

BLACK CREEK BASIN

**SOUTH LAKE ASBURY DAM
CLAY COUNTY, FLORIDA
INVENTORY NUMBER FL 153**

**PHASE 1 - INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM**



**PREPARED BY
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
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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.

SOUTH LAKE ASBURY DAM
PHASE I REPORT
NATIONAL DAM SAFETY INSPECTION PROGRAM

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PHASE I - INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

NAME OF DAM: SOUTH LAKE ASBURY DAM

ID NUMBER: FL 153

SECTION I - PROJECT INFORMATION

1.1 General.

a. Authority - The National Dam Safety Inspection program, of which the inspection of South 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 South Lake Asbury Dam to determine if it constitutes a hazard to human life or property.

1.2 Description of Project.

a. General. South Lake Asbury Dam -- also known locally as South Dam -- is the largest of three dams across distinct tributaries to the pool impounded by Lake Asbury Dam. An aerial photograph is shown on plate 2.

b. Description of Dam and Appurtenances. South Lake Asbury Dam is a rolled earthfill dam approximately 30.5 feet high and approximately 950 feet long. An unpaved public road runs along its crest which is about 37 feet wide. The water level in the pool is controlled by a drop-inlet c.m.p. culvert.

c. Location. The subject dam is located about 0.9 mile south of Lake Asbury Dam, which is situated on the right (south) bank of Black Creek some 2.75 miles below the confluence of North Fork and South Fork. The site of South Lake Asbury Dam is roughly 2 miles east, and 1 mile south, of Middleburg, Florida.

d. Size Classification. The "intermediate" size classification of South Lake Asbury Dam is justified by the reservoir capacity, but not by the dam height.

e. Hazard Classification. A "high" hazard classification has been assigned to South Lake Asbury Dam. This is due, in part, to the probability that any failure of the subject dam could precipitate failure of Lake Asbury Dam, which is situated downstream.

f. Ownership. Lake Asbury Lakelot Owners Association is the owner. Clay County has right-of-way for a road along the crown.

g. Purpose of Dam. Real estate development.

h. Design and Construction History. South Lake Asbury Dam was designed and built for Asbury Realty Company. The object was to enhance real estate values. The design engineer was Mr. James W. Norris. The dam was built by C. H. Barco Contracting Company, under supervision of L. Orlando Rowland, geologist. The dam was completed about 1967. A set of five drawings (plates 6-10), has been obtained from the owner. No further documents relating to design and construction of the dam seem to be available. Additional information was obtained by field observation and by questioning Mr. C. H. Barco -- the builder -- and representatives of past and present owners -- Asbury Realty Company and Lake Asbury Lakelot Owners Association, respectively. Because insufficient suitable material for core construction was found in the borrow area upstream of the dam, an additional borrow area was found some 700 feet southeast of the east abutment. According to information obtained orally, the low crest elevation at the abutments was intended to provide for grassed depressions that could serve as overflow spillways in an emergency. However, notes on one of the drawings (see plate 8) indicate lower elevation at the abutments due solely to overbuilding of the central part of the dam to compensate for anticipated settlement. Some six months after flooding of the pool, a drain was buried in the downstream slope to control seepage that was emerging at the face of the dam.

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

1.3 Pertinent Data:

Plans for the South Dam were available. (See plates 6-10) The following information is taken from the plans or based on either field estimates and measurements, or office computations.

a. Drainage Area. The total drainage area of the South Dam is 1.51 square miles including the normal pool area of 0.11 square miles. The drainage area extends south to approximately State Road 218.

- b. Discharge at Damsite. No discharge measurements are available.
- c. Reservoir. An area-capacity curve is shown on plate 4.

	<u>Elevation</u> Ft. M.S.L.	<u>Pool</u> Area Acres	<u>Storage</u> Capacity Acre-Feet
Top of dam	49.0	86	1,490
Overflow riser	45.0	70	1,180
Normal pool	45.0	70	1,180

- (1) Reservoir length (ft.): 4,600
- (2) Streambed elevation at centerline of dam (ft., m.s.l.): 18.5
- (3) Maximum tailwater elevation (ft., m.s.l.): 32.0

d. Outlet Structure.

- (1) Spillway: None.
- (2) Drop-inlet Culvert.
 - (a) Type: Corrugated metal pipe
 - (b) Number of pipes: 1
 - (c) Diameter size (inches): 36
 - (d) Length (feet): 160
 - (e) Primary control: Overflow into riser.

1 Size of Riser (diameter/inches): Varies from 48 to 66.

2 Type of Riser: Corrugated metal pipe.

3 Size of Trash Rack (diameter/inches): 108 (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 structure was not available. A curve developed by District personnel is shown on plate 5.

e. Dam.

- (1) Type: Earthfill
- (2) Length: 950 feet
- (3) Height: 30.5 feet
- (4) Top width: 37 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 back-filled 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. At the time of the inspection -- 15 February 1978 -- the dam appeared to be relatively sound.

b. Dam. As no evidence was seen of distortion or distress, the embankment is considered structurally stable. A wave-cut scarp was observed on the upstream slope. Several animal burrows were found on the downstream slope. There was a gully along about the lower third of the junction between the downstream face and the left (west) abutment. Evidently the gully had been formed by runoff. There was continuous flow due to seepage, but no movement of soil could be detected. A soft, very wet strip about one third of the way up the dam's face probably shows the location of the drain that was installed soon after flooding of the pool. Local residents said that the end of the pipe leading from the drain had been damaged by a mowing tractor. The existing end of the 4-inch-diameter pipe discharged into a shallow trench from which the damaged part of the pipe had been removed.

One member of the inspection team -- Harry Whitsett -- visited the dam again on 5 June 1978 to observe erosion reported by a local resident. The area of the reported erosion was about 20 feet west of the east extremity of the dam. It extended from about the centerline of the lime-rock stabilized road to the upstream edge of the crown. The depth of erosion was about a foot. It presented no threat to the integrity of the dam. That erosion was caused by surface runoff from somewhat higher ground to the east. It is a recurring problem that could be eliminated by provision of suitable drainage facilities east of the dam. Eastward from about the dam's midpoint, the road on the crest was sloped to drain to the upper pool. West of the midpoint, the road was crowned and about half the rainfall runoff was directed toward the lower pool. A 3-foot-deep gully had formed on the downstream face about 100 feet from the west end of the dam.

c. Drop-Inlet Culvert. The drop-inlet culvert, together with its slide gate, provides the only reservoir outlet. Pertinent dimensions are shown on plate 3. At the time of the inspection the upper pool was about at its normal 45-foot elevation, and controlled by the overflow riser. The discharge was small -- about 20 c.f.s. The downstream end of the culvert was not completely submerged by the lower pool. There was about a foot of air space. By light entering the riser, one could see through the culvert. It appeared to be essentially straight.

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

e. Downstream Channel. Below the subject dam, the natural stream has been flooded by the pool of Lake Asbury Dam. Thus, the downstream channel is large and unobstructed.

2.2 Evaluation.

a. System Operation Reliability. The drop-inlet culvert does not require any control for proper operation. It has proven adequate throughout some 11 years since the dam's construction. Reliability, in the event of a severe storm, could be improved by better provisions to preclude clogging of the drop-inlet culvert by debris.

b. Erosion. Surface runoff from higher ground to the east, and wave action in the upper pool, can cause erosion affecting the road on the dam's crest. Inconvenience to local residents assures repair of such erosion before it can threaten the dam. The entire crown should be sloped to drain to the upper pool. Any gullies, e.g., the ones observed on the downstream slope and at the left abutment, need prompt repair to prevent them from enlarging and compromising the integrity of the dam. Animal burrows could initiate dangerous subsurface erosion; the burrowing animals should be eradicated. The vegetative cover on the dam is not good. In some places there is a rank growth of blackberries. Water-loving plants grow in the wet areas. A regularly mowed cover of grass would do a better job of holding the soil, and would not obscure the condition of the slope.

c. Slope Protection. The small fetch of the reservoir would result in small waves. Suitable vegetation could provide adequate protection.

d. Seepage. The top seepage line emerges about a third of the way up the face of the dam. Apparently the buried drain removes enough of the seepage to prevent discernible flow at the surface. The functioning of the drain must be considered marginal because it allows seepage to appear at the surface. Emerging seepage tends to promote both sloughing and subsurface erosion, and is therefore very undesirable.

e. Drop-Inlet Culvert. The culvert appeared to be in good condition and functioning adequately.

SECTION 3 - OPERATIONAL PROCEDURES

3.1 Procedures. The reservoir is operated as a residential lake and normally maintained at elevation 45 feet. Flood flows are automatically taken by an overflow standpipe or riser culvert, so that no flood operation is normally required. The pool level could, if desired, be lowered to about elevation 26 by means of a submerged slide gate on the outlet culvert.

3.2 Maintenance of Dam. There are no written regular procedures for routine maintenance of the earth embankment. The local residents make much use of the road along the crown of the dam. When they note occasions for maintenance, they report same to the owner -- Lake Asbury Lakelot Owners Association -- for appropriate action. Clay County maintains the road that crosses the dam. The vegetative cover could be greatly improved by regular care.

3.3 Maintenance of Operating Facilities. Routine maintenance is limited to checking the culvert riser for debris and checking the operation of the slide gate.

3.4 Description of Warning System. The outlet culvert discharges directly into the North Dam pool; so there is no warning system.

3.5 Evaluation. The current operational procedures, except for maintenance of the dam, appear to be adequate. Regular care of the vegetative cover and prompt repair of erosion are needed.

SECTION 4 - HYDRAULIC/HYDROLOGIC

4.1 Evaluation of Features.

a. Design Data. The South Dam, as well as the other three dams in the Lake Asbury system, was 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, and no discharge measurements are available for the site. The outlet culvert has apparently operated satisfactorily during the 11 year history of the dam.

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

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

* (On basis of rainfall.)

Rainfall for the 100-year flood was from U. S. Weather Service TP-40 and PMF rainfall was from U. S. W. S. draft Hydrometeorological Report No. 51. S. C. S. Curve Number was 51 and TC was 3.41 hours.

On the following page are routing results for the South Dam.

	F L O O D			
	100-year	0.33 PMF	0.5 PMF	PMF
24-hour rainfall - in.	10.40	15.73	23.55	46.63
Rainfall excess - in.	3.97	8.14	14.98	36.80
Peak inflow - cfs	715	1,446	2,700	6,310
Peak outflow - cfs	107	628	2,600	6,300
Peak stage - ft.	47.7	49.5	50.1	50.8
Dam elevation - ft.	49.0	49.0	49.0	49.0
Freeboard - ft.	1.3	None	None	None
Overtopping - ft.	None	0.5	1.1	1.8

As indicated, the probable maximum flood would overtop the dam by about 1.8 feet. A flood one-third or one-half of the PMF could also be expected to cause overtopping. Routings indicate that the once in 100 years flood would not cause overtopping.

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.

SECTION 5 - STRUCTURAL STABILITY

5.1 Embankment.

a. Visual Observations. No evidence was seen of any subsidence, cracking, or sliding of the embankment. For details of visual inspection see paragraph 2.1.

b. Design and Construction Data. The available data consists of five drawings (plates 6-10).

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 -- cannot 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.

SECTION 6 - ASSESSMENT/REMEDIAL MEASURES

6.1 Dam Assessment.

a. Safety. South 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. South 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. Available documents pertaining to design and construction consist of just five drawings. However, the information therein was augmented by estimates from field observation and from office computations. In view of the conservatively flat slopes of the earth embankment, the available information is considered adequate for purposes of this report.

Further information regarding the actual existing hazard would be desirable. The "high hazard" classification is based primarily on the location of dwellings downstream of the dam. A better assessment of hazard could be made by checking the elevations of houses below the dam. Failure of the South Dam would affect downstream areas up to some elevation below 49 feet, m.s.l., the height of the dam. The actual elevation is dependent upon the rate of failure. Elevations up to at least 35 or 40 feet m.s.l., could be affected. (10 or 15 feet, at least, above the normal downstream water surface.)

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

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

6.2 Remedial Measures.

a. Alternatives. As stated in paragraph 6.1, this structures 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 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 outlet capacity, though other measures considered below would help.

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

(3) Drain. The drain buried in the downstream slope could be either modified or replaced to provide adequate seepage control.

b. Operation and Maintenance Procedures.

(1) Maintenance.

(a) Grass. A good cover of grass should be established and maintained to guard against erosion. Regular mowing and elimination of rank vegetation would also facilitate observation of the condition of the dam's surface.

(b) Periodic Observation. It would be prudent to arrange for an observer to periodically traverse the dam on foot, noting the condition of its surface and any evidence of seepage. If practical, the rate of flow from the drain in the downstream slope should be measured and recorded. All observations should be reported to the owner for appropriate actions as needed.

(c) Erosion. Prompt repair of erosion would minimize extent of needed repairs and avoid compromise of the dam's safety.

(d) Seepage. The significance of any change in seepage or in discharge from the drain should be evaluated by a competent engineer.

(e) Crest. A slope should be maintained on the dam's crest to assure drainage toward the upper pool.

(2) Operating Procedures.

(a) Partial Drawdown. Establish a procedure for partial drawdown of the pool in the event of a major storm warning. The additional flood storage could prove valuable. Addition of a slide gate or valve in the upper part of the drop-inlet riser could facilitate partial draw-down.

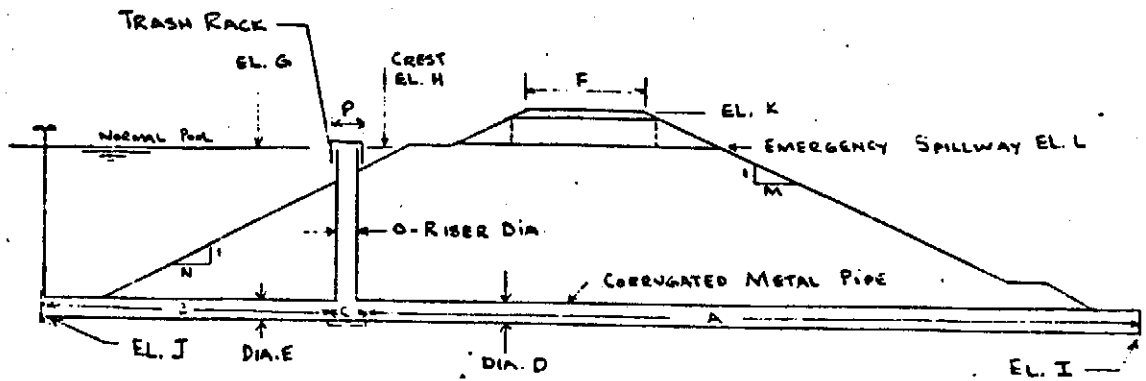
(b) Possible Building Restriction. Increases in hazard to life and property from possible dam failure could be minimized by encouraging construction of any additional dwellings near the lower pool above 35 to 40 feet m.s.l., (10 to 15 feet above normal level of that pool).

(c) Flood Warning. In the event of a possible threatened structural failure caused or evidenced by erosion, excessive seepage or displacement of part of the dam embankment or outlet, there might be ample time to effectively warn downstream areas that could be affected.

There would be little time for effective warning of a threatened overtopping failure caused by a major storm due to the short lag time between storm rainfall and peak runoff (only about 2 hours). With this short lag time, the only feasible warning system would involve some kind of automatic alarm related to a rainfall gage or a gate of the upstream pool level. Although feasible, full dependence on such a system might not be warranted, as a storm could occur any time of the day or night. Its effectiveness would depend upon full-time monitoring and the capability to quickly notify everyone that could be affected by a dam failure.

SECTION 7 - LIST OF PERTINENT REPORTS

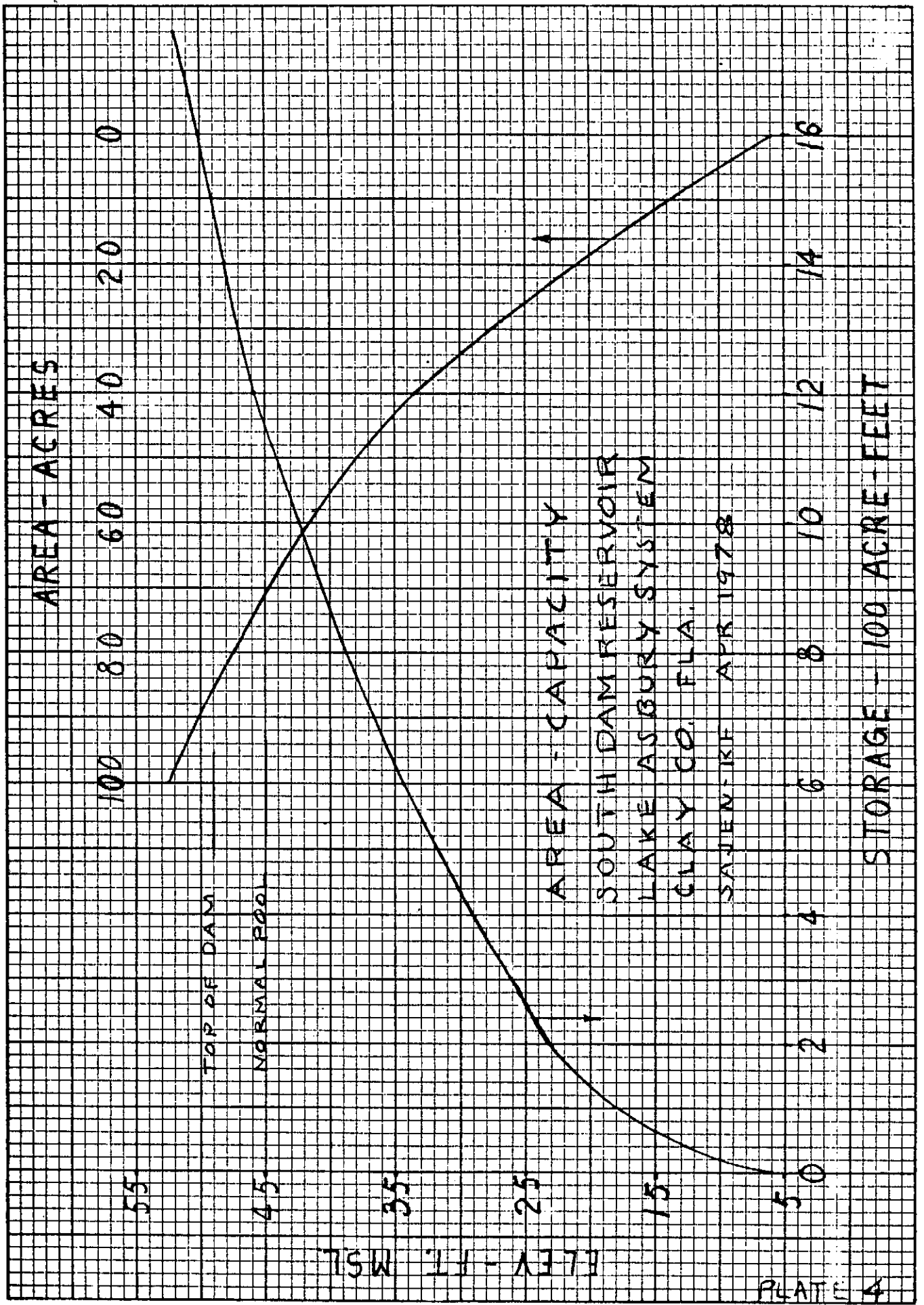
No pertinent reports are available.



TYPICAL OUTLET DETAIL

* DIMENSION		NORTH DAM	SOUTH DAM	LAKE LARC 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	30	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	30	50
I	DOWNSTREAM CULVERT INVERT - FT. M.S.L.	1.0	22	24	27
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	250	250
	HEIGHT OF DAM - FT	31	30.5	20	29

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



AREA - CAPACITY
SOUTH DAM RESERVOIR
LAKE ASBURY SYSTEM
CLAY CO. FLA.

SAJEN-KE APR 1978

STORAGE - 100 ACRE- FEET

