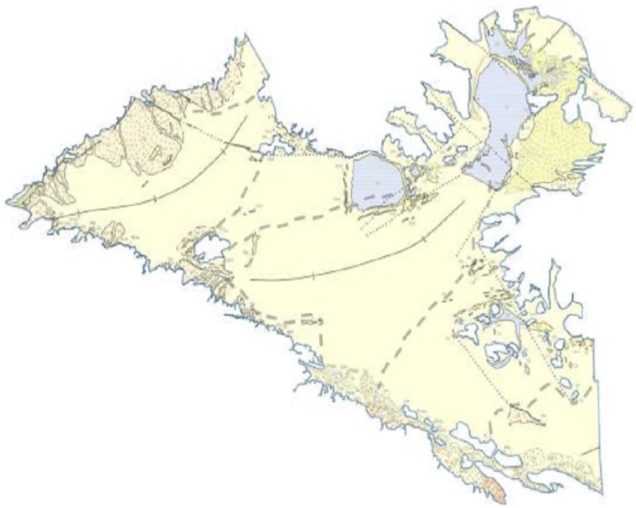
Summary Expert Report
Phase 3 – Basin Yield and Overdraft

Antelope Valley Area of Adjudication



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3.2 Inflows

3.2.1 Return Flows

Return flows, as used in this analysis, are the portion of the water applied on or near the ground surface that recharges the underlying aquifer. Return flows in the Antelope Valley occur from irrigated agriculture, and urban/M&I uses (i.e. landscape irrigation, recycled water and septic systems).

3.2.1.1 Return Flows Types

Agricultural Irrigation

Since the early 1900s about 17,600,000 acre-feet of groundwater has been applied to grow crops in the Antelope Valley (Table E3-1 and Appendix D). The portion of the applied irrigation water infiltrated past the root zone is the return flow. The irrigation return flow is a function of both the irrigation efficiency and the crop water requirement. Between 1919 and 2009, the total volume of irrigation water returned to the groundwater basin as return flow is about 5,000,000 acre-feet. Tables E3-1 and E3-2 summarize the historical irrigation water requirements and return flows for agricultural and M&I users. Estimates of the water applied for irrigation and irrigation return flows were developed by Luhdorff & Scalmanini and are described in detail in Appendix D. Table E3-3 contains the time history of estimated agriculture acreage, the total applied water requirement, the average unit water requirement, the total return flow, and the unit return flow. The total water applied for agriculture during the investigation period was about 12,400,000 acre-ft, averages about 225,000 acre-ft/yr, and range from a high of about 363,000 acre-ft/yr to a low of about 68,000 acre-ft/yr. Using a 15 year lag time, the total return flow from agriculture irrigation to the vadose zone during the investigation period is about 4,000,000 acre-ft, averages about 72,000 acre-ft/yr, and range from a high of about 109,000 acre-ft/yr to a low of about 15,000 acre-ft/yr.

Urban/Municipal and Industrial (M&I)

Urban/M&I return flows derive from outside irrigation, recycled water and septic system returns. Derivation of the return flow estimates for these areas are described in detail in Appendices D and G. Of the three sources of Urban/M&I return flows, only the outside irrigation is lagged. Using a 15 year lag time, the total return flow derived from irrigation during the investigation period is approximately 150,000 acre-feet, averages about 2,800 acre-ft/yr, and ranges from a high of about 8,000 acre-ft/yr to a low of about 800 acre-ft/yr. Recycled water and septic system effluent effectively reach the aquifer in the year applied. Over the investigation period the total recycled water return flow is about 133,000 acre-feet, averages about 2,000 acre-ft/yr, and ranges from a high of about 8,000 acre-ft/yr to zero during the beginning of the period. Septic system returns over the investigation period are about 460,000 acre-feet, average about 8,000 acre-ft/yr, and range from a high of about 20,000 acre-ft/yr to a low of about 1,000 acre-ft/yr. Table E3-1 summarizes all return flows on an annual basis.

3.2.1.2 Return Flow Lag Time

The return flows from irrigation (agriculture and Urban/M&I) may take many years to reach the phreatic zone. The length of time between the application of irrigation water and the arrival (at the water table) of irrigation water applied in excess of vegetative water requirements is referred to herein as lag time. This section describes the methods used to determine lag time and the results of the analysis. Return flows from non-agricultural recycled water and septic system discharge are not lagged in this analysis as the moisture content in the soil column beneath discharge sites becomes very high which leads to high vertical seepage velocities. For the purposes of this analysis, it is assumed that the portion of recycled water and septic system effluent that becomes deep percolation effectively reaches the phreatic zone in the year of application. The same would be true for any artificial recharge of water that is either long term or large relative to the area of application.

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