Section 3 | Issues and Needs

The purpose of this section is to identify the issues, needs, challenges and priorities for the Antelope Valley Region through the year 2035 related to water supplies and other resources. The section will assess the current and projected water demands of the Antelope Valley Region, which include agricultural and M&I demands on groundwater, imported water, and recycled water as well as an analysis of the current and projected supplies[1] needed to meet those demands. In addition, an assessment of the water quality issues and challenges affecting these sources will be presented. A discussion of the flood management, environmental resource management, and land use planning issues will be presented, as these issues affect the water supply and demand requirements within the Antelope Valley Region. Finally, the issues and needs resulting from climate change are discussed.

3.1 Water Supply Management Assessment

As development has increased the demand for both quantity and quality water in the Antelope Valley Region, the competition for available water supplies has also increased. Development of new water supplies and protection of existing water supplies, provision of proper infrastructure, and the need to maintain the groundwater levels are crucial to successfully meeting the future water demands within the Antelope Valley Region.

In order to assess the water supply for the Antelope Valley Region, a water budget was developed. Figure 3-1 presents a schematic of the water budget elements and their relationships. The main components of the water budget include demands, water entering, surface storage, groundwater storage, direct deliveries, recycle/reuse, and water leaving. Each of these components is discussed in more detail below.

[1] The analyses provided in the IRWM Plan are strictly for long-term planning purposes and have not been conducted to answer the questions being addressed within the adjudication.

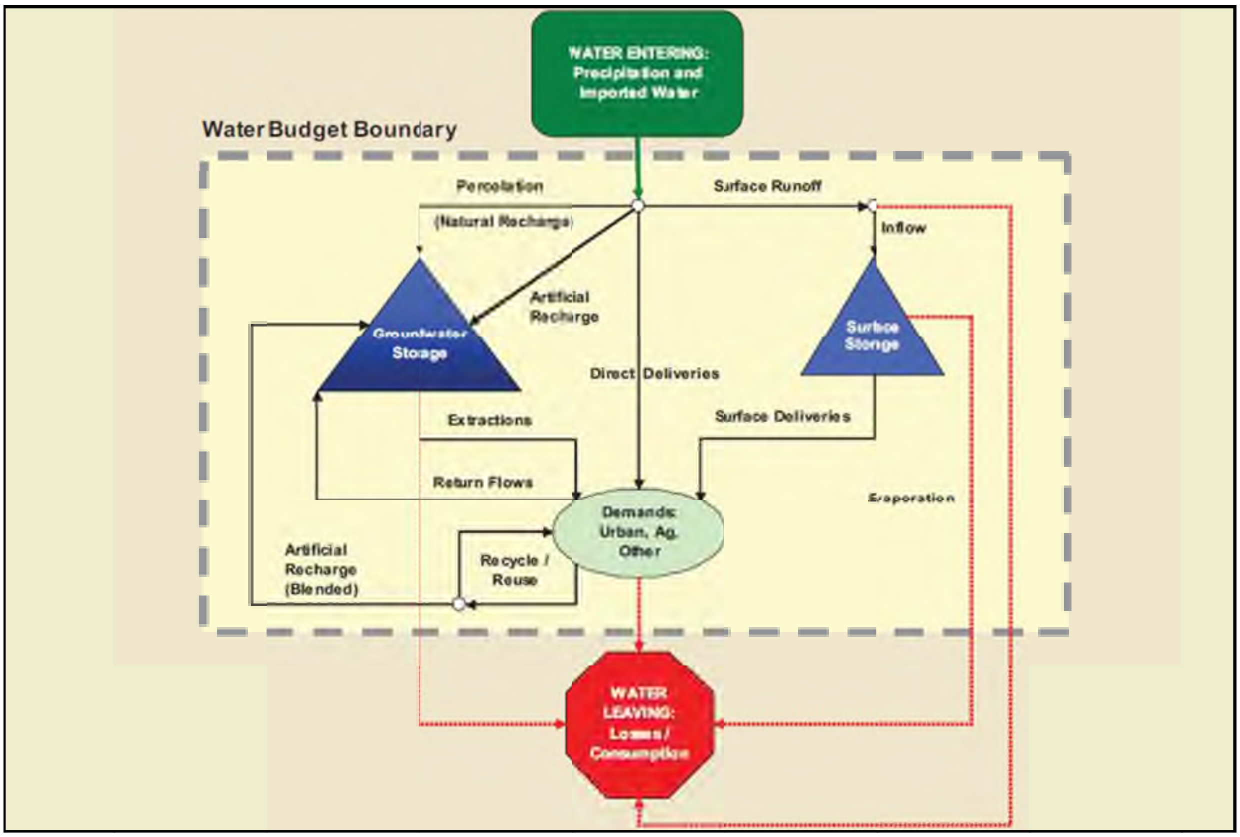
3.1.1 Water Entering

This component of the water budget includes sources of water from outside of the Antelope Valley Region entering the water budget boundary, such as precipitation and imported water.

3.1.1.1 Precipitation

As discussed in Section 2, the average annual precipitation for the Antelope Valley Region is approximately 7.5 inches per year. Precipitation entering the Antelope Valley Region is lost to evaporation (see Section 3.1.7), percolated to groundwater storage as natural recharge (see Section 3.1.6), or carried as runoff to surface storage (see Section 3.1.5).

Figure 3-1: Water Budget Schematic



Note: Some surface runoff provides water for environmental demands, including wetlands, clay pan/vernal pools, sand dune water sequestering, and dry lake bed resurfacing.

3.1.1.2 Imported Water

Imported water entering the Antelope Valley Region could come from a number of sources including the SWP, desalination, or transfers/exchanges with outside agencies. Currently, the only source of imported water to the Antelope Valley Region is SWP water. SWP water is used in the Antelope Valley Region for direct deliveries (see Section 3.1.2) or for artificial recharge to groundwater storage (see Section 3.1.6).

Imported Water Infrastructure

Imported water to the Antelope Valley Region is generally SWP water that is released from Lake Oroville into the Feather River where it then travels down the river to its convergence with the Sacramento River, the state's largest waterway. Water flows down the Sacramento River into the

Sacramento-San Joaquin Delta. From the Delta, water is pumped into the California Aqueduct. The Antelope Valley Region is served by the East Branch of the California Aqueduct. Water taken from the California Aqueduct by local SWP Contractors is then treated before distribution to customers.

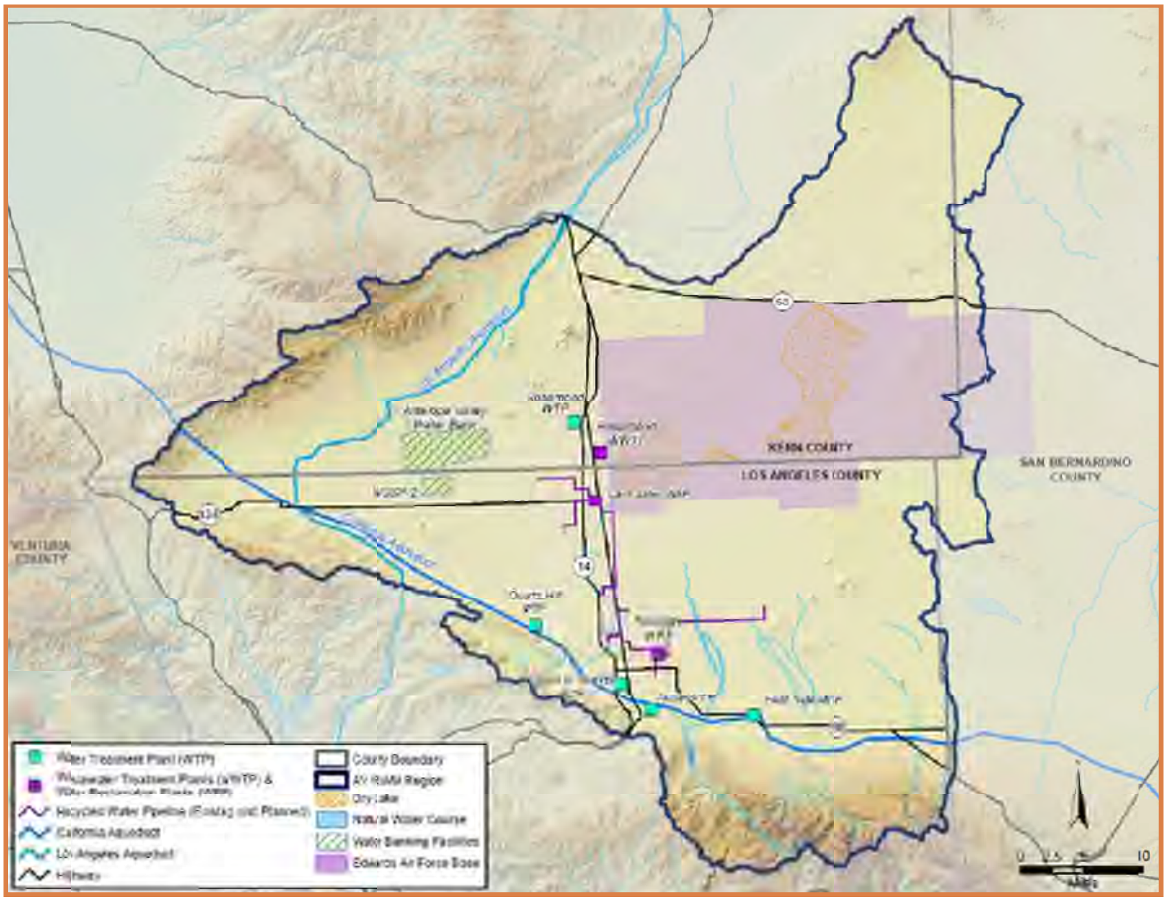
AVEK currently treats SWP water with four Water Treatment Plants (WTPs) that are capable of treating approximately 132,280 AFY of imported water. The main WTP, Quartz Hill WTP, is rated for 90 million gallons per day (mgd) (100,890 AFY). The Eastside WTP, expanded in 1988, provides a treatment capacity of 10 mgd (11,210 AFY). Rosamond WTP is a 14 mgd (15,695 AFY) capacity treatment plant. The fourth AVEK plant, Acton WTP, has a capacity of 4 mgd (4,484 AFY) and is located outside of the Antelope Valley Region boundaries. LACWD 40, QHWD, and RCSD all receive treated water from AVEK.

PWD's water treatment plant capacity is 35 mgd (39,235 AFY), but it is limited to treating 28 mgd (31,390 AFY) in accordance with the CDPH requirements to keep one filter offline in reserve (PWD 2001). Planned improvements at the plant will increase its treated output to 35 mgd. PWD is also in the preliminary design stage for a new water treatment plant with an initial capacity of 10 mgd.

LCID has an agreement with PWD to provide treatment for LCID's raw SWP water.

Major water-related infrastructure in the Antelope Valley Region is shown on Figure 3-2.

Figure 3-2: Major Infrastructure



Reliability

The amount of SWP supply that would be available for a given water demand is highly variable and depends on hydrologic conditions in northern California, the amount of water in SWP storage reservoirs at the beginning of the year, regulatory and operational constraints, and the total amount of water requested by contractors. The variability of SWP deliveries is described in the California DWR "Final 2011 SWP Reliability Report" (Reliability Report), the intent of which is to assist SWP contractors in assessing the reliability of the SWP component of their overall supplies.

In the Reliability Report, DWR presents the results of its analysis of the reliability of SWP supplies, based on model studies of SWP operations. In general, DWR model studies show the anticipated amount of SWP supply that would be available for a given SWP water demand, given an assumed set of physical facilities and operating constraints, based on 82 years of hydrology. The results are interpreted as the capability of the SWP to meet the assumed demand over a range of historic conditions for that assumed set of physical facilities and operating constraints. Although new facilities are planned to increase the water delivery capability of the SWP (such as delta improvements), the analyses contained in the Reliability Report assume no additional facilities. The effects of climate change were factored into the modeled future conditions.

The Reliability Report shows that existing SWP facilities will on average receive 61 percent of their full Table A Amount for current demand conditions and 60 percent of their full Table A Amount for 2031 demand conditions. This means that the SWP, using existing facilities operated under current regulatory and operational constraints, and with all contractors requesting delivery of their full Table A Amounts in most years, could deliver 60 percent of total Table A Amounts on a long-term basis. The Reliability Report also projects that SWP deliveries during multiple-year dry periods could average about 35 percent of total Table A Amounts and could possibly be as low as 9 percent during an unusually dry single year (the driest in 82 years of historical hydrology) according to DWR's 2011 modeling results. (DWR 2012b).

On August 31, 2007, a U.S. District Judge ruled that the SWP was in violation of the federal Endangered Species Act because it threatened the existence of the Delta smelt, a fish species living in the Sacramento Delta. To help protect the species, the Judge ordered water imports from the north to be cut by up to 35 percent from the SWP and the Central Valley Project, until the Biological Opinion for the species could be prepared. The U.S. Fish and Wildlife Service (USFWS) issued a Biological Opinion (BO) on the Long-Term Operational Criteria and Plan for the SWP and Central Valley Project on December 15, 2008, determining that the two water projects would likely jeopardize the continued existence of the species. The findings of this BO called for adaptively managed flow restrictions and have continued to influence pumping in the Delta despite ongoing debate and litigation. In 2009, the National Marine Fisheries Service (NMFS) issued a BO for winter-run and spring-run Chinook salmon and steelhead that put similar limits on pumping through part of the year and restrictions on total Delta exports during the months of April and May.

The SWP supply estimates in this IRWM Plan rely on the projections made in DWR's 2011 Reliability Report for future supply. DWR's projected supply estimates incorporate the restrictions set by both the USFWS and NMFS BOs, while acknowledging the challenge of accurately determining future water reliability as a result of adaptive management techniques and the potential for future changes in court rulings.

3.1.2 Direct Deliveries

Direct deliveries to the Antelope Valley Region consist of the SWP water contracted through AVEK, LCID, and PWD. The SWP is operated by DWR for the benefit of the SWP contractors. The SWP is the nation's largest state-built water and power development and conveyance system. The SWP includes 660 miles of aqueduct and conveyance facilities from Lake Oroville in the north to Lake Perris in the south. It also includes pumping and power plants, reservoirs, lakes, storage tanks, canals, tunnels, and pipelines that capture, store, and convey water to 29 water agencies.

The SWP is contracted to deliver a maximum 4.17 million AFY of Table A water to the 29 contracting agencies. Table A water is a reference to the amount of water listed in "Table A" of the contract between the SWP and the contractors and represents the maximum amount of water a contractor may request each year. AVEK, which is the third largest state water contractor, has a Table A Amount of 141,400 AFY. Approximately three (3) percent of AVEK's Table A deliveries have historically been supplied to AVEK customers outside of the Antelope Valley IRWMP Region boundary, leaving a maximum of about 137,150 AFY available for AVEK customers inside the IRWMP Region boundary.

By October 1st of every year, each contractor provides DWR a request for water delivery up to their full Table A Amount for the next year. Actual delivery from DWR may vary from the request due to variances in supply availability resulting from hydrology, storage availability, regulatory or operating constraints. When supply is limited, water is allocated based on a percentage of full contractual Table A Amounts.

A summary of the historical deliveries of SWP to the Antelope Valley Region are provided in Table 3-1. The table illustrates the Antelope Valley Region's increasing dependence on SWP water.

Table 3-1: Summary of Historical Wholesale (Imported) Supply (AFY) in the Antelope Valley Region

Year	AVEK Deliveries	AVEK Table A	PWD Deliveries	PWD Table A	LCID Deliveries	LCID Table A	Region Deliveries	Region Table A
1975	8,068	35,000	0	5,580	520	520	8,588	41,100
1980	72,407	69,200	0	11,180	191	1,150	72,598	81,530
1985	37,064	40,000	1,558	14,180	0	1,730	38,622	55,910
1990	47,206	132,100	8,608	17,300	1,747	2,300	57,561	151,700
1995	47,286	138,400	6,961	17,300	480	2,300	54,727	158,000
2000	83,577	138,400	9,060	21,300	0	2,300	92,637	162,000
2005	59,831	141,400	11,712	21,300	0	2,300	71,543	165,000
2010	57,713	141,400	10,969	21,300	0	2,300	68,682	165,000

Source: DWR 2012b

Future availability of the SWP water was estimated by DWR in its 2011 Reliability Report (2012b). For an average water year, it is anticipated that 61 percent of the Table A Amount in 2011 and 60 percent in year 2031 would be available for delivery to contractors. For a single dry water year, delivery of Table A water decreases to 9 percent for 2011 and 11 percent in year 2031. For a multi-dry water year, delivery of Table A water is estimated at 35 percent for 2011 and 34 percent in year 2031. For the purposes of this IRWM Plan, 2015 through 2035 deliveries were estimated at the 2031 delivery percentages. Maximum Table A water that could be available for the Region includes 137,150 AFY from AVEK (inside the IRWMP Region), 21,300 AFY from PWD, and 2,300 AFY from LCID.

In addition to SWP reliability constraints, AVEK is currently unable to beneficially apply its entire Table A amount of SWP water, even during years when the full Table A amount is available. This inability to fully use available supply is caused by the variability of demand during winter and summer and the limitations on existing infrastructure to receive, store, and deliver water to users. AVEK currently provides most of their water through direct deliveries to meet current demand (i.e., without storage). When demand is high during summer months, the aqueduct bringing water to AVEK has a conveyance capacity below the demand for water. Conversely, during the winter months, demand is much lower than aqueduct capacity. To accommodate the need to store water during the winter months for use in the dry summer months, AVEK has planned to use water banking projects to increase their ability to fully use the SWP allotment. AVEK and various partners recently completed the WSSP-2 that allows them to store up to 150,000 AF of water in the ground (as of late 2013, 35,000 AF is the total amount stored for all of the parties). Currently, the maximum withdrawal capacity in any one year is 20 mgd (approximately 23,000 AFY) and plans are underway to increase that annual withdrawal capacity to 50 mgd (approximately 56,000 AFY). Excess SWP water may be placed in the water bank during winter months when M&I demands are low (AVEK 2013).

To determine the most reasonable amount of available SWP water for AVEK, this analysis assumes that SWP reliability is limiting (i.e., not conveyance capacity). Without the WSSP-2 water bank, the conveyance capacity limitation would only allow AVEK to deliver 81,750 AFY. This estimate is based on 400 AF/day SWP deliveries from June 15 to September 30 that are limited by conveyance capacity and 150 AF/day SWP deliveries for the rest of the year that are limited by customer demands. This value is lower than 83,700 AFY, which is the value obtained by multiplying the SWP reliability factor of 61% to the available Table A amount of 137,150 AFY for AVEK customers inside the IRWMP Region. However, since these values are close (83,700 – 81,750 = 1,950), and since the WSSP-2 water bank is operational, this analysis assumes that the water bank can be used each year to supplement AVEK imported supplies in summer months to 61% of their Table A amount in 2010 and to 60% of their Table A amount in years 2015 through 2035.

Table 3-2 provides a summary of projected SWP availability to the Antelope Valley Region based on these assumptions.

Table 3-2: Summary of Projected Wholesale (Imported) Supply (AFY) in the Antelope Valley Region

	2010	2015	2020	2025	2030	2035
Maximum Table A	160,750	160,750	160,750	160,750	160,750	160,750
Average Year[(a)]	98,100	96,500	96,500	96,500	96,500	96,500
Reliability[(b)]	61%	60%	60%	60%	60%	60%
Single Dry Year[(c)]	14,500	17,700	17,700	17,700	17,700	17,700
Reliability[(b)]	9%	11%	11%	11%	11%	11%
Multi-Dry Year[(c)]	56,300	54,700	54,700	54,700	54,700	54,700
Reliability[(b)]	35%	34%	34%	34%	34%	34%

Notes: Numbers rounded to nearest 100 AFY.

(a) Assumes supply equivalent to the Antelope Valley Region's maximum Table A Amount (160,750 AFY) multiplied by the SWP reliability. This assumption relies on another assumption that conveyance constraints can be overcome by using the WSSP-2 water bank to supplement small amounts of water during an average year up to Table A amounts.

(b) Determined from DWR's Final 2011 "State Water Project Reliability Report" (DWR 2012b).

(c) Assumes supply equivalent to the Antelope Valley Region's maximum Table A Amount (160,750 AFY) multiplied by the SWP reliability. This assumption relies on another assumption that conveyance constraints can be overcome by using the WSSP-2 water bank to supplement small amounts of water during single dry year and multi-dry year periods.

3.1.3 Water Demands

The following subsection discusses the historical, current and projected water demands for the Antelope Valley Region. The demands are presented with urban demand (based on per capita estimates) and two agricultural scenarios (average and dry year estimates). Rainfall in the Region during average years typically reduces agricultural demands on imported supplies, therefore dry year agricultural demands are higher than average years. Projected water demands for the Antelope Valley Region are presented in Table 3-3 and graphically presented in Figure 3-3 and Figure 3-4. Later in this Section, water budgets are developed for the Region that compare average water years, dry water years, and multi-dry water years.

Table 3-3: Water Demand Projections (AF) for the Antelope Valley Region

	2010	2015	2020	2025	2030	2035
Urban Demand						
Boron	400	400	400	1,000	1,000	1,000
California City[(a)]	0	0	0	0	0	0
Edwards AFB	1,000	1,000	1,000	1,000	1,000	1,000
Mojave	1,000	1,000	1,000	1,000	1,000	1,000
North Edwards	200	200	200	200	200	200
Rosamond	4,000	4,000	4,000	5,000	5,000	5,000
Unincorporated Kern County	1,000	1,000	1,000	1,000	1,000	1,000
Lake Los Angeles	3,000	3,000	3,000	3,000	3,000	4,000
Lancaster	33,000	36,000	39,000	41,000	43,000	45,000
Littlerock	200	200	200	200	200	200
Palmdale	33,000	36,000	40,000	42,000	44,000	46,000
Quartz Hill	2,000	3,000	3,000	3,000	3,000	3,000
Sun Village	3,000	3,000	3,000	3,000	3,000	4,000
Unincorporated LA County	6,000	6,000	6,000	7,000	7,000	8,000
Total Urban Demand	87,000	95,000	103,000	108,000	113,000	118,000
Agricultural Demand						
Agricultural Demand Average Year	92,000	92,000	92,000	92,000	92,000	92,000
Agricultural Demand Dry Year	98,000	98,000	98,000	98,000	98,000	98,000
Total Region Average Year Demand	**179,000**	**187,000**	**195,000**	**200,000**	**205,000**	**210,000**
Total Region Dry Year Demand	**185,000**	**193,000**	**201,000**	**206,000**	**211,000**	**216,000**

Notes: All numbers rounded to nearest 1,000 AF (values below 500 AF were rounded to the nearest 100).
(a) California City has a population center outside the Region and only minimal population inside the Region.

Figure 3-3: Regional Average Year Water Demand

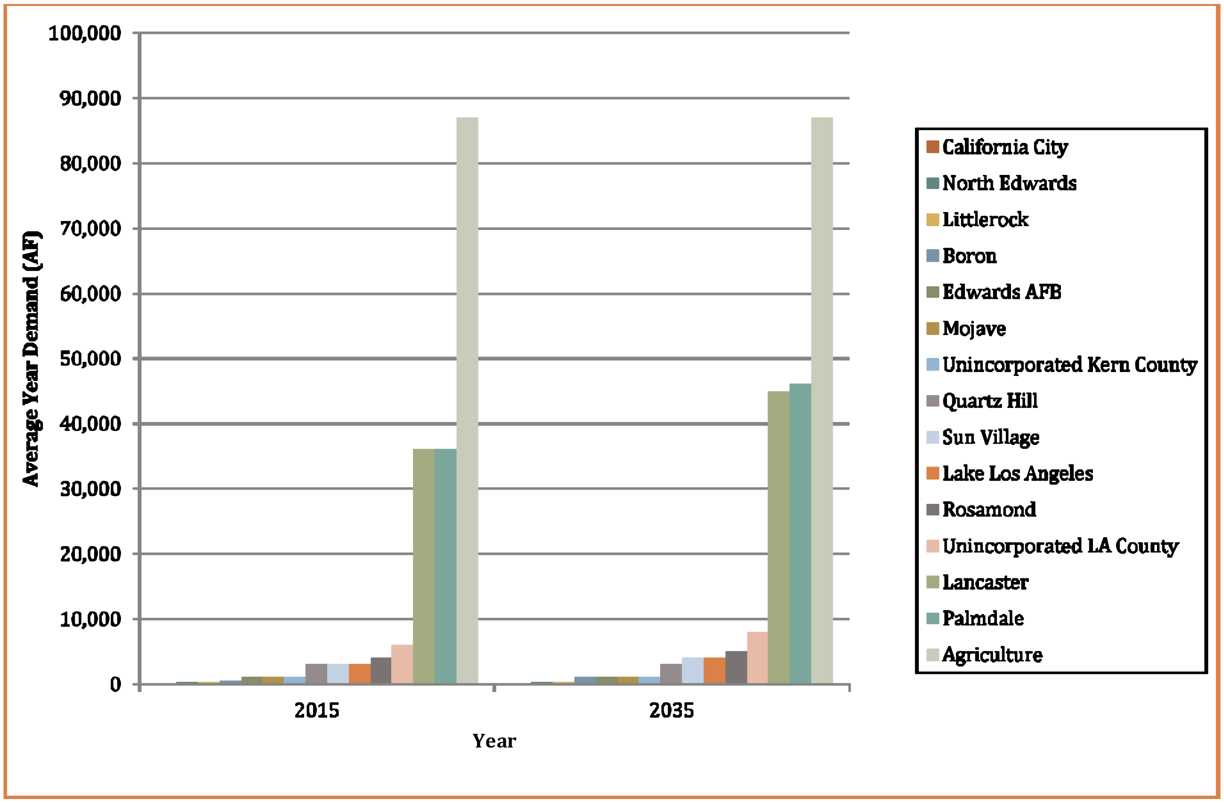
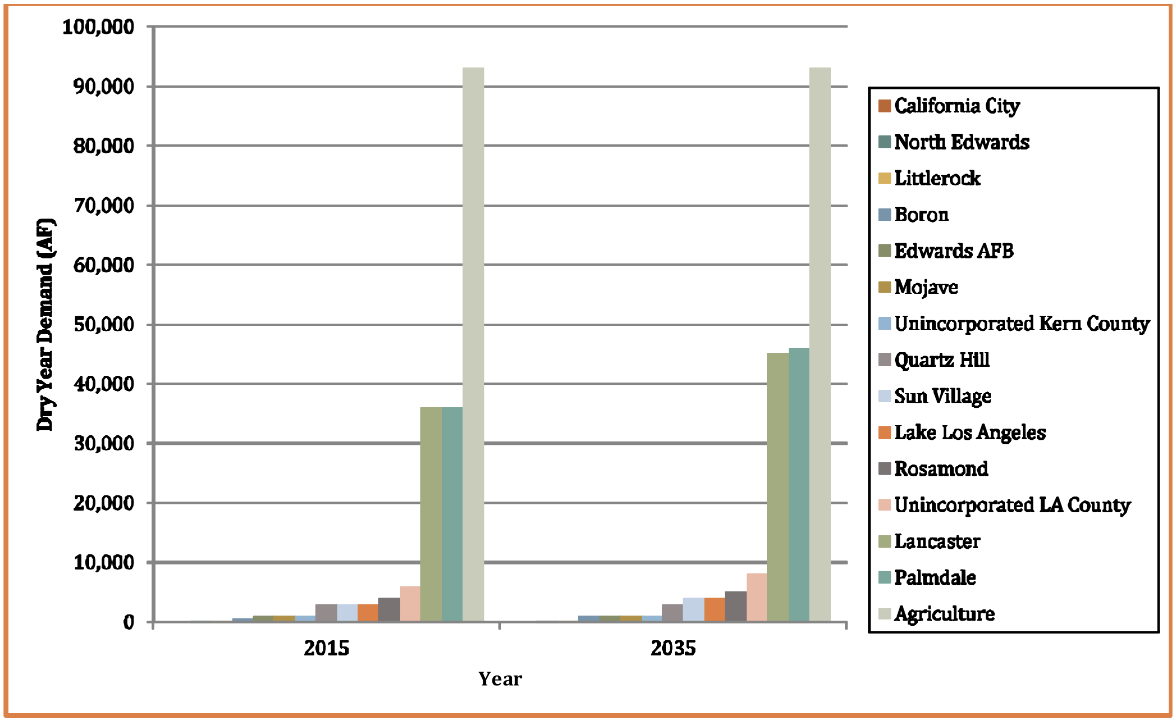


Figure 3-4: Regional Dry Year Water Demand



3.1.3.1 Urban (Municipal and Industrial) Demand

Urban water demands for 2010 were developed from the population projections presented in Table 2-3 (in Section 2) and utilize a regional water use per capita estimate of 199 gallons per day (gpd) per person (or 0.223 AFY per person). This per capita water use estimate was determined using a weighted average of total per capita water use estimates for the major water supply agencies in the Antelope Valley Region as shown in Table 3-4. As discussed in Section 2, growth rates within an agency are consistent and thus an average per capita water use is an appropriate estimate of demand. The rates of water use in areas that receive water from sources other than those included in Table 3-4 were assumed to have minimal impact on the average per capita rate and therefore were not included in the calculations to determine the average for the Region.

The per capita water use values could be reduced in the future with the implementation of more robust demand management measures. With the implementation of Senate Bill x7-7 in 2009, water suppliers have been required to reduce their average per capita daily water use rate by 20 percent from a baseline value by December 31, 2020. Each water purveyor may calculate their baseline per capita water use rate a number of ways. Whether an agency meets targets or not, they are required to design and implement water conservation programs to further reduce per capita consumption. With the implementation of these programs, it is expected that the average per capita water use in the Region will decrease. Once the next round of Urban Water Management Plans (UWMPs) are developed in 2015, the Region will have a better understanding of at the progress made on reducing per capita water demand.

Table 3-4: Per Capita Urban Water Use in the Antelope Valley Region

	2010 Population	2010 Urban Water Demand (AF)	Average per Capita Water Use (AFY/person)
AVEK (excluding purveyors)[(a)]	84,000	15,000	0.181
LCID[(b)]	3,000	1000	0.310
LACWD 40[(c)]	172,000	46,000	0.265
PWD[(d)]	109,000	20,000	0.181
QHWD[(d)]	18,000	6,000	0.314
RCSD[(d)]	18,000	3,000	0.170
Total	403,000	90,000	
Regional Average Per Capita Water Use (AFY/person)			0.223

Notes: All numbers rounded to the nearest 1,000. Numbers do not include private well owners. It is assumed that the demand and population numbers reported in the UWMPs provide an approximate per capita estimate for the Region.
(a) As determined from data in the AVEK's 2010 UWMP. Values exclude population and demand numbers for LCID, LACWD 40, PWD, QHWD, and RCSD that fall inside the AVEK service area.
(b) Values exclude LCID agricultural demand. Demand verified by personal communication with Brad Bones at LCID on August 21, 2013. Population sizes from the Annual CDPH Drinking Water Program Report.
(c) Population size from the Annual CDPH Drinking Water Program Report. Water demand based values from the Antelope Valley 2010 Integrated UWMP, based on land use.
(d) Based on values provided in the 2010 UWMPs and 2009 actual water use.
(e) Antelope Valley Region per capita water use was determined by dividing total water demand by total population. These numbers do not include private well owners.

3.1.3.2 Private Pumping/Small Mutual Water Demand

Water demands from private pumping and from small mutual water companies in the Antelope Valley Region are difficult to quantify as accurate data is not readily available. These demands were accounted for in Table 3-3 since people served by private wells and by small mutual water companies were included in the population projections. The Antelope Valley Region average per capita water use that was estimated in Table 3-4 was assumed to represent these populations.

3.1.3.3 Agricultural Water Demand

Historical total applied agricultural water demand (1999 to 2012) for the Antelope Valley Region is summarized in Table 3-5. Historical agricultural demand was determined by multiplying estimated crop water requirements from the County Farm Advisors by the crop acreages provided by the Los Angeles and Kern County Agricultural Commissioners' Inspection Reports. The crop water requirements are discussed in more detail below.

Prior to 2000, an accounting of the agricultural acreage within the Kern County portion of the Antelope Valley Region was not available. For the 2007 IRWMP, it had been assumed that Kern County agricultural groundwater demand was 18 percent of Los Angeles County agricultural groundwater demand. The 18 percent was determined by the USGS in 2003 from land use maps and agricultural pumpage data for Los Angeles County in 1961 and 1987. For the 2013 IRWMP Update, recent data from the Kern County Farm Bureau were used in the calculations in lieu of the 18 percent estimate.

Table 3-5: Historical Agricultural Water Use in the Antelope Valley Region

Year	Los Angeles County Ag Demand (AF)	Kern County Ag Demand (AF)	Total Ag Demand (AF)
1999	97,000	35,000	132,000
2000	109,000	36,000	145,000
2001	101,000	37,000	138,000
2002	105,000	39,000	144,000
2003	110,000	34,000	144,000
2004	104,000	27,000	131,000
2005	98,000	29,000	127,000

Note: Numbers rounded to the nearest 1,000 AF and assume average water year crop requirements.

Crop Water Requirements

Crop water use in the Antelope Valley Region can vary significantly from State-wide averages due to the unique requirements presented by the Antelope Valley Region's climate and physical characteristics, including low rainfall, sandy soils, and heavy winds. Thus, it is appropriate to develop crop water requirements specific to the Antelope Valley Region.

The first step in determining the crop water requirements involves determining the evapotranspiration for each crop (ETc) using the following equation:

$$ETc = Kc * ETo$$

Where Kc is the crop coefficient and ETo is the reference evapotranspiration.

An estimate of the ETo for Lancaster was developed based on data from the California Irrigation Management Information System (CIMIS) weather station in Palmdale, CA and historical water use ETo values for Palmdale. The Kc varies with the crop, its stage of development, and the frequency of irrigation; but it is independent of the location. Crop coefficients were adapted from a variety of published reports. The crop coefficients are presented in Table 3-6.

Table 3-6: Crop Coefficient (Kc) Estimates

Date	Pasture	Alfalfa[(a)]	Sudan[(b)]	Sod	Onions	Deciduous Fruit Trees[(c)]	Carrots	Potatoes
1-Jan	1.0	0.40		1.0				
15-Jan	1.0	0.40		1.0				
1-Feb	1.0	1.00		1.0			0.31	
15-Feb	1.0	1.15		1.0			0.31	
1-Mar	1.0	1.15		1.0	0.30	0.25	0.31	0.55
15-Mar	1.0	1.05		1.0	0.30	0.54	0.55	0.61
1-Apr	1.0	1.05		1.0	0.30	0.60	0.82	0.88
15-Apr	1.0	1.05		1.0	0.53	0.66	1.03	1.16
1-May	1.0	1.05		1.0	0.83	0.72	1.11	1.21
15-May	1.0	1.05		1.0	1.14	0.79	1.13	1.19
1-Jun	1.0	1.05		1.0	1.14	0.84	1.05	0.87
15-Jun	1.0	1.05	0.3	1.0	1.14	0.86	1.00	0.55
1-Jul	1.0	1.05	0.85	1.0	1.04	0.92		
15-Jul	1.0	1.05	1.10	1.0	0.92	0.94		
1-Aug	1.0	1.05	0.85	1.0	0.80	0.94		
15-Aug	1.0	1.05	1.10	1.0	0.68	0.94		
1-Sep	1.0	1.05	0.85	1.0		0.94		
15-Sep	1.0	1.05	1.00	1.0		0.91		
1-Oct	1.0	1.05	1.10	1.0		0.85		
15-Oct	1.0	1.05	1.10	1.0		0.79		
1-Nov	1.0	1.05		1.0		0.70		
15-Nov	1.0	0.40		1.0				
1-Dec	1.0	0.40		1.0				
15-Dec	1.0	0.40		1.0				

Sources: Hansen, B.R.; Shwannkl, L.; and Fulton, A. "Scheduling Irrigation: When and How much Water to Apply," Water Management Series Publication Number 3396, Department of Land, Air & Water Resources, University of California, Davis.
Pruitt, W.O.; Fereres, E.; Kelta, K.; and Snyder, R.L., "Reference Evapotranspiration (ETo) for California," UC Bull. 1922.
Notes:
(a) Kc of 1.05 takes into account reduced ETo during the cuttings throughout the season.
(b) Sudan was cut on 7/1, 8/16, and 10/16. ETo reduced for 1 to 2 weeks after cutting.
(c) Deciduous Fruit Tree Crop Coefficient were adapted from Orloff, S.B., "Deciduous Orchard Water Use: Clean Cultivated Trees for a Normal Year in Littlerock," Local Extension Publication.

Table 3-7 provides the ETc estimates for the Antelope Valley Region. The ETc is an estimate of the net water requirements for a crop (i.e., the amount of water) that is required for proper plant growth. Additionally, there are net water requirements for the crop which occur outside of the growing season. These include water applied to prepare the soil for planting, fumigation, and to prevent wind erosion. The sum of the ETc and these non-growing water requirements consist of the overall net crop requirement. The net water requirement does not account for water losses from inefficient irrigation systems, deep percolation, or runoff. In order to determine the gross water requirement, or the total amount of water which must be applied to the crop, the following calculation is used:

Gross Water Requirement = Net Water Requirement/Irrigation System Efficiency

Table 3-7: Crop Evapotranspiration (ETc) Estimates for the Antelope Valley Region

Date	Pasture/Sod ETo(a)	Alfalfa	Sudan	Sod	Onions	Deciduous Fruit Trees	Carrots	Potatoes
1-Jan	0.84	0.34	0.00	0.84	0.00	0.00	0.00	0.00
15-Jan	0.98	0.39	0.00	0.98	0.00	0.00	0.00	0.00
1-Feb	1.24	1.24	0.00	1.24	0.00	0.00	0.38	0.00
15-Feb	1.65	1.90	0.00	1.65	0.00	0.00	0.51	0.00
1-Mar	2.21	2.54	0.00	2.21	0.66	0.55	0.69	1.22
15-Mar	2.86	3.00	0.00	2.86	0.86	1.54	1.57	1.74
1-Apr	3.10	3.26	0.00	3.10	0.93	1.86	2.54	2.73
15-Apr	3.35	3.52	0.00	3.35	1.78	2.21	3.45	3.89
1-May	3.56	3.74	0.00	3.56	2.95	2.56	3.95	4.31
15-May	4.23	4.44	0.00	4.23	4.82	3.34	4.78	5.03
1-Jun	4.42	4.64	0.00	4.42	5.04	3.71	4.64	3.85
15-Jun	4.63	4.86	1.39	4.63	5.28	3.98	4.63	2.55
1-Jul	4.69	4.92	3.99	4.69	4.88	4.31	0.00	0.00
15-Jul	4.89	5.13	5.38	4.89	4.50	4.60	0.00	0.00
1-Aug	4.30	4.52	3.66	4.30	3.44	4.04	0.00	0.00
15-Aug	4.00	4.20	4.40	4.00	2.72	3.76	0.00	0.00
1-Sep	3.21	3.37	2.73	3.21	0.00	3.02	0.00	0.00
15-Sep	2.68	2.81	2.68	2.68	0.00	2.44	0.00	0.00
1-Oct	2.21	2.32	2.43	2.21	0.00	1.88	0.00	0.00
15-Oct	1.83	1.92	2.01	1.83	0.00	1.45	0.00	0.00
1-Nov	1.43	1.50	0.00	1.43	0.00	1.00	0.00	0.00
15-Nov	1.10	0.44	0.00	1.10	0.00	0.00	0.00	0.00
1-Dec	0.98	0.39	0.00	0.98	0.00	0.00	0.00	0.00
15-Dec	0.90	0.36	0.00	0.90	0.00	0.00	0.00	0.00
TOTAL (inches)	65.29	65.76	28.66	65.29	37.86	46.26	27.15	25.31

Note:
(a) Pasture ETo from the California Irrigation Management Information System (CIMIS), Palmdale Station 197 from January to December 2012.

The irrigation system efficiency used in this study, 75 percent, was developed from field observations by the University of California researchers and the Natural Resources Conservation Service (NRCS). Irrigation efficiency is the ratio of irrigation water used in evapotranspiration to the water applied or delivered to a field or farm. Greater controls are utilized by agricultural operations that use recycled water that justify higher irrigation efficiencies (discussed later in this document).

A summary of the crop water requirements is presented in Table 3-8. The crop water requirements for a single dry year and multi-dry years are the same. It is assumed that approximately 3 inches of net water demand would be met by rainfall for average water years and thus average year water requirements include a reduction in the total net water requirements.

Table 3-8: Crop Water Requirements for the Antelope Valley Region

Water Requirements	Pasture	Alfalfa	Sudan	Sod	Onions	Deciduous Fruit Trees	Carrots	Potatoes
Net ETo	65.29	65.76	28.66	65.29	37.86	46.26	27.15	25.31
Net Soil					3.54		4.46	
Net Non-Growing	0	2.00[a]	4	4	6.00[b]	0	6.50[b]	4
Total Net Dry Years (in.)	65.29	67.76	32.66	69.29	47.40	46.26	38.11	29.31
Total Net Average Years[c] (in.)	62.29	64.76	29.66	66.29	44.40	43.26	35.11	26.31
Irrigation Efficiency (%)	75	75	75	75	75	75	75	75
Total Gross for Dry Years (in.)	87.05	90.34	43.55	92.39	63.20	61.68	50.81	39.08
Total Gross for Dry Years (AF/acre)	7.25	7.53	3.63	7.70	5.27	5.14	4.23	3.26
Total Gross for Avg. Years (in.)	83.05	86.34	39.55	88.39	59.20	57.68	46.81	35.08
Total Gross for Average Years (AF/acre)	6.92	7.20	3.30	7.37	4.93	4.81	3.90	2.92

Notes:
(a) Assumes a 5-year life of an alfalfa stand. Includes the water requirement for pre-irrigation before field preparation and planning, and irrigation before and after application of herbicides.
(b) Includes water requirements for pre-irrigation before field preparation, fumigation, and "water capping" after fumigation.
(c) It is assumed that approximately 3 inches of net water demand would be met by rainfall for average water years and thus average year water requirements include a reduction in the total net water requirements.

Crop Acreages

Data regarding crop acreages in the Antelope Valley Region was available from the Los Angeles County and Kern County Commissioner Crop Reports. Table 3-9 provides a comparison of historical crop acreages in the Antelope Valley Region.

Table 3-9: Comparison of the Historical Crop Acreages

	1999	2000	2001	2002	2003	2004	2005	2010
Ag Commissioner[a]								
Field Crops	NA	NA	11,592	11,234	11,305	10,624	11,975	13,080
Vegetable/Root Crops	NA	NA	12,282	15,804	14,763	13,312	10,760	4,906
Fruits/Nut/Grapes Crops	NA	NA	2,866	1,947	1,955	1,920	2,117	603
Misc Nursery	NA	NA	621	617	599	608	675	450
Antelope Valley Region Total	—	---	27,361	29,602	28,622	26,464	25,526	19,040

Notes:
(a) Acreages for Kern County were estimated using the ratios of LA County Ag to Kern County Ag from the Inspection Reports (from 2007 IRWMP).

Projected Agricultural Demand

Projected water year agricultural demand is summarized in Table 3-10. Projections assume that crop acreages will remain approximately the same as in 2012 with the understanding that some shifting of acreages between crops may occur. Table 3-10 provides the estimates of agricultural water use for average and dry water years.

Table 3-10: Agricultural Water Use in the Antelope Valley Region

		Average Water Year		Dry Water Years	
Crop	Acreage[(a)]	Gross Crop Water Requirements (AF/acre)[(b)]	Gross Water Demand (AFY)[(c)]	Gross Crop Water Requirements (AF/acre)[(b)]	Gross Water Demand (AFY)[(c)]
Field Crops					
Alfalfa Hay	5,370	7.20	38,700	7.53	40,400
Grain Hay	7,160	3.30	23,600	3.63	26,000
Sudan Hay	300	3.30	1,000	3.63	1,100
Irrigated Pasture	250	6.92	1,700	7.25	1,800
Other Crops					
Onions	1,142	4.93	5,600	5.27	6,000
Fruits/Nuts/Grapes	603	4.81	2,900	5.14	3,100
Root Crops	3,764	3.90	14,700	4.23	15,900
Misc. Nursery (mostly sod)	450	7.37	3,300	7.70	3,500
Total Projected Ag Demand (AFY)	19,000		92,000		98,000

Notes: Totals rounded to the nearest 1,000 AF.
(a) Data from Los Angeles and Kern County Commissioner Reports. Acreage does not include land cultivated for recycled water purposes.
(b) From Farm Advisor gross crop water requirements specific to Antelope Valley Region.
(c) Acreage multiplied by crop water requirements.

3.1.4 Recycle/Reuse

3.1.4.1 Recycled Water Sources

Recycled water in the Antelope Valley is available from three primary sources: (1) the Lancaster WRP, (2) the Palmdale WRP, and (3) the Rosamond Wastewater Treatment Plant (WWTP). All three plants treat wastewater to a tertiary level. Since the RWMG prioritized the need to maximize beneficial use of water supplies within the Antelope Valley Region, proposed recycled water users served by these WRPs have been included below for discussion purposes, but only existing recycled water users are included in the Water Budget estimates for this Plan. Significant investments have been made to expand and upgrade the treatment plants to develop these recycled water supplies. Figure 3-5 shows the locations of the facilities and proposed infrastructure necessary to provide the recycled water quantities shown in Table 3-11.

EAFB has two treatment plants that distribute recycled water to the base. These include the EAFB Air Force Research Laboratory Treatment Plant which is a secondary wastewater treatment plant that discharges all its effluent to the evaporation ponds at the base.

The second plant is the EAFB Main Base WWTP which produces tertiary treated effluent for landscape irrigation at the base golf course with excess effluent discharged to the evaporation ponds when irrigation demand is low. Recycled water from these plants is not included in supply and demand calculations since all water is used on the base.

Table 3-11 provides a summary of the projected availability of the recycled water to the Antelope Valley Region through 2035.

Table 3-11: Potential Availability of Recycled Water (AFY) to the Antelope Valley Region

	2012	2015	2020	2025	2030	2035
Lancaster WRP[(a)(b)]	10,000	11,000	13,000	14,000	16,000	17,000
Palmdale WRP[(a)]	10,000	11,000	12,000	12,000	13,000	13,000
Rosamond WWTP[(c)]	---	1,000	1,000	1,000	1,000	1,000
Total Study Area	20,000	23,000	26,000	27,000	30,000	31,000

Notes: Totals rounded to the nearest 1,000 AF.
(a) Source: LACSD communication in December 2013.
(b) LWRP water availability excludes water used for environmental maintenance.
(c) Source: Rosamond 2010 UWMP, Table 6-3.

Recycled Water Infrastructure

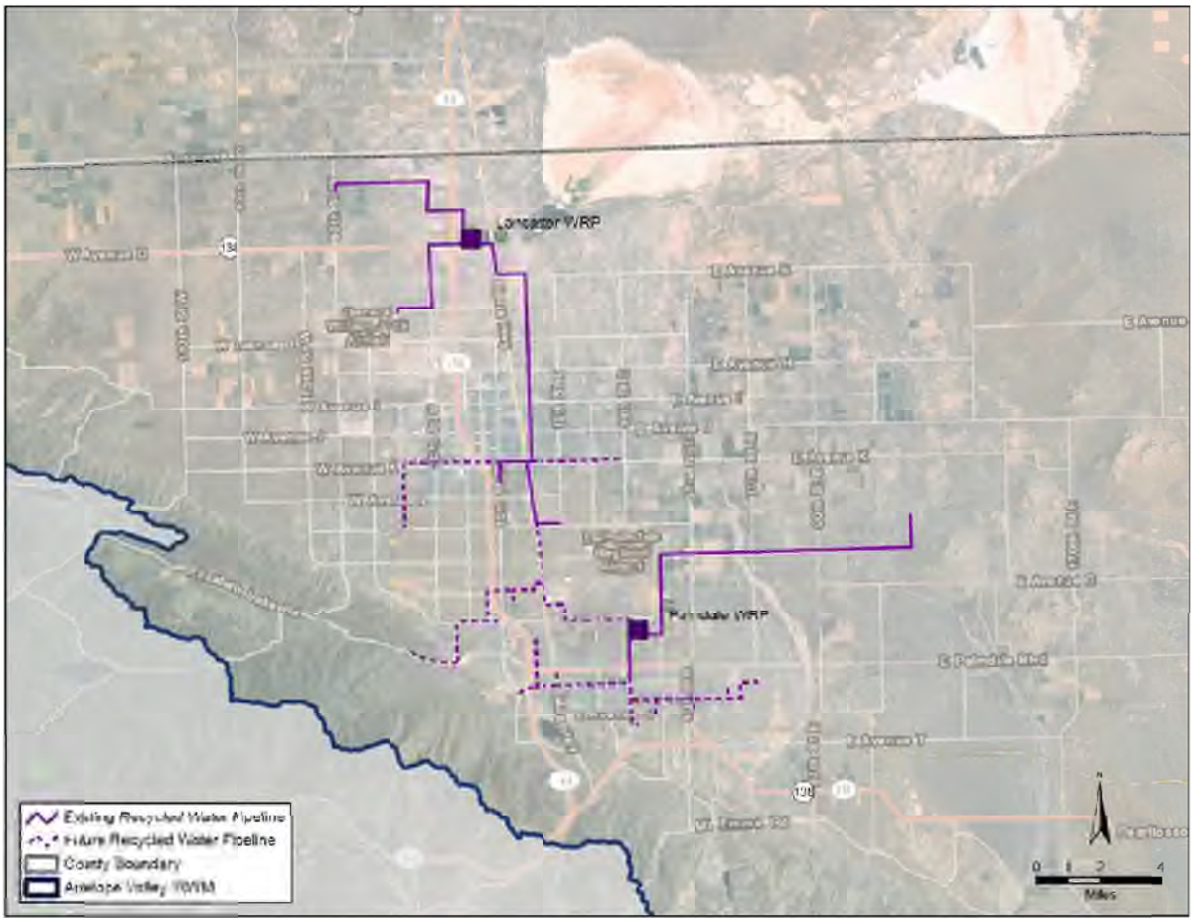
Distribution Pipeline: As shown in Figure 3-5, the recycled water distribution system in Lancaster, which serves sites such as Apollo Lakes, has been expanded for urban reuse as part of the Division Street Corridor Project. Figure 3-5 also shows the LACWD 40 Recycled Water Backbone distribution pipeline which is intended to further expand urban reuse in the Antelope Valley Region. This expansion throughout the Antelope Valley Region is a direct result of the substantial coordination and cooperation between Kern and Los Angeles Counties.

Lancaster WRP: The Lancaster WRP, built in 1959 and located north of the City of Lancaster, is owned, operated, and maintained by Los Angeles County Sanitation District No. 14. The Lancaster WRP, which has a permitted capacity of 18.0 mgd, treated an average flow of 14.1 mgd in 2012 to tertiary standards for agricultural and landscape irrigation, municipal and industrial (M&I) reuse, wildlife habitat, maintenance, and recreation. Recycled water produced at the Lancaster WRP and accounted for in the environmental maintenance and recreation reuse at Apollo Community Regional Park and Piute Ponds is not included in the potential availability (Table 3-11), since these flows will not likely be available for other M&I use in the Region.

Palmdale WRP: The Palmdale WRP, built in 1953 and located on two sites adjacent to the City of Palmdale, is owned, operated, and maintained by LACSD 20. Palmdale WRP, which has a permitted capacity of 12.0 mgd. The plant treated an average flow of 9.04 mgd in 2012 to tertiary standards. All tertiary treated water is used for agricultural and M&I reuse.

Rosamond WWTP: The Rosamond WWTP, located in the City of Rosamond, is owned, operated, and maintained by the RCSD. Rosamond WWTP, currently has a permitted capacity of 2.0 mgd. RCSD has recently increased the capacity to 2.5 mgd. The expansion will help supplement the existing tertiary treatment and disposal facility. The expanded plant is expected to be permitted in the fall of 2013 at which time it will be fully operational. The tertiary treated recycled water will be provided for landscape irrigation at median strips, parks, schools, senior complexes and new home developments.

Figure 3-5: Proposed Recycled Water Infrastructure



Reliability

Recycled water is assumed to be 100 percent reliable since it is based on a consistent water supply and is not expected to change for average, single-dry, or multi-dry year water conditions. Use of recycled water as a supply is limited more by recycled water infrastructure and demand for recycled water than reliability of such water as a supply.

3.1.4.2 Recycled Water Demand

Table 3-12 summarizes the existing and projected recycled water demand as listed in the 2014 SNMP for the Antelope Valley (Appendix G). While expanded recycled water use in the Antelope Valley Region is highly likely, only current recycled water uses are included in this IRWM Plan's supply and demand calculations to show the need for increased end use of recycled water supply. Recycled water used for environmental and recreational area maintenance at Piute Ponds and Apollo Community Regional Park is not included in demands since it was excluded from the recycled water availability in Table 3-11. Current M&I recycled water use for both the Lancaster and Palmdale WRPs is approximately 82 AFY. Approximately 3 AFY was used in 2010.

Current demands for recycled water include those for the North LA/Kern County Regional Recycled Water Project. To date, only a portion of the recycled water backbone project has been built. The Division Street Corridor uses an average of 2 AFY (personal communication with Aracely Jaramillo, LACWD 40) with approximately 3 AFY used in 2010. The Palmdale Regional Recycled Water Authority's water line to McAdam Park in Palmdale uses about 80 AFY (personal communication with Gordon Phair, City of Palmdale), but the Palmdale water line was not built until after 2010.

Although there is the potential to provide 31,000 AFY of recycled water, this is not an accurate estimate of future recycled water supply since distributions systems and end users are required to make use of that supply. Thus, while Table 3-12 provides the anticipated future recycled water demand to be served by the backbone system, those supplies not currently in use are not included in the Plan's supply and demand calculations.

Other future users of recycled water in the Region include the eSolar Power Plant and the Palmdale Hybrid Power Plant. Recycled water demand estimates for these projects are included in Table 3-12. The eSolar Sierra Sun Tower Power Plant is a solar thermal pilot project in the City of Lancaster that would potentially convert to using recycled water instead of potable water in the future. The Palmdale Hybrid Power Plant Project involves the construction of a 570 mega-watt (MW) natural gas and solar thermal electricity generating facility that would use recycled water for its cooling water demands. It should be noted that both the Palmdale Hybrid Power Plant and the eSolar Power Plant constitute new uses of water, meaning that supplying these facilities with recycled water would not offset potable water that is currently being used.

Table 3-12: Summary of Current and Projected Recycled Water Use Demands (AFY) in the Antelope Valley Region

	2010	2015	2020	2025	2030	2035
North LA/Kern County Regional Recycled Water Project	3	7,121	8,673	10,225	11,777	13,330
RCSD WTP Recycled Water Use	---	---	100	100	100	100
eSolar Power Plant	---	80	80	80	80	80
Palmdale Hybrid Power Plant	---	3,400	3,400	3,400	3,400	3,400
PWD Groundwater Recharge Project	---	---	---	---	5,000	5,000
Total Recycled Water Demand	3	10,601	12,253	13,805	20,357	21,910

Note: Demands do not include recycled water use for environmental maintenance.
Source: Draft Salt and Nutrient Management Plan for the Antelope Valley, Table 3-5 (portion). AFY values for the PWD Groundwater Recharge Project are adjusted for recent information obtained during IRWM project solicitation.

3.1.5 Surface Storage

3.1.5.1 Runoff

Surface water supplies in the Antelope Valley Region generally consist of runoff from Littlerock and Santiago Canyons in the Angeles National Forest that is intercepted by the Littlerock Dam and Reservoir. Littlerock Reservoir is co-owned by PWD and LCID. PWD and LCID jointly have long-standing water rights to 5,500 AFY from Littlerock Creek flows. Raw water is conveyed to Lake Palmdale for treatment and use via the Palmdale Ditch.

PWD is currently undergoing actions to increase the yield at Littlerock Reservoir. PWD's Littlerock Creek Sediment Removal Project proposes to restore the reservoir capacity to 3,325 AF through the removal of 900,000 cubic yards of sediment from behind the dam.

3.1.5.2 Surface Deliveries

LCID is currently able to purchase 1,000 AFY, or 25 percent yield from the reservoir from PWD, whichever is less (PWD 2001). This amount is effective until the 1992 reservoir rehabilitation agreement between PWD and LCID ends in 2042. When the 50-year term of the agreement expires, LCID regains its water rights according to the 1922 agreement between PWD and LCID. The 1922 agreement states that LCID has the exclusive right to the first 13 cubic feet per second (cfs) measured at the point of inflow to the reservoir. Flows greater than 13 cfs will be shared by PWD and LCID, with 75 percent to PWD and 25 percent to LCID. In addition, each district is allotted 50 percent of the Littlerock Reservoir storage capacity (PWD 2001). Currently, water from Littlerock Reservoir is only used for M&I uses.

Table 3-13 provides a summary of the historical surface deliveries from Littlerock Reservoir.

Table 3-13: Historical Surface Deliveries from Littlerock Reservoir (AFY)

Year	PWD Diversions	LCID Diversions	Total Diversions
1975[(a)]	1,586	1,513	3,099
1980[(a)]	913	1,950	2,863
1985[(a)]	1,460	1,375	2,835
1990[(a)]	110	200	310
1995[(a)]	3,771	0	3,771
2000[(a)]	6,500	0	6,500
2005[(a)]	6,900	0	6,900
2010[(b)]	1,861	0	1,861

Notes:
(a) PWD 2001.
(b) PWD 2010 UWMP.

Surface Water Infrastructure

The surface water storage facilities in the Antelope Valley Region include Littlerock Reservoir and Lake Palmdale. Littlerock Reservoir has an average seasonal inflow of approximately 3,500 AFY but an estimated storage capacity of only 2,765 AF due to sediment accumulation behind the dam.

Littlerock Reservoir discharges into Lake Palmdale, which has a capacity of approximately 4,250 AF. Lake Palmdale stores both surface water runoff and SWP imported water until the water is conveyed from the lake through a 42-inch pipeline to PWD's water treatment plant.

Reliability

In the PWD 2010 UWMP, historical data were used to determine how the reliability of the Littlerock Dam and Reservoir surface water supplies would be affected for average, single-dry, and multi-dry water years. PWD expects to use 4,000 AFY of its diversion rights in average, dry, and multi-dry water years. This was calculated as 50% of the average available yield from the Reservoir of 8,000 AF.

According to the PWD 2001 Water Master Plan, a reliability analysis was performed for the reservoir yield using actual hydrology from 1949 to 1999, obtained from the Los Angeles County Department of Public Works (LACDPW). This analysis estimated surface water ranging from a minimum of 1,178 to a maximum of 15,900 AFY (PWD 2001).

3.1.5.3 Evaporative/Conveyance Losses

There is an estimated conveyance loss of 9 percent for surface water deliveries (PWD 2001). This reduces the expected average annual yield to approximately 6,920 AFY. Additionally, there are evaporative losses at the reservoir site. In the PWD 2001 Water Master Plan, evaporative loss was estimated using monthly data for the Antelope Valley Region and reservoir area-capacity curve. Evaporative losses were incorporated into the expected annual surface deliveries and therefore do not need to be accounted for separately.

3.1.6 Groundwater Storage

3.1.6.1 Overview of Groundwater Storage

Groundwater Infrastructure

LCID has four (4) groundwater wells that supplied approximately 1,800 AFY of water in 2012 with half the supply going to agriculture. The wells have a maximum pumping capacity of 4,800 gpm (personal communication with Brad Bones, LCID, August 21, 2013)

LACWD 40 has 54 active wells. The combined groundwater extraction capacity is estimated at 38,000 AFY (33.6 mgd), yet this estimate does not necessarily reflect the maximum pumping capacity of LACWD 40.

PWD has twenty-five (25) active groundwater wells throughout the Lancaster and Pearland groundwater subunits, and the San Andreas Rift Zone. The total instantaneous capacity for all PWD wells operating is 16,093 gpm (25,958 AFY). PWD's total groundwater pumping in 2010 was 8,000 AFY and they project to consistently be able to pump 12,000 AFY for average, dry and multi-dry years (PWD 2011).

QHWD currently operates eleven (11) wells for a total maximum pumping capacity of 9,165 AFY (5,681 gpm) (LACWD 40 & QHWD 2011).

RCSD has three (3) wells with a combined maximum pumping capacity of 2,825 gpm (4,557 AFY). One new well is anticipated to come online in the near future with another 800 to 1,000 gpm capacity.

Reliability

Since long-term recharge is expected to be stable, it is anticipated that groundwater pumping, and hence supply, will be reliable even in short-term and multiple year droughts. Thus groundwater is considered a very reliable supply for the Antelope Valley Region. However, the pending adjudication may affect how much groundwater can physically be supplied to the Antelope Valley Region in the future. It is important to note that the return flows are dependent upon anticipated demand and may fluctuate with changes in the anticipated demand. The return flow estimates are meant to indicate a sense of the impact of return flows to the groundwater basin.

3.1.6.2 Percolation

For purposes of this IRWM Plan, direct percolation from precipitation on the Antelope Valley Region floor is assumed to be negligible. However, indirect percolation from irrigation return flows on the Antelope Valley Region floor does occur. There is the potential for direct percolation on the Antelope Valley Region floor to have an impact to the overall water budget. This component of the water budget is currently being studied in the Antelope Valley Region, and if new information is discovered that greatly differs from this assumption, this IRWM Plan may be amended to reflect this.

3.1.6.3 Total Sustainable Yield

TSY is composed of natural recharge, supplemental recharge from imported water, and associated return flows. Natural recharge can be variable and difficult to quantify. Historical estimates of natural recharge have ranged from 30,300 AFY to 81,400 AFY based on a variety of approaches (USGS 2003, USGS 1993). The earliest estimates of natural recharge ranged from 50,000 AFY to 81,400 AFY and were based on limited streamflow and rainfall data (USGS 1993). Later estimates were based on developing a relationship between rainfall and runoff and ranged from 40,280 AFY to 53,000 AFY (USGS 1993). An alternative method used a groundwater model, and found a natural recharge estimate of 30,300 AFY achieved a balance within the model (USGS 2003). Estimates for return flows are typically calculated using a percentage of applied water used for M&I irrigation, agricultural irrigation, and agricultural irrigation with recycled water. These estimates are added to recharge to get TSY. As part of the current adjudication proceedings, the TSY has been determined to be 110,000 AFY (i.e., recharge and return flows). A list of documents that reference estimates for TSY, natural recharge, and return flows is included in Appendix I.

For the purposes of this IRWM Plan, the adjudication finding for TSY (110,000 AFY) is utilized to determine the amount of water that may be sustainably pumped from the basin and represents the combination of natural recharge and return flows from M&I, agricultural, and agricultural reuse. Therefore, these components of TSY are not calculated separately. This Plan acknowledges that other estimates have been developed for TSY in the Valley as mentioned above.

For the purposes of this Plan, as determined by the Stakeholder Group at the October 16, 2013 stakeholder meeting, the discussions that follow in Sections 3 and 6 will utilize the 110,000 AFY for TSY for water balance and projection purposes[2]. Although unlikely, it is important to note that the value for TSY may be revisited by the Court after a period of monitoring and documentation. If a motion is filed with the Court to revise the TSY, the IRWMP will be updated to reflect the subsequent discussion.

3.1.6.4 Artificial Recharge

One typical source of artificial recharge is water banking through spreading basins that allow the water to infiltrate into the ground. Several water banking projects have been proposed in the Region and are discussed in later Sections of this Plan. AVEK's WSSP-2 project was completed in 2010 and can store up to 150,000 AFY. This project is a collaboration between several agencies. The partners can currently withdraw up to 20 mgd (approximately 23,000 AFY).

Another type of artificial recharge is through ASR projects. ASR projects involve the storage of water in an aquifer via artificial groundwater recharge when water is available (usually during spring runoff), and recovery of the stored water from the aquifer when water is needed (usually late summer). The source of water used for ASR can vary. Currently, the only source of ASR water available to the Antelope Valley Region is SWP water, but blended and non-blended recycled water are potential future sources. Although the Region plans to develop groundwater recharge projects with blended recycled water in the future, currently only SWP water is utilized for ASR in the Antelope Valley to a very limited extent.

LACWD 40 is the only agency within the Antelope Valley Region that has attempted to utilize ASR as a water supply management practice. Their program includes the use of new or existing wells for direct injection of water into the aquifer. LACWD 40's ASR program operated under a Conditional Waiver of Waste Discharge Requirements, for a period of 5 years with groundwater monitoring requirements stipulated in the waiver. The 2004 waiver stipulated that LACWD 40 could only inject water to fill the basin to the 2,150 feet groundwater contour interval. This groundwater depression has a radius of approximately 2 miles centered around the middle of Lancaster. As a condition of the waiver, LACWD 40 could only inject up to 6,843 AFY. For the first few years of the project, LACWD was only able to inject approximately 1,500 AFY. In 2010, another five-year Conditional Waiver was approved.

As of December 2010, all injection activities were halted as a result of operational and financial restraints. No future injection is being projected.

For the purposes of this Plan, ASR extraction of banked water will be considered to be negligible since injection has been discontinued.

[2] The number for TSY used in this 2013 IRWMP Update is selected strictly for long-term planning purposes and is not intended to answer the questions being addressed within the adjudication process

3.1.6.5 Extractions

Groundwater for the Antelope Valley Region is extracted from the Antelope Valley Groundwater Basin, as described in Section 2. Historically, groundwater has been the primary water supply source for the Antelope Valley Region.

When significant pumping in the Antelope Valley Region began (early 1900's), a decline in groundwater levels ensued in response to the change in the extraction versus recharge ratio. These changes varied spatially and temporally across the Antelope Valley Region. For instance, the eastern portion of the Buttes and Pearland subunits (described in Section 2.4.2.1) had relatively unchanged groundwater levels (declines of approximately 20 feet), whereas the western portion of these subunits had declines up to 100 feet. The groundwater level changes in the Lancaster subunit were more dramatic and varied with land use, with depressions of up to 200 feet in 1961 in areas with increased agricultural pumping (City of Lancaster 2007). With the introduction of SWP water and increasing urbanization, the water table depressions have either stabilized or increased in the Antelope Valley Region. However, a significant pumping depression from concentrated municipal groundwater pumping is still evident within the southern portion of the Lancaster subunit, between the Cities of Palmdale and Lancaster. Figure 3-6 to Figure 3-10 provide a set of contour maps of the groundwater levels for the Antelope Valley Region from 1915 to 2006.

3.1.6.6 Losses/Subsurface flow

Losses from evaporation and riparian evapotranspiration are discussed in Section 3.1.7 and have been included in the overall estimate of water loss for the water budget. Since the basin is a closed basin, losses from subsurface flow are assumed to be negligible for the purposes of this IRWM Plan.

3.1.7 Water Leaving

The final component to the Water Budget is water leaving the Antelope Valley Region. This includes water lost (either to evaporation or from subsurface flow) and water consumed. Total losses in the Antelope Valley Region have been estimated at approximately 10,000 AFY (USGS 1993). This estimate includes losses attributed to streambed wetting, riparian evapotranspiration, surface and soil evaporation, and diversions. However, further investigation and study are needed to more accurately determine the water losses in the Antelope Valley Region.

Figure 3-6: 1915 Groundwater Level Contour Map of the Antelope Valley Region

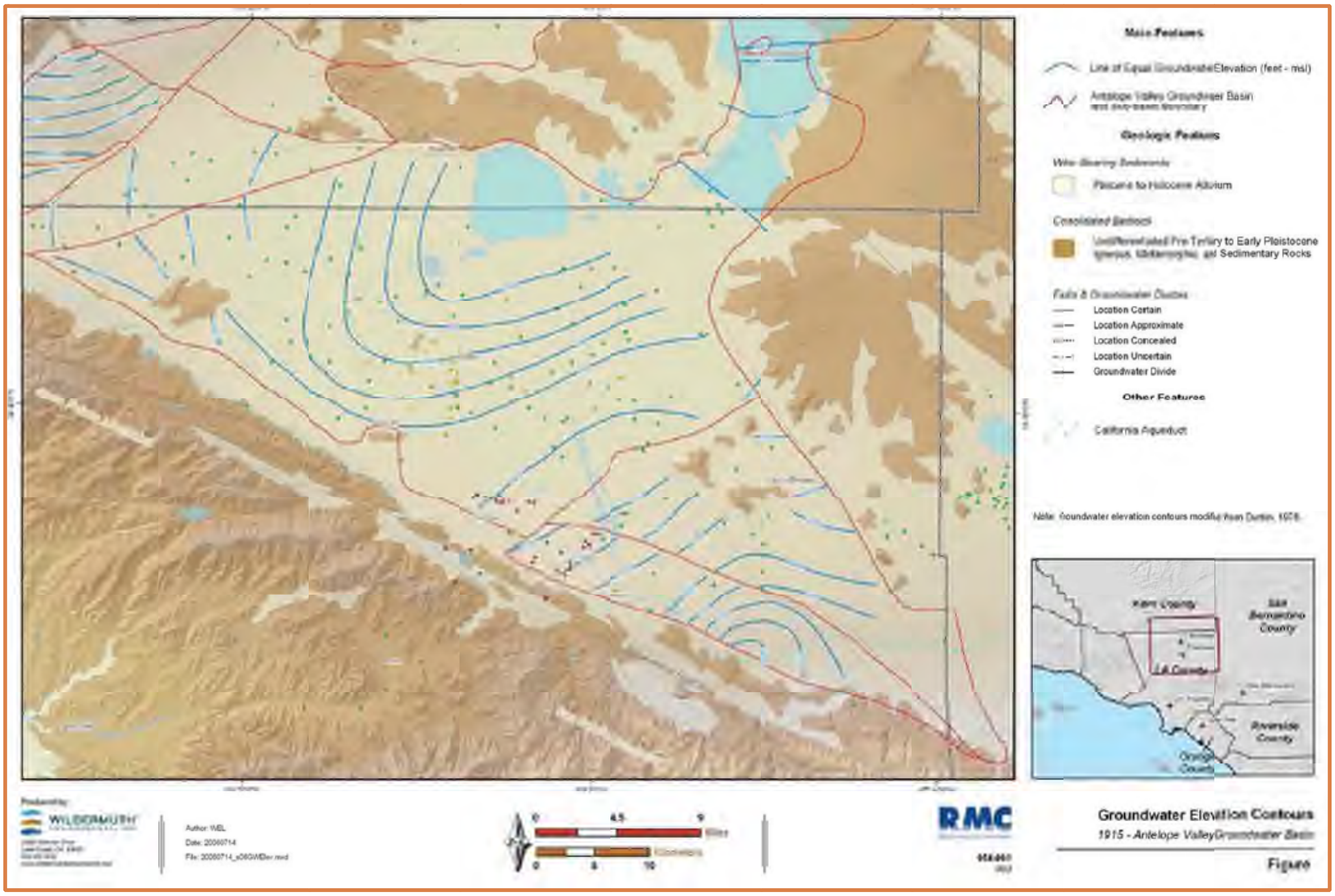


Figure 3-7: 1961 Groundwater Level Contour Map of the Antelope Valley Region

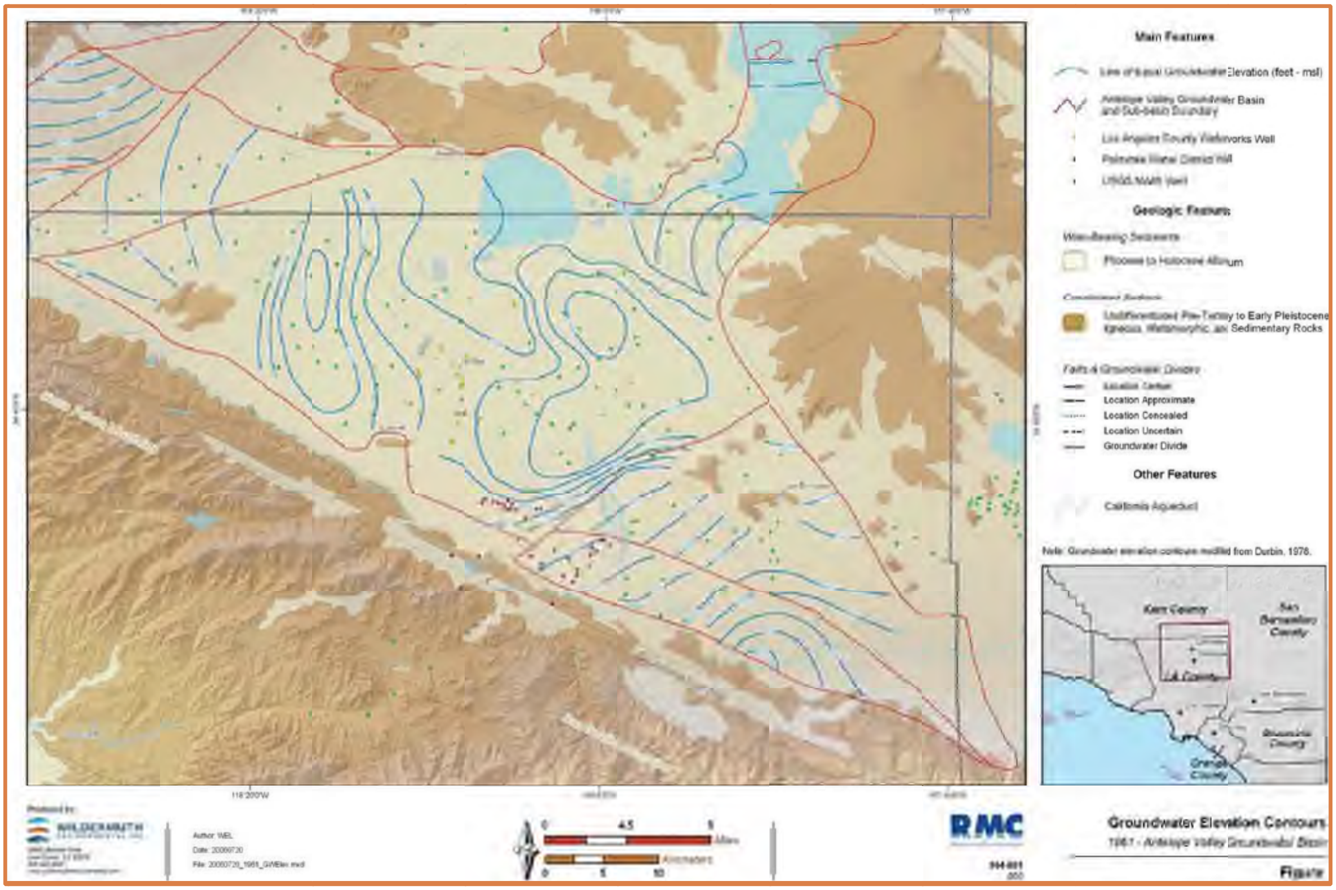


Figure 3-8: 1979 Groundwater Level Contour Map of the Antelope Valley Region

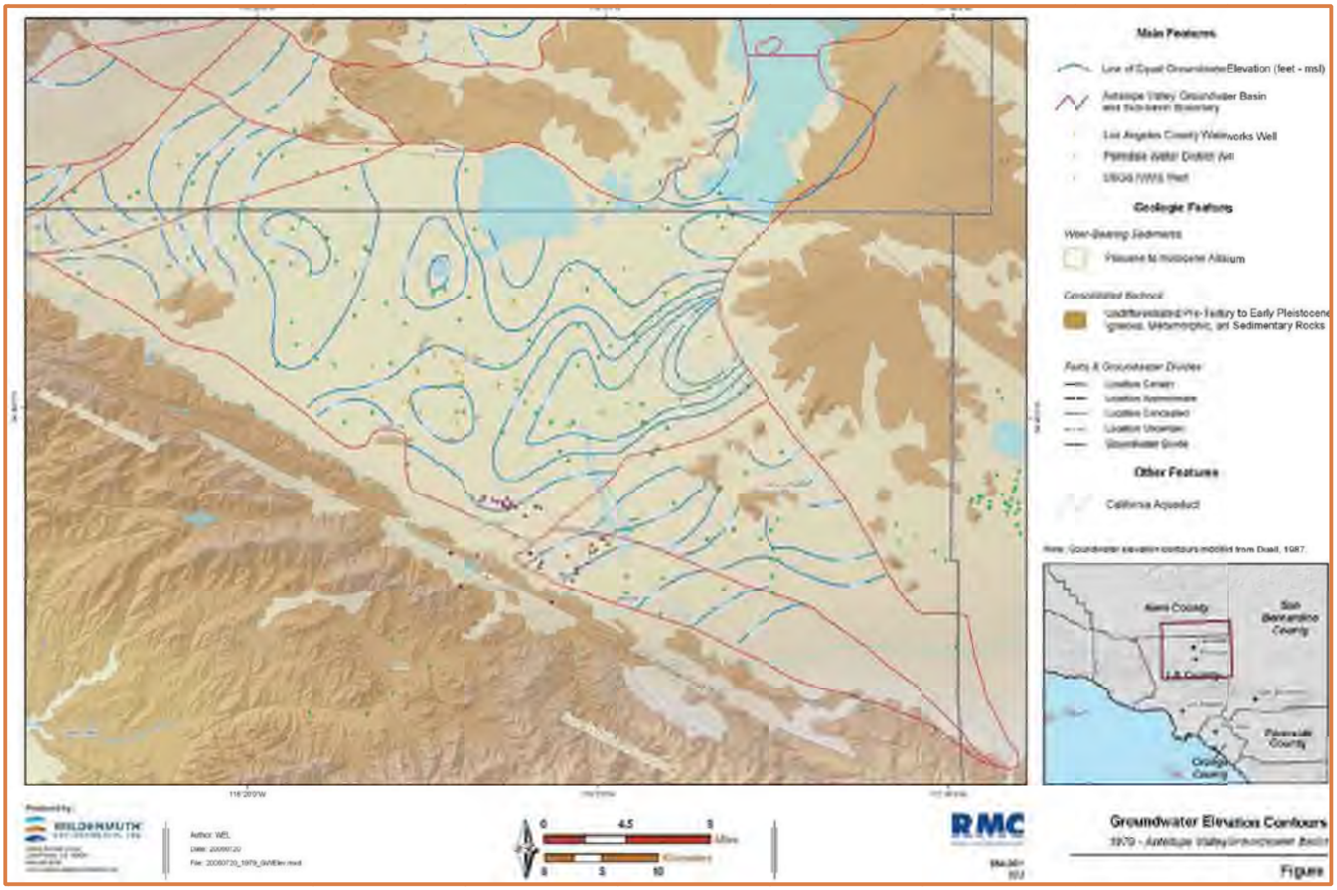


Figure 3-9: 1988 Groundwater Level Contour Map of the Antelope Valley Region

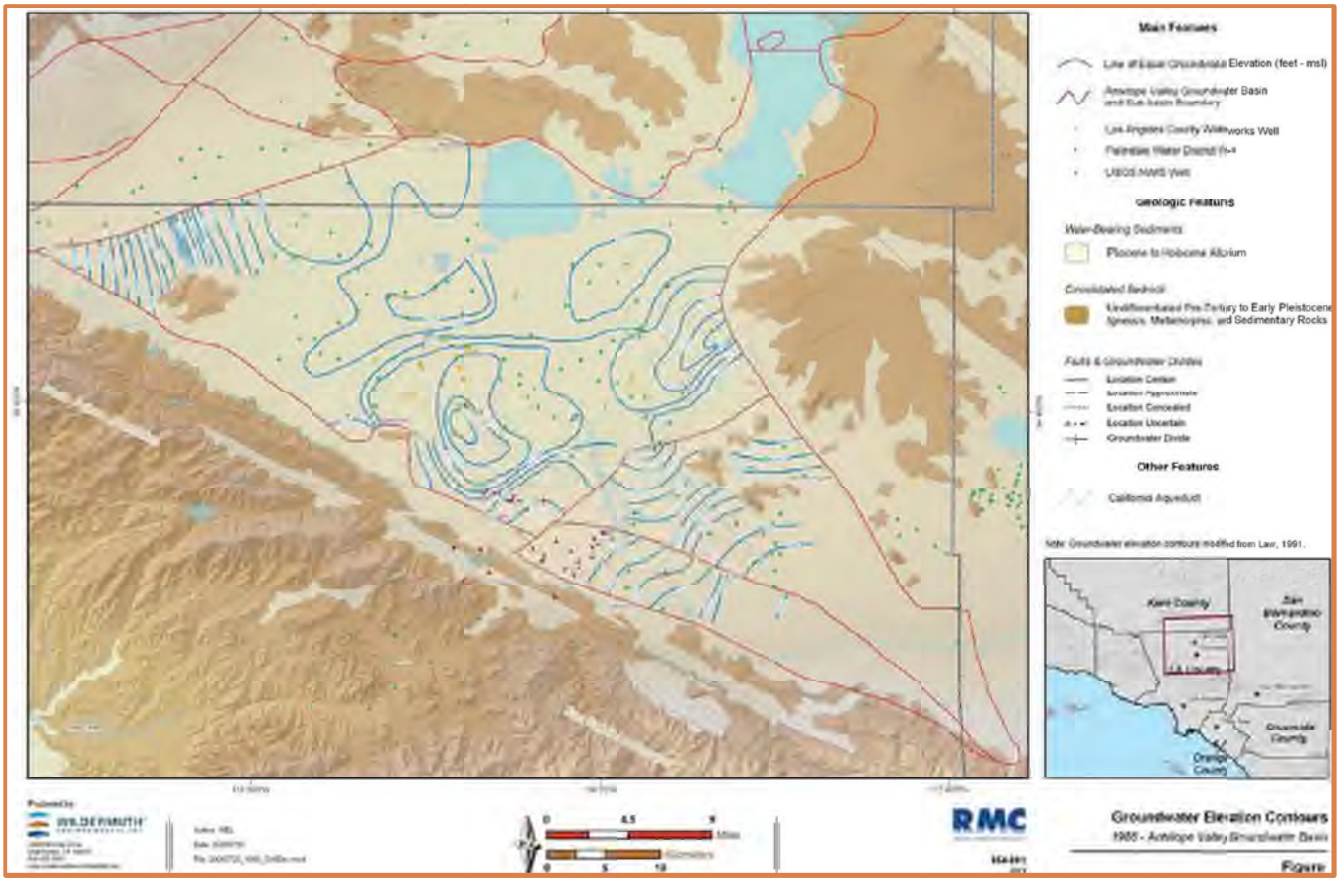


Figure 3-10: 2006 Groundwater Level Contour Map of the Antelope Valley Region