Photograph by R. L. Copeland
AERIAL VIEW OF NILES, CALIFORNIA AND FLOODING
ALAMEDA CREEK, DECEMBER 24, 1955

Base map by Topographic Division
U. S. Geological Survey, 1959

APPROXIMATE MEAN
DECLINATION, 1959

EXPLANATION

River miles measured upstream
from mouth

— · — · — Flood of Dec. 23, 1955

— — — Flood of Apr. 3, 1958

········· Flood of Dec. 23, 1955 and Apr. 3, 1958

Flooded in 1955 but not flooded in 1958

Flooded in 1958 but not flooded in 1955

Flood inundated area

SCALE 1:24 000

CONTOUR INTERVAL 5, 20 AND 40 FEET
DOTTED LINES REPRESENT 5 AND 10-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL
DEPTH CURVES IN FEET—DATUM IS MEAN LOWER LOW WATER
SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER
THE MEAN RANGE OF TIDE IS APPROXIMATELY 7 FEET

1962

ALAMEDA CREEK FLOOD HEIGHTS

Flood heights recorded at Geological Survey gaging station on Alameda
Creek near Niles, located 1 mile upstream from State Highway 9. Overflow
limits for only the 1955 and 1958 floods are shown.

Date of flood	Stage (feet)	Elevation above mean sea level (feet)
April 3, 1958	14.17	99.82
December 23, 1955	14.9	100.55
January 12, 1962	13.92	99.57

FLOODS IN ALAMEDA CREEK BASIN, AT FREMONT, CALIFORNIA, IN 1955 AND 1958

The approximate areas inundated by Alameda Creek and its distributary, Patterson Creek, during the floods of December 23, 1955, and April 3, 1958, in the reach of channel downstream from State Highway 9 at Fremont, California, are shown on a topographic map base to record the flood hazard in graphical form. The flood of December 1955 was the greatest since 1891 and was probably the greatest since at least January 1862. Greater floods are possible, but no attempt has been made to show their probable overflow limits.

Alameda Creek, which has a range in altitude from mean sea level to over 4,000 feet, discharges through a narrow canyon above Fremont onto a wide flood plain that drains into San Francisco Bay. Alameda Creek divides into two channels at a point about 7.4 miles upstream from its mouth (San Francisco Bay). The northern channel retains the name Alameda Creek. The southern channel, Patterson Creek, a man-made distributary, flows into San Francisco Bay at a point about 2 miles south of Alameda Creek.

The extent of inundation by Alameda Creek in the vicinity of Fremont is governed primarily by the magnitude of the flood flow. The extent of flooding is influenced also by reduction in channel capacity resulting from vegetation growth and changes in channel dimensions and alignment; by height, location, and condition of levees; and by man's encroachment upon the flood plain. In the lower elevations near San Francisco Bay, high tides may retard flood flow. In addition, the separation of Alameda Creek into two channels further complicates the relation between flood magnitude and extent of flooding. Future protective works may reduce the frequency of flooding in the area but will not necessarily eliminate flooding. New highways and other cultural changes may influence the inundation pattern of future floods.

Flood height.—The height of a flood at a gaging station is usually stated in terms of the gage height or stage, which is the elevation of the water surface above a selected datum plane. Elevations shown are in feet above mean sea level. Gage heights or stages at a gaging station in the Alameda Creek basin in the vicinity of Fremont can be converted to elevations above mean sea level by adding the gage height to the appropriate datum of gage listed below. Thus, during the flood of December 23, 1955, the maximum gage height on Alameda Creek at the gaging station near Niles, located about 1 mile upstream from State Highway 9, was 14.9 feet and the corresponding elevation above mean sea level was 100.55 feet.

Gaging Station	Datum of gage above mean sea level (feet)
Alameda Creek near Niles (1 mile upstream from State Highway 9)	85.65
Alameda Creek at Union City (Baker Road)	0.00
Patterson Creek at Union City (State Highway 17)	4.90

Gage height and year of occurrence of each annual flood (greatest flood each year) which exceeded elevation 95 feet, at the Geological Survey gaging station near Niles, are shown in figure 1. Extensive flooding does not occur during stages below 95-foot elevation. The irregular recurrence of floods is evident. The 95-foot elevation was exceeded 12 times in 37 years of record (fig. 1). Although floods above elevation 96 feet occurred on the average of about 3 per decade, 2 were experienced in some decades whereas 6 occurred during the period 1937–46.

Regulation.—Flow from about one-seventh of the Alameda Creek drainage area above Niles has been subject to some regulation by Calaveras Reservoir since 1916, although the dam was not completed until 1925. Because the flow from only this small part of the total drainage area is regulated, the effect of reservoir storage on annual flood peaks at Niles is not large.

Flood frequency.—Frequency of flooding on Alameda Creek is derived from the continuous record of annual floods since 1919 at the Geological Survey gaging station near Niles, supplemented by other streamflow records during the period 1891–1918. Large errors may result if the flood frequency curve is extrapolated beyond the limits shown.

Recurrence interval.—As applied to flood events, recurrence interval is the number of years, on the average, within which a given flood height will be equaled or exceeded once. It is inversely related to the chance of a specific flood being equaled or exceeded in any one year. Thus 25-year flood would have 1 chance in 25 of being equaled or exceeded in any one year, a 30-year flood would have 1 chance in 30 of being equaled or exceeded in any one year.

The relationship between recurrence interval and flood height at the gaging station on Alameda Creek near Niles is shown graphically in figure 2 and is tabulated in next column:

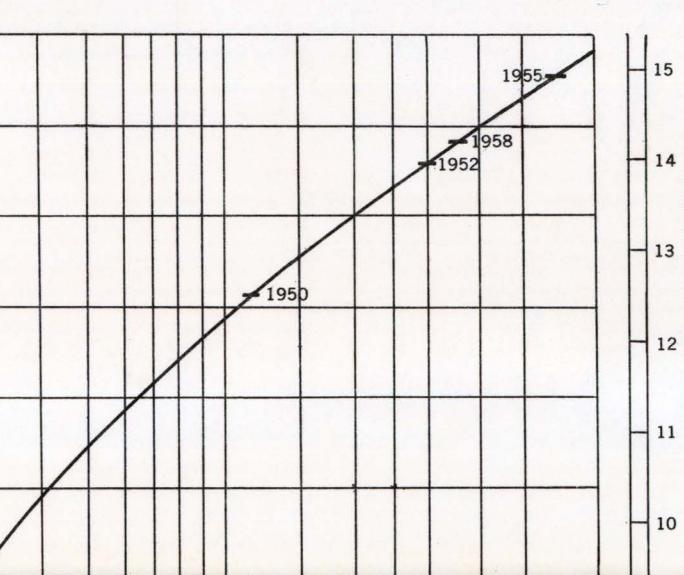| Recurrence interval (years)	Elevation above mean sea level Alameda Creek near Niles, 1 mile upstream from State Highway 9 (feet)
75	100.7
50	100.2
40	100.0
30	99.6
20	99.0
10	97.9
5	96.5
3	95.0

FIGURE 2.—FREQUENCY OF FLOODS AT GAGING
STATION ON ALAMEDA CREEK
NEAR NILES, CALIFORNIA

The elevations of 4 floods of record—1950, 1952, 1955, and 1958—are plotted on figure 2.

It is emphasized that recurrence intervals are average figures—the average number of years in which floods of specific gage height will be equaled or exceeded. Thus, on Alameda Creek, a flood that reaches 100-foot elevation at the gaging station near Niles is said to have a recurrence interval of 40 years, or a 1-in-40 chance of occurring in any one year. However, because of the erratic nature of flood occurrence, the 100-foot elevation may not be reached in a given 40-year period or it may be attained several times.

Flood profiles.—Profiles of the water surface along Alameda Creek and Patterson Creek below the point of diversion of Patterson Creek, constructed from marks left by the flood of April 3, 1958, (recurrence interval about 35 years) are shown in figure 3, together with profiles of hypothetical floods with 3, 15, 35, and 70-year recurrence intervals. Profiles of the hypothetical floods shown are derived from stage-frequency relations at the gaging station near Niles and at other points located downstream. Profiles for the hypothetical floods were not extended downstream below river mile 7.4 (Patterson Creek diversion point) because of uncertainties regarding distribution of flow, tide effects, and occurrence of levee breaks. Below river mile 7.4, the profile reflects conditions which existed at the time of the 1958 flood and in this reach a future flood of the same magnitude at the gaging station near Niles would not necessarily duplicate the profile shown in figure 3. Flood waters frequently overflow the banks of Alameda Creek at about mile 9.6. Changed conditions at this point of overflow as well as alterations in the creek channel or levee system can have a marked effect on the flood profiles downstream.

Upstream from river mile 7.4, profiles of floods corresponding to other flood heights can be plotted on figure 3 generally parallel to those shown.

Base lines for the profiles are located generally along the centerlines of the streams. River miles measured upstream from the mouth of Alameda Creek and Patterson Creek, used for the profiles of figure 3, are also marked along the streams on the map.

Depth of flooding at any point can be estimated by subtracting the ground elevation (shown by contours on the map) from the water surface elevation indicated by the profiles of figure 3.

Tributaries.—Alameda Creek and Patterson Creek are the principal sources of flooding in the Fremont vicinity, downstream from Niles. Tributaries overflow their banks as a result of local storms of high intensity, whether or not Alameda Creek is flooding. Areas inundated by overflows of tributaries are not shown because few data regarding the extent of their flooding are available. Tributaries in the lower reach of Alameda Creek are small and usually have peaked and receded considerably before Alameda Creek peak flow occurs, thereby having little effect on the Alameda Creek flood heights.

Additional data.—Other information pertaining to floods in the Alameda Creek basin may be obtained at the office of the U.S. Geological Survey, 345 Middlefield Road, Menlo Park, California, and from the following published reports:

Matthai, H. F., and others, 1957, Water Resources of the San Francisco Bay area, California: U.S. Geol. Survey Circ. 378.

Hoffman, Walter, and Rantz, S.E. (in press), Floods of December 1955–January 1956 in the far Western States: U.S. Geol. Survey Water-Supply Papers 1650-A and -B.

U.S. Geological Survey, 1960, Compilation of Records of Surface Waters of the United States through September 1950, Part 11-A, Pacific Slope Basins in California except Central Valley, U.S. Geol. Survey Water-Supply Paper 1315-B.

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Alameda County Flood Control and Water Conservation District
Alameda County Water District
California Division of Highways
Corps of Engineers

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FIGURE 1.—ANNUAL FLOODS ABOVE 95-FOOT
ELEVATION, 1924–60, ALAMEDA CREEK
NEAR NILES, CALIFORNIA

December 23, 1955, gage height 14.9 feet
April 3, 1958, gage height 14.17 feet

EXPLANATION
Profile of flood of April 3, 1958
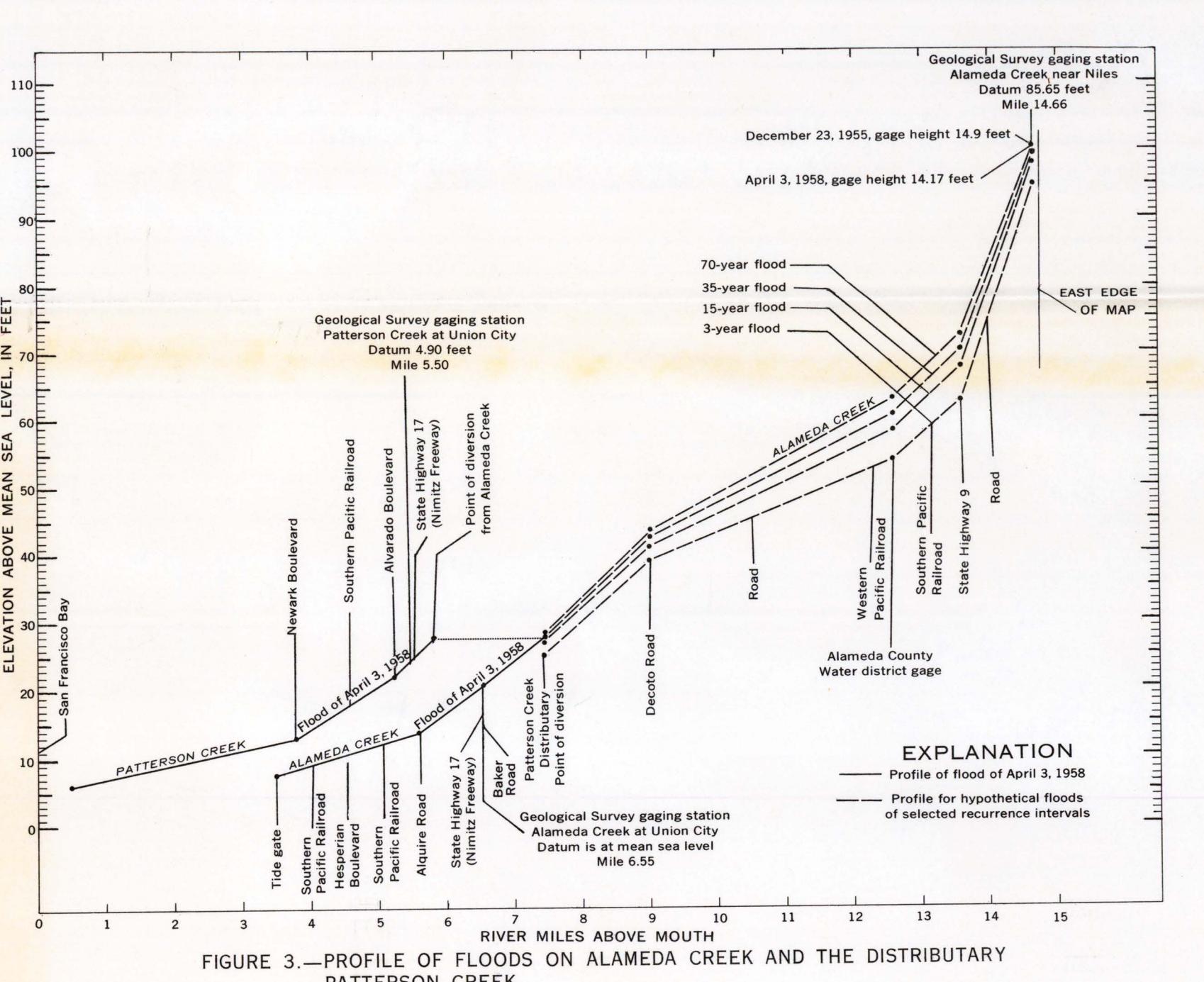Profile for hypothetical floods
of selected recurrence intervals

FIGURE 3.—PROFILE OF FLOODS ON ALAMEDA CREEK AND THE DISTRIBUTARY
PATTERSON CREEK