FRIANT DAM AND MILLERTON LAKE

San Joaquin River, California

REPORT ON RESERVOIR REGULATION FOR FLOOD CONTROL

December 1965
REVISED AUGUST 1980

DEPARTMENT OF THE ARMY

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

[R]

MILLERTON LAKE
SAN JOAQUIN RIVER, CALIFORNIA
PERTINENT DATA

GENERAL

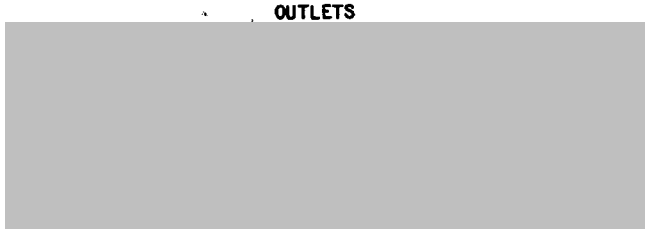
Drainage Areas:	
Friant Dam	1,638 sq mi
Mono Creek at Lake Thomas A. Edison	95.2 sq mi
South Fork San Joaquin River at Florence Lake	171 sq mi
Big Creek at Huntington Lake	80.5 sq mi
North Fork Willow Creek at Bass Lake	50.4 sq mi
Stevenson Creek at Shaver Lake	29.1 sq mi
San Joaquin River at Mammoth Pool Reservoir	1,003 sq mi
San Joaquin River ar Redinger Lake	1,295 sq mi
San Joaquin River at Kerckhoff Div	1,461 sq mi
San Joaquin River at Mendota	3,943 sq mi

Unimpaired Flows of Friant Dam:	
Mean Annual Runoff (1873-1977)	1,790,300 ac-ft
Average Flow	2,470 cfs
Min Mean Daily Inflow (10 Oct 1977)	0 cfs
Max Mean Daily Inflow (23 Dec 1955)	61,700 cfs
Max Instantaneous Inflow (23 Dec 1955)	97,000 cfs
Max Mean Daily Outflow (6 Jun 1969)	12,400 cfs
Min Mean Daily Outflow (20 Oct 1940)	5.5 cfs
San Joaquin River below Friant Dam ( )	ac-ft
Spillway Design Flood:	
Peak Inflow	197,000 cfs
Peak Outflow	158,500 cfs

DAM

SPILLWAY

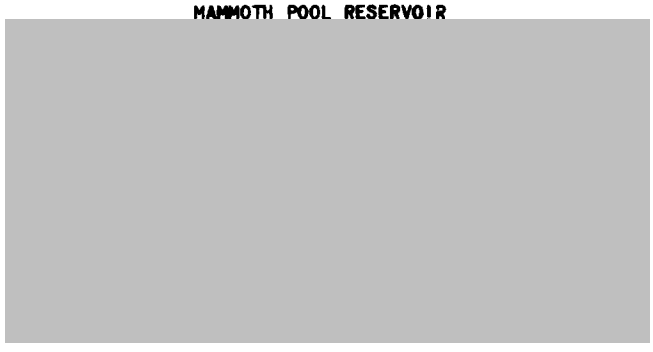
OUTLETS



RESERVOIR

Elevation	
Minimum operating level	466.1 feet
Gross pool	578.0 feet
Spillway flood pool	585.0 feet
Area	
Minimum operating level	2,100 acres
Gross Pool	4,850 acres
Spillway flood pool	5,085 acres
Storage Capacity	
Minimum operating level	130,000 ac-ft
Gross pool	520,500 ac-ft
Spillway flood pool	555,450 ac-ft

MAMMOTH POOL RESERVOIR



RESERVOIR

Stream	San Joaquin River
Drainage area	995 sq mi
Maximum storage capacity	123,000 ac-ft
Area at maximum storage	acres

FRIANT-KERN CANAL

Length	152 miles
Operating capacity below Friant Dam	4,000 cfs
Operating capacity at terminus of canal	2,000 cfs

MADERA CANAL

Length	35.9 miles
Capacity below Friant Dam	1,000 cfs
Capacity at Chowchilla River	625 cfs

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Department of the Army
Sacramento District, Corps of Engineers
Sacramento, California

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REPORT ON RESERVOIR REGULATION FOR FLOOD CONTROL FRIANT DAM AND MILLERTON LAKE SAN JOAQUIN RIVER, CALIFORNIA

CHAPTER I - GENERAL INFORMATION

1. AUTHORITY AND SCOPE

a. This report on reservoir regulation for flood control Friant Dam and Millerton Lake, San Joaquin River, California, is an appendix to the Master Manual of Reservoir Regulation, San Joaquin River Basin, California. It is prepared in accordance with instructions contained in ER 1110-2-240, EM 1110-2-3600, EC 1110-2-67, and EC-1110-2-208, all pertaining to requirements for reports on reservoir regulation for projects subject to the provisions of Section 7 of the Flood Control Act of 1944 (58 Stat. 890). The pertinent portion of that act reads as follows:

> "Hereafter it shall be the duty of the Secretary of War to prescribe regulations for the use of storage allocated for flood control or navigation at all reservoirs constructed wholly or in part with Federal funds provided on the basis of such purposes, and the operation of any such project shall be in accordance with such regulations . . ."

b. This report contains descriptive information about the project, the methods of operation, and the prescribed regulations for flood control operation. Location of the project is shown on chart 1. A portion of the material used in preparation of this report and some of the charts showing features of the project were furnished by the United States Water and Power Resources Service Mid-Pacific Region, Sacramento, California (formerly U.S. Bureau of Reclamation). A description of the overall San Joaquin River Basin plan for flood control is given in the Master Manual of Reservoir Regulation, San Joaquin River Basin, California.

2. PROJECT AUTHORIZATION

a. Friant Dam is one of the principal features of the Water and Power Resources Service Central Valley Project, which closely follows original plans of the State of California. The State's Central Valley project took form between 1920 and 1930. Specific recommendation for a dam at Friant to form one of the storage reservoirs in the Central Valley plan was made in 1927. The reservoir was to be operated for conservation and flood control.

b. The State Water Plan, presented as Bulletin 29 in 1931, formed the basis for the State's Central Valley project and was concerned with the initial units required to relieve the increasingly serious water supply situation. It provided for constructing Kennett Reservoir, the Delta Cross Channel, Friant Reservoir, the San Joaquin pumping system and conduits for the upper San Joaquin Valley and Contra Costa areas.

c. Conferences of Federal and State officials were held early in 1931 to seek an understanding of Federal participation in the project. The State's application for Federal financing through Public Works Administration loans and grants was not approved, and proposals for special Congressional legislation to authorize Federal loans and grants did not progress.

d. The project was authorized as a Federal Reclamation project in 1935 in the face of increasingly critical conditions of water shortage and economic distress, by the Finding of Feasibility of the Secretary of the Interior as approved by President Roosevelt. By direct presidential action, $20,000,000 of emergency relief appropriation funds were transferred to the Department of the Interior for construction of Friant Dam and other features of the Central Valley Project. Congressional authorization was provided in the River and Harbor Act (Public Law No. 392) of 26 August 1937 (50 Stat. 850), and the River and Harbor Act of 17 October 1940 (ch 895, 54 Stat. 1198, 1199) extended the authorization to include irrigation distribution systems.

3. CHANGES TO THE AUTHORIZED PLAN

There are no changes in the authorized plan; however, construction of power and flood control structures subsequent to project construction has resulted in operational changes.

a. Construction of Mammoth Pool in 1959 has resulted in a transfer of up to 85,000 acre-feet of flood control space from Millerton Lake to Mammoth Pool.

b. Construction of the Chowchilla Bypass Canal in 1966 about 10 miles above Mendota Dam has changed the flood control operation criteria at the USGS gaging station near Mendota from 10,000 c.f.s. to 6,500 c.f.s.

4. CONSTRUCTION HISTORY

Initial construction of Friant Dam was started in October of 1939 and was completed for interim storage in November 1942. Work deferred during the war, including spillway gates, outlet valves, Friant-Kern Canal stilling basin, etc., was again started in March of 1946 and the project was completed for operation in 1949.

CHAPTER II - BASIN DESCRIPTION

5. DESCRIPTION OF THE PROJECT AREA

a. The San Joaquin River basin lies between the crests of the Sierra Nevada Mountains and the Coast Range and extends from the southern boundary of the Tulare Lake basin, near Fresno, to the northern boundary of the Sacramento-San Joaquin Delta, near Stockton (see chart 1). It is drained by the San Joaquin River and its tributary system. The basin has an area of about 16,000 square miles extending about 130 miles from the crest of Sierra Nevada Range to the crest of the Coast Range and about 140 miles from the northern to southern boundaries. The Sierra Nevada mountains have an average crest elevation of about 10,000 feet with occasional peaks as high as 13,000 feet. The Coast Range crest elevations reach up to about 5,000 feet. The valley area measures about 100 miles by 50 miles and slopes gently from both sides towards a shallow trough somewhat west of the center of the valley. Valley floor elevations range from about 150 feet at the south to near sea level at the north. The trough forms the channel for the lower San Joaquin River and has an average slope of about 1.0 foot per mile between Mendota Dam and Vernalis.

b. Major tributary streams, from north to south, are the Cosumnes, Mokelumne, Calaveras, Stanislaus, Tuolumne, and Merced Rivers. These streams, plus the San Joaquin River, contribute the major portion of the surface inflow to the valley. Minor streams on the east side of the valley are the Fresno and Chowchilla Rivers and Burns, Bear, Owens, and Mariposa Creeks. Panoche, Little Panoche, Los Banos, San Luis, Orestimba, and Del Puerto Creeks comprise the minor streams on the west side. These west side streams contribute very little to the runoff of the San Joaquin River. Numerous other small foothill channels carry water only during intense storms. During high runoff periods a distributary channel of Kings River (called Kings River North) diverts water to the San Joaquin River. In addition, flood water is diverted to the San Joaquin River from Big Dry Creek Reservoir near Fresno. Flow from rivers and creeks are significantly reduced by storage, diversions, and channel seepage losses as they cross the valley floor so that only a portion of the water at the foothill line reaches the San Joaquin River. Peak flows from these tributaries usually do not coincide and, consequently, the combined capacity of tributary channels is considerably greater than that of the San Joaquin River. A general description of the entire San Joaquin River Basin and the flood control works along the main stem below Friant Dam is contained in the San Joaquin River Master Manual. A map of the basin above the Merced River showing topographic features, including locations of stream gaging stations is shown on chart 2. The basin areas are briefly described in the following paragraphs.

c. The watershed above Friant Dam drains 1,638 square miles on the western slope of the Sierra Nevada in Fresno and Madera counties, and is bounded on the north by the watersheds of Merced and Fresno Rivers, and on the south by that of the Kings River. It extends eastward to the crest of the Sierra with a general ridge elevation of about 10,000 feet and occasional peak elevations greater than 13,000 feet, and westward to Friant Dam about fifteen miles northerly from Fresno at an elevation of about 350 feet. The watershed is extremely rugged in character and the formation of the higher portion is largely granitic. The upper reaches of the river have several

large branches, the three principal ones being the North, Middle and South Forks, each of which has its source in glacial lakes near the summit of the range. Of these streams, the South Fork drains the largest area and is considered the head of the main stream. The North Fork rises on the southern slope of Mt. Lyell and flows in a nearly due south direction to its junction with the Middle Fork. The South Fork rises in Martha Lake, about 11,000 feet above sea level southwest of Mt. Hackel. The principal tributaries of the South Fork (Evolution, Piute, Bear and Mono Creeks), drain numerous lakelets, many of which are more than 11,000 feet high. Below their confluence, the Middle and South Forks form the main channel of the San Joaquin, which flows in a narrow and deep canyon with steep sides until it begins to emerge from the foothills. An area-elevation curve is shown on chart 3.

d. Vegetative cover over the watershed consists of grass with scattered light forest and brush in the lower elevations, heavy forest in the intermediate elevations, becoming moderate to light over the higher areas and being practically nonexistent in areas over 10,000 feet elevation. The soil cover over the area, except at highest elevations (over 10,000 feet) and in steep canyons, ranges from moderate to heavy.

e. The watershed area is sparsely populated and is used for grazing, mining, lumbering, hydro-electric power production, and recreation.

f. Below Friant Dam, the San Joaquin River basin above the mouth of Merced River is bounded on the east by the foothill line, on the west by the Coast Range and on the south by Kings River basin. It includes an area of about 7,900 square miles, most of which is on the alluvial valley floor sloping gently from both sides toward the San Joaquin River. Elevations decrease from about 350 feet at the foothill line to about 60 feet at the mouth of Merced River. To the west of the valley floor area, the Coast Range rises to a general ridge elevation of about 3,000 feet, with peak elevations as high as 5,000 feet. The eastern slope of the Coast Range drains into the San Joaquin River through a group of relatively small intermittent streams, principally Panoche, Los Banos, and San Luis Creeks, which enter the San Joaquin River between Mendota Dam (near the town of Mendota, Fresno County) and the mouth of Merced River.

g. From the mouth of the canyon below Friant Dam, the San Joaquin River flows in a southwesterly direction for about 60 miles to Mendota Pool, and then in a northwesterly direction for about 85 miles to the Merced River mouth near Newman. Below Mendota Pool, numberous levees have been built by reclamation districts and individual landowners throughout the length of the river channel (The levees of the Corps of Engineers' Lower San Joaquin River Project extend from the mouth of the Merced River downstream to the Delta area). Between Friant and Mendota Dams, several small tributaries enter the river, the largest is Little Dry Creek, which, during major rain floods, contains flood water diverted northward from the Big Dry Creek Flood Control Project in the adjacent Tulare Lake Basin. During periods of high flow, flood flows can be diverted above Mendota Pool through the Chowchilla Bypass Canal system, which heads about 10 miles above Medota Pool and rejoins the river about 31 miles downstream from Mendota Dam near El Nido. Also, during periods of excess flood flows on Kings River, water is released to Kings River North and diverted to the San Joaquin River via the Fresno Slough - James Bypass Canal system. San Joaquin River flows are modified by many

upstream reservoirs and diversions. Project water used along the Friant-Kern and Madera Canals are replaced by imported water from the Sacramento River via the Delta-Mendota Canal for use in the service area below Mendota Dam.

h. The San Joaquin River serves one of the world's most extensive service areas. The 152 mile-long Friant-Kern Canal exports water south from Friant Dam to extensive areas in the Tulare Basin which are lacking or are deficient in water supplies. The 36 mile-long Madera Canal diverts water northerly from Friant Dam to supply lands in the Madera Irrigation District and Chowchilla Water District with a supplemental and a new irrigation supply. The excellent soils, favorable climate, and availability of water for irrigation in the valley floor area, have made possible extensive agricultural development, with production of many different types of high value crops. In addition to agriculture, numerous agricultural processing plants and manufacturing plants operate throughout this area. Several railroads, including the main line of Atchison, Topeka, and Santa Fe, and the valley route of Southern Pacific, serve important agricultural centers within the area. U.S. Highway No. 99 and I-5 are the two principal motor routes north of Bakersfield. Many state and county roads also serve this area.

6. CLIMATE

a. A more detailed discussion of the climate of the San Joaquin Valley is contained in the Master Manual. The climate of the upper San Joaquin River watershed is characterized by wet, cool winters and dry, hot summers. Average annual precipitation varies from 10 inches in the valley to over 60 inches near the Sierra crest, as shown on chart 4. About 85 percent of the precipitation occurs during the winter months of November through April. The normal monthly distribution of precipitation is illustrated by the averages of selected stations (located on chart 4) as follow:

Month	Normal Monthly Precipitation (1941 - 1970)							
	Fresno Elev 328'		Auberry 1 NW Elev 2140'		N. Fork R.S. Elev 2630'		Huntington Lake Elev 7020'	
	Inches	Percent	Inches	Percent	Inches	Percent	Inches	Percent
Jan	1.84	18.0	4.09	17.0	5.97	17.8	6.71	16.4
Feb	1.72	16.8	3.97	16.4	5.24	15.7	6.26	15.3
Mar	1.62	15.8	3.55	14.7	4.88	14.6	6.39	15.6
Apr	1.24	12.1	2.76	11.4	3.60	10.8	4.19	10.2
May	0.32	3.1	0.92	3.8	1.35	4.0	1.80	4.4
Jun	0.06	0.6	0.14	0.6	0.30	0.9	0.58	1.4
Jul	0.00	0.0	0.03	0.1	0.05	0.1	0.18	0.4
Aug	0.02	0.2	0.03	0.1	0.02	0.1	0.19	0.5
Sep	0.07	0.7	0.28	1.2	0.37	1.1	0.84	2.1
Oct	0.42	4.1	0.99	4.1	1.23	3.7	1.86	4.6
Nov	1.22	11.9	3.03	12.6	4.22	12.6	4.84	11.8
Dec	1.71	16.7	4.35	18.0	6.23	18.6	7.07	17.3
TOTAL	10.24	100.0	24.14	100.0	33.46	100.0	40.91	100.0

Precipitation usually occurs as rain at elevations below 4,000 feet and as snow at higher elevations, although on rare occasions snow has occurred in the valley and rain has occurred at elevations above 10,000 feet.

b. During the winter, temperatures in the mountains hover near the freezing point, with minor variations above and below, and the accumulating snow pack becomes consolidated by alternate freezing and thawing. The snowpack accumulates until late March or early April, when increasing temperatures cause melting and runoff to begin. Snowpack data typical of wet, average, and dry years are illustrated by 1969, 1979, and 1977 respectively as shown in the following tabulation: (see chart 4 for station locations).

Snow course	Elev in feet	April snow survey data: Depth in Inches 1969	1979	1977	Water equivalent in inches 1969	1979	1977	Normal
Emerald Lake	10,600	161.5	101.3	28.1	69.5	34.6	7.5	35.0
Volcanic Knob	10,100	152.4	97.0	21.8	63.0	32.0	5.6	30.0
Agnew Pass	9,450	157.8	97.5	21.9	65.6	32.4	7.6	31.0
Coyote Lakes	8,800	180.1	105.0	29.7	76.0	33.9	7.8	32.0
Huntington Lake	7,000	122.3	91.3	10.1	53.6	29.7	4.8	19.0
Poison Meadow	6,700	121.4	97.3	4.5	54.3	40.0	1.8	25.0

c. The valley floor area is characterized by hot, dry summers and moderate winters. Temperatures in the mountains decrease generally with elevation. At higher elevations the summers are cool and winters are severe. Observed temperature extremes are 111°F and 15°F at Fresno, while those at Huntington Lake are 89°F and -18°F. The monthly distribution of mean temperatures is illustrated by representative stations (locations shown on chart 4) in the following tabulation:

Month	Monthly Mean Temperature (°F): Fresno Elev 328'	Auberry 1 NW Elev 2140'	N. Fork R.S. Elev 2630'	Huntington Lake Elev 7020'
January	45.3	43.4	41.5	31.1
February	49.9	46.1	43.8	31.1
March	53.9	48.8	47.6	32.0
April	60.3	54.9	53.4	37.2
May	67.4	62.4	60.0	44.2
June	73.9	69.7	67.5	52.2
July	80.6	78.5	76.9	60.6
August	78.3	76.7	76.0	59.7
September	73.8	71.8	70.2	55.4
October	64.2	61.6	60.4	47.2
November	53.5	51.2	50.3	39.0
December	45.8	44.7	43.9	33.5
AVERAGE	62.2	59.4	57.6	43.6

7. RUNOFF CHARACTERISTICS

The flow of the upper San Joaquin River is generally similar in seasonal distribution and is subject to the same seasonal utilization as the flows of all major streams flowing from the Sierra Nevada. In general, runoff during the months of November through March is the result of general rain storms, whereas runoff during the months of April through July usually results from melting of the mountain snowpack accumulated during the winter. Large rain floods are rare during the snowmelt season. Annual runoff at Friant Dam has ranged from a minimum of 361,500 acre-feet in water year 1977 to a maximum of 4,367,800 acre-feet in water year 1906. These extremes represent 10 and 240 percent, respectively, of the 107-year average runoff of 1,790,300 acre-feet. Annual runoff from the 1,638 square miles above Friant Dam averages about 20.52 inches and is about 53 percent of the total average annual precipitation of 39 inches. Monthly unimpaired runoff below Friant Dam for the period of record is shown on chart 5. Locations of stream gaging stations are shown on chart 2. About 72 percent of the runoff at Friant occurs during the snowmelt season (April through July). The monthly distribution of runoff is given in the following table:

Average Monthly Runoff Data

Month	Acre-Feet	Percent
October	23,600	1.3
November	31,000	1.7
December	53,500	3.0
January	77,900	4.3
February	90,800	5.1
March	137,800	7.7
April	239,500	13.4
May	442,500	24.7
June	419,200	23.4
July	189,100	10.6
August	58,900	3.3
September	26,700	1.5

CHAPTER III - FLOOD POTENTIAL

8. FLOOD CHARACTERISTICS

Floods in the upper San Joaquin River basin are rather frequent and of two general types, those which occur during the late fall and winter, primarily as a result of intense rainfall in the mountains, and those which occur during the late spring and the summer primarily as a result of mountain snowmelt. Rainfloods are characterized by high peak discharges caused by heavy general rains, sometimes augmented by melting snows at intermediate elevations. High stages last only a few days and runoff volumes are comparatively small. Generally, most of the precipitation falls as snow above the 5000 foot elevation and remains in the mountains until spring. Snowmelt floods are characterized by sustained, moderate flows for two to three months, yielding large volumes of runoff.

9. DOWNSTREAM AREAS SUBJECT TO FLOODING

Areas along the San Joaquin River downstream from Friant Dam that are subject to flooding consist of a trailer court above State Highway 41 and the east side of the town of Firebaugh below Mendota Dam. Most of the flooding occurs within the confines of dedicated floodways, and natural overflow basins.

10. RAINFLOOD POTENTIAL

a. Large rainstorms in the San Joaquin River Basin occur mostly in the months of November through March. For a specified ground condition, the seasonal variation of rainflood potential is dependent on the seasonal variation of storm potential, which is a function of latitude and the amount of storm precipitation that normally occurs at any location. This seasonal variation of storm potential is defined by criteria contained in office report "Reservoir Operation Criteria for Flood Control," dated October 1959.

b. Among the largest rainfloods on the San Joaquin River during the period of record (1904 to present) are those of January 1911, December 1937, December 1955 and January 1969. The largest rainflood occurred on 23 December 1955, and had an estimated, unregulated peak of 107,000 c.f.s. and a 7-day volume of 397,600 acre feet. Reportedly, the legendary floods of December 1862 and 1867 were larger than the December 1955 flood, unfortunately, no reliable flood data are available. The following table compares large unregulated flow estimates below Friant Dam:

Flood	Estimated Peak Flow (c.f.s.)	7-Day Volume (acre feet)
January 1911	49,000	240,000
December 1937	78,000	170,800
December 1955	107,000	397,600
January 1969	50,000	236,000

Rainflood frequency curves for the San Joaquin River below Friant and near Mendota are shown on charts 6 and 7 respectively.

11. SNOWMELT FLOOD POTENTIAL

Snowmelt is caused by the gradual melting of snow and ice which have accumulated during the winter in the high mountains. Snowmelt runoff does cause damage in the San Joaquin Valley by prolonging high stages in the lower channels, inundating bypass lands during part of the growing season and causing seepage through levees below Mendota Dam. The largest snowmelt flood of record on the San Joaquin River above Friant Dam was that of 1906, which had a maximum mean daily flow of 26,300 c.f.s. and an April-July volme of 3,339,400 acre feet. The second largest snowmelt flood occurred in 1969, which had an unregulated maximum mean daily flow of 24,500 c.f.s. and an April-July volume of 2,903,800 acre feet. Snowmelt frequency curves for the San Joaquin River below Friant and near Mendota are shown on charts 8 and 9 respectively.

12. RESERVOIR DESIGN FLOOD

Millerton Lake does not have a Reservoir Design Flood. Historical operations indicate that space available in upstream power reservoirs and flood control space in Millerton Lake can generally control about a 50-year rainflood event and about a 25-year snowmelt event to an objective flow of 8,000 c.f.s. immediately below Little Dry Creek. Uncontrolled local runoff below Friant Dam from Cottonwood Creek (54 sq. mi.) and Little Dry Creek (71 sq. mi.) can produce peak flows greater than 8,000 c.f.s. during rainflood events larger than once in 50 years. The local runoff generally peaks several hours before significant releases from Friant Dam are required. Rainflood frequency curves for Little Dry Creek near Friant are shown on chart 10.

13. SPILLWAY DESIGN FLOOD

The spillway design flood (SDF) developed by the WPRS has a regulated peak inflow of 197,000 c.f.s. and a 5-day volume of 810,000 acre feet. A routing of the SDF is shown on chart 11. The routing was made using minimum release rates indicated on the Emergency Spillway Release Diagram (shown in Appendix A, chart A-12).

CHAPTER IV - PROJECT FEATURES

14. DESCRIPTION OF THE PROJECT

a. Friant Dam is one of the key structures in the development of the water resources of the Central Valley. The multipurpose structure is located about 25 miles northeast of Fresno and an equal distance east of Madera. [redacted]. Outlet rating discharge curves are shown on chart A-4. The reservoir has a gross storage capacity of 520,500 acre-feet and covers an area of about 4,900 acres. The storage space above the canal headworks, including that reserved for flood control, is 435,000 acre-feet. The top 170,000 acre feet is reserved for control of fall and winter rain floods while up to 390,000 acre-feet of space, depending on forecasts of snowmelt runoff, is reserved for control of spring snowmelt floods. Area and capacity curves are shown on chart A-5, and a capacity table is given on chart A-6

b. Friant-Kern Canal diverts water southerly from Friant Dam to water deficient areas in the Tulare Lake Basin at the southern end of the San Joaquin Valley. The canal is about 152 miles long with a capacity of 4,500 c.f.s. which decreases gradually after the first 71 miles to 2,000 c.f.s. at its terminus.

c. Madera Canal diverts water northerly to Madera Irrigation District and Chowchilla Water District. It is 35.9 miles long and has an initial capacity of 1,200 c.f.s., decreasing to a capacity of 625 c.f.s. at the Chowchilla River.

15. RECREATION FACILITIES

The Millerton Lake State Recreation Area is administered by the State of California Department of Parks and Recreation. Millerton Lake, created by Friant Dam, is three miles wide at its widest point, and stretches more than 16 miles back up the river canyon. With 43 miles of shoreline, and activities ranging from swimming, boating, and waterskiing to hiking, camping, and horseback riding. The lake and the surrounding hills within the recreation area have become extremely popular. Facilities provided at Millerton Lake include 138 car access campsites, 30 boat access campsites, hundreds of picnic sites, a group picnic site that will accomodate 150 people, and boat launching ramps with ample parking lots on both sides of the lake. In addition, a marina is located on the south shore near the park headquarters, where fishing supplies, boat rentals, and dock rental space is available.

CHAPTER V - GENERAL PROJECT OPERATION

16. RESPONSIBILITY FOR OPERATION

Friant Dam and Millerton Lake are operated by the United States Department of the Interior, Water and Power Resources Service, under the jurisdiction of their Regional Director, Mid Pacific Region, Sacramento, California. Details concerning the responsibility for flood control operation are discussed in Appendix A of this report. Flood control regulations prescribed by the Secretary of the Army under the authority of Section 7 of the Flood Control Act of 1944 and in accordance with rules and regulations contained in the Code of Federal Regulations Title 33 Part 208.11 are reflected in the accompanying Field Working Agreement and Flood Control Diagram, included in Appendix A of this report.

17. UPSTREAM REGULATION

Significant regulation of flows occur in the San Joaquin River Basin above Friant Dam. The Southern California Edison Company has developed an extensive system of hydroelectric power plants and operates six major storage reservoirs aggregating a total of about 560,000 acre-feet of reservoir storage. These reservoirs (shown on chart 4) are Florence Lake, Huntington Lake, Mammoth Pool, Shaver Lake, Redinger Lake,and Lake Thomas A. Edison. Bass Lake on Willow Creek, a tributary of San Joaquin River, built and operated by Pacific Gas and Electric Company, has over 45,000 acre-feet of storage capacity. In addition, there are many diversion structures leading to 14 hydroelectric power plants above Friant Dam. Ward tunnel, with a capacity of 2,000 c.f.s., diverts storage from Florence Lake into Huntington Lake. Huntington-Shaver conduit, with a capacity of 1,450 c.f.s., diverts water from Huntington Lake into Shaver Lake. These reservoirs have considerable influence in reducing rain and snowmelt floods. Pertinent data on upstream developments are contained in chart 12.

18. PRESENT REGULATION

a. Present regulation of Friant Dam for flood control requires that releases from Millerton Lake shall be restricted to quantities which will not cause downstream flows to exceed, insofar as possible, any one of the following citeria:

(1) A combined flow to the San Joaquin River from Friant Dam, Cottonwood Creek and Little Dry Creek of 8,000 c.f.s.

(2) A flow of 6,500 c.f.s. at the "near Mendota" gage below Mendota Dam.

b. The maximum space in Millerton Lake below elevation 578 feet alocated to flood control is 170,000 acre-feet during the rain flood season and 390,500 acre-feet during the snowmelt season in accordance with the Flood Control Diagram in force.

19. DOWNSTREAM CHANNEL CAPACITIES

The San Joaquin River channel between Friant Dam and the "near Mendota" gage (the farthest downstream control point used in flood control operation of Millerton Lake), is typical of semi-arid streams in the southern Sierra Nevada. The natural channel of the San Joaquin River is largest at the foothill line and decreases in capacity as it extends on to the valley floor. Due to encroachments in the natural flood channel, objective flow criteria are, in some cases, smaller than the channel capacity. The following table lists the channel capacity and objective flow at control points of the various reaches:

Reach	Channel Capacity c.f.s.	Objective Flow c.f.s.
Friant Dam to SH 41 Bdg	19,000	8,000
SH 41 Bdg to blw Little Dry Cr.	15,000	8,000
Blw Little Dry Cr to Gravelly Ford	12,000	8,000
Gravelly Ford to Chowchilla Bypass	12,000*	8,000
Chowchilla Bypass to Mendota Dam	6,000*	4,500
Mendota Dam to "near Mendota" gage	10,000*	6,500

*channel capacity with levees

20. FLOOD DAMAGES

Friant Dam will normally control releases to downstream objective flows for floods whose volumes are exceeded about once in 25 years. This degree of protection is somewhat less than that provided at other major reservoirs in the Central Valley of California. The major rain flood of December 1955 was completely controlled, since it occurred relatively early in the rain flood season when storage in Millerton Lake was lower than required by the flood control criteria. If storage had been at the permissible level, uncontrolled flows exceeding 37,100 c.f.s. below Friant Dam (27,400 c.f.s. at the gage near Gravelly Ford) would have occurred and would have resulted in extensive damages between Friant Dam and the mouth of Merced River. Damages in this reach would be principally to agriculture and public facilities, although some urban damage would occur. The rural or agricultural losses would consist of damage to highly developed cropland, farm improvements, and stored supplies; extensive damage to irrigation facilities and equipment; costs of cleanup; and increased operating costs. Public facility losses would include severe damage to state highways, country roads, and levees. Highway flooding would cause extensive transportation losses. Urban Damage would occur in the trailer court above State Highway 41 and in the city of Firebaugh (population 2,600). Although of less magnitude than agricultural losses, the damages to residential, commercial, and industrial property would be significant.

21. CONSERVATION OPERATION

Millerton Lake storage is used to furnish an average annual supplemental canalside water supply of 602,000 acre-feet of class 1[1/] and 573,000 acre-feet of class 2[2/] water to the Friant-Kern Canal and 138,000 acre-feet of class 1 and 168,000 acre-feet of class 2 water to Madera Canal. It also furnishes 60,000 acre-feet annually for the city of Fresno and about 55,000 acre-feet annually for water-rights purposes along the San Joaquin River above Mendota Pool. During large snowmelt years, releases from Millerton Lake are used to supplement requirements at Mendota Pool on San Joaquin River which normally are supplied from imported Sacramento River water via the Delta-Mendota Canal. No releases are made specifically for fish conservation and there is no power plant at Friant Dam.

22. RELATION TO OTHER PROJECTS

Flood control operation of Millerton Lake is coordinated with the operation of Big Dry Creek Reservoir on the Fresno County Stream Group, Pine Flat Lake on Kings River, Hensley Lake on the Fresno River, and H.V. Eastman Lake on the Chowchilla River for the reduction of floodflows on the San Joaquin River between Friant Dam and Vernalis. Below the mouth of Merced River, flood flows come primarily from the major tributaries of San Joquin River and are controlled by reservoirs on those tributaries. The channels of the Lower San Joaquin River Levee Project are designed to carry controlled tributary flows in combination with sustained, regulated flows from the upper river of a 50-year flood event. The Chowchilla and Eastside Bypass systems (constructed by the State of California) are also a part of the overall plan for flood control on the main stem of San Joaquin River between Mendota Dam and the Merced River.

1/ Class 1 water is considered firm except in exceptionally dry years when a deficiency as high as 50% may occur, or in a critical dry period such as 1928-34 when deficiencies up to 50% could occur in two consecutive years.

2/ Class 2 water is available for irrigation purposes during spring months of wet years.

CHAPTER VI - OPERATIONAL CONTROLS

23. HYDROLOGIC FACILITIES

a. Hydrologic stations from which current reports are available for direct operation of Friant Dam, shown on charts 2 and 4, consist of the following:

b. Outflow from Friant Dam is the summation of flows through the Friant Kern Canal, Madera Canal, the river outlets, and over the spillway. These flows are calculated from the rating of the respective structures for various openings and heads.

c. Also available for record and planning purposes are various nonreporting stations including:

(1) Numerous stream gaging stations on the San Joaquin River and tributaries, as well as records from upstream power reservoirs.

(2) Numerous precipitation stations above and below the dam operated by the Weather Bureau.

(3) Numerous snow courses in the mountain areas above the dam operated by the California Cooperative Snow Surveys (California Department of Water Resources).

24. COORDINATION WITH OTHER AGENCIES

In order to assure that the flood control operation of Friant Dam will be as effective and reasonable as possible, it is essential that the operating agency keep advised at all times of possible flood hazards, weather conditions, inflow to the reservoir, flow in Little Dry Creek, and flow in Kings River North. This requires close liaison with other agencies, including the Weather Bureau, Corps of Engineers, and the State of California Department of Water Resources, on a daily or hourly basis.

25. OPERATIONAL FORECASTS

As part of the Central Valley operations, the Water and Power Resources Service has arranged with the NOAA Office in Sacramento to forecast the runoff from the streams entering San Joaquin River 6 to 24 hours in advance during flood periods. The data available are (1) current runoff at key gaging stations, (2) twice-daily precipitation data from the extensive reporting network of NOAA, (3) data from on-call type radio-reporting

precipitation stations operated by the Water and Power Resources Service and precipitation stations reporting every 6 hours operated by NOAA at key points in the San Joaquin Basin, and (4) a quantitative forecast of the average precipitation that can be expected over the Basin for the next 48 hours, made by NOAA on each day during the winter flood season from 1 November to 1 May. Seasonal forecasts used in operation for control of snowmelt floods and conservation purposes are made by the Water and Power Resources Service after consultation with the Corps of Engineers and the State of California as to acceptable forecasting methods. Use of the parameter and adjustment for upstream space for operation of Millerton Lake during rainflood periods is discussed in Appendix A. The forecast of full natural runoff of the San Joaquin River at Friant Dam is made for the periods February through July, March through July, and April through July, using equations which relate water equivalent of snow cover at various courses on the forecast date, various combinations of seasonal precipitation (both observed and expected), and the forecasted runoff. Adjustment of the forecast at any time in the season is made by deducting from the last forecast quantity the observed runoff since the date of forecast. The equations and curves shown on chart A-8 illustrate the relationships and list the precipitation stations and snow courses used in the various forecasts. These forecast equations are revised periodically as necessary to include up to date data. The equations evaluate the relationship between full natural runoff at Friant Dam and the independent variables of water equivalent of snow cover, antecedent precipitation, and runoff season precipitation. The index of antecedent precipitation is the average of the following four stations:

Water equivalent of the snow cover is determined as the mean of various courses on the date of the forecast. The combination of courses for any particluar forecast (as shown on chart A-8) is based on availability of data. The following courses are used:

Each forecast equation includes as one of the variables, the subsequent precipitation to June 30. The frequency distributions of rainfall which may occur during the period February-June, March-June, and April-June are shown on chart A-8. By use of these curves, the limits of the expected precipitation can be estimated for any degree of probablility. After the forecast runoff is determined, its distribution is based on historical distributions for hydrographs of comparable volumes.

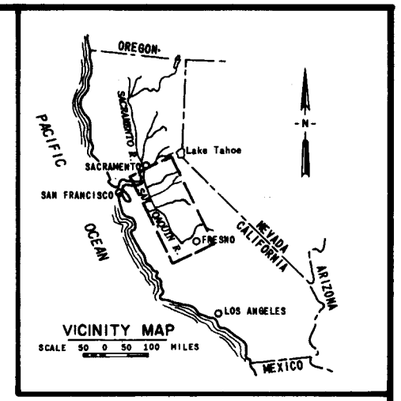
CHAPTER VII - PROJECT ACCOMPLISHMENTS

26. EXAMPLES OF OPERATION

Historical operation of San Joaquin River reservoirs including Millerton Lake during the period 1943 - 1978 is shown on chart 13. The Water and Power Resources Service spillway design flood routing using releases required by the emergency spillway release diagram, is shown on chart 11. Stage-duration curves are presented on chart 14, a stage-frequency curve on chart 15, and seasonal variation of reservoir storage frequency on chart 16.

27. OPERATION RECORD

The official operation record of Millerton Lake for flood-control purposes will be that contained in the monthly report of operations of the Central Valley Project, issued by the Water and Power Resources Service. A summary of the functional operation to date is shown graphically on chart 13.



FRIANT DAM AND MILLERTON LAKE
SAN JOAQUIN RIVER, CALIFORNIA

GENERAL MAP

LEGEND

- Drainage Boundary
- Interstate Highway
- State Highway
- Railroad
- Intermittent Stream
- Perennial Stream
- Lake

Scale 1:500,000

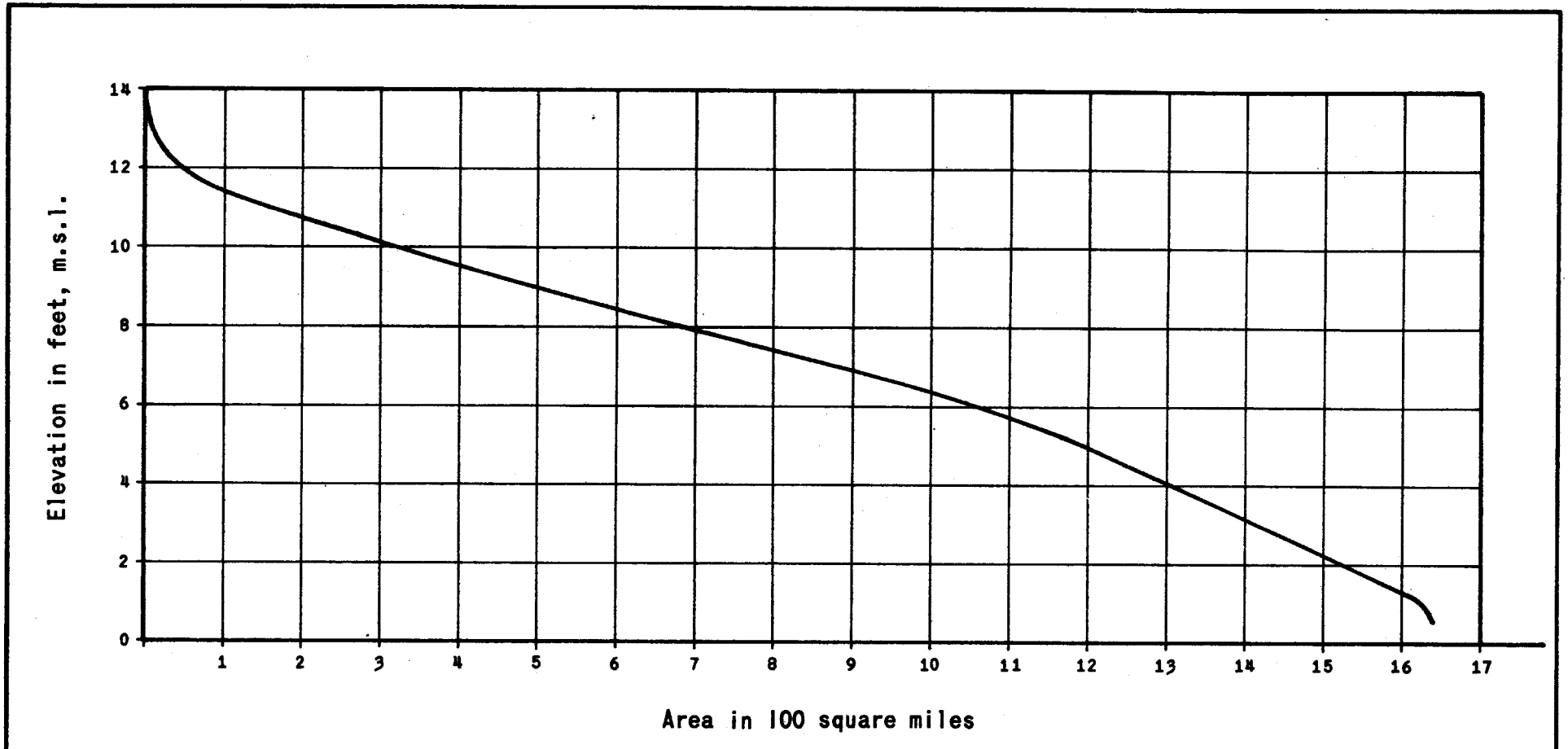
CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: L.H.C.
Drawn: L.H.C.

Date: OCTOBER 1979

CHART I

CHART 2



FRIANT DAM AND MILLERTON LAKE
SAN JOAQUIN RIVER, CALIFORNIA

AREA-ELEVATION CURVE

SAN JOAQUIN RIVER ABOVE FRIANT DAM

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: L.H.C.
Drawn: L.H.C.
Date: AUGUST 1979

CHART 3

CHART 4

HISTORICAL UNIMPAIRED FLOWS
BELOW FRIANT

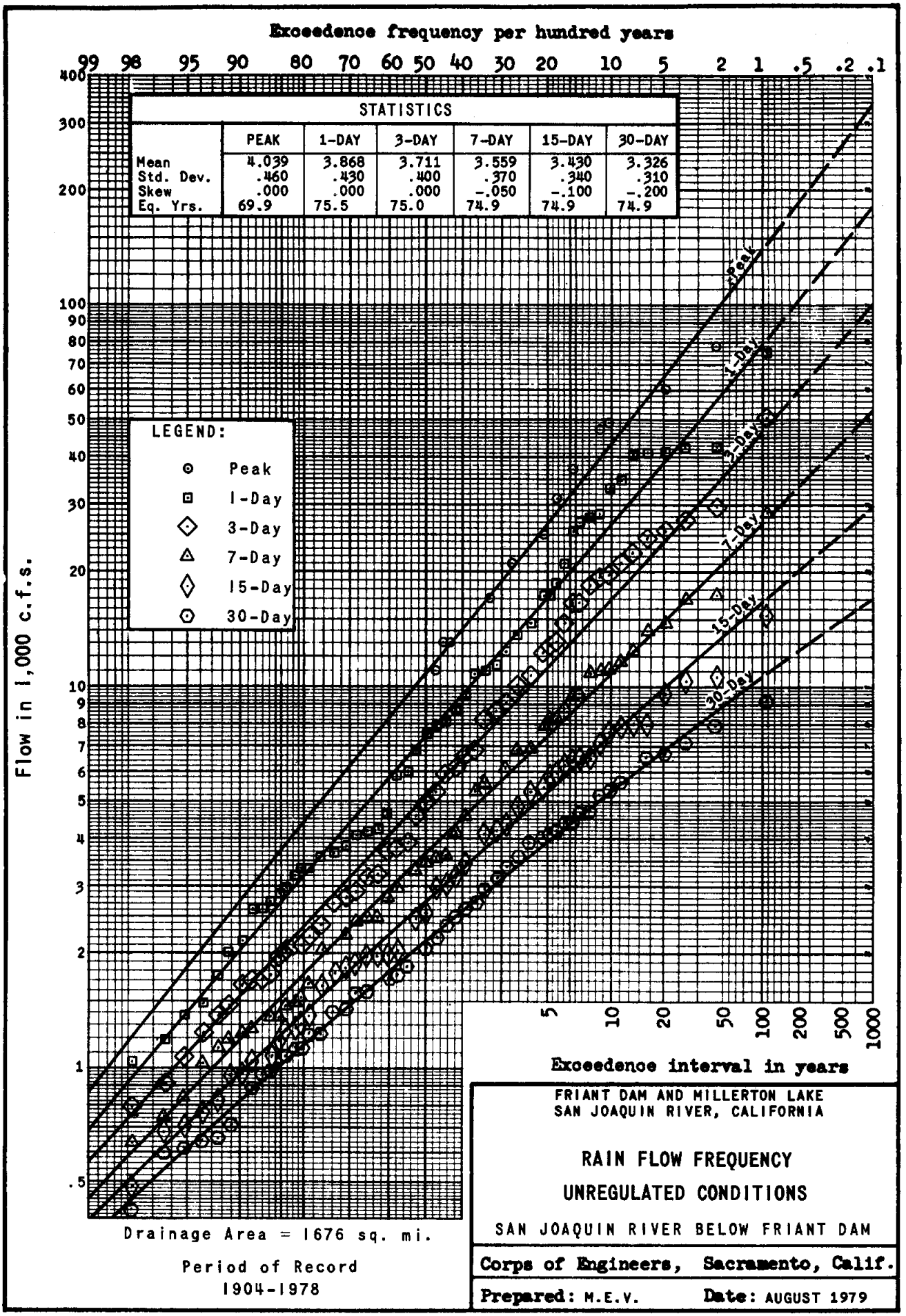
(Runoff in 1,000 acre-feet)

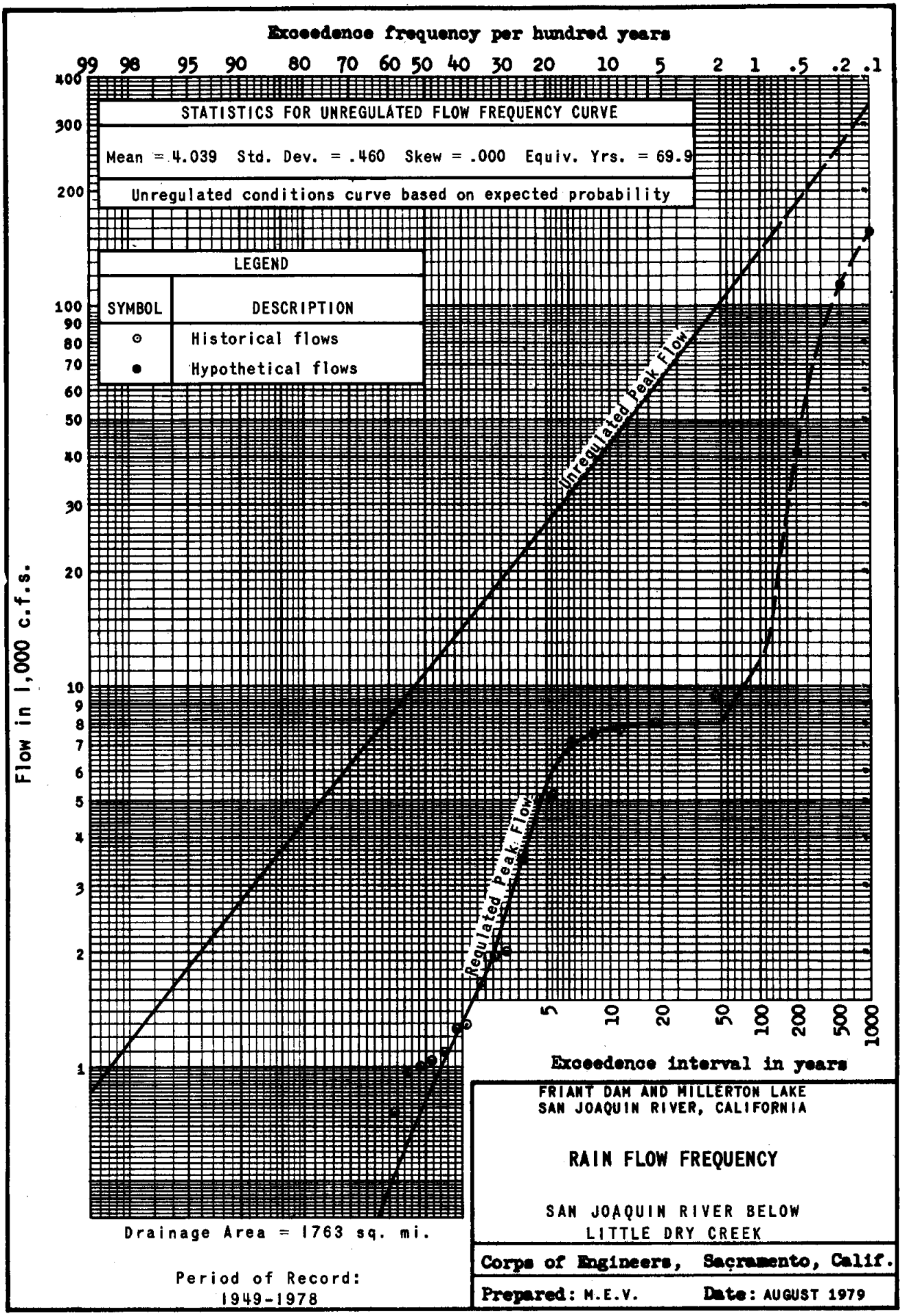
WATER YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANNUAL TOTAL
1873	23.3	33.2	34.3	39.9	42.9	90.4	153.7	265.3	231.6	86.0	38.7	24.3	1063.6
1874	37.5	34.7	39.7	75.8	84.2	133.3	222.2	383.3	453.3	179.5	58.9	40.6	1743.0
1875	24.5	21.6	28.2	32.6	33.8	50.0	118.8	206.3	147.6	82.0	56.3	35.3	837.0
1876	45.9	40.1	47.1	121.7	133.6	202.4	325.3	531.5	601.3	292.7	104.0	47.4	2493.0
1877	22.2	19.6	25.5	29.6	30.6	45.2	107.6	186.7	133.7	74.3	51.0	32.0	758.0
1878	40.8	35.7	41.9	108.2	118.9	180.1	289.5	472.9	535.0	260.4	92.5	42.1	2218.0
1879	31.8	19.6	25.2	37.4	70.9	120.1	229.0	326.0	379.6	141.6	48.3	22.7	1452.2
1880	22.9	24.5	70.1	50.7	54.2	75.6	288.4	809.8	1078.2	492.5	106.4	43.7	3117.0
1881	25.9	22.6	123.0	237.1	352.1	175.5	476.5	559.2	353.9	188.4	77.5	34.8	2626.5
1882	28.5	27.4	38.9	18.6	18.3	93.6	202.8	544.2	468.1	179.4	36.3	14.3	1670.4
1883	34.7	29.2	19.7	19.7	17.8	70.7	126.7	453.2	370.1	90.4	30.1	24.4	1286.7
1884	20.3	14.9	15.4	25.2	141.5	251.5	194.6	503.6	975.9	805.5	201.1	58.3	3207.8
1885	50.4	35.9	37.3	42.6	46.5	97.8	166.3	287.0	250.6	93.0	41.9	26.2	1175.3
1886	39.1	41.8	128.9	206.2	157.0	248.0	420.2	786.1	1042.4	612.3	161.7	61.3	3905.0
1887	30.9	44.1	45.6	52.2	57.0	120.0	204.2	352.4	307.8	114.2	51.4	32.2	1412.0
1888	26.5	23.4	30.5	35.3	36.6	54.1	128.6	223.2	159.8	88.8	61.0	38.2	906.0
1889	32.6	30.2	34.6	66.0	73.3	116.0	193.4	333.6	394.4	156.3	51.3	35.3	1517.0
1890	33.9	36.9	111.9	179.0	136.3	215.3	364.8	682.4	905.0	531.6	140.3	53.2	3390.0
1891	25.8	36.7	38.0	43.5	47.6	100.0	170.2	293.8	256.6	95.2	42.8	26.8	1177.0
1892	39.0	36.0	41.3	78.9	87.6	138.7	231.2	398.7	471.4	186.7	61.3	42.2	1813.0
1893	38.2	35.4	40.5	77.3	85.9	136.0	226.7	391.0	462.4	183.1	60.1	41.4	1778.0
1894	28.1	40.0	41.4	47.4	51.8	108.9	185.2	319.7	279.1	103.6	46.6	29.2	1281.0
1895	43.0	37.6	44.2	177.0	142.6	170.8	316.6	807.0	599.4	278.4	87.1	64.6	2768.3
1896	25.8	25.6	22.9	130.3	67.7	160.6	159.2	331.7	702.1	256.9	64.5	31.8	1979.1
1897	10.3	41.5	41.0	40.3	144.3	143.0	389.2	832.9	348.8	153.3	55.2	13.5	2213.3
1898	17.2	51.9	59.4	40.5	46.8	55.8	175.2	197.1	161.7	59.0	29.5	21.6	915.8
1899	31.3	18.3	23.6	28.5	35.8	165.3	251.9	229.4	339.2	104.3	26.3	9.0	1262.9
1900	13.2	33.6	62.6	138.0	29.7	107.5	122.6	352.0	340.8	101.0	24.0	12.1	1337.1
1901	27.7	109.1	63.5	215.6	267.7	257.7	278.5	672.4	713.9	213.1	145.9	23.7	2988.8
1902	30.1	41.8	53.6	31.2	42.5	100.6	272.7	421.5	515.1	118.4	53.8	22.7	1704.0
1903	21.3	35.3	38.0	65.9	61.7	86.3	227.5	549.6	465.0	123.0	35.5	17.9	1727.0
1904	18.5	20.0	20.1	21.4	40.9	153.0	231.1	726.0	515.1	170.3	88.2	57.4	2062.0
1905	142.4	47.8	39.3	41.1	59.3	136.7	199.0	434.2	469.0	151.0	50.5	25.1	1795.4
1906	21.0	19.8	23.7	165.9	73.6	362.8	446.0	889.0	1020.0	1000.0	272.7	73.3	4367.8
1907	39.9	35.2	48.9	104.2	119.3	307.0	497.0	567.0	619.0	546.0	171.1	59.3	3113.9
1908	40.4	26.2	40.5	53.1	58.1	120.0	199.0	219.0	176.0	119.0	73.2	39.0	1163.5
1909	23.9	16.2	18.5	277.0	183.0	133.0	352.0	646.0	827.0	309.0	78.1	37.0	2900.7
1910	25.0	49.6	220.0	188.2	86.4	190.0	378.3	479.4	238.5	98.2	37.7	50.2	2041.5
1911	28.0	23.1	31.2	254.0	206.0	350.6	430.0	570.9	943.1	593.0	113.5	42.6	3586.0
1912	29.3	25.0	20.3	28.3	25.6	58.2	80.7	261.1	370.7	92.3	34.1	18.3	1043.9
1913	13.2	16.7	16.6	19.4	12.0	37.7	99.1	262.1	180.3	104.3	67.0	39.3	867.7
1914	11.7	18.4	25.6	276.8	151.1	238.1	388.3	605.9	607.8	386.9	130.6	42.2	2883.4
1915	29.2	20.6	20.6	32.1	92.1	126.3	259.0	400.7	615.2	281.0	57.7	12.6	1947.1
1916	14.2	13.4	30.9	182.6	144.5	341.2	479.0	581.4	582.4	282.3	77.5	31.1	2760.5
1917	57.7	29.8	38.4	40.6	134.9	109.9	238.4	397.1	598.3	210.3	58.4	22.4	1936.2
1918	12.7	11.7	12.5	12.7	33.7	157.5	192.9	341.4	515.4	109.6	28.8	11.3	1440.2
1919	98.0	36.3	38.6	26.2	66.8	93.7	223.8	481.6	150.4	52.9	18.9	10.3	1297.5
1920	12.7	10.3	26.0	21.3	26.2	105.3	171.8	455.6	349.8	99.6	30.1	13.8	1322.5
1921	26.5	35.2	34.1	64.4	77.8	168.5	203.8	367.8	434.1	144.9	31.7	15.6	1604.4
1922	10.7	9.9	59.0	66.2	98.6	104.5	205.1	684.8	757.8	265.8	68.7	24.1	2355.2
1923	13.2	28.2	84.4	63.3	65.5	96.7	221.1	506.0	304.3	193.6	50.4	27.6	1654.3
1924	27.9	16.0	14.2	14.7	21.2	25.7	94.6	164.0	34.9	16.5	9.2	5.9	444.8
1925	9.6	26.2	27.3	27.1	84.5	100.7	219.1	418.8	313.3	146.2	53.0	12.9	1438.7
1926	19.8	16.4	21.3	16.5	57.0	96.3	347.0	378.4	146.1	43.5	12.3	6.9	1161.5
1927	5.8	55.7	49.5	46.8	154.5	150.9	275.3	507.6	495.5	196.7	47.6	15.4	2001.3
1928	20.1	68.6	32.8	33.4	48.1	149.9	188.9	373.0	175.5	44.0	13.7	5.7	1153.7
1929	8.5	10.3	14.6	16.0	22.9	64.7	107.2	308.6	210.5	75.2	18.7	5.2	862.4
1930	5.0	6.2	8.3	18.2	35.6	80.0	213.5	243.6	60.8	16.9	20.4	5.9	714.4

HISTORICAL UNIMPAIRED FLOWS
BELOW FRIANT
(Continued)

(Flows in 1,000 acre-feet)

WATER YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANNUAL TOTAL
1931	10.6	13.4	10.2	16.0	23.4	38.9	100.2	173.5	59.7	16.0	11.1	7.2	480.2
1932	5.9	8.4	71.8	58.9	167.7	156.6	238.1	491.5	543.6	238.8	51.4	14.7	2047.4
1933	12.6	8.9	14.6	26.5	25.3	73.4	159.0	213.4	410.1	118.9	29.3	14.7	1106.7
1934	6.8	10.3	38.1	46.8	50.3	109.4	166.1	146.2	68.9	27.3	13.4	7.9	691.5
1935	12.6	26.6	36.2	72.5	85.2	110.9	356.6	496.8	519.2	144.2	43.9	18.6	1923.3
1936	13.6	15.8	16.4	38.3	195.9	163.5	348.6	510.0	347.7	150.5	42.1	10.9	1853.3
1937	10.9	12.6	36.4	34.9	252.7	190.6	303.8	704.8	456.8	159.7	34.0	10.8	2208.0
1938	9.9	12.3	210.7	70.9	207.3	433.8	434.2	795.0	912.7	431.2	127.9	42.6	3688.5
1939	38.9	33.1	28.7	32.7	43.3	102.8	239.9	208.8	110.3	43.4	24.8	14.1	920.8
1940	34.8	14.2	11.4	134.1	139.8	210.0	290.0	558.6	362.9	96.6	21.2	7.0	1880.6
1941	10.1	11.7	98.4	105.8	182.8	208.6	242.4	711.2	641.5	330.9	85.8	23.3	2652.5
1942	21.5	30.3	96.0	113.1	102.6	128.5	298.5	465.4	632.6	284.0	64.7	16.7	2253.9
1943	10.1	42.5	43.4	169.7	113.3	267.7	335.1	502.5	325.1	178.8	49.9	15.6	2053.7
1944	10.5	15.1	19.8	31.2	55.4	111.6	140.8	408.2	140.9	142.6	35.0	15.7	1126.8
1945	12.7	58.4	56.1	44.1	237.7	147.9	275.9	476.8	487.6	240.2	73.9	26.8	2138.1
1946	59.1	65.6	118.3	78.9	53.8	125.8	310.4	463.9	279.9	117.8	36.9	19.1	1729.5
1947	24.8	64.9	84.5	47.7	64.0	100.3	171.0	347.7	145.8	42.7	16.8	11.6	1121.8
1948	22.8	18.2	15.4	18.9	20.2	42.6	164.6	390.6	372.6	107.9	26.0	15.0	1214.8
1949	10.5	7.9	14.6	16.2	25.9	63.0	234.5	409.5	268.3	63.2	25.6	14.9	1164.1
1950	9.8	16.1	17.2	43.2	90.1	89.6	280.1	379.0	262.9	87.0	21.7	13.8	1310.5
1951	17.1	247.0	300.4	111.2	104.2	119.2	201.9	321.9	278.0	114.7	31.7	11.7	1859.0
1952	12.3	20.4	83.4	133.0	98.7	176.7	385.2	819.9	640.8	335.3	101.4	33.0	2840.1
1953	16.9	18.7	42.9	85.0	48.0	71.5	197.2	211.3	320.2	171.6	30.2	13.2	1226.7
1954	9.4	16.6	16.6	33.4	65.4	127.2	278.4	439.5	217.6	80.4	20.2	9.1	1313.8
1955	6.0	17.8	31.2	41.6	48.9	74.1	126.5	337.8	348.2	87.9	29.6	11.4	1161.0
1956	6.1	13.2	460.5	271.2	140.8	169.5	278.3	568.0	613.8	317.8	86.5	34.4	2960.1
1957	26.3	21.7	20.7	29.5	66.9	90.1	142.2	326.7	439.9	115.0	31.7	15.9	1326.6
1958	16.4	18.5	43.3	42.6	112.5	181.4	362.6	795.5	622.3	287.5	107.9	40.5	2631.0
1959	16.1	14.6	14.6	37.0	89.6	113.6	203.1	208.1	153.0	41.5	16.8	41.4	949.4
1960	18.4	9.7	9.5	18.0	55.0	86.1	177.9	240.7	146.9	42.6	16.4	7.5	828.7
1961	8.5	22.3	31.2	19.0	30.8	48.9	124.6	171.6	128.0	27.4	24.8	10.4	647.5
1962	9.8	14.9	23.1	23.5	184.8	109.9	381.0	396.9	505.2	202.6	51.7	20.2	1923.6
1963	17.6	10.8	10.7	81.9	207.9	101.4	191.9	464.2	492.4	264.2	70.7	31.4	1945.1
1964	25.5	64.3	36.4	31.2	30.8	51.8	126.7	256.9	200.0	59.3	28.7	10.5	922.1
1965	10.2	34.0	203.9	187.8	114.1	128.2	250.8	431.3	472.2	266.7	137.8	35.1	2272.1
1966	17.4	101.1	66.5	61.8	55.4	125.8	277.2	361.6	147.7	50.4	25.0	8.8	1298.7
1967	6.4	28.7	212.7	92.5	100.8	243.0	249.6	659.2	823.5	594.3	154.2	66.8	3232.2
1968	26.9	22.9	34.3	36.9	75.4	82.9	146.1	231.1	131.2	43.8	22.1	8.5	862.1
1969	15.1	40.0	52.2	396.6	233.6	227.2	464.5	1096.4	874.2	462.8	137.1	40.5	4040.2
1970	32.6	31.7	47.1	159.4	83.3	136.9	146.0	375.8	278.5	106.6	36.7	11.0	1445.6
1971	9.3	38.6	73.3	74.9	71.8	109.6	171.5	293.4	364.7	140.6	48.0	21.5	1417.2
1972	13.3	25.5	57.5	41.3	50.1	138.4	124.0	268.2	213.3	47.0	15.8	44.7	1039.1
1973	19.5	33.6	46.8	81.7	128.3	131.1	248.2	708.1	462.4	127.0	44.4	15.6	2046.7
1974	21.0	87.6	81.8	134.5	66.3	209.7	267.1	596.6	482.0	161.7	59.5	19.7	2187.5
1975	17.6	18.7	32.2	36.4	76.0	135.7	131.4	547.0	573.9	159.7	41.2	25.8	1795.6
1976	48.5	32.7	23.7	18.6	37.9	58.9	81.6	174.2	59.4	34.6	23.6	35.3	629.0
1977	20.4	10.1	7.5	12.3	14.9	18.8	56.9	74.7	110.6	19.8	11.1	4.4	361.5
1978	5.3	9.5	80.6	158.0	195.8	326.3	345.7	694.8	829.1	462.6	148.9	145.6	3402.2
1979	33.4	29.6	33.0	95.2	102.0	182.5	243.7	599.4	339.1	113.5	41.9	17.3	1830.6
MEAN	23.7	31.0	53.3	78.0	90.9	138.2	239.6	443.9	418.4	188.4	58.7	26.6	1790.7


Exceedence frequency per hundred years
99 98 95 90 80 70 60 50 40 30 20 10 5 2 1 .5 .2 .1
STATISTICS
PEAK 1-DAY 3-DAY 7-DAY 15-DAY 30-DAY
Mean 4.039 3.868 3.711 3.559 3.430 3.326
Std. Dev. .460 .430 .400 .370 .340 .310
Skew .000 .000 .000 -.050 -.100 -.200
Eq. Yrs. 69.9 75.5 75.0 74.9 74.9 74.9
LEGEND:
Peak
1-Day
3-Day
7-Day
15-Day
30-Day
Flow in 1,000 c.f.s.
400 300 200 100 90 80 70 60 50 40 30 20 10 9 8 7 6 5 4 3 2 1 .5
5 10 20 50 100 200 500 1000
Exceedence interval in years
Drainage Area = 1676 sq. mi.
Period of Record
1904-1978
FRIANT DAM AND MILLERTON LAKE
SAN JOAQUIN RIVER, CALIFORNIA
RAIN FLOW FREQUENCY
UNREGULATED CONDITIONS
SAN JOAQUIN RIVER BELOW FRIANT DAM
Corps of Engineers, Sacramento, Calif.
Prepared: M.E.V. Date: AUGUST 1979


Exceedence frequency per hundred years
99 98 95 90 80 70 60 50 40 30 20 10 5 2 1 .5 .2 .1
STATISTICS FOR UNREGULATED FLOW FREQUENCY CURVE
Mean = 4.039 Std. Dev. = .460 Skew = .000 Equiv. Yrs. = 69.9
Unregulated conditions curve based on expected probability
LEGEND
SYMBOL
DESCRIPTION
Historical flows
Hypothetical flows
Unregulated Peak Flow
Regulated Peak Flow
Flow in 1,000 c.f.s.
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
4
3
2
1
5 10 20 50 100 200 500 1000
Exceedence interval in years
Drainage Area = 1763 sq. mi.
Period of Record:
1949-1978
FRIANT DAM AND MILLERTON LAKE
SAN JOAQUIN RIVER, CALIFORNIA
RAIN FLOW FREQUENCY
SAN JOAQUIN RIVER BELOW
LITTLE DRY CREEK
Corps of Engineers, Sacramento, Calif.
Prepared: M.E.V. Date: AUGUST 1979

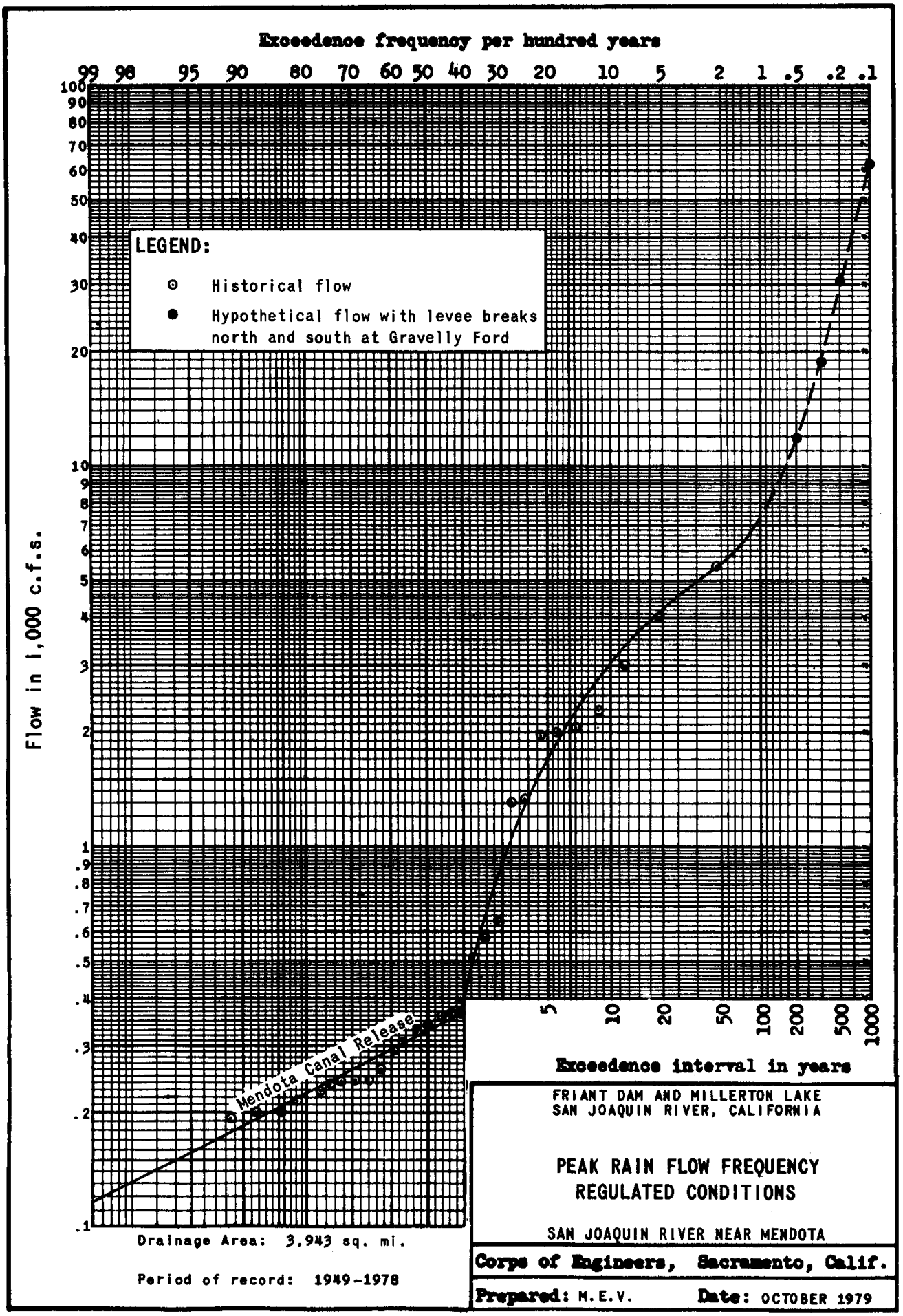
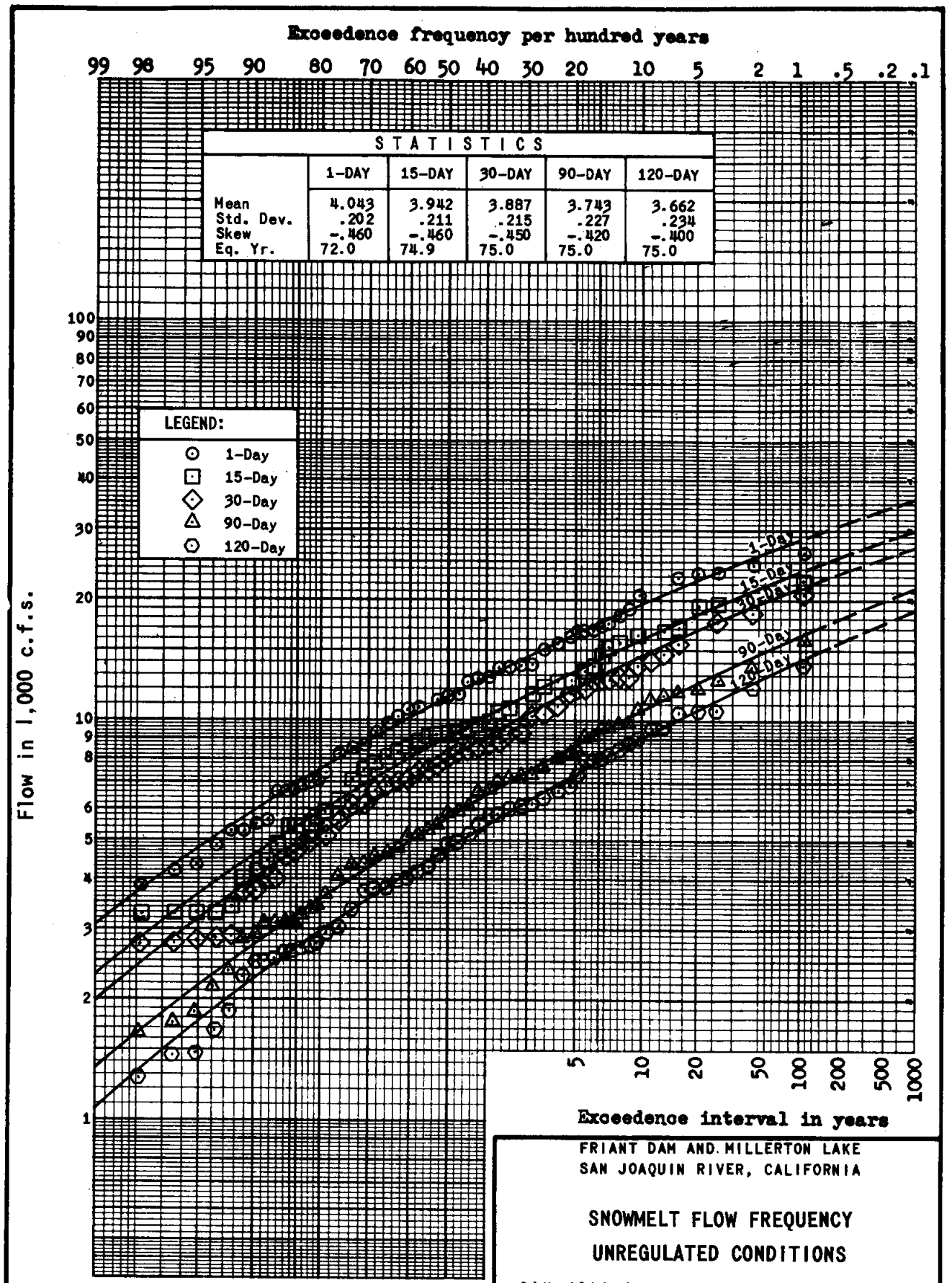

Exceedence frequency per hundred years
99 98 95 90 80 70 60 50 40 30 20 10 5 2 1 .5 .2 .1
100 90 80 70 60 50 40 30 20 10 9 8 7 6 5 4 3 2 1 .9 .8 .7 .6 .5 .4 .3 .2 .1
Flow in 1,000 c.f.s.
LEGEND:
Historical flow
Hypothetical flow with levee breaks north and south at Gravelly Ford
Mendota Canal Release
5 10 20 50 100 200 500 1000
Exceedence interval in years
Drainage Area: 3,943 sq. mi.
Period of record: 1949-1978
FRIANT DAM AND MILLERTON LAKE
SAN JOAQUIN RIVER, CALIFORNIA
PEAK RAIN FLOW FREQUENCY
REGULATED CONDITIONS
SAN JOAQUIN RIVER NEAR MENDOTA
Corps of Engineers, Sacramento, Calif.
Prepared: M.E.V. Date: OCTOBER 1979

CHART 7



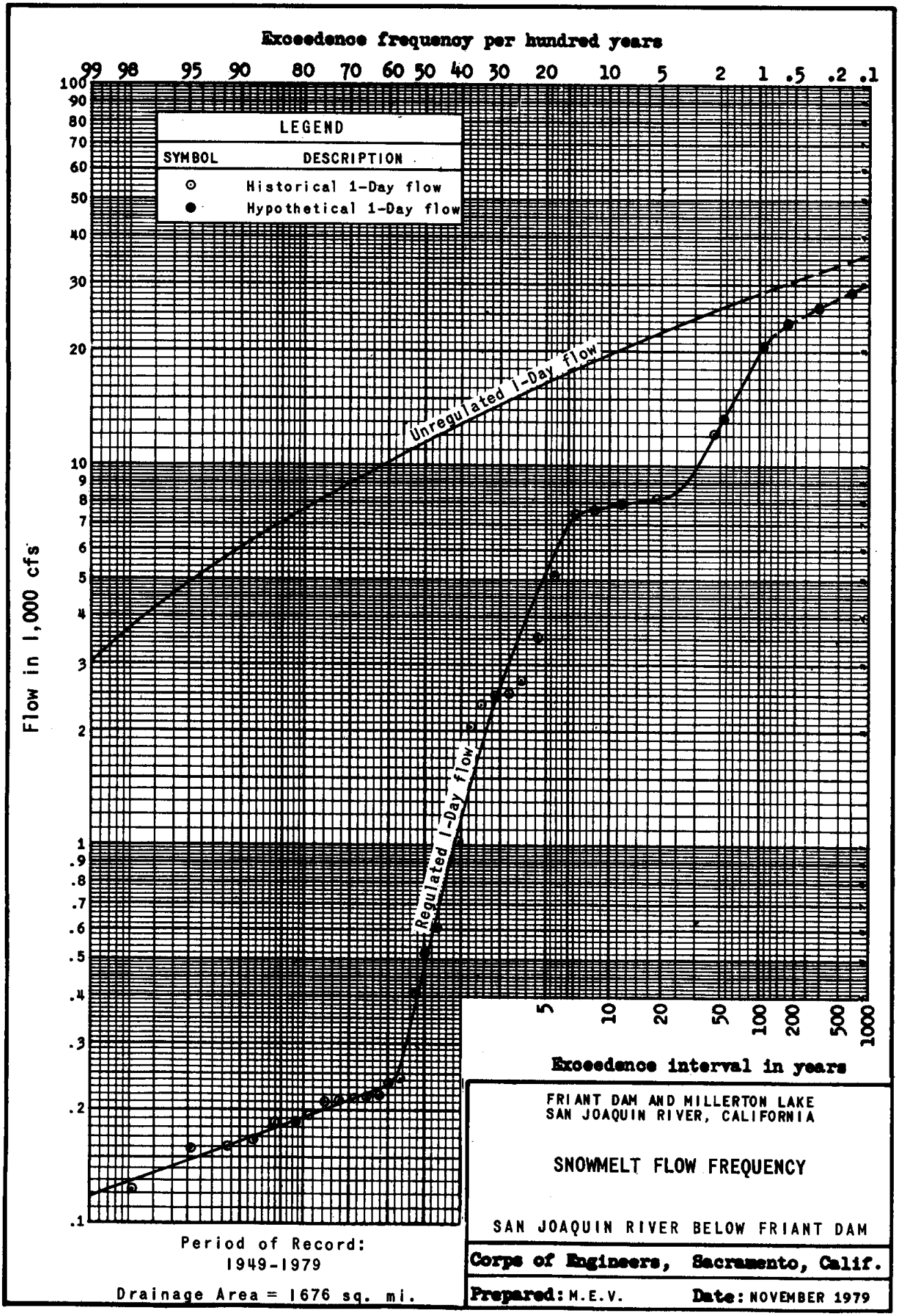
FRIANT DAM AND MILLERTON LAKE
SAN JOAQUIN RIVER, CALIFORNIA

SNOWMELT FLOW FREQUENCY
UNREGULATED CONDITIONS

SAN JOAQUIN RIVER BELOW FRIANT DAM

Corps of Engineers, Sacramento, Calif.

Prepared: M.E.V. Date: OCTOBER 1979


Exceedence frequency per hundred years
99 98 95 90 80 70 60 50 40 30 20 10 5 2 1 .5 .2 .1
LEGEND
SYMBOL DESCRIPTION
Historical 1-Day flow
Hypothetical 1-Day flow
Unregulated 1-Day flow
Regulated 1-Day flow
Flow in 1,000 cfs
100 90 80 70 60 50 40 30 20 10 9 8 7 6 5 4 3 2 1 .9 .8 .7 .6 .5 .4 .3 .2 .1
5 10 20 50 100 200 500 1000
Exceedence interval in years
Period of Record:
1949-1979
Drainage Area = 1676 sq. mi.
FRIANT DAM AND MILLERTON LAKE
SAN JOAQUIN RIVER, CALIFORNIA
SNOWMELT FLOW FREQUENCY
SAN JOAQUIN RIVER BELOW FRIANT DAM
Corps of Engineers, Sacramento, Calif.
Prepared: M.E.V. Date: NOVEMBER 1979

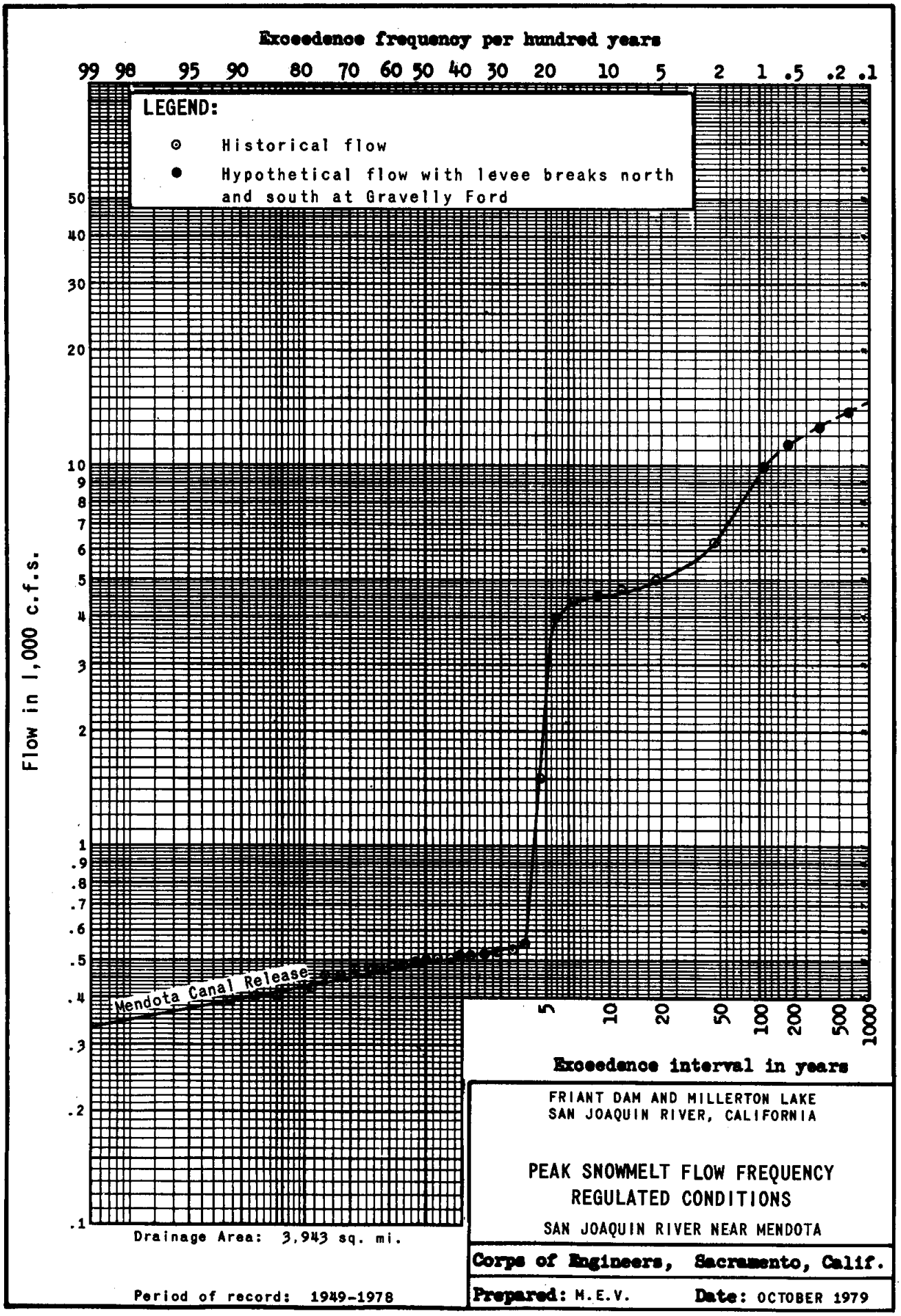

Exceedence frequency per hundred years
99 98 95 90 80 70 60 50 40 30 20 10 5 2 1 .5 .2 .1
LEGEND:
Historical flow
Hypothetical flow with levee breaks north and south at Gravelly Ford
Flow in 1,000 c.f.s.
50
40
30
20
10
9
8
7
6
5
4
3
2
1
.9
.8
.7
.6
.5
.4
.3
.2
.1
Mendota Canal Release
5 10 20 50 100 200 500 1000
Exceedence interval in years
Drainage Area: 3,943 sq. mi.
Period of record: 1949-1978
FRIANT DAM AND MILLERTON LAKE
SAN JOAQUIN RIVER, CALIFORNIA
PEAK SNOWMELT FLOW FREQUENCY
REGULATED CONDITIONS
SAN JOAQUIN RIVER NEAR MENDOTA
Corps of Engineers, Sacramento, Calif.
Prepared: M.E.V. Date: OCTOBER 1979

CHART 9

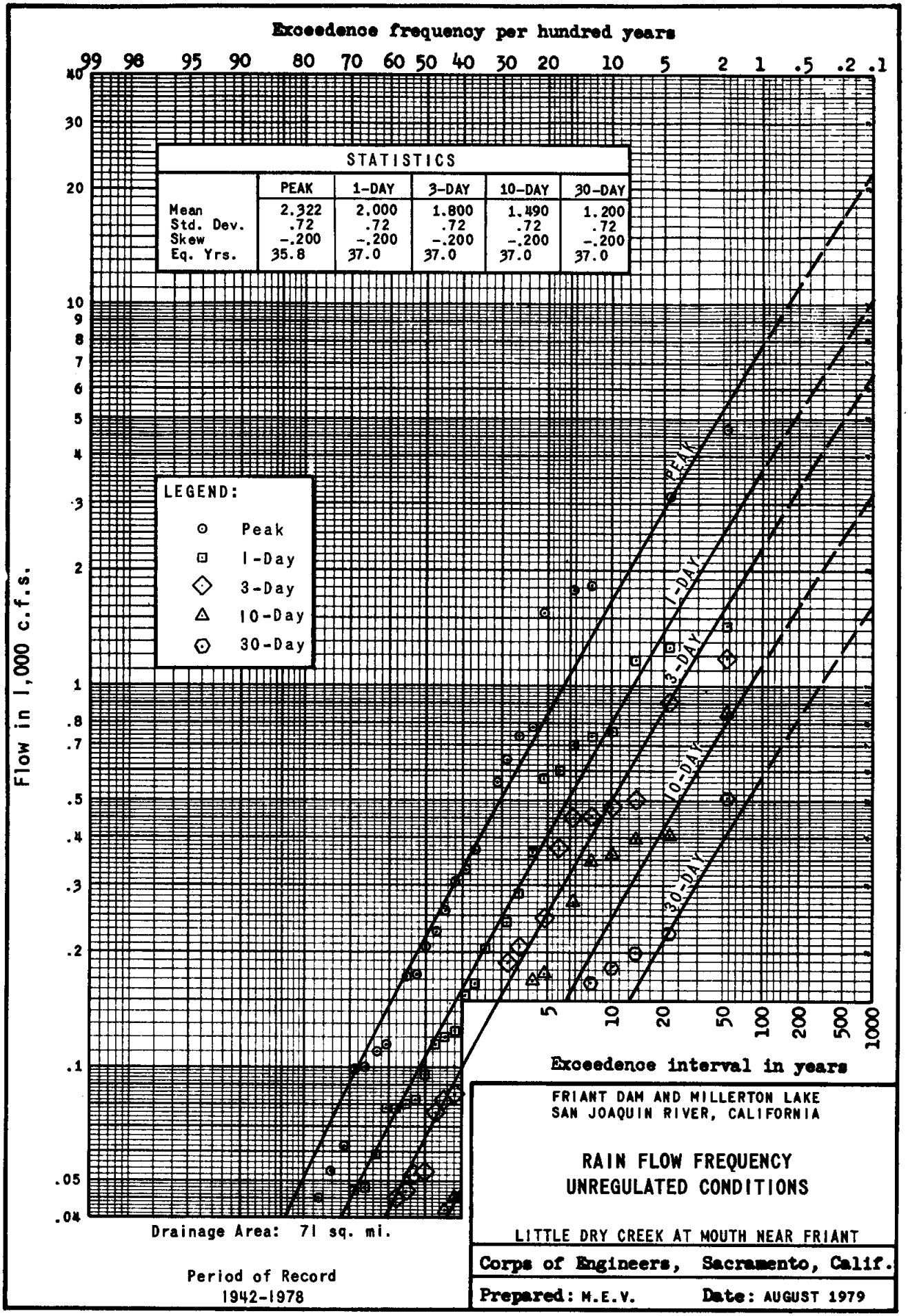
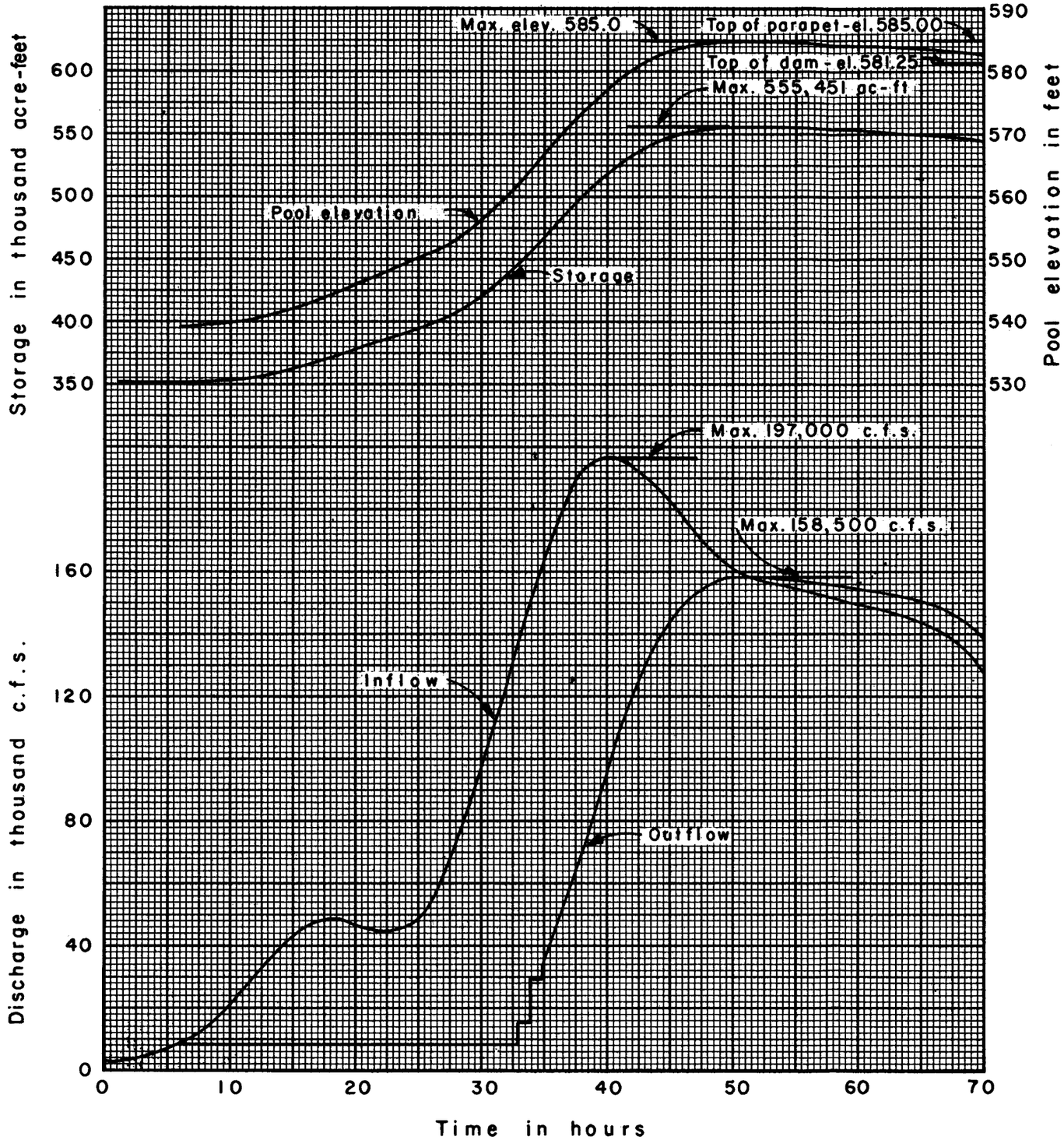

Exceedence frequency per hundred years
99 98 95 90 80 70 60 50 40 30 20 10 5 2 1 .5 .2 .1
STATISTICS
PEAK 1-DAY 3-DAY 10-DAY 30-DAY
Mean 2,322 2,000 1,800 1,490 1,200
Std. Dev. .72 .72 .72 .72 .72
Skew -.200 -.200 -.200 -.200 -.200
Eq. Yrs. 35.8 37.0 37.0 37.0 37.0
LEGEND:
Peak
1-Day
3-Day
10-Day
30-Day
PEAK
1-DAY
3-DAY
10-DAY
30-DAY
Flow in 1,000 c.f.s.
40 30 20 10 9 8 7 6 5 4 3 2 1 .8 .7 .5 .4 .3 .2 .1 .05 .04
5 10 20 50 100 200 500 1000
Exceedence interval in years
Drainage Area: 71 sq. mi.
Period of Record
1942-1978
FRIANT DAM AND MILLERTON LAKE
SAN JOAQUIN RIVER, CALIFORNIA
RAIN FLOW FREQUENCY
UNREGULATED CONDITIONS
LITTLE DRY CREEK AT MOUTH NEAR FRIANT
Corps of Engineers, Sacramento, Calif.
Prepared: M.E.V. Date: AUGUST 1979

CHART 10



NOTES:

Flood routing started at elevation 539.25 (Reservoir storage of 350,000 ac-ft). Discharge 8,000 c.f.s. until reaching reservoir stage where Corps of Engineers emergency release diagram, dated Sept. 1964, applies.

Routing furnished by U.S. Bureau of Reclamation.

FRIANT DAM AND MILLERTON LAKE
SAN JOAQUIN RIVER, CALIFORNIA

SPILLWAY DESIGN FLOOD ROUTING

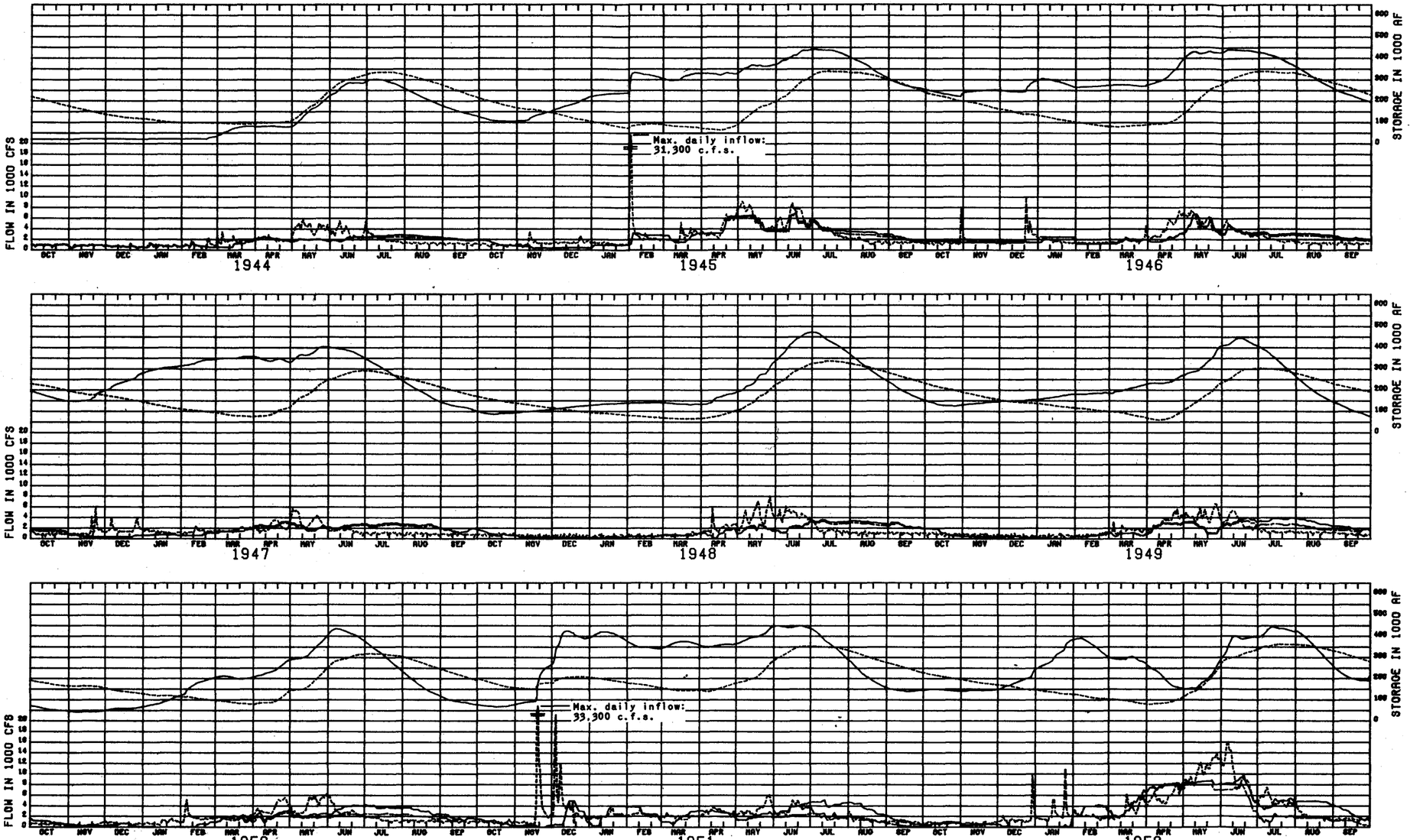
U.S. Army Engineer District Sacramento, Calif.

June 1965

CHART 11

PRINCIPAL EXISTING RESERVOIRS

CHART 12



LEGEND:

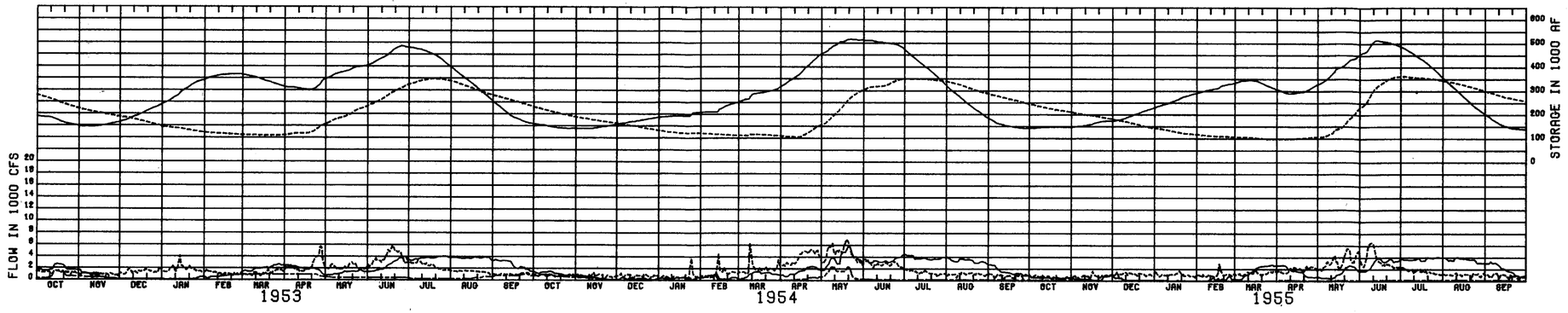
- Inflow
- Total outflow
- Release to San Joaquin River
- Millerton Lake storage
- Total upstream storage

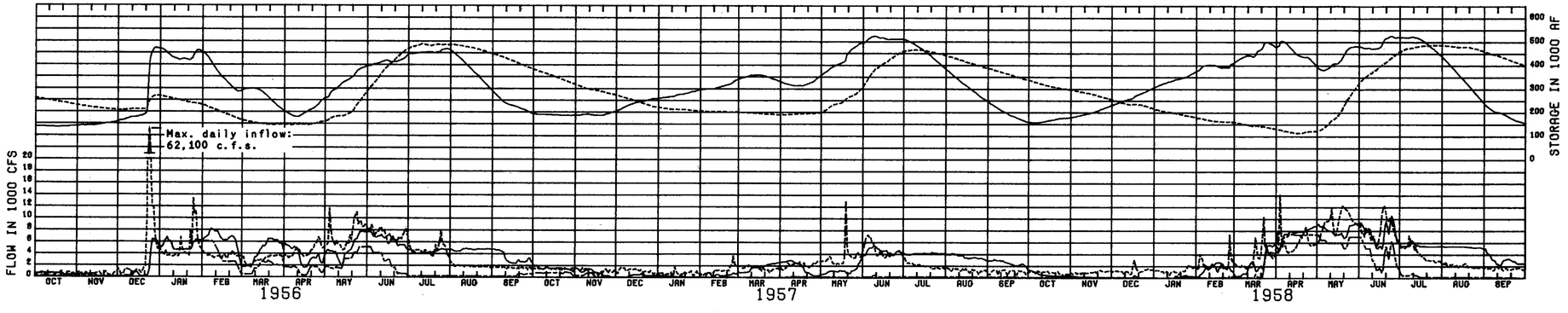
FRIANT DAM AND MILLERTON LAKE
SAN JOAQUIN RIVER, CALIFORNIA

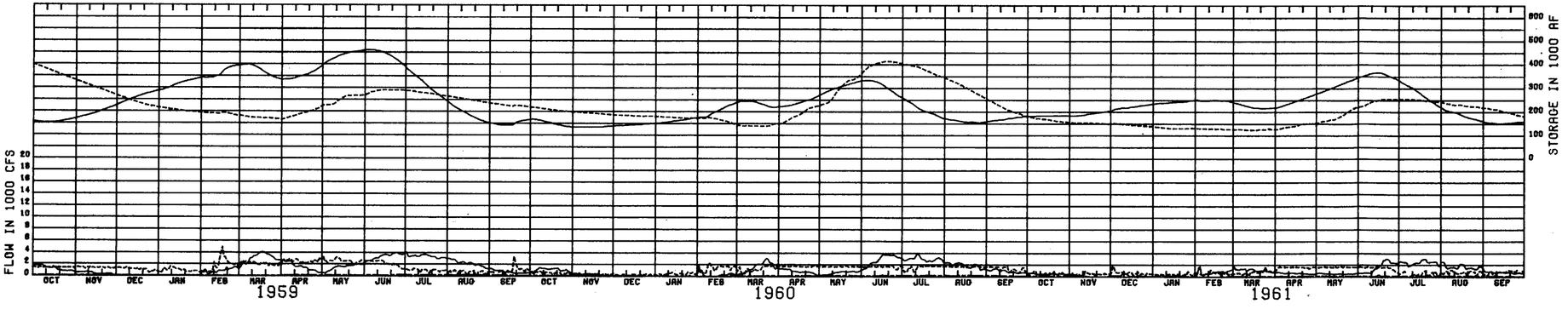
HISTORICAL OPERATION
MILLERTON LAKE

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: N.T.N., L.H.C. Date: OCTOBER 1979
Drawn: L.H.C.







LEGEND:

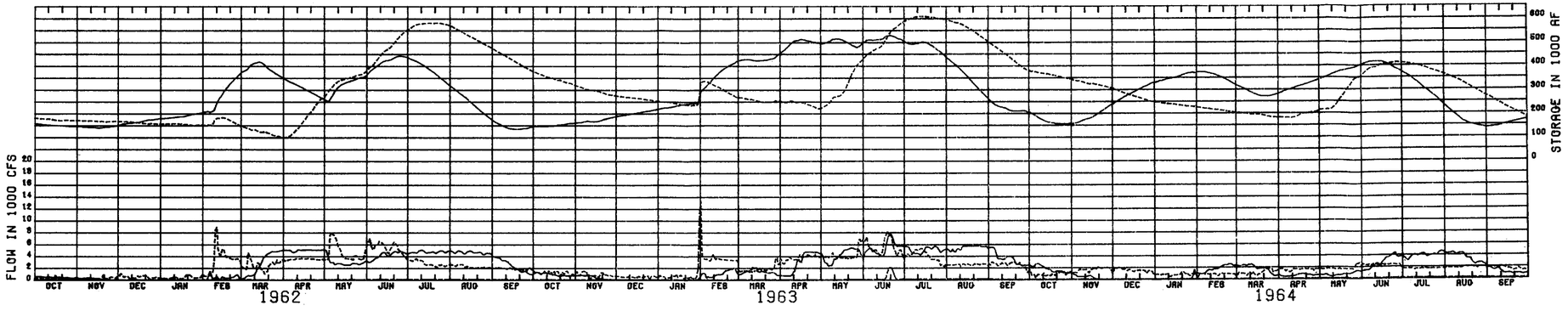
- Inflow
- Total outflow
- Release to San Joaquin River
- Millerton Lake storage
- Total upstream storage

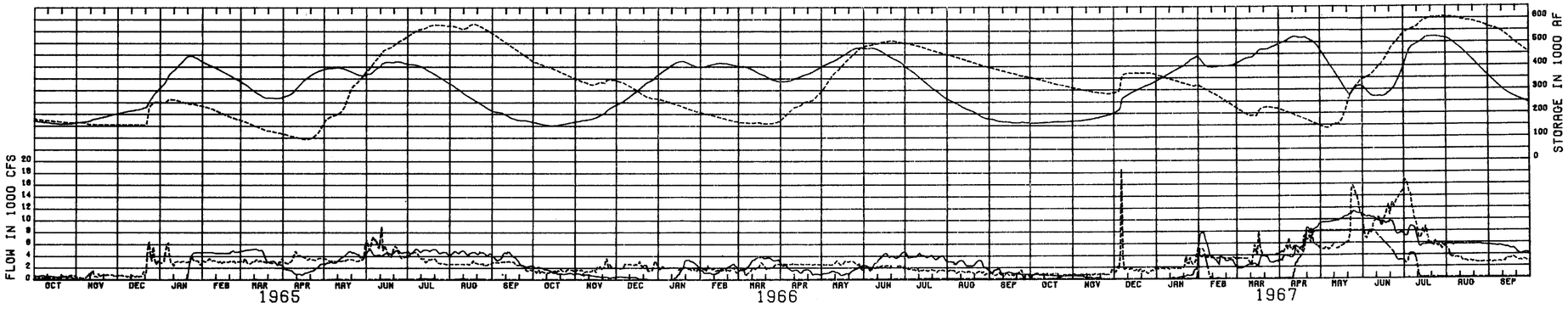
FRIANT DAM AND MILLERTON LAKE
SAN JOAQUIN RIVER, CALIFORNIA

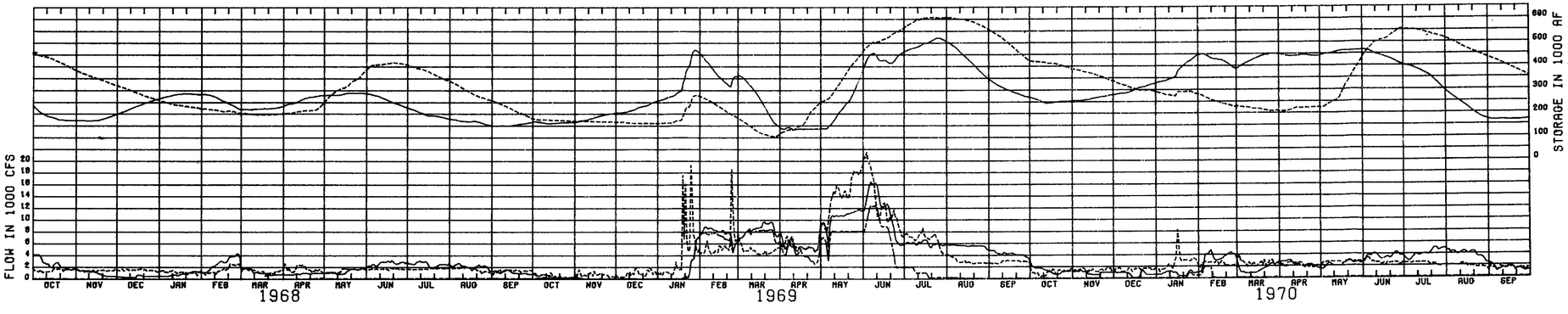
HISTORICAL OPERATION
MILLERTON LAKE

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: W.T.M., L.H.C. Date: OCTOBER 1979
Drawn: L.H.C.







LEGEND:

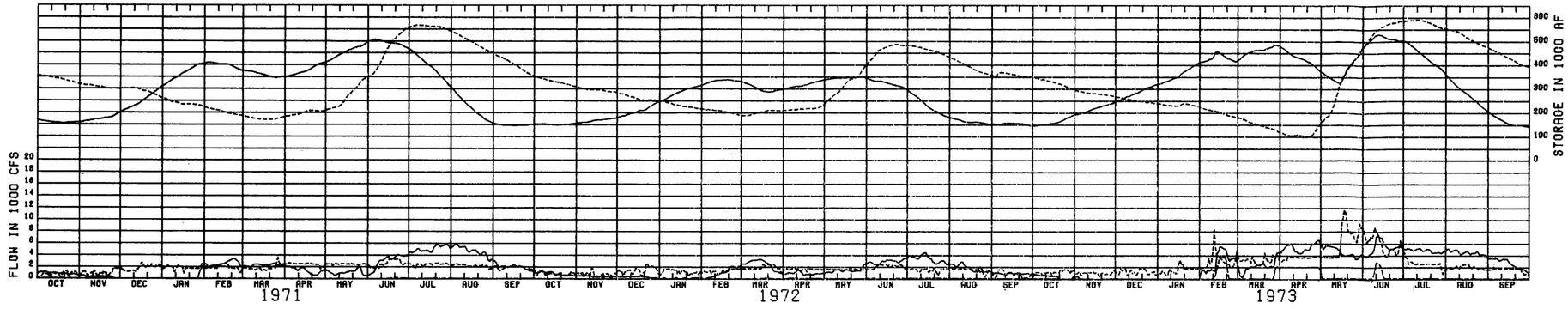
- Inflow
- Total outflow
- Release to San Joaquin River
- Millerton Lake Storage
- Total upstream storage

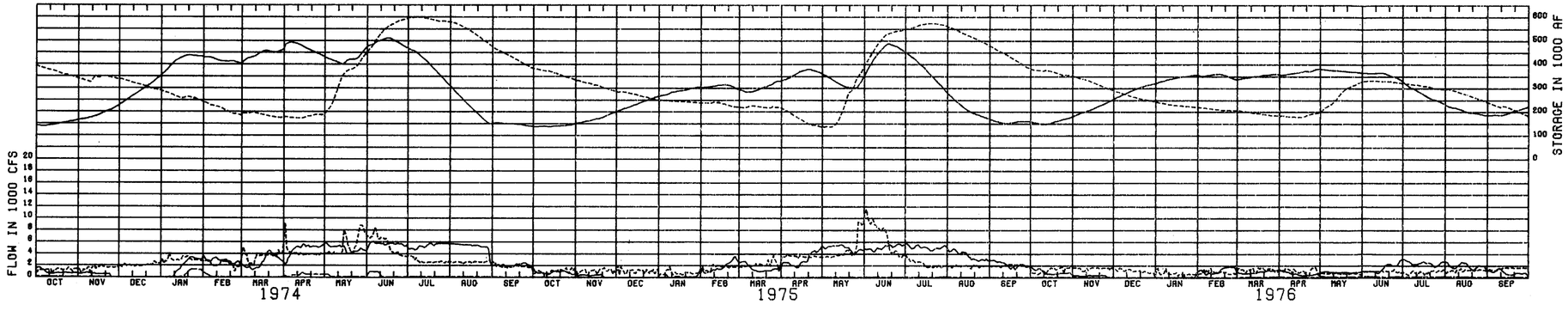
FRIANT DAM AND MILLERTON LAKE
SAN JOAQUIN RIVER, CALIFORNIA

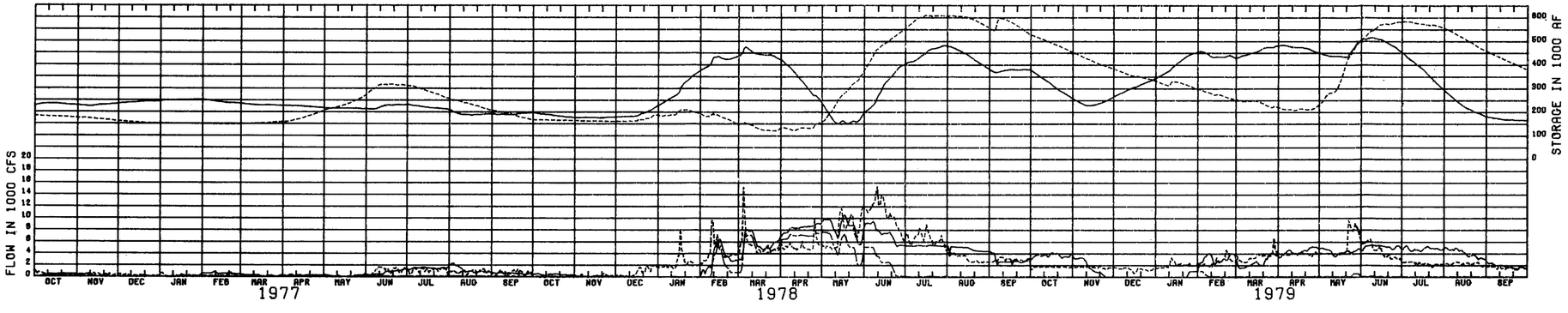
HISTORICAL OPERATION
MILLERTON LAKE

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: H.T.M.,L.H.C. Date: OCTOBER 1979
Drawn: L.H.C.







LEGEND:

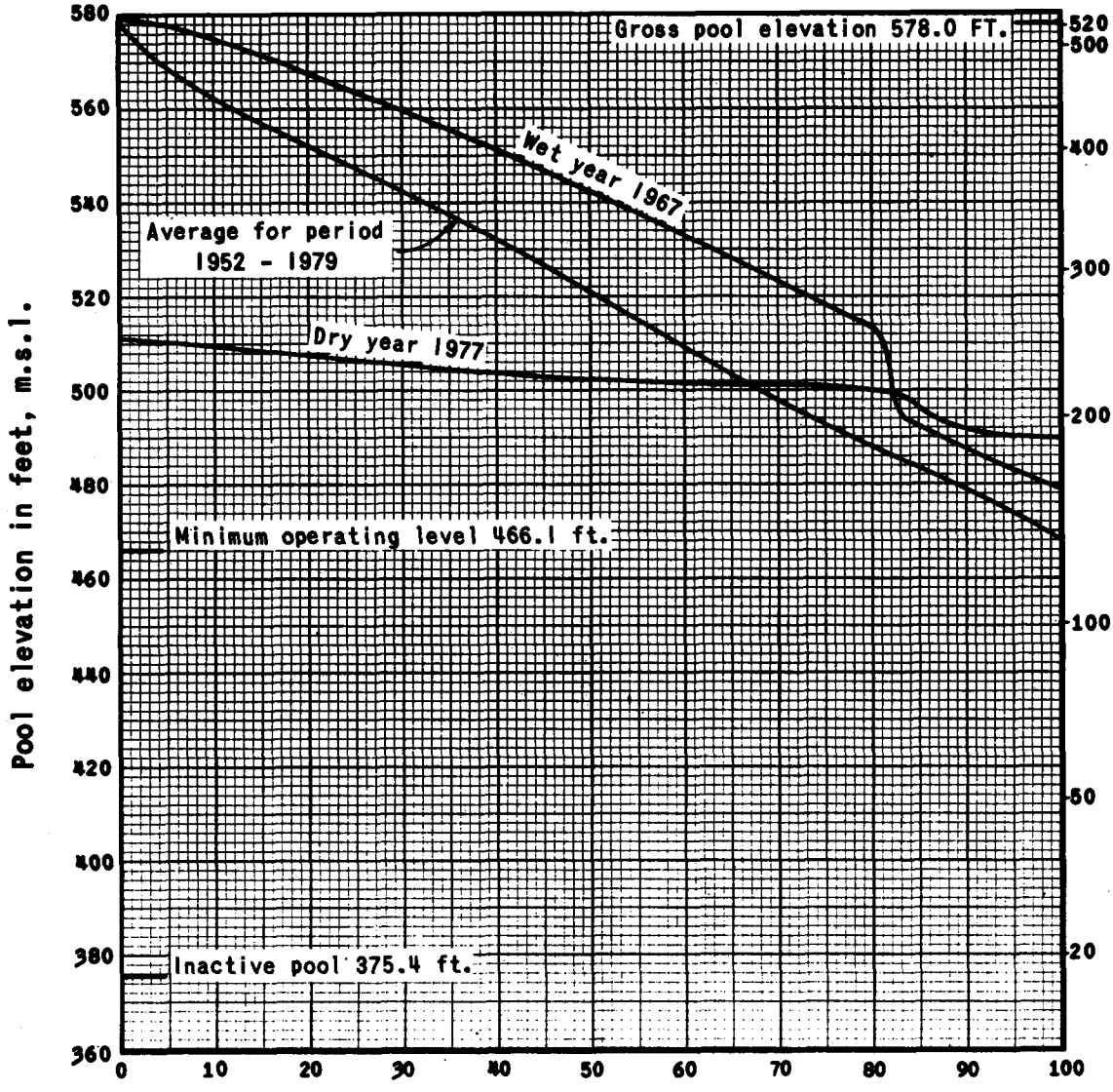
- Inflow
- Total outflow
- Release to San Joaquin River
- Millerton Lake storage
- Total upstream storage

FRIANT DAM AND MILLERTON LAKE
SAN JOAQUIN RIVER, CALIFORNIA

HISTORICAL OPERATION
MILLERTON LAKE

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: H.T.M.,L.H.C. Date: OCTOBER 1979
Drawn: L.H.C.



FRIANT DAM AND MILLERTON LAKE
SAN JOAQUIN RIVER, CALIFORNIA

STAGE - DURATION CURVES

Drainage Area: 1,638 sq. mi.

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: L.H.C.
Drawn: L.H.C.

Date: JANUARY 1980

CHART 14

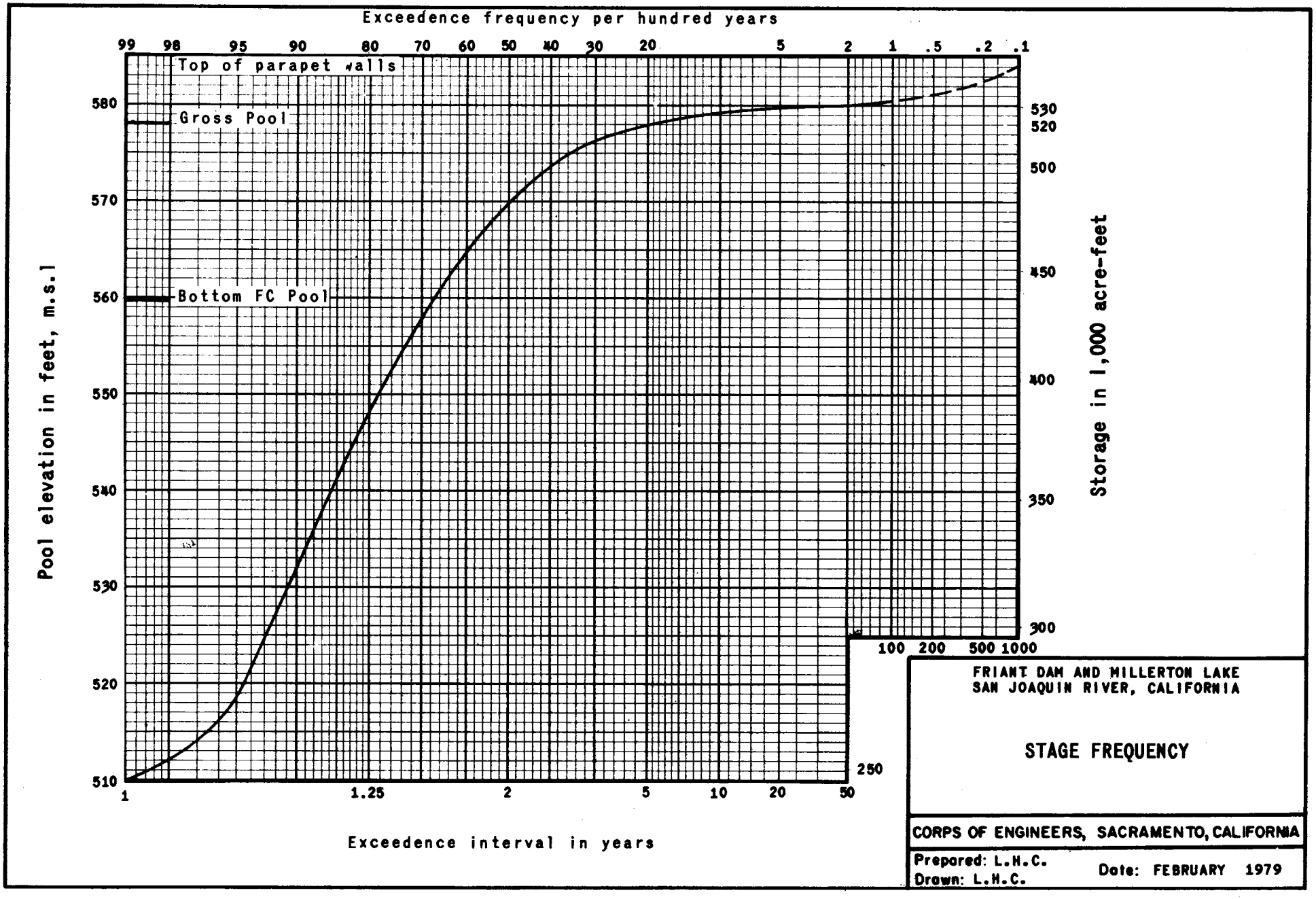
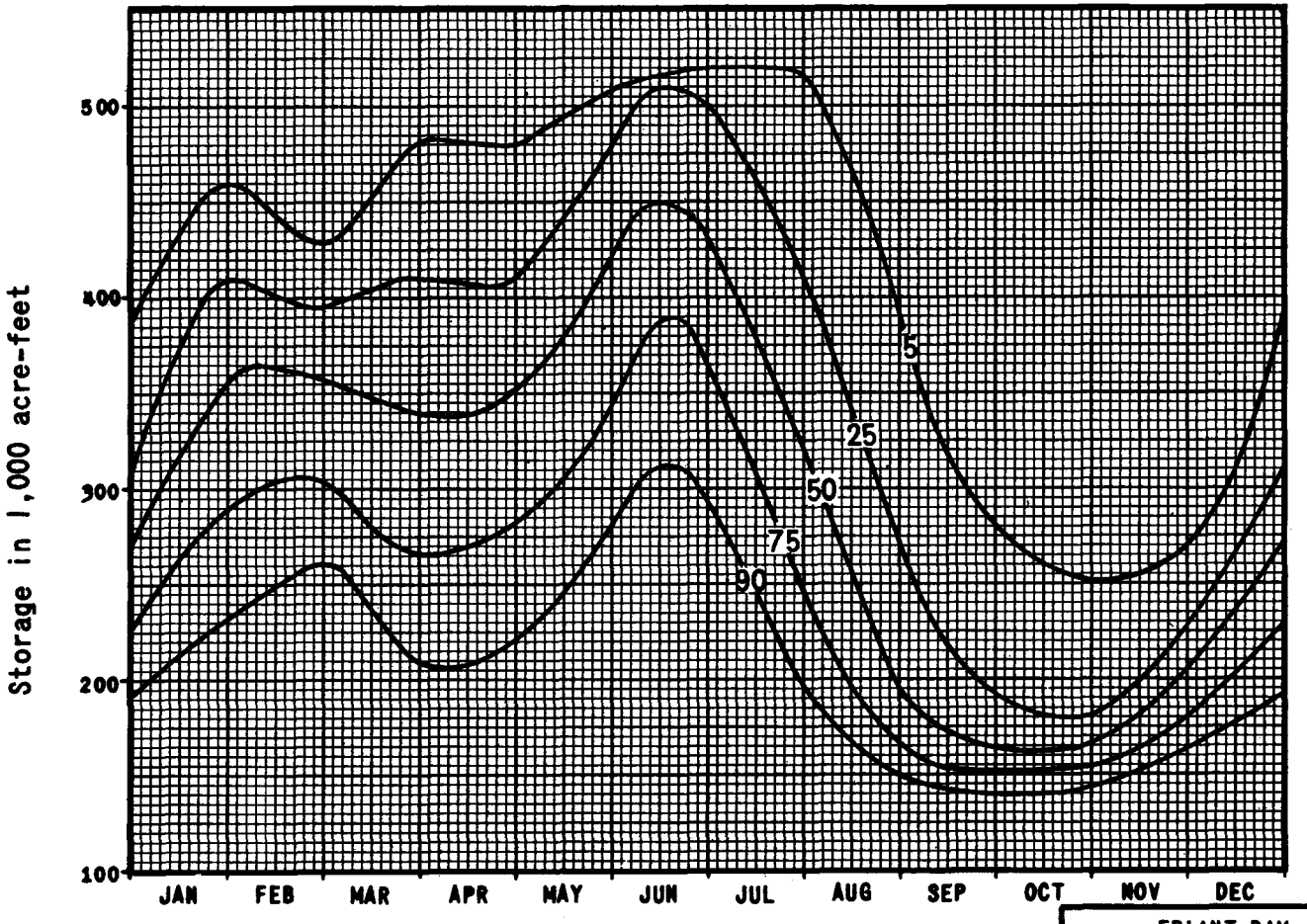

Exceedence frequency per hundred years
99 98 95 90 80 70 60 50 40 30 20 5 2 1 .5 .2 .1
Top of parapet walls
Gross Pool
Bottom FC Pool
580
570
560
550
540
530
520
510
Pool elevation in feet, m.s.l
530
520
500
450
400
350
300
250
100 200 500 1000
Storage in 1,000 acre-feet
1 1.25 2 5 10 20 50
Exceedence interval in years
FRIANT DAM AND MILLERTON LAKE
SAN JOAQUIN RIVER, CALIFORNIA
STAGE FREQUENCY
CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA
Prepared: L.H.C.
Drawn: L.H.C.
Date: FEBRUARY 1979

CHART 15



NOTE:

Indicated value is percentage of years that storage is exceeded on a given date based on total end of month storage for the years 1952-1978. Data extracted from U.S.G.S. water supply papers.

FRIANT DAM AND MILLERTON LAKE
SAN JOAQUIN RIVER, CALIFORNIA

SEASONAL VARIATION
OF RESERVOIR STORAGE FREQUENCY

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: L.H.C.
Drawn: L.H.C.

Date: FEBRUARY 1979

CHART 16

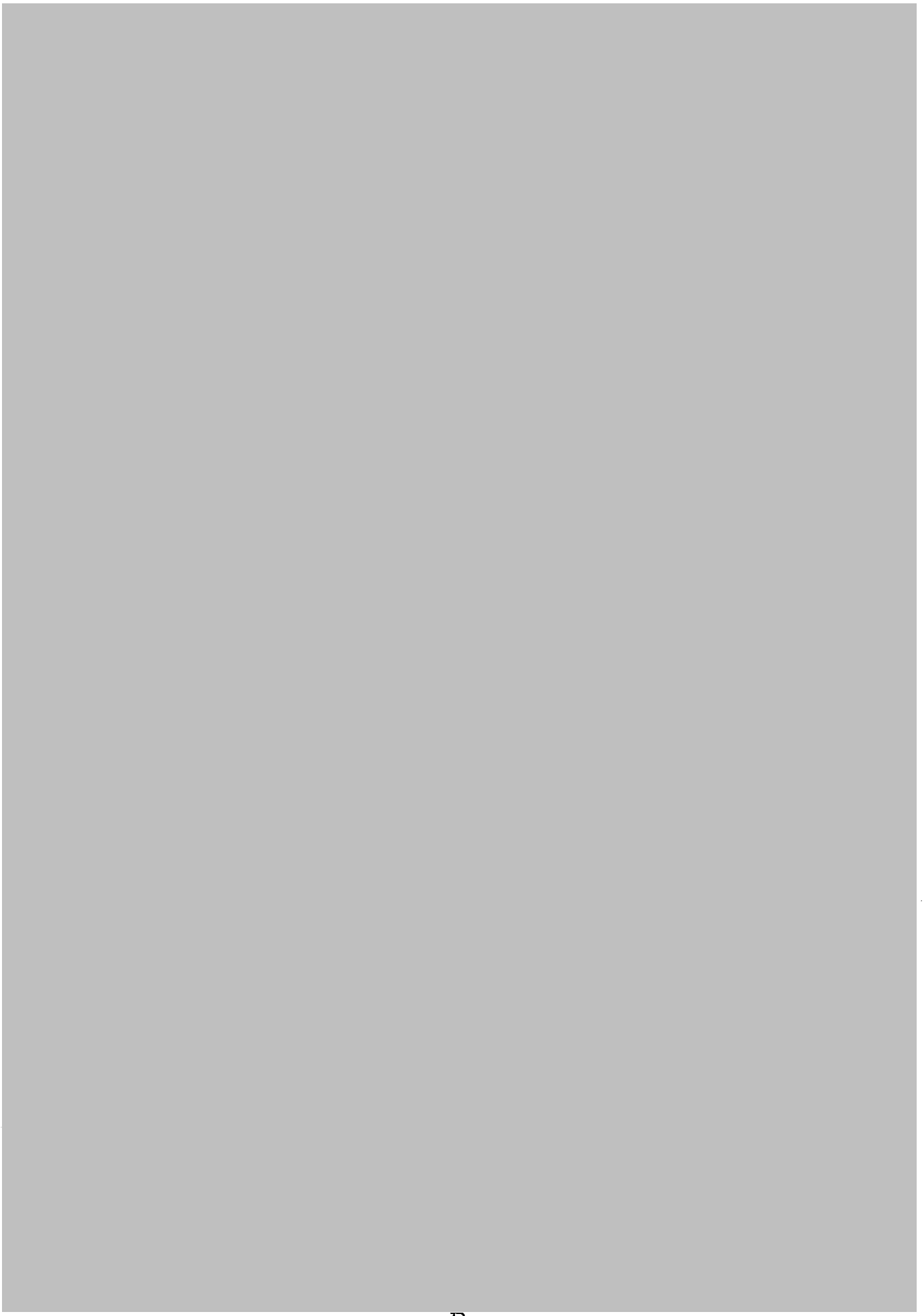
FRIANT DAM AND MILLERTON LAKE
SAN JOAQUIN RIVER, CALIFORNIA

REPORT ON RESERVOIR REGULATION
FOR FLOOD CONTROL

AUGUST 1980

APPENDIX A
STANDING OPERATING INSTRUCTIONS
AND
FLOOD CONTROL REGULATIONS
FOR
FRIANT DAM AND MILLERTON LAKE

Department of the Army
Sacramento District, Corps of Engineers
Sacramento, California



PERSONNEL CHART

APPENDIX A

STANDING OPERATING INSTRUCTIONS
AND FLOOD CONTROL REGULATIONS
FOR
FRIANT DAM AND MILLERTON LAKE
SAN JOAQUIN RIVER, CALIFORNIA

TABLE OF CONTENTS

Paragraph	Subject	Page
	Personnel Concerned in Flood Control Operation of Millerton Lake	
1	General	A-1
2	Flood Control Operation Requirements	A-1
3	Limitations on Storage	A-2
4	Limitations on Releases	A-2
5	Schedule of Flood Control Operation	A-2
6	Credit for Upstream Space	A-3
7	Emergency Operation of Gated Spillway	A-3
8	Standing Instructions During Flood Emergency	A-4
9	Operational Responsibilities	A-4
10	Operation Reports	A-5
11	Instructions to Damtender	A-6
12	Modification of Regulations	A-6

LIST OF CHARTS

Chart No.

A-1 Friant Dam Plan, Elevation and Section
A-2 Rating Table for Drum Gate Spillway
A-3 Spillway Rating Curves
A-4 Outlet Rating Discharge Curves
A-5 Area and Capacity Curves
A-6 Capacity Tables
A-7 Evaporation Coefficients
A-8 Runoff Forecast Charts
A-9 Summary of Forecasted and Actual Snowmelt Runoff into Millerton Lake
A-10 Discharge Rating Curves
A-11 Flood Control Diagram
A-12 Emergency Spillway Release Diagram

REPORT ON RESERVOIR REGULATION
FOR FLOOD CONTROL
FRIANT DAM AND MILLERTON LAKE
SAN JOAQUIN RIVER, CALIFORNIA

APPENDIX A

STANDING INSTRUCTIONS TO DAMTENDERS AND FLOOD CONTROL REGULATIONS

1. GENERAL

a. This appendix to the "Report on Reservoir Regulation for Flood Control, Friant Dam and Millerton Lake, San Joaquin River, California," is prepared in accordance with instructions contained in EM 1110-2-3600, paragraph 4-07, (Standing Instructions to Damtenders) and pertains to duties and responsibilities of the damtender in connection with the functional operation of Friant Dam and Millerton Lake, and the reporting of required hydrologic data.

b. Operational instructions to the damtender are briefly outlined with specific emphasis on the damtender's duties and responsibilies during extreme flood emergencies when communication facilities between him and his operating office may have been disrupted. It is designed to be used independently as an emergency flood control guide, or as published, in conjunction with the "Report on Reservoir Regulation for Flood Control." To facilitate independent use of this appendix, charts required for the emergency flood control operation of Millerton Lake are included herein. Charts A-1 through A-12 are included for use in accomplishing the various operational requirements specified herein.

2. FLOOD CONTROL OPERATION REQUIREMENTS

a. Friant Dam and Millerton Lake will be operated for flood control in accordance with rules and regulations prescribed by the Code of Federal Regulations Title 33 Part 208.11, and the Field Working Agreement for Cenral Valley Project Dams and Reservoirs, copies of which are attached at the end of this Appendix. Accompanying these regulations are the Flood Control Diagram and the Emergency Spillway Release Diagram, which together define the requirements for flood control operation of Friant Dam and Millerton Lake. The flood control objectives for Friant Dam and Millerton Lake are:

(1) Control the sum of the flows from Friant Dam, Cottonwood Creek and Little Dry Creek insofar as possible to 8,000 cubic feet per second, and to not exceed 6,500 c.f.s. at the U.S.G.S. gaging station "San Joaquin River near Mendota."

(2) To permit use of the maximum practical amount of storage space for conservation and other purposes without impairment of the flood control functions.

b. Flood control space in Millerton Lake shall be reserved on the basis of the Flood Control Diagram. Whenever encroachment into the currently required flood control space occurs, this water should be released in accordance with the schedule contained on the Flood control Diagram, Chart A-11.

c. The currently required flood control space is determined from Chart A-11, which indicates the required flood control space at any time in the flood season from 1 October to 31 July. The diagram requires:

(1) Flood control space increases from zero on 1 October to a maximum of 170,000 acre-feet on 1 November and is required until 31 January.

(2) A variable flood control space is required from 1 February to 30 June. This variable space is predicated on filling the reservoir (if possible) by the end of the snowmelt season without exceeding downstream objective flows.

d. The flood control operation is determined daily as described on chart A-11.

3. LIMITATIONS ON STORAGE

Operational limitations on storage in Friant Reservoir are specified on the Flood Control Diagram, chart A-11, and in paragraph 2 of this Appendix. There are no legal limitations on storage, as the taking line is above the maximum operating level.

4. LIMITATIONS ON RELEASES

Flood control releases from Millerton Lake shall be limited insofar as possible, to the following:

a. A combined flow to the San Joaquin River from Friant Dam, Cottonwood Creek, and Little Dry Creek of 8,000 c.f.s.

b. A flow of 6,500 c.f.s. at the "near Mendota" gage below Mendota dam.

5. SCHEDULE OF FLOOD CONTROL OPERATION

a. The flood control operation of Friant Dam and Reservoir consists of:

(1) Restricting the release to San Joaquin River from the reservoir to a variable quantity, up to 8,000 c.f.s., depending on the magnitude of flow entering the river from Little Dry Creek (including the flow into Little Dry Creek from Big Dry Creek Reservoir), or the flow entering above Mendota Pool from Kings River North, so as to limit the total flow at the "near Mendota" gaging station, insofar as possible, to 6,500 c.f.s.

(2) Reserving space in Millerton Lake on the basis of the Flood Control Diagram (chart A-11) which indicates space requirements according to the current flood hazard.

b. The diagram requires (1) minimum space reservation for control of rain flood runoff, consisting of 170,000 acre-feet from 1 November to 1 February, increasing from zero on 1 October and decreasing again to zero on 1 April; (2) transferable rainflood space in Mammoth Pool up to a maximum of 85,000 acre-feet from 1 November to 1 February and (3) supplemental space for control of runoff from snowmelt from 1 February to 1 July.

6. CREDIT FOR UPSTREAM SPACE

The upper San Joaquin River has been extensively developed for power purposes and a large amount of regulatory storage has been developed by the Southern California Edison Company and the Pacific Gas and Electric Company, as discussed in paragraph 17. When computing required rainflood space in Millerton Lake, credit may be taken for space which may be available in Mammoth Pool. Such credit is limited to the portion of required space exceeding 85,000 acre-feet. Space required as indicated by snowmelt parameters may be decreased by an amount equal to the space available in all upstream reservoirs less the adjustment to upstream space shown on chart A-11. This limitation is based on historical operation of upstream reservoirs which indicates that a portion of the upstream space is not utilized at the time of maximum storage at Friant.

7. EMERGENCY OPERATION OF GATED SPILLWAY

a. Although operation of spillway gates during extreme emergencies has been excluded from the official flood control regulations, advance preparation for such possible emergencies is considered to be highly desirable. Whenever the reservoir level approaches gross pool level and the reservoir is rising rapidly because of flood inflow, the necessity for emergency releases should be determined. The Emergency Spillway Release Diagram, chart A-12, has been devised for the convenience of the operating agency and indicates the releases that can be made without endangering the structure and without releasing quantities in excess of natural runoff. If deemed necessary to assure the safety of the structure or to minimize surcharge, the operating agency may, on the basis of forecasts, make releases greater than those indicated by the diagram.

b. The diagram is derived in accordance with procedures outlined in EM 1110-2-3600, and is based on minimum remaining volume of inflow when only reservoir elevations and inflow are known. This minimum volume of remaining inflow was estimated on the basis that inflow peak was past and that recession of flow would be somewhat steeper than in most observed floods, approximately that observed in the December 1937 flood. The diagram is thus designed to defer emergency releases until it is virtually certain that those or larger releases will be necessary. Accordingly, when such releases are indicated by the diagram, it is essential that they be made immediately in order that it will not subsequently become necessary to make larger releases. For this reason, the reservoir operators at the dam should be thoroughly familiar with the emergency release diagram and should be

empowered by standing instructions to initiate use of the diagram if required when communication with Central Valley Project operations office in Sacramento is disrupted.

8. STANDING INSTRUCTIONS DURING FLOOD EMERGENCY

a. The functional operation of Friant Dam and Millerton Lake is under the direction of the Regional Director, Mid-Pacific Region, U.S. Water and Power Resources Service. Instructions to U.S. Water and Power Resources Service personnel are the responsibility of the Regional Director. The following are suggested instructions for emergency operation of Friant Dam and Millerton Lake. During flood periods close contact will be maintained between the damtender (or operating personnel) and the Regional Office.

b. If communication is broken between the operating personnel and the Regional Office during a flood emergency, the following procedure is recommended:

(1) Continue releases in accordance with the last instructions received from the Regional Office and make every attempt to re-establish communication.

(2) If communications cannot be re-established and larger releases are required by the Flood Control Diagram (chart A-11), release should be increased in accordance with the diagram.

(3) Whenever the reservoir level of Millerton Lake approaches gross pool elevation (578 feet) and the reservoir level is rising because of flood inflow, the necessity for emergency spillway release from Millerton Lake should be determined. Chart A-12, Emergency Spillway Release Diagram, indicates the release considered permissible to avoid endangering the structure.

9. OPERATIONAL RESPONSIBILITIES

Responsibilities in connection with the operation of Millerton Lake in the interest of flood control are summarized in the following paragraphs. Names and addresses of key personnel concerned in the flood control operation are contained on the frontispiece.

a. The District Engineer, Corps of Engineers, is responsible for:

(1) Issuing advisories to the operating agency for emergency changes in operation.

(2) Advising the Division Engineer, South Pacific Division, of any departure from the flood-control regulations.

(3) Preparing monthly operation and other special reports relative to operation of the reservoir required by the Division Engineer, South Pacific Division.

(4) Preparing revisions to the flood control criteria found herein.

b. The Regional Director of the Water and Power Resources Service is responsible for:

(1) Accomplishing the physical operation of the reservoir and associated facilities in accordance with the official regulations.

(2) Advising the District Engineer of any emergency change in operation.

(3) Reporting to the District Engineer any unusual condition in the reservoir or along downstream channels that might interfere with the planned flood control operation of the reservoir.

(4) Keeping downstream interests advised of all changes of flood-control releases which affect them.

(5) Reporting by telephone or teletype to the Reservoir Control Section of the Corps of Engineers, and to the Department of Water Resources of the State of California, data as outlined in paragraph 10 below and other data that may be required from time to time.

(6) Keeping informed of the rules and regulations contained in the reservoir regulation manual and bringing to the attention of the District Engineer any feature of the manual that may require clarification.

(7) Keeping the District Engineer advised of any inaccuracies contained in the manual or that may develop as a consequence of changing conditions.

(8) Immediately after the end of the each month, transmitting to the Reservoir Control Section of the Corps of Engineers data specified in paragraph 10.

10. OPERATION REPORTS

a. The reservoir operator or operating agency shall report by telephone or teletype to the Reservoir Control Section of the Corps of Engineers and to the Department of Water Resources, State of California, each day between 8:00 and 9:00 a.m. and at other times upon request, data as follows:

(1) The amount of flood control space required by the regulations.

(2) Elevation, storage, inflow, outflow, and anticipated outflow changes.

(3) Precipitation received at the dam and at reporting stations in or adjacent to the drainage basin.

Data obtained on nonwork days shall be furnished on the first work day following.

b. Immediately after the end of each month, the operating agency shall dispatch to the Reservoir Control Section of the Corps of Engineers a summary of the following operation data:

(1) Daily inflow and storage at Millerton Lake.

(2) Daily release at Friant Dam (to river, Friant Kern, and Madera Canals).

(3) Daily requirement of flood control space at Millerton Lake.

11. INSTRUCTIONS TO DAMTENDER

Coordination of reservoir operation at Friant Dam with other units of Central Valley Project, including flood control operations, is attained by means of a project communications system which includes teletype, radio, and standard public utility telephone service. Reservoir operations are directed over this communications system by the Central Valley Project operations office in Sacramento. Reservoir operation in accordance with instructions, and the gathering and transmittal to Sacramento of basic information and operational data are accomplished at the dam.

12. MODIFICATION OF REGULATIONS

The official regulations are subject to temporary modification during flood emergencies by the Regional Director, Mid-Pacific Region, W.P.R.S.. Major changes in the regulations are subject to prior approval of the Division Engineer, South Pacific Division. Revisions to the Flood Control Diagram may be developed jointly by the Division Engineer and Regional Director.

DISCHARGE IN SECOND-FEET FOR ONE GATE

RESERVOIR ELEVATION FEET	ELEVATION OF HIGH POINT OF GATE - FEET																																		
	560	561	561.5	562	562.5	563	563.5	564	564.5	565	565.5	566	566.5	567	567.5	568	568.5	569	569.5	570	570.5	571	571.5	572	572.5	573	573.5	574	574.5	575	575.5	576	576.5	577	577.5	578
579.0	30150	26390	25200	24170	23000	22050	21000	20050	19070	18160	17190	16400	15600	14730	13930	13150	12320	11500	10770	10020	9270	8530	7760	7030	6320	5650	5020	4380	3750	3200	2690	2140	1590	1130	740	450
578.5	28920	25200	24040	22930	21890	20910	19900	18940	18050	17120	16200	15400	14600	13800	13000	12210	11410	10650	9910	9180	8460	7700	6980	6270	5600	4930	4320	3690	3120	2590	2090	1580	1120	740	450	200
578.0	27720	24040	22870	21800	20750	19820	18820	17900	17030	16130	15270	14450	13660	12860	12060	11300	10540	9780	9110	8380	7660	6920	6220	5540	4890	4260	3660	3080	2540	2020	1560	1110	740	450	200	0
577.5	26540	22870	21710	20690	19680	18730	17790	16890	16040	15160	14320	13520	12730	11960	11180	10420	9690	8980	8310	7600	6890	6170	5490	4850	4210	3620	3050	2520	2010	1530	1110	740	450	200	0	
577.0	25370	21710	20620	19610	18600	17710	16800	15900	15050	14210	13400	12600	11850	11080	10310	9580	8880	8200	7540	6820	6120	5430	4780	4170	3590	3020	2500	2000	1530	1110	740	450	200	0		
576.5	24190	20610	19540	18540	17580	16710	15800	14930	14120	13290	12470	11730	11000	10220	9470	8770	8090	7440	6770	6060	5400	4740	4120	3550	2990	2470	1980	1530	1110	740	450	200	0			
576.0	23040	19530	18480	17520	16590	15730	14860	14010	13200	12390	11600	10870	10150	9400	8670	7980	7330	6700	6020	5350	4700	4080	3500	2960	2450	1960	1520	1110	740	450	200	0				
575.5	21910	18470	17460	16540	15610	14780	13930	13100	12300	11500	10730	10020	9310	8600	7890	7220	6600	5970	5300	4650	4050	3460	2930	2420	1950	1510	1110	740	450	200	0					
575.0	20800	17440	16490	15560	14680	13840	13010	12220	11430	10660	9910	9210	8520	7830	7140	6490	5880	5260	4610	4000	3430	2900	2390	1940	1510	1100	740	450	200	0						
574.5	19680	16450	15510	14630	13760	12940	12120	11340	10570	9820	9110	8440	7760	7090	6410	5790	5200	4580	3970	3400	2870	2370	1920	1500	1100	740	450	200	0						
574.0	18600	15470	14580	13700	12860	12060	11260	10500	9740	9030	8340	7680	7020	6370	5720	5110	4540	3950	3370	2840	2350	1900	1480	1100	740	450	200	0							
573.5	17560	14530	13650	12810	12000	11200	10420	9690	8940	8280	7600	6950	6300	5680	5060	4470	3920	3360	2820	2330	1890	1470	1100	740	450	200	0								
573.0	16520	13600	12750	11930	11120	10360	9610	8900	8190	7530	6880	6250	5610	5020	4430	3860	3330	2810	2310	1870	1460	1100	740	450	200	0									
572.5	15510	12700	11880	11080	10290	9550	8830	8130	7450	6820	6180	5560	4950	4390	3830	3290	2790	2300	1850	1440	1090	740	450	200	0										
572.0	14510	11820	11020	10250	9500	8780	8080	7400	6740	6130	5510	4910	4320	3790	3250	2750	2280	1830	1430	1070	740	450	200	0											
571.5	13550	10970	10200	9450	8720	8020	7350	6690	6040	5460	4870	4290	3720	3220	2720	2250	1810	1420	1060	730	450	200	0												
571.0	12620	10150	9400	8670	7980	7300	6640	6000	5390	4820	4260	3690	3170	2700	2230	1790	1400	1050	730	450	200	0													
570.5	11700	9350	8630	7930	7260	6600	5960	5340	4780	4220	3670	3140	2640	2210	1770	1380	1030	720	450	200	0														
570.0	10810	8590	7890	7200	6550	5910	5310	4710	4180	3640	3120	2610	2170	1750	1370	1020	710	450	200	0															
569.5	9960	7840	7160	6500	5870	5260	4680	4130	3600	3090	2590	2140	1720	1340	1000	700	440	200	0																
569.0	9130	7120	6460	5830	5240	4640	4100	3550	3060	2570	2120	1680	1310	980	690	430	200	0																	
568.5	8330	6420	5790	5210	4620	4060	3520	3030	2550	2100	1660	1270	950	670	420	200	0																		
568.0	7550	5740	5160	4590	4040	3490	3000	2520	2070	1640	1250	910	640	410	200	0																			
567.5	6800	5100	4550	4020	3470	2980	2500	2050	1620	1230	890	620	380	200	0																				
567.0	6080	4510	3980	3440	2960	2480	2030	1600	1210	870	600	360	190	0																					
566.5	5400	3930	3410	2940	2450	2010	1580	1200	860	580	340	180	0																						
566.0	4760	3380	2910	2410	2000	1570	1190	860	580	310	170	0																							
565.5	4140	2870	2400	1980	1560	1190	860	580	290	160	0																								
565.0	3560	2400	1970	1560	1190	860	580	290	150	0																									
564.5	3010	1960	1570	1190	860	590	290	150	0																										
564.0	2490	1570	1190	880	590	300	150	0																											
563.5	2020	1200	890	600	300	150	0																												
563.0	1580	890	600	300	150	0																													
562.5	1190	590	300	150	0																														
562.0	840	300	150	0																															
561.5	540	150	0																																
561.0	290	0																																	
560.5	100																																		
560.0	0																																		

Note: Drum gates should be operated symmetrically to insure proper action in stilling basin.

7-24-64 D.C.G. 1 REVISED DISCHARGE TABLE AND ADDED SECTION THRU SPILLWAY CREST

SAFETY

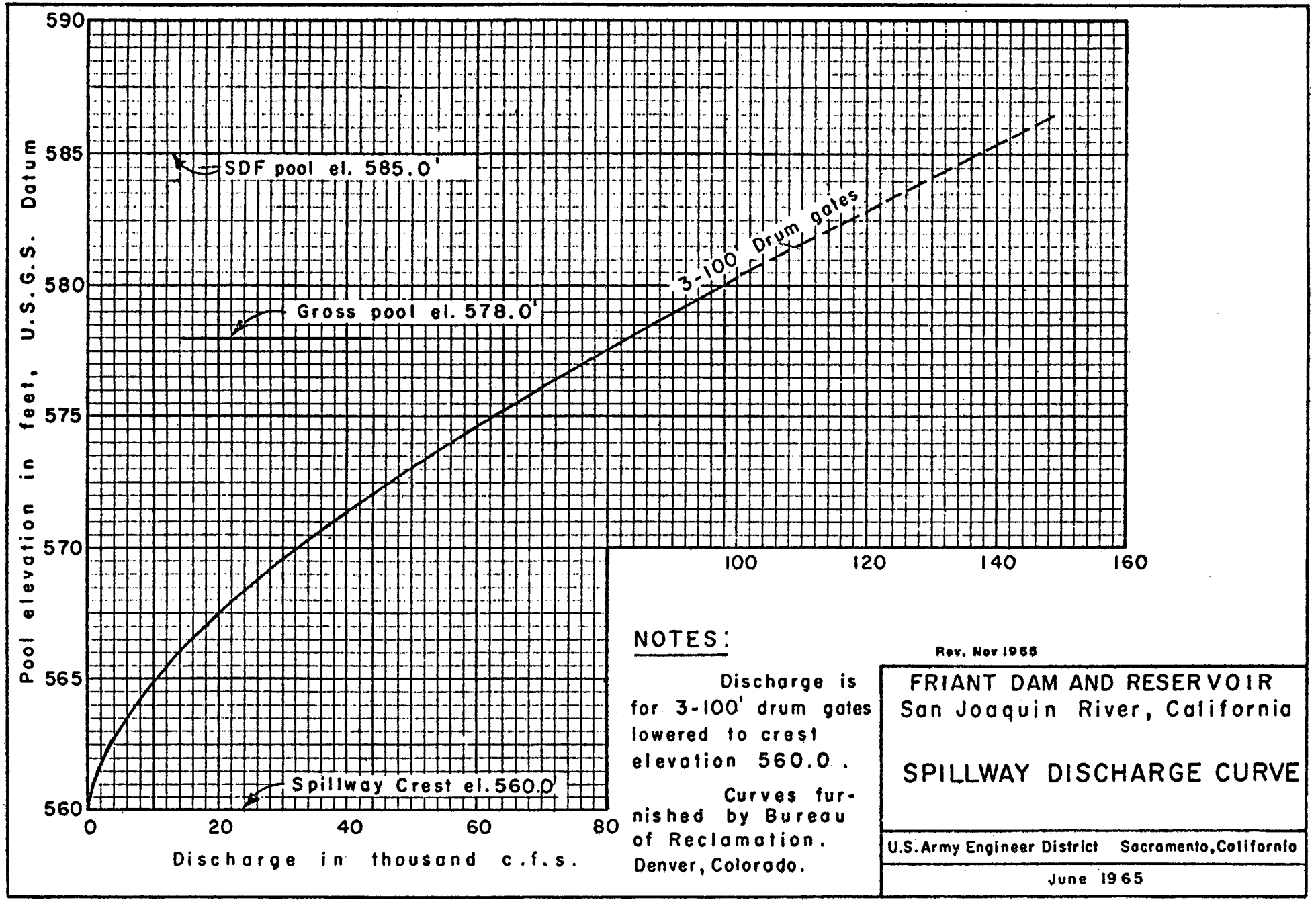
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL VALLEY PROJECT - CALIFORNIA

FRIANT DAM
RATING TABLE FOR DRUM GATE SPILLWAY

DRAWN J.B.S. SUBMITTED Harold M. Martin
TRACED M.F.V. RECOMMENDED R. F. Hawley
CHECKED A.E.L.-L.R.T. APPROVED W. H. Nadler
CHIEF DESIGNING ENGINEER

DENVER, COLORADO - FEB. 7, 1950 214-D-16753

CHART A-2



NOTES:

Discharge is for 3-100' drum gates lowered to crest elevation 560.0 .

Curves furnished by Bureau of Reclamation. Denver, Colorado.

Rev. Nov 1965

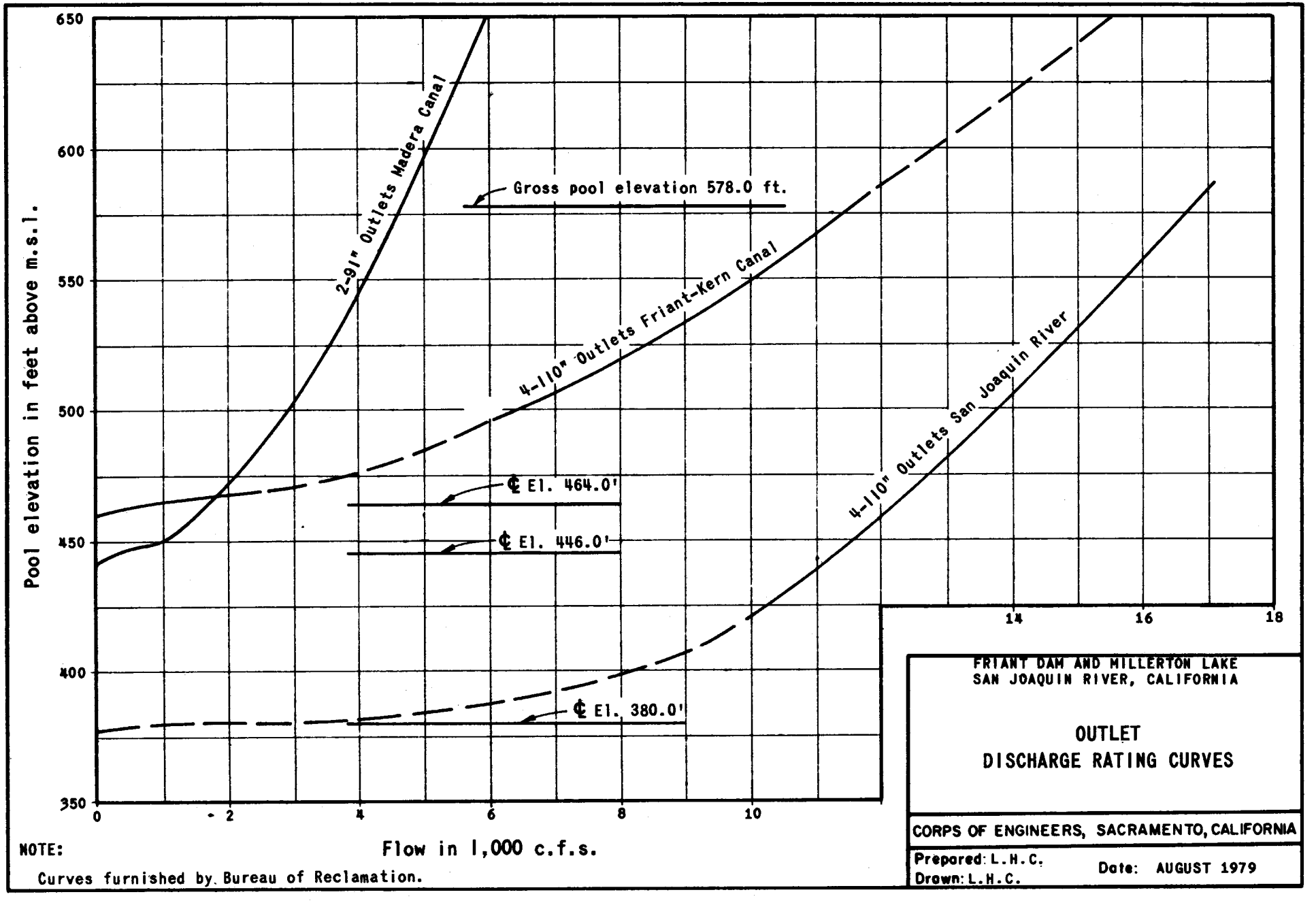
FRIANT DAM AND RESERVOIR
San Joaquin River, California

SPILLWAY DISCHARGE CURVE

U.S. Army Engineer District Sacramento, California

June 1965

CHART A-3



NOTE:
Curves furnished by Bureau of Reclamation.

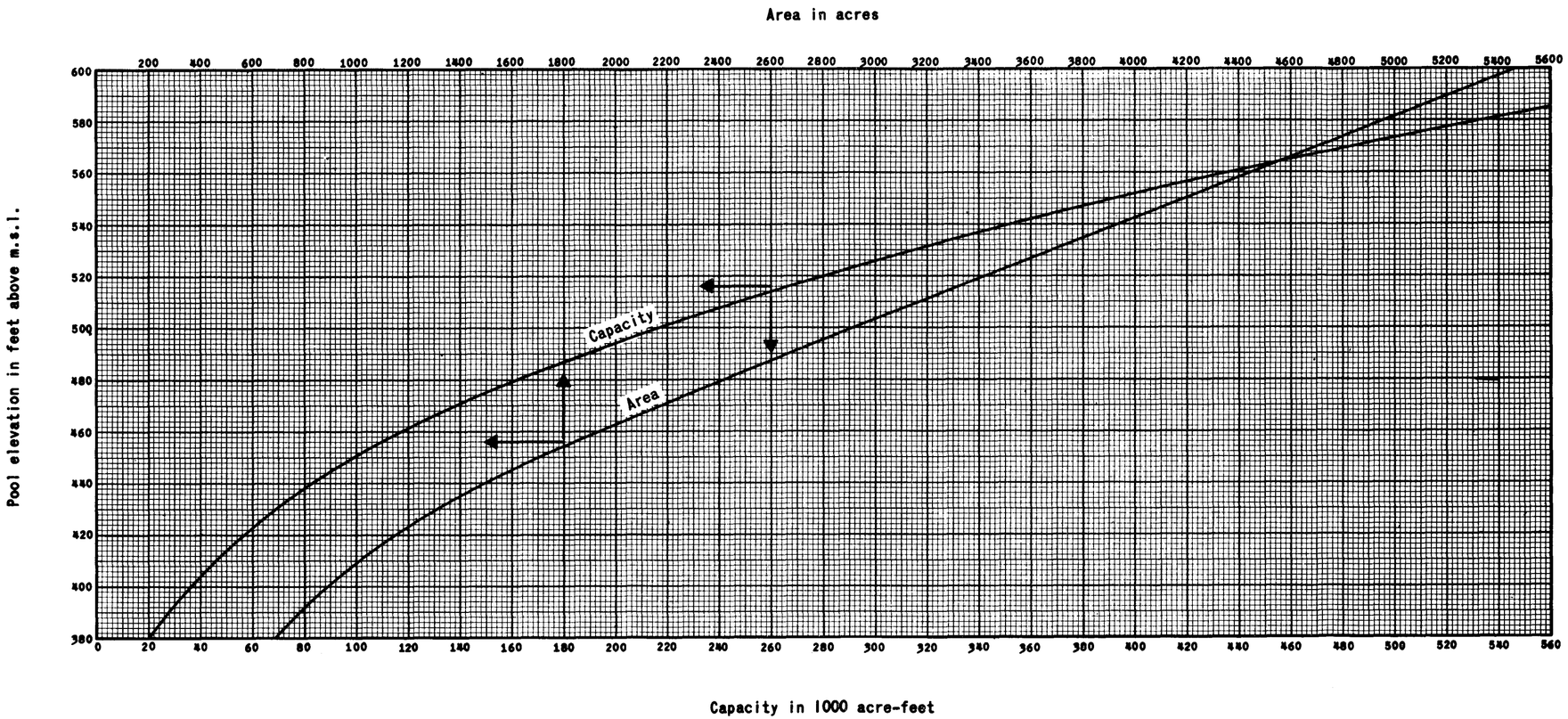
FRIANT DAM AND MILLERTON LAKE
SAN JOAQUIN RIVER, CALIFORNIA

OUTLET
DISCHARGE RATING CURVES

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: L.H.C.
Drawn: L.H.C.
Date: AUGUST 1979

CHART A-4



FRIANT DAM AND MILLERTON LAKE
SAN JOAQUIN RIVER, CALIFORNIA

AREA-CAPACITY CURVES

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: L.N.C.
Drawn: L.N.C.
Date: AUGUST 1979

CHART A-5

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
REGION II
BRANCH OF OPERATION AND MAINTENANCE
DIVISION OF IRRIGATION OPERATIONS

CAPACITIES OF MILLERTON LAKE RESERVOIR AT FRIANT, CALIFORNIA

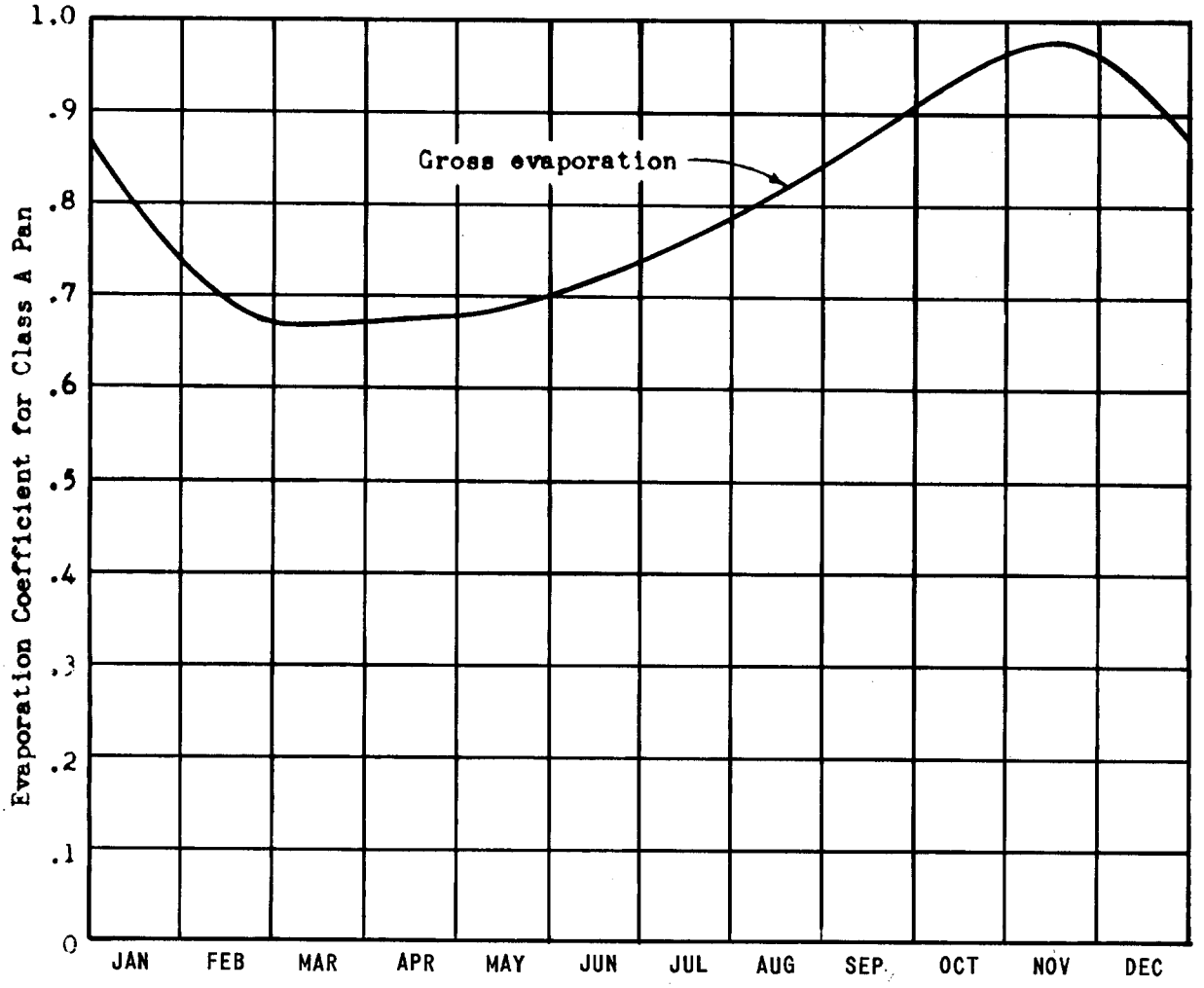
Calculations based on topographic maps of reservoir (scale 1 inch = 200 ft., with contour interval of 10 feet) prepared by Madera Irrigation District from surveys made in 1921.

Elev. Feet	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	Difference
						ACRE-FEET					
381	21,141	21,211	21,281	21,350	21,420	21,490	21,560	21,630	21,699	21,769	698
382	21,839	21,910	21,981	22,052	22,123	22,194	22,265	22,336	22,407	22,478	710
383	22,549	22,621	22,694	22,766	22,838	22,910	22,983	23,055	23,127	23,200	723
384	23,272	23,346	23,419	23,493	23,566	23,640	23,714	23,787	23,861	23,934	736
385	24,008	24,083	24,158	24,233	24,308	24,382	24,457	24,532	24,607	24,682	749
386	24,757	24,833	24,909	24,986	25,062	25,138	25,214	25,290	25,367	25,443	762
387	25,519	25,596	25,674	25,752	25,829	25,906	25,984	26,062	26,139	26,216	775
388	26,294	26,373	26,452	26,531	26,610	26,688	26,767	26,846	26,925	27,004	789
389	27,083	27,163	27,243	27,324	27,404	27,484	27,564	27,644	27,725	27,805	802
390	27,885	27,965	28,044	28,124	28,204	28,284	28,363	28,443	28,523	28,602	797
391	28,682	28,763	28,844	28,925	29,006	29,088	29,169	29,250	29,331	29,412	811
392	29,493	29,575	29,657	29,740	29,822	29,904	29,986	30,068	30,151	30,233	822
393	30,315	30,399	30,482	30,566	30,649	30,733	30,817	30,900	30,984	31,067	836
394	31,151	31,236	31,321	31,405	31,490	31,575	31,660	31,745	31,829	31,914	848
395	31,999	32,085	32,171	32,257	32,343	32,430	32,516	32,602	32,688	32,774	861
396	32,860	32,947	33,035	33,122	33,210	33,297	33,384	33,472	33,559	33,647	874
397	33,734	33,823	33,911	34,000	34,088	34,177	34,266	34,354	34,443	34,531	886
398	34,620	34,710	34,800	34,890	34,980	35,070	35,160	35,250	35,340	35,430	900
399	35,520	35,611	35,702	35,794	35,885	35,976	36,067	36,158	36,250	36,341	912
400	36,432	36,523	36,614	36,705	36,796	36,886	36,977	37,068	37,159	37,250	909
401	37,341	37,433	37,525	37,618	37,710	37,802	37,894	37,986	38,079	38,171	922
402	38,263	38,356	38,450	38,543	38,637	38,730	38,823	38,917	39,010	39,104	934
403	39,197	39,292	39,386	39,481	39,576	39,670	39,765	39,860	39,955	40,049	947
404	40,144	40,240	40,336	40,432	40,528	40,624	40,719	40,815	40,911	41,007	959
405	41,103	41,200	41,297	41,395	41,492	41,589	41,686	41,783	41,881	41,978	972
406	42,075	42,173	42,272	42,370	42,469	42,567	42,665	42,764	42,862	42,961	984
407	43,059	43,159	43,258	43,358	43,458	43,558	43,657	43,757	43,857	43,956	997
408	44,056	44,157	44,258	44,359	44,460	44,560	44,661	44,762	44,863	44,964	1,009
409	45,065	45,167	45,269	45,372	45,474	45,576	45,678	45,780	45,883	45,985	1,022
410	46,087	46,190	46,294	46,397	46,501	46,604	46,707	46,811	46,914	47,018	1,034
411	47,121	47,226	47,330	47,435	47,540	47,644	47,749	47,854	47,959	48,063	1,047
412	48,168	48,274	48,380	48,486	48,592	48,698	48,803	48,909	49,015	49,121	1,059
413	49,227	49,334	49,441	49,549	49,656	49,763	49,870	49,977	50,085	50,192	1,072
414	50,299	50,408	50,516	50,624	50,733	50,842	50,950	51,058	51,167	51,276	1,085
415	51,384	51,494	51,603	51,713	1,823	51,932	52,042	52,152	52,262	52,371	1,097
416	52,481	52,592	52,703	52,814	52,925	53,036	53,148	53,259	53,370	53,481	1,111
417	53,592	53,704	53,817	53,929	54,041	54,154	54,266	54,378	54,490	54,603	1,123
418	54,715	54,829	54,942	55,056	55,169	55,283	55,397	55,510	55,624	55,737	1,136
419	55,851	55,966	56,081	56,196	56,311	56,426	56,540	56,655	56,770	56,885	1,149
420	57,000	57,117	57,235	57,352	57,470	57,587	57,704	57,822	57,939	58,057	1,174
421	58,174	58,293	58,411	58,530	58,648	58,767	58,886	59,004	59,123	59,241	1,186
422	59,360	59,480	59,600	59,720	59,840	59,960	60,081	60,201	60,321	60,441	1,201
423	60,561	60,682	60,804	60,925	61,046	61,168	61,289	61,410	61,531	61,653	1,213
424	61,774	61,897	62,020	62,142	62,265	62,388	62,511	62,634	62,756	62,879	1,228
425	63,002	63,126	63,250	63,374	63,498	63,622	63,746	63,870	63,994	64,118	1,240
426	64,242	64,367	64,493	64,618	64,744	64,869	64,994	65,120	65,245	65,371	1,254
427	65,496	65,623	65,750	65,876	66,003	66,130	66,257	66,384	66,510	66,637	1,268
428	66,764	66,892	67,020	67,148	67,276	67,404	67,533	67,661	67,789	67,917	1,281
429	68,045	68,174	68,304	68,433	68,563	68,692	68,821	68,951	69,080	69,210	1,294
430	69,339	69,473	69,606	69,740	69,873	70,007	70,140	70,273	70,407	70,540	1,335

Elev. Feet	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	Difference
						ACRE-FEET					
431	70,674	70,809	70,944	71,079	71,214	71,348	71,483	71,618	71,753	71,888	1,349
432	72,023	72,159	72,296	72,432	72,568	72,705	72,841	72,977	73,113	73,250	1,363
433	73,386	73,524	73,662	73,799	73,937	74,075	74,213	74,351	74,488	74,626	1,378
434	74,764	74,903	75,042	75,182	75,321	75,460	75,599	75,738	75,878	76,017	1,392
435	76,156	76,297	76,437	76,578	76,719	76,860	77,000	77,141	77,282	77,422	1,407
436	77,563	77,705	77,847	77,990	78,132	78,274	78,416	78,558	78,701	78,843	1,422
437	78,985	79,129	79,272	79,416	79,559	79,703	79,847	79,990	80,134	80,277	1,436
438	80,421	80,566	80,711	80,856	81,001	81,147	81,292	81,437	81,582	81,727	1,451
439	81,872	82,019	82,165	82,312	82,458	82,605	82,751	82,898	83,044	83,191	1,465
440	83,337	83,489	83,641	83,794	83,946	84,098	84,250	84,402	84,555	84,707	1,522
441	84,859	85,013	85,166	85,320	85,474	85,627	85,781	85,935	86,089	86,242	1,537
442	86,396	86,551	86,707	86,862	87,017	87,173	87,328	87,483	87,638	87,794	1,553
443	87,949	88,106	88,263	88,420	88,577	88,734	88,891	89,048	89,205	89,362	1,570
444	89,519	89,676	89,836	89,995	90,153	90,312	90,471	90,629	90,788	90,946	1,586
445	91,105	91,265	91,425	91,585	91,745	91,906	92,066	92,226	92,386	92,546	1,601
446	92,706	92,868	93,030	93,191	93,353	93,515	93,677	93,839	94,000	94,162	1,618
447	94,324	94,487	94,651	94,814	94,978	95,141	95,304	95,468	95,631	95,795	1,634
448	95,958	96,123	96,288	96,453	96,618	96,783	96,948	97,113	97,278	97,443	1,650
449	97,608	97,775	97,941	98,108	98,274	98,441	98,608	98,774	98,941	99,107	1,666
450	99,274	99,448	99,623	99,798	99,972	100,146	100,321	100,496	100,670	100,844	1,745
451	101,019	101,195	101,372	101,548	101,724	101,900	102,077	102,253	102,429	102,606	1,763
452	102,782	102,960	103,138	103,316	103,494	103,672	103,850	104,028	104,206	104,384	1,780
453	104,562	104,742	104,922	105,102	105,282	105,461	105,641	105,821	106,001	106,181	1,799
454	106,361	106,543	106,725	106,906	107,088	107,270	107,452	107,634	107,815	107,997	1,818
455	108,179	108,362	108,546	108,730	108,913	109,096	109,280	109,463	109,647	109,830	1,835
456	110,014	110,199	110,385	110,570	110,756	110,941	111,126	111,312	111,497	111,683	1,854
457	111,868	112,055	112,242	112,430	112,617	112,804	112,991	113,178	113,366	113,553	1,872
458	113,740	113,929	114,118	114,307	114,496	114,685	114,874	115,063	115,252	115,441	1,890
459	115,630	115,821	116,012	116,203	116,394	116,584	116,774	116,966	117,157	117,348	1,909
460	117,539	117,738	117,938	118,137	118,336	118,536	118,735	118,934	119,133	119,333	1,993
461	119,532	119,733	119,935	120,136	120,337	120,538	120,740	120,941	121,142	121,344	2,013
462	121,545	121,748	121,952	122,155	122,358	122,561	122,765	122,968	123,171	123,375	2,033
463	123,578	123,783	123,989	124,194	124,400	124,605	124,810	125,016	125,221	125,427	2,054
464	125,632	125,840	126,047	126,254	126,462	126,670	126,877	127,084	127,292	127,500	2,075
465	127,707	127,916	128,126	128,336	128,545	128,754	128,964	129,174	129,383	129,592	2,095
466	129,802	130,013	130,225	130,437	130,648	130,859	131,071	131,283	131,494	131,706	2,115
467	131,917	132,131	132,344	132,558	132,772	132,985	133,199	133,413	133,627	133,840	2,137
468	134,054	134,270	134,485	134,701	134,917	135,133	135,348	135,564	135,780	135,995	2,157
469	136,211	136,429	136,647	136,864	137,082	137,300	137,518	137,736	137,953	138,171	2,178
470	138,389	138,612	138,836	139,059	139,283	139,506	139,729	139,953	140,176	140,400	2,234
471	140,623	140,848	141,074	141,300	141,525	141,750	141,976	142,202	142,427	142,653	2,255
472	142,878	143,106	143,334	143,561	143,789	144,017	144,245	144,473	144,700	144,928	2,278
473	145,156	145,386	145,616	145,846	146,076	146,306	146,535	146,765	146,995	147,225	2,299
474	147,455	147,687	147,919	148,152	148,384	148,616	148,848	149,080	149,313	149,545	2,322
475	149,777	150,011	150,246	150,480	150,715	150,949	151,183	151,418	151,652	151,887	2,344
476	152,121	152,358	152,594	152,831	153,067	153,304	153,541	153,777	154,014	154,250	2,366
477	154,487	154,726	154,965	155,204	155,443	155,681	155,920	156,159	156,398	156,637	2,389
478	156,876	157,117	157,358	157,599	157,840	158,081	158,323	158,564	158,805	159,046	2,411
479	159,287	159,530	159,774	160,017	160,260	160,504	160,747	160,990	161,233	161,477	2,433
480	161,720	161,967	162,214	162,461	162,708	162,954	163,201	163,448	163,695	163,942	2,469
481	164,189	164,436	164,687	164,937	165,186	165,435	165,684	165,933	166,183	166,432	2,492
482	166,681	166,933	167,184	167,436	167,687	167,939	168,191	168,442	168,694	168,945	2,516
483	169,197	169,450	169,705	169,958	170,212	170,466	170,720	170,974	171,227	171,481	2,538
484	171,735	171,991	172,247	172,503	172,759	173,016	173,272	173,528	173,784	174,040	2,561
485	174,296	174,554	174,813	175,072	175,330	175,588	175,847	176,106	176,364	176,622	2,585
486	176,881	177,142	177,403	177,664	177,925	178,185	178,446	178,707	178,968	179,229	2,609
487	179,490	179,753	180,016	180,279	180,542	180,805	181,069	181,332	181,595	181,858	2,631
488	182,121	182,387	182,652	182,917	183,183	183,449	183,714	183,979	184,245	184,510	2,655
489	184,776	185,044	185,312	185,580	185,848	186,116	186,383	186,651	186,919	187,187	2,679
490	187,455	187,726	187,997	188,268	188,539	188,810	189,081	189,352	189,623	189,894	2,710

Elev. Feet	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	Difference
					ACRE-FEET						
491	190,165	190,439	190,712	190,985	191,259	191,533	191,806	192,079	192,353	192,626	2,735
492	192,900	193,176	193,452	193,727	194,003	194,279	194,555	194,831	195,106	195,382	2,758
493	195,658	195,936	196,215	196,493	196,771	197,050	197,328	197,606	197,884	198,163	2,783
494	198,441	198,722	199,002	199,283	199,563	199,844	200,125	200,405	200,686	200,965	2,806
495	201,247	201,530	201,813	202,096	202,379	202,662	202,945	203,228	203,511	203,794	2,830
496	204,077	204,362	204,648	204,934	205,219	205,504	205,790	206,075	206,361	206,647	2,855
497	206,932	207,220	207,508	207,796	208,084	208,372	208,660	208,948	209,236	209,524	2,880
498	209,812	210,102	210,393	210,683	210,974	211,264	211,554	211,845	212,135	212,426	2,904
499	212,716	213,009	213,302	213,595	213,888	214,180	214,473	214,766	215,059	215,352	2,929
500	215,645	215,940	216,235	216,530	216,825	217,121	217,416	217,711	218,006	218,301	2,951
501	218,596	218,894	219,191	219,489	219,787	220,084	220,382	220,680	220,978	221,275	2,977
502	221,573	221,873	222,173	222,473	222,773	223,073	223,374	223,674	223,973	224,274	3,001
503	224,574	224,877	225,179	225,482	225,785	226,087	226,390	226,693	226,996	227,298	3,027
504	227,601	227,906	228,211	228,516	228,821	229,127	229,432	229,737	230,042	230,347	3,051
505	230,652	230,960	231,267	231,575	231,883	232,190	232,498	232,806	233,114	233,421	3,077
506	233,729	234,039	234,349	234,659	234,969	235,279	235,590	235,900	236,210	236,520	3,101
507	236,830	237,143	237,455	237,768	238,080	238,393	238,706	239,018	239,331	239,643	3,126
508	239,956	240,271	240,586	240,902	241,217	241,532	241,847	242,162	242,478	242,792	3,152
509	243,108	243,426	243,743	244,061	244,379	244,696	245,014	245,332	245,650	245,967	3,177
510	246,285	246,604	246,924	247,243	247,562	247,882	248,201	248,520	248,839	249,159	3,193
511	249,478	249,800	250,122	250,444	250,766	251,088	251,409	251,731	252,053	252,375	3,219
512	252,697	253,021	253,346	253,670	253,995	254,319	254,643	254,968	255,292	255,617	3,244
513	255,941	256,268	256,595	256,922	257,249	257,576	257,902	258,229	258,556	258,883	3,269
514	259,210	259,540	259,869	260,198	260,528	260,857	261,187	261,517	261,846	262,175	3,295
515	262,505	262,837	263,169	263,501	263,833	264,165	264,497	264,829	265,161	265,493	3,320
516	265,825	266,160	266,494	66,829	267,163	267,498	267,833	268,167	268,502	268,836	3,346
517	269,171	269,508	269,845	270,183	270,520	270,857	271,194	271,531	271,869	272,206	3,372
518	272,543	272,883	273,223	273,562	273,902	274,424	274,582	274,922	275,261	275,601	3,398
519	275,941	276,283	276,626	276,968	277,310	277,652	277,995	278,337	278,679	279,022	3,423
520	279,364	279,708	280,052	280,396	280,740	281,084	281,429	281,773	282,117	282,461	3,441
521	282,805	283,152	283,498	283,845	284,191	284,538	284,885	285,231	285,578	285,924	3,466
522	286,271	286,620	286,969	287,319	287,668	288,017	288,366	288,715	289,065	289,414	3,492
523	289,763	290,115	290,467	290,819	291,171	291,522	291,874	292,226	292,578	292,930	3,519
524	293,282	293,636	293,991	294,345	294,700	295,054	295,408	295,763	296,117	296,472	3,544
525	296,826	297,183	297,540	297,897	298,254	298,611	298,968	299,325	299,682	300,039	3,570
526	300,396	300,756	301,115	301,475	301,835	302,194	302,554	302,914	303,274	303,633	3,597
527	303,993	304,355	304,717	305,080	305,442	305,804	306,166	306,528	306,891	307,253	3,622
528	307,615	307,980	308,345	308,710	309,075	309,440	309,805	310,170	310,535	310,900	3,650
529	311,265	311,632	312,000	312,368	312,735	313,102	313,470	313,838	314,205	314,572	3,675
530	314,940	315,308	315,677	316,045	316,413	316,782	317,150	317,518	317,886	318,255	3,683
531	318,623	318,994	319,365	319,736	320,107	320,478	320,848	321,219	321,590	321,961	3,709
532	322,332	322,706	323,079	323,453	323,826	324,200	324,574	324,947	325,321	325,694	3,736
533	326,068	326,444	326,820	327,197	327,573	327,949	328,325	328,701	329,078	329,454	3,762
534	329,830	330,209	330,588	330,966	331,345	331,724	332,103	332,482	332,860	333,239	3,788
535	333,618	333,999	334,381	334,762	335,144	335,525	335,906	336,288	336,669	337,051	3,814
536	337,432	337,816	338,200	338,585	338,969	339,353	339,737	340,121	340,506	340,890	3,842
537	341,274	341,661	342,047	342,434	342,821	343,208	343,594	343,981	344,368	344,754	3,867
538	345,141	345,530	345,920	346,309	346,699	347,088	347,477	347,867	348,256	348,646	3,894
539	349,035	349,427	349,819	350,211	350,603	350,996	351,388	351,780	352,172	352,564	3,921
540	352,956	353,349	353,742	354,135	354,528	354,920	355,313	355,706	356,099	356,492	3,929
541	356,885	357,281	357,676	358,072	358,467	358,863	359,259	359,654	360,050	360,445	3,956
542	360,841	361,239	361,637	362,036	362,434	362,832	363,230	363,628	364,027	364,425	3,982
543	364,823	365,224	365,625	366,026	366,427	366,828	367,228	367,629	368,030	368,431	4,009
544	368,832	369,236	369,639	370,042	370,446	370,850	371,253	371,656	372,060	372,464	4,035
545	372,867	373,273	373,679	374,086	374,492	374,898	375,304	375,710	376,117	376,523	4,062
546	376,929	377,338	377,747	378,156	378,565	378,974	379,382	379,791	380,200	380,609	4,089
547	381,018	381,430	381,841	382,253	382,664	383,076	383,488	383,899	384,311	384,722	4,116
548	385,134	385,548	385,962	386,377	386,791	387,205	387,619	388,033	388,448	388,862	4,142
549	389,276	389,693	390,110	390,527	390,944	391,361	391,778	392,195	392,612	393,029	4,170
550	393,446	393,864	394,282	394,701	395,119	395,537	395,955	396,373	396,792	397,210	4,182

Elev. Feet	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	Difference
					ACRE-FEET						
551	397,628	398,049	398,470	398,891	399,312	399,733	400,154	400,575	400,996	401,417	4,210
552	401,838	402,262	402,685	403,109	403,532	403,956	404,380	404,803	405,227	405,650	4,236
553	406,074	406,500	406,927	407,353	407,779	408,206	408,632	409,058	409,484	409,911	4,263
554	410,337	410,766	411,195	411,624	412,053	412,482	412,911	413,340	413,769	414,198	4,290
555	414,627	415,059	415,490	415,922	416,354	416,786	417,217	417,649	418,081	418,512	4,317
556	418,944	419,378	419,813	420,247	420,682	421,116	421,550	421,985	422,419	422,854	4,344
557	423,288	423,725	424,162	424,600	425,037	425,474	425,911	426,348	426,786	427,223	4,372
558	427,660	428,100	428,540	428,980	429,420	429,860	430,299	430,739	431,179	431,619	4,399
559	432,059	432,502	432,944	433,387	433,829	434,272	434,715	435,157	435,600	436,042	4,426
560	436,485	436,929	437,374	437,818	438,262	438,706	439,151	439,595	440,039	440,484	4,443
561	440,928	441,375	441,822	442,269	442,716	443,163	443,610	444,057	444,504	444,951	4,470
562	445,398	445,848	446,298	446,747	447,197	447,647	448,097	448,547	448,996	449,446	4,498
563	449,896	450,348	450,801	451,254	451,706	452,158	452,612	453,064	453,515	453,968	4,525
564	454,421	454,876	455,332	455,787	456,242	456,698	457,153	457,608	458,063	458,519	4,553
565	458,974	459,432	459,890	460,348	460,806	461,264	461,722	462,180	462,638	463,096	4,580
566	463,554	464,015	464,476	464,936	465,397	465,858	466,319	466,780	467,240	467,701	4,608
567	468,162	468,626	469,089	469,553	470,016	470,480	470,944	471,407	471,871	472,334	4,636
568	472,798	473,264	473,730	474,197	474,663	475,129	475,595	476,061	476,528	476,994	4,662
569	477,460	477,929	478,398	478,867	479,336	479,806	480,275	480,744	481,213	481,682	4,691
570	482,151	482,621	483,091	483,561	484,031	484,501	484,971	485,441	485,911	486,381	4,700
571	486,851	487,324	487,797	488,269	488,742	489,215	489,688	490,161	490,634	491,106	4,728
572	491,579	492,055	492,530	493,006	493,481	493,957	494,432	494,908	495,383	495,859	4,755
573	496,334	496,812	497,290	497,769	498,248	498,726	499,204	499,683	500,161	500,640	4,784
574	501,118	501,599	502,080	502,561	503,042	503,523	504,005	504,486	504,967	505,448	4,811
575	505,929	506,413	506,897	507,380	507,864	508,348	508,832	509,316	509,799	510,283	4,838
576	510,767	511,254	511,740	512,227	512,714	513,200	513,687	514,174	514,661	515,147	4,867
577	515,634	516,123	516,613	517,102	517,592	518,081	518,570	519,060	519,549	520,039	4,894
578	520,528	521,020	521,512	522,005	522,497	522,989	523,482	523,973	524,466	524,958	4,922
579	525,450	525,945	526,440	526,936	527,431	527,926	528,421	528,916	529,411	529,907	4,952



AVERAGE MONTHLY
EVAPORATION COEFFICIENTS

Jan	0.804	Jul	0.768
Feb	0.696	Aug	0.816
Mar	0.672	Sep	0.876
Apr	0.672	Oct	0.936
May	0.684	Nov	0.960
Jun	0.720	Dec	0.924

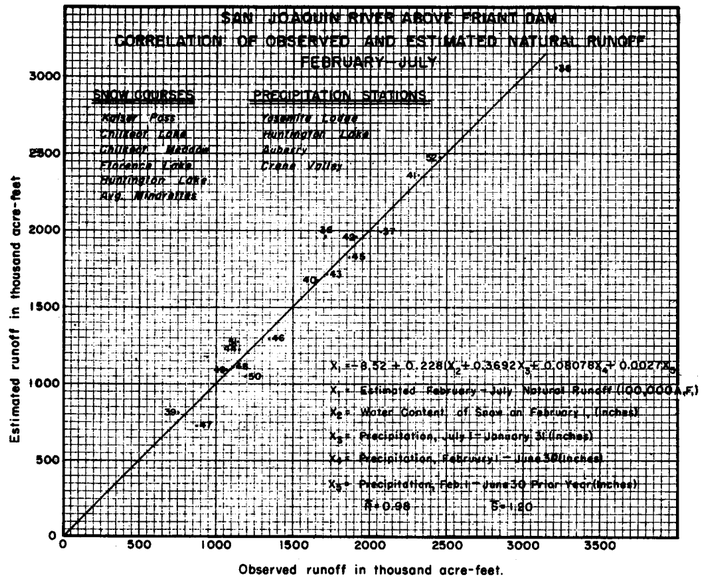
FRIANT DAM AND MILLERTON LAKE
SAN JOAQUIN RIVER, CALIFORNIA

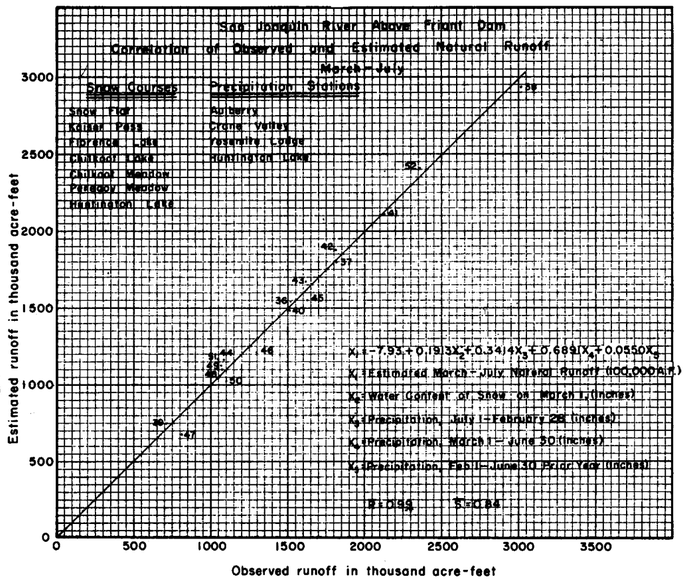
EVAPORATION COEFFICIENTS

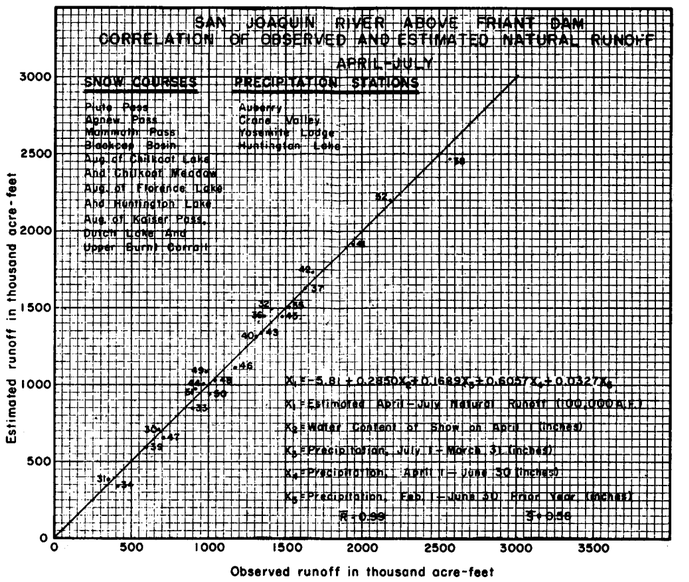
CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

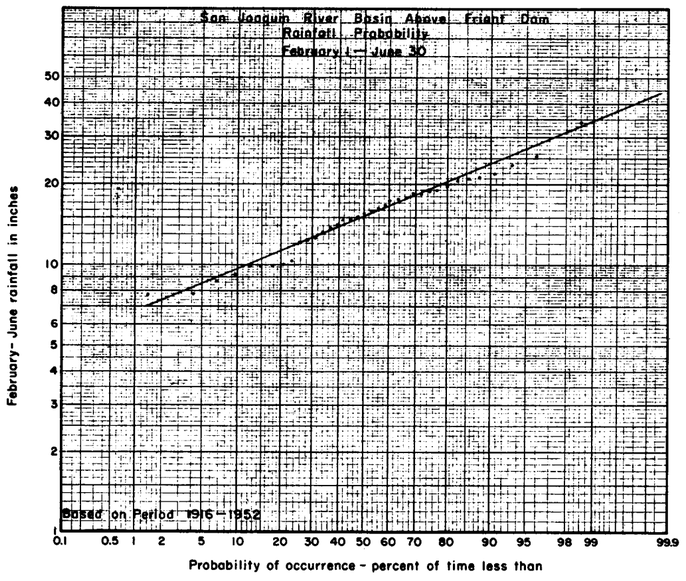
Prepared: L.R.B. Date: SEPTEMBER 1955

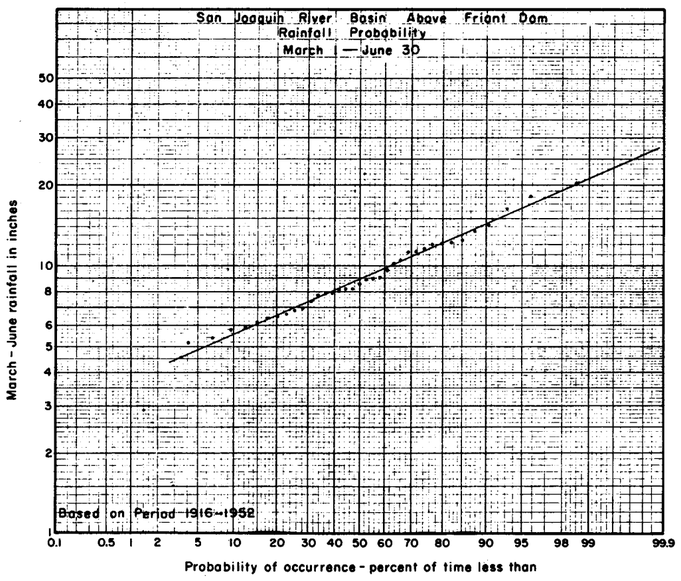
CHART A-7

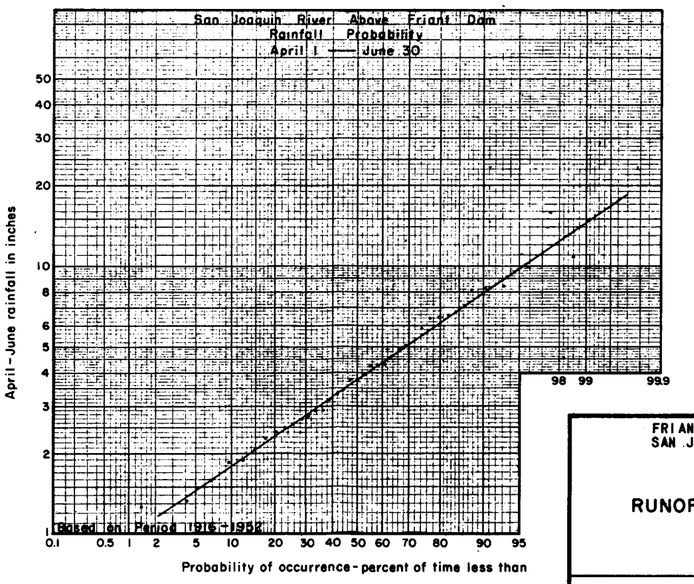












NOTES:

All curves furnished by the Water and Power Resources Service.

These forecast charts are presented only as an EXAMPLE of the type of charts utilized by the Water and Power Resources Service in forecasting seasonal natural runoff of the San Joaquin River at Friant Dam. Since these charts are continuously revised to conform with additional experience, they should not be used for current forecasts.

FRIANT DAM AND MILLERTON LAKE
SAN JOAQUIN RIVER, CALIFORNIA

RUNOFF FORECAST CHARTS

U.S. Army Engineer District — Sacramento, California

R.P.L. — Dec 1962

CHART A-8

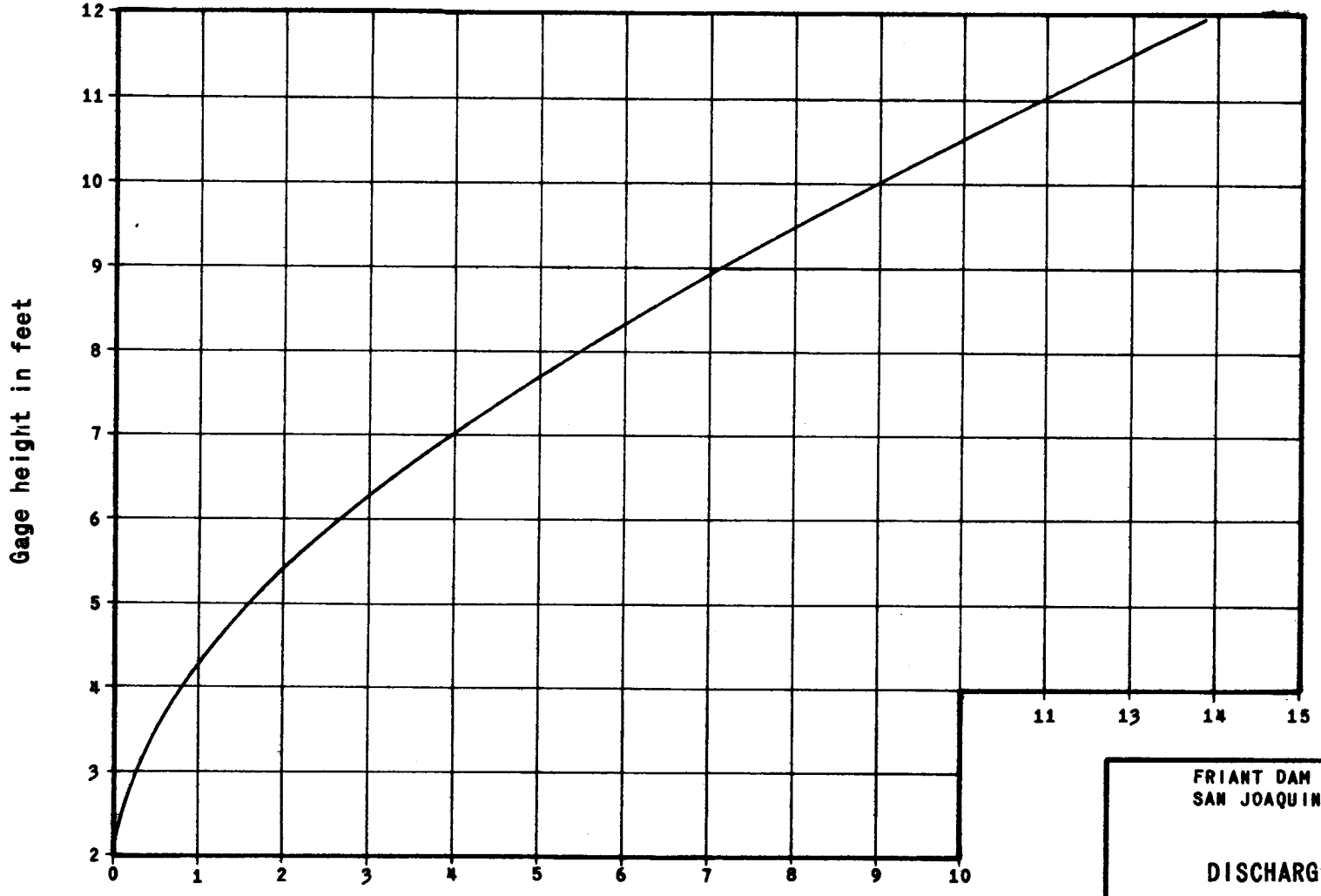
SUMMARY OF FORECASTED AND ACTUAL SNOWMELT RUNOFF INTO MILLERTON LAKE

(Flow in 1,000 acre-feet)

WATER YEAR	GIVEN DATE THROUGH 31 JULY RUNOFF																							
	1 FEBRUARY				1 MARCH				1 APRIL				1 MAY				1 JUNE				1 JULY			
	ACTUAL	FORECAST	ERROR	% ERROR	ACTUAL	FORECAST	ERROR	% ERROR	ACTUAL	FORECAST	ERROR	% ERROR	ACTUAL	FORECAST	ERROR	% ERROR	ACTUAL	FORECAST	ERROR	% ERROR	ACTUAL	FORECAST	ERROR	% ERROR
1953	1,020	1,200	+ 180	+ 15	972	860	- 112	- 13	900	770	- 130	- 17	703	NA	NA	NA	492	441	- 51	- 11	172	166	- 6	- 4
1954	1,208	950	- 258	- 27	1,143	1,000	- 143	- 14	1,016	1,100	+ 84	+ 7	737	802	+ 65	+ 8	298	350	+ 52	+ 15	80	84	+ 4	+ 5
1955	1,023	1,310	+ 287	+ 22	974	1,075	+ 101	+ 9	900	650	- 250	- 38	774	724	- 50	- 7	436	406	- 30	- 7	88	93	+ 5	+ 5
1956	2,088	2,300	+ 212	+ 9	1,947	2,020	+ 73	+ 4	1,778	1,575	- 203	- 13	1,500	1,502	+ 2	0	932	1,070	+ 138	+ 13	318	301	- 17	- 6
1957	1,181	925	- 256	- 28	1,114	823	- 291	- 35	1,024	670	- 354	- 53	882	562	- 320	- 57	555	451	- 104	- 23	115	91	- 24	- 26
1958	2,362	1,250	- 1,112	- 89	2,249	1,338	- 911	- 68	2,068	2,000	- 68	- 3	1,705	1,637	- 68	- 4	910	942	+ 32	+ 3	287	320	+ 33	+ 10
1959	809	910	+ 101	+ 11	719	1,105	+ 386	+ 35	606	710	+ 104	+ 15	403	447	+ 44	+ 10	194	189	- 5	- 3	41	35	- 6	- 17
1960	749	833	+ 84	+ 10	694	890	+ 196	+ 22	608	665	+ 57	+ 9	430	532	+ 102	+ 19	189	242	+ 53	+ 22	43	34	- 9	- 26
1961	531	920	+ 389	+ 42	500	550	+ 50	+ 9	452	480	+ 28	+ 6	327	296	- 31	- 10	155	154	- 1	- 1	27	40	+ 13	+ 32
1962	1,780	970	- 810	- 83	1,596	1,640	+ 44	+ 3	1,486	1,550	+ 64	+ 4	1,105	1,059	- 46	- 4	708	642	- 66	- 10	203	185	- 18	- 10
1963	1,722	1,090	- 632	- 58	1,514	805	- 709	- 88	1,413	850	- 563	- 66	1,221	958	- 263	- 27	757	524	- 233	- 44	264	143	- 121	- 85
1964	725	1,215	+ 490	+ 40	695	690	- 5	- 1	643	548	- 95	- 17	516	388	- 128	- 33	259	190	- 69	- 36	59	60	+ 1	+ 2
1965	1,663	2,070	+ 407	+ 20	1,549	1,570	+ 21	+ 1	1,421	1,270	- 151	- 12	1,170	1,175	+ 5	0	739	709	- 30	- 4	267	234	- 33	- 14
1966	1,018	1,560	+ 542	+ 35	963	1,225	+ 262	+ 21	837	845	+ 8	+ 1	560	515	- 45	- 9	198	160	- 38	- 24	50	50	0	0
1967	2,671	1,735	- 936	- 54	2,570	1,270	- 1,300	- 102	2,327	1,590	- 737	- 46	2,077	1,980	- 97	- 5	1,417	1,331	- 86	- 6	594	600	+ 6	+ 1
1968	710	1,110	+ 400	+ 36	635	820	+ 185	+ 23	552	593	+ 41	+ 7	406	372	- 34	- 9	175	141	- 34	- 24	44	30	- 14	- 47
1969	3,359	2,640	- 719	- 27	3,125	2,998	- 127	- 4	2,898	2,705	- 193	- 7	2,433	2,356	- 77	- 3	1,337	1,440	+ 103	+ 7	463	500	+ 37	+ 7
1970	1,127	1,520	+ 393	+ 26	1,044	1,185	+ 141	+ 12	907	970	+ 63	+ 6	761	NA	NA	NA	385	320	- 65	- 20	107	80	- 27	- 34
1971	1,152	1,630	+ 478	+ 29	1,080	1,170	+ 90	+ 8	970	980	+ 10	+ 1	799	740	- 59	- 8	505	580	+ 75	+ 13	141	180	+ 39	+ 22
1972	841	1,495	+ 645	+ 44	791	1,062	+ 271	+ 26	652	550	- 102	- 19	528	460	- 68	- 15	260	180	- 80	- 44	47	75	+ 28	+ 37
1973	1,805	1,702	- 103	- 6	1,677	1,720	+ 43	+ 2	1,546	1,730	+ 184	+ 11	1,297	1,280	- 17	- 1	589	572	- 17	- 3	127	122	- 5	- 4
1974	1,783	1,770	- 13	- 1	1,717	1,619	- 98	- 6	1,507	1,460	- 47	- 3	1,240	1,345	+ 105	+ 8	644	740	+ 96	+ 13	162	200	+ 38	+ 19
1975	1,624	1,024	- 600	- 59	1,548	1,200	- 348	- 29	1,412	1,370	- 42	- 3	1,281	1,467	+ 186	+ 13	734	887	+ 153	+ 17	160	217	+ 57	+ 26
1976	447	670	+ 223	+ 33	409	614	+ 205	+ 33	350	400	+ 50	+ 12	268	280	+ 12	+ 4	94	118	+ 24	+ 20	35	16	- 19	- 119
1977	296	633	+ 337	+ 53	281	305	+ 24	+ 8	262	90	- 172	- 191	205	50	- 155	- 310	130	55	- 75	- 136	20	25	+ 5	+ 20
1978	2,854	2,043	- 811	- 40	2,658	2,200	- 458	- 21	2,332	2,260	- 72	- 3	1,986	2,200	+ 214	+ 10	1,292	1,400	+ 108	+ 8	463	525	+ 62	+ 12
Mean(+)	1,406	1,402	+ 409	+ 30	1,314	1,221	+ 139	+ 14	1,187	1,092	+ 63	+ 7	974	963	+ 82	+ 10	553	547	+ 83	+ 13	168	169	+ 25	+ 15
Mean(-)	--	--	- 568	- 43	--	--	- 409	- 34	--	--	- 212	- 33	--	--	- 97	- 33	--	--	- 61	- 25	--	--	- 25	- 33
Extreme(+)	3,359	2,640	+ 1,448	+ 56	3,125	2,998	+ 386	+ 35	2,898	2,705	+ 184	+ 15	2,433	2,356	+ 214	+ 19	1,417	1,440	+ 153	+ 22	594	600	+ 62	+ 37
Extreme(-)	296	633	- 1,112	- 89	281	305	- 1,300	- 102	262	90	- 737	- 191	205	50	- 320	- 310	130	55	- 233	- 136	20	16	- 121	- 119

NOTES:

1. NA - Not Available.
2. Forecasts prepared and published by Bureau of Reclamation.
3. No forecast made prior to 1953.
4. Computed error based on past performance is not necessarily indicative of the accuracy that may be achieved in the future.



FRIANT DAM AND MILLERTON LAKE
SAN JOAQUIN RIVER, CALIFORNIA

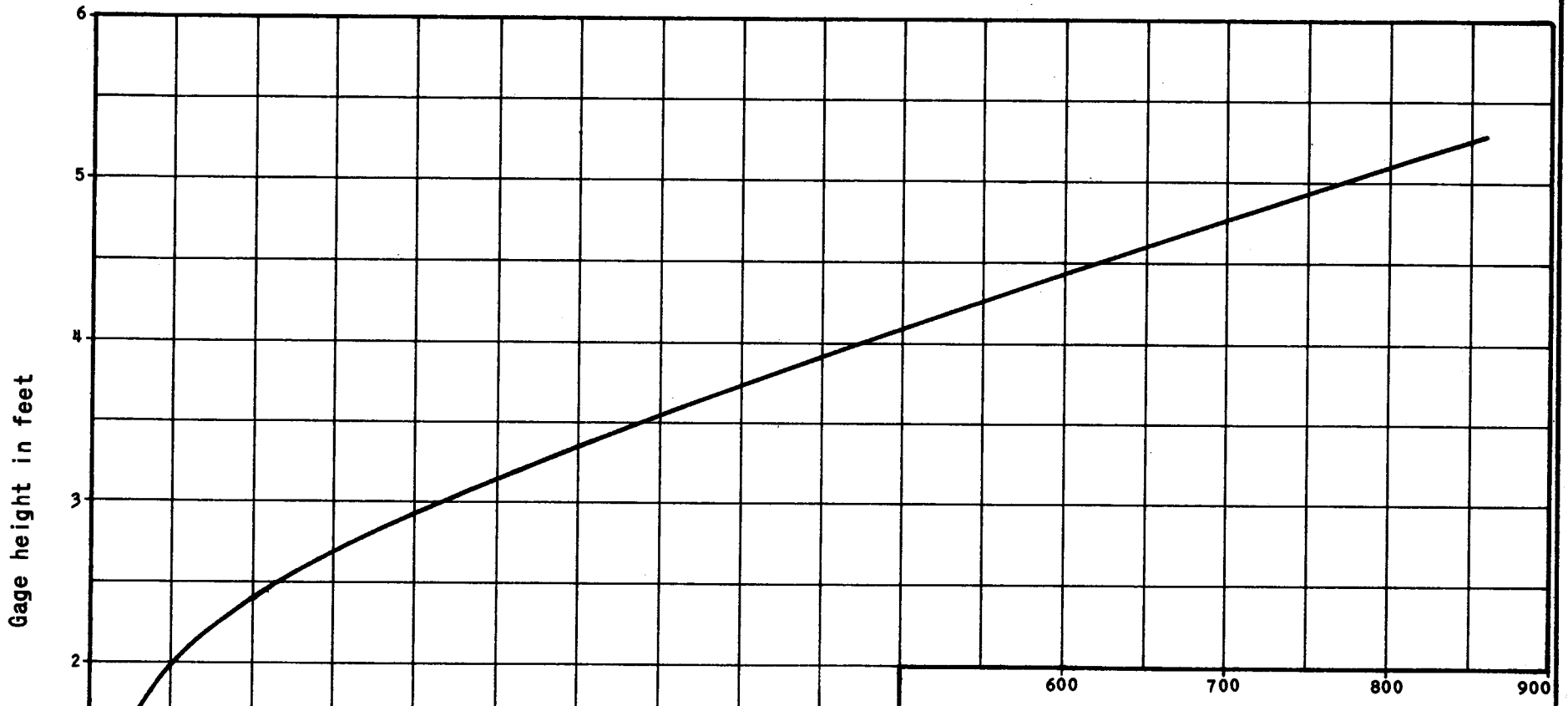
DISCHARGE RATING CURVE

SAN JOAQUIN RIVER BELOW FRIANT DAM

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: L.H.C.
Drawn: L.H.C.

Date: FEBRUARY 1979



From USBR rating table dated 3-12-63

FRIANT DAM AND MILLERTON LAKE
SAN JOAQUIN RIVER, CALIFORNIA

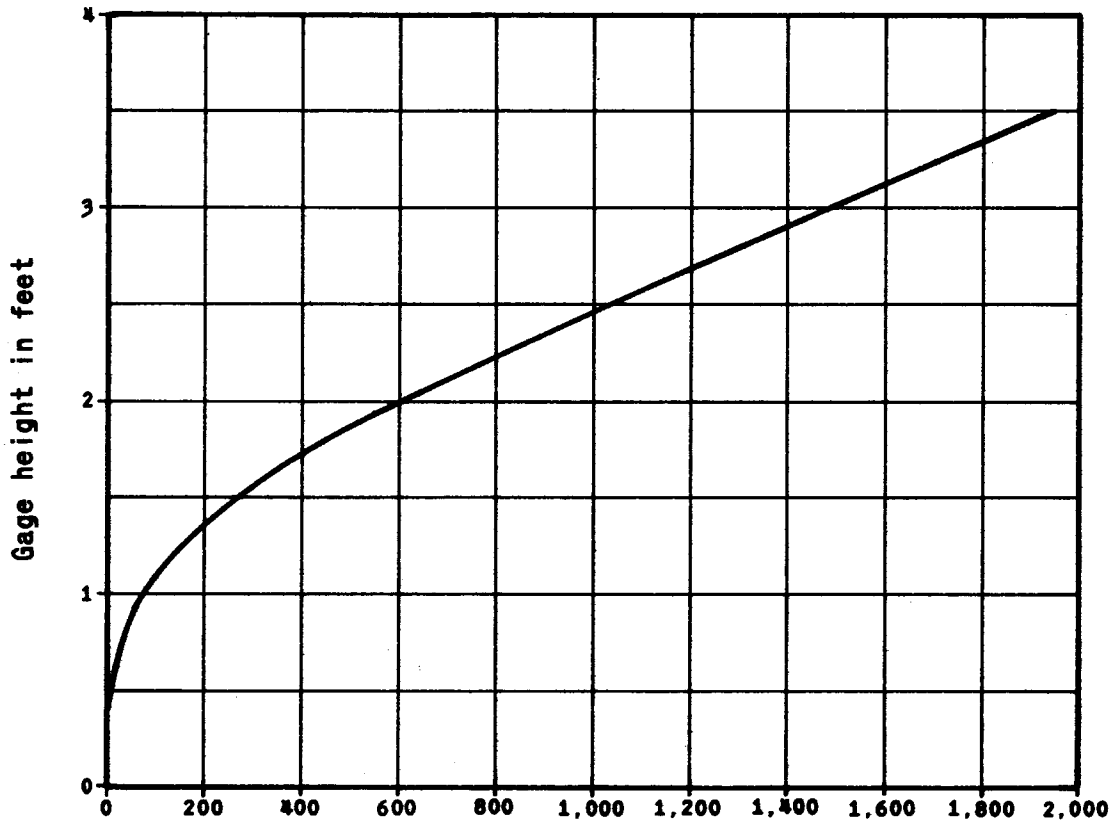
DISCHARGE RATING CURVE

COTTONWOOD CREEK NEAR FRIANT

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: L.H.C.
Drawn: L.H.C.

Date: OCTOBER 1979



From USBR rating table dated 2-10-62

FRIANT DAM AND MILLERTON LAKE
SAN JOAQUIN RIVER, CALIFORNIA

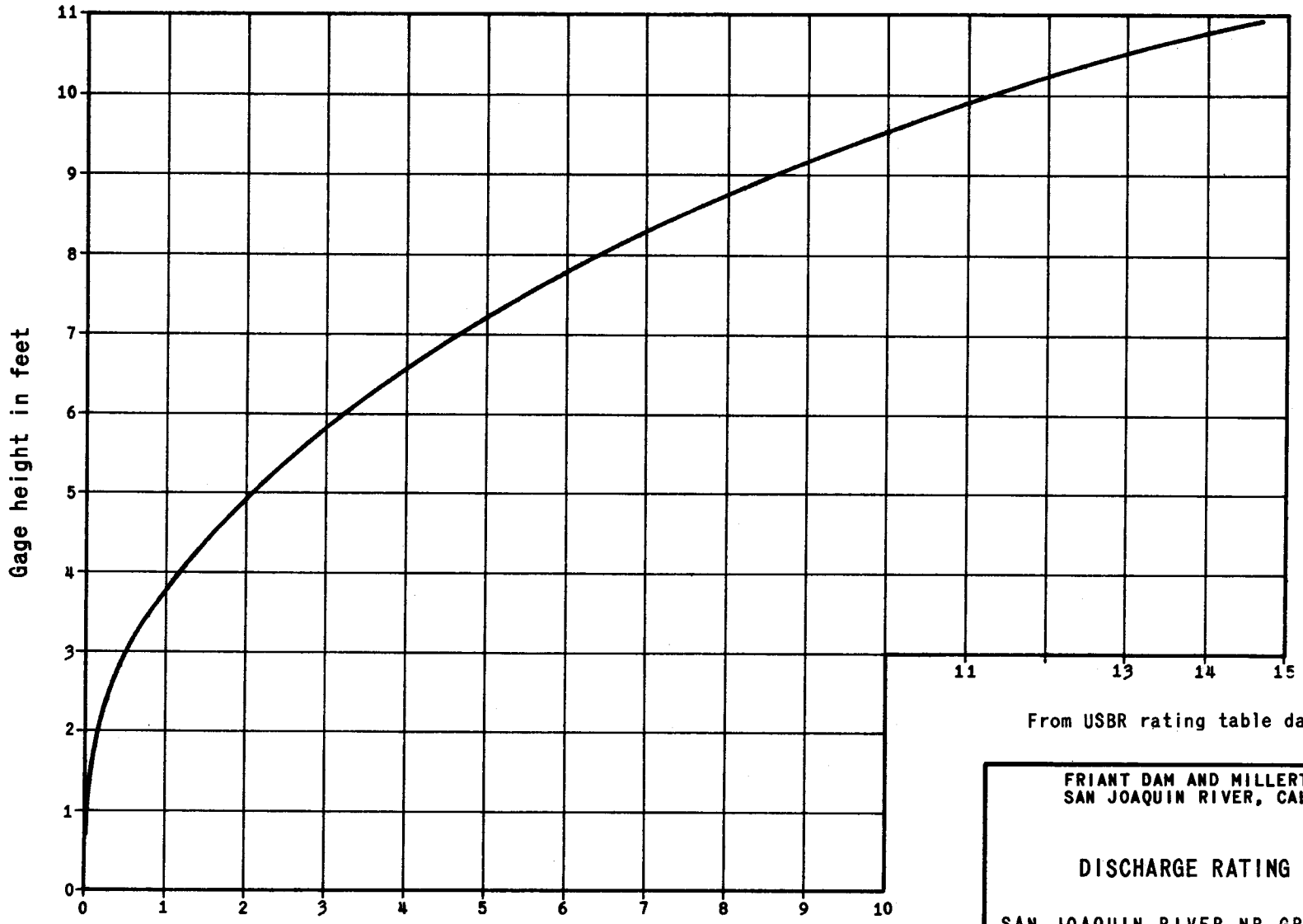
DISCHARGE RATING CURVE

LITTLE DRY CREEK AT MOUTH NEAR FRIANT

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: L.H.C.
Drawn: L.H.C.

Date: OCTOBER 1979



From USBR rating table dated 4-1-78

FRIANT DAM AND MILLERTON LAKE
SAN JOAQUIN RIVER, CALIFORNIA

DISCHARGE RATING CURVE

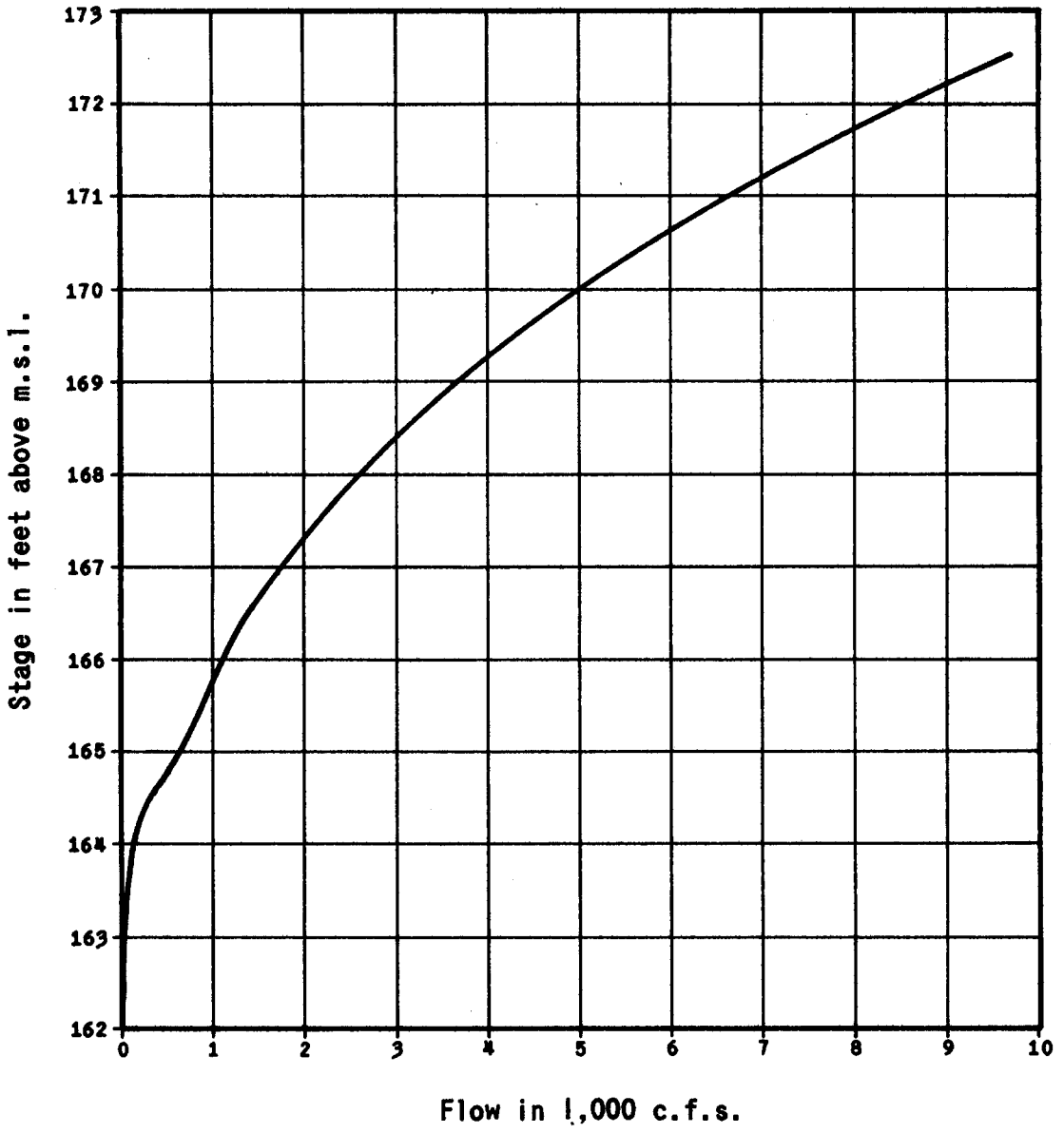
SAN JOAQUIN RIVER NR GRAVELLY FORD

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: L.H.C.
Drawn: L.H.C.

Date: OCTOBER 1979

SHEET 4 OF 7 CHART A-10



NOTE: Rating curve from California Department of Water Resources dated 1 February 1978.

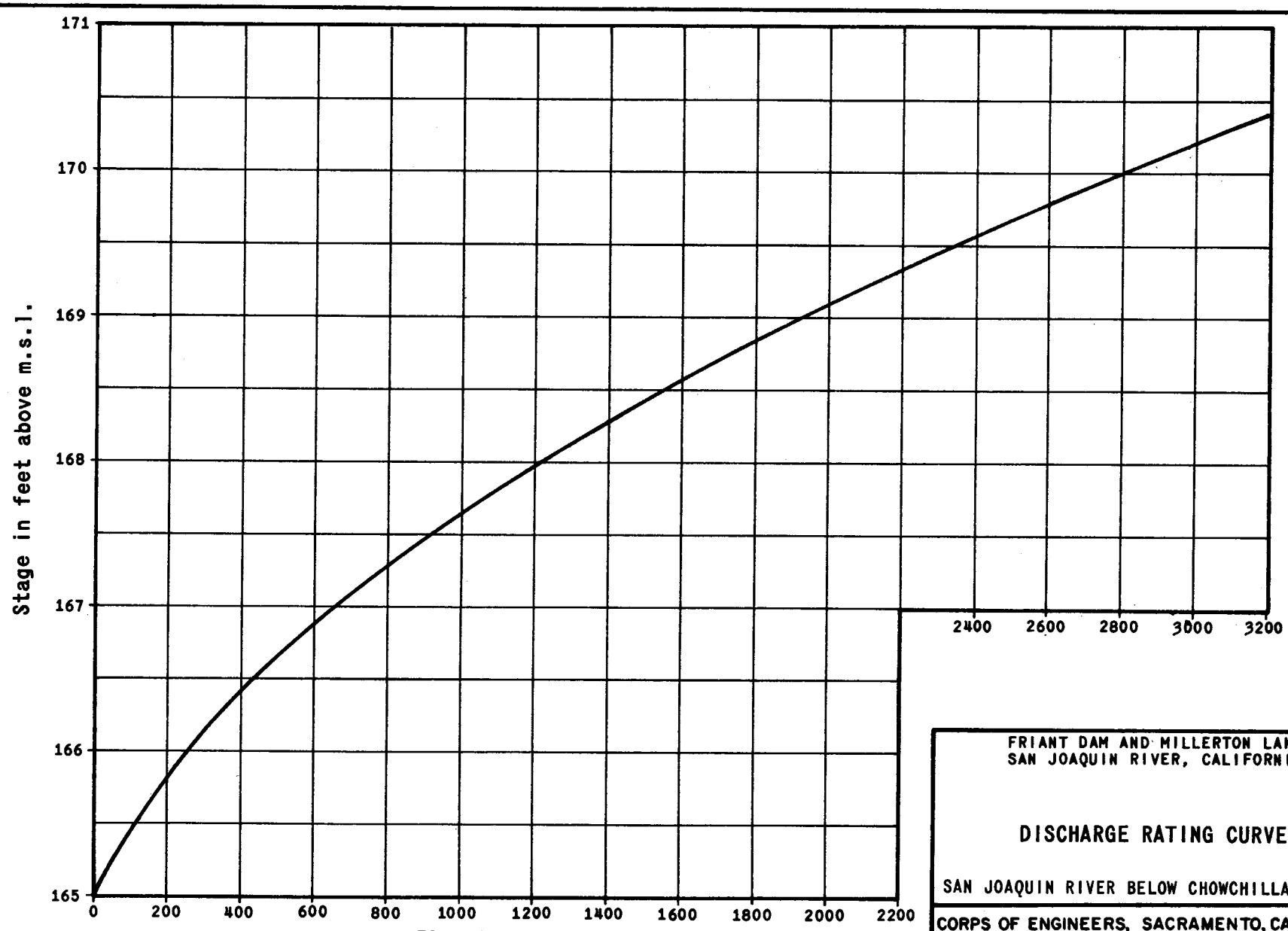
FRIANT DAM AND MILLERTON LAKE
SAN JOAQUIN RIVER, CALIFORNIA

DISCHARGE RATING CURVE

CHOWCHILLA BYPASS AT HEAD
BELOW BIFURCATION STRUCTURE

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: L.H.C.
Drawn: L.H.C.
Date: AUGUST 1979



NOTE: Rating curve from California Department of Water Resources dated 1 February 1978.

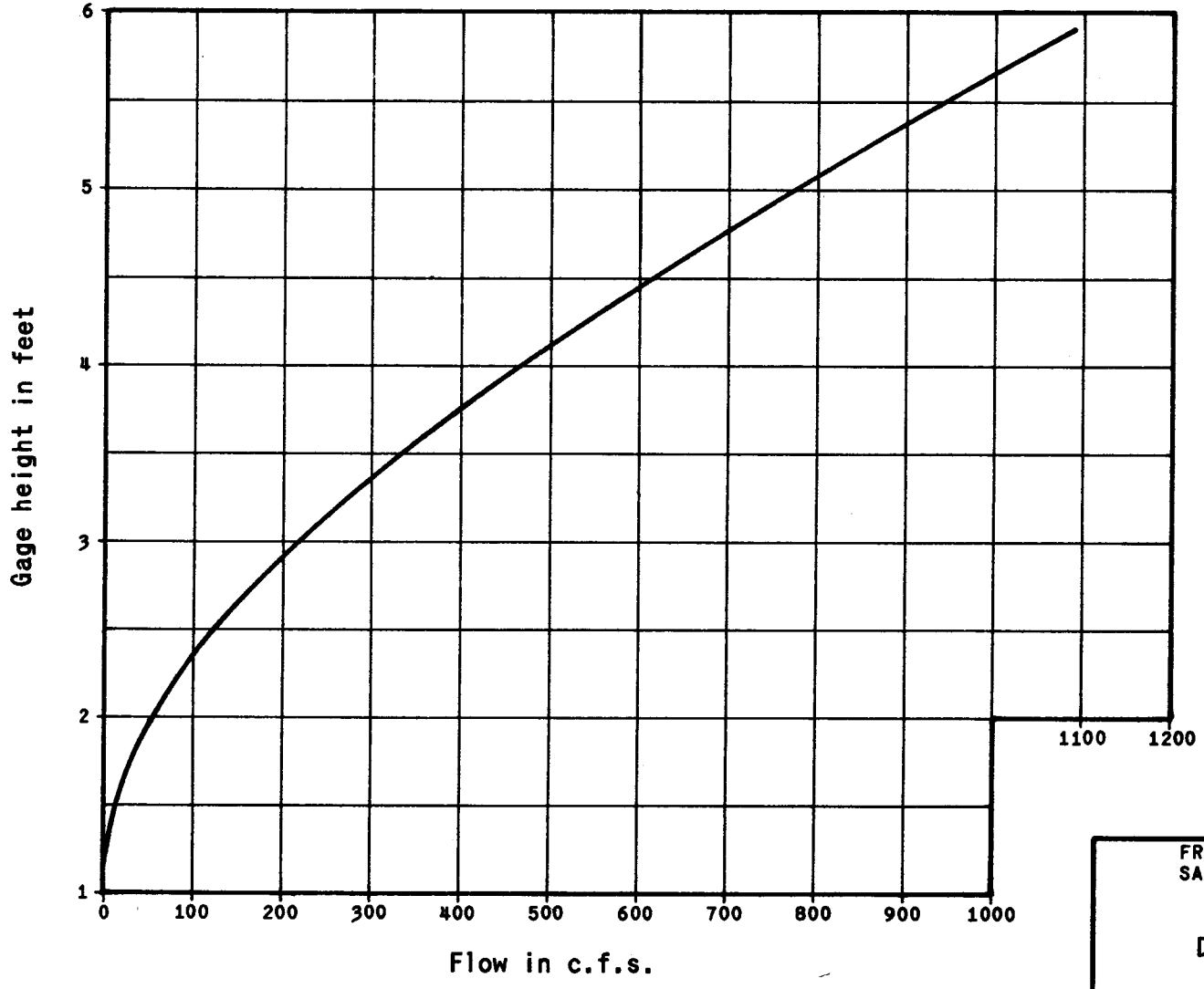
FRIANT DAM AND MILLERTON LAKE
SAN JOAQUIN RIVER, CALIFORNIA

DISCHARGE RATING CURVE

SAN JOAQUIN RIVER BELOW CHOWCHILLA BYPASS

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: L.H.C.
Drawn: L.H.C.
Date: AUGUST 1979



NOTE: U.S.B.R. rating curbe based on 1973 current meter measurements.

Drainage Area: 3,943 sq. mi.

FRIANT DAM AND MILLERTON LAKE
SAN JOAQUIN RIVER, CALIFORNIA

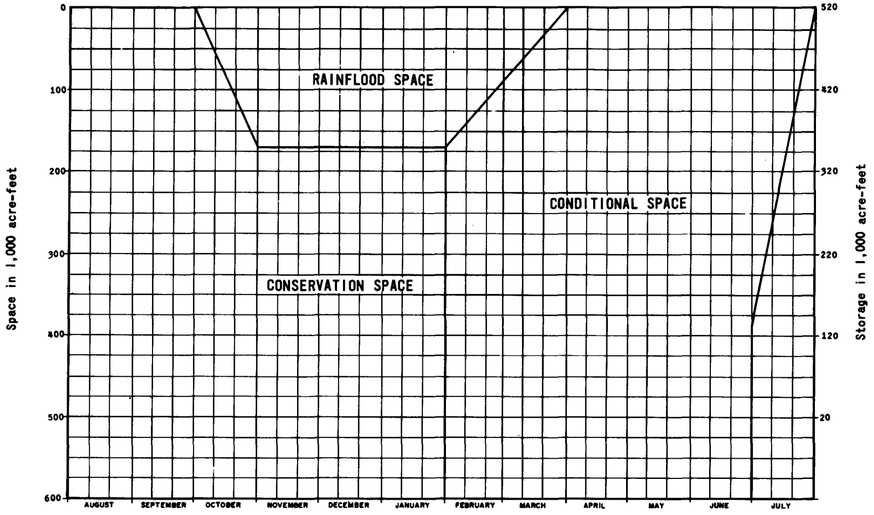
DISCHARGE RATING CURVE

SAN JOAQUIN RIVER NEAR MENDOTA

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: L.H.C.
Drawn: L.H.C.

Date: AUGUST 1979



USE OF DIAGRAM

1. When the storage level is in the range of conservation space, flood releases are not required.
2. Water stored in rainflood space shall be released as rapidly as possible without exceeding 8,000 cfs below Little Dry Cr. or 6,500 cfs at the near Mendota gage. Rainflood space in excess of 85,000 acre-feet may be replaced by an equal amount of space in Hammoth Pool.
3. When water is stored in the portion of conditional space required for flood control, a supplemental release in addition to irrigation demand must be made. The amount of conditional space required on a given date is determined from the forecasted unimpaired runoff into Millerton Lake, the amount of upstream space available, and the forecasted irrigation demand from that date to 15 June (after 31 May, use the forecasted irrigation demand for the next 15 days or until 1 August, whichever is less) using the adjacent diagram. The adjacent diagram is also used to compute the supplemental release.

ADDITIONAL CONSIDERATIONS

1. Reservoir releases will be determined by instructions hereon unless larger releases are required by the Emergency Spillway Release Diagram (Chart A-12).
2. The Corps of Engineers may direct flood releases to be increased or decreased from the computed release when warranted by existing conditions.
3. The treatment given to upstream space on this diagram is based on observed historic operation. If it is known that a portion of the upstream space will not be used, then no credit will be given for that space.

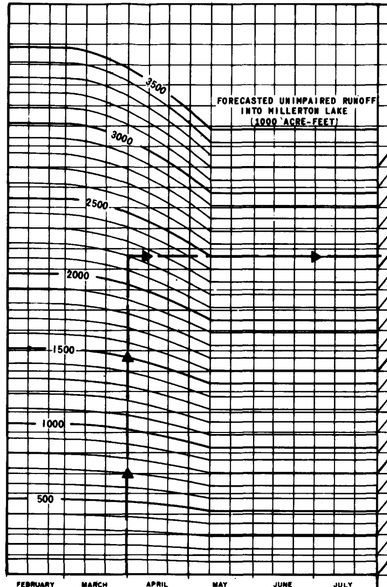
CONDITIONAL SPACE REQUIRED FOR FLOOD CONTROL COMPUTATION

1. Enter margin "A" at the date the required space is being computed, and move upward vertically to the Forecasted Unimpaired Runoff into Millerton Lake parameter, which is the forecasted runoff from that date through 31 July.
2. Move horizontally from the forecasted runoff point to the Forecasted Irrigation Demand from the given date to 15 June* (after 31 May use the Forecasted Irrigation Demand for the next 15 days or until 1 August, whichever is less).
3. Move vertically downward from the Forecasted Irrigation Demand to margin "B" to obtain Total Space Required for Flood Control. From this volume subtract the total adjusted space available in upstream reservoirs to obtain the conditional space required for flood control in Millerton Lake. The Adjustment to Upstream Space obtained from the graph on this page so titled, is subtracted from the total upstream space to compute the total adjusted space available in upstream reservoirs.

*Irrigation Demands shall be the amount of water determined by the Water and Power Resources Service to satisfy diversion requirements, channel losses, spreading, sinking, and other uses.

SUPPLEMENTAL RELEASE COMPUTATION

1. Perform Steps 1 and 2 above using the date for which the release is being computed.
2. Move vertically downward from the Forecasted Irrigation Demand to the Total Space Available for Flood Control parameter line which indicates the total space available on the given date in Millerton Lake and in upstream reservoirs minus the adjustment from the Adjustment to Upstream Space graph.
3. Move horizontally from the Total Space Available for Flood Control to the point directly above the given date on margin "C" to obtain the Supplemental Release (interpolate as required). The supplemental release must be added to the irrigation demand to obtain the total release.



A

SAMPLE COMPUTATION

GIVEN DATA:

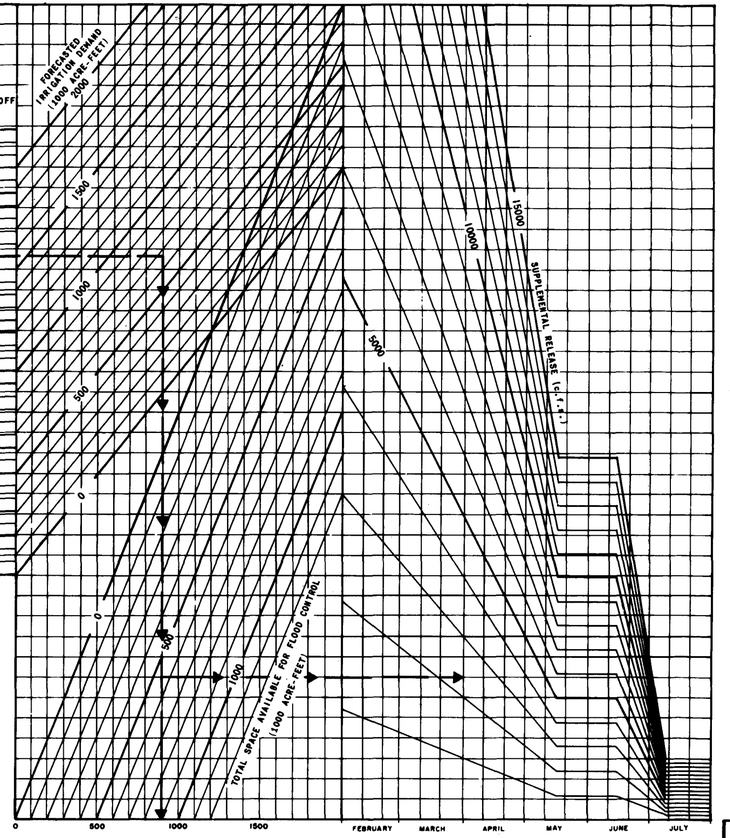
Date	1 April
Forecasted runoff from date to 31 July	2,200,000 ac-ft
Forecasted irrigation demand from date to 15 June	660,000 ac-ft
Requested irrigation release on 1 April	3,000 cfs
Space available in Millerton Lake	200,000 ac-ft
Space available in upstream reservoirs	440,000 ac-ft

COMPUTATION OF CONDITIONAL SPACE REQUIRED FOR FLOOD CONTROL:

Total space required for flood control (from diagram)	902,000 ac-ft
Adjustment to upstream space	100,000 ac-ft
Total adjusted space in upstream reservoirs	440,000 - 100,000 = 340,000 ac-ft
Conditional Reservation Required for Flood Control in Millerton Lake:	902,000 - 340,000 = 562,000 ac-ft

COMPUTATION OF TOTAL RELEASE FROM MILLERTON LAKE:

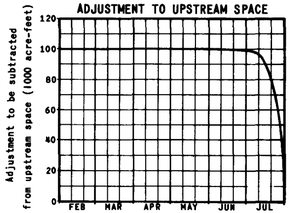
Total space available for flood control	200,000 + 340,000 = 540,000 ac-ft
Supplemental release (from diagram)	2,430 cfs
Total release	3,000 + 2,430 = 5,430 cfs



Total space required for flood control (1,000 acre-feet)

B

C



NORMAL IRRIGATION DEMAND DURING SNOWMELT OPERATION

	(1000 A.F.)	(MEAN C.F.S.)
FEBRUARY	130	2340
MARCH	139	2260
APRIL	234	3930
MAY	293	4770
JUNE	306	5140
JULY	314	5100

FRIANT DAM AND MILLERTON LAKE
SAN JOAQUIN RIVER, CALIFORNIA

FLOOD CONTROL DIAGRAM

Prepared Pursuant to Flood Control Regulations for Friant Dam and Millerton Lake (33 CFR 208.11)

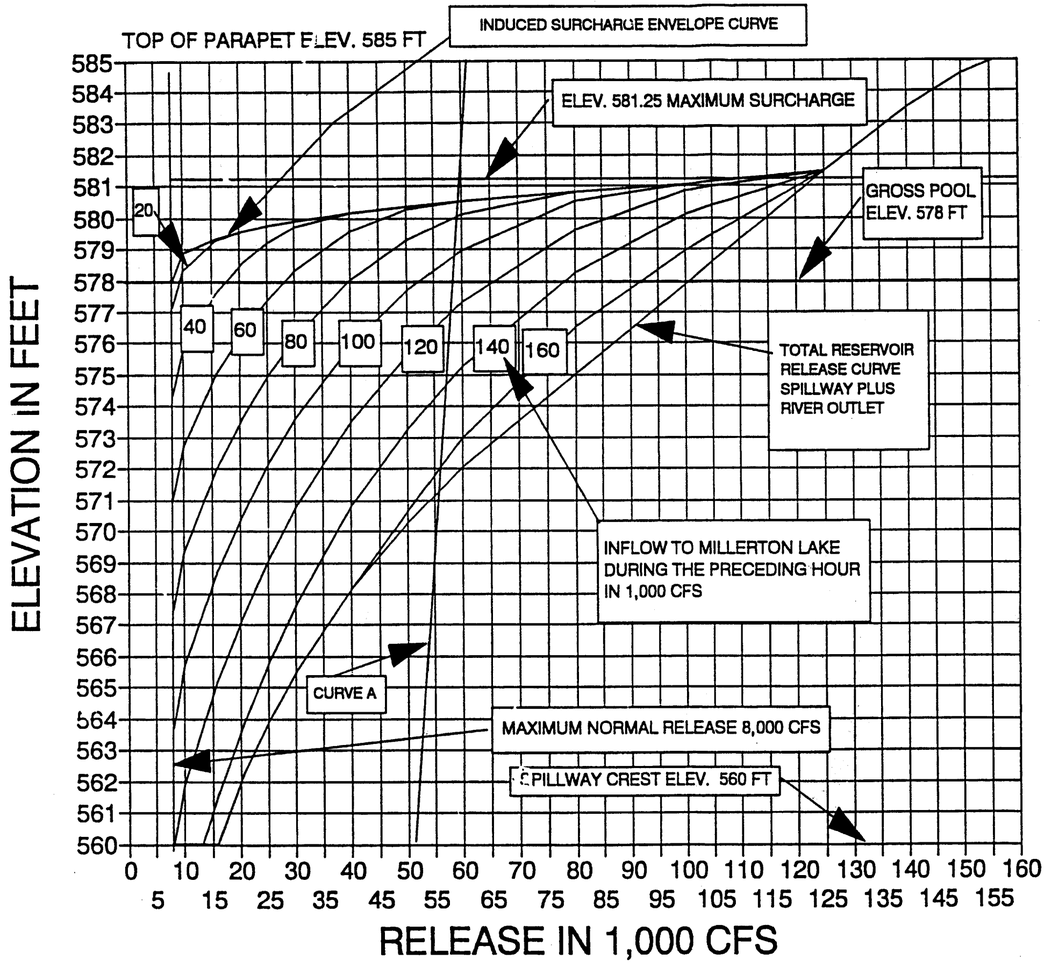
APPROVED: _____
Regional Director Mid Pacific Region
U.S.B.R.

APPROVED: _____
Brigadier General, USA, Division Engineer
South Pacific Division

File No.

Effective Date: [illegible] 1962

CHART A-11



Example 1

Given:
Reservoir level is rising
Present time is 0300
Present reservoir elevation is 575.1
Reservoir elevation at 0200 was 574.0
Average total release from 0200 to 0300 was 18000 cfs

Find:
Total release that should be made from 0300 to 0400

Solution:

STEP 1. Avg. elevation during preceding hour = (574.0+575.1)/2 = 574.5. For elevation 574.5, curve A gives a flow of 57,000 cfs.
STEP 2. 57,000 X (575.1 - 574.0) = 62,700 cfs
STEP 3. Avg inflow during preceding hour = 62,700 + 18,000 = 80,700 cfs.
STEP 4. For present elevation of 575.1 and avg inflow of 80,700 cfs, diagram yields a release of approximately 26,000 cfs.

Example 2

Given:
Reservoir level is falling
Present time is 0300
Present reservoir elevation is 574.7
Reservoir elevation at 0200 was 575.1
Reservoir elevation has decreased by 575.1 - 574.7 = 0.4 ft
Previous hour's release was 26,000 cfs

Find:
Total release that should be made from 0300 to 0400

Solution:

STEP 1. Avg. elevation during preceding hour = (574.7+575.1)/2 = 574.9. For elevation 574.9, curve A gives a flow of 57,000 cfs.
STEP 2. 0.4 X 57,000 cfs = 22,800 cfs
STEP 3. Decrease release by 0.3 X 22,800 = 6,840 cfs
STEP 4. For present elevation of 574.7, reduce release to 26,000 - 6,840 = 19,160 cfs

OPERATING INSTRUCTIONS:

1. When the reservoir is rising, read from curve "A" the flow corresponding to the average reservoir elevation during the preceding hour.
2. Multiply this value by the rise in reservoir elevation, in feet, during the preceding hour.
3. Add this product to the average total outflow from the reservoir during the preceding hour. This sum is the average inflow to the reservoir during the preceding hour.
4. Adjust the outflow each hour as indicated by the parameters on the basis of the inflow for the preceding hour and the current reservoir elevation.
5. After the reservoir elevation starts to fall, maintain current gate openings, until the elevation recedes to 580 feet.
6. When the reservoir elevation is below 580 feet and falling, read from curve "A" the flow corresponding to the average reservoir elevation during the preceding hour.
7. Multiply this value by the fall in reservoir elevation, in feet, during the preceding hour.
8. Decrease the release by 0.3 of the product obtained in step 7.
9. Repeat steps 6 through 8 each hour, as long as the reservoir is receding, until the release has been reduced to 8,000 c.f.s. which will be maintained until the pool has receded to the bottom of the required flood control space.

NOTES:

1. Follow the flood control diagram until larger releases are required by this schedule.
2. The Parameter values are the inflows to Millerton Lake during the preceding hour.
3. The total reservoir release taken from the parameter lines includes flow over the spillway, flow through the river outlet, and flow through the canal outlets. The total reservoir release taken from the Total Reservoir Release Curve includes flow through the river outlet and flow over the spillway only.
4. Top of spillway gates in raised position is at elevation 578 feet.
5. Spillway discharge is controlled by three 100 x 18 ft. drum gates.
6. Releases greater than those required by either diagram may be made on the basis of runoff forecasts in order to assure the safety of the structure.

FRIANT DAM AND MILLERTON LAKE
SAN JOAQUIN RIVER, CALIFORNIA

EMERGENCY SPILLWAY RELEASE DIAGRAM

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

Revised Nov 94

absence of any indication that further public comment would shed any new light on the matter, OSHA concludes that no change in the standard is warranted. Accordingly, the ground-fault protection standard at 29 CFR 1910.309(c) and 29 CFR 1926.400(h), as promulgated on December 21, 1976, is hereby reaffirmed.

(Secs. 6(b) and 8(c), Pub. L. 91-596, 84 Stat. 1593, 1599 (29 U.S.C. 655, 657); sec. 107, Pub. L. 91-54, 83 Stat. 96 (40 U.S.C. 333); Secretary of Labor's Order No. 8-76 (41 FR 25059); 29 CFR Part 1911.)

Signed at Washington, D.C., this 3d day of October 1978.

EULA BINGHAM,
Assistant Secretary of Labor.

[FR Doc. 78-28687 Filed 10-12-78; 8:45 am]

[3710-92-M]

Title 33—Navigation and Navigable Waters

CHAPTER II—CORPS OF ENGINEERS, DEPARTMENT OF THE ARMY

[ER 1110-2-241]

PART 208—FLOOD CONTROL REGULATIONS

Use of Storage Allocated for Flood Control and Navigation Purposes

AGENCY: U.S. Army Corps of Engineers, DOD.

ACTION: Final rule.

SUMMARY: This revision of 33 CFR 208.11 regulations prescribes the policy and procedure for regulating reservoir projects capable of regulation for flood control or navigation and the use of storage allocated for such purposes and provided on the basis of flood control and navigation. The revised regulations are applicable to dam and reservoir projects licensed, maintained, and operated under provisions of the Federal Power Act (41 Stat. 1063 (16 U.S.C. 791(A))), Pub. L. 83-436, and other similar authorizing legislation; as well as to reservoir projects constructed wholly or in part with Federal funds as directed by section 7 of the Flood Control Act of 1944. These regulations are intended to establish an understanding between project owners, operating agencies and the Corps of Engineers with regard to certain activities and responsibilities concerning water control management throughout the Nation in the interest of flood control and navigation. Interested persons were given until November 2, 1977 (42 FR 57141) to submit comments. No written comments were received.

DATES: This regulation is effective on October 15, 1978.

ADDRESSES: HQDA (DAEN-CWE-HY) Washington, D.C. 20314.

FOR FURTHER INFORMATION CONTACT:

Mr. Edgar P. Story, Engineering Division, Civil Works Directorate, Office of the Chief of Engineers, Washington, D.C. 20314 202-693-7330.

SUPPLEMENTARY INFORMATION: This final regulation is essentially the same as the proposed rule (42 FR 53637), however, certain reordering has been done of the reference material presented in § 208.11(b). Specifically, excerpts from sections 4(e), 10(a), and 10(c) of the Federal Power Act have been added for improved clarity. Also Federal Power Commission order No. 540 issued October 31, 1975, and published November 7, 1975 (40 FR 51998), amending § 2.9 of the Commission's general policy and interpretations which prescribed standardized conditions (Forms) for inclusion in preliminary permits and licenses issued under part I of the Federal Power Act has been cited and appropriately excerpted. Reference to and citation from article 33 of Federal Power Commission license No. 2009 have been deleted in lieu thereof.

In addition to the proposed action, certain project names and pertinent data are added to and deleted from the list of projects shown in § 208.11(e), list of projects (42 FR 53637). The following projects are added to the list of projects:

(a) U.S. Army Corps of Engineers, Missouri River Division area: Webster Dam and Lake.

(b) U.S. Army Corps of Engineers, New England Division area:

(i) Bear Swamp Pumped Storage Project.

(ii) Turners Falls Reservoir.

(c) U.S. Army Corps of Engineers, North Pacific Division area:

(i) American Falls Dam and Reservoir.

(ii) Anderson Ranch Dam and Reservoir.

(iii) Arrowrock Dam and Reservoir.

(iv) Brownlee Dam and Reservoir.

(v) Grand Coulee Dam and Franklin D. Roosevelt Lake.

(vi) Hells Canyon Dam and Reservoir.

(vii) Kerr Dam and Flathead Lake.

(viii) Mayfield Dam and Reservoir.

(ix) Mossyrock Dam and Davisson Lake.

(x) Oxbow Dam and Reservoir.

(xi) Priest Rapids Dam and Reservoir.

(xii) Ririe Dam and Reservoir.

(xiii) Rocky Reach Dam and Lake Entiat.

(xiv) Ross Dam and Reservoir.

(xv) Upper Baker Dam and Baker Lake.

(xvi) Wanapum Dam and Reservoir.

(xvii) Wells Dam and Lake Pateros.

(d) U.S. Army Corps of Engineers, South Atlantic Division area: Lewis M. Smith Dam and Reservoir.

(e) U.S. Army Corps of Engineers, South Pacific Division area:

(i) Indian Valley Dam and Reservoir.

(ii) Lemon Dam and Reservoir.

(iii) Navajo Dam and Reservoir.

(iv) Paoina Dam and Reservoir.

(v) Vallecito Dam and Reservoir.

The following projects are deleted from the list of projects:

(a) U.S. Army Corps of Engineers, South Altantic Division area: H. Neely Henry Dam and Reservoir.

(b) U.S. Army Corps of Engineers, South Pacific Division area:

(i) Causey Dam and Reservoir.

(ii) Devil Creek Dam and Reservoir.

NOTE.—The Chief of Engineers has determined that this rule does not contain a major proposal requiring preparation of an inflation impact statement under Executive Order 11821 and OMB Circular A-107 (Statutory Authority Pub. L. 90-483).

Dated: October 10, 1978.

CHARLES I. MCGINNIS,
Major General, USA,
Director of Civil Works.

Section 208.11 is revised to read as follows:

§ 208.11 Regulations for use of storage allocated for flood control or navigation and/or project operation at reservoirs subject to prescription of rules and regulations by the Secretary of the Army in the interest of flood control and navigation.

(a) *Purpose.* This regulation prescribes the responsibilities and general procedures for regulating reservoir projects capable of regulation for flood control or navigation and the use of storage allocated for such purposes and provided on the basis of flood control and navigation, except projects owned and operated by the Corps of Engineers; the International Boundary and Water Commission, United States and Mexico; and those under the jurisdiction of the International Joint Commission, United States, and Canada, and the Columbia River Treaty. The intent of this regulation is to establish an understanding between project owners, operating agencies, and the Corps of Engineers.

(b) *Responsibilities.* The basic responsibilities of the Corps of Engineers regarding project operation are set out in the cited authority and described in the following paragraphs:

(1) Section 7 of the Flood Control Act of 1944 (58 Stat. 890, 33 U.S.C. 709) directs the Secretary of the Army to prescribe regulations for flood control and navigation in the following manner:

Hereafter, it shall be the duty of the Secretary of War to prescribe regulations for the use of storage allocated for flood control or navigation at all reservoirs constructed wholly or in part with Federal funds provided on the basis of such purposes, and the operation of any such project shall be in accordance with such regulations: *Provided*, That this section shall not apply to the Tennessee Valley Authority, except that in case of danger from floods on the lower Ohio and Mississippi Rivers the Tennessee Valley Authority is directed to regulate the release of water from the Tennessee River into the Ohio River in accordance with such instructions as may be issued by the War Department.

(2) Federal Energy Regulatory Commission (formerly Federal Power Commission (FPC)) licenses.

(i) Responsibilities of the Secretary of the Army and/or the Chief of Engineers in Federal Energy Regulatory Commission (FERC) licensing actions are set out in the Federal Power Act. Pertinent sections of that Act are cited herein. The Commission may also stipulate, as part of license conditions, that the licensee enter into an agreement with the Department of the Army providing for operation of the project during flood times, in accordance with rules and regulations prescribed by the Secretary of the Army.

(A) Section 4(e) of the Federal Power Act requires approval by the Chief of Engineers and the Secretary of the Army of plans of dams or other structures affecting the navigable capacity of any navigable waters of the United States, prior to issuance of a license by the Commission as follows:

The Commission is hereby authorized and empowered to issue licenses to citizens * * * for the purpose of constructing, operating, and maintaining dams, water conduits, reservoirs, powerhouses, transmission lines, or other project works necessary or convenient for the development and improvement of navigation and for the development, transmission, and utilization of power across, along, from or in any of the streams or other bodies of water over which Congress has jurisdiction * * * *Provided further*, That no license affecting the navigable capacity of any navigable waters of the United States shall be issued until the plans of the dam or other structures affecting navigation have been approved by the Chief of Engineers and the Secretary of the Army.

(B) Sections 10(a) and 10(c) of the Federal Power Act specify conditions of project licenses including the following:

(1) Section 10(a). That the project adopted * * * shall be such as in the judgment of the Commission will be best adapted to a comprehensive plan for improving or developing a waterway or waterways for the use of benefit of interstate or foreign commerce, for the improvement and utilization of waterpower development, and for other beneficial public use * * *.

(2) Section 10(c). That the licensee shall * * * so maintain and operate said works as not to impair navigation, and shall conform to such rules and regulations as the Commission may from time to time prescribe for the protection of life, health, and property.* * *

(C) Section 18 of the Federal Power Act directs the operation of any navigation facilities built under the provision of that act, be controlled by rules and regulations prescribed by the Secretary of the Army as follows:

The operation of any navigation facilities which may be constructed as part of or in connection with any dam or diversion structure built under the provisions of this Act, whether at the expense of a licensee hereunder or of the United States, shall at all times be controlled by such reasonable rules and regulations in the interest of navigation; including the control of the pool caused by such dam or diversion structure as may be made from time to time by the Secretary of the Army, * * *

(ii) Federal Power Commission order No. 540 issued October 31, 1975, and published November 7,1975 (40 FR 51998), amending section 2.9 of the Commission's general policy and interpretations prescribed standardized conditions (forms) for inclusion in preliminary permits and licenses issued under part I of the Federal Power Act. As an example, article 12 of standard form L-3, titled: "Terms and Conditions of License for Constructed Major Projects Affecting Navigable Waters of the United States," sets out the Commission's interpretation of appropriate sections of the Act, which deal with navigation aspects, and attendant responsibilities of the Secretary of the Army in licensing actions as follows:

The United States specifically retains and safeguards the right to use water in such amount, to be determined by the Secretary of the Army, as may be necessary for the purposes of navigation on the navigable waterway affected; and the operation of the Licensee, so far as they affect the use, storage and discharge from storage of waters affected by the license, shall at all times be controlled by such reasonable rules and regulations as the Secretary of the Army may prescribe in the interest of navigation, and as the Commission may prescribe for the protection of life, health, and property, * * *, and the Licensee shall release water from the project reservoir at such rate * * *, as the Secretary of the Army may prescribe in the interest of navigation, or as the Commission may prescribe for the other purposes hereinbefore mentioned.

(3) Section 9 of Public Law 436, 83d Congress (68 Stat. 303) provides for the development of the Coosa River, Ala. and Ga., and directs the Secretary of the Army to prescribe rules and regulations for project operation in the interest of flood control and navigation as follows:

The operation and maintenance of the dams shall be subject to reasonable rules and regulations of the Secretary of the Army in the interest of flood control and navigation.

NOTE.—This Regulation will also be applicable to dam and reservoir projects operated under provisions of future legislative acts wherein the Secretary of the Army is directed to prescribe rules and regulations in the interest of flood control and navigation. The Chief of Engineers, U.S. Army Corps of Engineers, is designated the duly authorized representative of the Secretary of the Army to exercise the authority set out in the congressional acts. This regulation will normally be implemented by letters of understanding between the Corps of Engineers and project owner and will incorporate the provisions of such letters of understanding prior to the time construction renders the project capable of significant impoundment of water. A water control agreement signed by both parties will follow when deliberate impoundment first begins or at such time as the responsibilities of any corps-owned projects may be transferred to another entity. Promulgation of this regulation for a given project will occur at such time as the name of the project appears in the FEDERAL REGISTER in accordance with the requirements of § 208.11(d)(11). When agreement on a water control plan cannot be reached between the corps and the project owner after coordination with all interested parties, the project name will be entered in the FEDERAL REGISTER and the Corps of Engineers plan will be the officials water control plan until such time as differences can be resolved.

(c) *Scope and terminology.* This regulation applies to Federal authorized flood control and/or navigation storage projects, and to non-Federal projects which require the Secretary of the Army to prescribe regulations as a condition of the license, permit or legislation, during the planning, design and construction phases, and throughout the life of the project. In compliance with the authority cited above, this regulation defines certain activities and responsibilities concerning water control management throughout the Nation in the interest of flood control and navigation. In carrying out the conditions of this regulation, the owner and/or operating agency will comply with applicable provisions of Pub. L. 85-624, the Fish and Wildlife Coordination Act of 1958, and Pub. L. 92-500, the Federal Water Pollution Control Act Amendments of 1972. This regulation does not apply to local flood protection works governed by § 208.10, or to navigation facilities and associated structures which are otherwise covered by part 207 (Navigation Regulations) of title 33 of the code. Small reservoirs, containing less than 12,500 acre-feet of flood control or navigation storage, may be excluded from this regulation and covered under § 208.10, unless specifically required by law or conditions of the license or permit.

(1) The terms "reservoir" and "project" as used herein include all water resource impoundment projects constructed or modified, including natural lakes, that are subject to this regulation.

(2) The term "project owner" refers to the entity responsible for maintenance, physical operation, and safety of the project, and for carrying out the water control plan in the interest of flood control and/or navigation as prescribed by the Corps of Engineers. Special arrangements may be made by the project owner for "operating agencies" to perform these tasks.

(3) The term "letter of understanding" as used herein includes statements which consummate this regulation for any given project and define the general provisions or conditions of the local sponsor, or owner, cooperation agreed to in the authorizing legislative document, and the requirements for compliance with section 7 of the 1944 Flood Control Act, the Federal Power Act or other special congressional act. This information will be specified in the water control plan and manual. The letter of understanding will be signed by a duly authorized representative of the Chief of Engineers and the project owner. A "field working agreement" may be substituted for a letter of understanding, provided that the specified minimum requirements of the latter, as stated above, are met.

(4) The term "water control agreement" refers to a compliation of water control criteria, guidelines, diagrams, release schedules, rule curves and specifications that basically govern the use of reservoir storage space allocated for flood control or navigation and/or release functions of a water control project for these purposes. In general, they indicate controlling or limiting rates of discharge and storage space required for flood control and/or navigation, based on the runoff potential during various seasons of the year.

(5) For the purpose of this regulation, the term "water control plan" is limited to the plan of regulation for a water resources project in the interest of flood control and/or navigation. The water control plan must conform with proposed allocations of storage capacity and downstream conditions or other requirements to meet all functional objectives of the particular project, acting separately or in combination with other projects in a system.

(6) The term "real-time" denotes the processing of current information or data in a sufficiently timely manner to influence a physicial response in the system being monitored and controlled. As used herein the term connotes * * * the analyses for and execution of water control decisions for both minor and major flood events and for navigation, based on prevailing hydrometeorological and other conditions and constraints, to achieve efficient management of water resource systems.

(d) *Procedures.* (1) *Conditions during project formulation.* During the planning and design phases, the project owner should consult with the Corps of Engineers regarding the quantity and value of space to reserve in the reservoir for flood control and/or navigation purposes, and for utilization of the space, and other requirements of the license, permit or conditions of the law. Relevant matters that bear upon flood control and navigation accomplishment include: runoff potential, reservoir discharge capability, downstream channel characteristics, hydrometeorological data collection, flood hazard, flood damage charateristics, real estate acquisition for flowage requirements (fee and easement), and resources required to carry out the water control plan. Advice may also be sought on determination of and regulation for the probable maximum or other design flood under consideration by the project owner to establish the quantity of surcharge storage space, and freeboard elevation of top of dam or embankment for safety of the project.

(2) *Corps of Engineers involvement.* If the project owner is responsible for real-time implemenetation of the water control plan, consultation and assistance will be provided by the Corps of Engineers when appropriate and to the extent possible. During any emergency that affects flood control and/or navigation, the Corps of Engineers may temporarily prescribe regulation of flood control or navigation storage space on a day-to-day (real-time) basis without request of the project owner. Appropriate consideration will be given for other authorized project functions. Upon refusal of the project owner to comply with regulations prescribed by the Corps of Engineers, a letter will be sent to the project owner by the Chief of Engineers or his duly authorized representative describing the reason for the regulations prescribed, events that have transpired, and notification that the project owner is in violation of the Code of Federal Regulations. Should an impasse arise, in that the project owner or the designated operating entity persists in noncompliance with regulations prescribed by the Corps of Engineers, measures may be taken to assure compliance.

(3) *Corps of Engineers implementation of real-time water control decisions.* The Corps of Engineers may prescribe the continuing regulation of flood control storage space for any project subject to this regulation on a day-to-day (real-time) basis. When this is the case, consultation and assistance from the project owner to the extent possible will be expected. Special requests by the project owner, or appropriate operating entity, are preferred before the Corps of Engineers offers advice on real-time regulation during surcharge storage utilization.

(4) *Water control plan and manual.* Prior to project completion, water control managers from the Corps of Engineers will visit the project and the area served by the project to become familiar with the water control facilities, and to insure sound formulation of the water control plan. The formal plan of regulation for flood control and/or navigation, referred to herein as the water control plan, will be developed and documented in a water control manual prepared by the Corps of Engineers. Development of the manual will be coordinated with the project owner to obtain the necessary pertinent information, and to insure compatibility with other project purposes and with surcharge regulation. Major topics in the manual will include: Authorization and description of the project, hydrometeorology, data collection and communication networks, hydrologic forecasting, the water control plan, and water resource management functions, including responsibilities and coordination for water control decisionmaking. Special instructions to the dam tender or reservoir manager on data collection, reporting to higher Federal authority, and on procedures to be followed in the event of a communication outage under emergency conditions, will be prepared as an exhibit in the manual. Other exhibits will include copies of this regulation, letters of understanding consummating this regulation, and the water control agreements. After approval by the Chief of Engineers or his duly authorized representative, the manual will be furnished the project owner.

(5) *Water control agreement.* (i) A water control diagram (graphical) will be prepared by the Corps of Engineers for each project having variable space reservation for flood control and/or navigation during the year; e.g., variable seasonal storage, joint-use space, or other rule curve designation. Reservoir inflow parameters will be included on the diagrams when appropriate. Concise notes will be included on the diagrams prescribing the use of storage space in terms of release schedules, runoff, nondamaging or other controlling flow rates downstream of the damsite, and other major factors as appropriate. A water control release schedule will be prepared in tabular form for projects that do not have variable space reservation for flood control and/or navigation. The water control diagram or release schedule will be signed by a duly authorized representative of the Chief of Engineers, the project owner, and the designated operating agency, and will be used as the basis for carrying out this

regulation. Each diagram or schedule will contain a reference to this regulation.

(ii) When deemed necessary by the Corps of Engineers, information given on the water control diagram or release schedule will be supplemented by appropriate text to assure mutual understanding on certain details or other important aspects of the water control plan not covered in this regulation, on the water control diagram or in the release schedule. This material will include clarification of any aspects that might otherwise result in unsatisfactory project performance in the interest of flood contol and/or navigation. Supplementation of the agreement will be necessary for each project where the Corps of Engineers exercises the discretionary authority to prescribe the flood control regulation on a day-to-day (real-time) basis. The agreement will include delegation of the responsibility. The document should also cite, as appropriate, section 7 of the 1944 Flood Control Act, the Federal Power Act and/or other congressional legislation authorizing construction an/or directing operation of the project.

(iii) All flood control regulations published in the FEDERAL REGISTER under this section (part 208) of the code prior to the date of this publication which are listed in paragraph 208.11(e) are hereby superseded.

(iv) Nothing in this regulation prohibits the promulgation of specific regulations for a project in compliance with the authorizing acts, when agreement on acceptable regulations cannot be reached between the Corps of Engineers and the owner.

(6) *Hydrometeorological instrumentation.* The project owner will provide instrumentation in the vicinity of the damsite and will provide communication equipment necessary to record and transmit hydrometeorological and reservoir data to all appropriate Federal authorities on a real-time basis unless there are extenuating circumstances or are otherwise provided for as a condition of the license or permit. For those projects where the owner retains responsibility for real-time implementation of the water control plan, the owner will also provide or arrange for the measurement and reporting of hydrometeorological parameters required within and adjacent to the watershed and downstream of the damsite, sufficient to regulate the project for flood control and/or navigation in an efficient manner. When data collection stations outside the immediate vicinity of the damsite are required, and funds for installation, observation, and maintenance are not available from other sources, the Corps of Engineers may agree to share the costs for such stations with the project owner. Availability of funds and urgency of data needs are factors which will be considered in reaching decisions on cost sharing.

(7) *Project safety.* The project owner is responsible for the safety of the dam and appurtenant facilities and for regulation of the project during surcharge storage utilization. Emphasis upon the safety of the dam is especially important in the event surcharge storage is utilized, which results when the total storage space reserved for flood control is exceeded. Any assistance provided by the Corps of Engineers concerning surcharge regulation is to be utilized at the discretion of the project owner, and does not relieve the owner of the responsibility for safety of the project.

(8) *Notification of the general public.* The Corps of Engineers and other interested Federal and State agencies, and the project owner will jointly sponsor public involvement activities, as appropriate, to fully apprise the general public of the water control plan. Public meetings or other effective means of notification and involvement will be held, with the initial meeting being conducted as early as practicable but not later than the time the project first becomes operational. Notice of the initial public meeting shall be published once a week for 3 consecutive weeks in one or more newspapers of general circulation published in each county covered by the water control plan. Such notice shall also be used when appropriate to inform the public of modifications in the water control plan. If no newspaper is published in a county, the notice shall be published in one or more newspapers of general circulation within that county. For the purposes of this section a newspaper is one qualified to publish public notices under applicable State law. Notice shall be given in the event significant problems are anticipated or experienced that will prevent carrying out the approved water control plan or in the event that an extreme water condition is expected that could produce severe damage to property or loss of life. The means for conveying this information shall be commensurate with the urgency of the situation. The water control manual will be made available for examination by the general public upon request at the appropriate office of the Corps of Engineers, project owner or designated operating agency.

(9) *Other generalized requirements for flood control and navigation.* (i) Storage space in the reservoirs allocated for flood control and navigation purposes shall be kept available for those purposes in accordance with the water control agreement, and the plan of regulation in the water control manual.

(ii) Any water impounded in the flood control space defined by the water control agreement shall be evacuated as rapidly as can be safely accomplished without causing downstream flows to exceed the controlling rates; i.e., releases from reservoirs shall be restricted insofar as practicable to quantities which, in conjunction with uncontrolled runoff downstream of the dam, will not cause water levels to exceed the controlling stages currently in force. Although conflicts may arise with other purposes, such as hydropower, the plan or regulation may require releases to be completely curtailed in the interest of flood control or safety of the project.

(iii) Nothing in the plan of regulation for flood control shall be construed to require or allow dangerously rapid changes in magnitudes of releases. Releases will be made in a manner consistent with requirements for protecting the dam and reservoir from major damage during passage of the maximum design flood for the project.

(iv) The project owner shall monitor current reservoir and hydro- meteorological conditions in and adjacent to the watershed and downstream of the damsite, as necessary. This and any other pertinent information shall be reported to the Corps of Engineers on a timely basis, in accordance with standing instructions to the damtender or other means requested by the Corps of Engineers.

(v) In all cases where the project owner retains responsibility for real-time implementation of the water control plan, he shall make current determinations of: Reservoir inflow, flood control storage utilized, and scheduled releases. He shall also determine storage space and releases required to comply with the water control plan prescribed by the Corps of Engineers. The owner shall report this information on a timely basis as requested by the Corps of Engineers.

(vi) The water control plan is subject to temporary modification by the Corps of Engineers if found necessary in time of emergency. Requests for and action on such modifications may be made by the fastest means of communication available. The action taken shall be confirmed in writing the same day to the project owner and shall include justification for the action.

(vii) The project owner may temporarily deviate from the water control plan in the event an immediate short-term departure is deemed necessary for emergency reasons to protect the safety of the dam, or to avoid other serious hazards. Such actions shall be immediately reported by the fastest

means of communication available. Actions shall be confirmed in writing the same day to the Corps of Engineers and shall include justification for the action. Continuation of the deviation will require the express approval of the Chief of Engineers, or his duly authorized representative.

(viii) Advance approval of the Chief of Engineers, or his duly authorized representative, is required prior to any deviation from the plan of regulation prescribed or approved by the Corps of Engineers in the interest of flood control and/or navigation, except in emergency situations provided for in paragraph (d)(9)(vii) of this section. When conditions appear to warrant a prolonged deviation from the approved plan, the project owner and the Corps of Engineers will jointly investigate and evaluate the proposed deviation to insure that the overall integrity of the plan would not be unduly compromised. Approval of prolonged deviations will not be granted unless such investigations and evaluations have been conducted to the extent deemed necessary by the Chief of Engineers, or his designated representatives, to fully substantiate the deviation.

(10) *Revisions.* The water control plan and all associated documents will be revised by the Corps of Engineers, as necessary, to reflect changed conditions that come to bear upon flood control and navigation, e.g., reallocation of reservoir storage space due to sedimentation or transfer of storage space to a neighboring project. Revision of the water control plan, water control agreement, water control diagram, or release schedule requires approval of the Chief of Engineers or his duly authorized representative. Each such revision shall be effective upon the date specified in the approval. The original (signed document) water control agreement shall be kept on file in the Office, Chief of Engineers, Department of the Army, Washington, D.C. Copies of the agreement shall be kept on file and may be obtained from the office of the project owner, or from the office of the appropriate Division Engineer, Corps of Engineers.

(11) *Federal Register.* The following information for each project subject to section 7 of the 1944 Flood Control Act and other applicable congressional acts shall be published in the FEDERAL REGISTER prior to the time the projects becomes operational and prior to any significant impoundment before project completion or * * * at such time as the responsibility for physical operation and maintenance of the Corps of Engineers owned projects is transferred to another entity: (i) Reservoir, dam, and lake names, (ii) stream, county, and State corresponding to the damsite location, (iii) the maximum current storage space in acre-feet to be reserved exclusively for flood control and/or navigation purposes, or any multiple-use space (intermingled) when flood control or navigation is one of the purposes, with corresponding elevations in feet above mean sea level, and area in acres at the upper and lower limits of said space, (iv) the name of the project owner, and (v) congressional legislation authorizing the project for Federal participation.

(e) *List of projects.* The following tables, "Pertinent Project Data—Section 208.11 Regulation," show the pertinent data for projects which are subject to this regulation.

(Sec. 7, Pub. L. 78-534, 58 Stat. 890 (33 U.S.C. 709); the Federal Power Act, 41 Stat. 1063 (16 U.S.C. 791(A)); and Sec. 9, Pub. L. 83-436, 68 Stat. 303.)

[FR Doc. 78-29100 Filed 10-12-78; 8:45 am]

PERTINENT PROJECT DATA - SECTION 208.11 REGULATIONS

PROJECT NAME	STREAM	COUNTY & STATE	EXCLUSIVE FLOOD CONTROL/NAVIGATION STORAGE 1000 ac-ft	ELEV. LIMITS feet m.s.l. UPPER	ELEV. LIMITS feet m.s.l. LOWER	AREA acres UPPER	AREA acres LOWER	MULTIPLE-USE FLOOD CONTROL/NAVIGATION STORAGE 1000 ac-ft	ELEV. LIMITS feet m.s.l. UPPER	ELEV. LIMITS feet m.s.l. LOWER	AREA acres UPPER	AREA acres LOWER	PROJECT OWNER	AUTH. LEGIS.
Alpine Dam	Keith Creek	Winnebago,IL	0.585	796.0	764.0	51.88	0	-	-	-	-	-	City of Rockford,IL	PWA Proj.
Agency Valley Dam & Res	N. Fork Malheur Riv.	Malheur,OR	-	-	-	-	-	60.0	3340.0	3263.21	1,900	0	Bureau of Reclamation	PL 68-292
American Falls Dam & Reservoir	Snake River	Power,ID	-	-	-	-	-	1,700	4343.2	4295.6	56,100	0	Bureau of Reclamation	FPC NO. 2259
Anderson Ranch Dam & Reservoir	S.Fk. Boise River	Elmore,ID	-	-	-	-	-	423.2	4196.0	4043.0	4,740	1,150	Bureau of Reclamation	Rec. Proj. Act of 1939 (53 Stat. 1187)
Arrowrock Dam & Reservoir	Boise River	Elmore,ID	-	-	-	-	-	286.6	3216.0	2967.0	3,100	200	Bureau of Reclamation	Rec.Act of 17 Jun 1902 (32 Stat. 388)
Bear Creek Dam	Bear Creek	Marion & Ralls, MO	8.7	546.5	520.0	540	0	-	-	-	-	-	City of Hannibal,MO	PL 83-780
Bear Swamp Pumped Storage Proj.	Trib. of Deerfield River	Franklin, MA	-	-	-	-	-	(No specific FC/Nav. Storage Allocation)					New Eng Power CO.	Fed. Power Act.
Big Dry Creek and Diversion	Big Dry Creek and Dog Creek	Fresno,CA	16.25	425.0	393.0	1,530	0	-	-	-	-	-	Reclamation Board CA	PL 77-228
Bonny Dam & Reservoir	S. Fork Republican River	Yuma, CO	128.8	3710.0	3672.0	5,036	2,042	-	-	-	-	-	Bureau of Reclamation	PL 78-534
Boysen Dam & Reservoir	Wind River	Fremont, WY	146.0	4732.0	4725.0	22,100	19,560	146.1	4725.0	4717.0	19,560	16,955	Bureau of Reclamation	PL 78-534
Brownlee Dam & Reservoir	Snake River	Baker,OR; Washington,ID	-	-	-	-	-	980.3	2077.0	1976.0	13,840	6,650	Idaho Power Company	FPC No. 1971-C
Bully Creek Dam & Reservoir	Bully Creek	Malheur,OR	-	-	-	-	-	31.65	2523.0	2456.8	1,082	140	Bureau of Reclamation	PL 86-248
Camanche Dam & Reservoir	Mokelumne River	San Joaquin, CA	-	-	-	-	-	200.0	235.5	205.1	7,600	5,507	East Bay Mun Util Dist. Oakland,CA	PL 86-645
Canyon Ferry Dam & Lake	Missouri Riv.	Lewis & Clark, MT	104.3	3800.0	3797.0	35,181	34,435	799.1	3797.0	3770.0	34,435	24,126	Bureau of Reclamation	PL 78-534

PERTINENT PROJECT DATA - SECTION 208.11 REGULATIONS

PROJECT NAME	STREAM	COUNTY & STATE	EXCLUSIVE					MULTIPLE-USE					PROJECT OWNER	AUTH. LEGIS.
			FLOOD CONTROL/NAVIGATION					FLOOD CONTROL/NAVIGATION						
			STORAGE	ELEV. LIMITS		AREA		STORAGE	ELEV. LIMITS		AREA			
			1000 ac-ft	feet m.s.l. UPPER	LOWER	acres UPPER	LOWER	1000 ac-ft	feet m.s.l. UPPER	LOWER	acres UPPER	LOWER		
Cedar Bluff Dam & Reservoir	Smoky Hill River	Trego, KS	191.9	2166.0	2144.0	10,790	6,869	-	-	-	-	-	Bureau of Reclamation	PL 78-534
Clark Canyon Dam & Reservoir	Beaverhead River	Beaverhead, MT	79.1	5560.4	5546.1	5,903	5,160	50.4	5546.1	5535.7	5,160	4,496	Bureau of Reclamation	PL 78-534
Del Valle Dam & Reservoir	Alameda Creek	Alameda, CA	37.0	745.0	703.1	1,060	710	1.0	703.1	702.2	710	700	CA Dept of Water Resources	PL 87-874
East Canyon Dam & Reservoir	East Canyon Creek	Morgan, UT	-	-	-	-	-	48.0	5705.5	5577.0	684	127	Bureau of Reclamation	PL 81-273
Echo Dam and Reservoir	Weber River	Summit, UT	-	-	-	-	-	74.0	5560.0	5450.0	1,455	0	Bureau of Reclamation	PL 81-273
Emigrant Dam & Reservoir	Emigrant Creek	Jackson, OR	39.0	2241.0	2131.5	801	80	-	-	-	-	-	Bureau of Reclamation	PL 83-606
Enders Dam & Reservoir	Frenchman Creek	Chase, NB	30.0	3127.0	3112.3	2,405	1,707	-	-	-	-	-	Bureau of Reclamation	PL 78-534
Folsom Dam & Lake	American River	Sacramento, CA	-	-	-	-	-	400.0	466.0	427.0	11,450	9,040	Bureau of Reclamation	PL 81-356
Friant Dam & Reservoir (Millerton Lake)	San Joaquin River	Fresno, CA	-	-	-	-	-	390.0	578.0	466.3	4,850	2,101	Bureau of Reclamation	PL 75-392 & PL 76-868
Gaston-Roanoke Rapids Dam & Reservoir	Roanoke River	Northampton & Halifax, NC	63.0	203.0	200.0	22,500	20,300	-	-	-	-	-	VA Electric & Power Co.	Fed Power Act
Glen Elder Dam & Waconda Lake	Solomon River	Mitchell, KS	722.3	1488.3	1455.6	30,682	12,602	-	-	-	-	-	Bureau of Reclamation	PL 78-534 & PL 79-526
Glendo Dam & Reservoir	N. Platte River	Platte, WY	271.9	4653.0	4635.0	17,986	12,365	-	-	-	-	-	Bureau of Reclamation	PL 78-534
Grand Coulee Dam, Franklin D. Roosevelt Lake	Columbia River	Grant & Okanogan, WA	-	-	-	-	-	5185.45	1290.0	1208.0	82,280	45,592	Bureau of Reclamation	PL 89-561 3rd Powerhouse
Heart Butte Dam & Lake Tschida	Heart River	Grant, ND	150.0	2094.5	2064.5	6,625	3,400	-	-	-	-	-	Bureau of Reclamation	PL 78-534

PERTINENT PROJECT DATA - SECTION 208.11 REGULATIONS

PROJECT NAME	STREAM	COUNTY & STATE	EXCLUSIVE FLOOD CONTROL/NAVIGATION STORAGE 1000 ac-ft	ELEV. LIMITS feet m.s.l. UPPER	ELEV. LIMITS feet m.s.l. LOWER	AREA acres UPPER	AREA acres LOWER	MULTIPLE-USE FLOOD CONTROL/NAVIGATION STORAGE 1000 ac-ft	ELEV. LIMITS feet m.s.l. UPPER	ELEV. LIMITS feet m.s.l. LOWER	AREA acres UPPER	AREA acres LOWER	PROJECT OWNER	AUTH. LEGIS.
Hells Canyon Dam & Reservoir	Snake River	Wallowa, OR; Adams, ID	-	-	-	-	-	11.7	1688.0	1683.0	2,380	2,280	Idaho Power Company	FPC No. 1971-A
Hoover Dam & Lake Mead	Colorado River	Clark NV & Mohave, AZ	1500.0	1229.0	1219.6	162,700	156,500	15.853	1219.6	1083.0	156,500	83,500	Bureau of Reclamation	PL 70-642
Hungry Horse Dam & Reservoir	S. Fork Flathead Riv.	Flathead, MT	2982.0	3560.0	3336.0	23,800	5,400	-	-	-	-	-	Bureau of Reclamation	PL 78-329
Indian Valley Dam&Reservoir	N.Fork Cache Creek	Lake, CA	-	-	-	-	-	40.0	1485.0	1474.7	3,975	3,749	Yolo Cty Fl. Cont&WtrCons Dist.	PL 84-984
Jamestown Dam & Reservoir	James River	Stutsman,ND	185.4	1454.0	1432.67	13,206	2,555	6.6	1432.67	1429.8	2,555	2,085	Bureau of Reclamation	PL 78-534
Kerr Dam Flathead Lake	Flathead River	Lake, MT	-	-	-	-	-	1219.0	2893.0	2883.0	125,560	120,000	Montana Power Co.	FPC No. 5
Keyhole Dam & Reservoir	Belle Fourche	Crook, WY	140.2	4111.5	4099.3	13,686	9,394	-	-	-	-	-	Bureau of Reclamation	PL 78-534
Kirwin Dam & Reservoir	N. Fork Solomon River	Phillips,KS	215.1	1757.3	1729.25	10,640	5,073	-	-	-	-	-	Bureau of Reclamation	PL 78-534
Lemon Dam & Reservoir	Florida River	La Plata, Colorado	-	-	-	-	-	39.0	8148	8023	622	62	Bureau of Reclamation	PL 84-485
Lewis M. Smith Dam & Reservoir	Sipsey Fork Black Warrior Riv.	Cullman & Walker,AL	280.6	522.0	510.0	25,700	21,200	-	-	-	-	-	Alabama Power Co.	Fed.Power Act
Little Wood River Dam & Reservoir	Little Wood River	Blain,ID	30.0	5237.3	5127.8	574	0	-	-	-	-	-	Bureau of Reclamation	PL 84-993
Logan Martin Dam & Reservoir	Coosa River	Talladega, AL	245.3	477.0	465.0	26,310	15,260	-	-	-	-	-	Alabama Power Co.	PL 83-436
Los Banos Dam & Detention Res.	Los Banos Creek	Merced,CA	-	-	-	-	-	14.0	353.5	327.8	619	467	Bureau of Reclamation	PL 86-488
Lost Creek Dam & Res.	Lost Creek	Morgan,UT	-	-	-	-	-	20.0	6005.0	5912.0	365	93	Bureau of Reclamation	PL 81-273
Lovewell Dam & Reservoir	White Rock Creek	Jewell,KS	50.5	1595.3	1582.6	5,025	2,986	-	-	-	-	-	Bureau of Reclamation	PL 78-534

PERTINENT PROJECT DATA - SECTION 208.11 REGULATIONS

PROJECT NAME	STREAM	COUNTY & STATE	EXCLUSIVE FLOOD CONTROL/NAVIGATION STORAGE 1000 ac-ft	EXCLUSIVE FLOOD CONTROL/NAVIGATION ELEV. LIMITS feet m.s.l. UPPER	EXCLUSIVE FLOOD CONTROL/NAVIGATION ELEV. LIMITS feet m.s.l. LOWER	EXCLUSIVE FLOOD CONTROL/NAVIGATION AREA acres UPPER	EXCLUSIVE FLOOD CONTROL/NAVIGATION AREA acres LOWER	MULTIPLE-USE FLOOD CONTROL/NAVIGATION STORAGE 1000 ac-ft	MULTIPLE-USE FLOOD CONTROL/NAVIGATION ELEV. LIMITS feet m.s.l. UPPER	MULTIPLE-USE FLOOD CONTROL/NAVIGATION ELEV. LIMITS feet m.s.l. LOWER	MULTIPLE-USE FLOOD CONTROL/NAVIGATION AREA acres UPPER	MULTIPLE-USE FLOOD CONTROL/NAVIGATION AREA acres LOWER	PROJECT OWNER	AUTH. LEGIS.
Markham Ferry Dam & Lake Wash E. Hudson	Grand (Neosho) River	Mayes, OK	244.2	636.0	619.0	18,000	10,900	-	-	-	-	-	Grand River Dam Authority	PL 76-476
Mayfield Dam & Reservoir	Cowlitz River	Lewis, WA	-	-	-	-	-	21.4	425.0	415.0	2,070	1,825	City of Tacoma	FPC No. 2016-A
Medicine Creek Dam & Harry Strunk Lake	Medicine Creek	Frontier, NB	52.2	2386.2	2366.1	3,465	1,850	-	-	-	-	-	Bureau of Reclamation	PL 78-534
Mossyrock Dam Davisson Lake	Cowlitz River	Lewis, WA	-	-	-	-	-	1397.0	778.5	621.5	11,800	5,000	City of Tacoma	FPC No. 2016-B
Navajo Dam Reservoir	San Juan River	Rio Arriba & San Juan, NM	-	-	-	-	-	1036.1	6085	5990	15,610	7,400	Bureau of Reclamation	PL 84-485
New Exchequer Dam & Lake McClure	Merced River	Tuolomne, CA	-	-	-	-	-	400.0	867.0	799.7	7,110	4,849	Merced Irrig. District	PL 86-645
Norton Dam & Reservoir	Prairie Dog Creek	Norton, KS	98.8	2331.4	2304.3	5,316	2,181	-	-	-	-	-	Bureau of Reclamation	PL 78-534
Ochoco Dam & Reservoir	Ochoco Creek	Crook, OR	51.4	3136.2	3048.1	1,150	120	-	-	-	-	-	Bureau of Reclamation	PL 84-992
Oroville Dam & Lake	Feather River	Butte, CA	-	-	-	-	-	750.0	900.0	848.5	15,800	13,346	CA Dept of Wtr Resources	PL 85-500
Oxbow Dam & Reservoir	Snake River	Baker, OR; Adams, ID	-	-	-	-	-	5.0	1805.0	1800.0	1,165	1,115	Idaho Power Company	FPC No. 1971-B
Pactola Dam & Reservoir	Rapid Creek	Pennington, SD	43.0	4621.5	4580.2	1,232	860	-	-	-	-	-	Bureau of Reclamation	PL 78-534
Palisades Dam & Reservoir	Snake River	Bonneville, ID	1202.0	5620.0	5452.43	16,100	2,170	-	-	-	-	-	Bureau of Reclamation	PL 81-864
Paoina Dam & Reservoir	Muddy Creek	Gunnison, Colorado	-	-	-	-	-	17.0	6447.5	6373.0	334	120	Bureau of Reclamation	PL 80-117 PL 84-485
Pineview Dam & Reservoir	Odgen River	Weber, UT	-	-	-	-	-	110.0	4900.0	4818.0	2,874	0	Bureau of Reclamation	PL 81-273
Platora Dam & Reservoir	Conejos River	Conejos, CO	6.0	10034.0	10027.5	947	920	540.0	10027.5	994.5	920	0	Bureau of Reclamation	PL 76-640
Priest Rapids Dam & Reservoir	Columbia River	Grant, WA	-	-	-	-	-	44.0	488.0	481.5	7,100	6,500	Grant County PUD No. 2	FPC No. 2114-A
Prineville Dam & Reservoir	Crooked Creek	Crook, OR	153.0	3234.8	3112.0	2,990	120	-	-	-	-	-	Bureau of Reclamation	PL 84-992

PERTINENT PROJECT DATA - SECTION 208.11 REGULATIONS

PROJECT NAME	STREAM	COUNTY & STATE	EXCLUSIVE FLOOD CONTROL/NAVIGATION STORAGE 1000 ac-ft	ELEV. LIMITS feet m.s.l. UPPER	ELEV. LIMITS feet m.s.l. LOWER	AREA acres UPPER	AREA acres LOWER	MULTIPLE-USE FLOOD CONTROL/NAVIGATION STORAGE 1000 ac-ft	ELEV. LIMITS feet m.s.l. UPPER	ELEV. LIMITS feet m.s.l. LOWER	AREA acres UPPER	AREA acres LOWER	PROJECT OWNER	AUTH. LEGIS.
Prosser Creek & Reservoir	Prosser Creek	Nevada, CA	-	-	-	-	-	20.0	5741.2	5703.7	745	334	Bureau of Reclamation	PL 84-858
Red Willow Dam & Hugh Butler Lake	Red Willow Creek	Frontier, NB	48.9	2604.9	2581.8	2,682	1,629	-	-	-	-	-	Bureau of Reclamation	PL 78-534 &PL 85-783
Ririe Dam & Reservoir	Willow Creek Snake River	Bonneville,ID	-	-	-	-	-	90.0	5119.0	5023.0	1,560	360	Bureau of Reclamation	PL 87-874
Rocky Reach Dam Lake Entiat	Columbia River	Chelan, WA	-	-	-	-	-	37.0	707.0	703.0	9,600	0	Chelan Cnty PUD No. 1	FPC No. 2145
Ross Dam & Reservoir	Skagit River	Whatcom, WA	-	-	-	-	-	530.5	1602.5	1475.0	6,000	2,168	City of Seattle	FPC No. 553-C
Savage River Dam & Res.	Savage River	Garrett, MD	-	-	-	-	-	16.028	1468.5	1400.0	366	127	Upper Potomac Riv Commission	PL 79-526
Shadehill Dam & Reservoir	Grand River	Perkins, SD	217.7	2302.0	2272.0	9,900	4,800	-	-	-	-	-	Bureau of Reclamation	PL 78-534
Shasta Dam & Lake	Sacramento River	Shasta, CA	-	-	-	-	-	1300.0	1067.0	1018.6	29,570	23,894	Bureau of Reclamation	PL 75-392 &PL 76-868
Smith Mtn & Leesville Dam & Res.	Roanoke River	Bedford, Campbell & Pittsylvania,VA	-	-	-	-	-	(No Specific FC/Nav. Storage Allocation)					Appalacian Power Co.	Fed.Power Act
Trenton Dam & Reservoir	Republican River	Hitchcock,NB	133.8	2773.0	2752.0	7,975	4,974	-	-	-	-	-	Bureau of Reclamation	PL 78-534
Turner Falls Res (Includes Northfield Mtn Pumped Storage Project)	Connecticut River (Briggs Brook)	Franklin, MA	-	-	-	-	-	(No Specific FC/Nav. Storage Allocation)					Northeast Utilities Service Co. Hartford, CT	Fed. Power Act
Twitchell Dam & Reservoir	Cuyama River	Santa Barbara, CA	89.0	651.5	623.0	3,690	2,650	-	-	-	-	-	Bureau of Reclamation	PL 83-774
Upper Baker Dam Baker Lake	Baker River	Whatcom, WA	-	-	-	-	-	220.63	724.0	655.0	4,890	0	Puget Sound Power & Light Co.	Sec. 201 PL 89-298 FPC No. - 2150-B

PERTINENT PROJECT DATA - SECTION 208.11 REGULATIONS

PROJECT NAME	STREAM	COUNTY & STATE	EXCLUSIVE FLOOD CONTROL/NAVIGATION STORAGE 1000 ac-ft	EXCLUSIVE ELEV. LIMITS feet m.s.l. UPPER	EXCLUSIVE ELEV. LIMITS feet m.s.l. LOWER	EXCLUSIVE AREA acres UPPER	EXCLUSIVE AREA acres LOWER	MULTIPLE-USE FLOOD CONTROL/NAVIGATION STORAGE 1000 ac-ft	MULTIPLE-USE ELEV. LIMITS feet m.s.l. UPPER	MULTIPLE-USE ELEV. LIMITS feet m.s.l. LOWER	MULTIPLE-USE AREA acres UPPER	MULTIPLE-USE AREA acres LOWER	PROJECT OWNER	AUTH. LEGIS.
Vallecito Dam Reservoir	Los Pinos River	La Plata, Colorado	-	-	-	-	-	115.4	7665	7600	2,723	693	Bureau of Reclamation	PL 61-288 PL 68-292
Wanapum Dam & Reservoir	Columbia River	Grant, WA	-	-	-	-	-	151.6	571.5	560.0	14,400	9,600	Grant County PUD No. 2	FPC No. 2114-B
Wanship Dam & Rockport	Weber River	Summit, UT	-	-	-	-	-	61.0	6037.0	5930.0	1,077	121	Bureau of Reclamation	PL 81-273
Warm Springs Dam & Res.	Middle Fork Malheur Riv.	Malheur, OR	-	-	-	-	-	191.0	3406.0	3327.0	4,600	90	50%Vale Irr. Dist & 50% Bu. of Rec.	-
Waterbury Dam & Reservoir	Little River	Washington, VT	27.7	617.5	592.0	1,330	890	-	-	-	-	-	State of Vermont	PL 78-534
Weiss Dam & Reservoir	Coosa River	Cherokee, AL	397.0	574.0	564.0	50,000	30,200	-	-	-	-	-	Alabama Power Co.	PL 83-436
Wells Dam & Lake Pateros	Columbia River	Douglas, WA	-	-	-	-	-	74.0	779.0	771.0	10,700	7,700	Douglas Cnty PUD No. 1	FPC No. 2149
Webster Dam & Reservoir	S. Fork Solomon Riv.	Rooks, KS	183.4	1923.7	1892.45	8,480	3,766	-	-	-	-	-	Bureau of Reclamation	PL 534-78-2
Yellowtail Dam & Bighorn Lake	Bighorn River	Big Horn, MT	259.0	3657.0	3640.0	17,298	12,685	250.0	3640.0	3614.0	12,685	7,410	Bureau of Reclamation	PL 78-534

FIELD WORKING AGREEMENT
BETWEEN
DEPARTMENT OF THE INTERIOR, BUREAU OF RECLAMATION
AND
DEPARTMENT OF THE ARMY, CORPS OF ENGINEERS
FOR
FLOOD CONTROL OPERATION
OF
CENTRAL VALLEY PROJECT DAMS AND RESERVOIRS
IN
CALIFORNIA

THIS agreement, made and entered into this 14th day of August, 1978, between the Bureau of Reclamation and the Corps of Engineers,

WITNESSETH THAT:

WHEREAS, the Department of the Interior, acting through the Bureau of Reclamation, represented by its appropriate Regional Director, has constructed or assumed operation of Federally constructed dams and reservoirs on the Sacramento and San Joaquin Rivers and their tributaries, and is responsible for normal operation and structural safety of the projects, and

WHEREAS, the Department of the Army, acting through the Corps of Engineers, represented by its appropriate District and Division Engineers, is responsible for the flood control operation plans of said dams and reservoirs in accordance with Section 7 of the 1944 Flood Control Act (33 U.S.C. 709) and as promulgated in Code of Federal Regulations, Title 33, Part 208.11, and

WHEREAS, there is a need for a working agreement to insure a clear understanding of the flood control regulations and information exchange required for the projects operation.

NOW, THEREFORE, it is mutually understood and agreed by and between the parties hereto that the Central Valley Project will be operated in accordance with the following criteria:

(a) Conservation operations shall be in accordance with Bureau of Reclamation criteria as determined by the Regional Director or his designated representative.

(b) Storage space in the Central Valley Project shall be made available on a seasonal basis and operated for flood control in accordance with the Flood Control Diagrams currently in force.

(c) Emergency operation shall be in accordance with the procedure set forth on the Emergency Spillway Release Diagrams or procedures currently in force.

(d) The Regional Director is responsible for the safety of the dam and appurtenant facilities and for regulation of reservoirs in the Central Valley Project during surcharge storage utilization. Emphasis upon the safety of the dam is especially important in the event surcharge storage is utilized, which results when the total storage space reserved for flood control is exceeded. Any assistance provided by the Corps of Engineers concerning surcharge regulation is to be utilized at the discretion of the Regional Director, and does not relieve the Regional Director of the responsibility for safety of the dams in the Central Valley Project.

(e) Revisions of the Flood Control or Emergency Spillway Release Diagrams and procedures may be developed as necessary by parties of this agreement. Each such revision shall be effective on the date specified.

(f) Except as necessary in order to comply with Emergency Operation procedures, the flood control regulations shall not be construed to require dangerously rapid changes in magnitude of releases. Releases will be made in a manner consistent with requirements for protecting the dam, reservoir and appurtenances from major damages.

(g) Any water impounded in the flood control space defined by the Flood Control Diagrams shall be evacuated as rapidly as can be safely accomplished without causing downstream flows to exceed the controlling rates; i.e., releases from the reservoir shall be restricted insofar as practicable to quantities which, in conjunction with uncontrolled runoff downstream of the dams, will not cause water levels to exceed the controlling stages currently in force. Although conflicts may arise with other purposes, such as hydropower, the plan of regulation may require releases to be completely curtailed in the interest of flood control or safety of the projects.

(h) The Regional Director shall procure such current basic hydrologic data and make such current determinations of required flood control space and releases at the reservoir as are required to accomplish the flood control objectives.

(i) The Regional Director shall keep the District Engineer advised of such reservoir operating data as the District Engineer may request. The minimum data required is reservoir storage, inflow, releases and streamflow at control points designated by the Flood Control Diagrams on a daily basis.

(j) The flood control regulations are subject to temporary modification by the Corps of Engineers if found necessary in time of emergency. Requests for and action on such modifications may be made by the fastest means of communication available. The action taken shall be confirmed in writing the same day to the office of the Regional Director and shall include justification for the action.

(k) The Regional Director may temporarily deviate from the flood control regulations in the event an immediate short-term departure is deemed necessary for emergency reasons to protect the safety of the dam, or to avoid other serious hazards. Such actions shall be immediately reported by the fastest means of communication available. Actions shall be confirmed in writing the same day to the Corps of Engineers and shall include justification for the action. Continuation of the deviation will require the express approval of the Division Engineer.

IN WITNESS WHEREOF, the parties hereto have caused this memorandum of agreement to be executed as the day and date first above written.

CORPS OF ENGINEERS

By: William E. Vandenberg
Division Engineer
South Pacific Division

BUREAU OF RECLAMATION

By: M. A. Catino
Acting Regional Director
Mid Pacific Region

GPO 689-166/069