IV. HYDROLOGY

As has been pointed out in the preceding chapter, water supply used in the study area comes primarily from the Santa Maria Groundwater Basin and Lopez Reservoir. Both receive replenishment from precipitation, as do the Santa Maria River and many creeks in the area.

Many of the precipitation and stream gaging stations used for analysis in the study area do not have a long-term record, a continuous record, or both. Data for some of the gaging stations were missing for a number of days, months, or years. Measurements at some stations were discontinued, leaving data gaps.

Precipitation

Because both surface and groundwater are derived from rainfall, the amount of rain falling within the watershed in a given year is an indicator of the amount of water that will be available for use that year. From an analysis of long-term precipitation for the study area, a recent short-term base period can be chosen as representative of the long-term average precipitation. Therefore, analysis of historical information is required.

Data from 36 precipitation stations were supplied by the Counties of San Luis Obispo and Santa Barbara. These are included in Appendix B. The data, extending from calendar year 1869 through calendar year 1995, were arranged into a water year format. Data for water years 1996 through 2000 were also arranged into a water year format and are included in Appendix B, but they were not used in the hydrologic analysis for the base period. The stations extend from California State Polytechnic University in San Luis Obispo County to Betteravia Union Sugar Company[1] in Santa Barbara County. The elevations of the stations range from 10 feet above mean sea level (msl) at the wastewater plant in Oceano to 745 feet at the Bettencourt station. Plate 7 shows the locations of the 36 stations, and Table 14 lists the data point number, gage number, station name, and long-term precipitation for each station.

Mean annual (water year) precipitation for the 36 stations ranges from 12 to 35 inches, usually in the form of rain, about 75 percent falling between December and March. The smallest recorded annual rainfall, 3.49 inches, fell in 1948 at the Puritan Ice Company in Guadalupe. The greatest recorded annual rainfall, 71.03 inches, fell in 1983 at the Bettencourt station in Lopez Canyon.

[1]California State Polytechnic University is in Township 30 South, Range 12 East, Section 23D, Mount Diablo Base and Meridian, and Betteravia Union Sugar Company is in Township 10 North, Range 35 West, Section 24, San Bernardino Base and Meridian.

TABLE 14
PRECIPITATION STATIONS

Data Point Number	Gage Number	Station Name	Long-Term Average Precipitation to 1995, Inches
1	1.0	California State Polytechnic University	22.00
2	23.0	Suey Ranch	15.01
3	38.0	Nipomo 2NW	16.29
4	42.1	Runels Ranch	16.09
5	51.0	Huasna Valley	19.06
6	54.0	Union Oil Company, San Luis Obispo	19.98
7	55.0	Union Oil Company, Avila Beach	17.61
8	85.0	County Yard, Arroyo Grande	15.98
9	87.0	Police Department, Arroyo Grande	15.17
10	100.0	Ranchita Ranch	22.24
11	126.0	Police Department, Pismo Beach	16.12
12	127.1	Spencer Ranch	22.97
13	129.0	Perozzi Ranch	21.87
14	141.1	A.B. Cunningham	19.60
15	145.1	Wastewater Plant, San Luis Obispo	22.20
16	147.0	Bates Plumbing	16.41
17	151.1	Nipomo CDF	15.08
18	153.0	Bettencourt	35.41
19	157.1	CSA No 13, Oceano	15.84
20	175.1	Penny Ranch	19.00
21	177.1	Corporate Yard, Arroyo Grande	15.41
22	178.1	Lopez Dam, Lopez Reservoir	20.04
23	178.2	Tar Spring, USGS	15.58
24	179.1	Water Treatment Plant, Lopez Ter. Res.	16.84
25	193.0	Wastewater Plant, Lopez Lake	21.78
26	194.0	Wastewater Plant, Oceano	16.90
27	195.1	Police Department, Arroyo Grande	14.63
28	200.0	M. Bolding - Printz Road	18.17
29	205.0	County Yard, Arroyo Grande	14.47
30	205.2	Holzingers Cow Camp	18.28
31	BET387	Betteravia Union Sugar Company	13.42
32	PUR352	Puritan Ice Company	12.38
33	SMC380	Santa Maria City	13.41
34	SMH400	Santa Maria State Hwy. Maintenance Yard	13.59
35	UBA410	Union Oil Battles Plant, Santa Maria	12.74
36	UGO407	Union Oil Company, Guadalupe	13.71

Plate 8 shows lines of equal mean annual precipitation in and around the study area for water years 1870 through 1995. The isohyets were constructed using only those stations shown on Plate 8. The criteria for selection were length of record, consistency of data, accuracy of data, and proximity to the study area.

Annual precipitation and long-term mean precipitation for the period of record through water year 2000 for stations California State Polytechnic University at San Luis Obispo, Nipomo 2NW, and City of Santa Maria are shown in Figures 7-9, respectively. Because of the wet water year 1998, the long-term mean for the period of record through water year 2000 increased about 0.2 to 0.4 inch from the long-term mean for the period of record through water year 1995 at these stations. Similar increases were also seen at other stations (Appendix B).

Figure 10 shows the results of double mass analysis for the average of the stations at California State Polytechnic University and Santa Maria versus the Nipomo 2NW station. The relative linearity of the figure shows that the data for the Nipomo 2NW station are consistent. The station is located near the geometric center of the study area in Nipomo Valley and has a long-term continuous record.

From the data for the Nipomo 2NW station, water years 1984 through 1995 were selected as the base hydrologic period for this study. (See Appendix B for a detailed determination of the base hydrologic period.)

Precipitation data for Nipomo Mesa are lacking and installation of a station near Highway 1 and Willow Road could prove useful.

Surface Water

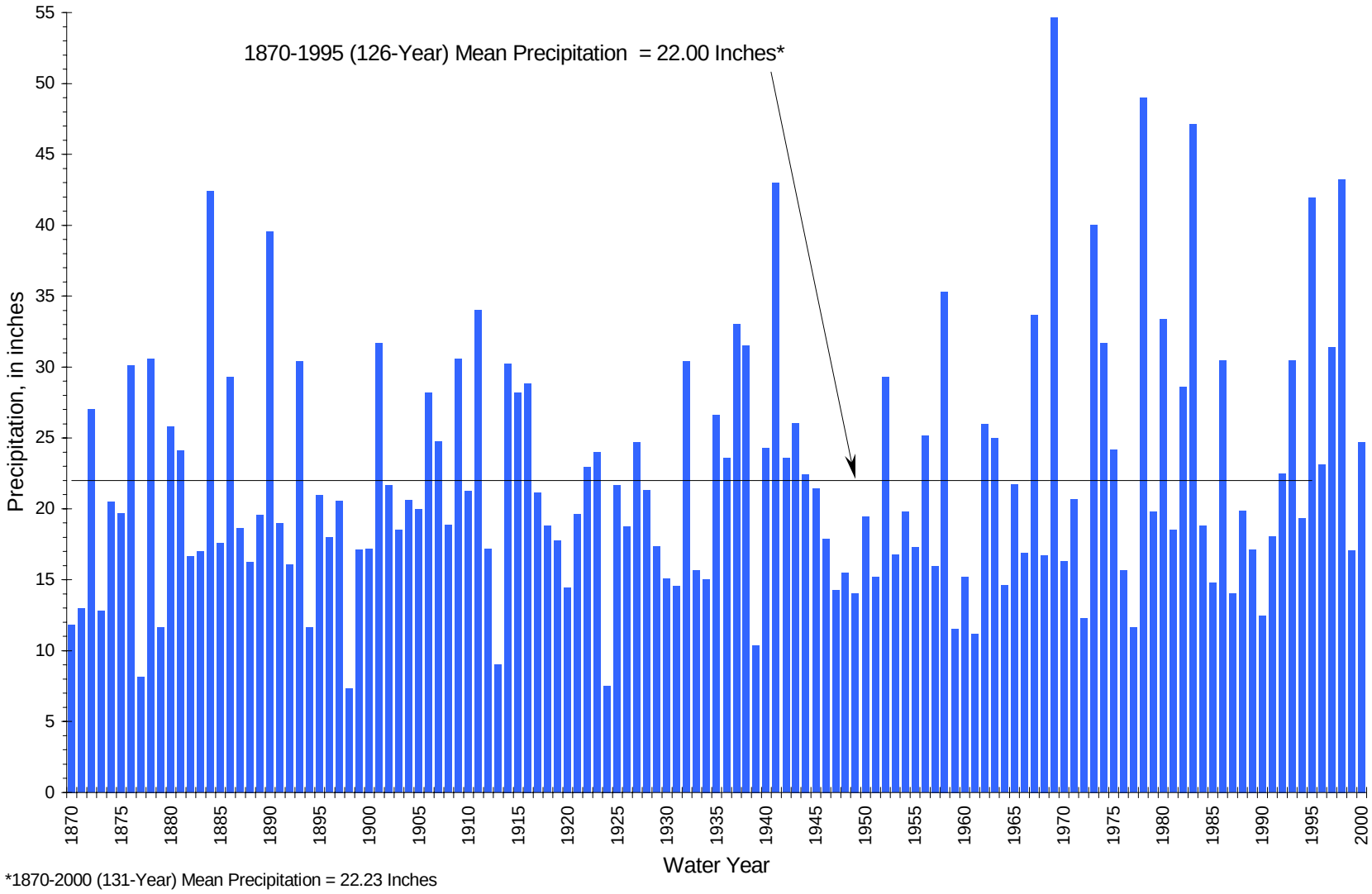
Watercourses contributing to the water supply are depicted in Plate 9. Discharge data for all stream gages pertinent to the study were supplied by San Luis Obispo and Santa Barbara Counties and the USGS. The locations of the discharge stations are shown on Plate 9, and data for each of the discharge stations are included in Appendix E. The data, extending from calendar year 1940 through calendar year 1995, were arranged into a water year format. These 11 river discharge stations extend from Lopez Creek near Arroyo Grande in San Luis Obispo County to Sisquoc River near Garey[2] in Santa Barbara County. The elevations of the stations range from 18 feet above msl[3] at the Pismo Creek station to 580 feet at the Lopez Creek station.

The Pismo Creek drainage area, which is about 47 square miles, attains a maximum elevation of almost 2,865 feet above msl. It consists of approximately 54 percent mountainous and foothill

[2]Lopez Creek near Arroyo Grande is at Latitude 36°13′48″, Longitude 120°28′22″ and Sisquoc River near Garey at Latitude 34°53′38″, Longitude 120°18′20″.

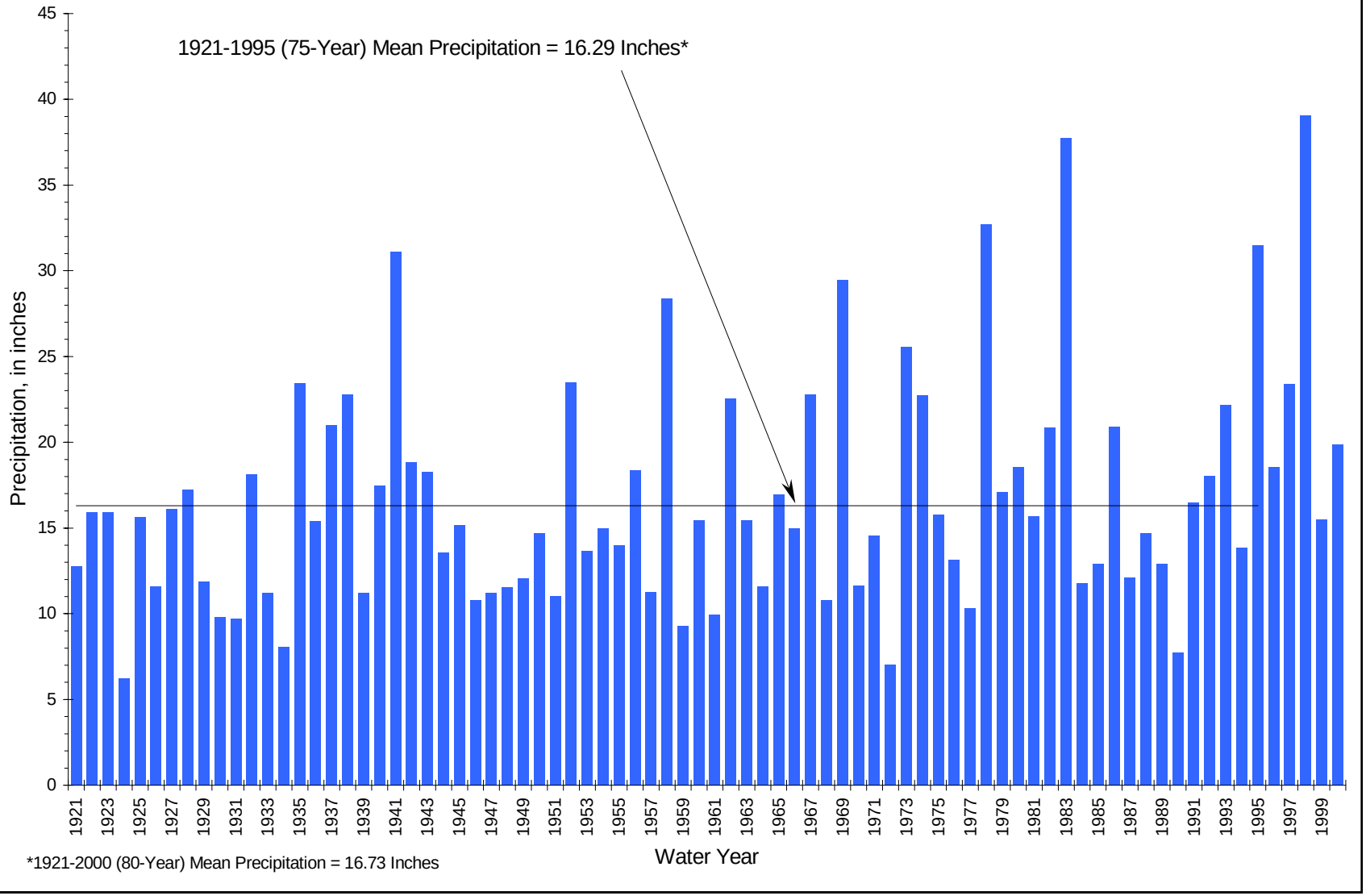
[3] Elevation estimated from USGS Pismo Beach Quadrangle (1978).

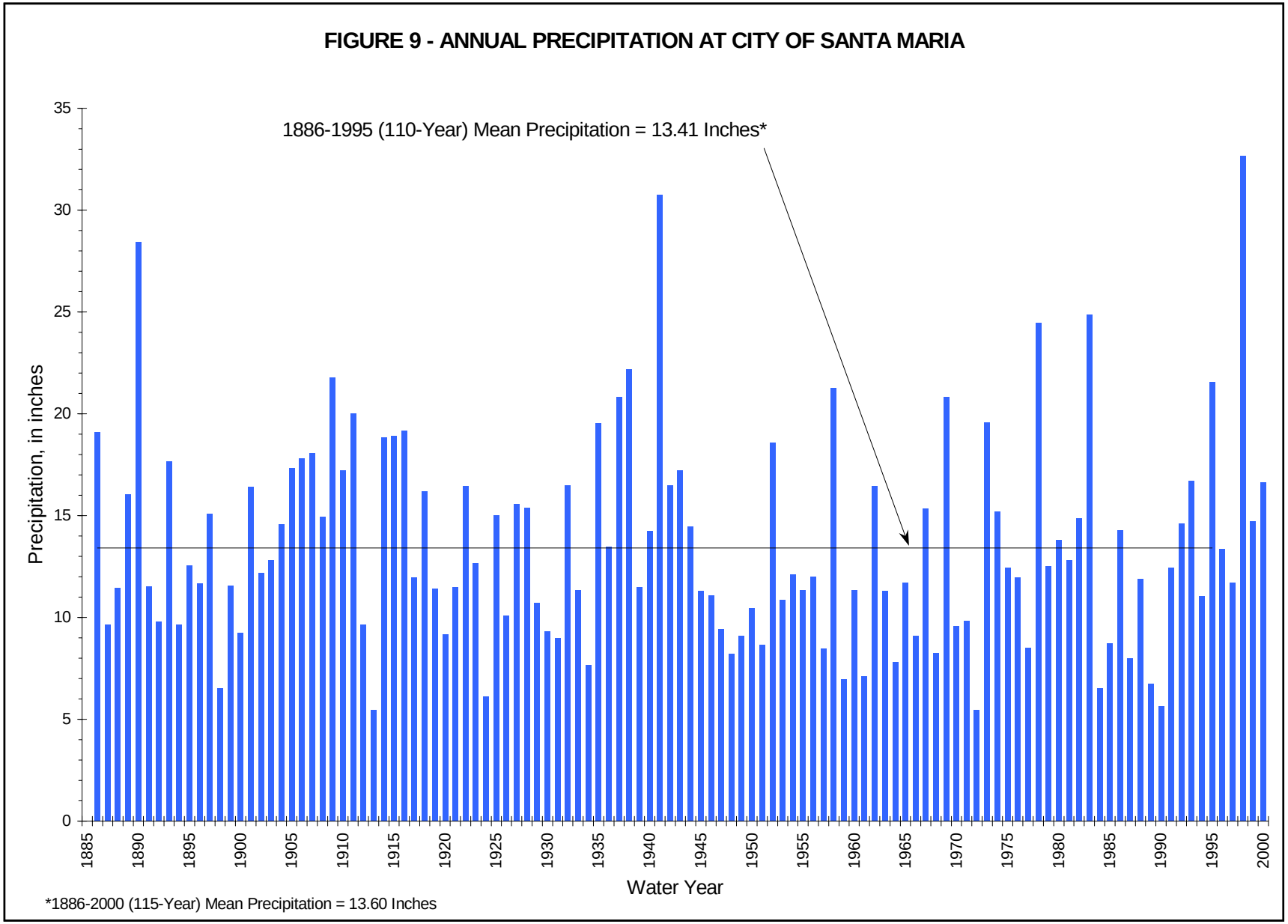
FIGURE 7 - ANNUAL PRECIPITATION AT CALIFORNIA STATE POLYTECHNIC UNIVERSITY, SAN LUIS OBISPO

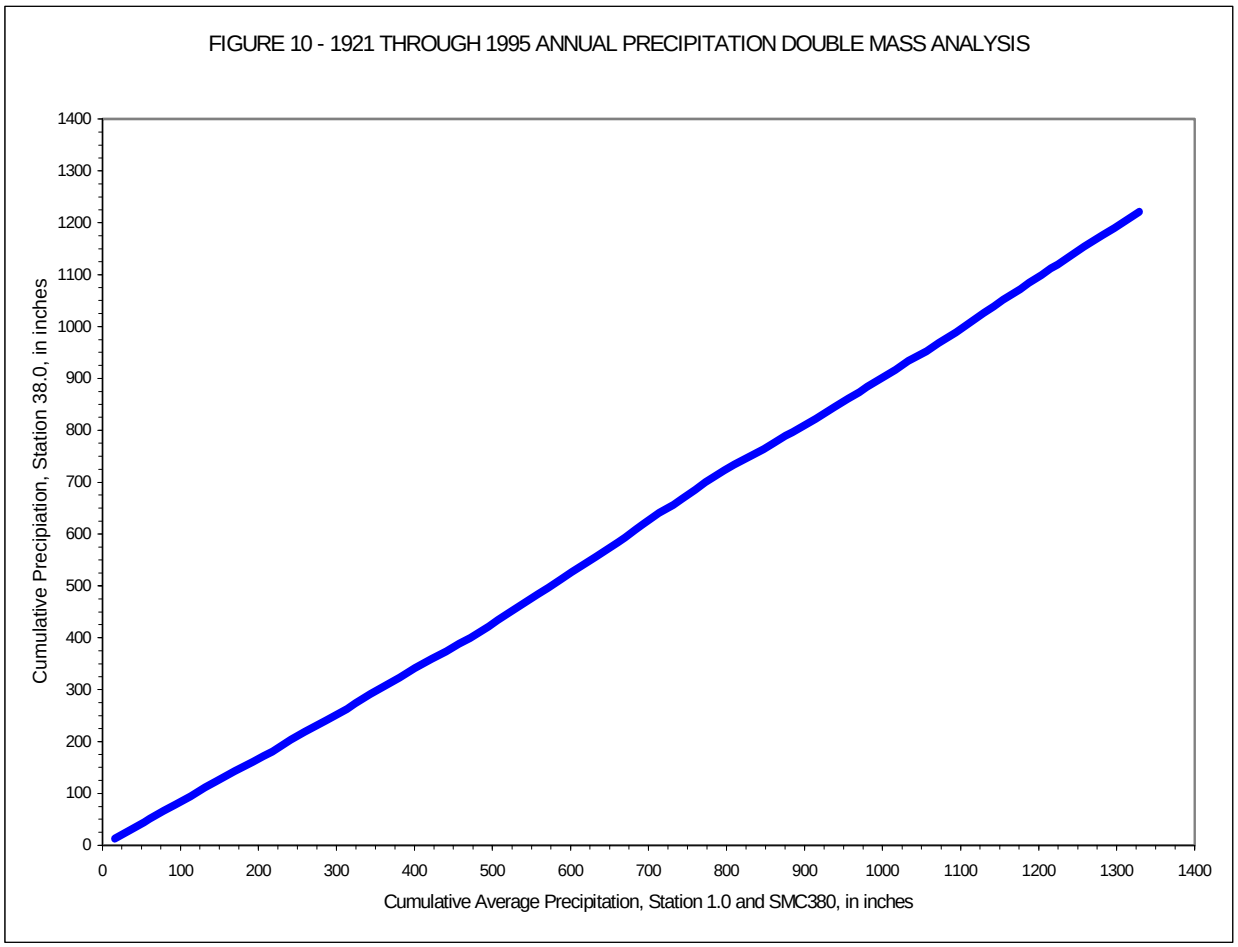


*1870-2000 (131-Year) Mean Precipitation = 22.23 Inches

FIGURE 8 - ANNUAL PRECIPITATION AT NIPOMO 2NW







area and 46 percent valley area. Pismo Creek measures about 13 miles from its headwaters to its confluence with the Pacific Ocean.

Pismo Creek is characteristic of small drainages in the study area with small incised channels. The creek flows through relatively rugged terrain, with small alluvial deposits appearing sporadically before it empties into the Pacific Ocean. Pismo Creek is not gaged except for a short period of record obtained from Balance Hydrologics, Inc., which collected Pismo Creek discharge data for January 2, 1989, through September 30, 1992. The elevation of the Pismo Creek stream gage is estimated to be 18 feet above msl. During the 12-year base period (1984 through 1995), the estimated average annual runoff ranged from 140 to 200 AF.

Arroyo Grande Creek watershed and its tributaries occupy 190 square miles and reach a maximum elevation of approximately 3,200 feet above msl. About 83 percent of the surface area of the drainage consists of mountains and foothills and 17 percent of valleys and mesas.

Arroyo Grande Creek, regulated by Lopez Dam since 1969, is one of the main watercourses within the study area and measures about 13 miles from the dam to its mouth at the Pacific

Ocean. Lopez Dam regulates surface releases to maximize groundwater recharge of the Santa Maria Groundwater Basin and provide flood control. The portion of the creek between the dam and the City of Arroyo Grande supports extensive agricultural activities.

As reported in Bulletin No. 1,[4] estimated mean seasonal runoff for water years 1895 through 1947 was 23,900 AF (Appendix E). Stream gaging data for Arroyo Grande Creek at Arroyo Grande, covering water years 1940 through 1995, are also shown in Appendix E. Analysis of this record indicates that the average annual runoff was 12,727 AF for 1940 through 1995 and 5,851 AF for the 1984 through 1995 base period, including all tributaries and excluding deliveries from Lopez Reservoir. These amounts are considerably lower than the mean seasonal runoff reported in Bulletin No. 1; however, the difference is attributable to impoundment of runoff at Lopez Reservoir.

Tar Spring Creek flows almost 10 miles in a westerly direction from its headwaters north of Newsom Ridge and south of Tar Spring Ridge to its confluence with Arroyo Grande Creek. Its watershed attains a maximum elevation of about 1,712 feet above msl and occupies almost 19 square miles. It consists of approximately 73 percent mountainous and foothill area and 27 percent valley area.

Tar Spring Creek, currently an ungaged drainage, and many small tributaries contributed between 1,200 and 1,400 AF of runoff during each year of the 12-year base period.

Los Berros Creek, another tributary of Arroyo Grande Creek, with headwaters located northeast of Temettate Ridge and south of Newsom Ridge, has a length of about 14 miles and its watershed attains a maximum elevation of about 1,804 feet above msl. The creek has a drainage area of 28 square miles and consists of approximately 83 percent mountainous and foothill area and 17 percent valley area.

Runoff from Temettate Creek and numerous other small tributaries accumulates prior to emptying into Los Berros Creek. The upstream 15 square miles (54 percent) of Los Berros Creek's 28-square-mile drainage is gaged; a continuous record for water years 1968 to 2000 is available. The base period runoff for the entire watershed was between 800 and 1,100 AF each year.

Historically, the bluffs at the edges of Nipomo Mesa experienced relatively small amounts of runoff. With increased development, larger amounts of precipitation are draining to the adjacent Arroyo Grande Plain and Santa Maria Valley portions of the study area. However, runoff amounts reaching these adjacent areas are still small and are not quantified in this report.

Black Lake Canyon occupies about one square mile in the west-central part of Nipomo Mesa. It is about one-quarter mile wide and the watershed attains a maximum elevation of about 400 feet

[4]California State Water Resources Board, *Water Resources of California*, Bulletin No. 1, 1951.

above msl along its four-mile length. Because of its unique flora and fauna, San Luis Obispo County designated the canyon as a Sensitive Resource Area.

Nipomo Creek has a drainage area of about 20 square miles, and its watershed attains a maximum elevation of about 1,804 feet above msl. Mountain and foothill areas account for 61 percent of the surface area, and valley areas account for about 39 percent. Nipomo Creek extends about nine miles from its headwaters to its confluence with the Santa Maria River.

Nipomo Creek meanders through Nipomo Valley parallel to and east of Highway 101. About a mile before emptying into the Santa Maria River, it flows westerly and crosses Highway 101. Precipitation falling on the western side of Temettate Ridge accumulates in numerous small tributaries that carry runoff to the mainstem of Nipomo Creek. The creek is ungaged; estimates of average annual base period runoff amount to 800-925 AF.

The Santa Maria River, regulated in part by Twitchell Dam since 1958, and its tributaries create a drainage area of 1,881 square miles, which attains a maximum elevation of approximately 8,700 feet above msl. Mountain and foothill areas account for 82 percent of the surface area, with valley areas accounting for the remaining 18 percent. The mainstem of the Santa Maria River measures about 18 miles, making it the longest watercourse draining the study area.

A portion of the Santa Maria River meanders through the southern edge of the study area and defines its southern boundary. Before reaching the Pacific Ocean, the river flows across or adjacent to extensive alluvial deposits with high infiltration potential (Hughes, 1977). Estimated seasonal natural runoff for water years 1895 through 1947, as reported in Bulletin No. 1, is shown in Appendix E. The mean seasonal runoff for this period amounted to about 90,900 AF.

Appendix E contains stream gaging data for the Sisquoc River near Garey from water years 1942 to 2000, Cuyama River below Twitchell Dam from water years 1959 through 1983, and Santa Maria River near Guadalupe from water years 1941 through 1987. Analysis of the records of the Santa Maria River near Guadalupe gage indicates that the average annual runoff for 1941 through 1987 was about 21,700 AF. This is considerably lower than the mean seasonal runoff of 90,900 AF reported in Bulletin No. 1; however, the difference is attributable to impoundment of runoff at Twitchell Reservoir.

Although not located within the study area, the U. S. Bureau of Reclamation completed Twitchell Reservoir on the Cuyama River in 1958 as a flood control and water conservation reservoir. Twitchell Dam regulates surface releases to the Santa Maria River system to maximize groundwater recharge of the Santa Maria Groundwater Basin and provide flood control.

Continuous streamflow data on Pismo Creek and the Santa Maria River at Guadalupe are lacking. Recording data at these locations would provide a more accurate and continuous record for determining hydrologic information. Also, installation of stream gages at the confluence with the Pacific Ocean at Arroyo Grande Creek and at Santa Maria River would be useful.

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