

4.5 Production Wells

The City of Pleasanton, California Water Service, San Francisco Water District (SFWD), and Zone 7 all use municipal supply wells to partially or entirely supply municipal and industrial water customers with potable water. The City of Pleasanton, California Water Service, Dublin San Ramon Services District (DSRSD) and the City of Livermore each has an annual groundwater pumping quota, that in aggregate total about 80% of the average safe natural yield of the groundwater basin. However, DSRSD and the City of Livermore are not currently pumping groundwater from the basin. SFWD does not have a pumping quota, but is limited by the relatively fixed demand of their customers. Zone 7 also does not have a maximum pumping quota. However, Zone 7 purchases water and artificially recharges it into the basin to refill the basin and offset its withdrawals. Zone 7's hydrologic inventory tracks the artificial recharge and extraction by Zone 7.

A list of the basin's municipal supply wells, along with the estimated production capacity and current status of each well, is given in Table 4.4. Groundwater pumping quantity and TDS from Zone 7 and retailer municipal supply wells are also summarized in Table 4.5. Reference H provides additional water quality detail for the municipal wells, including hydrochemographs of TDS, chlorides and nitrates. These graphs provide further evidence of the generally increasing concentrations of dissolved salts and minerals throughout the Main Basin groundwater.

Zone 7

Historically, Zone 7 has pumped groundwater solely as seasonal demand dictated, and when needed to meet daily peak demand. Zone 7 has seven wells it can use to pump groundwater for municipal supply. Historic average production from Zone 7's active wells has been approximately 2,500 AF/yr, but has varied from 0 to 7,850 AF/yr for 1987-97 depending on available surface water and annual basin management and delivered water strategies in place. Future plans call for even higher groundwater production by Zone 7.

TDS levels in Zone 7 production wells ranged from 390 to 740 mg/L in 2003, with a flow weighted average of 490 mg/L. The large variation in water quality, seen in the Hopyard Well No.6 (3S/1E 18A6) data is the result of this well being tested as an aquifer storage and recovery (ASR) well. During 1997-98, varying quantities of treated SBA water was injected into this well and the surrounding aquifer and then subsequently pumped during times of higher demand. This particular well operation was part of a pilot test being conducted for possible integration of ASR features into future well projects. Operations in the ASR mode are currently suspended until the cause of clogging of the well that reduced its production capacity is identified.

TABLE 4.4

ZONE 7
WATER RESOURCES ENGINEERING
MUNICIPAL SUPPLY WELLS - 2004

PURVEYOR	WELL	STATE WELL	HP	GPM	STATUS
City of Pleasanton	#5	3S/1E 16L 5	200	2000	ACTIVE
	#6	3S/1E 16L 7	200	2150	ACTIVE
	#7	3S/1E 18A 5	150	1900	INACTIVE
	#8	3S/1E 16A 2	450	3200	ACTIVE
Calif. Water Service					
	004-01	3S/2E 8H 1	50		INACTIVE - N
	005-01	3S/2E 16B 1	20	70	ACTIVE
	008-01	3S/2E 8P 1	25	370	ACTIVE
	009-01	3S/2E 9Q 1	40	730	ACTIVE
	010-01	3S/2E 8F 1	60	725	ACTIVE
	012-01	3S/2E 9P 1	60	850	ACTIVE
	014-01	3S/2E 8N 2	50	1000	ACTIVE
	015-01	3S/2E 16C 1	60	975	ACTIVE
	017-01	3S/2E 9L 1	50	460	ACTIVE
	019-01	3S/2E 8G 1	60	620	ACTIVE
	020-01	3S/2E 18B 1	60	280	ACTIVE
	024-01	3S/2E 7P 3	100	450	ACTIVE
	031-01	3S/2E 7R 3	125	750	ACTIVE
Zone 7	Hopyard 1	3S/1E 18A 1	150	700	ACTIVE
	Hopyard 4	3S/1E 17D 2	150	700	ACTIVE
	Hopyard 6	3S/1E 18A 6	500	3900	ACTIVE
	Mocho 1	3S/1E 9M 2	300	2300	ACTIVE
	Mocho 2	3S/1E 9M 3	250	2200	ACTIVE
	Mocho 3	3S/1E 9M 4		4000	ACTIVE
	Mocho 4	3S/1E 8H 18		3700	ACTIVE
	Stoneridge	3S/1E 9B 1	700	4000	ACTIVE
Camp Parks	Well 1	3S/1E 8H 2	100	550	INACTIVE
	Well 2	3S/1E 8H 3	60	500	INACTIVE
	Well 3	3S/1E 8H 4	60	450	INACTIVE
	Well 4	3S/1E 8H 5	60	NA	DESTROYED
DSRSD		3S/1W 1B 1	40	150	DESTROYED 1984
		3S/1W 1G 2	NA	NA	DESTROYED 1980
		3S/1W 1H 2	NA	NA	DESTROYED 1985
City of Livermore		3S/1E 1P 3		520	INACTIVE
SFWD (Upper Castlewood)	#4	3S/1E 19A 1	30		ACTIVE
	#3	3S/1E 19A 2	30		ACTIVE
	#2	3S/1E 19A 3	30		ACTIVE
	#1	3S/1E 19A 5	30	400	INACTIVE
Fairgrounds		3S/1E 20B 2	40	500	ACTIVE
		3S/1E 20C 3	50	300	ACTIVE
Castlewood Golf Course (Lower)		3S/1E 29E 3	25	350	ACTIVE
		3S/1E 29E 4	50	500	ACTIVE

TABLE 4.5

Municipal GW Pumping and TDS

STATION	HISTORIC ANNUAL AVG. PRODUCTION in AF	2003 PRODUCTION in AF	GROUNDWATER TDS (mg/l)		
			HISTORIC		2003
			MIN.	MAX.	
PLEASANTON					
3S/1E 16L5 PLEAS #5	1031	585	321	526	460
3S/1E 16L 7 PLEAS #6	1184	656	326	540	460
3S/1E 18A 5 PLEAS #7	545	0	311	714	
3S/1E 16A 2 PLEAS #8	738	2432	376	458	390
TOTAL PLEASANTON					414
CALIFORNIA WATER SERVICE COMPANY (CWS)					
3S/2E 7R 3 CWS# 31(7R3)		313			433
3S/2E 16B 1 CWS# 5(16B1)	52	84	405	530	523
3S/2E 8P 1 CWS# 8(8P 1)	187	450	362	599	535
3S/2E 9Q 1 CWS# 9(9Q 1)	231	0	424	549	524
3S/2E 8F 1 CWS#10 (8F1)	289	0	402	629	
3S/2E 9P 1 CWS#12 (9P1)	92	506	394	590	588
3S/2E 8N 2 CWS#14 (8N2)	482	1044	422	515	485
3S/2E 16C 1 CWS#15 (16C)	339	241	436	511	499
3S/2E 9L 1 CWS#17 (9L1)	66	0	346	670	
3S/2E 8G 1 CWS#19 (8G1)	120	218	391	613	582
3S/2E 18B 1 CWS#20 (18B)	119	402	286	413	387
3S/2E 7P 3 CWS#24 (7P3)	597	717	253	320	282
TOTAL CWS					460
ZONE 7					
3S/1E 18A 1 HOP 1	121	0	233	1015	
3S/1E 17D 2 HOP 9		23	330	534	459
3S/1E 18A 6 HOP 6	402	2280	216	640	503
3S/1E 9M 2 MOCHO 1	448	720	280	993	705
3S/1E 9M 3 MOCHO 2	583	738	326	968	546
3S/1E 9M 4 MOCHO 3		1072	470	644	580
3S/1E 8H 18 MOCHO 4		754	348	470	432
3S/1E 9B 1 STONERIDGE_1	1253	2643	325	525	405
TOTAL ZONE7					496
SFWD					
SF O-line	420	420	501	860	860

City of Pleasanton

The City of Pleasanton currently pumps groundwater from three municipal wells. A fourth well (3S/1E 18A5) has been inactive pending repair or rehabilitation. Pleasanton's current agreement with Zone 7 specifies their groundwater pumping quota as 3,500 AF/yr. The maximum pumpage occurred in 1991 when the city pumped 1,357 million gallons (MG) or 4,165 AF of groundwater (under drought conditions). As shown in Table 4.5, the average TDS of groundwater pumped from Pleasanton's wells in 2003 ranged from 390 to 460 mg/L and averaged approximately 415 mg/L.

California Water Service, Inc.

California Water Service (CWS) currently pumps groundwater from 11 of their 13 wells. High nitrate levels have restricted pumping from some of the CWS wells. Groundwater from those wells must be blended with treated surface water to reduce the total nitrate concentration prior to distribution to the transmission system. CWS's contract with Zone 7 specifies an independent pumping quota of 3,069 AF/yr. During 2003, TDS levels from CWS wells ranged from 280 to 590 mg/L with a flow weighted average TDS of 460 mg/L (Table 4.5).

San Francisco Water District

San Francisco Water District currently supplies municipal groundwater to the upper Castlewood Country Club area from the SFWD well field located along Valley Avenue in Pleasanton. Well number 19A3 is currently the primary source of groundwater with the remaining wells available to accommodate peak flow demands. SFWD 2003 municipal supply groundwater averaged 860 mg/L TDS.

Dublin San Ramon Services District

Although DSRSD has an independent pumping quota of 645 AF/yr in the Main Basin, they currently have no production wells of their own. However, they do manage the Camp Parks well field for the U.S. Army, which consists of three wells located near the intersection of Santa Rita and Stoneridge Avenues. These shallow wells were formerly used to supply potable water to the Camp Parks Army facility in Dublin but are now idle. Camp Parks now receives treated water from a Zone 7 turnout. The Camp Parks well field overlaps Zone 7's Mocho well field in aerial extent. However, the wells are generally not completed in the same aquifers with the Mocho wells being completed deeper than the Camp Parks wells. DSRSD has the option to purchase the Mocho No. 4 production well from Zone 7.

As shown in Figures 4.4 and 4.5, TDS is relatively high in the shallow groundwater in the vicinity of the Camp Parks well field. Because of the location of the well field and the high levels of TDS in the groundwater in this location, this site has been considered a potential site for a wellhead demineralization project (see Chapter 10).

City of Livermore

The City of Livermore possesses an independent pumping quota of 31 AF/yr, but has no municipal wells connected to their M & I distribution system. Livermore has a single well located at the Livermore Municipal Airport and has used it in the past to supply irrigation water to the city-operated Las Positas golf course.

4.6 Delivered Water Quality and Variability

The relationship between imported water, groundwater quality, and Zone 7 delivered water quality was introduced at the beginning of this chapter. Since 75–85% of the water delivered by Zone 7 is imported water, and because the quality of the imported water varies as a function of annual climatic conditions as well as seasonally, Zone 7 delivered water quality varies correspondingly.

The quality of Zone 7 deliveries also varies as a function of the surface water to groundwater ratio. The ratio of groundwater to surface water can vary by season, by day, and by turnout depending on demand. Table 4.6 shows typical summer and winter water ratio percentages of Zone 7 deliveries under three climatic conditions: dry, average and wet years.

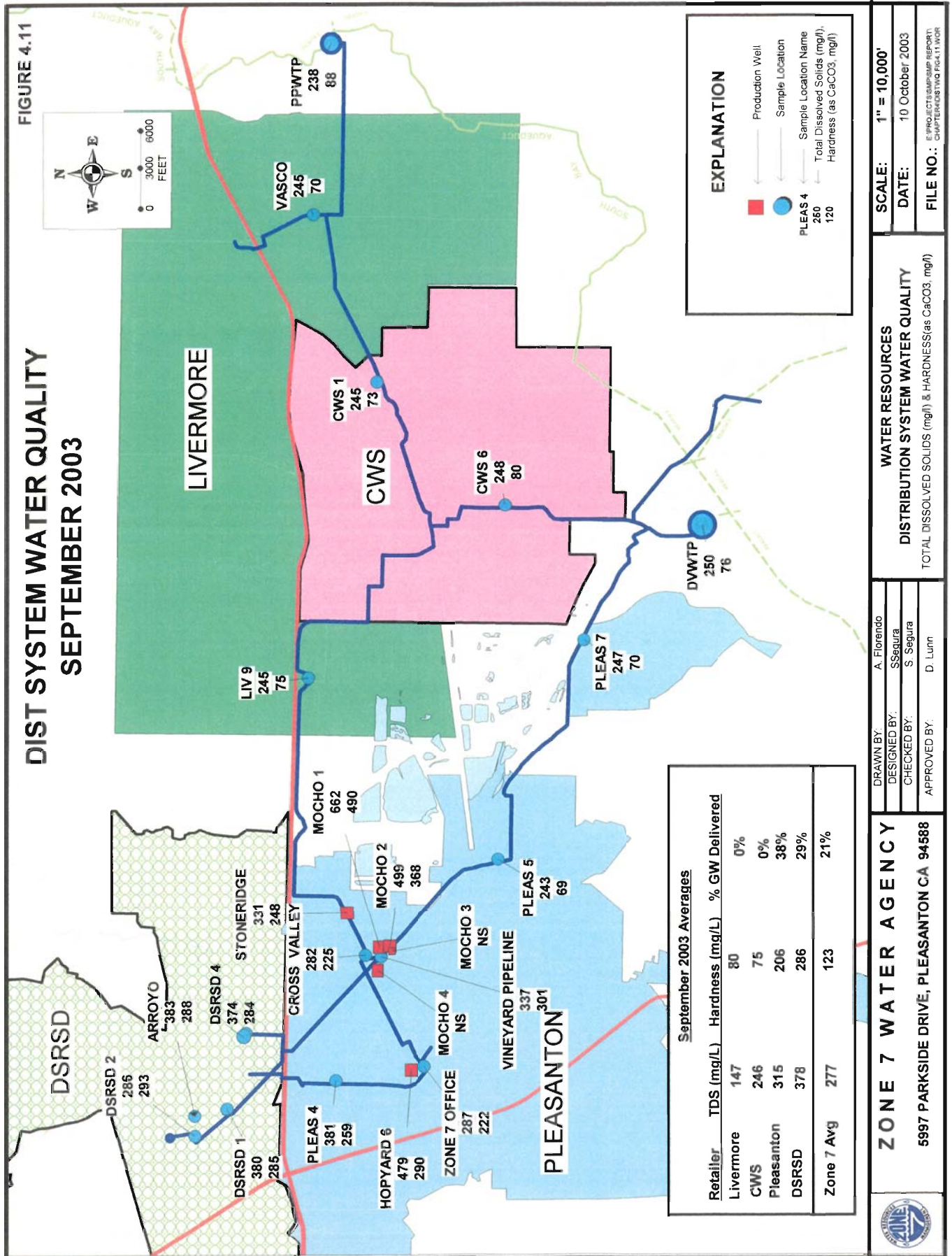
Table 4.6
Typical Delivered Water TDS
Under Historic Basin Management Strategy

Climatic Conditions	Delivered Water %SBA		Zone 7delivered (mg/L)	
	Winter	Summer	Winter	Summer
Dry	30%	30%	470	470
Average	100%	90%	270	240
Wet	100%	90%	170	180

Climatic Conditions	SBA TDS (mg/L)		GW TDS
	Winter	Summer	
Dry	500	500	450
Average	270	220	450
Wet	170	150	450

Water quality also varies within the Zone 7 distribution system. The blend of surface to groundwater varies between turnouts because of the locations of the wells relative to the turnouts and because of their intermittent use. Figure 4.11 shows TDS and hardness

FIGURE 4.11



variation in the distribution system under one groundwater water production scenario. Because Zone 7 production wells are all located in the western portion of the basin, the City of Pleasanton and DSRSD receive most of the groundwater pumped by Zone 7. California Water Service, the City of Livermore and the untreated customer demands are met almost entirely using imported surface water and local surface water.

California Water Service and the City of Pleasanton also operate wells and blend groundwater with their Zone 7 deliveries adding to the variability of *their* delivered water quality. Typical percentages of each type of water (i.e., surface water, Zone 7 pumped groundwater, retailer pumped groundwater) delivered by each retailer to their customers is shown in Figure 4.12.

Figure 4.13 shows Zone 7 treated water deliveries and annual average TDS for 1974 through 1997. The figure shows five graphs. The first graph shows the annual amount of surface water delivered. The second graph shows the annual amount of groundwater delivered. The third and fourth graphs show the annual average TDS of surface water and groundwater, respectively. The annual average TDS of imported surface varied from 100 to nearly 600 mg/L between 1974 and 1997, while the TDS of the delivered groundwater varied between 400 and 550 mg/L.

The fifth graph shows the annual average TDS of the total Zone 7 deliveries. The result of all the annual variations, many of which are not under Zone 7 control, is that the TDS of the delivered water can vary considerably on an annual basis. Similarly, Figure 4.14 illustrates the extent to which TDS can vary on a monthly basis (using 1997 data). The monthly variation may change from year to year based upon climatic conditions and the ratio of surface water to groundwater delivered.

Another variable not immediately discernable from these figures is which wells Zone 7 chooses to pump from. Historically, Zone 7 has typically chosen to pump from wells with the lowest TDS water, to deliver the highest quality groundwater available. As will be discussed in Chapter 8 in more detail regarding ASR wells, while viable in the short-term, this basin management strategy, without other offsetting measures, is not sustainable and will result in continued groundwater degradation.

4.7 Tertiary and RO Recycled Water Quality

To date there has been relatively limited use of recycled water in the Livermore-Amador Valley due in part to concerns about impacts on groundwater quality. The May 1992 Livermore-Amador Valley Water Recycling Study, the December 1993 RWQCB Master Water Recycling Permit, and this Salt Management Plan provide a framework where additional water recycling could be implemented while protecting groundwater beneficial uses.

FIGURE 4.12

TYPICAL MUNICIPAL DELIVERED WATER

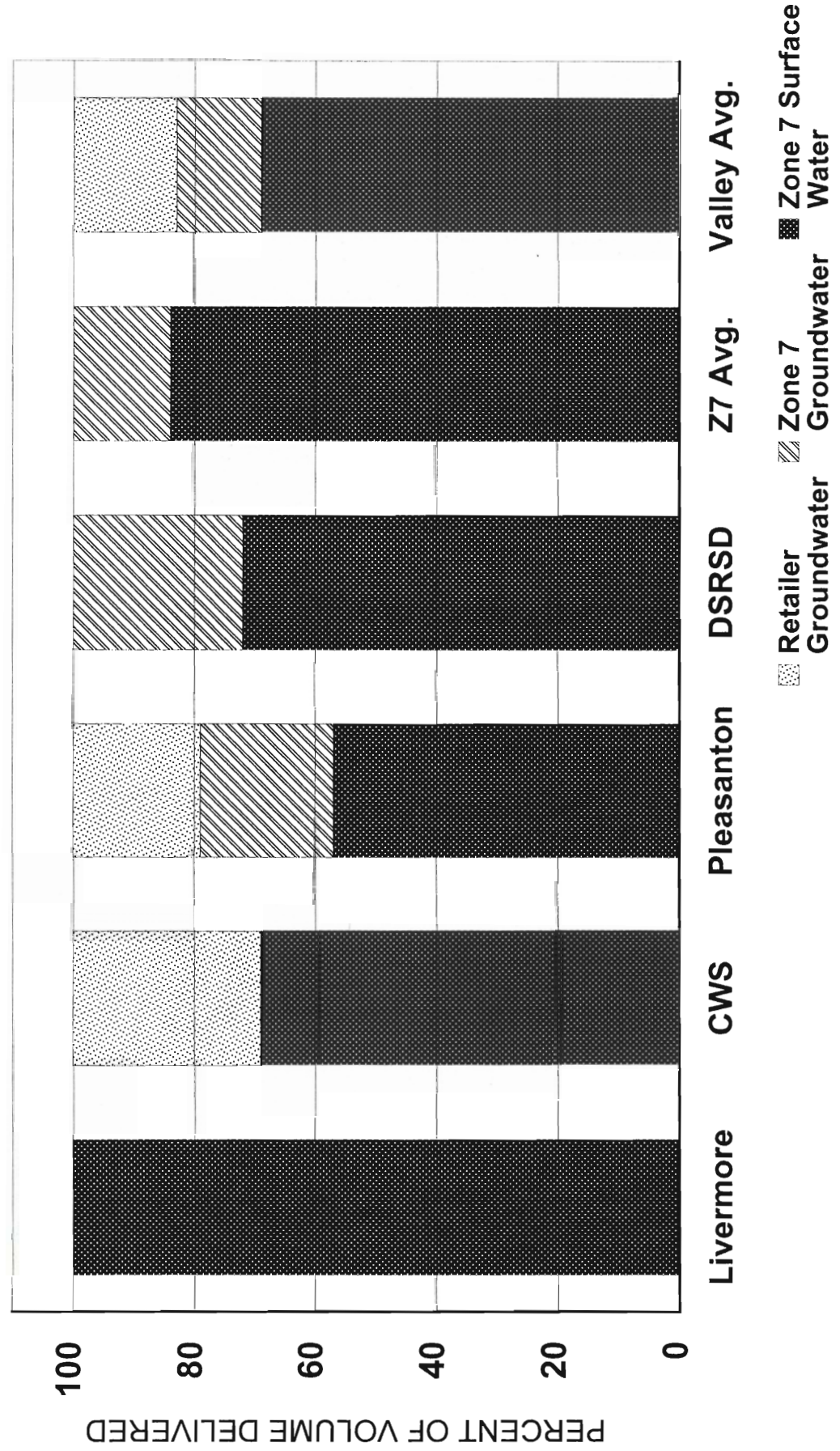


FIGURE 4.13

TREATED WATER DELIVERIES & WATER QUALITY 1974-97 WATER YEARS

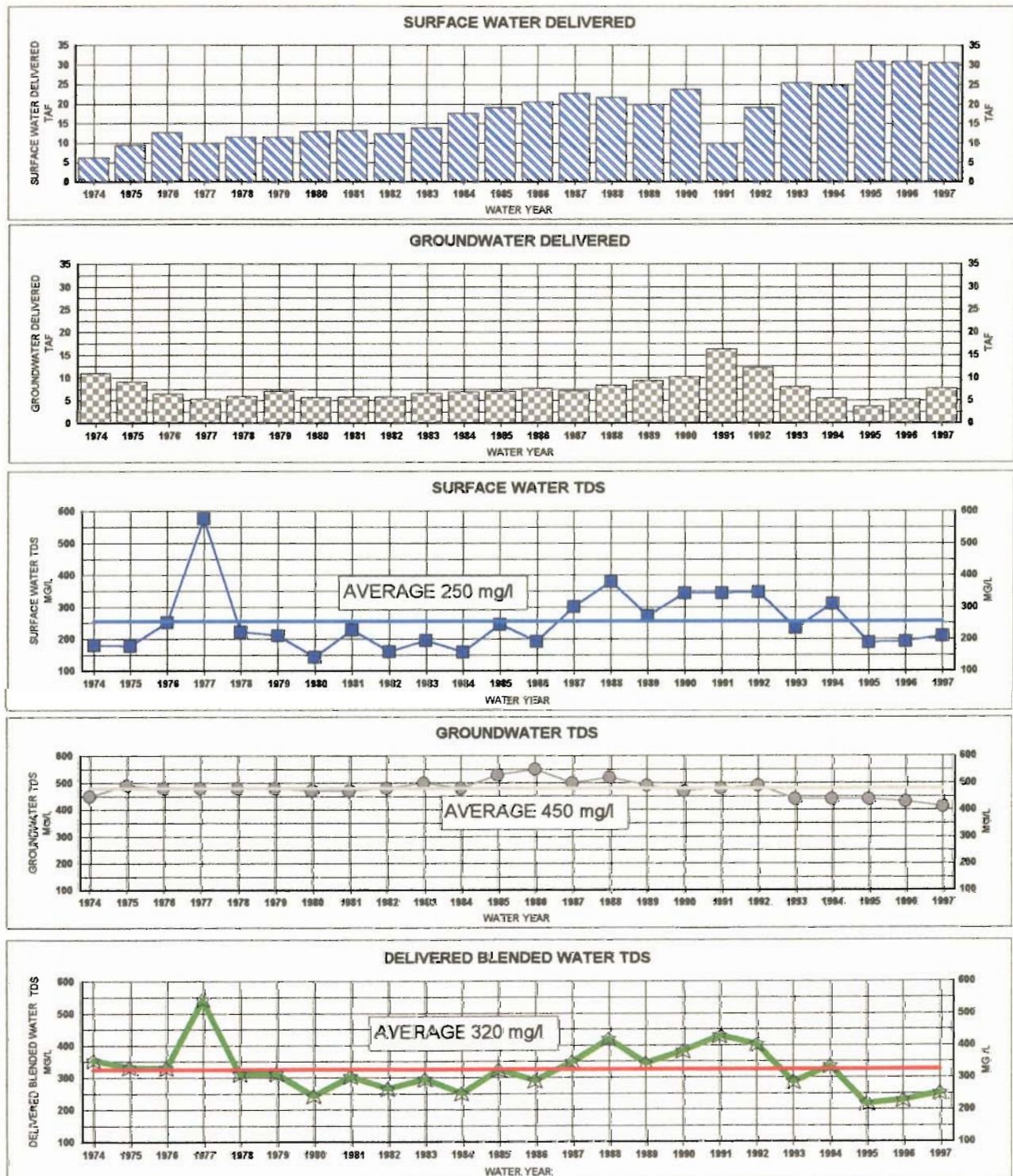


FIGURE 4.14

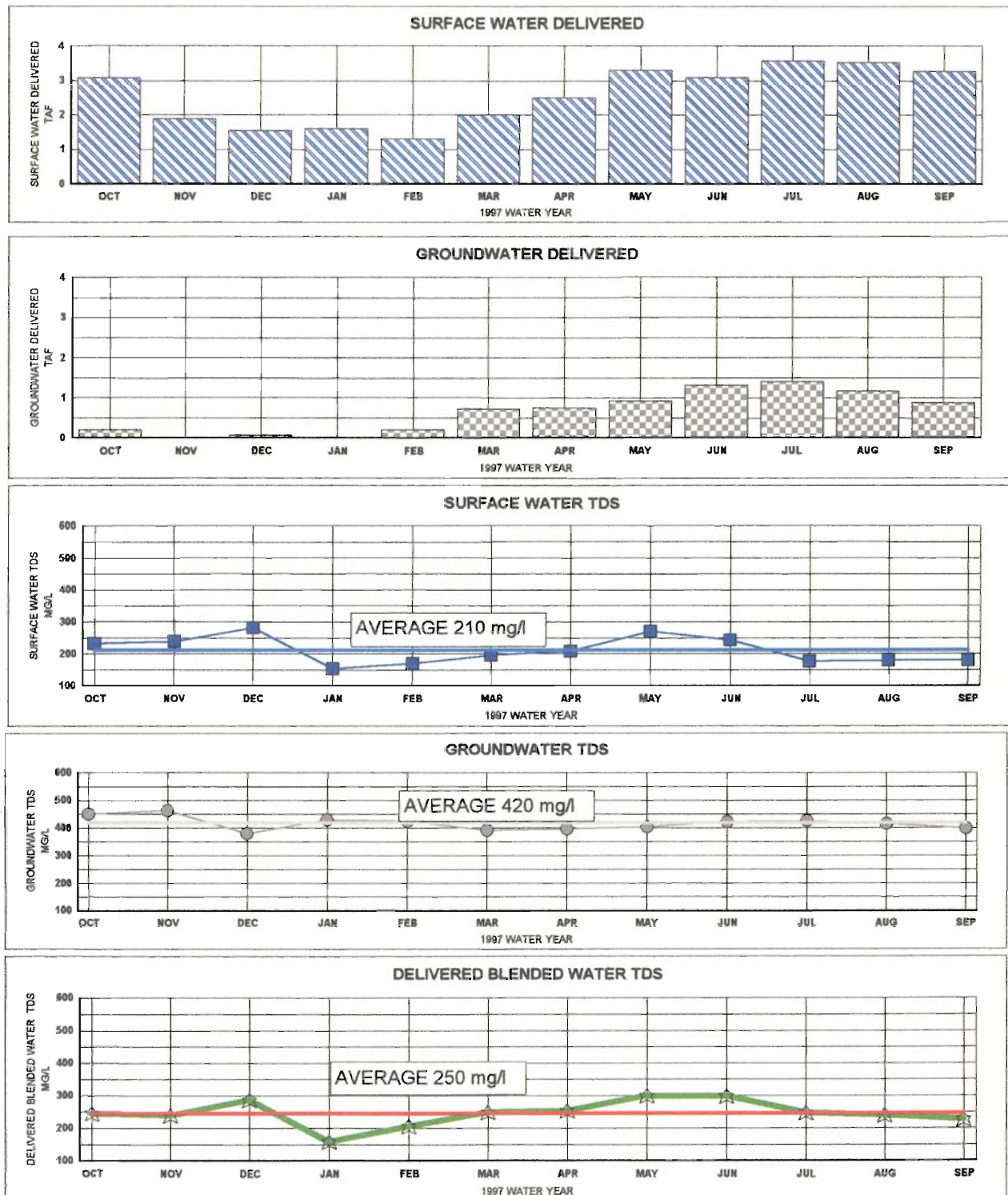
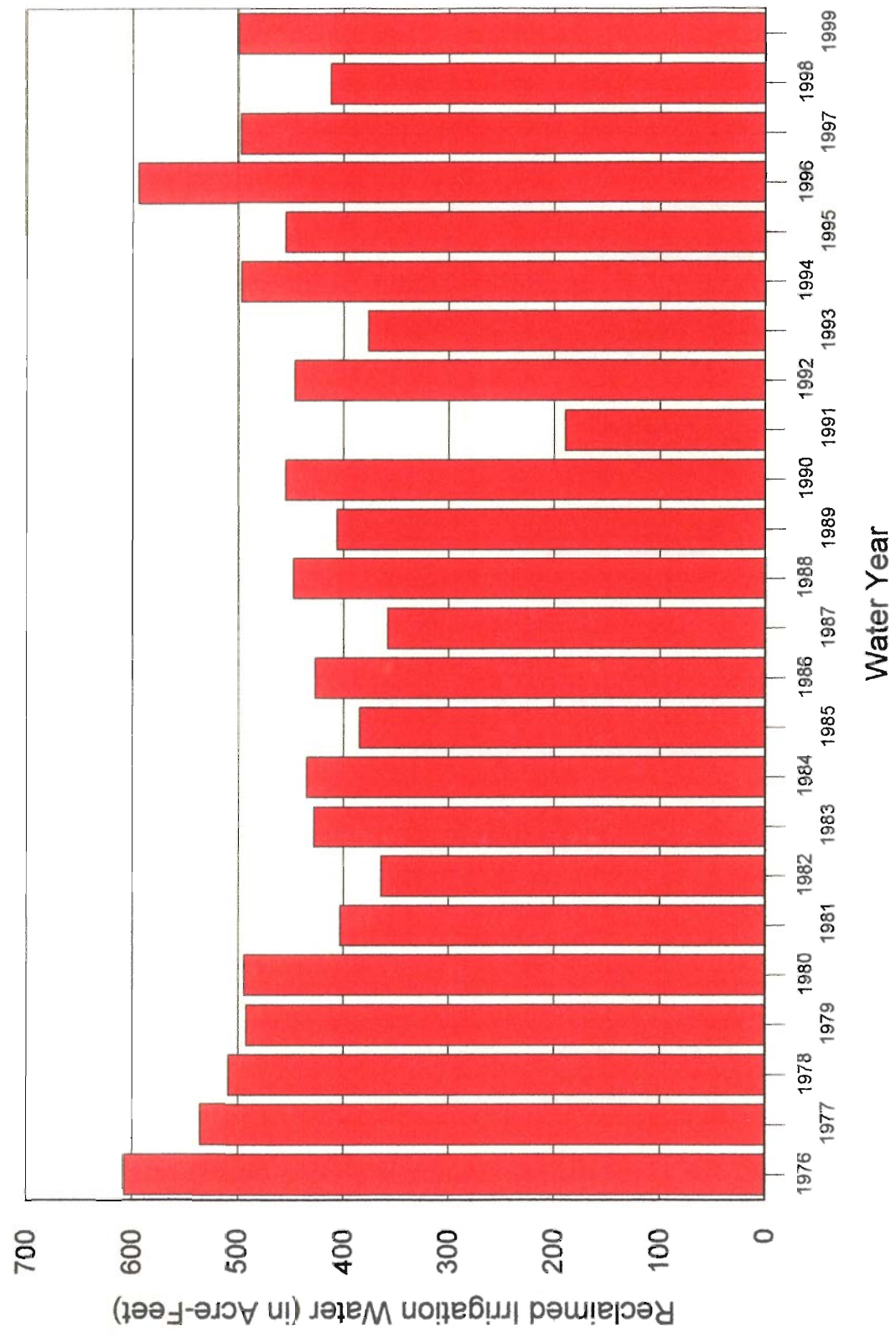
**TREATED WATER DELIVERIES & WATER QUALITY
1997 WATER YEAR**

FIGURE 4-15

LWRP RECLAIMED IRRIGATION WATER



Historically, the Livermore Water Reclamation Plant (LWRP) has recycled about 450 AF/year of tertiary recycled water (disinfected, filtered, secondary treated effluent). The annual volumes of recycled water spray irrigated on the Las Positas Golf course are shown in Figure 4.15. LWRP recycled water had an average TDS of 560 mg/L during the 1999 calendar year which is about twice the concentration in the long-term average 320 mg/L Zone 7 delivered water. This is as expected due to the typical 200 to 300 mg/L “salt increment” added to potable water as it is used in a household for various domestic purposes.

A portion of this recycled water is applied over the Main Basin where 100% of the applied salts are assumed to reach the Main Basin while the remainder is applied over a 33% salt impact zone (see discussion in Chapter 11 and Fig. 11.1).

Proposed expansion of Livermore tertiary recycled water deliveries to serve urban and agricultural development in North and South Livermore are summarized in Section 6.7. DSRSD began delivering tertiary recycled water (membrane filtered, ultraviolet disinfected) for irrigation of the Dublin Sports Grounds in 1999. Chapter VI also describes DSRSD plans to distribute tertiary recycled water for irrigation in DSRSD and EBMUD service areas north of I-580 as part of the DSRSD EBMUD Water Recycling Authority (DERWA) project. A majority of this irrigation will take place outside of the Main Basin and have minimal impact to the Main Basin salt load.

Both Livermore and DSRSD have constructed reverse osmosis (RO) recycled water demineralization facilities with a future goal of injecting RO treated recycled water into the groundwater basin for groundwater replenishment, to improve groundwater quality, and to offset net salt loading. The Livermore RO facility has a design capacity of 0.75 mgd and the DSRSD facility of 2.5 mgd. Performance studies of both facilities have been conducted to document the water quality of the RO product water. Due to concerns expressed by the general public neither of these groundwater injection projects is operating.

Table 4.7 compares key constituents of Zone 7 treated water, Zone 7 untreated inlet water, LWRP tertiary recycled water, LWRP RO product water, and the water quality results from a 16 week DSRSD performance evaluation testing of the CWR RO facility. Reference I presents the more detailed water quality comparison.