STATEMENT ON THE KISSIMMEE BASIN PROJECT

PRESENTED TO THE GOVERNOR AND CABINET

December 12, 1972

Tallahassee, Florida

by

CENTRAL AND SOUTHERN FLORIDA FLOOD CONTROL DISTRICT

A general plan for flood protection in the Kissimmee Basin was incorporated in the comprehensive plan for Central and Southern Florida presented to the Congress of the United States in 1948. That portion of the comprehensive plan which included the program in the Kissimmee Basin was authorized for construction by the Congress in 1954.

The inclusion of the Kissimmee Basin in the comprehensive plan was directly pursuant to Public Law No. 534, 1947. However, earlier Congressional Acts in 1937, 1939 and 1946 had directed that studies of regulating the Kissimmee River and its tributaries be made.

The general plan for the Kissimmee Basin submitted to the Congress in 1948 contemplated:

1. Use of the major lakes as storage basins for flood control and water conservation.
2. Connecting channels between the major lakes and provision of control structures.
3. Channel and control structures in the Kissimmee River portion of the Basin.

The purpose of this plan was to relieve flooding and minimize flood damages, largely in the upper basin. This was to be accomplished partially by flood storage in lakes of the upper basin, but primarily by providing the capability to more rapidly remove surplus flood producing water from the Basin when necessary. The report to Congress clearly stated that complete flood protection could not be provided, but that reasonable flood protection from the maximum flood of record would result from such a plan.

Some six hundred thousand acres in the Basin were flooded for varying durations in the major flood of 1947. Figures furnished in the report to Congress in 1948 indicated four million dollars in flood damages were sustained in 1947.

The system of works now in being in the Kissimmee Basin conforms closely with the general plan outlined in the 1948 report to the Congress. The major lakes of the upper basin are connected by channels; in most cases channels excavated by Disston in the 1880's, but enlarged to varying degrees under the project. Nine control structures regulate water levels and flows in the lake-channel system of the upper basin. A channel connects Lake Kissimmee with Lake Okeechobee. Five control structures in this channel control water elevations in the channel and regulate flows originating in both the upper and lower basins.

Work in the upper basin was started in the early 1960's. Regulation of the levels in some of the major lakes started in 1964 with completion of Structures 59, 61, and 65. Work in the lower basin started shortly thereafter with the lower control structure, S-65E, being completed in mid-1964. Channel excavation was completed in late 1970. It can be considered that in 1965 some degree of manmade control of flows and water levels in the Kissimmee Basin started.

Total project cost is $31,600,000; $27,400,000 for work in the lower basin. Estimated cost in 1956 was $30,900,000.

The basic justification for construction of the C-38 channel rests on the reduction of flood damages in the upper basin; that is, that portion of the Basin lying north of the outlet of Lake Kissimmee.

Figure 1 is a map of the upper basin, with the City of Kissimmee on the north shore of Lake Tohopekaliga and the City of St. Cloud on the south shore of East Lake Tohopekaliga. A portion of the City of Orlando is in this Basin. Natural drainage from the Orlando area reaches the main system by way of Shingle and Boggy Creeks. Shingle Creek enters Lake Tohopekaliga just west of the City of Kissimmee. Boggy Creek discharges to East Lake Tohopekaliga. Disney World discharges to Reedy Creek and, in flood times, to Shingle Creek.

On this map is shown the area flooded in 1953. Areas flooded for more than 80 days are shown in orange and shorter duration flooding in blue. A flood of this magnitude or greater can be expected to occur 6 or 7 times every hundred years. The 1947 flood was a somewhat more infrequent occurrence and in terms of flood damages was about 5% more destructive. Recent experience, then, indicates that major flooding can occur at comparatively short intervals; six years in the case of the 1947 and 1953 floods. It also indicates that the intervals between major floods can be comparatively long; the last major flood in this area having occurred in 1960 (twice in that year); 12 years ago.

Flooding in the upper basin is caused by the accumulation of runoff in the sloughs, ponds, creek flood plains and lakes of the region. Examples of the effect of this accumulation on the area's lakes are shown on Figures 2 and 3. Figure 2 is a water level graph of Lake Tohopekaliga for the period 1942 to date. Flood damages occur when lake stage rises above elevation 56.0 feet. In this period there were nine occasions, all prior to 1961, when lake stage exceeded flood damage elevation.

Figure 3 shows a similar graph for East Lake Tohopekaliga. Damages are experienced when a lake stage of 59.0 feet or more occurs. In the period since 1942 elevations above 59.0 feet also occurred nine times; again all before 1961.

As indicated earlier, effective regulation of stages in these lakes began in 1965. Considering the period 1942 through 1964, then, as representing the "natural" condition it can be seen that once every two to three years flood damages on lands adjacent to these two lakes occurred.

Flood damages related to expected frequency of damage incidence is shown on Figure 4. The relationship is shown in the form of a curve. The points on the curve represent estimates of damages which would be sustained as a result of floods of varying frequencies of occurrence, which is a measure of severity. The damage values are expressed in terms of 1972 dollars. The curve is for the upper basin only. What the curve says is that once every 10 years, for example, without water control, flood damages amounting to $2.4 million or more will be sustained in the Basin.

With severe floods there will still be flood damages, since the program did not intend by any means that all flood damages be prevented. Taking into account these "residual" damages, the estimated average annual flood damages prevented in the upper basin by project works amount to $750,000, at 1972 price levels.

The relationship of the C-38 channel which has been excavated downstream of Lake Kissimmee to flood damage reduction in the upper basin is illustrated in Figure 5. This is a rather technical approach but the relationship is not readily explainable in a more simplified fashion. The two curves shown are termed "discharge rating curves." Rating curves show the relationship between the elevation (or head) of water moving through an opening and the rate of flow.

The curve on the left shows the elevation - rate of flow relationship for the natural outlet of Lake Kissimmee to the Kissimmee River. This curve was developed by the U. S. Geological Survey. The curve on the right is the relationship for the present water control structure at the Lake Kissimmee outlet, with the excavated channel downstream.

The flood damage elevation for Lake Kissimmee is 53.0 ft. At this elevation the upper curve shows that water moved out of the upper basin, under natural conditions, at the rate of about 2200 cfs. At this same stage the lower curve shows the present potential for removing water from the upper basin at the rate of about 11,000 cfs. At the lower flow rate water will accumulate upstream faster and in greater volumes.

These curves, then, are indicative of the increased potential for preventing the excessive accumulation of water in the lakes of the upper basin during periods of severe rainfall. It is the accumulation of these surpluses which produce flooding and result in the flood damages which have been indicated. The ability that is now present to take the cork out of the bottle, as it were, when necessary, is just that ability which is required to reduce flooding damages in the upper basin.

The word "potential" has been emphasized. This carries with it the definite implication of use only when needed. It does not imply a continual and regular use. The natural condition, reflected by the curve on the left, does mean a continual and regular discharge of water from the upper basin at all times, at varying rates. The present situation provides options not formerly available. One of these options is to control discharges from Lake Kissimmee and thereby retain water in the upper basin.

The exercise of this option is reflected on the stage graphs for Lake Tohopekaliga and East Lake Tohopekaliga on Figures 2 and 3. It can be noted that the extreme low stages of the pre-1965 period are not duplicated subsequently. But it can also be noted that the capability, the potential, still exists to draw these lakes down for water quality management purposes, as was done in 1970-1971.

The rate at which water moves out of the Kissimmee Valley into Lake Okeechobee is a matter of some importance. The project system downstream of Lake Kissimmee is shown on Figure 6, which is a map of the lower basin. The potential for short-term sharp increases in rates of water movement is now available, as has been indicated. The potential being there, it will be used when needed. This was the case in October of 1969, when a high-intensity rainfall occurred over a concentrated area of the lower basin. This resulted in a peak rate of discharge to Lake Okeechobee of 23,500 cfs. But this is a comparatively rare occurrence, and perhaps should be put in a more appropriate context.

Figure 7 is a comparison of two incidents when high discharge rates were recorded. One is the October 1969 occurrence when the peak discharge rate of 23,500 cfs. was observed. The other was in October 1948 when a peak discharge rate under natural conditions of 17,400 cfs. was recorded. The figure shows discharge hydrographs, for both incidents, which plot daily discharge rate against time. The area under such a hydrograph represents the total volume of water discharged over any selected period of time.

The mean October flow rate for the pre-1965 period is 3800 cfs. This value was used as the base for computing discharge volumes under each of the two plotted hydrographs. For the 1969 occurrence flows exceeded this rate for 42 days. In this period 411,400 acre feet of water were discharged to Lake Okeechobee. In the comparable 42 day period during the 1948 occurrence, 635,800 acre feet of water were discharged. Although the peak discharge rate in 1969 was higher, over the 42 day period of maximum discharge intensity the volume of water entering the Lake was nearly 55% greater in 1948. The average rainfall over the lower basin which produced these discharges was about 30% greater in 1948 than in 1969.

This indicates that more or less instantaneous peak discharge rates, which occur infrequently, may not be of major impact. Longer term annual and seasonal effects should be examined. Figure 8 shows the results of an analysis of long-term annual rainfall-discharge relationships. This is, again, a rather technical presentation. Accumulated annual effective rainfall is plotted against accumulated annual discharge for the entire Kissimmee Basin. The relationship between annual effective rainfall and runoff for any watershed is such that when the values are accumulated they should plot as a straight line, provided there have been no changes in the hydrologic regime of the watershed. The straight line will sharply bend if changes have been imposed on the watershed. The line will bend upward if storage has been added to the watershed. It will bend downward if water has been diverted away from the watershed. This type of plot is a technique, devised by the U. S. Geological Survey, for detecting changes in the hydrology of watersheds.

The figure shows a straight line plot for the entire Kissimmee Basin for the period 1942 through 1972. The individual plotted points are shown and there are, of course, departures from the straight line. The plot shown, however, is a reasonable construction to place on the data. What is important is that there is no apparent or detectable break in the line from 1965 onward. Had the project work in the basin increased the annual volume of water moved into Lake Okeechobee the straight line would have bent downward in 1965 and continued in that direction through 1972.

Figure 9 shows seasonal rainfall-runoff relationships for the entire basin. These are wet season data, the period used being the 6 months of June through November. Each plotted point represents the June through November effective rainfall and runoff for the years 1942 through 1972. The left-hand panel shows the data for that portion of the period up through 1964; the right-hand panel for the period after 1964. The line on each panel represents the average of the plotted points. The slopes of the lines on both panels are very nearly the same. This shows that the wet season rainfall-runoff relationships are the same in both cases. It indicates that, on a seasonal as well as an annual basis, no more water is now being transported to Lake Okeechobee than was the case prior to construction of the C-38 channel.

To summarize:

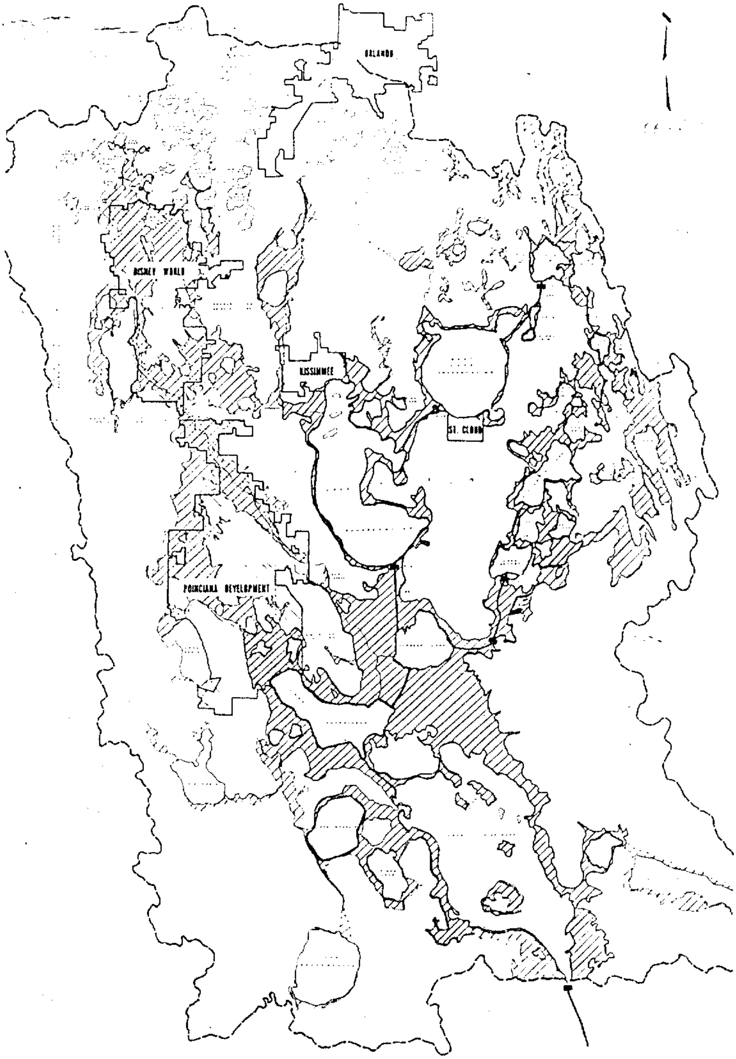
1. Justification for the C-38 channel rests to a high degree on the reduction of flood damages in the upper basin.
2. The Cities of Kissimmee and St. Cloud, plus portions of the City of Orlando, are within the area subject to flooding as a result of excessive accumulation of water in the upper basin.
3. The average annual flood damages prevented in the upper basin is estimated to be on the order of $750,000, at 1972 price levels.

4. The project system below Lake Kissimmee provides the potential for relief of water accumulations in the upper basin; but also provides a number of additional options, including retention of water in the upper basin, not heretofore available.

5. The system does provide the capability for increasing the more or less instantaneous peak discharge rate of water movement into Lake Okeechobee. The use of this capability does not appear to materially affect the time-volume impact of flow to the Lake under conditions of high discharge.

6. There is no indication that either the annual or seasonal hydrologic regime of the Kissimmee River watershed as a unit has been changed as a result of the project in the Basin.

UPPER KISSIMMEE RIVER BASIN FLOODED AREA 1953



FLOODING MORE THAN 80 DAYS

SECONDARY FLOODING

Figure 1

LAKE TOHOPEKALIGA

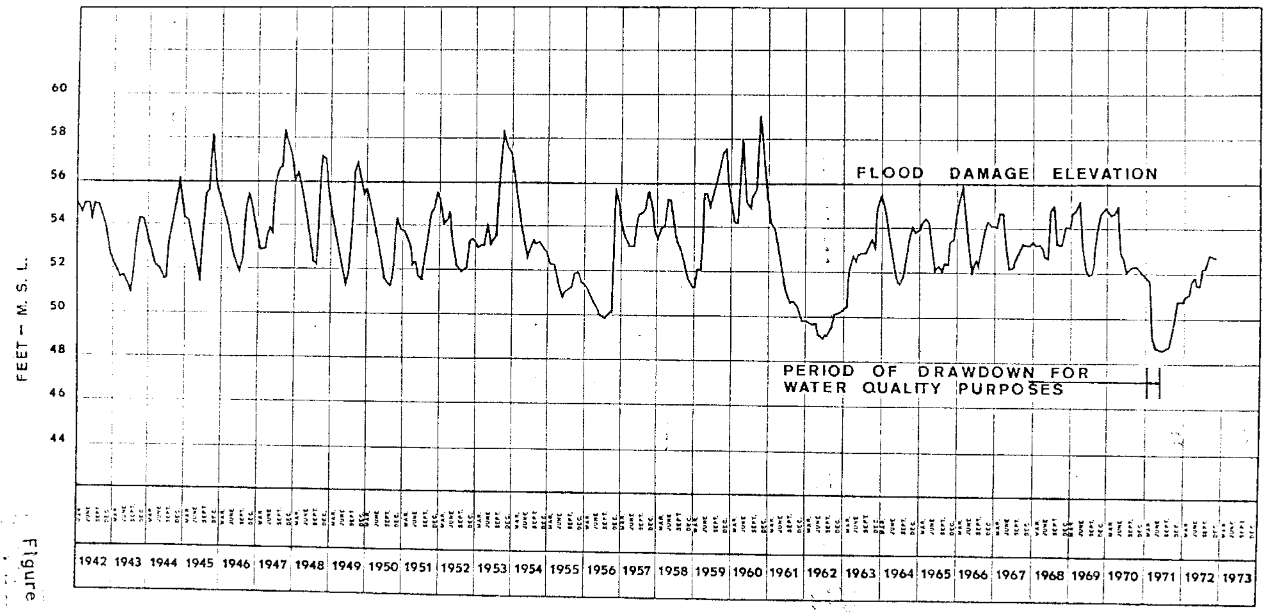


Figure 2

EAST LAKE TOHOPEKALIGA

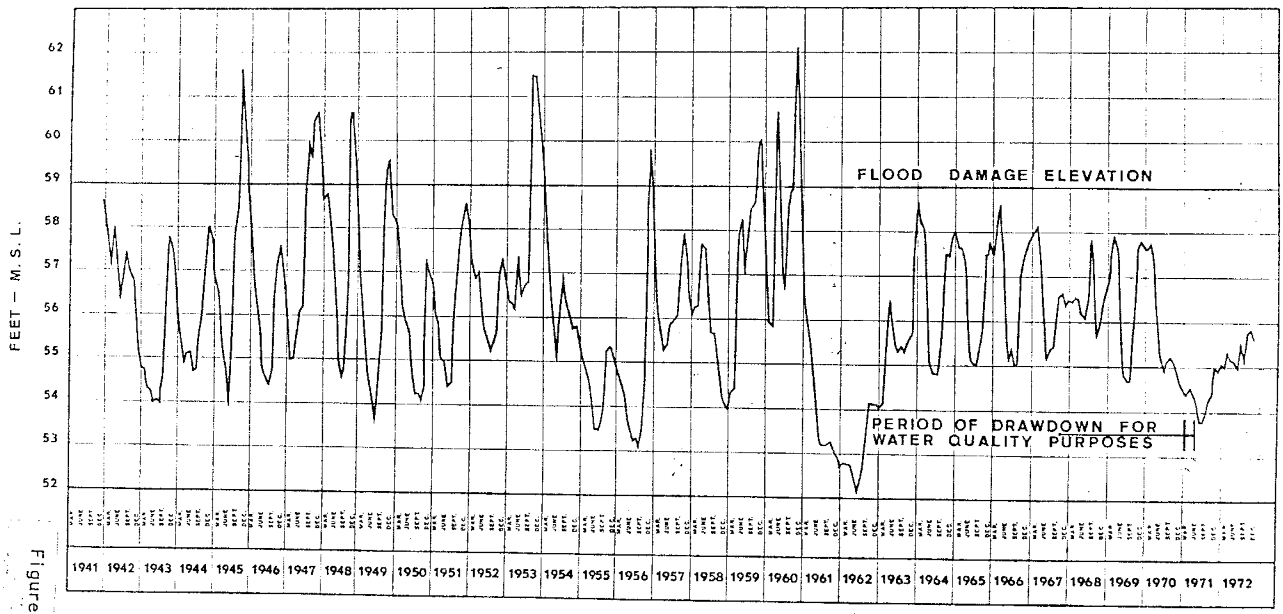


Figure 3

UPPER KISSIMMEE BASIN — FLOOD DAMAGE VS. FREQUENCY

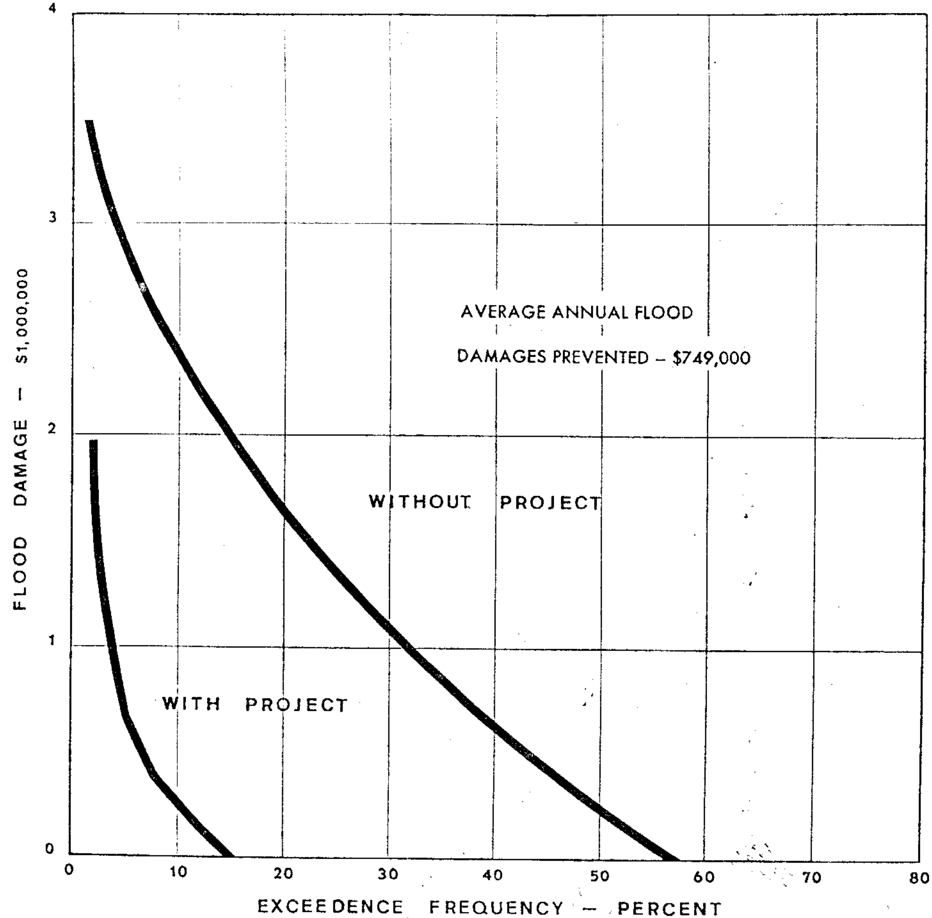


Figure 4

DISCHARGE RATING CURVES, OUTLET OF LAKE KISSIMMEE

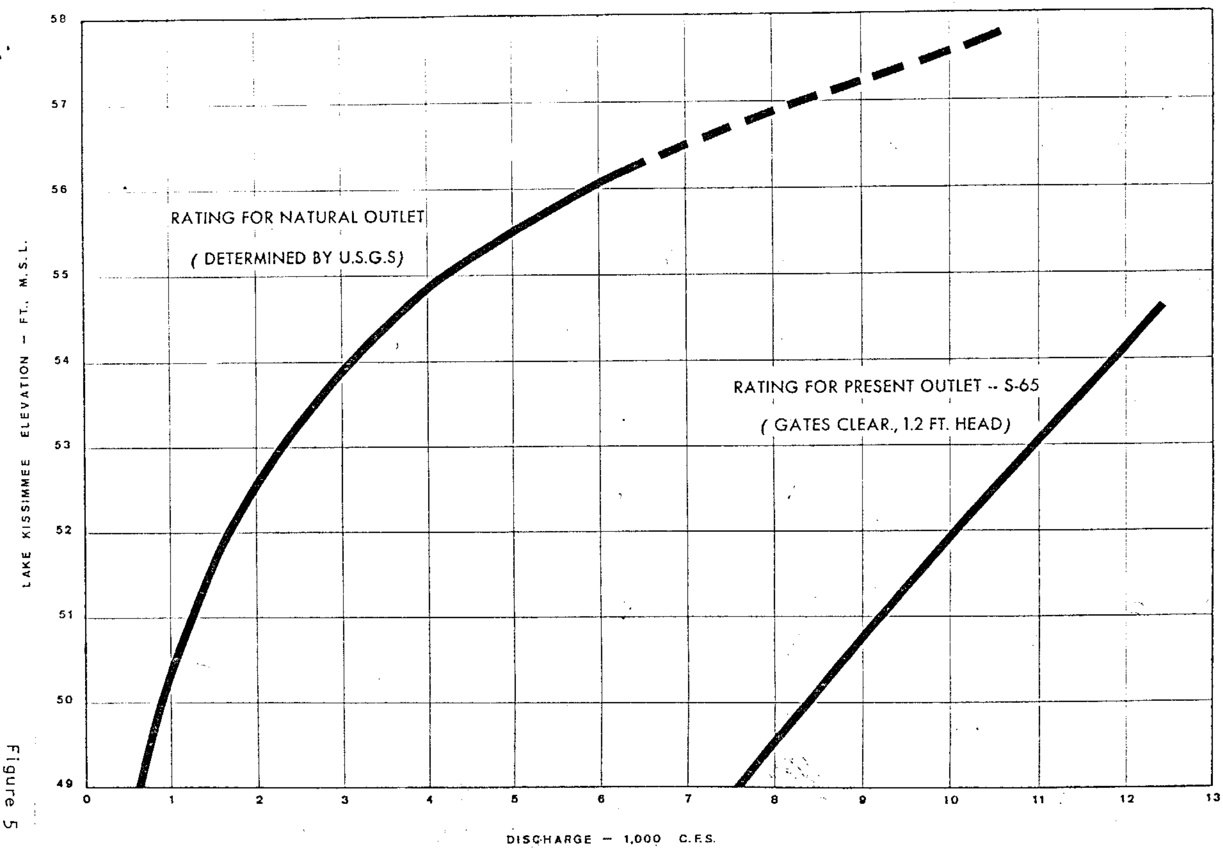
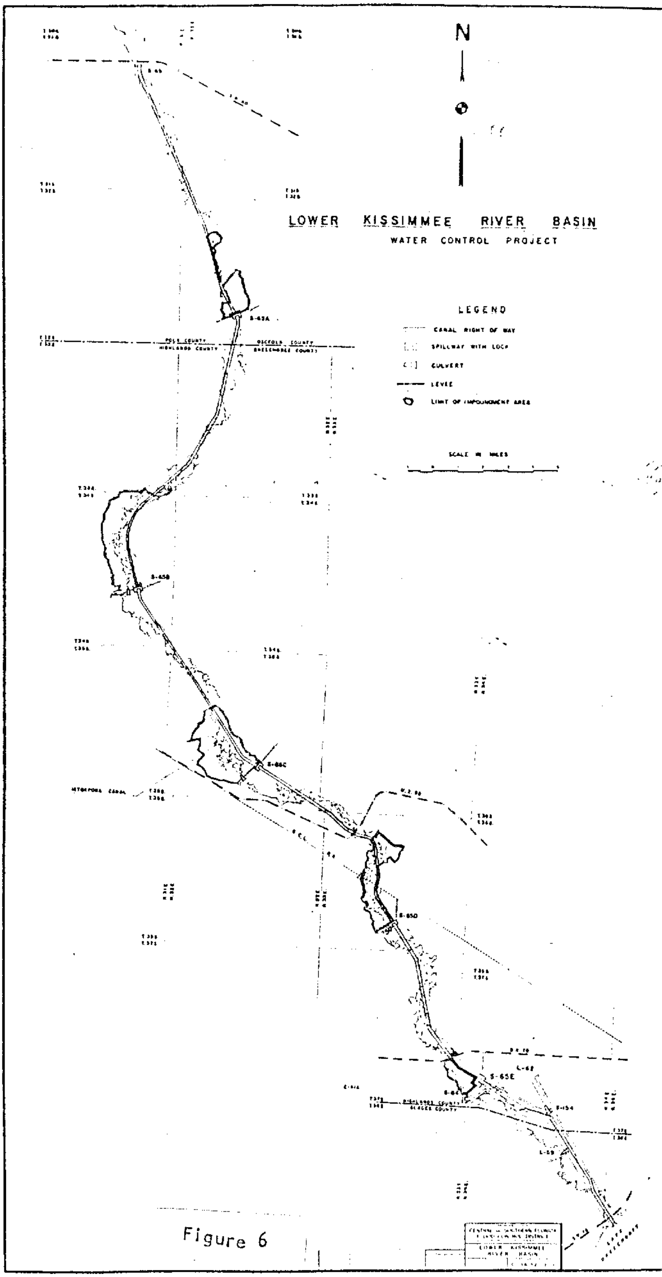


Figure 5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LOWER KISSIMMEE RIVER BASIN
WATER CONTROL PROJECT
LEGEND
CANAL RIGHT OF WAY
SPILLWAY WITH LOCK
CULVERT
LEVEE
LIMIT OF IMPOUNDMENT AREA
SCALE IN MILES
S-65A
POLK COUNTY
HIGHLANDS COUNTY
OSCEOLA COUNTY
OKEECHOBEE COUNTY
S-65B
S-65C
S-65D
S-65E
L-62
S-154
L-59
HIGHLANDS COUNTY
GLADES COUNTY

Figure 6

KISSIMMEE RIVER DISCHARGE HYDROGRAPHS FOR OCTOBER, 1948 AND OCTOBER, 1969

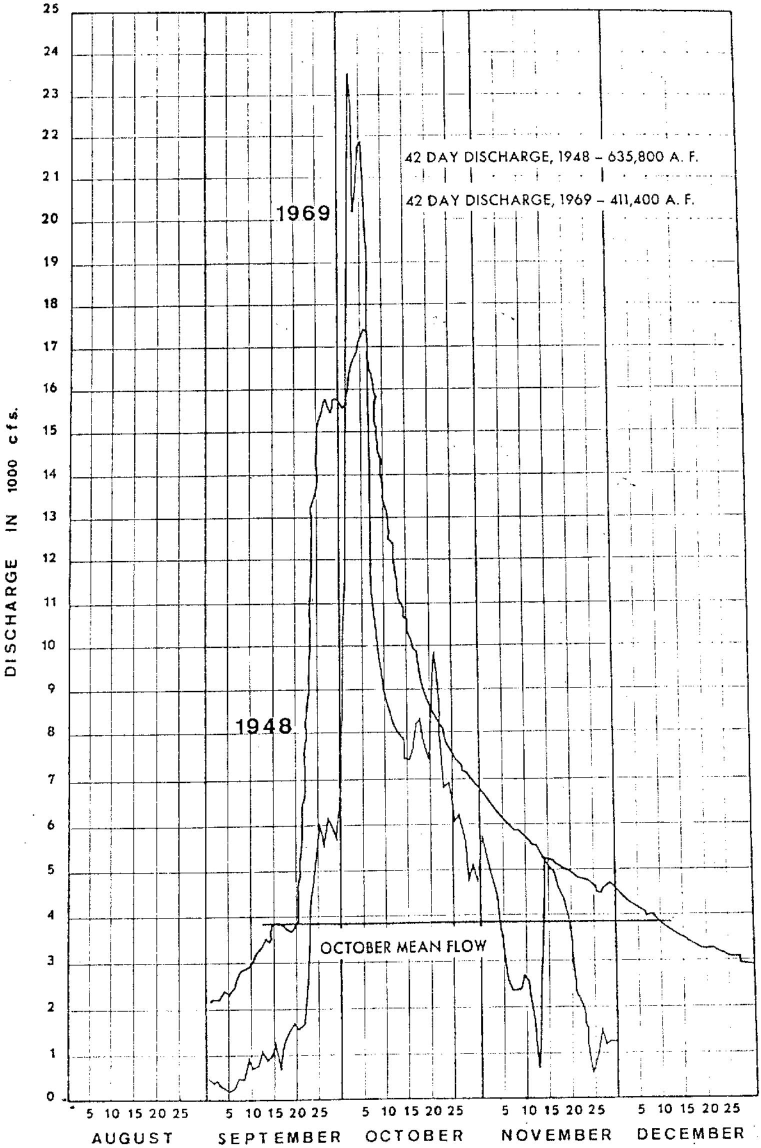


Figure 7

ACCUMULATED EFFECTIVE RAINFALL VS. ACCUMULATED RUNOFF ENTIRE KISSIMMEE BASIN

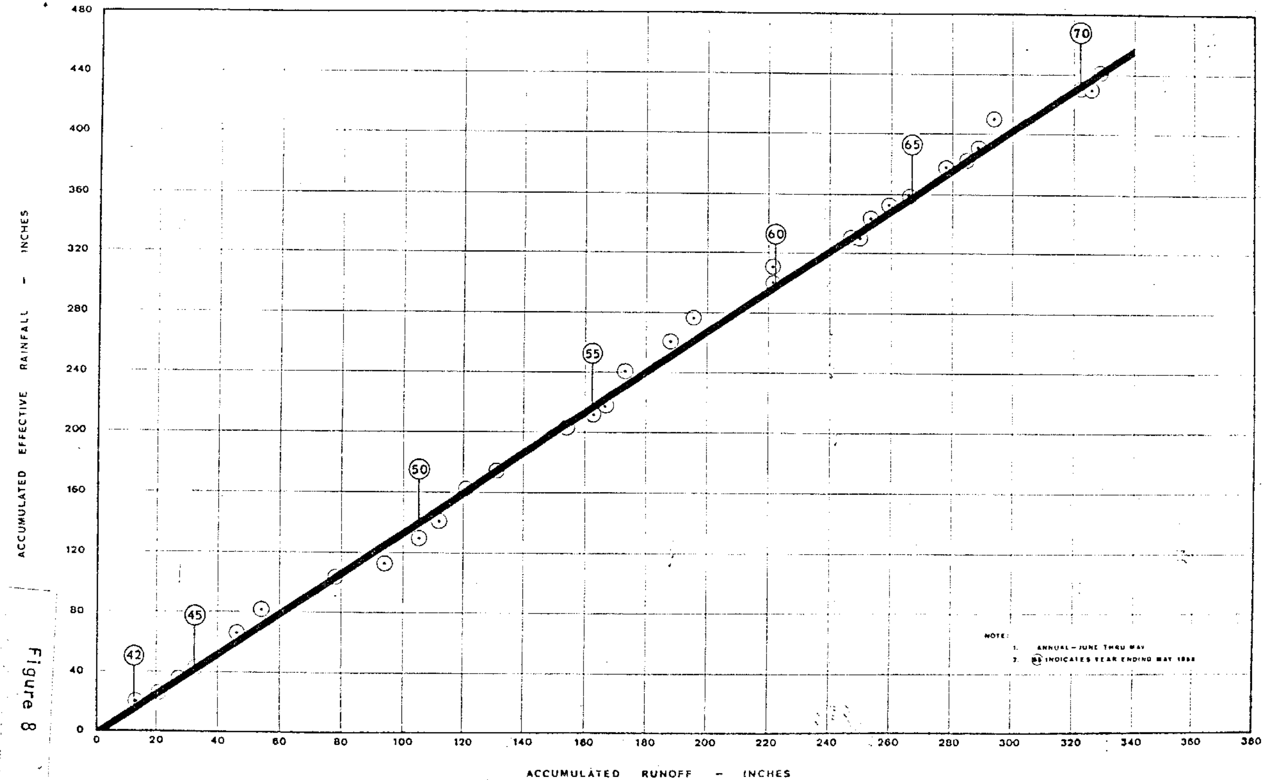
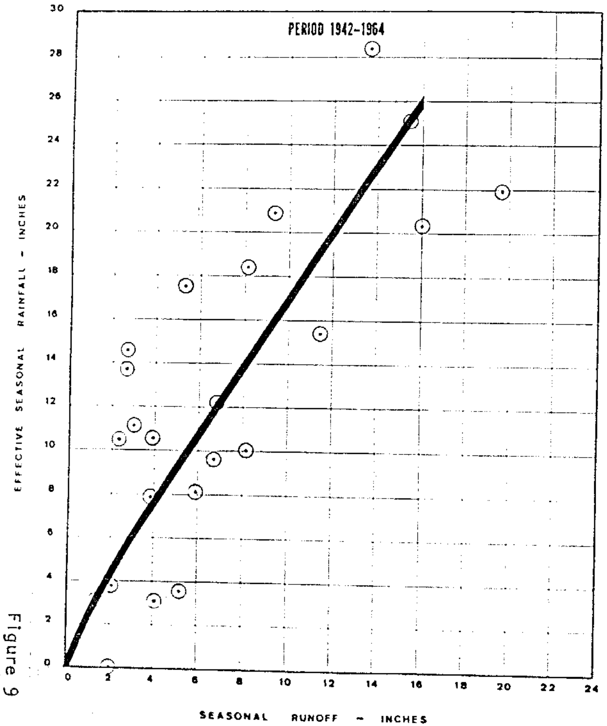


Figure 8

EFFECTIVE JUNE-NOVEMBER RAINFALL VS. RUNOFF FOR ENTIRE KISSIMMEE BASIN



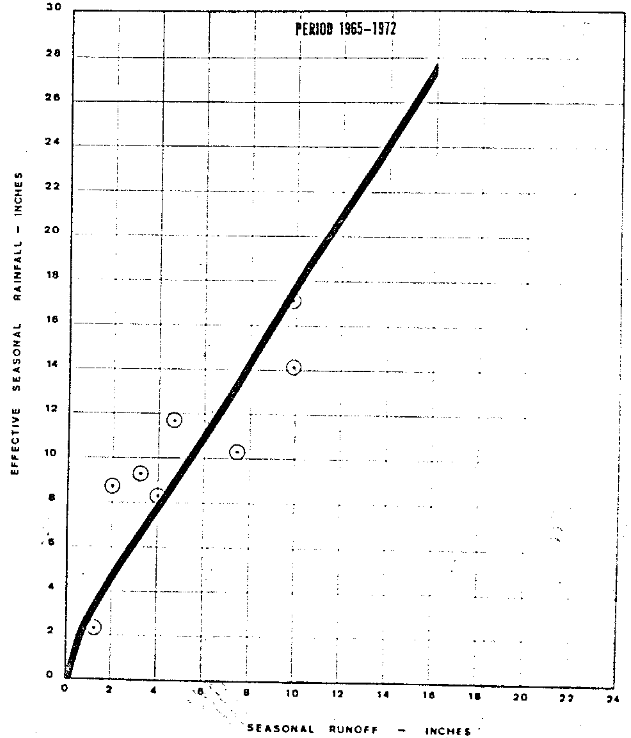


Figure 9