated by electrical use with an efficiency rating, or by a domestic use multiplier. United Water's Board of Directors voted in 2013 to eliminate the option of reporting by crop factor, effective January 1, 2014.

Groundwater Levels

This report presents water levels in two key wells for each basin and compares recent water levels to groundwater elevation benchmarks and Basin Management Objective (BMO) limits for groundwater elevations. The BMOs for selected wells are intended to sustain groundwater elevations above the low water levels recorded near the end of the 1984 to 1991 drought. Groundwater elevation benchmarks and BMOs were first introduced in the Draft 2011 Piru/Fillmore Basins AB 3030 Groundwater Management Plan update.

Groundwater elevations in the Piru key well located near Piru Creek dropped below its BMO in early summer 2015, continued to decline for the rest of the calendar year, and went dry November 2015. Groundwater elevations in the Piru key well located near Hopper Creek dropped below its BMO in August 2015 and continued to decline for the rest of the calendar year.

Groundwater elevations in the Fillmore key well located in the Bardsdale area dropped below its BMO in August 2015 and continued to decline for the rest of the calendar year. Groundwater elevations in the Fillmore basin key well located in the Sespe Uplands area dropped below its BMO near the end of calendar year 2015.

Surface Water Quality

Surface water quality records from years 2014 and 2015 are summarized in this report and compared to BMOs. The surface water quality BMOs were first introduced in the Draft 2011 Piru/Fillmore Basin AB 3030 Groundwater Management Plan update.

Surface water chloride concentrations in the Santa Clara River near the Ventura/Los Angeles County Line from calendar years 2014 and 2015 ranged above both the BMO of 100 mg/L and the 117 mg/L toxicity threshold for avocados (CH2M HILL, 2005). Monthly samples from this location ranged from 116 to 152 mg/L, and averaged 130 mg/L.

Sespe Creek has historically shown highly-variable chloride concentrations, but an upward trend is apparent for calendar years 2012 through 2015, with a maximum-recorded chloride concentration of 207 mg/L (three and a half times the BMO). In 2015, recorded concentrations of TDS, sulfate and boron also ranged above the BMOs.

Water quality samples from the Santa Clara River near Willard Road at the Fillmore/Santa Paula basin boundary also showed TDS, sulfate and chloride concentrations above BMOs in 2015.

Groundwater Quality

Maximum-recorded groundwater concentrations from 2015 are mapped for various constituents, and water quality time series for selected wells are shown in this report and compared to groundwater quality BMOs. The groundwater quality BMOs were first introduced in the Draft 2011 Piru/Fillmore Basins AB 3030 Groundwater Management Plan update.

Elevated chloride concentrations were seen in 2015 in groundwater east of Piru Creek, with the maximum chloride concentration in three wells ranging from 130 to 136 mg/L. The maximum 2015 chloride concentration in wells between Hopper Creek and Piru Creek was 116 mg/L. These elevated chloride concentrations in groundwater are believed to be associated with high-chloride effluent discharged into the Santa Clara River from Los Angeles County wastewater treatment plants (WWTPs) since 1999.

Upper Santa Clara River Chloride TMDL

In 2008 the Los Angeles Regional Water Quality Control Board (Regional Board) approved a chloride Total Maximum Daily Load (TMDL) for the Upper Santa Clara River. The TMDL included provisional changes to some water quality objectives, and mitigation for the continued loading of chloride in the Piru basin was to be addressed by the Alternative Water Resources Management Plan (AWRM) which included measures to export chloride from the basin. Over the next several years the AWRM proposal suffered a number of setbacks, including a lack of necessary funding and various proposals to scale back the scope of the project. The AWRM proposal eventually was abandoned but the timeline for chloride compliance in the TMDL remains in effect. A proposal for the deep injection of brines received significant community opposition, and the Sanitation Districts are now pursuing a project that would truck salts from the watershed as concentrated brines. Under the adopted Chloride TMDL chloride discharges of less than 100 mg/L are required by July 2019.

Los Angeles County Wastewater Treatment Plants

In the 2014 calendar year the Valencia WWTP discharged approximately 14,990 ac-ft of effluent into the Santa Clara River, with an average chloride concentration of 135 mg/L. In calendar year 2015 the Valencia WWTP discharged approximately 14,440 ac-ft of effluent into the Santa Clara River with an average chloride concentration of 144 mg/L. There is an upward trend in Valencia WWTP effluent chloride concentrations from 2012 through 2015. The Saugus WWTP is located several miles upstream of the Valencia plant and discharged about 6,000 ac-ft of water to the channel of the Santa Clara River in both 2014 and 2015, with chloride concentrations averaging about 135 mg/L. Much of the discharge from the Saugus plant percolates as recharge to the Eastern basin. Discharge from the Valencia plant, however, constitutes a significant percentage of the Santa Clara River base flow entering the Piru basin.

2014 AND 2015 PIRU AND FILLMORE BASINS BIENNIAL GROUNDWATER CONDITIONS REPORT

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1 BACKGROUND AND INTRODUCTION

United Water Conservation District (United) is a public agency authorized under the California Water Code section 74500 et al. to conduct water resource investigations, acquire water rights, build facilities to store and recharge water, construct wells and pipelines for water deliveries, commence actions involving water rights and water use, and to prevent interference with or diminution of stream/river flows and associated natural subterranean flows, and other activities. The area under United's jurisdiction includes much of the Ventura County portion of the Santa Clara River Valley and the greater Oxnard Plain. The District is governed by a seven-person board of directors elected by region, and receives revenue from property taxes, pump charges, recreation fees, and water delivery charges. United conducts various monitoring programs as part of its mission of water resource management. Much of the water quality and water level data contained in this report was collected by United staff. Other information, such as pumping records, is reported to United. Additional information is collected by other individuals or agencies and is later obtained and archived by United's Groundwater Department.

California Assembly Bill 3030 was enacted in 1992, which established in the California Water Code sections 10750-10756, a systematic procedure for a local agency to develop a groundwater management plan (CA-DWR, 2012). Subsequently, in 1995, a Memorandum of Understanding (M.O.U.) was signed among United Water Conservation District (United Water or United), the City of Fillmore, water companies and other pumpers to establish how an AB 3030 groundwater management plan would be formulated for the Piru and Fillmore groundwater basins (M.O.U.,1995). The M.O.U. established that the Management Plan would be a cooperative plan for the basins. After the adoption of the M.O.U., a Groundwater Management Plan (Plan) was formulated and adopted in 1996. The Plan outlined the roles of the various parties in implementing a groundwater management program, including the establishment of a Groundwater Management Council to manage the Plan. The Council consisted of seven members: two City Council representatives from Fillmore, four pumpers (of which two were from private entities and two from investor-owned companies or mutual water companies), and one elected board member from United Water.

SB 1938 (2002) and AB 359 (2013) required additional elements be included in all AB 3030 management plans, and an updated Draft Piru/Fillmore Basins AB 3030 Groundwater Management Plan was submitted to the AB 3030 Groundwater Management Council in 2011. The Draft Plan update included Basin Management Objectives (BMOs) for groundwater elevations, groundwater quality and surface water quality at various locations. It also included a groundwater export policy which provoked considerable discussion. In 2013 an updated version of the Draft Plan was submitted to the Council. The revised draft of the Plan was never adopted by the Council and therefore never finalized. The AB 3030 process has since been superseded by the Sustainable Groundwater Management Act.

On January 1, 2015 California legislation (AB 1739, SB 1168 and SB 1319) was enacted that requires every groundwater basin in California to be managed sustainably by the year 2042. These three original sustainability bills are collectively known as the Sustainability Groundwater Management Act (SGMA). The legislation provides for the formation of local Groundwater

Sustainability Agencies (GSAs) that will be responsible for writing and implementing Groundwater Sustainability Plans (GSPs). GSPs are to be submitted to the CA Department of Water Resources (CA DWR) for review and approval. Groundwater basins that have gone through an adjudication process (such as the Santa Paula basin) are exempt from a number of the SGMA requirements but do have new requirements to report basin conditions to the CA DWR. All other basins, including those formally governed under AB 3030, will be managed under the new legislation. Representatives for the Piru and Fillmore basins have until January 31, 2022 to submit Groundwater Sustainability Plans for these basins to the CA DWR. This report serves to keep interested parties current on the groundwater conditions of the Piru and Fillmore basins in the interim between the end of the AB 3030 program and the development of new GSAs and GSPs. A number of pumpers and various agencies, including United, are now involved in the formation of GSAs to comply with SGMA requirements.

This biennial report contains recent and historical hydrologic information related to the Piru and Fillmore basins, including: data on precipitation, groundwater recharge, surface water flows, groundwater extractions, groundwater levels, surface water quality, groundwater quality, the Chloride TMDL for the upper Santa Clara River, wastewater treatment plant discharges, the Toland Road Landfill and changes in agricultural land use.

2 BASIN DESCRIPTIONS AND HYDROGEOLOGIC SETTING

The Piru and Fillmore basins are two of the series of alluvial groundwater basins located along the Santa Clara River Valley in Ventura County, California (Figure 1). They lie within the Santa Clara River Watershed and fully within Ventura County. The basins are connected sub-basins in the larger groundwater system of the Santa Clara River valley, but the common vernacular is to refer to them as basins. Both basins are also located within United Water's District boundaries, except for the very eastern portion of the Piru basin (Figure 1). The City of Fillmore and the town of Piru are located within these basins, but the predominant land use is agricultural.

The eastern boundary of the Piru basin is approximately 1.7 Santa Clara River-miles west of the Ventura/Los Angeles County Line and approximately 2.2 Santa Clara River-miles east (outside) of United Water's boundary. This is at a point where the alluvium is thin and underlain by non water-bearing rocks. Other agencies (CA DWR) map additional areas as part of the Piru basin (lower Piru Creek and lower Tapo Canyon). The western boundary of the Piru basin is located approximately one mile upstream of the City of Fillmore near the Fillmore Fish Hatchery. The topographic narrows in this vicinity result in a gaining reach of the Santa Clara River. The Piru groundwater basin covers a surface area of approximately 7,025 acres (Mann, 1959).

The Fillmore basin is contiguous with and lies west of the Piru basin (Figure 1). The basin extends northward to include the Pole Creek fan and the greater floodplain of Sespe Creek, extending approximately four miles north of Highway 126. The western boundary of the Fillmore basin is located approximately 0.5 miles west of Willard Road, which is just east of the City of Santa Paula and is distinguished by an area of rising groundwater (a gaining reach of the river). The surface area of the Fillmore basin is approximately 18,580 acres (Mann, 1959).

2.1 PIRU BASIN

The Piru basin consists of recent and older alluvium underlain by the Pleistocene San Pedro formation. The recent and older alluvium exists almost basin-wide and is made up primarily of coarse sand and gravel. The recent alluvium ranges in thickness from approximately 20 feet near Blue Cut at the east end of the basin to 60-80 feet in the remainder of the basin. The older alluvium occurs as terrace deposits and as a layer of variable thickness (up to 80 feet) under the recent alluvium (Mann, 1959).

The San Pedro Formation is folded into a syncline with an east-west oriented axis and underlies the older alluvium, except at the east end of the basin where the older alluvium is underlain by impermeable Pico formation. The San Pedro formation consists primarily of permeable sand and gravel and can extend to a depth of approximately 8,800 feet, as interpreted from oil well electrical logs (Mann, 1959). The depth from which groundwater production is suitable for agricultural and urban use and can be reasonably extracted is however considerably shallower than 8,800 feet. Few water wells deeper than 700 feet exist in the Piru basin.

Three principal faults bound the Piru basin: the Oak Ridge fault to the south, and the San Cayetano and Camulos faults to the north (Figure 2).

The channel of the Santa Clara River lies along the southern margins of the Piru basin. Downstream of Newhall Bridge, near the east end of the basin, the channel begins to broaden significantly. The percolation of surface water in the channel of the Santa Clara River is the largest source of recharge to the Piru basin. There are no known structural or stratigraphic barriers impeding recharge from the Santa Clara River.

Groundwater flow in the alluvium of the Piru basin tends to be westerly, parallel to the river channel. Similarly, groundwater flow in the San Pedro formation is generally westerly with a small northerly and southerly components (Figures 3-6). Clay layers have been identified at some locations within the basin but are not thought to be continuous. The basin is considered to be an unconfined groundwater basin.

The reach of the Santa Clara River within the topographic narrows located about one mile upstream from the City of Fillmore (and near the Fillmore Fish Hatchery) displays perennial rising groundwater (a gaining stream reach) in all but the very driest of years (Figure 7). The gaining stream reach extends upstream to the vicinity of Hopper Creek when the Piru basin is full and contracts downstream towards the basin boundary as water levels fall within in the basin. This reach was dry fall of 2014 and much of calendar year 2015. This is a rare condition, directly related to drought conditions and low water levels in the Piru basin.

2.2 FILLMORE BASIN

The northern portion of the Fillmore basin located west of Sespe Creek is called the Sespe Upland (Figure 2). The Sespe Upland is characterized by steep south-sloping alluvial fan material, including complex terrace deposits, older alluvial fan deposits and recent alluvial fan deposits, which unconformably overlie the Pleistocene San Pedro formation (Mann, 1959).

The Pole Creek Fan is located between Sespe Creek and the Santa Clara River, and forms the northeastern portion of the basin underlying much of the City of Fillmore. This area is primarily composed of alluvial fan material.

The area of the Fillmore basin located south of the Santa Clara River is covered by recent sand and gravel deposits from the Santa Clara River and Sespe Creek. The recent sand and gravel of the Santa Clara River near the Fillmore Fish Hatchery (Figure 1) at the eastern boundary of the basin extend to a depth of about 60 feet and the older alluvial materials extend from depths of approximately 60 to 100 feet. In the Bardsdale area, the combined thickness of this alluvial fill is as much as 120 feet (Mann, 1959). At the downstream basin boundary near Willard Road, the recent alluvium is approximately 80 feet thick. West of the City of Fillmore, the recent alluvium of Sespe Creek is approximately 80 feet thick. The recent sand and gravel deposits associated with Sespe Creek and the Santa Clara River are extremely permeable.

The San Pedro formation underlies most of the Fillmore basin and is folded into a syncline with an east-west oriented axis. Along the main axis of the syncline near the center of the basin, the San Pedro formation reaches a depth of 8,430 feet (Mann, 1959). The depth from which groundwater production is suitable for agricultural and urban use and can be reasonably extracted is considerably shallower than 8,430 feet. Few wells in the basin are deeper than 800 feet in the Fillmore basin. At the western basin boundary, the San Pedro formation extends to a depth of 5,000 to 6,000 feet.

The two principle faults that bound the Fillmore basin are the Oak Ridge fault to the south and the San Cayetano fault to the northeast. Several other faults bound the basin on the northwest side (Figure 2).

The Santa Clara River and Sespe Creek cut through the Fillmore basin. These and underflow from Piru basin are the major sources of recharge to the Fillmore basin. Structural or stratigraphic barriers that might impede recharge from either the Santa Clara River or Sespe Creek have not been identified.

Groundwater flow in the Fillmore basin generally moves east-to-west through the alluvium. Groundwater recharge from Sespe Creek generally flows towards the southwest (Figures 3-6). The basin is considered to be an unconfined groundwater basin.

Near the Fillmore and Santa Paula basin boundary exists another reach of the Santa Clara River that displays perennial rising groundwater (gaining stream conditions) even in dry years (Figure 7). The length of the gaining stream reach is greatest when water levels are high in the Fillmore and Santa Paula basins and decreases as water levels fall in the Fillmore basin. This reach flowed continuously in calendar years 2014 and 2015.

3 PRECIPITATION

Ventura County precipitation in water years 2014 and 2015 was low enough to be considered drought conditions, and 2015 was the fourth consecutive year of drought. Precipitation for water year 2014 was less than half the historical average precipitation for Piru and Fillmore basins at the gauges identified below.

Piru basin precipitation data are from the Piru-Temescal Guard Station, Ventura County station 160 (Figure 1), located near the entrance to Lake Piru. Fillmore basin precipitation data are from the Fillmore Fish Hatchery, station 171, located near the Piru/Fillmore basin boundary. The data for these stations are available for download online through the Ventura County Watershed Protection District’s Hydrologic Data Server (VCWPD, 2016). Water year 2014 and 2015 data for the Piru-Temescal Guard Station, Ventura County station 160, were not available online, so preliminary data from United’s Daily Operations Logs are presented in this report.

Piru basin average (mean) and median water year precipitation from 1950 to 2015 was 20.01 inches and 17.08 inches respectively, as recorded at the Piru-Temescal Guard Station at Lake Piru. Recorded precipitation for the 2014 and 2015 water years was 7.72 and 12.18 inches respectively. The 2014 precipitation was 12.29 inches below the historical average and the 2015 precipitation was 7.83 inches below historical average precipitation.

Fillmore basin average and median water year precipitation from 1957 to 2015 was 18.32 inches and 16.05 inches respectively, as recorded at the Fillmore Fish Hatchery near the Piru-Fillmore basin boundary. Basin precipitation for water years 2014 and 2015 was 7.49 and 11.36 inches respectively. Precipitation for 2014 was 10.83 inches below the historical average and the 2015 precipitation was 6.96 inches below the historical average precipitation.

Plots of annual precipitation data for the period of record are shown for the Piru basin in Figure 8 and for the Fillmore basin in Figure 9. These figures show precipitation totals for individual water years, the mean and median precipitation and the cumulative departure from average precipitation over the period of record. Long-term wet and dry cycles are evident from the cumulative departure plots, where wet periods are indicated by upward trends and dry periods are indicated by downward trends. Since 1998 (the record-high year for these gauges), the Piru and Fillmore basins have had a greater number of below-average precipitation years than above-average precipitation years. Recorded precipitation in 2014 and 2015 was well below average.

4 GROUNDWATER RECHARGE

The primary sources of groundwater recharge in the Piru basin are the Santa Clara River and Piru Creek. The primary sources of groundwater recharge in the Fillmore Basin are the Santa Clara River, Sespe Creek, and underflow from the Piru basin. In both basins, recharge also takes place from streams overlying San Pedro Formation outcrop to the north, from direct rainfall penetration on San Pedro outcrop and alluvium of the main basin, and from agricultural return flow. United Water's Piru spreading grounds located just west of Piru Creek have not been used in recent years due to low water levels in Lake Piru and permitting issues at the facility (the diversion structure lacks a fish screen). Generalized areas of groundwater recharge and discharge are shown in Figure 7.

Groundwater levels in both basins benefit from wastewater discharges to the Santa Clara River in Los Angeles County, most notably from the Valencia treatment plant located adjacent to the Santa Clara River near Interstate 5. Dry season perennial surface water flow across the Los Angeles/Ventura County Line, commonly some 20-28 cfs, routinely infiltrates as groundwater recharge in the area upstream of the confluence with Piru Creek. Figure 10 shows historical annual surface water flows for the Santa Clara River near the Los Angeles/Ventura County Line plotted with Piru basin historical precipitation. Surface water sometimes extends across this "dry gap" (which commonly extends from near the historic Rancho Camulos to around Cavin Road) during the wet season when runoff from storms generate sufficient flow to overcome the significant infiltration capacity of this reach.

Groundwater recharge associated with Sespe Creek flows originating from the Sespe Creek watershed are a major source of recharge to the Fillmore basin. Figure 11 shows historical annual surface water flows for Sespe Creek plotted along with Fillmore basin historical precipitation. The average total annual flow in Sespe Creek from 1928 to 2015 is approximately 85,900 acre-feet. Most of the low flow and a portion of the high flow surface water provide recharge to the Fillmore basin. Flow data are available for download online from the United States Geological Survey (USGS, 2016).

United is party to a water conservation agreement between the California Department of Water Resources and the Downstream Water Users (DWUs). The DWUs consist of United, Los Angeles County Waterworks District, Newhall Land and Farming, and Valencia Water District. The program is designed to hold back flood flows in Castaic Lake (Figure 1) and release them at a later date (often in the spring) in a manner that allows the flows to percolate in the basins downstream of the dam, benefiting the DWU's. United often represents the DWUs in coordinating the storage and release of water with CA DWR, who operates Castaic Lake, and by monitoring the associated release to ensure that the flows are optimally benefiting the basins. In most years the majority of released water that makes it to the Ventura County line percolates in the Santa Clara River channel within the Piru basin, while some of the surface flow may make it to the Fillmore basin where the remainder percolates. Due to persistent dry conditions, there has not been a Castaic Lake release since 2011 (United, 2014).

United Water's fall conservation releases from Lake Piru provide groundwater recharge to both the Piru and Fillmore basins at a time when natural runoff in the Santa Clara River watershed is limited. The conservation releases also help to sustain groundwater underflow that exists between the groundwater basins downstream of Piru and Fillmore basins, which includes the Santa Paula, Mound and Oxnard Forebay basins. Release water that does not percolate into the Piru and Fillmore basins flows downstream to the Santa Paula basin and to the Freeman Diversion.

Table 1 shows estimates of the distribution of release water in each basin during United's conservation releases since 1999. Most of the released water is natural inflow from the Piru Creek watershed, but in some years a portion of this water is State Water purchased by United and conveyed from Pyramid Lake by way of middle Piru Creek (UWCD, 2014). The water in Pyramid Lake is a mixture of State Water and water from the watershed. Releases down middle Piru Creek commonly have a significant percentage of State Water even though United's allocation to purchase State Water is relatively small.

Below-average precipitation since 2012 and the subsequent low inflow into Lake Piru resulted in United Water's inability to perform fall conservation releases from Lake Piru in 2014 and 2015. The last time prior to 2013 that there was no conservation release was during the previous drought in 1990. United is however required to release water continuously to maintain fish habitat in lower Piru Creek, and some of this water serves as recharge to the Piru basin. Piru Mutual Water Company and Rancho Temescal operate diversions on lower Piru Creek that divert a portion of the creek flow for agricultural beneficial uses.

The benefit of United Water's conservation releases can be seen as groundwater levels in both Piru and Fillmore basins rose shortly after the start of each of the fall 2009 through 2012 conservation releases shown in Figure 12. Evident from the figure are the significant water level declines in both basins since 2012 at the onset of the current drought conditions. The spring Castaic Lake releases are also apparent in the figure for the Piru basin well.

Calendar Year	Total Conservation Released from SFD	Direct Deliveries in AF of SFD Release to:			
		Piru Basin	Fillmore Basin	Lower Basins	Surface water
	AF			(groundwater recharge)	Ag Deliveries via Pipelines
1999	22,800	5,700	3,500	11,200	2,400
2000	47,200	13,800	6,100	24,150	3,150
2001	47,400	14,000	2,900	28,300	2,200
2002	20,200	8,000	5,100	6,530	570
2003	29,000	21,000	3,500	3,600	900
2004	12,200	8,000	2,150	1,600	550
2005	9,100	na	na	4,500**	0
2005	23,400	na	na	17,200**	150

Calendar Year	Total Conservation Released from SFD AF	Direct Deliveries in AF of SFD Release to:			
		Piru Basin	Fillmore Basin	Lower Basins	Surface water
				(groundwater recharge)	Ag Deliveries via Pipelines
2006	30,900	na	na	17,200**	1,600
2007	40,700	15,900	6,300	12,200	6,400
2008	44,400	15,400	5,700	17,400	5,800
2009	26,700	13,200	4,700	5,200	3,000
2010	33,000	14,500	4,800	10,700	3,200
2011	31,700	12,400	3,300	14,100	1,600
2012	35,200	13,600	8,600	9,300	3,700
2013	0	0	0	0	0
2014	0	0	0	0	0
2015	0	0	0	0	0
Average	**25,217**	**10,367**	**3,777**	**10,177**	**1,957**
18 yr. Total	**453,900**	**155,500**	**56,650**	**183,180**	**35,220**

*2005 had two conservation releases. Portion of the release includes spill water when the lake was full

** measured at the Freeman Diversion

Table modified from Untied Water's 2013 Groundwater and Surface Water Condition Report (UWCD, 2014) and updated to include calendar years 2014 and 2015.

Table 1. Benefits of the SFD Conservation Release due to direct percolation.

5 GROUNDWATER EXTRACTIONS

Table 2 shows total reported groundwater extractions for Piru and Fillmore basins for calendar years 1980 through 2015. Pumping data are reported in this report as of the date of export from United's pumping database on April 22, 2016.

In calendar year 2014, a total of 14,102 acre-feet of groundwater extraction was reported for the Piru basin, which is 1,699 acre-feet greater than the historical average (from 1980 to 2015). In calendar year 2015, a total of 14,139 acre-feet of groundwater extraction was reported for the Piru basin, totaling 1,736 acre-feet more than the historical average. Agricultural water use accounted for approximately 97 percent of the groundwater extraction.

In calendar year 2014 a total of 50,327 acre-feet of groundwater extraction was reported for the Fillmore basin, which is 5,729 acre-feet greater than the historical average (from 1980 to 2015). In calendar year 2015 a total of 47,722 acre-feet of groundwater extraction was reported for the Fillmore basin, which is 3,124 acre-feet more than the historical average. Agricultural uses accounted for approximately 95 percent of the groundwater extraction.

In the early and mid-2000s the Piru and Fillmore basins had a lot of agricultural land transition from oranges to row crops and nurseries, which likely resulted in an increase in groundwater demand. A short discussion of changes in agricultural land use is presented later in this report.

Figures 13 and 14 plot annual groundwater extractions for Piru and Fillmore basins. Figures 15 and 16 show the distribution of recent pumping in the Piru and Fillmore basins, with scaled dots representing the magnitude of pumping reported for each well. Each dot on the maps represent a single well. In 2014 the single well with the greatest extraction in the Piru and Fillmore basins was one of California Department of Fish and Wildlife's wells at the Piru/Fillmore basin boundary that supplies the Fillmore Fish Hatchery. In 2015 the single well with the largest extraction in the Piru and Fillmore basins was a Farmers Irrigation Company well that was completed in 2012 just east of the Fillmore/Santa Paula basin boundary. Water pumped from this well in Fillmore basin is exported for use in Santa Paula basin (UWCD, 2013).

Groundwater extractions were reported by four methods to United Water in 2014 and 2015: crop factor, domestic multiplier, electrical meter and water meter. In 2013 United Water's Board of Directors voted to eliminate the option of reporting by crop factor, effective January 1, 2014. Beginning in 2014 a 10% penalty was assessed against pumpers that continued to report using the crop factor method.

Domestic (M&I) pumping can be reported using the multiplier 0.2 acre-feet per person per period with a minimum of 0.5 acre-feet (if there are 1 or 2 people reporting domestic usage on a well then 0.5 acre-feet is assessed). Beginning the first billing cycle (period 1) of 2015, an additional field was added to United Water's pumping database that allows for the identification of water reported using the domestic multiplier method. In previous years this was reported as M&I by the crop factor method. Details regarding the number of wells and amount of pumping reported by each method in 2014 and 2015 are shown in Table 3 (Piru basin) and Table 4 (Fillmore basin).

Calendar Year	Piru Basin (ac-ft)	Fillmore Basin (ac-ft)	Calendar Year	Piru Basin (ac-ft)	Fillmore Basin (ac-ft)
1980	12,619	38,752	1998	9,089	43,032
1981	13,459	33,060	1999	13,363	49,994
1982	9,317	37,123	2000	12,784	48,483
1983	7,251	29,894	2001	9,966	41,594
1984	12,968	46,292	2002	11,607	45,461
1985	15,053	47,786	2003	10,358	41,519
1986	12,042	40,932	2004	11,148	42,612
1987	15,518	46,340	2005	10,650	38,463
1988	14,342	49,336	2006	12,083	40,699

Calendar Year	Piru Basin (ac-ft)	Fillmore Basin (ac-ft)	Calendar Year	Piru Basin (ac-ft)	Fillmore Basin (ac-ft)
1989	15,311	54,911	2007	13,594	46,563
1990	17,050	55,718	2008	12,941	47,404
1991	16,123	51,060	2009	11,949	46,882
1992	12,197	45,780	2010	11,070	41,536
1993	11,373	43,332	2011	11,075	40,855
1994	12,264	45,885	2012	11,501	43,455
1995	10,255	42,785	2013	12,807	50,433
1996	12,575	42,380	2014	14,102	50,327
1997	12,568	47,142	2015	14,139	47,722
			Average	**12,403**	**44,598**

Table 2. Historical reported annual groundwater extractions for the Piru and Fillmore basins.

	Crop Factor 2014	Domestic Multiplier 2014	Electrical Meter 2014	Water Meter 2014	Crop Factor 2015	Domestic Multiplier 2015	Electrical Meter 2015	Water Meter 2015
Number of Wells[1]	42	n/a	33	51	13	12	35	59
Extractions (ac-ft)	1,791	n/a	4,829	7,482	332	25	5,813	7,969
Percent of Total Extractions	12.7%	n/a	34.2%	53.1%	2.3%	0.2%	41.1%	56.4%

[1] a well shared by different operators that use different reporting methods is counted as multiple wells

Table 3. Number of wells and amount of groundwater extractions reported to United Water under various reporting methods for the Piru basin for 2014 and 2015.

	Crop Factor 2014	Domestic Multiplier 2014	Electrical Meter 2014	Water Meter 2014	Crop Factor 2015	Domestic Multiplier 2015	Electrical Meter 2015	Water Meter 2015
Number of Wells[1]	134	n/a	65	125	46	64	61	148
Extractions (ac-ft)	3,836	n/a	17,514	28,977	1,138	98	13,919	32,567
Percent of Total Extractions	7.6%	n/a	34.8%	57.6%	2.4%	0.2%	29.2%	68.2%

[1] a well shared by different operators that use different reporting methods is counted as multiple wells

Table 4. Number of wells and amount of groundwater extractions reported to United Water under various reporting methods for the Fillmore basin for 2014 and 2015.

6 GROUNDWATER LEVELS

A total of 34 wells were monitored for groundwater levels in the Piru basin in 2014 and/or 2015 (Figure 17). The Water Resources Division of the Ventura County Watershed Protection District (VCWPD) monitored 8 wells on a quarterly basis. United Water monitored 28 wells on monthly, bimonthly or event-based schedules. Two wells were monitored by both United Water and Ventura County staff. The overlap between VCWPD and United Water's monitoring networks is useful to ensure consistency between data collected by the different entities. United Water currently has 7 of the 28 wells it monitors equipped with pressure transducers (with data loggers) that record groundwater elevations every four hours. Water levels are measured in the wells on United's water level monitoring schedules with either a steel survey tape, dual-wire or single-wire electric sounder.

Five of the Piru basin wells that United Water monitors on a monthly basis are the USGS-drilled nested monitoring well site located near the end of Powell Road and the north bank of the Santa Clara River. These are wells 4N/18W-31D03S (total depth 610' below ground surface), 4N/18W-31D04S (330'), 4N/18W-31D05S (240'), 4N/18W-31D06S (160') and 4N/18W-31D07S (70'). This site is unique for Piru and Fillmore basins in that it features five 2-inch diameter wells in a single borehole. Each well screen was sealed to isolate it from surrounding zones during construction of the nested well site. This enables comparison of groundwater elevations and groundwater quality at various known depths at a single location. Water levels in the five wells at this nested well site generally show at most a few feet of separation, even though the depths of their perforations vary significantly. This separation is most significant between the groundwater levels of the deepest completed piezometer and upper four piezometers at the nested site. A downward vertical gradient is observed at this location, as heads in the deepest well are lower than in the shallower completions. One of these wells is equipped with a pressure transducers and the shallowest of these nested piezometers (screened 50-70' below grade) was equipped with a pressure transducer until it went dry in June of 2013 (the bottom of the well is above the water table).

In 2014 and/or 2015 there were 40 wells monitored for groundwater levels in the Fillmore basin (Figure 17). VCWPD monitored 14 wells on a quarterly basis. United Water monitored 30 wells on monthly, bimonthly, semi-annual or event-based schedules. United Water and Ventura County monitored five common wells. The City of Fillmore has not monitored water levels in their wells in recent years, but Farmers Irrigation monitored their one well in the basin and also one of Limoneira's wells in the basin. United Water currently has 9 of the 30 Fillmore basin wells it monitors equipped with pressure transducers (with data loggers) that record groundwater levels every four hours.

Figure 18 shows hydrographs for selected wells in the Piru and Fillmore basins, including two key wells for both the Piru and Fillmore basins. These wells were selected based on their location and significant historical groundwater elevation records. The data indicate that water levels in both basins tend to return to their historic highs during wet cycles. When groundwater levels are at their historic highs (as seen in the hydrographs of Figure 18) the basins are essentially "full" and groundwater discharge at their downstream boundaries is likely at a maximum. As stated earlier, areas of groundwater discharge have historically been observed near the downstream basin narrows where the elevation of the water table is greater than the elevation of the river channel. Groundwater discharge to the Santa Clara River can be quantified by measuring gains in flow in the river within the gaining reaches.

The hydrographs generally show greater groundwater level variability in the Piru basin than in the Fillmore basin. This is true both seasonally and for wet and dry cycles. The difference may be in part due to the relative narrowness of the Piru basin in comparison to the Fillmore basin and the considerable groundwater recharge that Fillmore basin receives from Sespe Creek. Despite the relatively greater variability in groundwater levels, the Piru basin recovers to its historic highs during wet cycles due to its ability to accept large volumes of recharge through the channel of the Santa Clara River. The hydrographs show that 2005, a year of near-record precipitation and stream flow, was the last year that the Piru and Fillmore basins were full.

A comparison of groundwater elevations and cumulative departure from average precipitation is shown for the Piru and Fillmore basins in Figures 19 and 20, respectively. These figures show that in both basins there is a positive correlation between increased precipitation and rising groundwater levels. An inverse relationship is observed in the comparison of groundwater elevations and annual groundwater extractions, as shown for the Piru and Fillmore basins in Figures 21 and 22.

This report tracks water levels in two key wells from each basin relative to groundwater elevation Basin Management Objectives and benchmarks. The BMOs for these wells are intended to sustain groundwater elevations above the lowest recorded level of the 1984 to 1991 drought; the lowest water level recorded for each well from this period was established as the BMO. Benchmark #1 is the 2004 low water level year (final year of a 6 year moderately dry period) and benchmark #2 is defined as halfway between benchmark #1 and the BMO for each key well. The groundwater elevation benchmarks and BMOs were proposed in the Draft 2011 Piru/Fillmore Basins AB 3030 Groundwater Management Plan update.

Groundwater elevations in the Piru key well located near Piru Creek (4N/18W-29M02S) dropped below Benchmark #2 in early summer 2014 and continued to decline for the rest of the calendar year to an elevation near the BMO. In June 2015 water levels in well -29M02S dropped below the BMO and continued to decline for the rest of the calendar year. In November 2015 groundwater elevations dropped below the bottom of this well at least 7 feet below the BMO.

The groundwater elevations of the Piru key well located near Hopper Creek (4N/19W-25M01S) dropped below Benchmark #2 in winter 2014 and continued to decline for the rest of the calendar year. Water levels in well -25M01S fell below the BMO in August of 2015 and continued to decline for the rest of the calendar year (Figure 18). In December 2015 groundwater elevations in this well were at least 7 feet below the BMO.

For 2014 and 2015 the groundwater elevations in the Fillmore key well located in the Bardsdale area (03N/20W-02A01S) dropped below Benchmark #2 in early summer 2014 and continued to decline for the rest of the calendar year to near the BMO. Water levels in well -02A01S fell below the BMO elevation in August 2015 and continued to decline for the remainder of the calendar year. In December 2015 groundwater elevations in this well were at least 8 feet below the BMO.

Recorded groundwater elevations in the Fillmore basin key well located in the Sespe Upland area (04N/20W-23Q02S) were below or near Benchmark #2 for the majority of calendar year 2014. Water levels in well -23Q02S fell below the BMO in December 2015. Quarterly water level measurements by VCWPD are the only records available for this well, as United Water no longer measures the well. In December 2015 groundwater elevations in this well were at least 6 feet below the BMO.

Groundwater elevations declined more rapidly during the current drought than was observed in the last drought of similar magnitude in the 1980s. All 4 of the BMO wells presented in this report are currently below their BMOs in just 4 consecutive years of below average precipitation. It will take several years of above average precipitation to bring groundwater elevations back up to full basin levels as was observed in the 1980s drought (Figure 18).

Figures 23 and 24 show ranges of depth-to-groundwater for spring 2014 and spring 2015 at various wells. Measured depth-to-water is depicted as variable dot sizes. Maps showing groundwater elevation contours for spring/fall 2014 and spring/fall 2015 are shown in Figures 3-6. Each contour on the maps represent a line of equal groundwater elevation.

The contours for both basins are similar to past years and show a general east-to-west groundwater flow, except for the Sespe Upland, which show a more southwesterly groundwater flow direction. A comparison of the spring contour maps from 2012 through 2015 show an approximately 10 feet per year decline in water level elevations in eastern Piru basin during the 4 year period of below average rainfall. Over the same period at the boundary between Piru and Fillmore basin there was an approximately 4 feet per year decline in water level elevations; and at the west end of Fillmore basin at the Fillmore/Santa Paula basin boundary, water level elevations have remained relatively stable over the past 4 years. This denotes an overall flattening (shallowing) of the groundwater elevation gradients for Piru and Fillmore basins.

7 SURFACE WATER QUALITY

United Water conducts monthly surface water sampling for Total Dissolved Solids (TDS), chloride and nitrate in the Santa Clara River downstream of the Ventura/Los Angeles County Line. On a quarterly basis surface water samples are collected for general mineral analysis from the Santa Clara River downstream of the Ventura/Los Angeles County Line, Piru Creek below Santa Felicia Dam, Piru Creek near Piru, Hopper Creek, the Santa Clara River near the Fillmore Fish Hatchery (near Piru/Fillmore basin boundary), Pole Creek, Sespe Creek, and the Santa Clara River at Willard Road (near Fillmore/Santa Paula basin boundary). On alternate quarters United has a reduced suite of analytes run for some of these sample locations. Recorded concentrations of TDS, sulfate, chloride, nitrate and boron are presented in this report, with units reported in milligrams per liter (mg/L).

Higher than normal analyte concentrations were observed at a number of sample stations in 2014 and 2015. Dry conditions persist in the watershed and elevated concentrations were observed at a number of sample locations, as the mineral content of the region's surface waters commonly increase, to varying degrees, as flows diminish.

Figure 25 is a map of the surface water quality monitoring locations and Los Angeles Regional Water Quality Control Board (Regional Board or RWQCB-LA) Santa Clara River reaches and groundwater quality objective zones. Figures 26 through 30 present time series of historical surface water concentrations for TDS, sulfate, chloride, nitrate and boron, and show the maximum-recorded concentrations for these constituents in the 2015 calendar year. The water quality BMOs from the 2011 Draft Piru/Fillmore basin AB 3030 Groundwater Management Plan update are shown on the figures. The water quality BMOs are based on surface water quality objectives from the Los Angeles Regional Water Quality Board Basin Plan (CA RWQCB-LA, 1994).

From 1951 to 1968 elevated concentrations of TDS, sulfate, chloride and boron were recorded near the Ventura/Los Angeles County Line, and is generally attributed to the surface discharge of oil field brines prior to the enactment of the Federal Clean Water Act. Where data permits, water quality time series have been extended back to include this period.

More recently (since 1999), elevated chloride in the Santa Clara River near the Ventura/Los Angeles County Line has been observed, and can be attributed to effluent discharged into the Santa Clara River primarily by the Valencia Wastewater Treatment Plant (WWTP). In calendar years 2014 and 2015 chloride concentrations in the Santa Clara River near the Ventura/Los Angeles County Line ranged above the BMO of 100 mg/L and above the toxicity threshold for avocados of 117 mg/L (CH2M HILL, 2005). Recorded chloride concentrations ranged from 116 mg/L to 152 mg/L in 2014, and ranged from 122 mg/L to 147 mg/L in 2015 (Figure 28).

Following the development for a nutrients TMDL for the Santa Clara River (see UWCD, 2015 for discussion), a nitrogen removal facility came on-line at the Valencia WWTP in 2003 which has proven to be very successful in reducing ammonia in the WWTP effluent. Ammonia commonly oxidizes to nitrate in the river channel. Since completion of this facility nitrate concentrations have been greatly reduced in the Santa Clara River near the Los Angeles County Line (Figure 29). In recent years, nitrate concentrations in the surface waters of the Piru and Fillmore basins has not been considered a problem.

In calendar years 2014 and 2015 concentrations of TDS and sulfate in Piru Creek near Piru have been increasing compared to the previous few years but are still lower than those observed in 2005 through 2011. The Piru Creek sampling location immediately below Santa Felicia Dam ranged above its TDS, sulfate and chloride BMOs in 2015. Boron concentrations at this location ranged to within 80 percent the BMO in 2015.

The sample location near the Fillmore Fish Hatchery did not record any surface water constituents above BMOs in calendar years 2014 and 2015. Water in the Santa Clara River at this location, and under dry conditions in the watershed, predominately sources from rising groundwater and base flows from tributary streams. The quality of discharging groundwater in the downstream portion of the Piru basin is less sensitive to dry conditions than flows in the tributary streams. As mentioned earlier, this reach near the Fish Hatchery was dry fall of 2014 and much of calendar year 2015.

Sespe Creek has historically shown highly-variable chloride concentrations, but the source of the elevated chloride remains undetermined. An upward trend is apparent in samples from calendar years 2012 through 2015, with a maximum chloride concentration of 207 mg/L recorded in July 2015, which is three and a half times the BMO of 60 mg/l (Figure 28). In 2015 TDS, sulfate and boron concentrations also ranged above BMOs.

In 2014 and 2015 recorded boron concentrations in Sespe Creek continued to range above the 1.0 mg/L toxicity limit for citrus (Hem, 1989). The 2014 maximum-recorded concentration was 5.1 mg/L and the 2015 recorded high concentration was 5.0 mg/L (Figure 30). There has been an upward trend in boron concentration since 2011 which is likely a reflection of the drought conditions of the past 4 years and the resultant lower flows in the creek. The boron 2014 maximum-recorded concentration is the historic high for the record set that begins in 1951.

At the Santa Clara River sample site at Willard Road near the Fillmore/Santa Paula basin boundary, TDS, sulfate and chloride concentrations were above BMOs in 2015.

8 GROUNDWATER QUALITY

United's water quality monitoring program integrates its sampling with sampling conducted by a variety of other organizations. For purveyors' wells, monitoring of a variety of regulated constituents is required and ensures that groundwater is safe for potable use. Aesthetic standards such as taste, odor and color are also sampled. Monitoring the quality of water produced by wells also allows documentation of both abrupt and long-term changes in water quality.

United staff samples numerous monitoring and production wells on a regular basis in order to evaluate the quality of groundwater within United's boundary. Monitoring programs sometimes focus on specific areas within United's boundary, typically for a specific type of degradation or improvement of water quality. In addition to United's regular sampling programs, water quality data are routinely acquired from other sources, most notably the California State Water Resources Control Board Division of Drinking Water (program formally under California Department of Public Health) and the County of Ventura's Groundwater Section. Other sources of information may include the California Department of Water Resources, cities, consultant reports and technical studies, landfill operators and individual well owners.

Over the past fifteen years the main water quality concern for agricultural users in the Piru basin has been impacts associated with high chloride concentrations in the Santa Clara River flows sourcing from Los Angeles County. The high chloride concentrations in the eastern portion of the basin associated with these discharges has made a steady advance westward with groundwater flow down the Piru basin. The Piru basin generally does not have problems with nitrate contamination, and samples collected in 2015 show only two wells exceeding the MCL of 45 mg/L.

The Fillmore basin is not known for having any pervasive water quality problems. TDS concentrations can be somewhat elevated in some locations, as in other groundwater basins along the Santa Clara River Valley. The City of Fillmore no longer uses wells near the Santa Clara River, favoring locations near Sespe Creek where TDS tends to be lower. Naturally-occurring boron sourcing from the Sespe watershed, however, is sometimes a concern for citrus growers and the City of Fillmore. Deeper aquifer units may have elevated concentrations of iron and manganese, a common occurrence throughout Ventura County.

Figures 31 through 35 show the maximum-recorded concentrations for TDS, sulfate, chloride, nitrate and boron, respectively, for wells sampled in the 2015 calendar year. Figures 36 through 40 show historical time-series for TDS, sulfate, chloride, nitrate and boron, respectively, for selected wells in the Piru and Fillmore basins.

Both the 2015 maximum concentration maps and the time series maps show concentrations in relation to groundwater quality BMOs established in the Draft Piru/Fillmore Basin AB 3030 Groundwater Management Plan update. The BMOs are generally based on the groundwater quality objectives identified by the Los Angeles Regional Water Quality Control Board (CA RWQCB-LA, 1994), except for in the Piru basin east of Piru Creek. The BMOs for the Piru basin east of Piru Creek were set to agree with the Regional Board's objectives for the Piru basin west of Piru Creek. The Regional Board's Basin Plan objectives for groundwater east of Piru creek are set unreasonably high for TDS, sulfate and chloride, and are reflective of historic pollution in that portion of the basin as mentioned in the Surface Water Quality section above. For details on criteria the Regional Board used to set groundwater basin objectives refer to Draft 2013

Piru/Fillmore basins AB 3030 Groundwater Management Plan update (PF GMC, 2013) and California Regional Water Quality Control Board, Los Angeles Region's Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties (CA RWQCB-LA, 1994).

TDS is can be reported by either Total Filterable Residue (TFR) or by Summation (SUM), which is calculated by summing the mass of the major anions and cations in a water sample. TDS by Summation commonly yields a slightly higher value than the TDS by Total Filterable Residue. The evaporative method (TFR) is now the standard laboratory analysis for TDS. Figure 31 shows elevated TDS concentrations in the area immediately west of Hopper Creek. The 2015 maximum TDS SUM concentrations for seven wells in this area ranged from 894 to 2,410 mg/L.

Elevated chloride concentrations were recorded in 2015 in groundwater east of Piru Creek, with maximum chloride concentrations in three wells ranging from 130 mg/L to 136 mg/L (Figure 33). The maximum 2015 chloride concentration in wells located between Hopper Creek and Piru Creek was 116 mg/L. These elevated chloride concentrations that can be seen in the time series graphs in Figure 38 are thought to be associated with the high-chloride effluent discharged into the Santa Clara River by Los Angeles County wastewater treatment plants since 1999. A discussion of these plants is presented later in this report. A chloride TMDL for the Upper Santa Clara River was adopted in 2008, but the proposed TMDL actions to reduce and mitigate chloride impacts in the Piru basin have not yet been implemented (see discussion below).

Figure 34 shows the maximum-recorded nitrate concentrations in the Piru and Fillmore basins for the 2015 calendar year. Nitrate concentrations exceeding the primary health standard of 45 mg/L were recorded in two wells located in the Sespe Upland area (remaining Fillmore area), two wells located west of Piru Creek in Piru basin, and one well located in the Bardsdale area (south side of the Santa Clara River) of the Fillmore basin. The elevated nitrate concentrations in the Sespe Upland and west of Piru Creek in Piru basin may be related to agricultural practices. The shallow depths to water in the Bardsdale area makes wells in this area somewhat vulnerable to near-surface nitrogen sources such as septic tanks and fertilizer.

9 UPPER SANTA CLARA RIVER CHLORIDE TMDL

The federal Clean Water Act of 1972 requires the implementation of a Total Maximum Daily Load (TMDL) plan for waters of impaired water quality, as listed on the Environmental Protection Agency's (EPA) 303(d) list. Since the signing of the Clean Water Act, pollution control for the Nation's waterways has focused primarily on point discharges such as treatment plants and industrial outfalls, which are relatively easy to monitor and regulate. The TMDL provisions within the Clean Water Act were overlooked for many years, until their rediscovery by members of the environmental community in the late 1990s. A TMDL is a program which attempts to quantify and regulate all sources (point sources and non-point sources) of a particular contaminant within a watershed. The water body is evaluated to determine what mass of a given contaminant can be assimilated by the water body, keeping contaminant concentration below the specified goal. The daily allowable mass of a given contaminant is allocated between all sources in the watershed to bring the waterway within specified levels, resulting in the delisting of the water body/contaminant from the federal EPA's 303(d) list. In the Santa Clara River watershed, and other areas in the west where surface flow is highly variable, most discharges continue to be regulated in terms of concentration.

From 1990 to 2004 treatment plants in the SCR watershed were operating under the relaxed standards of the Regional Board's "Drought Policy." In 2001 the Los Angeles Regional Water Quality Control Board (Regional Board or RWQCB-LA) worked with dischargers and other interested parties to evaluate chloride in the Santa Clara River watershed. It was generally agreed that much of Ventura County was not currently impaired with respect to chloride. However, the continuous flow of water past Blue Cut near the Ventura/Los Angeles County Line, much of which originates as discharge from the Valencia wastewater treatment plant in Santa Clarita, was cause for concern among agricultural interests in Ventura County. Elevated chloride concentrations in the surface water at this location impair its value as irrigation water when diverted from the river, and the long-term recharge of this water was recognized to be degrading the groundwater in the eastern Piru basin.

Two early versions of a Chloride TMDL were approved by the RWQCB-LA but failed to be approved by the State Board. The Saugus and Valencia WWTPs were allowed to continue discharges under a revision to the interim chloride waste load allocation dated May 6, 2004. State Board Resolution 04-004 sets limits based on chloride concentrations of State Water Project water served from Castaic Lake plus a loading factor of 114 mg/L for the Saugus WWTP and 134 mg/L for the Valencia WWTP with a maximum interim waste load allocation of 230 mg/L for both WWTPs (CA RWQCB-LA, 2004). The plants continue to operate under these interim chloride waste load allocations.

The State Water Quality Control Board approved the amended plan in July 2004. Part of the plan required Regional Board staff to work with the major dischargers to conduct or contract for technical chloride studies in the Upper Santa Clara River. Four studies were planned:

- an Agricultural Threshold study,
- a Groundwater Surface Water Interaction Model Study,
- an Endangered Species Study,
- and Site-Specific Objectives/Anti-Degradation Analysis Study.

The Agricultural Threshold Study established a chloride concentration that will be protective of salt sensitive crops such as avocados, strawberries and nursery crops. The first phase included an extensive literature review and then an evaluation of the literature review. In September 2005 the evaluation of the literature review was published. It was determined for avocados that chloride damage will begin to occur somewhere between 100 mg/L and 120 mg/L (CH2MHILL, 2005).

Existing studies did not provide sufficient threshold data for strawberries or nursery crops. A revised chloride objective of 117 mg/L was proposed for surface water in the eastern Piru basin.

The Sanitation Districts of Los Angeles County sponsored the development of a chloride transport model to determine the assimilative capacity of the Santa Clara River and the adjacent groundwater basins for chloride released from upstream wastewater treatment plants and other sources. The first phase of the study consisted of a literature review, data compilation, data acquisition and monitoring. The second phase consisted of conceptual model development and numerical model. The numerical model was completed in 2008 and included various water supply and demand scenarios (CH2MHILL et al, 2008).

The Endangered Species Study determined that chloride concentrations protective of agriculture are also protective of endangered species in the Upper Santa Clara River.

The Site-Specific Objectives/Anti-Degradation Analysis Study took information from the Agricultural Threshold Study, the Surface Water-Groundwater Interaction Model and the Endangered Species Study, and proposed revised site-specific chloride objectives for the Upper Santa Clara River (SCVSD, 2008). The proposed new water quality objectives were determined to be consistent with the State's anti-degradation policy, provided all elements of the "Alternative Water Resources Management" (AWRM) Plan were implemented. By 2008 all four studies had been completed and a Memorandum of Understanding (M.O.U.) was signed among the Santa Clarita Valley Sanitation District of Los Angeles County, Upper Basin Purveyors, United Water and the Ventura County Agricultural Water Quality Coalition. The parties to the M.O.U. agreed to work together to implement the AWRM Plan, a basin-wide management approach to mitigate chloride concentrations which relied on dilution and chloride export from the Piru basin.

The proposed AWRM Plan included the construction of a small Reverse Osmosis (RO) plant at the Valencia wastewater plant, allowing the use of approximately 3 mgd of RO permeate as a source of dilution water. The RO permeate would either be discharged for in-stream blending in the Santa Clara River near the County Line, or used for blending with high-chloride groundwater pumped from the eastern Piru basin. The brine from the RO plant would be injected into old oil field wells located in Los Angeles County. A well field of approximately ten wells was proposed for the eastern Piru basin. High-chloride groundwater would be pumped and blended with the RO permeate. A pipeline would be built to convey the blended water to near the Fillmore Fish Hatchery at the west end of the Piru basin, where it would be discharged to the Santa Clara River. The pipeline was necessary to get the blended water across the "dry gap" in the central portion of the Piru basin.

An additional element of the AWRM program included the reduction of chloride in waste water effluent with the use of UV disinfection and the elimination of self-regenerating water softeners. The City of Santa Clarita voted in November 2008 to prohibit self-regenerating water softeners, the majority of which were removed in 2009. This ban led to decreased influent chloride concentrations received by the plants, and contributed to lower concentrations of effluent chloride discharged to the Upper Santa Clara River and flowing into Ventura County.

On December 11, 2008 the Los Angeles Regional Water Quality Control Board adopted a resolution to amend the Water Quality Control Plan for the Los Angeles Region to adopt the proposed site specific chloride objectives determined in the Site Specific Objective Study and to revise the Upper Santa Clara River Chloride TMDL. The amended objectives were conditional, provided that all aspects of the AWRM program were implemented (CA RWQCB-LA, 2008). The resolution set a 2015 deadline for the implementation of the compliance measures. In May 2010 the Santa Clarita Valley Sanitation District agreed to vote on a proposal for a more modest rate increase for planning and design support work relating to the AWRM project (CSD-LAC, 2010). Despite only minimal written protest by area property owners, the rate increase was voted down by the Sanitation District Board in July 2010.

In 2012 and 2013 the Upper Basin Purveyors, Kennedy-Jenks Consultants and Santa Clarita Valley Sanitation District of Los Angeles County worked with United to explore cheaper alternatives to the original AWRM Plan. Various proposals that would have eliminated the need for construction of a reverse osmosis plant and associated brine disposal facilities, and the pipeline down the Piru basin were evaluated. Ventura County interests were not convinced that the various modifications to the original AWRM proposal would result in sufficient chloride export from the Piru basin, and they did not support the proposed reductions in the scope of the AWRM project. It is now clear the chloride compliance deadline of 2017 will not be met.

Following abandonment of the AWRM blending and export scheme, the Sanitation Districts proposed RO treatment for a portion of their waste stream, allowing a blended discharge that complies with the 100 mg/L chloride discharge limit. Disposal of the brine produced by the RO treatment process remain a significant challenge. A proposal for deep well injection was met with significant local resistance. The proposal now favored by the Sanitation Districts is a process to concentrate brine, and trucking brine to a treatment plant in Carson that pipes effluent to the coast for ocean disposal. The Regional Board now requires that this project be completed by July 2019.

The current RO reliant compliance strategy will discharge water at less than 100 mg/L and will result in less total discharge to the SCR. The brine component is removed from the discharge stream, and the improved quality of the effluent makes it more attractive for reuse within the Eastern groundwater basin. The Sanitation Districts estimate that the combined discharge from the Saugus and Valencia WWTPs will be reduced by about 33 percent.

10 LOWER SANTA CLARA RIVER SNMP

In February 2009 the State Water Resources Control Board adopted the Recycled Water Policy, which encourages areas throughout the state to increase the use of recycled water to reduce demand on other fresh water supplies. The policy required the completion of salt and nutrient management plans (SNMPs) to assess the potential for salt and nutrient loading to local groundwater basins, a possible unintended consequence of the increased use of recycled water. Several groundwater basins within a single watershed are commonly grouped together for planning purposes. The Piru and Fillmore basins were included in the SNMP for the lower Santa Clara River. This plan also included water quality characterization of the Santa Paula, Mound and Oxnard Forebay basins (LWA et al., 2015).

The current disposal practice for effluent from the Piru and Fillmore WWTPs is discharge to percolation basins near the Santa Clara River. As the salt loads from these plants already remain in the basins where they originate (as opposed to being exported as flow down the Santa Clara River), little change to basin conditions is expected with the increased use of reclaimed water in the Piru and Fillmore basins. The SNMP characterized existing groundwater quality within the basins, and estimated available "assimilative capacity" for selected salts and nutrients compared to Basin Plan Water Quality Objectives (WQOs) established for various subareas within the basins. All of the subareas within the Piru and Fillmore basins had available assimilative capacity for TDS, chloride and nitrate. The areas with salt concentrations approaching regulatory objectives included the Sespe Upland (chloride) and the Bardsdale area (TDS). Chloride is higher than desired in the area east of Piru Creek, but as mentioned earlier the artificially-high objective of 200 mg/L remains in effect for this subarea.

Simple mass balance models were constructed for the various subareas, which included the estimated volumes and salt loads associated with known sources of recharge and areas of discharge. Future discharge scenarios and potential water reuse projects were then included in the models, allowing predictions as to whether the increased use of reclaimed water might lead to water quality problems. Salt loading is expected to increase over time in the Piru and Fillmore basins, but at a modest rate that meets the sustainability requirements detailed for this planning exercise.

11 WASTEWATER TREATMENT PLANTS

There is one wastewater treatment plant (WWTP) in the Piru basin and one in the Fillmore basin. Both plants discharge treated wastewater to percolation ponds near the north bank of the Santa Clara River. There are also two large wastewater treatment plants operated by the Los Angeles County Sanitation Districts that discharge tertiary treated water to Upper Santa Clara River (Figure 1).

11.1 PIRU WASTEWATER TREATMENT PLANT

The Piru Wastewater Treatment plant is located near Hopper Creek and Highway 126 in the Piru Basin (Figure 1). The plant is now operated by Ventura County Waterworks District No. 16 (VCWD 16) which took over in March 2010 from Ventura Regional Sanitation District. The plant discharges to percolation ponds located just west of the confluence of Hopper Creek and the Santa Clara River. Improvements to the existing Piru plant were completed in March 2010 to satisfy California Regional Water Quality Control Board, Los Angeles (Regional Board or RWQCB–LA) permit requirements (VCWD 16, 2010). Plant capacity was increased from 0.25 million gallons per day to 0.5 million gallons per day.

Effluent discharged from the Piru WWTP averaged 0.12 million gallons per day (0.19 cfs) for 2014 and 0.12 million gallons per day (0.18 cfs) for 2015 (Table 5). This is 25 percent less effluent discharge than was reported for 2012 and 2013. Effluent chloride concentrations have been relatively stable around 150 mg/L despite the steady rise of the reported Piru water supply mean chloride over the past 2 years (VCWD 16, 2013, 2014, 2015, 2016).

The high chloride effluent percolated in the Piru WWTP ponds is likely not of sufficient volume to significantly impact the groundwater quality of the basin (LWA et al., 2015). The 2015 maximum chloride concentration, in a shallow production well, located approximately one mile down-gradient from the Piru WWTP, on the south side of the Santa Clara River, was 57 mg/L. The location of the down-gradient well and the location of the Piru WWTP percolation ponds are shown on the map in Figure 33.

Annual monitoring reports for Piru WWTP for the 2014 and 2015 calendar years state that the plant was in compliance with Waste Discharge Requirements as set by the RWQCB–LA except for TDS, chloride, and the daily maximum & monthly average for total suspended solids (TSS). VCWD 16 maintains that even if all controllable sources of TDS and chloride were removed, the uncontrollable sources would still cause the levels of TDS and chloride to exceed the imposed discharge limits of 1200 mg/L and 100 mg/L respectively (VCWD 16, 2015, 2016). In 2015 the mean chloride concentration of the Piru community's supply water was above the 100 mg/L limit prior to further chloride loading through beneficial use and conveyed to the Piru WWTP. The VCWD 16 received a Notice of Violation from the RWQCB–LA for TDS and chloride exceedances dated December 17, 2013. VCWD 16 met with representatives of the RWQCB–LA on April 11, 2014 and followed up with a discussion summary letter on May 1, 2014.

VCWD 16 notified the RWQCB–LA of the exceedance of permit limits for TSS on December 29, 2014. "The violation was attributed to operational factors and pump malfunctions in combination with I&I [inflow and infiltration] from a storm event on December 12, 2014" (VCWD 16, 2015). Minimum depth to water in spring 2015 in a monitor well near the Piru plant percolation ponds was 75 feet (Figure 24). Water quality impacts associated with this exceedance are likely negligible due to the filtration capacity of the extensive unsaturated (vadose) zone present beneath the percolation ponds at the time of the TSS exceedance.

Year	Mean Chloride Effluent (mg/L)	Mean Chloride Water Supply (mg/L)	Effluent (mean mgd)
2014	147	89	0.12
2015	152	101	0.12

Table 5. 2014 and 2015 Piru WWTP mean chloride (mg/L) and effluent discharge (mgd).

11.2 FILLMORE WASTEWATER TREATMENT PLANT

A new City of Fillmore Water Recycling Plant (wastewater treatment plant) was completed in August 2009 and the plant began operation in September 2009. The plant is located near the

Santa Clara River east of Sespe Creek in the Fillmore basin (Figure 1). The plant has the capacity to treat 1.8 million gallons of water per day. The plant currently treats about 0.9 million gallons of water per day. In recent years some 20% (180,000 gallons per day) of the treated effluent is used for turf irrigation and other landscaping at two schools, a newly constructed green belt and the Two Rivers Park. The remaining 80% or 720,000 gallons per day is being discharged to percolation ponds (Water Quality Products, 2010).

Effluent discharged from the Fillmore WWTP averaged 0.88 million gallons per day (1.36 cfs) for 2014 (21% used for turf irrigation) and 0.88 million gallons per day (1.36 cfs) for 2015 (18% used for turf irrigation) (Table 6). There is an upward trend in Fillmore WWTP monthly mean effluent chloride concentrations for 2012 through 2015 (City of Fillmore, 2013, 2014, 2015, 2016).

The chloride constituent of the percolated effluent in the Fillmore WWTP's ponds is not likely significantly impacting the groundwater quality of the basin (LWA et al., 2015). The 2015 maximum chloride concentration in a shallow production well located approximately 0.3 miles down-gradient from the Fillmore WWTP, north of the Santa Clara River and east of Sespe Creek, was 62 mg/L. The location of the down-gradient well and the location of the Fillmore WWTP percolation ponds are shown in Figure 33.

Annual monitoring reports for Fillmore WWTP for the 2014 and 2015 calendar years state that the plant was not in compliance with waste discharge requirements as set by the RWQCB-LA for boron and chloride. The City of Fillmore received a Notice of Violation from the Regional Board for boron exceedance dated December 19, 2013. The influent levels of boron and chloride entering the Fillmore WWTP are higher than the imposed discharge limits of 1.0 mg/L and 100 mg/L respectively (City of Fillmore, 2015, 2016).

Year	Mean Chloride Effluent (mg/L)	Mean Chloride Water Supply (mg/L)	Effluent (mean mgd)	Effluent % Used for Turf Irrigation
2014	112	no data	0.88	21%
2015	115	no data	0.88	18%

Table 6. 2014 and 2015 Fillmore WWTP mean chloride (mg/L) and effluent discharge (mgd).

11.3 SAUGUS AND VALENCIA WASTEWATER TREATMENT PLANTS

The Saugus and Valencia Wastewater Water Reclamation Plants (wastewater treatment plants) are part of the Santa Clarita Valley Joint Sewerage System which serves Santa Clarita and adjacent portions of unincorporated Los Angeles County. The Saugus plant is located approximately 3.0 miles to the east of the Saugus plant (Figure 1). Both the Saugus and Valencia wastewater plants discharge tertiary treated water directly into the Santa Clara River east of the Ventura/Los Angeles County Line.

In calendar year 2014 the Saugus WWTP discharged approximately 6,110 ac-ft of treated effluent with an average chloride concentration of 134 mg/L into the Santa Clara River. In the 2015 calendar year the Saugus WWTP discharged approximately 5,720 ac-ft of effluent into the Santa Clara River, with an average chloride concentration of 137 mg/L. There is an upward trend in Saugus WWTP effluent chloride concentrations from 2012 through 2015 (CSD-LAC, 2012a, 2013a, 2014a, 2015a, 2016a) that can be seen in Figure 41. Staff from the Sanitation Districts report that discharge from the Saugus WWTP commonly percolates entirely in the channel of the Santa Clara River in the reach downstream of the point of discharge.

The Valencia WWTP is located approximately 1.2 miles southeast of Castaic Junction on Interstate Highway 5, just north of Six Flags Magic Mountain and west of Interstate 5. In calendar years 2014 and 2015, the Valencia WWTP discharged approximately 1,370 ac-ft/yr less than each of the previous two years. In the 2014 calendar year the Valencia WWTP discharged approximately 14,990 ac-ft of effluent into the Santa Clara River, with an average chloride concentration of 135 mg/L. In calendar year 2015 the Valencia WWTP discharged approximately 14,440 ac-ft of effluent into the Santa Clara River, with an average chloride concentration of 144 mg/L. There is also an upward trend in Valencia WWTP effluent chloride concentrations from 2012 through 2015 (CSD-LAC, 2012b, 2013b, 2014b, 2015b, 2016b) that can be seen in Figure 42.

Chloride concentrations in the Santa Clara River near the Los Angeles County Line are influenced by chloride in imported State Water, as Castaic Lake Water Agency delivers State Water to water retailers in the greater Santa Clarita area. Nearly 50% of the chloride load in wastewater discharges is from the chloride load in delivered water (CSD-LAC, 2008). Additional chloride loading occurs during beneficial use of the delivered water, but loading has been significantly reduced in recent years as the Los Angeles County Sanitation District has managed a successful campaign to remove thousands of self-regenerating water softeners from the community. The recent upward trend in chloride concentrations in the effluent from both the Saugus and Valencia WWTPs likely results in part from increasing chloride concentrations in imported State Water Project water, which forms a significant percentage of the water supply for Santa Clarita (Figures 41 and 42). Recent decreases in discharge volumes are related to water conservation measures in effect during the current drought conditions.

Figure 43 plots discharge from the Valencia WWTP for 2008 through 2015 for comparison with the flow and chloride concentrations in the Santa Clara River near the Ventura/Los Angeles County Line. During the fall of most years, as shown in the figure, the effluent from the Valencia WWTP discharge to the Upper Santa Clara River is greater than the total flow of the Santa Clara River near the Ventura/Los Angeles County Line. Base flow in the Santa Clara River near the Ventura/Los Angeles County Line would be much lower during the fall of most years without the effluent discharged by the Valencia WWTP. The up-stream Saugus WWTP discharge is also shown in the plot but, as mentioned earlier, commonly fully percolates into the Santa Clara River channel before it reaches the Valencia WWTP. Perennial dry season gauged Santa Clara River flow, just upstream from the Valencia WWTP, at LA County Gauge F92C (Santa Clara River at Old Road Bridge) is produced by the occurrence of rising groundwater (a gaining reach of the river).

In recent years the combined effect of the elimination of self-regenerating water softeners and variable chloride concentrations of the water purveyed by the State Water Project has been a slight downward trend of chloride concentrations near the Ventura/Los Angeles County Line for the 2008 through 2013 period (UWCD, 2015). Likely as a result of persistent drought conditions and the resulting higher concentrations of chloride in discharged Valencia WWTP effluent, the period of 2008 extended through 2015 shows an overall increase in chloride concentrations (Figure 43).

12 TOLAND ROAD LANDFILL

The Toland Road Landfill is located in the foothills on the north side of the Fillmore basin, approximately four miles west of the City of Fillmore and two miles north of Hwy 126 (Figure 44). The landfill, located at the end of Toland Road, opened in 1970 under operation by the Ventura County Public Works Department. Ventura Regional Sanitation District (VRSD) assumed operation of the landfill in 1972. VRSD obtained ownership of the landfill property in 1986 and purchased additional property adjacent to the landfill in 1988 (Slade, 1996). VRSD operates the landfill under a Conditional Use Permit from the County of Ventura. The containment systems for the facility and associated water quality monitoring is permitted and administered by the Regional Water Quality Control Board, Los Angeles (Regional Board or RWQCB-LA).

In 1996 the Ventura County Supervisors approved expansion of the landfill from a permitted 135 tons of waste per day to 1,500 tons of waste per day. The footprint extension of the landfill, which began in 1996, extended the life span of the landfill to approximately the year 2027. Requirements for the landfill expansion related to groundwater included the installation of: 1) additional alluvial monitor wells which were constructed in 1996, and additional Pico Formation monitor wells which were constructed in 1998; 2) a landfill liner above the existing waste stockpile beneath the expansion areas; 3) a leachate collection system beneath the liner; and 4) a gas collection system above the liner (Slade, 1996).

The geology of the landfill site is complex. The majority of the landfill footprint is located directly on top of overturned beds of Pico Formation, which overlie overturned beds of Las Posas Sand Formation (Lower San Pedro formation). The southern portion of the landfill footprint directly overlies overturned beds of Las Posas Sand Formation. The Pico formation consists of massive claystone or mudstone (Dibblee, 1990), which is considered impermeable to groundwater flow. The Las Posas Sand Formation is a permeable water-bearing formation, which is conducive to groundwater flow. The Culbertson Fault may form the contact between the Pico Formation and the Las Posas Sand Formation (Figure 44).

Pico Formation monitor wells surrounding the landfill have not detected the migration of contaminants from the facility. Likewise, water supply wells located within approximately a one-mile radius of the landfill do not contain contaminants indicative of a landfill release. Springs (seeps) located near the facility occur at elevations greater than the waste deposits. Elevated metal concentrations observed in some of the seeps are believed to be naturally occurring and not related to the presence of the landfill.

In December 2000 VRSD began operating a gas flare at the landfill. The flare is supplied by a system of horizontal and vertical gas extraction wells and associated piping that draw landfill gas from the waste fill to a central point, where it is continuously burned off. The gas extraction well network is expanded as the waste filling progresses. Current quantities of landfill gas collected and destroyed are approximately 1,800 standard cubic feet per minute (scfm).

The current groundwater monitoring network consists of 5 monitoring wells installed in March 2009 (TMW-1 through TMW-5) (VRSD, 2009). This monitoring network takes into account the future build-out of the landfill.

VRSD developed additional lined landfill areas and installed a stability berm at the foot of the landfill during the construction of Phase IIIA in 2007 and Phase IIIB in 2010/2011. The stability berm structure includes an impervious liner anchored in the Pico Formation, which underlies the alluvium in that portion of the canyon. This improvement has ensured the full containment of gas and leachate within the waste areas. The active landfill operations continue with the next planned 10 year (Phase IV) liner construction project starting in 2016. The design report for the liner was approved by the RWQCB-LA in October of 2015 after VRSD complied with revisions to the original proposed design.

VRSD received a Notice of Violation from the Regional Board dated August 4, 2014 for failure to properly manage the application of wastewater used for irrigation or dust control. In response, VRSD staff updated and later revised the Biosolids Operation Plan for Toland Road Landfill. The landfill Biosolids Drying Facility was voluntarily shut down in April of 2015 as the result of high total coliform test results in the treated condensate generated by the Biosolids Drying Facility. On May 29, 2015 VRSD received a Notice of Violation regarding this issue and a response letter was written (VRSD, 2014a, 2014b, 2015a, 2015b, 2016).

VRSD received a Notice of Violation dated June 11, 2015 from the Regional Board for the exceedance of storm-water benchmarks. VRSD submitted a response letter and has enacted corrective actions to ensure timely submittals of required plans when benchmarks are exceeded. “The VRSD has also implemented a number of new BMPs [Best Management Practices] in an effort to reduce potential for benchmark exceedances” (VRSD, 2016). The reports are available for download online through the California State Water Resources Control Board’s GeoTracker (CA SWRCB, 2016).

13 AGRICULTURAL LAND USE

Piru basin agricultural land use maps for 1997 and 2016 are shown in Figure 45 and Figure 46; and Fillmore basin agricultural land use maps for 1997 and 2016 are shown in Figure 47 and Figure 48. The 2016 agricultural land use map is from the Ventura County Agricultural Commissioner and is more detailed than the 1997 agricultural land use map. The 1997 map was an United Water in-house effort that was produced from aerial photo interpretation and some limited ground truthing. All citrus on the 2016 maps is displayed in orange for comparison to the 1997 maps.

The maps show that significant acreage was converted from citrus to row crops, particularly in the Piru basin and the Fillmore basin south of the river. They also show increased avocado acreage replacing citrus acreage in the Fillmore basin north of the Santa Clara River. In the early and mid-2000s there was a significant increase in container plant nurseries in both the Piru and Fillmore basins. These nursery operations commonly displaced citrus groves.

There has been concern centering on increased groundwater pumping to support agricultural expansion up the hillsides. Hillside expansion is apparent from the maps in the Fillmore basin along the southern flank of the Fillmore basin on the hillsides south of Bardsdale. In Piru basin there has been hillside expansion along most of the southern portion of the basin. In the northern portion of Piru basin there has been expansion of the large plantings near the western end of the basin in the vicinity of Fairview Canyon, northwest of the town of Piru and the hillsides along the lower Piru Creek stream channel.

14 SUMMARY

- Precipitation for water years 2012 through 2015 in Ventura County was low enough to consider the Piru and Fillmore basins to be experiencing drought conditions.

- Below average precipitation in 2012 through 2015 and the resulting low inflow into Lake Piru resulted in United Water’s inability to perform conservation releases from Lake Piru in fall 2013, 2014 or 2015.

- Groundwater elevations continued to decline in 2014 and 2015 in both Piru and Fillmore basins. Water levels in key monitoring wells dropped below their BMOs (early 1990s drought low) in 2015.

- Groundwater extractions were above average for both basins in 2014 and 2015.

- Drought conditions is the predominate factor leading to above average groundwater extractions the last 2 years, but other factors include groundwater exports to Santa Paula basin and agricultural expansion up the hillsides supported by groundwater pumping.

- United Water's Board of Directors voted in 2013 to eliminate the option of reporting by crop factor, effective January 1, 2014.

- The surface water sample location near the Fillmore Fish Hatchery that exhibits perennial flow in all but the driest years was dry in the fall of 2014 and much of calendar year 2015.

- Chloride in Sespe Creek is highly variable but an upward trend is apparent for calendar years 2012 through 2015, with a maximum-recorded chloride concentration of 207 mg/L (three and a half times the BMO of 60 mg/L).

- Chloride in the Santa Clara River near the Ventura/County Line ranged above 117 mg/L in 2014 and 2015, with measured concentrations as high as 152 mg/L.

- Elevated chloride concentrations in groundwater east of Piru Creek and immediately west of Piru Creek persist, and are associated with high chloride concentrations from WWTP discharges in Santa Clarita.

- Following abandonment of the AWRM blending and export scheme, the Sanitation Districts proposed reverse osmosis (RO) treatment for a portion of their waste stream and concentrating and trucking their brine, allowing a blended discharge that complies with the 100 mg/L chloride discharge limit. The Regional Board now requires that this project be completed by July 2019.

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16 FIGURES

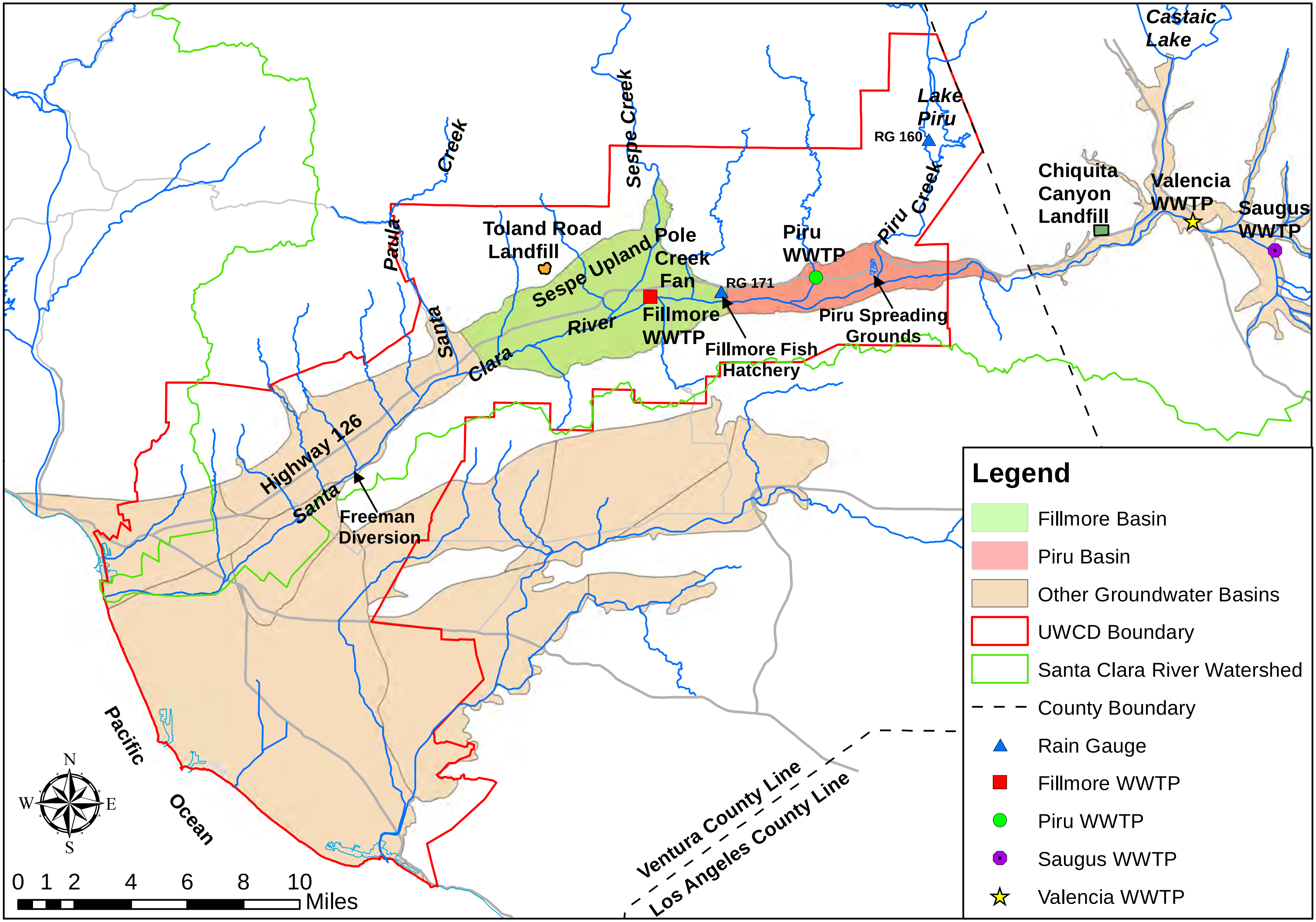

Figure 1. Regional location map.

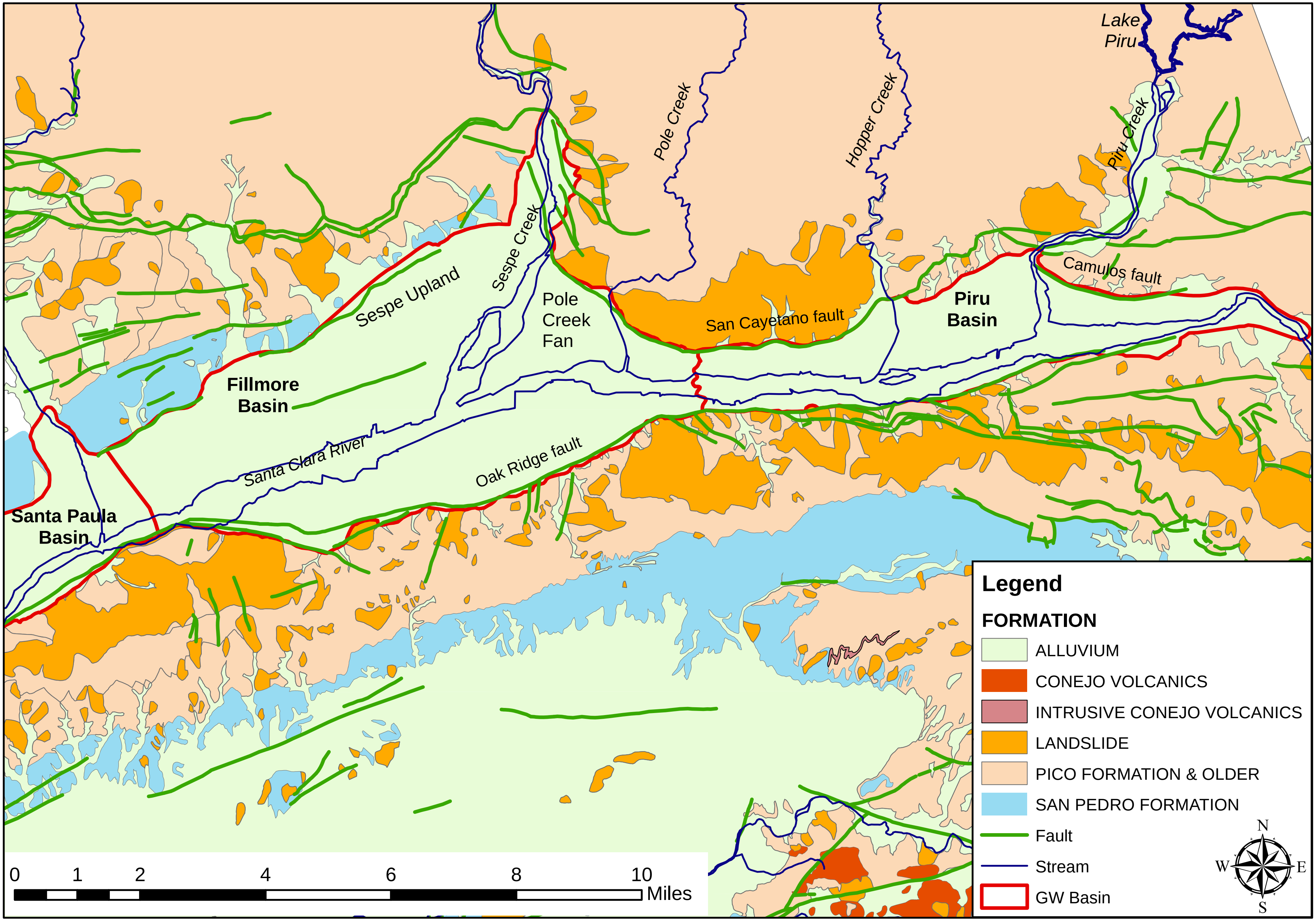

Figure 2. Surface geology map.

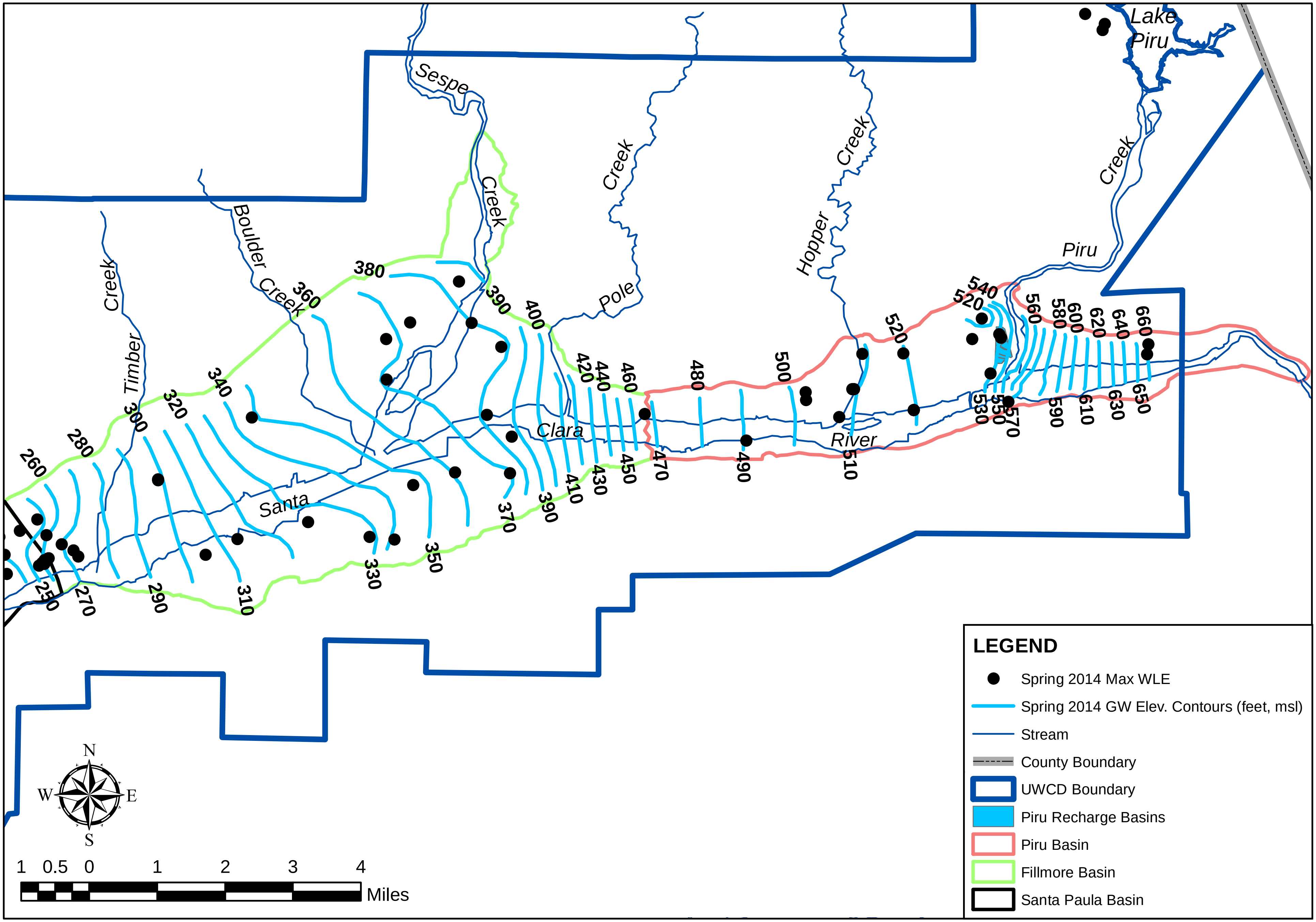

Figure 3. Spring 2014 groundwater elevation contours.

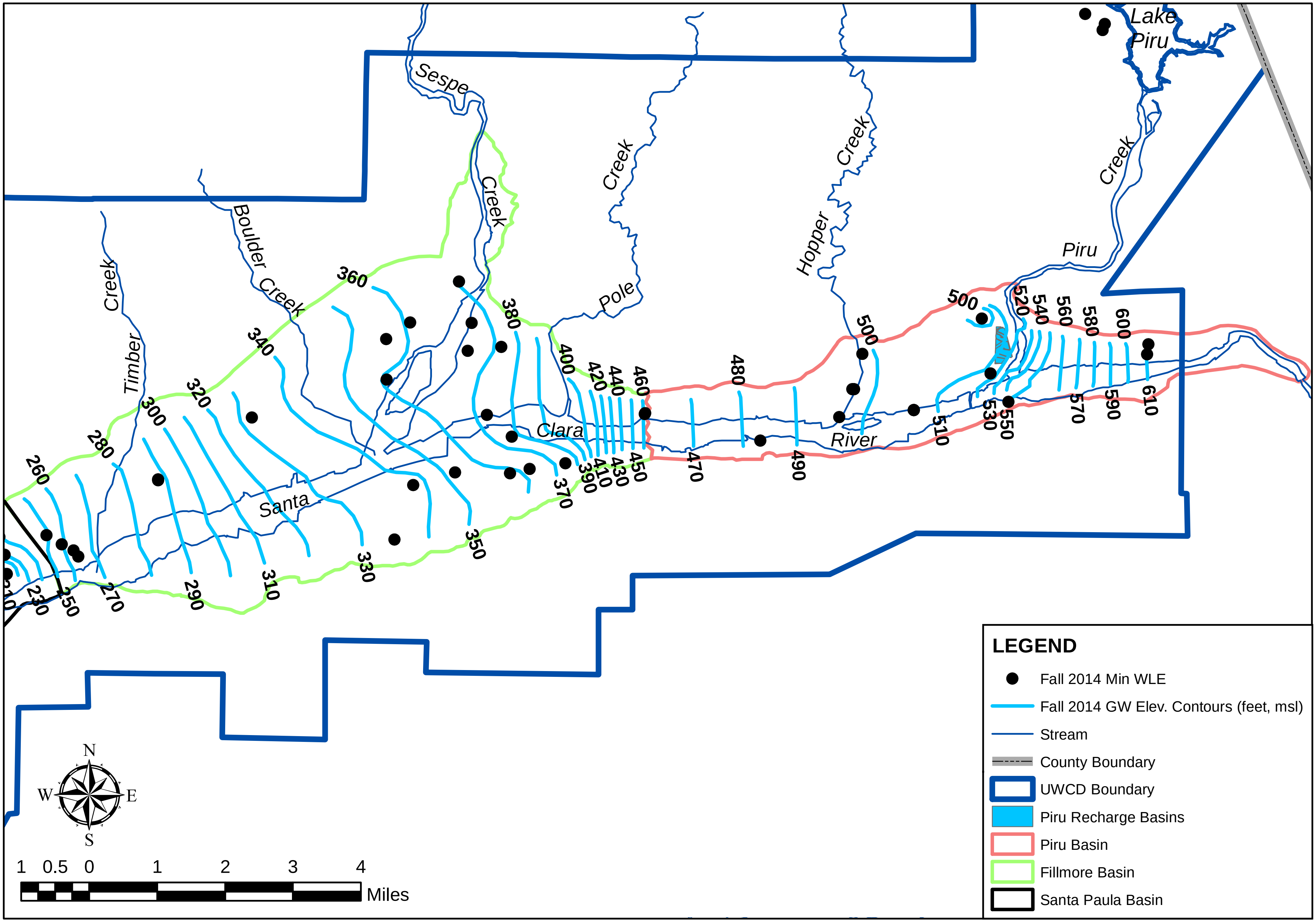

Figure 4. Fall 2014 groundwater elevation contours.

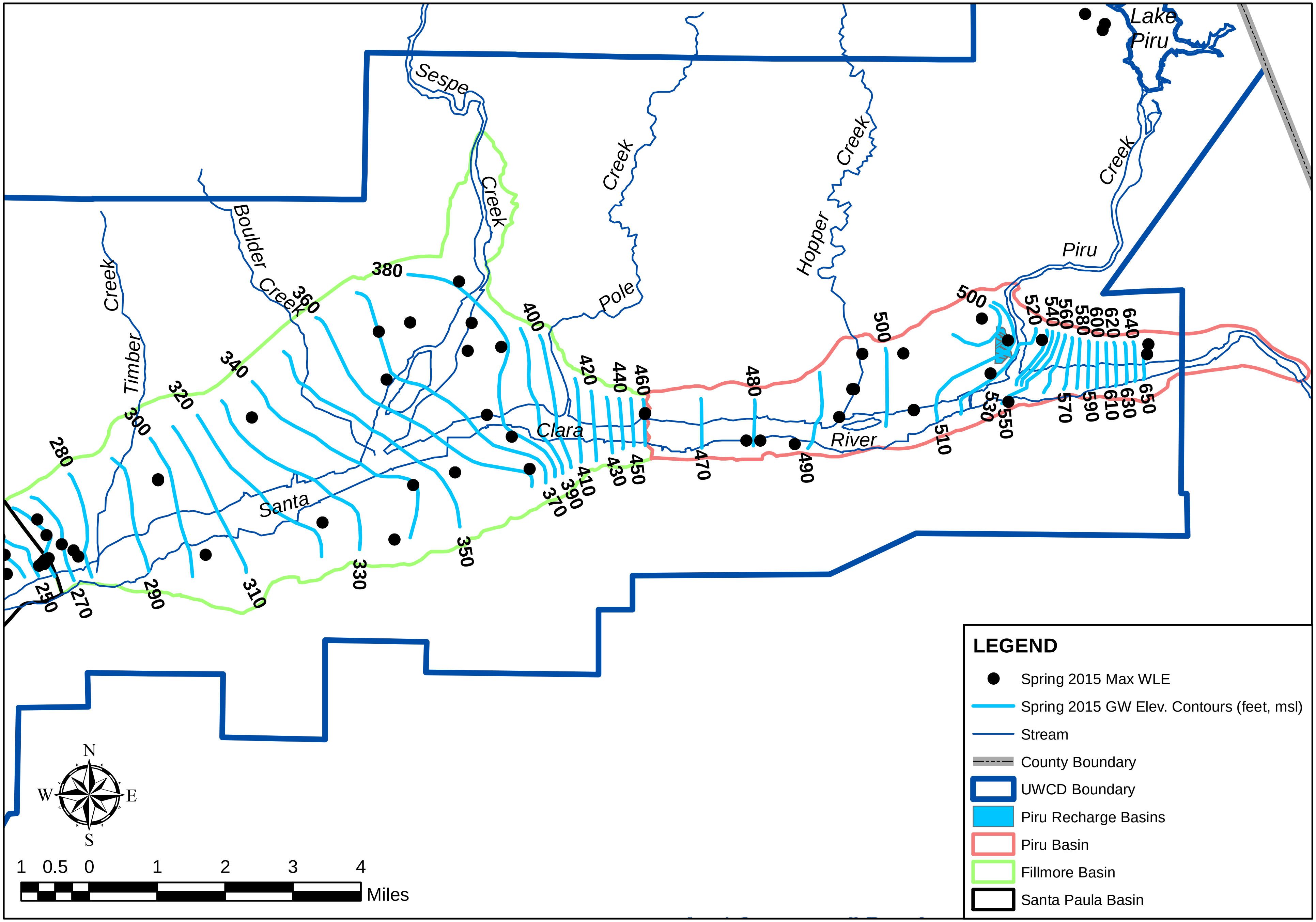

Figure 5. Spring 2015 groundwater elevation contours.

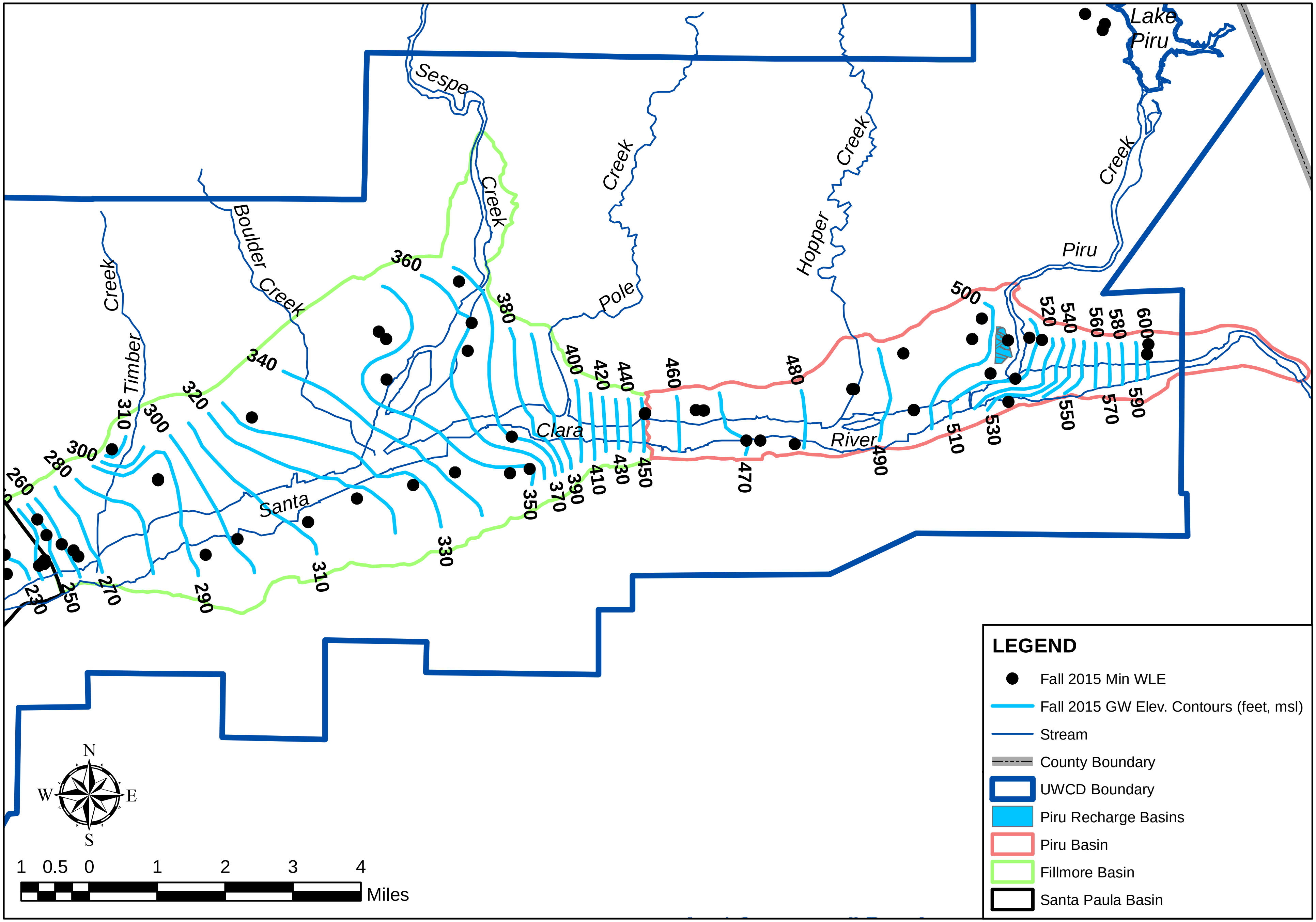

Figure 6. Fall 2015 groundwater elevation contours.

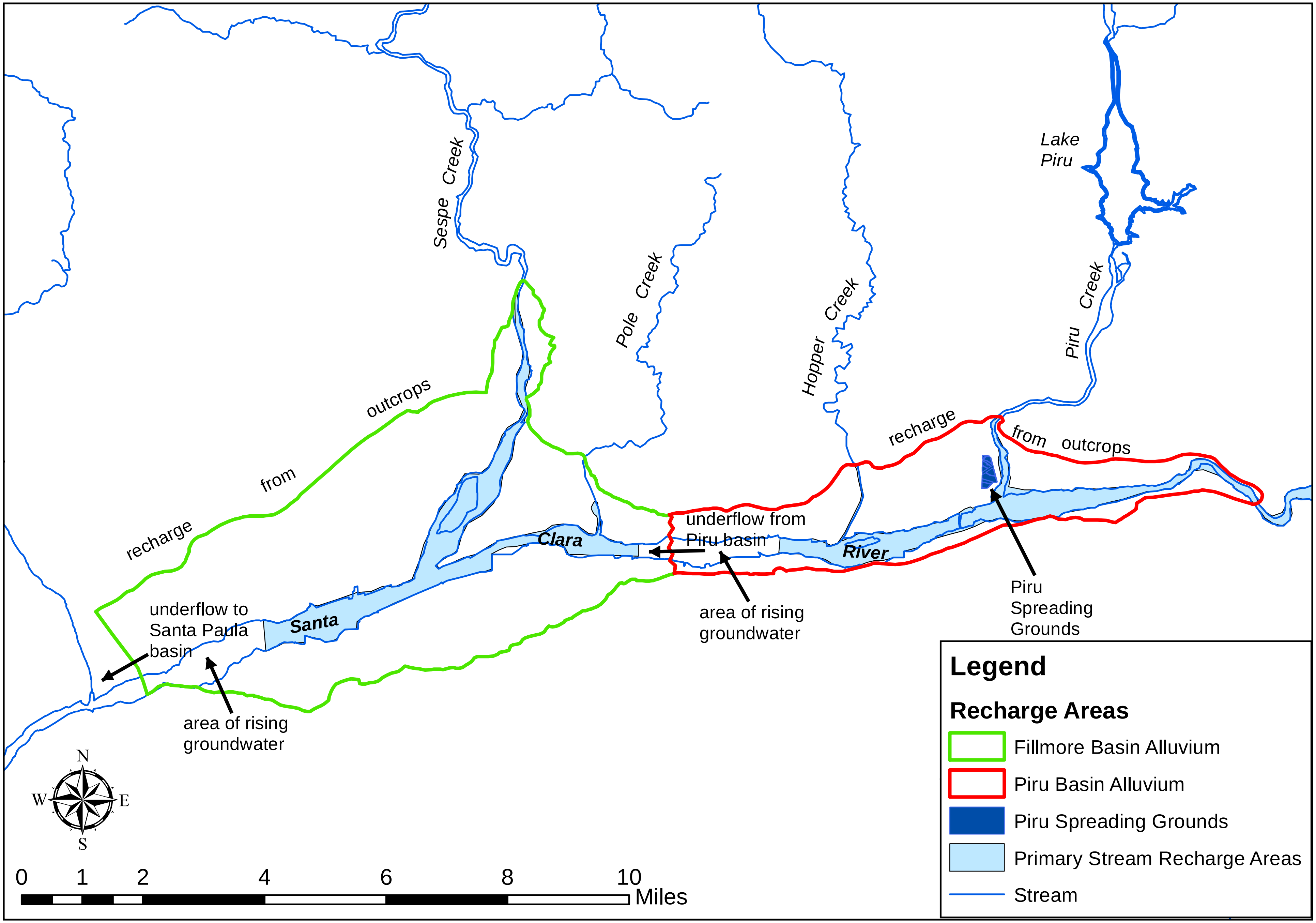

Figure 7. Groundwater recharge areas.

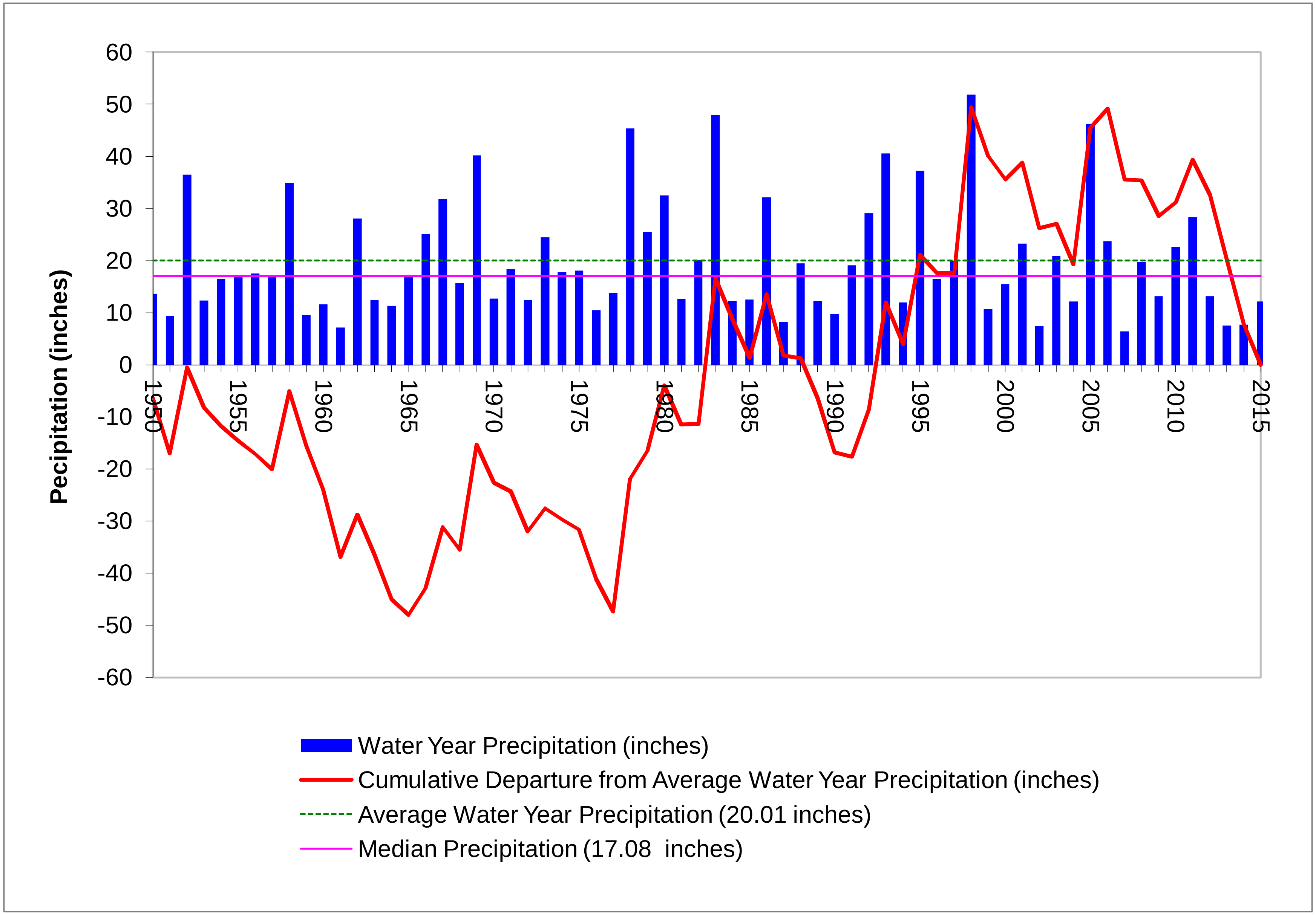

Figure 8. Piru basin historical annual precipitation (Piru-Temescal gauge; Data from Ventura County Watershed Protection District and United Water Conservation District).

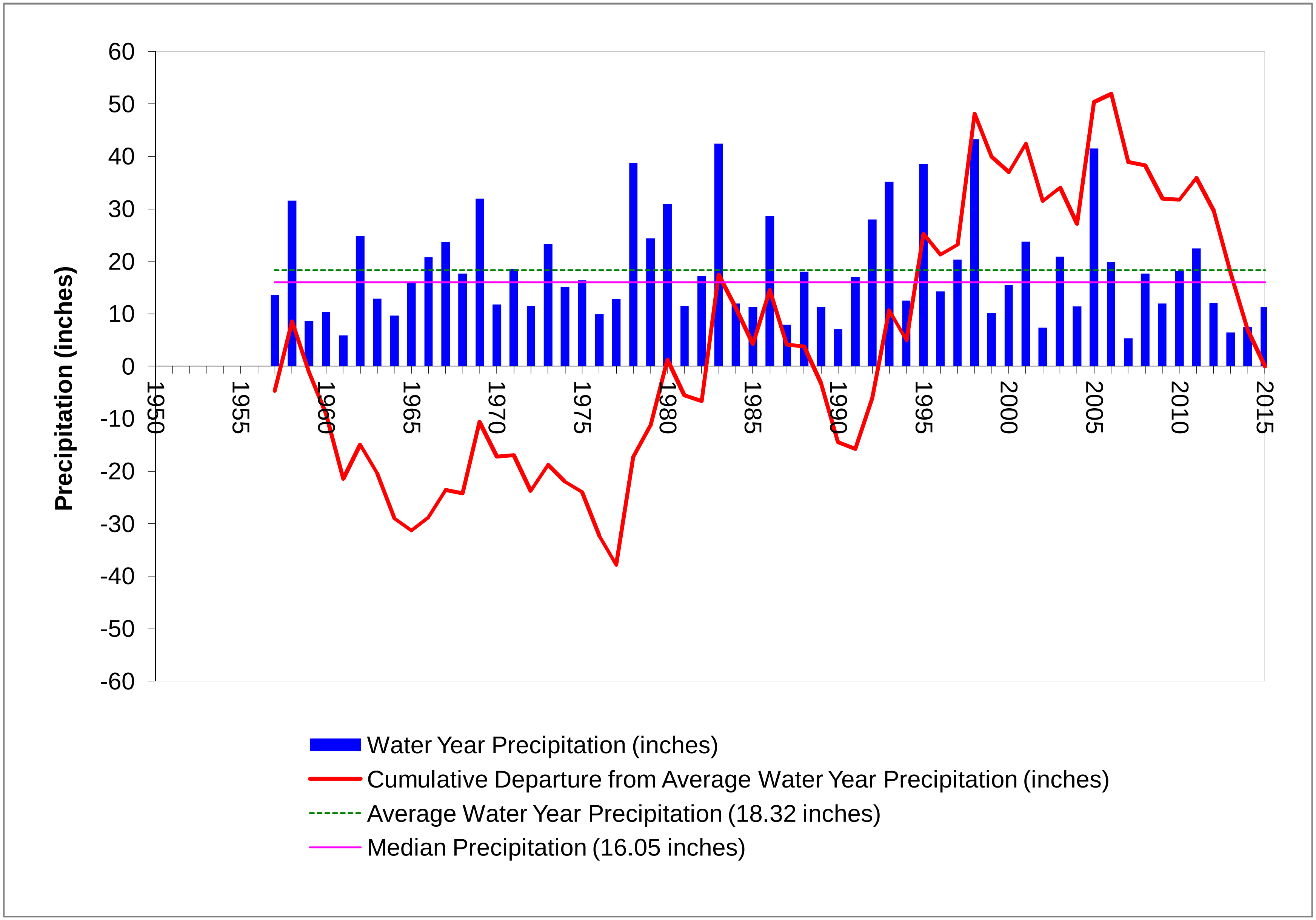

Figure 9. Fillmore basin historical annual precipitation (Fillmore Fish Hatchery Gauge; Data from Ventura County Watershed Protection District).

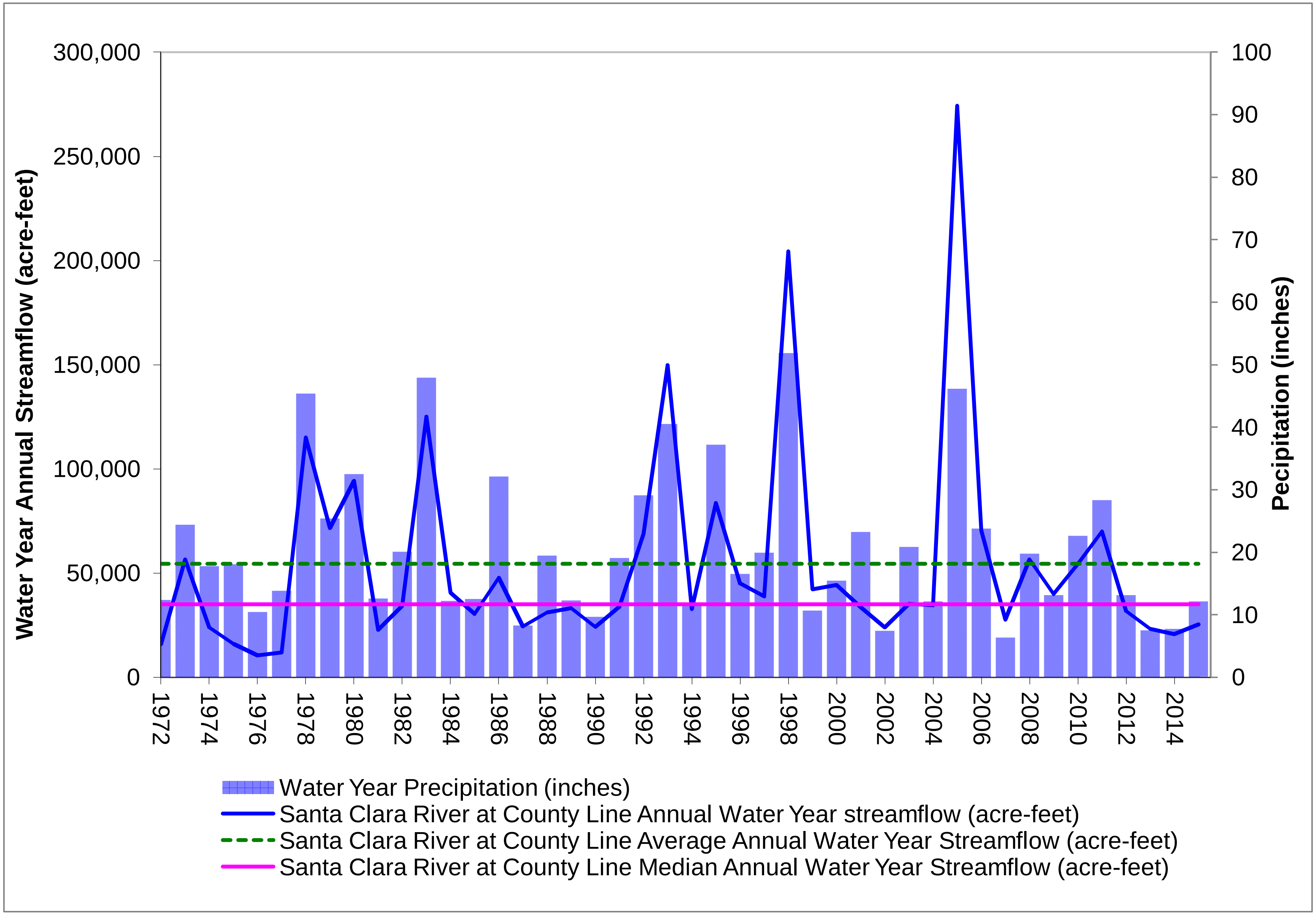

Figure 10. Santa Clara River historical annual streamflow near Ventura/L.A County Line and Piru basin precipitation (streamflow data from USGS).

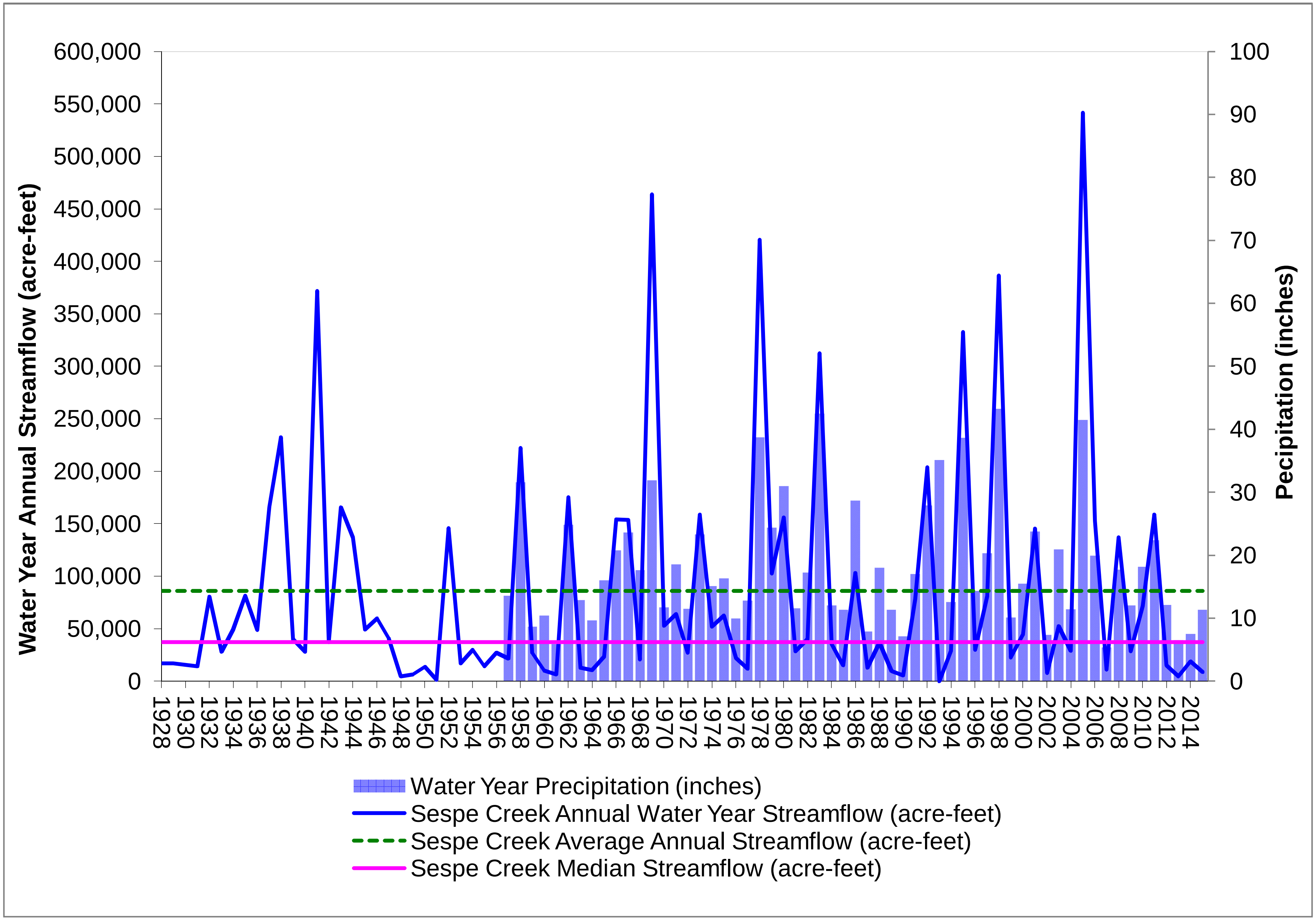

Figure 11. Sespe Creek historical annual streamflow and Fillmore basin precipitation (streamflow data from USGS and VCWPD).

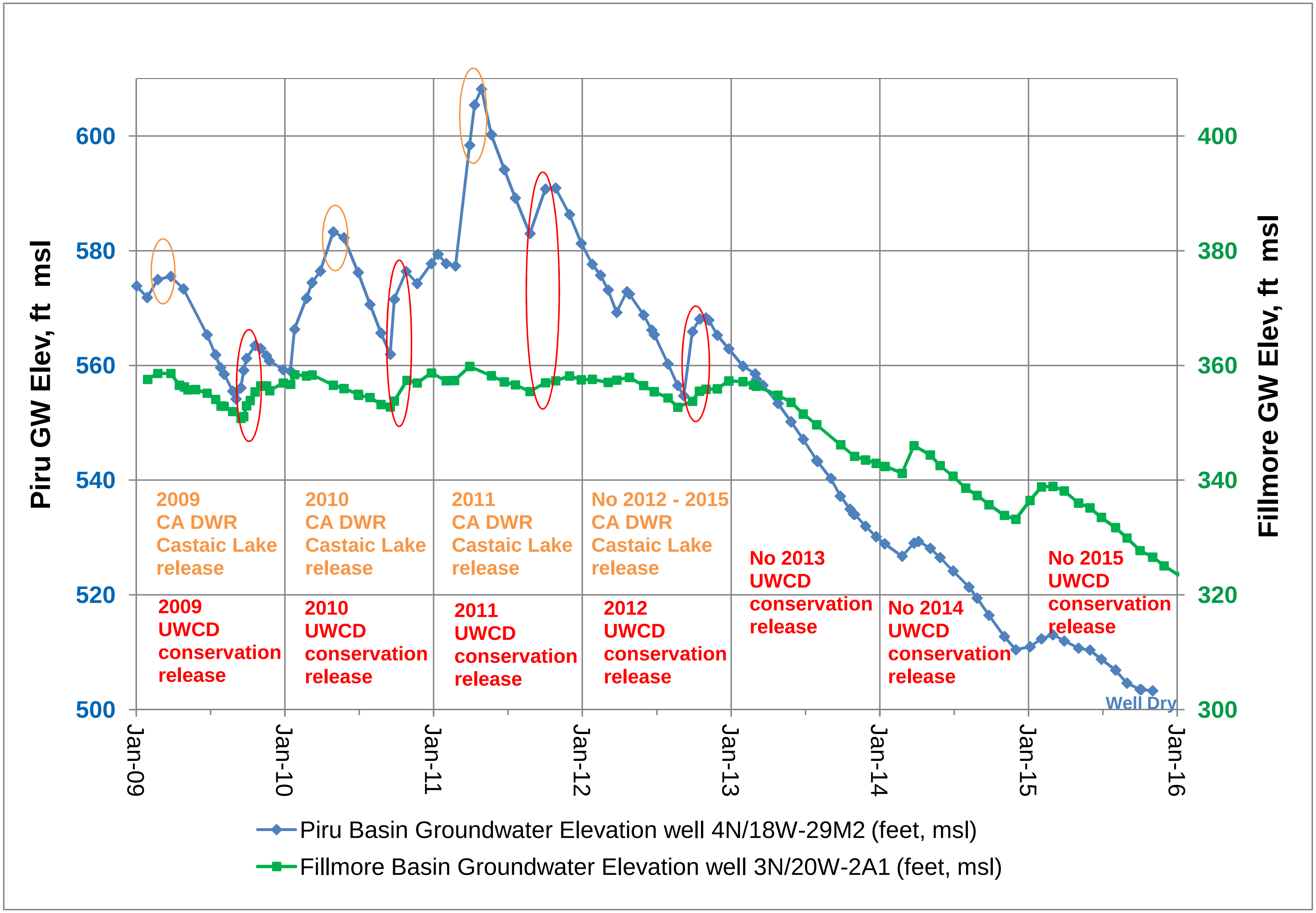

Figure 12. Piru basin and Fillmore basin groundwater levels response to United Water conservation releases and CA DWR Castaic Lake releases.

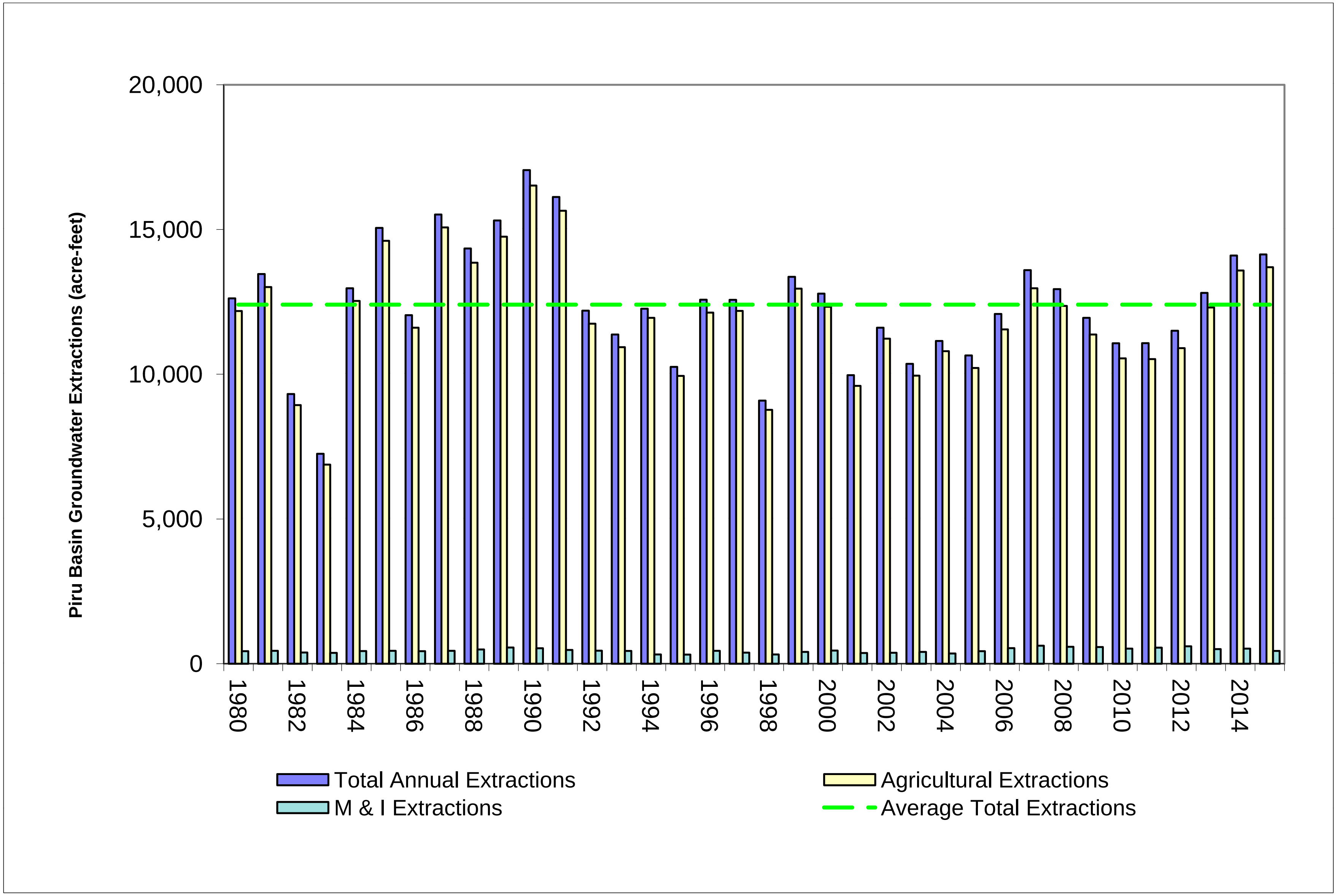

Figure 13. Historical annual groundwater extractions for the Piru basin (reported to United Water).

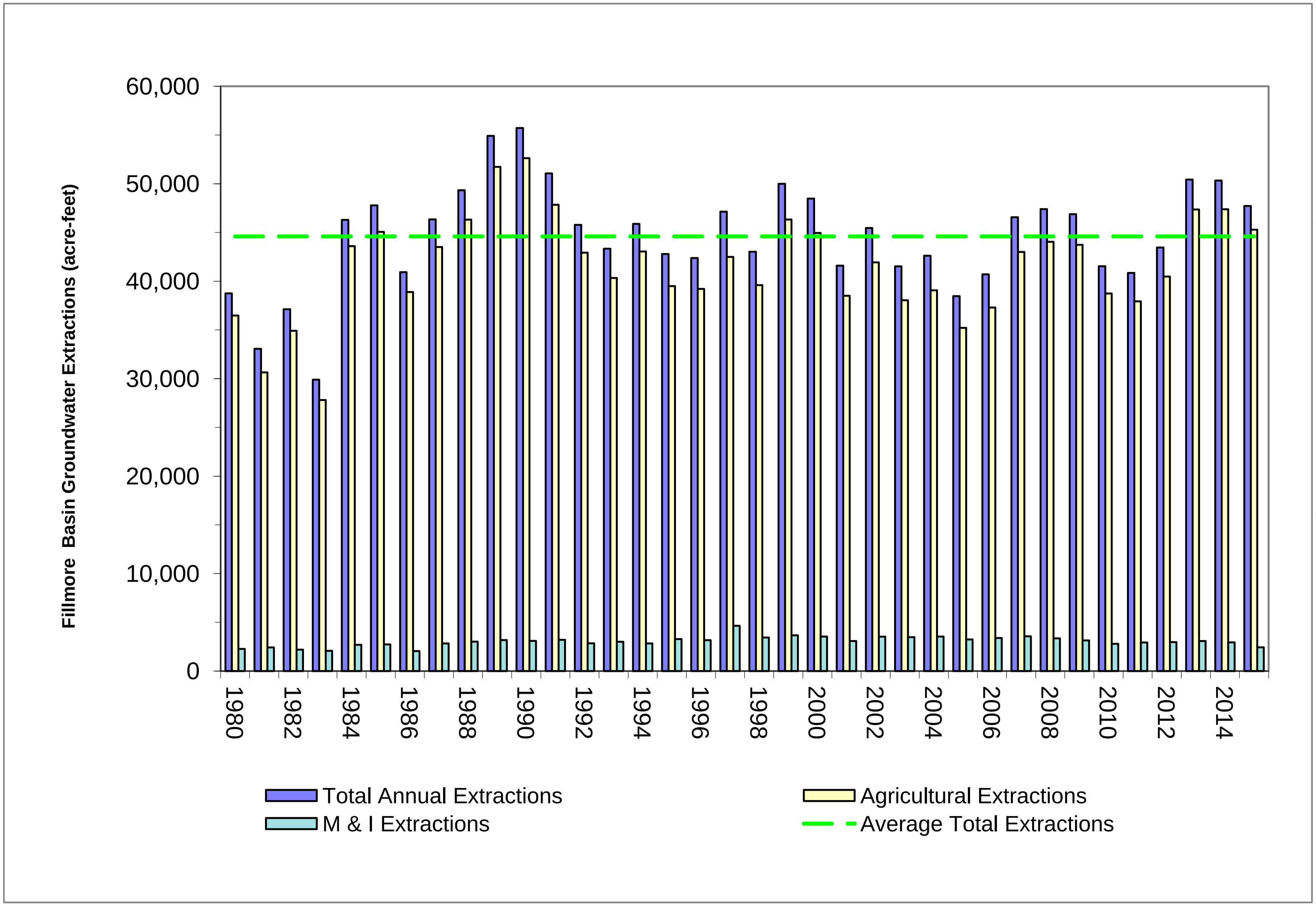

Figure 14. Historical annual groundwater extractions for the Fillmore basin (reported to United Water).

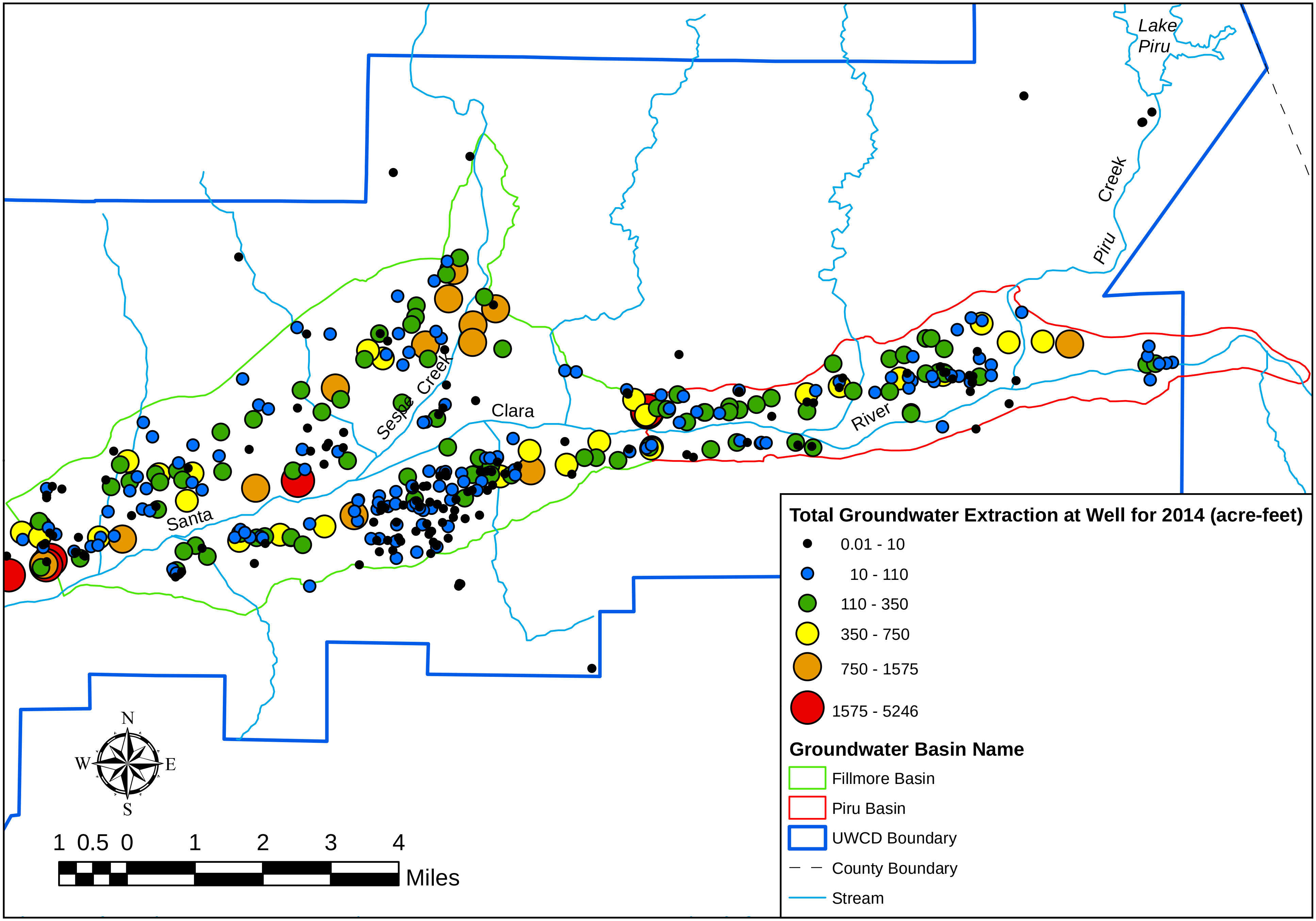

Figure 15. Groundwater extractions for 2014 by well.

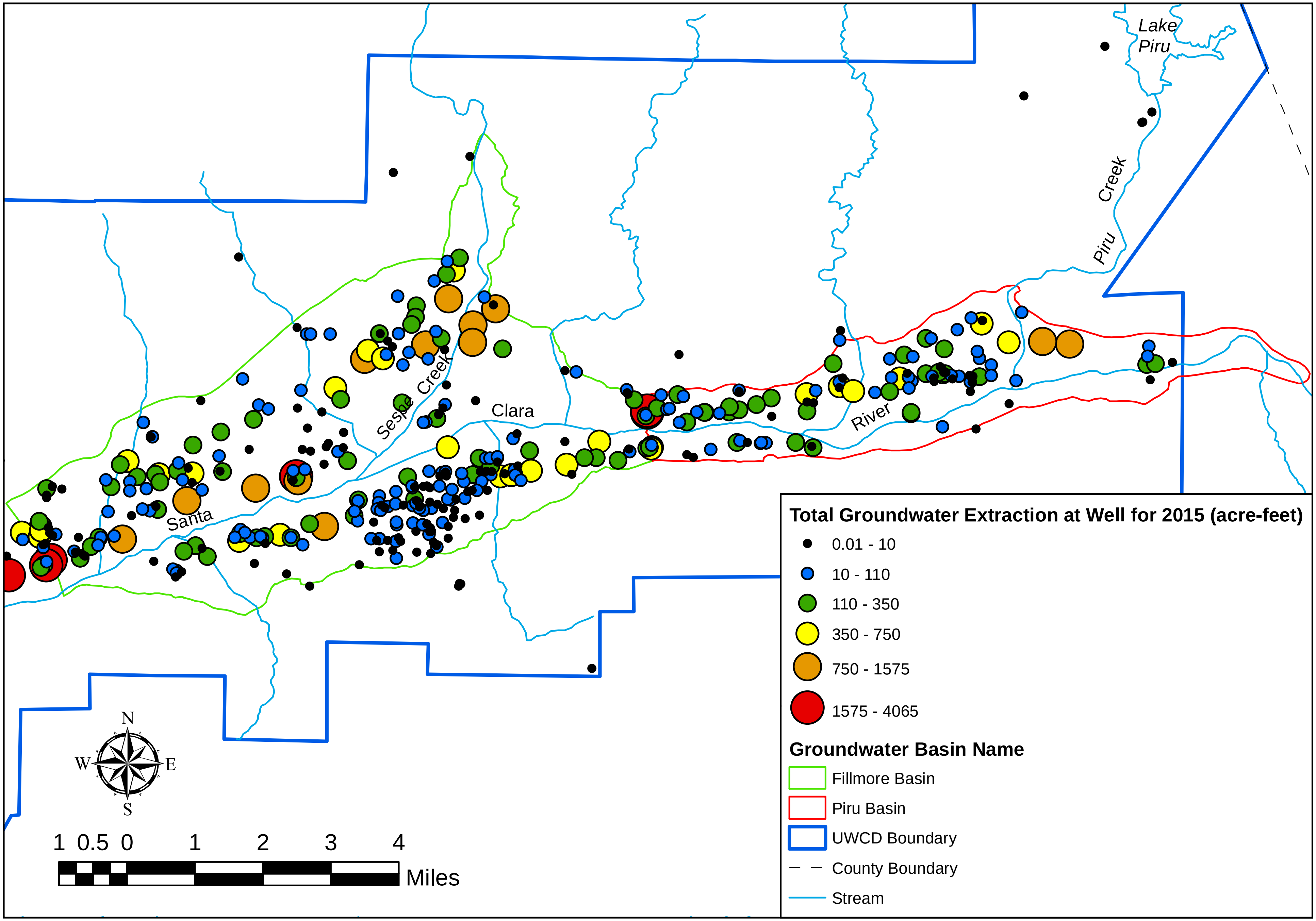

Figure 16. Groundwater extractions for 2015 by well.

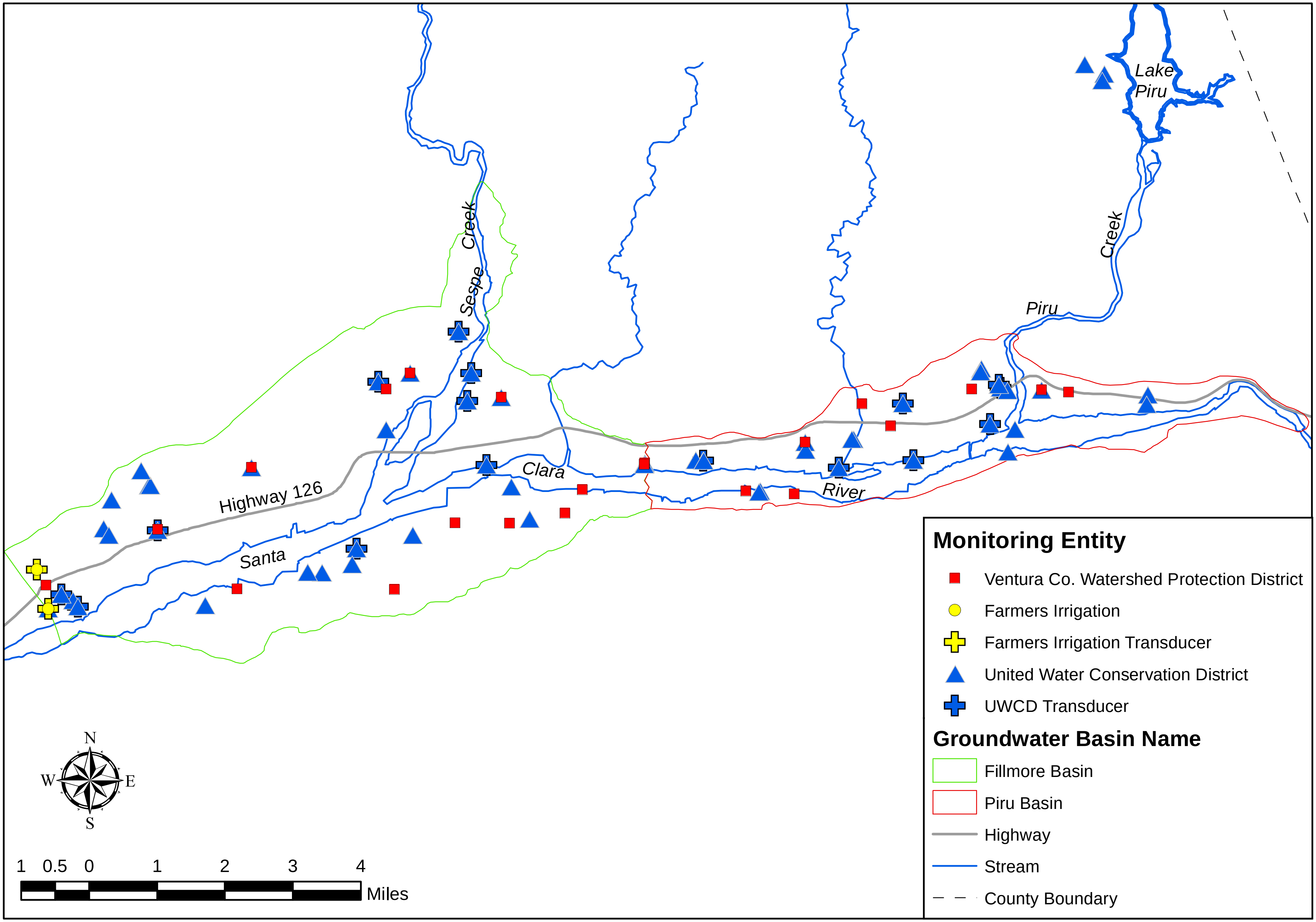

Figure 17. Locations of wells monitored for groundwater elevations in 2014 and/or 2015 within Piru basin and Fillmore basin.

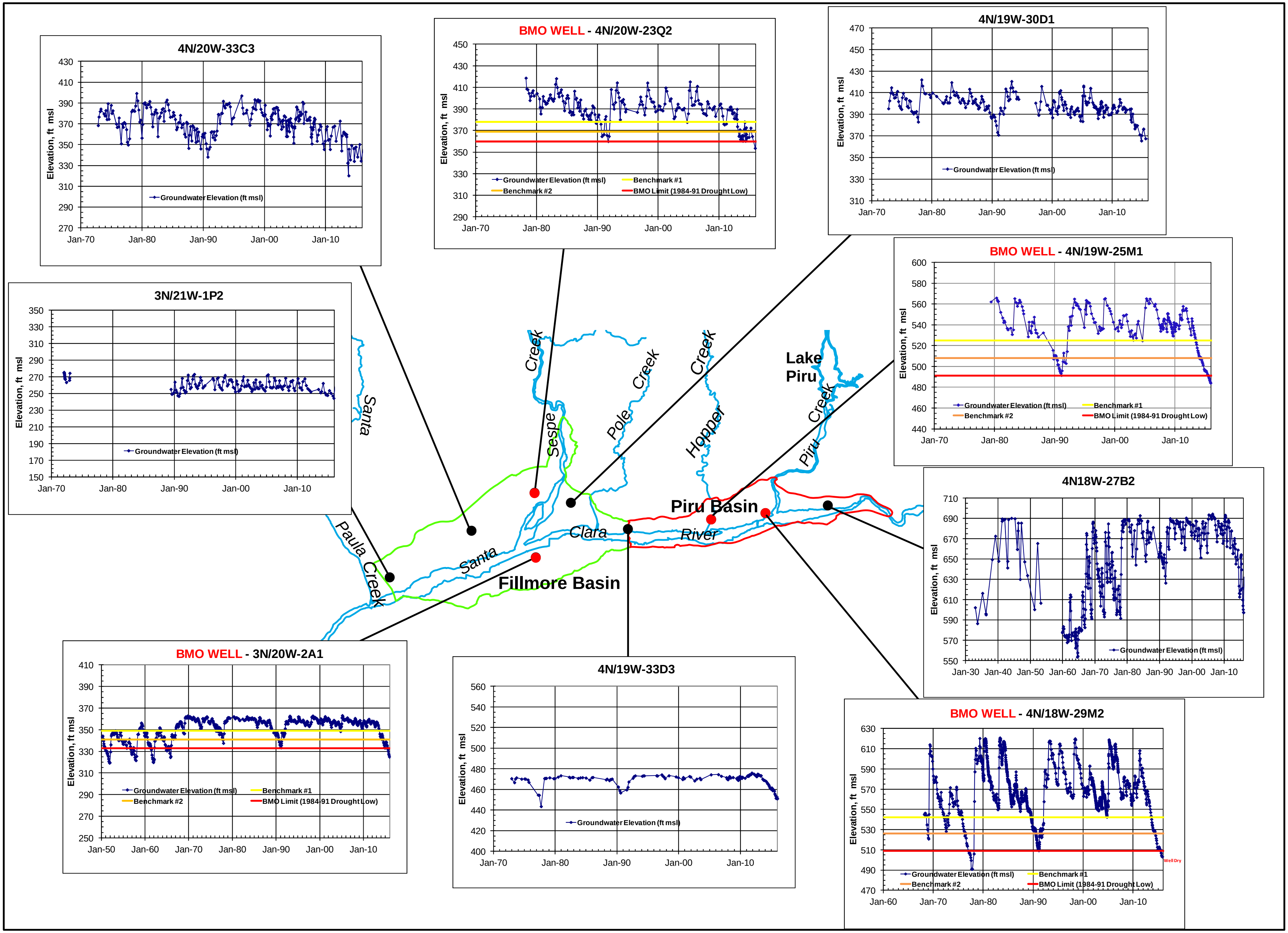

Figure 18. Groundwater elevation hydrographs.

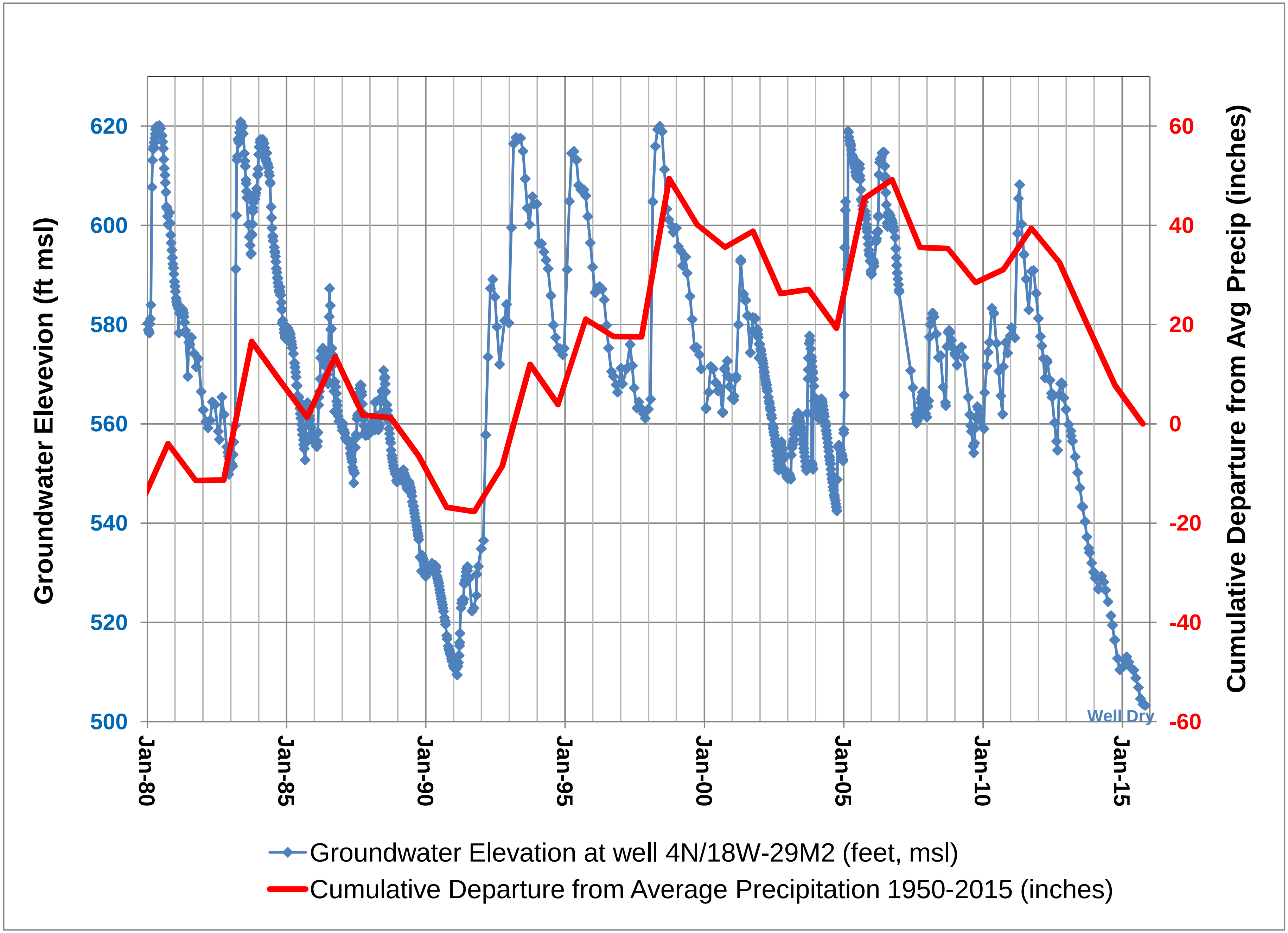

Figure 19. Groundwater elevations and cumulative departure from average precipitation for the Piru basin.

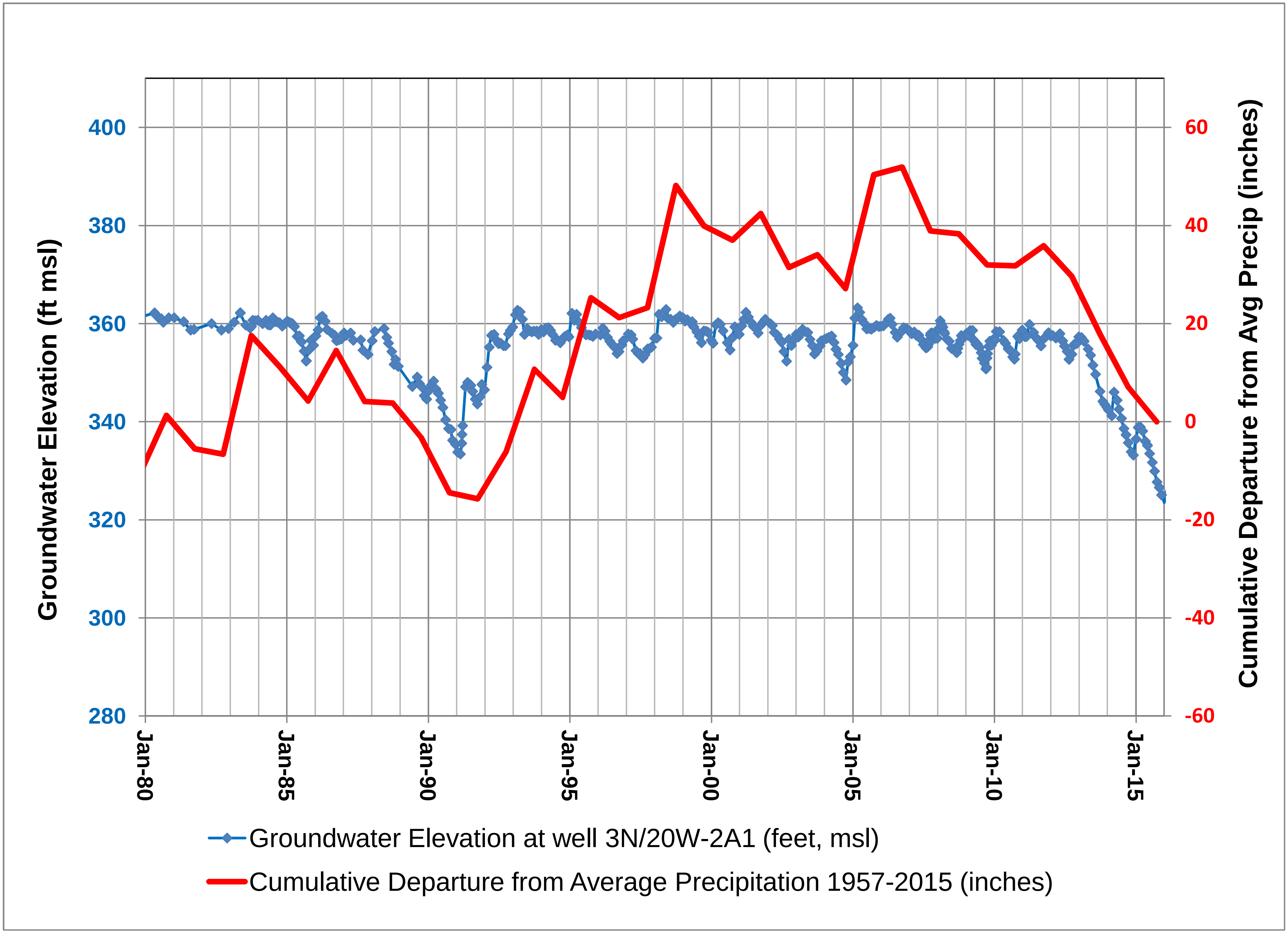

Figure 20. Groundwater elevations and cumulative departure from average precipitation for the Fillmore basin.

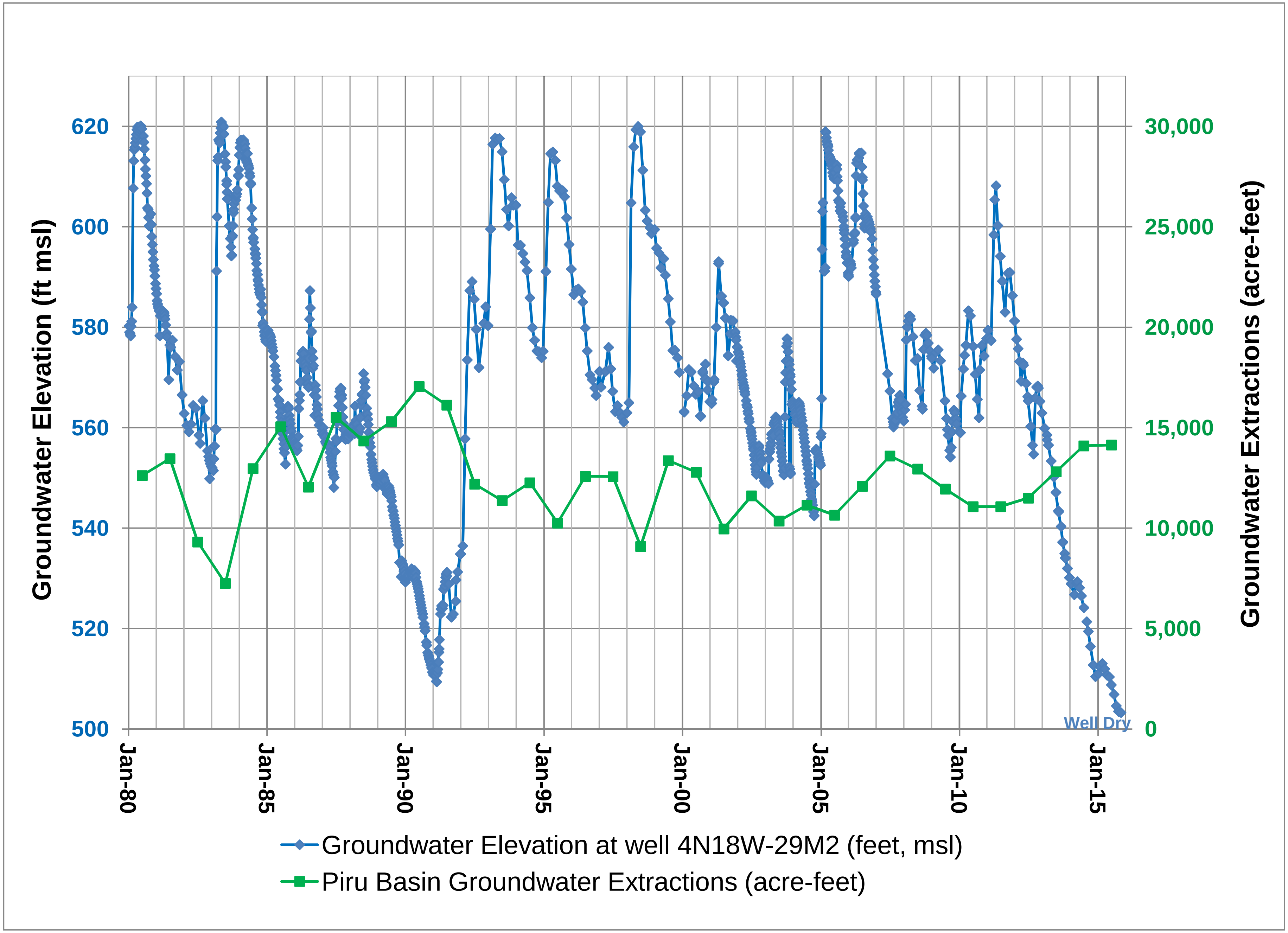

Figure 21. Historical annual groundwater elevations and extractions for the Piru basin.

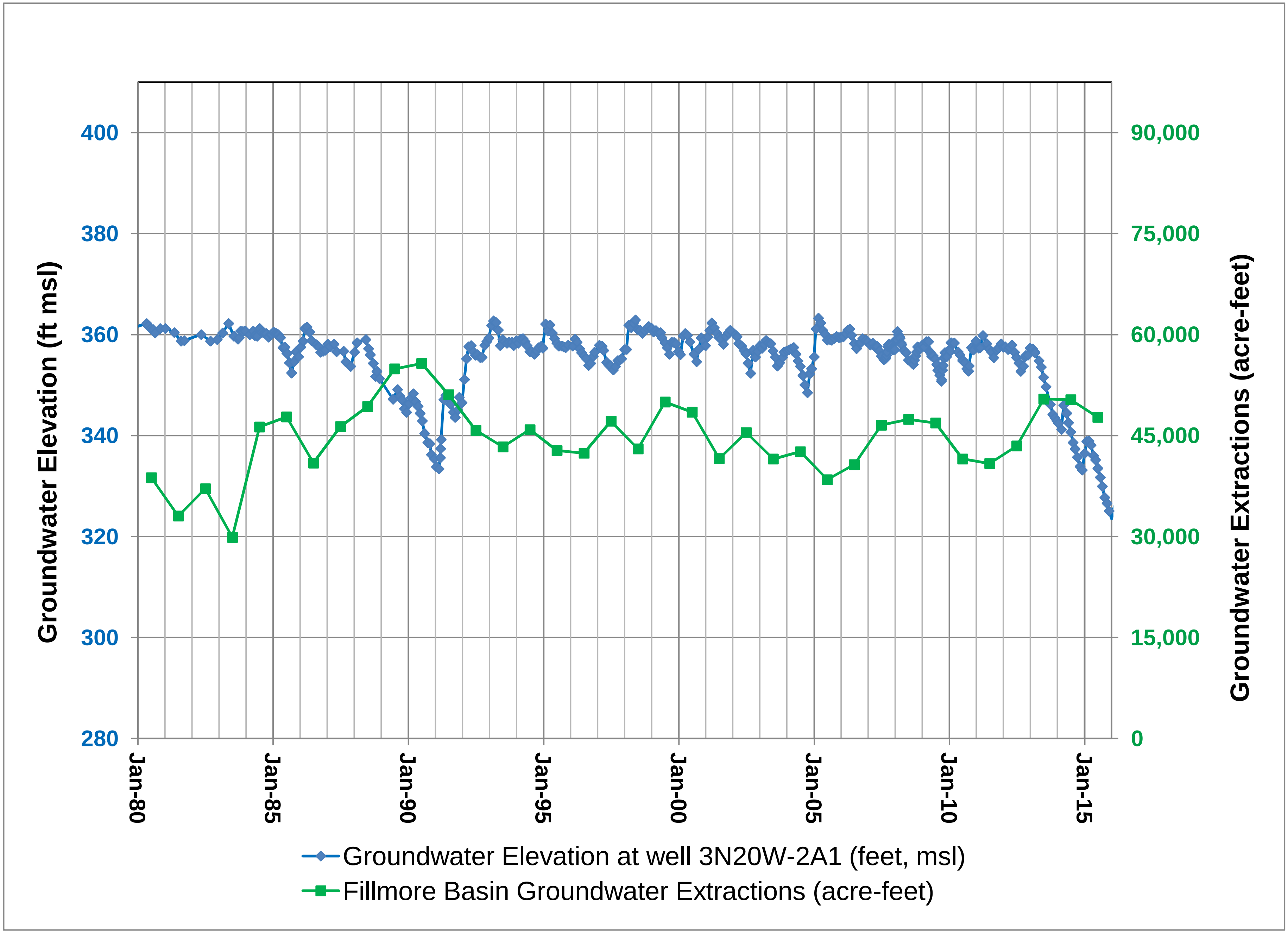

Figure 22. Historical annual groundwater elevations and extractions for the Fillmore basin.

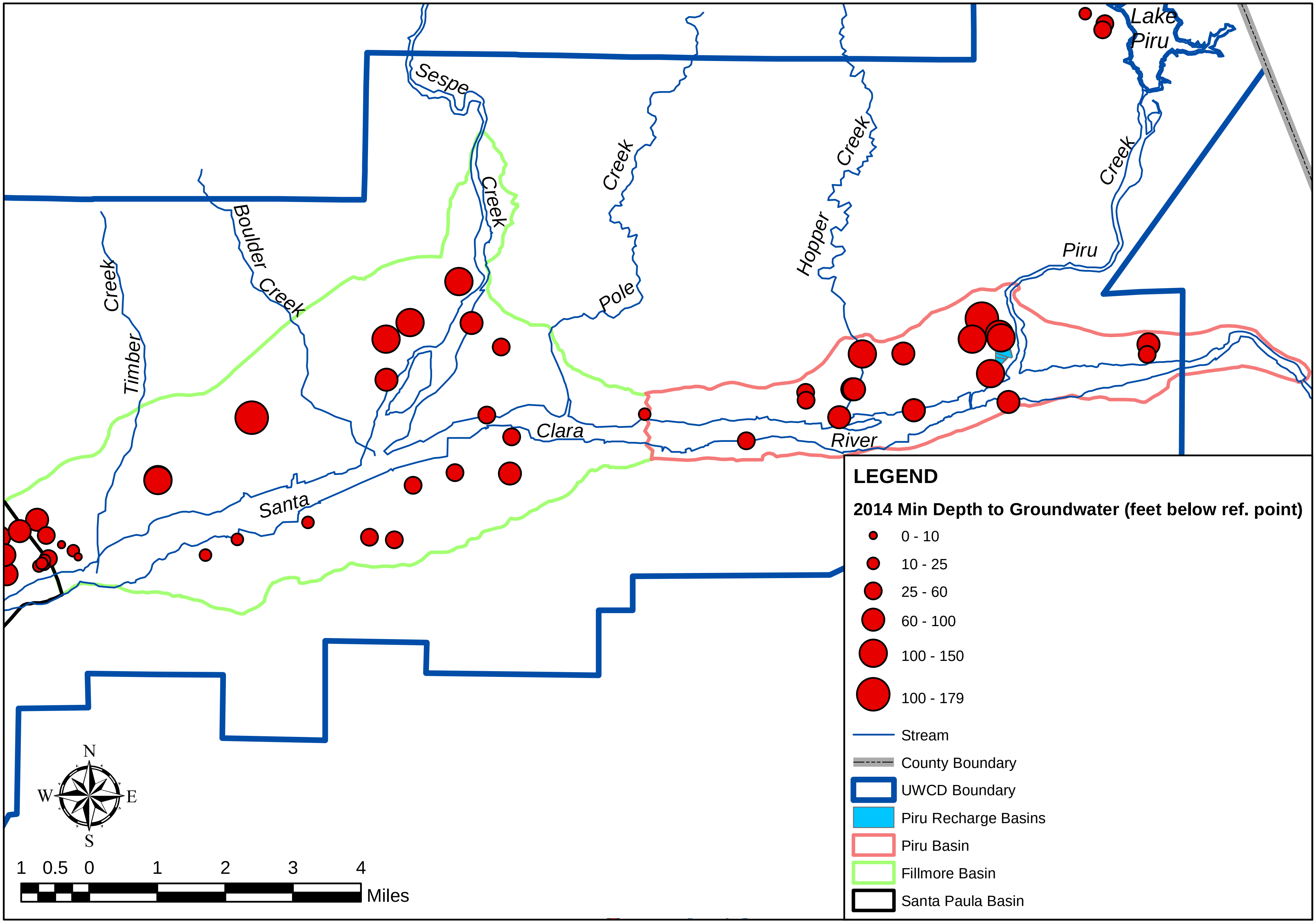

Figure 23. Spring 2014 depth to groundwater.

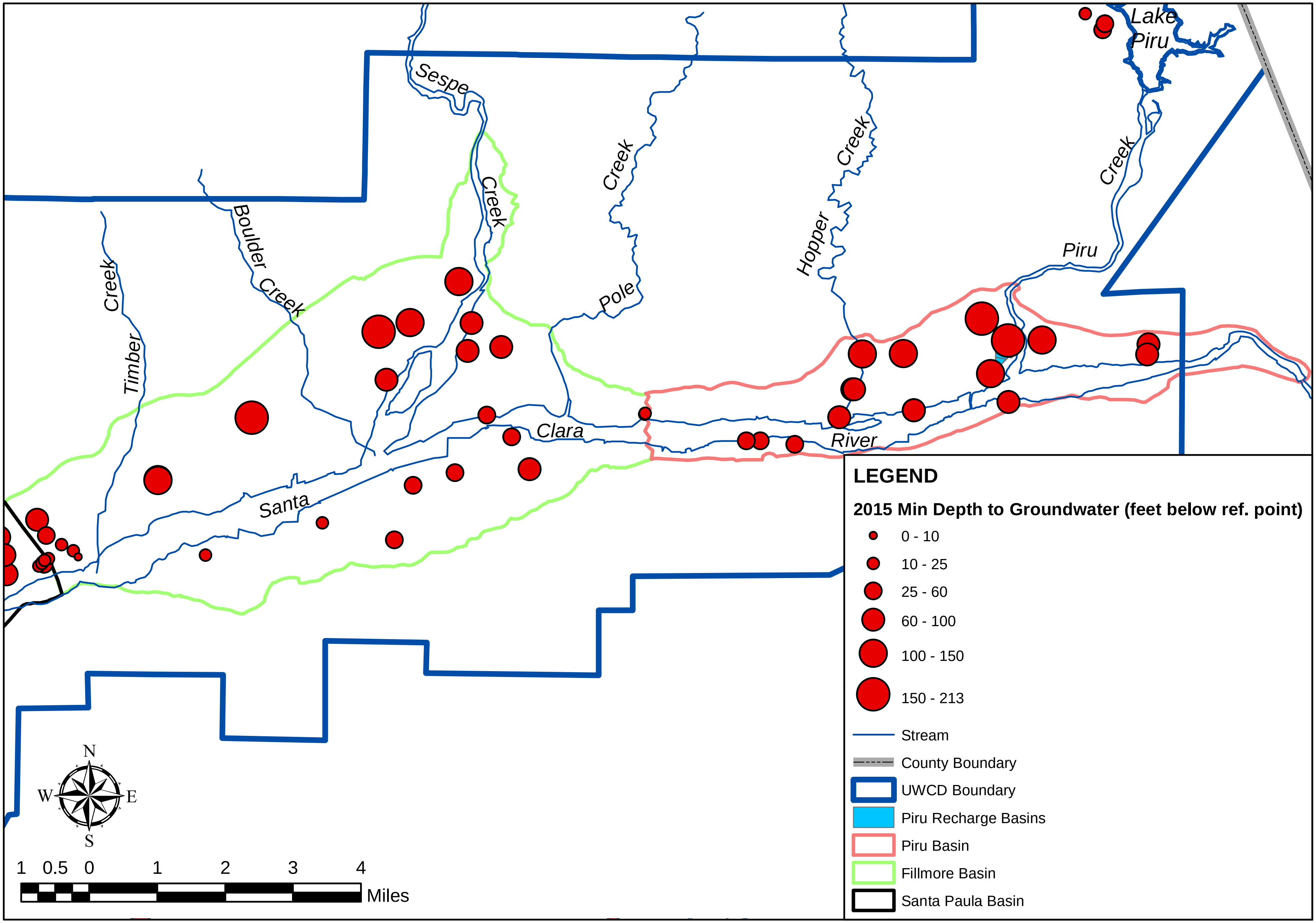

Figure 24. Spring 2015 depth to groundwater.

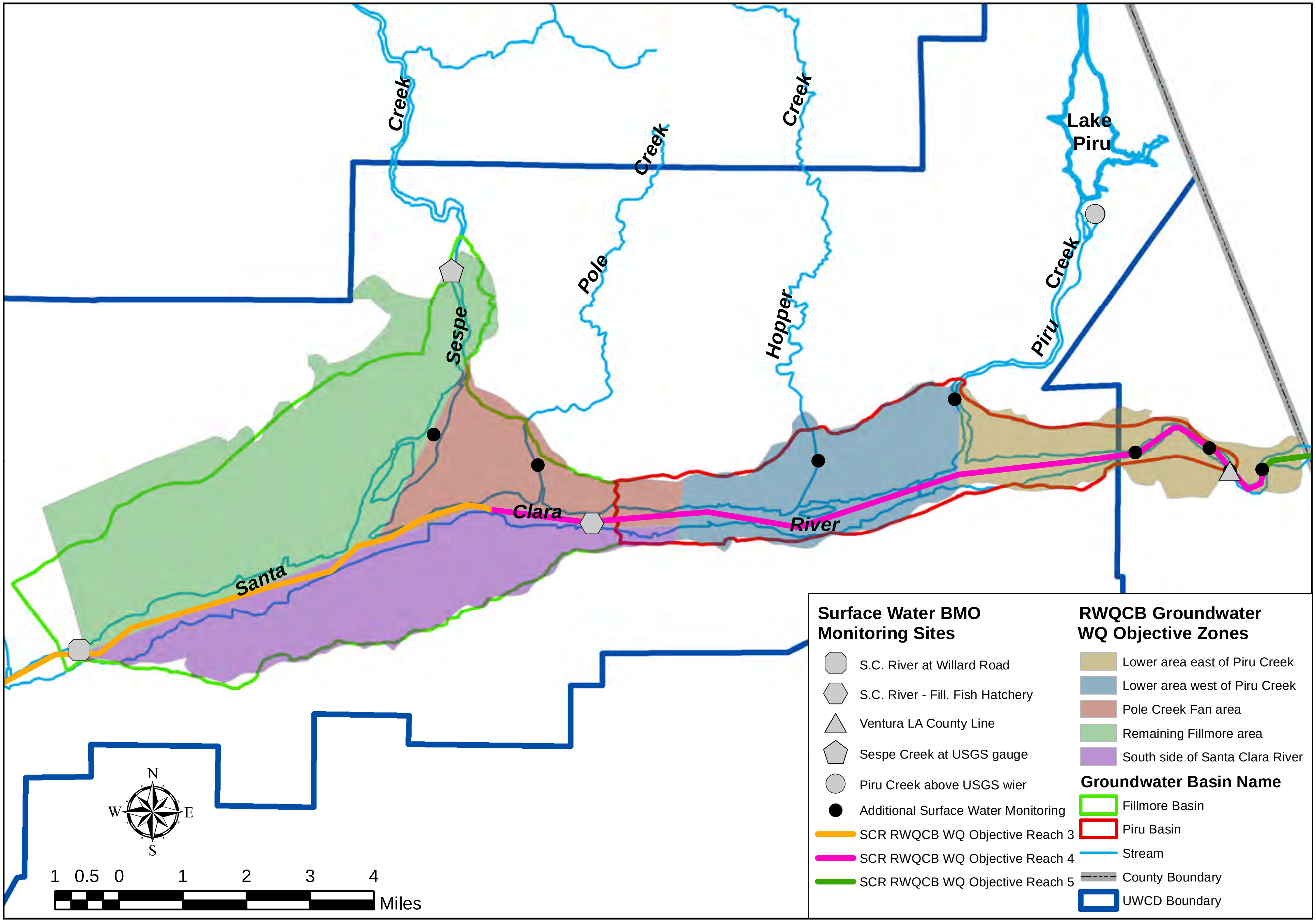

Figure 25. Surface water quality monitoring locations and Regional Water Quality Control Board Santa Clara River reaches; and Regional Water Quality Control Board groundwater quality objective zones map.

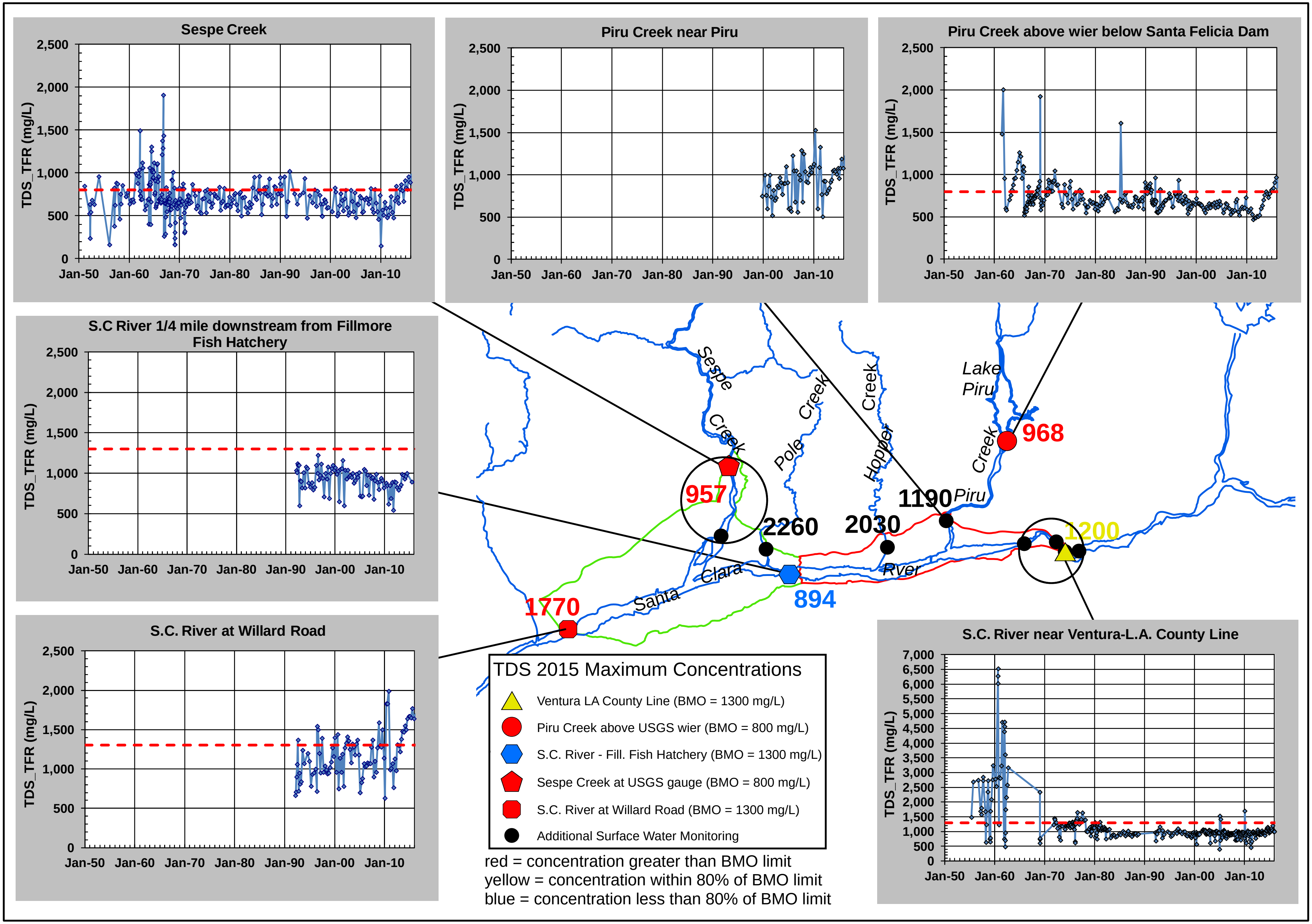

Figure 26. TDS surface water quality time series graphs with map of 2015 maximum concentrations in mg/L (black circles denote alternate sample sites); dashed red line is the BMO based on surface water quality objectives from the RWQCB-LA Basin Plan, 1994.

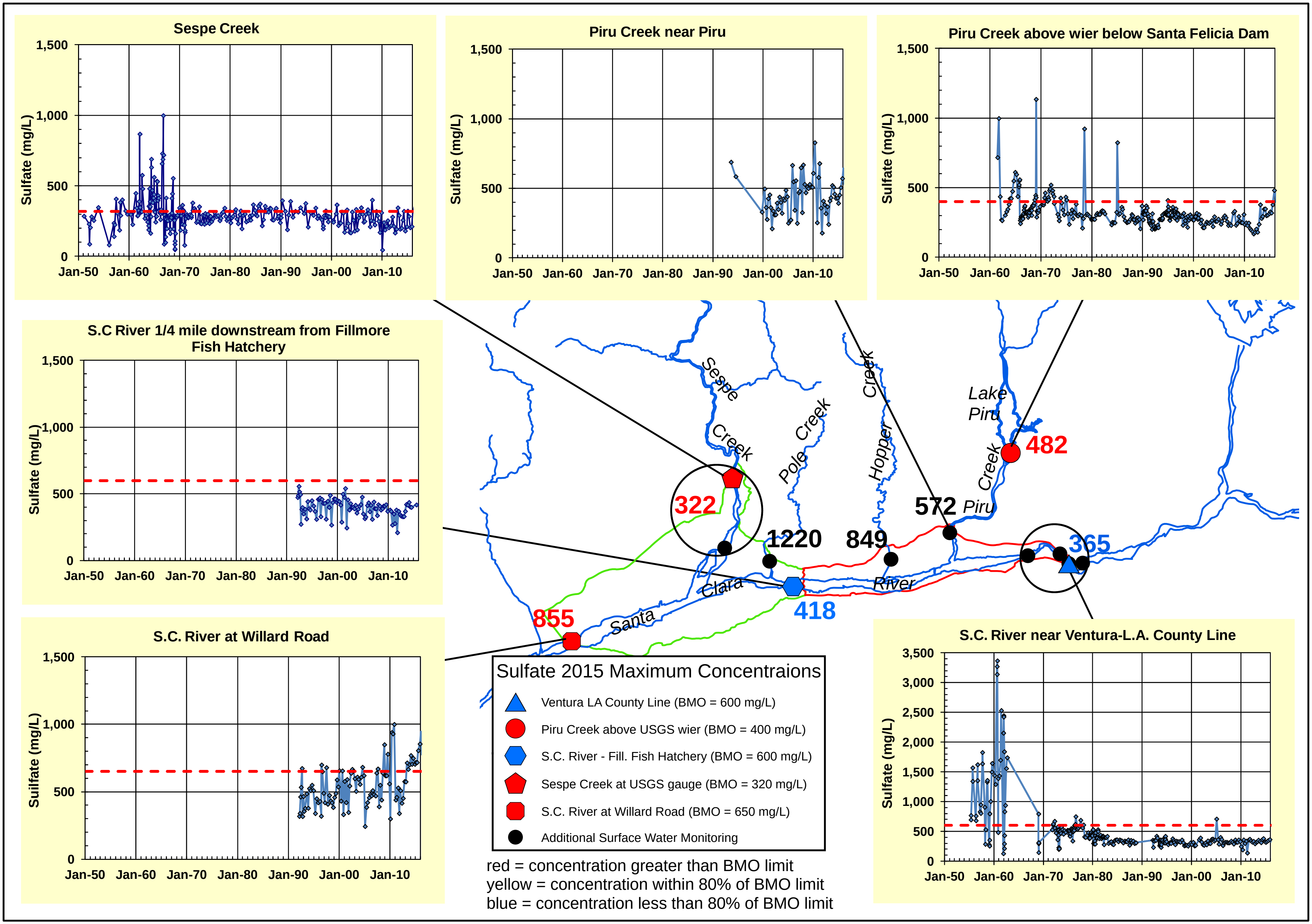

Figure 27. Sulfate surface water quality time series graphs with map of 2015 maximum concentrations in mg/L (black circles denote alternate sample sites); dashed red line is the BMO based on surface water quality objectives from the LRWQCB-LA Basin Plan, 1994.

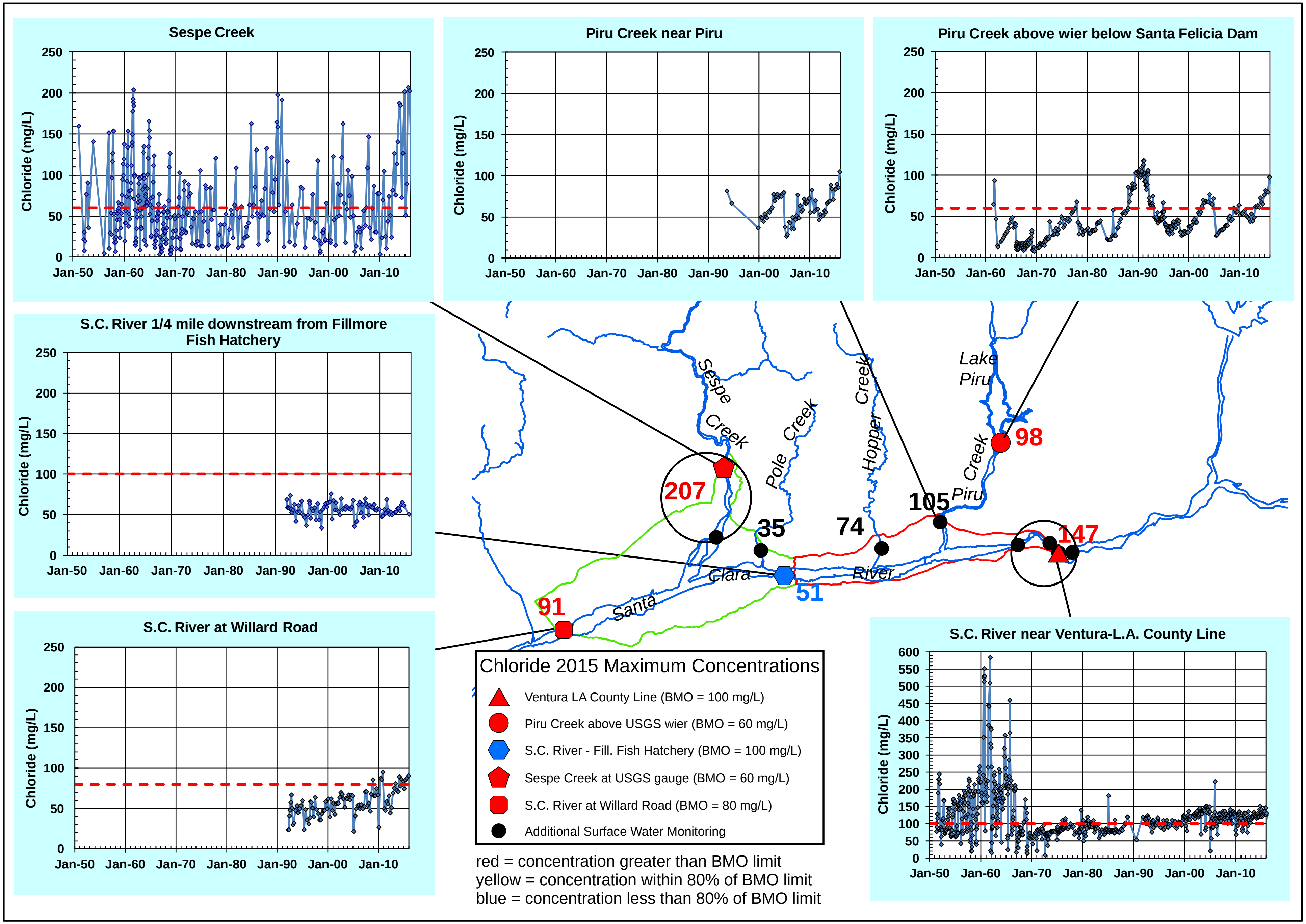

Figure 28. Chloride surface water quality time series graphs with map of 2015 maximum concentrations in mg/L (black circles denote alternate sample sites); dashed red line is the BMO based on surface water quality objectives from the RWQCB-LA Basin Plan, 1994.

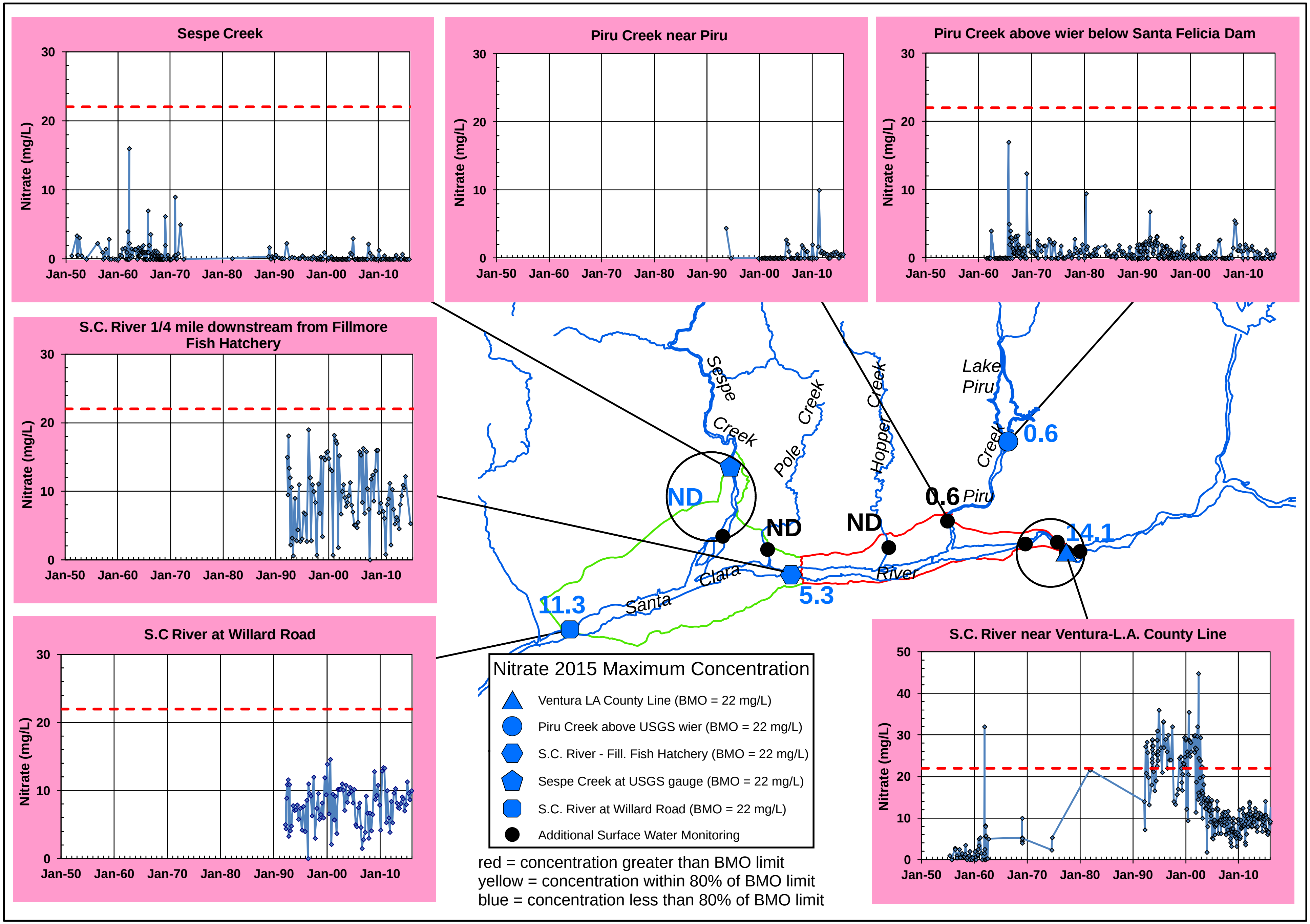

Figure 29. Nitrate surface water quality time series graphs with map of 2015 maximum concentrations in mg/L (black circles denote alternate sample sites); dashed red line is the BMO based on surface water quality objectives from the RWQCB-LA Basin Plan, 1994.

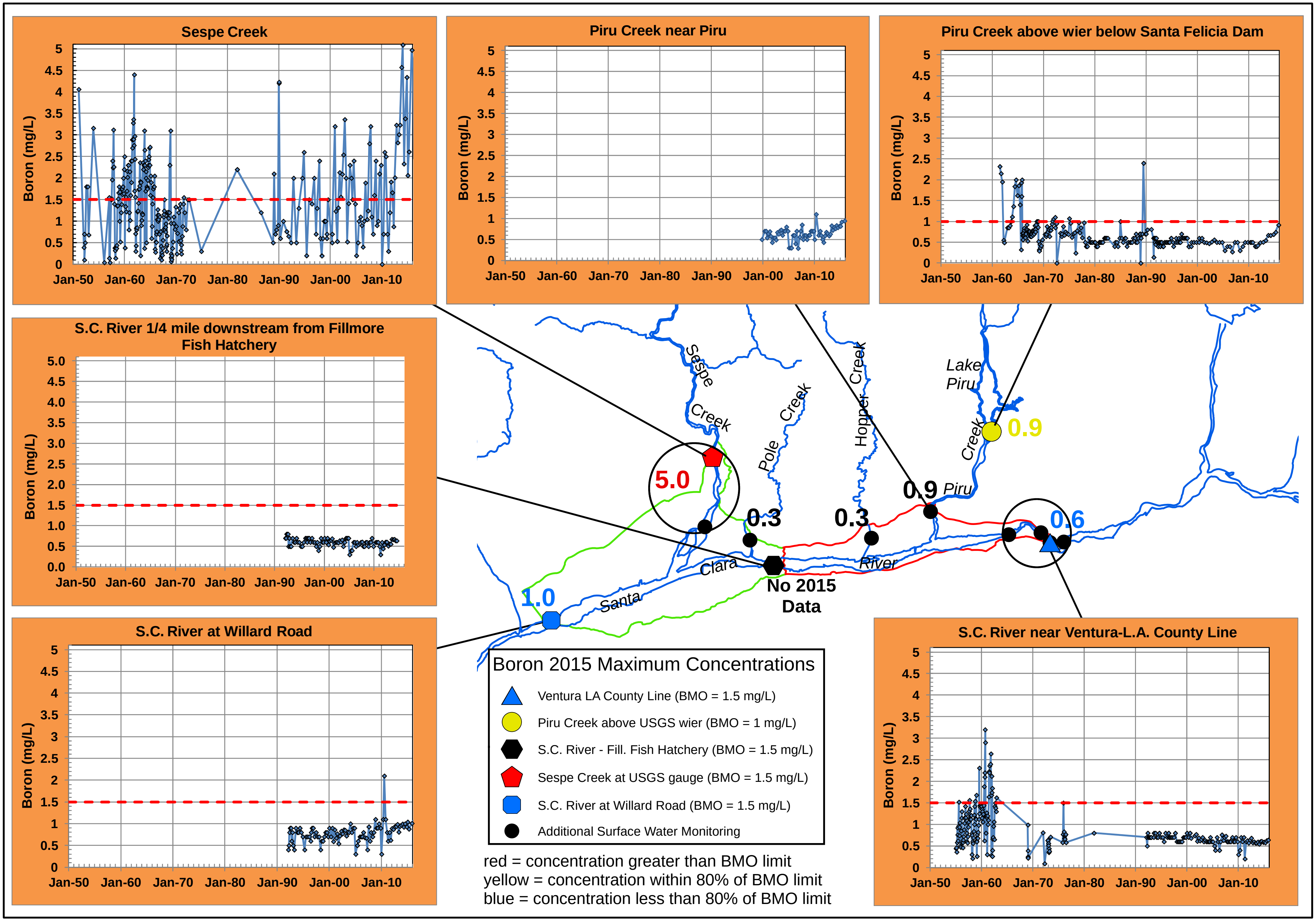

Figure 30. Boron surface water quality time series graphs with map of 2015 maximum concentrations in mg/L (black circles denote alternate sample sites); dashed red line is the BMO based on surface water quality objectives from the RWQCB-LA Basin Plan, 1994.

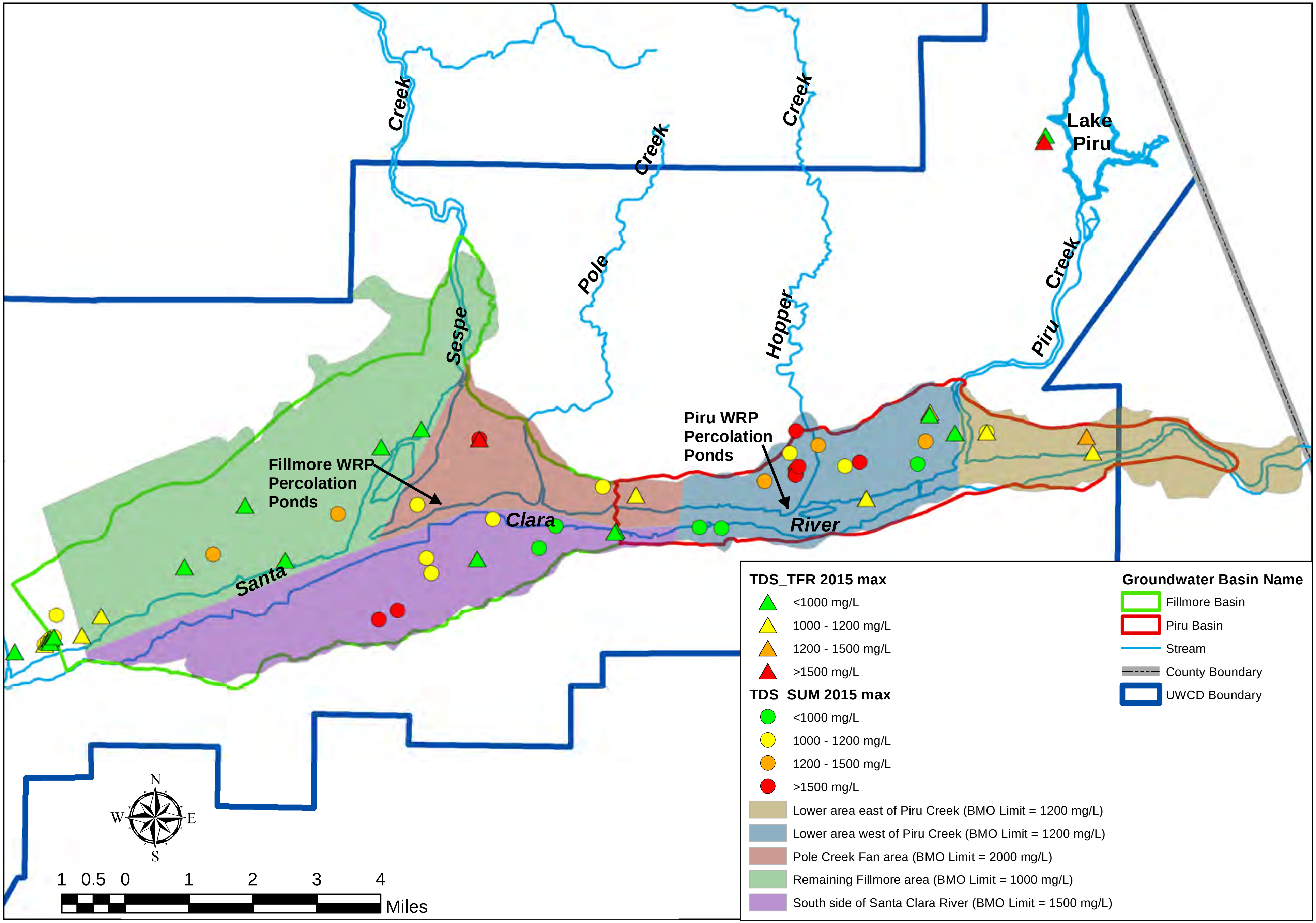

Figure 31. TDS groundwater quality map of 2015 maximum concentrations (mg/L). BMOs are generally based on the groundwater quality objectives identified by the Los Angeles Regional Water Quality Control Board Basin Plan, 1994 (except for in the Piru basin east of Piru Creek).

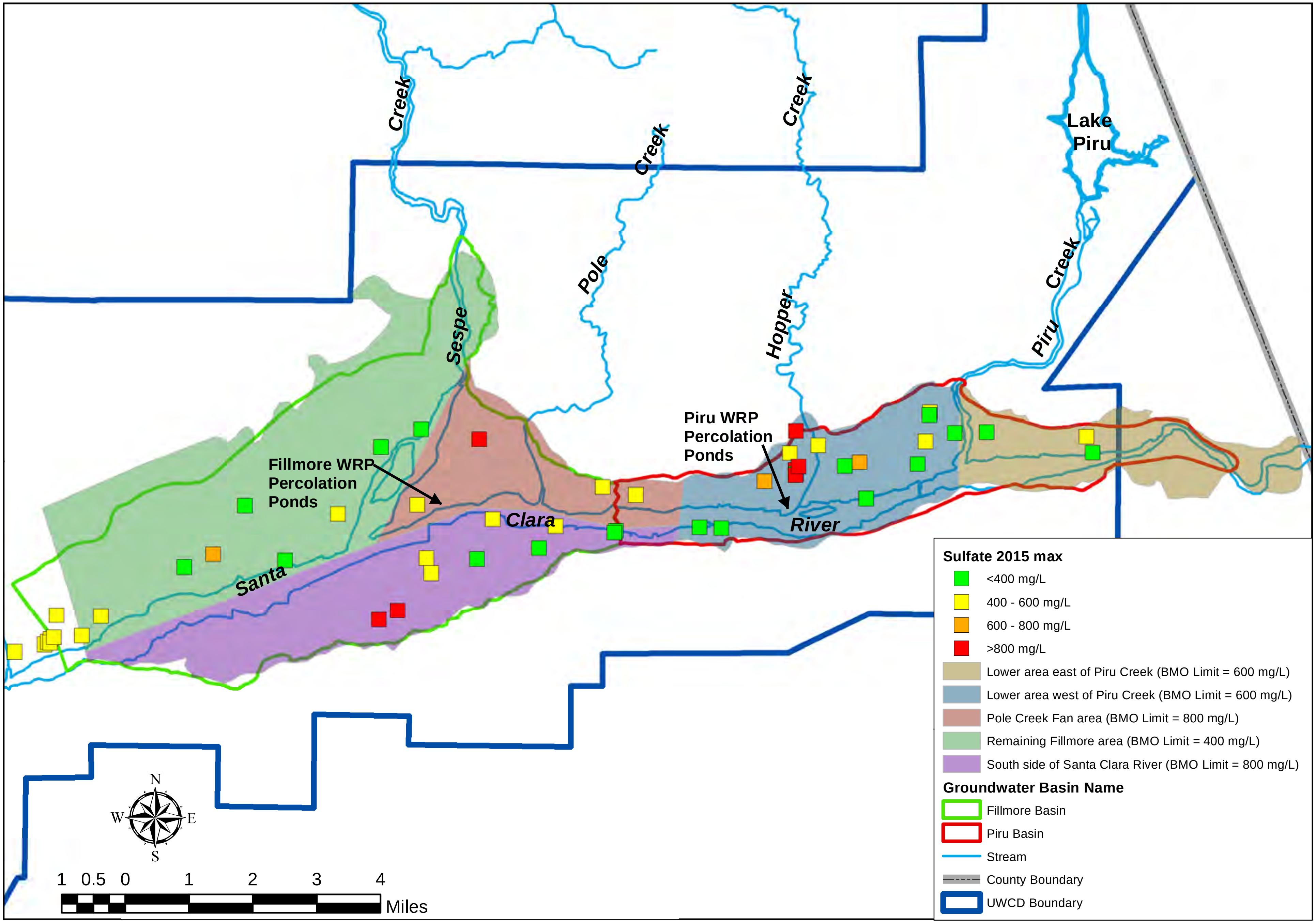

Figure 32. Sulfate groundwater quality map of 2015 maximum concentrations (mg/L). BMOs are generally based on the groundwater quality objectives identified by the Los Angeles Regional Water Quality Control Board Basin Plan, 1994 (except for in the Piru basin east of Piru Creek).

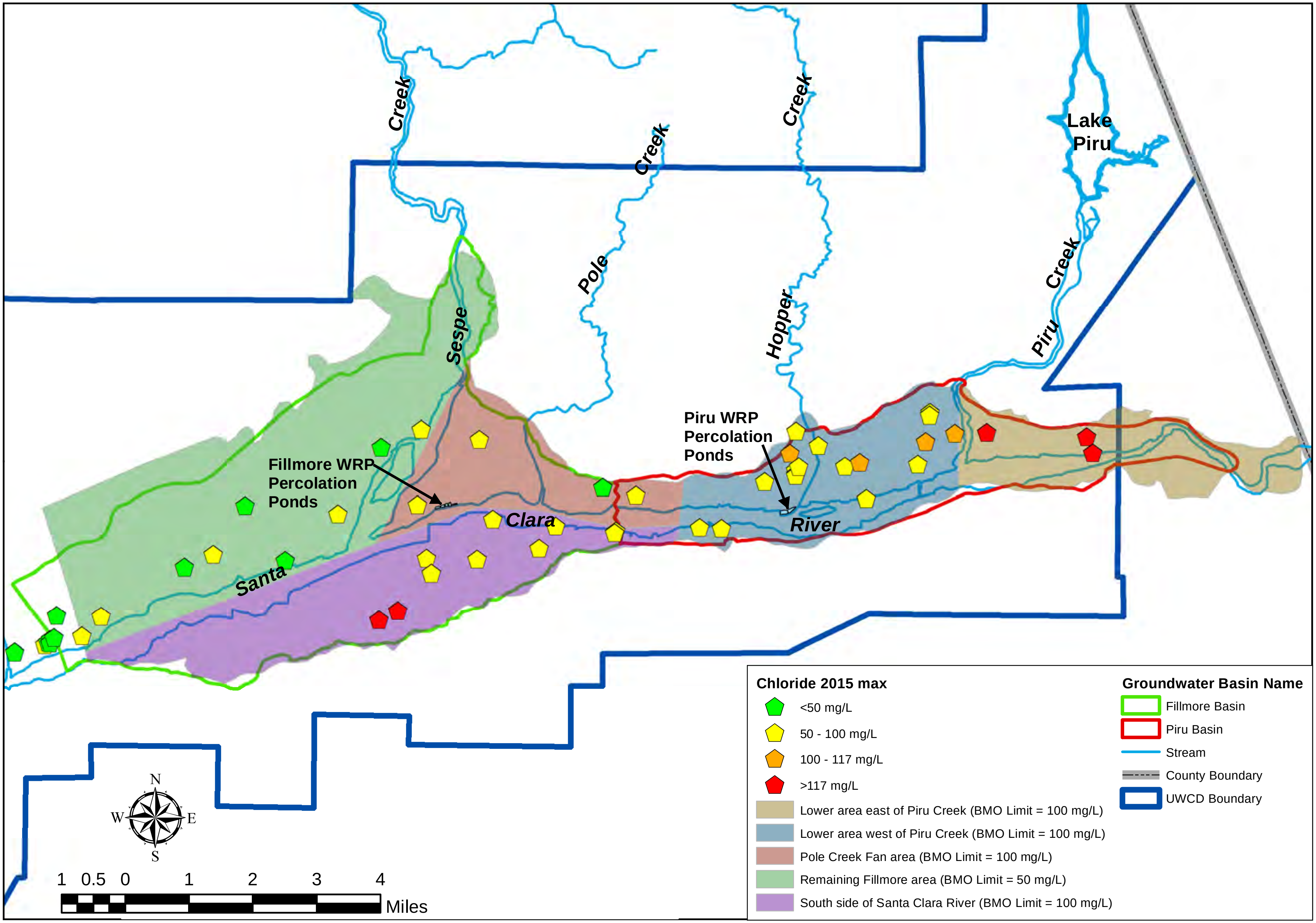

Figure 33. Chloride groundwater quality map of 2015 maximum concentrations (mg/L). BMOs are generally based on the groundwater quality objectives identified by the Los Angeles Regional Water Quality Control Board Basin Plan, 1994 (except for in the Piru basin east of Piru Creek).

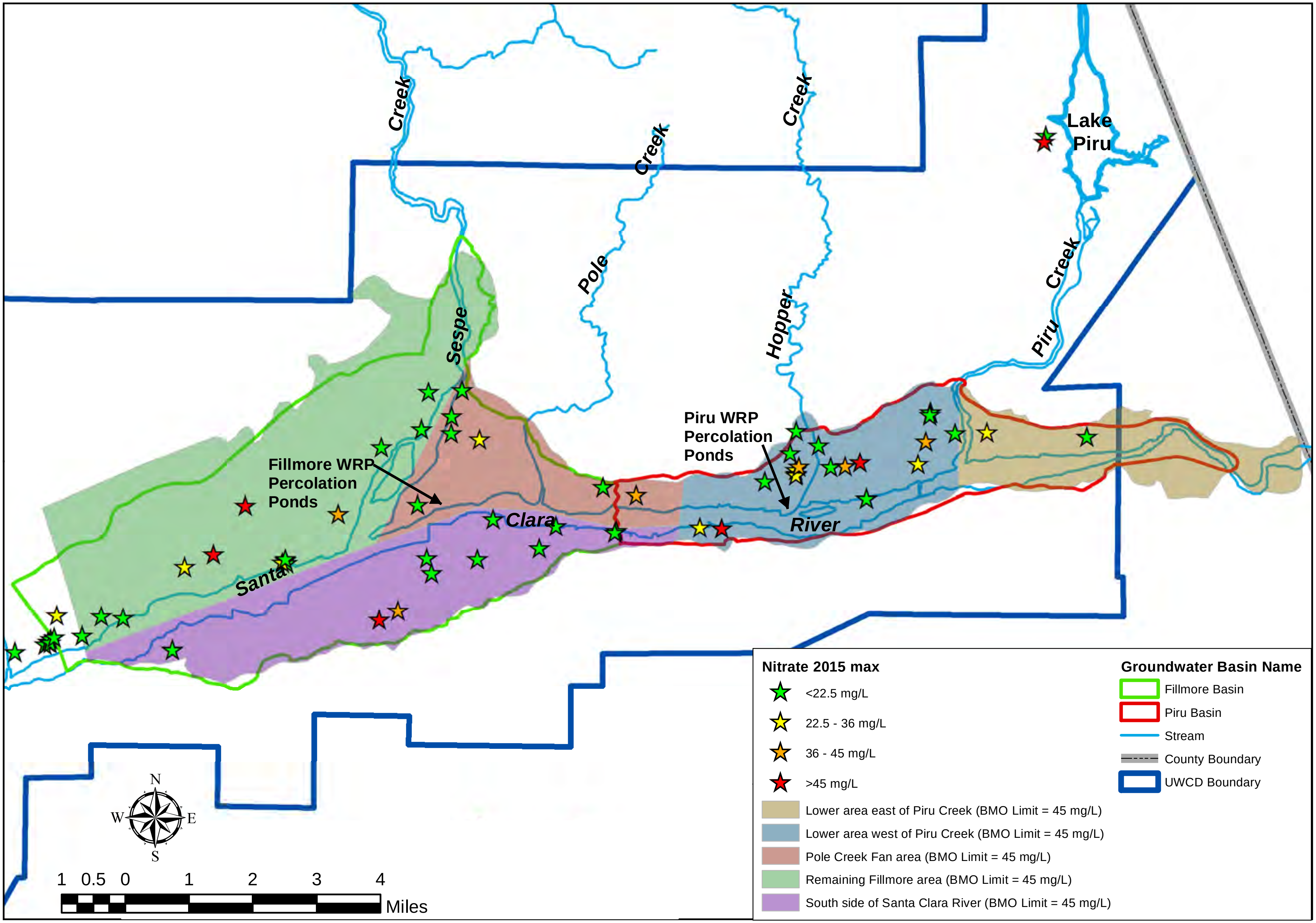

Figure 34. Nitrate groundwater quality map of 2015 maximum concentrations (mg/L). BMOs are generally based on the groundwater quality objectives identified by the Los Angeles Regional Water Quality Control Board Basin Plan, 1994 (except for in the Piru basin east of Piru Creek).

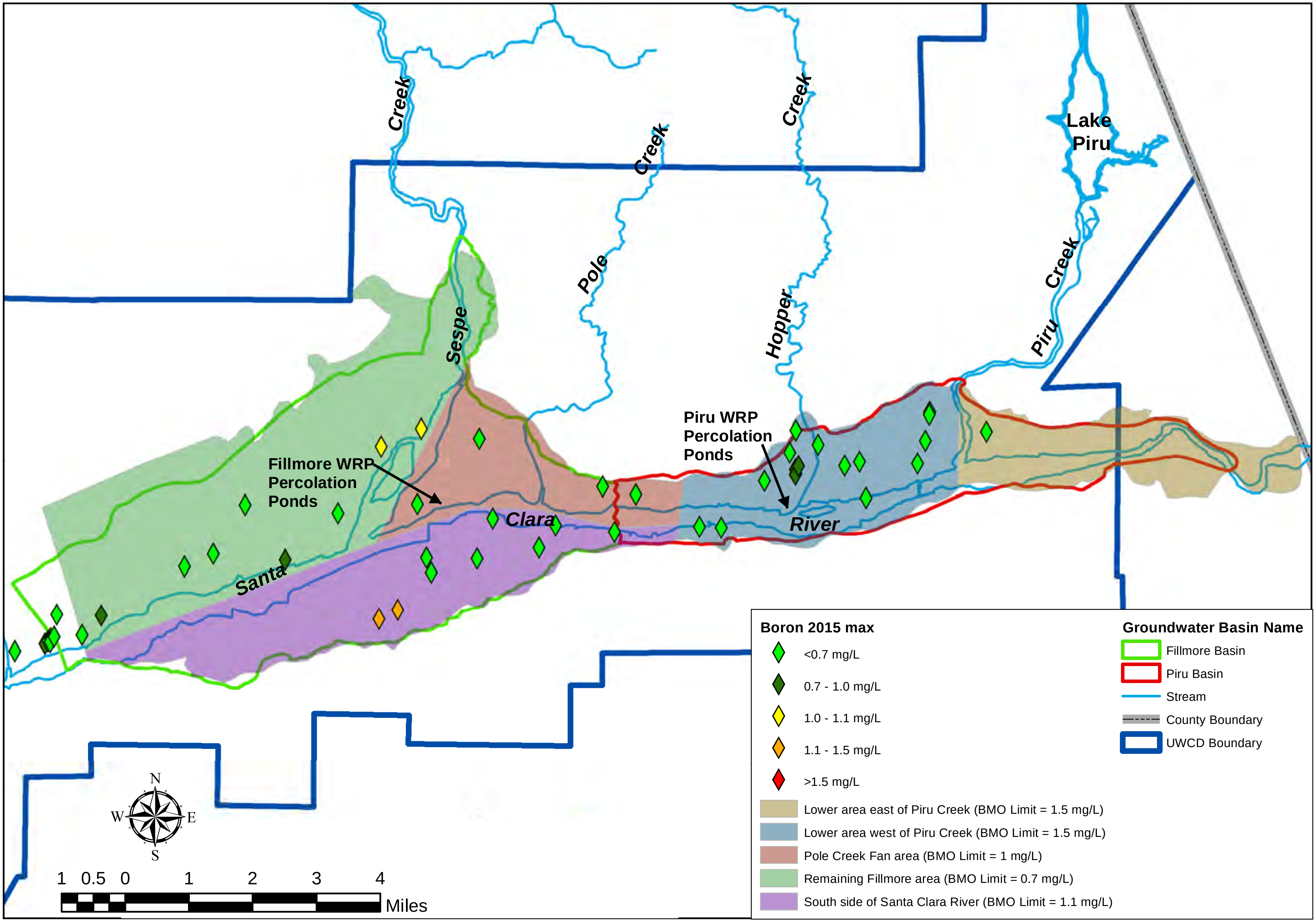

Figure 35. Boron groundwater quality map of 2015 maximum concentrations (mg/L). BMOs are generally based on the groundwater quality objectives identified by the Los Angeles Regional Water Quality Control Board Basin Plan, 1994 (except for in the Piru basin east of Piru Creek).

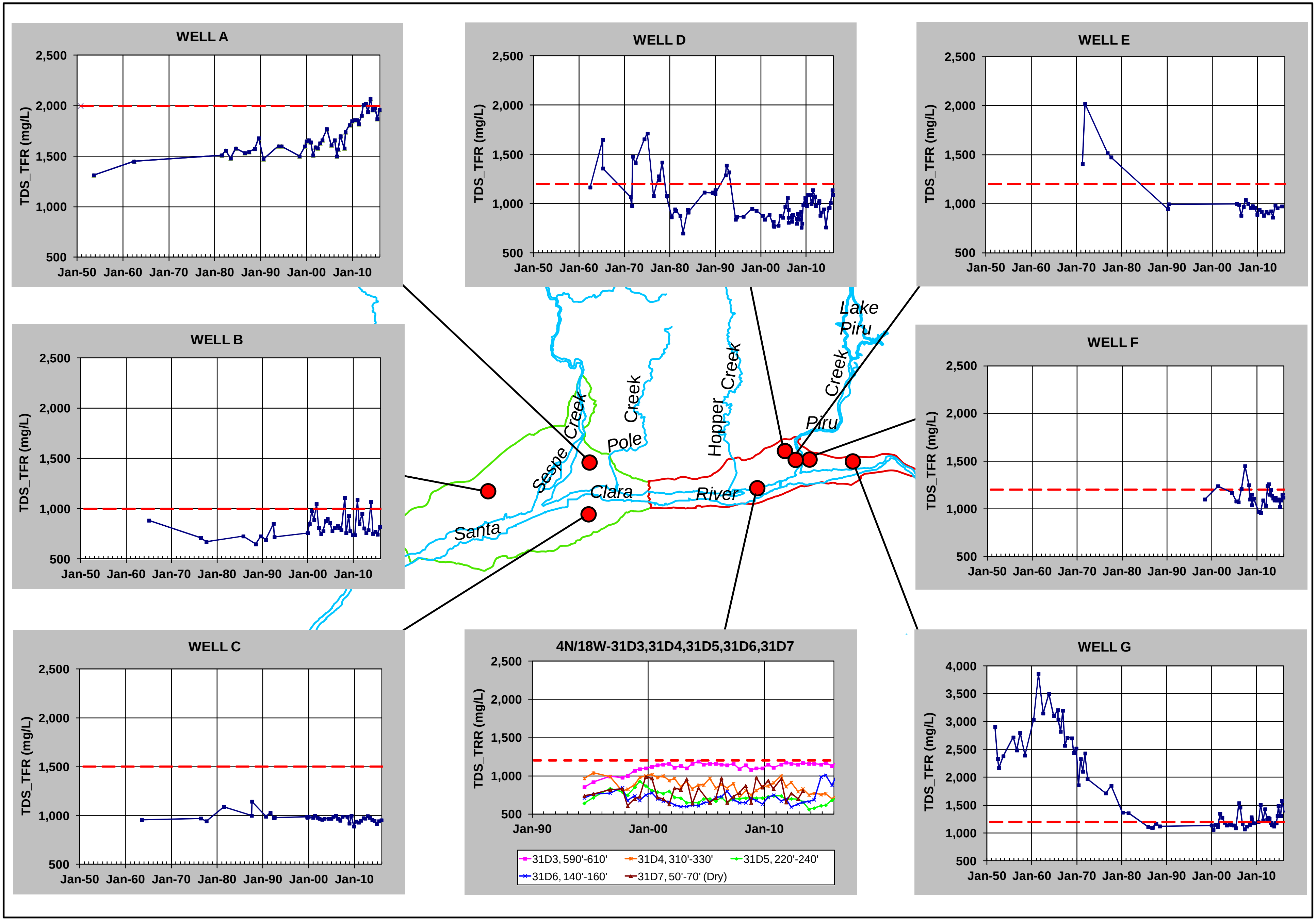

Figure 36. TDS groundwater quality time series graphs (mg/L); dashed red line is the BMO.

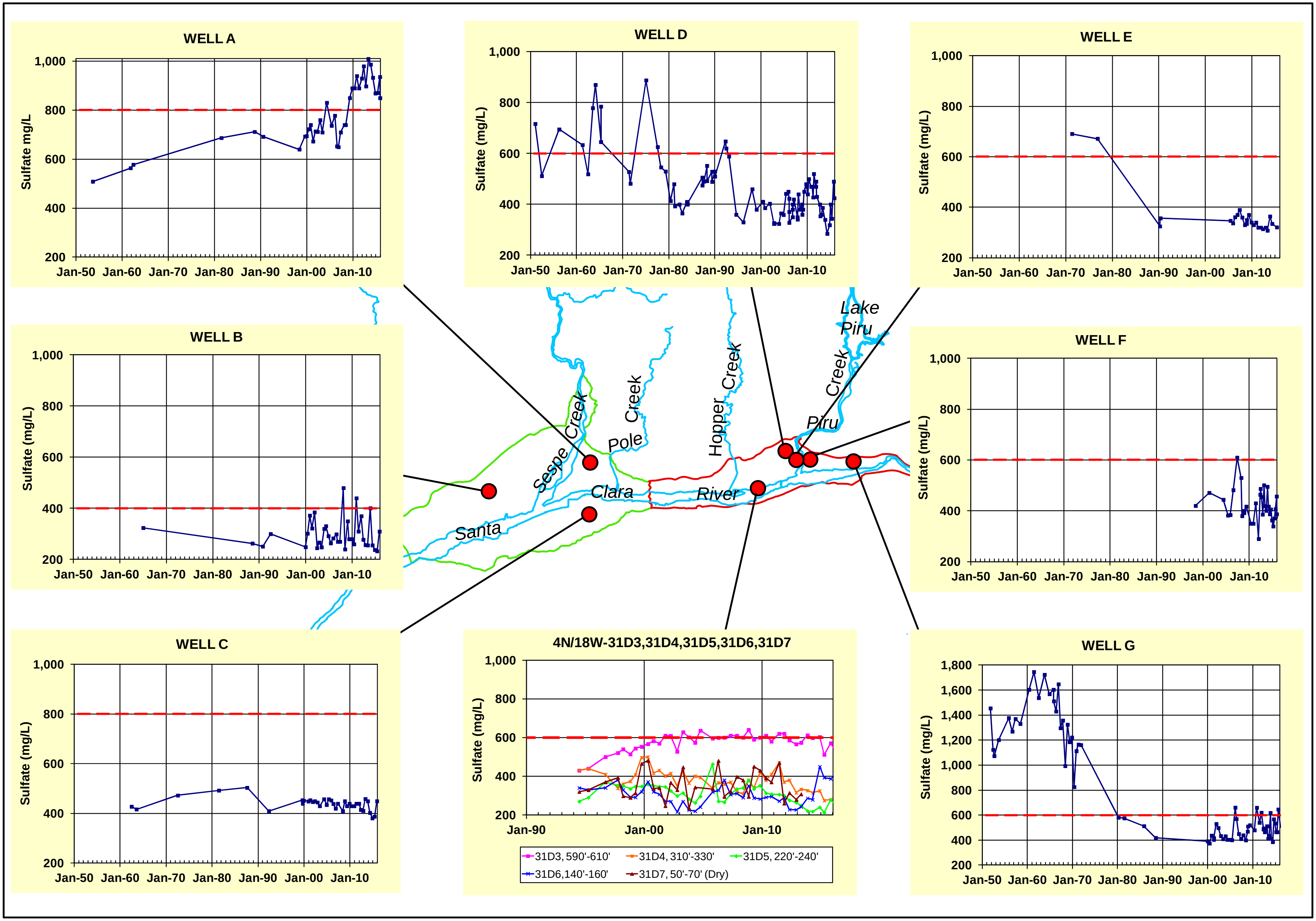

Figure 37. Sulfate groundwater quality time series graphs (mg/L); dashed red line is the BMO.

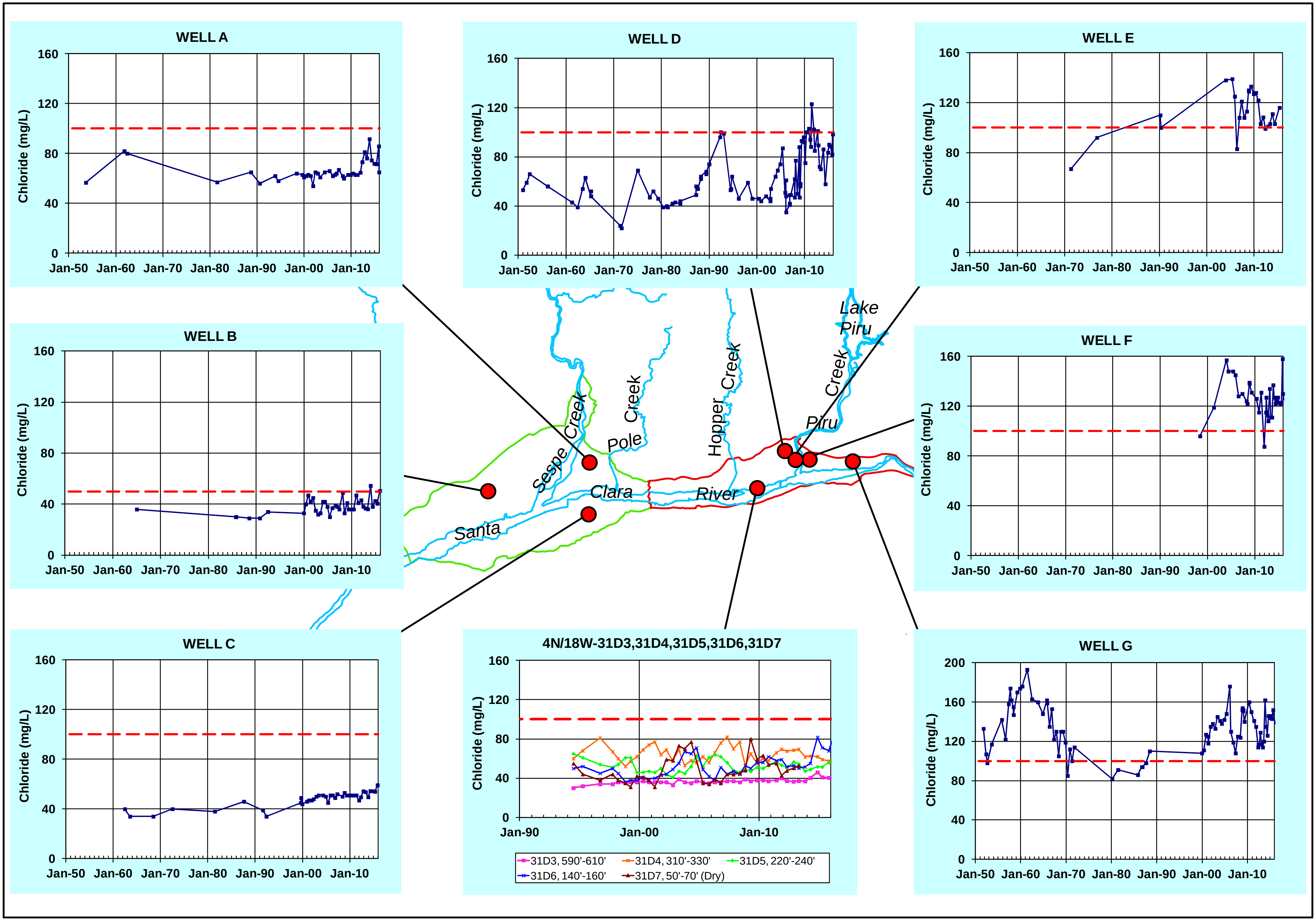

Figure 38. Chloride groundwater quality time series graphs (mg/L); dashed red line is the BMO.

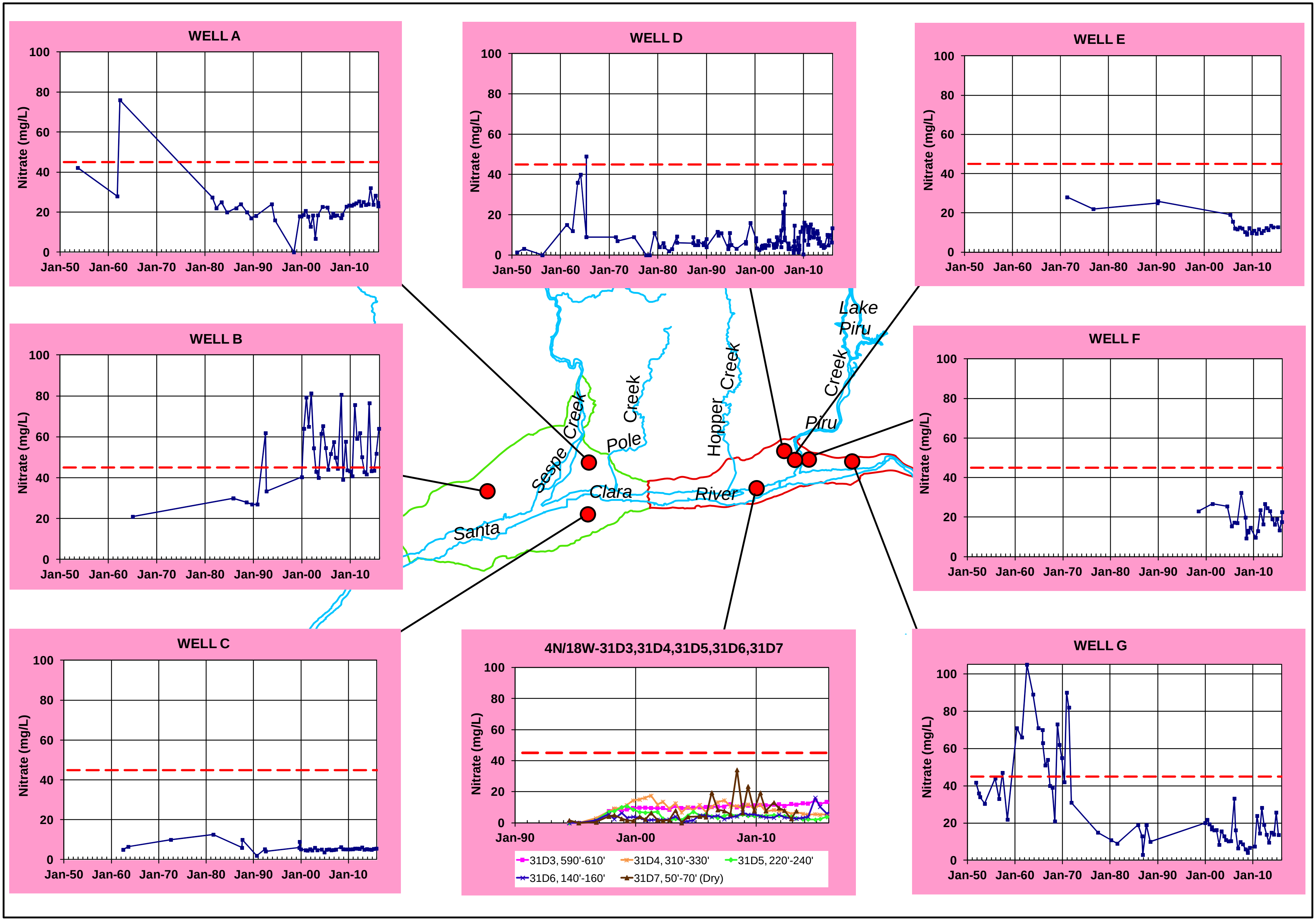

Figure 39. Nitrate groundwater quality time series graphs (mg/L); dashed red line is the BMO.

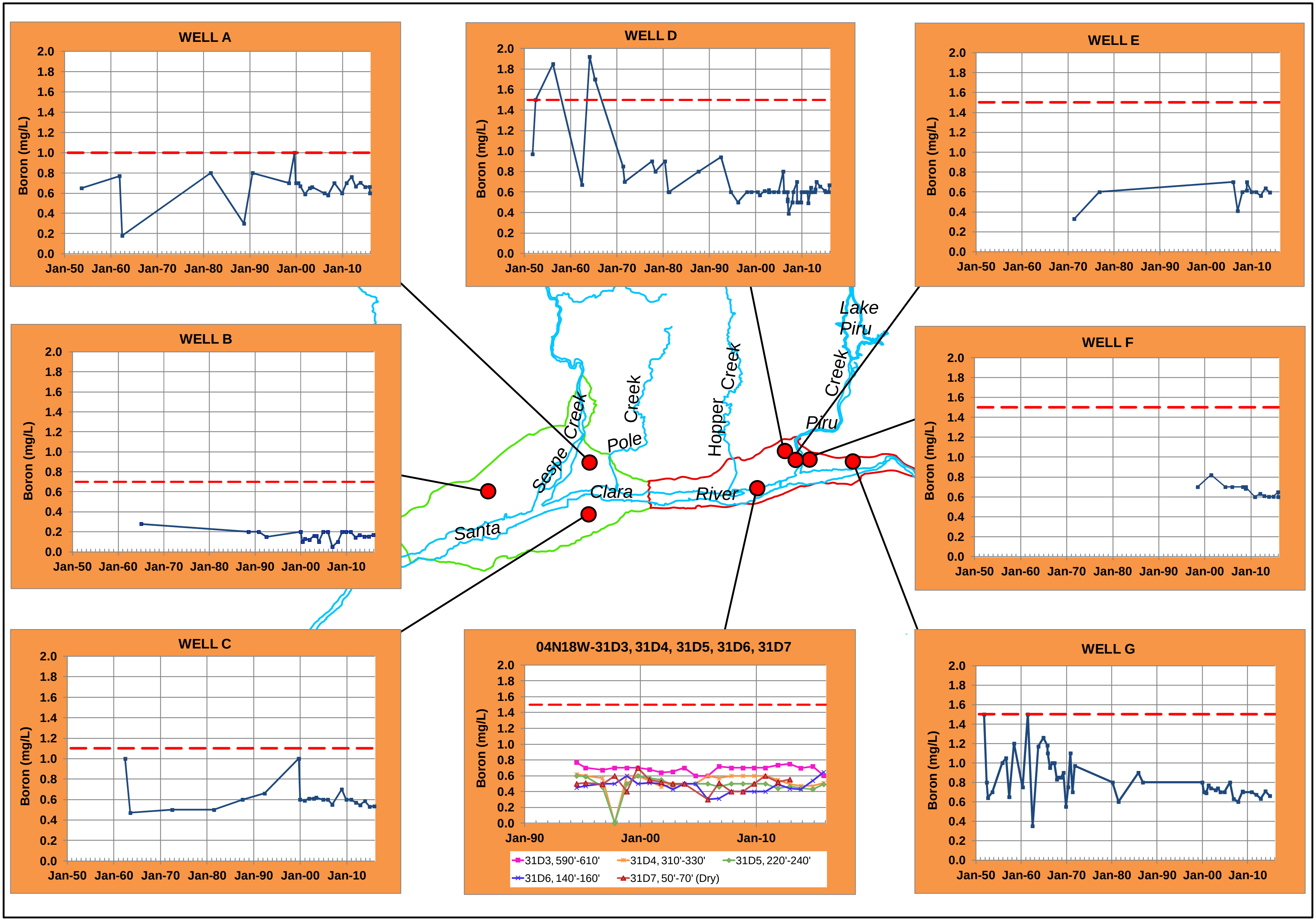

Figure 40. Boron groundwater quality time series graphs (mg/L); dashed red line is the BMO.

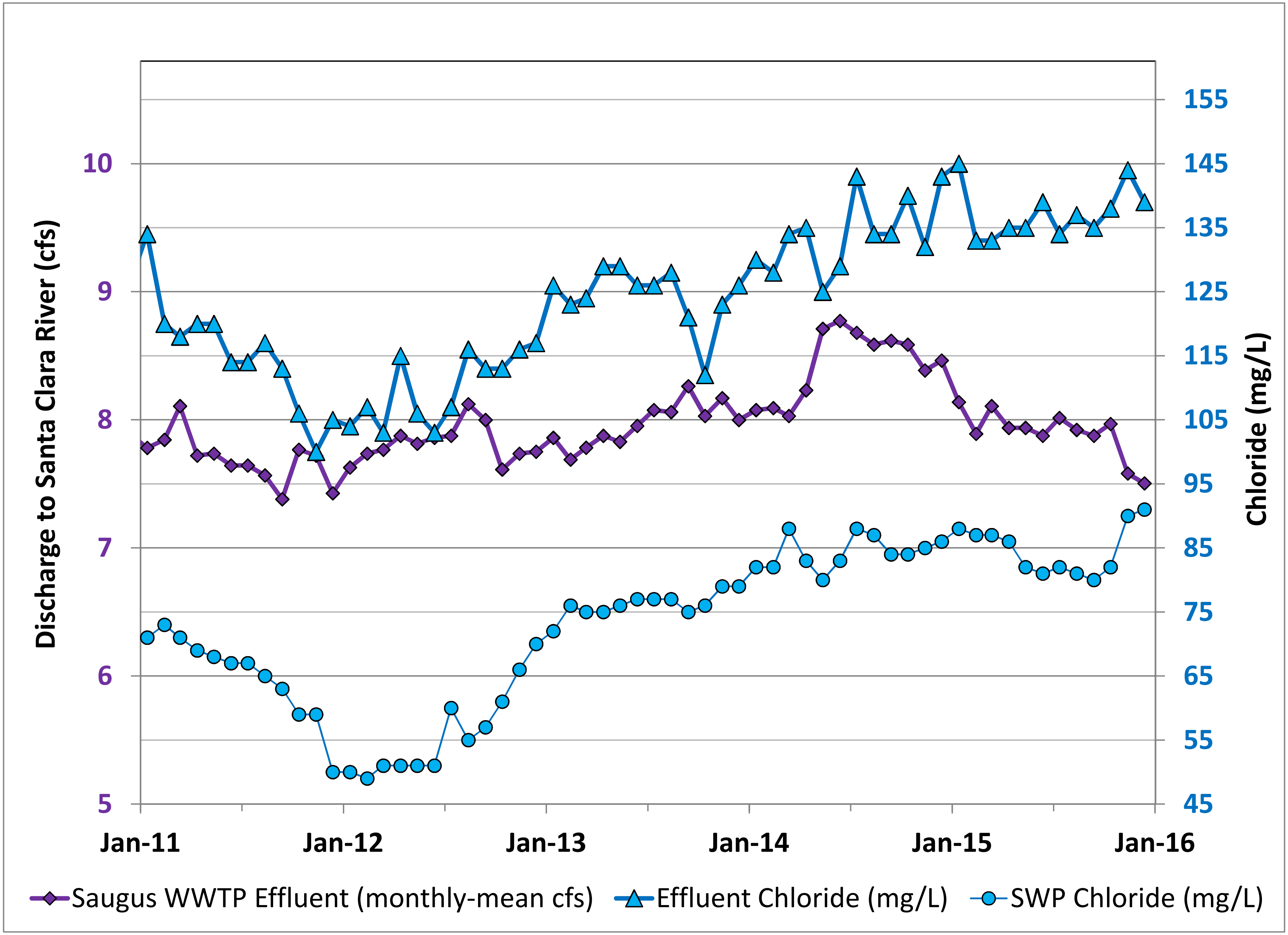

Figure 41. Saugus Wastewater Treatment Plant effluent (NPDES) and chloride concentration discharge to Santa Clara River; State Water Project chloride concentration.

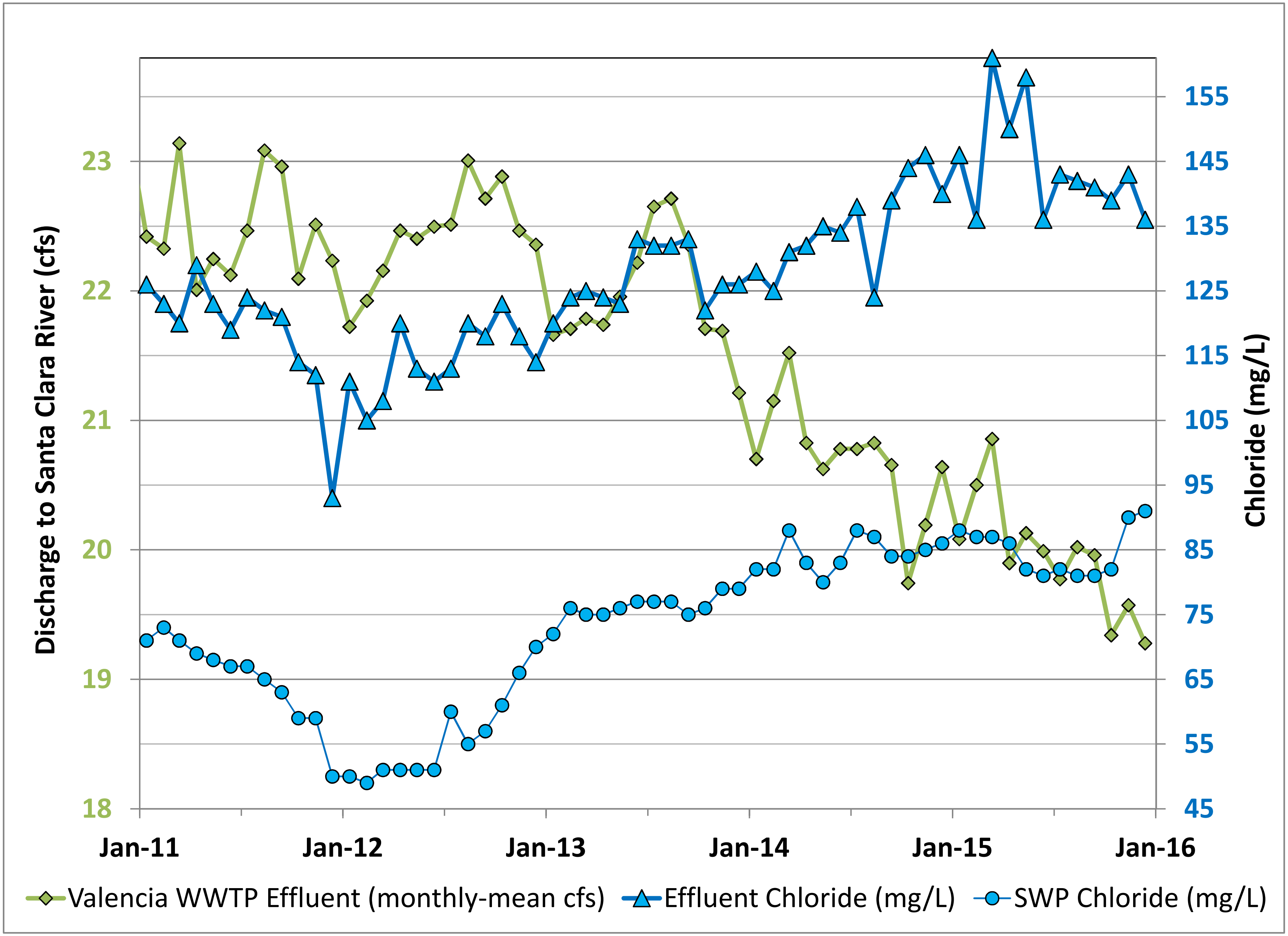

Figure 42. Valencia Wastewater Treatment Plant effluent (NPDES) and chloride concentration discharge to Santa Clara River; State Water Project chloride concentration.

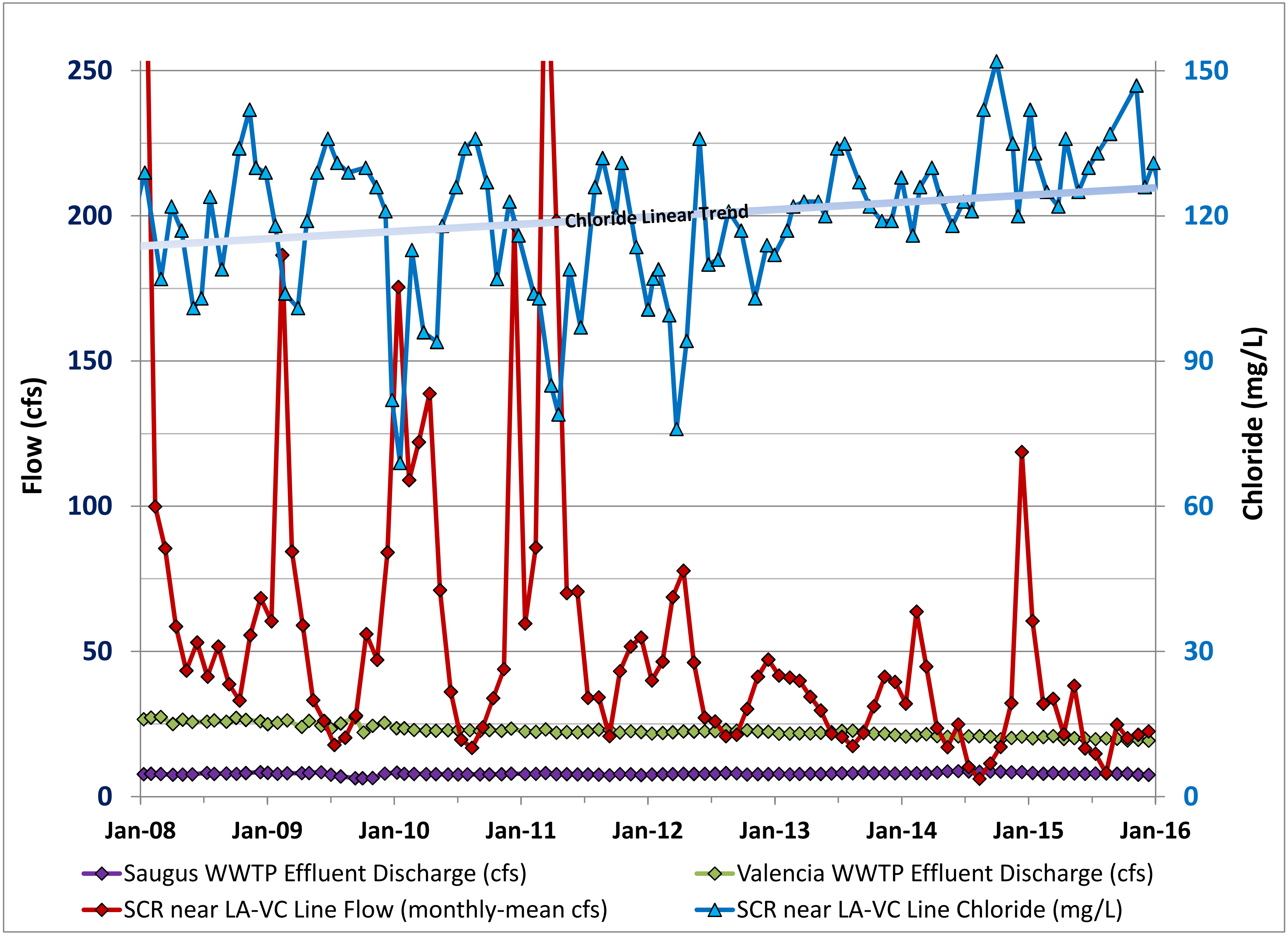

Figure 43. Saugus and Valencia WWTPs effluent (NPDES); Santa Clara River flow and chloride concentration near the Ventura/ Los Angeles County Line.

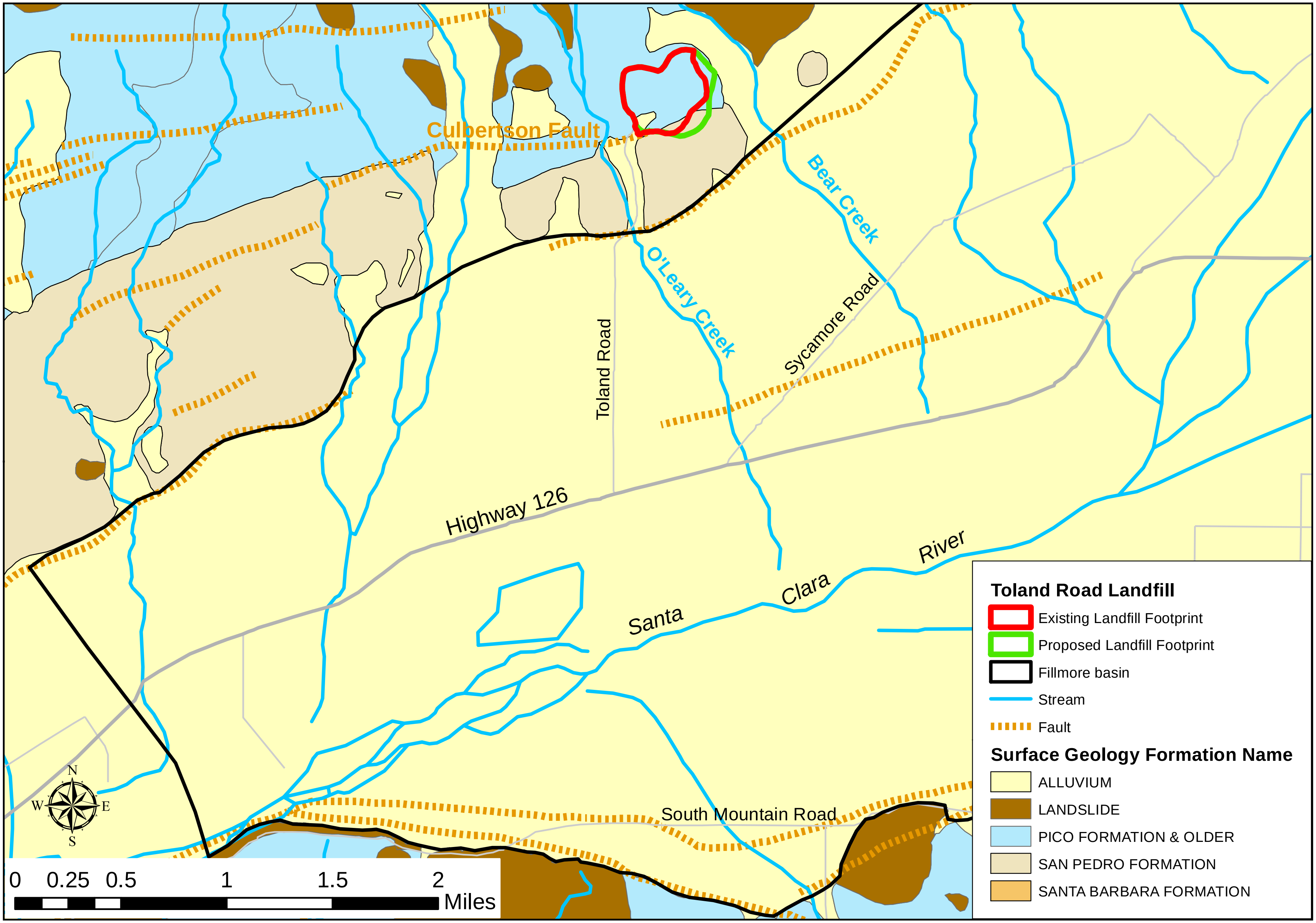

Figure 44. Toland Road Landfill regional location map.

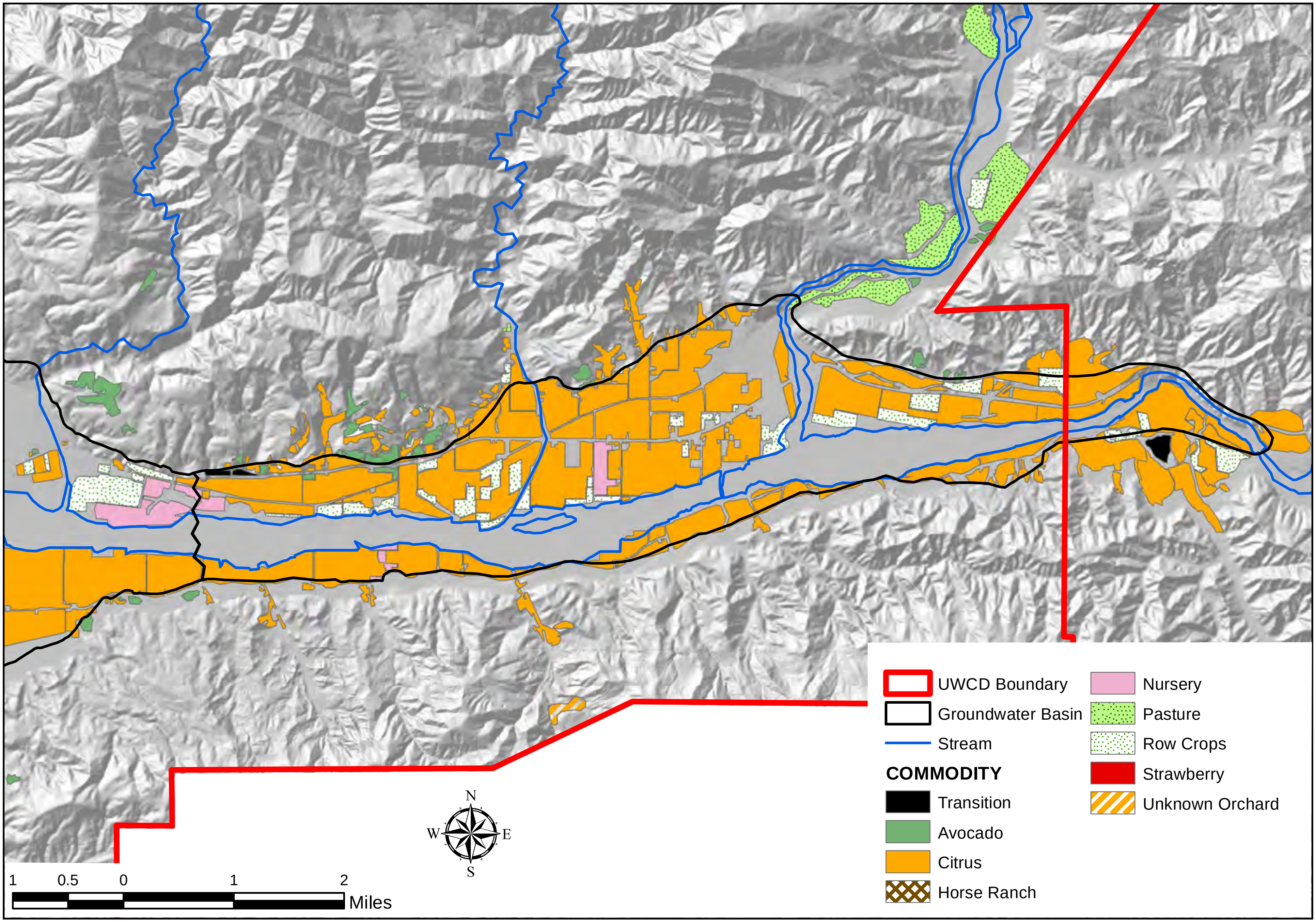

Figure 45. Piru basin agricultural land use map for 1997 with hillshade base.

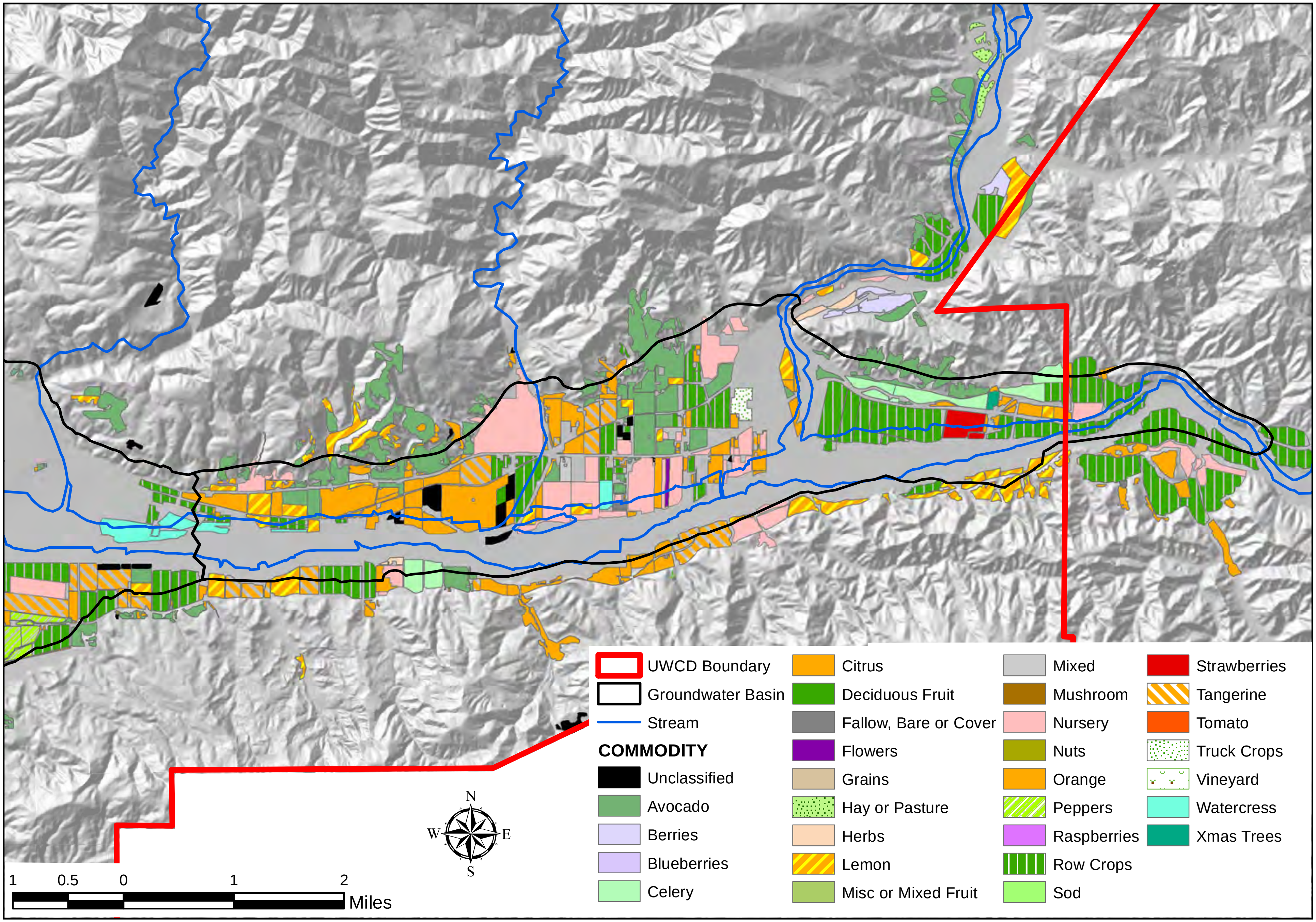

Figure 46. Piru basin agricultural land use map for 2016 (Ventura Co. Ag Commissioner) with hillshade base.

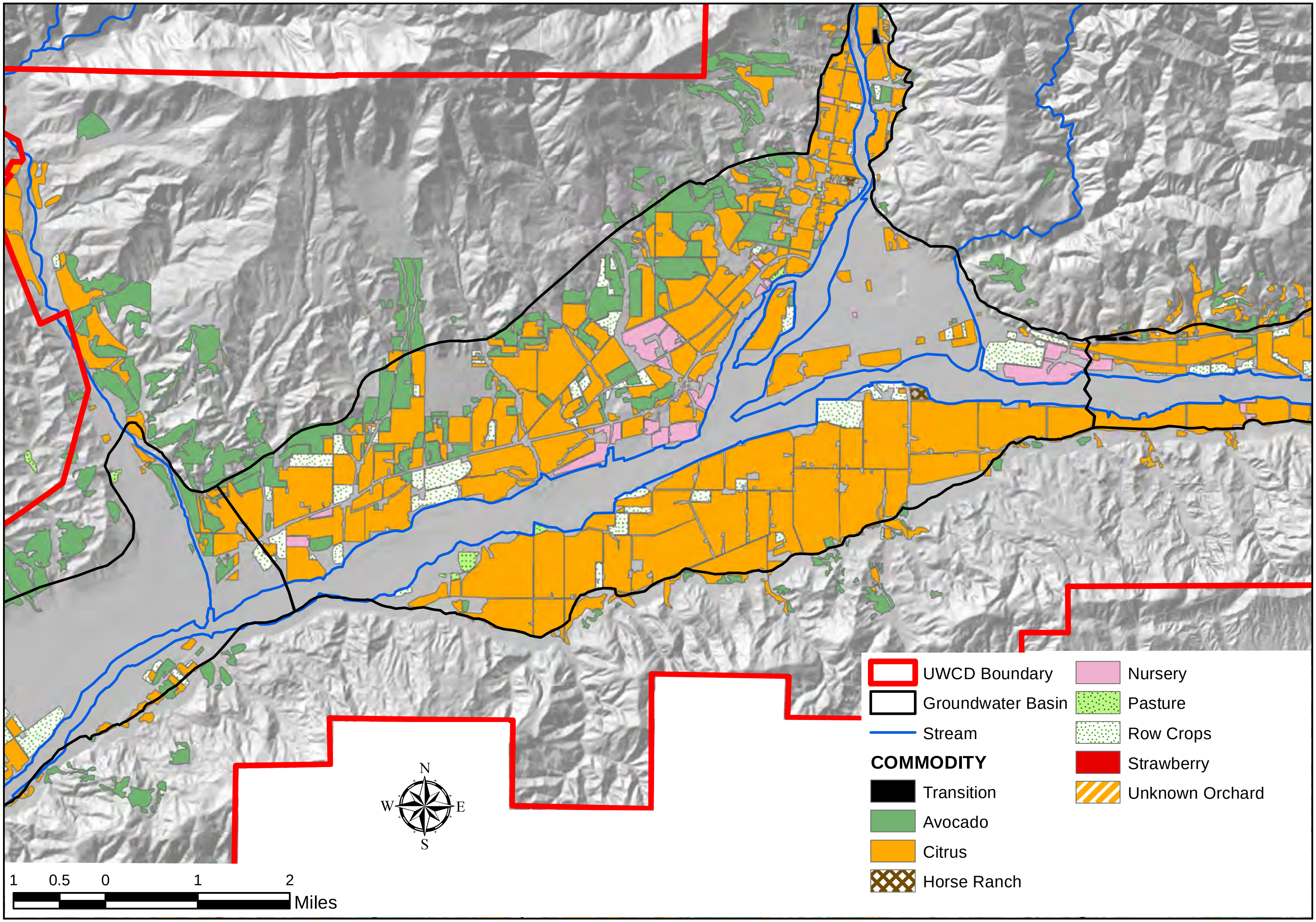

Figure 47. Fillmore basin agricultural land use map for 1997 with hillshade base.

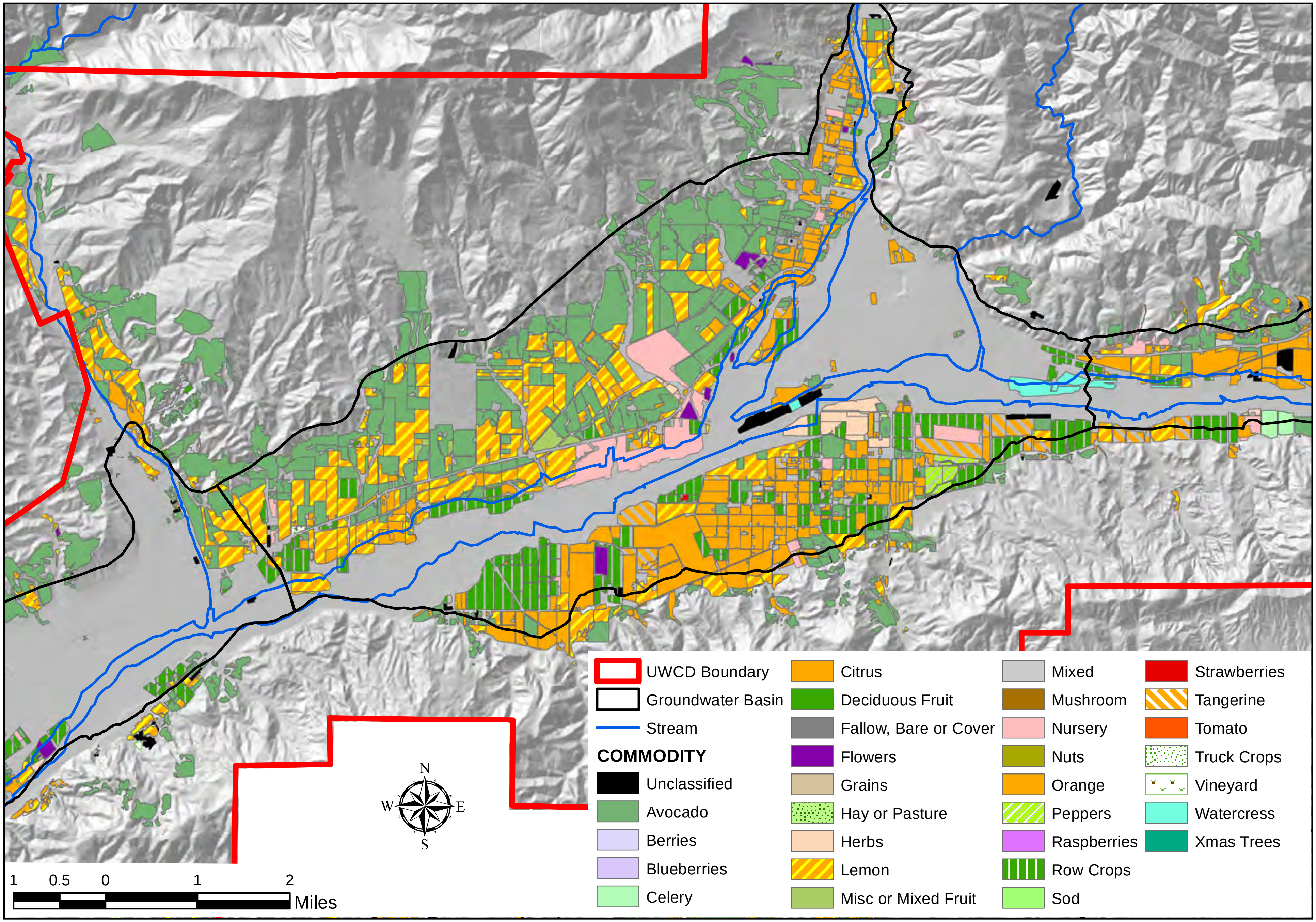

Figure 48. Fillmore basin agricultural land use map for 2016 (Ventura Co. Ag Commissioner) with hillshade base.