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ARMY ENGINEERING DISTRICT NORFOLK VA
NATIONAL DAM SAFETY PROGRAM. LAKE JACKSON DAM (VA 15306), POTOM--ETC(U)
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LEVEL II

POTOMAC RIVER BASIN



Name Of Dam: LAKE JACKSON DAM

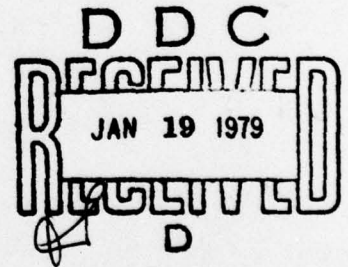
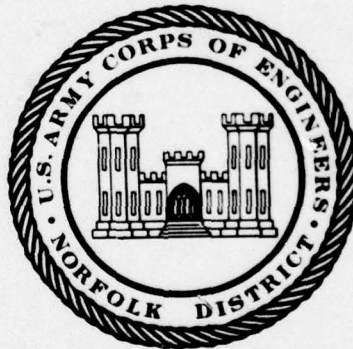
Location: PRINCE WILLIAM COUNTY

Inventory Number: VA. 15306

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PHASE I INSPECTION REPORT NATIONAL DAM SAFETY PROGRAM

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PREPARED BY
NORFOLK DISTRICT CORPS OF ENGINEERS
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NORFOLK, VIRGINIA 23510

JUNE 1978

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20. Abstract

Pursuant to Public Law 92-367, Phase I Inspection Reports are prepared under guidance contained in the recommended guidelines for safety inspection of dams, published by the Office of Chief of Engineers, Washington, D. C. 20314. 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 conditions 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.

Based upon the field conditions at the time of the field inspection and all available engineering data, the Phase I report addresses the hydraulic, hydrologic, geologic, geotechnic, and structural aspects of the dam. The engineering techniques employed give a reasonably accurate assessment of the conditions of the dam. It should be realized that certain engineering aspects cannot be fully analyzed during a Phase I inspection. Assessment and remedial measures in the report include the requirements of additional indepth study when necessary.

Phase I reports include project information of the dam and appurtenances, all existing engineering data, operational procedures, hydraulic/hydrologic data of the watershed, dam stability, visual inspection report and an assessment including required remedial measures.

LEVEL II

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LAKE JACKSON DAM
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PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam: Lake Jackson Dam

State: Virginia

County: Prince William

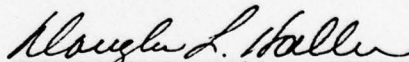
Stream: Occoquan River

Date of Inspection: 6 April 1978

Lake Jackson Dam is a rubble masonry structure with an uncontrolled spillway 213 feet long and has a spillway height of 28 feet. It is located on the Occoquan River approximately six miles south of Manassas, Virginia. The dam is used to create Lake Jackson, a high use recreational lake. The dam was constructed in 1928 and used by VEPCO to generate electricity until the mid-1950's. Few construction and design documents are still in existence. In 1972, the dam withstood the flood of record, Tropical Storm Agnes, which exceeded the one percent flood and reached elevation 164 msl. In 1974, the 25-foot wide tainter gate was reworked and two steel gates covering the old powerhouse intakes were installed. Other maintenance is done on a need-to basis generated by observations of Prince William County employees. Visual observation revealed a seep of clear water on the right abutment and a dam surface of spalled and weathered concrete.

An immediate downstream flood plain analysis is recommended to determine the exact extent of potential hazard caused by the dam. If sufficient hazard exists, the owner should at his expense engage the services of a Professional Engineer to establish an engineering data base, a structural stability and needed remedial measures (see Section 7). Immediate urgency is not required in light of the fact the dam withstood the flood of record.

APPROVED:



DOUGLAS L. HALLER
Colonel, CORPS OF ENGINEERS
DISTRICT ENGINEER

LAKE JACKSON DAM

SECTION 1. PROJECT INFORMATION

1.1 General:

1.1.1 Authority: Public Law 92-367, 8 Aug 72 authorized the Secretary of the Army, through the Corps of Engineers to initiate a national program of safety inspections of dams throughout the United States. The Norfolk District has been assigned the responsibility of supervising the inspection of dams in the Commonwealth of Virginia.

1.1.2 Purpose of Inspection: The purpose of the Phase I inspections is to identify expeditiously those dams which may be a potential hazard to human life or property.

1.2 Project Description:

1.2.1 Dam and Appurtenances: Lake Jackson Dam is a 28-foot high (ungated spillway crest), rubble masonry, gravity structure with an ungated "ogee" like spillway 213-foot long and a gated "ogee" like spillway 25-foot wide. The dam has a total length of 380 feet (approximate). The gated spillway has an electrically controlled tainter gate. The ungated spillway crest is at elevation 148.3 msl while the gated spillway crest is ten feet below at elevation 138.0 msl. The rubble masonry is faced with 2 feet of concrete to form the smooth "ogee" like surface. The upstream side of the dam is said to slope upstream and have a hollow interior. A catwalk runs the length of the spillway at elevation 167.0. Over the gated spillway, the catwalk becomes a platform to hold the hoist equipment for the tainter gate. Two-foot by four-foot piers at 16 feet on centers support the catwalk. An old powerhouse (floor elev. 167.0) stands unused on the left abutment. Twin steel gates have been installed over the intakes to close them off. Existence of a grout curtain or relief drains is unknown. There are no diversion or regulating outlets.

1.2.2 Location: Lake Jackson Dam is located on the Occoquan River approximately 6 miles south of the City of Manassas, Virginia, just west of State Route 234.

1.2.3 Size Classification: The dam is classified intermediate by storage capacity.

1.2.4 Hazard Classification: The dam is located in an urban area and is therefore given a high hazard classification in accordance with guidelines contained in Section 2.1.2 of "Recommended Guidelines for Safety Inspection of Dams" published by the Office, Chief of Engineers. The hazard classification used to categorize dams is a function of location only and unrelated to the stability or probability of failure.

1.2.5 Ownership: Prince William County, Virginia.

1.2.6 Purpose of Dam: The dam creates Lake Jackson, a high use recreational lake, with large housing subdivisions on either shore. The dam serves no other purpose.

1.2.7 Design and Construction History: The dam's construction was started by the L. E. Myers Construction Company in about 1928. During construction, ownership was transferred to VEPCO, who used the dam to generate electricity until the mid-1950's. The original designers are unknown. The only known drawings are attached in Appendix B. In 1963, Prince William County acquired the dam with thoughts of recreation and water supply. Water supply facilities have never been built. In 1974, Prince William County had the tainter gate and hoist machinery reworked. Two large steel gates were installed at the same time to close off the intakes on the powerhouse. Hoisting equipment for the gates have not been installed. The old turbines remain in place. All other electrical generating equipment has been removed. The powerhouse has been leased to the local recreational league for social functions. They are in the process of installing lights, insulation, heat, etc.

1.2.8 Normal Operating Procedures: Dam operations are generated by county employees' random observations. Normal river flow is allowed to pass over the ungated spillway.

1.3 Pertinent Data

1.3.1 Drainage Areas: The dam controls a drainage area of 343 square miles.

1.3.2 Discharge at Damsite: Maximum known flood at damsite: Tropical Storm Agnes 1972 estimated at 57,600 cfs. (See plate 7.)

1.3.2.1 Ungated spillway - pool level at top of dam (El. 167) - 61,500 cfs.

1.3.2.2 Gated spillway - pool level at top of dam (El. 167) - 9,400 cfs.

1.3.3 Dam and Reservoir Data:

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1.3.3.1 Pertinent data on the dam and reservoir are shown in the following table:

Table 1.1 DAM AND RESERVOIR DATA

ITEM	Elevation ft., msl	Area Acres	RESERVOIR		Length Miles
			Capacity		
			Acre Feet	Watershed Inches	
Top of dam	167.0	1,750	13,500	0.74	8.7
Ungated spillway crest	148.0	200	1,228	0.07	5.3
Gated spillway crest	138.0	60	400	0.02	3.4
Normal riverbed	120.0	-	-	-	-

SECTION 2: ENGINEERING DATA

2.1 Design: One design drawing has been found which shows the plan and elevation of the dam (See Plate 1). A second drawing describes the rubble masonry cross-section of the dam, but not the total existing cross-section. See description in paragraph 1.2.1. Original design calculations have not been found. Simple stability checks cannot be performed in the absence of adequate cross-sections and plans of the dam.

2.2 Construction: Other than a few photographs (See Plate 3), there are no construction records of the dam.

2.3 Operation: Prince William County does not employ regular operational procedures. Manual operations are performed as the need arises from casual observation of the dam by Prince William County employees or lakeside residents.

Electrical service to the dam is provided by Virginia Electric and Power Company. A backup power source is not available. There is no automatic operation of the tainter gate. The gate is electrically operated by the raise-lower switch. There are no limit switches to prevent overrun. In the event of a power failure, the gate may be manually operated with some difficulty by the use of a hand crank.

2.4 Evaluation: Engineering data for the dam is almost non-existent. Field investigations should be performed to allow adequate data to be developed.

SECTION 3: VISUAL INSPECTION

3.1 Findings: Information observed in the field is outlined in Appendix D. Overall, the concrete dam had severe signs of weathering and deterioration. Evidence of seepage along the right abutment contact did not appear to be critical, but determination could not be made on a visual inspection. Upon closure, the tainter gate did not seat firmly against the bottom sill to stop the flow of water.

3.2 Hazard Classification: A survey, through the use of U.S.G.S. quadrangle maps of the downstream area shows only four structures and a bridge which could be within the influence of a dam failure. This type of study is only cursory. A more exacting study is required to determine the dam's zone of influence.

3.3 Evaluation: The visual inspection revealed no apparent problems other than the deteriorated concrete, that would require an immediate action.

3.4 Attendees:

Prince William County
J. Charles Martorana
James H. Payne, Jr.

State Water Control Board
Robert V. Gay
J. Roy Murphy
D. Keith Drohan

Corps of Engineers
J. C. Irving
L. E. Holland
L. F. Baird
D. A. Pezza
Ward Rinehart, O.C.E.

SECTION 4: OPERATIONAL PROCEDURES.

4.1 Procedures and Maintenance: Most operating procedures are done as the need arises. Maintenance is performed monthly by county personnel. Large amounts of water-borne debris are caught by the catwalk piers. Debris removal is accomplished irregularly. The tainter gate lifting machinery is kept in good condition. Operating and maintenance manuals and records are not kept.

4.2 Warning System: There is no warning system maintained by Prince William County.

4.3 Evaluation: The dam does not require an elaborate operational and maintenance procedure. Monthly maintenance should keep the tainter gate and hoisting equipment in good repair.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Design: No hydraulic or hydrologic design data exists for the dam on Lake Jackson.

5.2 Hydrologic Records: Flow records in the Occoquan River have been maintained near Manassas (drainage area 343 square miles) since April 1968. The gaging station is located 650 feet below the dam and is maintained by the Virginia State Water Control Board (S.W.C.B.), as shown on Plate A-3. No regular record of the pool level is maintained by the operators of the dam.

5.3 Flood Experience: The largest known flood since construction of the dam occurred in June 1972 as a result of rainfall associated with Tropical Storm Agnes. The downstream gage was damaged by floodwaters; however, a discharge of 57,600 cfs was estimated by S.W.C.B. from highwater marks for the reach immediately downstream of the dam. The reservoir level rose to approximately elevation 164 with a tailwater of approximately elevation 160. This discharge substantially exceeds the one percent chance flood.

5.4 Reservoir Regulation:

5.4.1 A spillway rating curve was developed using procedures described in Design of Small Dams, Bureau of Reclamation, 1965. A reservoir storage capacity curve was estimated from U.S.G.S. Quadrangle sheets. A tailwater rating curve was developed by plotting published discharges and stages for the stream gage downstream.

5.4.2 There is no flood storage space in the reservoir and the average flow is about 437 cfs. Under normal conditions, the tainter gate remains closed and flow is over the crest of the ungated spillway with the pool level slightly above the spillway crest most of the time. Determinations of probable discharge from the reservoir under various flooding conditions are based on the assumption that the tainter gate has been fully opened in anticipation of flooding.

5.5 Flood Potential: The flood potential at the dam was determined by application of rainfall to an adjusted unit hydrograph for Upper Occoquan Creek. Because of the large drainage area involved and the limited surcharge storage available, it is considered that the reduction of peak flow by the reservoir would be minimal.

5.5.1 Rainfall for floods computed was taken from National Weather Service publication Hydrometeorological Report 33 for the Probable Maximum Flood (PMF) and Technical Paper 40 for the one percent flood.

5.6 Overtopping Potential: The probable rise in the reservoir and other pertinent information is summarized in the following table:

Table 5.1 RESERVOIR PERFORMANCE

	FLOOD				
	Avg Flow	One ^{1/} Percent	Agnes	1/2 PMF	^{2/} PMF
Peak inflow, cfs.	441	42,000	58,200	69,000	138,000
Peak outflow, cfs.	437	41,600	57,600	67,600	126,300
Peak elevation, ft. msl.	148.8	161.3	164.0	166.3	175.0
<u>Gated Spillway ^{3/}</u>					
Depth on spillway, ft.	0	23.3	26.0	28.3	37.0
Avg. velocity, fps.	0	17.3	18.5	19.6	20.9
<u>Overflow spillway</u>					
Depth of flow, ft.	0.8	13.3	16.0	18.3	27.0
Avg. velocity, fps.	2.7	13.1	14.8	15.7	19.4
<u>Non-overflow section</u>					
Depth of flow, ft.	0	0	0	0	8.0
Avg. velocity, fps.	0	0	0	0	10.3
<u>Tailwater elevation, ^{4/}</u>					
ft., msl.	123.0	154.5	159.8	162.4	174.0

1/ The One Percent Exceedence Frequency Flood has one chance in 100 of being exceeded in any given year.

2/ The Probable Maximum Flood is an estimate of flood discharges that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region.

3/ During average flow, the tainter gate remains closed.

4/ Tailwater elevation is at the stream gage.

5.7 Reservoir Emptying Potential: Assuming an average inflow of 437 cfs, it would take less than one day to bring the pool level down to elevation 140.5 from elevation 148.0. This operation is based on the assumption that the 25-foot tainter gate is operative and fully open. Presently, there is no method available for drawing the pool level below this elevation.

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation: Lack of information makes it impossible to perform a stability analysis. Visual observations do not reveal any problems which indicate instability. However, the dam has withstood the flood of record, Tropical Storm Agnes in 1972, where the flood elevation was estimated at elevation 164. (See plate 7). Structural stability should be insured through field tests and analysis.

SECTION 7: ASSESSMENT AND REMEDIAL MEASURES/RECOMMENDATIONS

7.1 Dam Assessment:

7.1.1 There are insufficient data to permit an adequate and reliable assessment of the dam.

7.1.2 The project does not meet Corps of Engineers screening criteria for spillway adequacy. Spillway has capability to pass 45% of the probable maximum flood and is therefore assessed as inadequate. In the event of an unusually heavy rainfall, an around the clock surveillance plan should be implemented and a warning system developed for use in the event of an emergency from overtopping.

7.2 Remedial Measures/Recommendations:

7.2.1 An immediate downstream flood plain analysis to be performed by the owner at his expense is recommended to determine the exact extent of potential hazard caused by the dam. If sufficient hazard exists, the owner should at his expense engage the services of a professional engineer to ascertain the stability of the dam under all conditions and to evaluate the significance of the right abutment seepage. The recommendations of the consultant should be implemented by the owner. Actions taken by the owner should be forwarded to the Commonwealth of Virginia, Attention: State Water Control Board.

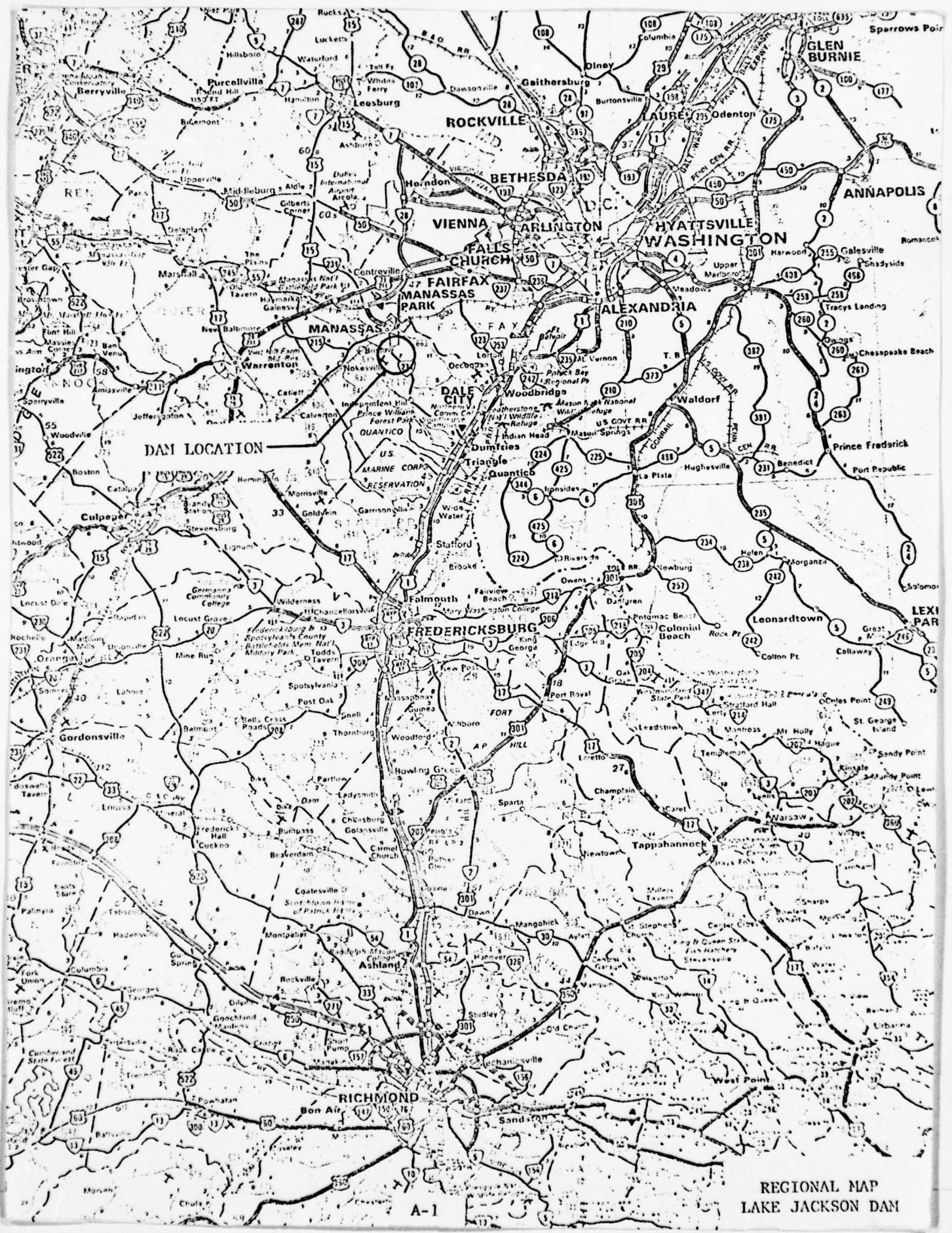
7.2.2 Install a new bottom sill and seal for the tainter gate.

7.2.3 Repair weathered concrete all along the catwalk and powerhouse by applying a topping or grout finish.

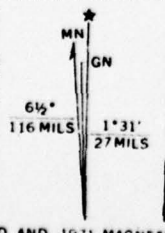
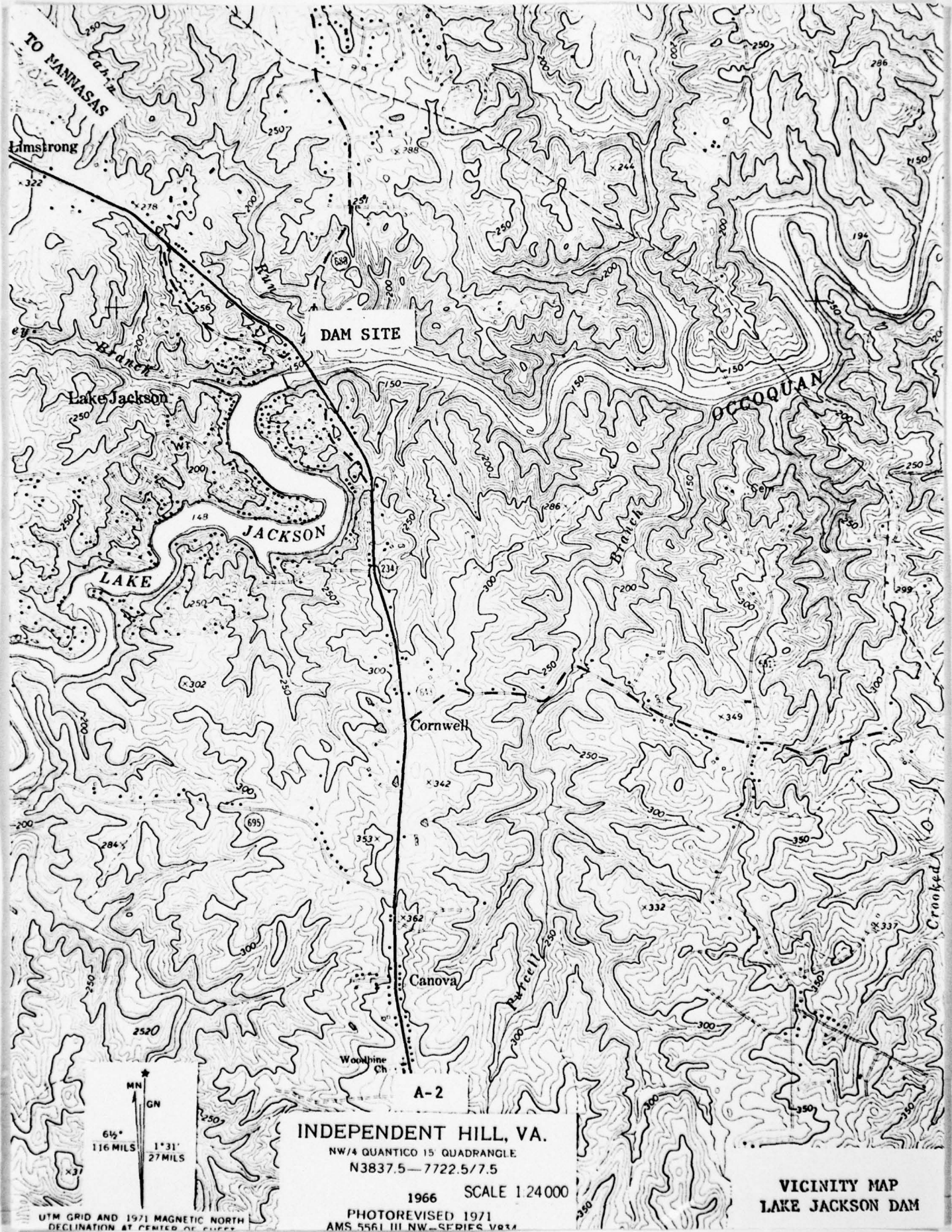
7.2.4 Provide access for any necessary repair of steel gates covering the powerhouse intakes.

APPENDIX A

MAPS



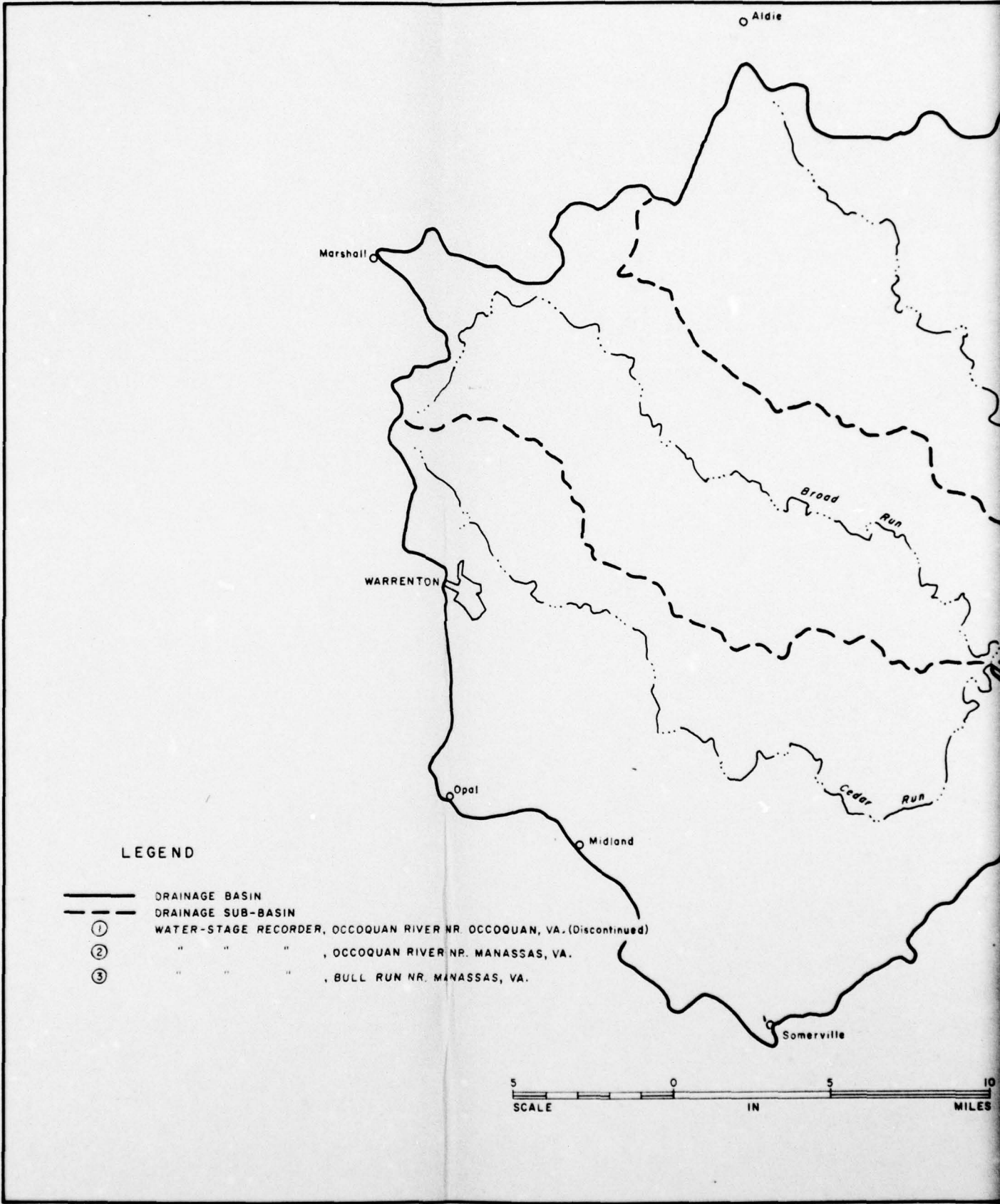
REGIONAL MAP
LAKE JACKSON DAM



INDEPENDENT HILL, VA.
 NW/4 QUANTICO 15 QUADRANGLE
 N3837.5—7722.5/7.5
 1966 SCALE 1:24000
 PHOTOREVISED 1971
 AMS 5561 III NW—SERIES V834

**VICINITY MAP
 LAKE JACKSON DAM**

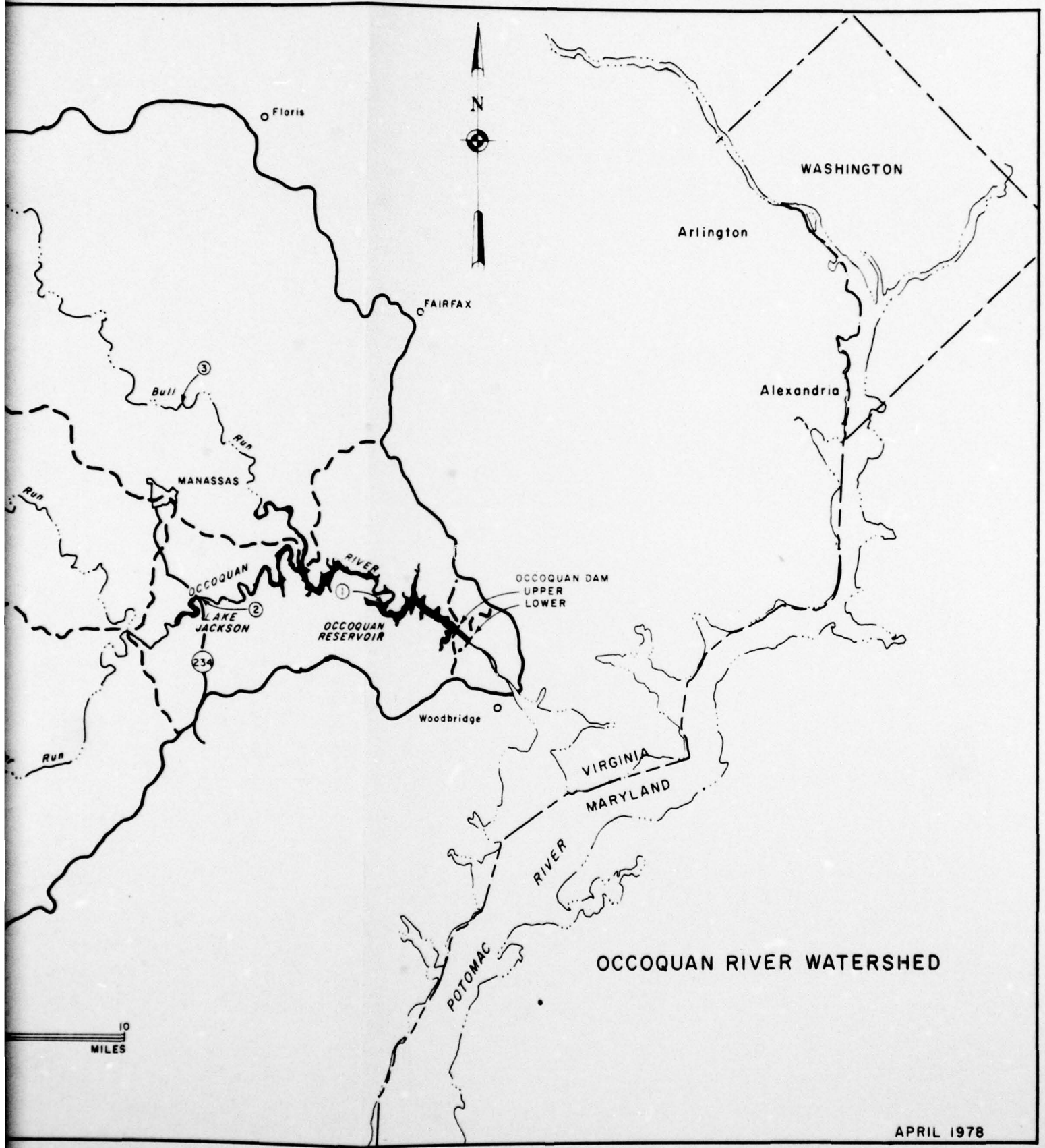
UTM GRID AND 1971 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET



LEGEND

- DRAINAGE BASIN
- - - - DRAINAGE SUB-BASIN
- ① WATER-STAGE RECORDER, OCCOQUAN RIVER NR OCCOQUAN, VA. (Discontinued)
- ② " " " , OCCOQUAN RIVER NR. MANASSAS, VA.
- ③ " " " , BULL RUN NR. MANASSAS, VA.





APRIL 1978

2

A-3

APPENDIX B

PLANS

APPENDIX C

PHOTOGRAPHS



C-1

LAKE JACKSON DAM - OVERVIEW



LAKE JACKSON DAM - ORIGINAL CONSTRUCTION
PLATE 3



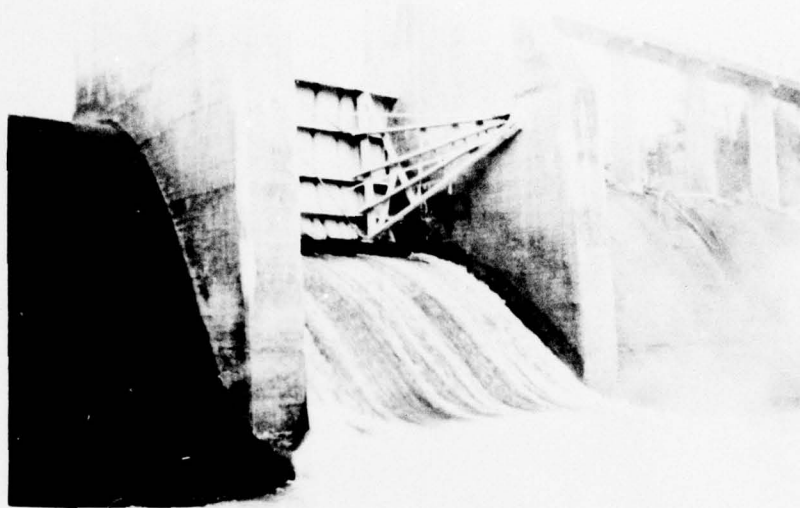
LAKE JACKSON DAM - SPALL ON
SURFACE OF SPILLWAY



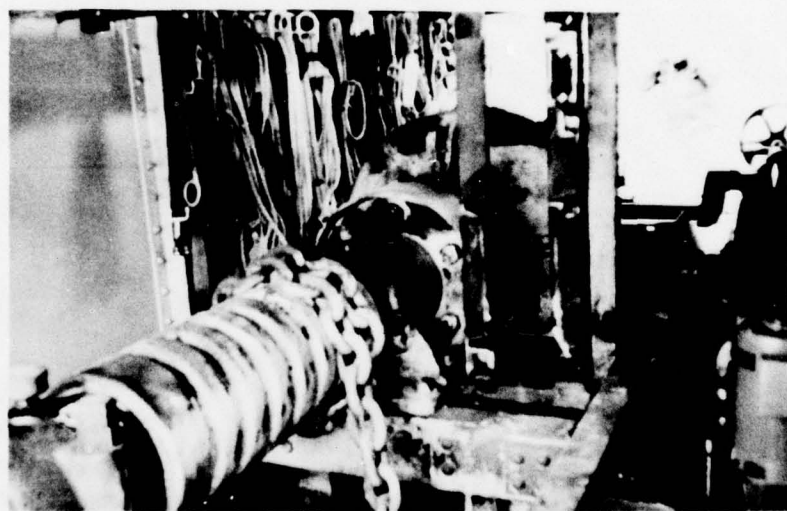
LAKE JACKSON DAM - SPALLING
AT CONSTRUCTION JOINT

PLATE 4

C-3

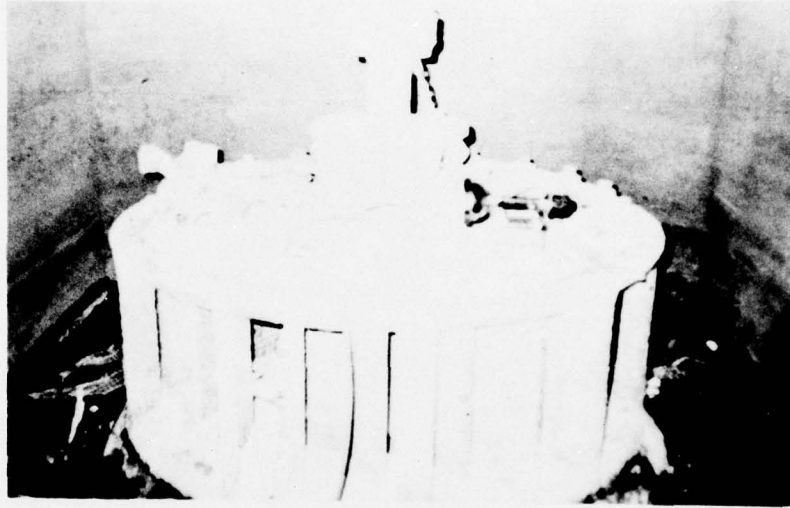


LAKE JACKSON DAM - TAINTER GATE



LAKE JACKSON DAM - TAINTER GATE
HOIST EQUIPMENT

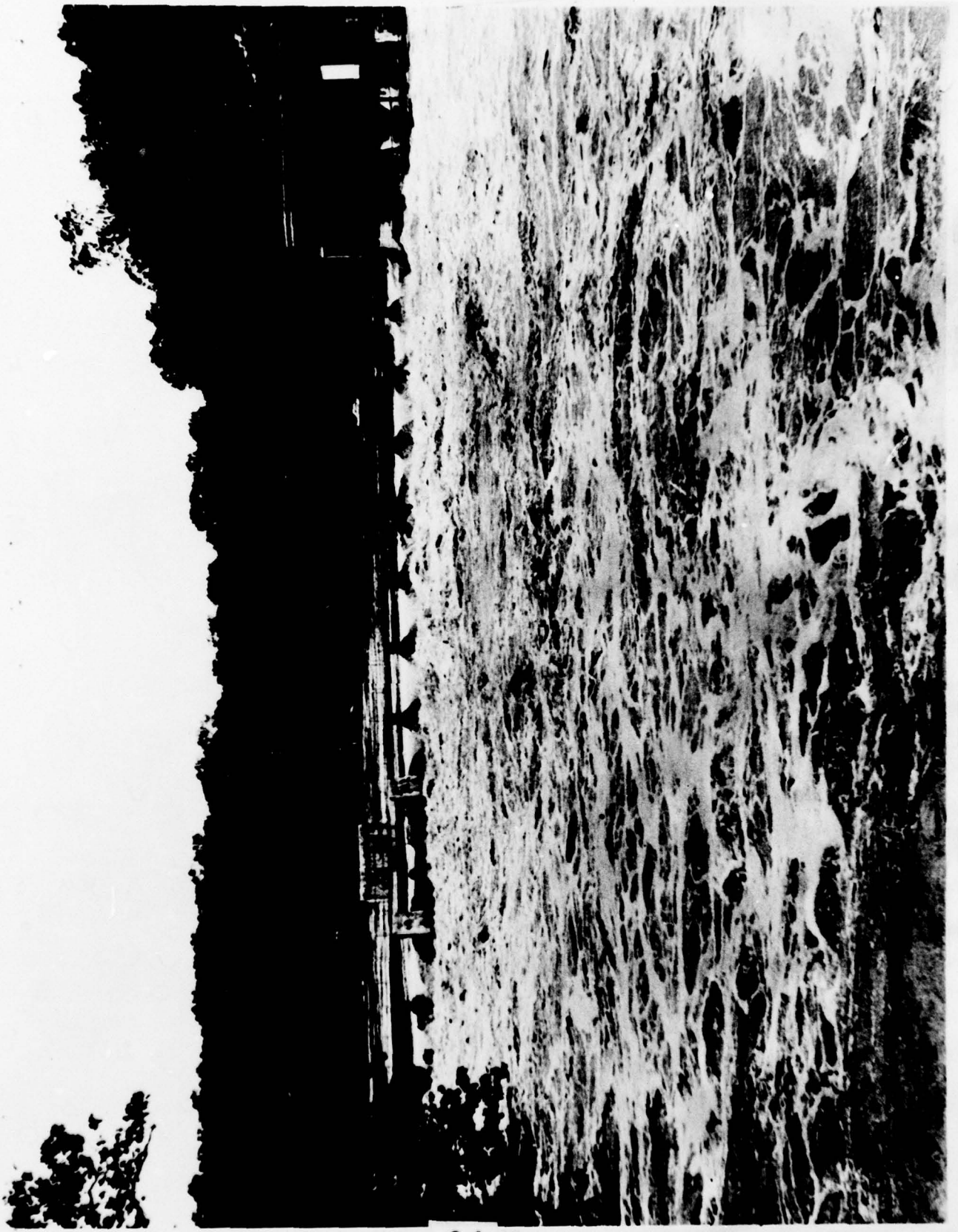
PLATE 5



LAKE JACKSON DAM - OLD TURBINE

PLATE 6

C-5



C-6

LAKE JACKSON DAM HURRICANE AGNES 1972

APPENDIX D

FIELD OBSERVATIONS

FIELD OBSERVATIONS

The visual inspection was conducted on 6 April 1978. The skies were cloudy and overcast. It was a mild day with the temperature between 50 to 60 degrees.

The tainter gate was opened to lower the lake level below the crest of the dam. This action was requested by the Corps of Engineers to expose the face of the spillway for inspection. A few cracks, severe weathering and deterioration of concrete were visible on the exposed spillway. However, the face was covered by a green algae-type growth which made thorough observations difficult.

The catwalk above the dam had much concrete deterioration along its top surface. This deterioration appeared to be the result of freeze-thaw action.

Over the top of the tainter gate is a machinery room. An electrical winch opens the gate. The opening height is graduated in revolutions. The tainter gate appeared to be in good condition. However, when it was closed at the end of the inspection, a large flow of water passed under the gate. A county representative remarked that the gate did not seal right away.

On the left, the dam ties into a powerhouse. On the upstream face of the powerhouse, there are two trash racks, both of which look in good condition. Behind the trash racks are two large steel doors. Only one small (24"x18") hatch gives access to the lower chambers and the gates. Two small windows on the upstream face are screened over. There is no access to the gates for repairs. Down in one of the lower chambers, the steel gate is in excellent condition. The old turbine is in place. The gate is composed of 12-inch wide flanges with a five inch flange width and 3/8 of an inch flange thickness. The members are approximately 2 feet on center and the gates span about 12 feet. There is a little bit of water on the floor but the seals appear to be very tight. A nine-inch bracing channel runs up the center of the gate with a 3-inch flange. There are four bracing channels diagonally combined to form a diamond on the gate. They measure 7 inches deep with a 2-1/2 inch flange width. Each brace has about a quarter of an inch flange thickness.

Granite gneiss outcroppings are prominent throughout the area. Both abutments tie into rock. The upstream and the downstream left abutment contact appeared sound. The downstream rightside had an exposed contact with evidence of seepage. The flow was clear and minimal. Also, along the downstream toe, approximately 30 feet right of the turbine house, cloudy water was noted. However, it was undetermined if the cloudiness was attributed to seepage.

The surrounding immediate upstream area is highly residential. The slopes are steep and primarily rock. Much debris has collected at the face of the dam. In the past, the county has performed irregular operations to remove debris.

The downstream channel is rock. The right bank has a steep rocky slope. The left side has a gentle slope and is primarily overburden. State Route 234 spans the river approximately 500 feet downstream of the dam.