Los Osos Community Services District

Water Master Plan
August 2002

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EXECUTIVE SUMMARY

The Los Osos Community Services District (LOCSD or District) supplies its customers with domestic water service and fire protection, among other services. The District was approved by voters in November 1998 and began operations in 1999 under the Community Services District Law of the California, Government Code, §61000 et al.

The District has been under a building moratorium since 1988, and is pursuing the implementation of a community-wide wastewater project due to groundwater contamination and in response to cease and desist orders issued by the Central Coast Regional Water Quality Control Board (RWQCB). Commitments have been received by the State Water Resources Control Board (SWRCB) to provide up to $70.5 million in funding from the State Revolving Fund program. It is expected that wastewater services will become available in late 2005, and that the building moratorium will be lifted at that time. The District must plan water services to not only meet current demands, but to anticipate growth following the cessation of the building moratorium, and in future years to come. In order to facilitate the goals of the District to provide a plan to meet the ultimate needs of the District's service area customers, the District has implemented this water master plan and capital improvement program.

LAND USE, STUDY AREA BOUNDARIES AND POPULATION

The San Luis Obispo County General Plan has established boundaries between the urban areas and the suburban/rural areas through the use of the Urban Services Line (USL) and the Urban Reserve Line (URL). The USL is an interior boundary around the urban areas of the community. The following three water purveyors exist within the USL boundary:

- LOCSD (referred herein as the LOCSD water service area)
- Cal Cities (Southern California Water Company); and
- S & T Mutual Water Company

In order to determine the existing and future population of the LOCSD water service area, a detailed analysis of vacant properties was performed. Based on this survey, 470 additional units may be developed within the LOCSD water service area at build-out. As many of these parcels are within the "prohibition zone", significant development will not occur until such time that wastewater facilities become available (late 2005 to 2006).

Population within the LOCSD water service area is projected to increase 14.4 percent (at build-out), from the current population of 8,149 to 9,324. Build-out of the LOCSD water service area is anticipated to occur around Year 2008. Cal-Cities will see the most growth and development within the USL, anticipating an increase in population of over 40 percent. Population in the S&T Mutual Water Company service area is essentially at build-out at this time, and no further growth is projected for this service area. Thus, within the prohibition zone, a 25 percent overall increase in population (from 14,233 to 17,803) is anticipated to reach build-out, once the moratorium is lifted. The total population surveyed by the above-referenced water purveyors is expected to reach 19,692 at build-out, which is anticipated to occur around Year 2015.

WATER QUALITY

The District's water supply consistently meets all State and Federal primary and secondary drinking water standards. However, water distribution system sampling indicated one exceedence of the copper standard. The District has implemented corrosion control measures at each well head, by introduction of ortho-phosphate into the distribution system. Continued monitoring will be required to determine the effectiveness of this treatment technique.

With groundwater as the District's sole source of water, the District will need to implement sampling/monitoring for trihalomethanes (THMs) and haloacetic acids (HAAs) beginning in January 2004.

BASIN-WIDE URBAN PURVEYOR WATER DEMANDS

As a component of its Wastewater System Facilities Plan, the District adopted an Urban Water Management Plan (UWMP). As recommended in the UWMP, the District plans to implement approximately $1.2 million in conservation measures within the collected area of the wastewater system. Water production data from the UWMP, which was based on actual purveyor use from 1994 through 1999, will be used to forecast future water demand. Table ES-1 summarizes existing and future water production.

Table ES-1. Existing and Build-Out Water Production for Urban Purveyors

Water Purveyor	Existing Average Daily Production		Build-Out Average Daily Production	
	(mgd)	(ac-ft/year)	(mgd)	(ac-ft/year)
LOCSD	0.98	1,100	1.21	1,358
Cal Cities	0.92	1,030	1.29	1,452
S&T Mutual	0.14	150	0.14	150
Total Purveyor Production	**2.04**	**2,280**	**2.64**	**2,960**

LOCSD water system demands were determined for existing conditions, and were used in the model to project system performance at build-out. These demands are summarized in Table ES-2.

Table ES-2. Summary of LOCSD Water System Demands

Demand Condition	LOCSD Water System Demands	
	Existing (MGD)5	Build-Out (MGD)
ADD 5	0.98	1.21
MDD 5	1.96	2.42
PHD 5	3.43 (2,382 gpm)	4.24 (2,946 gpm)

Notes:
1. Existing demand based on historical records
2. Build-Out demand based on 130 gpcd
3. MDD = ADD X 2.0
4. PHD = ADD X 3.5
5. ADD = Average Daily Demand
   MDD = Maximum Daily Demand
   PHD = Peak Hour Demand
   MGD = Million Gallons per Day

WATER STORAGE

The District's three water storage tanks comprise 1.31 million gallons (MG) of storage. To meet existing storage needs, for operational, fire and emergency storage, approximately 2.3 MG of storage is required, resulting in a present-day deficit of 0.84 MG. At system build-out, this deficit is projected to reach 1.01 million gallons. A new water storage tank is recommended at the "Highland" site. This new tank should be sized to meet build-out demands, and designed to match hydraulic grade with the existing 16th Street tanks. Further consideration should be given to abandoning the 10th Street water storage tank, pending completion of additional seismic and geotechnical evaluations. Should the cost to retrofit this tank be significant compared to the cost of developing new storage, the district should consider consolidating the 10th Street storage volume at the future Highland tank site. The resulting tank at Highland would be 1.4 MG. Consolidating the 10th Street storage at the Highland tank site would be beneficial for two main reasons:

- The 10th Street tank is lower in elevation than the 16th Street tanks, necessitating pumping of water from the 10th Street tank into the system. It would be desirable to eliminate the need for these pumps to simplify operations and be more energy efficient.

- The 10th Street tank is nearing 40 years of age, and the cost of repairs and re-coating could be significant, pending completion of the seismic and geotechnical evaluations.

WATER SUPPLY

As indicated in previous chapters, the two largest water providers within the Urban Services Line are the District and Cal-Cities. In addition to the above reference purveyors, the groundwater underlying the community is pumped by the S&T Mutual Water Company for use by its customers, by the County of San Luis Obispo for irrigation of the Community Park, large lot residences for private use, and by agricultural interests.

The detailed groundwater analysis conducted indicates the safe urban purveyor yield of the basin, with the District's wastewater project, to be 2,900 AFY. Given that the demand to the Basin is estimated at approximately 2,960 AFY, an additional source of supply, such as recycled water, will be necessary. Chapter 6 discusses the use of recycled water to address the entire 60 AFY shortfall. The recycled water study projects 115 AFY of savings in potable water pumping by irrigating area schools, the Community Park and the Sea Pines Golf Course with recycled water from the future wastewater treatment plant. As a result, this water conservation measure should adequately provide the additional source of supply needed to avoid importing water. Table ES-3 summarizes the projected supply and demand for the Los Osos Groundwater basin.

Table ES-3. Projected Water Production in Los Osos Groundwater Basin

Service Area	Build-Out Population	Per Capita Demand (gpcd)	Build-Out Demand (AFY)
LOCSD	9,324	130	1,358
Cal-Cities	7,944	130	1,157
Cal-Cities (Monarch Grove, Cabrillo Estates, BayView Heights, Large lots):	1,889	140	295
S & T Mutual Water Company	535	N/A	150
Total	19,692	------	2,960
TOTAL PURVEYOR PRODUCTION AT BUILD-OUT=			**2,960**
PURVEYOR SAFE YIELD (TABLE 5-8)=			**2,900**
BASIN DEFICIT WITHOUT WATER RECYCLING=			**60**
PROJECTED WATER RECYCLING DEMAND (CHAPTER 6)			**115**

HARVEST WELL PRODUCTION TO AUGMENT DEEP AQUIFER SUPPLY

As part of the upcoming wastewater project, the District will be installing harvest wells to manage the upper aquifer and potential localized mounding of groundwater in the areas of the community leach field systems. This harvest well water will be used, in part, to augment the deep aquifer water supply for potable water purposes. This upper aquifer harvest well water may also be used directly for irrigation in conjunction with the proposed recycled water system (see Chapter 6). The upper aquifer harvest well water must be blended with the deep aquifer supply to meet water quality standards for nitrates. Basin-wide, it is anticipated that 650,000 gpd of upper aquifer water must be harvested to manage the upper aquifer and control the potential mounding effects of the future wastewater effluent disposal system.

SUPPLEMENTAL WATER SUPPLY WELLS

With the Palisades Well supplying nearly 50 percent of the total LOCSD water supply, consideration must be given to the ability of the remaining wells to supply maximum day demand in the event that the Palisades Well is out of service. Should this be the case, the District will not be able to meet build-out maximum day demand of 1,869 gpm. The Palisades Well alone can provide 750 gpm (maximum sustained flow during peak month), while the other wells collectively produce 830 gpm. In addition, this same deficiency exists today, should the other system wells need to meet current maximum day demand of 1,585 gpm. Based on this analysis, it is recommended to construct two new production wells that will provide a total of 1,000 gpm to ensure that maximum day demand can be met in the event that the Palisades Well is out of service. The recommendation allows for variance in blending ratios of the harvest wells with the new production wells. It is recommended that the new deep wells be located adjacent to proposed harvest wells for bending efficiency.

RECYCLED WATER STUDY

In order to augment the projected 60 AFY water supply deficit for the Los Osos Groundwater basin, a recycled water study was conducted to identify the potential for recycled water use from the future wastewater treatment plant. The study focused on six sites within the community, including Sea Pines Golf Course, the four schools (Monarch Grove Elementary, Los Osos Middle School, Sunnyside Elementary, Baywood Elementary), and the Community Park.

These six sites collectively include approximately 35 acres of turf, plus 4 acres of ornamentals, that can be irrigated with recycled water. Although the future quality of the treatment plant effluent is not known, it was reasonably projected based on the known potable water quality parameters. The District's well water supply is of excellent mineral quality, and thus treatment plant effluent is expected to be of good to excellent quality from an agronomic standpoint. A wastewater supply and demand analysis was performed, and it is anticipated that any required diurnal storage for the recycled water peak demands can be met through the planned treatment plant effluent storage at the Tri-W site.

The study projects that 115 AFY of recycled water can be used for irrigation at these six sites, to augment the potable water supply. In-lieu groundwater pumping of the upper aquifer was considered; however, the required additional distribution system, wells and storage facilities associated with this option are undesirable from an economic standpoint.

The sensitivity of selling recycled water to San Luis Coastal Unified School District (SLCUSD) within the Cal-Cities water service area was considered. Based on meetings with Cal-Cities, the Cal-Cities Water Company is supportive of water conservation measures, but is concerned about the loss of water revenues from water sales to SLCUSD. Sale of recycled water to SLCUSD, and corresponding loss of potable water revenues, could impact Cal-Cities rate payers by approximately 3 percent. Recycled water sales to Sea Pines Golf Course and San Luis Obispo County (Community Park) will not impact water rates, as both users currently use private well water for irrigation.

WATER DISTRIBUTION

The District's water distribution system includes over 25 miles of water distribution pipelines, three water storage tanks, five water supply wells, one main gravity zone, and one hydro-pneumatic zone equipped with a booster station. A detailed hydraulic water model was developed using WaterCAD for the LOCSD water system. The model was calibrated through field hydrant testing to accurately represent existing hydraulic characteristics. Once the model was calibrated accurately, model runs were simulated to assess system performance.

In the analysis of the existing LOCSD distribution system, some areas in the network were found to experience less than desirable pressures during domestic demands and substandard pressures and/or flows under fire flow conditions. The distribution system also has an inadequate "backbone" or a series of larger diameter, looped pipes allowing flow to travel to several sections of the system with little head loss. The various improvements needed to improve water circulation, service pressures, and to meet fire flow demands, are discussed in Chapter 7.

In addition to water system hydraulics, there are other considerations to enhance and improve the LOCSD water system. Such considerations include replacement of polybutylene water services (which have not held up well in the past), upgrading the water meters, pump station upgrades, water storage, and seismic considerations in the event of a significant earthquake event. These improvements are also summarized in Chapter 7.

FUTURE WATER OPERATIONS FACILITY

The District's current operations yard at 953 El Moro Avenue is inadequate for staff to conduct day-to-day operations and maintenance functions. The water division of the District will also be assuming additional duties to operate harvest well and blending facilities, that will be developed as part of the upcoming wastewater project. The District plans to develop a water operations facility to meet future needs, and the facility will be developed in two phases. The facility is to be located at Eight Street and El Moro Avenue, on property owned by the District. The first phase development is to be completed as a first priority project, and will include the administration building and a well house, totaling 3,266 square feet. The second phase would be completed as a second priority project, including the maintenance shop and equipment storage building, totaling 2,419 square feet. The final facility will comprise 5,685 square feet.

CAPITAL IMPROVEMENT PROGRAM

The capital improvement program for the LOCSD water system is presented on a first, second and third priority basis. Costs for each of the recommended improvements listed were calculated, and are summarized in Tables ES-4, ES-5 and ES-6. A summary of the CIP is provided in Table ES-7. A population-based percentage of 14.4% was assigned to projects where the scope and cost of the CIP was proportionally increased to accommodate build-out of the community. These costs and corresponding development impact fees are included in Table ES-8. Given the advanced status of development within the service area, no improvement projects were identified that solely benefit future development. Based on the estimated number of future units within the LOCSD water service are (see Table 2-2), the present value of the proposed impact fee is as follows:

1. Cost of improvement benefitting future development = $1,133,000
2. Number of future units estimated in service area = 470
3. Present value of impact fee (cost per single family unit) = $2,410
   (Capital costs divided by number of future units)

Table ES-7. Capital Improvement Expense Summary

Capital Improvement Priority	Total Capital Improvement Expense
First Priority	$ 7,979,230
Second Priority	$ 4,740,330
Third Priority	$ 1,745,520
Total	$ 14,465,080

Table ES-5
Capital Improvement Projects
Second Priority

Project #	Title	Description	Zone	Quantity	Length (Ft)	Old Diameter (in)	New Diameter (in)	Street	Location	Construction Cost ($)		Subtotal ($)	Total Project Cost ($)*	Function
1	15th Street Upgrade	Upgrade Pipe	Upper		1,330	6	12	15th	From El Moro to Pismo	$150	LF	$199,500	$279,300	Distribution Loop in Upper Zone
												15th Street Upgrade Total	**$279,300**	
2	Pismo Ave. Upgrade	Upgrade Pipe	Upper		670	6	12	Pismo	From 14th to 16th	$150	LF	$100,500	$140,700	Distribution Loop in Upper Zone
												Pismo Ave. Upgrade Total	**$140,700**	
3	11th Street Upgrade	Upgrade Pipe	Upper		330	4	12	San Luis	From 11th to 12th	$150	LF	$49,500	$69,300	Distribution Loop in Upper Zone
		Upgrade Pipe	Upper		2,010	6	12	11th	From Ramona to Santa Ynez	$150	LF	$301,500	$422,100	Distribution Loop in Upper Zone
		Upgrade Pipe	Upper		680	8	12	11th	From Santa Ynez to Los Olivos	$150	LF	$102,000	$142,800	Distribution Loop in Upper Zone
												11th Street Upgrade Total	**$634,200**	
4	14th Street Upgrade	Upgrade Pipe	Main		715	6	12	14th	From Santa Maria to El Moro	$150	LF	$107,250	$150,150	Distribution Loop in Main Zone/School FF
												14th Street Upgrade Total	**$150,150**	
5	El Moro Upgrade	New Pipe	Main		330		12	El Moro	From 13th to 14th	$100	LF	$33,000	$46,200	Distribution Loop in Main Zone/School FF
		New Pipe	Main		340		12	El Moro	From 11th to 12th	$100	LF	$34,000	$47,600	Distribution Loop in Main Zone/School FF
		Upgrade Pipe	Main		330	6	12	El Moro	From 12th to 13th	$150	LF	$49,500	$69,300	Distribution Loop in Main Zone/School FF
		Upgrade Pipe	Main		370	10	12	El Moro	From 10th to 11th	$150	LF	$55,500	$77,700	Distribution Loop in Main Zone/School FF
		Upgrade Pipe	Main		630	10	12	El Moro	From 8th to 10th	$150	LF	$94,500	$132,300	Distribution Loop in Main Zone
		Upgrade Pipe	Main		360	10	12	El Moro	From 3rd to 4th	$150	LF	$54,000	$75,600	Distribution Loop in Main Zone
		New Pipe	Main		1,330		12	El Moro	From 4th to 8th	$100	LF	$133,000	$186,200	Distribution Loop in Main Zone
												El Moro Upgrade Total	**$634,900**	
6	3rd/Pismo Upgrade	Upgrade Pipe	Main		1,330	6	12	3rd	From El Moro to Pismo	$150	LF	$199,500	$279,300	Distribution Loop in Main Zone
		Upgrade Pipe	Main		340	6	12	Pismo	From 3rd to 4th	$150	LF	$51,000	$71,400	Distribution Loop in Main Zone
												3rd/Pismo Upgrade Total	**$350,700**	
7	4th/Ramona Upgrade	Upgrade Pipe	Main		680	8	12	4th	From Pismo to Ramona	$150	LF	$102,000	$142,800	Distribution Loop in Main Zone
		Upgrade Pipe	Main		330	6	12	Ramona	From	$150	LF	$49,500	$69,300	
												4th/Ramona Upgrade Total	**$212,100**	
8	Ramona Upgrade	Upgrade Pipe	Main		670	6	12	Ramona	From 6th to 8th	$150	LF	$100,500	$140,700	Distribution Loop in Main Zone
		Upgrade Pipe	Main		300	6	12	Ramona	From 9th to 10th	$150	LF	$45,000	$63,000	Distribution Loop in Main Zone
												Ramona Upgrade Total	**$203,700**	
9	Los Olivos Upgrade	Upgrade Pipe	Upper		670	8	12	Los Olivos	From 9th to 11th	$150	LF	$100,500	$140,700	Distribution Loop in Upper Zone
												Los Olivos Upgrade Total	**$140,700**	

Table ES-5
Capital Improvement Projects
Second Priority

Project #	Title	Description	Zone	Quantity	Length (Ft)	Old Diameter (in)	New Diameter (in)	Street	Location	Construction Cost ($)		Subtotal ($)	Total Project Cost ($)*	Function
10	Water Meter Upgrades		Both	2,734						$300	EA	$820,200	$1,148,280	Replace Meters and Upgrade to Radio Control
										Water Meter Upgrade Total			**$1,148,280**	
11	Fire Hydrant Installation	New Fire Hydrants	Both	5						$3,500	EA	$17,500	$24,500	Fire Hydrants in compliance with Fire Code Standards
										Fire Hydrant Installation Total			**$24,500**	
12	SCADA System Upgrade	Design/Construction of SCADA System	Both	1						$150,000	LS	$150,000	$210,000	
										SCADA System Upgrade Total			**$210,000**	
13	Water Operations Facility: Phase II	New 2,419 sf Water Operations Facility	Both	1						$402,190	LS	$402,190	$563,066	
										Water Operations Facility Total			**$563,066**	
										Total			**$4,740,330**	

* Total includes construction cost plus preliminary engineering, design engineering, administration construction management and inspection costs

Table ES-6
Capital Improvement Projects
Third Priority

Project #	Title	Description	Zone	Quantity	Length (Ft)	Old Diameter (in)	New Diameter (in)	Street	Location	Construction Cost ($)		Subtotal ($)	Total Project Cost ($)	Function
1	Nipomo Upgrade	Upgrade Pipe	Upper		600	6	12	Nipomo	From 12th to 14th	$150	LF	$90,000	$126,000	Upgrade for adequate FF to Commercial and RMF
												Nipomo Upgrade Total	$126,000	
2	15th/Ramona/14th Upgrade	Upgrade Pipe	Upper		450	4	8	15th	From Ramona going South	$130	LF	$58,500	$81,900	Replace 4" lines for FF
		Upgrade Pipe	Upper		1,000	6	12	Ramona	From 14th to 15th	$150	LF	$150,000	$210,000	Distribution Loop in Upper Zone
												15th/Ramona/14th Upgrade Total	$291,900	
3	Ferrell/Bush St. Upgrade	Upgrade Pipe	Upper		1,555	6&8	12	Ferrell	From 9th Street going north	$150	LF	$233,250	$326,550	Distribution Loop in Upper Zone
		Upgrade Pipe	Upper		1,355	8	12	Bush	From LOVR to Ferrell	$150	LF	$203,250	$284,550	Distribution Loop in Upper Zone
												Ferrell/Bush St. Upgrade Total	$611,100	
4	Dead-end Upgrade	Upgrade Pipe	Main		255	6	8	1st	South of Santa Maria	$130	LF	$33,150	$46,410	Upgrade Dead-end Lines for FF
		Upgrade Pipe	Main		260	4	8	4th	From Santa Ysabel going North	$130	LF	$33,800	$47,320	Upgrade Dead-end Lines for FF
		Upgrade Pipe	Main		400	6	8	5th	North of Santa Ysabel	$130	LF	$52,000	$72,800	Upgrade Dead-end Lines for FF
		Upgrade Pipe	Main		300	6	8	6th	North of Santa Ysabel	$130	LF	$39,000	$54,600	Upgrade Dead-end Lines for FF
		Upgrade Pipe	Main		260	4	8	7th	From Santa Ysabel going North	$130	LF	$33,800	$47,320	Upgrade Dead-end Lines for FF
		Upgrade Pipe	Main		245	6	8	8th	North of Santa Ysabel	$130	LF	$31,850	$44,590	Upgrade Dead-end Lines for FF
		Upgrade Pipe	Main		325	6	8	9th	North of Santa Ysabel	$130	LF	$42,250	$59,150	Upgrade Dead-end Lines for FF
		Upgrade Pipe	Main		430	6	8	10th	North of Santa Ysabel	$130	LF	$55,900	$78,260	Upgrade Dead-end Lines for FF
		Upgrade Pipe	Main		185	4	8	Santa Ynez	From 8th going West	$130	LF	$24,050	$33,670	Upgrade Dead-end Lines for FF
		Upgrade Pipe	Main		430	6	8	Ferrell	From northend going south	$130	LF	$55,900	$78,260	Upgrade Dead-end Lines for FF
												Dead-end Upgrade Total	$562,380	
5	12th/Santa Paula Upgrade	Upgrade Pipe	Main		490	4	8	Santa Paula	From 12th Street going west	$130	LF	$63,700	$89,180	Replace 4" lines for FF
		Upgrade Pipe	Main		330	4	8	12th	From Santa Paula going south.	$130	LF	$42,900	$60,060	Replace 4" lines for FF
												12th/Santa Paula Upgrade Total	$149,240	
6	14th Street Upgrade	Upgrade Pipe	Main		685	4	8	14th	From Santa Ysabel to Santa Paula.	$130	LF	$89,050	$124,670	Replace 4" lines for FF
												14th Street Upgrade Total	$124,670	

Table ES-6
Capital Improvement Projects
Third Priority

Project #	Title	Description	Zone	Quantity	Length (Ft)	Old Diameter (in)	New Diameter (in)	Street	Location	Construction Cost ($)		Subtotal ($)	Total Project Cost ($)	Function
7	**Loop Upgrades**	New Pipe	Upper		315		12	Ramona	From 17th to 18th	$100	LF	$31,500	$44,100	Distribution Loop in Upper Zone
		New Pipe	Upper		120		12	18th	At Paso Robles	$100	LF	$12,000	$16,800	Distribution Loop in Upper Zone
		New Pipe	Upper		325		8	South Bay Blvd	South of Santa Ysabel	$90	LF	$29,250	$40,950	Distribution Loop in Upper Zone
		New Pipe	Main		460		12	San Luis	Between 5th and 6th Street	$100	LF	$46,000	$64,400	Distribution Loop in Main Zone
												Loop Upgrades Total	**$166,250**	
8	**Valve Upgrades**	Upgrade Valves	Both	129						$1,800	EA	$232,200	$325,080	Isolate Intersections
												Valve Upgrade Total	**$325,080**	
												Total	**$1,745,520**	

*** Total includes construction cost plus preliminary engineering, design engineering, administration construction management and inspection costs**

Table ES-8
Capital Improvement Development Impact Fees

	Project	Total ($)	User Impact (%)	User Impact ($)
First Priority				
1-1	Highland/Water Main Upgrades - Main Zone	$3,936,100	14.40%	$566,798
1-1	Highland/Water Main Upgrades - Upper Zone	$158,900	0.00%	$0
1-2	Hydro-pneumatic Zone Expansion	$142,800	14.40%	$20,563
1-3	South Bay Well Upgrade	$28,000	14.40%	$4,032
1-4	Booster Pump Station Upgrade	$700,000	14.40%	$100,800
1-5	16th/El Moro Upgrade	$223,650	14.40%	$32,206
1-6	16th/Santa Maria Upgrade	$639,660	14.40%	$92,111
1-7	9th and 10th Street Upgrades	$37,800	0.00%	$0
1-8	2nd/Santa Ysabel Upgrade	$197,400	0.00%	$0
1-9	Supplemental Water Wells	$560,000	14.40%	$80,640
1-10	LOCSD/Cal-Cities Inter-Ties	$167,160	14.40%	$24,071
1-11	Polybutylene Water Services	$490,000	0.00%	$0
1-12	Seismic Upgrade to Palisades Well	$21,000	14.40%	$3,024
1-13	Seismic Upgrades and Tank Coating/Repairs to Storage Tanks	$28,000	0.00%	$0
1-14	Water Operations Facility: Phase I	$648,760	14.40%	$93,421
Second Priority				
2-1	15th Street Upgrade	$279,300	0.00%	$0
2-2	Pismo Ave. Upgrade	$140,700	0.00%	$0
2-3	11th Street Upgrade	$634,200	0.00%	$0
2-4	14th Street Upgrade	$150,150	0.00%	$0
2-5	El Moro Upgrade	$634,900	0.00%	$0
2-6	3rd/Pismo Upgrade	$350,700	0.00%	$0
2-7	4th/Ramona Upgrade	$212,100	0.00%	$0
2-8	Ramona Upgrade	$203,700	0.00%	$0
2-9	Los Olivos Upgrade	$140,700	0.00%	$0
2-10	Water Meter Upgrade	$1,148,280	0.00%	$0
2-11	Fire Hydrant Installation	$24,500	14.40%	$3,528
2-12	SCADA System Upgrade	$210,000	14.40%	$30,240
2-13	Water Operations Facility: Phase II	$563,066	14.40%	$81,082
Third Priority				
3-1	Nipomo Upgrade	$126,000	0.00%	$0
3-2	15th/Ramona/14th Upgrade	$291,900	0.00%	$0
3-3	Ferrell/Bush St. Upgrade	$611,100	0.00%	$0
3-4	Dead-end Upgrade	$562,380	0.00%	$0
3-5	12th/Santa Paula Upgrade	$149,240	0.00%	$0
3-6	14th Street Upgrade	$124,670	0.00%	$0
3-7	Loop Upgrades	$166,250	0.00%	$0
3-8	Valve Upgrade	$325,080	0.00%	$0
			Total	**$1,132,516**

CHAPTER 1

INTRODUCTION

The Los Osos Community Services District (LOCSD or District) supplies its customers with domestic water service and fire protection, among other services. The District was approved by voters in November 1998 and began operations in 1999 under the Community Services District Law of the California, Government Code, §61000 et al.

The District has been under a building moratorium since 1988, and is pursuing the implementation of a community-wide wastewater project due to groundwater contamination and in response to cease and desist orders issued by the Central Coast Regional Water Quality Control Board (RWQCB). Commitments have been received by the State Water Resources Control Board (SWRCB) to provide up to $70.5 million in funding from the State Revolving Fund program. It is expected that wastewater services will become available in late 2005, and that the building moratorium will be lifted at that time. The District must plan water services to not only meet current demands, but to anticipate growth following the cessation of the building moratorium, and in future years to come. In order to facilitate the goals of the District to provide a plan to meet the ultimate needs of the District's service area customers, the District has implemented this water master plan and capital improvement program.

SCOPE OF STUDY

The District contracted with John L. Wallace & Associates (JLWA) to prepare this comprehensive Water Master Plan to evaluate the existing water system and supplies, and to recommend a program of capital improvements to meet the District's water source area existing and future needs. The scope of this study includes the following:

- Review previous studies and background information relevant to this project, review the current land use and zoning elements for the District and project population and growth for the planning period. Identify the water use characteristics of the developed and undeveloped land areas for existing development and future build-out of the service area.

- Review historical production and consumption records to estimate existing average day, maximum day, and peak hour demands. Project future Basin water requirements.

- Develop and summarize planning and design criteria used to evaluate the existing and future water systems, including water supply capacity and redundancy, storage capacity, peaking factors, emergency power provisions, booster station capacity and redundancy, distribution system criteria, distribution system looping and reliability, and water quality relating to storage turn-over.

- Evaluate the adequacy and reliability of the existing water supplies including groundwater from the upper and lower aquifers, and identify the potential for recycled water use from the planned wastewater treatment facilities that will serve the District and community in the near future.

- Evaluate water supply sources to meet existing and future needs. Review the groundwater basin management plan recommendations, provide recommendations for locating groundwater wells, determine system and Basin yield, and develop water supply alternatives.

- Evaluate the seismic vulnerability and reliability of the LOCSD water system, and make recommended improvements to address these seismic issues.

- Discuss water quality issues, existing and anticipated water regulations germane to the LOCSD, and address these regulatory issues and impacts on the District's water system.

- Perform water system facilities electronic mapping, by developing mapping criteria, digitizing the system map to match the digital orthophoto.

- Evaluate the water supply and distribution system requirements to meet existing and future demands at average day, maximum day, and peak hour. Interview operations staff and identify existing water system deficiencies, and review the adequacy of existing fire hydrant locations and spacing.

- Develop a comprehensive computer model of the existing and proposed water systems in order to evaluate the adequacy of the distribution system infrastructure. Calibrate the model with fire hydrant field tests conducted throughout the service area.

- Identify existing system deficiencies based on the calibrated computer model and build-out flow requirements. Where deficiencies are found, recommend corrective improvements and the timing requirements thereof.

- Develop a comprehensive capital improvement program to implement the recommended improvements to the District's water system, and develop impact fees for the CIP.

ACKNOWLEDGMENTS

JLWA thanks and acknowledges the following District representatives for their efforts, involvement, input and assistance in preparing this engineering report and analysis:

Bruce Buel, General Manager
George Milanes, Utility Manager
Chief Bruce Pickens, LOCSD Fire Chief

The following JLWA key team members were involved in the preparation of this water master plan report:

Robert Miller, P.E., Water Resources Division Manager
Steven Tanaka, P.E., Senior Civil Engineer
Kari Wagner, Associate Engineer

JLWA also thanks and acknowledges Mr. Tim Cleath and Mr. Spencer Harris, Cleath & Associates, for their efforts and in-depth study of the water supply issues in the Los Osos area.

CHAPTER 2

STUDY AREA CHARACTERISTICS

This chapter describes the study area characteristics germane to this water master plan for the LOCSD. Included in this chapter is a description of the various land uses and zoning in and around the service area, a definition of the service area boundary, and population forecasts (and thus water demand projections) in and around the service area.

As noted previously, the community of Los Osos has been subject to a building moratorium since 1988, which has resulted in only limited development in the community since that time. Upon completion of the District's wastewater project, the moratorium will be lifted and development can once again proceed under normal circumstances.

LAND USE AND STUDY AREA BOUNDARIES

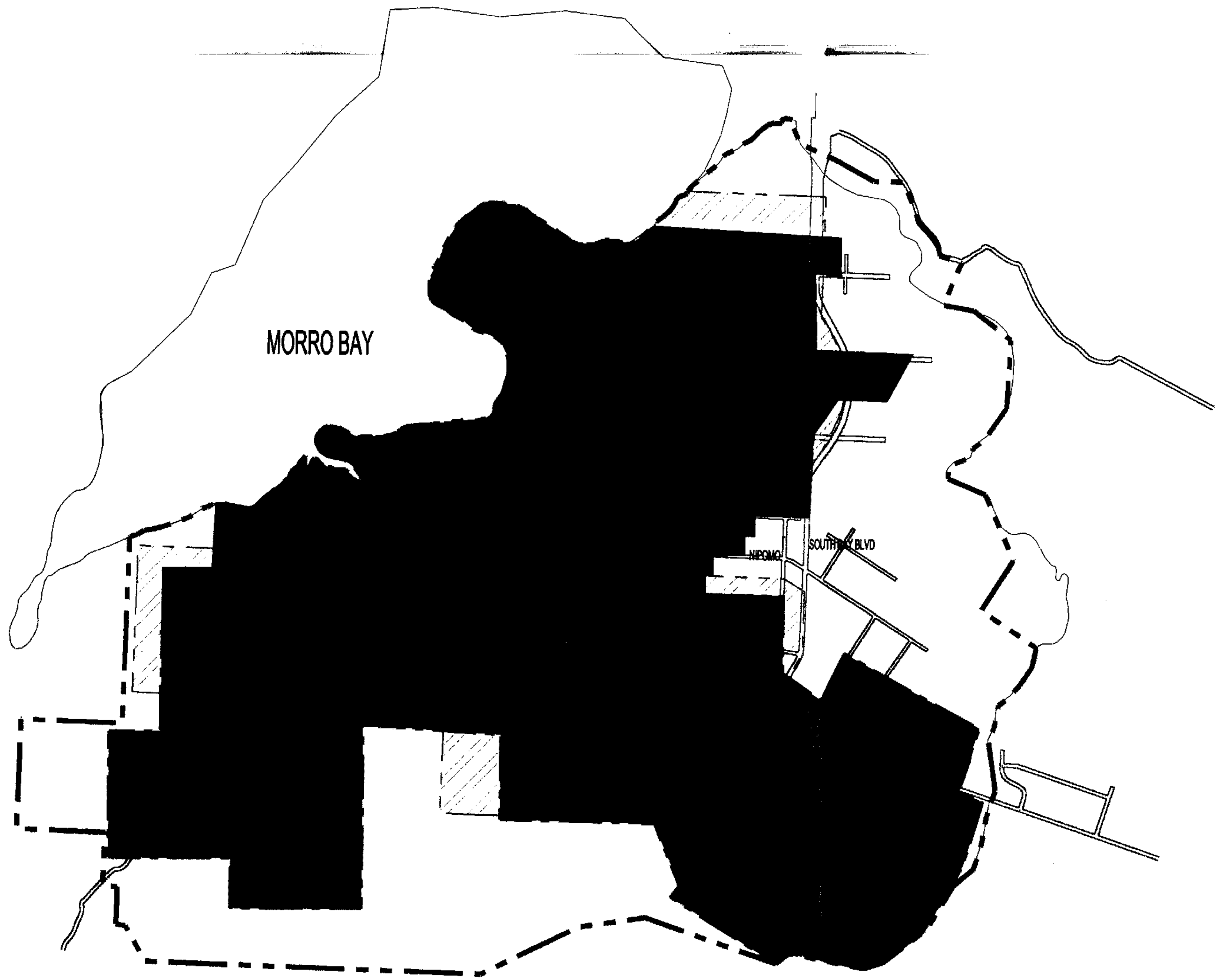
The community of Los Osos lies within the unincorporated, coastal area of San Luis Obispo County, just south of the City of Morro Bay. Los Osos is bordered on the northwest by the Morro Bay Estuary (an estuary of national importance) and Morro Bay State Park; to the east by Los Osos Creek and its riparian corridor; and to the south and southwest by the Irish Hills and Montana de Oro State Park. The Los Osos Valley lies to the east of the community.

The San Luis Obispo County General Plan has established boundaries between the urban areas and the suburban/rural areas through the use of the Urban Services Line (USL) and the Urban Reserve Line (URL). The USL is an interior boundary around the urban areas of the community. This boundary encompasses the area which is currently receiving community services or is expected to receive community services within the next 5 to 10 years. The URL is placed outside the USL, separating the urban areas from the more rural areas. The URL indicates the area which is designated to receive community services over a 20 year period. The Prohibition Zone established by the Regional Water Quality Control Board lies entirely within the USL boundary and generally encompasses properties with a development density of greater than one residential unit per acre.

The following three water purveyors exist within the USL boundary:

- LOCSD (referred herein as the LOCSD water service area)
- Southern California Water Company (Cal-Cities), and
- S & T Mutual Water Company (S&T MWC)

The LOCSD water service area encompasses approximately 633 acres of land with predominantly residential land uses. The above-referenced service area boundaries are depicted on Figure 2-1. Residential single family (RSF), residential multi-family (RMF), and residential suburban (RS) zoning make up 85 percent of the total service area. Zoning designations and the corresponding number of acres for LOCSD, Cal-Cities, S&T MWC, and outlying areas within the URL are shown in Table 2-1. Zoning designations are displayed graphically in Figure 2-2.



L.O.C.S.D.

Legend:

- Locsd Water Service Area
- Cal Cities Water Service Area
- Waste Water Prohibition Zone
- S & T Mututal Water Service Area
- LOCSD Service Area (USL)

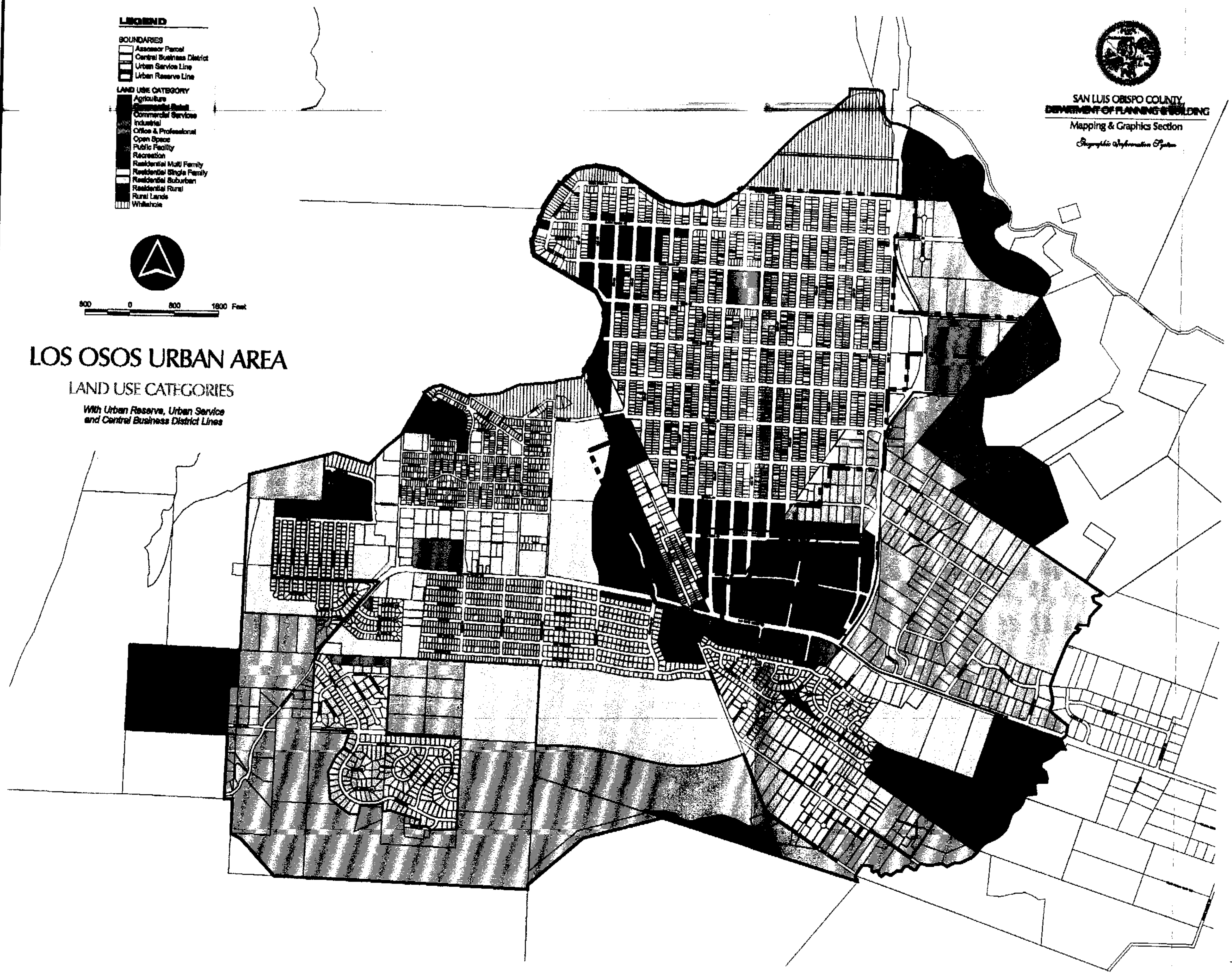
Water System Master Plan

Figure 2 - 1

Water Purveyor Boundaries

1" = 2000'

John L. Wallace & Associates



L.O.C.S.D.

Legend:

LOCSD Water Service Area

Water System Master Plan

Figure 2-2

LOCSD and Surrounding Area Land Uses

John L. Wallace & Associates

Table 2-1. Acreage by Zoning Designation Within URL

	LOCSD Water Service Area	Cal Cities	S & T Mutual Water Company	Private Wells	Total Area*
Agriculture	0	0	0	0	0
Rural Lands	0	0	0	0	0
Recreation	7	16	18	75	116
Open Space	11	84	0	68	163
Residential Rural	0	0	0	107	107
Residential Suburban	13	283	0	631	927
Residential Single Family	466	739	36	63	1,304
Residential Multi-Family	58	50	3	0	111
Office and Professional	9	16	0	0	25
Commercial Retail	33	37	0	0	70
Commercial Services	6	18	0	0	24
Industrial	0	0	0	0	0
Public Facilities	30	36	0	0	66
Total	633	1,279	57	944	2,913

*Total Area Provided by the San Luis Obispo County Planning Department

With regards to land use information and service area boundaries, this study addresses the following two issues:

- **Basin-Wide Water Supply Planning**: In order to determine the adequacy of existing and future groundwater supplies in the Los Osos area, land use projections were performed for each of the three water purveyors. In addition, agricultural and private well uses are addressed in detail in Chapter 5.

- **LOCSD Water Service Area Planning:** For elements of this study not relating to groundwater supply, land use information specific to the LOCSD water service area was required.

In order to determine the existing and future population characteristics of the LOCSD water service area, a detailed analysis of vacant properties was performed. Table 2-2 summarizes the results of this analysis. Development potential in Table 2-2 was derived from the current database developed for the LOCSD Wastewater Assessment District No. 1, including approved changes. It should be noted that many of these parcels are within the "prohibition zone" and will not be developed until community wastewater facilities are available. To be consistent with the Urban Water Management Plan, it will be assumed for this document that wastewater services will become available in August 2004. However, due to litigation delays, the expected date of service is late 2005 to 2006.

Table 2-2. Future Residential Units Within the LOCSD Water Service Area

Zoning Designation	Possible Number of Units
Residential Single Family	443
Residential Multi Family	27
Residential Suburban	0
TOTAL	**470**

DEMOGRAPHIC FORECASTS

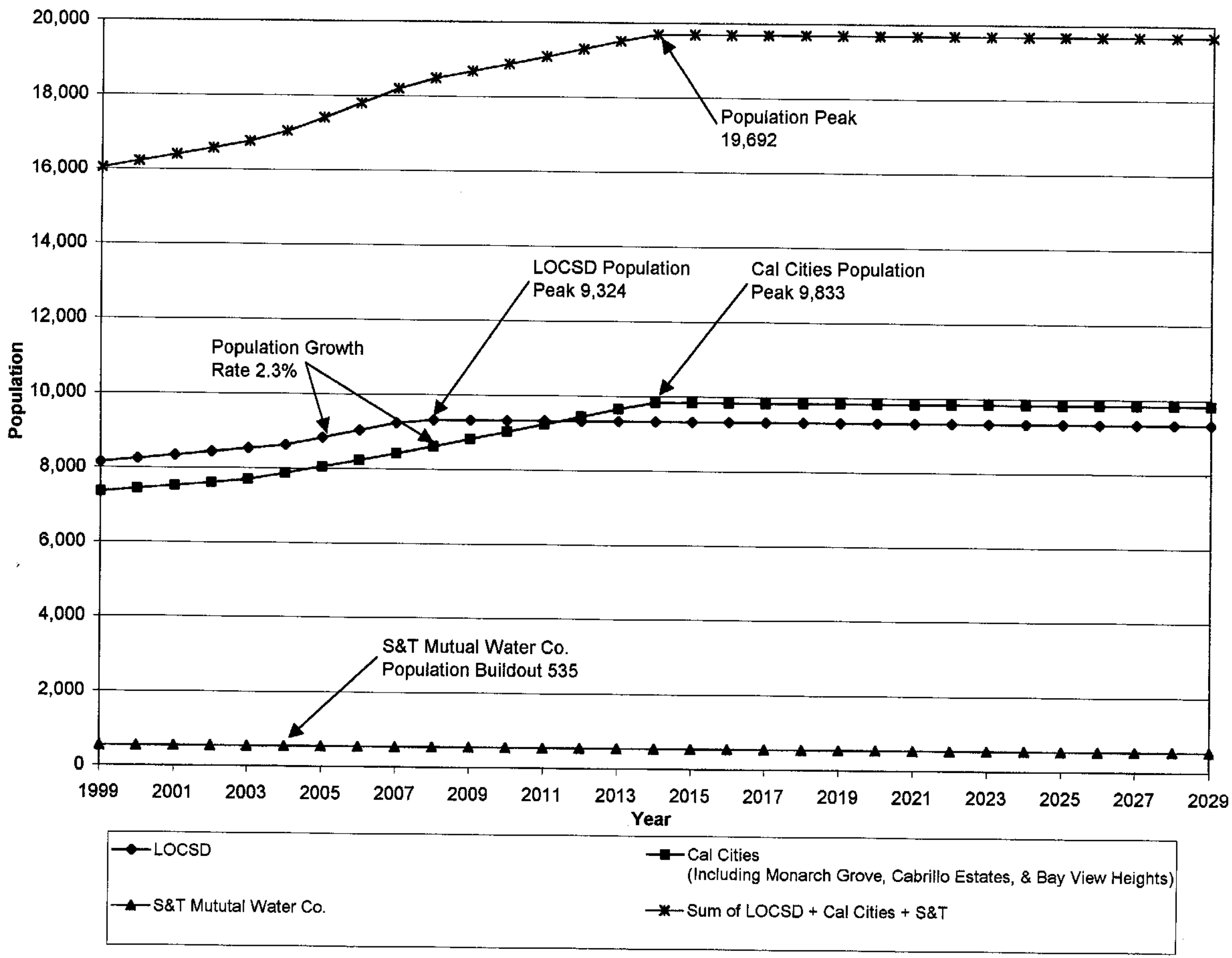
Population information for the Los Osos area was obtained from the 1990 Census, and adjusted based on the development that has occurred, albeit limited. This data was adapted to reflect the portion of each census tract that is contained within the Los Osos area. Future increases in population are estimated at 2.3% per year upon completion of the District's wastewater project (late 2005). Future population information was obtained from the LOCSD Working Group, the Wastewater System Facilities Plan, and the previously adopted Urban Water Management Plan. The estimated growth rate for 2004 is 1.15%. The annual population increase of 2.3% was based on the Los Osos Community Advisory Council's recommended growth rate. It is also consistent with the information contained in the February 1999 Draft Estero Area Plan Update. Population estimates for the urban water purveyors including Cal-Cities, S&T MWC, and LOCSD are summarized in Table 2-3 and depicted graphically on Figure 2-3.

Table 2-3. Population Estimates for Urban Water Purveyors

Purveyor Name / Area Designation	Existing Population	Build-out Population
Areas within Prohibition Zone:		
LOCSD Water Service Area	8,149	9,324
Cal Cities (Prohib. zone only)	5,549	7,944
S&T Mutual Water Co.	535	535
Total Within Prohibition Zone:	14,233	17,803
Additional Cal-Cities population in uncollected areas (Monarch Grove, Cabrillo Estates, Bayview Heights, East Side one-acre lots)	See Note *	1,889
Total Urban Purveyor Population	See Note *	19,692

*Note: * Water production and demand for existing areas is based on actual data. A detailed analysis of existing population in these areas was beyond the scope of this study.*

Figure 2-3 Projected Population for Los Osos Water Purveyors



CHAPTER 3

WATER QUALITY

This chapter describes the water quality parameters associated with the area water supplies. The sole source of water for the community of Los Osos has been its groundwater basin. Over the past decade, the community has made decisions not to import water. This section describes the water available to the LOCSD. Water quality issues associated with potential recycled water are presented in Chapter 6 of this Report.

DRINKING WATER STANDARDS

Drinking water standards are established by the United States Environmental Protection Agency (EPA) and by the California Department of Health Services (DHS). These federal and state agencies are responsible for ensuring that all public water systems are in compliance with the Safe Drinking Water Act (SDWA). The State of California has been consistent in applying drinking water standards as they are adopted by the EPA. Moreover, California has established action levels for contaminants not on the federal list. Future water quality regulations germane to the LOCSD are discussed later in this chapter.

Water Quality Parameters

State and Federal water standards fall into two categories:

- Primary Standards relate specifically to the health of the community as it might be affected by the water supply. Mandatory maximum contaminant levels (MCLs) are established for specific constituents.

- State Secondary Standards relate to aesthetic qualities of the water including taste, odor, color and some minerals. In California, maximum contaminant levels (MCLs) are also established for these secondary constituents.

Table 3-1 lists the current MCLs which the LOCSD must meet, along with other water quality parameters (secondary aesthetic standards). The results indicate the District's well supply meets all primary and secondary standards; however, water distribution system sampling indicated one exceedence of the copper standard. The District will be implementing corrosion control measures at each well head, by introduction of ortho-phosphate into the distribution system. Continued monitoring will be required to determine the effectiveness of this treatment technique.

Table 3-1. Year 2000 Water Quality Report, LOCSD

PARAMETER	State MCLs	State PHG or *MCLG*	Annual Range	Compliance Level
PRIMARY STANDARDS - Mandatory Health Related Standards				
Water Clarity (NTU)				
Source Turbidity	5	NS	0.1 - 0.3	0.3
Filter Effluent Turbidity	5	NS	n/a	n/a
Microbiological (Distribution System)				
Total Coliform	0%	0	0	1
Fecal Coliform/E. Coli	(a)	0	0	0
Inorganic Chemicals (Minerial Matter)				
Aluminum, ppm	1.0(*0.2)	NS	ND - 0.005	0.005
Antimony, ppm	0.006	0.02	NA	NA
Arsenic, ppb	50	NS	ND - 2	2
Barium, ppm	1	2	0.03 - 0.12	0.12
Beryllium, ppm	0.004	0.004	NA	NA
Cadmium, ppb	5	0.07	0.1	0.1
Chromium, ppb	50	2.5	1 - 14	14
Copper, ppm	AL=1.3	0.17	0.022 - 1.6	1.33
Cyanide, ppm	0.2	0.15	NA	NA
Fluoride, ppm	2	1	ND - 0.2	0.2
Lead, ppm (b)	AL=15	2	ND - 8.9	3.3
Mercury (inorganic), ppb	2	1.2	ND - 0.5	0.5
Nickel, ppb	100	n/a	ND - 4	4
Nitrate (as nitrate), ppm	45	45	ND - 15	15
Selenium, ppb	50	(50)	ND - 2	2
Thallium, ppm	0.002	0.0005	NA	NA
Radionuclides (pCi/L)				
Gross Alpha	15	(0)	ND - 2	2.0
Gross Beta	50	NS	NA	NA
Radium 226 + Radium 228	5 (c)	NS	NA	NA
Radium 222	NS	NS	NA	NA
Strontium-90	8	NS	NA	NA
Tritium	20,000	NS	NA	NA
Uranium	20	NS	NA	NA
SECONDARY STANDARDS - Aesthetic Standards (Taste, Odor & Color)				
Chemical Parameters				
Aluminum, ppb	200	NS	ND - 0.005	0.005
Chloride, ppm	500	NS	33 - 60	60
Color (units)	15	NS	1 - 2	2
Foaming Agents - MBAS, ppm	0.5	NS	NA	NA
Iron, ppb	300	NS	ND - 7	7
Manganese, ppm	0.05	NS	NA	NA
Odor Threshold (units)	3	NS	1 - 1.4	1.4
pH (units)	6.5-8.5	NS	NA	NA

Table 3-1. Year 2000 Water Quality Report, LOCSD

PARAMETER	State MCLs	State PHG or *MCLG*	Annual Range	Compliance Level
Silver, ppb	100	NS	ND - 0.5	0.5
Specific Conductance (umhos)	1,600	NS	267 - 705	705
Sulfate, ppm	500	NS	33 - 60	60
Total Dissolved Solids, ppm	1,000	NS	160 - 420	420
Zinc (mg/L)	5	NS	0.089	ND
Additonal Parameters (ppm)				
Hardness as CaCO3	NS	NS	79 - 280	n/a
Sodium	NS	NS	21 - 47	n/a
Aggressive Index	NS	NS	11 - 12	n/a

KEY TO ABBREVIATIONS

PHG = Public Health Goal
MCLG = Maximum Contamintant Level Goal
MCL = Maximum Contaminant Level
MFL = Million Fibers per Liter
NS = No Standard
NA = Not Analyzed
n/a = not applicable
ND = Not Detected
NTU = Nephelometric Turbidity Units
CaCO3 = Calcium Carbonate
ppm = parts per million or milligrams per liter
pCi/L = picoCuries per liter
< = less than

(a) Total coliform MCLs: No more than 5% of the monthly samples may be total coliform positive. Fecal coliform/E.coli MCLs: The occurrence of two consecutive coliform samples, one which contains fecal coliform/E.coli, constitutes an acute MCL violation.
(b) Treatment technique and action level per Federal Lead and Copper Rule.

Federal Lead and Copper Rule

Copper < 1.3 mg/L (90% of samples)
Lead < 0.015 mg/L (90% of samples)

(c) Standards are for radium 226 and 228 combined.

FUTURE REGULATIONS

Groundwater is the only source of water to the LOCSD, and none of the District's wells are under the influence of surface water. Recycled water may be available in the future to augment the potable water supply. This resource and corresponding regulations are discussed in Chapter 6 of this Report. Most anticipated federal and state drinking water regulations are directed toward surface water sources or groundwater under the direct influence of surface water, and therefore will most likely not impact the LOCSD. Based on conversations with the State Department of Environmental Management, the Disinfectant/Disinfection Byproduct Rule and revised Waterworks Standards will pose the most significant regulatory issues to the LOCSD.

Disinfectant/Disinfection Byproduct Rule

The purpose of the Rule is monitoring and reduction, as necessary, of potentially carcinogenic disinfection byproducts. The discussion herein is based on the latest draft, submitted for internal review by the Department of Environmental Management as of June 2000. The final requirements will be issued in the final Rule.

According to the latest draft, water systems with groundwater as their sole source will be required to begin sampling for trihalomethanes (THMs) and five specific haloacetic acids (HAA5) in their distribution system in January, 2004. Small groundwater systems (less than 10,000 people served) would collect a sample for measurement of total trihalomethanes (TTHMs) and HAA5 at the point in their distribution system with the longest residence time. If that sample exceeds the MCL (maximum contaminant limit) established in the California Code, samples must be repeated quarterly and a yearly average computed. If this value exceeds the MCL, the Code will require notification of a violation to the Department of Environmental Management and to the public.

If the yearly sample does not exceed the MCL, the LOCSD may adopt a reduced monitoring program and sample once per year during the month of warmest water at the point in the system with longest residence time. Any subsequent sample that exceeds the MCL would activate quarterly monitoring requirements, calculation of an annual average, and notifications as discussed above.

The TTHM and HAA5 requirements are a potential concern for the LOCSD. Both substances are formed by reactions between certain disinfectants (such as chlorine) and organic carbon. Groundwater samples recently collected by the LOCSD during a recharge study have yielded total organic carbon (TOC) values up to 10 mg/l. Values in this range are more common in surface water than in groundwater, where TOC measurements of 0 to 2 mg/l are expected. High concentrations increase the potential for formation of THMs and HAA5s. The District's use of orthophosphates for corrosion control might also enhance biological growth within the distribution system, resulting in an increase in organics and THM formation potential.

If system THMs and HAA5 approach the MCLs when the monitoring period begins, the LOCSD should consider pursuing a system for THM reduction. The most effective approaches focus on modifications to chlorination (switching to chloramination which reduces THM production) and removal of organic carbon from water sources. Chloramination may be relatively simple to implement, but will likely require extensive public notifications warning customers against fish toxicity in aquariums and potential toxicity effects on kidney dialysis patients. Best available technologies for treatment options would include activated carbon, enhanced coagulation, or enhanced softening. Such reduction may also need to be considered for the future wastewater treatment plant effluent, which will recharge the upper groundwater aquifer.

Waterworks Standards

According to the draft revision to the Waterworks Standards submitted for State review on February 1, 2001, water systems must be designed to provide a minimum pressure of 30 psi throughout the distribution system and at all times (except under fireflow conditions). Since the LOCSD system has historically experienced pressures in and below this range, this requirement presents a significant concern. Options for providing reliable system pressures in excess of 30 psi are addressed in the distribution system section of the Water Master Plan.

CHAPTER 4

WATER DEMAND AND STORAGE

This chapter describes the existing and projected water demand for the urban purveyors in the Los Osos area and the storage requirements for the LOCSD water system. The water demand forecasts will form the basis for assessing supply adequacy, modeling and identifying existing and future system needs, and identifying deficiencies.

BASIN-WIDE URBAN PURVEYOR DEMANDS

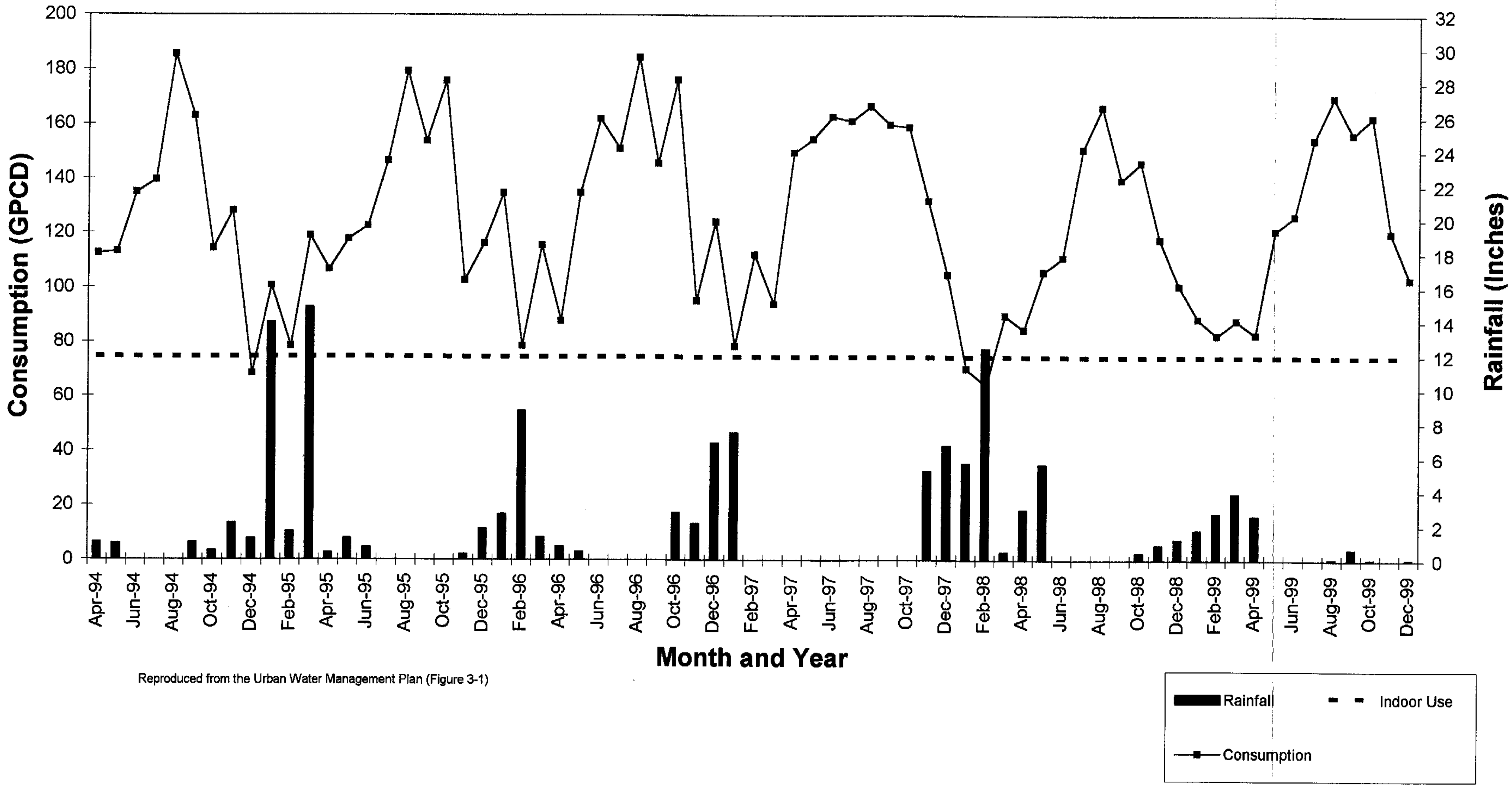
As a component of its Wastewater System Facilities Plan, the District adopted an Urban Water Management Plan in December 2000 (UWMP). As recommended in the UWMP, the District plans to implement approximately $1.2 million in conservation measures within the collected area of the wastewater system. Water production data from the UWMP, which was based on actual purveyor use from 1994 through 1999, will be used to forecast future water demand. The purpose of this section is to summarize the existing and build-out groundwater extractions necessary for urban purveyor use. Non-purveyor uses relating to agriculture and private domestic wells are described in Appendix B.

Due to the predominantly residential nature of the community, future water production estimates are calculated on a per capita basis. Table 4-1 summarizes existing and projected future water production. The following assumptions were employed in estimating future production:

- Future per capita production in the area collected by the wastewater project is estimated at 130 gpcd as indicated in the adopted UWMP.
- In uncollected areas served by Cal Cities, future per capita production with naturally occurring conservation is estimated at 140 gpcd.
- In the S&T Mutual Water Co. service area, future water production rates will persist at historical levels.

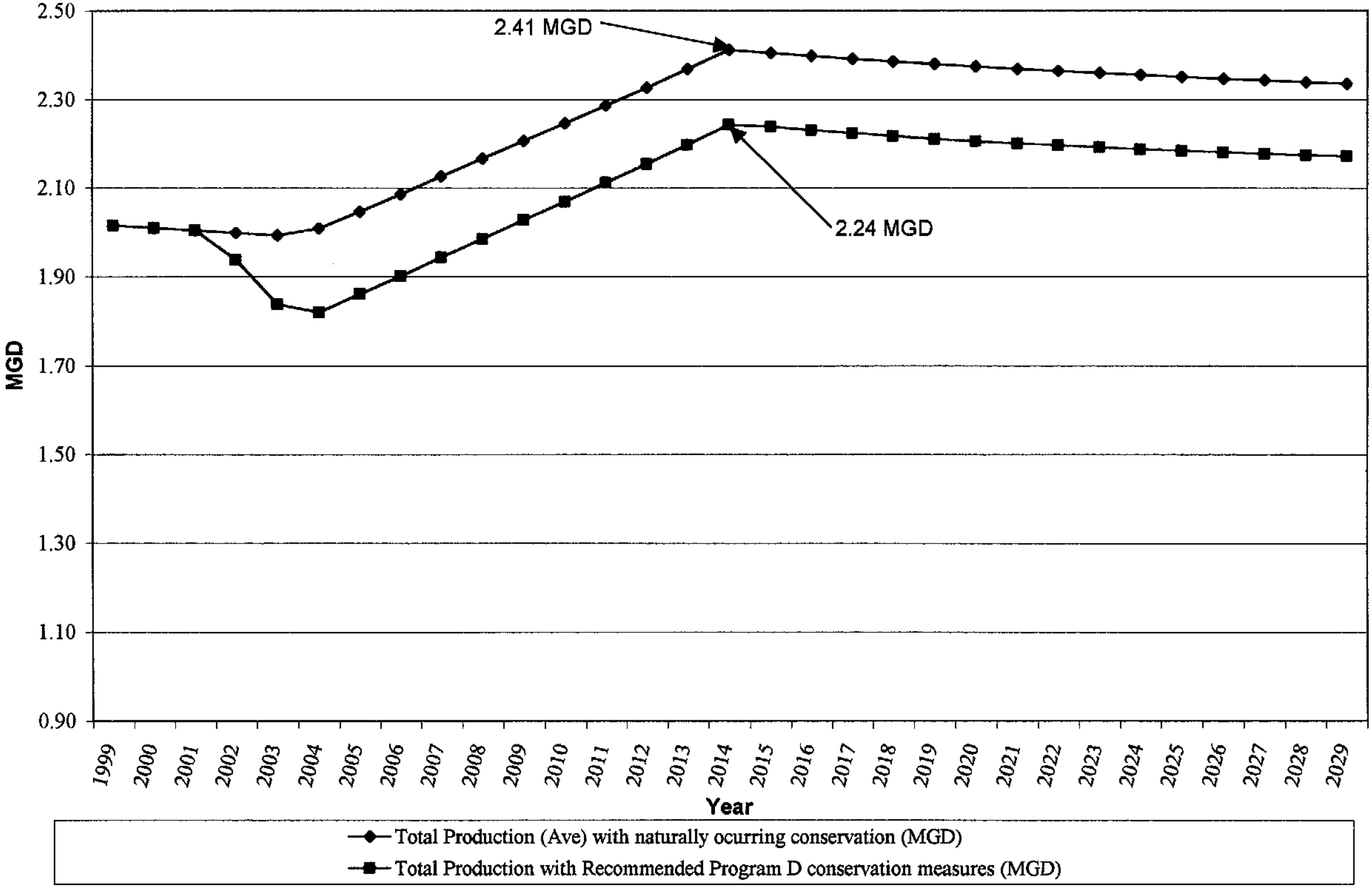
Total urban purveyor use without the proposed wastewater project is estimated at 3,160 acre feet per year using 140 gpcd. Figure 4-1 was originally printed in the UWMP and displays seasonal variations in water production as a function of rainfall. Figure 4-2 is also reprinted from the UWMP and depicts water production as a function of time for the collected area of the community. The peak water production (with conservation) is listed as 2.24 mgd, which does not include production related to S&T Mutual Water Co. and Cal-Cities customers outside of the collected area.

Figure 4-1 LOCSD and Cal Cities Consumption vs. Rainfall



Reproduced from the Urban Water Management Plan (Figure 3-1)

Figure 4-2. Comparison of Total Production
Between Naturally Ocurring Conservation versus the Recommended Program Conservation Measures



* Reproduced from the Urban Water Management Plan (Figure 3-2)

Table 4-1. Existing and Build-Out Water Production for Urban Purveyors

Water Purveyor	Existing Average Daily		Build-Out Average Daily Production	
	(mgd)	(ac-ft/year)	(mgd)	(ac-ft/year)
LOCSD	0.98	1,100	1.21	1,358
Cal-Cities	0.92	1,030	1.29	1,452
S&T MWC	0.14	150	0.14	150
Total Purveyor Production	**2.04**	**2,280**	**2.64**	**2,960**

LOCSD WATER SERVICE AREA DEMANDS

Water system demands are important characteristics of water systems, as these parameters are used to size pumping, storage and distribution system facilities. Each community water system exhibits unique characteristics that must be calculated and identified in order to better evaluate existing and future water distribution system requirements.

Hydraulic demand parameters are defined as follows:

- Average Day Demand (ADD). The ADD is the average water demand calculated over the year. This demand is generally determined by production records and customer meter readings or bills. The ADD is used also to determine the average per capita demand, which in turn is used to project future water system demands based on anticipated population growth. For the LOCSD water service area, the present-day ADD was determined to be 0.98 mgd, based on a review of the past production records from 1994 to 1999.

- Maximum Day Demand (MDD). The MDD is the maximum daily production of water needed to meet the peak demand of the year. This is generally during the summer as a result of increased irrigation demand. Based on a review of actual water production records, the maximum day demand for the LOCSD water service area was determined to be 2.0 times greater than the ADD or 1.96 mgd. In other terms, the MDD peaking factor was calculated at 2.0.

- Peak Hour Demand (PHD). The PHD of the system is critical in sizing water mains and pumping facilities. During peak hour demand is generally when customers will experience low service pressures in areas with undersized mains and/or lack of looped distribution pipelines. The PHD is generally determined by calculating the specific demand within the day, by monitoring tank levels and pumping records. In many municipal systems, the exact calculation of this parameter is difficult to ascertain. Some tank level information was available for the LOCSD water system. Using this information and data from communities of similar size, a PHD factor of 3.5 (3.5 times the ADD) was assigned to the LOCSD water system. Therefore, PHD is 3.43 mgd.

These hydraulic parameters are summarized for existing and future (build-out) demands for the LOCSD in Table 4-2.

Table 4-2. Summary of The LOCSD Water System Demands

Demand Condition	LOCSD Water System Demands	
	Existing (MGD)	Build-Out (MGD)
ADD	0.98	1.21
MDD	1.96	2.42
PHD	3.43 (2,382 gpm)	4.24 (2,946 gpm)

Notes:
1. Existing demand based on historical records
2. Build-Out demand based on 130 gpcd
3. MDD = ADD X 2.0
4. PHD = ADD X 3.5

EXISTING WATER STORAGE FACILITIES

The LOCSD currently operates three water storage tanks and one hydro-pneumatic tank in two separate pressure zones. The pressure zones are summarized as follows:

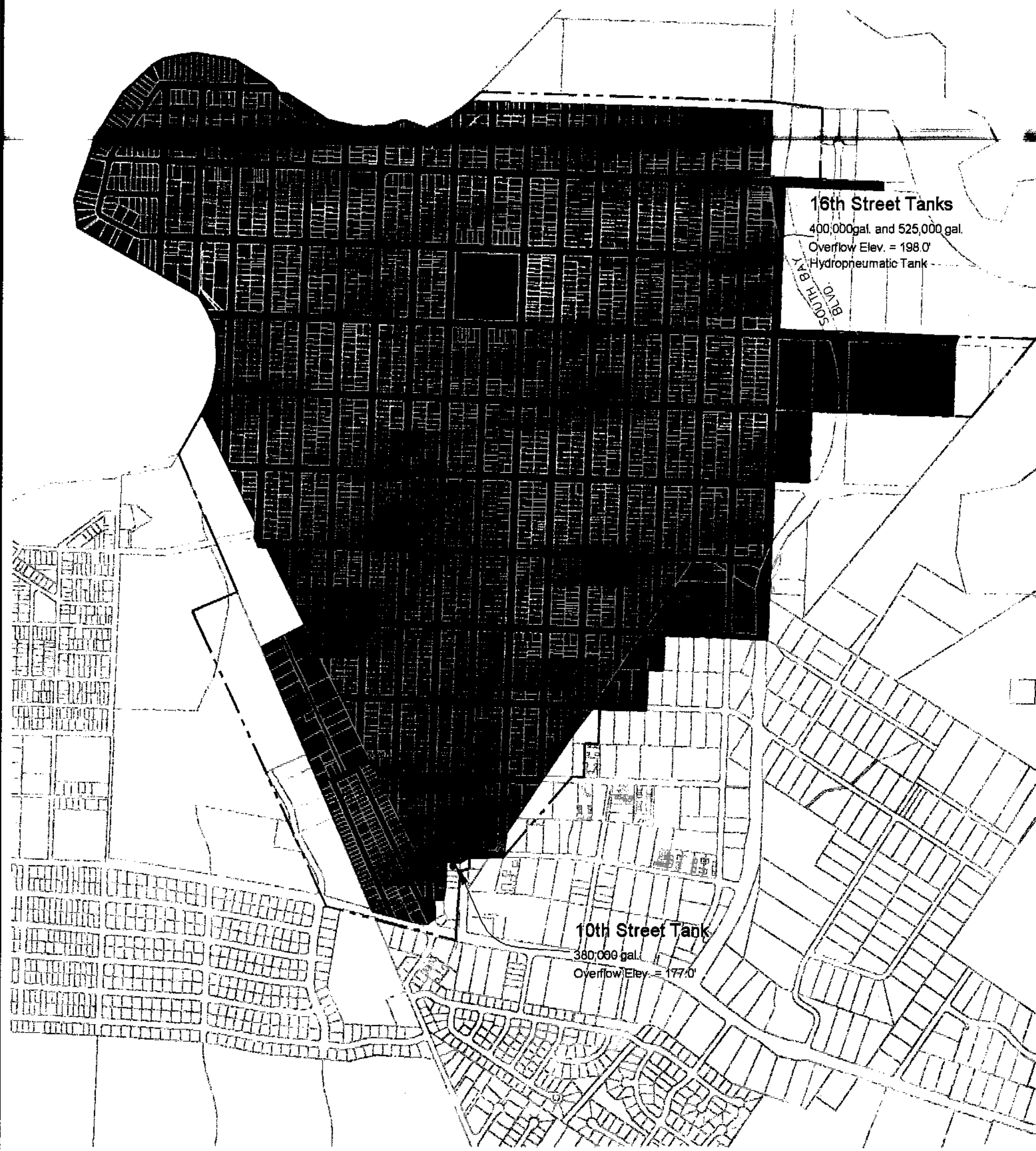
- Main Zone: Approximately 85 percent of the District's water use occurs within the main pressure zone. The main zone is fed by gravity via all three water storage tanks.

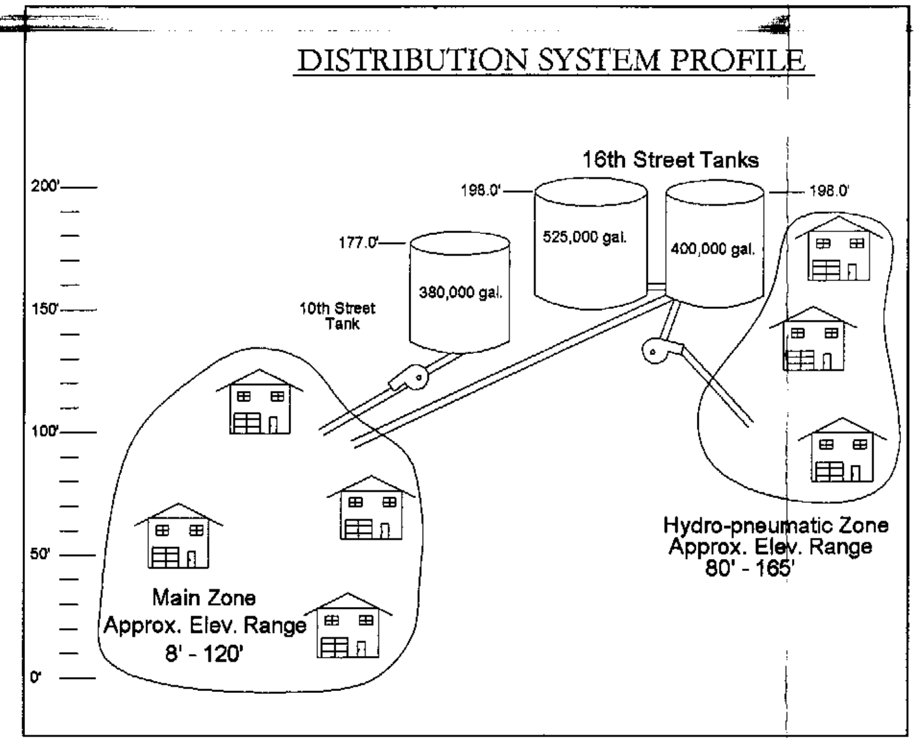
- Hydro-pneumatic Zone: Approximately 15 percent of the District's water use occurs within the hydro-pneumatic zone. This zone is fed by the two tanks at 16th Street. The two tanks feed the zone through three pumps and a hydro-pneumatic tank, to provide sufficient system pressure to this area of higher elevation. The hydraulic grade line is approximately 275 feet.

The locations of these facilities, along with the pressure zone boundaries, are shown in Figure 4-3. Table 4-3 summarizes the existing water storage system.

STORAGE ANALYSIS

The District receives water via five wells, which are distributed throughout the District's Water Service Area. However, 50 percent of the water is from the Palisades Well alone. In the event of





L.O.C.S.D.

Legend:

- LOCSD Water Service Area
- Main Zone
- Existing Hydro-pneumatic Zone (Remaining System is Gravity Fed)

Water System Master Plan

Figure 4-3

Existing Pressure Zones and Distribution System Hydraulic Profile

1" = 1200'

0 300 600 1200

John L. Wallace & Associates JLWA

Table 4-3. Existing LOCSD Water Storage Facilities

Storage Facility (Date Installed)	Volume (gallons)	Material	Overflow Elevation, MSL
16th Street Tank #1 (1986)	400,000	Steel	198.0
16th Street Tank #2 (1986)	525,000	Steel	198.0
10th Street Tank (1962)	380,000	Steel	177.0
Main Zone Total	1,305,000		

a system emergency, adequate water supply should be provided by the storage facilities within the system. Following is a list of reasons:

- The wells would not serve as storage for the hydro-pneumatic zone.
- In an emergency event, well production may be disabled or contaminated and therefore, the wells should not be considered for emergency storage.

The LOCSD does have an emergency connection to Cal-Cities in the event of temporary system failures. Each water district is capable of receiving water from the other. However, in the event of an area-wide emergency, water supply from Cal-Cities may also not be reliable and therefore should not be considered in the storage analysis.

For the purposes of this study, the wells and the connection to Cal-Cities will not be considered in the storage analysis. There are three types of storage commonly evaluated in a storage analysis: emergency, fire and operational. The sum of these three are recommended to be the total storage volume available for the system.

Emergency Storage

Emergency storage is intended to provide for conditions such as extended power outages, line breaks, pump failure, and similar problems. Most water planners accept that during emergencies supply per capita may be reduced to minimum levels. Typically, on that basis, an emergency storage volume of 50 gpcd for three days is accepted as a reasonable value. The recommended emergency storage is listed in Table 4-4.

Fire Storage

Table 4-4. Emergency Storage Recommendations

	Estimated Population	Required Emergency Storage (MG)
Existing Conditions	8,149	1.22

Fire Storage is the volume of water needed to control fire in a building or group of buildings. The determination for this storage is based upon a recommended flow rate, its duration and a minimum residual pressure established by the agency of interest.

The agencies which establish the relationships between land use and fire requirements include the Uniform Fire Code (UFC) and the Insurance Services Offices (ISO). The services of ISO are advisory only, and are used to establish insurance ratings for cities and communities across the nation. The flow rate and duration for fire flow vary greatly with the type of development, with UFC values ranging from 1,500 to 15,000 gpm for different building types and sizes. Requirements established by the LOCSD Fire Department were used for the different zoning types. To determine the required fire storage in the Los Osos Community, the most stringent fire flow requirement, 3,500 gpm for 3 hours will be used. A fire suppression volume of 0.63 million gallons will be recommended to meet these criteria.

Operational Storage

Operational storage is the amount of water needed to equalize the daily supply and demand. Without this storage, water production facilities large enough to meet the instantaneous peak demands of the system would be required. With adequate operating storage, well pumps can operate at the daily average rate, while storage facilities meet the hourly peaks. This operating method also prevents the unnecessary use of additional well pumps at times when electrical rates are the highest.

AWWA M-32 recommends operational storage to be 20 to 25 percent of build-out average day demand for the given zone, or up to 15 percent of the maximum day demand. Using 25 percent of build-out maximum day demand, the recommended operational storage is 0.30 MG. Table 4-5 summarizes the total storage recommendations for the existing and future conditions for LOCSD.

Water Storage Tank Evaluations

The LOCSD retained the services of Advantage Technical Services (ATS) to conduct physical inspections of the 10th Street and 16th Street tanks. These physical inspections were conducted from March 6 to March 8, 2001. The inspections were conducted pursuant to American Water Works Association Standard for Inspecting and Repairing Steel Water Tanks, Standpipes, Tanks, and Elevated Tanks, for Water Storage (D101-53-R1979). In addition, the LOCSD retained the services of Lampman & Smith, Structural Engineers, to evaluate the structural/seismic integrity of these water storage tanks. This cursory structural evaluation was also conducted in March 2001. The structural evaluation was based on AWWA Standard for Welded Steel Tanks for Water Storage (D100), Uniform Building Code (1997), and a referenced steel tank design manual.

Table 4-5. Total Storage Recommendations

	Storage Component (MG)			Total Required Storage (MG)	Total Available Storage (MG)	Storage Surplus/ (Deficit)
	Emergency	Fire	Operational			
Existing Conditions	1.22	0.63	0.30	2.15	1.31	(0.84)
Build-Out	1.40	0.63	0.30	2.33	1.31	(1.02)

Physical Inspection of Water Storage Tanks. The two 16th Street water storage tanks, and the 10th Street water storage tank, were inspected in detail. The inspections revealed a number of deficiencies that will require attention. The following summarizes the key water storage tank maintenance/repair recommendations noted in the reports:

10th Street Tank

Immediate to within 1 year:

- Apply weld patches to shell and roof areas of heavy corrosion, particularly at guard-rail attachments and at highly corroded areas near the shell bottom.
- Spot-repair coating on corroded structure and plate on tank interior.
- Repair damaged coatings on shell and roof where ladder and guardrail welding occurred.
- Caulk or weld internal laps at roof plate and compression ring.
- Replace roof vent with tamper-resistant and corrosion resistant bug-proof screen. Equip vent with pressure relief and vacuum, in accordance with AWWA D100.

- Provide applicable training and monitoring programs for heavy metals protection and protection from and handling of, lead-based paints.

- Instruct and document training of tie-off procedures while working atop tanks, and consider design of a permanent tie-off for personnel.

Within 2 to 3 years:

- Re-coat tank exterior. Alternatively, spot-coat areas of most active corrosion to defer entire re-coating.

Within 3 to 5 years:

- Re-inspect and evaluate internal coatings.

16th Street Tank (400,000 gallon capacity)

Immediate:

- Apply weld patches to shell and roof areas of heavy corrosion, particularly at highly corroded areas near the shell bottom.

- Re-coat tank interior with epoxy coating system (similar to 10th Street Tank).

- Caulk or weld internal laps at roof plate and compression ring.

- Replace roof vent with tamper-resistant and corrosion resistant bug-proof screen. Equip vent with pressure relief and vacuum, in accordance with AWWA D100.

- Instruct and document training of tie-off procedures while working atop tanks, and consider design of a permanent tie-off for personnel. Provide slip-resistant surface to work on the roof adjacent to the roof hatch, level gauge and ladder.

- Remove gauge board brackets, floats and cables.

Within 1 to 2 years:

- Re-coat tank exterior. Abrasive-blast lead-based paint, or encapsulate. Encapsulation will not provide a good surface for the new coating to adhere to.

- Add second shell manway or flush cleanout .

16th Street Tank (525,000 gallon capacity)

Immediate to within 1 year:

- Apply weld patches to shell and roof areas of heavy corrosion, particularly at highly corroded areas near the shell bottom.
- Evaluate anchor bold design with reduced cross section of anchors due to corrosion. Blast and coat anchor bolts. Seal and fill the concrete interface to prevent further reduction of anchor strength due to rusting of bolts.
- Replace corroded level gauge brackets.
- Provide applicable training and monitoring programs for heavy metals protection and protection from and handling of, lead-based paints.
- Remove silt from tank bottom, and monitor condition of interior coating system.
- Instruct and document training of tie-off procedures while working atop tanks, and consider design of a permanent tie-off for personnel. Provide slip-resistant surface to work on the roof adjacent to the roof hatch, level gauge and ladder.

Within 1 to 2 years:

- Re-coat tank exterior. Alternatively, spot-coat areas of concentrated corrosion to defer re-coating for several years.

Within 5 years:

- Re-coat tank interior.

Structural Evaluation of LOCSD Water Storage Tanks. The evaluation of the LOCSD water storage tanks revealed some deficiencies, as noted in the April 2001 report. The deficiencies are noted as follows:

10th Street Tank

- No Base anchorage or foundation.

- Safety factor (FS) less than 1.0 for resistance to sliding (greater than 1.5 recommended).

16th Street Tank (400,000 gallon capacity)

- No Base anchorage or foundation.

- Safety factor (FS) less than 1.0 for resistance to sliding (greater than 1.5 recommended).

16th Street Tank (525,000 gallon capacity)

- Base anchorage provided by thirty-two 7/8" or 1" anchor bolts, but are dependent on depth of anchor bolt embedment into concrete foundation. Connection between gusset plates and shell appear to be undergoing initial stages of corrosion.

- Foundation provided, but size of footing and reinforcement could not be verified.

- Safety factor (FS) less than 1.0 for resistance to sliding (greater than 1.5 recommended).

Seismic Recommendations:

- At all three tank sites, conduct geotechnical investigations to determine base material depth, allowable bearing pressure, strength of existing anchor bolts (testing laboratory), and determine friction coefficients between tank base and finish grade materials.

- Further evaluate tank shell and connections to identify areas of corrosion.

- Obtain recommendations for resistance to sliding, including flexible couplings, seismic valves, and seismic pipe loops.

- Evaluate seismic loads on retaining wall during seismic event at the 10th Street Tank.

Hydraulic Considerations of the 10th Street Tank. The 10th Street tank is lower in elevation than the other storage tanks. This requires pumping from the storage tank to the distribution system to accommodate for this lower elevation. This is not an efficient operation of this storage tank, particularly in light of the current energy crisis and energy costs. One consideration would be to abandon this tank, and consolidate the required storage at the new tank site. The 10th Street tank is nearing 40 years old, and has experienced significant corrosion at the base of the tank and in other localized areas throughout the tank surface area. Re-coating of this tank may cost around $60,000. With the other incidental repairs and seismic retrofit work needed, the near-term costs to fully repair the tank could approach $150,000 or more. The incremental cost of building additional new storage within the future tank site (Highland), to account for abandonment of the current 10th Street tank, would be approximately the same in capital cost dollars. In addition, this would eliminate the need for an auxiliary pump station to pump water from the 10th Street Tank to the distribution system. From a long-term cost perspective, it appears that abandonment of the 10th Street tank (and providing equivalent storage in the Highland tank) may be more cost-effective than upgrading the existing tank. However, the final decision to abandon the 10th Street tank should not be made until the seismic and geotechnical evaluations have been completed. After completion of these studies, final costs associated with repair and retrofit of this tank can be assessed.

Storage Recommendations

Based on the storage calculations and analysis, the District's water storage capabilities have a current deficit of 0.84 MG. In the future, with demands from anticipated build-out, the estimated future deficit is 1.02 MG. With a suitable location for the future storage tank (Highland), it is recommended that "build-out" storage be provided in the near-term. Providing the existing storage deficit today, then incrementally providing the future storage would not prove cost-effective. The site is situated such that overflow elevations can match the existing 16th Street tanks, to maximize use of a single pressure zone (main zone). In addition, the District should consider abandonment of the 10th Street tank, following completion of the seismic and geotechnical evaluations. Should the capital costs to retrofit this tank prove to be significant compared to development of new storage, the District should consolidate the needed storage at the future Highland tank. This would require the new tank size to be 1.4 MG. Confirmation of the viability of providing this amount of storage at the new tank site will require additional review and consideration prior to design.

CHAPTER 5

WATER SUPPLY

This chapter describes the water supplies available to the District. The sole source of water for the Community of Los Osos has been its groundwater basin. This section describes the water available to the LOCSD.

WATER SERVICE PROVIDERS IN THE LOS OSOS AREA

As indicated in previous chapters, the two largest water providers within the Urban Services Line are the District and Cal-Cities. Cal-Cities is a subsidiary of Southern California Water Company, which is a California Corporation regulated by the Public Utilities Commission (PUC). Southern California Water Company is a subsidiary of American States Water Company, a publicly traded corporation. Policies are established by Corporate Directors in accordance with PUC regulations. Refer back to Figure 2-1 for a depiction of the District's water service area boundaries for the District and Cal-Cities. Table 5-1 shows the pumping records of the District and Cal-Cities over a six year period.

In addition to the above reference purveyors, the groundwater underlying the community is pumped by S&T Mutual Water Company for use by its customers, by the County of San Luis Obispo for irrigation of a community park, large lot residences for private use, and by agricultural interests.

In Chapter 2, population at build-out was projected for the LOCSD, Cal-Cities and S&T MWC service areas, along with development areas of Cal-Cities outside the water conservation boundary including Monarch Grove, Cabrillo Estates and Bayview Heights. Projected water production for these areas is summarized in Table 4-1. This projected demand information will be used to evaluate future basin yield (supply) versus water demand as indicated in Table 5-2. The detailed groundwater analysis included herein indicates the safe urban purveyor yield of the basin, with the District's wastewater project, will be 2,900 AFY (see Appendix B - Table 6). Given that the demand to the Basin is estimated at approximately 2,960 AFY, an additional source of supply, such as recycled water, will be necessary. Chapter 6 discusses the use of recycled water to address the entire 60 AFY shortfall.

In Chapter 6, the recycled water study projects 115 AFY of savings in potable water pumping by irrigating area schools, the Community Park and the Sea Pines Golf Course with recycled water from the future wastewater treatment plant. As a result, this water conservation measure should adequately provide the additional source of supply needed to avoid importing water.

Table 5-1. Water Supply Sources

Year	LOCSD			Cal Cities			Combined Total Production (AF)
	Cumulative Well Production		Yearly Production (AF)	Cumulative Well Production		Yearly Production (AF)	
	Ave Daily Production (MGD)	Ave (GPDA)		Ave Daily Production (MGD)	Ave (GPDA)		
1994	0.915	328.6	1,024.4	0.887	359.3	993.2	2,017.6
1995	1.030	368.4	1,153.4	0.881	356.8	986.8	2,140.2
1996	0.988	353.3	1,107.1	0.918	370.3	1,028.3	2,135.4
1997	1.057	379.4	1,184.3	0.987	394.6	1,105.6	2,289.9
1998	0.957	339.3	1,071.4	0.885	350.5	991.3	2,062.8
1999	1.036	372.0	1,160.0	0.980	381.9	1,097.7	2,257.7
Total AVE	0.984	352.3	1,102.4	0.923	368.9	1,033.9	2,136.3

Notes

MGD: Million Gallons Per Day

N/A: Not Available

GPDA: Gallons Per Day Per Account

AF: Acre Foot

Source: LOCSD 1993-1999 and Cal Cities 1994-1999 Well Log data sheets

*Reproduced from the Urban Water Management Plan (Table 4-1)

Calculation:
Ave Daily Production MG/Day * 1,000,000 gallons * 365 days / 325850 gallons= AF

Table 5-2. Projected Water Production in Los Osos Groundwater Basin

Service Area	Build-Out Population	Per Capita Demand (gpcd)	Build-Out Demand (AFY)
LOCSD	9,324	130	1,358
Cal-Cities	7,944	130	1,157
Cal-Cities (Monarch Grove, Cabrillo Estates, BayView Heights, Large lots):	1,889	140	295
S & T Mutual Water Company	535	N/A	150
Total	19,692	-------	2,960
TOTAL PURVEYOR PRODUCTION AT BUILD-OUT=			**2,960**
PURVEYOR SAFE YIELD (Appendix B - Table 6)=			**2,900**
BASIN DEFICIT WITHOUT WATER RECYCLING=			**60**
PROJECTED WATER RECYCLING DEMAND (CHAPTER 6)			**115**

SOURCES OF WATER

In July 1989, the California Department of Water Resources (DWR) published a report entitled "Geohydrology and Management of Los Osos Valley Groundwater Basin, San Luis Obispo County." The report attempted to, among other items, estimate the safe yield of the groundwater basin, analyze sea water intrusion, evaluate groundwater management alternatives and determine whether the community needs to import supplemental water.

Subsequent to the preparation of the DWR report, under the terms of the Groundwater Analysis and Management Agreement, the water purveyors hired URS Greiner Woodward Clyde and Team Engineering to prepare a model of the groundwater basin, in part due to concerns over the reliability of the DWR evaluation. That model was prepared along with the Baseline Report of the Los Osos Valley Groundwater Basin, Los Osos, California dated August 3, 2000 and the Management Scenario, Los Osos Valley Groundwater Basin, Los Osos, California dated August 14, 2000. As the next step in its water management planning efforts, the District hired consulting engineers to prepare a water management plan (Urban Water Management Plan, December 2000) for the District. In addition, the District hired Cleath & Associates to complete a safe yield analysis of the groundwater basin. The safe yield analysis, ground water basin management plan, and a water system supply sources analysis completed by Cleath and Associates are located in Appendix B, C and D, respectively. The following sections in this chapter summarize the findings of the Cleath and Associates analysis:

- Safe Yield Analysis of the Los Osos Valley Ground Water Basin
- Ground Water Basin Management Plan
- Water System Supply Sources Assessment

SAFE YIELD ANALYSIS OF THE LOS OSOS VALLEY GROUND WATER BASIN

The basin safe yield is essentially the average quantity of water that can be pumped from the ground water basin every year without causing water supply or water quality problems. This yield value, typically reported in acre-feet per year, is key to responsible ground water basin planning and management.

For the purpose of basin yield analysis and modeling, the Los Osos Valley ground water basin has been divided into two vertically discrete aquifers, the upper aquifer (shallow zone), and the lower aquifer (middle zone and deep zone). The basin is comprised of three compartments; 1) West side, 2) East side, and 3) Los Osos Creek. The relationship between these compartments is shown graphically in Appendix B, Figure 1 and in basin cross-section A-A' (Figure 2).

The basin yield was evaluated in 1989 by the Department of Water Resources (DWR, Geohydrology and Management of Los Osos Valley Ground Water Basin, July 1989). The DWR study relied heavily on a ground water basin model developed by the U. S. Geological Survey (U.S.G.S., 1988, Hydrogeology and Water Resources of the Los Osos Valley Ground-Water Basin, Water Resources Investigations Report 88-4081). The U.S.G.S. model was subsequently revised by URS and Team Engineering, who released the results as two separate reports.

The basin yield under current conditions can be estimated by analytical methods as well as modeling methods. Estimating the basin yield using both analytical and modeling methods gives a greater assurance as to the reliability of the basin yield estimates.

The principal findings of this safe yield analysis of current conditions are briefly described as follows:

- The Los Osos Valley ground water basin under existing conditions is estimated to have a yield of **3,560 acre-feet per year** using analytical methods of analysis. The GBMP model yield estimate of 3,730 acre-feet per year compares favorably with this analytical method result. This yield figure represents the amount of ground water that may be safely pumped every year, on average, with the current septic systems and agricultural irrigation practices in place. Ground water production in the basin has averaged 3,380 afy over the past 10 years.

- The Los Osos Valley ground water basin under the proposed community wastewater disposal conditions is estimated to have a safe yield of **3,940 acre-feet per year**, of which the three water purveyors are apportioned **2,900 acre-feet per year at build-out**.

GROUND WATER BASIN MANAGEMENT PLAN

The Ground Water Basin Management Plan is a reference to the results of the management scenarios performed by URS/Team Engineering using a ground water flow model of the basin (URS, Baseline

Report of the Los Osos Valley Groundwater Basin, August 2000; Management Scenario, Los Osos valley Groundwater Basin, August 14, 2000).

The following recommended management practices are based on the URS/Team Engineering Management Scenario Report:

- Perform maximum possible wastewater disposal at the Broderson site. Shifting some disposal to the east side of community would help mitigate potential sea water intrusion at the 3rd Street and 8th Street wells but is not necessary for basin-wide management.

- Connect CCW (California Cities Water) and LOCSD systems if sea water intrusion occurs following implementation of GBMP alternative pumping program. This reduces pumping of well closest to the Bay, thus minimizing the potential for sea water intrusion.

- Shift purveyor production at build-out, at least during the peak demand months, to inland wells.

WATER SYSTEM SUPPLY SOURCES ASSESSMENT

The water supply source facilities for the Los Osos Community Services District (LOCSD) consist of five active ground water wells and one inactive well which produce from the Los Osos ground water basin. The assessment of existing water source facilities includes an evaluation of each well with respect to source capacity, an assessment of pumping practices, and Title 22 compliance. Below is a summary of the findings.

- The Los Osos CSD wells have a system capacity **of 1,580 gallons per minute** which exceeds the historic maximum daily demand of 1,176 gallons per minute. With select pump replacements, maximum system capacity with the existing wells could be 1,950 gpm.

- Water supply and water storage capacity meet Title 22 requirements. The main water quality concerns in the basin are nitrates and sea water intrusion.

- New well sites may be considered to produce water from the shallow aquifer in the western basin compartment and in the shallow and deep aquifers within the eastern basin compartment. A reduction in production from the West side compartment is necessary to stop sea water intrusion.

HARVEST WELL PRODUCTION TO AUGMENT DEEP AQUIFER SUPPLY

As part of the Los Osos wastewater project, the LOCSD will be embarking on a large-scale project to sewer the community within the prohibition zone defined by the Regional Water Quality Control

Board. As part of the treated effluent disposal system, leach fields will discharge the tertiary treated water from the LOCSD wastewater plant into the underlying upper groundwater zone. Since the groundwater will be percolating in "localized" areas as opposed to individually by wide-spread private septic tank/leach field systems, there is the potential for localized mounding of the groundwater in the areas of the proposed leach fields. Harvest wells will need to be installed, to extract groundwater down gradient of the proposed leach fields.

This harvested groundwater may be blended with potable water to augment the potable water supply, and may also be used to meet the recycled water demand (see Chapter 6). This section focuses on the potable water element, using harvest well water to augment the LOCSD water supply. Basin-wide, it is estimated that approximately 650,000 gpd (730 AFY) of water must be pumped from the upper aquifer to prevent localized groundwater mounding. This groundwater, once extracted, will be suitable to blend with potable water, such that the blended product water will meet all drinking water standards, and specifically, nitrate concentrations (below 45 mg/L NO_3). Over time, the groundwater basin will improve with respect to nitrates, and the blending ratios of deep aquifer water to upper zone harvest well water will lessen over the years. The actual blending ratios and details of this option will be provided under a separate technical memorandum to be prepared by Montgomery Watson Harza during the design phase.

SUPPLEMENTAL WATER SUPPLY WELLS

With the Palisades Well supplying nearly 50 percent of the total LOCSD water supply, consideration must be given to the ability of the remaining wells to supply maximum day demand in the event that the Palisades Well is out of service. Should this be the case, the District will not be able to meet build-out maximum day demand of 1,869 gpm. The Palisades Well alone can provide 750 gpm (maximum sustained flow during peak month), while the other wells collectively produce 830 gpm. In addition, this same deficiency exists today, should the other system wells need to meet current maximum day demand of 1,585 gpm.

The projected deficit to meet maximum day demand considers the future water harvesting wells, estimated to produce 650,000 gpd (451 gpm), and "credits" for recycled water use at Los Osos Middle School and Baywood Elementary School (refer to Chapter 6). For these two school, the peak month demand was considered as a "credit" towards meeting the potable water demand. Collectively, recycled water irrigation at these two schools would lessen the maximum day demand by 84 gpm. The credits and deficits are summarized in Table 5-3. Based on this analysis, it is recommended to construct two new production wells that will provide a total of 1,000 gpm to ensure that maximum day demand can be met in the event that the Palisades Well is out of service. The recommendation allows for variance in blending ratios of the harvest wells with the new production wells. It is recommended that the location of new production wells be coordinated and located as closely as possible to proposed harvest wells, to minimize the cost associated with dedicated harvest well pipelines from the harvest well to the point of blending at the deep aquifer well. It is envisioned that the two new deep aquifer wells could be located near the Paso Robles and Scenic harvest wells,

Table 5-3. Summary of Credits and Deficits for Existing Well Supply System

Item	Existing	Future Build-Out
Palisades Well Supply	750 gpm	750 gpm
Other LOCSD System Wells Supply	830 gpm	830 gpm
Total Well Supply	1,580 gpm	1,580 gpm
Maximum Day Demand	**1,585 gpm**	**1,869 gpm**
Water Harvesting Well (credit)	----	(160 gpm)[1]
Los Osos Middle School Water Recycling (credit)	----	(70 gpm)
Baywood Elementary School (credit)	----	(14 gpm)
Supply Deficit With Palisades Well Out of Service	**755 gpm**	**795 gpm**

[1] Assumes 20% blending ratio with proposed production wells.

as shown on Figure 5-1. Also, the existing El Moro potable water well could easily be supplied with harvest water from the planned El Moro harvest well. The required blending facilities at each potable water wellhead would include piping the harvested water to the potable well, valving, in-line static mixer, disinfection equipment, flow metering, and telemetry/controls to regulate the blending ratios of the deep aquifer and harvest well waters. The cost for providing the needed blending facilities, valving, flow meter and controls is estimated to cost approximately $25,000, excluding the disinfection facilities. For the two new deep aquifer wells, the cost for such blending facilities is included in the overall capital improvement program (CIP) costs identified in Chapter 8. Both wells should be designed to discharge into the proposed hydro-pneumatic zone. The main zone will then be fed through pressure reducing valves between the zones.

Table 5-3. Summary of Credits and Deficits for Existing Well Supply System

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Palisades Well Supply	750 gpm	750 gpm
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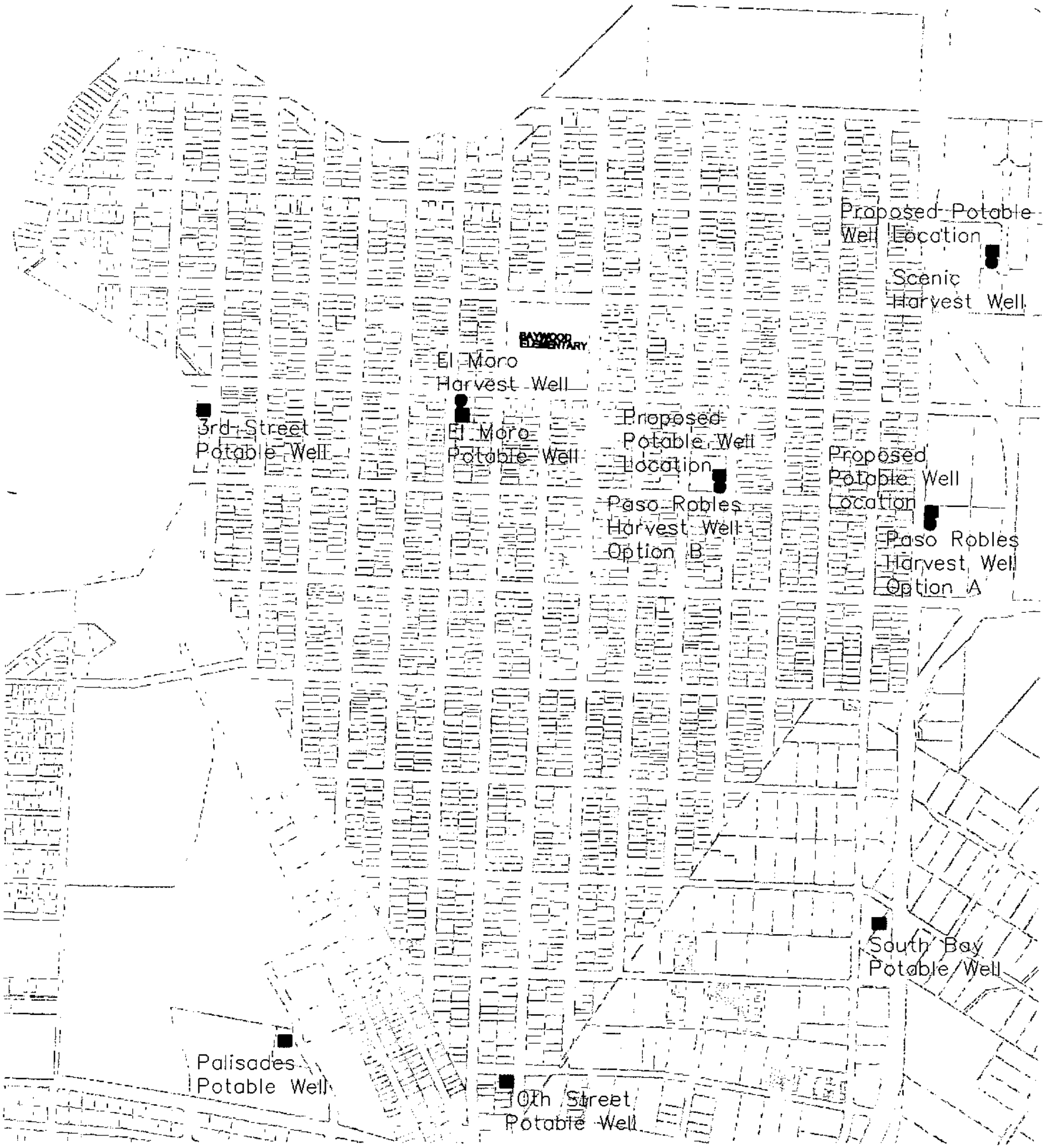
[1] Assumes 20% blending ratio with proposed production wells.

as shown on Figure 5-1. Also, the existing El Moro potable water well could easily be supplied with harvest water from the planned

El Moro harvest well. The required blending facilities at each potable water wellhead would include piping the harvested water to the potable well, valving, in-line static mixer, disinfection equipment, flow metering, and telemetry/controls to regulate the blending ratios of the deep aquifer and harvest well waters. The cost for providing the needed blending facilities, valving, flow meter and controls is estimated to cost approximately $25,000, excluding the disinfection facilities. For the two new deep aquifer wells, the cost for such blending facilities is included in the overall capital improvement program (CIP) costs identified in Chapter 8. Both wells should be designed to discharge into the proposed hydro-pneumatic zone. The main zone will then be fed through pressure reducing valves between the zones.



L.O.C.S.D.

Water System Master Plan

Harvest and Potable Well Locations

LEGEND

Existing Potable Well	■
Proposed Potable Well	■
Proposed Harvest Well	●

1" = 1,000'

Figure 5-1

John L. Wallace & Associates

CHAPTER 6

RECYCLED WATER USE FEASIBILITY STUDY

This chapter presents the feasibility study conducted to determine the viability of using recycled wastewater from the LOCSD's planned wastewater treatment facility (Tri-W site) for area landscaping. This study was conducted to focus on augmenting over 60 AFY of potable water supply, which is the estimated overdraft of the upper and lower aquifer at build-out.

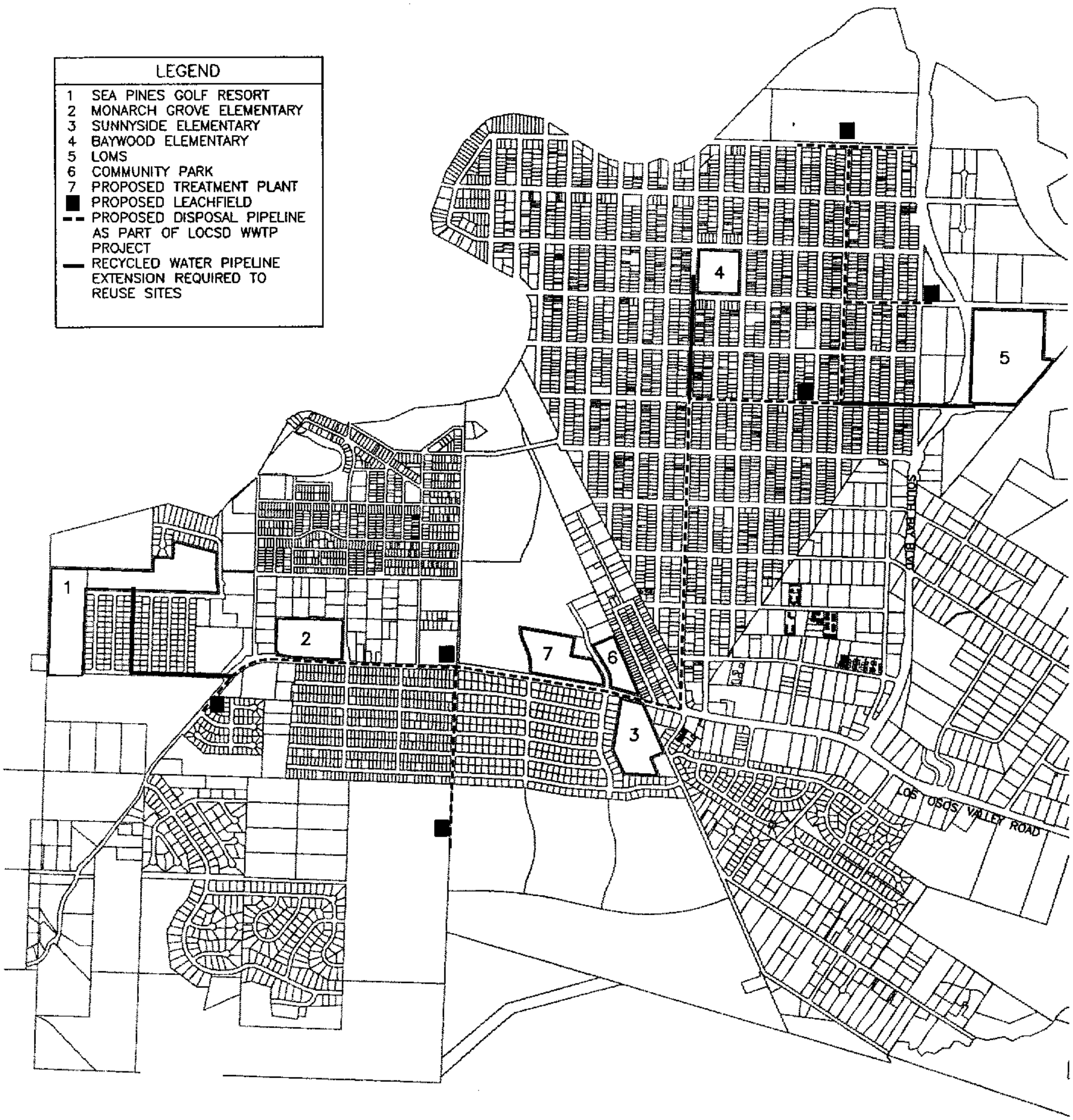
This chapter is presented as follows:

- Water and Recycled Water Quality
- Recycled Water Quantity/Availability
- Monarch Grove WWTP Effluent Quality
- Regulatory Overview
- Recycled Water Market and Demands
- Water Sales in Cal-Cities and S&T Mutual Water Company Service Areas
- Upper Aquifer Water for Irrigation in Lieu of Potable Water
- Use of Harvesting Well Water to Supplement Recycled Water
- Evaluation of Recycled Water Service to Customers
- Recommended Reuse Plan

This recycled water element focuses on six major potential customers of recycled water in the Los Osos community, as follows:

- Los Osos Middle School
- Sunnyside Elementary School
- Monarch Grove Elementary School
- Baywood Elementary School
- Community Park
- Sea Pines Golf Course

The locations of these sites are shown on Figure 6-1. Each site is depicted on Figures 6-2 through 6-7. These site figures depict the general layout of the sites, the irrigated areas, and surrounding land uses.



L.O.C.S.D.

Water System Master Plan

Recycled Water Irrigation Sites

Figure 6 - 1

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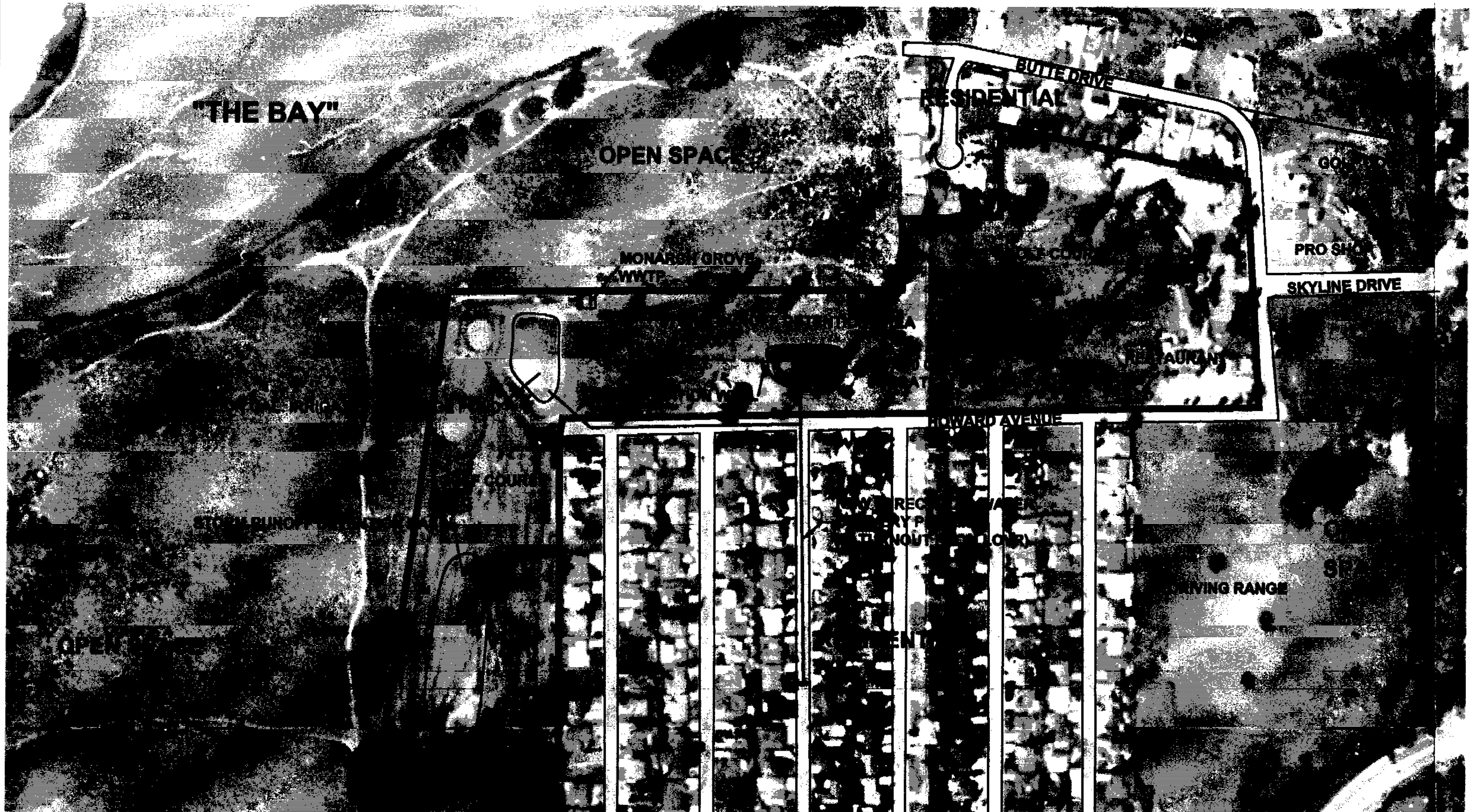
L.O.C.S.D.



Water System Master Plan

Figure 6 - 2

Sea Pines Golf Course

1" = 300'

0 75 150 300

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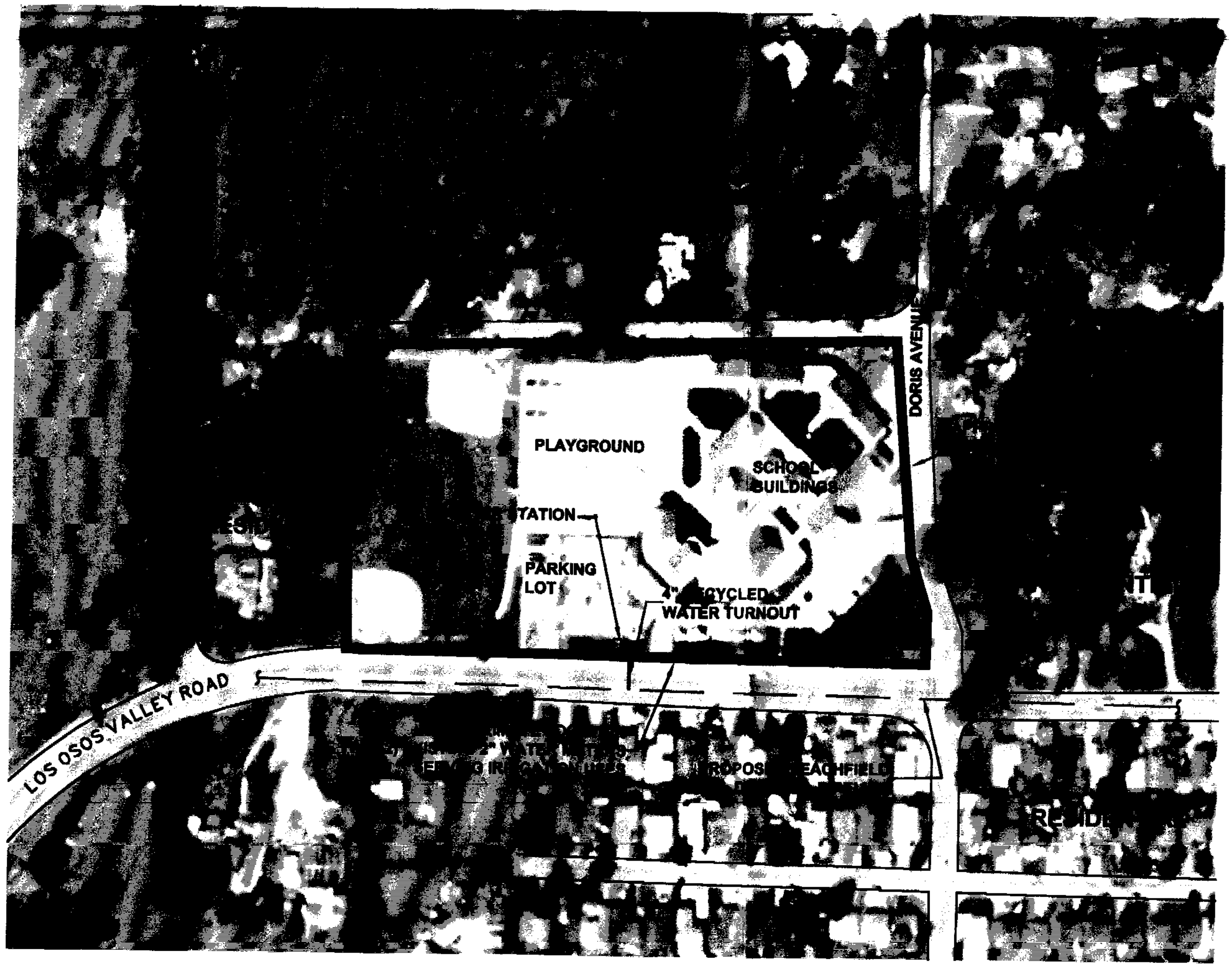

L.O.C.S.D.

Water System Master Plan

Figure 6 - 3

Monarch Grove Elementary

1" = 200'

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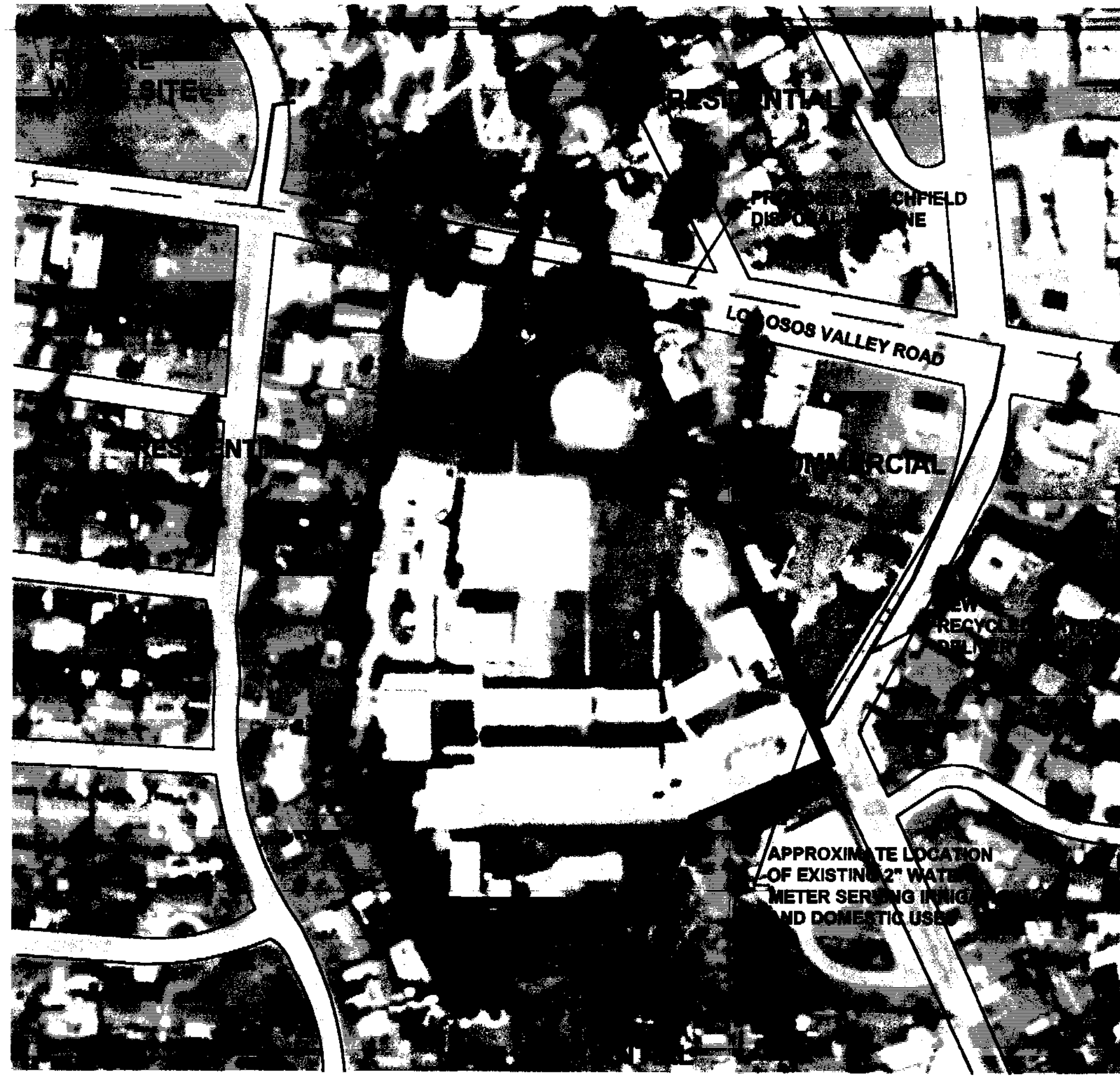

L.O.C.S.D.

Water System Master Plan

Figure 6 - 4

Sunnyside Elementary

1" = 200'

0 50 100 200

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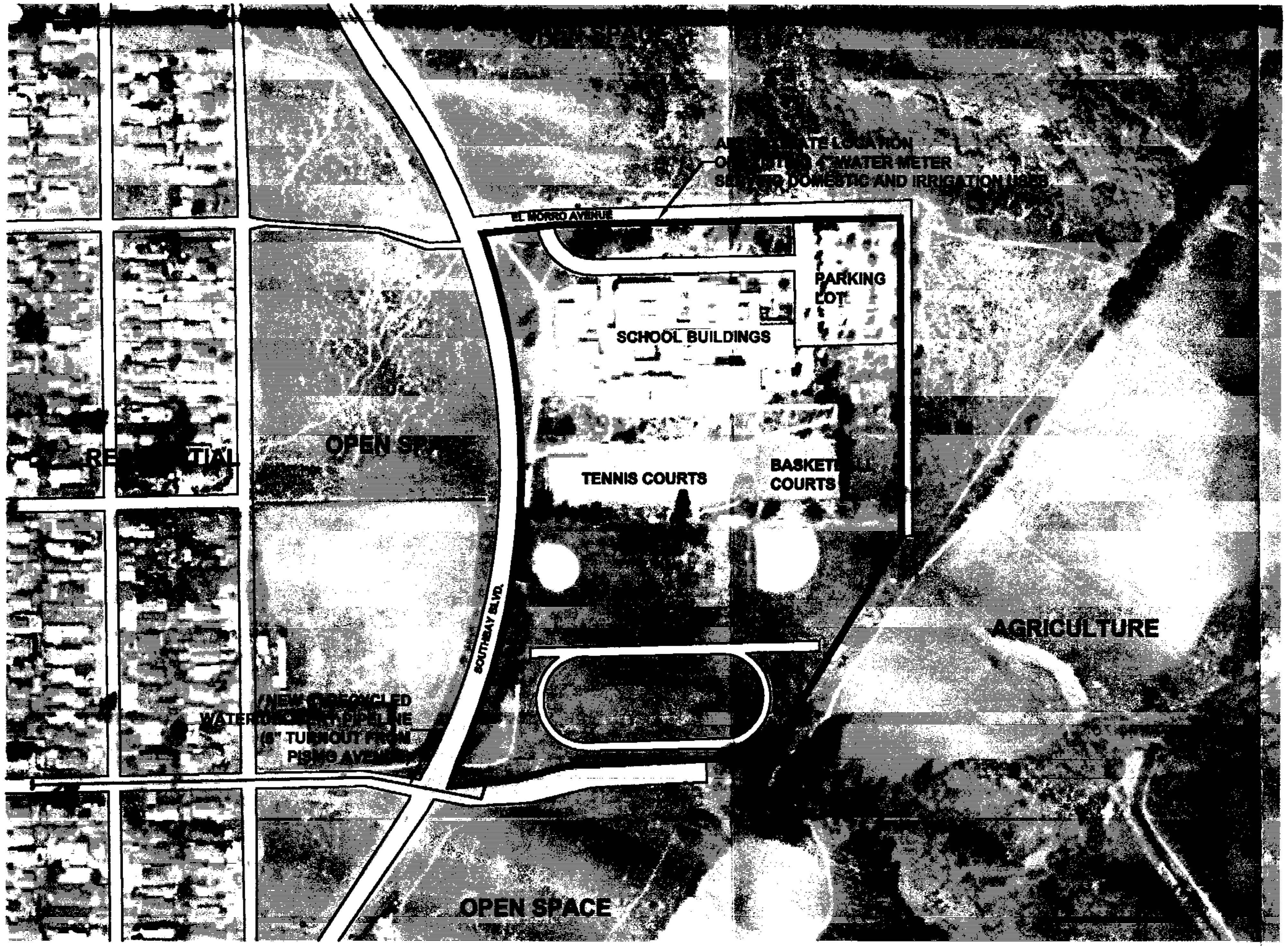

L.O.C.S.D.

Water System Master Plan

Figure 6 - 6

Los Osos Middle School

1" = 300'

0 75 150 300

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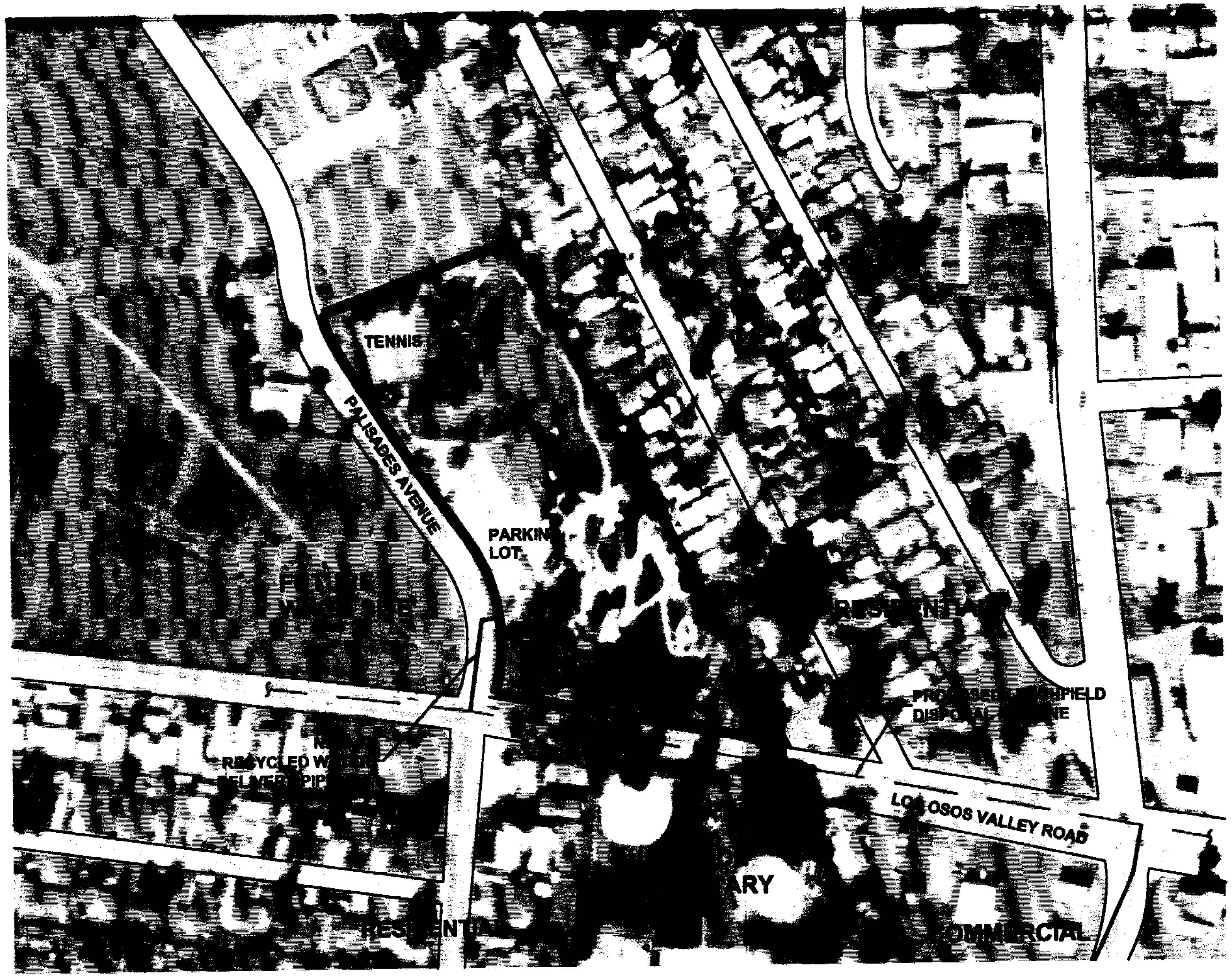

L.O.C.S.D.

Water System Master Plan

Figure 6 - 7

Community Park

1" = 200'
0 50 100 200

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DESCRIPTION OF SITES

The six sites considered for recycled water irrigation are described in the following subsections.

Los Osos Middle School

The school is located at South Bay Boulevard and El Moro Avenue, approximately 2 miles northeast of the Tri-W site. Water is served to the school by LOCSD. Service for irrigation and domestic water is through a single 4-inch meter. The irrigation system is completely separate from the domestic system, immediately downstream of the meter. The school includes approximately 11 acres of irrigated turf, and 0.5 acres of ornamentals. The irrigation system is pressurized through the water system supply pressure.

Sunnyside Elementary School

This site is located on Los Osos Valley Road, across from the Tri-W site. Water is supplied by Cal Cities Water Company. The school includes approximately 3 acres of irrigated turf, and 0.6 acres of ornamentals. Domestic and irrigation water are served through a single meter, believed to be 2-inch in size. The irrigation system is pressurized through an on-site booster pump.

Monarch Grove Elementary School

This school is located on Los Osos Valley Road approximately 4,000 feet west of the Tri W site. Water is supplied by Cal Cities Water Company. The school includes approximately 2.7 acres of irrigated turf, and 1 acre of ornamentals. Domestic and irrigation water is served through four separate 2-inch meters (two domestic, two irrigation). The irrigation system is pressurized through an on-site booster pump.

Baywood Elementary School

This school is located on El Moro Avenue, approximately one mile north of the Tri W site. Water service is provided by LOCSD. The school includes approximately 1.6 acres of irrigated turf, and 1.4 acres of ornamentals. Domestic and irrigation water service to the site is through two meters; one combined meter to serve domestic and irrigation and one 6-inch meter to serve domestic demands.

Community Park

The park is located at the intersection of Palisades Avenue and Los Osos Valley Road, across from the Tri-W site. Domestic water is supplied by Cal-Cities Water Company. A single on-site well pumps groundwater to irrigate the 1.7 acres of turf and 0.5 acres of ornamentals. The park is owned, operated and maintained by San Luis Obispo County.

Sea Pines Resort Golf Course

Sea Pines Resort is locate along Howard Avenue, west of Inyo Street, and west of Solano Street. The 9-hole golf course comprises approximately 15 acres of irrigated turf for the fairways, greens and tees. The golf course irrigation system is comprised of two storage reservoirs (2.7 MG and 0.5 MG), one on-site well, and a pumping station to pressurize water to the irrigation system. Water for irrigation is provided by the on-site water well, and treated effluent from the Monarch Grove wastewater treatment plant. The 0.5 MG pond receives treated effluent from the treatment plant, and pumped well water. This water is conveyed to the 2.7 MG pond through a 6-inch gravity pipeline. The Pro-Shop and Hole No. 1 are irrigated using potable water from Cal-Cities Water Company.

The driving range, which is comprised of approximately 7.5 acres of irrigated turf, is located east of Norte Road and west of Inyo Street. Due to the likelihood that this driving range will develop into homes in the future, the driving range is not included in the estimated demands for recycled water.

Monarch Grove WWTP. The wastewater treatment plant is a 35,000 gpd tertiary wastewater plant which serves the Monarch Grove development. The treatment plant and water reclamation operations are regulated by Regional Board Order No. 93-82. The treatment plant currently produces approximately 18,000 gallons per day (20 AFY), all of which is used for irrigation of the golf course. If the WWTP is at capacity, it could delivery up to 35,000 gpd (39 AFY) to the golf course in the future.

WATER AND RECYCLED WATER QUALITY

The chemical make-up of water used for irrigation purposes is very important in ensuring maintenance of the quality of the landscaping being irrigated. Key water quality parameters from an agronomic aspect are described as follows:

1. Sodium, Sodium Adsorption Ratio (SAR), and Adjusted SAR (aSAR)

Sodium is not an essential plant nutrient, yet it is always present in the irrigation waters and it can become the most important single constituent in the water if it exceeds tolerable concentrations. Acceptable levels of sodium are judged in proportion to divalent cations, principally calcium and magnesium in the water. The criteria commonly used to determine the potential effect of this critical element are sodium adsorption ratio (SAR) and adjusted SAR. Adjusted SAR accounts for the presence of carbonates and bicarbonates in the irrigation water, because of their tendency to precipitate calcium from the solution, aggravating the effect of sodium. The most widely accepted method of adjusting the SAR is the so-called Cax method, wherein the ratio of bicarbonate to calcium is used to determine the adjustment factor. Long-term use of irrigation water with high SAR can result in gradual elevation of soil solution SAR and deleterious effects on soil structure, leading to progressively reduced soil permeability, water-logging, and anaerobic (oxygen deficient) conditions in the root zone.

2. Calcium

Calcium is essential for all plant life. It is almost always available in abundance in the soil, as far as plant nutrition requirements are concerned. However, calcium also plays another important role in the soil solution. It can balance the adverse impacts of sodium on soil physical structure and the soil's ability to transport water. Native soils in California are generally rich in calcium compounds.

3. Chloride

Chloride is also essential to plant life, but sufficient in extremely low concentrations. This element is almost never deficient in the environment. Concentrations of chlorides at 140 mg/L and higher can begin to be harmful due to toxicity to the plant tissues.

4. Dissolved Solids, Specific Conductance

Total dissolved solids (TDS) is a direct measure of salinity in the irrigation water. An indirect index of salinity is the electrical conductance (EC, inverse of electrical resistance) of the water sample. Elevated TDS concentrations of irrigation water can cause deleterious effects to plant growth and to soil conditions and characteristics.

5. Boron

Boron is an essential nutrient for plant germination and growth. However, beyond a narrow band of concentrations (0.1 to 5 mg/L), it becomes toxic to plant life. Boron is not highly mobile and cannot be easily flushed out of the root zone; however, boron can be taken up by the plant roots to the leaf tips. Thus, for turf grasses, where frequent mowing generally occurs, removal of boron can be effective

Irrigation water quality parameters for the District's water supply are summarized in Table 6-1. Since actual treatment plant effluent quality data is not available, actual recycled water effluent quality could not be determined. However, in general, mineral quality of treated wastewater, as compared to source drinking water, can degrade by several hundred mg/L (or higher) TDS. This of course depends on local factors, including the use of self-regenerating water softeners. The mineral quality of the drinking water in Los Osos is of very good quality. To be conservative, it was assumed that the mineral quality of the wastewater will "double". The resulting projected recycled water quality from the LOCSD WWTP is presented in Table 6-2.

Table 6-1. Summary of Potable Water Quality, LOCSD Area Wells

	Well					
	10th St.	3rd St.	Palisades	8th St.	South Bay	Total/Aggregate:
Capacity, gpm	330	100	750	390	200	1,770
Capacity, % of Total	19%	6%	42%	22%	11%	100%
Boron, mg/L	NA	NA	NA	NA	NA	NA
Chlorides, mg/L	36	33	41	60	43	44
TDS, mg/L	330	160	380	420	360	365
EC, millimhos/cm	0.6	0.3	0.6	0.7	0.6	0.6
pH	7.5	7.6	7.4	7.6	7.5	7.5
Magnesium, mg/L	32	9.9	40	41	36	37
Sodium, mg/L	38	21	37	47	30	38
Calcium, mg/L	35	15	43	45	32	39
SAR, mg/L	1.12	1.03	0.98	1.22	0.86	1.0

Notes:
1. All water quality data extracted from DHS Engr. Report dated March 21, 2000.
2. NA=not available.

Table 6-2. Projected Recycled Water Quality, LOCSD WWTP Effluent

	Total:
Boron, mg/L	NA
Chlorides, mg/L	88
TDS, mg/L	730
EC, millimhos/cm	1.2
pH	7.5
Magnesium, mg/L	73
Sodium/mg/L	75
Calcium, mg/L	78
SAR, mg/L	1.5

NA=not available

Guidelines for irrigation water quality impacts, and LOCSD effluent quality parameters, are shown in Table 6-3. Based on the projected water quality of the LOCSD recycled water, the recycled water will be of good quality for general landscape uses in the area.

Table 6-3. Guidelines for Irrigation Water Quality Impacts

Parameter	LOCSD Recycled Water Quality	Degree of Restriction on Use		
		None	Slight to Moderate	Severe
Boron, mg/L	NA	<0.7	0.7-1.0	>3.0
Chloride, mg/L	90	<140	140-350	>350
TDS, mg/L	730	<450	450-2,000	>2,000
EC, mmhos/cm	1.2	<0.7	0.7 - 3.0	>3.0
SAR = 0-3, and EC (mmhos) =		**>0.7**	0.7-0.2	>0.2
SAR = 3-6, and EC (mmhos) =		*>1.2*	1.2-0.3	<0.3
SAR = 6-12, and EC (mmhos) =		>1.9	1.9-0.5	<0.5
SAR = 12-20, and EC (mmhos) =		>2.9	2.9-1.3	<1.3
SAR = 20-40, and EC (mmhos) =		>5.0	5.0-2.9	<2.9

Monarch Grove WWTP Effluent Quality

The quality of the treated effluent (water supply quality in parentheses) at the Monarch Grove WWTP (based on Year 2000 quality data) is as follows:

- TDS, 775 mg/L (518 mg/L)
- Sodium, 175 mg/L (148 mg/L)
- Chlorides, 300 mg/L (215 mg/L)

JLWA met with representatives of the Sea Pines Golf Course to discuss the feasibility of using additional recycled water on the golf course. Mike Goldsbury, Superintendent, indicated the course fairways and tees generally do not see impacts from recycled water use; however, seasonally, particularly during the summer months, the greens do see signs of stress from recycled water use (yellowing of the greens). Flushing by winter rains generally improves the quality of the greens. It was noted that the soils on the golf course are highly permeable. These well draining soils will be helpful in preventing any long-term impacts from using recycled water on the golf course. The chlorides, at 300 mg/L, are at relatively high levels, to a concentration where leaf burn and detrimental impacts to greens can occur, particularly in the absence of good soil drainage. It is expected that the LOCSD effluent quality will be of similar or better quality than the Monarch Grove WWTP quality; thus, blending of LOCSD effluent with Monarch Grove effluent for irrigation is expected to yield good results on the golf course, especially given the relatively high permeability (good soil drainage characteristics) of the on-site soils.

RECYCLED WATER DEMAND PROJECTION CRITERIA

Recycled water demands must be projected on the basis of sound engineering judgment and established duty factors for the various uses. Turf and landscape irrigation projections are usually estimated by a combination of actual water use records, consideration of climate and evapotranspiration for the geographic area, peaking factors and others. Demand projections are summarized in Table 6-4, and indicate a demand of over 100 AFY recycled water at area sites.

Irrigation and potable water use data were collected for the various sites. For the schools, Monarch Grove Elementary School was the only school that has separate irrigation meters to determine actual use demands. Based on this irrigation data, Monarch Grove Elementary School uses approximately 3.5 AFY/Acre for combined turf and landscape irrigation. It was attempted to extrapolate these same use demands to the other three schools; however, the balance of potable water demands did not make sense using this data. It was concluded that each site may have a wide range of use demands, specific to each school for the soil permeability conditions present at each site, and how well established the turf is. A combination of actual use demands (for Monarch Grove Elementary School), expected agronomic demands based on other use data, review of irrigation system plans, and consideration of area evapotranspiration data all were used to estimate reuse demands for the sites. Table 6-4 summarizes the use demands for the four schools, Community Park and Sea Pines Golf Course.

It was noted that at Sea Pines Golf Course (SPGC), permeability of the soils is very high. Through discussions with SPGC staff, it has been observed that storm runoff collected in retention ponds on the course has percolated at a rate of up to 5 feet per day. Furthermore, irrigation water demand data (on-site well pumpage and Monarch Grove WWTP effluent data) indicates that the irrigation rate at SPGC is over 5 AFY/Acre. The irrigation demands were conservatively projected at 5 AFY/acre, and adjusted for the ultimate 25 AFY to be provided by Monarch Grove WWTP. These demands are also reflected in Table 6-4.

Table 6-4. Recycled Water Demands

Site	Estimated Turf Irrigation Area (acres)	Estimated Ornamental Irrigation Area (acres)	Billed Average Total Water Use (AFY)	Average Domestic Usage (AFY)	Irrigation Demands				
					Average Demand (AFY)	Peak Hour Demand (gal/hour)	Maximum Day Demand (AF)	Maximum Month Demand (AF)	Peak Flow (gpm)
Sea Pines Golf Resort	15	0	n/a	0[a]	55.00[c]	33,943[d]	1.25	25.00	566[d]
Los Osos Middle School	10.9	0.5	47.09	18.59	28.50	41,863	0.46	9.25	230[b]
Sunnyside Elementary School	3.1	0.6	11.98	2.73	9.25	12,597	0.14	2.78	210
Baywood Park Elementary School	1.6	1.4	14.95	7.45	7.50	8,146	0.09	1.80	136
Monarch Grove Elementary School	2.7	1.0	11.75	2.50	9.25	11,691	0.13	2.58	195
Community Park	1.7	0.5	n/a	0[a]	5.50	7,166	0.08	1.58	119
Totals	**35**	**4**			**115.00**	**115,406**	**2.15**	**43.00**	**1456**

Notes:

a - Domestic water demands by S&T Mutual and Cal-Cities not included in this table.

b - Based on review of actual irrigation plans.

c - Based on application rate of 5 AFY/acre, minus 20 AFY contributed by Monarch Grove WWTP.

d - Based on continual delivery to storage ponds on site, from 6:00 a.m. to 10:00 p.m. during max. day demand.

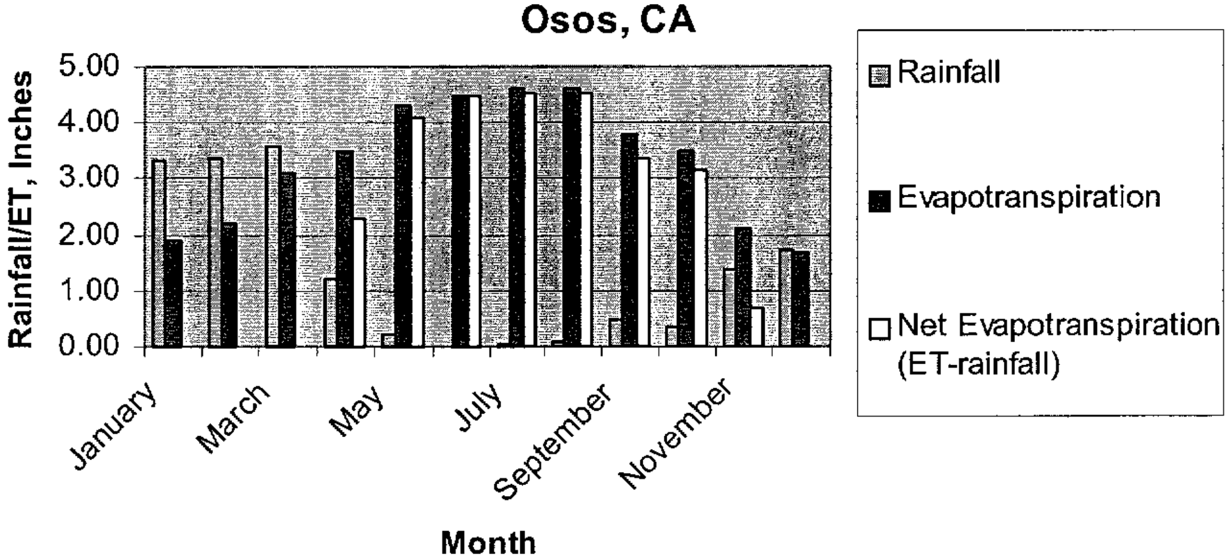
Turf Demand (AFY/acre)	2.5 (except golf course)
Ornamental Demand (AFY/acre)	2.5
Peak Month Factor (turf)	10 inches per acre (0.83 AF/mo)
Peak Day Factor	1.5 times peak month
Peak Hour Factor	2.5 times the peak day
Peak Month Factor (ornamental)	4 inches per acre (0.33 AF/mo)

California Irrigation Management Information System (CIMIS) Data

The California Irrigation Management Information System web site was accessed to determine evapotranspiration rates and rainfall data for Los Osos. A specific weather station in Los Osos was not available from this site; however, information for Morro Bay was referenced. Climate in Morro Bay and Los Osos are very similar in nature. Rainfall in Morro Bay area averages 15.73 inches per year. The San Luis Obispo County Department of Public Works provided JLWA with data from one weather station in Los Osos (No. 201.1), with rainfall data from 1976 to 1983. This data showed an average annual rainfall of 21 inches during that period of record. This period of rainfall data included the extreme wet year of 1983, where 42 inches of rainfall fell in that calendar year. Figure 6-8 depicts the rainfall distribution in the Los Osos area, by month.

Based on a review of the rainfall and evapotranspiration data for the area, the net evapotranspiration, accounting for rainfall throughout the year, is 27 inches (2.25 feet). This finding is consistent with estimate turf irrigation demands.

Figure 6-8. Rainfall and Evapotranspiration, Los Osos, CA



Turf Irrigation

Turf irrigation includes general landscape irrigation of parks, golf courses, cemeteries, and other landscaped areas. Average annual demands (AADs) for turf irrigation can range from 2.0 to 3.0 AFY/acre in arid western regions. However, in the cooler Coastal climates, lower demands can be expected. For this study, the AAD used was 2.5 AFY/acre for the schools and Community Park. This estimate was based on a detailed review of actual potable and irrigation uses for the five sites, and consideration of the CIMIS evapotranspiration and rainfall data from the Morro Bay and Los Osos areas. For Sea Pines Golf Course, the AAD used was 5.0 AFY/acre (adjusted for Monarch Grove WWTP effluent supply) which is based on actual usage records for the golf course.

Maximum Month Demand
Maximum Month Demand (MMD) varies greatly from the AAD in most arid regions, due to climate changes and evapotranspiration rates from winter to summer. MMD is important to consider for availability of plant recycled water for various customers, and seasonal storage requirements. For purposes of this study, the MMD factor for landscape irrigation used was 0.83 AF/month, based on a review of irrigation plans and interviews with representatives of the schools and golf course.

Maximum Day Demand
Maximum Day Demand (MDD) is important in determining on-site or off-site storage requirements to meet the demands, and available recycled water for delivery to customers. MDD is generally depicted as a ratio of the MDD to the MMD. Based on prior irrigation demand references for turf irrigation, the MDD is generally 1.5 to 2.0 times the MMD. A MDD of 1.5 was used for this study.

Peak Hour Demand
Peak Hour Demand (PHD) is important in determining proper distribution system sizing (pipelines and pumping requirements). With recycled water irrigation for landscape irrigation, demands and irrigation schedules are generally restricted to night-time irrigation, an 8- to 10-hour irrigation "window." Due to this restriction, PHD for recycled water systems is typically high compared to that for potable water systems. PHD for recycled water systems are generally in the area of 2.5 - 3 times the MDD for arid regions, and can be less for cooler Coastal areas. A PHD factor (for the schools) and Community Park of 2.5 was used for turf irrigation for this study. This factor was based on a review of the actual capabilities of the irrigation circuits of each irrigation system at each school and Community Park. For the Sea Pines Golf Course, delivery of recycled water to on-site storage ponds will be "off-peak" from the other users, between 8:00 am and 9:00 pm each day. This schedule will minimize storage and hydraulic pumping requirements at the LOCSD WWTP.

RECYCLED WATER QUANTITY/AVAILABILITY

For reuse projects which involve predominantly landscape irrigation of public landscaped areas, the irrigation demand is typically high during the night-time, and low to zero during the daytime. This is due to the restrictions on irrigation relative to public exposure to recycled water. The available flow of recycled water from treatment plants, however, is opposite the demand of recycled water. Typical wastewater flows are high during morning hours, and evening hours, and very low during the night-time hours (when recycled water demands are highest).

Since the District does not have specific data available to determine the diurnal fluctuation of wastewater through the treatment plant, general diurnal curves are referenced from textbook resources. For a community of 14,600 people, a peaking factor of 2.0 to 4 (Metcalf & Eddy) is expected. For the purposes of this study, a peaking factor of 2.0 was assumed to be reflective of the community wastewater flow characteristics. The daytime peak factor is not as critical as the night-time flow factor, however, in regards to availability of recycled water for reuse. A night-time low-flow factor of 0.4 is assumed to be reasonable for the community of Los Osos, also based on textbook references. With an estimated per capita ADWF of 69 (Project Report, March 2001), the District may expect an ADWF of 1.0 mgd at start-up, with build-out ADWF around 1.3 to 1.4 mgd (population 18,428). Projected flow characteristics (at 1 mgd flow) are as follows:

- Night-time WWTP Flow, 0.4 mgd (278 gpm)
- Average dry weather flow (ADWF), 1.0 mgd (694 gpm)
- Peak hourly flow (summer ADWF), 2.0 mgd (1,388 gpm)

The night-time low flow condition is critical with respect to assessing the need for recycled water storage to meet the needed recycled water demands. LOCSD WWTP flows were estimated using expected diurnal fluctuations for a typical community of the same size as Los Osos. Irrigation demands were also estimated, based on review of irrigation plans and interviews with each User. For the golf course, irrigation demand is based on a uniform delivery rate at the "off-peak" hours when the schools and Community Park are not irrigating, between 6:00 am and 10:00 pm each day, since the golf course draws water directly from their storage ponds. For the schools and Community Park, demands were based on review of individual irrigation circuits and a night-time irrigation window from 10:00 pm to 6:00 am. Table 6-5 summarizes this demand data. The demands are summarized graphically on Figure 6-9.

Storage

A routing/storage curve was developed, using the hourly demand/reuse data, and projected WWTP flows, as shown on Figure 6-10. This chart indicates that approximately 90,000 gallons of daily storage is required for reuse. This amount of storage essentially doubles if delivery to Sea Pines Golf Course is 24-hours per day. This storage requirement of 90,000 gpd is within the 250,000 gallons storage already projected at the LOCSD WWTP site.

Table 6-5 Diurnal Flow/Demand Data

Time	Los Osos Middle School	Sunnyside Elementary School	Baywood Park Elementary School	Monarch Grove Elementary School	Community Park	On Demand Total	Sea Pines Golf Resort	Cumulative Irrigation Demands	Projected WWTP Outflow	Projected WWTP Flow	WWTP Flow as % of Avg.
	Demand (gph)										
00:00	13800.0	5100.0	0.0	3584.0	0.0	22484	0	22484	20833	16800	40%
01:00	13800.0	5100.0	0.0	5400.0	0.0	24300	0	46784	37633	16800	40%
02:00	13800.0	5100.0	4800.0	5700.0	4400.0	33800	0	80584	54433	16800	40%
03:00	13800.0	5100.0	5400.0	5400.0	4800.0	34500	0	115084	71233	16800	40%
04:00	13800.0	5100.0	5506.0	4800.0	5506.0	34712	0	149796	88033	16800	40%
05:00	13800.0	12596.6	8146.3	11691.4	7165.7	53400	0	203196	110923	22890	55%
06:00	13800.0	2411.0	5400.0	5400.0	4400.0	31411	0	234607	142423	31500	75%
07:00	60.0	60.0	60.0	60.0	60.0	300	31539	266446	184423	42000	100%
08:00	0.0	0.0	0.0	0.0	0.0	0	31539	297985	235663	51240	122%
09:00	0.0	0.0	0.0	0.0	0.0	0	31539	329524	298663	63000	150%
10:00	0.0	0.0	0.0	0.0	0.0	0	31539	361063	382663	84000	200%
11:00	0.0	0.0	0.0	0.0	0.0	0	31539	392602	466663	84000	200%
12:00	0.0	0.0	0.0	0.0	0.0	0	31539	424141	517063	50400	120%
13:00	0.0	0.0	0.0	0.0	0.0	0	31539	455680	559063	42000	100%
14:00	0.0	0.0	0.0	0.0	0.0	0	31539	487219	598963	39900	95%
15:00	0.0	0.0	0.0	0.0	0.0	0	31539	518758	640963	42000	100%
16:00	0.0	0.0	0.0	0.0	0.0	0	31539	550297	687163	46200	110%
17:00	0.0	0.0	0.0	0.0	0.0	0	31539	581836	741763	54600	130%
18:00	0.0	0.0	0.0	0.0	0.0	0	31539	613375	815263	73500	175%
19:00	0.0	0.0	0.0	0.0	0.0	0	31539	644914	888763	73500	175%
20:00	12634.0	0.0	0.0	0.0	0.0	12634	0	657548	930763	42000	100%
21:00	13800.0	0.0	0.0	0.0	0.0	13800	0	671348	962263	31500	75%
22:00	13800.0	0.0	0.0	0.0	0.0	13800	0	685148	983263	21000	50%
23:00	13800.0	4800.0	0.0	0.0	0.0	18600	0	703748	1000063	16800	40%
TOTAL (mgd)	**0.15**	**0.045**	**0.029**	**0.042**	**0.026**	**0.29**	**0.41**	**0.70**	**1.00**	**1.00**	

Figure 6-9
Distribution of Reuse Demands and WWTP Flow

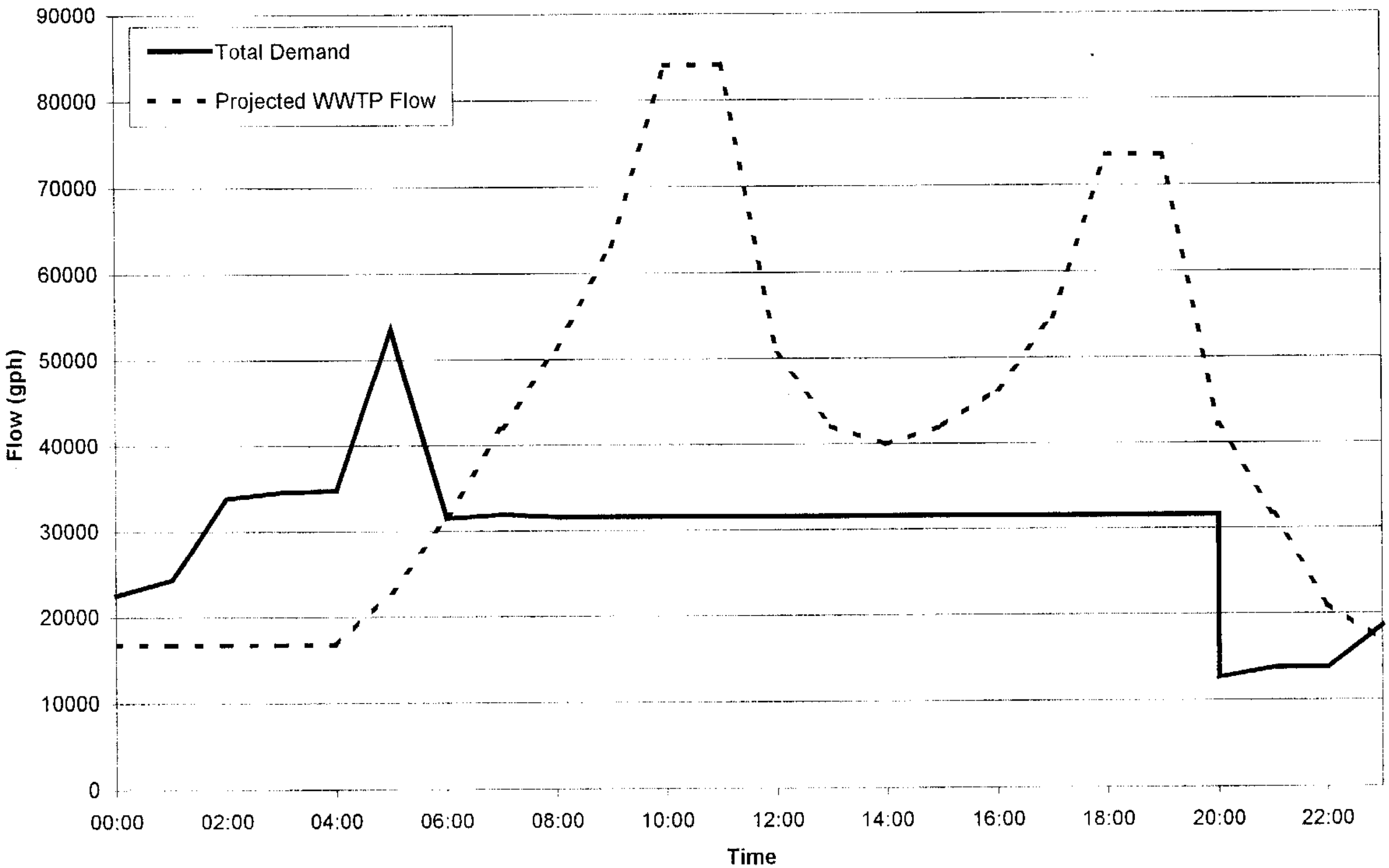
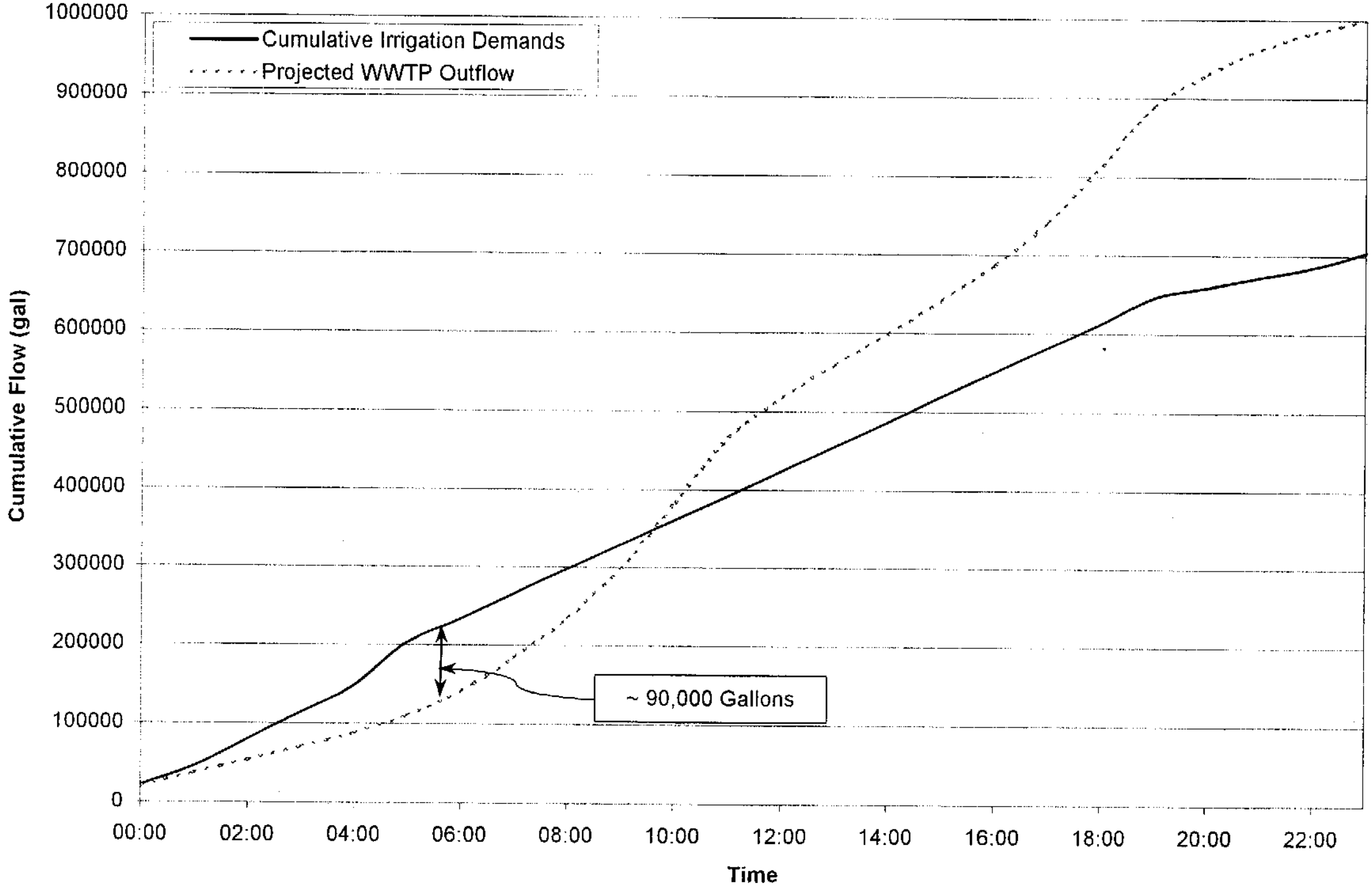


Figure 6-10
Recycled Water Storage Evaluation



RECYCLED WATER REGULATIONS

This sub-section discusses regulatory issues and requirements with respect to the District's existing potential and future water recycling program.

Treatment and Application Standards

The California Department of Health Services (DHS) establishes water quality standards and treatment reliability criteria for water recycling under Title 22, Chapter 4, of the California Code of Regulations (Title 22), and in Title 17, Division 1, Chapter 5, Group 4, Article 1, Section 7604. Requirements for recycled water use in California, not described in Title 22, are considered and approved by DHS on a case-by-case basis. A review of the location of potable water wells relative to each user site was reviewed, and all five sites are more than 100 feet from any domestic water well.

Title 22 sets bacteriological water quality standards on the basis of the expected degree of public contact with recycled water. For water reuse applications with a high potential for the public to come in contact with the recycled water, Title 22 requires disinfected tertiary treatment. For applications with lower potential for public contact, Title 22 requires three levels of secondary treatment, basically differing by the amount of disinfection required. In addition to establishing recycled water quality standards, Title 22 specifies the reliability and redundancy for each recycled water treatment and use operation. Title 17 provides protection against cross-connections between potable water systems and recycled water systems. The latest versions of these regulations (both Title 17 and 22) were issued by the California DHS on August 30, 1999 for public comment prior to formal adoption, which was originally expected in the Fall of 2000. As of this time, formal adoption of these proposed regulations has not occurred.

The nine California Regional Water Quality Control Boards (Regional Board) oversee and permit the use of recycled water in California. The Regional Board authority to adopt permits and enforce proper use of recycled water is under the Porter-Cologne Water Quality Act of 1969. The Regional Board adopts permits for recycled water use which are consistent with DHS water recycling criteria. Locally, San Luis Obispo County is regulated by the Central Coast Region, Region 3, Regional Board office located in San Luis Obispo.

Future Regulatory Changes

At this time, the proposed Title 22 water recycling regulations are draft and have not yet been formally adopted. These regulations will not likely impact future planning for recycled water use in the area, given the recommended treatment process at the LOCSD wastewater plant. Proposed changes to the Title 22 regulations primarily focus on processes to achieve filtration and disinfection, and are summarized in the following paragraphs.

The significant pending changes to Title 22 tertiary water treatment standards are with respect to the disinfection and filtration processes. These proposed changes are described as follows:

1. *Section 60301.230, Disinfected Tertiary Recycled Water*
The chlorine disinfection process to achieve a 2.2 MPN would require a "CT" (chlorine dosage times time, milligrams-minutes/liter) of not less than 450 at all times with a modal[1] contact time of at least 90 minutes, based on peak dry weather flow. The current criteria requires a 2 hour detention time at plant maximum flow rate. The combined disinfection/filtration process must also achieve 99.999 percent removal of the plaque-forming units of F-specific bacteriophage MS2, or polio virus in the recycled water. A virus that is at least as resistant to disinfection as polio virus may be used for purposes of the demonstration. This proposed requirement allows alternative disinfection processes, in combination with conventional filtration (chemical coagulation, clarification prior to filtration) and direct filtration alternatives. The proposed treatment process must be able to demonstrate that it reliably meets the virus removal criteria.

2. *Section 60301.320, Filtered Wastewater*
The filtration requirement recognizes direct filtration as an acceptable alternative, and now lists microfiltration, ultrafiltration, nanofiltration and reverse osmosis as other alternative means of filtration.

Groundwater Recharge Regulations

Groundwater recharge regulations, drafted by DHS, have been in circulation for a number of years. These guidelines have proven to be difficult to apply "across the board" to all projects, and in some cases, adherence to these older guidelines has been difficult. Revised draft regulations were circulated, dated April 23, 2001, and most recently August 2, 2002. The latter draft regulations were received very recently, and thus were not able to be detailed or summarized in this report. Highlights of the April 23, 2001 draft regulations are summarized herein, and complete copies of these draft regulations, April 23, 2001 and August 2, 2002, are included in Appendix E. A summary of the pertinent regulations and commentary to the April 23, 2001 draft regulations are provided in Table 6-6. LOCSD should continue to review and stay abreast of these draft regulations as they develop, as these draft regulations have to potential to have significant impacts on the harvest well and blending requirements for potable water.

Based on discussions with DHS, the LOCSD project will likely be considered as one that "incidentally results in treated wastewater reaching groundwater." This does not mean that the LOCSD will be exempt

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[1] The amount of time elapsed between the time that a tracer, such as a salt or dye, is injected into the influent at the entrance to a chamber and the time that the highest concentration of the tracer is observed in the effluent from the chamber.

from all DHS requirements nor the Regional Board water quality objectives. A detailed engineering report, as required by DHS, will still be required to be submitted. The treated effluent which is recharged to the groundwater will need to meet all Regional Board permit requirements and Basin Plan objectives for the local groundwater.

Table 6-6. Summary of Draft Groundwater Recharge Regulations

Section/Reference	Summary of Regulation	Comments
60320(a) and (b), Applicability and General Requirements	Applies only to "planned" groundwater recharge reuse projects (PGRRPs). Does not apply to a wastewater disposal project incidentally resulting in groundwater recharge.	The understanding from DHS is that the Los Osos project will not be considered as a PGRRP. Groundwater quality issues will still need to be addressed, but certain requirements in these draft regulations will not apply.
60320 (c)	Recycled water must be from WWTP under a comprehensive industrial pretreatment and source control program.	Federal Pretreatment program does not apply to Dischargers less than 5.0 mgd. LOCSD would likely receive an exemption from this requirement, particularly in light of the inapplicability of section 60320(a). Given the nature of zoning/land uses within LOCSD, industrial pollutants should not pose any concern.
60320(d)	Requires project proponent to prove financial assurance mechanisms to cover costs of inadvertent contamination of water supplies or violations, resulting from proposed groundwater recharge.	This requirement may still apply to the LOCSD project.
60320.010(a), Control of Pathogenic Microorganisms	WWTP discharge must meet filtered, disinfected tertiary requirements at all times.	LOCSD treatment plant will meet these requirements.

Section/Reference	Summary of Regulation	Comments
60320(c) and (d)	For surface spreading project, requires 6 month retention prior to extracting for potable use, and limits discharge within 500 feet of point of recharge. For subsurface injection project, the criteria is 9 months retention, and no discharge within 2000 feet of point of recharge.	Definition of LOCSD's project is likely somewhere in between the two definitions. However, since DHS is treating this project as one that incidentally results in treated wastewater reaching the groundwater, it may not be an issue. Consideration should be given, however, to meeting the objectives of a surface spreading project, at a minimum.
60320.020, Control of Total Nitrogen	A specific discharge level of total nitrogen is not specified at this time. The commentary on this section suggests a nitrogen level ranging from 1 mg/L to 10 mg/L. DHS has a nitrite standard of 1 mg/L, and the total nitrogen level needed to ensure compliance with the nitrite level is uncertain at this time.	This will likely need to be evaluated by the Engineer, and will on a case-by-case basis.
60320.030, Control of Regulated Contaminants	The recycled water must be in compliance with all primary and secondary standards, Regional Board water quality objectives, and public health goals.	Evaluation of meeting PHGs will be considered based on existing and background water qualities, and potential downstream users of the groundwater. Due to the number of recharge sites, LOCSD customers would be considered downgradient users from the leach field recharge sites.

Section/Reference	Summary of Regulation	Comments
60320.040, Control of Nonregulated Contaminants	The total organic carbon (TOC) of the filtered wastewater shall not exceed 16 mg/L for more than two consecutive days. Other detailed limitations for TOC are based on the fraction of contributory recycled water contributions (RWCs) to the Basin, and whether the Project recharges by spreading or injection. Recharge by injection requires the entire wastewater stream to be treated by reverse osmosis (RO), and must meet a TOC of 1 mg/L divided by the maximum average RWC contribution. Recharge by spreading requires a TOC concentration of 1 mg/L divided by the RWC contribution, or be treated by RO. The maximum RWC shall be 0.5, unless otherwise approved by the Department.	The specific TOC requirements will need to be developed and negotiated as part of the permitting and design process for the treatment plant.

RECYCLED WATER ACCEPTABLE USES

The LOCSD wastewater facility will produce a tertiary recycled water that is defined by Title 22 as "Disinfected Tertiary Recycled Water." As such, unrestricted use of the recycled water on parks, playgrounds, schoolyards, direct use on food crops, and other like uses, is allowed under Title 22 criteria. The specific market for recycled water in the Los Osos area will be limited to landscape irrigation, however, except for the remainder of treated effluent which will be percolated into the underlying upper groundwater basin.

RECYCLED WATER SALES IN CAL-CITIES AND S&T MUTUAL WATER COMPANY SERVICE AREAS

Recycled water sales outside of the District's service area may impact neighboring water purveyors' water accounts and rates. This section assesses the potential economic issues associated with recycled water sales outside of the LOCSD service area.

Cal-Cities Water Company

On April 23, 2001, JLWA met with Warren Morgan, Coastal District Manager, and Roger Brett, Customer Service Superintendent of Southern California Water Company (Cal-Cities Water Company) to discuss water recycling at Monarch Grove and Sunnyside Schools.

Mr. Morgan indicated that there would be an issue in regards to selling recycled water to the two schools. This lost water revenue from the irrigation of the schools using recycled water would need to be passed on to the rate payers in the Cal-Cities service area, if not paid for through the wastewater project or through other means. The Water Company supports water conservation and water recycling, but this issue must be addressed.

Cal-Cities serves approximately 2,567 service connections, serving 5,459 customers. From 1994 to 1999, the average production for Cal-Cities was 1,034 AFY (169 gpcd). The Monarch Grove and Sunnyside Schools combined use approximately 30 AFY (13,068 hcf/year) of potable water for irrigation. This equates to approximately 3 percent of total service area potable water demand. The estimated lost revenues by serving the two schools with recycled water for irrigation is estimated at $22,582 per year. This would have the potential to increase water rates to Cal-Cities customers in the area by up to 3 percent, or approximately $0.75 per month per service connection. If these costs were instead to be borne by the LOCSD wastewater customer base, estimated at 4,742 sewer connections, the monthly burden to cover this cost would be approximately $0.40 per month per sewer service connection, on the average.

S&T Mutual Water Company

S&T serves domestic water to the Sea Pines restaurant and clubhouse, along with some incidental landscape irrigation. Cal-Cities provides domestic water to the Pro-Shop and lodge. Golf course irrigation is served by well and treatment plant effluent from the Monarch Grove WWTP. Thus, any recycled water use on the golf course will not impact water rates in the S&T service area. Furthermore, augmenting the irrigation water supply with LOCSD recycled water will also not have any impact on local water rates.

UPPER AQUIFER IRRIGATION IN LIEU OF DOMESTIC WATER OR RECYCLED WATER

The hydrogeologic assessment and studies for the Los Osos wastewater project indicate that approximately 650,000 gpd (730 AFY) of water from the upper aquifer must be pumped (in addition to the 300,000 gpd pumped by Cal-Cities Water Company) to de-water the aquifer and prevent surfacing of groundwater in particular areas. A network of water harvesting wells would be required, and based on blending requirements for harvesting wells and deep aquifer water (for potable purposes), there will be excess upper aquifer water from harvesting wells available for irrigation purposes.

If this harvested water were to be used in lieu of recycled water for irrigation on the five various use sites, additional dedicated distribution piping would be required to convey water from the harvest well sites to each irrigation site. Approximately 4 miles of dedicated pipeline distribution system would be required, estimated to cost around $750,000. System storage of the pumped groundwater would also be required, if the harvest well pumps cannot meet peak irrigation demands. The cost for such storage would be approximately $125,000, excluding any land acquisition costs. A dedicated pump station would also be required (if storage is required), estimated to cost approximately $50,000 including telemetry and controls. The total cost of "in-lieu" use of upper aquifer groundwater could cost around $1,000,000 in capital costs.

USE OF HARVESTING WELL WATER TO SUPPLEMENT RECYCLED WATER

Another alternative to utilize some harvesting well water is to augment the recycled water supply from the treatment plant with harvesting well water. Since 730 AFY must be pumped from the upper aquifer, and the recycled water demand is approximately 115 AFY, it is evident that there will be a surplus of harvest well water that still must be put to use (potable water blending or disposal). With the locations of the various proposed harvest well sites, it would be relatively simple to provide two or more direct connections to the recycled water irrigation system to allow introduction of harvest well water directly into the recycled water system. Of course, it is also evident that this could lead to the potential of just re-circulating harvest water and treated effluent through the effluent distribution system and groundwater recharge/harvest well network. Thus, harvest water, if used for recycled water demand, would best be put to use to off-set peak irrigation demands during the night-time irrigation period. If the cost of effluent storage at the treatment plant is of concern, this alternative should be researched further to determine if effluent storage (clearwell) volume (and thus cost) could be reduced at the treatment plant. The cost for two connections to the recycled water distribution system, including telemetry, controls and metering, is estimated at $50,000.

EVALUATION OF RECYCLED WATER SERVICE TO CUSTOMERS

This subsection describes the required improvements needed to serve the five sites with recycled water. The costs developed for these alternatives assumes the following:

- Since only one school (Los Osos Middle School) and the Community Park would require high delivery pressure (the other schools are equipped with booster stations, Sea Pines Golf Course recycled water delivery is to surface storage), delivery pressure will be at the pressure required for leach field disposal only. Los Osos Middle School and the Community Park will require a booster station to serve their respective irrigation systems.

- Pipeline costs for the leach field pipeline system are considered "sunk" costs with regards to the overall costs for this water recycling alternative.

- The costs for on-site retrofits are estimated, and assumed to be paid for by the User. Recycled water turn-outs, meters and pipeline extensions will be paid for by the LOCSD WWTP project.

- The cost of recycled water to San Luis Coastal School District for the four schools will be based on a percentage of the LOCSD and/or Cal-Cities potable water rates. The actual negotiated rate will be based on a reasonable rate of return to the School District to defray capital costs for the on-site retrofits.

- Sea Pines Golf Course provides well water, and Monarch Grove WWTP effluent to irrigate the golf course. Similarly, the Community Park is irrigated with local well water. The well water is "free" except for pumping costs. In order for it the viable for the golf course and Community Park to use recycled water from LOCSD, the cost of delivered recycled water must be equitable to the well water. Energy costs to pump an acre-foot of water is approximately $50, and thus the cost to SPGC and County to purchase recycled water from LOCSD is estimated at $50/AF.

For the four schools and Community Park, a review of the irrigation and potable water plans was conducted, along with cursory site visits to review on-site conditions. Costs were estimated for relocation of "pressure-side" irrigation lines not meeting State Health separation criteria, signage, and change out of hose bibbs to quick-couplers. Estimated water bill savings were estimated based on various discount water rates. Capital recovery of the costs of retrofitting the schools was estimated. These costs are summarized in Table 6-7. Cost backup is provided in Appendix C.

Los Osos Middle School

The school irrigation system pressurizes off of existing potable water service pressure. Since LOMS and Community Park are the only sites that would require a high delivery pressure, it was not feasible from an energy standpoint to pressurize the entire recycled water distribution system to feed these sites. Thus, the cost for an on-site booster station was included in the User retrofit costs. The estimated retrofit cost to be borne by the User (San Luis Coastal School District) is $20,600.

Table 6-7 Summary of Recycled Water Costs to Users

		Percentage of Potable Water Rate							
		75		80		85		90	
Site	Retrofit Costs to User, $	Annual Water Savings, $	Capital Recovery, yrs	Annual Water Savings, $	Capital Recovery, yrs	Annual Water Savings, $	Capital Recovery, yrs	Annual Water Savings, $	Capital Recovery, yrs
Los Osos Middle School[1]	20,652	3,880	6	3,104	7	2,328	9	1,552	14
Baywood Elementary[1]	1,344	1,021	2	817	2	613	3	408	4
subtotal	**21,996**	**4,901**	**5**	**3,921**	**6**	**2,941**	**8**	**1,960**	**12**
Sunnyside Elementary[2]	3,060	1,763	2	1,410	3	1,058	3	705	5
Monarch Grove Elementary[2]	7,092	1,763	5	1,410	6	1,058	7	705	11
subtotal	**10,152**	**3,526**	**3**	**2,821**	**4**	**2,116**	**5**	**1,410**	**8**
Community Park	21,060	--	--	--	--	--	--	--	--
Sea Pines Golf Resort[3]	0	--	--	--	--	--	--	--	--

Notes:

1 - Potable water served by LOCSD. Potable water rate = $1.25/ccf

2 - Potable water served by Cal-Cities. Potable water rate = $1.75/ccf

3 - Golfcourse irrigation supplied by private well and Monarch Grove WWTP effluent. Community Park irrigation by private well.

Approximately 900 LF of recycled water pipeline will be required to extend from the planned leach field disposal pipeline southwest of LOMS. Although the pipe could have been sized hydraulically for 4-inch, the pipe was sized for 6-inch given the length of pipeline to the school. Additionally, the pipeline was aligned in Pismo Avenue, to be installed within the existing pedestrian tunnel, to avoid trenching or boring across South Bay Boulevard. The pipeline would then reduce to 4-inch and connect into a new dedicated service meter. This service would then feed the new booster station (provided by San Luis Coastal School District). It is assumed the new booster station will be in the vicinity of the southwest corner of the school and play fields.

Baywood Elementary

The estimated retrofit cost to be borne by the User (San Luis Coastal School District) is $1,300. This cost includes signage, and relocation of some potable water pipelines to meet separation requirements.

Approximately 1,600 LF of recycled water pipeline will be required to extend from the planned leach field disposal pipeline south of the school. Although the pipe could have been sized hydraulically for 4-inch, the pipe was sized for 6-inch given the length of pipeline to the school. The pipeline would then reduce to 4-inch and connect into a new dedicated service meter.

Sunnyside Elementary

The estimated retrofit cost to be borne by the User (San Luis Coastal School District) is $3,000. This cost includes signage, relocation of some potable water pipelines to meet separation requirements, and change-out of hose bibbs to quick couplers.

Approximately 600 LF of recycled water pipeline will be required to extend from the planned leach field disposal pipeline south of the school. The pipe was sized for 4-inch to serve the school. The pipeline would then connect into a new dedicated service meter.

Monarch Grove Elementary

The estimated retrofit cost to be borne by the User (San Luis Coastal School District) is $7,100. This cost includes signage, relocation of some potable water pipelines to meet separation requirements, and charge-out of hose bibbs to quick couplers.

A 4-inch turn-out in LOVR from the planned leach field disposal pipeline will serve the school. A new 4-inch meter will also be installed to serve the school.

Sea Pines Golf Course

The golf course already uses tertiary effluent for irrigation. No modifications are required to their irrigation system, and signage is already in place. The golf course also has notifications on the score cards for patrons. The cost of the retrofit to Sea Pines Golf Course (SPGC) is essentially zero. As indicated earlier, the cost of irrigation water to SPGC is currently zero, except for pumping costs for the well water. It is estimated that the sale of recycled water to the golf course should be at a rate commensurate with this cost, or around $50/AF, otherwise, delivery of recycled water to the golf course will not be feasible.

Approximately 2,300 LF of 6-inch recycled water pipeline will be required to extend from the planned leach field disposal pipeline in LOVR to the golf course for a cost of $202,000 as noted in the Los Osos Wastewater Project - Monarch Grove/Sea Pines Evaluation completed by Montgomery Watson Harza. The pipeline would discharge directly into the 2.7 MG storage pond. This pond will then feed the secondary pond by gravity. A 4-inch meter will be installed near the intersection of Glenn Street and Howard Road.

Community Park

The estimated retrofit cost for Community Park is $21,060. This cost includes estimates for pipeline relocation, change-out of hose bibbs to quick-couplers and signage. This cost is an estimate only. Actual irrigation plans were not available for review at the time of this report. A 3-inch turn-out in Los Osos Valley Road or Palisades Avenue will serve the park. Similar to SPGC, the County receives well water "free", except for pumping costs to extract well water.

RECOMMENDED REUSE PLAN

Based on the evaluation of recycled water use in the LOCSD service area, there were two options available for reuse: 1) recycle water at the six sites (4 schools, Community Park, golf course); 2) pump upper aquifer groundwater in lieu of recycled or potable water use. Of these two alternatives, there is a significant cost advantage to serving recycled water to area customers. The cost advantage stems mainly from the assumption that the capital costs for the leach field disposal pipeline system are considered "sunk" costs relative to the recycled water alternative. In other words, the leach field disposal pipeline system is a necessary component of the treatment plant project regardless of the recycled water use component. Thus, the cost of the recycled water component is only the cost to extend service to these sites.

In-lieu pumping of upper aquifer groundwater requires a separate distribution system and pumping station, and storage facilities, which will cost $1,000,000 or more to construct. The estimated capital cost to LOCSD for using recycled water is approximately $292,000. A summary of these costs is included in Table 6-8.

Table 6-8. Summary of Recycled Water Capital Costs to LOCSD

Site	Retrofit Costs
LOMS	$72,600
Baywood Elementary	$67,200
Sunnyside Elementary	$24,600
Monarch Grove Elementary	$10,800
Community Park	$14,400
Sea Pines Golf Course	$202,000
TOTAL	**$391,600**

If these capital costs are amortized for 40 years at 3 percent interest (compounded annually), the unit cost per AFY of potable water saved (excluding operation/energy costs) would be as follows:

Alternative	Amortized Cost, $	Cost (Capital) per AFY, $
Recycled Water Use	$16,927	$147
In-Lieu Groundwater	$43,260	$397

With either alternative, given the amount of recharge to the upper aquifer from the LOCSD WWTP, upper aquifer pumping will be required. However, by using recycled water for irrigation, approximately 115 AFY of recycled water use can avert that same amount of pumping of the lower aquifer.

Based on this evaluation of recycled water alternatives, it is recommended that recycled water use be implemented, to augment the 60 AFY shortfall of potable water projected at build-out in the LOCSD service area.

CHAPTER 7

WATER DISTRIBUTION

This chapter presents the LOCSD water distribution system, design and performance parameters to meet customer demands for service and fire protection, development of the hydraulic model and calibration, and the results of model runs for existing and future demands. Included are the specific recommendations of distribution system improvements identified by the water model runs, plus other major and minor facilities related to the water distribution system, including wells, tanks, pump stations and other related facilities. These recommendations are then incorporated into the final master plan recommendations and capital improvement plan presented in Chapter 8.

EXISTING FACILITIES

The existing distribution system consists of over 25 miles of pipelines, and includes 162 existing fire hydrants. The existing water distribution system is shown on Figure 7-1. An inventory of the existing pipeline network is summarized in Table 7-1.

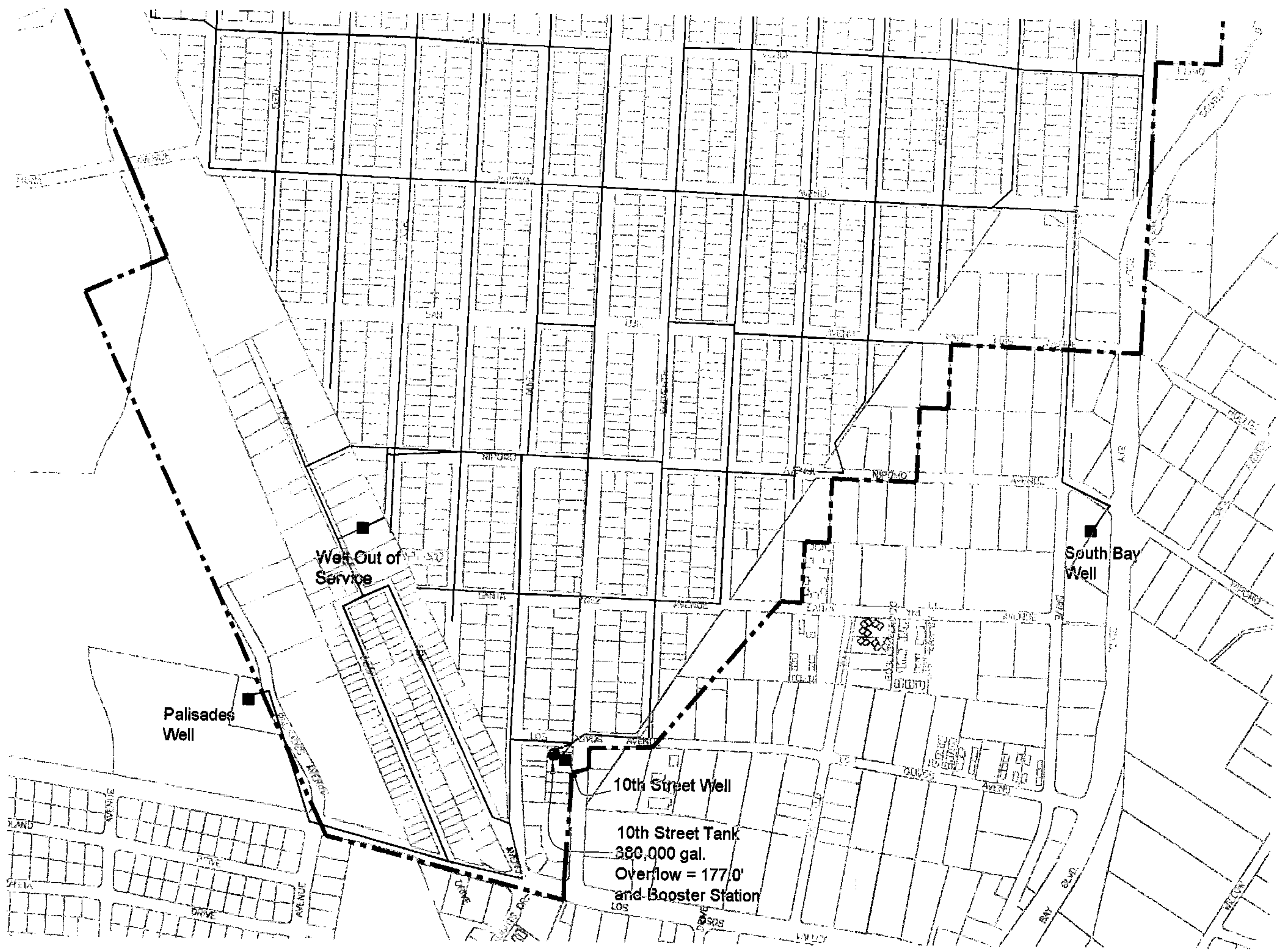
Table 7-1. Existing Pipeline Inventory

Diameter (inches)	Length	
	Feet	Miles
3	80	0.02
4	2,800	0.53
6	82,800	15.68
8	11,100	2.10
10	36,200	6.86
12	330	0.06
Total	**133,310**	**25.25**

The distribution system consists mainly of asbestos cement and polyvinyl chloride (PVC) pipe, with some steel. The approximate lineal footage of each pipe material throughout the distribution system is summarized as follows:

- Asbestos Cement 81,455 LF (15.4 miles)
- PVC 40,578 LF (9.6 miles)
- Steel 1,237 LF (0.2 miles)

See Figure 7-1B



L.O.C.S.D.

Legend:

- LOCSD Water Service Area
- 4" and Smaller
- 6" Line
- 8" Line
- 10" Line
- 12" Line
- Well
- Tank

Water System Master Plan

Figure 7-1A

Existing Facilities

1" = 600'

0 150 300 600

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See Figure 7-1A

L.O.C.S.D.

Legend:

LOCSD Water Service Area
4" and Smaller
6" Line
8" Line
10" Line
12" Line
Well
Tank

Water System Master Plan

Figure 7-1B

Existing Facilities

1" = 600'
0 150 300 600

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DESIGN REQUIREMENTS

The design requirements for the water distribution system relate primarily to the flow and pressure delivered by the system. Pressures below 20 psi are not acceptable in a municipal water system. Ideally, normal operating (static) pressures will be within the range of 40 to 80 psi. This is the range which most people find comfortable and which will serve most fire sprinkler systems. Pressures higher than 80 psi are acceptable within the distribution system, but should be reduced to 80 psi at the service connection to prevent water hammer effects or leakage through rapidly-weakening washers and seats.

The flow requirements examined in the network model include fire flow, maximum day demand, peak hour demand, and average day demand. These demands are summarized in Chapter 4. The various flow scenarios are summarized as follows (See Chapter 4 for definitions):

> Fire Flow: Residential, commercial and school fire flow requirements were established based on discussions and coordination with LOCSD fire department staff. Residential (including multi-family) fire flow of 1,500 gpm, commercial fire flow of 2,500 gpm, and school fire flow of 3,500 gpm were modeled and deficiencies were noted. In accordance with UFC requirements, no more than 1,000 gpm was extracted from any single fire hydrant. It was assumed that maximum day demand was occurring concurrent with the fire flow and all wells were turned off. The 16^{th} Street Reservoirs were modeled half full and the 10^{th} Street Reservoir's hydraulic grade line matched the 16^{th} Street Reservoirs.
>
> Maximum Day Demand: This flow scenario was generally employed concurrently with fire flow. Domestic demand was distributed throughout the LOCSD based on the existing demand distribution apparent from the meter database. As described in Chapter 4, Water Demand, the peaking factor applied to the average day demand to reach the maximum day demand was 2.0 for both zones.
>
> Peak Hour Demand: This demand condition was used to identify system deficiencies at the maximum domestic use. A peaking factor of 3.5 was applied to the ADD for both zones. The 16^{th} Street Reservoirs were modeled half full and 10^{th} Street Reservoir's hydraulic grade line matched the 16^{th} Street Reservoirs.
>
> Average Day Demand: The flow condition was used to generate the pressure contour map and was intended to reflect the most common system conditions. The 16^{th} Street Reservoirs were modeled at full capacity. The 10^{th} Street Reservoir was closed.

The following parameters were employed to identify deficient conditions for each run of the model:

1. Domestic pressures below 40 psi at ADD, and below 30 psi at MDD, were highlighted in each run.

2. Pipeline velocities exceeding 5 feet per second (fps) at ADD were identified. In general, velocities higher than 5 fps create higher pressure losses.

3. During fire flow model runs, pressure below 20 psi at any node in the system were identified in accordance with UFC Requirements.

The hydraulic design parameters and criteria for the LOCSD water system evaluation are summarized in Table 7-2.

Table 7-2. Summary of Hydraulic Parameters and Design Criteria

Hydraulic Parameters and Design Criteria	Value
Fire Flow Requirements	Residential - 1,500 gpm Commercial - 2,500 gpm School - 3,500 gpm
Maximum Day Demand Factor	2.0 times ADD
Peak Hour Demand Factor	3.5 times ADD
Minimum Service Pressure@ADD	40 psi
Minimum Service Pressure@MDD	30 psi
Minimum Residual Pressure (@MDD and fire flow conditions)	20 psi
Pipeline Velocity@ADD	5 ft/s
Pipeline Velocity@MDD	< 10 ft/s
Fire Hydrant Spacing	At every intersection, Existing Residential - 600 ft New Residential - 500 ft Commercial - 500 ft
Fire Hydrant	6" Wet Barrel Residential: 1 - 4" and 1 - 2.5" outlet Commercial: 2 - 4" and 1 - 2.5" outlet
Valving	Placed such that no shut down of greater than 500 feet in commercial/residential areas (or greater than 800 feet for 1 acre or larger lots)

HYDRAULIC EVALUATION

In order to evaluate the performance of the existing water system, identify deficiencies in the network, and recommend improvements, a computer model was developed using Haestad's WaterCAD computer program. The model was calibrated through field hydrant testing to accurately represent existing hydraulic characteristics. Elevation data for the nodes were obtained through electronic files containing one foot contours throughout the LOCSD. The elevations were verified by comparisons with static pressure readings in the field. The Hazen-Williams roughness coefficients ("C" factor) for the pipelines in the model were calibrated to match the residual pressure readings of the field tests. The calibrated model matches the actual system performance within an average of 1.4 psi (no more than 3.4 psi) at 11 different locations throughout the water distribution system. Table 7-3 summarizes the calibration results. The following roughness values were utilized in the final calibrated model:

C = 135 for Polyvinyl Chloride (PVC)
C = 115 for Asbestos Cement (AC)
C = 100 for Steel

System Performance

In the analysis of the existing LOCSD water distribution system, some areas in the network were found to experience less than desirable pressures during domestic demands and substandard pressures and/or flows under fire flow conditions. The distribution system also has an inadequate "backbone" or a series of larger diameter, looped pipes allowing flow to travel to several sections of the system with little head loss.

Pressure contour maps were generated from the model runs to illustrate the system pressures during existing average day demand conditions and average day demand conditions for the future expanded hydro-pneumatic zone. These pressure contours are shown on Figures 7-2 and 7-3, respectively.

In addition to water system hydraulics, there are other considerations to enhance and improve the LOCSD water system. Such considerations include replacement of polybutylene water services (which have not held up well in the past), upgrading the water meters, pump station upgrades, water storage, and seismic considerations in the event of a significant earthquake event. The areas identified by the model and all other system improvements are described in the following sections.

FIRST PRIORITY CAPITAL IMPROVEMENTS

Highland Tank and Water Main Upgrade

As discussed in Chapter 4, it is recommended that a 1.02 MG water storage facility be constructed on a first priority basis, to provide adequate system storage to meet existing and future storage needs. In addition, it is recommended to consolidate storage from the 10th

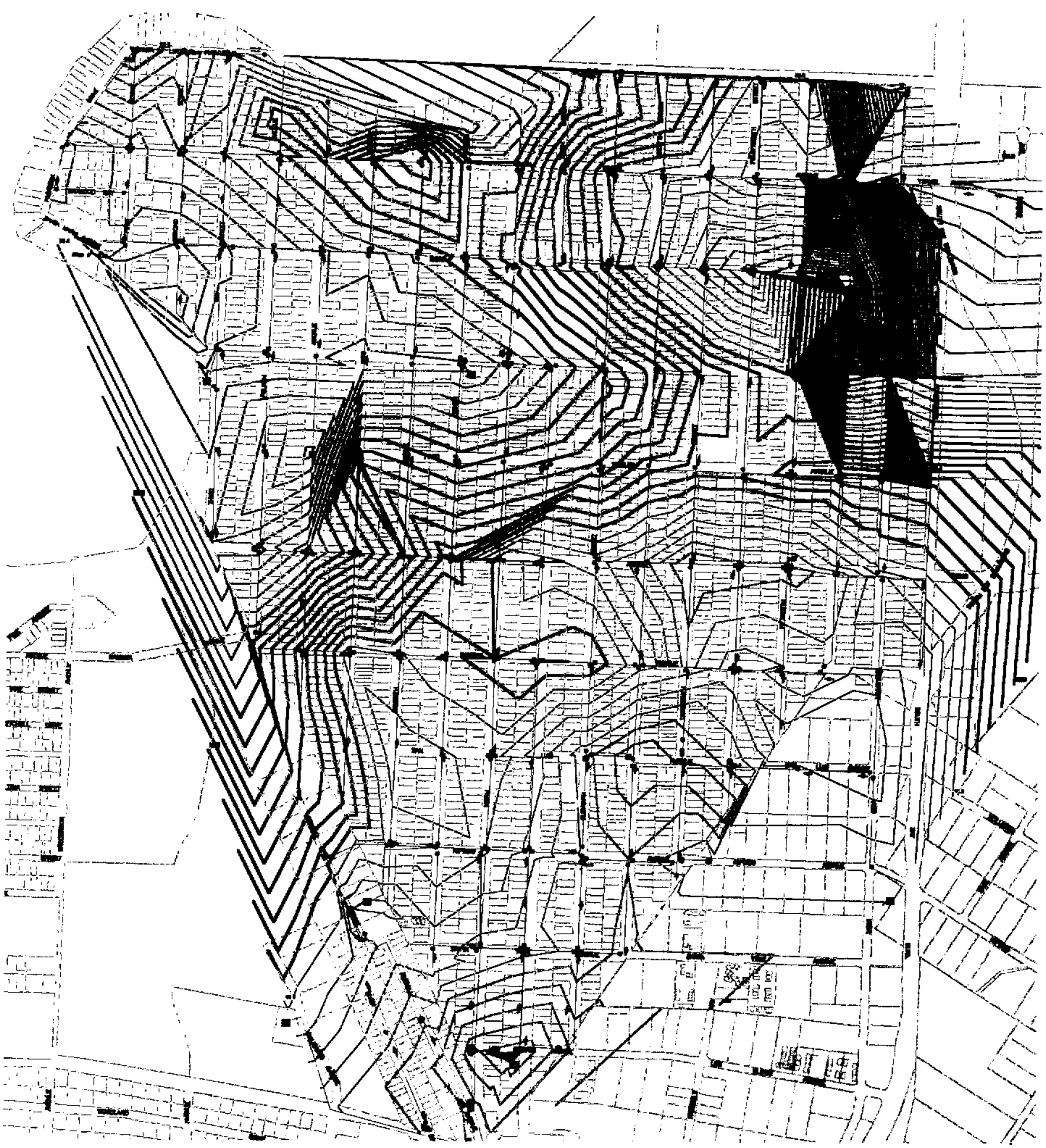
Table 7-3. Model Calibration and Testing

FF Testing - Monday Jan. 22, 2001 (9:00a.m. to 12:00p.m.)		TANK LEVELS		FIELD			MODEL		
FH#	DESCRIPTION	10TH	16TH	FLOW	STATIC	RESIDUAL	STATIC	RESIDUAL	COMMENTS
4	SW Santa Maria and 3rd	31.57 (ON)	34.41	1010	67	63	72.49	66.7	Retest
5	SW Santa Maria and 9th	31.07 (ON)	33.74	975	57	52	57.97	54.01	Good
6	SE El Moro and 11th	31.07 (OFF)	32.11	890	56	51	58.78	53.81	Good
7	NE Paso Robles and 6th	32.09 (OFF)	30.47	845	44	40	49.81	39.13	Retest
8	NE Pismo and 17th	30.55 (ON)	33.41	790	41	34	40.11	35.61	Good
9	NE San Luis and 7th	31.57 (OFF)	31.42	720	35	28	37.24	30.95	Good
10	NW Nipomo and 11th	30.6 (OFF)	33.01	660	30	26	31.02	27.2	Good

FF Testing - Friday Jan. 26, 2001 (11:00a.m. to 2:00p.m.)		TANK LEVELS		FIELD			MODEL		
FH#	DESCRIPTION	10TH	16TH	FLOW	STATIC	RESIDUAL	STATIC	RESIDUAL	COMMENTS
4 - Retest	SW Santa Maria and 3rd	36.32 (OFF)	35.65	1025	72	64	72.26	64.36	Good
7 - Retest	NE Paso Robles and 6th	35.85 (OFF)	35.38	845	53	43	51.83	39.61	Good
7B	SE El Moro and 6th	35.49 (OFF)	34.85	975	65	53	69.33	52.92	Good
1	NE Santa Paula and 17th	36.33 (OFF)	32.9	935	63	58	83.69	73.98	Retest
2	NE Santa Ysabel and 17th	36.33 (OFF)	33.53	995	83	55	90.02	84.91	Retest
3	NW Paso Robles and 18th	36.31 (OFF)	33.91	1095	75	80	93.37	87.71	Retest

FF Testing - Friday Feb. 2, 2001 (2:30p.m. to 4:00p.m.)		HYDROPNEUMATIC TANK LEVEL	FIELD			MODEL		
FH#	DESCRIPTION	Level = 152' (Base Elev) + 7' (Tank Level) + Pressure Reading*2.31	FLOW	STATIC*	RESIDUAL	STATIC	RESIDUAL	COMMENTS
1 - Retest	NE Santa Paula and 17th	269.88	1010		61		60.89	Good
2 - Retest	NE Santa Ysabel and 17th	262.95	1070		70		69.68	Good
3 - Retest	NW Paso Robles and 18th	260.64	1070		75		74.19	Good

* - Steady State Conditions were not available to read static pressures. Steady state was acquired during fire flow



Contour Legend
Pressure (psi)

	<=	20.00
	<=	30.00
	<=	40.00
	<=	60.00
	<=	100.00

1" = 1,000'

L.O.C.S.D.

Water System Master Plan

Pressure Map
Existing Hydrostatic Contours

Figure 7- 2

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L.O.C.S.D.

Water System Master Plan

Pressure Map
Future Hydrostatic Contours

Figure 7-3

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Street tank to this new tank, thus requiring storage of 1.40 MG. To supply the water distribution system, a 16-inch water supply line will need to be constructed from the Highland tank, north on Alexander Avenue to Woodland Drive, east on Woodland Drive to Palisades Avenue, north on Palisades Avenue to LOVR, east on LOVR to 9th Street, and north on 9th Street to Santa Ynez Avenue. This improvement would upgrade the 6- and 10-inch water main on Los Osos Valley Road, from Palisades to 9th Street and the 6- and 10-inch water main on 9th Street from Los Osos Valley Road to Santa Ynez Avenue. Therefore, it is recommended to upgrade and install 6,600 feet of new 16-inch water main on the route describe above to supply water from the new Highland Tank to the main distribution system. Figure 7-4 depicts the location of the new Highland Tank and the water main improvements.

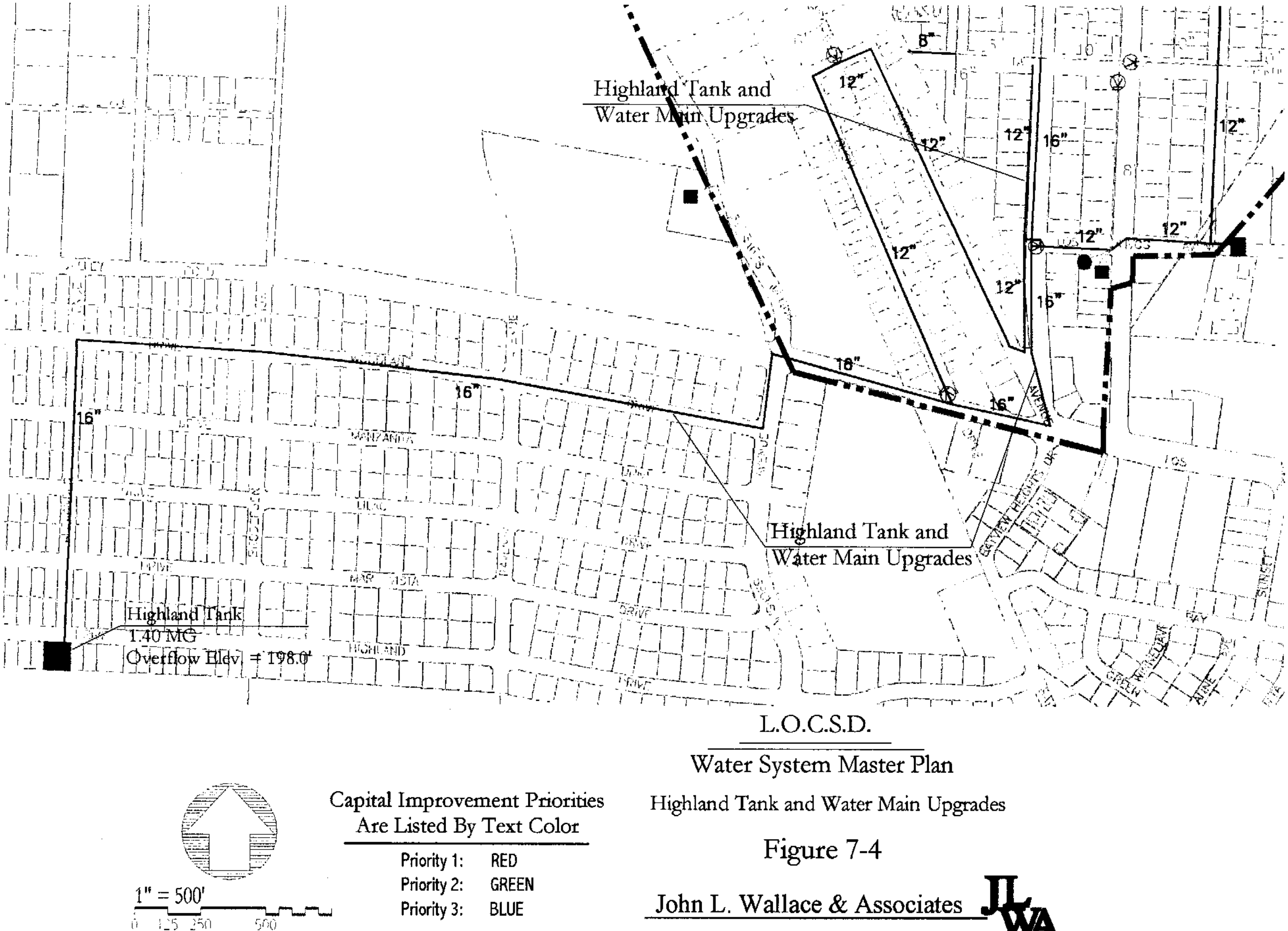
The extension of the hydro-pneumatic zone is recommended following the Highland Tank upgrade. As part of this extension, a new waterline in 9th Street and Los Olivos will be incorporated to serve the residents experiencing low system pressure. It is recommended to include the addition of 1,050 feet of 12-inch waterline in 9th Street, from Ferrell to Santa Ynez Avenue, and 85 feet of 12-inch waterline in Los Olivos, from 9th Street going east, to the water main upgrades already listed previously.

Hydro-pneumatic Zone Expansion

The hydraulic model showed several areas that were experiencing low pressures under static, peak hour and fire flow conditions. These conditions were a result of high elevations scattered throughout town. It is recommended to extend the hydro-pneumatic zone by installing 10 check valves and 3 pressure reducing valves (PRVs). The extension of the hydro-pneumatic zone will increase the pressure to the setting of the pumps located at the 16th Street Reservoir. The valves should be located in the following locations:

- On 15th Street at Santa Maria **(PRV)**
- On 14th Street at El Moro
- On 13th Street at El Moro
- On Paso Robles at 12th Street
- On 12th Street at Paso Robles
- On 11th Street at Paso Robles
- On Ramona at 10th Street **(PRV)**
- On Nipomo at 10th Street
- On Santa Ynez at 10th Street
- On 10th Street at Santa Ynez
- On 9th Street at Los Olivos **(PRV)**
- On Bush at Los Osos Valley Road
- On Ferrell at Bush

The existing and future distribution system profile is depicted on Figure 7-5. The remaining upgrades listed below are under the assumption that the hydro-pneumatic zone has been extended as shown in this figure.



L.O.C.S.D.

Water System Master Plan

Highland Tank and Water Main Upgrades

Figure 7-4

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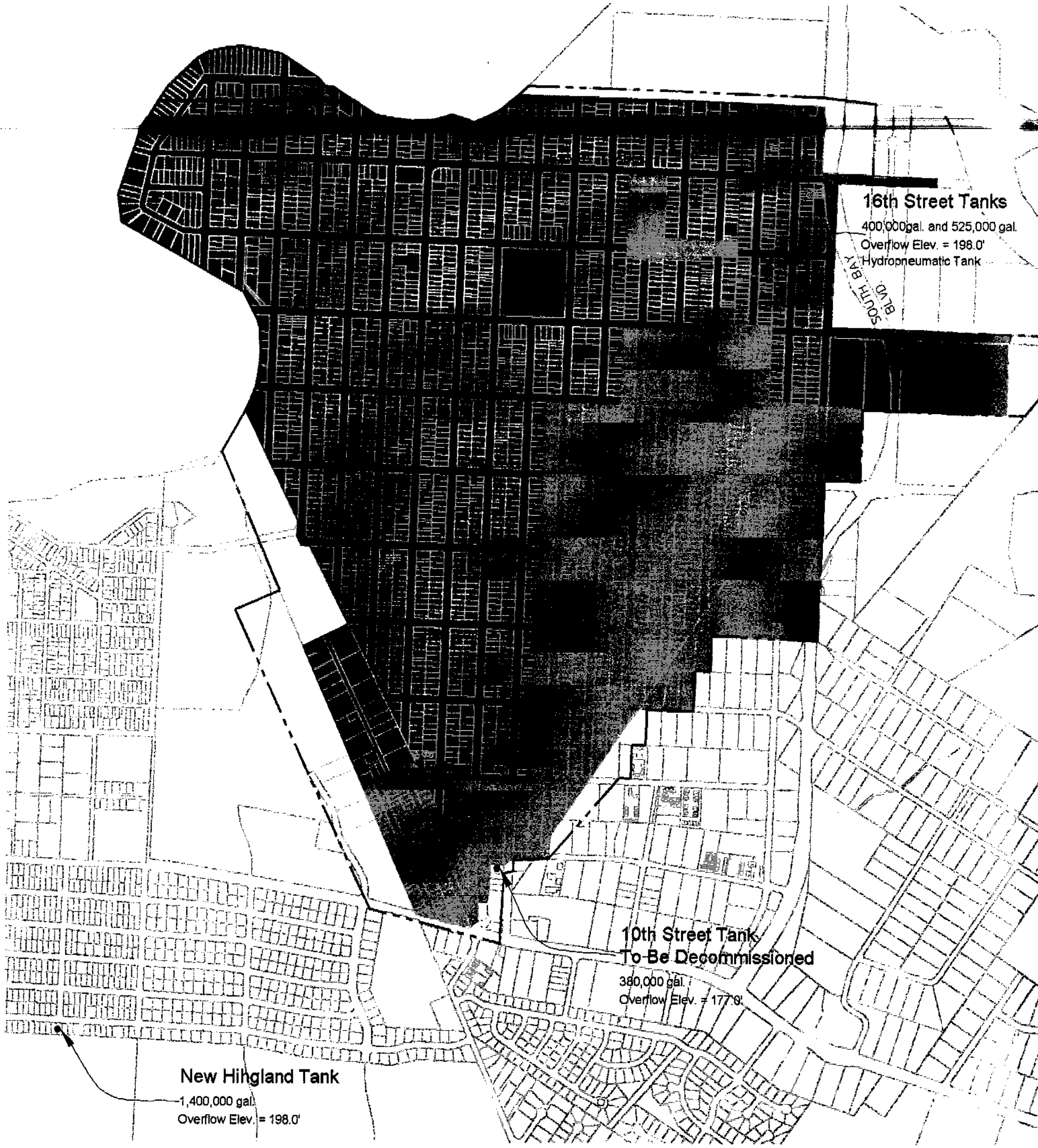
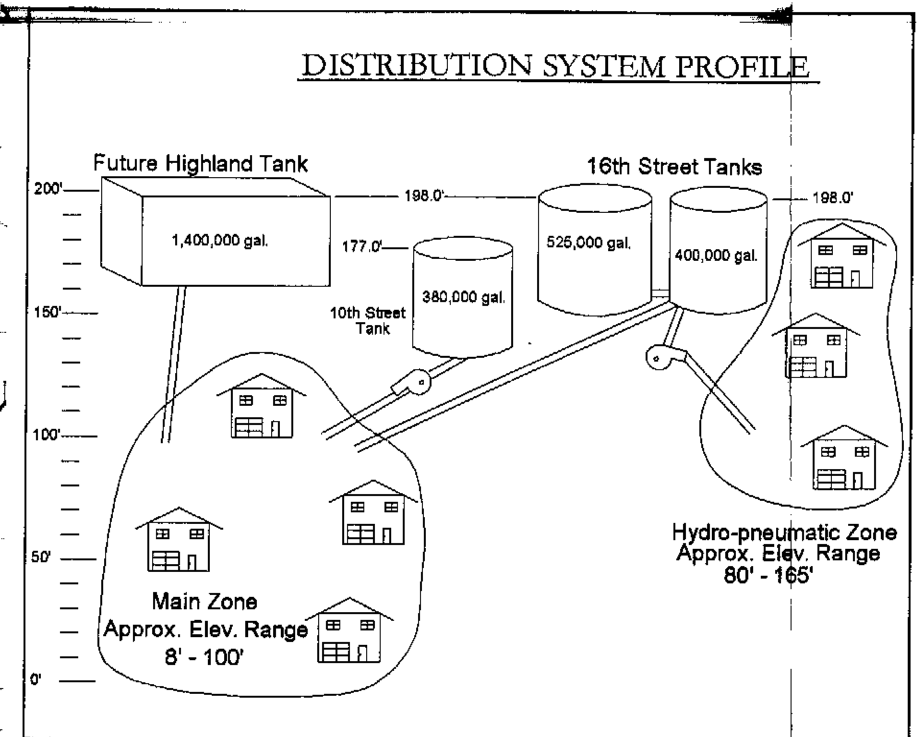
Capital Improvement Priorities Are Listed By Text Color

Priority 1:	RED
Priority 2:	GREEN
Priority 3:	BLUE





L.O.C.S.D.

Legend:

- LOCSD Boundary
- Main Zone
- Existing Hydropneumatic Zone
- Future Hydropneumatic Zone

Water System Master Plan

Figure 7-5.

Existing and Future Pressure Zones and Future Distribution System Hydraulic Profile

1" = 1200'
0 300 600 1200

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South Bay Well

The well pump for the South Bay well, which will now be within the new hydro-pneumatic zone, will require a new pump. Due to the expansion of the hydro-pneumatic zone, the South Bay well will be required to pump to a hydraulic grade line 90 feet higher than the existing hydraulic grade line. With the hydro-pneumatic zone expansion included as part of the first priority of improvements, this well pump replacement should also be included as part of the system upgrade during this time-frame.

Booster Pump Station Upgrade for Hydro-pneumatic Zone

The existing booster station to the hydro-pneumatic zone has a number of deficiencies, noted as follows:

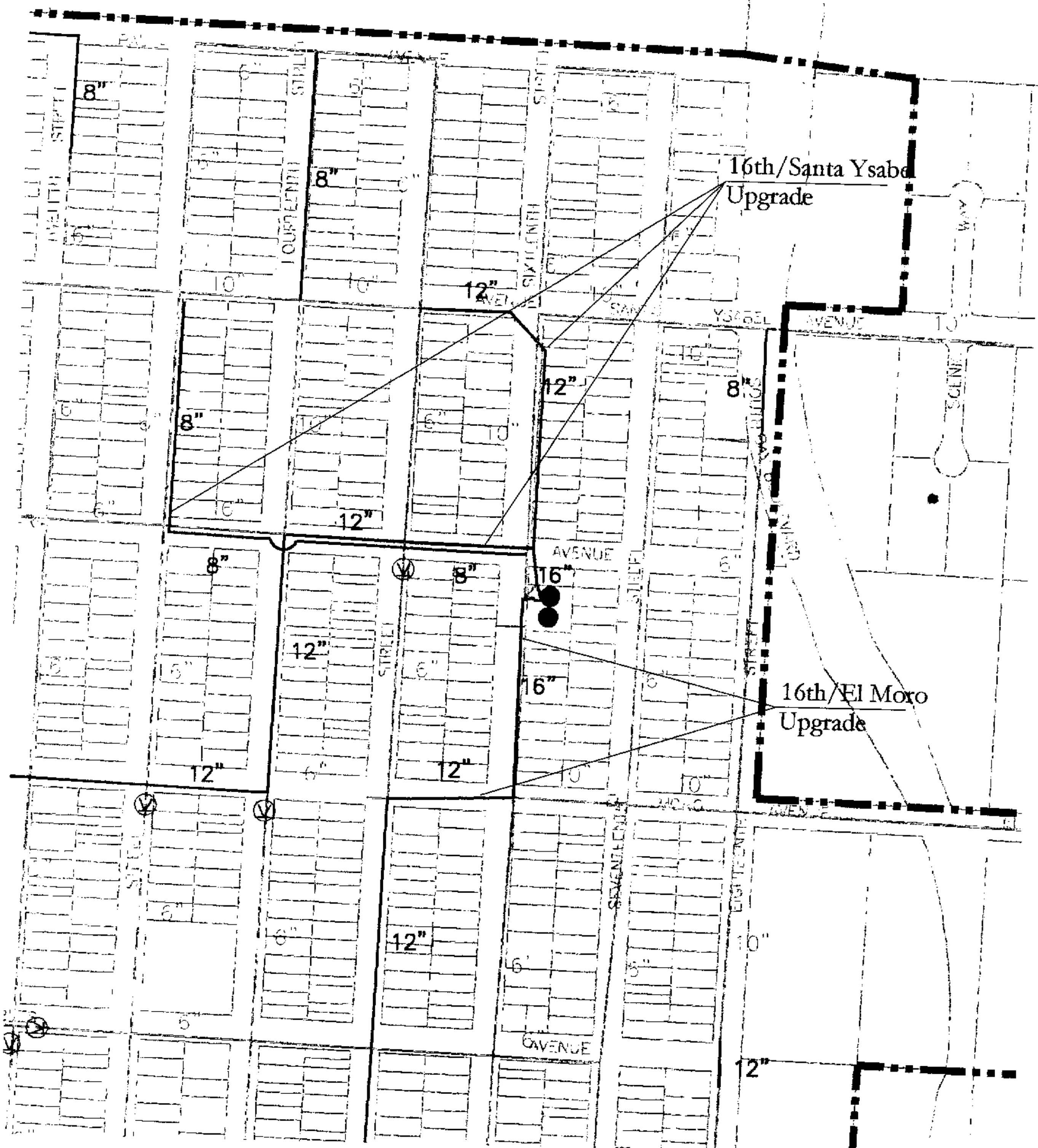
- The pump station is exposed to weather (no building).
- Controls are old and out-of-date.
- System pressures fluctuate 20 psi between on/off operation of pumps.
- Inefficient constant-speed pumps.
- Standby diesel-powered pump only provides marginal system pressure in the event of a power outage.

It is recommended that the booster station be upgraded as part of the hydro-pneumatic zone expansion. This project should be implemented in conjunction with the hydro-pneumatic zone upgrade. The new booster station should include the following features:

- Variable frequency drive pumps.
- Standby generator.
- Pumps and generator in enclosed building.
- State-of-the-art controls and SCADA interfacing capability.
- Fire pump to meet 3,500 gpm school fire flow requirement.

16th Street and El Moro Upgrade

The south section of the hydro-pneumatic zone is currently being served via a 10-inch water line from the 16th Street Reservoirs. The required fire flow in this zone is driven by the middle school (3,500 gpm) and the commercial zone around Santa Ynez (2,500 gpm). As a result, the zone yields inadequate flow and high velocities. The south section of the hydro-pneumatic zone relies solely on the waterline from the 16th Street Reservoirs to distribute water. It is recommended to upgrade 600 ft of 10-inch waterline to 16-inch PVC in 16th Street, from the reservoirs to El Moro Avenue. Included in this upgrade is the replacement of the 345 ft of 6-inch waterline on El Moro, between 15th and 16th Street, to 12-inch PVC. These upgrades will start the "backbone" needed in the hydro-pneumatic zone. Refer to Figure 7-6 for a depiction of these improvements.



Capital Improvement Priorities Are Listed By Text Color

Priority 1:	RED
Priority 2:	GREEN
Priority 3:	BLUE

L.O.C.S.D.

Water System Master Plan

16th Street, El Moro & Santa Maria Upgrades

Figure 7-6

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16th Street and Santa Maria Upgrade

The 16th Street and Santa Maria Upgrade is comprised of two components as follows:

1. 16th Street is the main transmission line from the 16th Street Reservoirs to the main zone. The required fire flow in the main zone is driven by the elementary school (3,500 gpm) and the commercial zone (2,500 gpm) in the north west section of the LOCSD. The main zone is currently being served from the 16th Street Reservoirs by a 6-, 8- and 10-inch waterline. Refer to Figure 7-6 for a depiction of these improvements. To better serve the main zone, it is recommended to do the following:

    - Remove or abandon in place the 6-inch waterline, from 15th Street to 16th Street on Santa Maria,
    - upgrade 150 feet of 10-inch waterline, from the 16th Street Reservoirs to Santa Maria, to 16-inch PVC,
    - upgrade 950 feet of 10-inch waterline to 12-inch PVC on 16th Street, from Santa Maria to Santa Ysabel, and on Santa Ysabel, from 16th Street to 15th Street,
    - and upgrade 700 feet of 8-inch waterline to 12-inch PVC on Santa Maria, from 14th Street to 16th Street.

2. The hydraulic model indicated, under static conditions, areas adjacent to the 16th Street Reservoir, not currently being served in the hydro-pneumatic zone, were experiencing inadequate pressures due to higher elevations. To alleviate this problem, it is recommended to extend the hydro-pneumatic zone to include:
    - Upgrade of 250 feet of 10-inch waterline to 12-inch PVC on Santa Ysabel, from 14th Street to 16th Street,
    - 980 feet of new 8-inch PVC in Santa Maria Avenue, from 13th Street to 16th Street, and
    - 630 feet of new 8-inch PVC in 13th Street, from Santa Maria to Santa Ysabel.

9th and 10th Street Upgrades

Two locations within the system were recognized to be major corridors for water distribution to the elementary school. With minor improvements, an increase in flow to the school would be accomplished. It is recommended to replace 35 feet of 6-inch waterline to 12-inch PVC on 9th Street, at Santa Maria and 145 feet of 6-inch waterline to 12-inch PVC on 10th Street, at Santa Ysabel.

2^{nd} Street and Santa Ysabel Upgrade

Located in the northwest section of the LOCSD are several commercial properties requiring 2,500 gpm. These properties are currently being served via a 6-inch waterline, incapable of suppling the required fire flow. It is recommended to upgrade 940 feet of 6-inch waterline to 12-inch PVC on 2^{nd} Street, between Santa Ysabel to Santa Maria, and on Santa Ysabel, between 2^{nd} and 3^{rd} Street.

LOCSD/Cal-Cities Inter-Ties

As mentioned previously, the LOCSD and Cal-Cities water systems border each other. The two water purveyors currently share one inter-tie at the intersection of Los Olivos and 11^{th} Street. The inter-tie is only used for emergency purposes. At this time, LOCSD's hydraulic grade line is lower than Cal-Cities, requiring the LOCSD to boost water into the Cal-Cities distribution system. Upon completion of the hydro-pneumatic zone expansion, the hydraulic grade line of both distribution systems will be similar at this tie-in location. To benefit both the LOCSD and Cal-Cities it is recommended to construct a permanent inter-tie at this location, which would include a two-way meter and gate valves that would remain normally closed. In addition to this inter-tie, it is recommended to construct an additional inter-tie at Santa Ynez and Mountain View. In order for the LOCSD to make this connection, the inter-tie will require 660 feet of 8-inch PVC water main from Santa Ynez to Nipomo on Mountain View. Both inter-ties will provide an emergency connection to either water purveyor's distribution system, without having to boost the pressure to feed into the system. The LOCSD is capable of providing between 1,800 gpm and 2,600 gpm to the Cal-Cities distribution system and Cal-Cities is capable of providing between 2,300 gpm and 2,600 gpm to the LOCSD distribution system at each of the proposed inter-ties. This improvement provides both distribution systems with supply redundancy in case of an emergency.

Polybutylene Water Services

The District has a number of polybutylene water services throughout the service area. These services have proven to be unreliable, and District staff have experienced a number of breaks and leaks associated with these types of services. The District desires to implement a replacement program for such services. Quantifying the services will not be easy, as there is no existing information on specific accounts relating to type of water service. Replacement of such services should be with Schedule 80 PVC per District standards.

With the wastewater collection system being implemented in the near future, one way of quantifying polybutylene services may be during the construction of the wastewater collection system. As trenches are being dug on virtually every street, the Contractor(s) should "as-built" the conditions of the street and trench, and record every utility and utility service encountered. This would provide a substantial means of recording and documenting the services. Of course, with the sewer lines being installed at least 10 feet from the existing water mains, water services on one side of the street will be recorded. However, the findings of water services on one side of the street should be relatively indicative of the other side, assuming that development and installation of water services on both sides of the street occurred within the same time frame.

The following are considerations in regards to replacement of the polybutylene services:

- In conjunction with the wastewater collection system construction, have Contractors provide unit prices for water service replacements in their bid. Since the SRF Loan program does not consider change orders in the financing of the wastewater project, additional services provided by the Contractor during installation of the collection system should not have an impact on the wastewater system financing. However, the time schedule for the wastewater collection system may be an issue with the extra work.

- Replace the polybutylene services at the same time as any scheduled water main replacements or upgrades. Replacements should be conducted geographically and in clusters.

- For remaining polybutylene services, allot monies in the CIP for scheduled replacement of a certain number of services annually.

Another consideration was to pothole within specific tract areas, assuming that the Contractor for the development would have used similar type services throughout the tract development. Recent information from the District staff indicates that use of certain types of materials within the same development are not consistent. Thus, quantifying these services by potholing and correlation of these results to the entire tract development is not considered feasible.

For the purposes of the CIP, it was assumed that approximately 25 percent of the water services are polybutylene throughout the District service area. Thus, 700 service replacements are estimated in Chapter 8.

Seismic Upgrades to Palisades Well

With the Palisades Well providing over half of the entire LOCSD water supply, even with adequate emergency storage provisions, the water supply could be severely impacted by a major seismic event. It is always difficult and expensive to plan storage facilities for long-term catastrophic events. However, one consideration to ensure the reliability of the Palisades Well, besides emergency standby power, is to provide a means of safeguarding against a large main break between the Palisades Well and the distribution system. It is conceivable that the 10-inch water line on Palisades Avenue could rupture during a seismic event. Thus, a flanged riser with a manual isolation valve should be placed on the 10-inch line near the Palisades Well, and the "mating" flanged riser with manual isolation valve should be provided at the intersection of LOVR and Bush Drive. Thus, in the event of failure of this 10-inch line, the District staff could connect temporary above-ground piping from the well to the distribution system. A schematic portrayal of this improvement is shown on Figure 7-7.

Seismic Upgrades and Tank Coating/Repairs to Storage Tanks

As discussed in Chapter 4, the two 16th Street tanks, and the 10th Street tank, underwent inspections in March 2001. The physical inspections, and seismic/structural studies conducted, revealed a number of deficiencies to these tanks. The details of the tank repairs and retrofit requirements are included in Chapter 4 of this Report.

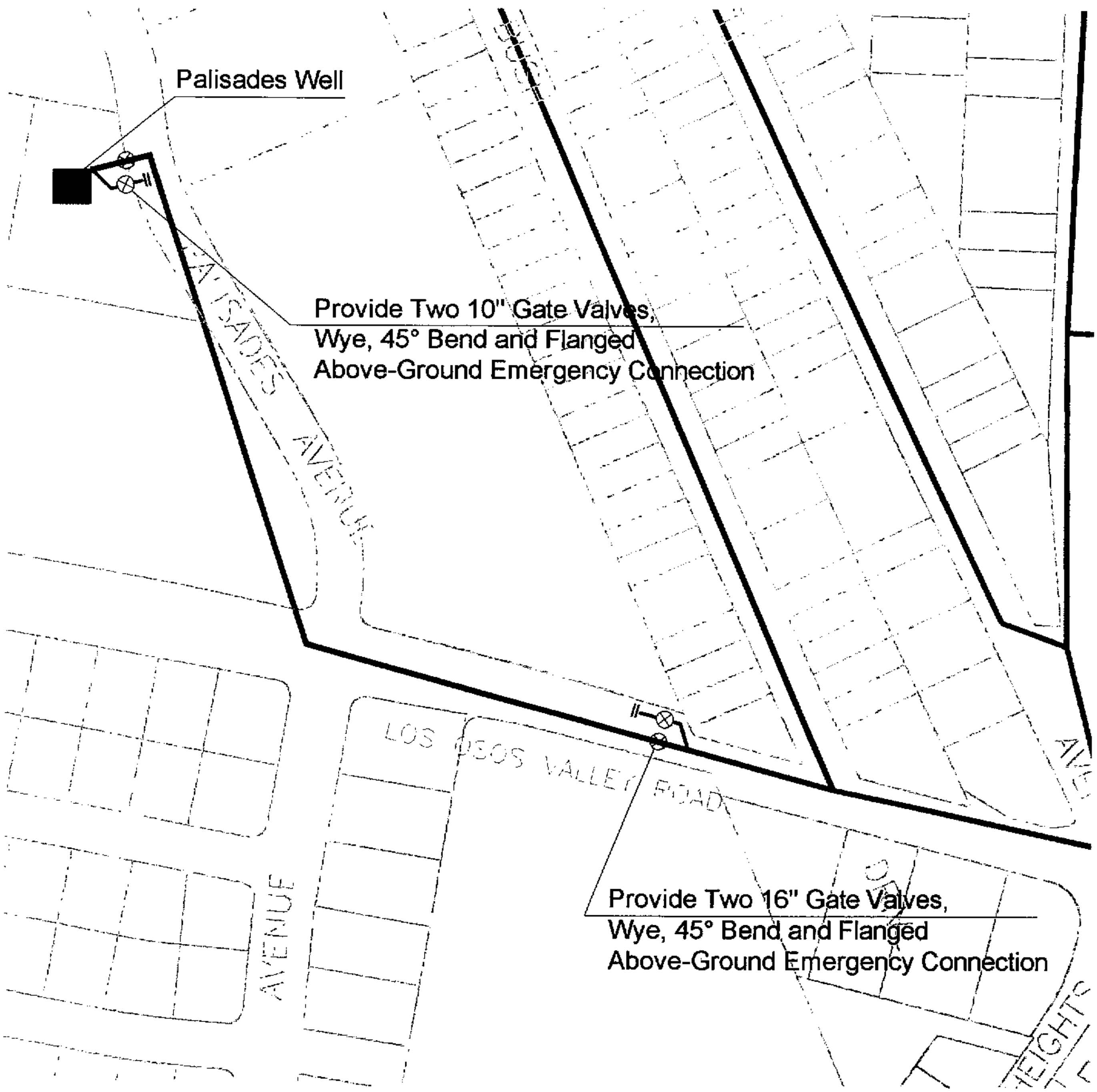
10th Street Tank. This tank is nearing 40 years of service. Overall, the tank is in fair condition; however, there is significant corrosion at the base of this tank, and the tank will require re-coating. Furthermore, some of the remaining coating materials on the tank are lead-based. The tank will require an anchoring system as part of the seismic retrofit to prevent sliding, and additional seismic upgrades will be required to safeguard against rupture during a seismic event. The estimated costs for the incidental repairs and patching of this tank is around $70,000, as budgeted in the LOCSD water fund. This cost does not include the seismic retrofit costs, nor the cost of re-coating the tank (estimated at $60,000).

In addition, due to the elevation differential between this tank and the 16th Street tanks, pumping from the 10th Street tank will still be required to maintain good circulation of water through the tank. Should there be sufficient room at the Highland site, it would be desirable to "transfer" this storage to the Highland tank site, and matching tank elevations with the 16th Street tanks. This work would need to be coordinated with the Highland tank project.

16th Street Tanks. The 16th Street tanks are also in good to fair condition, but will require a number of repairs to prevent continued tank corrosion. These tanks will also require additional investigations and implementation of seismic improvements to safeguard against sliding, and equipping the tanks with flexible connections and other seismic improvements to minimize the possibility of rupture between the tank and connecting appurtenances. The District has budgeted exterior and interior coating of both tanks, along with a number of other incidental repairs to the tanks.

SECOND PRIORITY CAPITAL IMPROVEMENTS

The second priority projects create a network of waterlines to adequately supply the required fire flow to all areas of the District. Currently, the distribution network is comprised mainly of 6-inch waterlines looped throughout the system. Although these waterlines are looped and do supply adequate fire flow to the residential zones, the water lines are incapable of suppling the fire flow needed at the elementary school and the commercial districts. The 6-inch waterlines also produce borderline velocities and high headlosses during residential fire



L.O.C.S.D.

Water System Master Plan

Emergency Connection Provisions

Figure 7-7

1" = 200'

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flow conditions. Listed below are projects that will upgrade these 6-inch waterlines to 12-inch PVC waterlines and will complete a "backbone" to both the main and hydro-pneumatic zones.

15th Street Upgrade

- Upgrade 1,330 feet of 6-inch waterline to 12-inch PVC in 15th Street, from El Moro to Pismo, in the hydro-pneumatic zone.

Pismo Avenue Upgrade

- Upgrade 670 feet of 6-inch waterline to 12-inch PVC in Pismo, from 14th Street to 16th Street in the hydro-pneumatic zone.

11th Street Upgrade

- Upgrade 330 feet of 4-inch waterline to 12-inch PVC in San Luis, from 11th Street to 12th Street, in the hydro-pneumatic zone.
- Upgrade 2,690 feet of 6- and 8-inch waterline to 12-inch PVC in 11th Street, from Ramona to Los Olivos, in the hydro-pneumatic zone.

14th Street Upgrade

- Upgrade 715 feet of 6-inch waterline to 12-inch PVC in 14th Street, from Santa Maria to El Moro, in the main zone.

El Moro Upgrade

- Install 670 feet of new 12-inch PVC waterline in El Moro, between 13th Street to 14th Street and 11th Street to 12th Street, in the main zone.
- Upgrade 330 feet of 6-inch waterline to 12-inch PVC in El Moro, from 12th Street to 13th Street, in the main zone.
- Upgrade 370 feet of 10-inch waterline to 12-inch PVC in El Moro, from 10th Street to 11th Street, in the main zone.
- Upgrade 990 feet of 10-inch waterline to 12-inch PVC in El Moro, between 8th Street and 10th Street and 3rd Street and 4th Street, in the main zone.
- Install 1,330 feet of new 12-inch PVC in El Moro, from 4th Street to 8th Street, in the main zone.

3rd Street and Pismo Upgrade

- Upgrade 1,670 feet of 6-inch waterline to 12-inch PVC in 3rd Street, from El Moro to Pismo, and in Pismo, from 3rd Street to 4th Street, in the main zone.

4th Street and Ramona Upgrade

- Upgrade 680 feet of 8-inch waterline to 12-inch PVC in 4th Street, from Pismo to Ramona, in the main zone.
- Upgrade 330 feet of 6-inch waterline to 12-inch PVC in Pismo, from 4th Street to 5th Street, in the main zone.

Ramona Upgrade

- Upgrade 970 feet of 6-inch waterline to 12-inch PVC in Pismo, between 6th Street to 8th Street and 9th Street and 10th Street, in the main zone.

Los Olivos Upgrade

- Upgrade 670 feet of 8-inch waterline to 12-inch PVC in Los Olivos, from 9th Street to 11th Street, in the hydro-pneumatic zone.

Upgrade/Replacement of Water Meters

Based on information provided by the District and the Urban Water Management Plan, there are 2,734 service connections and water meters in the LOCSD service area. The LOCSD desires to upgrade and replace all of the District's meters with state-of-the-art water meters. These meters will allow drive-by reading of the meters, increase billings and revenue by replacing older meters, and improve on the accuracy of meter readings and billings.

It is estimated that the entire change-out of meters will cost $1,148,280. This cost includes the cost of each meter replacement, and the radio equipment required to read the new meters. This cost is estimated at $300 per meter replacement. The meter reading could be accomplished in one to two man-days per month. It is also estimated that annual labor cost savings to read the meters will be $13,500, based on a savings of 7 man-days per month (total of 9 man-days [3 man-days with 3 operators] per month, minus 2 man-days to read the new meters) at $20/hour plus fringe benefits. The present worth of the annual meter reading costs, on a 20-year life cycle cost basis is $162,000, based on the assumption that inflation and salary increases are equal during this period. Meter replacement District-wide will be expensive. The incentives for streamlining labor efforts, and the improved revenues from new meters are desirable. However, the District must also consider the cost associated with a meter replacement program.

As District staff encounters faulty meters, they are being replaced with new Badger meters. These meters are compatible with the radio-read type meters, should the District decide to pursue these types of meters in the future.

Fire Hydrant Installations

This study identified 11 new fire hydrants that are needed to meet the LOCSD system fire hydrant spacing criteria noted previously in this Chapter. Of the 11 recommended fire hydrants, 6 are able to be installed in conjunction with another capital improvement project and therefore will not have an additional CIP expense. The installation of needed fire hydrants will improve fire fighting capabilities throughout the service area. Figure 7-8 depicts the locations of these future fire hydrants.

SCADA System Upgrade

The District's SCADA system will require upgrades to allow efficient and remote operation of the system. This will include status of all of the supply wells (including future water harvesting wells), storage tank levels, hydro-pneumatic system pump status, and other system parameters.

The planned wastewater treatment plant project will include a complete SCADA system for the wastewater treatment plant, leach field system and the water harvesting well system. It is recommended that the water system SCADA system design be addressed at the same time as the WWTP project.

THIRD PRIORITY CAPITAL IMPROVEMENTS

Nipomo Upgrade

Located in the southeast section of the LOCSD are several commercial properties requiring 2,500 gpm. These properties are currently being served by a 6-inch waterline incapable of supplying the required fire flow. It is recommended to replace 600 feet of 6-inch waterline to 12-inch PVC on Nipomo Avenue, from 12th and 14th Street.

15th Street, Ramona and 14th Street Upgrade

It is recommended to upgrade 1,000 feet of 6-inch waterline to 12-inch PVC in Ramona, from 14th Street to 15th Street and in 14th Street, from Ramona to San Luis. Within this project, it is also recommended to upgrade the 4-inch waterline (450 feet) to 8-inch PVC in 15th Street, from Ramona going south. The 4-inch waterline is a dead-end main, incapable of suppling the required fire flow (1,500 gpm) for the residential zone.

Ferrell and Bush Upgrade

Located at the end of the hydro-pneumatic zone is the development on Ferrell Avenue and Bush Drive. It is recommended to upgrade 1,555 feet of 6- and 8-inch waterline in Ferrell Avenue, from 9th Street going north and 1,355 feet of 8-inch waterline on Bush Drive to 12-inch PVC. This project will increase the flow, decrease the borderline velocities, and decrease the head loss through this development.

Dead-end Upgrades

Within a water distribution network, dead-end lines are not recommended. The lines have the potential for water quality problems and do not allow for good circulation as a looped system. Unfortunately, the LOCSD has several dead-end lines located near the bay which are unable to be looped. Therefore, the diameter of the waterline must be sized to serve the zone with velocities less than 5 fps and capable of the required fire flow. The following projects are included in this upgrade:

- Upgrade 255 feet of 6-inch waterline to 8-inch PVC in 1st Street, from Santa Maria going south.
- Upgrade 260 feet of 4-inch waterline to 8-inch PVC in 4th Street, from Santa Ysabel going north.
- Upgrade 400 feet of 6-inch waterline to 8-inch PVC in 5th Street, from Santa Ysabel going north.
- Upgrade 300 feet of 6-inch waterline to 8-inch PVC in 6th Street, from Santa Ysabel going north.
- Upgrade 260 feet of 4-inch waterline to 8-inch PVC in 7th Street, from Santa Ysabel going north.
- Upgrade 245 feet of 6-inch waterline to 8-inch PVC in 8th Street, from Santa Ysabel going north.
- Upgrade 325 feet of 6-inch waterline to 8-inch PVC in 9th Street, from Santa Ysabel going north.
- Upgrade 430 feet of 6-inch waterline to 8-inch PVC in 10th Street, from Santa Ysabel going north.
- Upgrade 185 feet of 4-inch waterline to 8-inch PVC in Santa Ynez, from 8th Street going west.
- Upgrade 430 feet of 6-inch waterline to 8-inch PVC in Ferrell, from the northern end going south.

12th Street and Santa Paula Upgrade

- Upgrade 490 feet of 4-inch waterline to 8-inch PVC in Santa Paula from 12th Street going west.
- Upgrade 330 feet of 4-inch waterline to 8-inch PVC in 12th Street, from Santa Paula going south.

14th Street Upgrade

- Upgrade 685 feet of 4-inch waterline to 8-inch PVC in 14th Street, from Santa Ysabel to Santa Paula.

Loop Upgrades

As mentioned previously, dead-end lines are not recommended in the system. The following are dead-end lines that can be looped:

- Install 315 feet of 12-inch PVC in Ramona Street, from 17th Street to 18th Street.
- Install 120 feet of 12-inch PVC in 18th Street, at Paso Robles Street.
- Install 325 feet of 8-inch PVC in South Bay Boulevard, south of Santa Ysabel Street.
- Install 460 feet of 12-inch PVC between 5th and 6th Street at San Luis Avenue.

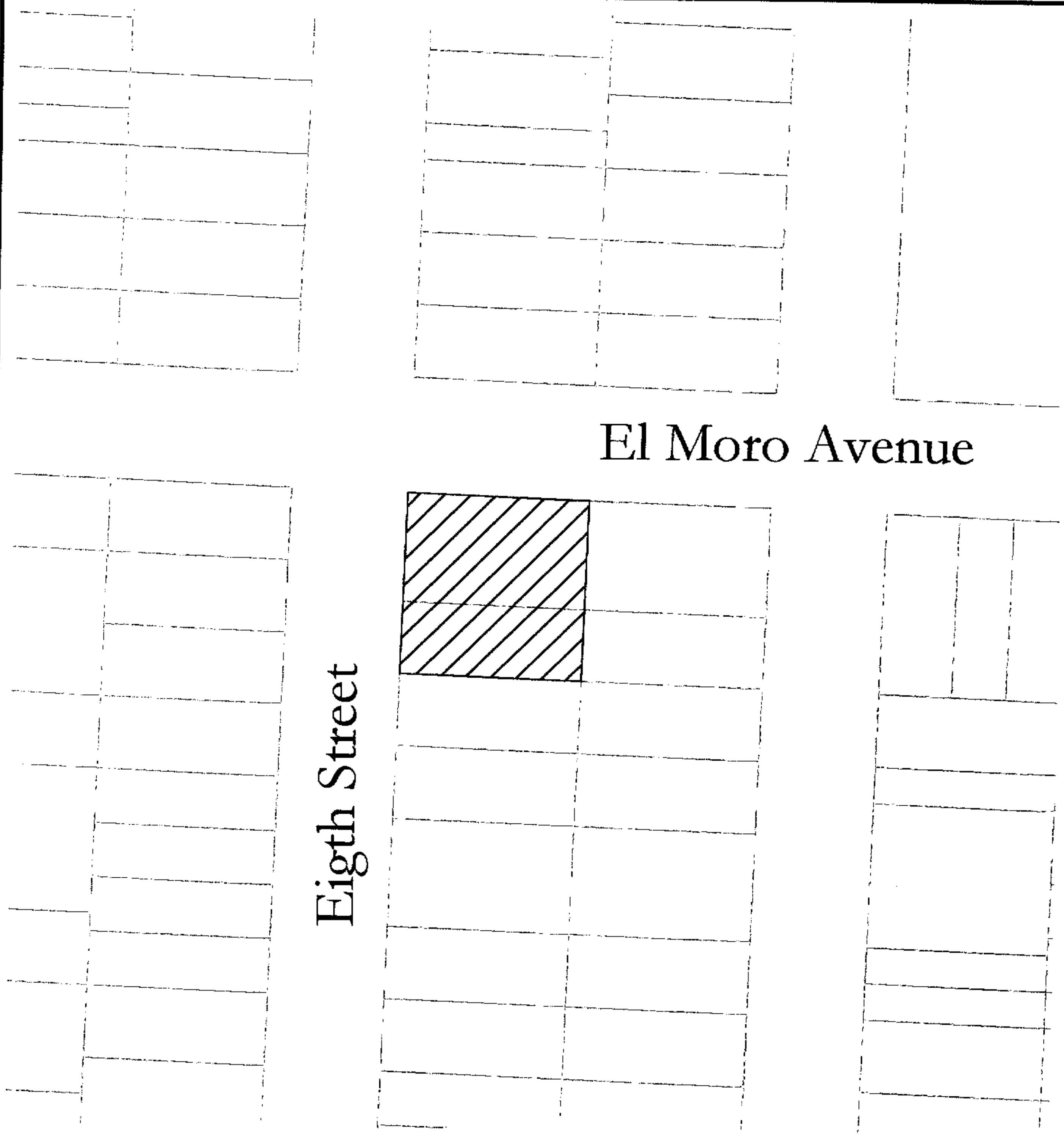
Valve Upgrades

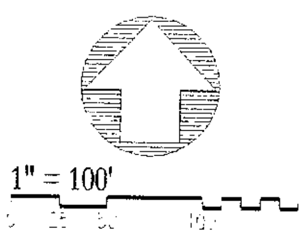
In order to meet the District's criteria for valve spacing for pipeline isolation, 129 new isolation valves were identified throughout the system. Figure 7-8 depicts the locations of these new valves. New valve installation should be scheduled with any scheduled main line replacement, or with a main line replacement in close proximity to a needed isolation valve. Other valve installations should be scheduled year-to-year until all needed valves are installed. The estimated number of new valves (129) does not include those valves that will be installed on upgraded pipelines in the future. It is assumed that isolation valves on new upgraded pipelines are included in the cost for the new pipeline. Since new valve installations are not as critical as up-sizing a main to improve hydraulics, or fire hydrant installations to improve public safety, the schedule for on-going valve installations should be performed on a third priority basis, and consider the following:

- Target valve installations on older pipelines, not scheduled to be replaced, which may run a higher probability of main breaks.
- Schedule valve installations prior to scheduled pavement projects.

FUTURE WATER OPERATIONS FACILITY

The Los Osos Community Services District currently operates the utility division from an operations yard located at 953 El Moro. The existing facilities are inadequate for staff to properly operate and maintain the existing facilities as well as conduct maintenance repairs on the existing equipment and use the facility for storage. In addition, the water division will be assuming additional duties due to the wastewater project which will include harvest well water blending and other miscellaneous activities. Therefore, the LOCSD has purchased additional property adjacent to the existing operations yard. Figure 7-9 shows the location of the two properties. A proposed water utility





L.O.C.S.D.

Water System Master Plan

Proposed Water Operations Facility

Figure 7-9

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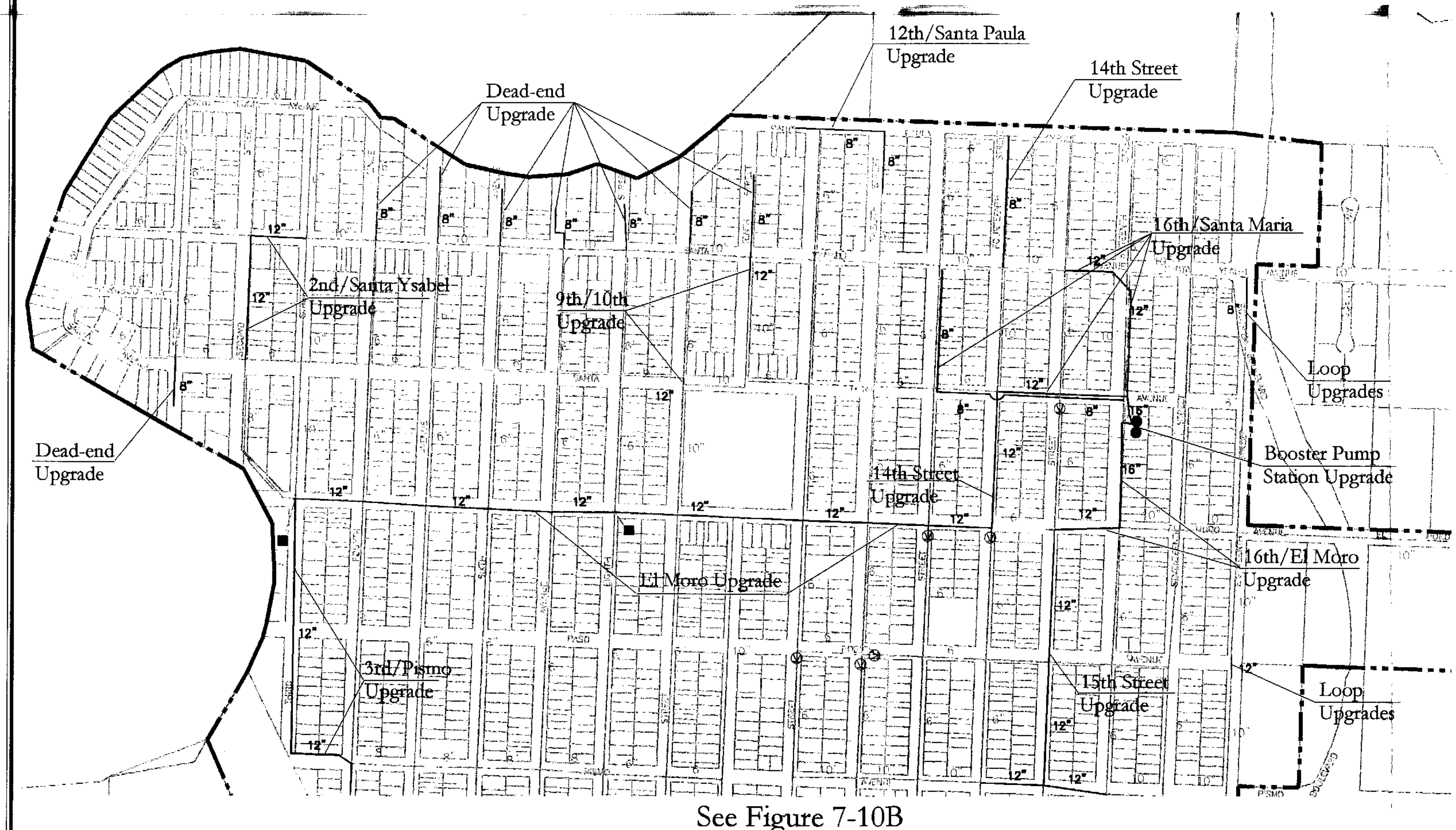
facility is proposed for the new site. The design and construction of the facility will be completed in two phases. The first phase is recommended to be completed as a first priority project. The project would include the administrative building and the well house for a total of 3,266 sf. The second phase is recommended to be completed as a second priority project. This project would include the maintenance shop and equipment storage building and the open bay vehicle storage for a total of 2,419 sf. The final water facilities yard will be a total of 5,685 sf. The future facility is sized to meet existing and future needs of the water operations division. The cost associated with this project was completed by Architect, David Fernandez of FZ Design.

FUTURE DISTRIBUTION SYSTEM

Figure 7-10 provides an overview of the water system capital improvements described herein. In general, the future system will meet or exceed the fire flow requirements. The figure shows the pressure reducing valves and gate valves for the hydro-pneumatic zone expansion, the recommended pipeline upgrades, and the proposed Highland tank location. Chapter 8 provides an overview of all recommendations and the estimated cost for each capital improvement.



L.O.C.S.D.

Legend:

LOCSD Water Service Area

Check Valve (Priority 1)

Capital Improvement Priorities Are Listed By Text Color

Priority 1: RED
Priority 2: GREEN
Priority 3: BLUE

Water System Master Plan

Figure 7-10A

Capital Improvements Plan

1" = 600'

0 150 300 600

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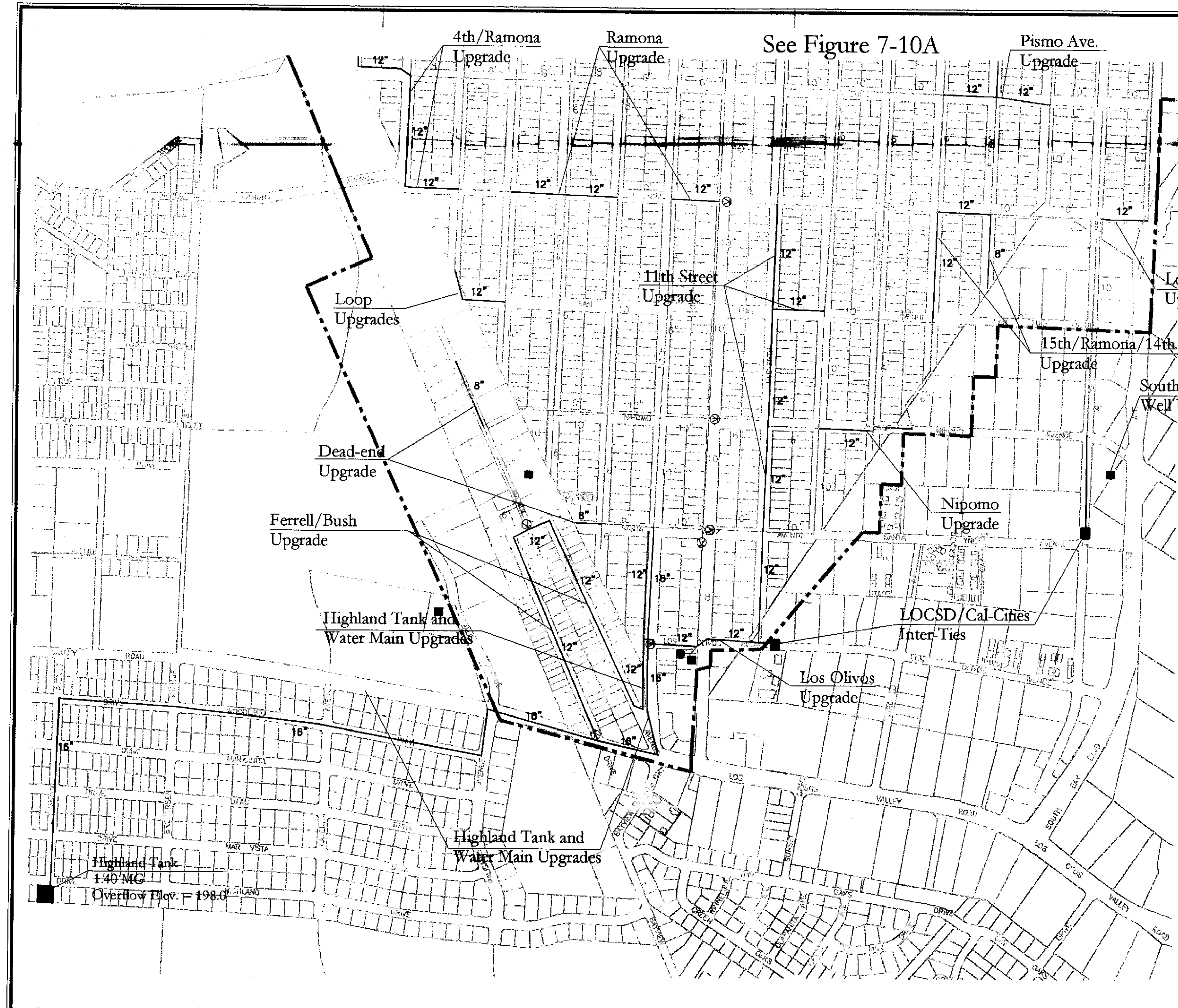

L.O.C.S.D.

Legend:

- LOCSD Water Service Area
- Check Valve or PRV (Priority 1)

Capital Improvement Priorities Are Listed By Text Color

Priority 1: RED
Priority 2: GREEN
Priority 3: BLUE

Water System Master Plan

Figure 7-10B

Capital Improvements Plan

1" = 600'
0 150 300 600

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CHAPTER 8

SUMMARY OF RECOMMENDATIONS AND CAPITAL IMPROVEMENT PROGRAM

This chapter summarizes the LOCSD recommended improvements to meet existing and future needs, and the capital improvement program to assist the LOCSD in the financial planning aspects of implementing the recommended improvements. The improvements are described as first, second and third priorities. The costs for these improvements are summarized in Tables 8-1, 8-2 and 8-3 at the end of this Chapter.

BASIS OF CAPITAL IMPROVEMENT PROGRAM COSTS

The capital improvement program (CIP) costs were developed based on engineering judgment, confirmed bid prices for similar work in the Central Coast area, consultation with vendors and contractors, established budgetary unit prices for the work, and other reliable sources. Hard construction costs are escalated by a factor of 1.4, to allow budget for preliminary engineering, engineering, administration, construction management and inspection costs. All CIP costs are expressed in Year 2001 dollars, using an ENR Construction Cost Index of **6288**, and will need to be escalated to the year or years scheduled for the work. The units costs for pipe upgrades include new water services, valves, and hydrants where required. The unit cost for new pipe includes only the proposed pipeline, valves, and appurtenant connections.

SUMMARY OF DISTRIBUTION SYSTEM IMPROVEMENTS

This section summarizes all of the capital improvements identified and listed throughout the report. These improvements are presented as first, second and third order priorities. The costs of these improvements were estimated as described in the above section, Basis of Capital Improvement Program Costs and are presented in Tables 8-1 through 8-3 located after this section.

First Priority

1-1. Highland Tank and Water Main Upgrades

- Construct 1.40 MG Highland Tank (or max volume feasible).
- Construct 6,600 feet of 16-inch water supply line from Highland Tank to Santa Ynez Avenue via the route described:
  - From the Highland tank, north on Alexander Avenue to Woodland Drive,
  - east on Woodland Drive to Palisades Avenue,
  - north on Palisades Avenue to LOVR,

  - east on LOVR to 9th Street,
  - north on 9th Street to Santa Ynez Avenue.
- Construct 85 feet of 12-inch waterline in Los Olivos at 9th Street.
- Construct 1,050 feet of 12-inch waterline in 9th Street from Ferrell Avenue to Santa Ynez Avenue

1-2. Hydro-pneumatic Zone Expansion

- Install 10 check valves and 3 PRVs at the locations indicated in Chapter 7.

The following upgrades listed below are under the assumption that the hydro-pneumatic zone has been extended.

1-3. South Bay Well Upgrade

- Upgrade Pump for new hydro-pneumatic zone expansion

1-4. Booster Pump Station Upgrade

- Variable frequency drive pumps.
- Standby generator.
- Pumps and generator in enclosed building.
- State-of-the-art controls and SCADA interfacing capability.
- Fire pump to meet 3,500 gpm school fire flow requirement.

1-5. 16th Street and El Moro Upgrade

- Upgrade 600 ft of 10-inch waterline in 16th Street to 16-inch PVC, from the 16th Street Tanks to El Moro Avenue.
- Upgrade 345 ft of 6-inch waterline on El Moro, between 15th and 16th Street, to 12-inch PVC.

1-6. 16th Street and Santa Maria Upgrade

- Remove or abandon in place the 6-inch waterline, from 15th Street to 16th Street on Santa Maria.
- Upgrade 150 feet of 10-inch waterline, from the 16th Street Reservoirs to Santa Maria, to 16-inch PVC.
- Upgrade 950 feet of 10-inch waterline to 12-inch PVC on 16th Street, from Santa Maria to Santa Ysabel, and on Santa Ysabel, from 16th Street to 15th Street.
- Upgrade 700 feet of 8-inch waterline to 12-inch PVC on Santa Maria, from 14th Street to 16th Street.
- Upgrade of 250 feet of 10-inch waterline to 12-inch PVC on Santa Ysabel, from 14th Street to 16th Street,

- Construct 980 feet of new 8-inch PVC in Santa Maria Avenue, from 13th Street to 16th Street,
- Construct 630 feet of new 8-inch PVC in 13th Street, from Santa Maria to Santa Ysabel.

1-7. 9th and 10th Street Upgrades

- Upgrade 35 feet of 6-inch waterline to 12-inch PVC on 9th Street, at Santa Maria
- Upgrade 145 feet of 6-inch waterline to 12-inch PVC on 10th Street at Santa Ysabel.

1-8. 2nd Street and Santa Ysabel Upgrade

- Upgrade 645 feet of 6-inch waterline to 12-inch PVC on 2nd Street, from Santa Ysabel to Santa Maria,
- Upgrade 295 feet of 6-inch waterline to 12-inch PVC on Santa Ysabel, between 2nd and 3rd Street.

1-9. Supplemental Water Supply Wells

- Construct two new wells that will provide a total of 1,000 gpm of well capacity to the District's system. These wells would not be extracting at the same time as the other wells, but would be considered stand-by and would be cycled along with the other wells. These new wells would allow demand (at build-out) to be met with the Palisades Well out of service. A third future well may be required, but should be deferred until future demands with water conservation can be confirmed.

1-10. LOCSD/Cal-Cities Inter-Ties

- Construct a new inter-tie connection at the existing Los Olivos and 11th Street inter-tie.
- Construct a new inter-tie at Santa Ynez and Mountain View.
- Construct 660 feet of 8-inch PVC on Mountain View, from Santa Ynez to Nipomo.

1-11. Replace Polybutylene Water Services

- Replace 700 polybutylene water services with Schedule 80 PVC water services. Such work should be scheduled following confirmation of locations of services (confirmation to be made during construction of sewage collection system).

1-12. Seismic Upgrades to Palisades Well

- Palisades Well. Equip 10-inch water line on Palisades Avenue and Bush Drive with valving and flanged risers for above-ground connection, to allow rapid shutdown of a ruptured transmission main (between Palisades Well and distribution system).

1-13. Seismic Upgrades and Tank Coating/Repairs to Storage Tanks

- 10th Street Tank. Provide further evaluation of the 10th Street tank, and the possibility of consolidating this storage at the Highland tank site. This would enhance system operations by eliminating the required pumps to pump water into the distribution system due to the low elevation of this tank. This would also alleviate the need to conduct seismic retrofits and tank re-coating work that will be costly.

- 16th Street Tanks. Conduct a seismic evaluation of these tanks to identify seismic deficiencies. Provide the tank re-coating and lining, as already budgeted in the District's capital budget, and implement the incidental repairs to the tanks as noted in the recent inspection reports. Recommended improvements as part of this study should then be included in Priority 1 capital improvements.

1-14. Water Operations Facility: Phase I

- Design and construct the first phase of the water operations facility at 953 El Moro. The new facility will include an administration building and a well house adequately sized to meet existing and future needs of the water operations division. The building will be 3,266 sf.

Second Priority

2-1. 15th Street Upgrade

- Upgrade 1,330 feet of 6-inch waterline to 12-inch PVC in 15th Street, from El Moro to Pismo, in the hydro-pneumatic zone.

2-2. Pismo Avenue Upgrade

- Upgrade 670 feet of 6-inch waterline to 12-inch PVC in Pismo, from 14th Street to 16th Street in the hydro-pneumatic zone.

2-3. 11th Street Upgrade

- Upgrade 330 feet of 4-inch waterline to 12-inch PVC in San Luis, from 11th Street to 12th Street, in the hydro-pneumatic zone.
- Upgrade 2,690 feet of 6- and 8-inch waterline to 12-inch PVC in 11th Street, from Ramona to Los Olivos, in the hydro-pneumatic zone.

2-4. 14th Street Upgrade

- Upgrade 715 feet of 6-inch waterline to 12-inch PVC in 14th Street, from Santa Maria to El Moro, in the main zone.

2-5. El Moro Upgrade

- Install 670 feet of new 12-inch PVC waterline in El Moro, between 13th Street to 14th Street and 11th Street to 12th Street, in the main zone.
- Upgrade 330 feet of 6-inch waterline to 12-inch PVC in El Moro, from 12th Street to 13th Street, in the main zone.
- Upgrade 370 feet of 10-inch waterline to 12-inch PVC in El Moro, from 10th Street to
- 11th Street, in the main zone.
- Upgrade 990 feet of 10-inch waterline to 12-inch PVC in El Moro, between 8th Street and 10th Street and 3rd Street and 4th Street, in the main zone.
- Install 1,330 feet of new 12-inch PVC in El Moro, from 4th Street to 8th Street, in the main zone.

2-6. 3rd Street and Pismo Upgrade

- Upgrade 1,670 feet of 6-inch waterline to 12-inch PVC in 3rd Street, from El Moro to Pismo, and in Pismo, from 3rd Street to 4th Street, in the main zone.

2-7. 4th Street and Ramona Upgrade

- Upgrade 680 feet of 8-inch waterline to 12-inch PVC in 4th Street, from Pismo to Ramona, in the main zone.
- Upgrade 330 feet of 6-inch waterline to 12-inch PVC in Pismo, from 4th Street to 5th Street, in the main zone.

2-8. Ramona Upgrade

- Upgrade 970 feet of 6-inch waterline to 12-inch PVC in Pismo, between 6th Street and 8th Street and between 9th Street and 10th Street, in the main zone.

2-9. Los Olivos Upgrade

- Upgrade 670 feet of 8-inch waterline to 12-inch PVC in Los Olivos, from 9th Street to 11th Street, in the hydro-pneumatic zone.

2-10. Water Meter Upgrades

- Upgrade 2,734 of the District's water meters with state-of-the-art water meters.

2-11. Fire Hydrant Installations

- Install 5 new fire hydrants throughout service area, to improve fire fighting capabilities throughout the LOCSD water service area.

2-12. SCADA System Upgrade

- In conjunction with the WWTP project, design and construct upgrade the SCADA system for the LOCSD water supply and distribution system.

2-13. Water Operations Facility: Phase II

- Design and construct the second phase of the water operations facility at 953 El Moro. The new facility will include the maintenance shop and equipment storage building and the open bay vehicle storage adequately sized to meet existing and future needs of the water operations division. The building will be 2,419 sf.

<u>Third Priority</u>

3-1. Nipomo Upgrade

- Replace 600 feet of 6-inch waterline to 12-inch PVC on Nipomo Avenue, from 12th and 14th Street.

3-2. 15th Street, Ramona and 14th Street Upgrade

- Upgrade 450 feet of 4-inch waterline to 8-inch PVC in 15th Street, from Ramona going south.
- Upgrade 1,000 feet of 6-inch waterline to 12-inch PVC in Ramona, from 14th Street to 15th Street and in 14th Street, from Ramona to San Luis.

3-3. Ferrell and Bush Street Upgrade

- Upgrade 1,555 feet of 6- and 8-inch waterline in Ferrell Avenue, from 9th Street going north to 12-inch PVC
- Upgrade 1,355 feet of 6-inch waterline on Bush Drive to 12-inch PVC.

3-4. Dead-end Upgrades

- Upgrade 255 feet of 6-inch waterline to 8-inch PVC in 1st Street, from Santa Maria going south.
- Upgrade 260 feet of 4-inch waterline to 8-inch PVC in 4th Street, from Santa Ysabel going north.
- Upgrade 400 feet of 6-inch waterline to 8-inch PVC in 5th Street, from Santa Ysabel going north.
- Upgrade 300 feet of 6-inch waterline to 8-inch PVC in 6th Street, from Santa Ysabel going north.
- Upgrade 260 feet of 4-inch waterline to 8-inch PVC in 7th Street, from Santa Ysabel going north.
- Upgrade 245 feet of 6-inch waterline to 8-inch PVC in 8th Street, from Santa Ysabel going north.
- Upgrade 325 feet of 6-inch waterline to 8-inch PVC in 9th Street, from Santa Ysabel going north.
- Upgrade 430 feet of 6-inch waterline to 8-inch PVC in 10th Street, from Santa Ysabel going north.
- Upgrade 185 feet of 4-inch waterline to 8-inch PVC in Santa Ynez, from 8th Street going west.
- Upgrade 430 feet of 6-inch waterline to 8-inch PVC in Ferrell, from the northern end going south.

3-5. 12th Street and Santa Paula Upgrade

- Upgrade 490 feet of 4-inch waterline to 8-inch PVC in Santa Paula from 12th Street going west.
- Upgrade 330 feet of 4-inch waterline to 8-inch PVC in 12th Street, from Santa Paula going south.

3-6. 14th Street Upgrade

- Upgrade 685 feet of 4-inch waterline to 8-inch PVC in 14th Street, from Santa Ysabel to Santa Paula.

3-7. Loop Upgrades

- Install 315 feet of 12-inch PVC in Ramona Street, from 17th Street to 18th Street.
- Install 120 feet of 12-inch PVC in 18th Street, at Paso Robles Street.
- Install 325 feet of 8-inch PVC in South Bay Boulevard, south of Santa Ysabel Street.
- Install 460 feet of 12-inch PVC between 5th and 6th Street at San Luis Avenue.

3-8. Valve Upgrade

- Install isolation valves in system where required to meet system criteria for shutoff/isolation. Note that these valve installations are on those pipelines not scheduled for replacement/upgrade. Valves on the new upgraded pipelines are included in the cost of the pipeline installation.

DEVELOPMENT IMPACT FEE

Table 8-4 shows the percentage of each CIP that benefits future development. A population-based percentage of 14.4% was assigned to projects where the scope and cost of the CIP was proportionally increased to accommodate build-out of the community. Given the advanced status of development within the service area, no improvement projects were identified that solely benefit future development. Based on the estimated number of future units within the LOCSD water service are (see Table 2-2), the present value of the proposed impact fee is as follows:

- Cost of improvement benefitting future development = $1,133,000
- Number of future units estimated in service area = 470
- Present value of impact fee (cost per single family unit) = $2,410
  (Capital costs divided by number of future units)

IMPLEMENTATION SCHEDULE - PRIORITY NO. 1 IMPROVEMENTS

Figure 8-1 displays an implementation schedule for the first priority capital improvements. Environmental review for all projects listed could be accomplished in a consolidated effort. In addition, rate modifications will be required in order to implement the listed projects (see Conceptual Financing Plan below). A detailed rate analysis will be performed following the preliminary design of the Baywood Tank and associated pipeline upgrades. Projects No. 2 and No. 3 are scheduled to be completed during the same month, since the proposed booster station will be sized to efficiently accommodate the expanded pressure zone.

Table 8-1
Capital Improvement Projects
First Priority

Project #	Title	Description	Zone	Quantity	Length (Ft)	Old Diameter (in)	New Diameter (in)	Street	Location	Construction Cost ($)		Subtotal ($)	Total Project Cost ($)*	Function
1	Highland/Water Main Upgrades	New 1.4MG Tank	Main	1.40				Highland Drive	Intersection of Highland Drive and Alexander Ave.	$1.25	MG	$1,750,000	$2,450,000	Supply Storage
		Upgrade Pipe	Main		4,070	6&10	16	LOVR & 9th	See Description in Chapter 8	$180.00	LF	$732,600	$1,025,640	Tie Tank to System
		New Pipe	Main		2,530		16	Alexander, Woodland & Palisades	See Description in Chapter 8	$130	LF	$328,900	$460,460	Tie Tank to System
												Main Zone Subtotal	**$3,936,100**	
		New Pipe	Upper		85		12	Los Olivos	At 9th	$100	LF	$8,500	$11,900	Supply to Low Pressure Area
		New Pipe	Upper		1,050		12	9th	From Ferrell to Santa Ynez	$100	LF	$105,000	$147,000	Supply to Low Pressure Area
												Upper Zone Subtotal	**$158,900**	
												Highland/Water Main Upgrades Total	**$4,095,000**	
2	Hydro-pneumatic Zone Expansion	Check Valves	Upper	10						$1,200	EA	$12,000	$16,800	Extend Upper Zone
		PRV	Upper	3						$30,000	EA	$90,000	$126,000	Extend Upper Zone
												Hydro-pneumatic Zone Expansion Total	**$142,800**	
3	South Bay Well Upgrade	Upgrade Pumps for Hydro-pneumatic Expansion	Upper	1						$20,000	LS	$20,000	$28,000	Match hydraulic grade on new hydro-pneumatic zone
												South Bay Well Upgrade Total	**$28,000**	
4	Booster Pump Station Upgrade	Upgrade Pumps for Hydro-pneumatic Expansion	Upper	1						$500,000	LS	$500,000	$700,000	
												Booster Pump Station Upgrade Total	**$700,000**	
5	16th/El Moro Upgrade	Upgrade Pipe	Upper		600	10	16	16th	From Pump to El Moro	$180	LF	$108,000	$151,200	Adequate Distribution Line From Tank
		Upgrade Pipe	Upper		345	6	12	El Moro	From 15th to 16th	$150	LF	$51,750	$72,450	Adequate Distribution Line From Tank
												16th/El Moro Upgrade Total	**$223,650**	
6	16th/Santa Maria Upgrade	Upgrade Pipe	Main		150	10	16	16th	From Tank to Santa Maria	$180	LF	$27,000	$37,800	Adequate Distribution Line From Tank
		Upgrade Pipe	Main		950	10	12	16th	From Santa Maria to Santa Ysabel	$150	LF	$142,500	$199,500	Adequate Distribution Line From Tank
		Upgrade Pipe	Main		700	8	12	Santa Maria	From 14th to 16th	$150	LF	$105,000	$147,000	Adequate Distribution Line From Tank
		Upgrade Pipe	Upper		250	10	12	Santa Ysabel	From 15th to 16th	$150	LF	$37,500	$52,500	Adequate Distribution Line From Tank
		New Pipe	Upper		980		8	Santa Maria	From 13th to 16th	$90	LF	$88,200	$123,480	Supply to Low Pressure Area
		New Pipe	Upper		630		8	13th	Ysabel	$90	LF	$56,700	$79,380	Supply to Low Pressure Area
												16th/Santa Maria Upgrade Total	**$639,660**	

Table 8-1
Capital Improvement Projects
First Priority

Project #	Title	Description	Zone	Quantity	Length (Ft)	Old Diameter (in)	New Diameter (in)	Street	Location	Construction Cost ($)		Subtotal ($)	Total Project Cost ($)*	Function
7	9th and 10th Street Upgrades	Upgrade Pipe	Main		35	6	12	9th	From Santa Maria to 10" pipeline	$150	LF	$5,250	$7,350	Distribution Loop in Main Zone
		Upgrade Pipe	Main		145	6	12	10th	From Santa Ysabel going South	$150	LF	$21,750	$30,450	Distribution Loop in Main Zone
		9th and 10th Street Upgrades Total											$37,800	
8	2nd/Santa Ysabel Upgrade	Upgrade Pipe	Main		645	6	12	2nd	From Santa Ysabel to Santa Maria	$150	LF	$96,750	$135,450	Fire Flow to Commercial Zone
		Upgrade Pipe	Main		295	6	12	Santa Ysabel	From 2nd to 3rd	$150	LF	$44,250	$61,950	Fire Flow to Commercial Zone
		2nd/Santa Ysabel Upgrade Total											$197,400	
9	Supplemental Water Wells	Two New Wells Totaling 1,000 gpm	Main	2						$200,000	EA	$400,000	$560,000	Offset Future Water Supply Deficit
		Supplemental Water Wells Total											$560,000	
10	LOCSD/Cal-Cities Inter-Ties	Upgrade Existing Inter-tie	Upper	1				Los Olivos	At Los Olivos and 11th Street	$30,000	EA	$30,000	$42,000	Emergency Connection
		New Inter-tie connection	Upper	1				Mountain View	At Mountain View and Santa Ynez	$30,000	EA	$30,000	$42,000	Emergency Connection
		New Pipe	Upper		660		8	Mountain View	From Santa Ynez to Nipomo	$90	LF	$59,400	$83,160	Emergency Connection
		LOCSD/Cal-Cities Inter-Ties Total											$167,160	
11	Polybutylene Water Services	Replace Water Services	Both	700						$500	EA	$350,000	$490,000	
		Polybutylene Water Services Total											$490,000	
12	Seismic Upgrade to Palisades Well	Seismic Upgrade	Main	1						$15,000	LS	$15,000	$21,000	
		Seismic Upgrade to Palisades Well Total											$21,000	
13	Seismic Upgrades and Tank Coating/Repairs to Storage Tanks	Seismic Evaluation and Engineering	Both	1						$20,000	LS	$20,000	$28,000	
		Seismic Upgrades and Tank Coating/Repairs to Storage Tanks Total											$28,000	
14	Water Operations Facility: Phase I	New 3,266 sf Water Operations Facility	Both	1						$463,400	LS	$463,400	$648,760	
		Water Operations Facility Total											$648,760	
		Total											$7,979,230	

* Total includes construction cost plus preliminary engineering, design engineering, administration construction management and inspection costs

Table 8-2
Capital Improvement Projects
Second Priority

Project #	Title	Description	Zone	Quantity	Length (Ft)	Old Diameter (in)	New Diameter (in)	Street	Location	Construction Cost ($)		Subtotal ($)	Total Project Cost ($)*	Function
1	**15th Street Upgrade**	Upgrade Pipe	Upper		1,330	6	12	15th	From El Moro to Pismo	$150	LF	$199,500	$279,300	Distribution Loop in Upper Zone
										15th Street Upgrade Total			**$279,300**	
2	**Pismo Ave. Upgrade**	Upgrade Pipe	Upper		670	6	12	Pismo	From 14th to 16th	$150	LF	$100,500	$140,700	Distribution Loop in Upper Zone
										Pismo Ave. Upgrade Total			**$140,700**	
3	**11th Street Upgrade**	Upgrade Pipe	Upper		330	4	12	San Luis	From 11th to 12th	$150	LF	$49,500	$69,300	Distribution Loop in Upper Zone
		Upgrade Pipe	Upper		2,010	6	12	11th	From Ramona to Santa Ynez	$150	LF	$301,500	$422,100	Distribution Loop in Upper Zone
		Upgrade Pipe	Upper		680	8	12	11th	From Santa Ynez to Los Olivos	$150	LF	$102,000	$142,800	Distribution Loop in Upper Zone
										11th Street Upgrade Total			**$634,200**	
4	**14th Street Upgrade**	Upgrade Pipe	Main		715	6	12	14th	From Santa Maria to El Moro	$150	LF	$107,250	$150,150	Distribution Loop in Main Zone/School FF
										14th Street Upgrade Total			**$150,150**	
5	**El Moro Upgrade**	New Pipe	Main		330		12	El Moro	From 13th to 14th	$100	LF	$33,000	$46,200	Distribution Loop in Main Zone/School FF
		New Pipe	Main		340		12	El Moro	From 11th to 12th	$100	LF	$34,000	$47,600	Distribution Loop in Main Zone/School FF
		Upgrade Pipe	Main		330	6	12	El Moro	From 12th to 13th	$150	LF	$49,500	$69,300	Distribution Loop in Main Zone/School FF
		Upgrade Pipe	Main		370	10	12	El Moro	From 10th to 11th	$150	LF	$55,500	$77,700	Distribution Loop in Main Zone/School FF
		Upgrade Pipe	Main		630	10	12	El Moro	From 8th to 10th	$150	LF	$94,500	$132,300	Distribution Loop in Main Zone
		Upgrade Pipe	Main		360	10	12	El Moro	From 3rd to 4th	$150	LF	$54,000	$75,600	Distribution Loop in Main Zone
		New Pipe	Main		1,330		12	El Moro	From 4th to 8th	$100	LF	$133,000	$186,200	Distribution Loop in Main Zone
										El Moro Upgrade Total			**$634,900**	
6	**3rd/Pismo Upgrade**	Upgrade Pipe	Main		1,330	6	12	3rd	From El Moro to Pismo	$150	LF	$199,500	$279,300	Distribution Loop in Main Zone
		Upgrade Pipe	Main		340	6	12	Pismo	From 3rd to 4th	$150	LF	$51,000	$71,400	Distribution Loop in Main Zone
										3rd/Pismo Upgrade Total			**$350,700**	
7	**4th/Ramona Upgrade**	Upgrade Pipe	Main		680	8	12	4th	From Pismo to Ramona	$150	LF	$102,000	$142,800	Distribution Loop in Main Zone
		Upgrade Pipe	Main		330	6	12	Ramona	From	$150	LF	$49,500	$69,300	
										4th/Ramona Upgrade Total			**$212,100**	
8	**Ramona Upgrade**	Upgrade Pipe	Main		670	6	12	Ramona	From 6th to 8th	$150	LF	$100,500	$140,700	Distribution Loop in Main Zone
		Upgrade Pipe	Main		300	6	12	Ramona	From 9th to 10th	$150	LF	$45,000	$63,000	Distribution Loop in Main Zone
										Ramona Upgrade Total			**$203,700**	
9	**Los Olivos Upgrade**	Upgrade Pipe	Upper		670	8	12	Los Olivos	From 9th to 11th	$150	LF	$100,500	$140,700	Distribution Loop in Upper Zone
										Los Olivos Upgrade Total			**$140,700**	

Table 8-2
Capital Improvement Projects
Second Priority

Project #	Title	Description	Zone	Quantity	Length (Ft)	Old Diameter (in)	New Diameter (in)	Street	Location	Construction Cost ($)		Subtotal ($)	Total Project Cost ($)*	Function
10	**Water Meter Upgrades**		Both	2,734						$300	EA	$820,200	$1,148,280	Replace Meters and Upgrade to Radio Control
												Water Meter Upgrade Total	**$1,148,280**	
11	**Fire Hydrant Installation**	New Fire Hydrants	Both	5						$3,500	EA	$17,500	$24,500	Fire Hydrants in compliance with Fire Code Standards
												Fire Hydrant Installation Total	**$24,500**	
12	**SCADA System Upgrade**	Design/Construction of SCADA System	Both	1						$150,000	LS	$150,000	$210,000	
												SCADA System Upgrade Total	**$210,000**	
13	**Water Operations Facility: Phase II**	New 2,419 sf Water Operations Facility	Both	1						$402,190	LS	$402,190	$563,066	
												Water Operations Facility Total	**$563,066**	
												Total	**$4,740,330**	

*** Total includes construction cost plus preliminary engineering, design engineering, administration construction management and inspection costs**

Table 8-3
Capital Improvement Projects
Third Priority

Project #	Title	Description	Zone	Quantity	Length (Ft)	Old Diameter (in)	New Diameter (in)	Street	Location	Construction Cost ($)		Subtotal ($)	Total Project Cost ($)	Function
1	Nipomo Upgrade	Upgrade Pipe	Upper		600	6	12	Nipomo	From 12th to 14th	$150	LF	$90,000	$126,000	Upgrade for adequate FF to Commercial and RMF
												Nipomo Upgrade Total	$126,000	
2	15th/Ramona/14th Upgrade	Upgrade Pipe	Upper		450	4	8	15th	From Ramona going South	$130	LF	$58,500	$81,900	Replace 4" lines for FF
		Upgrade Pipe	Upper		1,000	6	12	Ramona	From 14th to 15th	$150	LF	$150,000	$210,000	Distribution Loop in Upper Zone
												15th/Ramona/14th Upgrade Total	$291,900	
3	Ferrell/Bush St. Upgrade	Upgrade Pipe	Upper		1,555	6&8	12	Ferrell	From 9th Street going north	$150	LF	$233,250	$326,550	Distribution Loop in Upper Zone
		Upgrade Pipe	Upper		1,355	8	12	Bush	From LOVR to Ferrell	$150	LF	$203,250	$284,550	Distribution Loop in Upper Zone
												Ferrell/Bush St. Upgrade Total	$611,100	
4	Dead-end Upgrade	Upgrade Pipe	Main		255	6	8	1st	South of Santa Maria	$130	LF	$33,150	$46,410	Upgrade Dead-end Lines for FF
		Upgrade Pipe	Main		260	4	8	4th	From Santa Ysabel going North	$130	LF	$33,800	$47,320	Upgrade Dead-end Lines for FF
		Upgrade Pipe	Main		400	6	8	5th	North of Santa Ysabel	$130	LF	$52,000	$72,800	Upgrade Dead-end Lines for FF
		Upgrade Pipe	Main		300	6	8	6th	North of Santa Ysabel	$130	LF	$39,000	$54,600	Upgrade Dead-end Lines for FF
		Upgrade Pipe	Main		260	4	8	7th	From Santa Ysabel going North	$130	LF	$33,800	$47,320	Upgrade Dead-end Lines for FF
		Upgrade Pipe	Main		245	6	8	8th	North of Santa Ysabel	$130	LF	$31,850	$44,590	Upgrade Dead-end Lines for FF
		Upgrade Pipe	Main		325	6	8	9th	North of Santa Ysabel	$130	LF	$42,250	$59,150	Upgrade Dead-end Lines for FF
		Upgrade Pipe	Main		430	6	8	10th	North of Santa Ysabel	$130	LF	$55,900	$78,260	Upgrade Dead-end Lines for FF
		Upgrade Pipe	Main		185	4	8	Santa Ynez	From 8th going West	$130	LF	$24,050	$33,670	Upgrade Dead-end Lines for FF
		Upgrade Pipe	Main		430	6	8	Ferrell	From northend going south	$130	LF	$55,900	$78,260	Upgrade Dead-end Lines for FF
												Dead-end Upgrade Total	$562,380	
5	12th/Santa Paula Upgrade	Upgrade Pipe	Main		490	4	8	Santa Paula	From 12th Street going west	$130	LF	$63,700	$89,180	Replace 4" lines for FF
		Upgrade Pipe	Main		330	4	8	12th	From Santa Paula going south.	$130	LF	$42,900	$60,060	Replace 4" lines for FF
												12th/Santa Paula Upgrade Total	$149,240	
6	14th Street Upgrade	Upgrade Pipe	Main		685	4	8	14th	From Santa Ysabel to Santa Paula.	$130	LF	$89,050	$124,670	Replace 4" lines for FF
												14th Street Upgrade Total	$124,670	

Table 8-3
Capital Improvement Projects
Third Priority

Project #	Title	Description	Zone	Quantity	Length (Ft)	Old Diameter (in)	New Diameter (in)	Street	Location	Construction Cost ($)		Subtotal ($)	Total Project Cost ($)	Function
7	**Loop Upgrades**	New Pipe	Upper		315		12	Ramona	From 17th to 18th	$100	LF	$31,500	$44,100	Distribution Loop in Upper Zone
		New Pipe	Upper		120		12	18th	At Paso Robles	$100	LF	$12,000	$16,800	Distribution Loop in Upper Zone
		New Pipe	Upper		325		8	South Bay Blvd	South of Santa Ysabel	$90	LF	$29,250	$40,950	Distribution Loop in Upper Zone
		New Pipe	Main		460		12	San Luis	Between 5th and 6th Street	$100	LF	$46,000	$64,400	Distribution Loop in Main Zone
												Loop Upgrades Total	**$166,250**	
8	**Valve Upgrades**	Upgrade Valves	Both	129						$1,800	EA	$232,200	$325,080	Isolate Intersections
												Valve Upgrade Total	**$325,080**	
												Total	**$1,745,520**	

*** Total includes construction cost plus preliminary engineering, design engineering, administration construction management and inspection costs**

Figure 8-1
Implementation Schedule for Priority No. 1 Improvements

Project / Task Name	Duration (Months)
1. Highland Tank and Water Main Upgrades	
Preliminary design and survey	3
Environmental review (all Phase 1 CIP's)	10
Easement / land acquisition	6
Final design and permitting	8
Bidding / award / notice to proceed	3
Construction	9
Rate Study (after prelim design)	2
Process rate adjustment	5
2. and 3. Hydropneumatic zone expansion / South Bay Well Upgrade	
Preliminary design and survey	2
Final design and permitting	2
Bidding / award / notice to proceed	2
Construction	2
4. Booster Pump Station Upgrade	
Preliminary design and survey	2
Final design and permitting	4
Bidding / award / notice to proceed	3
Construction	4
5. 16th / El Moro Upgrade	
Preliminary design and survey	1
Final design and permitting	2
Bidding / award / notice to proceed	2
Construction	2
6. 16th / Santa Maria Upgrade	
Preliminary design and survey	2
Final design and permitting	3
Bidding / award / notice to proceed	3
Construction	3
7. 9th/10th Street Upgrades	
Preliminary design and survey	1
Final design and permitting	1
Bidding / award / notice to proceed	2
Construction	1
8. 2nd / Santa Ysable Upgrade	
Preliminary design and survey	2
Final design and permitting	3
Bidding / award / notice to proceed	3
Construction	3
9. Supplemental Water Wells	
Hydrogeology study and testing	2
Preliminary design and survey	1
Final design and permitting	2
Bidding / award / notice to proceed	2
Construction	3
10. LOCSD/Cal-Cities Inter-Ties	
Preliminary design and survey	1
Final design and permitting	2
Bidding / award / notice to proceed	2
Construction	2

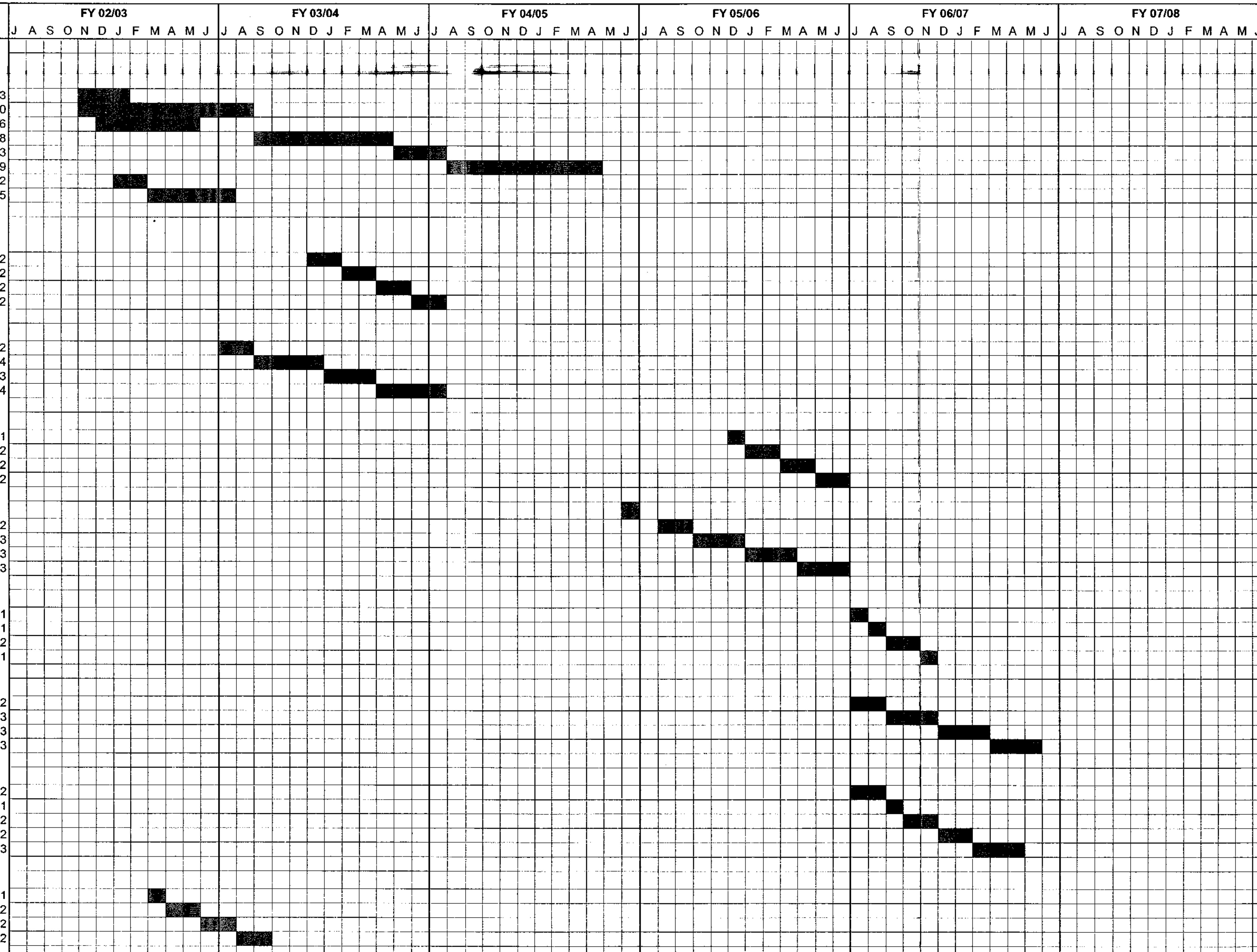

Figure 8-1
Implementation Schedule for Priority No. 1 Improvements

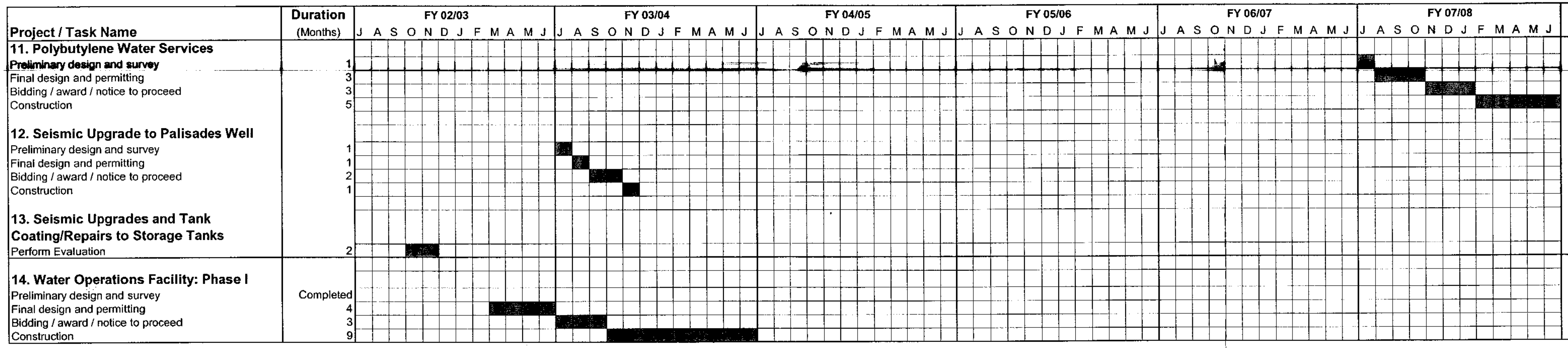

Table 8-4
Capital Improvement Development Impact Fees

	Project	Total ($)	User Impact (%)	User Impact ($)
First Priority				
1-1	Highland/Water Main Upgrades - Main Zone	$3,936,100	14.40%	$566,798
1-1	Highland/Water Main Upgrades - Upper Zone	$158,900	0.00%	$0
1-2	Hydro-pneumatic Zone Expansion	$142,800	14.40%	$20,563
1-3	South Bay Well Upgrade	$28,000	14.40%	$4,032
1-4	Booster Pump Station Upgrade	$700,000	14.40%	$100,800
1-5	16th/El Moro Upgrade	$223,650	14.40%	$32,206
1-6	16th/Santa Maria Upgrade	$639,660	14.40%	$92,111
1-7	9th and 10th Street Upgrades	$37,800	0.00%	$0
1-8	2nd/Santa Ysabel Upgrade	$197,400	0.00%	$0
1-9	Supplemental Water Wells	$560,000	14.40%	$80,640
1-10	LOCSD/Cal-Cities Inter-Ties	$167,160	14.40%	$24,071
1-11	Polybutylene Water Services	$490,000	0.00%	$0
1-12	Seismic Upgrade to Palisades Well	$21,000	14.40%	$3,024
1-13	Seismic Upgrades and Tank Coating/Repairs to Storage Tanks	$28,000	0.00%	$0
1-14	Water Operations Facility: Phase I	$648,760	14.40%	$93,421
Second Priority				
2-1	15th Street Upgrade	$279,300	0.00%	$0
2-2	Pismo Ave. Upgrade	$140,700	0.00%	$0
2-3	11th Street Upgrade	$634,200	0.00%	$0
2-4	14th Street Upgrade	$150,150	0.00%	$0
2-5	El Moro Upgrade	$634,900	0.00%	$0
2-6	3rd/Pismo Upgrade	$350,700	0.00%	$0
2-7	4th/Ramona Upgrade	$212,100	0.00%	$0
2-8	Ramona Upgrade	$203,700	0.00%	$0
2-9	Los Olivos Upgrade	$140,700	0.00%	$0
2-10	Water Meter Upgrade	$1,148,280	0.00%	$0
2-11	Fire Hydrant Installation	$24,500	14.40%	$3,528
2-12	SCADA System Upgrade	$210,000	14.40%	$30,240
2-13	Water Operations Facility: Phase II	$563,066	14.40%	$81,082
Third Priority				
3-1	Nipomo Upgrade	$126,000	0.00%	$0
3-2	15th/Ramona/14th Upgrade	$291,900	0.00%	$0
3-3	Ferrell/Bush St. Upgrade	$611,100	0.00%	$0
3-4	Dead-end Upgrade	$562,380	0.00%	$0
3-5	12th/Santa Paula Upgrade	$149,240	0.00%	$0
3-6	14th Street Upgrade	$124,670	0.00%	$0
3-7	Loop Upgrades	$166,250	0.00%	$0
3-8	Valve Upgrade	$325,080	0.00%	$0
			Total	**$1,132,516**

CONCEPTUAL FINANCING PLAN

Following the implementation of a pending rate increase, the LOCSD water service area will operate with an estimated annual revenue base of $708,000. This revenue will not accommodate the direct implementation or financing of significant capital improvements for the system. In addition, when compared with the magnitude of the Priority No. 1 Capital Improvements, impact fees are not expected to provide an adequate revenue source. The District has applied for $10,000,000 in low interest loans from the California Infrastructure and Economic Development Bank (CIEDB). This cost represents the maximum loan amount that can be awarded through the program. The District's preliminary application has been reviewed and approved by the CIEDB staff and it appears likely that the funding will be obtained. Five conceptual financing alternatives have been identified which include water rate increases of varying magnitude. These alternatives (A through E) are included at the end of this chapter. Each alternative assumes that the District will utilize low interest loan funds to the extent possible and will issue Certificates of Participation (COP's) or an equivalent financing instrument to finance any remaining balance. Table 8-5 displays each of the alternatives:

Table 8-5. Summary of Conceptual Financing Alternatives

Alternative	Proposed Capital Improvements	Total CIP Cost[1]	Implementation Period (years)	Water Rate Increase
A	Project No. 1 - Highland Tank and related improvements	$4,095,000	5	**31%**
B	Project No.'s 1, 2, 3, and 4	$4,965,800	5	**39%**
C	All Priority No. 1 Projects	$7,979,230	5	**66%**
D	All Priority No. 1 & 2 Projects	$12,719,560	10	**137%**
E	All Priority No. 1, 2, and 3 Projects	$14,465,080	10	**174%**

Notes:
1. Total CIP Cost reported in Year 2001 dollars. Water rate calculations include an inflationary adjustment factor.
2. COP annual debt estimated based on a 20-year term with a 7% interest rate.
3. Annual revenues are assumed to include impact fees in the amount of $45,000 per year for the five year plans and $87,000 per year for the 10-year plans.

LOCSD Water Master Plan
Conceptual Financing Alternatives

Alternative A
Implement Priority 1 - Highland Tank and Related Improvements

Assumptions:
1. CSIB loan would be repaid over 30 years with an interest rate of 3.50%
2. A 10% reserve factor will be required for the CSIB annual payment
3. Over the five year period average connection fees will be $45,000 per year.
4. The mid point of construction multiplier will be 1.07
5. The COP funding will be repaid over 20 years with an interest rate of 7.00%
6. The financing costs associated with COP's will be 15%.
7. Current water rate base is $620,000, 13.4% increase proposed
   Future rate base after proposed increase = $708,000
8. LOCSD reserve funds would not be used for capital projects

Project Cost	$4,095,000
Inflation factor	1.07
Future project cost	$4,381,650
LOCSD Reserve Funds	$0
COP Funding:	$0
COP Interest Rate	7.00%
COP Period	20.00 years
COP Financing Cost Factor	1.15
COP Financed project cost	$0
COP Annual Payment	$0
CSIB Funding	$4,381,650
CSIB Interest Rate	3.50%
CSIB Period	30.00 years
CSIB Annual P&I	$238,236
CSIB Reserve Factor	1.10
CSIB Annual Amount	$262,060
COP Payment + CSIB Annual	$262,060
Connection fee revenues	$45,000
Required revenue increase	$217,060
Current rate base	$708,000
Percent Increase	**30.7%**

LOCSD Water Master Plan
Conceptual Financing Alternatives

Alternative B
Implement Projects 1, 2, 3, and 4 (Priority 1)

Assumptions:
1. CSIB loan would be repaid over 30 years with an interest rate of 3.50%
2. A 10% reserve factor will be required for the CSIB annual payment
3. Over the five year period average connection fees will be $45,000 per year.
4. The mid point of construction multiplier will be 1.07
5. The COP funding will be repaid over 20 years with an interest rate of 7.00%
6. The financing costs associated with COP's will be 15%.
7. Current water rate base is $620,000, 13.4% increase proposed
   Future rate base after proposed increase = $708,000
8. LOCSD reserve funds would not be used for capital projects

Project Cost	$4,965,800	
Inflation factor	1.07	
Future project cost	$5,313,406	
LOCSD Reserve Funds	$0	
COP Funding:	$0	
COP Interest Rate	7.00%	
COP Period	20.00	years
COP Financing Cost Factor	1.15	
COP Financed project cost	$0	
COP Annual Payment	$0	
CSIB Funding	$5,313,406	
CSIB Interest Rate	3.50%	
CSIB Period	30.00	years
CSIB Annual P&I	$288,897	
CSIB Reserve Factor	1.10	
CSIB Annual Amount	$317,787	
COP Payment + CSIB Annual	$317,787	
Connection fee revenues	$45,000	
Required revenue increase	$272,787	
Current rate base	$708,000	
Percent Increase	**38.5%**	

LOCSD Water Master Plan
Conceptual Financing Alternatives

Alternative C
Implement Priority 1 Projects

Assumptions:
1. CSIB loan would be repaid over 30 years with an interest rate of 3.50%
2. A 10% reserve factor will be required for the CSIB annual payment
3. Over the five year period average connection fees will be $45,000 per year.
4. The mid point of construction multiplier will be 1.07
5. The COP funding will be repaid over 20 years with an interest rate of 7.00%
6. The financing costs associated with COP's will be 15%.
7. Current water rate base is $620,000, 13.4% increase proposed
   Future rate base after proposed increase = $708,000
8. LOCSD reserve funds would not be used for capital projects

Project Cost	$7,979,230	
Inflation factor	1.07	
Future project cost	$8,537,776	
LOCSD Reserve Funds	$0	
COP Funding:	$0	
COP Interest Rate	7.00%	
COP Period	20.00	years
COP Financing Cost Factor	1.15	
COP Financed project cost	$0	
COP Annual Payment	$0	
CSIB Funding	$8,537,776	
CSIB Interest Rate	3.50%	
CSIB Period	30.00	years
CSIB Annual P&I	$464,210	
CSIB Reserve Factor	1.10	
CSIB Annual Amount	$510,631	
COP Payment + CSIB Annual	$510,631	
Connection fee revenues	$45,000	
Required revenue increase	$465,631	
Current rate base	$708,000	
Percent Increase	**65.8%**	

LOCSD Water Master Plan
Conceptual Financing Alternatives

Alternative D
Implement Priority 1 and 2 Projects over 10 years

Assumptions:
1. CSIB loan would be repaid over 30 years with an interest rate of 3.50%
2. A 10% reserve factor will be required for the CSIB annual payment
3. Over the ten year period average connection fees will be $87,000 per year.
4. The mid point of construction multiplier will be 1.12
5. The COP funding will be repaid over 20 years with an interest rate of 7.00%
6. The financing costs associated with COP's will be 15%.
7. Current water rate base is $620,000, 13.4% increase proposed
   Future rate base after proposed increase = $708,000
8. LOCSD reserve funds would not be used for capital projects

Project Cost	$12,719,560	
Inflation factor	1.12	
Future project cost	$14,245,907	
LOCSD Reserve Funds	$0	
COP Funding:	$4,245,907	
COP Interest Rate	7.00%	
COP Period	20.00	years
COP Financing Cost Factor	1.15	
COP Financed project cost	$4,882,793	
COP Annual Payment	$460,901	
CSIB Funding	$10,000,000	
CSIB Interest Rate	3.50%	
CSIB Period	30.00	years
CSIB Annual P&I	$543,713	
CSIB Reserve Factor	1.10	
CSIB Annual Amount	$598,085	
COP Payment + CSIB Annual	$1,058,986	
Connection fee revenues	$87,000	
Required revenue increase	$971,986	
Current rate base	$708,000	
Percent Increase	**137.3%**	

LOCSD Water Master Plan
Conceptual Financing Alternatives

Alternative E
Implement Priority 1, 2, and 3 Projects over 10 years

Assumptions:
1. CSIB loan would be repaid over 30 years with an interest rate of 3.50%
2. A 10% reserve factor will be required for the CSIB annual payment
3. Over the ten year period average connection fees will be $87,000 per year.
4. The mid point of construction multiplier will be 1.15
5. The COP funding will be repaid over 20 years with an interest rate of 7.00%
6. The financing costs associated with COP's will be 15%.
7. Current water rate base is $620,000, 13.4% increase proposed
   Future rate base after proposed increase = $708,000
8. LOCSD reserve funds would not be used for capital projects

Project Cost	$14,465,080	
Inflation factor	1.15	
Future project cost	$16,634,842	
LOCSD Reserve Funds	$0	
COP Funding:	$6,634,842	
COP Interest Rate	7.00%	
COP Period	20.00	years
COP Financing Cost Factor	1.15	
COP Financed project cost	$7,630,068	
COP Annual Payment	$720,224	
CSIB Funding	$10,000,000	
CSIB Interest Rate	3.50%	
CSIB Period	30.00	years
CSIB Annual P&I	$543,713	
CSIB Reserve Factor	1.10	
CSIB Annual Amount	$598,085	
COP Payment + CSIB Annual	$1,318,309	
Connection fee revenues	$87,000	
Required revenue increase	$1,231,309	
Current rate base	$708,000	
Percent Increase	**173.9%**	

Appendix A
References

APPENDIX A
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Appendix B
Safe Yield Analysis of the Los Osos Valley Ground Water Basin

APPENDIX B

to the
LOS OSOS COMMUNITY SERVICES DISTRICT
WATER MASTER PLAN

SAFE YIELD ANALYSIS
of the
LOS OSOS VALLEY GROUND WATER BASIN

Prepared for

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July 2002

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TABLE OF CONTENTS

INTRODUCTION

The basin safe yield is essentially the average quantity of water that can be pumped from the ground water basin every year without causing water supply or water quality problems. This yield value, typically reported in acre-feet per year, is useful for planning purposes and for ground water basin management. Results of the safe yield analysis of the Los Osos Valley ground water basin is presented herein for both current conditions and for a management scenario that incorporates the proposed community wastewater project.

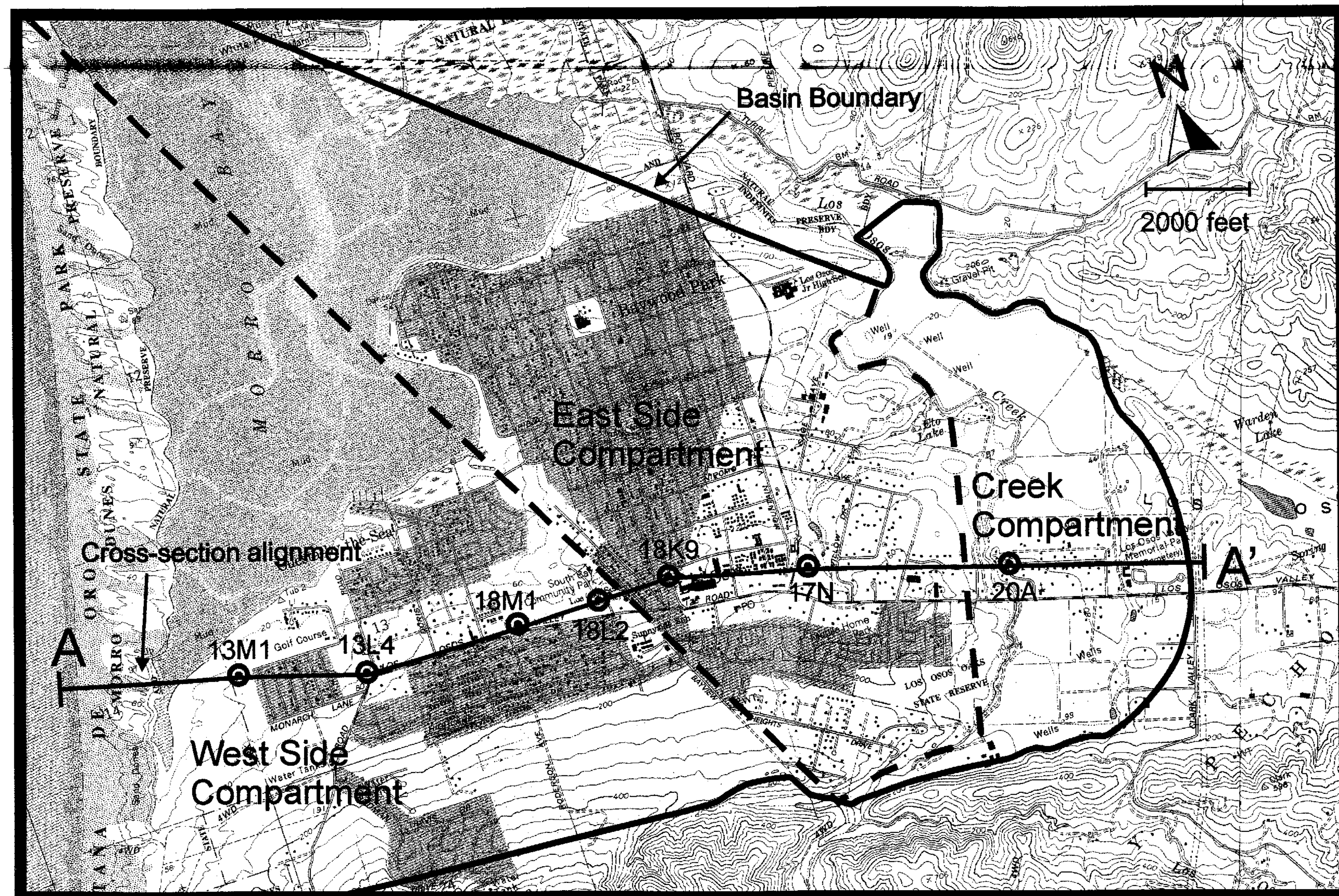
The Los Osos Valley ground water basin covers approximately 10 square miles, of which approximately 3.3 square miles overlie the bay and sand spit, and 6.7 square miles overlie Los Osos, Baywood Park, and the Los Osos Creek valley. The basin also extends offshore, although large portions of the aquifers are filled with sea water. For practical purposes, the offshore aquifers do not contribute to the basin yield and are excluded from basin modeling efforts. The onshore boundaries of the ground water basin and the basin compartments are shown in Figure 1.

The ground water basin is bounded by non-water bearing rocks on the north, east, and south. On the west, the basin is bounded by the sea water/fresh water interface. The structure of the basin is roughly a synclinal trough, with an east-west axis that is plunging to the west. Dip slopes at the edges of the basin reach approximately 4 degrees (7 percent). The basin is bisected by an inferred southeast-northwest trending fault splay associated with the Los Osos fault zone. Sediments forming the basin include dune sands, the Paso Robles Formation, and the Careaga Formation.

For the purpose of basin yield analysis and modeling, the Los Osos Valley ground water basin has been divided into two vertically discrete aquifers, the upper aquifer (shallow zone), and the lower aquifer (middle zone and deep zone). The basin is comprised of three compartments; 1) West side, 2) East side, and 3) Los Osos Creek. The relationship between these compartments is shown graphically in Figure 1 and in basin cross-section A-A' (Figure 2).

BASIN SAFE YIELD

The basin yield was evaluated in 1989 by the Department of Water Resources (DWR, Geohydrology and Management of Los Osos Valley Ground Water Basin, July 1989). The DWR study relied heavily on a ground water basin model developed by the U. S. Geological Survey (U.S.G.S., 1988, Hydrogeology and Water Resources of the Los Osos Valley Ground-Water Basin, Water Resources Investigations Report 88-4081). The U.S.G.S. model was subsequently revised by URS and Team Engineering, who released the results as two separate reports. A brief review of these efforts with respect to basin yield is presented below.



Base map: USGS Topographic Map, Morro Bay South, 1994

Map Scale: 1 inch = 2,000 feet

⦿ Well location

Figure 1

Los Osos Valley
Ground Water Basin

Cleath & Associates

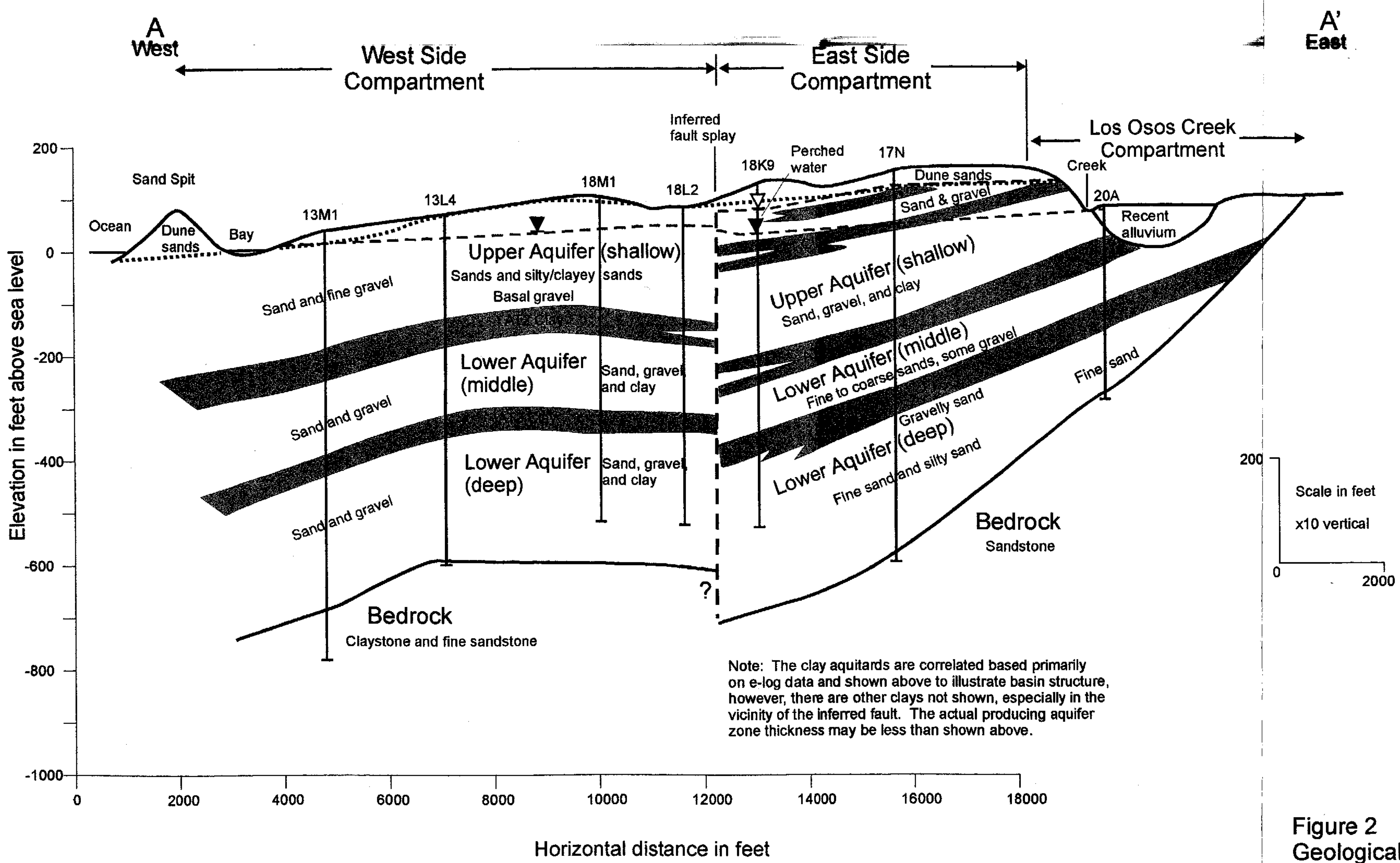


Figure 2
Geological Cross-Section A-A'
Generalized Basin Structure

Cleath & Associates

1989 DWR Study

In the DWR study, the basin yield (long-term sustainable yield) was defined as the amount of water that could be extracted without the average water level in all three layers of the aquifer in the western part of the basin dropping below sea level. This definition stems from the assumptions that the first problem to arise from basin overdraft would be sea water intrusion, and that water levels below sea level on the west side would result in sea water intrusion.

The DWR/U.S.G.S. methodology in determining basin yield was to input hydrologic budget items for 1970-77 and for 1986 into a ground water flow model (model calibration) and to simulate water level response to various basin management scenarios. These scenarios included variations in wastewater disposal and options for importing water. The water levels in the three model layers were simulated for each scenario, and the results summarized in Table 11, page 43 of the DWR study. Out of the seven management alternatives, three did not consider importing water, and two of those (Alternatives 1 and 4) did not consider exporting wastewater. These two DWR alternatives simulate no change in wastewater disposal from the current septic tanks (Alternative 1) and disposal of treated wastewater at proposed sites (Alternative 4). Except for a variation in the proposed disposal sites, these two alternatives are essentially the same as those identified for assessment in the Water Master Plan.

The basin yield estimates in the DWR report were 2,200 acre-feet per year for Alternative 1, and 4,200 acre-feet per year for Alternative 4. The additional 2,000 acre-feet gain in basin yield between Alternative 1 and 4 was based on disposal of an average 2,340 acre-feet per year (2.1 mgd) of treated wastewater at the Broderson site south of Highland Avenue. Average annual basin-wide production for both alternatives was set at 5,110 afy, including 3,920 afy purveyor production, 980 afy agricultural production, and 210 afy private domestic production.

2000 URS Corporation Study

As mentioned above, the DWR analysis relied heavily on a U.S.G.S. ground water flow model of the basin. This flow model did not incorporate an inferred fault splay that separates the west side of the basin from the east side (The Morro Group, 1989, Supplemental EIR - CSA 9 Wastewater Treatment Facilities). The inferred fault splay, referred to as Strand B of the Los Osos fault, is interpreted as a restriction to ground water flow, based on differences in water level hydrographs on either side of the lineament (EDA and The Morro Group, 1997, Preliminary Engineering Evaluation, Los Osos/Baywood Park Community Drainage Project). The subsequent major revision of the U.S.G.S. model by URS and Team Engineering did incorporate the Strand B ground water barrier, along with rotating the orientation of the model grid to more closely parallel the inferred principal groundwater flow directions in the basin.

URS modeled several Management Scenarios which reportedly showed that seawater intrusion would not be likely to occur in any layer. Assuming sea water intrusion is the first indicator of overdraft, then the basin was reportedly not in overdraft for these Scenarios. The Management Scenario report includes a table of recommended pumpage for the purveyors that totals 3,150 afy.

Basin Yield - Current Conditions

The basin yield under current conditions can be estimated by analytical methods as well as modeling methods. Estimating the basin yield using both analytical and modeling methods gives a greater assurance as to the reliability of the basin yield estimates.

<u>Analytical Methods</u>

The safe yield of a ground water basin is almost always estimated by using the hydrologic balance equation, in one form or another. The hydrologic balance equation, in its simplest form, is basin inflow - basin outflow = change in basin storage. If more water enters the ground water basin than exits the basin over a period of time, the average water level in the basin will rise in proportion to the extra volume of water it is storing. Conversely, when more water leaves the basin than comes in, the average water level in the basin will drop.

The key to determining safe yield with the hydrologic balance equation is to identify how the elements of inflow and outflow will affect each other as ground water extractions increase over time. Typically, with the onset of development and increased ground water production in a basin, recharge from stream seepage will increase, subsurface ground water inflow from adjacent formations will increase, percolation of precipitation will increase (through concentration of runoff from hardscapes), subsurface outflow will decrease, evapotranspiration will decrease, and surface outflow will decrease, all in response to water level declines. After a period of years, unless the basin is being overdrafted, elements of recharge and discharge from the basin will reach dynamic equilibrium, and water levels will be stable over the normal seasonal fluctuations and drought/wet cycles. With a new phase of basin development, the process is repeated. The hydrologic equation can balance over a wide range of inflows and outflows, all of which produce dynamic equilibrium (stable average water levels). The safe yield is the amount of basin production that results in a dynamic equilibrium close to, but not exceeding, the threshold for avoiding problems in the basin. The main concern with pumping in the Los Osos Valley ground water basin is the potential for sea water intrusion. Maintaining water levels at or above sea level near the bay is recommended to avoid landward migration of sea water.

The approach used herein to determine the current basin yield is to focus on what is known, and to adapt the hydrologic equation to fit the available information. The two most reliable and extensive data sets available include water levels and production. Water levels and production records have been collected basin-wide since the 1970's. Records for individual well production are available for the LOCSD system since 1978, and for the CCW system since 1986. Total water system production is available for the LOCSD, CCW, and S&T Mutual systems beginning in 1970. These records, along with precipitation, allow the dynamic relationship between water levels and production to be evaluated directly, without having to itemize the entire hydrologic budget.

As previously mentioned, the basin has been divided into three compartments, the West side compartment, the East side compartment, and the Los Osos Creek compartment (Figure1). The West side and East side compartments also have shallow and deep aquifers. These three compartments have been selected based on the hydrogeologic framework of the basin and the yields of each are estimated separately. The hydrographs of wells within each compartment have distinct patterns that also support the divisions.

The West side and East side compartments are separated by the inferred Strand B of the Los Osos fault zone. This fault is inferred based on surface features (springs, vegetation) and changes in shallow ground water levels across the lineament (The Morro Group). The division between the East side compartment and the Los Osos Creek compartment is based on hydrograph differences. To the west side of the compartment dividing line, the characteristic rising water levels of the shallow East side are seen in hydrographs. On the east, the creek compartment hydrographs for wells show a completely different pattern, with wide fluctuations associated with seasonal recharge and agricultural pumping (see attached representative basin hydrographs). The yield of each compartment is estimated below.

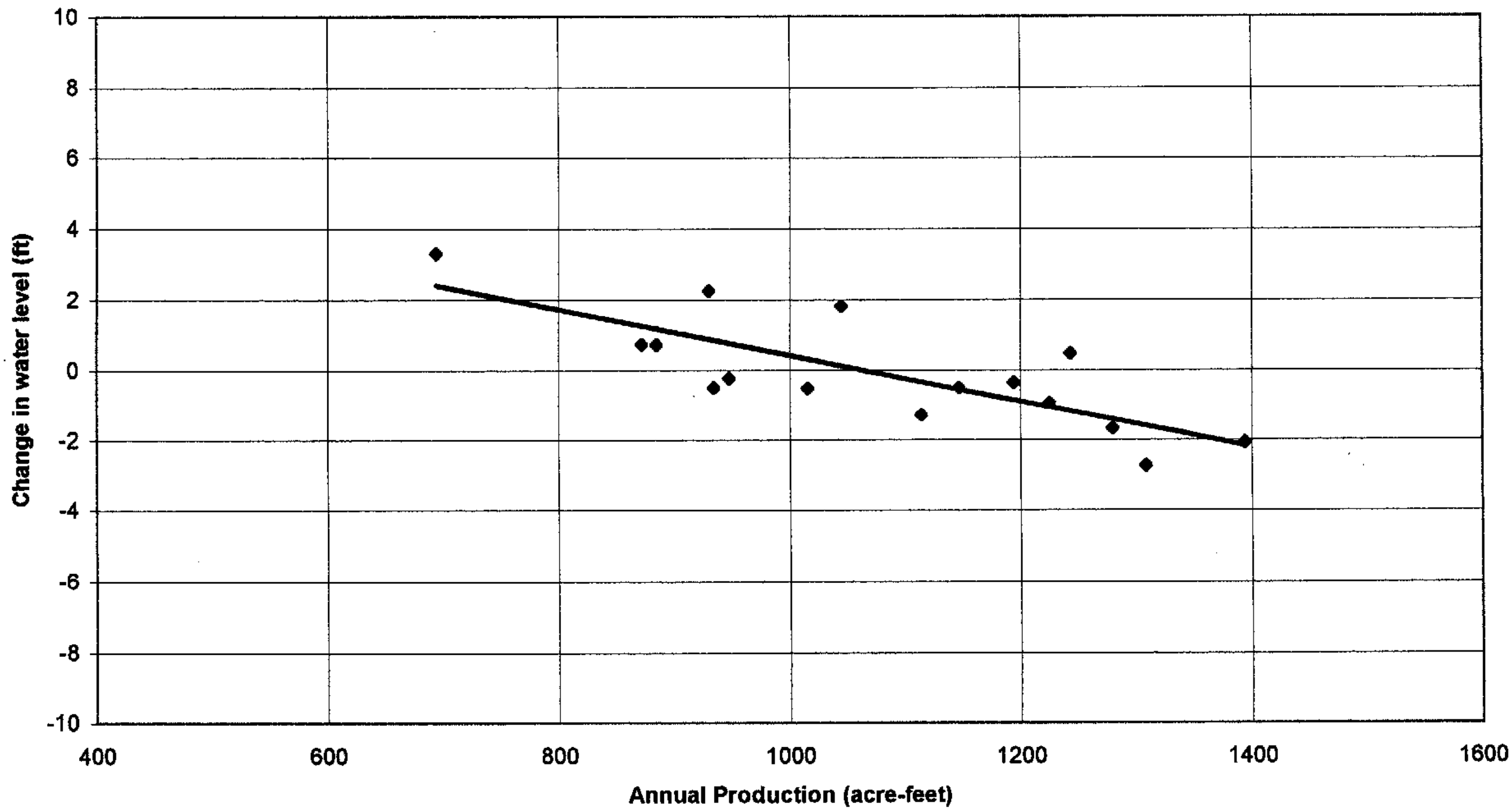
Basin Compartment #1: West side.

The methodology used to evaluate the yield of basin compartment #1 is the Hill Method, developed by R. A. Hill for ground water investigations in Arizona and Southern California (Todd, 1959). The Hill Method compares the annual production to the annual change in ground water level. When the method assumptions are satisfied, data from individual years will plot along a straight line. The safe yield of the basin reportedly lies at the intercept of the fitted straight line with the zero change in water elevation. This zero change in water level would represent a point of equilibrium between the elements of recharge and discharge. The assumptions in the Hill Method are that the water supply to the basin is reasonably constant and should approximate the long-term mean supply.

Unfortunately, whether or not the particular point of equilibrium determined by the Hill method is actually the safe yield is questionable, since it only represents the point of equilibrium over the period of record and under the historical range of ground water extractions. Should the ground water extractions be increased over the same period (representing the long-term mean supply) the equilibrium point may increase as well due to dynamic adjustment in the basin.

Nevertheless, the Hill Method is a useful starting point for evaluating yield values. A plot of annual production versus average change in fall-to-fall water level is shown in Figure 3 for the water years 1982 through 1997 at deep aquifer well 30S/11E-13P02 (hydrograph attached). The water level data were plotted using a 5-year moving average to smooth out annual variations in

Figure 3
Deep Aquifer - West
30S/11E-13P02
Hill Method 1982-1997



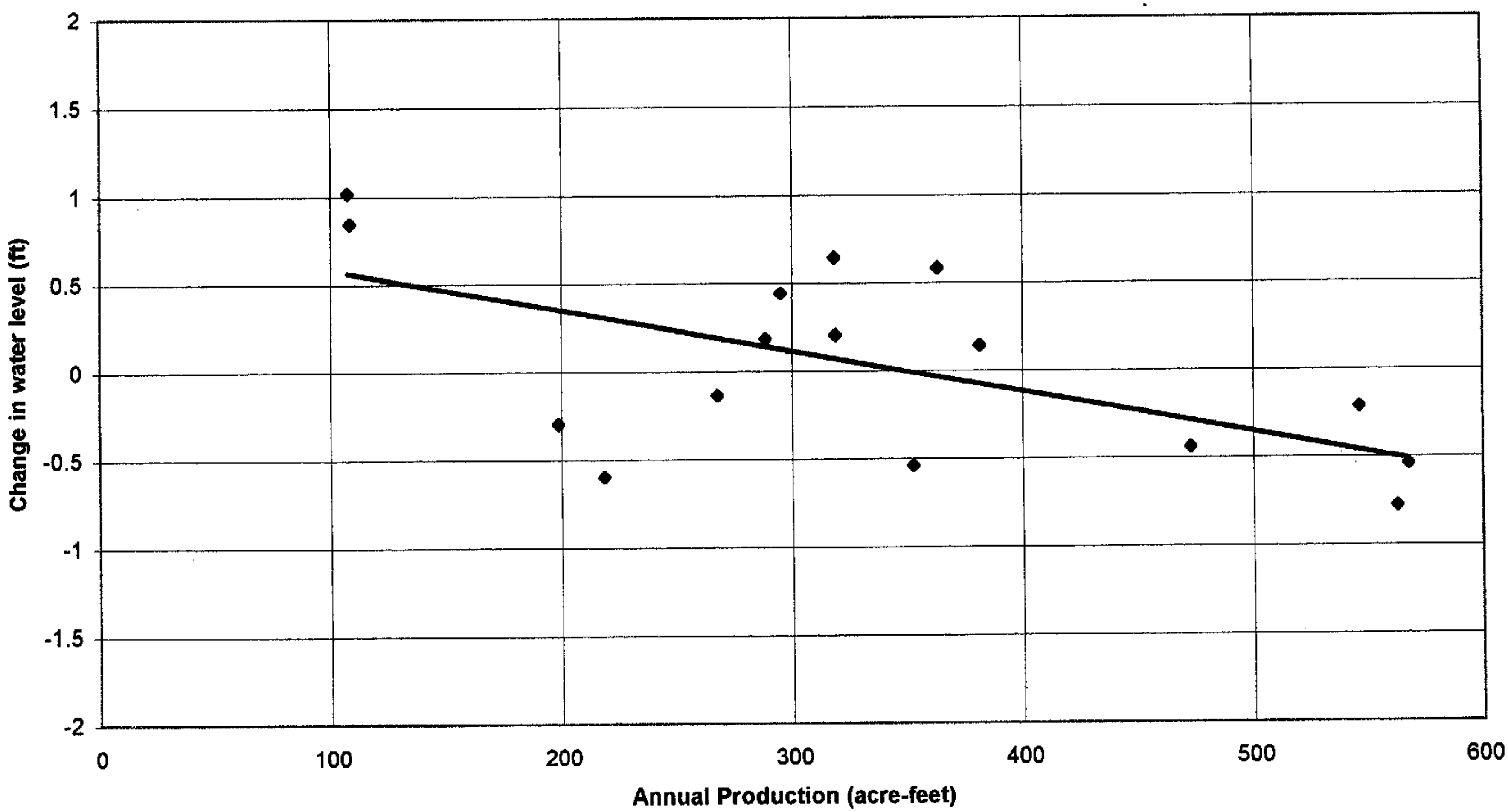
supply. The best-fitted straight line intercepts the point of zero change in water level at approximately 1,080 afy. The distribution of data points above and below the zero intercept suggests a dynamic equilibrium has been reached, however, the average water levels in the West side deep aquifer at this particular dynamic equilibrium are below sea level, and do not meet the criteria for the safe yield threshold (i.e. avoiding problems).

In fact, the occurrence of sea water intrusion in the West side deep aquifer in CCW and S&T Mutual wells in 1997 confirms that the compartment was being overdrafted. Therefore, the yield of the west side deep aquifer is less than 1,080 afy. The amount of reduction from 1,080 afy needed to bring water levels above sea level at the bay is estimated from correlation between production and water levels at the U.S.G.S. observation well Howard East (30S/10E-13M02; hydrograph attached). This deep aquifer well is located at Sea Pines golf course. Between 1988 and 1993, water levels at 13M02 rose 5 feet, while production in the West side deep aquifer declined approximately 500 acre-feet (approximately 1 foot rise per 100 afy production decline). The water levels at 13M02 have been fluctuating between sea level and approximately 2-3 feet below sea level, therefore, a reduction of 300 afy in West side deep aquifer production should keep water level fluctuations in the well at or above sea level, and restrict further sea water intrusion. The estimated yield of the West side deep aquifer is estimated at **780 afy**.

A Hill method analysis was also performed on the shallow aquifer data. A plot of annual production versus average change in fall-to-fall water level for the West side shallow aquifer well 30S/10E-13K01 is shown in Figure 4 for the water years 1982 through 1997 years (hydrograph attached). The best-fitted straight line intercepts the point of zero change in water level at approximately 350 afy. Water levels in the shallow aquifer are above sea level and do not show an overall declining trend. This information, together with the Hill method distribution suggest that at least 350 afy may be safely pumped from the shallow aquifer.

The hydrographs for West side shallow aquifer wells show a pattern that follows both precipitation and production. The water levels declined beginning in the mid 1980's to a record low in 1990, but have been generally rising ever since to record highs. This correlates with the drought period and recent wet climate, but also correlates with a sharp increase in West side shallow aquifer production between 1986 and 1991 followed by a sharp decline in production through the present as the CCW Skyline well was phased out. With these two variables (supply and production) moving in opposite directions, it is not possible to isolate the relationship between production and water levels independent of precipitation, beyond what is provided by the Hill method. Therefore, the yield of the West side shallow aquifer is estimated at **350 afy**. Total West side compartment yield is estimated at 1,130 afy with the current septic tanks and on-site wastewater disposal methods in place.

Figure 4
Shallow Aquifer - West
30S/10E-13K01
Hill Method 1982-1997



Basin Compartment #2: East side.

Wells in the shallow aquifer of the East side compartment can be distinguished from those of the West side and Los Osos Creek compartments by their hydrographs. Almost all of the East side shallow wells show a dramatic increase in water levels through the 1970's and early 1980's with little to no subsequent water level decline during the 1987-1990 drought (for example, wells 30S/11E-07Q01 and 17F02; attached). The East side shallow aquifer is full, and has been full since the mid-1980's. Wells pumping historically from the shallow aquifer include CCW Los Olivos #3 and #4 wells, the old LOCSD 8th Street Well, the old LOCSD 10th Street Well, the old LOCSD 12th Street Well, and the active LOCSD 3rd Street Well. The active LOCSD 10th Street well and South Bay well are also partially completed in the shallow aquifer.

The relationship between water levels and production in the East side shallow aquifer cannot be evaluated using the Hill method, because so much recharge attributable to development has occurred that any effect of production on water levels has been largely eliminated. The dominance of elements of recharge on water levels over the selected base period between 1973 and 1984 (-0.2 inches cumulative departure from mean precipitation) is illustrated in the following table.

Table 1
Water level rise in the East side shallow aquifer
Base period 1973 - 1984

Well ID	Average water level rise
30S/11E-07Q01	1.0 ft/yr
30S/11E-08M01	0.6 ft/yr
30S/11E-17E01	1.3 ft/yr
30S/11E-17F02	0.9 ft/yr
30S/11E-18H1	0.8 ft/yr
30S/11E-18K01	2.5 ft/yr
30S/11E-18K03	1.3 ft/yr
30S/11E-18Q01	1.5 ft/yr
Average	1.2 ft/yr

A review of ground water elevation contour maps prepared for November 1973 (County Engineering Department) and for Fall 1984 (The Morro Group) indicate that an average rise of one foot per year over approximately 1,540 acres of the East side compartment is reasonable. Assuming a 12 percent specific yield in fine sands, this rate of water level rise would be equivalent to 185 acre-feet per year net gain in storage. The actual recharge rate would have been much higher, since water was flowing out of the compartment, both subsurface and through production, over the base period.

The production records from the individual East side shallow aquifer wells between 1973 and 1984 are incomplete. Well-by-well CSA-9A production records go as far back as July 1977, while CCW records for individual wells have been obtained starting in March 1982. Fortunately, most of the historical East side shallow aquifer production was by the former CSA-9A, and the corresponding estimate for average East side shallow aquifer purveyor production over the base period is 350 afy. Private domestic production in the East side shallow aquifer over the same period is estimated at 150 afy, based on 70 percent of average private domestic production in the basin over the base period reported by the U.S.G.S. (1988). With an estimated historical production of 500 afy, the shallow aquifer still gained 185 afy in storage over the base period, which is induced recharge that may be consumed. Assuming 40% return flow factor under existing conditions of septic systems, 185 afy water consumption would allow approximately 300 afy production. Therefore, the yield of the East side shallow aquifer is estimated at **800 afy**.

The East side compartment's deep aquifer is the most difficult aquifer to evaluate, because of a lack of data and use. LOSCD Ferrell #2 pumped historically from the East side deep aquifer beginning in 1976 and continuing through 1989. The new LOCSD 8th Street well began pumping from the deep aquifer in 1987, and other wells have more recently been completed (partially) in the deep aquifer, including the active LOCSD 10th Street and South Bay wells. The 10th Street well is cased with 35 feet of perforations in the shallow aquifer and 140 feet in the deep aquifer, however, the permeability of the upper perforated interval is estimated at twice that of the lower zone from electric log evaluation (assume 65 percent of yield from the deep aquifer). The LOCSD South Bay well has 60 feet of perforations in the shallow aquifer and 20 feet of perforations in the deep aquifer (assume 25 percent yield from the deep aquifer).

As mentioned above, the LOCSD 8th Street well began pumping in 1987. During this same period, the water levels in the DWR deep observation well MBO#5 (30S/10E-12J01), located near the bay on the East side, dropped below sea level. There also may have been an influence in the late 1970's by historical LOCSD Ferrell #2 production on well MBO#5 water levels, although significant data gaps exist in the hydrograph.

Maintaining water levels at or above sea level near the bay is recommended to avoid landward migration of sea water. Therefore, MBO#5 is a useful well for monitoring the effects of production on the East side deep aquifer. A Hill method analysis was performed over the period from 1986-1997 to identify the relationship between pumping in the deep aquifer and water level changes in MBO#5 (Figure 5). The results indicate that an average 830 afy may be produced with no net change in water levels at MBO#5. A new dynamic equilibrium has been reached at MBO#5 near sea level, therefore, continued purveyor yield from of the East side deep aquifer at an average annual rate of at least **830 afy** is safe.

Basin Compartment #3: Los Osos Creek.

The third and final basin compartment surrounds Los Osos Creek, and as mentioned earlier, is characterized by hydrographs with wide water level fluctuations. These fluctuations are controlled in large part by seasonal irrigation and by percolation of precipitation and runoff in Los Osos Creek. To estimate the yield of the Los Osos Creek compartment, the average annual rise in water levels (Fall to Spring) was determined from the historical record of eleven wells in the 570-acre alluvial valley portion of the compartment between 1985 and 1997 (-3.03 inches cumulative departure). The resulting average annual rise was 8.4 feet over the compartment. Assuming a specific yield of 10 percent in the creek alluvium, the resulting average annual storage gain in the compartment is estimated at 480 acre-feet.

An estimated 480 afy may be consumed by users in the Los Osos Creek compartment and the aquifer will be fully replenished, on average, every year. Consumptive use of the water assumes no return flows from irrigation back into the alluvium, therefore, the amount that may be safely pumped is proportional to the amount of irrigation and private domestic return flow. For the purposes of this analysis, a 60 percent irrigation efficiency is assumed based on prior work by the DWR (40 percent return flow). The resulting safe compartment yield would be **800 afy**.

Basin safe yield.

The estimated safe yield of the Los Osos Valley ground water basin is equivalent to the sum of the individual compartments. Due to the methodology used herein, the safe yield value is presented as gross pumpage (demand), with disposal and agricultural practices as it exists now. The estimated basin safe yield for each compartment are summarized in Table 2 below.

Figure 5
Deep Aquifer - East Compartment
30S/10E-12J01 (MBO#5)
Hill method 1986-1997

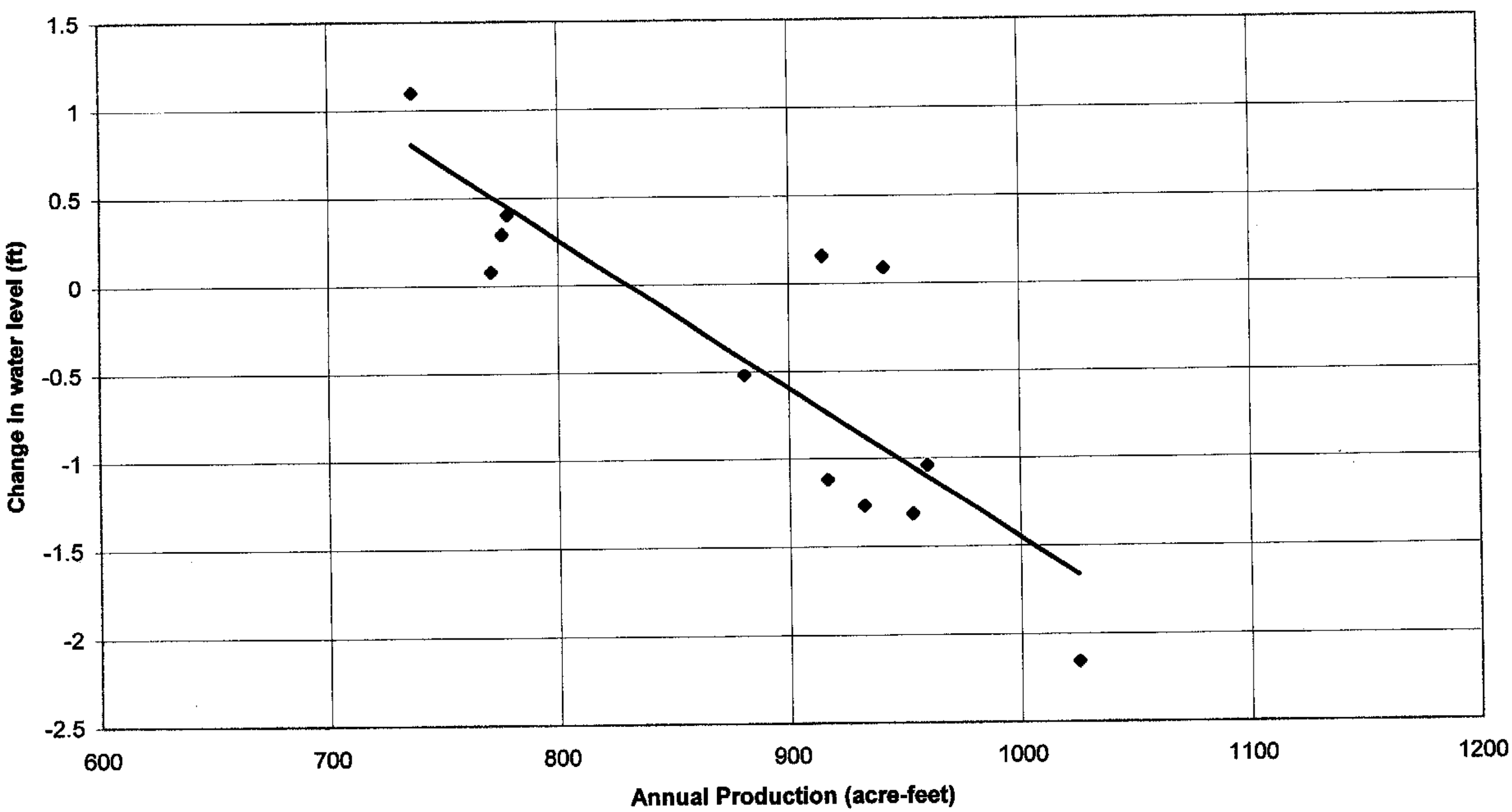


Table 2
Yield Analysis - Analytical Methods
Current Conditions (septic systems)

Compartment	Estimated Basin Yield (afy)
West Side (deep)	780
West Side (shallow)	350
East Side (deep)	830
East Side (shallow)	800
Los Osos Creek	800
Basin Total	**3,560**

The West side deep aquifer is being significantly over pumped. In fact, over the last 10 years production in the deep west aquifer has averaged 1,060 afy. Sea water intrusion in the middle zone of the West side deep aquifer has reached purveyor wells (increased chloride and total dissolved solids concentrations). Basin production has averaged 3,380 acre-feet per year over the last 10 years (1992-2001), and has only exceeded the estimated basin safe yield in one year (3,600 acre-feet pumped in 1995).

2002 GBMP Model

The GBMP model was developed for use as a tool to aid in basin management. The primary benefit of a ground water flow model is its ability to incorporate the dynamic relationship between elements of recharge and discharge. This feature facilitates the assessment of various wastewater disposal and production scenarios that would otherwise require individual hydrologic budget calculations. Although the GBMP model has some limitations, it is the best available tool for evaluating management scenarios, provided the results are interpreted with care. A solute transport package has recently been incorporated, and is currently being applied to estimate the fate of nitrates and the relationship between the shallow and deep aquifer.

Model Hydrologic Base Period

The purpose of a hydrologic base period is to define a specific period of time over which elements of recharge and discharge in a groundwater basin may be compared. This period of time, when properly selected, will allow investigators to evaluate long-term basin trends. Several hydrologic base periods have been already selected above for various analytical yield analyses.

To assess potential base periods, a graph showing the cumulative departure from mean precipitation for the appropriate location is prepared. The departure from mean precipitation is the difference between a specific year precipitation value and the mean precipitation value of the data set. The cumulative departure from mean graphs the sum of these departures over time, beginning with the first year departure and adding each subsequent year departure (cumulative). The cumulative departure value would be similar at the beginning year and ending year of a representative hydrologic base period. The model precipitation values are derived from the Station 197 (South Bay Fire Department). A graph of the cumulative departure from mean precipitation for Station 197 is shown in Figure 6.

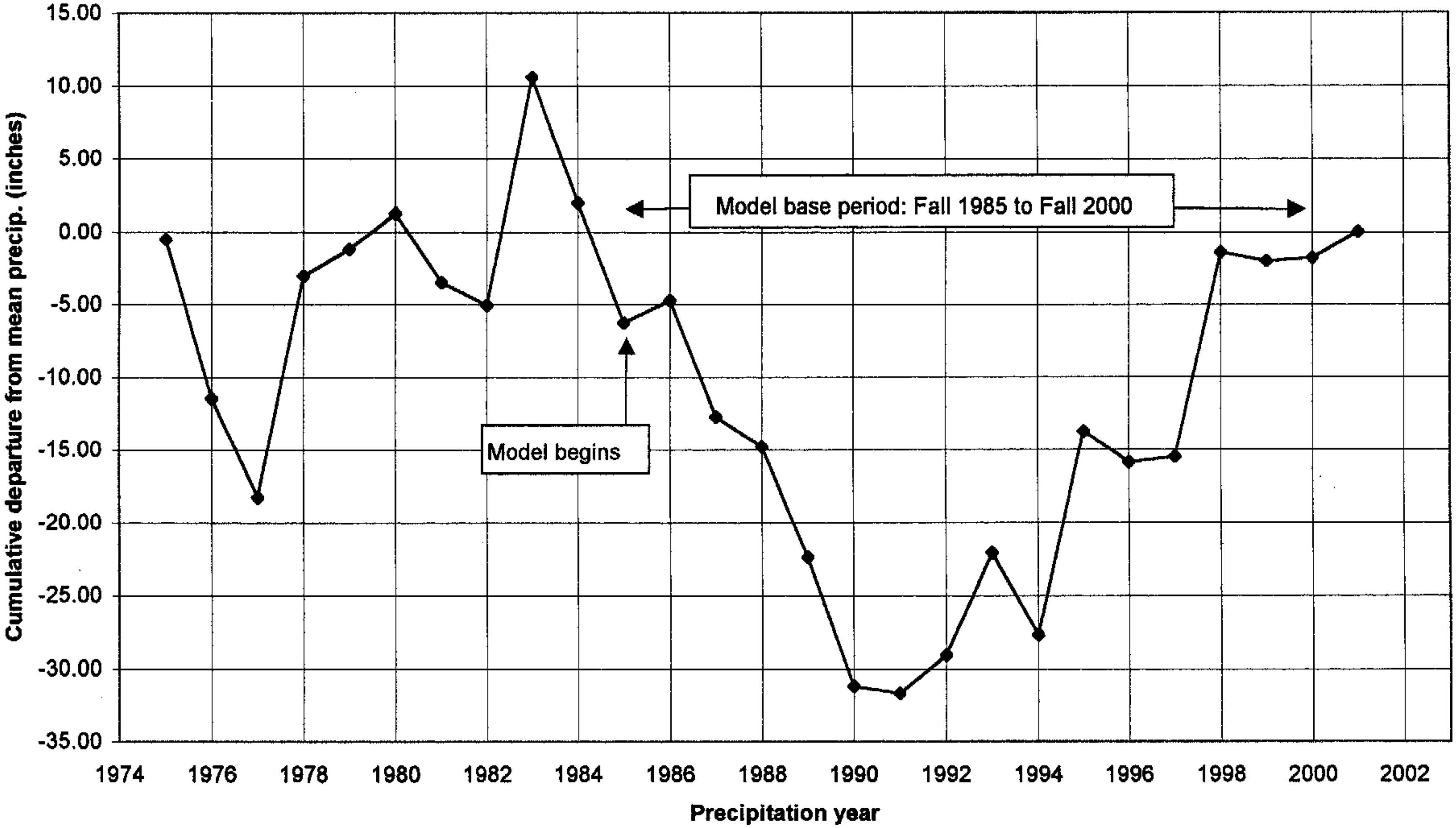
A hydrologic base period from Fall 1985 to Fall 2001 (15 years) was selected for the model yield analyses. The cumulative departure from mean precipitation over the base period for Station 197 is 4.48 inches, however, when adjusted to modeled precipitation, the departure over the base period is only 1.7 inches. By comparison, the range of fluctuation in cumulative departure over the historical record is 42.3 inches, from a high of 10.6 inches in 1983 to a low of -31.7 inches in 1991. The recharge from precipitation assigned to each new stress period for the 2002 update is based on using a recharge matrix from an existing original stress period with similar rainfall. In other words, the actual historical rainfall for stress periods between Fall 1995 and Fall 2000 were compared to prior rainfall between Fall 1985 and Fall 1995 to find a suitable match. Therefore, the modeled precipitation is similar to but not exactly equal to the historical precipitation (and results in a 1.7 inches cumulative departure over the base period).

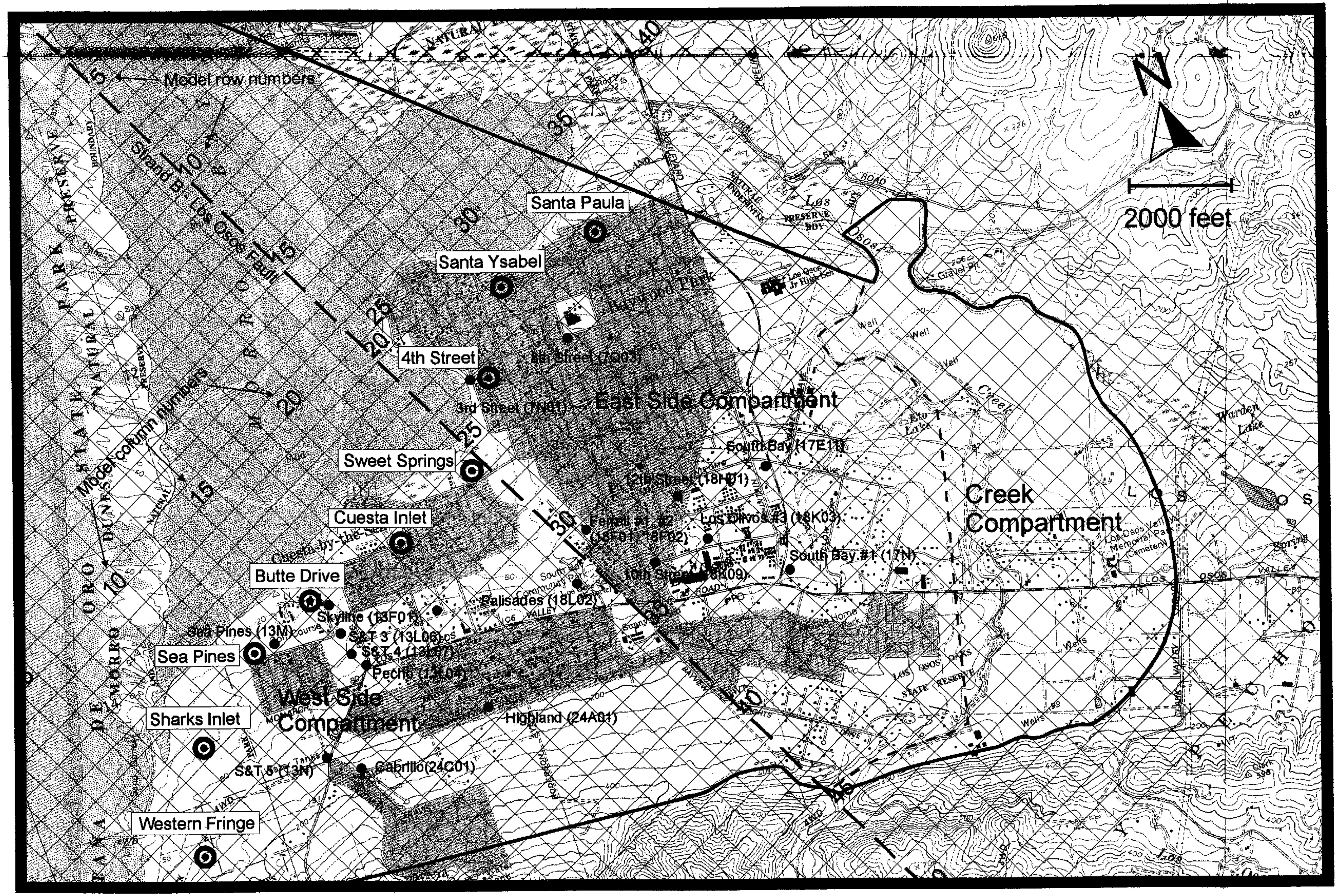
Existing Conditions Calibration

Prior to using the model for basin yield analyses under the wastewater project, an existing conditions yield scenario was performed to compare with the analytical methods results. This comparison was useful in assessing the performance of the model outside of its historical run, and providing a means of calibration for the wastewater project yield analysis.

A series of monitoring wells were "constructed" in the model along the bay front to monitor modeled water levels in each of the three model layers at nine discrete locations (Figure 7). The model grid locations for wells and model layer assignments for pumping were reviewed and adjusted as appropriate. Production for the current conditions scenario was allowed at all existing active purveyor well locations, including the newer wells S&T #5 and CCW South Bay #1, at selected inactive purveyor wells locations (Ferrell and Highland) and at a new shallow well location at the north end of Palisades Avenue.

Figure 6
Cumulative Departure Curve
Los Osos Station 197 (South Bay Fire Dept.)





Base map: USGS topo map
Morro Bay South (1994)

Base map scale: 1 inch = 2000 feet

Explanation

- Purveyor well (not all wells active)
- Simulated monitoring well
- Model grid cell
- Ground water basin limits

Figure 7

Model Grid
Los Osos GBMP Model

Cleath & Associates

Production in the Los Osos Creek compartment over the 16-year historical modeled period is roughly equivalent to the safe yield value based on the analytical method analysis (800 afy). The model does not incorporate return flows for unmetered pumpage, and the net production from the Creek compartment averages 570 afy (equivalent to 814 afy, assuming 30 percent return flow for irrigation). Production for private east side domestic wells was set within the range of "build out" values at 200 afy. Again, since the production is interpreted by the model as net consumption, the actual pumpage in the model was set at 120 afy (assuming 40 percent return flow for domestic use). The total production for private domestic and agricultural purposes on the east side of the basin averages 1000 afy (690 afy consumed).

A series of model runs were performed, with production in each successive run adjusted until water levels along the bay equilibrated at or above sea level. The principals of the GWBMP were applied, to the extent possible (limited by well capacities), in that peak summer demand was shifted inland. The maximum pumping capacity of a well was assessed based on well construction, historical production and water levels. The model was run over two base period cycles with the results of the second cycle used for the analysis. Additional cycles did not affect the results significantly.

The results of the model scenario for current condition compare favorably with the analytical method results (within 5 percent). A summary of the results of the current conditions model scenario is as follows:

Table 3
Yield Analysis - GBMP Model
Current Conditions (septic systems)

Compartment	Estimated Yield (afy)	Average water elevation* (feet above sea level)			Difference from analytical method (Calibration)
		Layer 1	Layer 2	Layer 3	
West Side (deep)	750	--	1.5	1.5	-30 afy
West Side (shallow)	410	1.1	--	--	+60 afy
East Side (deep)	1020	--	3.3	4.9	+190 afy
East Side (shallow)	750	2.6	--	--	-50 afy
Los Osos Creek	800	--			-0-
Basin Total	3,730	--			+170 afy

* West side heads for Butte Drive, East side heads for 3rd Street.

Impacts to the Los Osos Creek compartment were analyzed based on average water level decline. The average simulated water level decline between the current condition basin safe yield scenario and actual historical water levels was 1 foot. A total of 20 private domestic and agricultural wells with historical water level records within the Creek compartment were reviewed. This amount of decline would not be expected to significantly affect wells. Overall, the basin yield estimates using two completely different methods are within five percent of each other.

Ground Water Production versus Basin Yield

Ground water production from the basin overall has exceeded the basin yield in four of the years since 1986 but has been less than the basin yield over the past six years (Figure 8). The ground water production has been distributed in such a way as to cause excessive pumpage in the deep West side aquifer, resulting in sea water intrusion in the vicinity of Pecho Road. This localized over-pumping has occurred every year since 1983. In other areas, the pumpage has not been sufficient to offset recharge, resulting in rising water. Currently, the ground water basin as a whole is not in overdraft, although shifting production away from the area of sea water intrusion is recommended for optimal basin management.

Basin Yield - Wastewater Project Scenario

The analytical methods used for the existing conditions yields analysis cannot be used for management scenarios, because these methods require actual historical records of water levels and production for the condition under analysis. An alternative approach to the analysis would be through development of a hydrologic budget. As mentioned previously, a ground water flow model has the advantage over a hydrologic budget analysis because it is truly dynamic. Given the close correlation between the flow model results of the current condition and the independent analytical methods results, use of the flow model for the future conditions analysis is appropriate.

The 2002 GBMP updated model is designed for a full community wastewater collection system, as currently proposed by the LOCSD, and all of the septic systems in the prohibition zone have been turned off. The current wastewater project includes 1.4 mgd disposal. Community leach field locations and disposal amounts are listed in the following table.

Figure 8
Basin-wide production

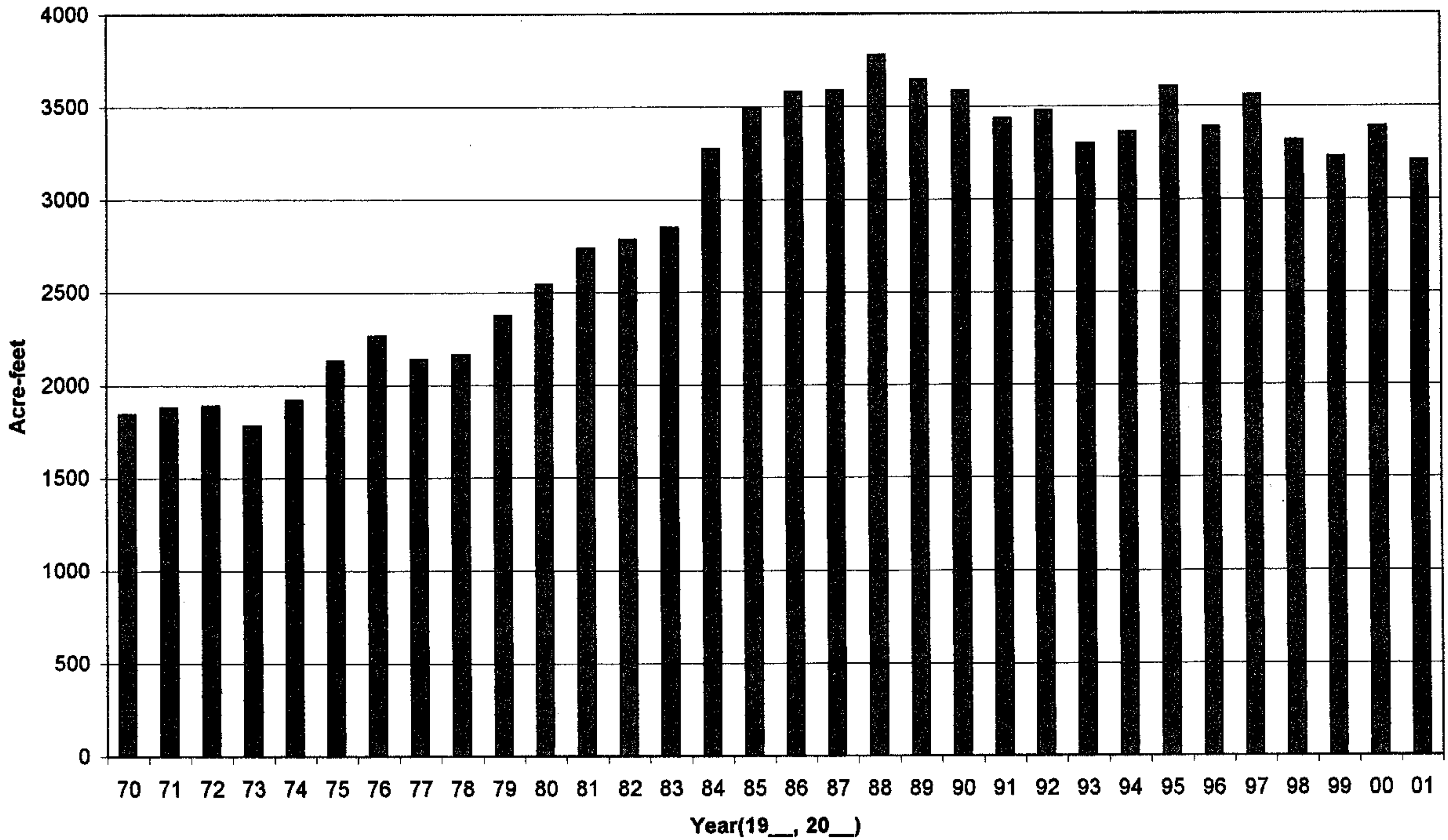


Table 4
Wastewater Disposal Sites
Los Osos CSD

Site ID	Disposal Capacity (gallons per day)
Broderson	800,000
Ziebarth/Pine	125,000
Vista de Oro	25,000
Pismo Avenue	150,000
Santa Maria Avenue/18th Street	175,000
South Bay Blvd. (North)	125,000*
TOTAL	1,400,000

*modeled flow for the South Bay Boulevard disposal field is 50% of above listed capacity to account for partial loss of water from basin.

The objective of the yield analysis was to maximize basin production, following the GWBMP guidelines, without causing sea water intrusion. As with the current conditions scenario, a network of monitoring wells was simulated along the bay (Figure 7). Additional checks on targets within the basin were made to ensure adequate saturated thicknesses for sustained production.

Numerous combinations of production from existing wells and potential future wells were simulated. Unlike the URS Management Scenarios simulations, which focused only the 11-year calibration period (Fall 1985 to Fall 1996), the safe yield simulations were run over a 14-year representative hydrologic base period (Fall 1985 to Fall 1999). In addition, production values assigned to wells were not allowed to exceed the physical well capacity.

The results of the future conditions scenario are presented in tables and as a collection of simulated hydrographs for the 27 discrete points monitored. Table 5 below presents a summary of the model yield results by compartment, with adjustments to the West side compartment shallow/deep aquifer proportion based on studies completed on the West side for the Broderson disposal field (Cleath & Associates, 2000).

Table 5
Estimated Basin Safe Yield
Future Conditions (community wastewater project)

Compartment	GBMP Modeled Yield (afy)	Adjustments based on model calibration	Estimated Yield (afy)
West Side (deep)	940	+30 afy	970
West Side (shallow)	600	-60 afy	540
East Side (deep)	920	-190 afy	730
East Side (shallow)	850	+50 afy	900
Los Osos Creek	800	-0-	800
Basin Total	4,110	-170 afy	**3,940**

A comparison with the existing conditions safe yield shows increases in the basin on both the West side and East side compartments, attributable to both the wastewater project and potential (future) well sites. A breakdown of the pumpage for the future conditions scenario is presented below. The purveyor production (LOCSD, CCW, and S&T Mutual) has not been subdivided, since this is flexible in the model.

Table 6
Estimated Basin Yield by User Class
Future Conditions - community sewer project

User Class	Production (afy)
Purveyor (LOCSD, CCW, S&T)	2,900
Sea Pines golf course	40
Private Domestic	200
Agriculture	800
Total	3,940

As mentioned, water levels from each of the three model layers at nine locations along the bay were monitored during the yield scenario. The model was run over two base period cycles with the results of the second cycle used for the analysis, similar to the existing conditions scenario. Results of additional cycles oscillated between higher and lower heads. Simulated hydrographs showing the model cycle are attached.

Table 7
Simulated Water Elevations
Future Conditions Scenario - 3940 afy production

Monitoring Well ID	Model Location		Average water elevation - 2nd Model cycle in feet above mean sea level		
	Row	Column	Layer 1	Layer 2	Layer 3
Western Fringe	29	5	17.1	5.9	5.1
Sharks Inlet	26	8	4.1	4.1	4.1
Sea Pines	25	12	3.1	3.5	3.5
Butte Drive	25	15	1.6	3.0	3.1
Cuesta Inlet	26	19	2.7	2.2	2.4
Sweet Springs	23	26	1.9	2.9	3.0
3rd Street	24	26	3.7	2.6	3.3
Santa Ysabel	22	24	6.6	3.0	3.4
Santa Paula	23	33	48.3	16.6	4.5

As was done with the current conditions model, impacts to the Los Osos Creek compartment under the wastewater project model scenario were analyzed based on average water level decline. The average simulated water level decline, compared to historical conditions, was 14 foot in 20 private domestic and agricultural wells with historical water level records within the Creek compartment. This amount of decline would not be expected to significantly affect wells, which are generally 100-150 feet deep in the Los Osos Creek valley and closer to 200 feet deep to the west. Note that this does not include perched aquifer wells in the private domestic areas, which are typically less than 100 feet deep. The perched aquifer is not part of the ground water model or the analytical method analysis, and will not be significantly affected by basin pumpage.

SUMMARY OF FINDINGS

The principal findings of this Water Supply appendix are briefly described as follows:

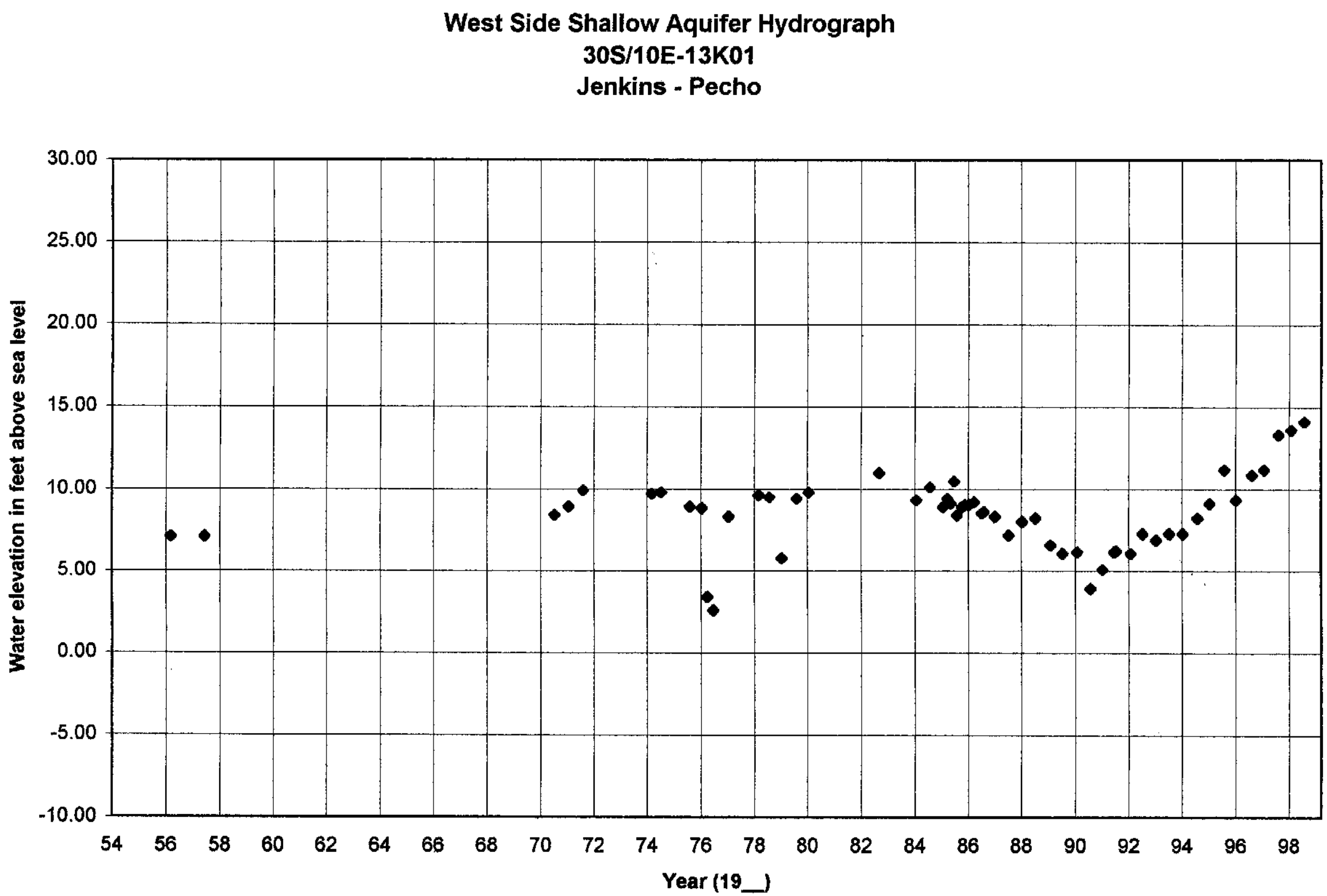
1) The Los Osos Valley ground water basin under existing conditions is estimated to have a yield of **3,560 acre-feet per year** using analytical methods of analysis. The GBMP model yield estimate of 3,730 acre-feet per year compares favorably with this analytical method result. This yield figure represents the amount of ground water that may be safely pumped every year, on average, with the current septic systems and agricultural irrigation practices in place. Ground water production in the basin has averaged 3,380 afy over the past 10 years.

2) The Los Osos Valley ground water basin under the proposed community wastewater disposal conditions is estimated to have a safe yield of **3,940 acre-feet per year**, of which the three water purveyors are apportioned **2,900 acre-feet per year**.

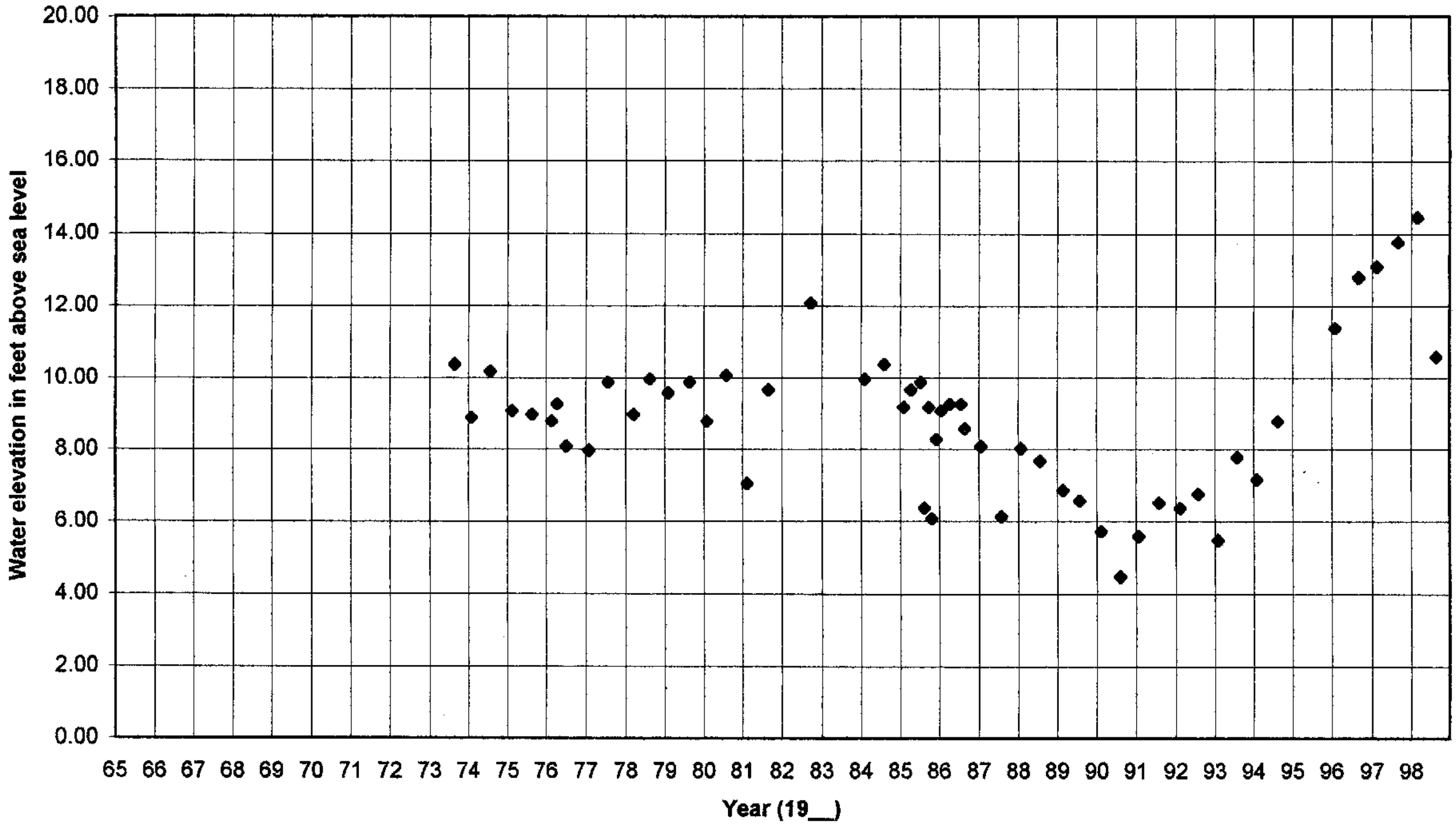
Attachments:

Representative Hydrographs
GBMP Model Inputs
Simulated Model Hydrographs - Wastewater Project Scenario

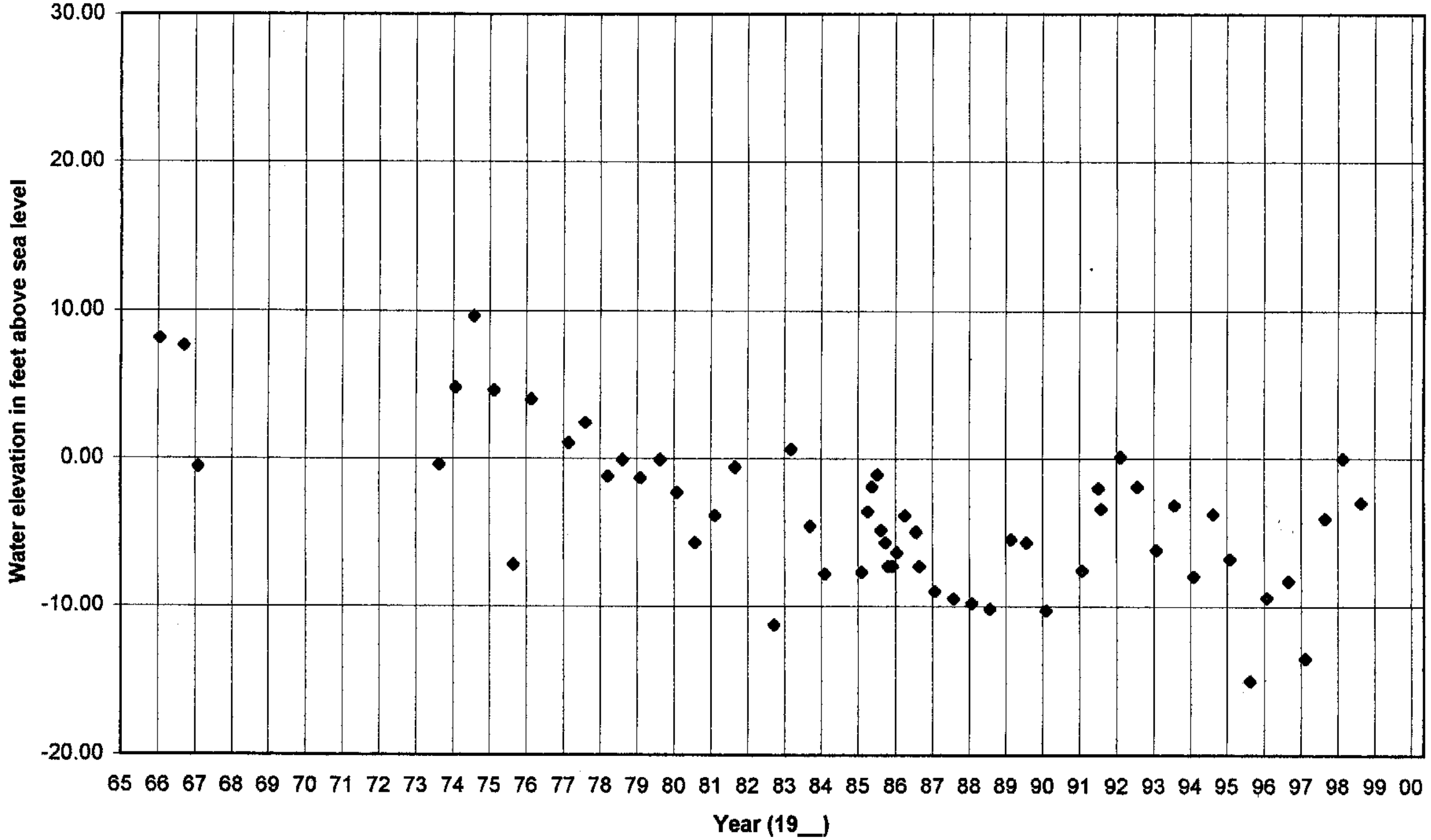
Representative Hydrographs

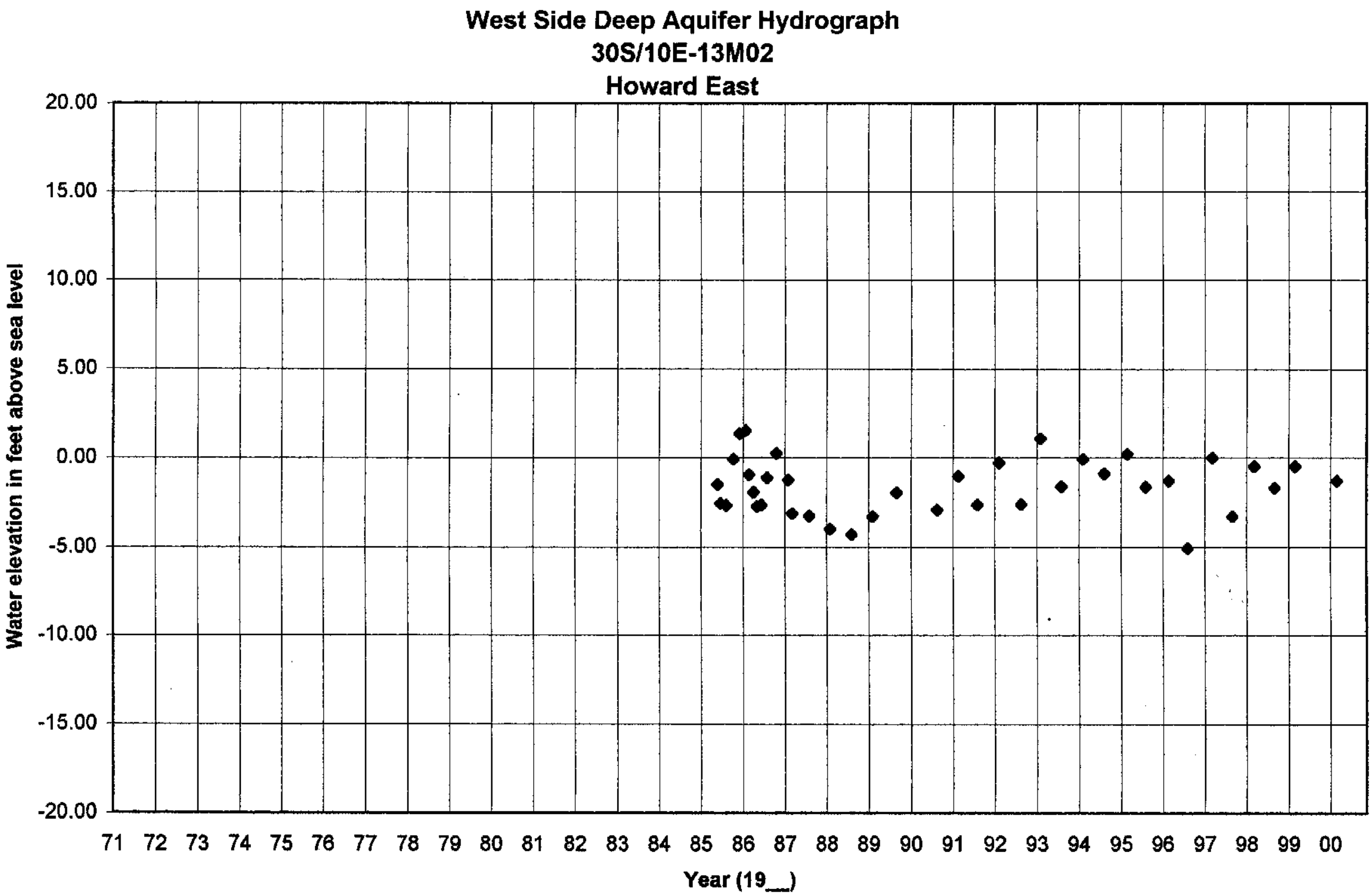

West Side Shallow Aquifer Hydrograph
30S/10E-13K01
Jenkins - Pecho
30.00
25.00
20.00
15.00
10.00
5.00
0.00
-5.00
-10.00
Water elevation in feet above sea level
54
56
58
60
62
64
66
68
70
72
74
76
78
80
82
84
86
88
90
92
94
96
98
Year (19__)

West Side Shallow Aquifer Hydrograph
30S/10E-13P01
Linsley - LOVR

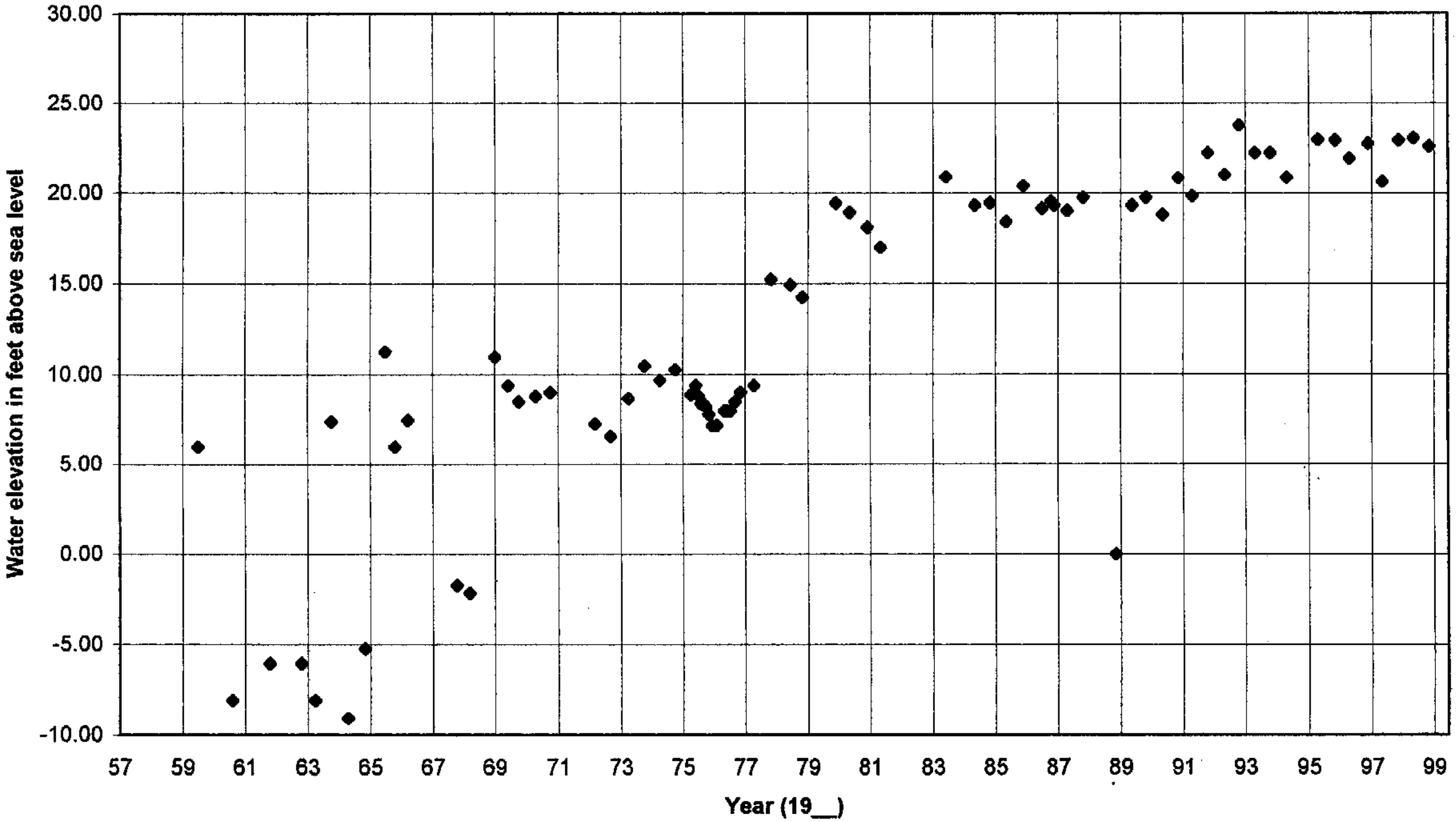


West Side Deep Aquifer Hydrograph
30S/11E-13P02
Kumabe Irrigation

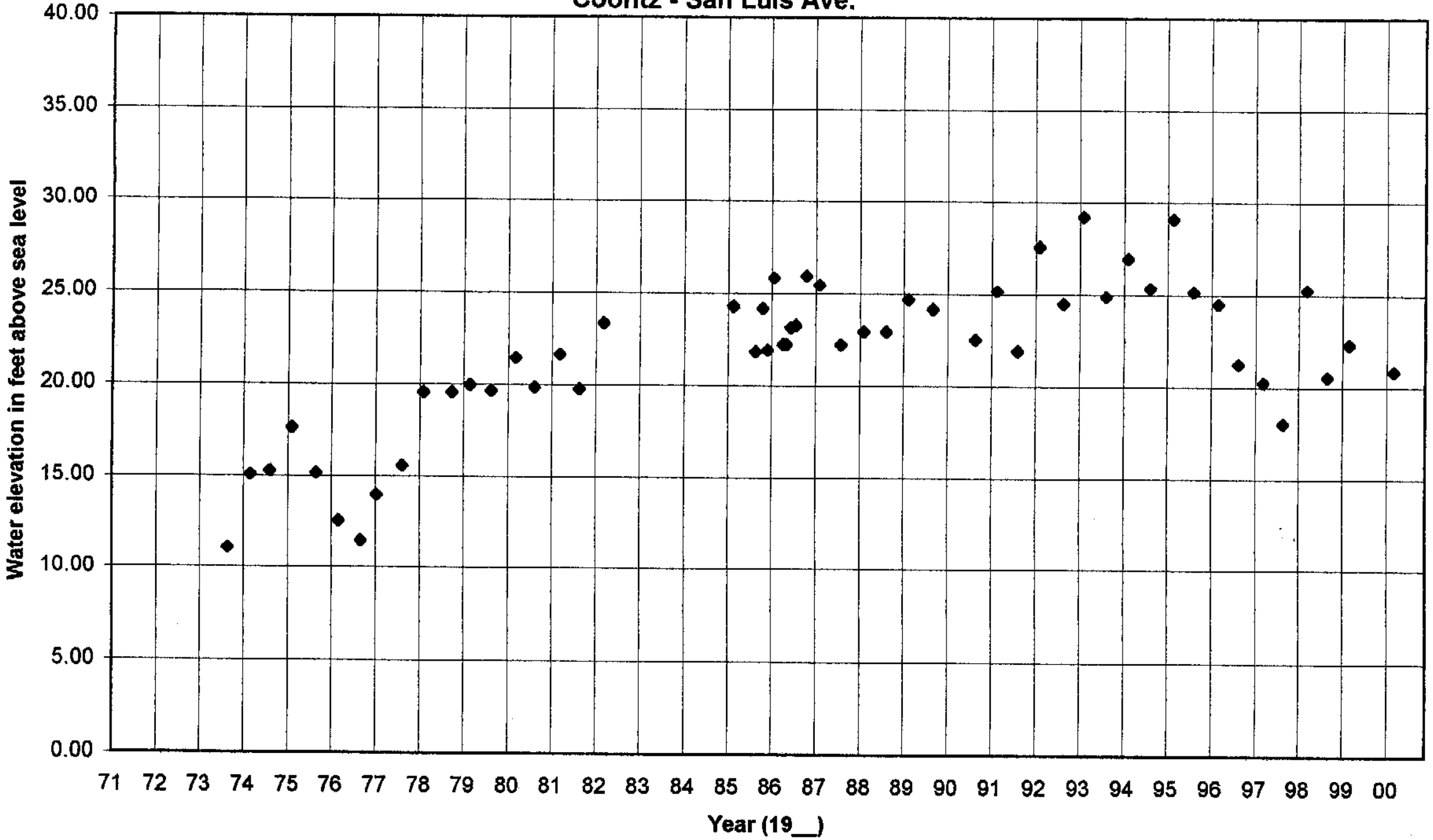



West Side Deep Aquifer Hydrograph
30S/10E-13M02
Howard East
Water elevation in feet above sea level
20.00
15.00
10.00
5.00
0.00
-5.00
-10.00
-15.00
-20.00
71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 00
Year (19__)

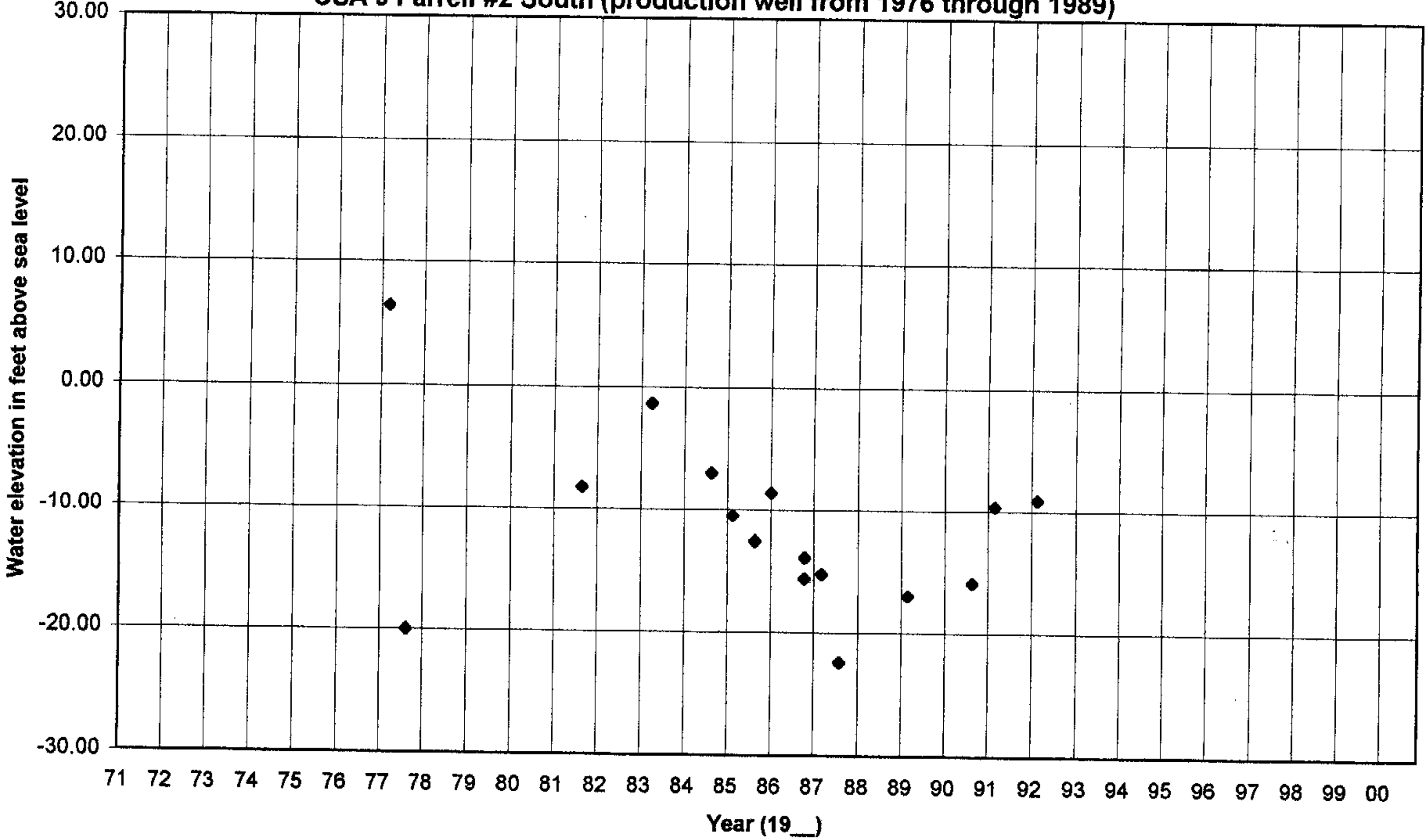
East Side Shallow Aquifer Hydrograph
30S/11E-07Q01
CSA #9 - 8th Old



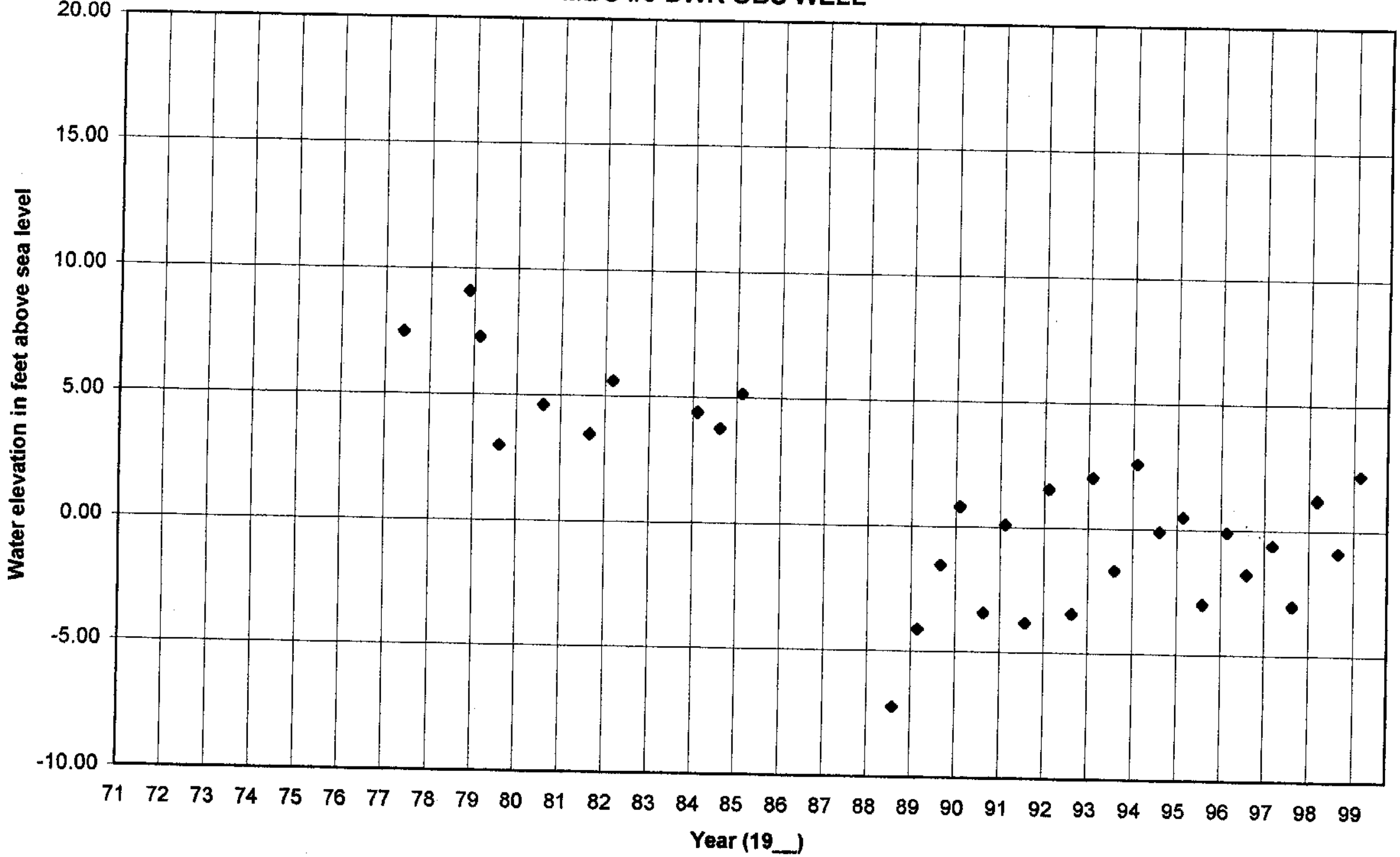
East Side Shallow Aquifer Hydrograph
30S/11E-17F02
Coontz - San Luis Ave.



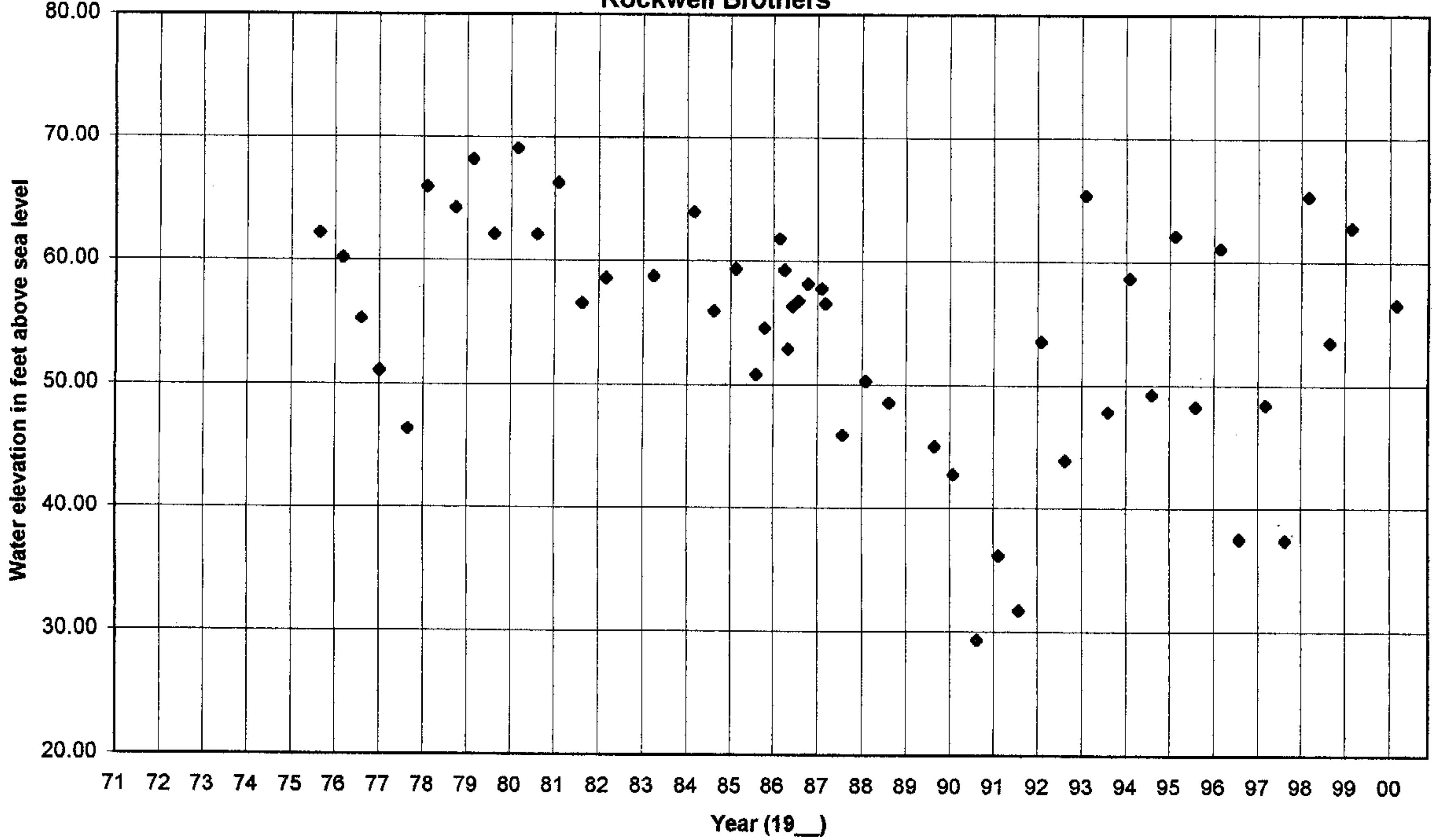
East Side Deep Aquifer Hydrograph
30S/11E-18F02
CSA 9 Farrell #2 South (production well from 1976 through 1989)



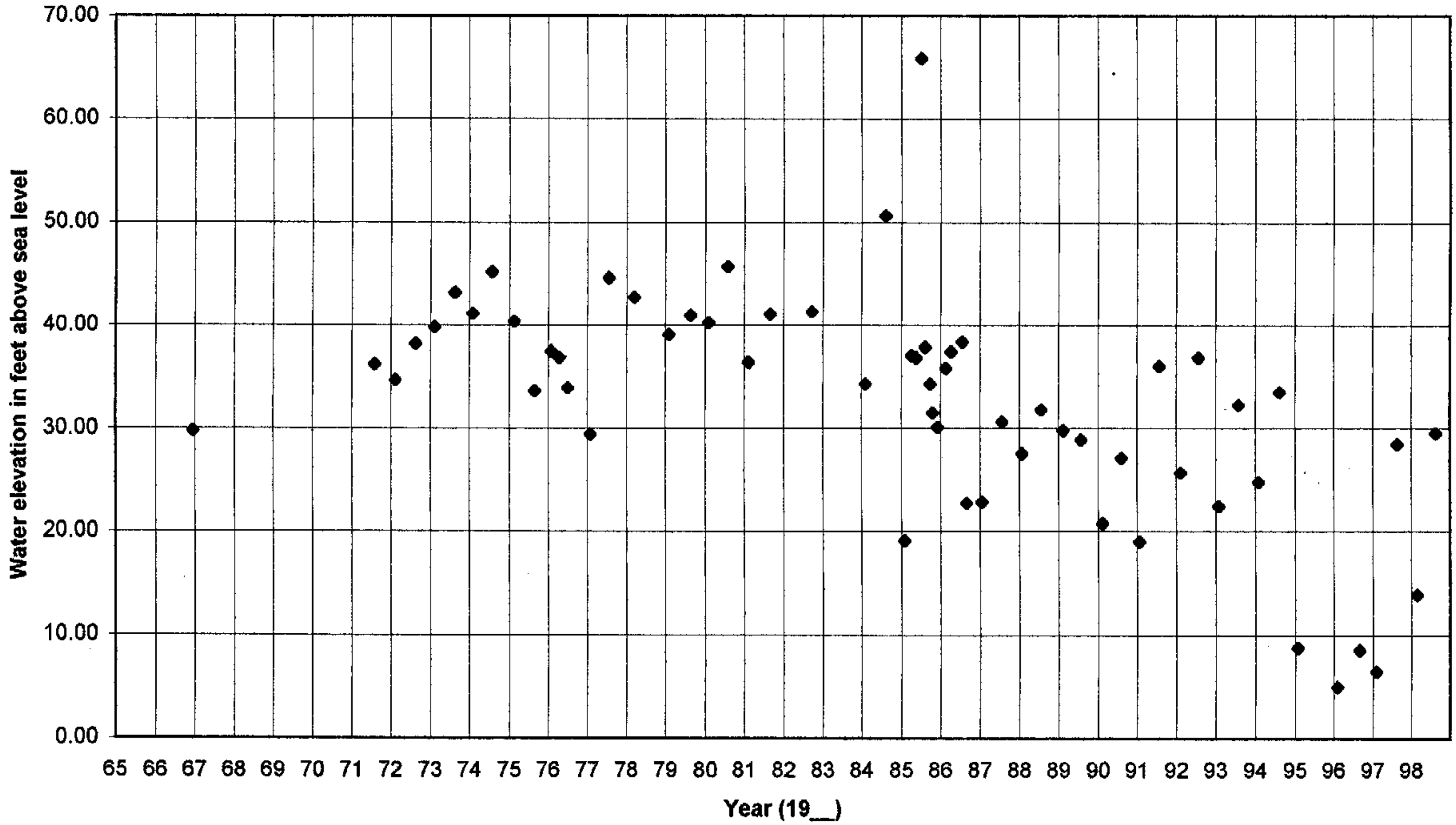
East Side Deep Aquifer Hydrograph
30S/10E-12J01
MBO #5 DWR OBS WELL



Creek Compartment Aquifer Hydrograph
30S/11E-21E04
Rockwell Brothers



Creek Compartment Aquifer Hydrograph
30S/11E-20B01
Blodgett - LOVR



GBMP Model Inputs

GBMP Model Inputs
Current Condition - Without Wastewater Project

Well Name	Row	Column	Layer distribution 1	2	3	summer afy	winter afy	ttl afy	Model Inputs Summer 1 ft3/day	2 ft3/day	3 ft3/day	Winter 1 ft3/day	2 ft3/day	3 ft3/day	
irr						0.68	0.32								
dom						0.57	0.43								
Sea Pines	26	14	1			27.2	12.8	40	6492.23	0	0	3055.167	0	0	39.9
ST 5	30	12	0	1	0	62.7	47.3	110	0	14965.55	0	0	11289.8	0	109.7
ST 4	28	15	0.2	0.8	0	22.8	17.2	40	1088.403	4353.613	0	821.0762	3284.305	0	39.9
Pecho	28	15	0	1	0	0	0		0	0	0	0	0	0	0
Cabrillo	31	12	0	0.5	0.5	77.7	32.3	110	0	9272.91	9272.91	0	3854.762	3854.762	109.7
Palisades D	32	23	0	0	1	171	129	300	0	0	40815.12	0	0	30790.36	299.2
Rosina D	29	19	0	1	0	175	175	350	0	41769.86	0	0	41769.86	0	349
Skyline	26	16	1	0	0	50	50	100	11934.25	0	0	11934.25	0	0	99.7
Highland	33	17	1	0	0	106.2	53.8	160	25348.34	0	0	12841.25	0	0	159.6
Palisades S (new)	31	23	1	0	0	57	43	100	13605.04	0	0	10263.45	0	0	99.7
Rosina S (new)	29	19	1	0	0	0	0		0	0	0	0	0	0	0
						0	0		0	0	0	0	0	0	0
10th	34	25	0.35	0.65	0	114	86	200	9523.529	17686.55	0	7184.416	13342.49	0	199.5
8th Deep	25	29	0	1	0	228	172	400	0	54420.16	0	0	41053.81	0	398.9
3rd	24	26	1	0	0	30	30	60	7160.548	0	0	7160.548	0	0	59.8
Ferrell			0.5	0.5	0	85.5	64.5	150	10203.78	10203.78	0	7697.589	7697.589	0	149.6
SB	34	31	0.75	0.25	0	85.5	64.5	150	15305.67	5101.89	0	11546.38	3848.795	0	149.6
Los Olivos	34	27	1	0	0	91.2	68.8	160	21768.07	0	0	16421.52	0	0	159.6
SB#1	38	29	0.25	0.5	0.25	171	129	300	10203.78	20407.56	10203.78	7697.589	15395.18	7697.589	299.2
Private A*	34	34	1			22.8	17.2	40	5442.016	0	0	4105.381	0	0	39.9
Private B*	36	33	1			22.8	17.2	40	5442.016	0	0	4105.381	0	0	39.9
Private C*	36	35	1			22.8	17.2	40	5442.016	0	0	4105.381	0	0	39.9
Agriculture*	existing model inputs			1		326.4	153.6	480	0	77906.76	0	0	36662.01	0	478.7
totals								3330	148959.7	256088.6	60291.81	108939.4	178198.6	42342.71	3321

* net output (consumed)

NOTE: The well production values used for this simulation are not the only combination that meets the objectives of the analysis. The distribution of pumpage between purveyors may be shifted in some cases.

These production estimates may require adjustment based on other information not incorporated into the GWBM model.

Entity	net* (afy)	ttl pump (afy)	future wells (afy)	
Sea Pines		40		
SCWC		1180	0	
LOCSD		1360	250	
S&T		150		
PVT*	120	200		
AG*	480	800		
ttl check		3730		
			analytical	diff
SW		408	320	-88
DW		902	800	-102
SE*	120	753	800	47
DE		868	630	-238
CK*	480	800	800	0
ttl check		3731	3350	-381

ttl check 3330
3730 (with net AG/PVT adjusted to gross)

purveyor well production (AF)

	summer	winter	
inland	1021.8	718.2	1740
bayside	505.8	444.2	950
ttl check	1527.6	1162.4	2690
percent	0.57	0.43	2690

LOCSD

	summer	winter	
	771	589	1360
percent	0.57	0.43	

SCWC

	summer	winter	
	671.1	508.9	1180
percent	0.57	0.43	

S&T

	summer	winter	
	85.5	64.5	150
percent	0.57	0.43	
			2690

GBMP Model Inputs
Wastewater Project Scenario

Well Name	Row	Column	Layer distribution 1	2	3	summer afy	winter afy	ttl afy	Model Inputs Summer 1 ft3/day	Summer 2 ft3/day	Summer 3 ft3/day	Winter 1 ft3/day	Winter 2 ft3/day	Winter 3 ft3/day	
irr						0.68	0.32								
dom						0.57	0.43								
Sea Pines	26	14	1			27.2	12.8	40	6492.23	0	0	3055.167	0	0	39.9
ST 5	30	12	0	1	0	62.7	47.3	110	0	14965.55	0	0	11289.8	0	109.7
ST 4	28	15	0.2	0.8	0	22.8	17.2	40	1088.403	4353.613	0	821.0762	3284.305	0	39.9
Pecho	28	15	0	1	0	0	0		0	0	0	0	0	0	0
Cabrillo	31	12	0	0.5	0.5	129	71	200	0	15395.18	15395.18	0	8473.315	8473.315	199.5
Palisades D	32	23	0	0	1	285	215	500	0	0	68025.21	0	0	51317.26	498.6
Rosina D	29	19	0	1	0	184.5	165.5	350	0	44037.37	0	0	39502.36	0	349
Skyline	26	16	1	0	0	50	50	100	11934.25	0	0	11934.25	0	0	99.7
Loma S (new)			1	0	0	75	75	150	17901.37	0	0	17901.37	0	0	149.6
Palisades S (new)	31	23	1	0	0	75	75	150	17901.37	0	0	17901.37	0	0	149.6
Rosina S (new)	29	19	1	0	0	75	75	150	17901.37	0	0	17901.37	0	0	149.6
10th	34	25	0.35	0.65	0	129	71	200	10776.62	20013.73	0	5931.321	11015.31	0	199.5
8th Deep	25	29	0	1	0	171	129	300	0	40815.12	0	0	30790.36	0	299.2
8th S (new)	24	26	1	0	0	70	70	140	16707.95	0	0	16707.95	0	0	139.6
Pismo S (new)			1	0	0	50	50	100	11934.25	0	0	11934.25	0	0	99.7
SB	34	31	0.75	0.25	0	100.5	49.5	150	17990.88	5996.959	0	8861.178	2953.726	0	149.6
Los Olivos	34	27	1	0	0	106.2	53.8	160	25348.34	0	0	12841.25	0	0	159.6
SB#1	38	29	0.25	0.5	0.25	168.9	101.1	270	10078.47	20156.94	10078.47	6032.762	12065.52	6032.762	269.3
Private A*	34	34	1			22.8	17.2	40	5442.016	0	0	4105.381	0	0	39.9
Private B*	36	33	1			22.8	17.2	40	5442.016	0	0	4105.381	0	0	39.9
Private C*	36	35	1			22.8	17.2	40	5442.016	0	0	4105.381	0	0	39.9
Agriculture*	existing model inputs			1		326.4	153.6	480	0	77906.76	0	0	36662.01	0	478.7
totals								3710	182381.5	243641.2	93498.85	144139.4	156036.7	65823.34	3700

* net output (consumed)

NOTE: The well production values used for this simulation are not the only combination that meets the objectives of the analysis. The distribution of pumpage between purveyors may be shifted in some cases.

These production estimates may require adjustment based on other information not incorporated into the GWBM model.

Entity	net* (afy)	ttl pump (afy)	future wells (afy)
Sea Pines		40	
SCWC		1380	150
LOCSD		1540	400
S&T		150	
PVT*	120	200	
AG*	480	800	
ttl check		4110	

	net* (afy)	ttl pump (afy)	Calib adj.	Yield
SW		598	-88	510
DW		1192	-102	1090
SE*	120	850	0	850
DE		670	0	670
CK*	480	800	0	800
ttl check		4110	-190	3920

ttl check 3710
4110 (with net AG/PVT adjusted to gross)

purveyor well production (AF)

	summer	winter	
inland	1181.3	808.7	1990
bayside	573.3	506.7	1080
ttl check	1754.6	1315.4	3070
percent	0.57	0.43	3070

LOCSD

	summer	winter	
	880.5	659.5	1540
percent	0.57	0.43	

SCWC

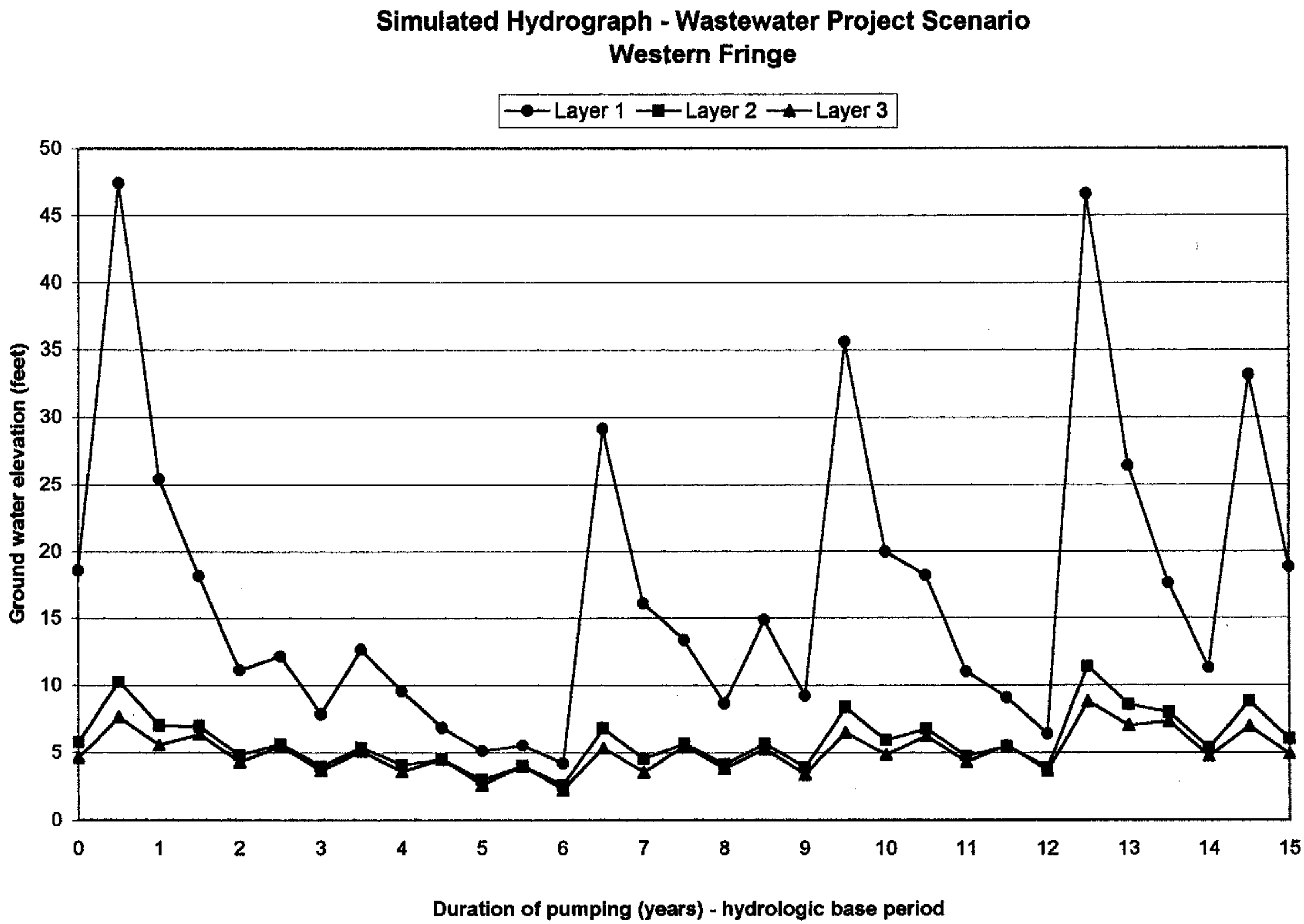
	summer	winter	
	788.6	591.4	1380
percent	0.57	0.43	

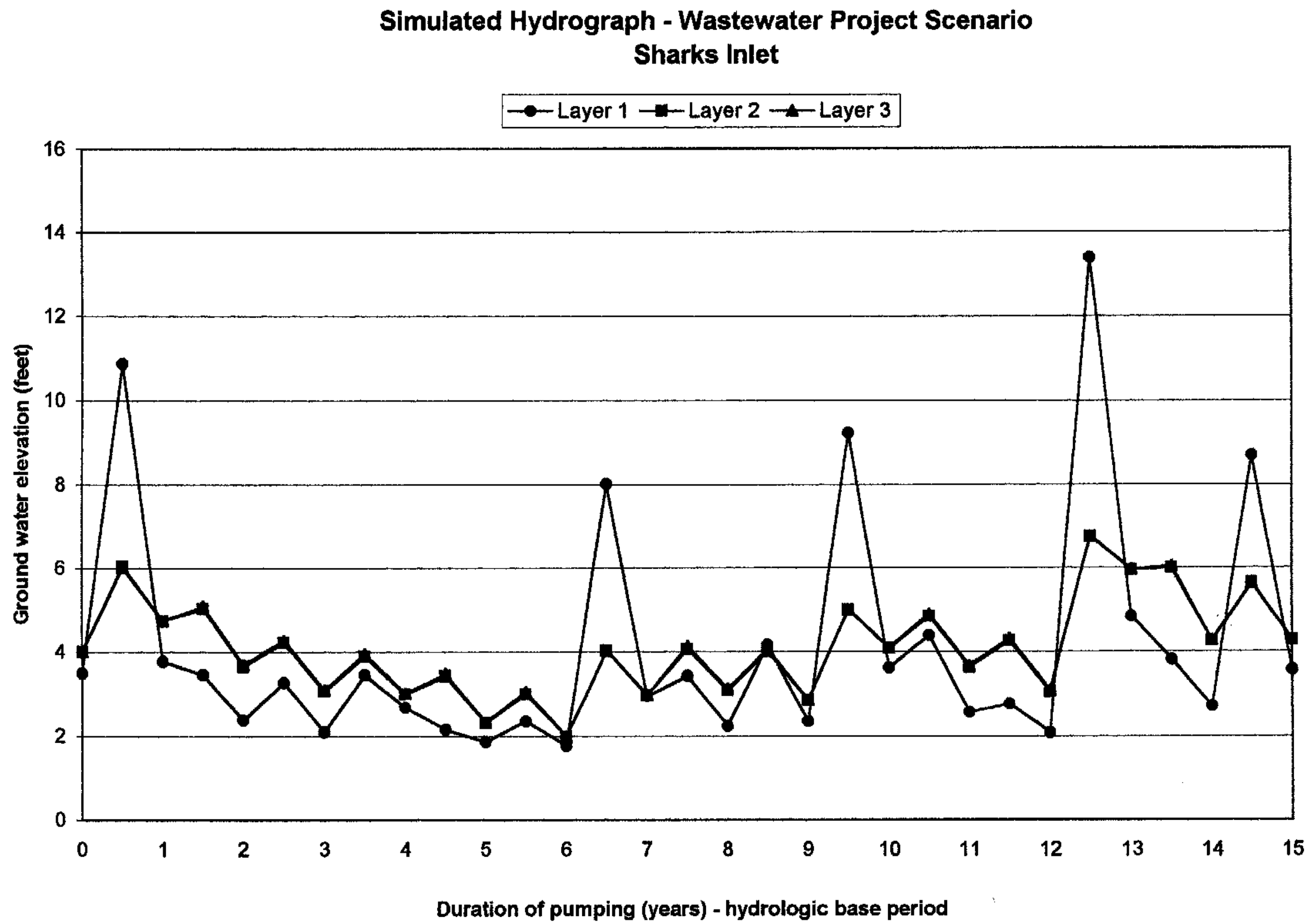
S&T

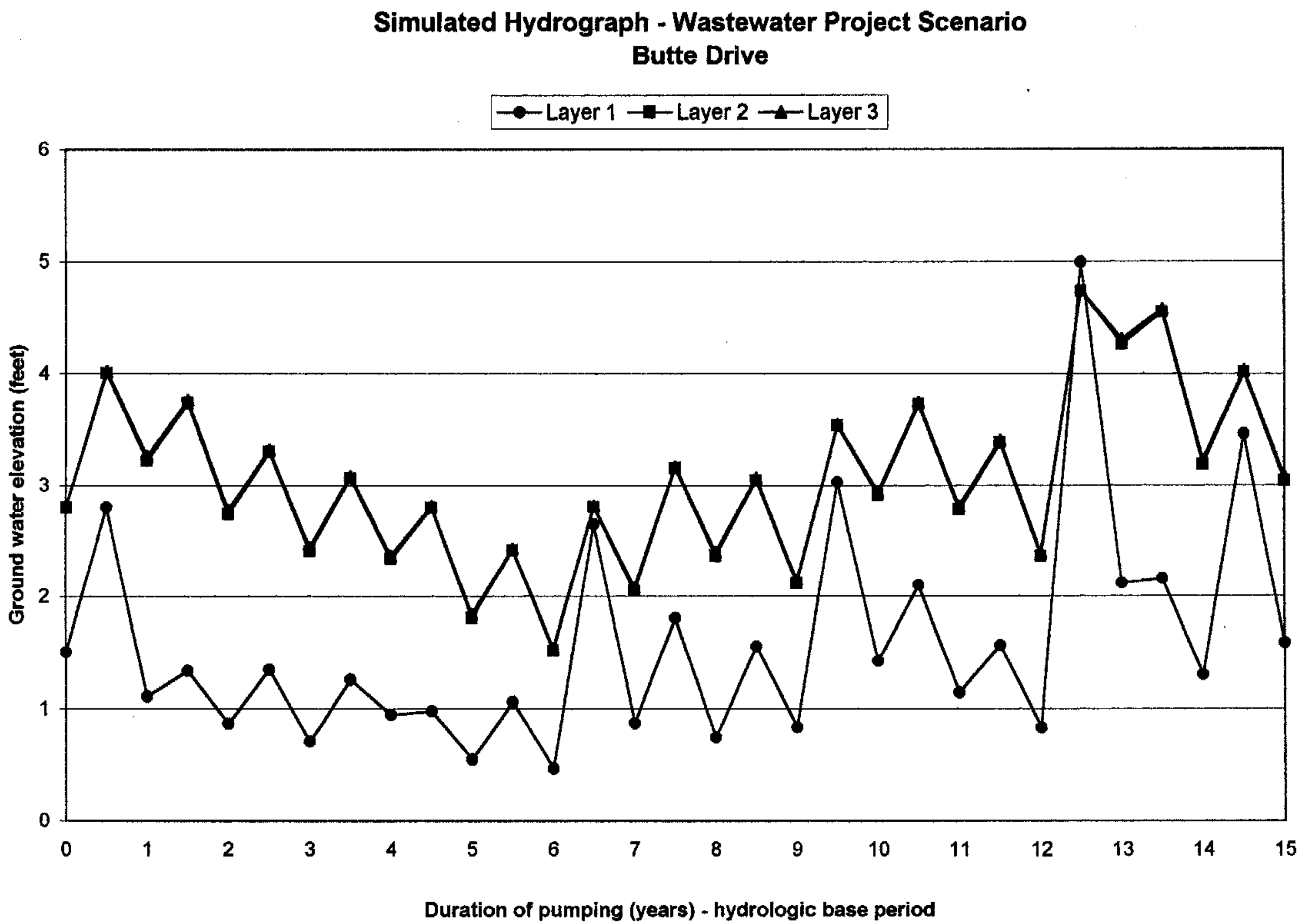
	summer	winter	
	85.5	64.5	150
percent	0.57	0.43	

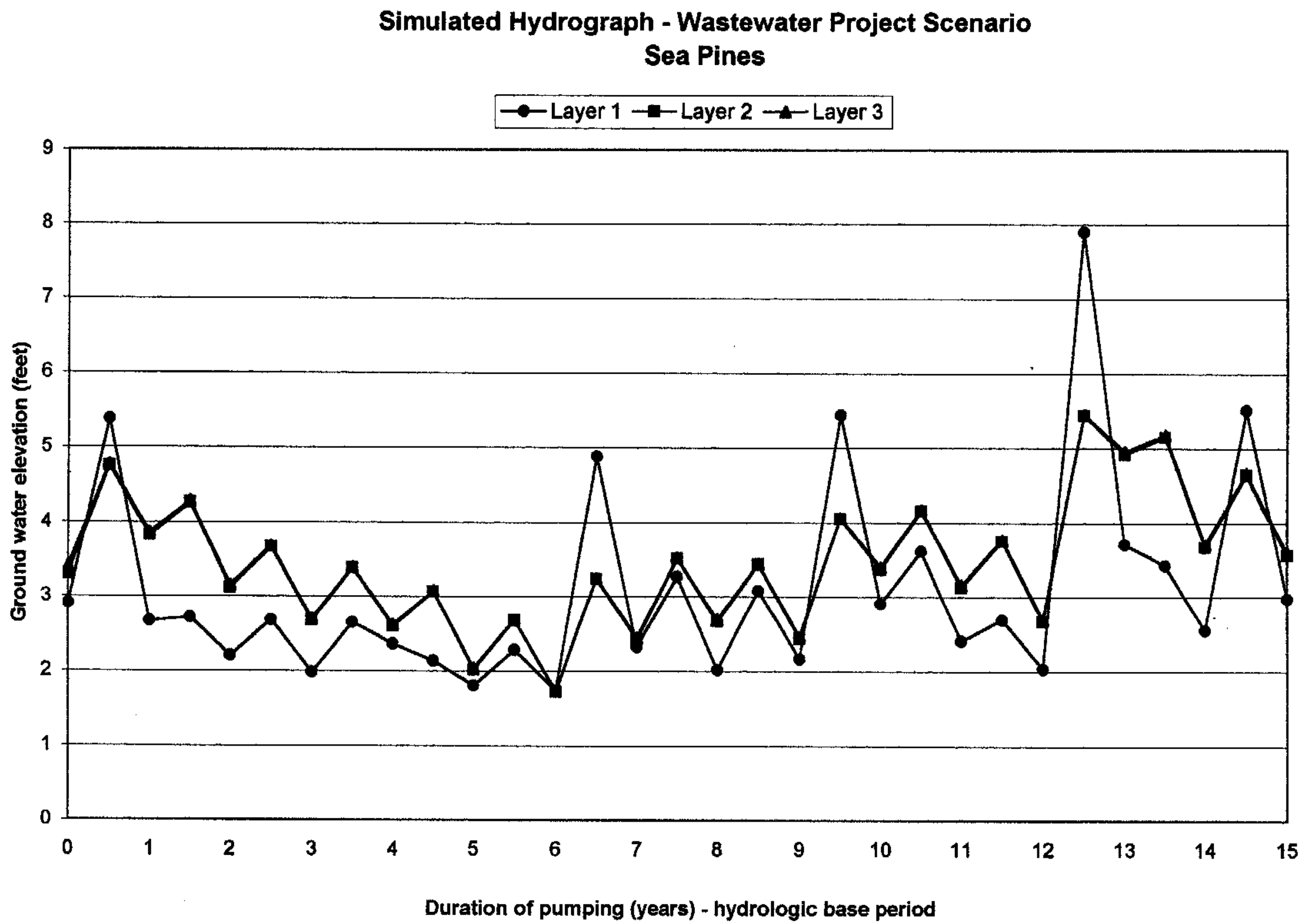
3070

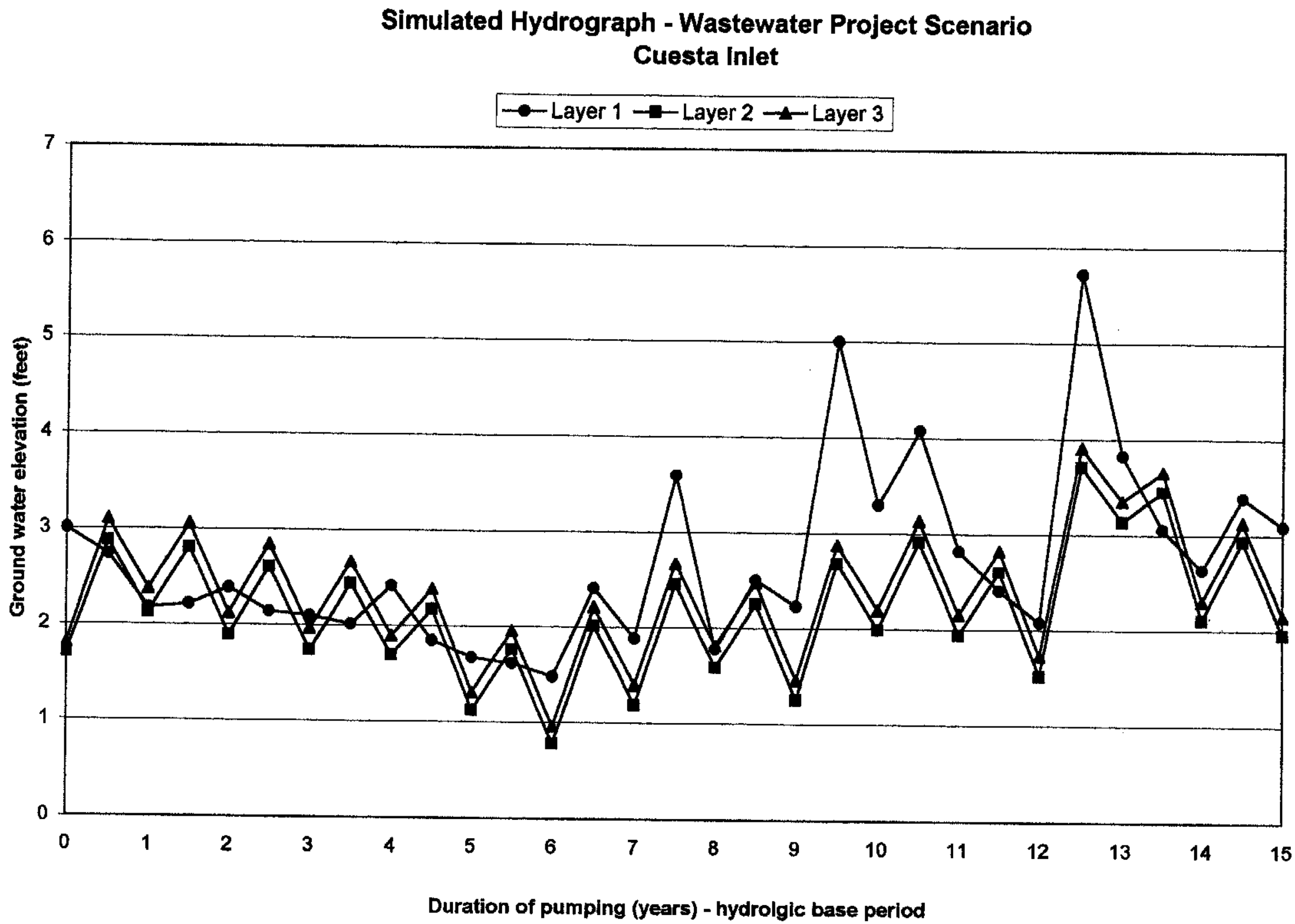
Simulated Model Hydrographs - Wastewater Project Scenario

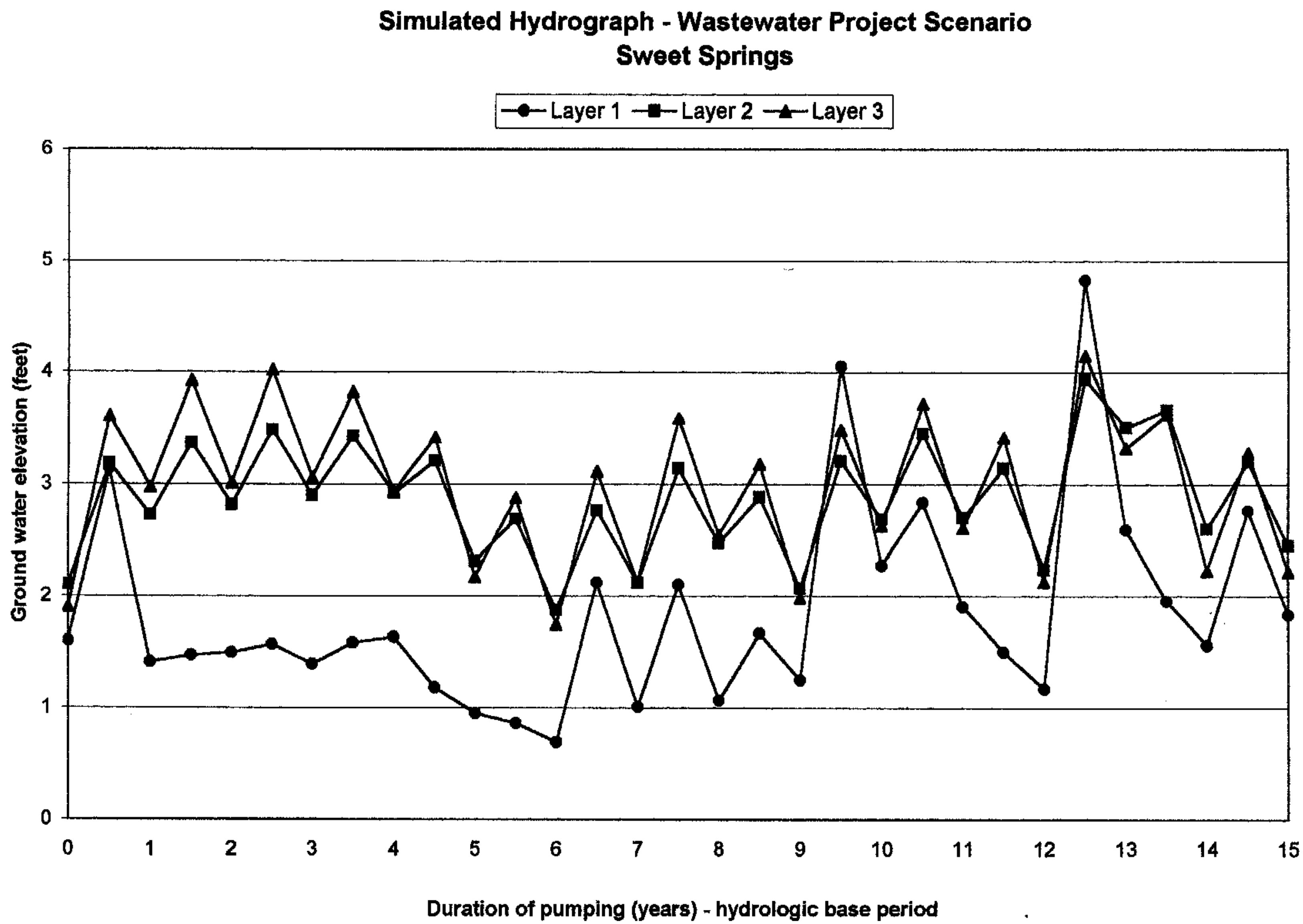

Simulated Hydrograph - Wastewater Project Scenario
Western Fringe
Layer 1
Layer 2
Layer 3
Ground water elevation (feet)
50
45
40
35
30
25
20
15
10
5
0
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Duration of pumping (years) - hydrologic base period


Simulated Hydrograph - Wastewater Project Scenario
Sharks Inlet
Layer 1
Layer 2
Layer 3
Ground water elevation (feet)
0
2
4
6
8
10
12
14
16
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Duration of pumping (years) - hydrologic base period

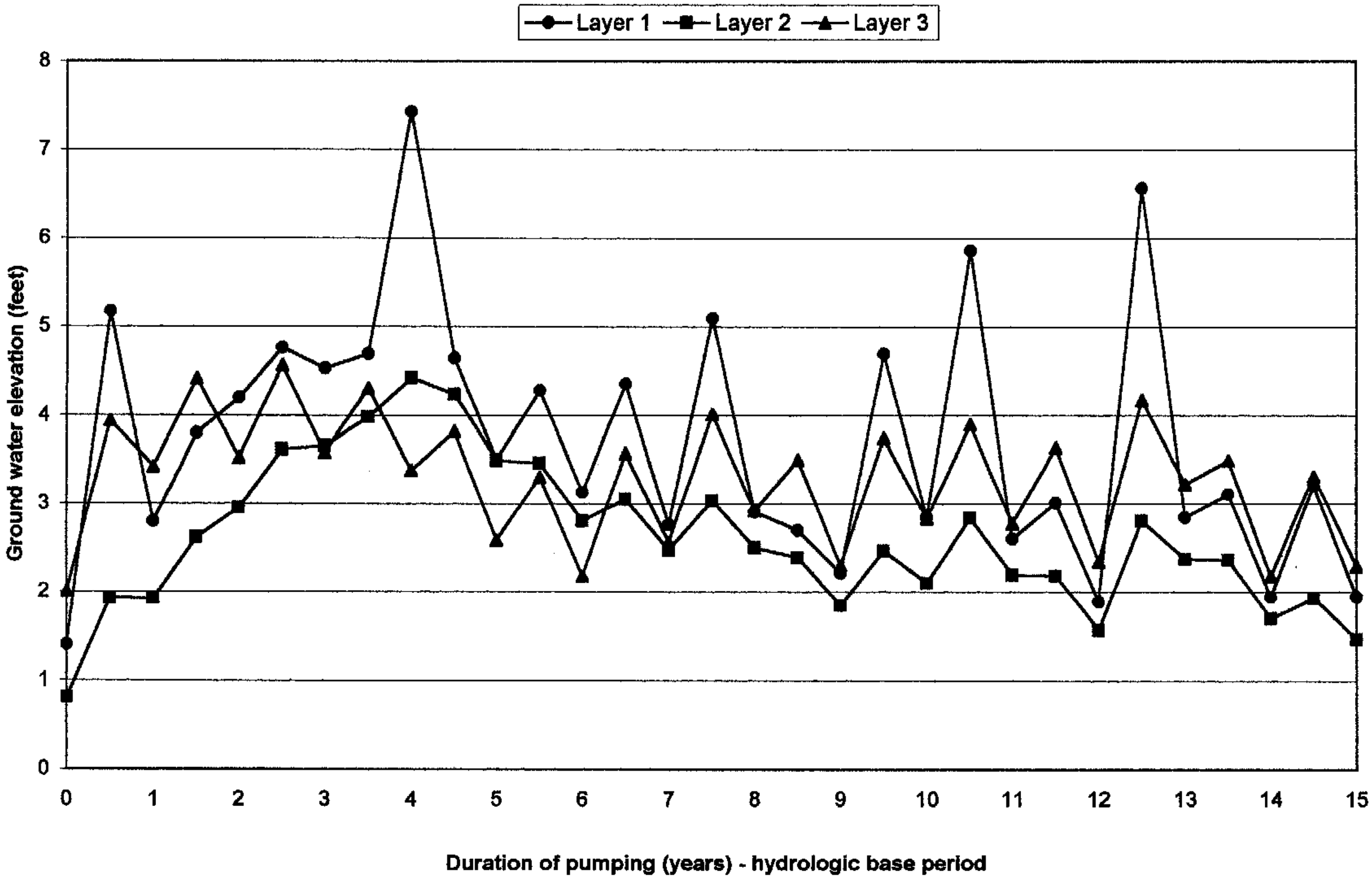

Simulated Hydrograph - Wastewater Project Scenario
Butte Drive
Layer 1
Layer 2
Layer 3
Ground water elevation (feet)
0
1
2
3
4
5
6
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Duration of pumping (years) - hydrologic base period

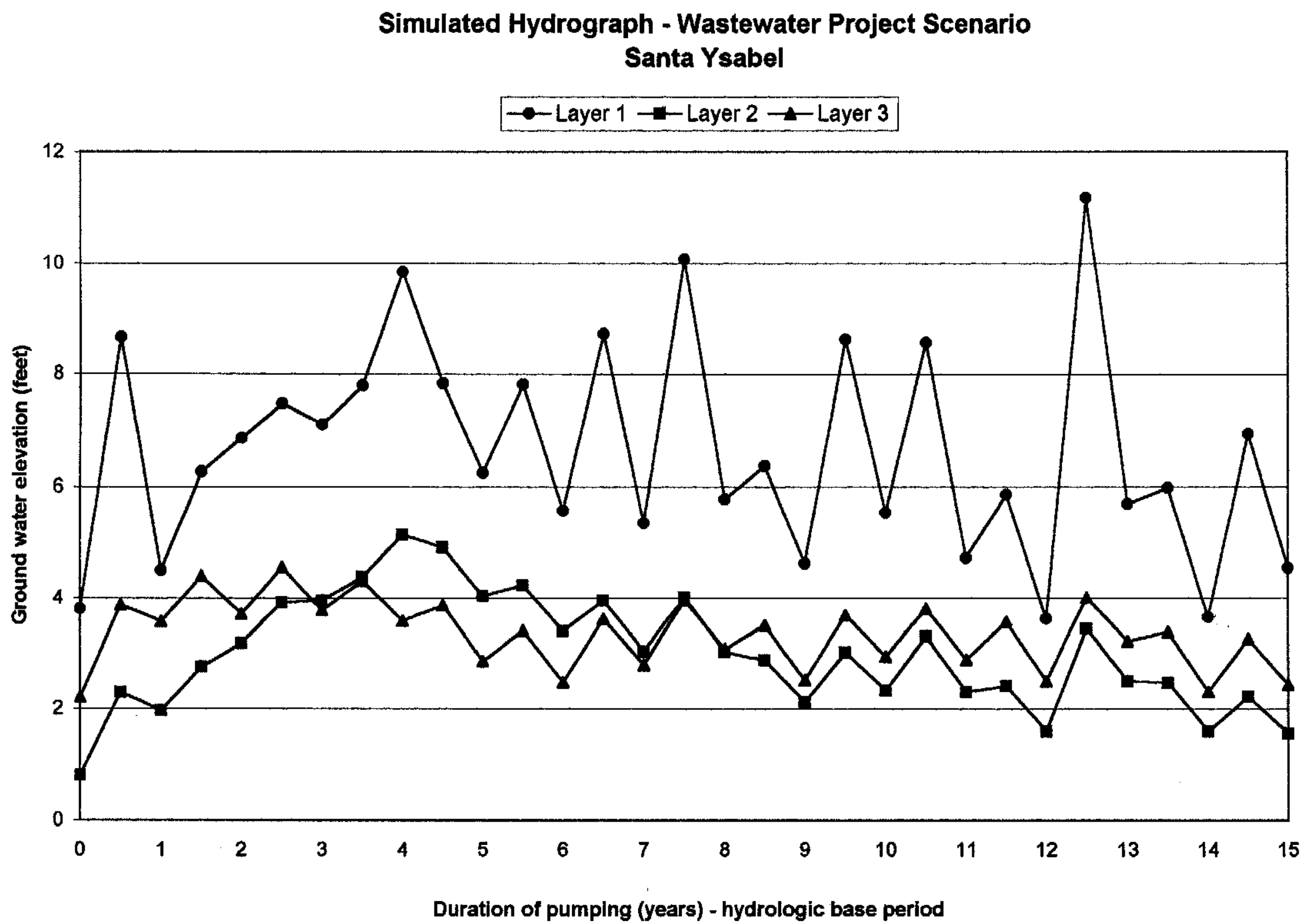

Simulated Hydrograph - Wastewater Project Scenario
Sea Pines
Layer 1
Layer 2
Layer 3
Ground water elevation (feet)
0
1
2
3
4
5
6
7
8
9
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Duration of pumping (years) - hydrologic base period

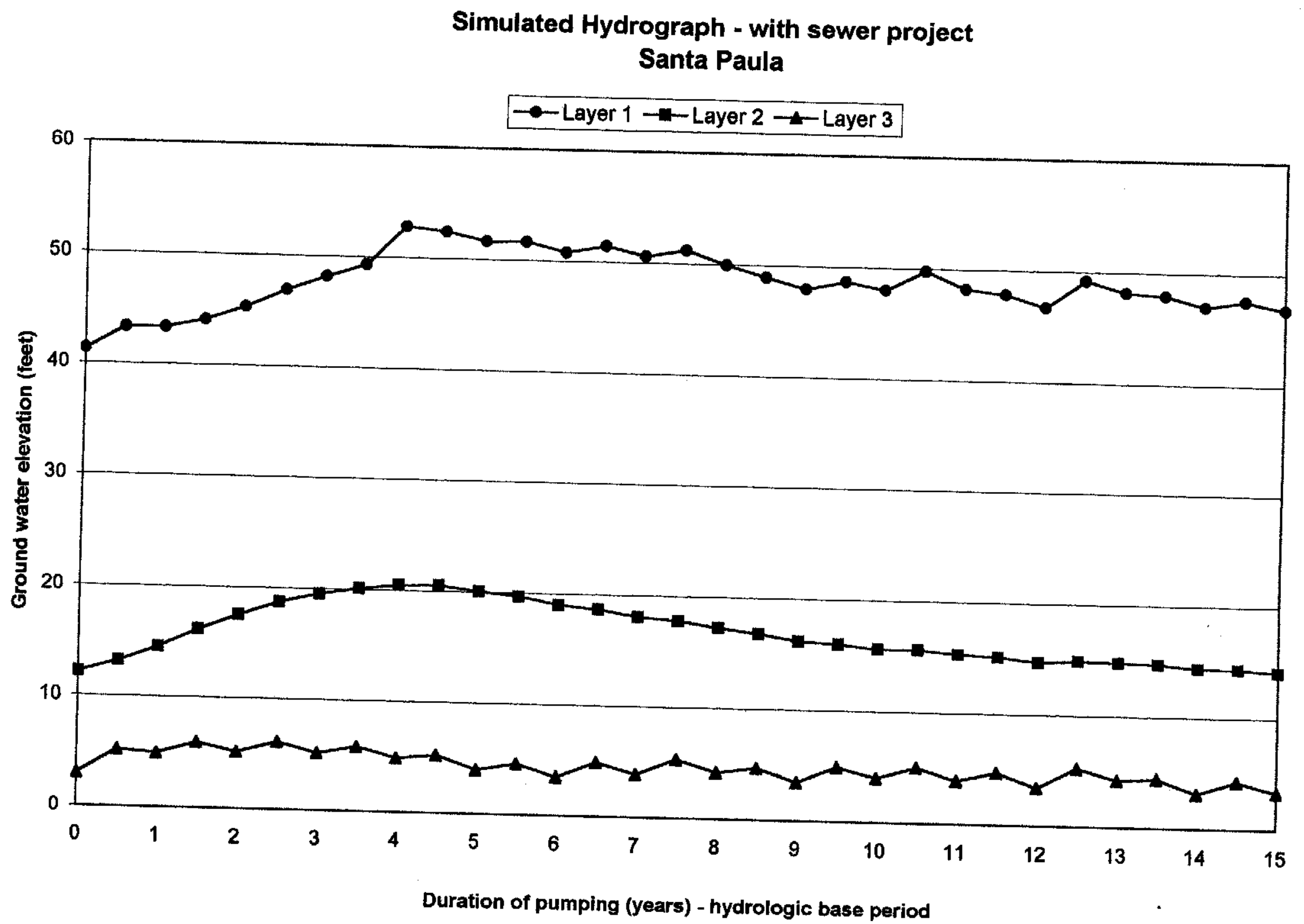

Simulated Hydrograph - Wastewater Project Scenario
Cuesta Inlet
Layer 1
Layer 2
Layer 3
Ground water elevation (feet)
0
1
2
3
4
5
6
7
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Duration of pumping (years) - hydrolgic base period


Simulated Hydrograph - Wastewater Project Scenario
Sweet Springs
Layer 1
Layer 2
Layer 3
Ground water elevation (feet)
0
1
2
3
4
5
6
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Duration of pumping (years) - hydrologic base period

Simulated Hydrograph - Wastewater Project Scenario
3rd Street




Simulated Hydrograph - Wastewater Project Scenario
Santa Ysabel
Layer 1
Layer 2
Layer 3
Ground water elevation (feet)
0
2
4
6
8
10
12
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Duration of pumping (years) - hydrologic base period



Simulated Hydrograph - with sewer project
Santa Paula
Layer 1
Layer 2
Layer 3
Ground water elevation (feet)
60
50
40
30
20
10
0
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Duration of pumping (years) - hydrologic base period

Appendix C
Ground Water Basin Management Plan

APPENDIX C
to the
LOS OSOS COMMUNITY SERVICES DISTRICT
WATER MASTER PLAN

GROUND WATER BASIN MANAGEMENT PLAN

Prepared for

John L. Wallace & Associates

July 2002

Prepared by

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INTRODUCTION

The Ground Water Basin Management Plan is a reference to the results of the management scenarios performed by URS/Team Engineering using a ground water flow model of the basin (URS, Baseline Report of the Los Osos Valley Groundwater Basin, August 2000; Management Scenario, Los Osos valley Groundwater Basin, August 14, 2000). The original GBMP ground water model was used to simulate various basin management alternatives. Six model runs were performed by URS, included two baseline runs and four management scenarios. The four management scenarios consisted of variations in wastewater disposal sites and purveyor production to assess the potential for sea water intrusion. The disposal volume for the scenarios was 1 mgd. Detailed descriptions of the scenarios are in the URS report.

URS Scenarios

The results of the URS scenarios are as follows:

URS Scenario 1 - Broderson Disposal/TAC Build-Out Pumping. According to the report text, the 3rd Street well would begin to pump sea water within a few months, and sea water intrusion may be a concern at the 8th Street well. West side pumping depressions that extend below sea level in model layers 2 and 3 are described as not connected to Morro Bay.

URS Scenario 2 - Broderson Disposal/Alternative Build-Out Pumping. Changes between Scenario 1 and 2 involve the shift of purveyor production further inland. The report states that the rotation of pumping eliminated the pumping depressions that extended into Morro Bay, while it may also be due to the fact that the 3rd Street well is inactive.

URS Scenario 3 - Two Disposal Sites/Alternative Build-out Pumping. This scenario shifts approximately 230,000 gallons per day of wastewater disposal from the Broderson site to South Bay Boulevard. The model report states that "seawater intrusion is not likely to occur in any layer, even with the 3rd Street well pumping at a modest rate".

URS Scenario 4 - Broderson Disposal Site/Exchange Pumping. All purveyor wells were assumed to be operated as one system, with the objective of finding the best combination of pumpage to avoid seawater intrusion. The results are interpreted by URS as showing that seawater intrusion is not likely to occur in any layer.

The following excerpts from the URS Management Scenario Report include statements from which a ground water basin management plan can be drafted:

> "This scenario [3] may not be feasible and would likely be costly. Developing and running this scenario should not be viewed as a recommendation regarding the need for constructing a second

disposal facility east of the [Strand B] fault. This scenario was developed to explore the range of opportunities associated with mitigating the potential impacts that were seen in the results of Scenario 1. Indeed, the results of Scenario 2 suggest that pumping, even at "build-out" levels, can be managed to avoid sea water intrusion." (URS, 2000b, page 6-1)

"This scenario [4] may not be feasible and would likely be costly to develop interconnections to the CCW (California Cities Water) and CSD (Los Osos Community Services District) systems. Developing and running this scenario should not be viewed as a recommendation regarding the need for constructing interconnections and establishing an agreement to share/sell/buy pumped groundwater. It does point to, however, the potential desirability to develop an interconnected system that could be used to respond to conditions in the future if pumping rotation within each water purveyor's system is not sufficient to avoid seawater intrusion. This scenario was developed to explore the range of opportunities associated with mitigating the potential impacts that were seen in the results of Scenario 1. Indeed, the results of Scenario 2 suggest that pumping, even at "build-out" levels, can be managed to avoid sea water intrusion." (URS, 2000b, page 7-1)

Based on the above statements, the recommended plan would be to implement Scenario 2, with the options to shift disposal to the East side or interconnect water systems as secondary strategies. For the purpose of reference and discussion herein, the URS Ground Water Basin Management Plan is summarized as follows:

Recommended Ground Water Basin Management Practices

The following recommended management practices are based on the URS/Team Engineering Management Scenario Report:

1) Perform maximum possible wastewater disposal at the Broderson site. Shifting some disposal to East side of community would help mitigate potential sea water intrusion at the 3rd Street and 8th Street wells but is not necessary for basin-wide management.

2) Connect CCW (California Cities Water) and LOCSD systems if sea water intrusion occurs following implementation of GBMP alternative pumping program.

3) Shift purveyor production at build-out, at least during the peak demand months, to inland wells.

Table 1 compares the URS management scenarios and their relative mitigation potential on sea water intrusion in the shallow and deep aquifers. The relative mitigation potential is based on a review of movie (AVI) files which show the areas below sea level over the model period using color flood frames.

Table 1
Comparison of URS Management Scenarios

URS Scenario	Potential for mitigating sea water intrusion (1st ranking = best)							
	Layer 1 (shallow aquifer)		Layer 2 (deep aquifer)		Layer 3 (deep aquifer)		Overall Rank	
	West	East	West	East	West	East	West	East
Scenario 1	4th	4th	4th	4th	4th	4th	4th	4th
Scenario 2	2nd	3rd	2nd	2nd	1st	2nd	2nd	2nd
Scenario 3	3rd	1st	3rd	1st	2nd	1st	3rd	1st
Scenario 4	1st	2nd	1st	3rd	3rd	3rd	1st	3rd

Scenario 1 is the poorest management option for each of the three layers, with the remaining three scenarios fairly evenly matched. Scenario 3 appears to be the best overall management option for the basin. The differences in potential sea water mitigation between Scenarios 2, 3, and 4 on the on the West side are minimal, compared to the differences in potential sea water mitigation on the East side, where Scenario 3 is much better than the others.

With respect to model management protocols, the URS Baseline Report includes recommendations regarding update of the baseline report, and an outline for annual reports. These recommendations include protocol for measuring ground water levels, and advises updating the model no more than once every 5 to 7 years (first update in 2005-2007).

Appendix D
Water System Supply Sources Assessment

APPENDIX D

to the

LOS OSOS COMMUNITY SERVICES DISTRICT
WATER MASTER PLAN

WATER SYSTEM SUPPLY SOURCES ASSESSMENT

Prepared for

John L. Wallace & Associates

July 2002

Prepared by

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INTRODUCTION

The water supply source facilities for the Los Osos Community Services District (LOCSD) consist of five active ground water wells and one inactive well which produce from the Los Osos ground water basin. The assessment of existing water source facilities includes an evaluation of each well with respect to source capacity, an assessment of pumping practices and Title 22 compliance.

For reference, the following terms used in Task 5.3 are defined:

Pump Capacity -	The instantaneous discharge rate (flow) of ground water provided by the well pump under operating system pressures.
Sustained Yield -	The maximum ground water pumping rate for a well, sustained over a prescribed period of time (i.e. 3-day, 30-day, long-term, etc.), that does not result in aquifer zone dewatering.
Source Capacity -	Either the pump capacity or the 30-day sustained yield, whichever is less.
System Capacity -	The sum of the individual source capacities.
System Yield -	The sum of the individual long-term sustained yields. The maximum system yield is constrained by basin yield and the activities of other water purveyors and users.

The distinction between capacity and yield is important to understanding source evaluations. Capacities mainly consider system pumps and operating pressures, while yields mainly consider the hydrology and hydrogeology. Often, the pump capacity will exceed the long-term sustained yield of a well, because demand cycles require pumping in excess of the long-term yield during peak periods. When planning for future community growth and the availability a water supply, the yields are a limiting factor. When planning a system to deliver the water to users, the capacities can become a limiting factor.

Current Water System Capacity

The capacity of the current system supply sources has been assessed using both historical records and recent pumping tests. As defined above, the source capacity for a well is either the pump capacity or the 30-day sustained yield, whichever is less. The pump capacity is obtained directly from historical records. The 30-day sustained yield value is derived primarily from pumping tests conducted at each well. These pump tests have been used to assign maximum recommended 30-day yield capacities (attached). The source capacities are summarized in the following table and discussed for each well below.

Table 1
Source Capacity - July 2002

Well	Pump Capacity (gpm)	30-Day sustained yield (gpm)	Source Capacity (gpm)
3rd Street	85	80	80
8th Street	420	440	420
10th Street	300	220	220
South Bay	195	110	110
Palisades	750	1100	750
System total	1,750	1,950	1,580

Historical records of production were also reviewed, and the maximum single month historical production exceeded the estimated 30-day yield at the 10th Street and South Bay wells. This is because both these wells were pumped below the top of the casing perforations and aquifer dewatering was occurring. As defined above, sustained yield estimates preclude aquifer dewatering. When an aquifer tapped by a well is dewatered, the following impacts to the well can occur:

- Cascading water creates turbulent flow conditions in the well bore, which reduces well efficiency.
- The potential for gravel pack disturbance and sanding increases.
- Aeration of the aquifer is increased, enhancing potential problems related to biofouling.
- Aquifer transmissivity and well specific capacity decline.

The present facilities have a system source capacity of 1,580 gpm. Some wells in the LOCSD system are pumped at rates higher than the recommended maximum source capacity, while others are pumped at lower rates. In fact, the source capacity is independent of the pump capacity.

Pumping Practices

LOCSD pumping practices carry over from the former County Services Area 9A practices. Each well is on a float switch at the 16th Street reservoir, and the Palisades well is also equipped with a timer. Wells are individually set to activate when storage is drawn below a specific level and to shut off when storage reaches a specific level.

The LOSCD utilities department collects and analyzes well production and power consumption to determine which wells are providing the most efficient service and to identify potential equipment problems. The tank switch settings are in the process of being reviewed. The following table lists the order of pumping for the tank switches, and some of the factors considered. None of the wells reportedly produces sand.

Table 2
Pumping Practices - LOCSD as of June 2001

Well ID	Efficiency		Other considerations for use	Tank level switch (feet of water)	
	gal/kWh	Rank		Start	Stop
3rd Street	582 - 607	1st	artesian flow (rare)	33.0	37.4
8th Street	490 - 525	4th	iron and manganese filtration	32.9	37.4
10th Street	500 - 543	3rd	cascading water	33.3	37.5
South Bay	430 - 458	5th	iron bacteria / cascading water	33.3	37.4
Palisades	544 - 597	2nd	high capacity	28.0*	37.5

*Notes: Palisades is placed last in the tank switch lineup because it is operated using a timer.

In terms of annual production, the Palisades well has historically pumped the most water (up to 700 afy), although this has been cut back over the last 10 years to closer to 300 afy average. The 10th Street well is also operated at close to 300 afy, followed by the 8th Street well (200 afy), South Bay well (200 afy but not without problems), and the 3rd Street well (80 afy).

Based on the evaluation of the constant discharge tests and well construction, recommendations for maximum annual production and recommended instantaneous discharge rates have been prepared. These recommendations are discussed below.

Annual production at the 3rd Street well of up to **80 afy** is recommended, based on some assumptions regarding construction. An instantaneous discharge rate of 65 gpm would be optimum, however, there is really no reason to change the current pumping practice of the well, which operates at 80 gpm.

Annual production at the 10th Street well should not exceed approximately 290 afy, and a pumping rate of 260 gpm would be optimum to avoid cascading water, based on the pumping test. The GBMP recommendations would place the 10th Street well high in the ranking of locations to pump within the basin, although proximity to other wells may result in a pumping trough that reduces the maximum recommended annual production volume. A maximum yield of **250 afy** results from GBMP model runs.

Production at the South Bay well should be reduced to no more than **150 afy** to minimize falling water. The iron bacteria problem at the South Bay well is being promoted by the continual aeration of the borehole and filter pack. A reduction in discharge rate from the current rate of 190 gpm to approximately 120 gpm is recommended, so that pumping lifts are lower, and the well may operated for longer periods to avoid standing idle. This well is also in a favorable location from a standpoint of GWBMP recommendations, and should be pumped at the maximum recommended rate.

Production at the 8th Street well can theoretically approach 600 afy from a capacity standpoint. A discharge rate of up to 440 gpm could be acceptable with sand production monitoring. Modeling efforts indicate the well should not be tapped for more than **400 afy**.

The Palisades well has the greatest capacity of any well in the entire basin. The well was drilled using reverse-rotary and perforated below 350 feet depth. Significantly more drawdown may be developed without exposing the perforations than most other LOCSD wells. Based on the constant discharge test and well construction, the Palisades well could be equipped with a well capacity of up to 1,200 gpm (pending analysis of sanding potential at the higher discharge rate) and, if the water were available, could produce over 1,000 afy. In reality, however, the Palisades well cannot be used to its full potential. The basin will not yield 1,000 afy at that location without pulling in sea water, according to the GWBMP model. Despite it's tremendous capacity, the operation of other pumping wells, especially California Cities Water Company (CCW) Rosina and Pecho wells, limit the effective use of the Palisade well to an estimated **400 afy**. The recommended maximum yields and pumping rates for each system well is summarized below.

Table 3
Recommended Maximum Yield and Pump Capacity
Existing Conditions

Well ID	Maximum Yield (afy)	Maximum Pump Capacity* (gpm)
3rd Street	80	80
8th Street	400	440
10th Street	250	260
South Bay	150	120
Palisades	400	1,200
System Total	1,280	2,100*

* Note: The maximum pump capacity is greater than the maximum source capacity (see definitions). A sand test would be recommended at the Palisades well prior to increasing pump capacity.

The pumping practices of California Cities Water Company have been changing over the last 18 months. The Skyline, Los Olivos #3, Cabrillo, and Highland wells were out of service at the beginning of 2001, with Rosina and Pecho as the only two active wells. Since then, the Cabrillo well has gone into production, and the new South Bay #1 well is also on-line. Los Olivos #3 and Skyline will eventually be brought on-line. There are no plans to re-activate the Highland well. The water company intends to significantly reduce production at the Pecho and Rosina wells, in keeping with the GWBMP recommendations to shift production inland.

S&T Mutual water company operates three wells and has drilled a fourth well that is currently in the process of being equipped. Pumping practices are constrained by nitrates in the shallow aquifer and sea water intrusion in the lower aquifer at the S&T well field. The water company currently blends water from Wells 3 and 4, and has brought power to the new well, which has good water quality. Plans for future pumping are to shift production to the new well (Well 5) to the maximum extent possible.

Other principal water users in the basin include Sea Pines golf course and agricultural use along the Los Osos Creek valley. The golf course has expanded slightly in recent years, and has also begun using reclaimed wastewater from the Monarch Grove wastewater treatment plant. Pumping practices are assumed to be typical for golf course operation, with high demands peaking during the summer and low demand in winter. Only one shallow aquifer well is used for irrigation.

Agricultural pumping practices are seasonal and vary based on the cropping patterns, which may be controlled by the market from year to year. Lettuce, broccoli and peas are common, and a turf farm operates year-round. Most of the farmed lands are double cropped.

System Yield and Title 22 Compliance

The evaluation of system yield and Title 22 compliance has been performed with respect to the adequacy of the water supply and with respect to salinity and nitrate issues. The supply evaluation is based on the requirements in Title 22, Article 2, Sections 64562, 64563, and 64564. The water quality issues have been evaluated based on sea water intrusion, salt loading and nitrate loading issues.

<u>Water Supply</u>

According to Title 22, Section 64562:

> (a) Sufficient water shall be available from the water sources and distribution reservoirs to supply adequately, dependably and safely the total requirements of all users under maximum demand conditions before agreement is made to permit additional service connections to a system.

The procedures to evaluate whether sufficient water is available is presented in Title 22 Sections 64562, 64563, and 64564 and essentially consist of determining the existing source capacity, storage capacity, and maximum demand condition. Title 22 emphasizes that historical records should be used whenever possible, before resorting to charts for estimating system parameters. Therefore, actual LOCSD records have been used for this analysis.

The existing Title 22 source capacity for each well is the sustained yield for peak month demand conditions, and has been determined previously based on historical records and a recent constant discharge tests. The results are summarized in the following table as follows:

Table 4
System Capacity compared to Historical Production

Well	Source Capacity July 2002	Maximum historical monthly production.
3rd Street (30S/10E- 07N01)	80 gpm	3,628,000 gal. (Oct. 1995) = 80 gpm
8th Street (30S/11E-07Q03)	420 gpm	16,580,700 gal. (July 1990) = 370 gpm
10th Street (30S/11E-18K02)	220 gpm	17,259,000 gal. (June 1995) = 400 gpm
South Bay (30S/11E-17E11)	110 gpm	7,981,600 gal. (Aug. 1997) = 180 gpm
Palisades (30S/11E-18L02)	750 gpm	22,638,000 gal. (June 1992) = 520 gpm
System Capacity	1,580 gpm	1,550 gpm

Several of the well have been pumped historically at rates higher than their source capacity. This is because water levels have been allowed to drop into the perforated interval with partial dewatering of the aquifer occurring. As mentioned previously, this practice may lead to problems at a particular well, and should be avoided if possible. Certainly, there are other factors to consider when operating a water supply system, of which cascading water is only one. For the purposes of Tittle 22 compliance, however, the safe and dependable supply would avoid cascading water in wells if possible.

The system total capacity for July 2002 is estimated at 1,580 gpm. This represents the maximum recommended flow that can be sustained for a peak demand month. To estimate the maximum day demand, historical records of daily production at each well from October 1996 through January 1999 were reviewed. The greatest daily production is assumed to be roughly equivalent to the maximum daily demand. The greatest single day production during the period reviewed was 1,693,900 gallons pumped between the mornings of August 20th and August 21st, 1998 (equivalent to a constant discharge rate of 1176 gpm for one day). The total production for August 1998, also the greatest monthly production in the period reviewed, was 39,049,000 gallons.

Based on the available historical records, the needed source capacity for the system is 1.7 mgd. The current system capacity of 1,580 gpm is equivalent to 2.28 mgd and exceeds the maximum daily demand/needed source capacity. The maximum system capacity of 2.8 mgd (1,950 gpm) can be obtained, if needed, by placing a larger pump in the Palisades well.

The total storage capacity of the system, provided by three storage tanks, is 1,240,000 gallons. This storage volume is adequate based on historical records. System wells pump into the two 16th Street tanks. These tanks are connected. The third storage tank at 10th Street is filled from the 16th Street tanks. Stored water at the 16th Street tanks can reach a maximum 40 feet in water height. Over the last five years, the level in the tanks has dipped as low as 27 feet (of water height) approximately five times, or an average of one day per year. Therefore, the system utilizes less than half of its storage capacity during peak demand periods.

The LOCSD system meets Title 22 compliance standards for a dependable and safe water supply. System capacity exceeds maximum demand, and storage capacity is adequate.

Water Quality

The main water quality issues in the basin include salinity increases due to sea water intrusion and elevated nitrate concentration in the shallow aquifer due to existing wastewater disposal practices. With respect to sea water intrusion, current efforts underway by CCW and S&T Mutual to shift production away from the impacted area should improve the sea water intrusion situation. Overall production from the West side deep aquifer should be limited to 800 afy. Continued monitoring of water levels at the Howard Street observation well 13M02 and the former Kumabe well 13P02 will indicate whether or not the movement of sea water has been reversed. The implementation of the sewer project will enhance recharge to the West side deep aquifer, but not to the extent that production may be resumed at the present levels. A modest increase in yield of one to two hundred acre-feet per year is likely. None of the LOCSD wells have experienced sea water intrusion nor, with the exception of the 3rd Street well, will be subject to sea water intrusion impacts following the sewer project.

Nitrates are the central issue for the wastewater project, and the preservation of the shallow aquifer for use as a drinking water supply is the reason for the Regional Water Quality Control Board's orders to eliminate failing septic systems. The wastewater project will result in the net export of nitrates from the basin, and will eventually lower the nitrate concentrations in the shallow aquifer to acceptable levels. The time required to clean the upper aquifer is currently being evaluated using the GBMP model with the solute transport package. Until the nitrates are below drinking water standards, treatment by blending with deep aquifer water or nitrate removal will be necessary.

Ground Water Well Siting Recommendations

Additional wells may be drilled to increase the water system capacity. Maintaining well spacing, preferably 2,000 feet or more for deeper supply wells completed in the same aquifer, is recommended. Each location for new water wells should be evaluated on a site specific basis to estimate potential well capacity. The GBMP model may be used to roughly estimate the yield of an area, but not the capacity of a well at a given location. The areas which will support new production in the basin, based on the GBMP Model are:

- Shallow aquifer wells north of Los Osos Valley Road in the West side compartment. There is an existing untapped production potential that will increase with implementation of the wastewater project. Several locations for wells have been proposed, such as the north end of Palisades Avenue, near Broderson Avenue and Loma Street, and along Rosina Drive. Blending or treatment for nitrates should be expected.

- East side aquifer wells. Potential for developing additional East side production exists with and without the wastewater project. A shallow/deep (mixed) aquifer well located between the 8th Street well and the LOCSD South Bay well would maintain adequate spacing to avoid well interference. A shallow aquifer well at the LOSCD 8th Street facility would be recommended to tap the shallow aquifer and provide a replacement location for the 3rd Street well (when needed). The electric log for the 8th Street test hole and an addendum to the driller's formation log show the main shallow sand aquifer zone between 75 and 125 feet depth. Blending or treatment for nitrates may be necessary. The Ferrell Avenue well site is also an optional location for increasing basin yield.

SUMMARY OF FINDINGS

- The Los Osos CSD wells have a system capacity **1,580 gallons per minute** which exceeds the historic maximum daily demand of 1,176 gallons per minute. With select pump replacements, maximum system capacity with the existing wells could be 1,950 gpm.

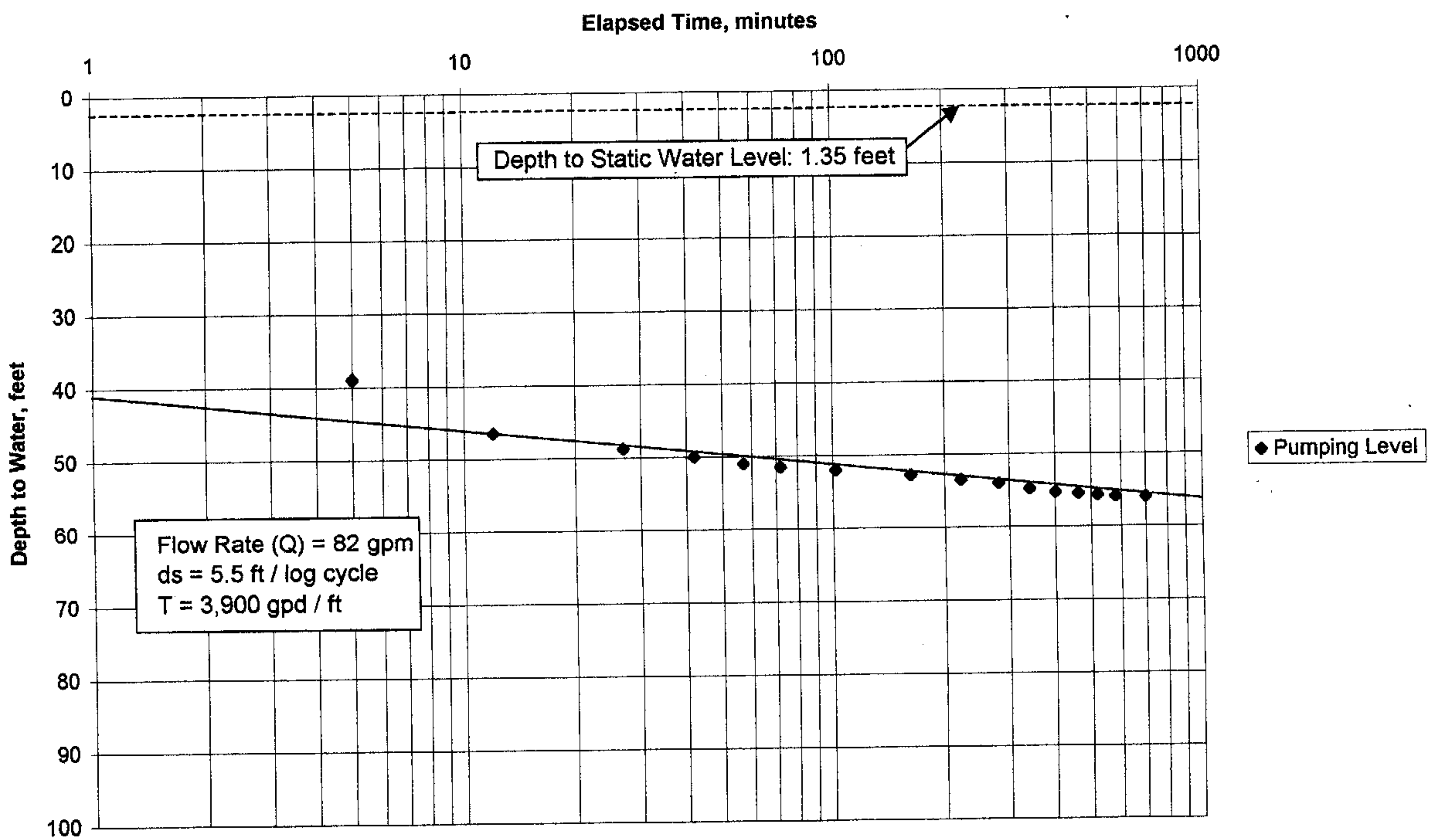
- Water supply and water storage capacity meets Title 22 requirements. The main water quality concerns in the basin are nitrates and sea water intrusion.

- New well sites may be considered to produce water from the shallow aquifer in the western basin compartment and in the shallow and deep aquifers within the eastern basin compartment. A reduction in production from the West side compartment is necessary to stop sea water intrusion.

Attachment:

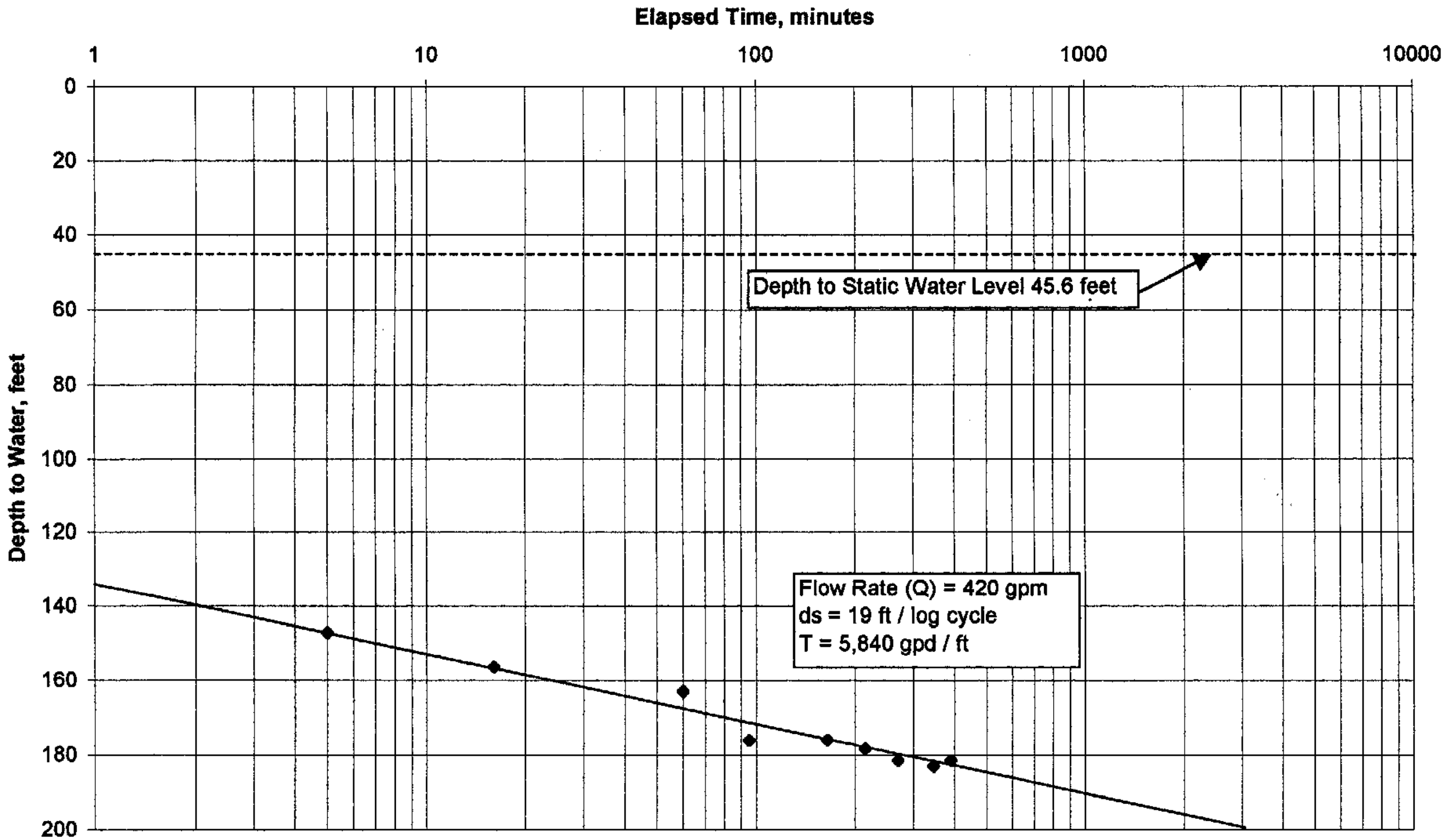
Constant Discharge Tests

Pumping Test - 3rd Street
December 27, 2000

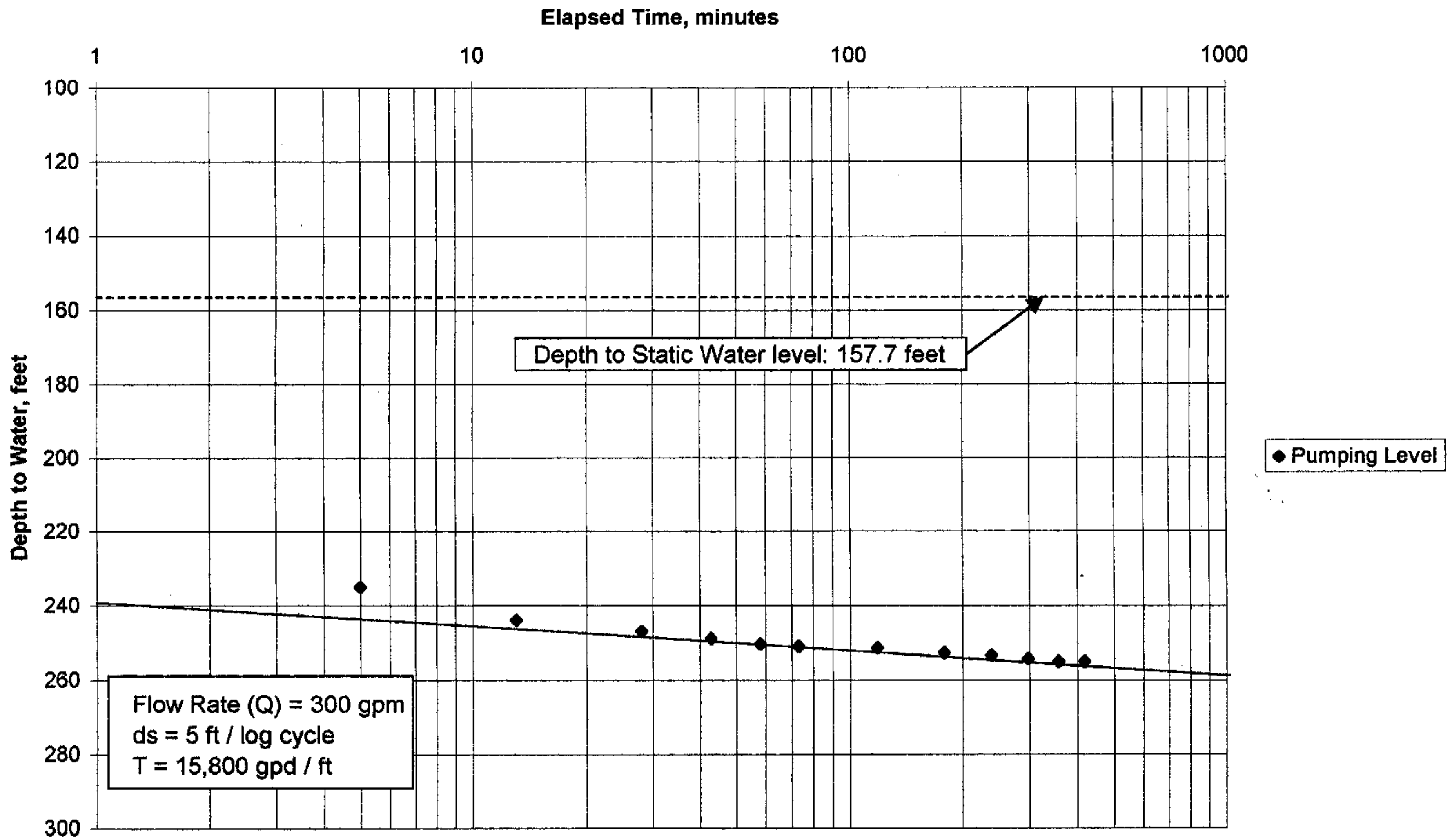


Pumping Test - 8th Street
July 18, 2002

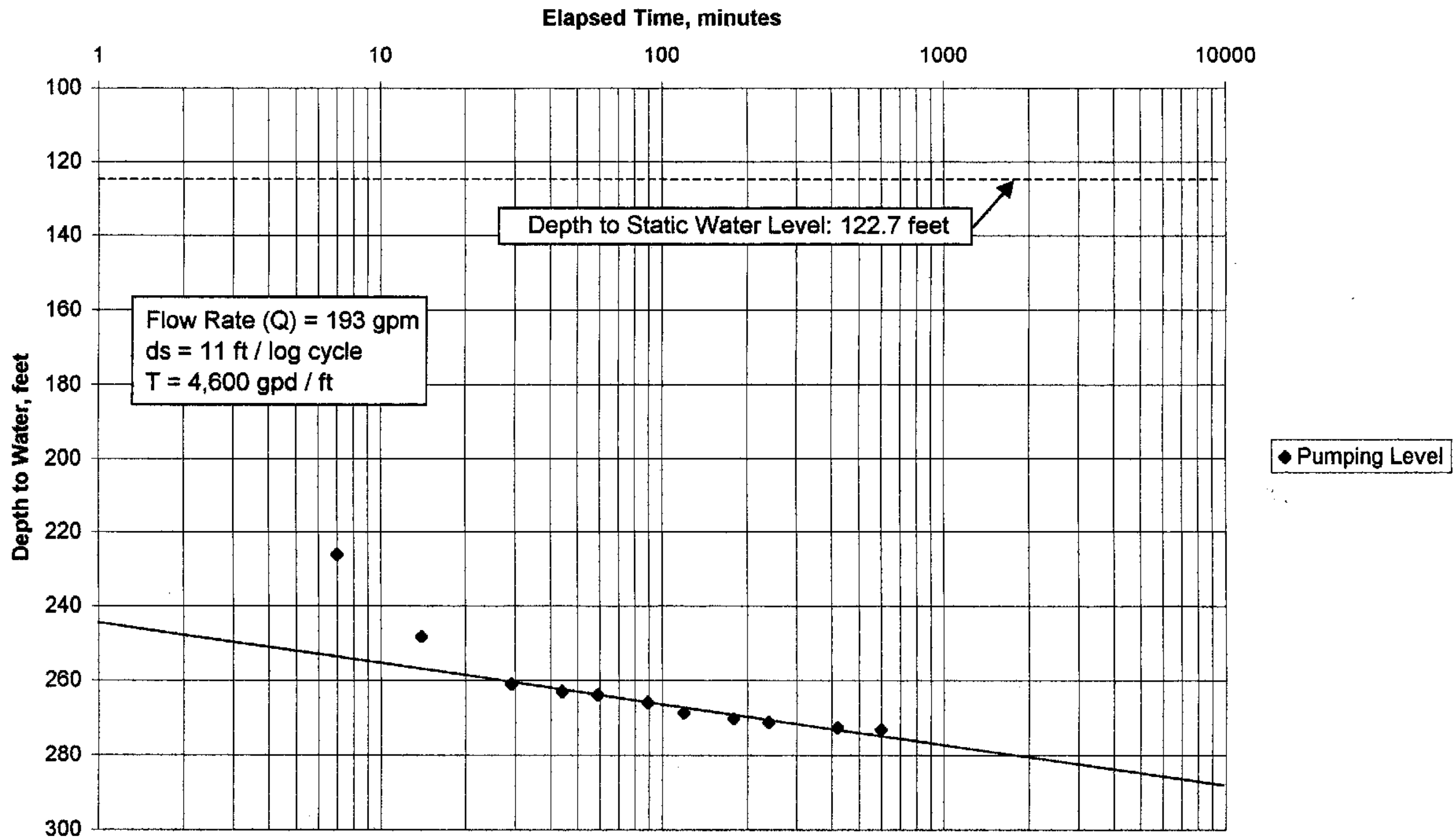
Depth to Static Water Level: 45.6 feet **Pumping Rate: approx. 420 gpm**



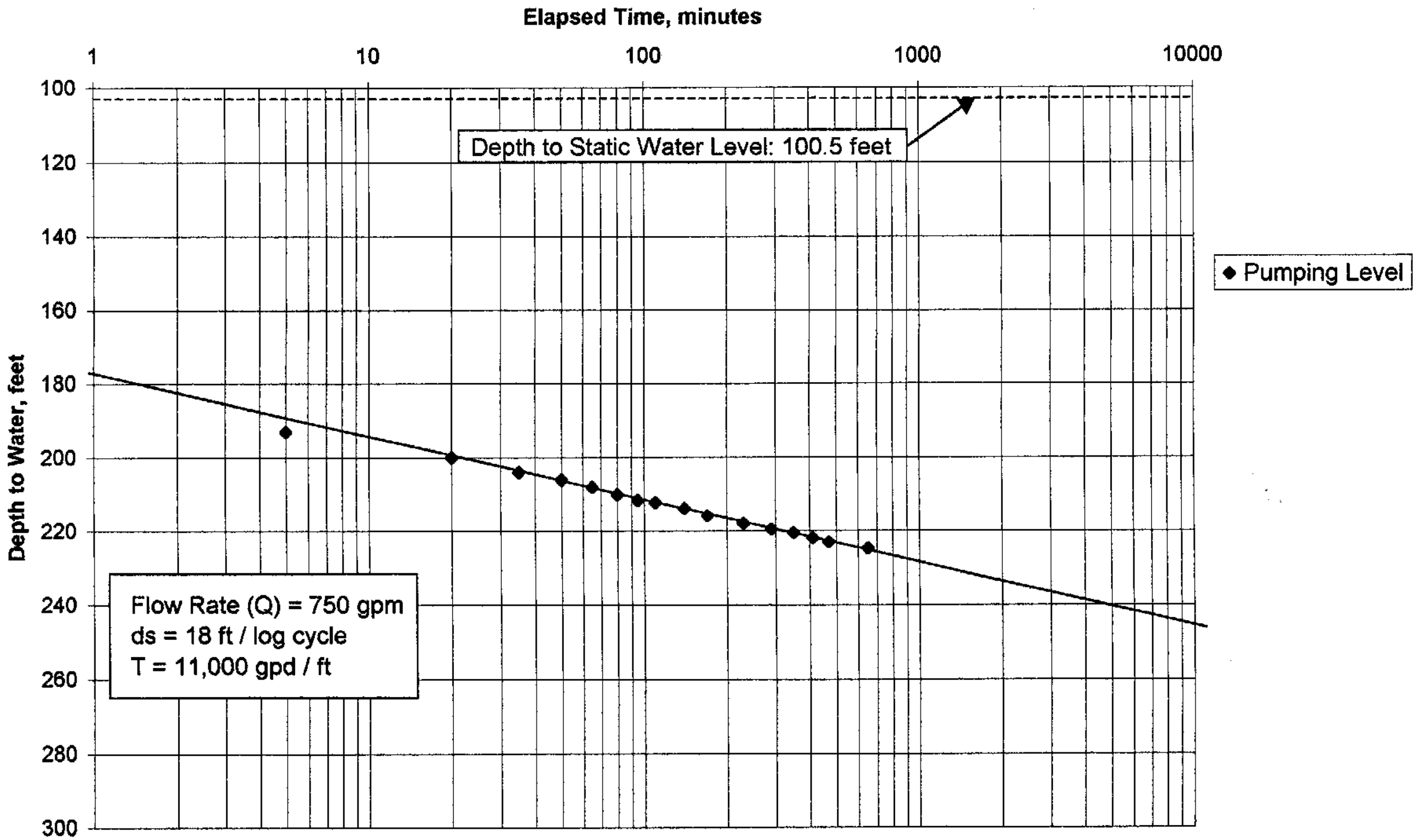
Pumping Test -10th Street
December 27, 2000



Pumping Test - South Bay
January 2, 2001



Pumping Test - Palisades
December 29, 2000



Appendix E
Draft DHS Groundwater Regulations

This is a DRAFT regulation; it reflects the Department of Health Services' most current thinking on the regulation of recharge of groundwater with recycled water. We would appreciate any informal comments you might have on this draft; they can be emailed to Bob Hultquist: bhultqui@dhs.ca.gov.

Title 22, CALIFORNIA CODE OF REGULATIONS
DIVISION 4. ENVIRONMENTAL HEALTH
CHAPTER 3. RECYCLING CRITERIA

ARTICLE 1. DEFINITIONS

Section 60301.080. 24-hour Composite Sample.

"24-hour composite sample" means a combination of no fewer than eight individual samples obtained at equal time intervals during a 24-hour period, such that the volume of each individual sample is proportional to the flow at the time of sampling.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60301.090. Applied Recycled Water.

"Applied recycled water" means recycled water that has been spread onto or injected into the ground.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60301.120. Aquifer.

"Aquifer" means a saturated, permeable geologic unit that can transmit water under ordinary hydraulic gradients.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60301.370. Groundwater.

"Groundwater" means water below the land surface.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60301.380. Groundwater Basin.

"Groundwater basin" means a subsurface structure having the character of a basin with respect to the collection, retention, and outflow of water or an aquifer or system of aquifers, whether basin-shaped or not, that has reasonably well defined boundaries and more or less definite areas of recharge and discharge."

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60301.610. Mound.

"Mound" means a localized, temporary elevation in a water table, above the surrounding regional groundwater level, that builds up as a result of the localized downward percolation of waters that have been discharged to a spreading area.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60301.665. Planned Groundwater Recharge Reuse Project (PGRRP).

"Planned groundwater recharge reuse project (PGRRP)" means a project using recycled water designed, constructed, or operated for the purpose of recharging by infiltration or injection of recycled water a groundwater basin designated in the Water Quality Control Plan, as defined in Water Code section 13050(j), for use as a source of domestic water supply.

NOTE: Authority cited: Section 13521, Water Code.

Reference: Sections 13520, 13521, and 13050(j), Water Code.

Section 60301.690. Project Sponsor.

"Project sponsor" means an agency or agencies that receives water recycling requirements for a PGRRP from a RWQCB.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60301.693. Public Water System.

"Public water system" means a system for the provision of water for human consumption through pipes or other constructed conveyances that has 15 or more service connections or regularly serves at least 25 individuals daily at least 60 days out of the year. A public water system includes the following:

(a) Any collection, treatment, storage, and distribution facilities under control of the operator of the system which are used primarily in connection with the system.

(b) Any collection or pretreatment storage facilities not under the control of the operator that are used primarily in connection with the system.

(c) Any water system that treats water on behalf of one or more public water systems for the purpose of rendering it safe for human consumption.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 116275(h), Health and Safety Code.

Section 60301.695. Recycled Water.

"Recycled water" means water which, as a result of treatment of waste, is suitable for a direct beneficial use or a controlled use that would not otherwise occur and is therefore considered a valuable resource.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13050, Water Code.

Section 60301.705. Recycled Water Contribution (RWC).

"Recycled water contribution (RWC)" means the fraction of the total PGRRP recharge water that is of recycled water origin.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60301.720. Regional Groundwater Level.

"Regional groundwater level" means the water table that would exist in the absence of the PGRRP.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60301.770. Reverse Osmosis.

"Reverse osmosis" means a pressure-driven membrane process in which the pressure applied to the salt solution exceeds its osmotic pressure against a semipermeable membrane, thereby forcing water (permeate) through the membrane and leaving salts and low-molecular solutes (brine) behind.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60301.775. RWQCB.

"RWQCB" means Regional Water Quality Control Board.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60301.810. Spreading Area.

"Spreading area" means an area where water is applied for purposes of recharging the groundwater.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60301.840. Subsurface Injection.

"Subsurface injection" means the controlled insertion of water below the ground surface resulting in the recharge of a groundwater basin, and includes direct injection into the saturated zone and injection into the vadose zone.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60301.850. Surface Spreading.

"Surface spreading" means the controlled application of water to the spreading area resulting in the recharge of a groundwater basin.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60301. 860. Total Nitrogen.

"Total nitrogen" means the summation of ammonia, nitrite, nitrate, and organic nitrogen, expressed in units of nitrogen.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60301.870. Total Organic Carbon (TOC).

"Total organic carbon (TOC)" means the oxidizable organic carbon present in the recycled water measured by an approved laboratory pursuant to subsection 64415(a) using an approved analytical method pursuant to 40 Code of Federal Regulations subsection 141.142(b).

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

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Section 60302. Source Specifications.

The requirements in this chapter shall apply only to recycled water ~~from sources that contain domestic waste, in whole or in part.~~ of municipal wastewater origin.

NOTE: Authority cited: Section 13521, Water Code.
Reference: Sections 13520 and 13521, Water Code.

ARTICLE 5.1. PLANNED GROUNDWATER RECHARGE REUSE PROJECTS

~~**Section 60320. Groundwater Recharge.**~~

~~(a) Reclaimed water used for groundwater recharge of domestic water supply aquifers by surface spreading shall be at all times of a quality that fully protects public health. The State Department of Health Services' recommendations to the Regional Water Quality Control Boards for proposed groundwater recharge projects and for expansion of existing projects will be made on an individual case basis where the use of reclaimed water involves a potential risk to public health.~~

~~(b) The State Department of Health Services' recommendations will be based on all relevant aspects of each project, including the following factors: treatment provided; effluent quality and quantity; spreading area operations; soil characteristics; hydrogeology; residence time; and distance to withdrawal.~~

~~(c) The State Department of Health Services will hold a public hearing prior to making the final determination regarding the public health aspects of each groundwater recharge project. Final recommendations will be submitted to the Regional Water Quality Control Board in an expeditious manner.~~

Note: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code.

Reference: Section 13520, Water Code.

Section 60320. Applicability and General Requirements.

(a) This article shall apply only to planned groundwater recharge reuse projects (PGRRPs).

(b) This article shall not apply to a wastewater disposal project that incidentally results in treated wastewater reaching groundwater.

(c) All recycled water used for PGRRPs shall be from a wastewater collection system operating under a comprehensive industrial pretreatment and pollutant source control program that includes contaminants specified by the Department based on its review of the engineering report. The program shall be approved by the RWQCB for the control of discharge of toxic wastes from point sources.

(d) Each project sponsor shall establish a financial assurance mechanism to cover:

(1) The costs associated with any PGRRP violation of this chapter or PGRRP impact that has resulted in, or is anticipated to result in, an increase of any of the contaminants specified in sections 60320.010, 60320.020, 60320.030, and 60320.040 in a drinking water supply; and

(2) Any and all financial burdens to downgradient drinking water sources directly resulting from the PGRRP operation.

(e) The State Department of Health Services will hold a public hearing for each PGRRP prior to submitting its recommendations for the initial permit to the RWQCB, and at any time an increase in RWC has been proposed.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60320.010. Control of Pathogenic Microorganisms.

(a) For each PGRRP, the wastewater shall be treated to meet the following:

(1) The definition of filtered wastewater, pursuant to section 60301.320; and

(2) The definition of disinfected tertiary recycled water, pursuant to section 60301.230.

(b) If the wastewater being used for recharge does not meet the criteria in sections 60301.230 and 60301.320, pursuant to section 60321 (Sampling and Analysis), the PGRRP shall:

(1) Suspend recharge of the recycled water until the criteria is met, and

(2) Inform the Department and the RWQCB in the next monthly report.

(c) For a surface spreading project, the applied recycled water shall be retained underground for a minimum of six months prior to extraction for use as a drinking water supply, and shall not be extracted within 500 feet of a point of recharge.

(d) For a subsurface injection project, the applied recycled water shall be retained underground for a minimum of nine months prior to extraction for use as a drinking water supply, and shall not be extracted within 2000 feet of a point of recharge.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60320.020, Control of Total Nitrogen.

(a) The total nitrogen concentration of the recycled water shall not exceed X* mg/L as nitrogen unless the project sponsor demonstrates that the X* mg/L standard is consistently met in the applied recycled water prior to its reaching the interface of the mound and the regional groundwater table.

(b) Each week the PGRRP shall collect and analyze a grab or 24-hour composite sample of:

(1) Recycled water, or

(2) Applied recycled water prior to its reaching the interface of the mound and the regional groundwater table, if the PGRRP has been approved for mound monitoring, pursuant to section 60320.050.

(c) The PGRRP sponsor shall require the laboratory to notify the PGRRP within 24 hours of completing the analysis of a sample that contains total nitrogen at a level greater than X* mg/L;

(d) Each week, the PGRRP shall determine compliance as follows:

(1) Within 48 hrs of being informed by the laboratory of a total nitrogen result greater than X* mg/L, the PGRRP shall collect and analyze a confirmation sample; and

(2) If the average of the initial and confirmation samples is greater than X* mg/L, the PGRRP shall:

(A) Suspend recharge of the recycled water,

(B) Investigate the causes and make appropriate corrections, and

(C) Within 48 hrs of receiving the confirmation sample result, notify the Department and RWQCB.

* Previous drafts have used 10 mg/L because all forms of nitrogen can convert to nitrate in groundwater and the nitrate standard is 10 mg/L as nitrogen in drinking water. We now have a 1 mg/L nitrite standard and the Department is unsure what total nitrogen limit in recharge water is necessary to assure that the nitrite standard will not be exceeded as a result of any PGRRP. A preliminary evaluation of the issue suggests that 1 mg/L may be necessary. X could be anything from 1 to 10 mg/L in the final criteria.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60320.030. Control of Regulated Contaminants and Physical Characteristics.

(a) The recycled water shall be in compliance with the following:

(1) Primary maximum contaminant levels specified in chapter 15: Inorganic chemicals in table 64431-A (except for nitrogen compounds); radionuclides in table 4, section 64443; organic chemicals in table 64444-A; and *new/pending federal & state regs (e.g., arsenic, uranium, DBPs, radon);*

(2) Action level for lead in section 64678, chapter 15;

(3) Applicable water quality objectives specified in the Water Quality Control Plan established by the RWQCB; and

(4) Secondary MCLs for the constituents and characteristics in tables 64449-A and B ("Upper" levels) in chapter 15.

(b) The recycled water shall not exceed any public health goal (PHG) for a contaminant, or the level of the contaminant in the receiving groundwater, whichever is higher, unless the Department approves a higher level based on a review that includes the following:

(1) Source(s) of contaminant(s);

(2) Level(s) of contaminant(s) in alternative recharge water(s);

(3) Level(s) of contaminant(s) in public drinking water source(s) that are downgradient of the PGRRP;

(4) Feasibility of measuring the contaminant(s) levels of detection;

(5) Estimated impact on the groundwater basin in terms of overall water quality and supply;

(6) Estimated impact on regional water quality and supply;

(7) Applicability and effectiveness of soil and aquifer treatment;

(8) Feasibility of treatment technology available for contaminant(s) removal from drinking water sources if contamination should occur;

(9) Acceptance of the PGRRP by the downgradient public water systems if one or more PHG(s) is not met; and

(10) Overall economic feasibility of PGRRP (downgradient public water system costs and recycled water costs) and alternatives.

(c) On a quarterly basis at regular intervals, the PGRRP shall collect 24-hour composite or grab samples. At the end of each calendar year, the PGRRP shall determine compliance with paragraphs (a)(1) through (3) and subsection (b) by averaging the year's results. If the recycled water is out of compliance, the PGRRP shall submit a report to the Department and the RWQCB that describes the reasons and the corrective actions taken.

(d) Each year, the PGRRP shall collect a representative grab sample to determine compliance with subsection (a)(4); if the single sample result (or average of samples collected during the year, if more than one) exceeds a secondary MCL, the PGRRP shall inform the Department and RWQCB in the next monthly report.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60320.040. Control of Nonregulated Contaminants.

(a) The TOC of the filtered wastewater shall comply with the following:

(1) Not exceed a TOC level of 0.016 g/L for more than two consecutive days;

(2) Each day, the PGRRP shall collect and analyze a 24-hour composite sample before any reverse osmosis treatment;

(3) If the TOC in the filtered wastewater exceeds 0.016 g/L for more than two consecutive days, the PGRRP shall suspend recharge of recycled water until the TOC is less than 0.01 g/L.

(b) Each PGRRP shall comply with the following TOC criteria, as applicable:

(1) For a PGRRP using surface spreading, the recycled water TOC level shall be less than 0.001 g/L divided by the maximum average RWC specified by the Department, or be treated by reverse osmosis to do so.

(2) For a PGRRP using surface spreading that has been approved for mound monitoring pursuant to section 63020.050:

(A) The recycled water TOC level shall be less than 0.0015 g/L divided by the maximum average RWC specified by the Department, or be treated by reverse osmosis to do so; and

(B) The applied recycled water TOC level measured in the mound shall be less than 0.001 g/L divided by the maximum average RWC specified by the Department.

(3) For a PGRRP using direct injection, the entire wastewater stream shall be treated with reverse osmosis and the recycled water TOC shall be less than 0.001 g/L divided by the maximum average RWC specified by the Department.

(c) To determine compliance with subsection (b), each day, the PGRRP shall:

(1) Collect a 24-hour composite sample for TOC analysis, except that if 100 per cent of the wastewater stream is treated by reverse osmosis, the PGRRP may collect a grab sample;

(2) Determine compliance and take action as follows:

(A) If a 30-day running average of the TOC samples exceeds the applicable criteria, the PGRRP shall submit a report to the Department and RWQCB within 60 days that describes the reasons for the violation and the corrective actions that have been taken to avoid future violations; and

(B) If the 30-day running average of the TOC samples has not met the applicable criteria for more than 14 consecutive days, the PGRRP shall suspend recharge of the recycled water until the criteria are met and within 7 days of the suspension, notify the Department and the RWQCB.

(d) The PRGRRP shall comply with the criteria for the daily-running-average RWC (average RWC) as follows:

(1) The average RWC in each aquifer shall not exceed:

(A) 0.50 unless the Department has approved an alternative maximum average RWC pursuant to section 60320.095, and

(B) The maximum average RWC specified by the Department.

(2) Each day, the average RWC shall be calculated by dividing the total volume of recycled water recharged during the preceding 2000 days by the total volume of water recharged during that period at the recharge facilities used by the PGRRP.

(A) If the average RWC does not meet the criteria in subparagraph (d)(1)(A), the PGRRP shall suspend recharge of the recycled water until the criteria is met and within 7 days of the suspension, notify the Department and the RWQCB.

(B) If the average RWC does not meet the criteria in subparagraph (d)(1)(B), the PGRRP shall notify the Department and RWQCB within 7 days and submit a report to both within 60 days describing the reason and corrective actions taken to avoid future violations.

(e) The PGRRP shall ensure that no groundwater is extracted for use as a drinking water supply from an aquifer within which the average RWC is higher than that specified by the Department, based on its review of the PGRRP's engineering report.

(f) The PGRRP shall conduct the following monitoring and report any positive results to the Department and the RWQCB in the next monthly report:

(1) Each quarter, as a minimum, the PGRRP shall sample and analyze the recycled water for the unregulated chemicals in table 64450, chapter 15, Priority Pollutants (xxxxxxxxxxxxxx), and for those chemicals with state action levels that the Department has specified, based on a review of the PGRRP engineering report and the affected groundwater basin(s); and

(2) Each year, the PGRRP shall monitor the recycled water for endocrine disrupting chemicals and pharmaceuticals specified by the Department, based on a review of the PGRRP engineering report and the affected groundwater basin(s).

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60320.050. Mound monitoring for TOC and total nitrogen

To obtain approval for mound monitoring of applied recycled water, a PGRRP shall demonstrate the following to the Department:

(a) That it can continuously track the regional groundwater level and the thickness of the mound at the point of sampling;

(b) That the mound is of sufficient thickness to enable samples to be collected without drawing water from below the regional groundwater table;

(c) That the sampling system can obtain mound samples regardless of change in the regional groundwater table elevation;

(d) That the location of the mound is such that it is feasible to reach it with a monitoring well;

(e) That samples can be collected continuously whenever a mound of applied recycled water is present;

(f) That the samples represent applied recycled water and not a comingling of applied recycled water and other waters used to recharge the groundwater basin; and

(g) That the proposed monitoring is representative of the applied recycled water throughout the mound underneath the entire spreading area.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60320.070. Monitoring Wells

(a) As a minimum, each PGRRP shall site and construct monitoring wells, as follows:

(1) At locations one-quarter and one-half of the distance (plus or minus 10%) from the recharge area to the nearest downgradient domestic water supply well; and

(2) Such that samples can be obtained independently from each aquifer potentially conveying the applied recycled water.

(b) Monitoring shall be conducted and reported as follows:

(1) Each quarter, as a minimum, samples shall be collected at each monitoring well;

(2) Each sample shall be analyzed for TOC, total nitrogen, constituents and characteristics in tables 64449-A and B, total coliform levels, and any water quality constituents specified by the Department based on the results of the recycled water monitoring conducted pursuant to this chapter; and

(3) If any of the monitoring results indicates that an MCL, a PHG, or a state action level has been exceeded or that coliforms are present, the PGRRP shall notify the Department and the RWQCB within 48 hours of receiving the result. Any positive findings shall be noted in the monthly report.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60320.080. Engineering Report.

(a) Any project sponsor proposing a PGRRP shall submit an engineering report that includes an operations plan to the RWQCB and the Department. This report shall be prepared by an engineer registered in California and experienced in the fields of wastewater treatment and public water supply, in conjunction with a geologist experienced in hydrogeology and registered in California, and shall satisfy the requirement in section 60323(a).

(b) Proposed PGRRPs shall not recharge recycled water until the project sponsor submits a complete engineering report to the RWQCB and the Department and receives a permit from the RWQCB.

(c) For a PGRRP with a permit from the RWQCB as of the effective date of this regulation, the project sponsor shall submit an engineering report pursuant to this section to the RWQCB(s) and the Department within two years.

(d) The engineering report shall consist of a comprehensive investigation and evaluation of the PGRRP, impacts on the existing and potential uses of the impacted groundwater basin, and the proposed means for achieving compliance with sections 60320.010 through 60320.050 and sections 60325 through 60355. The engineering report shall include, but not be limited to, the following:

(1) A description of the proposed PGRRP, including the anticipated TOC level and proposed RWC;

(2) An engineering plan of the recycling plant, transmission facilities, spreading basins/subsurface injection wells, and monitoring wells;

(3) A hydrogeologic study on the impacted groundwater basin that details the following:

(A) Impact of the recharge project on domestic groundwater sources;

(B) Description of any other existing or proposed PGRRPs that could impact the groundwater basin, and an estimate of the cumulative impact with and without the proposed PGRRP;

(C) Source, area of recharge, quantity, quality, and groundwater flow patterns of all aquifers in all impacted groundwater basins;

(D) The horizontal and vertical extent of the underground zone within which the applied recycled water has not been retained for the period of time or distance specified in subsection 60320.010(c) or (d), as applicable;

(E) The aquifer zone within which the RWC is higher than that proposed pursuant to paragraph (d)(1);

(G) For all wells that will be impacted by the proposed project

1. Use of each;

2. Identification of which well(s) is (are) subject to the highest RWC; and

3. The estimated or measured shortest recycled water retention time underground and horizontal separation, along with the methods for obtaining these;

(F) A description of the pre-project groundwater quality in the impacted groundwater basin;

(H) Quantitative descriptions of the aquifer transmissivity, groundwater movement, historic depth-to-groundwater, safe yield of the basin, influence of localized pumping, and usable storage capacity of the groundwater basin; and

(I) Description of any existing or anticipated flows into, or recharges of, the basin that could affect the quality of water in the monitoring wells or drinking water wells downgradient of the PGRRP.

(4) For the wastewater or treated wastewater proposed for use by the PGRRP, the results of one year of quarterly monitoring for TOC, BOD, SS, total coliforms, total nitrogen, all regulated and unregulated chemicals listed in sections 64431, 64439, 64441, 64443, 64444, 64449, and 64450, chapter 15, title 22, lead, Priority Pollutants (xxxxxxxxxxxxxxxxxx) and chemicals that have state action levels, as specified by the Department on the basis of vulnerability. *+DBP standards*;

(5) For any dilution waters proposed for use by the PGRRP, a quantitative and qualitative characterization of the water quality;

(6) Identification of the agency responsible for preventing the use of groundwater for drinking water within certain areas pursuant to paragraphs (d)(3)(D) and (E) and subsection 60320.040(f), and the mechanism that will be used;

(7) A contingency plan for diversion of recycled water when required pursuant to sections 60320.010(b)(1), 60320.020(d)((2)(A), and 60320.040(b)(3), (d)(2)(B), and (e)(2)(A);

(8) A description of how the data will be obtained and a sample calculation for RWC;

(9) Identification of the maximum average RWC (daily-running-average) for the PGRRP;

(10) For each month for the first twenty years of operation, the predicted RWC and the average RWC characteristic of each month along with all quantities and sources of water used to make the determinations;

(11) A plan for monitoring groundwater flow and water quality in the impacted groundwater basin, including a map of the locations of monitoring wells in the spreading basin and groundwater basin, details on their construction, and a rationale for their siting;

(12) A water quality monitoring plan for the recycled water and monitoring wells;

(13) A description of the industrial pretreatment and pollutant source control program, pursuant to section 60320 (c);

(14) A list of the endocrine disrupting chemicals and pharmaceuticals in the wastewater, as well as data on the levels where measurable;

(15) For PGRRPs using mound monitoring, a description of the mound monitoring program, including the demonstration in section 63020.050; and

(16) An analysis of the PGRRP impact that includes a determination of the possible violations or situations that could occur that might pose a risk to public health and a plan with associated costs for mitigating each along with the financial assurance mechanism that would be utilitized. Such violations or situations include, but shall not be limited to:

(1) RWC;

(2) Minimum retention time; and

(3) MCL exceedance or microbiological problem in a drinking water supply well.

(e) The operations plan shall include, but not be limited to, the following:

(1) A description of the operational and management personnel, their qualifications, experience, and responsibilities;

(2) Routine testing procedures for the integrity of the membranes, if membrane technology is used;

(3) Routine maintenance and performance monitoring for the disinfection system;

(4) Maintenance and calibration schedules for all monitoring equipment, process alarm set points and response procedures for all alarms;

(5) Water blending plan, as applicable;

(6) Maintenance of injection and monitoring wells, and spreading basins;

(7) Vector control activities related to the PGRRP;

(8) A description of how the PGRRP will measure the retention time to demonstrate compliance with subsection 60320.010(c) or (d); and

(9) A list of the pesticides and herbicides used in the spreading facilities.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60320.090. Annual and Five Year Reports.

(a) Every year, the project sponsor shall provide to the RWQCB, the Department, and all downgradient public drinking water systems a report that includes the following:

(1) Summary of compliance with the monitoring requirements and criteria in sections 60320.010, 60320.020, 60320.030, 60320.040, and 60320.050;

(2) Summary of any corrective actions taken as the result of violations and any suspensions of recharge of recycled water; including a schedule for making needed improvements.

(3) Any detections of monitored constituents and any observed trends in the monitoring wells,

(4) Information related to travel of recharge waters, i.e., the leading edge of the recharged water plume,

(5) A description of any changes in the operation of any unit processes or facilities, and

(6) A description of any anticipated changes, along with an evaluation of their expected impact on subsequent unit processes.

(b) Every five years, the project sponsor shall update the engineering report and submit it to the RWQCB and the Department. The update shall include, but not be limited to, a demonstration:

(1) That the maximum RWC pursuant to subsection 60320.040(b)(2) and (3) will not be exceeded,

(2) That the RWC used to determine the required treatment in subsection 60320.040(c), (d), or (e) can be determined,

(3) That the minimum retention time underground pursuant to subsection 60320.010(b) or (c) will be met, and

(4) Any inconsistencies between model prediction and observation and/or measurement and how they are being dealt with.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60320.095. Alternatives.

(a) The project sponsor may apply to the Department to reduce the distance in subsection 60320.010(c) or (d) to as little as 200 feet, if the sponsor can demonstrate with tracer test results that the required retention time will be achieved at the proposed alternative distance.

(b) If a PGRRP can demonstrate that the applied recycled water has reached PGRRP monitoring wells for at least five years and the PGRRP has been in compliance with the required RWC, the project sponsor may apply to the RWQCB and the Department to increase the allowed maximum average RWC of 0.50. Based on its review of the engineering report, the Department may designate monitoring well sites in addition to those specified in section 60320.070 for conducting this demonstration. A comprehensive report of any demonstration in support of the application shall be prepared and signed by an engineer registered in California and experienced in the fields of wastewater treatment and public water supply; the report shall include, but not be limited to:

(1) PGRRP operations, monitoring, and compliance data;

(2) Additional analytical studies, as required by the Department, if needed to make the determination;

(3) Additional treatment studies, as required by the Department, if needed to make the determination;

(4) In vivo toxicity bioassays;

(5) Demonstration that the project sponsor can incorporate an additional barrier into the PGRRP that will be as effective as a maximum average RWC of 0.50 in protecting the downgradient drinking water sources from contamination by nonregulated and currently unidentified contaminants of potential public health concern. This demonstration could include a comparison of applied recycled water before and after the additional barrier;

(6) Advisory panel review of proposal;

(7) Validation of appropriate construction and siting of monitoring wells; and

(8) An updated engineering report.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

This is a <u>DRAFT</u> regulation; it reflects the Department of Health Services' most current thinking on the regulation of recharge of groundwater with recycled water. We would appreciate any informal comments you might have on this draft; they can be emailed to Bob Hultquist: <u>bhultqui@dhs.ca.gov</u>.

Title 22, CALIFORNIA CODE OF REGULATIONS
DIVISION 4. ENVIRONMENTAL HEALTH
CHAPTER 3. RECYCLING CRITERIA

ARTICLE 1. DEFINITIONS

Section 60301.080. 24-hour Composite Sample.

"24-hour composite sample" means a combination of no fewer than eight individual samples obtained at equal time intervals during a 24-hour period, such that the volume of each individual sample is proportional to the flow at the time of sampling.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60301.120. Aquifer.

"Aquifer" means a geologic formation, group of formations, or portion of a formation capable of yielding significant quantities of ground water to wells or springs.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60301.190. Diluent Water.

"Diluent water" means water that is not treated wastewater that is used to supplement the recycled water in a GRRP prior to surface spreading or injection.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60301.370. Groundwater.

"Groundwater" means water below the land surface in a zone of saturation.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60301.380. Groundwater Basin.

"Groundwater basin" means a subsurface structure having the character of a basin with respect to the collection, retention, and outflow of water or an aquifer or system of aquifers, whether basin-shaped or not, that has reasonably well defined boundaries and more or less definite areas of recharge and discharge.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60301.390. Groundwater Recharge Reuse Project (GRRP).

"Groundwater recharge reuse project (GRRP)" means a project that uses recycled water and has been designed, constructed, or operated for the purpose of recharging by infiltration or injection of recycled water a groundwater basin designated in the Water Quality Control Plan [defined in Water Code section 13050(j)] for use as a source of domestic water supply.

NOTE: Authority cited: Section 13521, Water Code.
Reference: Sections 13520, 13521, and 13050(j), Water Code.

Section 60301.610. Mound.

"Mound" means a localized, temporary elevation in a water table that builds up as a result of the localized downward percolation of waters that have been discharged to a spreading area.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60301.670. Project Sponsor.

"Project sponsor" means an agency or agencies that receives water recycling requirements for a GRRP from a RWQCB.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60301.680. Public Water System.

"Public water system" means a system for the provision of water for human consumption through pipes or other constructed conveyances that has 15 or more service connections or regularly serves at least 25 individuals daily at least 60 days out of the year. A public water system includes the following:

(a) Any collection, treatment, storage, and distribution facilities under control of the operator of the system which are used primarily in connection with the system.

(b) Any collection or pretreatment storage facilities not under the control of the operator that are used primarily in connection with the system.

(c) Any water system that treats water on behalf of one or more public water systems for the purpose of rendering it safe for human consumption.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 116275(h), Health and Safety Code.

Section 60301.680. Recharge Water.

"Recharge water" means recycled water that may have been supplemented with diluent water, from the point that the recycled water or diluted recycled water has been spread onto or injected into the ground until it has met the criteria in section 60320.010(c) or (d).

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 116275(h), Health and Safety Code.

Section 60301.690. Recycled Water.

"Recycled water" means water which, as a result of treatment of waste, is suitable for a direct beneficial use or a controlled use that would not otherwise occur and is therefore considered a valuable resource.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13050, Water Code.

Section 60301.705. Recycled Water Contribution (RWC).

"Recycled water contribution (RWC)" means the fraction of the total volume of GRRP recharge water that is recycled water.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60301.770. RWQCB.

"RWQCB" means Regional Water Quality Control Board.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60301.780. Saturated Zone.

"Saturated zone" means an underground zone in which all interstices in and between natural geologic materials are filled with water.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60301.810. Spreading Area.

"Spreading area" means an area where recharge water is applied for purposes of recharging the groundwater.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60301.840. Subsurface Injection.

"Subsurface injection" means the controlled insertion of recharge water below the ground surface resulting in the recharge of a groundwater basin, and includes direct insertion into the saturated zone and insertion into the vadose zone.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60301.850. Surface Spreading.

"Surface spreading" means the controlled application of recharge water to the spreading area resulting in the recharge of a groundwater basin.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60301. 860. Total Nitrogen.

"Total nitrogen" means the sum of ammonia, nitrite, nitrate, and organic nitrogen concentrations, expressed as nitrogen.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60301.870. Total Organic Carbon (TOC).

"Total organic carbon (TOC)" means oxidizable organic carbon measured by an approved laboratory pursuant to subsection 64415(a) using an approved analytical method pursuant to 40 Code of Federal Regulations subsection 141.142(b).

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60302. Source Specifications.

The requirements in this chapter shall apply only to recycled water ~~from sources that contain domestic waste, in whole or in part.~~of municipal wastewater origin.

NOTE: Authority cited: Section 13521, Water Code.
Reference: Sections 13520 and 13521, Water Code.

ARTICLE 5.1. PLANNED GROUNDWATER RECHARGE REUSE PROJECTS

~~**Section 60320. Groundwater Recharge.**~~

~~(a) Reclaimed water used for groundwater recharge of domestic water supply aquifers by surface spreading shall be at all times of a quality that fully protects public health. The State Department of Health Services' recommendations to the Regional Water Quality Control Boards for proposed groundwater recharge projects and for expansion of existing projects will be made on an individual case basis where the use of reclaimed water involves a potential risk to public health.~~

~~(b) The State Department of Health Services' recommendations will be based on all relevant aspects of each project, including the following factors: treatment provided; effluent quality and quantity; spreading area operations; soil characteristics; hydrogeology; residence time; and distance to withdrawal.~~

~~(c) The State Department of Health Services will hold a public hearing prior to making the final determination regarding the public health aspects of each groundwater recharge project. Final recommendations will be submitted to the Regional Water Quality Control Board in an expeditious manner.~~

Note: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code.
Reference: Section 13520, Water Code.

Section 60320. Applicability and General Requirements.

(a) This article shall apply only to groundwater recharge reuse projects (GRRPs).

(b) This article shall not apply to a wastewater disposal project.

(c) All recycled water used for a GRRP shall be from a wastewater management agency that administers an industrial pretreatment and pollutant source control program that includes contaminants specified by the Department based on its review of the engineering report. For programs subject to the Pretreatment Regulations in Code of Federal Regulations (CFR) Section 40 Part 403, inclusion of pretreatment and source control program requirements to address Department-specified contaminants shall be made in accordance with the program modification procedures in 40 CFR 403.18. For wastewater management agencies not subject to the Federal Pretreatment Regulations, these program requirements shall be approved by the RWQCB.

(d) All diluent water used for a GRRP shall be from a source that has been evaluated by a source water assessment.

(e) Prior to the onset of operation, each project sponsor shall have in place a financial assurance mechanism to cover the estimated costs that could be associated with any GRRP failure to comply with this chapter or GRRP impact that has resulted in, or is anticipated to result in, an increase of pathogenic microorganisms or any of the contaminants specified in sections 60320.020, 60320.030, and 60320.040 in a drinking water supply.

(f) The State Department of Health Services will hold a public hearing for each GRRP prior to submitting its recommendations for the initial permit to the RWQCB, and at any time an increase in RWC has been proposed.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60320.010. Control of Pathogenic Microorganisms.

(a) For each GRRP, the wastewater shall be treated to meet the following:

(1) The definition of filtered wastewater, pursuant to section 60301.320; and

(2) The definition of disinfected tertiary recycled water, pursuant to section 60301.230.

(b) If the recycled water being used for recharge does not meet the criteria in sections 60301.230 and 60301.320, pursuant to section 60321 (Sampling and Analysis), the GRRP shall:

(1) Suspend recharge of the recycled water until the criteria is met; and

(2) Inform the Department and the RWQCB in the next monthly report.

(c) For a surface spreading project, all the recharge water shall be retained underground for a minimum of six months prior to extraction for use as a drinking water supply, and shall not be extracted within 500 feet of a point of recharge.

(d) For a subsurface injection project, all the recharge water shall be retained underground for a minimum of nine months prior to extraction for use as a drinking water supply, and shall not be extracted within 2000 feet of a point of recharge.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60320.020. Control of Nitrogen Compounds.

(a) For an existing GRRP with its existing Department-specified maximum average RWC, the total nitrogen concentration of the recycled water, or if supplemented with diluent water, the blend of the two, shall not exceed the total nitrogen level specified by the Department based on its review of the GRRP's historical nitrogen data and other operational data.

(b) For any new GRRP and any existing GRRP with an increased Department-specified maximum average RWC, the total nitrogen concentration of the recycled water, or if supplemented with diluent water, the blend of the two, shall not exceed 3 mg/L as nitrogen unless the project sponsor demonstrates that the nitrite and nitrate drinking water standards are consistently met in the recharge water, if approved for mound monitoring pursuant to section 60320.050.

(c) Each week the GRRP shall collect and analyze two grab or 24-hour composite samples at least three days apart of:

(1) Recycled water, or if supplemented with diluent water, the blend of the two, or

(2) Recharge water prior to its reaching the regional groundwater table, if the GRRP has been approved for mound monitoring, pursuant to section 60320.050.

(d) The GRRP sponsor shall require the laboratory to notify the GRRP within 24 hours of completing the analysis of a sample that contains total nitrogen at a level greater than the applicable level or MCL in subsection (a) or (b).

(e) Within 48 hours of being informed by the laboratory pursuant to subsection (d), the GRRP shall collect and analyze a confirmation sample. If the average of the initial and confirmation samples also exceeds the applicable criterion, the GRRP shall:

(1) Suspend recharge of the recycled water,

(2) Investigate the causes and make appropriate corrections, and

(3) Within 48 hrs of receiving the confirmation sample result, notify the Department and RWQCB.

(f) Diluent water shall be monitored quarterly for nitrate and nitrite; within 48 hours of being informed by the laboratory of a nitrate and/or nitrite result greater than an MCL, the GRRP shall collect and analyze a confirmation sample. If the average of the initial and confirmation samples exceeds an MCL, the GRRP shall suspend use of the diluent water and proceed as in paragraphs (e)(2) and (3).

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60320.030. Control of Regulated Contaminants and Physical Characteristics.

(a) The recycled water shall be in compliance with the following:

(1) Primary maximum contaminant levels specified in chapter 15: Inorganic chemicals in table 64431-A (except for nitrogen compounds); radionuclides in table 4, section 64443; organic chemicals in table 64444-A; and *new federal & state regs (e.g., arsenic,, radon) will be added as they are adopted;*

(2) MCLs for disinfection byproducts in section 64533, chapter 15.5;

(3) Action levels for lead and copper in section 64678, chapter 15;

(4) Secondary MCLs for the constituents and characteristics in tables 64449-A and B ("Upper" levels), chapter 15.

(b) On a quarterly basis at regular intervals, the GRRP shall collect 24-hour composite or grab samples of the recycled water to determine compliance with paragraphs (a)(1), (2), and (3). The GRRP shall determine compliance on the basis of a running-quarterly average, calculated each quarter using the previous four quarters of data. If the recycled water is out of compliance, the GRRP shall submit a report to the Department and the RWQCB that describes the reasons and the corrective actions taken.

(c) Each year, the GRRP shall collect a representative grab sample of the recycled water to determine compliance with subsection (a)(4); if the single sample result (or average of samples collected during the year, if more than one) exceeds a secondary MCL, the GRRP shall inform the Department and RWQCB and describe the reasons and the corrective actions taken in the next monthly report.

(d) If the Department identifies a contaminant that may potentially pose a risk of contamination to a drinking water supply based on an assessment of data and/or the discharges to the sources of the recycled water, it may designate the public health goal (PHG) for that contaminant or the level of that contaminant in the receiving groundwater, whichever is higher, as a recycled water quality goal for a GRRP. The GRRP shall then operate the available treatment and recharge facilities to minimize any contaminant level in excess of the goal. Data collected pursuant to subsection (b) shall be used to monitor the GRRP's operations.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60320.040. Control of Nonregulated Contaminants.

(a) The TOC in any portion of the filtered wastewater that is not subsequently treated with reverse osmosis shall:

(1) Not exceed 16 mg/L for more than two consecutive samples; if the TOC fails to comply with this criteria, the GRRP shall suspend recharge of recycled water until the TOC is less than 0.01 g/L; and

(2) Be monitored as follows:

(A) For one year after initial startup, the GRRP shall collect and analyze a 24-hour composite sample twice a week;

(B) Subsequently, the Department may allow the GRRP to collect and analyze weekly 24-hour composite samples, based on its review of the first year of data.

(b) Any existing GRRP with its existing Department-specified maximum average RWC shall not exceed a TOC level specified by the Department based on its review of the GRRP's historical TOC data and other operational data. The TOC shall be measured as follows:

(1) In the recycled water; or

(2) A surface spreading project approved for mound monitoring pursuant to section 63020.050 may opt to monitor the undiluted recycled water in the mound.

(c) Any new GRRP and any existing GRRP with an increased Department-specified maximum average RWC shall not exceed a TOC level of 0.5 mg/L divided by the Department-specified maximum average RWC, or the recycled water shall be treated by reverse osmosis to do so. For a GRRP using direct injection, the entire wastewater stream shall be treated with reverse osmosis. The TOC shall be measured as follows:

(1) In the recycled water; or

(2) A surface spreading project approved for mound monitoring pursuant to section 63020.050 may opt to monitor the undiluted recycled water in the mound.

(d) To determine compliance with subsections (b) and (c),

(1) Each week during which the GRRP is recharging, the GRRP shall collect a 24-hour composite, except that if 100 per cent of the wastewater stream is treated by reverse osmosis, the GRRP may collect a grab sample;

(2) Each month, the GRRP shall determine whether the average of the most recent 20 TOC samples exceeds the applicable criterion;

(A) If the criterion is exceeded, the GRRP shall suspend recharge of the recycled water until the criterion are met and, within 7 days of the suspension, notify the Department and the RWQCB;

(B) New GRRPs shall begin determining compliance as soon as 4 samples have been collected, averaging all available samples up to 20;

(3) If a single sample exceeds the applicable criterion, the GRRP shall submit a report to the Department and RWQCB within 60 days that describes the reasons and the corrective actions that have been taken to avoid future occurrences.

(e) Each GRRP shall operate its available treatment and recharge facilities to minimize any TOC concentration in the recycled water prior to recharge or in the mound (if approved for mound monitoring) that exceeds a TOC goal established by dividing 0.3 mg/L by the Department-specified maximum average RWC for the GRRP.

(f) The GRRP shall comply with the criteria for the monthly-running-average RWC (average RWC) as follows:

(1) The average RWC in each aquifer shall not exceed the maximum average RWC specified by the Department, based on its review of the GRRP's engineering report (section 60320.080).

(2) Once a month, the average RWC shall be calculated by dividing the total volume of recycled water recharged during the preceding 60 calendar months by the total volume of recharge water during that period at the recharge facilities used by the GRRP.

If the average RWC does not comply with paragraph (1), the GRRP shall notify the Department and RWQCB within 7 days and submit a report to both within 60 days describing the reason and corrective actions taken to avoid future occurrences.

(g) The GRRP shall conduct the following monitoring and report any positive results to the Department and the RWQCB in the next monthly report:

(1) Each quarter, as a minimum, the GRRP shall sample and analyze the recycled water for:

(A) Unregulated chemicals in table 64450, chapter 15;

(B) Priority Toxic Pollutants [chemicals listed in the Water Quality Standards, Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California, and 40 CFR Part 131, Federal Register 65(97), May 18, 2000, p. 31682]; and

(C) Chemicals with state action levels that the Department has specified, based on a review of the GRRP engineering report and the affected groundwater basin(s); and

(2) Each year, the GRRP shall monitor the recycled water for endocrine disrupting chemicals and pharmaceuticals specified by the Department, based on a review of the GRRP engineering report and the affected groundwater basin(s).

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60320.050. Mound Monitoring for TOC and Nitrogen Compounds.

To obtain approval for mound monitoring in a spreading recharge project, a GRRP shall demonstrate the following to the Department:

(a) For the monitoring of TOC, that mound samples are representative of undiluted recycled water;

(b) For the monitoring of nitrogen compounds, that mound samples are representative of recharge water; and

(c) That the mound monitoring is representative of mounds of recharge water throughout the spreading area.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60320.060. Department-Specified Maximum Average RWC Greater than 0.50.

(a) A project sponsor may apply to increase the Department-specified maximum average RWC for a GRRP to greater than 0.50 by submitting a proposal to the Department. The proposal shall include a comprehensive report prepared and signed by an engineer registered in California and experienced in the fields of wastewater treatment and public water supply; the report shall include, but not be limited to:

(1) GRRP operations, monitoring, and compliance data;

(2) A demonstration that the recharge water has reached at least one GRRP monitoring well for at least one year with an average RWC of at least 0.4 and the GRRP has been in compliance with the existing Department-specified maximum average RWC,

(3) A demonstration that the water quality data collected at the monitoring well used in the demonstration in paragraph (1)

(A) Meets all the primary drinking water standards for the parameters specified pursuant to section 60320.070(b)(2); and

(B) Indicates that the GRRP is not causing the nonregulated contaminants specified pursuant to section 60320.070(b)(2) to increase over the levels in the recycled water;

(4) Any additional analytical and/or treatment studies requested by the Department to make the determination in subsection (b);

(5) Validation of appropriate construction and siting of monitoring wells;

(6) Scientific peer review by an advisory panel that includes, as a minimum, a toxicologist, a registered engineering geologist or hydrogeologist, an engineer registered in California and experienced in the fields of wastewater treatment and public water supply, a microbiologist, and a chemist; and

(7) An updated engineering report.

(b) Prior to the GRRP's proceeding with an increase in the RWC,

(1) The Department will specify the increment for the increase based on its review of the Engineering Report submitted under subsection (a); and

(2) The project sponsor shall obtain written approval from the Department and the RWQCB.

(c) A GRRP with a Department-specified maximum average RWC greater than 0.50 shall:

(1) Use ultra-violet light treatment with a fluence of at least **Y mJ/cm2*** and hydrogen peroxide addition with a dose of at least **Z mg/L*;** and

The Department requests input on the appropriate criteria to use.

(2) Conduct a Tentatively Identified Chemicals (TIC) analysis of the recycled water every year.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60320.070. Monitoring Between GRRP and Downgradient Drinking Water Supply Wells.

(a) Each GRRP shall site and construct monitoring wells, as follows:

(1) At locations within three months travel time of the recharge area and at additional intermediate points between the recharge area and the nearest downgradient domestic water supply well; and

(2) Such that samples can be obtained independently from each aquifer potentially conveying the recharge water.

(b) Monitoring shall be conducted and reported as follows:

(1) Each quarter, at a minimum, samples shall be collected at each monitoring well;

(2) Each sample shall be analyzed for TOC, total nitrogen, constituents and characteristics in tables 64449-A and B, total coliform levels, and any water quality constituents specified by the Department based on the results of the recycled water monitoring conducted pursuant to this chapter; and

(3) If any of the monitoring results indicates that an MCL has been exceeded or that coliforms are present, the GRRP shall notify the Department and the RWQCB within 48 hours of receiving the result.

(4) Any positive findings shall be noted in the monthly report to the RWQCB.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60320.080. Engineering Report.

(a) Any project sponsor proposing a GRRP shall submit an engineering report that includes an operations plan to the RWQCB and the Department. This report shall be prepared by an engineer registered in California and experienced in the fields of wastewater treatment and public water supply, in conjunction with a geologist experienced in hydrogeology and registered in California, and shall satisfy the requirement in section 60323(a).

(b) Proposed GRRPs shall not recharge recycled water until the project sponsor submits a complete engineering report to the RWQCB and the Department and receives a permit from the RWQCB.

(c) For a GRRP with a permit from the RWQCB as of the effective date of this regulation, the project sponsor shall submit an engineering report pursuant to this section to the RWQCB(s) and the Department within two years.

(d) The engineering report shall consist of a comprehensive investigation and evaluation of the GRRP, impacts on the existing and potential uses of the impacted groundwater basin, and the proposed means for achieving compliance with sections 60320.010 through 60320.050 and sections 60325 through 60355. The engineering report shall include, but not be limited to, the following:

(1) A description of the proposed GRRP, including the anticipated TOC level and proposed RWC;

(2) An engineering plan of the recycling plant, transmission facilities, spreading basins/subsurface injection wells, and monitoring wells;

(3) A hydrogeologic study on the impacted groundwater basin that addresses the following:

(A) Impact of the recharge project on domestic groundwater sources;

(B) Description of any other existing or proposed GRRPs that could impact the groundwater basin, and an estimate of the cumulative impact on water quantity and quality with and without the proposed GRRP;

(C) Source, area of recharge, quantity, quality, and groundwater flow patterns of all aquifers in all impacted groundwater basins;

(D) The horizontal and vertical extent of the underground zone within which the recharge water has not been retained for the period of time or distance specified in subsection 60320.010(c) or (d), as applicable;

(E) The aquifer zone within which the RWC is higher than that proposed pursuant to paragraph (d)(1);

(F) For new projects, a description of the pre-project groundwater quality in the impacted groundwater basin;

(G) For all wells that will be impacted by the proposed project

1. Use of each;
2. Identification of well(s) subject to the highest RWC; and
3. The estimated or measured shortest recycled water retention time underground and horizontal separation, along with the methods for obtaining these;

(H) Quantitative descriptions of the aquifer transmissivity, groundwater movement, historic depth-to-groundwater, safe yield of the basin, influence of localized pumping, and usable storage capacity of the groundwater basin; and

(I) Description of any existing or anticipated flows into, or recharges of, the basin that could affect the quality of water in the monitoring wells or drinking water wells downgradient of the GRRP.

(4) For the wastewater, treated wastewater, or recycled water proposed for use by the GRRP, the results of one year of quarterly monitoring for:

(A) TOC, BOD, SS, total coliforms, and total nitrogen;

(B) All regulated and unregulated chemicals listed in sections 64431, 64439, 64441, 64443, 64444, 64449, and 64450, chapter 15, and section 64533, chapter 15.5, title 22;

(C) Lead and copper;

(D) Priority Toxic Pollutants [chemicals listed in the Water Quality Standards, Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California, and 40 CFR Part 131, Federal Register 65(97), May 18, 2000, p. 31682]; and

(E) Chemicals that have state action levels that have been specified by the Department on the basis of vulnerability.

(5) For any diluent waters proposed for use by the GRRP, a quantitative and qualitative characterization of the water quality;

(6) Identification of the agency responsible for preventing the use of groundwater for drinking water within certain areas pursuant to paragraphs (d)(3)(D) and (E) and subsection 60320.040(f), and the mechanism that will be used;

(7) A contingency plan for diversion of recycled water when required pursuant to sections 60320.010(b)(1), 60320.020(d)((2)(A), and 60320.040(b)(3), (d)(2)(B), and (e)(2)(A);

(8) A description of how the data will be obtained and a sample calculation for RWC;

(9) Identification of the maximum average RWC for the GRRP, pursuant to section 60320.040(d);

(10) A plan for monitoring groundwater flow and water quality in the impacted groundwater basin, including a map of the locations of monitoring wells in the spreading basin and groundwater basin, details on their construction, and a rationale for their siting;

(11) A water quality monitoring plan for the recycled water, recharge water, and monitoring wells;

(12) A description of the industrial pretreatment and pollutant source control program, pursuant to section 60320(c);

(13) A list of endocrine disrupting chemicals and pharmaceuticals identified in the wastewater, as well as data on the levels where measurable;

(14) For GRRPs using mound monitoring, a description of the mound monitoring program, including the demonstration in section 63020.050; and

(15) An analysis of the GRRP impact that includes a determination of the possible violations or situations that could occur that might pose a risk to public health and a plan with associated costs for mitigating each along with the financial assurance mechanism that would be utilized. Such violations or situations include, but shall not be limited to:

(A) RWC;

(B) Minimum retention time; and

(C) MCL exceedance or microbiological problem in a drinking water supply well.

(e) The operations plan shall include, but not be limited to, the following:

(1) A description of the operational and management personnel, their qualifications, experience, and responsibilities;

(2) If RO membrane technology is used, the outine testing procedures for the integrity of the RO membranes and the RO membrane replacement schedule;

(3) Routine maintenance and performance monitoring for the disinfection system;

(4) Maintenance and calibration schedules for all monitoring equipment, process alarm set points and response procedures for all alarms;

(5) Water blending plan, as applicable;

(6) Maintenance of injection and monitoring wells, and spreading basins;

(7) Vector control activities related to the GRRP;

(8) A description of how the GRRP will measure the retention time to demonstrate compliance with subsection 60320.010(c) or (d);

(9) A list of the pesticides and herbicides used in the spreading facilities; and

(10) The procedures used to operate for compliance with subsections 60320.030(d) and 60320.040(d).

(f) An evaluation for any contaminant with sample results exceeding a PHG in the monitoring conducted pursuant to paragraph (d)(4) that includes the following:

(1) Source(s) of contaminant(s);

(2) Level(s) of contaminant(s) in alternative sources of water for recycled water and estimated impacts of the possible alternatives on the groundwater basin and/or the region in terms of overall water quality and supply;

(3) Level(s) of contaminant(s) in public drinking water source(s) that are downgradient of the GRRP;

(4) Feasibility of measuring the contaminant(s) at the PHG level(s);

(5) Applicability and effectiveness of soil and aquifer treatment;

(6) Feasibility of treatment technology available for contaminant(s) removal from drinking water sources if contamination should occur;

(7) Acceptance of the GRRP by the downgradient public water systems if one or more PHG(s) is not met; and

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60320.090. Annual and Five Year Reports.

(a) Every year, the project sponsor shall provide to the RWQCB, the Department, and all downgradient public drinking water systems a report that includes the following:

(1) Summary of compliance with the monitoring requirements and criteria in sections 60320.010, 60320.020, 60320.030, 60320.040, and 60320.050;

(2) Summary of any corrective actions taken as the result of violations and any suspensions of recharge of recycled water; including a schedule for making needed improvements.

(3) Any detections of monitored constituents and any observed trends in the monitoring wells,

(4) Information related to travel of recharge waters, i.e., the leading edge of the recharged water plume,

(5) A description of any changes in the operation of any unit processes or facilities, and

(6) A description of any anticipated changes, along with an evaluation of their expected impact on subsequent unit processes.

(b) Every five years, the project sponsor shall update the engineering report and submit it to the RWQCB and the Department. The update shall include, but not be limited to, a demonstration:

(1) That the maximum RWC pursuant to subsection 60320.040(b)(2) and (3) will not be exceeded,

(2) That the minimum retention time underground pursuant to subsection 60320.010(b) or (c) will be met, and

(3) Any inconsistencies between groundwater model prediction and observation and/or measurement and how they are being dealt with.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.

Section 60320.095. Alternatives.

(a) The project sponsor may apply to the Department to reduce the distance in subsection 60320.010(c) or (d) to as little as 200 feet, if the sponsor can demonstrate with tracer test results that the required retention time will be achieved at the proposed alternative distance.

(b) The project sponsor may apply to the Department to use one or more wastewater constitutents as a surrogate for nonregulated contaminants (section 60320.040) in place of TOC. Department approval of the alternative will be based on:

(1) Ability to quantify the constitutent(s) in the wastewater, recycled water and groundwater samples;

(2) The effect of the engineered and natural treatment systems on the constituents is similar to the effect of the systems on the potential harmful nonregulated components of the organic material in the wastewater and recycled water; at least one of the constituents shall be present in the treated water at a level that enables a determination of constituent reduction through the treatment process; and

(3) Identification of treatment performance standards for the constituent(s) that are as protective of public health as the TOC criteria in section 60320.040.

NOTE: Authority cited: Section 208, Health and Safety Code and Section 13521, Water Code. Reference: Section 13520, Water Code.