Effect of Aquatic Plants On Medium Sized Canals

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"If a Silver Dollar tossed into a canal can be seen as it settles on the bottom, the canal is not deep enough." This enlightening and amazingly true statement relating to aquatic plants is attributed to Lamar Johnson, a civil engineer, who worked faithfully many years with the Everglades Drainage District and later with Central and Southern Florida Flood Control District. He was instrumental in planning and designing conveyance channels throughout the Everglades and along the Florida east coast.

The area shown in Figure 1 illustrates the vastness of the Corps of Engineers Project of which the Flood Control District is sponsor as representative of the State. The project encompasses some 16,600 square miles in 18 counties in central and southern Florida. There have been, and are yet, many intriguing and puzzling elements of planning and final design of this unique flood control project.

The element with which this paper deals is one that is not wholly solved by scientific standards, even though much has been learned from experience, and a workable rule-of-thumb has emerged. How deep should a canal be to minimize aquatic growth and yet be economically feasible to construct?

During the early stages of design of project canals, the first and most logical consideration was given to providing adequate canal capacity for immediate removal of flood waters from the local areas; so that, a repetition of the 1947 flood, which resulted in damages estimated at $59,000,000. would not occur. After several canals were constructed according to orthodox design criteria, and then placed in operation by the C&SF Flood Control District, the abnormally high cost of maintaining these canals became a big factor. Of course, the normal maintenance of silting was expected and routine, but that was not the main factor. Aquatic plants, both emersed and submersed, had greatly increased the problem. Most canals were being clogged by growths so dense that water would not move, even by forced pumping.

Blackburn, et al.[1] observed that canal design can be changed in certain areas to reduce submersed weed growth. However, souch a design should be related to the "Angle of repose" of the soil material through which the canals are excavated, or to the natural ratio of the horizontal distance to vertical drop of side slopes. The foregoing conclusians were reached following the investigations of five canals in a 60-mile radius of Fort Lauderdale after determining the influence of various biological, chemical, and physical conditions on growth of submersed weeds. In the study it was found that light penetration, various chemical compounds, tannic acid, and turbidity contents of canal waters had the greatest influence on weed growth. Full sunlight at a 15-foot depth varied between 0 and 45%.

As it generally conceded, tanic acid and amount of turbidity are factors related to light penetration. Therefore, it appears that the minimum size of a canal is likely to be dependent upon the type of contents of water to be transported.

We don't know how many silver dollars Lamar Johnson experimented with or how many coins he was able to recover, but we do know that light and nutrients are essential for weed growth. Therefore, we can concur with his observation on the basis of experience and general knowledge of plant growth.

As many of you know, the Federal project as authorized by Congress is limited to providing primary outlet facilities. Local interests provide secondary drainage works. The terminal sections of the primary canals in the upper reaches of the drainage areas where discharges are relatively low require minimum size criteria. This is a compromis of construction methods, maintenance, and right-of-way requirements. These terminal reaches were originally designed with a minimum section 6 feet deep and a 10-foot bottom width. High maintenance costs due to aquatic weeds led to modification of the minimum suze criteria. Presently, the minimum section is 10 feet deep with a 5-foot bottom width. This, of course, applies only to the terminal reaches where discharge is relatively low. Most of the project canals are excavated in sand which requires side slopes of 1 on 2 and 1 on 3, causing additional weed problems. The current minimum size criteria is a compromise, but would appear to be satisfactory considering the relatively small length of canal and discharge involved.

We can therefore say that we have developed a practical solution to the problem. A depth of 6 feet does not dork very well in discouraging submersed aquatic growth in the Everglades area canals, but a depth of 10 feet works quite well. There would be necessary variations on this depending on turbidity, color, agitation of the flow, etc. If this were to be applied in other areas, some adjustment would likely be required unless the water characteristics were similar. At any rate, our solution — while not the last word in reducing submersed weed growth to an absolute minimum — works out as a practical rule-of-thumb in the Everglades area.

LITERATURE CITED

1. Blackburn, R. D., P. F. White, and L. W. Weldon, 1964. Certain environmental factors that may affect the growth of submersed aquatic weeds in Florida canals. Hyacinth Control J. 3:20.

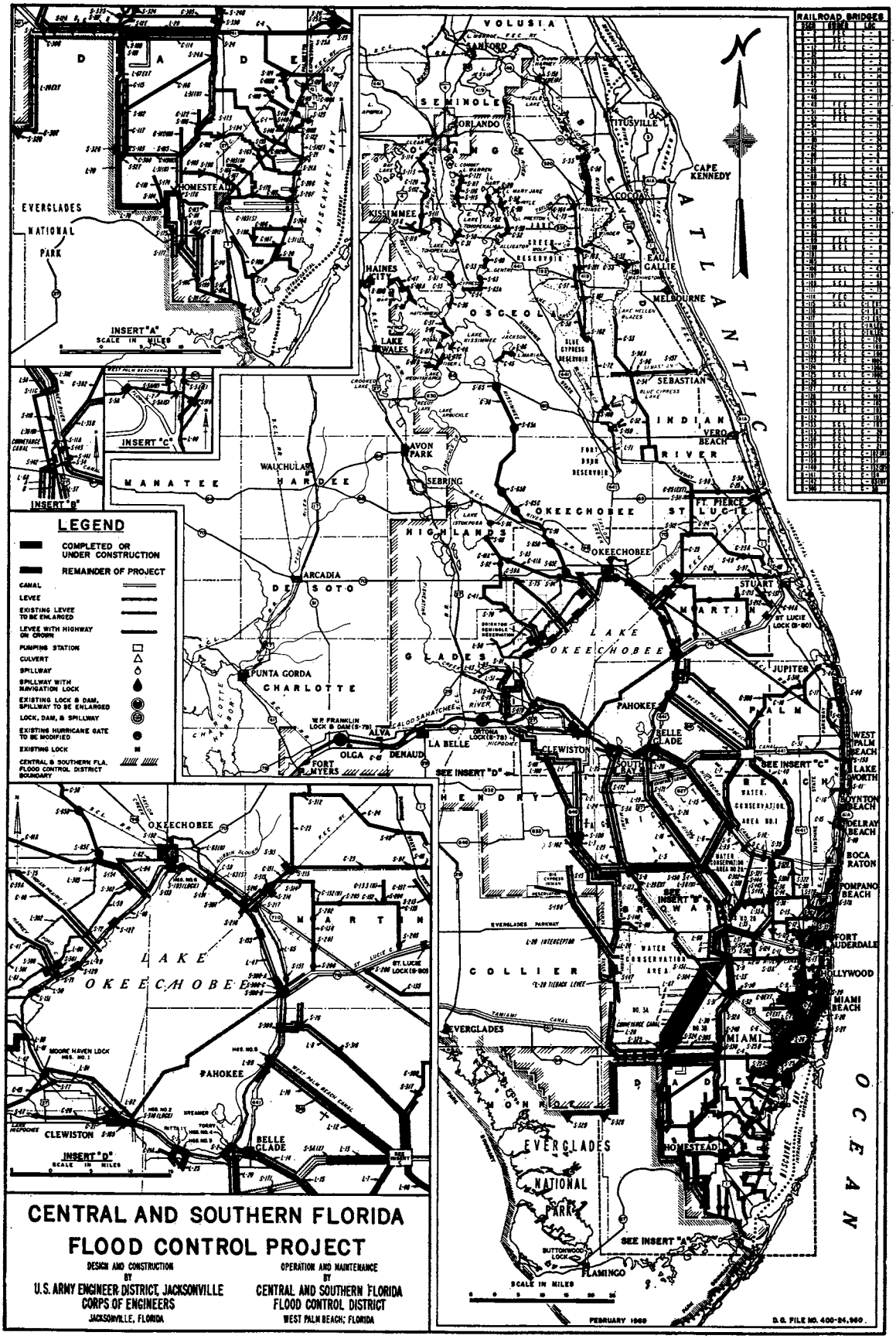
LEGEND
COMPLETED OR UNDER CONSTRUCTION
REMAINDER OF PROJECT
CANAL
LEVEE
EXISTING LEVEE TO BE ENLARGED
LEVEE WITH HIGHWAY ON CROWN
PUMPING STATION
CULVERT
SPILLWAY
SPILLWAY WITH NAVIGATION LOCK
EXISTING LOCK & DAM, SPILLWAY TO BE ENLARGED
LOCK, DAM, & SPILLWAY
EXISTING HURRICANE GATE TO BE MODIFIED
EXISTING LOCK
CENTRAL & SOUTHERN FLA. FLOOD CONTROL DISTRICT BOUNDARY
RAILROAD BRIDGES
INSERT "A"
INSERT "B"
INSERT "C"
INSERT "D"
SEE INSERT "A"
SEE INSERT "C"
SEE INSERT "D"
ATLANTIC OCEAN
LAKE OKEECHOBEE
EVERGLADES NATIONAL PARK
CENTRAL AND SOUTHERN FLORIDA
FLOOD CONTROL PROJECT
DESIGN AND CONSTRUCTION BY U.S. ARMY ENGINEER DISTRICT, JACKSONVILLE CORPS OF ENGINEERS JACKSONVILLE, FLORIDA
OPERATION AND MAINTENANCE BY CENTRAL AND SOUTHERN FLORIDA FLOOD CONTROL DISTRICT WEST PALM BEACH, FLORIDA
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Figure 1.