UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

CAUSES OF FLOODING OF LITTLE CHARLEY BOWLEGS CREEK UPSTREAM FROM HIGHLANDS HAMMOCK STATE PARK, FLORIDA

By
W. R. Murphy, Jr.
U. S. Geological Survey

OPEN-FILE REPORT
68-196
[redacted]

Prepared by
UNITED STATES GEOLOGICAL SURVEY
in cooperation with
FLORIDA BOARD OF PARKS AND HISTORIC MEMORIALS
and
DIVISION OF GEOLOGY, FLORIDA BOARD OF CONSERVATION

Tallahassee
1968

CONTENTS

	Page
INTRODUCTION	1
THE PROBLEM	4
FLOOD DATA AND RELATED OBSERVATIONS	4
HYDROLOGIC CRITERIA FOR CONTROL OPERATION	15
CONCLUSIONS	15

ILLUSTRATIONS

Figure Page

1. Location of Highlands Hammock State Park, Hardee and Highlands Counties, Florida........................ 2

2. Sites referred to in report and features pertinent to flooding problem upstream from Highlands Hammock State Park... 3

3. Days of flooding between Sites D and E............. 5

4. Scene looking southeast from east end of bridge at Site E indicating beginning of flooding on low lying pasture, July 11, 1967. Gage height at Site D, 17.1 feet or elevation 79.4 feet above msl.............. 6

5. Discharge at Site A, water level of Little Charley Bowlegs Creek at Sites A, B, D, and flashboard regulation at control, Site B 7

6. Selected water-surface profiles.................... 9

7. Cross-sections of creek channel at Sites B-E....... 10

8. Scene looking upstream from Site D, March 25, 1967. Note the improved channel with no observable constrictions in the half mile reach upstream from Site D... 11

9. Scene looking downstream, about halfway between Sites D and E, March 25, 1967. Note the channel almost completely choked by vegetation...................... 12

10. Scene looking southward or upstream from Site E, July 11, 1967. Note the extreme clogging of channel by vegetation.. 13

11. Scene looking northward or downstream from Site E, March 25, 1967. Note the channel, moderately clogged by vegetation...................................... 14

CAUSES OF FLOODING OF LITTLE CHARLEY BOWLEGS CREEK UPSTREAM FROM HIGHLANDS HAMMOCK STATE PARK, FLORIDA

by

W. R. Murphy, Jr.
U.S. Geological Survey

INTRODUCTION

Highlands Hammock State Park is in the northwestern part of Highlands County in south-central Florida (fig. 1). The park is drained by Little Charley Bowlegs Creek which flows northward to discharge into Charlie Creek several miles downstream from the northern park boundary. The major water-control structure in this part of the drainage system is a concrete dam, 90 feet long, in Little Charley Bowlegs Creek at Site B (fig. 2). The crest of the dam was placed approximately at the original streambed elevation when constructed in the 1930's. The elevation of the crest of the dam is 77.6 feet above msl (mean sea level). Two rows of flashboards, 0.6-foot high, are provided that effectively raise the crest elevation to 78.2 and 78.8 feet above msl, respectively, when placed on the control. In addition, two 24-inch gated culverts, when open, permit the flow to bypass the dam. Their bottom elevation is 75.8 ft. msl.

The drainage basin upstream from the southern boundary of the park has little relief and much of the land surface ranges in elevation from 80 to 85 feet above msl. The average annual rainfall in the area is about 55 inches, most of which falls from June to October. During periods of heavy rainfall, part of the area upstream from the park may be flooded for periods of more than four months.

Continuous streamflow records were collected at the dam, Site B, the Little Charley Bowlegs Creek near Sebring, auxiliary station, from January 1952 to June 1953, and have been collected at Site A, the station on Little Charley Bowlegs Creek, near Sebring, since June 1953. The drainage area above these locations is approximately the same (41.9 square miles). The average flow was 43.1 cfs (cubic feet per second) for the 14 years of record, January 1952 to September 1966, and the maximum flow was 874 cfs on September 27, 1960. Periods of no flow have occurred in most years.

Records of placement of flashboards on the dam are incomplete. However, continuous water level of the upstream pool at the dam, Site B, has been recorded since January 1952 and that of the lower pool, Site A, since June 1953. Water-level records for Little Charley Bowlegs Creek at Cottage Road, (Site C, fig. 2) and for Little Charley Bowlegs Creek at South Fenceline (Site D, fig. 2) were collected periodically from January 1952 to July 1958 and daily since July 1965. Continuous water level records for Little Charley Bowlegs Creek near Crewsville, Site E, have been collected since July 25, 1967.

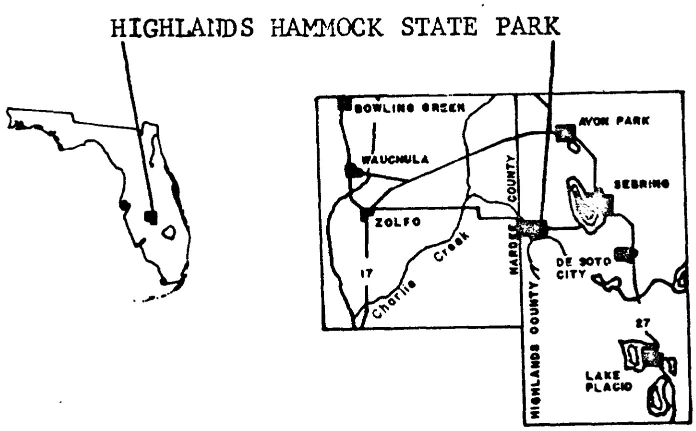


Figure 1. Location of Highlands Hammock State Park, Hardee and Highlands Counties, Florida

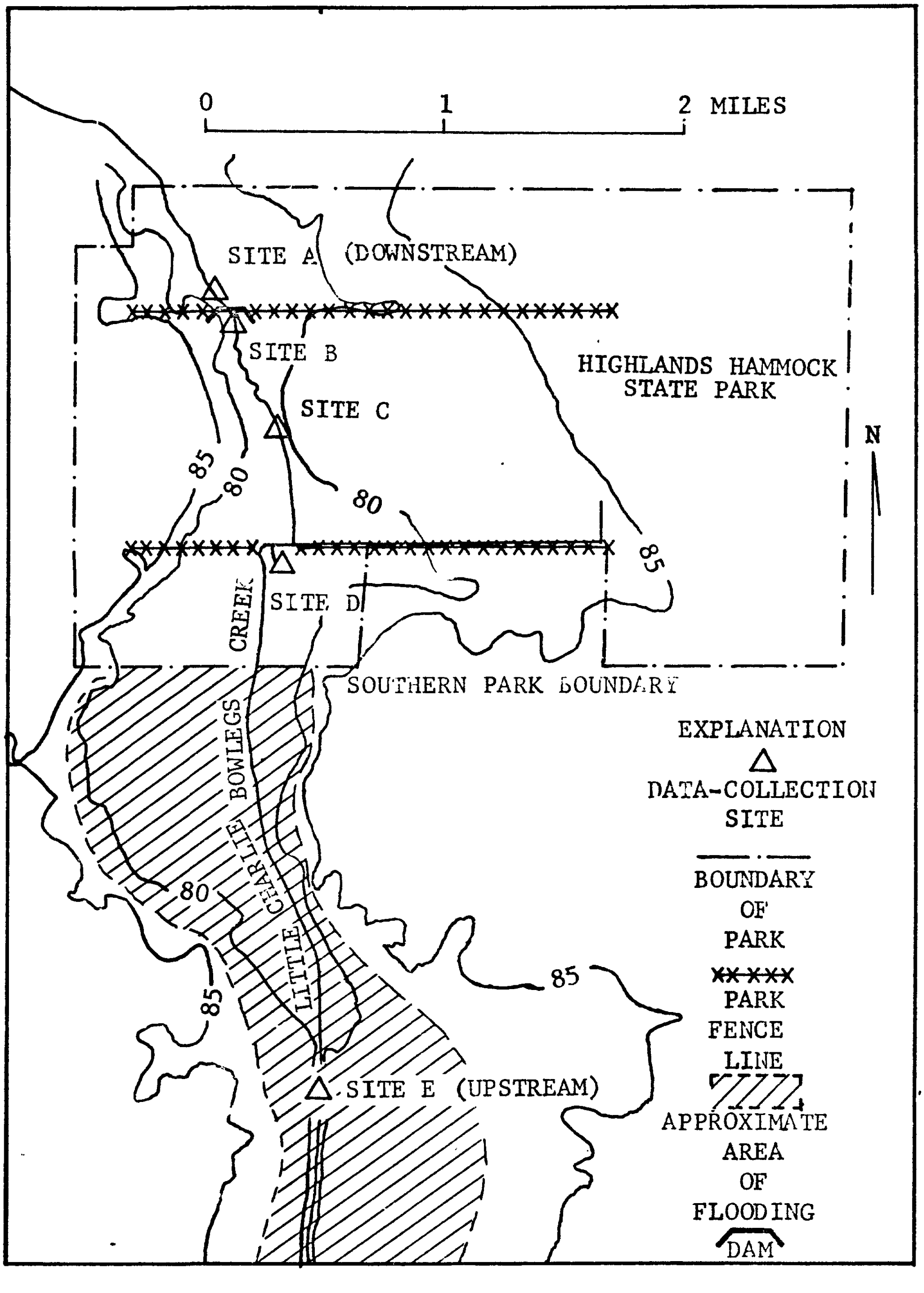


Figure 2. Sites referred to in report and features pertinent to flooding problem upstream from Highlands Hammock State Park.

THE PROBLEM

Land owners upstream from the park allege that the dam on Little Charley Bowlegs Creek at Site B causes flooding of their low lands during periods of heavy rainfall. The alleged effects from the dam have been the subject of litigation. Due to the recurrence of the floods, the Florida Board of Parks requested the U.S. Geological Survey to investigate the causes of flooding and the effects of flashboard operation.

The following factors upstream from Site A were considered in evaluating the causes of flooding: (1) the concrete dam at Site B and flashboard operation at the dam; (2) channel alignment and possible constrictions within and upstream from the park; (3) the effect of the bridge opening at Site D; and (4) channel conveyance or adequacy of the stream channel to permit rapid drainage from the area of flooding.

FLOOD DATA AND RELATED OBSERVATIONS

Periods of flooding between Sites D and E are shown on figure 3. The duration of this flooding may be as long as four months. The stage at which flooding occurs is based on the following field observations made in July 1967. On July 6, 1967, the park superintendent observed some flooding on low-lying pasture near the county bridge at Site E (fig. 4), 2-1/2 miles upstream from Site D. Gage height at Site D was 17.1 feet (79.4 feet above msl). Discharge at Site A was 70 cfs. On July 7, 1967 the stage at Site D was 17.3 feet or 79.7 feet above msl when an upstream land owner requested that boards be removed from the dam. The top row of boards was removed on July 7. Discharge at Site A was 92 cfs before boards were removed on this date. Bottom row of boards was removed on July 8. On July 11, 1957 a Geological Survey engineer noted some flooding near the county bridge at Site E (fig. 4) at a stage of 17.1 feet or 79.4 feet above msl at Site D. Discharge at Site A was 46 cfs with no boards on the dam. These observations establish that 79.3 feet above msl or 17.0 feet on the staff-gage at Site D is the approximate level above which flooding is expected in the vicinity of Site E.

The slope of the water surface from Site D, to the dam at the northern boundary, Site B, is negligible during periods of little or no flow (all boards on dam). This relation is demonstrated by a comparison of elevations of water levels on figure 5 at the two sites during late December 1965. Removal of the two rows of flashboards increases the fall to at least 1-1/2 feet during periods of discharge of more than 200 cfs, even when the concrete crest is submerged. This relation is shown by a comparison of elevation of water levels at the two sites from August 15 to 26, 1966.

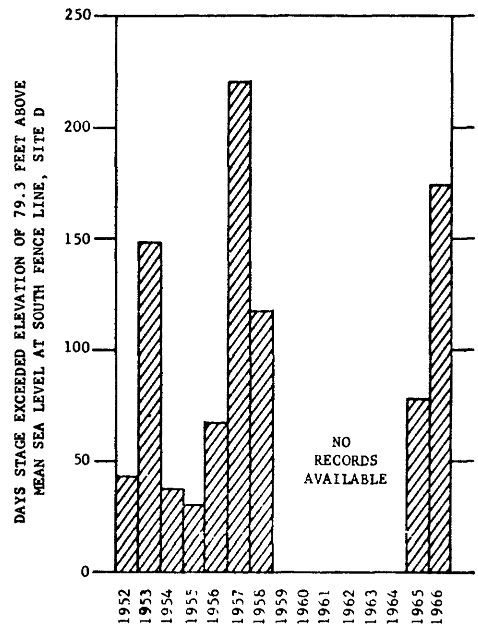
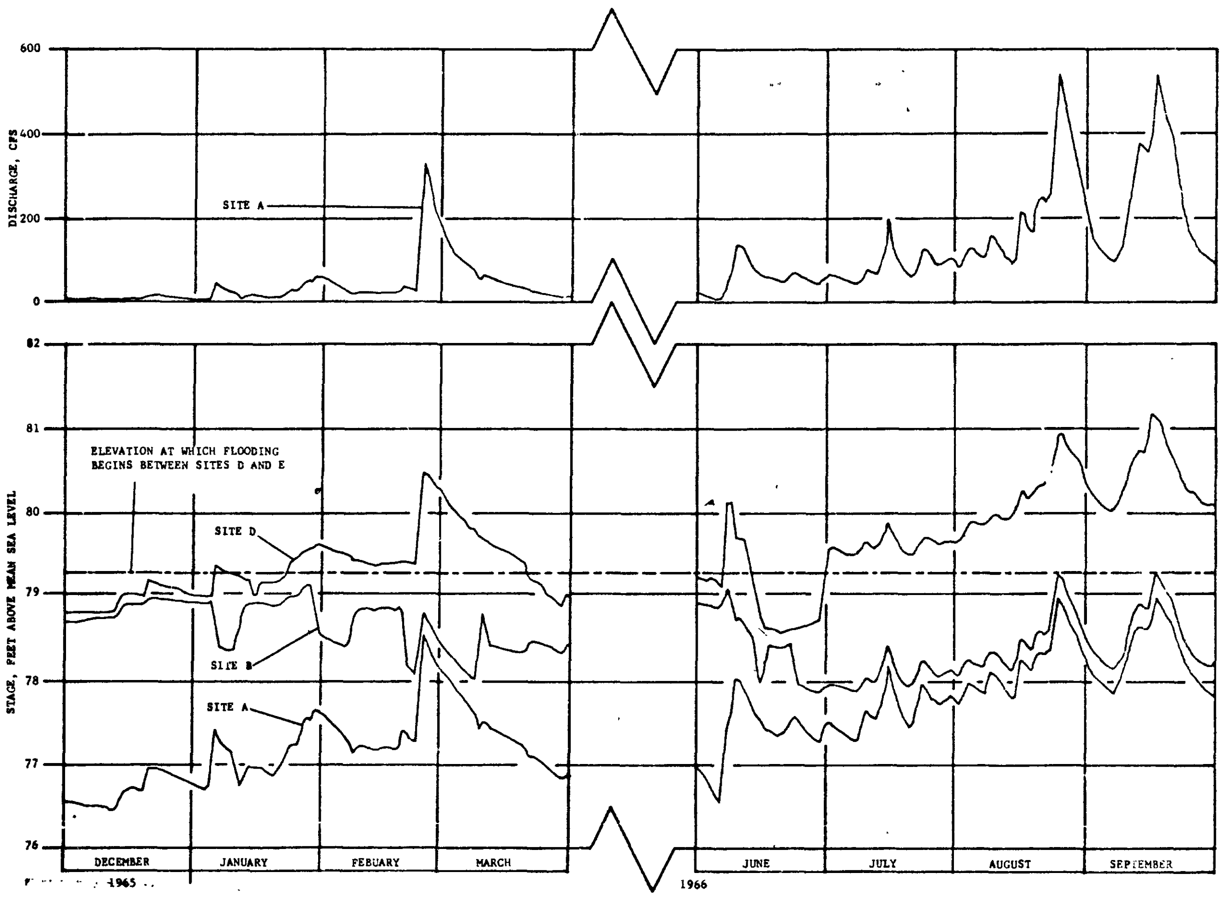


Figure 3. Days of flooding between Sites D and E.

Figure 4.--Scene looking southeast from east end of bridge at Site E indicating beginning of flooding on low lying pasture, July 11, 1967. Gage height at Site D, 17.1 feet or elevation 79.4 feet above msl.



All boards found in on Dec. 16

Boards removed Jan. 4

Boards placed Jan. 10

Boards removed Jan. 29

Boards placed Feb. 6

Boards removed Feb. 19, 23

Boards placed Mar. 9

Boards removed Mar. 10

Assumed all boards in place June 1

Boards removed June 8

Boards placed Jan. 10

Boards removed Jan. 16

Boards removed June 23, Assumed all out

Dam submerged August 15 to August 26

Figure 5. Discharge at Site A, water level of Little Charley Bowlegs Creek at Sites A, B, D, and flashboard regulation at control, Site B.

Profiles of the water surface for selected highwater periods are shown in figure 6. The increase in slope at Sites D, C and B indicates that flow at these sites was free of backwater affect.

Profiles of the water surface for a selected low-water period are also shown in figure 6. The profile shown for April 30, 1968 represents conditions near the end of an extended drought; with all boards on the dam; and with leakage through the boards only. The profile for 10:00 a.m. May 16, 1968, represents conditions after some rainfall at the end of the drought with all boards on the dam, and leakage only (estimated 0.1 cfs). All boards were removed from the dam and both 24 inch gated culverts (invert elevation 75.8 feet msl) were opened at 10:00 a.m. May 16, 1968. The profile for 4:00 p.m. May 17, 1968 represents conditions thirty hours after boards were removed from the dam and gated culverts were opened and immediately before all boards were placed on the dam and culvert gates were closed. The stage at Site B fell 1.07 feet while the stage at Site E fell only 0.02 foot. This comparison of profiles for May 16 and 17 shows that manipulation at the control structure (Site B) has little or no effect on stages at Site E.

Analyses of the plot of streamflow measurements on the high-water rating for the station at Site A show that the channel constrictions downstream from the dam at Site B cause no detectable backwater during periods of flooding. In August 1966, when the discharge exceeded 500 cfs with no flashboards in the dam, the head difference between Sites A and B was only 0.2 foot. This observation indicates that flood heights between Sites B and C are not significantly affected by the dam without the flashboards in place.

On July 11, 1967, the channel of Little Charley Bowlegs Creek within the park was inspected for constrictions which might cause backwater, and none were observed. In addition, cross sections of the channel were made at Sites B to E (fig. 7). These sections show that the area of the channel markedly increases downstream from Site E. In the reach extending a half mile upstream from Site D to the park limits, the channel is improved and has no constrictions that would cause backwater (fig. 8). The channel for another half mile or more upstream is badly chocked by hyacinths and brush (fig. 9). Similar channel conditions continue farther upstream to a point near and south of Site E (figs. 10 and 11). However, just downstream from Site E the channel is only moderately clogged by vegetation.

Observations of flow conditions at Site D on February 25, 1966, also show that the constriction of the bridge opening does not cause backwater. On this date the discharge at Site B was 250 cfs, and flow was observed through only half the width of the bridge opening. However, in spite of this unimpeded discharge at Site D, land owners upstream near Site E experienced flooding.

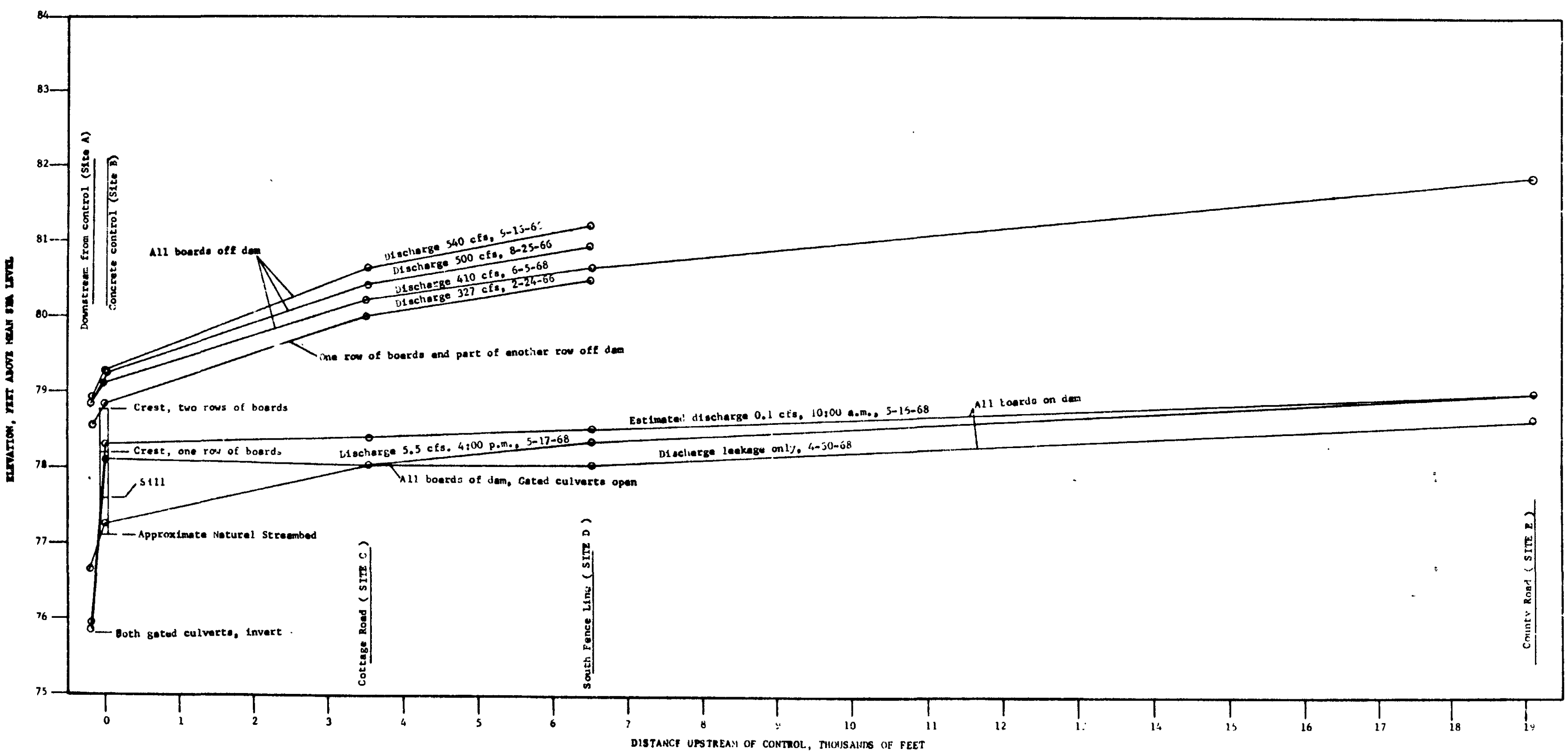


Figure 6. Selected water surface profiles

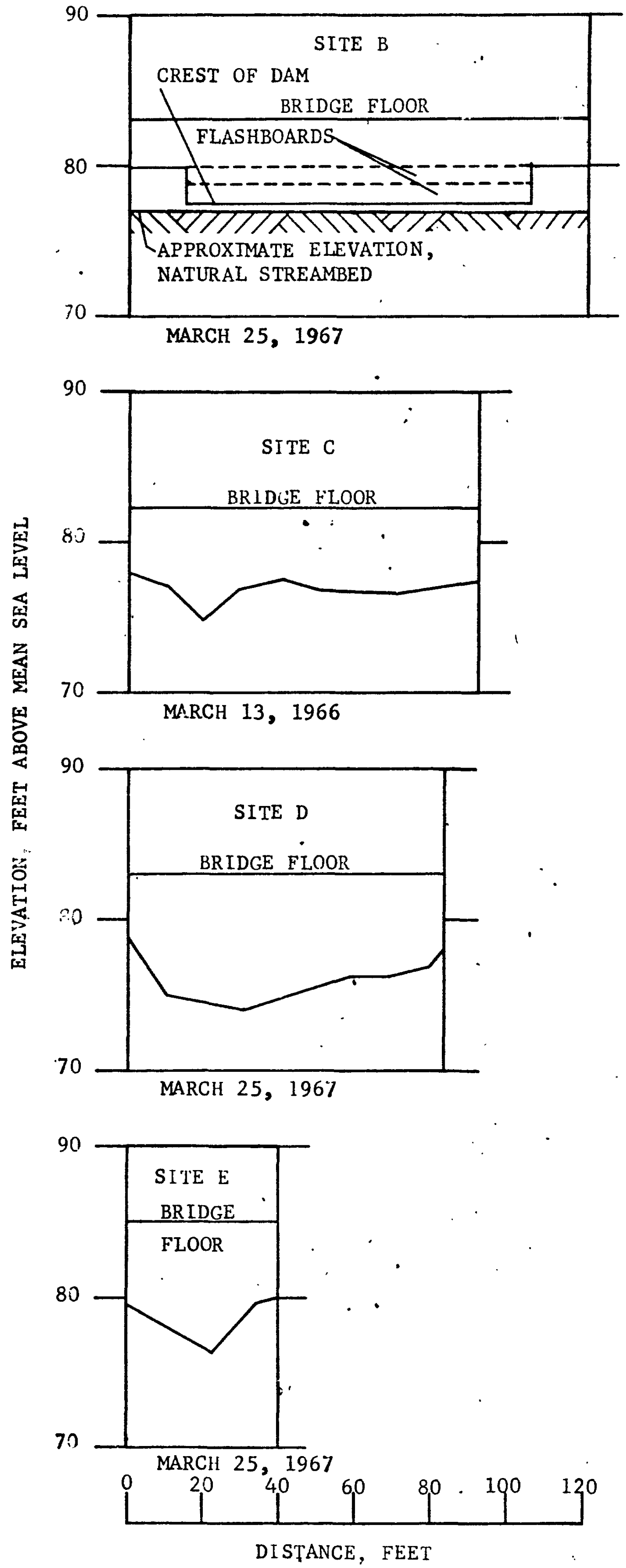


Figure 7. Cross-sections of creek channel at Sites B-E.

Figure 8.--Scene looking upstream from Site D, March 25, 1967. Note the improved channel with no observable constrictions in the half mile reach upstream from Site D.

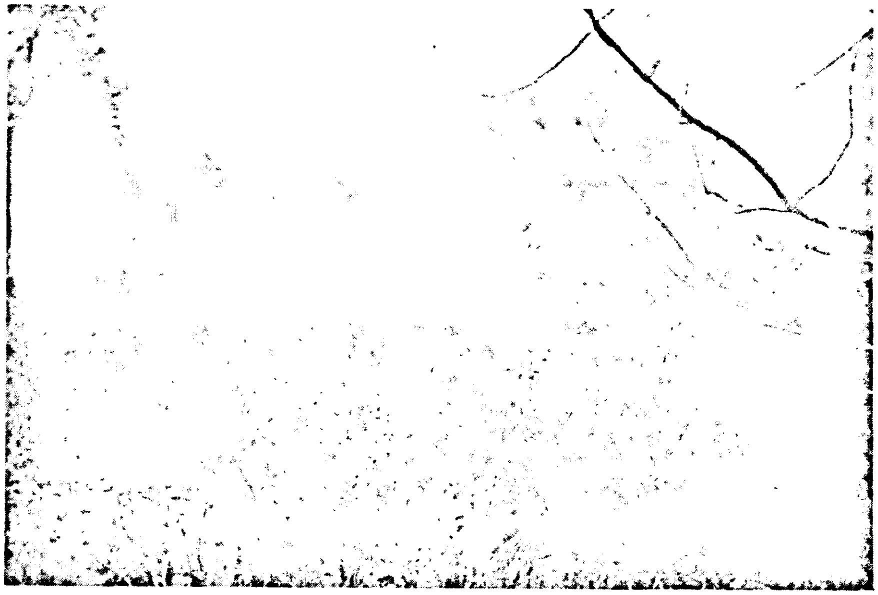


Figure 9.--Scene looking downstream, about halfway between Sites D and E, March 25, 1967. Note the channel almost completely choked by vegetation.

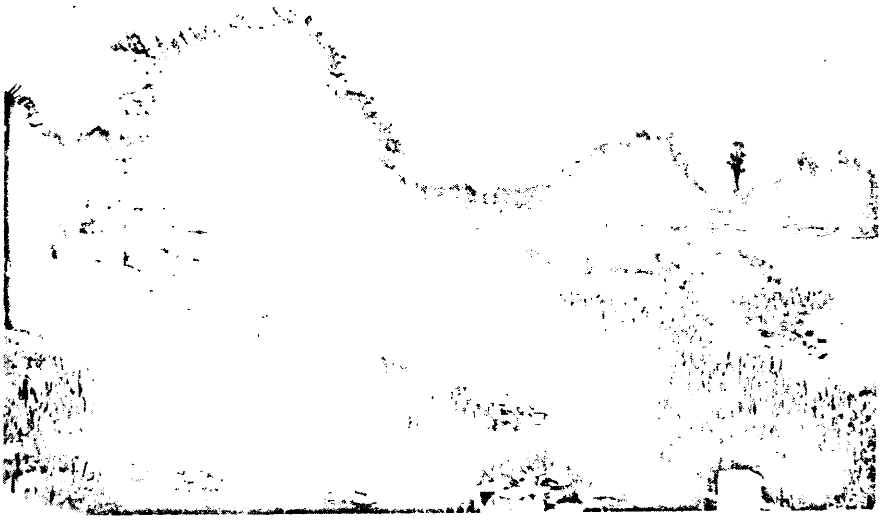


Figure 10.--Scene looking southward or upstream from Site E, July 11, 1967. Note the extreme clogging of channel by vegetation.

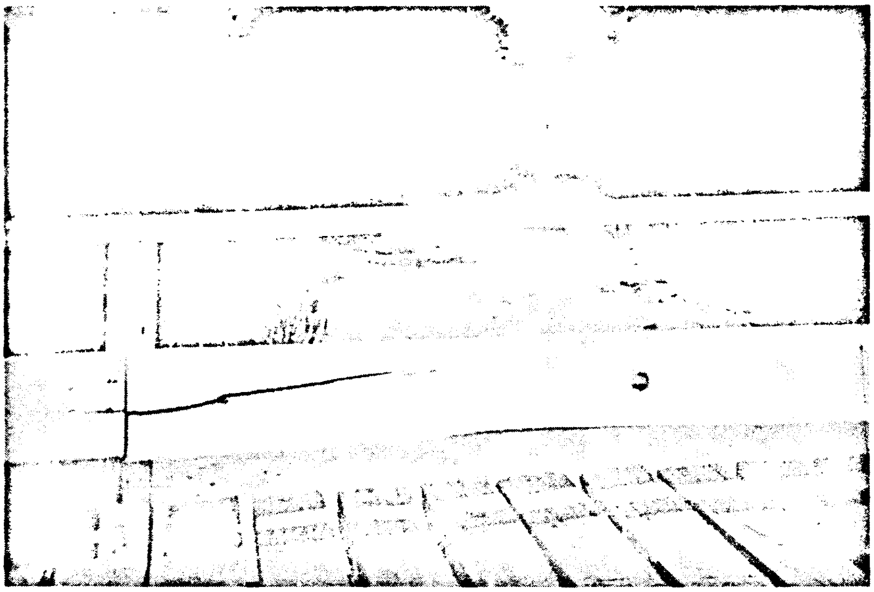


Figure 11.--Scene looking northward or downstream from Site E, March 25, 1967. Note the channel, moderately clogged by vegetation.

HYDROLOGIC CRITERIA FOP CONTROL OPERATION

The following suggested schedule for operation of flashboards on the dam was developed from hydrologic criteria previously described.

1. In wet periods when the water level at the staff gage at south fence line, Site D, reaches 17.0 feet gage reading, or 79.3 feet msl, the top row of flashboards should be removed from the concrete dam at Site B to drain water from the park. Prior to or following heavy rains when the water level at the south fence line, Site D, is anticipated to rise or is rising and it is apparent that the 17.0-foot gage reading will be reached, the top row of boards should be pulled prior to reaching 17.0 feet. The water level at Site D should fall 0.1 to 0.5 foot in a day unless flooding occurs upstream. If the water level as indicated by the staff gage at Site D does not decline and continue to decline, the bottom row of boards on the dam should be removed.

2. When the water level at Site D declines to 16.0 feet, and water has drained from the lowlands near the county bridge, Site E, the bottom row of flashboards should be placed on the dam to conserve water for use by the unusual plant life preserved in the park. The water level at Site D should rise to 16.5 feet within several days and continue to rise. If the desired height is not reached, the top row of flashboards should be placed on the dam.

3. In general, flashboards should be placed on the dam at the end of wet periods in November or December and should not be removed until the rainy season begins about June, except when unseasonally heavy rainfall causes the condition given in item 1. Every effort should be made to conserve water during the dry period, December to June.

CONCLUSIONS

The field observations and data presented permit the following conclusions with respect to the problem of flooding:

1. The concrete dam (with flashboards in place) creates a nearly level conservation pool within the park during low water. The shape of the high-water profiles indicate that little or no backwater from the dam (without flashboards) extends beyond the park boundary during flood stages.

   The lowlands upstream from the park form a broad, flat marsh that would experience flooding following heavy rains even if there were no dam.

Based on the above conclusions it is apparent that the "Remarks" paragraphs in "Surface Water Records of Florida, Volume I: Streams" for the water years 1965 and 1966 are somewhat in error for Sites C and D. Regulation of stages at these sites applies only to low flow.

2. The channel downstream from the control does not cause sufficient backwater to reduce the slope between south fence line and north fence line even in periods of discharge when the control crest is submerged.

3. No channel constrictions occur within the park which would cause backwater in the park or on the lowlands upstream from the park. The bridge opening in the road fill at the south fence line at Site D adequately carries flood flows and causes no backwater.

4. The channel upstream from the south park boundary is inadequate to convey flood flows to the park because of: (1) its lack of adequate slope, (2) its small cross-sectional area, and (3) its clogged condition due to vegetation (1967). Flooding of lowlands upstream from the park is attributable chiefly to these factors.