2012 AND 2013 PIRU AND FILLMORE BASINS AB 3030 BIENNIAL GROUNDWATER CONDITIONS REPORT

February 2015

PREPARED FOR PIRU/FILLMORE BASINS GROUNDWATER MANAGEMENT COUNCIL

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: Agricultural well in west Fillmore basin. By Lori Reed.

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EXECUTIVE SUMMARY

This 2012 and 2013 AB 3030 Biennial Groundwater Conditions Report was prepared by the United Water Conservation District (United Water or United) Groundwater Resources 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, waste water reclamation plants, the Toland Landfill and agricultural land use in the Piru and Fillmore basins.

This report serves to keep the Piru/Fillmore Basins AB 3030 Groundwater Management Council current on the groundwater conditions of the Piru and Fillmore basins which will enable it to make informed groundwater management decisions. Below is a summary of the information contained in this report.

Precipitation

Ventura County precipitation in water years 2012 and 2013 was low enough to be considered drought conditions. Piru basin precipitation for the 2012 and 2013 water years was 13.17 and 7.55 inches respectively, as recorded at the Piru-Temescal Guard Station at Lake Piru. The 2012 precipitation was 7.15 inches below the historical average precipitation from 1950 to 2013; and the 2013 precipitation was 12.77 inches below historical average precipitation.

Fillmore basin precipitation for water years 2012 and 2013 was 12.08 and 6.48 inches respectively, as recorded at the Fillmore Fish Hatchery near the Piru-Fillmore basin boundary. The 2012 precipitation was 6.55 inches below the historical average precipitation from 1957 to 2013; and the 2013 precipitation was 12.15 inches below the historical average precipitation.

Conservation Release

United Water's usual fall conservation releases from Lake Piru provides 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. United Water's 2012 conservation release from Lake Piru begin on September 5, 2012 and ended on November 1, 2012. Approximately 35,220 acre-feet of water were released through Santa Felicia Dam.

Below-average precipitation in 2012 and 2013 and the subsequent low inflow into Lake Piru resulted in United Water's inability to perform a fall conservation release from Lake Piru in 2013.

Groundwater Extractions

In calendar year 2012 a total of 11,501 acre-feet of groundwater extraction from the Piru basin was reported to United Water, which is 801 acre-feet below the historical average (from 1980 to 2013). In calendar year 2013 a total of 12,807 acre-feet of groundwater extraction was reported for the Piru basin, totaling 505 acre-feet above the historical average.

In calendar year 2012 a total of 43,455 acre-feet of groundwater extraction was reported for the Fillmore basin, which is 877 acre-feet less than the historical average (from 1980 to 2013). In calendar year 2013 a total of 50,433 acre-feet of groundwater extraction was reported for the Fillmore basin, which is 6,101 acre-feet more than the historical average.

In 2012 and 2013 well production could be measured and reported to United by water meter, estimated by electrical use with an efficiency rating, or estimated with crop factors. United Water's Board of Directors voted in 2013 to eliminate the option of reporting by crop factor, so reporting use by meter or efficiency conversion will be required for the 2014 and future reporting periods.

Groundwater Elevations

This report presents water levels in two key wells for each basin relative to groundwater elevation benchmarks and groundwater elevation Basin Management Objective (BMO) limits. The BMOs for the selected wells is intended to sustain groundwater elevations above the low of the 1984 to 1991 drought. The 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 Benchmark #1 in fall 2013 and continued to decline for the rest of the calendar year to near its Benchmark #2. Groundwater elevations in the Piru key well located near Hopper Creek dropped below its Benchmark #1 in summer 2013 and continued to decline for the rest of the calendar year to near its Benchmark #2.

Groundwater elevations in the Fillmore key well located in the Bardsdale area dropped below its Benchmark #1 in fall 2013 and continued to decline for the rest of the calendar year to near its Benchmark #2. Groundwater elevations in the Fillmore basin key well located in the Sespe Uplands area dropped below its Benchmark #1 in winter 2013 and dropped below its Benchmark #2 in spring 2013, and continued to decline for the rest of the calendar year to within 6 feet of its BMO.

Surface Water Quality

Surface water quality records from years 2012 and 2013 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 2012 and 2013 ranged above both the AB 3030 BMO of 100 mg/L and the 117 mg/L toxicity threshold for avocados (CH2M HILL, 2005).

In calendar years 2012 and 2013 there was an overall reduction in concentrations of Total Dissolved Solids (TDS) and sulfate in Piru Creek near Piru compared to the higher concentrations recorded in 2010. Water quality at the Piru Creek sampling location immediately below Santa Felicia Dam at the USGS stream gauge ranged above the TDS and chloride BMOs in 2013.

Sespe Creek has historically shown highly variable chloride concentrations, but an upward trend is apparent for calendar years 2012 and 2013, with a maximum-recorded chloride concentration of 188 mg/L (three times its BMO). 2013 TDS, sulfate and boron concentrations also ranged above the BMOs.

Water quality samples from the Santa Clara River at the Willard Road sampling site near the Fillmore/Santa Paula Basin boundary also showed TDS, sulfate and chloride concentrations above its BMOs in 2013.

Groundwater Quality

Maximum-recorded 2013 groundwater concentrations are mapped and selected water quality time series 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 2013 in groundwater east of Piru Creek, with the maximum chloride concentration in three wells ranging from 113 to 134 mg/L. The maximum 2013 chloride concentration in wells between Hopper Creek and Piru Creek was 114 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 reclamation plants (WRPs) over the past fifteen years.

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. The board of the Santa Clarita Valley Sanitation District of Los Angeles County failed to approve the necessary rate increases to fund the AWRM mitigation measures. In 2013 the Upper Basin Purveyors, Kennedy-Jenks Consultants and Santa Clarita Valley Sanitation District of Los Angeles County were still working to craft alternatives to the original AWRM Plan that would possibly eliminate the need for the construction of a reverse osmosis plant and associated brine disposal facilities, which are a significant and costly aspect of the original AWRM proposal.

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. The chloride issue in the upper Santa Clara River area is expected to be back before the Regional Board in 2014.

Los Angeles County wastewater reclamation plants

In calendar year 2012 the Saugus WRP discharged approximately 5,670 ac-ft of treated effluent with an average chloride concentration of 110 mg/L into the Santa Clara River. In the 2013 calendar year the Saugus WRP discharged approximately 5,770 ac-ft of effluent into the Santa Clara River, with an average chloride concentration of 124 mg/L. There is an upward trend in Saugus WRP effluent chloride concentrations from 2012 to 2013 (CSD-LAC, 2012a, 2013a, 2014a).

In the 2012 calendar year the Valencia WRP discharged approximately 16,280 ac-ft of effluent into the Santa Clara River, with an average chloride concentration of 115 mg/L. In calendar year 2013 the Valencia WRP discharged approximately 15,890 ac-ft of effluent into the Santa Clara River with an average chloride concentration of 127 mg/L. There is also an upward trend in Valencia WRP effluent chloride concentrations from 2012 to 2013 (CSD-LAC, 2012b, 2013b, 2014b). The recent upward trend in chloride concentrations in the effluent from both the Saugus and Valencia WRPs likely results in part from increasing chloride concentrations in imported State Water Project water.

Toland Landfill

Annual and semi-annual monitoring reports for Toland (Road) Landfill for the 2012 and 2013 calendar years state that the Landfill was in compliance with waste discharge requirements as set by the California Regional Water Quality Control Board - Los Angeles (VRSD, 2012a, 2012b, 2013a, 2013b, 2014).

1 BACKGROUND AND INTRODUCTION

California Assembly Bill 3030 was enacted in 1992, which established in the California Water Code sections 10750-10756, providing 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 outlines 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 Plan states that the Council shall consist of seven members: two City Council representatives from Fillmore, four pumpers (of which two will be 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 includes Basin Management Objectives (BMOs) for groundwater elevations, groundwater quality and surface water quality at various locations. It also includes a groundwater export policy which has provoked considerable discussion since its introduction. In 2013 an updated version of the Draft Plan was submitted to the Council. The revised draft of the Plan has not yet been adopted by the Council.

In 2011, the Groundwater Management Council voted to change the annual report requirement to a biennial (once every two years) report requirement. United Water, as the lead agency, has prepared this 2012 and 2013 Biennial Groundwater Conditions Report to meet the requirement of the Piru/Fillmore Basins AB 3030 Groundwater Management Plan. This report serves to keep the Piru/Fillmore Basins AB 3030 Groundwater Management Council current on the groundwater conditions of the Piru and Fillmore basins, which may assist them in making informed groundwater management decisions.

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 proposed chloride TMDL for the upper Santa Clara River, waste water reclamation plants, the Toland 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 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 wells in the basin are deeper than 700 feet 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 major 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 and 4). Clay layers have been identified at some locations within the basin but are not continuous. The basin is considered to be an unconfined groundwater basin.

The reach of the Santa Clara River within 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 5). 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.

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 are the two 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 (Figure 3 and Figure 4). 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) in all but the very driest years (Figure 5). 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.

3 PRECIPITATION

Ventura County precipitation for water years 2012 and 2013 was low enough to be considered drought conditions.

Piru basin precipitation data are from the Piru-Temescal Guard Station, Ventura County station number 160 (Figure 1), located near the entrance to Lake Piru. Fillmore basin precipitation data are from the Fillmore Fish Hatchery, station number 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, 2014).

Piru basin precipitation for water year 2012 and water year 2013 was 13.17 inches and 7.55 inches respectively. The 2012 precipitation was 7.15 inches below the historical average (mean) precipitation (20.32 inches, years 1950 to 2013), and 2013 precipitation was 12.77 inches less than the historical average precipitation.

Fillmore basin precipitation for water years 2012 and 2013 was 12.08 inches and 6.48 inches, respectively. The 2012 precipitation was 6.55 inches below the historical average precipitation (18.63 inches, years 1957 to 2013), and 2013 precipitation was 12.15 inches less than the historical average precipitation.

Plots of annual precipitation data for the period of record are shown for the Piru basin in Figure 6 and for the Fillmore basin in Figure 7. 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 term wet and dry cycles are evident from the cumulative departure plots. 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 2012 and 2013 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 the relative health of the Piru and Fillmore basins and permitting issues at the facility (the diversion structure lacks a fish screen). Generalized areas of groundwater recharge and discharge are shown in Figure 5.

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 near Interstate 5. Dry season perennial surface water flow across the Los Angeles/Ventura County Line diminishes to a trickle about 2 miles upstream of the Piru Creek/Santa Clara River confluence. Surface water only crosses this "dry gap" during the wet season when precipitation from storms generates high enough flows that surface water connection is established across the basin. The median total annual flow in the Santa Clara River near the Los Angeles/Ventura County Line from 1972 to 2013 is approximately 37,000 acre-feet. Figure 8 shows historical annual surface water flows for the Santa Clara River near the Los Angeles/Ventura County Line plotted with Piru basin historical precipitation.

Groundwater levels in the Fillmore basin benefit greatly from recharge of Sespe Creek flows originating from the Sespe Creek Watershed. Figure 9 shows historical annual surface water flows for Sespe Creek plotted with Fillmore basin historical precipitation. The average total annual flow in Sespe Creek from 1928 to 2013 is approximately 88,600 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, 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. United Water's 2012 conservation release from Lake Piru began on September 5, 2012 and ended on November 1, 2012. Approximately 35,220 acre-feet of water were released through Santa Felicia Dam (SFD). Table 1 from Untied Water's 2013 Groundwater and Surface Water Condition Report (UWCD, 2014) shows estimates of the distribution of percolated flows in each basin during United's conservation releases since 1999.

The 2012 release was slightly more than the 16 year average of the releases in terms of total quantity of the release. The lowest volume released in the fifteen years prior to 2013 was in the dry year of 2004 at 12,200 AF. The last time prior to 2013 that there was no conservation release was during the drought in 1990. Figure 10 shows the 2012 conservation release and the associated direct benefit to each basin. Flow measurements were made near the Piru/Fillmore basin boundary to calculate the amount of water that percolated into the Piru Basin, and measurements were also made at Willard Rd. for the Fillmore/Santa Paula basin boundary to calculate what percolated in the Fillmore Basin. The remaining discharge measured at Willard Rd. either benefits the Santa Paula Basin or is diverted at the Freeman Diversion ("Lower Basins" in following table).

Water storage in Lake Piru at the end of the 2012 release was approximately 16,900 acre-feet. The release of purchased State Water from Pyramid Lake brought Lake Piru storage back up to approximately 20,000 acre-feet, the "minimum pool" United strives to maintain in the lake. Below-average precipitation in 2013 and the resulting low inflow into Lake Piru resulted in United Water's inability to perform a fall 2013 conservation release.

Both the Piru and Fillmore basins benefited from United Water's 2012 conservation release. The benefit of United Water's conservation releases can be seen as groundwater levels in both basins rose shortly after the start of the 2012 release (Figure 11). The conservation releases also help to sustain groundwater underflow that exists between the groundwater basins downstream of Piru and Fillmore basins which include: Santa Paula, Mound and Oxnard Forebay basins. The release water that did not percolate into the Piru and Fillmore basins flowed downstream to the Santa Paula Basin and to the Freeman Diversion.

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)	Deliveries PTP and PV
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

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)	Deliveries PTP and PV
2005	9,100	na	na	4,500**	0
2005	23,400	na	na	17,200**	150
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
Average	**28,369**	**11,962**	**4,358**	**11,449**	**2,201**
16 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 1. Benefits of the SFD Conservation Release due to direct percolation.

5 GROUNDWATER EXTRACTIONS

Table 2 shows tabulated total groundwater extractions for Piru and Fillmore basins for 1980 to 2013.

For calendar year 2012 a total of 11,501 acre-feet of groundwater extraction was reported for the Piru basin, which is 801 acre-feet less than the historical average of 12,302 acre-feet (1980 to 2013). For calendar year 2013 a total of 12,807 acre-feet of groundwater extraction was reported from the Piru basin, which is 505 acre-feet above the historical average. Agricultural water use accounted for approximately 95 percent of the groundwater extraction. An amendment was made in this report for 2007 pumping that was reported incorrectly high in past reports.

For calendar year 2012 a total of 43,455 acre-feet of groundwater extraction was reported for the Fillmore basin, which is 877 acre-feet less than the historical average of 44,332 acre-feet (1980 to 2013). For calendar year 2013 a total of 50,433 acre-feet of groundwater extraction was reported for the Fillmore basin, which is 6,101 acre-feet above the historical average. Agricultural uses accounted for approximately 94 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 Agricultural Land Use is presented later in this report.

Figures 12 and 13 show historical groundwater extractions for Piru and Fillmore basins and figures 14 and 15 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 2012 the single well with the largest 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 2013 the single well with the largest extraction in the Piru and Fillmore basins was Farmers Irrigation's well that was completed in 2012 just east of the Santa Paula and Fillmore basins boundary (UWCD, 2013).

The three allowable methods for reporting groundwater extraction to United Water in 2012 and 2013 was by crop factor, 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. Details regarding the number of wells and amount of pumping reported by each method in 2012 and 2013 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	1997	12,568	47,060
1981	13,459	33,060	1998	9,089	42,968
1982	9,317	37,123	1999	13,363	49,972
1983	7,251	29,894	2000	12,784	48,483
1984	12,968	46,292	2001	9,965	41,549
1985	15,053	47,786	2002	11,607	45,416
1986	12,042	40,932	2003	10,358	41,474
1987	15,518	46,340	2004	11,148	42,567
1988	14,342	49,336	2005	10,650	38,428
1989	15,311	54,911	2006	12,083	40,675
1990	17,050	55,718	2007	13,594	46,563
1991	16,123	51,060	2008	12,941	47,404
1992	12,197	45,757	2009	11,949	46,882
1993	11,373	43,249	2010	11,070	41,536
1994	12,264	45,802	2011	11,075	40,855

Calendar Year	Piru Basin (ac-ft)	Fillmore Basin (ac-ft)	Calendar Year	Piru Basin (ac-ft)	Fillmore Basin (ac-ft)
1995	10,255	42,703	2012	11,501	43,455
1996	12,575	42,862	2013	12,807	50,433
			Average	**12,302**	**44,332**

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

	Crop Factor 2012	Electrical Meter 2012	Water Meter 2012	Crop Factor 2013	Electrical Meter 2013	Water Meter 2013
Number of Wells[1]	63	18	26	62	17	32
Extractions (ac-ft)	4,081	2,841	4,579	3,959	3,750	5,099
Percent of Total Extractions	35.5%	24.7%	39.8%	30.9%	29.3%	39.8%
[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 2012 and 2013.

	Crop Factor 2012	Electrical Meter 2012	Water Meter 2012	Crop Factor 2013	Electrical Meter 2013	Water Meter 2013
Number of Wells[1]	186	42	63	180	45	70
Extractions (ac-ft)	9,987	18,077	15,392	9,989	19,348	21,096
Percent of Total Extractions	23.0%	41.6%	35.4%	19.8%	38.4%	41.8%
[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 2012 and 2013.

6 GROUNDWATER LEVELS

There were 32 wells monitored for groundwater levels in the Piru basin in 2012 and 2013 (Figure 16). The Water Resources Division of the Ventura County Watershed Protection District (VCWPD) monitored 10 wells on a quarterly basis. United Water monitored 26 wells on monthly, bimonthly, semi-annual or event-based schedules. Four 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 26 wells it monitors equipped with pressure transducers (with data loggers) that record groundwater elevations every four hours. Water levels are measured in all the wells on United's water level monitoring schedules with either a steel survey tape or a dual-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. Two of these wells are equipped with pressure transducers. The shallowest of these nested piezometers (screened 50-70' below grade) has been dry since June of 2013 (the bottom of the well is above the water table).

In 2012 and 2013 there were 29 wells monitored for groundwater levels in the Fillmore basin (Figure 16). VCWPD monitored 12 wells on a quarterly basis. United Water monitored 19 wells on monthly, bimonthly, semi-annual or event-based schedules. United Water and Ventura County monitored four common wells. The City of Fillmore has not monitored water levels in their wells in recent years and Farmers Irrigation monitored their well in the basin and also one of Limoneira's wells in the basin. United Water currently has 5 of the 19 wells it monitors equipped with pressure transducers (with data loggers) that record groundwater levels every four hours.

Figure 17 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 17) 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 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 along the gaining reach.

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 from 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 are shown for the Piru and Fillmore basins in Figures 18 and 19. 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 shown for the Piru and Fillmore basins in Figures 20 and 21.

This report tracks water levels for two key wells in 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 low for this period in each well is established as the BMO for the well. Benchmark #1 is the 2004 low water level and benchmark #2 is defined as halfway between benchmark #1 and the BMO for each key well. The groundwater elevation benchmarks and BMOs were first introduced in the Draft 2011 Piru/Fillmore Basins AB 3030 Groundwater Management Plan update.

For 2012 and 2013 groundwater elevations in the Piru key well located near Piru Creek (4N/18W-29M02S) dropped below Benchmark #1 in fall 2013 and continued to decline for the rest of the calendar year to near Benchmark #2. In December 2013 well -29M02S was four feet above its Benchmark #2 and 21 feet above its BMO. The groundwater elevations of the Piru key well located near Hopper Creek (4N/19W-25M01S) dropped below Benchmark #1 in summer 2013 and continued to decline for the rest of the calendar year to near Benchmark #2. Well -25M01S was three feet above its Benchmark #2 in December 2013 and 20 feet above its BMO (Figure 14).

For 2012 and 2013 the groundwater elevations in the Fillmore key well located in the Bardsdale area (03N/20W-02A01S) dropped below Benchmark #1 in fall 2013 and continued to decline for the rest of the calendar year to near Benchmark #2. Well -02A01S was two feet above Benchmark #2 and ten feet above its BMO in December 2013. Recorded groundwater elevations in the Fillmore basin key well located in the Sespe Upland area (04N/20W-23Q02S) dropped below Benchmark #1 in winter 2013, dropped below Benchmark #2 in spring 2013, and continued to decline for the rest of the calendar year to within 6 feet of its BMO. Well -23Q02S was one foot above its BMO in December 2013. AB 3030 Council Members were notified that water levels in key wells had fallen below the various benchmarks.

Maps showing groundwater elevation contours for spring 2012 and spring 2013 are shown in Figures 3 and 4. Each contour on the maps represent a line of equal groundwater elevation. The contours for both basins show a general east-to-west groundwater flow, except for the Sespe Upland, which show a more southwesterly groundwater flow direction. Figures 22 and 23 show ranges of depth-to-groundwater for spring 2012 and spring 2013 at various wells (as variable dot sizes). Note that in spring of 2012 one well at the Fillmore/Santa Paula basin boundary was flowing artesian (Figure 22).

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 2012 and 2013. Dry conditions persist in the watershed and elevated concentrations were unexpected 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 24 is a map of the surface water quality monitoring locations and Los Angeles Regional Water Quality Control Board (Regional Board) Santa Clara River reaches and groundwater quality objective zones. Figures 25 through 29 present time series of historical surface water concentrations for TDS, sulfates, chlorides, nitrates and boron, and show the maximum-recorded concentrations for these constituents in the 2013 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 was 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, elevated chloride in the Santa Clara River near the Ventura/Los Angeles County Line can be attributed to effluent discharged into the Upper Santa Clara River by the Saugus and Valencia Water Reclamation Plants (WRPs). In calendar years 2012 and 2013 chloride concentrations in the Santa Clara River near the Ventura/Los Angeles County Line ranged above the AB 3030 BMO (100 mg/L) and the toxicity threshold for avocados (117 mg/L) (CH2M HILL, 2005). Recorded chloride concentrations in 2012 ranged from 76 mg/L to 136 mg/L, and ranged from 112 mg/L to 135 mg/L in 2013 (Figure 27).

In 2003 a nitrogen removal facility came on-line at the Valencia WRP which has proven to be very successful in reducing ammonia in the WRP effluent. Ammonia commonly oxidizes to nitrate in the river channel. Since completion of this facility nitrate concentrations have been greatly reduced in the Upper Santa Clara River (Figure 28).

Between 2002 and 2010 samples from Piru Creek near Piru showed an upward trend in TDS and sulfate, but samples from calendar years 2012 and 2013 show an overall reduction in concentrations. The Piru Creek sampling located immediately below Santa Felicia Dam ranged above its TDS and Chloride BMOs in 2013. Sulfate concentrations at this location also ranged to within 80 percent the BMO in 2013.

Sespe Creek has historically shown highly-variable chloride concentrations, and the source of the elevated chloride remains undetermined. An upward trend is apparent in samples from calendar years 2012 and 2013, with a maximum chloride concentration of 188 mg/L recorded in November 2013, which is more than three times the BMO of 60 mg/l (Figure 27). In 2013 TDS, sulfate and boron concentrations also ranged above BMOs.

In 2012 and 2013 recorded boron concentrations in Sespe Creek continued to range above the 1.0 mg/L toxicity limit for citrus (Hem, 1989). The 2012 maximum-recorded concentration was 3.2 mg/L and the 2013 recorded high concentration was 4.6 mg/L (Figure 29). There has been an upward trend in boron concentration since 2011 which is likely a reflection of the drought conditions of 2012 and 2013 and the resultant lower flows in the creek.

The sample location near the Fillmore Fish Hatchery did not show any of the five surface water constituents above BMOs in calendar years 2012 and 2013. Water in the Santa Clara River at this location, and under dry conditions in the watershed, predominately sources from rising groundwater. 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.

The Santa Clara River sample site at Willard Road near the Fillmore/Santa Paula basin boundary showed TDS, sulfate and chloride concentrations above BMOs in 2013.

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 ensures that groundwater is safe for potable use, and ensures taste and odor are within established guidelines. Monitoring of 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 the 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 Department of Public Health (DPH) and the County of Ventura's Groundwater Section. Other sources of information 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 in the Piru basin has been impacts associated with high chloride concentrations in the Santa Clara River flows sourcing from Los Angeles County. The chloride plume associated with these discharges has made a steady advance with groundwater flow down the Piru basin. The Piru basin generally does not have problems with nitrate contamination, and samples collected in 2013 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 30 through 34 show the maximum-recorded concentrations for TDS, sulfate, chloride, nitrate and boron, respectively, for wells sampled in the 2013 calendar year. Figures 35 through 39 show historical time-series for TDS, sulfate, chloride, nitrate and boron, respectively, for selected wells in the Piru and Fillmore basins.

Both the 2013 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 AB 3030 BMOs for the Piru basin east of Piru Creek were set to agree with the Regional Board 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. The Basin Plan objectives for this area were set at a time when groundwater in this area was still degraded by brine discharges from oil field operations dating prior to the passage of the Clean Water Act. 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 higher value than the TDS by Total Filterable Residue. The evaporative method (TFR) is now the standard laboratory analysis for TDS. Figure 30 shows elevated TDS concentrations in the area immediately west of Hopper Creek. The 2013 maximum TDS concentrations for eight wells in this area ranged from 940 to 2,270 mg/L (by Summation).

Elevated chloride concentrations were recorded in 2013 in groundwater east of Piru Creek, with maximum chloride concentrations in three wells ranging from 113 mg/L to 134 mg/L (Figure 32). The maximum 2013 chloride concentration in wells located between Hopper Creek and Piru Creek was 114 mg/L. These elevated chloride concentrations are thought to be associated with the high-chloride effluent discharged into the Santa Clara River by Los Angeles County water reclamation 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 TMDL actions to reduce and mitigate chloride impacts in the Piru basin have not been implemented (see discussion below).

Figure 33 shows the maximum-recorded nitrate concentrations in the Piru and Fillmore basins for the 2013 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 two wells 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. 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 most discharges continue to be regulated in terms of concentration. When the discharge rate or volume of discharges is known, conversion to mass loading is easily accomplished when required.

From 1990 to 2004 treatment plants in the 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) 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 Saugus and Valencia water reclamation plants 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. In 2001 it was agreed by many that discharges of 143 mg/L chloride in the Santa Clarita area would be attainable by the water reclamation plants, and following dilution by rising groundwater east of Blue Cut the water quality would be protective of agriculture in Ventura County. A draft TMDL based on the compromise discharge limit of 143 mg/l was successfully challenged based on procedural technicalities and subsequently abandoned.

The Regional Board redrafted the chloride TMDL, proposing discharge limits at the existing water quality objective of 100 mg/L, but with interim limits based on 2001 chloride discharges. The TMDL had an implementation schedule of up to 17 years. Early in the implementation period the major dischargers would contract or conduct studies to evaluate chloride toxicity to sensitive crops such as strawberry and avocado. The findings of this study might then be used to revise the surface water chloride objective in the Basin Plan. Los Angeles County dischargers would also evaluate the feasibility of providing a long-term alternative water supply to growers with surface water diversions near the County Line who are most impacted by the current discharges with elevated chloride. This TMDL was approved by the Los Angeles Regional Board in October 2002 and submitted to the State Board for approval.

The 2002 chloride TMDL was remanded by State Board, and sent back to the Regional Board for modification. A new version of the chloride TMDL was approved by the Regional Board in July of 2003 and was before the State Board in 2004. The revised version shortened the implementation period to 13 years and extended the interim chloride limits, which are based on 2001 discharges, through the entire implementation period. State Board Resolution 03-008 requires average monthly interim limits based on 2001 discharges were 200 mg/L for the Saugus WRP and 187 mg/L for the Valencia WRP. The maximum daily interim limits based on 2001 discharge limits were 218 mg/L for the Saugus WRP and 196 mg/L for the Valencia WRP (CA RWQCB-LA, 2003).

The Saugus and Valencia WRPs currently operate 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 WRP and 134 mg/L for the Valencia WRP with a maximum interim waste load allocation of 230 mg/L for both WRPs (CA RWQCB-LA, 2004).

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 Plan" (AWRM) 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 includes 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 has led to decreased influent chloride concentrations received by the plants and has 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 of 2009 the Santa Clarita Valley Sanitation District was to vote on the proposed rate increase required to fund the AWRM project, which would have increased residential sewer rates in Santa Clarita from $14.92 per month to $47 per month by 2015. Board members postponed the vote in response to public protest over the proposed hike. 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 were still working with United to craft 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 now appears highly unlikely that the Sanitation Districts will meet their chloride compliance deadline of 2017. The chloride issue in the upper Santa Clara River area is expected to be back before the Regional Board in 2014.

10 SANTA CLARA RIVER NUTRIENT TMDL

In 2001 the Regional Board held public meetings in Ventura County to initiate work on the nutrient TMDL for various impacted reaches of the Santa Clara River and its tributaries. The TMDL work was initiated to address surface water impairments on the EPA's 1998 303(d) list. A revised version of the 303(d) list was adopted in 2002 and the following listings are addressed in the TMDL:

- Reach 3, Freeman Diversion to Fillmore (Figure 23): ammonia
- Reach 5, Blue Cut to Hwy. 99: nitrate plus nitrite
- Brown Barranca/Long Canyon: nitrate plus nitrite
- Todd Barranca/Wheeler Canyon: nitrate plus nitrite

Additionally, several reaches were downgraded in 2002 to State Enforceable Programs or Monitoring Lists, and these effects should also be alleviated by the implementation of the TMDL:

- Reach 5, Blue Cut to Hwy. 99: ammonia
- Reach 6, Hwy. 99 to Bouquet Canyon Road: ammonia, organic enrichment, low dissolved oxygen

A Steering Committee was formed to work closely with the Regional Board in the creation of the TMDL. Dr. Arturo Keller of UC Santa Barbara was selected by the committee to facilitate the TMDL development. Systech Engineering Inc. of San Ramon, CA was hired by the group to perform a detailed analysis of the watershed, addressing all significant point and non-point nutrient sources in the study area. The modeling included load characterization (source analysis and linkage analysis), load allocation, and development of the TMDL. The modeling demonstrated that high nitrogen loads in the various impaired reaches were most closely associated with discharges from wastewater treatment plants. The Nutrient TMDL was approved in 2003 by the Regional and State Boards. The TMDL included an implementation period of eight years to allow for additional studies on ammonia toxicity and in-stream plant growth, and the construction of additional nutrient removal facilities at the water reclamation plants if they are determined to be necessary. As mentioned previously, the ammonia nitrogen removal facility constructed in 2003 at the Valencia treatment plant was successful in reducing ammonia nitrogen from effluent water. As a result, nitrate and ammonia concentrations were greatly reduced in the Upper Santa Clara River. See the nitrate time series graphs in Figure 28 for the Santa Clara River near the Ventura County Line. Improvements to the Fillmore and Santa Paula WRPs helped to reduce nitrogen loads associated with these facilities.

In the main channel of the Santa Clara River, nitrogen impairments were reduced primarily by the construction of nitrogen removal facilities at the major water reclamation plants in Los Angeles and Ventura Counties. Reductions in nitrogen loads associated with agriculture were anticipated by implementing Best Management Practices (BMPs) for irrigation and fertilizer applications, as coordinated though the Agricultural Waiver program in Ventura County.

The Regional Board has shown interest in preserving the relatively natural and pristine conditions of the Santa Clara River watershed, conditions that are increasingly rare in southern California. The impairments addressed in the Nutrient TMDL are largely aimed at minimizing impairments to aquatic habitat and species, such as excessive plant and algal growth in the river channel and ammonia toxicity for fish. Low total nitrogen is also desirable for water recharging the drinking water aquifers within the Santa Clara River valley. Nitrogen concentrations observed in the river and most tributaries are typically less than those considered to be detrimental to human health.

11 WASTEWATER RECLAMATION PLANTS

There is one wastewater reclamation plant (WRP) 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 reclamation 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 RECLAMATION PLANT

Improvements to the existing Piru Wastewater Reclamation Plant were completed in March 2010 to satisfy Los Angeles Regional Water Quality Control Board permit requirements (VCWD 16, 2010). Plant capacity was increased from 0.25 million gallons per day to 0.5 million gallons per day. The Piru 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.

Effluent discharged from the Piru WRP averaged 0.18 million gallons per day (0.28 cubic feet per second) for 2012 and 0.15 million gallons per day (0.23 cfs) for 2013 (Table 5). There is a downward trend in Piru WRP monthly mean effluent chloride concentrations for 2012 through 2013 (VCWD 16, 2013, 2014). A downward trend is also seen in the reported Piru water supply mean chloride concentrations for 2012 and 2013.

The high chloride effluent percolated in the Piru WRP's ponds is likely not of sufficient volume to significantly impact the groundwater quality of the basin. The 2013 maximum chloride concentration, in a shallow production well, located approximately one mile down gradient from the

Piru WRP, on the south side of the Santa Clara River, is 65 mg/L. The location of this well and the location of the Piru WRP percolation ponds are shown on the map in Figure 32.

Annual monitoring reports for Piru WRP for the 2012 and 2013 calendar years state that the plant was in compliance with waste discharge requirements as set by the California Regional Water Quality Control Board - Los Angeles except for TDS and chloride. 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, 2013, 2014). In 2012 the mean chloride concentration of the Piru area supply water was above the 100 mg/L limit before the water was further loaded with chloride through use before the influent entered the Piru WRP. The VCWD 16 received a Notice of Violation from the Regional Board for TDS and chloride exceedance dated December 17, 2013.

Year	Mean Chloride Effluent (mg/L)	Mean Chloride Water Supply (mg/L)	Effluent (mean mgd)
2012	161	106	0.18
2013	143	87	0.15

Table 5. 2012 and 2013 Piru WRP mean chloride (mg/L) and effluent discharge (mgd).

11.2 FILLMORE WASTEWATER RECLAMTION PLANT

A new Fillmore Wastewater Reclamation 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. Some 20% (200,000 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 800,000 gallons per day is being discharged to percolation ponds (Water Quality Products, 2010).

Effluent discharged from the Fillmore WRP averaged 0.88 million gallons per day (1.37 cfs) for 2012 and 0.89 million gallons per day (1.38 cfs) for 2013 (Table 6). There is an upward trend in Fillmore WRP monthly mean effluent chloride concentrations for 2012 through 2013 (City of Fillmore, 2013, 2014).

The chloride constituent of the percolated effluent in the Fillmore WRP's ponds is not likely significantly impacting the groundwater quality of the basin. The 2013 maximum chloride concentration in a shallow monitor well located approximately 0.15 miles up-gradient from the Fillmore WRP, on the north side of the Santa Clara River, was 82 mg/L. The 2013 maximum chloride concentration in a shallow production well located approximately 0.3 miles down-gradient from the Fillmore WRP, north of the Santa Clara River and east of Sespe Creek, was 74 mg/L. The locations of these wells and the location of the Fillmore WRP percolation ponds are shown in Figure 32.

Annual monitoring reports for Fillmore WRP for the 2012 and 2013 calendar years state that the plant was in compliance with waste discharge requirements as set by the California Regional Water Quality Control Board - Los Angeles except for boron and chloride. The influent levels of boron and chloride entering the Fillmore WRP are higher than the imposed discharge limits of 1.0 mg/L and 100 mg/L respectively (City of Fillmore, 2013, 2014). The City of Fillmore received a Notice of Violation from the Regional Board for boron exceedance dated December 19, 2013.

Year	Mean Chloride Effluent (mg/L)	Mean Chloride Water Supply (mg/L)	Effluent (mean mgd)
2012	100	no data	0.88
2013	116	no data	0.89

Table 6. 2012 and 2013 Fillmore WRP mean chloride (mg/L) and effluent discharge (mgd).

11.3 SAUGUS AND VALENCIA WASTEWATER RECLAMTION PLANTS

The Saugus and Valencia Water Reclamation 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 1.2 miles east of Castaic Junction on Interstate Highway 5. The Valencia plant is located approximately 3.1 miles to the southeast of the Saugus plant, just north of the South Fork of the Santa Clara River and west of Interstate 5 (Figure 1). Both the Saugus and Valencia water reclamation plants discharge tertiary treated water directly into the Santa Clara River east of the Ventura/Los Angeles County Line.

In the 2012 calendar year, the Saugus WRP discharged approximately 5,670 ac-ft of effluent to the Santa Clara River, with an average chloride concentration of 110.0 mg/L. In calendar year 2013 the Saugus WRP discharged approximately 5,770 ac-ft of effluent to the Santa Clara River, with an average chloride concentration of 124.4 mg/L. There is an upward trend in Saugus WRP effluent chloride concentrations from 2012 to 2013 (CSD-LAC, 2012a, 2013a, 2014a) that can be seen in Figure 40.

For the 2012 calendar year, the Valencia WRP discharged approximately 16,280 ac-ft of effluent to the Santa Clara River, with an average chloride concentration of 115.0 mg/L. For the 2013 calendar year, the Valencia WRP discharged approximately 15,890 ac-ft of effluent to the Santa Clara River with an average monthly chloride concentration of 126.7 mg/L. There is also an upward trend in Valencia WRP effluent chloride concentrations from 2012 to 2013 (CSD-LAC, 2012b, 2013b, 2014b) that can be seen in Figure 41.

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 WRPs likely results in part from increasing chloride concentrations in imported State Water Project water (Figures 40 and 41).

Figure 42 plots discharge from the Saugus and Valencia WRPs for 2008 through 2013 for comparison with the flow and chloride concentrations in the Santa Clara River near the Ventura/Los Angeles County Line. During the fall of each year, as shown in the figure, the combined 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 Saugus and Valencia WRPs. Also note that the combined effect of the elimination of self regenerating water softeners and inconsistent 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.

Annual monitoring reports for Saugus and Valencia WRPs for the 2012 and 2013 calendar years state that the plants were in compliance with waste discharge requirements as set by the California Regional Water Quality Control Board - Los Angeles. As mentioned previously, the Saugus and Valencia WRPs have been operating under an interim waste load allocation for chloride since 2004. (CSD-LAC, 2013a, 2013b, 2014a, 2014b). The interim chloride limits are considerably higher than the 117 mg/L proposed objective of 117 mg/L.

12 TOLAND LANDFILL

The Toland 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 at the end of Toland Road (Figure 43). The Landfill 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 continues to own the landfill today and operates 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.

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 (Lower San Pedro 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.

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.

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.

The Landfill developed additional lined areas and installation of the stability berm at the foot of the landfill during the construction of Phase IIIA in 2007 and Phase IIIB in 2010/2011. This stability berm structure included 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.

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 destruction is approximately 1,800 standard cubic feet per minute (scfm).

Annual and semi-annual monitoring reports for Toland (Road) Landfill for the 2012 and 2013 calendar years state that the Landfill was in compliance with waste discharge requirements as set by the California Regional Water Quality Control Board - Los Angeles (VRSD, 2012a, 2012b, 2013a, 2013b, 2014). The reports are available for download online through the California State Water Resources Control Board's GeoTracker (CA SWRCB, 2014).

13 AGRICULTURAL LAND USE

Piru basin agricultural land use maps for 1997 and 2014 are shown in Figure 44 and Figure 45. Fillmore basin agricultural land use maps for 1997 and 2014 are shown in Figure 46 and Figure 47.

The 2014 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 2014 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. This hillside expansion is not readily apparent from the maps.

14 SUMMARY

- Precipitation for water years 2012 and 2013 in Ventura County was low enough to consider the Piru and Fillmore basins to be experiencing drought conditions.

- Increases in groundwater elevations associated with United Water's fall 2012 conservation release can be seen in key monitoring wells.

- Below-average precipitation in 2012 and 2013 and the low inflow into Lake Piru resulted in United Water's inability to perform a conservation release from Lake Piru in fall 2013.

- Groundwater extractions were below average for both basins in 2012 and above average for both basins in 2013.

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

- Both Piru key wells showed groundwater elevations in December 2013 below their Benchmark #1 and near their Benchmark #2. The Fillmore key well in the Bardsdale area showed a groundwater elevation in December 2013 below its Benchmark #1 and near its Benchmark #2. The Fillmore key well in the Sespe Upland area showed a groundwater elevation below its Benchmark #2 and within 6 feet of its BMO limit in December 2013.

- Chloride in the Santa Clara River near the Ventura/County Line ranged above 117 mg/L in 2012 and 2013, with measured concentrations as high as 136 mg/L.

- TDS and sulfate in Piru Creek near Piru show an upward trend since 2002 although in calendar years 2012 and 2013 there has been an overall reduction in concentrations of these constituents compared to the 2010 highs at this sampling location.

- Chloride in Sespe Creek is highly variable but an upward trend is apparent for calendar years 2012 and 2013, with a maximum-recorded chloride concentration of 188 mg/L (three times the BMO of 60 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 in the discharges from WRPs in Santa Clarita.

- The AWRM proposal for the Upper Santa Clara River TMDL was not funded by the Santa Clarita Valley Sanitation Districts, and subsequent proposals to reduce the scope of the original AWRM project did not advance. A new proposal to address chloride issues in the upper Santa Clara River is expected in 2014.

- There is an upward trend in chloride concentrations in the effluent from the Saugus and Valencia WRPs 2012 and 2013. The upward trend in the WRPs' chloride concentrations is likely related in part to increases in chloride in imported State Water Project supplies over the same period.

- The semi-annual monitoring reports for Toland Landfill for 2012 and 2013 stated that the landfill was in compliance with waste discharge requirements.

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16 FIGURES

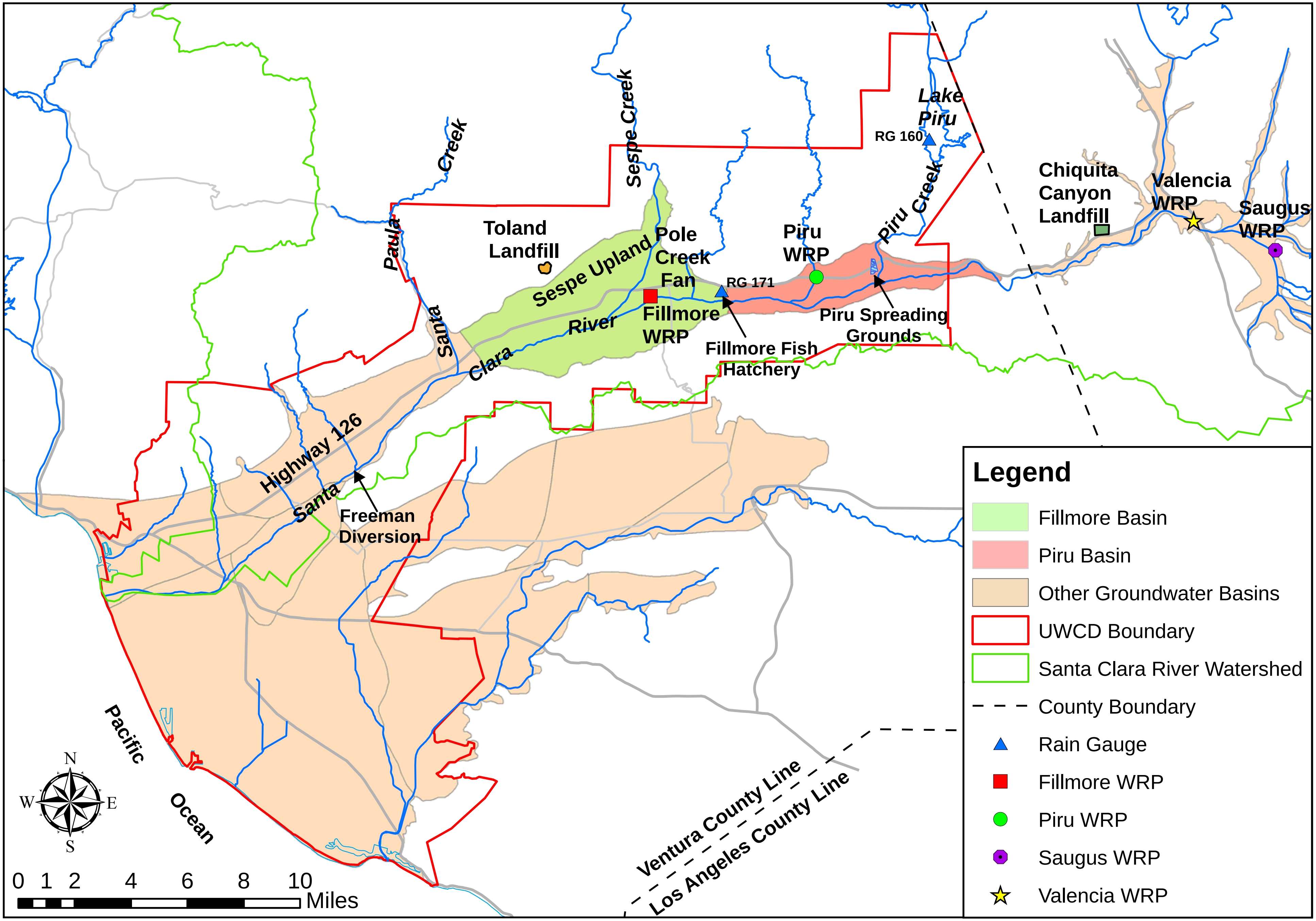

Figure 1. Regional location map.

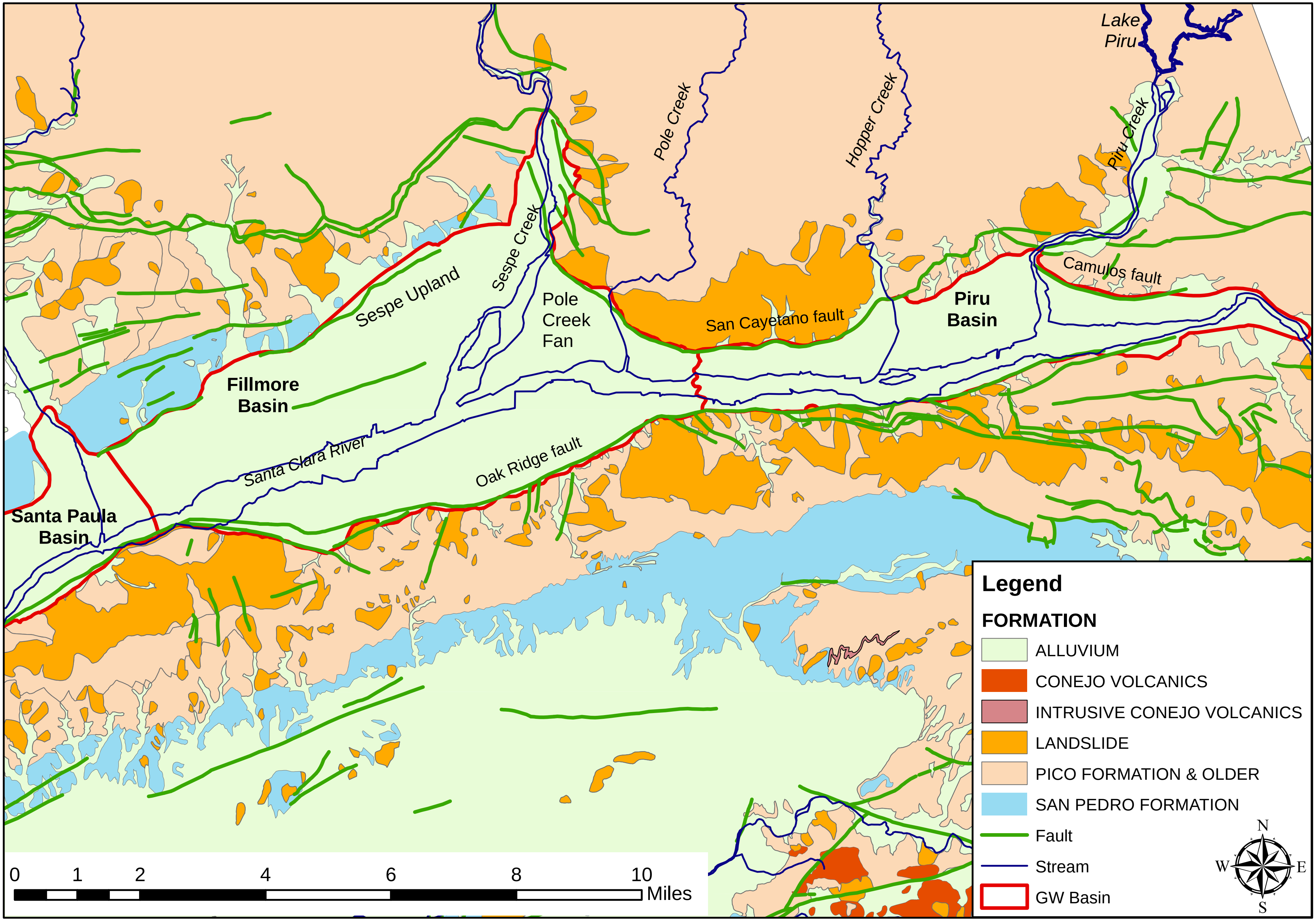

Figure 2. Surface geology map.

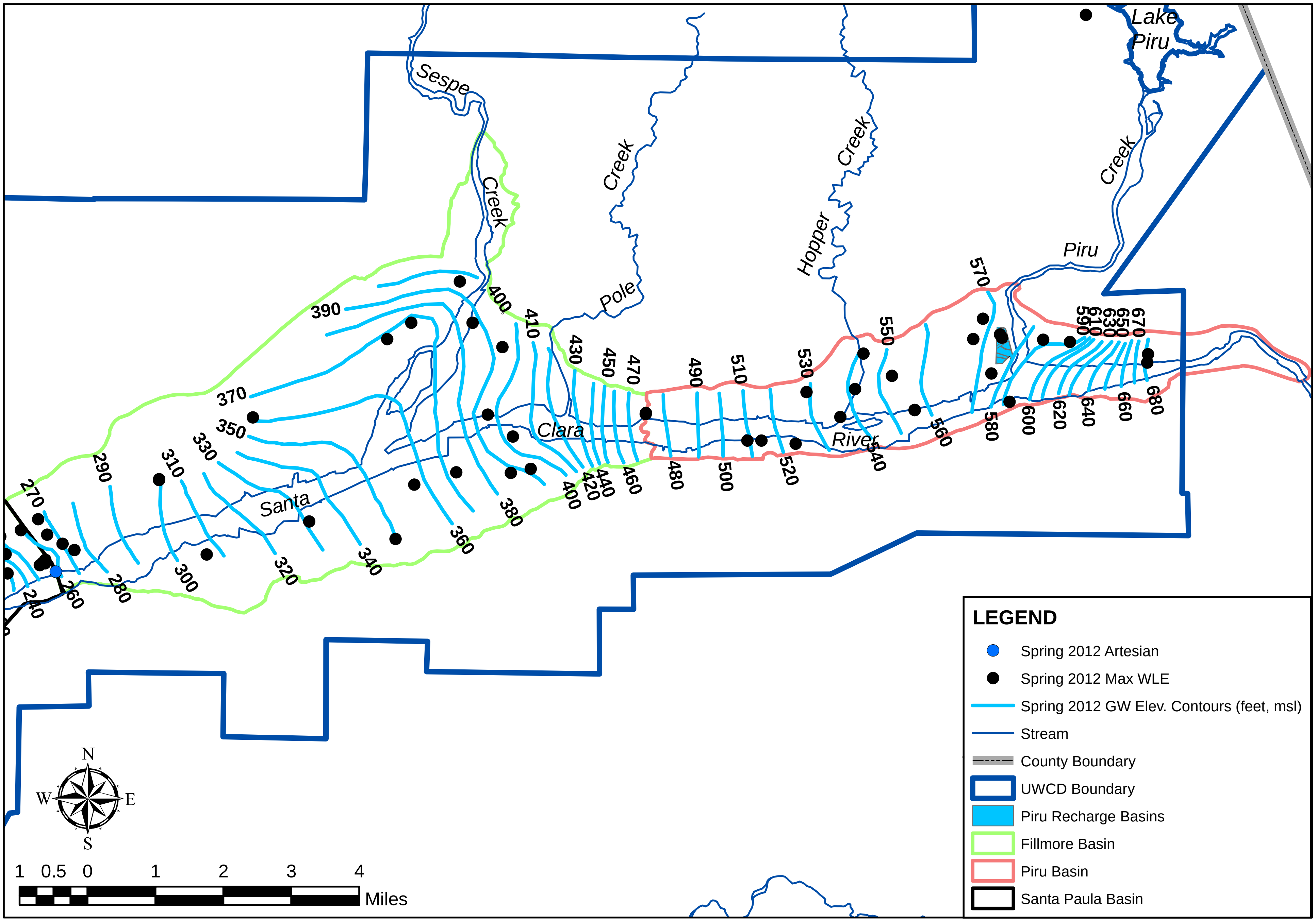

Figure 3. Spring 2012 groundwater elevation contours.

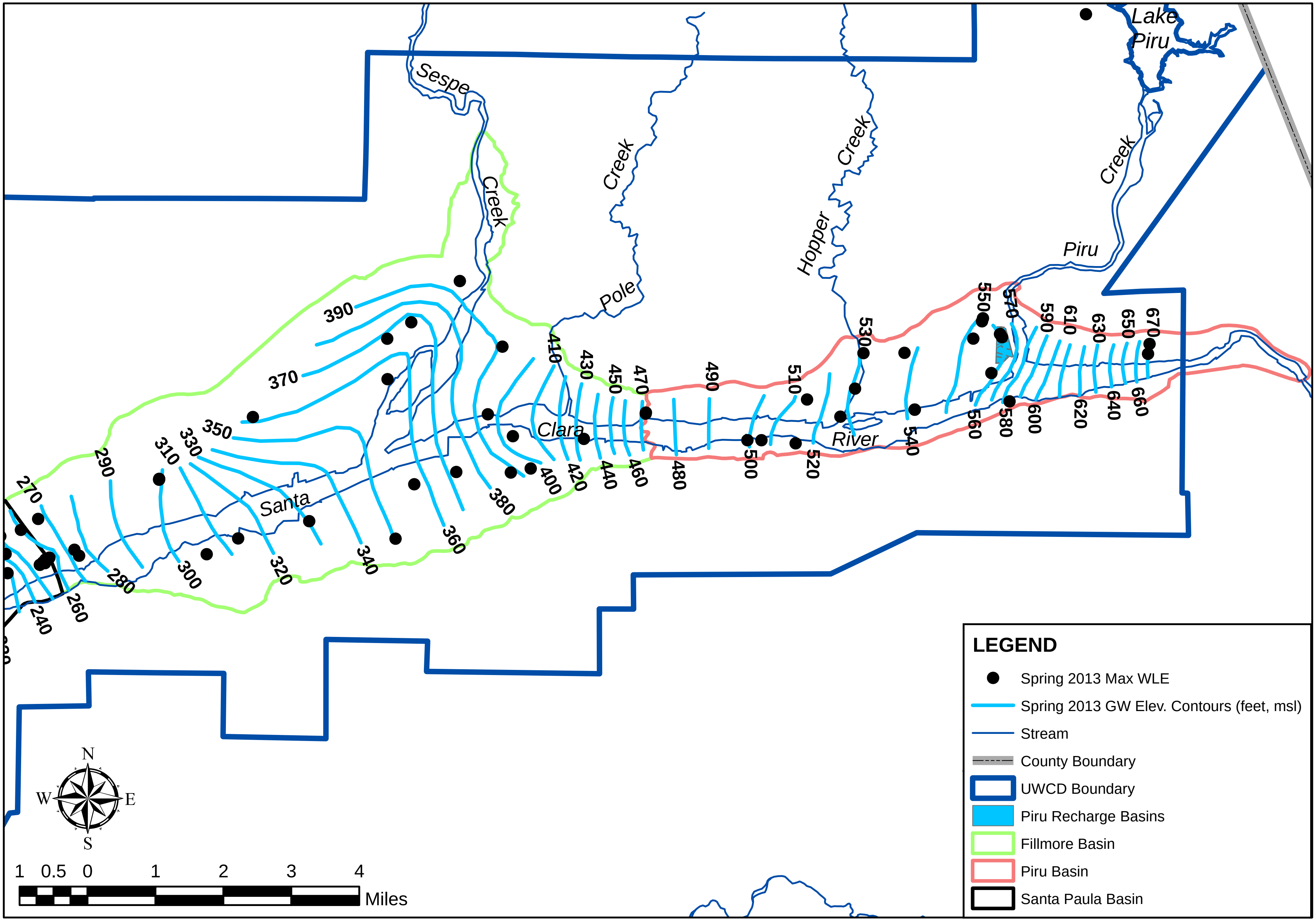

Figure 4. Spring 2013 groundwater elevation contours.

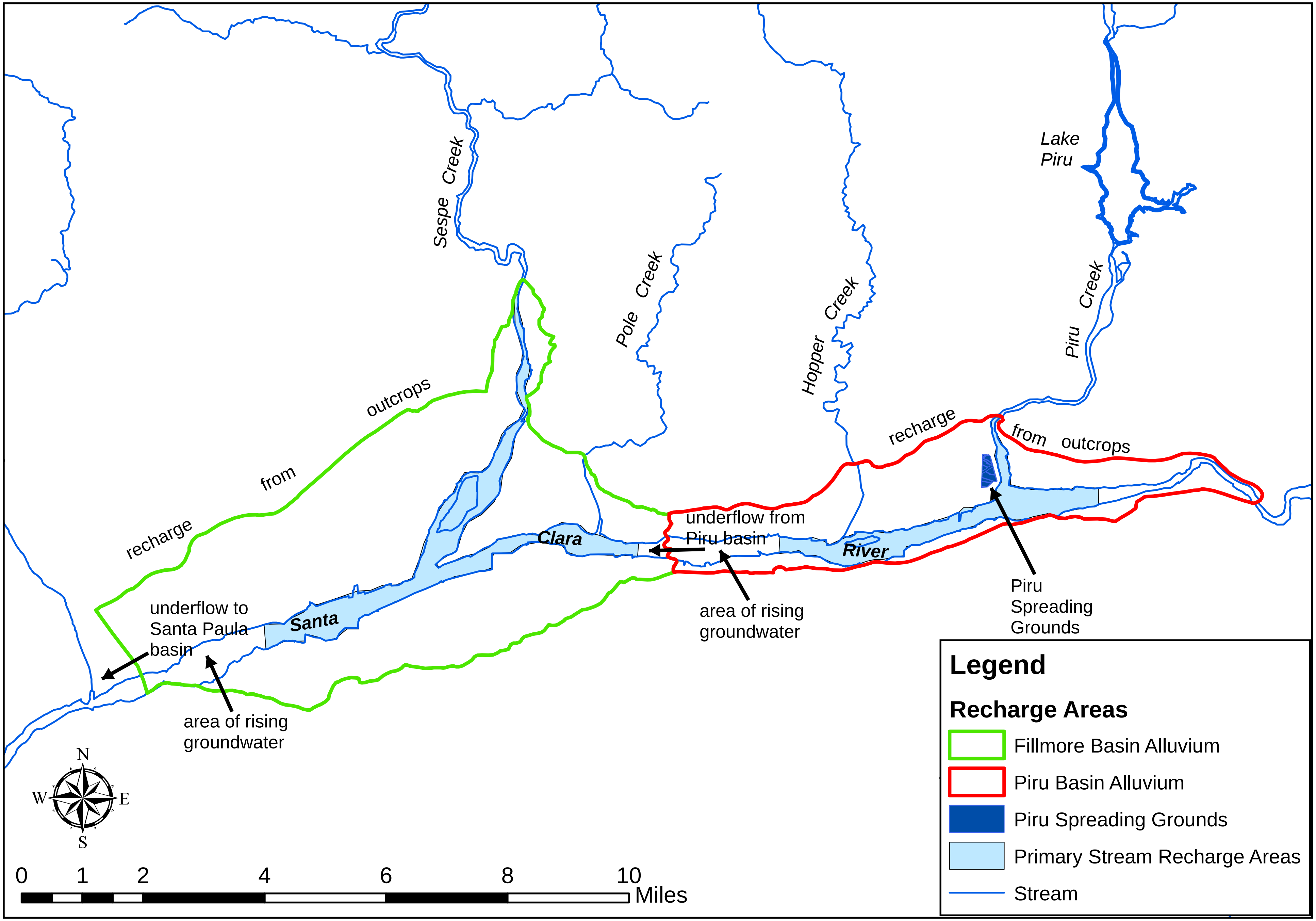

Figure 5. Groundwater recharge areas.

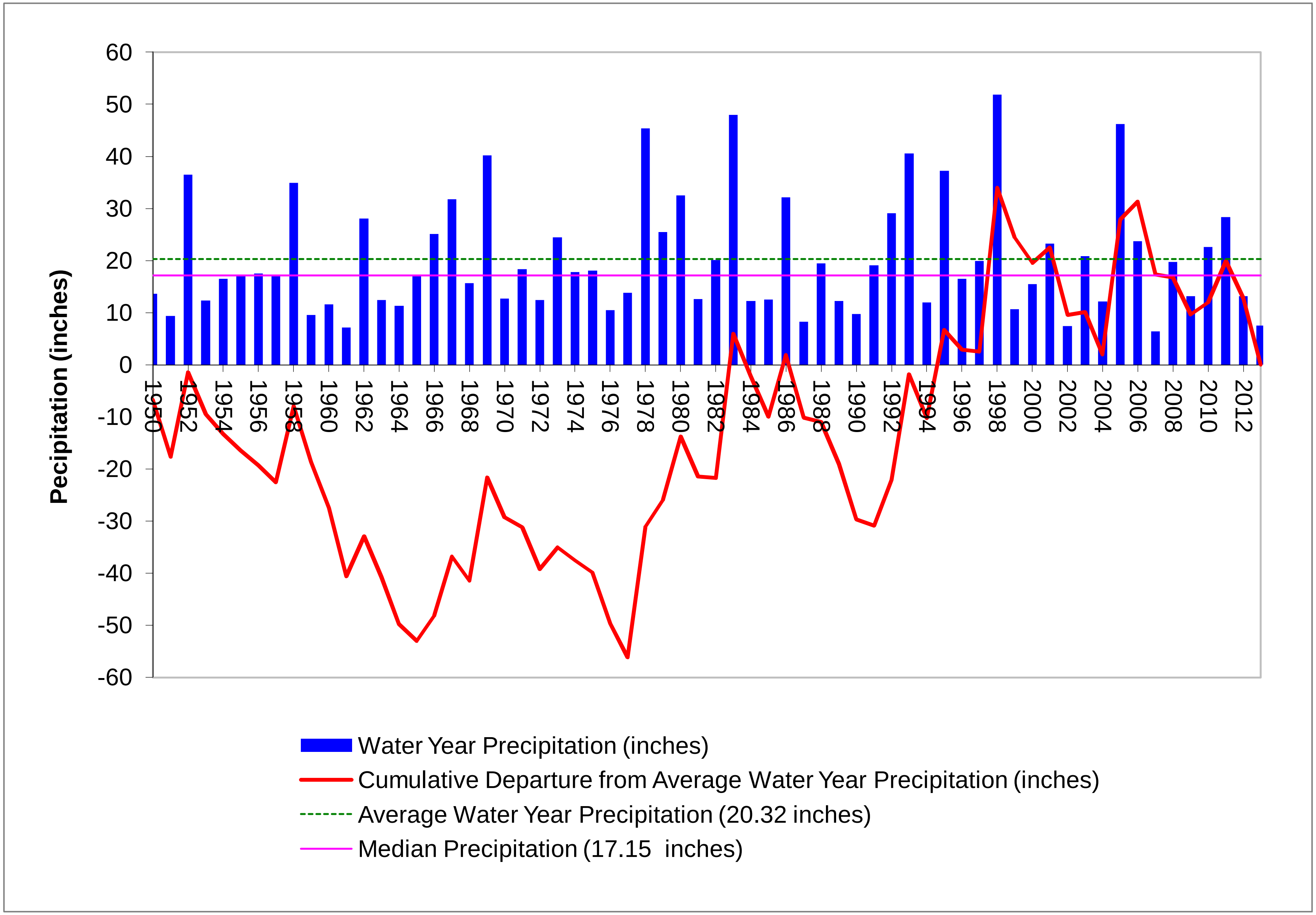

Figure 6. Piru basin historical annual precipitation (Piru-Temescal gauge; Data from Ventura County Watershed Protection District).

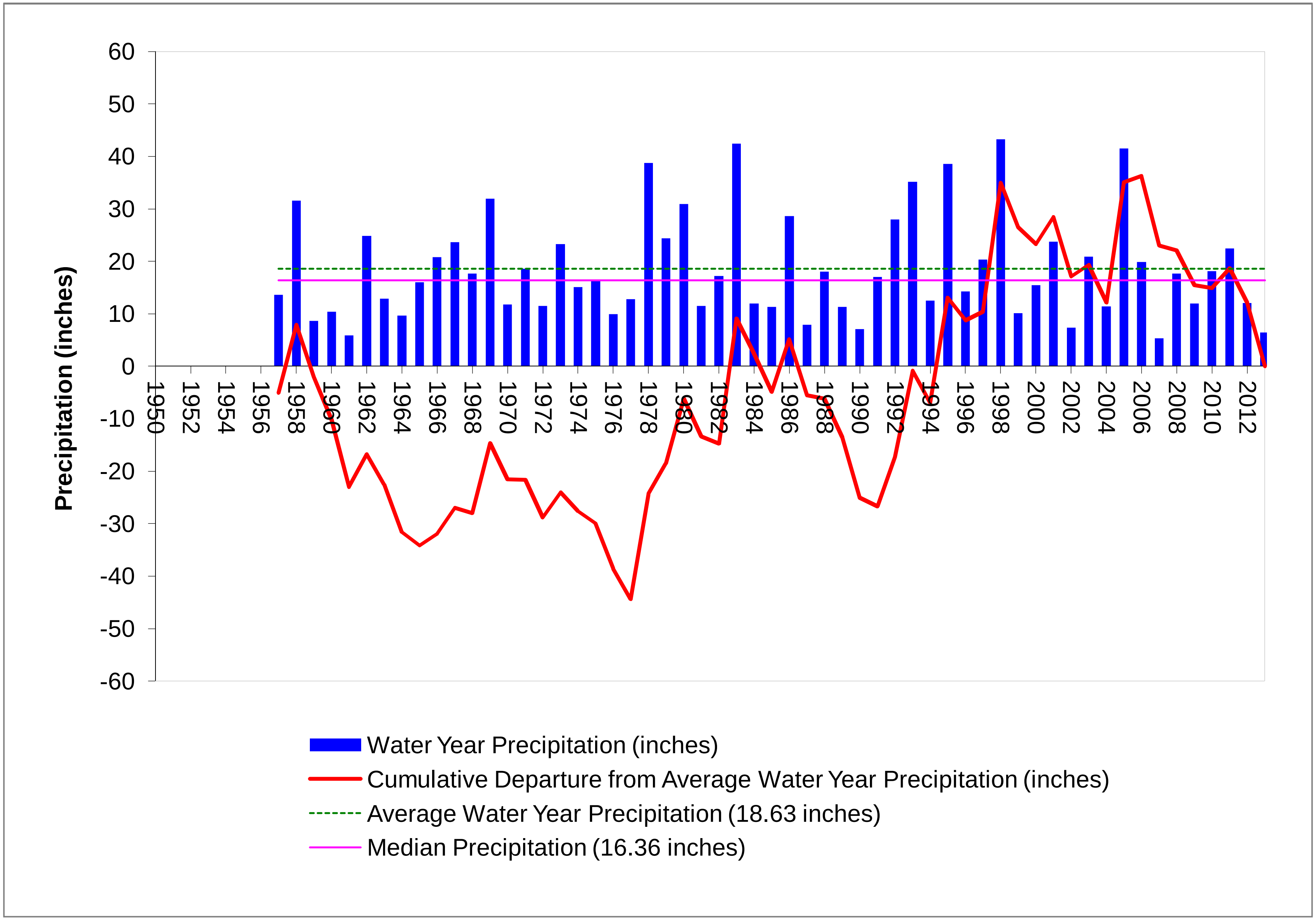

Figure 7. Fillmore basin historical annual precipitation (Fillmore Fish Hatchery Gauge; Data from Ventura County Watershed Protection District).

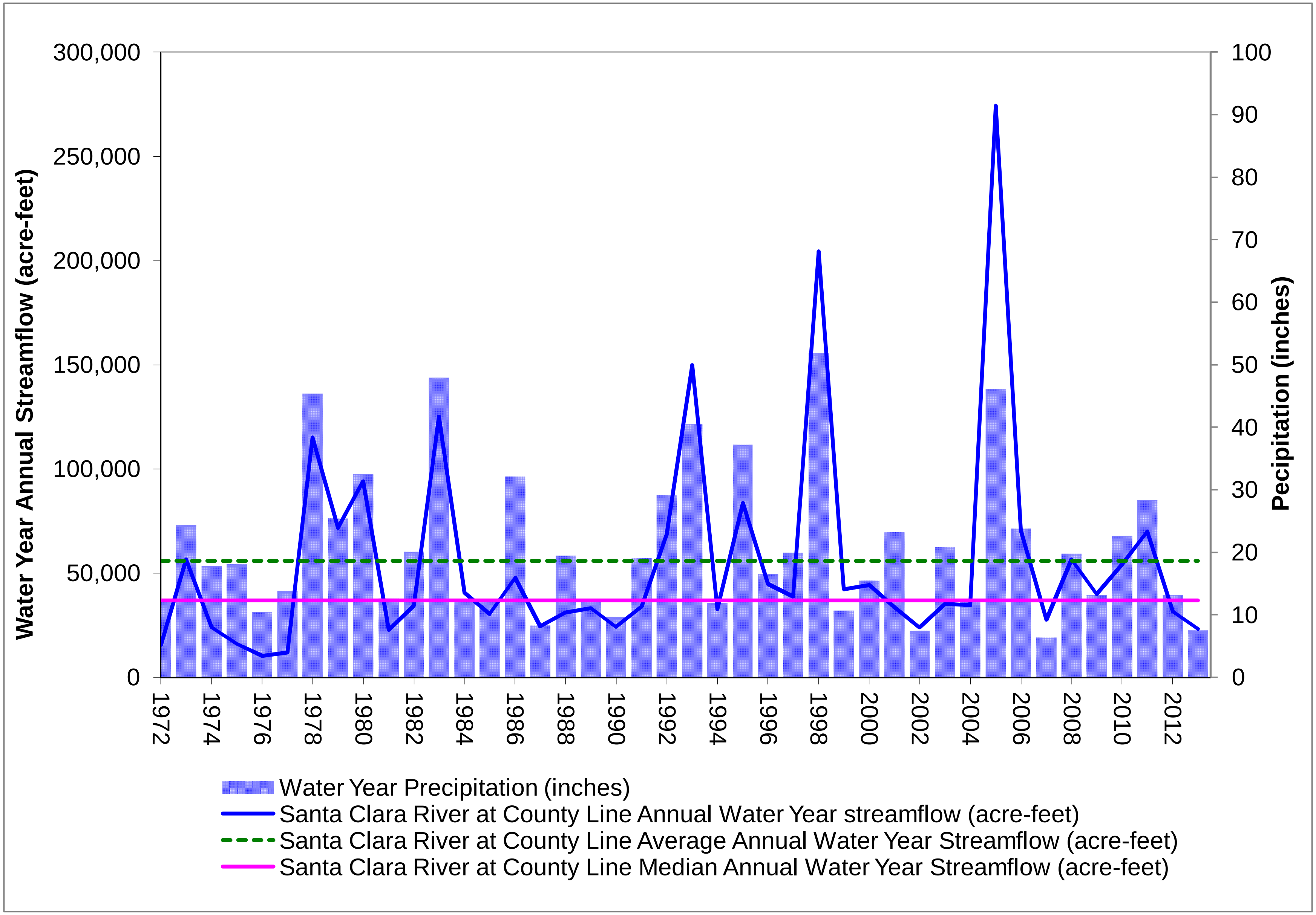

Figure 8. Santa Clara River historical annual streamflow near Ventura/L.A County Line and Piru basin precipitation (streamflow data from USGS).

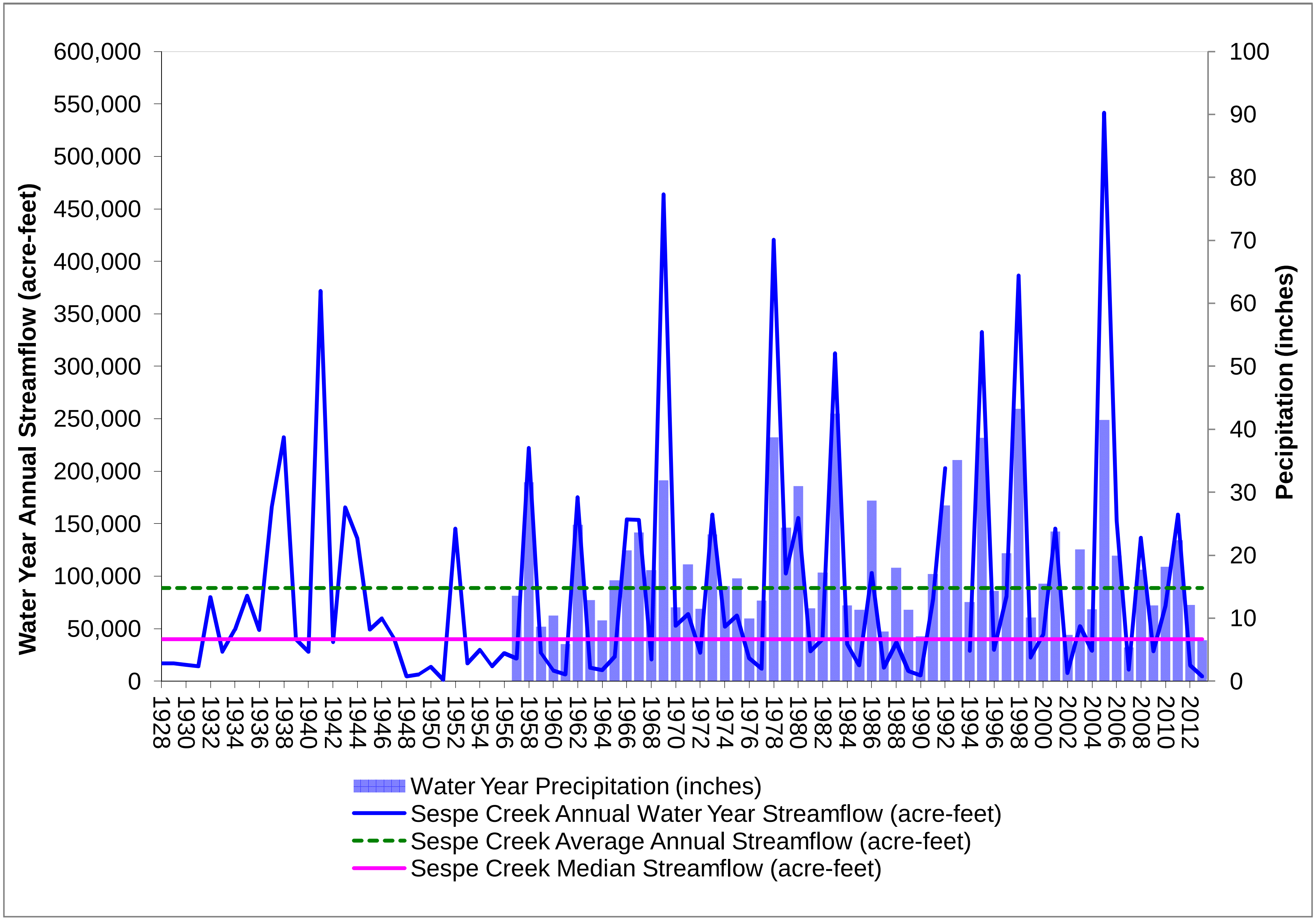

Figure 9. Sespe Creek historical annual streamflow and Fillmore basin precipitation (streamflow data from USGS and VCWPD).

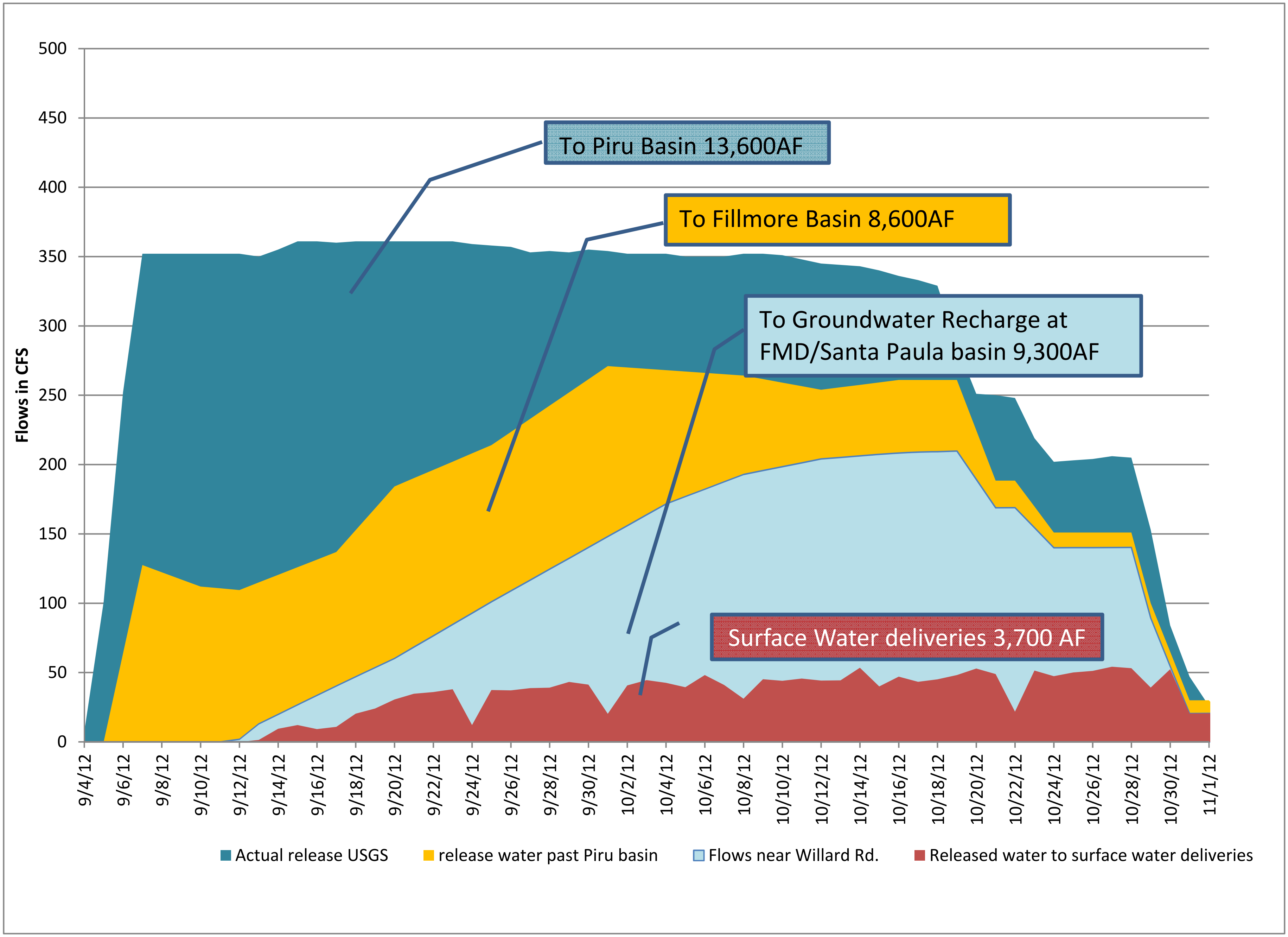

Figure 10. Benefits of the direct percolation of the 2012 Lake Piru conservation release (35,200 AF).

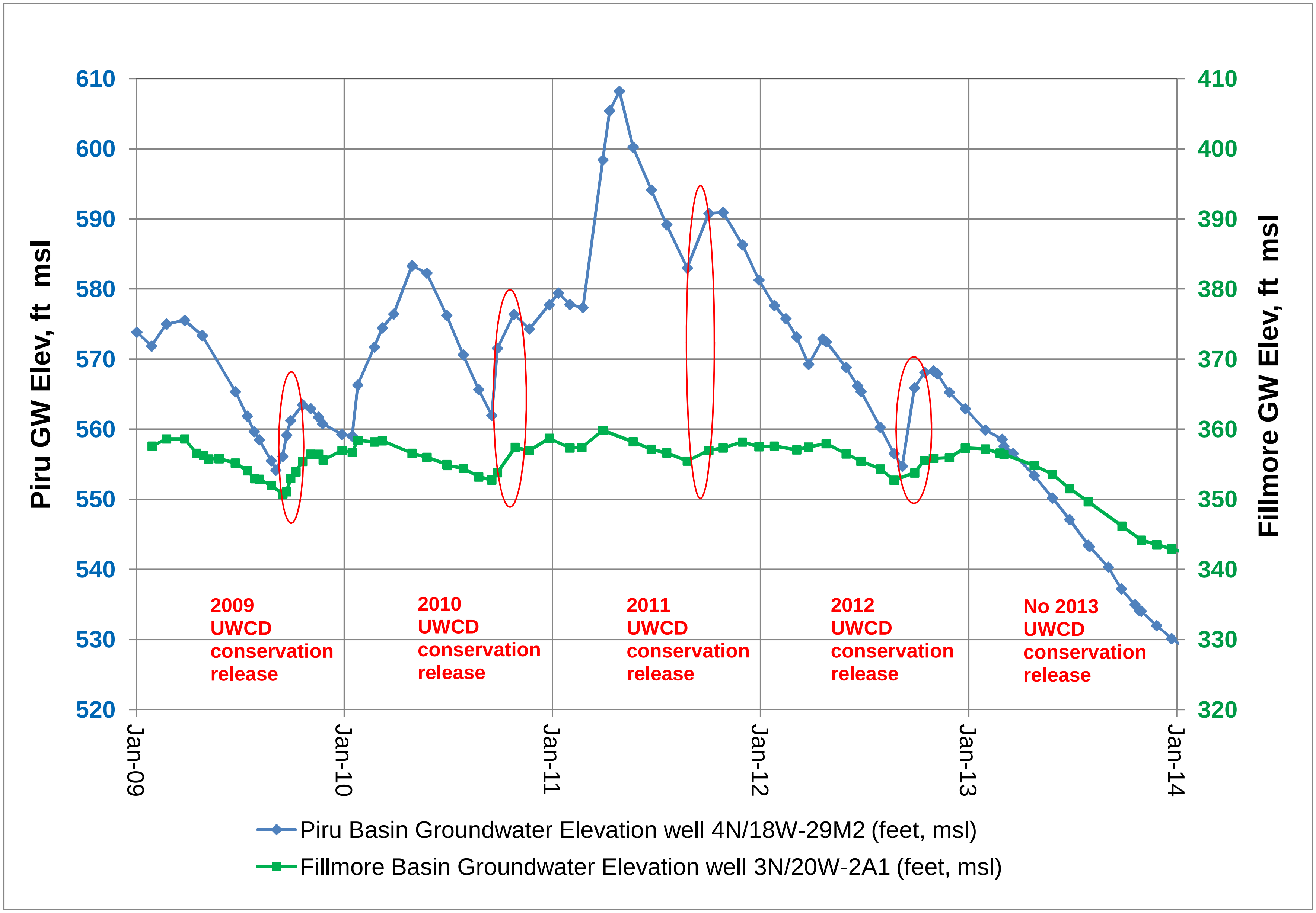

Figure 11. Piru basin and Fillmore basin groundwater levels response to United Water conservation releases.

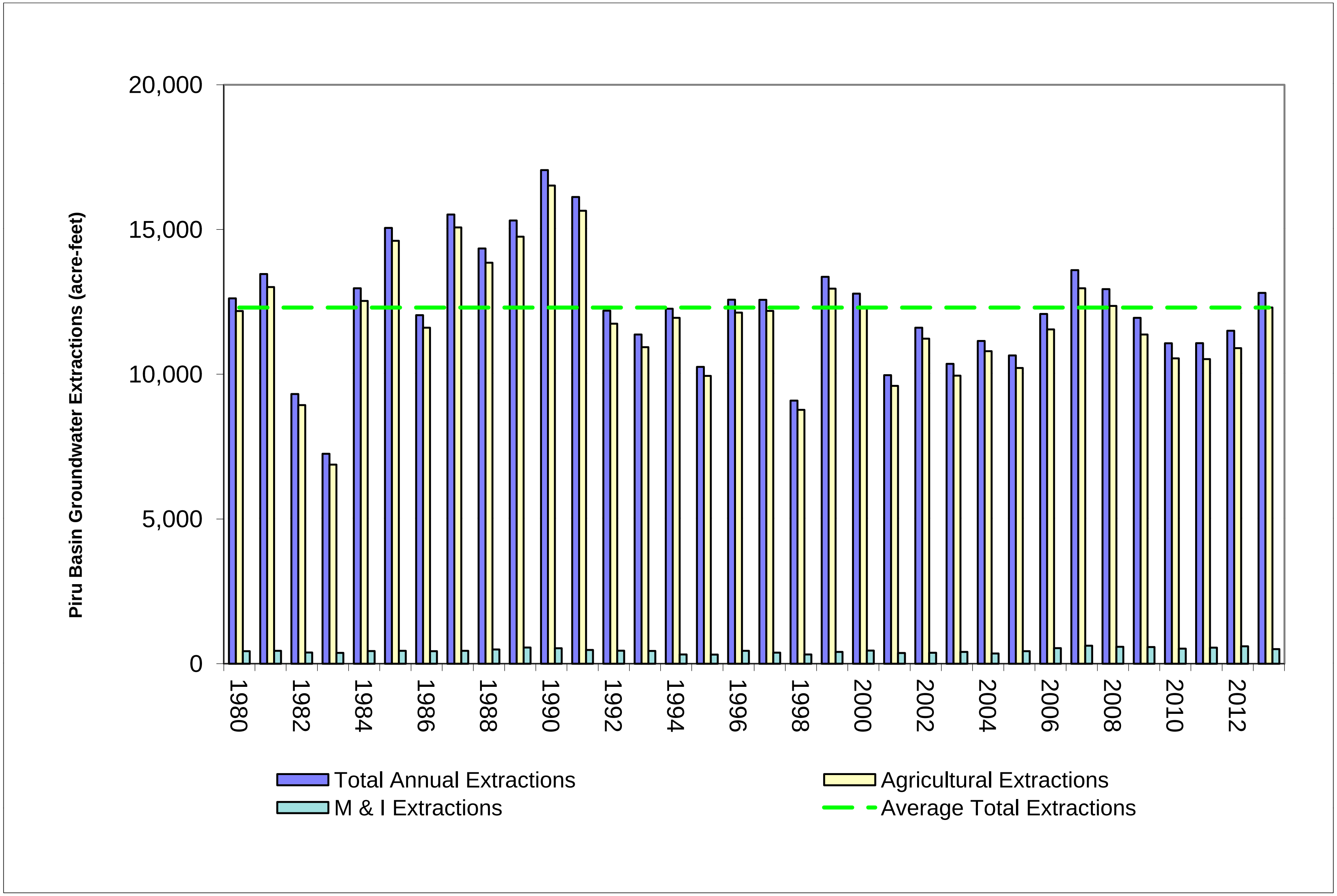

Figure 12. Historical annual groundwater extractions for the Piru basin (reported to United Water).

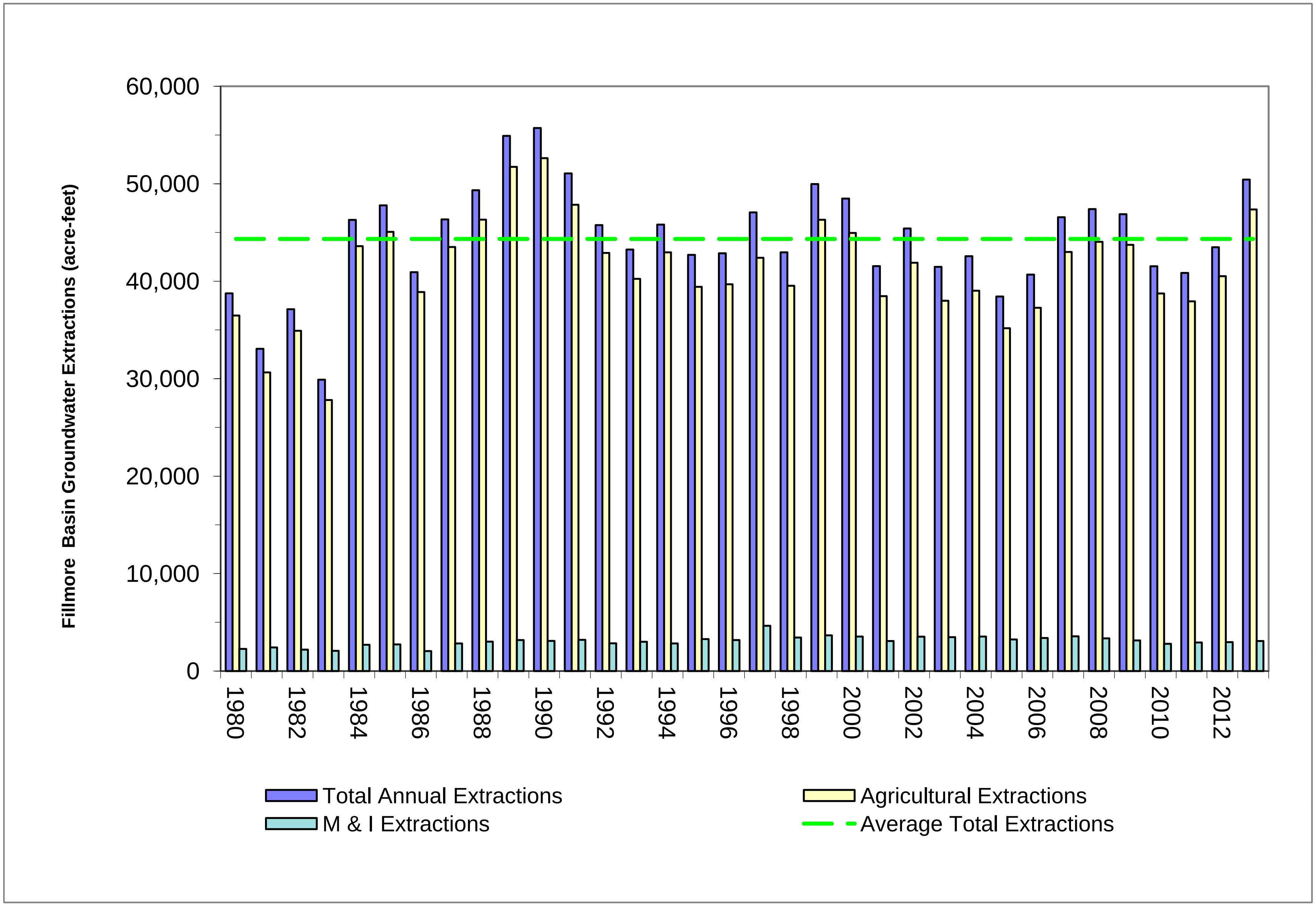

Figure 13. Historical annual groundwater extractions for the Fillmore basin (reported to United Water).

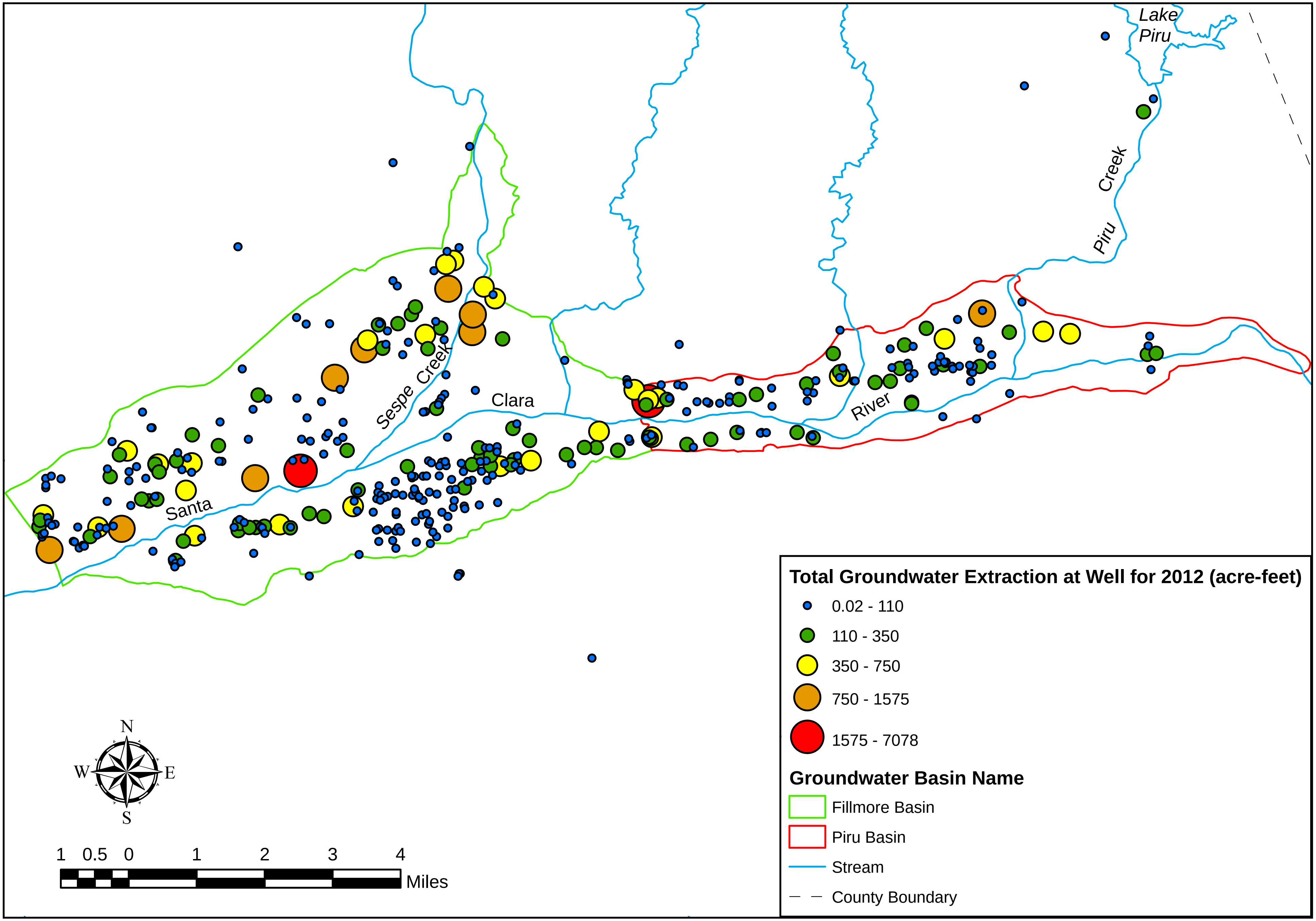

Figure 14. Groundwater extractions for 2012 by well.

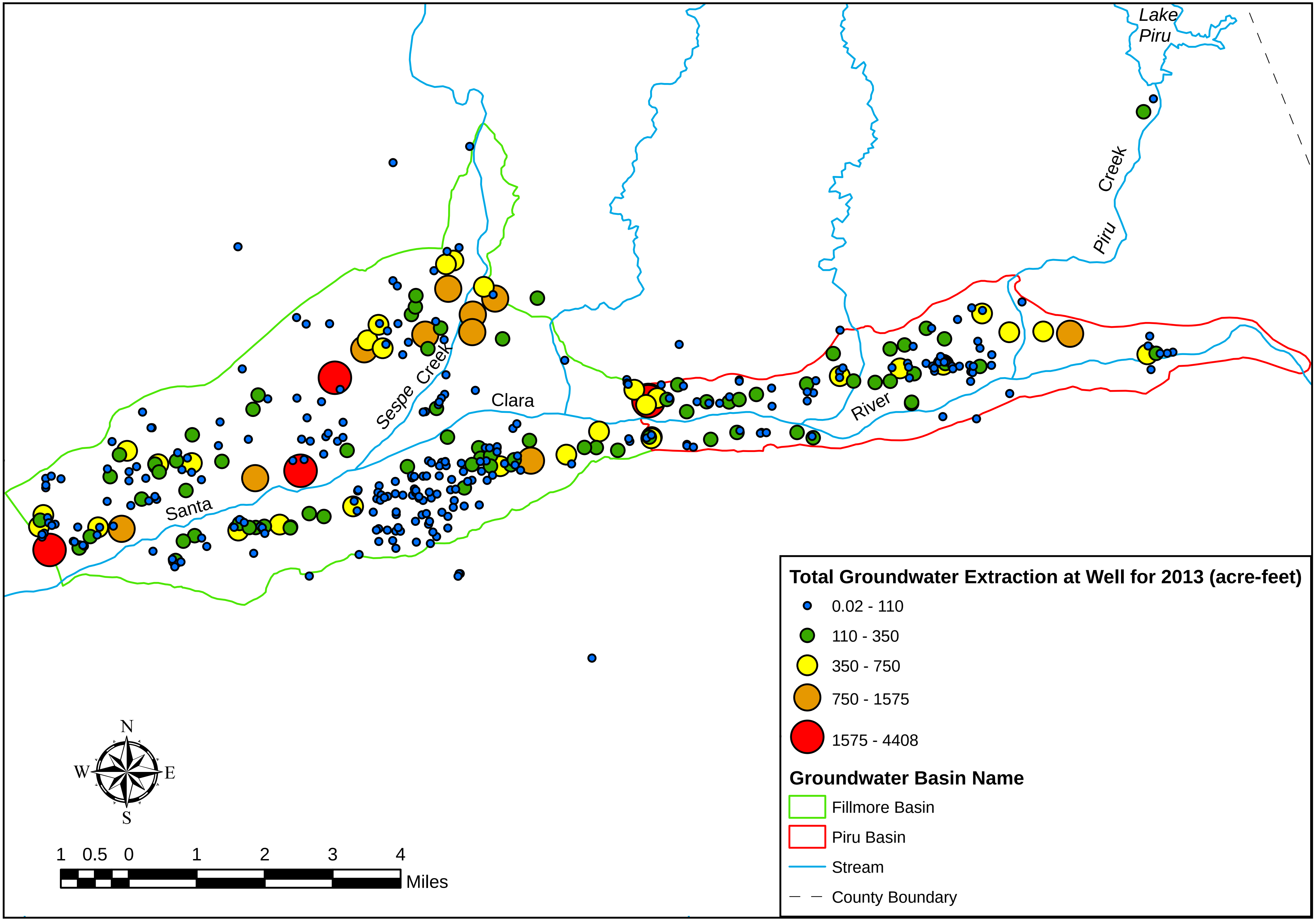

Figure 15. Groundwater extractions for 2013 by well.

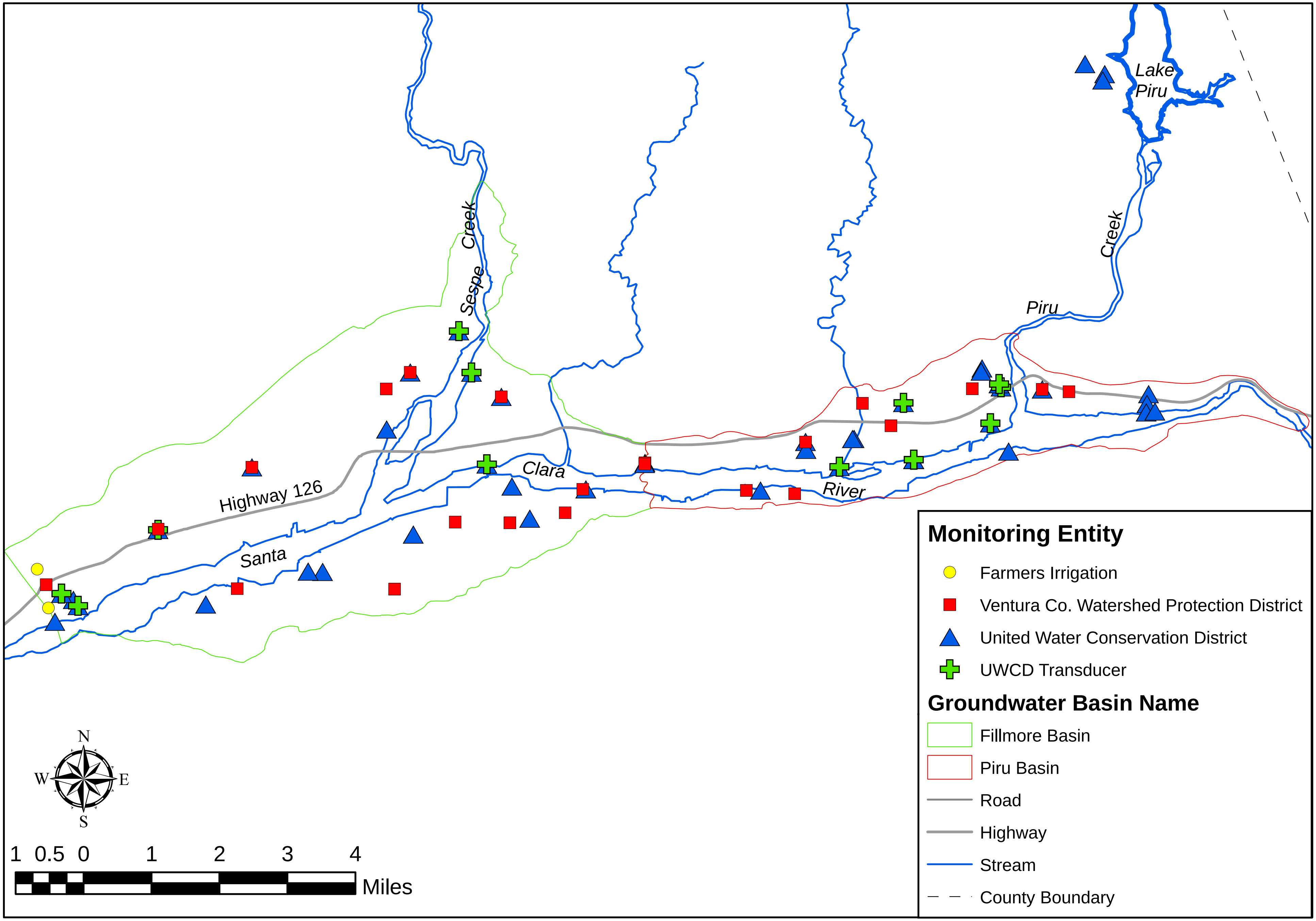

Figure 16. Locations of wells monitored for groundwater elevations in 2012 and/or 2013.

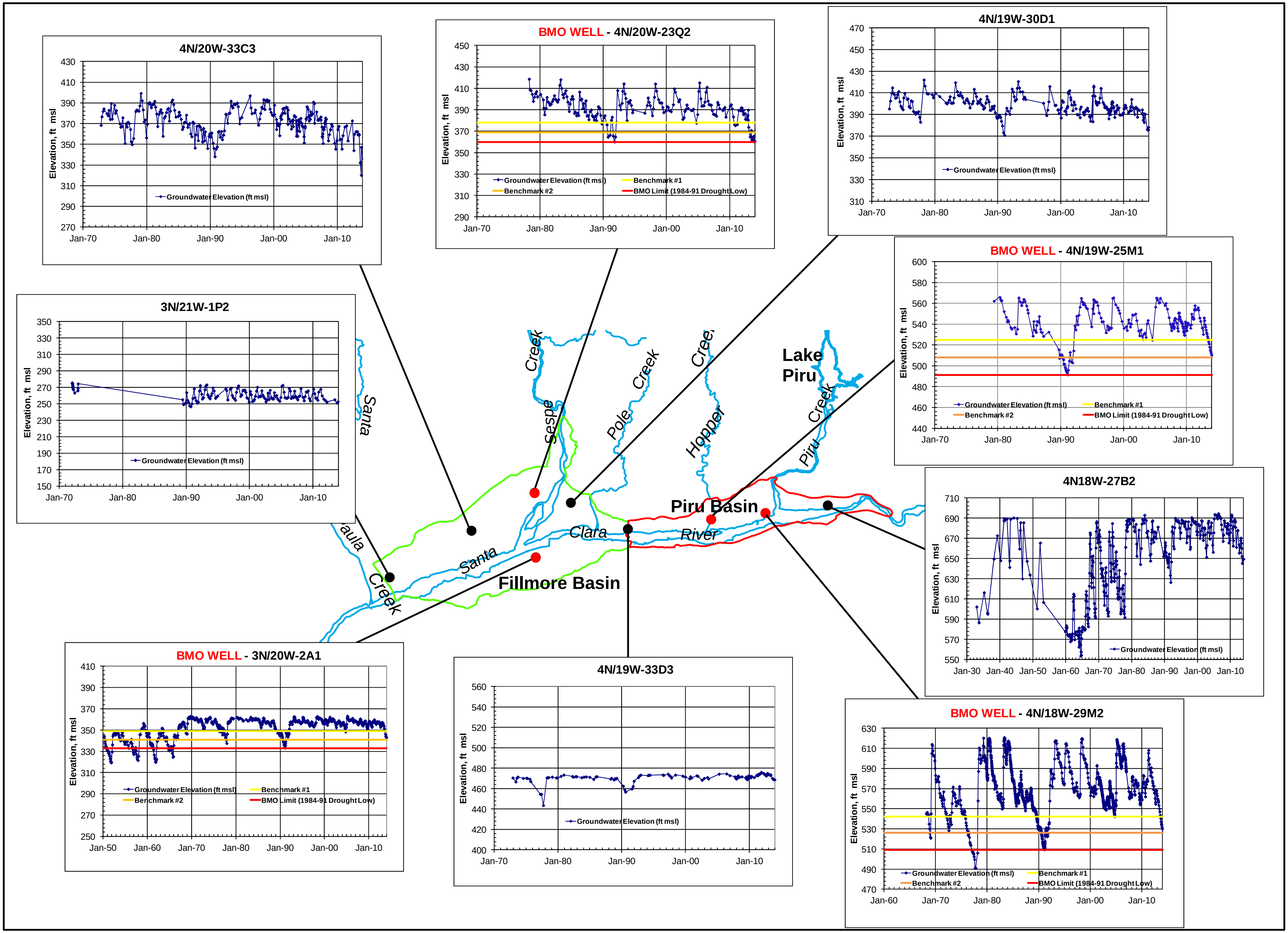

Figure 17. Groundwater elevation hydrographs.

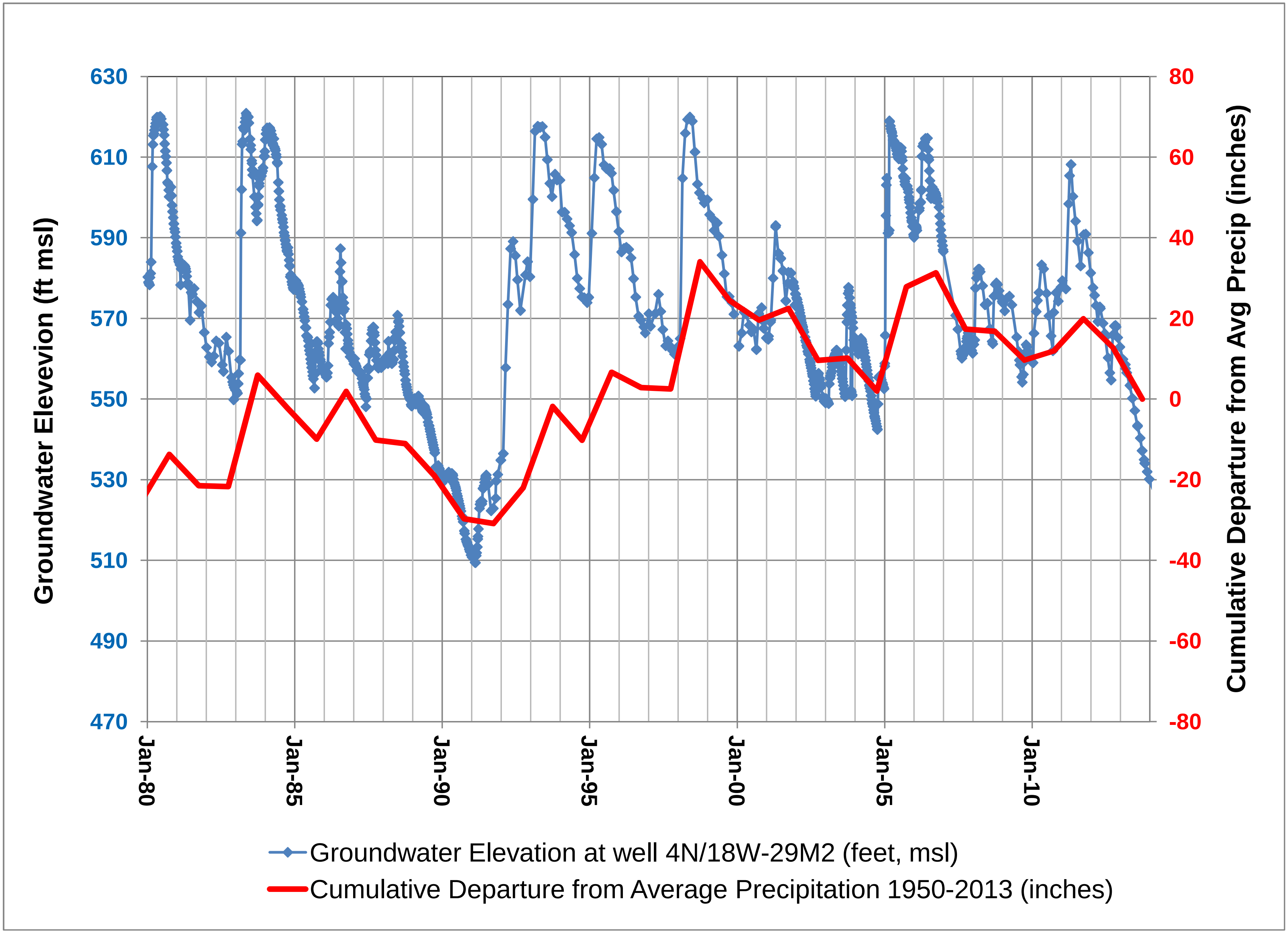

Figure 18. Groundwater elevations and cumulative departure from average precipitation for the Piru basin.

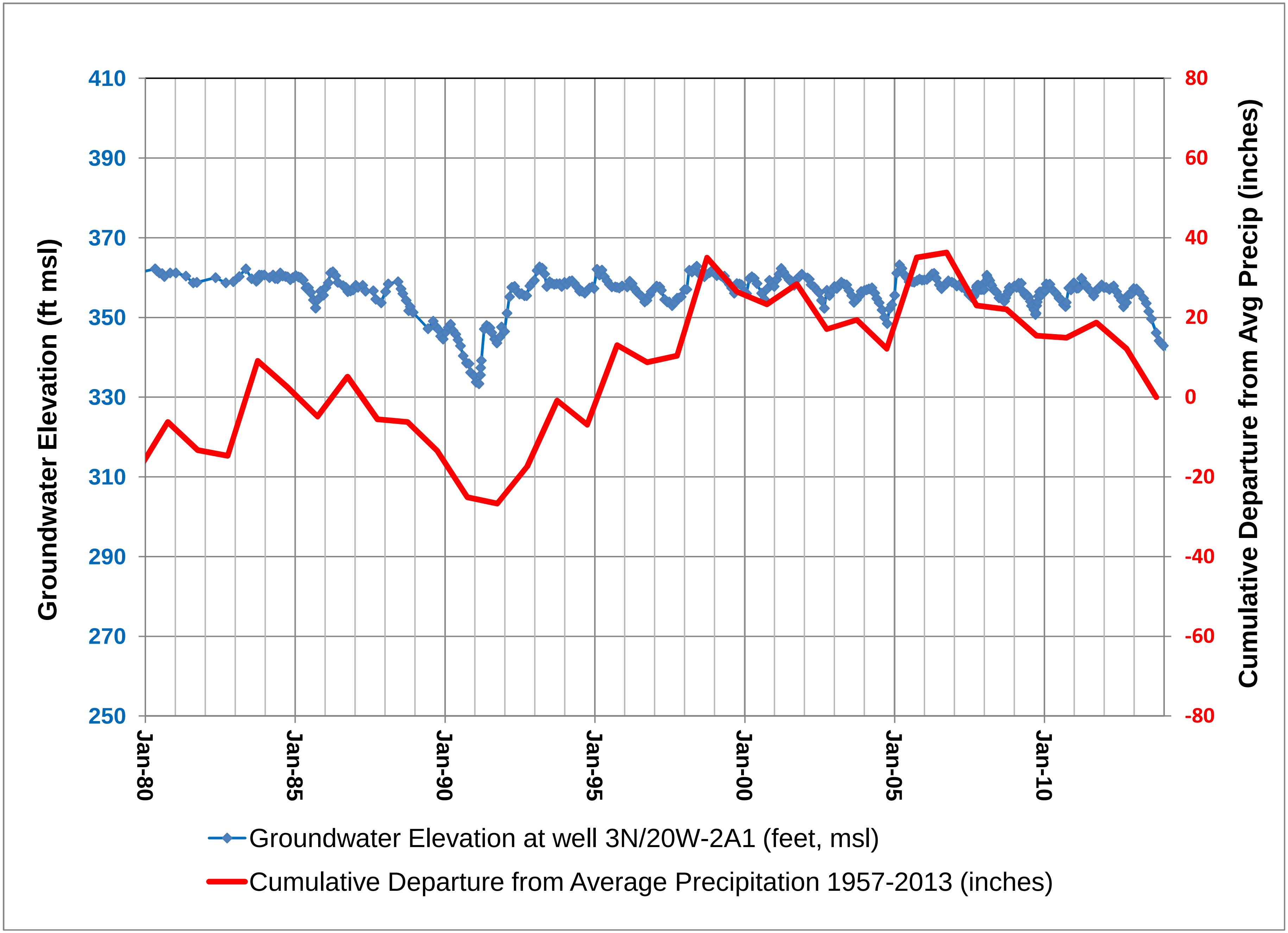

Figure 19. Groundwater elevations and cumulative departure from average precipitation for the Fillmore basin.

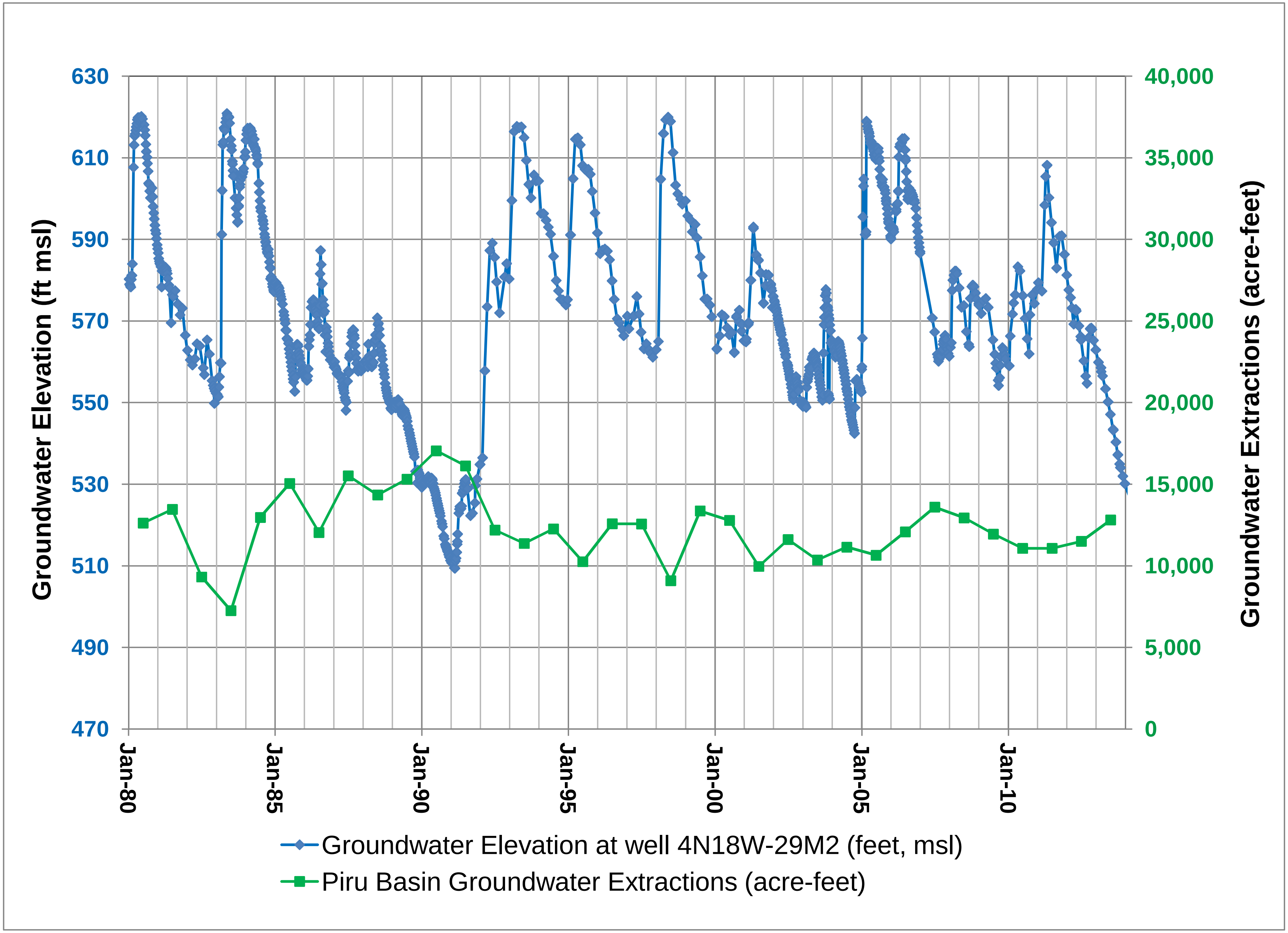

Figure 20. Historical annual groundwater elevations and extractions for the Piru basin.

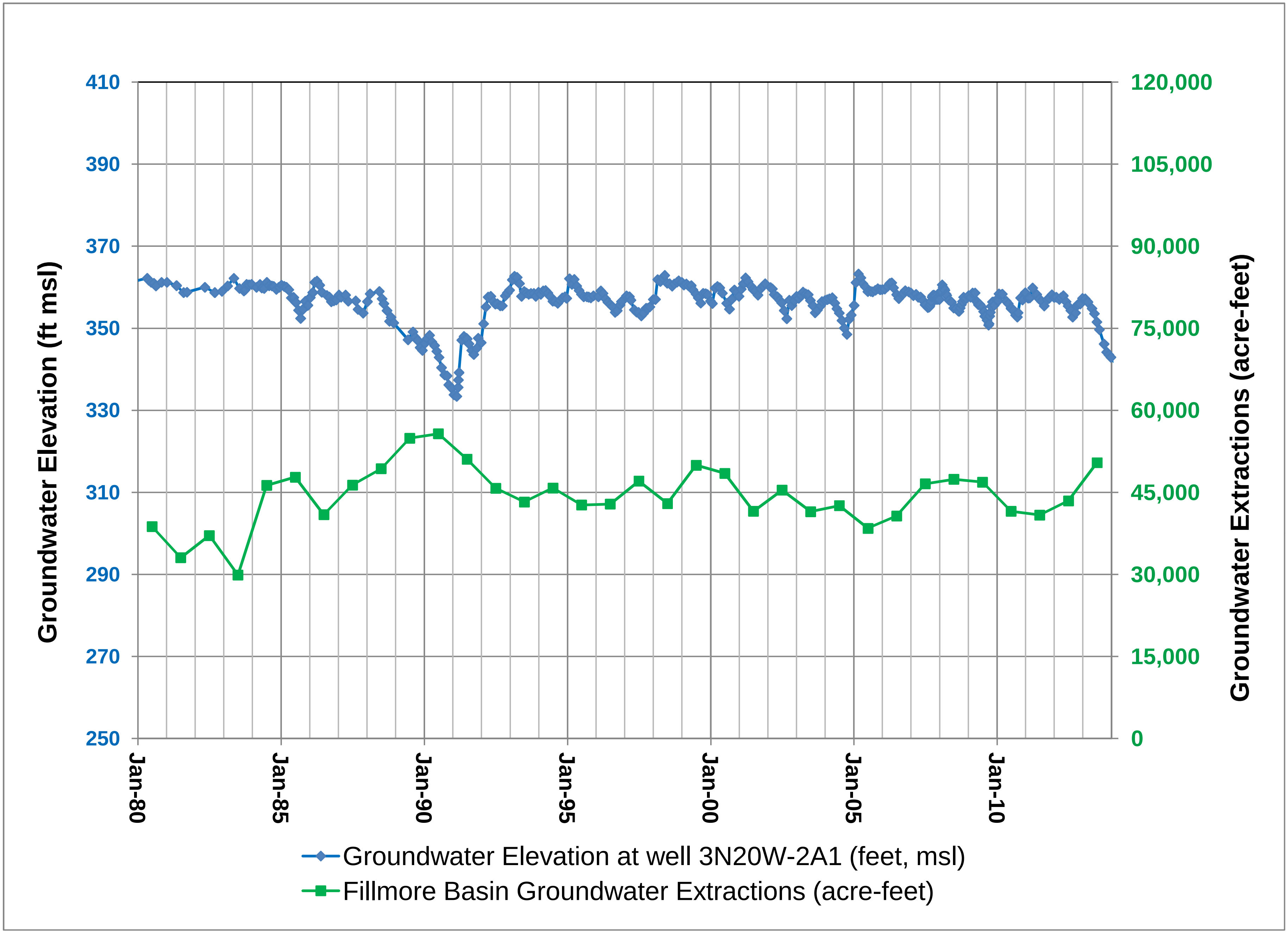

Figure 21. Historical annual groundwater elevations and extractions for the Fillmore basin.

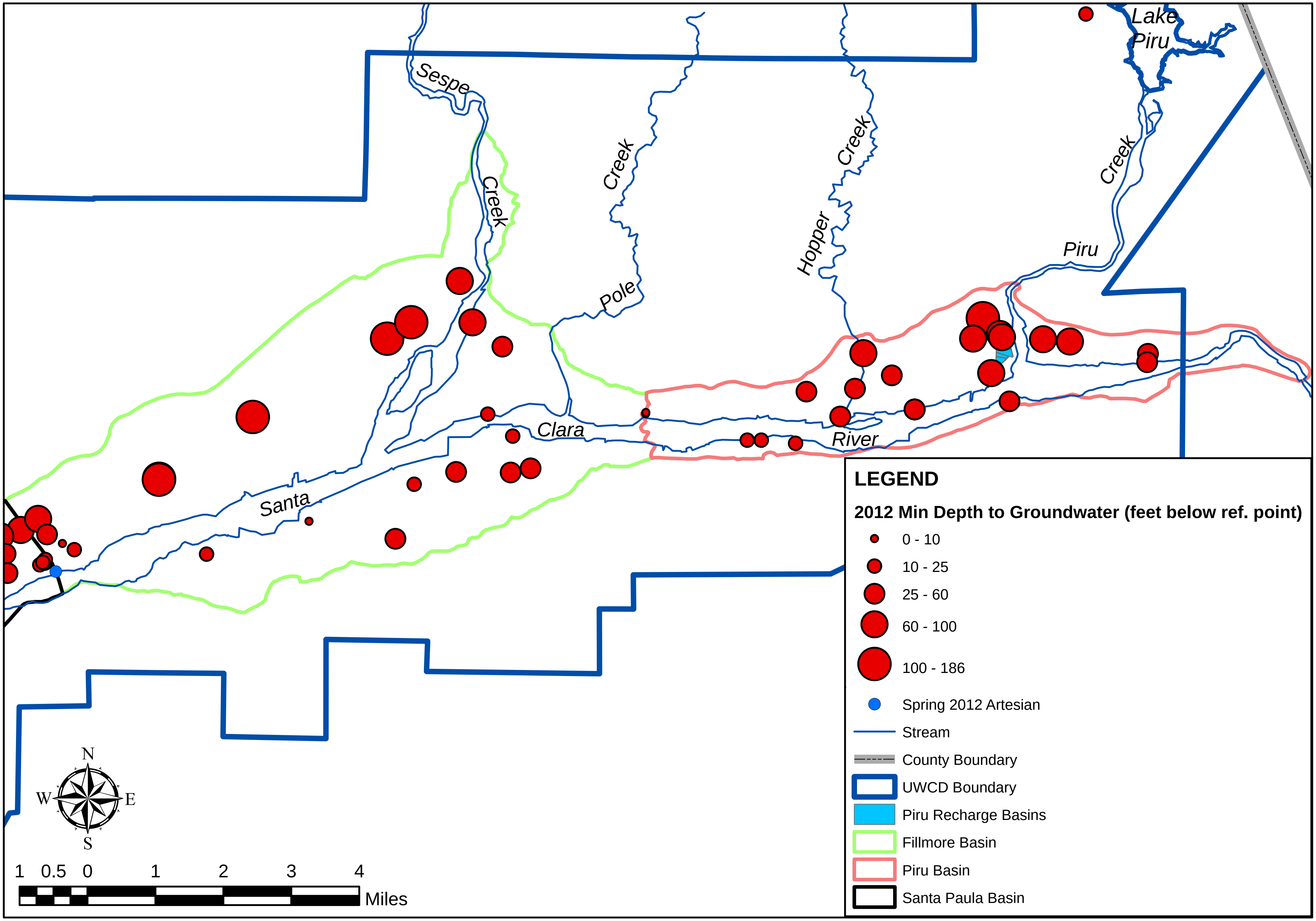

Figure 22. Spring 2012 depth to groundwater.

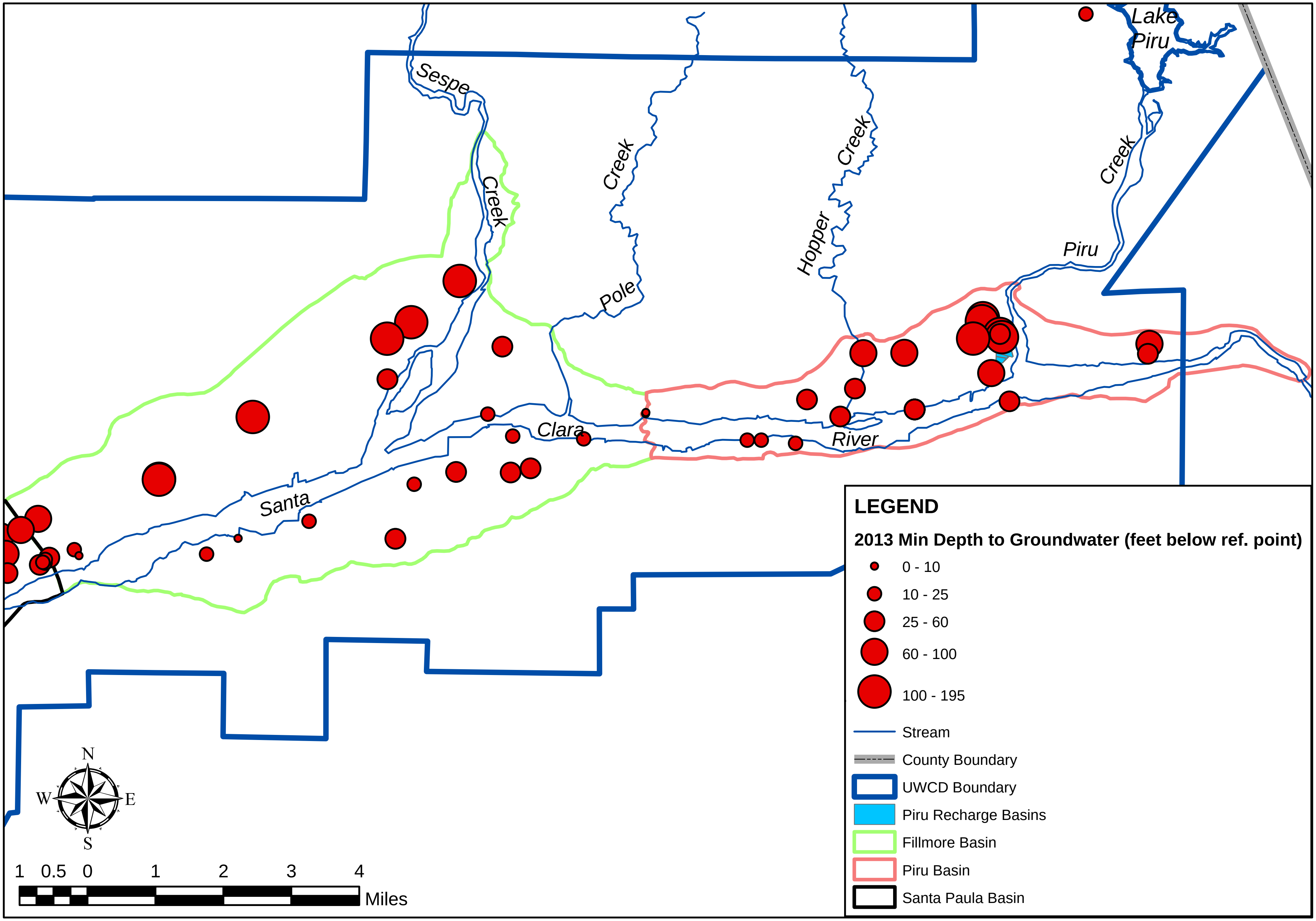

Figure 23. Spring 2013 depth to groundwater.

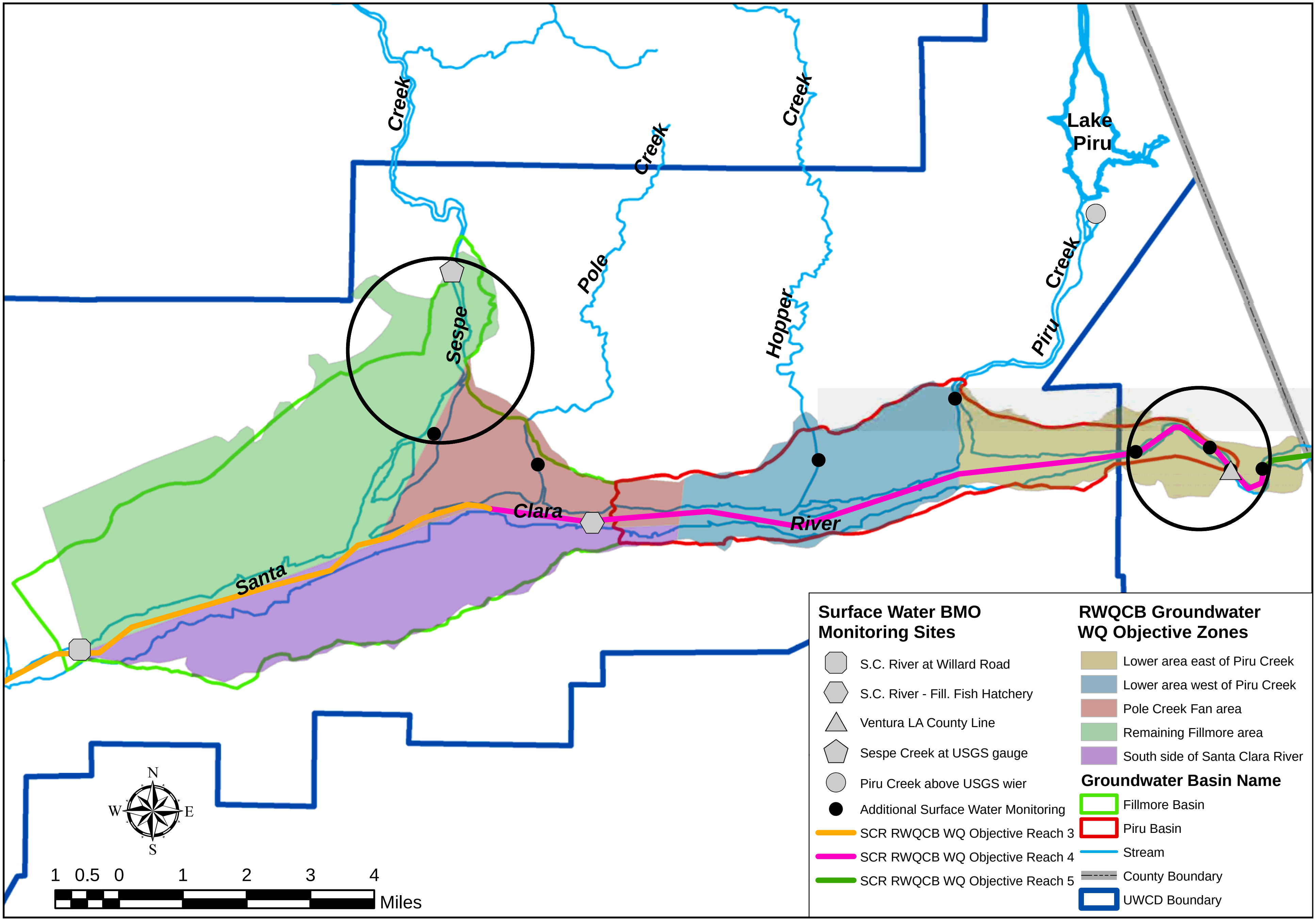

Figure 24. Surface water quality monitoring locations (black circles denote alternate sample sites) Regional Water Quality Control Board Santa Clara River reaches; and Regional Water Quality Control Board groundwater quality objective zones map.

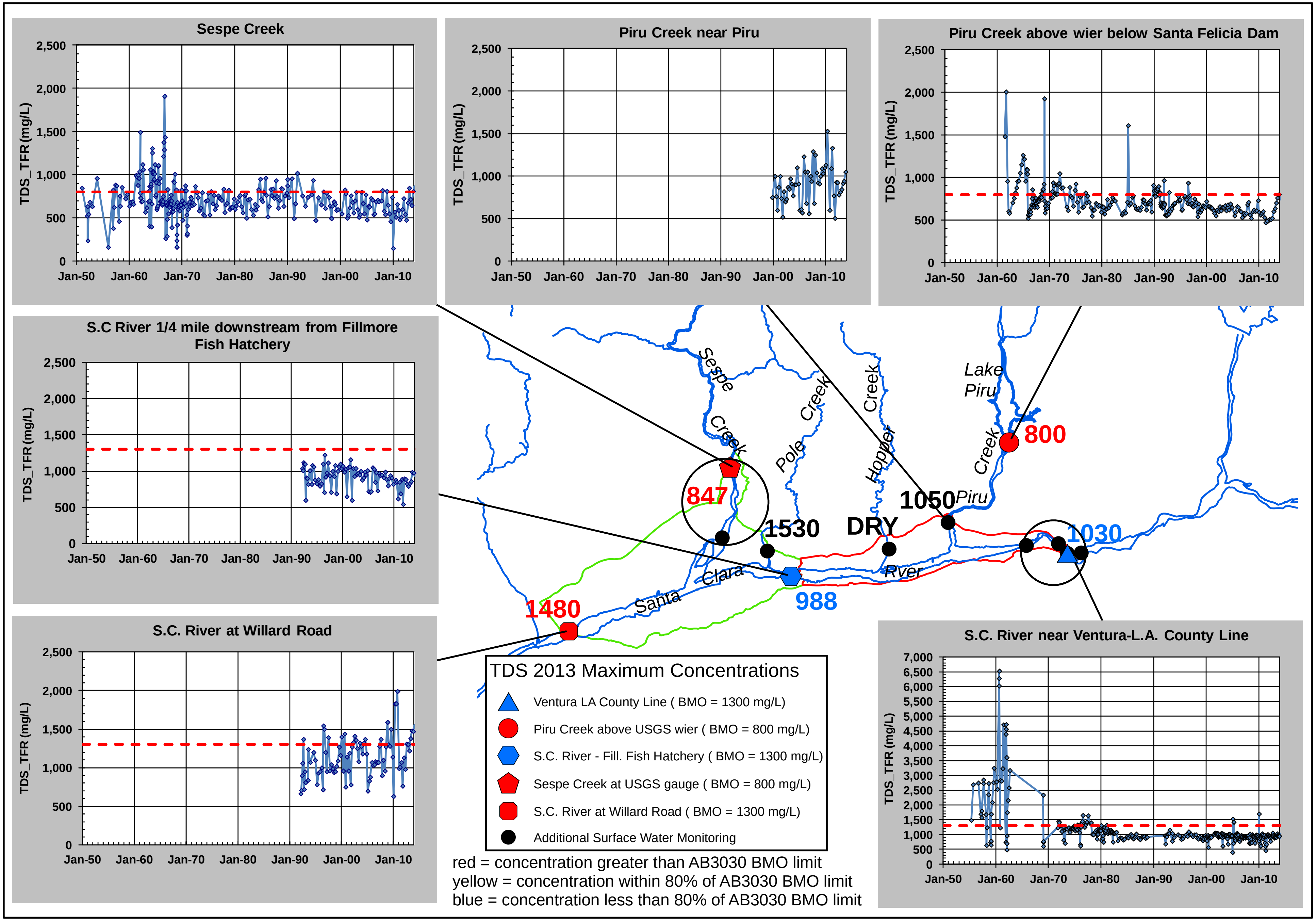

Figure 25. TDS surface water quality time series graphs with map of 2013 maximum concentrations (mg/L); dashed red line is AB 3030 BMO.

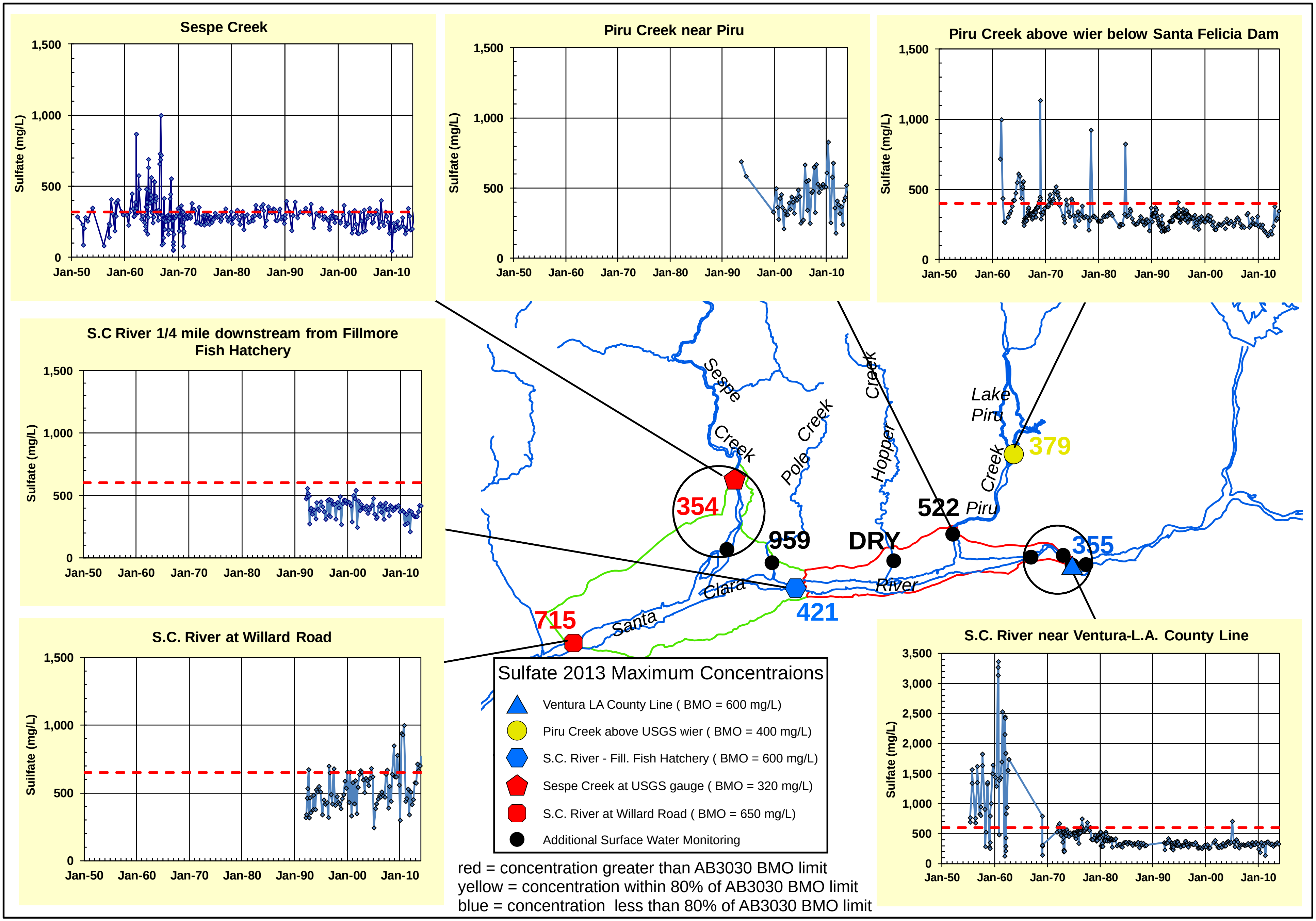

Figure 26. Sulfate surface water quality time series graphs with 2013 maximum concentrations (mg/L); dashed red line is AB 3030 BMO.

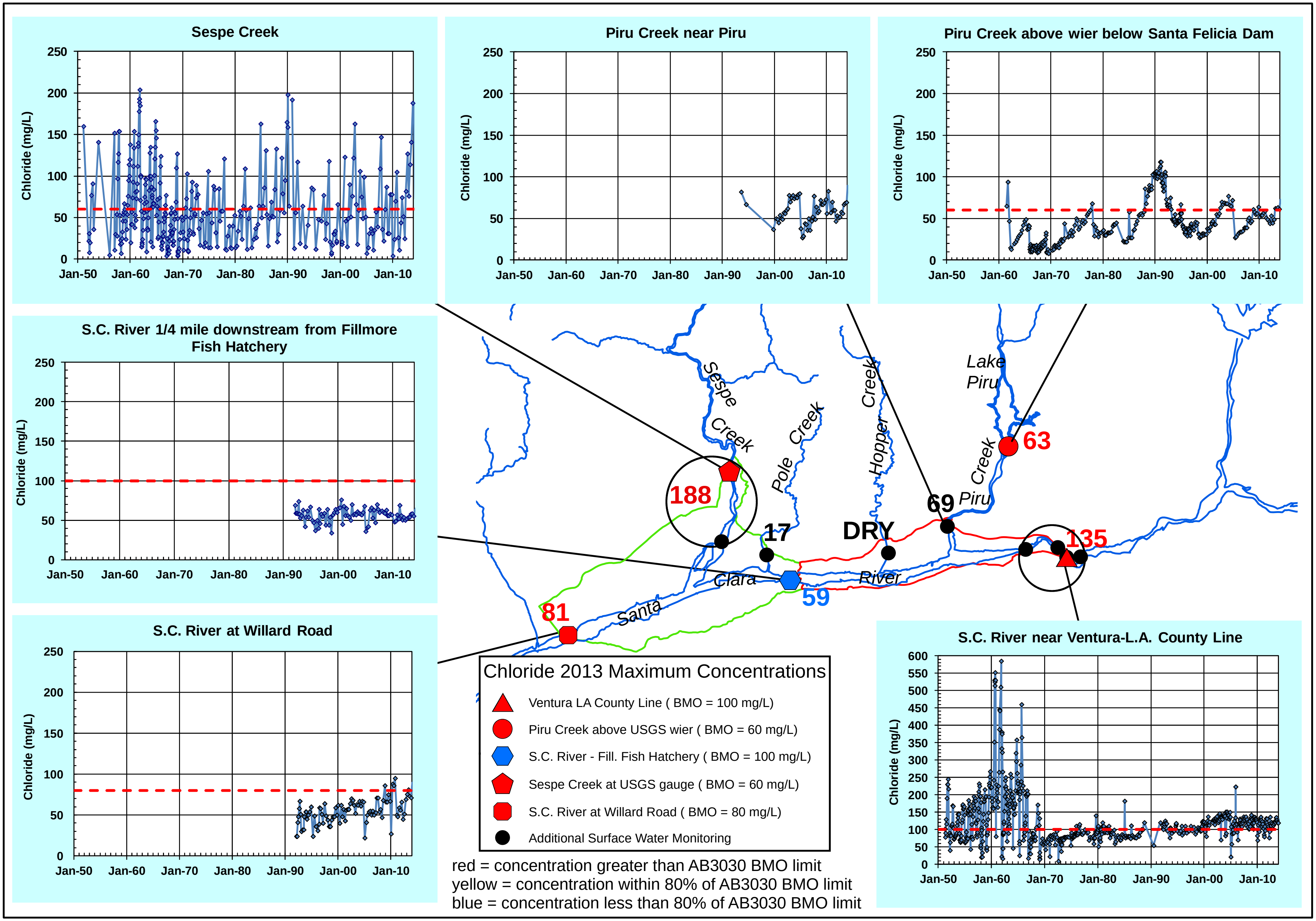

Figure 27. Chloride surface water quality time series graphs with map of 2013 maximum concentrations (mg/L); dashed red line is AB 3030 BMO.

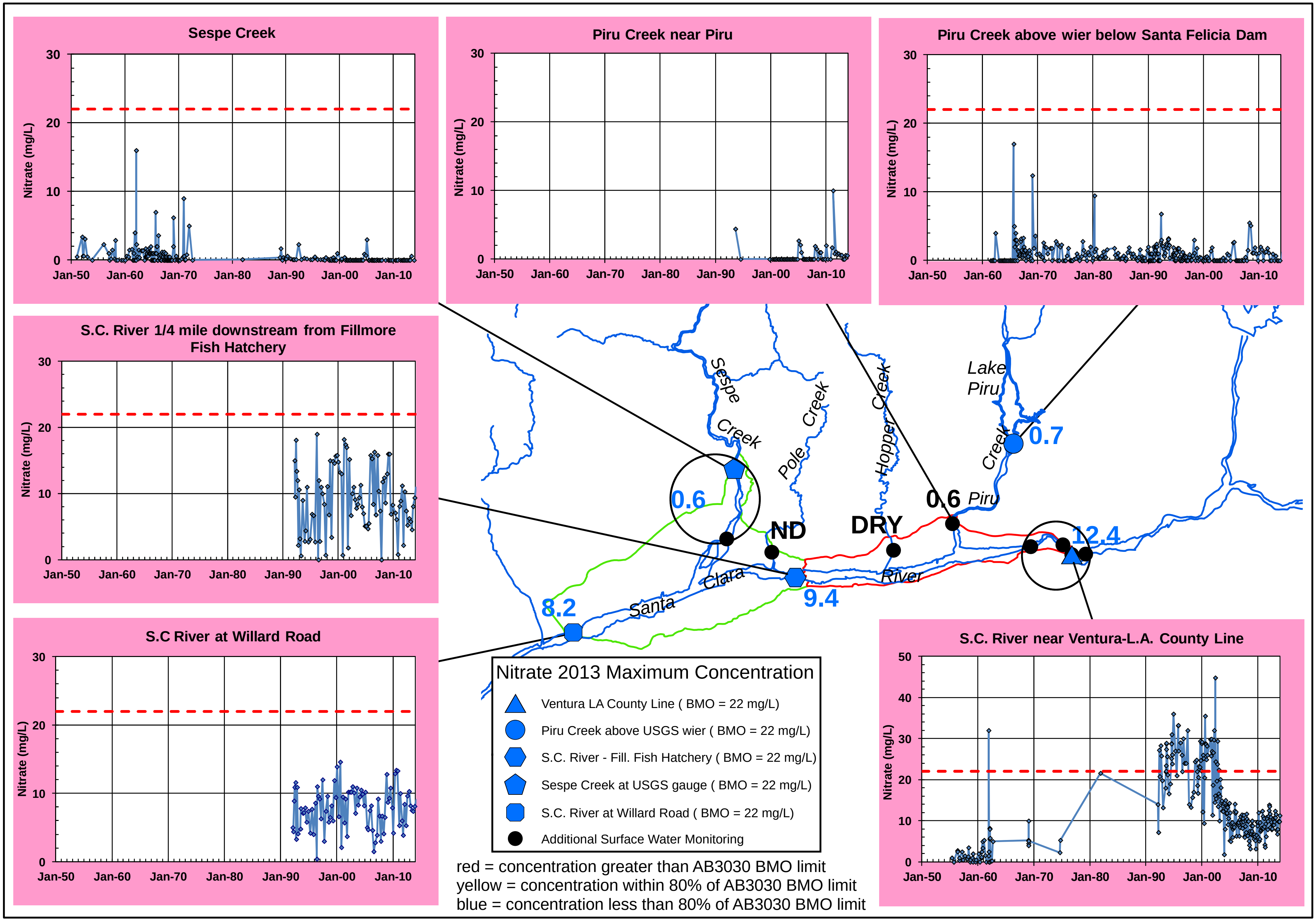

Figure 28. Nitrate surface water quality time series graphs with map of 2013 maximum concentrations (mg/L as NO3); dashed red line on graphs is AB 3030 BMO.

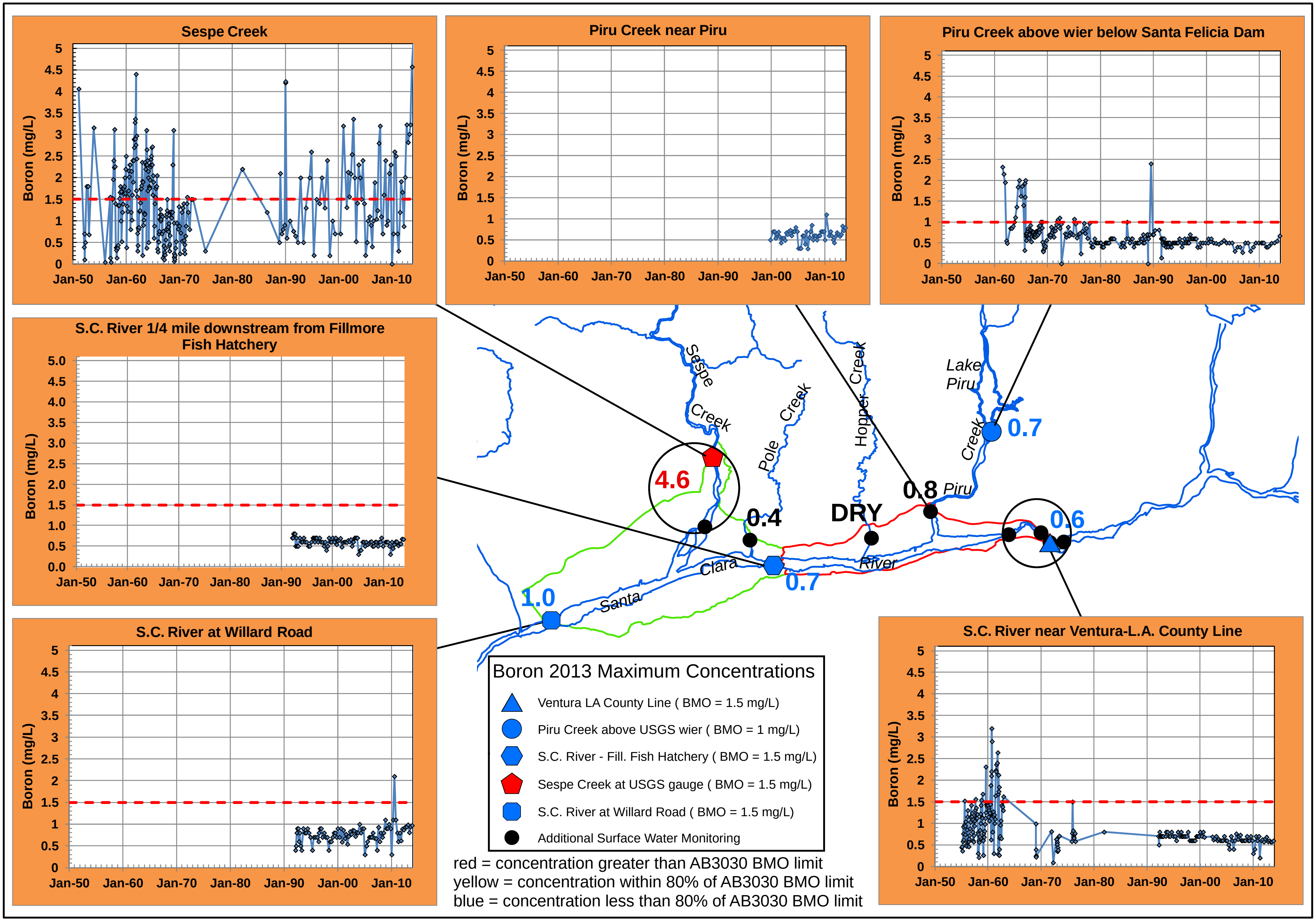

Figure 29. Boron surface water quality time series graphs with map of 2013 maximum concentrations (mg/L); dashed red line is AB 3030 BMO.

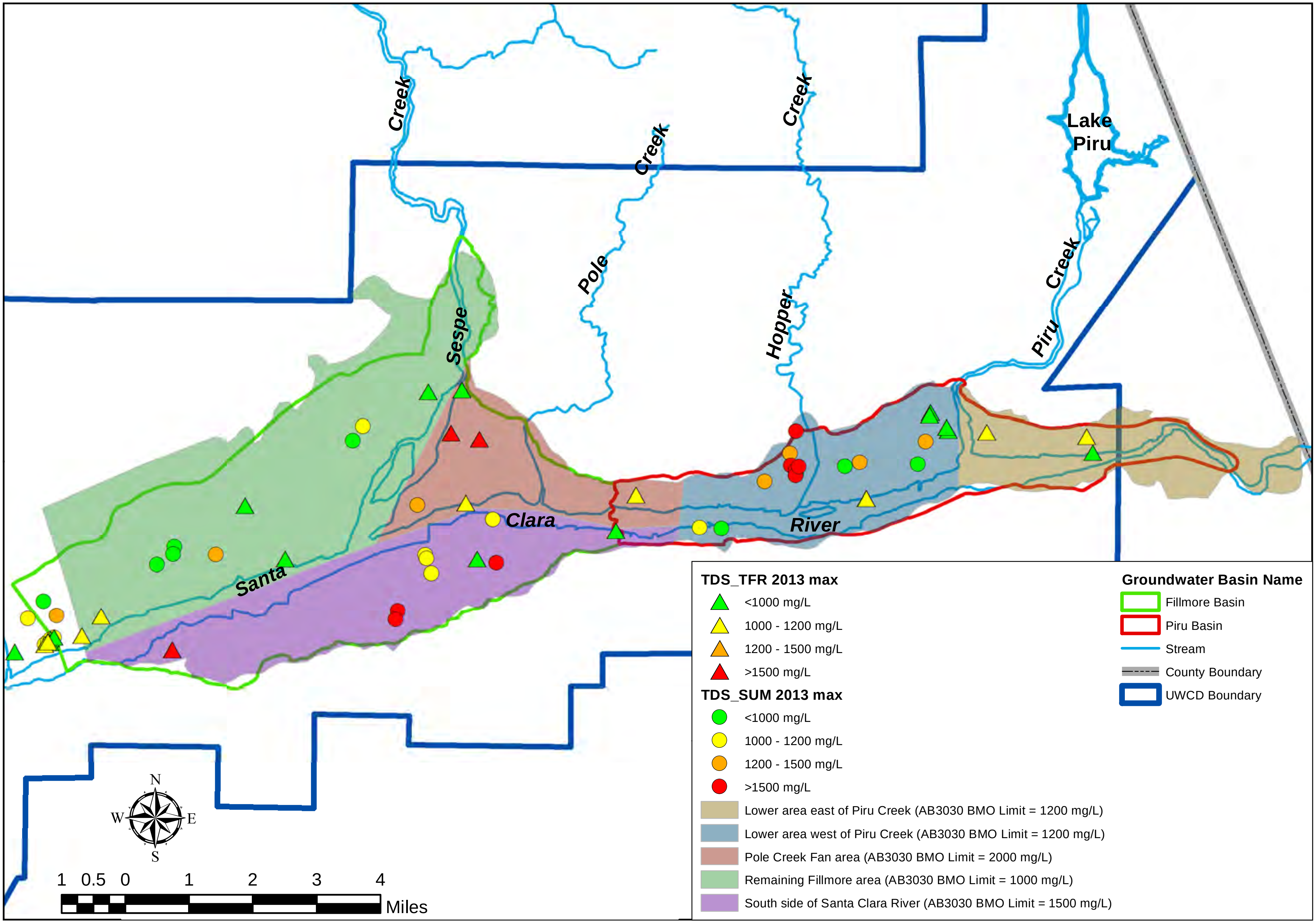

Figure 30. TDS groundwater quality map of 2013 maximum concentrations (mg/L).

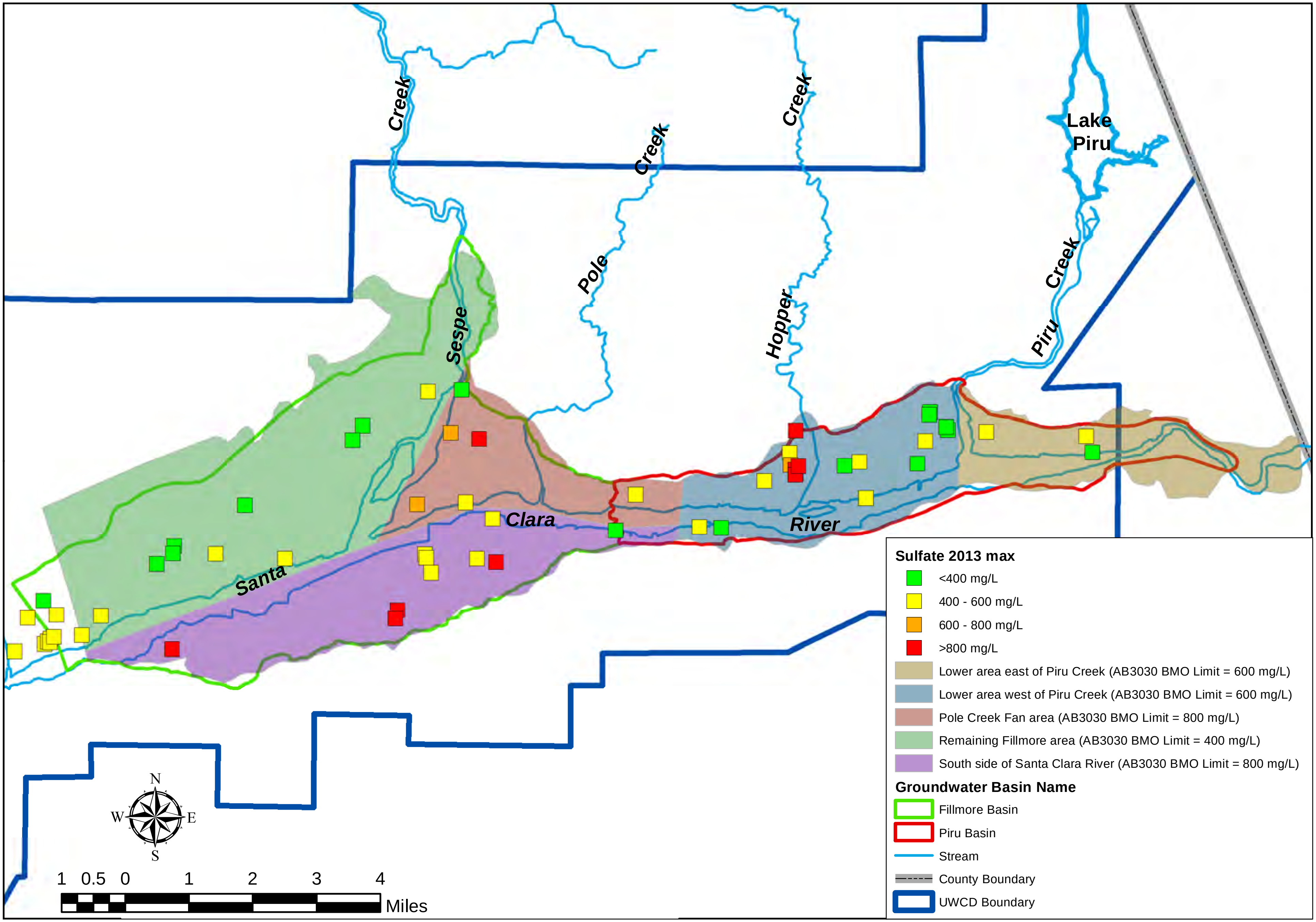

Figure 31. Sulfate groundwater quality map of 2013 maximum concentrations (mg/L).

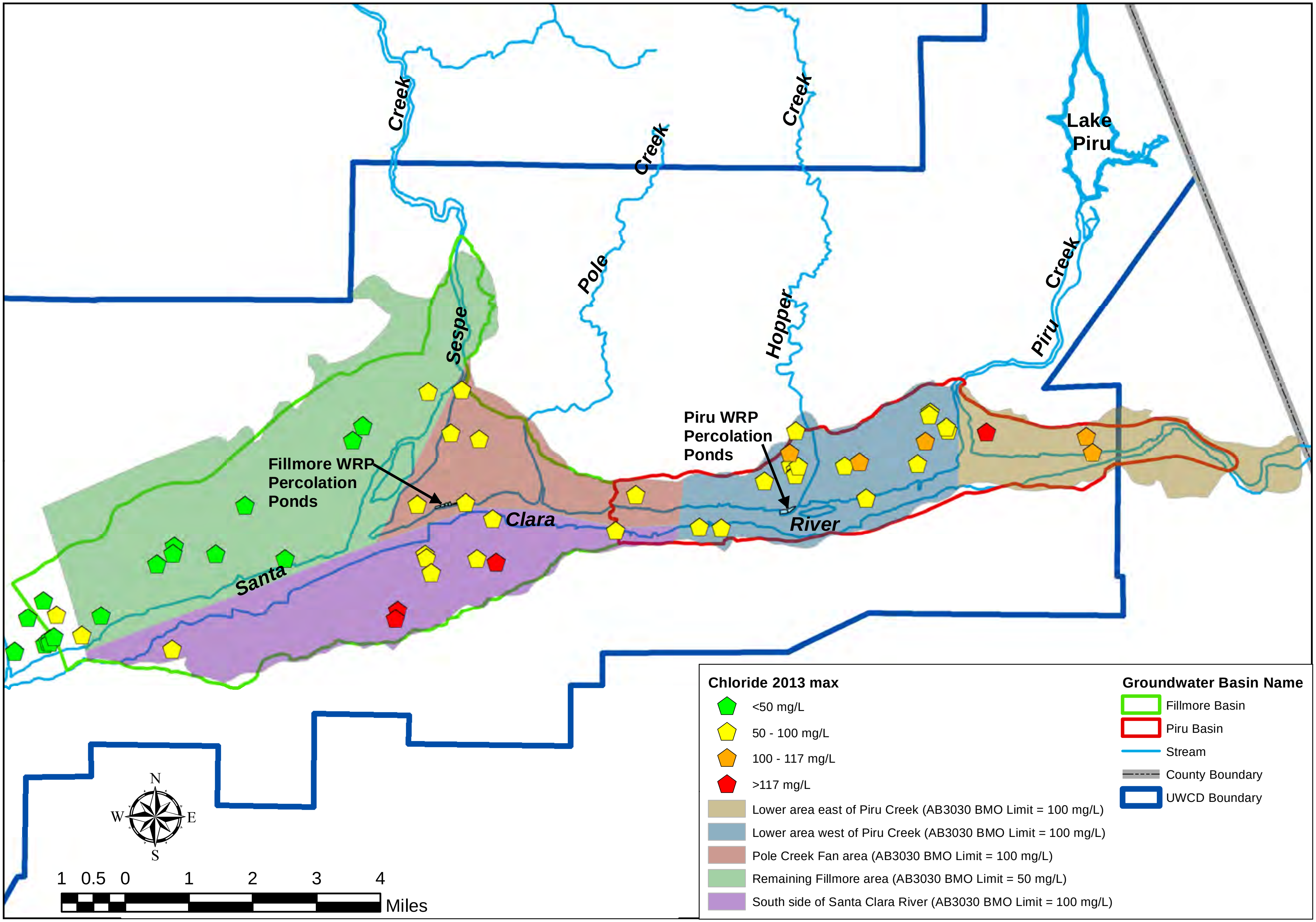

Figure 32. Chloride groundwater quality map of 2013 maximum concentrations (mg/L).

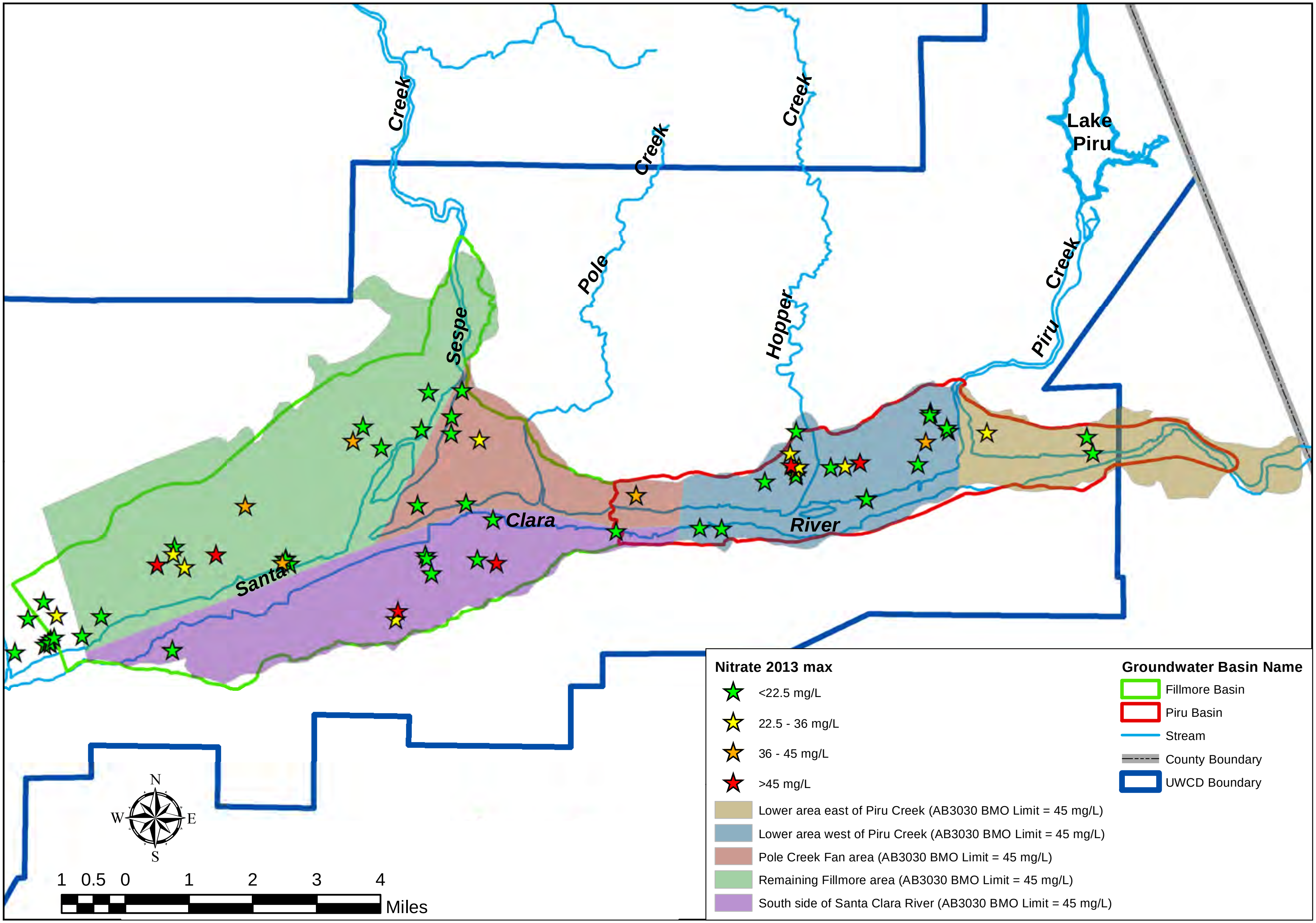

Figure 33. Nitrate groundwater quality map of 2013 maximum concentrations (mg/L as NO3).

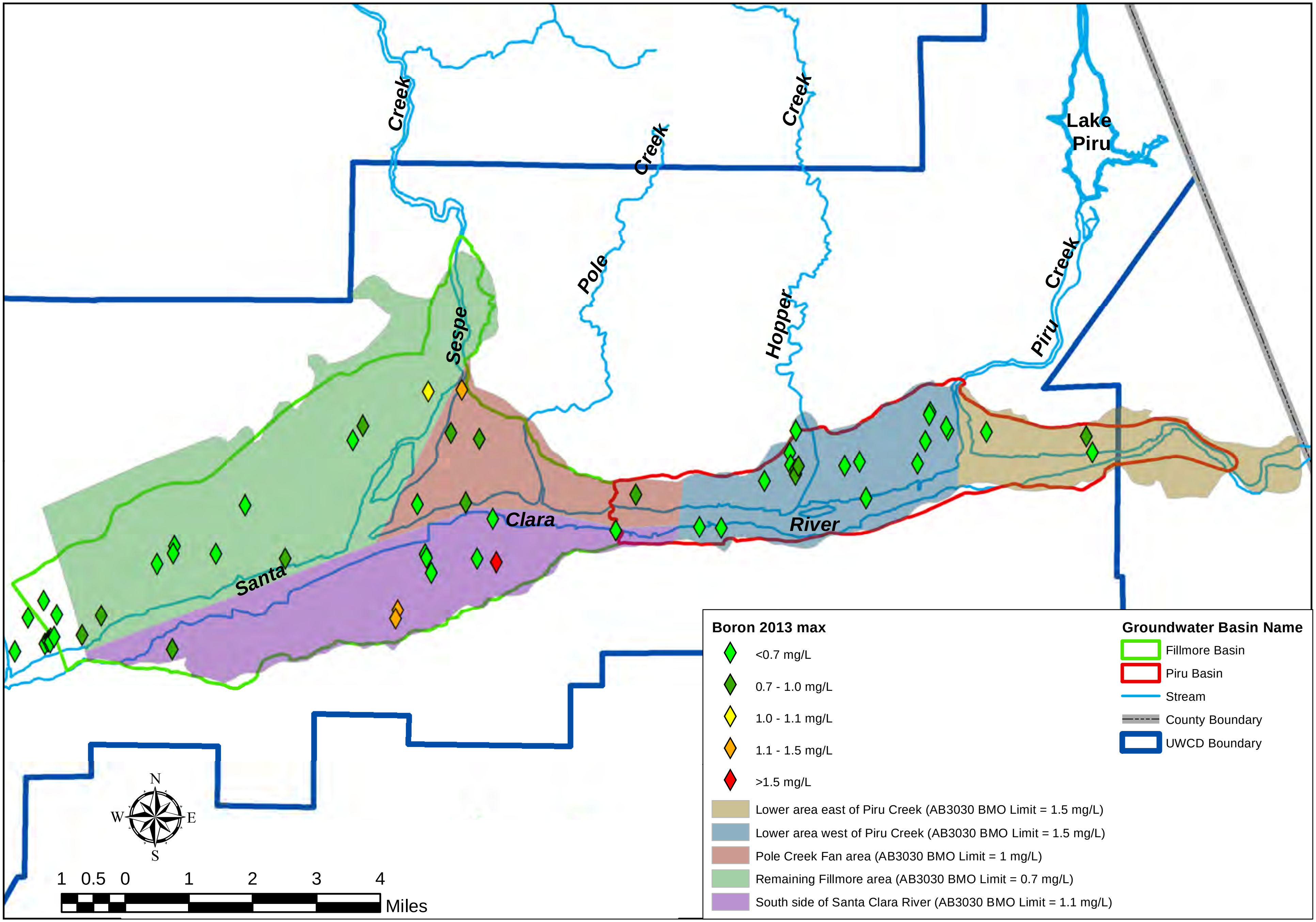

Figure 34. Boron groundwater quality map of 2013 maximum concentrations (mg/L).

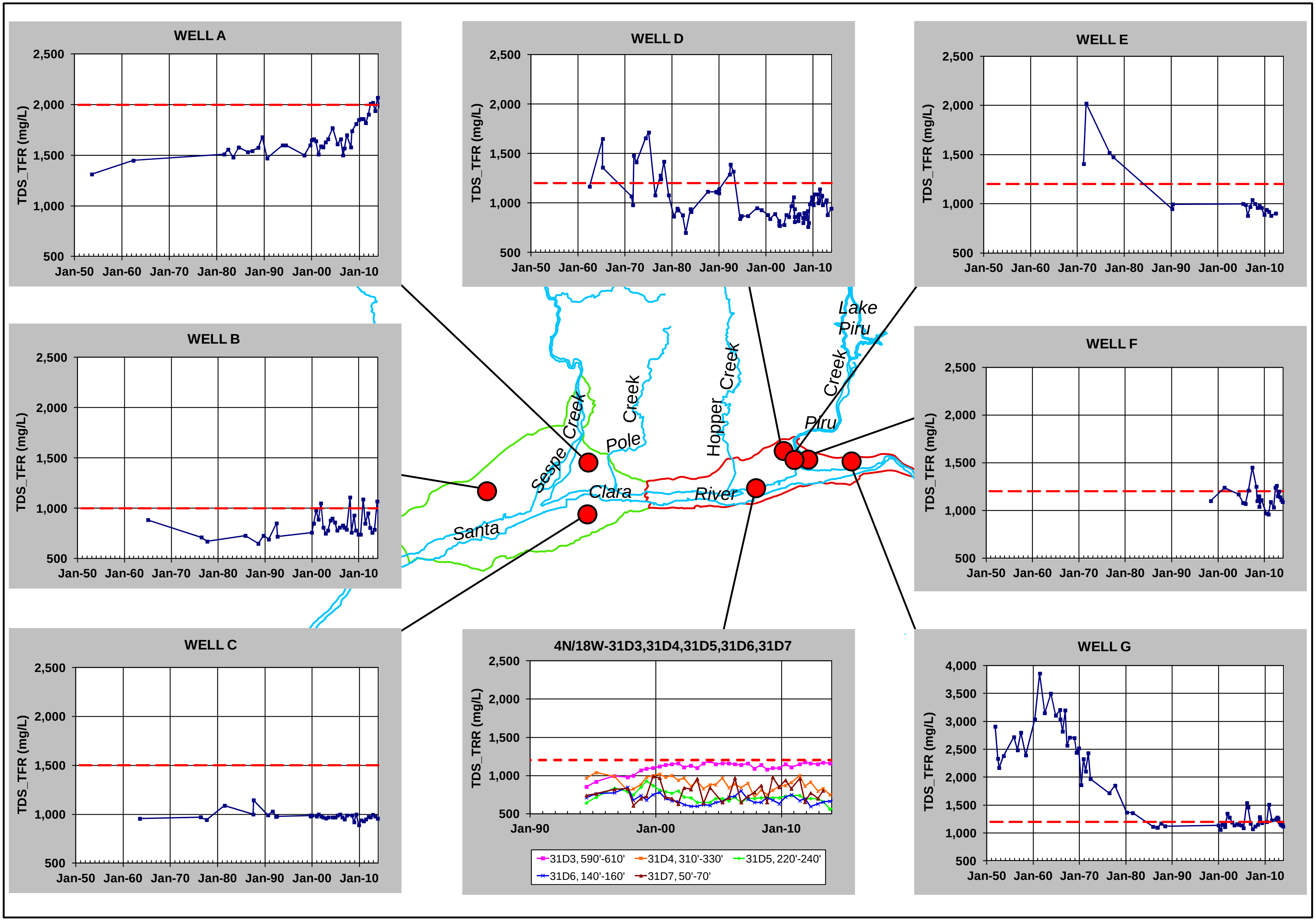

Figure 35. TDS groundwater quality time series graphs (mg/L); dashed red line is AB 3030 BMO.

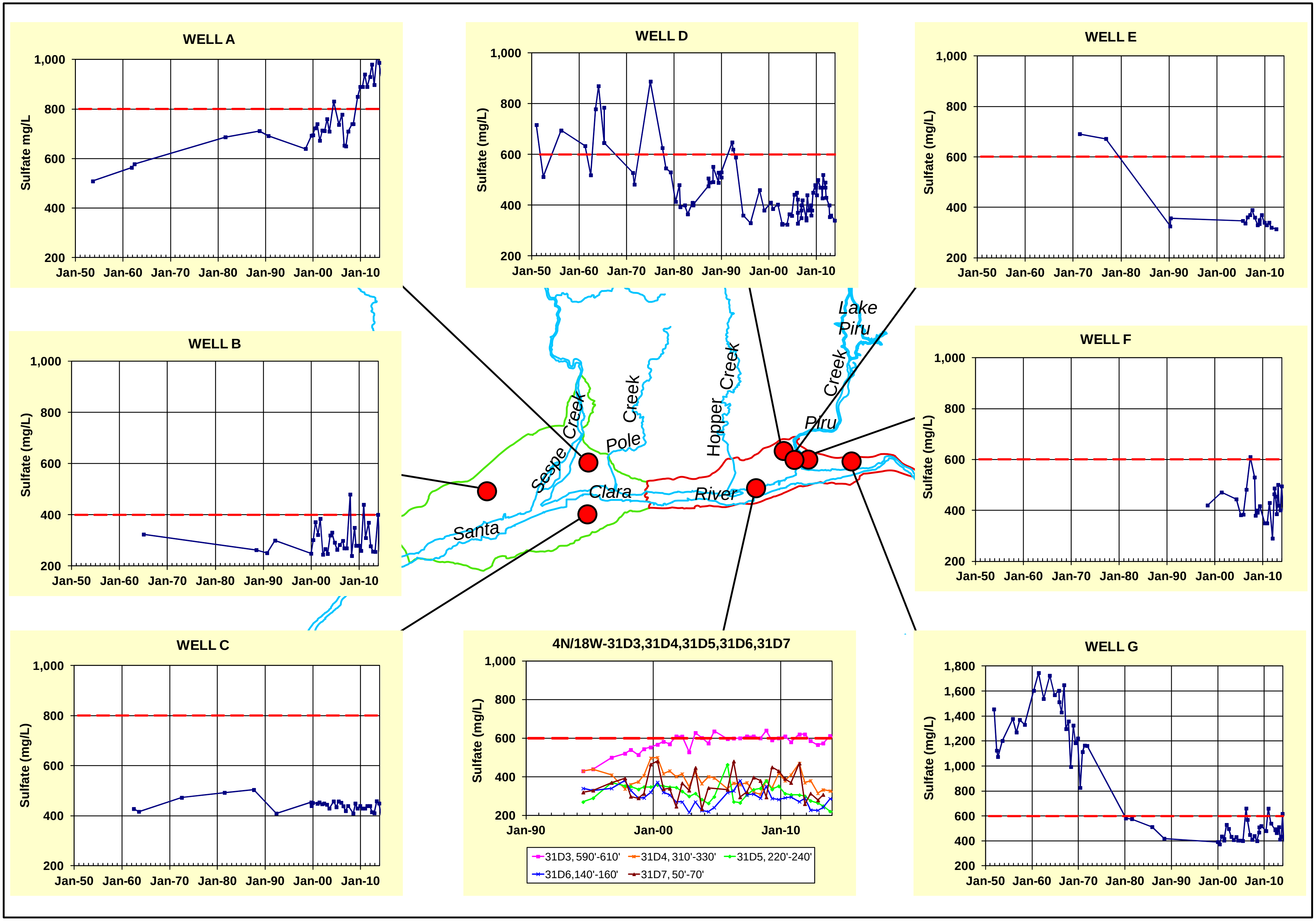

Figure 36. Sulfate groundwater quality time series graphs (mg/L); dashed red line is AB 3030 BMO.

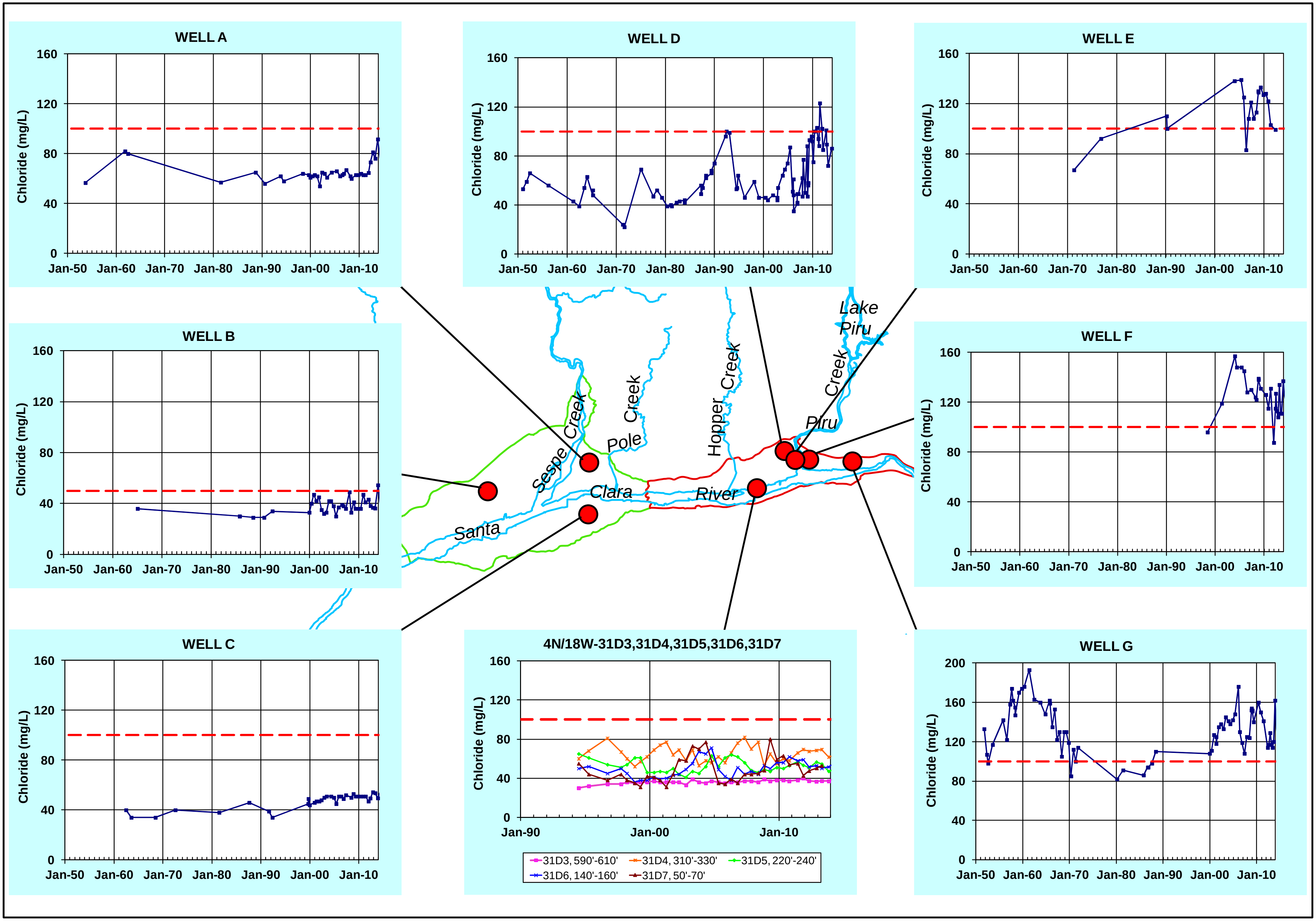

Figure 37. Chloride groundwater quality time series graphs (mg/L); dashed red line is AB 3030 BMO.

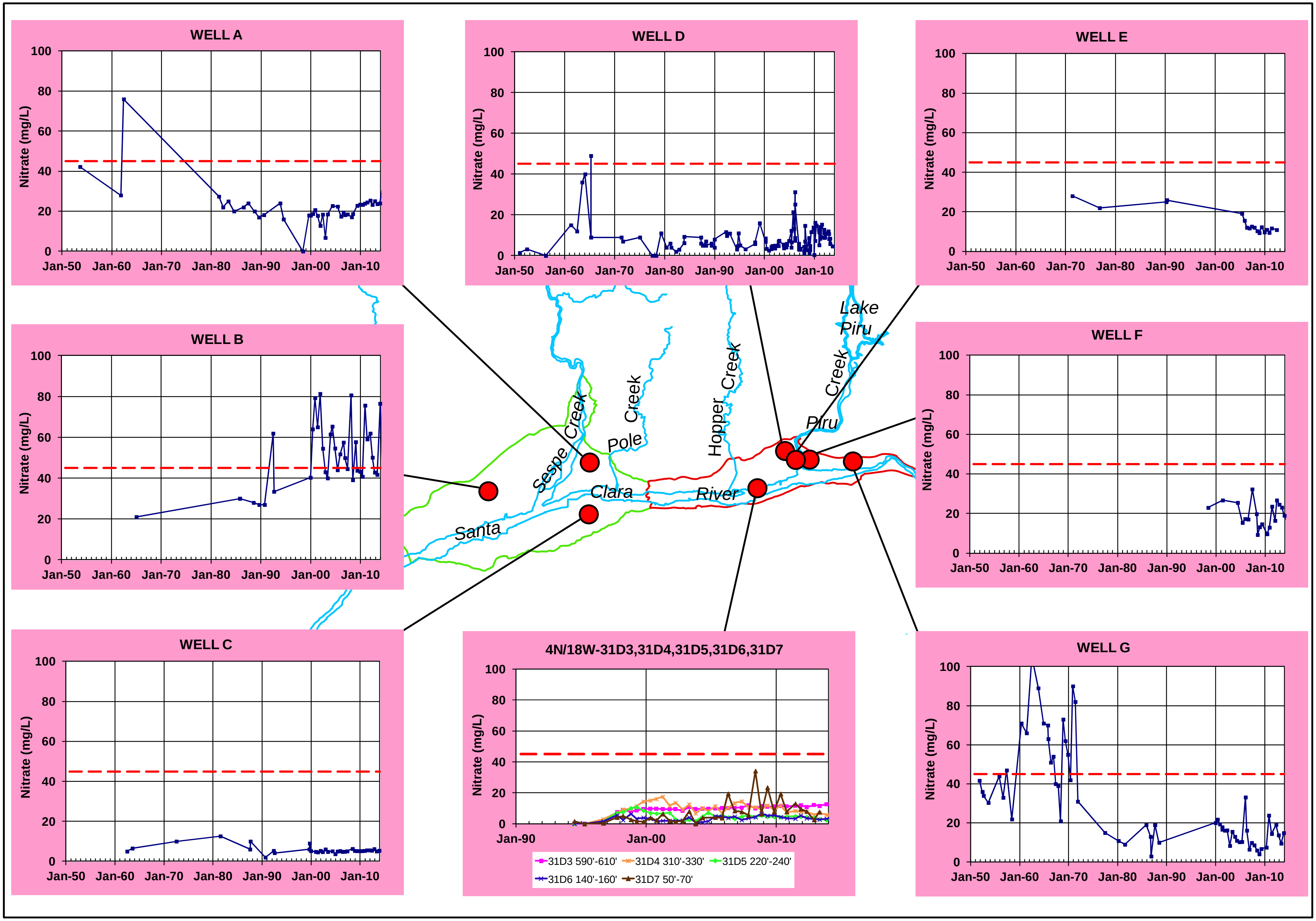

Figure 38. Nitrate groundwater quality time series graphs (mg/L as NO3); dashed red line is AB 3030 BMO.

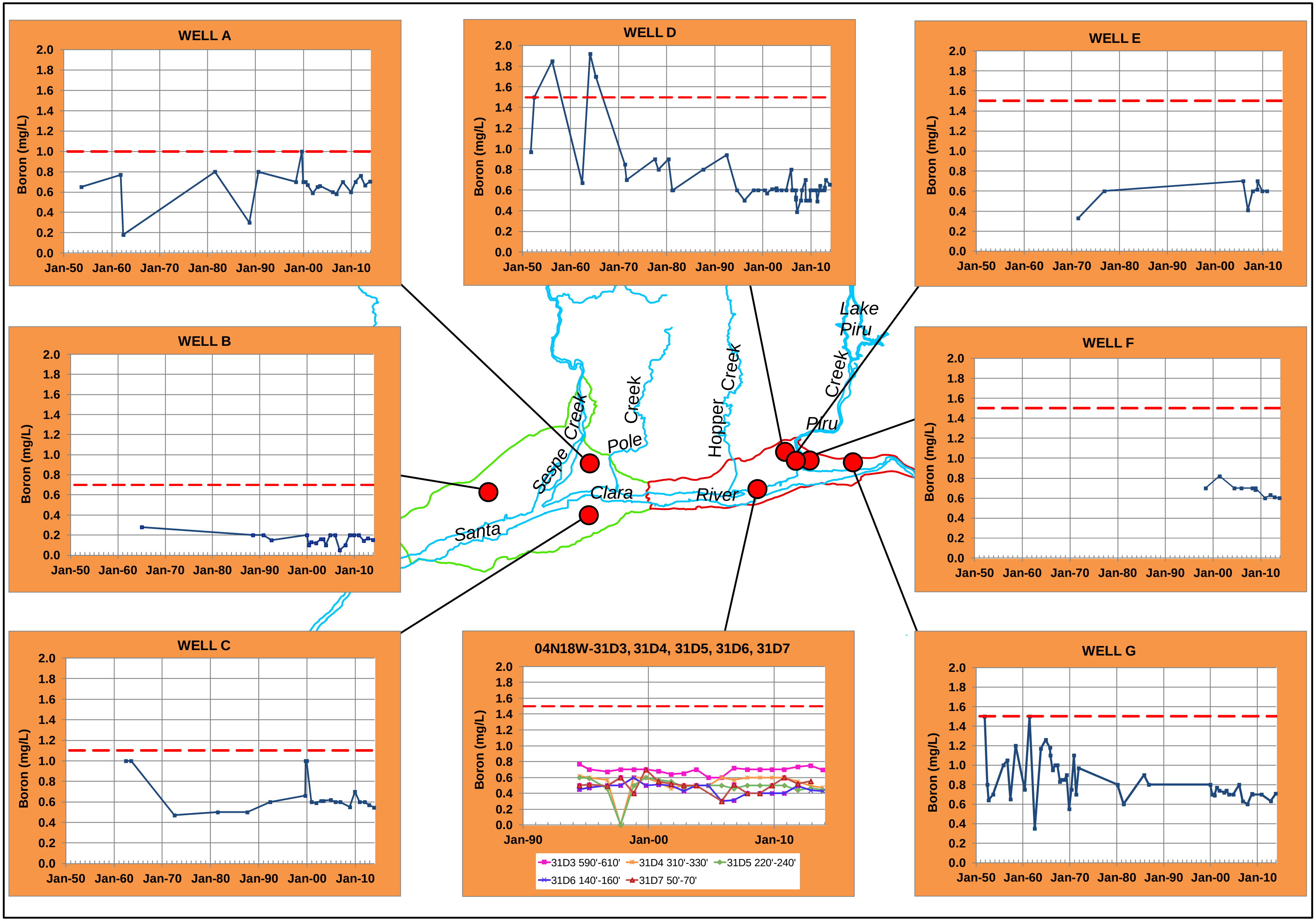

Figure 39. Boron groundwater quality time series graphs (mg/L); dashed red line is AB 3030 BMO.

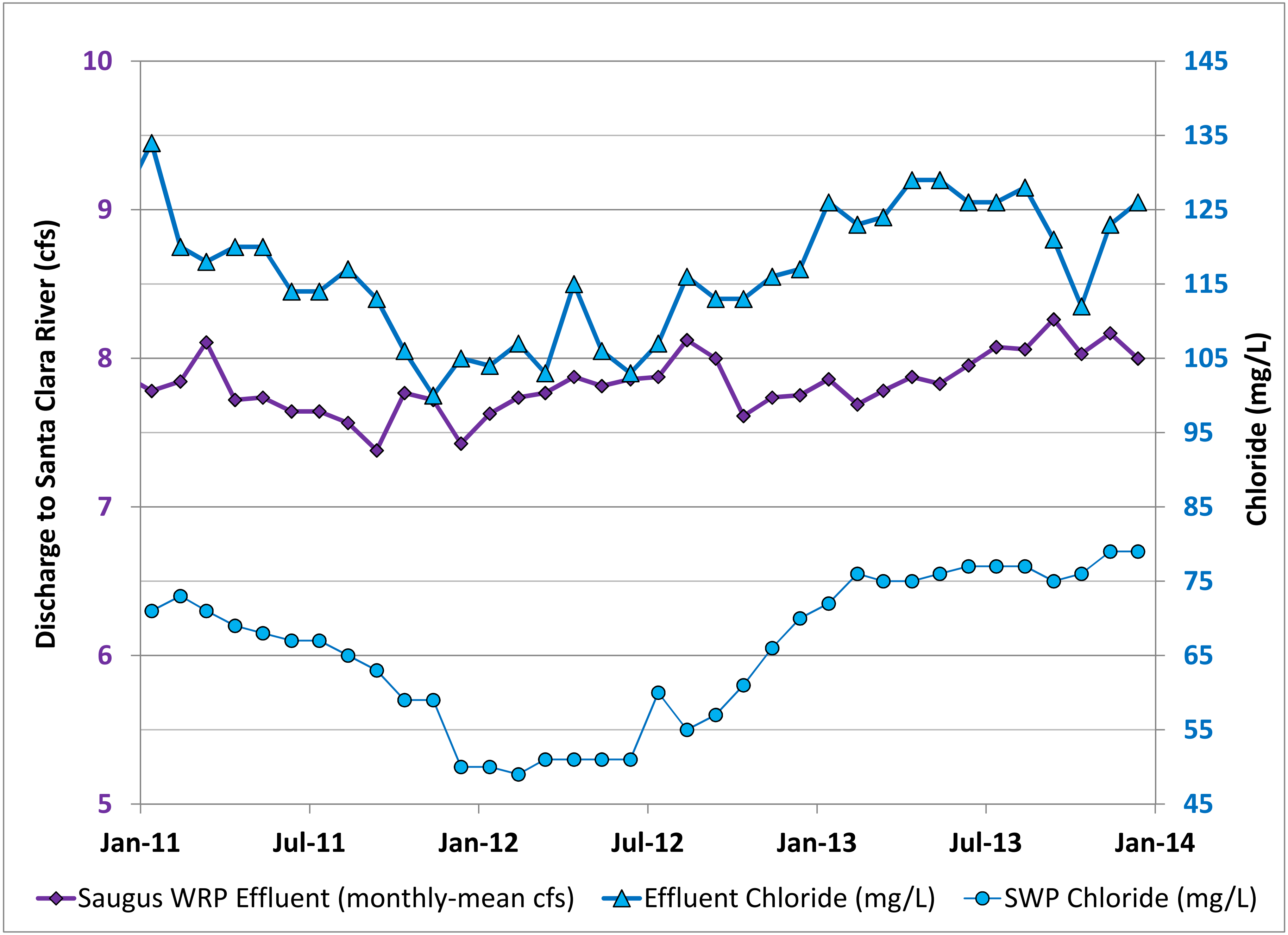

Figure 40. Saugus Wastewater Reclamation Plant effluent (NPDES) and chloride concentration discharge to Santa Clara River; State Water Project chloride concentration.

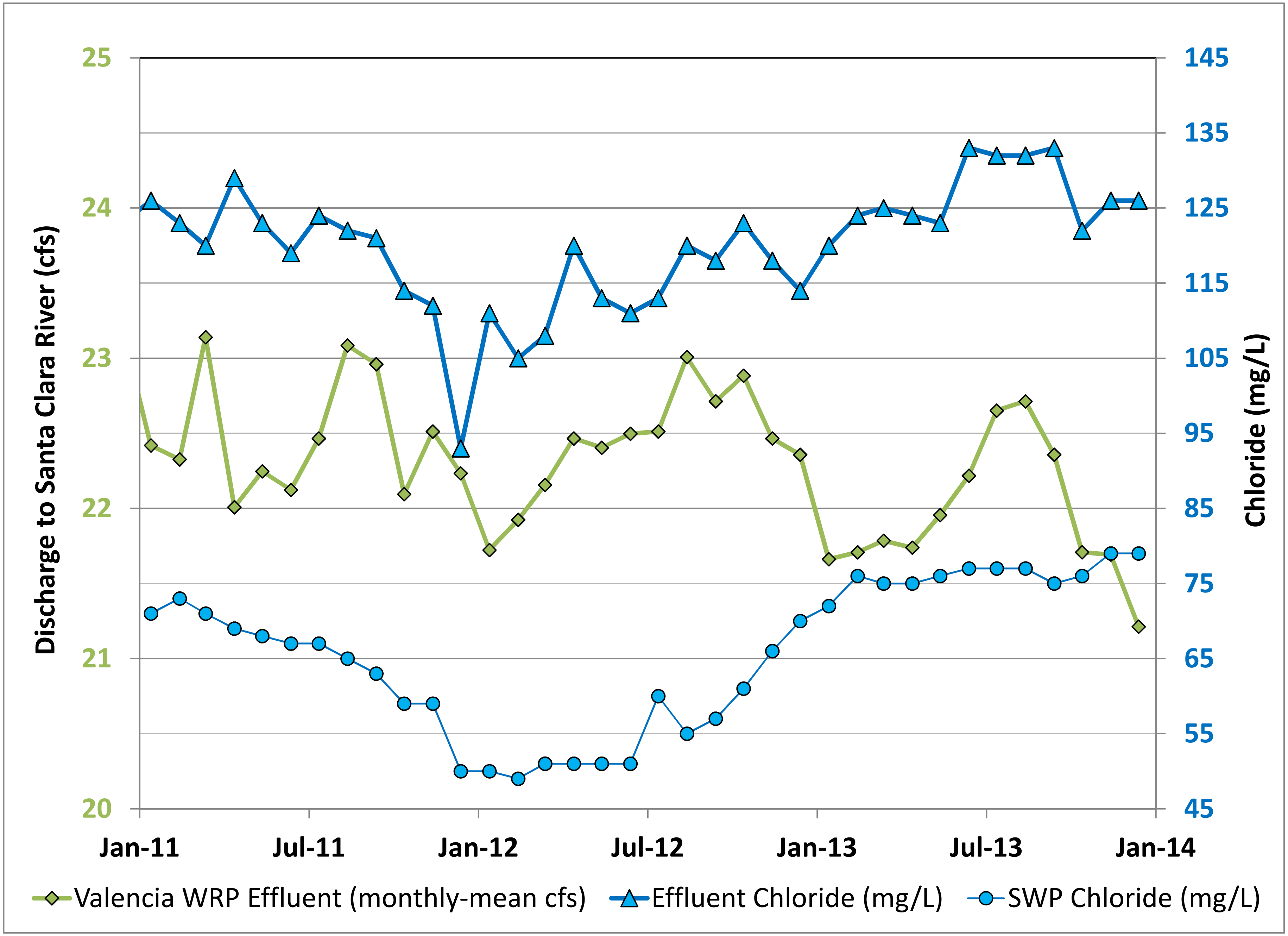

Figure 41. Valencia Wastewater Reclamation Plant effluent (NPDES) and chloride concentration discharge to Santa Clara River; State Water Project chloride concentration.

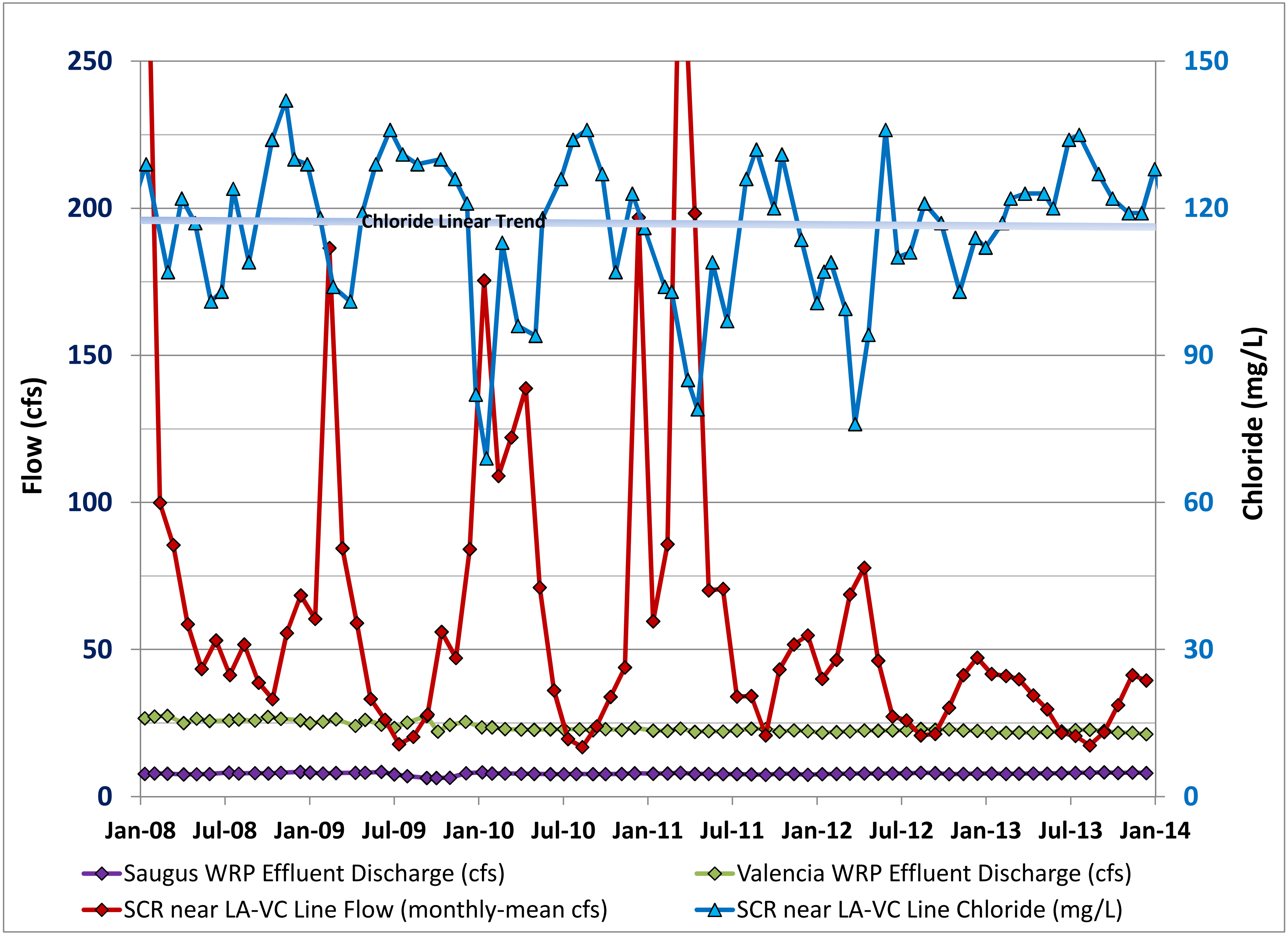

Figure 42. Saugus and Valencia WRPs effluent (NPDES); Santa Clara River flow and chloride concentration near the Ventura/Los Angeles County Line.

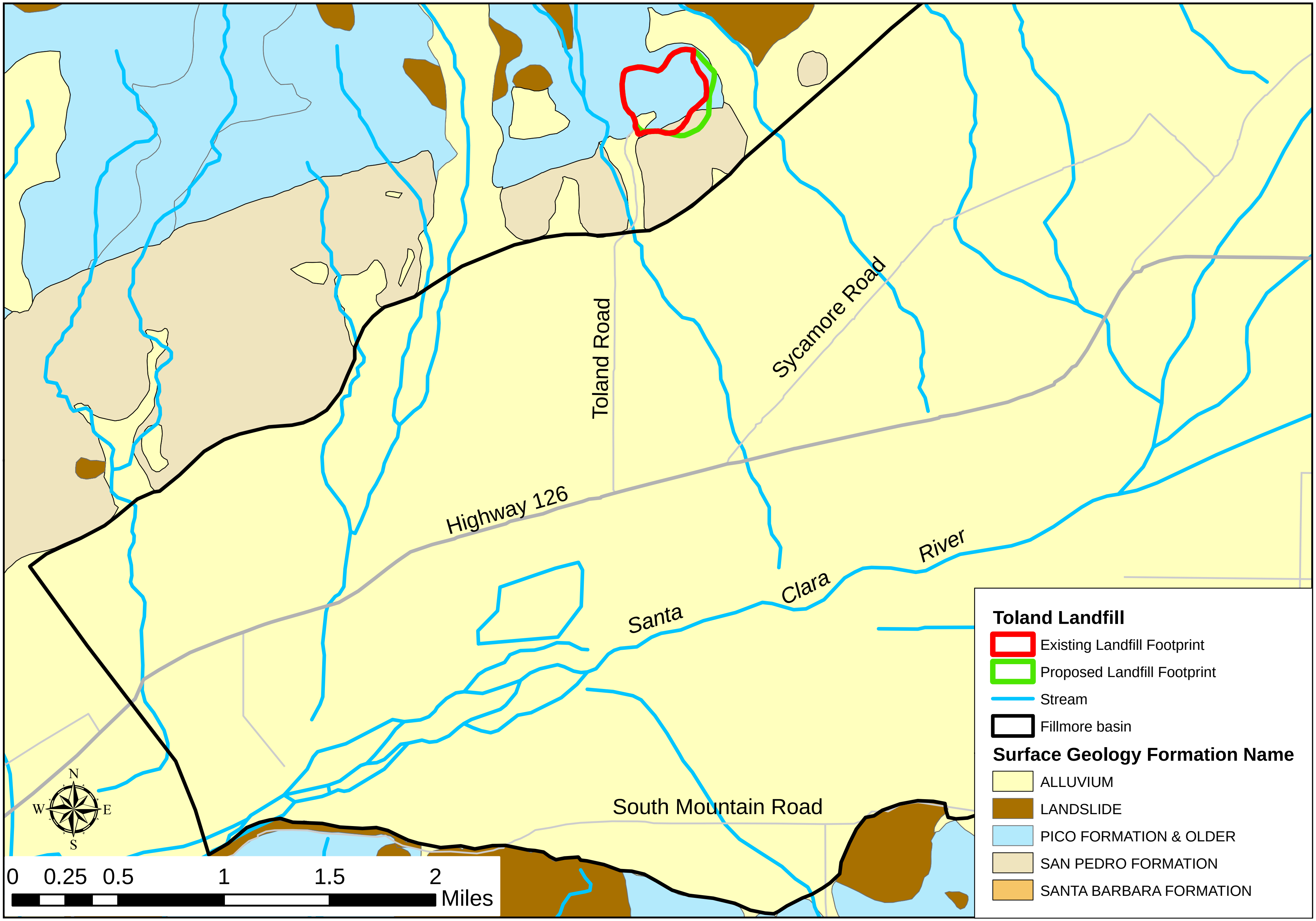

Figure 43. Toland Landfill regional location map.

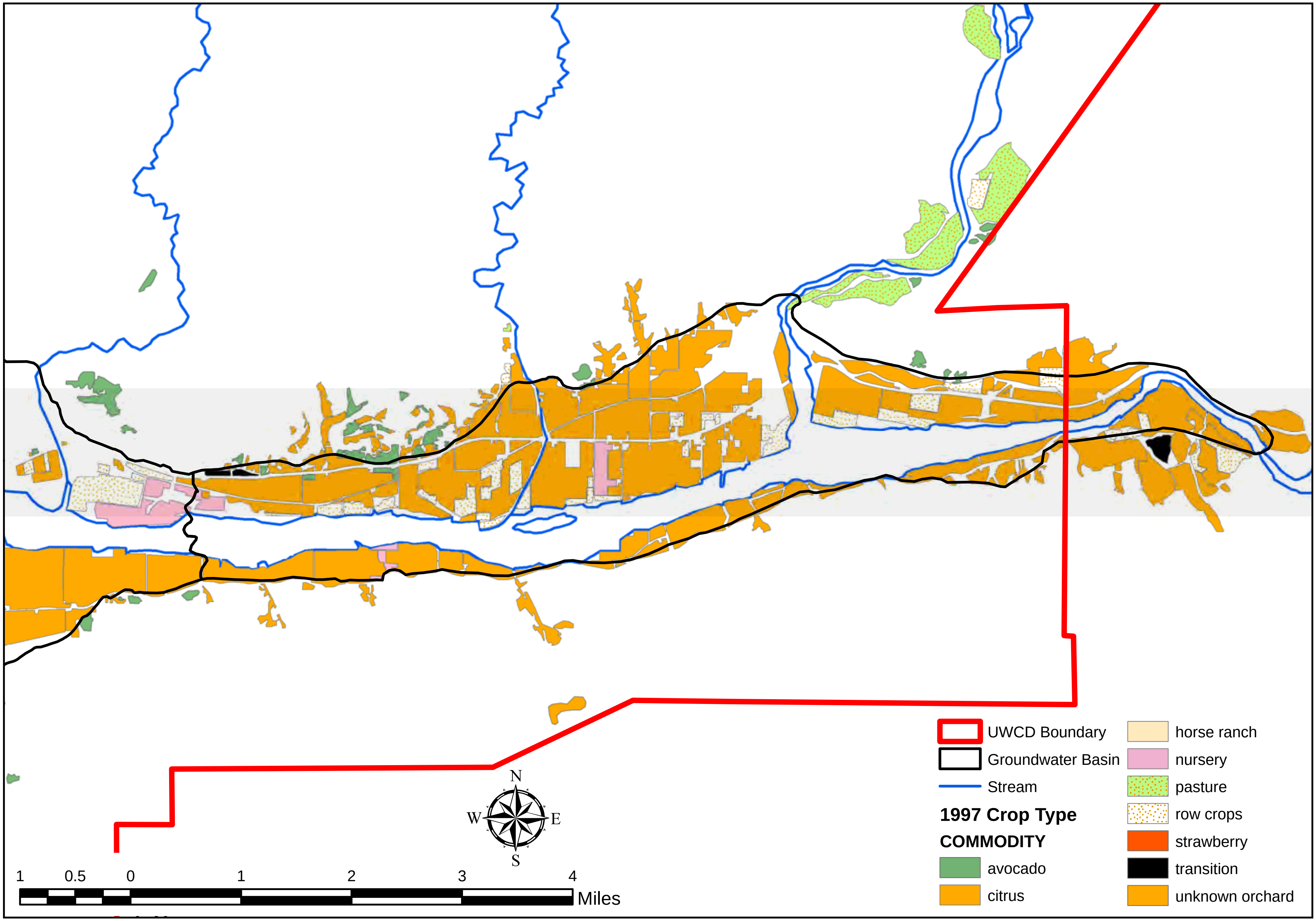

Figure 44. Piru basin agricultural land use map for 1997.

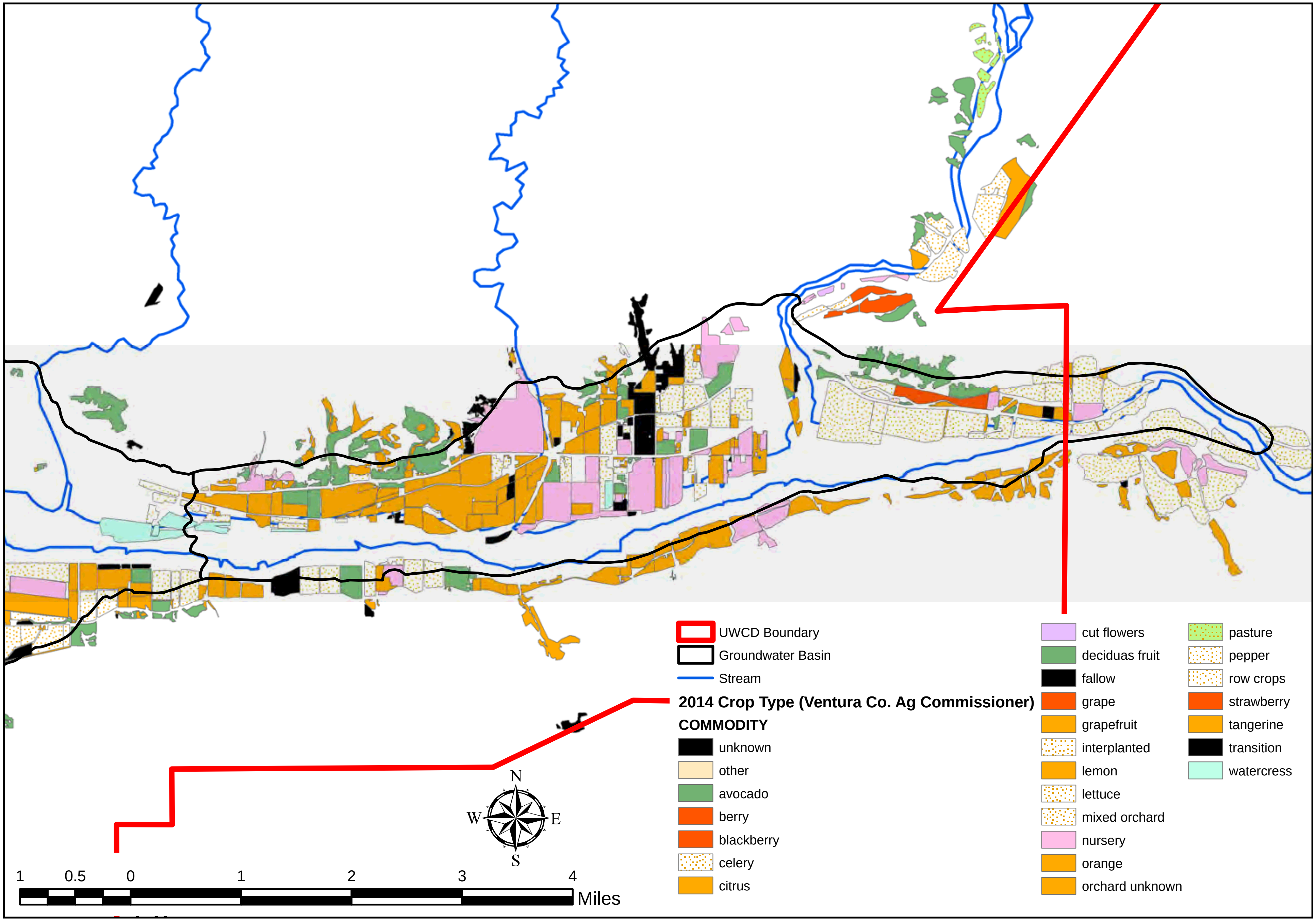

Figure 45. Piru basin agricultural land use map for 2014.

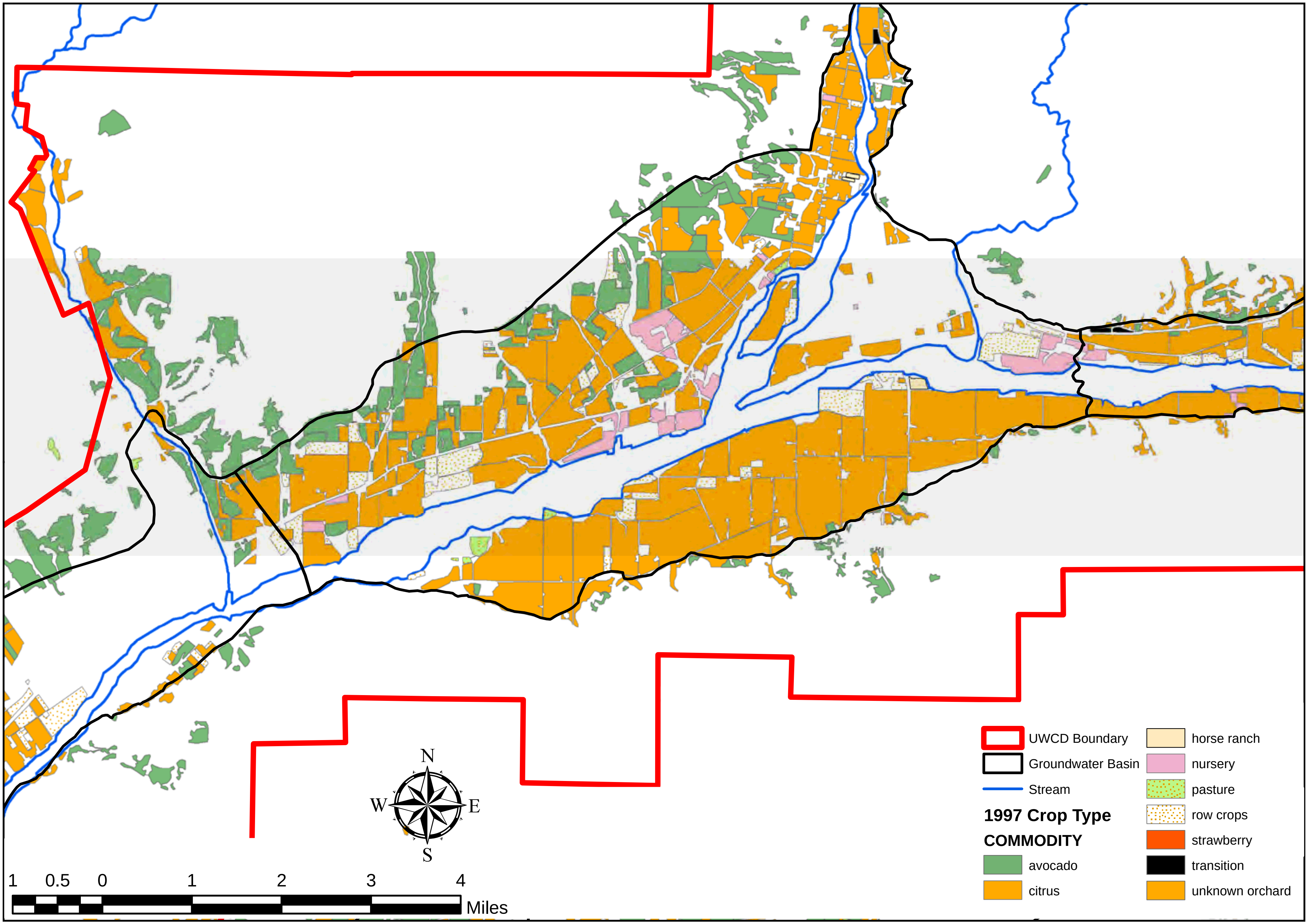

Figure 46. Fillmore basin agricultural land use map for 1997.

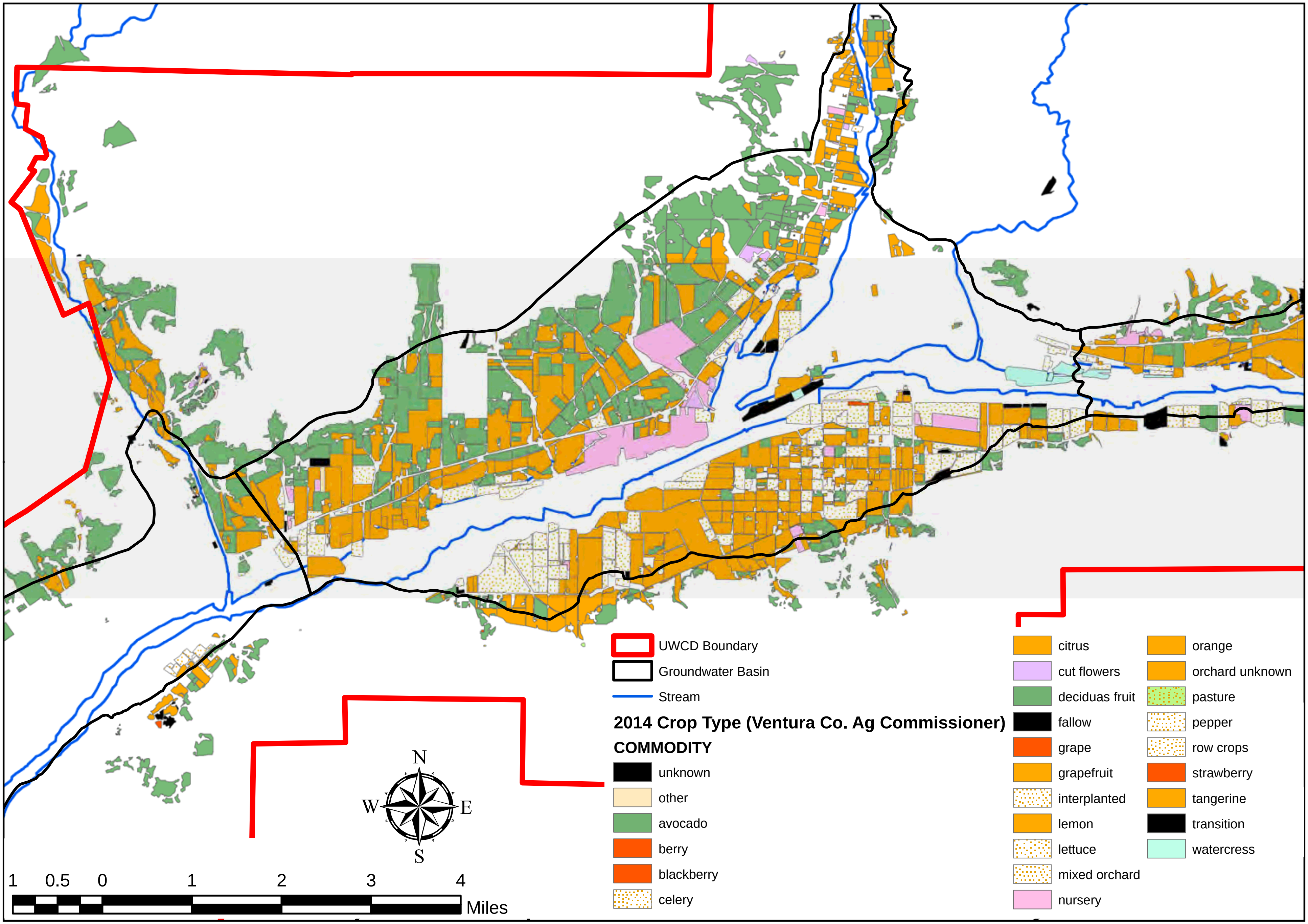

Figure 47. Fillmore basin agricultural land use map for 2014.