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The Resources Agency
Department of Water Resources
Southern District**

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**EVALUATION OF GROUNDWATER OVERDRAFT
IN THE SOUTHERN CENTRAL COAST REGION
PART 2**

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This TIR is primarily a working paper and is subject to revision or replacement.

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EVALUATION OF GROUNDWATER OVERDRAFT IN SOUTHERN CENTRAL COAST REGION PART 2

SUMMARY OF FINDINGS

Change in groundwater storage was estimated for Goleta, Foothill, Santa Barbara, Montecito, Carpinteria, Santa Maria, Lompoc Plain, and Paso Robles Groundwater Basins. The findings are:

Groundwater Basin	Hydrologic Base Period	Change in Groundwater Storage
Goleta	1988-1996	+857 AFY
Foothill	1988-1996	-158 to -217 AFY
Santa Barbara	1988-1996	+243 AFY
Montecito	1988-1996	+192 AFY
Carpinteria	1988-1996	+126 AFY
Santa Maria	1977-1995	+13,621 AFY
Lompoc Plain	1982-1994	-795 AFY
Paso Robles	1978-1993	-3 to -60 AFY

- Lompoc Plain and Foothill Groundwater Basins were found to be in overdraft.
- Goleta, Santa Barbara, Montecito, and Carpinteria Basins were found not to be in overdraft.
- Parts of Paso Robles Basin are in overdraft, but because most of the Basin is confined, it could not be evaluated using the specific yield method.
- An evaluation using the water balance method is needed to determine if the entire Paso Robles Basin is in overdraft.

INTRODUCTION

This is a report on the second part of an investigation to evaluate overdraft in groundwater basins in the southern Central Coast Region of California. Earlier (Pierotti and Lewy, 1998)¹, groundwater overdraft was evaluated in Cuyama Valley, San Antonio Creek Valley, and Santa Ynez Upland Groundwater Basins. In Part 2, detailed studies were made of eight additional basins (Figure 1).

Other basins in the southern Central Coast Region remaining to be evaluated, should funding be available, are the central portion of the Santa Ynez River Valley Basin and the Morrow, Los Osos, Chorro, and Carrizo Plain Basins plus several smaller coastal basins. Pierotti and Lewy (1998, p.5) listed the basins in the table "Summary of Data Available for Groundwater Basins in the Southern Central Coast Region".

For the evaluation of overdraft in the basins, either the water balance method or the specific yield method (DWR, 1993, p. 89) could be used. For this investigation, the specific yield method was chosen. A negative change in storage during the hydrologic base period indicates a basin is in overdraft.

A hydrologic base period is a relatively short period representing long-term hydrologic conditions. It must include both normal and extremely wet and dry years and recent cultural conditions. In choosing a base period, both the beginning and end of the base period should be preceded by a series of dry years or a series of wet years (DWR, 1971) so that the amounts of water in transit in the zone of aeration at the start and end of the base period are nearly the same.

Rainfall data were obtained from several rain gages in Santa Barbara and San Luis Obispo Counties. The data were tabulated by water year, which is from October 1 to September 30 and is identified by the year of the second date. Rainfall hydrographs and cumulative departure curves were made for several rain gage stations, and the base period was determined for the basins.

Change in groundwater storage is calculated by the formula:

$$\frac{\text{Area} \times \text{specific yield} \times \text{change in groundwater level elevation}}{\text{change in groundwater storage}} =$$

Specific yield is the ratio of the volume of water that will drain, under the influence of gravity, to the volume of saturated rock (Heath, 1983). It is applied to unconfined aquifers. For this study, specific yield was estimated from well drillers' lithologic descriptions of borehole cuttings, which

¹References cited are listed at the back of the report.

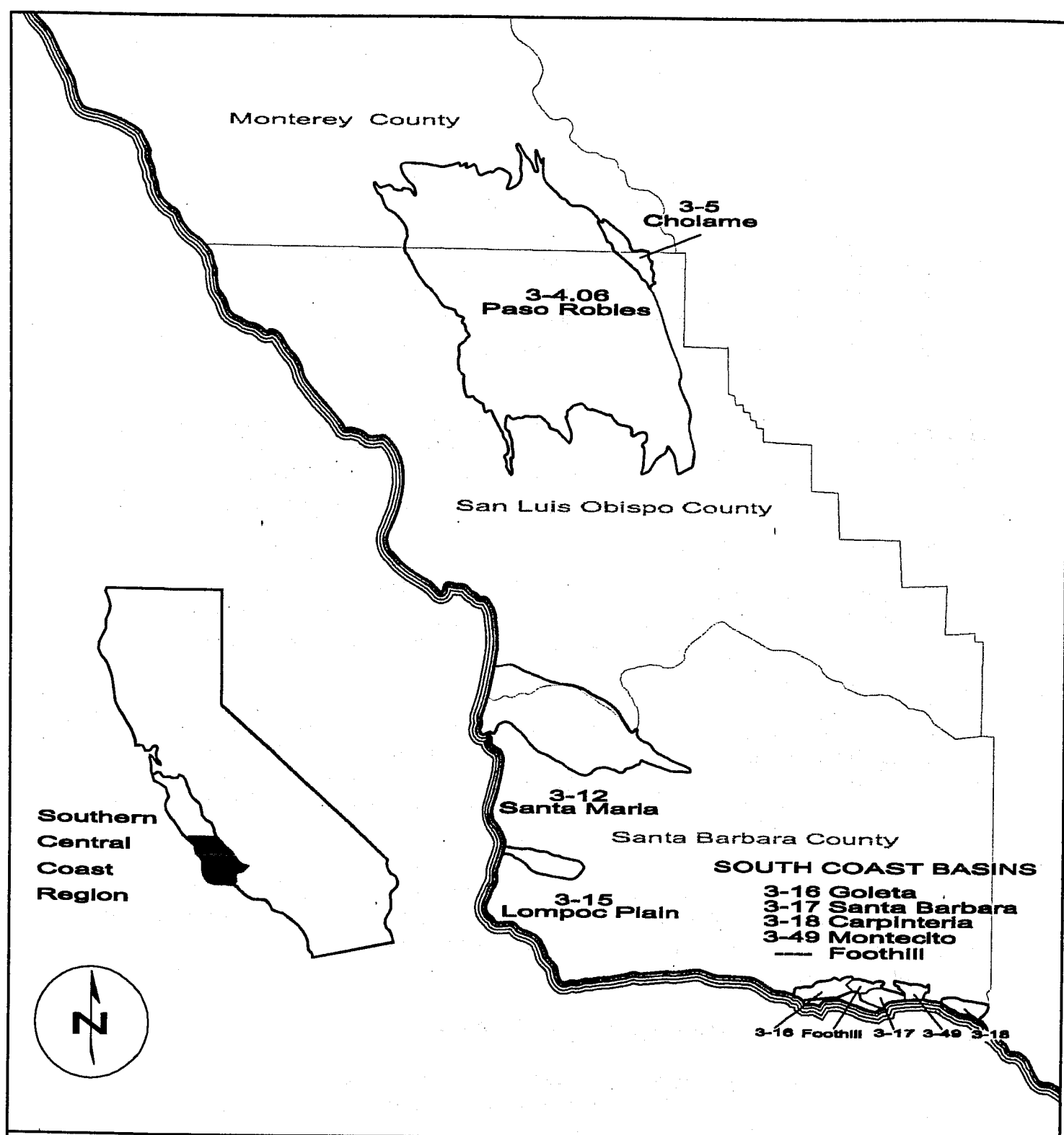


FIGURE 1. GROUNDWATER BASINS

are found on well completion reports filed with the Southern District.

The specific yields of the sediments were estimated using a weighted average method because the aquifers in the study area are composed of a heterogeneous mix of gravel, sand, silt, and clay that vary with depth. Therefore, a discrete value was assigned to each of the materials penetrated by a borehole as indicated on the well driller's lithologic description. The values were obtained from a list of driller terms compiled by the U.S. Geological Survey, which range from 3 percent for clay to 25 percent for sand and gravel. The values were then weighted to account for the thickness of the individual intervals. To derive a specific yield representative of the sediments, the weighted values were totaled and divided by the depth of the well or by a maximum depth for this investigation. The weighted specific yield values for each well were plotted on a map, the wells were grouped, and an average specific yield was assigned to each area.

Groundwater level data were obtained from the U.S. Geological Survey and other agencies. Hydrographs showing groundwater levels were constructed for the wells. One groundwater level measurement each year was used. Ideally, groundwater levels are measured on the same date each year. In this investigation, April 1, which is midway through the water year, was the preferred date; however, when it was not available, the measurement used was that taken on the next closest date either before or after April 1. Excluded were measurements taken at pumping wells, recently pumped wells, or wells near pumping wells or near recently pumped wells.

Many wells have measurement records covering 40 or 50 years, but some have much shorter records. Commonly, gaps are found in the data. In many cases, the frequency of measurement will vary among the wells and, at a given well, measurements may have been taken annually, biannually, monthly, daily, or only sporadically.

The areas formed by the lines of equal annual decline and by the lines of equal specific yield were determined with an electronic planimeter. The product of the area, average specific yield, and average annual decline were calculated and totaled to determine the average annual change in storage.

Table 1 contains a summary of information regarding the eight groundwater basins in this report. A list of the references used in the study follows the text. All plates referred to in the text are bound in back of report.

TABLE 1. SUMMARY OF GROUNDWATER BASINS

County	Basin Number	Basin Name	Basin Subarea	Total Wells	Wells w/ Declining Levels	Min. Decline (ft/yr)	Max. Decline (ft/yr)	Wells w/ Rising Levels	Min. Rise (ft/yr)	Max. Rise (ft/yr)	Rainfall Station	Base Hydrologic Period
San Luis Obispo	3-4.06	Paso Robles	San Miguel	3	2	-0.31	-0.49	1		0.66	Paso Robles	'78 - '93
San Luis Obispo	3-4.06	Paso Robles	Paso Robles	6	5	-0.06	-0.63	1		1.33	Paso Robles	'78 - '93
San Luis Obispo	3-4.06	Paso Robles	Atascadero	5	5	-0.05	-1.04	0			Paso Robles	'78 - '93
San Luis Obispo	3-4.06	Paso Robles	Santa Margarita	3	1		-0.08	2	0.18	1.05	Paso Robles	'78 - '93
San Luis Obispo	3-12.00	Santa Maria	Oso Flaco	8	2		-0.21	6	0.01	1.63	Santa Maria	'77 - '95
Santa Barbara	3-12.00	Santa Maria	Santa Maria Valley	31	5	-0.01	-1.42	26	0.03	4.69	Santa Maria	'77 - '95
Santa Barbara	3-15.00	Lompoc	Lompoc Plain	12	10	-0.09	-0.87	2	0.03	0.09	Lompoc	'82 - '94
Santa Barbara	3-16.00	Goleta	Goleta	23	0			23	0.45	4.51	Santa Barbara	'88 - '96
Santa Barbara	***	Foothill	Foothill	10	3	-0.61	-2.36	7	0.44	5.00	Santa Barbara	'88 - '96
Santa Barbara	3-17.00	Santa Barbara	Santa Barbara	24	1		-0.17	23	0.03	8.48	Santa Barbara	'88 - '96
Santa Barbara	3-49.00	Montecito	Montecito	28	3	-0.01	-1.43	25	0.14	1.67	Santa Barbara	'88 - '96
Santa Barbara	3-18.00	Carpinteria	Carpinteria	23	11	-0.02	-1.38	12	0.01	2.53	Santa Barbara	'88 - '96

SOUTH COAST GROUNDWATER BASINS OF SANTA BARBARA COUNTY

Goleta, Foothill, Santa Barbara, Montecito, and Carpinteria Groundwater Basins underlie the southern coastal plain of Santa Barbara County. These are alluvium-filled basins where faulting has predominated in defining their boundaries, influencing the movement of groundwater, and determining the areas in which unconsolidated deposits could accumulate.

The basins are underlain at depth and juxtaposed along faults by consolidated rocks, which are essentially nonwater bearing. These include the Jurassic² Franciscan Complex, undifferentiated Cretaceous and Eocene marine deposits, the terrestrial Sespe Formation of Oligocene age, and the Miocene Vaqueros, Rincon, and Monterey Formations of marine origin (Dibblee, 1982).

Urban and residential development overlies the Foothill, Santa Barbara, and Montecito Basins; whereas irrigated agriculture prevails in the Goleta and Carpinteria Basins, with limited urban and residential development in the vicinity of Goleta and the City of Carpinteria.

The basins share a Mediterranean-type climate with warm, dry summers and cool, moist winters. All have coastal fog throughout the year and winters that are typically free of frost. Ninety-five percent of the rainfall comes between November and March.

Rainfall measurements recorded at the Santa Barbara Sanitation Plant (1867-1996) were used to determine the long-term annual average for the southern coastal plain of 18.00 inches. The cumulative departure from the mean was then plotted (Figure 3), from which an eight-year hydrologic base period was selected. This base period includes water year 1988 through water year 1996, during which time the average annual rainfall was 18.06 inches.

Goleta Groundwater Basin

The Goleta Groundwater Basin is the westernmost in the series of alluvial basins located along the southern coastal plain of Santa Barbara County. The basin underlies about 9,200 acres, or 14.5 square miles (Santa Barbara County Water Agency, 1996), with ground surface elevations ranging from sea level at Goleta Beach County Park to more than 600 feet in the extreme northeast portion of the basin. In forming a backdrop to the basin, the Santa Ynez Mountains demarcate its northern boundary (Plate 1)³, while the southern and western boundaries are defined by faults that restrict the flow of groundwater. Along its western margin, the basin's water-bearing sediments pinch-out against the coast and consolidated rocks of the Santa Ynez Mountains (Leed, Hill and Jewett, 1969). The tables and figure referred to are in Appendix A.

² Geologic time scale included in Figure 2

³ Plates are bound at back of report

Relative Duration of Major Geologic Intervals	Era	Period	Epoch	DURATION IN MILLIONS OF YEARS (Approximate)	MILLIONS OF YEARS AGO (Approximate)
CENOZOIC	CENOZOIC	QUATERNARY	Holocene Approx. last 10,000 years		
			Pleistocene	2	2
MESOZOIC		TERTIARY	Pliocene	3	5
			Miocene	18	23
			Oligocene	15	38
			Eocene	16	54
			Paleocene	11	65
PALEOZOIC	MESOZOIC	CRETACEOUS		71	136
		JURASSIC		54	190
		TRIASSIC		35	225
	PALEOZOIC	PERMIAN		55	280
		PENNSYLVANIAN		45	325
		MISSISSIPPIAN		20	345
		DEVONIAN		50	395
		SILURIAN		35	430
		ORDOVICIAN		70	500
		CAMBRIAN		70	570
PRECAMBRIAN	PRECAMBRIAN Formation of Earth's crust about 4,600 million years ago			4,030	4,600

Department of Water Resources, Southern District

FIGURE 3. SANTA BARBARA AREA RAINFALL

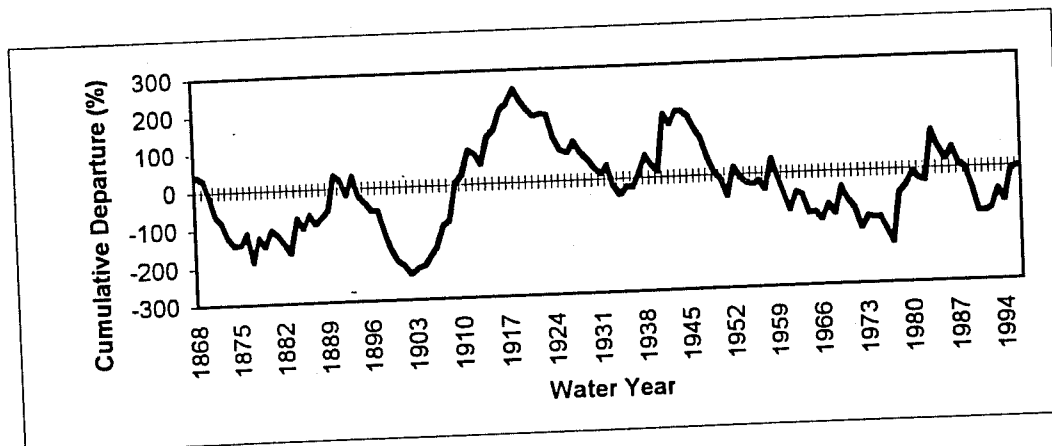
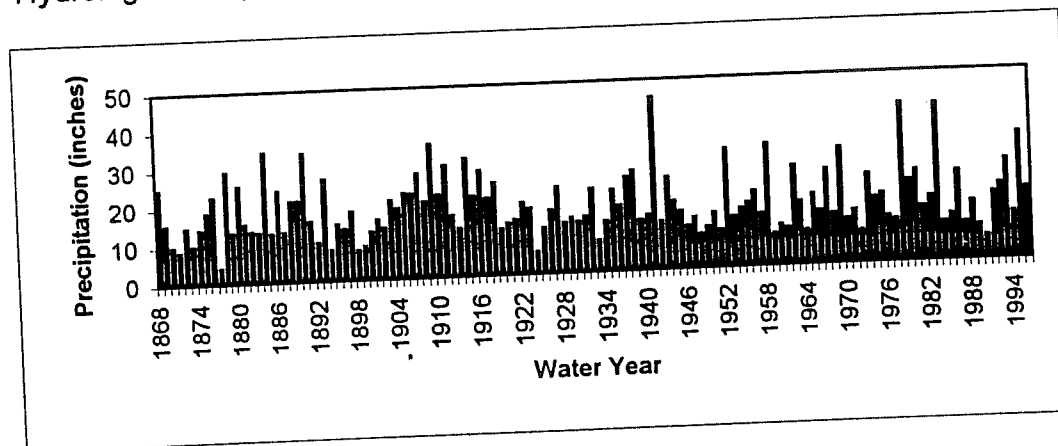
Rain gage station: Santa Barbara Sanitation Plant

Location: T4N, R27W: 34 25' N 119 41' W

Elevation: 6.5 feet

Mean annual rainfall: (1867-1996) 18.00 inches

Hydrologic base period: water years 1988-1996; Mean: 18.06 inches



Water-bearing Rocks

The Santa Barbara Formation is the major source of groundwater within the basin. This formation is of Pliocene age and marine origin and consists primarily of unconsolidated lenses of sand, silt, and clay, which attain a maximum thickness of about 2,000 feet (Upson and Thomasson, 1951b; Santa Barbara County Water Agency, 1996). Overlying the Santa Barbara Formation are Holocene and Pleistocene alluvial deposits from which shallow wells derive limited amounts of groundwater. The fine-grained nature of the deposits tend to inhibit their ability to yield appreciable amounts of water (Upson and Thomasson, 1951b; Santa Barbara County Water Agency, 1996). The Holocene alluvial deposits range in thickness up to a maximum of about 100 feet (Leed, Hill, and Jewett, 1969), and the Pleistocene alluvial deposits range up to 250 feet in the foothills northeast of Goleta (Upson and Thomasson, 1951b).

Faulting

Movement along the Goleta fault, which parallels the northern foothills, has uplifted lower fine-grained deposits of the Santa Barbara Formation along its south side, creating a partial barrier that impedes the flow of groundwater entering the basin as underflow from the Santa Ynez Mountains (Upson and Thomasson, 1951b). Similarly, the northwest-trending Modoc fault bordering the eastern flank of the basin restricts the flow of groundwater from entering the basin from the northeast, except near the fault's southeast juncture with the More Ranch fault, where groundwater from the adjacent Foothill Groundwater Basin discharges freely into the Goleta Groundwater Basin (Freckleton, 1989). The southern boundary of the basin was formed by vertical offset along the More Ranch fault, which has uplifted consolidated rocks on its south side, creating an effective barrier to the discharge of groundwater to the Pacific Ocean except along the outlet at Goleta Slough and at a smaller slough about 3 miles farther west. On the north side, or downthrown side of the fault, the unconsolidated deposits of the Santa Barbara Formation have accumulated to their maximum thickness of about 2,000 feet near the central portion of the basin. At the coast, the uplifted consolidated rocks act as an effective barrier to the inland migration of sea water into the basin's lower aquifers (Upson and Thomasson, 1951b; Santa Barbara County Water Agency, 1996).

Movement of Groundwater

Recharge to the Goleta Groundwater Basin comes primarily from infiltration of rainfall, seepage loss from streams, and underflow from the adjoining Santa Ynez Mountains. Groundwater movement within the basin somewhat conforms to the surface drainage of the basin. Groundwater entering the basin from the northwest, north, and east converges toward the center of the basin and discharges to the Pacific Ocean through Goleta Slough as do most of the creeks and streams. In the extreme western portion of the basin, far less groundwater discharges through a small slough northwest of Coal Oil Point (Upson and Thomasson, 1951b; Santa Barbara County Water Agency, 1996).

Aquifers

The water-bearing deposits of the Goleta Basin were divided by Upson and Thomasson (1951b) into a "shallow water body" and a "deep water body". The shallow water body occurs in the upper beds of the Holocene alluvium and, where found, the Pleistocene alluvium. The aquifer is continuous beneath most of the basin to a maximum depth of about 100 feet and is unconfined. The lower deep water body from which most wells pump, occurs in the lower beds of the Holocene alluvium, the Pleistocene alluvium, and the Santa Barbara Formation. The deep water body is confined by fine-grained sediments in the lower portions of the Holocene alluvium and occurs north of the More Ranch fault to about Hollister Avenue as shown on Plate 2 (Evenson, *et al.*, 1962; Leed, Hill, and Jewett, 1969). North of the confined zone, both aquifers are in hydrologic continuity and are considered unconfined.

Specific Yield

An estimate of the specific yield was made from lithologic descriptions of 65 boreholes in the basin. Depths of wells range from 110 feet to 710 feet, with an average depth of about 360 feet. Because the historical depth to water ranged from slightly above ground surface (artesian flow) to about 260 feet, a maximum depth of 500 feet was set to estimate the specific yield of the underlying sediments. As averaged, the specific yield of the basin was estimated to be about 10 percent. Locations of the wells used to estimate specific yield are shown on Plate 1.

Groundwater Levels

Groundwater level data were provided by the U.S. Geological Survey from 48 wells monitored in the basin. Of these wells, 16 were missing data necessary to this study, and another nine wells were seated within the zone of confinement, resulting in 23 wells being selected for this analysis.

Table A-1 gives a description of the 23 wells used in this study. Hydrographs provided in Figure A-1 also show the long-term trend in water levels for each of the wells. The changes in groundwater levels over the eight-year base period are plotted and lines of equal change are shown on Plate 2.

Table A-2 gives the overall calculations for the central and eastern areas of the basin, while Table A-3 presents the calculation for the northern portion of the basin. The western portion of the basin, however, was not calculated because of a lack of data. Together the two tables show that, within the area evaluated (6,080 acres, or 9.5 square miles), groundwater increased by about 860 acre-feet per year between 1988 and 1996.

Foothill Groundwater Basin

The inland Foothill Groundwater Basin is a small discrete basin underlying about 2,880 acres, or 4.5 square miles (Santa Barbara County, 1994), northeast of the community of Goleta and northwest of the City of Santa Barbara. Ground surface elevation ranges from about 150 feet above mean sea level south of Highway 101 to more than 1,070 feet in the extreme northeast portion of the basin. Previously unrecognized as a basin and divided along a vaguely defined groundwater divide (Evenson *et al.*, 1962; Muir, 1968), the basin includes the areas formerly included in the eastern part of the Goleta Groundwater Basin and the northwest part of the Santa Barbara Groundwater Basin. However, a more recent study by Freckleton (1989) of the U.S. Geological Survey concluded that the Foothill Basin is a separate groundwater basin bordered on the north and northeast by the Santa Ynez Mountains and on the northwest, southwest, south, and southeast by faults, which restrict the flow of groundwater. The tables and figure referred to may be found in Appendix B.

Water-bearing Rocks

Most groundwater is extracted from the Santa Barbara Formation of Pliocene age. The marine formation consists of sand, silt, and clay and attains a maximum thickness of about 400 feet within the basin (Freckleton, 1989). Of lesser importance as a water producer are the overlying Pleistocene and Holocene alluvial deposits composed chiefly of lenses of gravel, sand, silt, and clay. Along the downthrown sides of the Mission Ridge fault, these surficial deposits reach a maximum thickness of about 400 feet (Freckleton, 1989).

Faulting

The Goleta fault bordering on the northwest, Modoc fault on the southwest, and Mission Ridge fault on the southeast all act as barriers to the movement of groundwater within the Santa Barbara Formation, as indicated by large water level differences across these faults (Upson and Thomasson, 1951b; Evenson *et al.*, 1962). However, the faults are not believed to restrict the flow of groundwater within the unfaulted overlying alluvial deposits (Freckleton, 1989). The More Ranch fault, along a portion of the basin's southern boundary, juxtaposes consolidated rocks against the water-bearing deposits and thus is also an effective barrier.

Movement of Groundwater

Groundwater replenishment is derived from direct infiltration of rainfall along the northern fringes of the basin, seepage loss from streams entering the basin, and subsurface inflow from fractured and weathered zones in the consolidated rocks of the Santa Ynez Mountains bordering on the north. Groundwater flows southward through the basin and is discharged as subsurface flow through the Holocene alluvium at two locations along faults. The first location is across the Modoc fault between Atascadero and Cieneguitas Creeks, where groundwater discharges into the Goleta Groundwater Basin. The other is along the Mission Ridge fault south of the confluence of

Arroyo Burro and San Roque Creeks, where groundwater discharges to the Santa Barbara Groundwater Basin (Freckleton, 1989).

Aquifers

The principal aquifer of the Foothill Basin is within the Santa Barbara Formation and is confined except along the northern margins of the basin. Confining beds of fine-grained sediments in the upper part of the formation range in thickness from a few feet to 100 feet along the basin's southern boundaries (Martin, 1984; Freckleton, 1989). A shallow aquifer is within the Pleistocene and Holocene alluvial deposits and is generally unconfined, except perhaps, along the basin's southernmost margin (Freckleton, 1989).

Specific Yield

Specific yield was estimated from 17 boreholes located within the basin. Well depths average 367 feet, but range from 210 to 640 feet. As calculated, the specific yield of the basin is estimated to be 9.7 percent. Locations of wells used to estimate specific yield are shown on Plate 3.

Groundwater Levels

Groundwater level data were obtained from the U.S. Geological Survey from 10 wells located in the central and western portion of the basin. Because no data from wells in the eastern portion of the basin were obtained, that area was not evaluated in this study. Of the 10 wells for which data were provided, seven were found to extract from confined zones within the Santa Barbara Formation and therefore could not be used. Of the remaining three wells, well 4N/28W-12C02 is believed to be located north of the area of confinement of the Santa Barbara Formation, although information regarding its depth was missing. Well 4N/27W-5P01 is a shallow well with a depth of 200 feet, although it too is located north of the Santa Barbara Formation's area of confinement. The third well, 4N/27W-8M06, has a depth of 280 feet, but is not believed to penetrate the Santa Barbara Formation, as determined from geologic sections shown by Freckleton (1989). However, Freckleton delineates an area of confinement within the alluvium along the southern portion of the basin in his Figure 1, although he made no mention of it in the report's text. Moreover, in speaking of the alluvial deposits, Freckleton stated only that, "ground water generally is unconfined in the younger and older alluvium; however, there are areas of local confinement."

Therefore, in the current study, two evaluations were made: one using the two wells believed to be outside the Santa Barbara Formation's area of confinement and omitting well 4N/27W-8M06 because it is located within Freckleton's alluvial area of confinement. The other assumes that the alluvial deposits are unconfined and utilizes the data from well 4N/27W-8M06 in addition to the data from the other two wells.

Table B-1 gives a description of the 10 wells for which data were provided by the U.S. Geological Survey. In addition, hydrographs show the long-term trend in groundwater levels (Figure B-1).

The changes in groundwater levels, measured in feet, were plotted and lines of equal change are shown on Plate 4 for the base period of 1988 through 1996.

Tables B-2 and B-3 present the two sets of calculations used in the evaluation of overdraft. Table B-2 assumes the alluvial deposits are unconfined and utilizes the data from well 4N/27W-8M06 in addition to data from wells 4N/28W-12C02 and 4N/27W-5P01. Table B-3 assumes the alluvial deposits are confined and uses only the data from wells 4N/28W-12C02 and 4N/27W-5P01. As calculated from Table B-2, the central and western areas of the Foothill Groundwater Basin show an overdraft of about 158 acre-feet per year. Table B-3 indicates an overdraft of around 217 acre-feet per year.

Santa Barbara Groundwater Basin

The Santa Barbara Groundwater Basin underlies an area of about 7,360 acres, or 11.5 square miles (Santa Barbara County Water Agency, 1996). Ground surface elevation ranges from sea level to more than 700 feet. The basin is defined by faults that impede the flow of groundwater on its north, northwest, and southwest sides. Shallow basement rocks along the foothills of the Santa Ynez Mountains define its northeast boundary, while the southern boundary is the Pacific Ocean. The basin's eastern flank between the Santa Barbara and Montecito Groundwater Basins is arbitrarily defined, because no hydrologic or geologic barrier exists between them (Santa Barbara County Water Agency, 1996). Appendix C contains the tables and figures referred to.

Water-bearing Rocks

The principal water-bearing deposits of the basin are found within the Santa Barbara Formation. The unconsolidated Pliocene marine formation is characterized as lenticular deposits of fine to coarse sand, silt, and clay. Of secondary importance as a water producer are the overlying alluvial deposits, which include alluvium of Holocene and Pleistocene age. Collectively, the basin's water-bearing deposits attain a maximum thickness of more than 1,000 feet along the northeast side of the Mesa fault (Martin, 1984).

Faulting

Four major faults define portions of the basin's boundaries and, to varying degrees, impede the movement of groundwater. The Mission Ridge fault defines the north and northwest boundaries and significantly restricts groundwater from entering the basin from the north. Near the fault's northwest juncture with the Mesa fault, the barrier effect diminishes and groundwater flows across the fault from the Foothill Basin (Freckleton, 1989). Between the Mesa and parallel Lavigia fault, a shallow "step-up" subbasin is formed, which demarcates the basin's southwestern boundary. Hydraulic continuity across the Mesa fault is believed to be impeded near the ocean, where basement rocks are uplifted to near land surface along the southwest side of the fault (Martin and Berenbrock, 1986). Offshore are upthrown basement rocks along an unnamed fault,

which formerly was thought to provide a barrier to the intrusion of sea water; however, studies conducted by the U.S. Geological Survey have conclusively demonstrated that the fault is not an effective barrier (Martin, 1984).

Movement of Groundwater

Groundwater replenishment is derived from subsurface inflow from the Foothill Groundwater Basin bordering on the north, from seepage loss from streams entering the basin, and from direct infiltration of rainfall. Groundwater moves southward and converges toward Santa Barbara Estero -a former shallow ocean inlet- prior to discharging to the ocean as subsurface outflow or as leakage across the offshore fault (Martin and Berenbrock, 1986).

Aquifers

The water-bearing deposits of the basin were divided into five zones by Martin (1984): (1) shallow zone, (2) upper producing zone, (3) middle zone, (4) lower producing zone, and (5) deep zone. Of these, the upper and lower producing zones are the two main aquifers. The upper producing zone is contained in the basal portion of the Holocene alluvium and is about 50 feet thick throughout much of the basin. Fine-grained deposits present in the shallow zone partially confine the underlying upper producing zone toward the coast. The middle zone is composed of fine-grained deposits that correspond to the upper portion of the Santa Barbara Formation and confine the underlying lower producing zone throughout most of the basin. The middle zone thickens seaward, ranging from about 100 feet south of the Mission Ridge fault to more than 300 feet beneath downtown Santa Barbara. The lower producing zone is the main source of water for wells in the basin. It consists largely of coarse to medium sand, fine gravel, and shell fragments and ranges in thickness from about 50 feet along the northern fringes of the basin to more than 200 feet toward the coast. The underlying deep zone consists of fine-grained deposits and essentially demarcates the base of the basin because of poor quality water and low hydraulic conductivity.

Specific Yield

The specific yield was estimated from lithologic logs of 26 boreholes located across the basin. Depths of wells range from 62 feet to 710 feet, but average about 340 feet. Because of the variation in basin depth caused by faulting, well logs were evaluated to the depth of the completed well. As calculated, the specific yield of the basin was estimated to be about 10 percent. Locations of the wells used to estimate specific yield are shown on Plate 3.

Groundwater Levels

Analysis of water levels was limited to wells perforated within the upper producing zone and located outside the area of shallow confinement (Plate 4). Groundwater level data were provided by the U.S. Geological Survey for 24 wells throughout the basin. Of these, only eight wells were

suited for this study, most others wells were either perforated within the lower producing zone and thus were considered confined or were shallow, overlying the area of shallow confinement.

Table C-1 gives a brief description of the 24 wells for which water level data were provided. In addition, hydrographs show the long-term trends in water levels (Figure C-1). The changes in groundwater levels, measured in feet, were plotted and lines of equal change are shown on Plate 4.

Table C-2 presents the calculations used in the evaluation of overdraft for the basin. The evaluation showed a surplus of 243 acre-feet per year during the hydrologic base period.

Montecito Groundwater Basin

The Montecito Groundwater Basin underlies an area of about 4,288 acres, or 6.7 square miles (Santa Barbara County Water Agency, 1996). Ground surface elevation ranges from sea level to about 750 feet. The basin is bordered on the north by the Santa Ynez Mountains and on the south by the Pacific Ocean and an offshore fault. The southeast margin is defined by the Fernald fault, which juxtaposes consolidated rocks against the water-bearing deposits of the basin, while its northeast boundary is defined by a drainage divide that separates the Montecito and Carpinteria watersheds. The basin's western boundary with the Santa Barbara Groundwater Basin is approximate; the southwest portion is an arbitrarily selected boundary, and the drainage divide separating the Montecito and Santa Barbara watersheds serves as the basin's northwest boundary. The table and figure referred to may be found in Appendix D.

Water-bearing Rocks

The principal water-bearing deposit from which wells of the basin extract is the Pleistocene Casitas Formation of continental origin (Muir, 1968; Santa Barbara Water County Agency, 1996). The unconsolidated formation is poorly sorted and consists chiefly of lenticular beds of sand, gravel, silt, and clay, although boulders and cobbles are common throughout. Maximum thickness is about 500 feet (Muir, 1968). Of secondary importance as a water producer are the overlying Pleistocene and Holocene alluvial deposits. The Pleistocene alluvium consists largely of a fanglomerate faces composed of boulders and reddish clay, which, where saturated, yields only modest amounts of water to wells. The Holocene alluvium deposited along stream channels attains thicknesses of up to 80 feet and yields several hundred gallons per minute to wells near the coast (Hoover, 1980b). In contrast to its importance as a water producer in the Santa Barbara Basin, the Pliocene Santa Barbara Formation, which occurs only in a restricted area in the southwest portion of the basin, is penetrated by few wells. The water-bearing deposits collectively attain a maximum thickness of about 1,200 feet along the basin's southern boundary with the coast (Hoover, 1980b).

Faulting

Two major east-west-trending faults impede the flow of groundwater and divide the basin into three subbasins (Santa Barbara County Water Agency, 1996). The Arroyo Parida fault is the northernmost fault and separates the northern subbasin from the central subbasin on the south. The central subbasin, in turn, is bounded on the south by the Montecito fault, which forms the northern boundary of the southern subbasin. The southern subbasin is bounded on its south by the Pacific Ocean and an offshore fault. The offshore fault is believed by Hoover (1980b) to be an extension of the Rincon Creek fault known to the Carpinteria Basin. The Fernald fault juxtaposes consolidated rocks against the basin's unconsolidated sediments and forms the basin's southeastern boundary west of the community of Summerland.

Movement of Groundwater

Recharge to the basin is derived from seepage loss from streams, direct infiltration of rainfall, and subsurface inflow from consolidated sedimentary rocks. Although the movement of groundwater is impeded in places by faults, the general direction of flow is toward the south. The discharge of groundwater from the basin is through either pumpage or subsurface outflow to the ocean (Hoover, 1980a,b).

Aquifers

Groundwater is extracted mainly from the Casitas Formation. Groundwater in the formation is partially confined along the northside of the Arroyo Parida fault in the northern subbasin and also inland from the coast in the southern subbasin. Water-bearing deposits form a shallow aquifer within the Pleistocene and Holocene alluvium; the aquifer is generally unconfined (Geotechnical Consultants, 1979; Hoover, 1980b). Along the northern margin of the basin, numerous small wells tap the consolidated Sespe Formation, although yields tend to be sufficient for domestic purposes only (Hoover, 1980b).

Specific Yield

An estimate of specific yield was made from the lithologic logs of 48 boreholes across the basin. All wells were evaluated to their completed depths, which range from 142 to 684 feet, and average 308 feet. As calculated, the specific yield of the basin was estimated to be about 11 percent. Locations of the wells used to determine specific yield are shown on Plate 5.

Groundwater Levels

Groundwater level data were provided by the Montecito Water District from 60 wells monitored by the district. Of these wells, nearly half did not have groundwater level measurements dating to 1988, or the beginning of this investigation's hydrologic base period (1988-1996). Groundwater level measurements were found to be sufficient from 28 wells; these are listed in Table D-1 in

Appendix D, along with a brief description of each. Eight of the 28 wells were located within the area of confinement north of the Arroyo Parida fault and thus were excluded from use in this study.

Included in Appendix D are the hydrographs of wells from which data were available that show the long-term trends in groundwater levels (Figure D-1). The changes in groundwater levels, measured in feet, are plotted and lines of equal change are shown on Plate 6.

Table D-2 gives the calculations used in the evaluation of overdraft for each of the three subbasins. All show modest increases in storage over the hydrologic base period. The evaluation shows an overall increase of 192 acre-feet per year.

Carpinteria Groundwater Basin

The Carpinteria Groundwater Basin, which is the easternmost of the five alluvial basins located along the southern coastal plain of Santa Barbara County, underlies approximately 7,700 acres, or roughly 12 square miles (Santa Barbara County Water Agency, 1996). Ground surface elevation ranges from sea level to about 680 feet atop Shepard Mesa. The basin is bounded on the north by the foothills of the Santa Ynez Mountains and on the south and southwest by the Pacific Ocean. Its western boundary is demarcated by Toro Canyon and consolidated rocks that outcrop and form the canyon's western flank. Toward the southeast, the groundwater basin is bounded by faults and on the east, by Rincon Creek. The tables and figure referred to are in Appendix E.

Water-bearing Rocks

The chief water-bearing deposits in the Carpinteria area are the Pleistocene terrestrial Casitas Formation, composed of lenticular deposits of poorly sorted clay, silt, sand, and gravel, interspersed by cobbles and boulders of mostly Eocene age sandstone (Upson and Thomasson, 1951b). The Casitas Formation attains a thickness of about 4,000 feet beneath the central portion of the basin. Of secondary importance as a source of groundwater are the alluvial deposits of Holocene age, which overlie the Casitas Formation in most places and line the stream channels. The deposits consist largely of fluvial lenses of sand, silt, and clay with minor amounts of gravel and reach a maximum thickness of about 250 feet (Upson and Thomasson, 1951b). Of negligible use as a groundwater source, although water bearing, are the Pliocene marine Santa Barbara Formation and alluvium of Pleistocene age.

Faulting

Faulting occurs in the southeast portion of the basin where vertical displacement of the Casitas and Santa Barbara Formations on the west-trending Rincon Creek fault is estimated to be on the order of 3,000 feet or more (Upson and Thomasson, 1951b). The south-dipping thrust fault is known to impede the movement of groundwater and, together with the Carpinteria fault on the

south, creates a shallow step-up basin that wedges-out westward. Uplift of consolidated rocks along the southside of the Carpinteria fault, in turn, is believed to act as a barrier to the encroachment of sea water along that portion of the basin (Upson and Thomasson, 1951b). Although several minor faults have been mapped in the northeast portion of the basin- most notably the Shepard Mesa fault -they are not known to affect the movement of groundwater.

Movement of Groundwater

Recharge to the groundwater basin is derived chiefly from the direct infiltration of rainfall and seepage loss from streams crossing the unconfined portion of the basin and from subsurface inflow from the consolidated sedimentary rocks bordering the northern margin of the basin. In the west and central portions of the basin, groundwater that is not pumped flows south and is either discharged offshore or passes as subsurface outflow through the El Estero Slough to the ocean. North of the Rincon Creek fault, in the eastern portion of the basin, groundwater flows southwest and discharges to the ocean through El Estero Slough. South of the Rincon Creek fault, groundwater moves west to northwest to where it crosses the fault south of the City of Carpinteria prior to discharging to the ocean through El Estero Slough. (Upson and Thomasson, 1951b; Geotechnical Consultants, 1986).

Aquifers

Upson and Thomasson (1951b) discerned two main water bodies underlying the Carpinteria area. They termed them the "shallow water body", which is chiefly unconfined, and the "deep water body", which is largely confined except along a roughly mile wide strip bordering the northern fringes of the basin where the deep water body is recharged. The deep water body is confined by fine-grained beds of silt and clay within the lower portion of the Holocene alluvium; these beds effectively retard the movement of groundwater from the upper portion of the Holocene alluvium to the deep water body in the underlying Casitas Formation.

Specific Yield

A representative estimate of the specific yield of the basin was attained from the lithologic logs of 62 boreholes within the basin. Well depths range from 80 to 975 feet, but average 443 feet, with a median depth closely approximating the average at 422 feet. Thus, the specific yield of the underlying sediments was evaluated to a maximum depth of 500 feet in those wells that exceeded that depth. As derived from the calculations, a representative specific yield for the basin was estimated to be 10 percent. Locations of the wells used to determine specific yield are shown on Plate 5.

Groundwater Levels

Historical groundwater level data were provided by the U. S. Geological Survey for 30 wells monitored by the Carpinteria County Water District. Of these wells, seven could not be used for

this study because of critical gaps in the data, while another eight wells were excluded from use because of their locations within the area of confined groundwater. As a result, 15 wells were found to be suitable and were used in the evaluation of overdraft.

Table E-1 in Appendix E provides a description of the wells from which data were sufficient to calculate an average annual change in groundwater levels over the eight-year hydrologic base period (1988 - 1996). Also included are hydrographs of those wells that show the long-term trend in groundwater levels for the Carpinteria area (Figure E-1). The annual changes in groundwater levels, measured in feet, are plotted and lines of equal change are shown on Plate 6.

Table E-2 gives the calculations used in the evaluation of overdraft for the Carpinteria Groundwater Basin. The unconfined part of the basin, which underlies 3,685 acres, or about 5.76 square miles, was evaluated. The evaluation showed an increase in groundwater storage of about 126 acre-feet per year.

SANTA MARIA GROUNDWATER BASIN

The Santa Maria Groundwater Basin, which is located in the northwest portion of Santa Barbara County and extends into the southwest portion of San Luis Obispo County (Figure 1), underlies an area of about 110,000 acres, or 170 square miles (Santa Barbara County, 1994). Ground surface elevation ranges from sea level at the coast to about 350 feet in the eastern portion of the basin. In the Orcutt highlands bordering the south, elevation ranges from about 200 feet to about 600 feet. The coastal alluvial basin is bounded on the east and northeast by the San Rafael Mountains and on the south by the Solomon and Casmalia Hills. The north and northwest boundaries used in this study are essentially those used in Bulletin 118-80 (DWR, 1980) and include Nipomo Mesa north of the Santa Maria River and an arbitrarily defined boundary extending from western Nipomo Mesa to the coast north of the lakes at Oso Flaco (Plate 7). A recent study of the Arroyo Grande area (DWR, 1999) shows hydraulic continuity beyond these geographical boundaries. The western boundary of the basin is open to the sea, where the water-bearing deposits extend for an undetermined distance offshore. Structurally, the basin is underlain and defined by the Santa Maria Valley syncline, a down-warped fold in the basement rocks that provided for the subsequent accumulation of the overlying water-bearing deposits composing the groundwater basin (Woodring and Bramlette, 1950). The tables and figures referred to may be found in Appendix F.

The Cities of Santa Maria and Guadalupe overlie the central and western portions of the basin, respectively, and extensive unincorporated urban development is expanding in the Orcutt area. Elsewhere, extensive irrigated agriculture predominates. Oil exploration has continued in the area since the early 1900s, while production activity has been centered primarily in the Santa Maria Valley oil field located south of the City of Santa Maria and in the Guadalupe oil field in the far southwest portion of San Luis Obispo County (Arnold and Anderson, 1907; Frame, 1938).

Water-bearing Rocks

The principal water-bearing deposits from which wells extract groundwater are, in order of importance: Holocene alluvium, Pleistocene Paso Robles Formation, and Pleistocene Orcutt Sand and Pliocene Careaga Sand. The Holocene alluvium is composed of unconsolidated lenticular bodies of gravel, sand, silt, and clay that attain a maximum thickness of about 250 feet (Miller and Evenson, 1966). Toward the western portion of the basin, fine-grained deposits of silt and clay in the upper 100 feet of the alluvium act as a confining layer to the underlying aquifer.

The Paso Robles Formation is of continental origin and characterized by fluvial deposits of sand and gravel interbedded by silt and clay. Toward the base of the formation, beds of fossiliferous freshwater limestone and marl help to distinguish it from the underlying Careaga Sand of marine origin (Woodring and Bramlette, 1950). The formation reaches thicknesses of up to 2,000 feet.

The Orcutt Sand, which is found beneath the southern margin of the basin, overlies the Paso Robles Formation in this region. It consists primarily of continental deposits of light tan or gray sand interbedded with coarse gravel and minor amount of silt and clay in the upper parts of the formation. Along the axis of the Santa Maria Valley syncline, the Orcutt Sand attains a maximum thickness of about 225 feet (Worts, 1951).

The marine Careaga Sand is characterized by unconsolidated deposits of white to yellowish-brown sand and gravel containing minor amounts of silt and is often locally fossiliferous. Thickness ranges up to about 650 feet (Worts, 1951). Collectively, the water-bearing deposits attain an overall thickness of about 2,800 feet near the axis of the Santa Maria Valley syncline, but in general, average about 1,000 feet (Santa Barbara County Water Agency, 1996).

Nonwater-bearing Rocks

The basin's water-bearing deposits are underlain by a series of consolidated marine sedimentary rocks, ranging in age from Jurassic through upper Tertiary, that are essentially nonwater bearing. The basement rocks attain a thickness of more than 10,000 feet and include the Jurassic Franciscan Complex and Knoxville Formation, followed by the lower Miocene pyroclastic Obispo Formation, the middle through upper Miocene Monterey Formation, and the Pliocene Sisquoc and Foxen Mudstone Formations (modified from Woodring and Bramlette, 1950; Worts, 1951; Hall *et al.*, 1966).

Faulting

No faults are known to inhibit the flow of groundwater within the basin, although, the northwest-trending Santa Maria fault located beneath the City of Santa Maria and the Santa Maria oil field is known to vertically displace the Paso Robles and Careaga Formations by about 150 feet (Worts, 1951). En echelon to the Santa Maria fault on the southeast is the Bradley Canyon fault, which is also known to vertically offset the Paso Robles and Careaga Formations. Both faults are truncated

on the north by the Santa Maria River fault mapped by Hall (1977), which trends outside of the northeast margin of the basin. Sylvester and Darrow (1979) have suggested that this fault is a northern extension of a major regional fault, referred to as the Santa Maria River- Foxen Canyon-Little Pine fault.

Movement of Groundwater

Since 1962 and the completion of Twitchell Reservoir, recharge to the basin has been derived primarily from the percolation of controlled releases of water conserved in the reservoir. Other sources include the direct percolation of rainfall, agricultural and municipal return flows, and subsurface inflow from adjoining uplands. Recharged water from Twitchell Reservoir mounds beneath the Santa Maria River along the northeast margin of the basin and, from there, moves west to southwest across the basin toward the Pacific Ocean (Worts, 1951; Santa Barbara County Water Agency, 1994; Cleath, 1996).

Aquifers

In the eastern and central portions of the basin, groundwater is contained as a single body within the Holocene alluvium, Paso Robles Formation, and Orcutt Sand where it is unconfined. Toward the coast, fine-grained sediments within the upper portion of the alluvium form a shallow aquifer of poor quality water and, within the lower portion of the alluvium and the other underlying water-bearing deposits, form a lower confined aquifer. The Careaga Formation, because of its depth is tapped by few wells and is believed to be almost everywhere confined by beds of clay, limestone, and marl at the base of the Paso Robles Formation (Woodring and Bramlette, 1950; Worts, 1951).

Specific Yield

Individual estimates of specific yield were made for the eastern, central, and western portions of the basin, the boundaries of which coincide with range boundaries. Thus, the area east of Range 33 West is regarded as the eastern portion of the basin; the area between Range 33 West and Range 34 West, as the central portion of the basin; and the area west of Range 34 West, as the western portion of the basin. As a whole, well depths within the basin range from 90 feet to more than 1,000 feet; however, the average depth is about 350 feet as determined from the lithologic logs of 215 boreholes. The median depth was found to be about 290 feet. Therefore, it was felt that a representative estimate of specific yield for most of the wells in the basin would be obtained by evaluating the logs to a maximum depth of 500 feet. As calculated from 71 well logs, the specific yield corresponding to the eastern portion of the basin was estimated to be 13 percent; as determined from 115 logs, the specific yield of the central portion of the basin is 15 percent; and from 29 logs, the specific yield of the western portion of the basin is 14 percent. Locations of the wells used to determine specific yield are shown on Plate 7.

Rainfall

Rainfall data collected by the City of Santa Maria were made available from the Santa Barbara County Water Agency. The data document 110 years of rainfall, beginning in 1886 and ending in 1996. Over that period, yearly rainfall averaged 13.41 inches. The cumulative departure from the average yearly rainfall was then plotted as a graph and is included in Appendix F as Figure F-1. From the graph, a representative 18-year hydrologic base period was determined beginning in water year 1977 and ending in water year 1995. Accordingly, the average annual rainfall over the base period was 13.42 inches, which is close to the long-term average annual rainfall of 13.41 inches.

Groundwater Levels

Historical groundwater level data were obtained for 55 wells from multiple sources that include the U.S. Geological Survey, the Santa Barbara County Water Agency, and the Santa Maria Valley Water Conservation District. Upon compilation of the data, it was determined that the data from 16 wells were insufficient to be used in this study, leaving 39 wells from which a value of average annual change over the 18-year hydrologic base period could be calculated. In addition, upon plotting the well locations on base maps, 12 wells were found to overlie the area of confinement in the western portion of the basin and thus were excluded in the final evaluation of overdraft. Therefore, the evaluation of overdraft used the data from the remaining 27 wells, of which all but one were located within either the eastern or central portions of the basin.

Table F-1 contained in Appendix F gives a brief description of all 39 wells from which a value of average annual change could be determined. Also given in Appendix F are hydrographs of the wells that show the long-term trends in water levels in the basin (Figure F-2). Plotted in Plate 8 are the well locations and the corresponding values of average annual change measured in feet, from which lines of equal change are drawn.

The actual calculations for the evaluation of overdraft from the eastern, central, and western portions of the basin are given in Tables F-2, F-3, and F-4, respectively. Table F-5 summarizes the results of the evaluation of overdraft for the basin as a whole. Table F-5 also shows that an assessment of the basin, which, excluding the area under confinement, underlies a total of 73,240 acres, or about 114 square miles, resulted in an overall surplus of 13,621 acre-feet per year during the 18-year base period.

LOMPOC PLAIN GROUNDWATER BASIN, LOWER SANTA YNEZ RIVER VALLEY

The Lompoc Plain is an elongated valley in the western portion of Santa Barbara County (Figure 1) and encompasses approximately 15,376 acres, or about 24 square miles, that range in elevation from mean sea level at the coast to about 120 feet near the eastern boundary of the plain (Miller,

1976). The climate is typified by dry summers and cool, moist winters with coastal fog common throughout the year. Land use consists primarily of irrigated agriculture, while urban and residential use is chiefly in and around the City of Lompoc, which is located in the eastern portion of the plain. The Santa Ynez River provides the major source of recharge to the underlying aquifers; it flows westward along most of the northern perimeter of the plain before discharging into the Pacific Ocean near Surf. Appendix G contains the tables and figures referred to.

Water-bearing Rocks

The major water-bearing materials are unconsolidated river channel deposits of Holocene age, Holocene alluvium, and, to a lesser extent, buried terrace deposits of Pleistocene age. Other water-bearing deposits include the terrestrial Pleistocene Paso Robles Formation and Orcutt Sand and the marine Careaga Sand of Pliocene age (Upson and Thomasson, 1951a; Miller, 1976; Bright *et al.*, 1992). Within the basin, these three water-bearing deposits are generally not tapped by wells because of their greater depth beneath the plain; however, in the surrounding uplands, these deposits do serve as major groundwater sources. The maximum thickness of these combined deposits is about 1,500 feet (Bright *et al.*, 1992; Santa Barbara County Water Agency, 1996).

Nonwater-bearing Rocks

Underlying the basin's water-bearing deposits are consolidated rocks, which are essentially nonwater bearing. These are the Jurassic Franciscan Complex and Cretaceous Knoxville Formation (Hall, 1982). The Neogene marine deposits include the lower Miocene Tranquillion Volcanics of Dibblee (1950), the middle to upper Miocene Monterey Formation, and the Pliocene Sisquoc and Foxen Mudstone Formations (modified from Woodring and Bramlette, 1950; Miller, 1976; Bright *et al.*, 1992).

Basin Structure

The geologic structure of the basin is dominated by a series of anticlinal and synclinal folds within the underlying nonwater-bearing rocks as shown on Plate 9. As a consequence, the unconsolidated sediments tend to be thick where they overlie synclines and thin where they overlie anticlines. Beneath the Lompoc Plain, the Santa Rita syncline strikes west for the entire length of the plain and essentially defines the basin. In the northeastern portion of the basin, the Burton Mesa anticline trends west to northwest, creating the upland area to the north of the basin known as the Burton Mesa (Bright *et al.*, 1992).

A fault occurs along the southern perimeter of the basin, but does not directly affect the flow of groundwater entering the basin from the Santa Ynez Mountains on the south. This fault, first mapped by Hall (1977) and called the Lompoc-Solvang fault, was described as a steep south-dipping thrust fault. Later, Sylvester and Darrow (1979) also recognized the fault, but referred to it on their maps as the Santa Ynez River fault (Bright *et al.*, 1992). A possible western extension to this fault was identified by Evenson and Miller (1963) in the Lompoc Terrace southwest of the

Lompoc Plain. This south-dipping thrust fault was subsequently named the Lompoc Terrace fault by Sylvester and Darrow (1979).

Movement of Groundwater

Groundwater recharge occurs primarily as seepage loss from the Santa Ynez River, which enters the plain from the southeast, flowing north before changing direction toward the west. Additional recharge is derived as infiltration of rainfall and as underflow and seepage loss from streams entering the plain from the Lompoc Uplands on the north and northeast and from the Santa Ynez Mountains and Lompoc Terrace toward the south and southwest. Infiltration of sewage effluent and excess irrigation water also contribute. Groundwater flows westward beneath the plain prior to discharging into the Pacific Ocean (Upson and Thomasson, 1951a; Miller, 1976; Bright *et al.*, 1992).

Aquifers

The groundwater of the basin is both confined and unconfined. Bright *et al.* (1992) divided the river channel deposits and the upper portion of the Holocene alluvium into two water-bearing zones. These zones are unconfined and referred to as the "shallow" and "middle" zones, which extend throughout the entire basin to a depth of about 150 feet. The lower portion of the Holocene alluvium forms the "main" zone from which most production wells draw (Bright *et al.*, 1992). The main zone is confined by clay and silt lenses in the mid-portion of the alluvium; it attains a maximum thickness of about 90 feet. The main zone is confined primarily beneath the central and western areas of the plain; it is not confined near the north-central or south-central perimeters nor in the eastern areas. The buried terrace deposits beneath the southern portion of the plain, the Paso Robles Formation, and the Orcutt and Careaga Sands form the lower aquifer (Upson and Thomasson, 1951a; Miller, 1976), but remain generally untapped by wells of the Lompoc Plain (Bright *et al.*, 1992), as was previously noted.

Specific Yield

Lithologic logs from 96 water boreholes were used to estimate the specific yield of the basin. Depths of wells range from 48 feet to 216 feet, with an average well depth of 149 feet. Thus, the wells used to estimate specific yield are seated within the Holocene alluvial deposits. As averaged, the specific yield of the basin was estimated to be 12 percent. Locations of the wells are shown on Plate 9.

Rainfall

Rainfall, as measured at the Lompoc Highway Maintenance Yard for 1938 through 1996, averaged 14.48 inches. The cumulative departure from the mean was plotted (Figure G-1), and a 12-year hydrologic base period was determined. This period is 1982 through 1994 when the annual rainfall averaged 14.41 inches.

Groundwater Levels

Groundwater level data from 24 wells were furnished by the U.S. Geological Survey; however, only 12 wells were found suitable for this investigation. Seven wells were omitted because their depths were greater than 150 feet and they pump from the confined main zone of the lower portion of the Holocene alluvium. Four other wells had gaps in the data and thus could not be used, and the depth of another well is unknown. The remaining 12 wells were found suitable; they either draw from the unconfined shallow and middle zones of the upper portion of the Holocene alluvium or are located outside the area of confinement of the main zone.

Table G-1 in Appendix G provides a description of the 12 wells selected for this study. In addition, hydrographs show the long-term groundwater levels in the 12 wells (Figure G-2). The changes in groundwater levels during the base period at the 12 wells are plotted and lines of equal change are shown on Plate 10.

Table G-2 shows the overall calculations for the basin. In 1982 through 1994, groundwater overdraft is estimated to have been about 795 acre-feet per year.

PASO ROBLES GROUNDWATER BASIN

The Paso Robles Groundwater Basin is a large inland basin underlying roughly 580,700 acres, or 907 square miles, of the upper Salinas River drainage area in portions of northeast San Luis Obispo and southeast Monterey Counties (DWR, 1958). The area includes the Paso Robles Basin (3-4.06) and Cholame Valley Basin (3.5), which are contiguous and were combined for this evaluation as the Paso Robles Groundwater Basin (Figure 1). Ground surface elevation ranges from about 500 feet above sea level along the Salinas River at Bradley in Monterey County to about 2,650 feet in the Red Hills in the far eastern portion of the basin. Surrounding highlands composed of nonwater-bearing consolidated rocks confine the basin and define its boundaries (Plate 11). Internally, the basin's topography is characterized by rolling hills dissected by ephemeral creeks and streams that form narrow alluvial-lined valleys, which drain to the north-flowing Salinas River located along the western margin of the basin. The tables and figures referred to may be found in Appendix H.

Land use across much of the basin consists of limited rural residential development and irrigated agriculture, of which the cultivation of alfalfa and vineyards predominate (DWR, 1987). Urban areas tend to congregate along the Salinas River corridor; they include San Miguel, Paso Robles, Atascadero, Templeton, and Santa Margarita, through which U.S. Highway 101 serves as the main thoroughfare. In the eastern portion of the basin, along State Highway 46, are located the rural communities of Shandon and Cholame. Rainfall averages 15 to 20 inches annually in the western portions of the basin and 9 to 11 inches in the drier eastern areas (DWR, 1958). In the southeast and south-central areas, the San Juan, Commatti, and Huerhuero Creeks provide drainage; in the northeast and north-central portions of the basin, drainage is afforded by Cholame

Creek and the Estrella River; and in the far northwest portion of the basin, the Nacimiento River is the principal drainage and a primary tributary to the Salinas River.

Water-bearing Rocks

The major water-bearing deposit from which wells extract groundwater is the Pleistocene Paso Robles Formation of terrestrial origin. The formation consists of unconsolidated fluvial deposits of poorly sorted sand, gravel, silt, and clay, which attain a thickness of 2,000 feet beneath the central portion of the basin east of the City of Paso Robles (DWR, 1958). Limited amounts of groundwater are also derived from Holocene alluvial deposits, which line the channels of rivers and streams. Generally coarser grained than the Paso Robles Formation, the alluvial deposits consist chiefly of unconsolidated lenses of fine to coarse sand pebbles and boulders interbedded with minor amounts of silt and clay. The deposits vary in thickness, ranging up to about 130 feet along the Salinas River, but are generally less than 30 feet in the minor stream valleys (DWR, 1958). Of the total surface area overlying the basin (580,700 acres), estimates are that 562,100 acres is underlain by surficial deposits of the Paso Robles Formation and 30,300 acres, primarily located along stream channels, is of alluvial deposits (DWR, 1958).

Nonwater-Bearing Rocks

The basin's water-bearing sediments are bounded and underlain at depth by an association of nonwater-bearing crystalline igneous and metamorphic rocks, which, in turn, are overlain by consolidated Tertiary marine sedimentary rocks. North of the City of Paso Robles and along the upper reaches of San Juan Creek, Mesozoic (Salinian) granitoid rocks outcrop and expose the lower sequence of the basement complex (DWR, 1958; Norris and Webb, 1990). Farther east toward the San Andreas fault and in the Santa Lucia Range to the west, various pre-Tertiary metamorphic rocks (Sur Series) are exposed; these consist of schist, marble, gneiss, and quartzite (DWR, 1958; Norris and Webb, 1990). In most places, these crystalline rocks are unconformably overlain by a series of Miocene marine formations, which include the Vaqueros, Monterey, and Santa Margarita Formations. Found mostly in the eastern portion of the basin, the Miocene marine series is unconformably overlain by the Pliocene marine Etchegoin Formation. In other areas toward the west, the Santa Margarita Formation is often found in unconformable contact underlying the Pleistocene Paso Robles Formation (DWR, 1958; Johanson, 1979).

Basin Structure

The basement complex underlying the basin has undergone moderate warping, which has resulted in synclinal and anticlinal structures that tend to cause the overall thickness of the overlying water-bearing deposits to vary, in addition to influencing the occurrence and movement of groundwater. The folds, as do the faults of the region, trend generally in a northwest direction. Anticlinal areas of significance include the Bradley and Huerfano anticlines located in the north and central portions of the basin, respectively, and the Cholame Hills in the northeastern part of the basin, which are essentially a dissected monocline. Synclinal warping is parallel to the Bradley

and Huerhuero anticlines and in the area underlying San Miguel (DWR, 1958).

Two major fault systems occur along the margins of the basin, but are not believed to significantly hinder the movement of groundwater within the basin. The San Andreas fault trends northwest in the bordering uplands along the eastside of the basin and is known to restrict groundwater flow, but because of its remoteness, exerts little influence on the movement of groundwater within the basin (Johanson, 1979). Along the western margin of the basin, the parallel Rinconada and San Marcos faults trend in a northwest direction south of the City of Paso Robles, but are not believed to impede the movement of groundwater, as determined from groundwater levels of wells located on opposite sides of these faults (Johanson, 1979). As a whole, the basin is a downthrown block wedged between the San Andreas fault on the east and Nacimiento fault on the west in the bordering Santa Lucia Range (DWR, 1958).

Movement of Groundwater

Groundwater replenishment is derived primarily from infiltration of rainfall, seepage loss from streams, and underflow entering the basin from surrounding upland areas. In areas overlying anticlinal folding, erosion of tilted beds of the Paso Robles Formation further induce the infiltration of rainfall and stream seepage (DWR, 1958). Movement of groundwater is in general northwest toward the Salinas River, after which it flows from the basin to the lower Salinas River Valley. In the far northeast portion of the basin in the vicinity of Chalome, groundwater flows southwest toward the Estrella River, which is a tributary of the Salinas River (Johanson, 1979).

Aquifers

The aquifers have been variously described as "essentially unconfined" with "confining clay beds of limited areal extent" (DWR, 1958) and as "unconfined" in the alluvium and "mostly confined" in the Paso Robles Formation (Johanson, 1979). During the current study, it was found that groundwater in the Holocene alluvium was mostly unconfined and groundwater within the Paso Robles Formation was almost everywhere confined.

Specific Yield

A total of 469 drillers' lithologic logs of boreholes throughout the basin were evaluated to a maximum depth of 500 feet. This evaluation resulted in an overall weighted average specific yield of 9 percent for the basin. Evaluation of 10 drillers' logs of wells along the Salinas River show a weighted average specific yield of 14 percent for the Holocene alluvium. These estimates generally concur with previous Department studies, which assigned a specific yield of 8 percent for the basin (DWR, 1958), 15 percent for the alluvium, and 9 percent for the Paso Robles Formation (Johanson, 1979).

Rainfall

Rainfall measurements recorded at the City of Paso Robles (1887-1995) were used to determine the long-term annual average of 15.20 inches. The cumulative departure from the mean was then plotted (Figure H-1), from which a 15-year hydrologic base period was selected. This base period covers water year 1978 through water year 1993, during which time the average annual rainfall was 15.06 inches.

Groundwater Levels

Because the specific yield method of determining groundwater overdraft can be used only in areas where the groundwater is unconfined, it was necessary to identify and exclude wells penetrating zones of confinement before analysis could continue. It was determined that 85 percent of the well completion reports for wells currently monitored for water levels show a rise in the water levels after penetrating the first water-bearing zone during the drilling operation. A rise in the water level as the hole is drilled deeper into the aquifers indicates that the groundwater is under pressure. In general, this rise ranged from 10 feet to as much as 150 feet after the well was developed. In reviewing the 469 well logs used to determine specific yield and other logs, it was again observed from those containing water level information that 86 percent show increases in water levels with increasing depth of drilling and only 14 percent show no change. When plotted on a map, the distribution of wells shows that confinement of the groundwater of varying degrees is widespread in the Paso Robles Formation throughout the basin.

Although groundwater in the Paso Robles Formation appears to be mostly confined, an attempt was made to identify and delineate unconfined areas in the formation. About five small groups of wells that show no evidence of confinement were identified; however, because of limited or conflicting information, no areas of unconfined groundwater could be delineated in the Paso Robles Formation.

To evaluate groundwater conditions in the unconfined Holocene alluvium along the Salinas River, 17 shallow wells ranging in depth from 40 to 124 feet were identified. A brief description of each well is given in Table H-1 in addition to hydrographs that show the long-term trend in groundwater levels (Figure H-2). Four of these wells show rising water levels during the hydrologic base period and averaged +0.18 to +1.33 feet per year. Areas of rising water levels were delineated south of San Miguel, north of Templeton, and north of Santa Margarita. Thirteen wells show declining levels averaging -0.05 to -1.04 feet per year during the hydrologic base period. Areas of declining water levels were delineated north and south of San Miguel, at Paso Robles, at Templeton, at Atascadero, and north of Santa Margarita.

Lines of equal change in water levels were drawn on topographic maps around the three areas of rising water levels and five areas of declining water levels, as shown on Plates 12, 13, and 14. The acreage of each area, which was determined with an electronic planimeter, was multiplied by the average annual change in water level and the average specific yield to determine the average

annual change in storage. It is estimated that the overdraft in the alluvium along the Salinas River between Santa Margarita and San Miguel is 3 to 60 acre-feet per year. The calculations of overdraft are shown on Tables H-2 and H-3.

The 17 wells used to determine groundwater conditions in the alluvium are sporadically spaced over an area along the upper Salinas River, which is approximately 30 miles long and 0.5 to 1 mile wide. Because the wells are sporadically located, there are areas where no data are available, and because the average change in water levels varies greatly between many of the wells, there is a large range of possible interpretations when contouring the data. Two fairly conservative interpretations of the data resulted in an estimated overdraft of 3 to 60 acre-feet per year; however, more liberal interpretations would likely yield higher estimates.

References

- Arnold, R., and Anderson, R., 1907, Geology and oil resources of the Santa Maria Oil District, Santa Barbara County, California: U. S. Geological Survey, Bulletin 322.
- Berenbrock, C., 1988, Ground-water quality in the Lompoc Plain, Santa Barbara County, California, 1983: U.S. Geological Survey Water-Resources Investigation Report 87-4101, 54 pp.
- Bright, D.J., Stomas, C.L., Martin, P. and Nash, D.B., 1992, Ground-water hydrology and quality in the Lompoc area, Santa Barbara County, California, 1987-88: U.S. Geological Survey Water-Resources Investigations Report 91-4172.
- California Department of Water Resources, (DWR), 1958, San Luis Obispo County investigation: Bulletin 18, vol. 1-2.
- , 1971, Preliminary evaluation of the water supply of the Arroyo Grande and Paso Robles areas: Southern District Report.
- , 1980, Ground water basins in California: Bulletin 118-80, 73 pp.
- , 1981, Index to sources of hydrologic data, Bulletin 230-81, 696 pp.
- , 1987, Southern central coast land use survey, 1985, 25 pp.
- , 1993, California water plan update: Bulletin 160-93, vol. 1, 398 pp.
- , 1999, Water resources of the Arroyo Grande and Nipomo Mesa area, final draft.

- Cleath, T.S., 1996, Status of the Santa Maria Ground Water Basin: Cleath and Associates, 12 pp.
- David Keith Todd Consulting Engineers, Inc., 1978, Groundwater basin data: status and needs: *prepared for* the City of Santa of Barbara, 95 pp.
- Dibblee, T. W. Jr., 1950, Geology of southwestern Santa Barbara County, California: California Division of Mines Bulletin 150 *in* South Coast Ranges, 1991, South Coast Geological Society, Inc., pp 3-33.
- , 1982, Geology of the Santa Ynez-Topatopa Mountains, southern California: *in* Geology and Mineral Wealth of the California Transverse Ranges, 1982, South Coast Geological Society, Inc., pp. 41-56.
- Eicher, D. L., 1976, Geologic time, second edition: Prentice-Hall Inc., Englewood Cliff, NJ, 150 pp.
- Evenson, R.E., and Miller, G.A., 1963, Geology and ground-water features of the Point Arguello Naval Missile Facility, Santa Barbara County, California: U.S. Geological Survey Water-Supply Paper 1619-F, 35 pp.
- Evenson, R.W., Wilson, H. D., and Muir, K. S., 1962, Yields of the Carpinteria and Goleta Ground-Water Basins, Santa Barbara County, California 1941-1958: U. S. Geological Survey Open-File Report.
- Frame, R.G., 1938, Santa Maria Valley Oil Field: summary of operations, California oil fields, California Division of Oil and Gas, 20 pp.
- Freckleton, J. R., 1989, Geohydrology of the Foothill Ground-Water Basin near Santa Barbara, California: U.S. Geological Survey Water-Resources Investigation Report 89-4017, 46 pp.
- Geotechnical Consultants, 1979, Hydrogeologic investigation of the Montecito Ground Water Basin, Montecito, California: *prepared for* the Montecito Water District.
- , 1986, Hydrogeologic update Carpinteria Groundwater Basin: *prepared for* the Carpinteria County Water District, 45 pp.
- Hall, C. A., 1977, Origin and development of the Lompoc-Santa Maria pull-apart basin and its relationship to the San Simeon-Hosgri fault, California: Geological Society of America.
- , 1982, Pre-Monterey subcrop and structure contour maps, western San Luis Obispo and Santa Barbara Counties, south-central California, U.S. Geological Survey, 27 pp.

- Hall, C.A., Turner, D.L., and Surdam, R.C., 1966, Potassium-argon age of the Obispo Formation with *Pecten lom pocensis* Arnold, southern Coast Ranges, California: Geological Society of America Bulletin, v. 77.
- Heath, R. C., 1983, Basic ground-water hydrology: U. S. Geological Survey Water Supply-Paper 2220, 84 pp.
- Hoover, M. F., 1980a, Hydrologic summary of the Carpinteria, Montecito, and Santa Barbara Water District service areas: *prepared for* the Santa Barbara Regional Water Reclamation Study, 9 pp.
- , 1980b, Safe yield evaluation of the Montecito Basin and Toro Canyon area: *prepared for* the Montecito Water District, 40 pp.
- Hutchinson, C. B., 1979, Ground-water monitoring at Santa Barbara, California: phase 1 -coastal monitor-well installation and initial measurements: U. S. Geological Survey Open-File Report 79-923, 24 pp.
- Johanson, S., 1979, Ground water in the Paso Robles Basin: California Department of Water Resources, District Report, 88 pp.
- , 1981, Water quality in the Paso Robles area: California Department of Water Resources, Memorandum Report, 116 pp.
- Leed, Hill, and Jewett, Inc., 1969, Ground water resources available to Goleta County Water District, January 1969: *prepared for* Goleta County Water District.
- Mann, J. F., 1976, Safe yield of the Goleta Ground Water Basin: *prepared for* Goleta County Water District, 20 pp.
- Martin, P., 1984, Ground-water monitoring at Santa Barbara, California: phase 2 -effects of pumping on water levels and on water quality in the Santa Barbara Ground-Water Basin: U.S. Geological Survey Water-Supply Paper 2197, 31 pp.
- Martin, P., and Berenbrock, C., 1986, Ground-water monitoring at Santa Barbara, California: phase 3-development of a three-dimensional digital ground-water flow model for Storage Unit I of the Santa Barbara Ground-Water Basin: U.S. Geological Survey Water-Resources Investigation Report 86-4103, 58 pp.
- Miller, G.A., 1976, Ground-water resources in the Lompoc area, Santa Barbara County, California: U.S. Geological Survey Open-File Report 76-183, 78 pp.

- Miller, G.A., and Evenson, R.E., 1966, Utilization of ground water in the Santa Maria Valley area, California: U. S. Geological Survey Water-Supply Paper 1819-A, 23 pp.
- Muir, K. S., 1968, Ground-water reconnaissance of the Santa Barbara-Montecito area, Santa Barbara County, California: U. S. Geological Survey Water-Supply Paper 1859-A, 28 pp.
- Norris, R. M., and Webb, R. W., 1990, Geology of California: John Wiley and Sons, Inc., pp. 359-411.
- Pierotti, B., and Lewy, R., 1998, Evaluation of groundwater overdraft in the southern Central Coast Region: Technical Information Record SD-98-1, 13 pp.
- Santa Barbara County, 1994, Santa Barbara County groundwater conditions and information: Santa Barbara County Comprehensive Plan, May 1994.
- Santa Barbara County Water Agency, 1994, Santa Maria Valley resources report, 114 pp.
- , 1996, Santa Barbara County, 1996 groundwater resources report, 47 pp.
- Sylvester A. G., and Darrow, A.C., 1979, Structure and neotectonics of the western Santa Ynez fault system in southern California: *in* Tectonophysics, vol. 52, Elsevier Scientific Publishing Company, Amsterdam, The Netherlands, pp 389-405.
- Upson, J. E., and Thomasson, H. G. Jr., 1951a, Geology and water resources of the Santa Ynez River Basin, Santa Barbara, California: U. S. Geological Survey Water-Supply Paper 1107, 192 pp.
- , 1951b, Geology and ground-water resources of the south coast basins of Santa Barbara County, California: U.S. Geological Survey Water-Supply Paper 1108, 143 pp.
- U.S. Geological Survey, 1991, Water resources data for California, water year 1991: U.S. Geological Survey Water-Data Report CA-91-5, vol. 5.
- Wilson, H. D. Jr., 1959, Ground-water appraisal of the Santa Ynez River Basin, Santa Barbara County, California, 1945-52: U.S. Geological Survey Water-Supply Paper 1467, 119 pp.
- Woodring W. P., and Bramlette, M. N., 1950, Geology and paleontology of the Santa Maria District California: U.S. Geological Survey Professional Paper 222, 183 pp.
- Worts, G. F., 1951, Geology and ground-water resources of the Santa Maria Valley area, California: U.S. Geological Survey Water-Supply Paper 1000, 169 pp.

APPENDIX A
GOLETA GROUNDWATER BASIN

TABLE A-1. SELECTED WELLS SHOWING GROUNDWATER LEVELS IN THE GOLETA GROUNDWATER BASIN

Well Number	Ave. Annual Change	Well Depth	Upper Perforations	Lower Perforations	Water Level Elevation 1988	Water Level Elevation 1996	Well Use
(All values in feet)							
04N/28W-02N02S	2.00				125.76	141.75	
04N/28W-02P03S	0.55	271	40	297	144.79	149.22	Irrigation
04N/28W-04R04S	0.45				36.16	39.77	
04N/28W-05N04S	0.46	145	60	135	64.87	68.53	Domestic
04N/28W-05R08S	1.18	140	50	130	34.78	44.18	Domestic
04N/28W-07R01S	1.39	335	155	325	-4.12	6.96	Industrial
04N/28W-08B01S	1.32	220	120	210	-47.85	-37.27	
04N/28W-08F02S	3.52	454	92	430	-22.50	5.66	Test
04N/28W-08K01S	3.61	320	220	320	-64.13	-35.25	Domestic
04N/28W-08N08S	0.97	385	280	380	-2.76	5.00	Industrial
04N/28W-09A03S	0.52				27.05	31.21	
04N/28W-09C05S	1.63	130	60	120	-37.26	-24.24	Domestic
04N/28W-09J02S	3.49	400	90	390	-60.87	-32.97	Domestic
04N/28W-09K02S	3.21	180	110	170	-58.00	-32.33	Domestic
04N/28W-10F03S	4.51	305	150	300	-80.73	-44.67	Domestic
04N/28W-10J01S	3.27	816	213	792	-89.00	-62.86	Municipal
04N/28W-10Q02S	2.95				-83.00	-59.43	
04N/28W-18B02S	1.09	504	290	390	-2.39	6.35	Domestic
04N/28W-18E01S	1.03	500	200	340	-4.10	4.16	Industrial
04N/28W-18F01S	1.79				-8.18	6.12	
04N/29W-13A02S	0.81	315	160	310	-4.11	2.39	Domestic
04N/29W-13G03S	0.82				-3.61	2.98	
04N/29W-13R02S	0.77	330	300	330	-0.25	5.87	Test

Table A-2. Calculations for Central and Eastern Goleta Basin

AREAL DESIGNATION*	AREA (IN ACRES)	SPECIFIC YIELD (%)	ANNUAL CHANGE (IN FEET)	STORAGE (IN ACRE-FEET)
+A1	67	0.10	4.75	31.83
+B1	94	0.10	4.25	40.43
+C1	395	0.10	3.75	149.90
+D1	141	0.10	3.25	46.37
+D2	201	0.10	3.25	66.11
+D3	75	0.10	3.25	24.67
+E1	213	0.10	2.75	59.28
+E2	152	0.10	2.75	42.30
+E3	76	0.10	2.75	21.15
+F1	118	0.10	2.25	26.87
+F2	204	0.10	2.25	46.45
+F3	73	0.10	2.25	16.62
+G1	101	0.10	1.75	17.89
+G2	324	0.10	1.75	57.38
+G3	106	0.10	1.75	18.77
+H1	203	0.10	1.25	25.68
+H2	117	0.10	1.25	14.80
+H3	12	0.10	1.25	1.52
+I1	672	0.10	0.75	51.00
+I2	6	0.10	0.75	0.46
+J1	716	0.10	0.25	18.11
+J2	2	0.10	0.25	0.05
+K1	67	0.10	1.75	11.87
Area=	4,135 ACRES or 6.50 Sq. Mi.		Surplus=	790 AFY

* Areal Designations not shown on Plate 2, but were used to facilitate planimetry basin area

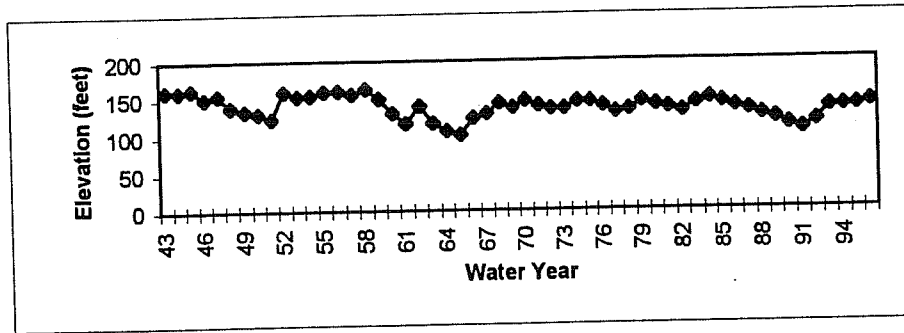
Table A-3. Calculations for Northern Goleta Basin

AREAL DESIGNATION*	AREA (IN ACRES)	SPECIFIC YIELD (%)	ANNUAL CHANGE (IN FEET)	STORAGE (IN ACRE-FEET)
+A1	55	0.10	1.25	6.96
+B1	122	0.10	0.75	9.26
+B2	121	0.10	0.75	9.18
+C1	647	0.10	0.25	16.37
+C2	690	0.10	0.25	17.46
+C3	310	0.10	0.25	7.84
Area =	1,945 ACRES or 3.04 Sq. Mi.		Surplus =	67 AFY

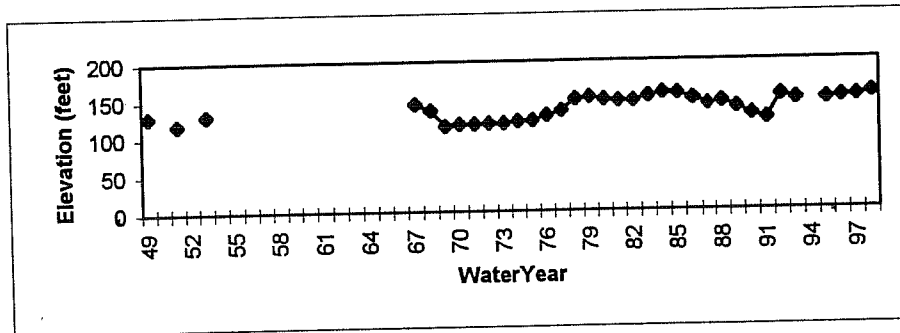
* Areal Designations not shown on Plate 2, but were used to facilitate planimetering basin area

Figure A-1. Goleta Groundwater Basin, South Coast Basins

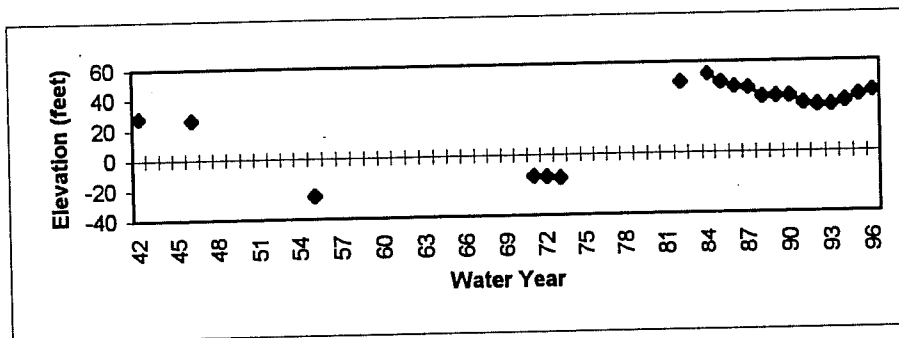
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04N/28W-02P03S



04N/28W-04R04S



04N/28W-05N04S

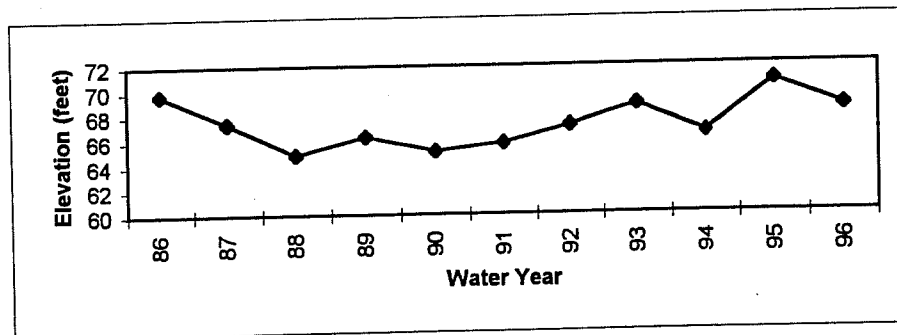
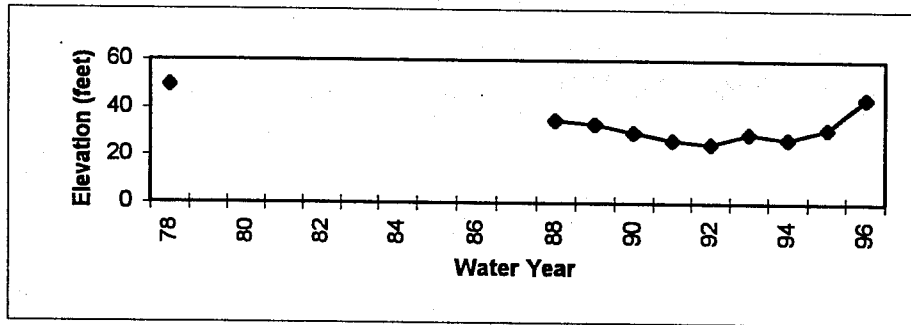
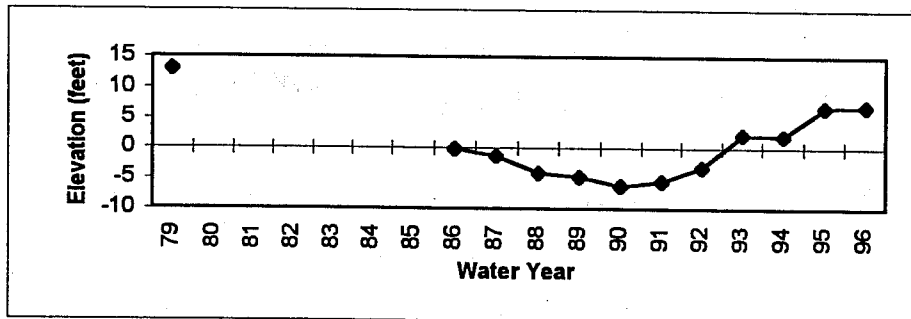


Figure A-1 cont. Goleta Groundwater Basin, South Coast Basins

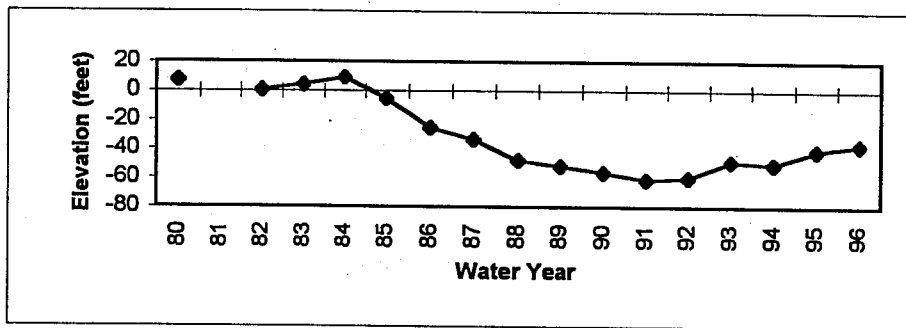
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04N/28W-07R01S



04N/28W-08B01S



04N/28W-08F02S

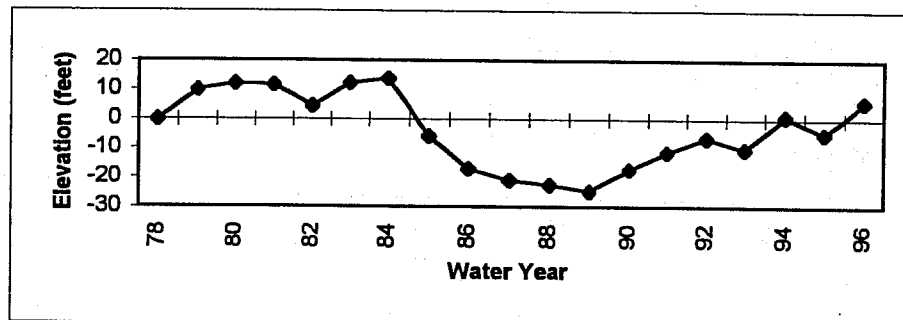
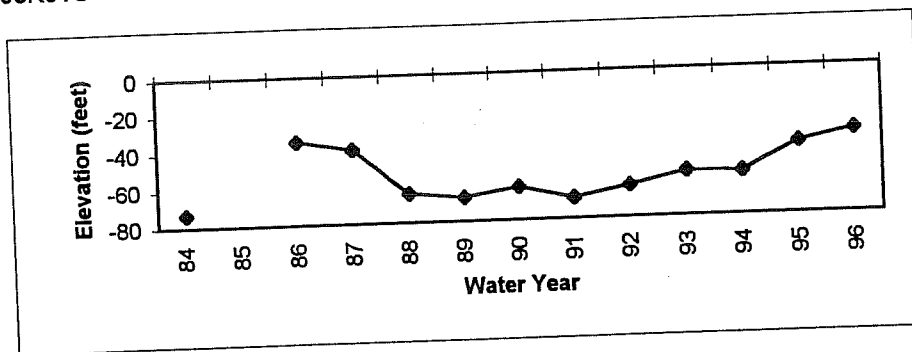
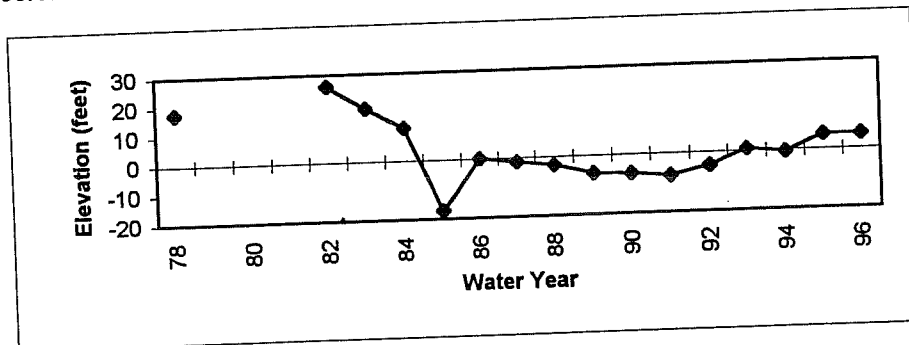


Figure A-1 cont. Goleta Groundwater Basin, South Coast Basins

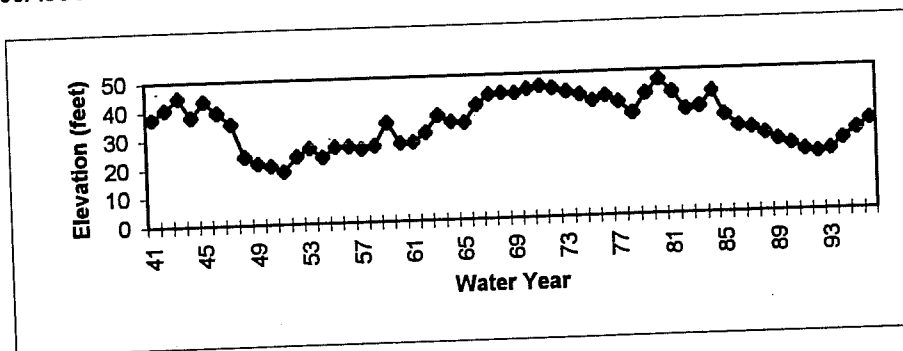
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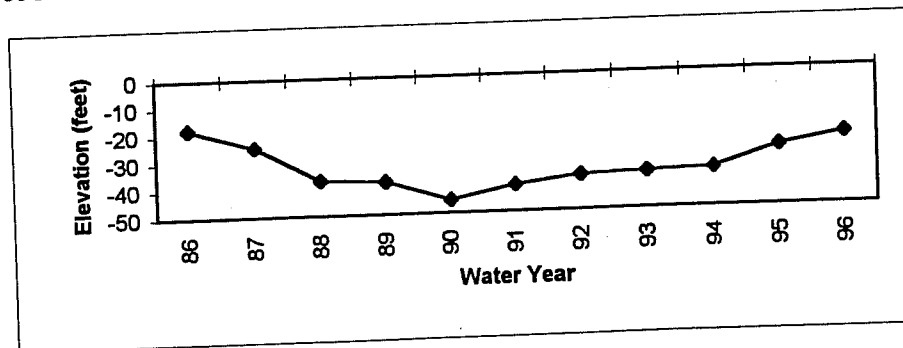
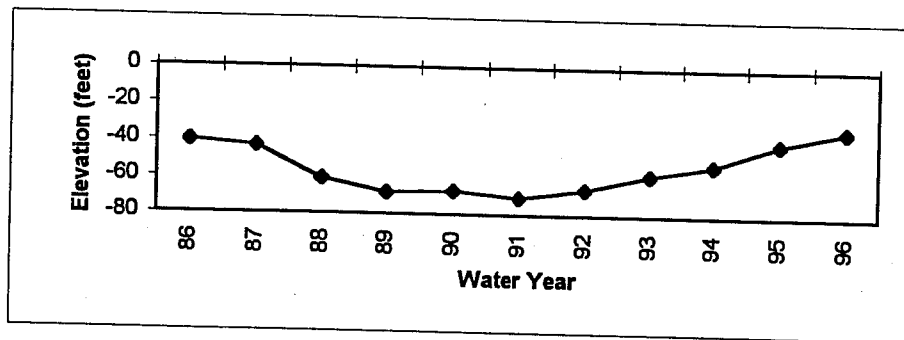
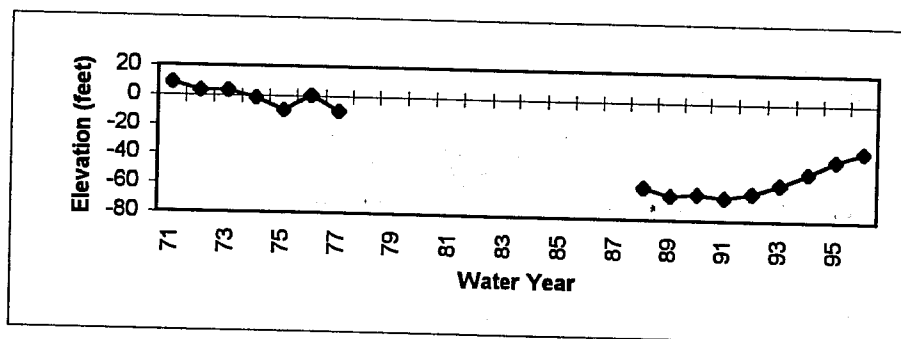


Figure A-1 cont. Goleta Groundwater Basin, South Coast Basins

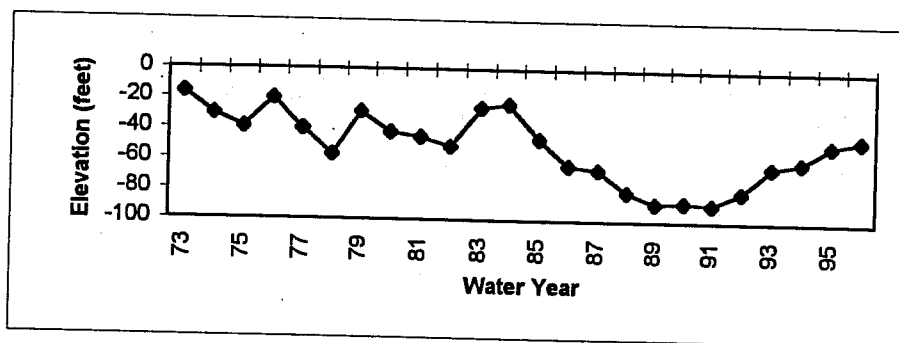
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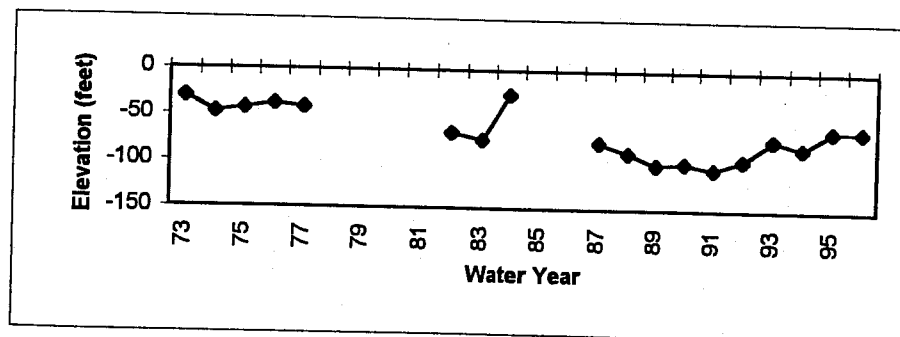
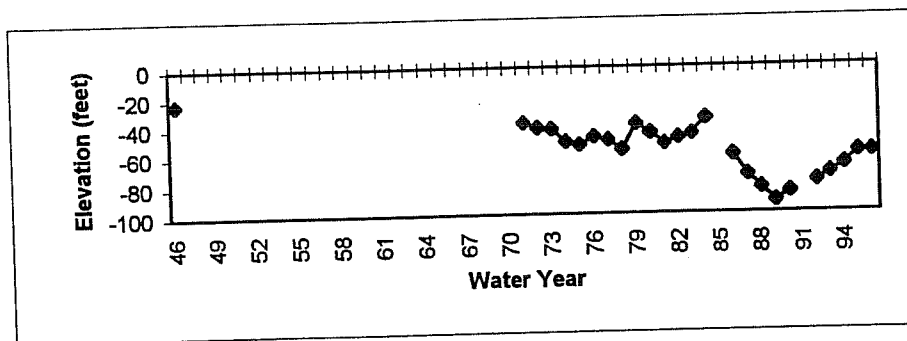
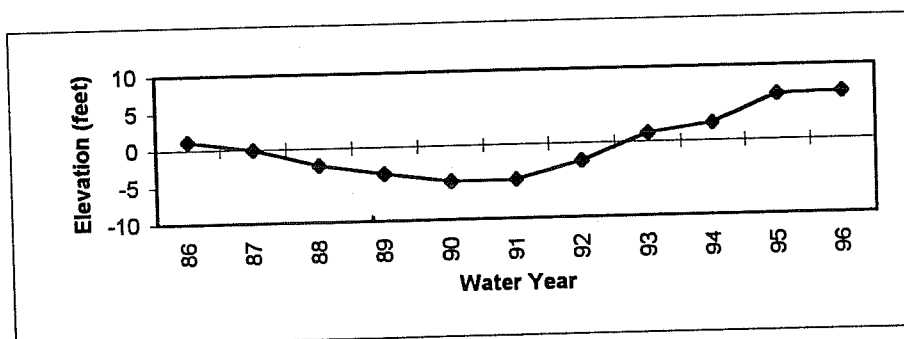


Figure A-1 cont. Goleta Groundwater Basin, South Coast Basins

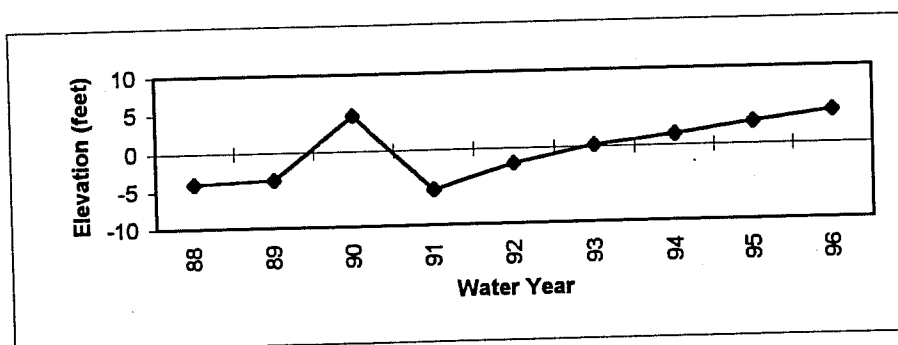
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04N/28W-18B02S



04N/28W-18E01S



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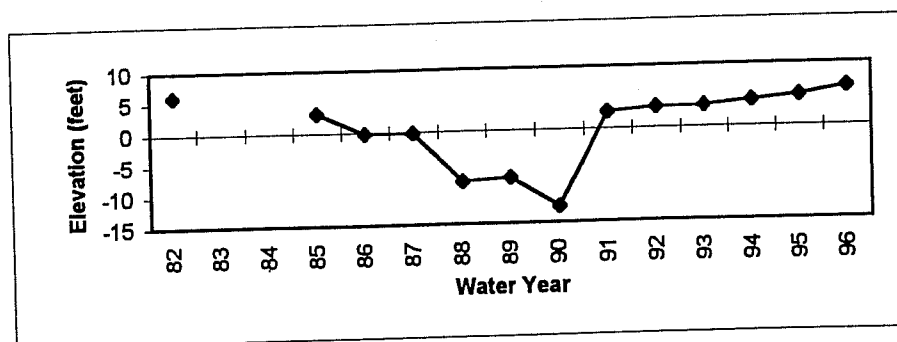
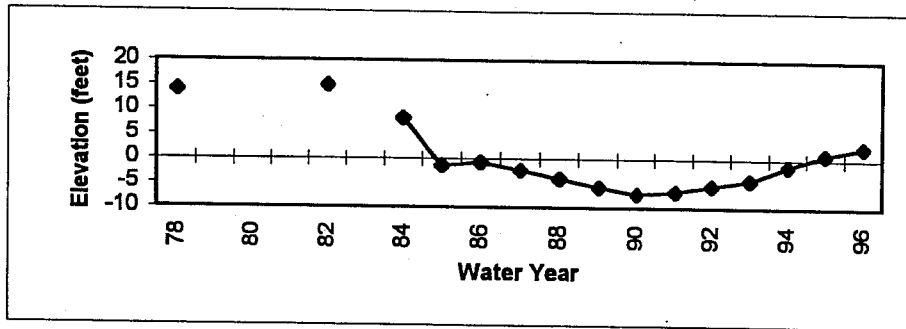
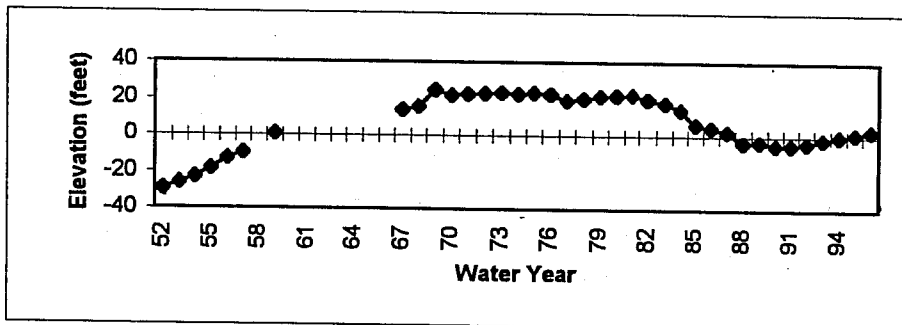


Figure A-1 cont. Goleta Groundwater Basin, South Coast Basins

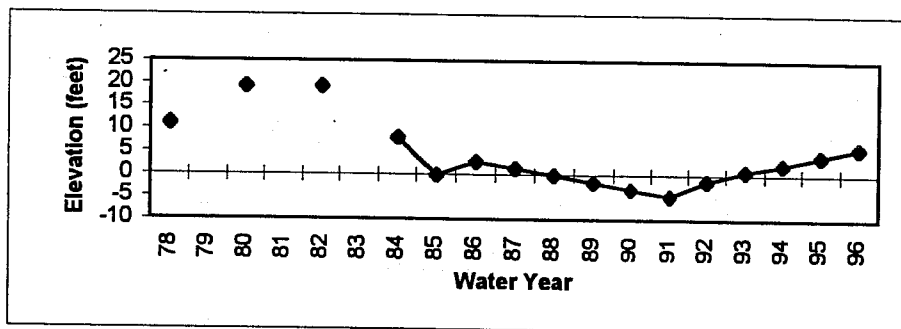
04N/29W-13A02S



04N/29W-13G03S



04N/29W-13R02S



APPENDIX B
FOOTHILL GROUNDWATER BASIN

TABLE B-1. SELECTED WELLS SHOWING GROUNDWATER LEVELS IN THE FOOTHILL GROUNDWATER BASIN

Well Number	Ave. Annual Change	Well Depth	Upper Perforations	Lower Perforations	Surface Elevation	Water Level Elevation 1988	Water Level Elevation 1996	Well Use
(All values in feet)								
04N/27W-05P01S	-2.36	200	60	160	305	196.36	177.50	Observation
04N/27W-07D01S	0.44	500	215	480	180	106.45	110.00	Municipal
04N/27W-07H05S	2.34	500	200	500	225	137.00	155.72	
04N/27W-07R03S	1.24	510	165	500	185	110.43	120.34	Municipal
04N/27W-08E01S	-1.48	580	52	580	251	145.25	133.38	
04N/27W-08L03S	5.00	610	260	600	230	120.68	160.64	Municipal
04N/27W-08M05S	3.96	680	620	660	217	106.92	138.56	Observation
04N/27W-08M06S	1.27	280	260	280	217	148.04	158.21	Observation
04N/28W-12C02S	-0.61				215	118.49	113.60	
04N/28W-12H04S	3.07	290	200	280	172	88.05	112.64	Domestic

Table B-2. Calculations for Foothill Basin
(alluvial deposits unconfined)

AREAL DESIGNATION*	AREA (IN ACRES)	SPECIFIC YIELD (%)	ANNUAL CHANGE (IN FEET)	STORAGE (IN ACRE-FEET)
+A1	135	0.97	1.75	22.21
+B1	172	0.97	1.25	20.21
+C1	238	0.97	0.75	16.78
+D1	170	0.97	0.25	4.00
+D2	38	0.97	0.25	0.89
-E1	254	0.97	-0.25	-5.97
-E2	56	0.97	-0.25	-1.32
-F1	234	0.97	-0.75	-16.50
-F2	83	0.97	-0.75	-5.85
-G1	180	0.97	-1.25	-21.15
-G2	107	0.97	-1.25	-12.57
-H1	135	0.97	-1.75	-22.21
-H2	122	0.97	-1.75	-20.07
-I1	102	0.97	-2.25	-21.57
-I2	166	0.97	-2.25	-35.11
-J1	141	0.97	-2.75	-36.45
-J2	92	0.97	-2.75	-23.78
Area =	2,425 ACRES or 3.79 Sq. Mi.		Overdraft =	-158 AFY

* Areal Designations not shown on Plate 2, but were used to facilitate planimetry basin area

Table B-3. Calculations for Foothill Basin
(alluvial deposits confined)

AREAL DESIGNATION*	AREA (IN ACRES)	SPECIFIC YIELD (%)	ANNUAL CHANGE (IN FEET)	STORAGE (IN ACRE-FEET)
+C1	20	0.97	0.75	1.41
+D1	146	0.97	0.25	3.43
-E1	254	0.97	-0.25	-5.97
-E2	25	0.97	-0.25	-0.59
-F1	234	0.97	-0.75	-16.50
-F2	83	0.97	-0.75	-5.85
-G1	180	0.97	-1.25	-21.15
-G2	107	0.97	-1.25	-12.57
-H1	135	0.97	-1.75	-22.21
-H2	122	0.97	-1.75	-20.07
-I1	102	0.97	-2.25	-21.57
-I2	166	0.97	-2.25	-35.11
-J1	141	0.97	-2.75	-36.45
-J2	92	0.97	-2.75	-23.78

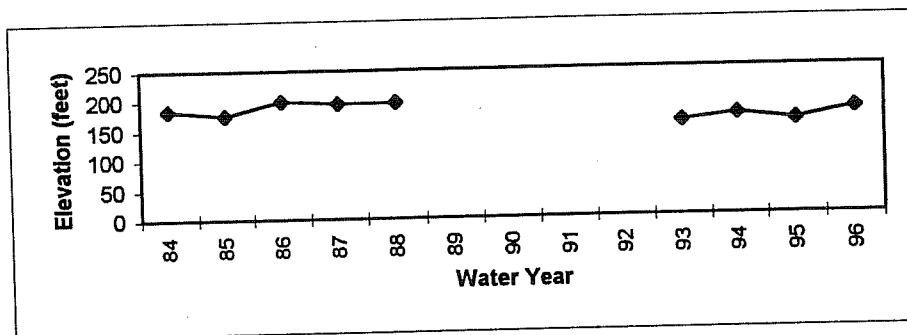
Area = 1,807 ACRES
or 6.50 Sq. Mi.

Overdraft = -216.89 AFY

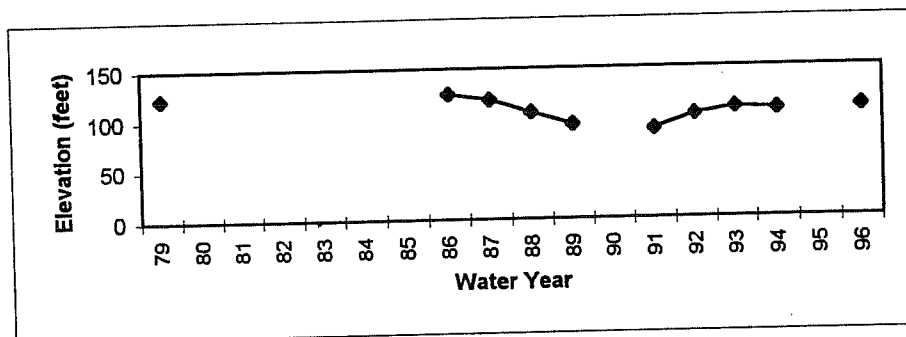
* Areal Designations not shown on Plate 2, but were used to facilitate planimetry basin area

Figure B-1. Foothill Groundwater Basin, South Coast Basins

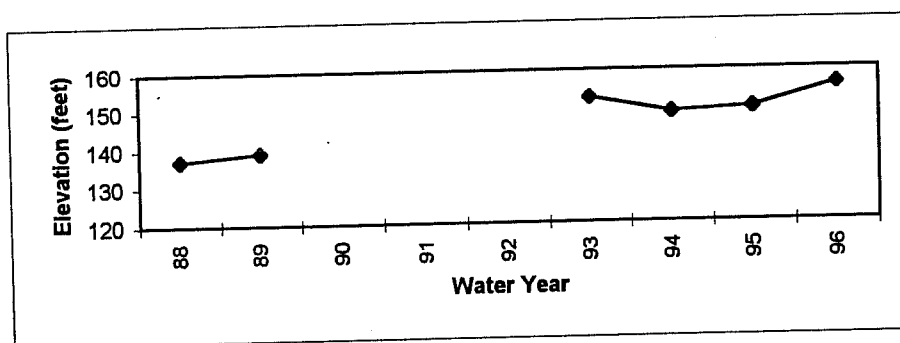
04N/27W-05P01S



04N/27W-07D01S



04N/27W-07H05S



04N/27W-07R03S

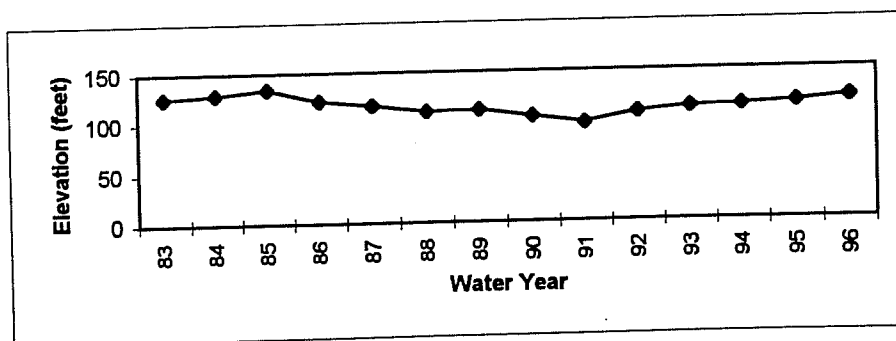
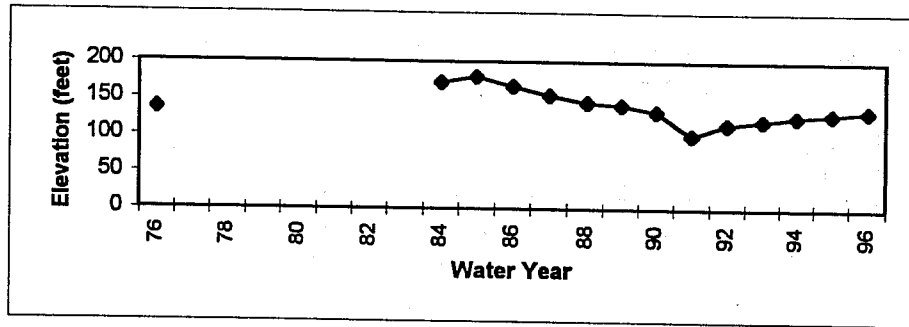
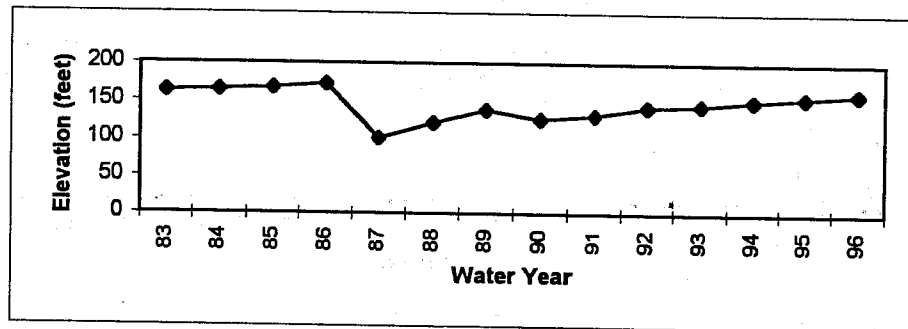


Figure B-1 cont. Foothill Groundwater Basin, South Coast Basins

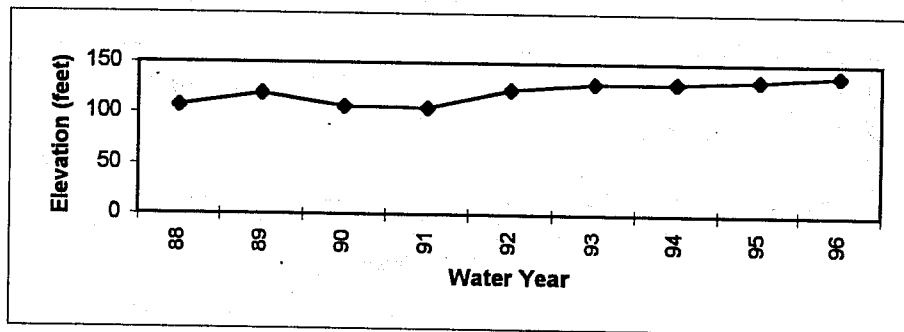
04N/27W-08E01S



04N/27W-08L03S



04N/27W-08M05S



04N/27W-08M06S

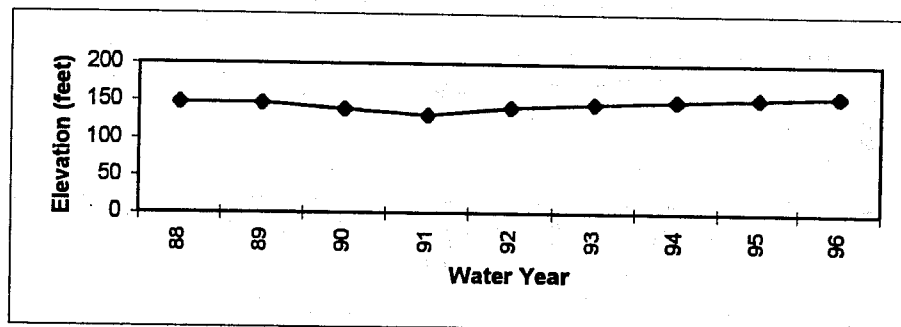
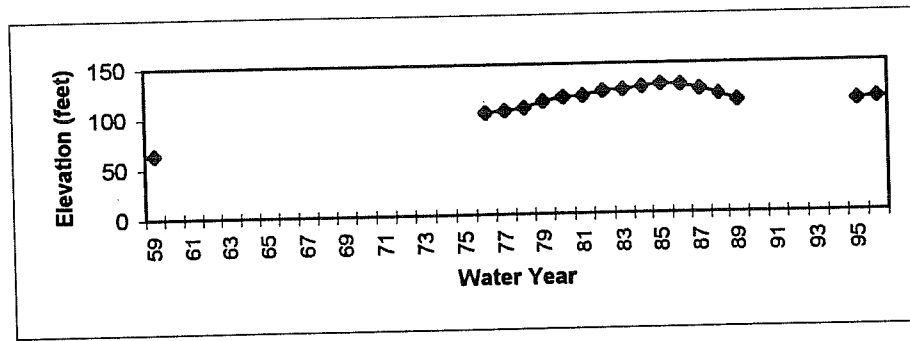
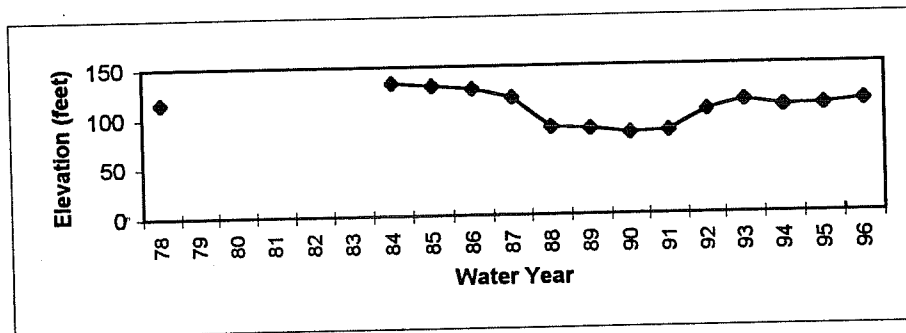


Figure B-1 cont. Foothill Groundwater Basin, South Coast Basins

04N/28W-12C02S



04N/28W-12H04S



APPENDIX C
SANTA BARBARA GROUNDWATER BASIN

TABLE C-1. SELECTED WELLS SHOWING GROUNDWATER LEVELS IN THE SANTA BARBARA GROUNDWATER BASIN

Well Number	Ave. Annual Change	Well Depth	Upper Perforations	Lower Perforations (All values in feet)	Surface Elevation	Water Level Elevation 1988	Water Level Elevation 1996	Well Use
04N/27W-08R02S	1.81	205	155	205	230	104.61	119.09	Observation
04N/27W-09M01S	0.03	120	30	110	240	131.68	131.90	Observation
04N/27W-09Q01S	-0.17	240			306	174.02	172.66	Observation
04N/27W-13R01S	0.48	540	255	540	39	7.57	11.41	Observation
04N/27W-14K02S	3.26	380	260	380	42	-5.26	20.83	Unused
04N/27W-14P01S	7.16	783	181	783	18	-28.57	28.68	Unused
04N/27W-14R01S	2.63	635	107	635	28	2.15	23.18	Unused
04N/27W-15E01S	3.29	231			145	36.15	62.44	Observation
04N/27W-15K01S	6.35	464	264	284	19	-16.09	34.73	Observation
04N/27W-16C01S	2.12	330	290	330	210	91.41	108.39	Observation
04N/27W-16C02S	2.16	230	190	230	210	89.81	107.07	Observation
04N/27W-16E02S	2.14	450	350	450	130	75.88	92.98	Municipal
04N/27W-16R01S	6.94	625	545	625	85	-12.55	42.93	Observation
04N/27W-17J01S	1.54	320	190	320	139	91.93	104.25	Observation
04N/27W-18Q01S	0.07				130	95.70	96.23	Observation
04N/27W-18Q04S	0.28	240	90	230	95	93.45	95.66	Municipal
04N/27W-21B01S	4.67	454	145	350	68	-2.20	35.13	Unused
04N/27W-22A02S	8.48	290	270	290	6.5	-44.48	23.37	Observation
04N/27W-22C01S	2.65	635	180	615	40	18.84	40.00	Municipal
04N/27W-22G02S	2.99	200	180	200	20	-6.06	17.84	Observation
04N/27W-22Q01S	0.28	60	20	60	13	7.39	9.61	Observation
04N/27W-23E06S	2.81	495	475	495	11	-10.16	12.30	Observation
04N/27W-23F02S	6.24	380	360	380	7	-28.5	21.45	Observation
04N/27W-23H04S	0.43	95	75.5	91	7	4.52	7.94	Observation

Table C-2. Calculations for Santa Barbara Basin

AREAL DESIGNATION*	AREA (IN ACRES)	SPECIFIC YIELD (%)	ANNUAL CHANGE (IN FEET)	STORAGE (IN ACRE-FEET)
-A1	583.00	0.10	-0.25	-14.58
-A2	387.00	0.10	-0.25	-9.68
+A1	162.00	0.10	0.25	4.05
+A2	237.00	0.10	0.25	5.93
+A3	694.00	0.10	0.25	17.35
+A4	390.00	0.10	0.25	9.75
+B1	131.00	0.10	0.75	9.83
+B2	377.00	0.10	0.75	28.28
+C1	93.00	0.10	1.25	11.63
+C2	287.00	0.10	1.25	35.88
+D1	113.00	0.10	1.75	19.78
+D2	189.00	0.10	1.75	33.08
+E1	253.00	0.10	2.25	56.93
+F1	76.00	0.10	2.75	20.90
+G1	42.00	0.10	3.25	13.65

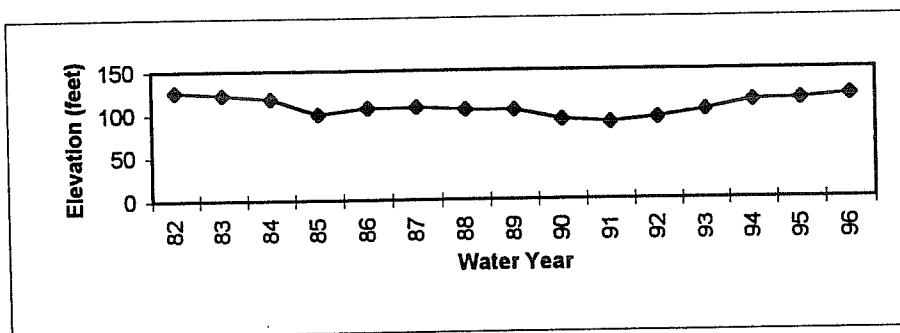
Area = 4,014 ACRES
or 6.27 Sq. Mi.

Surplus = 243 AFY

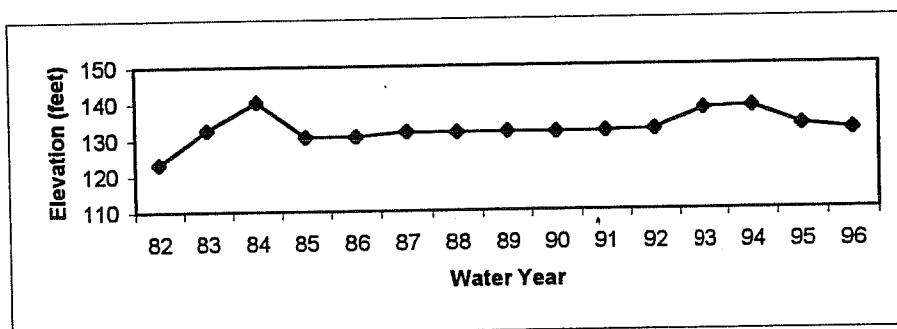
* Areal Designations not shown on Plate 2, but were used to facilitate planimetering basin area

Figure C-1. Santa Barbara Groundwater Basin, South Coast Basins

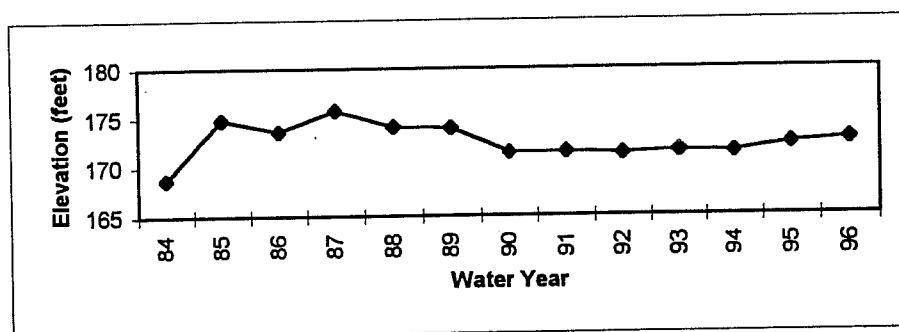
04N/27W-08R02S



04N/27W-09M01S



04N/27W-09Q01S



04N/27W-13R01S

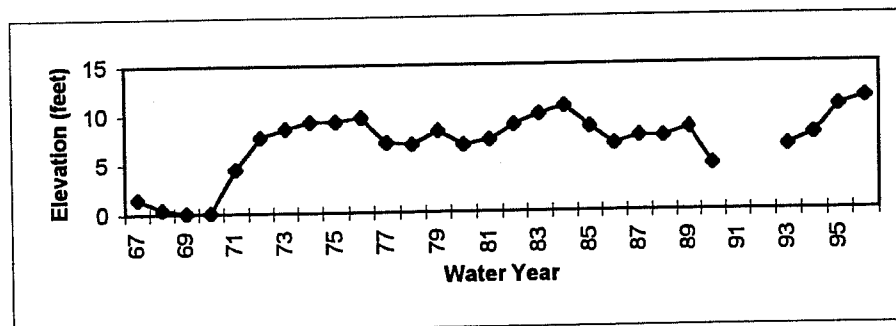
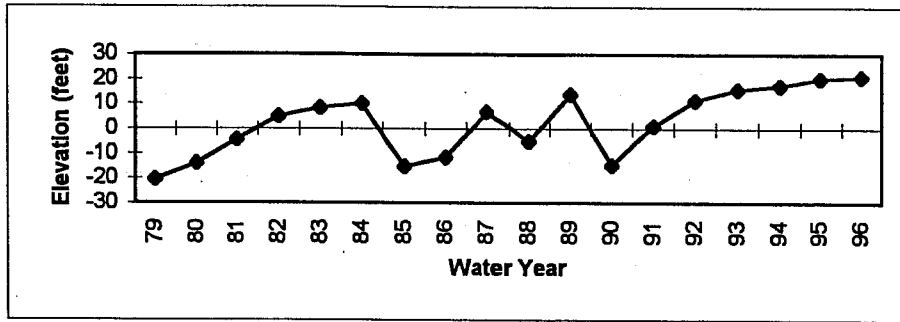
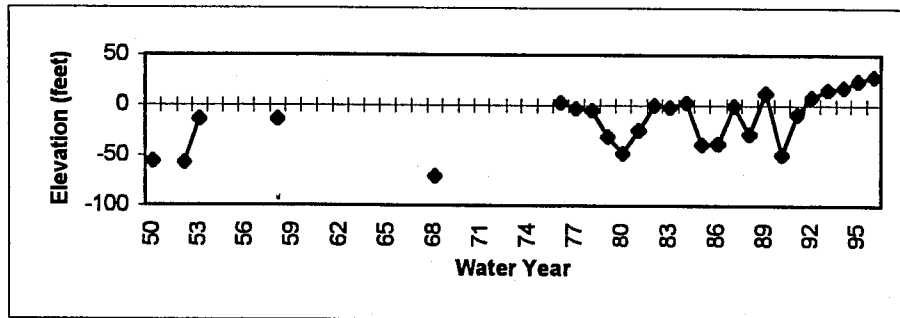


Figure C-1 cont. Santa Barbara Groundwater Basin, South Coast Basins

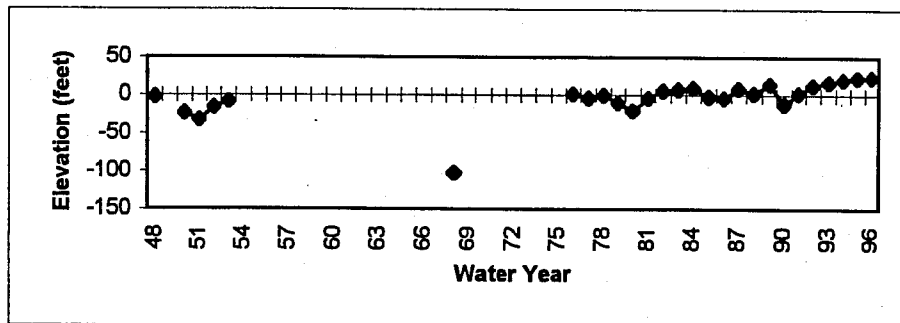
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04N/27W-14P01S



04N/27W-14R01S



04N/27W-15E01S

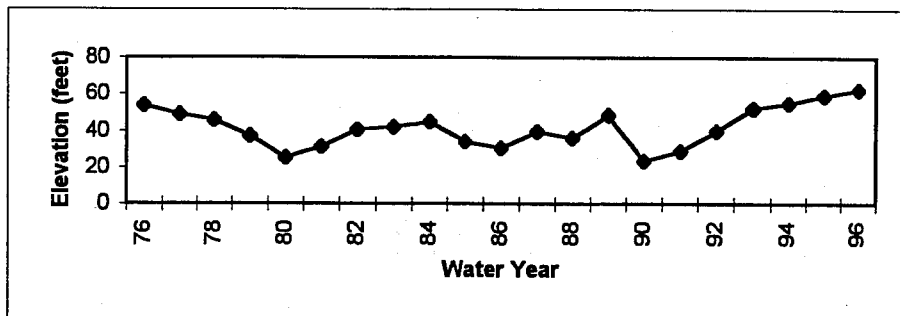
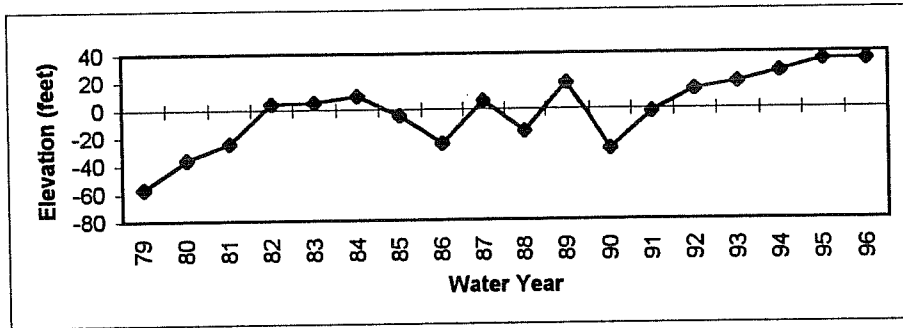
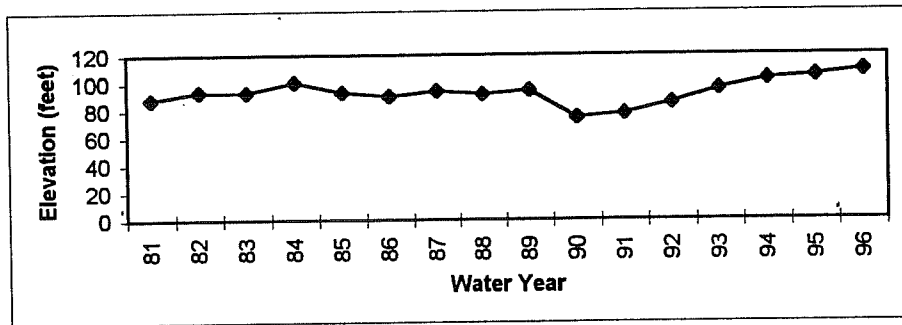


Figure C-1 cont. Santa Barbara Groundwater Basin, South Coast Basins

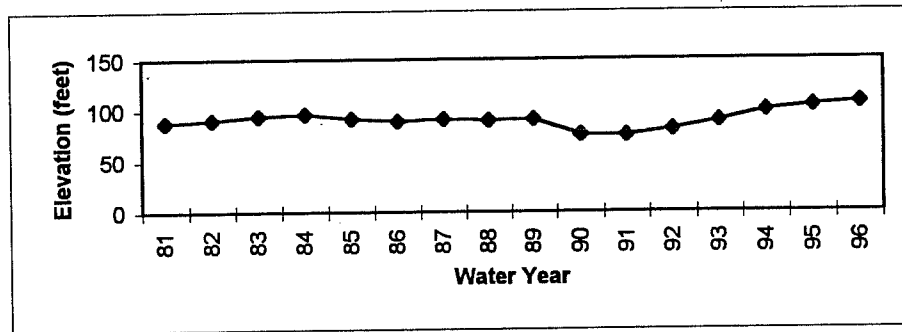
04N/27W-15K01S



04N/27W-16C01S



04N/27W-16C02S



04N/27W-16E02S

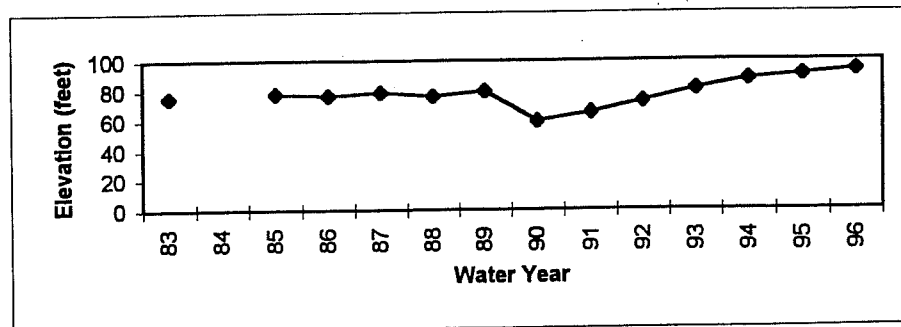
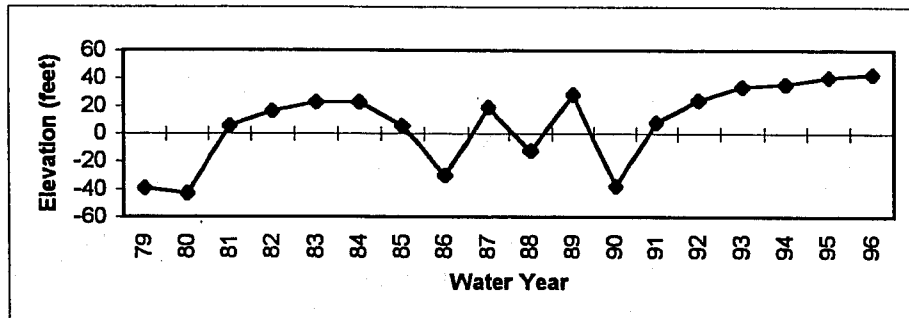
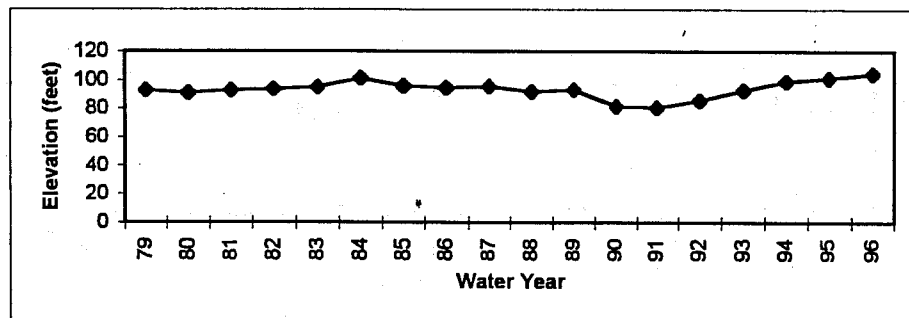


Figure C-1 cont. Santa Barbara Groundwater Basin, South Coast Basins

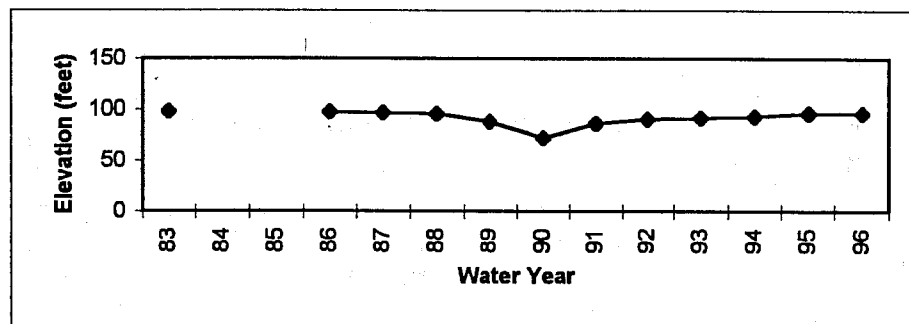
04N/27W-16R01S



04N/27W-17J01S



04N/27W-18Q01S



04N/27W-18Q04S

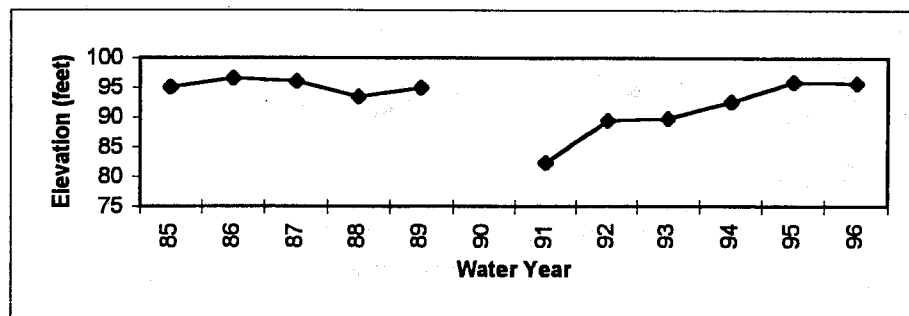
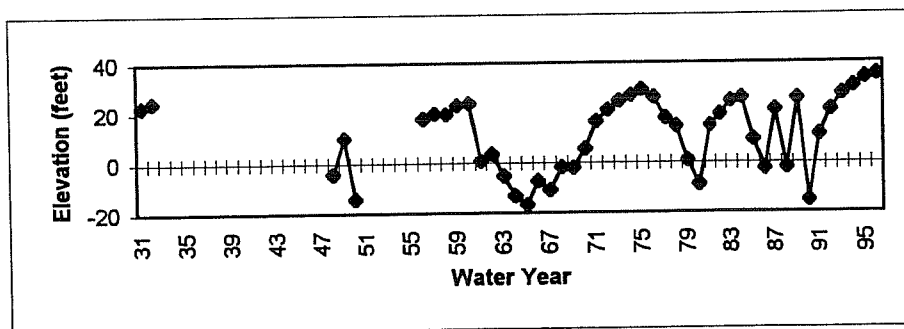
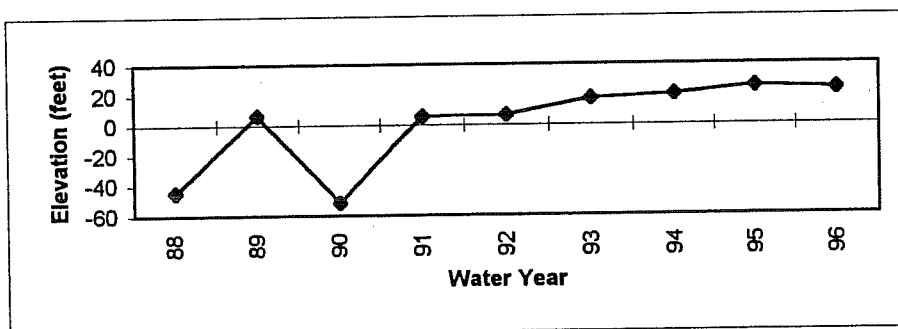


Figure C-1 cont. Santa Barbara Groundwater Basin, South Coast Basins

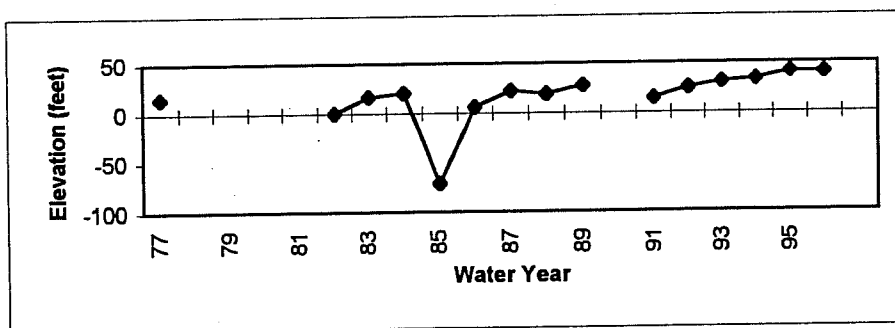
04N/27W-21B01S



04N/27W-22A02S



04N/27W-22C01S



04N/27W-22G02S

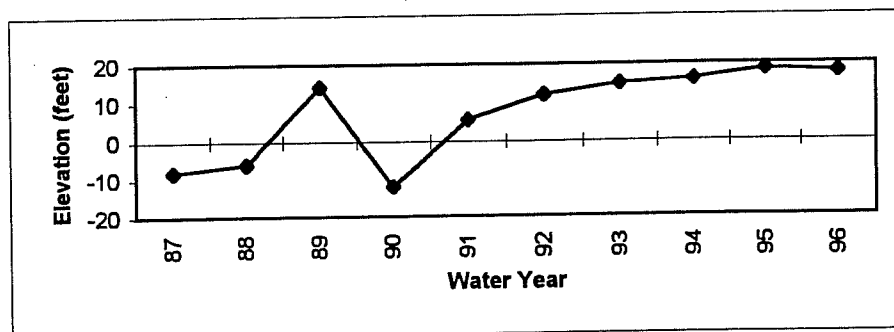
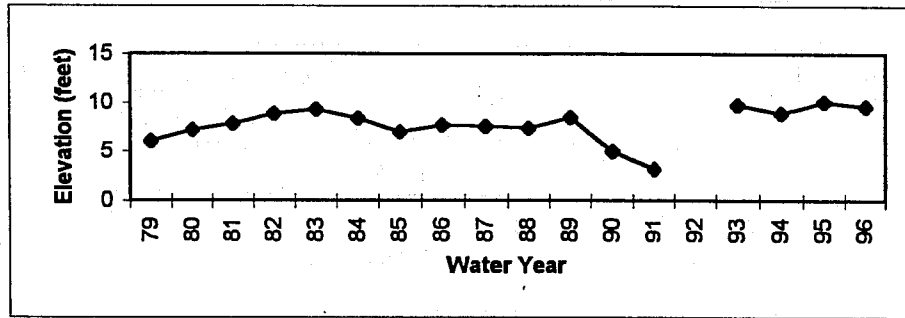
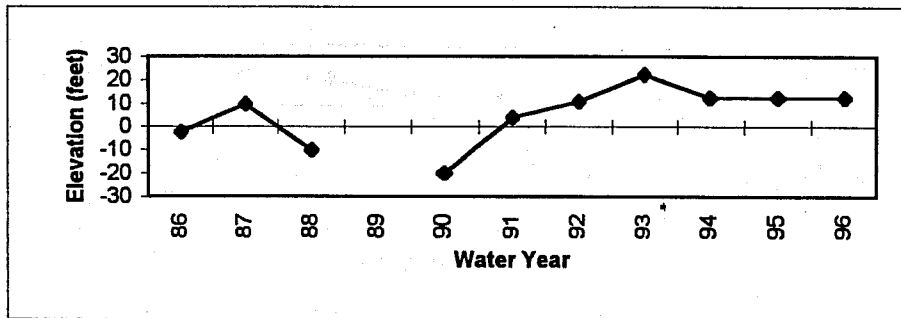


Figure C-1 cont. Santa Barbara Groundwater Basin, South Coast Basins

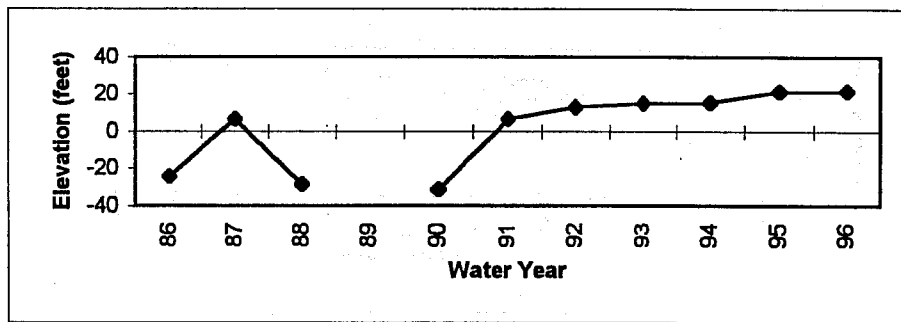
04N/27W-22Q01S



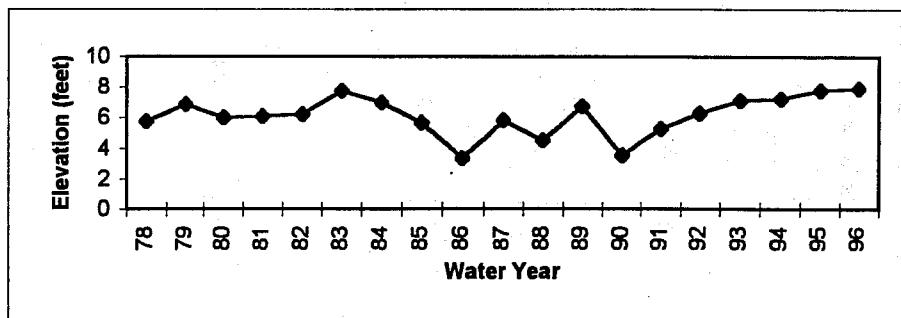
04N/27W-23E06S



04N/27W-23F02S



04N/27W-23H04S



APPENDIX D
MONTECITO GROUNDWATER BASIN

TABLE D-1. SELECTED WELLS SHOWING GROUNDWATER LEVELS IN THE MONTECITO GROUNDWATER BASIN

Well Number	MWD Designation	Ave. Annual Change	Well Depth	Upper Perforations	Lower Perforations	Water Level Elevation 1988	Water Level Elevation 1996	Well Use
(All values in feet)								
04N/26W-07A(1)	1-5	0.60*				505.29	510.10	
04N/26W-07R01	1-7	-0.01	490	200	480	253.81	253.72	Municipal
04N/26W-07R02	1-8	1.45				242.92	254.52	
04N/26W-08D(1)	1-4	0.47*	284	204	264	421.78	425.54	Domestic
04N/26W-08L01	1-18	0.59	190	80	180	246.25	251.00	Domestic
04N/26W-08P01	1-17	0.59	420	57	363	190.76	195.50	Irrigation
04N/26W-08P03	1-19	0.32				191.75	194.28	
04N/26W-08R02	1-14	0.94				216.38	223.90	
04N/26W-09P01	1-13	1.11	240	60	240	220.05	228.90	Domestic
04N/26W-09Q01	1-10	0.56				226.68	231.13	
04N/26W-09Q02	1-11	0.98				225.20	233.03	
04N/26W-15D02	1-9	0.73				241.15	247.00	
04N/26W-16A(1)	1-3	1.50*	146	111	141	206.62	218.58	Domestic
04N/26W-16C01	1-12	0.64				204.27	209.40	
04N/26W-16D(1)	1-2	1.00*	250	80	250	213.58	221.58	Domestic
04N/26W-16N01	3-15	0.34				7.50	10.20	
04N/26W-16N02	3-12	0.69*	470	90	470	7.80	13.31	Municipal
04N/26W-16P05	3-2	0.51*	450	130	450	51.00	55.07	Domestic
04N/26W-17B04	1-15	1.34	634	69	634	192.80	203.50	Municipal
04N/26W-17F(1)	2-1	1.06*				28.00	36.50	
04N/26W-17K01	3-11	0.25	618	167	607	22.27	24.30	Domestic
04N/26W-17K02	3-10	0.14				20.99	22.10	
04N/26W-17L01	3-9	1.67				16.32	29.66	
04N/26W-17Q02	3-13	0.43				9.60	13.01	
04N/26W-17R(1)	3-14	0.93				12.49	19.89	
04N/26W-18C(1)	2-2	-1.11				293.34	284.47	
04N/26W-18D(1)	2-3	-1.43				299.57	288.14	
04N/26W-18R01	3-3	1.29	198	80	198	16.20	26.50	Domestic

* Indicates that a fall water level or an estimated water level was substituted to determine the annual change in water levels

Table D-2. Calculations for Montecito Basin
(northern subbasin)

AREAL DESIGNATION*	AREA (IN ACRES)	SPECIFIC YIELD (%)	ANNUAL CHANGE (IN FEET)	STORAGE (IN ACRE-FEET)
+A1	511	0.11	0.25	14.56
+A2	139	0.11	0.25	3.96
+A3	601	0.11	0.25	17.13
+B1	786	0.11	0.75	67.20

Area = 2,037 Acres
or 3.18 Sq. Mi.

Surplus = 103 AFY

(central subbasin)

AREAL DESIGNATION*	AREA (IN ACRES)	SPECIFIC YIELD (%)	ANNUAL CHANGE (IN FEET)	STORAGE (IN ACRE-FEET)
-A1	54	0.11	-1.25	-7.70
-B1	46	0.11	-0.75	-3.93
-C1	50	0.11	-0.25	-1.43
+A1	119	0.11	0.25	3.39
+A2	99	0.11	0.25	2.82
+B1	125	0.11	0.75	10.69
+C1	195	0.11	1.25	27.79

Area = 688 Acres
or 1.08 Sq. Mi.

Surplus = 32 AFY

(southern subbasin)

AREAL DESIGNATION*	AREA (IN ACRES)	SPECIFIC YIELD (%)	ANNUAL CHANGE (IN FEET)	STORAGE (IN ACRE-FEET)
+A1	67	0.11	1.75	13.37
+B1	99	0.11	1.25	14.11
+C1	90	0.11	0.75	7.70
+C2	208	0.11	0.75	17.78
+D1	168	0.11	0.25	4.79
+D2	22	0.11	0.25	0.63
-E1	40	0.11	-0.25	-1.14

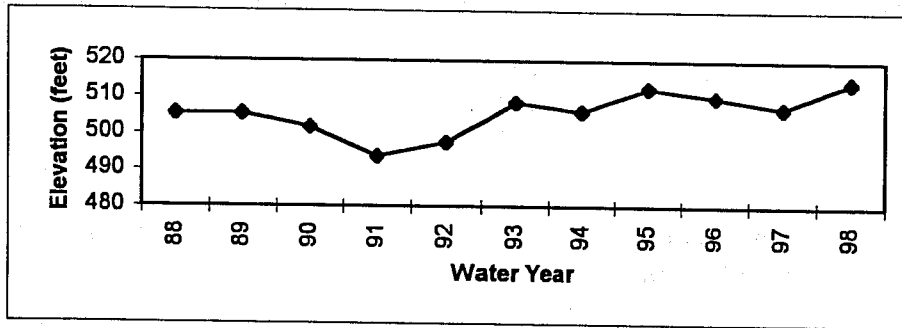
Area = 694 Acres
or 1.08 Sq. Mi.

Surplus = 57 AFY

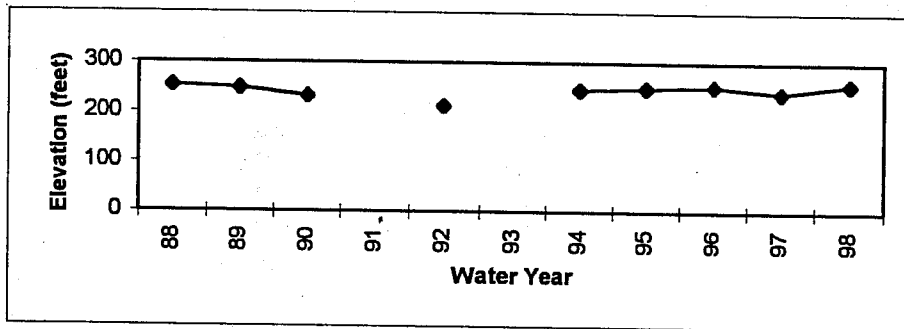
* Areal Designations not shown on Plate 4, but were used to facilitate planimetry of basin area

Figure D-1. Montecito Groundwater Basin, South Coast Basins

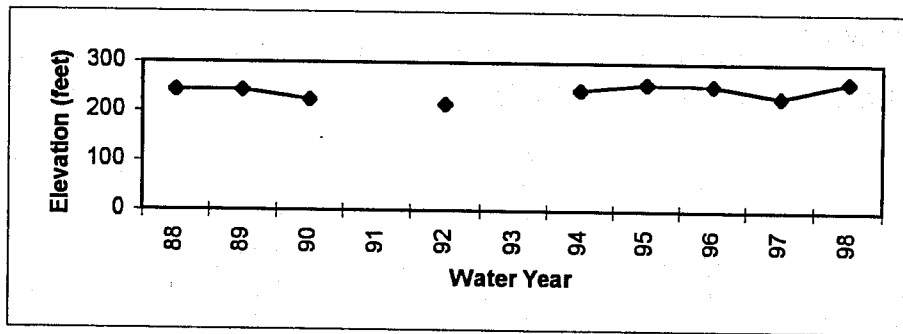
04N/26W-07A(1)



04N/26W-07R01



04N/26W-07R02



04N/26W-08D(1)

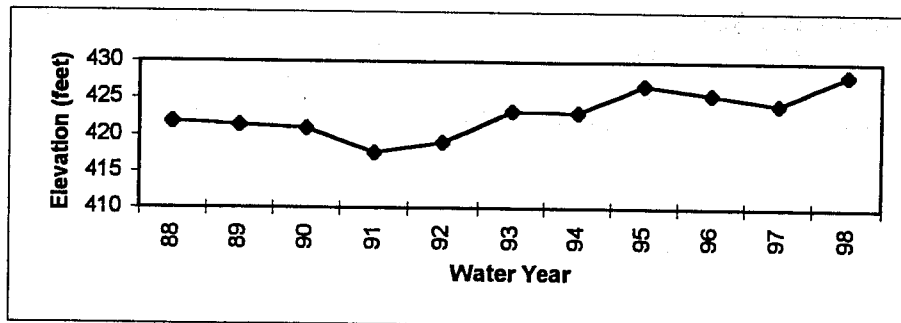
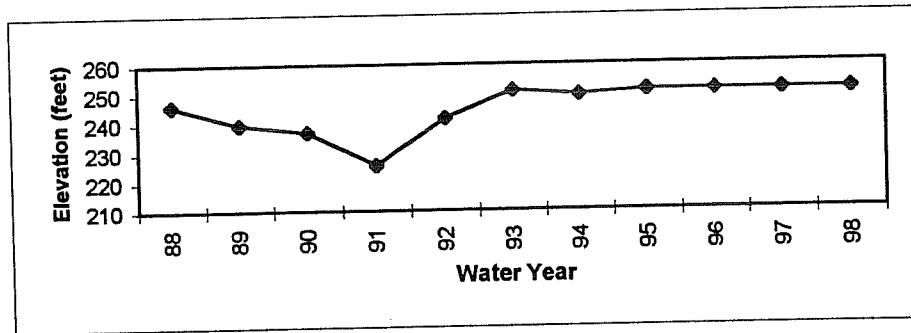
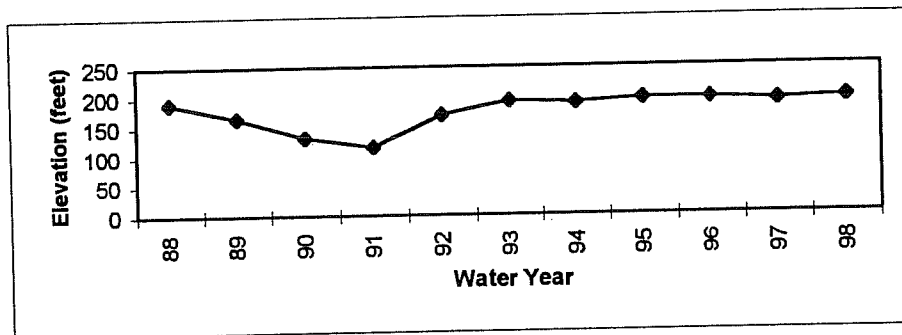


Figure D-1 cont. Montecito Groundwater Basin, South Coast Basins

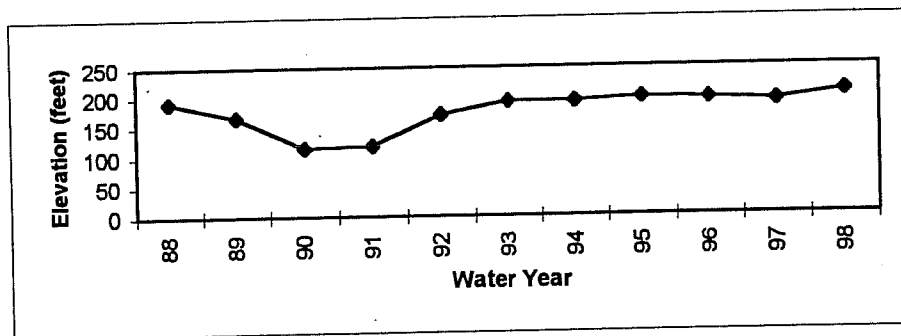
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04N/26W-08P01



04N/26W-08P03



04N/26W-08R02

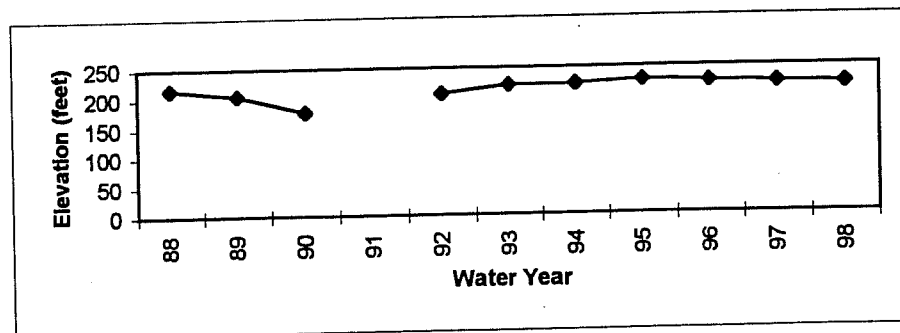
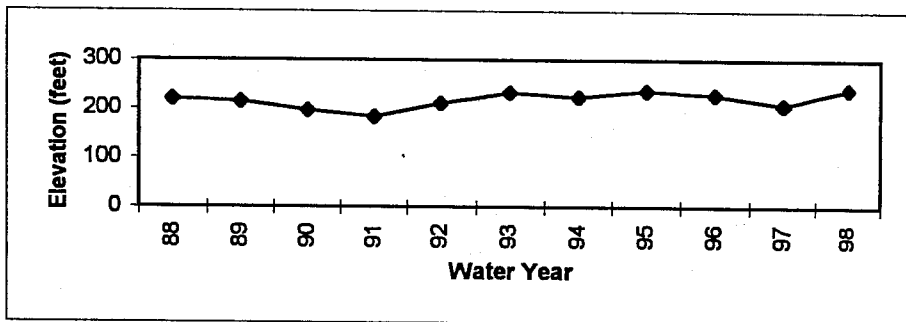
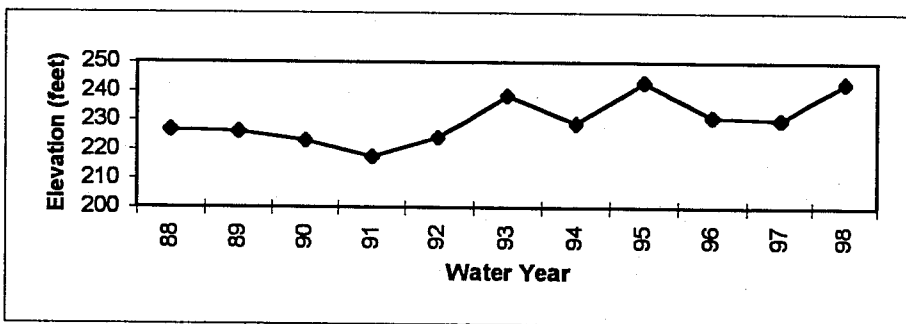


Figure D-1 cont. Montecito Groundwater Basin, South Coast Basins

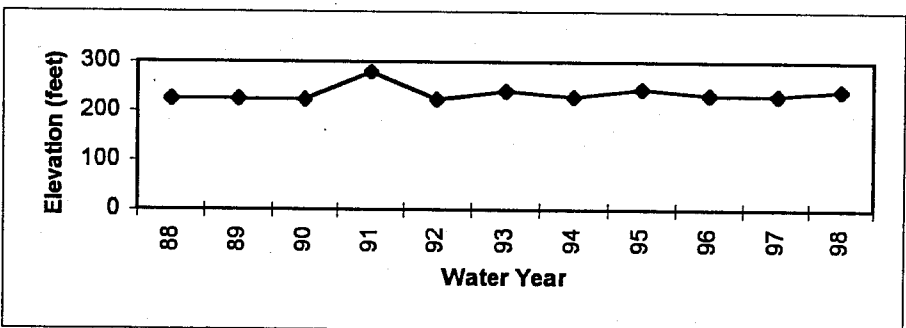
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04N/26W-09Q01



04N/26W-09Q02



04N/26W-15D02

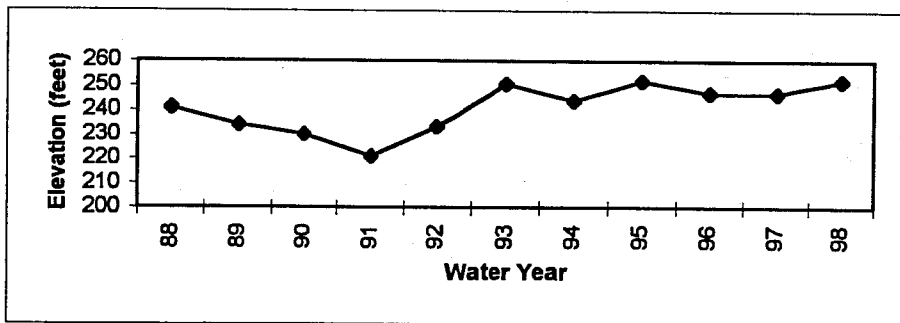
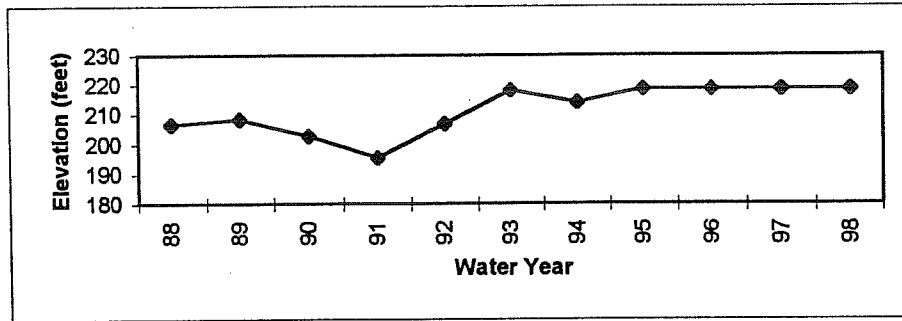
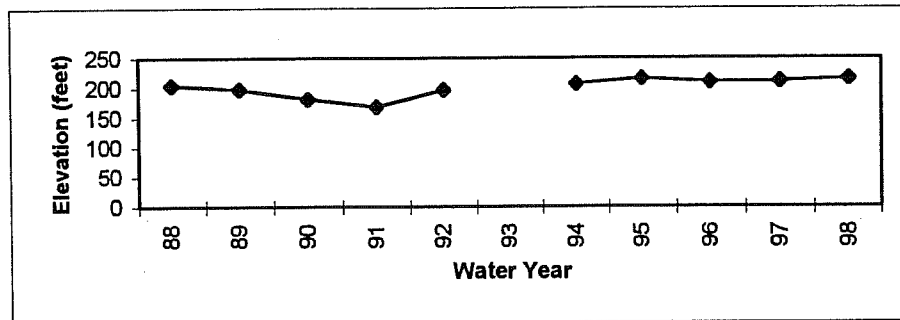


Figure D-1 cont. Montecito Groundwater Basin, South Coast Basins

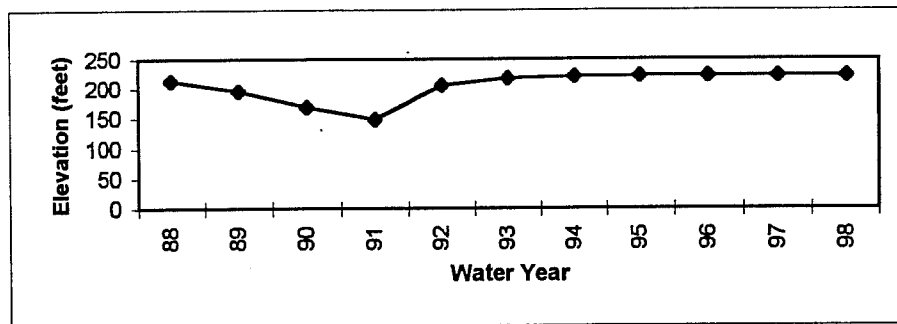
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04N/26W-16C01



04N/26W-16D(1)



04N/26W-16N01

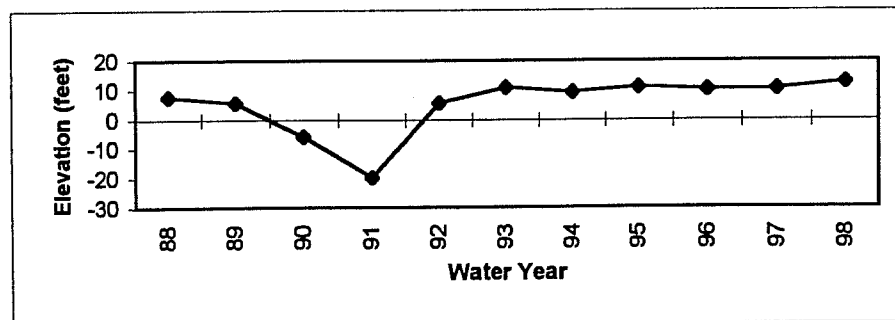
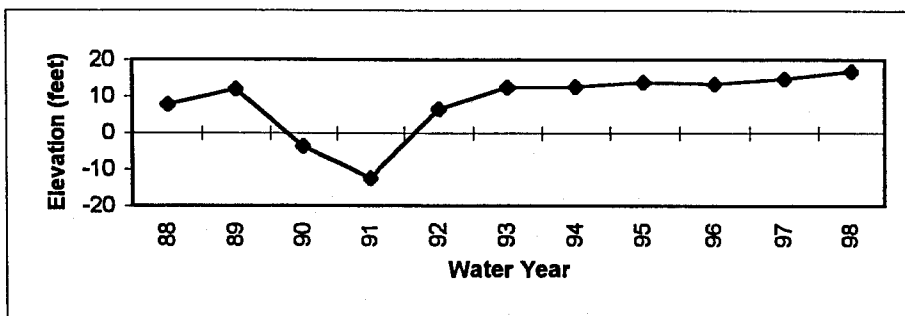
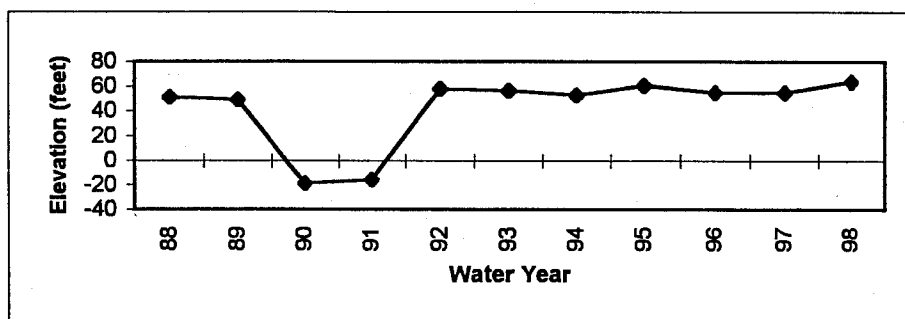


Figure D-1 cont. Montecito Groundwater Basin, South Coast Basins

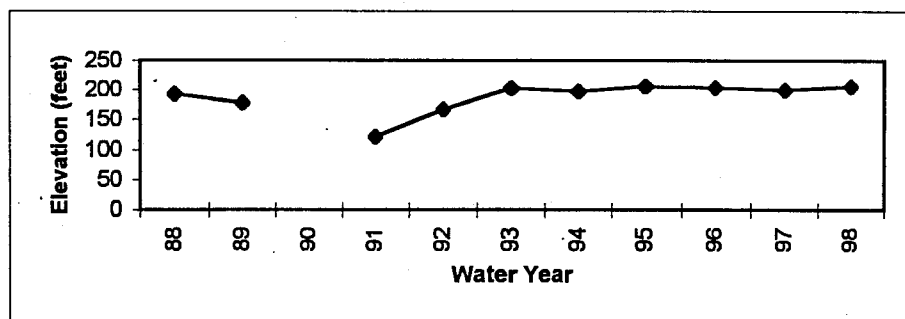
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04N/26W-16P05



04N/26W-17B04



04N/26W-17K(1)

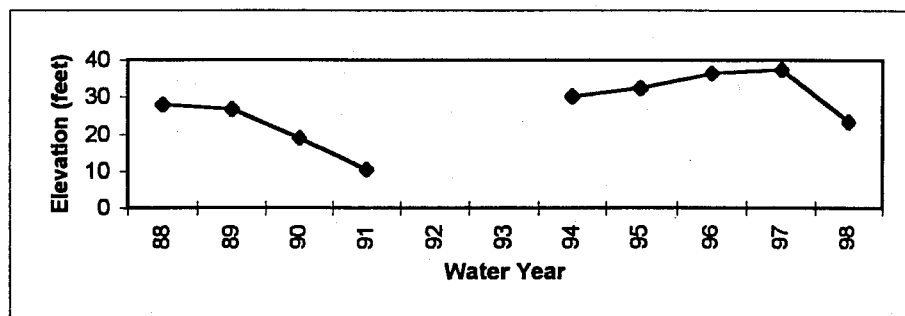
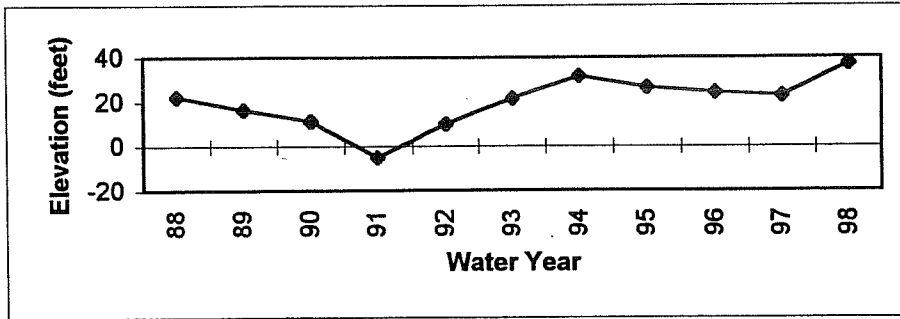
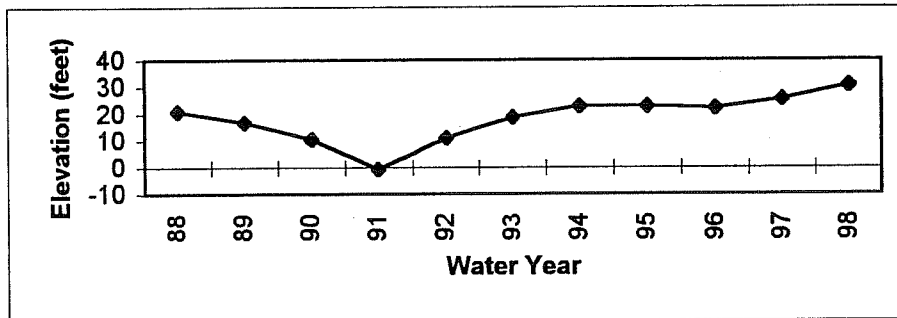


Figure D-1 cont. Montecito Groundwater Basin, South Coast Basins

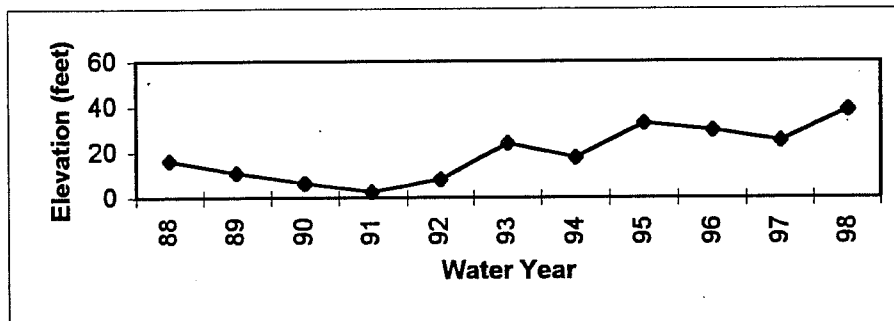
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04N/26W-17K02



04N/26W-17L01



04N/26W-17Q02

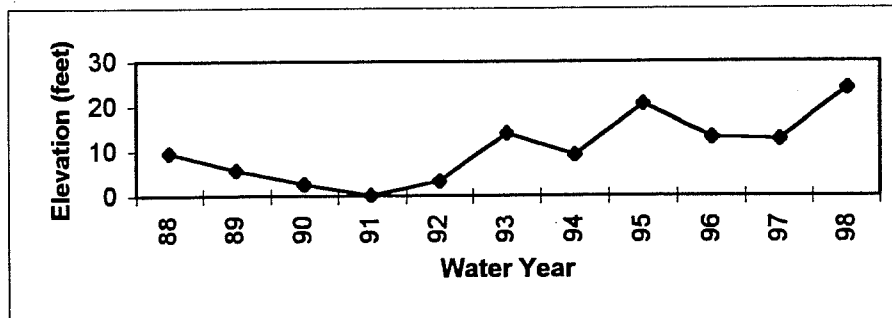
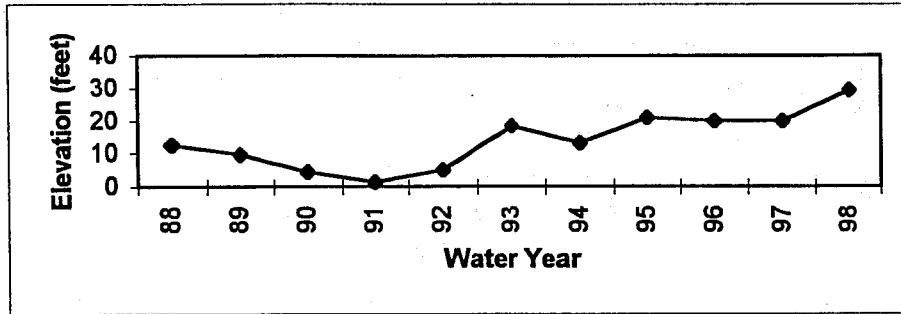
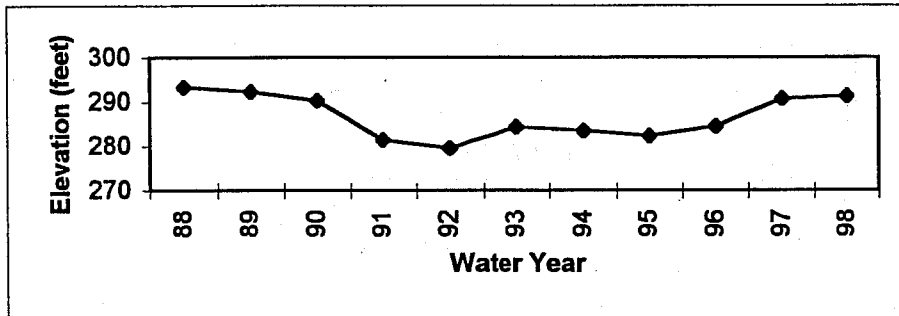


Figure D-1 cont. Montecito Groundwater Basin, South Coast Basins

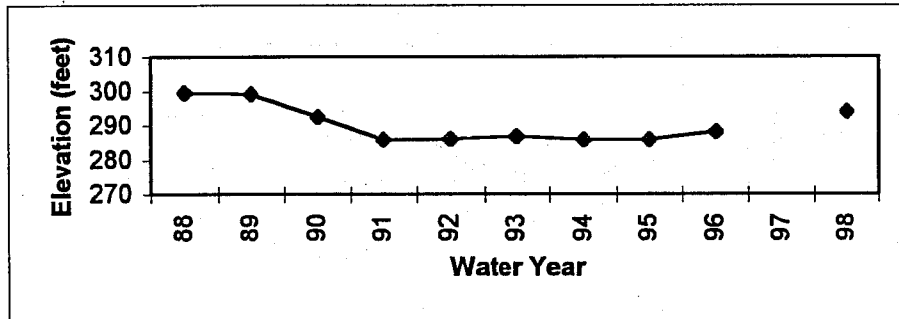
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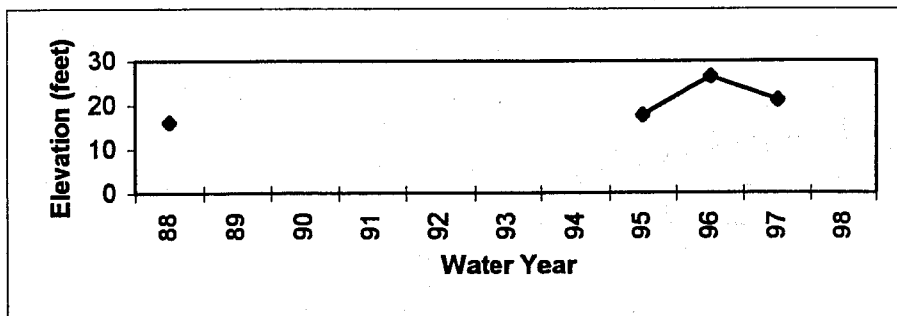
04N/26W-18C(1)



04N/26W-18D(1)



04N/26W-18R01



APPENDIX E
CARPINTERIA GROUNDWATER BASIN

TABLE E-1. SELECTED WELLS SHOWING GROUNDWATER LEVELS IN THE CARPINTERIA GROUNDWATER BASIN

Well Number	Ave. Annual Change	Well Depth	Upper Perforations	Lower Perforations	Surface Elevation	Water Level Elevation 1988	Water Level Elevation 1996	Well Use
(All values in feet)								
04N/25W-19F04S	2.53	250			106	14.34	34.55	Unused
04N/25W-19H01S	1.21	360			120	27.25	36.92	Unused
04N/25W-19J05S	2.17	100			55	0.11	17.50	Unused
04N/25W-19M03S	2.06	204			65	6.00	22.50	Unused
04N/25W-20K03S	1.00	408			45	20.47	28.50	Unused
04N/25W-20L04S	1.58	264	62	254	111	2.92	15.58	Unused
04N/25W-21N01S	1.02	405			41	19.45	27.64	Unused
04N/25W-21N04S	1.04	406			51	17.20	25.52	Unused
04N/25W-21R01S	-0.33	434	82	416	108	43.13	40.50	Unused
04N/25W-22R04S	0.23	504	192	504	218	203.00	204.84	Domestic
04N/25W-23P01S	-0.81	465			480	263.04	256.58	Unused
04N/25W-26A01S	-0.68	480	228	480	420	232.15	226.68	Unused
04N/25W-27F02S	0.10	1150	455	801	133	50.75	51.53	Municipal
04N/25W-27R02S	-0.83*	421	295	420	132	45.65	39.05	Irrigation
04N/25W-28F07S	-1.38	1245	310	1230	63	31.33	20.29	Municipal
04N/25W-28J01S	-1.09	175			89	38.68	29.97	Irrigation
04N/25W-28M01S	-0.28	152			53	34.08	31.87	Observation
04N/25W-29R01S	<0.01	176			32	25.84	25.87	Unused
04N/25W-30D01S	0.59*	210			7	4.27	9.00	Unused
04N/25W-35A02S	-0.04	403	55	401	147	133.22	132.87	Unused
04N/25W-35A03S	-0.02	146			147	115.39	115.27	Unused
04N/25W-35E01S	-1.24	420	260	385	249	83.33	73.42	Unused
04N/26W-23A02S	-0.28	330			63	13.65	11.44	Unused

* Indicates that a fall water level or an estimated water level was substituted to determine the annual change in water levels

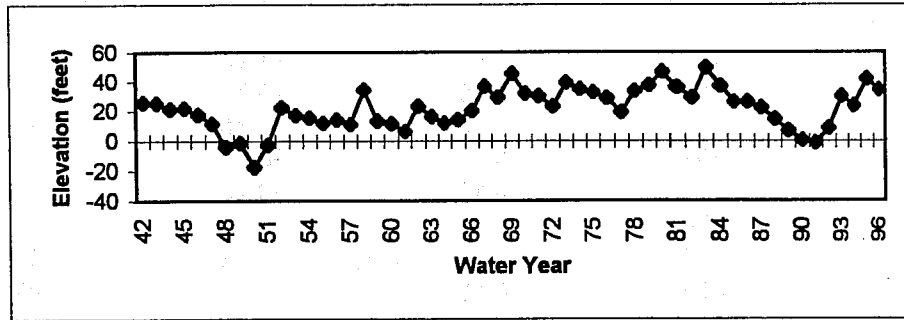
Table E-2. Calculations for Carpinteria Basin

AREAL DESIGNATION*	AREA (IN ACRES)	SPECIFIC YIELD (%)	ANNUAL CHANGE (IN FEET)	STORAGE (IN ACRE-FEET)
-A1	56	0.10	-1.25	-7.00
-B1	140	0.10	-0.75	-10.50
-B2	561	0.10	-0.75	-42.08
-C1	252	0.10	-0.25	-6.30
-C2	147	0.10	-0.25	-3.68
-C3	270	0.10	-0.25	-6.75
-C4	142	0.10	-0.25	-3.55
+A1	401	0.10	0.25	10.03
+A2	193	0.10	0.25	4.83
+A3	65	0.10	0.25	1.63
+B1	361	0.10	0.75	27.08
+B2	59	0.10	0.75	4.43
+C1	406	0.10	1.25	50.75
+C2	240	0.10	1.25	30.00
+C3	32	0.10	1.25	4.00
+D1	192	0.10	1.75	33.60
+E1	140	0.10	2.25	31.50
+F1	28	0.10	2.75	7.70
Area =	3,685 ACRES or 5.76 Sq. Mi.		Surplus =	126 AFY

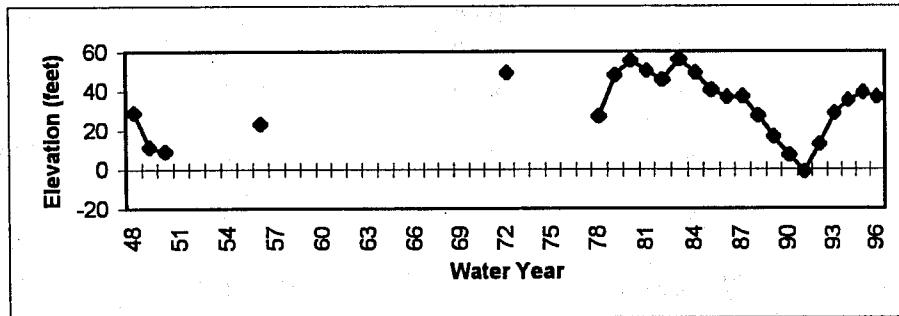
* Areal Designations not shown on Plate 4, but were used to facilitate planimetering basin area

Figure E-1. Carpinteria Groundwater Basin, South Coast Basins

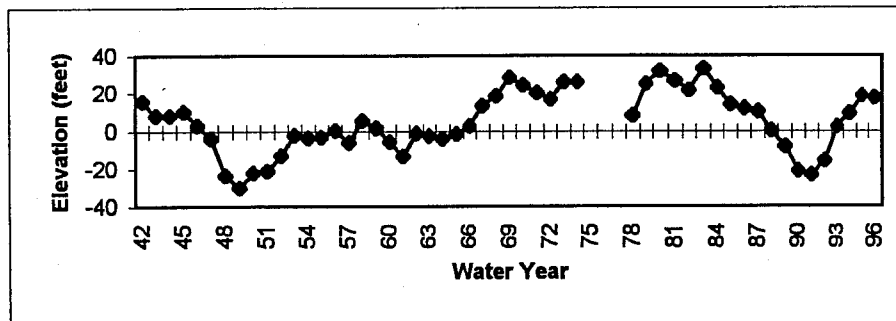
04N/25W-19F04S



04N/25W-19H01S



04N/25W-19J05S



04N/25W-19M03S

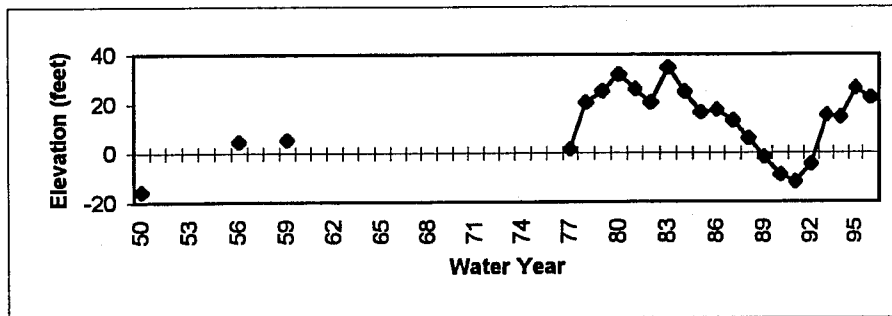
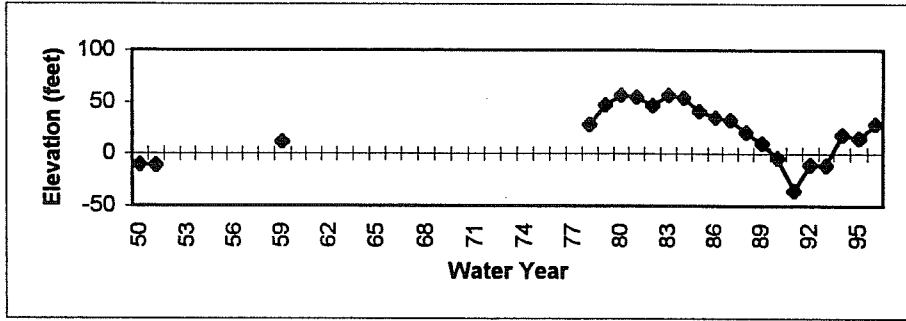
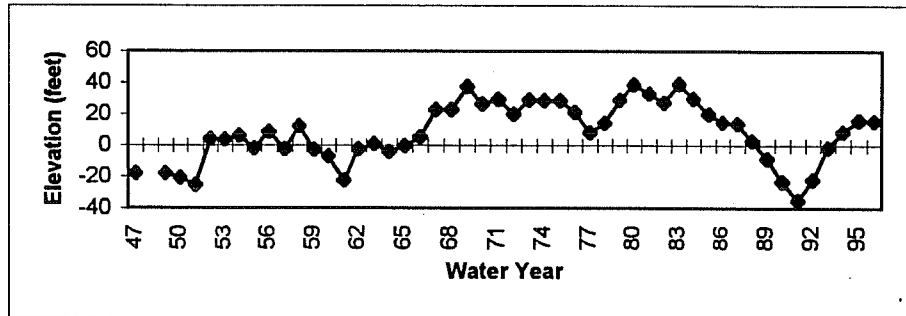


Figure E-1 cont. Carpinteria Groundwater Basin, South Coast Basins

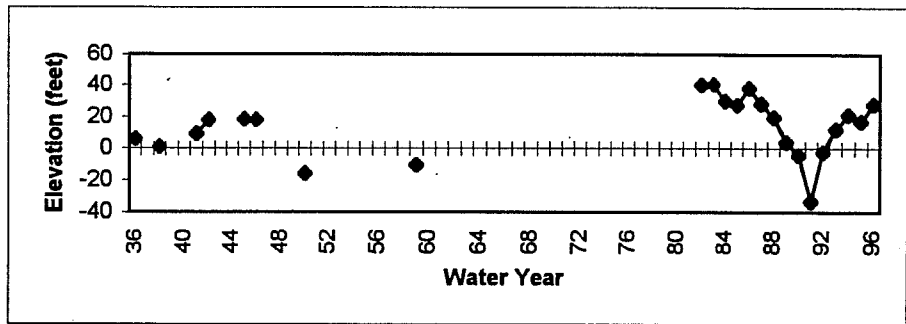
04N/25W-20K03S



04N/25W-20L04S



04N/25W-21N01S



04N/25W-21N04S

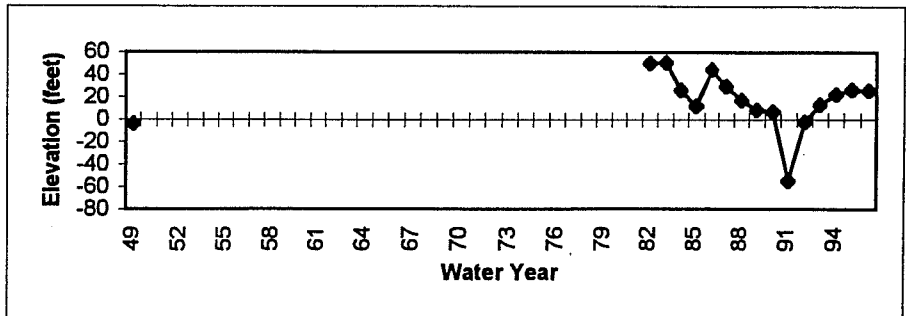
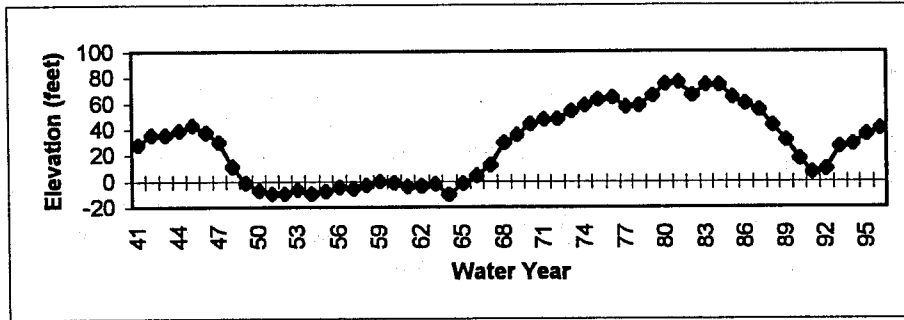
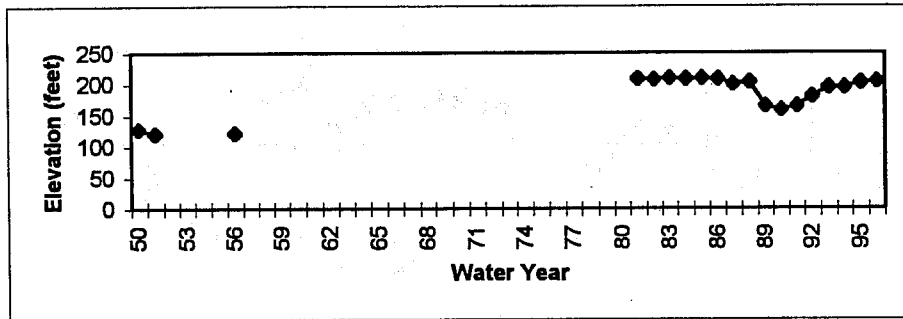


Figure E-1 cont. Carpinteria Groundwater Basin, South Coast Basins

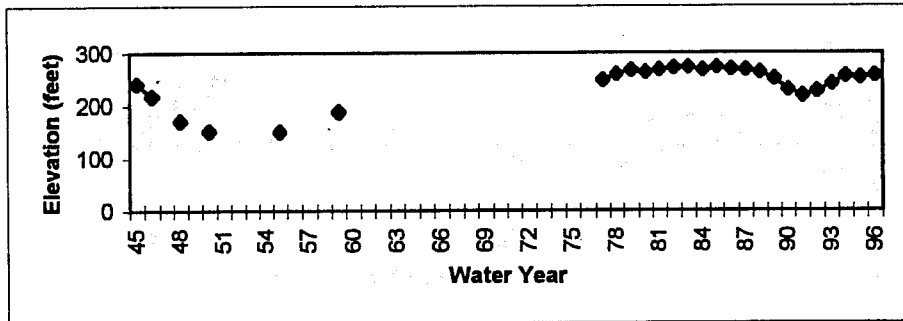
04N/25W-21R01S



04N/25W-22R04S



04N/25W-23P01S



04N/25W-26A01S

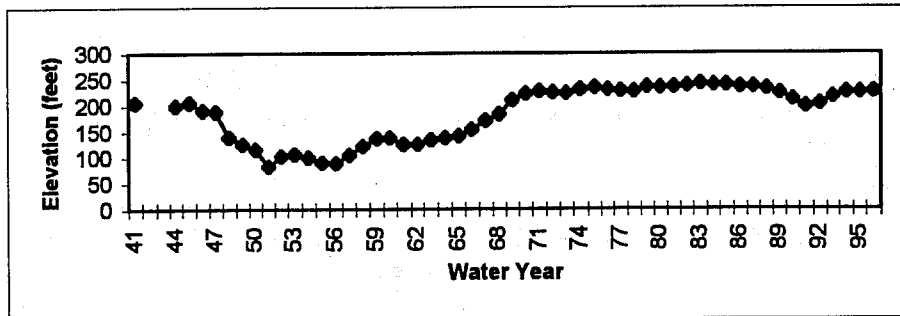
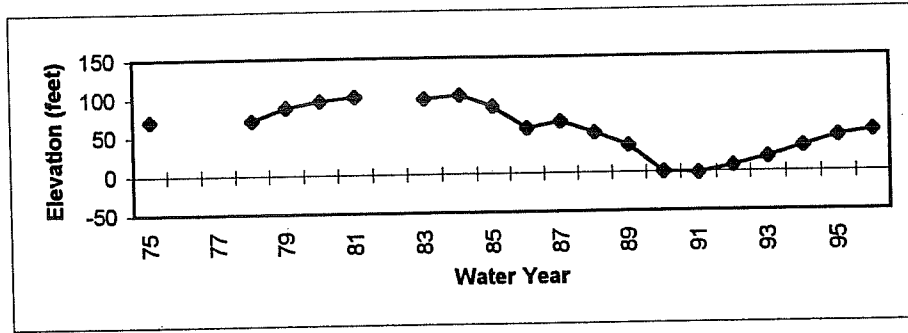
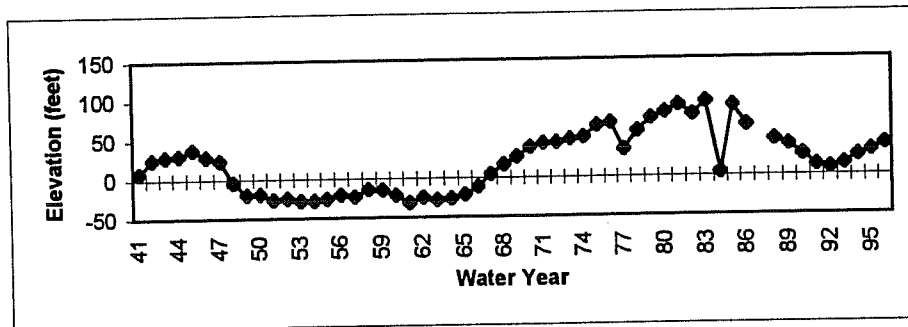


Figure E-1 cont. Carpinteria Groundwater Basin, South Coast Basins

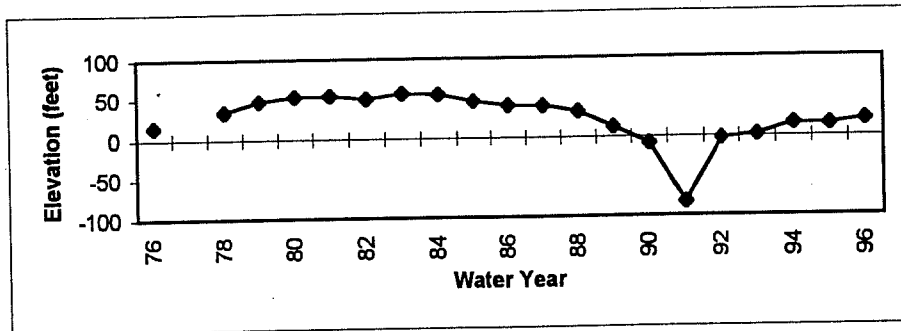
04N/25W-27F02S



04N/25W-27R02S



04N/25W-28F07S



04N/25W-28J01S

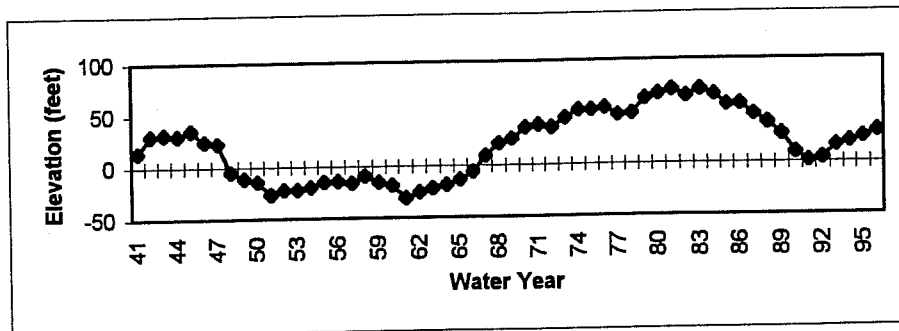
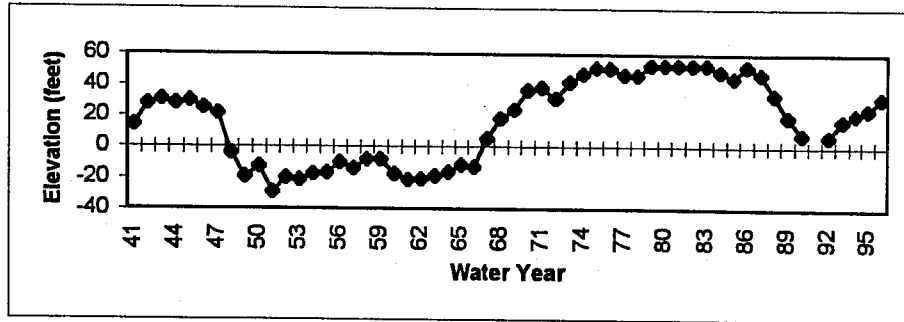
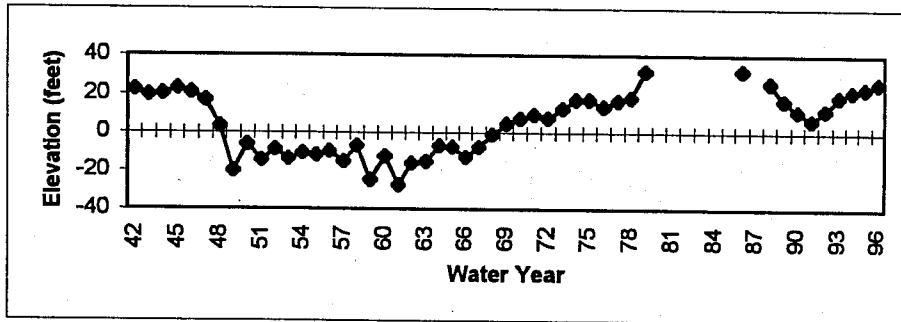


Figure E-1 cont. Carpinteria Groundwater Basin, South Coast Basins

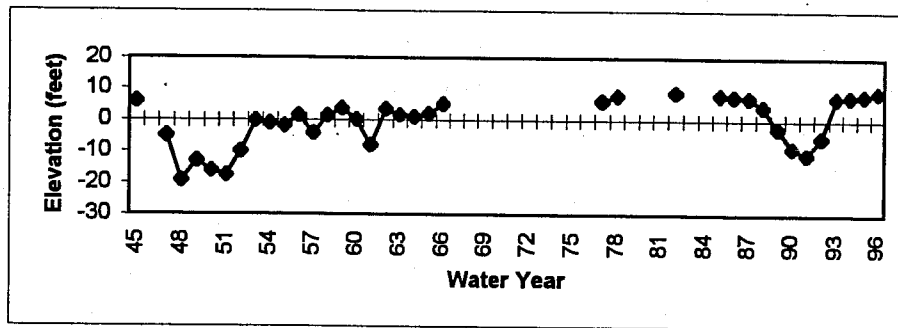
04N/25W-28M01S



04N/25W-29R01S



04N/25W-30D01S



04N/25W-35A02S

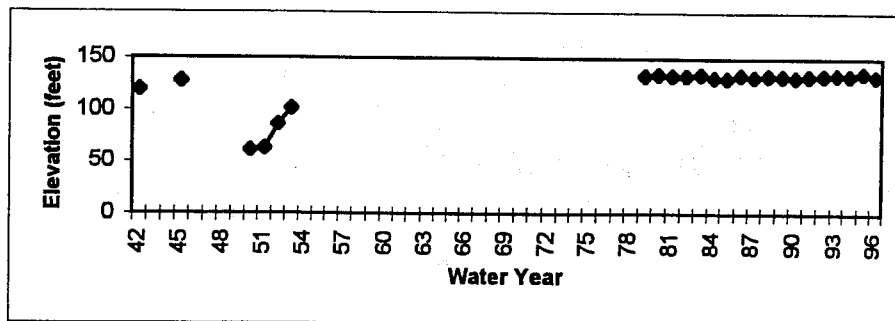
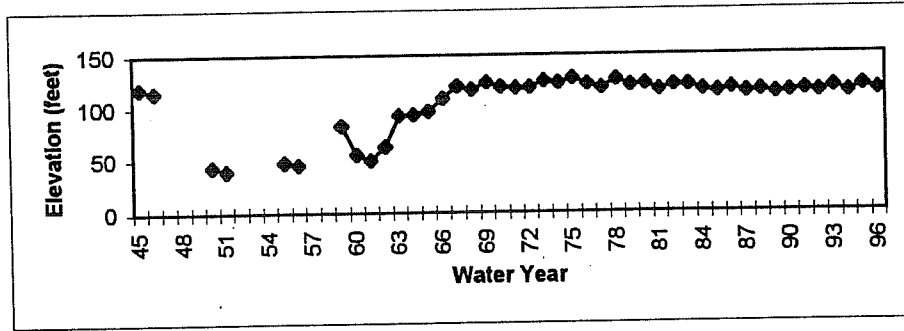
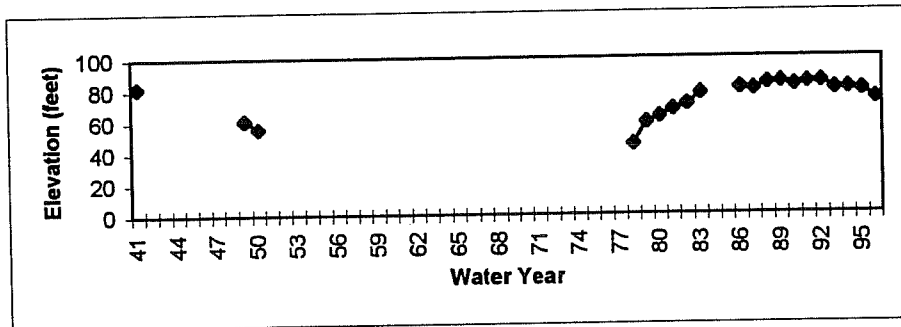


Figure E-1 cont. Carpinteria Groundwater Basin, South Coast Basins

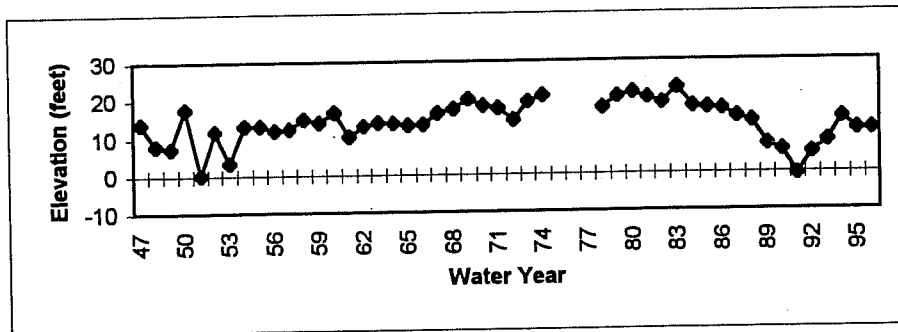
04N/25W-35A03S



04N/25W-35E01S



04N/26W-23A02S



APPENDIX F
SANTA MARIA GROUNDWATER BASIN

FIGURE F-1. SANTA MARIA GROUNDWATER BASIN

Rain Gage Station: Santa Maria

Location : T10N, R34W: 34 57' N 120 26' W

Elevation: 223 feet

Mean Annual Rainfall: (1886-1996) 13.41 inches

Hydrologic base period: water years 1977-1995; Mean: 13.42 inches

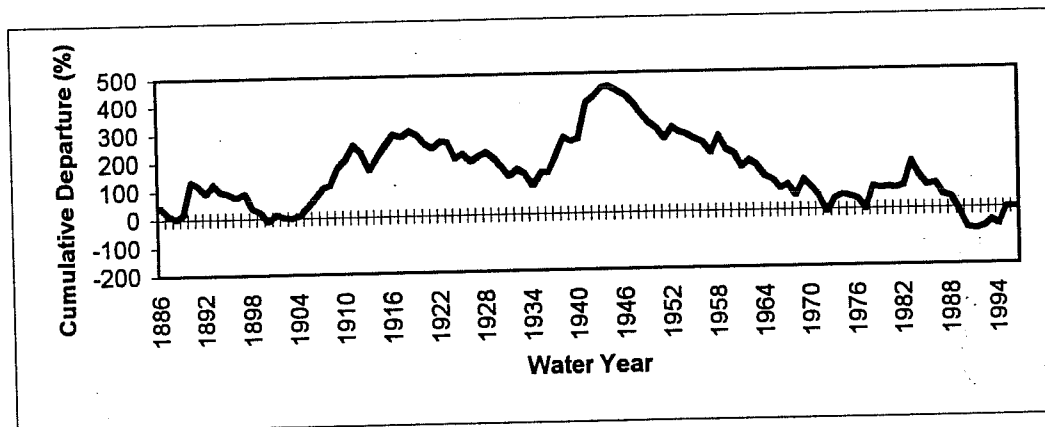
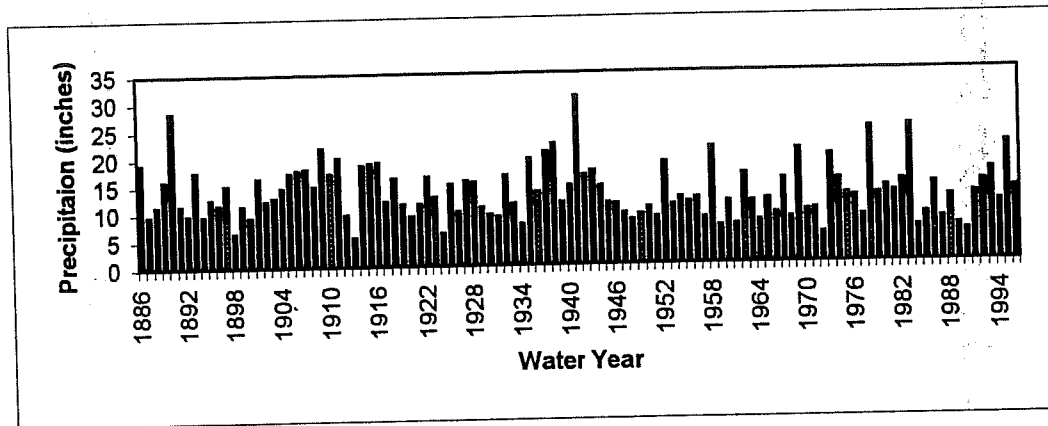


TABLE F-1. SELECTED WELLS SHOWING GROUNDWATER LEVELS IN THE SANTA MARIA GROUNDWATER BASIN

Well Number	Ave. Annual Change	Well Depth	Upper Perforations	Lower Perforations	Surface Elevation	Water Level Elevation 1988	Water Level Elevation 1996	Well Use
(All values in feet)								
09N/32W-07Q01S	0.85				421	325.69	340.91	Domestic
09N/32W-08N01S	1.73	103.5			420	337.93	369.04	Domestic
09N/32W-16L01S	1.81	120	36	95	468	400.89	433.52	Irrigation
09N/32W-17G01S	1.23	107			447	379.05	401.20	Domestic
09N/33W-12C01S	0.99	75	34	55	395	268.18	285.91	Irrigation
09N/34W-03F01S	1.81	461	321	449	265	14.50	47.00	Municipal
09N/34W-06K02S	0.29	139			161	66.14	71.41	Industrial
09N/34W-08H01S	0.49	200			222	71.50	80.30	Industrial
09N/34W-09R01S	-0.35	510	363	458	275	71.07	64.76	Industrial
10N/33W-16N02S	4.85	240			292	173.79	261.10	Irrigation
10N/33W-18G01S	2.24	436	132	422	273	148.70	189.00	Irrigation
10N/33W-19B01S	4.69	307	92	248	275	108.00	192.45	Irrigation
10N/33W-19K01S	-0.01	423	262	417	280	128.01	127.75	Irrigation
10N/33W-20H01S	2.39	251	100	175	300	189.23	232.16	Irrigation
10N/33W-27G01S	3.11	272	140	260	338	236.80	292.81	Irrigation
10N/33W-28A01S	3.23	81			325	223.40	281.51	Domestic
10N/33W-29F01S	1.50				315	102.57	129.50	Irrigation
10N/33W-30G01S	-1.29	676	325	662	320	110.00	86.81	Domestic
10N/33W-30M01S	-1.42	500	190	485	310	98.30	72.82	Industrial
10N/33W-35C01S	2.35	159.5			348	271.71	313.93	Irrigation
10N/34W-04R01S	1.79	186	90	174	192	52.20	84.34	Irrigation
10N/34W-06N01S	1.05	190			152	44.30	63.21	Irrigation
10N/34W-13G01S	2.17	450	136	395	253	103.93	142.95	Irrigation
10N/34W-13J01S	1.86	308			260	120.21	153.72	Irrigation
10N/34W-24K01S	-0.30	714	650	710	254	88.70	90.75	Unused
10N/35W-06A03	1.52*	117.6			75	35.40	62.80	Observation
10N/35W-09F01S	0.54*	400	228	240	88	26.95	36.64	Irrigation
10N/35W-21B01S	0.15*	310	102	300	94	50.35	53.00	Irrigation
10N/35W-23M02S	0.83*	180			125	40.10	54.96	Irrigation
10N/35W-24B01S	0.61*	290	122	288	145	45.55	56.50	Irrigation
10N/35W-24Q01S	0.82	310			162	39.84	54.53	Stock
10N/36W-01H01	0.01*	379	265	370	140	20.86	20.96	Industrial
10N/36W-02Q07	0.08*	47	19	47	15	8.55	9.90	Observation
10N/36W-12P01S	0.03*	172			28	24.92	25.52	Domestic
11N/34W-30Q01S	1.63	180			148	44.80	74.10	
11N/35W-20E01S	-0.21*		150	444	49	27.80	24.00	
11N/35W-28F02	-0.21*				80	56.86	53.10	Observation
11N/35W-28M01S	0.66*	376?			77	18.10	30.00	
11N/35W-33G01S	0.44*	141			90	37.00	45.00	Irrigation

* Indicates well overlies area of confinement and indicated value was not used in the assessment of overdraft.

Table F-2. Calculations for Eastern Santa Maria Basin

AREAL DESIGNATION*	AREA (IN ACRES)	SPECIFIC YIELD (%)	ANNUAL CHANGE (IN FEET)	STORAGE (IN ACRE-FEET)
+A1	832	0.13	4.75	517.32
+B1	395	0.13	4.25	219.75
+C1	487	0.13	3.75	239.06
+C2	287	0.13	3.75	140.88
+C3	114	0.13	3.75	55.96
+D1	650	0.13	3.25	276.53
+D2	119	0.13	3.25	50.63
+D3	626	0.13	3.25	266.32
+E1	1069	0.13	2.75	384.81
+E2	296	0.13	2.75	106.55
+E3	118	0.13	2.75	42.48
+E4	340	0.13	2.75	122.39
+F1	1842	0.13	2.25	542.52
+F2	2005	0.13	2.25	590.52
+F3	593	0.13	2.25	174.65
+F4	138	0.13	2.25	40.64
+F5	563	0.13	2.25	165.82
+G1	902	0.13	1.75	206.63
+G2	1110	0.13	1.75	254.27
+G3	1230	0.13	1.75	281.76
+G4	296	0.13	1.75	67.81
+H1	620	0.13	1.25	101.45
+H2	2025	0.13	1.25	331.34
+H3	1029	0.13	1.25	168.37
+H4	580	0.13	1.25	94.90
+H5	603	0.13	1.25	98.67
+H6	128	0.13	1.25	20.94
+I1	2502	0.13	0.75	245.63
+I2	855	0.13	0.75	83.94
+I3	429	0.13	0.75	42.12
+I4	214	0.13	0.75	21.01
+J1	684	0.13	1.25	111.92
+J2	1275	0.13	1.25	208.62
+K1	453	0.13	0.75	44.47
+L1	927	0.13	0.25	30.34
+L2	148	0.13	0.25	4.84
+L3	159	0.13	0.25	5.20
-M1	476	0.13	-0.25	-15.58
-M2	186	0.13	-0.25	-6.09
-N1	382	0.13	-0.75	-37.50
-N2	234	0.13	-0.75	-22.97
-O1	761	0.13	-1.25	-124.52
Area =	28,682		Surplus =	6,154 AFY

* Areal Designations not shown on Plate 6, but were used to facilitate planimetry basin area

Table F-3. Calculations for Central Santa Maria Basin

AREAL DESIGNATION	AREA (IN ACRES)	SPECIFIC YIELD (%)	ANNUAL CHANGE (IN FEET)	STORAGE (IN ACRE-FEET)
-A1	548	0.15	-0.25	-20.73
+A1	724	0.15	0.25	27.39
+A2	2367	0.15	0.25	89.53
+B1	2913	0.15	0.75	330.55
+B2	914	0.15	0.75	103.72
+B3	1169	0.15	0.75	132.65
+C1	1450	0.15	1.25	274.23
+C2	1100	0.15	1.25	208.04
+C3	1871	0.15	1.25	353.85
+C4	1133	0.15	1.25	214.28
+C5	738	0.15	1.25	139.57
+D1	1331	0.15	1.75	352.42
+D2	1523	0.15	1.75	403.25
+D3	1536	0.15	1.75	406.69
+D4	2410	0.15	1.75	638.11
+D5	1447	0.15	1.75	383.13
+E1	697	0.15	1.25	131.82
+E2	1063	0.15	1.25	201.04
+E3	959	0.15	1.25	181.37
+E4	925	0.15	1.25	174.94
+F1	477	0.15	0.75	54.13
+F2	527	0.15	0.75	59.80
+F3	600	0.15	0.75	68.09
+F4	409	0.15	0.75	46.41
+G1	375	0.15	0.25	14.18
+G2	624	0.15	0.25	23.60
+G3	661	0.15	0.25	25.00
-H1	466	0.15	-0.25	-17.63
-H2	715	0.15	-0.25	-27.04
-I1	644	0.15	-0.75	-73.08
-K1	394	0.15	-1.25	-74.52
+L1	1786	0.15	2.25	608.00
+L2	939	0.15	2.25	319.66
+M1	688	0.15	2.75	286.26

Area = 36,123

Surplus = 6,039 AFY

* Areal Designations not shown on Plate 6 , but were used to facilitate planimetering basin area

Table F-4. Calculations for Western Santa Maria Basin

AREAL DESIGNATION	AREA (IN ACRES)	SPECIFIC YIELD (%)	ANNUAL CHANGE (IN FEET)	STORAGE (IN ACRE-FEET)
+A1	1284	0.14	0.25	45.16
+A2	1398	0.14	0.25	49.17
+B1	1188	0.14	0.75	125.36
+C1	243	0.14	1.25	42.74
+C2	736	0.14	1.25	129.44
+D1	1638	0.14	1.75	403.32
+E1	1721	0.14	2.25	544.83
+F1	227	0.14	2.75	87.83
Area =	8,435		Surplus =	1,428 AFY

* Areal Designations not shown on Plate 6, but were used to facilitate planimetry basin area

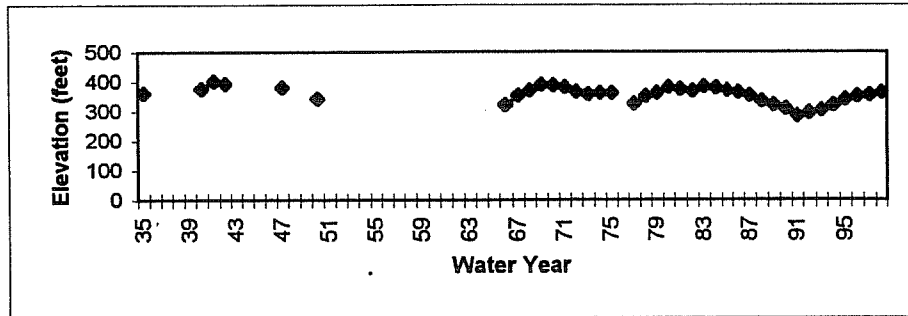
Table F-5. Summary of Calculations for Entire Santa Maria Basin

	Specific Yield (percent)	Area (in acres)	Change in Storage (in acre-feet)
Eastern Area:	0.13	28,682	6,154
Central Area:	0.15	36,123	6,039
Western Area:	0.14	8,435	1,428

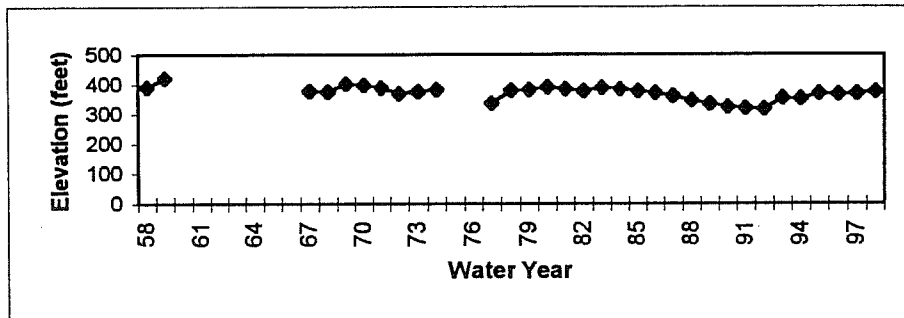
Area = 73,240 Acres Surplus = 13,621 AFY
114.44 Sq./Mi.

Figure F-2. Santa Maria Groundwater Basin

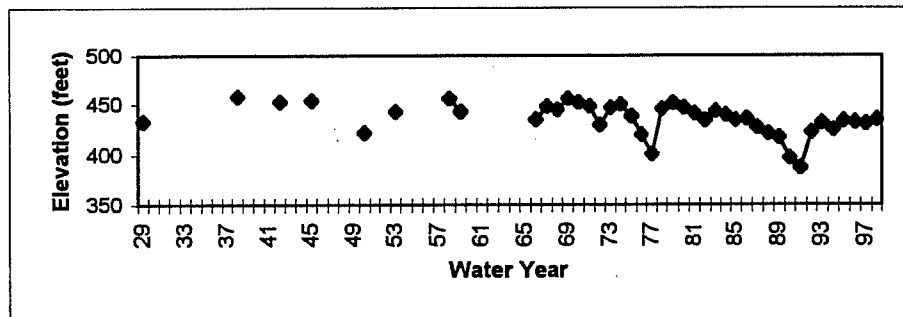
9N/32W-07Q01S



9N/32W-08N01S



9N/32W-16L01S



9N/32W-17G01S

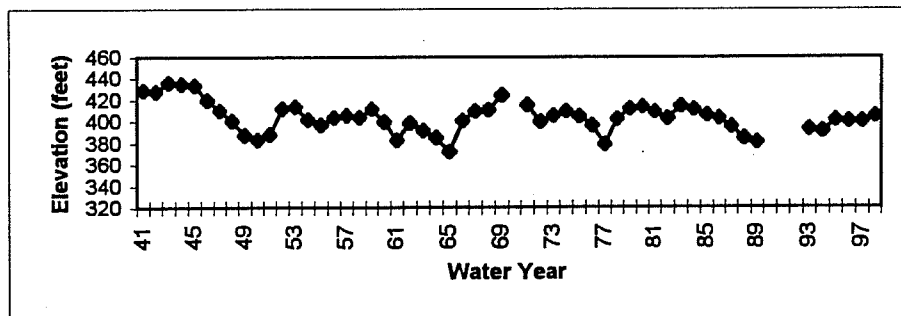
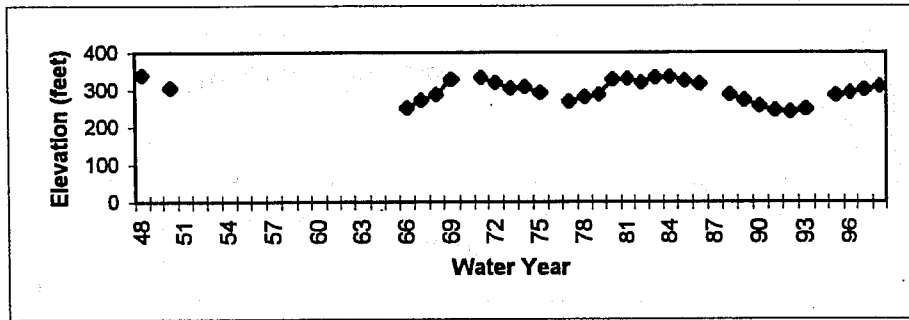
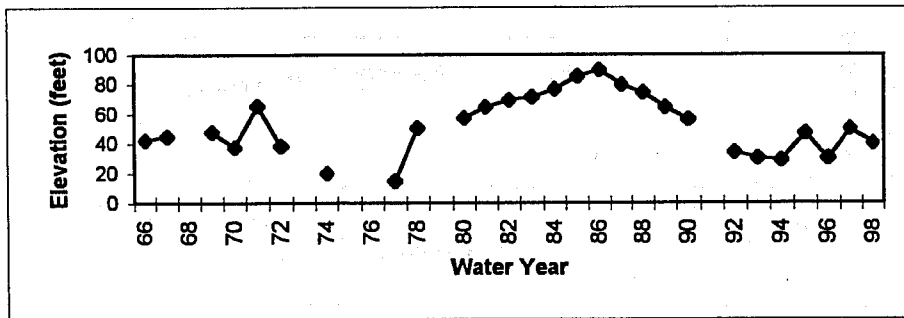


Figure F-2 cont. Santa Maria Groundwater Basin

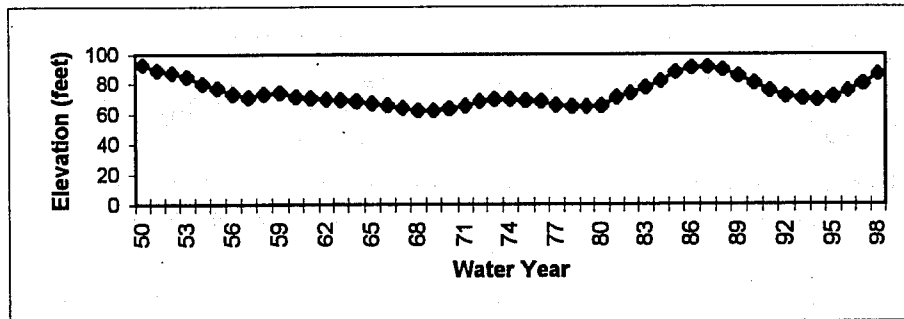
9N/33W-12C01S



9N/34W-03F01S



9N/34W-06K02S



9N/34W-08H1S

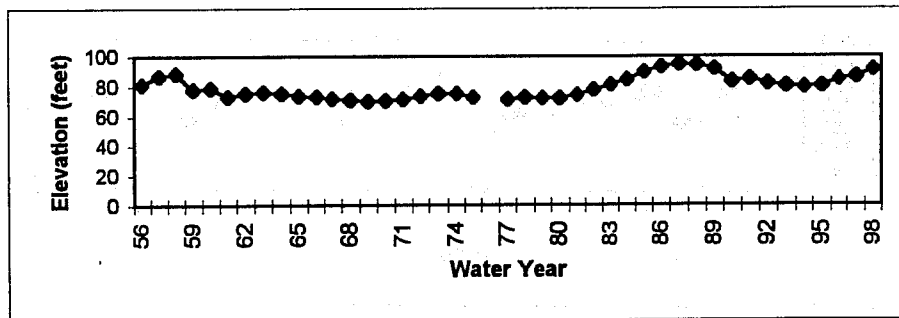
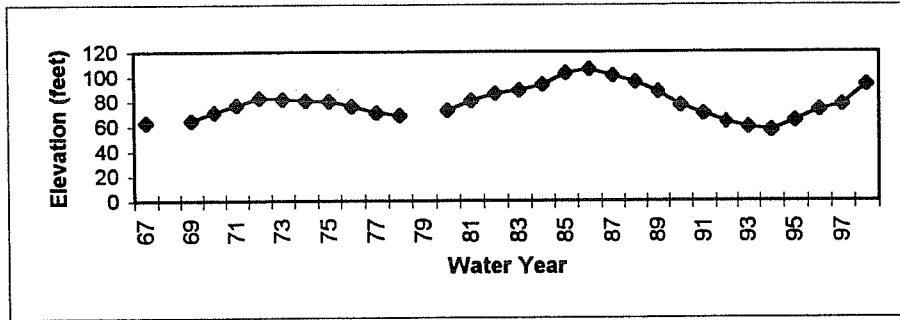
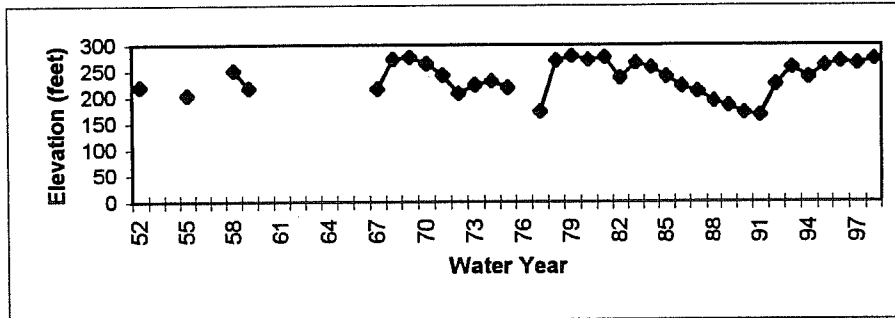


Figure F-2 cont. Santa Maria Groundwater Basin

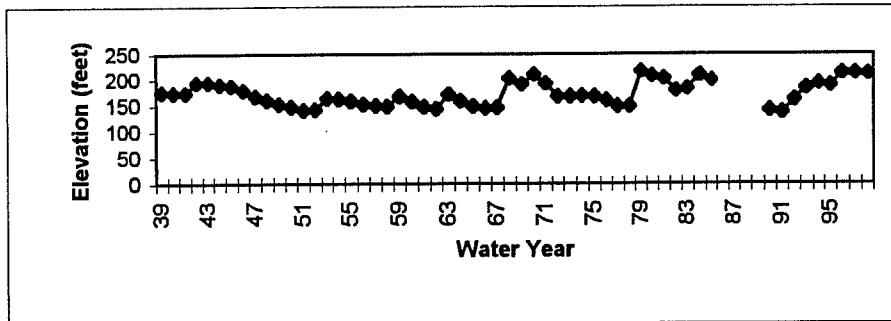
9N/34W-09R1S



10N/33W-16N02S



10N/33W-18G01S



10N/33W-19B01S

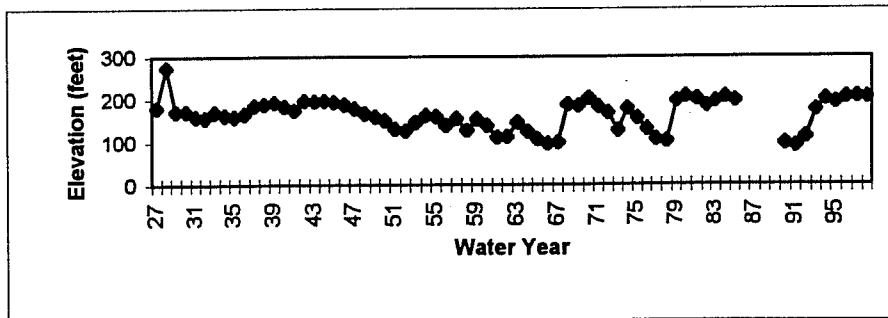
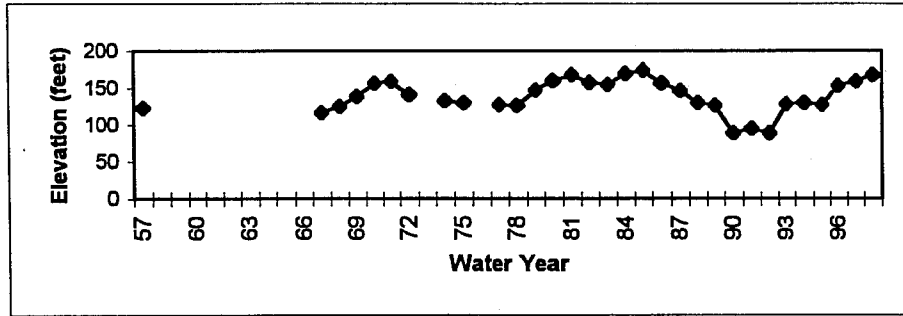
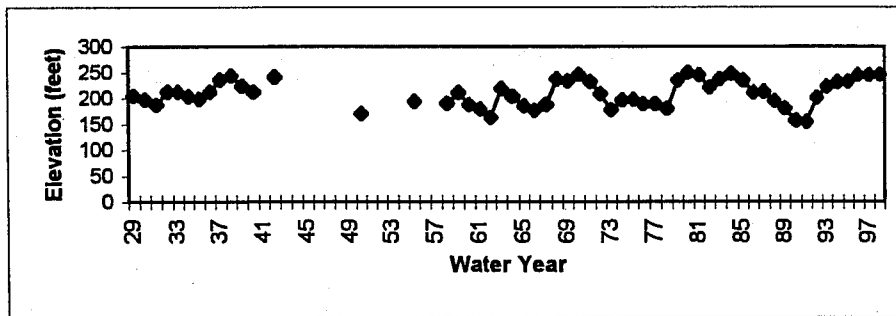


Figure F-2 cont. Santa Maria Groundwater Basin

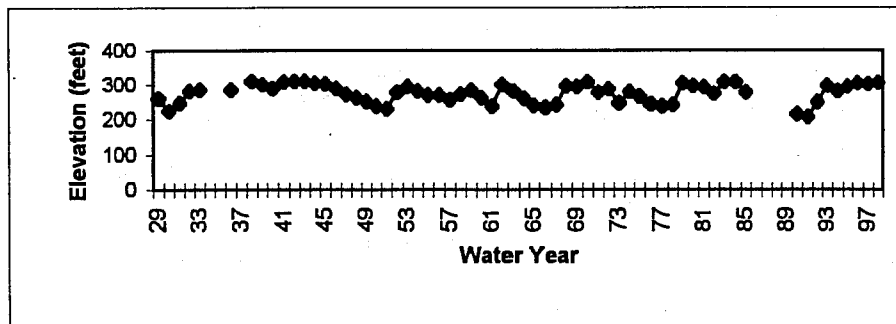
10N/33W-19K01S



10N/33W-20H01S



10N/33W-27G01S



10N/33W-28A01S

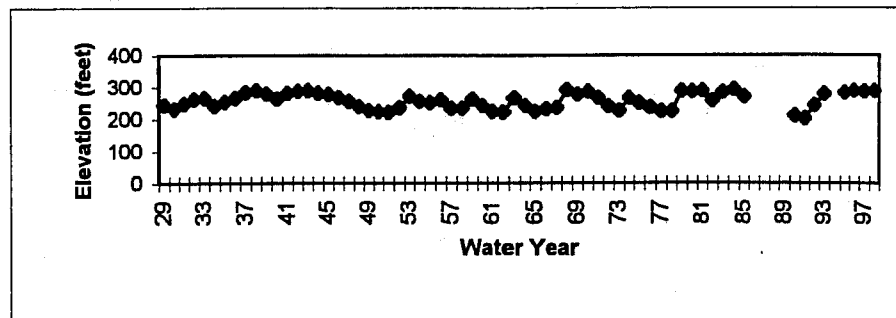
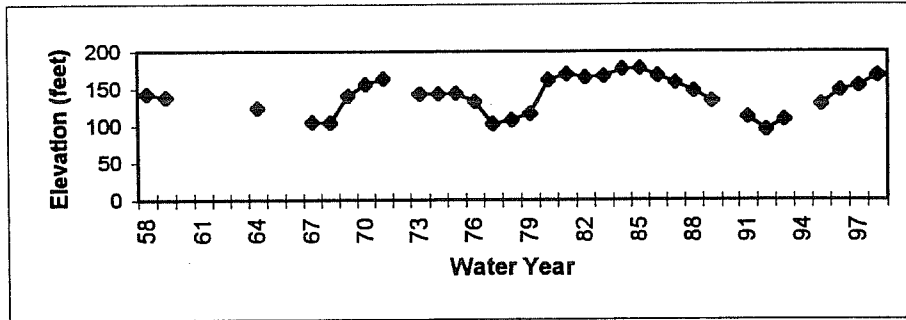
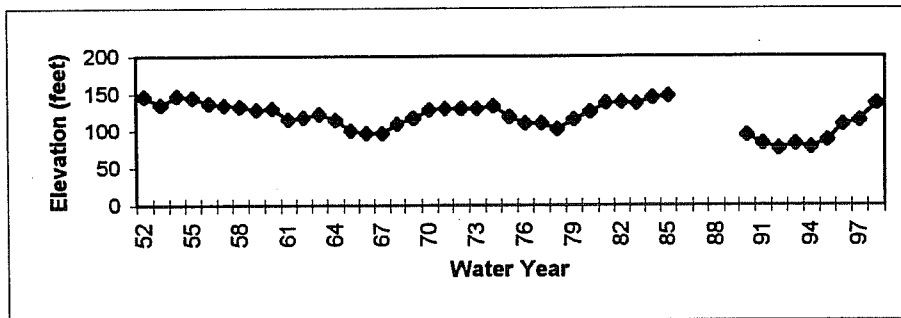


Figure F-2 cont. Santa Maria Groundwater Basin

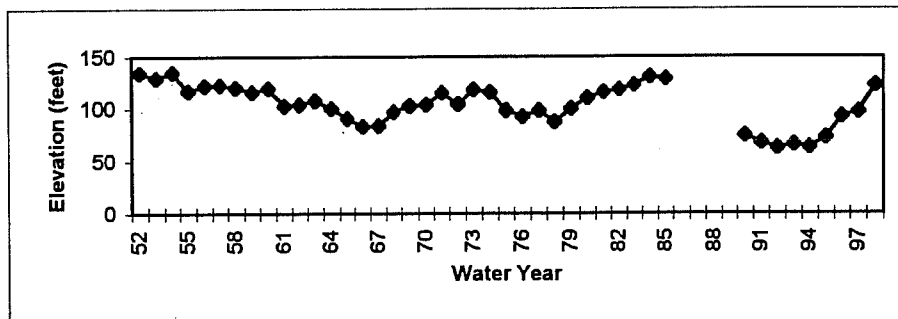
10N/33W-29F01S



10N/33W-30G01S



10N/33W-30M01S



10N/33W-35C01S

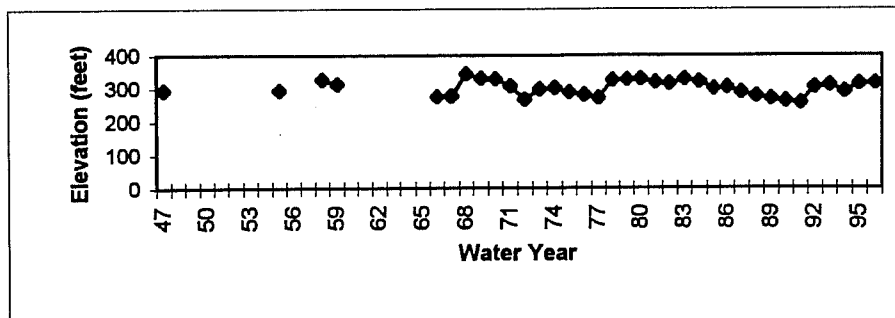
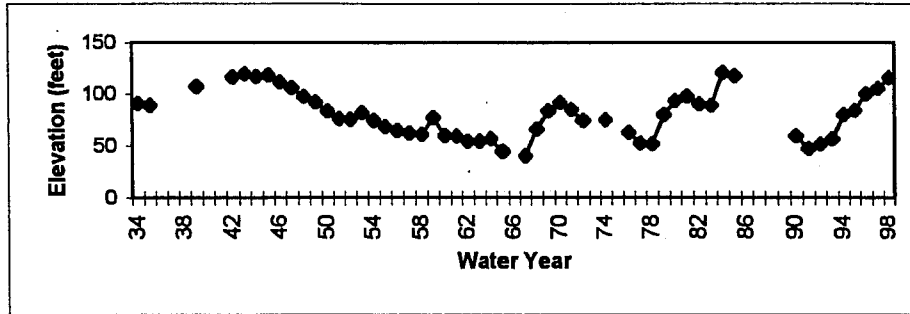
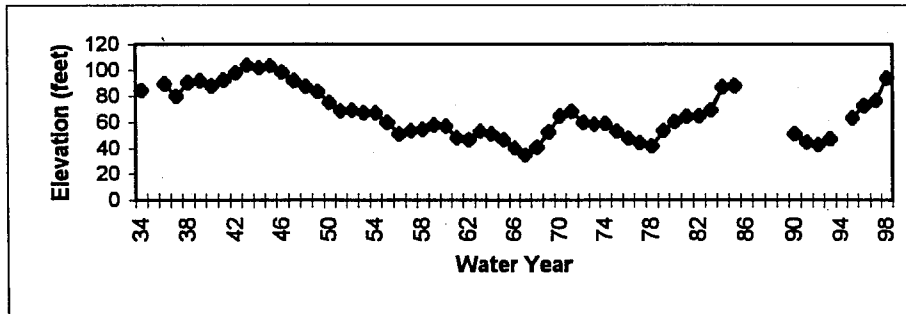


Figure F-2 cont. Santa Maria Groundwater Basin

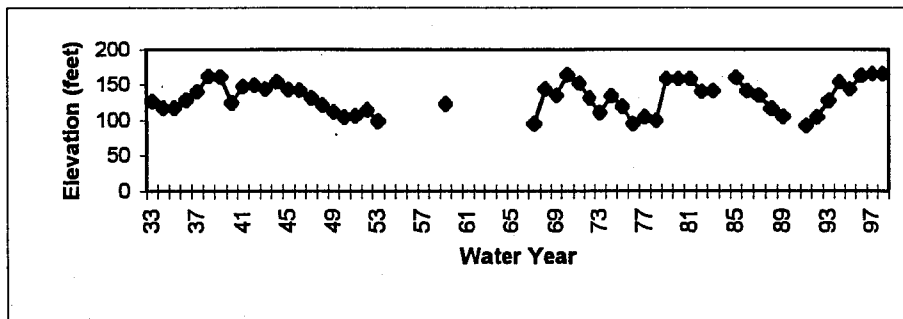
10N/34W-04R01S



10N/34W-06N01S



10N/34W-13G01S



10N/34W-13J01S

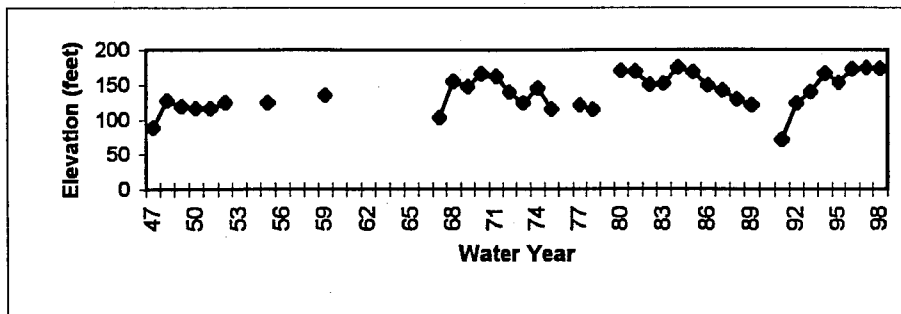
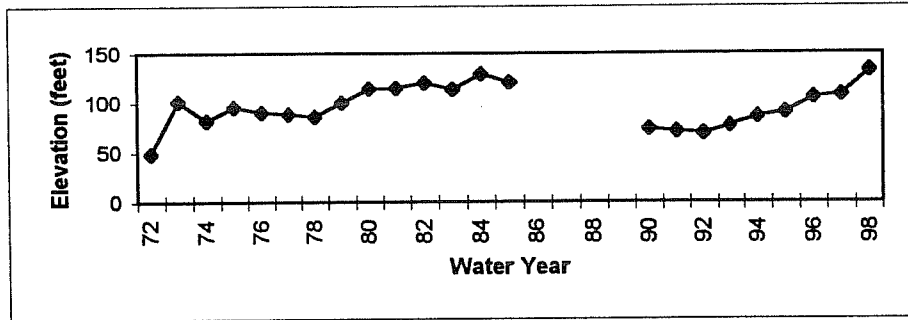
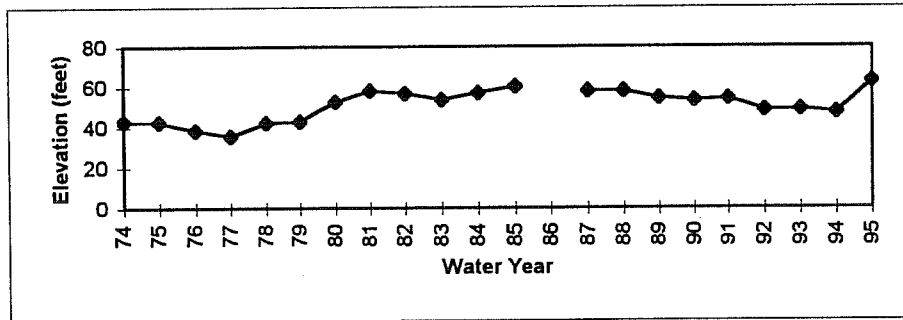


Figure F-2 cont. Santa Maria Groundwater Basin

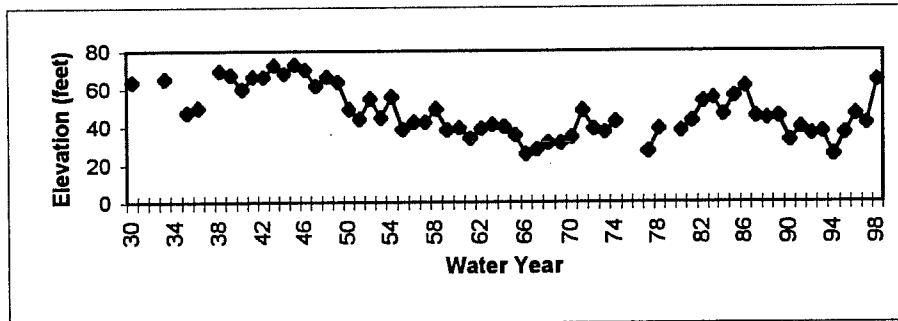
10N/34W-24K01S



10N/35W-06A03S



10N/35W-09F01S



10N/35W-21B01S

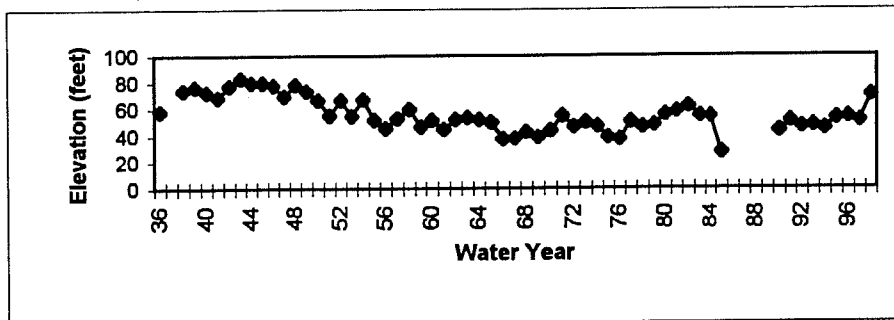
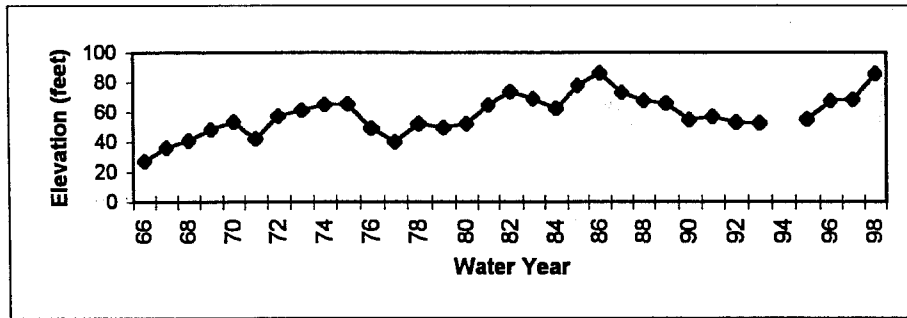
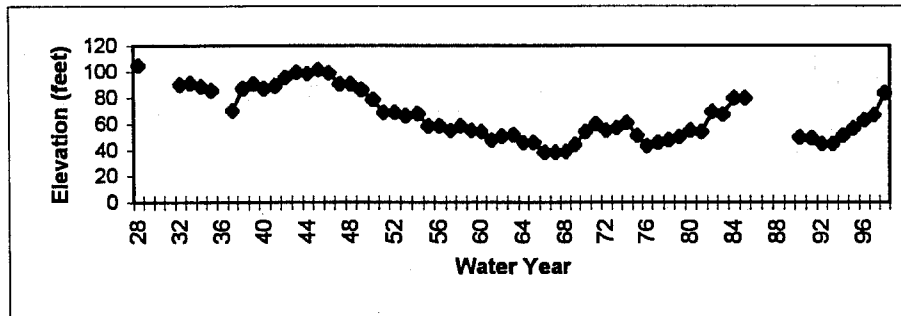


Figure F-2 cont. Santa Maria Groundwater Basin

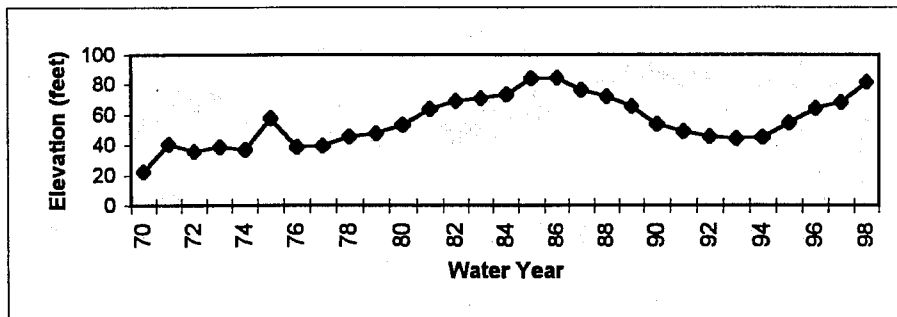
10N/35W-23M02S



10N/35W-24B01S



10N/35W-24Q01S



10N/36W-01H01S

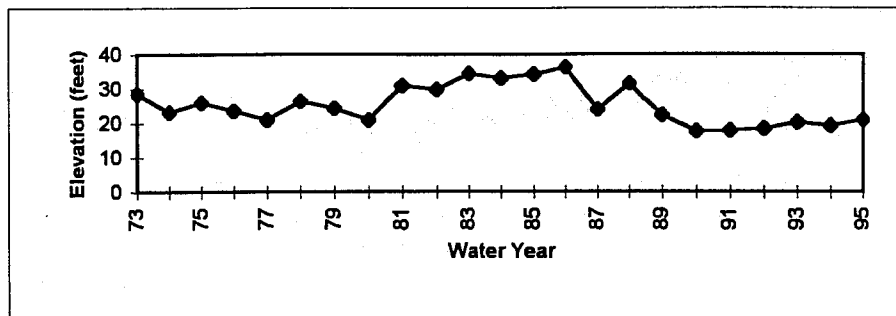
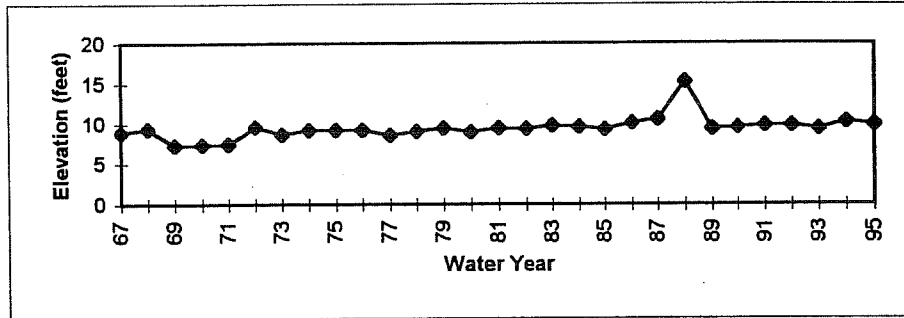
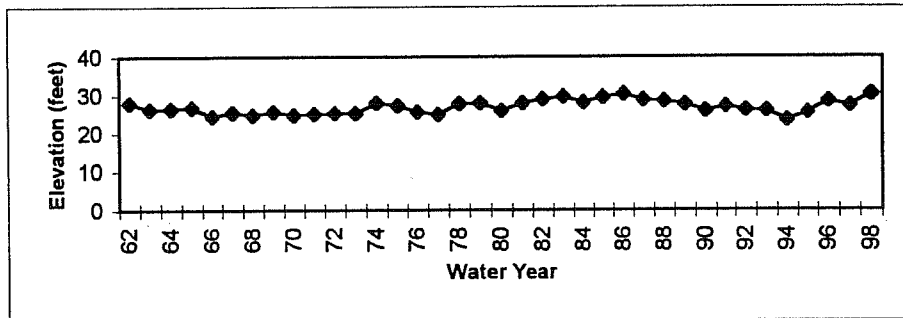


Figure F-2 cont. Santa Maria Groundwater Basin

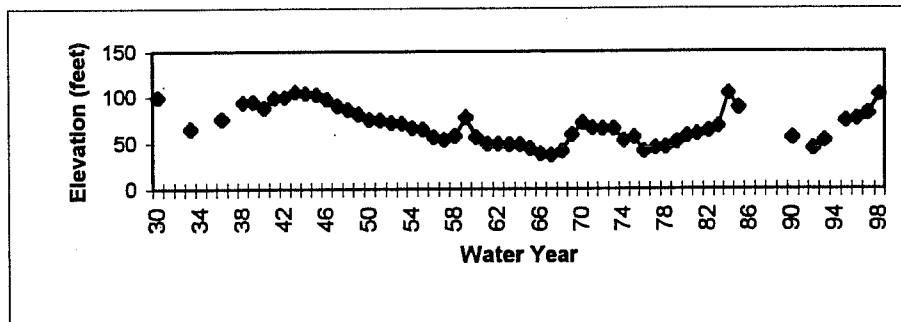
10N/36W-02Q07S



10N/36W-12P01S



11N/34W-30Q01S



11N/35W-20E01S

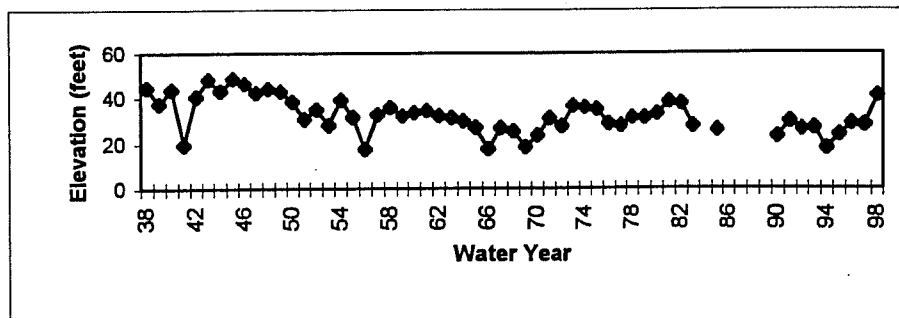
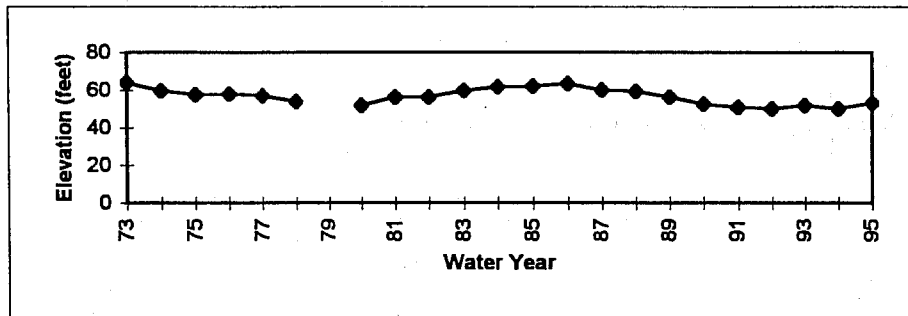
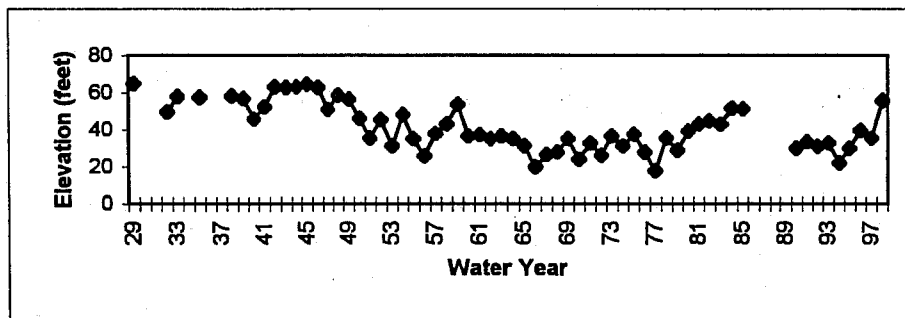


Figure F-2 cont. Santa Maria Groundwater Basin

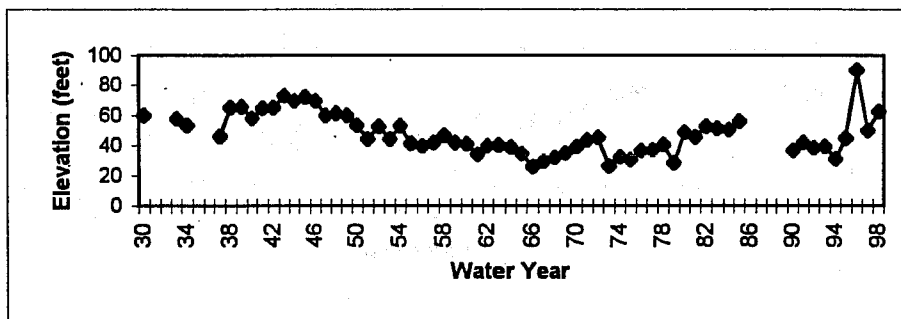
11N/35W-28F02S



11N/35W-28M01S



11N/35W-33G01S



APPENDIX G
LOMPOC PLAIN GROUNDWATER BASIN

FIGURE G-1. LOMPOC PLAIN RAINFALL

Rain gage station: Lompoc Highway Maintenance Yard

Location: T6N, R34W; 34 39' N 120 27' W

Elevation: 98 feet

Mean Annual Rainfall: (1938-1996): 14.48 inches

Hydrologic base period: water years 1982-1994; Mean: 14.41 inches

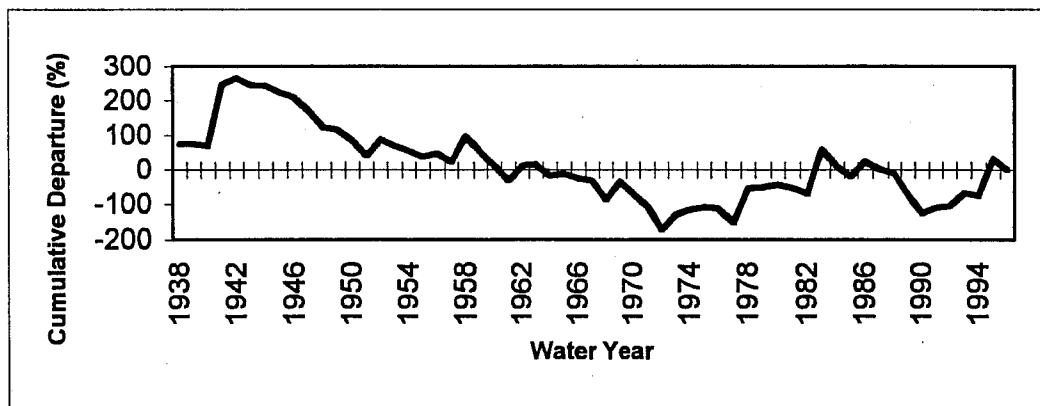
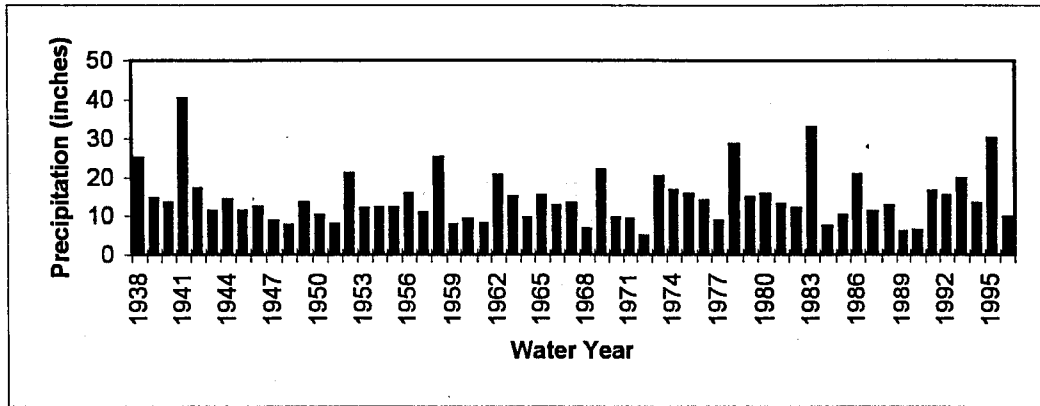


TABLE G-1. SELECTED WELLS SHOWING GROUNDWATER LEVELS IN LOMPOC PLAIN

Well Number	Ave. Annual Change	Well Depth	Upper Perforations	Lower Perforations (All values in feet)	Ground Elevation	Water Level Elevation 1982	Water Level Elevation 1994	Well Use
7N/34W-20K04S	-0.09	186	90	174	75	48.08	47.00	Public Supply
7N/34W-22J06S	-0.10	135			97	52.25	52.00	Irrigation
7N/34W-24N01S	-0.50	183			130	59.23	53.28	Irrigation
7N/34W-26H03S	-0.36	123			113	58.82	54.55	Unused
7N/34W-35K09S	-0.14	128	52	124	98	80.40	78.76	Irrigation
7N/35W-18H01S	-0.11	112	83	88	6	5.15	3.80	Observation
7N/35W-18J02S	0.03	122	100	105	7	4.42	4.78	Observation
7N/35W-23J05S	-0.85	143			43	27.25	17.01	Unused
7N/35W-24J04S	-0.87	171	165	170	52	27.23	16.78	Unused
7N/35W-25F07S	-0.24	30			47	36.51	33.59	Observation
7N/35W-27H01S	0.09	142	80	124	27	12.95	14.00	Irrigation
7N/35W-35A03S	-0.55	100	78	92	46	35.29	28.65	Irrigation

Table G-2. Calculations for Lompoc Plain Basin

AREAL DESIGNATION	AREA (IN ACRES)	SPECIFIC YIELD (%)	ANNUAL CHANGE (IN FEET)	STORAGE (IN ACRE-FEET)
-1A	1201	0.12	-0.25	-34.86
-1B	1639	0.12	-0.25	-47.57
-1C	1820	0.12	-0.25	-52.83
-1D	1441	0.12	-0.25	-41.83
-1E	1440	0.12	-0.25	-41.80
-2A	2081	0.12	-0.75	-181.20
-2B	1681	0.12	-0.75	-146.37
-2C	1281	0.12	-0.75	-111.54
-2D	1877	0.12	-0.75	-163.44
+3A	322	0.12	0.25	9.35
+3B	593	0.12	0.25	17.21

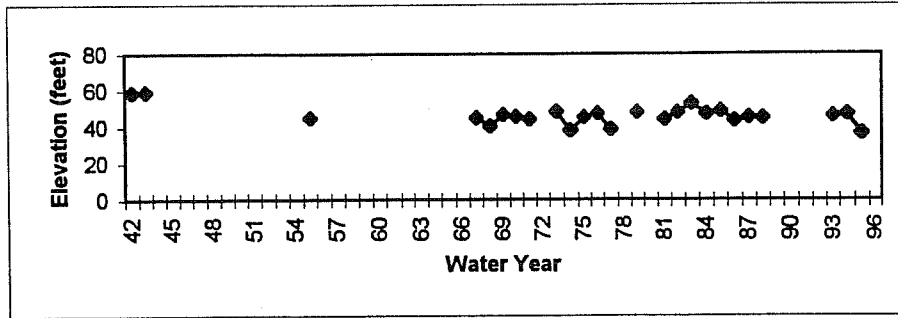
Area = 15,376 ACRES
or 24.03 Sq.Mi.

Overdraft = -795 AFY

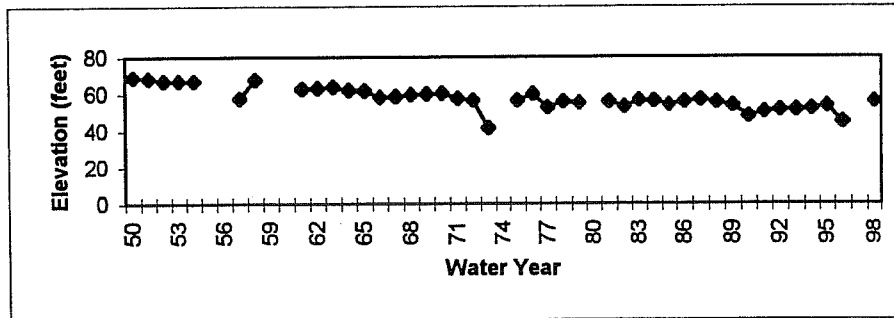
* Areal Designations not shown on Plate 8, but were used to facilitate planimetering basin area

Figure G-2. Lompoc Plain, Lower Santa Ynez River Valley

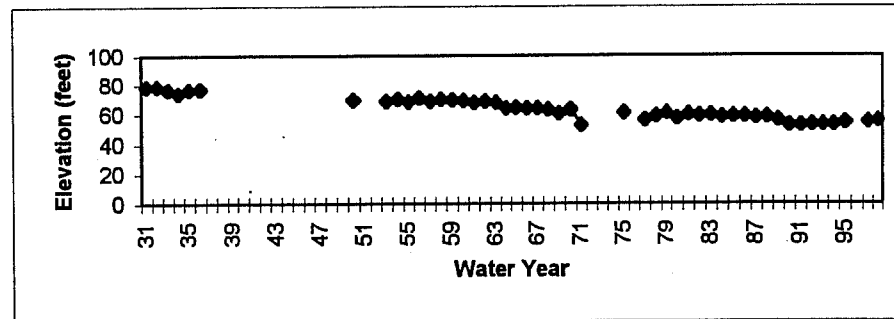
7N/34W-20K04



7N/34W-22J06



7N/34W-24N01



7N/34W-26H03

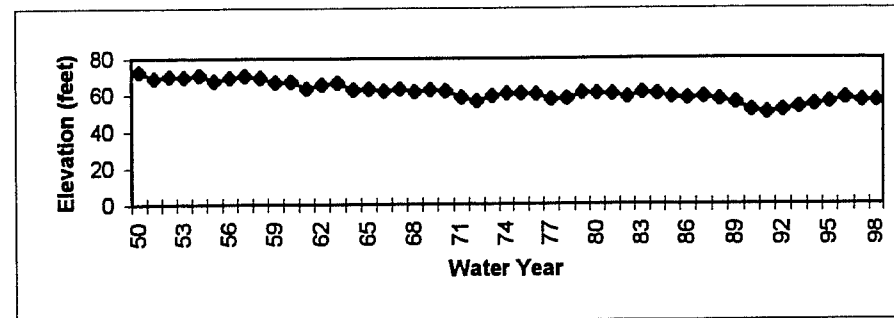
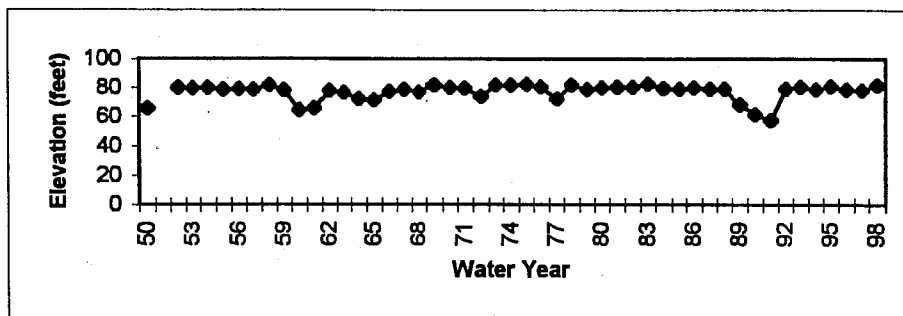
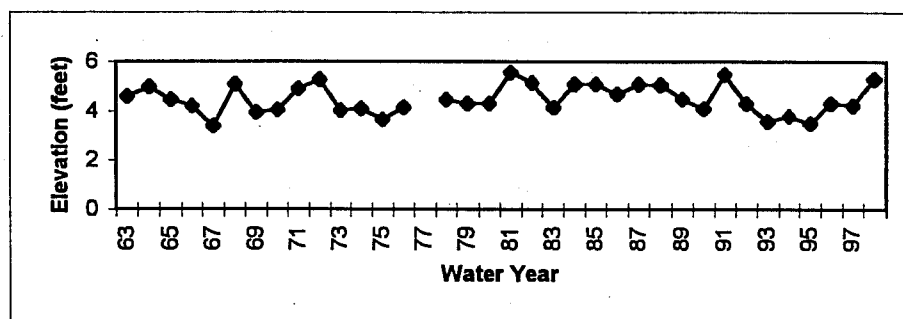


Figure G-2 cont. Lompoc Plain, Lower Santa Ynez River Valley

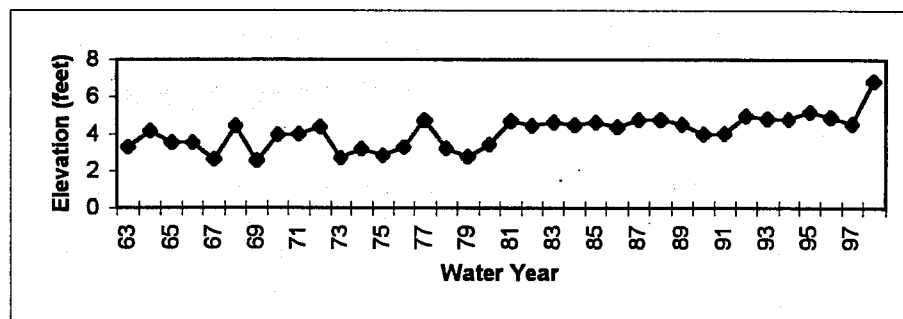
7N/34W-35K09



7N/35W-18H01



7N/35W-18J02



7N/35W-23J05

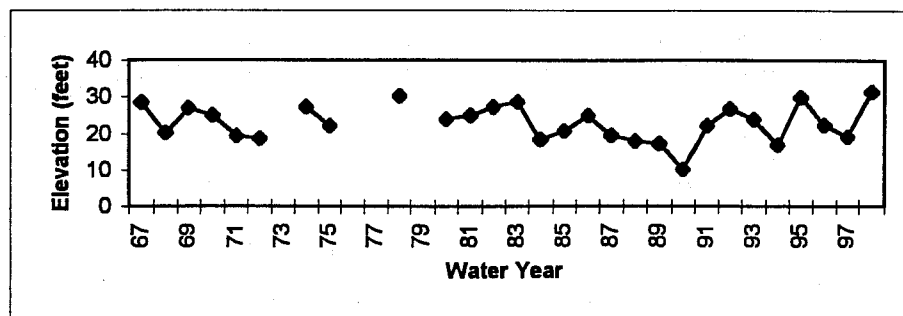
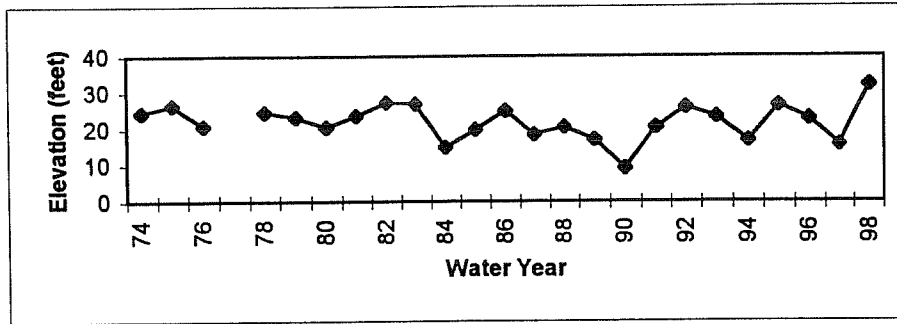
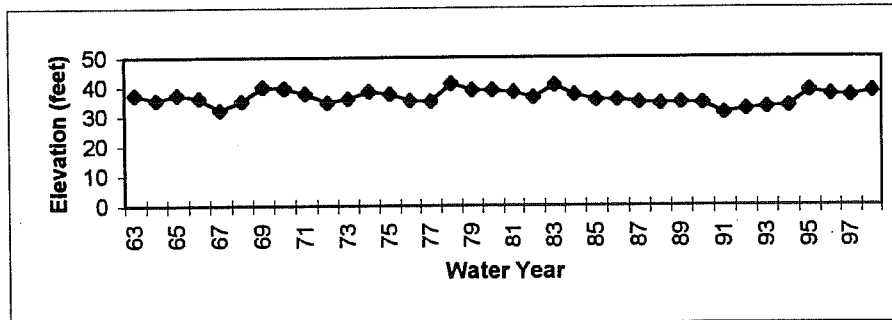


Figure G-2 cont. Lompoc Plain, Lower Santa Ynez River Valley

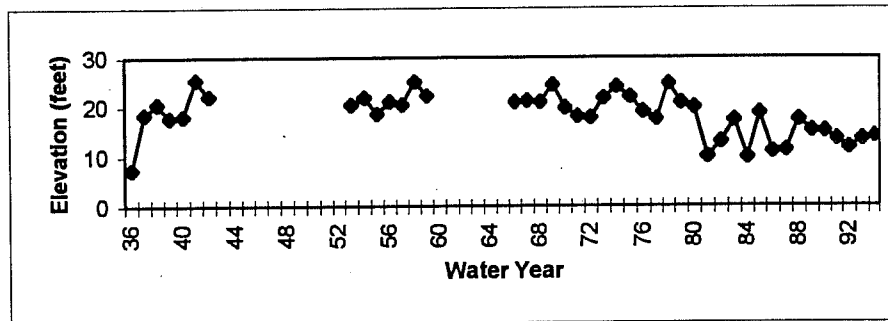
7N/35W-24J04



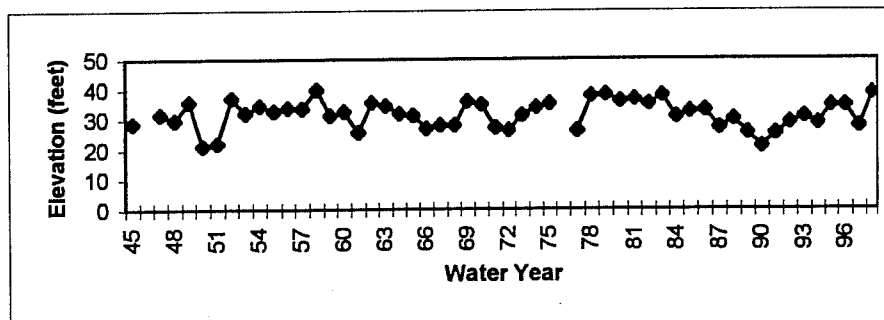
7N/35W-25F07



7N/35W-27H01



7N/35W-35A03



APPENDIX H
PASO ROBLES GROUNDWATER BASIN

FIGURE H-1. PASO ROBLES GROUNDWATER BASIN RAINFALL

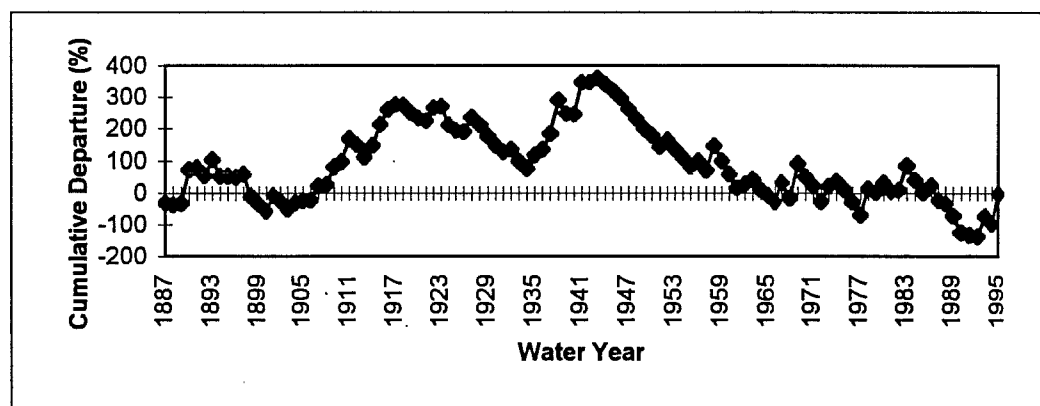
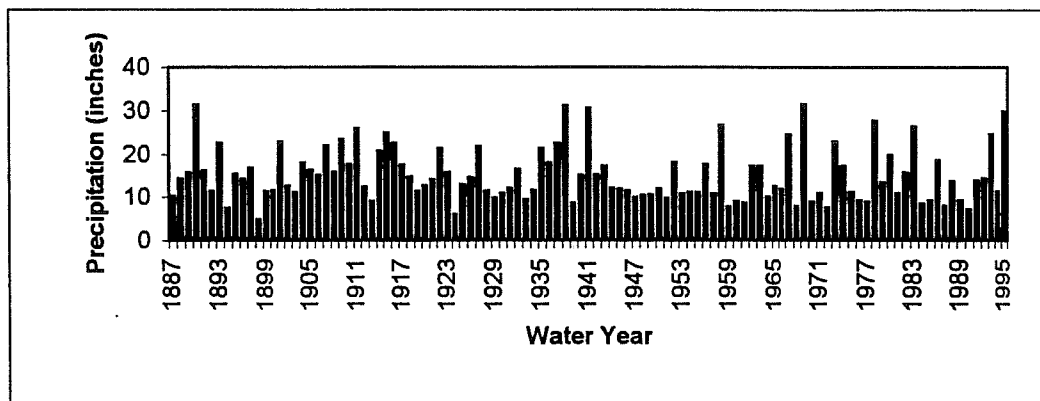
Rain gage station: Paso Robles

Location: T26S, R12E: 35 37' N 120 41' W

Elevation: 699 feet

Mean Annual Rainfall: (1887-1995) 15.20 inches

Hydrologic base period: 1978-1993; Mean: 15.06 inches



**TABLE H-1. SELECTED WELLS SHOWING GROUNDWATER LEVELS
IN THE PASO ROBLES GROUNDWATER BASIN**

Well Number	Ave. Annual Change	Well Depth	Surface Elevation	Water Level Elevation 1978	Water Level Elevation 1993	Well Use
(All values in feet)						
25S/12E-08R02	-0.31	76	591	577.90	573.20	Domestic
25S/12E-28N01	-0.49	49	639	628.50	629.90	Irrigation
25S/12E-32K01	0.66	120	681	611.00	620.90	Domestic
26S/12E-21L01	-0.11	72	660	650.00	648.30	Domestic
26S/12E-33Q04	-0.63	76	690	685.00	675.50	Municipal
27S/12E-21C01	1.33	55	741	732.80	752.70	Irrigation
27S/12E-21N04	-0.29	37	740	734.80	730.40	Irrigation
27S/12E-29P04	-0.10	124	756	745.20	743.70	Municipal
27S/12E-32C07	-0.06	45	761	750.50	749.60	Domestic
28S/12E-04J02	-0.13	86	795	785.33	783.33	Irrigation
28S/12E-11N06	-1.04	90	825	814.99	799.39	Municipal
28S/12E-14B04	-0.37	80	841	824.30	818.80	Irrigation
28S/12E-14K01	-0.22	64	840	823.40	820.10	Municipal
28S/13E-31R02	-0.05	60	894	882.90	882.20	Irrigation
29S/13E-05F03	0.18	40	916	903.30	906.10	Municipal
29S/13E-08N05	-0.08	87	960	958.10	956.90	Domestic
29S/13E-19H02	1.05	49	1002	980.60	997.70	Municipal

Table H-2. Calculations for Paso Robles Water Table Aquifer

AREAL DESIGNATION**	AREA (IN ACRES)	SPECIFIC YIELD (%)	ANNUAL CHANGE (IN FEET)	STORAGE (IN ACRE-FEET)
+SM1A	176	0.14	1.25	30.80
+SM2A	162	0.14	0.75	17.01
+SM3A	328	0.14	0.25	11.48
+SM3B	442	0.14	0.25	15.47
-SM1A	121	0.14	-0.25	-4.24
-SM2A	11	0.14	-0.25	-0.39
-ATS1A	4	0.14	-1.25	-0.70
-ATS2A	16	0.14	-0.75	-1.68
-ATS3A	202	0.14	-0.25	-7.07
+TPL1A	55	0.14	1.25	9.63
+TPL2A	92	0.14	0.75	9.66
+TPL3A	247	0.14	0.25	8.65
-TPL1A	45	0.14	-1.25	-7.88
-TPL2A	97	0.14	-0.75	-10.19
-TPL3A	410	0.14	-0.25	-14.35
-TPL3B	10	0.14	-0.25	-0.35
-TPL4A	393	0.14	-0.25	-13.76
-TPL5A	151	0.14	-0.75	-15.86
-TPL6A	166	0.14	-0.25	-5.81
+PR1A	66	0.14	0.75	6.93
+PR2A	97	0.14	0.25	3.40
-PR1A	62	0.14	-0.75	-6.51
-PR2A	104	0.14	-0.25	-3.64
-PR2B	176	0.14	-0.25	-6.16
-PR3A	300	0.14	-0.25	-10.50
-MG1A	191	0.14	-0.25	-6.69
Area =	4,124 Acres or 6 Sq. Mi.		Overdraft =	-2.73 AFY

** Areal Designations not shown on Plate 9, but were used to facilitate planimetering basin area

Table H-3. Calculations for Paso Robles Water Table Aquifer

AREAL DESIGNATION**	AREA (IN ACRES)	SPECIFIC YIELD (%)	ANNUAL CHANGE (IN FEET)	STORAGE (IN ACRE-FEET)
+2SM1A*	176	0.14	1.25	30.80
+2SM2A*	162	0.14	0.75	17.01
+2SM3A	297	0.14	0.25	10.40
+2SM4A	228	0.14	0.25	7.98
-2SM1A	246	0.14	-0.25	-8.61
-2SM2A*	11	0.14	-0.25	-0.39
-2ATS1A*	4	0.14	-1.25	-0.70
-2ATS2A	25	0.14	-0.75	-2.63
-2ATS3A	342	0.14	-0.25	-11.97
+2TPL1A	110	0.14	1.25	19.25
+2TPL2A	156	0.14	0.75	16.38
+2TPL3A	367	0.14	0.25	12.85
-2TPL1A	54	0.14	-1.25	-9.45
-2TPL2A	144	0.14	-0.75	-15.12
-2TPL3A	529	0.14	-0.25	-18.52
-2TPL3B*	10	0.14	-0.25	-0.35
-2TPL4A	520	0.14	-0.25	-18.20
-2TPL5A	203	0.14	-0.75	-21.32
-2TPL6A	264	0.14	-0.25	-9.24
+2PR1A*	66	0.14	0.75	6.93
+2PR2A*	97	0.14	0.25	3.40
-2PR1A*	62	0.14	-0.75	-6.51
-2PR2A	598	0.14	-0.25	-20.93
-2PR3A	677	0.14	-0.25	-23.70
-2MG1A	478	0.14	-0.25	-16.73

Area = 5,826 acres
or 9.1 Sq. Mi.

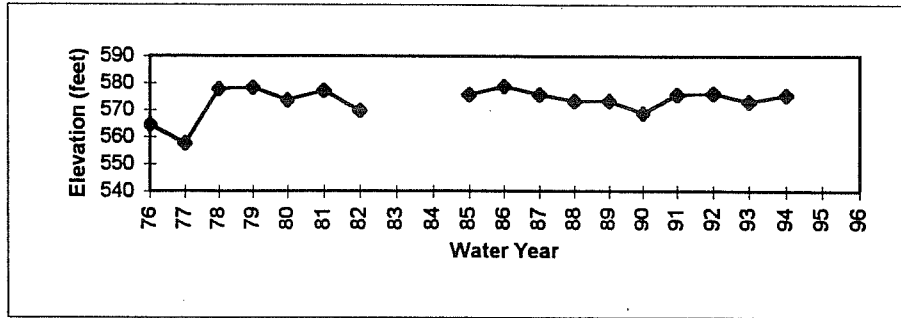
Overdraft = -59.36 AFY

* Indicates contour value remained unchanged from Table H-2.

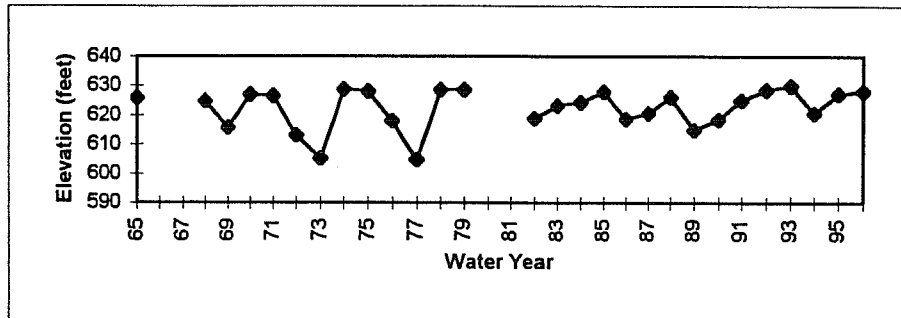
** Areal Designations not shown on Plate 9, but were used to facilitate planimetering basin area

Figure H-2. Paso Robles Groundwater Basin

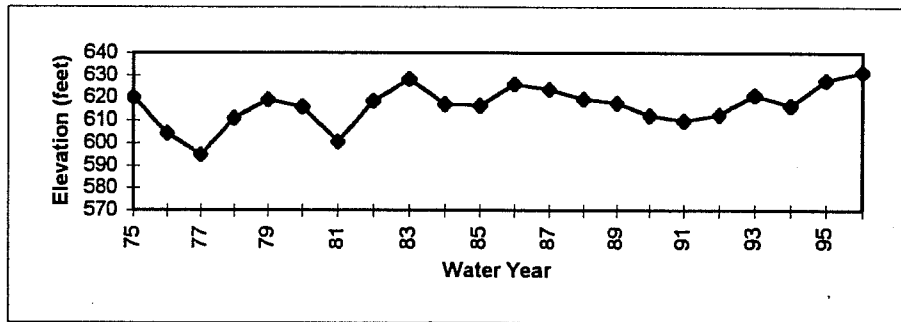
25S/12E-08R02



25S/12E-28N01



25S/12E-32K01



26S/12E-21L01

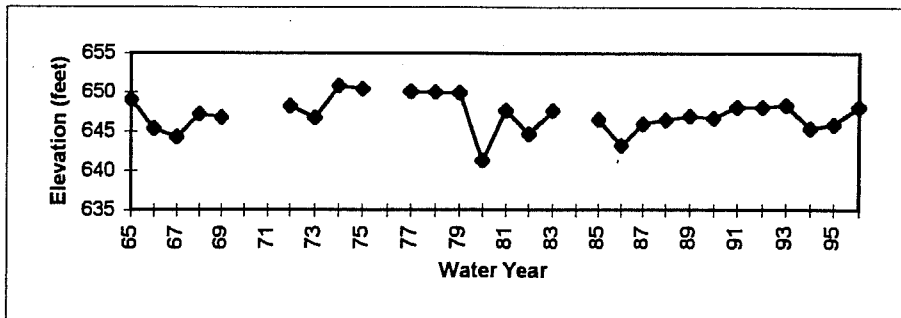
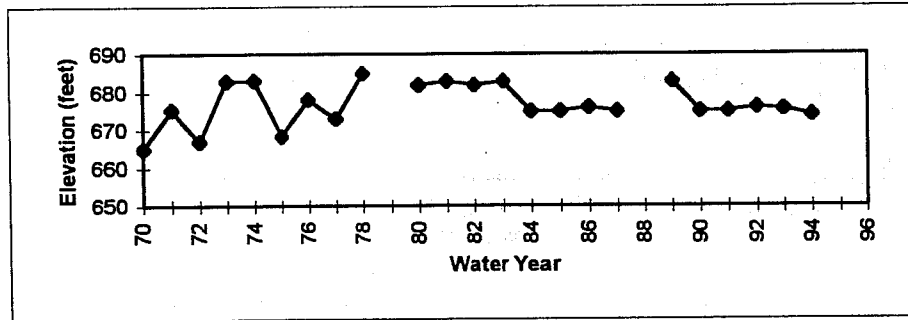
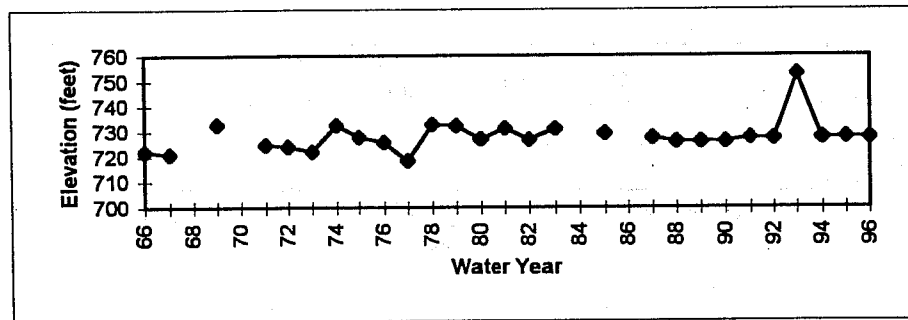


Figure H-2 cont. Paso Robles Groundwater Basin

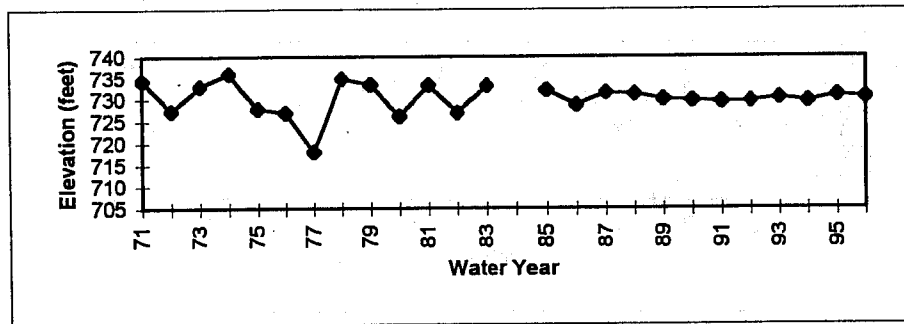
26S/12E-33Q04



27S/12E-21C01



27S/12E-21N04



27S/12E-29P04

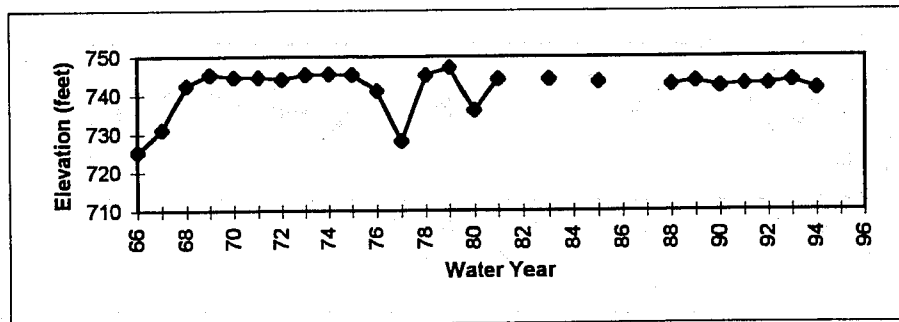
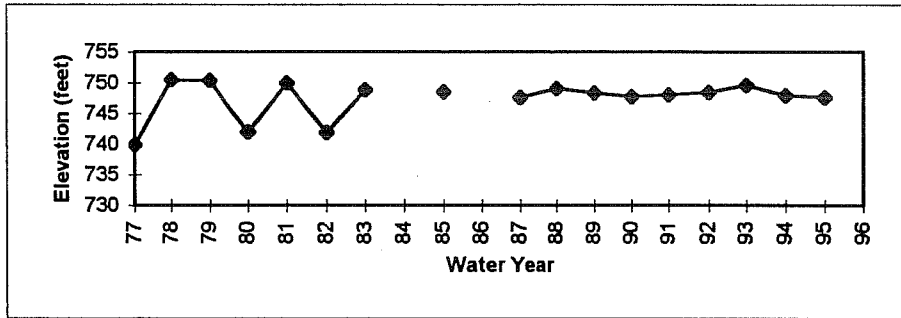
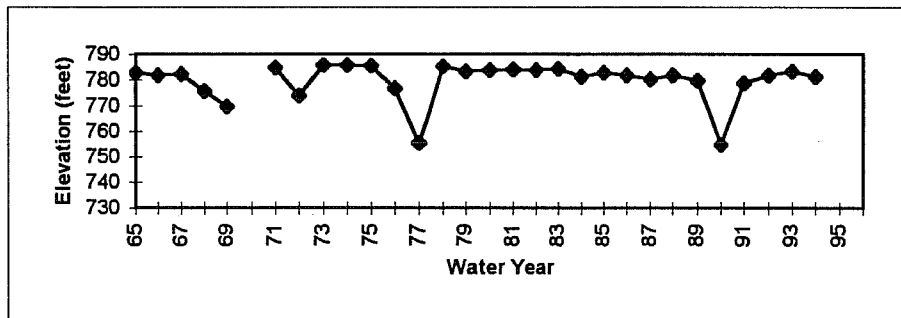


Figure H-2 cont. Paso Robles Groundwater Basin

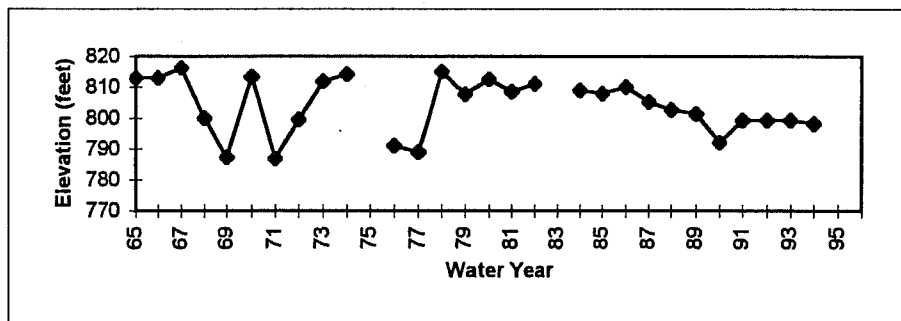
27S/12E-32C07



28S/12E-04J02



28S/12E-11N06



28S/12E-14B04

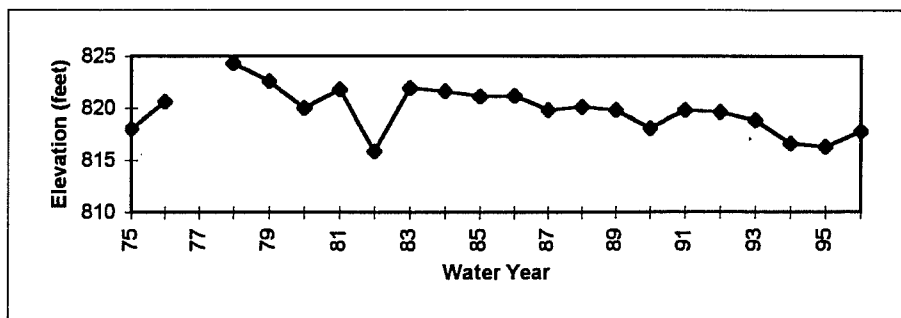
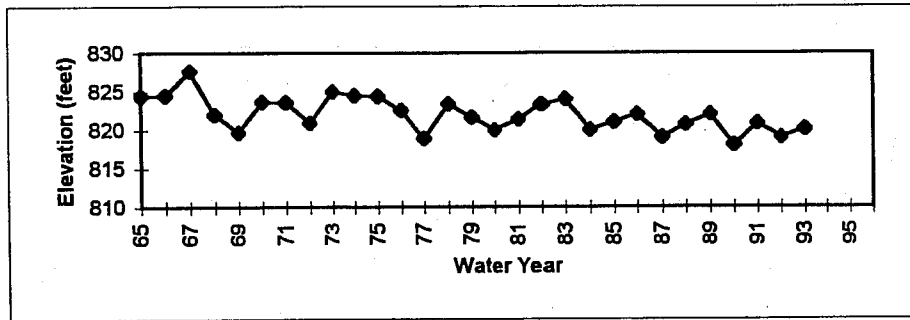
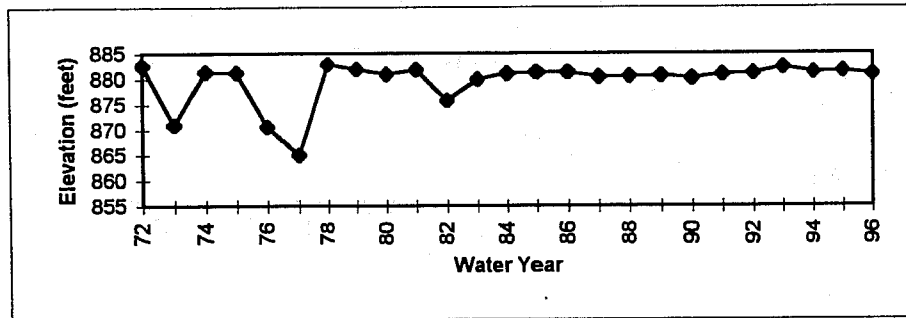


Figure H-2 cont. Paso Robles Groundwater Basin

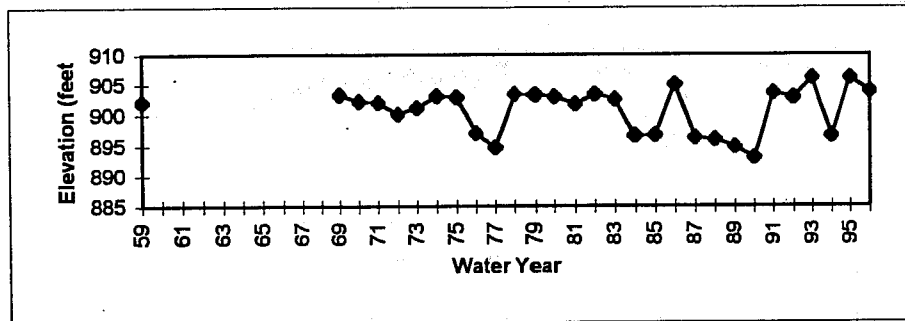
28S/12E-14K01



28S/13E-31R02



29S/13E-05F03



29S/13E-08N05

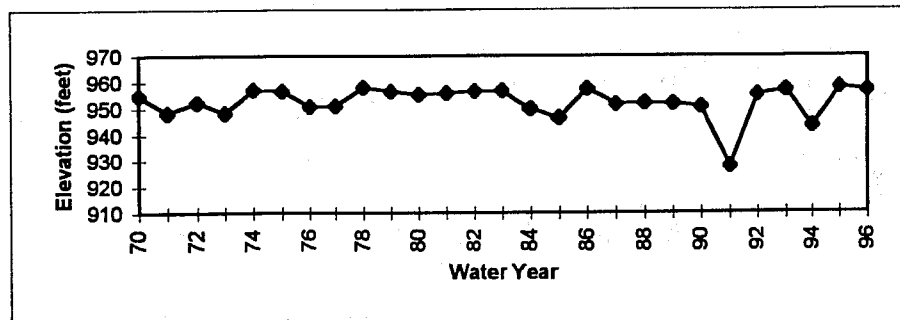
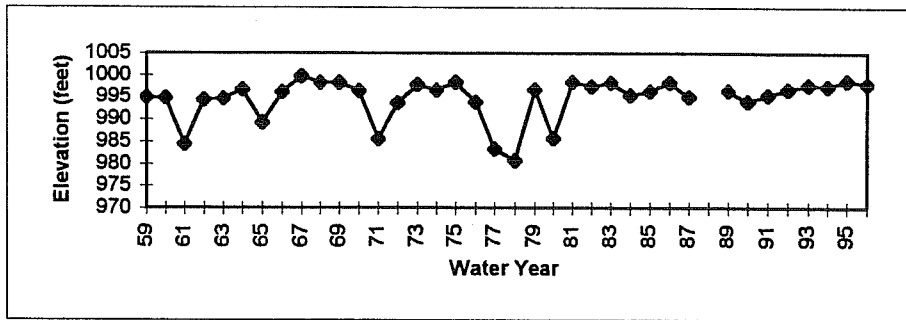
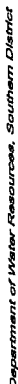


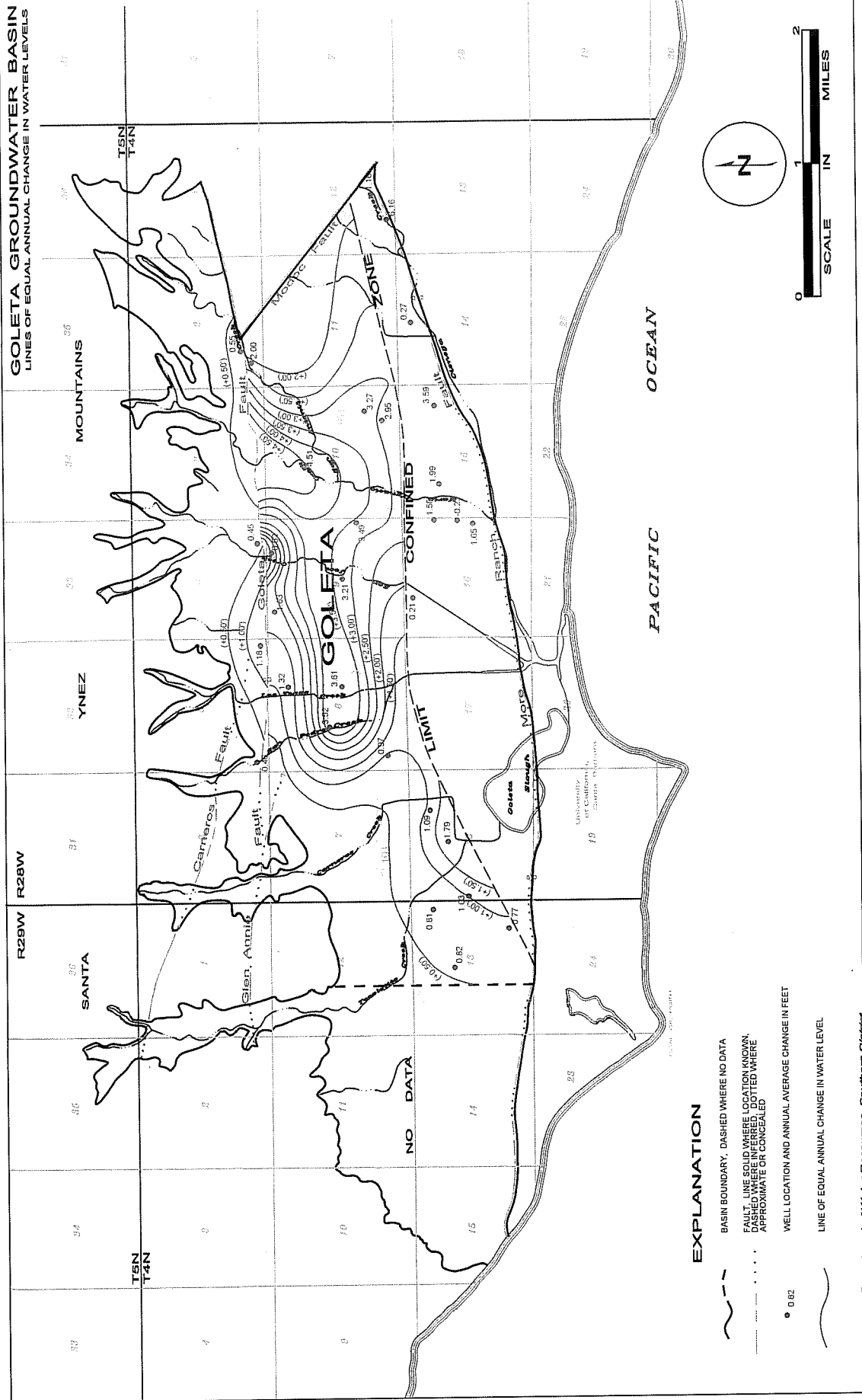
Figure H-2 cont. Paso Robles Groundwater Basin

29S/13E-19H02





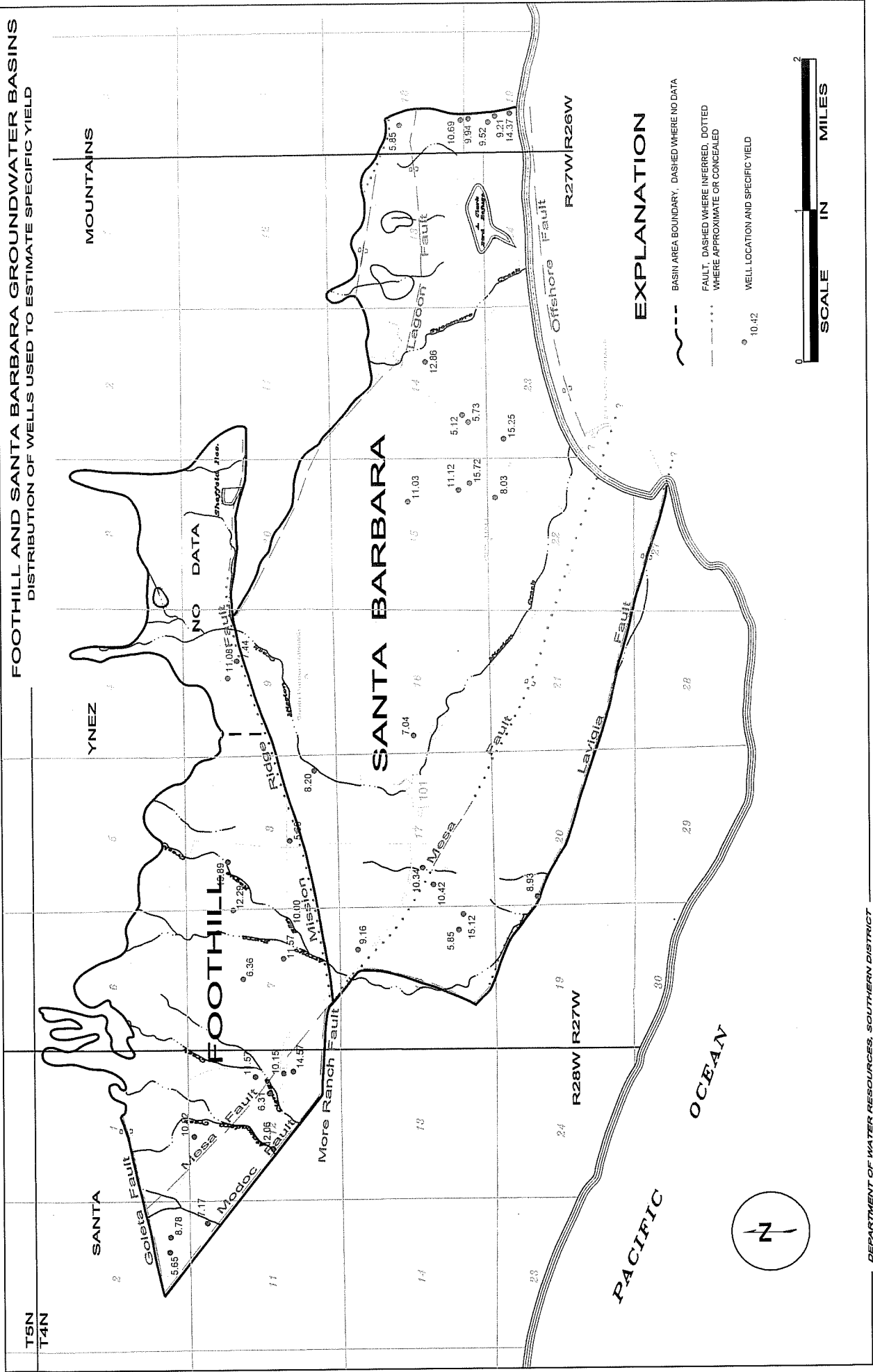
GOLETA GROUNDWATER BASIN LINES OF EQUAL ANNUAL CHANGE IN WATER LEVELS



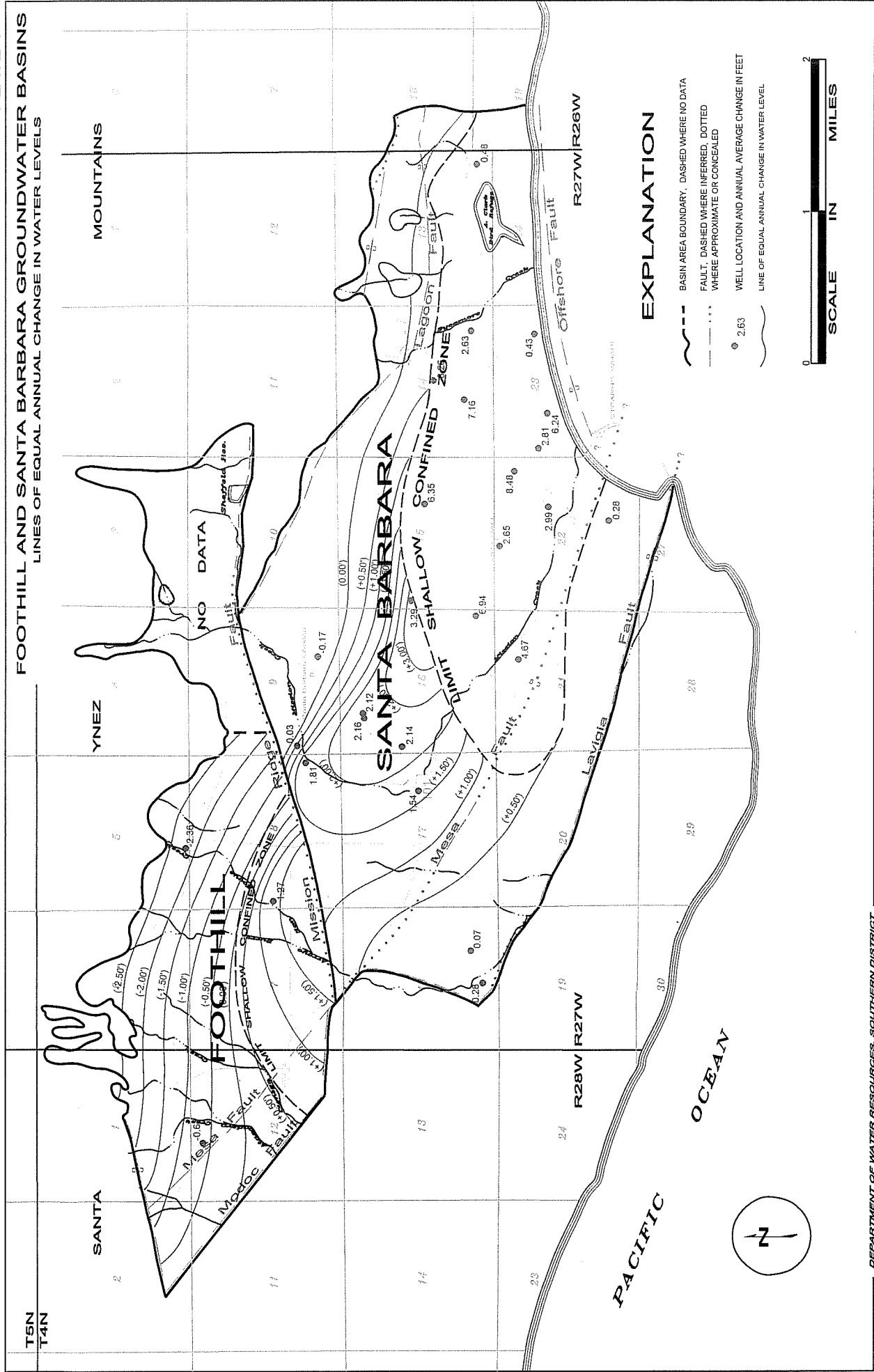
EXPLANATION

- BASIN BOUNDARY, DASHED WHERE NO DATA
- FAULT, LINE SOLID WHERE LOCATION KNOWN, DASHED WHERE INFERRED, DOTTED WHERE APPROXIMATE OR CONCEALED
- 0.82 WELL LOCATION AND ANNUAL AVERAGE CHANGE IN FEET
- LINE OF EQUAL ANNUAL CHANGE IN WATER LEVEL

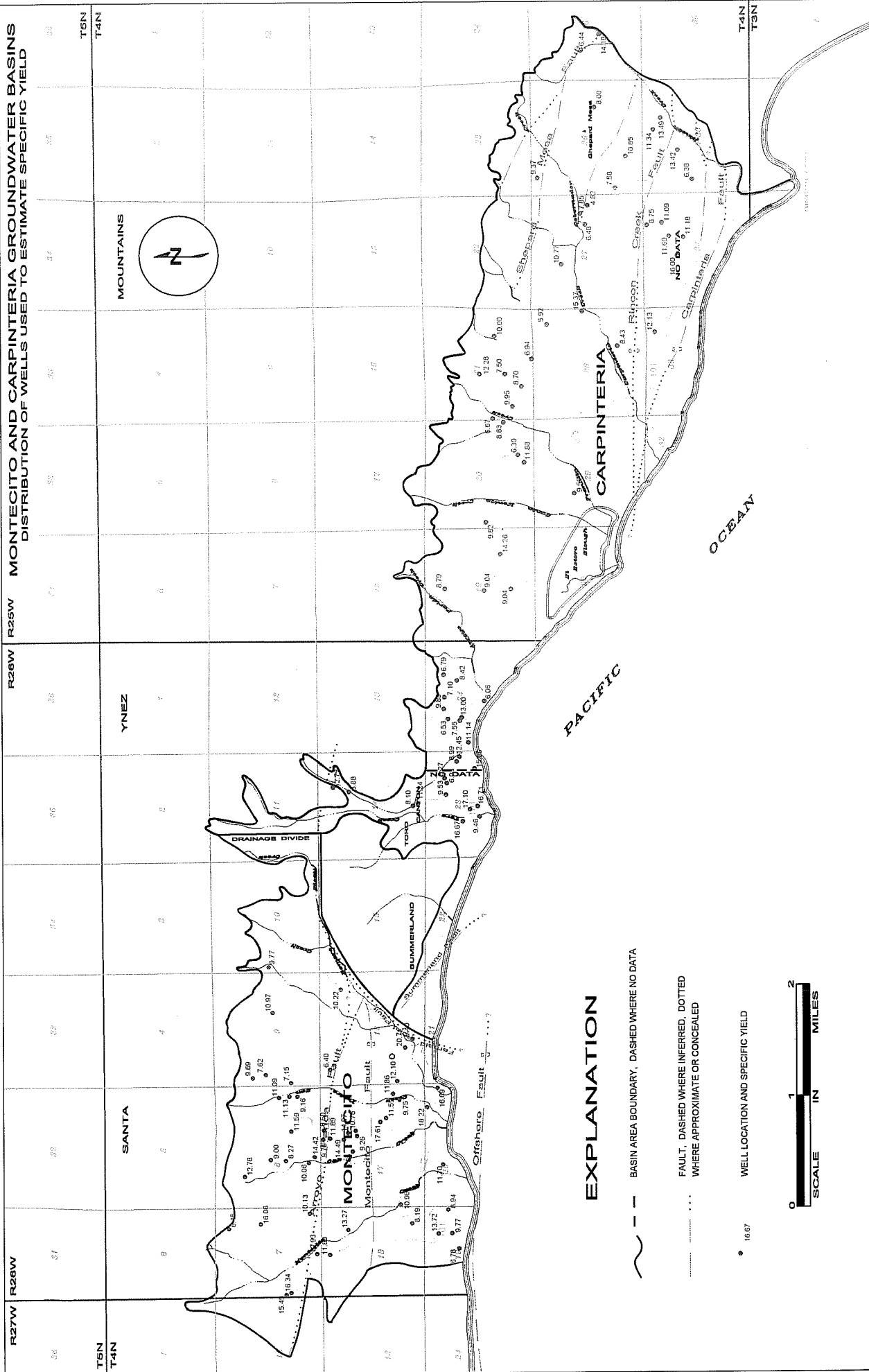
FOOTHILL AND SANTA BARBARA GROUNDWATER BASINS
DISTRIBUTION OF WELLS USED TO ESTIMATE SPECIFIC YIELD



FOOTHILL AND SANTA BARBARA GROUNDWATER BASINS
LINES OF EQUAL ANNUAL CHANGE IN WATER LEVELS



MONTECITO AND CARPINTERIA GROUNDWATER BASINS
DISTRIBUTION OF WELLS USED TO ESTIMATE SPECIFIC YIELD

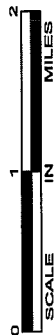


EXPLANATION

--- BASIN AREA BOUNDARY, DASHED WHERE NO DATA

..... FAULT, DASHED WHERE INFERRED, DOTTED WHERE APPROXIMATE OR CONCEALED

• 16.67 WELL LOCATION AND SPECIFIC YIELD



MONTECITO AND CARPINTERIA GROUNDWATER BASINS
LINES OF EQUAL CHANGE IN WATER LEVELS

R26W

R25W

R26W

R27W

R28W

TSN
T4N

MOUNTAINS

YNEZ

SANTA

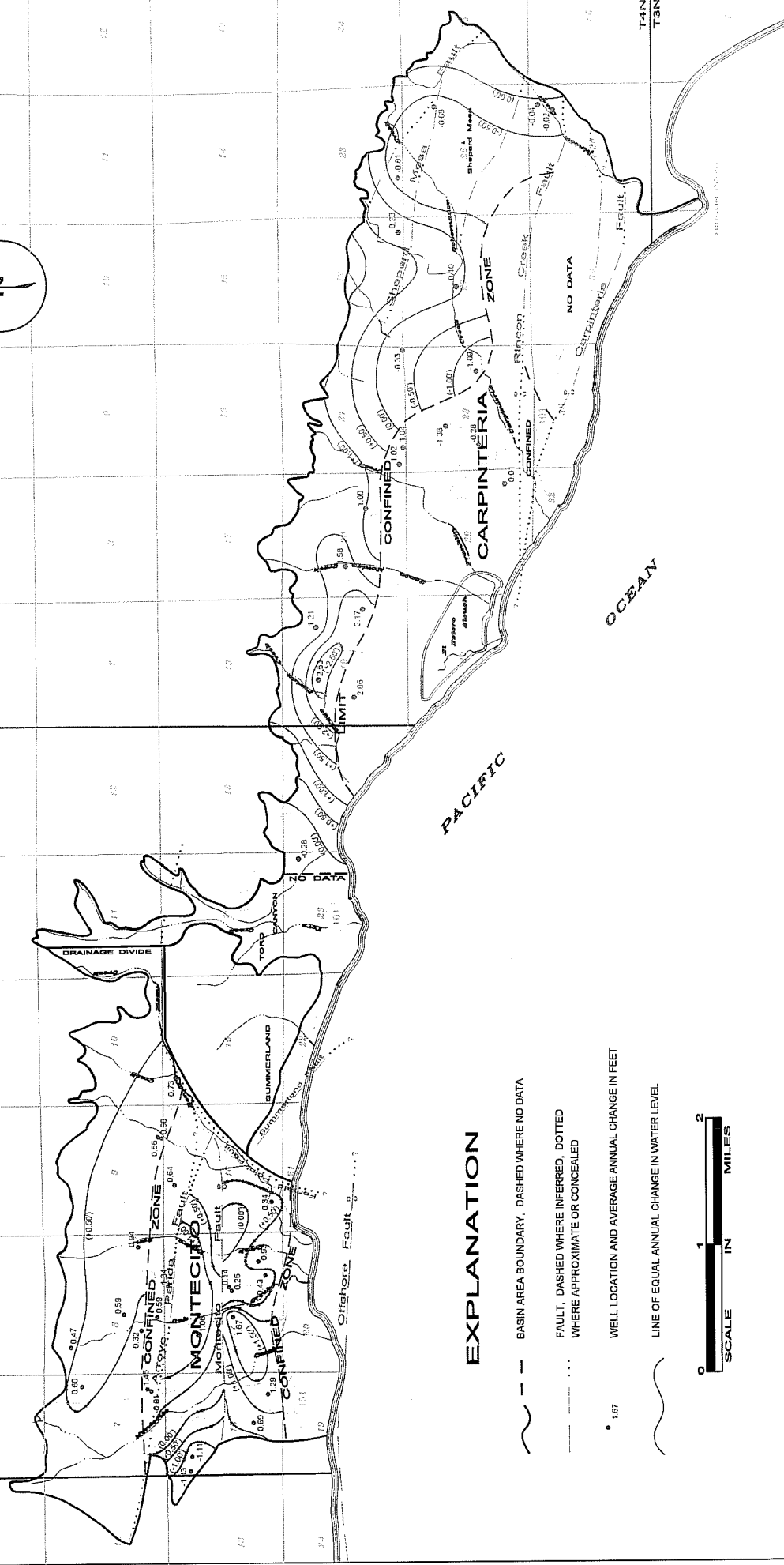
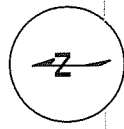
MONTECITO

CARPINTERIA

PACIFIC

OCEAN

TSN
T3N

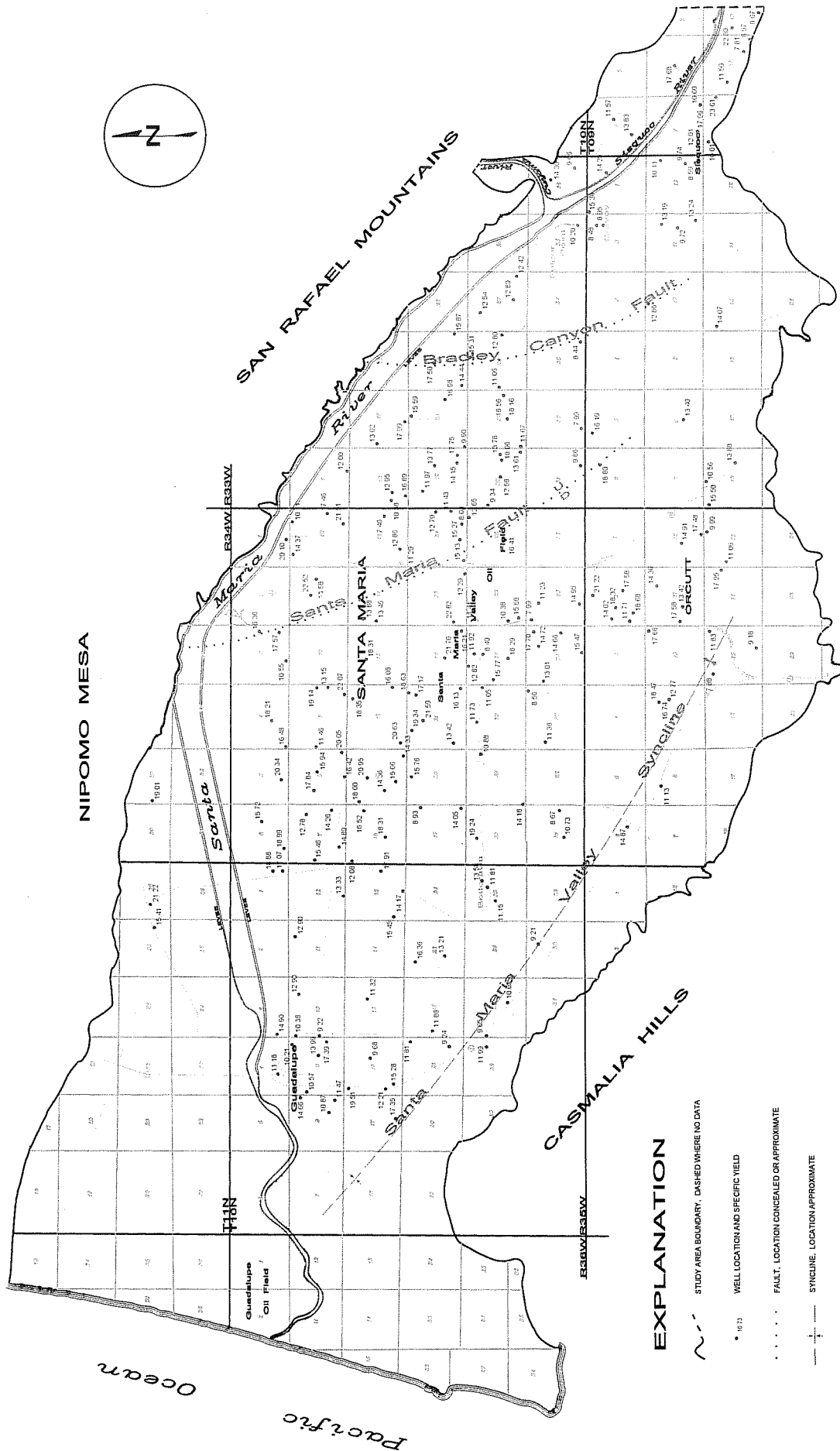


EXPLANATION

- BASIN AREA BOUNDARY, DASHED WHERE NO DATA
- ... FAULT, DASHED WHERE INFERRED, DOTTED WHERE APPROXIMATE OR CONCEALED
- 167 WELL LOCATION AND AVERAGE ANNUAL CHANGE IN FEET
- LINE OF EQUAL ANNUAL CHANGE IN WATER LEVEL



SANTA MARIA VALLEY
DISTRIBUTION OF WELLS USED
TO ESTIMATE SPECIFIC YIELD



EXPLANATION

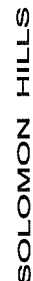
STUDY AREA BOUNDARY, DASHED WHERE NO DATA

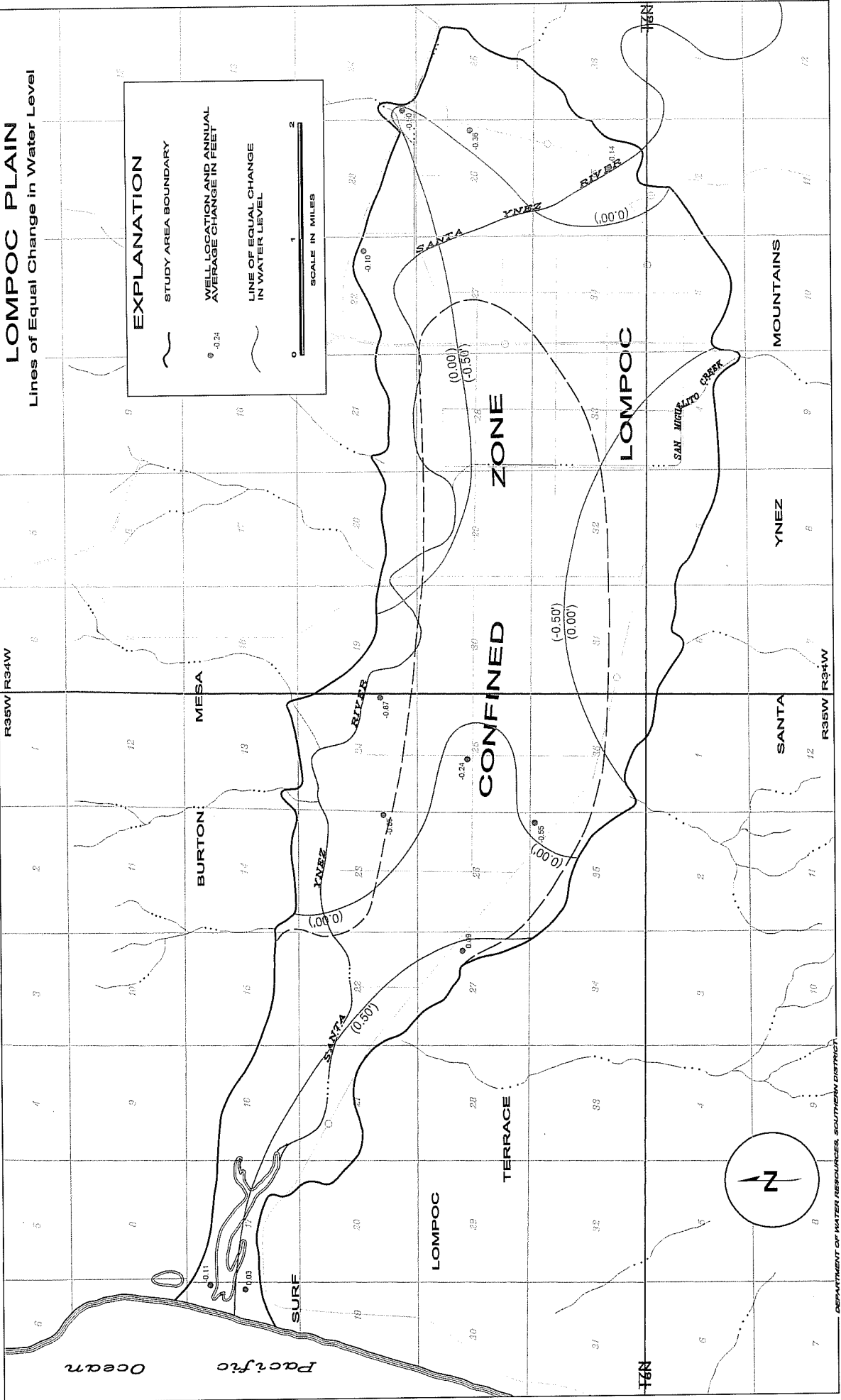
WELL LOCATION AND SPECIFIC YIELD

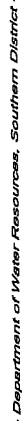
FAULT, LOCATION CONCEALED OR APPROXIMATE

SYNCLINE, LOCATION APPROXIMATE

SCALE IN MILES
0 1 2 3







**SALINAS RIVER CORRIDOR
SAN MIGUEL AREA**
LINES OF EQUAL ANNUAL CHANGE

