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Technical Memorandum 4- Regional Water Demand for Phase 1 Conjunctive Use and Enhanced Aquifer Recharge Project:

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Technical Memorandum 4 – Regional Water Demand

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From: Sevim Onsoy and Sachi Itagaki, Kennedy/Jenks Consultants, Mary Stallard, Montclair Environmental

Subject: **Regional Water Demand**
Santa Cruz County Conjunctive Water Use and Enhanced Aquifer Recharge Study
K/J 0864005

1. Introduction

Kennedy/Jenks Consultants (Kennedy/Jenks) is pleased to provide the Santa Cruz County Health Services Agency (County) with Technical Memorandum 4 (TM4) in support of the Conjunctive Use and Enhanced Aquifer Recharge Project (Conjunctive Use Project). The Conjunctive Use Project is one of sixteen projects funded by a Proposition 50 Water Bond grant from the State Water Resources Control Board to the Regional Water Management Foundation, a subsidiary of the Community Foundation of Santa Cruz County. The Conjunctive Use Project is Project #3 of the grant and is being administered by the County.

1.1 Purpose

The objective of the Conjunctive Use Project is to assess the most the appropriate approaches for coordinating water projects in the Santa Margarita Groundwater Basin for increasing the volume of groundwater storage in order to improve the drinking water supply reliability, mitigate declines in groundwater levels, and increase stream baseflow (Figure 1). The Conjunctive Use Project will investigate the opportunities to use water exchanges, winter streamflow diversion, and/or reclaimed wastewater to replenish groundwater storage (Figure 1).

Understanding of the regional water supply is an important component for the Conjunctive Use Project. TM4 provides a brief summary of the overall regional water supply and demand in the Santa Margarita Groundwater Basin and provides a framework and boundary in which to evaluate potential projects. Additional refinements to this work will be useful, particularly after the 2010 UWMP update and resolution of instream flow requirements to further evaluate water needs and availability. This work corresponds to Task 4 of the County's Phase 1 Conjunctive Use and Enhanced Aquifer Recharge Project general scope of work (SOW). Task 4 consists of an inventory of current and future water supply and demand, and identification of other potential water sources and issues.

TM4 provides a regional evaluation to look for potential partners in the vicinity of the specific project area. The regional area includes the northern portion of Santa Cruz County and the specific project area is the southwestern portion of the Santa Margarita Groundwater Basin, and

includes parts of Scotts Valley District (SVWD), San Lorenzo Valley Water District (SLVWD) and the City of Santa Cruz Water Department (SCWD) as shown on Figure 1.

2. Scotts Valley Water District

The SVWD provides water to the majority of customers in the City of Scotts Valley and to some customers outside the city limits. In 1994, SVWD formally adopted its Groundwater Management Plan (Todd Engineers, 1994), and has been managing groundwater resources through a comprehensive monitoring program of groundwater conditions in the Scotts Valley area for over 20 years. Results, analysis and interpretation of the monitoring program are reported each year in the Annual Groundwater Management Report. The most recent was issued in May 2009 (Kennedy/Jenks, 2009a). Below is a brief summary of the information provided in the Annual Report and other sources.

2.1 Current Water Supply and Demand

The following subsections provide information on current water supply and demand. This information comes from the SVWD Groundwater Management Program WY2007 and WY2008 Annual Report (Kennedy/Jenks, 2008, 2009a), the SVWD Urban Water Management Plan (SVWD, 2005), and the Groundwater Modeling Study of the Santa Margarita Groundwater Basin (ETIC, 2006).

2.1.1 Groundwater Supply Sources

Groundwater production currently provides 100% of the SVWD's potable water supply from seven production wells: Groundwater production by SVWD in water year 2008 (WY2008) was 1,664 acre-feet per year (AFY). The water year represents the period from October to the following September, and is used because if more closely approximates the climatic conditions in the area which control water usage. Precipitation, in the form of rainfall, is the primary source of groundwater recharge in the basin. Groundwater recharge occurs from both the direct percolation of rainfall through the soil and the infiltration of runoff through streambeds (Kennedy/Jenks, 2009a).

The WY2008 groundwater production represents a decline of about 94 acre-feet from WY2007, and a 400 acre-feet decline over the five-year interval from WY2003 to WY2008. The WY2008 groundwater production is about 20% lower than during WY2003. Prior to 2003, groundwater production grew accordingly with the increase in population in Scotts Valley (Figure 2). From WY1977 through WY2003, groundwater production rose steadily from about 500 acre-feet to over 2,000 acre-feet (Figure 2). Groundwater production from WY2005 through WY2008 has averaged approximately 1,720 AFY (Kennedy/Jenks, 2009a).

Figure 3 shows SVWD monthly production on average from WY1997 through WY2004, as well as specifically in WY2006 and WY2007. As shown, monthly water production is typically between 100 and 150 acre-feet/month during the wetter months of November through April and between 175 and 250 acre-feet/month during the drier months of May through October. The lower summer demand in WY2007 as compared with WY2006 and the longer-term average is attributed to increased water recycling and conservation during WY2007 (Kennedy/Jenks, 2008).

2.1.2. Other Water Supply Sources

Since WY2004, SVWD has actively worked to control growth of water supply demand primarily through implementing the Water Conservation and the Recycled Water Programs. The observed decline in groundwater production is considered to primarily represent the effects of these programs. In the past five years groundwater production has steadily declined by about 75 AFY, even though the number of service connections has continued to grow (Kennedy/Jenks, 2009a).

Water Conservation: In areas where groundwater is the primary source such as SVWD, water conservation can be considered as an in-lieu groundwater recharge source as it helps to sustain groundwater levels and long-term groundwater production by reducing groundwater pumping. In recent years, SVWD has implemented several water conservation policies and practices to encourage water conservation among customers through coordinating public outreach activities, issuing monetary rebates to customers, and implementing conservation best management practices (BMPs). Among these activities, SVWD added a water conservation section to its website to promote rebate program and indoor/outdoor water conservation ideas (http://www.svwd.org/index/Water_Conservation).

SVWD adopted the California Urban Water Conservation Council's (CUWCC) Memorandum of Understanding (MOU) in 2005. As a signatory to the MOU, SVWD reports to the CUWCC on the implementation status of conservation BMPs as requested by the CUWCC. The Water Conservation Program was credited with reducing groundwater production by 250 to 450 acre-feet during WY2008 (Kennedy/Jenks, 2009a).

Water Recycling: SVWD's Water Recycling Program augments the water supply and offsets groundwater pumping for non-potable uses, especially for landscape irrigation. The source of recycled water is the tertiary water treatment plant operated by the City of Scotts Valley in conjunction with the SVWD.

Recycled water deliveries have been increasing steadily since they began in 2002, reaching nearly 159 acre-feet serving 26 sites in WY2008 (Figure 4). Through WY2008, all of the recycled water use sites were located within the Santa Margarita Groundwater Basin. Therefore, all of the approximately 159 AFY of recycled water usage is considered to represent

an equivalent decrease in groundwater pumping in the basin. This reduced pumping is considered to be left in storage in the groundwater basin and available for future beneficial use. Currently, SVWD estimates that approximately 80 acre-feet of this decrease in groundwater pumping is realized directly by the SVWD while the remainder is realized by the other purveyors in the area (Kennedy/Jenks, 2009a).

Therefore, the SVWD Water Conservation and Water Recycling Programs combined have been credited with successfully decreasing the SVWD groundwater demand between 2505 and 450 AFY, which represents a 14% to 22% reduction over existing demand (Kennedy/Jenks, 2009a). It should be noted that to continue to maintain these water savings, conservation programs should account for decay of device effectiveness and maintain funding for replacement of devices over time.

2.1.3 Water Use by Customer Type

SVWD serves primarily residential customers with some commercial development. Computer software development and disk drive assembly are the major industries in the area. Currently, there is no commercial agriculture in the service area. Based on the information from the SVWD's 2005 UWMP (SVWD, 2005), SVWD had 3,773 active water service connections that served an estimated population of 11,195 in 2005 (Table 1). Single family residential is the largest customer type in terms of both the number of accounts and total amount of water consumed. Approximately 1,250 AFY of water delivered by SVWD was used by the 3,054 single-family customers in 2005. This represents about 62% of total water delivered. Except for the commercial sector and parks/landscape customers, water used by other customer types is relatively small (SVWD, 2005).

2.2 Future Water Supply and Demand

The population in the SVWD service area is projected to increase by 9% from 2005 to 2025, reaching 12,288 (SVWD, 2005). Although the UWMP does not predict when build-out is likely to occur in Scotts Valley, it notes that since the terrain in the Scotts Valley area reduces the available land for development; most new connections after 2005 will most likely be created by zoning changes to a higher density, infill projects, and redevelopment.

Accordingly, residential growth within the SVWD service area is expected to occur with the addition of more multi-family units and condensed housing. The number of metered service connections is projected to reach 4,110 by 2025, which is an 8% increase from the 2005 conditions (SVWD, 2005). This anticipated increase in growth and development will continue to put pressure on SVWD's groundwater supply; however, production volumes for the past several years (Figure 2) indicate that this pressure will be alleviated to some extent through water conservation, water recycling, and possibly other water sources, as described further in Section 2.2.1 below.

Table 1 - SVWD Current Number of Customers and Water Use

Customer Class	No. of Accounts (8/31/05)	2005 Usage (AFY)	Percent of Total Water Use
Single Residential	3,054	1,249	62
Residential –Duplex	68	35	1.7
Residential – Triplex	12	6	0.3
Residential 4-Plex	21	18	0.9
Residential – Multi Unit	26	40	2
Landscape	66	80	4
Parks	16	2	0.1
Landscape/Parks – Recycled	*21*	*122*	*6.1*
School	22	56	2.8
Public Buildings	N/A[(a)]	12	0.6
Fire Service	202	2	0.1
Commercial	209	277	13.8
Industrial	58	110	5.5
Total	**3,775**	**2,009**	**100**

Source: Compiled from data in Tables 2-3 and 4-2 of the 2005 UWMP (SVWD, 2005).
(a) N/A indicates no specific information given.

2.2.1 Future Water Supply

The SVWD 2005 UWMP presents estimates of sustainable yield for the entire Santa Margarita Basin, which includes the area tapped by SVWD production wells in addition to the SLVWD well fields and several other water purveyors and private users. As reported in the UWMP, the groundwater sustainable yield for the Santa Margarita Basin is estimated to be 4,200 AFY (Table 2) (SVWD, 2005). This volume was originally approximated in 1995, and was reevaluated and deemed reasonable in 1998 using the basic water balance equation: inflow minus outflow equals change in storage (SVWD, 2005).

In 2006, the basin-wide Santa Margarita Basin Groundwater Model was completed. Based on this analysis, the sustainable yield for the entire Santa Margarita Basin was estimated at 3,320 AFY (ETIC 2006) which is significantly less than the earlier estimates using the overall water balance approach. Further analysis estimated the sustainable yield in the Scotts Valley portion of the Santa Margarita Basin at 2,600 AFY (ETIC 2006).

The 3,300 AFY estimate represents the groundwater volume that is available under the current production well pumping configuration without causing any overall change in storage, while the

4,200 AFY estimate represents the groundwater volume that can be removed from the Basin given an optimal spatial distribution of wells and average aquifer conditions. In addition to the assumption of optimal well locations, there are other assumptions and uncertainties inherent in defining inflows and outflow for the basin that contribute to the overall uncertainty in the 4,200 AFY estimate. To be conservative, 3,320 AFY is used as the best current estimate of available groundwater volume in the Santa Margarita Basin and that is the volume included in Table 2 below and in this section. Using 3,300 AFY as the Santa Margarita Basin sustainable groundwater yield, the total supply available from the various sources will increase from 3,450 AFY in 2005 to 3,855 AFY in 2025/

The projected increase in supply is a result of a projected increase in recycled water from the SVWD (Table 2). As presented in Section 2.1.2, 133 acre-feet of recycled water were supplied by SVWD in WY2007. This is just 12% of the maximum 1.0 million gallon per day (MGD) tertiary wastewater treatment plant capacity for generating recycled water (SVWD, 2005). As shown on Table 2, projections in the UWMP are that recycled water supply will increase in response to demand to 535 AFY by 2015 and remain at that level through 2025.

Table 2 - Santa Margarita Basin Current and Projected Future Water Supply

Water Supply (AFY)[(a)]	2005	2010	2015	2020	2025
Groundwater (sustainable yield)	3,320	3,320	3,320	3,320	3,320
Recycled Water	130	350	535	535	535
Total Supply	**3,450**	**3,670**	**3,855**	**3,855**	**3,855**

Source: SVWD's 2005 UWMP for Recycled Water and ETIC 2006 for Groundwater
(a) Estimated for normal year hydrologic conditions.

Estimates of recycled water demand (and supply) are based on potential new customers identified by the SVWD (SVWD, 2005). The SVWD Groundwater Management Plan 2007 Annual Report (Kennedy/Jenks, 2009a) indicates that several efforts are underway to expand the SVWD Water Recycling Program through the development of a Facilities Planning Report that is being completed in 2009 (Kennedy/Jenks, 2009b).

In addition, the City of Scotts Valley has passed an ordinance mandating use of recycled water for new construction where economically feasible (Kennedy/Jenks, 2009a). As a participant in the Santa Cruz County Conjunctive Use Study, Phase 1 currently in progress, the feasibility of injecting/recharging excess wet season recycled water into groundwater during the winter is being evaluated. Draft groundwater recharge reuse regulation was issued by the Department of Public Health in August 2008 for allowing recharge of aquifers with recycled water. Some of the constraints on groundwater recharge reuse discussed in the draft regulation include the requirement for dilution water prior to recharge, minimum retention time in the aquifer of 6

months before entering a drinking water well as documented by a tracer study, total organic carbon limitations, and extensive monitoring of both wastewater treatment and groundwater during operation. As a result of the extensive requirements, which may be difficult to physically meet within Scotts Valley, and because recycled water demand for irrigation in excess of supply on a year-round basis has been identified, it is unlikely that recharge of recycled water will be recommended at this time.

Another potential source of groundwater supply is increased recharge by storm water. Rainfall that is captured by storm drains that discharge directly to creeks is essentially lost as a source of groundwater recharge. The topic of surface water availability and the consequence of direct discharge of stormwater to creeks are described in greater detail in the technical memorandum for Task 2. Recent groundwater model analysis by the SVWD suggests groundwater recharge lost due to precipitation runoff in the Scotts Valley Groundwater Subarea in the range of 500 and 1,000 AFY (Kennedy/Jenks, 2009a).

Increased urbanization and direct piping of stormwater to Carbonera Creek has increased runoff and reduced groundwater recharge. The City of Scott's Valley Storm Water Management Plan (SWMP) that was approved, with modifications, by the Central Coast Regional Water Quality Control Board in March 2009, includes interim hydromodification control criteria for new and redevelopment projects. Hydromodification are changes to the storm water runoff characteristics of a watershed caused by changes in land use that result in increased downcutting and erosion in creeks. The SWMP and hydromodification control criteria will likely result in measures to reduce runoff that will, in turn, increase recharge. The hydromodification criteria will eventually be enforced through a new city ordinance (City of Scotts Valley, 2008).

SVWD's long-term goal for evaluating potentially viable new water supplies is to actively investigate and ultimately implement groundwater augmentation measures that would increase long-term groundwater supplies and provide for future water supply reliability and security. In addition to significantly increasing recycled water supply and increasing storm water recharge, SVWD plans to diversify its water portfolio through other potential long-term options for groundwater augmentation, including increased water conservation and in-lieu recharge (Kennedy/Jenks, 2008). SVWD anticipates groundwater augmentation in the range of 500 to 1,000 AFY in the long-term in an effort to significantly increase groundwater levels in the Scotts Valley area (Kennedy/Jenks, 2008).

2.2.2 Future Water Demand

Based on the 2005 UWMP, total SVWD demand is also projected to increase gradually from 2,011 AFY in 2005 to 2,346 AFY in 2025 (Table 3). Considering other groundwater users in the Santa Margarita Groundwater Basin (primarily SLVWD), total demand in the Scotts Valley area in 2025 is projected to reach 4,548 AFY, which is about a 12% increase from total demand in 2005 (SVWD, 2005).

As discussed in Section 2.1.3, SVWD groundwater production in recent years declined from its peak in WY2003 to an average of 1,740 AFY for WY2005 through WY2007 (Figure 2). Based on the 2005 UWMP projections (SVWD, 2005), SVWD groundwater pumping is anticipated to increase to 1,891 AFY by 2010, then decrease to 1,746 AFY by 2015, and then slowly increase to 1,811 AFY by 2025 (Table 3). Although these projections show groundwater pumping not changing significantly, the 2005 UWMD indicated that demand is projected to continue to increase. However, recent economic downturn, additional efforts in water conservation, and future measures to meet California's goals to reduce statewide per capita water consumption 20% by the year 2020 (20x2020) will likely result in minimal increases to groundwater pumping rates in the near term.

In addition, the SVWD's Recycled Water Program continues to expand, and much of the increased demand in the SVWD service area is projected to be met primarily with recycled water. Future demand projections for SLVWD and other water users in the Santa Margarita Basin are also included in Table 3. Future demand for SLVWD is discussed further in Section 3.2 and for other water users is discussed in Section 5. In aggregate, Table 3 indicates that there will likely be a continued deficit which could be met with groundwater pumping in the future. As the 2010 UWMP are prepared and demand projections revised to reflect water conservation efforts, it is likely that the deficit will be further minimized. It may be prudent in future phases of this project to revisit the overall supply and demand as well as Scotts Valley specific supply and demand.

Table 3 - Santa Margarita Basin Current and Projected Future Water Supply and Demand

Water Supply and Demand (AFY)	2005	2010	2015	2020	2025
Total Supply[(a)]	**3,450**	**3,670**	**3,855**	**3,855**	**3,855**
SVWD Potable Demand	1,881	1,891	1,746	1,785	1,811
SVWD Recycled Water Demand	130	350	535	535	535
Total SVWD Demand	**2,011**	**2,241**	**2,281**	**2,320**	**2,346**
Other Demand[(b)]	1,993	2,046	2,100	2,153	2,202
Total Demand	**4,004**	**4,287**	**4,381**	**4,473**	**4,548**
Estimated Consumption (93% of Total Demand)	3,724	3,987	4,074	4,160	4,230
Total Supply Minus Estimated Consumption	**-274**	**-317**	**-219**	**-305**	**-375**

Source: UWMP (SVWD, 2005) and Annual Report (ETIC, 2006).
(a) See Table 2 above for detail.
(b) Includes SLVWD well fields and other production in the Santa Margarita Groundwater Basin.

Table 4 presents the SVWD's current and anticipated water demand by each customer type as presented in the UWMP (SVWD, 2005). The total water demand is estimated to reach approximately 2,242 AFY in 2010, an increase of approximately 230 AFY or about 10% from the 2005 demand. By 2025, estimated demand would reach approximately 2,347 AFY, about 14% higher than the 2005 demand.

Table 4 - SVWD Projected Future Water Demand by Customer Class

Customer Class	2005	2010	2015	2020	2025
Single Residential	1249	1378	1401	1431	1437
Residential –Duplex	35	41	42	43	43
Residential – Triplex	6	8	8	8	8
Residential 4-Plex	18	24	24	26	26
Residential – Multi Unit	40	52	57	58	58
Commercial – Retail	184	205	209	213	215
Commercial – Offices	93	104	106	107	109
Landscape – Domestic	202	225	229	233	236
Industrial	110	123	125	127	129
School	56	63	64	65	66
Parks	2	3	3	3	3
Public Buildings	12	13	14	14	14
Fire Services	2	3	3	3	3
Total[(a)]	**2009**	**2242**	**2285**	**2331**	**2347**
% Increase from 2005	**0**	**10.4**	**12.0**	**13.8**	**14.4**

Source: UWMP (SVWD, 2005)
(a) Totals in this table differ slightly from those shown in Table 3, also from the UWMP.

3. San Lorenzo Valley Water District

Based on information on their website (www.slvwd.com), the SLVWD serves more than 7,300 metered connections. Established in 1941, the District supplies water to the southwestern portion of the City of Scotts Valley and the communities of Boulder Creek, Brookdale, Ben Lomond, Zayante, Mañana Woods and Felton. In 2007, the Mañana Woods Mutual Water Company formally joined SLVWD, and SLVWD took over the operation of the two Mañana Woods production wells. The Mañana Woods Mutual Water Company was previously a private water supplier that delivered water to its residences near Scotts Valley. In 2008, SLVWD took over as water supplier for the City of Felton, when the SLVWD completed the purchase of the system from German-owned Rheinisch-Westfälisches Elektrizitätswerk (RWE).

3.1 Current Water Supply and Demand

SLVWD has recently completed a Watershed Master Plan (SLVWD, 2009) and a Water Master Plan (Johnson, 2009). A brief summary is provided below based on information from these reports and other sources.

3.1.1 Water Supply Sources

SLVWD relies entirely on local water supplies of groundwater and of surface water from five tributaries to the San Lorenzo River, all with pre-1914 water rights. SLVWD does not import water from state or federal agencies (SLVWD, 2009, Johnson, 2009).

SLVWD's surface water supply flows primarily from creeks on the western side of the watershed. Together, these creeks, which are tributaries to the San Lorenzo River, provide approximately half of the total water supply (SLVWD, 2009). SLVWD currently operates four standalone water systems with separate water supplies: The Northern System, the Southern System, the Mañana Woods System and the Felton System. Together, these four water systems serve approximately 7,400 connections for 22,500 people (Johnson, 2009, SLVWD, 2009). The Southern System and the Mañana Woods System each serve a portion of the Scotts Valley area. The Southern System and the Mañana Woods system rely solely on groundwater.

SLVWD produces groundwater using four well fields: the Pasatiempo, the Olympia, the Quail Hollow, and the recently-acquired Mañana Woods fields. The Pasatiempo and Mañana Woods well fields are in the Pasatiempo Groundwater Subarea in the southwest portion of the Santa Margarita Groundwater Basin, and are within the specific project area for this conjunctive use evaluation (Figure 5). These well fields are southwest of the SVWD boundary. The Olympia and Quail Hollow wells produce water from the central portion of the Santa Margarita Groundwater Basin, outside of the conjunctive use project area. There are currently two active Pasatiempo production wells, one Mañana Woods well, two Olympia wells, and two Quail Hollow wells (Johnson, 2009).

In addition to groundwater, SLWVD seasonally supplements the water supplied by the Olympia wells with surface water from several creeks in the northern portion of the basin. SLWVD also has water rights to Loch Lomond Reservoir, but has not exercised those rights to date (Johnson, 2009) The recently acquired Felton supply consists of surface water diversions from tributaries to San Lorenzo River located downstream of the other SLVWD surface water diversions.

3.1.2 Other Water Supply Sources

Currently, water conservation is the only other source of water supply for the SLVWD. SLVWD has been active in promoting public awareness and education about the need to conserve

water. SLVWD has a website (http://www.slvwd.com/conservation.html) dedicated to water conservation that provides information to its customers about conservation practices and technologies. SLVWD also offers rebate programs for replacement of traditional toilets with ultra low flow toilets and installation of high efficiency clothes washers (http://www.slvwd.com/water credit program3.htm).

In response to the lack of rainfall in recent years, water conservation has become an imperative component of SLVWD's long-term water planning in order to sustain water supplies through the summer and to avoid shortfalls. Since SLVWD depends on local surface water and groundwater, its water supply is highly vulnerable to shortage in drought years. During summer 2007, SLVWD implemented Phase 2 of its Drought Contingency Plan, asking all customers to reduce water use by 20%. Due to continuing dry conditions in 2008 and 2009, SLVWD continued enforcement of the Phase 2 water restrictions described in the Drought Contingency Plan, urging customers to continue to implement water conservation measures to avoid shortfalls later in 2008 and 2009. During the implementation of the mandatory water conservation program, SLVWD intensifies public information and media campaign actions and activities, initiates neighborhood education programs, and engages in an aggressive leak detection program (SLVWD, 2008).

3.1.3 Historical and Current Groundwater and Surface Water Production

Table 5, compiled from production data provided by SLVWD, shows how water production has changed over the years. As shown, total production increased from approximately 1,650 acre-feet in 1988 to 2,060 acre-feet in 1997. For the past ten years, growth in production has been modest (less than 1% per year) but steady, reaching approximately 2,220 acre-feet in 2007.

Table 5 - Historical SLVWD Water Production

SLVWD Water Production (AFY)[a]	1988	1997	2001	2003	2007
Total Production	**1,650**	**2,060**	**2,100**	**2,130**	**2,220**
South Well Field[b]	240	430	440	440	440
Olympia Well Field	410	410	550	430	550
Quail Hollow Well Field	510	230	220	320	460
Surface Water Production[c]	490	990	890	940	770

(a) from SLVWD database
(b) currently includes Pasatiempo and Mañana Woods wells
(c) Without Felton surface water source

As shown in Table 6, groundwater supplied approximately 57% and surface water sources supplied approximately 43% of SLVWD's water during WY2006 and WY2007. An average of 417 AFY, or 19% of the total supply, was pumped from the Pasatiempo and Mañana Woods wells, which are in the specific area of interest for this conjunctive use project.

Based on the monthly data provided by SLVWD and shown on Figure 5, SLVWD water production in WY2007 during the wetter months of November through April ranged from approximately 120 to 170 acre-feet per month, while the range for October and May through September was approximately 180 to 250 acre-feet per month. Pumping from the Pasatiempo and Mañana Woods well fields ranged from 20 to 35 acre-feet during the wetter months and 37 to 52 acre-feet during the dry months. Pumping from the other well fields (Olympia and Quail Hollow) shows much more significant seasonal variation because surface water replaces much of the Olympia well field pumping during the wet months. These other wells pumped a minimum of less than 11 acre-feet during March of WY2007 and a maximum of over 148 acre-feet in July.

Table 6 - Recent SLVWD Water Production

SLVWD Water Production (AFY)	WY2006	WY2007	2-Year Average %
Pasatiempo Well Field	387	423	17.2
Mañana Woods Well Field	7	17	1.6
Olympia Well Field	357	554	20.6
Quail Hollow Well Field	329	461	17.9
Surface Water Sources[(a)]	1,114	768	42.6
Total Production	**2,193**	**2,223**	**100**

Source: Data provided by SLVWD
[(a)] Without Felton surface water source

3.1.4 Water Use by Customer Type

Similar to SVWD, the area served by SLVWD is primarily residential, with some commercial and industrial customers. Specific information on the types and numbers of SLVWD customers was not available.

3.2 Future Water Supply and Demand

Although the SLVWD has not prepared its own UWMP or GWMP, the supply and demand information and projections presented in the SVWD 2005 UWMP (SVWD, 2005) also include the SLVWD well fields. Based on the "Total Supply" projections shown on Table 3 above (from the SVWD 2005 UWMP), groundwater supply for the SLVWD service areas are projected to remain unchanged through 2025.

On the demand side, as calculated from the projections shown on Table 3, the SVWD 2005 UWMP predicts that "Other Demand" for groundwater will increase by approximately 5.3% between 2005 and 2015, and by another 4.8% between 2015 and 2025. Although specific projections for SLVWD groundwater production are not broken out, production from SLVWD

wells makes up over half of this "Other Demand" for potable water. Based on the data in Table 5, SLVWD water production increased approximately 7.8% during the ten-year period from 1997 through 2007, so these projections for future SLVWD demand appear to be reasonable.

4. City of Santa Cruz

In addition to the limits of the City of Santa Cruz, the SCWD service area includes unincorporated areas to the north and east of city limits and a small portion of the City of Capitola. An estimated population of 90,000 is served by the SCWD. The governing body for the Water Department is the Santa Cruz City Council, which is advised by a seven member Water Commission.

Unless otherwise noted, the information provided in this section is from the City of Santa Cruz's 2005 UWMP (SCWD, 2006) or it's Integrated Water Plan (SCWD, 2005). Water volumes are presented in units of million gallons (MG) in the SCWD UWMP, but have been converted to AF in this document, where appropriate, for ease of comparison with the information for other water suppliers.

4.1 Current Water Supply and Demand

The SCWD relies on both surface water and groundwater. Surface water is the primary source of water and is supplemented by groundwater when the SCWD's surface water becomes inadequate to meet the peak demand. The SCWD's water supply relies entirely on rainfall, surface runoff, and groundwater infiltration occurring within watersheds located in Santa Cruz County. The SCWD does not purchase water from state or federal agencies and does not import water from outside the Santa Cruz area.

4.1.1 Surface Water Supply

On average, about 75% of the SCWD's annual water supply needs are met by surface water diversions from the San Lorenzo River and the North Coast streams. In general, the North Coast sources are tapped to the greatest extent possible because of their excellent water quality and lowest production cost. North Coast sources consist of surface diversions from three coastal streams and a natural spring, including Liddell Spring, Laguna Creek, Reggiardo Creek, and Majors Creek. Diversions are limited primarily by flows and are least affected by water right limitations, as the use of these sources by the SCWD dates back as far as 1890. Daily production from the North Coast sources varies seasonally from 5 MGD in spring to 2 MGD in fall.

San Lorenzo River is the SCWD's largest source of water supply. Water needed to meet daily demand is diverted from the San Lorenzo River at two surface water diversion points: Tait

Street Diversion and Felton Diversion Station. The Tait Street Diversion is the main surface water diversion and dates back to the 1920s. Under normal operations, about 7.5 MGD can be produced at the Tait Street Diversion. The Tait Street Diversion is supplemented by two auxiliary wells that are hydraulically connected to the river. The Felton Diversion is operated intermittently as needed during the winter months of dry years.

Withdrawals from the Loch Lomond Reservoir are made mainly in the summer and fall months when the North Coast and San Lorenzo River sources become untreatable due to excessive turbidity from storm runoff or when flows drop off and additional supply is needed to meet higher daily demands in the peak season. Some withdrawals from Loch Lomond can also occur during the winter as well. Constructed in 1960, the Loch Lomond Reservoir has a maximum capacity of 2,810 MG (8,620 AF) and accounts for about 20% of the SCWD's annual supply. Raw water is conveyed from Loch Lomond in the Newell Creek Pipeline for treatment at the Graham Hill Water Treatment Plant. In addition to the SCWD, SLVWD is entitled to receive a portion of the water stored in this reservoir.

4.1.2 Groundwater Supply

The Live Oak Wells are pumped during summer and fall as supplemental water when the SCWD's other sources are inadequate to meet peak season daily demands. The Live Oak Well system consists of three production wells located in the southeast portion of the SCWD water service area. Groundwater production from these wells falls outside of the Santa Margarita Groundwater Basin, which is the major groundwater basin that SVWD and SLVWD depend on. The entire production of the SCWD's Live Oak Well field is derived from the Purisima Formation, which is the primary source of groundwater in the mid-Santa Cruz County region. Recharge to the Purisima Formation is thought to occur from deep percolation of rainfall in the upper watersheds and along the existing streambeds.

Even though groundwater constitutes only 4 to 5% of the entire SCWD water supply on an annual basis, it has been a crucial component of the water system for meeting peak season demands and during periods of drought. The three currently active SCWD production wells are normally operated 150 to 200 days of the year during the dry season at a combined rated of about 1.0 MGD. Details on the SCWD's historical groundwater pumping can be found in the 2005 UWMP (SCWD, 2006).

4.1.3 Other Water Supply Sources

The SCWD actively promotes water conservation and water efficiency practices as a means to protect natural resources, to stretch existing water supplies, to minimize the need for costly water supply projects, and to maximize sustainability in meeting future water needs. In June 2001, the SCWD became a signatory to the CUWCC MOU and joined the CUWCC in promoting water conservation. The City of Santa Cruz's General Plan calls for a strong emphasis on water

conservation and elimination of water waste to stretch existing sources, minimize the need for new water sources, and protect the environment. The SCWD has adopted an ordinance prohibiting water waste and is continuing to implement a broad set of conservation programs which are projected to result in long-term water savings of approximately 920 AFY. The SCWD's estimated water savings target through the implementation of water conservation programs is approximately 860 AFY for 2010. Between 2000 and 2005, the SCWD achieved water savings through conservation of about 470 AFY on average (SCWD, 2006).

4.1.4 Historical and Current Water Production

Figure 6 illustrates total annual gross water production by the SCWD over the 20-year period between 1985 and 2004 from each of the main production sources (SCWD, 2006). During this period, total water production varied from a low of 3,300 MG per year (or approximately 10,000 AFY) in 1990 to over 4,400 MG per year (or over 13,500 AFY) in 2000, depending on hydrologic conditions, operations and maintenance, customer demand, and other factors. As shown on Figure 6, production decreased from 2000 to 2002 and remained steady at approximately 4,000 MG per year (or approximately 12,300 AFY) from 2002 to 2004.

As shown on Figure 6, gross production from 2000 to 2004 for the North Coast sources averaged 1,348 MG, or 32%, while the San Lorenzo River supplies (including Tait wells) averaged 1,990 MG, or about 47% of the total annual supply. Together, North Coast and San Lorenzo River provided nearly 80% of the SCWD's yearly water needs for this time period. Water supplied from Loch Lomond reservoir averaged 716 MG or 17% of the SCWD's total annual supply. Groundwater pumping from the Live Oak Wells provided only an average of 151 MG or about 4% of the total supply annually.

Historically, net water production averages about 6% less than gross production. The difference between gross and net production is due to raw water sales, turnouts, maintenance, and losses from leakage on the North Coast transmission main. From 2000 to 2004, net water production averaged 3.9 billion gallons per year, which is about 7% less than the gross production of 4.2 billion gallons annually.

Treated net water production varies seasonally from a low of mid-200s MG (approximately 800 AF per month) in winter to a high of mid-400s MG (approximately 1,400 AF per month) in summer (SCWD, 2006). A monthly production graph for 1996 through 2002 presented in a report prepared by the SCWD Water Conservation Office (SCWD, 2004), shows production in the range of approximately 750 AF per month to over 900 AF per month during the period from November to March, and peak production in July up to approximately 1,500 AF per month. Average daily water demand ranges from about 8.5 MGD during the winter season to 14.5 MGD in summer months, with peak days reaching up to 16 MGD (SCWD, 2006). Based on information on the production section of the SCWD website (http://www.ci.santa-

cruz.ca.us/wt/production/production.html), daily SCWD water production can be as high as 18 MGD during the summer months.

4.1.5 Water Use by Customer Type

According to the SCWD's 2005 UWMP, the SCWD has 23,799 customers in the service area (SCWD, 2006). Similar to SVWD and SLVWD, single family residential class is the largest customer category in terms of both the number of accounts and total amount of water consumed (Table 7). Single residential customers use approximately 1.5 billion gallons annually (approximately 4,630 AFY), representing 42% of total water use. Multi-family residential and business sectors also consume significant amount of water, approximately 2,520 and 2,090 AFY, which represents 23 and 19% of total water use, respectively.

Table 7 - City of Santa Cruz Current Water Use by Customer Class

Customer Class	No. of Accounts	Average Annual Usage (AF)	Percent of Total Water Use
Single Residential	18,352	4,630	42
Multiple Residential	2,636	2,520	23
Business	1,886	2,090	19
Industrial	56	750	7
Municipal	230	190	2
Irrigation	412	410	4
Golf Irrigation	6	340	3
Coast Irrigation	36	190	2
Other	185	12	-
Total	**23,799**	**11,130**	**100**

Source: SCWD, 2006

4.2 Future Water Supply and Demand

According to the SCWD's 2005 UWMP, the number of SCWD's customer accounts is anticipated to increase by approximately 3,000, or 10%, between 2005 and 2030 (Table 8), which will increase water demand. Supply from existing sources is expected to remain relatively constant for this time period; therefore new supplies are needed to meet this projected increase in demand.

Table 8 - City of Santa Cruz Projected Number of Service Connections by Customer Class

Customer Class	2005	2010	2015	2020	2025	2030
Single Residential	17,926	18,182	18,494	18,823	19,087	19,352
Multi-Family Residential	2,719	2,791	2,865	2,942	3,017	3,092
Business	2,314	2,469	2,593	2,693	2,820	2,947
Industrial	50	52	54	56	58	60
Municipal	21	224	232	238	248	258
Irrigation	356	373	387	400	415	430
Golf Irrigation	6	6	6	6	6	6
Coast Irrigation	29	29	29	29	29	29
Other	263	293	304	310	320	330
Total Connections	**25,689**	**26,429**	**26,979**	**27,517**	**28,025**	**28,534**
% Increase from 2005	**0**	**2.8**	**4.8**	**6.6**	**8.3**	**10.0**
Total System Demand (Table 10)	**14,930**	**15,440**	**15,630**	**15,830**	**16,080**	**16,340**
% Increase in demand from 2005 (Table 10)	**0**	**3.4**	**4.7**	**6.0**	**7.7**	**9.4**

Source: City of Santa Cruz 2005 UWMP, estimated based on demographic data and land use information.

The increase in service connections can then be compared to the total estimated demand found in Table 10. The percent increase in demands found in Table 10 are slightly lower in the later years reflecting the impacts of water conservation on per unit demand.

4.2.1 Future Water Supply

Table 9 presents projections of water supply and water production for each of the SCWD's current major sources. Estimates are based on normal water conditions in future years with no change to current operations or water rights. Based on these projections, the SCWD supply would remain constant at approximately 4.3 billion gallons per year (approximately 13,200 AY) into the foreseeable future. However, even for single dry water years, estimated water supply from these sources is estimated to be reduced significantly to approximately 11,700 AFY (SCWD, 2006). During multiple dry years, further reductions would be expected, with the estimated water supply ranging from 8,300 AFY to 10,740 AFY (SCWD, 2006). Regardless, based on projected demand, the SCWD needs additional water sources to meet demand in the future.

As discussed above, SCWD has an active water conservation program that is projected to provide 300 MG per year (approximately 920 AFY) water savings in the future (SCWD, 2006). The implementation of the other water augmentation options described below is anticipated to require a regional approach to planning and capital investment. The success of these programs is dependent upon coordinated planning, design and implementation. These and other alternatives for water augmentation considered by the SCWD, SVWD, and SLVWD will be

identified and evaluated for effectiveness in addressing regional water supply and demand issues as part of Task 5 of this project.

Table 9 - City of Santa Cruz Current and Future Planned Water Supply Sources

Water Supply Sources (AF) [(a)]	2005	2010	2015	2020	2025	2030
Groundwater Production	570	570	570	570	570	570
Surface Water Diversions						
North Coast Sources	3,310	3,310	3,310	3,310	3,310	3,310
San Lorenzo River	6,160	6,160	6,160	6,160	6,160	6,160
Loch Lomond Reservoir	3,200	3,200	3,200	3,200	3,200	3,200
Transfer in or out		Potential transfer of up to 1,400 AFY out to Soquel Creek Water District.				
Desalination		Potential production of 1,400 AFY in normal water years for transfer to Soquel Creek Water District.				
Other	-	-	-	-	-	-
Total (Average Year)	**13,240**	**13,240**	**13,240**	**13,240**	**13,240**	**13,240**
Total (Single Dry Year)	**11,660**	**11,660**	**11,660**	**11,660**	**11,660**	**11,660**
Total (Multiple Dry Years)	**8,290**	**8,290**	**8,290**	**8,290**	**8,290**	**8,290**

Source: City of Santa Cruz 2005 UWMP, data converted from MGY to AFY and rounded to nearest 10 AFY
(a) Volumes are estimated for average water year.

It should be noted that the total average annual runoff in the San Lorenzo River is 93,000 AFY, which should be compared to the UWMP average year San Lorenzo River availability of 6,160 AFY. In hydrologically wet years, the annual runoff can range from about 120,000 AFY up to a peak of 280,000 AFY in 1993. However, it should be noted that even in hydrologically wet years, diversion of more water may not be feasible as there is insufficient storage in Loch Lomond and water demands are lower in the diversion periods so the water, unless it can be stored elsewhere, will naturally flow out to the ocean.

Water Recycling: The City of Santa Cruz owns and operates a regional wastewater treatment facility providing service to a population of approximately 130,000 in the cities of Santa Cruz and Capitola and parts of unincorporated Santa Cruz County. The SCWD has conducted a conceptual level evaluation of water supply alternatives which identified wastewater reclamation as a potentially viable new water source for the SCWD (Black and Veatch Engineers, 2002). Reclaimed water exchange with the North Coast farmers is considered viable for the SCWD. The general concept is that reclaimed water would be delivered to farmers for irrigation supply in exchange for groundwater that farmers currently use. A rough estimate of groundwater pumping that could potentially be exchanged with reclaimed water is 400 to 500 MG per year (Black and Veatch Engineers, 2002).

Desalination: The SCWD has recently completed a conceptual evaluation of water supply alternatives which identified ocean-water desalination as a potentially viable new water source for the SCWD (Black and Veatch Engineers, 2002). In response to projected shortfalls in future water supplies during drought conditions, the SCWD is evaluating the feasibility of securing a supplemental source of water through seawater desalination. Objectives of this effort are two-fold: to reduce reliance on well water and prevent the threat of seawater intrusion in local groundwater aquifers. The SCWD's Integrated Water Plan envisions building and operating a new seawater desalination plant with a 2.5 MGD capacity in a cooperative arrangement with the Soquel Creek Water District (SCWD, 2006).

The general concept for a regional desalination facility is to provide water to the SCWD during drought years and to the Soquel Creek Water District during non-drought, normal rainfall years. This supply is projected to become available beginning around the year 2010. In the near term, the plant would be operated only in drought conditions. After 2015, up to 1.25 MGD of water from the desalination plant may be needed on a regular basis as a supplemental water supply for the SCWD, depending on the actual water demands at that time stemming from the physical expansion and the amount of growth in the City and County of Santa Cruz and the City of Capitola under future General Plans (SCWD, 2006).

SCWD's proposed water portfolio for the future under both "normal" and "drought" conditions is summarized in Figure 7 from the Fall 2008 Integrated Water Plan Update (SCWD and Soquel Creek Water District, 2008). As shown, SCWD plans to supplement current supply primarily through conservation with limited water recycling during normal rainfall periods, and to add rationing, desalination, and banked water to the supply during drought periods.

4.2.2 Future Water Demand

Forecasts for the SCWD service area suggest that the total annual water demand would increase to 4.8 billion gallons (approximately 14,700 AFY) in 2030 (Table 10). Including the expected system losses, the total demand would actually be 5.3 billion gallons (approximately 16,300 AFY) in 2030 (SCWD, 2006).

Table 10 - City of Santa Cruz Water Demand Projections (AF)

Customer Class	2005	2010	2015	2020	2025	2030
Single Residential	4,890	4,850	4,850	4,860	4,870	4,890
Multi-Family Residential	2,920	2,950	2,980	3,020	3,060	3,110
Business	2,700	2,850	2,980	3,070	3,200	3,340
Industrial	1,760	2,030	2,030	2,040	2,040	2,050
Municipal	170	170	180	180	190	200
Wastewater Plant	70	70	70	70	70	80
Irrigation	440	460	480	490	510	530
Golf irrigation	360	360	360	360	360	360
Coast irrigation	100	100	100	100	100	100
Other	50	50	60	60	60	60
Metered Water Consumption	**13,440**	**13,900**	**14,070**	**14,250**	**14,470**	**14,710**
Water Losses	1,490	1,540	1,560	1,580	1,610	1,640
Total System Demand	**14,930**	**15,440**	**15,630**	**15,830**	**16,080**	**16,340**
% Increase from 2005	**0**	**3.4**	**4.7**	**6.0**	**7.7**	**9.4**

Source: SCWD, 2006

5. Area wide Supply and Demand

This Section provides information on other water suppliers and users in the project area, as well as an overall summary of significant water supply and demand factors for the area of interest.

5.1 Other Water Demands in the Area

Currently, several other water users, in addition to SVWD and SLVWD, depend on groundwater in the Scotts Valley area. These users were accounted for in the SVWD 2005 UWMP (SVWD, 2005), under “Other Demand”, although no breakdown for specific users were provided. This “Other Demand” was shown as 1,993 AFY in 2005, with a projection to reach 2,202 by 2025. Based on data provided by SLVWD, approximately 1,000 AFY was pumped from SLVWD wells in 2005, leaving approximately 1,000 AFY in additional demand from other groundwater users. Historical and current users are briefly described below.

Mount Hermon Association – As a private water purveyor, Mount Hermon Association supplies water to a nearby area outside of the Scotts Valley city limits. Based on data provided by the Mount Hermon Association, groundwater pumping by this purveyor has steadily increased from 90 acre-feet in WY1984 to 215 acre-feet in WY2007.

Environmental Remediation Activities - Historically, environmental remediation activities in the basin have accounted for significant groundwater production in the basin, primarily for the Watkins-Johnson Superfund Site and the Camp Evers MTBE plume. However, based on data provided by Watkins-Johnson, groundwater production for environmental remediation has

steadily declined from 464 acre-feet in WY1986 to 144 acre-feet in WY2007. Communication with the regulators is underway to monitor the potential shut-down of remedial activities at the Watkins-Johnson Superfund Site.

Hanson Quarry – A significant amount of groundwater was used for gravel mining operations, gravel washing and dust control until the quarry was closed in 2004. Groundwater use ranged from 96 acre-feet to 470 acre-feet between WY1976 and WY2004, but no pumping has been reported since 2004.

Other Private Users – Based on the "Other Demand" volume presented in the UWMP and the volumes reported for Mount Hermon and the Watkins-Johnson site above, groundwater pumping by other private users is Santa Margarita Basin is estimated to be approximately 600 acre-feet for WY2005. The Groundwater Modeling Study of the Santa Margarita Groundwater Basin (ETIC, 2006) provided WY2004 pumping data for other private users that accounted for a little over half of this volume. The largest other users shown in this report include the Valley Gardens Golf Course (113 acre-feet), Montevalle Mobile Park (60 acre-feet), Spring Lakes (46 acre-feet), Vista del Lago (38 acre-feet), and Mission Springs (30 acre-feet).

5.2 Water Supply and Demand Summary

Table 11 that follows summarizes the key information on current and future water supply and demand that is presented in Sections 2 through 5. This table focuses on information for the areas of most interest for this conjunctive use project, i.e., the southern portion of the Santa Margarita Basin (Scotts Valley area) and the area served by SCWD. As shown, this table indicates a significant and increasing deficit in available supply in the future based on current groundwater and surface water supplies.

The actual deficit may be adjusted because it is based on supply and demand in an "average" year and does not account for prolonged drought. An estimate of supply that accounts for SCWD's single dry year supply would increase the deficit to approximately 4,400 AFY in 2005 up to 5,700 AFY in 2025. On the other hand, since the estimated supply of 3,320 AFY shown for the Santa Margarita Basin is a more conservative estimate of "sustainable yield" than the earlier higher estimate, the estimated deficit is likely to be fairly conservative. In addition, the estimated deficit shown on Table 11 does not account for measures already taken to reduce demand on groundwater and surface water sources, including water conservation by SCWD and SVWD and use of recycled water by SVWD. As shown, these measures have already reduced demand significantly and will likely reduce demand further in the future. However, it is clear from these projections that other water sources and approaches to regional water management must be identified and utilized to meet projected future demand and to improve the overall reliability of water supply to the Scotts Valley and Santa Cruz area. As noted earlier, the demand estimates should be reviewed once the 2010 UWMP are completed by SCWD and SVWD.

Table 11 - Project Area Water Supply and Demand Summary

	2005	2015	2025
	<----------AFY---------->		
ESTIMATED SUPPLY			
Santa Margarita Basin[1]	3,320	3,320	3,320
SCWD[2]	13,240	13,240	13,240
Total	**16,560**	**16,560**	**16,560**
ESTIMATED DEMAND			
Santa Margarita Basin[3]	4,004	4,381	4,548
SCWD[4]	15,000	15,600	16,100
Total	**19,004**	**19,981**	**20,648**
ESTIMATED DEFICIT	**2,444**	**3,421**	**4,088**
IDENTIFIED POTENTIAL ADDITIONAL SOURCES			
SVWD Recycled Water[5]	130	535	535
SVWD Conservation[6]	170 to 320	<---------- 320+---------->	
SCWD Recycled Water[7]	0	<----------up to 1,500---------->	
SCWD Conservation[8]	470	920	920
SCWD Desalination[9]	0	<----------1,400---------->	

6. Opportunities for Water Exchange or Transfer

6.1 Intertie System

The Santa Cruz County water agencies and Santa Cruz County are cooperating to develop an intertie system to help manage water resources on a regional basis. Currently, only emergency interties exist between the SCWD system and the SVWD and Soquel Creek Water District. These connections, however, were set up to feed water from the SCWD system to the adjacent Districts for short-term emergency purposes. The interties are not intended for, nor are the adjacent systems currently capable of, transferring or exchanging non-emergency water with the SCWD.

The project to develop a new intertie system is an effort to develop water markets between the water agencies in Santa Cruz County that would allow for banking excess water when transfers and conservation meet the needs of the region and conserving the groundwater and surface water resources when alternative supplies are available for transfer. The ability to share water efficiently would allow the water agencies to work collaboratively towards a variety of goals, including sustainable water supply, drought preparedness, reducing dependence on

groundwater, reducing stream diversions during critical habitat periods, increased use of recycled water, and development of alternative water sources through water market exchanges.

Towards this goal of regional interties, SVWD submitted two grant applications in January 2009 on behalf of five agencies (SVWD, SLVWD, and SCWD, along with the Soquel Creek Water District and Santa Cruz County) to the U.S. Bureau of Reclamation under its "Water for America: Water Marketing and Efficiency Grant" and "Water for America: Expand, Protect, and Conserve Our Nation's Water Resources-System Optimization Reviews" opportunities.

The primary goal of the project proposed in these grant applications is to optimize water resource management and exchanges amongst the agencies. The implementation of the proposed program is subdivided into two main tasks: 1) hydraulic modeling, and 2) conjunctive use through water markets, banking and conservation. The grant proposal specifies that current demands, projected future demands and shortages for each agency would be taken into consideration as interties between the agencies are developed. Water rights, in-stream flows, and possible storm water for recharge would also be considered as part of the project. After completion of all the tasks, integration of the systems through the hydraulic model and water agreements, the agencies anticipate a conceptual plan would be designed and preliminary costs assessed for the intertie system.

In addition to these proposed and existing interties between water districts, there are also existing interties within the agencies that might be of use for regional water management. These include an intertie between the northern and southern portions of the SLVWD, an intertie to allow SLVWD to tap into the Loch Lomond reservoir, and an emergency intertie between SLVWD and its newly-acquired Felton supply.

6.2 Potential Alternative Supply Sources

The interties described above would provide a system for better management of the regional groundwater resources by allowing for in-lieu recharge of the groundwater resources. In-lieu recharge consists of replacing a groundwater supply with a supply of another type that has excess water during part or all of the year. This alternative source would most likely be available in the winter months. In this type of arrangement, the in-lieu water would substitute for the groundwater as the water supply. By not pumping, the groundwater stays in storage allowing groundwater levels to recover. This saved groundwater storage provides for more water supply during times of greater need, such as an extended drought period. In addition to the surface water supply in rivers and creeks, potential water sources for in-lieu exchanges include storm water, recycled water, and desalinated water. Water quality and other considerations associated with in-lieu use of storm water and recycled water, as well as for potential direct recharge to groundwater, are discussed briefly in Section 7.

7. Regulatory and Water Quality Considerations

This section presents an overview of the potential regulatory and water quality requirements and issues that should be evaluated when contemplating the reuse of storm water or recycled water. In addition to these general concerns, each specific water source and application may have additional specific considerations related to the water quality and/or proposed reuse location and/or type.

7.1 General Water Quality Considerations

The potential water quality impacts of each project alternative must be considered, using the Regional Water Quality Control Board (RWQCB) Central Coast Basin Plan and associated amendments as a starting point. These documents can be accessed at: http://www.waterboards.ca.gov/centralcoast/publications_forms/publications/basin_plan/index.shtml. The Basin Plan specifies the beneficial uses associated with each surface water body and the water quality objectives (WQOs) associated with each beneficial use. In some cases, total maximum daily loads (TMDLs) have been established for the amount of a particular material that can be discharged to a water body on a regular basis and be assimilated such that levels remain protective for the beneficial uses designated for that water body.

It appears that the only TMDLs that have been approved to date for the project area are a nitrate TMDL and a sediment TMDL for San Lorenzo River, including Carbonera Creek, Lompico Creek, and Shingle Mill Creek. Reduction of peak stormwater flows as could occur through implementation of Low Impact Development (LID) measures, especially to Carbonera Creek, will likely have benefits in reducing erosion, and thereby sediments to the creek and assist in meeting the sediment TMDL.

In addition, the Central Coast RWQCB adopted a TMDL for pathogens in San Lorenzo River Estuary, San Lorenzo River, Branciforte Creek, Camp Evers Creek, Carbonera Creek, and Lompico Creek in March 2008, but this does not appear to have been formally approved by the state yet. Similarly, LID could improve water quality so that pathogens would also be reduced and assist in meeting the sediment TMDL.

Progress on the development, approval, and implementation of these and other TMDLs can be tracked at the basin plan website listed above in this paragraph. In addition to these Basin Plan water quality considerations, the Endangered Species Act and potential impacts on salmon and steelhead must be considered.

7.2 Storm Water

Regulatory and water quality considerations specific to the use of storm water from the Scotts Valley area are described below.

7.2.1 Regulatory Considerations

In general, the discharge of storm water to surface waters in California is regulated by the State Water Resources Control Board (SWRCB) and its nine RWQCBs through National Pollutant Discharge Elimination System (NPDES) permits. Currently, the discharge of storm water to surface waters in the Scotts Valley area is regulated primarily through City efforts and requirements. In addition, many industrial/other facilities and construction projects over one acre fall under general NPDES permits for storm water management and must prepare and implement Storm Water Management Plans (SWMPs) that address the specific storm water runoff concerns that apply to their facility/project. Small (less than 100,000 people) municipalities such as Scotts Valley fall under a General Permit for the Discharge of Storm Water from Small Municipal Separate Storm Sewer Systems (MS4s), which the SWRCB has just been in the process of implementing and enforcing in the past few years. The Small MS4 permit requires the discharger to develop and implement a Storm Water Management Plan (SWMP) with the goal of reducing the discharge of pollutants to the maximum extent practicable. The management programs specify what stormwater BMPs will be used to address certain program areas. The program areas include public education and outreach; illicit discharge detection and elimination; construction and post-construction; and good housekeeping for municipal operations.

The City of Scotts Valley has submitted a draft SWMP to the Central Coast RWQCB (City of Scotts Valley, 2008) addressing these required Small MS4 program elements. The RWQCB has recently approved the City's SWMP (City of Scotts Valley, 2008). Following SWMP approval, the City of Scotts Valley will implement the specified monitoring program and prepare annual reports demonstrating that the community has implemented the plan and complied with the measurable goals. This program will enhance the efforts the City of Scotts Valley has already made towards improving storm water quality, maintaining pre-development runoff rates, limiting erosion, etc.

Santa Cruz County, with the City of Capitola has also prepared a SWMP for the areas within the County except for Scotts Valley, Santa Cruz and Watsonville which have their own SWMP programs. The County's SWMP program was originally approved in 2003 and was recently updated in 2010.

The use of storm water to recharge groundwater has a set of requirements different from those for surface water discharge. Recharge of storm water through grassy swales, "filter strips" and similar impoundments is generally unregulated in California. More "engineered" storm water

recharge facilities generally fall under the category of a “Class V well” under the federal Underground Injection Control (UIC) regulations. Per EPA, a Class V well is by definition any bored, drilled, or driven shaft, or dug hole that is deeper than its widest surface dimension, or an improved sinkhole, or a subsurface fluid distribution system (an infiltration system with piping to enhance infiltration capabilities).

To comply with UIC in California for storm water “injection”, one must: 1) submit an Inventory Form to EPA describing the planned “injection”; once this form is submitted the submitter is then “authorized by rule” to operate; 2) respond to any request from EPA for additional information or investigations; 3) apply for a permit if EPA requires it (no record of this being required in California has been identified) and, 4) make sure the “injection” facilities are not adversely affecting drinking water sources. In addition, the RWQCBs have the authority to issue Waste Discharge Requirements (WDRs) for any discharges that may impair beneficial use, but they have not issued these for storm water recharge to date.

The Scotts Valley draft SWMP contains BMPs for storm water management that would apply to infiltration as well as surface discharge (i.e., measures to make sure the water is as clean as possible). Already existing measures to increase/improve storm water infiltration in Scotts Valley include: 1) construction measures to allow more infiltration have been required since the mid-1990s at least; and, 2) new hydromodification standards have been recently established for new/redevelopment projects. Similar measures are found in the County’s SWMP.

7.2.2 Water Quality Considerations

The primary concerns for discharge of storm water into surface waters in the project area are the TMDLs described in Section 7.1 (i.e., sediment and pathogens). Other contaminants of concern in municipal systems are total suspended solids (TSS), total organic compounds (TOC), and pH. In general, municipalities under the Small MS4 permit are not required to perform chemical monitoring. However, a wide variety of chemical contaminants may be present in storm water. Fuel hydrocarbons, heavy metals and other chemicals may be monitored as part of site-specific industrial permits. Pesticides, PCBs, dioxins and other persistent synthetic organic compounds may also be present in storm water from some areas.

These water quality issues will also be of concern if direct injection of storm water is considered for ground water recharge. On the other hand, these water quality issues will be less of a concern with surface or near-surface storm water infiltration because of the subsurface materials the water must pass through provide filtration and treatment before reaching the groundwater. In general, the farther the infiltration point is located both laterally and vertically from a water supply well the more water quality is protected. In addition, common sense dictates that storm water from industrial/commercial sites with significant outdoor chemical use or storage should not be used for infiltration projects.

7.3 Recycled Water

Regulatory and water quality considerations specific to the use of recycled water are described below.

7.3.1 Regulatory Considerations

Permits for the use of recycled water in California are granted by the SWRCB and its nine RWQCBs. The California Department of Public Health (CDPH) reviews and establishes water recycling criteria and regulations. For each water-recycling project, CDPH makes recommendations to the appropriate RWQCB, and the RWQCB issues the permit and provides ongoing oversight of the project. To establish uniform requirements for the use of recycled water, the SWRCB adopted a statewide Recycled Water Policy on February 3, 2009 (http://www.waterboards.ca.gov/water_issues/programs/water_recycling_policy/). The regulatory provisions of this policy will not go into effect until approval by the Office of Administrative Law. The primary purpose of the policy is to increase the use of recycled water.

Reuse of recycled water at the surface (e.g. for irrigation) is relatively straightforward and is already significantly implemented by SVWD under its permit Order No. 01-067. In general, the water must be "disinfected tertiary" recycled water to be used for most applications, including irrigation, recreational impoundments, cooling systems, and toilet flushing, among others. In addition to meeting water quality criteria (see Section 7.3.2), there are specific requirements for conveyance systems, "use area" evaluations and postingsRegulations related to recycled water in California can be found at:
http://www.waterboards.ca.gov/water_issues/programs/grants_loans/water_recycling/statutes_regulations.shtml .

For groundwater recharge using recycled water, only surface infiltration has generally been allowed. However, in Southern California, the injection or recharge of highly treated recycled water directly to groundwater has been allowed in Orange County and at the Montebello Forebay in Los Angeles County for many years. The Orange County project provides additional treatment of the recycled water with reverse osmosis, while the Montebello Forebay project recharges tertiary treated recycled water.

For a new recharge project, CDPH holds a public hearing before implementation, and provides recommendations to the RWQCB, which then prepares and issues the permit. CDPH is currently developing regulations as described in section 2.2.1, for the use of recycled water for recharge projects, and has a website dedicated to information on this (http://www.cdph.ca.gov/healthinfo/environhealth/water/Pages/Waterrecycling.aspx).

7.3.2 Water Quality Concerns

Wastewater undergoes primary, secondary and tertiary treatment at water reclamation plants. During primary treatment, large solids are removed. Secondary treatment uses bacteria to remove approximately 90% to 95% of the remaining solids and uses a disinfectant, such as chlorine, to destroy bacteria, viruses, and other pathogens. For some recycled water uses (e.g., some industrial and irrigation uses where access is controlled), secondary treatment is sufficient. For many reuse applications, advanced tertiary treatment processes, such as filtration are required. The Scotts Valley treatment plant includes a Tertiary Treatment Facility with sand filters and ultraviolet lights for water disinfection, and the treated water generated by this facility meets unrestricted use criteria for recycled water in Scotts Valley (http://www.scottsvalley.org/wastewater_recycling/wastewaterhistory.html).

Water quality standards for recycled water use in California are incorporated in Title 22, Chapter 3, Division 4 of the California Code of Regulations, with stipulations applying to the various types of reuse and levels of required treatment. Periodic monitoring is required to ensure standards are met. Recycled water for groundwater recharge and many other uses must meet the State of California drinking water standards. Even so, concerns remain with recycled water application, especially for groundwater recharge, primarily related to unregulated/emerging constituents such as pharmaceuticals and endocrine disrupters (http://www.cdph.ca.gov/CERTLIC/DRINKINGWATER/Pages/EmergingContaminants.aspx). Currently, the CDPH provides guidance on monitoring for such constituents on a project-by-project basis

8. References

Black and Veatch Engineers, 2002, City of Santa Cruz /Soquel Creek Water District Evaluation of Regional Water Supply Alternatives. Prepared in Association with Hopkins Groundwater Consultants, March 2002.

City of Scotts Valley, 2008, Storm Water Management Plan, draft stamped October 26, 2008.

ETIC Engineering, Inc., 2006, Groundwater Modeling Study of the Santa Margarita Groundwater Basin. Prepared for Scotts Valley Water District, May 2006.

Johnson, N., 2009, San Lorenzo Valley Water District Water Supply Master Plan, Administrative Draft, report prepared for the San Lorenzo Valley Water District, Boulder Creek, California, May 2009.

Kennedy/Jenks Consultants, 2008, 2007 Annual Report Scotts Valley Water District Groundwater Management Program. Prepared for Scotts Valley Water District. May 2008.

Kennedy/Jenks Consultants, 2009a, 2008 Annual Report Scotts Valley Water District Groundwater Management Program. Prepared for Scotts Valley Water District. May 2009.

Kennedy/Jenks Consultants, 2009b, Final Recycled Water Facilities Planning Report. Prepared for Scotts Valley Water District. May 2009.

Kestrel Consulting, Inc., 2005, Northern Santa Cruz County Integrated Regional Water Management Plan. Prepared with Gary Fiske & Associates. October 2005.

Santa Cruz Water Department and Soquel Creek Water District ($SCWD^2$), 2008, Integrated Water Plan Update. Fall 2008.

Santa Cruz Water Department (SCWD), 2006, City of Santa Cruz 2005 Urban Water and Water Management Plan. Prepared by City of Santa Cruz Water Department. February 2006.

Santa Cruz Water Department (SCWD), 2005, Integrated Water Plan, Final Program Environmental Impact Report, Response to Comments, October 2005.

Santa Cruz Water Department (SCWD), 2004. Adequacy of Municipal Water Supplies to Support Future Development in the City of Santa Cruz Water Service Area. March 2004.

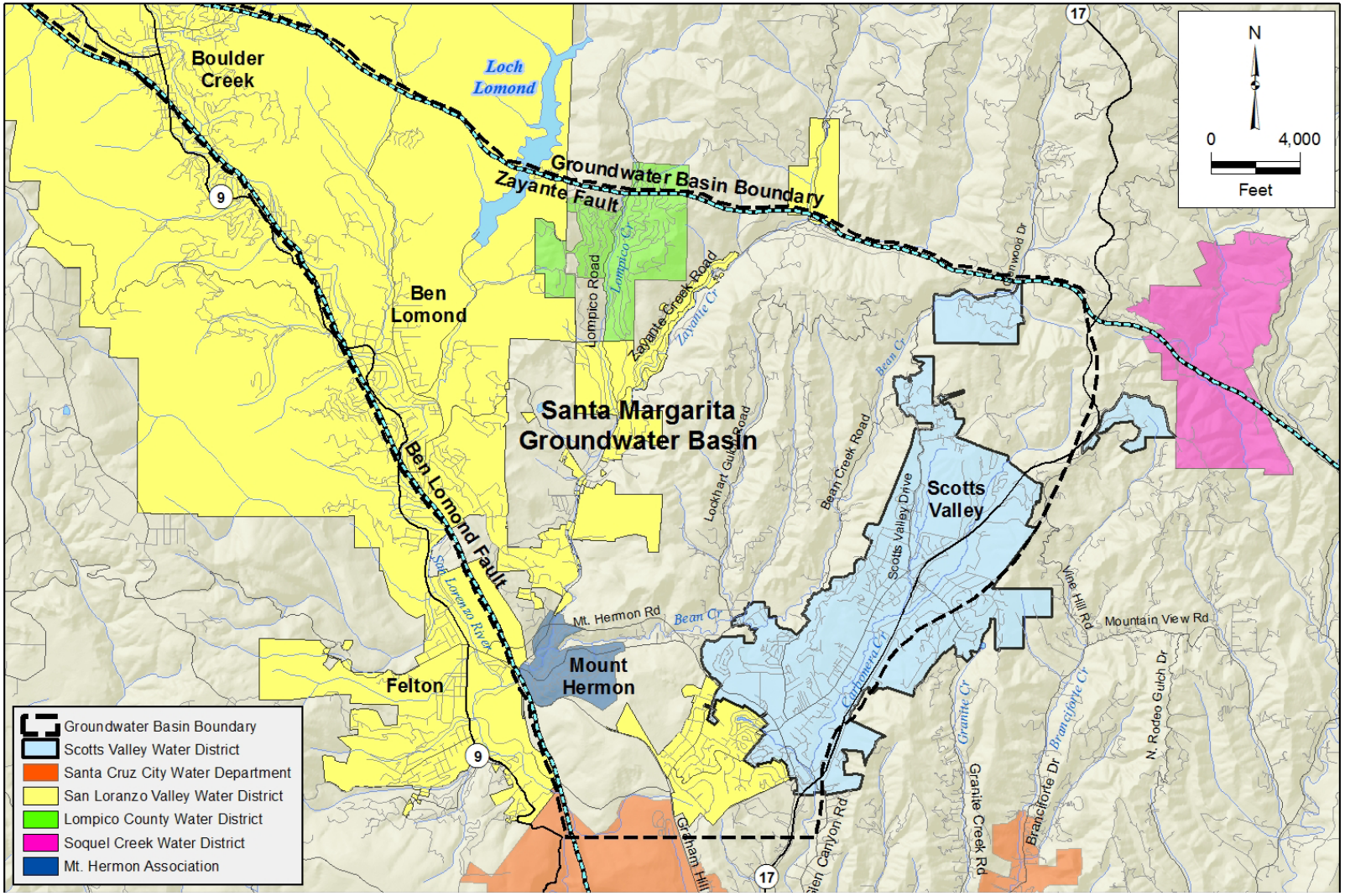
San Lorenzo Valley Water District (SLVWD), 2009, Watershed Management Plan, Part I: Existing Conditions Report, Final Version, May 11, 2009.

San Lorenzo Valley Water District, (SLVWD), 2008. Letter from James A. Mueller, District Manager, to Customers regarding Drought Contingency Management Plan. April 28, 2008.

Scotts Valley Water District (SVWD), 2005, Urban Water Management and Water Contingency Plan. Prepared by SVWD Staff and ETIC Engineering, Inc. December 2005.

Todd Engineers, 1994, Scotts Valley Groundwater Management Plan (AB 3030), report prepared for Scotts Valley Water District, 94 p.

FIGURES



Source: Kennedy/Jenks 2009a

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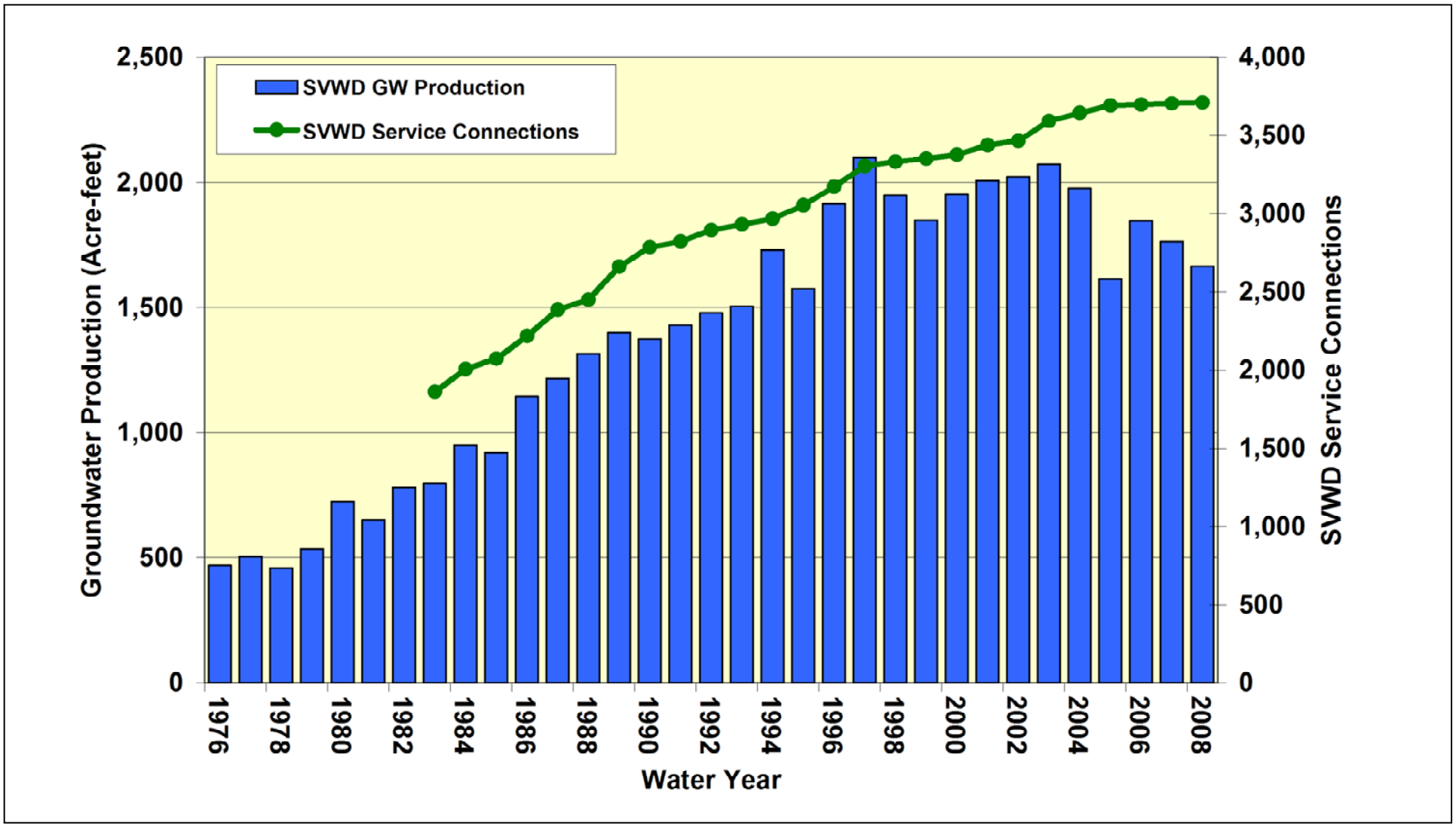
TM4 – Regional Water Demand
Conjunctive Use and Enhanced Aquifer Recharge Project
Santa Cruz County, California

Project Area Map with Water District Boundaries

K/J 0864005
November 2010

Figure 1



Source: Kennedy/Jenks 2009a

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TM4 – Regional Water Demand
Conjunctive Use and Enhanced Aquifer Recharge Project
Santa Cruz County, California

SVWD Annual Groundwater Production and Service Connections

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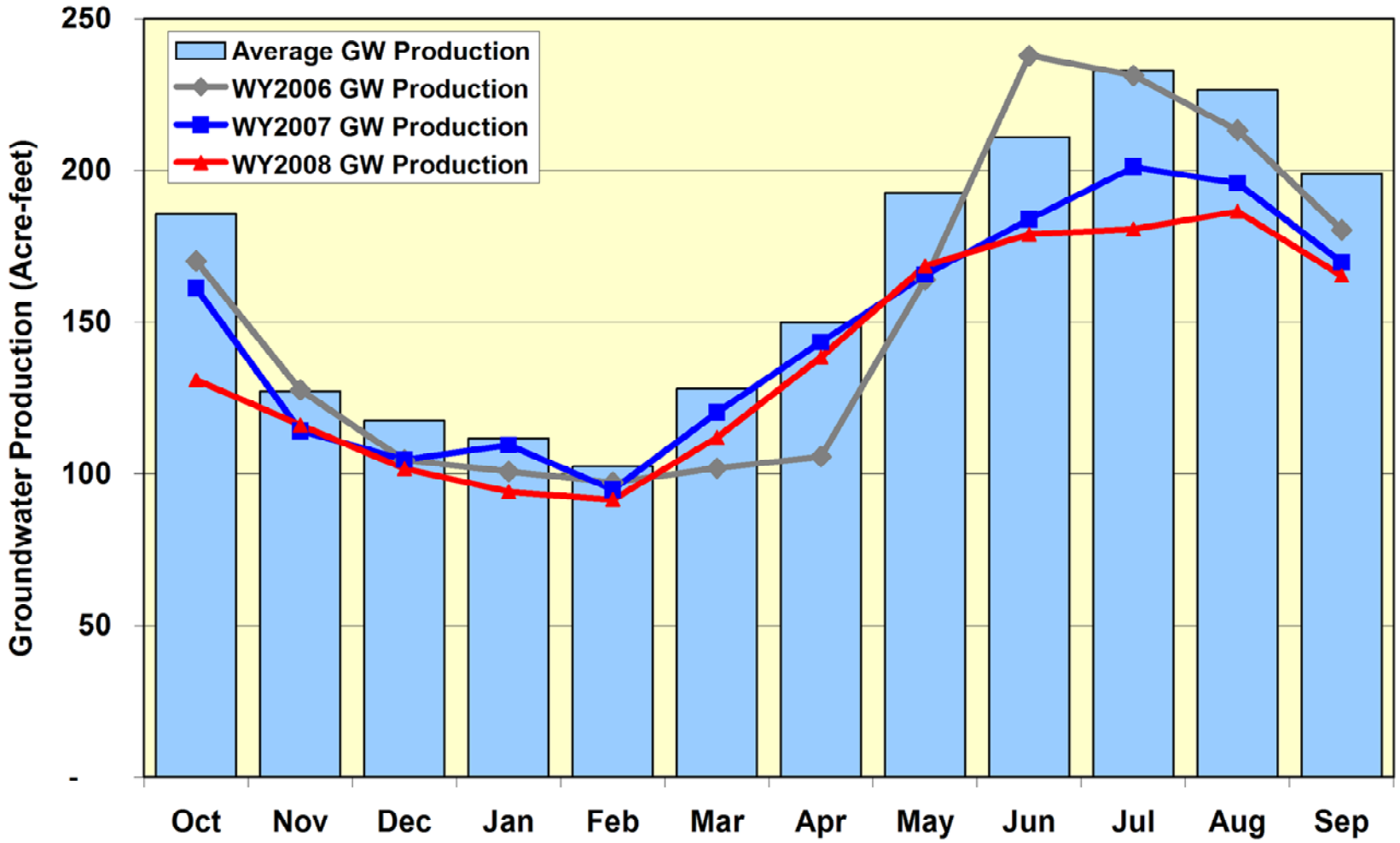
November 2010

Figure 2



Source: Kennedy/Jenks 2009a

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TM4 – Regional Water Demand
Conjunctive Use and Enhanced Aquifer Recharge Project
Santa Cruz County, California

Comparison of Monthly SVWD Groundwater Production to WY1997-2004 Average Production

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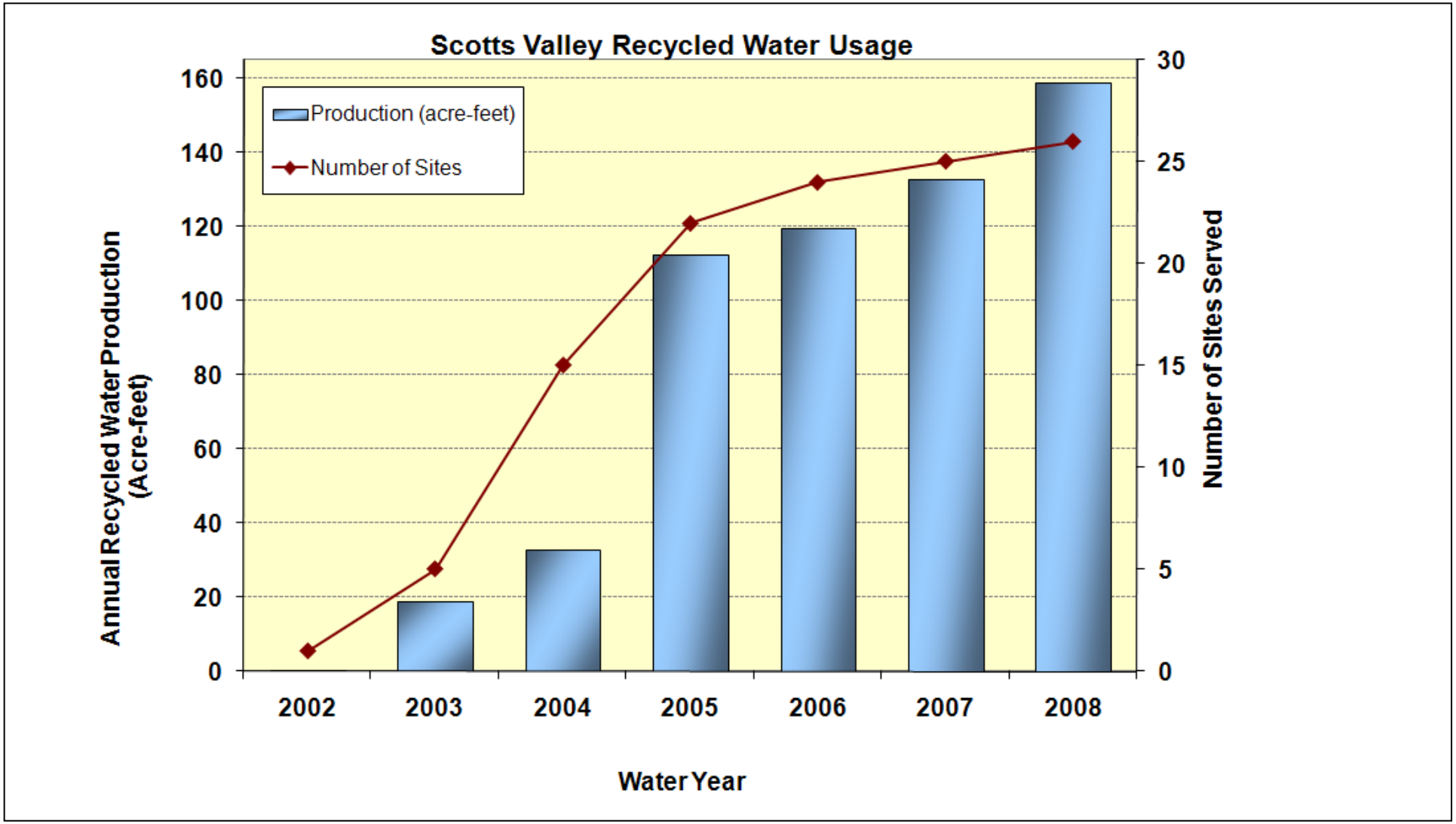
Figure 3



Source: Kennedy/Jenks 2009a

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TM4 – Regional Water Demand
Conjunctive Use and Enhanced Aquifer Recharge Project
Santa Cruz County, California

SVWD Annual Recycled Water Production and Number of Recycled Water Sites

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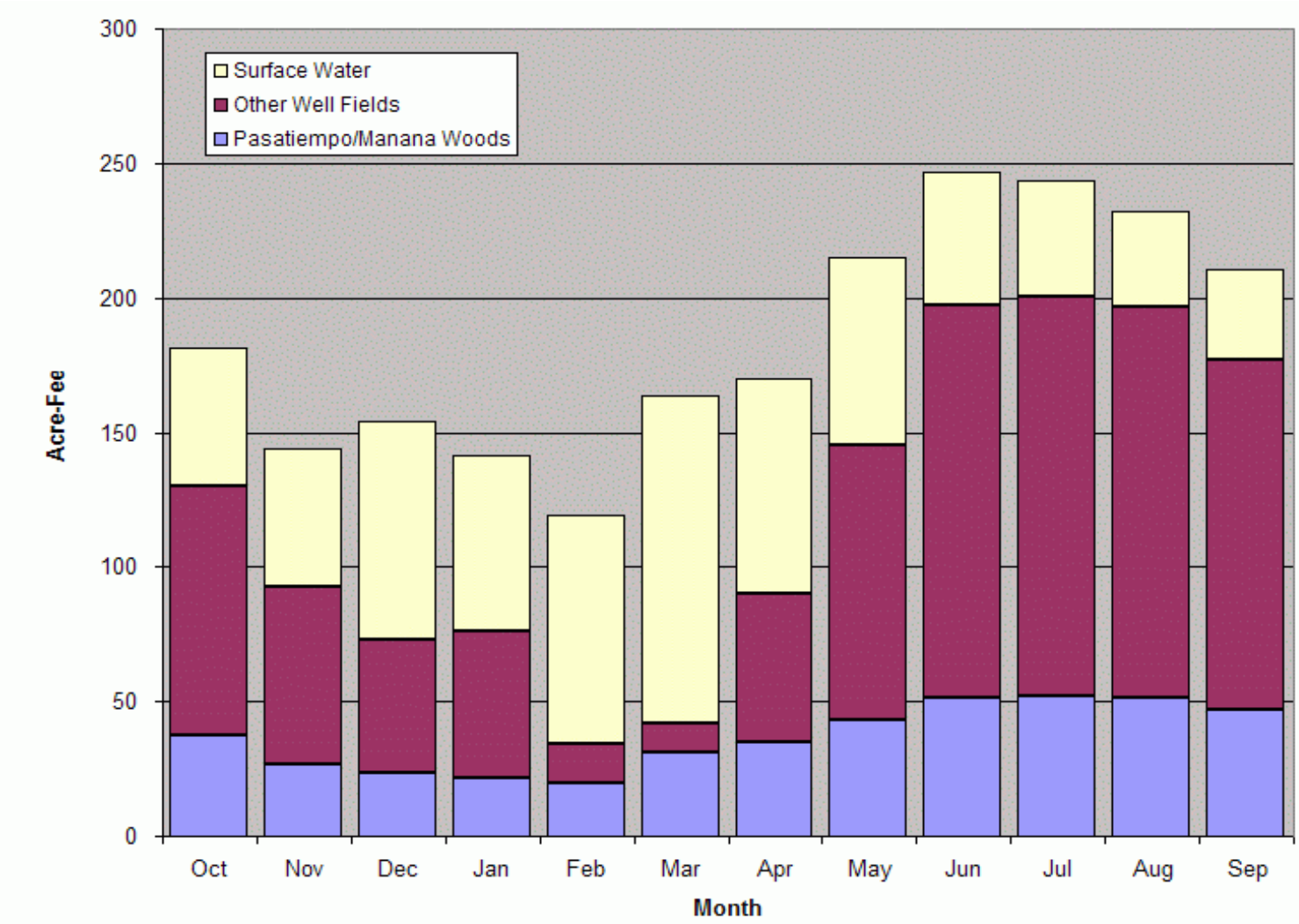
Figure 4



Source: SLVWD 2008

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TM4 – Regional Water Demand
Conjunctive Use and Enhanced Aquifer Recharge Project
Santa Cruz County, California

SLVWD Monthly Water Production for WY 2007

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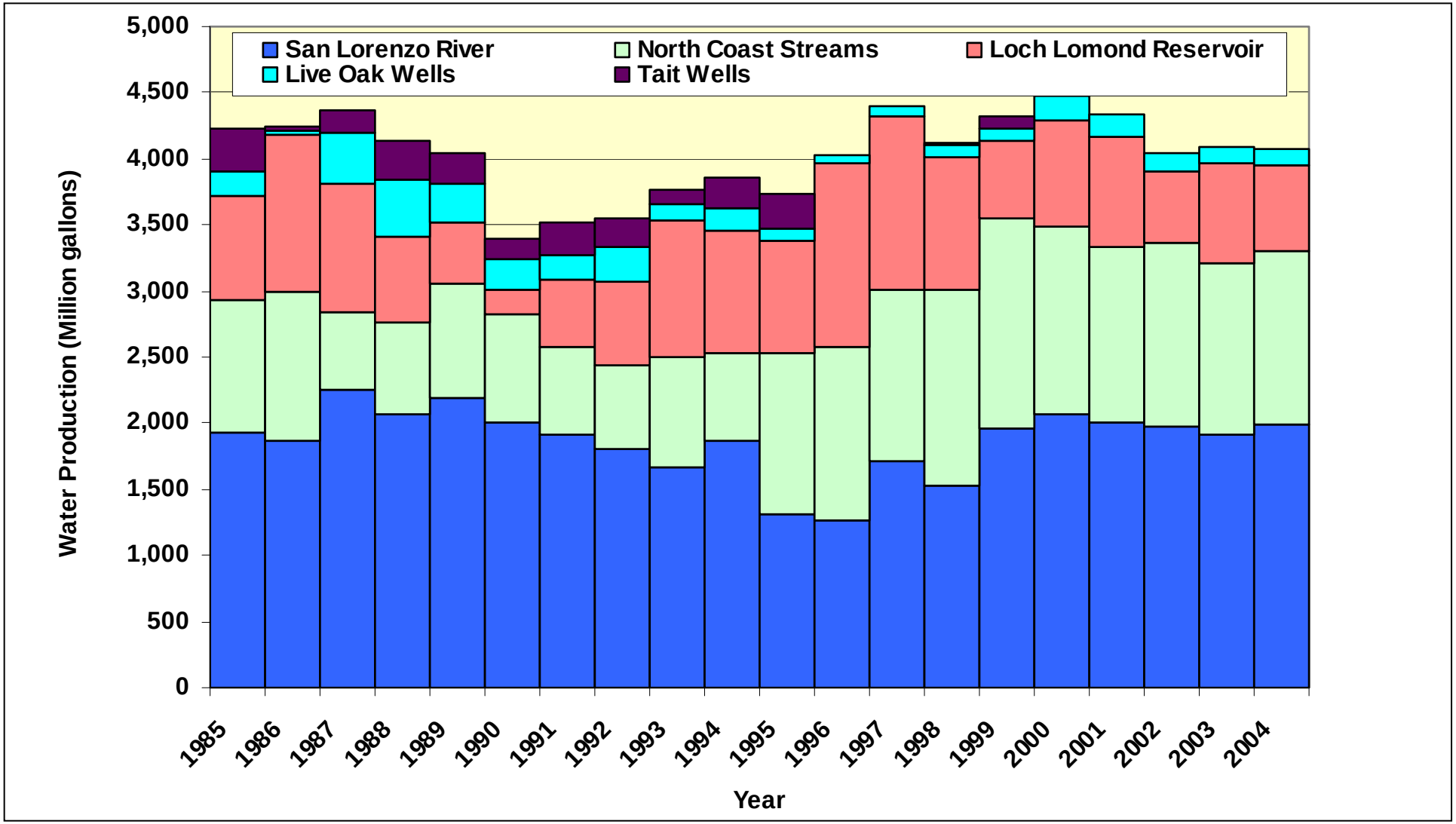
Figure 5



Source: SCWD, 2006
Note: Beginning in 2000, Tait Well production was reported with San Lorenzo River Production

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TM4 – Regional Water Demand
Conjunctive Use and Enhanced Aquifer Recharge Project
Santa Cruz County, California

City of Santa Cruz Annual Water Production for WY2007

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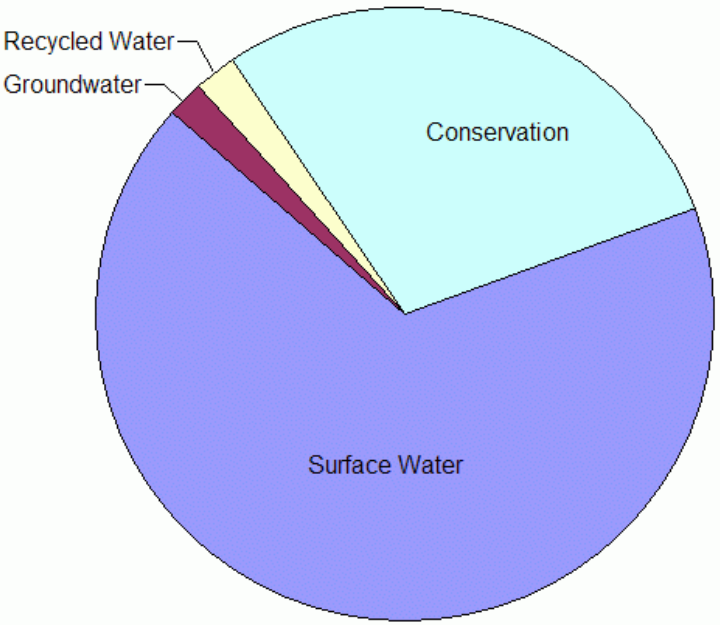
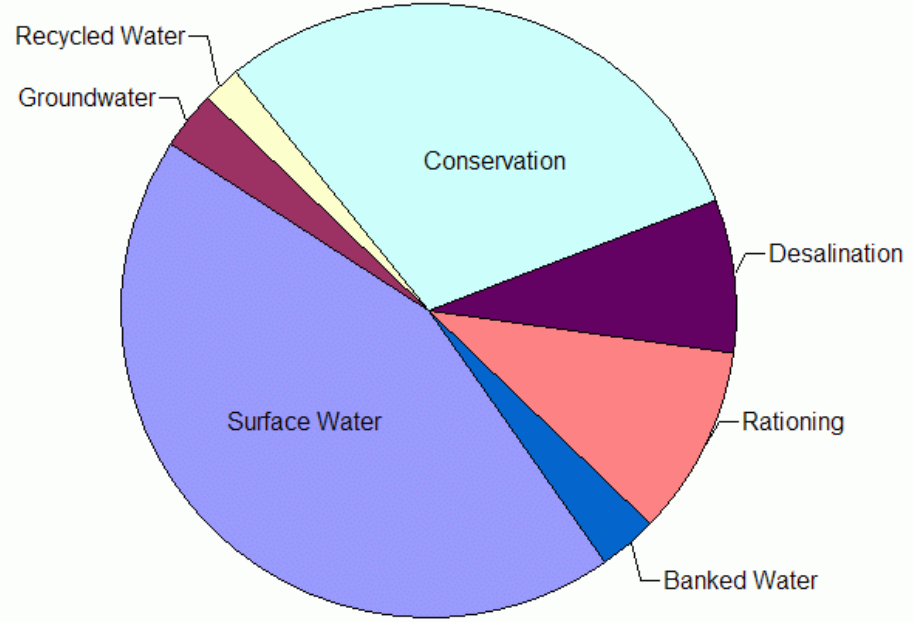
Figure 6





Source: SCWD², 2008

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Conjunctive Use and Enhanced Aquifer Recharge Project
Santa Cruz County, California

City of Santa Cruz Water Department
Future Water Portfolio

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Figure 7