

AD-A058 820 NEW JERSEY STATE DEPT OF ENVIRONMENTAL PROTECTION TRENTON
NATIONAL DAM SAFETY PROGRAM. INDIAN LAKE DAM (NJ00167), PASSAIC--ETC(U)
AUG 78 D J LEARY

F/G 13/2
DACHW61-78-C-0124

UNCLASSIFIED

N/L

1 OF 2
AD
A058820



AD A0 58820

Approved for public release;
distribution unlimited

(1)
B.S.

PASSAIC RIVER BASIN
DEN BROOK, MORRIS COUNTY
NEW JERSEY

LEVEL II

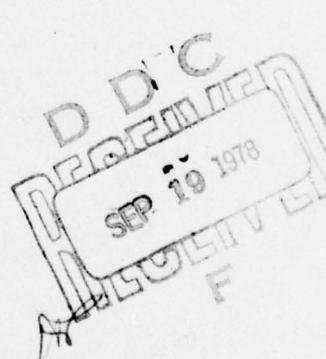
INDIAN LAKE DAM

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

DDC FILE COPY

ORIGINAL CONTAINS COLOR PLATES: ALL ABC
REPRODUCTIONS WILL BE IN BLACK AND WHITE

NJ 00167



DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CUSTOM HOUSE - 2D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106
AUGUST 1978

78 09 11 011

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER NJ00167	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Phase I Inspection Report National Dam Safety Program Indian Lake Dam Morris County, N.J.	5. TYPE OF REPORT & PERIOD COVERED <i>(9) FINAL</i>	6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) <i>(10) Dennis J. Leary P.E.</i>	8. CONTRACT OR GRANT NUMBER(s) <i>(15) DACW61-78-C-0124</i>	
9. PERFORMING ORGANIZATION NAME AND ADDRESS Langan Engineering Associates, Inc. 970 Clifton Ave. Clifton, N.J. 07013	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS	
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer District, Philadelphia Custom House, 2d & Chestnut Streets Philadelphia, Pennsylvania 19106	12. REPORT DATE <i>(11) August 1978</i>	13. NUMBER OF PAGES 86
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) <i>(12) 109P.</i>	15. SECURITY CLASS. (of this report) Unclassified	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.	<i>(6) DDCI APPROVED SEP 19 1978</i>	
17. DISTRIBUTION National Dam Safety Program. Indian Lake Dam number (NJ00167), Passaic River Basin, Den Brook, Morris County, New Jersey. Phase I Inspection Report.	<i>(port)</i>	
18. SUPPLEMENTARY NOTES Copies are obtainable from National Technical Information Service, Springfield, Virginia, 22151.		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Dams--New Jersey National Dam Safety Program Phase I Dam Safety Dam Inspection, Indian Lake Dam N.J.		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report cites results of a technical investigation as to the dam's adequacy. The inspection and evaluation of the dam is as prescribed by the National Dam Inspection Act, Public Law 92-367. The technical investigation includes visual inspection, review of available design and construction records, and preliminary structural and hydraulic and hydrologic calculations, as applicable. An assessment of the dam's general condition is included in the report.		

NOTICE

THIS DOCUMENT HAS BEEN REPRODUCED
FROM THE BEST COPY FURNISHED US BY
THE SPONSORING AGENCY. ALTHOUGH IT
IS RECOGNIZED THAT CERTAIN PORTIONS
ARE ILLEGIBLE, IT IS BEING RELEASED
IN THE INTEREST OF MAKING AVAILABLE
AS MUCH INFORMATION AS POSSIBLE.

ACQUISITION FILE	
NDS	White Section
RDC	Buff Section <input type="checkbox"/>
TRANSMITTED	
SPECIAL FORM	
PY	
DISTRIBUTION/AVAILABILITY CODES	
N.L. A.D.L. and/or SPECIAL	
A	

78 09 11 011

2



DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CUSTOM HOUSE-2 D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

IN REPLY REFER TO
NAPEN-D

Honorable Brendan T. Byrne
Governor of New Jersey
Trenton, New Jersey 08621

1 SEP 1978

Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for Indian Lake Dam in Morris County, New Jersey which has been prepared under authorization of the Dam Inspection Act, Public Law 92-367. A brief assessment of the dam's condition is given on the first four pages of the report.

Based on visual inspection, available records, calculations and past operational performance, Indian Lake Dam, a high hazard potential structure, is judged to be in fair overall condition. However, the dam's spillway is considered seriously inadequate since 21 percent of the Probable Maximum Flood (PMF) would overtop the dam. To insure adequacy of the structure, the following actions, as a minimum are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures and studies within six months from the date of approval of this report. Any remedial measures necessary to insure the adequacy of the spillway and to prevent overtopping should be initiated within calendar year 1979. In the interim, a detailed emergency operation plan warning system, should be promptly developed. Also, during periods of unusually heavy precipitation, around-the-clock surveillance should be provided.

b. Within three months from the date of approval of this report engineering studies and analysis should be performed to determine the condition and effectiveness of the timber sheet pile cutoff along the upstream face of the spillway. This should include necessary borings, test pits, etc. as required to determine the nature of the spillway foundation materials and the condition of the connection between the cutoff wall and spillway. Piezometers should also be installed upstream and downstream of the spillway and monitored during a time when the lake is normally drawn down.

THIS PAGE IS BEST QUALITY PRACTICABLE
FROM COPY FURNISHED TO DDG

2

NAPEN-D

Honorable Brendan T. Byrne

c. Within three months from the date of approval of this report the owner of Lake Estling should make necessary repairs to its spillway to ensure its satisfactory performance during extreme floods as it effects the performance of Indian Lake Dam.

d. The following remedial measures should be completed within the below listed times from the date of approval of this report:

(1) Within three months provide erosion protection for the downstream abutments of the spillway.

(2) Within one year repair the concrete support for the floor stand gate operator and the bulkhead.

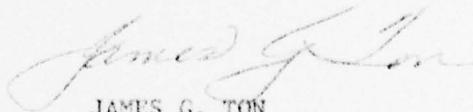
(3) Within three months evaluate alternative locations for the 12 inch diameter sewer pipe supported by a steel beam beneath the spillway bridge. Floating debris could catch on it and obstruct the spillway.

A copy of the report is being furnished to Mr. Dirk C. Hofman, New Jersey Department of Environmental Protection, the designated State Office contact for this program. Within five days of the date of this letter, a copy will also be sent to Congresswoman Helen S. Heyner of the Thirteenth District. Under the provisions of the Freedom of Information Act, the inspection report will be subject to release by this office, upon request, thirty days after the date of this letter.

Additional copies of this report may be obtained from the National Technical Information Services (NTIS), Springfield, Virginia, 22161 at a reasonable cost. Please allow four to six weeks from the date of this letter for NTIS to have copies of the report available.

An important aspect of the Dam Safety Program will be the implementation of the recommendations made as a result of the inspection. We accordingly request that we be advised of proposed actions taken by the State to implement our recommendations.

Sincerely yours,



1 Incl
As stated

JAMES G. TON
Colonel, Corps of Engineers
District Engineer

Cy furn:
Mr. Dirk C. Hofman, P.E.
Department of Environmental Protection

THIS PAGE IS BEST QUALITY PRACTICABLE
FROM COPY FURNISHED TO DDC

INDIAN LAKE DAM (NJ00167)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 27 June also 5, 12 and 19 July by Langan Engineering Associates, Inc. under contract to the State of New Jersey. The state, under agreement with the U. S. Army Engineer District, Philadelphia, had this inspection performed in accordance with the National Dam Inspection Act, Public Law 92-367.

The Indian Lake Dam, a high hazard potential structure, is judged to be in fair overall condition. However, the dam's spillway is considered seriously inadequate since 21 percent of the Probable Maximum Flood (PMF) would overtop the dam. To insure adequacy of the structure, the following actions, as a minimum are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures and studies within six months from the date of approval of this report. Any remedial measures necessary to insure the adequacy of the spillway and to prevent overtopping should be initiated within calendar year 1979. In the interim, a detailed emergency operation plan warning system, should be promptly developed. Also, during periods of unusually heavy precipitation, around-the-clock surveillance should be provided.

b. Within three months from the date of approval of this report engineering studies and analysis should be performed to determine the condition and effectiveness of the timber sheet pile cutoff along the upstream face of the spillway. This should include necessary borings, test pits, etc. as required to determine the nature of the spillway foundation materials and the condition of the connection between the cutoff wall and spillway. Piezometers should also be installed upstream and downstream of the spillway and monitored during a time when the lake is normally drawn down.

c. Within three months from the date of approval of this report the owner of Lake Estling should make necessary repairs to its spillway to ensure its satisfactory performance during extreme floods as it effects the performance of Indian Lake Dam.

d. The following remedial measures should be completed within the below listed times from the date of approval of this report:

(1) Within three months provide erosion protection for the downstream abutments of the spillway.

(2) Within one year repair the concrete support for the floor strand gate operator and the bulkhead.

(3) Within three months evaluate alternative locations for the 12 inch diameter sewer pipe supported by a steel beam beneath the spillway bridge. Floating debris could catch on it and obstruct the spillway.

APPROVED:

James G. Ton
JAMES G. TON
Colonel, Corps of Engineers
District Engineer

DATE:

1 Sep 78

THIS PAGE IS BEST QUALITY PRACTICABLE
FROM COPY FURNISHED TO DDC

PHASE 1 REPORT
NATIONAL DAM SAFETY PROGRAM

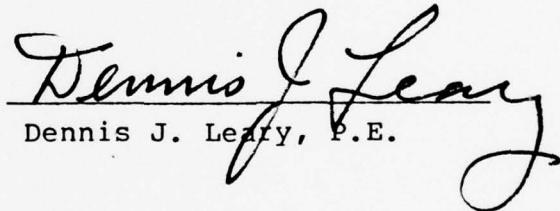
Name of Dam: INDIAN LAKE DAM
ID Number : Fed ID No. NJ00167
State Located: New Jersey
County Located: Morris
Stream: Den Brook
River Basin: Passaic
Date of Inspections: 27 June and 5,12 and 19 July 1978

ASSESSMENT OF GENERAL CONDITIONS

Indian Lake Dam is in fair condition. There is a possibility of seepage under the spillway and erosion of the downstream toe of the spillway during an extreme flood. Because Indian Lake receives flow from Lake Estling, some maintenance work on the abutments of the arch spillway of Estling Lake Dam is necessary to ensure its satisfactory performance under extreme flood conditions. The condition and effectiveness of the timber sheet pile cutoff along the upstream face of the spillway should be determined. This will require at least one boring and possibly a test pit to determine the nature of the spillway foundation materials and the condition of the connection between the cutoff wall and spillway. Piezometers should be installed upstream and downstream at the spillway and monitored during a time when the lake is normally drawn

down. Erosion protection should be provided for the downstream abutments of the spillway to prevent loss of embankment in the event of overtopping of the dam. The concrete support to the floor stand gate operator and the bulkhead should be repaired. Alternative locations of the 12-in-dia sewer pipe between the spillway side walls should be evaluated.

The spillway capacity as determined by CE screening criteria is seriously inadequate. We estimate the dam can adequately pass only 20% of the PMF. The capacity of the spillway and the spillway design flood should be determined using more precise and sophisticated methods and procedures. The need for and type of mitigating measures should be determined. Around the clock surveillance during periods of unusually heavy precipitation should be provided, and a warning system established.


Dennis J. Leahy, P.E.



OVER VIEW

INDIAN LAKE DAM
21 June 1978

CONTENTS

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY REPORT

INDIAN LAKE DAM N.J. NO. 34 FED. ID No. NJ00167

	<u>Page</u>
SECTION 1 PROJECT INFORMATION	I1
1.1 <u>General</u>	I1
1.2 <u>Project Description</u>	I1
1.3 <u>Pertinent Data</u>	I2
SECTION 2 ENGINEERING DATA	I3
2.1 <u>Regional Geology</u>	I4
2.2 <u>Site Geology</u>	I5
SECTION 3 VISUAL INSPECTION	I5
SECTION 4 OPERATIONAL PROCEDURES	I6
SECTION 5 HYDRAULIC/HYDROLOGIC	I6
SECTION 6 STRUCTURAL STABILITY	I7
SECTION 7 ASSESSMENT, RECOMMENDATIONS/ REMEDIAL MEASURES	I7
7.1 <u>Assessment</u>	I7
7.2 <u>Recommendations/Remedial Measures</u>	I8
FIGURES	<ol style="list-style-type: none">1. Regional Vicinity Map2. Essential Project Features3. Regional Geologic Features
APPENDICES	<ol style="list-style-type: none">1. Check List Visual Inspection2. Photographs3. Hydrologic Computations4. References

SECTION 1 PROJECT INFORMATION

1.1 General

Authority to perform the Phase I safety inspection of Indian Lake Dam was received from the State of New Jersey, Department of Environmental Protection, Division of Water Resources by letter dated 26 May 1978. This Authority was given pursuant to the National Dam Inspection Act, Public Law 92-367.

The purpose of the Phase I investigation is to develop an assessment of the general conditions with respect to safety of Indian Lake Dam and appurtenances based upon available data and visual inspection, and, determine any need for emergency measures and conclude if additional studies, investigations and analyses are necessary and warranted. The assessment has been made using screening criteria established in Recommended Guidelines for Safety Inspection of Dams prepared by the Department of Army, Office of the Chief of Engineers. It is not the purpose of the inspection to imply that a dam meeting or failing to meet the screening criteria, is per se, certainly adequate or inadequate.

1.2 Description of Project

Indian Lake Dam was built in 1921. It is a 340-ft-long, 15-ft-high earth dam. The crest width varies from 27 ft to 52 ft. It is located along North Shore Road at the northeast end of Indian Lake in the Township of Denville, Morris County, N.J. The dam is at 40°53.5' latitude and 74°28.9' longitude. The dam includes a free fall ogee shaped spillway. The length of the spillway is 40 ft. The spillway is covered downstream by a concrete bridge that is five feet above water level. Indian Lake is fed from above by Lake Estling which in turn is fed by Lake Shongum. The area of Indian Lake is 88 acres and the watershed area is 4740 acres which includes Lake Estling catchment area. A regional vicinity map is given in Fig. 1.

Indian Lake Dam is classified as being "Intermediate" on the basis of its reservoir storage volume, which is more than 1,000-acre feet, but less than 50,000-acre feet. It is classified as "Small" on the basis of its total height, which is less than 40 feet. The overall size classification is the larger of these two determinations, and accordingly the dam is classified as "Intermediate" in size.

In the National Inventory of Dams, Indian Lake Dam has been classified as having "High Hazard Potential" on the basis that failure of the dam would cause excessive property damage to residences downstream, and could potentially cause more than a few deaths. Visual inspection of the downstream area shows that breach of the dam would cause damage to residences and be hazardous to people utilizing Routes 80 and 46. Accordingly, It is proposed not to change the Hazard Classification.

The dam is owned by the Indian Lake Community Club and the lake is used for recreation.

At the time of our inspection the water level was approximately one inch above spillway crest and tailwater level was about seven feet below lake water level. The tail race water level is controlled by a pond between the dam and Interstate Route 80. The pond discharges into the Rockaway River.

1.3 Pertinent Data

The maximum length of Indian Lake is 3600 ft. The length of the pool and downstream channel between North Shore Road and Route 80 is approximately 800 ft. The spillway was designed for a 3 ft head and has a reported capacity of 1065 cfs. Two bottom outlets are located at the spillway side walls. The outlet pipes, 2-ft-dia. cast iron pipes, lead to 30-inch diameter control gates at the abutment walls and then into 2 ft by 2 ft culverts which run through the abutment walls. The crest of the dam is at elevation 513.5 and the crest of the spillway is at elevation 508.

The spillway is reported to be founded on medium sand. A timber sheet pile cutoff is reported to extend below the upstream face of the spillway to a depth of about 4.5 ft. This information should be checked. The references are difficult to decipher.

The upstream slope of the embankment is reported to have been constructed with a 2.5 hor to 1 vert. and the downstream slope at a 2 hor to 1 vert. The embankment is reported to have been constructed of sand and clay soil spread in shallow layers and compacted by rolling with a weighted down traction engine that gave a contact stress of approximately 30 lb/in². Presently, the upstream side of the dam has a concrete bulkhead and stone faced upper wall at the highway. The wall and bulkhead are separated by a 7-ft-wide walkway. The downstream side of the dam has been filled in and is used for parking.

Lake Estling feeds Indian Lake by way of a free fall arch spillway that is located at the southern end of Indian Lake. The developed length of the crest is approximately 30 ft.

The locations and elevations of the different parts of the dam and appurtenances have been obtained by means of surveyors transit and rod, USGS Maps, and reference documents. They are considered approximate. Essential Project Features are given in Fig 2.

SECTION 2 ENGINEERING DATA

Information on the design and construction is very limited and there is a lack of information concerning the nature of the foundation, which is very important particularly with respect to evaluation of the stability of the spillway section. What information is available indicates the dam and appurtenances were responsibly designed and constructed.

2.1 Regional Geology

Indian Dam is located in the New Jersey Highlands physiographic province. The New Jersey Highlands extend across the State in a northeast-southwest direction from the border of New York to the Delaware River and includes the northwest portions of Hunterdon, Passaic, and Morris Counties and the southeastern parts of Warren and Sussex Counties. This province is part of the New England Physiographic Province and lies between the Appalachian Ridge and Valley Province to the northwest and the Piedmont Province to the southeast. See Fig 3.

The Highlands are characterized by rounded and flattopped northeast-southwest ridges and mountainas up to 1,400 ft high separated by narrow valleys. The orientation of the valleys are usually, but not always controlled by the underlying geologic structure.

The regional geologic structure reflects the very old age of bedrock. A number of regional faults cross the area in a northeast southwest direction, including the Ramapo Fault; the more than 30 mile long fault scarp forms the eastern border of the province. Faults control many of the river valley orientations. The relatively uniform slope of the mountain elevations, from northwest to southeast, is a direct result of the faulting. The entire area is part of the now dissected Schooley Peneplain.

The Pleistocene Age Wisconsin glacier covered all of the dam site area.

The glacier stripped most of the existing overburden and weathered rock and uncovered the numerous hard bedrock knobs and ridges seen throughout the province. Most of the side-slopes in the area are covered with heavy boulder tills (ground moraine), whereas glacial outwash and recent alluvium cover the valleys.

2.2 Site Geology

Indian Lake Dam is located on a broad valley bottom near the terminal moraine. The dam area is urbanized with a number of commercial buildings, residences and roads. The terrain, particularly on the left abutment, has been extensively reworked and graded and little of the natural topography remains. On the right abutment, a commercial building has been constructed into the hillside. It is assumed that rock excavation would have been prohibitive and the excavation was made in overburden.

Although the foundation material on the left abutment could not be determined from surface exposures, natural slopes of up to 24° do exist on the right abutment. This slope appears to be composed primarily of glacial outwash material, a rounded cobbly, gravelly, silty sand. The Engineering Soil Survey of New Jersey (Report No. 9, Morris County) reports that residual soils may be possible on the right abutment and glacial outwash on the left abutment.

SECTION 3 VISUAL INSPECTION

The general conditions and maintenance of Indian Lake Dam and appurtenant structures appear good.

There is some concrete deterioration in the downstream spillway sidewalls and weathering at the spillway construction joints, otherwise the spillway section appears in adequate condition. The concrete bulkhead at the right side of the spillway has cracked and some of the stone facing has fallen out but this is not considered serious.

The bottom outlets are in functional condition and the gate valves seem to be in satisfactory condition. They can be easily operated by one man with a ratchet lever handle. The concrete support for the floor stand operator for the control valve at the left side of the spillway has broken up and should be repaired.

The masonry arch spillway at Lake Estling has had the mortar washed out from the rock blocks at the abutments and is in need of repair.

A 12-in-dia sewer pipe passes under the bridge between the sidewalls of the Indian Lake spillway. The pipe is supported by a steel beam and could cause obstruction of the spillway by floating debris during an extreme flood.

SECTION 4 OPERATIONAL PROCEDURES

Water levels are not being recorded. The lake is lowered approximately twice a year when the level rises during storms and every 3 or 4 years to allow maintenance and repair of docks. No flow measurements or systematic inspections are made.

SECTION 5 HYDRAULIC/HYDROLOGY

The hydraulic/hydrologic evaluation for Indian Lake Dam is based on a spillway design flood (SDF) equal to the probable maximum flood (PMF) in accordance with evaluation guidelines for dams classified as high hazard and intermediate in size. The PMF has been determined by developing a synthetic hydrograph based on the maximum probable precipitation of 22.5 inches (200 square mile - 24 hour). Hydrologic computations are given in Appendix 3. The PMF determined for the subject watershed is 16,448 cfs.

The spillway is essentially a broad crested weir with a length of 40 ft. After flowing over the spillway the water passes through the dam via a bridge opening with dimensions of 40-ft-wide by 11-ft-high to a small pond with its water surface elevation approximately 7 ft below Indian Lake.

The original design data indicates the spillway was designed to pass a flood of approximately 1100 cfs with a 3 ft head and with 1 ft of freeboard remaining to the crest of the dam. Our calculations indicate with the existing available head of 5.5 ft to the dam crest the maximum capacity of the spillway is 1702 cfs which is less than the required SDF.

Flood routing calculations indicate that Indian Lake Dam will overtop by approximately 4 ft under the PMF. We estimate that Indian Lake Dam can adequately pass approximately 20% of the PMF.

SECTION 6 EVALUATION OF STRUCTURAL STABILITY

From visual observations the general stability of the dam spillway appears to be adequate. However, two factors must be considered. The first is the nature of the clay and sand foundation of the spillway. The stability of the spillway depends on the efficiency of the timber cut off below the spillway. No previous operating record for a normal flood can ensure satisfactory performance during an extreme flood. The second is the maximum flood the structures can withstand. An extreme flood would pass over the crest of the dam, i.e. over the road. This could result in erosion of the downstream slope which could undermine the downstream portion of the spillway abutments.

Indian Lake Dam is located in Seismic Zone 1 of the Seismic Zone Map of Contiguous States. The degree of stability of the dam and appurtenances are assumed to be within conventional safety margins and to present no hazard from earthquakes. If, however, there is loose sand below the dam, or, the Seismic Zone rating is seriously increased in the future, or data becomes available to indicate it may be increased, further study with respect to seismic stability may be necessary.

SECTION 7 ASSESSMENT, RECOMMENDATION, REMEDIAL MEASURES

7.1 Assessment

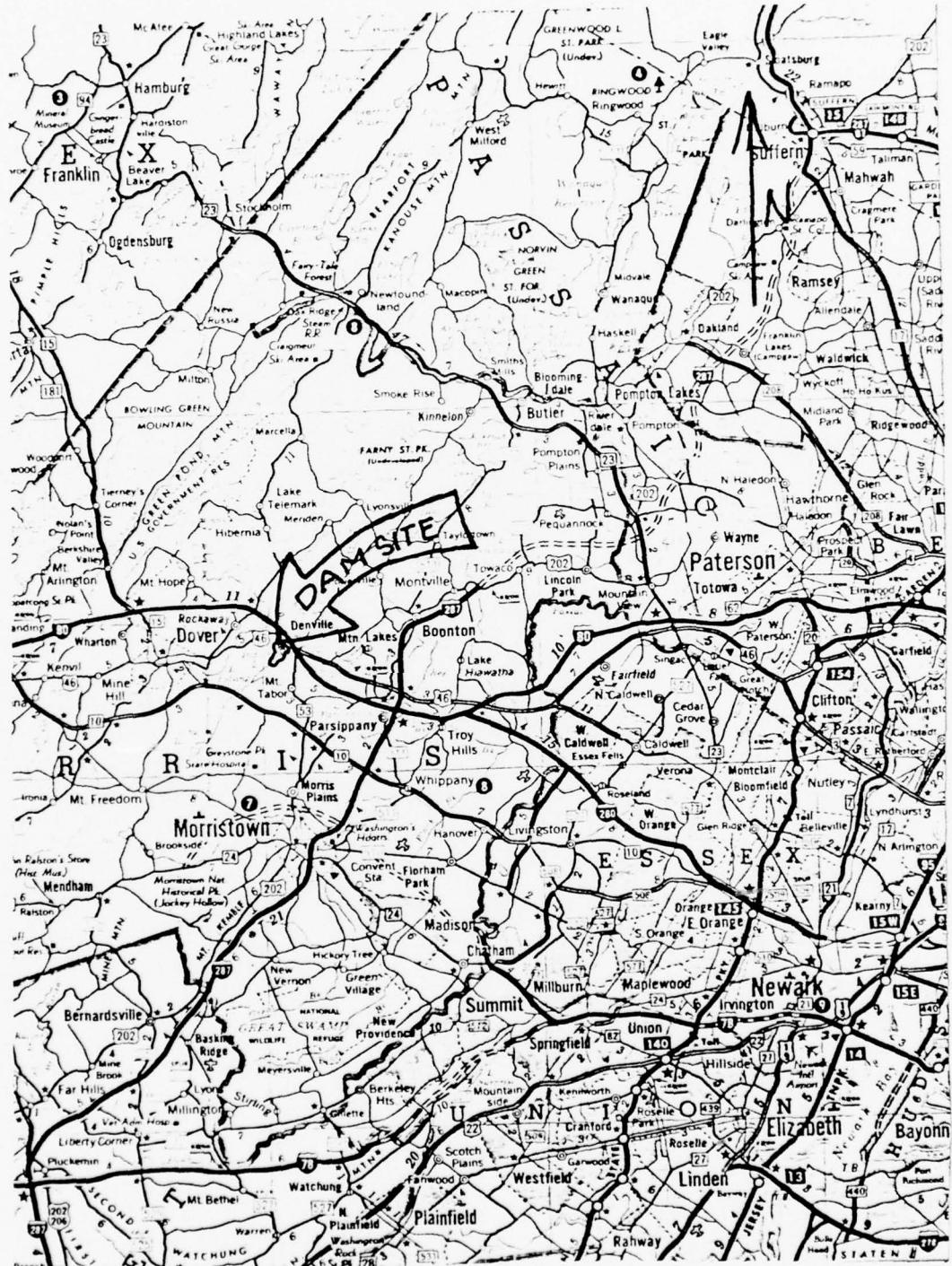
The available information on Indian Lake Dam is not sufficient to draw a conclusion concerning the actual degree of stability. However, conditions appear satisfactory. We are concerned about the possibility of seepage under the spillway and erosion of the downstream toe of the spillway during an extreme flood.

Because Indian Lake receives the flow from Lake Estling, some maintenance work on the abutments of the arch spillway of Estling Lake Dam is necessary to ensure its satisfactory performance under extreme flood conditions.

7.2 Recommendations/Remedial Measures

We recommend the following remedial measures;

1. Determine the condition and effectiveness of the timber sheet pipe cutoff along the upstream face of the spillway. This will require at least one boring and possibly a test pit to determine the nature of the spillway foundation materials and the condition of the connection between the cutoff wall and spillway. Piezometers could be installed upstream and downstream and the spillway and monitored during a time when the lake is normally drawn down. This should be done very soon.
2. Provide erosion protection for the downstream abutments of the spillway to prevent loss of embankment in the event of overtopping of the dam. This should be done very soon.
3. Make necessary repairs to the Lake Estling spillway to ensure its satisfactory performance during extreme floods. This should be done very soon.
4. Repair concrete support to the floor stand gate operator and the bulkhead. This should be done in the near future.
5. Evaluate alternative locations of the pipe between the spillway side walls. This should be done very soon.
6. The spillway capacity as determined by CE screening criteria is seriously inadequate. We estimate the dam can adequately pass only 20% of the PMF. The capacity of the spillway and SDF should be determined using more precise and sophisticated methods and procedures. A more extensive topographic survey of the dam and vicinity should be made. The need for and type of mitigating measures should be determined. Around the clock surveillance during periods of unusually heavy precipitation should be provided, and a warning system established. This should be done soon.



SCALE: 1" ≈ 5.2 MILES

REGIONAL VICINITY MAP INDIAN LAKE DAM

Fig 1

Culvert Under
Franklin Road

Indian
Lake

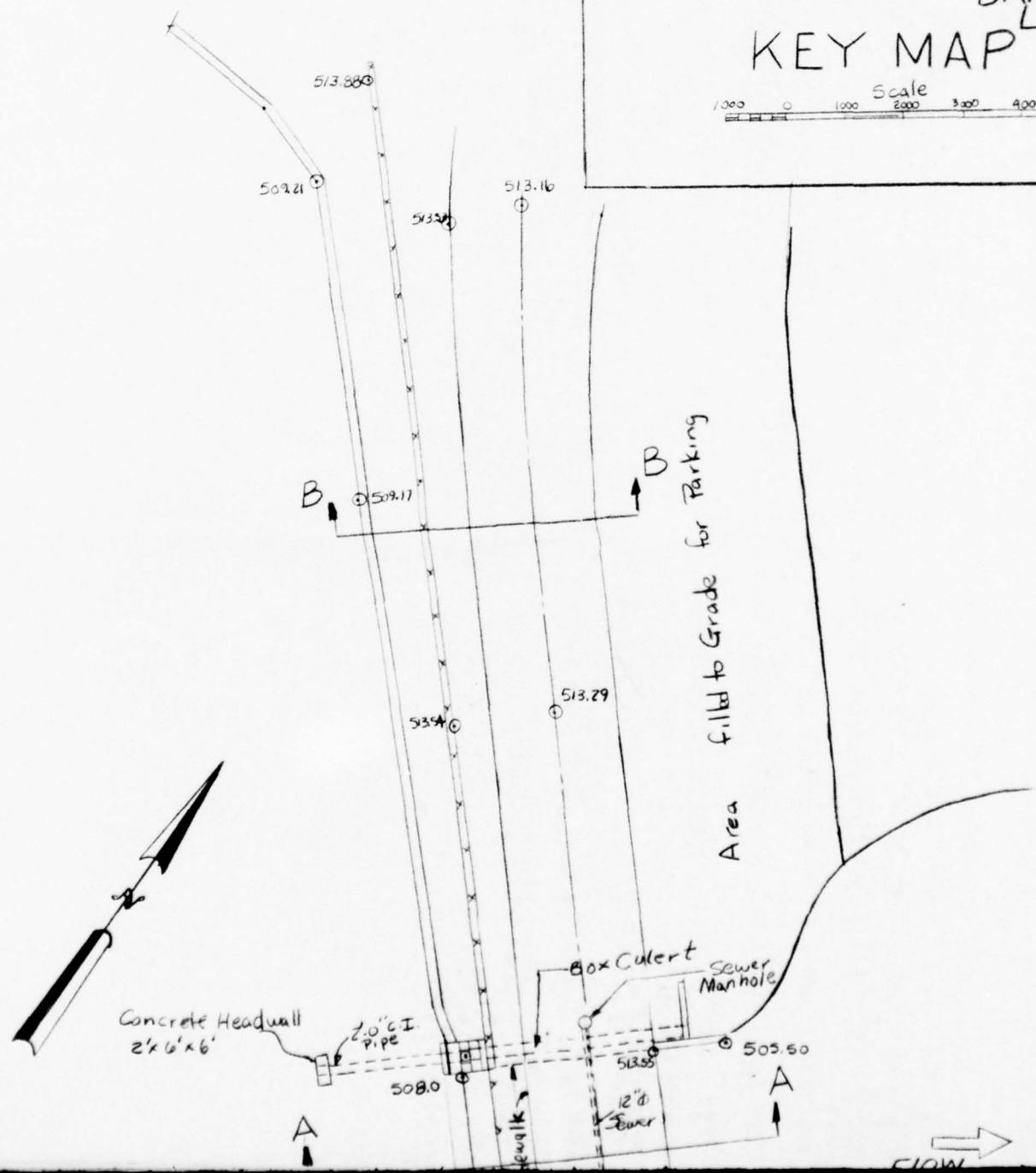
Estling Lake

SPILLWAY
from Lake Estling

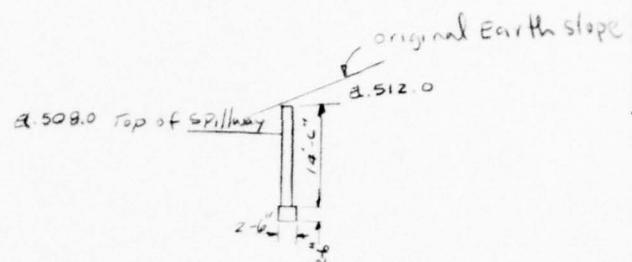
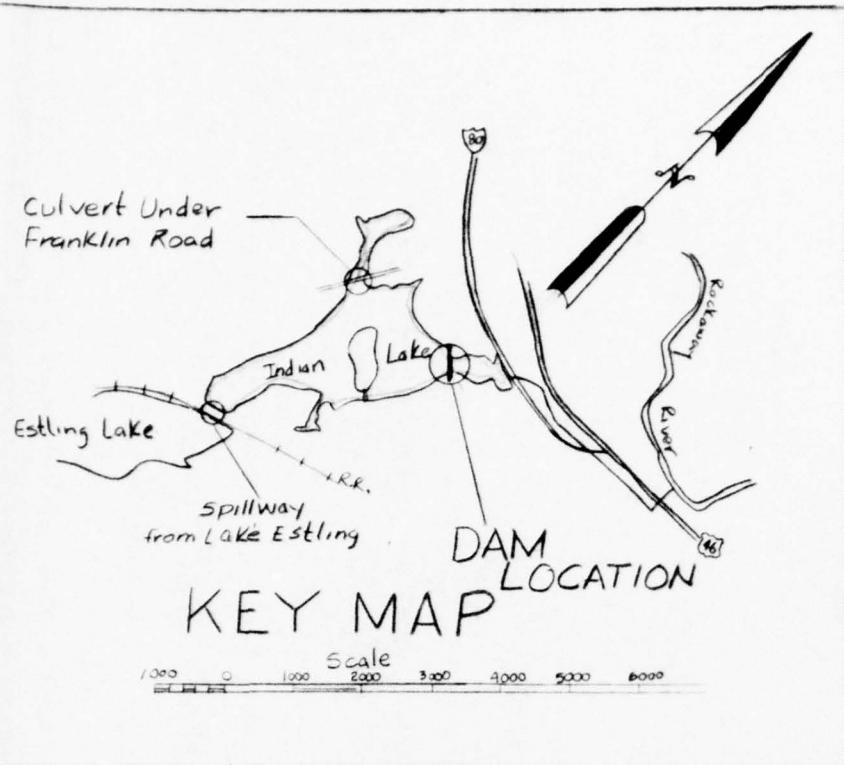
DAM LOCAT

KEY MAP

Scale
1000 0 1000 2000 3000 4000 5000

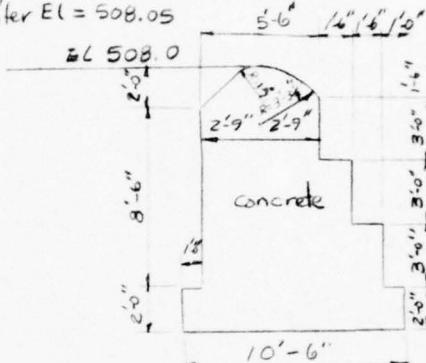


2

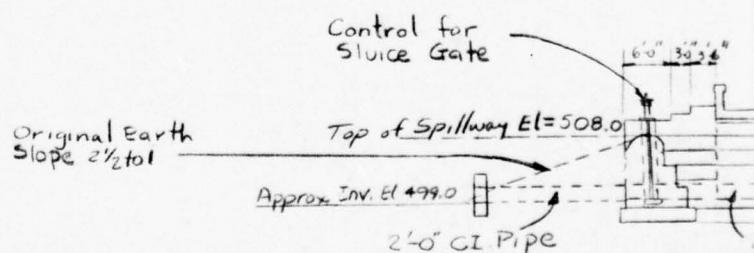
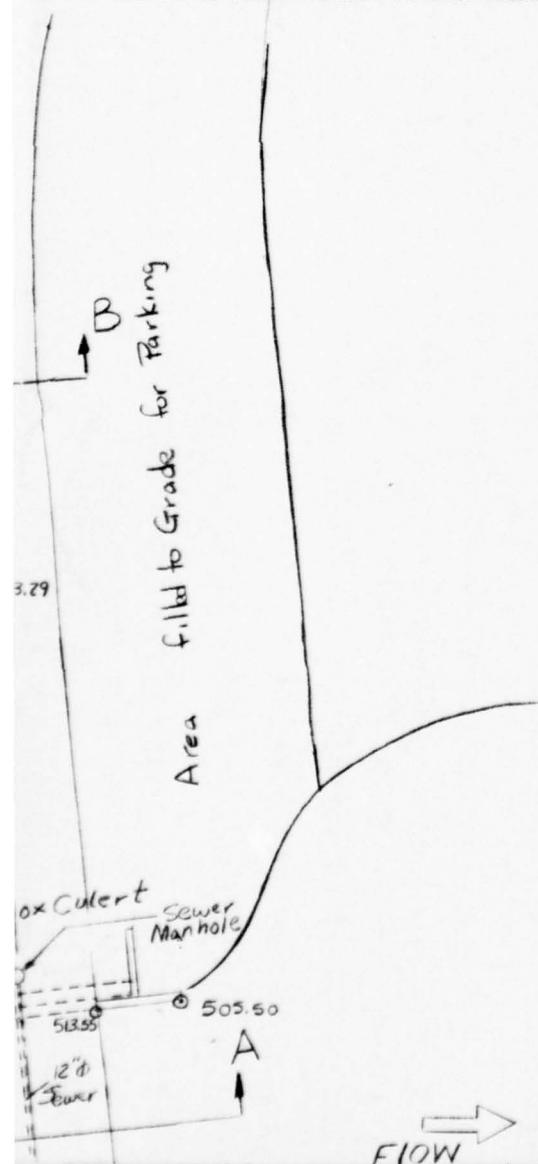


CORE WALL
on each side of spillway 8'-0" long

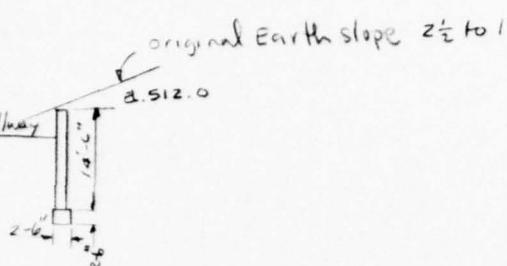
Note
July 12, 1978
water El = 508.05



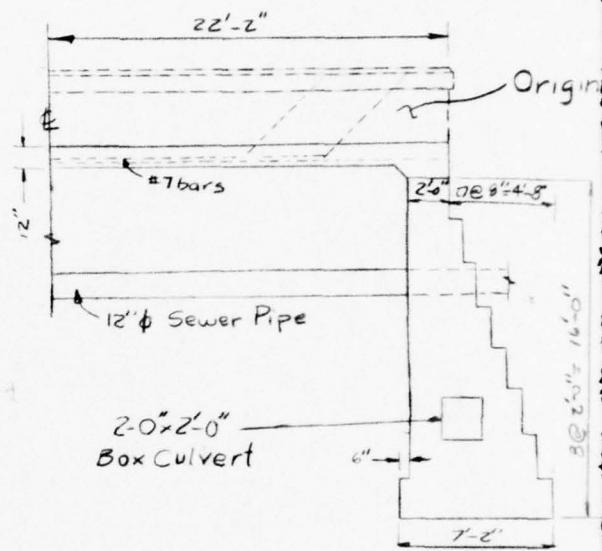
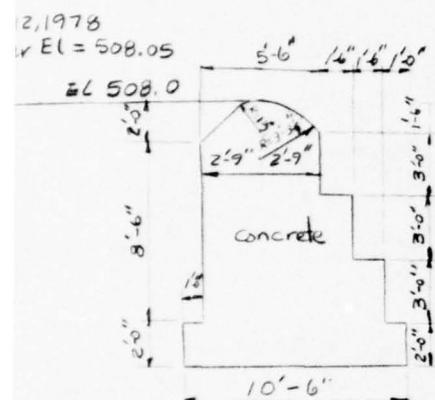
CROSS SECTION OF SPILLWAY



ORIGINAL SECTION A-A ALONG

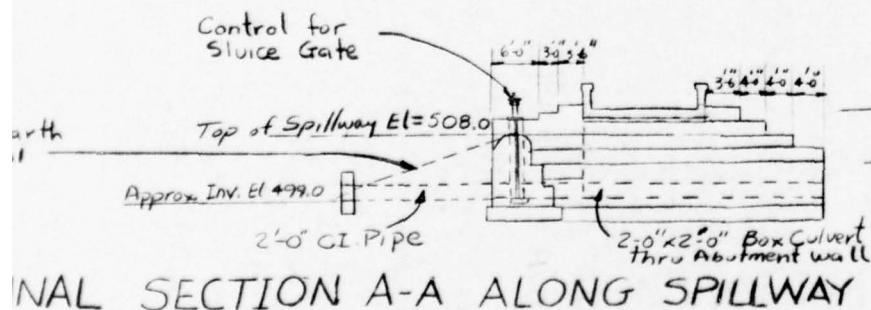


CORE WALL
on each side of spillway 8'-0" long

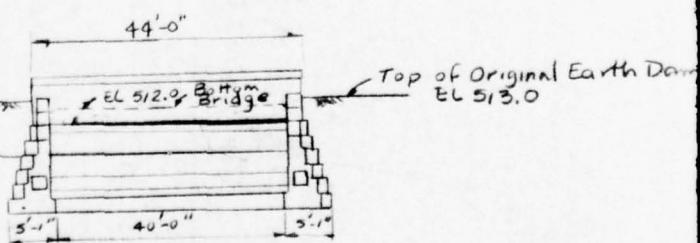


SECTION OF SPILLWAY

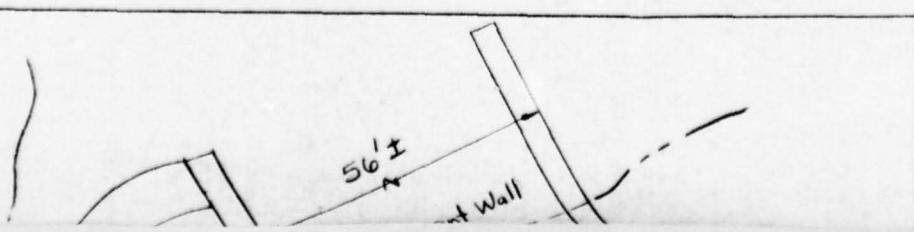
HALF LONGIT. SECTION B

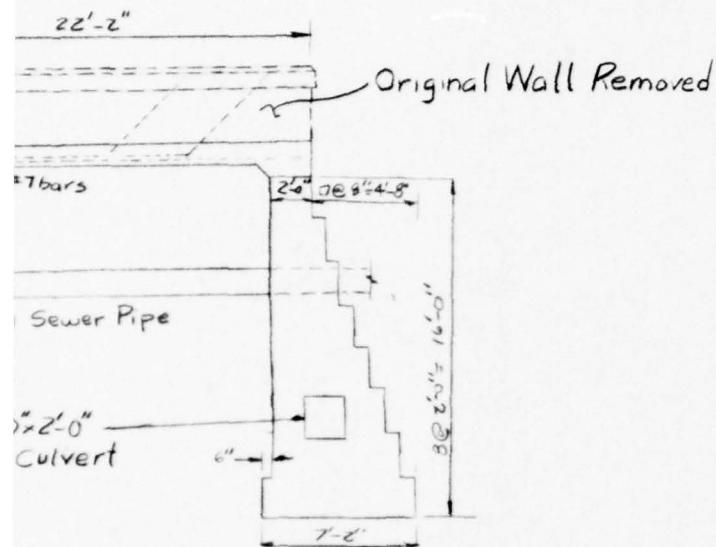


NAL SECTION A-A ALONG SPILLWAY

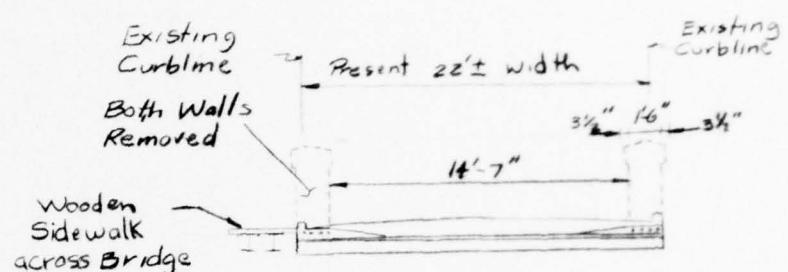


ELEVATION

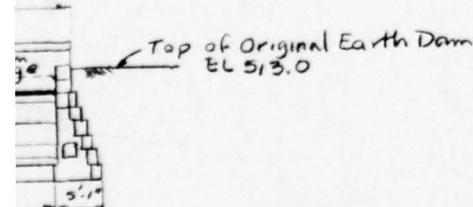




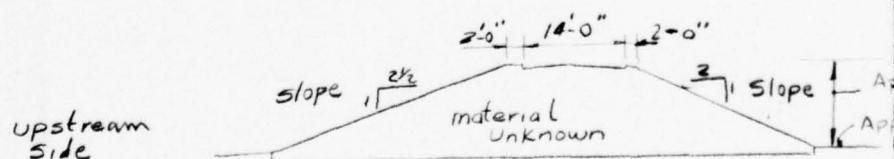
NGIT SECTION BRIDGE



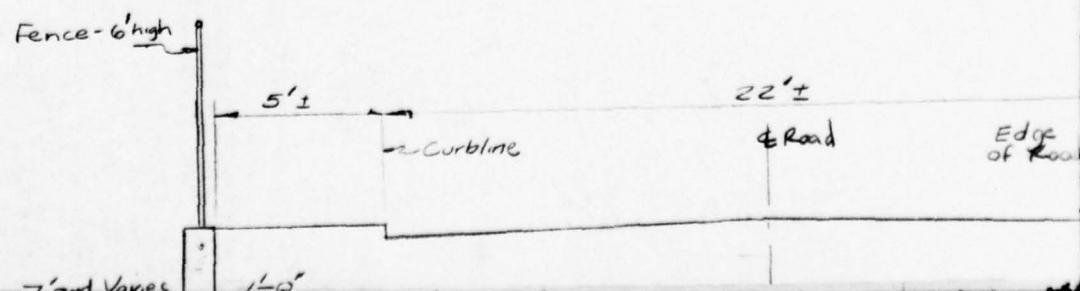
BRIDGE CROSS SECTION

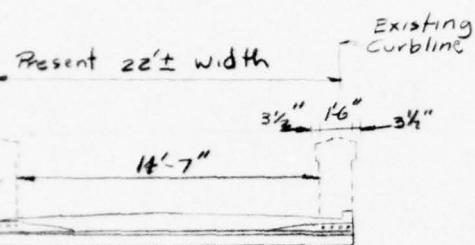


10N

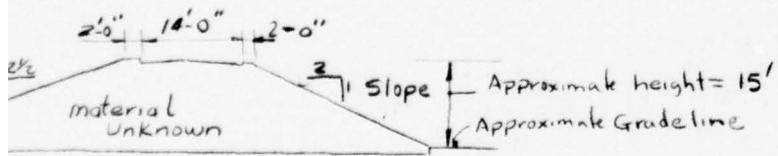


ORIGINAL EARTH DAM CROSS SECTION

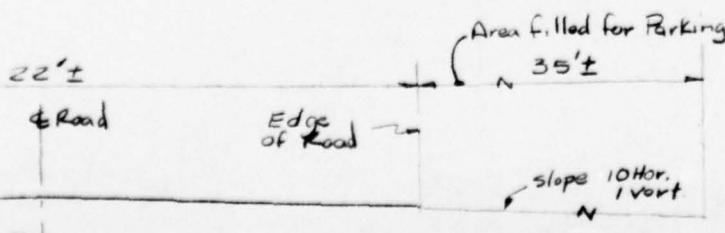




RIDGE CROSS SECTION



EARTH DAM CROSS SECTION



INDIAN
LAKE

Scale 1" = 20'-0"

concrete Headwall
2' x 6' x 6'

508.0

2" CI PIPE

509.90

Wooden Stake

513.56 505.70

509.35

513.85 513.16

513.70

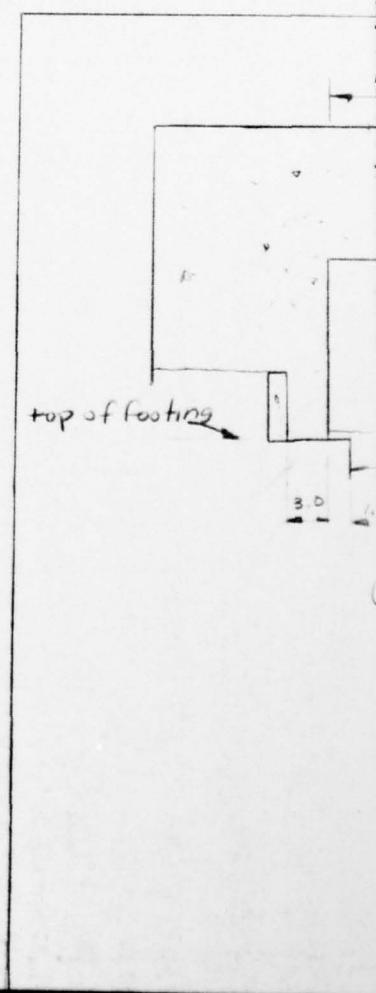
513.72

FLOW
Water Level

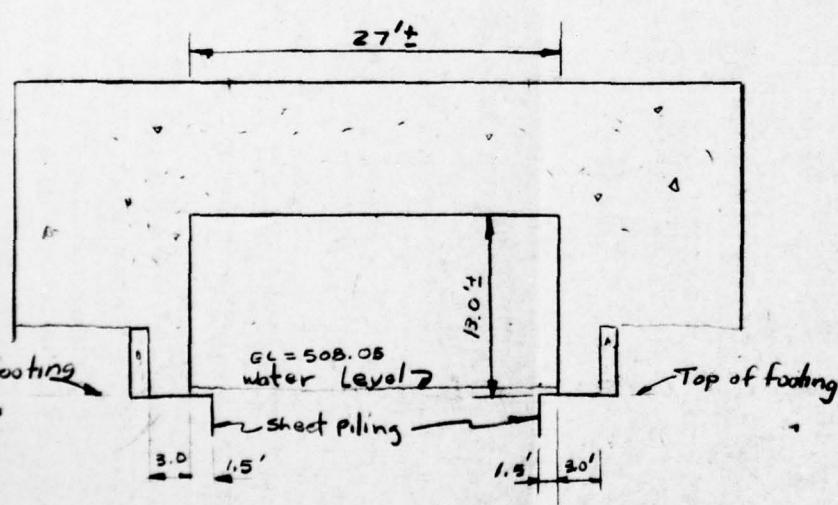
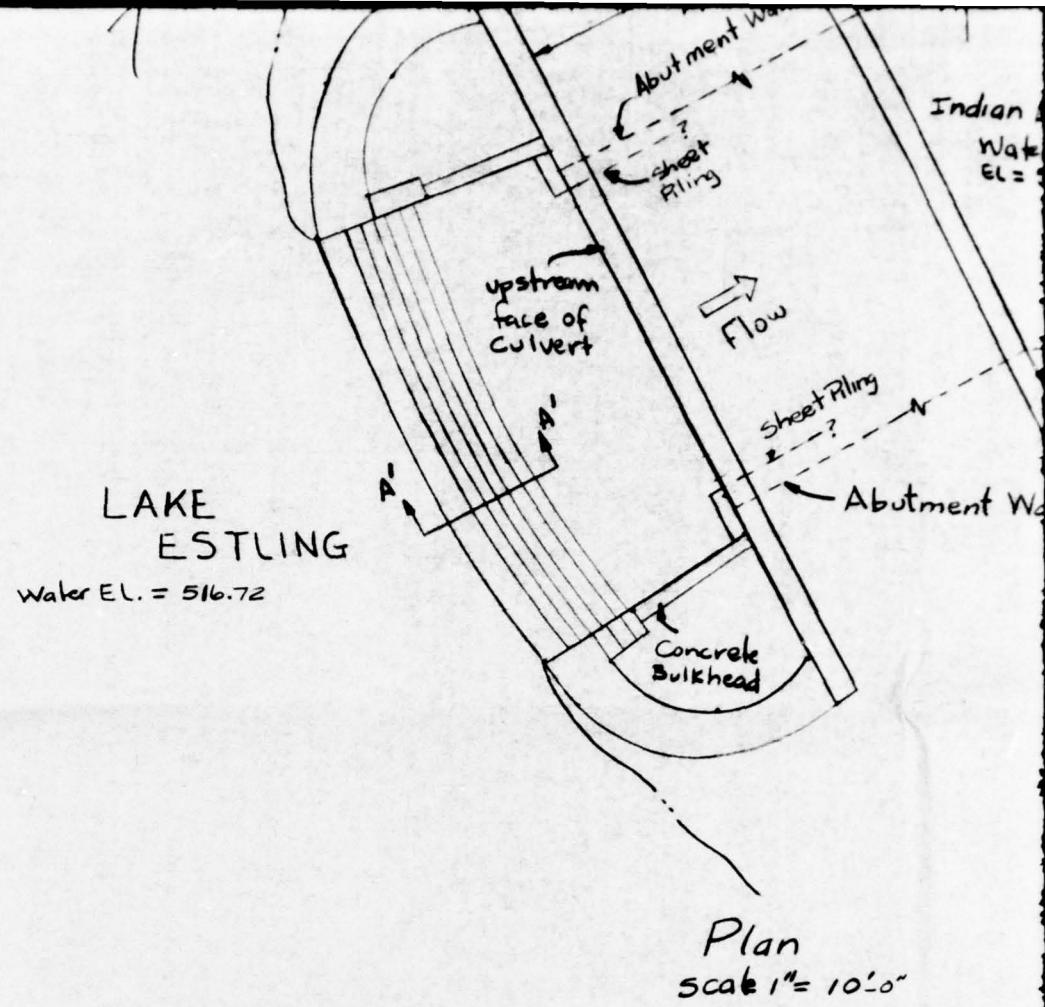
Box culvert
Sewer Manhole

for Parking

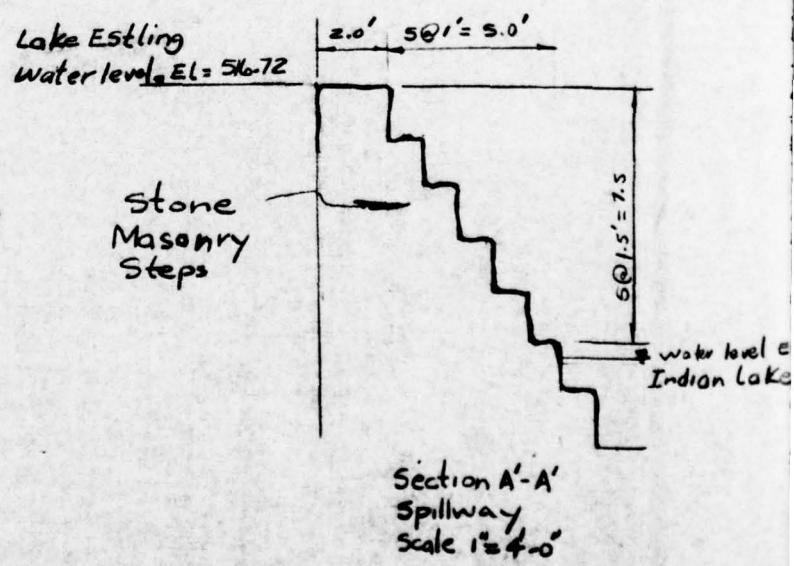
Area filled to Grade
for Parking



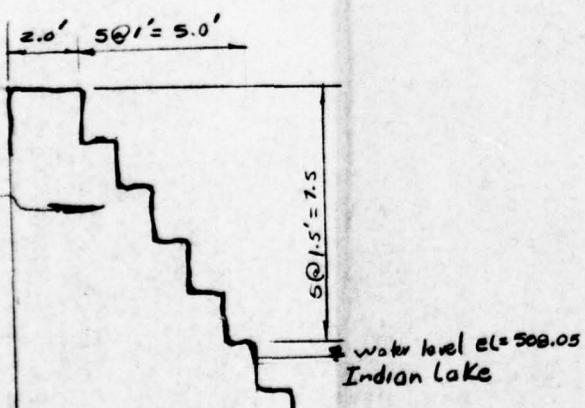
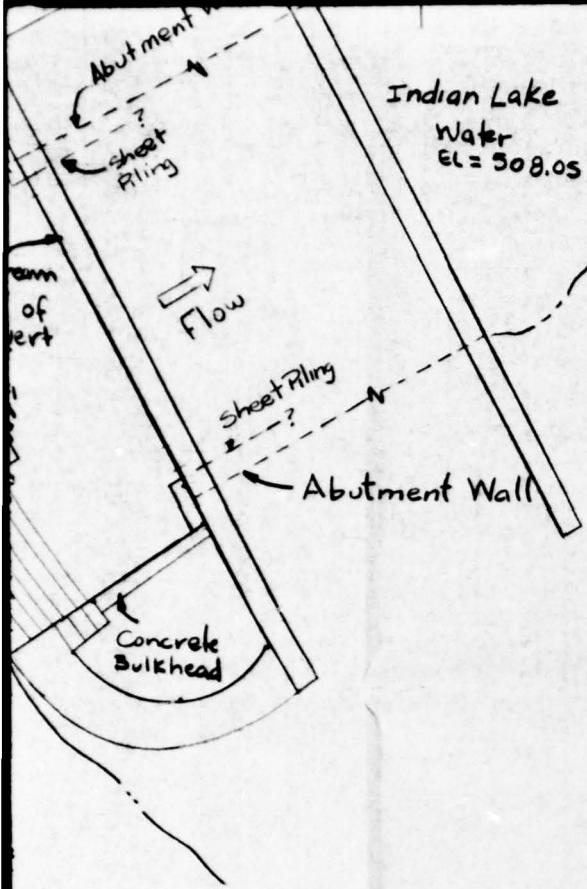
Water Level Elev = 501.72



Upstream face of Culvert
Scale 1" = 10'-0"

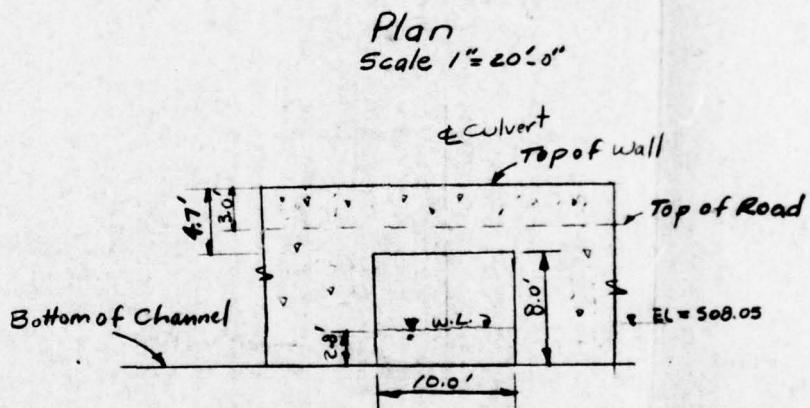
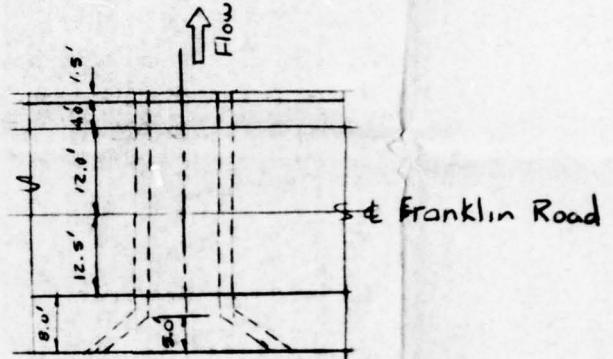
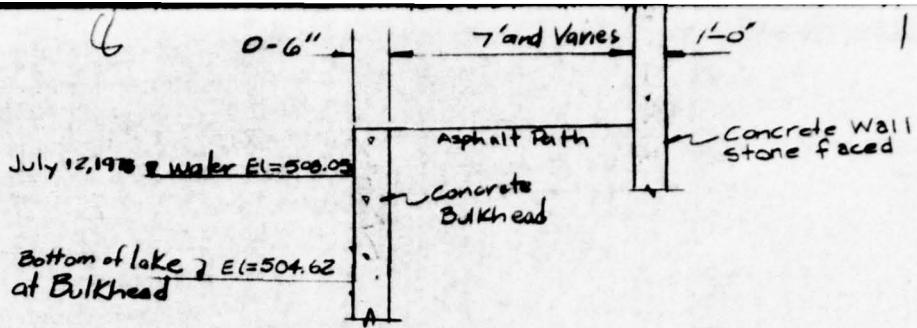


SPILLWAY FROM LAKE ESTLING INTO INDIAN LAKE

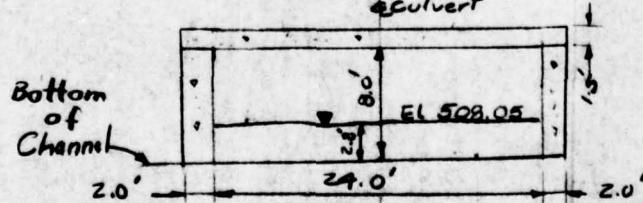


Section A'-A'
Spillway
Scale 1" = 4'-0"

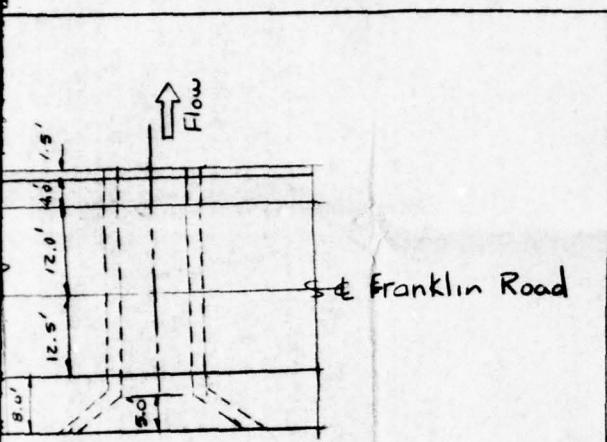
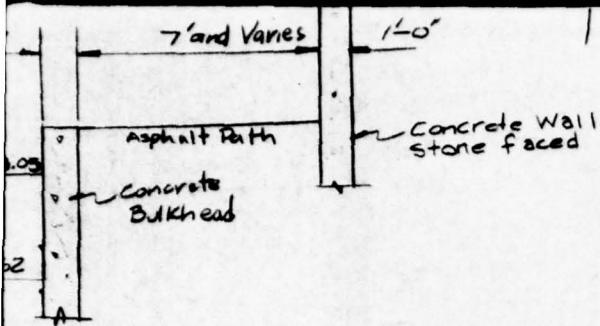
INDIAN LAKE



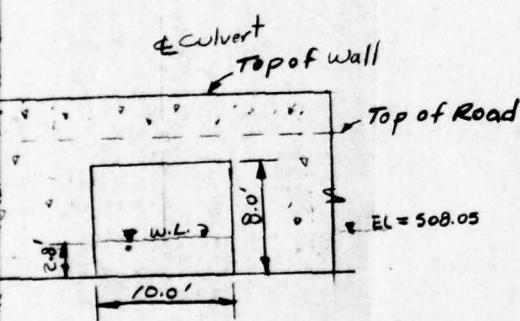
Downstream face of Culvert
scale 1" = 10'-0"
Culvert



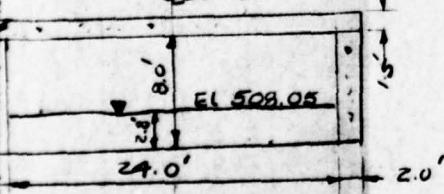
CULVERT UNDER FRANKLIN ROAD



Plan
Scale 1" = 20'-0"



Downstream face of Culvert
scale 1" = 10'-0"
& culvert

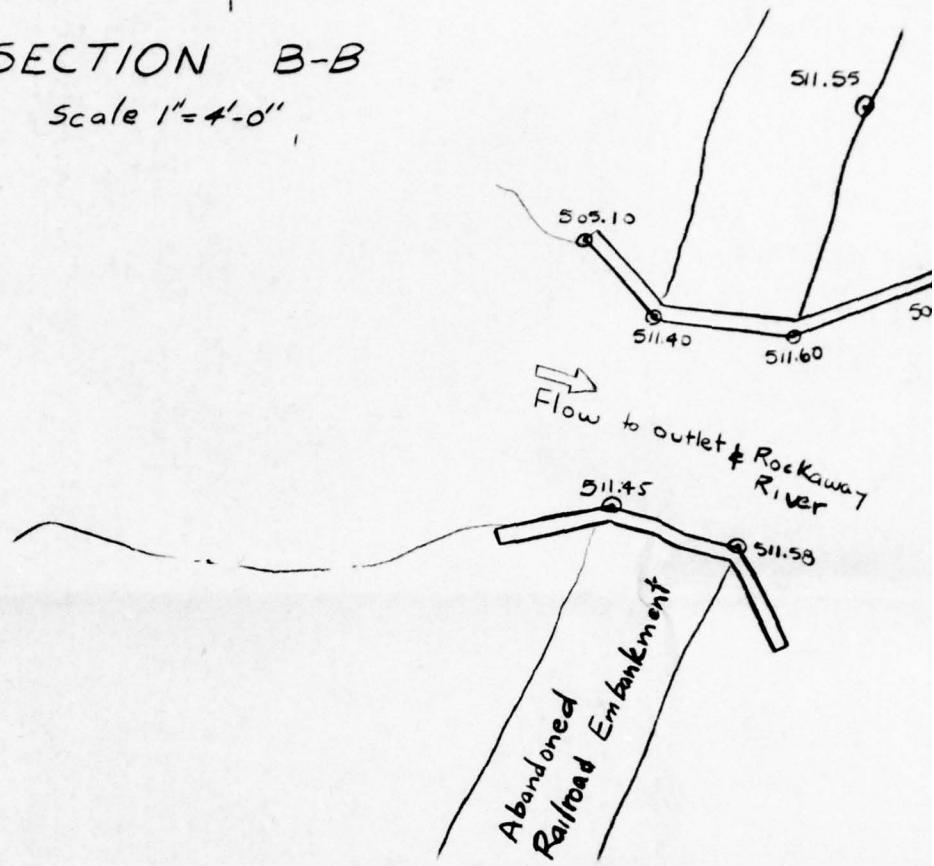


Upstream face of Culvert
scale 1" = 10'-0"

CULVERT UNDER FRANKLIN ROAD

SECTION B-B

Scale 1" = 4'-0"



OUTLET OF STILLING BASIN

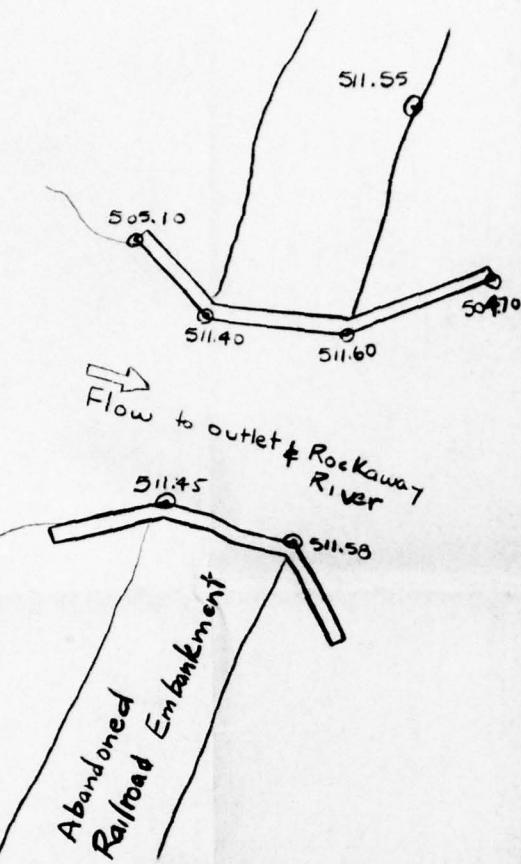
Scale 1" = 20'-0"

Note: The elevations shown were obtained using a surveyor's transit and level and USGS Map for BOONTON QUADRANGLE. The reference elevation of 520.0 at the N.E. corner of the bathhouse was used and later adjusted to the as built drawings of the spillway's recorded elevation of 508.0.

9

SECTION B-B

Scale 1"=4'-0"



10

OUTLET OF STILLING BASIN

Scale 1"=20'-0"

Note: The elevations shown were obtained using a surveyor's transit and level and USGS Map for BOONTON QUADRANGLE. The reference elevation of 520.0 at the N.E. corner of the bathhouse was used and later adjusted to the as built drawings of the spillway's recorded elevation of 508.0.

DATE	DESCRIPTION	NO.
REVISIONS		



PROJECT	PHASE I
INSPECTION & EVALUATION	
of	
NEW JERSEY DAMS	

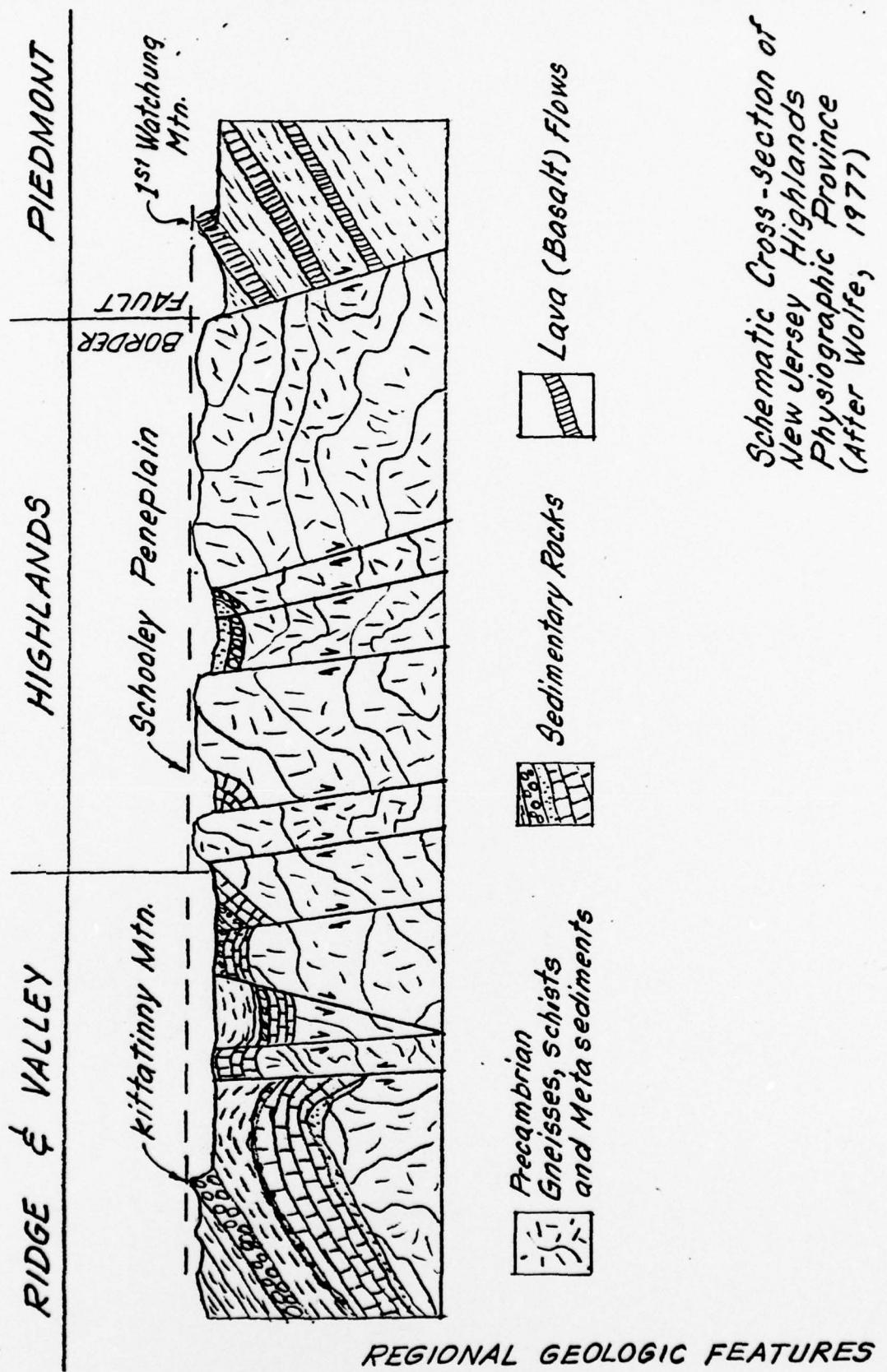
DRAWING TITLE

INDIAN LAKE DAM
JULY 1978

FED. ID. NO. NJ.00167 N.J. No. 34

JOB NO. J783	DRAWING NO.
DATE 5 July 1978	
SCALE as noted	
DRA. BY JC	
CHKD. BY D.J.L.	OF. SHEETS

FIG. 2



Schematic Cross-section of
 New Jersey Highlands
 Physiographic Province
 (After Wolfe, 1977)

Fig 3

APPENDIX 1

CHECK LIST

VISUAL INSPECTION

INDIAN LAKE DAM

Check List
Visual Inspection
Phase 1

Name Dam	Indian Lake Dam	County	Morris	State	New Jersey	Coordinator	N.J. DEP
Date(s) Inspection	19 July 1978	Weather	Sunny	Temperature	70-80° F		
	27 June 1978						
	5 July 1978						
	12 July 1978						

Pool Elevation at Time of Inspection 508.1 M.S.L.

Tailwater at Time of Inspection 501.7 M.S.L.

Inspection Personnel:

D. Leary (27 June & 5 July)	D. Lachel (12 July)	Mr. Ray Mitchell - Donville
A. Puyo (27 June & 5 July)	G. Bondy (19 July)	Township Water Dept. (19 July)
C. Campbell (12 July)		
D. Leary		Recorder

Section 1

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	Minor Cracks in Surface of Asphalt road paving	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None Observed	
SLoughing or Erosion of embankment and abutment slopes	None Observed	
Vertical and horizontal alignment of the crest	Good	
RIPRAP FAILURES		None observed crack at top of upstream concrete bulkhead and stones have fallen from stone facing of upper retaining wall above concrete bulkhead at right side of spillway.

Sheet 2

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Good at embankment abutments and at spillway sidewalls	
ANY NOTICEABLE SEEPAGE	None observed	
STAFF GAGE AND RECORDER	None observed	
DRAINS	None observed	

VISUAL EXAMINATION OF CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	OUTLET WORKS	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
		Spillway sidewalls have a 2 ft x 2 ft concrete outlet conduit located in each spillway sidewall. Left sidewall is deteriorated, outlet conduit could not be observed.	
	INTAKE STRUCTURE	Reported to be functional, could not be observed. Has two 30 inch gates, one at each spillway sidewall. Both gates appear to be in satisfactory working order.	
	OUTLET STRUCTURE	Reported to be functional, could not be observed.	
	OUTLET CHANNEL	Stilling pond and Den Brook appeared satisfactory without obstructions.	
	EMERGENCY GATE	No emergency gate observed	

UNGATED SPILLWAY		REMARKS OR RECOMMENDATIONS
VISUAL EXAMINATION OF	OBSERVATIONS	
CONCRETE WEIR	Appears to be generally in satisfactory condition with weathering of vertical grooves of what appears to be construction joints.	
APPROACH CHANNEL	Appears satisfactory	
DISCHARGE CHANNEL	Appears satisfactory	
BRIDGE AND PIERS	Good condition, however, pipe is below bridge and across spillway and could cause obstruction	

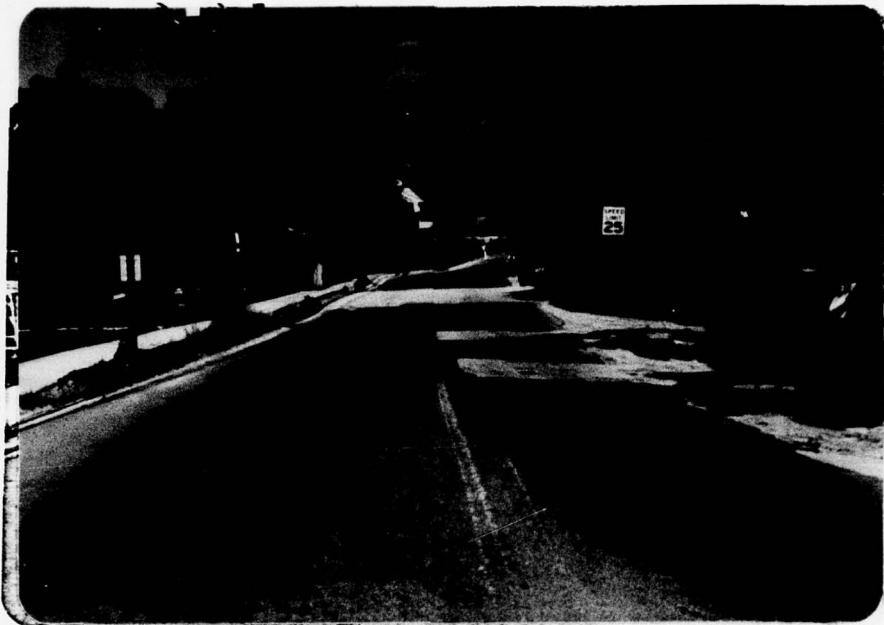
VISUAL EXAMINATION OF		RESERVOIR	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES			No signs of slope instability observed. Residential area surrounds Lake. Slopes vary from about 30 hor to 1 vert to 15 hor to 1 vert.	
SEDIMENTATION			There could be considerable sedimentation in Lake because Lake Estling and Shongum feed Indian Lake. However, no measurements were made.	

DOWNSTREAM CHANNEL		
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	No obstructions or debris observed.	
SLOPES	Appeared relatively flat and stable.	
APPROX DATE NO. OF HOMES AND POPULATION		Nearest City reported to be Denville with population of 11,000. Routes 80 and 46 are located immediately downstream of dam.

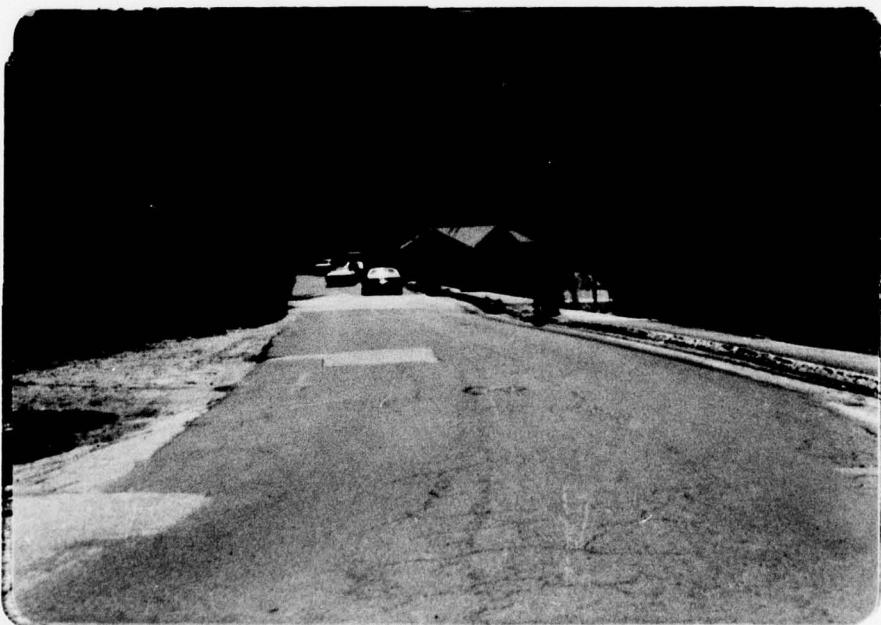
APPENDIX 2

PHOTOGRAPHS

INDIAN LAKE DAM

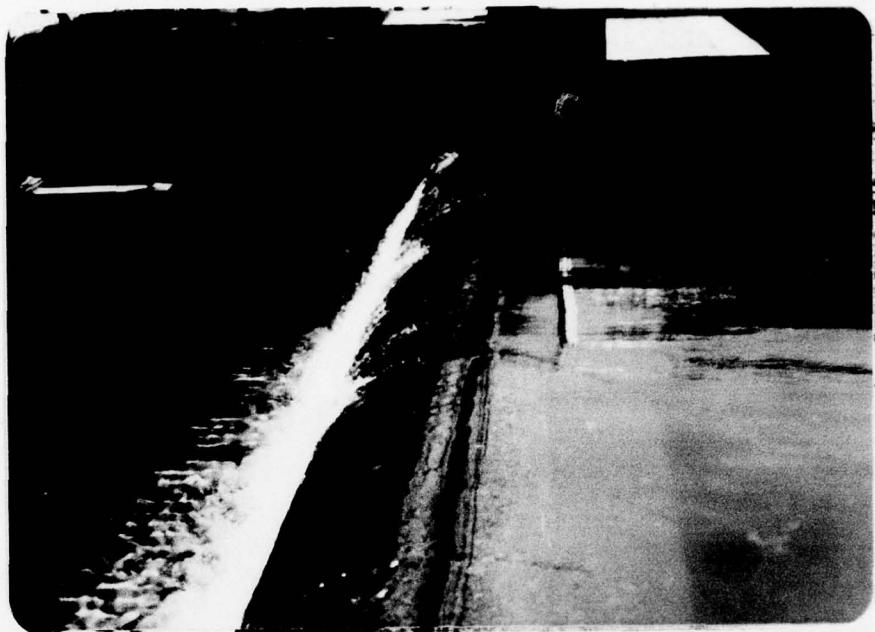


Crest of dam looking Northwest 5 July 1978



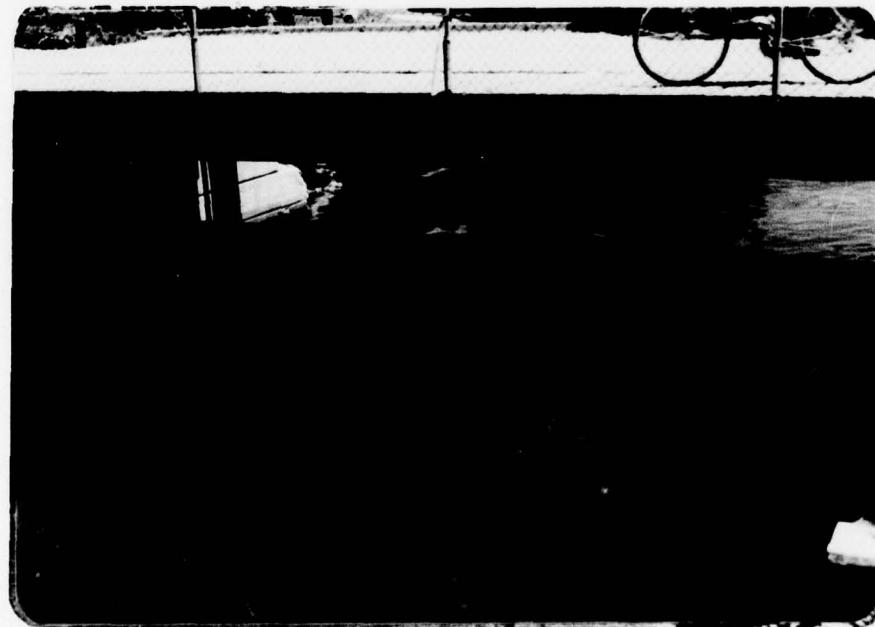
Crest of dam looking Southeast 5 July 1978

INDIAN LAKE DAM



Spillway looking Southeast

5 July 1978



Spillway looking downstream.
Note steel beam pipe support across
spillway.

5 July 1978

INDIAN LAKE DAM



Right sidewall of spillway

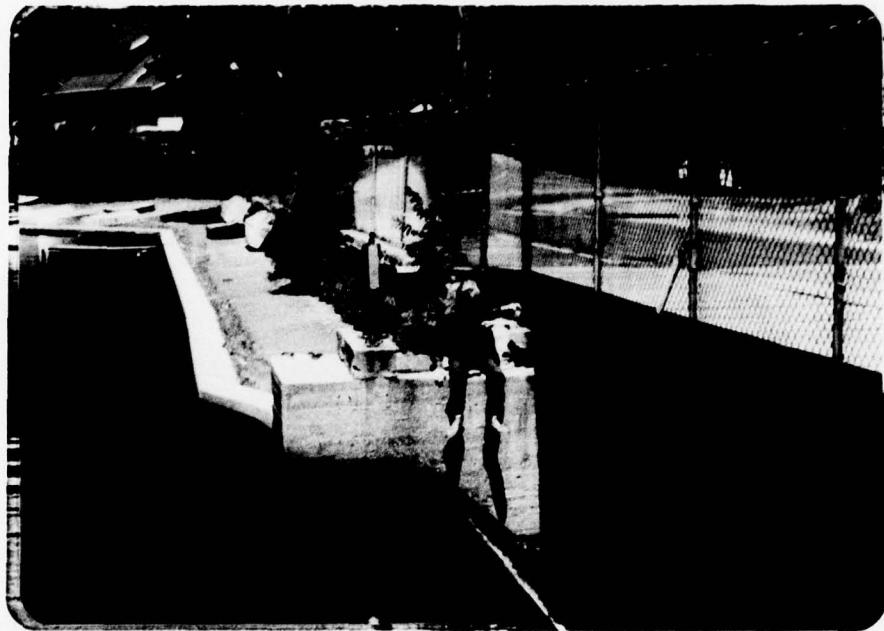
5 July 1978



Deterioration of concrete at left
downstream sidewall of spillway

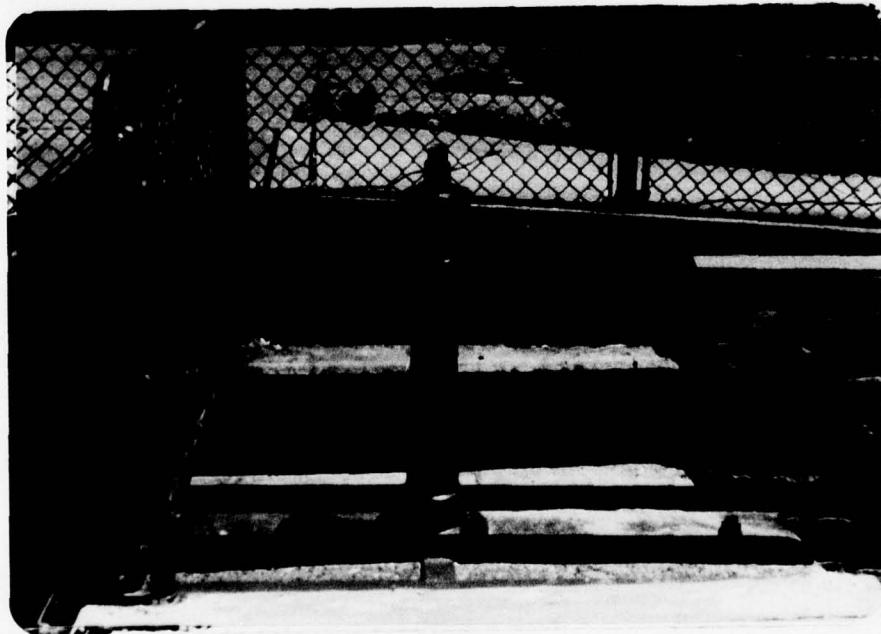
5 July 1978

INDIAN LAKE DAM



Left spillway sidewall and
drawdown control valve

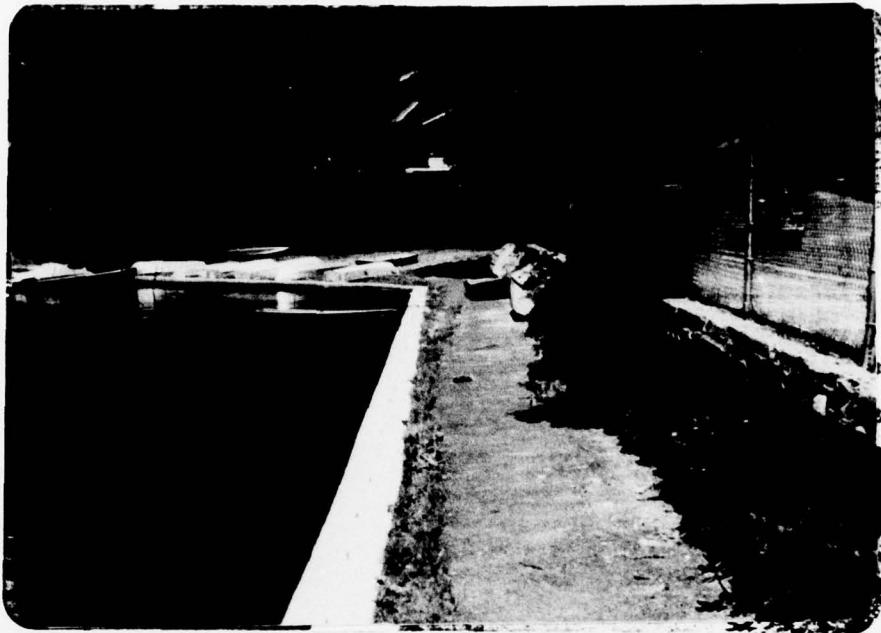
5 July 1978



Drawdown control valve of upstream
end of right sidewall

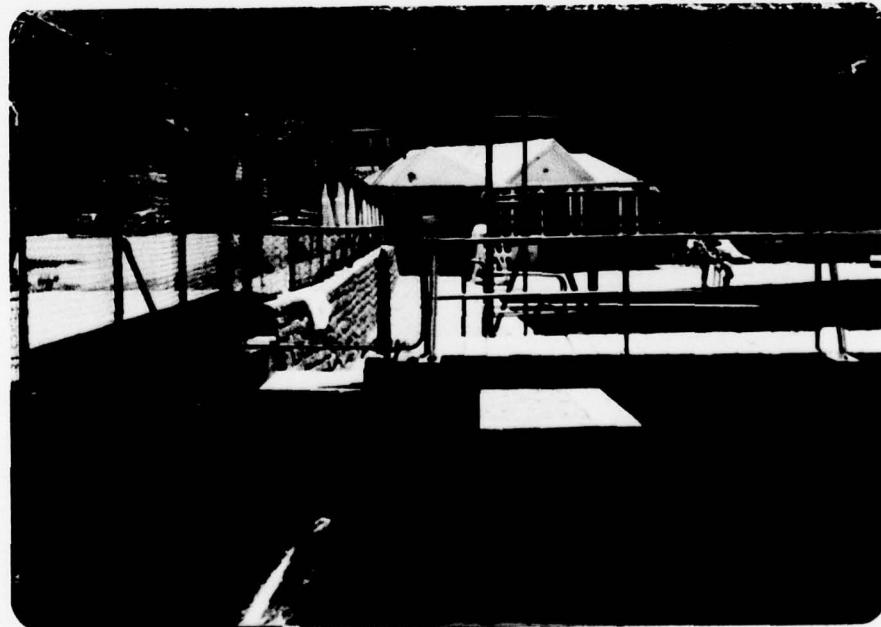
5 July 1978

INDIAN LAKE DAM



Upstream left embankment

5 July 1978



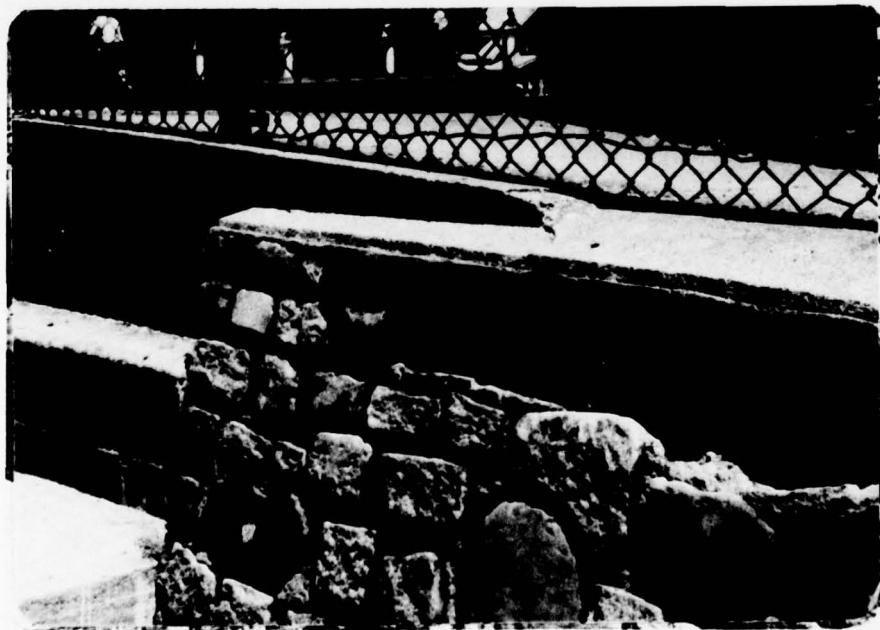
Upstream right embankment

5 July 1978

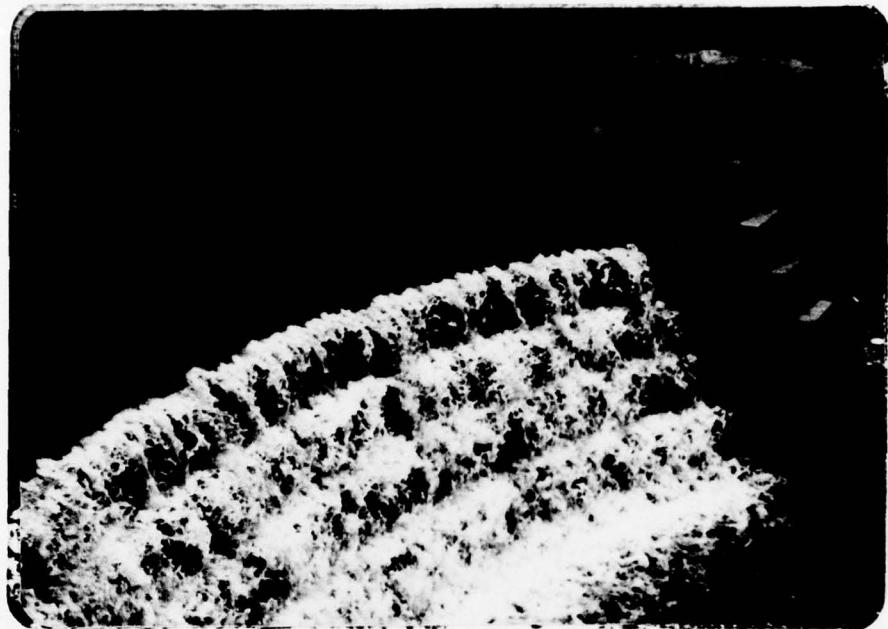
INDIAN LAKE DAM



Crack in concrete bulkhead of right upstream section of embankment 5 July 1978



Deterioration of upstream facing of right embankment 5 July 1978



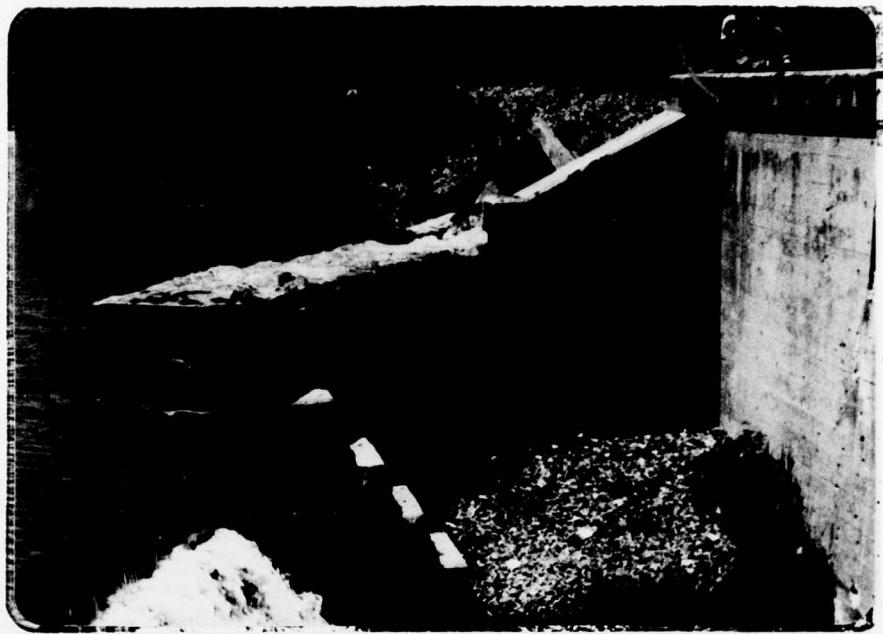
Spillway from Lake Estling into
Indian Lake

5 July 1978



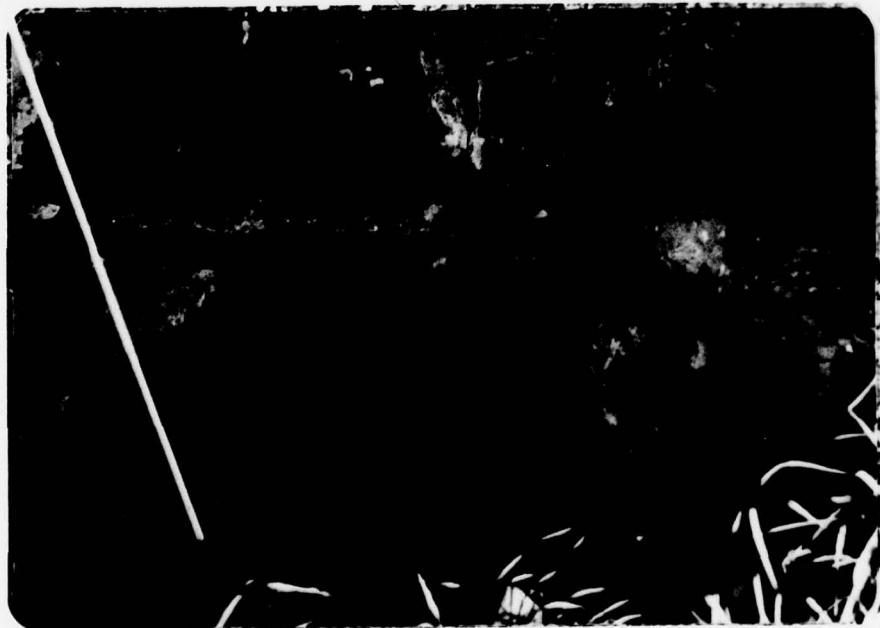
Steel sheet pile around right pier 5 July 1978
of Lake Estling discharge culvert
under railroad

INDIAN LAKE DAM



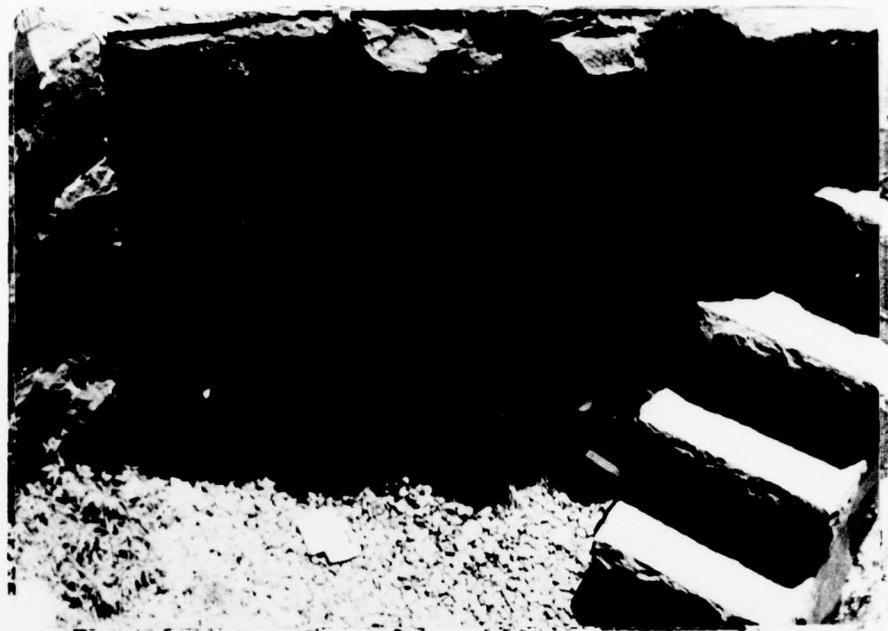
Left abutment of spillway from
Lake Estling

5 July 1978



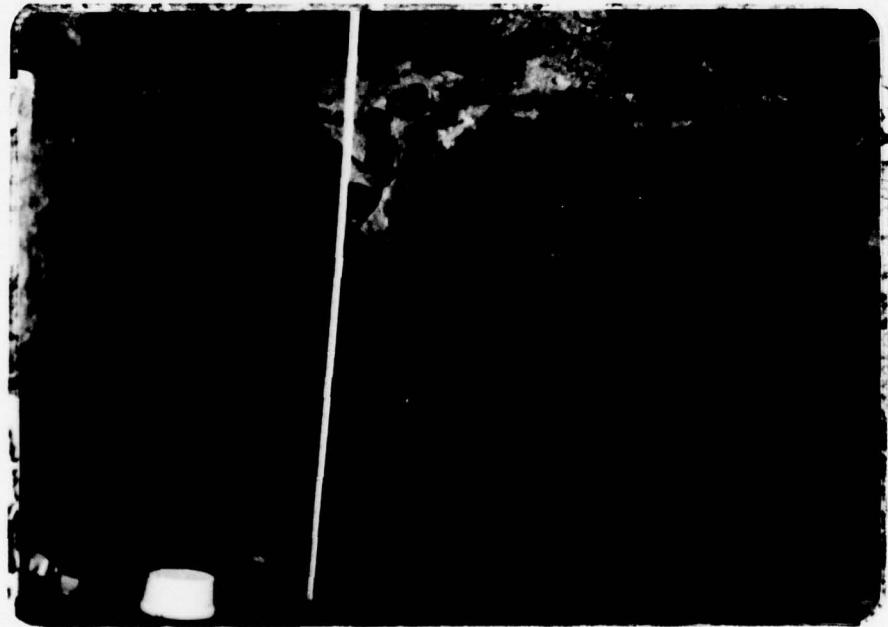
Deterioration of mortar and leakage 5 July 1978
at left abutment of spillway from
Lake Estling

INDIAN LAKE DAM



Right abutment of spillway from
Lake Estling

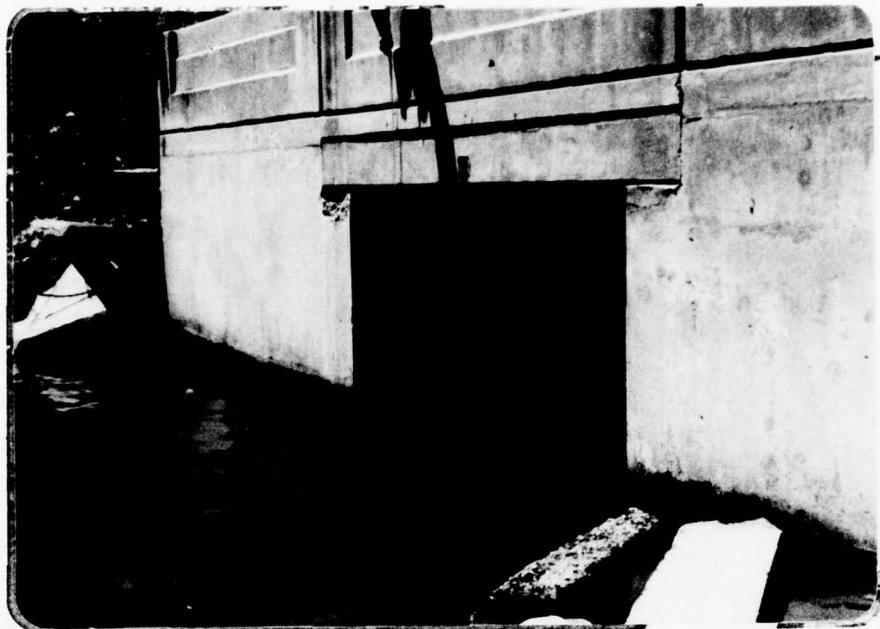
5 July 1978



Deterioration of mortar and leakage
of right abutment of spillway from
Lake Estling

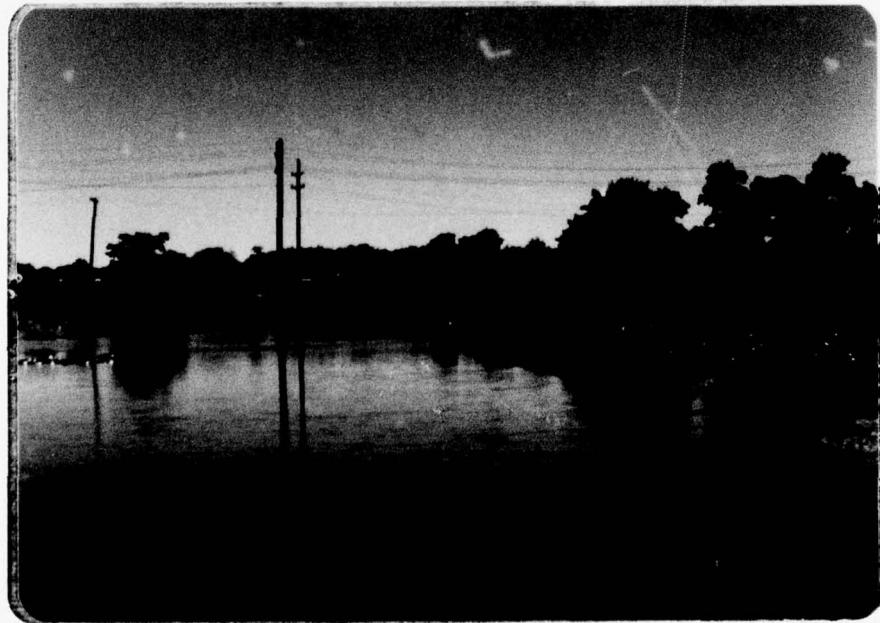
5 July 1978

INDIAN LAKE DAM



Culvert under Franklin Road

5 July 1978



Stilling basin downstream of Indian Lake spillway looking Southeast

5 July 1978

VISUAL

CONCRE

APPROA

DISCH

BRIDC

1-5

APPENDIX 3

HYDROLOGIC COMPUTATIONS

INDIAN LAKE DAM

HYDROLOGICAL COMPUTATIONS
INDIAN LAKE DAM

Location Morris County

Drainage Area

Indian Lake Subbasin	617 acres	or .96 sq mi
Lake Estling Subbasin	<u>4120 acre</u>	<u>or 6.44 sq mi</u>
Totals	4737	7.40 sq mi

Lake Area

Indian -	88 acres
Estling -	75 acres

Approach

Due to the presence of an adjacent lake within catchment area multiple PMF and routing were performed. The effect of Shongum Lake was not considered and PMF and routing was done for only Lake Estling and Indian Lake.

Evaluation Criteria

Size - Intermediate
 Hazard - High

Spillway Design Flood

PMF

Calculate PMP

1. Dam Located in Zone C PMP = 22.5"

2. Adjustment Factors

Duration (hr)	% of 24 hr	Reduction Factor *
0-6	112	
0-12	123	
0-24	132	
0-48	142	
		{ 0.8 all ours

P 48 "Small Dams"

BY JC DATE 7/28/78 Indian Lake

JOB NO. J-783

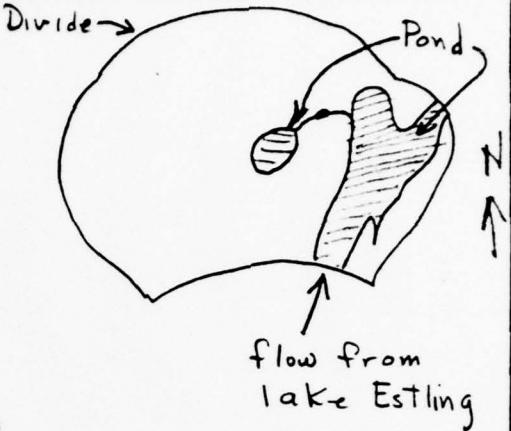
CKD GED DATE _____

SHEET NO. 1 OF 25

(INDIAN LAKE)

DETERMINE TIME OF CONCENTRATION

Since there is no one defined main channel for the Indian Lake water shed, we will take overland flow to determine T_c



The average slope of the water basin = 3.6 %

Average Length = 4700

From a site inspection the ground cover is "Forrest with Heavy Ground Litter & Meadow"

A From SCS Tech Rel #55

Fig 3-1 vel. = 0.46 ft/sec

$$T_c = \frac{\text{length}}{\text{velocity}} = \frac{4700}{0.46(3600)} = \underline{\underline{2.8 \text{ hours}}}$$

B Determine T_c by SCS #55 Fig 3-3

Take l = Greatest flow length
= 6500 feet; CN = 60

∴ Lag Time = 1.35 HR

BY JC

DATE 8/19

Indian

JOB NO. J-783

CKD GED

DATE 8/30

SHEET NO. 2 OF 25

$$T_c = \frac{1.35}{0.6} = 2.25 \text{ HOURS}$$

Take $T_c = 2.3 \text{ HOURS}$

DETERMINE TIME TO PEAK

$$T_p = \frac{D}{2} + 0.6 T_c$$

Take $D = 30 \text{ min}$

$$\therefore T_p = \frac{30}{2} + 0.6(2.3) = 1.63 \text{ HOURS}$$

∴ Take $T_p = 1.6 \text{ HOURS}$

UNIT HYDROGRAPH

Take q_p from SCS formula

$$q_p = \frac{484 A}{T_p} = \frac{484 (0.96)}{1.6} = 290 \text{ cfs}$$

A curvilinear hydrograph may be constructed from the values of q_p and T_p by using ratios tabulated in "Design of Small Dams" pg 74
Take the time increment = D

BY JC	DATE 8/19	Indian	JOB NO. J-183
CKD CED	DATE 8/30		SHEET NO. 3 OF 25

LANGAN ENGINEERING ASSOCIATES, INC.

Hours	T/T _P	Q/q _p	UNIT HYDROGRAPH Q (cfs)
.5	0.31	0.16	46
1.0	0.63	0.61	177
1.5	0.94	0.98	284
2.0	1.25	0.88	255
2.5	1.56	0.60	174
3.0	1.88	0.40	116
3.5	2.19	0.24	70
4.0	2.50	0.16	46
4.5	2.81	0.097	28
5.0	3.13	0.06	17
5.5	3.44	0.04	12
6.0	3.75	0.02	6
6.5	4.07	0.017	5
7.0	4.38	0.010	3

$$\sum q = 1227 \text{ cfs}$$

Area Under Unit Graph = $\frac{1227 (.5)(3600)(12)}{617 (43560)} = 0.99 \text{ in}$

Since the outflow from Lake Estling discharges directly into Indian Lake the hydrologic characteristic of Lake Estling will be determined

BY JC DATE 8/19 Indian
 CKED DATE 8/30

JOB NO. J-783
 SHEET NO. 4 OF 25

LANGAN ENGINEERING ASSOCIATES, INC.

(LAKE ESTLING)

DETERMINE TIME OF CONCENTRATION

There is a stream running through the Estling water shed

From inspection of air photos the ground cover is

"Forest with heavy Ground Litter & Meadow"

$$C N = 60$$

The stream has irregular side slopes and bottom, & the section is filled with large growth ∴ Take Manning $N = 0.06$

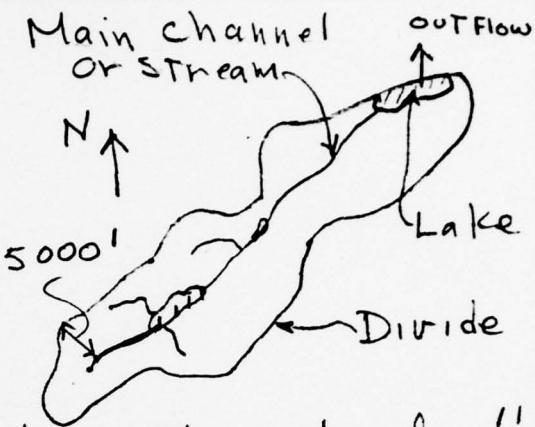
The approximate cross section

Slope of the Stream

$$\begin{aligned} &= \frac{800 - 516}{24,000} \\ &= 0.0118 \end{aligned}$$

The slope of the south portion of the water shed is $\approx 6.4\%$

From SCS Tech Rel #55



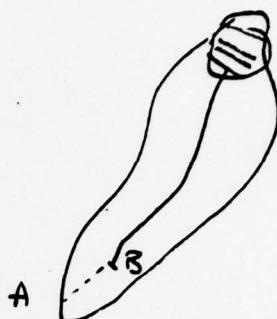
BY JC DATE 8/19 Indian
CKD QED DATE 8/30

JOB NO. J-783
SHEET NO. 5 OF 25

A overland flow time

Fig 3-1 velocity = .64 ft/sec

$$T_{AB} = \frac{5000}{0.64 (3600)} = 2.17 \text{ hr}$$



Stream Flow

Estimated velocity at in-stream 6 fps

$$T_{BC} = \frac{24000}{6 (3600)} = 1.11 \text{ hrs}$$

$$T_C = T_{AB} + T_{BC} = 2.17 + 1.1 = \underline{\underline{3.22}}$$

E

B Determine T_c by Fig 3.3 Tech Ref #55

$$\text{Avg slope} = 3\%$$

$$l = 20,000'$$

$$\therefore \text{Lag Time} = 3.5 \text{ hr}$$

$$\therefore T_c = \frac{3.5}{0.6} = \underline{\underline{5.8 \text{ hr}}}$$

Take $T_c = 3.2 \text{ Hours}$

DETERMINE TIME OF PEAK

$$T_p = \frac{D}{2} + 0.6 T_c$$

Take $D \approx 0.2 T_c \& 0.3 T_c$

$$\therefore D = .8 \text{ hr}$$

$$T_p = \frac{0.8}{2} + 0.6(3.2) = 2.32 \text{ hr}$$

BY JC DATE 8/19 INDIAN

JOB NO. J-783
SHEET NO. 7 OF 25

LANGAN ENGINEERING ASSOCIATES, INC.

Take $T_p = 2.5$ HOURSUNIT HYDROGRAPHTake q_p from SCS formula

$$q_p = \frac{484A}{T_p} = \frac{484(6.44)}{2.5} = 1210 \text{ cfs}$$

A curvilinear hydrograph may be constructed from the values of q_p & T_p by using SCS ratios

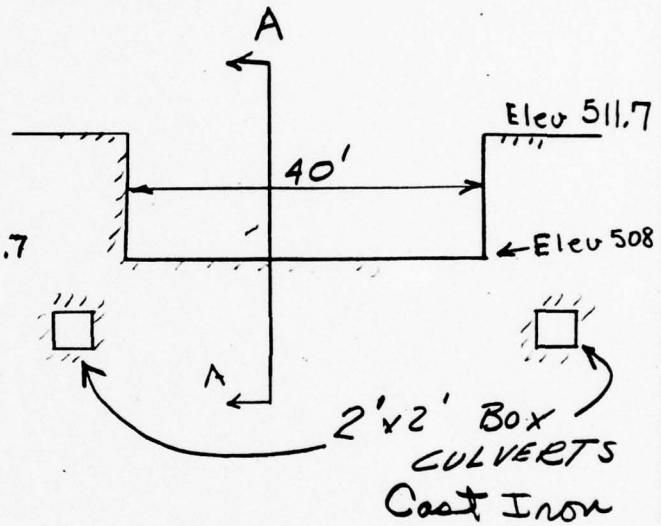
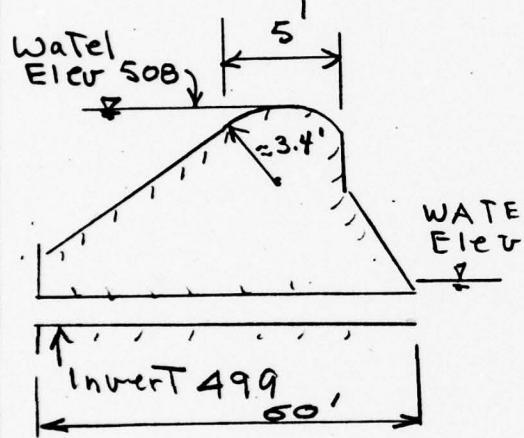
HOURS D	T/T_p	q/q_p	UNIT HYDROGRAPH q (cfs)
0.5	.20	.08	97
1.0	.40	.32	387
1.5	.60	.60	726
2.0	.80	.90	1089
2.5	1.0	1.0	1210
3.0	1.2	.92	1113
3.5	1.4	.78	944
4.0	1.6	.60	726
4.5	1.8	.42	508
5.0	2.0	.32	387
5.5	2.2	.24	290
6.0	2.4	.17	205
6.5	2.6	.14	169
7.0	2.8	.10	121
7.5	3.0	.07	85
8.0	3.2	.055	67
8.5	3.4	.04	48
9.0	3.6	.03	36
9.5	3.8	.02	24
10.0	4.0	.018	22
			$\Sigma = 8205 \text{ cfs}$

BY JG DATE 8/15 INDIAN
CHECKED JK DATE 8/30JOB NO. J-783
SHEET NO. 8 OF 25

Area Under Unit Graph = $\frac{8205 (.5)(3600)(12)}{(4120) 43560} = \underline{.99 \text{ in}}$

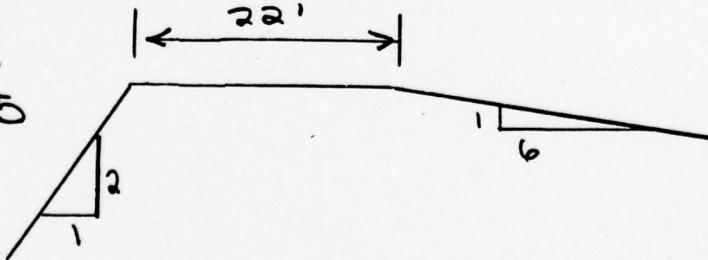
SPILL WAY CAPACITY

Indian lake



Typical Reservoir Cross - Section

Top of Reservoir
Low point = 518.5



Take equation of the weir

$$Q = CL H^{3/2}$$

BY JC

DATE 8/22

Indian

JOB NO. J-783

CKD (S)

DATE 8/30

SHEET NO. 9 OF 25

LANGAN ENGINEERING ASSOCIATES, INC.

The Coefficients C will be determined
from "Handbook of Hydraulics" King
& Brater, Chapter 5

Spillway: Elev Crest 508.0

$C_{avg} = 3.3$ pg 5.50 Table 5-12

$L = 40$ feet

Reservoir

$C_{avg} = 3.0$ pg 5-49 Table 5-9

BY JC DATE 8/22 Indian

JOB NO. J-783
SHEET NO. 10 OF 25

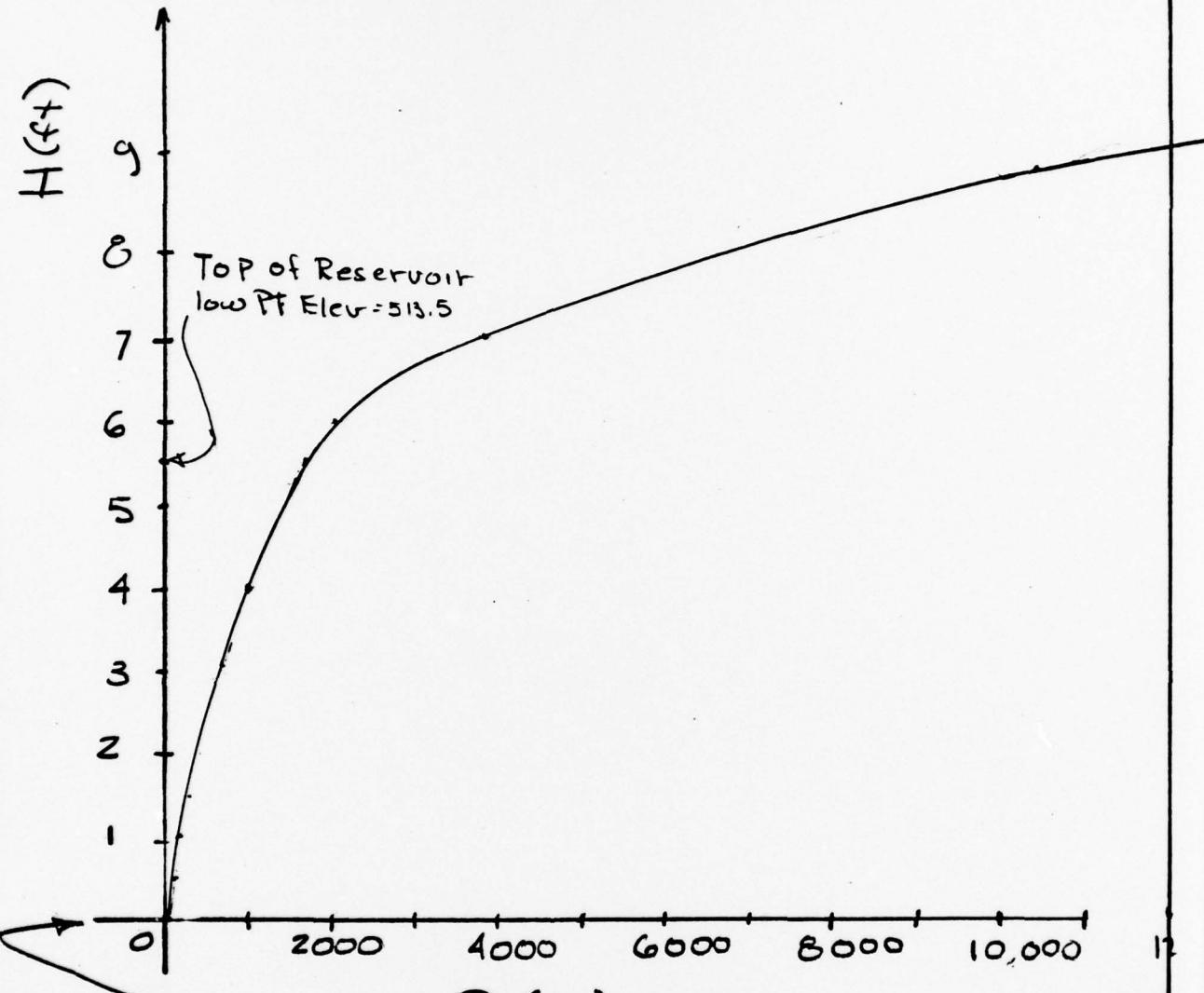
CKD ~~100~~

DATE 8/30

LANGAN ENGINEERING ASSOCIATES, INC.

Elev (ft)	SP, 11way		Reservoir		Q TOTAL (CFS) $Q_s + Q_r$	
	H ft	Q_s (C+S)	H ft	L ft	Q_r (C+S)	
508	0	0			0	
508.5	.5	47			47	
509.0	1.0	132			132	
509.5	1.5	242			242	
510.0	2	373			373	
511	3	686			686	
512	4	1056			1056	
513.5	5.5	1702			1702	
514	6	1940		.5	100	106
515	7	2445		1.5	250	1378
517	9	3564		3.5	350	6875
						10439
BY JC		DATE 8/22	Indian		JOB NO. J-783	
CKD/CED		DATE 8/30			SHEET NO. 11 OF 25	

LANGAN ENGINEERING ASSOCIATES, INC.



Spillway Capacity
Curve
Indian Lake

BY JC

DATE 8/22

Indian

JOB NO. J-783

CKD/CED

DATE 8/30

SHEET NO. 12 OF 25

Reservoir Storage Capacity (Indian)

assume a linear distribution for the increase in the area with elevation. Start at zero storage at the crest of the spillway

Lake area = 87.6 Acres, Elevation 508

Area Elevation 520 = 176.3 Acres

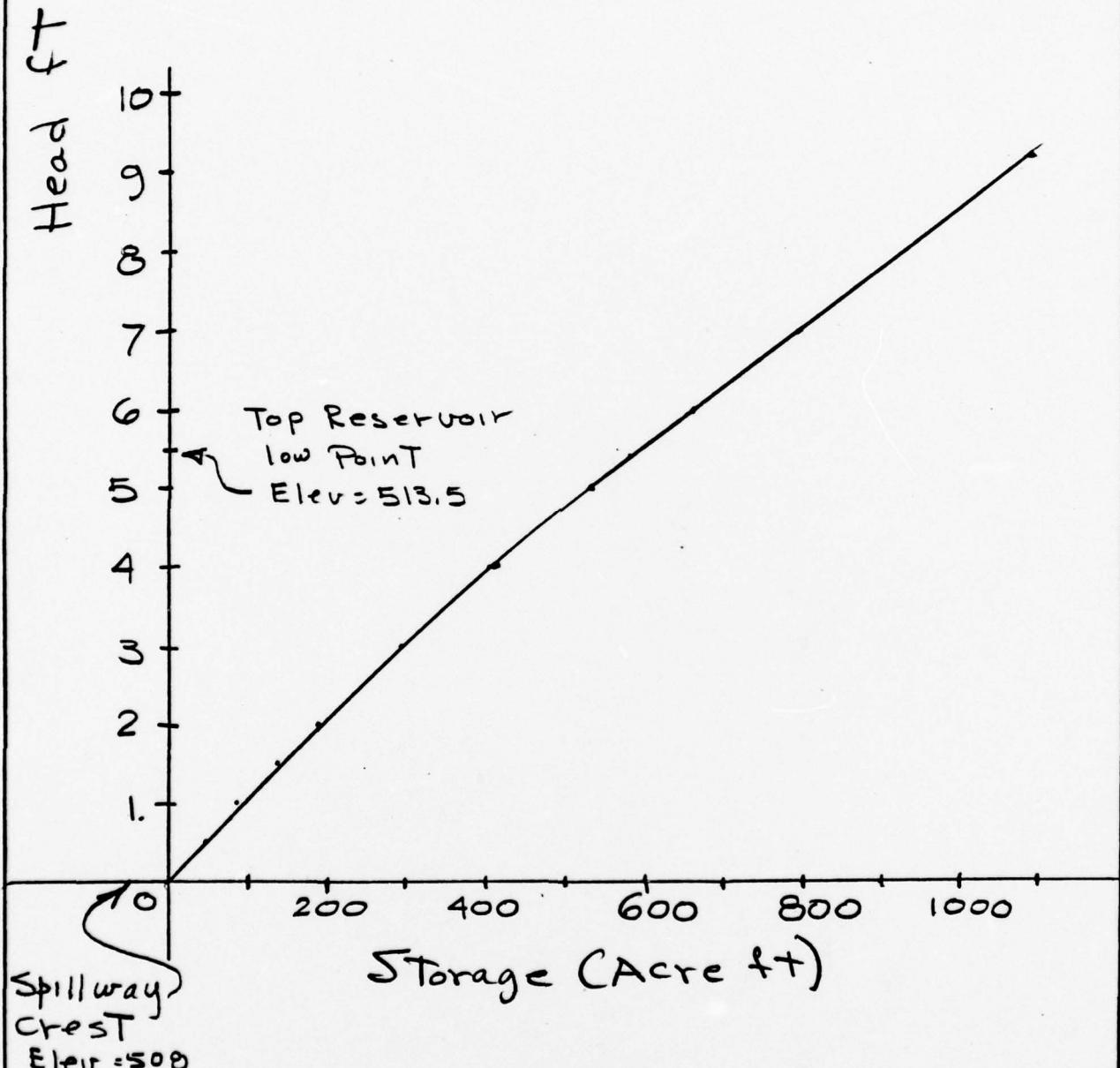
∴ Area increase per foot of Elevation.

$$= \frac{(176.3 - 87.6)}{520 - 508} = 7.4 \text{ Acres}$$

Elev	H (ft +)	Area (Acres)	Δ Area (Acres)	Storage (acre-ft)
508	0	87.6		
508.5	0.5	91.3	3.7	45
509	1.0	95.0	3.7	91
509.5	1.5	98.7	3.7	140
510	2.0	102.4	3.7	190
511	3.0	109.8	7.4	296
512	4.0	117.2	7.4	410
513	5.0	124.6	7.4	531
514	6.0	132.0	7.4	659
515	7.0	139.4	7.4	795
517	9.0	154.2	14.8	1088

LANGAN ENGINEERING ASSOCIATES, INC.

STORAGE CAPACITY CURVE
Indian Lake



BY JC DATE 8/22 Indian

JOB NO. J-783

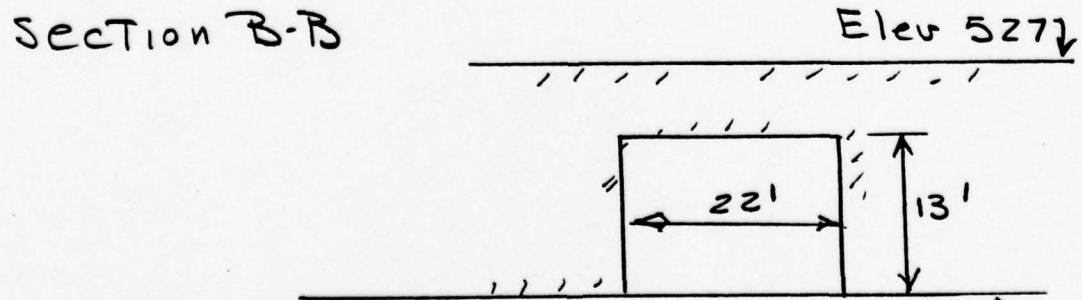
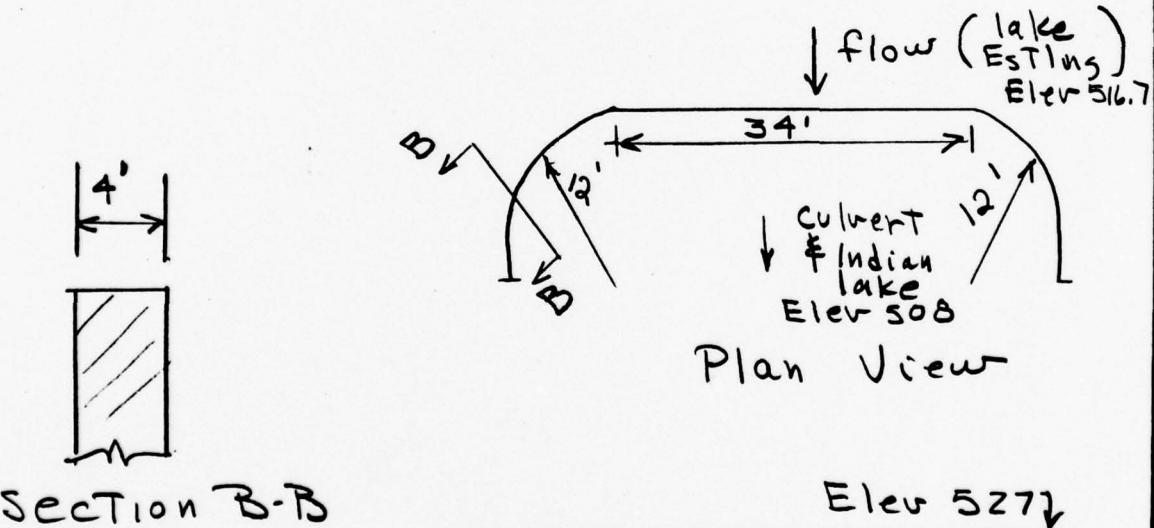
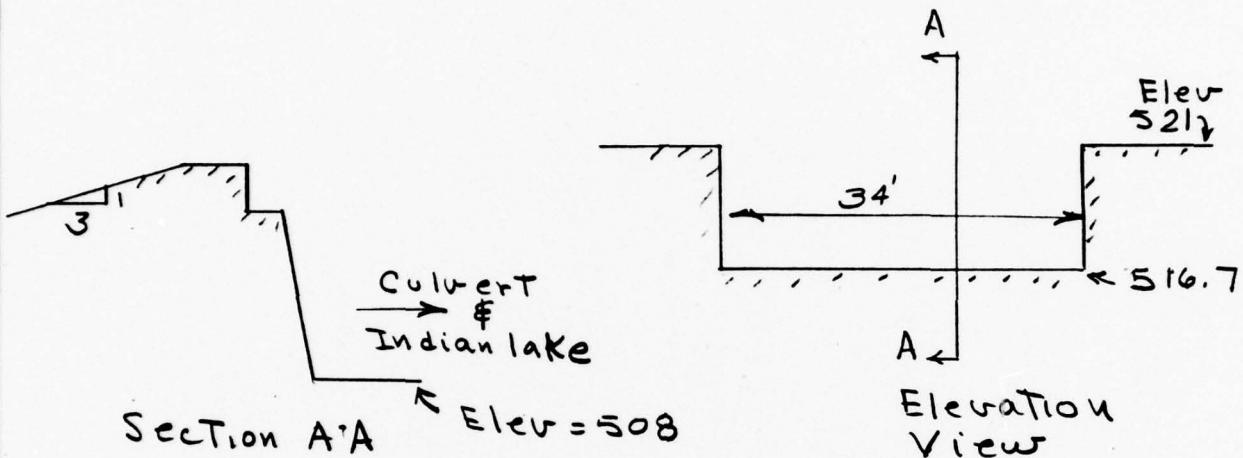
CKD GED DATE 8/30

SHEET NO. 14 OF 25

LANGAN ENGINEERING ASSOCIATES, INC.

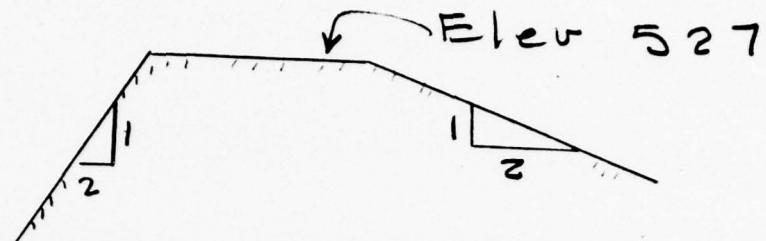
SPILLWAY CAPACITY

Lake EST Ling



Upstream face of culvert connecting
Lake Est Ling To Indian lake

BY JC DATE 8/22 Indian JOB NO. J-783
CKD DATE 8/30 SHEET NO. 15 OF 25



Section C-C

Typical Cross Section of
Railroad Crossing Dividing
Lake Estling from Indian Lake

The flow will

- (1) run over the spillway section A-A,
- (2) then overtop and run over section B-B, and
- (3) finally run over the railroad tracks

Use Eq For weir flow

$$Q = C L H^{3/2}$$

C will be determined from

BY JC DATE 8/22 Indian
CROSSED DATE 8/30

JOB NO. J-783
SHEET NO. 16 OF 25

"Handbook of Hydraulics" King & Brater
for Spillway section AA

Pg 5-50, Table 5-13 $C_{avg} = 3.2$

Section BB Pg 5-46 Table 5-3

$C_{avg} = 2.7$; $L = \pi R = \pi(12) \approx 38'$

Section CC Pg 5-49, Table 5-9

$C_{avg} = 3.0$

The culvert capacity will be determined from "Open-Channel Hydraulics" - Chow Page 498

Fig 17-29. The culvert is flowing Partly full.

Top of culvert at Elevation = 521

Bottom of culvert at Elevation = 508

LANGAN ENGINEERING ASSOCIATES, INC.

Elev (ft)	Spillway Section A-A		Spillway Section B-B		Reservoir		Culvert		TOTAL Q Q _A +Q _B +Q _R Q _A +Q _B +Q _R	
	H (ft)	Q _A (cfs)	H (ft)	Q _B (cfs)	L (ft)	Q _R (cfs)	H (ft)	Q _C (cfs)	H (ft)	Q _C (cfs)
516.7	0								0	109
517.7	1	108.0							308	
518.7	2	308							565	
519.7	3	565							870	
520.7	4	870								
522.7	6	1599	1.7	227			14.7	1.13	175	3850
524.7	8	2462	3.7	730			16.7	1.28	200	4400
527.7	11	3969	6.7	1779						3192
528.7	12	4523	7.7	2192			0.7	300	527	5697
530.7	14	5699	9.7	3100			1.7	600	3989	5280*
							3.7	800	17081	5940*
									22.7	270
										22,958

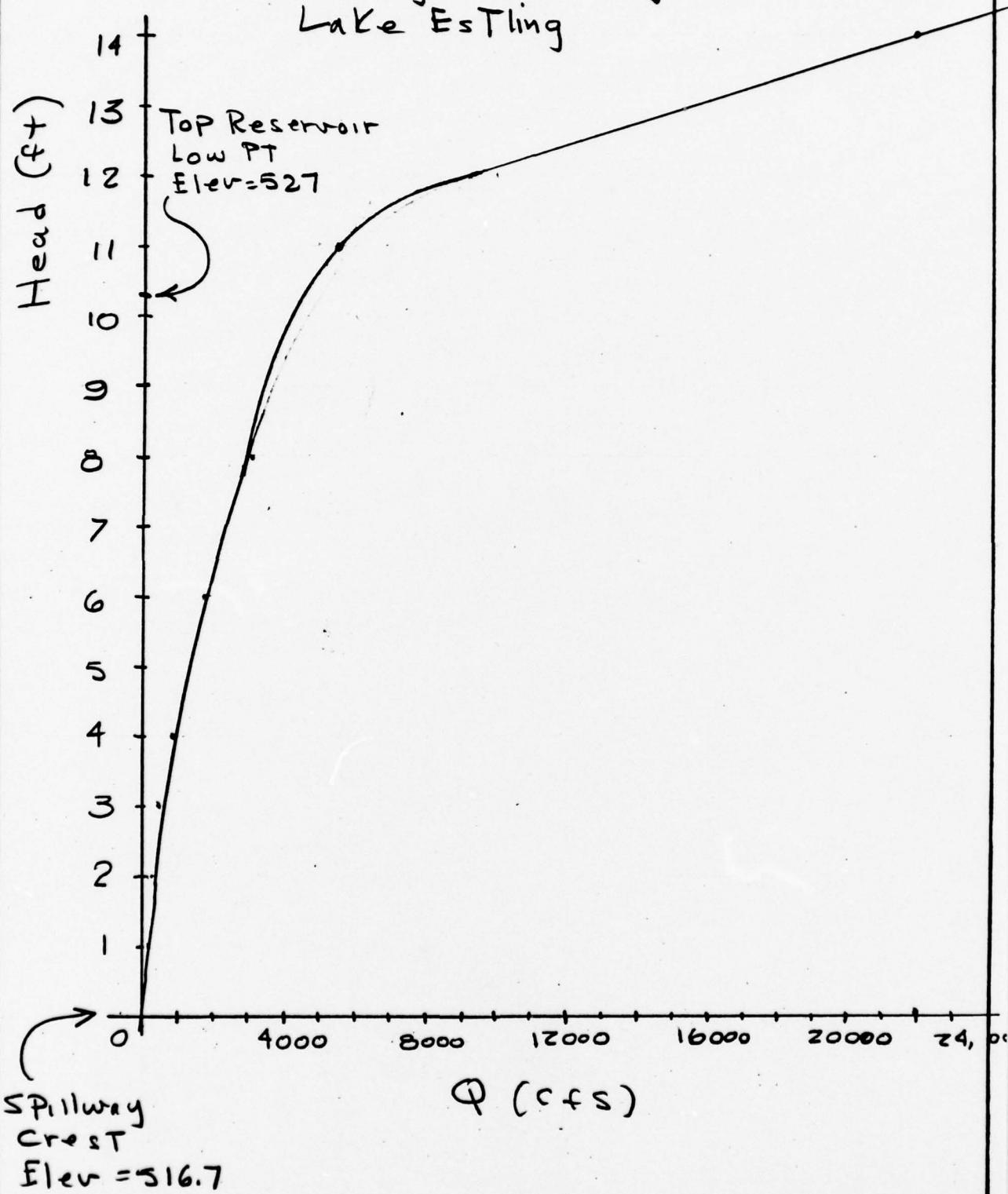
* The culvert controls at this El.ev.

BY JC DATE 8/22 Indian
CKD ~~SPD~~ DATE 8/30

JOB NO. J-783
SHEET NO. 18 OF 25

LANGAN ENGINEERING ASSOCIATES, INC.

SPillway Capacity Curve
LAKE ESTLING



BY JC DATE 9/22 Indian

JOB NO. J-783

CKD/CED DATE 8/30

SHEET NO. 19 OF 25

Reservoir Storage Capacity (Estling)

Assume a linear distribution for the increase in the area with elevation. Start at a zero storage at the crest of the spillway

$$\text{Lake area (Elev 516.7)} = 75 \text{ acres}$$

$$\text{Area Elev 520} = 90 \text{ acres}$$

$$\therefore \text{Area increase per foot of Elev} = \frac{90 - 75}{520 - 516.7} = 4.5 \text{ acres}$$

Elev (ft)	H (ft)	Area (acres)	Avg Area (acres)	Storage (acre-ft)
516.7	0	75		
517.7	1	79.5	77	77
518.7	2	84	80	159
519.7	3	88.5	82	245
520.7	4	93.0	84	336
522.7	6	102.0	88.5	531
524.7	8	111.0	93	744
527.7	11	124.5	99.5	1097
528.7	12	129.0	102.0	1224
530.7	14	138.0	106.5	1491

BY. JC

DATE 8/22

Indian

JOB NO. J-183

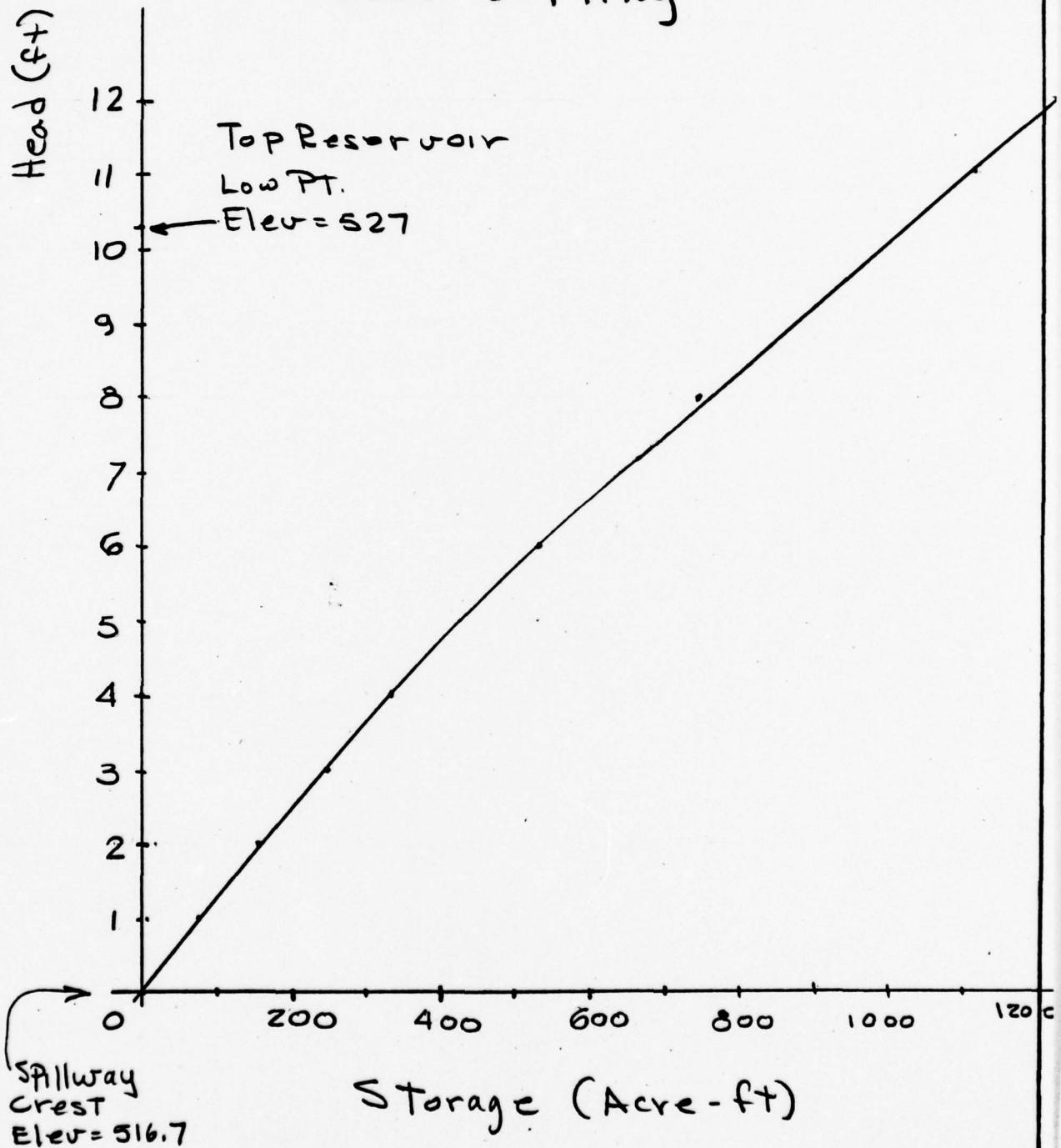
CKD/CED

DATE 8/30

SHEET NO. 20 OF 25

LANGAN ENGINEERING ASSOCIATES, INC.

Storage Capacity Curve Lake Estling



BY NC DATE 8/22 Indian

JOB NO. J-783
SHEET NO. 21 OF 25

CKD/CED

DATE 8/30

LANGAN ENGINEERING ASSOCIATES, INC.

INDIAN LAKE SUMMARY

ELRV	H ft	Q cfs	Storage
508	0	0	0
508.5	0.5	47	45
509.0	1.0	132	91
509.5	1.5	242	140
510.0	2	373	190
511.0	3	686	296
512.0	4	1056	410
513.5	5.5	1702	531
514.0	6	2046	659
515.0	7	3823	795
517.0	7	10439	1088

HYDROGRAPH AND FLOOD ROUTING

1. Hydrograph and flood routing determined using HEC 1
2. PMF for Indian Lake = 17400 cfs (routed to 16448)
3. Routing indicates dam will overtop by \approx 4.0 ft for PMF

BY JC

DATE

Indian

JOB NO. J-783

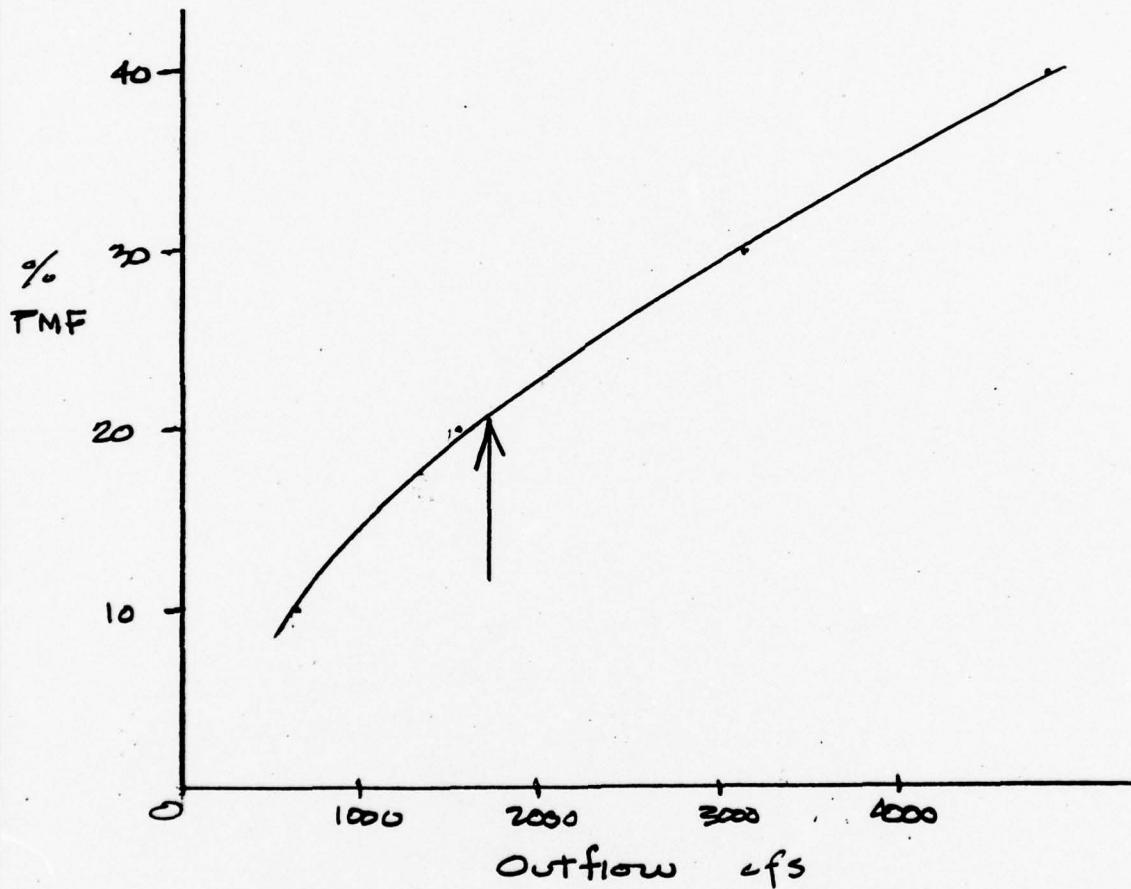
CHECKED

DATE 30 Aug

SHEET NO. 22 OF 25

OVERTOPPING POTENTIAL

1. Various % PMF have been routed (HEC 1, attached)
2. Plot peak outflow vs % PMF



3. Dam overtops at approx el 513.5 with $Q = 1702 \text{ cfs}$
- \therefore dam can pass 20% PMF

BY J.C. DATE INDIAN
 CKD EED DATE 5/30

JOB NO. J-783
 SHEET NO. 23 OF 25

LANGAN ENGINEERING ASSOCIATES, INC.

DRAWDOWN ANALYSIS

1. Outlet structures - 2 24" ϕ CIP
 invert = 499.0
 tailwater elevation = 501.7
 spillway crest = 508.
2. Storage between spillway crest and invert is estimated to approximately 700 ac ft. Assume area varies linearly with height and area @ 9' = 88 acres

Elev	Acres	Δ Storage	Total Storage
508	88	86.84	700
507	85.67	84.51	
506	83.34	82.18	
505	81.01	77.5	
504	78.68	75.19	
503	76.35	72.86	
502	74.02	70.53	
501	71.69	0	
500	69.36		
499	67.		

$$\left(\frac{88+x}{2}\right)9 = 700 \quad x = 67 \quad \text{area changes by } 2.33 \text{ acre/ft}$$

3. Outlet capacity
 Culvert flow - use B.P.R. Hydraulic Circular * 10

Elev	Head	Q 1 pipe	Q 2 pipes
508	6.3	29	58
507	5.3	25	50
506	4.3	22	44
505	3.3	19	38
504	2.3	14	28
503	1.3	6	12
502	0.3	1	2
501			

BY GED DATE _____ INDIAN

JOB NO. J-783
 SHEET NO. 24 OF 25

LANGAN ENGINEERING ASSOCIATES, INC.

4. Assume inflow to be 2 cfs/sq mil
 $7.4 \times 2 = 14.8$ cfs

Elevation	Q_{out}	Q_{infl}	Q_{net}^*	Storage	Δt hr	Δt yrs
508	58	34	24	86.84	26.9	
507	56	47	32	84.5	31.95	2.45
506	44	41	26	82.1	38.2	3.84
505	38	33	18 **	77.5	52.1	6.22
504	28	20	5			
503	12	7				
502	2					

$$* Q_{net} = Q_{outflow} - 14$$

** Inflow becomes greater than outflow capacity
 \therefore lake level would stabilize at approx 505 and
theoretically could be lowered to 501.7, then
to lower elevation.

BY GED

DATE

Initial

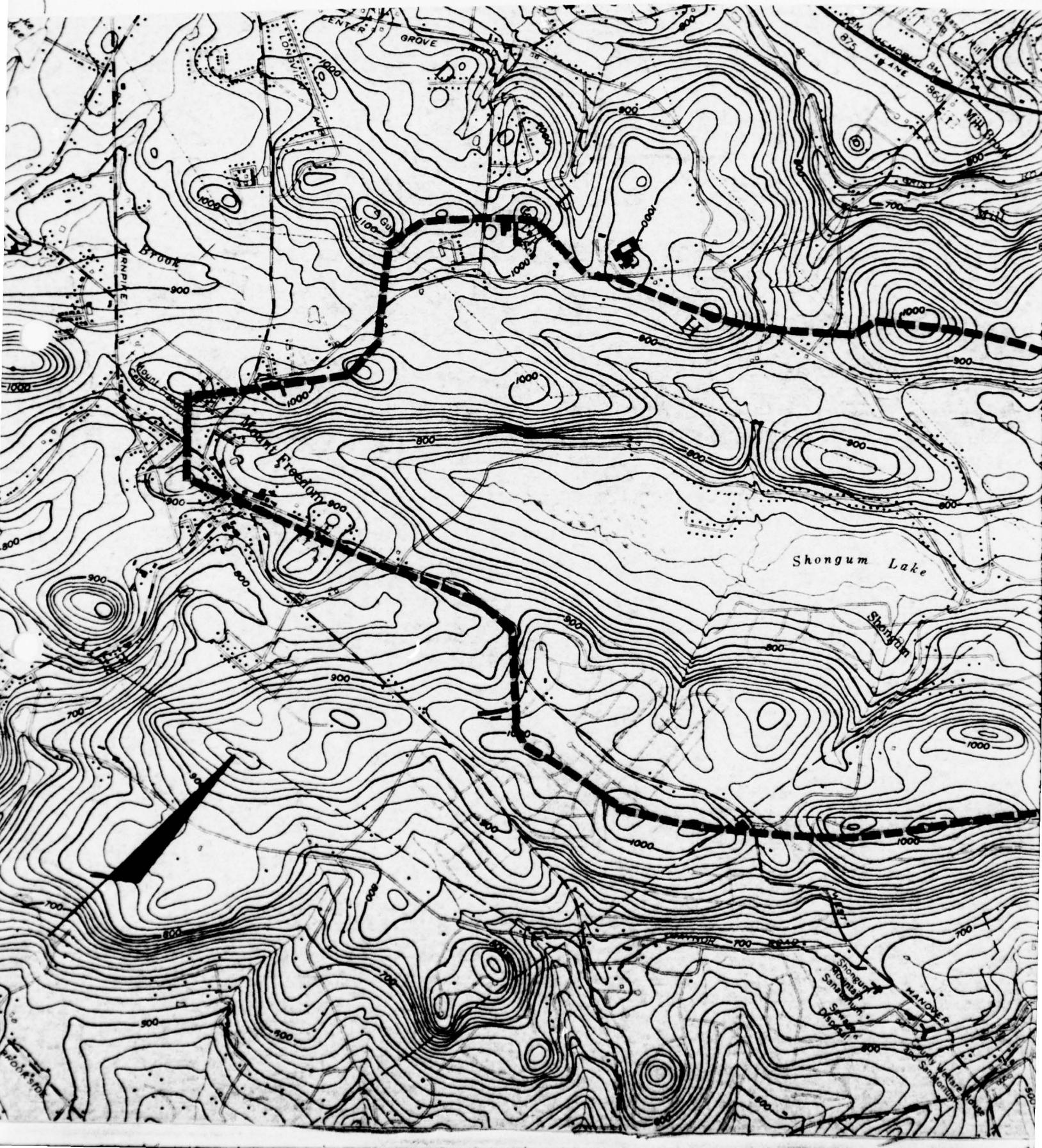
CKD GED

DATE

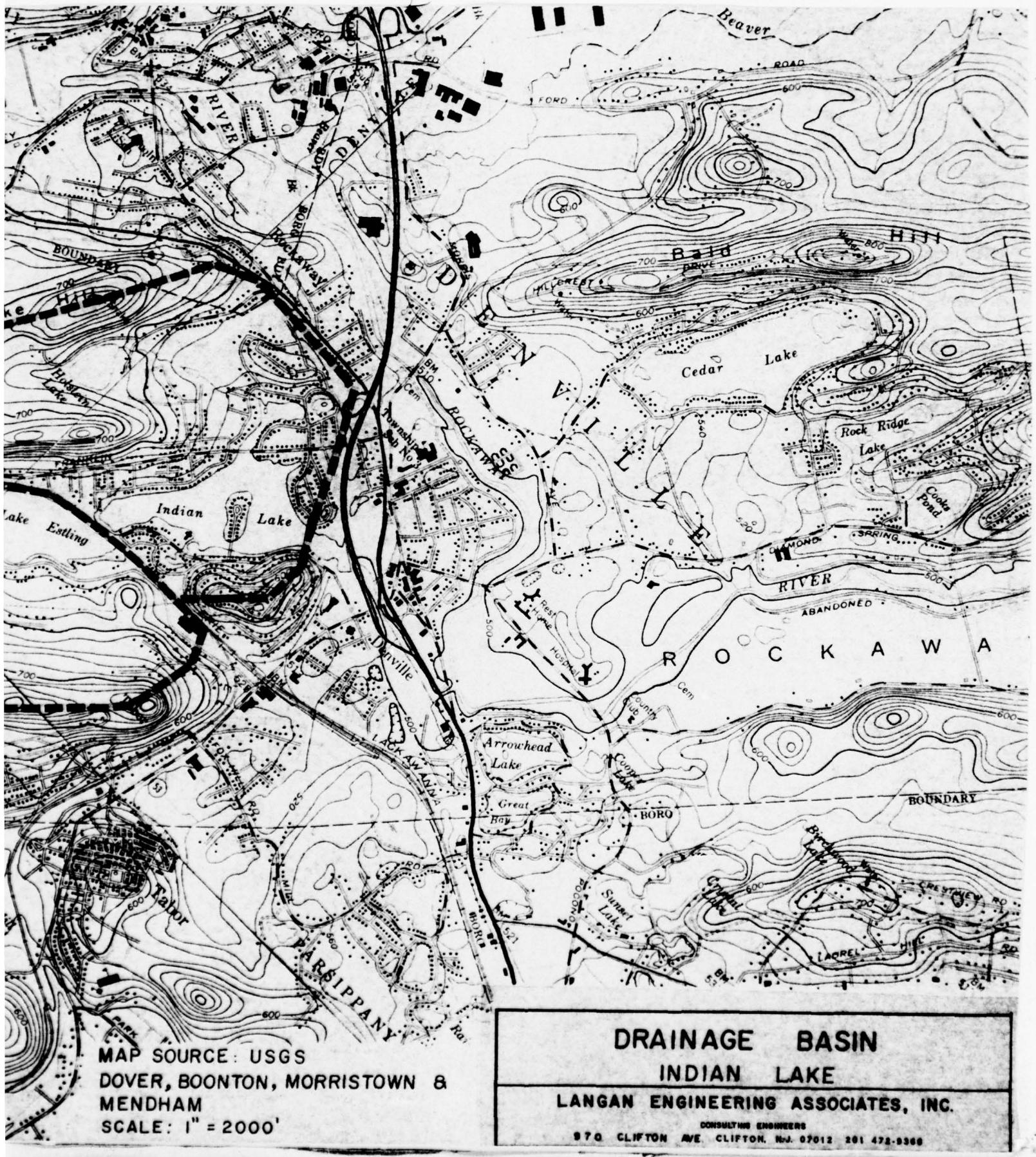
SBE

JOB NO. J-783

SHEET NO. 25 OF 25







HEC-1 OUTPUT

INDIAN LAKE DAM

STRTOI -2.00 RECESSION DATA ORCSN# 0.0 RTIOR# 1.00

	END-OF-PERIOD TIME	FLOW RAIN	PERIOD EXCS	COMP Q
SUM	25.40	19.93		165335.

STORAGE#	77.	159.	245.	336.	531.	744.	1097.	1224.	1491.	0.
OUTFLOW#	109.	308.	565.	870.	1826.	3192.	5697.	9269.	22958.	0.

HYDROGRAPH ROUTING

```

ROUTING-ESTLING
 1      ICOMP    1      IECON    0      ITAPE    0      JPRT    0      INAME    1
      0      ROUTING DATA
 0.0      CLOSS    AVG      IRES    0.0      ISAME    1

```

	NSRFS	NSFLD	LAG	AMSKK	X	TSK	STORA
STORAGE#	1	0	0	0.0	0.0	0.0	0.
OUTFLOW#	77.	159.	245.	336.	531.	744.	1097.
	109.	308.	565.	870.	1826.	3192.	5697.

SUB-AREA RUNOFF COMPUTATION

```

COMPUTE HYDROGRAPH-INDIAN
  ISTAQ    ICOMP    IECON    ITAPE    JPLT    JPRT    INAME
      2       0        0        0        0        0        1
  IHYDG    IUHG    TAREA    SNAP    TRSDA    TRSPC    RATIO
      1      -1     0.96    0.0     0.96    0.80     0.0
  SPFE    PMIS    R6    R7    R8    R9    R10
      0     24.00   105.00   115.00   125.00   137.00

```

0.0 0.0 1.00 0.0 0.0 1.00 0.0 0.0 1.00 0.0 0.0 0.0

STRTQ# -2.00 RECEDSION DATA
QRCSEN# 0.0 RTIOR# 1.00

END-OF-PERIOD FLOW
TIME RAIN EXCS COMP Q
SUM 26.54 20.50 25592.

COMBINE HYDROGRAPHS

COMBINE OUTFLOW OF ESTLING TO INFLOW OF INDIAN
ISTAQ ICOMP IECON ITAPE JP LT JPR T INAME
2 2 0 0 0 0 0 1

HYDROGRAPH ROUTING

ROUTE	INDIAN	ISTAQ	ICOMP	IECON	ITAPE	JP LT	JPR T	INAME	
		3	1	0	0	0	0	1	
				ROUTING DATA					
				CLOSS	Avg	IRES	I SAME		
				0.0	0.0	1	0		
				NSTDLS	LAG	AMSKK	X	TSK	STORA
				1	0	0.0	0.0	0.0	0.
STORAGE#	45.	91.	140.	190.	296.	410.	600.	659.	1088.
OUTFLOW#	47.	132.	242.	373.	686.	1056.	1702.	2046.	3823.

PEAK FLOW SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS

OPERATION	STATION	PLAN	1.00	0.50	0.40	0.30	RATIOS APPLIED TO FLOWS	0.20	0.10
-----------	---------	------	------	------	------	------	-------------------------	------	------

HYDROGRAPH AT	1	1	15319.	7659.	6128.	4596.	3064.	1532.
ROUTED TO	1	2	0.	0.	0.	0.	0.	0.
	1	1	15135.	6430.	4725.	3432.	2131.	892.
HYDROGRAPH AT	2	2	0.	0.	0.	0.	0.	0.
	1	1	2914.	1457.	1166.	874.	583.	291.
2 COMBINED	2	2	0.	0.	0.	0.	0.	0.
	1	1	17403.	7162.	5263.	3798.	2335.	969.
ROUTED TO	3	2	0.	0.	0.	0.	0.	0.
	1	1	16448.	6647.	4873.	3124.	1547.	640.
	2	2	0.	0.	0.	0.	0.	0.

MC DONNELL DOUGLAS AUTOMATION COMPANY -- ST. LOUIS MESSAGE OF THE DAY

* LABOR HOLIDAY SCHEDULE *

* THE ST. LOUIS ASP/JES SYSTEMS WILL DISCONTINUE OPERATIONS AT
* 0830, SUNDAY, 3 SEPTEMBER. NORMAL OPERATIONS WILL RESUME AT
* 0130, TUESDAY, 5 SEPTEMBER.
* HAVE A HAPPY HOLIDAY.

MC DONNELL DOUGLAS AUTOMATION COMPANY -- ST. LOUIS
OS/MVT RELEASE 21.7 COMPUTER SYSTEM SY0

ASP JOB NO. = 5538 JOBNAME = LANG0876 START TIME = 16.45.12 START DATE = 08/30/78

STEPNAME	COND	COMP CODE	CORE USED	REGION REQUEST	DASD TRKS UNITS	TAPE DASD I/O TAPE I/O UNITS (MIN)	CPU (MIN)	STEP TIME (MIN)	STEP MRU	
GO	0000	194 K	194 K	100	1	0	.158	.000	.005	.084
* TOTAL JOB USAGE *										
CPU (MIN)	I/O (MIN)	CPU USAGE (MRU)	CORE (MRU)	MAIN RESOURCE UNIT SUMMARY	RESOURCE OCCUPANCY (MRU) - -	INIT/TERM (MRU)	JOB TOTAL (MRU)			
.005	.158	.05	.18	.00	.04	.00	.05			.32

***** ONE OR MORE STEPS IN THIS JOB UTILIZED A PROPRIETARY PACKAGE *****

CLIENT CHARGE NO. 1560972 RUN LIMITS ***
CLIENT DEFINED SUB-ACC'TING CPU (MIN) .50 DEFAULT PROGRAMMER NAME FIELD
GED

listcf ind10 'breakdown' -

IND10 19:12 AUG 30, '78

LMDSD09 JOB 5529 (LANG0872) IN BREAKDOWN FT06F001 16.16.39 30 AUG 78 GED

IEC-1 VERSION DATED JAN 1973
UPDATED AUG 74
CHANGE NO. 01

EC-1 VERSION DATED JAN 1973
UPDATED AUG 74
CHANGE NO. 01

**INDIAN LAKE DAM
DETERMINE INFLOW HYDROGRAPH FOR PMF-
INDIAN LAKE DAM
N.J. DAM INSPECTION**

NO	JOB SPECIFICATION						IPLT	IPRT	NSTAN
	NHR	NMIN	IDAY	IHR	IMIN	METRC			
110	0	30	0	0	0	0	0	0	0
			JOPER	NWT					
			3	0					

SUB-AREA RUNOFF COMPUTATION

	GIVEN	UNIT	GRAPH,	MNGU,	20	944.	726.	508.	387.
	1039.	1210.	1113.						
97.	726.								
205.	169.	121.	85.	67.					
290.									
	UNIT	GRAPH	TOTALS	8204.	CFS OR 0.99	INCHES OVER THE AREA			
							36.	24.	22.

RECEDITION DATA	RTIOR# 1.00	
STRTO#	QRCN# 0.0	
TIME	END-OF-PERIOD FLOW	COMP Q
	RAIN EXCS	
1	0.00	0.00
2	0.00	0.00
3	0.00	0.00
4	0.00	0.00
5	0.00	0.00
6	0.00	0.00
7	0.00	0.00
8	0.00	0.00
9	0.00	0.00
10	0.00	0.00
11	0.00	0.00
12	0.00	0.00
13	0.01	0.00
14	0.01	0.00
15	0.01	0.00
16	0.01	0.00
17	0.01	0.00
18	0.01	0.00
19	0.01	0.00
20	0.01	0.00
21	0.01	0.00
22	0.01	0.00
23	0.01	0.00
24	0.01	0.00
25	0.08	0.00
26	0.08	0.00
27	0.09	0.00
28	0.09	0.00
29	0.11	0.00
30	0.11	0.00
31	0.29	0.04
32	0.29	0.19
33	0.11	0.01
34	0.11	0.01
35	0.08	0.00
36	0.08	0.00
37	0.01	0.00
38	0.01	0.00
39	0.01	0.00
40	0.00	0.00

41	0.00	105.
42	0.01	82.
43	0.01	63.
44	0.01	53.
45	0.01	42.
46	0.01	33.
47	0.01	29.
48	0.01	24.
49	0.05	21.
50	0.05	19.
51	0.05	17.
52	0.05	13.
53	0.05	13.
54	0.05	13.
55	0.05	13.
56	0.05	13.
57	0.05	13.
58	0.05	13.
59	0.05	13.
60	0.05	13.
61	0.16	19.
62	0.16	44.
63	0.16	92.
64	0.16	159.
65	0.16	238.
66	0.16	310.
67	0.16	371.
68	0.16	419.
69	0.16	452.
70	0.16	477.
71	0.16	496.
72	0.16	509.
73	1.01	602.
74	1.01	936.
75	1.21	1573.
76	1.21	2531.
77	1.51	3730.
78	1.51	4997.
79	3.83	6483.
80	3.83	8532.
81	1.41	10965.
82	1.41	13247.
83	1.11	14899.
84	1.11	15319.
85	0.08	14617.
86	0.08	13164.
87	0.08	11153.
88	0.08	9052.
89	0.08	7098.
90	0.08	5375.
91	0.08	4015.

92	0.08	0.00	2996.
93	0.08	0.00	2204.
94	0.08	0.00	1629.
95	0.08	0.00	1198.
96	0.08	0.00	683.
97	0.0	0.0	626.
98	0.0	0.0	448.
99	0.0	0.0	290.
100	0.0	0.0	158.
101	0.0	0.0	102.
102	0.0	0.0	59.
103	0.0	0.0	35.
104	0.0	0.0	13.
105	0.0	0.0	13.
106	0.0	0.0	13.
107	0.0	0.0	13.
108	0.0	0.0	13.
109	0.0	0.0	13.
110	0.0	0.0	13.
SUM	25.40	19.93	165335.

CFS	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
INCHES	15319.	10825.	3387.	1503.	165328.
AC-FT		15.64	19.57	19.90	19.90
	5371.	6721.	6835.	6835.	

HYDROGRAPH ROUTING

ROUTING-ESTLING

1	ICOMP	IECON	ITAPE	JPLT	JPT	I NAME
		0	ROUTING DATA	0	0	1
		QLOSS	CLOSS	Avg	IRES	ISAME
NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA
1	0	0	0.0	0.0	0.0	0.

STORAGE#
OUTFLOW#

77.	159.	245.	336.	531.	744.	1097.	1224.	1491.
109.	308.	565.	870.	1826.	3192.	5697.	9269.	22958.

56	49.	13.	41.
57	48.	13.	39.
58	47.	13.	36.
59	46.	13.	34.
60	45.	13.	32.
61	45.	16.	30.
62	45.	32.	31.
63	46.	68.	34.
64	50.	125.	43.
65	56.	198.	58.
66	64.	274.	78.
67	75.	341.	103.
68	86.	395.	131.
69	98.	435.	160.
70	110.	464.	189.
71	122.	486.	218.
72	133.	502.	245.
73	145.	555.	274.
74	165.	769.	325.
75	201.	1254.	433.
76	264.	2052.	627.
77	360.	3131.	986.
78	486.	4364.	1607.
79	638.	5740.	2515.
80	820.	7507.	3729.
81	1037.	9749.	3268.
82	1230.	12106.	9579.
83	1320.	14073.	14202.
84	1338.	15109.	15135.
85	1335.	14968.	14963.
86	1314.	13891.	13860.
87	1279.	12158.	12109.
88	1239.	10102.	10045.
89	1192.	8075.	8375.
90	1136.	6236.	6803.
91	1075.	4695.	5543.
92	1002.	3506.	5022.
93	915.	2600.	4402.
94	825.	1916.	3767.
95	740.	1414.	3167.
96	663.	1041.	2670.
97	593.	755.	2222.
98	531.	537.	1827.
99	476.	369.	1559.
100	426.	224.	1313.
101	382.	130.	1096.
102	344.	81.	909.
103	311.	47.	786.
104	281.	24.	687.
105	255.	13.	600.
106	233.	13.	528.

107	213.	13.	468.
108	195.	13.	415.
109	179.	13.	368.
110	165.	13.	327.

	CFS	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
INCHES	15135.	10075.	3329.	1468.	161490.	161490.
AC-FT		14.55.	19.23.	19.44.		19.44.
		4999.	6605.	6677.		6677.

59	0.06	0.00	2.
60	0.06	0.00	2.
61	0.16	0.06	5.
62	0.16	0.06	15.
63	0.16	0.06	32.
64	0.16	0.06	48.
65	0.16	0.06	58.
66	0.16	0.06	65.
67	0.16	0.06	69.
68	0.16	0.06	72.
69	0.16	0.06	74.
70	0.16	0.06	75.
71	0.16	0.06	75.
72	0.16	0.06	76.
73	1.02	0.92	116.
74	1.02	0.92	268.
75	1.22	1.12	520.
76	1.22	1.12	775.
77	1.53	1.43	996.
78	1.53	1.43	1202.
79	3.87	3.77	1491.
80	3.87	3.77	2047.
81	1.42	1.32	2690.
82	1.42	1.32	2914.
83	1.12	1.02	2651.
84	1.12	1.02	2269.
85	0.09	0.00	1889.
86	0.09	0.00	1464.
87	0.09	0.00	1021.
88	0.09	0.00	655.
89	0.09	0.00	418.
90	0.09	0.00	259.
91	0.09	0.00	161.
92	0.09	0.00	102.
93	0.09	0.00	57.
94	0.09	0.00	31.
95	0.09	0.00	17.
96	0.09	0.00	10.
97	0.09	0.00	5.
98	0.09	0.00	2.
99	0.09	0.00	2.
100	0.09	0.00	2.
101	0.09	0.00	2.
102	0.09	0.00	2.
103	0.09	0.00	2.
104	0.09	0.00	2.
105	0.09	0.00	2.
106	0.09	0.00	2.
107	0.09	0.00	2.
108	0.09	0.00	2.
109	0.09	0.00	?

	110	0.0	0.0	2.
	SUM	26.54	20.50	25592.
CFS	PEAK	6-HOUR	24-HOUR	72-HOUR
2914.	1784.	515.	233.	TOTAL VOLUME
INCHES	17.29	19.96	20.66	2550.
AC-FT	885.	1022.	1058.	20.66
				1058.

COMBINE HYDROGRAPHS

COMBINE OUTFLOW OF ESTLING TO INFLOW OF INDIAN
 1STAQ ICOMP IECON ITAPE JPLT JPRT INAME
 2 2 0 0 0 0 1

	SUM OF 2 HYDROGRAPHS AT					
	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	2.
14.	59.	123.	151.	143.	136.	130.
113.	108.	103.	98.	92.	86.	81.
62.	57.	53.	50.	46.	43.	41.
35.	46.	66.	90.	116.	143.	173.
293.	321.	390.	592.	953.	1403.	1982.
7959.	12494.	16853.	17403.	16852.	15324.	13130.
5704.	5123.	4460.	3797.	3184.	2680.	2226.
1097.	911.	788.	689.	602.	530.	470.
CFS	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME	
17403.	11504.	3843.	1701.	187080.		
INCHES	14.46	19.32	19.60	19.60		
AC-FT	5707.	7626.	7735.	7735.		

HYDROGRAPH ROUTING

ROUTE	INDIAN	1STAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
	3	1	0	0	0	0	0	1
				ROUTING DATA				
				LOSS	CLOSS	Avg	IRES	ISAME
				0.0	0.0	0.0	1	0

STORAGE	NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	
OUTFLOW	1	0	0	0.0	0.0	0.0	0.	
45.	91.	140.	190.	296.	410.	600.	659.	1088.
47.	132.	242.	373.	686.	1056.	1702.	2016.	10439.
TIME	EOP	STOR	Avg	IN	EOP	OUT		
1	0.	0.	2.	2.	0.	0.		
2	0.	0.	2.	2.	0.	0.		
3	0.	0.	2.	2.	0.	0.		
4	0.	0.	2.	2.	0.	0.		
5	0.	0.	2.	2.	0.	0.		
6	0.	0.	2.	2.	0.	0.		
7	1.	2.	2.	2.	0.	0.		
8	1.	2.	2.	2.	0.	0.		
9	1.	2.	2.	2.	0.	0.		
10	1.	2.	2.	2.	0.	0.		
11	1.	2.	2.	2.	0.	0.		
12	1.	2.	2.	2.	0.	0.		
13	1.	2.	2.	2.	0.	0.		
14	1.	2.	2.	2.	0.	0.		
15	1.	2.	2.	2.	0.	0.		
16	1.	2.	2.	2.	0.	0.		
17	1.	2.	2.	2.	0.	0.		
18	1.	2.	2.	2.	0.	0.		
19	2.	2.	2.	2.	0.	0.		
20	2.	2.	2.	2.	0.	0.		
21	2.	2.	2.	2.	0.	0.		
22	2.	2.	2.	2.	0.	0.		
23	2.	2.	2.	2.	0.	0.		
24	2.	2.	2.	2.	0.	0.		
25	2.	2.	2.	2.	0.	0.		
26	2.	2.	2.	2.	0.	0.		
27	2.	2.	2.	2.	0.	0.		
28	2.	2.	2.	2.	0.	0.		
29	2.	2.	2.	2.	0.	0.		
30	2.	2.	2.	2.	0.	0.		
31	3.	3.	3.	3.	0.	0.		
32	4.	4.	4.	4.	0.	0.		
33	8.	8.	8.	8.	91.	0.		
34	14.	14.	14.	14.	137.	0.		
35	20.	20.	20.	20.	147.	0.		
36	25.	25.	25.	25.	140.	11.		
37	30.	30.	30.	30.	133.	20.		
38	34.	34.	34.	34.	128.	28.		
39	38.	38.	38.	38.	124.	35.		
40	42.	42.	42.	42.	120.	41.		
41	45.	45.	45.	45.	115.	46.		
42	47.	47.	47.	47.	111.	51.		
43	49.	49.	49.	49.	106.	55.		

45	53.	95.	63.
46	54.	89.	65.
47	55.	83.	66.
48	55.	78.	66.
49	55.	73.	66.
50	55.	68.	66.
51	55.	64.	66.
52	55.	59.	66.
53	55.	55.	65.
54	54.	51.	64.
55	54.	48.	63.
56	53.	45.	61.
57	52.	42.	60.
58	51.	39.	58.
59	50.	37.	57.
60	49.	35.	55.
61	49.	35.	54.
62	48.	40.	53.
63	48.	56.	53.
64	49.	78.	55.
65	51.	103.	58.
66	54.	130.	64.
67	58.	158.	71.
68	62.	188.	79.
69	68.	219.	89.
70	74.	249.	101.
71	81.	279.	114.
72	89.	307.	128.
73	98.	355.	148.
74	112.	491.	178.
75	135.	773.	231.
76	172.	1178.	326.
77	226.	1692.	478.
78	300.	2396.	700.
79	405.	3408.	1040.
80	554.	4891.	1545.
81	741.	6867.	3119.
82	949.	10226.	7292.
83	1157.	14673.	11988.
84	1301.	17128.	15259.
85	1354.	17128.	16448.
86	1344.	16088.	16219.
87	1288.	14227.	14952.
88	1202.	11915.	13020.
89	1110.	9747.	10937.
90	1025.	7928.	9022.
91	951.	6383.	7343.
92	897.	5414.	6116.
93	859.	4792.	5273.
94	827.	4129.	4545.
95	797.	3491.	3874.

AD-A058 820 NEW JERSEY STATE DEPT OF ENVIRONMENTAL PROTECTION TRENTON
NATIONAL DAM SAFETY PROGRAM. INDIAN LAKE DAM (NJ00167), PASSAIC--ETC(U)
AUG 78 D J LEARY

F/G 13/2
DACP61-78-C-0124

N/L

UNCLASSIFIED

2 OF 2
AD
A058820



END
DATE
FILED
11-78
DDC

96	767.	2932.	3457.
97	734.	2453.	3030.
98	702.	2028.	2604.
99	672.	1695.	2217.
100	645.	1438.	1965.
101	617.	1206.	1802.
102	587.	1004.	1658.
103	556.	849.	1552.
104	524.	738.	1445.
105	494.	645.	1340.
106	464.	566.	1239.
107	435.	500.	1142.
108	408.	443.	1050.
109	383.	394.	968.
110	359.	350.	890.
SUM			178678.
CFS	PEAK	6-HOUR	72-HOUR
INCHES	16448.	11156.	3692.
AC-FT		14.02	18.57
		5535.	7327.

RUNOFF SUMMARY, AVERAGE FLOW

	PEAK	6-HOUR	24-HOUR	72-HOUR	AREA
HYDROGRAPH AT ROUTED TO	1 15319.	10825.	3387.	1503.	6.44
HYDROGRAPH AT 2 COMBINED ROUTED TO	1 15135.	10075.	3329.	1468.	6.44
	2 2914.	1784.	515.	233.	0.96
	2 17403.	11504.	3843.	1701.	7.40
	3 16448.	11156.	3692.	1624.	7.40

LABOR HOLIDAY SCHEDULE

THE ST. LOUIS ASP/JES SYSTEMS WILL DISCONTINUE OPERATIONS AT
0830, SUNDAY, 3 SEPTEMBER. NORMAL OPERATIONS WILL RESUME AT
0130, TUESDAY, 5 SEPTEMBER.
HAVE A HAPPY HOLIDAY.

APPENDIX 4

REFERENCES

INDIAN LAKE DAM

APPENDIX 4
REFERENCES
INDIAN LAKE DAM

Written Documents

1. "Contract and Specifications covering Construction of Earth Dam, Concrete Spillway and Bridge at Denville, New Jersey for Joseph B. Righter, Esq." dated 2 August 1921.
2. Sheet 2 of Revised Spillway Capacity Calculations.
3. Memorandum on Changes in Plans for Proposed Lenapi Lake Dam for J.B. Righter, Denville, New Jersey, dated 19 August 1921.
4. Monthly Construction Progress Reports dated 30 September and 31 October 1921.
5. Inspection Report - Letter dated 21 October 1921 to Mr. A.B. Cohen from Hydraulic Engineer Mr. H.T. Critchlow.
6. Letter to H.T. Critchlow from A.B. Cohen concerning gate valve., dated 26 October 1921.
7. Memorandum regarding Construction Inspection of dam on 3 November 1921 from H.T. Critchlow.
8. Memorandum regarding inspection of dam construction 21 December 1921 from H.T. Critchlow.
9. Letter concerning dam inspections from D.C. Hofmann, Chief Bureau of Water Control to Frank Vanone, Denville Twp. Administrator, dated 12 September 1972.

Drawings

1. General Layout and Details of Proposed Lenapi Lake and Dam, dated 19 July 1921
2. General Layout and Details of Proposed Lanapi Lake and Dam, Revised 18 August 1921.

APPENDIX 4 Cont'd

INDIAN LAKE DAM

Other

1. Eby, C.F., 1976, Soil Survey of Morris County, New Jersey, U.S. Department of Agriculture, Soil Conservation Service, 111 pp.
2. Lewis, J.V., and H.B. Kummel, 1924, The Geology of New Jersey, Bulletin 14, Geological Survey of New Jersey, Trenton, New Jersey, 146 pp.
3. Lucey, C.S., 1972, Geology of Morris County in Brief, State of New Jersey, Bureau of Geology and Topography, Trenton, New Jersey, 13 pp.
4. Minard, J.P., W.W. Holman, A.R. Jumikis, 1953, Engineering Soil Survey of New Jersey, Report No. 9, Morris County, Rutgers University, New Brunswick, New Jersey, 86 pp.
5. Rogers, F.C., D.R. Lueder, and G.H. Obear, 1951, Engineering Soil Survey of New Jersey, Report No. 3, Passaic County, Rutgers University, New Brunswick, New Jersey, 45 pp.
6. Widmer, K., 1964, The GEology and GEOgraphy of New Jersey, Volume 19, The New Jersey Historical Series, D. Van Nostrand Co., Inc., Princeton, New Jersey, 193 pp.
7. Wolfe, P.E., 1977, The Geology and Landscapes of New Jersey, Crane, Russak & Company, Inc., New York, New York 351 pp.