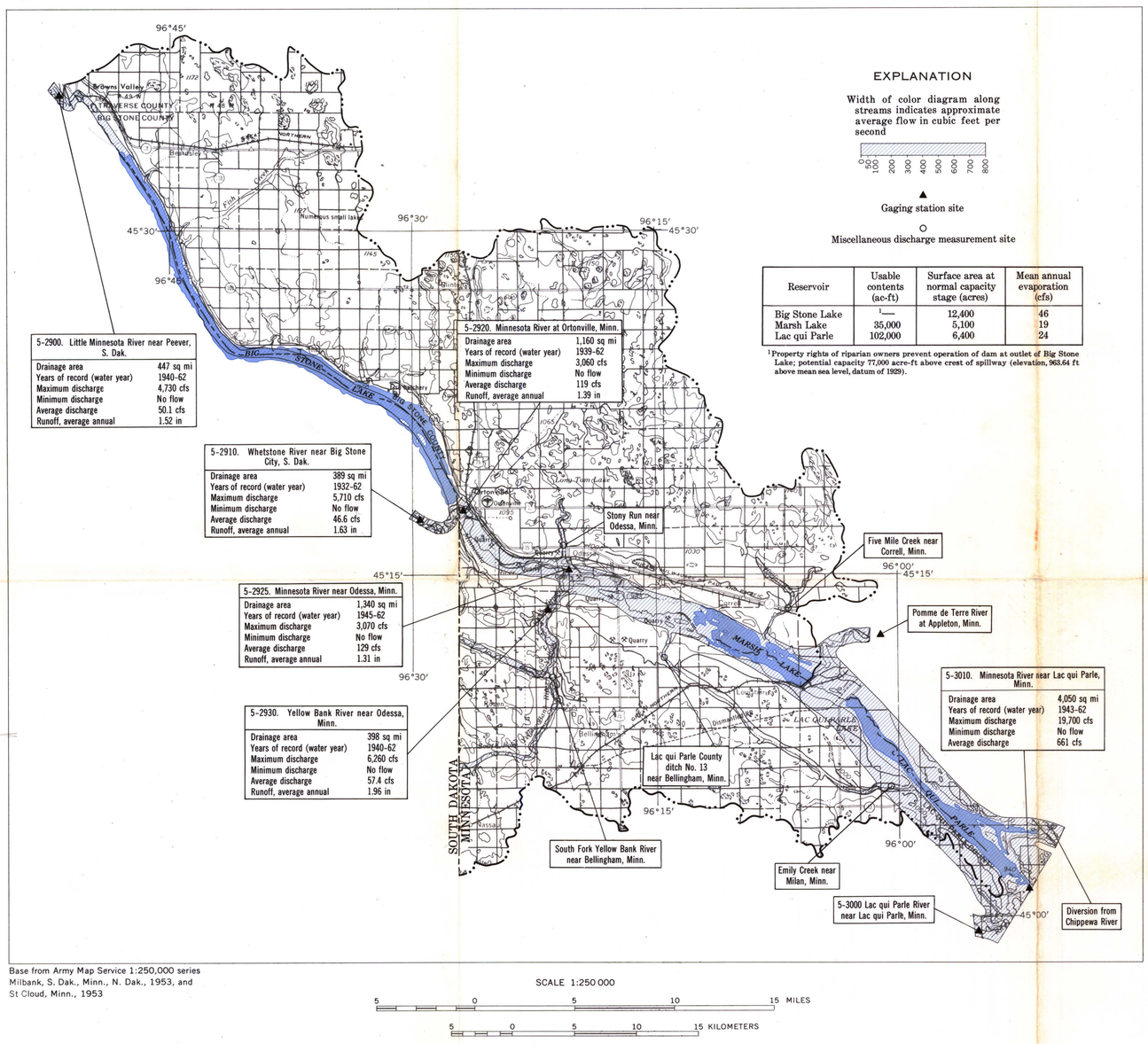
SURFACE WATER



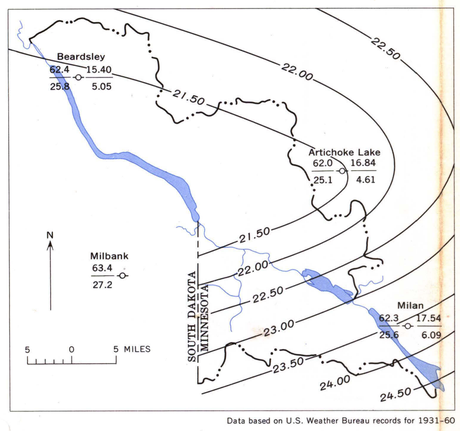
Reservoir	Usable contents (ac-ft)	Surface area at normal capacity stage (acres)	Mean annual evaporation (cfs)
Big Stone Lake	[1]—	12,400	46
Marsh Lake	35,000	5,100	19
Lac qui Parle	102,000	6,400	24

[1]Property rights of riparian owners prevent operation of dam at outlet of Big Stone Lake; potential capacity 77,000 acre-ft above crest of spillway (elevation, 963.64 ft above mean sea level, datum of 1929).

Base from Army Map Service 1:250,000 series
Milbank, S. Dak., Minn., N. Dak., 1953, and
St Cloud, Minn., 1953

SCALE 1:250 000
5 0 5 10 15 MILES
5 0 5 10 15 KILOMETERS
CONTOUR INTERVAL 50 FEET

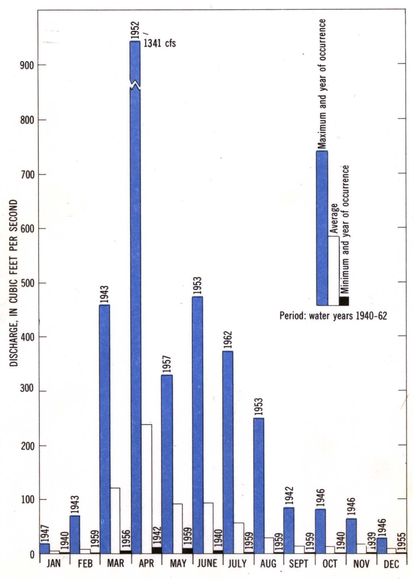
THE AVERAGE DISCHARGE IS THE THEORETICAL MAXIMUM AVAILABLE IN A STREAM.— *Water losses in transmission and lack of suitable reservoir sites prevent utilization of the average streamflow. Evaporation loss, lack of storage capacity, and economic considerations limit the use of the three reservoirs for flood control or storage to supplement low flow. Part of flood flow from the Chippewa River is diverted into the Lac qui Parle reservoir. Reservoir contents and surface area for Big Stone Lake furnished by Minnesota Department of Conservation, Division of Waters; for Marsh Lake and Lac qui Parle by Corps of Engineers, U.S. Army. The mean annual evaporation computed from data published in Technical Paper No. 37, Evaporation Maps for United States, U.S. Weather Bureau*



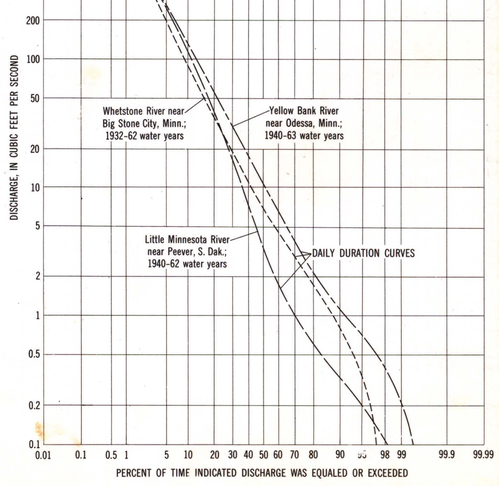
Data based on U.S. Weather Bureau records for 1931-60

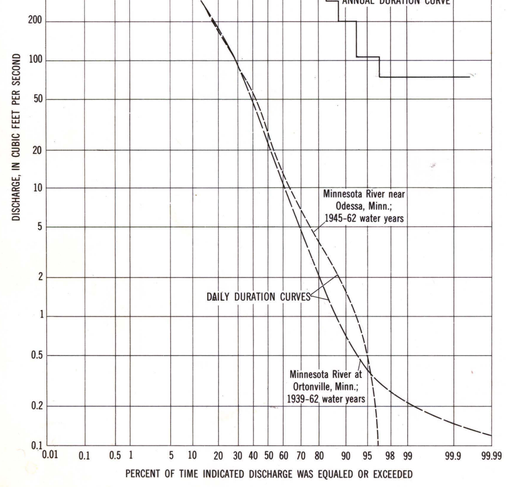
EXPLANATION
—23.00— Isohyet
Shows annual precipitation, in inches
62.4 15.40 / 25.8 5.05 U.S. Weather Bureau station
Numbers to left indicate mean temperature. Numbers to right indicate mean precipitation. Upper numbers from data collected April to September. Lower numbers from data collected October to March

PRECIPITATION.—*During the growing season precipitation is adequate for general farming but the resulting runoff of about 1½ inches per year is not adequate for industrial supply without storage*

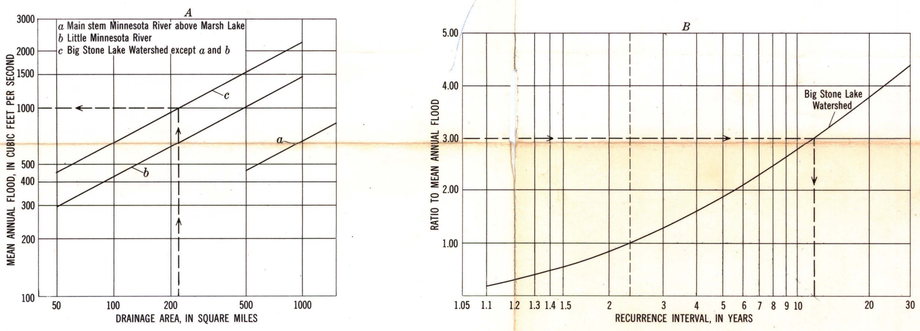


VARIATION IN MEAN MONTHLY DISCHARGE OF YELLOW BANK RIVER NEAR ODESSA IS TYPICAL OF THE STREAMS IN THE WATERSHED.

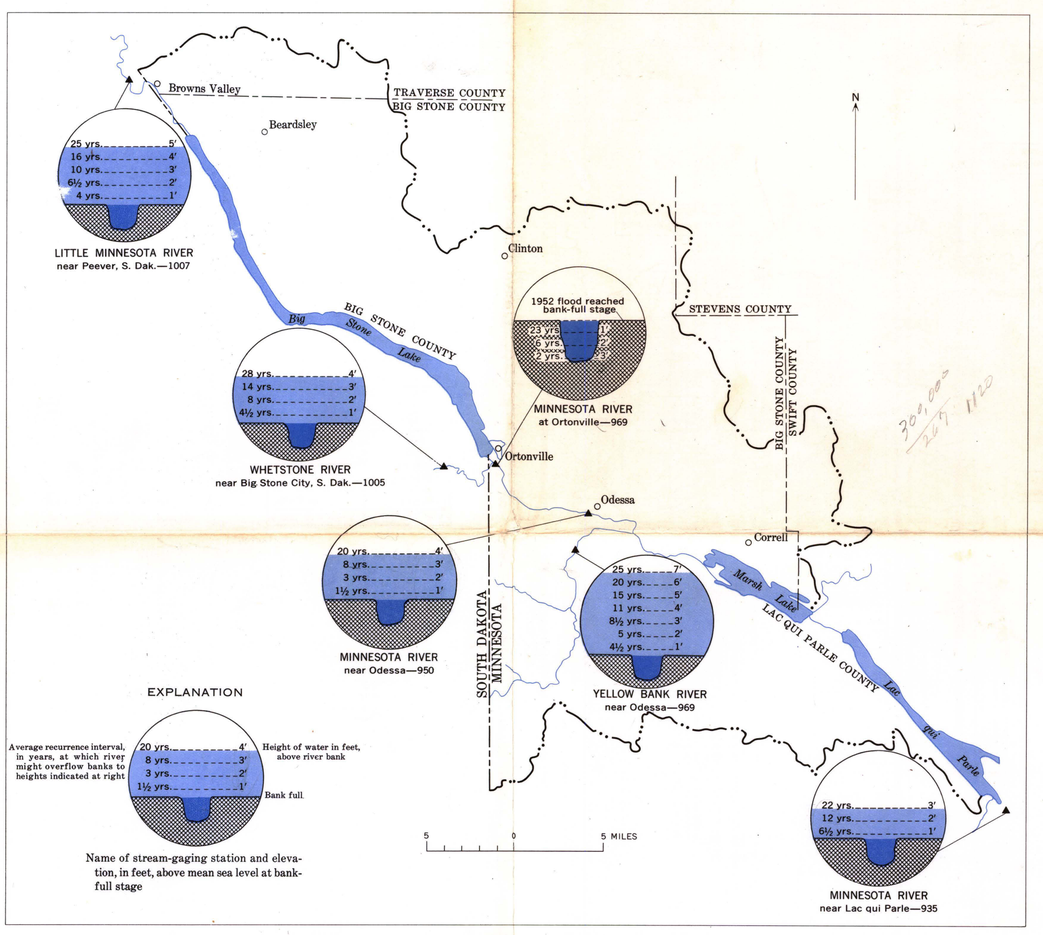




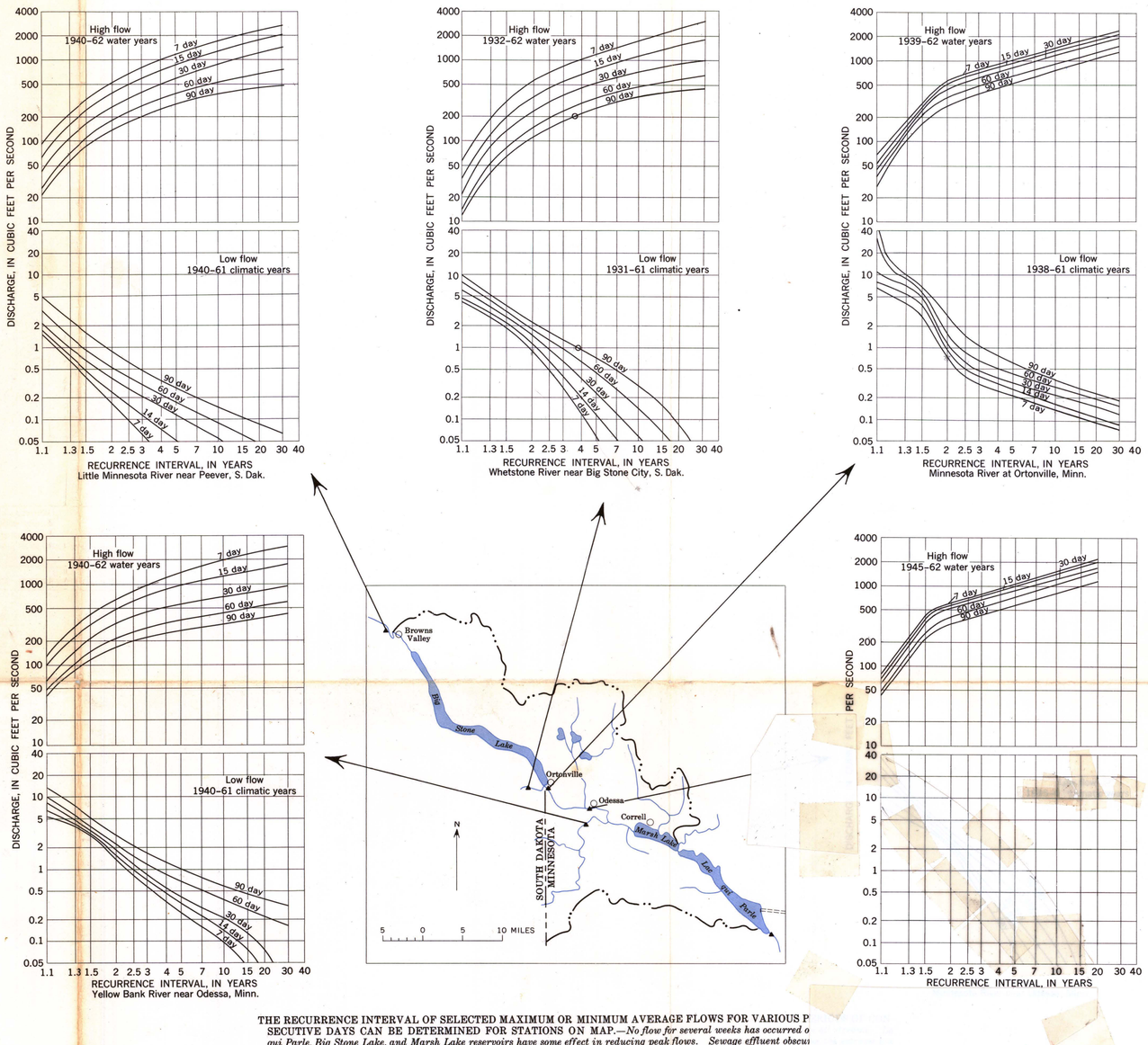
SIMILAR FLOW DURATION CURVES INDICATE SIMILARITY OF STREAMFLOW AND BASIN CHARACTERISTICS—*Sewage effluent entering the Minnesota River at Ortonville flattens the extreme low end of the curve. Mean annual discharge from Lac qui Parle reservoir is largely unaffected by change in reservoir storage although it is increased by diversion of flood flow from the Chippewa River. Example—Diagram (A), daily duration curves. —A mean daily flow of 10 cfs may be expected to be equaled or exceeded 50 percent of the time on Yellow Bank River near Odessa. Diagram (B), annual duration curve. —A mean yearly flow of 600 cfs may be expected to be equaled or exceeded about 58 to 62 percent of the time on Minnesota River near Lac qui Parle, Minn.*



THE RECURRENCE INTERVAL OF A FLOOD OF A SELECTED MAGNITUDE CAN BE DETERMINED FROM THE RELATION CURVES (*A*) AND THE FLOOD-FREQUENCY CURVES (*B*).— *Relation curve (c) and frequency curve from Prior and Hess(1961). Example.—Find the recurrence interval of a flood of 3000 cfs at a 220 sq. mi. drainage area site on the Yellow Bank River.*
1.) Relation curve "c" in diagram (A) shows that for a drainage area of 220 sq. mi. the mean annual flood is 1000 cfs.
2.) The ratio of the 3000 cfs flood to the mean annual flood of 1000 cfs is 3000/1000 or 3.00.
3.) Entering diagram (B) with a ratio of 3.00 the flood-frequency curve shows that the 3000 cfs flood will occur on an average once every 12 years. The magnitude of a flood at a specified recurrence interval at this same site can also be found by reversed procedure



HEIGHT AND FREQUENCY OF FLOODING CAN BE RELATED TO LOCATIONS IN THE VICINITY OF THE GAGE BY DETERMINING CHANNEL SHAPE FROM TOPOGRAPHIC MAPS.— *Water did not overflow banks at gaging station, Minnesota River at Ortonville, and average recurrence intervals are those related to height of water below river bank*



THE RECURRENCE INTERVAL OF SELECTED MAXIMUM OR MINIMUM AVERAGE FLOWS FOR VARIOUS P
SECUTIVE DAYS CAN BE DETERMINED FOR STATIONS ON MAP.—*No flow for several weeks has occurred o qui Parle, Big Stone Lake, and Marsh Lake reservoirs have some effect in reducing peak flows. Sewage effluent obscu flow characteristics of the Minnesota River at Ortonville. Frequency curves for Minnesota River near Lac qui Parle are n of the regulation of discharge from these reservoirs, Example—For the Whetstone River near Big Stone City, the average 90 days will be greater than 200 cfs at average intervals of 3½ years. The average minimum flow for 90 days will be average intervals of 3½ years.*

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WATER RESOURCES OF THE BIG STONE LAKE WATERSHED, WEST- CENTRAL MINNESOTA

By

R. D. Cotter, L. E. Bidwell, E. L. Oakes, and G. H. Hollenstein

1966