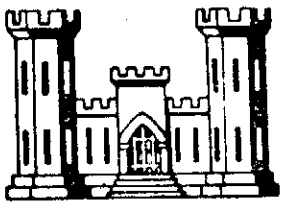
BLACK CREEK BASIN

LAKE RYAN DAM
CLAY COUNTY, FLORIDA
INVENTORY NUMBER FL 151

PHASE 1 - INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM



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

JULY 1978

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 RYAN DAM
PHASE I REPORT
NATIONAL DAM SAFETY INSPECTION PROGRAM

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LAKE RYAN DAM

SECTION I - PROJECT INFORMATION

1.1 General.

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

1.2 Description of Project.

a. General. Two of the three dams across distinct tributaries to the pool impounded by Lake Asbury Dam are roughly equal in volume and much smaller than the third. Lake Ryan Dam is the higher of the two small dams. An aerial photograph is shown on plate 2.

b. Description of Dam and Appurtenances. Lake Ryan Dam is a rolled earthfill dam approximately 29 feet high and approximately 250 feet long. Its crest, which is about 23 feet wide, has never supported a public road. The water level in the pool is controlled by a drop-inlet c.m.p. culvert.

c. Location. The subject dam is located about 0.3 mile south and 0.5 mile west 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 Lake Ryan Dam is roughly one and a half miles east, and half a mile south, of Middleburg, Florida.

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

e. Hazard Classification. A "high" hazard classification has been assigned to Lake Ryan Dam. This is due, in part, to the possibility that a failure of the subject dam could increase the chance of overtopping of Lake Asbury Dam, which is situated downstream, if its pool was already well above normal stage.

f. Ownership. Lake Ryan Dam is owned by the Lake Asbury Lakelot Owners Association, Incorporated, P. O. Box 261, Orange Park, Florida, 32073.

g. Purpose of Dam. Real estate development.

h. Design and Construction History. Lake Ryan 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 1969. Plans and other documents relating to design and construction do not seem to be available. Information was obtained by field observations and by questioning Mr. C. H. Barco -- the builder -- and representatives of past and present owners of Asbury Realty Company and Lake Asbury Lakelot Owners Association, respectively. Apparently, the ends of the dam's crest were constructed to lower elevations than the center. The reason is probably the same as at South Lake Asbury Dam -- the largest of the three dams that share the same lower pool and the same design engineer. Construction drawings (available only for that dam) indicate lower elevation at the abutments due solely to overbuilding of the central part of the dam to compensate for anticipated settlement.

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

1.3 Pertinent Data.

As plans for this dam were not located, most of the following information is based on either field estimates and measurements or office computations.

a. Drainage Area. The total drainage area of Lake Ryan Dam is 0.66 square mile. Included in that figure is a 0.44-square-mile area which contains a swamp. The swamp apparently can drain to Lake Ryan under some conditions, and also drains to another basin to the west. This area was not field checked, except on the Lake Ryan end where there is evidence of a shallow dry ditch. The remaining 0.22-square-mile area always drains to Lake Ryan and would provide the most significant peak flow.

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

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

	Elevation Ft. m.s.l.	Pool Area Acres	Storage Capacity Acre-Feet
Top of Dam	55.9	8	81
Overflow Culvert Riser	50.0	5.5	42
Normal Pool	50.0	5.5	42

(1) Reservoir length (ft.): 1,200
(2) Streambed elevation at centerline of dam (ft. m.s.l.): 27
(3) Maximum tailwater elevation (ft. m.s.l.): 32

d. Outlet Structure.

(1) Spillway. None.

(2) Drop-inlet Culvert.

(a) Type: Corrugated metal pipe

(b) Number of pipes: 1

(c) Diameter size (inches): 24

(d) Length (ft.): 120

(e) Primary control - overflow into riser

1 Size of riser (inches): 60
2 Type of riser: corrugated metal pipe
3 Size of trash rack (diameter - inches): 84
(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: 250 feet.

(3) Height: 29 feet.

(4) Top width: 23 feet.

(5) Side slopes: 1 vertical on 2 horizontal. The downstream slope was measured and it is presumed that the upstream slope is the same, as on the other dams of the Lake Asbury complex.

(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. 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. There was no appreciable erosion on the upstream face which was protected from the minor wave action by dense vegetation. At the junctions of the dam's faces with the left (north) abutment, there are shallow drains with paved inverts. Those drains have prevented erosion by runoff from the road nearby. Minor gullying was noted on the downstream slope, mainly on the lower part. There was some slight flow due to seepage, but no movement of soil could be detected. Much of the slope supported rank vegetation. That growth made observation of the dam's surface difficult.

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 50-foot elevation. That stage was controlled by the overflow riser, which appeared to be in satisfactory condition. The downstream end of the culvert was submerged and, therefore, not visible for inspection.

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 Channel. Flooding of the natural channel by the pool of Lake Asbury Dam did not extend far enough upstream to reach the subject dam. The downstream channel is much narrower than those for the other two dams above Lake Asbury Dam. Also, the adjacent land was steeper and less developed.

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 seven or eight years since the reservoir was filled. 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. All gullies on the downstream face need prompt repair to prevent them from enlarging and compromising the integrity of the dam. The vegetative cover on the downstream slope is far from ideal. 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 dense vegetation near the waterline on the upstream slope appeared to be providing fully adequate protection from the minor wave action there.

d. Seepage. Repair of the small gullies with free-draining material (e.g., clean sand) would probably control the seepage. However, any increse in seepage would deserve prompt attention.

e. Drop-inlet Culvert. The culvert seemed to be functioning adequately. The overflow riser appeared to be in satisfactory condition. The downstream end of the culvert was submerged.

SECTION 3 - OPERATIONAL PROCEDURES

3.1 Procedures. The Lake Ryan reservoir is operated as a residential lake and normally maintained at elevation 50 feet, m.s.l. Flood flows are automatically taken by a drop-inlet culvert so that no flood operation is normally required. The pool level can, if desired, be lowered to as low as about elevation 29 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 that passes by the north end of the dam and affords them a limited view of the embankment. When they note occasion for maintenance, they report same to the owner -- Lake Asbury Lakelot Owners Association -- for appropriate action.

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

3.4 Description of Warning System. The outlet discharges into an arm of the North Dam reservoir at an elevation several feet above the lake stage. Discharges through the outlet culvert do not cause any damage. For these reasons, 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 Lake Ryan Dam was reportedly designed for the 100-year flood. Flood analysis indicates the Lake Ryan Dam can satisfactorily 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 seven- or eight-year history of the dam.

c. Overtopping Potential. The Lake Ryan Dam is categorized as being a high hazard, small-sized dam. The Hydrologic Evaluation Guidelines recommend a spillway design flood of from one-half the probable maximum flood to the full probable maximum flood. Routings were done for the reservoir using the Corps of Engineers' HEC-1 program with runoff computations 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. Weather Service Draft Hydrometeorological Report No. 51. Soil Conservation Service curve number was 44 and TC was 2.71 hours.

Following are routing results for the Lake Ryan Dam:

	FLOOD			
	100-yr	0.33 PMF	0.5 PMF	PMF
24 hour rainfall - in.	10.40	15.73	23.55	46.63
Rainfall excess - in.	3.00	6.71	13.08	34.21
Peak inflow - c.f.s.	86	193	382	970
Peak outflow - c.f.s.	33	70	376	970
Peak stage - ft.	52.0	56.1	56.8	57.4
Dam elevation - ft.	55.95	55.95	55.95	55.95
Freeboard - ft.	3.9	None	None	None
Overtopping - ft.	None	0.15	0.85	1.45

The reservoir passed the routed 100-year flood with substantial freeboard. As indicated, the 1/2 probable maximum flood could be expected to overtop the dam by about 0.85 foot. The preceding table is based on the assumption that only the 0.22-square-mile drainage area contributes runoff. Routings were also run assuming that one-half of the upstream swamp area also contributes runoff to Lake Ryan, for a total drainage area of 0.44 square mile. Answers were similar. The reservoir passed the 100-year flood without overtopping, but with only 0.7 foot freeboard. The larger floods all caused 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. 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 -- 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. Lake Ryan Dam is considered to be unsafe. The Hydrologic Evaluation Guidelines recommend a Spillway Design Flood (SDF) in the range of one-half to one times the Probable Maximum Flood (PMF) for dams with "high" hazard and "small" size classifications. Lake Ryan Dam could probably withstand a flood somewhat larger than the 100-year flood for which it reportedly was designed. A 1/3 PMF could be expected to overtop the dam. 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 observations, office computations, and general familiarity with soils occurring in the area. In view of the conservative design of the earth embankment, the available information is considered adequate for purposes of this report. Further determination of the actual existing hazard would be desirable. The "high hazard" classification is based primarily on the location of the dwellings downstream of the dam. A better assessment of hazard could be made by checking the elevations of houses below the dam. Failure of Lake Ryan Dam would affect downstream areas up to some elevation below 56 feet, m.s.l., the height of the dam. The actual elevation is dependent upon the rate of failure. Elevations up to at least 40 to 45 feet, m.s.l., or so, could be affected, especially near the dam (about 10 to 20 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 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 overflow spillway would substantially decrease the chance of the dam's being overtopped during a severe flood. Compliance with the recommendation that the SDF be in the range of 1/2 PMF to 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.

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 periodically to traverse the dam on foot, noting the conditions of its surface and any evidence of seepage. All observations should be reported to the owner for appropriate action as needed.

(c) Erosion. Prompt repair of erosion with suitable granular material could control seepage, minimize extent of needed repairs, and avoid compromise of the dam's safety.

(d) Seepage. The significance of any change in seepage 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.

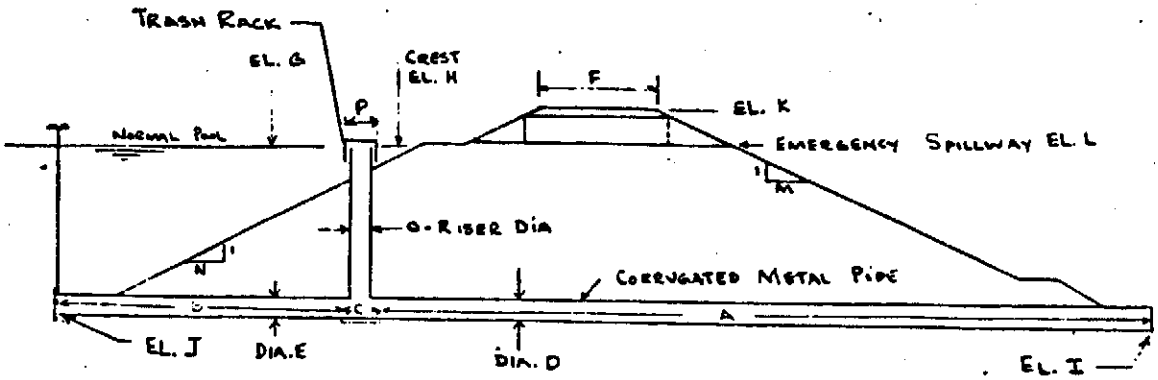
(a) Partial Drawdown. Establish a procedure for partial drawdown of the pool in the event of a major storm warning. The additional flood storage could prove valuable. Addition of a slide gate or valve in the upper part of the drop-inlet riser could facilitate partial drawdown.

(b) Possible Building Restriction. Increases in hazard to life and property from possible failure of Lake Ryan Dam could be minimized by encouraging construction of any additional dwellings downstream of the dam at elevations well above the normal stage of adjacent water. Minimum construction elevations could range from something like 40 or 45 feet m.s.l., along the upper part of the discharge channel down to about 35 feet m.s.l., (10 feet above normal water level) along the shore of the lower pool.

(c) Flood Warning. In the event of threatened structural failure 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 (less than 2 hours). With this short lag time, a feasible warning system would have to utilize some kind of automatic alarm activiated by a rainfall gage or by a water level gage in the upstream pool. Although such a system is feasible, full dependence on it 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 who could be affected by a dam failure.

SECTION 7 - LIST OF PERTINENT REPORTS

No pertinent reports are available.

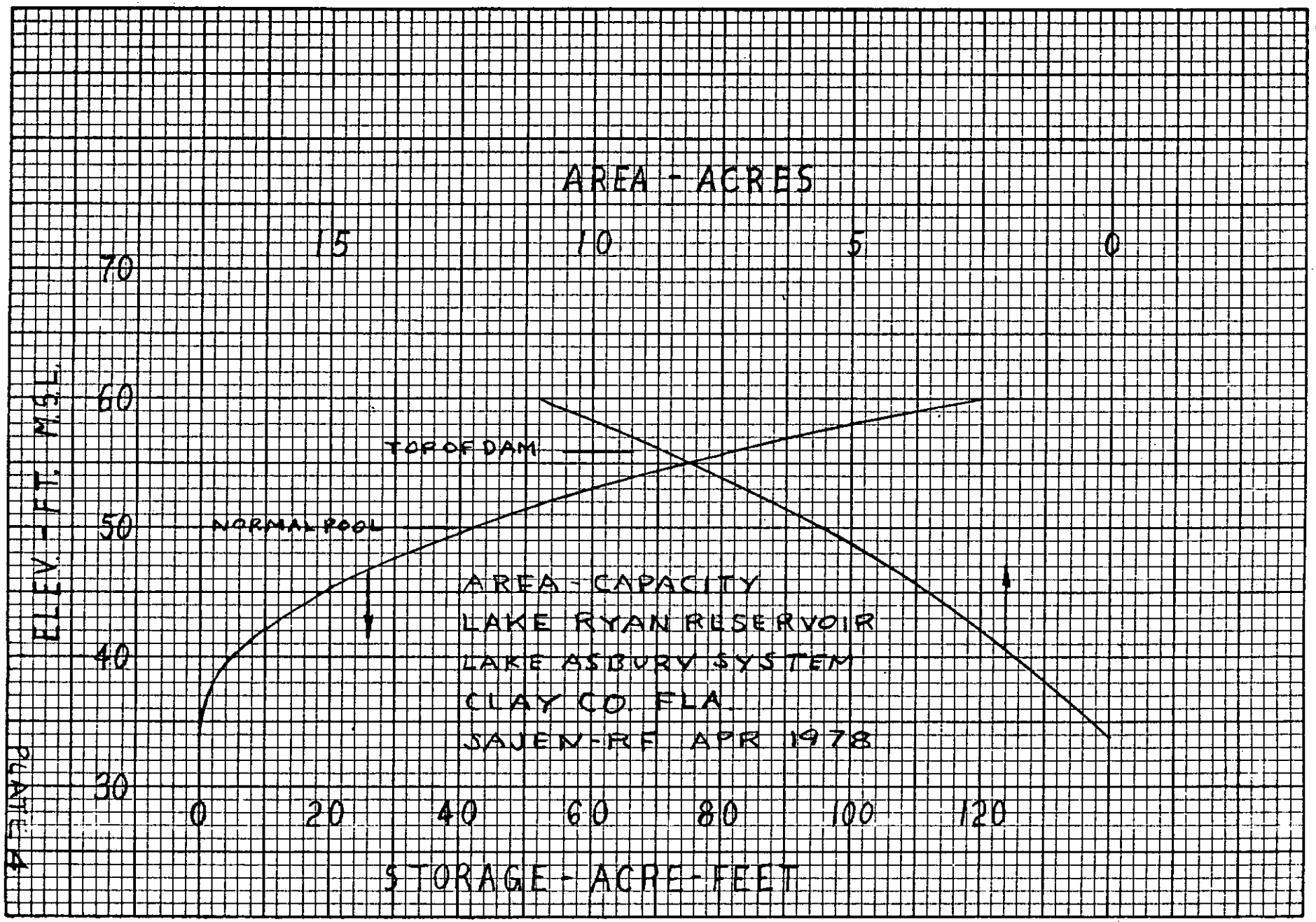


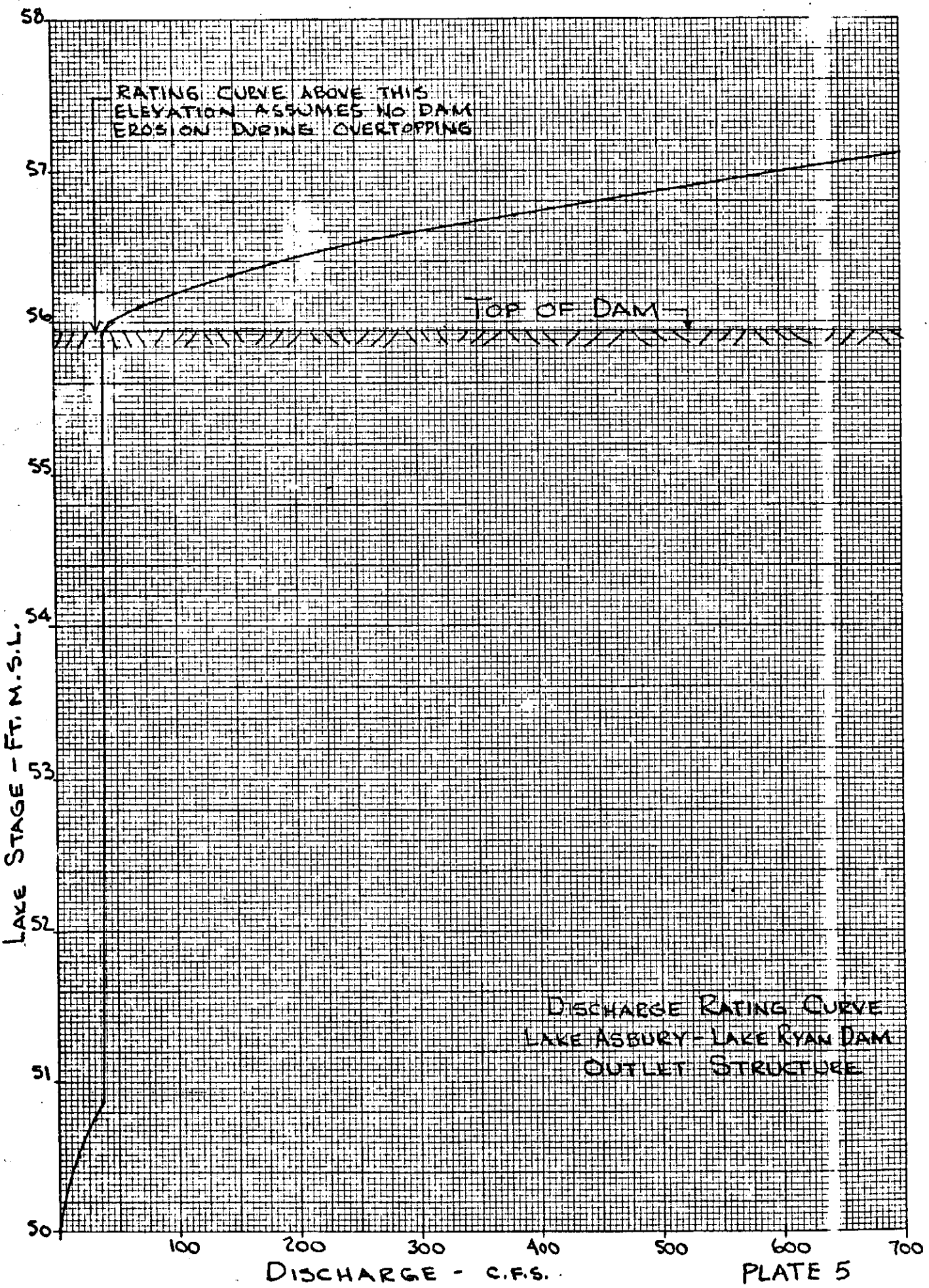
TYPICAL OUTLET DETAIL

* DIMENSION		NORTH	SOUTH	LAKE LARC	LAKE RYAN
SYMBOL	DESCRIPTION	DAM	DAM	DAM	DAM
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	25
G	NORMAL POOL EL. FT. M.S.L.	25	45	39	50
H	RISER CREST EL. FT. M.S.L.	25	45	39	30
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 SIDESLOPE	3	3	2.5	2
N	UPSTREAM EMBANKMENT SIDESLOPE	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




RATING CURVE ABOVE THIS ELEVATION ASSUMES NO DAM EROSION DURING OVERTOPPING
TOP OF DAM
LAKE STAGE - FT. M.S.L.
58
57
56
55
54
53
52
51
50
100
200
300
400
500
600
700
DISCHARGE - C.F.S.
DISCHARGE RATING CURVE
LAKE ASBURY - LAKE RYAN DAM
OUTLET STRUCTURE
PLATE 5
46 1323
K·E 10 X 10 TO ½ INCH 7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.