State of California

THE RESOURCES AGENCY

Department of Water Resources

BULLETIN No. 161

FLOOD!

DECEMBER 1964—JANUARY 1965

JANUARY 1965

HUGO FISHER
Administrator
The Resources Agency

EDMUND G. BROWN
Governor
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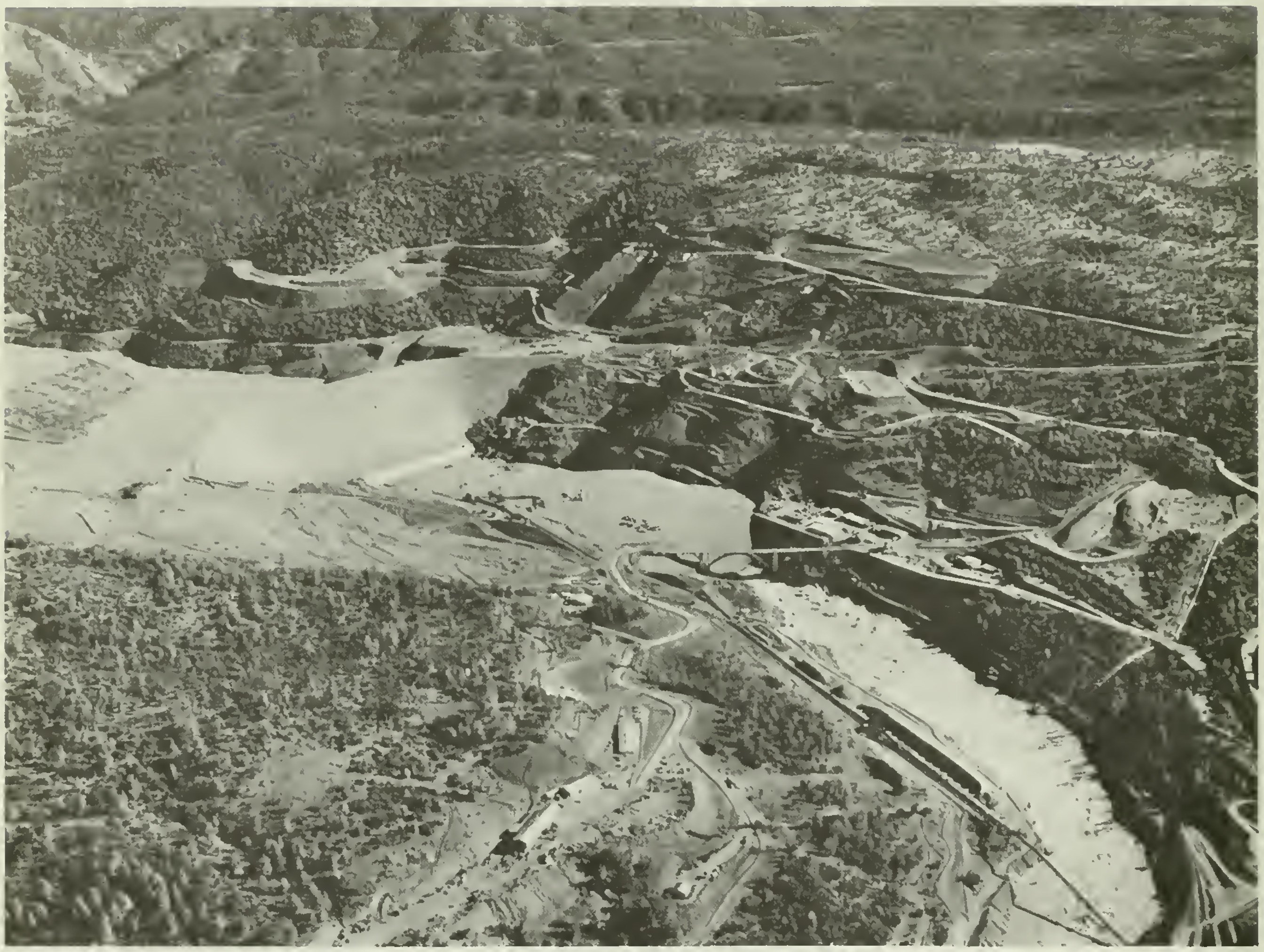

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FOREWORD

The purpose of this report is to document and disseminate, very quickly, as much data as possible about the Floods of December 1964 - January 1965.

Here then, is published a great deal of preliminary information about the floods: The meteorological conditions and the storm itself; precipitation amounts; runoff quantities and hydrographs; reservoir operation data; damage information; and pictures.

But raw figures and graphs and charts and even pictures do not tell the entire story of a flood, for floods effect people. And once again during the Christmas season it was the people of many areas of Northern California who were challenged and tested by a capricious mother nature. "Good will to men" took a somewhat different form during Christmas 1964 in these areas of Northern California. It took such improbable forms as helicopter pilots flying -- and dying on rescue missions, and in many places there were more sandbags filled than stockings, and the lights were on the levees -- not on the trees. That part of the flood story, the people, is beyond the scope of this report.

This report is for the engineers, planners, and other technical people who need to know as much as they can, as quickly as they can, about the flood. Much of the data is of course preliminary and will be revised, where necessary, when this information is published at a later date in the annual Bulletin 69-65 - California High Water.

Much of the data for this report was furnished by the many public and private agencies involved with hydrological activities and flood operations. Their cooperation is gratefully acknowledged.

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STATE OF CALIFORNIA
THE RESOURCES AGENCY
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THE FLOODS OF DECEMBER 1964 - JANUARY 1965

INTRODUCTION

Flood! With quickening pace the rivulets of water stream down the slopes of the mountains of the Coast Range and Sierra to swell into wild angry rivers. Combining forces, these raging torrents surge through the foothill areas and sweep relentlessly into the vulnerable valleys below.

This scene has been repeated many times in California since the legendary flood of 1861-62. Each time the dark, swirling waters find more works of man built to slow and control them. But in California, man is not yet to that inevitable point in time when he is master of the flood situation, and he is particularly defenseless in the North Coast.

Nature once again chose Christmas to prove how vulnerable the North Coast area is -- and she made her point. "A major American disaster" said Governor Brown viewing the North Coast devastation. Further inland, the Sacramento Valley, too, was subjected to rainfall that seemed interminable and runoff quantities that staggered the imagination. But here, in the Sacramento Valley, man had made his mark; with dams and reservoirs, channels, bypasses, and levees. Man won in the inland fight -- if anyone wins in a flood. At least man didn't lose.

There were a number of similarities between the floods of 1964 and 1955. The weather patterns had shown evidence several times during the fall of 1964 of developing into a 1955 storm situation. Once again, on the weekend of December 19-20, meteorological events began etching a picture of impending trouble. A combination of factors; a warm mass of

moist Pacific air, a flow of cold air from an Alaskan high, a low pressure trough off the coast, and a strong westerly flow completed the meteorological picture to provide almost optimum conditions for heavy precipitation. This was the weather pattern on December 21, 1964 -- and in December 1955.

The potential of the meteorological situation was realized. The North Coast received very heavy rainfall accompanied by strong gusty winds. As the storm moved inland, precipitation was centered primarily in the basins of the Feather, Yuba, and American Rivers. The heaviest rains occurred on December 22 and 23, however, the nine-day totals (December 19-27) were also quite impressive.

Resultant runoff from the streams of the Coast Range, almost without exception, produced peak stages and peak flows that exceeded previous records. Runoff from the Sierra, in the Feather, Yuba, and American Rivers surpassed all previous records. In the remaining watersheds of the Sacramento Valley, peak stages and flows tended to about equal those experienced in 1955. In the northern San Joaquin Valley, runoff from streams of the Sierra was high but not of record-breaking proportions. The second storm, of early January, was centered further south than the Christmas storm and produced flows in northern San Joaquin streams that were generally higher.

This flood report provides in subsequent pages a compilation in more detail of the facts and figures of the December 1964 - January 1965 flood. The period covered is from December 19, 1964 to January 15, 1965. The information is presented in various forms -- tables, graphs, plates and written description. It is a provisional technical record, subject to change later as all basic data is collected and analyzed more thoroughly.

METEOROLOGY OF THE FLOODS OF DECEMBER 1964 - JANUARY 1965

December 18-27, 1964 -- The Warm Phase

The memories of the notorious flood of December 1955 had scarcely dimmed with the residents of the North Coast area when another flood, even more destructive, hit this portion of the state nine years later. The flood of December 1964 - January 1965 has much similarity to the earlier flood with respect to the meteorological features; ironically, the peak flows on many of the streams occurred on the same date as in the earlier flood.

The broad-scale pressure pattern at the onset of the flood-producing rains was an elongated area of low pressure across the Pacific Ocean, extending from the coast of British Columbia southwestward and westward into the latitude band 30°-40°N across the international date line. To the south of this elongated west-to-east low, the westerly winds were increasing on December 20 and carrying a series of frontal systems eastward toward the Washington-Oregon coast. This progression of events hastened the transport of warm, moist air from the southerly latitudes of the Pacific toward the coast. Here strong winds impinging on the coastal and inland mountain barriers were to bring optimum orographic lifting and release heavy precipitation from the cloud masses.

Another characteristic of the flow pattern was an area of high pressure over Alaska. The effect of this pressure feature was most clearly observed at the upper levels of the atmosphere, where the injection of cold polar air southward across the Gulf of Alaska was forced to flow into juxta-position with the warm air current emanating from the southerly latitudes.

This strong contrast between cold and warm air masses brought into confluence served to strengthen the westerly wind flow and maintain an energy-explosive frontal boundary straddled across the Oregon coast.

On Plate 1 is shown a schematic flow chart at the 500 millibar pressure surface (about 18,000 feet above sea level) depicting the general air flow of the troposphere during the pre-Christmas period when the rains fell most intensely over Northern California. This flow pattern bears a close resemblance to that in December 1955. The belt of maximum winds in the 1964 storm was a little further north than in the 1955 pattern, but in both years the origin of the problem was the sustained flow of moist, tropical air over California.

In the following paragraphs the synoptic events are described in more detail with additional charts to illustrate this meteorological event.

On the weekend of December 19 and 20, 1964, a semistationary low was centered off the British Columbia coast. This low was narrowly separated from a more extended area of low pressure in the central Pacific by a ridge of high pressure extending southeastward from the Aleutian Islands. A weak southwest flow of moderately moist air over California was bringing some light precipitation to Northern and Central California. The snow level* of the precipitation in the central Sierra (American River Basin) was about 6,000 feet. Late on Sunday, December 20, the protective ridge collapsed and a migratory low pressure center headed towards the Oregon coast. This development was to set the stage for the next five days when

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*Snow level here is defined as the level where the precipitation form changes from rain to snow.

a strengthened southwest current was to bring a warm, moist air mass to batter the northern half of the state. On the following days a series of migratory low pressure centers moved eastward from the vast mid-Pacific spawning area toward the Pacific Northwest, but the frontal system separating the cold and warm air masses did not penetrate southward into California, except briefly, until Christmas Day. To the south of this front the pressure gradient directed from south to north remained strong. This pressure differential, which is normal to the wind flow, is shown on Plate 2 where the time graph of the pressure difference between San Francisco and Arcata has been plotted along with the Oakland and Medford 850 millibar wind speeds (about 5,000 feet). On the upper part of the plate is shown the 6 hourly rainfall distribution at Ukiah (this station lies somewhat to the south of the heavy rainfall area in the Eel River Basin). This plot illustrates the sustained strong flow which prevailed for a three-day period over the North Coast, as well as the inland areas.

The heavy rains were accompanied by strong, gusty surface winds. Rainfall reports from many stations in open exposures, especially in the North Coast area, indicate that the catch was deficient due to the turbulent winds. The airport at Arcata reported gusts of 40 to 50 mph. Other stations reported gusts of similar magnitude.

The warmth of the tropical air mass is illustrated by the time plot of the air temperature at two mountain stations, Sexton Summit in southern Oregon (elevation 3,841 feet) and Blue Canyon in the Sierra Nevada (elevation 5,280 feet). This is shown on Plate 3. The snow level at the warmest period was about 9,500 feet in southern Oregon and 10,500 feet at

the latitude of the Central Sierra. Significant also is that the high snow level remained for a period of several days.

Before the onset of the warm rainstorm, there was a snowpack of 2- to 3-foot depth in the mountains with the snow line near the 5,000-foot level. Warm temperatures accompanied the heavy rain on December 21 and 22, and measurements taken in the snowpack at a number of points in the Sierra following the storm indicated that the shallow, lower elevation snow melted and ran off as would be expected. However, at the higher elevations (above about 6,000 feet), the existing snowpack intercepted and retained much of the rainfall. As a result, and contrary to popular belief, the net contribution to the rain-fed runoff was probably negligible.

The heavy rains occurred primarily on the two days, December 21 and 22. Mass or accumulative rainfall curves for a number of stations are shown on Plates 4 and 5. The curves for the stations in the North Coast area, Ukiah, Willits-Howard, Redwood Creek (O'Kane)*, are based on either 6 hourly or variable-time increment data, but these curves serve to illustrate the time distribution of the rainfall. For the Sierra basins, mass rainfall curves for Brush Creek in the Feather River Basin, Camptonville in the Yuba Basin, and Blue Canyon in the American River Basin are shown on Plate 5. The data for Brush Creek and Camptonville have been obtained from the Department's radio rain gages; data for Blue Canyon, available only through December 31, was taken from the published "Local Climatological Data" by the U. S. Weather Bureau. The table below shows one-day, two-day,

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*Station located near where Highway 299 crosses Redwood Creek.

and three-day precipitation totals for selected Sierra stations for this storm compared to previous record storms.

TABLE 1

PRECIPITATION COMPARISONS - SIERRA NEVADA

Station	Dec. 1955	Oct. 1962	Jan.-Feb. 1963	Dec. 1964
		One-Day		
Brush Creek	8.68	11.40	4.99	9.41
Camptonville	8.85	6.94	5.91	8.83
Blue Canyon	7.44	7.37	8.70	9.33
		Two-Day		
Brush Creek	11.93	18.75	9.78	14.56
Camptonville	13.18	13.32	9.98	16.03
Blue Canyon	13.36	13.81	13.96	15.24
		Three-Day		
Brush Creek	13.64	23.70	12.55	18.76
Camptonville	16.38	18.47	12.07	20.03
Blue Canyon	18.55	19.55	16.01	19.79

On December 23, the weather maps indicated a general relaxing of the southwest flow of moist air. This occurred when the frontal boundary in the Pacific shifted far enough south to cut off the previously extended fetch of southwest winds blowing from the warm oceanic region of the Hawaiian Islands. Some precipitation still continued to fall through the Christmas holiday, but not with the intensity of the 2-day period December 21-22.

On December 26, a migratory low moving eastward on the frontal boundary into Washington succeeded in pushing the cold front southward across California, with the front passing the North Coast area in the early afternoon hours on December 26 and the lower Sacramento Valley late that evening. The passage of this front ended the warm phase of the storm.

The cold air pouring southward out of Alaska in the wake of the cold front established a pronounced trough of low pressure, both at the surface (sea level) and aloft, just off the west coast. The snow level in the North Coast area lowered to 1,500 feet and in the Central Sierra (east of Sacramento) to 3,000 feet. While the cold air feeding into this trough was unstable and generated numerous showers, including hail, the saving feature was that much of the precipitation falling on the already saturated watersheds came as snow.

During the post-frontal cold phase of the storm, snow fell in the mountains accompanied by strong winds, bringing blizzard-like conditions. This seriously impeded highway travel on the trans-Sierra routes and in the mountain regions of northwestern California where rescue operations were being carried out to aid flood-stricken inhabitants.

For the isohyetal maps, a map was prepared covering separately the warm phase of the storm, i.e., from the morning of December 18 to the morning of December 27, the latter date being the day the cold front moved through the state. For the North Coast area this is shown on Plate 7, and for the Central Valley drainage on Plate 9. In addition, for the North Coast area, Plate 8 shows the isohyetal map for the 24-hour period ending at 0800, December 22, 1964; this points out the heavy rain which fell on this area during the severest part of the storm.

Several stations in the south fork drainage of the Eel River reported quite large amounts: for the 24-hour period ending at 0800, December 22, Richardson Grove had 11.30 inches; Willits-Howard 8.67 inches; Garberville 8.29 inches; and Standish-Hickey State Park 10.57 inches.

For the 9-day period, December 18-27, the zones of maximum amounts included 30 inches in the Eel River Basin, and 25 inches in the Redwood Creek Basin and the lower Klamath River Basin. Maximum amounts in the Russian River Basin were 20 inches; Cache Creek Basin 5 inches; and in the Feather, Yuba, and American River Basins 35 inches.

January 2-7, 1965 -- The Second Phase

The cold trough of low pressure which developed off the coast on December 27 continued to maintain itself for the following 10 days. With this semistationary circulation pattern, northerly storm systems moving through the Gulf of Alaska were swept southward into this large scale trough. One frontal system, which was not significantly active weatherwise when it entered the trough on January 2, began to intensify at longitude 130°W and brought a new 5-day precipitation siege to the northern and central part of California. While this storm raised the snow level in the North Coast area from 1,500 to 3,500 feet and in the Sierra Nevada from 3,000 to 5,500 feet, this storm did not have the extreme warmth of the December storm. Nevertheless, rainfall below the snow level was intense enough to bring new crests to most streams of the Sacramento drainage. Most of the rain fell in the 5-day period ending at 0800, January 7, with 10 inches in the Feather-Yuba Basins, and 9 inches in the American River Basin. This rainfall extended southward into the Sierra basins of the San

Joaquin Valley. The rainfall was sufficient to bring substantial runoff for the basins from the Mokelumne River south to the Chowchilla and Fresno Rivers. Rainfall amounts in these basins varied from 5 to 6 inches.

Mass rainfall curves for the two stations, Brush Creek in the Feather River Basin and Camptonville in the Yuba River Basin, are shown on Plate 6. The snow level in the Feather River Basin on January 3 was below the elevation of Brush Creek (3,560 feet), but rose to above the station elevation on January 4. The steepness of the mass rainfall curve around noon on January 4 was partly caused by the melting of snow which accumulated in the collecting funnel of the rain gage.

Above the snow level, accumulations to the snowpack amounted to 4 to 5 feet. Norden, at elevation 6,900 feet, which reported a snowpack of 86 inches on December 30, had 140 inches by January 4.

An isohyetal map for the Central Valley drainage covering the 5-day period from 0800, January 2 to 0800, January 7, 1965, is shown on Plate 10.

DECEMBER 25, 1964

U. S. 101 HIGHWAY THROUGH KLAMATH. THE KLAMATH RIVER ENVELOPED THIS COMMUNITY TO A DEPTH OF 15 FEET AT THE HEIGHT OF THE FLOOD; 98% OF THE TOWN WAS DESTROYED.

(PHOTOGRAPH COURTESY OF EUREKA NEWSPAPERS INC.)

DECEMBER 23, 1964

AERIAL VIEW OF HOLMES FLAT ALONG THE SURGING EEL RIVER

(PHOTOGRAPH COURTESY OF EUREKA NEWSPAPERS INC. - NEIL K. HULBERT)

DECEMBER 23, 1964

THE JOHN NUNES HOME AT GRIZZLY BLUFFS ENGULFED IN THE RAMPAGING FLOOD WATERS OF THE EEL RIVER. THE TEN MEMBER RAMILY WAS TRAPPED IN THE ATTIC FOR TWO AND A HALF DAYS BEFORE RESCUE. THE TWO MEMBERS SHOWN CLIMBED OUT ON TOP OF THE HOUSE AFTER CUTTING A HOLE THROUGH THE ROOF.

(PHOTOGRAPH COURTESY OF EUREKA NEWSPAPERS INC.- NEIL K. HULBERT)

DECEMBER 23, 1964

EEL RIVER DELTA AND FLOODED AGRICULTURAL LANDS NEAR FERNDALE. NOTE VEHICLES PARKED ON ONLY HIGH GROUND IN FRONT OF OLD FERNDALE CREAMERY.

(PHOTOGRAPH COURTESY OF EUREKA NEWSPAPERS INC. - NEIL K. HULBERT)

DECEMBER 24, 1964

DEVASTED TOWN OF WEOTT ALONG SOUTH FORK EEL RIVER.
U. S. 101 HIGHWAY IN BACKGROUND.

(PHOTOGRAPH COURTESY OF EUREKA NEWSPAPERS INC.- NEIL K. HULBERT)

RUNOFF

North Coast Area

The recent floods on the Smith, Klamath, and Eel Rivers exceeded all previous floods of record -- possibly even the unrecorded floods of 1861-62. The record-breaking flows in the Smith, Klamath, and Eel River Basins were generated by the 24-hour intense burst of rainfall that started on the late afternoon of December 21 -- and which followed the earlier, but less intense, precipitation. Although heavy flooding occurred along portions of the Russian and Mad Rivers, newly constructed dams (since 1955) temporarily retained upstream runoff and subsequently alleviated downstream peaks. On Redwood Creek, the town of Orick witnessed the passage of a crest within a foot of the 1955 peak.

The waves of devastation annihilated 26 important U. S. Geological Survey stream gages in the North Coast. Only on the Russian and the little Mattole Rivers are there composite records from which an exact analysis of the flood can be made. Consequently much of the data on the character of the rise was pieced together from scattered but valuable observations taken by residents throughout the North Coast.

The text which follows covering North Coast runoff is somewhat detailed and lengthy. However, this coverage in detail seems quite well justified considering the great significance of this flood and considering that previous floods in this area have not been too well documented.

At this time, the analysis of the flood can only be provisional. With the information available, this treatment will attempt to recreate, where possible, certain phases of the hydrological mechanism responsible for propagating the North Coast flood of December 1964.

Smith River Basin

Heavy precipitation during the latter half of December 1964 propagated record flows in the 613 square mile Smith River Basin. Located in the extreme northwest corner of the state, recorded precipitation for the December storm ranged from 9.21 inches on the coast at Crescent City to 26.59 inches at Gasquet Ranger Station, 12 miles inland along the Middle Fork of the Smitb River.

According to residents in the area, the Smith River near Crescent City apparently peaked during the morning of December 22 and held steady throughout the day at a level just under the 1955 peak stage. A sudden surge that evening pushed the river up another 5 feet to a reported stage of 44.5 feet around 2100 Pacific Standard Time (PST). One observer speculated that this rapid rise and even more rapid recession was caused by the breaching of a slide across the South Fork of the Smith River.

The maximum flow past the "Smith River near Crescent City" stream gage was reported to be 192,000 cfs compared to the 1955 peak of 165,000 cfs.

Tabulated below are representative stream and rainfall data available at this time.

TABLE 2

REPRESENTATIVE RAINFALL TOTALS FOR THE DECEMBER STORM
SMITH RIVER BASIN

Precipitation Gage	Rainfall Period (inclusive)	Rainfall Total (inches)
Crescent City	19-27	9.21
Crescent City 7ENE	19-27	18.71
Gasquet Ranger Station	19-27	26.59

TABLE 3

SELECTED PEAK RUNOFF EVENTS
SMITH RIVER BASIN

Stream Gaging Station	Drainage Area (Sq. Mi.)	Provisional Peak Flow (cfs)	Peak Discharge Per Sq. Mi.	Dec. 20-26, Runoff Volume		
				SFD	Acre-Feet	Inches Per Sq. Mi.
Smith River nr Crescent City	613	192,000	314	354,000	700,000	22

Klamath River Basin

The December flood affected devastation throughout the Klamath Basin from Iron Gate Dam in extreme north central California to the community of Klamath at the mouth of the river. The flood completely destroyed the important USGS stream gages on the Klamath River near Seiad Valley, and at Somesbar, in addition to inundating the gage below Iron Gate Dam and near Klamath. Many of the historic peaks which occurred in 1955 were exceeded. Only in the Trinity River subbasin were there instances of peak flows lower (because of Trinity Dam) than those occurring in 1955.

The following analysis first discusses the flood on the Klamath River from Iron Gate to Somesbar; then on the Trinity River from Trinity Dam to Hoopa; and lastly in the ungaged region from Klamath to Somesbar and Hoopa. Because of data limitations, this discussion has to be limited to generalities.

At Iron Gate Dam, Pacific Power and Light (PP&L) reported that a peak spill of around 23,000 cfs occurred at 2100 PST on December 22 over the 745-foot long side-channel spillway. The spillway has a design capacity of

30,000 cfs. The region above Iron Gate Dam (and from Shasta Valley) has perennially produced significantly lower runoff than the downstream regions through the combined effect of topography, diversions, and a series of four major PP&L dams. This flow past Iron Gate Dam during the flood merely sustained the recession further downstream.

The Shasta River peaked at 12.48 feet about 2200 PST, December 22. In 1955, the river peaked at 9.43 feet (6,090 cfs). The Shasta River is partially regulated by the 72,000 acre-foot Lake Dwinnel.

On the Klamath River at the Oak Knoll Ranger Station, an observer reported a peak 2 feet higher than the 1955 crest had occurred around 1800 PST, December 22. No discharge figures are available as this is not a rated section. The ranger estimated the recent peak to be 10 feet above flood stage.

At Happy Camp, another Forest Service ranger provided important relative stage data on the crest at this community. His data indicates the December flood peaked at around 0100 PST, December 23, approximately 10 feet above the 1955 crest.

Immediately above the "Klamath River at Somesbar" stream gage the Salmon River flows into the Klamath River. A Corps of Engineers' field team reported that a 2 to 3 million cubic yard slide occurred in the Salmon River canyon about 6 miles upstream from the mouth of the river. Reports from residents indicate that the slide occurred several hours before noon on December 22, impounded water to an unknown depth and eventually breached around 1700 PST, December 22.

At the "Klamath River at Somesbar" stream gage, high water marks suggest that the peak flow was around 300,000 cfs (75.4 feet). This radio telemark stream gage was completely destroyed.

Further downstream at Orleans, a crest occurred around 2400 PST, December 22, approximately 13 feet above the 1955 crest.

Tabulated below are peak stage data for the Klamath River at various points.

TABLE 4

PEAK STAGE DATA FOR THE KLAMATH RIVER

Station	Peak Stage Feet	Time - Date of Peak		1955 Peak Stage Feet
Iron Gate	13.63	2100	12/22/64	--
Shasta River near Yreka	12.48	2200	12/22/64	9.43
Oak Knoll	37.9	1800	12/22/64	35.9
Seiad Valley	--	Evening of December 22		29.2
Happy Camp	90-91	0130	12/23/64	81-82
Somesbar	75.4	--	--	59.4
Orleans	60	2300	12/22/64	47
Weitchpec	70	0100-0200	12/23/64	50
Klamath Glen	55.4	0200	12/23/64	49.7

Trinity Subbasin

During the storm period December 19-26, Trinity Reservoir stored approximately 372,200 acre-feet of runoff from the 718-square mile basin

above the dam. Apparently only 10 inches of runoff was contributed from the upstream area. The peak inflow to the reservoir probably occurred around 1400 PST, December 22, judging from reports received on the "Trinity River above Coffee Creek" stream gage which indicated the peak passed at 1230 PST that day.

Further downstream, "Trinity River near Burnt Ranch" stream gage recorded a peak of 79,000 cfs (29.84 feet) occurring at 2400, December 22. This flow was 93,000 cfs below the 1955 peak. (Trinity Reservoir undoubtedly had a peak inflow in excess of 100,000 cfs and was responsible for the comparatively low flows through this reach of the river.)

Along the South Fork Trinity River, peaks occurred in the late afternoon of December 22 in the upstream regions. At the "Trinity River near Salyer" stream gage, a peak of 95,000 cfs (47.6 feet) was generated around 2400 PST, December 22, compared to the 1955 peak of 65,100 cfs (39.4 feet).

Near Hoopa, the reported peak of 260,000 cfs (42.3 feet) occurred around 0200 PST, December 23. The peak here was probably caused by the near coincidence of the two peaks from the Trinity River and South Fork Trinity River plus heavy local runoff.

At this time, hydrographs of the Trinity River are not available for presentation here. Representative rainfall totals for the Klamath and Trinity River Basins are tabulated below.

TABLE 5

REPRESENTATIVE RAINFALL TOTALS FOR THE DECEMBER STORM
KLAMATH RIVER BASIN

Precipitation Gage	Rainfall Period (inclusive)	Rainfall Total (inches)
Orleans	19-26	17.66
Klamath Glen	19-26	18.15
Yreka	19-26	10.03
Fork Jones	19-26	6.50
Happy Camp	19-26	16.07

TABLE 6

REPRESENTATIVE RAINFALL TOTALS FOR THE DECEMBER STORM
TRINITY RIVER BASIN

Precipitation Gage	Rainfall Period (inclusive)	Rainfall Total (inches)
Forest Glen	20-26	22.06
Big Bar RS	19-26	12.91
Salyer RS	19-24	15.78
Hayfork RS	19-26	10.03
Hoopa 2SE	20-26	18.70
Coffee Creek RS	20-26	15.56

At "Klamath River near Klamath" stream gage a flow of about 650,000 cfs (55.3 feet) reportedly occurred around 0200 PST, December 23.

This tremendous discharge completely inundated the community of Klamath to a depth of 15 feet.

At this time, preliminary analysis shows that the hydrological mechanism which generated the peak at the town of Klamath was the result of the following:

(1) The surge from the Salmon River canyon,

(2) The tremendous local inflow from the basin below the Somesbar (Klamath River) and Hoopa (Trinity River) stream gages,

(3) The flow from the Klamath River above the Somesbar stream gage, and

(4) The flow from the Trinity River above the Hoopa stream gage.

Available reports would indicate that the surge from the Salmon River passed the town of Klamath before the 0200 PST peak. However, the recession from this surge would have been in progress to supplement the 0200 PST peak.

Analysis of the local ungaged area has shown it to be potentially a significant contributor of runoff. In fact the entire area possesses hydrological and topographical characteristics similar to the Smith River Basin from which acceptable analogies have been drawn. A synthesized hydrograph for this area shows that a peak of over 130,000 cfs could have been generated from the intense rainfall beginning the late afternoon of December 21. This local inflow peak would have passed Klamath several hours before the heavy contribution from the upper Klamath and Trinity Rivers arrived, but as with the Salmon surge, would have supplemented the 0200 PST peak.

The contribution from the Trinity River would have appeared in the downstream area before the record flows from the Klamath River became available. However, the time (in view of the hydrograph's durations) between arrival of these two peaks would have been insignificant. Thus, the near coincidence of the record flows out of the Klamath and Trinity Rivers supplemented by significant local inflow and the Salmon River surge combined to produce the destructive flows that inundated the town of Klamath.

Redwood Creek Basin

The USGS maintains two stream gages along this 50-mile long river. The upstream gage is known as "Redwood Creek near Blue Lake" and is set several hundred feet upstream from Highway 299 bridge, while the second gage, at Orick, is near the mouth of the river. The upstream river gage and an adjacent rain gage (Redwood Creek O'Kane) are equipped with radio telemarks which can be interrogated by the Eureka Weather Bureau.

During the December deluge over the Redwood Creek Basin, the upstream river gage withstood the record flow and, along with the rain gage, was interrogated frequently from Eureka. The downstream gage, however, was partially torn loose from the U. S. 101 highway bridge to which it is attached. Nonetheless, an observer at Orick was able to provide valuable stage information almost to the crest before he was forced to evacuate through a foot of water in his establishment.

These three gages were able to provide some interesting data on the character of the storm and flood in the basin. Interesting because the volume of runoff past the upstream gage was computed to be 27.9 inches from

December 20 through December 26, whereas the measured rainfall at the adjacent rain gage for the same period was 24 inches. Heavier upstream rainfall, poor rain gage exposure, rain gage location, and/or high winds could have acted individually or collectively to produce the obvious inconsistency. It can be said (with some reservation) that an average of about 35 inches of rain should have occurred over the basin.

The rain at Redwood Creek O'Kane, of course, cannot be taken as representing the basin average rainfall. However, since no rain gages are located in the basin above Redwood Creek O'Kane, no reasonable quantitative estimate of heavier upstream rain is possible at this time.

Heavier rainfall (other than that indicated at O'Kane) did occur in the basin above "Redwood Creek near Blue Lake". Table 7 illustrates that, per square mile, the region above this gage produced substantially a greater runoff volume -- somewhere in the order of 30 percent. That is, the basin above the upper gage produced about 0.74 sfd/sq.mi., whereas the basin between the Blue Lake gage above the Orick gage generated 0.56 sfd/sq.mi. The rain gage is protected by a tall, dense, circumjacent stand of trees which alleviate localized gusts near the orifice. High winds accompanied the rainfall throughout the North Coast and this factor remains as one of the most probable agents responsible for the discrepancy between rainfall and runoff. Weather stations at Arcata and Red Bluff indicated wind velocities in excess of 50 miles per hour.

TABLE 7

SELECTED PEAK RUNOFF EVENTS
REDWOOD CREEK BASIN

Stream Gaging Station	Drainage Area (Sq. Mi.)	Provisional Peak Flow (cfs)	Peak Discharge Per Sq. Mi.	Dec. 20-26 Runoff Volume		
				SFD	Acre-Feet	Inches Per Sq. Mi.
Redwood Creek nr Blue Lake	67.5	15,100	224	50,600	100,000	28
Redwood Creek at Orick	278	50,000	180	169,000	340,000	23

As on other North Coastal rivers there occurred two distinct peaks, approximately 24 hours apart, with the first and lower crest occurring on the afternoon of December 21. The first rise was generated by the brief but intense burst of rainfall from 0700 PST to 1100 PST on December 21.

TABLE 8

TIME TO PEAK FROM END OF PEAK RAINFALL

Gaging Station	December 21, 1964		December 22, 1964	
	Time of Peak	Time to Peak	Time of Peak	Time to Peak
Redwood Creek near Blue Lake	1300 PST	2 hours	1400 PST	0 hours
Redwood Creek At Orick	1700 PST	6 hours	1900 PST	3 hours

Following 6 hours of insignificant rainfall, over 8.5 inches of rain were reported at the rain gage during the next 21 hours. This produced a peak at "Redwood Creek near Blue Lake" of around 15,000 cfs and a stage of

15.6 feet, (compared to 12,100 cfs and stage of 13.68 feet in 1955). Further downstream at Orick a peak near 50,000 cfs occurred several hours later.

Time of peaks tabulated here disagree somewhat with the figures shown in Table 8. Examination of the hydrographs on Plate 11 indicate that the river had effectively peaked (within 0.2 foot) slightly earlier from the prolonged, intense burst of rainfall beginning 1700 PST, December 21. In the basin above Blue Lake, the ratio of rain to runoff was approaching (if not equaling) unity. In other words, almost 100 percent was occurring as runoff. The intense rain had (by 1400 PST, December 22) completely saturated the basin so that even had the rain continued at the same intensity, a substantially higher peak would not have occurred.

Mad River Basin

On December 20, an observer at Ruth Dam reported a 24-hour total rainfall of 5.77 inches. Runoff from this rainfall was sufficient to fill the nearly 3,000 acre-foot of storage remaining in Ruth Reservoir and initiate minor spilling over the 100-foot wide spillway. Thus, the new Ruth Dam (maximum capacity 51,800 acre-feet) was not able to store (permanently) any of the excessive runoff that resulted from the heavy rain during the subsequent two days. The volume of runoff contributed from the Mad River Basin above Ruth Dam has been estimated to be

approximately 129,000 acre-feet (20 inches per square mile) for the period December 20 through 26, inclusive.

At "Mad River near Forest Glen" stream gage about 9 miles downstream, a reported peak of 20,100 cfs (16.86 feet) occurred at 1700 PST, December 22. This crest was far below the 1955 peak of 39,200 cfs (24.5 feet).

At "Mad River near Arcata" stream gage, a peak of 71,000 cfs (23.4 feet) occurred at 0200, December 23. In 1955, the Mad River near Arcata peaked at 77,800 cfs (27.30 feet). The intakes to the stream gage were damaged such that drawdown within the gage well occurred. The discharge was rated to the 26.0-foot high water mark found on the outside of the well.

TABLE 9

SELECTED PEAK RUNOFF EVENTS
MAD RIVER BASIN

Stream Gaging Station	Drainage Area (Sq. Mi.)	Provisional Peak Flow (cfs)	Peak Discharge Per Sq. Mi.	Dec. 20-26, Runoff Volume		
				SFD	Acre-Feet	Inches Per Sq. Mi.
Ruth Dam	119	--	--	65,000*	129,000*	20*
Mad River nr Forest Glen	143	20,100	141	--	--	--
Mad River nr Arcata	484	71,000	147	213,000	420,000	16

*Estimated

TABLE 10

REPRESENTATIVE RAINFALL TOTALS FOR THE DECEMBER STORM
MAD RIVER BASIN

Precipitation Gage	Rainfall Period (inclusive)	Rainfall Total (inches)
Forest Glen	20-26	22.06
Bridgeville	20-26	16.99
Blue Lake Guest	20-24	17.98

Ruth Dam probably held in temporary storage about 24,000 acre-feet (3.76 inches) during the time of peak runoff. Because of this, the reservoir probably delayed the upstream peak contribution and alleviated the downstream crest until portions of intervening local inflow passed the Arcata gage.

Mattole River Basin

The 240-square mile Mattole River Basin experienced heavy rainfall during the storm period. At Honeydew, a December 19-24 rainfall total of 26.0 inches was recorded.

The resulting runoff generated a peak flow of over 80,000 cfs (28.2 feet) on December 22, well below the 90,400 cfs (29.6 feet) recorded in 1955.

Eel River Basin

Every important stream gage in the Eel River was either destroyed or inundated. At this time, only the Fernbridge stage hydrograph is complete for the entire storm runoff duration. The following discussion is

therefore based on preliminary high water marks and corresponding peak discharges. Residents of the basin provided information on the time the crest apparently occurred.

Scott Dam is a concrete gravity structure situated in the headwaters of the Eel River Basin north of Clear Lake. At the start of the storm, only 16,400 acre-feet of storage (1.05 inches/square mile) was available behind Scott Dam in Lake Pillsbury. The reservoir became full early December 21 and by 1600 PST that day was reportedly spilling 6,400 cfs. At the peak the following afternoon, approximately 58,000 cfs was passing over the crest of the dam. The time of this peak was probably around 1900 PST. Eight miles downstream at Van Arsdale Dam an observer recorded the passage of a crest at 1930 PST, December 22, which was later estimated to be 62,000 cfs. Scott Dam undoubtedly attenuated the inflow hydrograph both in magnitude and duration, causing the time of peak contribution to be delayed several hours in the downstream regions.

At the "Eel River above Dos Rios" stream gage, high water marks indicated that the river crested at 54 feet (175,000 cfs) about 8.6 feet above the December 1955 peak.

On the Middle Fork of the Eel River, the U. S. Forest Service rangers near Covelo provided valuable stage information. They indicated that a minor peak occurred at 2000 PST, December 21 as a result of the heavy rain which fell around noon. A prolonged intense period of rainfall through the morning of the 22nd generated a peak flow of 165,000 cfs (33.1 feet) at 2100, December 22. The 1955 peak was 89,100 cfs (25.0 feet).

TABLE 11

SELECTED PEAK RUNOFF EVENTS
EEL RIVER BASIN

Stream Gaging Station	Drainage Area (Sq. Mi.)	Provisional Peak Flow (cfs)	Peak Discharge Per Sq. Mi.	Dec. 20-26, Runoff Volume		
				SFD	Acre-Feet	Inches Per Sq. Mi.
Eel River below Scott Dam	290	58,000	200	104,200	207,000	13
Eel River at Alderpoint	2,079	600,000	289	1,510,000	2,980,000	27
South Fork Eel River nr Miranda	537	200,000	372	390,000	772,000	27
Eel River at Scotia	3,113	750,000	241	1,860,000	3,720,000	22

At the "Eel River below Dos Rios" stream gage, the reported peak was 460,000 cfs (63.1 feet) occurring around 1800 PST, December 22.

Further downstream on the Eel River at Alderpoint a reported peak of 600,000 cfs (90.5 feet) occurred around 2000 PST, December 22. This is approximately 224,000 cfs and 18 feet above the 1955 peaks. At 0600 PST, December 19, the stage was 4.9 feet, indicating that the river rose 85.6 feet in 86 hours. Extremely heavy flows eminating from the North Fork contributed markedly to this peak.

In the headwaters of the South Fork Eel River, near Branscomb, a peak of 19,900 cfs (16.14 feet) occurred on December 22. Further downstream a peak estimated at 200,000 cfs (45.9 feet) was interpreted from high water marks at the inundated stream gage of "South Fork Eel River near Miranda".

Apparently the 43.9 square miles above the Branscomb gage did not experience as heavy rainfall as occurred in the South Fork basin below. In addition, the peak at Branscomb was slightly lower than the 1955 peak.

The stream gage near Miranda is a radio telemark stream gage interrogated from Eureka. Around 2200 PST, December 21, the power to the relay station atop nearby Pratt Mountain was lost and no signals could be received from the Miranda gage. The last available reading was taken at 2135 which indicated a stage of 31.7 feet -- around 100,000 cfs. The river had been holding steady near this stage for three hours -- probably as the result of a short period of light rainfall. The subsequent period of intense rainfall beginning the late afternoon of December 21 and continuing through the following morning, generated the peak of 200,000 cfs at about 1800 PST, December 22 -- 27,000 cfs above the 1955 peak.

At Scotia, the Eel River reportedly peaked at around 750,000 cfs (70 feet) on December 23 at 0200 PST, over 200,000 cfs and 8 feet above the previous maximum of 1955. The last reported stage received from this stream gage before it malfunctioned was 61.9 feet (the 1955 peak stage) at 1200, December 22.

At Bridgeville, on the Van Duzen River, a peak of 49,800 cfs (22.6 feet) was reported. In 1955, the Van Duzen River crested at 43,500 cfs (21.3 feet). Residents living 20 miles downstream at the confluence of the Van Duzen and Eel Rivers reported that the peak from the Van Duzen occurred simultaneously with that from the Eel River.

At Fernbridge, a wire-weight gage was used to determine the Eel River's stage during the flood. The peak at the bridge was estimated to be

29.5 feet occurring around 0400 PST, December 23. The previous maximum stage in 1955 was 27.7 feet. The discharge could have exceeded 800,000 cfs.

Representative December storm rainfall totals recorded at various points in the Eel River Basin are tabulated below.

TABLE 12

REPRESENTATIVE RAINFALL TOTALS FOR THE DECEMBER STORM
EEL RIVER BASIN

Precipitation Gage	Rainfall Period (inclusive)	Rainfall Total (inches)
Standish-Hickey S.P.	19-26	28.62
Alderpoint	19-25	17.52
Garberville	20-26	21.75
Dos Rios	19-24	23.32

Consistent time periods are not available at this time. The high winds (over 50 miles per hour) occurring throughout the North Coast undoubtedly affected the above rainfall totals.

From the Eel River Basin above Dos Rios, the runoff -- though record breaking -- does not appear to have been capable of contributing markedly to the downstream peaks. In the Middle and North Forks of the Eel River, reports indicate that staggering runoff amounts occurred. Apparently heavy, but unreported, precipitation fell in these two subbasins.

The record runoff throughout the South Fork basin was most certainly generated by heavier rainfall than that reported. The lack of rainfall recording charts in the basin, coupled with high winds persisting through December 21 and 22, prohibits any accurate analysis at this time.

Undoubtedly though, the character of the rainfall and resulting runoff was similar (but on a larger scale) to that propagated in the Redwood Creek Basin.

As the South Fork Eel River near Miranda reportedly crested two hours before the Eel River at Alderpoint, the peak contributions from these basins appeared separately at Scotia. However, the magnitude of the flows and near coincidence of peaks effectively combined to generate the record flows past Scotia and Fernbridge.

Russian River Basin

Although rainfall amounts in the Russian River Basin were less than in other North Coast basins, high river stages occurred along the entire length of the Russian River. One exception to this general rainfall pattern apparently occurred above Coyote Dam where extremely heavy precipitation totals were recorded.

As a consequence, the peak inflow into Lake Mendocino (Coyote Dam) was 21,000 cfs as the river rose 5.20 feet above the 1955 recorded stage of 15.06. This flood control reservoir effectively contained the excessive flows from the East Fork Russian River until the Russian River began receding in the downstream reaches. Storage increased from 70,800 acre-feet (0800 PST, December 19) to a maximum of 129,250 acre-feet (1700 PST, December 24).

On the Russian River near Hopland, a reported peak flow of 41,200 cfs (26.06 feet) occurred around 1900 PST, December 22. Further downstream at Healdsburg, a peak of 67,100 cfs (26.62 feet) occurred at 0430 PST, December 23, and at Guerneville 90,000 cfs (49.6 feet) around 1800, December 23.

TABLE 13

SELECTED PEAK RUNOFF EVENTS
RUSSIAN RIVER

Stream Gaging Station	Drainage Area (Sq. Mi.)	Provisional Peak Flow (cfs)	Peak Discharge Per Sq. Mi.	Dec. 20-26, Runoff Volume		
				SFD	Acre-Feet	Inches Per Sq. Mi.
East Fork Russian River nr. Calpella	93	21,000	226	33,000	65,000	13.1
Russian River nr. Hopland	362	41,200	114	101,000	200,000	10.4
Russian River near Healdsburg	791	67,100	85	194,000	385,000	9.1
Russian River near Guerneville	1,342	90,000	67	318,000	630,000	9

Uniformly heavy rainfall (of about 11 inches for the storm period) was recorded in the basin below Coyote Dam, whereas extremely heavy but unrecorded rainfall occurred above Coyote Dam as indicated by Willits-Howard FRS. Table 14 represents rainfall totals recorded at selected rain gages in and around the Russian River Basin.

TABLE 14

REPRESENTATIVE RAINFALL TOTALS FOR THE DECEMBER STORM
RUSSIAN RIVER BASIN

Precipitation Station	Precipitation (Inches)		
	Dec. 21-23	Dec. 19-24	Total Dec.
Willits Howard	19.00	22.88	31.09
Ukiah	9.68	11.80	16.52
Hopland	9.57	11.76	16.20
Healdsburg	9.59	11.94	15.55
Guerneville	7.57	10.62	14.55

Runoff Volume - North Coast

The runoff volume from the heavy precipitation over the North Coast was the greatest of record. In 1955, most rivers experienced two major rises -- the second being the highest and responsible for the resulting devastation. In 1964, however, only minor rises preceded the record peaks of December 22 and 23. The subsequent runoff volumes therefore are not completely comparable. On a few North Coast streams the volume produced by the 1955 runoff with its two consecutive peaks exceeded the volume of the higher single-peaked runoff in 1964. The 1955 and 1964 runoff volumes are compared in the following tabulation.

TABLE 15

ESTIMATED STORM RUNOFF VOLUMES FOR THE DECEMBER FLOODS OF 1955 AND 1964

Drainage Basin	Drainage Area (Sq. Mi.)	December 1964			December 1955		
		Period (inclusive)	Runoff Volume		Period (inclusive)	Runoff Volume	
			Inches	Acre-Feet		Inches	Acre-Feet
Smith River	613	20-26	22	700,000	18-23	18.2	600,000
Klamath River	6,180*	20-26	9	3,020,000	20-26	8.3	2,730,000
Redwood Creek	278	20-26	23	340,000	18-24	13.8	200,000
Mad River	484	20-26	16	420,000	18-24	14.6	380,000
Van Duzen River	320	20-26	19	320,000	18-24	15	260,000
Eel River	3,113	20-26	22	3,720,000	20-26	14.8	2,450,000
Mattole River	240	20-26	22	280,000	18-24	27.4	350,000
Russian River	1,340	20-26	9	630,000	19-25	11.6	830,000
Other Coastal Streams	1,500	20-26	12	960,000	18-24	13	1,040,000
Total				10,390,000			8,860,000

*The basin above the upstream community of Klamath River (near the confluence of the Shasta and Klamath Rivers) has not been included.

For the Eel River the 1964 runoff volume was 49 percent more than that for 1955. The Smith and Klamath Rivers had respectively 21 percent and 8 percent greater total runoff. For the North Coast as a whole, the volume of water which passed into the Pacific Ocean from December 20-26 has been estimated to be around 10.4 million acre-feet.

The runoff volumes calculated above will disagree with earlier published figures because of information received just prior to publication of this report.

Central Valley Area

As the storm pushed further inland, heavy rainfall created major rises in many streams draining from the leeward or eastern side of the Coast Range and in most streams flowing to the Central Valley from the Sierra Nevada north of Stockton. Hydrographs of selected streams and reservoir operations are illustrated on Plates 15-24. Gage heights for selected streams in the Central Valley are tabulated on Plates 25-27.

From the drainage area above Shasta Dam, inflow increased to a peak of 187,100 cfs, which may be compared to the 201,000 cfs flood crest that occurred in December 1955. Shasta Reservoir again controlled the flood water and the storage was increased nearly 800,000 acre-feet. The regulated releases from Keswick Dam reached 50,000 cfs.

By mid-afternoon of December 22, the rising stages created by the heavy rainfall became flood crests of record levels for many streams flowing from the Coast Range. Cottonwood Creek near Cottonwood surpassed the previous high stage of 15.4 feet and 52,300 cfs which was recorded in 1941. The new maximum stage is 19.6 feet and 56,000 cfs. Thomes Creek at Paskenta also experienced a new maximum stage, 15.3 feet and 33,000 cfs, which exceeded the December 1955 stage of 13.9 feet and 23,500 cfs. Ord Ferry on the Sacramento River crested at 173,000 cfs with a stage of 119.0 feet.

Streams flowing from the northern Sierra Nevada began to rise as the rainfall intensified over the Feather, Yuba, and American River Basins

during the early evening hours of December 22. The Feather River crested above Oroville Dam, which is presently under construction, at a peak flow of approximately 250,000 cfs. Near midnight, this peak was reduced by the partially completed dam to a peak outflow from the two diversion tunnels of about 157,000 cfs. The dam is being built over the old stream gaging station, Feather River near Oroville, where previous high flows were experienced in 1937 (185,000 cfs), 1940 (152,000 cfs), 1955 (203,000 cfs), and 1963 (191,000 cfs). The previous historic maximum flow of 230,000 cfs was recorded in 1907 at a point five miles below the dam.

The Yuba River at Englebright Dam also established a record when it reached a stage of 546.0 feet and a peak flow of 166,000 cfs. This is the second new maximum since the near-legendary flood of 1955 established a record stage of 544.7 feet with a flow of 148,000 cfs. In February 1963 a peak flow of 150,000 cfs was recorded at a stage of 544.8 feet.

These record flows contributed to the anxiety of Yuba City residents where channel clearing during recent years and a delayed Feather peak kept the flood crest stage at 76.42 feet. A stage of 82.42 feet was reached at the time of the disastrous levee failures in December 1955.

A few smaller streams in the Sacramento Valley also experienced new maximum flood stages. Butte Creek near Chico reached a stage of 14.1 feet with a flow of 21,300 cfs.

Rainfall in the American River basin created high stages on most tributaries above Folsom Reservoir. Hell Hole Dam, a small sloping-core rockfill structure being built on the Middle Fork, failed under the stress of the flood water. This partially-completed dam retained approximately 30,000 acre-feet before failure occurred. This volume of water added to

the peak inflow to Folsom Reservoir which reached 280,000 cfs. Previous maximum inflows occurred in December 1955 (218,000 cfs) and February 1963 (240,200 cfs).

Storage in Folsom Reservoir increased 322,000 acre-feet and controlled releases were increased to a peak rate of 115,000 cfs. These releases were reflected in high stages at the "H" Street Bridge in Sacramento which attained a crest at 41.89 feet.

The flow from the American River, together with approximately 75,000 cfs at Verona on the Sacramento River, required the opening of all 48 gates at the Sacramento Weir. Total flow past Sacramento including both the Sacramento River and the Yolo Bypass was estimated to be 445,000 cfs.

All weirs of the Sacramento River Flood Control Project experienced periods of overflow, and this data is summarized in the following table.

TABLE 16

SACRAMENTO RIVER FLOOD CONTROL PROJECT
WEIR OVERFLOW DATA

Weir	Beginning of Overflow		Period of Overflow (hours)	Peak Stage and Discharge	
	Date	Time			
Moulton	12/22/64 1/4/65	1930 1545	211 163	82.38 82.14	25,600 23,600
Colusa	12/22/64	1520	520	68.06	69,500
Tisdale	12/22/64	1900	*	50.10	29,000
Fremont (West End)	12/22/64	2000	*	39.5	245,000
Sacramento	12/23/64	0310**	222***	32.35	101,500

*Continued overflow January 19, 1965.
**First group of five gates opened; all gates open by 1503 on 12/23/64.
***Closing operations began 0800 on 12/30/64 and all gates were replaced by 0900 on 1/1/65.

South of the American River Basin rainfall amounts were generally less than the 20- to 40-inch totals which fell farther north. Stream levels reflected the lesser rainfall; however, several streams at the northern end of the San Joaquin Valley experienced notable peak flows. The Cosumnes River at Michigan Bar, for example, reached a crest of 13.8 feet and a flow of 37,500 cfs which was not far below the December 1955 stage of 14.59 feet and flow of 42,000 cfs.

Stream gaging stations on the San Joaquin River north of Newman recorded rises which were generally due to releases made from Sierra reservoirs on the Stanislaus and Tuolumne Rivers. However, early in January when additional rainfall occurred and after flood-retention ability of most of these reservoirs had been exhausted, the releases were increased. Flow from Exchequer Reservoir on the Merced River, Melones and Tulloch Reservoirs on the Stanislaus, Don Pedro on the Tuolumne, in addition to local runoff from the Merced County Stream Group (Burns, Bear, Owens, and Mariposa Creeks), caused a crest stage of 28.2 feet and 21,200 cfs at Vernalis on January 12.

DECEMBER 24, 1964

AERIAL VIEW OF BIDWELL BAR ABOVE DEBRIS-CHOKED CONFLUENCE OF MIDDLE AND NORTH FORKS OF FEATHER RIVER. BACKWATER CREATED BY OROVILLE DAM EMBANKMENT EXTENDED UPSTREAM TO MIDDLE FORK BRIDGE UNDER CONSTRUCTION.

(DWR PHOTO)

DECEMBER 23, 1964

FEATHER RIVER AT OROVILLE DAM EMBANKMENT. LOOKING UPSTREAM AT FLOOD WATERS ISSUING FROM DIVERSION TUNNELS BELOW HANSEL'S BRIDGE AND EMBANKMENT.

(DWR PHOTO)

DECEMBER 23, 1964

AERIAL VIEW OF PARTIALLY COMPLETED THERMALITO DIVERSION DAM ON FEATHER RIVER BELOW OROVILLE DAM EMBANKMENT. NOTE CONSTRUCTION FACILITIES AND CONTRACTOR'S HAUL RAILROAD.

(DWR PHOTO)

DECEMBER 24, 1964 AERIAL VIEW OF BORROW AREA ALONG FEATHER RIVER BELOW OROVILLE AND OROVILLE DAM EMBANKMENT. HISTORIC DREDGER TAILINGS AT RIGHT CENTER OF PICTURE PARTIALLY INUNDATED BY FLOOD WATERS. (DWR PHOTO

DECEMBER 23, 1964 AERIAL VIEW OF FEATHER RIVER AT OROVILLE LOOKING DOWNSTREAM. HIGHWAY 40A AT LEFT BANK; CONTRACTOR'S HAUL RAILROAD IN CENTER. NOTE PARTIALLY INUNDATED TRACKS IN BACKGROUND. (DWR PHOTO)

DECEMBER 25, 1964 BRIDGE AND FLOODED ORCHARDS -- FEATHER RIVER NEAR BORROW AREA. (DWR PHOT

CEMBER 24, 1964 AERIAL VIEW OF MARYSVILLE LOOKING SOUTHWEST. (DWR Photo)

DECEMBER 25, 1964 SACRAMENTO RIVER AT SACRAMENTO WEIR NEAR SACRAMENTO. (DWR PHOTO)

DECEMBER 23, 1964 AERIAL VIEW OF TOWER BRIDGE AT SACRAMENTO RIVER AT SACRAMENTO. (DWR PHOTO)

DECEMBER 24, 1964 AMERICAN RIVER AT FOLSOM BRIDGE WITH FOLSOM DAM AND RESERVOIR IN BACKGROUND. (DWR Photo)

DECEMBER 27, 1964

BANK SLOUGHING ENDANGERING HOMES BUILT ON FLOOD PLAIN OF AMERICAN RIVER IN VICINITY OF CARMICHAEL.

(DWR PHOTO)

DECEMBER 24, 1964 AMERICAN RIVER AT SACRAMENTO ABOVE "H" STREET BRIDGE. (DWR PHOTO)

ECEMBER 28, 1964

EMERGENCY REPAIRS BEING MADE TO LEFT BANK OF AMERICAN RIVER BELOW "H" STREET BRIDGE. SACRAMENTO STATE COLLEGE IN BACKGROUND.

(DWR PHOTO)

DECEMBER 24, 1964 AERIAL VIEW OF SEWAGE TREATMENT PLANT ALONG AMERICAN RIVER NEAR CARMICHAEL. (DWR Photo)

FLOOD AREAS AND FLOOD DAMAGE

North Coast Area

The first day of winter, December 21, 1964, rather appropriately arrived with heavy rains in Northern California. However, as discussed on preceding pages the rain became an extended downpour with subsequent disastrous flooding.

On many swollen streams in the North Coast, walls of water tore down highway and railroad bridges, overturned autos, smashed houses and farm buildings, and swept away entire villages. The North Coast, where flood control works are essentially nonexistent, was hardest hit, but this intense Christmas week storm caused extensive flooding of urban and suburban areas throughout Northern California. Thirty-four counties received damage, and Governor Brown proclaimed all of these counties as disaster areas. Six of these counties, located in the northwest area, suffered flood damage exceeding the combined damage to all other counties. These six counties, Del Norte, Humboldt, Mendocino, Siskiyou, Trinity, and Sonoma, where there is almost no flood protection, suffered complete havoc. The few existing flood control projects on the Mad, Eel and Russian Rivers saved millions of dollars, and the proposed projects for the Eel River delta would have saved millions more.

Various categories of flood damages to the six North Coast counties noted above are discussed in the following pages and summarized in tables 17, 18, 19, 20, and 21. It should be noted that estimates relative to damage and costs are necessarily preliminary following a disaster -- and will probably change significantly when final reports are in. The majority of the damage

figures for the North Coast were obtained from the California Disaster Office and the Red Cross.

TABLE 17

FLOOD DAMAGE ESTIMATE
(In Dollars)

County	Protective Health & Sanitation	Dikes, Levees & Drainage	Public Buildings	Public Utilities
Del Norte	$ 100,000	0	$ 413,000	$ 40,000
Siskiyou	300,000	$1,250,000	150,000	200,000
Humboldt	2,000,000	1,500,000	300,000	10,000
Trinity	150,000		90,000	550,000
Mendocino	50,000	200,000	150,000	25,000
Sonoma	500,000	20,000	100,000	100,000

It is difficult to bring the magnitude of this flood into focus, but some comparisons to the 1955 flood can be made. District I of the State Division of Highways encompasses the counties of Del Norte, Humboldt, Mendocino, and the westerly sections of Siskiyou and Trinity. In the 1955 flood, District I lost one bridge -- the one in Hoopa on the Trinity River. As an aftermath of the 1964 flood, District I records sixteen State highway bridges destroyed. The Humboldt County Road Department listed ten county bridges completely washed out or damaged beyond salvage. Virtually the whole region from Scotia to Crescent City was isolated as the rampaging Eel, Mad, and Klamath Rivers and Redwood Creek made U. S. Route 101 impassable.

It has been estimated the State Division of Highways has at least a 2-year task to restore the highways and bridges to their pre-flood condition.

Again, the magnitude of this flood overwhelms that of the 1955 flood when listing the number of cities and communities which have been devastated.

Communities Destroyed

Klamath

Orleans

Myers Flat

Weott

South Fork

Shively

Pepperwood

Stafford

Ti-Bar

Communities Partially Destroyed

Metropolitan

Rio Dell

Scotia

Klamath and Orleans in the north, and Weott and Myers Flat in the south, are major centers of population, aside from the Eureka-Arcata, Fortuna complex. The total extent of damages to many small hamlets has not yet been determined. The Crescent City area, hard hit by the flood, prompted Congressman Don Clausen (while accompanying Governor Brown on his inspection trip) to remark "this is becoming the disaster district of the nation". It was Crescent City that suffered such havoc when struck by the Alaskan earthquake tidal wave Easter weekend, 1964.

At Fernbridge, the focal point of the Eel River stage measurements, the peak reached an estimated 29.5 feet, compared to the 1955 peak of 27.7 feet. Flood stage is 17.0 feet. Some 4,000 persons abandoned their homes in at least ten towns in the redwood country. At Orick, 800 residents also fled their homes when the flashy Redwood Creek reached a height of 23.27 feet, with a flood stage of 19 feet.

In the counties of Del Norte, Siskiyou, Humboldt, Trinity, Mendocino, and Sonoma at least 1,025 homes were destroyed and 3,759 more damaged. Three hundred seventy-four small businesses were either destroyed or damaged, and over 800 farm buildings destroyed or damaged.

TABLE 18

ESTIMATE OF HOMES, FARM DWELLINGS AND TRAILER HOMES
DESTROYED OR DAMAGED
(In Dollars)

County	Amount
Del Norte	$ 7,232,000
Siskiyou	2,770,000
Humboldt	13,850,000
Trinity	980,000
Mendicino	500,000
Sonoma	5,875,000

The timber industry is one of the primary supporters of the economies of the northwest counties, and the flood damage was a devastating blow to the industry. Millions of board feet of lumber were lost when logs were swept from log decks and floated downstream. An estimated 100 million board feet

of lumber is in the Crescent City harbor and on the beach. Forest access roads, highways, and railroads were impassable. In some areas 80 percent of the county road system sustained major damage. Because of the lack of transportation for logs and cut lumber, 4,000 workers are without jobs, and an additional 8,000 workers will be affected as more than half the lumber mills face closure. Weekly payroll loss could rise to $675,000.

Also hard hit was the dairy and livestock industry. Five thousand head of livestock were lost, thirty-five hundred of which were cows and calves. Pasture land was awash with mud and debris. Providing feed for the surviving cattle was a major problem, and sixty tons of hay and grain were flown to the area for the starving cattle.

TABLE 19

ESTIMATE OF DAMAGE
(In Dollars)

County	Debris Clearance	Non-Federal Aided County Roads	Federal Aided County Roads
Del Norte	$ 465,000	$1,050,000	$1,625,000
Siskiyou	250,000	1,855,000	1,598,000
Humboldt	4,000,000	6,500,000	2,000,000
Trinity	150,000	2,555,000	120,000
Mendocino	300,000	2,550,000	5,200,000
Sonoma	100,000	561,000	5,000

Preliminary flood damage estimates were compiled by the California Disaster Office from information collected by survey teams of State, Federal, and local public agencies, and Red Cross workers. Months of work by survey teams in the field and in the office will be necessary before the complete picture unfolds.

TABLE 20

FLOOD DAMAGE ESTIMATE
(In Dollars)

County	State Highways	Total State Highways County Roads & Bridges	Total Public Damage*	Private Damage	Total Private & Public Damage
Del Norte	$ 4,600,000	$ 7,275,000	$ 9,875,000	$ 8,000,000	$17,875,000
Siskiyou	5,850,000	9,303,000	9,303,000	6,700,000	16,283,000
Humboldt	14,150,000	26,500,000	30,650,000	23,000,000	57,500,000
Trinity	1,740,000	4,415,000	4,415,000	1,700,000	6,215,000
Mendocino	3,600,000	11,350,000	11,850,000	3,300,000	15,150,000
Sonoma		566,000	566,000	6,200,000	6,366,000

*Includes damage to state and local highways.

As the grim task of cleaning up the flood-stricken areas started, the death toll began to rise. Rescue workers used helicopters to probe the slowly receding rivers for victims and survivors. Hundreds of persons had been stranded for days without food or shelter in the flood isolated valleys and foothills of the Eel River Canyon. Fog, rain, snow, and winds frustrated rescue efforts for areas which could be reached only by air and prolonged the misery of flood damage.

As rescue operations swung into full scale, another storm whipped into Northern California with rains, snow, and hurricane gusts of wind. Rising rivers again forced an estimated 1,300 persons to flee for the second time from the Eel, Mad, Klamath, and Russian River Valleys, and evacuation centers were reopened. River crests from this second storm were far below the earlier flood stages, and additional flooding from the second storm was minor and could do very little material damage beyond the prior flood.

Finally, on January 6, residents of the northwest area were able to relax a moment to look back -- and ahead -- as the rivers began to fall and the weather forecast for only scattered showers diminished the threat of renewed floods.

TABLE 21

RED CROSS RECORDS - JANUARY 4, 1965

County	Deaths	Injured	Hospitalized	Families Suffering Loss
Del Norte	1	264	15	1,342
Siskiyou	1	101	6	800
Humboldt	19	1,250	30	3,000
Trinity	2	3	3	400
Mendocino	1			446
Sonoma		35	1	2,214

The Christmas week flood took its toll of human lives, livestock, houses, farms and even total villages -- and it took something else too: water.

A preliminary estimate showed 10.4 million acre-feet of water ran off into the sea from California's North Coast. This estimate includes everything from the Russian River north, including the Eel, Mad, Van Duzen and Klamath Rivers.

This wasted water is more than the total of the yearly amount the State Water Project will deliver in 1990, plus the State's annual share from the Colorado River.

Central Valley Area

Flooded Areas

In the Central Valley Area the total area flooded amounted to about 375,000 acres. A breakdown of the estimated total of areas flooded, by major

drainage basins, are the Sacramento Basin - 325,000 acres, and the San Joaquin Basin - 50,000 acres. Major flooded areas included 20,000 acres on Thomes Creek, Cottonwood Creek and other Sacramento River tributaries in the vicinity of Red Bluff; 50,000 acres along Sacramento River, mainly from Red Bluff to Colusa; 75,000 acres in bypasses and floodways in the Sacramento Basin; 100,000 acres in Butte Basin; 25,000 acres on Feather River and tributaries; 20,000 acres along the Cosumnes River and in the Mokelumne-Cosumnes Delta area; and 18,000 acres on the Stanislaus River.

It should be noted that estimates relative to damage and cost are necessarily preliminary following a disaster and will probably change significantly when final reports are in. The majority of the damage figures listed here for the Central Valley Area were obtained from the U. S. Corps of Engineers.

There are no known cases where people died in the Central Valley as a direct result of flooding; however, there are a number of instances where deaths occurred as an indirect result of the flood. These instances included such situations as people venturing out in a boat during high water and drowning as a result of the high flood flows.

Flood Damages

Preliminary estimates have been made of the flood damages for the December 1964 - January 1965 floods. These estimates should be considered as being only approximate. More final estimates will be made after detailed field examination. The estimates of flood damages contained here represent damages from stream overflow and stream bank and levee erosion. Losses from general storm damage, such as slides and falling trees, as well as from rain

damage or ponded surface water, have not been included. Total flood damage in the Central Valley Area is now estimated at about $29,000,000.

Sacramento Basin

The combined damages in the Sacramento Basin total about $25,000,000. About $7,000,000 of these damages occurred above the foothill line and represent loss of highway bridges, roads, cabins, a dam under construction, and other improvements. The $18,000,000 damages remaining represents losses on the valley floor area. Most of this damage was to agricultural properties and loss of livestock; however, the figure includes a substantial amount for flood fighting and levee repair at many locations where urban-suburban protection was involved.

In the Sacramento River "Major and Minor Tributaries Project" the only levee breaks were on Deer Creek tributary to the Sacramento River near Vina. Here there were two levee breaks, one on the right bank and the other on the left bank situated just upstream from Keefer Road.

Within the "Sacramento River Flood Control Project" the major problems were from boils and banks eroding from current action, and trees toppling and taking large sections of the berm with the root system, thus undermining the waterward slope of the levee system. In these cases rock riprap was dumped into the damaged reach. The other problem was erosion to levees caused by wave wash action. In these instances canvas panels or wood wave wash panels were placed to retard the erosion of the levee section. There were numerous trouble spots on the Sacramento River and four on the Feather River. On the Feather River, one problem area occurred on the right bank one mile downstream from Gridley Bridge, two on the right bank just

below Shanghai Bend, and the other on the left bank downstream from Nicolaus. On the American River, a trouble spot developed on the left bank just downstream from the "H" Street Bridge on the City of Sacramento side. Flood fighting was also carried out on the levees of Cache Creek, the Sutter and Yolo Bypasses and several islands in the Delta region -- mainly Twitchell, Venice and Webb Tract.

The flood fight utilized local agency and Department of Water Resources' forces and approximately 1200 inmates from conservation camps of the Department of Corrections. These inmate crews were in the immediate charge of about 250 crew chief personnel of the Division of Forestry who were in turn advised by Department of Water Resources' engineers. These forces represented about 20 conservation camps throughout the state. The Division of Forestry also supplied approximately 20 pieces of heavy equipment such as dump trucks and bulldozers.

The only islands in the Delta that were inundated were the ones that are designed to go under during times of high water. They were Prospect, Liberty, Little Holland Tract, and McCormack and Williamson Tracts northeast of Walnut Grove.

San Joaquin Basin

Total damage in the San Joaquin Basin was near $4,000,000. Practically all of this damage was below the foothill line and occurred to highly developed agricultural crop land. Major flooding occurred on the Stanislaus and Cosumnes Rivers, and damages of $2,000,000 and $1,500,000, respectively, resulted. About $500,000 total damage occurred on the Merced, San Joaquin, Chowchilla and Fresno Rivers, and on Merced County streams.

In the "San Joaquin River Flood Control Project" there were nine breaks within a short reach of the left bank levee of the Stanislaus River in Reclamation District 2031 -- which is just about at its confluence with the San Joaquin River. The district's levee along the San Joaquin River was opened to discharge the trapped flood water so that the land that was inundated would drain. In the same general area on the right bank of the Stanislaus River, in Reclamation District 2064, there were six trouble spots within a two-mile reach caused by high flood flows.

Another levee break occurred in the State's "Lower San Joaquin River Flood Control Project". The Eastside Bypass right bank levee was breached by flood water ponding on the landward side of the levee system. This breach occurred very near its junction with the San Joaquin River.

DECEMBER 24, 1964

FLOODED FARM IN YOLO BYPASS.

(DWR PHOTO)

DECEMBER 27, 1964

VIEW OF TWITCHELL ISLAND FLOOD FIGHT IN SACRAMENTO-SAN JOAQUIN DELTA. CONSERVATION CREW INMATES DIRECTED BY DWR ENGINEERS SAVED THE ISLAND FROM INUNDATION.

(DWR PHOTO)

DECEMBER 27, 1964

AERIAL VIEW OF TWITCHELL ISLAND FLOOD FIGHT IN SACRAMENTO-SAN JOAQUIN DELTA. DREDGE ASSISTED FLOOD FIGHT CREWS IN COMBATING DAMAGE CAUSED BY HIGH TIDES, HIGH DELTA INFLOW, AND WAVE WASH.

(DWR PHOTO)

DECEMBER 27, 1964

PHOTO ILLUSTRATING EFFECT OF TREES BEING PERMITTED TO ENCROACH ON RIVER SIDE OF LEVEE SLOPE. THESE TREES INITIATE EDDYING ACTION SUBSEQUENTLY CAUSING TREES TO TOPPLE AND PULL OUT LARGE SECTIONS OF THE LEVEE WITH THEIR ROOT SYSTEM.

(DWR PHOTO)

DECEMBER 24, 1964 FLOOD FIGHT CREWS PLACING CANVAS WAVE WASH PANELS ON YOLO BYPASS LEVEES DURING THE NIGHT IN THE VICINITY OF SACRAMENTO BYPASS. (DWR PHOTO)

APPENDIX A

TABLE A-1

PEAK FLOWS AND STAGES
(Preliminary Data, Subject to Revision)

Stream and Station	Drainage Area in Sq. Mi.	Period of Record	Source of Record (a)	Previous Maximum of Record			December 1964 - January 1965			
				Date	Stage in ft.	Dischg. in cfs	Date	Time	Stage in ft.	Dischg. in cfs
North Coastal Area										
Smith River near Crescent City	613	1931-	USGS	12/22/55	41.20	165,000	12/22/64	-	44.5[f]	192,000**
Shasta River near Yreka	796	*1933	USGS	12/22/55	9.43	6,090	12/22/64	2200	12.48**	-
Scott River near Fort Jones	662	1941-	USGS	12/22/55	21.40	38,500	No record - station destroyed			
Klamath River near Seiad Valley	6,980	1912-25 1951-	USGS	12/22/55	29.2[f]	122,000[c]	No record - station destroyed			
South Fork Salmon River near Forks of Salmon	252	1953-	USGS	12/22/55	18.86	24,200	12/22/64	-	21.73	31,000**
Klamath River at Somesbar	8,480	1927-	USGS	12/22/55	59.4[f]	202,000[c]	12/22/64	-	75.4[f]	300,000**[c]
Trinity River near Burnt Ranch	1,438	1931-40 1956-	USGS	12/22/55	43.2[f]	172,000	12/22/64	2400	29.84	79,000
South Fork Trinity River at Forest Glen	208	1959-	USGS	12/22/55	25.26[f]	42,400	12/22/64	1600	29.0	62,000**
South Fork Trinity River near Hyampom	342	1956-	USGS	12/22/55	22.2[b,f]	39,400	12/22/64	1530	31.0**[g]	-
Hayfork Creek near Hayfork	87.2	1956-	USGS	2/8/60	11.67	4,210	12/22/64	1100	14.45	7,000**
Hayfork Creek near Hyampom	379	1953-	USGS	12/22/55	18.00	25,300	12/22/64	-	19.13	29,000**
South Fork Trinity River near Salyer	899	1911-13 1950-	USGS	12/22/55	39.4[f]	65,100	12/22/64	2400	47.6	95,000**
Willow Creek at Willow Creek	43.3	1959-	USGS	12/2/62	10.02	5,190	No record - channel destroyed			
Trinity River near Hoopa	2,848	*1911-	USGS	12/22/55	36.90	190,000	12/22/64	2100	42.3[f]	260,000**[c]
Klamath River near Klamath	12,100	*1910-	USGS	12/22/55	49.7[f]	425,000[c]	12/23/64	0200	55.3[f]	650,000**
Redwood Creek at Orick	278	1911-13 1953-	USGS	1/18/53 12/22/55	23.95[f] 23.95	50,000 50,000	12/22/64	2200	23.27[f]	50,000
Mad River near Forest Glen	143	1953-	USGS	12/22/55	24.5[f]	39,200	12/22/64	1700	16.86	20,100

TABLE A-1 (Continued)

Stream and Station	Drainage Area in Sq. Mi.	Period of Record	Source of Record (a)	Previous Maximum of Record			December 1964 - January 1965			
				Date	Stage in ft.	Dischg. in cfs	Date	Time	Stage in ft.	Dischg. in cfs
North Coastal Area (Continued)										
Mad River near Arcata	484	1910-13 1950-	USGS	12/22/55	27.30[b]	77,800	12/23/64	0200	23.40[f]	71,000[c]
Eel River below Scott Dam near Potter Valley	290	1922-	USGS	12/11/37	22.9[f]	41,100[c]	12/22/64	-	24.2[f]	58,000**[c]
Eel River at Van Arsdale Dam near Potter Valley	349	1909-	USGS	12/22/55	31.4[f]	48,600	12/22/64	1900	-	62,000**
Eel River above Dos Rios	705	1950-	USGS	12/22/55	45.4[f]	123,000[c]	12/22/64	-	54.0[f]	175,000**
Black Butte River near Covelo	162	*1951-	USGS	12/21/55	35.8[b,f]	25,000	12/22/64	-	33.0[f]	50,000**
Middle Fork Eel River below Black Butte River near Covelo	367	1951-	USGS	12/21/55	25.0[f]	89,100	12/22/64	2100	33.1[f]	165,000**
Eel River below Dos Rios	1,484	1911-13 1951-	USGS	12/22/55	49.86	283,000[c]	12/22/64	1800[m]	63.1[f]	460,000**[c]
North Fork Eel River near Mina	250	1953-	USGS	12/22/55	24.00	58,400	No record - station destroyed			
Eel River at Alderpoint	2,079	1955-	USGS	12/22/55	72.5[f]	376,000[c]	12/22/64	2000[m]	90.5[f]	600,000**[c]
South Fork Eel River near Branscomb	43.9	1946-	USGS	12/22/55	16.20	20,100	12/22/64	-	16.14	19,900
South Fork Eel River near Miranda	537	1939-	USGS	12/22/55	42.7[f]	173,000	12/22/64	1800[m]	45.9[f]	200,000**
Eel River at Scotia	3,113	*1910-	USGS	12/22/55	61.90	541,000	12/23/64	0200	70.0[f]	750,000**
Van Duzen River nesr Bridgeville	216	1950-	USGS	12/22/55	21.3[f]	43,500	12/22/64	-	22.6	49,800**
Eel River at Fernbridge	-	-	USWB	12/22/55	27.7	-	12/23/64	0400	29.5	800,000**
Mattole River near Petrolia	240	*1911-	USGS	12/22/55	29.60	90,400	12/22/64	1145	28.20	>80,000
Russian River near Ukiah	99.6	*1911-	USGS	12/21/55	21.0	18,900	12/22/64	1100	19.45	18,000
East Fork Russian River near Calpella	93.0	1941-	USGS	12/21/55	15.06[b]	13,300[c]	12/22/64	-	20.26	21,000**[g]
Russian River near Hopland	362	1939-	USGS	12/22/55	27.00	45,000[c]	12/22/64	1800	26.06	41,200[c]

TABLE A-1 (Continued)

Stream and Station	Drainage Area in Sq. Mi.	Period of Record	Source of Record (a)	Previous Maximum of Record			December 1964 - January 1965			
				Date	Stage in ft.	Dischg. in cfs	Date	Time	Stage in ft.	Dischg. in cfs
North Coastal Area (Continued)										
Russian River near Cloverdale	502	1951-	USGS	12/22/55	30.9[f]	53,000[c]	12/23/64	-	31.6	54,000**[c]
Russian River near Healdsburg	793	1939-	USGS	2/28/40	30.0	67,000	12/23/64	0430	26.62	67,100**[c]
Russian River near Guerneville	1,340	*1939-	USGS	12/23/55	49.7[f]	90,100[c]	12/23/64	1800	49.6[f]	90,000[c]
Central Valley Area										
Cow Creek near Millville	425	1949-	USGS	12/27/51	21.55	45,200	12/22/64	1130	18.4	30,300
Cottonwood Creek near Cottonwood	922	1940-	USGS	3/1/41	15.4	52,300	12/22/64	1400	19.6	56,000**
Battle Creek below Coleman Fish Hatchery near Cottonwood	358	1961-	USGS	12/11/37	15.8[b,f]	35,000	12/22/64	1200	12.5	8,780
Paynes Creek near Red Bluff	92.7	1949-	USGS	12/1/61	11.33	10,600	12/22/64	1200	8.7	4,950
Sacramento River at Red Bluff	-	-	DWR	2/28/40	32.2	-	12/22/64	2100	27.7	170,000[c]
Mill Creek near Los Molinos	131	*1909-	USGS	12/11/37	23.4[f]	23,000	12/22/64	1200	15.3	13,200
Thomes Creek at Paskenta	194	1920-	USGS DWR	12/21/55	13.89	23,500	12/22/64	1300	15.3	33,000**
Deer Creek near Vina	208	*1911-	USGS DWR	12/10/37	19.2[f]	23,800	12/22/64	1200	14.7	18,800
Big Chico Creek near Chico	72.5	1930-	USGS	12/10/37	16.6[b]	8,260	12/21/64	2300	14.6	8,400**
Sacramento River at Ord Ferry	-	*1921-	DWR	2/28/40	121.7	370,000[c]	12/23/64	1800-2100	119.0	173,000[c]
Sacramento River at Colusa	-	1940-	USGS DWR	2/8/42	69.20	49,000[c]	1/7/65	0800-1600	67.0	42,800[c]
Butte Creek near Chico	147	1930-	USGS	12/22/55	13.35	18,700[c]	12/22/64	1400	14.1	21,300**[c]
North Fork Feather River at Pulga (formerly Big Bar)	1,953	*1910-	USGS	12/23/55	35.60	72,400[c,e]	12/22/64	1300	35.2	71,800[c,e]
Middle Fork Feather River near Merrimac	1,068	1951-	USGS	2/1/63	21.65	65,400	No record - station destroyed			

TABLE A-1 (Continued)

Stream and Station	Drainage Area in Sq. Mi.	Period of Record	Source of Record (a)	Previous Maximum of Record			December 1964 - January 1965			
				Date	Stage in ft.	Dischg. in cfs	Date	Time	Stage in ft.	Dischg. in cfs
Central Valley Area (Continued)										
Feather River at Oroville above Fish Barrier Dam	3,632	1901-	USGS DWR	3/19/07	39.3[b]	230,000[c]	12/23/64	1200	25.3	157,000[c,h]
Feather River near Gridley	-	*1929-	DWR	12/23/55	102.25	-	12/23/64	0800	100.4	153,000[c,h]
Yuba River at Englebright Dam	1,104	1941-	USGS PG&E	2/1/63	544.84	150,000[c,d]	12/22/64	2200	546.0	166,000**[c,d]
Deer Creek near Smartville	84.6	1935-	USGS	10/13/62	13.77	11,600[c]	12/22/64	1500	11.85	8,260[c]
Feather River at Yuba City	-	1944-	DWR	12/24/55	82.42	-	12/23/64	1200	76.4	-
Feather River at Nicolaus	5,928	1943-	USGS DWR	12/23/55	51.60	357,000[c]	12/23/64	1500	51.6	283,000[c,h]
Sacramento River at Verona	-	1929-	USGS DWR	3/1/40	41.20	79,200[c]	12/25/64	0600	39.7	75,000[c,h]
Middle Fork American River near Auburn	612	1911-	USGS	2/1/63	43.1[f]	121,000	12/23/64	1340	60.4**[f,k]	-
American River at Sacramento	1,900[g]	1925-	DWR	11/21/50	45.73	176,000[c]	12/24/64	1100	41.89	115,000[c]
Sacramento River at Sacramento	-	*1879-	USGS DWR	11/21/50	30.14[b]	104,000[c]	12/24/64-12/25/64	1900-1400	29.4	99,600[c]
Cache Creek at Rumsey Bridge	-	1957-	DWR	2/24/58	18.4	-	1/5/65	1800	16.8	37,800[c]
Yolo Bypass near Lisbon	-	1914-	DWR	12/24/55	23.4[b]	304,800	12/25/64	0700	25.1	345,000**
Sacramento River near Rio Vista	-	1906-	USCE	12/25/55	10.2	-	12/26/64 12/27/64	1000 1100	9.5	-
Cosumnes River at Michigan Bar	537	1907-	USGS DWR	12/23/55	14.59	42,000[c]	12/23/64	0800	13.8	37,500
Mokelumne River near Thornton (Benson's Ferry)	-	1959-	DWR	2/10/60	8.7	-	12/24/64	0900	15.5**	-
Mormon Slough at Bellota	-	1948-	DWR	4/2/58	20.65	15,400[c]	12/24/64	0500	8.56	3,000[c]
Stanislaus River at Orange Blossom Bridge	-	1940-	DWR	11/21/50	30.05	52,000[c]	12/24/64	1700	26.4	39,800[c]
Stanislaus River at Ripon	-	1940-	USGS DWR	12/24/55	63.25	62,500	12/25/64	0600	62.26	32,800[c]

TABLE A-1 (Continued)

Stream and Station	Drainage Area in Sq. Mi.	Period of Record	Source of Record (a)	Previous Maximum of Record			December 1964 - January 1965			
				Date	Stage in ft.	Dischg. in cfs	Date	Time	Stage in ft.	Dischg. in cfs
Central Valley Area (Continued)										
Tuolumne River at Modesto	-	*1878-	USGS DWR	12/9/50	69.19	57,000[c]	1/7/65	1700-2200	55.3	11,500[c]
Merced River near Stevinson	1,274	1940-	USGS USBR DWR	12/5/50	74.79	13,600[c]	1/8/65	1800	72.08	10,600[c]
Bear Creek at McKee Road	-	-	USCE	12/-/55	23.0	9,500	1/7/65	0600	15.2	5,600
Chowchilla River at Buchanan Dam Site, near Raymond	238	*1921-	USGS DWR	12/23/55	16.50[b]	30,000	12/23/64	1100	583.1	6,250
Fresno River near Knowles	132	*1911-	USGS	12/23/55	11.52	13,300	12/23/64	1100	5.5	2,900
San Joaquin River at Fremont Ford Bridge	8,090	1937-	USGS USBR DWR	4/6/58	71.14[b]	5,910[c]	1/10/65	0600	64.63	2,650[j]
San Joaquin River near Newman	9,990	1912-	USGS DWR	3/7/38	65.81	33,000[c]	1/10/65	0700	62.67	11,500[c]
San Joaquin River at Crows Landing Bridge	-	1941-	DWR	4/7/58	61.9[b]	-	1/10/65	2000	54.0	11,250[c]
San Joaquin River at Patterson Bridge	-	1938-	DWR	6/13/38	54.0[b]	-	1/11/65	0800	47.00	10,750[c]
San Joaquin River at Grayson	-	1928-	DWR	3/8/41	45.15	23,900	1/11/65	2345	39.23	8,500[c]
San Joaquin River near Vernalis	14,010	*1922-	USGS	12/9/50	32.81	79,000	1/12/65	0500-2400	28.2	21,200[c]
San Joaquin River at Mossdale Bridge	-	1920-	DWR	12/10/50	24.4	-	1/12/65	1700	13.92	-

LEGEND

(a) USGS - United States Geological Survey
USBR - United States Bureau of Reclamation
USWB - United States Weather Bureau
USCE - United States Corps of Engineers
DWR - California State Department of Water Resources
PG&E - Pacific Gas and Electric Company
b - Site and datum then in use
c - Affected by storage and/or diversion
d - Includes flow through powerhouse
e - Includes flow bypassing station
f - From flood marks
g - Estimated
h - Affected by partially completed Oroville Dam
j - Does not include flow that bypasses station
k - Peak of flood wave resulting from failure of Hell Hole Dam on the Rubicon River
m - Approximate time
* - Incomplete record
** - Maximum of record

7	8	9	10	11	12	13	14
974.7	1,881.1	1,985.8	1,989.6	1,993.9	1,999.6	2,004.2	2,008.6
92.2	86.3	79.6	72.3	68.6	64.9	61.1	57.1
304.0	3,280.7	3,238.4	3,197.6	3,194.0	3,194.4	3,200.9	3,203.2
214.3	213.3	210.9	207.8	204.4	203.7	203.2	202.5
41.4	30.9	23.9	23.6	22.2	21.3	21.2	21.9
633.8	637.5	605.5	577.4	574.3	574.3	576.2	577.8
686.1	1,684.1	1,678.2	1,671.8	1,665.5	1,660.2	1,654.9	1,650.6
266.1	261.3	254.7	252.0	251.2	255.7	258.4	256.4
108.3	109.6	110.8	111.9	113.3	114.1	114.7	115.5
265.9	266.2	266.8	267.1	267.1	267.3	267.5	267.5
167.8	183.7	182.0	176.7	168.9	160.7	151.9	143.7
56.4	56.4	56.3	56.2	56.1	56.1	56.0	52.1
78.7	74.5	78.4	78.4	78.4	78.4	78.4	78.4
104.0	99.9	97.3	96.3	95.7	95.3	95.0	94.7
69.3	62.8	59.1	57.2	53.3	52.4	51.3	51.1
145.5	159.0	162.8	161.8	160.8	159.9	159.8	160.6
79.9	81.0	81.1	81.1	80.9	80.7	80.6	79.4
199.7	203.5	203.9	203.5	199.0	197.5	195.4	193.4
234.5	237.1	239.5	241.4	246.7	249.8	252.9	256.0

APPENDIX A

TABLE A-2

RESERVOIR OPERATIONS

DURING PERIOD DECEMBER 1964 AND JANUARY 1965

(Preliminary Data, Subject to Revision)

Watershed	Reservoir	Crest Elevation feet	Capacity in 1000's of Acre-Feet	Water in Storage, Thousands of Acre-Feet																								
				20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Trinity	Trinity	2,395	2,500.0	1,489.0	1,491.7	1,535.7	1,687.1	1,773.7	1,827.4	1,859.6	1,885.5	1,902.4	1,916.2	1,925.6	1,933.4	1,939.3	1,943.8	1,949.8	1,953.9	1,957.4	1,965.4	1,974.7	1,881.1	1,985.8	1,989.6	1,993.9	1,999.6	2,004.2	2,008.6
E. F. Russian	Mendocino	784	122.5	45.2	75.8	91.8	121.0	128.7	126.0	120.4	119.5	114.3	106.7	96.6	87.6	79.3	75.2	74.4	75.3	76.0	89.1	92.2	86.3	79.6	72.3	68.6	64.9	61.1	57.1
Sacramento	Shasta	1,078	4,500.0	2,527.0	2,576.4	2,733.9	3,052.9	3,204.7	3,276.6	3,305.0	3,319.5	3,310.1	3,286.2	3,278.3	3,262.4	3,254.7	3,257.1	3,261.4	3,253.3	3,244.9	3,285.0	3,304.0	3,280.7	3,238.4	3,197.6	3,194.0	3,194.4	3,200.9	3,203.2
Clear Creek	Whiskeytown	1,210	241.0	208.8	209.5	221.6	242.4	245.2	243.9	241.9	240.6	238.6	236.0	232.8	229.2	225.2	221.1	217.6	213.6	209.8	213.3	214.3	213.3	210.9	207.8	204.4	203.7	203.2	202.5
Stony Creek	Black Butte	515	160.0	29.0	29.8	37.4	74.0	96.5	94.9	79.5	55.5	34.6	22.5	25.1	23.7	22.9	21.5	20.2	21.3	22.9	42.1	41.4	30.9	23.9	23.6	22.2	21.3	21.2	21.9
American	Folsom	480	1,000.0	577.0	596.5	650.1	838.3	888.2	861.5	733.0	688.4	673.4	642.9	643.0	636.4	629.4	623.9	621.1	625.7	632.9	612.3	633.8	637.5	605.5	577.4	574.3	574.3	576.2	577.8
Putah Creek	Berryessa	456	1,600.0	1,355.0	1,358.4	1,393.2	1,478.9	1,511.2	1,519.8	1,523.4	1,534.4	1,544.3	1,551.3	1,558.2	1,563.9	1,567.7	1,571.2	1,577.9	1,596.5	1,619.7	1,678.6	1,686.1	1,684.1	1,678.2	1,671.8	1,665.5	1,660.2	1,654.9	1,650.6
Merced	Lake McClure	710	289.0	14.6	16.0	17.6	38.6	101.8	153.4	169.2	185.0	197.7	206.8	213.3	220.9	228.2	232.9	237.6	241.4	247.8	256.9	266.1	261.3	254.7	252.0	251.2	255.7	258.4	256.4
Tuolumne	Cherry Valley	4,715	268.0	10.5	11.5	14.5	36.7	60.0	70.3	80.7	85.8	89.4	92.5	94.9	97.2	98.9	100.4	103.7	103.7	104.8	106.4	108.3	109.6	110.8	111.9	113.3	114.1	114.7	115.5
	Hetch-Hetchy	3,812	360.0	138.2	137.6	138.5	174.7	212.7	238.3	246.6	252.3	256.1	257.3	258.9	260.3	261.0	261.7	262.4	262.9	263.4	264.1	265.9	266.2	266.8	267.1	267.1	267.3	267.5	267.5
	Don Pedro	609	289.0	87.4	87.4	87.8	144.2	144.3	190.6	196.4	196.1	204.5	204.3	199.1	193.5	180.6	172.5	165.2	165.2	158.3	152.3	167.8	183.7	182.0	176.7	168.9	160.7	151.9	143.7
Stanislaus	Donnell's	4,921	64.5	-	26.7	27.0	40.7	58.3	57.7	57.5	57.3	57.1	57.0	57.0	56.9	56.7	56.6	56.5	56.4	56.3	56.4	56.4	56.4	56.3	56.2	56.1	56.1	56.0	52.1
	Beardsley	3,405	97.5	-	36.9	37.0	44.7	53.9	69.0	75.9	97.6	97.2	78.9	78.8	78.6	78.5	78.4	78.3	78.4	78.4	78.4	78.7	74.5	78.4	78.4	78.4	78.4	78.4	78.4
	Melones	723	112.5	-	42.4	46.4	87.2	113.2	104.9	99.9	101.3	100.1	98.2	97.2	96.7	96.0	95.0	94.5	94.7	94.7	96.7	104.0	99.9	97.3	96.3	95.7	95.3	95.0	94.7
	Tulloch	515	68.4	-	53.9	54.2	59.1	69.5	64.4	70.0	67.8	67.6	64.6	63.6	63.9	63.2	63.2	60.9	62.3	65.5	68.5	69.3	62.8	59.1	57.2	53.3	52.4	51.3	51.1
Calaveras	New Hogan	725	325.0	16.8	19.4	22.3	31.8	56.3	73.7	77.8	82.7	92.1	97.9	102.7	107.0	111.6	114.2	115.9	118.2	121.5	124.6	145.5	159.0	162.8	161.8	160.8	159.9	159.8	160.6
Mokelumne	Salt Springs	3,960	139.4	-	6.3	5.2	6.0	31.7	54.2	64.5	69.9	73.6	76.6	78.4	79.9	81.8	81.8	77.3	77.3	76.9	78.8	79.9	81.0	81.1	81.1	80.9	80.7	80.6	79.4
	Pardee	575	210.0	-	201.8	203.6	219.5	219.5	213.9	211.9	212.3	211.2	209.3	206.4	202.9	197.6	192.4	189.9	189.2	189.7	189.8	199.7	203.5	203.9	203.5	199.0	197.5	195.4	193.4
	Camanche	235.5	431.5	-	55.6	61.5	69.8	124.2	168.9	177.3	189.0	200.6	210.5	214.3	221.5	225.7	229.3	239.8	230.4	229.0	232.5	234.5	237.1	239.5	241.4	246.7	249.8	252.9	256.0

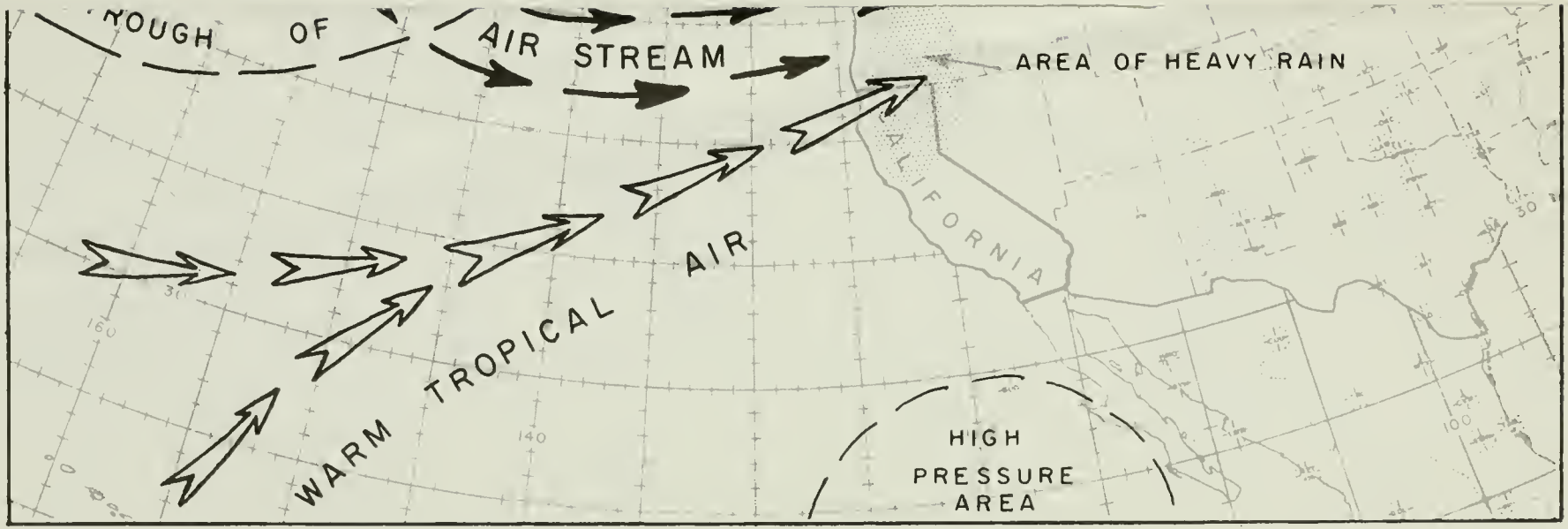


PLATE I

SCHEMATIC DIAGRAM OF WEATHER PATTERN
AT 500 MILLIBARS DECEMBER 22, 1964

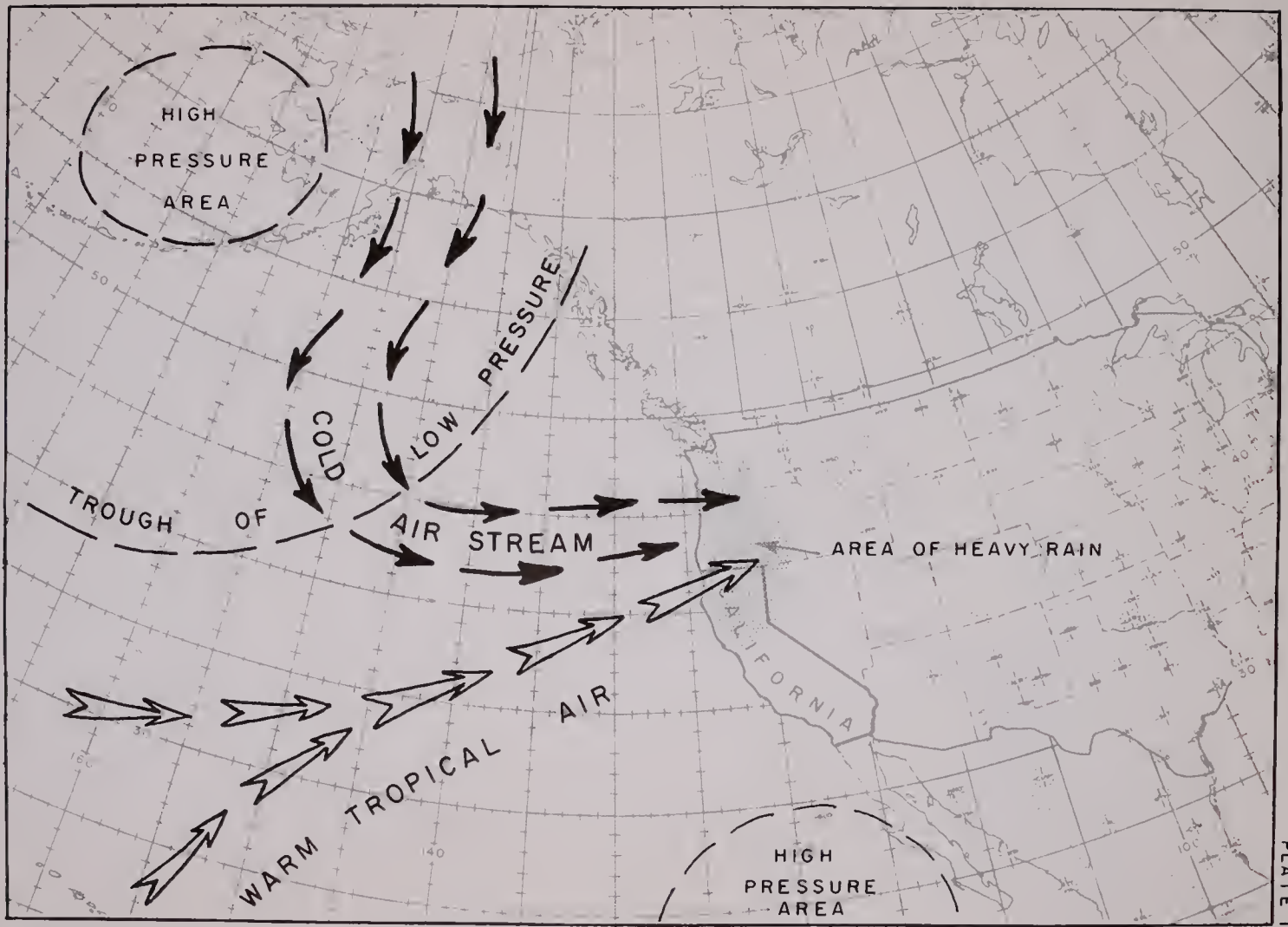
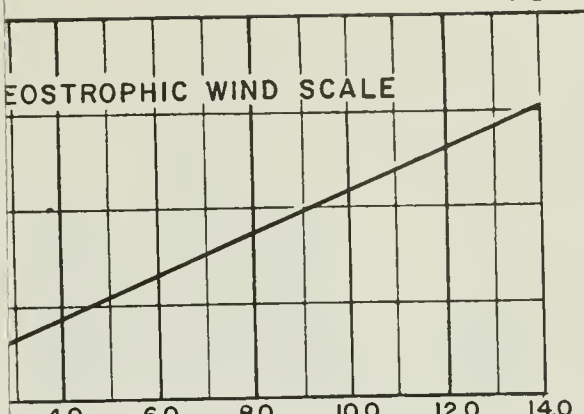


PLATE I

SCHEMATIC DIAGRAM OF WEATHER PATTERN
AT 500 MILLIBARS DECEMBER 22, 1964



NOTES

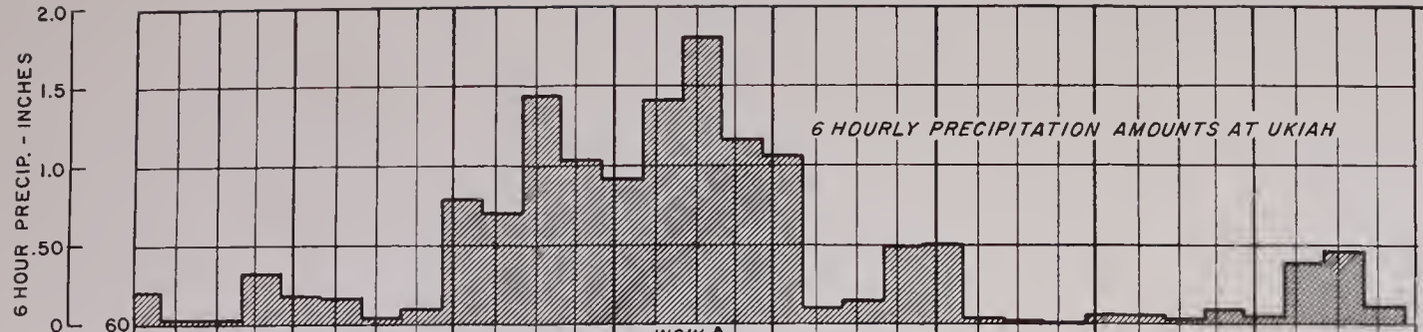
the direction from which the wind was blowing:

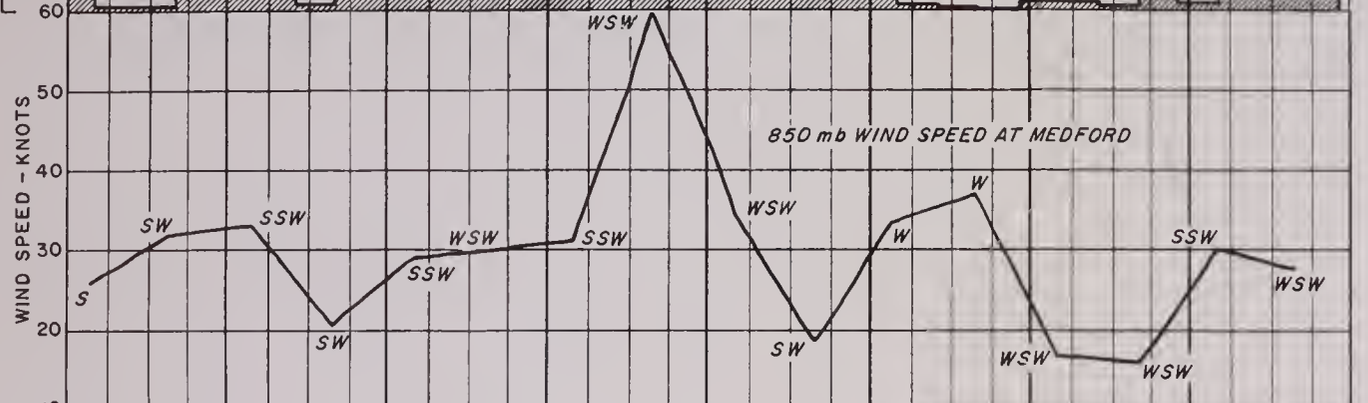
b pressure is at at elevation of about 5,000 feet.

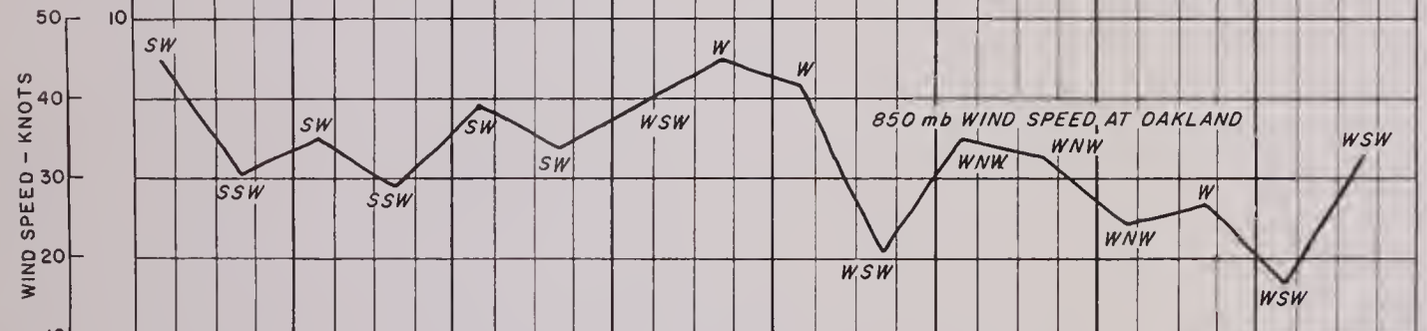
STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF OPERATIONS

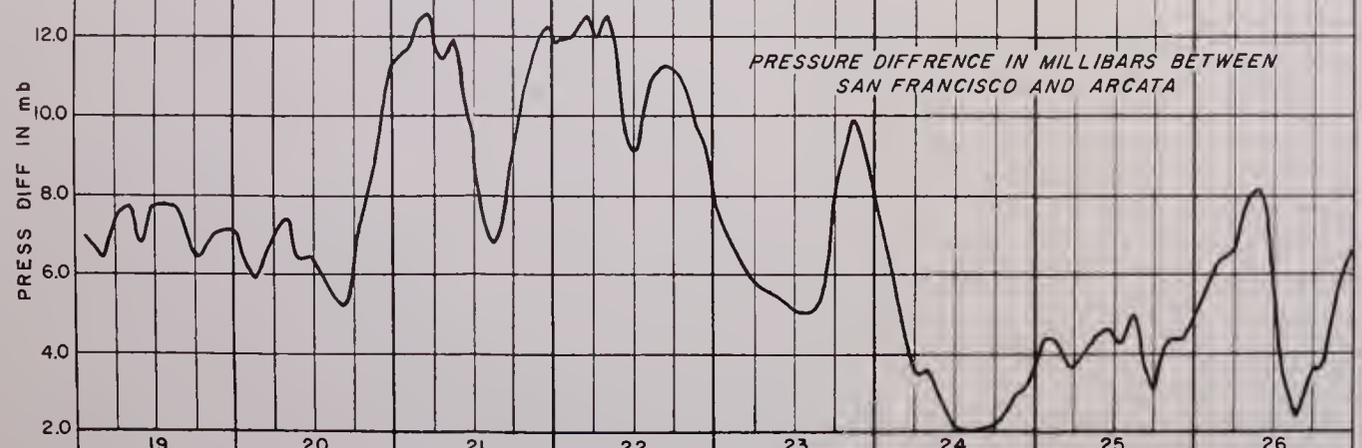
FLOOD OF
DECEMBER 1964 - JANUARY 1965

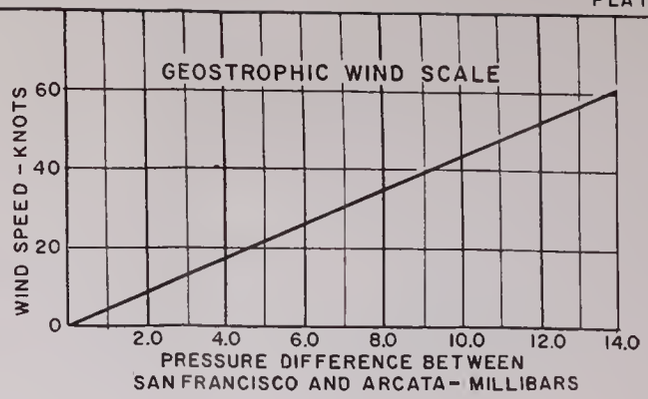
METEOROLOGICAL DATA
ESSURE GRADIENT AND WIND
DECEMBER 19 - 26, 1964











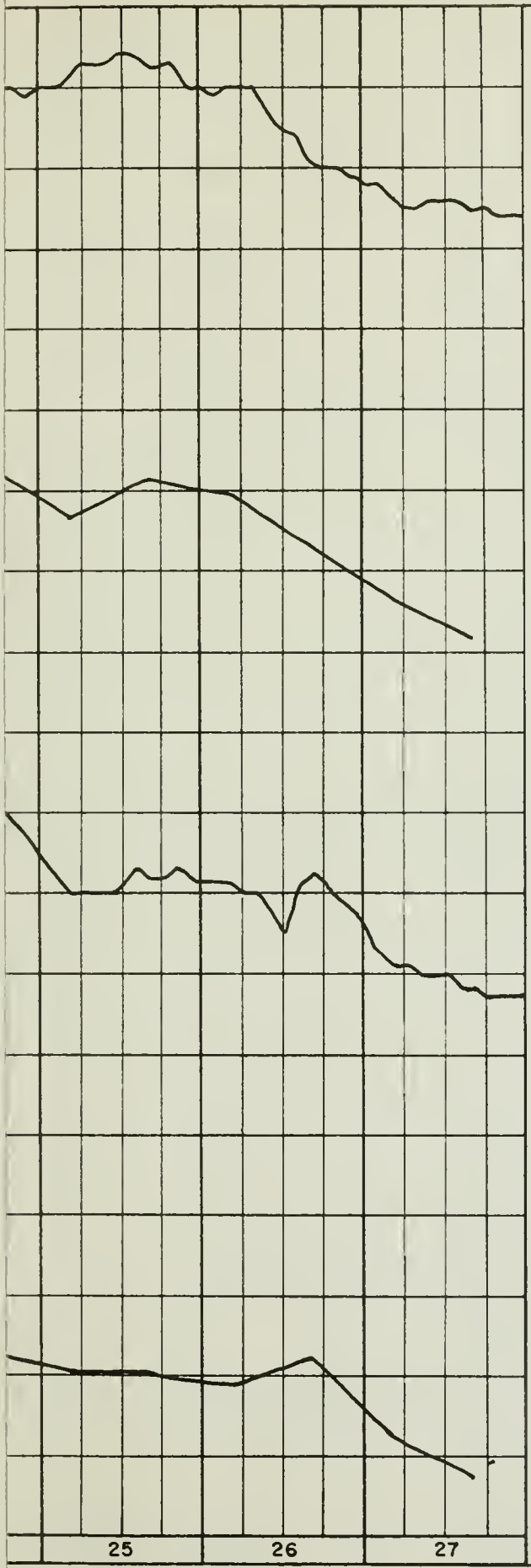
NOTES

SSW — Indicates the direction from which the wind was blowing: The 850 mb pressure is at at elevation of about 5,000 feet.

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF OPERATIONS

FLOOD OF
DECEMBER 1964 - JANUARY 1965

METEOROLOGICAL DATA
PRESSURE GRADIENT AND WIND
DECEMBER 19 - 26, 1964



AIR TEMPERATURE AT SEXTON SUMMIT
ELEVATION 3841 FEET

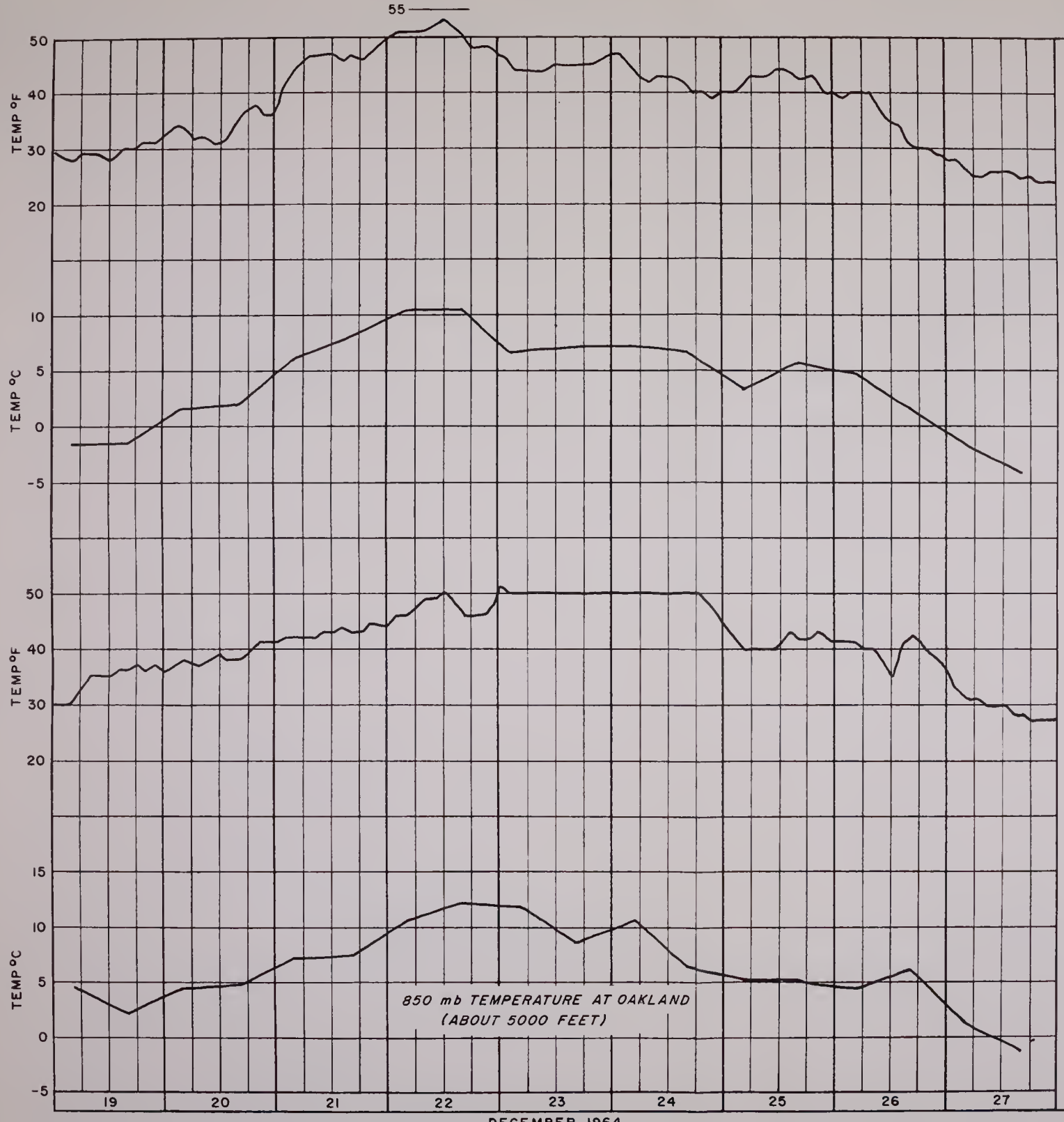
850 mb TEMPERATURE AT MEDFORD
(ABOUT 5000 FEET)

AIR TEMPERATURE AT BLUE CANYON
ELEVATION 5280 FEET

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF OPERATIONS

FLOOD OF
DECEMBER 1964 - JANUARY 1965

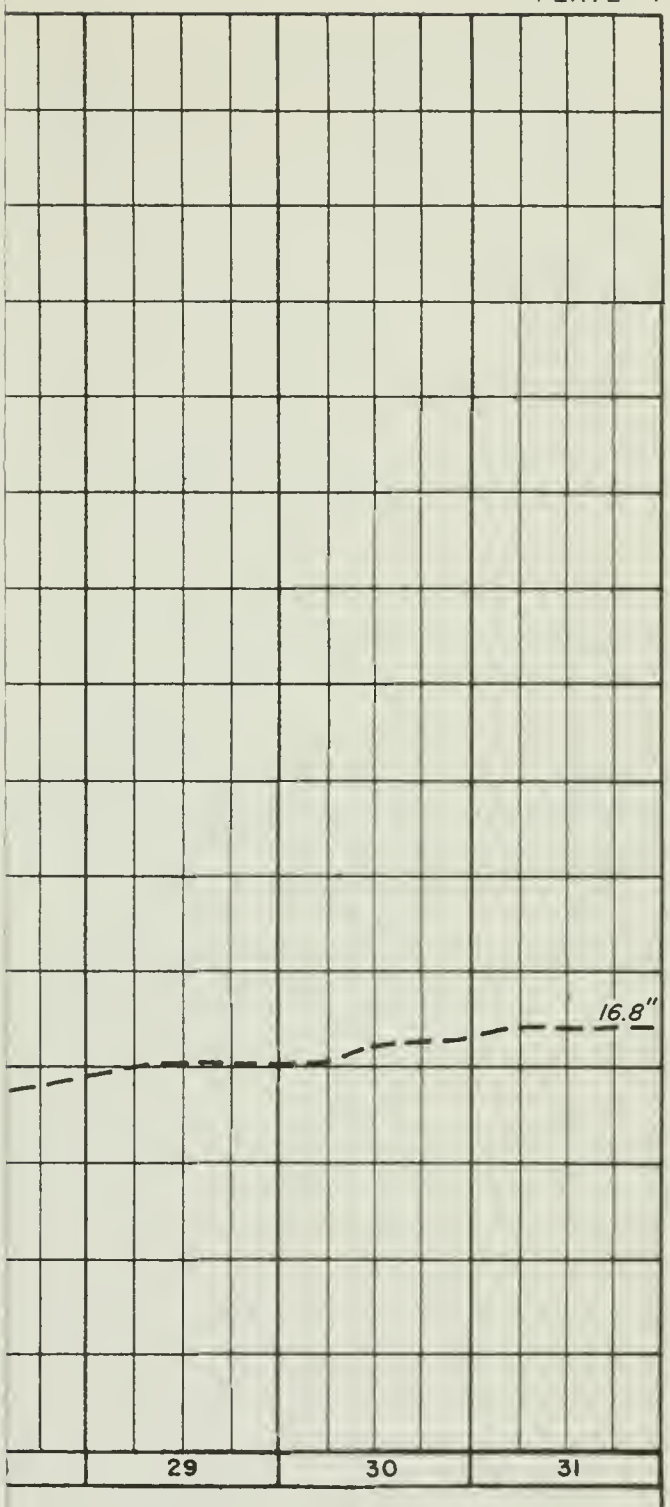
METEOROLOGICAL DATA
TEMPERATURE
DECEMBER 19 – 27, 1964



STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF OPERATIONS

FLOOD OF
DECEMBER 1964 - JANUARY 1965

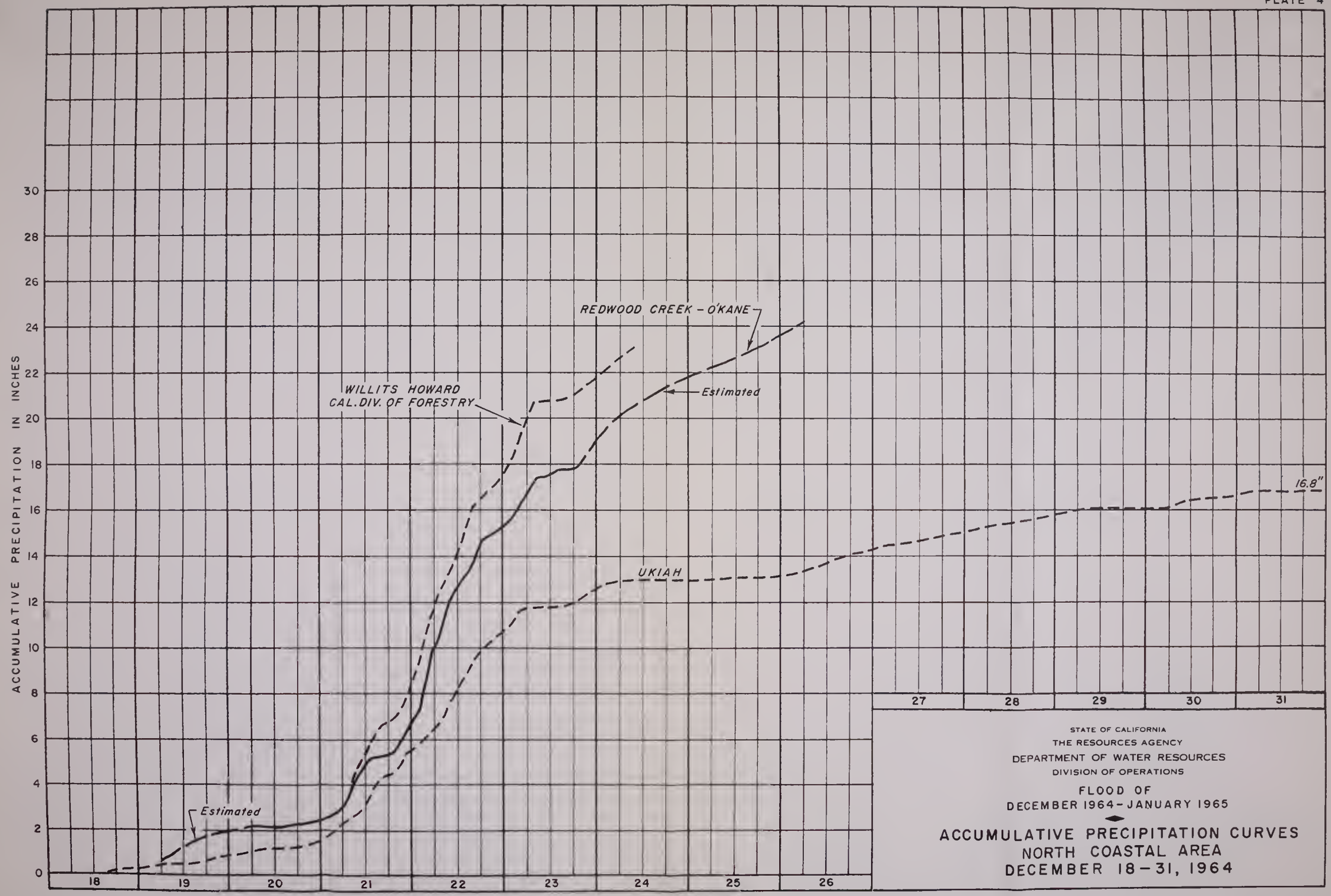
METEOROLOGICAL DATA
TEMPERATURE
DECEMBER 19 - 27, 1964



STATE OF CALIFORNIA
THE RESOURCES AGENCY
)EPARTMENT OF WATER RESOURCES
DIVISION OF OPERATIONS

FLOOD OF
ECEMBER 1964 - JANUARY 1965

.ATIVE PRECIPITATION CURVES
NORTH COASTAL AREA
ECEMBER 18 - 31, 1964

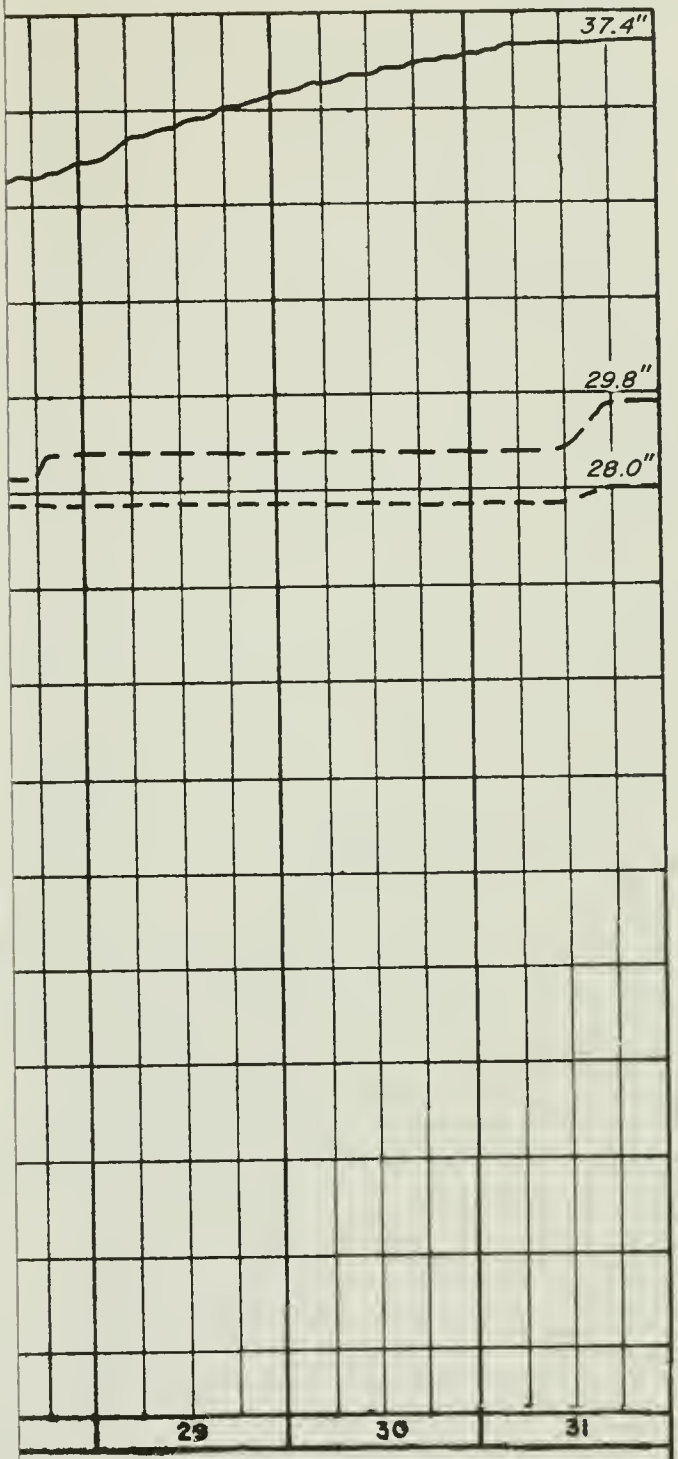


STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF OPERATIONS

FLOOD OF
DECEMBER 1964 - JANUARY 1965

ACCUMULATIVE PRECIPITATION CURVES
NORTH COASTAL AREA
DECEMBER 18 - 31, 1964

PLATE 5

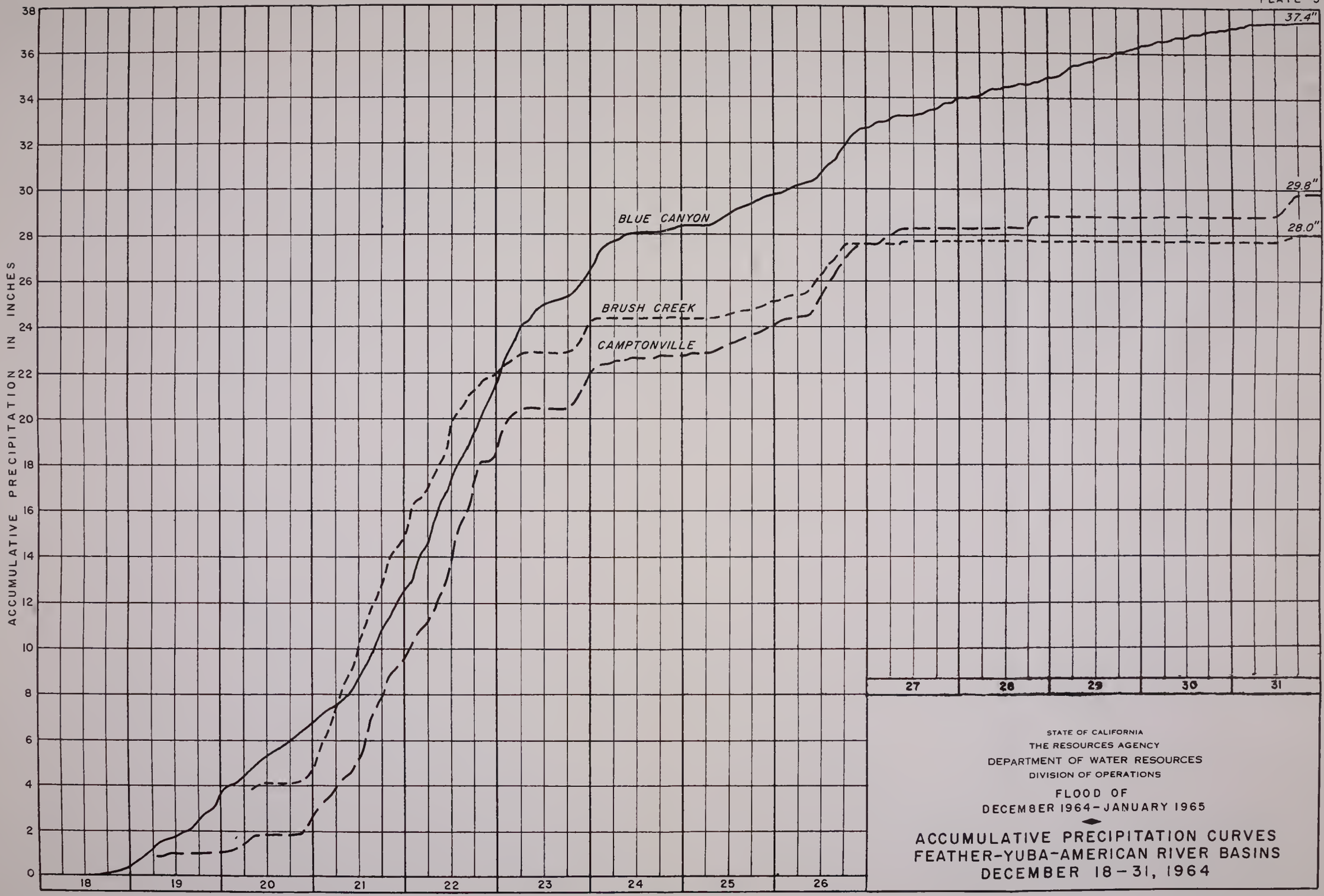


STATE OF CALIFORNIA
THE RESOURCES AGENCY
ARTMENT OF WATER RESOURCES
DIVISION OF OPERATIONS

FLOOD OF
EMBER 1964 - JANUARY 1965

TIVE PRECIPITATION CURVES
UBA-AMERICAN RIVER BASINS
EMBER 18 - 31, 1964

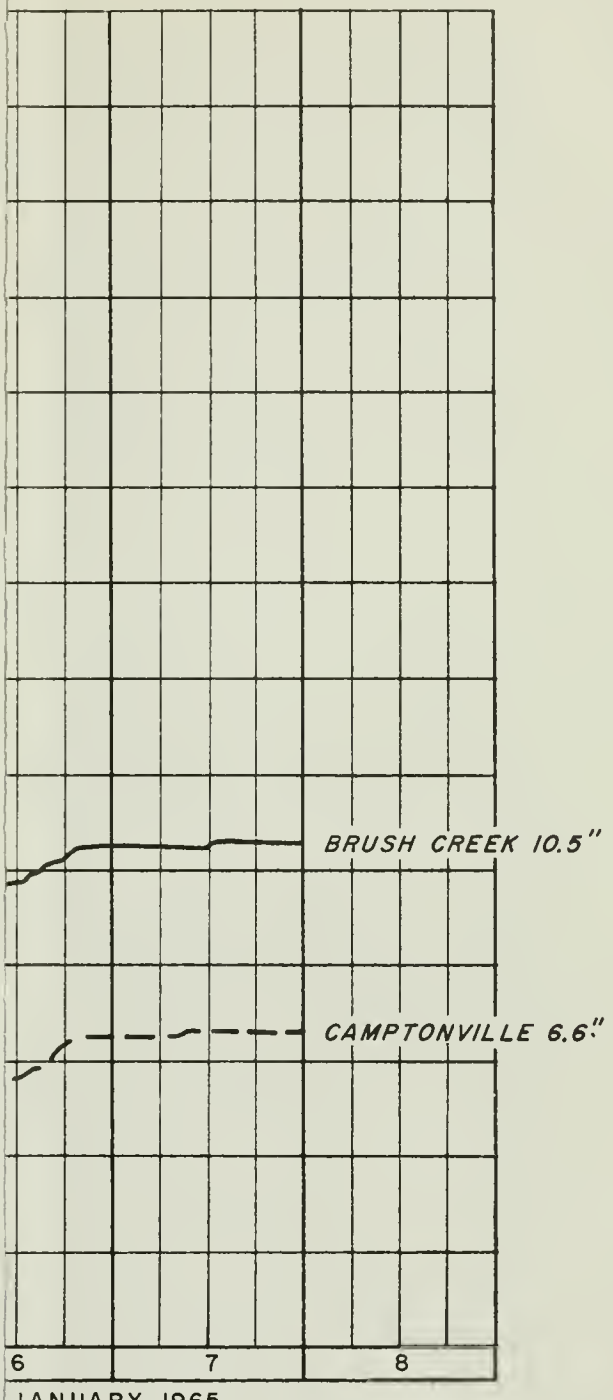
PLATE 5



STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF OPERATIONS

FLOOD OF
DECEMBER 1964 - JANUARY 1965

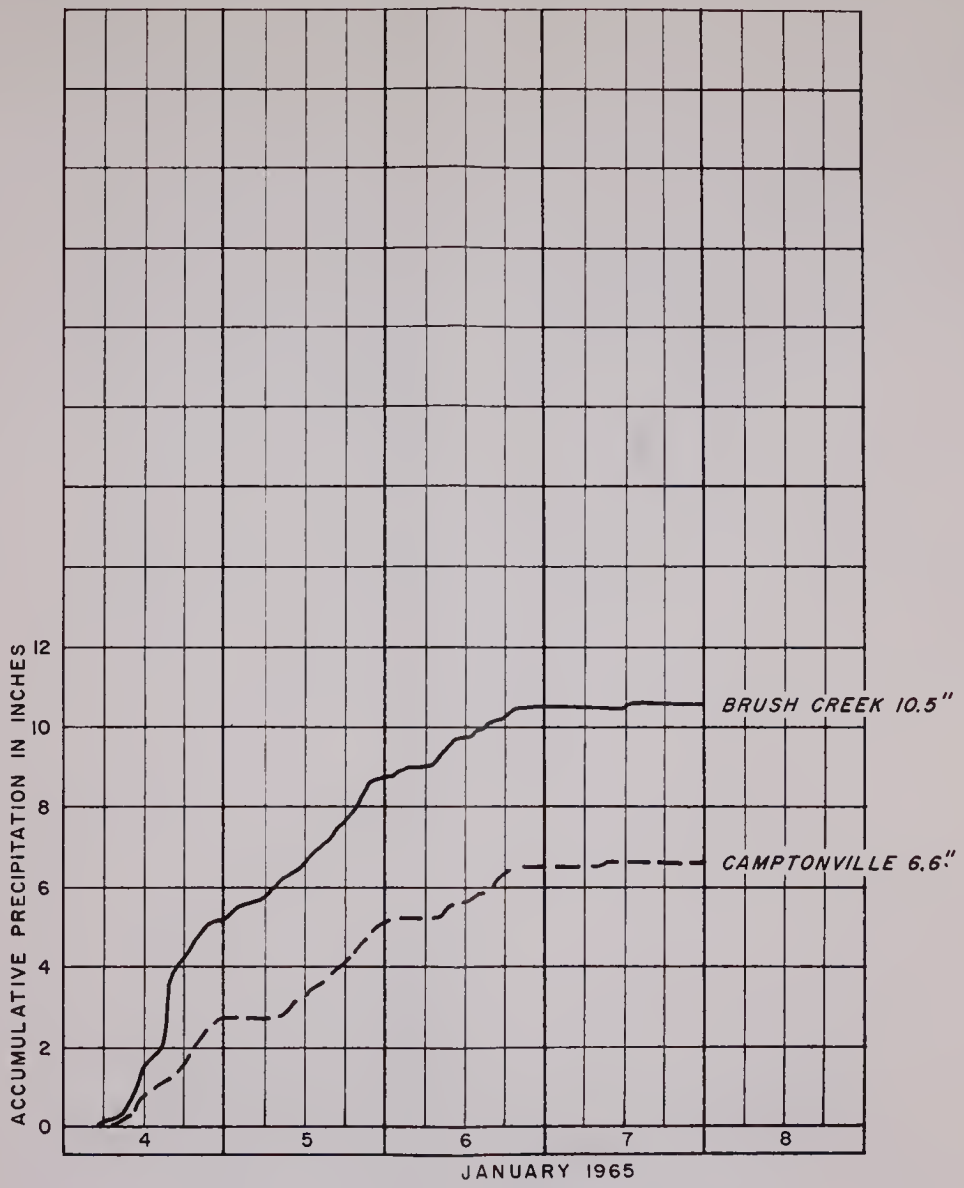
ACCUMULATIVE PRECIPITATION CURVES FEATHER-YUBA-AMERICAN RIVER BASINS DECEMBER 18 - 31, 1964



STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF OPERATIONS

FLOOD OF
DECEMBER 1964 - JANUARY 1965

LATIVE PRECIPITATION CURVES
ATHER-YUBA RIVER BASINS
JANUARY 4-7, 1965

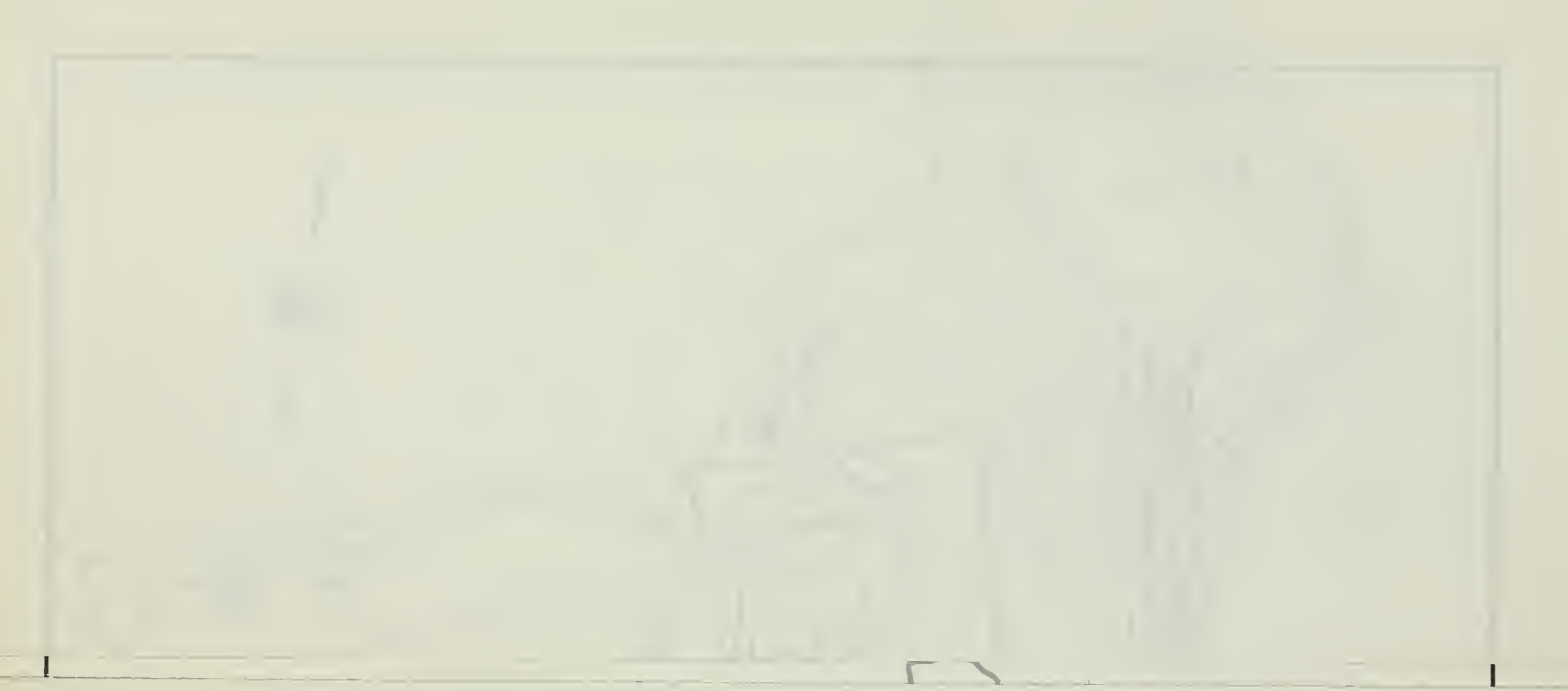


STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF OPERATIONS

FLOOD OF
DECEMBER 1964 – JANUARY 1965

ACCUMULATIVE PRECIPITATION CURVES FEATHER-YUBA RIVER BASINS JANUARY 4–7, 1965


LEGEND
10 ISOHYETS OF RAINFALL IN INCHES
RESERVOIR
NATURAL LAKE
DRAINAGE BASIN BOUNDARY
CLEAR LAKE RES
IRON GATE RESERVOIR
LAKE ALMANOR
LAKE PILLSBURY
LAKE MENDOCINO
SHASTA RIVER
KLAMATH RIVER
SCOTT RIVER
TRINITY RIVER
TRINITY LAKE
LEWISTON RESERVOIR
TRINITY RIVER BASIN
SMITH RIVER BASIN
KLAMATH RIVER BASIN
EEL RIVER BASIN
RUSSIAN RIVER BASIN
MAD RIVER
EEL RIVER
NAVARRO RIVER
CENTRAL VALLEY AREA
SAN FRANCISCO BAY AREA
PACIFIC OCEAN
OREGON
STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF OPERATIONS
FLOOD OF
DECEMBER 1964 – JANUARY 1965
ISOHYETAL MAP
NORTH COASTAL AREA
DECEMBER 18-27 1964 (9 DAYS)
SCALE OF MILES
16 0 16 32

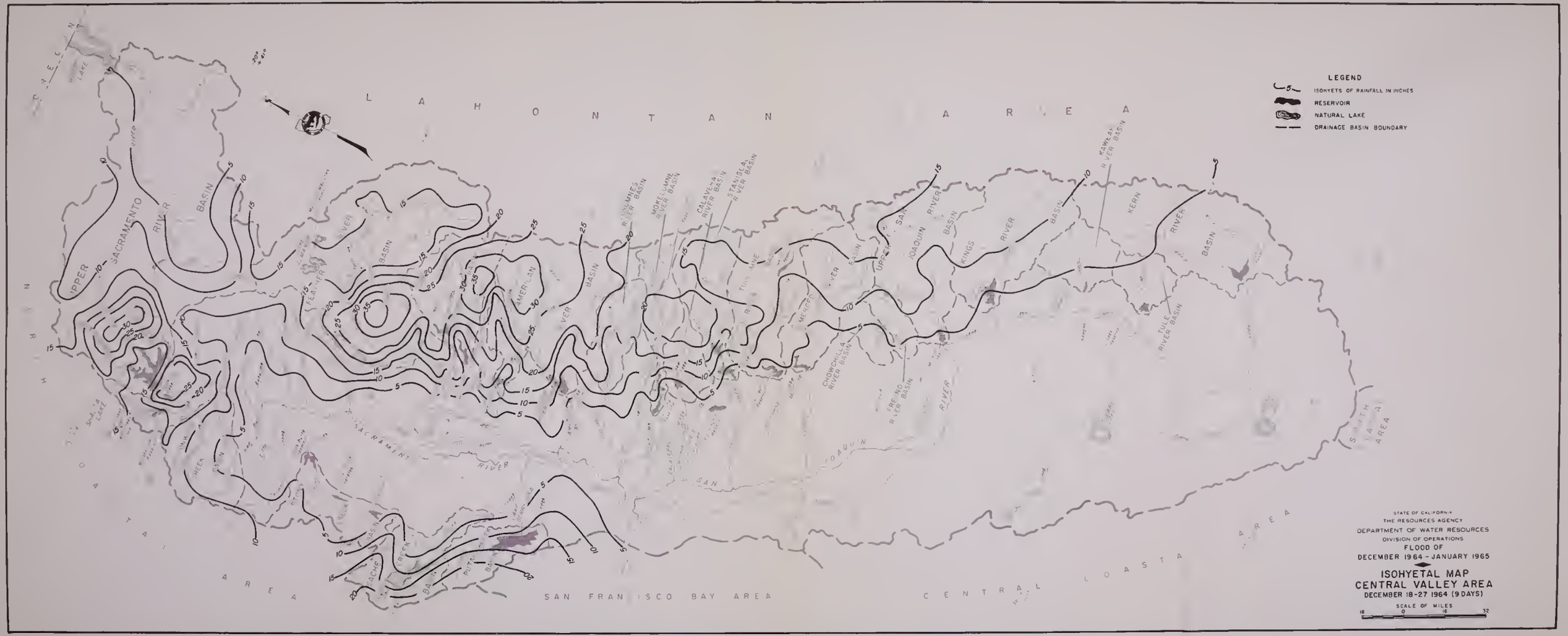


STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF OPERATIONS
FLOOD OF
DECEMBER 1964 – JANUARY 1965

ISOHYETAL MAP
NORTH COASTAL AREA

24 HOUR PERIOD ENDING
0800 PST DECEMBER 22 1964

SCALE OF MILES
16 0 16 32

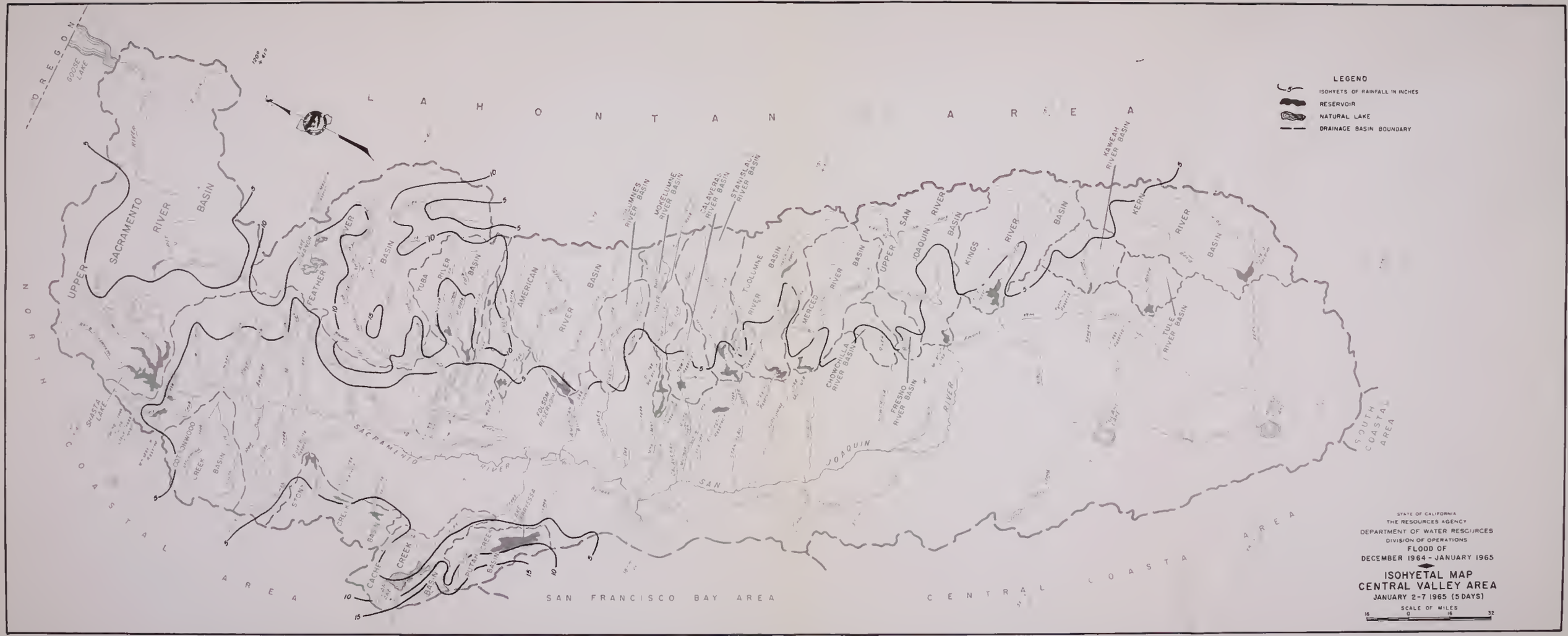


STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF OPERATIONS

FLOOD OF
DECEMBER 1964 - JANUARY 1965

ISOHYETAL MAP
CENTRAL VALLEY AREA
DECEMBER 18-27 1964 (9 DAYS)

SCALE OF MILES
16 0 16 32



STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF OPERATIONS

FLOOD OF
DECEMBER 1964 - JANUARY 1965

ISOHYETAL MAP
CENTRAL VALLEY AREA
JANUARY 2-7 1965 (5 DAYS)

SCALE OF MILES
16 0 16 32

SMITH RIVER NEAR CRESCENT CITY

PERIDD DF RECORD: 1931 – PRESENT

DATE	FLDW IN C F S
12 22 64	192,000
12 22 55	165,000
10 29 50	152,000
11 23 53	141,000

14

REDWOOD CREEK AT ORICK

PERIOD OF RECORD: 1910 – 15, 1916 – PRESENT

DATE	FLOW IN C F S
1 18 53	50,000
12 22 55	50,000
12 22 64	50,000

REDWOOD CREEK NEAR BLUE LAKE

PERIOD DF RECDRD: 1953 – 58, 1964 – PRESENT

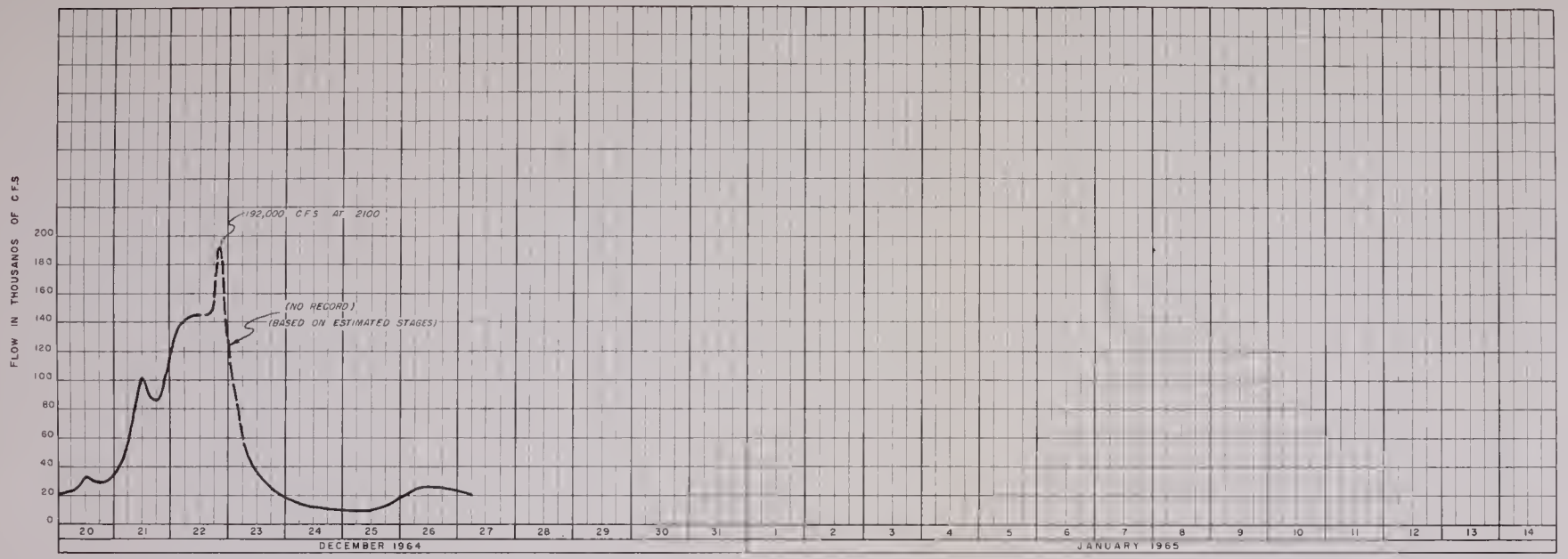
DATE	FLOW IN C F S
12 22 64	15,100
12 21 55	12,100

14

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF OPERATIONS

FLOOD OF DECEMBER 1964 – JANUARY 1965

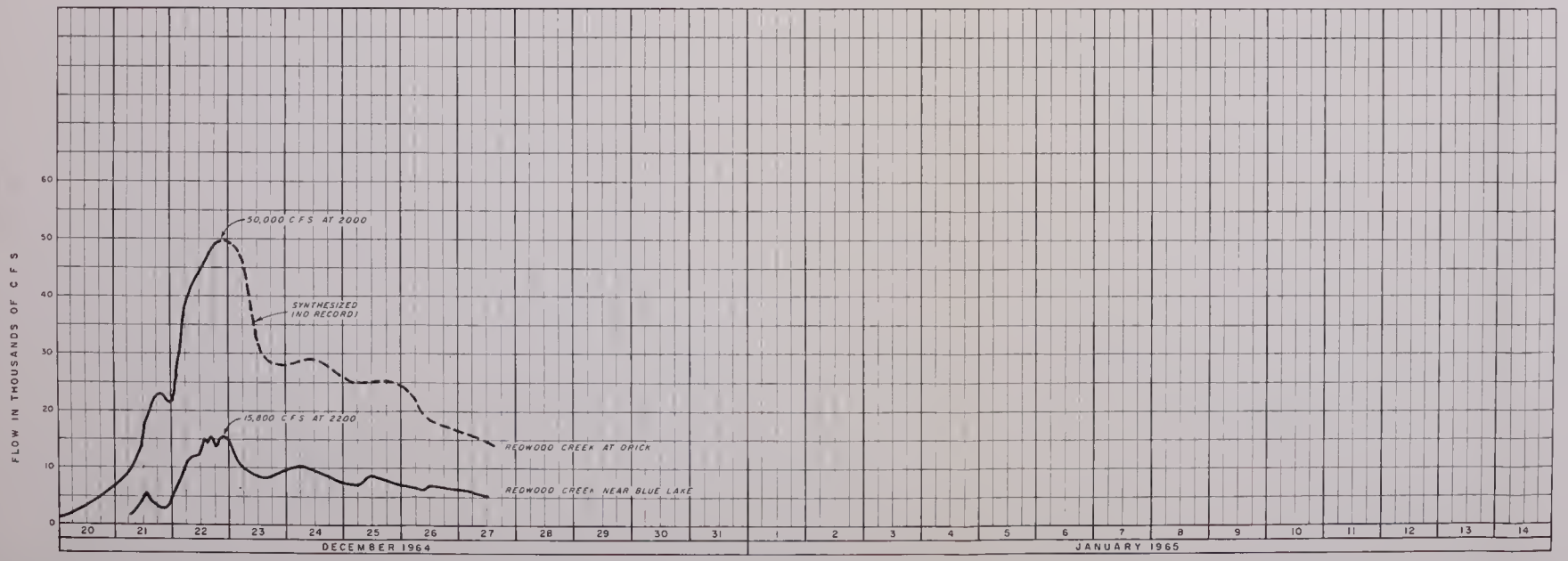
HYDROGRAPHS OF SMITH RIVER AND REDWOOD CREEK



SMITH RIVER NEAR CRESCENT CITY

PERIOD OF RECORD 1931 – PRESENT

DATE	FLOW IN C.F.S
12 22 64	192,000
12 22 55	165,000
10 29 50	152,000
11 23 53	141,000



REDWOOD CREEK AT ORICK

PERIOD OF RECORD 1910 – 15, 1916 – PRESENT

DATE	FLOW IN C.F.S
1 18 53	50,000
12 22 55	50,000
12 22 64	50,000

REDWOOD CREEK NEAR BLUE LAKE

PERIOD OF RECORD 1953 – 58, 1964 – PRESENT

DATE	FLOW IN C.F.S
12 22 64	15,100
12 21 55	12,100

STATE OF CALIFORNIA
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FLOOD OF
DECEMBER 1964 – JANUARY 1965

HYDROGRAPHS OF SMITH RIVER AND REDWOOD CREEK

MAD RIVER NEAR ARCATA

PERIDD OF RECDRD: 1910-13, 1950-PRESENT

DATE	FLDW IN C F S
12 22 55	77,800
12 23 64	71,000

TRINITY RIVER NEAR HOOPA

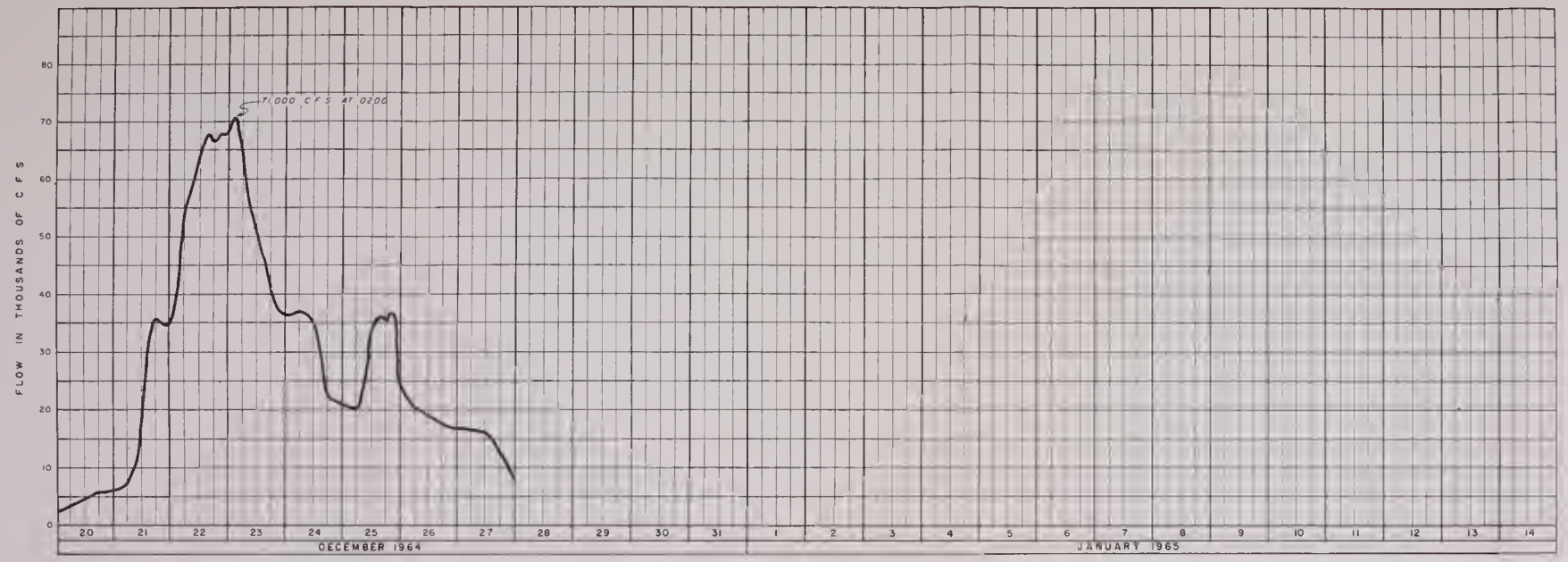
PERIDD DF RECDRD: 1911-14, 1916-18, 1931-PRESENT

DATE	FLDW IN C F S.
12 22 64	260,000
12 22 55	190,000
2 19 58	125,000
2 28 40	124,000

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF OPERATIONS

FLOOD OF DECEMBER 1964 - JANUARY 1965

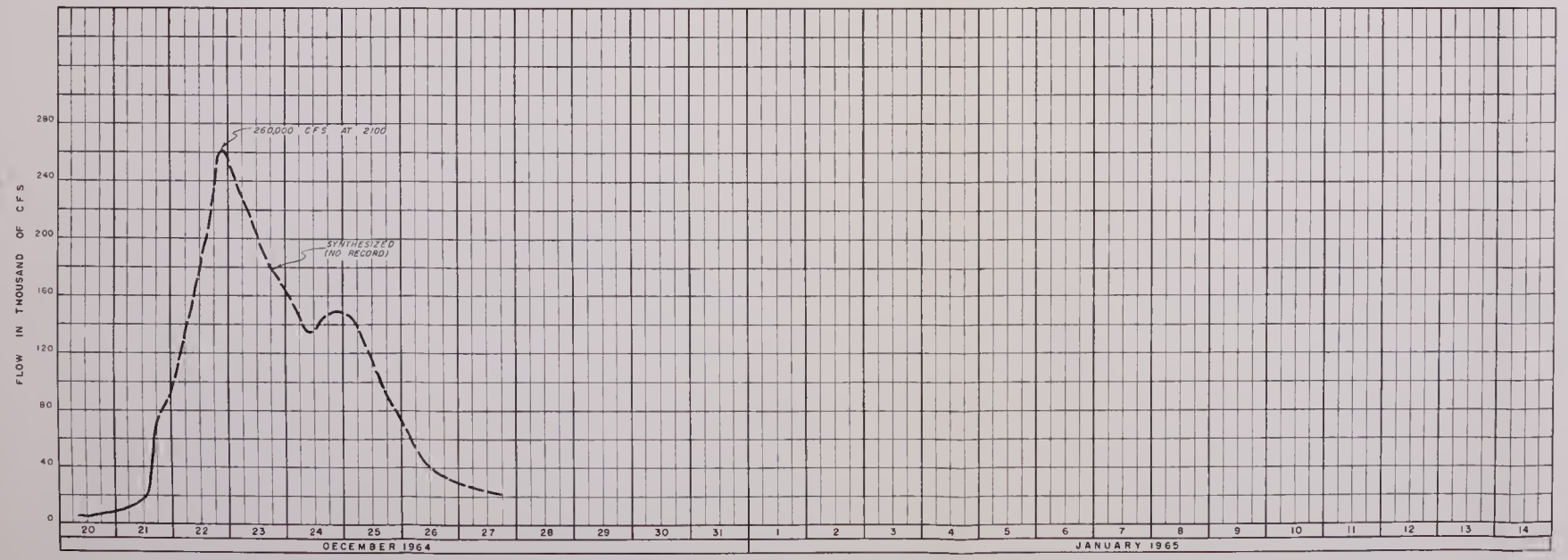
HYDROGRAPHS OF MAD AND TRINITY RIVERS



MAD RIVER NEAR ARCATA

PERIOD OF RECORD 1910-13, 1950-PRESENT

DATE	FLOW IN C F S
12 22 55	77 800
12 23 64	71,000



TRINITY RIVER NEAR HOOPA

PERIOD OF RECORD 1911-14 1916-18, 1931-PRESENT

DATE	FLOW IN C F S
12 22 64	260,000
12 22 55	190,000
2 19 58	125 000
2 26 40	124 000

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF OPERATIONS

FLOOD OF DECEMBER 1964 - JANUARY 1965

HYDROGRAPHS OF MAD AND TRINITY RIVERS

EEL RIVER AT ALDERPOINT

PERIOD OF RECORD: 1955–PRESENT

DATE	FLOW IN C.F.S
12 22 64	600,000
12 22 55	376,000
2 8 60	220,000

EEL RIVER AT SCOTIA

PERIOD OF RECORD: 1910–15, 1916–PRESENT

DATE	FLOW IN C.F.S.
12 22 64	750,000
12 22 55	541,000
12 11 37	345,000
2 8 60	343,000

STATE OF CALIFORNIA
THE RESOURCES AGENCY
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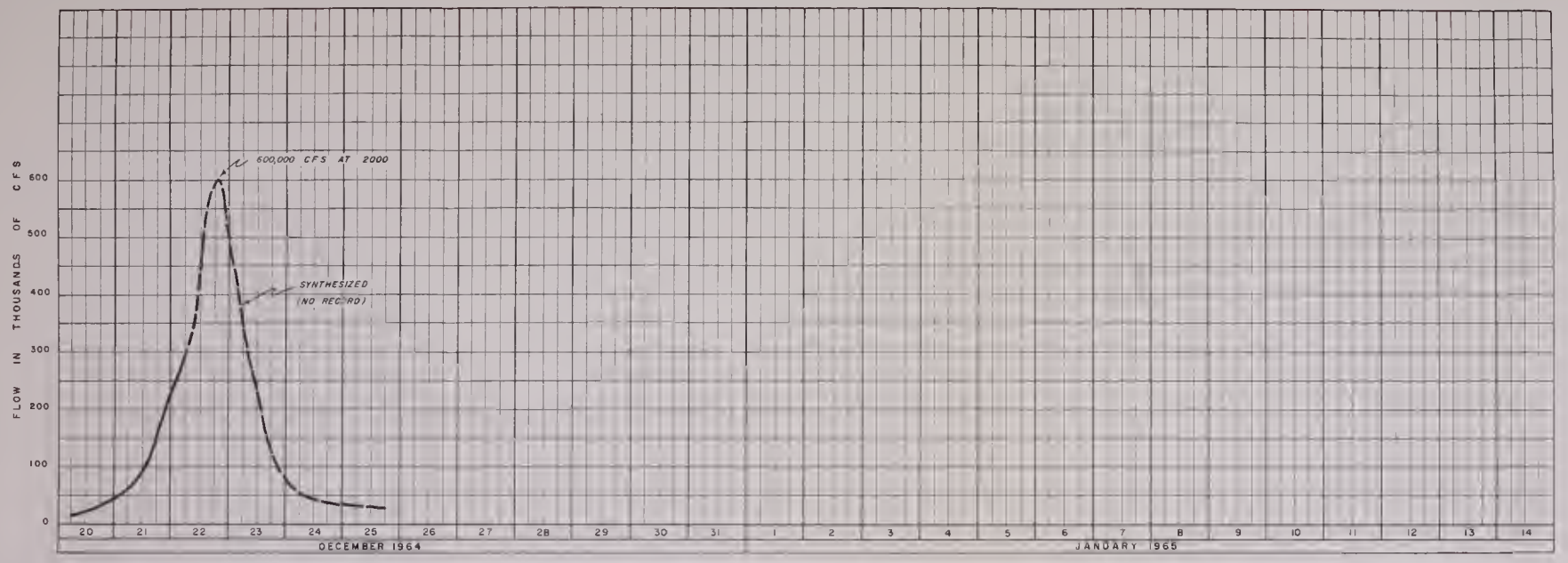
FLOOD OF DECEMBER 1964 – JANUARY 1965

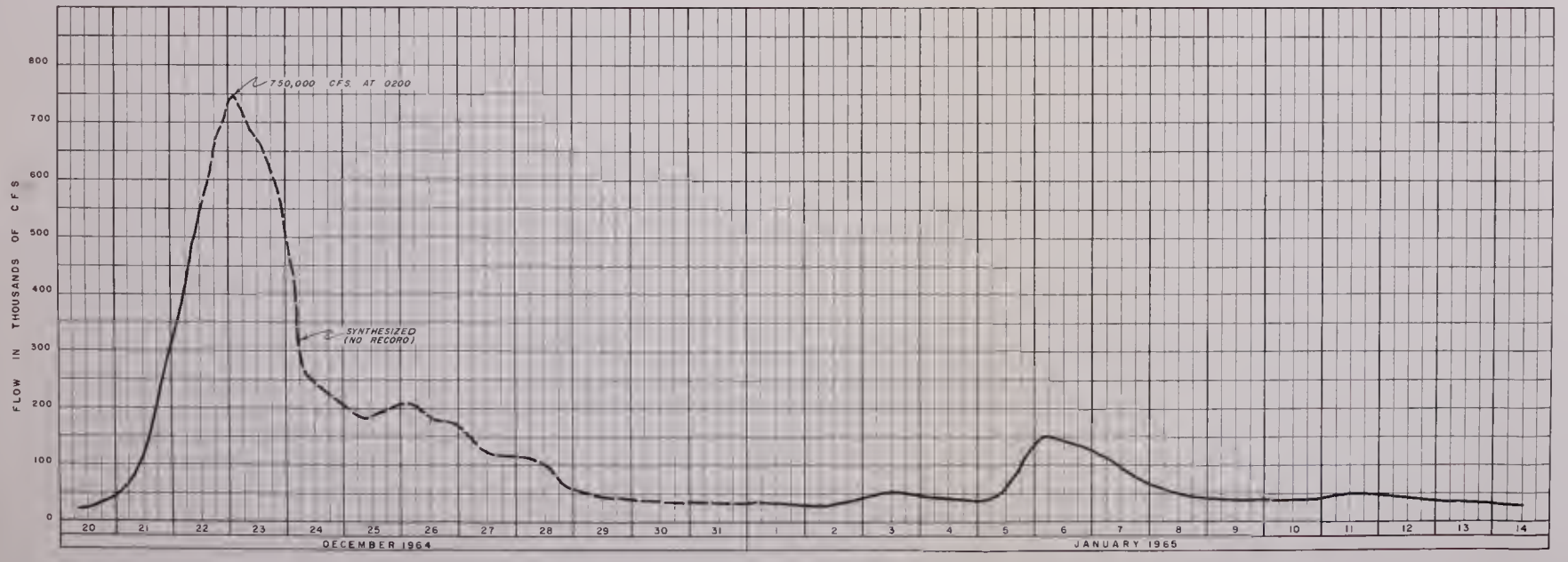
HYDROGRAPHS OF EEL RIVER



EEL RIVER AT ALDERPOINT

PERIOD OF RECORD 1955–PRESENT

DATE	FLOW IN C F S
12 22 64	600 000
12 22 55	276,000
2 8 60	220,000



EEL RIVER AT SCOTIA

PERIOD OF RECORD 1910–15, 1916–PRESENT

DATE	FLOW IN C F S
12 22 64	750 000
12 22 55	541 000
12 11 37	345,000
2 8 60	343 000

STATE OF CALIFORNIA
THE RESOURCES AGENCY
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DIVISION OF OPERATIONS

FLOOD OF
DECEMBER 1964 – JANUARY 1965

HYDROGRAPHS OF EEL RIVER

LAKE MENDOCINO (COYOTE DAM)

GROSS POOL 122,500 ACRE-FEET COMPLETED 1959

PERIOD OF RECORD: 1959–PRESENT

DATE	INFLOW IN C F S
12 22 64	21,000
2 8 60	10,200
1 31 63	8,800

RUSSIAN RIVER NEAR HOPLAND

PERIOD OF RECORD: 1939–PRESENT

DATE	FLOW IN C.F S
12 22 55	45,000
12 22 64	41,200
2 28 40	34,100

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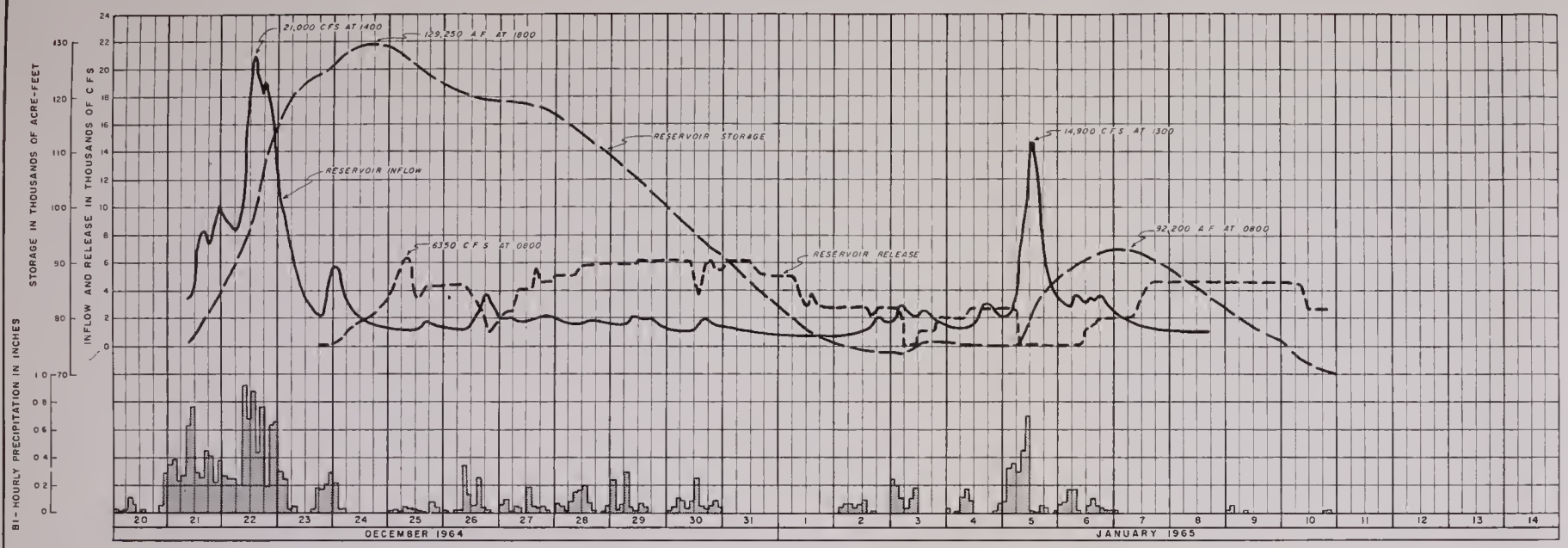
DIVISION OF OPERATIONS

FLOOD OF DECEMBER 1964 – JANUARY 1965

OPERATION OF LAKE MENDOCINO RESERVOIR AND HYDROGRAPH OF RUSSIAN RIVER

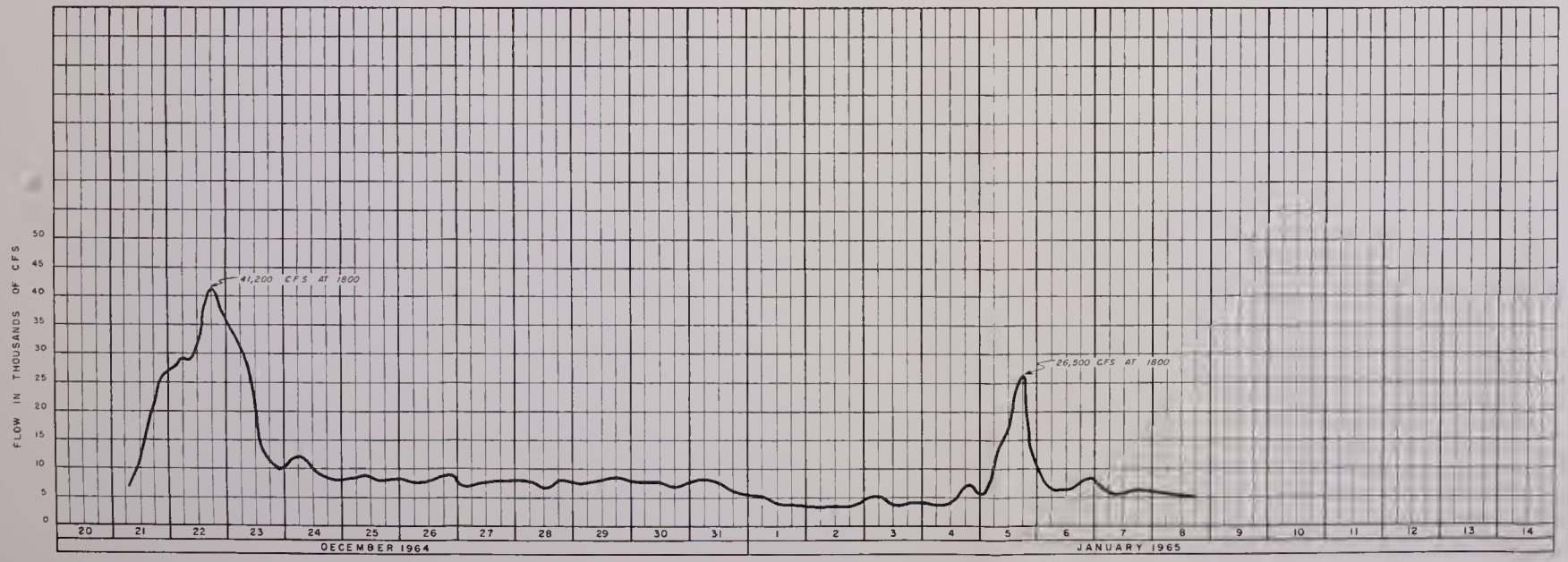


LAKE MENDOCINO (COYOTE DAM)

GROSS POOL 122,500 ACRE FEET COMPLETED 1959

PERIOD OF RECORD, 1959–PRESENT

DATE	INFLOW IN C F S
12 22 64	21,000
2 8 60	10,200
1 31 63	8,800



RUSSIAN RIVER NEAR HOPLAND

PERIOD OF RECORD 1939–PRESENT

DATE	FLOW IN C F S
12 22 55	45,000
12 22 64	41,200
2 28 40	34,100

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF OPERATIONS

FLOOD OF DECEMBER 1964 – JANUARY 1965

OPERATION OF LAKE MENDOCINO RESERVOIR AND HYDROGRAPH OF RUSSIAN RIVER

OROVILLE DAM EMBANKMENT

(Under Construction)

Outflow shown is hydrograph of Feather River at Oroville above Fish Barrier Dam

PERIOD OF RECORD: 1902–PRESENT

DATE	FLOW IN C F S
12 22 64	250,000*
12 23 64	157,000**
3 19 07	230,000

*Peak inflow behind Oroville Dam Embankment

**Peak discharge of Feather River at Oroville above Fish Barrier Dam

BLACK BUTTE RESERVOIR

GROSS POOL 160,000 ACRE-FEET COMPLETED 1963

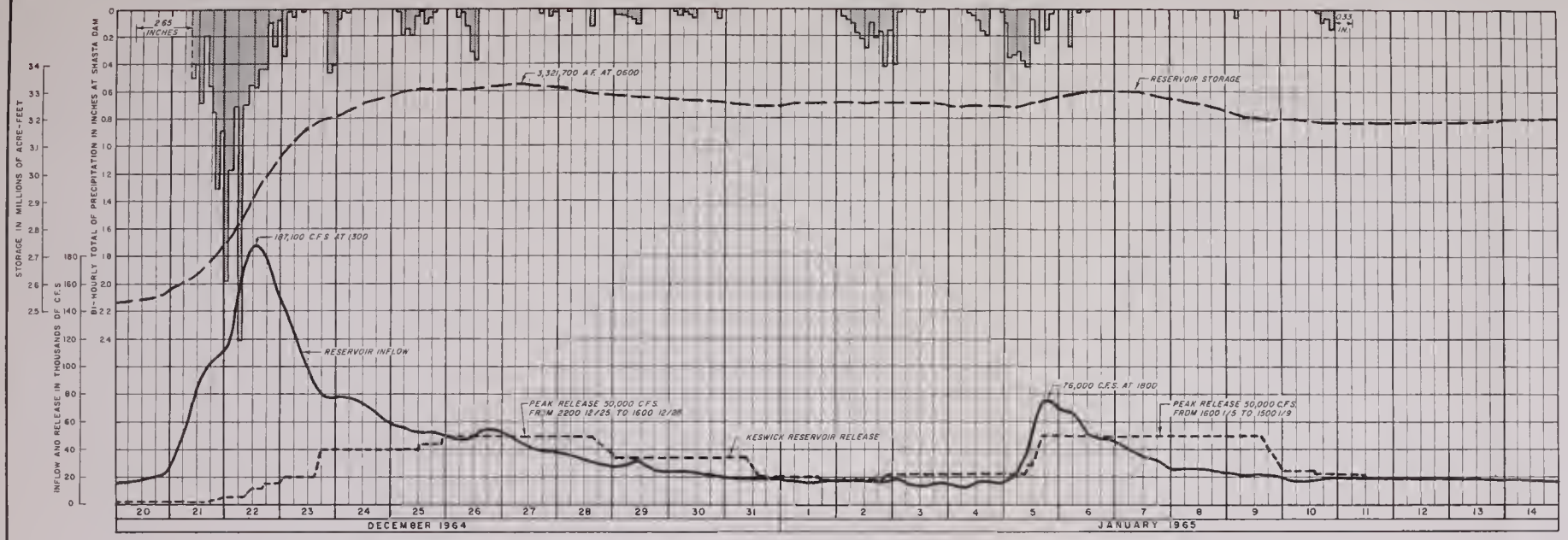
PERIOD OF RECORD 1963–PRESENT

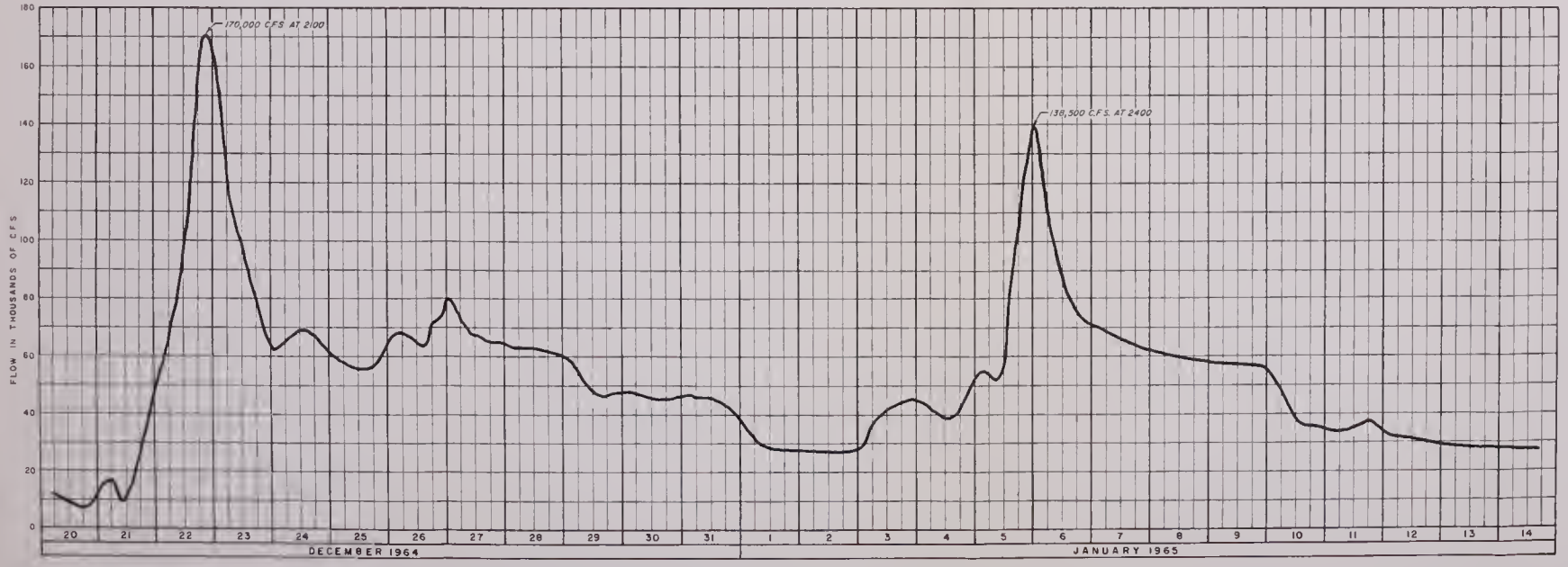
DATE	INFLOW IN C F S
12 23 64	48,000

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF OPERATIONS

FLOOD OF DECEMBER 1964 – JANUARY 1965

OROVILLE DAM EMBAMKMENT, FEATHER RIVER, AND OPERATION OF BLACK BUTTE RESERVOIR, STONY CREEK





SHASTA RESERVOIR

GROSS POOL 4,492,700 ACRE FEET
SHASTA RESERVOIR OPERATION STARTED 1943

PERIOD OF RECORD 1925–PRESENT

INFLOW TO SHASTA RESERVOIR COMPUTED SINCE 1945

REPORTED AS "SACRAMENTO RIVER AT KESWICK" 1942-45

"SACRAMENTO RIVER AT KENNETT" 1925-42

DATE	INFLOW IN C.F.S.
12 22 55	201,000*
12 22 64	187,100*
2 28 40	182,000

*Data furnished by U.S. Bureau of Reclamation

SACRAMENTO RIVER AT RED BLUFF

FLOW REGULATED BY SHASTA RESERVOIR SINCE 1943

PERIOD OF RECORD 1878–PRESENT

PRIOR TO CONSTRUCTION OF SHASTA DAM

DATE	FLOW IN C.F.S.
2 28 40	290,000
12 11 37	284,000

SINCE CONSTRUCTION OF SHASTA DAM

DATE	FLOW IN C.F.S.
12 22 64	170,000
1 5 65	138,500
2 19 58	138,000
12 27 51	136,000

STATE OF CALIFORNIA
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FLOOD OF DECEMBER 1964 – JANUARY 1965

OPERATION OF SHASTA RESERVOIR AND HYDROGRAPH OF SACRAMENTO RIVER

BUTTE CREEK NEAR CHICO

PERIOD OF RECORD: 1930–PRESENT

DATE	FLOW IN C F S.
12 22 64	21,300
12 22 55	18,700
1 5 65	17,400

YUBA RIVER AT SMARTVILLE

COMPUTED FROM SUMMATION OF "AT ENGLEBRIGHT DAM" AND "DEER CREEK NEAR SMARTVILLE"

PERIOD OF RECORD: 1903–PRESENT

REPORTED AS "AT SMARTVILLE" (INCLUDES DEER CREEK) 1903-41; 1941–PRESENT, COMPUTED AS STATED ABOVE

DATE	FLOW IN C F S.
12 22 64	171,800
12 23 55	156,500
2 1 63	155,000

STATE OF CALIFORNIA
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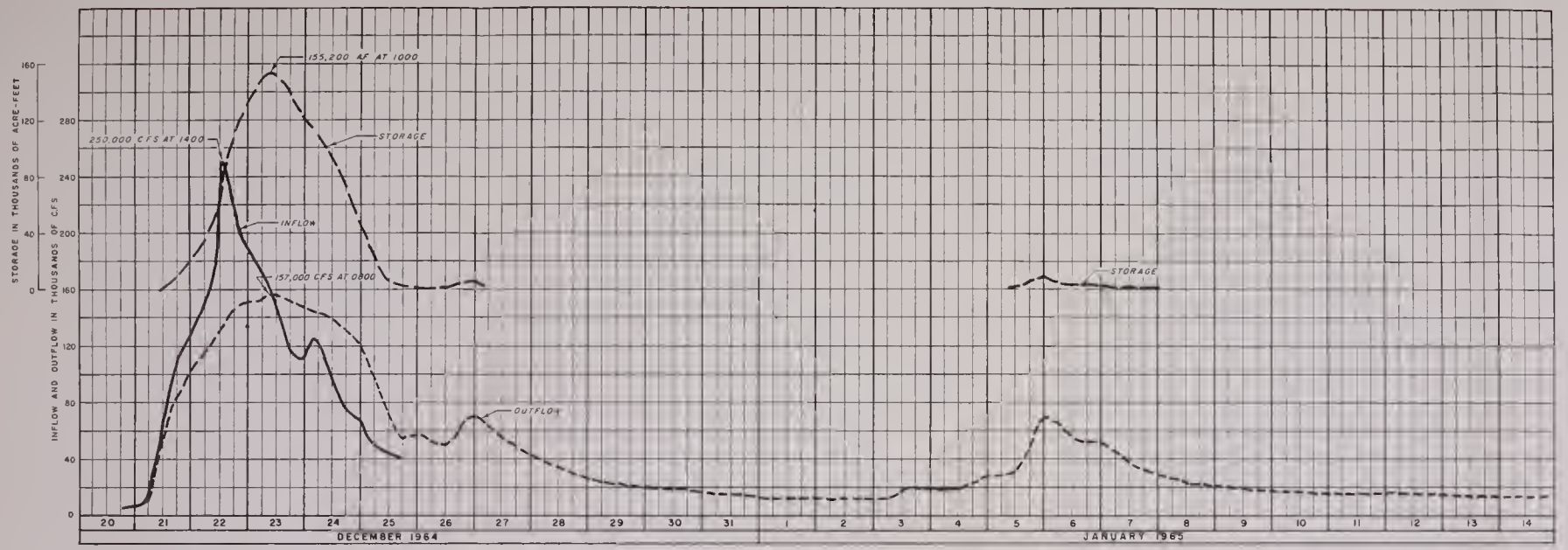
DIVISION OF OPERATIONS

FLOOD OF DECEMBER 1964 – JANUARY 1965

HYDROGRAPHS OF BUTTE CREEK AND YUBA RIVER



OROVILLE DAM EMBANKMENT

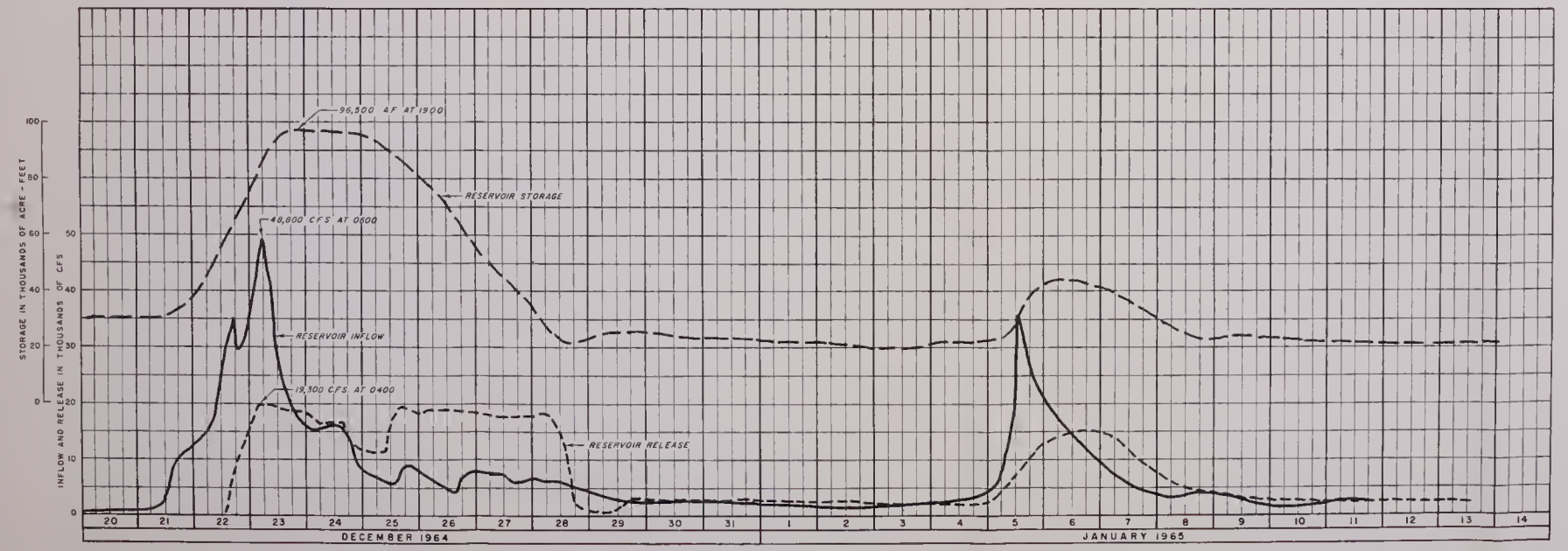
(Under Construction)

Outflow shown is hydrograph of Feather River at Oroville above Fish Barrier Dam

PERIOD OF RECORD 1902–PRESENT

DATE	FLOW IN C.F.S
12 22 64	250,000*
12 23 64	157,000**
3 19 07	230,000

*Peak inflow behind Oroville Dam Embankment
**Peak discharge of Feather River at Oroville above Fish Barrier Dam



BLACK BUTTE RESERVOIR

GROSS POOL 160,000 ACRE-FEET COMPLETED 1963

PERIOD OF RECORD 1963–PRESENT

DATE	INFLOW IN C.F.S
12 23 64	48 000

STATE OF CALIFORNIA
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FLOOD OF DECEMBER 1964 – JANUARY 1965

OROVILLE DAM EMBAMKMENT, FEATHER RIVER, AND OPERATION OF BLACK BUTTE RESERVOIR, STONY CREEK

FOLSOM RESERVOIR

GROSS POOL 1,000,000 ACRE-FEET COMPLETED 1956. FLOW REGULATED BY FOLSOM RESERVOIR SINCE 1955.

PERIOD OF RECORD: 1904–PRESENT

REPORTED AS "AMERICAN RIVER AT FAIR OAKS" 1904-55

DATE	INFLOW IN C.F.S.
12 23 64	280,000*
2 1 63	240,200**
12 23 55	218,000**

*Peak of flood wave resulting from failure of "Hell Hole Dam" on the Rubicon River

**Records furnished by U.S. Bureau of Reclamation

FLOW PAST LATITUDE OF SACRAMENTO

FLOW PAST LATITUDE OF SACRAMENTO RECORD IS OBTAINED BY SUMMATION OF THE FOLLOWING: SACRAMENTO RIVER AT SACRAMENTO AND YOLO BYPASS NEAR LISBON (PUBLISHED AS "AT LISBON" PRIOR TO 2 19 59)

PERIOD OF RECORD: 1914–PRESENT

DATE	FLOW IN C F S
12 25 64	445,000
12 24 55	405,000

STATE OF CALIFORNIA
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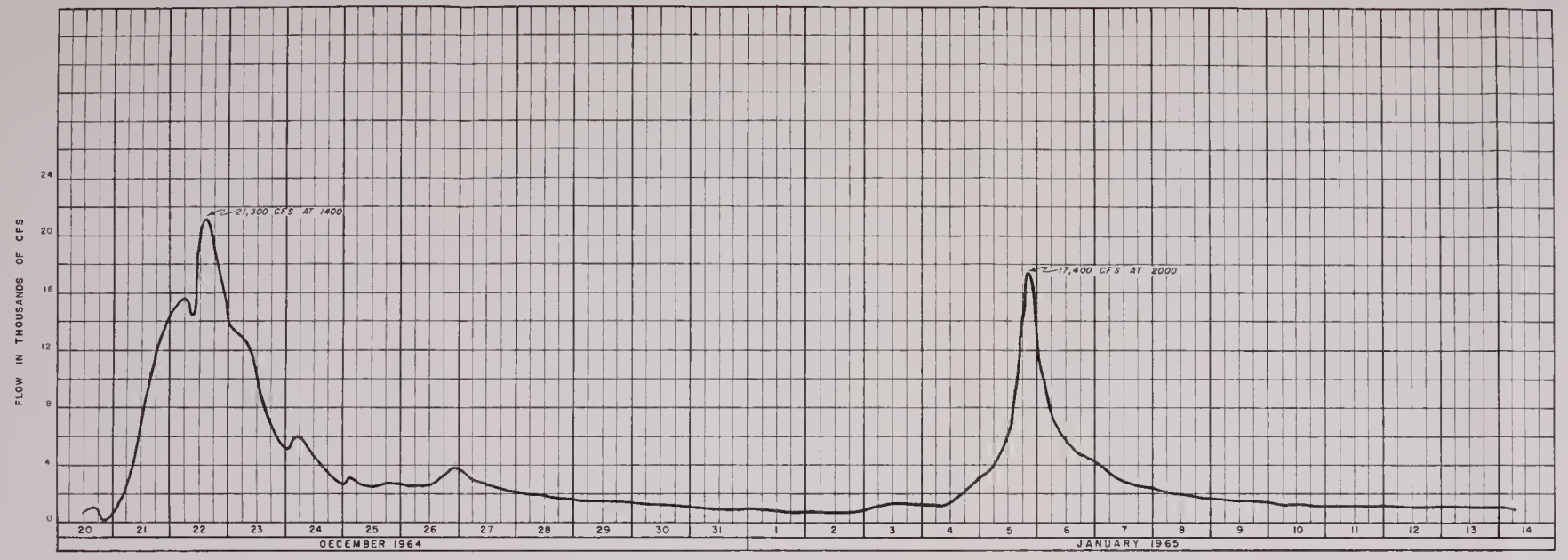
DIVISION OF OPERATIONS

FLOOD OF DECEMBER 1964 – JANUARY 1965

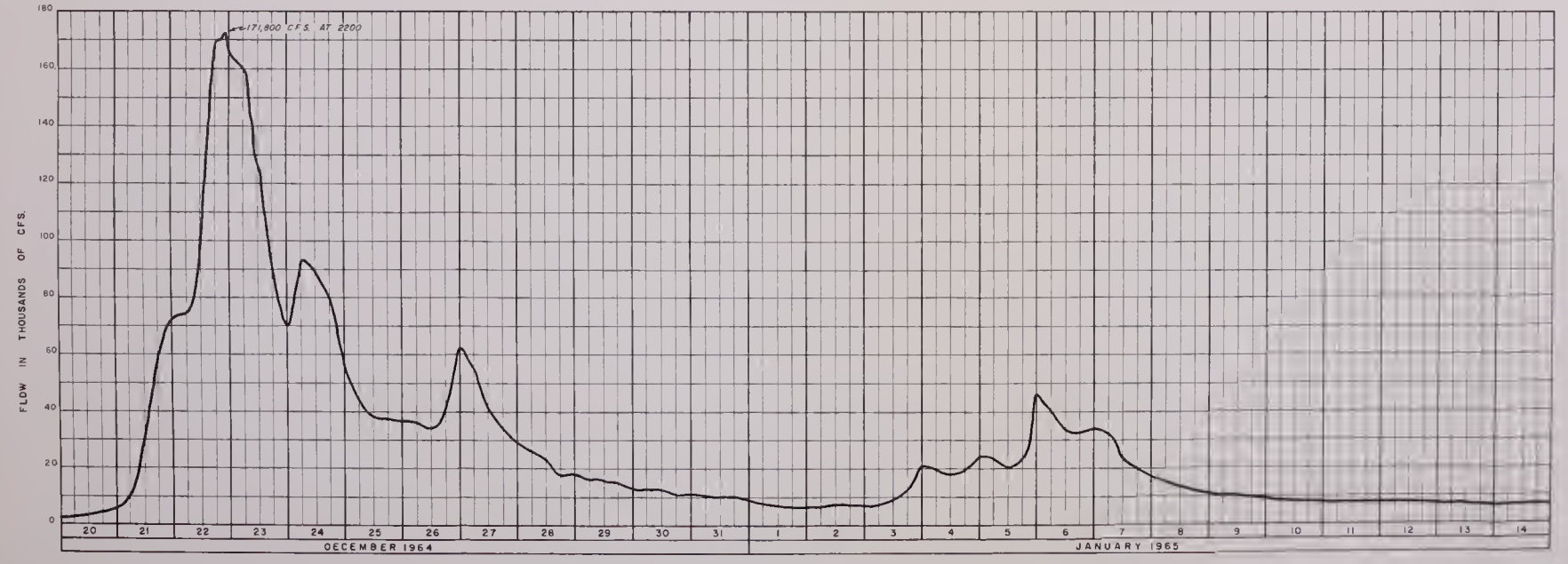
OPERATION OF FOLSOM RESERVOIR, AMERICAN RIVER, AND HYDROGRAPHS OF FLOW PAST LATITUDE OF SACRAMENTO



BUTTE CREEK NEAR CHICO

PERIOD OF RECORD: 1930–PRESENT

DATE	FLOW IN C.F.S.
12 22 64	21 300
12 22 55	18 700
1 5 65	17 400



YUBA RIVER AT SMARTVILLE

COMPUTED FROM SUMMATION OF "AT ENGLEBRIGHT DAM" AND "DEER CREEK NEAR SMARTVILLE"

PERIOD OF RECORD: 1903–PRESENT

REPORTED AS "AT SMARTVILLE" (INCLUDES DEER CREEK 1903-41, 1941–PRESENT COMPUTED AS STATED ABOVE

DATE	FLOW IN C.F.S.
12 22 64	171 800
12 23 55	156 500
2 1 63	155 000

STATE OF CALIFORNIA
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DEPARTMENT OF WATER RESOURCES
DIVISION OF OPERATIONS

FLOOD OF DECEMBER 1964 – JANUARY 1965

HYDROGRAPHS OF BUTTE CREEK AND YUBA RIVER

COSUMNES RIVER AT MICHIGAN BAR

PERIOD OF RECORD: 1907–PRESENT

DATE	FLOW IN C.F.S
12 23 55	42,000
2 1 63	39,400
12 23 64	37,500

SAN JOAQUIN NR. VERNALIS

PERIOD OF RECORD: 1922–PRESENT

DATE	FLOW IN C F S
12 '9 '50	79,000*
3 16 38	51,200*
12 25 55	50,900
4 5 58	41,400

*Includes flow through levee breaks

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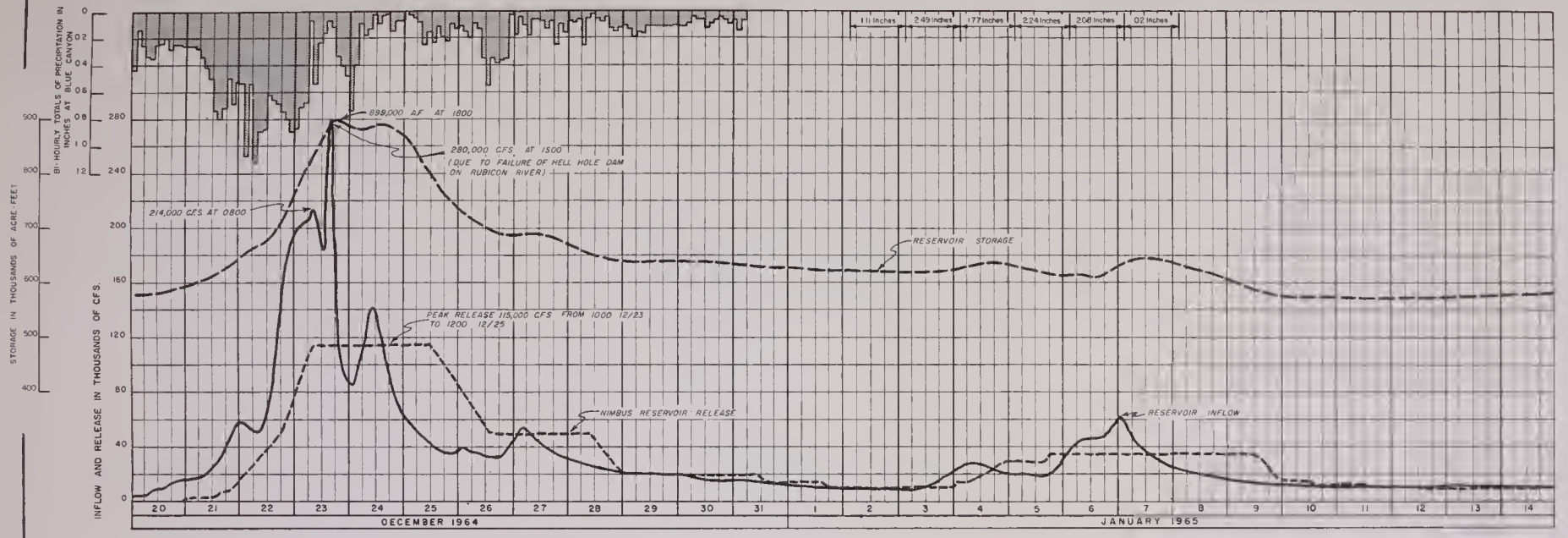
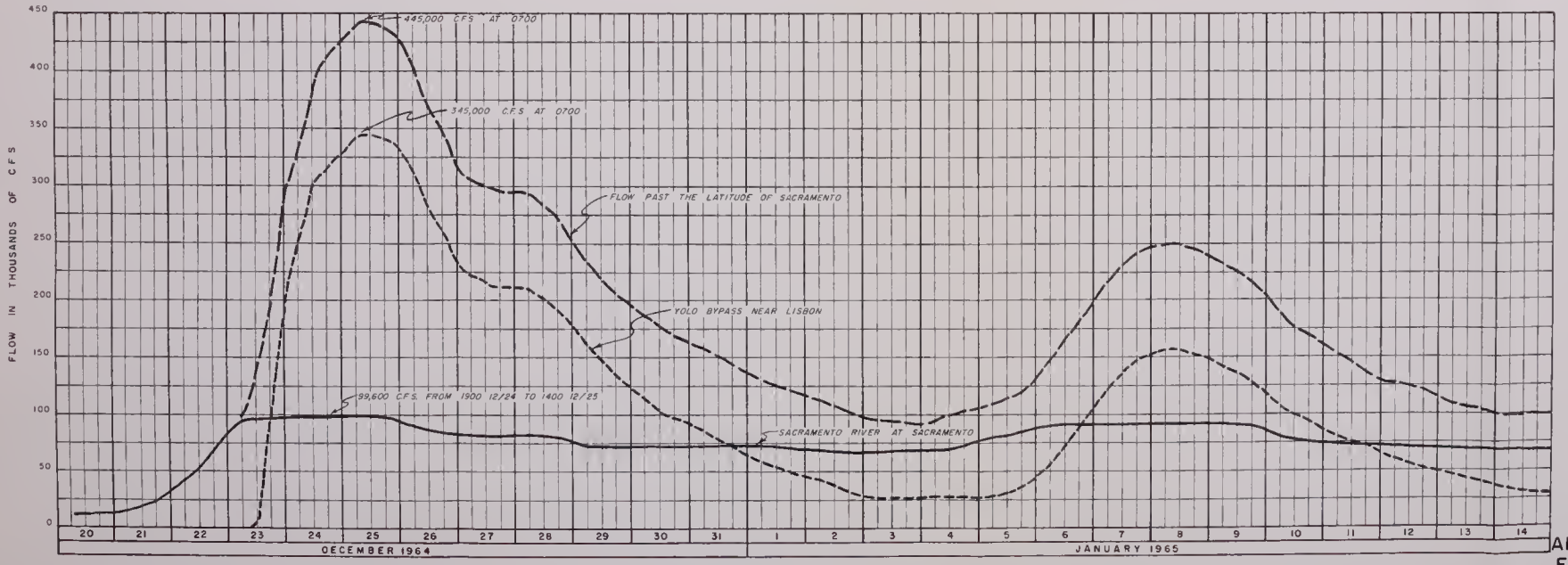
DEPARTMENT OF WATER RESOURCES
DIVISION OF OPERATIONS

FLOOD OF DECEMBER 1964 – JANUARY 1965

HYDROGRAPHS OF COSUMNES AND SAN JOAQUIN RIVERS





FOLSOM RESERVOIR

GROSS POOL 1,000,000 ACRE-FEET COMPLETED 1956 FLOW REGULATED BY FOLSOM RESERVOIR SINCE 1955

PERIOD OF RECORD 1904–PRESENT

REPORTED AS "AMERICAN RIVER AT FAIR OAKS" 1904-55

DATE	INFLOW IN C.F.S.
12 23 64	260,000*
2 1 63	240 200**
12 23 55	218 000**

*Peak of flood wave resulting from failure of "Hell Hole Dam" on the Rubicon River

**Records furnished by U.S. Bureau of Reclamation

FLOW PAST LATITUDE OF SACRAMENTO

FLOW PAST LATITUDE OF SACRAMENTO RECORD IS OBTAINED BY SUMMATION OF THE FOLLOWING SACRAMENTO RIVER AT SACRAMENTO AND YOLO BYPASS NEAR LISBON (PUBLISHED AS "AT LISBON" PRIOR TO 2 19 59)

PERIOD OF RECORD 1914–PRESENT

DATE	FLOW IN C.F.S.
12 25 64	445 000
12 24 55	405 000

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FLOOD OF DECEMBER 1964 – JANUARY 1965

OPERATION OF FOLSOM RESERVOIR, AMERICAN RIVER, AND HYDROGRAPHS OF FLOW PAST LATITUDE OF SACRAMENTO

PARDEE RESERVOIR

GROSS POOL 210,000 ACRE-FEET COMPLETED 1929

PERIOD OF RECORD: 1929–PRESENT

DATE	INFLOW IN C F S
12 3 50	34,000
12 24 64	32,100
12 23 64	30,500
11 20 50	30,000

NOTE SEE RESERVOIR RELEASE HYDROGRAPH OF PARDEE RESERVOIR SHOWN ABOVE FOR INFLOW TO THIS RESERVOIR

CAMANCHE RESERVOIR

GROSS POOL 431,500 ACRE-FEET COMPLETED 1963

PERIOD OF RECORD: 1963–PRESENT

STATE OF CALIFORNIA
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DEPARTMENT OF WATER RESOURCES
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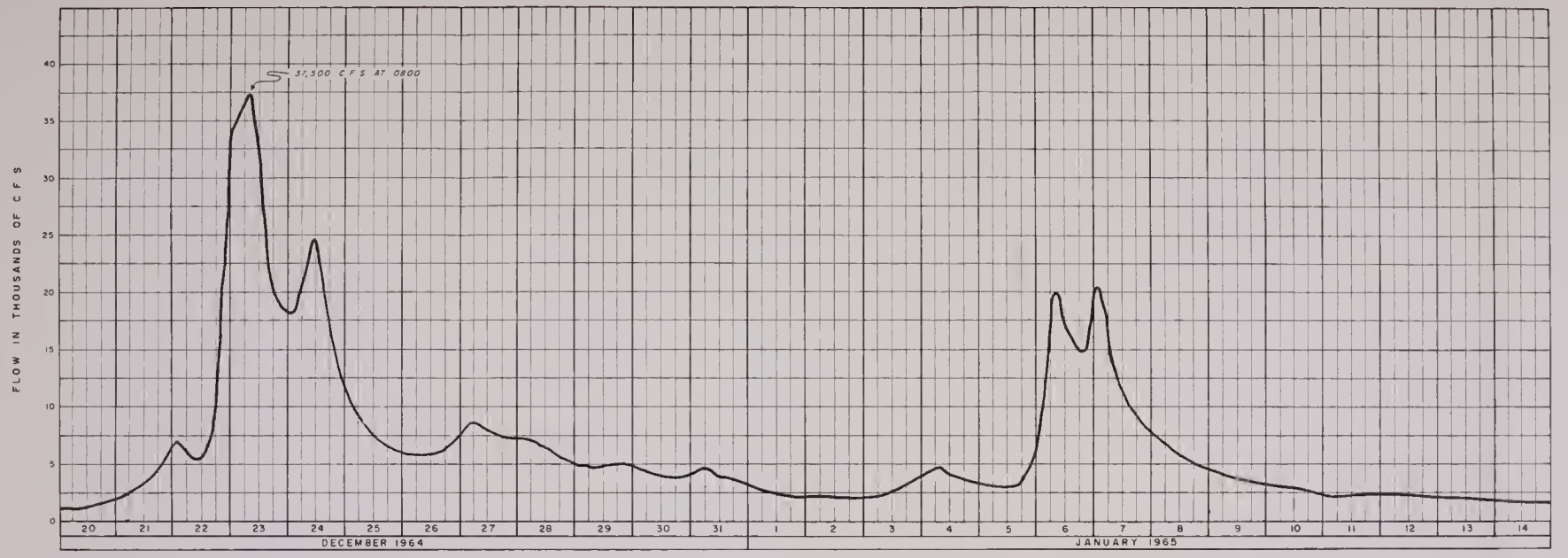
FLOOD OF DECEMBER 1964 – JANUARY 1965

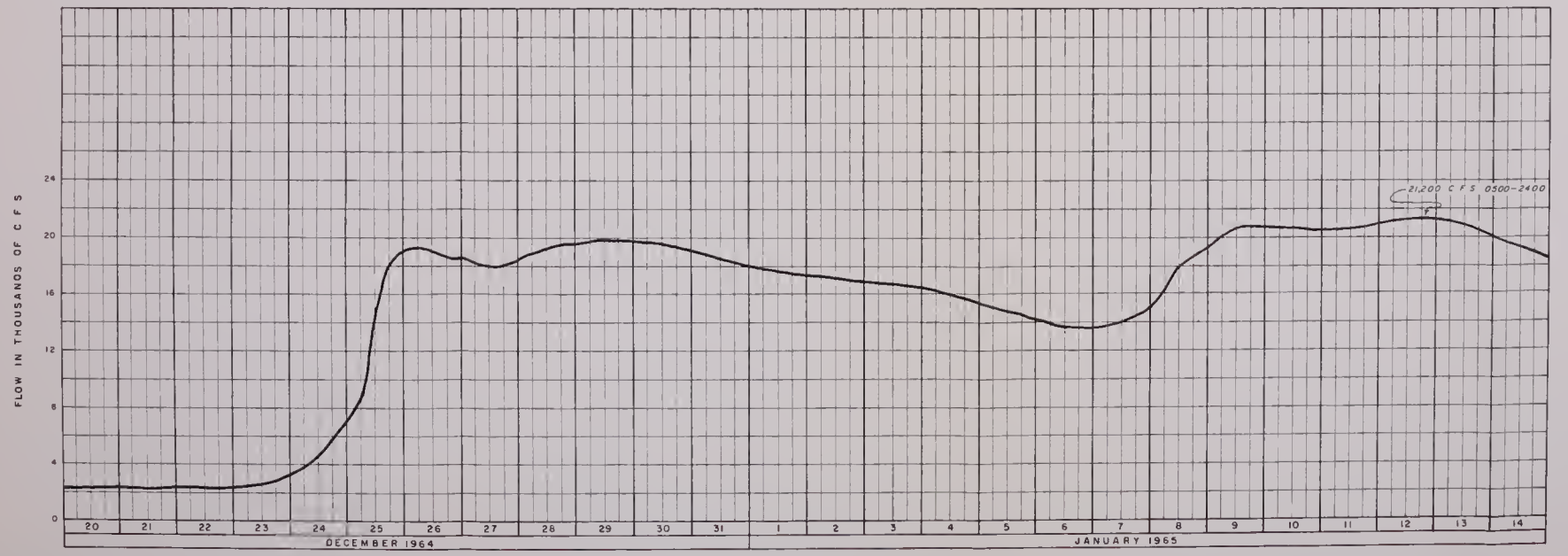
OPERATION OF PARDEE AND CAMANCHE RESERVOIRS, MOKELUMNE RIVER



COSUMNES RIVER AT MICHIGAN BAR

PERIOD OF RECORD 1907–PRESENT

DATE	FLOW IN C.F.S
12 23 55	42,000
2 1 63	39,400
12 23 64	37,500



SAN JOAQUIN NR VERNALIS

PERIOD OF RECORD 1922–PRESENT

DATE	FLOW IN C.F.S
12 9 50	79,000*
3 16 38	51,200*
12 25 55	50,900
4 5 58	41,400

*Includes flow through levee breaks

STATE OF CALIFORNIA
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FLOOD OF DECEMBER 1964 – JANUARY 1965

HYDROGRAPHS OF COSUMNES AND SAN JOAQUIN RIVERS

LAKE McCLURE (EXCHEQUER DAM)

GROSS POOL 289,000 ACRE-FEET COMPLETED 1926

PERIOD OF RECORD: 1926–PRESENT

DATE	INFLOW IN C.F.S.
12 23 55	100,000
11 19 50	83,000

MERCED RIVER NEAR STEVINSON

PERIOD OF RECORD: 1940–PRESENT

DATE	FLOW IN C.F.S.
12 5 50	13,600

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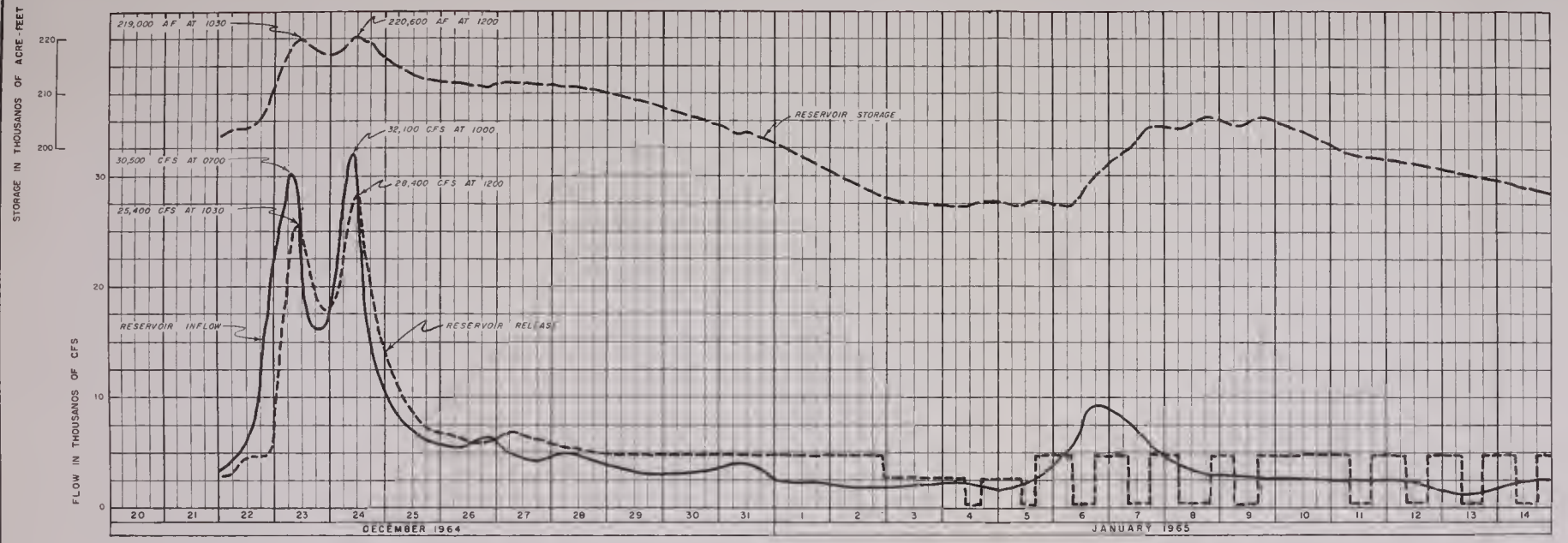
FLOOD OF DECEMBER 1964 – JANUARY 1965

OPERATION OF LAKE McCLURE RESERVOIR AND HYDROGRAPH OF MERCED RIVER

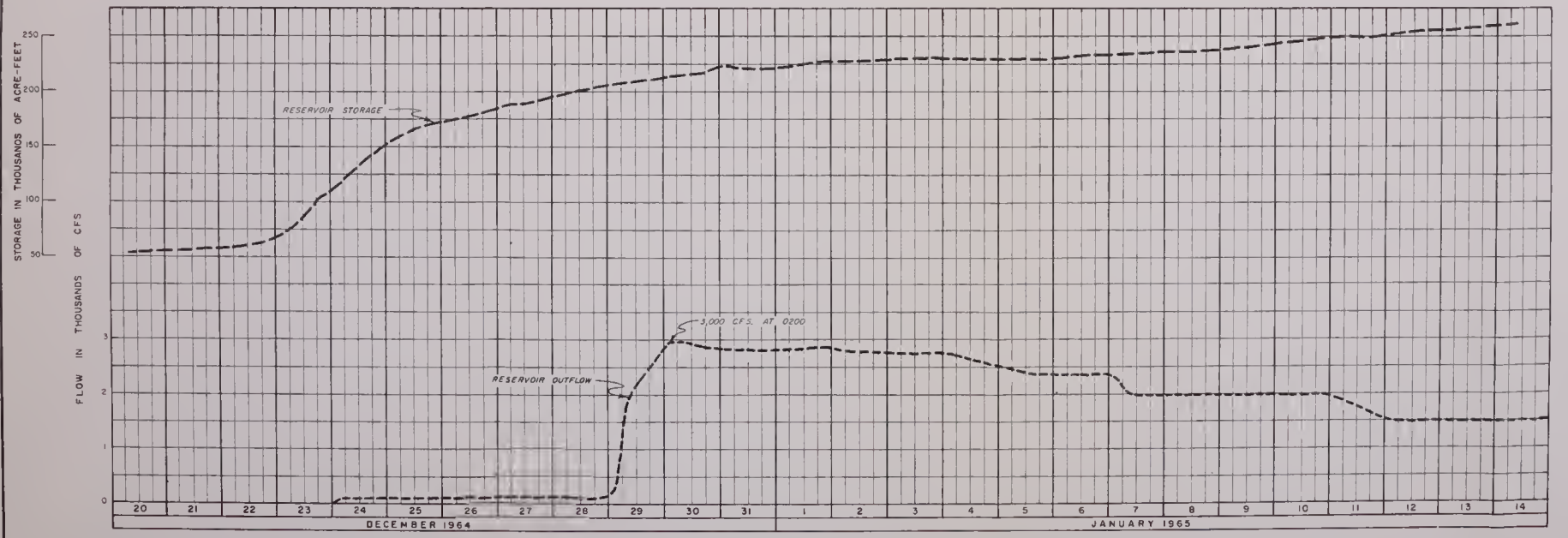


PAROEE RESERVOIR

GROSS POOL 210,000 ACRE FEET COMPLETED 1929

PERIOD OF RECORD 1929-PRESENT

DATE	INFLOW IN C.F.S.
12 3 50	34 000
12 24 64	32,100
12 23 64	30,500
11 20 50	30 000



NOTE SEE RESERVOIR RELEASE HYDROGRAPH OF PARDEE RESERVOIR SHOWN ABOVE FOR INFLOW TO THIS RESERVOIR

CAMANCHE RESERVOIR

GROSS POOL 431,500 ACRE FEET COMPLETED 1963

PERIOD OF RECORD 1963-PRESENT

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OPERATION OF PARDEE AND CAMANCHE RESERVOIRS, MOKELUMNE RIVER

DON PEDRO RESERVOIR

GROSS POOL 289,000 ACRE-FEET COMPLETED 1922

PERIOD OF RECORD: 1922–PRESENT

DATE	INFLOW IN C F S
12 '22 55	100,000
11/19 50	86,000

TUOLUMNE RIVER AT MODESTO

PERIOD OF RECORD: 1950–PRESENT

DATE	FLOW IN C.F S
12 9 50	57,000

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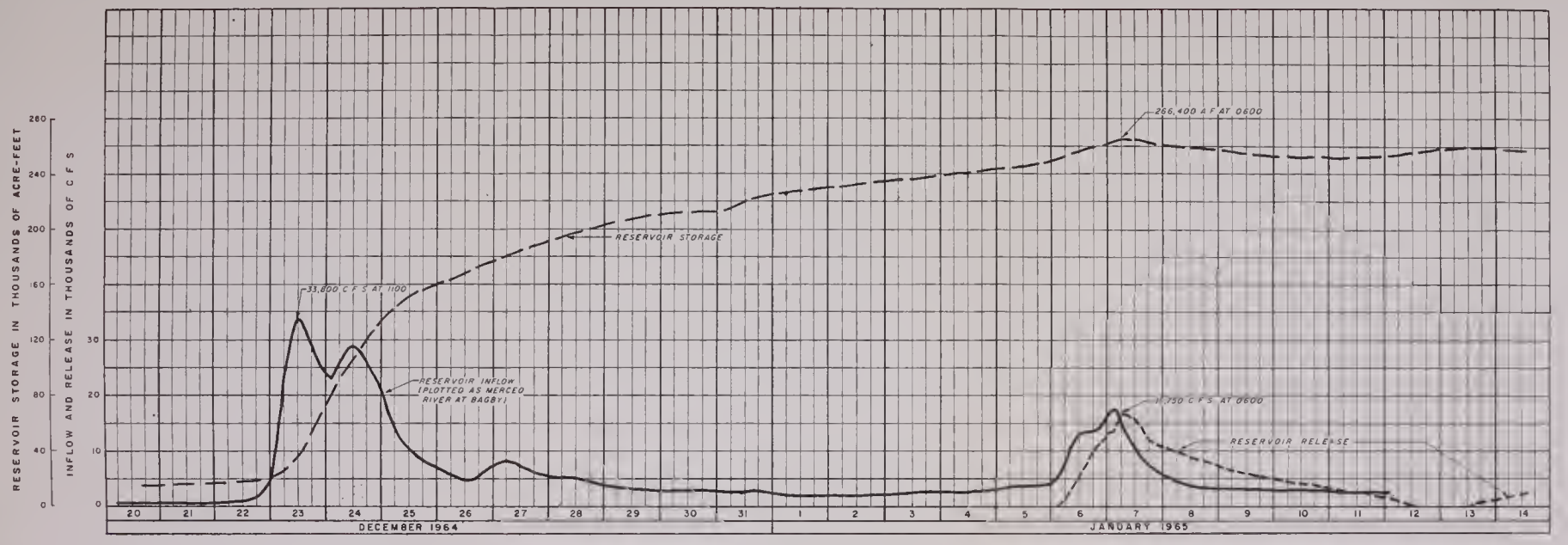
FLOOD OF DECEMBER 1964 – JANUARY 1965

OPERATION OF DON PEDRO RESERVOIR AND HYDROGRAPH OF TULOUMNE RIVER

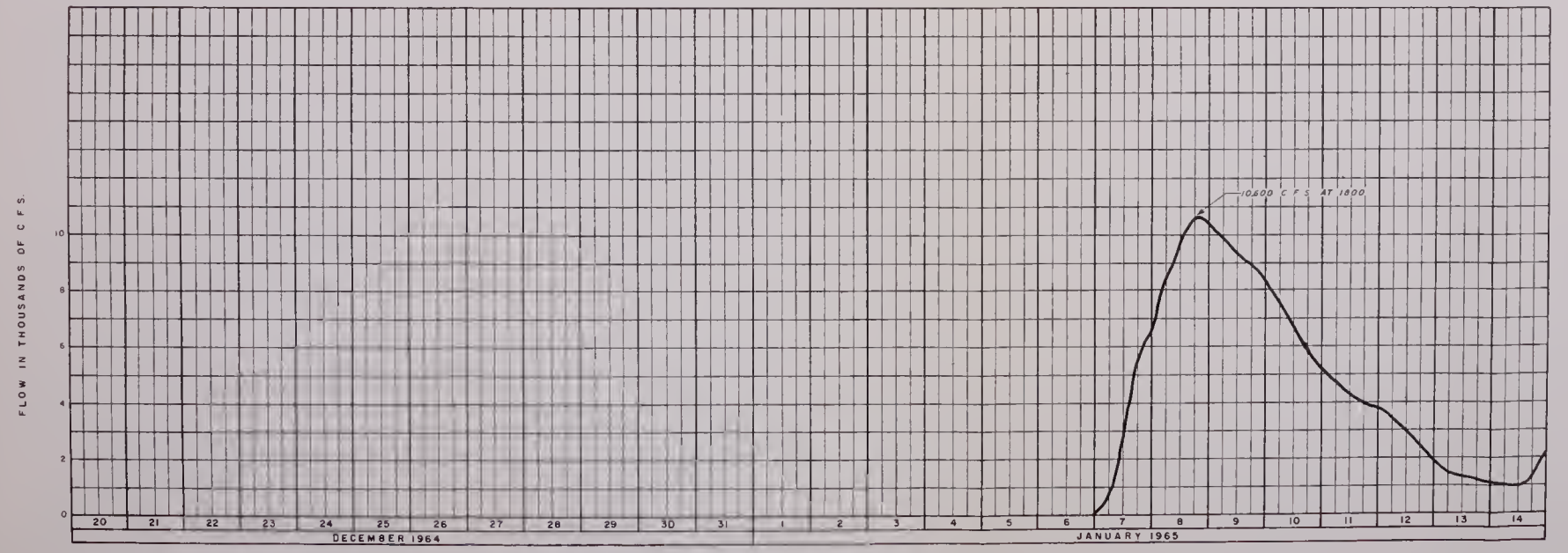


LAKE McCLURE (EXCHEQUER DAM)

GROSS POOL 219 000 ACRE FEET COMPLETED 1926

PERIOD OF RECORD 1926–PRESENT

DATE	INFLOW IN C F S
12 23 55	100,000
11 19 50	83,000



MERCED RIVER NEAR STEVINSON

PERIOD OF RECORD 1940–PRESENT

DATE	FLOW IN C F S
12 5 50	13,600

STATE OF CALIFORNIA
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FLOOD OF DECEMBER 1964 – JANUARY 1965

OPERATION OF LAKE Mc CLURE RESERVOIR AND HYDROGRAPH OF MERCED RIVER

MELONES RESERVOIR

GROSS POOL 112,610 ACRE-FEET COMPLETED 1926

PERIOD OF RECORD: 1926–PRESENT

DATE	INFLOW IN C F S
12 23 55	100,000

TULLOCH RESERVOIR

GROSS POOL 68,400 ACRE-FEET COMPLETED 1957

PERIOD OF RECORD: 1957–PRESENT

DATE	INFLOW IN C F S.
12 24 '64	43,300
2 1 63	21,000
4 3 58	16,000

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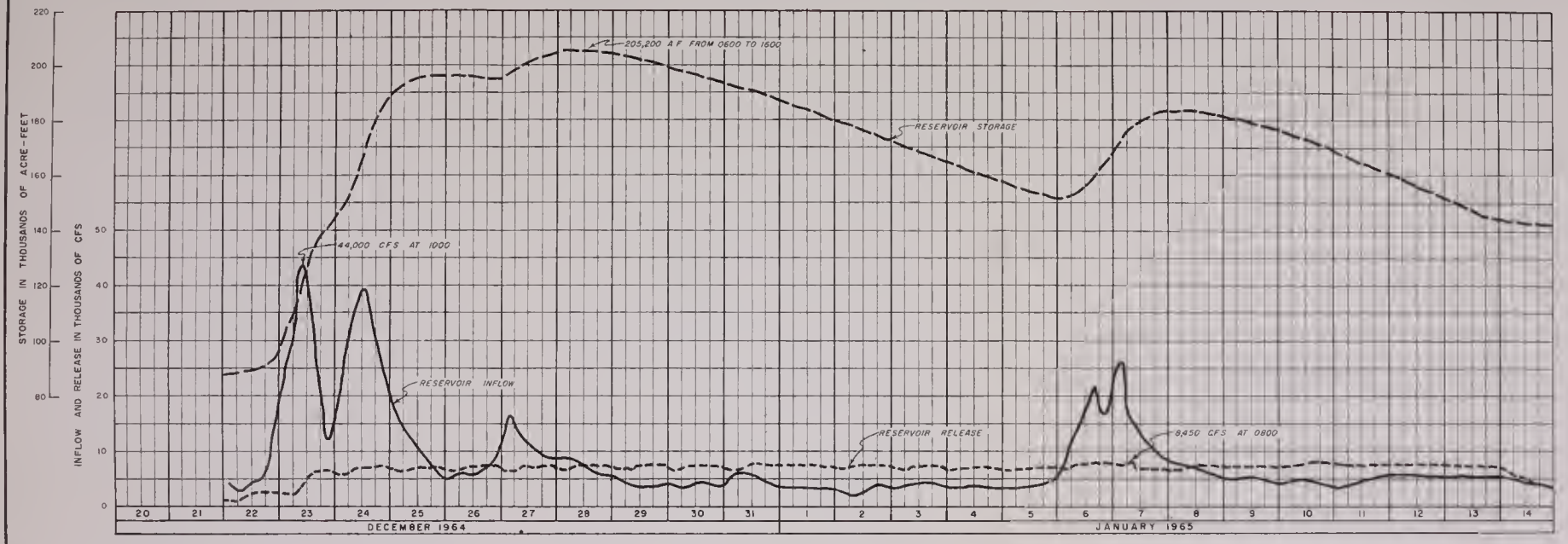
FLOOD OF DECEMBER 1964 – JANUARY 1965

OPERATION OF MELONES AND TULLOCH RESERVOIRS, STANISLAUS RIVER

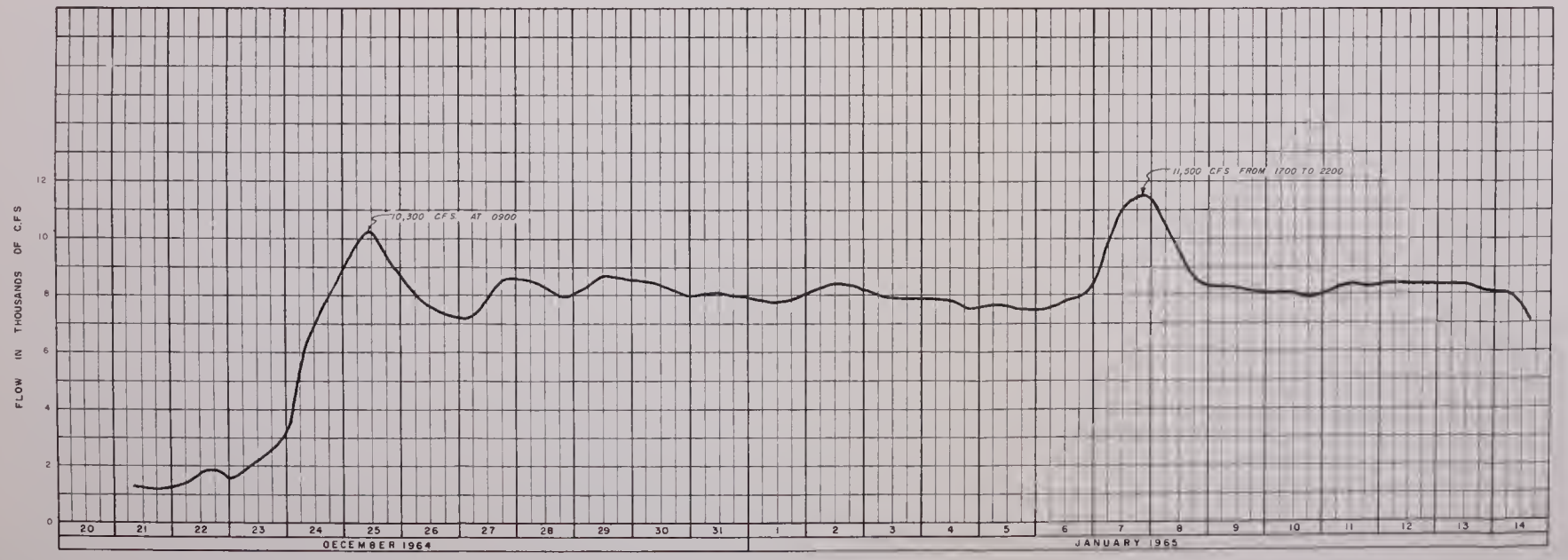


DON PEDRO RESERVOIR

GROSS POOL 289,000 ACRE-FEET COMPLETED 1922

PERIOD OF RECORD 1922–PRESENT

DATE	INFLOW IN C F S
12 22 55	100 000
11 19 50	86,000



TUOLUMNE RIVER AT MODESTO

PERIOD OF RECORD 1950–PRESENT

DATE	FLOW IN C F S
12 9 50	57 000

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FLOOD OF DECEMBER 1964 – JANUARY 1965

OPERATION OF DON PEDRO RESERVOIR AND HYDROGRAPH OF TULOUMNE RIVER

STANISLAUS RIVER AT ORANGE BLOSSOM

PERIOD OF RECORD: 1940–PRESENT

DATE	FLOW IN C.F.S
11 21 50	52,000

HOGAN RESERVOIR

GROSS POOL 76,000 ACRE-FEET COMPLETED 1930

PERIOD OF RECORD: 1930–1963

DATE	INFLOW IN C.F.S
12 23 55	31,000

NEW HOGAN RESERVOIR

GROSS POOL 325,000 ACRE-FEET COMPLETED 1963

PERIOD OF RECORD: 1963–PRESENT

DATE	INFLOW IN C.F.S
12 23 64	20,600

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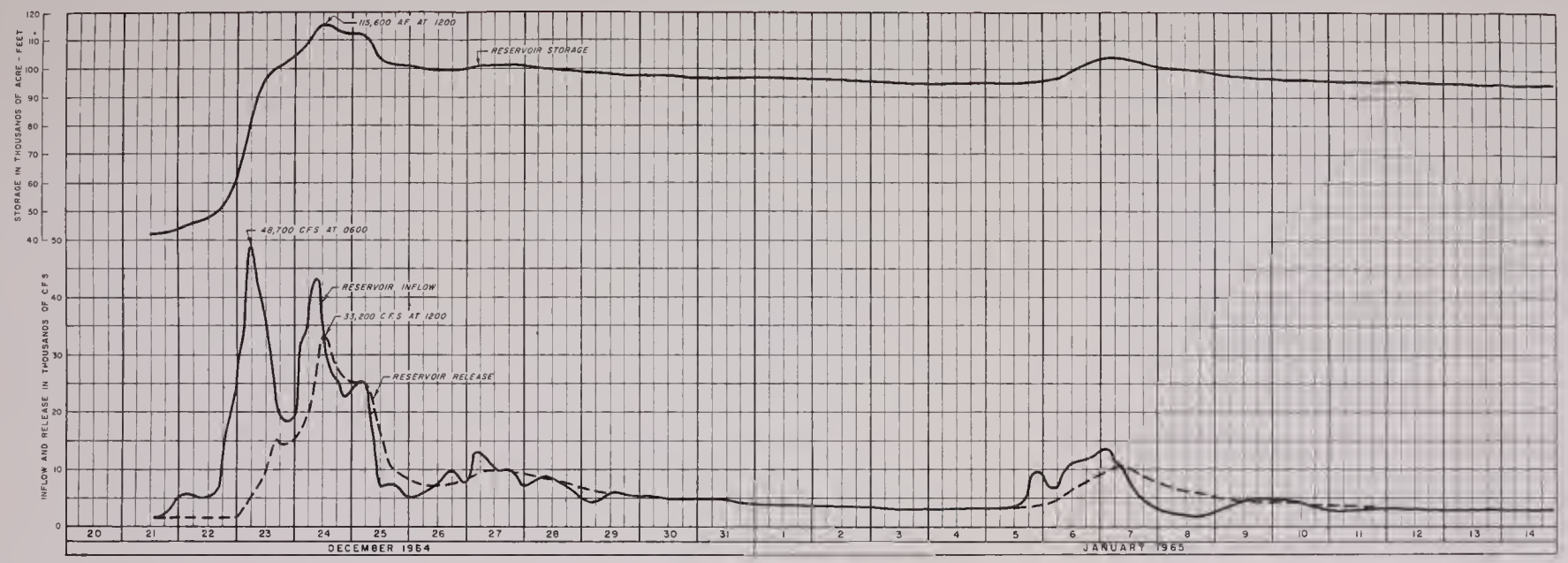
FLOOD OF DECEMBER 1964 – JANUARY 1965

HYDROGRAPH OF STANISLAUS RIVER AND OPERATION OF NEW HOGAN RESERVOIR, CALAVERAS RIVER

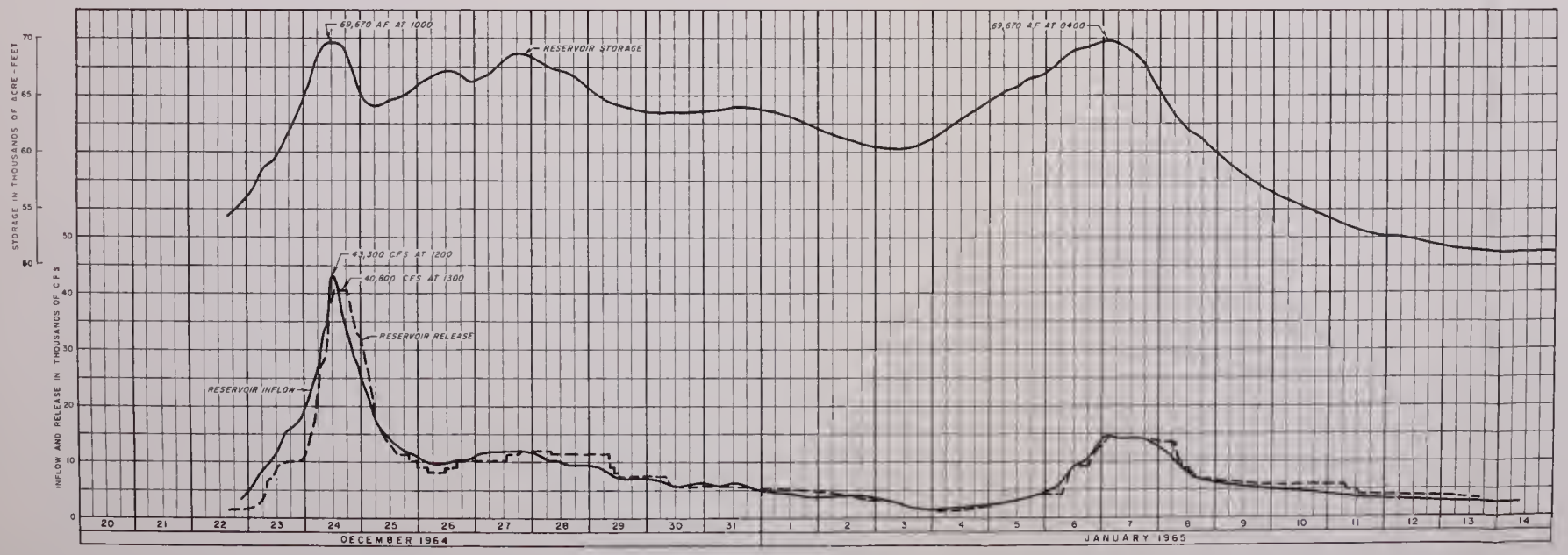


MELONES RESERVOIR

GROSS POOL 112,610 ACRE FEET COMPLETED 1926

PERIOD OF RECORD 1926–PRESENT

DATE	INFLOW IN C.F.S
12 22 55	100 000



TULLOCH RESERVOIR

GROSS POOL 68 400 ACRE FEET COMPLETED 1957

PERIOD OF RECORD 1957–PRESENT

DATE	INFLOW IN C.F.S
12 24 64	43 300
2 1 63	21,000
4 3 58	16,000

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OPERATION OF MELONES AND TULLOCH RESERVOIRS, STANISLAUS RIVER

SACRAMENTO RIVER AT RED BLUFF

SACRAMENTO RIVER AT ORD FERRY

SACRAMENTO RIVER AT COLUSA

SACRAMENTO RIVER AT SACRAMENTO

YOLO BYPASS NEAR LISBON

SACRAMENTO RIVER AT RIO VISTA

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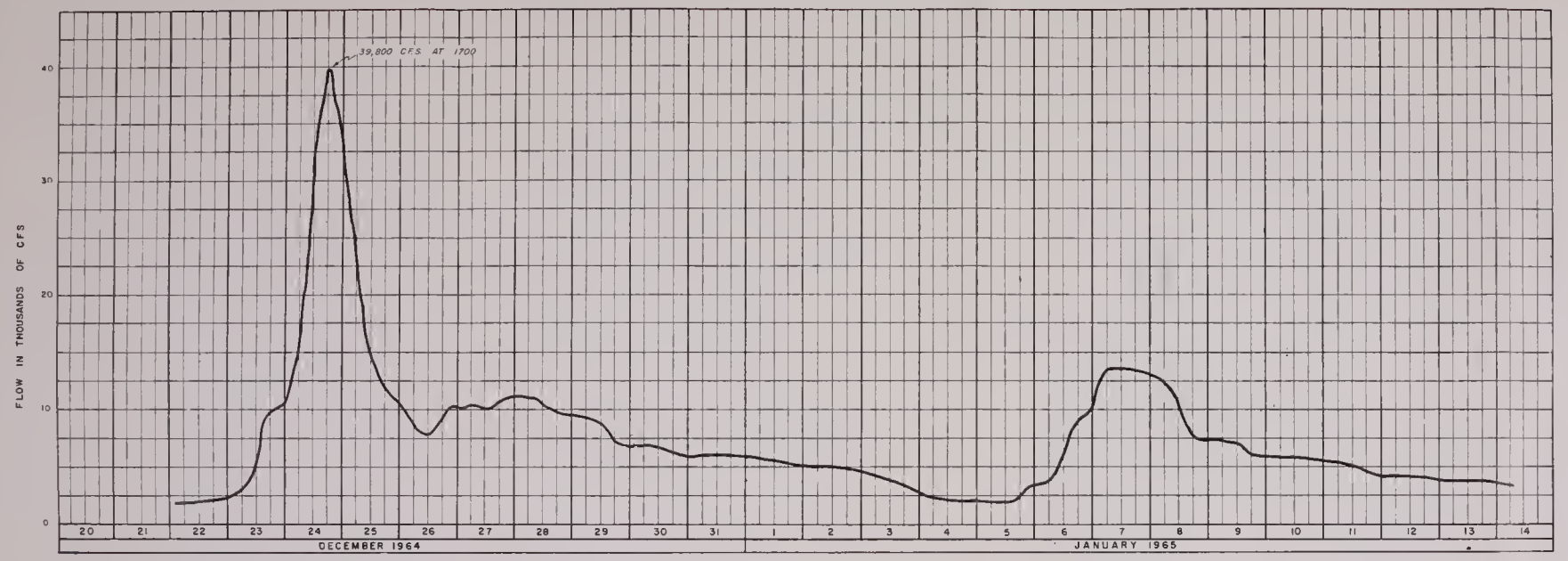
FLOOD OF
DECEMBER 1964 – JANUARY 1965

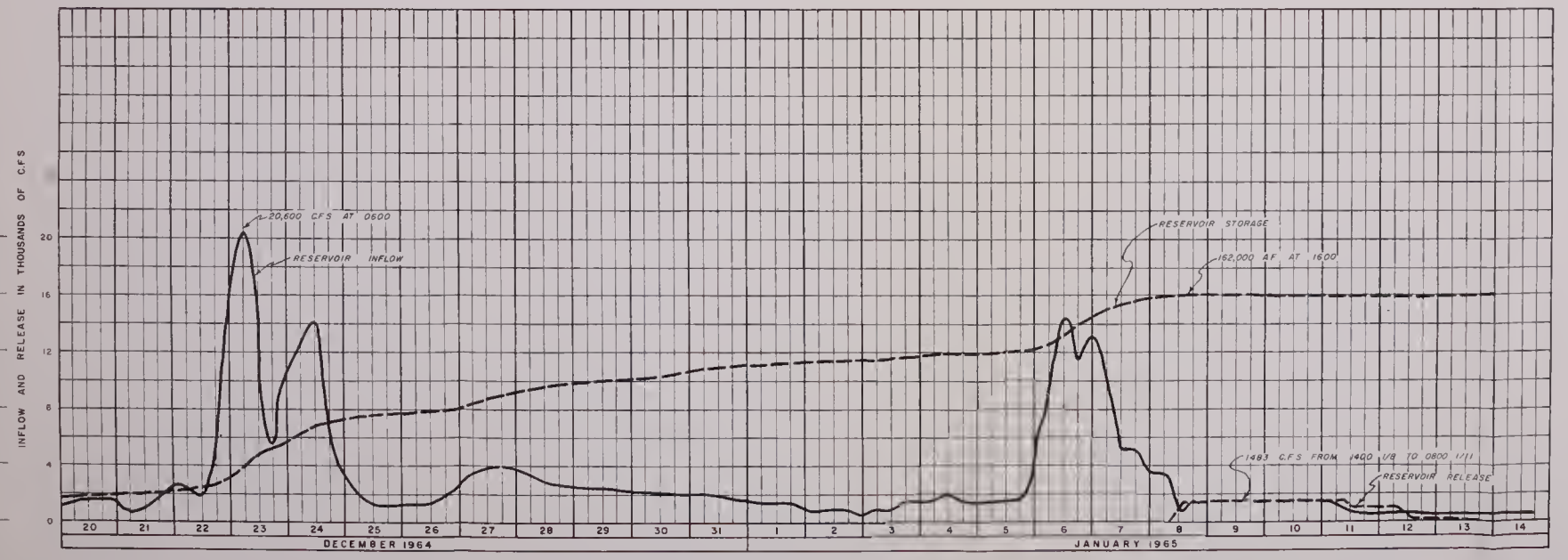
GAGE HEIGHTS OF SACRAMENTO RIVER AND YOLO BYPASS



STANISLAUS RIVER AT ORANGE BLOSSOM

PERIOD OF RECORD 1940–PRESENT

DATE	FLOW IN C.F.S
11 21 50	52,000



HOGAN RESERVOIR

GROSS POOL 76,000 ACRE FEET COMPLETED 1930

PERIOD OF RECORD 1930–1963

DATE	INFLOW IN C.F.S
12 23 55	31,000

NEW HOGAN RESERVOIR

GROSS POOL 325 000 ACRE-FEET COMPLETED 1963

PERIOD OF RECORD 1963–PRESENT

DATE	INFLOW IN C.F.S
12 23 64	20 600

STATE OF CALIFORNIA
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HYDROGRAPH OF STANISLAUS RIVER AND OPERATION OF NEW HOGAN RESERVOIR, CALAVERAS RIVER

FEATHER RIVER AT OROVILLE ABOVE FISH BARRIER DAM

FEATHER RIVER NEAR GRIDLEY

FEATHER RIVER AT YUBA CITY

FEATHER RIVER AT NICOLAUS

YUBA RIVER AT ENGLEBRIGHT DAM

CACHE CREEK AT RUMSEY BRIDGE

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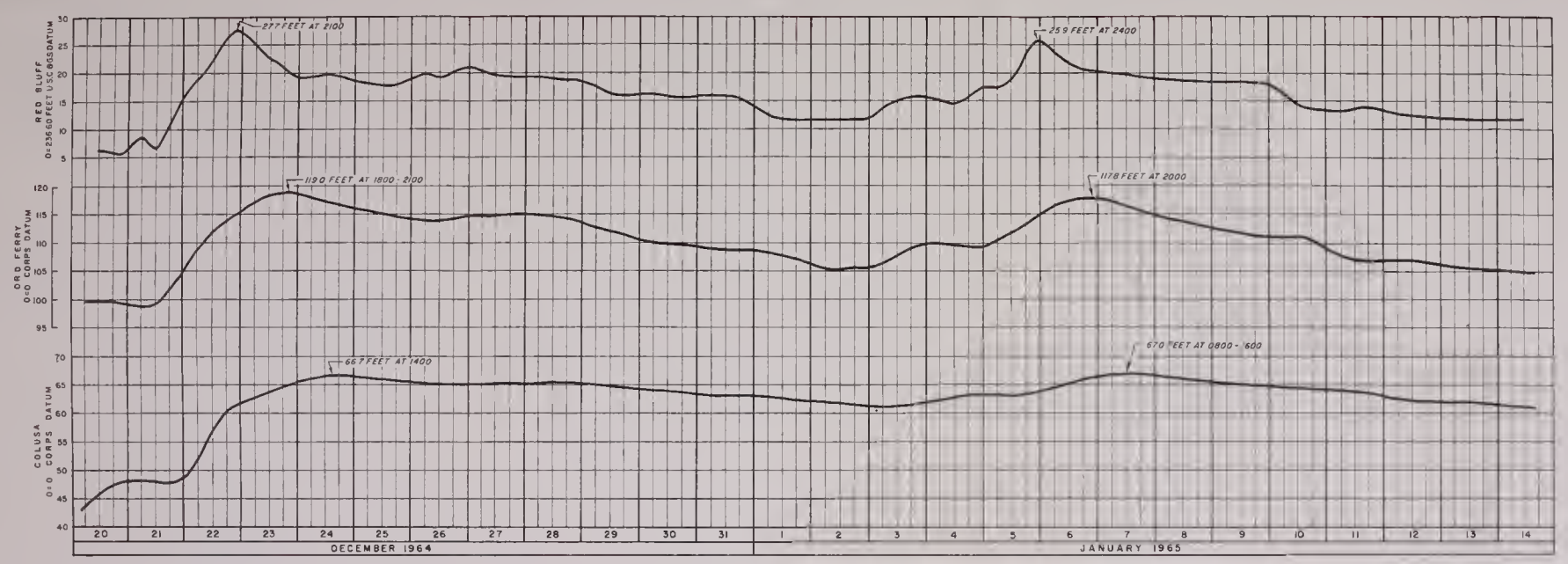
DECEMBER 1964 - JANUARY 1965

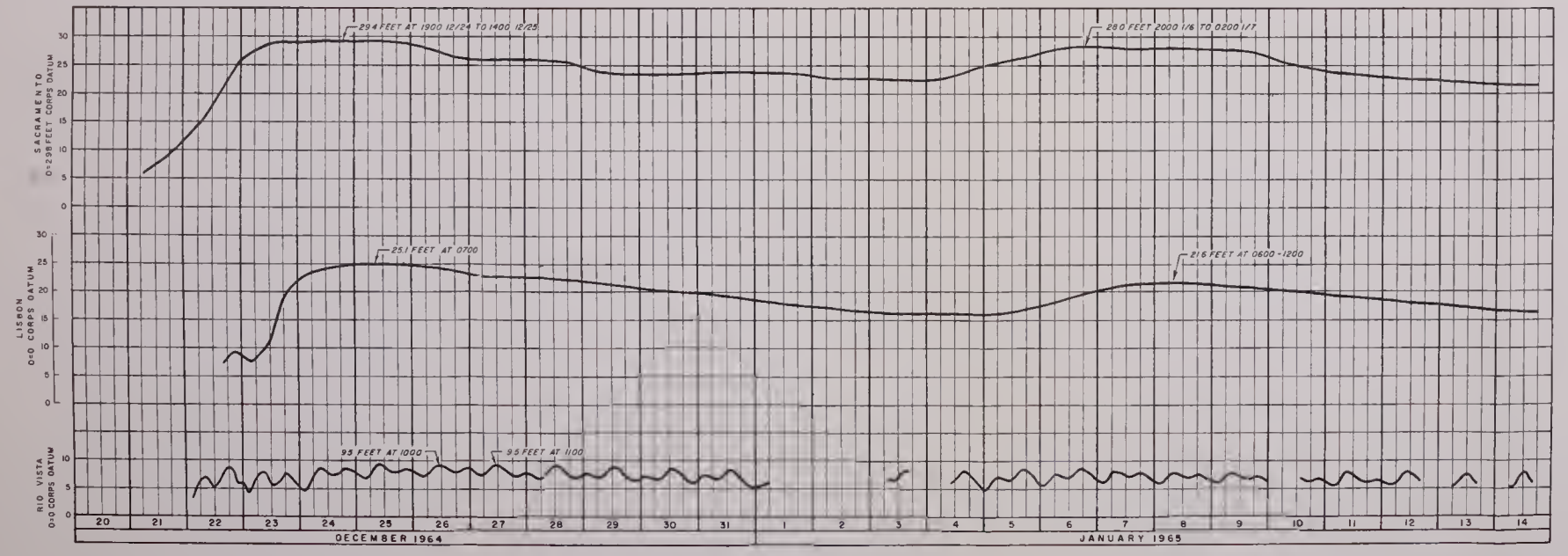
GAGE HEIGHTS OF FEATHER RIVER, YUBA RIVER, AND CACHE CREEK



SACRAMENTO RIVER AT REO BLUFF

SACRAMENTO RIVER AT ORD FERRY

SACRAMENTO RIVER AT COLUSA



SACRAMENTO RIVER AT SACRAMENTO

YOLO BYPASS NEAR LISBON

SACRAMENTO RIVER AT RIO VISTA

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GAGE HEIGHTS OF SACRAMENTO RIVER AND YOLO BYPASS

SAN JOAQUIN RIVER NEAR NEWMAN

SAN JOAQUIN RIVER NEAR VERNALIS

STATE OF CALIFORNIA
THE RESOURCES AGENCY
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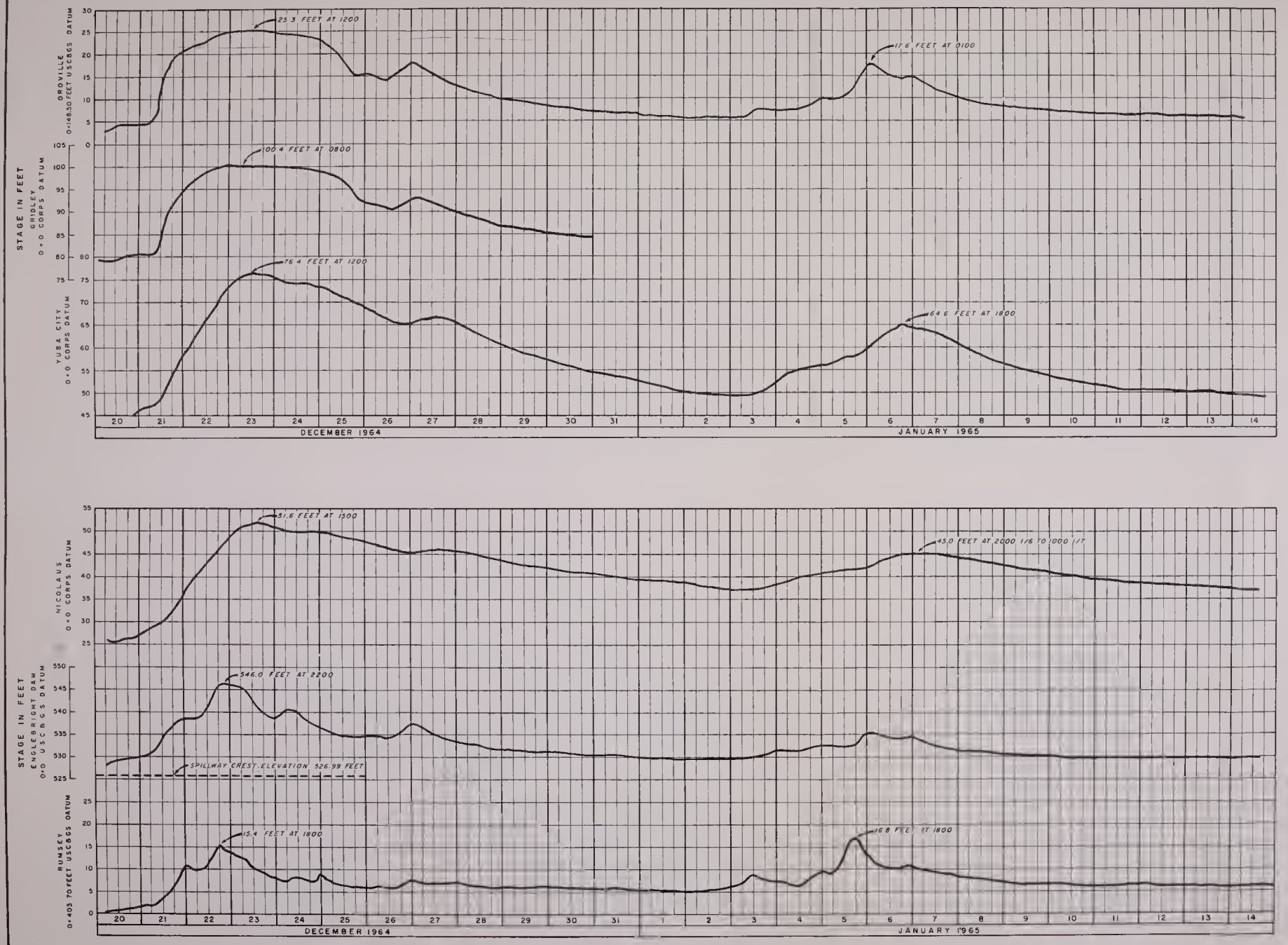
DECEMBER 1964 - JANUARY 1965

GAGE HEIGHTS OF SAN JOAQUIN RIVER



STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
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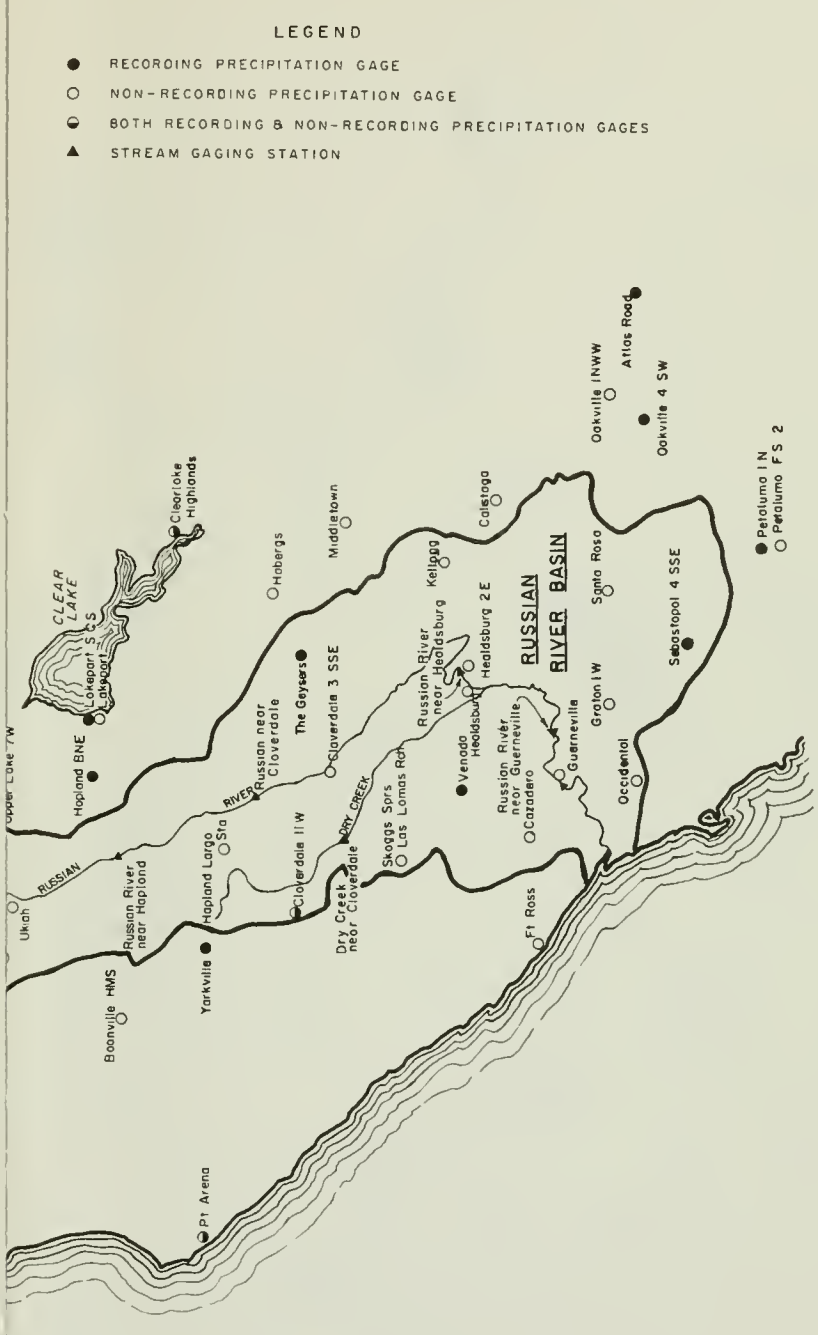
FLOOD OF DECEMBER 1964 - JANUARY 1965

GAGE HEIGHTS OF FEATHER RIVER, YUBA RIVER, AND CACHE CREEK



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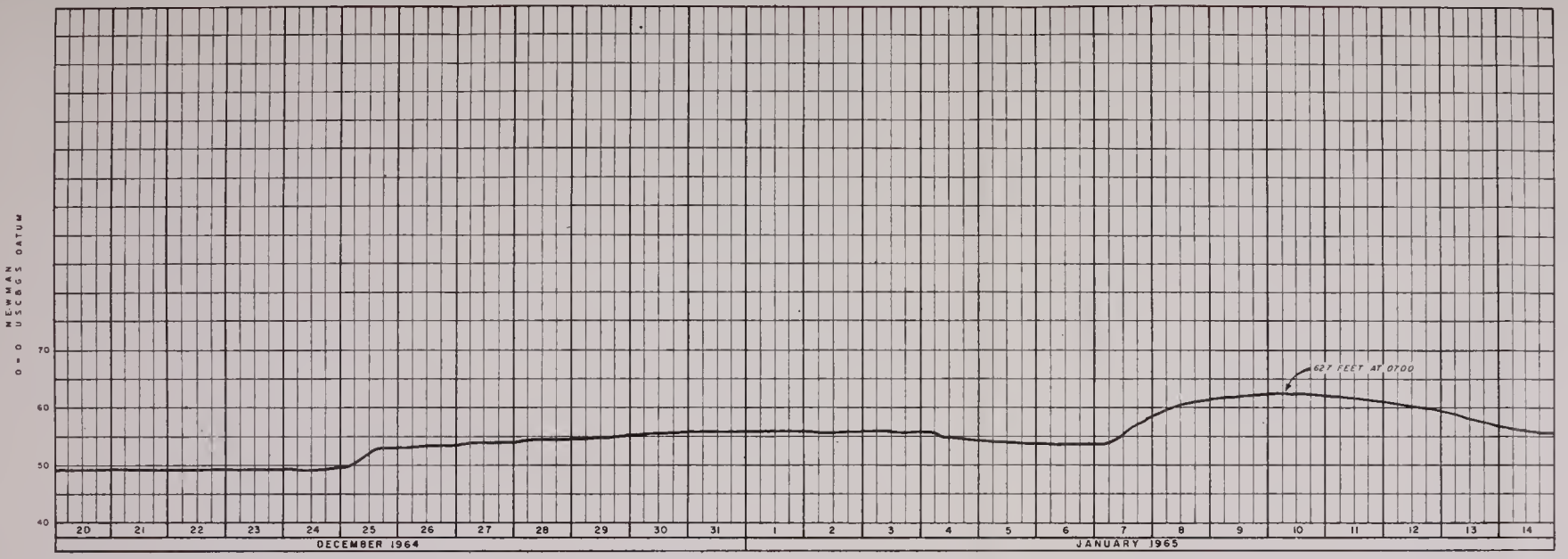
FLOOD OF
DECEMBER 1964 - JANUARY 1965

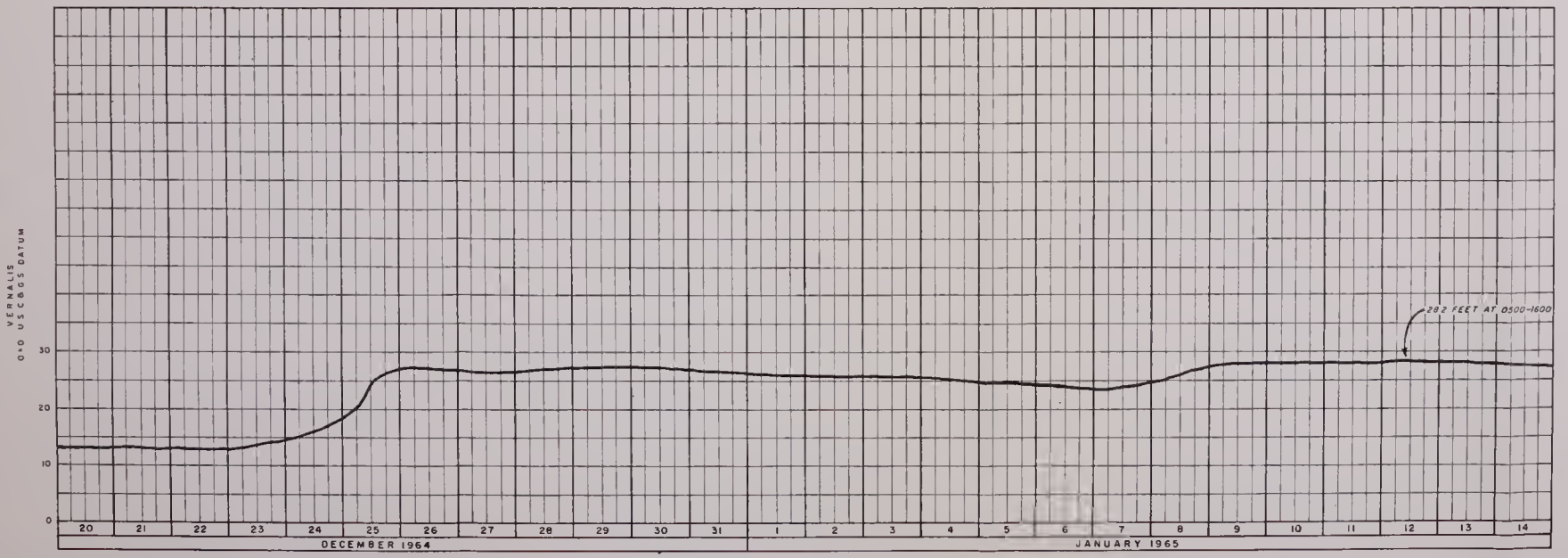
PRECIPITATION AND STREAM GAGING STATIONS
NORTH COASTAL AREA

SCALE OF MILES

8 0 8 16 24



SAN JOAQUIN RIVER NEAR NEWMAN



SAN JOAQUIN RIVER NEAR VERNALIS

STATE OF CALIFORNIA
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GAGE HEIGHTS OF SAN JOAQUIN RIVER

STATE OF CALIFORNIA
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FLOOD OF DECEMBER 1964 – JANUARY 1965

MAJOR DISASTER AREAS

SCALE OF MILES
40 0 40 80 120

LEGEND
RECORDING PRECIPITATION GAGE
NON-RECORDING PRECIPITATION GAGE
BOTH RECORDING & NON-RECORDING PRECIPITATION GAGES
STREAM GAGING STATION
KLAMATH RIVER BASIN
TRINITY RIVER BASIN
SMITH RIVER BASIN
MAD RIVER BASIN
EEL RIVER BASIN
REDWOOD CREEK BASIN
MATTOLE RIVER BASIN
RUSSIAN RIVER BASIN
P A C I F I C O C E A N
OREGON
CALIFORNIA
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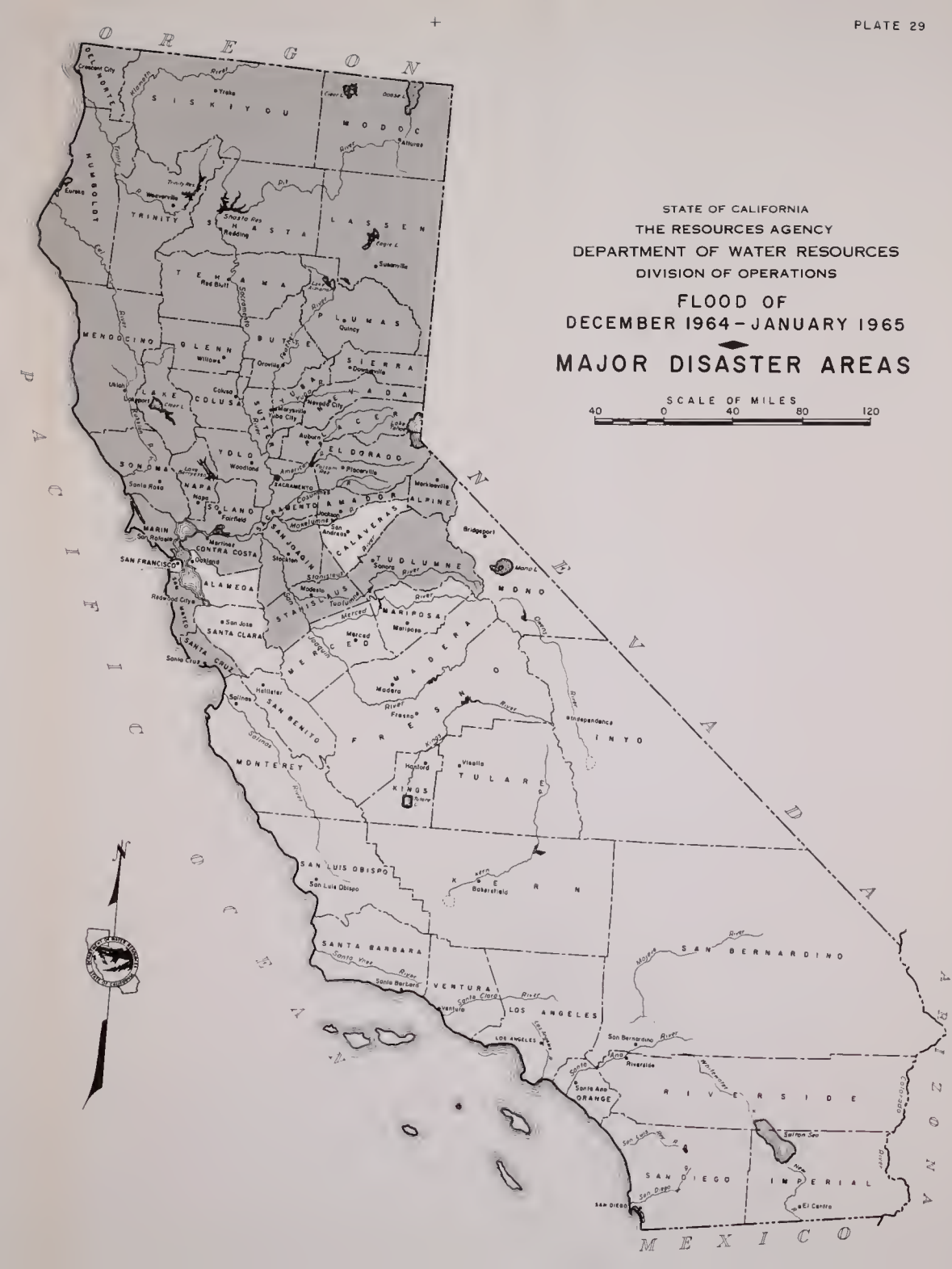
DIVISION OF OPERATIONS
FLOOD OF
DECEMBER 1964 - JANUARY 1965
PRECIPITATION AND STREAM GAGING STATIONS
NORTH COASTAL AREA
SCALE OF MILES
0 8 16 24


STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF OPERATIONS
FLOOD OF
DECEMBER 1964 – JANUARY 1965
MAJOR DISASTER AREAS
SCALE OF MILES
40 0 40 80 120
OREGON
NEVADA
ARIZONA
MEXICO
PACIFIC OCEAN
SISKIYOU
MODOC
HUMBOLDT
TRINITY
SHASTA
LASSEN
TEHAMA
PLUMAS
MENDOCINO
GLENN
BUTTE
SIERRA
LAKE
COLUSA
NEVADA
PLACER
YOLO
EL DORADO
SONOMA
NAPA
SOLANO
SACRAMENTO
AMADOR
ALPINE
MARIN
CONTRA COSTA
SAN FRANCISCO
ALAMEDA
SAN JOAQUIN
CALAVERAS
TUOLUMNE
STANISLAUS
MARIPOSA
MONO
SANTA CLARA
MERCED
MADERA
FRESNO
INYO
SAN BENITO
MONTEREY
KINGS
TULARE
KERN
SAN LUIS OBISPO
SANTA BARBARA
VENTURA
LOS ANGELES
SAN BERNARDINO
ORANGE
RIVERSIDE
SAN DIEGO
IMPERIAL
Eureka
Crescent City
Yreka
Alturas
Weaverville
Shasta Res.
Redding
Susanville
Red Bluff
Quincy
Willows
Oroville
Downieville
Ukiah
Colusa
Nevada City
Marysville
Yuba City
Auburn
Lake Tahoe
Woodland
Placerville
Sacramento
Markleeville
Santa Rosa
Napa
Fairfield
Jackson
Monolith
San Andreas
Bridgeport
Mono L.
Oakland
Martinez
Stockton
Sonora
Modesto
Redwood City
San Jose
Merced
Mariposa
Madera
Fresno
Independence
Hollister
Salinas
Coalinga
Hanford
Visalia
Bakersfield
San Luis Obispo
Santa Barbara
Ventura
Los Angeles
San Bernardino
Riverside
Santa Ana
Salton Sea
El Centro
San Diego
Mojave River
Santa Ana River
Santa Clara River
Santa Ynez River
Salinas River
San Luis Rey R.
San Diego R.
Colorado River

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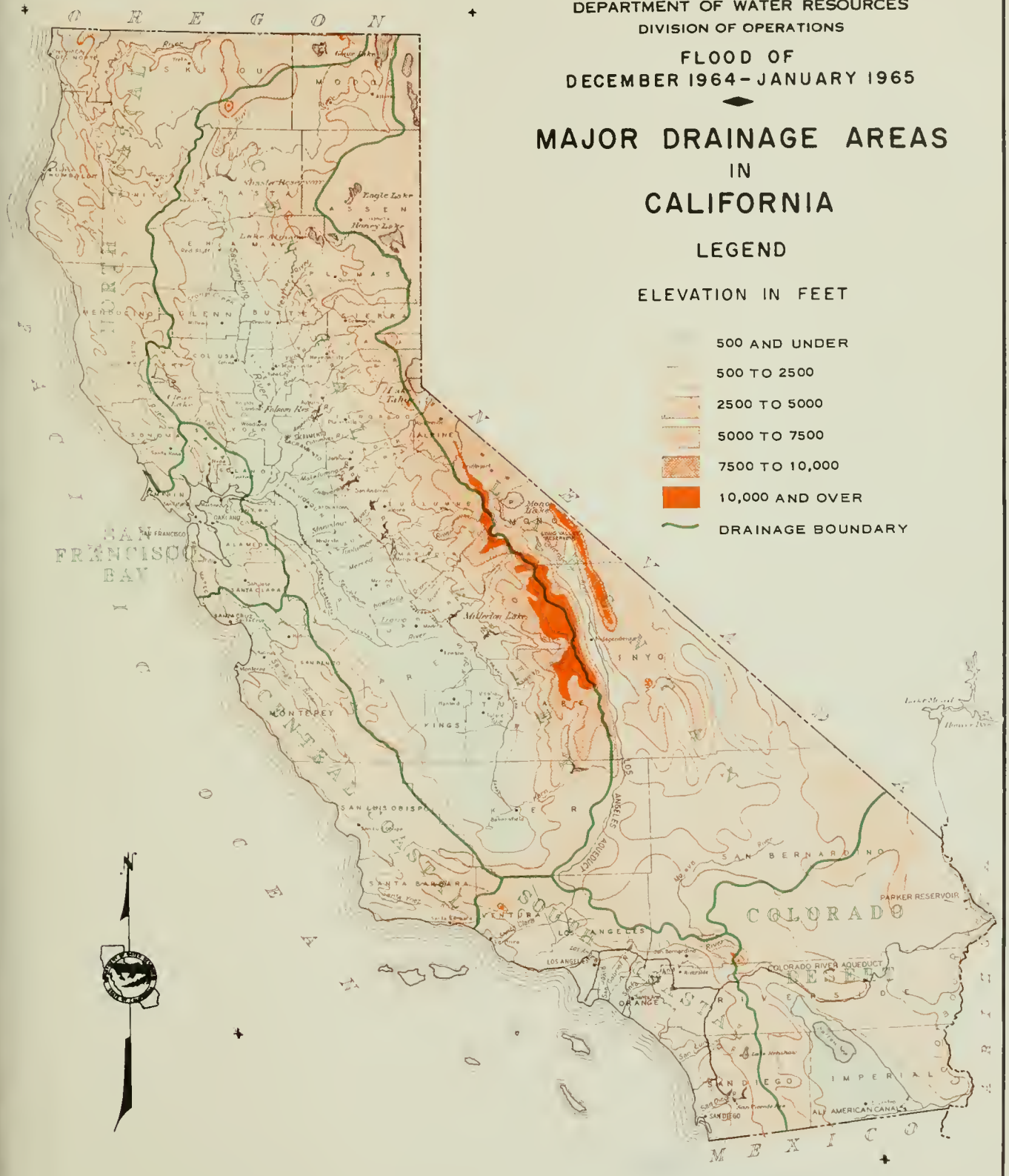
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF OPERATIONS

FLOOD OF
DECEMBER 1964 - JANUARY 1965

MAJOR DRAINAGE AREAS IN CALIFORNIA



LEGEND

ELEVATION IN FEET

- 500 AND UNDER
- 500 TO 2500
- 2500 TO 5000
- 5000 TO 7500
- 7500 TO 10,000
- 10,000 AND OVER
- DRAINAGE BOUNDARY