

NEW BULLARDS BAR RESERVOIR
North Yuba River, California

**RESERVOIR REGULATION
FOR FLOOD CONTROL**

APPENDIX V
To
Master Manual of Reservoir Regulation
Sacramento River Basin, California

JUNE 1972

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

SPDED-TH (21 Dec 71) 3d Ind

SUBJECT: Report on Reservoir Regulation for Flood Control, New Bullards
Bar Dam and Reservoir, North Yuba River, California

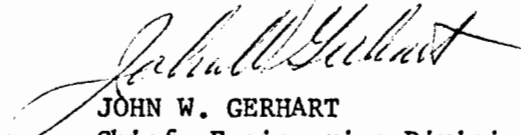
DA, South Pacific Division, Corps of Engineers, 630 Sansome Street,
Room 1216, San Francisco, California 94111 1 August 1972

TO: HQDA (DAEN-CWE-H) WASH DC 20314

Approval of the New Bullards Bar Reservoir Manual is recommended.

FOR THE DIVISION ENGINEER:

2 Incl
1. wd 2 cys
2. nc


JOHN W. GERHART
Chief, Engineering Division

NEW BULLARDS BAR DAM AND RESERVOIR NORTH YUBA RIVER, CALIFORNIA

PERTINENT DATA

GENERAL

Drainage Area	489 sq mi
Flows at Damsite	
Mean Annual Natural (1941-1971) . .	1,100,000 ac ft
Maximum Flows of Record	
December 1955	70,000 c.f.s.
January-February 1963	83,000 c.f.s.
December 1964	92,000 c.f.s.
January 1970	59,000 c.f.s.
Standard Project Flood	156,000 c.f.s.
Spillway Design Flood	226,000 c.f.s.

NEW BULLARDS BAR DAM AND RESERVOIR

Reservoir

Elevation

Minimum power pool	1732.0 ft
Flood control (Bottom)	1916.75 ft
Gross pool	1988.20 ft
Spillway design flood pool	1962.5 ft

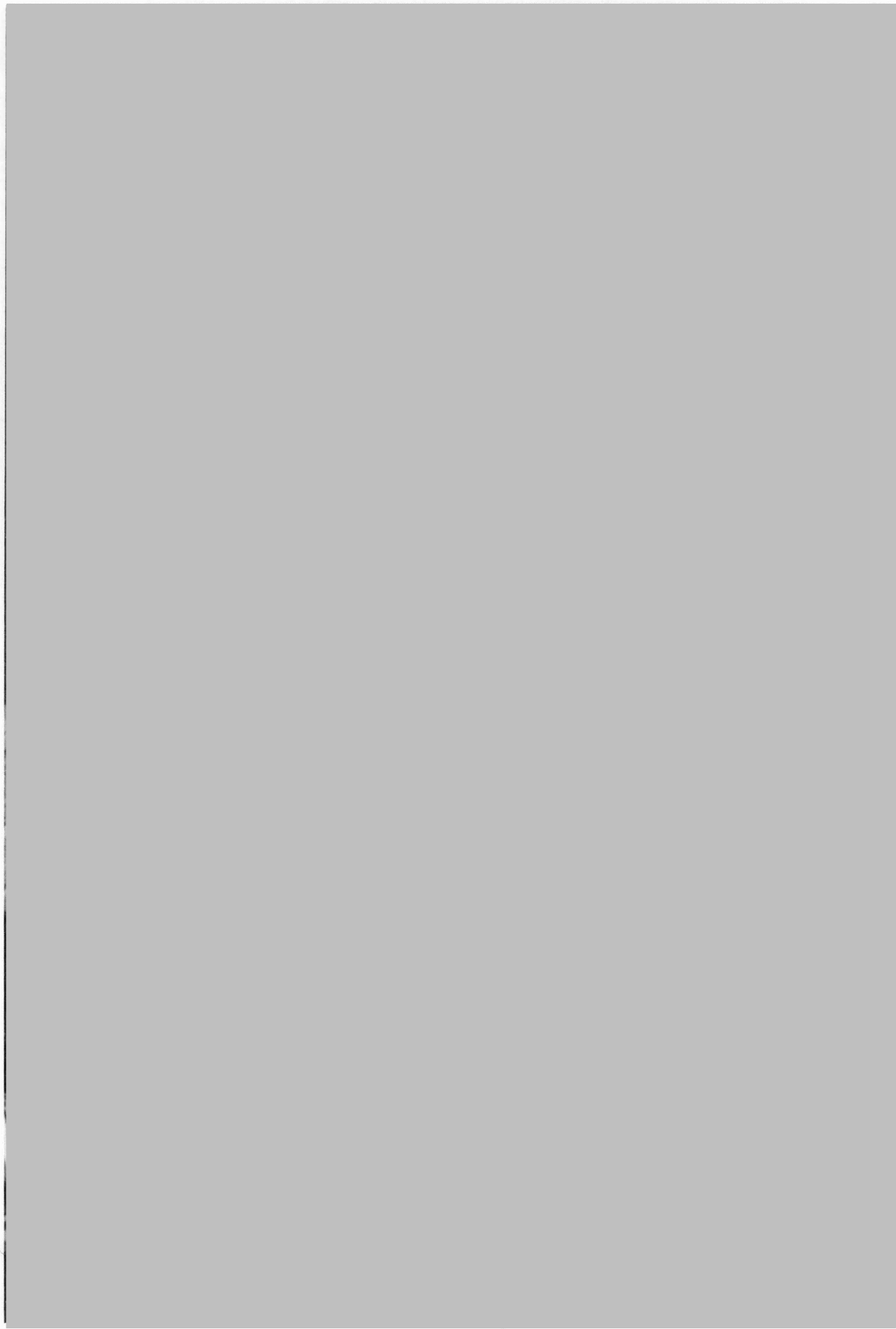
Area

Minimum power pool	1,910 ac
Flood control pool (Bottom)	4,201 ac
Gross pool	4,790 ac
Spillway design flood pool	4,915 ac

Storage Capacity

Minimum power pool	233,600 ac ft
Flood control pool (Bottom)	790,000 ac ft
Gross pool	960,000 ac ft
Spillway design flood pool	998,000 ac ft

NEW BULLARDS BAR DAM AND RESERVOIR





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NORTH YUBA RIVER, CALIFORNIA**

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SACRAMENTO RIVER BASIN, CALIFORNIA**

JUNE 1972

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

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REPORT ON RESERVOIR REGULATION
FOR FLOOD CONTROL

NEW BULLARDS BAR DAM AND RESERVOIR
NORTH YUBA RIVER, CALIFORNIA

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1. The first part of the document is a letter from the President of the United States to the Congress, dated January 1, 1861.

2. The second part is a report from the Secretary of the Treasury, dated January 1, 1861.

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THE HISTORY OF THE

REIGN OF KING CHARLES THE FIRST

BY JOHN BURNET

IN TWO VOLUMES. THE FIRST CONTAINS THE HISTORY OF THE REIGN OF KING CHARLES THE FIRST, FROM HIS MARRIAGE TO HIS DEATH. THE SECOND CONTAINS THE HISTORY OF THE REIGN OF KING CHARLES THE SECOND, FROM HIS MARRIAGE TO HIS DEATH.

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REPORT ON RESERVOIR REGULATION
FOR FLOOD CONTROL

NEW BULLARDS BAR DAM AND RESERVOIR
NORTH YUBA RIVER, CALIFORNIA

CHAPTER I - GENERAL INFORMATION

1. AUTHORITY AND SCOPE

a. This report on reservoir regulation for flood control, New Bullards Bar Dam and Reservoir (also referred to as Bullards Bar Dam and Reservoir), North Yuba River (a major tributary to Yuba River), California, is an appendix to the Master Manual of Reservoir Regulation, Sacramento River Basin, California. It is prepared in accordance with instructions contained in ER 1110-2-240, EM 1110-2-3600, and EC 1110-2-67, 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 method 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 Yuba County Water Agency, Marysville, California. A description of the overall Sacramento River Basin plan of flood control is given in the Master Manual of Reservoir Regulation, Sacramento River Basin, California.

2. AUTHORIZATION FOR FLOOD CONTROL ALLOCATION

a. A monetary contribution by the Federal Government toward the construction cost of New Bullards Bar Dam and Reservoir in the interest of flood control was authorized by the Flood Control Act of 27 October 1965 (Public Law 89-298, 89th Congress, 1st Session). Based on the flood control benefits to be derived, 11.5 percent of the construction cost of the dam and reservoir, exclusive of power and recreational facilities,

was allocated to flood control with total sum not to exceed \$12,900,000. The economic justification for this allocation is set forth in House Document 180, 89th Congress, 1st Session.

b. A contract, No. DA-04-167-CIVENG-66-94, was entered into between the United States and Yuba County Water Agency on 9 May 1966, and was approved by the Secretary of the Army on 13 May 1966. Under the terms of this contract, the Yuba County Water Agency agreed to construct and to maintain New Bullards Bar Dam and Reservoir, to reserve 170,000 acre-feet of storage space for flood control, to provide for operation of the reservoir in such manner as will produce the flood control benefits upon which the monetary contribution was predicated, and to operate the dam for flood control in accordance with rules and regulations prescribed by the Secretary of the Army pursuant to the provisions of Section 7 of the Flood Control Act of 1944 (58 Stat. 890).*

*A draft of proposed flood control regulations is included as appendix A to this report.

CHAPTER II - BASIN DESCRIPTION

3. DESCRIPTION OF THE AREA

a. The Yuba River drainage basin lies entirely on the western slope of the Sierra Nevada and has a total area of about 1,350 square miles above its confluence with Feather River. A map of the basin is shown on chart 1. About 36 percent of this area (489 square miles) will be controlled by New Bullards Bar Dam and Reservoir, the remaining 64 percent will be uncontrolled area until the authorized Marysville Dam and Reservoir is built and put into operation. With the exception of about 100 square miles of flat agricultural land which is located on the valley floor below the foothill line, Yuba River Basin consists mostly of hilly and mountainous terrain, with about 40 percent of the total area above 5,000 feet. From its junction with the Feather River at Marysville the area extends north-easterly to the summit of the Sierra Nevada. It slopes westward from elevations of 9,000 feet to the foothill line where the elevation is 500 feet, while the valley floor area slopes gently from the foothills (elevation 500) toward the Feather River where the elevation is about 60 feet. Topography of the basin is shown on chart 2.

b. The drainage system above New Bullards Bar Dam includes North Yuba River and its two major tributaries: Canyon Creek and Slate Creek. The slope of North Yuba River above the dam averages about 100 feet per mile, ranging from about 50 feet per mile in the lower reaches to more than 500 feet per mile in the upper reaches. The drainage system of the uncontrolled Yuba River area includes Middle and South Yuba Rivers, Deer Creek which empties into Yuba River from the left a few miles downstream from Englebright Dam, and Dry Creek which enters into Yuba River from the right on the valley floor a few miles upstream from the Marysville Dam site. The slope of Yuba River averages about 30 feet per mile in the lower reaches to more than 400 feet per mile on the upper uncontrolled tributaries. The stream profiles are shown on chart 3. Chart 4 shows area-elevation curves for the controlled area above New Bullards Bar Dam, and for the uncontrolled Yuba River Basin area above Feather River and below New Bullards Bar Dam.

c. Geologically, the Yuba River lies largely within the Sierra Nevada geomorphic province, with soils falling into three general groupings, namely: (1) recent and older alluvial soils, (2) valley filling soils, and (3) residual or upland soils. Soils representing each of these major groups can be found in almost any section of the basin. The type of parent rock materials from which the soils of the basin were formed occur in zones. These zones provide an effective way of classifying the soil type for agricultural or other land use. Soil depths vary roughly inversely with

elevation and range from several hundred feet on the valley floor to bare rock at high elevations. The physical features within these zones are summarized as follows:

<u>Location</u>	<u>Description</u>
Valley floor	Alluvial soils of mixed origin, variable soil profile.
Western foothills to 1,000 foot elevation	Residual soils from granitic parent rock, high infiltration rates.
Upland zone (1,000-2,500 foot elevation)	Residual soils derived from igneous and metavolcanic parent rock, soils shallow and rocky.
Low mountain zone (2,500-5,000 foot elevation)	Residual soils derived from igneous rock, deep, rather rocky, mixed with soils of clay-loam texture.
High mountain zone above 5,000 foot elevation	Shallow soils and bare rock of igneous origin.

d. Vegetation on the Yuba River Basin generally varies with elevation. On the valley floor portion of the basin native vegetation has been largely replaced by orchards and field and forage crops. In the foothill area there are patches of cultivated lands scattered among the natural grass and brush lands. The low mountain portion of the basin varies from deciduous brush and trees to moderately dense coniferous forests. The high mountain portion has extensive coniferous forests below about the 7,000 foot level. Above that level numerous small patches of timber are scattered through a predominantly grass or bare rock area.

e. Economic development within the basin is dominated by the location of natural resources. The valley floor is largely agricultural. The largest center of population is the city of Marysville. Other communities are relatively small. The economy of the foothill and low mountain portion of the basin is based on livestock, mining, timber, and hydroelectric developments, while in the high mountain portion of the basin it is associated with timber and recreation activities.

4. CLIMATE

a. The climate of the Yuba River Basin varies widely, with marked differences in temperature and precipitation within short distances. In the mountains, winter temperatures are moderately severe, with minimums below freezing during the period from early November to the end of March, while warm days and cool nights characterize the summer months. Frosts may occur in any month of the year at high elevations. The climate of the valley floor is characterized by hot summers and cool winters. Temperatures have ranged from summer highs of 114° F. to winter lows of 17° F. Monthly average temperatures characteristic of Yuba River Basin are given in the following tabulation.

MONTHLY MEAN TEMPERATURES (DEGREES F.)

Month :	Marysville Elev. 62			:	Nevada City Elev. 2,600			:	Bowman Lake Elev. 5,350		
	Max.	Mean	Min.		Max.	Mean	Min.		Max.	Mean	Min.
Jan	53.8	46.0	37.4		52.0	39.2	28.3		44.5	35.4	26.2
Feb	59.6	50.1	40.6		54.5	41.3	29.9		45.5	35.9	26.0
Mar	65.5	54.8	43.7		58.4	44.8	30.8		49.7	39.2	28.3
Apr	72.5	60.6	47.4		65.1	50.2	35.4		56.6	45.2	33.5
May	80.3	66.8	51.6		70.4	56.2	39.2		63.6	51.7	39.6
Jun	89.2	73.7	57.5		80.8	62.9	45.0		71.8	59.4	47.3
Jul	96.3	79.0	60.5		89.8	69.9	48.8		80.2	67.3	54.3
Aug	94.4	77.0	58.5		88.7	68.0	47.3		79.7	66.6	53.6
Sep	88.8	73.5	55.2		82.9	63.8	43.2		74.8	62.3	49.2
Oct	78.4	64.5	49.0		72.9	54.9	37.7		64.5	53.1	41.7
Nov	65.7	54.1	41.4		62.4	46.4	32.5		54.6	44.3	34.2
Dec	55.4	47.0	37.9		54.6	41.3	28.9		47.8	38.5	29.5

b. Normal annual precipitation varies considerably throughout the basin, ranging from a low of about 20 inches on the valley floor to over 90 inches along the high portion of the Sierra Nevada as shown on chart 5. The greater part of the precipitation occurs during the period October to April, with maximum storm intensities during December, January, February, and March. A large portion of the precipitation in the watershed of the Yuba River falls in the form of snow in the winter and melts during the spring and early summer. Normal monthly and annual precipitation amounts for three stations typical of Yuba River Basin are given in the following tabulation.

NORMAL MONTHLY PRECIPITATION

	Marysville			Camptonville			Bowman Dam	
Month :	Elev. 62		:	Elev. 2,755		:	Elev. 5,347	
	Inches	%		Inches	%		Inches	%
Jan	3.99	19.4		11.63	19.4		12.48	18.7
Feb	3.86	18.7		10.06	16.8		11.45	17.2
Mar	2.68	13.0		8.42	14.1		10.13	15.2
Apr	1.74	8.5		4.95	8.3		5.15	7.7
May	.80	3.9		2.91	4.9		3.61	5.4
Jun	.22	1.1		.77	1.3		1.23	1.9
Jul	.01	0.1		.03	0.1		.16	0.2
Aug	.02	0.1		.04	0.1		.13	0.2
Sep	.23	1.1		.57	0.9		.74	1.1
Oct	1.13	5.5		3.39	5.7		3.83	5.7
Nov	2.03	9.8		6.36	10.6		7.02	10.5
Dec	3.88	18.8		10.63	17.8		10.84	16.2
Total	20.59	100.0%		59.76	100.0%		66.77	100.0%

c. Above 5,000 foot elevation, snow normally accumulates during winter months until about the first of April, when increasing temperatures mark the beginning of the snowmelt season. Snow falling at lower elevations usually melts within a short period of time. Basin snowpack data for a wet year (1952), a near normal year (1954), and normal 1 April values at selected representative snow courses are given in the following tabulation.

1 APRIL SNOW SURVEY DATA

		:Elev.:	Depth in		Water Equivalent			
Snow Course		: in :	Inches		Inches		% Normal	
No.:	Name	:Feet :	1954 :	1952 :	1954 :	1952 :	Normal :	1954 : 1952
83	Bowman Lake	5,680	47.1	158.6	20.9	71.5	20.6	101 347
81	Cisco	5,950	51.2	167.1	21.7	72.0	24.3	88 290
74	Yuba Pass	6,700	68.1	164.0	28.3	77.1	30.4	93 254
66	Meadow Lake	7,200	119.8	239.8	49.1	118.0	54.9	89 215
65	Castle Creek #5	7,400	108.2	211.7	47.4	97.3	50.9	93 191

A complete list of snow courses and their locations are given on chart 5.

5. RUNOFF CHARACTERISTICS

Maximum flows of Yuba River and its principal tributaries occur between the months of November and April and are the result of direct runoff from intense precipitation augmented occasionally by melting snow. The largest known flood discharge of Yuba River at Marysville was in December 1964 and reached a peak flow of 180,000 c.f.s. This same storm also produced the largest known flood discharge of North Yuba River at New Bullards Bar Dam where the peak flow was recorded at 91,600 c.f.s. Minimum flows near the mouth of Yuba River occur between early July and late October following prolonged periods of little or no rainfall. Runoff from the upper portions of the watershed is mostly derived from melting snow and occurs principally during the late spring and early summer months. During late summer and early fall, runoff diminishes and streamflow is sustained by springs and drainage of lakes, reservoirs, and seepage areas. The lower portion of the watershed (below about 5,000 foot elevation) does not ordinarily accumulate snow cover, and therefore, the runoff timing varies more directly with precipitation. Discharge in the Yuba River Basin varies greatly from season to season and within each season. Monthly normal flows for Yuba River Basin are illustrated by the following tabulation.

NORMAL MONTHLY RUNOFF (PREPROJECT)

Month:	Yuba River		North Yuba River		Middle Yuba		South Yuba	
	near		below Bullards		River above		River	
	Marysville		Bar Reservoir		Oregon Creek		at Jones Bar	
	(D.A. = 1,339 sq.mi.)		(D.A. = 489 sq.mi.)		(D.A. = 162 sq.mi.)		(D.A. = 308 sq.mi.)	
	ac.-ft.	%	ac.-ft.	%	ac.-ft.	%	ac.-ft.	%
Oct	29,730	1.6	19,060	1.8	4,290	1.7	7,260	2.0
Nov	50,160	2.7	38,540	3.6	9,450	3.6	9,370	2.7
Dec	211,680	11.3	110,840	10.2	29,040	11.2	37,660	10.8
Jan	225,560	12.1	113,330	10.4	28,330	10.9	38,420	11.1
Feb	251,600	13.6	132,960	12.2	32,010	12.3	40,870	11.8
Mar	242,940	13.1	125,890	11.6	30,490	11.8	36,690	10.5
Apr	302,280	16.3	178,550	16.4	41,900	16.2	50,600	14.6
May	320,760	17.2	197,080	18.1	48,320	18.6	71,950	20.7
Jun	161,040	8.7	100,870	9.3	24,410	9.4	46,160	13.3
Jul	36,130	1.9	34,730	3.2	5,850	2.3	5,860	1.7
Aug	14,230	0.7	19,960	1.8	2,800	1.1	1,450	0.4
Sep	14,760	0.8	14,960	1.4	2,220	0.9	1,360	0.4
TOTAL	1,860,870	100.0	1,086,770	100.0	259,110	100.0	347,650	100.0

The maximum recorded seasonal runoff of North Yuba River at New Bullards Bar Dam occurred in 1952 and exceeded 1,795,000 acre-feet, while the minimum seasonal runoff occurred in 1961 and was less than 537,000 acre-feet. These are 163 and 49 percent of the 31-year average of 1,100,000 acre-feet. Variation of maximum and minimum seasonal runoff within the Yuba River Basin is illustrated in the following tabulation.

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	YUBA RIVER NEAR MARYSVILLE		NORTH YUBA RIVER AT NEW BULLARDS BAR RESERVOIR		MIDDLE YUBA RIVER NEAR NORTH SAN JUAN (ABOVE OREGON CREEK)		SOUTH YUBA RIVER AT JONES BAR
DRAINAGE AREA (SQ MI)	1,339		489		162		308
PERIOD OF RECORD	1943 - 1967		1940 - 1969		1940 - 1969		1940 - 1948; 1959 - 1969
YEARS OF RECORD	25		20		20		20
	Date : cfs : cfs/sq mi :	Date : cfs : cfs/sq mi :	Date : cfs : cfs/sq mi :	Date : cfs : cfs/sq mi :			
INSTANTANEOUS FLOW							
MAXIMUM	22 DEC 64 180,000 134.4	22 DEC 64 91,600 190.0	31 JAN 63 31,600 195.0	22 DEC 64 53,600 174.0			
MINIMUM	2 JUL 59 10 0.01	3 JAN 50 90 0.2	3 JAN 50 10 0.06	10 SEP 43 1 0			
MEAN DAILY FLOW							
MAXIMUM	22 DEC 64 130,000 97.1	22 DEC 64 63,700 132.2	22 DEC 64 15,700 96.9	22 DEC 64 22,800 74.0			
MINIMUM	2 JUL 59 16	5 OCT 61 93	4 OCT 61 20	7 SEP 47 1.2			
MEAN	2,564 1.9	1,522 3.2	359 2.2	484 1.6			
	WATER-YEAR : 1,000 : ac-ft : INCHES :	WATER-YEAR : 1,000 : ac-ft : INCHES :	WATER-YEAR : 1,000 : ac-ft : INCHES :	WATER-YEAR : 1,000 : ac-ft : INCHES :			
ANNUAL FLOW							
MAXIMUM	1952 3,915 54.8	1952 1,795 69.8	1952 490 56.7	1967 597 36.3			
MINIMUM	1961 639 8.9	1961 537 20.9	1961 100 11.6	1961 89 5.4			
MEAN	1,856 26.0	1,087 42.3	259 30.0	348 21.2			

6. FLOOD CHARACTERISTICS

Because channel capacities far exceed maximum snowmelt runoff rates, snowmelt floods are not a problem in the Yuba River Basin even though runoff volumes are substantially larger during the spring and early summer months. Damaging flows on Yuba River are caused by intense winter rain floods of short duration similar to that of December 1964, which had a peak flow of 180,000 c.f.s. at the mouth of Yuba River and a 10-day volume of 1,090,000 acre-feet. The largest rain floods recorded at New Bullards Bar Reservoir and at Marysville during the last 20 years are listed in the table below.

MAJOR RAIN FLOODS

Date	North Yuba River at New Bullards Bar Dam			Yuba River at Marysville		
	Peak	Maximum	Maximum	Peak	Maximum	Maximum
	Flow	1-day	3-days	Flow	1-day	3-days
	(c.f.s.)	(ac.-ft.)	(ac.-ft.)	(c.f.s.)	(ac.-ft.)	(ac.-ft.)
Nov 1950	47,000	60,000	150,000	79,000	110,000	302,000
Dec 1955	70,000	113,000	256,000	155,000	270,000	595,000
Jan-Feb 1963	83,000	85,000	190,000	146,000	202,000	362,000
Dec 1964	91,600	156,000	313,000	180,000	258,000	650,000
Jan 1970*	59,000	95,000	205,000	106,000	188,000	386,000
SPF(1)	150,000	232,000	375,000	295,000	386,000	745,000
PMF(1)	227,000	380,000	722,000	505,000	900,000	1,738,000
PMF(2)	226,000	350,000	670,000	-	-	-

*Bullards Bar Reservoir in partial operation.

- (1) Concurrent flood - storm centered over Yuba River drainage area, downstream from New Bullards Bar Dam (1970 computations).
- (2) Probable maximum flood (used as spillway design flood) with storm centered over North Yuba River drainage area, upstream from New Bullards Bar Dam (1958 computations).

7. DOWNSTREAM AREAS SUBJECT TO FLOODING

About 292,000 acres in the Feather River Basin are subject to inundation by flows from Yuba and Feather Rivers. An additional 50,000 acres in Yuba River Basin are subject to inundation from Yuba River. The Marysville-Yuba City urban and suburban area with a combined population of about 40,000

persons is located in the flood prone area. In general, the elevation of this area is some 10 to 25 feet below flood plain level. The city of Marysville occupies a particularly hazardous position, being entirely surrounded by levees and subject to a potential inundation depth of 20 to 25 feet in the event of levee failure. The rural flood plain area, with interspersed small residential communities, has similar flood problems. Levee failures permit flood waters to debouch onto large areas of highly developed agricultural and residential lands. Flood waters from such inundation range up to 20 feet of depth where pocketed behind project levees and may not be evacuated from the area for 60 to 90 days.

CHAPTER III - FLOOD POTENTIAL

8. RAIN FLOOD POTENTIAL

Large and damaging rain floods may occur in Yuba River Basin at any time from November to April. At the beginning of the rain flood season the ground is extremely dry, and about 3 to 5 inches of precipitation are required to satisfy the retention storage capacity of the soil before any significant runoff will occur. Later in the season when the ground may be very wet and there may be a moderate snow cover at the higher elevations, heavy rainfall over the basin may cause a large flood runoff. An intense storm with a high freezing level may result in flood runoff from almost the entire basin, with as much as two inches of snowmelt augmenting the rainfall. Yuba River floods, in conjunction with Feather River floods, were a constant threat to the urban areas of Marysville and Yuba City prior to the construction of New Bullards Bar Reservoir on North Yuba River and Oroville Reservoir on Feather River. For instance, during the December 1955 flood, in which Yuba River had a peak flow of about 155,000 c.f.s. at the Marysville gage, 4,400 acres were flooded east of Marysville, and during the December 1964 flood, in which Yuba River had a peak flow of about 180,000 c.f.s. at the Marysville gage, 4,700 acres were flooded. The rain flood potential of the basin is illustrated by frequency curves of rain flood volumes for New Bullards Bar Reservoir inflows under preproject conditions, and for Yuba River at Englebright Dam, as shown on charts 6 and 7, respectively.

9. SEASONAL VARIATION OF RAIN FLOOD POTENTIAL

Large rain storms in the Yuba River Basin occur most frequently in the months of November through March and are not known to occur in the months of June through August. For a specified ground condition, the seasonal variation of rain flood 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 demonstrated by criteria contained in Office Report, "Reservoir Operation Criteria for Flood Control, Sacramento-San Joaquin Valley, California," October 1959.

10. SNOWMELT FLOOD POTENTIAL

Since maximum flows on Yuba River from snowmelt do not exceed the existing channel capacities, these flows by themselves do not present a serious flood threat. However, melting of antecedent snow cover augments peak flows and volumes of rain floods, and therefore has been included in derivation of the standard project and probable maximum floods.

11. STANDARD PROJECT FLOODS

By the use of criteria published in the office report, "Standard Project Rain Flood Criteria, Sacramento-San Joaquin Valley, California," April 1957 (revised September 1958), a standard project flood was developed for the uncontrolled drainage area located below New Bullards Bar Dam and above the site of the authorized Marysville Dam. A concurrent standard project flood was developed for the controlled area located above New Bullards Bar Dam. Experience with large Yuba River floods indicates that such a storm is more likely to occur than one centered over the New Bullards Bar Reservoir, and thus would define more adequately the flood potential within the Yuba River Basin by producing the most critical peak floodflows. The peak flows and 3-day volumes of the standard project floods as developed for the controlled area at New Bullards Bar Reservoir and for the uncontrolled area at the Marysville Dam site are listed in the following tabulation.

Locations	: D.A. : (sq.mi.)	: Peak : (c.f.s.)	: 3-Day Volume : (ac.-ft.)
New Bullards Bar Dam	489	150,000	374,000
Marysville Dam site	835	190,000	510,000

Two hourly concurrent standard project flood inflows to New Bullards Bar and standard project flood inflows for the uncontrolled area contributing to the Yuba River at Marysville Dam site are tabulated on chart 8. Regulation by existing upstream Yuba Basin reservoirs during the standard project flood was not considered inasmuch as these reservoirs do not contain flood control space and would ordinarily have negligible influence on large floods even though they often control or essentially control small and moderate floods.

12. SPILLWAY DESIGN FLOOD

The probable maximum flood at New Bullards Bar Reservoir; i.e., the largest flood considered to be reasonably possible from a combination of the most critical meteorological and hydrological conditions at this location, has a peak flow of 226,000 c.f.s. with a 3-day flood volume of 670,000 acre-feet, and was used as the basis for design of the spillway for New Bullards Bar Reservoir. The derivation of this flood is described in the Office Report, "Flood Control Hydrology, Feather River Basin, California," dated March 1958. A routing of this flood through New Bullards Bar Reservoir is shown on chart 9. The maximum outflow is 158,000 c.f.s., with maximum reservoir storage of 998,000 acre-feet, and a maximum pool elevation of 1,962.5 feet.

CHAPTER IV - PLAN OF DEVELOPMENT

13. GENERAL

The Yuba County Water Agency plan for the development of the water resources of Yuba River consists of five units which will be briefly described in the following paragraphs inasmuch as these units are functionally integrated with the New Bullards Bar Dam and Reservoir. The units are listed as follows:

- a. New Bullards Bar Project
- b. Middle-Yuba/Oregon Creek Diversion Project
- c. New Colgate Project
- d. New Narrows Project
- e. Recreation Facilities

14. NEW BULLARDS BAR PROJECT

a. The New Bullards Bar Dam and Reservoir is the most important unit of the Yuba River Plan of Development and is located 1.5 miles downstream of the former Bullards Bar Dam (see chart 1) which is now completely inundated by the New Bullards Bar Reservoir. It is built for multipurpose functions, namely: flood control, conservation, power generation, water supply, and recreation. The most important features of the project including the reservoir, dam, spillway, and outlets are briefly described in the following subparagraphs with additional related information listed in the pertinent data on the inside cover of this report.

b. The New Bullards Bar Reservoir storage is expected to fluctuate between a minimum power pool storage of 233,600 acre-feet (elevation 1,732.0 feet) during late fall of an abnormally dry year to a maximum normal full pool of 960,000 acre-feet (elevation 1,955.0 feet) during late spring of a normal water year. The total normal full pool storage capacity includes a maximum of 170,000 acre-feet allocated for flood control storage. The water surface area is expected to vary from a minimum of 1,910 acres (elevation 1,732 feet) to a maximum of 4,790 acres (elevation 1,955.0 feet). At normal full pool elevation the reservoir will extend a maximum of 16 miles with the length of the shoreline approximately 55 miles. Area and capacity curves are shown on chart A-1 and area and capacity tables are listed on chart A-2.







18. RECREATION FACILITIES

New Bullards Bar Dam and Reservoir, situated amid extremely scenic surroundings even though remotely located from heavy population centers, is expected to attract many visitors to the recreational areas created by the reservoir and the surrounding environmental resources. For instance, the Forest Service estimated that total recreational use was about 32,500 visitor days for 1970 while projected recreational use for 1980 has been forecast at 170,000 visitor days. Recreational pursuits at New Bullards Bar Reservoir include picnicking, camping, boating, fishing, and limited swimming. Established recreation areas with associated facilities were constructed by the Yuba County Water Agency under terms and conditions provided by the Davis-Grunsky Act and include Burnt Bridge, Cottage Creek, Dark Day, Hornswoggle, and Schoolhouse, shown on chart 17. Also shown on chart 17 are additional recreation areas currently under development including Garden Point, Frenchy Point, and Madrone boat access campgrounds. Picnic and camp sites, boat launching ramps, parking areas, vista points, access roads, water supplies, and sanitation facilities have been or are being provided. The U. S. Forest Service operates and maintains all recreational facilities with the exception of a boat ramp at the dam which is administered by the Yuba County Water Agency. The Agency is also planning to construct and operate a commercial marina adjacent to this boat ramp in order to meet projected 1980 recreational use demands.

19. CONSTRUCTION HISTORY

a. A contract for construction of New Bullards Bar Project was awarded (by the Yuba County Water Agency) to Perini-Yuba Associates on 2 May 1966.

Initially, construction work on the project began on 1 June 1966 when the contractor commenced access road construction to the main damsite. Excavation for the diversion tunnel began in July 1966 and was completed in October 1966. The tunnel was plugged in August 1968 shortly after the outlet works were completed. Foundation excavations for the dam and spillway structure began in September 1966. The dam was essentially completed in December 1969. The spillway gates were installed and ready for operation in January 1970. Both the New Colgate and New Narrows Power Houses were completed and in operation in early 1970.

b. During the January 1969 flood, while the project was still under construction, the reservoir served as a detention structure and was filled to a maximum elevation of 1,763 feet (298,500 acre-feet). During 24-31 January, water spilled over Block 17 and as an emergency measure, the 180 inch penstock valve was opened on 26 January. Again, during the large January 1970 flood, the New Bullards Bar Dam and Reservoir, which was then essentially complete, provided flood control regulation through limited operation by the contractor and the total maximum storage reached 920,000 acre-feet on 21 January. The overall project was completed and officially transferred to Yuba County Water Agency in June 1970, with dedication ceremony held on 8 August 1970.

CHAPTER V - GENERAL PROJECT OPERATION

20. RESPONSIBILITY FOR OPERATION

New Bullards Bar Dam is operated by the Yuba County Water Agency, Marysville, California. Operation in the interest of flood control is in accordance with rules and regulations to be prescribed by the Secretary of the Army pursuant to Section 7 of the Flood Control Act of 1944. A draft of proposed regulations is contained in appendix A. The flood control diagram is shown on chart A-6, and the emergency spillway release diagram on chart A-7. Details concerning the responsibility for flood control operation are discussed in paragraph 7 of Appendix A.

21. PRESENT REGULATION

a. There are no reservoirs located above New Bullards Bar Dam but there are 20 reservoirs with storage capacities of 1,000 acre-feet or more located elsewhere within the Yuba River Basin. None of these reservoirs have flood control space and most of them are either small or have small tributary areas and are located at high elevations in the upper basins of South and Middle Yuba Rivers, thus they normally have little effect on floods. However, a few of the larger reservoirs often control or considerably reduce early season rain floods when they are more likely to have empty conservation space; therefore, they may occasionally have considerable effect on the operation of New Bullards Bar Reservoir. These reservoirs are listed below, and are shown on chart 1.

<u>Reservoir</u>	<u>Storage Capacity (acre-feet)</u>
Lake Spaulding	74,800
Lake Fordyce	46,600
Bowman Lake	68,000
Scotts Flat	49,000
Jackson Meadow	66,700
Harry L. Englebright	70,000

b. In addition to the newly effected diversions from Middle Fork Yuba River and Oregon Creek to North Yuba River above New Bullards Bar Dam referred to in paragraph 15, there are other diversions within the Yuba River Basin leading to several powerplants. Other interbasin diversions are those from Lake Spaulding through Drum Canal (maximum capacity 570 c.f.s.) to the upper Bear River Basin, Slate Creek diversion to Feather River Basin, and occasional spills from South Yuba Canal into an old unnamed canal (capacity 100 c.f.s.) leading to Bear River Basin.

22. DOWNSTREAM CHANNEL CAPACITIES

North Yuba and Yuba River from Bullards Bar Dam to Feather River have a total length of about 35 miles. The portion above the foothill line has a large channel capacity, and little damage is experienced from floodflows in this reach. Between the foothill line and Feather River, high levees of the Sacramento River Flood Control Project give a moderate degree of protection to the urban area of Marysville, as well as to large agricultural areas located to the north and south of Yuba River below the foothill line. The capacity of the project floodway below the foothill line is estimated to be about 120,000 c.f.s. without freeboard encroachment. However, when the Feather River flows are low, the Yuba River levees will pass considerably higher flows without freeboard encroachment because of reduced backwater effects. It can be safely assumed that with reasonable maintenance of Feather and Yuba River flood channels a design flow of 120,000 c.f.s. under high backwater conditions and 180,000 c.f.s. under low backwater conditions are reliable estimates of safe Yuba River channel capacity downstream from Marysville damsite. Flows for which the Feather River system levees were designed, assuming no upstream levee failures, are listed below.

<u>Location</u>	<u>Design Flow (c.f.s.)</u>
(1) Feather River above Yuba	210,000
(2) Yuba River above Mouth	120,000*
(3) Feather River below Yuba	300,000
(4) Feather River below Bear	320,000

*180,000 c.f.s. if coincident Feather River flows are low.

23. FLOOD DAMAGES

a. As referred to in paragraph 10, Yuba River Basin experiences no snowmelt floods and, therefore, all flood damages within the basin are caused by winter rains augmented by some snowmelt. Damages caused by recent floods, based on prices and conditions at the time of the flood, are as follows:

<u>Floods</u>	<u>Damages (\$)</u>
November 1950	3,620,000
December 1955	2,500,000
March-April 1958	114,000
January-February 1963	1,950,000
December 1964	5,680,000
January 1970*	418,000

*New Bullards Bar Reservoir in partial operation.

b. Even though complete protection on Yuba River is not possible without the authorized Marysville Reservoir as noted in paragraph 27, with 170,000 acre-feet of flood control space available in New Bullards Bar Reservoir there is a considerable reduction of flood damages along Yuba River and on lower Feather River below Yuba River. Operation of New Bullards Bar Dam and Reservoir in accordance with the plan of operation contained herein would eliminate damages within the Yuba River Basin resulting from floods having an exceedence interval of 60 years or less (60-year flood), and would considerably reduce damages caused by floods having an exceedence interval of more than 60 years including the standard project flood.

. New Bullards Bar Project also assists in providing a high degree of protection along Feather River below Yuba River when operated in conjunction with Oroville Reservoir. Rain flood damage flow curves for Yuba River are shown on chart 18.

24. CONSERVATION OPERATION

a. New Bullards Bar Reservoir storage is used to furnish an average 335,000 acre-feet of annual releases to meet all prior and new irrigation demands scheduled during the months of March through October. Of the total irrigation demand, 135,000 acre-feet is required to meet prior downstream irrigation rights and requirements, and the remainder of 200,000 acre-feet represents new irrigation demand. While prior irrigation demands are met at all times, new irrigation demands are subject to reduction criteria during years of sub-normal streamflow, based on runoff forecasts for Yuba River at Smartville. Specifically, the reduction criteria call for full releases for March through May and, should a reduction of runoff be indicated (based on the forecast for that year), it would go into effect from June through October.

b. Releases for maintenance of fish life at points of diversion are in accordance with an agreement between Yuba County Water Agency and the California Department of Fish and Game, dated 2 September 1965. The agreement calls for monthly releases at all three project dams (New Bullards Bar, Our House, and Log Cabin Dams), and downstream of Narrows powerplants in addition to irrigation releases. However, releases for fish life are subject to reductions in critical dry years. These reductions are based on the 1 April streamflow forecasts for the Yuba River at Smartville, prepared by the California Department of Water Resources, and are effective from the time such forecasts are made until the 1 April forecasts of the following year.

25. POWER OPERATION

a. Operation of New Bullards Bar Reservoir for power generation is based on an established minimum storage in New Bullards Bar and Englebright Reservoirs as determined by Yuba County Water Agency. The overall power generation is based on integration of the power generating facilities of New Colgate powerplant with those of the existing and New Narrows powerplants, conforming with established conservation demands and flood control space requirements. In general, when the power generated by the three powerplants is less than the minimum requirement, additional water releases are made from New Bullards Bar Reservoir to the maximum capability of the New Colgate plant. If this does not meet the minimum firm power requirement, water from Englebright Reservoir is released through the two Narrows powerplants up to their maximum capabilities.

b. The New Colgate powerplant and the two Narrows powerplants, in turn, are operationally integrated into the Northern California network of the Pacific Gas and Electric Company. The total rated capacity of the three plants [REDACTED] follows, as closely as possible, other Northern California load curves, with minimum monthly kilowatt-hour output as provided under a contract with Pacific Gas and Electric Company.

26. RELATION TO OTHER PROJECTS

Flood control operation of New Bullards Bar Reservoir will be closely coordinated with that of Oroville Reservoir for the most effective flood regulation within the entire Feather-Yuba-Bear basins until the authorized Marysville Reservoir is added to the system. With Marysville Reservoir in, the New Bullards Bar Reservoir will be directly coordinated with Marysville Reservoir for flood control purposes within the Yuba River Basin as referred to in paragraph 27. In turn, the operation of the Yuba River reservoirs will be integrated with Oroville Reservoir to regulate floods along the Feather River to safe objective channel capacities.

CHAPTER VI - FLOOD CONTROL DESIGN REQUIREMENTS

27. HYDROLOGIC BASIS FOR DESIGN

Because of the extensive urban development in the Marysville-Yuba City area, protection against rain floods of standard project flood magnitude is highly desirable if economically justifiable. However, because almost two-thirds of the area within Yuba River Basin is not controlled by New Bullards Bar Reservoir (see chart 1), such a protection is physically not possible by this reservoir alone. Therefore, the reservoir design flood for New Bullards Bar Reservoir was selected on the basis of hydrologic and economic considerations to provide the desired degree of protection to the Marysville-Yuba City area in conjunction with a main stem reservoir. The design flood thus selected is equivalent to the concurrent standard project flood resulting from a standard project storm centered over the uncontrolled area as referred to in paragraph 11. Until the authorized Marysville Reservoir is built and put into operation for flood control purposes, New Bullards Bar Reservoir provides protection to the Marysville-Yuba City area against all floods equal to or less than an estimated exceedence interval of about 60 years.

28. FLOOD CONTROL SPACE REQUIREMENTS

Planning studies indicate that to control the standard project flood at the mouth of Yuba River about 400,000 acre-feet of flood control space is required. Only part of the total required flood control space can efficiently be allocated to New Bullards Bar Reservoir which controls less than one-half of Yuba River Basin runoff. The balance of the required flood control space is allocated to the authorized Marysville Reservoir. By agreement between the Yuba County Water Agency and the Corps of Engineers, a total of 170,000 acre-feet of flood control space has been allocated in the New Bullards Bar Reservoir. Because of its comparatively remote location and resulting coordination problems, it is considered that space in New Bullards Bar Reservoir will be only about 80 percent as effective as equal space in the authorized Marysville Reservoir; i.e., 170,000 acre-feet of flood control space at New Bullards Bar Reservoir is approximately equivalent to 140,000 acre-feet provided on Yuba River main stem. Accordingly, the remaining 260,000 acre-feet would be required at Marysville Reservoir. A routing of the component of the standard project flood through New Bullards Bar Reservoir and its effect on the standard project floods at downstream points are shown on chart 19. Routings of the December 1955 and December 1964 floods through New Bullards Bar Reservoir are shown on charts 20 and 21, respectively.

29. MINIMUM RELEASE REQUIREMENTS

a. Because of the large uncontrolled areas downstream from New Bullards Bar Dam and because the authorized Marysville Reservoir on the main stem, when constructed, will provide the remaining required flood control space for the Yuba River Basin, release capacity at New Bullards Bar Reservoir to fully utilize channel capacities throughout the range of flood control space is not essential or economically feasible.

b. Release facilities provided for New Bullards Bar Reservoir would permit a total outflow of 20,000 c.f.s. at the bottom of the flood control reservation, and 50,000 c.f.s. outflow with flood control storage of 70,000 acre-feet (see chart A-3). Chart A-4 shows spillway rating curves under various conditions for both free outflow (all gates wide open) and for restricted outflow when required (all gates partially open). Some damage at high flows can occur to power facilities below New Bullards Bar Reservoir. Therefore, releases in excess of 50,000 c.f.s. from that reservoir should be limited to inflow quantities already exceeded during the current flood. Changes in reservoir release should be gradual in order to permit orderly evacuation of people and personal property in advance of rising water downstream and to minimize bank caving after extended periods of bankfull flows, except during extremely large floods when emergency spillway release criteria are invoked. A limiting rate of change in release from New Bullards Bar Reservoir of 5,000 c.f.s. per hour is considered to be reasonable and should be used for flood control operational purposes.

30. MULTIPLE USE OF RESERVOIR SPACE

The allocation of a portion of project costs to flood control at New Bullards Bar Reservoir is based on optimum use of reservoir space for all project purposes with space reserved for flood control use on a priority basis when needed, as defined in approved flood control regulations. Since the rain flood potential varies seasonally, it is possible to obtain optimum usage of reservoir space during the rain flood season by carefully defining seasonal limits and the flood control space requirements, thus releasing unneeded reservoir space for other uses. Although snowmelt flood potential also varies seasonally, it is not necessary to reserve joint use space for control of snowmelt runoff as explained in paragraph 10.

31. FLOOD CONTROL DIAGRAM

A flood control diagram for the New Bullards Bar Reservoir, prepared as part of the proposed flood control regulations, is shown on chart A-6. This diagram is designed to provide a maximum flood control space reservation of 170,000 acre-feet between 1 November and 1 April of each year when the rain flood potential within the Yuba River Basin is high, and

variable smaller amount of flood control space at the beginning and end of the rain flood season when the rain flood potential is considered to be low. The diagram is designed for coordinated operation, in conjunction with the authorized Marysville Reservoir, which will control the standard project flood to non-damaging flows at the mouth of Yuba River.

32. MONTHLY SPACE REQUIREMENTS

The flood control space requirement for New Bullards Bar Reservoir at the end of each month throughout the year is defined on the flood control diagram as follows:

<u>Month</u>	<u>End-of-Month Requirement</u>
July	0 acre-feet
August	0 acre-feet
September	56,000 acre-feet
October	170,000 acre-feet
November	170,000 acre-feet
December	170,000 acre-feet
January	170,000 acre-feet
February	170,000 acre-feet
March	170,000 acre-feet
April	70,000 acre-feet
May	0 acre-feet
June	0 acre-feet

CHAPTER VII - OPERATIONAL CONTROLS

33. HYDROLOGIC FACILITIES



34. FORECASTS OF FLOOD RUNOFF

a. Since channel capacities of Yuba River system exceed maximum expected snowmelt floodflows, it is not considered necessary to forecast snowmelt runoff for flood control operation; however, to effectively operate New Bullards Bar Reservoir for control of rain floods, it will be necessary to obtain or make frequent forecasts of rain flood inflow to New Bullards Bar Reservoir and of local inflow downstream from the reservoir.

b. A method of forecasting the inflow hydrograph to New Bullards Bar Reservoir has been developed by the State-Federal Forecast Center, and that agency prepares periodic inflow forecasts during flood periods. The forecast method is illustrated by the rain flood forecasting criteria shown on chart 24. Figure "a" of the criteria gives the rainfall-runoff relationship as computed by the State-Federal Forecasting Center for the area above Englebright Dam, and because this area is hydrologically similar to that of the area above New Bullards Bar Dam, this rainfall-runoff relationship is assumed to be identical to that for the area above New Bullards Bar Reservoir. Figure "a" gives the total potential runoff

resulting from total basin mean precipitation from any desired period. Figure "b" of the criteria shown on chart 24 adjusts the total potential runoff to immediate runoff caused by the rainfall only during a specified period of precipitation. This adjustment is based mainly on the freezing level of the total contributing area above New Bullards Bar Dam (489 square miles). The approximate freezing level is usually reported during storm periods by the National Weather Service. An average freezing level should be used whenever this level changes rapidly during a storm period.

c. The estimated basin mean adjusted runoff given by chart 24, along with the prestorm AI value and the base flow, could be applied to the unit hydrograph ordinates and the basin AI-loss-rain relationship to determine an inflow hydrograph to New Bullards Bar Reservoir. Also, when desired, an approximate runoff volume for any specified duration can be directly computed by application of chart 24.

35. COORDINATION WITH OTHER AGENCIES

In order to insure that the flood control operation of New Bullards Bar Reservoir 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, and flows in downstream tributaries and in the Yuba River below New Bullards Bar Dam. This requires close liaison with other agencies, including the Department of Water Resources, State of California, the National Weather Service, and the Corps of Engineers, on a daily or hourly basis as required.

CHAPTER VIII - PROJECT ACCOMPLISHMENTS

36. EXAMPLES OF OPERATION

Routings of the December 1955 and December 1964 historical rain floods through New Bullards Bar Reservoir are shown on charts 20 and 21, respectively. At the beginning of each routing, it was assumed that there was 170,000 acre-feet of empty space in New Bullards Bar Reservoir. A routing through New Bullards Bar of the component of the standard project flood occurring above the dam is shown on chart 19. Also shown on this chart are the unregulated and regulated standard project floods on Feather River below Yuba River and below Bear River, thus illustrating the result of a coordinated operation of New Bullards Bar and Oroville Reservoirs for flood control purposes along Feather River. The routing of the probable maximum flood (spillway design flood) through New Bullards Bar Reservoir is shown on chart 9. The initial stage at the beginning of this routing is based on the occurrence of the probable maximum storm two days after the end of the standard project storm. A maximum pool elevation of 1,962.5 (chart A-7) and a peak outflow of 158,000 were obtained. Stage-duration curves are presented on chart 25, a frequency of maximum annual pool elevation curve on chart 26, and a seasonal variation of reservoir storage frequency on chart 27. Peak rain flood frequency curves under preproject and project conditions for Yuba River at mouth are shown on chart 28.

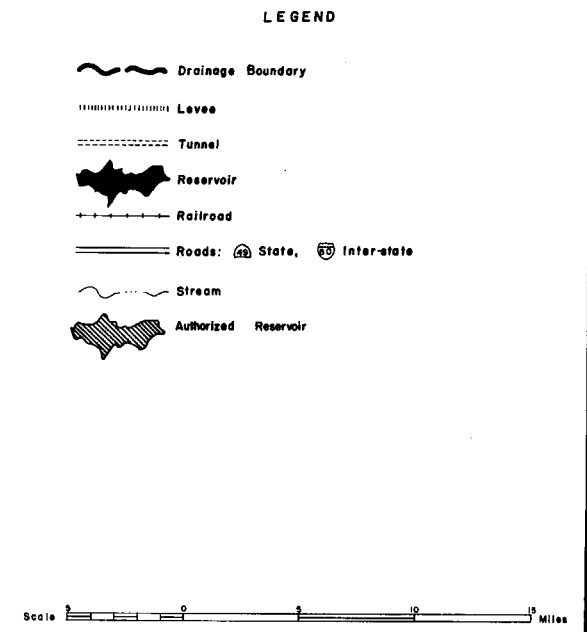
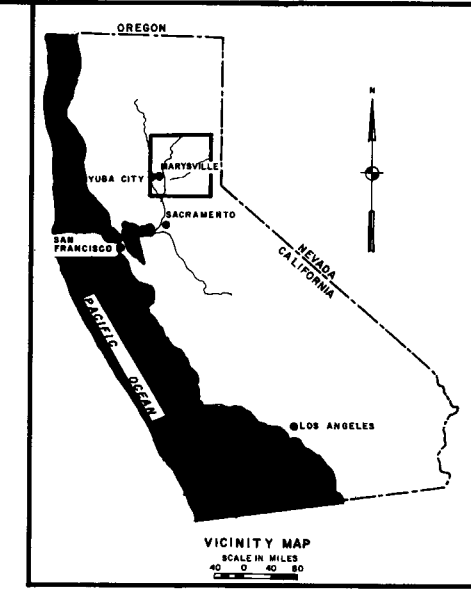
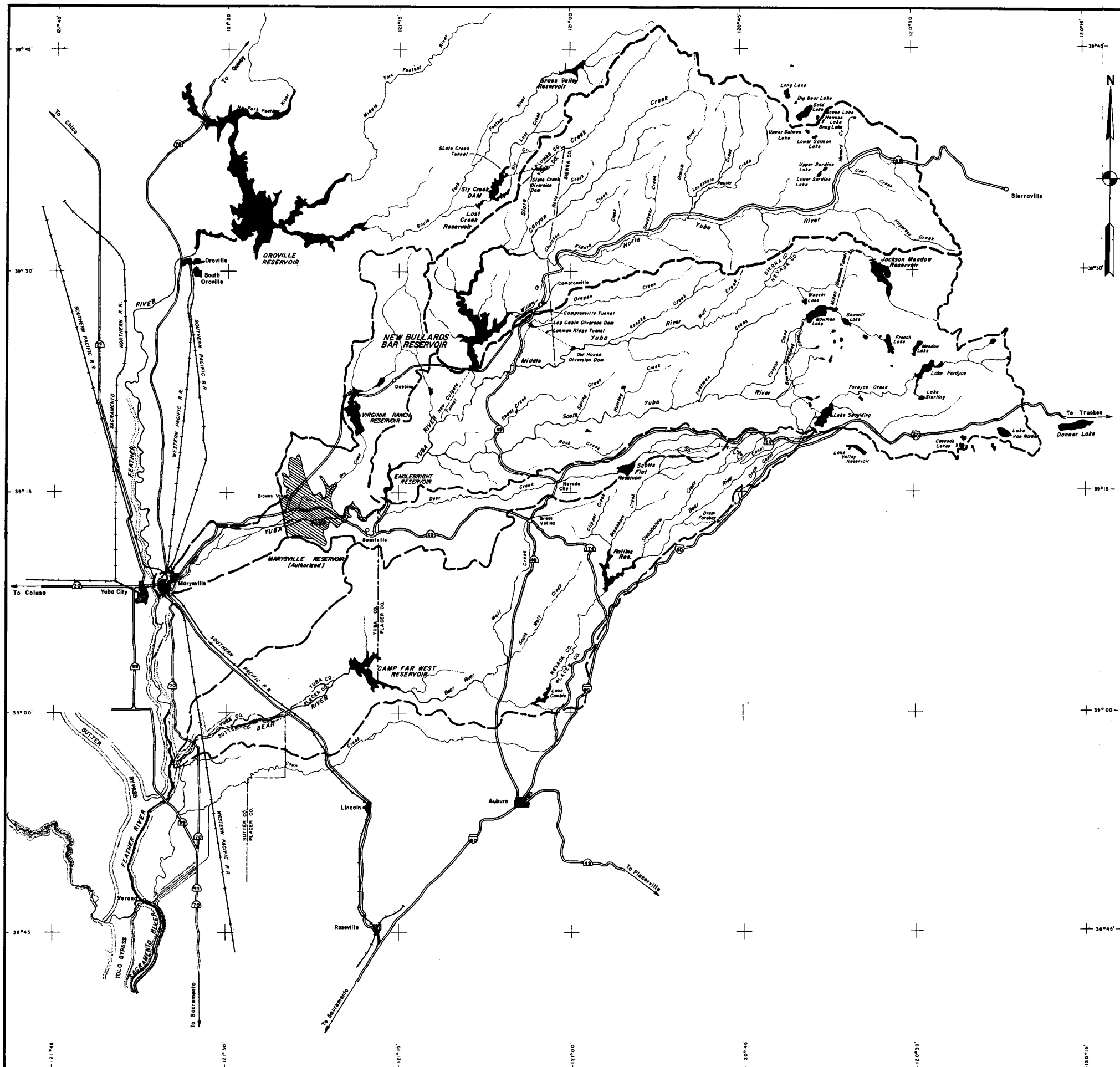
37. OPERATION RECORD

The historical record of operation for New Bullards Bar Reservoir (October 1969 - September 1971) is shown in graphical form on chart 29. A record of flood control requirements and of storage and flow pertinent to the flood control operation is contained in the monthly reports submitted to the Chief of Engineers by the District Engineer, Corps of Engineers, Sacramento, California. A copy of this monthly report form is shown on chart 30.

CHAPTER IX - STUDIES IN PROGRESS OR PLANNED

38. COORDINATED SYSTEM OPERATION STUDIES

Current studies in connection with the authorized Marysville Reservoir have the objective of defining coordinated operation of New Bullards Bar and Marysville Reservoirs to achieve flood control objectives on Yuba River and assist in meeting the objectives on Feather River below the mouth of Yuba River. Future studies will include coordinated system operation studies of Feather River system, including Oroville Reservoir and related features, New Bullards Bar Reservoir, the authorized Marysville Reservoir, and other related flood control features to meet flood control objectives on Feather River including any related effects on Sacramento River stages and flows.



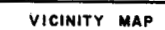
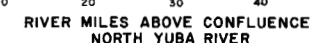
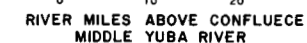
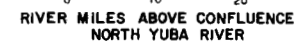
NEW BULLARDS BAR DAM AND RESERVOIR
North Yuba River, California

GENERAL MAP

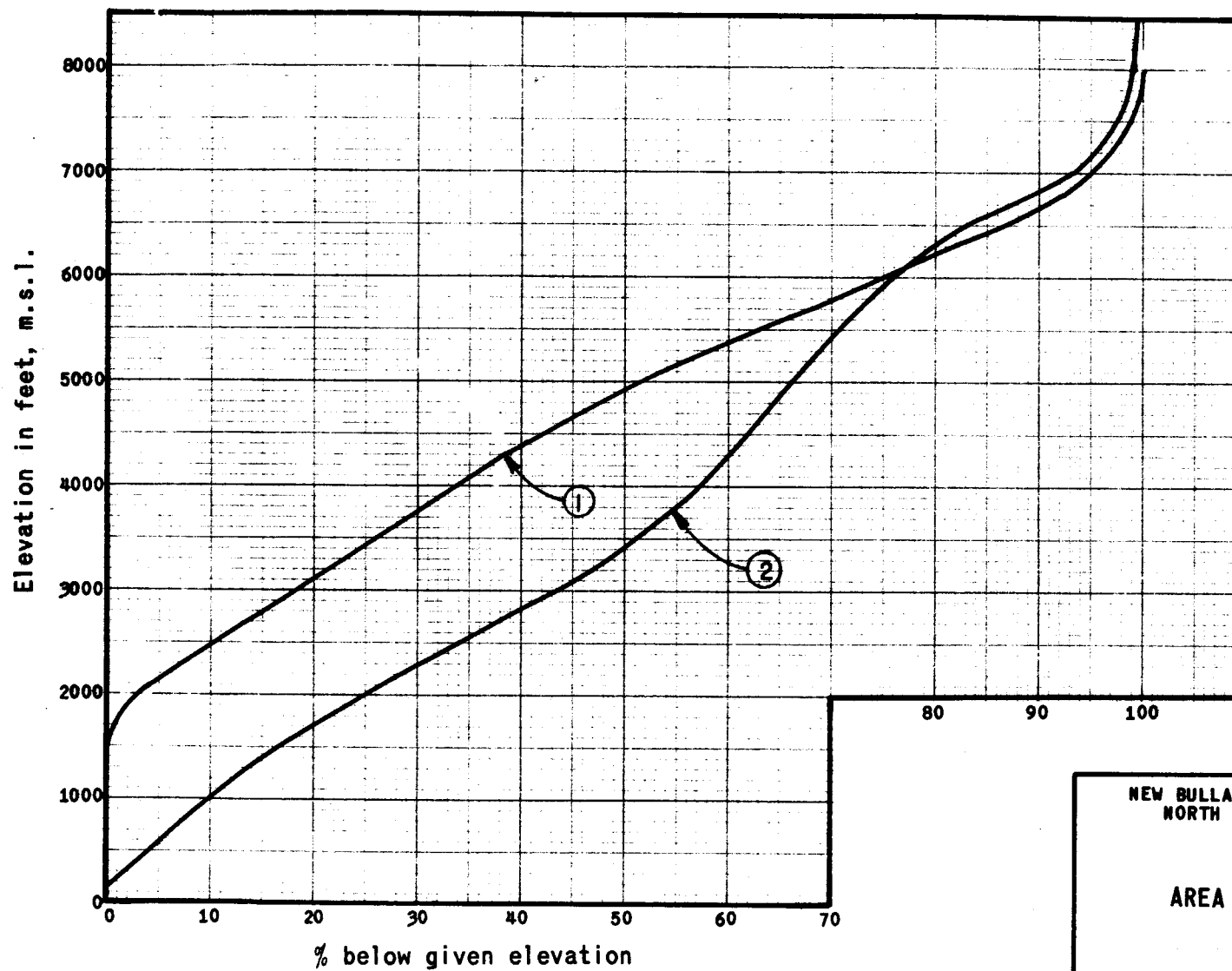
CORPS OF ENGINEERS
Prepared: C.D.M.
Drawn: R.E.V.

SACRAMENTO, CALIFORNIA
Date: November 1971





NEW BULLARDS BAR RESERVOIR North Yuba River, California	
STREAM PROFILES	
CORPS OF ENGINEERS	SACRAMENTO, CALIFORNIA
Prepared: C. D. M.	Date: November 1971
Drawn: R.E.Y.	



LEGEND

1. No. Yuba River Basin above New Bullards Bar Dam - D.A. = 488 sq mi.
2. Yuba River Basin between New Bullards Bar Dam and mouth D.A. = 861 sq mi.

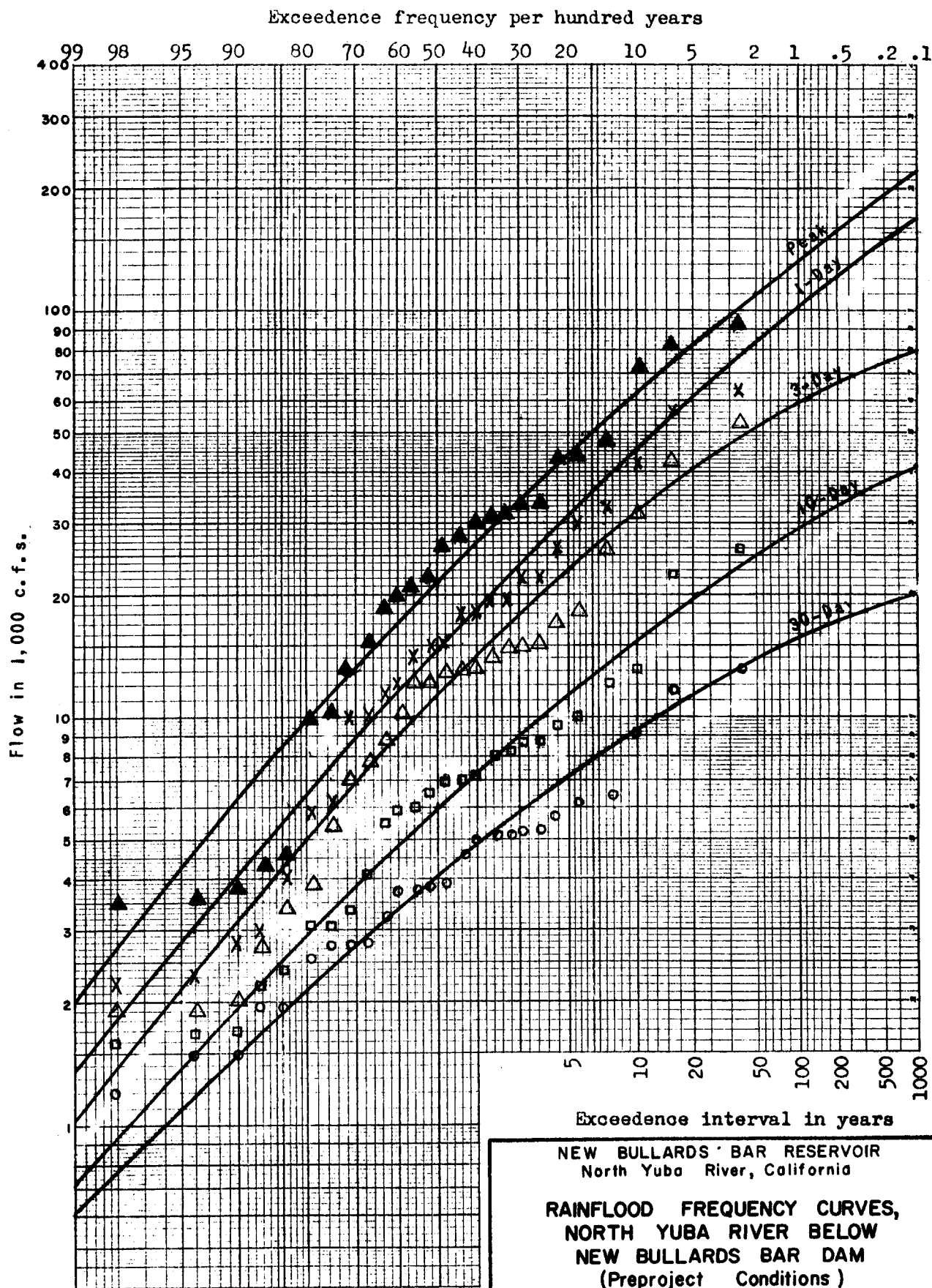
NEW BULLARDS BAR DAM AND RESERVOIR
NORTH YUBA RIVER, CALIFORNIA

AREA - ELEVATION CURVES

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: D.D.D.
Drawn: R.E.Y., B.J.C. Date: OCTOBER 1971



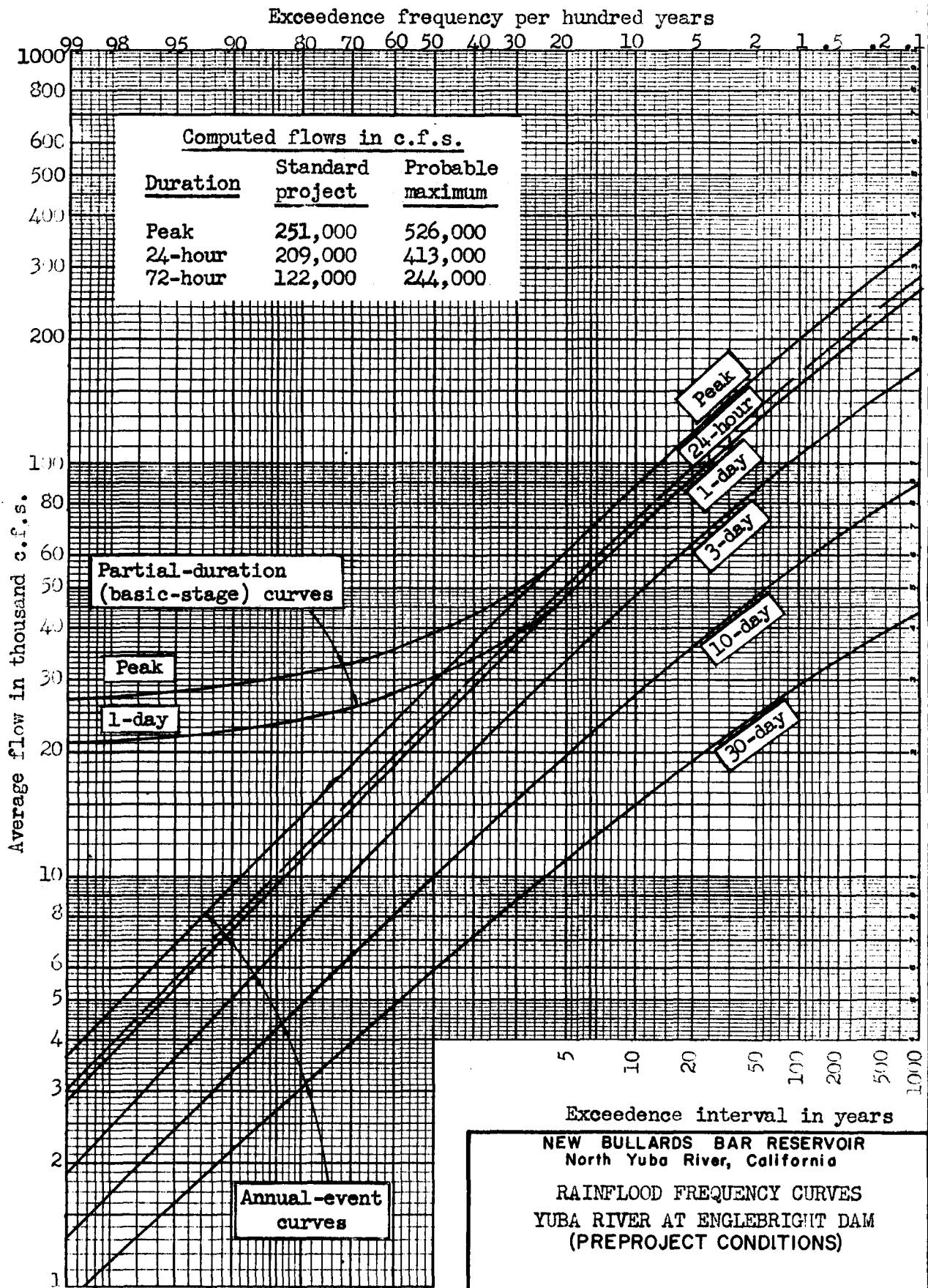


DRAINAGE AREA: 489 sq. mi.

Record period: 1941-1966

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

NOVEMBER 1971



Drainage area: 1108 sq. miles

Corps of Engineers

Sacramento, Calif.

V.G.K.

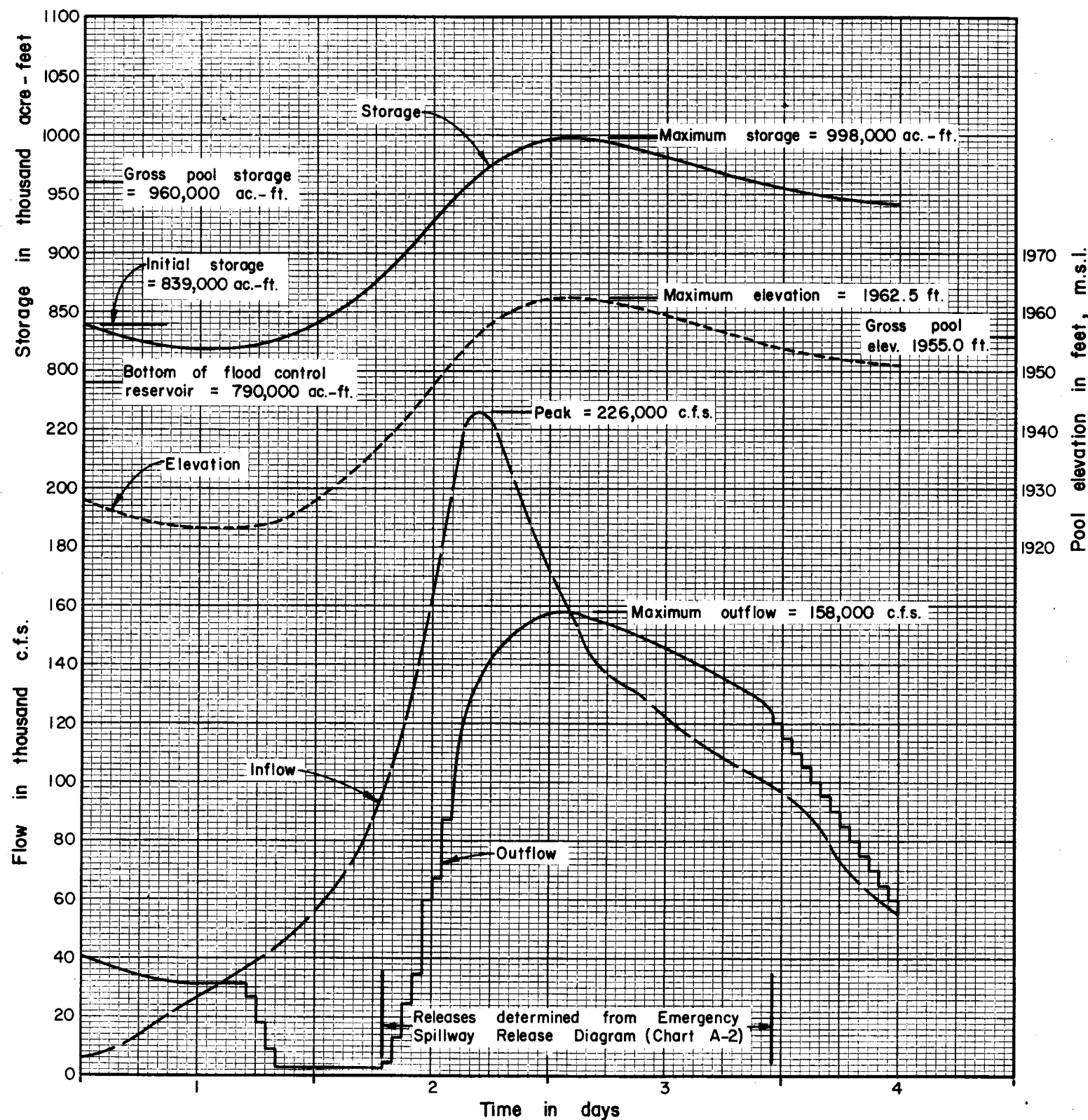
Mar 1958

File: FE-26-42

CHART 7

ALTERNATIVE STANDARD PROJECT FLOOD HYDROGRAPHS (C.F.S.)

Day and Time	Centered above New Bullards Bar Reservoir		Centered between New Bullards Bar Reservoir and Marysville damsite	
	Inflow to New Bullards Bar Reservoir	Component Local Flow	Local Flow	Component Inflow to New Bullards Bar Reservoir
1-2	1000	↑ HYDROGRAPH NOT COMPUTED ↓	870	1000
4	1180		1470	1180
6	1360		1720	1360
8	1540		1990	1540
10	1720		2340	1720
12	2380		2860	2260
14	4560		4180	4080
16	10,840		8320	9160
18	25,540		17,490	21,340
20	43,450		29,570	36,890
22	50,160		37,630	43,050
24	43,240		38,990	37,190
2-2	32,460		37,830	27,910
4	24,140		37,610	20,990
6	18,850		38,060	16,790
8	15,680		37,190	14,460
10	13,970		34,050	13,050
12	12,470		29,190	11,760
14	11,020		23,910	10,370
16	10,260		19,430	9,470
18	9,910		16,240	8,960
20	12,080		15,380	10,840
22	16,670		18,840	14,960
24	26,710		26,850	23,820
3-2	43,410		37,320	38,540
4	55,950		47,790	49,990
6	61,350		54,660	55,570
8	63,890		63,160	58,490
10	70,440		74,690	64,740
12	82,050		88,710	75,720
14	92,100		102,420	85,190
16	100,660		115,160	92,840
18	111,810		130,420	103,000
20	125,630		150,760	116,190
22	141,760		172,030	132,250
24	155,590		183,510	146,030
4-2	154,870		186,770	145,100
4	143,760		180,680	134,140
6	131,230		171,210	121,920
8	114,910		160,000	106,520
10	97,620		146,470	90,600
12	82,050		132,200	76,640
14	69,170		118,550	65,050
16	62,010		106,450	58,600
18	59,920		95,390	56,570
20	56,680		84,230	53,410
22	48,560		71,730	45,940
24	40,340		59,980	38,470
5-2	34,780		51,200	33,410
4	30,640		44,890	29,620
6	27,290		39,800	26,560
8	24,520		35,230	24,020
10	22,030		30,990	21,720
12	19,740		27,200	19,600
14	17,710		23,980	17,500
16	15,930		21,060	15,300
18	14,300		18,050	13,200
20	12,840		14,950	11,200
22	11,500		11,850	9,200
24	10,310		8,850	7,200



NOTES:

1. Initial storage is based on the occurrence of spillway design storm 2 days after the end of the concurrent standard project storm.
2. The flood was routed in accordance with criteria shown on the Emergency Spillway Release Diagram, Chart A-2.

NEW BULLARDS BAR RESERVOIR
NORTH YUBA RIVER, CALIFORNIA

SPILLWAY DESIGN FLOOD ROUTING

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: D.D.D.
Drawn: T.G.K.

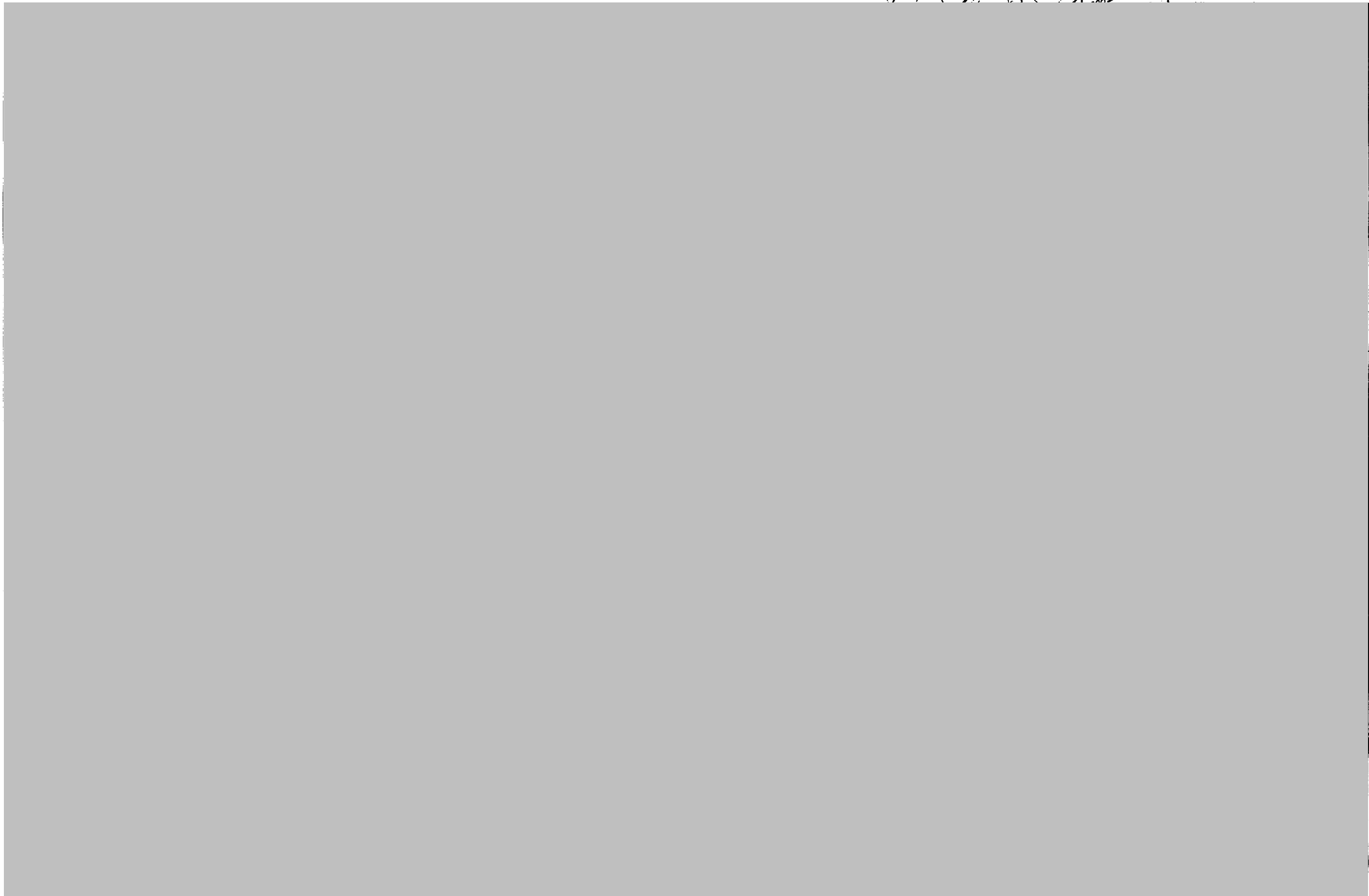
Date: OCTOBER 1971

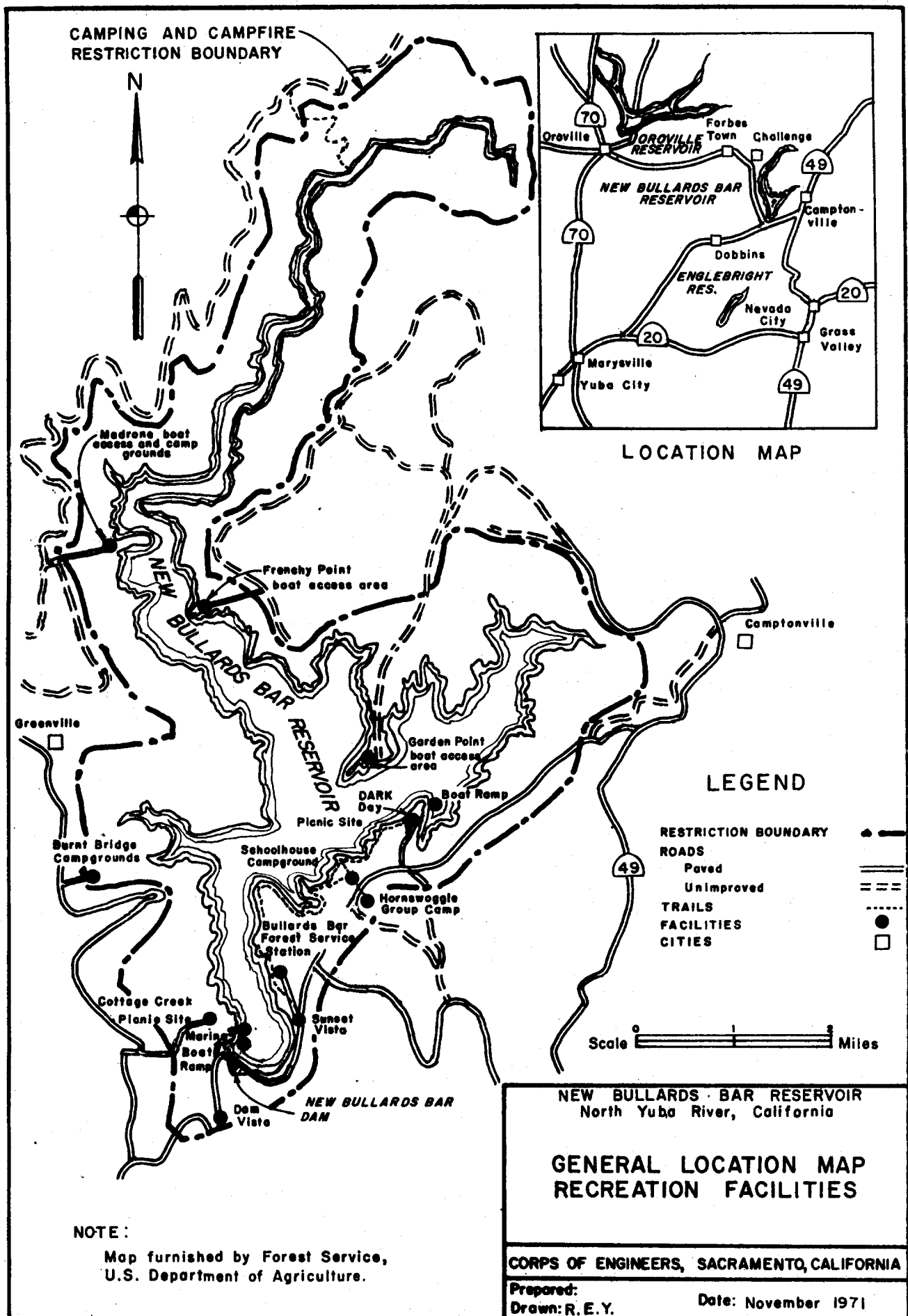


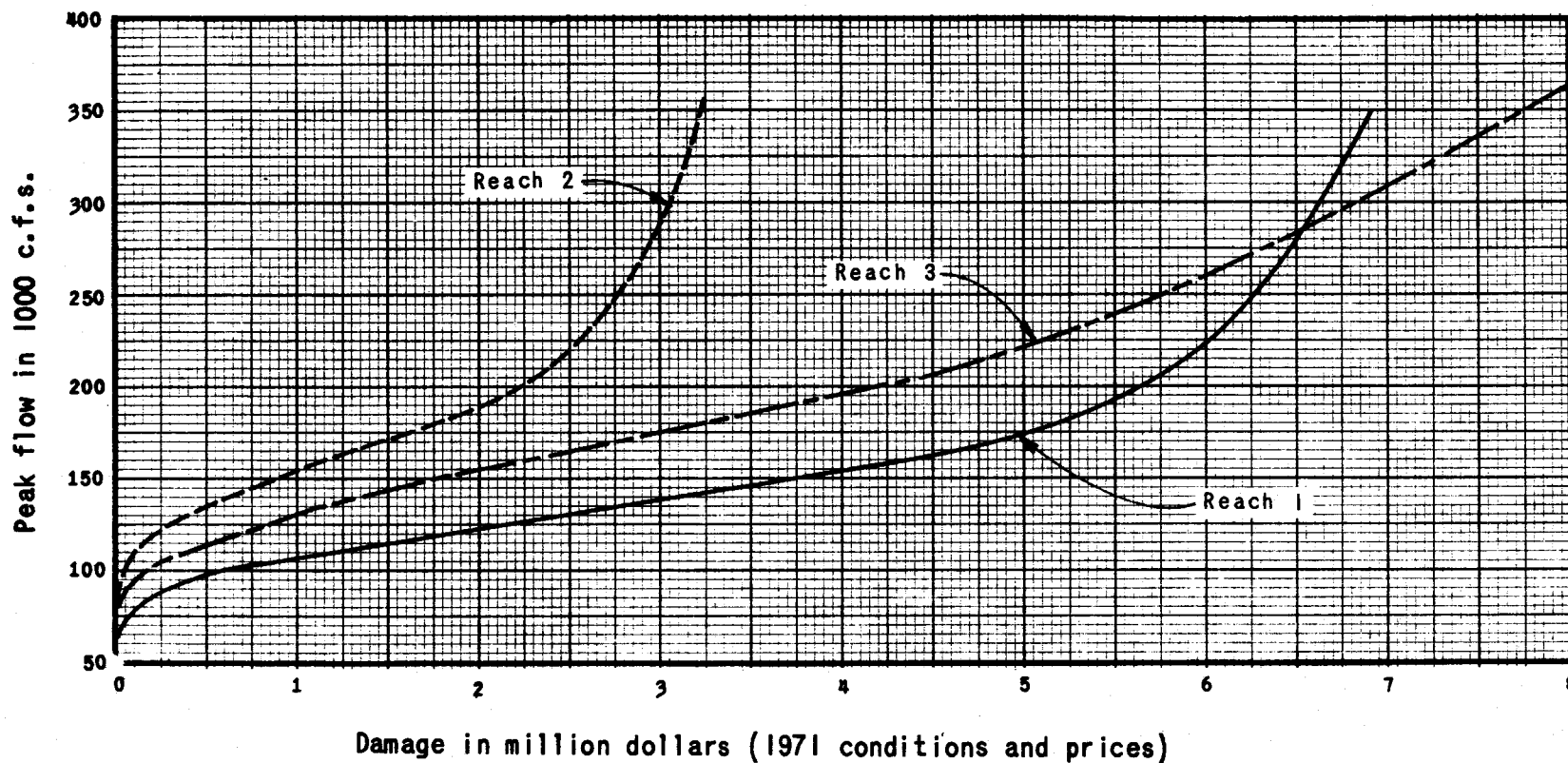












NOTES:

- (1) Reach 1 includes area inclosed by Yuba River levee system and extending to Hiway 99E.
- (2) Reach 2 includes areas located to the south of left Yuba River main levee and extending to Hiway 99E but excluding area described in Note 3.
- (3) Reach 3 includes the town of Linda and vicinity.

NEW BULLARDS BAR DAM AND RESERVOIR
(NORTH YUBA RIVER, CALIFORNIA)

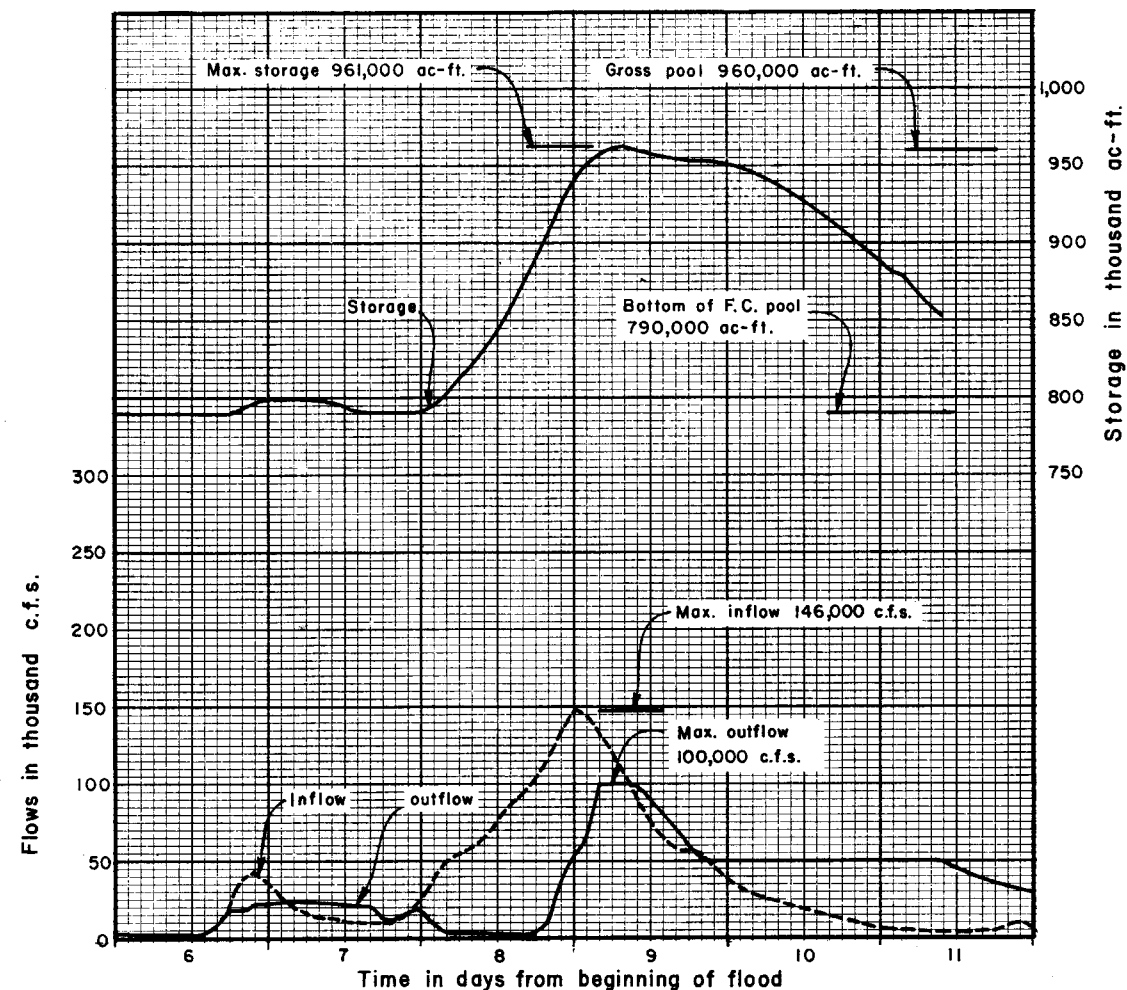
DAMAGE-FLOW CURVES
(YUBA RIVER BELOW FOOTHILL LINE)

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

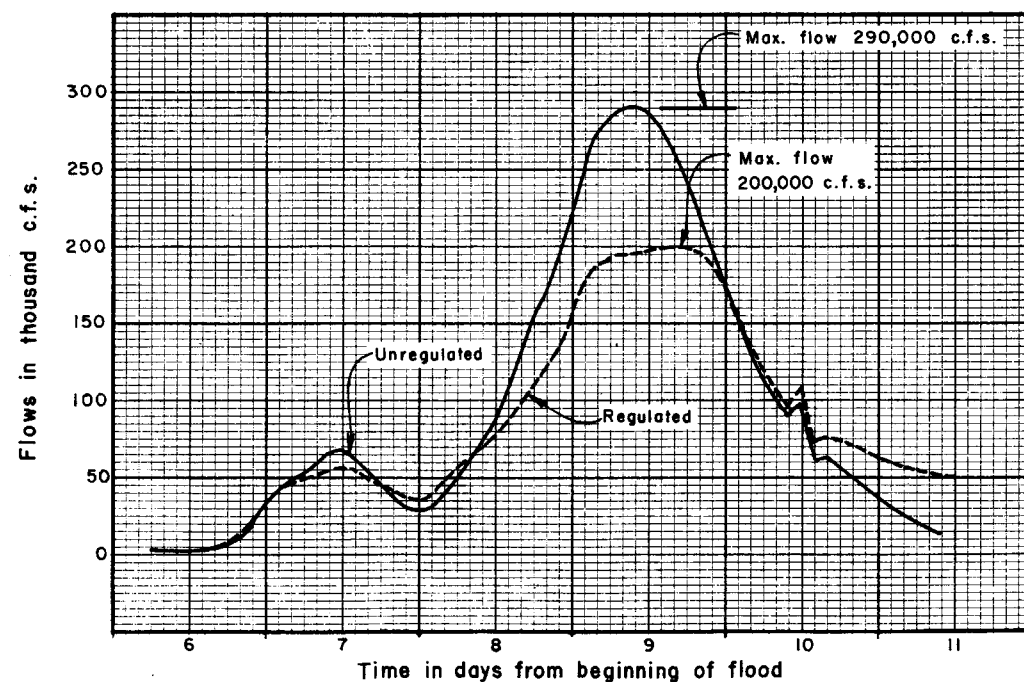
Prepared: D.D.D.

Drawn: R.E.Y.

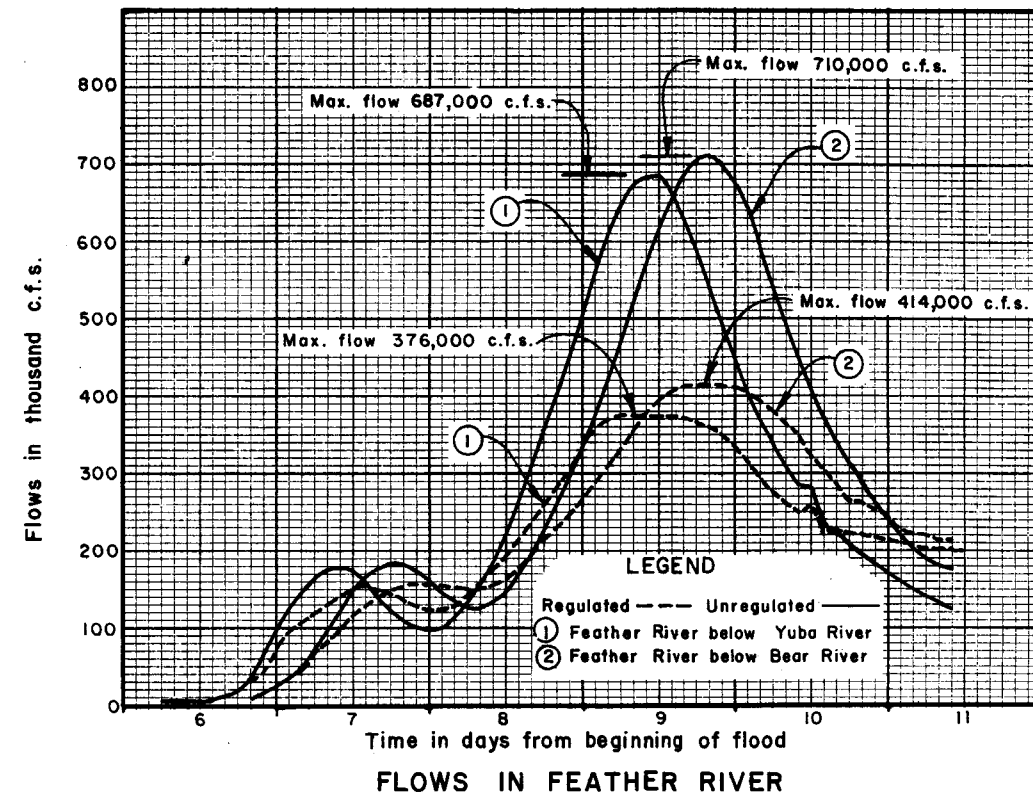
Date: October 1971



STANDARD PROJECT FLOOD COMPONENT
ABOVE NEW BULLARDS BAR DAM



YUBA RIVER AT MOUTH



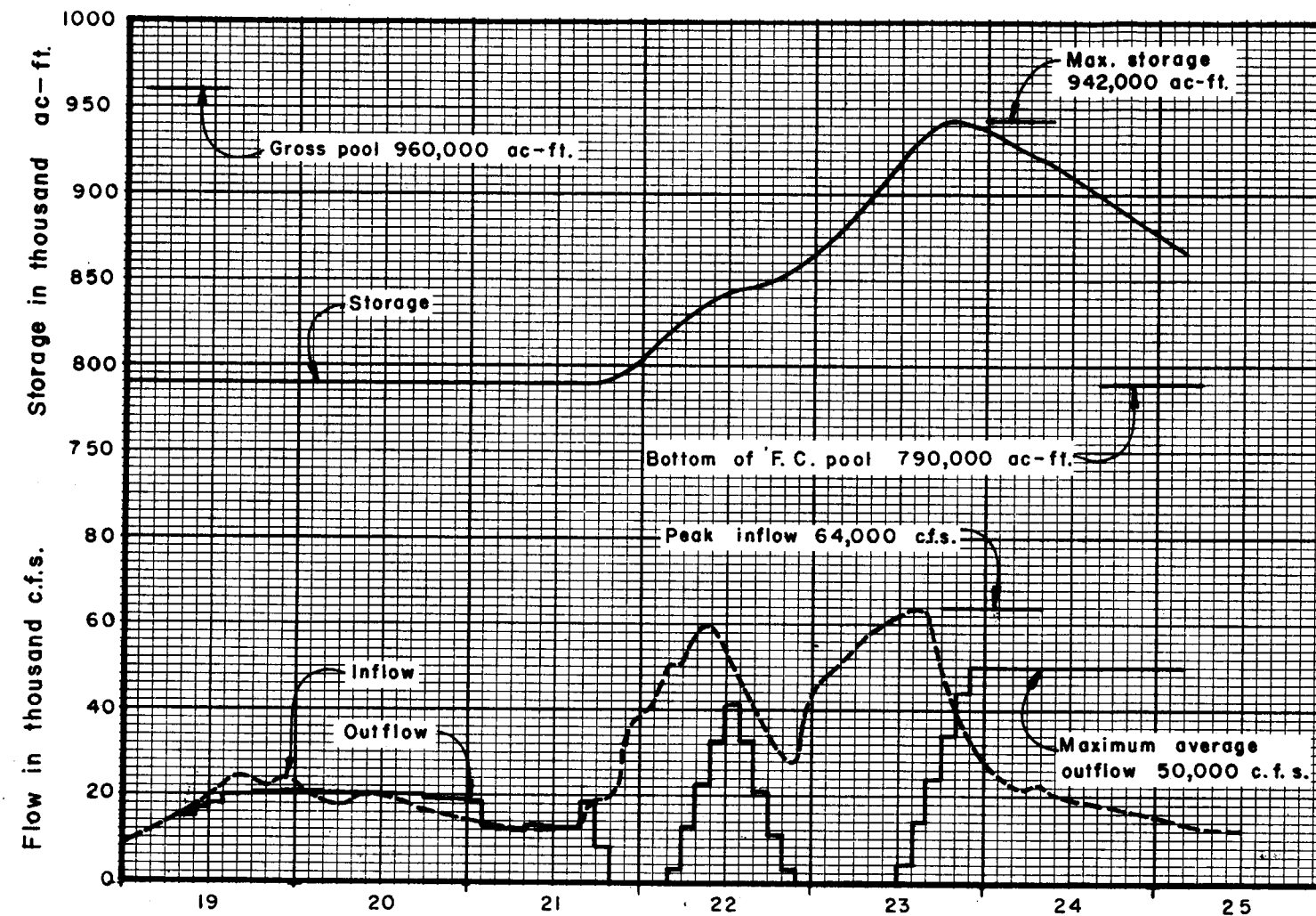
NOTES:

- Standard project storm centered on Yuba River below New Bullards Bar Dam (regulation by Oroville and New Bullards Bar Reservoir)
- Routing through New Bullards Bar Reservoir is based on criteria on charts A-6 and A-7 and in paragraph 4 of the Appendix A. The following assumptions were made to allow for contingencies of operation:
 - 25 percent error in forecasting of Yuba River flows below New Bullards Bar Dam.
 - 100 percent of objective flows:
(Feather River = 150,000 c.f.s. below Oroville and 180,000 c.f.s. above Yuba River; Yuba River = 120,000 c.f.s. at mouth).
- Maximum Bear River flow assumed = 40,000 c.f.s..

NEW BULLARDS BAR RESERVOIR
North Yuba River, California

STANDARD PROJECT FLOOD ROUTING

CORPS OF ENGINEERS SACRAMENTO, CALIFORNIA
Prepared: D.D.D. Date: OCTOBER 1971
Drawn: R.E.Y.



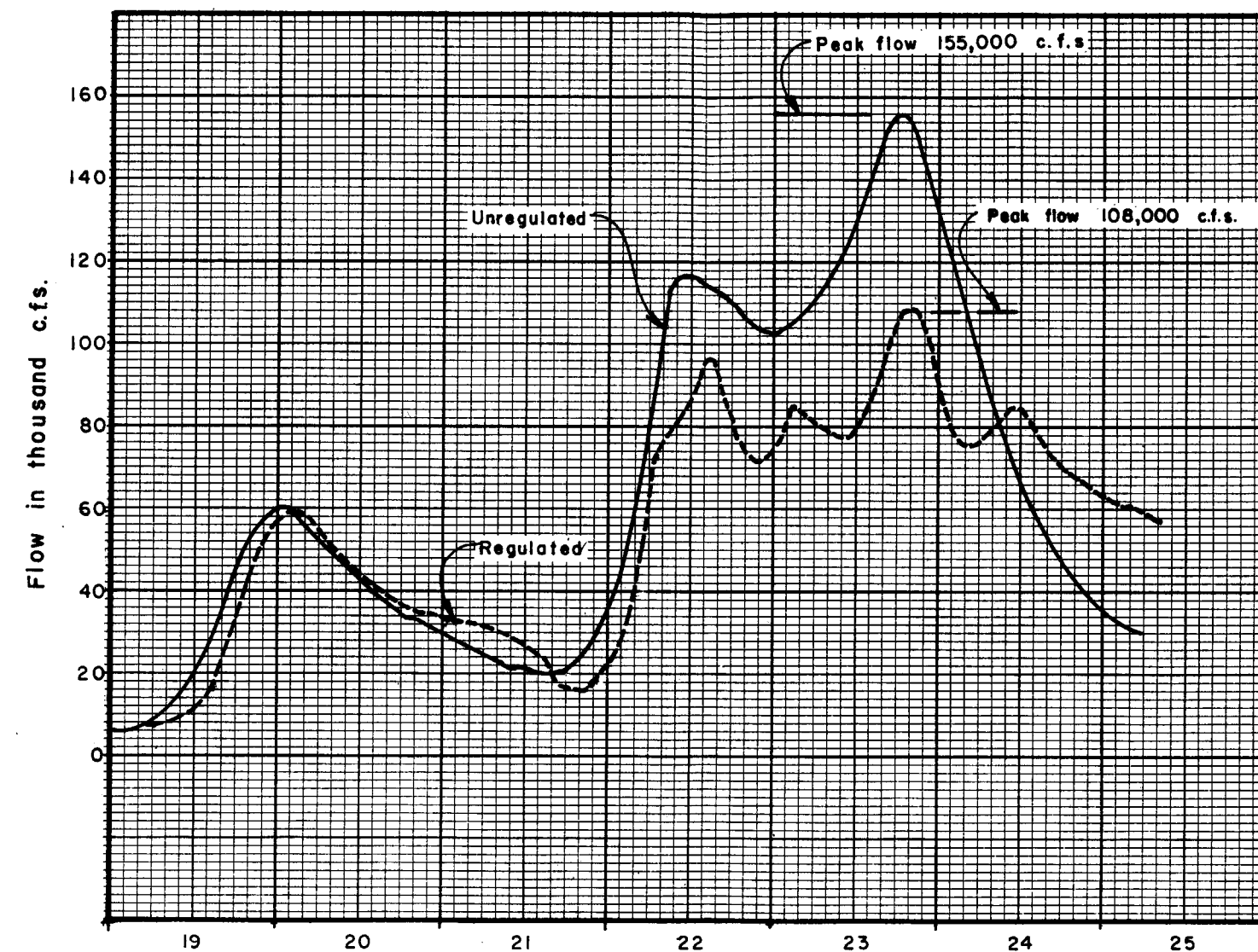
DECEMBER 1955

NEW BULLARDS BAR RESERVOIR

NOTE:

Routing through New Bullards Bar Reservoir is made in conformity with the preliminary flood control diagram (Chart A-6) and for the more critical condition of high coincidental flow in Feather River, i.e., the maximum objective flow rate in Yuba River of 120,000 c.f.s. Allowances for operational contingencies include assumption

that releases to this objective flow rate will be impaired through portions of the period with the result that maximum accomplishment will average 80 percent or 96,000 c.f.s. and that error of forecasting local flow will average 25 percent.



DECEMBER 1955

YUBA RIVER AT MOUTH

NEW BULLARDS BAR RESERVOIR
North Yuba River, California

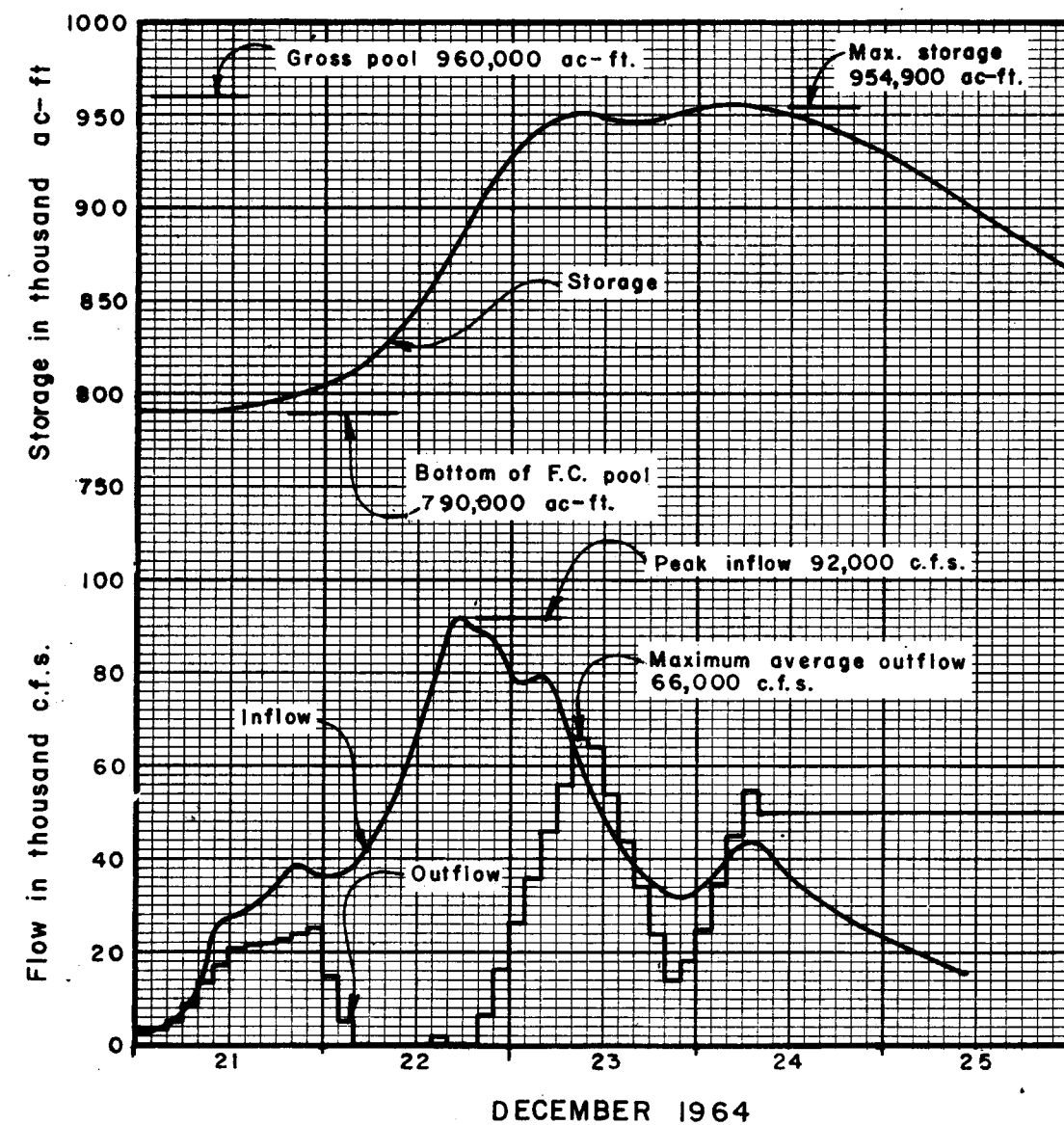
1955 FLOOD ROUTING

CORPS OF ENGINEERS

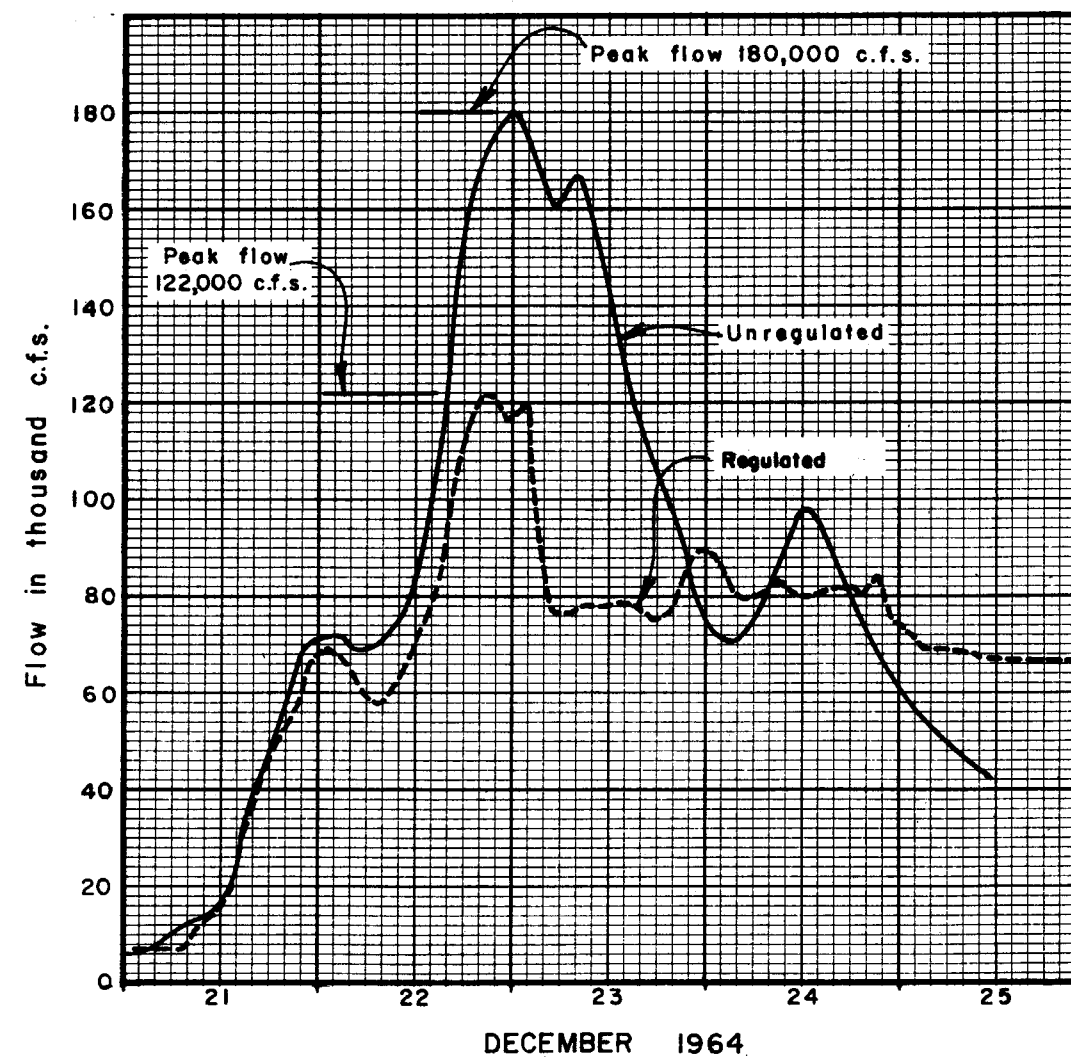
SACRAMENTO, CALIFORNIA

Prepared: D.D.D.
Drawn: R.E.Y.

Date: OCTOBER 1971



NEW BULLARDS BAR RESERVOIR



YUBA RIVER AT MOUTH

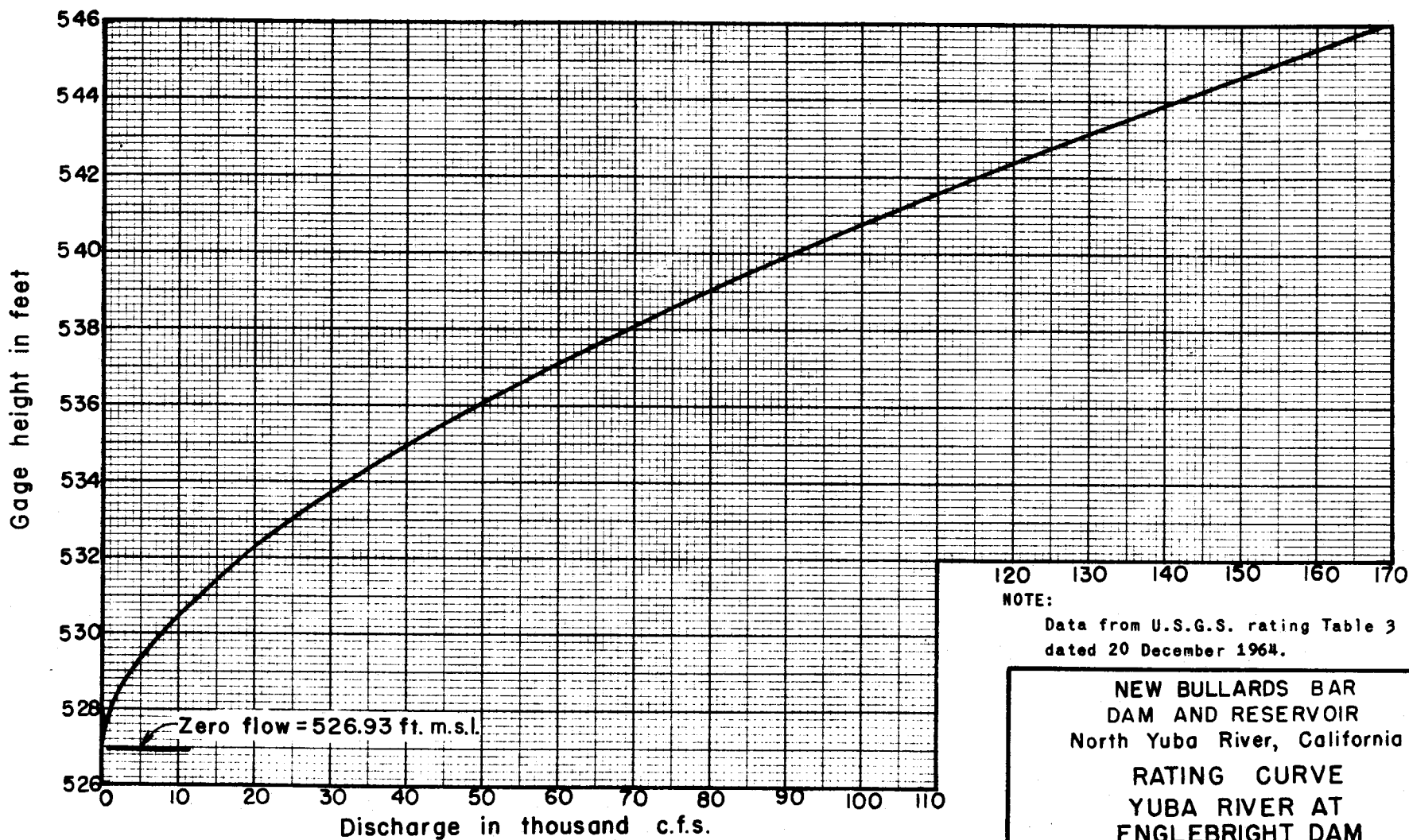
NOTE:

Routing through New Bullards Bar Reservoir is made in conformity with the preliminary flood control diagram (Chart A-6) and for the more critical condition of high coincidental flow in Feather River, i.e., the maximum objective flow rate in Yuba River of 120,000 c.f.s. Allowances for operational contingencies include assumption that releases to this objective flow rate will be impaired through portions of the period with the result that maximum accomplishment will average 80 percent or 96,000 c.f.s. and that error of forecasting local flow will average 25 percent.

NEW BULLARDS BAR RESERVOIR
North Yuba River, California

1964 FLOOD ROUTING

CORPS OF ENGINEERS	SACRAMENTO, CALIFORNIA
Prepared: D.D.D.	Date: OCTOBER 1971
Drawn: R.E.Y.	

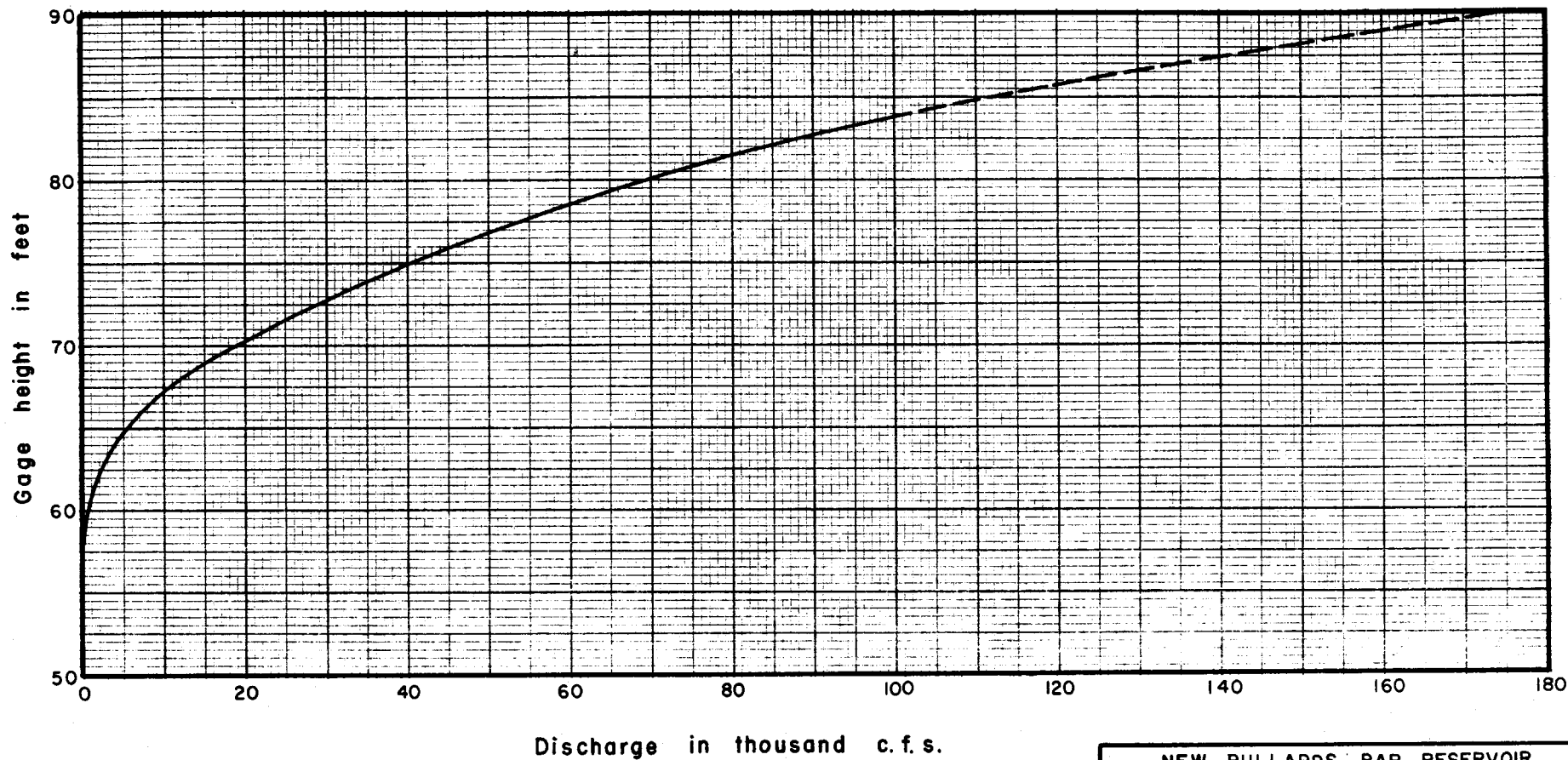


NEW BULLARDS BAR
DAM AND RESERVOIR
North Yuba River, California
RATING CURVE
YUBA RIVER AT
ENGLEBRIGHT DAM

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: D.D.D.
Drawn: R.E.Y.

Date: October 1969



NOTES:

1. Data from U.S.G.S. rating table No.15 dated 26 February 1970.
2. Gage is set to datum of Corps of Engineers, which is 2.95 ft. below mean sea level.
3. Curve affected by backwater from Feather River.

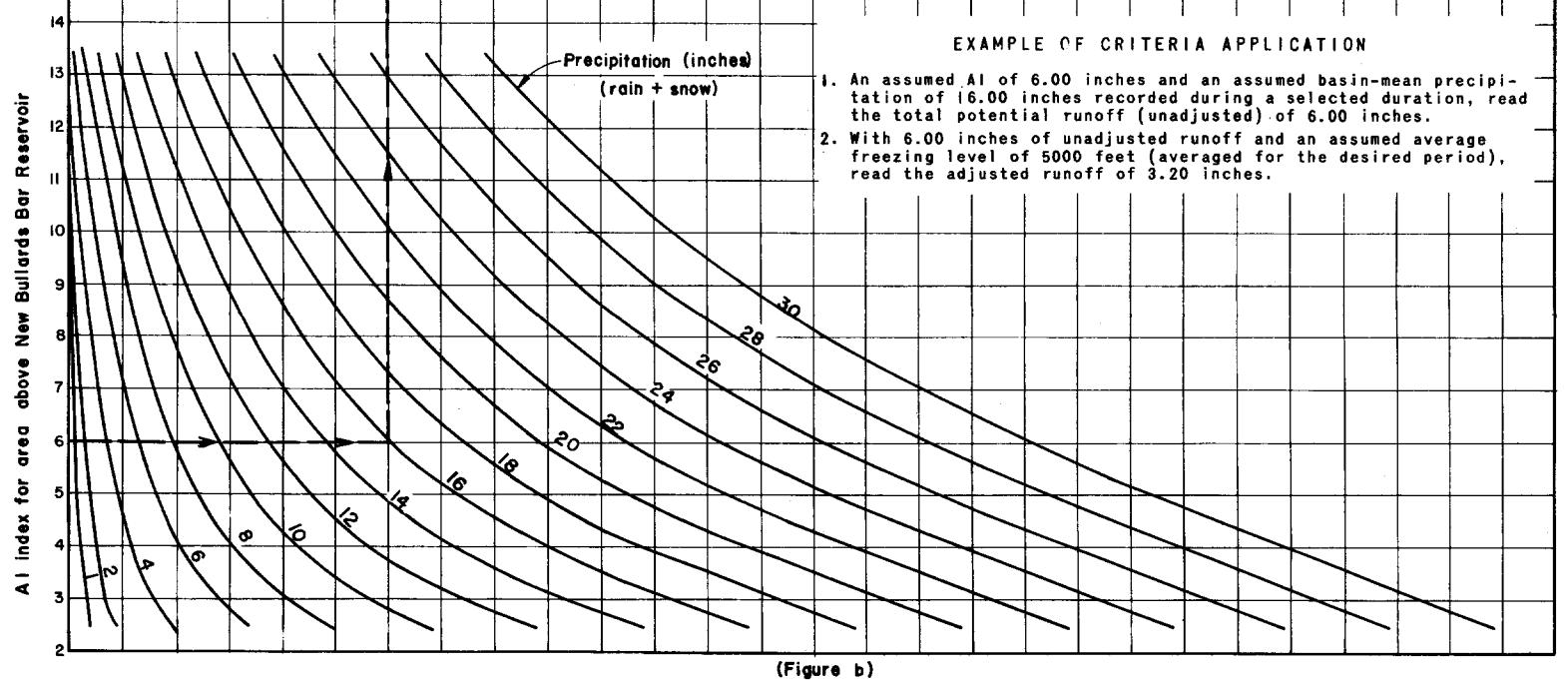
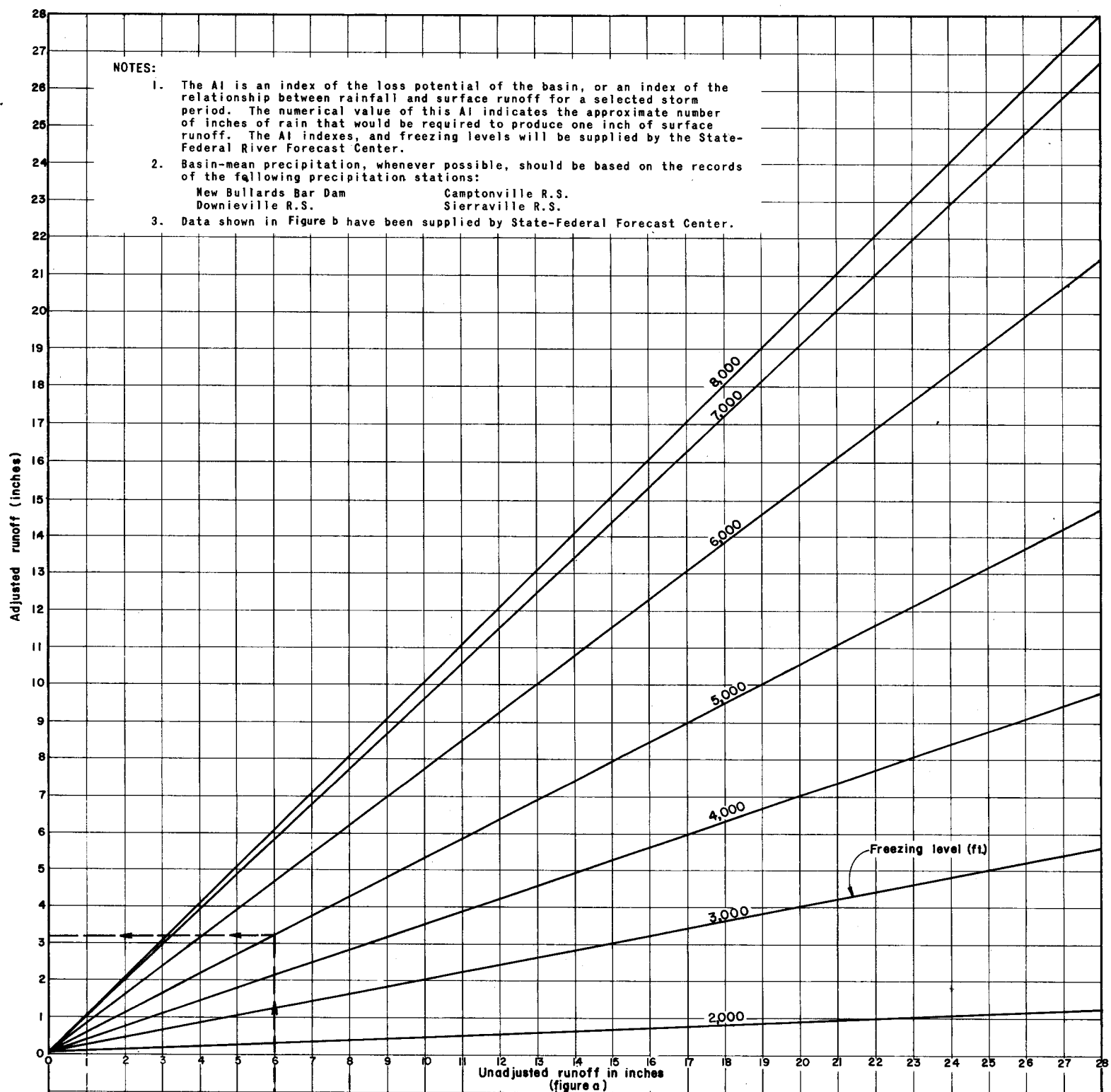
NEW BULLARDS BAR RESERVOIR
North Yuba River, California

RATING CURVE
YUBA RIVER NEAR MARYSVILLE

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: C.D.M
Drawn: R.E.Y.

Date: November 1971

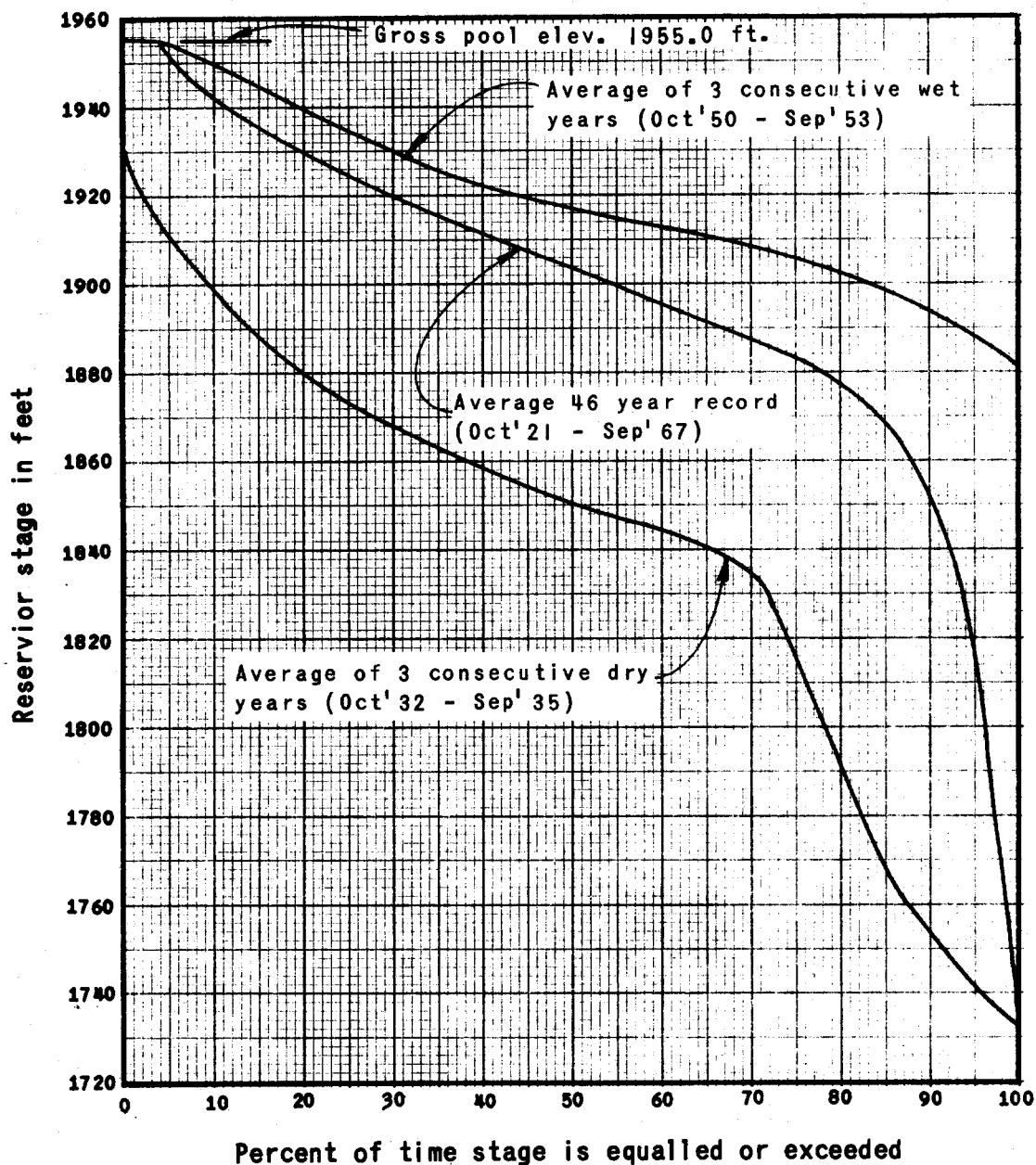


(Figure b)

RAIN FLOOD FORECASTING CRITERIA

NEW BULLARDS BAR DAM AND RESERVOIR
 North Yuba River, California

CORPS OF ENGINEERS SACRAMENTO, CALIF.
 Prepared: D.O.D. Date: October 1969
 Drawn: R.E.Y.



NOTE:

Curves based on Yuba County Water Agency hypothetical multiple-purpose monthly operation study IE 69-3, dated November 1969. (July 1921 - September 1967)

NEW BULLARDS BAR RESERVOIR
NORTH YUBA RIVER, CALIFORNIA

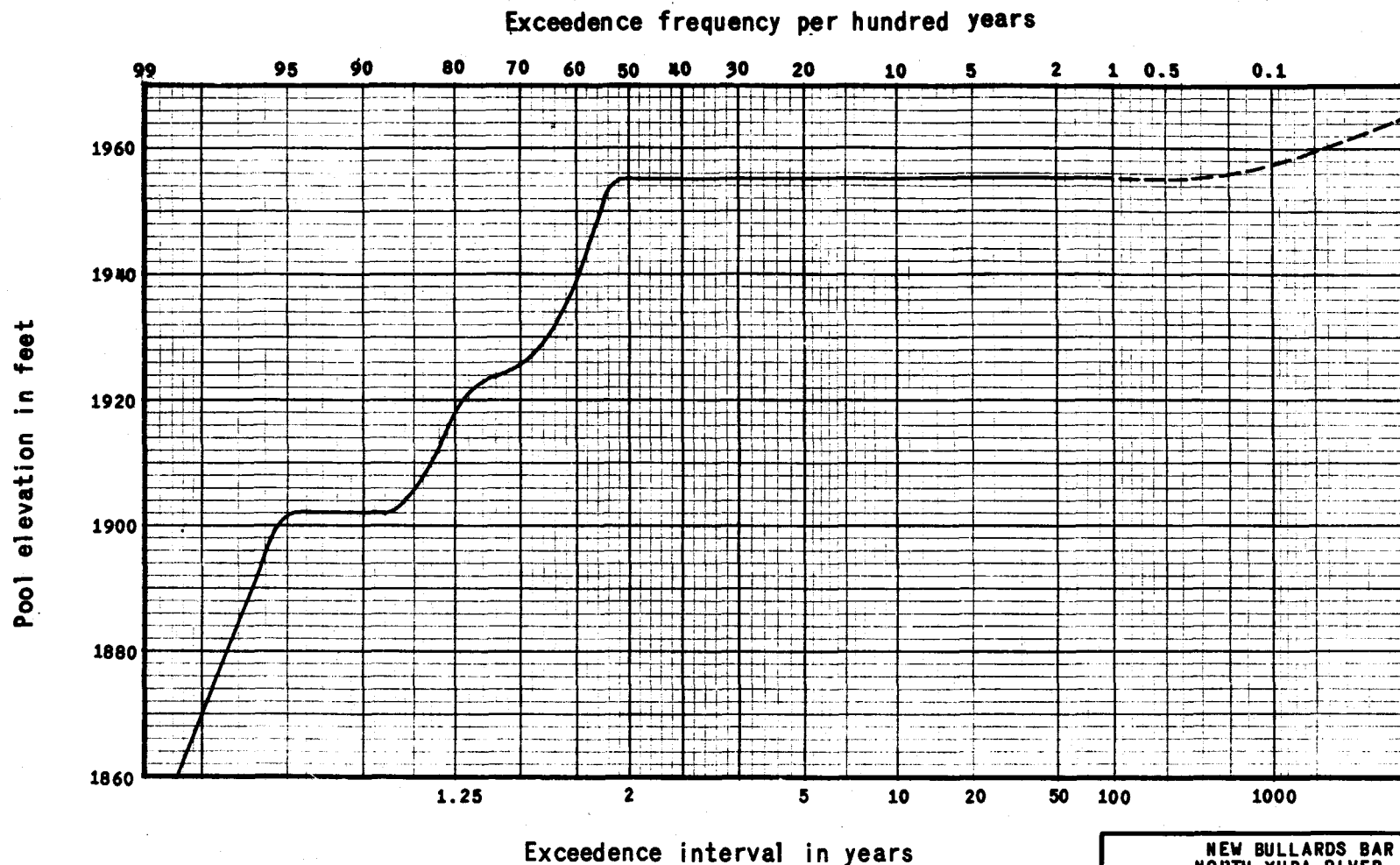
STAGE-DURATION CURVES

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: D. D. D.

Date: October 1971

Drawn: R. E. Y.



NOTES:

- (1) Curves based on monthly hypothetical multiple-purpose reservoir operation (1921-1967), using flood control diagram shown on Chart A-6.
- (2) Extension of curve above gross pool was estimated.

**NEW BULLARDS BAR RESERVOIR
NORTH YUBA RIVER, CALIFORNIA**

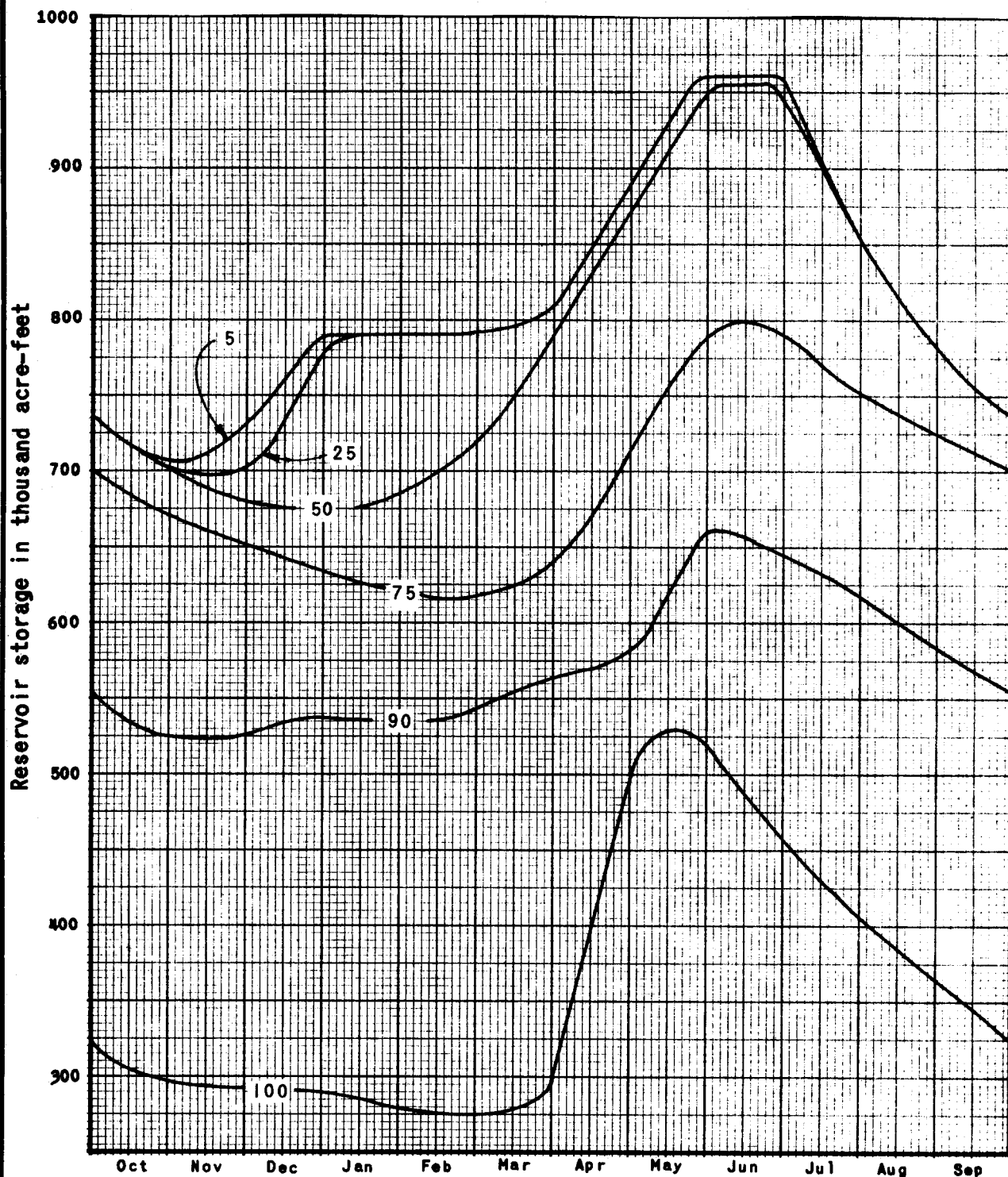
**FREQUENCY OF MAXIMUM
ANNUAL POOL ELEVATION**

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: D.D.D.

Drawn: R.E.Y.

Date: October 1971



NOTES:

- (1) Indicated value is percentage of years that storage is exceeded on given date based on total end of month storage (1921-1967).
- (2) Curves computed from data furnished by Yuba County Water Agency.

**NEW BULLARDS BAR RESERVOIR
NORTH YUBA RIVER, CALIFORNIA**

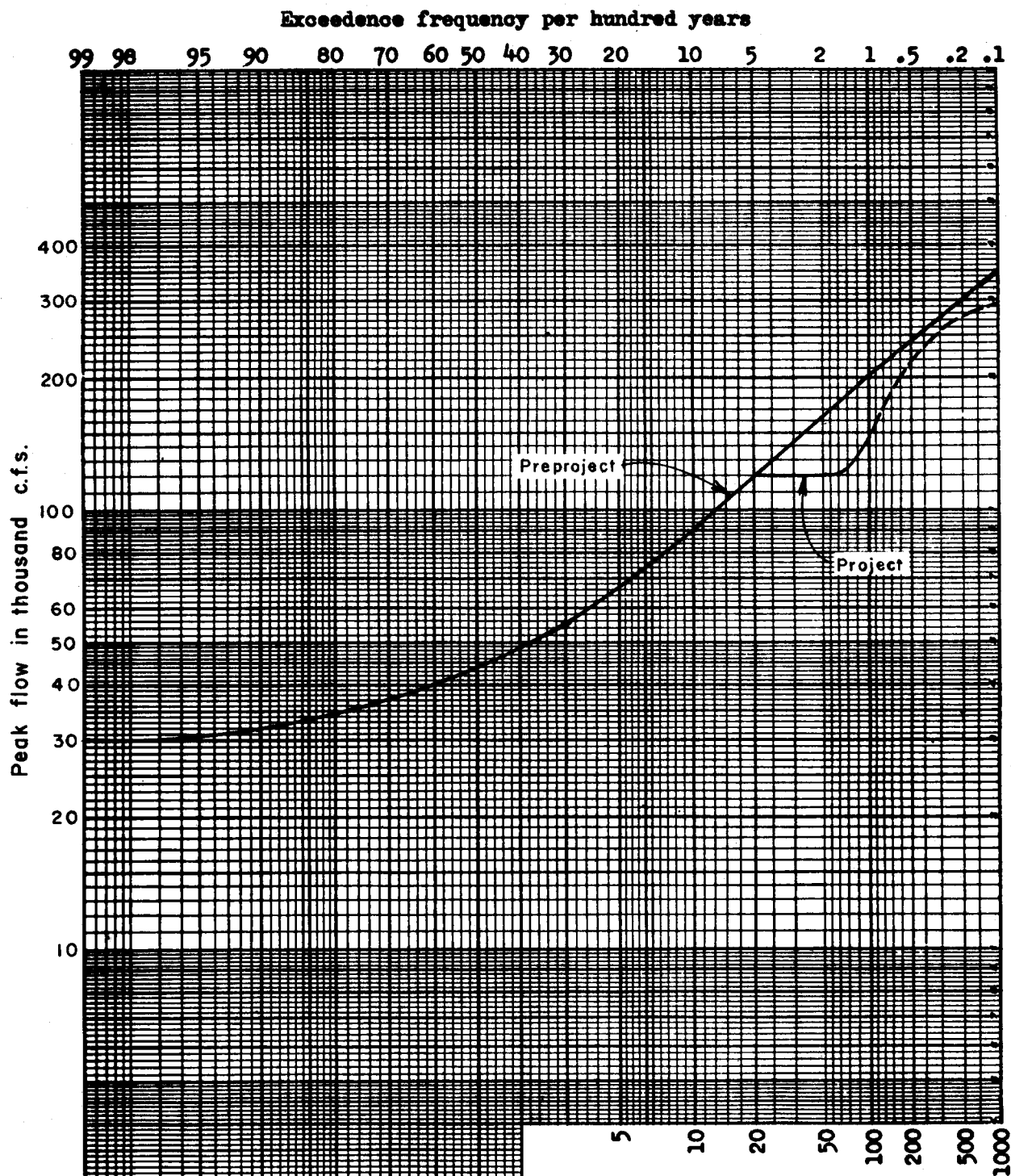
**SEASONAL VARIATION
OF
RESERVOIR STORAGE FREQUENCY**

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: D.D.D.

Drawn: R.E.Y.

Date: October 1971



Exceedence interval in years

NEW BULLARDS BAR RESERVOIR
North Yuba River, California

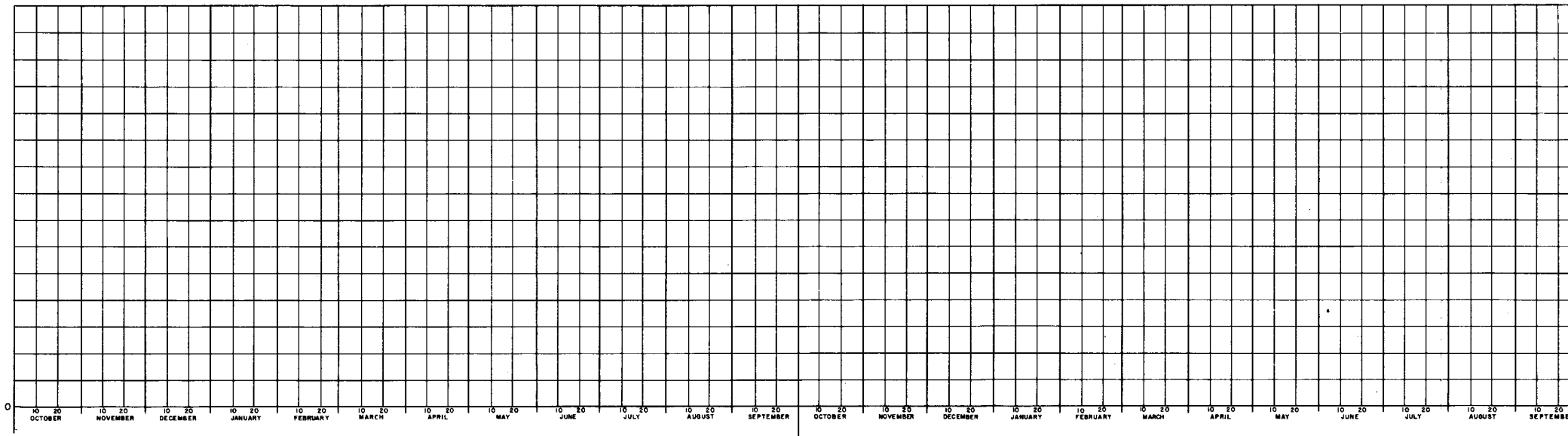
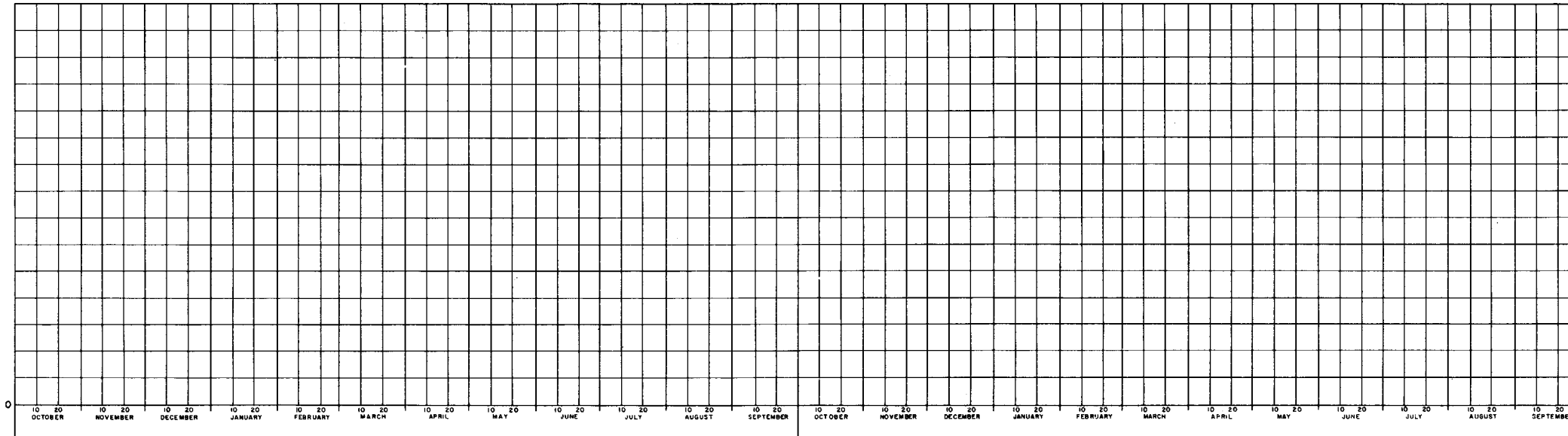
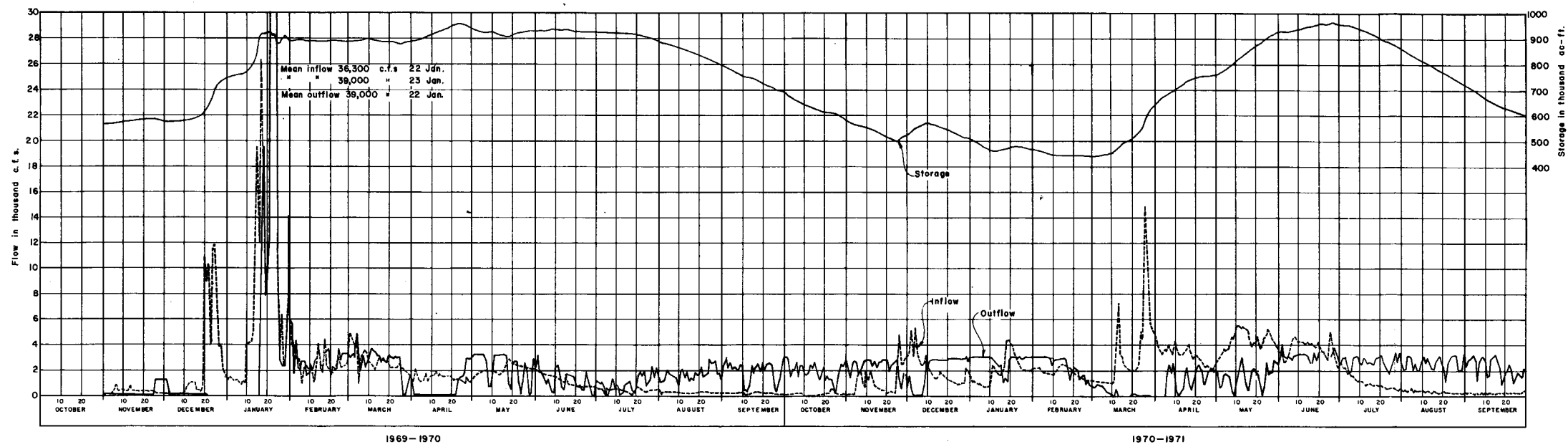
RAINFLOOD FREQUENCY CURVES YUBA RIVER AT MOUTH

Corps of Engineers, Sacramento, Calif.

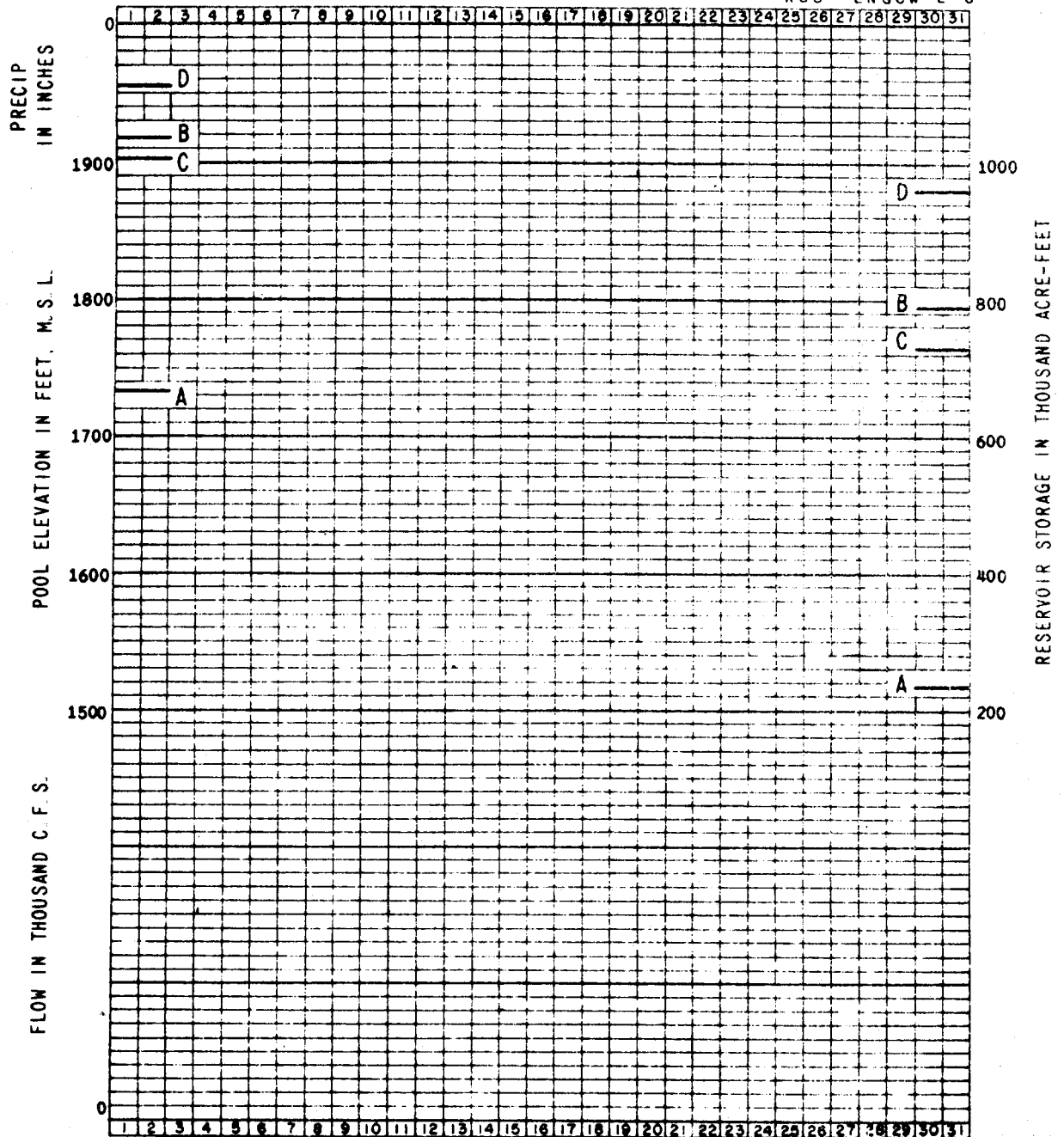
Prepared: D.D.D.

Date: NOVEMBER 1971

1356



NEW BULLARDS BAR RESERVOIR North Yuba River, California	
OPERATION RECORD	
U.S. Army Engineer District Prepared: H.A.Z. Drawn: R.E.V.	Sacramento, California Date: November 1971



- A. Min. power pool elev: 1732.0 ft
storage: 235,600 ac-ft
- B. Bottom of flood control reservation:
elev: 1916.75 ft
storage: 790,000 ac-ft
- C. Spillway crest (gated ogee)
elev: 1902.0 ft
storage: 729,600 ac-ft
- D. Gross pool - elev: 1955.0 ft
capacity: 960,000 ac-ft
(Top of 3 - 30'0" x
53'0" Tainter Gates)

Outlet valve intake
elev C: 1395.0 ft
type: 1 - 84" Ø Butterfly
1 - 72" Ø Hollow-jet

Release capacities:	Pool elev	Discharge
	1732 ft	1,800 cfs
	1917 ft	2,800 cfs
	1955 ft	3,000 cfs

MONTHLY RESERVOIR OPERATION

NEW BULLARDS BAR RESERVOIR

(OPERATED BY YUBA
COUNTY WATER AGENCY)

NORTH YUBA RIVER, CALIFORNIA

DRAINAGE AREA: 489 SQ. MILES

SOUTH PACIFIC DIVISION
SACRAMENTO DISTRICT
SACRAMENTO, CALIFORNIA

**REPORT ON RESERVOIR REGULATION
FOR FLOOD CONTROL**

**NEW BULLARDS BAR DAM AND RESERVOIR
NORTH YUBA RIVER, CALIFORNIA**

JUNE 1972

**APPENDIX A
STANDING INSTRUCTIONS TO DAMTENDERS
INCLUDING EMERGENCY SPILLWAY OPERATION
AND FLOOD CONTROL REGULATIONS**

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

REPORT ON RESERVOIR REGULATION
FOR FLOOD CONTROL

NEW BULLARDS BAR DAM AND RESERVOIR
NORTH YUBA RIVER, CALIFORNIA

APPENDIX A
STANDING INSTRUCTIONS TO DAMTENDERS
INCLUDING EMERGENCY SPILLWAY OPERATIONS
AND FLOOD CONTROL REGULATIONS

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2	Flood Control Operation Requirements	1
3	Limitations on Storage	2
4	Limitations on Releases	2
5	Emergency Operation of Gated Spillway	2
6	Standing Instructions During Flood Emergency	3
7	Operational Requirements	3
8	Operation Reports	4
9	Modification of Regulations	4

PART II - FLOOD CONTROL REGULATIONS

LIST OF CHARTS

Chart No.

A-1	Area and Capacity Curves
A-2	Area and Capacity Tables
A-3	Spillway and Outlet Rating Curves
A-4	Spillway Discharge Rating Curves
A-5	Rating Curve, North Yuba River Below New Bullards Bar Dam
A-6	Flood Control Diagram
A-7	Emergency Spillway Release Diagram

REPORT ON RESERVOIR REGULATION
FOR FLOOD CONTROL

NEW BULLARDS BAR DAM AND RESERVOIR
NORTH YUBA RIVER, CALIFORNIA

APPENDIX A
STANDING INSTRUCTIONS TO DAMTENDERS
INCLUDING EMERGENCY SPILLWAY OPERATIONS
AND FLOOD CONTROL REGULATIONS

PART I - STANDING OPERATING INSTRUCTIONS

1. GENERAL

a. This report on standing operating instructions, emergency spillway operations, and flood control regulations, New Bullards Bar Dam and Reservoir (also referred to as Bullards Bar Dam and Reservoir), North Yuba River (a major tributary to Yuba River), California, is an appendix to the "Report on Reservoir Regulation for Flood Control, Yuba River Basin, California". It is prepared in accordance with instructions contained in EM 1110-2-3600, paragraph 4-07, (Standing Instructions to Damtenders) pertaining to duties and responsibilities of the damtender in connection with the functional operation of New Bullards Bar Dam and Reservoir and reporting of required hydrologic data.

b. This report briefly outlines operational instructions to the damtender with specific emphasis on his duties and responsibilities during extreme flood emergencies when communication facilities between him and his operating office (Yuba County Water Agency) have been disrupted. The report has been designed to be used as a supplement, and not as a substitute to the more detailed and complete report on reservoir regulation for flood control referred to in paragraph 1a above.

2. FLOOD CONTROL OPERATION REQUIREMENTS

a. New Bullards Bar Dam and Reservoir will be operated for flood control in accordance with flood control regulations prescribed by the Secretary of the Army, which are contained in this report. Accompanying the regulations are the flood control diagram, chart A-6, and the emergency spillway release diagram, chart A-7, which together define the criteria for flood control operation of New Bullards Bar Reservoir. The primary objectives of flood control operation are (1) to minimize flood damages downstream, and (2) to avoid causing damage, insofar as practicable, that would not have occurred under conditions without the project. To that end, water stored in the flood control space as determined from the flood control diagram will be released as rapidly as possible without causing flows in Yuba River below New Bullards Bar Dam to exceed the controlling flow rates given on the flood control diagram and in paragraph 4 below.

b. A maximum of 170,000 acre-feet of space is dedicated to flood control on a seasonal basis as indicated on the flood control diagram. When not reserved for flood control, this space is allocated for other purposes. Area and capacity curves are shown on chart A-1 and area and capacity tables are listed on chart A-2.

3. LIMITATIONS ON STORAGE

Operational limitations on storage in New Bullards Bar Reservoir are specified on the flood control diagram, chart A-6 of this report.

4. LIMITATIONS ON RELEASES

a. Except during emergency spillway operations, as described in paragraph 5 below, releases from New Bullards Bar Reservoir shall be restricted insofar as possible to those flows which will not cause flows in the Yuba River at Marysville to exceed 120,000 c.f.s. (180,000 c.f.s. when Feather River is low) but limited to 50,000 c.f.s. unless inflows during the current flood have exceeded that amount. If inflow has exceeded 50,000 c.f.s., water could be released at rates up to the maximum rate of inflow if such releases do not increase flows at the mouth of Yuba River above the previously specified flow rate (the project design flow for floodway and the levee system below the foothill line). Spillway and outlet rating curves are shown on chart A-3. Chart A-4 shows spillway rating curves under various conditions for both free outflow (gates fully open) and for restricted outflow when required (all gates partially open). A rating curve for North Yuba River below New Bullards Bar Dam is shown on chart A-5. Rating curves for Yuba River at Englebright Dam and near Marysville may be found on charts 22 and 23 of the Report on Reservoir Regulation for Flood Control, New Bullards Bar Dam and Reservoir. Releases also will be limited so that flow in Feather River below Yuba River will not exceed 300,000 c.f.s.; in Feather River below Bear River, flow will not exceed 320,000 c.f.s. (the project design flows at these respective points).

b. During very large floods, higher releases may be required, as indicated by the emergency spillway release diagram, chart A-7, in order to minimize uncontrolled spillway discharges.

c. Flood control releases from New Bullards Bar Reservoir are not to be changed more than 5,000 c.f.s. in any 1-hour period.

5. EMERGENCY OPERATION OF GATED SPILLWAY

Whenever water is stored into the flood control space and the reservoir is rising rapidly because of flood inflow, the necessity for emergency

spillway releases should be determined by the operating agency, or by the damtender if communications have been lost, using the emergency spillway release diagram (chart A-7). Emergency spillway releases should be initiated when current storage and rate of rise of water surface elevation in feet per hour indicate that outflows greater than the current release are required. The diagram indicates the release considered necessary to avoid jeopardizing the safety of the structure, without releasing quantities in excess of natural runoff. 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 spillway release diagram and should be supplied with standing instructions to initiate use of the diagram, if required, when communication with the Yuba County Water Agency office is disrupted.

6. STANDING INSTRUCTIONS DURING FLOOD EMERGENCY

Whenever communications between the Yuba County Water Agency and the damtender are broken during a flood period, the damtender shall continue to operate in accordance with the latest instructions until communications are restored or until emergency spillway operation, in accordance with paragraph 5 above, becomes necessary.

7. OPERATIONAL REQUIREMENTS

New Bullards Bar Reservoir is operated by the Yuba County Water Agency, and the Administrator of the Agency is responsible for:

- a. Accomplishing the physical operation of the reservoir and associated facilities in accordance with the official regulations.
- b. Advising the District Engineer, Sacramento District, Corps of Engineers, of any need for emergency change in flood control operation.
- c. Reporting to the District Engineer, Sacramento District, Corps of Engineers, any unusual condition in the reservoir or along downstream channels that might temporarily interfere with the planned flood control operation of the reservoir.
- d. Keeping downstream interests advised of impending changes in flood control releases which may affect them.
- e. Reporting by telephone to the Reservoir Regulation Section, Sacramento District, Corps of Engineers, the data outlined in paragraph 8a below, and other data that may be requested from time to time.

f. Keeping informed of the rules and regulations contained in these instructions and bringing to the attention of the District Engineer, Sacramento District, Corps of Engineers, any feature contained herein that may require clarification or revision.

g. Immediately after the end of each month, transmitting to the Reservoir Regulation Section, Sacramento District, Corps of Engineers, data specified in paragraph 8b below.

8. OPERATION REPORTS

a. The reservoir operator or operating agency shall report by telephone to the Reservoir Regulation Section of the Corps of Engineers each work day between 8:00 and 9:00 a.m. during flood periods, and at other times upon request, data as follows:

(1) Elevation, storage, inflow, outflow, and anticipated outflow changes at New Bullards Bar Reservoir.

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

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

(1) Daily inflow, outflow, elevation, and storage at New Bullards Bar Reservoir.

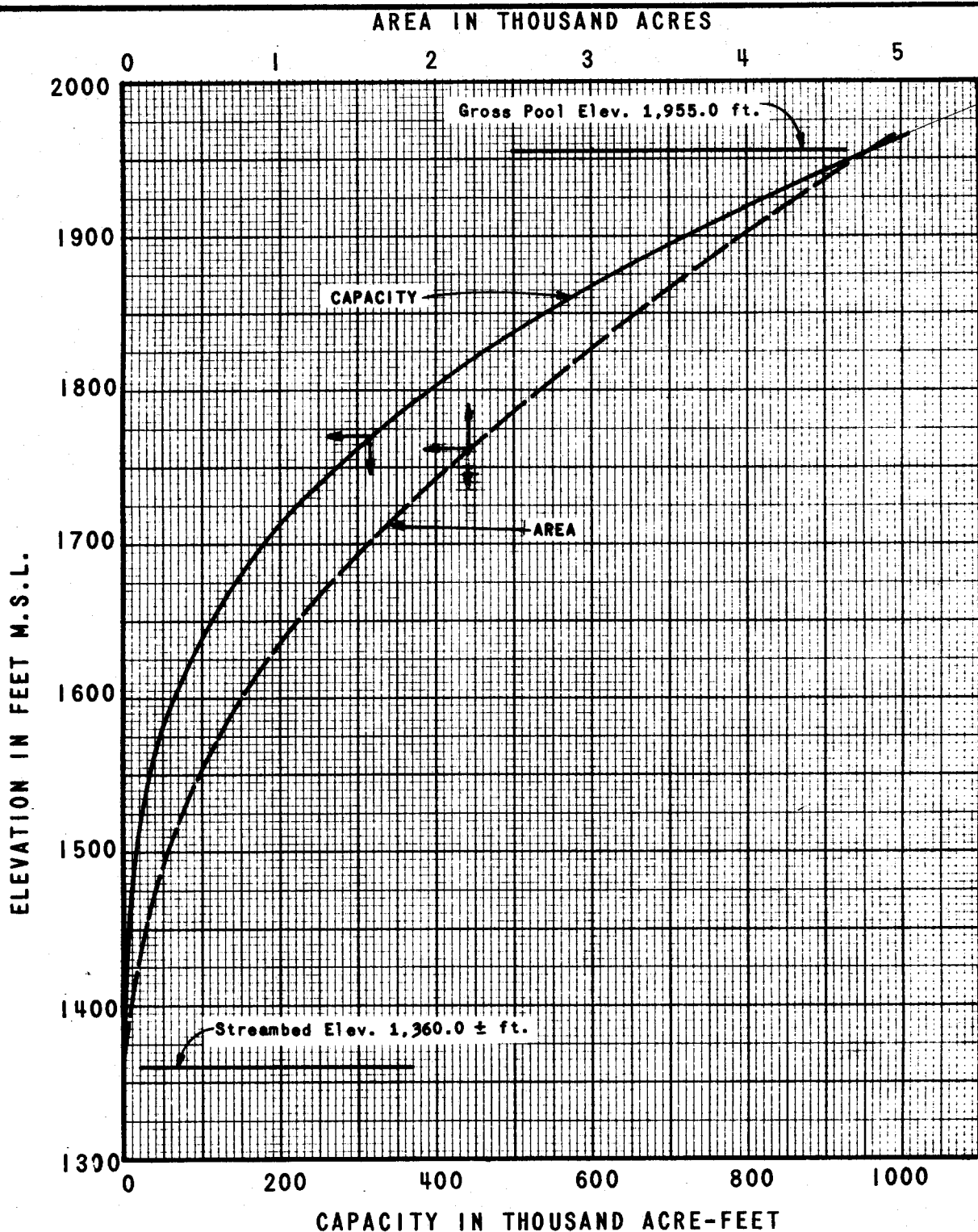
(2) Daily requirement of flood control space at New Bullards Bar Reservoir.

(3) Precipitation at New Bullards Bar Dam.

9. MODIFICATION OF REGULATIONS

a. The official regulations are subject to temporary modification by the District Engineer, Corps of Engineers, during flood emergencies. Permanent changes in the regulations may be made by reissuing them in the same manner as when originally prescribed.

b. The Administrator of the Yuba County Water Agency may temporarily suspend application of the flood control regulations for New Bullards Bar Reservoir in the event this is deemed necessary for emergency reasons to protect the safety of the dam, or to avoid other severe hazards. Revision of the flood control diagram for New Bullards Bar Dam and Reservoir may be made when necessary with the mutual consent of the Corps of Engineers and the Yuba County Water Agency.



NOTE:

Curves based on data furnished
by International Engineering
Company, Inc.

NEW BULLARDS BAR DAM AND RESERVOIR

NORTH YUBA RIVER, CALIFORNIA

AREA AND CAPACITY CURVES

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: CDM

Drawn: R.E.Y.

Date: OCTOBER 1971

NEW BULLARDS BAR RESERVOIR, NORTH YUBA RIVER, CALIFORNIA

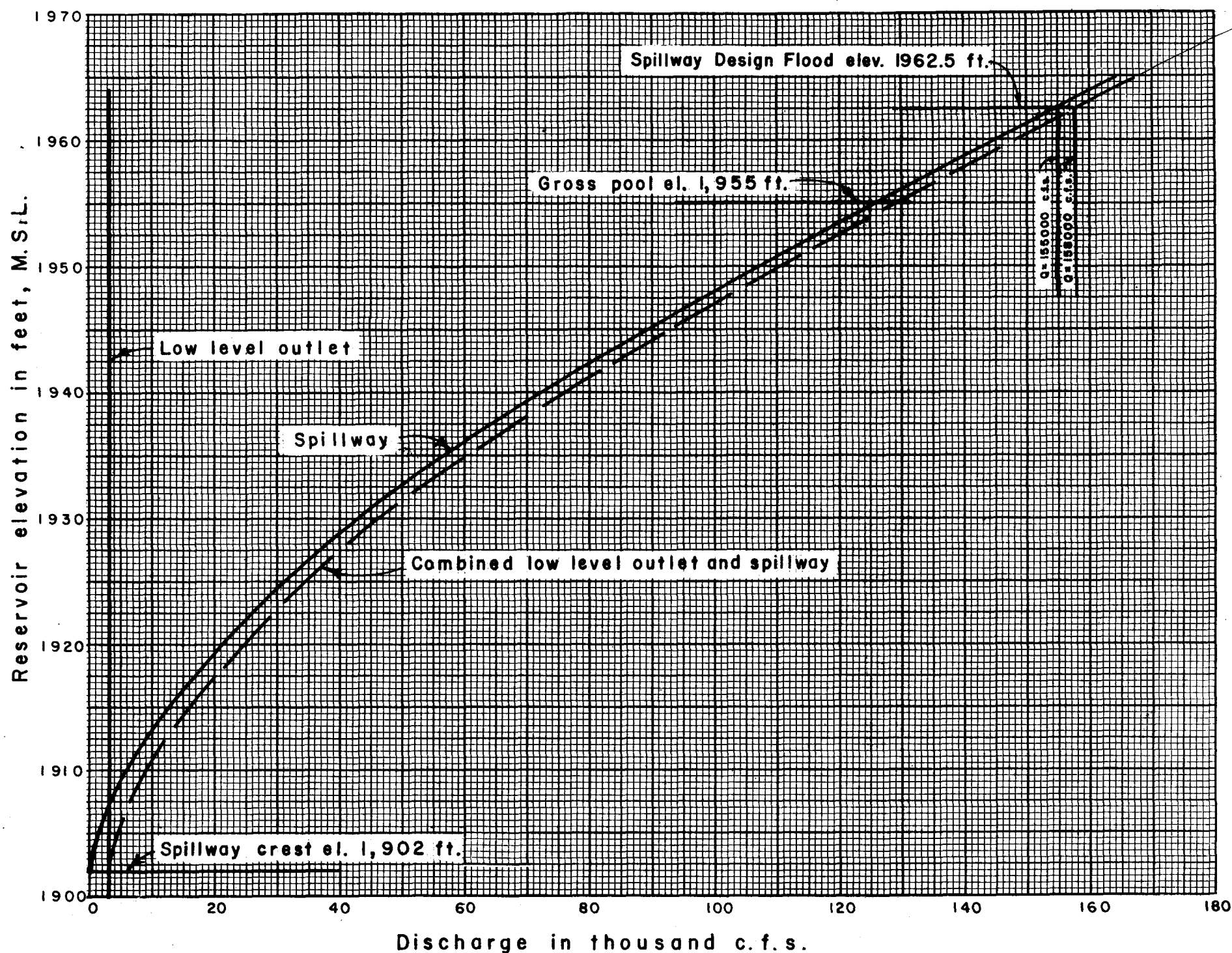
AREA AND CAPACITY TABLE
NEW BULLARDS BAR RESERVOIR

Oct. 1969

Elev in feet	Area in acres	Active capacity in acre-feet									
		0	1	2	3	4	5	6	7	8	9
1340	0	0									
1400	50	1,000									
1410	62	1,750									
1420	75	2,500									
1430	95	3,450									
1440	115	4,400									
1450	135	5,600									
1460	160	7,000									
1470	185	8,500									
1480	215	10,100									
1490	245	13,000									
1500	275	15,800									
1510	305	18,000									
1520	340	22,000									
1530	380	26,000									
1540	425	30,000									
1550	475	34,500									
1560	525	40,000									
1570	575	45,100									
1580	630	51,100									
1590	690	58,000									
1600	750	64,900	65,700	66,500	67,400	68,200	69,000	69,800	70,600	71,500	72,300
1610	820	73,100	73,800	74,600	75,400	76,200	77,000	77,800	78,700	79,600	80,400
1620	890	81,300	82,200	83,200	84,100	85,000	86,000	87,000	88,000	89,000	90,000
1630	960	91,000	91,800	92,600	93,400	94,200	95,000	96,100	97,200	98,400	99,500
1640	1,040	100,600	101,500	102,400	103,200	104,100	105,000	106,200	107,400	108,600	109,800
1650	1,120	111,000	112,200	113,400	114,600	115,800	117,000	118,200	119,400	120,600	121,800
1660	1,200	123,000	124,200	125,400	126,600	127,800	129,000	130,400	131,800	133,200	134,600
1670	1,280	136,000	137,200	138,400	139,600	140,800	142,000	143,400	144,700	146,100	147,400
1680	1,375	148,800	150,000	151,300	152,500	153,800	155,000	156,400	157,800	159,200	160,600
1690	1,475	162,000	163,600	165,200	166,800	168,400	170,000	171,700	173,300	175,000	176,600
1700	1,575	178,300	179,600	181,000	182,300	183,700	185,000	186,600	188,200	189,800	191,400
1710	1,675	193,000	194,800	196,600	198,400	200,200	202,000	204,000	205,900	207,900	209,800
1720	1,780	211,800	213,400	215,100	216,700	218,400	220,000	222,000	224,000	226,000	228,000
1730	1,890	230,000	231,800	233,600	235,400	237,200	239,000	241,100	243,200	245,400	247,500
1740	2,000	249,600	251,500	253,400	255,200	257,100	259,000	261,200	263,400	265,600	267,800
1750	2,110	270,000	272,200	274,400	276,600	278,800	281,000	283,200	285,300	287,500	289,600
1760	2,220	291,800	294,000	296,300	298,500	300,800	303,000	305,400	307,800	310,200	312,600
1770	2,335	315,000	317,400	319,800	322,200	324,600	327,000	329,200	331,400	333,600	335,800
1780	2,455	338,000	340,800	343,600	346,400	349,200	352,000	354,400	356,800	359,200	361,600
1790	2,575	364,000	366,600	369,200	371,800	374,400	377,000	379,600	382,200	384,900	387,500
1800	2,695	390,100	392,700	395,300	397,800	400,400	403,000	405,900	408,800	411,700	414,600
1810	2,815	417,500	420,400	423,300	426,200	429,100	432,000	434,900	437,800	440,600	443,500
1820	2,935	446,400	449,100	451,800	454,600	457,300	460,000	463,000	466,000	469,000	472,000
1830	3,055	475,000	478,000	481,000	484,000	487,000	490,000	493,500	497,000	500,500	504,000
1840	3,175	507,500	510,500	513,500	516,500	519,500	522,500	526,000	529,500	533,000	536,500
1850	3,300	540,000	543,400	546,800	550,200	553,600	557,000	560,300	563,600	567,000	570,300
1860	3,430	573,600	577,300	581,000	584,600	588,300	592,000	595,600	599,200	602,800	606,400
1870	3,560	610,000	613,400	616,800	620,200	623,600	627,000	630,600	634,100	637,700	641,200
1880	3,690	644,800	648,800	652,900	656,900	661,000	665,000	668,600	672,200	675,800	679,400
1890	3,825	683,000	686,800	690,600	694,400	698,200	702,000	705,900	709,700	713,600	717,400
1900	3,965	721,300	725,400	729,600	733,700	737,900	742,000	746,000	750,000	754,000	758,000
1910	4,105	762,000	766,200	770,400	774,600	778,800	783,000	787,000	791,000	795,000	799,000
1920	4,250	803,000	807,400	811,800	816,200	820,600	825,000	829,500	834,000	838,500	843,000
1930	4,400	847,500	851,600	855,700	859,800	863,900	868,000	872,700	877,400	882,100	886,800
1940	4,550	894,500	896,000	900,500	905,000	909,500	914,000	918,700	923,400	928,100	932,800
1950	4,710	937,800	942,000	946,500	951,000	955,500	960,000	965,100	970,300	975,400	980,600
1960	4,875	985,700	990,600	995,400	1,000,300	1,005,100	1,010,000				

NOTES:

- Table furnished by International Engineering Company, Inc., 6 May 1969. Elevations given are U.S.G.S. datum.
- Minimum power pool elevation - 1732.0 feet.
- Gross pool elevation - - - - - 1955.0 feet
- Top of dam elevation - - - - - 1965.0 feet
- Top of parapet wall elevation - 1967.7 feet



NOTE:

Curves based on data furnished
by International Engineering
Company, Inc.

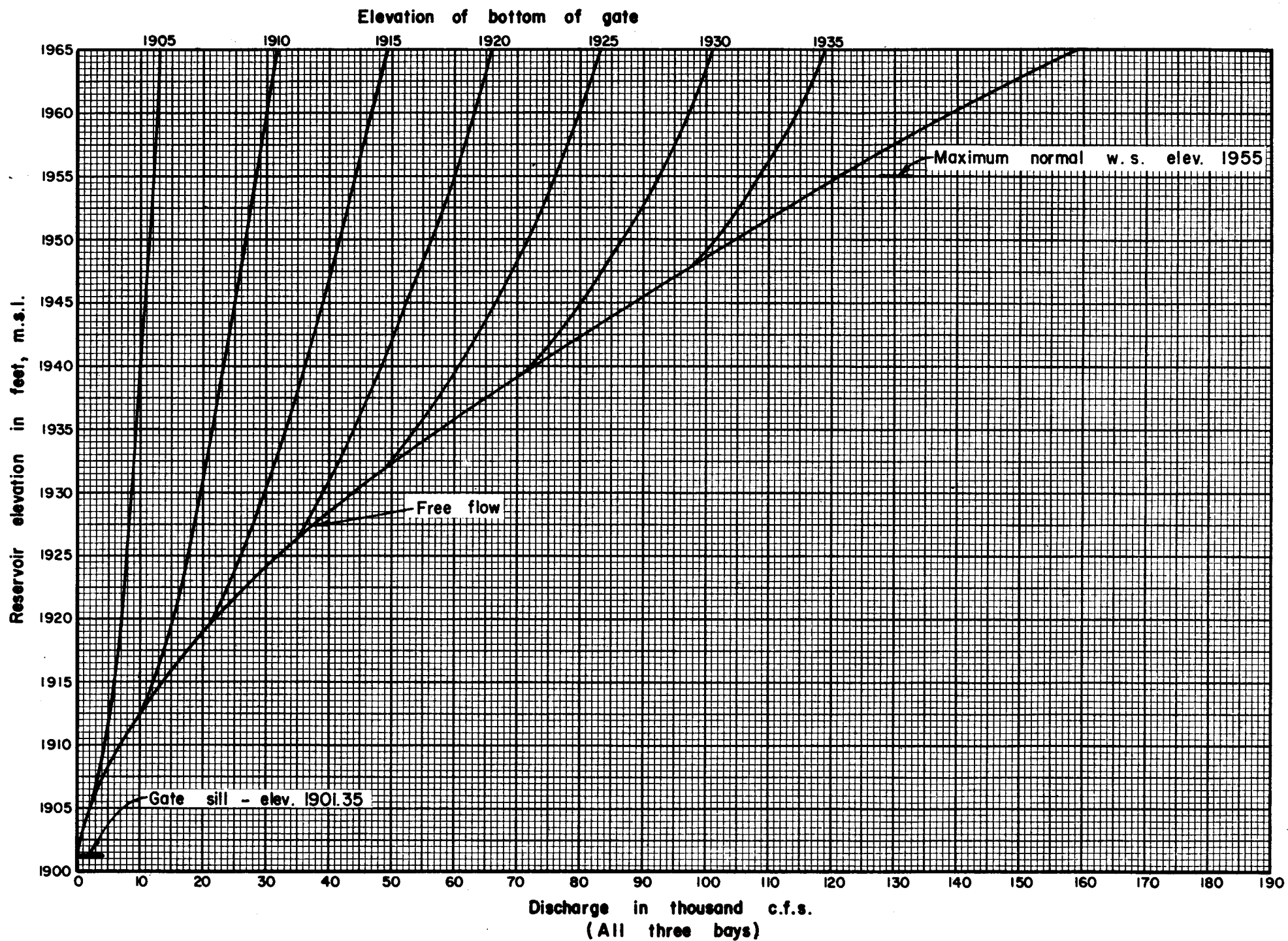
NEW BULLARDS BAR DAM AND RESERVOIR
North Yuba River, California

**SPILLWAY AND OUTLET
RATING CURVES**

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: C. D. M.
Drawn: L. R. B.

Date: October 1969



Note:

Drawing furnished by International Engineering
Company Inc.

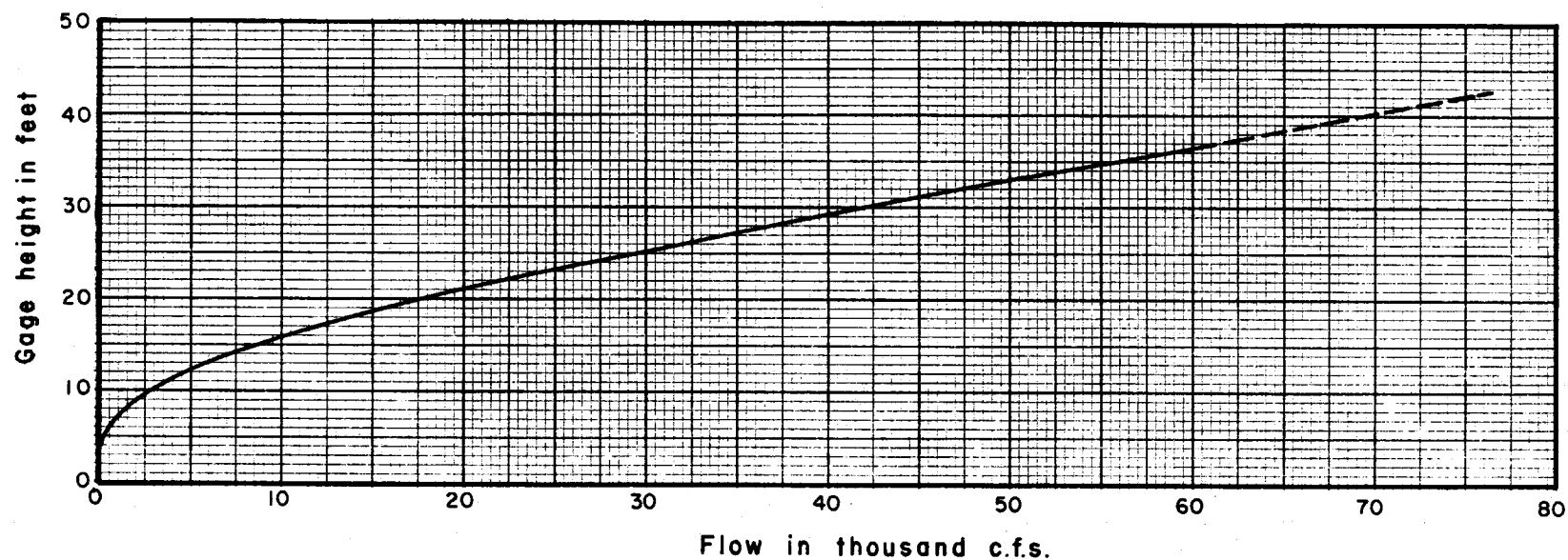
NEW BULLARDS BAR RESERVOIR
NORTH YUBA RIVER, CALIFORNIA

SPILLWAY DISCHARGE RATING CURVES

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: D.D.D.
Drawn: T.G.K.

Date: FEBRUARY 1972



NEW BULLARDS BAR RESERVOIR
North Yuba River, California

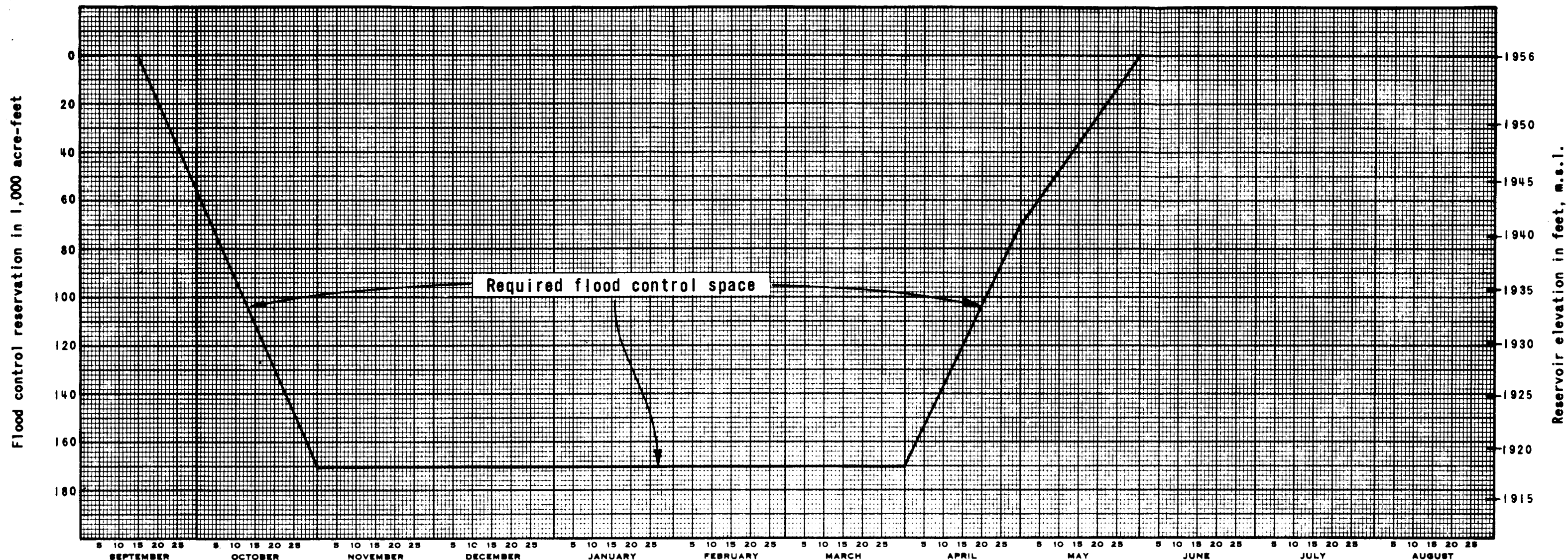
RATING CURVE
NORTH YUBA RIVER
(Below New Bullards Bar Dam)

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: D.D.D.

Drawn: R.E.Y.

Date: November 1971



NOTES:

1. Water stored into the flood control reservation shall be released as rapidly as possible without causing flows in North Yuba River below New Bullards Bar Dam to exceed 50,000 c.f.s. Greater releases, up to the maximum experienced rate of inflow to the reservoir during the current flood event, may be made when reservoir storage and actual or forecast inflows indicate such releases are required, provided downstream limitations on flows are observed.
2. Water will not be released at such rates as will cause flows to exceed 120,000 c.f.s. in Yuba River at Marysville when concurrent flows in Feather River are high. If necessary, however, releases may be increased when concurrent flows in Feather River are low; provided that flows in Yuba River at Marysville do not exceed 180,000 c.f.s.
3. Flood control releases shall not be changed more than 5,000 c.f.s. per hour.
4. When flood control releases are required by this diagram and the reservoir elevation is rising rapidly, the necessity for emergency spillway releases shall be determined by the operating agency, or by the dam operator if communications have been lost, by frequently checking the emergency spillway release diagram to determine if releases at rates greater than flood control objective rates are required.

NEW BULLARDS BAR DAM AND RESERVOIR
North Yuba River, California

FLOOD CONTROL DIAGRAM

Prepared Pursuant to Flood Control Regulations for New Bullards Bar Dam and Reservoir in accordance with the Code of Federal Regulations Title 33 Part 208.11.

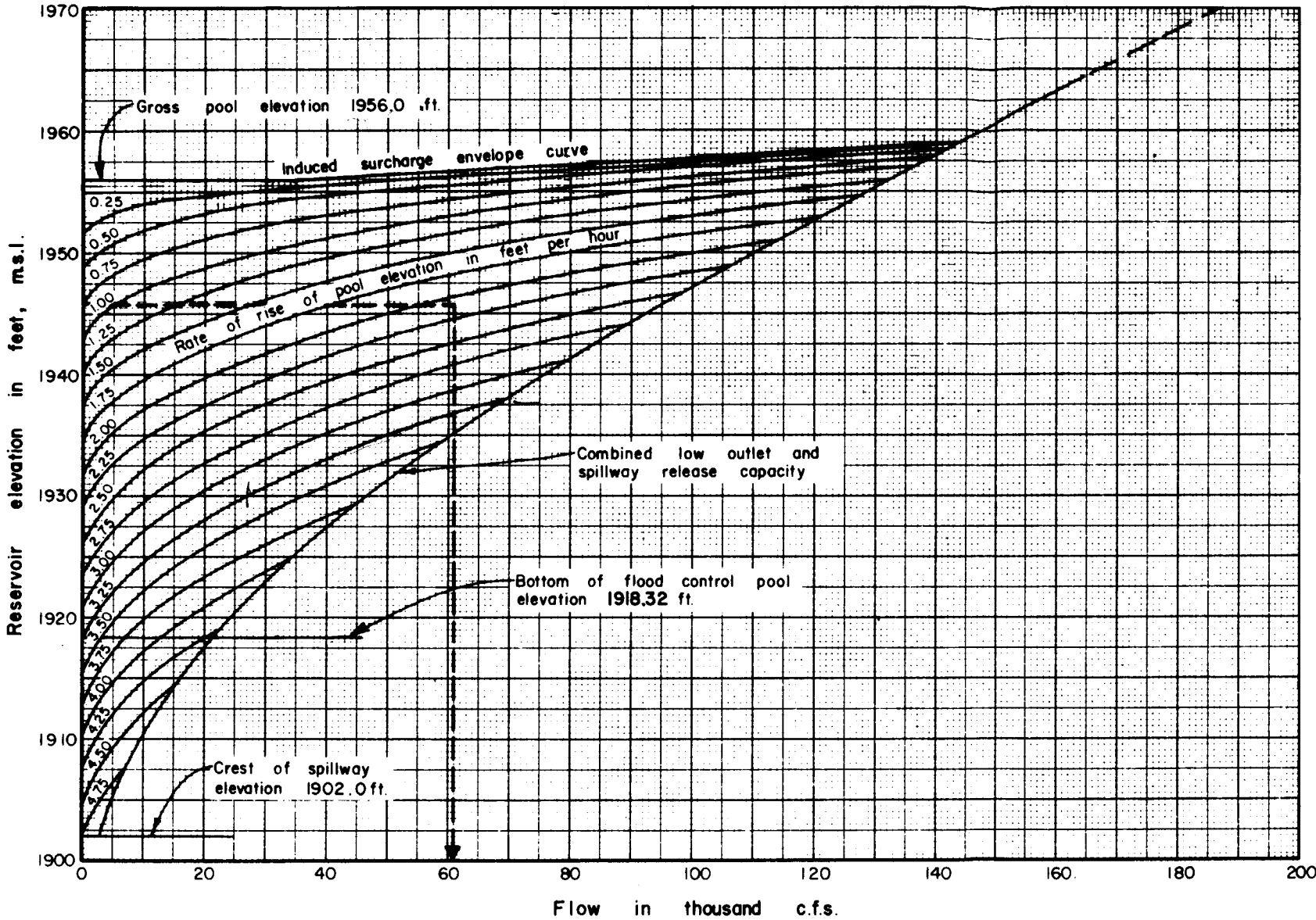
APPROVED: *[Signature]*
ADMINISTRATOR, YUBA COUNTY WATER AGENCY

APPROVED: *[Signature]*
COLONEL, USA, DIVISION ENGINEER
SOUTH PACIFIC DIVISION

Effective Date: 8 JAN 1978 File No: YU-1-20-12

OPERATING INSTRUCTIONS

1. Follow regular flood control regulation schedule until larger releases are required by this schedule.
2. Adjust the spillway outflow each hour on the basis of the rise of pool elevation in feet for the preceding hour and the current reservoir elevation as indicated by the curves. (If the reservoir elevation is still rising, continue this spillway outflow adjustment until the gates are fully open.)
3. After the reservoir elevation starts to fall, maintain current gate openings until the reservoir water surface has receded to 1956.0 feet (gross pool). Once the pool has dropped below elevation 1956.0 feet, the releases may be decreased by 5,000 c.f.s. each hour until outflow is reduced to 50,000 c.f.s. after which objective releases required by the flood control diagram will be made until the pool has receded to the bottom of the required flood control space.
4. Once operation in accordance with the emergency spillway release diagram is initiated, gate changes shall be made only in accordance with the above criteria.



NOTE:
Discharge through the spillway is controlled by three 30.0' x 53.0' gates.

EXAMPLE OF DIAGRAM USE (All values in 1000's)

Reservoir elev. in ft. (at end of hour)	Rate of rise of pool elev. ft./hr.	Release for next hour (c.f.s.)
1943.7		
1945.8	2.1	61.0
1947.7	1.9	67.0
1949.6	1.9	90.0
1951.7	2.1	Gates fully open
1953.7	2.0	Gates fully open

Assume reservoir elevation at 1945.8 feet (see dashed line) and the rise of pool elevation for the previous hour at 2.1 feet, read from diagram the required average release of 61,000 c.f.s. for the next hour of operation, and adjust spillway gates accordingly.

NEW BULLARDS BAR DAM AND RESERVOIR
North Yuba River, California

EMERGENCY SPILLWAY RELEASE DIAGRAM

Prepared Pursuant to Flood Control Regulations for New Bullards Bar Dam and Reservoir in accordance with the Code of Federal Regulations Title 33 Part 208.11.

APPROVED: *[Signature]* ADMINISTRATOR, YUBA COUNTY WATER AGENCY

APPROVED: *[Signature]* COLONEL, USA, DIVISION ENGINEER
SOUTH PACIFIC DIVISION

Effective Date: 8 JAN 1978 File No. YU-1-20-13

FIELD WORKING AGREEMENT
BETWEEN
YUBA COUNTY WATER AGENCY
AND
DEPARTMENT OF THE ARMY, CORPS OF ENGINEERS
FOR
FLOOD CONTROL OPERATION
OF
NEW BULLARDS BAR DAM AND RESERVOIR
ON
NORTH YUBA RIVER, CALIFORNIA

THIS agreement, made and entered into this 3rd day of January 1978, between the Yuba County Water Agency and the Corps of Engineers,

WITNESSETH THAT:

WHEREAS, under terms of contract number DA-04-167-CIVENG-66-94 entered into 9 May 1966 by the United States of America and the Yuba County Water Agency, the Water Agency agreed to provide 170,000 acre-feet of flood space in New Bullards Bar Reservoir, and

WHEREAS, Yuba County Water Agency, owner and operator of New Bullards Bar Reservoir, represented by the Administrator is responsible for normal operations and structural safety of the project, 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 plan of said dam and reservoir 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, 15 May 1976, 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 project operation.

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

(a) Conservation operations shall be in accordance with Yuba County Water Agency criteria as determined by the Administrator or his designated representative.

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

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

(d) The Yuba County Water Agency is responsible for the safety of the dam and appurtenant facilities and for regulation of the New Bullards Bar 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 Yuba County Water Agency, and does not relieve the Yuba County Water Agency of the responsibility for safety of the New Bullards Bar Project.

(e) Revisions of the Flood Control or Emergency Spillway Release Diagrams 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 Diagram 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 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.

(h) The Administrator shall procure such current basic hydrologic data and make such current determinations of required flood control space and releases at the reservoir independently or in conjunction with the Corps of Engineers as are required to accomplish the flood control objectives.

(i) The Administrator shall keep the District Engineer advised of such reservoir operating data as the District Engineer may request. The minimum data required is reservoir storage, releases and streamflow at control points designated by the Flood Control Diagram 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 Administrator and shall include justification for the action.

(k) The Administrator 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

YUBA COUNTY WATER AGENCY

By:


Division Engineer
South Pacific Division

By:


Administrator

CODE OF FEDERAL REGULATIONS

TITLE 33 - NAVIGATION AND NAVIGABLE WATERS

Chapter II - Corps of Engineers
Department of the Army

PART 208 - FLOOD CONTROL REGULATIONS

NEW BULLARDS BAR DAM AND RESERVOIR
NORTH YUBA RIVER, CALIFORNIA

Pursuant to the provisions of Section 7 of the Act of Congress approved December 22, 1944 (58 Stat. 890; 33 U.S.C. 709), the following Part #208. _____ regulations are hereby prescribed to govern the operation of New Bullards Bar Dam and Reservoir on North Yuba River, California, in the interest of flood control:

PART 208. - NEW BULLARDS BAR DAM AND RESERVOIR, CALIFORNIA.

The Yuba County Water Agency, Marysville, California, represented by the Administrator in charge of the Agency, hereinafter referred to as the Administrator, shall operate or otherwise effect the operation of New Bullards Bar Dam and Reservoir in the interest of flood control in accordance with instructions furnished by the Department of the Army, represented by the District Engineer in charge of the locality, hereinafter referred to as the District Engineer, as follows:

a. Storage space in New Bullards Bar Reservoir of 170,000 acre-feet below elevation 1955.00 feet, shall be kept available for flood control purposes on a seasonal basis in accordance with the Flood Control Diagram currently in force. The Flood Control Diagram in force as of the

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promulgation of this section is that dated _____, File No.

YU-1-20-12.

b. Except when greater releases are required as prescribed in paragraph (c) of this section, releases from New Bullards Bar Reservoir shall be restricted insofar as possible to quantities which will not cause flows in the North Yuba River below Bullards Bar Dam, or in Yuba River above Feather River to exceed the controlling flow rates specified on the Flood Control Diagram currently in force. Any water temporarily stored in the flood control space indicated by the Flood Control Diagram shall be released as rapidly as can be safely accomplished without causing downstream flows to exceed the rates of flow shown thereon.

c. In the event the reservoir level at New Bullards Bar Reservoir approaches or exceeds the top of flood control pool elevation 1955, subsequent operation shall be in accordance with the Emergency Spillway Release Diagram currently in force, or the Flood Control Diagram currently in force, whichever requires the greater release. The Emergency Spillway Release Diagram in force as of the promulgation of this section is that dated _____, File No. YU-1-20-13.

d. Except as necessary in order to comply with the provisions of the Emergency Spillway Release Diagram under paragraph (c) above, the regulations of this section shall not be construed to require dangerously rapid changes in magnitudes of release or that releases be made in a manner that will be inconsistent with requirements for protecting the dam and reservoir from major damages.

e. The Administrator 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 prescribed in this section.

f. The Administrator shall keep the District Engineer currently advised of reservoir storage and such other operating data as the District Engineer may request.

g. The flood control regulations of this section are subject to temporary modification by the District Engineer if found necessary in time of emergency. Requests for and action on such modifications may be made by any available means of communication, and the action taken by the District Engineer shall be confirmed in writing under date of same day to the office of the Administrator.

h. The Administrator may temporarily suspend application of the flood control regulations of this section in the event it is deemed necessary for emergency reasons to protect the safety of the dam, or to avoid other serious hazards. Such action shall be immediately reported by any available means of communication, and confirmed in writing under date of same day to the District Engineer.

i. Revision of the Flood Control or Emergency Spillway Release Diagrams requires approval of the Chief of Engineers, or his duly authorized representative, and the Administrator of the Agency. Each such revision shall be effective upon the date specified in the approval, and from that date until replaced shall be the diagram in force for the

purpose of this section. The Flood Control and Emergency Spillway Release Diagrams are on file in the Office, Chief of Engineers, Department of the Army, Washington, D.C., and the office of the Administrator of the Agency, Marysville, California. Copies of the diagrams currently in force shall be kept on file in and may be obtained from the offices of the District Engineer, Corps of Engineers, Sacramento, California, and the Administrator, Yuba County Water Agency, Marysville, California.