MONTANA DEPARTMENT OF FISH AND GAME
FISHERIES DIVISION

JOB PROGRESS REPORT

State Montana Title Seasonal measurements of basic water chemistry, plankton production and certain physical characteristics of Flathead Lake.

Project No. F-33-R-7

Job No. II-a

Period Covered July 1, 1972 through June 30, 1973

ABSTRACT

Specific and localized collection of certain chemical, physical and biological characteristics of Flathead Lake were continued during the period April, 1972, through February, 1973. This work complemented the fish sampling program by aiding in defining specific influences and effects on the movement and distribution of fish.

The thermal warming and pattern of spring turbidities during the 1972 season were discussed.

Lake level elevations, 1928 through 1973, were plotted and presented as hydrographs. These graphs illustrate the annual storage pattern of the lake and offer visual comparisons of these patterns.

BACKGROUND

Basic limnological data are essential in a study to determine the effect of environmental changes in fish growth, movement and distribution.

OBJECTIVES

The objectives of this job are to measure the basic chemical, physical and biological characteristics of the lake and to sample fish in the same general areas. These data will be used for assessing the factors that influence the movement of the fish and their distribution.

PROCEDURES

Water temperature profiles were made by using a resistance thermometer coupled to a depth sensor unit (Bathythermonitor). Water depths in feet were recorded for each 1° F. change in water temperature and compiled into station profiles. Secchi disc readings were made wherever temperature data were taken.

Plankton abundance was determined with two nets, one which has a 45 cm diameter opening with a 0.1061 mm mesh silk collecting bag. The second net was a 5-inch Clarke-Bumpus (C-B) automatic plankton sampler with a #12 mesh (0.0047 inch or 130 microns aperture) net bag and collection bucket. Each net has a flow meter mounted in the mouth to measure the water velocity through the nets. A two-minute haul was made with the larger net while a one-minute haul was ample with the C-B sampler. The C-B sampling was done in cooperation with the University of Montana graduate level study on the zooplankton of Flathead Lake.

FINDINGS

Basic chemical, physical and biological characteristics of Flathead Lake continued to be monitored. Rather than to establish annual criteria for the entire lake as previously described by Hanzel, (1970, 1971, 1972, 1973) more specific and localized collections were made to aid in determining the influence and effect of these environmental characteristics on the movement and distribution of fish. This specialized work was done in conjunction with the fish sampling program conducted April, 1972 to February, 1973.

Surface plankton hauls were confined to those areas where the purse seine activities were in operation. These samples were not analyzed but were preserved and stored and will be used as reference collections when considering the food preference and consumption of the kokanee.

Information on the zooplankton community in the lake for the 1972 season is available through a graduate level study by Dave Potter, University of Montana. A winter series of plankton taken with the aid of an automatic Clark-Bumpus (C-B) sampler was accomplished cooperatively with this same student. Sample areas included the eight stations previously sampled during the C-B series in the fall of 1971 and the spring of 1972, (Hanzel, 1973). One additional station was sampled during this winter period; that representing Big Arm Bay with sample depths to 110 feet. The results of the three series of C-B plankton and the analysis of the zooplankton in the lake for the 1971 and 1972 seasons will be included in Mr. Potter's thesis scheduled to be completed in 1974.

Water Temperature

A temporary thermocline formed in early June, 1972, but winds and cool air temperatures following this period destroyed it and kept the lake in an unstable condition until mid-July. Permanent stratification has previously been recorded during early June for the 1967, 1969 and 1970 seasons. Stratification during the 1968 and 1971 seasons did not occur until mid-July.

Thermocline depth during the 1972 season was 10 to 20 feet deeper along the western or lee-shore than areas along the opposite or eastern shore. Southern stations continually recorded surface temperatures 6° to 10° F. warmer than did stations in the northern areas. The upper limit of the thermocline reached its maximum depth of 84 feet on September 6 at a southern west shore station. On this date, other stations recorded thermocline depths that ranged from 50 to 70 feet below the surface. The seasonal maximum surface temperature of 71° F. was reached on August 9 at Yellow Bay.

Temperature profiles during the November C-B plankton series found the lake in a near holothermal state with temperatures ranging from 46° to 48° F. throughout the water column.

Spring Turbidities

Maximum turbidities caused by spring run-off in the Upper Flathead River drainage reached the lake on May 30. A reading of 1.5 feet was recorded by the secchi disc in the inlet area. Secchi disc readings on this date in the southern areas of the lake had not been affected by visible silt patterns and secchi disc readings measured 15 feet. Turbidities did reach the southern areas by June 20, when the readings measured 8 feet. The settling rate as illustrated by the disc readings at the off-shore Yellow Bay (southern) station were as follows: July 5-9 feet; July 12-12 feet; July 21-18 feet; August 9-22 feet. September disc readings average 25 feet in the southern areas or five feet more than the average of the northern stations. The seasonal maximum secchi disc reading of 30 feet was recorded on November 2 in Skidoo Bay.

Lake Elevations

Flathead Lake, the reservoir basin for the entire upper Flathead River system, is isolated from the lower part of the watershed by Kerr Dam, a private power dam, located near the outlet of the lake. Kerr Dam is the regulatory device for the year-around lake level and by agreement elevations are maintained within a prescribed 10-foot level.

Power demands and flood control requirements for the entire northwest United States within the Columbia River drainage have an effect or dictate the controlling of levels of Flathead Lake. Since seasonal demands for water are not predictable, the patterns of discharge, spilling and/or lake levels are also not predictable; at least to the limits described by a memorandum of understanding approved by the Federal Power Commission in an Order issued February 24, 1966. The following are extracted from a letter by Regional Engineer, M. Frank Thomas, Federal Power Commission, that states the Order describing the operations at Kerr Dam and the levels of Flathead Lake.

"On May 31, 1962, the Montana Power Company, licensee for the Kerr hydro-electric development, on the Flathead River, and the Corps of Engineers entered a Memorandum of Understanding which set further principles and procedures for regulation of Flathead Lake, the storage reservoir of the Kerr development, in the interests of flood control. The agreement, as amended on October 15, 1965, filed on October 19, 1965, for approval by the Commission under Article 21 of the Kerr license, providing:

> The operations of the Licensee, insofar as they affect the use, storage, and discharge from storage of the water of Flathead Lake, shall at all times be controlled by such seasonable rules and regulations...as the Federal Power Commission may prescribe in the interests of flood control and the fullest practicable utilization of the waters of Flathead River and Clark Fork for power, irrigation and other beneficial uses.

The amended agreement provides in general that: (1) The Licensee and the Corps of Engineers will cooperate in exchanging data and coordinating operations for flood control. (2) Conditions permitting, the lake will be drawn down to elevation 2,883 feet, the minimum level under the license, by April 15 and will be raised to elevation 2,890 feet by Memorial Day (May 30) and to elevations 2,893 feet the maximum level under license, by June 15. (3) When the lake reaches elevation 2,886 feet, in a moderate or major flood year, the Licensee will gradually open its spill-gates to maintain free flow and will not close the gates until after the danger of exceeding elevation 2,893 feet has passed.

The amended agreement has been endorsed by both the Flathead Lakers, Inc., an association of Lakeside residents who are interested in having the lake level brought up to the maximum under license as soon in the recreation season as possible, and the Upper Flathead Valley Flood Control Association, an organization of farm owners at the upper end of the lake who are interested in having the lake kept down to prevent inundation of their lands by late floods. At a conference held in Missoula, Montana, on September 28, 1965, attended by representatives of these two landowners' groups, the licensee, the Corps of Engineers, and the Commission, various differences were settled, and the terms of the settlement were incorporated into the agreement by the amendment of October 15, 1965." (Thomas, 1973)

Fluctuating water levels in a body of water does affect the fisheries, so to better understand the changes that have occurred in this lake during the past years, U.S.G.S. water level readings from May 1, 1928 through August 28, 1973, were plotted on a hydrograph to graphically illustrate yearly water levels. The hydrographs represent only 4 dates per month; the 1st, 7th, 14th and 28th. The water year was defined as a period September through August, Figures 1-23.

Water levels during the spring run-off of the years 1933, 1948 and 1950 exceeded the limits of the hydrograph and are so plotted.

A comparison of the hydrographs illustrates the change in pattern of the lake levels after the completion of the controlling structure, Kerr Dam, in 1938. Although the yearly patterns of lake levels differed after Kerr Dam, no major changes were noted until the completion of Hungry Horse Dam in 1952.

Further attempt has not been made at this time to characterize or analyze these data. The purpose is to present these annual patterns as a source for determining the annual fluctuation or to illustrate the changes that have occurred in the past for any particular water year.

RECOMMENDATIONS

Data accumulated during the last six years on this study have established baseline information, seasonal patterns and area variability within the lake for certain basic chemical, physical and biological characteristics. It is, therefore, recommended that seasonal measurements of these parameters over the entire lake be discontinued as a specific job under this investigation. Certain characteristics should be continued to be monitored but undertaken within specific areas or localities. This data will further aid in defining the influences and effects of a particular parameter has on fish movement or distribution.

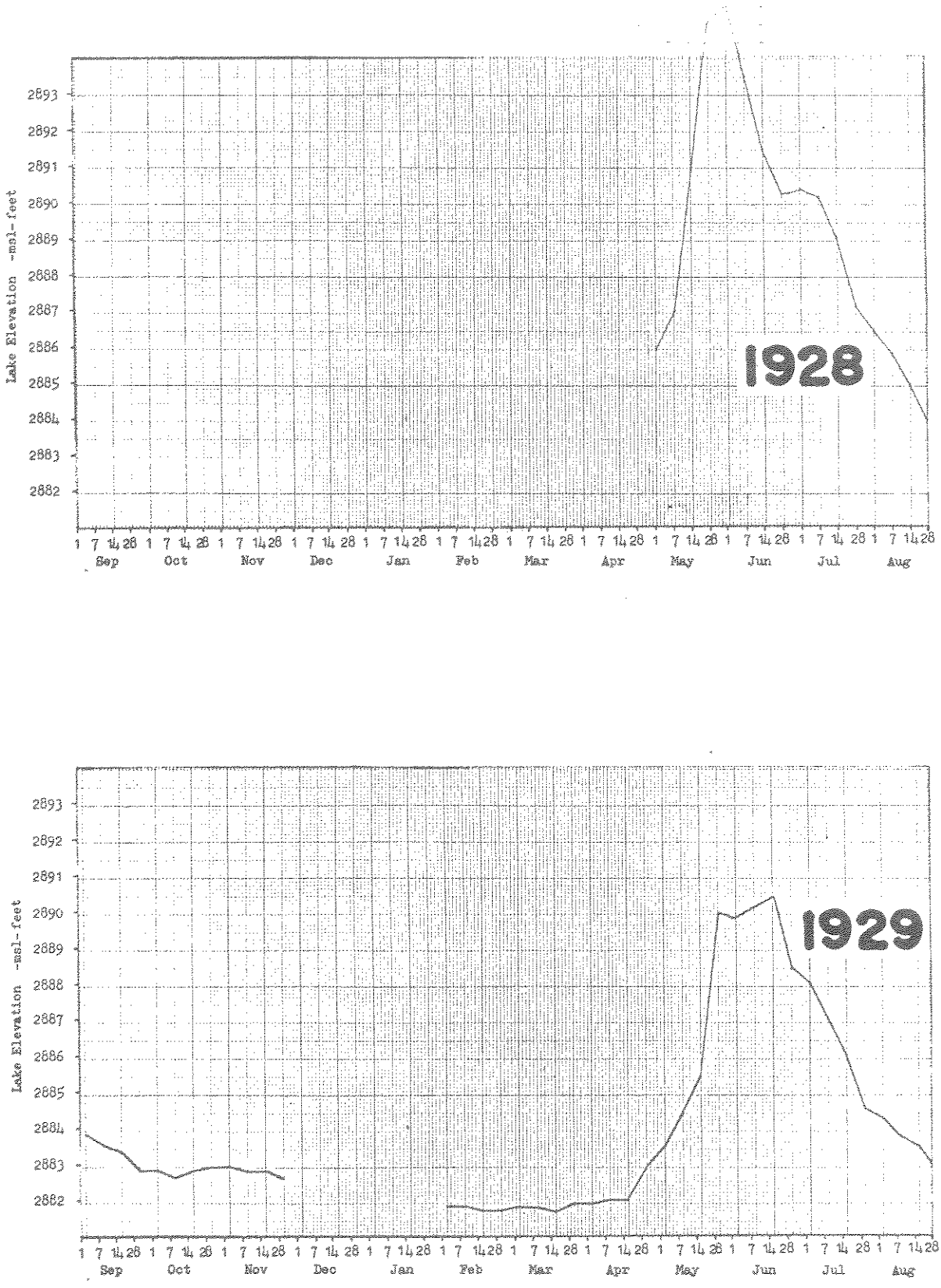
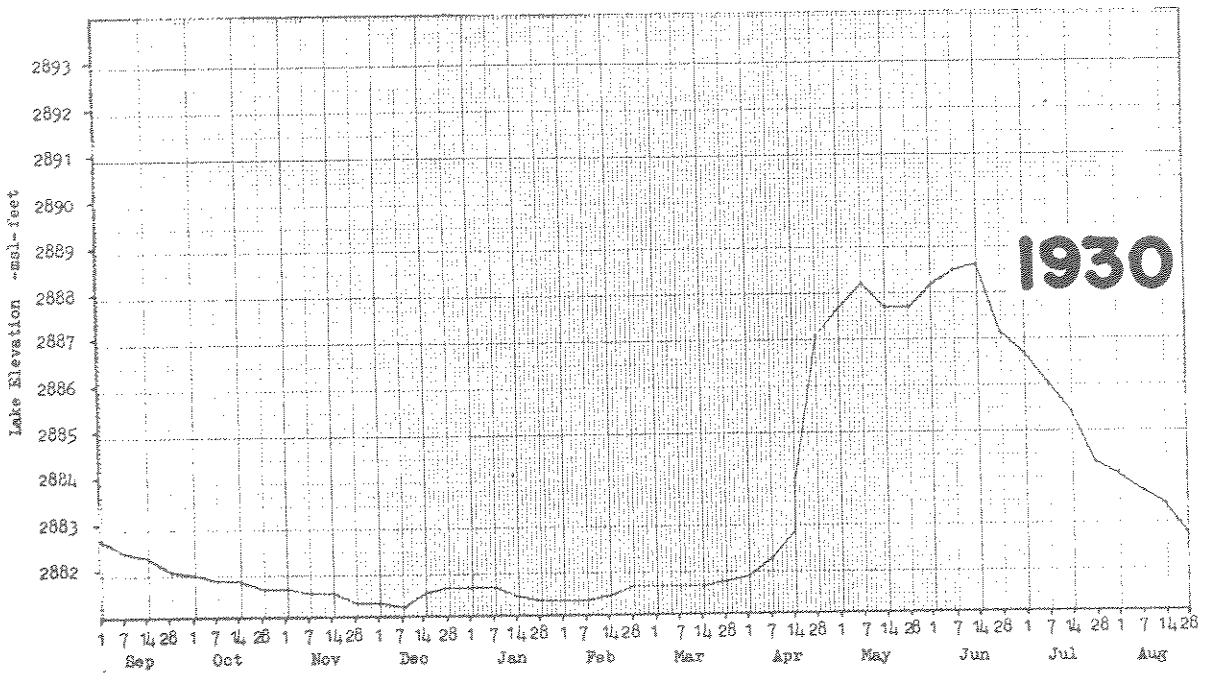


Figure 1-23. Hydrograph of Flathead Lake water level, in feet, U.S.G.S. gauge Somers, Montana, 1928 and 1929.



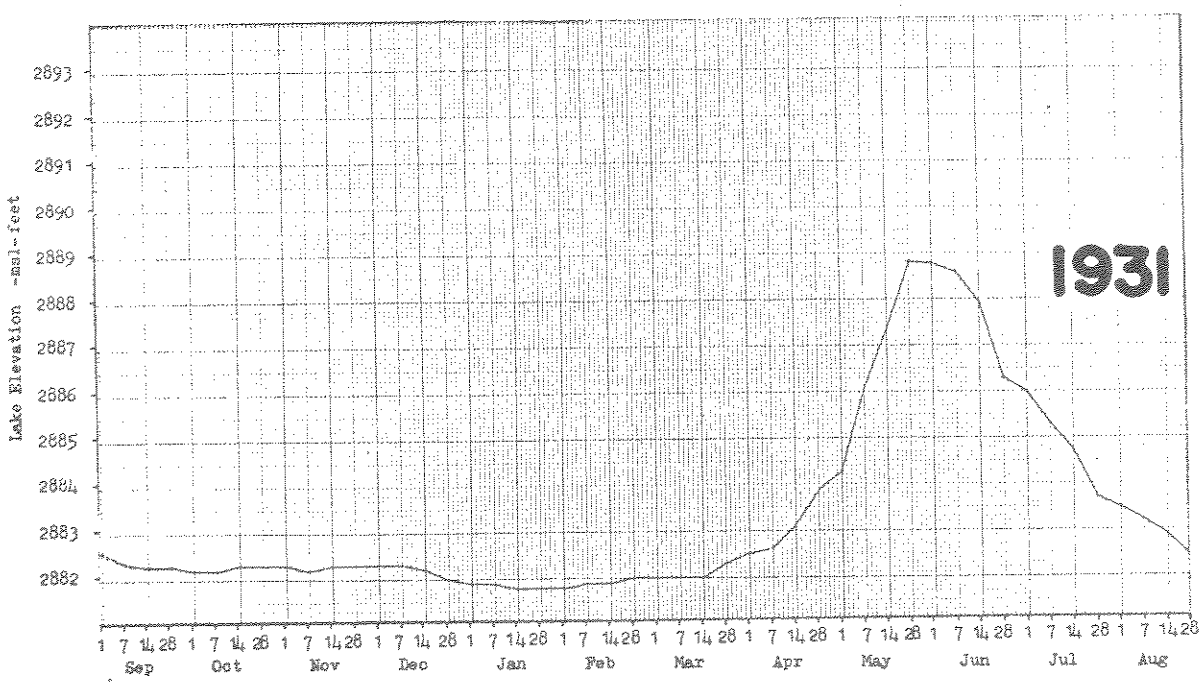


Figure 1-23. Hydrograph of Flathead Lake water level, in feet, U.S.G.S. gauge Somers, Montana 1930 and 1931.

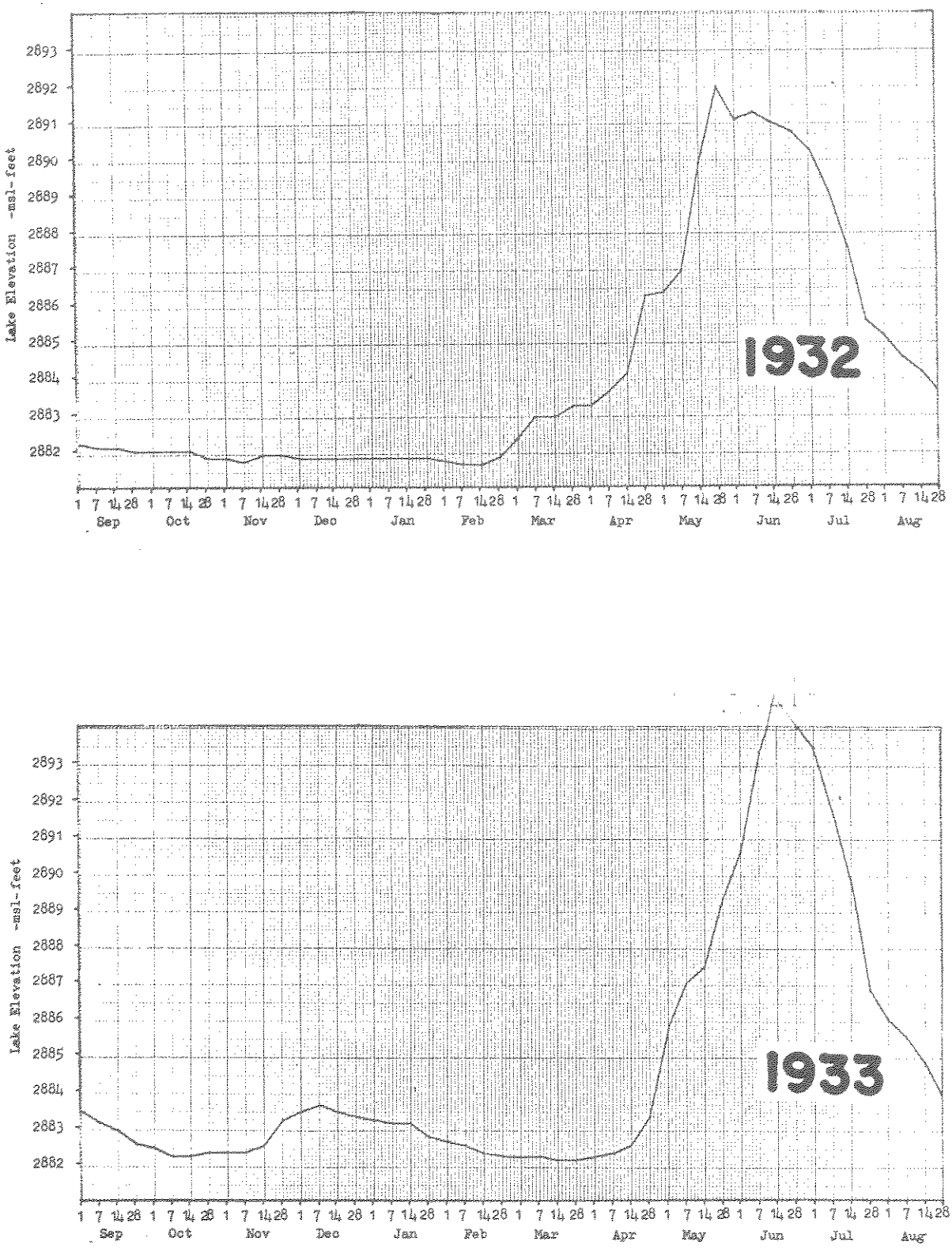
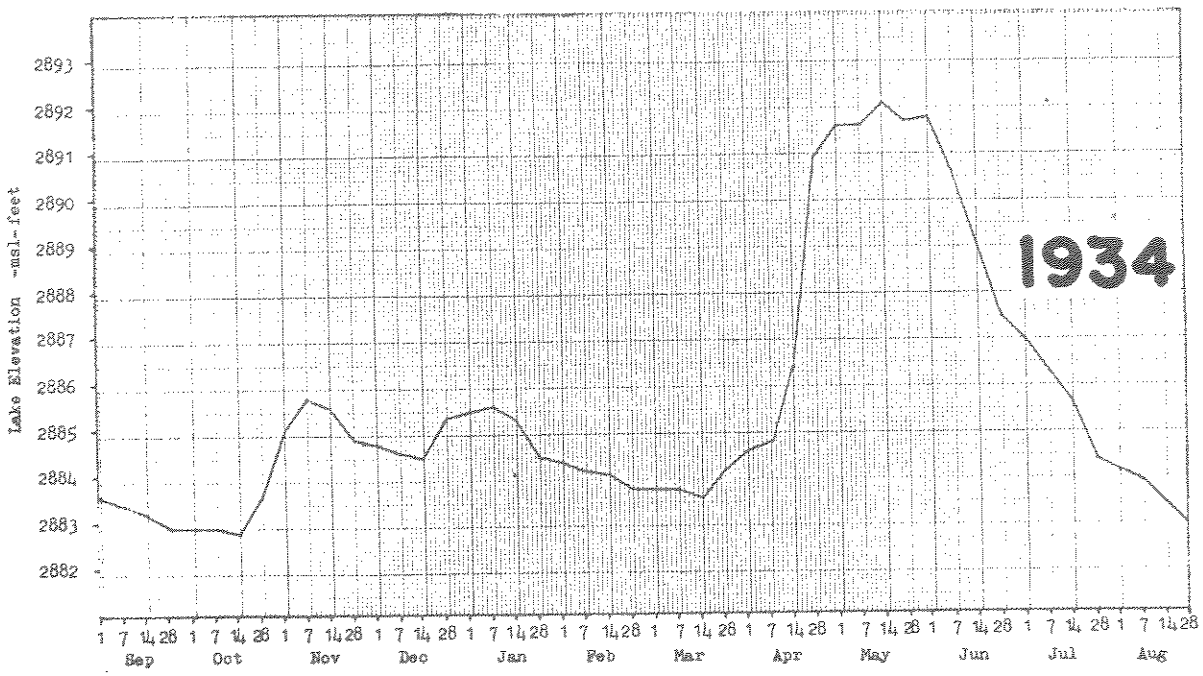


Figure 1-23. Hydrograph of Flathead Lake water level, in feet, U.S.G.S. gauge Somers, Montana, 1932 and 1933.



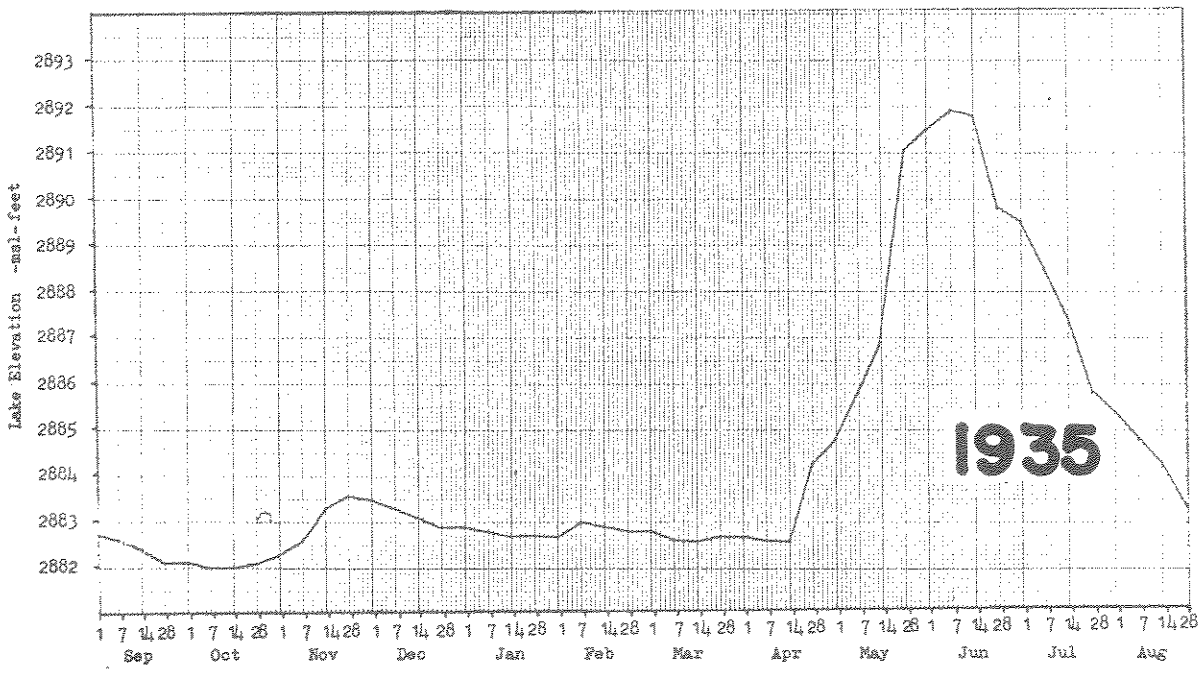
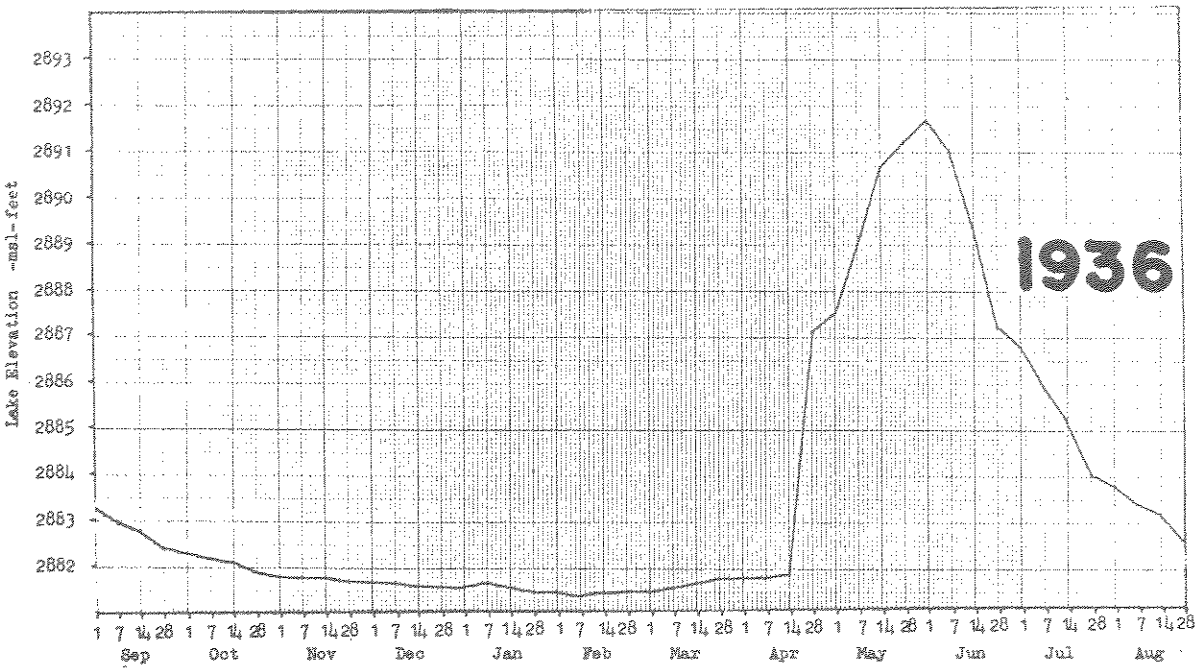


Figure 1-23. Hydrograph of Flathead Lake water level, in feet, U.S.G.S. gauge Somers, Montana, 1934 and 1935.



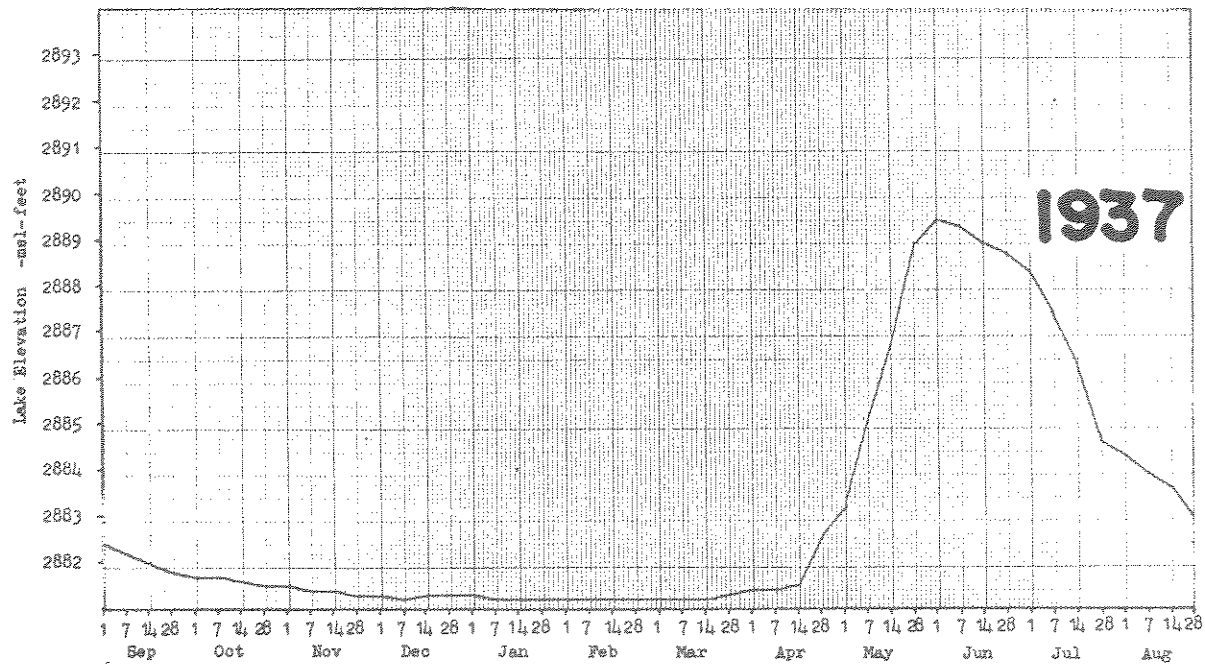


Figure 1-23. Hydrograph of Flathead Lake water level, in feet, U.S.G.S. gauge Somers, Montana, 1936 and 1937.

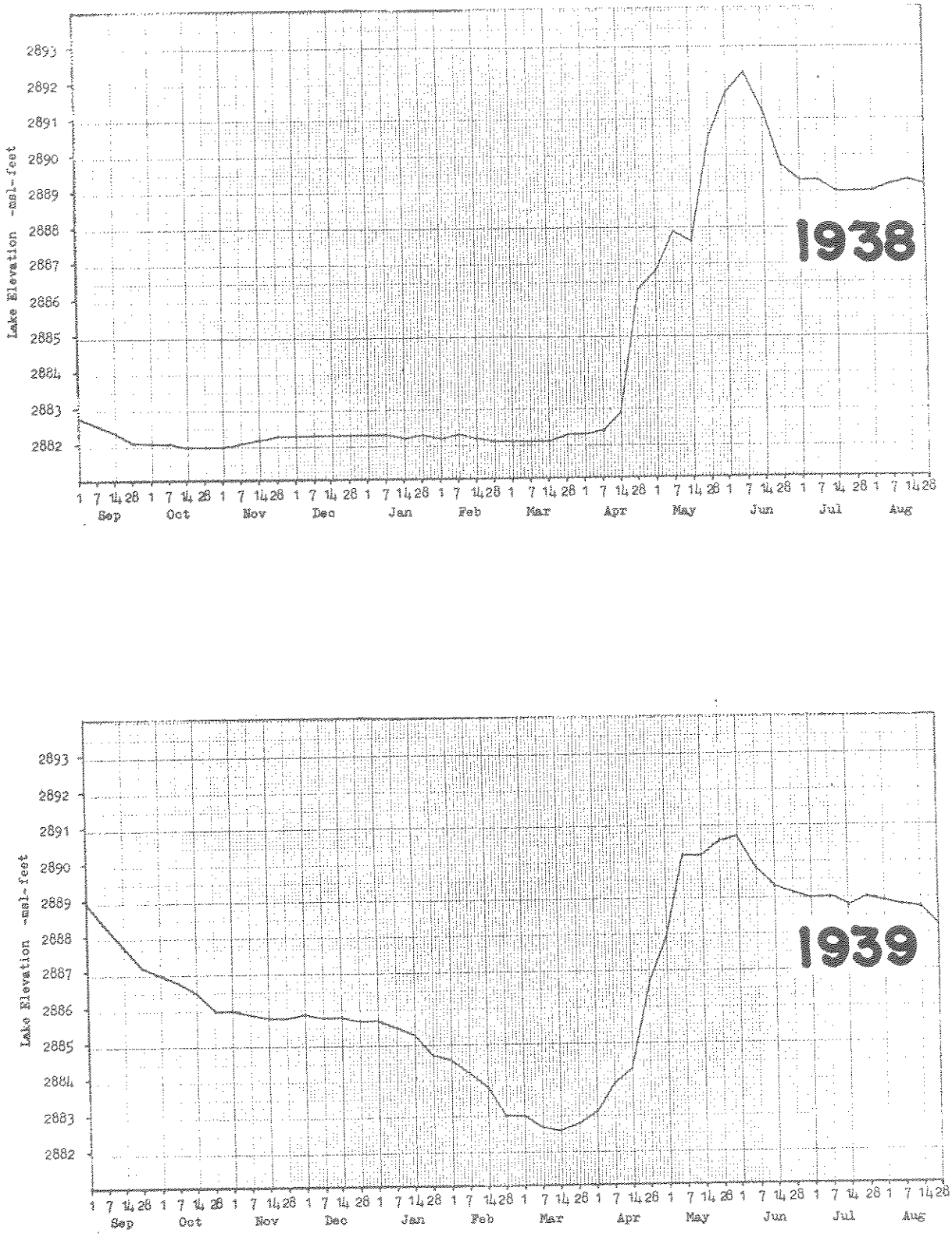


Figure 1-23. Hydrograph of Flathead Lake water level, in feet, U.S.G.S. gauge Somers, Montana, 1938 and 1939.

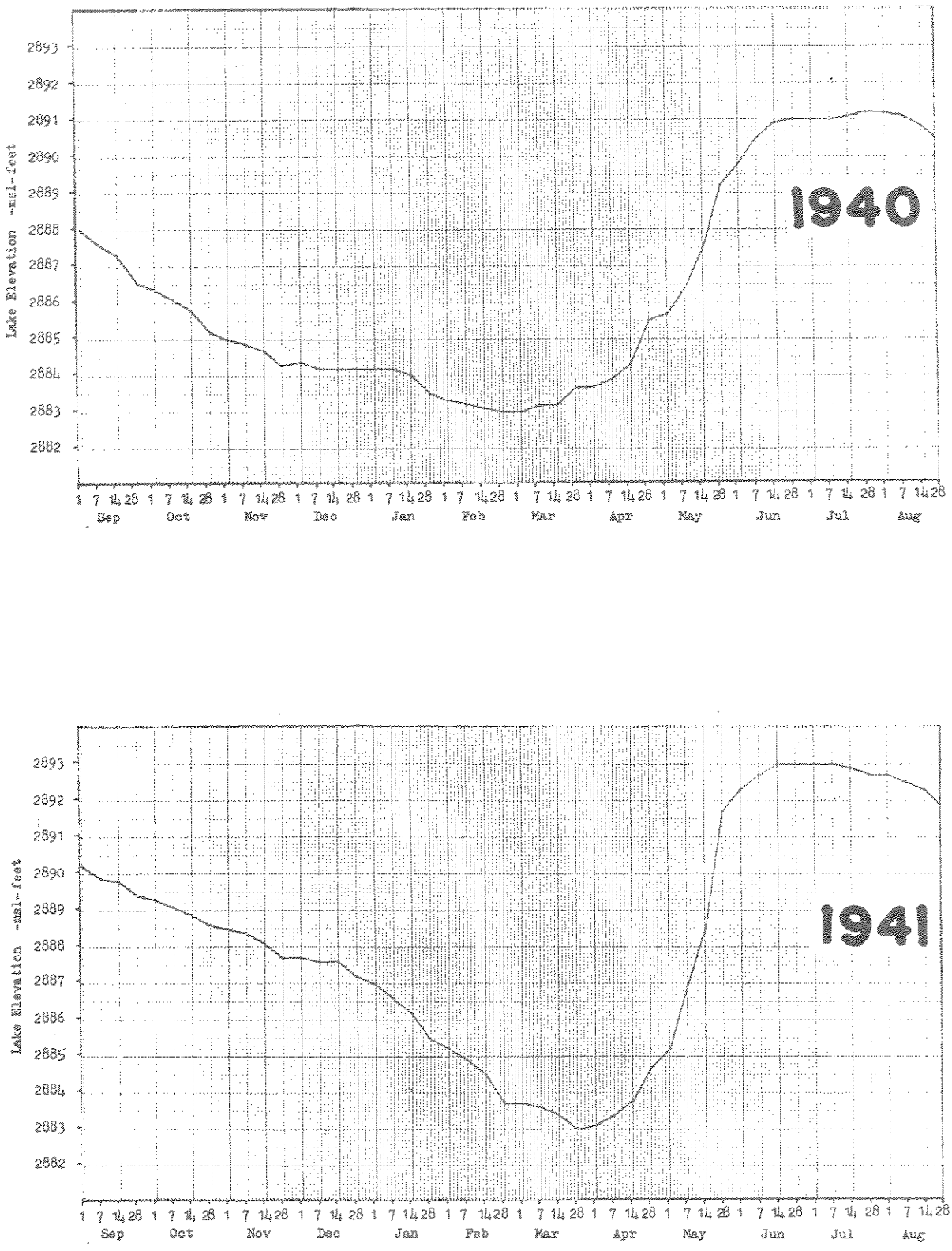
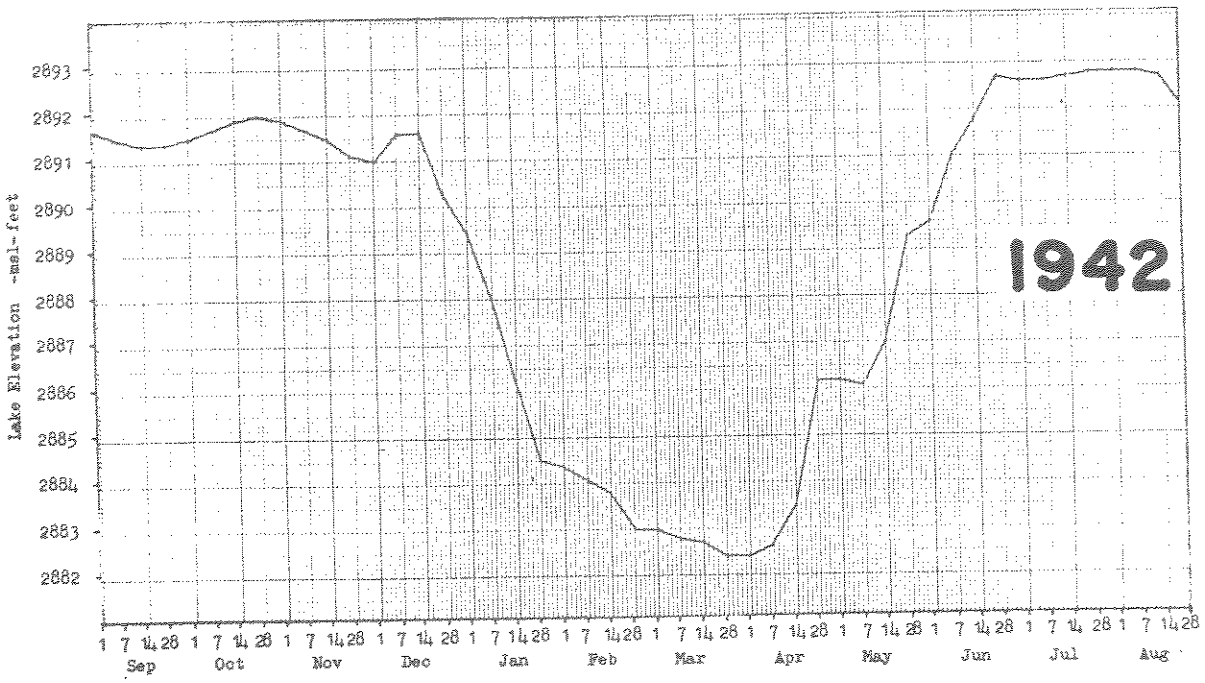


Figure 1-23. Hydrograph of Flathead Lake water level, in feet, U.S.G.S. gauge Somers, Montana, 1940 and 1941.



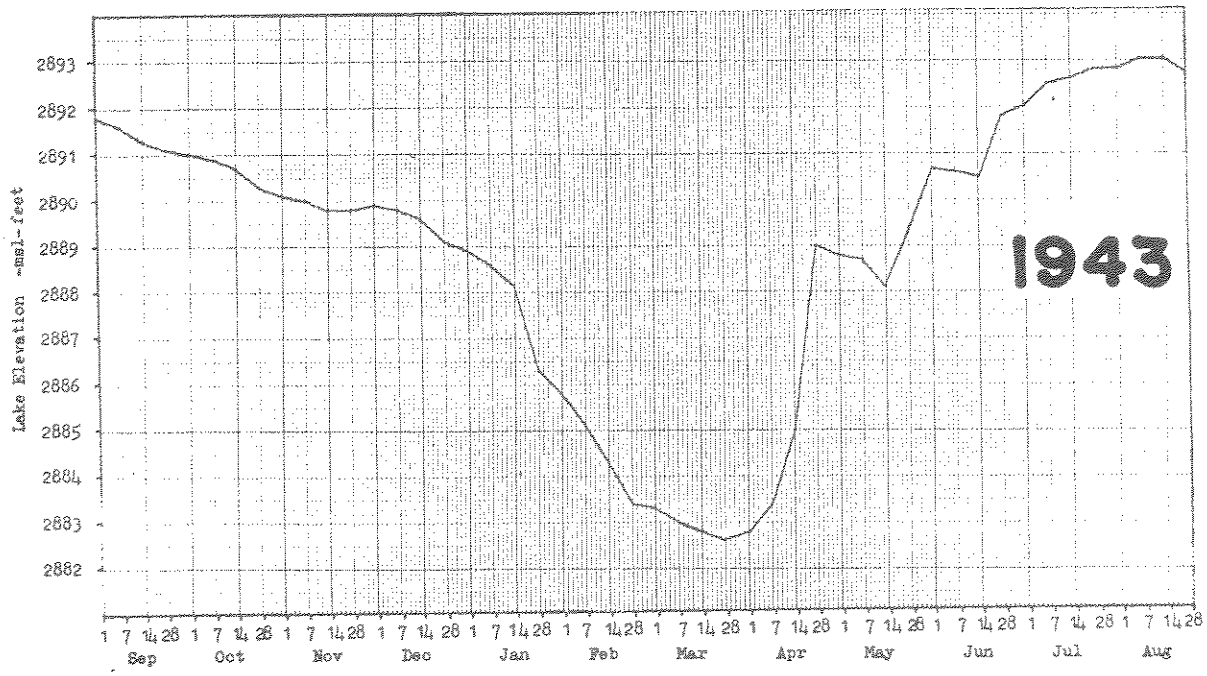
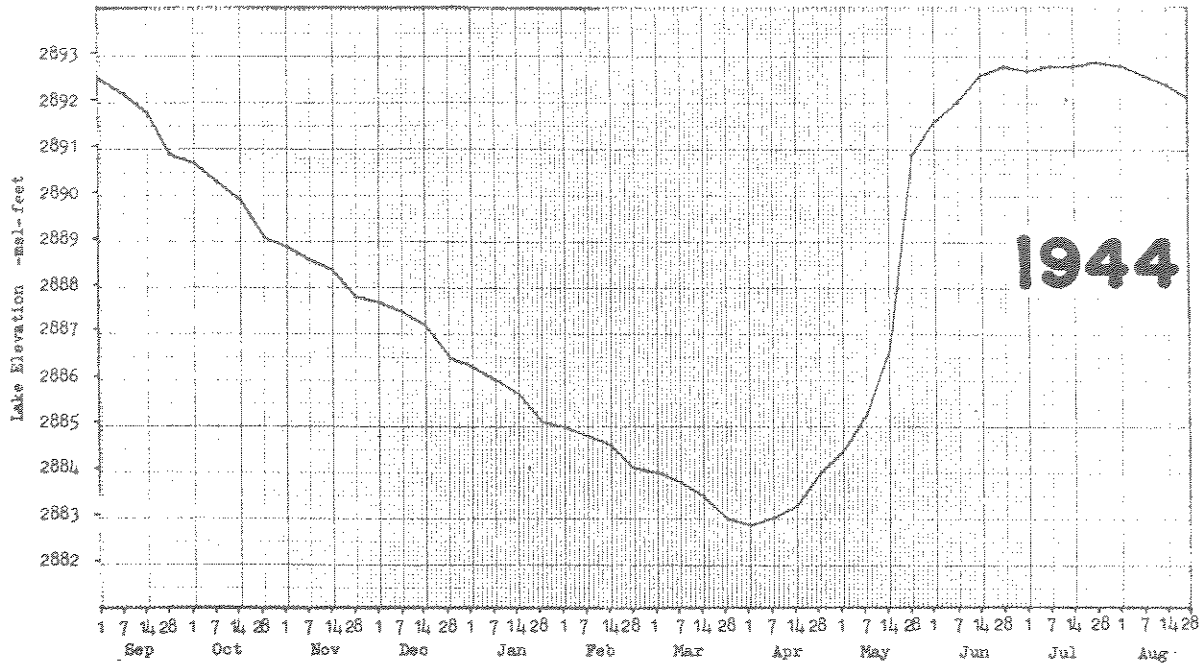


Figure 1-23. Hydrograph of Flathead Lake water level, in feet, U.S.G.S. gauge Somers, Montana, 1942 and 1943.



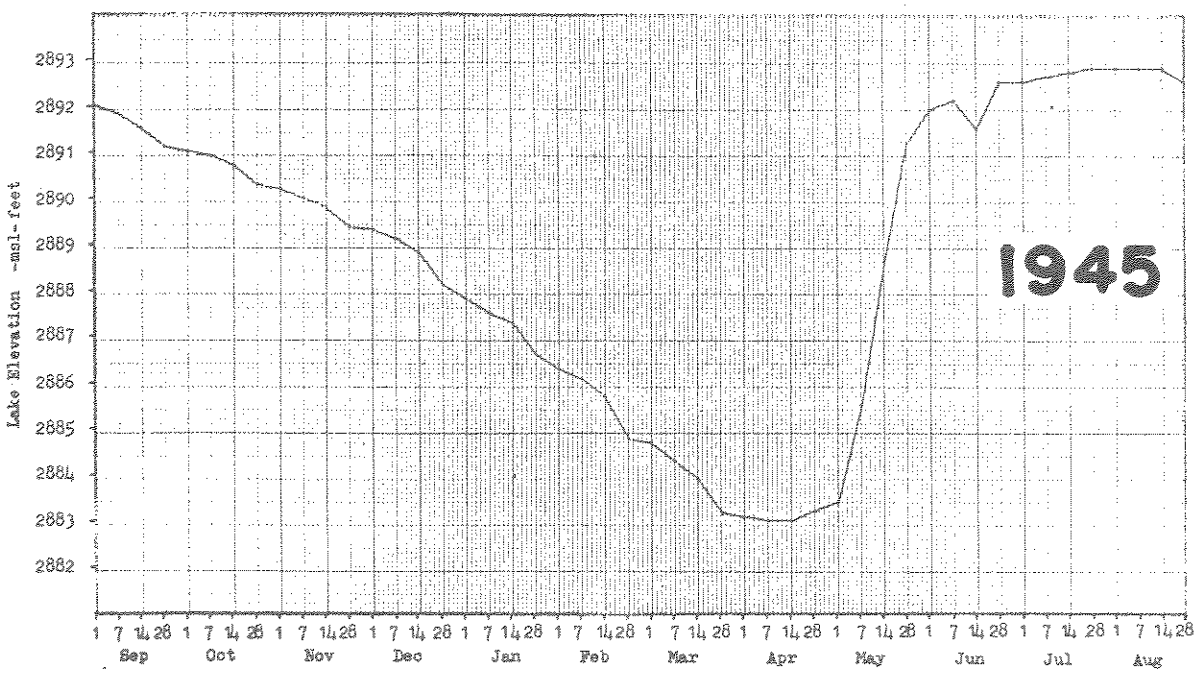
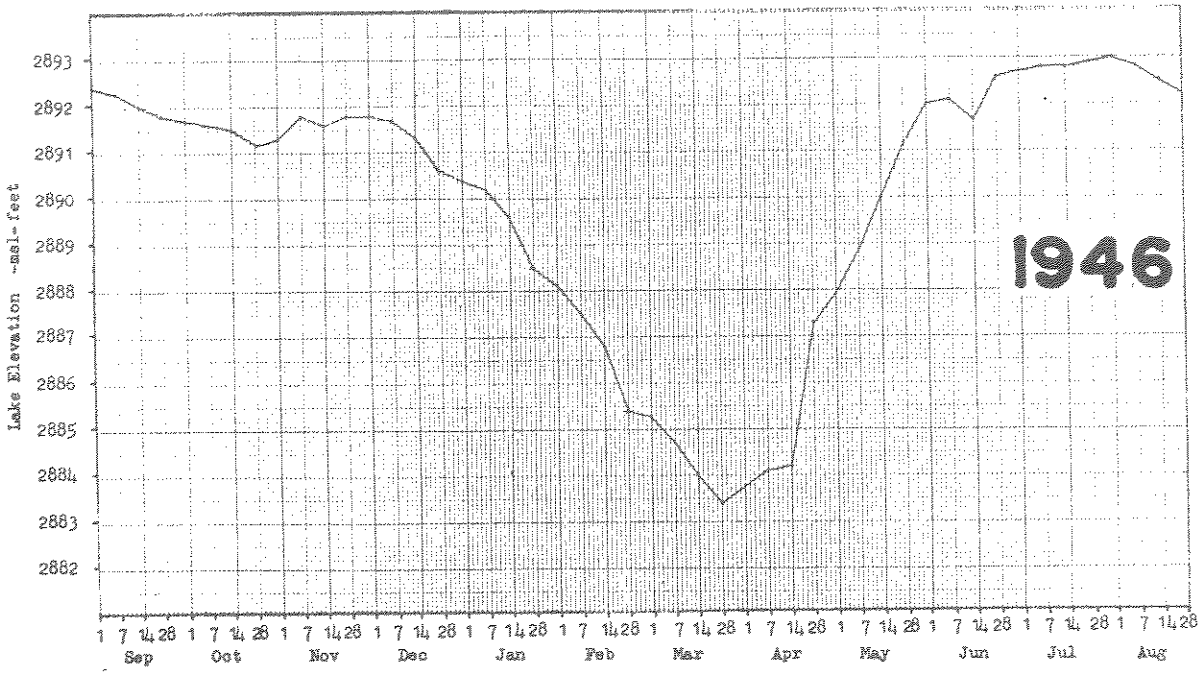


Figure 1-23. Hydrograph of Flathead Lake water level, in feet, U.S.G.S. gauge Somers, Montana, 1944 and 1945.



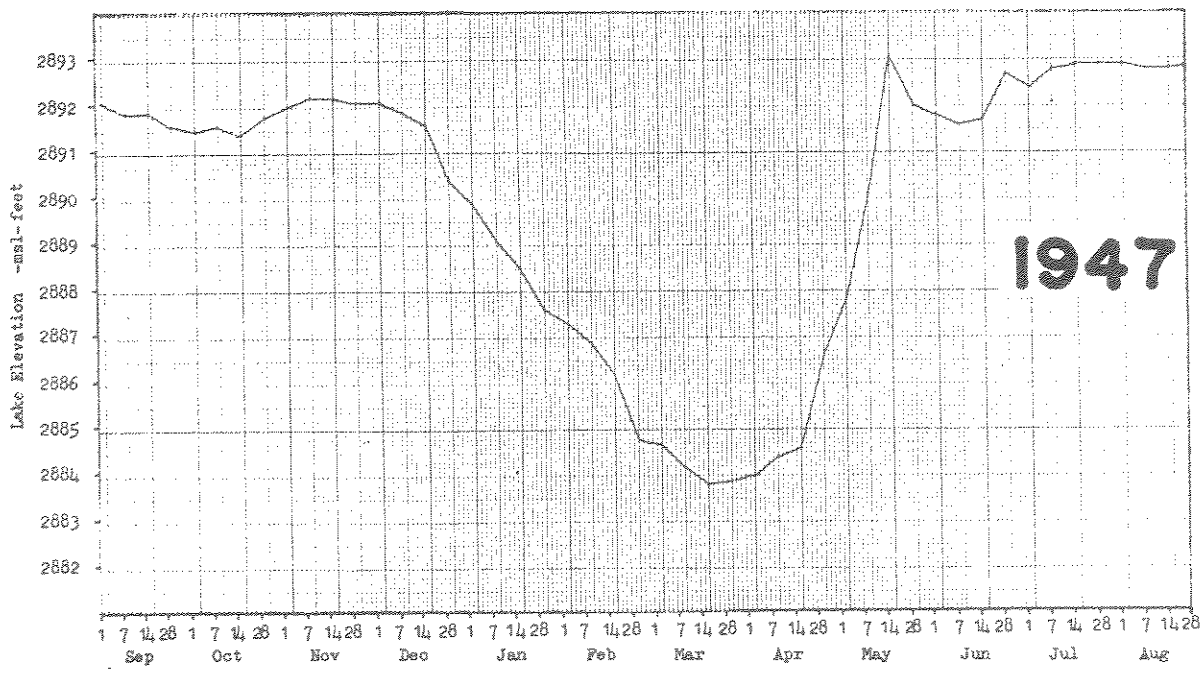
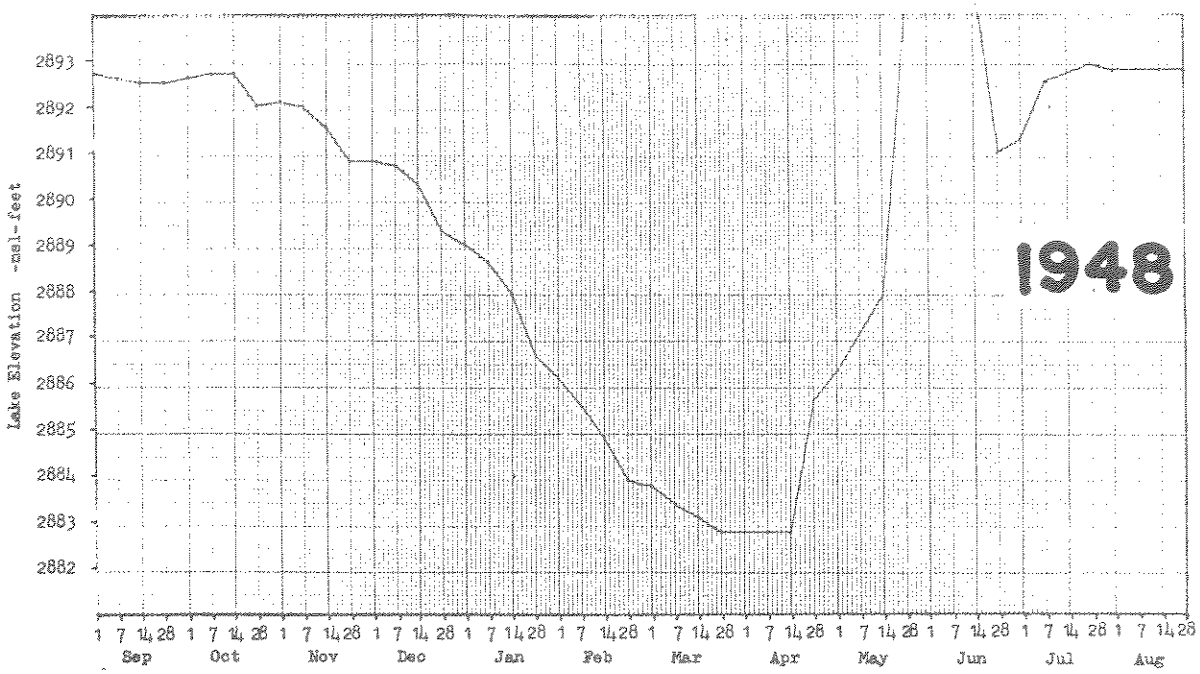


Figure 1-23. Hydrograph of Flathead Lake water level, in feet, U.S.G.S. gauge Somers, Montana, 1946 and 1947.



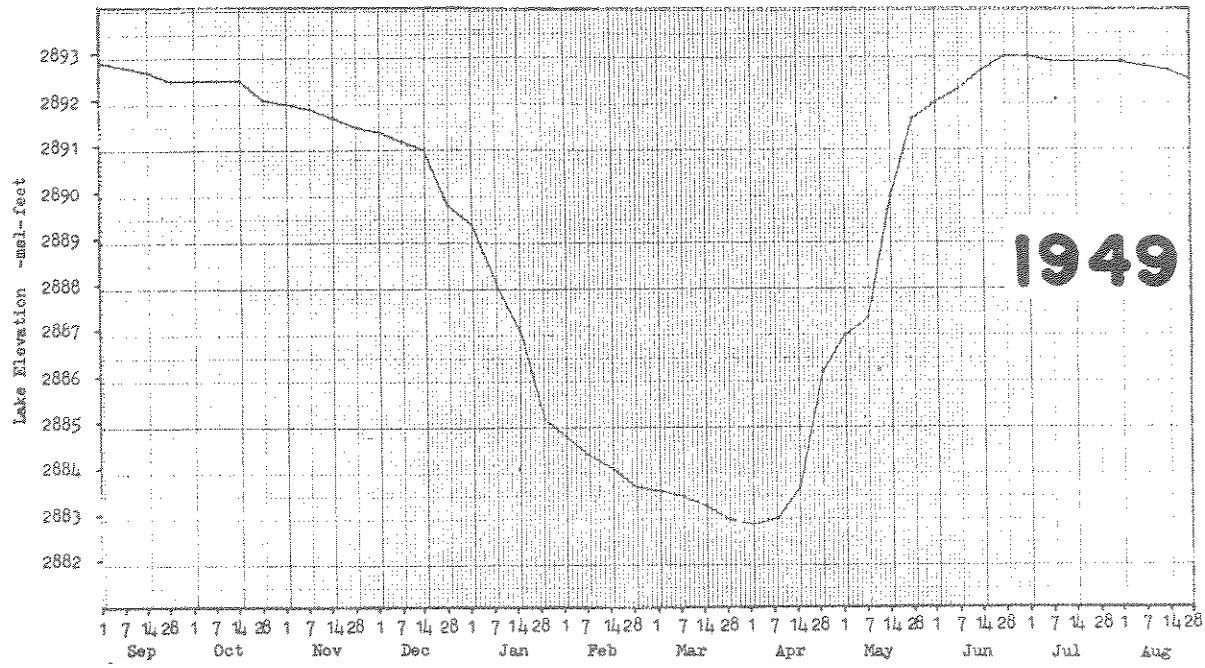
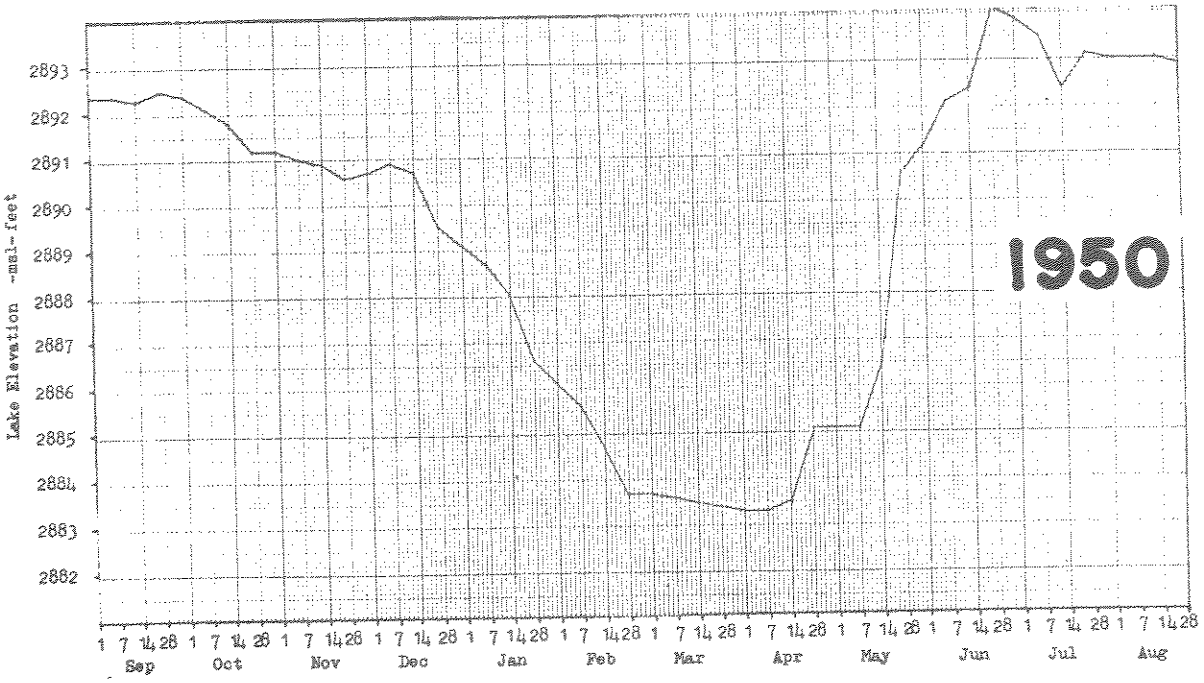


Figure 1-23. Hydrograph of Flathead Lake water level, in feet, U.S.G.S. gauge Somers, Montana 1948 and 1949.



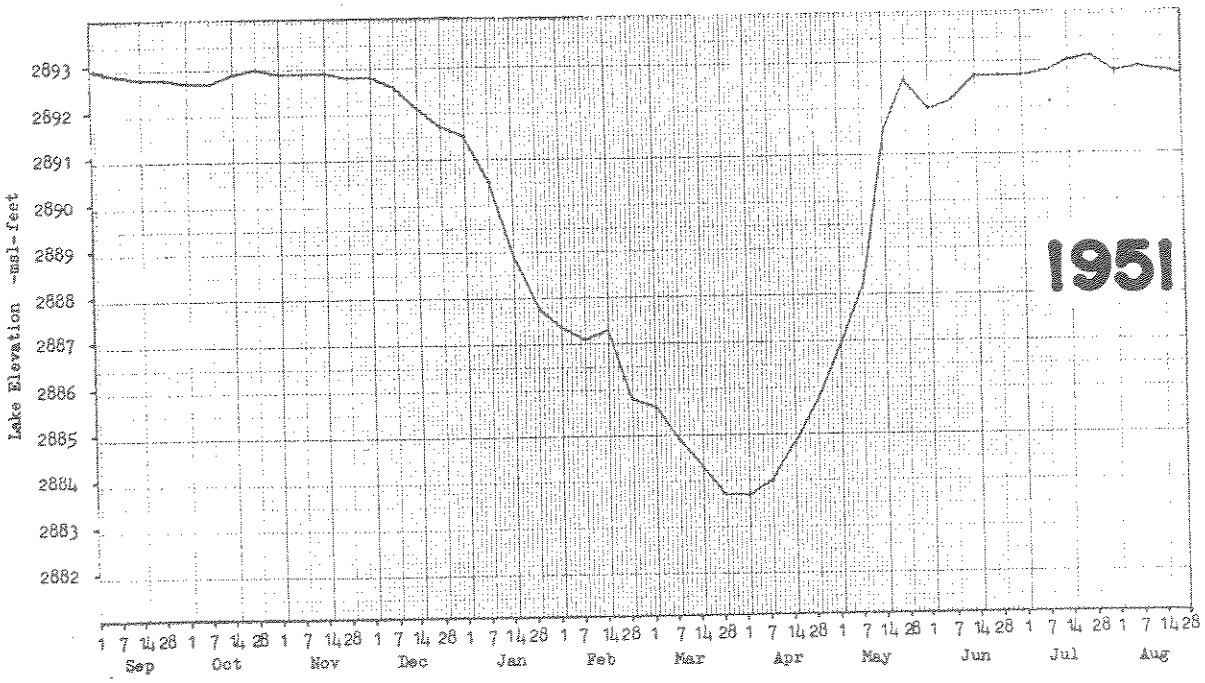
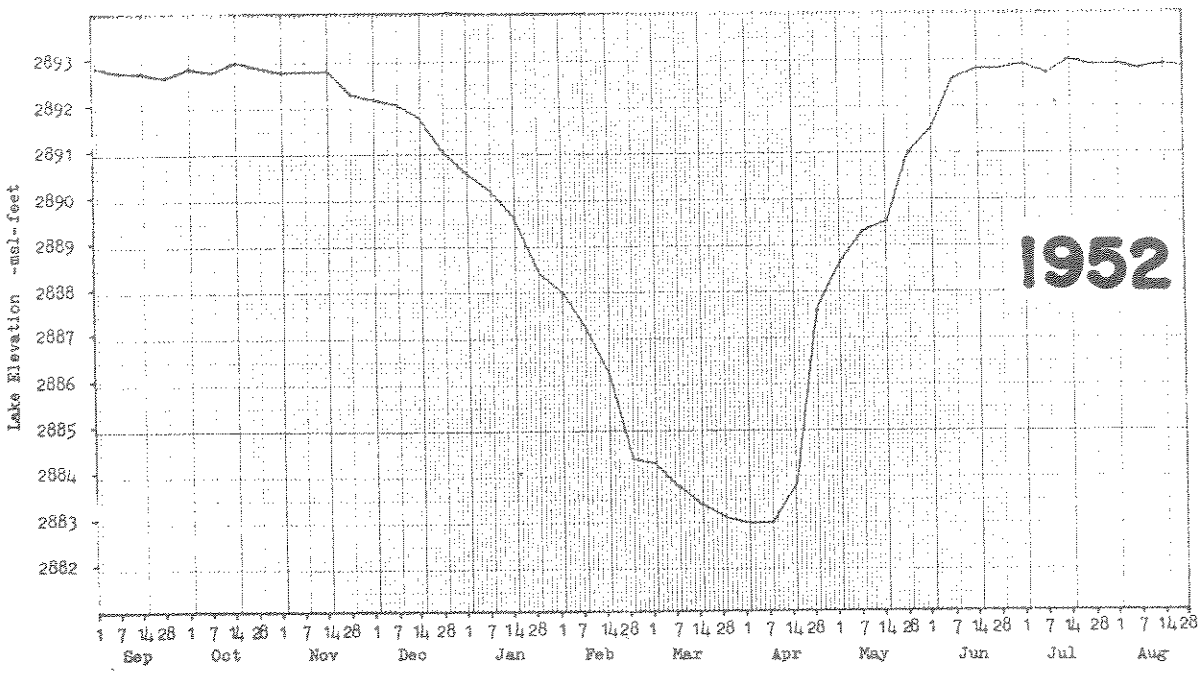


Figure 1-23. Hydrograph of Flathead Lake water level, in feet, U.S.G.S. gauge Somers, Montana, 1950 and 1951.



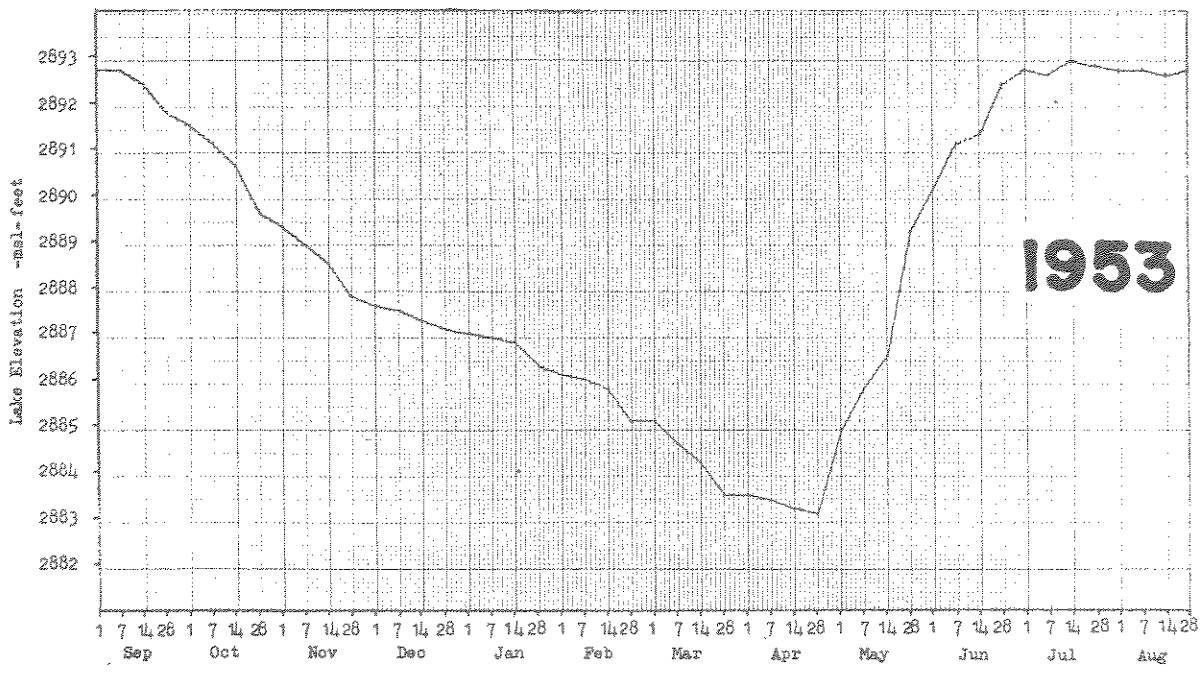


Figure 1-23. Hydrograph of Flathead Lake water level, in feet, U.S.G.S. gauge Somers, Montana, 1952 and 1953.

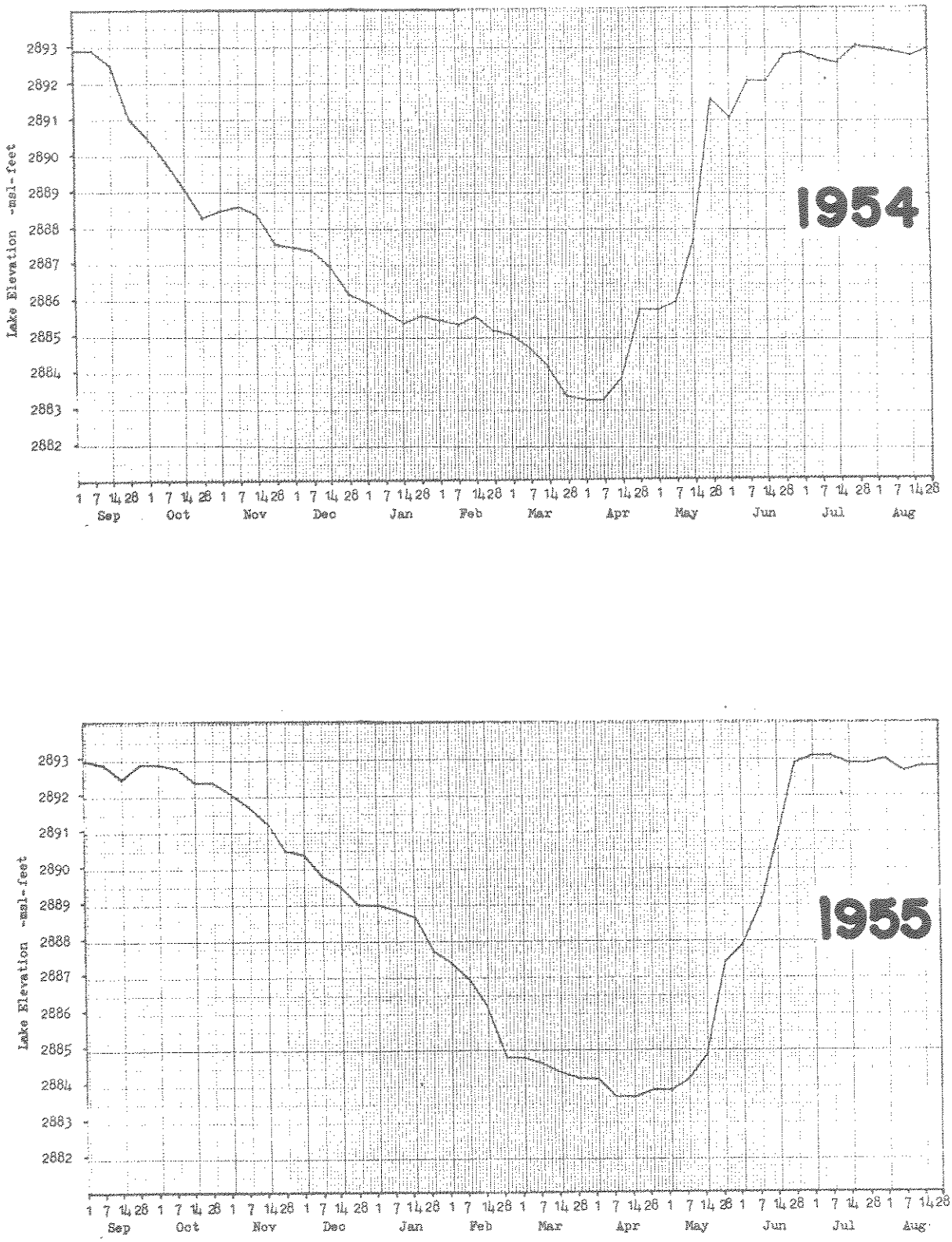
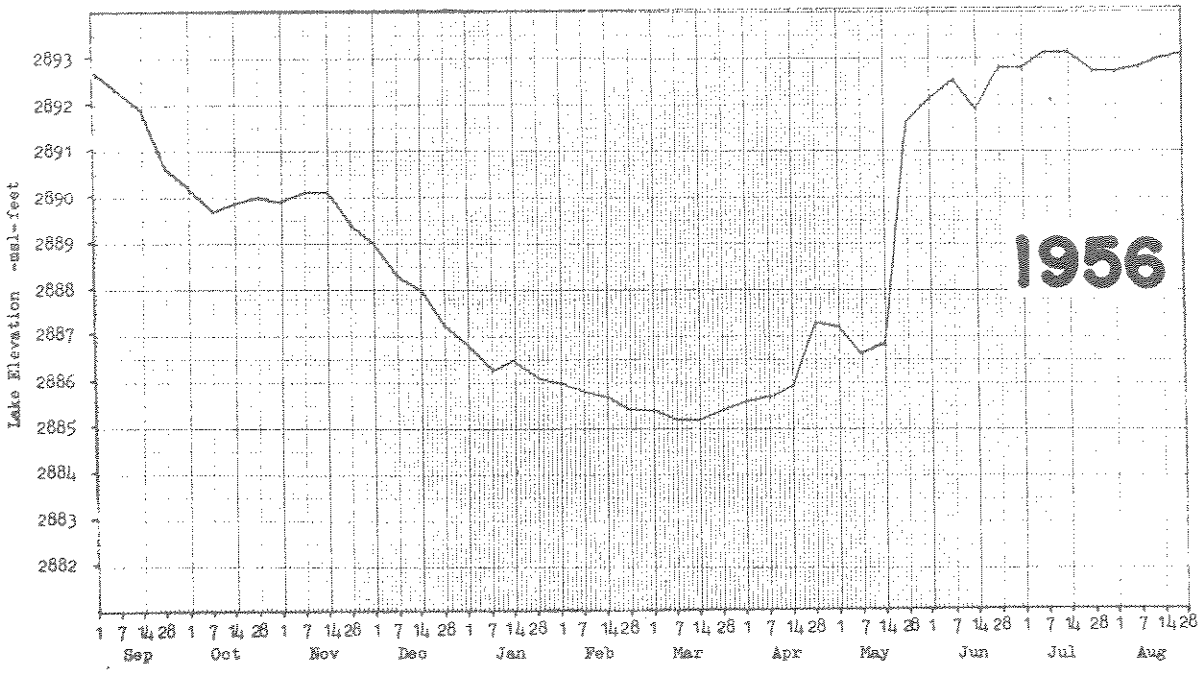


Figure 1-23. Hydrograph of Flathead Lake water level, in feet, U.S.G.S. gauge Somers, Montana, 1954 and 1955.



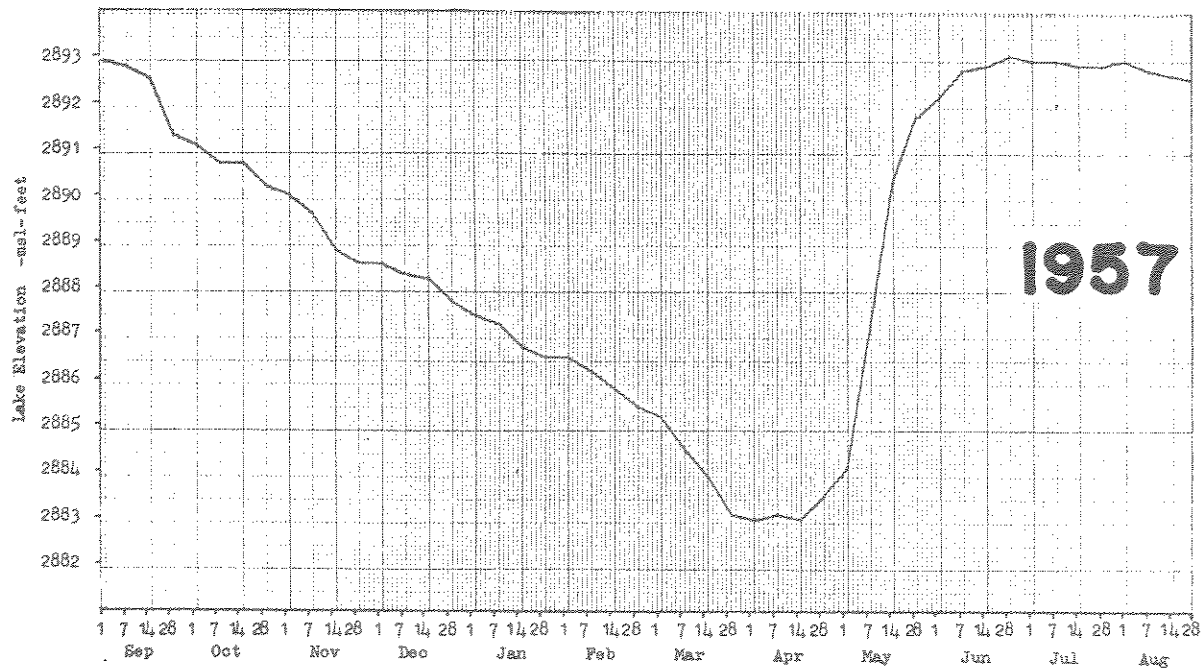
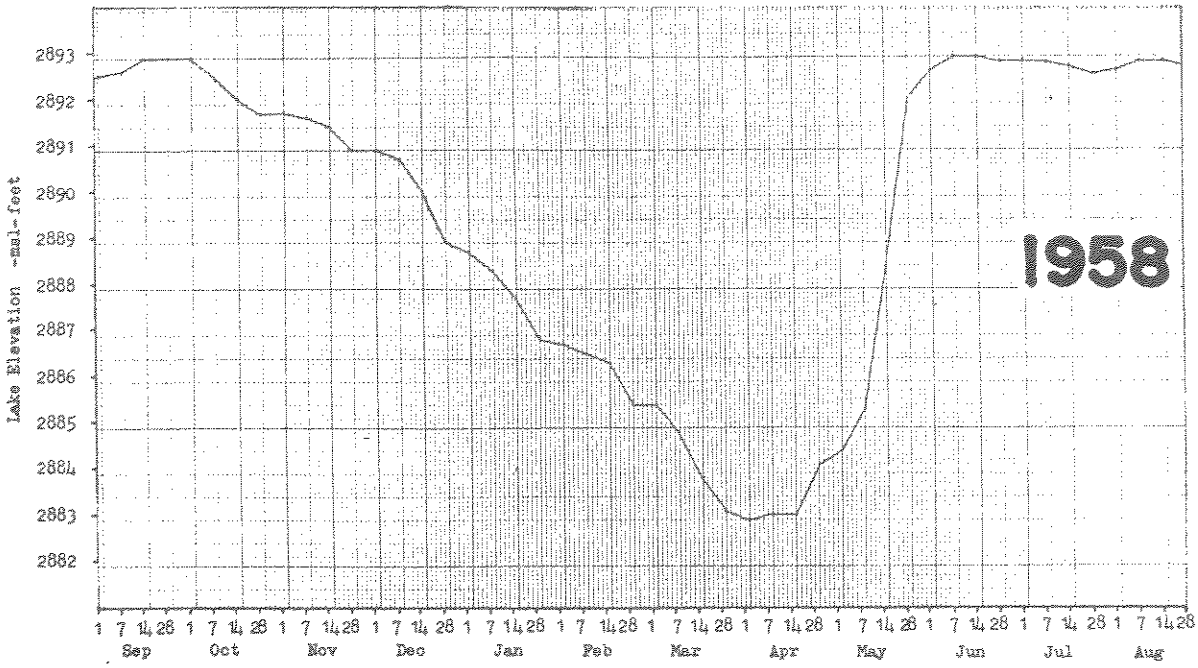


Figure 1-23. Hydrograph of Flathead Lake water level, in feet, U.S.G.S. gauge Somers, Montana, 1956 and 1957.



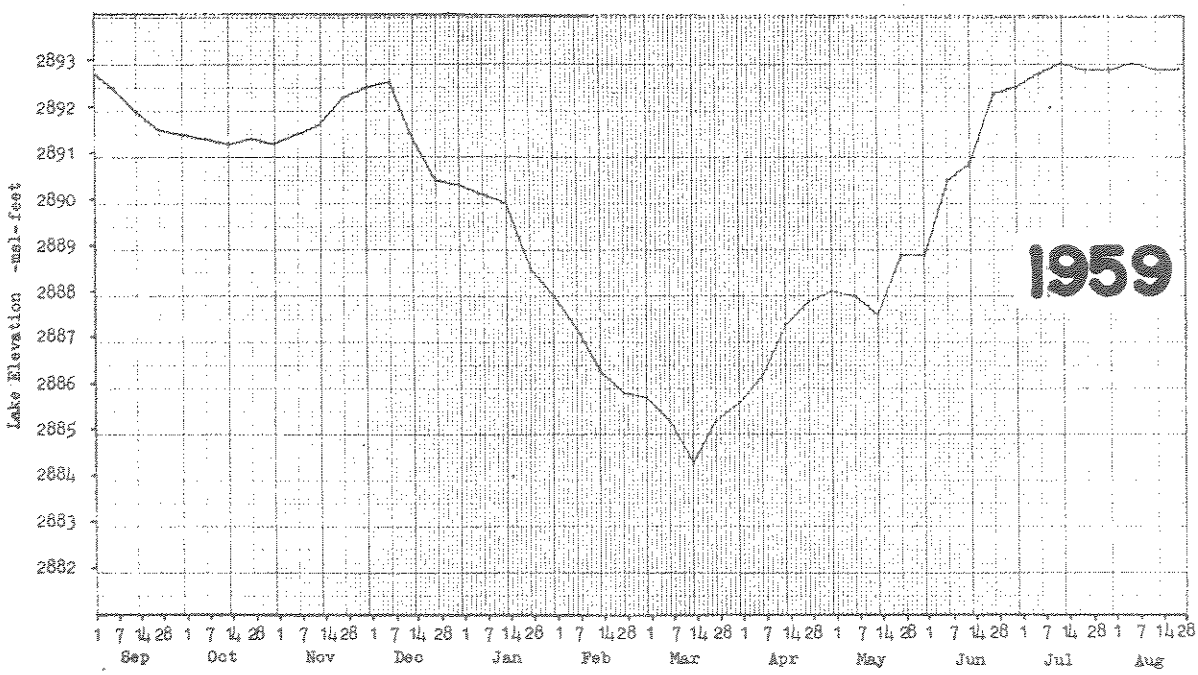


Figure 1-23. Hydrograph of Flathead Lake water level, in feet, U.S.G.S. gauge Somers, Montana, 1958 and 1959.

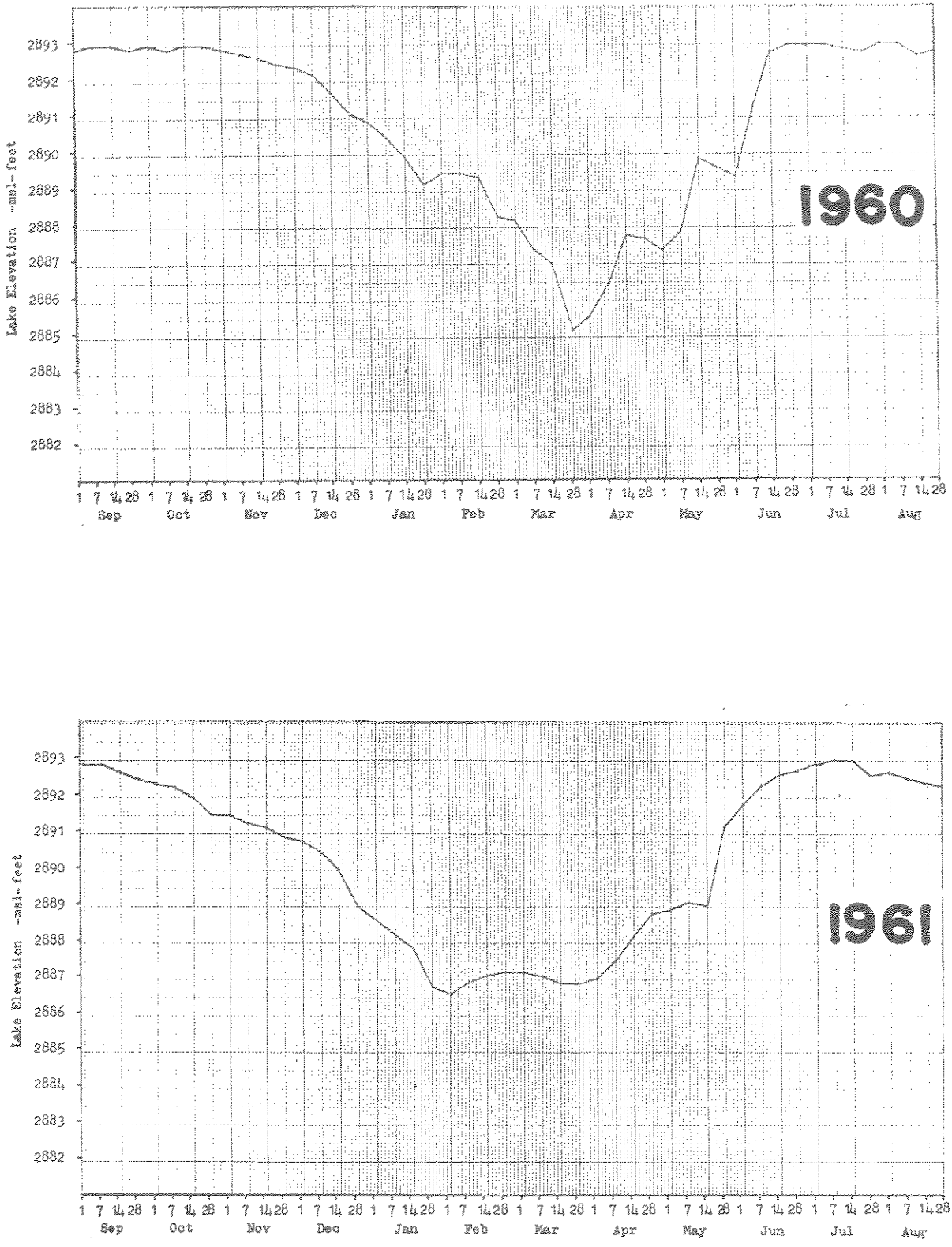
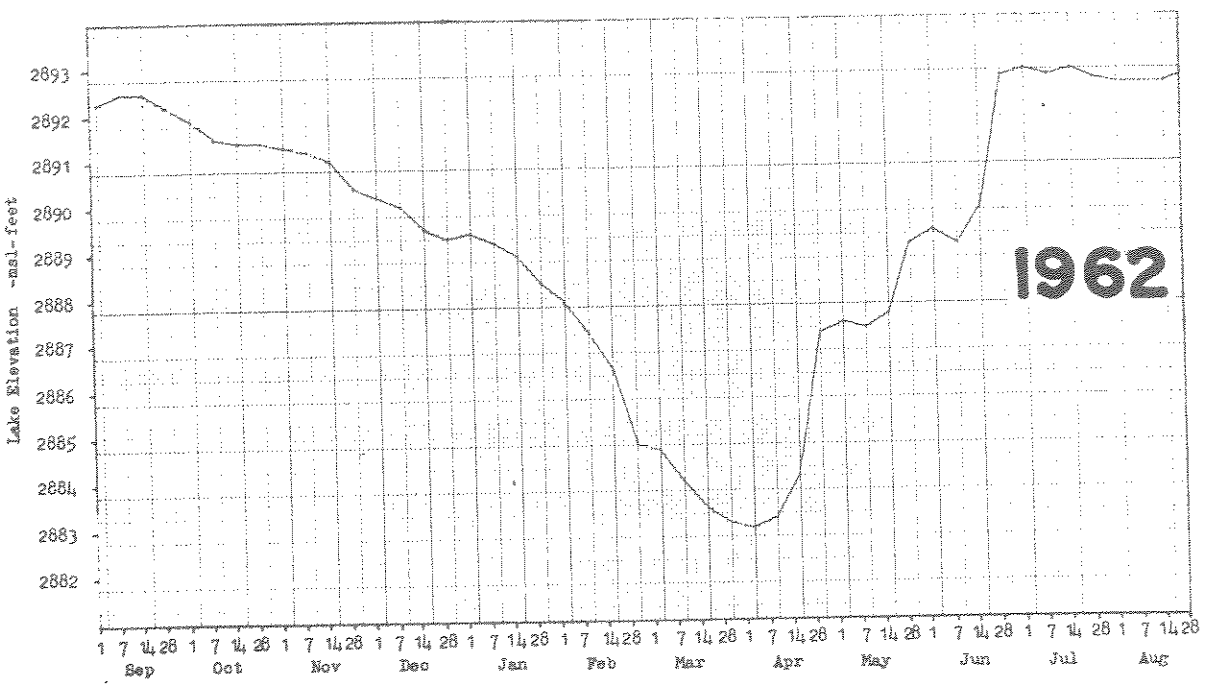


Figure 1-23. Hydrograph of Flathead Lake water level, in feet, U.S.G.S. gauge Somers, Montana, 1960 and 1961.



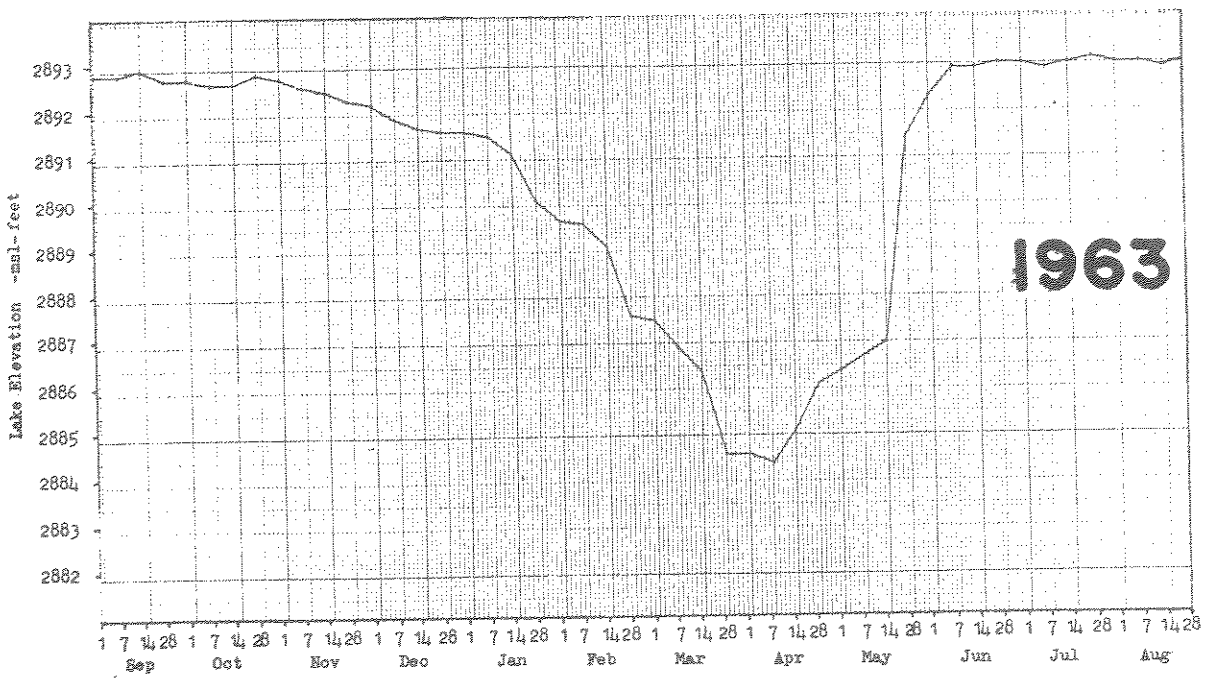
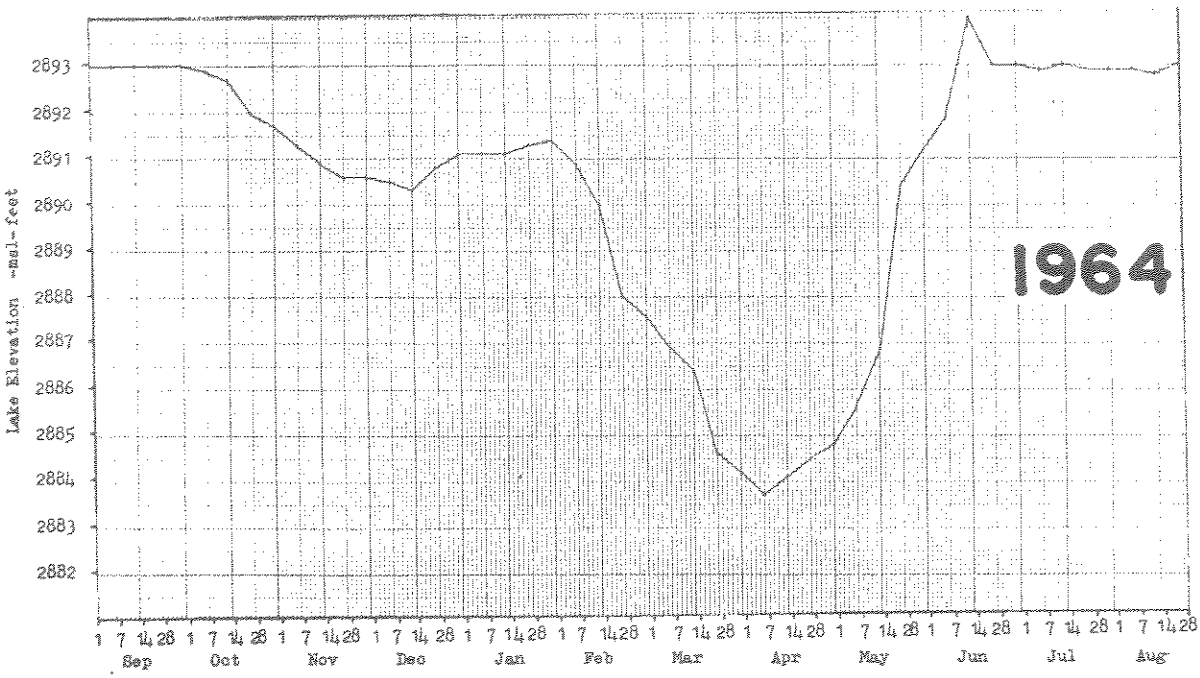


Figure 1-23. Hydrograph of Flathead Lake water level, in feet, U.S.G.S. gauge Somers, Montana, 1962 and 1963.



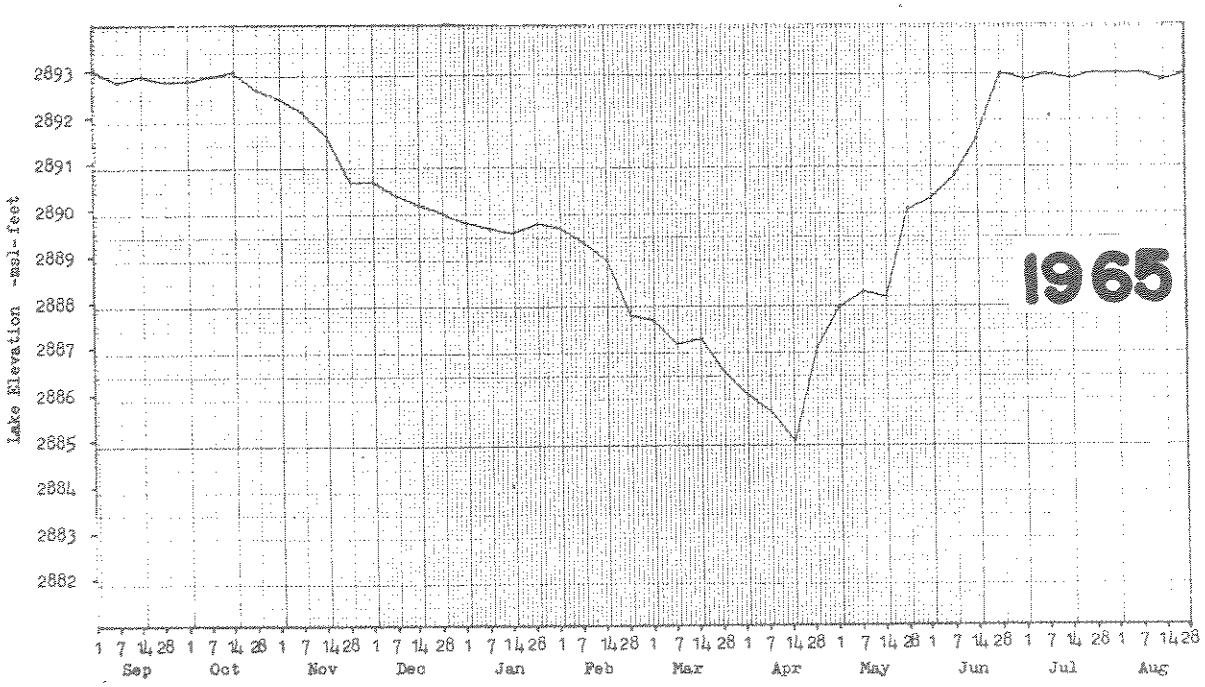
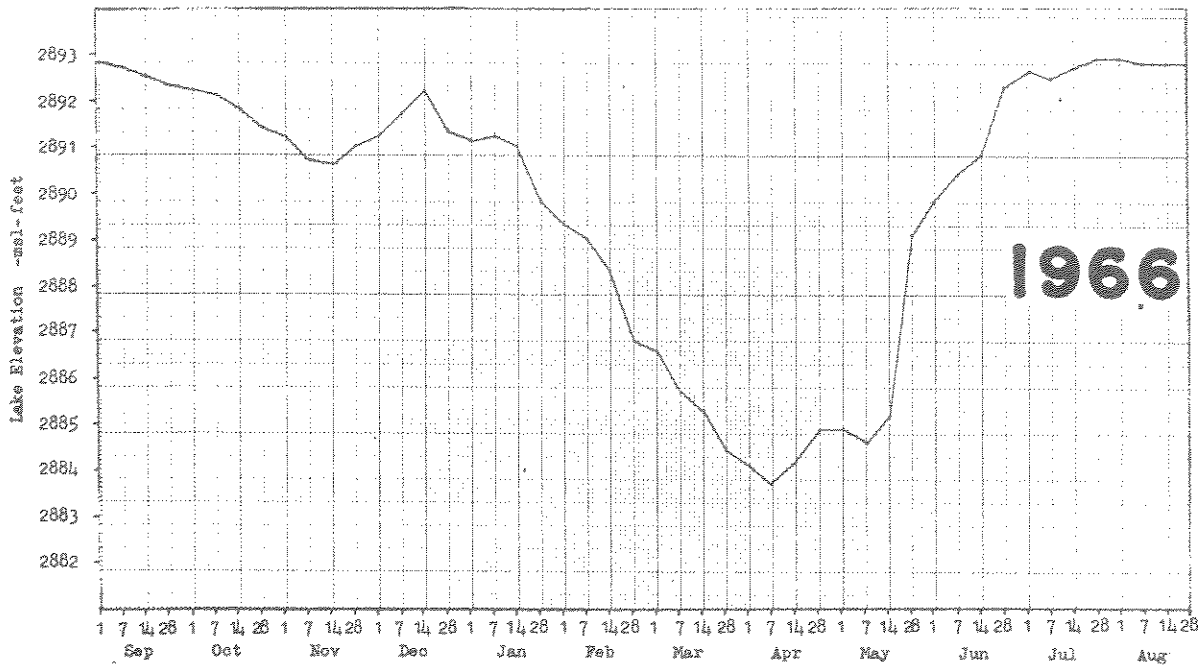


Figure 1-23. Hydrograph of Flathead Lake water level, in feet, U.S.G.S. gauge Somers, Montana, 1964 and 1965.



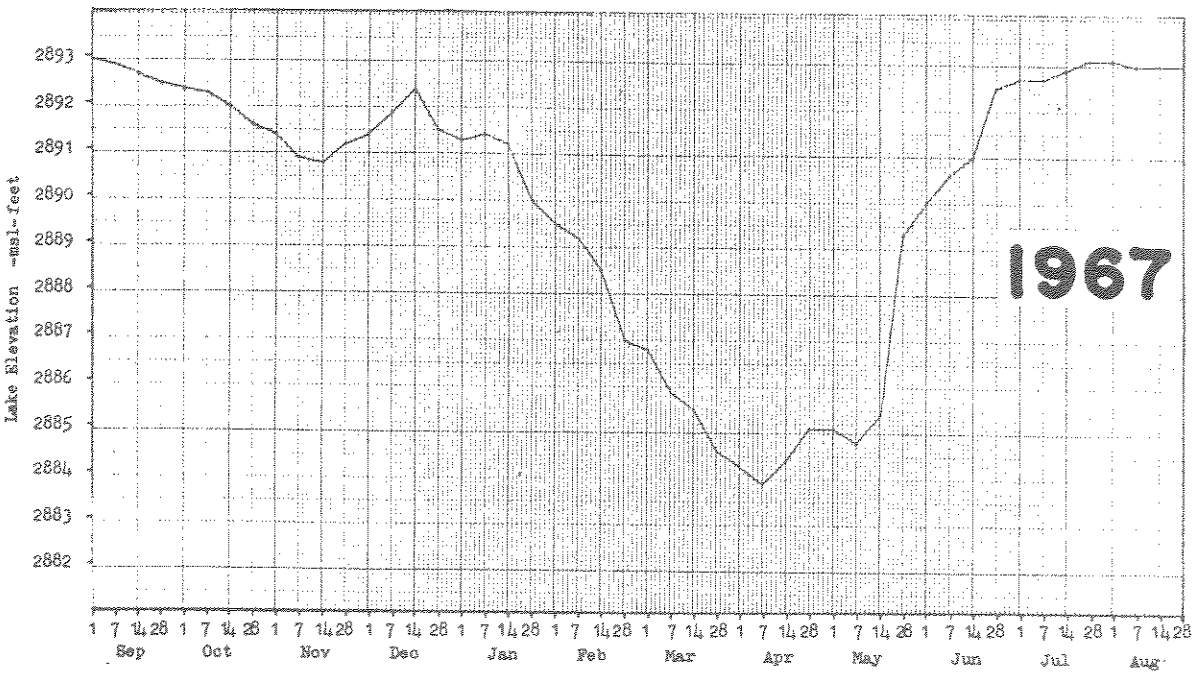


Figure 1-23. Hydrograph of Flathead Lake water level, in feet, U.S.G.S. gauge Somers, Montana, 1966 and 1967.

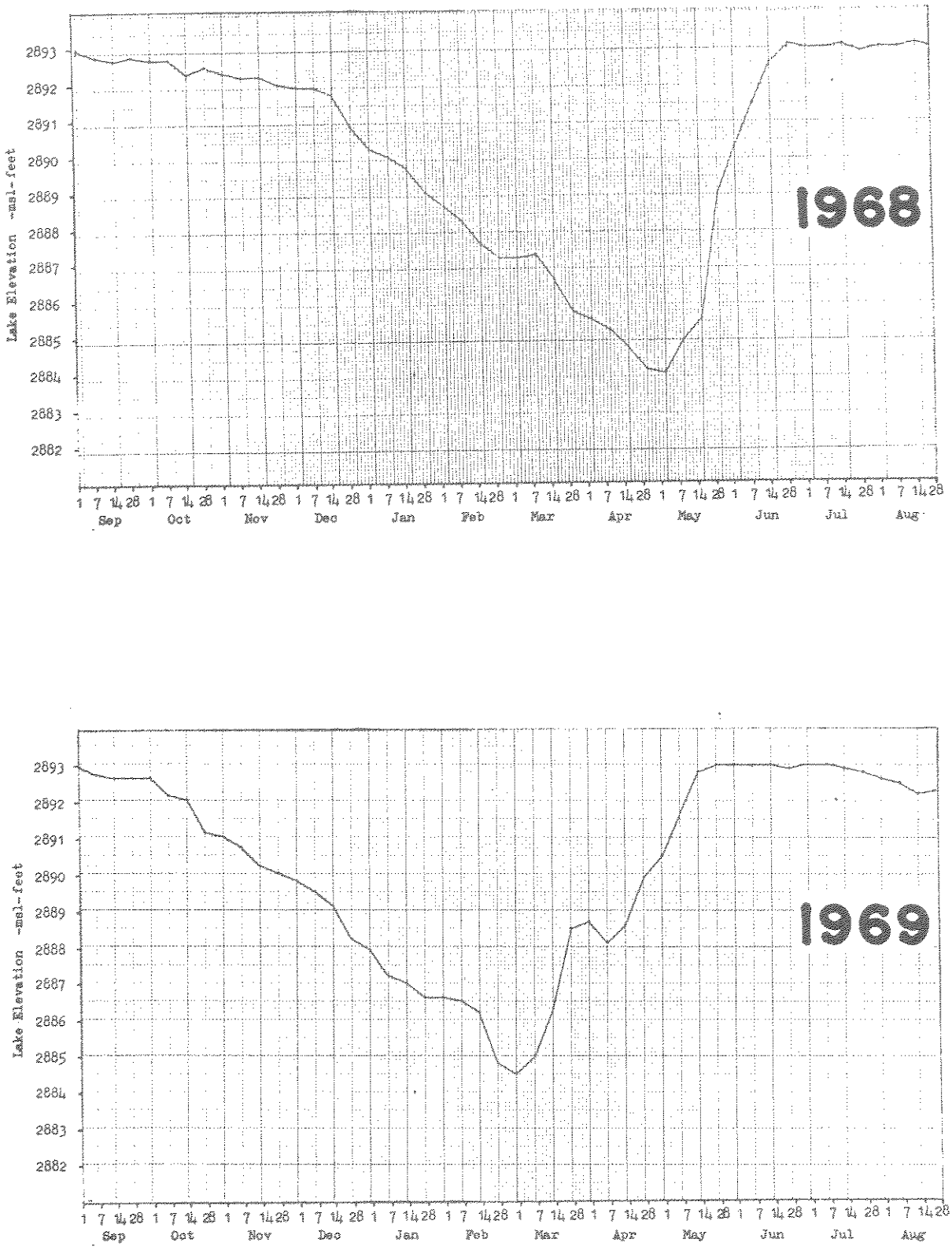
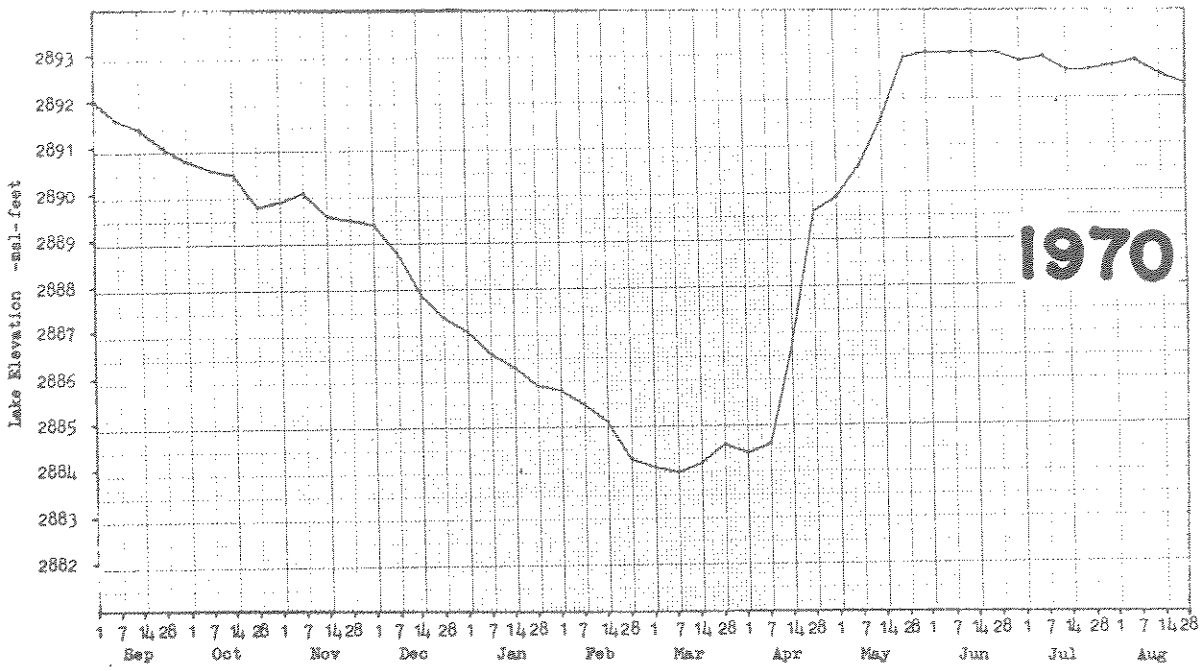


Figure 1-23. Hydrograph of Flathead Lake water level, in feet, U.S.G.S. gauge Somers, Montana, 1968 and 1969.



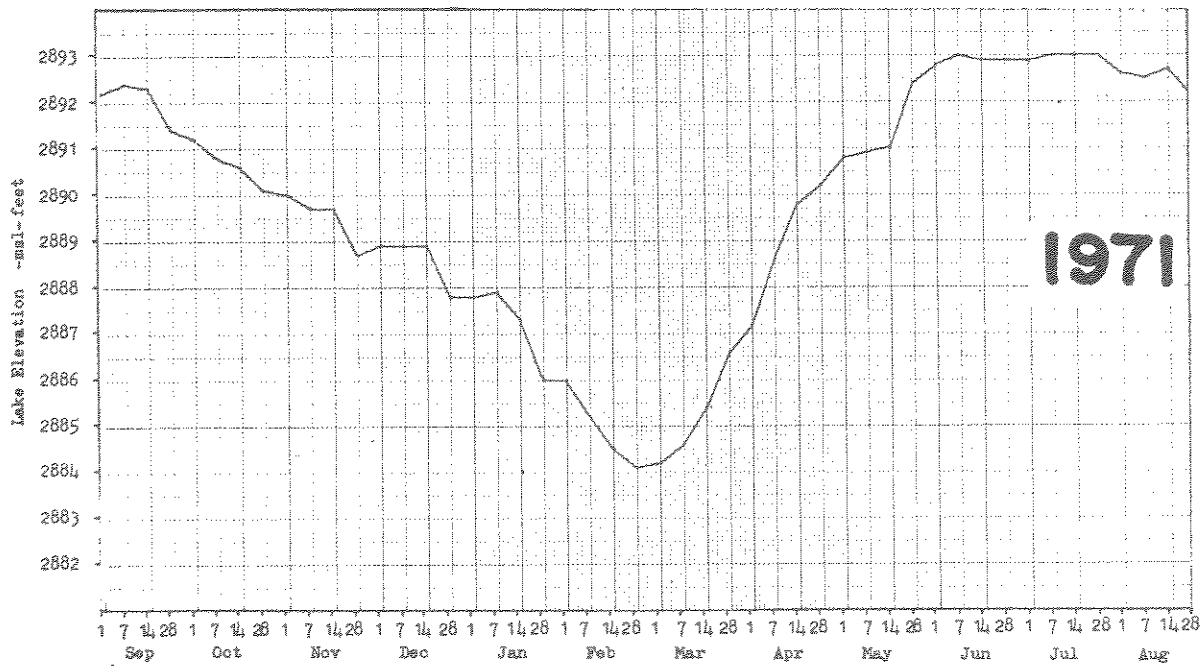
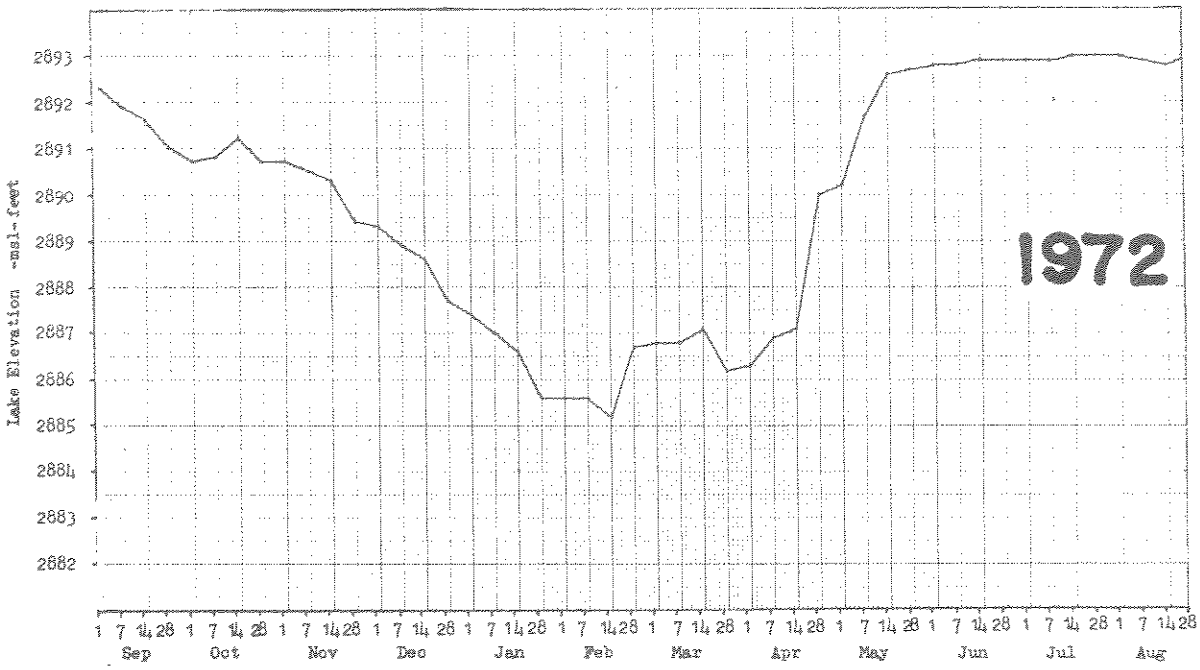


Figure 1-23. Hydrograph of Flathead Lake water level, in feet, U.S.G.S. gauge Polson, Montana, 1970 and 1971.



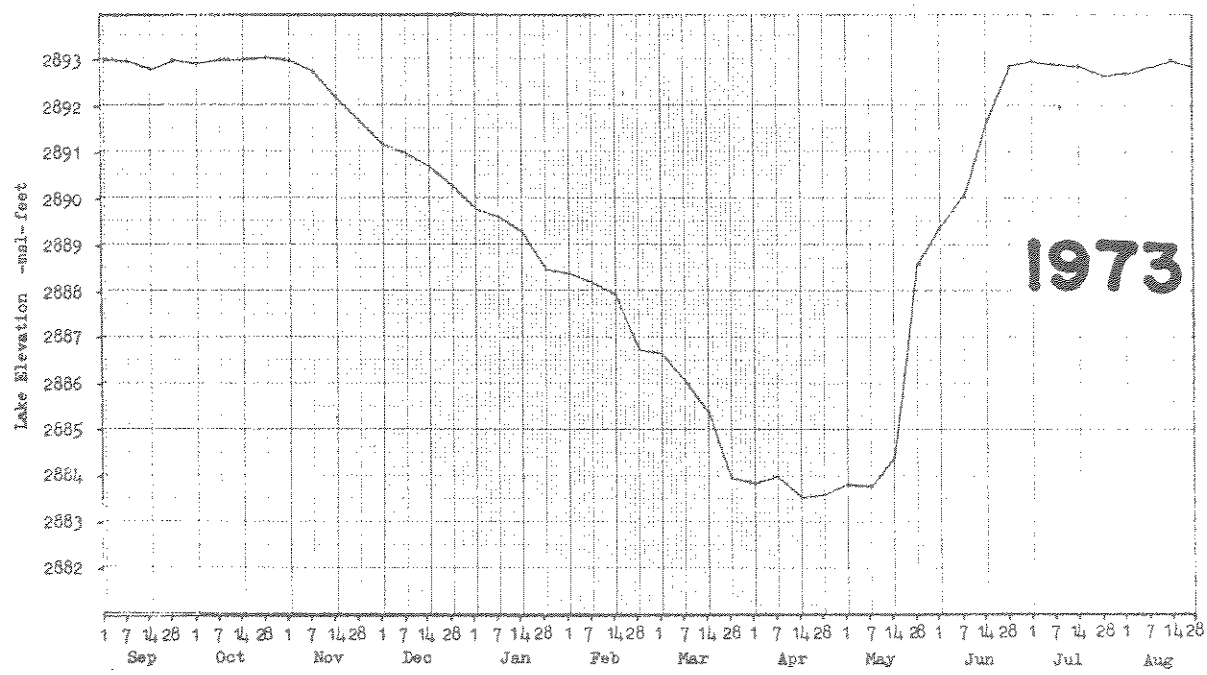


Figure 1-23. Hydrograph of Flathead Lake water level, in feet, U.S.G.S. gauge Polson, Montana, 1972 and 1973.

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Date: May 29, 1974

Waters referred to:

Flathead Lake 07-6400-03