BLACK CREEK BASIN

LAKE ASBURY DAM
CLAY COUNTY, FLORIDA
INVENTORY NUMBER FL150

PHASE 1 - INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

PREPARED BY
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

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PREFACE

This report is prepared under guidance contained in Department of the Army, Office of the Chief of Engineers, Recommended Guidelines for Safety Inspection of Dams, for a Phase I Investigation. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. Additional data or data furnished containing incorrect information could alter the findings of this report.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

LAKE ASBURY DAM
PHASE I REPORT
NATIONAL DAM SAFETY INSPECTION PROGRAM

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SECTION I - PROJECT INFORMATION

1.1 General.

a. Authority. The National Dam Safety Inspection program, of which the inspection of Lake Asbury Dam is a part, was authorized by Congress in the National Dam Inspection Act (PL 92-367) passed in August 1972. This act authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of safety inspection of dams throughout the United States.

b. Purpose of Inspection. This inspection provides for the evaluation of the general condition of Lake Asbury Dam to determine if it constitutes a hazard to human life or property.

1.2 Description of Project.

a. General. Lake Asbury Dam, also known locally as North Dam, is the longest and the most northerly of four related dams. The other three cross distinct streams tributary to the pool impounded by Lake Asbury Dam. An aerial photo is shown on plate 2.

b. Description of Dam and Appurtenances. Lake Asbury Dam is a rolled earthfill dam approximately 31 feet high and 1,600 feet long. An unpaved public road runs along its crest which is about 38 feet wide.

Provisions for water level control consist of an overflow spillway and two drop-inlet c.m.p. culverts. The spillway is an ungated 3-barrel concrete box culvert.

c. Location. The dam is located on the right (south) bank of Black Creek about 2.75 miles below the confluence of North Fork and South Fork. The site is roughly two miles east, and a little south, of Middleburg, Florida.

d. Size Classification. The dam is in the "intermediate" size category. This classification, which is not justified by the height of the dam, is barely justified by the storage capacity.

e. Hazard Classification. A "high" hazard classification has been assigned to the dam due to hazard potential only slightly above the minimum associated with this classification.

f. Ownership. Lake Asbury Lakelot Owners Association is the principal owner. Battery Bluff Partnership, Limited, owns part of the north side of the dam. Clay County has right-of-way for a road along the crown. Should any modification to the dam be contemplated, complications could arise due to need for concurrence of the owners.

g. Purpose of Dam. Real estate development.

h. Design and Construction History. Lake Asbury Dam was designed and built for Asbury Realty Company. The object was to enhance real estate values. The design engineer was Dole Kelly. The dam was built by Carraway Construction Company under supervision of L. Orlando Rowland, geologist. The dam was completed about 1965. Plans and other documents relating to design and construction do not seem to be available. Information was obtained by field observation and by questioning representatives of Asbury Realty Company and of Lake Asbury Lakelot Owners Association (now principal owner of the dam). Mr. Carraway is deceased, and his construction firm no longer exists. Personnel at Asbury Realty Company said that, upon first raising of the pool, excessive leakage from the pool occurred in an area where limestone had been exposed by borrowing of the overburden for dam construction. The pool was drained. The exposed limestone was then grouted and covered with a blanket of clay.

i. Normal Operational Procedures. See Section 3, "Operational Procedures."

1.3 Pertinent Data.

As plans for this dam were not located, much of the following information is estimated or based on field measurements or office computations.

a. Drainage Areas. The total drainage area of the North Dam is 3.44 square miles. The three separate upstream dams control 2.52 square miles, leaving a 0.92 square mile local area for the North Dam. Included in the 2.52 square mile area is a swampy 0.44 square mile area upstream of Lake Ryan which can contribute runoff under some conditions.

b. Discharge at Damsite. No discharge measurements are available.

c. Reservoir. An area-capacity curve is shown on plate 4.

	ELEVATION FEET, M.S.L.	POOL AREA ACRES	STORAGE CAPACITY ACRE-FEET
Top of dam (low point)	29.1	127	1,670
Overflow spillway crest	25.9	108	1,300
Overflow culvert risers	25.0	99	1,220
Normal pool	25.0	99	1,220

(1) Reservoir length (ft.): 4,700.

(2) Streambed elevation at centerline of dam (ft., m.s.l.): minus 2.

(3) Maximum tailwater elevation (ft., m.s.l.): 7.

d. Outlet Structures.

(1) Spillway. This is a multiculverted chute spillway for discharging flood water from the lake into Black Creek. Pertinent spillway data obtained by field measurements are shown below:

(a) Crest shape	Broad-crested
(b) Crest elevation (ft., m.s.l.)	25.9
(c) Number of discharge bays	3
(d) Size of box culverts (w.x.h.)	8 x 4.75
(e) Net crest length (ft.)	24
(f) Total width of spillway (ft.)	25.3
(g) Gates	None
(h) Stilling basin	None

(2) Drop-inlet Culverts -

(a) Type - corrugated metal pipe.

(b) Number of pipes 2

(c) Diameter size (in.) 24

(d) Length (ft.) 170

(e) Primary control - overflow into riser:

1 Size of riser (dia. - in.): 42.

2 Type of riser: Corrugated metal pipe.

3 Size of trash rack (dia. - in.): 72. (Note: see detail of typical culvert and trash rack on plate 3.).

(f) Auxiliary Control: Vertical slide gate (hand operated).

(3) Discharge Rating Curve: A discharge rating curve for the outlet structures was not available. A curve developed by District personnel is shown on plate 5.

e. Dam.

(1) Type: Earthfill.

(2) Length: 1,600 feet.

(3) Height: 31 feet.

(4) Top width: 38 feet.

(5) Side slopes: 1 vertical on 3 horizontal.

(6) Zoning: The dam was constructed of sandy soil, much of it with varying admixture of clay or silt. The less permeable material was used in a central core.

(7) Keyway: A keyway was excavated in the area of the core and backfilled with core material.

(8) Cutoff: None.

(9) Grout curtain: None.

f. Geology and Soils. The subject damsite lies in the coastal lowlands between the Florida Central Highlands and the Atlantic Ocean. The shallow limestone at the site is a rocky facies of the Hawthorne Formation, underlain by clay to a depth of several hundred feet and overlain by sands. Varying admixtures of clay and silt occur in the sands. The depth and thickness, and even the occurrence, of the shallow limestone are nonuniform.

SECTION 2 - VISUAL INSPECTION AND ENGINEERING DATA

2.1 Findings.

a. General. The dam has been operating at essentially the design waterhead virtually all the time since filling of the reservoir. During the inspection of 15 February 1978, no reason was seen for doubting the soundness of the dam.

b. Dam. All visible evidence indicated that the embankment was generally in very good condition. Only one small hole dug by an animal was noted. A gully in the downstream slope had recently been repaired. To preclude further gullying there, the unpaved road on the crown had been dressed with a slight pitch to direct runoff toward the reservoir. Grass cover on the dam was excellent in most areas. At several spots near the southwest end of the dam, the sod on the downstream slope had been damaged by vehicles (probably 4-wheel-drive). There were a few large bushes and small trees on the embankment. The two c.m.p. culverts pass through the dam where it crosses old streambeds near the ends of the alinement. One slightly soft moist spot was found at the toe of the downstream slope. That spot was just southwest of the southwesterly culvert. There was no visible emergence of seepage. A very low timber retaining wall ran along the toe of the dam in the vicinity of the northeasterly culvert.

c. Outlet Structures.

(1) Spillway. The ungated spillway to provide for high-level discharge is a 3-barrel concrete box culvert. The openings are 8 feet wide and 4.75 feet high, with invert elevation of 25.9 feet, m.s.l. The roof slab of the culvert serves as a bridge. There are two short concrete wingwalls upstream and a concrete liner slab between the wingwalls. Downstream there is a chute channel which consists of concrete inverted T-walls at the sides and a 3-inch-thick sand-cement floor. The chute channel extends to the downstream toe of the dam on the same slope as the dam's face. About 30 feet from the culvert, the sand-cement floor had been repaired in a small area approximately 4 feet by 8 feet in extent. Local residents said that a drain was installed in that area to relieve hydrostatic pressure that had damaged the floor of the chute. Three buried plastic tubes lead from the drain to the lower extremity of the chute where the ends of the tubes are draped over the southwest side wall. Clear water was flowing from those tubes.

The chute's side walls extend about 20 feet along the edges of the discharge channel. In that reach, their tops are horizontal. Probing along the walls with a stick revealed soil in the channel bottom. The water depth was about 3 to 4 feet. It is not known if any provisions have been made for dissipating the energy of discharging water or for preventing erosion from undermining the end of the chute. The culvert structure and chute appeared to be in good condition.

(2) Drop-inlet Culverts. The two culverts are alike. Pertinent dimensions are shown on plate 3. At the downstream end of the northeast culvert, a timber support had collapsed and the pipe lay on the ground. The resulting slight bend in the c.m. pipe did not appear to be detrimental. Local residents said that the vertical slide gate at the upstream end of the culvert had been removed for repair and temporarily replaced with a cone plug. At the time of the inspection, the pool water level was 0.67 feet below the normal elevation of 25. That was due to discharge controlled by the slide gate of the culvert near the southwest end of the dam. At that culvert, no defects were noted. Both culverts appeared to be in satisfactory condition.

d. Reservoir Area. The reservoir shoreline is residential and largely developed. The lake is used for boating, fishing, and related activities. In most places along the shoreline, the land slopes are gentle.

e. Downstream Channels. The three outlet structures communicate with Black Creek via separate channels. Those channels appeared open and exhibited no significant erosion. This is consistent with the small flows that can be accommodated by the c.m.p. culverts, and with complete absence of spillway discharges (according to local residents).

2.2 Evaluation.

a. System Operation Reliability. Neither the drop-inlet culverts nor the ungated spillway require any control for proper operation. According to local residents, the c.m.p. culverts alone have proven adequate to control the pool level throughout some 13 years since the dam's construction. Reliability of the system, in the event of a severe storm, could be improved by better provisions to preclude clogging of the outlet structures by debris.

b. Erosion. The grass cover on the dam is providing excellent protection from erosion. Operation of vehicles on the downstream face of the dam--if allowed to persist--could severely damage the sod and thereby render the dam highly susceptible to erosion. A recently repaired gully on the downstream face apparently was due to runoff from the crown. Recurrence of such gullys could be avoided by maintaining on the crown a grade that assures drainage toward the reservoir. Trees and large bushes are not desirable on a dam; they should be removed.

c. Slope Protection. There is no evidence of damaging wave attack on the upstream face of the dam. Apparently the small fetch of the reservoir results in low waves, and the vegetation is providing adequate protection.

d. Seepage. The drain beneath the spillway chute slab appears to be functioning adequately. The moist spot near the southwesterly culvert does not appear to present any threat to the dam. Currently there is no evident cause for concern about seepage. However, any evidence of changing seepage would merit prompt attention.

e. Outlet Structures. The spillway and the drop-inlet culverts appear to be serviceable. They could accommodate much more intense storms than those they have experienced. Upon completion of northeast culvert slide gate repairs, both culverts will be available for lowering the pool, should occasion arise. The owner should investigate possible need to provide for energy dissipation and/or erosion protection at the lower end of the chute.

SECTION 3 - OPERATIONAL PROCEDURES

3.1 Procedures. The reservoir is operated as a residential lake and normally maintained at elevation 25 feet, m.s.l. Flood flows are automatically taken by overflow facilities, so that no flood operation is normally required. The pool level can be lowered by submerged slide gates if desired. That is occasionally done for weed control (Elodea). The pool could be drained to about elevation 2 feet, m.s.l., by use of the slide gates.

3.2 Maintenance of Dam. There are no written regular procedures for routine maintenance of the earth embankment. The dam appeared to be well maintained. The local residents frequently use the road along the crown of the dam. Apparently they do a good job of noting occasions for maintenance and reporting same to the owner--Lake Asbury Lakelot Owners Association--for appropriate action. Clay County maintains the road that crosses the dam.

3.3 Maintenance of Operating Facilities. Routine maintenance is limited to clearing trash from the culvert risers and trash guards, and checking operation of the slide gates.

3.4 Description of Warning System. As flood flows are normally handled automatically and normal flood discharges do not cause downsteam damage, there is no warning system.

3.5 Evaluation. The current operational procedures appear to be generally adequate.

SECTION 4 - HYDRAULIC/HYDROLOGIC

4.1 Evaluation of Features.

a. Design Data. The North Dam, as well as the other three dams in the Lake Asbury system, were reportedly designed for the 100-year flood. Flood analysis indicates that the system can handle the 100-year flood.

b. Experience Data. There are no gages or gaging records for the dam. No discharge measurements are available for the site. Local residents report that water has never flowed over the overflow spillway since construction of the dam about 13 years ago.

c. Overtopping Potential. The North Dam is of intermediate size and is in the high hazard category. The Hydrologic Evaluation Guidelines recommend a spillway capacity for the probable maximum flood. Routings were done for the entire four reservoir system using the Corps of Engineers HEC-1 program with runoff computation by Soil Conservation Service methods. The following flood were analyzed:

100-year flood
1/3 probable maximum flood*
1/2 probable maximum flood*
probable maximum flood

*(On basis of rainfall).

Where capacity of upstream dams was exceeded, overtopping without embankment failure was assumed for the purposes of routing computations only. The 100-year flood rainfall was from U. S. Weather Service TP-40 and PMF (probable maximum flood) rainfall was from U. S. Weather Service draft Hydrometeorological Report No. 51. Soil Conservation Service Curve Number was 72 and Tc was 2.36 hours (local area).

Following are tabulated results of the above routings for the North Dam.

	FLOOD			
	100-yr.	0.33 PMF	0.5 PMF	PMF
24 hr. rainfall - in.	10.40	15.73	23.55	46.63
24 hr. rainfall excess - in. (local area)	6.85	11.87	19.45	42.27
Peak inflow - c.f.s.	1,044	1,695	5,194	13,192
Peak outflow - c.f.s.	293	840	4,502	12,906
Peak stage - ft.	27.5	29.4	30.6	32.0
Dam elev. - (low pt.)	29.1	29.1	29.1	29.1
Freeboard - ft.	1.6	None	None	None
Overtopping - ft.	None	0.3	1.5	2.9

As indicated, the probable maximum flood would overtop the dam by as much as 2.9 feet. The dam could be expected to take the 100-year flood without overtopping and perhaps could contain a somewhat larger flood.

d. Probable Maximum Flood (Definition). The probable maximum flood is that flood discharge which would result from the most severe combination of critical meteorological and hydrologic conditions that are reasonably possible in the region. Since there is great uncertainty in estimating potential extreme hydrologic magnitudes, a considerable amount of judgment is required to estimate that flood, especially when detailed investigations are not done. Nevertheless, the resulting flood must be one that the engineer considers is virtually impossible of exceedence, because the flood is ordinarily used to assure the integrity of a dam whose failure would cause loss of life and major property damage that would not occur under natural conditions. If the consequence of failure is not disastrous, it is not always economically feasible to protect against that flood and it may not be applicable. Probable maximum flood estimates are applicable to projects where consideration is to be given to virtually complete security against potential floods or dam failures.

e. Consequences of Upstream Dam Failure. There are three dams upstream of the North Dam. Any failure of an upstream dam would increase the possibility of a failure of the North Dam, the impact being primarily dependent upon the rapidity of the upstream failure and the rate at which the extra volume of water in storage spilled. Considering an upstream structural failure during a nonflood period with a normal water level at the North Dam; because of small storage volumes in Lake Ryan and Lake Larc reservoirs, the North Dam reservoir might be able to contain water spilled from a failure of either of those two dams. The situation is different in regard to the South Dam. Failure of the upstream South Dam and its emptying within a period of 16 hours or less would almost surely cause an overtopping failure of the North Dam, regardless of other inflows. The practical conclusion to be made is that a conceivable failure of the South Dam (as it would probably cause emptying in significantly less than 16 hours) is potentially much more serious to the North Dam than a failure of one of the other upstream dams. As an overtopping failure of any upstream dam would likely occur during a major storm over the entire reservoir system, the North Dam could be expected to be concurrently at a high stage with less reserve storage and much more vulnerable to its own failure due to a spill from any upstream failure.

SECTION 5 - STRUCTURAL STABILITY

5.1 Embankment.

a. Visual Observations. No evidence was seen of any movement or instability of the embankment. For details of visual inspection see paragraph 2.1.

b. Design and Construction Data. No documents relating to design or construction of the dam could be found.

c. Seismic Stability. The dam is located in Seismic Zone 1, where the appropriate seismic coefficient is 0.025. A meaningful stability analysis--with or without this coefficient--can not be performed now due to lack of data. The pertinent data could be obtained by a program of field sampling and laboratory testing as part of a Phase II investigation, should such an investigation be found advisable. In view of the kind of materials used for construction, the dam appears to be of conservative design. It is considered virtually certain that the seismic stability of the embankment is adequate.

5.2 Spillway. The subject dam has a concrete box culvert for a spillway. Based on the visual inspection, it was not found necessary to perform a stability analysis since the box culvert is not subject to any loads tending to displace it.

SECTION 6 - ASSESSMENT/REMEDIAL MEASURES

6.1 Dam Assessment.

a. Safety. Lake Asbury Dam is considered to be unsafe. The Hydrologic Evaluation guidelines recommend a Spillway Design Flood (SDF) equal to the Probable Maximum Flood (PMF) for dams with "High" hazard and "Intermediate" size classifications. Lake Asbury Dam could probably withstand a flood somewhat larger than the 100-year flood--for which it reportedly was designed. It would be overtopped by 1/3 PMF. Overtopping is considered to result in embankment failure.

b. Adequacy of Information. Although documents pertaining to design and construction are not available, much pertinent information could be reasonably estimated from field measurements, office computations, and general familiarity with soils occurring in the area. In view of the conservatively flat slopes of the earth embankment, the available information is considered adequate for purposes of this report.

c. Urgency. In the near future action should be taken to perform the remedial measures proposed below.

d. Necessity for Phase II. No futher investigation is considered necessary to assess the safety of the dam.

6.2 Remedial Measures.

a. Alternatives. As stated in paragraph 6.1, this structure does not meet recommended safety criteria and therefore needs modification or removal.

(1) Additional Outlet. To protect against overtopping from PMF conditions, additional outlet capacity should be provided. Construction of an additional overflow spillway would substantially decrease the chance of the dam's being overtopped during a severe flood. Compliance with the recommendation that the SDF equal the PMF would be achieved only by provision of greatly enlarged spillway capacity, though other measures considered below would help.

(2) Dam Crest. The crest could be brought up to a uniform elevation. That change would increase the pool elevation required for overtopping of the dam; it would also increase flow capacities of the outlet structures.

(3) Drop-inlet Culverts. A floating debris barrier encompassing the existing trash rack and extending about 10 or 15 feet from the riser could be constructed at each culvert. That would increase the probability that the culverts would perform adequately during floods.

(4) Spillway. A semicircular floating debris barrier could be installed in front of the spillway approach where no provision has yet been made for excluding debris. That would increase the probability that the spillway would perform adequately during floods.

b. Operation and Maintenance Procedures.

(1) Maintenance.

(a) Grass. It is important that the grass cover on the dam be kept healthy and that it be mowed regularly. This would guard against erosion and facilitate observation of the condition of the dam's surface.

(b) Barriers. Unauthorized vehicles must be excluded from the face of the dam by installation and maintenance of suitable barriers.

(c) Seepage. It would be prudent periodically to make and record observations so that any change in seepage would be detected.

(1) Drain. Seepage collected by the drain beneath the chute slab dishcarges through plastic tubes draped over a sidewall. The flow rate could easily be measured by timed filling of a suitable container.

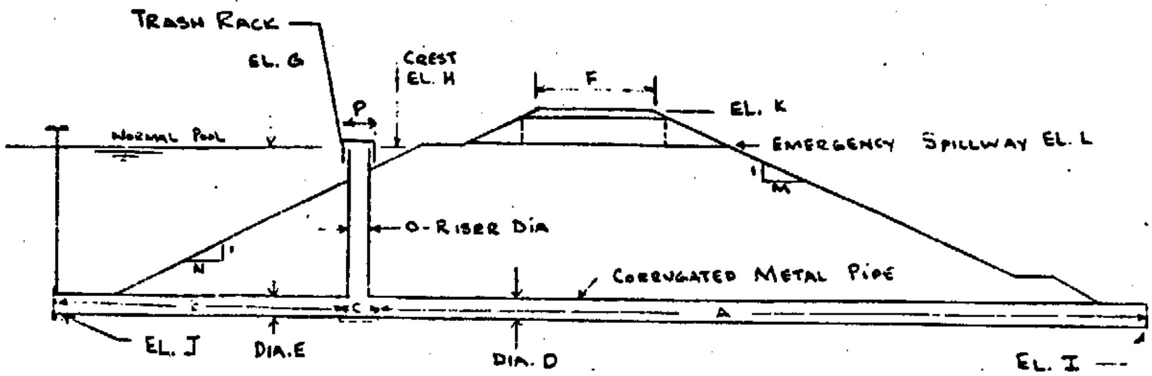
(2) Toe of Dam. Any emerging seepage, or soft wet spots, in the vicinity of the toe could readily be detected by an observer traversing the area on foot.

(d) Spillway Approach. The approach to the spillway should periodically be cleared of any debris or rank vegetation.

(2) Operating Procedures. Establish a procedure for partial drawdown of the pool in the event of a major storm warning. The additional flood storage could prove valuable.

SECTION 7 - LIST OF PERTINENT REPORTS

No pertinent reports are available.



TYPICAL OUTLET DETAIL

* DIMENSION		NORTH DAM	SOUTH DAM	LAKE LACS DAM	LAKE RYAN DAM
SYMBOL	DESCRIPTION				
A	LENGTH OF PRIMARY CULVERT - FT	170	160	80	120
B	LENGTH OF DRAWDOWN CULVERT - FT	63	60	39	65
C	TRANSITION - FT	10	10	10	10
D	DIA. OF PRIMARY CULVERT - INCHES	24	36	36	24
E	DIA OF DRAWDOWN CULVERT - INCHES	24	30	30	24
F	TOP WIDTH OF DAM - FT.	38	37	29	23
G	NORMAL POOL EL. FT. M.S.L.	25	45	39	50
H	RISER CREST EL. FT. M.S.L.	25	45	39	50
I	DOWNSTREAM CULVERT INVERT - FT. M.S.L.	1.0	22	24	[illegible]
J	UPSTREAM CULVERT INVERT - FT. M.S.L.	2.0	23	25	28
K	EL. TOP OF DAM - FT. M.S.L.	29.1	49.0	42.1	55.9
L	EL. SPILLWAY CREST - FT. M.S.L.	25.9	—	—	—
M	DOWNSTREAM EMBANKMENT SIDE SLOPE	3	3	2.5	2
N	UPSTREAM EMBANKMENT SIDE SLOPE	3	3	2.5	—
O	DIA. OF RISER PIPE - INCHES	42	66 TO 48	54	60
P	DIA OF TRASH RACK - INCHES	72	108	72	84
	LENGTH OF DAM - FT	1600	950	350	250
	HEIGHT OF DAM - FT	31	30.5	20	29

* DIMENSIONS AND ELEVS SHOWN ARE APPROXIMATE AND ARE BASED ON FIELD OBSERVATIONS OR ESTIMATES.

PLATE 3

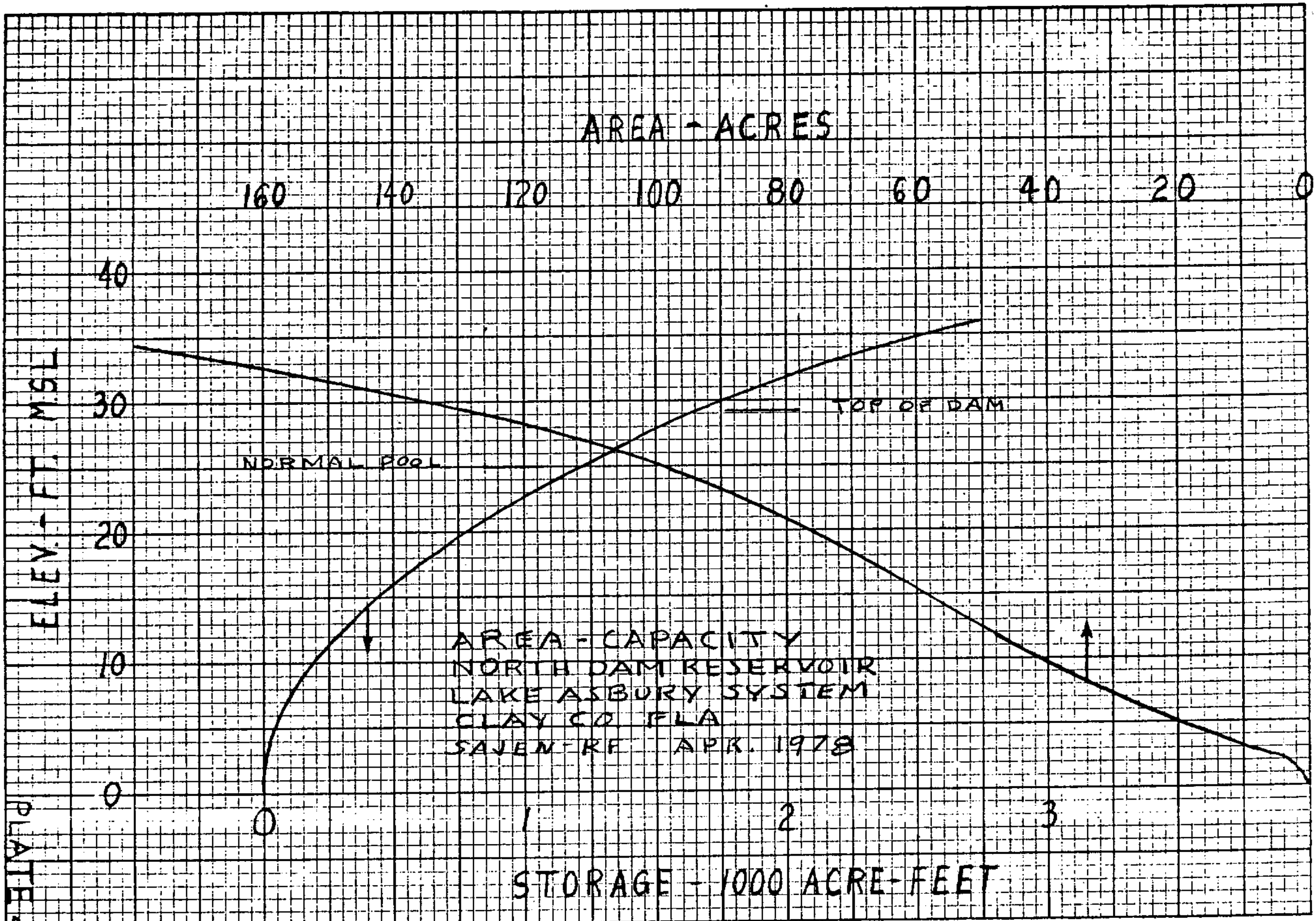
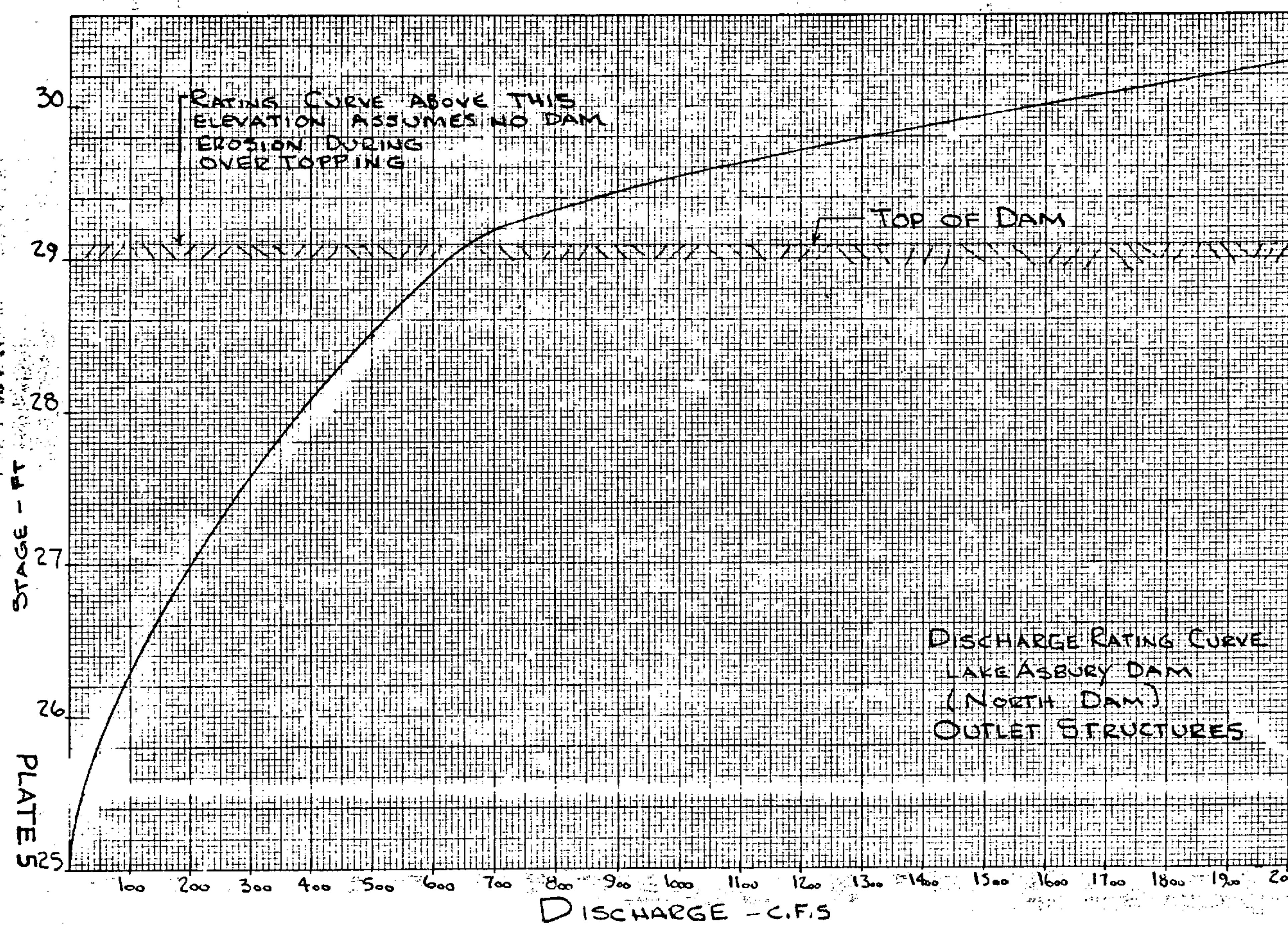

AREA - ACRES
160
140
120
100
80
60
40
20
0
ELEV.- FT. MSL
40
30
20
10
0
TOP OF DAM
NORMAL POOL
AREA - CAPACITY
NORTH DAM RESERVOIR
LAKE ASBURY SYSTEM
CLAY CO. FLA.
SAJEN-RF APR. 1978
0
1
2
3
STORAGE - 1000 ACRE-FEET

PLATE 4



RATING CURVE ABOVE THIS ELEVATION ASSUMES NO DAM EROSION DURING OVER TOPPING
TOP OF DAM
DISCHARGE RATING CURVE
LAKE ASBURY DAM
(NORTH DAM)
OUTLET STRUCTURES
STAGE - FT
25
26
27
28
29
30
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
DISCHARGE - C.F.S

PLATE 5