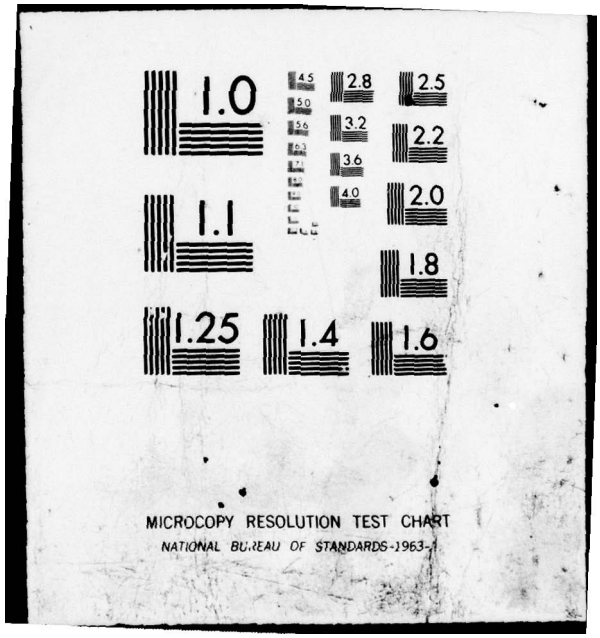
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WHIPPANY RIVER, MORRIS COUNTY
NEW JERSEY

LEVEL II

POCAHONTAS DAM
NJ 00360

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

(6) Pocahontas Dam (NJ-00360). Passaic River Basin, Whippany River, Morris County, New Jersey. Phase 1 Inspection Report.



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(10) Richard J. /McDermott
John E. /Gribbin

(15) DACW61-79-C-0011

DEPARTMENT OF THE ARMY
Philadelphia District
Corps of Engineers
Philadelphia, Pennsylvania

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Embankments
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Visual Inspection
National Dam Inspection Act Report
Pocahontas 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.

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

20 SEP 1979

Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for Pocahontas 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, Pocahontas Dam, a high hazard potential structure, is judged to be in fair overall condition. The dam's spillway is considered inadequate since 9 percent of the Spillway Design Flood--SDF - would overtop the dam. (The SDF, in this instance, is one half of the Probable Maximum Flood.) The spillway is considered "inadequate" instead of "seriously inadequate" because dam failure resulting from overtopping would not significantly increase the hazard to loss of life downstream from the dam from that which would exist just before overtopping failure. 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 1980. In the interim, a detailed emergency operations plan and warning system, should be promptly developed. Also, during periods of unusually heavy precipitation, around the clock surveillance should be provided.

b. In addition, the following remedial measures should be implemented by the owner within six months.

(1) Sediment accumulated upstream of the outlet works gate should be removed.

(2) The eroded area at the east end of the dam should be filled and stabilized.

(3) The concrete cribwall should be backfilled with suitable material and stabilized.

(4) The chain link fence on the west side of the dam should be repaired.

(5) Debris accumulated on the downstream side of the spillway and on the spillway crest should be removed.

(6) The concrete spillway should be thoroughly inspected and renovated by sand blasting, pressure grouting where needed and coating with epoxy.

(7) The scoured channel bottom immediately downstream from the spillway apron should be filled and suitably stabilized.

(8) The owner of the dam should initiate a formal program of annual inspection and maintenance. The inspections should be performed by a qualified professional engineer and recorded on standardized check-list forms. Inspection check-lists and complete records of maintenance should be included in a permanent file. Repairs should be made as required and the following maintenance should be performed annually: properly fill and sod any eroded surfaces, clear the downstream channel and repair the chain-link fence and cribwall. The lake should be lowered completely at least once every three years for the purpose of removing sediment at the spillway and to permit complete inspection and repair of the dam and appurtenances.

c. Within one year from the date of approval of this report, comprehensive topographic survey of the dam and appurtenances should be performed by a qualified licensed land surveyor or professional engineer. The survey map should be related to existing construction drawings and should become a part of the owner's permanent file for 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 Millicent 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.

NAPEN-D
Honorable Brendan T. Byrne

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,

JAMES G. TON
Colonel, Corps of Engineers
District Engineer

1 Incl
As stated

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

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

POCAHONTAS DAM (NJ00360)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 24 April 1979 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.

Pocahontas Dam, a high hazard potential structure, is judged to be in fair overall condition. The dam's spillway is considered inadequate since 9 percent of the Spillway Design Flood--SDF - would overtop the dam. (The SDF, in this instance, is one half of the Probable Maximum Flood.) The spillway is considered "inadequate" instead of "seriously inadequate" because dam failure resulting from overtopping would not significantly increase the hazard to loss of life downstream from the dam from that which would exist just before overtopping failure. 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 1980. In the interim, a detailed emergency operations plan and warning system, should be promptly developed. Also, during periods of unusually heavy precipitation, around the clock surveillance should be provided.

b. In addition, the following remedial measures should be implemented by the owner within six months.

(1) Sediment accumulated upstream of the outlet works gate should be removed.

(2) The eroded area at the east end of the dam should be filled and stabilized.

(3) The concrete cribwall should be backfilled with suitable material and stabilized.

(4) The chain-link fence on the west side of the dam should be repaired.

(5) Debris accumulated on the downstream side of the spillway and on the spillway crest should be removed.

(6) The concrete spillway should be thoroughly inspected and renovated by sand blasting, pressure grouting where needed and coating with epoxy.

(7) The scoured channel bottom immediately downstream from the spillway apron should be filled and suitably stabilized.

(8) The owner of the dam should initiate a formal program of annual inspection and maintenance. The inspections should be performed by a qualified professional engineer and recorded on standardized check-list forms. Inspection check-lists and complete records of maintenance should be included in a permanent file. Repairs should be made as required and the following maintenance should be performed annually: properly fill and sod any eroded surfaces, clear the downstream channel and repair the chain-link fence and cribwall. The lake should be lowered completely at least once every three years for the purpose of removing sediment at the spillway and to permit complete inspection and repair of the dam and appurtenances.

c. Within one year from the date of approval of this report, comprehensive topographic survey of the dam and appurtenances should be performed by a qualified licensed land surveyor or professional engineer. The survey map should be related to existing construction drawings and should become a part of the owner's permanent file for the dam.

APPROVED: _____

JAMES G. TON
Colonel, Corps of Engineers
District Engineer

DATE: 19 September 1979

PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam:	Pocahontas Dam, NJ00360
State Located:	New Jersey
County Located:	Morris
Drainage Basin:	Passaic River
Stream:	Whippany River
Date of Inspection:	April 24, 1979

Assessment of General Condition of Dam

Based on visual inspection, past operational performance and Phase I engineering analyses, the dam is assessed as being in fair overall condition.

Hydraulic and hydrologic analyses indicate that the spillway is inadequate. Discharge from the spillway is not sufficient to pass the designated spillway design flood (SDF) without an overtopping of the dam. (The SDF for Pocahontas Dam is equal to one-half the probable maximum flood.) The spillway is capable of passing approximately 4½ percent of the probable maximum flood or 9 percent of the SDF. Therefore, the owner should engage a qualified professional engineer in the near future to perform accurate hydraulic and hydrologic analyses relating to the spillway capacity. Based on the findings of the analyses, remedial measures should be undertaken to prevent damage, especially erosion of areas adjacent to the dam, due to overtopping of the dam resulting from a storm equivalent to the SDF. In the interim, a detailed emergency operation plan and warning system should be promptly developed. Also, during periods of unusually heavy precipitation, around the clock surveillance should be provided.

In addition, the following remedial measures should be implemented by the owner in the near future.

1) Sediment accumulated upstream of the outlet works gate should be removed.
2) The eroded area at the east end of the dam should be filled and stabilized.
3) The concrete cribwall should be backfilled with suitable material and stabilized.
4) The chain link fence on the west side of the dam should be repaired.
5) Debris accumulated on the downstream side of the spillway and on the spillway crest should be removed.
6) The concrete spillway should be thoroughly inspected and renovated by sand blasting, pressure grouting where needed and coating with epoxy.
7) The scoured channel bottom immediately downstream from the spillway apron should be filled and suitably stabilized.

The owner of the dam should, in the near future, initiate a formal program of annual inspection and maintenance. The inspections should be performed by a qualified professional engineer and recorded on standardized check-list forms. Inspection check-lists and complete records of maintenance should be included in a permanent file, available for public inspection. Repairs should be made as required and the following maintenance should be performed annually: properly fill and sod any eroded surfaces, clear the downstream channel and repair the chain-link fence and cribwall. The lake should be lowered completely at least once every three years for the purpose of removing sediment at the spillway and to permit complete inspection and repair of the dam and appurtenances.

A comprehensive topographic survey of the dam and appurtenances should be performed in the near future by a qualified licensed land surveyor or

professional engineer. The survey map should be related to existing construction drawings and should become a part of the owner's permanent file for the dam.

Richard J. McDermott, P.E.

John E. Gribbin, P.E.



OVERVIEW - POCAHONTAS DAM

24 APRIL 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. 30214. 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; nowever, 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.

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

POCAHONTAS DAM, I.D. NJ00360

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

Pocahontas Dam was inspected on April 24, 1979 to generally assess the structural integrity and operational adequacy of the dam and appurtenances.

1.2 Description of Project

a. Description of Dam and Appurtenances

Pocahontas Dam is a concrete free overflow dam with a gated outlet works. The majority of the dam consists of two overflow sections with ogee shaped crests that serve as an uncontrolled spillway. The overall spillway crest length is 114.2 feet while the overall dam length is 168 feet.

A concrete apron 10 feet wide is located along the downstream side of the dam and an earth berm with a slope of 2 horizontal to 1 vertical is located along the upstream side of the dam. The east end of the dam consists of a 2-foot thick concrete wall section approximately 40 feet long.

Between the overflow section and the wall section of the dam, there is a 4 foot by 4 foot cast iron lift gate that serves as outlet works. The gate is bolted to the downstream side of the dam. Concrete wing walls or training walls are located on either side of the outlet works as well as at the west end of the dam and between the east and west overflow sections of dam. A 3-foot deep concrete cut-off wall is located beneath the entire overflow portion of the dam.

The elevation of the overflow crest is 303.0 (N.G.V.D.). The top elevation of the wall section forming the east end of the dam is 305.3 and corresponds to the top of dam. The ground rises steeply away from either end of the dam. The elevation of the apron on the downstream side of dam is 295.6. The hydraulic height of the dam is 9.7 feet.

b. Location

Pocahontas Dam is constructed across the Whippany River and impounds Lake Pocahontas. It is located in the Town of Morristown, Morris County, New Jersey, approximately one-half mile downstream from Speedwell Dam. The area immediately west of the dam consists of garden apartment buildings owned by the Morristown Housing Authority.

The following characteristics relating to size and downstream hazard for Pocahontas Dam have been determined for this Phase I assessment:

Height: 11.3 feet

Storage: 74 Acre-feet (at top of dam)

Potential Loss of life:

Three garden apartment buildings are located within 300 feet of dam with adjacent ground elevations from 7 feet to 12 feet above the downstream channel bottom. Several dwellings and commercial buildings are located along the downstream channel at locations greater than 1100 feet downstream from dam. Dam failure due to overtopping could cause loss of more than a few lives.

Potential Economic Loss:

Dam failure due to overtopping would probably cause water damage to downstream structures mentioned above. One secondary road bridge 1100 feet downstream from the dam would be overtopped by SDF outflow.

Therefore, Pocahontas Dam is classified as "Small" size and "High" hazard potential.

d. Ownership

Pocahontas Dam is owned and operated by the Town of Morristown, P.O. Box 709, Morristown, N.J. 07960.

e. Purpose of the Dam

The dam impounds a recreational and flood control lake with residential development along its shoreline on one side.

f. Design and Construction History

The original Pocahontas Dam was constructed prior to the year 1900 as an earth dam with concrete spillway. The spillway section was to the east of the earth embankment. Some additions reportedly were made in 1905. In February 1917, heavy ice broke up the top of the left hand or west end of the old earthen dam and a part of the dam was washed away. The normal flow of water through the breached section eventually washed away about 34 feet of the old earth dam and, in doing so, undermined the abutment or training wall of the concrete section. The abutment subsequently leaned over against an old sluice gate causing a slight crack to appear in the concrete dam near the abutment.

Repairs and additions to the dam were completed in 1920, under the direction of then Municipal Engineer of Morristown, Arthur S. Pierson. The repair work included the construction of an additional concrete spillway section, new concrete abutments, the installation of a new sluice gate between new concrete abutments at the east end of the spillway, an apron on the downstream side and fill on the upstream side of the spillway.

On the night of March 15, 1940, a heavy storm occurred over the drainage basin for Pocahontas Dam. It was reported in the newspapers that "Lake Pocahontas overflowed causing water to rise in streets to 3 feet in half an hour." An inspection by representatives of the New Jersey State Water Policy Commission

made on March 27, 1940, showed that the earth embankments at the dam were in need of immediate attention. The earth embankment beyond the left end of the spillway was found to be in a very dangerous condition. The embankments were then repaired by the Town.

More recently, on November 30, 1965, an inspection of the dam was carried out by the Senior Engineer, Hydraulics, of the Bureau of Water Control. The inspection revealed serious defects in the dam. There were large cracks across the entire length of the wall on the east side of the dam and the wall was out of alignment; the training walls were badly eroded, and the sluice gate was corroded and appeared inoperable. The defects were such that serious hazard would exist during a heavy storm. The Town of Morristown was required to drain the lake and keep it drained until repairs were carried out. The lake was drained in early 1967 and it took 25-1/2 hours to reach the original channel depth. The repairs to the dam were completed in 1969 under the direction of David B. Keller of Winston & Keller, Inc., Consulting Engineers of Morristown, N.J. The repairs included shotcrete application at spalled concrete surfaces, installation of a new sluice gate and repairs to the concrete wall section. It has been reported that a crib wall on the downstream side of the dam was also installed at that time.

g. Normal Operation Procedure

There is no formal operational procedure at this facility. The gate has not been operated and the lake has not been lowered since the dam was reconstructed in 1969.

The only maintenance carried out by the Department of Parks and Grounds of the Town of Morristown has been the clearing of debris from the downstream area of the dam.

1.3 Pertinent Data

a.	Drainage area	26.8 sq. mi.
b.	Discharge at Damsite	
	Maximum known flood at damsite	2000 c.f.s. (gaging station 2½ miles downstream from dam)
	Outlet works at pool elevation	213 c.f.s.
	Spillway capacity at normal pool elevation	40 c.f.s.
	Spillway capacity at top of dam	1565 c.f.s.
c.	Elevation	
	Top of dam	305.3
	Maximum pool-design surcharge	313.0
	Recreation pool	303.2
	Spillway crest	303.0
	Downstream bed	294±
	Maximum tailwater	304±
d.	Reservoir	
	Length of pool at top of dam	2250 feet
	Length of recreation pool	2100 feet
e.	Storage (Acre-feet)	
	Recreation pool	39 acre-feet
	Design surcharge	252 acre-feet
	Top of dam	74 acre-feet

f. Reservoir Surface (Acres)

Top of dam	18.2 acres
Maximum pool	30 acres
Recreation pool	15.4 acres
Spillway crest	15.4 acres

g. Dam

Type	Concrete Gravity
Length	168 feet
Height	11.3 feet
Side slopes - upstream fill	2 horiz. to 1 vert.
- downstream	Ogee shaped
Cutoff	Concrete cutoff wall

h. Spillway

Type	Ogee crest
Length of weir	114.16 feet
Crest elevation	303.0
Approach channel	N.A.
Discharge channel	Cribwall directs discharge into downstream channel

i. Regulating Outlet

4' x 4' cast iron lift gate

SECTION 2: ENGINEERING DATA

2.1 Design

No engineering data is available for the original dam constructed prior to 1900, or for additions made to it around 1905. After damage to the dam in 1917 by ice, the dam was repaired, spillway extended and an outlet gate provided. One drawing prepared by Arthur A. Pierson showing the proposed work is available.

Major renovation of the dam was carried out in 1969. Plans prepared in March 1968 by Winston & Keller Inc., Consulting Engineers of Morristown, N.J. for the renovation of the dam are available. The plans include:

1) General Location Plan
2) General Site Plan
3) Plan, profile and section
4) Gate details
5) Repair details

Specifications for this work are also available.

A force diagram showing theoretical lines of force in concrete spillway section for full and empty lake conditions is available.

Calculations for 15-year and 50-year floods are also available in the NJDEP files. These calculations show heads of 4.6 feet and 5.2 feet over the spillway for 15-year and 50-year flows, respectively. The respective heads over the concrete wall section are 1.8 feet and 2.4 feet.

Stream gaging records for U.S.G.S. Gaging Station 1-3815.00, located at the Morristown Sewage Treatment Plant, are available. The

gaging station is approximately 2½ miles downstream from the dam and has a drainage area of 29.4 square miles.

2.2 Construction

A report on inspection made by the Water Engineer of the Department of Conservation and Development during the repair work in 1920 is available. It was reported that the work was being performed in a satisfactory and workmanlike manner. Some of the changes made in the design were also reported. The double sheet piling under the new spillway at the west end was omitted because the underlying material (hard-pan) made it impractical to drive same. The footing under this portion of the dam was extended to a depth of 6 feet below the elevation of the foot of the ogee slope. An 8" diameter cast iron pipe closed with a gate valve was laid through the concrete near the west bank. The purpose of the pipe was to furnish water to a small turbine for generating current to park lighting. No evidence of the 8" pipe or turbine was found at the time of inspection. The concrete core wall at the west end had not been completed for its full length at the time of inspection.

2.3 Operation

No formal records of operation of the lake or dam have been kept by the owners. The water level in the impoundment has not been lowered since the renovation work performed in 1969.

Reports of two inspections have been obtained. These are the inspections mentioned in paragraph 1.2.f. An inspection of the dam was conducted by an Assistant Division Engineer on March 27, 1940 after the heavy storm of March 15, 1940. It was reported that the earth embankments forming the wings of the dam had been permitted to slump slightly below grade at the right end of the dam and very seriously exposing the core wall at the left end of the dam. The spillway was in good condition. There was also no evidence of the flood gate having been raised.

Another inspection of the dam was carried out by the Senior Hydraulics Engineer on November 30, 1965. Only the east side of the dam was inspected. At the time of inspection it was reported that a large crack extended across the entire wall on the east side of the dam several feet below the top of this wall. The wall was apparently out of alignment with the rest of the dam and the to portion of it had been thrust 0.4 feet downstream. Also, several cracks extended across the top of the wall, the cracks being 0.3 feet wide at the top.

It was also reported that the wingwalls immediately below the sluice gate were badly eroded and that the steel gate itself was corroded and appeared inoperable at the time of inspection.

It was further reported that a severe storm would submerge the wall in question, possibly causing failure and resulting in damage and loss of life downstream. It was recommended that the dam be kept drained until repairs could be undertaken.

2.4 Evaluation

a. Availability

Available engineering information is limited to that which is on file at the NJDEP and the Town of Morristown. The NJDEP file contains copies of plans, calculations, correspondence, photographs, inspection reports and specifications. The file is available for inspection at the offices of the Bureau of Flood Plain Management, 1474 Prospect Street, Trenton, N.J. The Town of Morristown file contains only plans and is available for inspection at the office of the Town Engineer, 27 Dumont Place, Morristown, N.J. 07960.

b. Adequacy

The available information forms a fair description of the subject dam and is considered to be of significant assistance in the performance of a Phase I evaluation. A list of absent information is included in paragraph 7.1.b.

c. Validity

Most information that could be verified is valid within a reasonable allowance for error.

SECTION 3: VISUAL INSPECTION

3.1 Findings

a. General

The inspection of Pocahontas Lake Dam was performed on April 24, 1979 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 dam, appurtenant structures and adjacent areas were examined.
2. The dam and accessible appurtenant structures were measured and key elevations were determined by surveyor's level.
3. The dam, appurtenant structures and adjacent areas were photographed.
4. Cross sections of the downstream channel were determined.

Information presented in the following portions of this section consists of observations made during the field inspection.

b. Dam

The general condition of the concrete wall surfaces of the dam appeared to be good. The training walls, overflow section and east wall section appear to be aligned true to the construction drawings. Some surface cracks were observed in the east and west training walls. A surface crack was also observed in the concrete wall section forming the east end of the dam.

At the time of inspection, discharge over the spillway obscured the spillway and apron surfaces. However, the condition of

these surfaces appeared to be generally satisfactory. Some wearing of the surface, manifest as exposed aggregate, was noted.

At the east end of the wall section, erosion in the soil adjacent to the dam was observed. The eroded area was partially filled with broken pieces of bituminous pavement which constitutes an insufficient repair.

Earth berms are located along both the upstream and downstream sides of the concrete wall section. The top of the upstream berm was approximately 1 foot below the top of wall while the downstream berm was within approximately 5 feet below the top of wall.

The generalized soils description of the dam site consists of alluvial deposits composed of a wide range of grain sizes sorted into rough, intermingled layers by successive stages of water action. The alluvial soil overlies a layer of uniform deposits of silt, sand and gravel known as Wisconsin Stratified Drift.

According to the Geologic Map of New Jersey, the Ramapo Fault lies in the vicinity of the east end of the dam and forms the contact line between Precambrian Losee Gneiss to the west and Triassic Brunswick Formation to the east.

c. Appurtenant Structures

The outlet works consist of a cast iron lift gate on the downstream side of a vertical concrete wall spanning two training walls. The gate, stem and the operating mechanism appeared to be in good overall condition.

The surface of the gate and the slide rails on which it is mounted were rusted and surface cracks were observed in the vertical concrete wall. The gate was not operated at the time of inspection.

A pipe located in the west training wall or abutment of the dam, appeared to be a storm drain serving the adjacent residential area.

d. Reservoir Area

Pocahontas Lake is long and narrow, averaging 350 feet in width with an overall length of about 2,100 feet. It is located in a residential area of Morristown and is downstream from Speedwell Lake. Its shores are steeply sloped with an average grade of approximately 15 percent. Three garden apartment buildings are located along the westerly lake shore. Soundings in the vicinity of the outlet works indicated an accumulation of sediment with a depth of approximately 5 feet.

A chain-link fence is located along the eastern bank of the lake and along the downstream channel. In the area immediately downstream from the dam, the fence post foundations are undermined causing instability in several sections of the fence. The remainder of the fence appeared to be in satisfactory condition.

e. Downstream Channel

The downstream channel is a river with a substantial base flow. Its bed contains many rocks but is essentially free of significant obstructions. The channel is well formed and has large trees along its banks. Downstream from the dam, approximately 20 feet from the apron, a large accumulation of rocks

has formed. Immediately downstream from the apron the channel bed has been scoured to a depth of nearly 3 feet below the apron surface.

A concrete cribwall extends downstream from the west end of the dam. Forming the side wall of a spillway discharge channel, the cribwall protects the downstream bank and directs discharge from the west end of the dam into the downstream channel. The cribwall appeared to be intact structurally. However, fill behind the cribwall was inadequate and undermining of the fence post foundations was apparent.

SECTION 4: OPERATIONAL PROCEDURES

4.1 Procedures

The water level in Pocahontas Lake is regulated naturally by flow over the spillway of the dam. Reportedly, during intense storms which cause high water levels in the lake, the outlet works is not used to augment the capacity of the spillway.

The lake can be lowered by opening the outlet works gate. Approximately 25½ hours is required to lower the lake to its original channel depth. However, at the present time no formal nor informal procedure for operating the dam and appurtenances is employed by the Town of Morristown. Reportedly, the gate has not been opened since the dam was repaired in 1969.

4.2 Maintenance of the Dam

There is no program of regular inspection and maintenance of the dam and appurtenant structures. Maintenance is performed by the Department of Parks and Grounds of the Town of Morristown as the need arises.

Reportedly, the only regular maintenance is the clearing of debris from the downstream area of the dam.

4.3 Maintenance of Operating Facilities

The gate and its operating mechanism are maintained by the Town of Morristown, Department of Parks and Grounds as the need arises. It is not known when the gate was last serviced.

4.4 Description of Warning System

No warning system is currently in use nor is one known to have been utilized in the past.

4.5 Evaluation

There has been no maintenance documentation for the facilities at Pocahontas Dam. The operation of the spillway, since the 1969 repairs to the dam, has been satisfactory to the extent that the dam has not been known to have overtopped since that time. Areas of maintenance that have not been adequately performed are:

1. Sediment allowed to accumulate behind outlet works gate.
2. Erosion at east end of dam not properly filled.
3. Scour immediately downstream from apron not filled.
4. Fill behind cribwall not properly maintained and fence post foundations allowed to become undermined.

SECTION 5: HYDRAULICS/HYDROLOGIC

5.1 Evaluation of Features

a. Design Data

The intensity of storm water runoff that the spillway should be able to handle is based on the size and hazard classification of the dam. This runoff intensity, 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 Pocahontas Lake Dam falls in a range of 1/2 PMF to PMF (Probable Maximum Flood). Since the characteristics of Pocahontas Dam as described in Paragraph 1.2.c. fall into the lower end of the prescribed classification range, 1/2 PMF is used as the SDF.

The SDF peak inflow calculated for Pocahontas Dam is 16,843 c.f.s. This value is the maximum outflow from Speedwell Dam obtained after routing a 1/2 PMF flow through Speedwell Lake. The unit hydrograph used for calculating the inflow hydrograph to Speedwell Lake was derived by the use of the HEC-1-DB Flood Hydrograph Computer Program using Snyder's coefficients. In addition, the routings through Speedwell Lake and Pocahontas Lake have been computed by the HEC-1-DB program. Hydrologic computations and computer output are contained in Appendix 4.

Magnitudes of discharge over the spillway have been calculated using coefficients of discharge for an ogee spillway. Adjustments to the value of the coefficient of discharge were made to take into account the incline on the upstream side of the dam, and the effect of the tailwater stages. The spillway discharge with lake level equal to the top of dam (elevation 305.3) was computed to be 1565 c.f.s.

Hydraulic analysis relating to the downstream channel indicates that the tailwater elevation would be approximately 1.5 feet above the spillway crest at the time of SDF peak outflow from Pocahontas Lake resulting in a submerged condition for the spillway. The flood routing analysis of Pocahontas Lake indicates that the combination of relatively long spillway crest and small lake storage capacity results in a relatively small attentuation of the SDF as it passes through the lake. The analyses outlined above indicate that dam failure resulting from overtopping would not significantly increase the hazard to loss of life downstream from the dam from that which would exist without overtopping failure. 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

According to a member of the staff of the Department of Parks and Grounds of the Town of Morristown, the dam has not overtopped in recent years, but on one occasion flood waters raised the lake level to within a few inches of the top of dam. Reportedly, tailwater stage during that flood was near the elevation of the spillway crest. In addition, water reportedly discharged at that time from the lake through the eroded area at the east end of the dam.

c. Visual Observations

No evidence was found at the time of inspection that indicated overtopping of the dam since its renovation in 1969. However, the eroded area at the east end of the dam indicated that discharge from the lake could have occurred at that location.

d. Overtopping Potential

As indicated in paragraph 5.1.a, a storm of magnitude equivalent to the SDF would cause overtopping of the dam to a height of 8.3 feet over the dam. Computations indicate that the dam can pass approximately 4½ percent of the PMF or 9 percent of the SDF without overtopping of the dam crest.

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

The overflow section and the wall section of the dam appeared, at the time of inspection, to be outwardly structurally stable with no evidence of displacement, differential settlement or large cracks.

b. Design and Construction Data

The only data that is available is a force diagram for the overflow section of the dam. The diagram shows theoretical force lines for the full and empty conditions to be within the middle third of the section over the full depth of the wall. No other analysis pertaining to structural stability and no construction data for the dam are available.

c. Operating Records

There are no operating records available for the dam. The water level of Lake Pocahontas is not monitored.

d. Post Construction Changes

Since the dam was reconstructed in 1920, the following changes have taken place:

1. Repair of the deteriorated concrete in 1969 by the application of shotcrete.
2. Installation of a new gate.
3. Construction of crib wall on the downstream side of the dam.

e. Seismic Stability

Pocahontas Dam is located in seismic Zone 1 as defined in "Recommended Guidelines 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. Pocahontas Dam outwardly appeared to be stable at the time of inspection.

According to Lamont-Doherty Geological Observatory of Columbia University, no seismic activity has been detected in recent years along the Ramapo Fault in the vicinity of Pocahontas Lake. The maximum recorded magnitude of seismic event for any location on the Ramapo Fault is 3.1 (Nuttly scale).

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 Pocahontas Dam is assessed as being inadequate. The spillway is capable of passing flows equal to about 4½ percent of the PMF without an overtopping of the dam. A storm of magnitude equivalent to the SDF (1/2 PMF) would result in an overtopping of the dam.

The dam appeared to be outwardly structurally stable at the time of inspection. No reported nor written evidence was found that would contradict this assessment.

b. Adequacy of Information

Information sources for this study include: 1) field inspection, 2) plans, correspondence and reports in NJDEP files, 3) USGS quadrangle sheet, 4) aerial photography from Morris County, 5) topographic maps from Morristown, 6) consultation with local municipal officials. The information obtained is sufficient to allow a Phase I assessment as outlined in "Recommended Guidelines for Safety Inspection of Dams."

Some data not available are as follows:

1. Lake elevation gaging records
2. Foundation and soil report for the site
3. Structural design computations and reports

c. Necessity for Additional Data/Evaluation

Although complete engineering data pertaining to Pocahontas Dam is not available, additional data is 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 and Appendix 4, the spillway is considered to be inadequate. Therefore, it is recommended that a qualified professional engineer be engaged in the near future to perform more accurate hydraulic and hydrologic analyses relating to the spillway capacity. The analyses should more accurately determine runoff characteristics of the watershed and should refine the computed discharge capacities of the spillway and downstream channel. Based on the findings of these analyses, remedial measures should be undertaken to prevent damage due to overtopping of the dam resulting from a storm equivalent to the SDF. In the interim, a detailed emergency operation plan and warning system should be promptly developed. Also, during periods of unusually heavy precipitation, around the clock surveillance should be provided.

It is further recommended that the following measures be undertaken by the owner in the near future.

1) Sediment accumulated upstream of the outlet works gate should be removed.

2) The eroded area at the east end of the dam should be filled and stabilized.

3) The concrete cribwall should be backfilled with suitable material and stabilized.

4) The chain-link fence on the west side of the dam should be repaired.

5) Debris accumulated on the downstream side of the spillway and on the spillway crest should be removed.

6) The concrete spillway should be thoroughly inspected and renovated as outlined below:

   a. Drain the lake to an elevation equal to the invert of the lift gate.
   b. Thoroughly inspect and sand blast all concrete.
   c. Pressure grout all major cracks and patch all spalls and deteriorated surfaces.
   d. Apply an epoxy preservative coating to all surfaces.

7) The scoured channel bottom immediately downstream from the spillway apron should be filled and suitably stabilized.

b. Maintenance

In the near future, the owner of the dam should initiate a program of periodic inspection and maintenance, the complete records of which to be kept on file and made available to the public. A visual inspection by a qualified professional engineer should be make annually and reported on a standardized

check-list form. Repairs should be made as required and the following maintenance should be performed annually: fill and sod any eroded surfaces, clear the downstream channel and repair the chain-link fence and crib wall. In addition, the lake should be lowered at least once every three years at which time the submerged portions of the dam and appurtenances should be inspected and repaired and accumulated sediment removed.

c. Additional studies

A detailed topographic survey of the dam including the area around the dam should be undertaken in the near future by a qualified licensed land surveyor or professional engineer. The survey map should be related to existing construction drawings and should become a part of the permanent record mentioned above.

PLATES

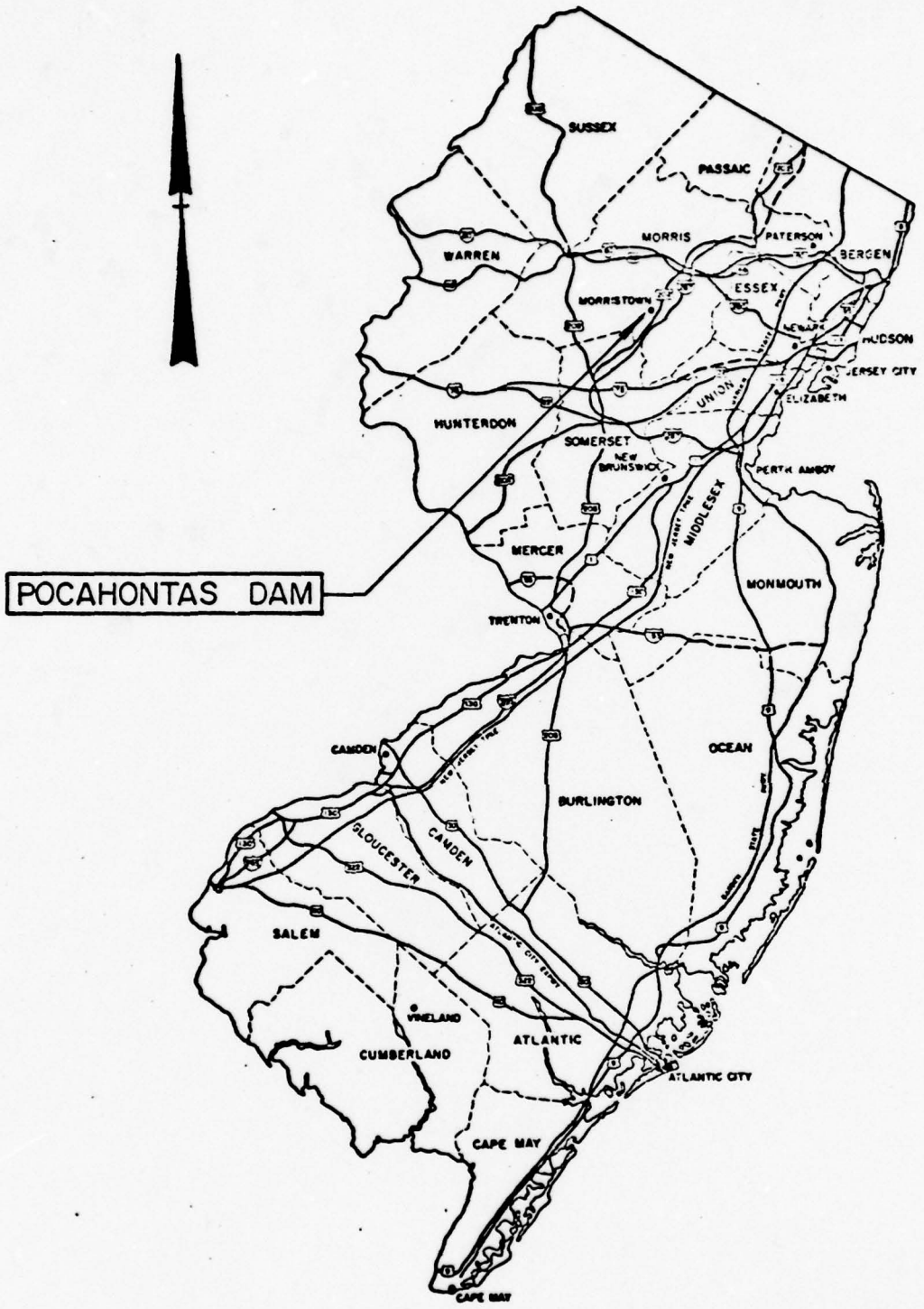


PLATE 1

STORCH ENGINEERS
FLORHAM PARK, NEW JERSEY

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

INSPECTION AND EVALUATION OF DAMS

KEY MAP

POCAHONTAS DAM

I.D. N.J. 00360	SCALE: NONE
	DATE: MAY, 1979



PLATE 2

STORCH ENGINEERS
FLORHAM PARK, NEW JERSEY

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

INSPECTION AND EVALUATION OF DAMS

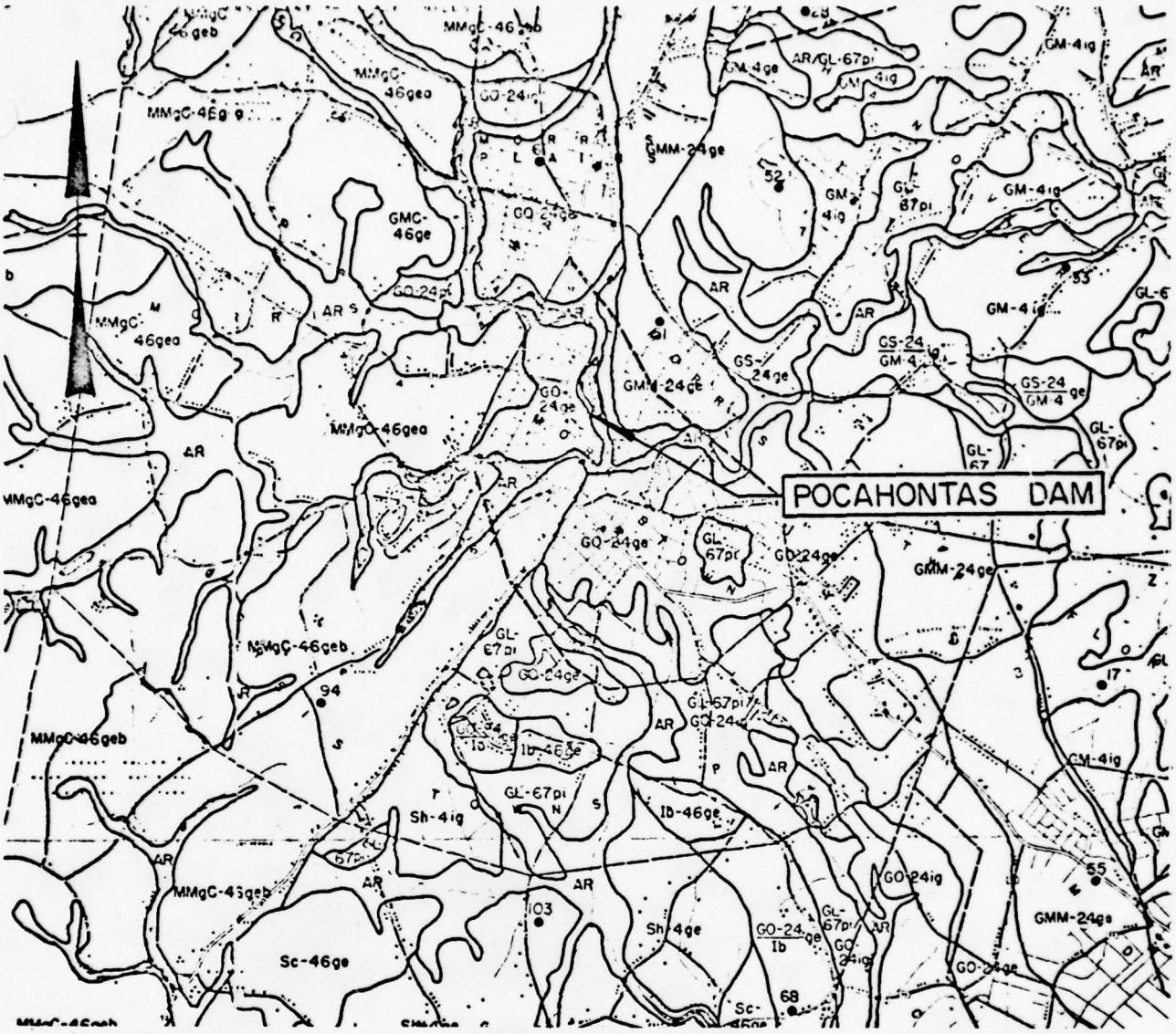
VICINITY MAP

POCAHONTAS DAM

I.D. N.J. 00360

SCALE: AS SHOWN

DATE: MAY, 1979



Legend

AR — Recent alluvium composed of statified materials deposited by streams.

GO-24 — Well-sorted, uniform deposits of silt, sand and gravel. (Wisconsin Stratified Drift)

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

STORCH ENGINEERS
FLORHAM PARK, NEW JERSEY

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

INSPECTION AND EVALUATION OF DAMS

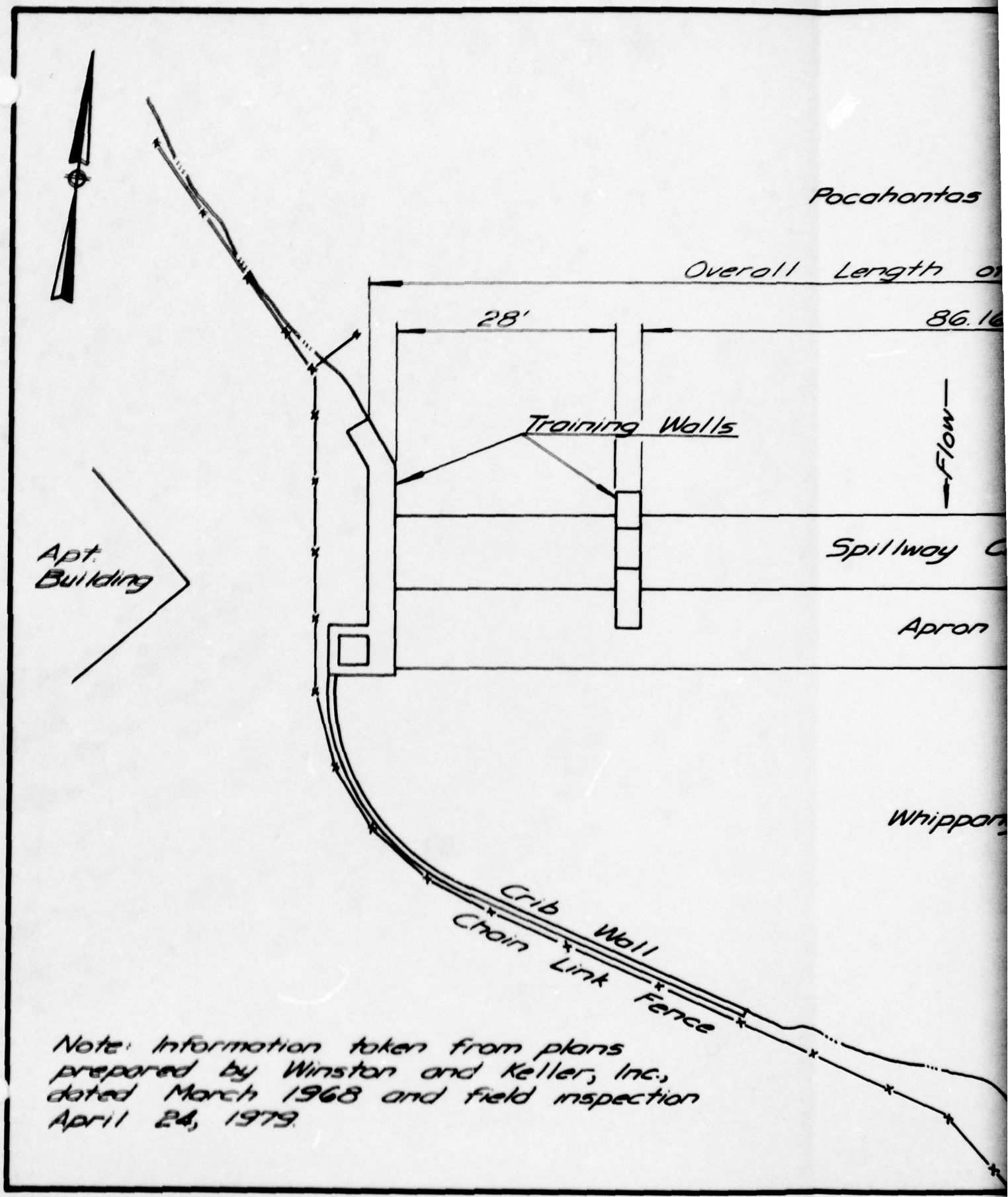
SOIL MAP

POCAHONTAS DAM

I.D. N.J. 00360

SCALE: NONE

DATE:



Note: Information taken from plans prepared by Winston and Keller, Inc., dated March 1968 and field inspection April 24, 1979.

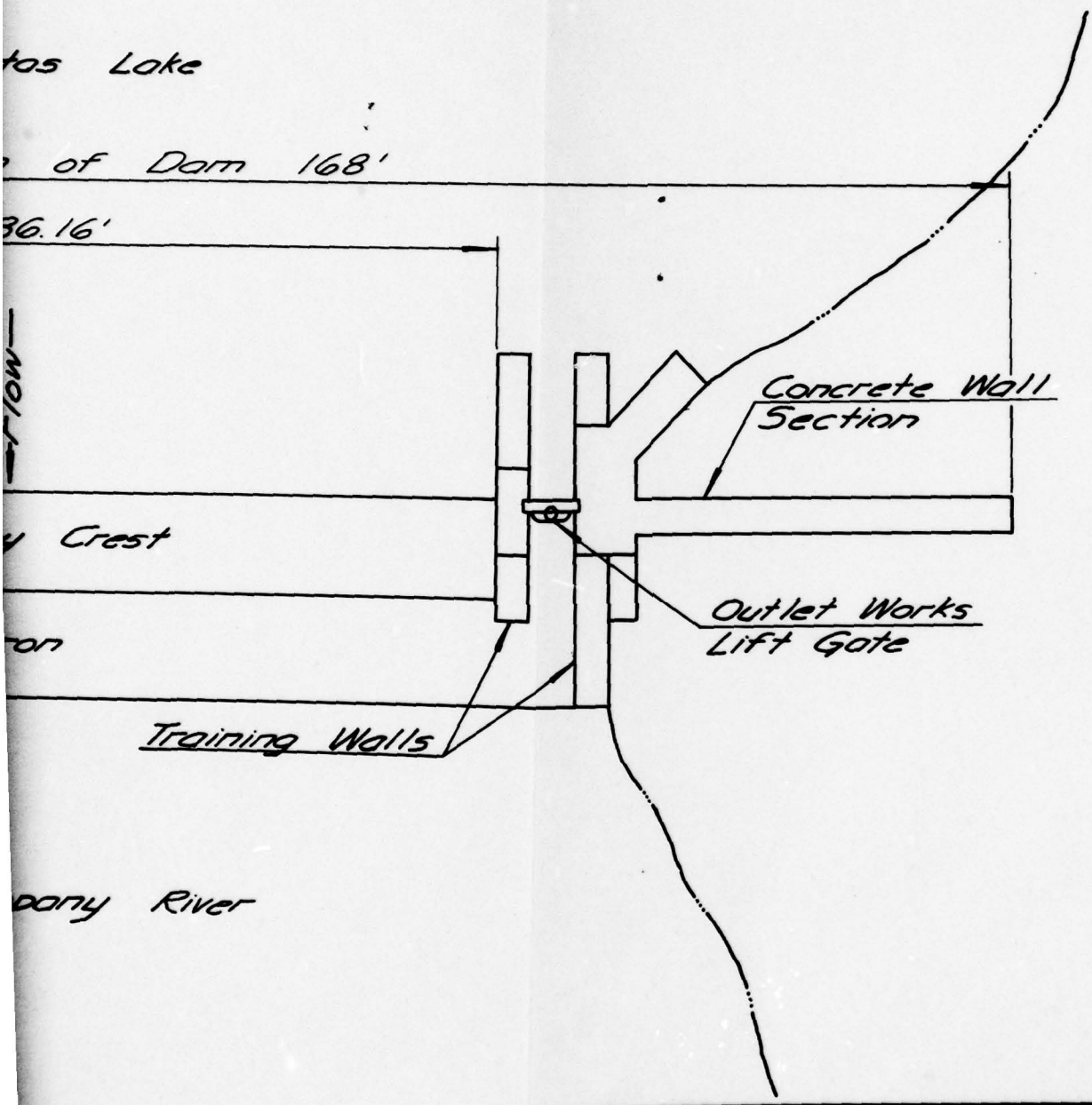


PLATE 4

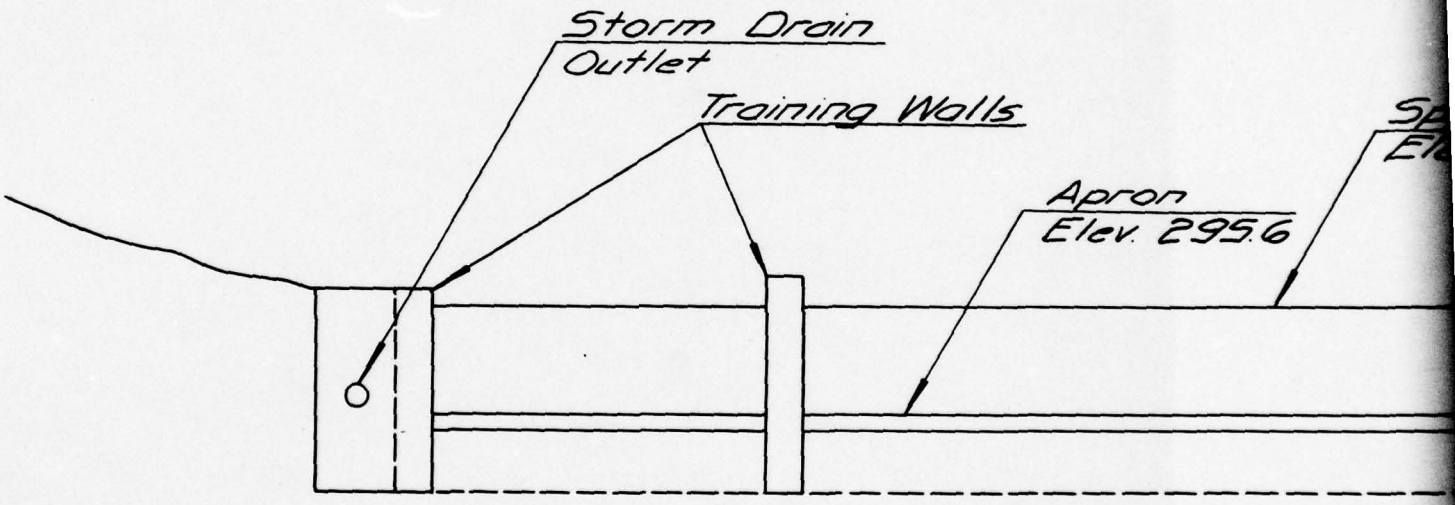
STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS

GENERAL PLAN

POCAHONTAS DAM

I.D. N.J. 00360	SCALE: NOT TO SCALE
	DATE: JUNE 1979



Note: Information token from plans prepared by Winston and Keller, Inc. dated March 1968 and field inspection April 24, 1979.

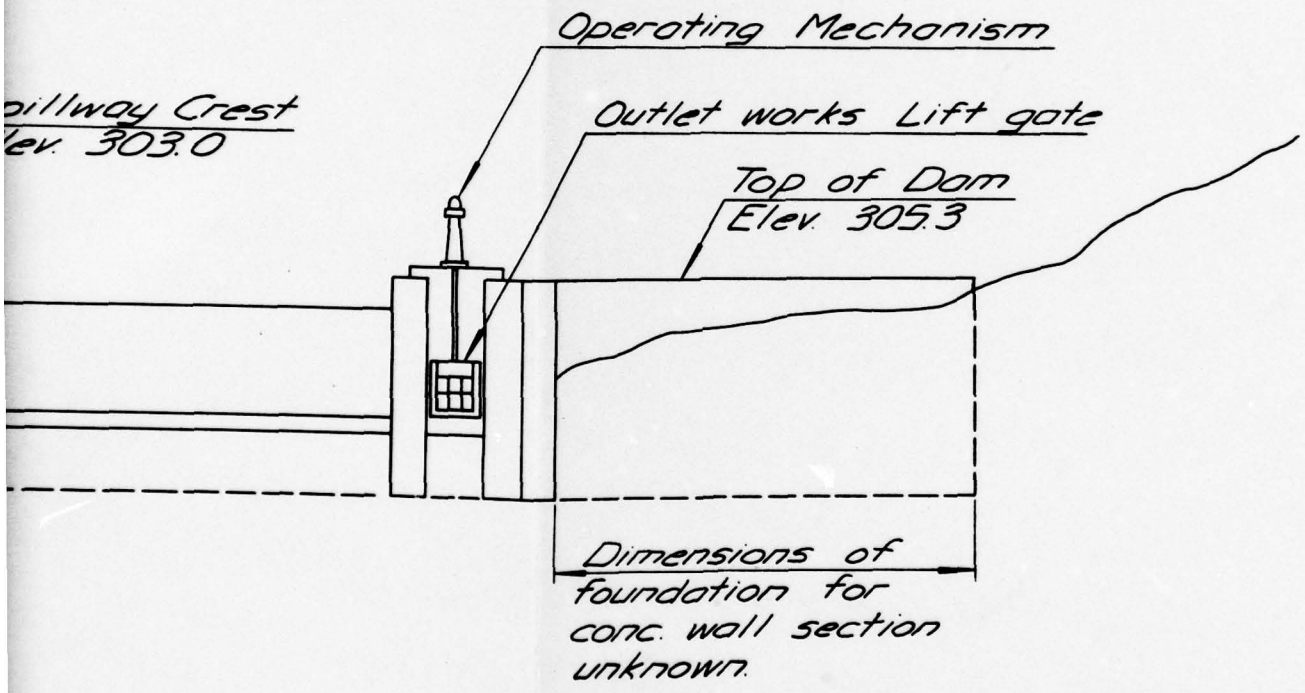


PLATE 5

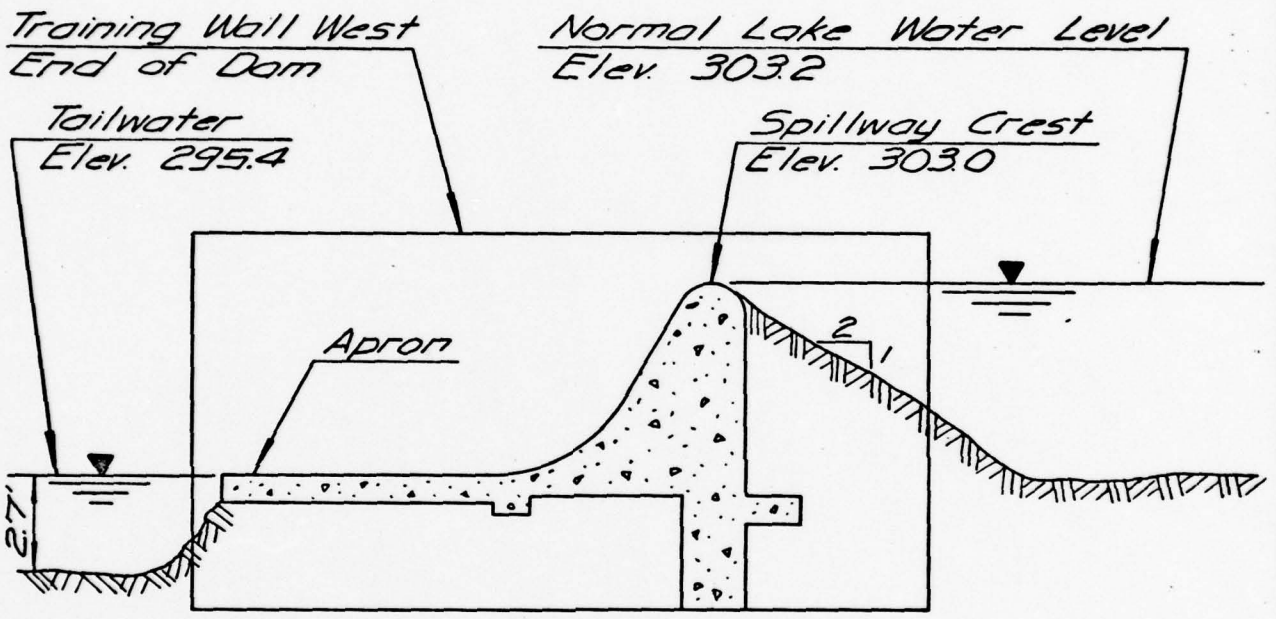
STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS

FRONT ELEVATION

POCAHONTAS DAM

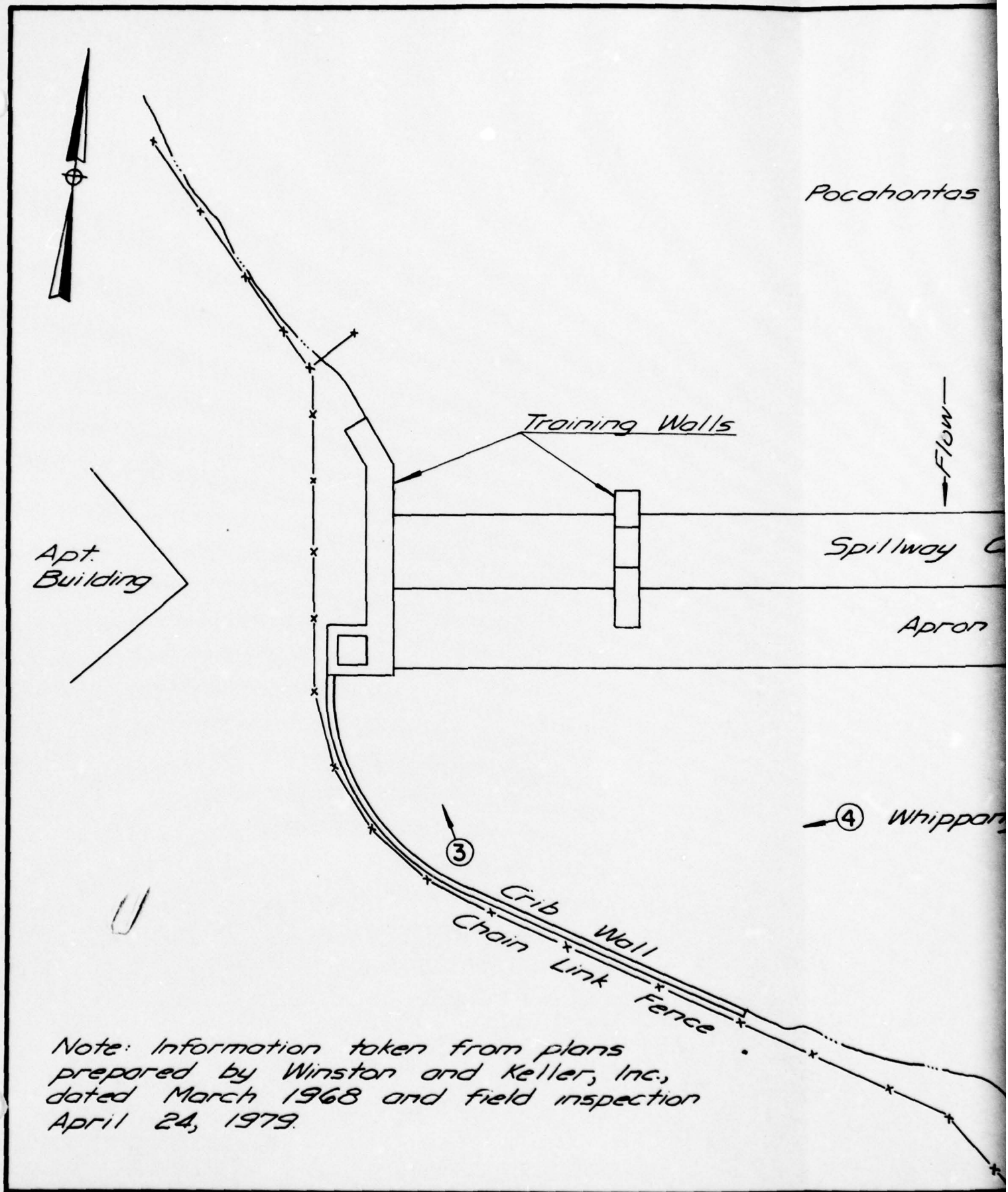
I.D. N.J. 00360	SCALE: NOT TO SCALE
	DATE: JUNE, 1979



Note: Information taken from plans by Arthur S. Pierson prepared in 1919, plans by Winston and Keller Inc., prepared in 1968 and field inspection April 24, 1979.

PLATE 6

STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	INSPECTION AND EVALUATION OF DAMS SPILLWAY SECTION POCAHONTAS DAM
DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY	I.D. N.J. 00360 — SCALE: NOT TO SCALE DATE: JUNE, 1979



Note: Information taken from plans prepared by Winston and Keller, Inc., dated March 1968 and field inspection April 24, 1979.

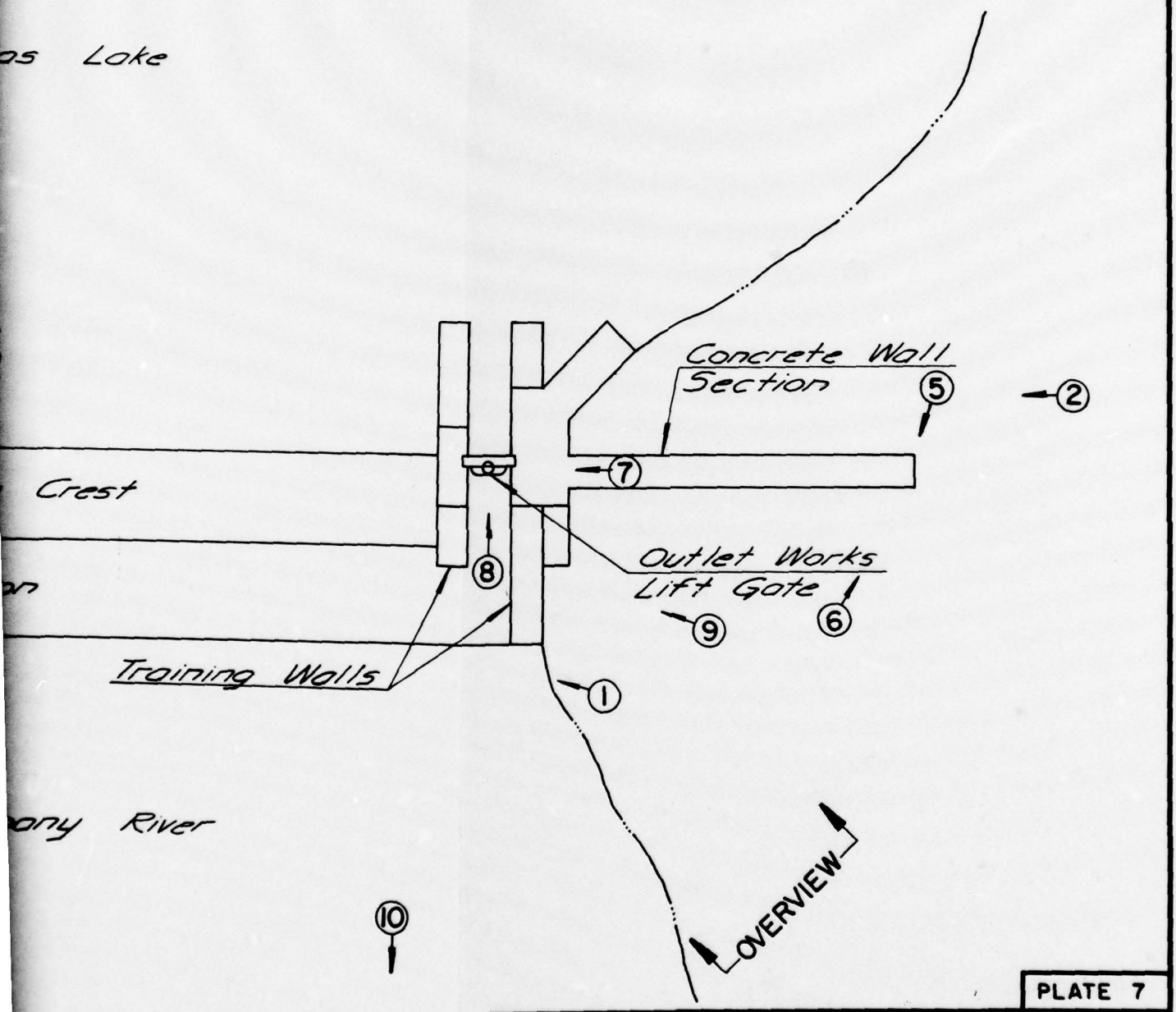


PLATE 7

STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS

PHOTO LOCATION PLAN

POCAHONTAS DAM

I.D. N.J. 00360	SCALE: NOT TO SCALE
	DATE: JUNE, 1979

APPENDIX 1

Check List - Visual Inspection

Check List - Engineering Data

Check List
Visual Inspection
Phase I

Name of Dam Pocahontas County Morris State New Jersey Coordinators NJDEP

Date(s) Inspection 4/24/79 Weather Fair Temperature 70°F

Pool Elevation at Time of Inspection 303.2 M.S.L. Tailwater at Time of Inspection 295.4 M.S.L.

Inspection Personnel:

John Gribbin David Hoyt

Ronald Lai Joseph Fox

Richard McDermott

John Gribbin Recorder

Present: George McCloud, Superintendent of Streets and Sanitation.

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
GENERAL	Majority of dam is free overflow weir with outlet works gate and 40-foot long concrete wall section at east end.	All exposed surfaces appeared to be composed of concrete applied by a Shotcrete process.
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	Junctions with abutments appear to be in generally satisfactory condition with some erosion at east end of dam.	Concrete wall section at east end of dam is backfilled with soil berms on its upstream and downstream sides.
DRAINS	N.A.	Drain in west training wall appeared to be storm drain. Water was discharging from pipe at time of inspection.
WATER PASSAGES	N.A.	
FOUNDATION & APRON	Apron appeared to be in good condition.	Surface obscured by discharge.
VERTICAL AND HORIZONTAL ALIGNMENT	Vertical alignment: Level Horizontal alignment: Straight	

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	Minor cracks in spillway training walls and east section of dam.	Overflow portions of dam submerged by lake and overflow. Recommend future inspection under drawn-down condition.
STRUCTURAL CRACKING	None observed.	
CONSTRUCTION JOINTS	Submerged by flow.	
MONOLITH JOINTS	N.A.	
LEAKAGE	None observed.	
SEEPAGE	None observed.	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	N.A.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	N.A.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	N.A.	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	N.A.	
RIPRAP FAILURES	N.A.	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SURFACES IN OUTLET CONDUIT	N.A.	
INTAKE STRUCTURE	Upstream masonry training walls in good condition.	
OUTLET STRUCTURE	Downstream masonry training walls in good condition.	
OUTLET CHANNEL	Same as spillway outlet channel.	
GATE AND GATE HOUSING	Gate, lift stem and operating mechanism appear to be in good condition.	Gate not operated at time of inspection.

SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
GENERAL	Weir appears to be in generally good condition. Surface of concrete is somewhat worn with agregate exposed.	Spillway is overflow portion of dam.
APPROACH CHANNEL	N.A.	
DISCHARGE CHANNEL	Cribwall downstream from west end of spillway appears to be intact structurally. Fill behind cribwall is inadequate and chain link fence along top of bank is unstable due to undermined post foundations.	East end of spillway and outlet works discharge directly into downstream channel. Discharge from west end of spillway flows at right angle to spillway along cribwall approx. 30 feet downstream from spillway.
APRON	Appears to be in good condition.	Same as apron for overflow portion of dam.

INSTRUMENTATION

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

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Slopes range from 10% to greater than 50%. Average slope approx. 15%.	
SEDIMENTATION	Significant accumulation of sediment was noted in the vicinity of the outlet works. Sediment is as much as 5 feet deep.	
STRUCTURES ALONG BANKS	Three brick garden apartment buildings located along west bank of lake with adjacent ground elevations from 3 to 4 feet above normal lake level. Other dwellings near west bank and railroad tracks near east bank are all at elevations in excess of 10 feet above the normal lake level.	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Wide well defined stream with no significant obstructions. Secondary road bridge approx. 1100 feet downstream from dam.	Rocks and minor debris immediately downstream from bridge comprise a minor obstruction to flow.
SLOPES	Slopes range from 8% to greater than 50%. Average slope approx. 20%.	High water mark observed in area immediately downstream from dam approx. 3' above top of cribwall.
STRUCTURES ALONG BANKS	Three garden apartment buildings within 300 feet of dam with adjacent ground elevations from 7 to 12 feet above the channel bottom. Several dwellings and commercial buildings along channel at locations greater than 1100 feet downstream from dam.	

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM		REMARKS
DAM -	PLAN	Plans titled "Proposed Rehabilitation - Pocahontas Dam" prepared by Winston and Keller, Inc., Consulting Engineers of Morristown, N.J. Dated March 1968.
	SECTIONS	
SPILLWAY -	PLAN	Winston and Keller, Inc. - Plans 1968
	SECTIONS	Plans showing "Extension of Concrete Spillway at Pocahontas Lake" prepared by Arthur S. Pierson City Engineer, Morristown, N. J., Undated. (Prepared in or about 1919).
	DETAILS	
OPERATING EQUIPMENT PLANS & DETAILS		Not Available.
OUTLETS -	PLAN	Winston and Keller, Inc. - Plans, 1968
	DETAILS	Winston and Keller, Inc. - Plans, 1968
	CONSTRAINTS	Not Available
	DISCHARGE RATINGS	Available - Calculations in NJDEP File.
HYDRAULIC/HYDROLOGIC DATA		Available - Calculations in NJDEP File. Stream gauging records at Morristown Sewage Disposal Plant
RAINFALL/RESERVOIR RECORDS		Not Available
CONSTRUCTION HISTORY		Available in NJDEP File for Reconstruction and Rehabilitation.
LOCATION MAP		Available, Winston and Keller, Inc., Plans

ITEM	REMARKS
DESIGN REPORTS	Not Available
GEOLOGY REPORTS	Not Available
DESIGN COMPUTATIONS	
HYDROLOGY & HYDRAULICS	Available in NJDEP File.
DAM STABILITY	Not Available
SEEPAGE STUDIES	Not Available
MATERIALS INVESTIGATIONS	
BORING RECORDS	Not Available
LABORATORY	Not Available
FIELD	Not Available
POST-CONSTRUCTION SURVEYS OF DAM	Not Available
BORROW SOURCES	Not Available

ITEM	REMARKS
MONITORING SYSTEMS	None
MODIFICATIONS	Available: Arthur S. Pierson Plans Winston and Keller, Inc. Plans.
HIGH POOL RECORDS	Not Available
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	Not Available
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	 Breach in west end of old earthen dam in Feb. 1971 Not available
MAINTENANCE OPERATION RECORDS	Not Available

APPENDIX 2

Photographs



PHOTO 1

DOWNSTREAM FACE OF SPILLWAY



PHOTO 2

CREST OF DAM AND SPILLWAY

POCAHONTAS DAM
24 APRIL 1979



PHOTO 3

WEST TRAINING WALL FOR SPILLWAY



PHOTO 4

CRIBWALL BANK PROTECTION DOWNSTREAM OF SPILLWAY

POCAHONTAS DAM
24 APRIL 1979



PHOTO 5

EROSION AT EAST END OF DAM



PHOTO 6

JUNCTION BETWEEN EAST END OF DAM AND BANK

POCAHONTAS DAM
24 APRIL 1979

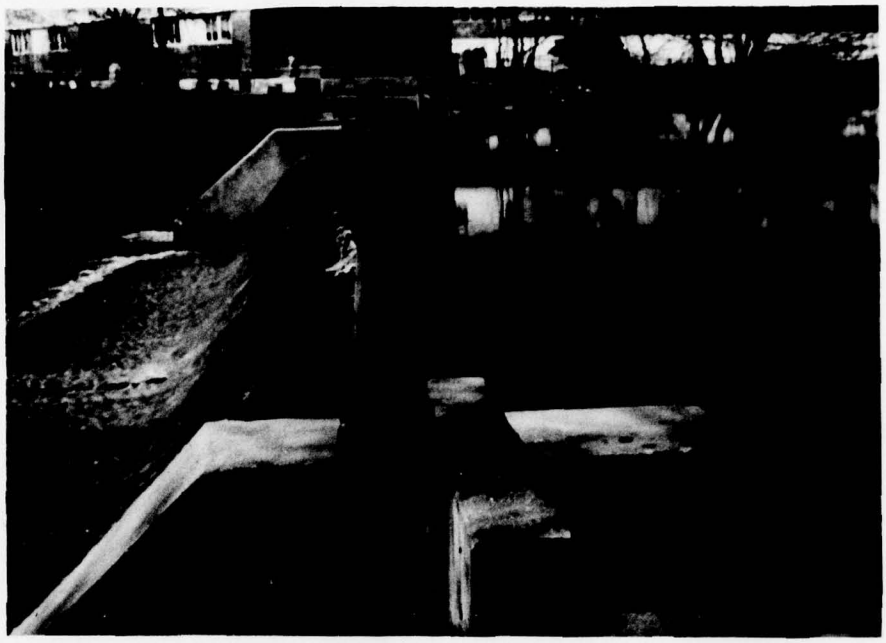


PHOTO 7

GATE OPERATING MECHANISM



PHOTO 8

DOWNSTREAM VIEW OF GATE

POCAHONTAS DAM
24 APRIL 1979



PHOTO 9

DOWNSTREAM TOE OF DAM



PHOTO 10

DOWNSTREAM CHANNEL

POCAHONTAS DAM
24 APRIL 1979

APPENDIX 3

Engineering Data

CHECK LIST

HYDROLOGIC AND HYDRAULIC DATA

ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 20% developed, 80% wooded

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 303.2 (38 acre-feet)

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

ELEVATION MAXIMUM DESIGN POOL: 313.6

ELEVATION TOP DAM: 305.3

SPILLWAY CREST: Concrete Weir

a. Elevation 303.0
b. Type Ogee Crest
c. Width 9.0 feet
d. Length 114.2 feet
e. Location Spillover overflow portion of dam
f. Number and Type of Gates N.A.

OUTLET WORKS: 4' x 4' sluice

a. Type Cast iron lift gate
b. Location Adjacent to east end of spillway
c. Entrance inverts 295.6
d. Exit inverts 295.6
e. Emergency draindown facilities: Raise gate

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) 1565 c.f.s.

APPENDIX 4

Hydrologic Computations

STORCH ENGINEERS

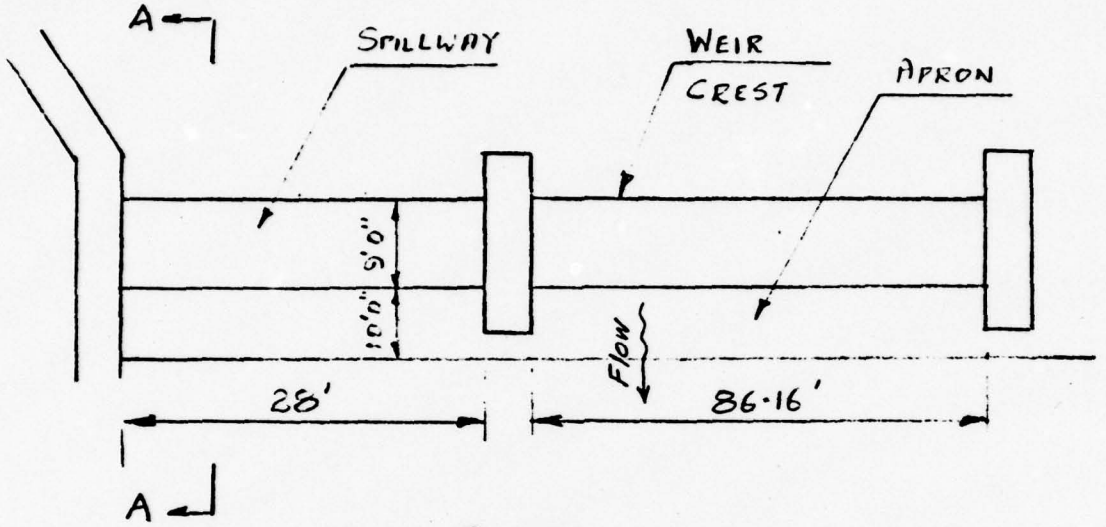
Sheet 1 of 26

Project SE # 1132 B POCAHONTAS DAM — Made By DMP Date 5/2

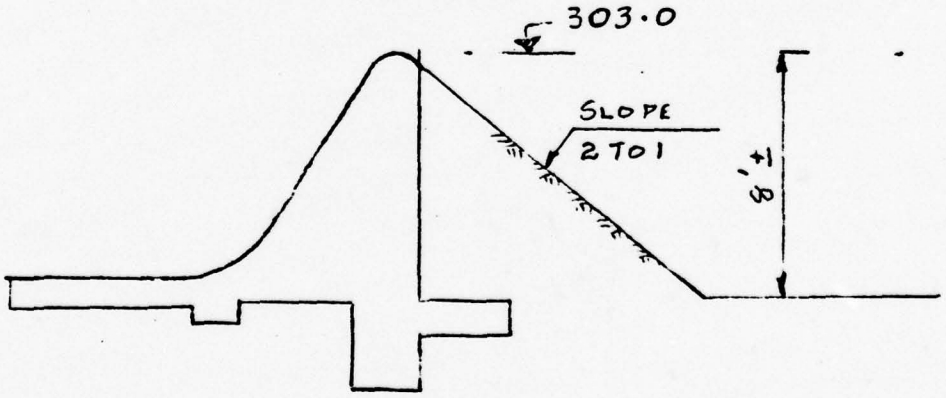
HYDRAULICS — Chkd By JG Date 5/20

HYDRAULICS

PRINCIPAL SPILLWAY



PLAN



SECTION AA

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SPILLWAY DISCHARGE

The discharge over ogee spillway will be calculated by the following formula :

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

where Q = Discharge
C = a variable coefficient of discharge
L = effective length of crest
H_e = total head on the crest

The coefficient of discharge will be calculated using figures 249 and 251 on pages 378 and 379 of 'Design of Small Dams'.

The adjustment for sloping upstream face will be made by interpolating between curves for 1:3 and 2:3 in figure 251.

The effect of end contractions due to the pier and abutment effects will be taken into account using the following formula :-

$$L = L' - 2(NK_p + K_a) H_e$$

where L = effective length of crest
L' = net length of crest
N = number of piers
K_p = pier contraction coefficient
K_a = abutment contraction coefficient
H_e = total head on crest

$$L = (28' + 86.16') - 2(0.02 + 0.10) H_e = 114.16 - 0.24 H_e.$$

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STORCH ENGINEERS

Sheet 3 of 26

Project SE #1132 B PECHANGAS LAKE DAM

Made By DMP Date 5/4

HYDRAULICS

Chkd By JG Date 5/20

Lake Stage Elev.	Hc (ft)	L (114.16 - 0.24H) (ft)	$\frac{P}{H_o}$	C_o (VERTICAL)	$\frac{C_{INCLINED}}{C_{VERTICAL}}$	C (INCLINED)
303	0	114.16	0			-
303.5	0.5	114.04	16	3.95	1.001	3.95
304	1.0	113.92	8	3.95	1.001	3.95
304.5	1.5	113.80	5.33	3.95	1.001	3.95
305	2.0	113.68	4.0	3.95	1.001	3.95
305.3	2.3	113.61	3.48	3.95	1.001	3.95
306	3.0	113.44	2.67	3.95	1.001	3.95
310	7.0	112.48	1.14	3.90	1.004	3.92
315	12.0	111.28	0.67	3.84	1.008	3.87
320	17.0	110.08	0.47	3.79	1.011	3.83
325	22.0	108.88	0.36	3.74	1.012	3.78

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ADJUSTMENT FOR TAILWATER - POCAHONTAS DAM

TAILWATER ELEVATIONS.

Section 1+00 will be used to compute tailwater elevations at different flows.

To Determine Q for Tailwater Elevation 298.2

$$\text{Area} = \tfrac{1}{2}(16\times3.5) + \tfrac{20}{2}(3.5+4.1) + \tfrac{22}{2}(4.1+3.5) + \tfrac{1}{2}(14\times3.5)$$

$$= 28 + 76 + 83.6 + 24.5 = 212.1 \text{ S.F}$$

Wetted Perimeter : $(16.5+20+22+14.5) = 73$ Ft

Slope of Stream bed $= \dfrac{294.1-292.5}{100} = 0.016$ ft/ft.

n for mannings formula : 0.030

$$Q = \frac{1.49}{n}(A)\,R^{2/3}\,S^{1/2}$$

$$= \frac{1.49}{0.03}(212.1)\left(\frac{212.1}{73}\right)^{2/3}(0.016)^{1/2}$$

$$= \frac{1.49}{0.03}(212.1)(2.04)(0.1265) = 2718 \text{ CFS}$$

Q for Tailwater Elevation 303.2

$$\text{Area} = \tfrac{1}{2}(16\times5) + \frac{16.1}{2}(5+8.5) + \tfrac{20}{2}(8.5+9) + \tfrac{22}{2}(9+8.5) + \tfrac{14}{2}(8.5+5) + \tfrac{1}{2}(38\times5)$$

$$= 40 + 108.7 + 175 + 192.5 + 94.5 + 95 = 705.7 \text{ S.F}$$

Wetted Perimeter $= 17 + 16.5 + 20 + 22 + 14.5 + 38 = 128$ Ft

$$Q = \frac{1.49}{0.03}(705.7)\left(\frac{705.7}{128}\right)^{2/3}(0.016)^{1/2} = 13.916 \text{ CFS}$$

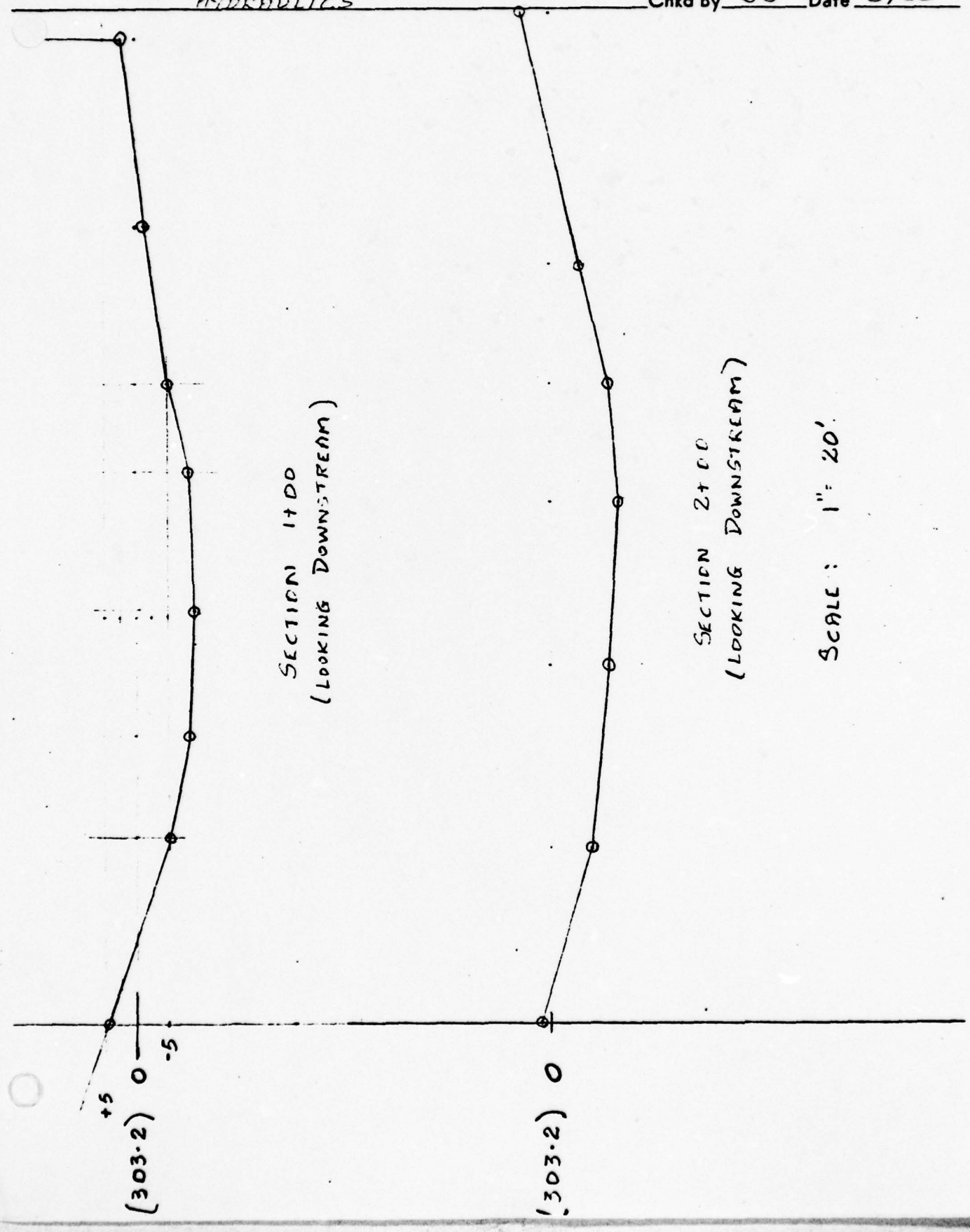
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STORCH ENGINEERS

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Project #1132B POCAHONTAS LAKE DAM Made By DMP Date 5/8

HYDRAULICS Chkd By JG Date 5/20



Q for Tailwater Elevation 305.7

$$\text{Area} = \tfrac{1}{2}(23.5\times7.5) + \tfrac{16.1}{2}(7.5+11) + \tfrac{20}{2}(11+11.5) + \tfrac{22}{2}(11.5+11) + \tfrac{14}{2}(11+7.5) + \tfrac{1}{2}(55\times7.5)$$

$$= 88.1 + 145.9 + 225 + 247.5 + 129.5 + 206.3 = 1045.3 \text{ SF}$$

Wetted Perimeter = $25+16.5+20+22+14.5+55.5 = 153.5$ Ft

$$Q = \frac{1.49}{0.03}(1045.3)\left(\frac{1045.3}{153.5}\right)^{2/3}(0.016)^{1/2} = 23.746 \text{ CFS}$$

Q for Tailwater Elevation 308.2

$$\text{Area} = \tfrac{1}{2}(31\times10) + \tfrac{16.1}{2}(10+13.5) + \tfrac{20}{2}(13.5+14) + \tfrac{22}{2}(14+13.5) + \tfrac{14}{2}(13.5+10) + \tfrac{55}{2}(10+3)$$

$$= 155 + 189 + 275 + 302 + 165 + 358 = 1444 \text{ SF}$$

Wetted Perimeter = $32.2+16.5+20+22+14.5+55.5+3$

$= 163.7$ Ft

$$Q = \frac{1.49}{0.03}(1444)\left(\frac{1444}{163.7}\right)^{2/3}(0.016)^{1/2} = 39.014 \text{ CFS}$$

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STORCH ENGINEERS

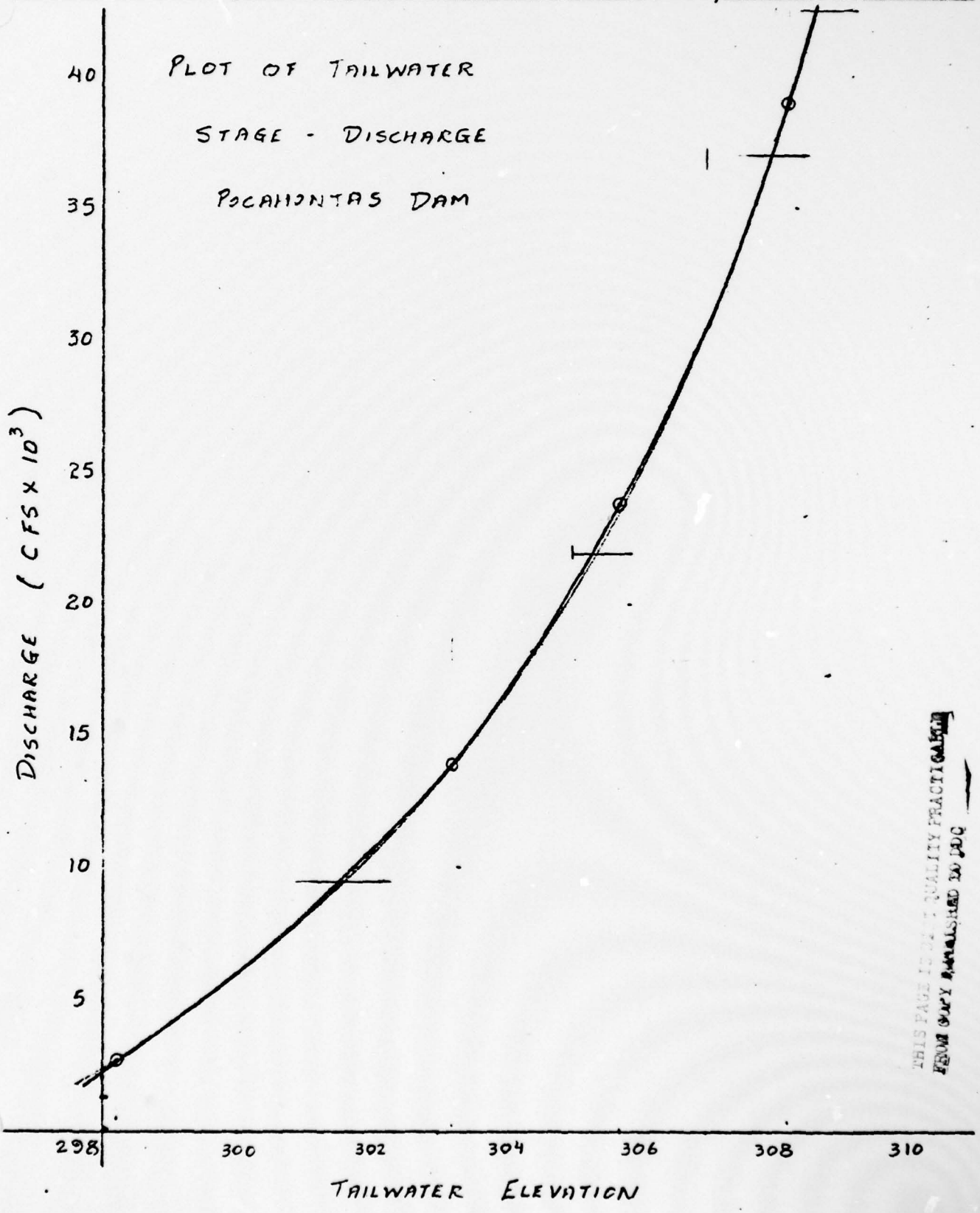
Sheet 7 of 26

Project # 1132 B POCAHONTAS LAKE DAM

Made By DNF Date 5/9

HYDRAULICS

Chkd By JG Date 5/20



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ESTIMATE OF DISCHARGE OVER SPILLWAY & DAM AT VARIOUS ELEVATIONS

Elevation 310 :

$$Q = (3.92)(112.48)(7)^{3/2} + (2.63)(50)(4.7)^{3/2}$$

$$= 8.166 + 1.340 = 9.506 \text{ CFS}$$

Elevation 315 :

$$Q = (3.87)(111.28)(12)^{3/2} + (2.63)(50)(9.7)^{3/2}$$

$$= 17902 + 3.973 = 21875 \text{ CFS}$$

Elevation 320:

$$Q = (3.83)(110.08)(17)^{3/2} + (2.63)(50)(14.7)^{3/2}$$

$$= 29.552 + 7,411 = 36\,963 \text{ CFS}$$

Elevation 312 :

$$Q = (3.90)(112.0)(9)^{3/2} + (2.63)(50)(6.7)^{3/2}$$

$$= 11.794 + 2.281 = 14.075 \text{ CFS}$$

Elevation 317 :

$$Q = (3.85)(110.8)(14)^{3/2} + (2.63)(50)(11.7)^{3/2}$$

$$= 22.346 + 5.263 = 27.609 \text{ CFS}$$

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STORCH ENGINEERS

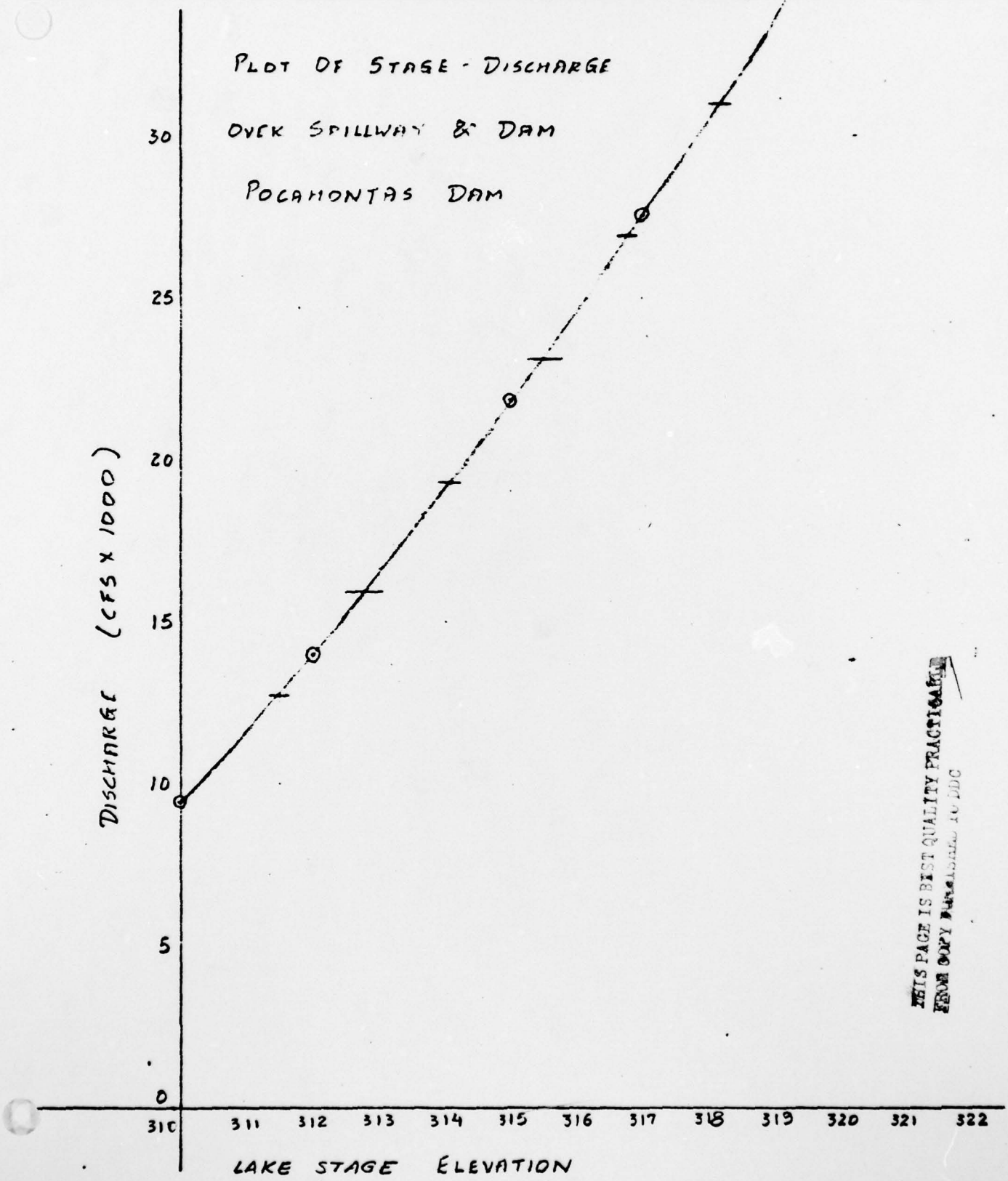
Sheet 9 of 26

Project S.E. # 1132B POCAHONTAS DAM

Made By DMP Date 5/14

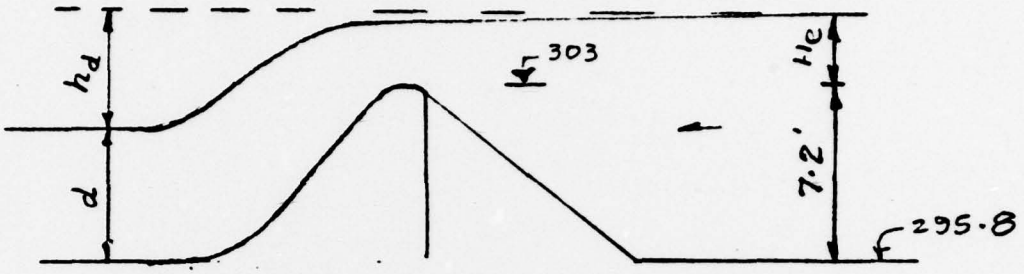
HYDRAULICS

Chkd By JG Date 5/20



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SUBMERGED CREST COEFFICIENTS



Ref: DESIGN OF SMALL DAMS FIG. 252 Page 380

Lake Stage Elev.	Estimate of flow downstream (CFS)	Tailwater Elevation	H_e (ft.)	d (ft)	h_d (ft)	$\frac{h_d}{H_e}$	$\frac{h_d + d}{H_e}$	% Decrease in C Value
310	9.506	301·5	7	5·7	8·5	1·21	2·03	0
315	21,875	305·3	12	9·5	9·7	0·81	1·60	0·8
320	36,963	308·0	17	12·2	12·0	0·71	1·42	3·5

ADUSTED COEFFICIENTS

Lake Stage Elevation	Unadjusted C	% Decrease in C Value	Adjusted C
310	3·92	0	3·92
315	3·87	0·8	3·84
320	3·83	3·5	3·70

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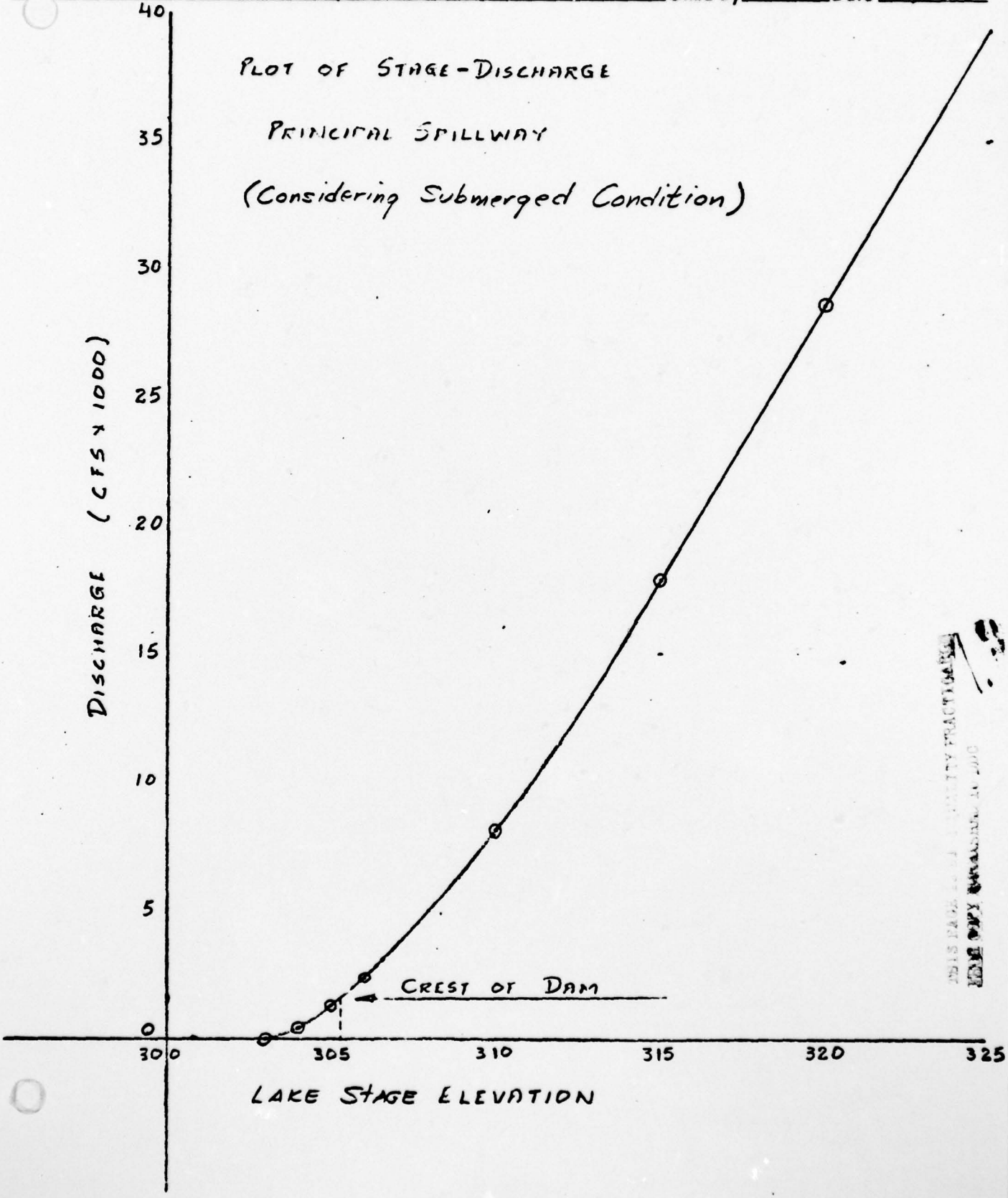
Lake Stage Elev.	H_e (ft)	Adjusted C	L (ft)	Q (CFS)
303.2	0.2	3.95	114.11	40
303.5	0.5	3.95	114.04	159
304	1.0	3.95	113.92	450
304.5	1.5	3.95	113.80	826
305	2.0	3.95	113.68	1270
305.3	2.3	3.95	113.61	1565
306	3.0	3.95	113.44	2328
310	7.0	3.92	112.48	8166
315	12.0	3.84	111.28	17.763
320	17.0	3.70	110.08	28 549

STORCH ENGINEERS

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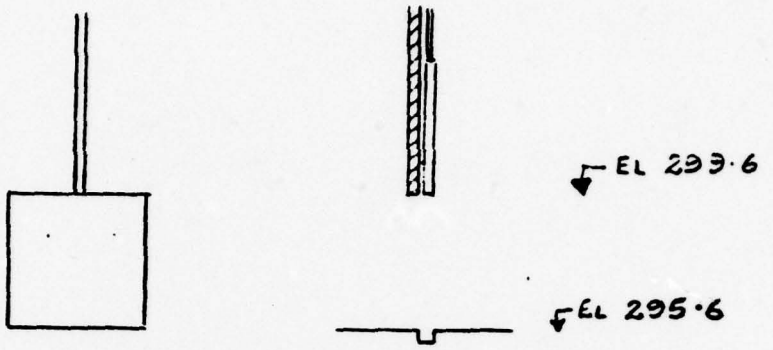
Project SE # 1132 B POCAHONTAS LAKE DAM Made By [illegible] Date 5/11

HYDRAULICS Chkd By JG Date 5/20



OUTLET WORKS

The outlet works consists of one sluice gate 4'x4'



ELEVATION SECTION

SLUICE GATE

The discharge through sluice gate opening will be calculated by the following orifice formula :-

$$Q = C A \sqrt{2gH}$$

where. A = area of the opening
H = the head at the center-line of the orifice.
C = coefficient of discharge for orifice

The value of C from Table 33 Design of Small Dams (Page 472) } = 0.70

A = 16 S.F

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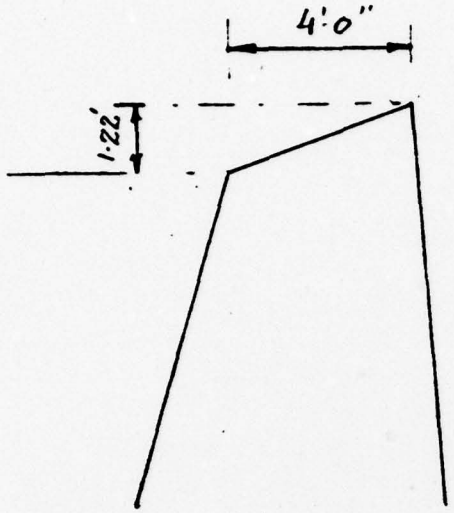
Lake Stage Elevation	h (Ft)	Q (Calc'd) (CFS)
303.2	5.6	213
303.5	5.9	218
304	6.4	227
304.5	6.9	236
305	7.4	244
305.3	7.7	249
306	8.4	260
310	12.4	316
315	17.4	375
320	22.4	425
325	27.4	470

HYDRAULICS

Speedwell Dam

HYDRAULICS

PRINCIPAL SPILLWAY



TYPICAL SPILLWAY SECTION.

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The discharge over the crest of principal spillway will be calculated by the following formula:

$$Q = C L H_c^{3/2}$$ (Ref: Design of Small Dams P 373)

where Q = discharge
C = a variable coefficient of discharge
L = effective length of crest and
H_e = total head on the crest, including velocity of approach head, h_a

The pier and abutment effects will be accounted for by the following formula:

$$L = L' - 2(NK_p + K_a) He$$

(Ref: Design of Small Dams P 373)

where L = effective length of crest
L' = net length of crest
N = number of piers
K_p = pier contraction coefficient
K_a = abutment contraction coefficient and
H_e = total head on crest

For Speedwell Lake Dam spillway,

$L' = 61'5'' + 15'4'' + 48'10\frac{1}{2}'' = 125'\cdot 7\frac{1}{2}''$

$= 125\cdot 625'$

$N = 1$
$K_p = 0.02$
$K_a = 0.20$

Coefficient of Discharge :-

Ref : Handbook of Hydraulics, King & Brater

Page 5.26

From Table 5.12 using data for fig. 5-14 which is nearest to the Speedwell Lake Dam spillway section.

The coefficient of discharge varies from 3.38 to 3.44

Use coefficient of discharge = 3.4.

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Elevation	He (Ft)	L' (Ft)	$2(NK_p + K_a)$	$L = L' - \Sigma(NK_p + K_a)H_e$ (Ft)
311.82	0	125.625	0.44	125.625
312	0.18	125.625	0.44	125.5
313	1.18	125.625	0.44	125.1
314	2.18	125.625	0.44	124.7
315	3.18	125.625	0.44	124.2
316	4.18	125.625	0.44	123.8
316.5	4.68	125.625	0.44	123.6
317	5.18	125.625	0.44	123.3
318	6.18	125.625	0.44	122.9
319	7.18	125.625	0.44	122.5
320	8.18	125.625	0.44	122.0
325	13.18	125.625	0.44	119.8
330	18.18	125.625	0.44	117.6

Elevation	He (Ft)	L (Ft)	Q (CFS)	
311.82	0	125.6	0	
312	0.18	125.5	33	
313	1.18	125.1	545	
314	2.18	124.7	1365	
315	3.18	124.2	2395	
316	4.18	123.8	3,597	
316.5	4.68	123.6	4,255	CREST OF DAM
317	5.18	123.3	4,942	
318	6.18	122.9	6,420	
319	7.18	122.5	8,013	
320	8.18	122.0	9,704	
325	13.18	119.8	19,490	*
330	18.18	117.6	30,994	

* Submerged conditions take place above Elevation 320

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STORCH ENGINEERS

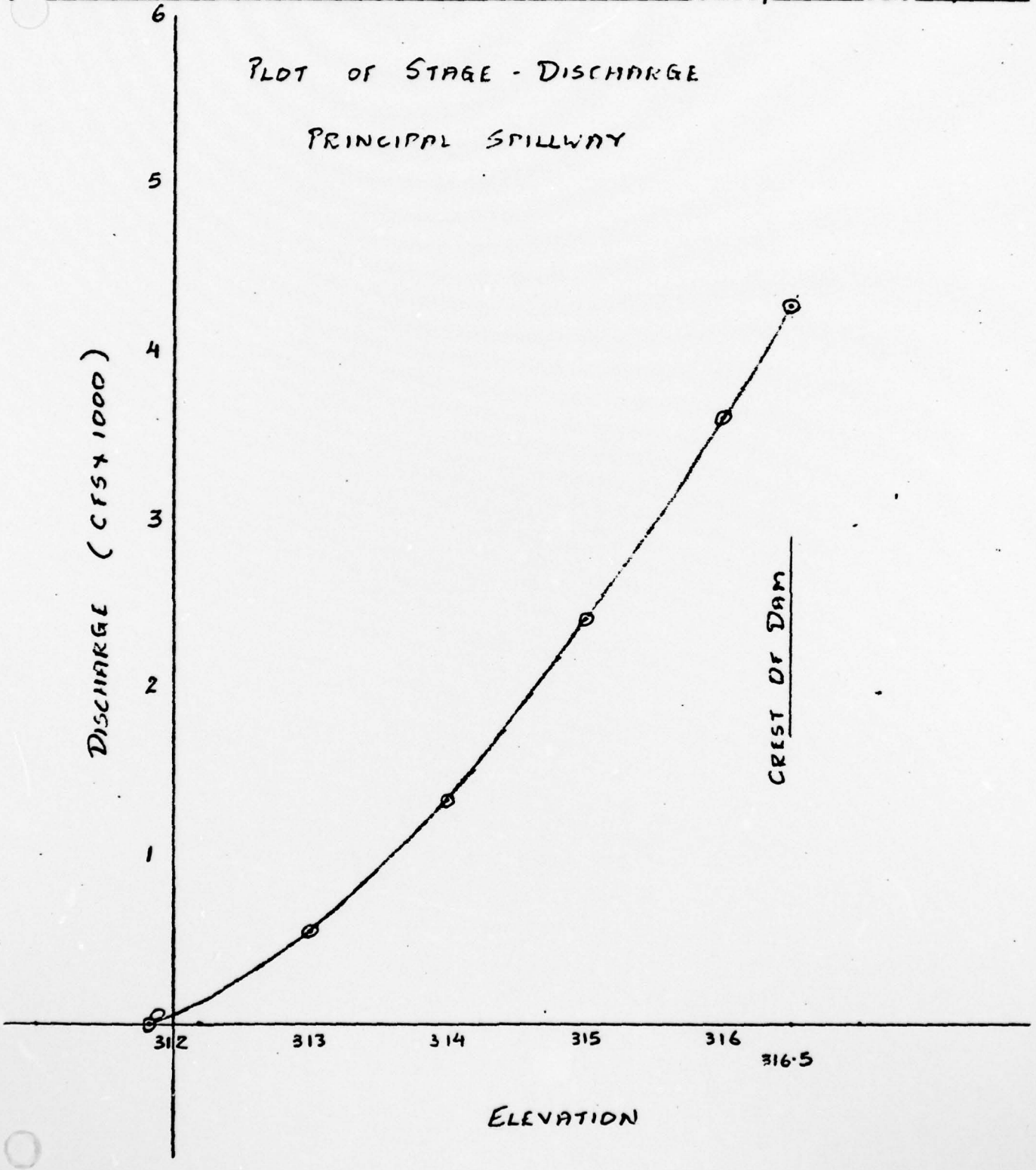
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Project S.E. #1132B SPEEDWELL DAM — Made By DMP Date 11/30

HYDRAULICS — Chkd By JG Date 5/11

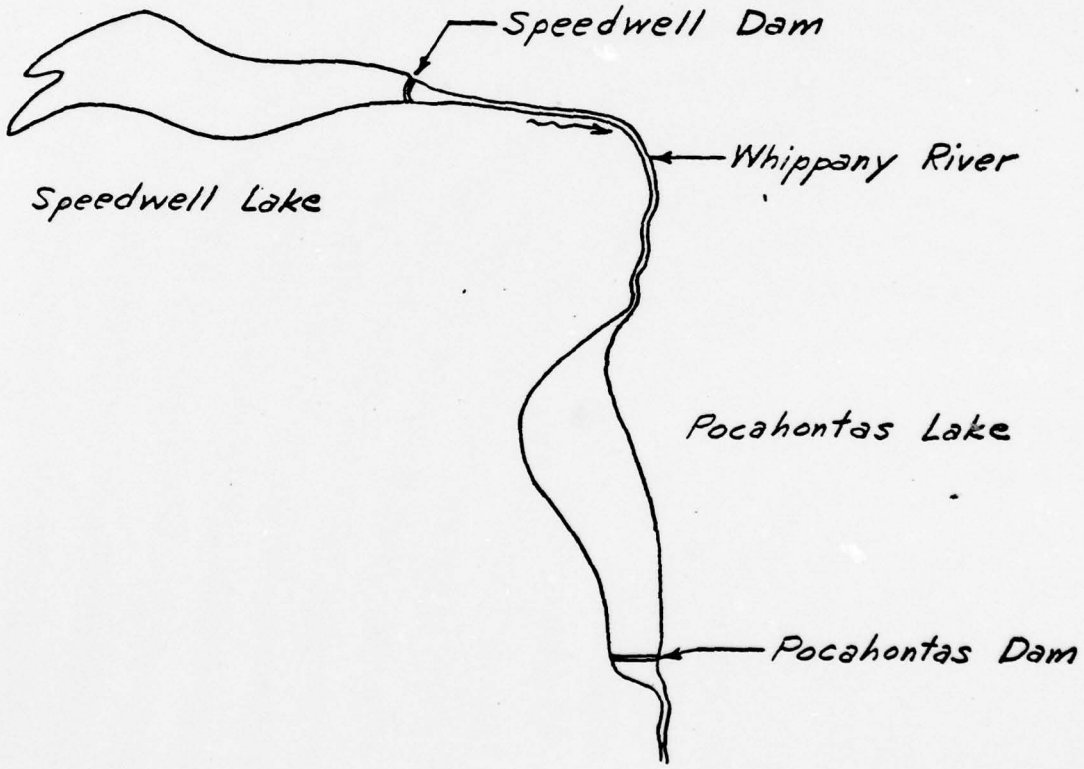
PLOT OF STAGE - DISCHARGE

PRINCIPAL SPILLWAY



HYDROLOGY

Inflow hydrograph was developed using outflow hydrograph for Speedwell Dam.



SDF for Pocahontas Dam is 1/2 PMF

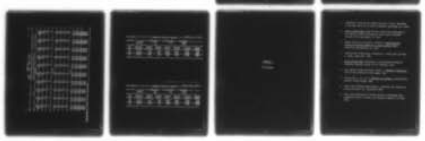
On the following pages, parameters are developed to be used in the HEC-1-DB computer program in computing applicable hydrographs and routings for Speedwell Dam and Pocahontas Dam.

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NATIONAL DAM SAFETY PROGRAM. POCAHONTAS DAM (NJ-00360). PASSAIC--ETC(U)
JUN 79 R J MCDERMOTT, J E GRIBBIN DACW61-79-C-0011

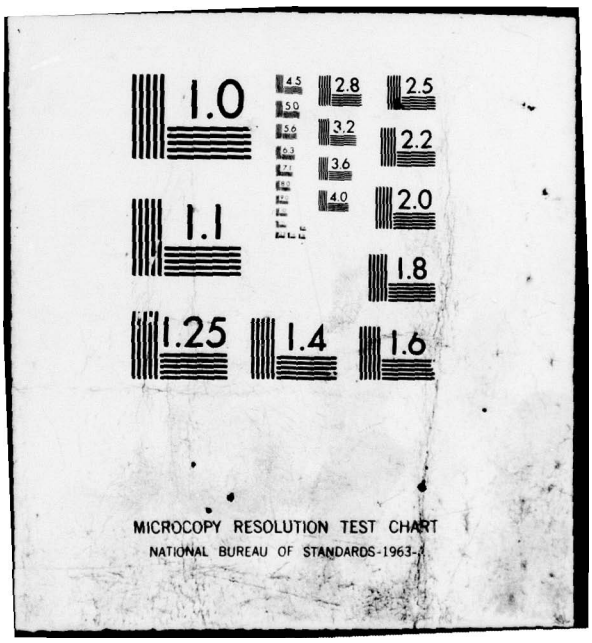
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4.0
4.5
5.0
5.6
6.3
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

UNIT HYDROGRAPH

For Speedwell Lake Dam, the unit hydrograph is developed using the following Snyder's coefficients:-

$$C_t = 2.00$$

& $C_p = 0.62$

Length of the main channel from outlet to divide L } = 7.9 Miles

Distance from the outlet to a point on the stream nearest the centroid of the basin L_c } = 2.3 Miles

$$t_p = C_t (L L_c)^{0.3}$$

$$\therefore \quad t_p = 2.00 (7.9 \times 2.3)^{0.3} = \underline{4.77 \text{ Hrs.}}$$

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Precipitation

(Re: "Design of Small Dams" USDI, 1973.)

From Fig. 15, Zone 6, Probable Maximum Precipitation = 25.2 inches for 6-hr duration and 25 sq. mi. area.

Duration (hr.)	% PMP
6	93
12	100
24	108

Infiltration

Land use: 20% developed, 80% wooded.

Use: Initial infiltration = 1.0 inch

Constant infiltration = 0.10 inch/hr.

Lake Storage Volume

Storage volumes will be computed using HEC-1-DB program from the following data taken from USGS quadrangle and aerial photos.

Speedwell Lake:

Stage Elev.	Surface Area (acres)
311.8	20.2
320	216
340	909

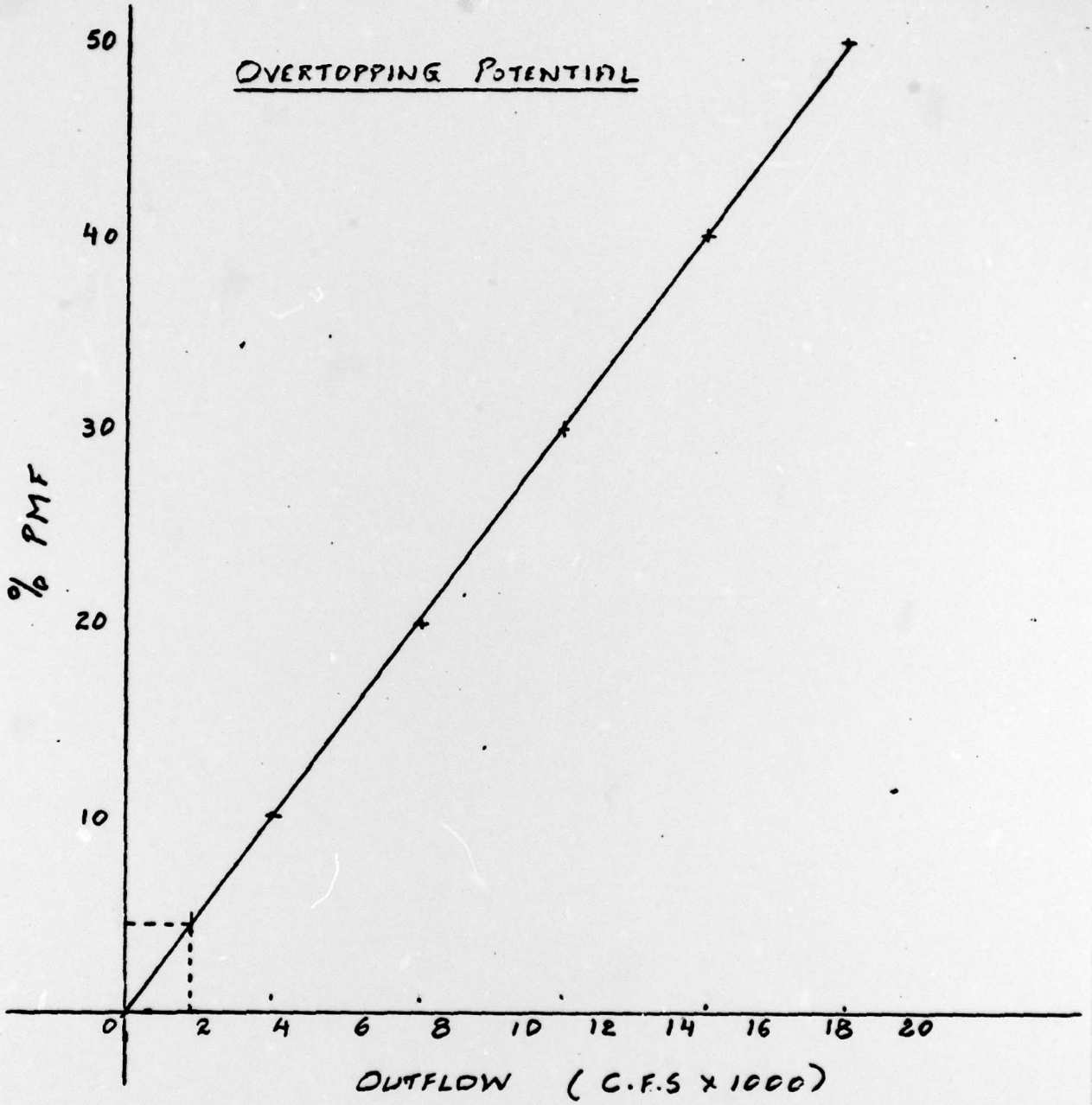
Pocahontas Lake:

Stage Elev.	Surface Area (acres)
295.6	0
303.2	15.4
314	30
324	47

Routing

The 1/2 PMF will be routed through Speedwell Dam and then through Pocahontas Dam by Modified Puls method using HEC-1-DB program.

For dam overtopping analysis for Speedwell Dam, the length of dam will be taken as 177 ft. This length is due to the fact that the ground elevation adjacent to each end of dam is equal to the elevation of the top of dam. When the lake overtops the dam, water will discharge over this ground.



Overtopping of dam occurs at elevation 305.30 with outflow of 1.565 C.F.S which is 4½ % PMF.

HEC-1-DB COMPUTATIONS

```
KI                    NATIONAL DAM SAFETY PROGRAM.
KA                POCAHONTAS DAM, MORRISTOWN, NEWJERSEY.
KA                      MULTI RATIO PMF ROUTING.
KB     150          1         0                                    0         0         5
KS       5
KJ       1          5         1
KJ1    0.5        0.4       0.3       0.2       0.1
KK       0      SPEED                    0         0         1         0
KI1                   INFLOW HYDROGRAPH TO SPEEDWELL LAKE.
KM       1          1      25.2                 25.2         0                             1
KP       0       25.2        93       100       108
KT                                                          1.0      0.10
KW    4.77       0.62
KX    -1.0      -0.05       2.0
KK       1        DAM                    0         0         1         0
KI1                   ROUTE DISCHARGE THROUGH SPEEDWELL LAKE.
KY                                       1         1
KY1      1                                                -312.1        -1
KY4  311.8        312       313       314       315       316     316.5       317       318       319
KY4    320        321       322       323       324       325
KY5      0         33       545      1355      2395      3597      4255      4942      6420      8013
KY5   9704      11338     12798     14144     15457     16625
KA    20.2        216       909
KE   311.8        320       340
KS   311.8
KD   316.5       2.63       1.5       177
KK       1      PO DAM                    0         0         1
KI1                   ROUTE DISCHARGE THRU POCAHONTAS LAKE.
KY                                       1         1
KY1      1                                                -303.2        -1
KY4    303      303.5       304     304.5       305     305.3       306       310       315       320
KY5      0        159       450       826      1270      1565      2328      8166     17763     28549
KA       0       15.4        30        47
KE   295.6      303.2       314       324
KS     303
KD   305.3       2.63       1.5        50
KK      99
KA
KA
KA
KB
KA
```

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NATIONAL DAM SAFETY PROGRAM.
POCAHONTAS DAM, MORRISTOWN, NEWJERSEY.
MULTI RATIO PMF ROUTING.

JOB SPECIFICATION

NO	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
150	1	0	0	0	0	0	0	3	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 5 LRTIO= 1

RTIOS= .50 .40 .30 .20 .10

****

SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH TO SPEEDWELL LAKE.

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
SPEED	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	25.20	0.00	25.20	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	25.20	93.00	100.00	108.00	0.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .830

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.10	0.00	0.00

UNIT HYDROGRAPH DATA
TP= 4.77 CP= .62 NTA= 0

RECESSION DATA
STRTQ= -1.00 QRCSN= -.05 RTIOR= 2.00

APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC= 5.46 AND R= 4.42 INTERVALS

UNIT HYDROGRAPH 27 END-OF-PERIOD ORDINATES, LAG= 4.78 HOURS, CP= .63 VOL= 1.00

183.	664.	1291.	1840.	2116.	2009.	1658.	1321.	1052.	838.
668.	532.	424.	337.	269.	214.	171.	136.	108.	86.
68.	55.	44.	35.	29.	22.	18.			

END-OF-PERIOD FLOW

PMF HYDROGRAPH

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	1.00	1	.11	0.00	.11	24.
1.01	2.00	2	.11	0.00	.11	22.
1.01	3.00	3	.11	0.00	.11	20.
1.01	4.00	4	.11	0.00	.11	19.
1.01	5.00	5	.11	0.00	.11	18.
1.01	6.00	6	.11	0.00	.11	17.
1.01	7.00	7	.24	0.00	.24	16.
1.01	8.00	8	.24	.09	.15	32.
1.01	9.00	9	.24	.14	.10	102.
1.01	10.00	10	.24	.14	.10	255.
1.01	11.00	11	.24	.14	.10	491.
1.01	12.00	12	.24	.14	.10	781.
1.01	13.00	13	1.95	1.85	.10	1387.
1.01	14.00	14	2.33	2.23	.10	2843.
1.01	15.00	15	2.92	2.82	.10	5612.
1.01	16.00	16	7.39	7.29	.10	10616.
1.01	17.00	17	2.72	2.62	.10	17932.
1.01	18.00	18	2.14	2.04	.10	25923.
1.01	19.00	19	.17	.07	.10	32300.
1.01	20.00	20	.17	.07	.10	35246.
1.01	21.00	21	.17	.07	.10	34063.
1.01	22.00	22	.17	.07	.10	29885.
1.01	23.00	23	.17	.07	.10	24816.
1.02	0.00	24	.17	.07	.10	20105.
1.02	1.00	25	0.00	0.00	0.00	16226.
1.02	2.00	26	0.00	0.00	0.00	13101.
1.02	3.00	27	0.00	0.00	0.00	10561.
1.02	4.00	28	0.00	0.00	0.00	8482.
1.02	5.00	29	0.00	0.00	0.00	6783.
1.02	6.00	30	0.00	0.00	0.00	5407.
1.02	7.00	31	0.00	0.00	0.00	4308.
1.02	8.00	32	0.00	0.00	0.00	3432.
1.02	9.00	33	0.00	0.00	0.00	2734.
1.02	10.00	34	0.00	0.00	0.00	2178.
1.02	11.00	35	0.00	0.00	0.00	1755.
1.02	12.00	36	0.00	0.00	0.00	1637.
1.02	13.00	37	0.00	0.00	0.00	1528.
1.02	14.00	38	0.00	0.00	0.00	1425.
1.02	15.00	39	0.00	0.00	0.00	1330.
1.02	16.00	40	0.00	0.00	0.00	1241.
1.02	17.00	41	0.00	0.00	0.00	1158.
1.02	18.00	42	0.00	0.00	0.00	1080.
1.02	19.00	43	0.00	0.00	0.00	1008.
1.02	20.00	44	0.00	0.00	0.00	940.
1.02	21.00	45	0.00	0.00	0.00	877.
1.02	22.00	46	0.00	0.00	0.00	819.
1.02	23.00	47	0.00	0.00	0.00	764.
1.03	0.00	48	0.00	0.00	0.00	713.
1.03	1.00	49	0.00	0.00	0.00	665.
1.03	2.00	50	0.00	0.00	0.00	620.
1.03	3.00	51	0.00	0.00	0.00	579.
1.03	4.00	52	0.00	0.00	0.00	540.
1.03	5.00	53	0.00	0.00	0.00	504.
1.03	6.00	54	0.00	0.00	0.00	470.
1.03	7.00	55	0.00	0.00	0.00	439.
1.03	8.00	56	0.00	0.00	0.00	409.
1.03	9.00	57	0.00	0.00	0.00	382.
1.03	10.00	58	0.00	0.00	0.00	356.
1.03	11.00	59	0.00	0.00	0.00	332.
1.03	12.00	60	0.00	0.00	0.00	310.
1.03	13.00	61	0.00	0.00	0.00	289.
1.03	14.00	62	0.00	0.00	0.00	270.
1.03	15.00	63	0.00	0.00	0.00	252.
1.03	16.00	64	0.00	0.00	0.00	235.
1.03	17.00	65	0.00	0.00	0.00	219.
1.03	18.00	66	0.00	0.00	0.00	205.
1.03	19.00	67	0.00	0.00	0.00	191.
1.03	20.00	68	0.00	0.00	0.00	178.
1.03	21.00	69	0.00	0.00	0.00	166.
1.03	22.00	70	0.00	0.00	0.00	155.
1.03	23.00	71	0.00	0.00	0.00	145.
1.04	0.00	72	0.00	0.00	0.00	135.
1.04	1.00	73	0.00	0.00	0.00	126.
1.04	2.00	74	0.00	0.00	0.00	118.
1.04	3.00	75	0.00	0.00	0.00	110.

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END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.04	4.00	76	0.00	0.00	0.00	102.
1.04	5.00	77	0.00	0.00	0.00	95.
1.04	6.00	78	0.00	0.00	0.00	89.
1.04	7.00	79	0.00	0.00	0.00	83.
1.04	8.00	80	0.00	0.00	0.00	78.
1.04	9.00	81	0.00	0.00	0.00	72.
1.04	10.00	82	0.00	0.00	0.00	68.
1.04	11.00	83	0.00	0.00	0.00	63.
1.04	12.00	84	0.00	0.00	0.00	59.
1.04	13.00	85	0.00	0.00	0.00	55.
1.04	14.00	86	0.00	0.00	0.00	51.
1.04	15.00	87	0.00	0.00	0.00	48.
1.04	16.00	88	0.00	0.00	0.00	45.
1.04	17.00	89	0.00	0.00	0.00	42.
1.04	18.00	90	0.00	0.00	0.00	39.
1.04	19.00	91	0.00	0.00	0.00	36.
1.04	20.00	92	0.00	0.00	0.00	34.
1.04	21.00	93	0.00	0.00	0.00	31.
1.04	22.00	94	0.00	0.00	0.00	29.
1.04	23.00	95	0.00	0.00	0.00	27.
1.05	0.00	96	0.00	0.00	0.00	26.
1.05	1.00	97	0.00	0.00	0.00	24.
1.05	2.00	98	0.00	0.00	0.00	22.
1.05	3.00	99	0.00	0.00	0.00	21.
1.05	4.00	100	0.00	0.00	0.00	19.
1.05	5.00	101	0.00	0.00	0.00	18.
1.05	6.00	102	0.00	0.00	0.00	17.
1.05	7.00	103	0.00	0.00	0.00	16.
1.05	8.00	104	0.00	0.00	0.00	15.
1.05	9.00	105	0.00	0.00	0.00	14.
1.05	10.00	106	0.00	0.00	0.00	13.
1.05	11.00	107	0.00	0.00	0.00	12.
1.05	12.00	108	0.00	0.00	0.00	11.
1.05	13.00	109	0.00	0.00	0.00	10.
1.05	14.00	110	0.00	0.00	0.00	10.
1.05	15.00	111	0.00	0.00	0.00	9.
1.05	16.00	112	0.00	0.00	0.00	8.
1.05	17.00	113	0.00	0.00	0.00	8.
1.05	18.00	114	0.00	0.00	0.00	7.
1.05	19.00	115	0.00	0.00	0.00	7.
1.05	20.00	116	0.00	0.00	0.00	6.
1.05	21.00	117	0.00	0.00	0.00	6.
1.05	22.00	118	0.00	0.00	0.00	6.
1.05	23.00	119	0.00	0.00	0.00	5.
1.06	0.00	120	0.00	0.00	0.00	5.
1.06	1.00	121	0.00	0.00	0.00	5.
1.06	2.00	122	0.00	0.00	0.00	4.
1.06	3.00	123	0.00	0.00	0.00	4.
1.06	4.00	124	0.00	0.00	0.00	4.
1.06	5.00	125	0.00	0.00	0.00	3.
1.06	6.00	126	0.00	0.00	0.00	3.
1.06	7.00	127	0.00	0.00	0.00	3.
1.06	8.00	128	0.00	0.00	0.00	3.
1.06	9.00	129	0.00	0.00	0.00	3.
1.06	10.00	130	0.00	0.00	0.00	2.
1.06	11.00	131	0.00	0.00	0.00	2.
1.06	12.00	132	0.00	0.00	0.00	2.
1.06	13.00	133	0.00	0.00	0.00	2.
1.06	14.00	134	0.00	0.00	0.00	2.
1.06	15.00	135	0.00	0.00	0.00	2.
1.06	16.00	136	0.00	0.00	0.00	2.
1.06	17.00	137	0.00	0.00	0.00	1.
1.06	18.00	138	0.00	0.00	0.00	1.
1.06	19.00	139	0.00	0.00	0.00	1.
1.06	20.00	140	0.00	0.00	0.00	1.
1.06	21.00	141	0.00	0.00	0.00	1.
1.06	22.00	142	0.00	0.00	0.00	1.
1.06	23.00	143	0.00	0.00	0.00	1.
1.07	0.00	144	0.00	0.00	0.00	1.
1.07	1.00	145	0.00	0.00	0.00	1.
1.07	2.00	146	0.00	0.00	0.00	1.
1.07	3.00	147	0.00	0.00	0.00	1.
1.07	4.00	148	0.00	0.00	0.00	1.
1.07	5.00	149	0.00	0.00	0.00	1.
1.07	6.00	150	0.00	0.00	0.00	1.

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HYDROGRAPH ROUTING

ROUTE DISCHARGE THROUGH SPEEDWELL LAKE.

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
DAM	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-312.	-1

STAGE	311.00	312.00	313.00	314.00	315.00	316.00	316.50	317.00	318.00	319.00
	320.00	321.00	322.00	323.00	324.00	325.00				
FLOW	0.00	33.00	545.00	1365.00	2395.00	3597.00	4255.00	4942.00	6420.00	8013.00
	9704.00	11338.00	12798.00	14144.00	15457.00	16625.00				
SURFACE AREA=	20.	216.	909.							
CAPACITY=	0.	826.	11280.							
ELEVATION=	312.	320.	340.							

CREL	SPWID	COOW	EXPW	ELEVL	COOL	CAREA	EXPL
311.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COOD	EXPD	DAMWID
316.5	2.6	1.5	177.

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STATION DAM, PLAN 1, RATIO 1

½ PMF

END-OF-PERIOD HYDROGRAPH ORDINATES

Route Discharge thru Speedwell Lake

OUTFLOW

24.	18.	14.	13.	11.	10.	9.	10.	21.	74.
176.	300.	494.	999.	1936.	3545.	6288.	9969.	13390.	15860.
16843.	16271.	14467.	12138.	9820.	7878.	6314.	5064.	4126.	3366.
2665.	2094.	1642.	1288.	1036.	872.	799.	743.	693.	646.
602.	561.	528.	497.	464.	433.	403.	376.	350.	326.
304.	284.	264.	246.	230.	215.	200.	187.	174.	162.
151.	141.	132.	123.	115.	107.	100.	93.	87.	81.
75.	70.	66.	61.	57.	53.	50.	46.	43.	40.
38.	35.	33.	32.	31.	29.	27.	26.	24.	22.
21.	20.	18.	17.	16.	15.	14.	13.	12.	11.
10.	10.	9.	8.	8.	7.	7.	6.	6.	6.
5.	5.	5.	4.	4.	4.	3.	3.	3.	3.
3.	2.	2.	2.	2.	2.	2.	2.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	0.	0.	0.	0.	0.	0.

STORAGE

3.	2.	2.	2.	1.	1.	1.	1.	3.	6.
11.	18.	30.	55.	109.	218.	401.	635.	873.	1060.
1141.	1094.	954.	782.	626.	500.	403.	326.	262.	204.
155.	119.	92.	72.	57.	49.	45.	42.	40.	38.
36.	34.	32.	30.	28.	26.	24.	22.	21.	19.
18.	17.	16.	15.	14.	13.	12.	12.	11.	10.
10.	9.	9.	8.	8.	8.	7.	7.	7.	6.
6.	6.	6.	6.	5.	5.	5.	5.	5.	5.
4.	4.	4.	4.	4.	4.	4.	3.	3.	3.
3.	2.	2.	2.	2.	2.	2.	2.	2.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

STAGE

311.9	311.9	311.9	311.9	311.9	311.9	311.9	311.9	311.9	312.1
312.3	312.5	312.9	313.6	314.6	316.0	317.6	319.0	320.2	321.0
321.4	321.2	320.6	319.8	319.0	318.2	317.6	317.0	316.4	315.8
315.2	314.7	314.3	313.9	313.6	313.4	313.3	313.2	313.2	313.1
313.1	313.0	313.0	312.9	312.8	312.8	312.7	312.7	312.6	312.6
312.5	312.5	312.5	312.4	312.4	312.4	312.3	312.3	312.3	312.3
312.2	312.2	312.2	312.2	312.2	312.1	312.1	312.1	312.1	312.1
312.1	312.1	312.1	312.1	312.0	312.0	312.0	312.0	312.0	312.0
312.0	312.0	312.0	312.0	312.0	312.0	312.0	312.0	311.9	311.9
311.9	311.9	311.9	311.9	311.9	311.9	311.9	311.9	311.9	311.9
311.9	311.9	311.9	311.9	311.8	311.8	311.8	311.8	311.8	311.8
311.8	311.9	311.8	311.8	311.8	311.8	311.8	311.8	311.8	311.8
311.8	311.9	311.8	311.8	311.8	311.8	311.8	311.8	311.8	311.8
311.8	311.9	311.8	311.8	311.8	311.8	311.8	311.8	311.8	311.8

PEAK OUTFLOW IS 16843. AT TIME 21.00 HOURS

DAM DATA

TOPEL	COQD	EXPD	DAMWID
305.3	2.6	1.5	50.

STATION PO DAM, PLAN 1, RATIO 1

½ PMF

END-OF-PERIOD HYDROGRAPH ORDINATES

Route Discharge Thru Pocahontas Dam

OUTFLOW

27.	22.	17.	14.	12.	11.	10.	10.	15.	46.
120.	251.	426.	842.	1709.	3275.	5833.	9371.	13043.	15537.
16813.	16412.	14774.	12448.	10107.	8152.	6523.	5229.	4242.	3468.
2761.	2180.	1724.	1357.	1089.	904.	811.	759.	706.	658.
613.	572.	537.	506.	473.	442.	413.	385.	359.	334.
312.	291.	271.	253.	235.	220.	205.	191.	178.	166.
156.	147.	137.	128.	119.	111.	105.	98.	91.	85.
79.	74.	69.	64.	60.	56.	52.	49.	45.	42.
39.	37.	34.	33.	31.	30.	28.	27.	25.	23.
22.	20.	19.	18.	17.	15.	14.	13.	13.	12.
11.	10.	9.	9.	8.	8.	7.	7.	6.	6.
5.	5.	5.	4.	4.	4.	4.	3.	3.	3.
3.	3.	2.	2.	2.	2.	2.	2.	2.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	0.	0.	0.	0.	0.

STORAGE

37.	37.	37.	37.	37.	37.	36.	36.	37.	38.
82.	96.	51.	60.	76.	97.	127.	170.	209.	237.
252.	247.	228.	203.	178.	155.	135.	120.	108.	99.
91.	85.	79.	70.	65.	61.	60.	59.	57.	56.
55.	54.	54.	53.	52.	51.	51.	50.	49.	48.
48.	47.	47.	46.	46.	45.	45.	45.	44.	44.
44.	43.	43.	42.	42.	41.	41.	41.	40.	40.
40.	40.	39.	39.	39.	39.	38.	38.	38.	38.
38.	38.	38.	38.	37.	37.	37.	37.	37.	37.
37.	37.	37.	37.	37.	37.	37.	37.	37.	37.
37.	36.	36.	36.	36.	36.	36.	36.	36.	36.
36.	36.	36.	36.	36.	36.	36.	36.	36.	36.
36.	36.	36.	36.	36.	36.	36.	36.	36.	36.
36.	36.	36.	36.	36.	36.	36.	36.	36.	36.
36.	36.	36.	36.	36.	36.	36.	36.	36.	36.

STAGE

303.1	303.1	303.1	303.0	303.0	303.0	303.0	303.0	303.0	303.1
303.4	303.7	304.0	304.5	305.4	306.5	308.0	309.9	311.5	312.5
313.0	312.9	312.2	311.2	310.3	309.3	308.4	307.7	307.1	306.6
306.2	305.8	305.4	305.1	304.8	304.6	304.5	304.4	304.3	304.3
304.2	304.2	304.1	304.1	304.0	304.0	303.9	303.9	303.8	303.8
303.8	303.7	303.7	303.7	303.6	303.6	303.6	303.6	303.5	303.5
303.5	303.5	303.4	303.4	303.4	303.4	303.3	303.3	303.3	303.3
303.2	303.2	303.2	303.2	303.2	303.2	303.2	303.2	303.1	303.1
303.1	303.1	303.1	303.1	303.1	303.1	303.1	303.1	303.1	303.1
303.1	303.1	303.1	303.1	303.1	303.0	303.0	303.0	303.0	303.0
303.0	303.0	303.0	303.0	303.0	303.0	303.0	303.0	303.0	303.0
303.0	303.0	303.0	303.0	303.0	303.0	303.0	303.0	303.0	303.0
303.0	303.0	303.0	303.0	303.0	303.0	303.0	303.0	303.0	303.0
303.0	303.0	303.0	303.0	303.0	303.0	303.0	303.0	303.0	303.0
303.0	303.0	303.0	303.0	303.0	303.0	303.0	303.0	303.0	303.0

PEAK OUTFLOW IS 16813. AT TIME 21.00 HOURS

Speedwell Dam

SUMMARY OF DAM SAFETY ANALYSIS

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	312.10	311.80	316.50
STORAGE	7.	0.	272.
OUTFLOW	84.	0.	4255.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	321.36	4.86	1141.	16843.	12.00	21.00	0.00
.40	320.28	3.78	886.	13568.	11.00	21.00	0.00
.30	319.14	2.64	653.	10237.	9.00	21.00	0.00
.20	317.81	1.31	435.	6858.	6.00	21.00	0.00
.10	315.83	0.00	206.	3395.	0.00	21.00	0.00

Pocahontas Dam

SUMMARY OF DAM SAFETY ANALYSIS

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	303.20	303.00	305.30
STORAGE	39.	36.	74.
OUTFLOW	64.	0.	1565.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	313.03	7.73	252.	16813.	19.00	21.00	0.00
.40	311.69	6.39	215.	13534.	17.00	21.00	0.00
.30	310.31	5.01	181.	10239.	16.00	21.00	0.00
.20	308.55	3.25	139.	6828.	13.00	21.00	0.00
.10	306.59	1.29	98.	3386.	9.00	21.00	0.00

APPENDIX 5

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