OVERVIEW OF THE CRESTON SUBAREA
OF THE PASO ROBLES GROUNDWATER BASIN

This overview of the Paso Robles Groundwater Basin (Basin) and the Creston Subarea are provided to establish the groundwater setting and identify groundwater issues that may be used to develop groundwater management goals, objectives, and actions as part of the Paso Robles Groundwater Basin Management Plan. The following information was summarized from existing reports and available information for the Basin and the Creston Subarea.

Paso Robles Groundwater Basin

The basin-wide information includes the general groundwater setting of the Paso Robles Groundwater Basin and recent hydrologic conditions.

Groundwater Setting of the Paso Robles Groundwater Basin

The Paso Robles Groundwater Basin covers about 505,000 acres in southern Monterey County and northern San Luis Obispo County. The Paso Robles Groundwater Basin is subdivided into eight subareas. The groundwater system in the Paso Robles Groundwater Basin consists of the Paso Robles Formation and the shallow alluvial aquifers associated with creeks and rivers.

The shallow alluvial aquifers are present along the Salinas River, Estrella River, Huerhuero Creek, and other tributary creeks. Groundwater stored in the alluvial aquifer system accounts for about two percent of the total groundwater storage in the entire Basin. While the amount of total storage may be small, the alluvial aquifers are a significant source of recharge to the Paso Robles Formation, particularly along the western end of the Basin where the Salinas River is located. The coarse-grained deposits of the shallow alluvium act as an unconfined aquifer.

In areas where the alluvial aquifers are not present, the Paso Robles Formation is exposed at the ground surface. The Paso Robles Formation consists of less permeable, interbedded deposits with highly variable thicknesses and permeability, but is the primary aquifer for most agricultural and municipal users. Groundwater stored in the Paso Robles Formation generally occurs under semi-confined to confined conditions. The two primary sources of recharge to the Paso Robles Formation include the infiltration of precipitation and the percolation of stream flow into the shallow alluvial aquifers that infiltrates the Paso Robles Formation.

The alluvium and Paso Robles Formation rest on older consolidated sediments. Faults have created a conduit to allow water trapped in these older sediments to come to the surface as geothermal water.

There are currently about 150 wells located within the limits of the Paso Robles Groundwater Basin that are monitored by the San Luis Obispo County Department of Public Works and the Monterey County Water Resources Agency (Figure 1). These wells are used to track the changes in groundwater level trends through time at a specific location (presented in well hydrographs), or across an area for a specific date (presented as water level maps).

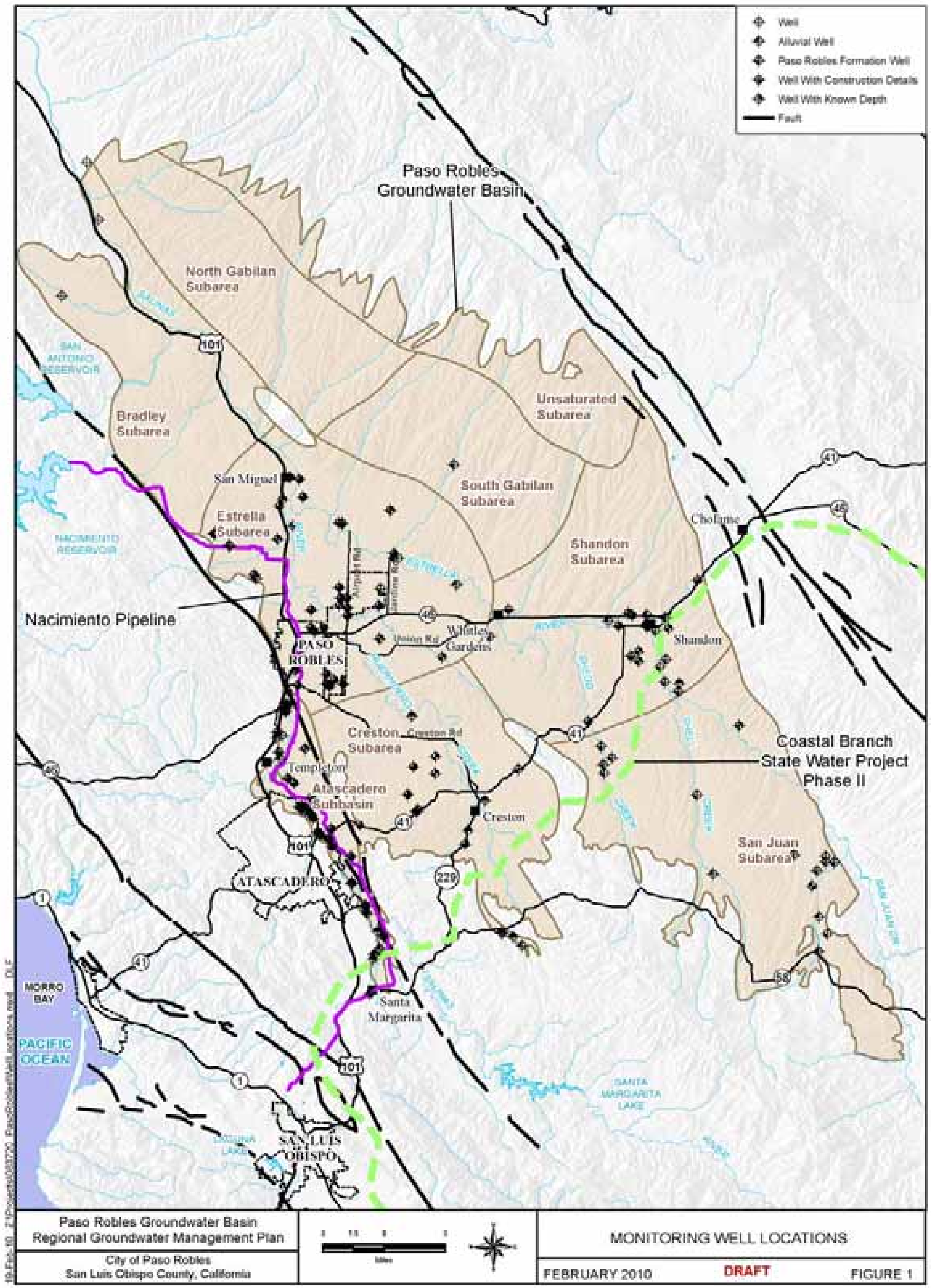

Figure 1. Location of Groundwater Monitoring Wells in the Paso Robles Groundwater Basin

Recent Hydrologic Conditions

This section summarizes the recent hydrologic conditions for the areas tributary to the Paso Robles Groundwater Basin. The annual precipitation is measured at seven rainfall gauge stations located throughout the Basin to record the geographic variation in rainfall. The Atascadero MWC Station No. 34 is one of the gauges with a long, continuous period of record. The long-term average annual precipitation at this gauge is 17.6 inches per year for the 1916 to 2009 period.

During the 1998 to 2009 period, the Atascadero MWC Station No. 34 averaged 16.7 inches per year. Based on this comparison, the average annual precipitation for the 1998 to 2009 period is somewhat drier than the long-term average.

While the 12-year average for the 1998 to 2009 period may not differ greatly from the long-term average, there is considerable annual variation in precipitation. During the 1998 to 2009 period, the annual precipitation at the Atascadero MWC Station No. 34 ranged from a minimum of 7.6 inches in 2007 to a maximum of 34.6 inches in 2005. Additionally, the last three years (2007 to 2009) received below average rainfall.

Creston Subarea

The following information for the Creston Subarea includes the recent land and water conditions and local groundwater conditions.

Land and Water Use

The Creston Subarea is located in the southern portion of the Paso Robles Groundwater Basin and has an area of approximately 57,000 acres, which makes up about 11 percent of the area of the Basin. The Rinconada fault separates the Creston Subarea from the Atascadero Subbasin. The Huerhuero Creek flows northwest through the subarea, entering the Estrella Subarea southeast of the City of Paso Robles. This subarea includes the community of Creston. There are no public water purveyors in the subarea.

The water use in 2006 totaled about 12,311 acre-feet representing about 14 percent of the water use in the Basin. The primary use of groundwater in this subarea is for agriculture, with rural uses making up most of the remaining water use. The water users in the Creston Subarea and their uses are shown in Table 1.

Table 1. Total Estimated Pumping in 2006 in Creston Subarea (AF)

Agriculture	Municipal	Small Community	Small Commercial	Rural	**Total**
9,936	0	7	37	2,331	**12,311**
(81%)	(0%)	(<1%)	(<1%)	(19%)	**(100%)**

(Todd, 2009)

Local Groundwater Conditions

In the Creston Subarea, the groundwater system consists of the Paso Robles Formation and the shallow alluvial aquifers associated with the Huerhuero Creek and other tributary creeks.

Most production wells extract water from the Paso Robles Formation. Wells in the Creston Subarea typically range in depth from 200 to 800 feet, and average between 300 to 400 feet. Groundwater wells production ranges from less than 100 to 1,000 gallons per minute.

Groundwater Flow

Groundwater flows from areas with higher elevations to lower elevations. Figure 2 shows the groundwater elevations and general flow directions for Spring 2009. Groundwater generally flows to the west, towards the Estrella Subarea, and then north paralleling the Salinas River to the Basin outlet into the Salinas Valley Groundwater Basin. There is a groundwater low (pumping depression) in the Estrella Subarea beneath the City of Paso Robles.

There are currently about 13 wells located within Creston Subarea that are included in the groundwater monitoring network. Based on the groundwater level data collected in the Creston Subarea, there has been a general decline in groundwater levels observed and recorded at selected wells located throughout the subarea since the 1960's. The rate of decline changes through time in response to changing hydrologic conditions and changes in the amount of local groundwater pumping.

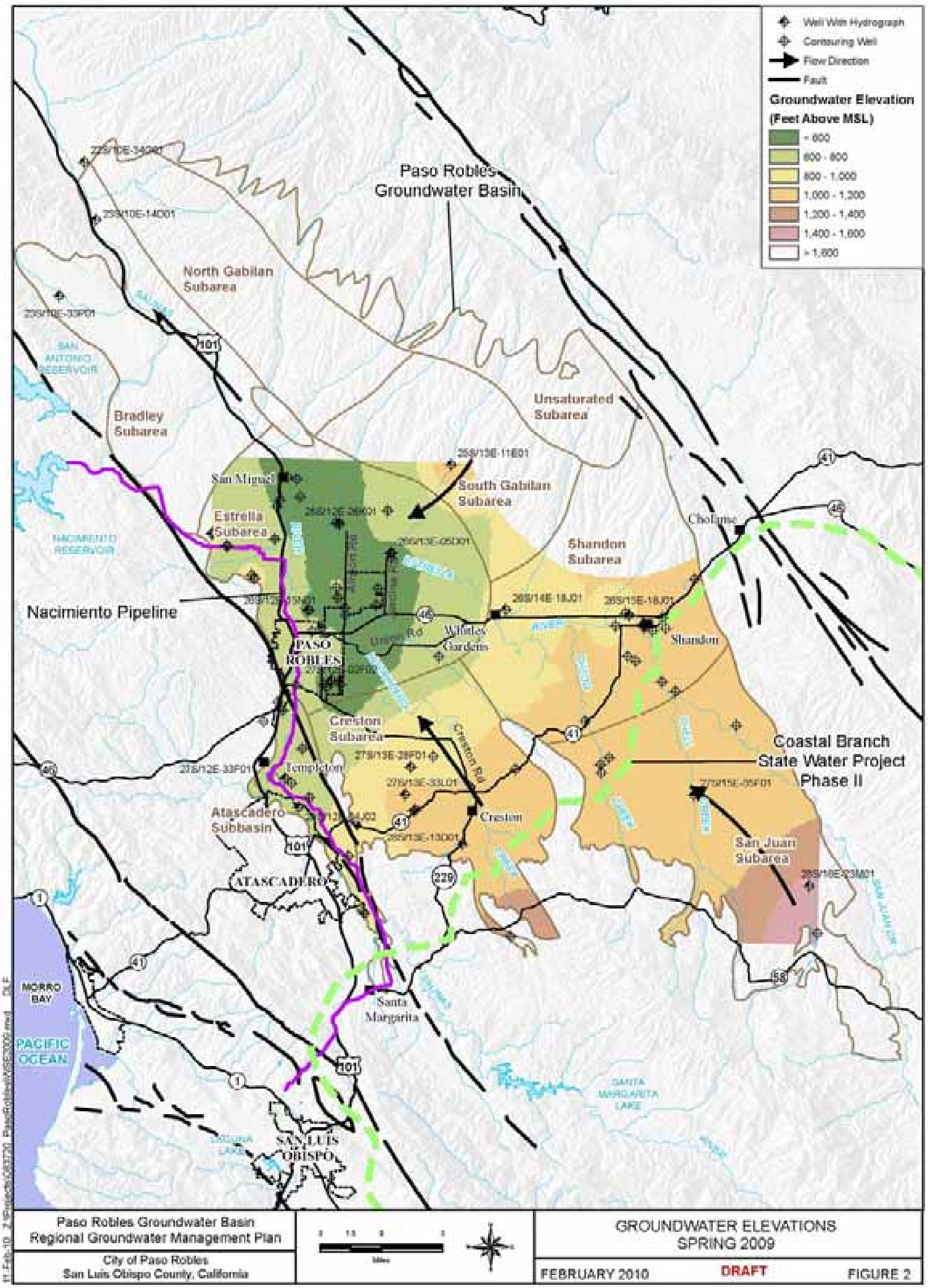

Figure 2. Spring 2009 Groundwater Levels in Paso Robles Groundwater Basin

Groundwater Levels

Several wells have been identified in the Creston Subarea to demonstrate how groundwater levels have changed through time (well hydrographs) at discrete locations in the subarea. These wells were selected to represent a range of the conditions in the subarea through an extended period of record. Figures 3 through 5 show the groundwater level trends in key wells in the Creston Subarea. The locations of these wells are shown on Figure 6. A brief discussion is provided for each well.

Well 27S/13E-28F01 – This well is located near the center of the greatest groundwater level decline as shown on Figure 6 and is considered to be just outside of the pumping depression that is centered on the Estrella Subarea. Over the 45-year period of record, spring groundwater levels in this well declined almost 60 feet. Since 1997, spring groundwater levels have declined almost 40 feet as shown on Figure 3. During this 12-year period, the rate of decline has averaged about 3 feet per year. The seasonal variation (difference between spring and fall observations) in groundwater levels is about 10 to 20 feet during this period.

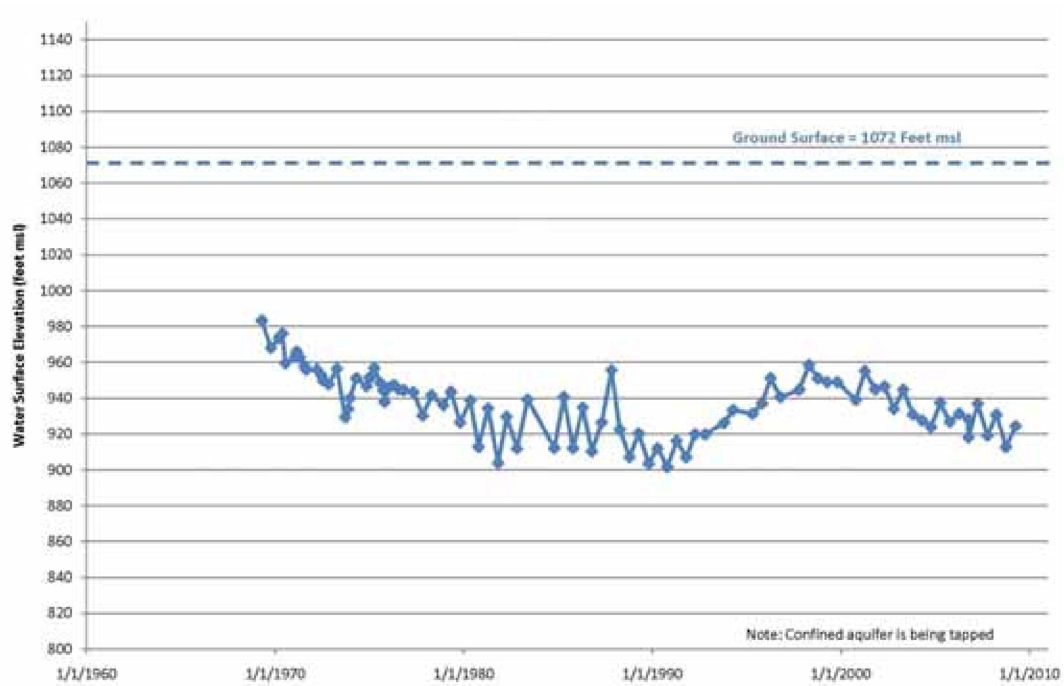

Figure 3. Hydrograph for Well 27S/13E-28F01

Well 27S/13E-33L01 – This well is located near the center of the greatest groundwater level decline as shown on Figure 6, and is considered to be on the southeast edge of the pumping depression that is centered in the Estrella Subarea. Over the 45-year period of record, the spring groundwater levels in this well declined about 40 feet as shown on Figure 4. During this 12-year period, the rate of decline of spring groundwater levels has averaged about 3 feet per year. The seasonal variation (difference between spring and fall observations) in groundwater levels is about 10 to 50 feet during this period.

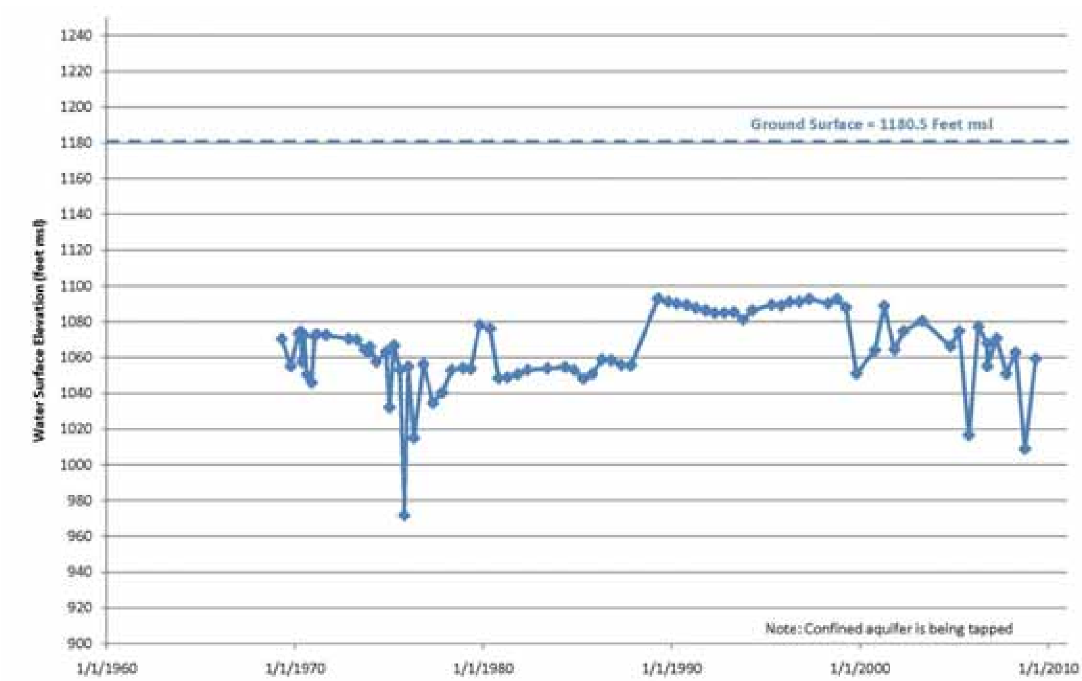

Figure 4. Hydrograph for Well 27S/13E-33L01

Well 28S/13E-13D01 – This well is located along Highway 229 as shown on Figure 6 and is considered to be in the portion of the subarea that is beyond the pumping depression. Over the 50-year period of record, spring groundwater levels in this well have been fairly constant, with no periods of decline as shown in Figure 5. The seasonal variation (difference between spring and fall observations) in groundwater levels ranges from less than10 feet to about 20 feet during this period.

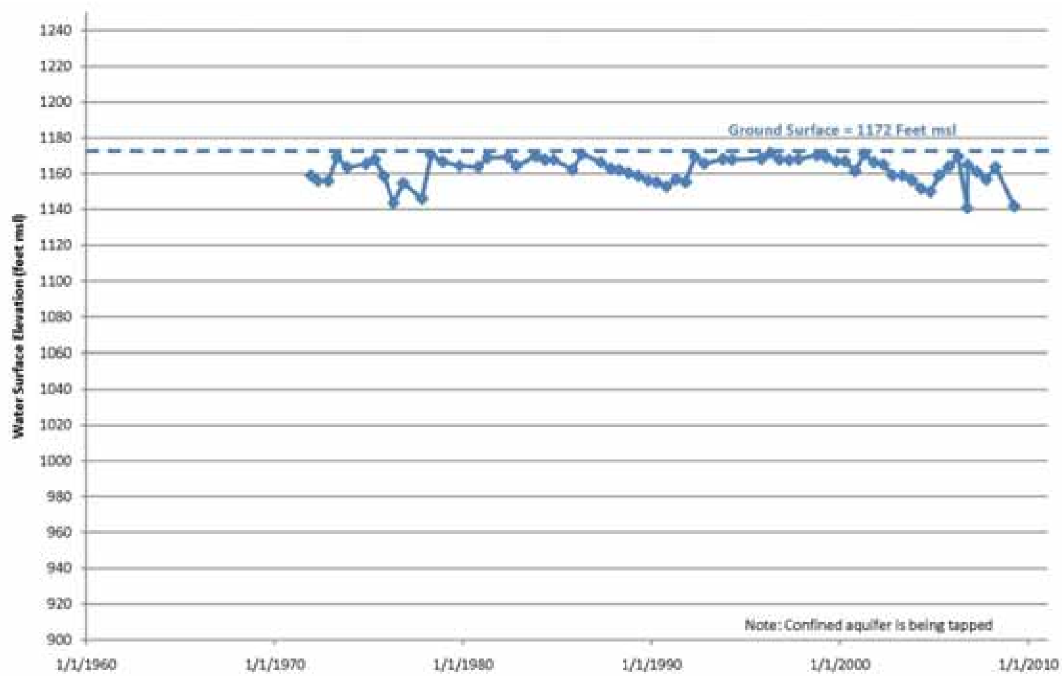

Figure 5. Hydrograph for Well 28S/13E-13D01

Change in Groundwater Storage

It should be noted that the lack of data in the northwest and northern portion of the Creston Subarea may not accurately represent the estimated decline in groundwater levels, and additional observations wells are needed to provide more complete mapping of the groundwater levels in this area.

For purposes of this discussion, groundwater level trends within Creston Subarea vary depending on location relative to Highway 41. Groundwater levels north of Highway 41 are represented by wells 27S/13E-28F01 and 27S/13E-33L01). Groundwater levels south of Highway 41 are represented by well 28S/13E-13D01.

Between 1970 and 1990 there was a decline in groundwater levels in wells northwest of Highway 41. Between 1990 and 2000, groundwater levels stabilized or increased. Since 2000, groundwater levels have fallen in response to increased groundwater pumping.

Groundwater levels south of Highway 41 have been relatively stable through the 1970 to 2000 period, but do show some declines since 2000.

Between 1997 and 2009 groundwater levels within the Creston Subarea have declined as shown on Figure 6. In the part of the subarea near the Estrella Subarea groundwater levels have declined by more than of 70 feet since 1997. Groundwater levels may continue to decline in this part of the subarea in the future even under ‘normal’ hydrologic conditions due to the high groundwater pumping rates.

Groundwater levels south and east of the pumping depression have experienced groundwater declines of 10 to 30 feet during the 1997 to 2009 period. Groundwater level declines in this area may be subject to below normal hydrologic conditions. Some of the recent, localized declining water levels may also be contributed to an increase in agricultural activities and rural ranchette population increases. Groundwater levels in the Creston Subarea have generally declined between 10 and 30 feet during this period.

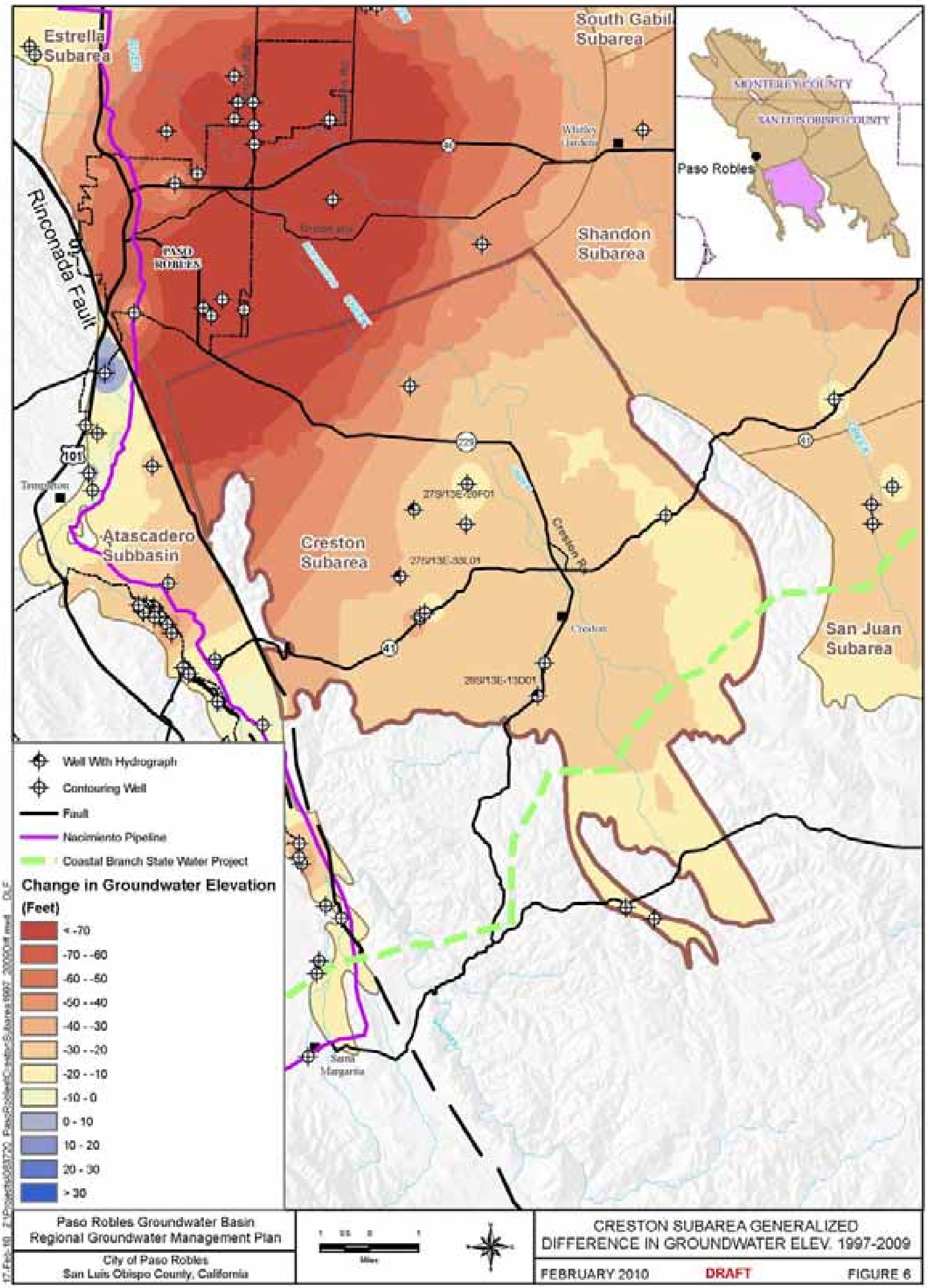

Figure 6. Change in Groundwater Levels in the Creston Subarea for the 1997 to 2009 Period

Groundwater Quality Information

Groundwater quality in the subarea is generally good to moderate for municipal use. Total dissolved solids (TDS), a measurement of the salts in the water, is typically used to assess water quality. For municipal purposes, the TDS should be less than 500 mg/l, but can be usable up to 1,000 mg/l.

The general mineral character of both surface water and groundwater in the Creston subarea is predominately calcium bicarbonate to calcium-sodium bicarbonate. The average shallow aquifer water TDS (excluding Section 14) is 240 mg/l, compared to an average of 450 mg/l in deeper aquifer zones.

Groundwater quality in the subarea (excluding Section 14) is generally suitable for irrigation without restriction, with slight to moderate restrictions for trees and vines in a few wells sampled due to sodium or chloride ion toxicity (Fugro and Cleath, 2002).

Highly mineralized sodium chloride water is documented locally in the shallow alluvial deposits of Section 14 (T27S/R13E; Old Geneseo School area). The cause of the mineralization is not known, but is not likely from the geothermal resource, which occurs as sodium bicarbonate water below depths of 500 feet in the area.

References

Fugro and Cleath, 2002. *Paso Robles Groundwater Basin Study,* August 2002

Fugro, 2010. *Paso Robles Groundwater Basin Balance Review and Update.* February 2010

Todd, 2009. *Evaluation of Paso Robles Groundwater Basin Pumping, Water Year 2006.* May 2009