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NEW JERSEY DEPT OF ENVIRONMENTAL PROTECTION TRENTON
NATIONAL DAM SAFETY PROGRAM. DECOZEN'S DAM (NJ00353) PASSAIC RI--ETC(U)
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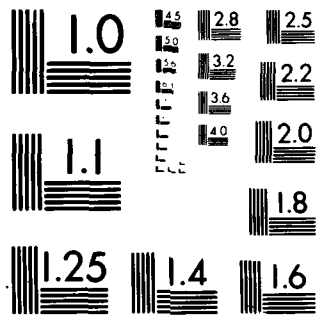
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PASSAIC RIVER BASIN
TROY BROOK, MORRIS COUNTY
NEW JERSEY

**DE COZEN'S DAM
NJ 00353**

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JUL 31 1980

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



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DEPARTMENT OF THE ARMY

Philadelphia District
Corps of Engineers
Philadelphia, Pennsylvania

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DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
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PHILADELPHIA, PENNSYLVANIA 19106

IN REPLY REFER TO
NAPEN-N

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

24 JUL 1969

Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for De Cozen's 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 in the front of the report.

Based on visual inspection, available records, calculations and past operational performance, De Cozen's Dam, initially listed as a "high" hazard potential structure, but reduced to a "significant" hazard potential structure as a result of this inspection, is judged to be in fair overall condition. The dam's spillway is considered inadequate because a flow equivalent to nine percent of the Spillway Design Flood - SDF - would cause the dam to be overtopped. (The SDF, in this instance, is one half of the Probable Maximum Flood). To ensure 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 one year from the date of approval of this report. Within three months of the consultant's findings, remedial measures to ensure spillway adequacy should be initiated.

b. The two areas of seepage observed at the toe of the dam should be monitored monthly in order to detect any changes in their condition.

c. With the lake drawn down, the concrete spillway and outlet structure should be thoroughly inspected by a professional consultant engaged by the owner within one year from the date of approval of this report. Based on the inspection, any necessary remedial measures should be determined and implemented. Also, the outlet structure should be repaired to prevent leakage during times of high lake stage.

d. Within one year from the date of approval of this report, the following remedial measures should be completed:

NAPEN-N

Honorable Brendan T. Byrne

- (1) All trees on the embankment should be removed.
 - (2) The animal hole and erosion gully on the downstream side of the dam should be filled and sodded.
 - (3) The spillway discharge channel should be renovated to increase its capacity and prevent overflow.
- e. Within six months from the date of approval of this report, the owner should develop an emergency action plan together with an effective warning system outlining actions to be taken by the operator to minimize downstream effects of an emergency at the dam.

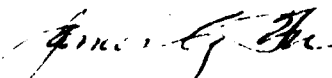
f. Within one year from the date of approval of this report, the owner should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam.

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 Fenwick of the Fifth District. Under the provision of the Freedom of Information Act, the inspection report will be subject to release by this office, upon request, five 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 Inspection 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,



JAMES G. TON
Colonel, Corps of Engineers
District Engineer

1 Incl
As stated

Copies furnished:
Mr. Dirk C. Hofman, P.E., Deputy Director
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

Mr. John O'Dowd, Acting Chief
Bureau of Flood Plain Regulation
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

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DE COZEN'S DAM (NJ00353)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 14 November 1979 and 21 March 1980 by Storch Engineers 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.

De Cozen's Dam, initially listed as a "high" hazard potential structure, but reduced to a "significant" hazard potential structure as a result of this inspection, is judged to be in fair overall condition. The dam's spillway is considered inadequate because a flow equivalent to nine percent of the Spillway Design Flood - SDF - would cause the dam to be overtopped. (The SDF, in this instance, is one half of the Probable Maximum Flood). To ensure 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 one year from the date of approval of this report. Within three months of the consultant's findings, remedial measures to ensure spillway adequacy should be initiated.

b. The two areas of seepage observed at the toe of the dam should be monitored monthly in order to detect any changes in their condition.

c. With the lake drawn down, the concrete spillway and outlet structure should be thoroughly inspected by a professional consultant engaged by the owner within one year from the date of approval of this report. Based on the inspection, any necessary remedial measures should be determined and implemented. Also, the outlet structure should be repaired to prevent leakage during times of high lake stage.

d. Within one year from the date of approval of this report, the following remedial measures should be completed:

(1) All trees on the embankment should be removed.

(2) The animal hole and erosion gully on the downstream side of the dam should be filled and sodded.

(3) The spillway discharge channel should be renovated to increase its capacity and prevent overflow.

e. Within six months from the date of approval of this report, the owner should develop an emergency action plan together with an effective warning system outlining actions to be taken by the operator to minimize downstream effects of an emergency at the dam.

f. Within one year from the date of approval of this report, the owner should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam.

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

DATE: *2 July 1970*

10 Richard J. McLehert

15 DACW62-79-C-0017

11 Apr 80

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PHASE I REPORT

NATIONAL DAM SAFETY PROGRAM

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Name of Dam:	DeCozen's Dam (NJ00353) Passaic River Basin
State Located:	New Jersey Troy Brook, Morris County
County Located:	Morris New Jersey
Drainage Basin:	Passaic River
Stream:	Troy Brook
Date of Inspection:	November 14, 1979 March 21, 1980

Phase I Inspection Report

9 Final report

Assessment of General Condition of Dam

Based on visual inspection, past operational performance and Phase I engineering analyses, DeCozen's Dam is assessed as being in fair overall condition.

Based on investigations of the downstream flood plain made in connection with this report, it is recommended that the hazard potential classification be downgraded from "High" to "Significant" hazard.

Hydraulic and hydrologic analysis indicate that the spillway is inadequate. The discharge capacity of the spillway is not sufficient to pass the designated spillway design flood (SDF) without an overtopping of the dam. (The SDF for DeCozen's Dam is equal to one-half the probable maximum flood.) The spillway is capable of passing approximately 4 percent of the probable maximum flood, or 8 percent of the SDF. Therefore, the owner should, in the future, engage a professional engineer experienced in the design and construction of dams to perform more accurate hydraulic and hydrologic analyses. Based on the findings of the analyses, the need for and type of remedial measures should be determined and then implemented.

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Two areas of seepage were observed at the toe of dam. Arrangements should be made in the near future to monitor the seepage on a monthly basis in order to detect any changes in its condition. The monitoring should be performed by a professional engineer experienced in the design and construction of dams.

In addition, it is recommended that the following remedial measures be undertaken by the owner in the future:

- 1) With the lake drawn down, the concrete spillway and outlet structure should be thoroughly inspected by a professional engineer experienced in the design and construction of dams. Based on the inspection, any necessary remedial measures should be determined and then implemented. Also, the outlet structure should be repaired to prevent leakage during times of high lake stage.
- 2) All trees on the embankment should be removed.
- 3) The animal hole and erosion gully on the downstream side of the dam should be filled and sodded.
- 4) The spillway discharge channel should be renovated to increase its capacity and prevent overflow.

In the near future, the owner of the dam should develop written operating procedures and a periodic maintenance plan to insure the safety of the dam.


Richard J. McDermott, P.E.


John E. Gribbin, P.E.



OVERVIEW - DE COZEN'S DAM

29 NOVEMBER 1979

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from 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 condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. It is important to note that the condition of dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that the unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from 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 condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. It is important to note that the condition of dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that the unsafe conditions be detected.

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PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

DECOZEN'S DAM, I.D. NJ00353

SECTION 1: PROJECT INFORMATION

1.1 General

a. Authority

Public Law 92-367, August 8, 1972 authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The Division of Water Resources of the New Jersey Department of Environmental Protection (NJDEP) in cooperation with the Philadelphia District of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the State of New Jersey. Storch Engineers has been retained by the NJDEP to inspect and report on a selected group of these dams. The NJDEP is under agreement with the Philadelphia District of the Corps of Engineers.

b. Purpose of Inspection

The visual inspection of DeCozen's Dam was made on November 14, 1979 and March 21, 1980. The purpose of the inspection was to make a general assessment of the structural integrity and operational adequacy of the dam structure and its appurtenances.

1.2 Description of Project

a. Description of Dam and Appurtenances

DeCozen's Dam is a rock fill embankment with a concrete chute-type spillway and a stone masonry wall located along its upstream side.

A paved walkway is located along the embankment crest which is oriented in a north-south direction. The upstream face consists of a concrete capped stone masonry wall for the majority of its length, the remainder of which consists of a concrete wall.

The spillway is located at the left, or north, end of the dam and consists of a concrete lined channel across the crest and extending approximately 20 feet down the natural slope adjacent to the left end of the dam. At the end of the concrete channel, an earth channel conveys discharge to a small lake located immediately downstream from the subject dam. A timber walkway spans the spillway at the dam crest.

The outlet works is located immediately south of the spillway and consists of a cut through the embankment lined with stone masonry and concrete abutments or training walls. The outlet is regulated by timber stoplogs. The discharge channel consists of a concrete lined channel containing concrete baffle-like obstructions. A timber walkway spans the outlet opening at the dam crest.

The dam has an overall length of 250 feet and a crest elevation of 327.4, National Geodetic Vertical Datum (N.G.V.D.). The dam crest is taken to be the top of the wall forming the

upstream face of dam. The elevation of the spillway crest is 325.7 while that of the outlet discharge channel bottom is 316.5. The height of dam is 10.9 feet.

b. Location

DeCozen's Dam is located on property of the Interpace Corporation office complex in the Township of Parsippany-Troy Hills. The dam is readily accessible by internal roads of the office complex.

c. **Size and Hazard Classification**

Size and Hazard Classification criteria presented in "Recommended Guidelines for Safety Inspection of Dams," published by the U.S. Army Corps of Engineers are as follows:

SIZE CLASSIFICATION

	<u>Impoundment</u>	
	<u>Storage (Ac-ft)</u>	<u>Height (Ft.)</u>
Small	< 1000 and ≥ 50	< 40 and ≥ 25
Intermediate	≥ 1000 and < 50,000	≥ 40 and < 100
Large	$\geq 50,000$	≥ 100

HAZARD POTENTIAL CLASSIFICATION

<u>Category</u>	<u>Loss of Life</u> (Extent of Development)	<u>Economic Loss</u> (Extent of Development)
Low	None expected (no permanent structures for human habitation)	Minimal (Undeveloped to occasional structures or agriculture)
Significant	Few (No urban developments and no more than a small number of inhabitable structures)	Appreciable (Notable agriculture, industry or structures)
High	More than a small number	Excessive (Extensive community, industry or agriculture)

The following data relating to size and downstream hazard for DeCozen's Dam have been obtained for this Phase I report:

Storage: 51 Acre-feet

Height: 10.9 feet

Potential Loss of Life:

A heavily travelled road, Cherry Hill Road, is located downstream from the dam. Across Cherry Hill Road an office building and parking area are located in the flood plain of the dam. Failure of the dam could possibly cause loss of life.

Potential Economic Loss:

Cherry Hill Road and the downstream office building as well as cars in its parking area could sustain damage as a result of failure of the dam.

Therefore, DeCozen's Dam is classified as "Small" size and "Significant" hazard potential.

d. Ownership

DeCozen's Dam is owned and maintained by the Interspace Corporation, Cherry Hill Road, Parsippany-Troy Hills, N. J. Telephone 201-335-1111.

e. Purpose of Dam

The purpose of the dam is the impoundment of a lake used for recreation and aesthetics.

f. Design and Construction History

DeCozen's Dam reportedly was designed in 1954. However, no information concerning the design or construction is available.

g. Normal Operational Procedures

The dam and appurtenances are maintained by the maintenance crew of Interpace Corp. There is no fixed schedule of maintenance; repairs are made as the need arises.

The maintenance department reports that normally before every major storm stoplogs are pulled to provide more retention capacity. It is also reported that the dam has not been overtopped during the last ten years.

1.3 Pertinent Data

a. Drainage Area 0.4 Sq. Miles

b. Drainage at Damsite

Maximum flood at damsite Unknown

Outlet works at normal pool elevation 48 c.f.s.

Spillway capacity at top of dam 50 c.f.s.

c. Elevation (feet above MSL)

Top of dam 327.4

Maximum pool-design surcharge 328.7

Normal pool 325.9

Spillway crest 325.7

Discharge channel invert 316.5

d. Reservoir

Length of maximum pool	1400 feet (Estimated)
Length of normal pool	1200 feet (Scaled)

e. Storage (Acre-feet)

Spillway crest	38 Acre-feet
Design surcharge	63 Acre-feet
Top of dam	51 Acre-feet

f. Reservoir Surface (Acres)

Spillway crest	10.0 Acres
Top of dam	11.7 Acres
Maximum pool - design surcharge	13.1 Acres

g. Dam

Type	Rockfill (Reportedly)
Length	250 feet
Height	10.9 feet
Side slopes	
Embankment - Upstream	3 horiz. to 1 vert.
- Downstream	3 horiz. to 1 vert.
Zoning	Unknown
Impervious core	Stone masonry on upstream side of embankment
Cutoff	Unknown
Grout curtain	Unknown

h. Diversion and Regulating Tunnel **N.A.**

i. Spillway

Type	Uncontrolled concrete chute
Width of control section	9 feet
Crest elevation	325.7
Gates	N.A.
Upstream channel	N.A.
Downstream channel	Earth channel discharging into downstream lake

j. Outlet Works (Functioning as auxiliary spillway)

Type	Sharp crested weir
Width	3.9 feet
Crest elevation	325.9
Gates	Stoplogs form weir
Upstream channel	N.A.
Downstream channel	Concrete channel discharging into downstream lake

k. Regulating Outlets

Timber stoplogs between 2 stone masonry and concrete abutments or training walls in cut through embankment.

SECTION 2: ENGINEERING DATA

2.1 Design

No calculations, reports or plans pertaining to the design of the dam are available.

2.2 Construction

No data or reports pertaining to the construction of the dam are available.

2.3 Operation

No data pertaining to the operation of the dam are available.

2.4 Evaluation

a. Availability

No engineering information pertaining to the dam is available.

b. Adequacy

Available data is not adequate to be of significant assistance to the performance of a Phase I evaluation. A list of absent information is included in paragraph 7.1.b.

c. Validity

The validity of engineering data cannot be assessed due to the absence of data.

SECTION 3: VISUAL INSPECTION

3.1 Findings

a. General

The inspection of DeCozen's Lake Dam took place on November 14, 1979 and March 21, 1980 by members of the staff of Storch Engineers. A copy of the visual inspection check list is contained in Appendix 1. The following procedures were employed for the inspection:

- 1) The embankment of the dam, appurtenant structures and adjacent areas were examined.
- 2) Areas of suspected seepage were noted and located.
- 3) The embankment and appurtenant structures were measured and key elevations determined by the use of a surveyor's level.
- 4) The embankment and appurtenant structures and adjacent areas were photographed.
- 5) Depths of water were measured at various locations in the lake.

b. Embankment

The paved walkway on the crest was in generally good condition. The stone masonry wall along the upstream face was in generally satisfactory condition except at two points where the concrete cap was broken and the top of wall deteriorated. Two areas of seepage were noted on the downstream side of the dam. The downstream face was very wet and soft near the toe at the approximate center of the dam and a small area of standing water was observed immediately downstream from the toe about midway between the center and the north end of the dam.

On March 21, 1980, during a storm, leakage was observed discharging from the junction between the left training wall of the outlet works and the downstream side of the embankment. The lake stage was approximately 0.5' above the spillway crest. The leakage was discharging as a trickle.

The downstream face was covered with a stand of cut grass and some small trees were located along the crest. The top of a stone masonry wall was exposed at various locations along the downstream side of the crest. The full extent of the wall could not be determined at the time of inspection. One animal hole was observed on the downstream face.

A ditch or gully was observed on the downstream face running from the spillway to the outlet works discharge channel. The gully appeared to be the result of overflow from the spillway or overtopping of the dam. On March 21, 1980, during a storm, the spillway discharge channel was overflowing into the gully.

Riprap was observed along the sloped upstream face, adjacent to the stone masonry wall. The stones appeared to be of adequate size.

c. Spillway and Outlet

Concrete surfaces in the spillway chute appeared to be in satisfactory condition. The stone masonry headwalls at the upstream end of the spillway and outlet structures were generally in good condition.

The concrete bottom portions of the outlet works training walls appeared to be in satisfactory condition. The stone masonry portions appeared to be sound but some deterioration

in the form of dislodged stones was noted. The concrete cap was significantly spalled around its edges. Concrete surfaces in the outlet channel were in satisfactory condition.

The downstream surface of the set of timber stoplogs appeared to be in satisfactory condition. The timber walkways spanning the spillway and outlet works were in satisfactory condition.

d. Reservoir Area

The shores of the lake are grass covered at the east end and tree lined at the west end. Slopes are generally moderate. Soundings in the lake in the vicinity of the outlet works indicated little accumulation of sediment.

e. Downstream Area

Immediately downstream from the dam lies a small lake into which the *downstream channel discharges*. A heavily travelled public road (Cherry Hill Road) is located immediately downstream from the second lake. Beyond the road, flow from the downstream channel is conveyed by a 10-foot diameter corrugated metal pipe. A large office building and parking area are located downstream from the road.

SECTION 4: OPERATIONAL PROCEDURES

4.1 Procedures

The level of water in the impoundment of DeCozen's Dam is regulated naturally by discharge over the concrete spillway and timber stoplogs of the outlet works. Reportedly, the stoplogs are pulled at the time of intense storms to augment the spillway and to increase retention capacity.

The timber stoplogs are also pulled to lower the lake to facilitate maintenance operations. Reportedly, in 1970 the lake was lowered three-quarters of its full depth for maintenance purposes and since then the lake has been lowered 8 inches each year for lake maintenance.

4.2 Maintenance of the Dam

Reportedly, the only program of regular maintenance of the dam and appurtenant structures is the mowing of grass and the removal of weeds. Other maintenance is performed on an "as needed" basis by Interpace Corp.

The most recent maintenance was repair to the concrete at the outlet works and the spillway in 1970.

4.3 Description of Warning System

Reportedly, no formal warning system is in use at the present time.

4.4 Evaluation of Operation Adequacy

Maintenance documentation is poor; however the general condition of the dam indicates that maintenance has been generally adequate.

Maintenance of the dam appears to be insufficient in the following areas:

- 1) Concrete cap on upstream stone masonry wall was broken.
- 2) Erosion gully not filled and stabilized.
- 3) Animal hole not filled.

Operation of the dam during storms reportedly has been successful in preventing overtopping of the embankment.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design Data

The quantity of storm water runoff that the spillway should be able to pass without an overtopping of the dam is based on the size and hazard classification of the dam. This runoff, called the Spillway Design Flood (SDF), is described in terms of frequency or probable maximum flood (PMF) depending on the extent of the dam's size and potential hazard. According to the "Recommended Guidelines for Safety Inspection of Dams," published by the U.S. Army Corps of Engineers, the SDF for DeCozen's Dam falls in a range of 100-year frequency to 1/2 PMF. In this case the high end of the range, 1/2 PMF, is chosen because of the hazard potential resulting from the road and office building downstream from the dam.

The SDF hydrograph for DeCozen's Lake was computed by the HEC-1-DB computer program using the Soil Conservation Service triangular unit hydrograph with the curvilinear transformation. Hydrologic computations and computer output are contained in Appendix 4. The calculated SDF peak inflow for DeCozen's Dam is 1047 c.f.s.

Discharge capacity for the spillway was computed by considering free discharge through the spillway chute and over the stoplogs of the outlet works. Hydraulic computations are contained in Appendix 4.

The SDF was routed through the dam by the use of the HEC-1-DB computer program using the modified Puls method. In routing the SDF, it was found that the dam would be

overtopped to a depth of 1.3 feet. Accordingly, the subject spillway is assessed as being inadequate in accordance with criteria developed by the U.S. Army Corps of Engineers.

b. Experience Data

The maintenance department of Interpace Corp. reported that the dam has not been overtopped due to high lake water level during the last 10 years. No experience data relating to the period preceding the past 10 years could be obtained.

c. Visual Observations

A gully was observed on the downstream side of the dam in the vicinity of the spillway. Based on observations made during a storm the gully has apparently been formed by overflowing of the spillway discharge channel.

d. Overtopping Potential

As indicated in paragraph 5.1.a, a storm of magnitude equivalent to the SDF would cause overtopping of the dam by a depth of 1.3 feet above the top of dam. The spillway is capable of passing approximately 4 percent of the PMF or 8 percent of the SDF with lake level equal to the top of dam (elev. 227.4).

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

The embankment appeared at the time of inspection to be outwardly stable. However, two areas of suspected seepage were observed at the toe. The effect of the observed seepage on the structural stability of the dam cannot be assessed with the information available for this Phase I study. However, the seepage does not appear to indicate immediate embankment instability.

b. Generalized Soils Description

The generalized soils description of the dam site consists of recent alluvium composed of stratified materials deposited by streams overlying glacial quaternary deposits. The quaternary deposits consist of a thin layer of glacial stratified drift overlying a thicker layer of glacial ground moraine. The stratified drift is composed of silty sands, silty gravels, sandy gravels and gravelly sands. The quaternary deposits overly soft red shale bedrock identified as the Brunswick Formation.

c. Design and Construction Data

Analysis of structural stability and construction data for the embankment and spillway structure are not available.

d. Operating Records

No operating records are available for the dam.

e. **Post Construction Changes**

According to the maintenance department of Interpace Corp., the extension of the masonry wall on the upstream side of the south end of the dam in 1970 was the only post construction change.

f. **Seismic Stability**

DeCozen's Dam is located in Seismic Zone 1 is defined in "Recommended Guideline for Safety Inspection of Dams," which is a zone of very low seismic activity. Experience indicates that dams in Seismic Zone 1 will have adequate stability under seismic loading conditions if stable under static loading conditions. DeCozen's Dam appeared to be outwardly stable under seismic loading conditions at the time of inspection.

SECTION 7: ASSESSMENT AND RECOMMENDATIONS

7.1 Dam Assessment

a. Safety

Based on hydraulic and hydrologic analyses outlined in Section 5 and Appendix 4, the spillway of Decozen's Dam is assessed as being inadequate.

The dam appeared, at the time of inspection, to be generally outwardly stable. Two areas of seepage were observed on the downstream side of the dam near the toe. However, the observed seepage does not appear to be an indication of immediate embankment instability.

b. Adequacy of Information

Information sources for this study include: 1) field inspection, 2) USGS quadrangle, 3) aerial photography and 4) consultation with representatives of Interpace Corp. The information outlined is sufficient to allow a Phase I assessment as outlined in "Recommended Guidelines for Safety Inspection of Dams."

Some of the absent data are as follows:

- 1) Soils Report
- 2) Construction drawings and as-built plans
- 3) Structural Design Report
- 4) Hydraulic Design Report
- 5) Maintenance Documentation

c. **Necessity for Additional Data/Evaluation**

Although some data pertaining to DeCozen's Dam are not available, additional data are not considered imperative for this Phase I evaluation.

7.2 **Recommendations**

a. **Remedial Measures**

Based on hydraulic and hydrologic analyses outlined in paragraph 5.1.a., the spillway is assessed as being inadequate. It is therefore recommended that a professional engineer experienced in the design and construction of dams be engaged in the future to perform more accurate hydraulic and hydrologic analyses. Based on the findings of the analyses, the need for and type of remedial measures should be determined and then implemented.

Two areas of seepage were observed at the toe of dam. Arrangements should be made in the near future to monitor the seepage on a monthly basis in order to detect any changes in its condition. The monitoring should be performed by a professional engineer experienced in the design and construction of dams.

In addition, it is recommended that the following remedial measures be undertaken by the owner in the future:

- 1) With the lake drawn down, the concrete spillway and outlet structure should be thoroughly inspected by a professional engineer experienced in the design and construction of dams. Based on the inspection, any necessary remedial measures should

be determined and then implemented. Also, the outlet structure should be repaired to prevent leakage during times of high lake stage.

- 2) All trees on the embankment should be removed.
- 3) The animal hole and erosion gully on the downstream side of the dam should be filled and sodded.
- 4) The spillway discharge channel should be renovated to increase its capacity and prevent overflow.

b) Maintenance

In the near future, the owner of the dam should develop written operating procedures and a periodic maintenance plan to insure the safety of the dam.

PLATES

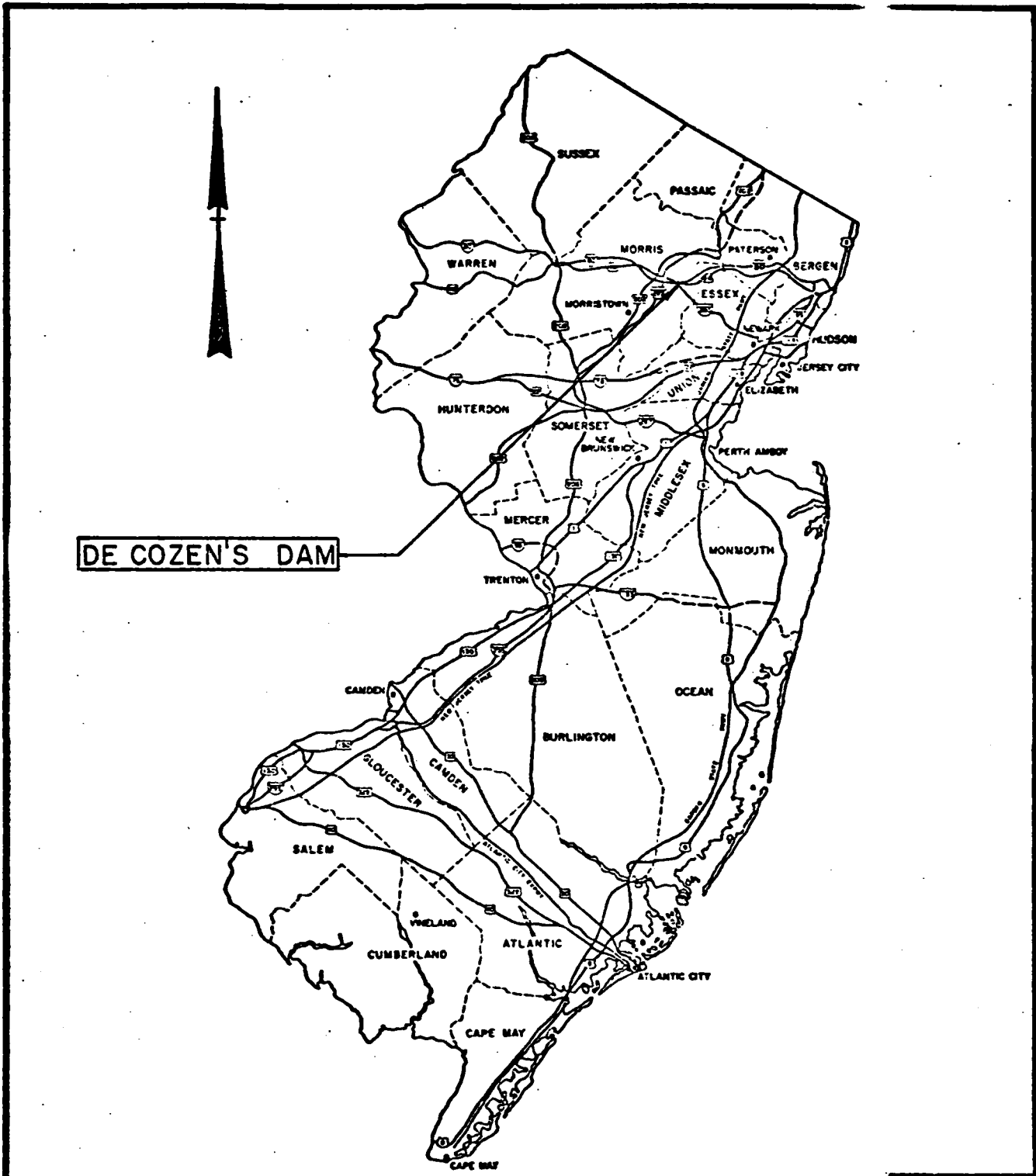


PLATE I

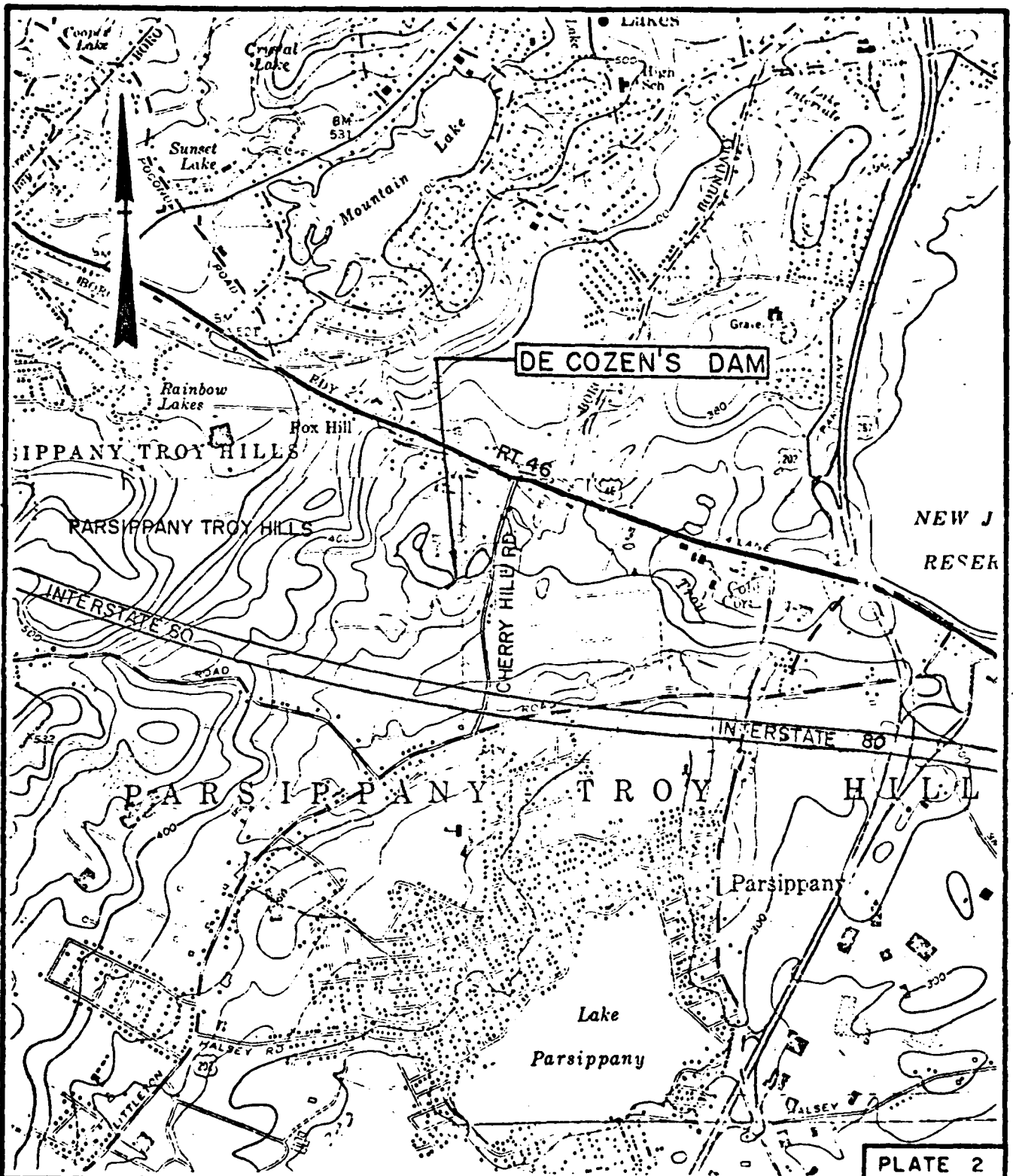
STORCH ENGINEERS
FLORHAM PARK, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS
KEY MAP
DE COZEN'S DAM

DIVISION OF WATER RESOURCES
N.J. DEPT. OF ENVIR. PROTECTION
TRENTON, NEW JERSEY

I. D. N.J. 00353

SCALE: NONE
DATE: NOV., 1979



STORCH ENGINEERS
FLORHAM PARK, NEW JERSEY

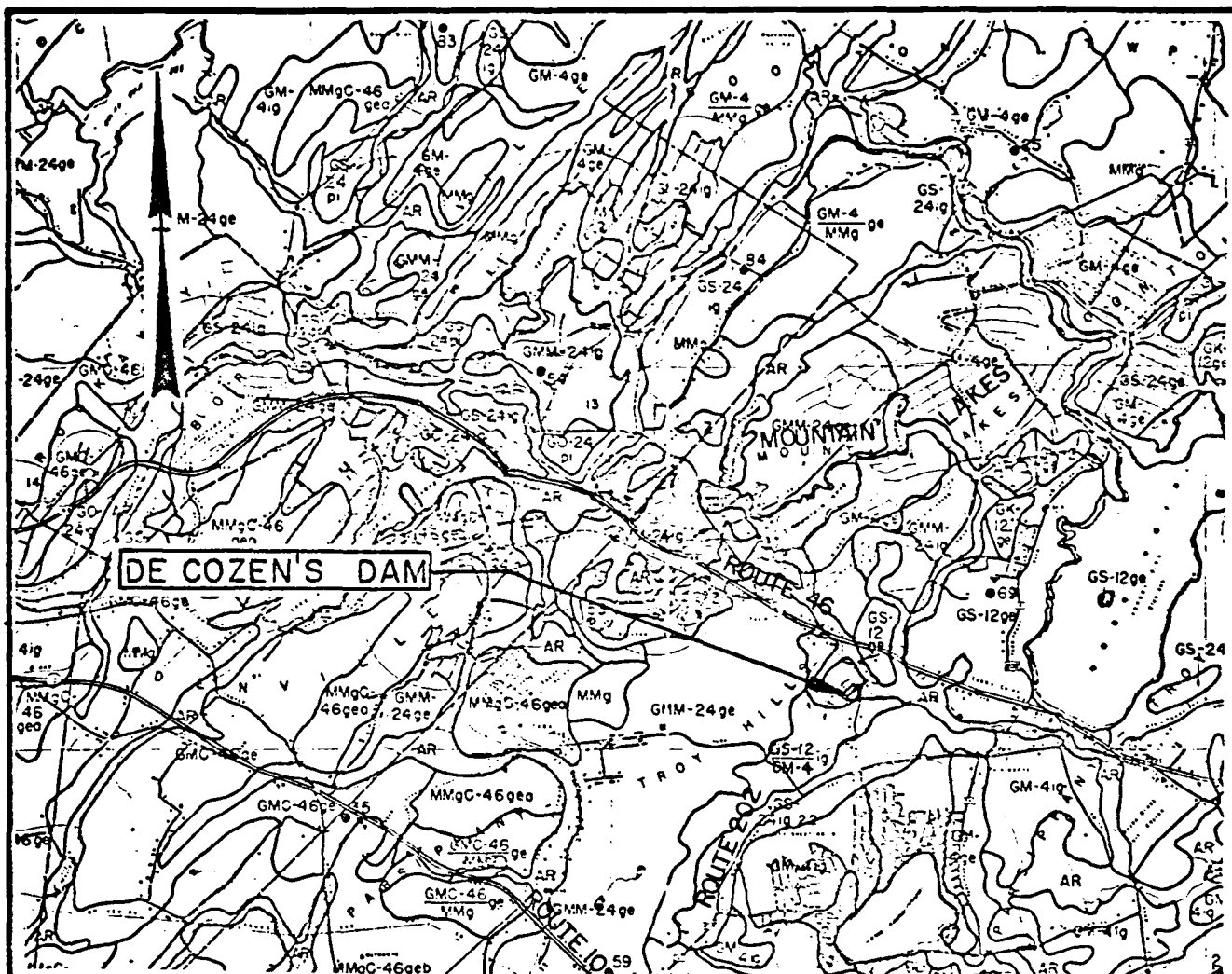
DIVISION OF WATER RESOURCES
N.J. DEPT. OF ENVIR. PROTECTION
TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS
VICINITY MAP
DE COZEN'S DAM

I. D. N. J. 00353

SCALE: AS SHOWN

DATE: NOV., 1979



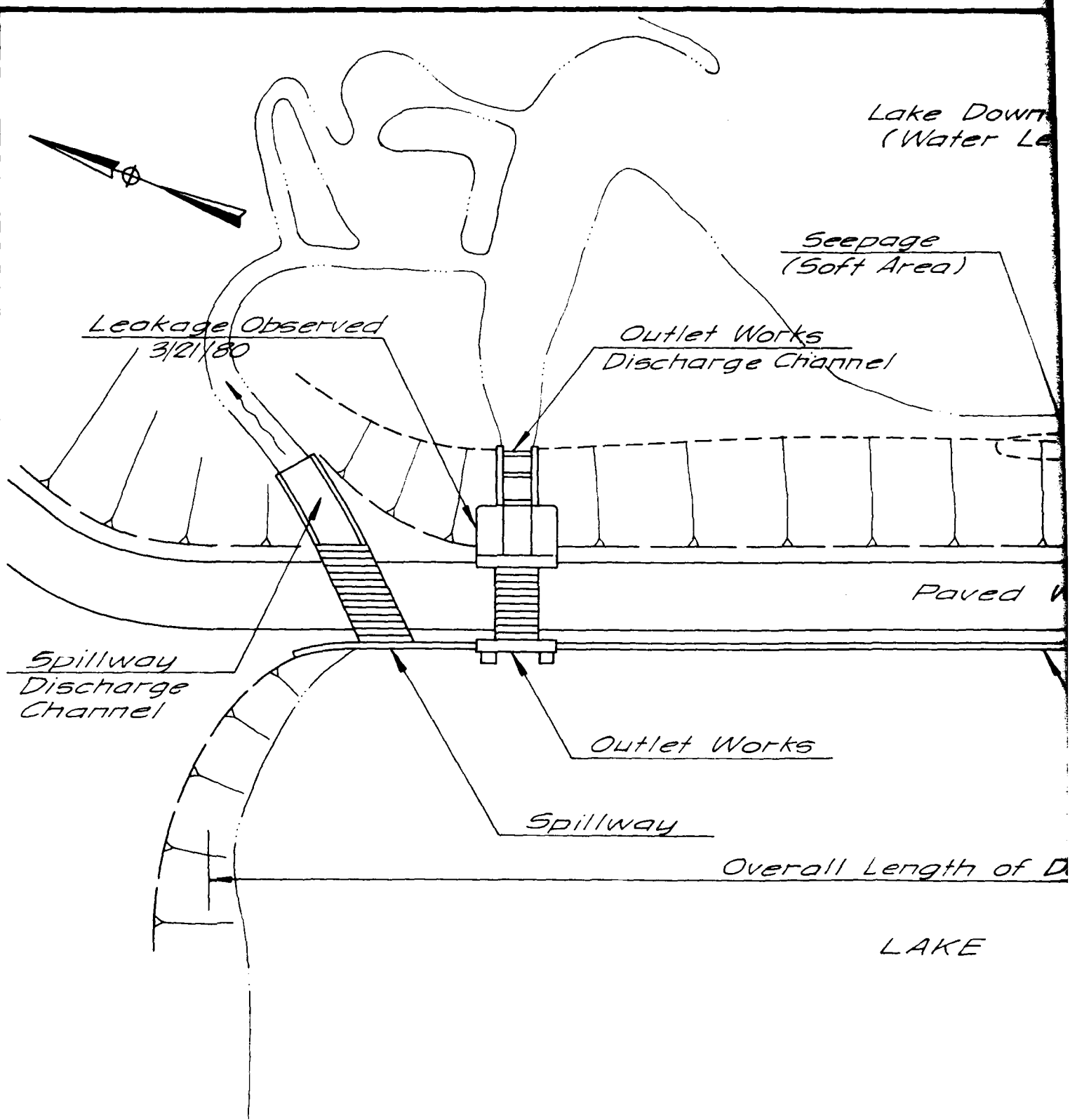
Legend

- AR Recent alluvium composed of stratified materials deposited by streams.
- GS-12 Glacial stratified drift deposited by melt waters flowing from the Wisconsin glacier composed of silty sands, silty gravels, sandy gravels and gravelly sands.
- GM-4 Glacial ground moraine composed of silts and silty sands deposited during the Wisconsin glaciation.

NOTE: Information taken from Rutgers University Soil Survey of New Jersey, Report No. 9, Morris County, and Geologic Map of New Jersey prepared by Lewis and Kummel.

PLATE 3

<p>STORCH ENGINEERS FLORHAM PARK, NEW JERSEY</p>	<p>INSPECTION AND EVALUATION OF DAMS SOIL MAP DE COZEN'S DAM</p>	
<p>DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY</p>	<p>I.D. NJ 00353</p>	<p>SCALE: NONE DATE: NOV., 1979</p>



Note:
 Information taken from field
 inspection November 14, 1979.
 and March 21, 1980.

Lake Downstream from Dam
(Water Level Elev. 318.0)

Storage Area

Seepage
(Standing Water)

Paved Walkway

Upstream Face
(Masonry Wall)

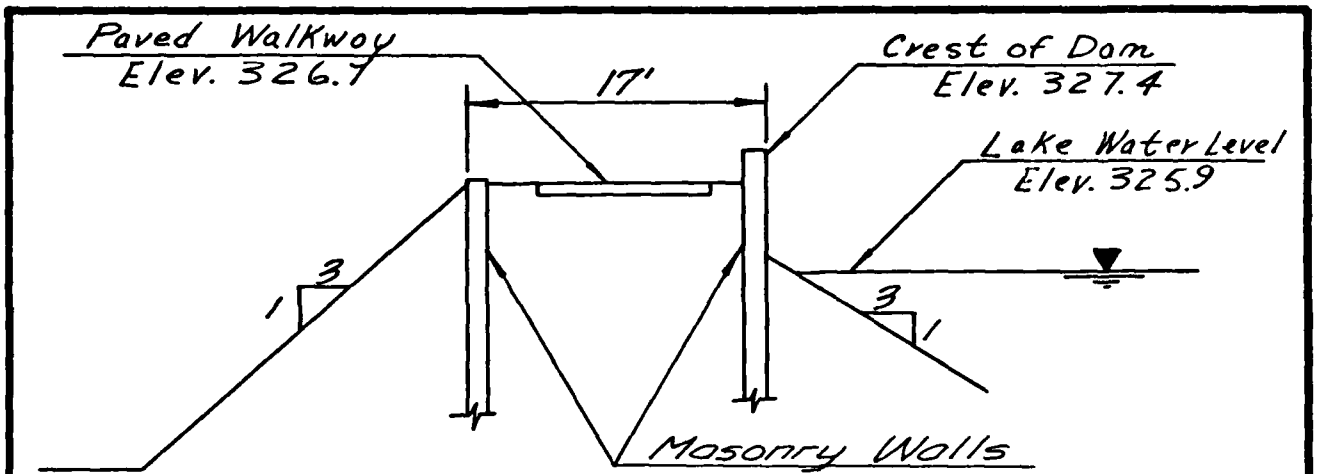
Concrete Wall

Length of Dam = 250'

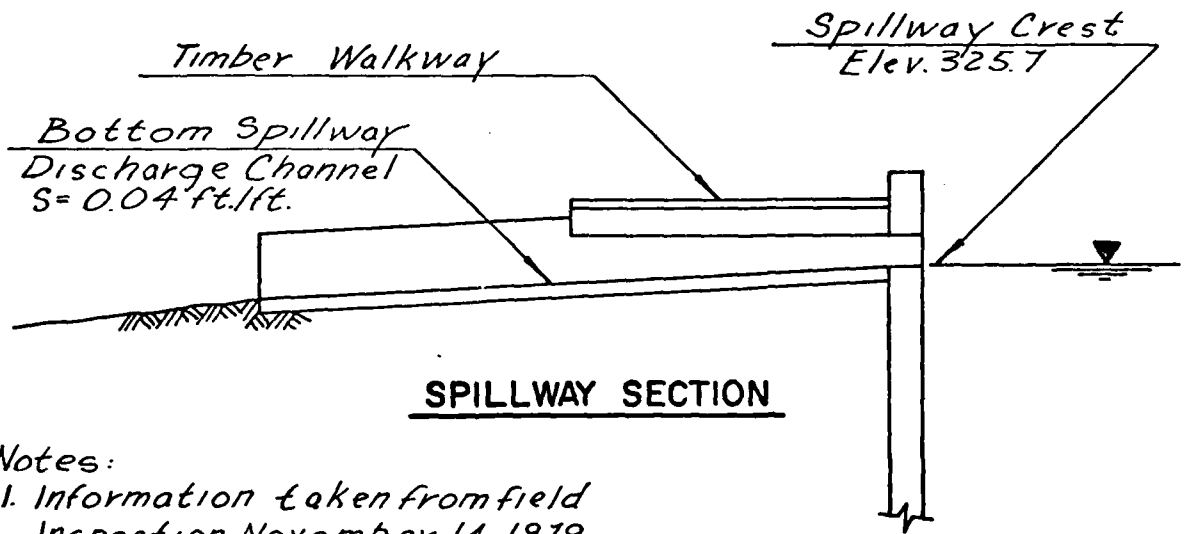
LAKE

PLATE 4

STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY
INSPECTION AND EVALUATION OF DAMS GENERAL PLAN DE COZEN'S DAM	
I.D.N.J. 00353	SCALE: NOT TO SCALE
	DATE: DEC. 1979



DAM SECTION



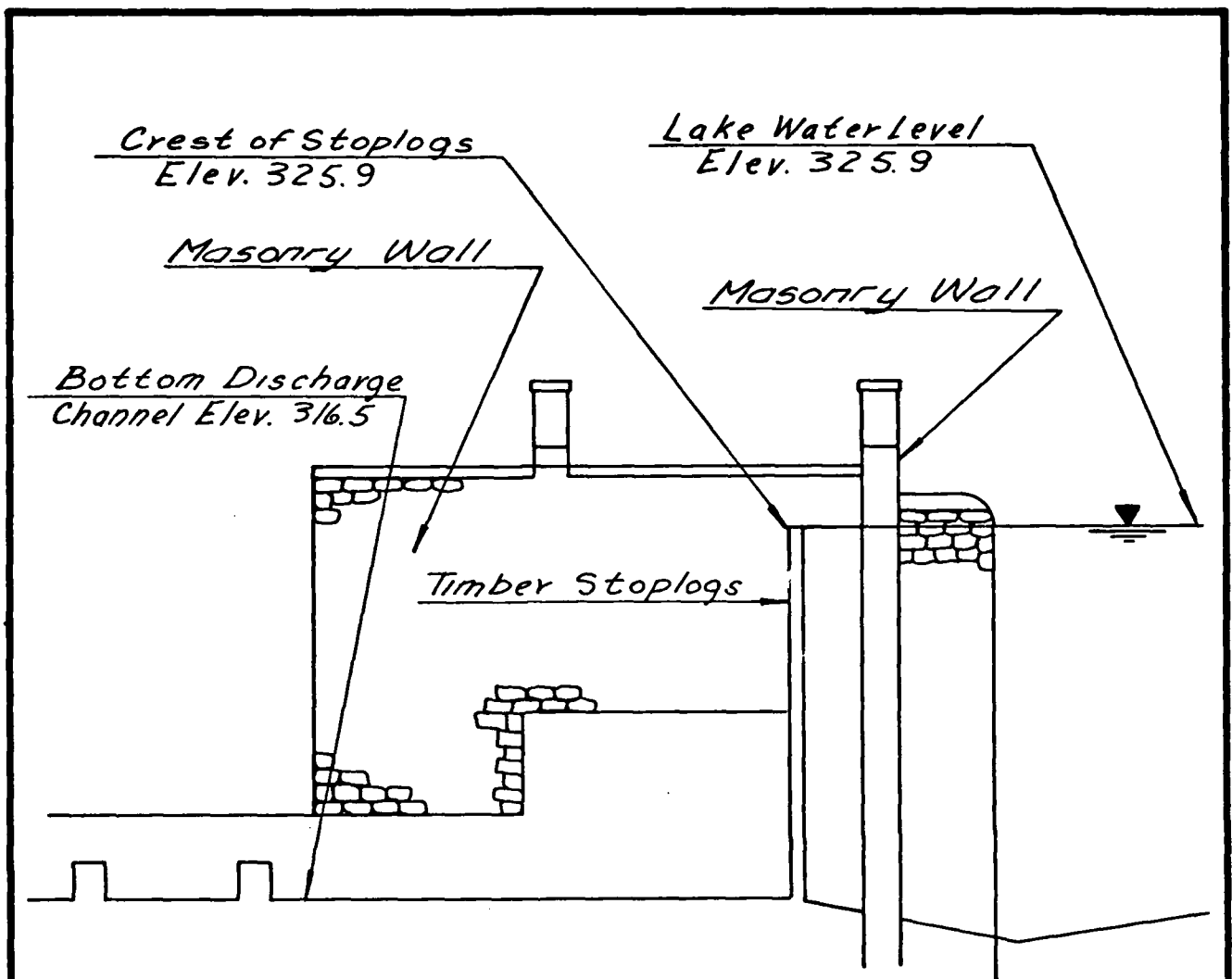
SPILLWAY SECTION

Notes:

1. Information taken from field inspection November 14, 1979.
2. Elevations based on NGVD taken from Twp. of Parsippany Municipal Aerial Topography.

PLATE 5

<p>STORCH ENGINEERS FLORHAM PARK, NEW JERSEY</p>	<p>INSPECTION AND EVALUATION OF DAMS TYPICAL SECTIONS DE COZEN'S DAM</p>	
<p>DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY</p>	<p>I.D.N.J. 00353</p>	<p>SCALE: NOT TO SCALE DATE: DEC. 1979</p>

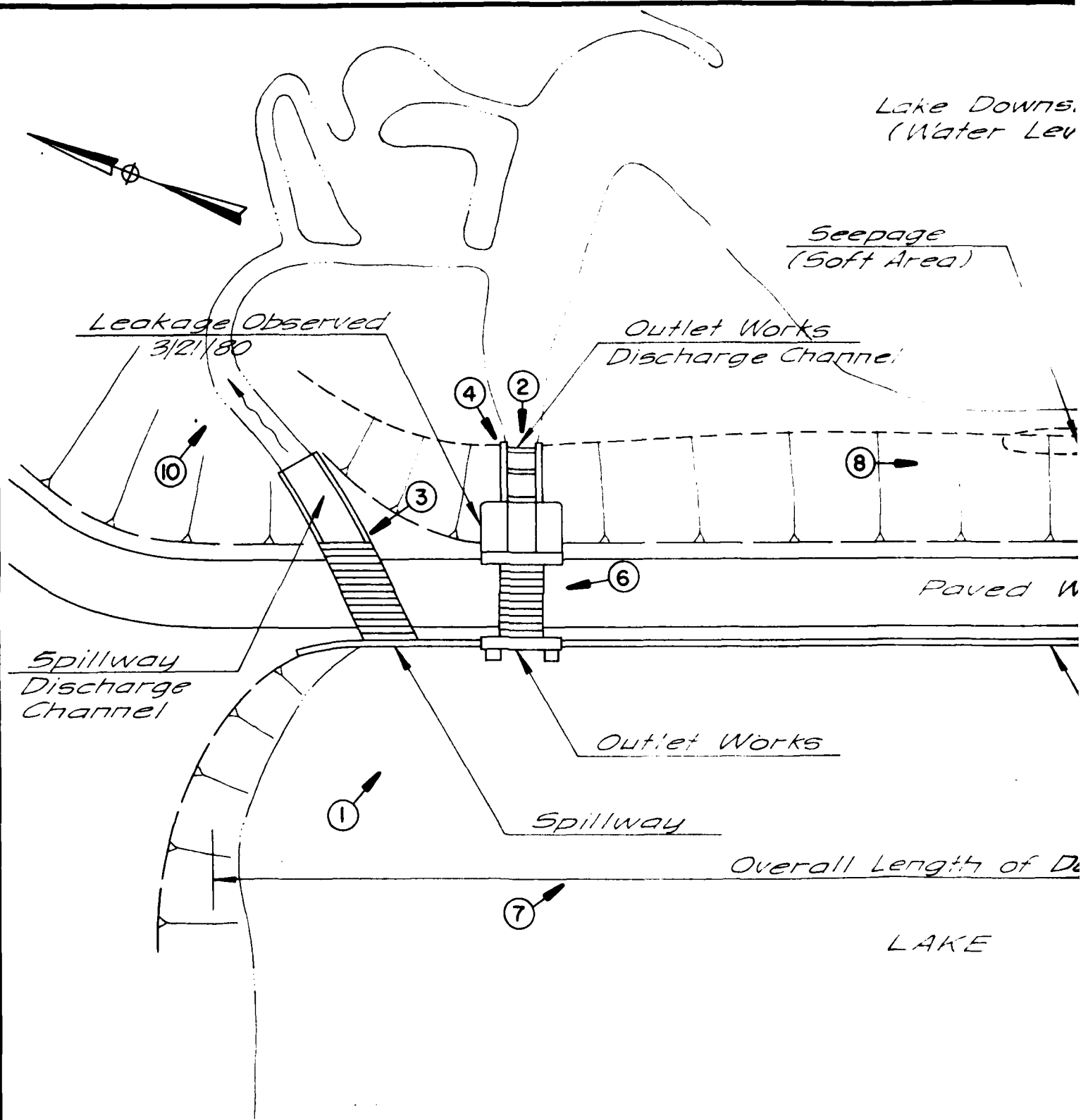


Notes:

1. Information taken from field Inspection November 14, 1979.
2. Elevations based on N & V D Taken from Twp. of Parsippany Municipal Aerial Topography.

PLATE 6

<p>STORCH ENGINEERS FLORHAM PARK, NEW JERSEY</p>	<p>INSPECTION AND EVALUATION OF DAMS OUTLET WORKS SECTION DE COZEN'S DAM</p>	
<p>DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY</p>	<p>I.D.N.J. 00353</p>	<p>SCALE: NOT TO SCALE DATE: DEC. 1979</p>



Note:
 Information taken from field
 inspection November 14, 1979.

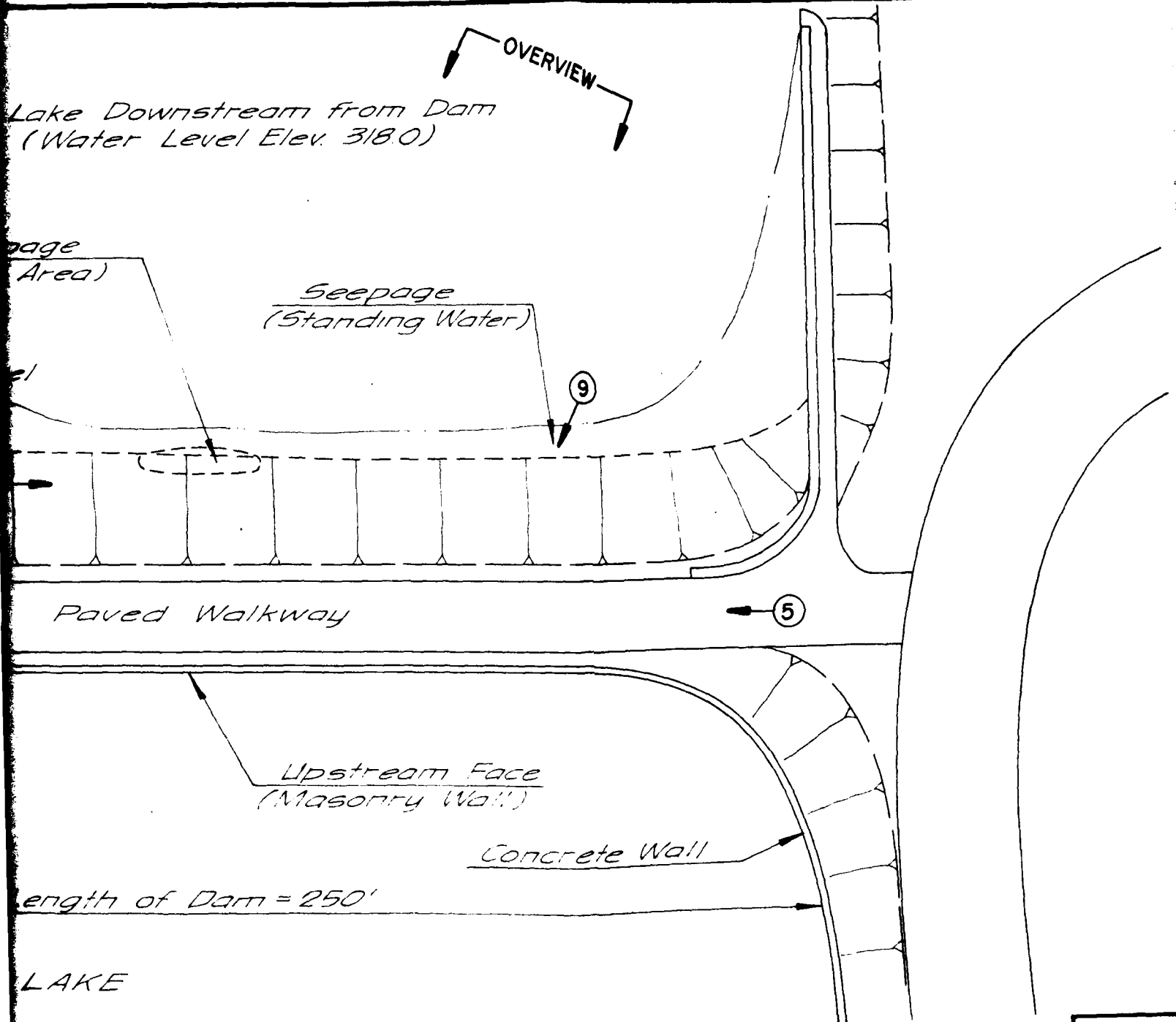


PLATE 7

<p>STORCH ENGINEERS FLORHAM PARK, NEW JERSEY</p>	<p>DIVISION OF WATER RESOURCE N.J. DEPT. OF ENVIR. PROTECTIO TRENTON, NEW JERSEY</p>
<p>INSPECTION AND EVALUATION OF DAMS PHOTO LOCATION PLAN DE COZEN'S DAM</p>	
<p>I.D.N.J. 00353</p>	<p>SCALE: NOT TO SCALE DATE: DEC. 1979</p>

APPENDIX 1

Check List - Visual Inspection

Check List - Engineering Data

Check List
Visual Inspection
Phase I

Name of Dam DeGozen's Dam County Morris State New Jersey Coordinators NJDEP

Date(s) Inspection 11/14/79 Weather Cloudy Temperature 45° F
3/21/80 Rain

Pool Elevation at Time of Inspection 325.9 M.S.L. Tailwater at Time of Inspection 318.0 M.S.L.

Inspection Personnel:

<u>John Gribbin</u>	<u>Alan Volle</u>
<u>Ronald Lai</u>	<u>Thomas Miller</u>
<u>Richard McDermott</u>	<u>J. Gribbin</u> Recorder

Present: Mr. Larry O'Rourke, Maintenance Supervisor, Interpace Corp. 11/14/79

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
GENERAL	<p>Paved walkway in generally good condition is located on the crest. Downstream face covered with good stand of grass with small trees located along crest. The top of a stone masonry wall was exposed at some locations along the downstream side of the crest. One animal hole noted on downstream face.</p>	<p>Stone masonry wall could be corewall.</p>
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	<p>Junctions at abutments appeared to be sound.</p>	
ANY NOTICEABLE SEEPAGE	<p>Two areas of seepage were noted.</p> <ol style="list-style-type: none"> 1. The downstream face was very wet and soft near the toe at the approx. mid-point of the dam. 2. A small puddle of standing water was noted immediately downstream from the toe about midway between the center and the north end of the dam. 	<p>One point of leakage was noted on 3/21/80: Water was discharging from the embankment adjacent to left training wall of the outlet works. Discharge was a trickle. Lake stage was approx. 0.5' above spillway crest.</p>
UPSTREAM FACE	<p>The stone masonry wall is in generally satisfactory condition although in two places its concrete cap was broken off. The concrete wall was in generally good condition.</p>	<p>A concrete capped stone masonry wall comprises the upper portion of the upstream face of dam for most of its length. A concrete wall forms the south portion of the upstream face.</p>
DRAINS	<p>None observed</p>	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None observed	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE.	None observed	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Ditch or gully was observed running from downstream end of spillway across portion of embankment to outlet works discharge channel. Ditch appeared to be formed by overflow from spillway or overtopping of dam. On 3/21/80, during storm, the discharge channel was overflowing into the ditch.	Recommend increasing discharge channel capacity.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Vertical: level Horizontal: Straight	
RIPRAP	Riprap was observed along the upstream face, upstream from the stone masonry wall. The stones appeared to be of adequate size.	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SURFACES IN OUTLET CONDUIT	N.A.	
INTAKE STRUCTURE	Stone masonry headwall at upstream end of outlet appeared to be in generally good condition. Concrete bottom portions of training walls appeared to be in satisfactory condition. Stone masonry portion appeared to be sound but some deterioration in the form of dislodged stones was noted.	Outlet works formed by stone masonry and concrete abutments or training walls constructed through earth embankment.
OUTLET STRUCTURE	Concrete cap was formed on top of downstream portion of training walls. Concrete cap was significantly spalled around the edges.	
OUTLET CHANNEL	Concrete outlet channel with rectangular section with a series of concrete weirs or baffles appeared to be in satisfactory condition.	
GATE AND GATE HOUSING	Downstream surface of timber stoplogs appeared to be in satisfactory condition. Timber walkway spanning training walls at crest of dam appeared to be in satisfactory condition.	

SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ENTRANCE	Entrance to chute type spillway formed by opening in stone masonry wall on upstream face of dam.	
DISCHARGE CHANNEL	Discharge channel bottom formed by concrete slab across crest of dam and extending approx. 20 feet downstream from the crest. Slab appeared to be in satisfactory condition. Timber walkway spanning discharge channel at crest of dam was in satisfactory condition.	

INSTRUMENTATION

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None observed	
OBSERVATION WELLS	None observed	
WEIRS	None observed	
PIEZOMETERS	None observed	
OTHER	N.A.	

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	The shores of the lake are grass covered at the east end and tree lined at the west end. Slopes are generally moderate.	
SEDIMENTATION	Soundings in the lake in the vicinity of the outlet works indicated little accumulation of sediment.	
STRUCTURES ALONG BANKS	Two large office buildings are located within 200 feet of both the north and south shores of the lake.	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
<p>CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)</p>	<p>Downstream channel consists of a small, meandering; earth lined stream connecting the spillway with a lake immediately downstream from the dam. The stream separates into two branches each of which contains a small stone weir near its discharge into the downstream lake.</p>	
<p>SLOPES</p>	<p>Stream banks were grass lined and had moderate slopes.</p>	
<p>STRUCTURES ALONG BANKS</p>	<p>Heavily travelled public road located immediately downstream from lake located downstream from dam. Large office building located immediately downstream from road. Flow from the channel is conveyed by a 10' CMP downstream from the road.</p>	

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

REMARKS

ITEM

DAM - PLAN	Not available
SECTIONS	
SPILLWAY - PLAN	Not available
SECTIONS	
DETAILS	
OPERATING EQUIPMENT PLANS & DETAILS	Not available
OUTLETS - PLAN	Not available
DETAILS	
CONSTRAINTS	
DISCHARGE RATINGS	
HYDRAULIC/HYDROLOGIC DATA	Reportedly, plan showing lake depths on file at Interpace Corp.
RAINFALL/RESERVOIR RECORDS	Not available
CONSTRUCTION HISTORY	Not available
LOCATION MAP	Not available

ITEM **REMARKS**

DESIGN REPORTS

Not available

GEOLOGY REPORTS

Not available

DESIGN COMPUTATIONS
HYDROLOGY & HYDRAULICS
DAM STABILITY
SEEPAGE STUDIES

Not available

MATERIALS INVESTIGATIONS
BORING RECORDS
LABORATORY
FIELD

Not available

POST-CONSTRUCTION SURVEYS OF DAM

Not available

BORROW SOURCES

Not available

ITEM

REMARKS

MONITORING SYSTEMS

Not Available

MODIFICATIONS

Not available

HIGH POOL RECORDS

Not available

**POST CONSTRUCTION ENGINEERING
STUDIES AND REPORTS**

Not available

**PRIOR ACCIDENTS OR FAILURE OF DAM
DESCRIPTION
REPORTS**

Not available

**MAINTENANCE
OPERATION
RECORDS**

Not available

APPENDIX 2

Photographs



PHOTO 1

ENTRANCES TO SPILLWAY AND OUTLET WORKS



PHOTO 2

DOWNSTREAM SIDE OF OUTLET WORKS SHOWING STOPLOGS

DE COZEN'S DAM
14 NOVEMBER 1979



PHOTO 3
SPILLWAY DISCHARGE



PHOTO 4
OUTLET WORKS DISCHARGE

DE COZEN'S DAM
14 NOVEMBER 1979

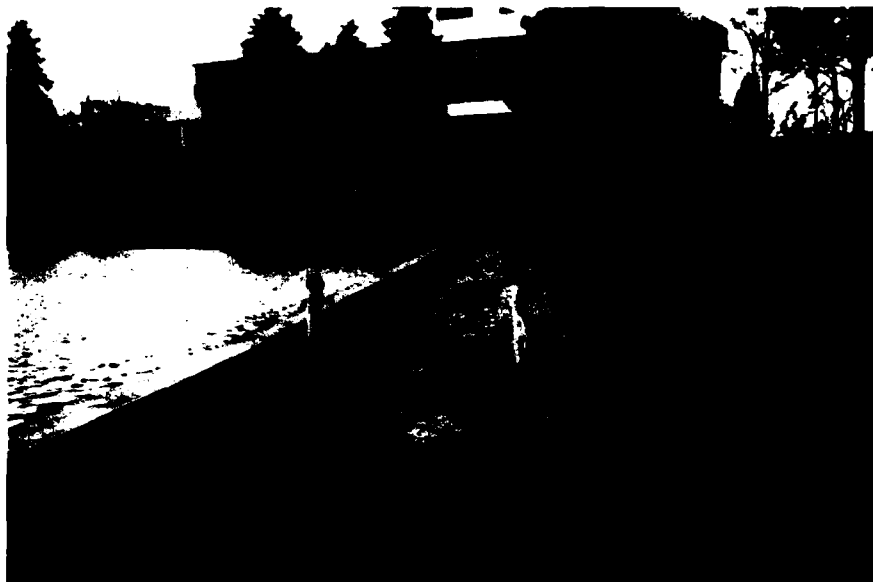


PHOTO 5
CREST OF DAM



PHOTO 6
TIMBER WALKWAYS OVER OUTLET WORKS AND SPILLWAY

DE COZEN'S DAM
14 NOVEMBER 1979



PHOTO 7
UPSTREAM FACE OF DAM

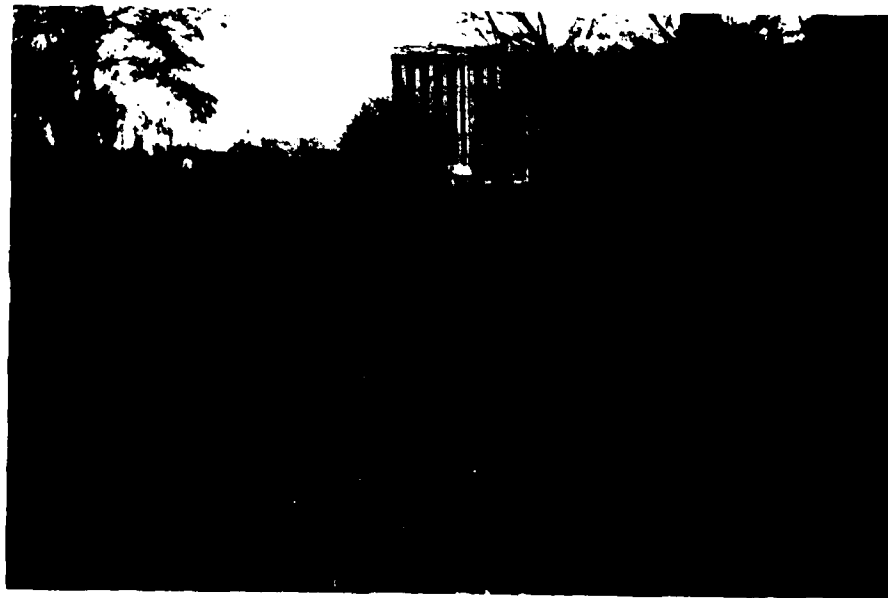


PHOTO 8
DOWNSTREAM FACE OF DAM

DE COZEN'S DAM
14 NOVEMBER 1979



PHOTO 9
SEEPAGE AT TOE OF DAM



PHOTO 10
SPILLWAY DISCHARGE CHANNEL

DE COZEN'S DAM
14 NOVEMBER 1979

APPENDIX 3

Engineering Data

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: Partly wooded, partly developed

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 325.9 (38 acre-feet)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): N.A.

ELEVATION MAXIMUM DESIGN POOL: 328.7

ELEVATION TOP DAM: 327.4

PRINCIPAL SPILLWAY CREST: _____

a. Elevation 325.9

b. Type Concrete chute

c. Width 9 feet

d. Length 37 feet

e. Location Spillover Across top of dam at north end

f. Number and Type of Gates None

AUXILIARY SPILLWAY CREST: Outlet works function as auxiliary spillway

a. Elevation 325.9

b. Type Sharp crested weir (stoplogs)

c. Width -

d. Length 3.9 feet

e. Location Spillover At centerline of dam

f. Number and Type of Gates One gate (stoplogs)

OUTLET WORKS: _____

- a. Type Timber stoplogs
- b. Location Adjacent to spillway
- c. Entrance invert 316.5
- d. Exit invert 316.5
- e. Emergency draindown facilities: Pull stoplogs

HYDROMETEOROLOGICAL GAGES: None

- a. Type N.A.
- b. Location N.A.
- c. Records N.A.

MAXIMUM NON-DAMAGING DISCHARGE:

(Lake stage equal to top of dam) 50 c.f.s.

APPENDIX 4

Hydraulic/Hydrologic Computations

HYDROLOGYHYDROLOGIC ANALYSIS - RUNOFF HYDROGRAPH

WILL BE DEVELOPED BY THE HEC-1-DB
COMPUTER PROGRAM USING THE SCS
TRIANGULAR UNIT HYDROGRAPH WITH THE
CURVILINEAR TRANSFORMATION.

DRAINAGE AREA = 0.4 SQUARE MILES

INFILTRATION DATA:

INITIAL INFILTRATION = 1.0 IN

CONSTANT INFILTRATION = 0.1 IN./HOUR

TIME OF CONCENTRATION

BY CHART ON SCS, TR-55 OVERLAND FLOW

OVERLAND FLOW 4300 FT at 6%

CHANNEL FLOW 900 FT at 2%

$$T_c = \left(\frac{4300}{1.6} + \frac{900}{1.5} \right) \frac{1}{3600} = .75 + .17 = .92 \text{ HOURS}$$

TIME OF CONCENTRATION - BY KERBY - PG 14-36
 "HANDBOOK OF APPLIED HYDROLOGY"
 - CHOW

$$T_c^{2.14} = \frac{2}{3} L n \sqrt{S}$$

WHERE : T_c = overland time of concentration (min)
 L = length of overland flow (ft)
 n = roughness coefficient ($n = 0.4$)
 S = slope = 6%

$$T_c^{2.14} = \frac{2}{3} (4300) (0.4) \sqrt{0.06}$$

overland	$T_c = 52$ MINUTES	=	$.87$ HOURS
channel	T_c (from previous page)	=	$.17$ HOURS
			<u>1.0 HOURS</u>

$$\text{TOTAL } T_c = 1.0 \text{ HOURS}$$

TIME OF CONCENTRATION - BY CALIFORNIA CULVERTS PRACTICE
 Ref: "DESIGN OF SMALL DAMS" pg 71

$$T_c = \left(\frac{11.9 L^3}{H} \right)^{0.385}$$

$$T_c = \left(\frac{11.9 (.98)^3}{275} \right)^{0.385}$$

$$T_c = 0.3 \text{ HOURS}$$

T_c = Time of concentration (hours)
 L = length of watercourse (miles)
 H = elevation difference in feet
 $L = 5200'$
 $H = 275'$

TIME OF CONCENTRATION - BY SNYDER Pg 135

"INTRODUCTION TO HYDROLOGY"

VISSMAN ET AL

$$t_L = C_L (LLCA)^{0.3} \quad \text{where:}$$

t_L = lag time (hours)

C_L = coefficient representing variations of watershed slopes & storages
ave $C_L = 2.0$

L = Length of main channel from outlet to divide (0.95 MILES)

L_c = Length along main channel to a point opposite the watershed centroid (0.40 MILES)

$$t_L = 2.0 (.40 + .95)^{0.3}$$

$$\text{LAG} = 1.5 \text{ HOURS}$$

SNYDER'S METHOD GENERALLY NOT APPLICABLE TO DRAINAGE AREAS LESS THAN 10 SQUARE MILES $\therefore t_L = 1.5$ WILL NOT BE CONSIDERED IN CHOOSING LAG TIME FOR COMPUTER INPUT

$$\text{USE } T_C = 0.9 \text{ HOURS}$$

$$\text{LAG TIME} = 0.54 \text{ HOURS}$$

STORCH ENGINEERS

Sheet 4 of 10

Project DE COZENS DAM

Made By STO Date 1/14/80

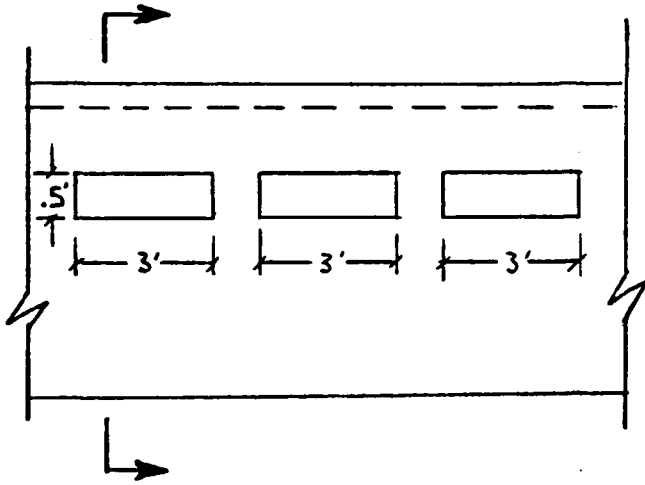
Chkd By RL Date 2/12/80

LAKE STORAGE VOLUME

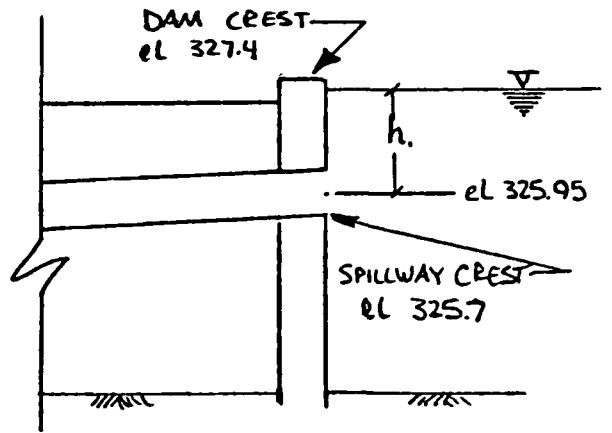
<u>ELEVATION (M.S.L.)</u>	<u>STORAGE (AC-FT)</u>
314.3	0
326.3	40
328	57
330	76
332	100
334	125

INFORMATION DETERMINED FROM SOUNDINGS
TAKEN DURING FIELD INSPECTION AND
AERIAL TOPOGRAPHICAL MAPS.

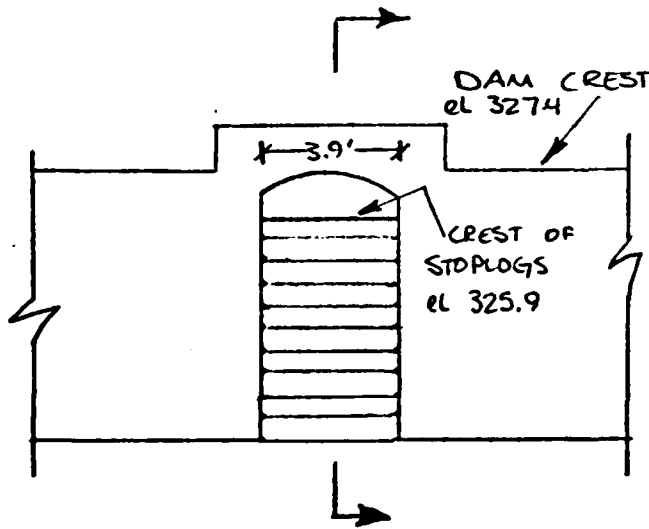
HYDRAULICS



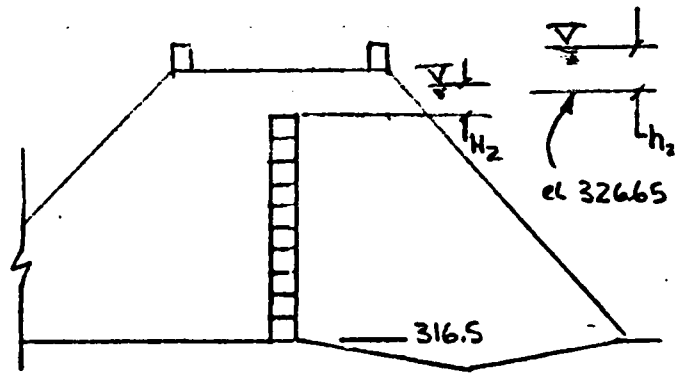
SPILLWAY ELEVATION



SPILLWAY SECTION



OUTLET WORKS ELEVATION



OUTLET WORKS SECTION

STORCH ENGINEERS

Project DE COZENS DAM

Sheet 6 of 10

Made By STD Date 1/15/80

Chkd By RL Date 2/12/80

STAGE DISCHARGE TABULATION

DISCHARGE AT THE SPILLWAY IS TREATED AS ORIFICE FLOW AT WATER LEVELS GREATER THAN 326.2 ($h_1 \geq 0.25'$) AT WATER LEVELS GREATER THAN 325.9 THERE IS ADDITIONAL UNCONTROLLED DISCHARGE OVER THE TIMBER STOPLOGS AT THE OUTLET WORKS. THIS DISCHARGE IS TREATED AS FLOW OVER A SHARP-CRESTED WEIR AT WATER LEVELS LESS THAN 327.4 ($h_2 \leq 1.5'$) AND AS ORIFICE FLOW AT WATER LEVELS GREATER THAN 327.4 ($h_2 \geq 0.75'$)

NOTE: DISCHARGE VALUES IN THE FOLLOWING TABULATION DO NOT INCLUDE OVERTOPPING OF 250' OF DAM CREST AS THIS WILL BE COMPUTED BY HEC-1-D'S COMPUTER PROGRAM

STAGE - DISCHARGE TABULATION (cont)

FORMULAS USED IN STAGE - DISCHARGE TABULATION ARE:

ORIFICE FLOW; $Q_{OR} = CA\sqrt{2gh}$; h = head for orifice

OVERTOPPING FLOW; $Q_{OV} = CLH^{3/2}$; H = head for overtopping

SPILLWAY

A = 4.5 SF

C_{ORIFICE} = 0.6

OUTLET WORKS

A = 5.8 SF

C_{ORIFICE} = 0.6

L = 3.9'

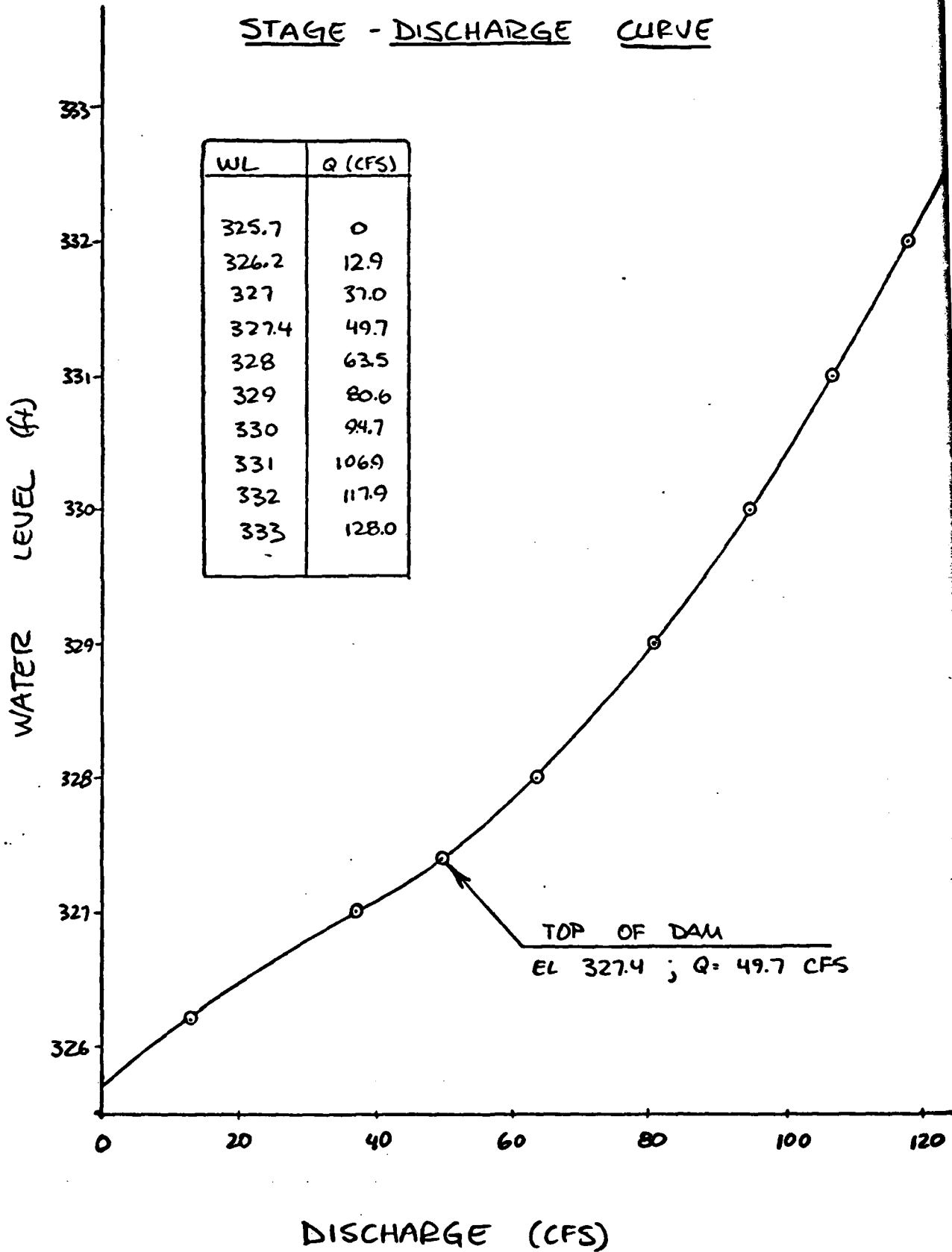
C_{OVERTOPPING} = 3.3 (AVE FOR 0' < H < 8')

WATER LEVEL	SPILLWAY DISCHARGE CREST EL 325.7		DISCHARGE AT OUTLET WORKS STOPLOGS CREST EL. 325.9				TOTAL DISCHARGE (CFS)
	h ₁ (ft)	Q _{OR} (CFS)	h ₂ (ft)	Q _{OR} (CFS)	H ₂ (ft)	Q _{OV} (CFS)	
325.7	0	0	NA.	-	0	0	0
326.2	0.25	10.8	N.A.	-	0.3	2.1	12.9
327	1.05	22.8	NA	-	1.1	14.8	37.0
327.4	1.45	26.1	NA	-	1.5	23.6	49.7
328	2.05	31.0	1.35	32.5	NA	-	63.5
329	3.05	37.8	2.35	42.8	NA	-	80.6
330	4.05	43.6	2.35	51.1	NA	-	94.7
331	5.05	48.7	4.35	58.2	NA	-	106.9
332	6.05	53.3	5.35	64.6	NA	-	117.9
333	7.05	57.6	6.35	70.4	NA	-	128.0
334	8.05	61.5	7.35	75.7	NA	-	137.2

N.A. = NOT APPLICABLE

* VALUES OF "C" WERE OBTAINED FROM THE "HANDBOOK OF HYDRAULICS" BY BRATER & KING

STAGE - DISCHARGE CURVE



OUTLET WORKS CAPACITY

OUTLET WORKS CONSIST OF TWELVE STOPLOGS AT THE DOWNSTREAM END OF A CUT THROUGH THE DAM (SEE PLATE 6). ASSUME DRAWDOWN BY REMOVING 3 STOPLOGS AT A TIME UNTIL WATER LEVEL RECESSES TO TOP OF REMAINING STOPLOGS. DISCHARGE WILL BE CALCULATED AS FLOW OVER A SHARP-CRESTED WEIR ($C=3.3$, $L=3.9'$), USING THE EQUATION, $Q = CLH^{3/2}$. DEPTH AT OUTLET WORKS = $9.4'$, BY REMOVING 3 STOPLOGS AT A TIME, THE WEIR DROPS $2.4'$ AT EACH INCREMENT. THE AVERAGE HEAD, $H_{AVE} = 1.2'$ ($C_{AVE} = 3.3$)

$$\text{MAXIMUM } Q = CLH^{3/2} = (3.3) 3.9 (2.4)^{3/2}$$

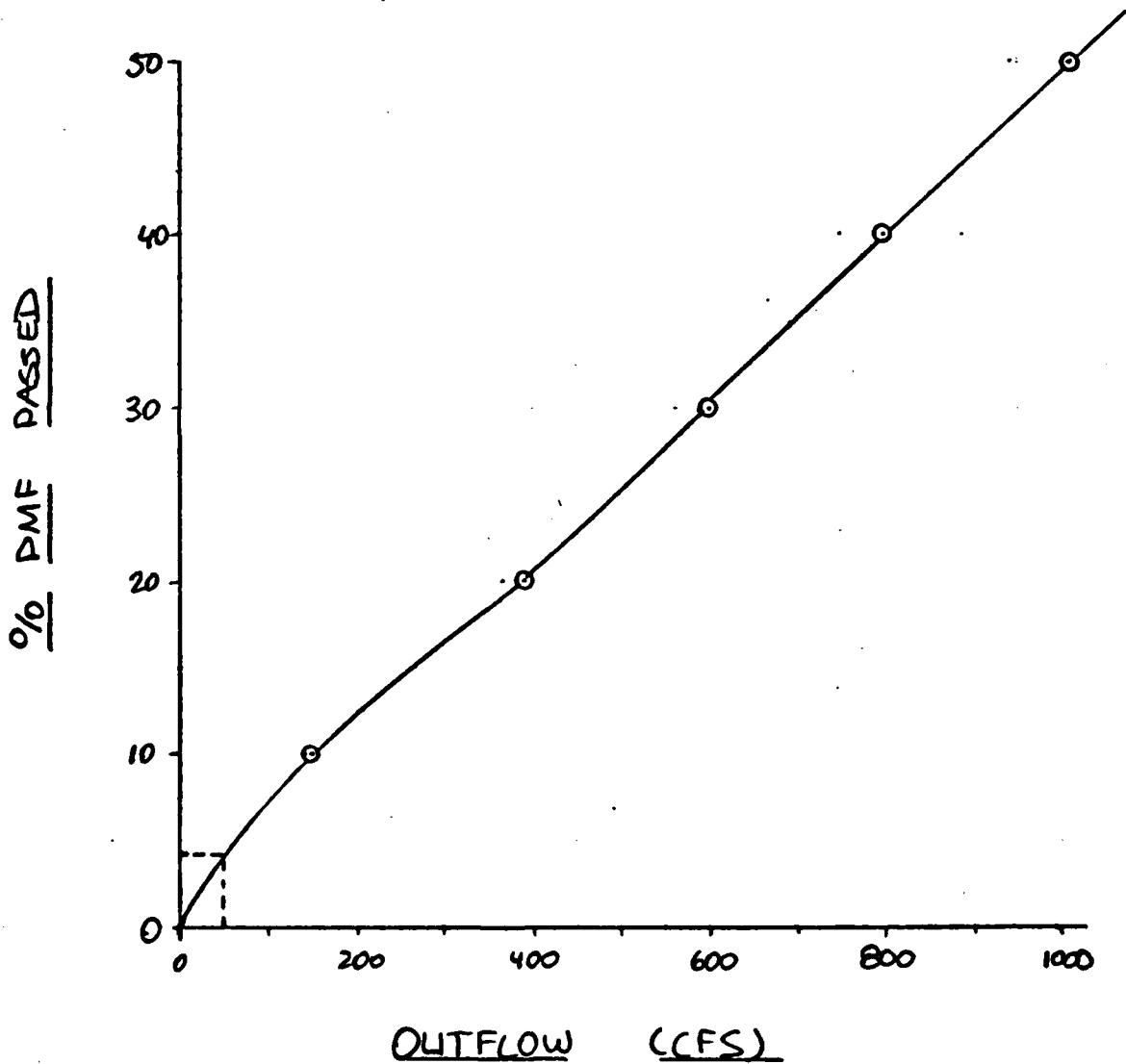
$$\text{MAXIMUM DISCHARGE} = 48 \text{ CFS}$$

$$\text{AVERAGE } Q = C_{AVE} L H_{AVE}^{3/2} = (3.3) 3.9 (1.2)^{3/2} = 17 \text{ CFS}$$

$$\text{DRAWDOWN} = \frac{\text{STORAGE}}{\text{AVERAGE DISCHARGE}} = \frac{38 \text{ AC-FT } (43560 \text{ SF/AC})}{17 \text{ CFS } (3600 \text{ SEC/HR})}$$

$$\text{DRAWDOWN} = 27.0 \text{ HOURS} = 1.1 \text{ DAYS}$$

OVERTOPPING POTENTIAL



OVERTOPPING OF THE DAM OCCURS AT ELEVATION 327.4, WITH $Q = 50$ CFS \therefore DAM CAN PASS APPROXIMATELY 4.2 % PMF OR 8.4 % SDF

HEC-1-DB COMPUTATIONS

.....
 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION JULY 1978
 LAST MODIFICATION 26 FEB 79

RUN DATE: 80/JUL/23
 TIME: 15.30.50.

NATIONAL DAM SAFETY PROGRAM
 CE COZENS DAM
 MULTI-RATIO PMF ROUTING

NG NMR NMIN IDAY IHR IMIN METRC IPLI IPRI NSTAN
 150 0 5 0 0 0 0 0 0 0 0 0
 JOPEB MWY LROPI IRACE
 5 0 0 0

RTIOS= .50 .40 .30 .20 .10
 MULTI-PLAN ANALYSES TO BE PERFORMED
 NPLAN= 1 NRATIO= 5 LRTIO= 1

***** SUB-AREA RUNOFF COMPUTATION *****

INFLOW HYDROGRAPH TO LAKE

ISTAG ICOMP IECON ITAPE JPT JPRI INAME ISTAGE IAUIG
 LAKE 0 0 0 0 0 0 1 0 0

IHYDG IUNG IAREA IAREA SNAP TRSFC RATIO ISNOW ISAME LOCAL
 1 2 .38 .38 0.00 .38 0.00 0.000 6 1 0
 HYDROGRAPH DATA

SPFE 0.00 25.50 100.00 109.00 117.00 R48 R72 R96
 0.00 0.00 0.00 0.00 0.00 0.00 0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA
 LROPI STRKS RTIOL ERAIN STRKS RTIOL RATIO CNSTL ALSMX RTIMP
 0 0.00 1.00 0.00 0.00 1.00 1.00 0.10 0.00 0.00

UNIT HYDROGRAPH DATA
 TC= 0.00 LAG= .54

RECESSION DATA
 SIRIAG= -1.00 OKCSN= -.05 RTIOR= 2.00

UNIT HYDROGRAPH 14 END OF PERIOD ORDINATES, TC= 0.00 HOURS, LAG= .54 VOL= 1.00
 19. 56. 113. 264. 305. 315. 304. 274. 236.
 146. 111. 88. 71. 57. 44. 28. 22.
 17. 11. 9. 7. 5. 4. 3. 2.
 12. 1. 0. 0. 0. 0. 0. 0.

1.01	6.05	73	.03	.00	.03
1.01	6.10	74	.03	.00	.03
1.01	6.15	75	.03	.00	.03
1.01	6.20	76	.03	.00	.03
1.01	6.25	77	.03	.00	.03
1.01	6.30	78	.03	.00	.03
1.01	6.35	79	.03	.00	.03
1.01	6.40	80	.03	.00	.03
1.01	6.45	81	.03	.00	.03
1.01	6.50	82	.03	.00	.03
1.01	6.55	83	.03	.00	.03
1.01	6.60	84	.03	.00	.03
1.01	6.65	85	.03	.00	.03
1.01	6.70	86	.03	.00	.03
1.01	6.75	87	.03	.00	.03
1.01	6.80	88	.03	.00	.03
1.01	6.85	89	.03	.00	.03
1.01	6.90	90	.03	.00	.03
1.01	6.95	91	.03	.00	.03
1.01	7.00	92	.03	.00	.03
1.01	7.05	93	.03	.00	.03
1.01	7.10	94	.03	.00	.03
1.01	7.15	95	.03	.00	.03
1.01	7.20	96	.03	.00	.03
1.01	7.25	97	.03	.00	.03
1.01	7.30	98	.03	.00	.03
1.01	7.35	99	.03	.00	.03
1.01	7.40	100	.03	.00	.03
1.01	7.45	101	.03	.00	.03
1.01	7.50	102	.03	.00	.03
1.01	7.55	103	.03	.00	.03
1.01	7.60	104	.03	.00	.03
1.01	7.65	105	.03	.00	.03
1.01	7.70	106	.03	.00	.03
1.01	7.75	107	.03	.00	.03
1.01	7.80	108	.03	.00	.03
1.01	7.85	109	.03	.00	.03
1.01	7.90	110	.03	.00	.03
1.01	7.95	111	.03	.00	.03
1.01	8.00	112	.03	.00	.03
1.01	8.05	113	.03	.00	.03
1.01	8.10	114	.03	.00	.03
1.01	8.15	115	.03	.00	.03
1.01	8.20	116	.03	.00	.03
1.01	8.25	117	.03	.00	.03
1.01	8.30	118	.03	.00	.03
1.01	8.35	119	.03	.00	.03
1.01	8.40	120	.03	.00	.03
1.01	8.45	121	.03	.00	.03
1.01	8.50	122	.03	.00	.03
1.01	8.55	123	.03	.00	.03
1.01	8.60	124	.03	.00	.03
1.01	8.65	125	.03	.00	.03
1.01	8.70	126	.03	.00	.03
1.01	8.75	127	.03	.00	.03
1.01	8.80	128	.03	.00	.03
1.01	8.85	129	.03	.00	.03
1.01	8.90	130	.03	.00	.03
1.01	8.95	131	.03	.00	.03
1.01	9.00	132	.03	.00	.03
1.01	9.05	133	.03	.00	.03
1.01	9.10	134	.03	.00	.03
1.01	9.15	135	.03	.00	.03
1.01	9.20	136	.03	.00	.03
1.01	9.25	137	.03	.00	.03
1.01	9.30	138	.03	.00	.03
1.01	9.35	139	.03	.00	.03
1.01	9.40	140	.03	.00	.03
1.01	9.45	141	.03	.00	.03
1.01	9.50	142	.03	.00	.03
1.01	9.55	143	.03	.00	.03
1.01	9.60	144	.03	.00	.03

MO.	DA	HR.	MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1	01	12	05	145	.17	.16	.01	53.
1	01	12	10	146	.17	.16	.01	61.
1	01	12	15	147	.17	.16	.01	78.
1	01	12	20	148	.17	.16	.01	105.
1	01	12	25	149	.17	.16	.01	144.
1	01	12	30	150	.17	.16	.01	188.
0	00	00	00	151	.17	.16	.01	233.
0	00	00	00	152	.17	.16	.01	277.
0	00	00	00	153	.17	.16	.01	311.
0	00	00	00	154	.17	.16	.01	351.
0	00	00	00	155	.17	.16	.01	378.
0	00	00	00	156	.17	.16	.01	408.
0	00	00	00	157	.20	.20	.01	415.
0	00	00	00	158	.20	.20	.01	429.
0	00	00	00	159	.20	.20	.01	443.
0	00	00	00	160	.20	.20	.01	458.
0	00	00	00	161	.20	.20	.01	474.
0	00	00	00	162	.20	.20	.01	490.
0	00	00	00	163	.20	.20	.01	507.
0	00	00	00	164	.20	.20	.01	525.
0	00	00	00	165	.20	.20	.01	544.
0	00	00	00	166	.20	.20	.01	564.
0	00	00	00	167	.20	.20	.01	585.
0	00	00	00	168	.26	.20	.01	607.
0	00	00	00	169	.26	.20	.01	630.
0	00	00	00	170	.26	.20	.01	654.
0	00	00	00	171	.26	.20	.01	679.
0	00	00	00	172	.26	.20	.01	705.
0	00	00	00	173	.26	.20	.01	732.
0	00	00	00	174	.26	.20	.01	760.
0	00	00	00	175	.26	.20	.01	789.
0	00	00	00	176	.26	.20	.01	819.
0	00	00	00	177	.26	.20	.01	850.
0	00	00	00	178	.26	.20	.01	882.
0	00	00	00	179	.26	.20	.01	915.
0	00	00	00	180	.26	.20	.01	949.
0	00	00	00	181	.26	.20	.01	984.
0	00	00	00	182	.26	.20	.01	1020.
0	00	00	00	183	.26	.20	.01	1057.
0	00	00	00	184	.26	.20	.01	1095.
0	00	00	00	185	.26	.20	.01	1134.
0	00	00	00	186	.26	.20	.01	1174.
0	00	00	00	187	.26	.20	.01	1215.
0	00	00	00	188	.26	.20	.01	1257.
0	00	00	00	189	.26	.20	.01	1300.
0	00	00	00	190	.26	.20	.01	1344.
0	00	00	00	191	.31	.30	.01	1389.
0	00	00	00	192	.31	.30	.01	1435.
0	00	00	00	193	.24	.24	.01	1482.
0	00	00	00	194	.24	.24	.01	1530.
0	00	00	00	195	.24	.24	.01	1579.
0	00	00	00	196	.24	.24	.01	1629.
0	00	00	00	197	.24	.24	.01	1680.
0	00	00	00	198	.24	.24	.01	1732.
0	00	00	00	199	.24	.24	.01	1785.
0	00	00	00	200	.24	.24	.01	1839.
0	00	00	00	201	.24	.24	.01	1894.
0	00	00	00	202	.24	.24	.01	1950.
0	00	00	00	203	.24	.24	.01	2007.
0	00	00	00	204	.24	.24	.01	2065.
0	00	00	00	205	.24	.24	.01	2124.
0	00	00	00	206	.24	.24	.01	2184.
0	00	00	00	207	.24	.24	.01	2245.
0	00	00	00	208	.24	.24	.01	2307.
0	00	00	00	209	.24	.24	.01	2370.
0	00	00	00	210	.24	.24	.01	2434.
0	00	00	00	211	.24	.24	.01	2500.
0	00	00	00	212	.24	.24	.01	2567.
0	00	00	00	213	.24	.24	.01	2635.
0	00	00	00	214	.24	.24	.01	2704.
0	00	00	00	215	.24	.24	.01	2775.
0	00	00	00	216	.24	.24	.01	2847.
0	00	00	00	217	.24	.24	.01	2920.
0	00	00	00	218	.24	.24	.01	2994.
0	00	00	00	219	.24	.24	.01	3069.
0	00	00	00	220	.24	.24	.01	3145.
0	00	00	00	221	.24	.24	.01	3222.
0	00	00	00	222	.24	.24	.01	3300.
0	00	00	00	223	.24	.24	.01	3379.
0	00	00	00	224	.24	.24	.01	3459.
0	00	00	00	225	.24	.24	.01	3540.
0	00	00	00	226	.24	.24	.01	3622.
0	00	00	00	227	.24	.24	.01	3705.
0	00	00	00	228	.24	.24	.01	3789.
0	00	00	00	229	.24	.24	.01	3874.
0	00	00	00	230	.24	.24	.01	3960.
0	00	00	00	231	.24	.24	.01	4047.
0	00	00	00	232	.24	.24	.01	4135.
0	00	00	00	233	.24	.24	.01	4224.
0	00	00	00	234	.24	.24	.01	4314.
0	00	00	00	235	.24	.24	.01	4405.
0	00	00	00	236	.24	.24	.01	4497.
0	00	00	00	237	.24	.24	.01	4590.
0	00	00	00	238	.24	.24	.01	4684.
0	00	00	00	239	.24	.24	.01	4779.
0	00	00	00	240	.24	.24	.01	4875.
0	00	00	00	241	.24	.24	.01	4972.
0	00	00	00	242	.24	.24	.01	5070.
0	00	00	00	243	.24	.24	.01	5169.
0	00	00	00	244	.24	.24	.01	5269.
0	00	00	00	245	.24	.24	.01	5370.
0	00	00	00	246	.24	.24	.01	5472.
0	00	00	00	247	.24	.24	.01	5575.
0	00	00	00	248	.24	.24	.01	5679.
0	00	00	00	249	.24	.24	.01	5784.
0	00	00	00	250	.24	.24	.01	5890.
0	00	00	00	251	.24	.24	.01	6000.
0	00	00	00	252	.24	.24	.01	6110.
0	00	00	00	253	.24	.24	.01	6222.
0	00	00	00	254	.24	.24	.01	6335.
0	00	00	00	255	.24	.24	.01	6449.
0	00	00	00	256	.24	.24	.01	6564.
0	00	00	00	257	.24	.24	.01	6680.
0	00	00	00	258	.24	.24	.01	6797.
0	00	00	00	259	.24	.24	.01	6915.
0	00	00	00	260	.24	.24	.01	7034.
0	00	00	00	261	.24	.24	.01	7154.
0	00	00	00	262	.24	.24	.01	7275.
0	00	00	00	263	.24	.24	.01	7397.
0	00	00	00	264	.24	.24	.01	7520.
0	00	00	00	265	.24	.24	.01	7644.
0	00	00	00	266	.24	.24	.01	7769.
0	00	00	00	267	.24	.24	.01	7895.
0	00	00	00	268	.24	.24	.01	8022.
0	00	00	00	269	.24	.24	.01	8150.
0	00	00	00	270	.24	.24	.01	8279.
0	00	00	00	271	.24	.24	.01	8409.
0	00	00	00	272	.24	.24	.01	8540.
0	00	00	00	273	.24	.24	.01	8672.
0	00	00	00	274	.24	.24	.01	8805.
0	00	00	00	275	.24	.24	.01	8939.
0	00	00	00	276	.24	.24	.01	9074.
0	00	00	00	277	.24	.24	.01	9210.
0	00	00	00	278	.24	.24	.01	9347.
0	00	00	00	279	.24	.24	.01	9485.
0	00	00	00	280	.24	.24	.01	9624.
0	00	00	00	281	.24	.24	.01	9764.
0	00	00	00	282	.24	.24	.01	9905.
0	00	00	00	283	.24	.24	.01	10047.
0	00	00	00	284	.24	.24	.01	10190.
0	00	00	00	285	.24	.24	.01	10334.
0	00	00	00	286	.24	.24	.01	10479.
0	00	00	00	287	.24	.24	.01	10625.
0	00	00	00	288	.24	.24	.01	10772.
0	00	00	00	289	.24	.24	.01	10920.
0	00	00	00	290	.24	.24	.01	11069.
0	00	00	00	291	.24	.24	.01	11219.
0	00	00	00	292	.24	.24	.01	11370.
0	00	00	00	293	.24	.24	.01	11522.
0	00	00	00	294	.24	.24	.01	11675.
0	00	00	00	295	.24	.24	.01	11829.
0	00	00	00	296	.24	.24	.01	11984.
0	00	00	00	297	.24	.24	.01	12140.
0	00	00	00	298	.24	.24	.01	12297.
0	00	00	00	299	.24	.24	.01	12455.
0	00	00	00	300	.24	.24	.01	12614.

0.00	0.00	217	.01	.01	.01	5
0.00	0.00	218	.01	.01	.01	5
0.00	0.00	219	.01	.01	.01	5
0.00	0.00	220	.01	.01	.01	5
0.00	0.00	221	.01	.01	.01	5
0.00	0.00	222	.01	.01	.01	5
0.00	0.00	223	.01	.01	.01	5
0.00	0.00	224	.01	.01	.01	5
0.00	0.00	225	.01	.01	.01	5
0.00	0.00	226	.01	.01	.01	5
0.00	0.00	227	.01	.01	.01	5
0.00	0.00	228	.01	.01	.01	5
0.00	0.00	229	.01	.01	.01	5
0.00	0.00	230	.01	.01	.01	5
0.00	0.00	231	.01	.01	.01	5
0.00	0.00	232	.01	.01	.01	5
0.00	0.00	233	.01	.01	.01	5
0.00	0.00	234	.01	.01	.01	5
0.00	0.00	235	.01	.01	.01	5
0.00	0.00	236	.01	.01	.01	5
0.00	0.00	237	.01	.01	.01	5
0.00	0.00	238	.01	.01	.01	5
0.00	0.00	239	.01	.01	.01	5
0.00	0.00	240	.01	.01	.01	5
0.00	0.00	241	.01	.01	.01	5
0.00	0.00	242	.01	.01	.01	5
0.00	0.00	243	.01	.01	.01	5
0.00	0.00	244	.01	.01	.01	5
0.00	0.00	245	.01	.01	.01	5
0.00	0.00	246	.01	.01	.01	5
0.00	0.00	247	.01	.01	.01	5
0.00	0.00	248	.01	.01	.01	5
0.00	0.00	249	.01	.01	.01	5
0.00	0.00	250	.01	.01	.01	5
0.00	0.00	251	.01	.01	.01	5
0.00	0.00	252	.01	.01	.01	5
0.00	0.00	253	.01	.01	.01	5
0.00	0.00	254	.01	.01	.01	5
0.00	0.00	255	.01	.01	.01	5
0.00	0.00	256	.01	.01	.01	5
0.00	0.00	257	.01	.01	.01	5
0.00	0.00	258	.01	.01	.01	5
0.00	0.00	259	.01	.01	.01	5
0.00	0.00	260	.01	.01	.01	5
0.00	0.00	261	.01	.01	.01	5
0.00	0.00	262	.01	.01	.01	5
0.00	0.00	263	.01	.01	.01	5
0.00	0.00	264	.01	.01	.01	5
0.00	0.00	265	.01	.01	.01	5
0.00	0.00	266	.01	.01	.01	5
0.00	0.00	267	.01	.01	.01	5
0.00	0.00	268	.01	.01	.01	5
0.00	0.00	269	.01	.01	.01	5
0.00	0.00	270	.01	.01	.01	5
0.00	0.00	271	.01	.01	.01	5
0.00	0.00	272	.01	.01	.01	5
0.00	0.00	273	.01	.01	.01	5
0.00	0.00	274	.01	.01	.01	5
0.00	0.00	275	.01	.01	.01	5
0.00	0.00	276	.01	.01	.01	5
0.00	0.00	277	.01	.01	.01	5
0.00	0.00	278	.01	.01	.01	5
0.00	0.00	279	.01	.01	.01	5
0.00	0.00	280	.01	.01	.01	5
0.00	0.00	281	.01	.01	.01	5
0.00	0.00	282	.01	.01	.01	5
0.00	0.00	283	.01	.01	.01	5
0.00	0.00	284	.01	.01	.01	5
0.00	0.00	285	.01	.01	.01	5
0.00	0.00	286	.01	.01	.01	5
0.00	0.00	287	.01	.01	.01	5
0.00	0.00	288	.01	.01	.01	5
SUM		23.87	21.18	2.69	626.35	
		(.606.)	(.538.)	(.68.)	(1773.63)	

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2394.	786.	218.	218.	62656.
CU S	59.	22.	6.	6.	1774.
INCH		19.25	21.31	21.31	21.31
HR		488.8	541.18	541.18	541.18
AC-FT		392.	432.	432.	432.
THOUS CU H		481.	332.	332.	532.

SUMMARY OF DAM SAFETY ANALYSIS

.....	ELEVATION STORAGE OUTFLOW	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM	TIME OF FAILURE HOURS
		325.90	325.70	327.40	0.00
		39.	38.	51.	0.00
		5.	0.	50.	0.00
RATIO OF PMF	MAXIMUM RESERVOIR W.S. ELEV	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS
.50	328.68	67.	1007.	6.58	16.17
.40	328.47	61.	800.	6.08	16.25
.30	328.26	57.	596.	5.50	16.25
.20	328.03	54.	391.	4.50	16.50
.10	327.67		149.	2.67	16.50

APPENDIX 5

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