Section 4: Basin and Antidegradation Analysis

4.1 Antidegradation Policy

In 1968, the State Board adopted Resolution No. 68-16, "*Statement of Policy with Respect to Maintaining High Quality of Waters in California*," establishing an Antidegradation Policy for the protection of water quality in California. The Resolution states that whenever the existing quality of a water is better than the applicable established water quality objectives, such existing quality shall be maintained until it has been demonstrated to the State that any change will be consistent with the maximum benefit to the people of the State, will not unreasonably affect present and anticipated beneficial use(s) of such water and will not result in water quality less than that prescribed by the respective Regional Board.

In order to determine whether the projects, identified in Section 3, if implemented, will satisfy the Antidegradation Policy, the following were performed:

1. Identified the Beneficial Uses of the Antelope Valley Groundwater Basin
2. Identified the water quality objectives established by the Regional Board and other criteria to protect the beneficial uses of the Antelope Valley Groundwater Basin
3. Projected whether the identified projects, if implemented, will significantly change the water quality of the Antelope Valley Groundwater Basin
4. Determined whether any projected changes to the groundwater would exceed water quality objectives or unreasonably affect beneficial uses of the groundwater
5. Demonstrated whether any projected change would be consistent with the maximum benefit to the people.

The State Board determined that the use of recycled water, in accordance with the Recycled Water Policy, which supports the sustainable use of groundwater and/or surface water, which is sufficiently treated so as not to adversely impact public health or the environment and which ideally substitutes for use of potable water, is presumed to have a beneficial impact. The Recycled Water Policy also discusses State mandates to increase recycled water use while protecting water quality. Increased use in the region is especially critical given the basin's limited supply, potential climate change impacts, and threatened imported water supply. Recycled water produced and used in the Antelope Valley is regulated by the Regional Board and must meet environmental and health standards established for its intended use. As discussed in the AV IRWMP and Water Plans of the Antelope Valley Region's water and municipal agencies, there are plans to increase recycled water use in the Antelope Valley in order to decrease the demand for potable supplies while potentially increasing their availability and reliability.

To satisfy the Antidegradation and Recycled Water Policies, the basin background groundwater quality and the potential water quality impacts of the projects, identified in Section 3, on the Antelope Valley Groundwater Basin were examined. In order to assess the groundwater and the impacts of these projects, the basin's water quality goals, with respect to the SNMP constituents of concern, were selected based on protecting the groundwater's beneficial uses, as discussed later in this Section. To assess the magnitude of the basin's need for water quality protection, the baseline "assimilative capacity" for each SNMP constituent of concern was determined by subtracting the baseline concentrations established in Section 3 from the SNMP water quality management goals. Constituent balances for those constituents with a significant potential to exceed water quality management goals (i.e., TDS and arsenic) were created and projections were calculated using an instantaneous mixing model for the groundwater basin. Included in the model are calculated impacts of the identified projects in various scenarios, including simulated drought conditions, over the 25-year planning period (2011-2035). The results from the 25-year scenarios were used to predict results over longer periods. Then, the groundwater quality projections that were calculated using the model were compared to the assimilative capacities for each SNMP constituent of concern to determine whether significant degradation of the water would occur if the SNMP projects are to be implemented as planned. In addition, future salt and nutrient concentrations will be monitored (as described in Section 5) to evaluate actual water quality and predictions as compared to the SNMP water quality management goals to ensure consistency with the Antidegradation Policy.

4.2 Beneficial Uses

As a regulatory agency, the Lahontan Regional Board's primary responsibility is to protect water quality within its jurisdiction, under which the Antelope Valley falls. The Regional Board adopted and implemented the "*Water Quality Control Plan for the Lahontan Region*" (Basin Plan; Regional Board 1995), which, among other functions, sets forth water quality standards for the surface and groundwater within the Regional Board's jurisdiction. The Basin Plan includes the designated uses of water within the Lahontan Region and the narrative and numerical objectives which must be maintained or attained as a means to protect those uses.

The Regional Board has designated the following beneficial uses to the Antelope Valley Groundwater Basin (Basin Unit 6-44):

- *Agricultural Supply (AGR):* Beneficial uses of waters used for farming, horticulture, or ranching, including, but not limited to, irrigation, stock watering, and support of vegetation for range grazing.
- *Freshwater Replenishment (FRSH):* Beneficial uses of waters used for natural or artificial maintenance of surface water quantity or quality (e.g., salinity).
- *Industrial Service Supply (IND):* Beneficial uses of waters used for industrial activities that do not depend primarily on water quality including, but not limited to, mining, cooling water supply, geothermal energy production, hydraulic conveyance, gravel washing, fire protection, and oil well repressurization.
- *Municipal and Domestic Supply (MUN):* Beneficial uses of waters used for community, military, or individual water supply systems including, but not limited to, drinking water supply.

The beneficial uses for groundwater listed in the Basin Plan are for each groundwater basin or sub-basin as an entirety. The Regional Board recognizes that, in some areas, useable groundwater occurs above or below an aquifer of highly mineralized groundwater, which can contain concentrations of dissolved solids and metals, such as arsenic, unsuitable for drinking water. Therefore, a beneficial use designation in the Basin Plan does not indicate that all of the groundwaters in that particular location are suitable (without treatment) for a designated beneficial use. However, all waters in the Lahontan Region are designated as MUN unless they have been specifically exempted by the Regional Board through adoption of a Basin Plan amendment after consideration of substantial evidence to exempt such water. A MUN exemption has not been adopted for the Antelope Valley Groundwater Basin or any of its sub-basins.

4.3 Water Quality Objectives and Other Criteria

Water quality objectives are the allowable limits or levels of water quality constituents established for the beneficial uses of water or the prevention of nuisance within a specified area. Therefore, the Regional Board established water quality objectives for the waters within the Lahontan Region that it considers protective of the designated beneficial uses. The general methodology used in establishing water quality objectives involves, first, designating beneficial water uses, and second, selecting and quantifying the water quality parameters necessary to protect the most vulnerable (sensitive) beneficial uses. As additional information is obtained on the quality of the Lahontan Region's waters and the beneficial uses of those waters, certain water quality objectives may be updated to reflect the levels necessary to protect those beneficial uses. Revised water quality objectives would then be adopted as part of the Basin Plan by amendment.

The Regional Board has not established water quality objectives specific to the Antelope Valley Region. However, water quality objectives have been established that apply to all groundwaters in the Lahontan Region. These objectives are aimed to be protective of the beneficial uses assigned to the groundwater basins.

The water quality objectives that apply to groundwater designated as MUN are based on drinking water standards specified in Title 22 of the California Code of Regulations (CCR). Table 4-1 lists the water quality objectives associated with salts and nutrients that are applicable to the MUN designated groundwaters. The MUN water quality objectives for arsenic, chromium, fluoride, and nitrate are based on the Title 22 CCR drinking water primary Maximum Contaminant Levels (MCLs), which are health-based. While there are primary MCLs for nitrite and nitrate plus nitrite, only nitrate is examined in this SNMP because nitrite is not typically observed above detection levels in samples from the Antelope Valley groundwater. The MUN water quality objectives for total dissolved solids (TDS) and chloride are based on the Title 22 CCR Secondary Maximum Contaminant Levels (SMCLs) determined for "Consumer Acceptance," although no fixed consumer acceptance contaminant level has been established. According to Title 22 CCR, constituent concentrations lower than the "Recommended" contaminant levels are desirable for a higher degree of consumer acceptance. Constituent concentrations ranging up to the "Upper" contaminant levels are acceptable if it is neither reasonable nor feasible to provide more suitable waters. Constituent concentrations ranging to the "Short Term" contaminant level are acceptable for community water systems on a temporary basis pending construction of treatment facilities or development of acceptable new water sources or on a case-by-case basis.

Table 4-1: Lahontan Basin Plan MUN Water Quality Objectives

Constituent	Units	MUN Water Quality Objective
Arsenic	µg/L	10
Chromium, total	µg/L	50
Fluoride	mg/L	2
Nitrate	mg/L as N	10
Total dissolved solids	mg/L	500 (recommended)/1000 (upper)/1500 (short term)
Chloride	mg/L	250 (recommended)/500 (upper)/600 (short term)

In California, boron is not regulated in drinking water and therefore, there is no established drinking water MCL for boron. However, the California Department of Public Health (CDPH) has established a health-based advisory level, or "notification level," for boron at 1000 µg/L. An exceedance of the notification level does not pose a significant health risk but may, in certain cases, warrant notification to the local governing bodies pursuant to the California Health & Safety Code. Notification levels are non-regulatory and are established by CDPH as precautionary measures for constituents that may be considered candidates for establishment of MCLs, but have not yet undergone or completed the regulatory standard-setting process prescribed for MCL development and are not drinking water standards.

To examine the appropriate water quality to protect AGR uses, Regional Board staff suggested using the State Board's online searchable database of water quality based numeric thresholds.[1] These thresholds may be used to assess whether beneficial uses of surface water or groundwater are likely to be impaired or threatened. The thresholds listed under "Agricultural Water Quality Goals" in the database are based on the paper, "*Water Quality for Agriculture*," published by the Food and Agriculture Organization of the United Nations in 1985, and containing guidelines on water quality protective of various agricultural uses of water, including irrigation of various types of crops and stock watering. Information on each of SNMP constituents was retrieved from the database and the thresholds listed under "Agricultural Water Quality Goals" were compiled. The listed thresholds for each constituent are listed in Table 4-2.

Crop information for the Antelope Valley Region was found in Los Angeles County Annual Crop Reports and Kern County Annual Pesticide Use Reports (Beeby et al. 2010). According to the reports, the following crops are grown in the region:

- Alfalfa, hay & other grains
- Apples
- Carrots
- Cherries
- Grapes
- Miscellaneous nursery
- Nectarines
- Onions
- Peaches
- Pears
- Plums
- Potatoes
- Pumpkins
- Squash
- Watermelons

"*Water Quality for Agriculture*" suggests that a maximum chloride concentration of 106 mg/L will not restrict the use of water as agricultural supply, especially if the water used is for irrigation of avocadoes, strawberries, or Indian Summer raspberries, which are sensitive to high concentrations of chloride. These crops are not commercially grown in the Antelope Valley and are not expected to be grown in the future. The next most chloride sensitive crops listed in "Water Quality for Agriculture" and that are grown in the Antelope Valley region are a variety of grapes, stone fruits, and citrus crops, which have a chloride tolerance maximum of 238 mg/L. The chloride threshold level of 238 mg/L is comparable to the recommended drinking water standard of 250 mg/L.

"*Water Quality for Agriculture*" indicates that the guideline provided for fluoride reflects the then-current information available and is supported by only limited, long-term field experience. The value is conservative, meaning that if the suggested limit is exceeded, toxicity to the plant may not occur.

The IND beneficial use by definition does not depend primarily on water quality, so water quality objectives do not apply. The FRSH beneficial use option for the groundwater is currently not being

[1] Accessible at http://www.waterboards.ca.gov/water_issues/programs/water_quality_goals/.

utilized and there are presently no related established water quality objectives for this use in the Antelope Valley.

Table 4-2: Recommended AGR Water Quality Thresholds

Constituent	Units	Recommended AGR Water Quality Thresholds
Arsenic	µg/L	100
Chromium, total	µg/L	none
Fluoride	mg/L	1
Nitrate	mg/L as N	none
Total dissolved solids	mg/L	450
Chloride	mg/L	238
Boron	µg/L	700

4.4 SNMP Water Quality Management Goals

As mentioned earlier, the purpose of developing the AV SNMP is to address the management of salts and nutrients to maintain water quality objectives and support beneficial uses. Considering the regulations and recommendations discussed and the purpose of this SNMP, certain water quality objectives and other levels were assigned as the SNMP water quality management goals. These levels are listed in Table 4-3 below. The SNMP water quality management goals are meant to serve as a management and planning tool for groundwater quality and not to serve as a basis for regulatory or discharge limits.

The SNMP water quality management goals for arsenic, chromium, and nitrate are based on the primary drinking water MCLs. The goal for boron is based on the AGR beneficial use threshold and the CDPH notification level. The goal for fluoride is based on the AGR beneficial use threshold and the MCL.

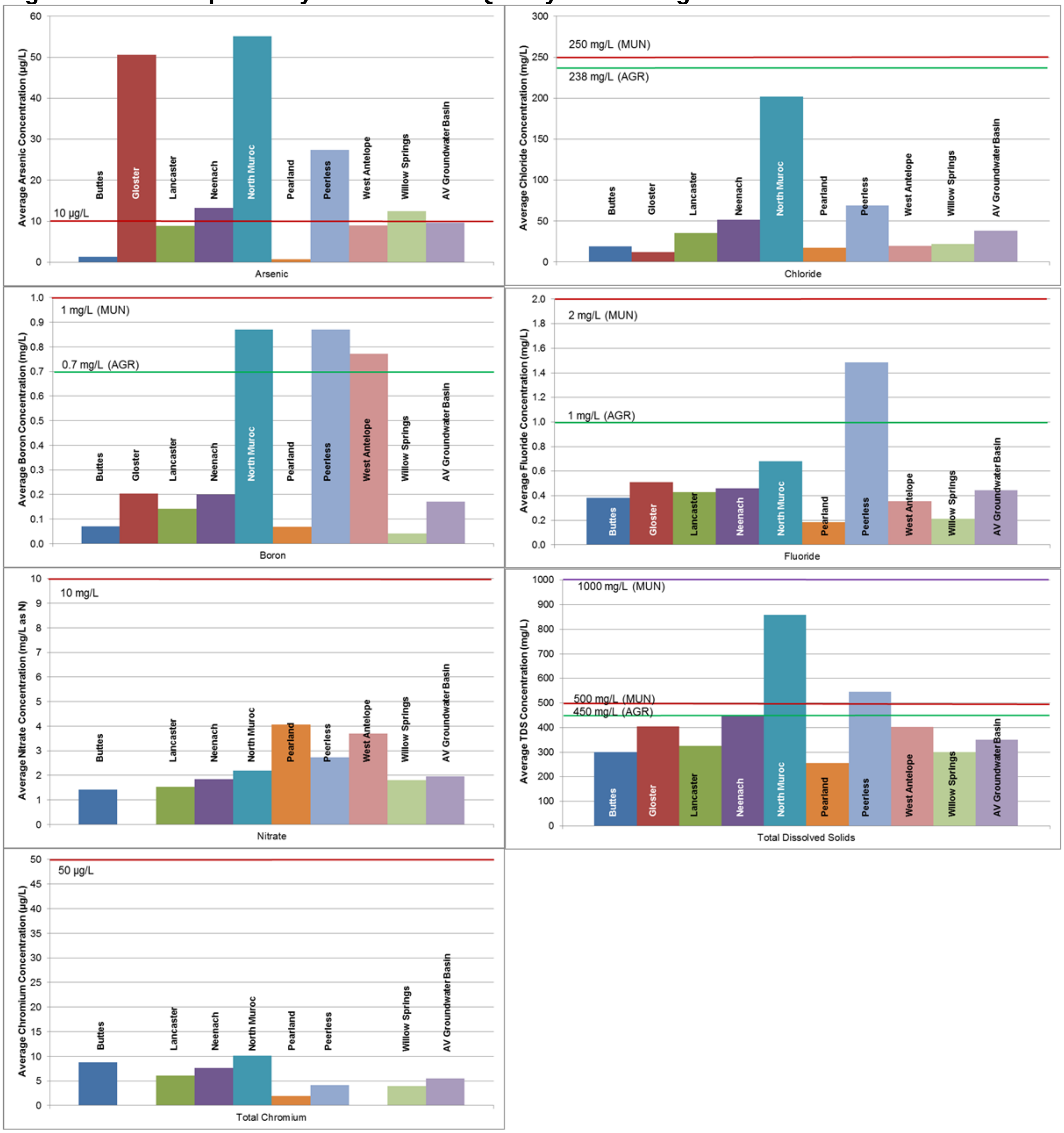
Per direction from the Regional Board, the goals for chloride and TDS are based on the baseline basin or sub-basin groundwater quality. If the basin's baseline groundwater quality is below the TDS or chloride constituent's respective AGR water quality threshold, the AGR threshold is assigned as the SNMP water quality management goal for that particular constituent in the basin. If the basin's baseline groundwater quality exceeds the AGR threshold, the recommended SMCL, or the upper SCML in the case that the recommended SCML is exceeded, is assigned as the SNMP water quality management goal for that particular constituent in the basin. The same strategy is used for assigning SNMP management goals to the sub-basins. Comparisons of the SNMP water quality management goals with the sub-basin average water quality are depicted in Figure 4-1. All of the SNMP water quality management goals are consistent with the Basin Plan.

Table 4-3: SNMP Water Quality Management Goals

Constituent	Units	MUN	AGR	SNMP Water Quality Management Goals
Arsenic	µg/L	10	100	10
Chromium, total	µg/L	50	none	50
Fluoride	mg/L	2	1	1-2 [b]
Nitrate	mg/L as N	10	none	10
Total dissolved solids	mg/L	500-1000-1500	450	450-500-1000[b]
Chloride	mg/L	250-500-600	238	238-250-500[b]
Boron	mg/L	1[a]	0.7	0.7-1[b]

a. California Notification Level
b. Basin and sub-basin goals are based on baseline groundwater quality

Figure 4-1: Antelope Valley Groundwater Quality and Management Goals



4.5 Assimilative Capacity

The Recycled Water Policy defines assimilative capacity for a constituent as the difference between a water quality objective and the mean concentration of the basin or sub-basin. Because specific numerical water quality objectives are not established for the Antelope Valley Groundwater Basin, the baseline assimilative capacity in this SNMP is calculated as the difference between the SNMP water quality management goal for a particular constituent and the mean baseline concentration of the basin or sub-basin. The SNMP constituents' baseline concentrations, as discussed in Section 3, are based on the water quality data from GAMA and NWIS for the period from 2001 through 2010. Baseline water quality was presented in Table 3-1 and baseline assimilative capacities for the Antelope Valley basin and sub-basins are shown in Table 4-4. A negative calculated value for assimilative capacity indicates that the baseline water quality already exceeds the SNMP water quality management goal and there is no assimilative capacity at this time for that particular constituent.

The magnitude of assimilative capacity for the sub-basins can be visualized in Figure 4-1 as the amount between the bar graph value and the SNMP water quality management goal. For the four sub-basins with planned projects (Lancaster, Neenach, Buttes, and Pearland), the only absence of assimilative capacity is with arsenic in the Neenach sub-basin. A small amount of arsenic assimilative capacity is available for the Antelope Valley Groundwater Basin and the Lancaster sub-basin and a small amount of TDS assimilative capacity is available for the Neenach sub-basin.

In regards to the remainder sub-basins, while some of the sub-basins lack assimilative capacity for certain constituents, it is important to note that none of the projects identified in Section 3 are expected to affect these groundwaters due to proximity and because these sub-basins' groundwaters are upstream of the projects. Also, much of the groundwater quality exceedances are due to natural causes, such as with arsenic and boron, and meeting water quality goals would most likely require treatment.

Gloster, North Muroc, Peerless, and Willow Springs sub-basins have groundwater quality exceeding the arsenic SNMP water quality management goal, and therefore, have no assimilative capacity with regards to arsenic. The high arsenic values have been known in the area to be naturally occurring, due to the movement of water through the basin rocks and soils.

North Muroc, Peerless, and West Antelope sub-basin average concentration of boron exceeded the level that "*Water Quality for Agriculture*" (Ayers & Westcot 1985) suggested for non-restricted agricultural use. Thus, these sub-basin areas may not be suitable or preferable for some boron-sensitive crops. However, all the sub-basins have assimilative capacity with respect the CDPH notification level for boron.

All the sub-basins have assimilative capacity with regards to chloride. However, the North Muroc sub-basin has an average groundwater quality of approximately 200 mg/L chloride and an assimilative capacity with respect to chloride of only approximately 36 mg/L. The remaining sub-basins have over 165 mg/L of chloride assimilative capacity, which is much greater than the ambient concentrations and thus considered ample.

All the sub-basins have assimilative capacity with regards to nitrate. The Pearland sub-basin has the highest average nitrate groundwater quality, calculated as over 4 mg/L as nitrogen. The assimilative capacity is slightly greater than this concentration, calculated at approximately 6 mg/L as nitrogen, and thus considered ample. Very localized exceedances of the nitrate SNMP water quality management goal have been known to occur within the Antelope Valley and these situations are mitigated by individual clean-up and remediation programs overseen by the Regional Board. Average conditions of the sub-basins do not exceed these goals.

Only the Peerless sub-basin has an average fluoride concentration that exceeds the level listed in the State Board's online searchable database of water quality based numeric thresholds for non-restricted agricultural use. So, this sub-basin area may not be suitable or preferable for some fluoride-sensitive crops. However, all the sub-basins have assimilative capacity with respect to fluoride and the drinking water MCL.

With respect to TDS, the North Muroc and Peerless sub-basins have average concentrations that do not meet the TDS-sensitive agricultural use level of 450 mg/L or the drinking water recommended SMCL of 500 mg/L, but have assimilative capacity with respect to the upper SMCL of 1000 mg/L. The rest of the sub-basins have assimilative capacity with respect to the 450 mg/L level.

Table 4-4: Antelope Valley Basin Baseline Assimilative Capacities

	Arsenic (µg/L)	Boron (mg/L)		Chloride (mg/L)		Fluoride (mg/L)		Nitrate (mg/L)	Total Chromium (µg/L)	Total Dissolved Solids (mg/L)		
SNMP water quality mgmt. goal	10	0.7	1	238	250	1	2	10	50	450	500	1000
Buttes	8.7	0.63	0.93	219	231	0.6	1.6	8.6	41	149.5	200	700
Gloster	-40.7	0.50	0.80	226	238	0.5	1.5	(no results)	(no results)	45.8	96	596
Lancaster	1.1	0.56	0.86	203	215	0.6	1.6	8.5	44	124.7	175	675
Neenach	-3.2	0.50	0.80	186	198	0.5	1.5	8.2	42	3.6	54	554
North Muroc	-45.1	-0.17	0.13	36	48	0.3	1.3	7.8	40	-408.2	-358	142
Pearland	9.2	0.63	0.93	221	233	0.8	1.8	5.9	48	194.5	244	744
Peerless	-17.5	-0.17	0.13	169	181	-0.5	0.5	7.3	46	-96.7	-47	453
West Antelope	1.1	-0.07	0.23	218	230	0.6	1.6	6.3	(no results)	47.5	98	598
Willow Springs	-2.4	0.66	0.96	216	228	0.8	1.8	8.2	46	148.9	199	699
AV Groundwater Basin	0.3	0.53	0.83	200	212	0.6	1.6	8.0	44	99.8	150	650

4.6 Salt and Nutrient Balance

To assess the salt and nutrient impacts of current and future projects and water uses within the Antelope Valley, projected constituent loadings and unloadings, with respect to the SNMP constituents of concern were determined. Further extensive calculations were performed for predicting TDS and arsenic impacts. Other constituents were not further examined because the assimilative capacities of the basin with respect to those constituents are large proportions of their respective SNMP water quality management goals and impacts from water use are not expected to significantly increase the basin concentrations. Further discussion on the selection process is presented later in this section.

Conceptual mass balance and concentration models were developed for the constituents of concern by taking into consideration the use of water within the Antelope Valley Groundwater Basin and by making reasonable assumptions of the constituent concentrations and loadings.

Figure 4-2 depicts the direct loading and unloading of water, salts, and nutrients in and out of the groundwater aquifer. Return flows from agricultural irrigation, outdoor municipal and industrial (M&I) water use, and on-site waste disposal systems (such as septic tanks and leach fields), along with natural recharge from precipitation and mountain runoff are considered sources of direct loading to the groundwater. Aquifer recharge projects may also directly load salts and nutrients to the groundwater aquifer. Since the Antelope Valley is a closed basin, the only major outflow is groundwater pumping. Subsurface inflow from other basins and subsurface outflow of the aquifer are considered insignificant.

Figure 4-2: Aquifer Loading/Unloading

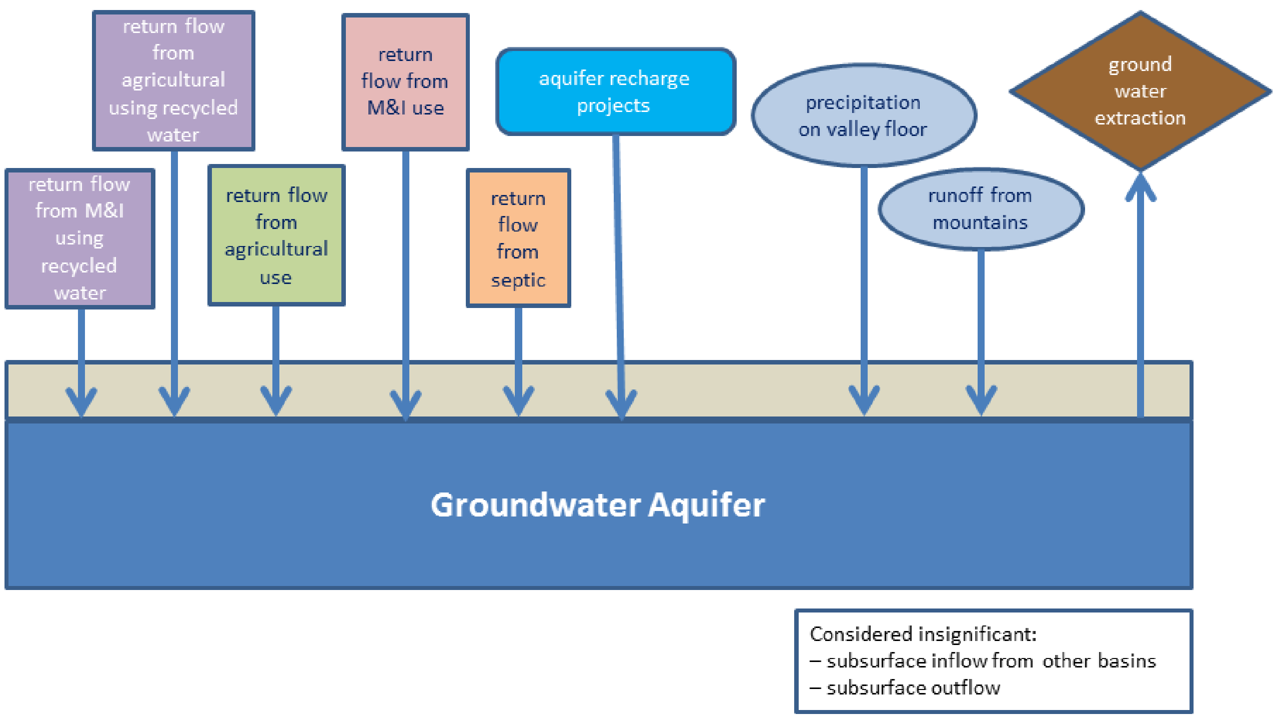
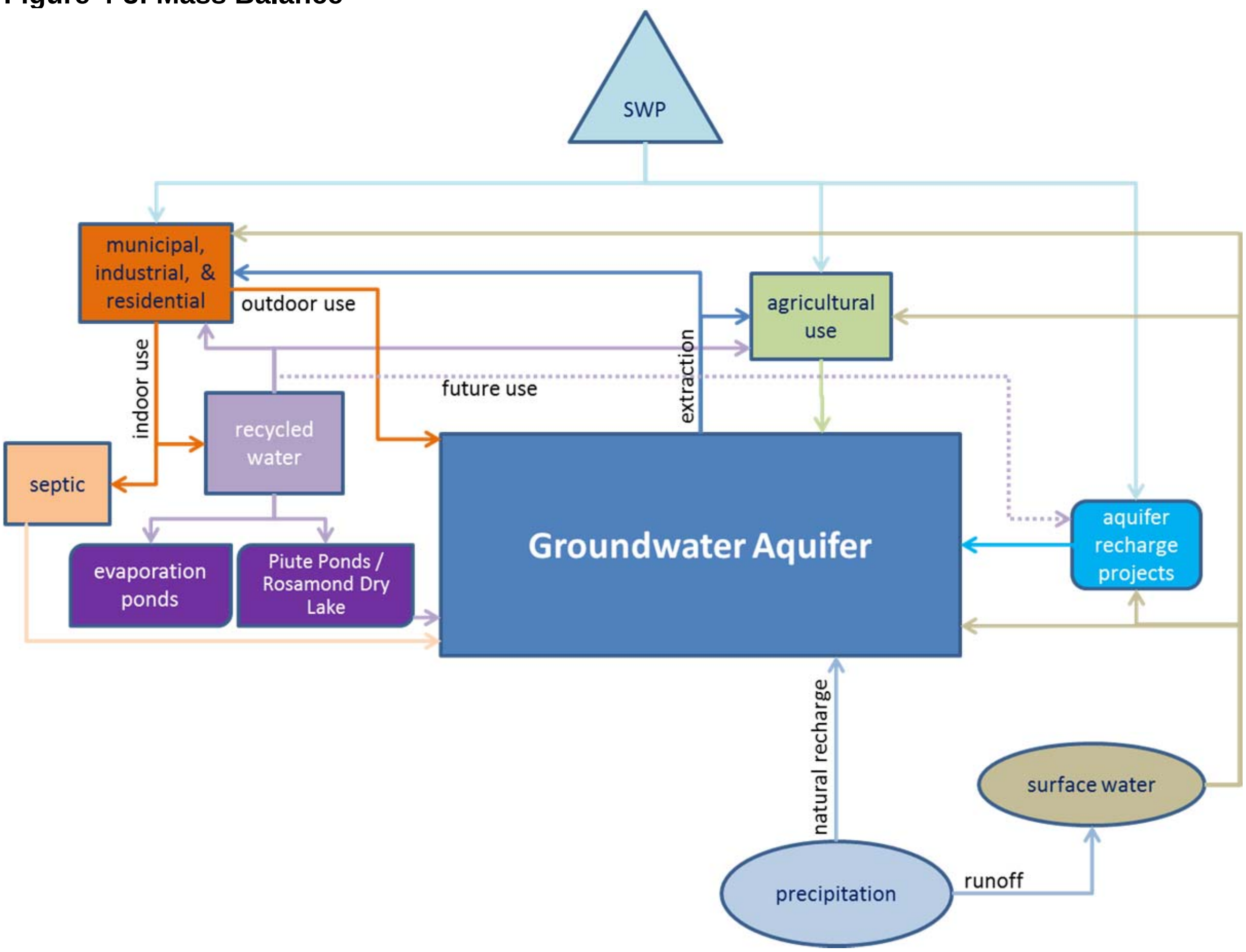


Figure 4-3 depicts the conceptual model of the constituent balance, which takes into consideration the water balance of the various types of water entering and exiting the groundwater basin. The two major outside sources of water to the basin include imported water via the California State

Water Project (SWP) and precipitation, which is represented in the model by natural recharge. The other major sources of water that are used within the Antelope Valley region include groundwater from extraction (i.e., pumped groundwater), recycled water from wastewater treatment, and surface water flow. The major uses of water are M&I and agricultural uses, which contribute to return flows to the groundwater basin. M&I is further broken down into indoor and outdoor use. Outdoor use includes activities, such as landscape irrigation, that contribute to return flows to the groundwater aquifer. After water is used indoors, it typically either goes to the local sewers or to an on-site waste disposal system (i.e., septic tanks with leach fields). On-site waste disposal systems also contribute to percolating flows to the groundwater aquifer. Wastewater collected from the sewers are processed by wastewater treatment plants and the resulting effluent may be used as recycled water for M&I uses (indoor and outdoor), agricultural irrigation, or for aquifer recharge projects in the future. Artificial aquifer recharge projects may use imported, recycled, or stormwater to augment water in the aquifer.

Figure 4-3: Mass Balance



Taking the conceptual models into consideration, a completely mixed model of the principal aquifer was developed to evaluate and predict the effects of salt and nutrient loading on overall groundwater quality of the Antelope Valley groundwater aquifer for the planning period (through 2035). The spreadsheet model was created to predict the impact of current and future water use in the Antelope Valley on the groundwater basin's salt and nutrient load. The model allows for improvements and addition of more details as additional data is collected for validation and verification. As such, the model presented here should be viewed as a tool that will be refined and improved over time. A short description of the methods used is provided below and summarized in Table 4-5.

A general water budget was developed that incorporated findings from the Antelope Valley Groundwater Adjudication Case Summary Expert Report for Phase 3 – Basin Yield and Overdraft (Summary Expert Report; Beeby et al. 2010). Specifically, the model uses the same flow assumptions as the subject report and arrives at the same sustainable yield, which is based on pumping of locally derived ("native") waters and supplemental pumping of return flow from imported water use. It is important to note that the model is intended for planning purposes only and nothing in this model shall be interpreted to interfere in any way with the ongoing adjudication actions, settlement process, or rulings of the Court. The Summary Expert Report describes the basin's sustainable yield as the rate of pumping that will produce return flows in combination with other recharge that will result in no long-term depletion of groundwater storage and no purposeful increase in storage. In general, imported water and pumped groundwater are used to meet agricultural and M&I water demands, each demand producing differing amounts of return flows and recharge to the aquifer via deep percolation. These flows combine with natural recharge for a total quantity of water that may be pumped on a sustainable basis with no long term-depletion of groundwater storage. Through a series of calculations, the Summary Expert Report concludes that the average sustainable yield of the basin is 110,500 acre-feet per year (AFY). The SNMP model assumes that the average annual pumped groundwater supply is equal to the basin's sustainable yield (110,500 AFY) and that the groundwater volume is 55 million acre-feet (AF; DWR 1980). These assumed flows could be refined as additional information is obtained in the future to improve the model.

In order to estimate sustainable yield, return flows and recharge of water to the groundwater from natural recharge and water use were determined. Water demands and sources were identified. Land uses in the basin include agricultural and several municipal-type uses (also termed "municipal and industrial" or "M&I"). The Summary Expert Report describes two independent analyses as a basis for using 60,000 AFY as an estimate of average long-term natural recharge. Return flows were then estimated, taking into consideration agricultural and M&I uses, as well as return flow from recycled water usage, as 50,500 AFY.

Based on historical average rates, the Summary Expert Report assumes 25% for the average agricultural return flow rate. Of the water utilized for M&I uses, about 44% is consumptively used, 11% becomes return flow through outside irrigation, and the remaining 45% is used indoors and goes either to a sewer or to an on-site waste disposal system. It is assumed that all of the water going to an on-site waste disposal system is returned to the groundwater. Of the water that is applied outdoors, the model assumes that 20% flows to the groundwater.

The Summary Expert Report estimates that approximately 70% of the urban areas in the Antelope Valley are sewered and the remaining areas are served by on-site waste disposal systems (e.g., septic tanks). The Summary Expert Report also estimates that the mutual and small water companies' customers make up about 4.4% of the Antelope Valley's M&I demand and the customers all use on-site waste disposal systems. Rural residential areas make up about 7.1% of the M&I demand and all of these areas utilize on-site waste disposal systems. As a result, approximately 28% of the Antelope Valley's M&I water utilized is conveyed to one of the water reclamation plants (WRPs) and approximately 17% is of the M&I flow is conveyed to on-site waste disposal systems and ultimately reaches the groundwater. The Summary Expert Report also estimated that approximately 500 AFY of the water conveyed to the WRPs becomes return flow during treatment (i.e. through percolation ponds).

The SNMP model uses the estimates of sustainable yield calculated in the Summary Expert Report that use imported water deliveries and land use present in 2005. Land use was divided into approximately 51.5% agricultural and 48.5% M&I. Imported deliveries were comprised of 9,300 AFY for agricultural use and 64,200 AFY for M&I uses. These land use and imported delivery levels were assumed the same throughout the planning period, but may be adjusted if additional data becomes available.

As with the Summary Expert Report, average annual flow conditions were assumed in the baseline model throughout the planning period. As such, inflow to and outflow from the aquifer are assumed equal so there is no change in storage. The model, however, allows for volume changes, which were applied to some of the scenarios tested. Also, for conservative planning purposes, the model assumes an instantaneous mixing of waters and constituents added on a yearly basis, rather than assuming it typically may take months to years for the applied water to travel through soil and reach the aquifer.

Table 4-5: Antelope Valley SNMP Groundwater Model Flow Assumptions

Flows	Assumed Quantities
Imported Water	73,500 AFY total Agriculture: 9,300 AFY M&I: 64,200 AFY (2005 levels, assumed same throughout planning period)
M&I Use	Of the total flow to M&I: 44% is consumptively used, 11% becomes return flow from outdoor use, and 45% is subsequently conveyed to WRPs (sewered; 28% of total M&I) or on-site waste disposal systems (unsewered; 17% of total M&I) from indoor use Of the urban areas: 70% sewered, 30% unsewered Mutual and small water companies deliver about 4.4% of M&I demand and customers all use on-site waste disposal systems Rural residential makes up about 7.1% of M&I demand and customers all use on-site waste disposal systems
Natural recharge	60,000 AFY: Infiltration of stormwater (precipitation and mountain runoff), no inflow from adjacent aquifers
Return Flow	Of the amount applied to each use, the percentage returned: M&I outdoor = 20%, Agr. = 25%, recycled water for M&I outdoor use = 20%, on-site waste disposal systems = 100% WRP return flow = 500 AF (from percolation ponds) Calculated total inflow to groundwater = 110,500 AFY
Total Groundwater pumped	110,000 AFY at steady conditions, but may vary Agriculture = 45,000 AFY; M&I = 65,000 AFY
Aquifer volume	55,000,000 AF
Land Use	Agriculture = 51.5 %, M&I = 48.5% (2005 levels, assumed same throughout planning period); used for determining “native” sustainable yield

Note: Assumptions and numbers found herein are selected strictly for long-term planning purposes (e.g., develop the constituent model) and are not intended to answer the questions being addressed within the adjudication process.

Before further development of the model, the SNMP constituents to incorporate into the model were selected. To determine which constituents have a potential to significantly impact the basin and beneficial uses, a simplified and highly conservative set of calculations were performed. The calculations assume that the entire volume of State Water Project imported water contracted to the

Antelope Valley (165,000 AFY) and the entire average sustainable yield (110,500 AFY) are converted to recycled water. Assuming that the entire mass of salts and nutrients calculated for this flow instantaneously enters and mixes with the aquifer (55 million AF) on a yearly basis for 25 years, TDS and arsenic are the only SNMP constituents expected to exceed a concentration greater than the baseline plus 20% of the assimilative capacity (the Recycled Water Policy discusses an allowance of multiple projects using 20% of the basin's assimilative capacity over the course of a decade). The remaining constituents were calculated to not have a significant potential to impact the basin's beneficial uses. Note that this is an overly conservative calculation that assumes only the mass of constituents and not the accompanying water enters the basin. In other words, the calculations assume no consumption of the constituents (e.g., uptake by plants, attenuation, or chemical transformation) and 100% evapotranspiration. Evapotranspiration is water that is lost to the atmosphere via evaporation and plant transpiration, and it has a large impact on water availability. According to USGS, half of annual rainfall is consumed by evapotranspiration. The calculations also ignore changes in the basin volume and naturally occurring processes (such as attenuation to the substrate during infiltration through unsaturated zone or dissolution from rocks and soil, as is the case with arsenic), as well as other processes that would reduce the mass of salts entering the basin. To be conservative, recycled water concentrations were assumed because constituents were measured highest in that source water (see Table 3-3). Even though chromium in recycled water was either not detected or measured at concentrations below the reporting limit, the detection limit concentration was used in the calculations. Nitrate loadings may be higher than calculated due to nitrification or lower due to denitrification and plant uptake. However, the available nitrate baseline assimilative capacity is a wide margin since it is more than half of the total SNMP management goal of 10 mg/L as N. Table 4-6 includes the calculation results. Real world applications of water are expected to yield lower impacts to the basin than these conservative calculations assume.

Table 4-6: Simplified SNMP Constituent Impacts

Constituent	Recycled Water Concentration[1] (mg/L)	Total Mass to Basin Over 25 Years[2] (tons)	Baseline Average Antelope Valley Basin Concentration (mg/L)	Baseline Basin Mass[3] (tons)	Resulting Basin Concentration After 25 Years[4] (mg/L)	Baseline Assimilative Capacity (mg/L)	Percent Assimilative Capacity Used[5]
Arsenic	0.0055	52	0.0097	720	0.0103	0.00034	>100
Boron	0.6	5,600	0.17	13,000	0.25	0.5	14
Chloride	167	1,600,000	38.4	2,900,000	59	200	10
Fluoride	0.36	3,400	0.44	33,000	0.5	0.6	8
Nitrate as N	7	66,000	1.97	150,000	2.8	8	11
Chromium	0.01[6]	94	0.0055	410	0.006	0.044	3
TDS	545	5,100,000	350	26,000,000	418	100	68

[1] Recycled water concentration is the calculated average of the recycled water concentrations provided in Table 3-3.
[2] Assume mass from entire volume of contracted imported (165,000 AFY) and sustainable yield (110,500 AFY). Values displayed have been rounded to two significant figures.
[3] Assume volume of the aquifer is 55 million acre feet. Values displayed have been rounded to two significant figures.
[4] Calculated by adding the total mass load over 25 years and the baseline mass of the basin and dividing by the aquifer volume of 55 million acre feet.
[5] Calculated by dividing the increase in constituent concentration (the resulting concentration minus the baseline concentration) by the baseline assimilative capacity available.
[6] Although chromium in recycled water was either not detected or measured at concentrations below the reporting limit; the detection limit concentration is used.

The analysis above demonstrates that TDS and arsenic necessitate further detailed evaluation due to their significant potential to impact the basin's beneficial uses, so these constituents were incorporated into the model. The model assumes that the entire mass of each of these constituents in the applied water will enter the groundwater with the respective return flow, and will instantaneously mix with the groundwater in the aquifer. This is a conservative assumption and could be lowered for well managed/regulated projects. In reality, there may be some uptake by the irrigated vegetation, retention within the soil, or some other method of consumption. Recycled water projects are regulated so that water must be applied at agronomic rates so that deep percolation of the applied water, and accompanying constituents, is minimized. If more information becomes available, the model allows for refinement of each use's constituent mass contribution to the groundwater basin. Similar enhancements can be made to the model if certain practices are put in place to manage the constituent contribution of water use activities (e.g., irrigating at agronomic rates with respect to the constituent). Note that both arsenic and TDS are naturally occurring within the basin soil and rock, but these impacts are difficult to determine and, therefore, are not incorporated into the model. It is unlikely that the SNMP water quality management goal for arsenic will be achievable in the groundwater given the high natural occurrence of the compound in the Antelope Valley, and a more likely scenario is management applied to the drinking water prior to supply (e.g., supply well head treatment). Nevertheless, arsenic was incorporated into the model to understand the potential effects of the SNMP projects.

This is a conservative assumption and could be lowered for well managed/regulated projects. The following source water concentrations were used in the SNMP model. Based on observations at Littlerock Reservoir, which is fed by natural run-off from snow packs in the local mountains and from rainfall, water entering the groundwater by means of natural recharge was assumed to contain 150 mg/L of TDS and no detectable arsenic (see Table 3-3). For a conservative projection, one half of the detection level (2 µg/L) was used in the model. The initial groundwater concentrations were based on the calculations performed in Section 3 and are 350 mg/L TDS and 9.66 µg/L arsenic. The imported water concentrations were provided in Section 3 and are 300 mg/L TDS and 3.8 µg/L arsenic. Recycled water values were calculated as the weighted average, based on the projected contribution of each recycled water facility to the overall recycled water volume and their respective constituent concentrations provided in Section 3, and rounded up – 500 mg/L TDS and 1 µg/L arsenic.

Typical TDS increases from domestic water use range from 150-380 mg/L (Metcalf & Eddy 2003) and the model assumes an increase of 175 mg/L, which is consistent with actual values measured in the Lancaster and Palmdale WRPs influent (LACSD 2013a and 2013b) as compared to the water treatment plant effluent (see Table 3-3). Arsenic is not typically increased due to domestic water use, which is consistent with actual values measured in the Lancaster and Palmdale WRPs influent as compared to the water treatment plant effluent. However, to be conservative, the model assumes one half of the detection level (1 µg/L) increase in arsenic due to domestic use. A summary of the constituent concentrations is listed in Table 4.7.

Table 4.7: Constituent Concentrations Used in Salt Balance Model

Parameter	TDS (mg/L)	Arsenic (µg/L)
Natural Recharge	150	1
Imported Water	300	3.8
Recycled Water	500	1
Aquifer Baseline	350	9.66
Increase from Domestic Indoor Use	175	0.5

Several scenarios were tested with the model, the first being no project or base case, where groundwater extraction is consistent with the sustainable yield, so that there is no change in groundwater storage, and no new projects are implemented. The second scenario incorporates the projects listed in Section 3 to the base case. The third scenario incorporates just recycled water usage without the artificial aquifer recharge projects (i.e., water banking projects). Note that the model assumes that 90% of the return flows from recycled water use and the banking/recharge projects becomes pumped water supply. The fourth and fifth scenarios consider recycled water usage and a fraction of the flows for the artificial recharge projects. A sixth scenario considers an increased incidence of dry years for the region and no groundwater recharge during those years.

Population growth is accounted for in the recycled water availability projections, which are derived using population growth forecasts. In contrast, potable water supplies are not expected to change significantly, even with increased population growth.

Linear regressions were performed using the 25-year planning period results to predict: 1) in which year water quality could potentially reach or exceed the SNMP management goals, and 2) the water quality levels in 2110 (after 100 years).

Scenario 1: Base Case

As mentioned earlier, the base case condition (Scenario 1) assumes that the 25-year planning period will remain status quo with groundwater extraction rates consistent with the sustainable yield and that no new projects identified in Section 3 will be implemented. This scenario results in no change in aquifer storage, because inflow is assumed to be equal to outflow. According to the model and considering Scenario 1, the average TDS concentration in the groundwater basin will increase by 14 mg/L by 2035 or by 54 mg/L in one hundred years, and will reach 450 mg/L in approximately 184 years. The model's Scenario 1 calculations also indicate that the groundwater basin arsenic concentration will increase by 0.12 µg/L by 2035, will be 10.1 µg/L in 2110, and will reach 10 µg/L in 72 years. Results are summarized in Table 4-8 and depicted in Figures 4-4 and 4-5. The top charts in Figures 4-4 and 4-5 are set to encompass constituent concentrations starting at zero units (mg/L or µg/L, as appropriate). Since it is difficult to discern the individual concentration increases for each scenario, the bottom charts are set at a narrower concentration range to provide better detail.

Scenario 2: Incorporation of All Future Projects

The second scenario is one in which all the projects identified in Section 3 are assumed be implemented by the projected dates within the 25-year planning period. This scenario considers the water inputs and return flows resulting from the new projects in addition to the conditions presented in Scenario 1. It is assumed that 90% of the return flows from recycled water use and the banking/recharge projects becomes pumped water supply, and 10% of the flows remain in the basin. For projecting further in the future than the planning period, the linear regressions assume no additional projects other than the ones included in the 25-year planning period. According to the model for Scenario 2, the average TDS concentration in the groundwater basin will increase by 21 mg/L by 2035 or by 88 mg/L in a hundred years, and will reach 450 mg/L in 113 years. The model's Scenario 2 calculations also indicate that the groundwater basin arsenic concentration will increase by 0.13 µg/L by 2035, will be 10.1 µg/L in 2110, and will reach 10 µg/L in 64 years. Results are summarized in Table 4-8 and depicted in Figures 4-4 and 4-5.

Scenario 3: Recycled Water Projects Only

To assess the potential effects of the recycled water projects alone without the potential dilution from the recharge projects, the third scenario tested is one in which only the recycled projects and none of the recharge projects identified in Section 3.5 are assumed to be implemented by the projected dates within the 25-year planning period. For projecting further in the future than the planning period, the linear regressions assume no additional projects other than the recycled water projects included in the 25-year planning period. According to the model and considering Scenario

3, the average TDS concentration in the groundwater basin will increase by 16 mg/L by 2035 or by 66 mg/L in a hundred years, and will reach 450 mg/L in 151 years. The model's Scenario 3 calculations also indicate that the groundwater basin arsenic concentration will increase by 0.12 µg/L by 2035, will be 10.1 µg/L in 2110, and will reach 10 µg/L in 70 years. Results are summarized in Table 4-8 and depicted in Figures 4-4 and 4-5.

Scenario 4 and 5: Recycled Water and Partial Groundwater Recharge Projects

Because it can take a considerable amount of time to get recharge projects implemented, it is possible that the projections presented in Section 3 of this report may not be met. Therefore, the fourth and fifth scenarios include all of the recycled projects and some fraction of the recharge projects identified that are assumed to be implemented by the projected dates within the 25-year planning period. To avoid assigning a likelihood of one project being implemented over another, a fraction of the total flows for all the recharge projects were assumed to be implemented. Scenario 4 assumes half of the projected inflow for the recharge projects will be implemented, whereas Scenario 5 assumes a quarter (25%) of inflow of the recharge projects will be implemented. To project further in the future than the planning period, the linear regressions assume no additional projects will be implemented after the 25-year planning period.

According to the model and considering Scenario 4, the average TDS concentration in the groundwater basin will increase by 19 mg/L by 2035 or by 77 mg/L in a hundred years, and will reach 4500 mg/L in 129 years. The model's Scenario 4 calculations also indicate that the groundwater basin arsenic concentration will increase by 0.13 µg/L by 2035, will be 10.2 µg/L in 2110, and will reach 10 µg/L in 66 years. Results are summarized in Table 4-8 and depicted in Figures 4-4 and 4-5.

According to the model and considering Scenario 5, the average TDS concentration in the groundwater basin will increase by 18 mg/L by 2035 or by 72 mg/L in a hundred years, and will reach 450 mg/L in 139 years. The model's Scenario 5 calculations also indicate that the groundwater basin arsenic concentration will increase by 0.12 µg/L by 2035, will be 10.2 µg/L in 2110, and will reach 10 µg/L in 69 years. Results are summarized in Table 4-8 and depicted in Figures 4-4 and 4-5.

Scenario 6: Extreme Drought

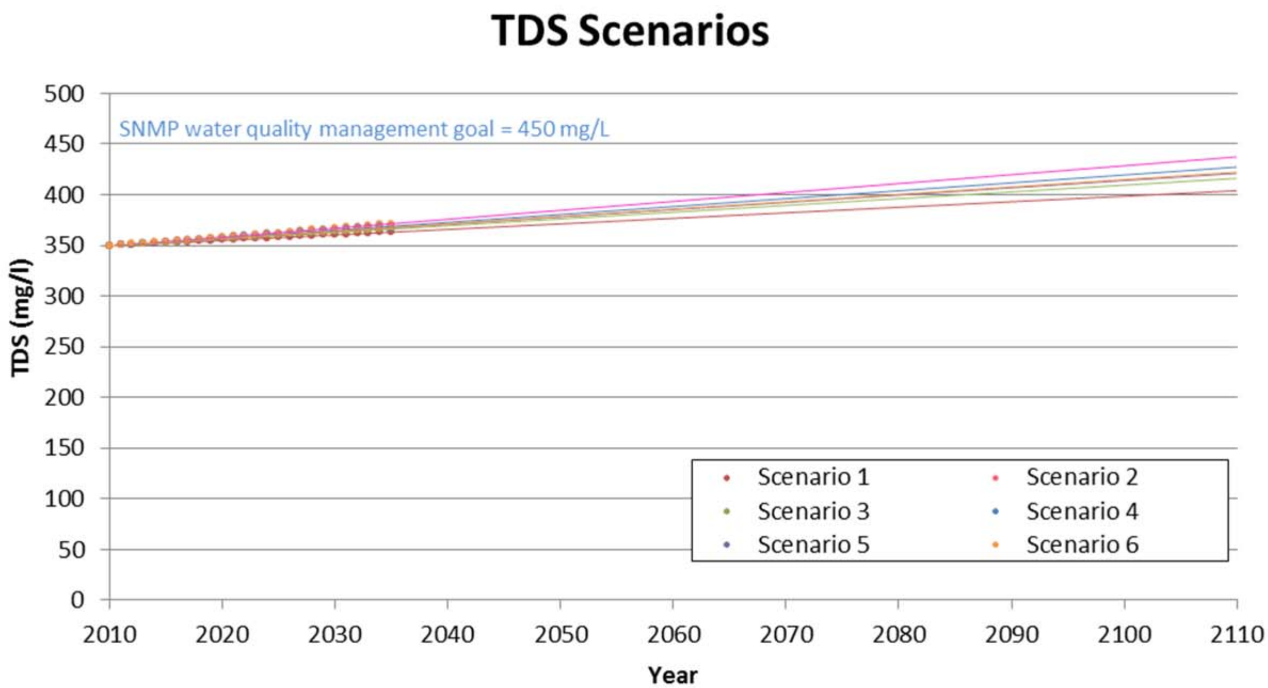
The scenarios mentioned above take into consideration average conditions, where periodic dry and wet years are averaged over the planning period to generate an average annual condition. Because the Antelope Valley is susceptible to drought conditions and decreases to imported water availability, an extreme drought scenario was examined where the annual natural recharge was decreased by 25% during the entire 25-year planning period. It is expected that any drought will not be this persistent, but this scenario can be viewed as an extreme case that provides a lower bound for natural recharge. In addition, the imported water rate was left unchanged, but no recharge projects were included. The groundwater extraction was not reduced, which resulted in the aquifer losing storage over the 25-year planning period. Due to limitations of the model, total sustainable yield findings of Summary Expert Report were ignored and the flow adjustments were made to the overall planning period rather than each individual year. This was accomplished by reducing the natural recharge by 25% for the entire planning period, while keeping imported water constant and including recycled water. These assumptions resulted in an increase after 25 years of only 1.5 mg/L TDS when compared with a similar scenario without drought conditions (Scenario 3). Moreover, the Scenario 6 TDS results are similar to the Scenario 5 (recycled water and 25% of recharge projects implemented) results. The model's Scenario 6 calculations indicate a steeper increase in arsenic concentrations than with the other scenarios tested. According to the model, the groundwater basin arsenic concentration will increase by 0.18 µg/L by 2035, will be 10.4 µg/L in 2110, and will reach 10 µg/L in 47 years. Results are summarized in Table 4-8 and depicted in Figures 4-4 and 4-5.

Table 4.8: Concentration Projections

Scenario	Concentration in 2035		Concentration by 2110		Years to Reach SNMP Water Quality Management Goal	
	TDS	Arsenic	TDS	Arsenic	TDS	Arsenic
	mg/L	µg/L	mg/L	µg/L	450 / 500 mg/L	10 µg/L
1	364	9.78	404	10.13	184 / 276	72
2	371	9.79	438	10.19	113 / 170	64
3	366	9.78	416	10.14	151 / 227	70
4	369	9.79	427	10.17	129 / 194	66
5	368	9.79	422	10.15	139 / 209	69
6	368	9.84	422	10.38	139 / 208	47

Note: The baseline Antelope Valley Groundwater Basin concentrations are 350 mg/L of TDS and 9.66 µg/L of arsenic.

Figure 4-4: TDS Model Predictions



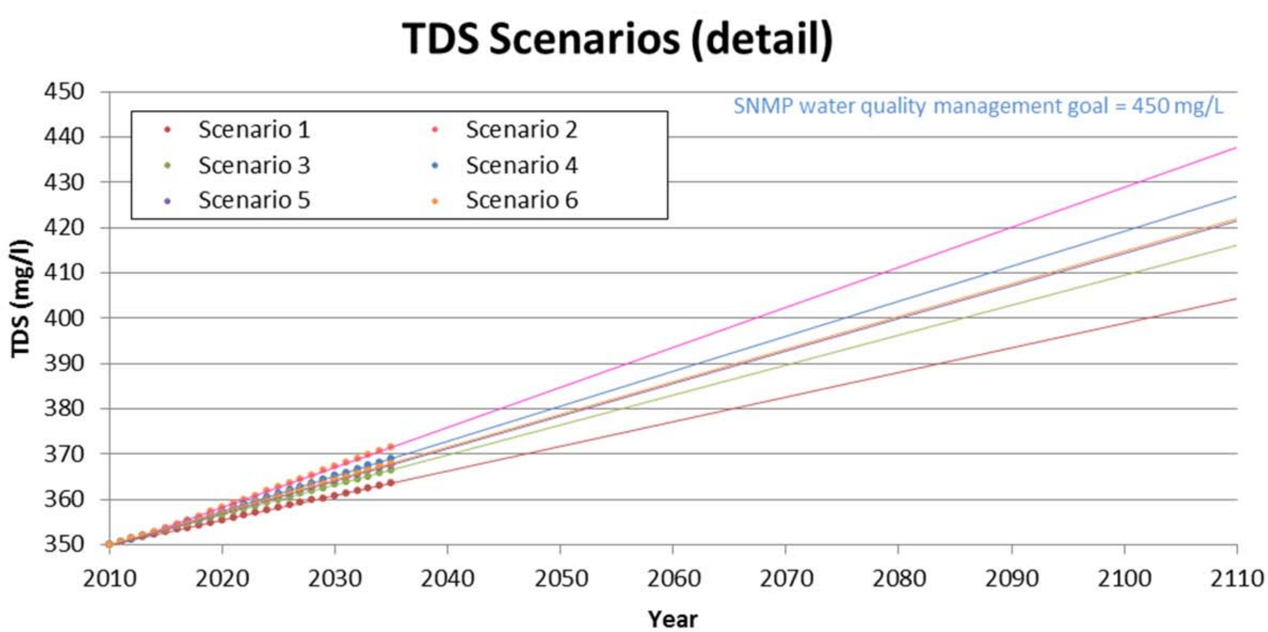
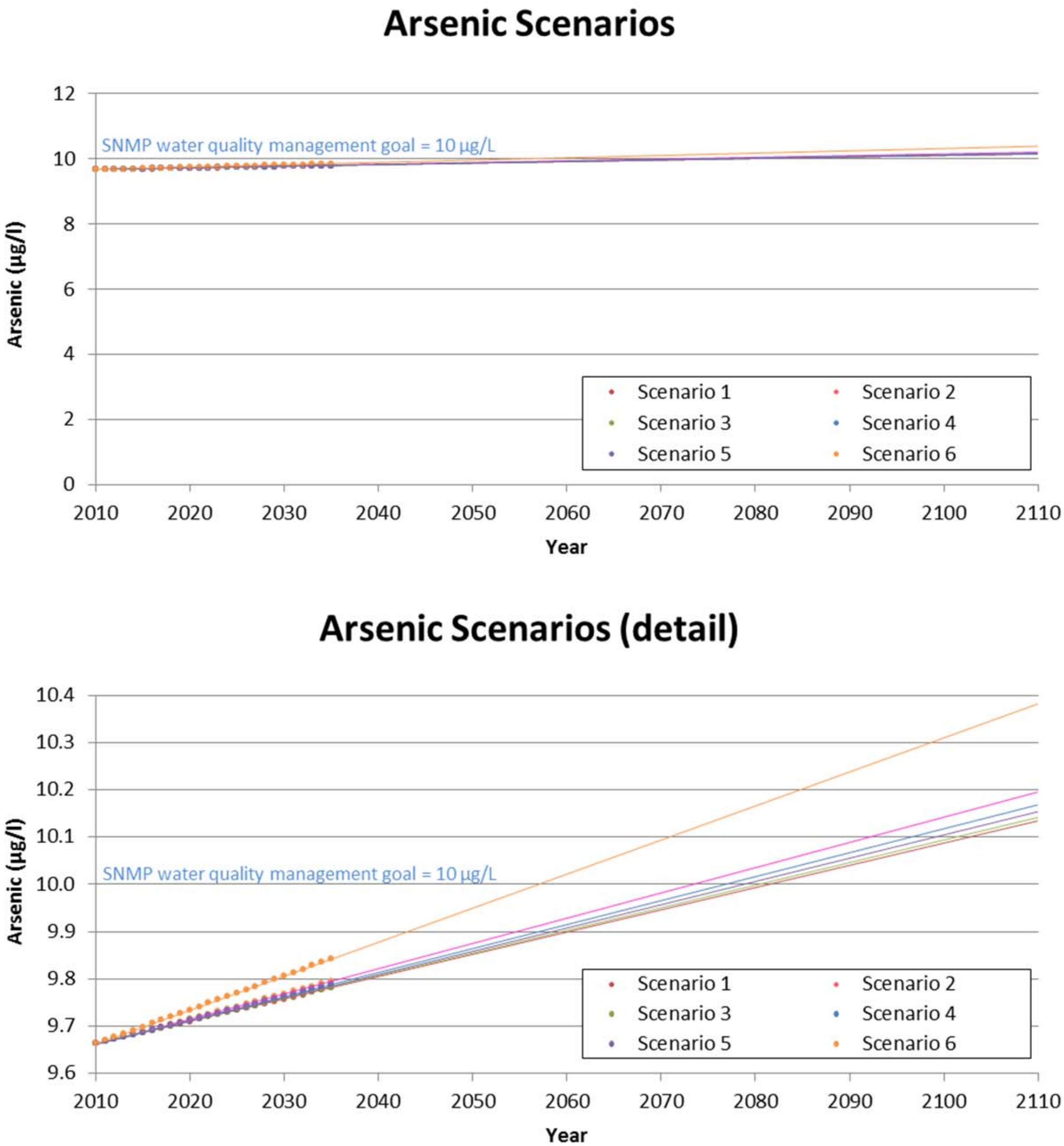


Figure 4-5: Arsenic Model Predictions



The model predicts that for each Scenario, the average Antelope Valley Basin groundwater condition with respect to TDS will not exceed the management parameters until at least 110 years. This is ample time to plan for salt management measures before a critical situation arises, although that does not appear to be necessary within the 25-year planning period. Arsenic, on the other hand, could potentially exceed the SNMP water quality management goal in as early as 47 years, but not within the 25-year planning period. It should be mentioned that there has been sub-basin average and localized exceedances of the management parameter, but these have been attributed to naturally occurring arsenic in the basin. It is understood in the region that arsenic concentrations may continue to be a concern and efforts are underway, such as well head treatment or natural attenuation projects, to ensure that the drinking water supplied to the public meets drinking water quality standards.

The Recycled Water Policy discusses an allowance of using 20% of the basin's assimilative capacity for multiple projects, over the course of a decade (10 years), to streamline the permitting process where no SNMP has been developed. A summary of basin assimilative capacity usage with respect to TDS and arsenic, calculated using the SNMP model, is included in Table 4-9. According to the model, the projects in the SNMP would be able to meet this criterion, except in the case where there are extreme drought conditions, in which the arsenic concentration increase would use 21% of the assimilative capacity. As discussed in the next sub-section, it is reasonable to assume that recycled water use despite the potential increase in arsenic concentration, which would be slight and still remain under the 10 µg/L SNMP water quality management goal, would be preferable to not having that recycled water available to meet demands during drought conditions. Also, it is important to keep in mind that many of the assumptions in the model are conservative, including the assumption that natural recharge water and domestic use of water adds arsenic equal to half the detection level. If a lower value is assumed, say one quarter of the detection level, Scenario 6 would meet the 20% criterion for 10 years.

The model predicts that after 25 years for each scenario, the water quality will not be degraded past 21% of the assimilative capacity for TDS. However, arsenic concentrations have the potential to use up much more assimilative capacity, but would not reach a 10 µg/L average basin concentration. However, given that in-lieu recycled water use in the regional would allow for potable supplies to be available for use, the increases would be offset by the benefit of having an increase in reliability of the potable supply for the residents of the water supply strapped region.

Table 4.9: Assimilative Capacity Usage

Scenario	Concentration increase in 10, 25 Years				Assimilative capacity used			
	TDS (mg/L)		Arsenic (µg/L)		TDS		Arsenic	
	10 years	25 years	10 years	25 years	10 years	25 years	10 years	25 years
1	5	14	0.05	0.12	5%	14%	14%	35%
2	8	21	0.05	0.13	8%	21%	15%	39%
3	7	16	0.05	0.12	7%	16%	14%	35%
4	8	19	0.05	0.13	8%	19%	15%	37%
5	7	18	0.05	0.12	7%	18%	14%	36%
6	7	18	0.07	0.18	7%	18%	21%	53%

Model sensitivities to the constituent concentrations used for the source waters (see Table 4-7) were examined by increasing the TDS and arsenic concentrations by 25%. Increasing these concentrations had the greatest effect on Scenario 2, which has the greatest loading to the groundwater. Table 4-10 lists the increased concentration results over the original Scenario 2 25-year projection (see Table 4-8). 50% increases were also tested and were at most double that of the 25% increase results. Increasing the imported water concentration had the greatest impact on the projections. Increasing the TDS content of the waters, except the imported water, by 50% in the model still resulted in over a century before the groundwater basin would be expected to exceed the SNMP water quality management goal. The imported water TDS 50% increase resulted in an 80-year period before the groundwater basin would be expected to exceed the SNMP water quality management goal. Because arsenic concentrations in the source waters are low or below detection levels, increasing the arsenic content yielded similar results as originally projected.

Table 4-10: SNMP Model Result Variations for Source Water Concentrations 25% Increase

Parameter	Concentration Increase to Initial Scenario 2 Projections	
	TDS (mg/l)	Arsenic (µg/L)
Natural Recharge	2	0.01
Imported Water	5	0.06
Recycled Water	1	0.01
Increase from Domestic Indoor Use	1	0.01

Agricultural land use has seen a decreasing trend in the Antelope Valley. Changing the land use assumptions and imported flows to either all agricultural or all municipal did not have much effect on the initial model projections. If the assumptions were changed to all municipal, an extreme case, the greatest effects were 1 mg/l TDS and 0.04 µg/L arsenic decreases over the initial 25-year projections results in Table 4-8. If the assumptions were changed to all agricultural water use, which is an unlikely case, the greatest effects were 1 mg/l TDS and 0.06 µg/L arsenic increases over the initial 25-year projections results in Table 4-8.

Model sensitivities to the imported water deliveries assumptions were examined. Changes in deliveries were applied to annual average of the whole 25-year period (no single year differences) and the average sustainable yield was altered due to limitations on the model. An increase in deliveries by 25% resulted in at most 3 mg/L TDS and 0.03 µg/L arsenic increases over the initial 25-year projections results in Table 4-8, while decreasing deliveries by 25% resulted in the same concentration decreases over the initial 25-year projections results. These results are consistent with the expectation that additional imported water to the basin will result in an increased load.

4.7 Antidegradation Analysis

The SNMP antidegradation analysis relies on the assessment of observed and future simulated groundwater concentrations compared to the baseline groundwater concentrations and SNMP water quality management goals, in consideration of projects that have the potential to affect the groundwater salt and nutrient concentrations. Groundwater monitoring will be used to confirm model and other predictions. Model improvements may be made based on new information, such as monitoring results.

The SNMP antidegradation analysis found that, in most cases, there will be no significant degradation of groundwater quality associated with the implementation of the SNMP projects as described in the initial constituent impact calculations (Table 4-6) and the SNMP model scenarios. The exception is with arsenic, but this is a naturally occurring constituent in the basin and it is typically not detected in stormwater and is measured at low levels in the imported and recycled water. To be protective, the projections are an overestimation of arsenic loading to the basin because of the conservative assumptions used in the model. One such assumption is that all of the applied arsenic associated with each use will reach the groundwater, whereas in reality natural attenuation typically occurs, thereby reducing the amount of arsenic that reaches the groundwater. It may be that return flows from water use in the basin cause dilutive effect to the groundwater with respect to arsenic.

It is not anticipated that future concentrations of the SNMP constituents of concern will be significantly increased with implementation of the recycled water and recharge projects. The average concentrations of the SNMP constituents in the Antelope Valley groundwater basin do not currently exceed SNMP water quality management goals and are not predicted to exceed these goals in the 25-year planning period. All of the SNMP water quality management goals are consistent with the Basin Plan. It is proposed that any change in groundwater quality associated with the projects with respect to the SNMP constituents of concern is consistent with the Antidegradation Policy for the following reasons:

The water quality changes will not result in water quality less than prescribed in the Basin Plan.

According to the initial constituent impact calculations and the SNMP model, current observed average SNMP salt and nutrient constituent concentrations in the Antelope Valley groundwater basin and simulated future concentrations through 2035 do not and will not exceed SNMP water quality management goals if the identified projects are implemented. All of the SNMP water quality management goals are consistent with the water quality prescribed in the Basin Plan. In the case of some Antelope Valley sub-basins, average baseline water quality may already exceed the SNMP water quality management goals. However, none of the projects identified are located within those sub-basins or considered to have an impact on them since the projects are located hydrologically downgradient.

The water quality changes will not unreasonably affect present and anticipated beneficial uses.

Recycled water use and aquifer recharge projects are not expected to affect present or anticipated beneficial uses. While TDS concentrations in the recycled water are higher than in background groundwater, the average concentration in the Antelope Valley groundwater basin is projected to remain below the SNMP water management goal in the future. Because TDS concentrations in the groundwater are projected to remain below 450 mg/L, local groundwater can be used for municipal use and all other beneficial uses defined in the Basin Plan (i.e. agricultural supply, industrial service supply, and freshwater replenishment) with no restrictions. Future water use is expected to increase TDS concentrations in the groundwater above existing background levels in the 25-year planning period, but not significantly, and the basin average will remain within an acceptable range that will not unreasonably affect present and anticipated beneficial uses. In the case of some sub-basins (e.g., North Muroc and Peerless) average baseline water quality already exceeds 450 and 500 mg/L, but the concentrations are all under the upper SMCL of 1000 mg/L, and thus meet MUN objectives. Furthermore, none of the projects identified are located within those sub-basins or considered to have an impact on them.

Arsenic concentrations in the recycled, imported, and natural recharge water are lower than in background groundwater and the average concentration in the Antelope Valley groundwater basin is projected to remain below the SNMP water management goals in the 25-year planning period. Because arsenic concentrations in the groundwater are projected to remain below 10 µ/L, local groundwater can be used for municipal use and all other beneficial uses defined in the Basin Plan with no restrictions. Under conservative assumptions, future water use is projected to increase arsenic concentrations in the groundwater above existing background levels in the 25-year planning period, but the basin average will remain within an acceptable range to protect present and anticipated beneficial uses. However, this is a conservative projection and it may be that return flows from use of waters with very low arsenic concentrations would cause dilutive effects to the groundwater with respect to arsenic. There are localized exceedances of arsenic in the groundwater, but they are attributed to dissolution of arsenic in basin rocks and soils and, thus, are naturally occurring. Public supply wells with arsenic concentrations above the MCL are typically shut down and/or abandoned. Other options include arsenic removal treatment at the wellhead and blending with lower arsenic concentration sources to decrease the arsenic level to below the MCL.

The remaining SNMP constituents have been projected to remain below their respective SNMP water quality management goals within the 25-year planning period if the identified projects are implemented. The constituent levels are not projected to change significantly and, thus, these water quality changes will not unreasonably affect present and anticipated beneficial uses. In the case of some sub-basins, average baseline water quality already exceeds the SNMP water quality management goal to protect the AGR beneficial use with respect to boron and fluoride, but the constituent concentrations are all under the SNMP water quality management goal to protect the MUN beneficial use. So, there may be some restrictions on the cultivation of boron or fluoride sensitive crops in these areas, which most likely has been the case historically since these constituents are naturally occurring in these areas. In any case, none of the projects identified are located within those sub-basins or considered to have an impact on them.

The water quality changes are consistent with the maximum benefit to the people of the state.

Recycled water is considered a valuable resource and is suitable for various beneficial uses. Implementation of the recycled water projects identified will increase the water supply available to the Antelope Valley Region and therefore reduce the Regional gap between supply and demand. The recycled water available to the Region is equal to the supply for over 20,000 average single-family households in the Antelope Valley. As identified in the AV IRWMP, recycled water is a much needed sustainable and reliable water supply option for the region. The recycled water projects have the potential to increase availability of supplies during SWP disruption and decrease the long-term costs of water. Recycled water use also supports adaptation to climate change impacts that increase overall demands and/or reduce supplies, as well as mitigates against climate change by reducing greenhouse gas emissions associated with the energy to import water. By using locally produced recycled water, and therefore reducing the demand for imported water from other parts of the State, the amount of recycled water that could be used in the 25-year planning period has the potential to annually save the equivalent of over 35,000 to 52,000 barrels of oil and reduce greenhouse gas emissions and other air pollutants by 48,000 to 71,000 tons annually.

Aquifer recharge projects allows for the capture of otherwise unused imported water and stormwater, as well as recycled water and increases the amount of overall supplies. Like recycled water, aquifer recharge reduces the regional gap between supply and demand and supports adaptation to climate change impacts that increase overall demands and/or reduces supplies.

Despite the potential to increase the arsenic concentration of the basin’s groundwater, which nevertheless would remain under the 10 µg/L SNMP water quality management goal unless increased by naturally occurring causes, implementation of the identified projects is preferable to not having the increased supply reliability available, especially during drought conditions. Increased use of recycled water and artificial recharge projects are benefits to the people of the Antelope Valley and contribute to the goals prescribed by the Recycled Water Policy for California.

The projects are consistent with the use of best practicable treatment or control to avoid pollution or nuisance and maintain the highest water quality consistent with maximum benefit to the people of the state.

Pollution is defined in the California Water Code, section 13050(l), to mean that beneficial uses of water are unreasonably affected. As demonstrated above, implementation of the projects identified in this SNMP will not cause an exceedance of the SNMP water quality management goals and therefore will not unreasonably affect the basin’s beneficial uses. This SNMP includes an implementation measures roadmap that incorporates, as needed, the best practicable treatment or control to avoid pollution or nuisance and maintain the highest water quality consistent with maximum benefit to the people of the state. The SNMP monitoring plan results will be used to compare future groundwater quality to applicable SNMP water quality management goals and determine whether additional measures to manage constituent load to the basin are needed for implementation.