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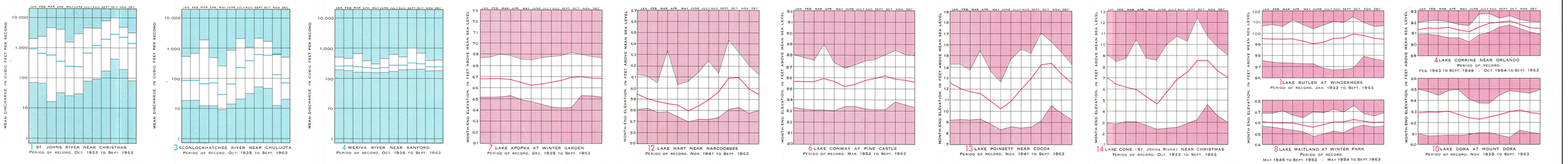
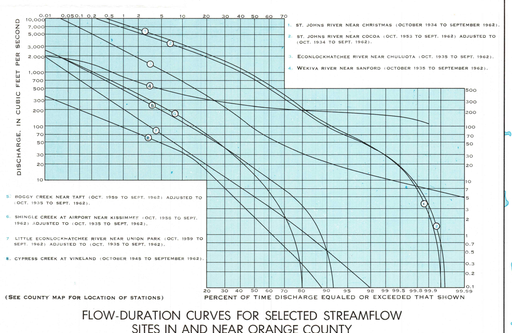


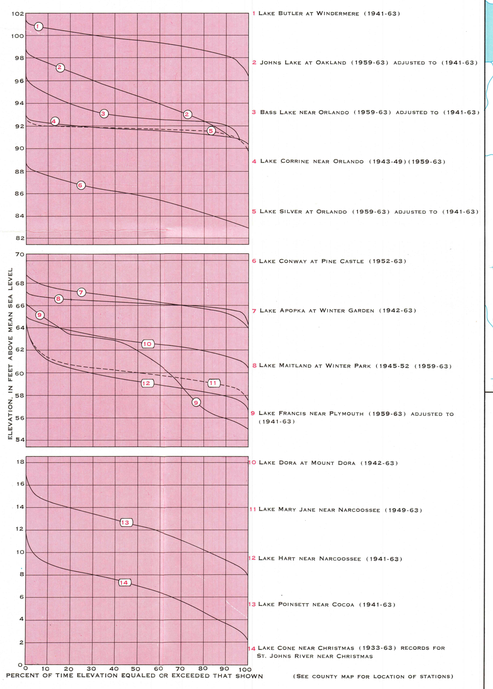
STREAM AND LAKE HYDROGRAPHS FOR SELECTED STATIONS IN ORANGE COUNTY AND VICINITY

Unshaded part of blue graphs shows maximum and minimum monthly mean discharge for the periods indicated.
Heavy blue lines show the average monthly mean discharges for the periods indicated.
(See County map for location of stations.)

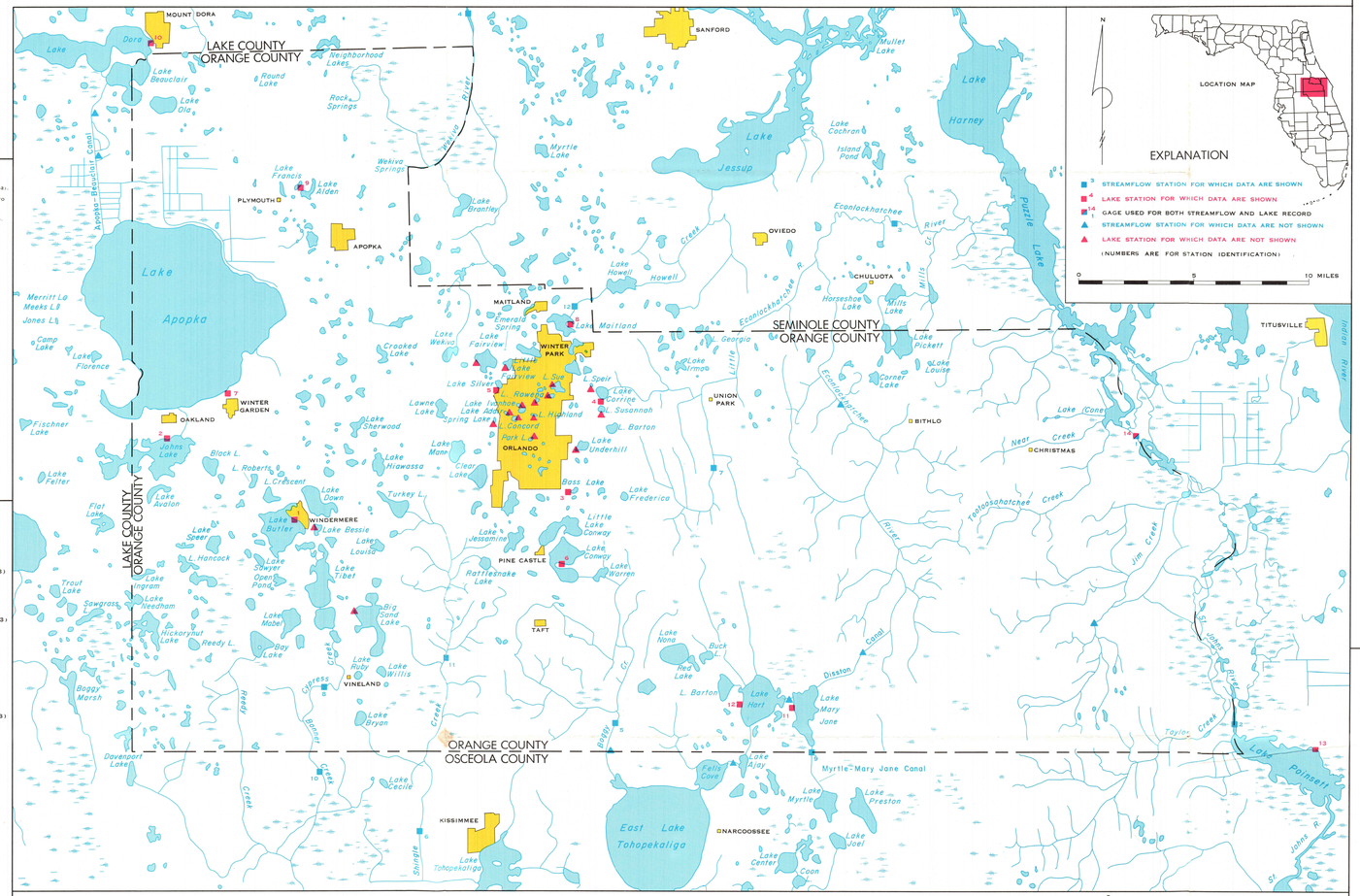
Unshaded part of red graphs shows maximum and minimum month-end elevations for the periods indicated.
Heavy red lines show the average month-end elevations for the periods indicated.
(See County map for location of stations.)

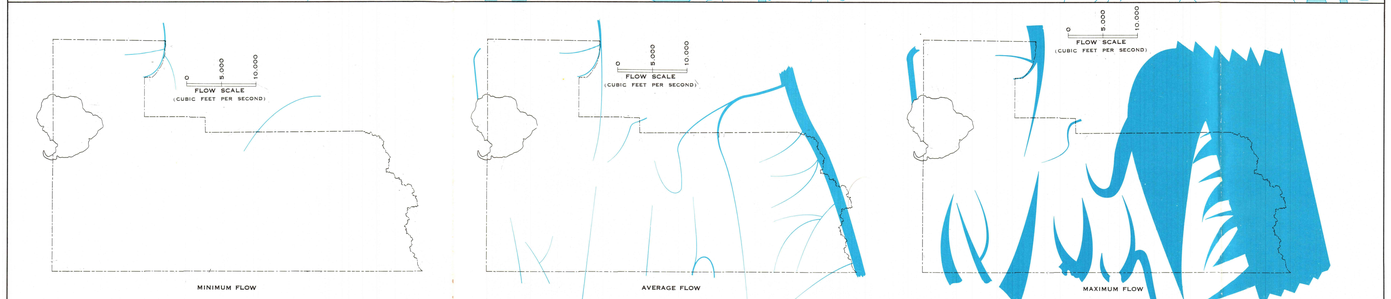


FLOW-DURATION CURVES FOR SELECTED STREAMFLOW SITES IN AND NEAR ORANGE COUNTY



STAGE-DURATION CURVES FOR SELECTED LAKES IN AND NEAR ORANGE COUNTY





COMPARATIVE FLOW CONDITIONS FOR STREAMS IN ORANGE COUNTY

AVAILABILITY AND QUALITY OF SURFACE WATER IN ORANGE COUNTY, FLORIDA

By
Warren Anderson and Boyd F. Joyner

Prepared by the
UNITED STATES GEOLOGICAL SURVEY
in cooperation with the
BOARD OF COUNTY COMMISSIONERS OF
ORANGE COUNTY, FLORIDA

Surface water is abundant in Orange County owing primarily to more than 1,100 bodies of water ranging from tiny water-filled sinks to huge Lake Apopka. Rock Springs, Wekiva Springs, and several smaller springs are additional permanent sources of water. Streams and swamps associated with them are intermittent water sources except for the Wekiva River and the Little Econlockhatchee River.

The average amount of water received daily by Orange County is about 3.5 billion gallons. Of this, 2.5 billion gallons is derived from rainfall within the county, more than 800 million gallons is water flowing along the eastern border in the St. Johns River, and the remainder is surface and underground inflow from Lake and Osceola Counties.

About 70 percent of the rain on Orange County returns to the atmosphere by evaporation and transpiration, about 20 percent flows out as streamflow, and about 10 percent flows out underground.

The average amount of water in streams only, in Orange County, is about 1,500 mgd (million gallons per day). Storage in lakes is about 18 billion gallons in only their uppermost foot of depth; enough to supply nearly 50 mgd for a year. These prodigious amounts of water present a rosy picture indeed, when one considers that the entire water use in Orange County as late as 1963 was less than 200 mgd. However, two-thirds of the water in streams is in the St. Johns and Wekiva Rivers; both of which are in thinly populated areas and at low elevations. Then, too, the 50 mgd were pumped proportionately from the county's lakes, some of them would probably be intermittently drained and the average elevation of many others would be greatly lowered. These average figures are deceptive in that this is the amount of water available only if all flow in excess of the average can be stored and released when the flow is less than average. Owing to unfavorable physiography and to evaporation losses, this cannot be done in Orange County. Actually, during extreme droughts the amount of water in the streams is less than 80 mgd, mostly in the Wekiva River.

Important functions of streams other than as sources of supply are removal of excess water and conveyance and dilution of wastes. Most streams in Orange County remove excess water very efficiently. For instance, following the severe flood of March 1960, streams in Orange County not sustained by lake storage had either ceased to flow or receded to very low base flow within sixty days and to preflood conditions within thirty days. Even the St. Johns River and Myrtle-Mary Jane Canal with their tremendous lake storage and Wekiva River with its hugh ground-water reservoir had returned to preflood conditions within ninety days. Only the Wekiva River which is spring fed has a continuous flow adequate to effectively dilute and convey significant amounts of waste.

Lakes in Orange County range in size from less than an acre to Lake Apopka's 31,000 acres. Lake elevations range from less than three feet to nearly 160 feet. Observed depths range from about two feet for Lake Poinsett to 334 feet for the three small maps beneath the large map. Maximum flows, which are usually the result of a severe storm following an extended period of above normal rainfall, are many times the average flows. During extreme droughts there would be virtually no surface flow from the county were it not for several large springs in the Wekiva basin and the effluent from the Orlando sewer system in the Econlockhatchee basin. From 1933 to 1963, only one drought, 1939, was severe enough to cause cessation of flow in the St. Johns River. Flow ceases in all streams not fed with water from the artesian aquifer in spite of storage in lakes and in the water table aquifer. This is because evaporation from lakes is nearly as great as rainfall on the lakes so that when rainfall is deficient lake levels fall below the lip of the lake outlets and because the poorly developed stream channels have not incised the water-table aquifer to the lower water-table levels.

The stage and flow-duration curves show the percent of time during the periods of record that specific stages or discharges were equaled or exceeded but they do not show the chronological sequence of occurrences. For example, on 40 percent of the days of record, the stage of Lake Cone (Curve 14) was 7.6 or more feet above mean sea level and the discharge of St. Johns River near Christmas (Curve 1) was 1,200 or more cubic feet per second. The flow-duration curves show that the flow of only the Wekiva River continuously exceeds the 17 mgd (26 cubic feet per second) used by Orlando in 1960. The stage-duration curves show some lakes vary in stage as much as ten feet and others vary less than three feet. The range in stage of Lake Sherwood (no record shown) is more than 20 feet. Lake Corrine and Lake Silver have the smallest range in stage. These lakes are 20 to 25 feet higher than the pressure surface in the artesian aquifer and therefore are not affected by it. They have relatively small and level drainage areas and surface outlets to remove excess surface inflow. Lake Francis has the largest range in stage. It is a land-locked lake amoung rather steep-sided high sandy hills that contribute little if any surface inflow to the lake. Its range in stage overlaps the range of the pressure surface of the artesian aquifer by about seven feet.

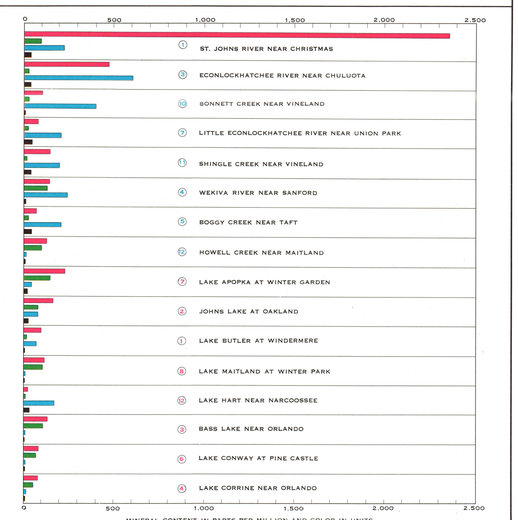
The hydrographs show the similarity of the seasonal variation in the average conditions of streams and lakes. The similarity is because the factors that determine seasonal variations, rainfall and evaporation, affect all sites. The ranges in fluctuations vary greatly from stream to stream or lake to lake because topography and geology vary greatly from place to place.

The quality of water in streams changes rapidly with changes in flow as illustrated by the observed extremes in mineral content and color of water from selected surface sources in and near Orange County during the period 1953 to 1965. During floods, the mineral content of streams is usually low, but color, especially early in floods, is high because of the organic matter washed into the streams by overland flow. When the flow in streams, is low, mineral content is higher because the water is derived from ground water. Color is usually lower at low flow because the ground water is clear and there is no overland flow to introduce organic matter.

Differences in mineral content and color at high and low water and the rates at which changes take place are considerably less for lakes than for streams because of the large volume of water stored in lakes.

Except for the St. Johns River, the water in streams and lakes in Orange County is low in mineral content. During droughts the water in the St. Johns River is highly mineralized and the concentrations of dissolved solids, chlorides, and sulfate exceed the limits recommended for drinking water by the U. S. Public Health Service.

The color present in much of the surface water in Orange County, especially in streams, must be reduced before it can be used for many purposes.



QUALITY OF WATER FROM SELECTED SURFACE SOURCES IN AND NEAR ORANGE COUNTY