An Overview of the Groundwater Flow and Chemistry of the Central Part of the Western San Joaquin Valley, California.

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Setting and Geology (Belitz, Heimes et al. 1990)

The San Joaquin Basin is an asymmetrical basin enclosed by the Sierra Nevada Mountains on the east, the Coast Ranges on the west, the Tehachapi Mountains on the south, and the San Francisco Bay-Delta region on the north. The Central Part of the Western San Joaquin Valley, as defined by the source report, is bounded by the San Joaquin River on the east the Coast Ranges on the west. The Pleistocene Corcoran Clay layer of the Tulare Formation divides the groundwater flow system into an upper semiconfined zone and a lower confined zone. Above the Corcoran Clay layer, three hydrogeologic units can be identified: Coast Range alluvium (marine), Sierran sand (micaceous), and flood-basin deposits.

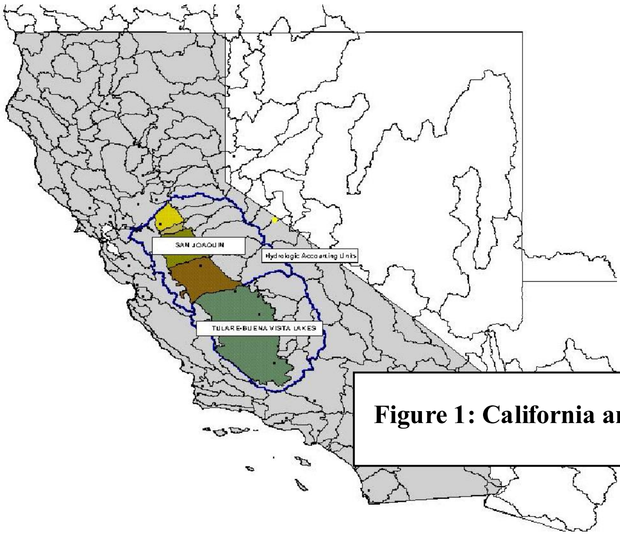

Figure 1: California and the San Joaquin Basin

The Coast Range alluvium is generally oxidized and range in thickness from 850 feet along the Coast Ranges to 0 feet closer to the valley's axis. These deposits range greatly in texture and permeability based on position along the alluvial fan. The Sierran sand is 400 to 500 feet thick in the valley center thins to west, as the alluvial deposits of Coast Ranges increase in thickness. The Sierran sand is reduced in the valley trough. Erosion through time has created a largely interfingered system in the valley of Sierran sand and Coast Range alluvium. The varied textual and geochemical properties of each have created a fairly complex situation.

The Corcoran Clay was formed as lake deposits of clayey silt, and creates a low permeability boundary of 20 to 120 feet in thickness, found 900 feet deep along the Coast Ranges and 400 feet in the valley trough.

Ground-water Flow System

The San Joaquin Valley is not the place that it once was. Human induced stresses have greatly altered the chemistry and flow regime of the region. Several major human activities should be noted for their influence: "percolation of irrigation water past crop roots, historical pumping from below the Corcoran Clay Member of the Tulare Formation, delivery of surface water, and installation of regional subsurface tile-drain system. This summary will focus on the pre-development groundwater flow system of the semiconfined zone.

Recharge was largely derived from infiltration of stream water from intermittent streams, and possibly from ephemeral streams of the Coast Ranges. None of these streams, flowing west to east, actually reach the San Joaquin River in the valley trough (the eastern boundary of the study area). Earlier studies estimated that recharge from the four major streams of the region accounts for about 40,000 acre-feet of recharge per year. The soil salinity data and the presence of low permeability mudflows in interfan areas have been used to infer that recharge was limited mostly to streams. Recent visitors to the valley will find it hard to imagine the extensive marshes and artesian wells that once predominated.

The ground-water gradients in the semiconfined zone were from the southwest to northeast, reflecting the topography of the region. Low rates of recharge contributed to a gradient of only 1 to 3 feet per miles. Other reports indicate similar features of the confined zone, although heads were about 10 to 20 feet lower in the confined zone along the Coast Ranges and 0 to 10 feet higher along the valley trough (Williamson, Prudic et al. 1989). Slug tests from another study reveal that hydraulic conductivity ranges from 10^{-4} to 10^{-5} ft/s for the Coast Ranges alluvium and from 10^{-3} to 10^{-4} ft/s for the Sierran sand (Belitz, Phillips et al. 1993).

The Upshot

The Central Part of the Western San Joaquin Valley is a complex hydrogeological setting that has been influenced greatly by anthropogenic activities, mostly for agriculture. This sub-region and the San Joaquin Basin as a whole are valuable resources for California and have an estimated usable groundwater supply of 80 million acre-feet (Department of Water Resources 1975). These groundwater resources are vital for agricultural, domestic (many cities from Bakersfield to Sacramento drink it), and for in-stream uses in the San Joaquin Basin. Despite its importance, the State of California has failed to remedy conditions of overdraft, more than one million acre-feet per year (Department of Water Resources 1998). Other serious issues affecting groundwater in the region are salinity, trace elements (e.g. selenium), and nutrient and pesticide contamination from agricultural activities (Domagalski 1992; Dubrovsky, Kratzer et al. 1995; San Joaquin Valley Drainage Implementation Program and University of California. Salinity/Drainage Task Force 2000). To ensure the longevity of these resources, the role of the State in groundwater management and the effect of agricultural activities on groundwater quality and flow should be examined.

References

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