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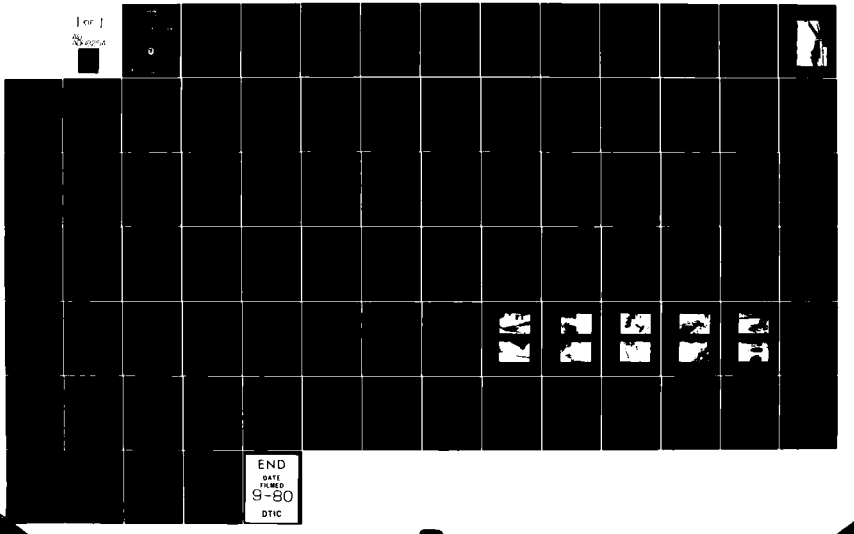

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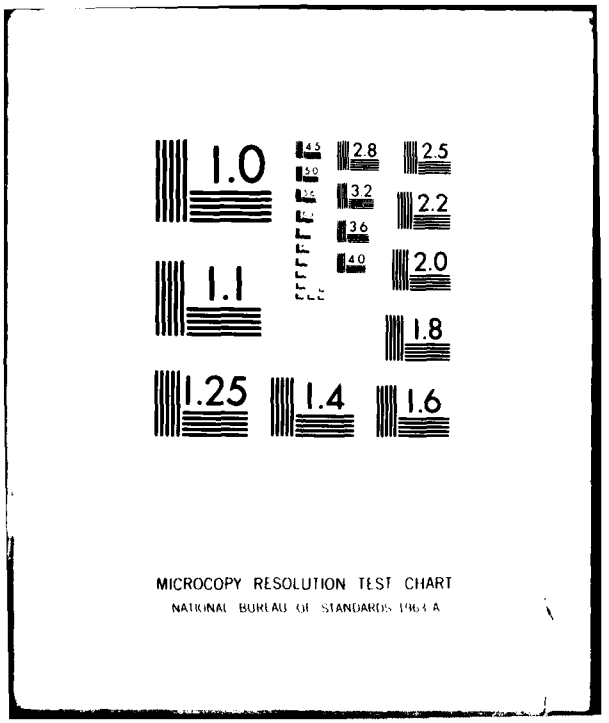
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RARITAN RIVER BASIN
SOUTH BRANCH OF RARITAN RIVER
HUNTERDON COUNTY
NEW JERSEY

CLINTON MILLS DAM
NJ 00122

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

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

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MARCH 1980

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

(10) Richard J. McDermott

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Dams	National Dam Safety Program
Embankments	Clinton Mills Dam, New Jersey
Visual Inspection	Spillways
Structural Analysis	Seepage

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

IN REPLY REFER TO
NAPEN-N

11 AUG 1980

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

Dear Governor Byrne:

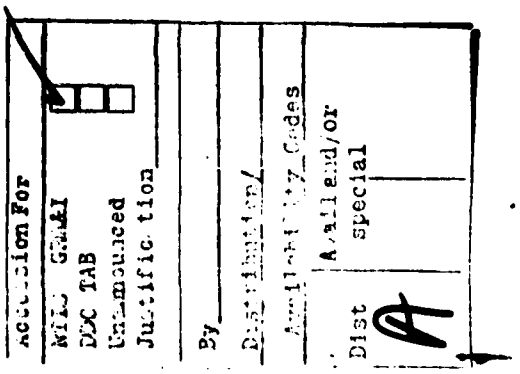
Inclosed is the Phase I Inspection Report for Clinton Mills Dam in Hunterdon County, New Jersey which has been prepared under authorization of the Dam Inspection Act, Public Law 92-367. A brief assessment of the dam's condition is given in the front of the report.

Based on visual inspection, available records, calculations and past operational performance, Clinton Mills 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 five 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 six months 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 owners should, within six months from the date of approval of this report, 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.

c. The following remedial measures should be initiated within six months from the date of approval of this report:



(1) The low level outlet should be investigated and if found to be insufficient to achieve a draw down of the impoundment, should be replaced by a suitable outlet facility designed by a professional consultant engaged by the owner.

(2) The spillway should be thoroughly inspected with the impoundment drawn down. During the inspection, special care should be taken to observe any indication of seepage under the spillway. The spillway should then be renovated in accordance with the findings of the inspection.

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

(4) The training wall at the left end of the spillway should be repaired and the adjacent area suitably filled and stabilized.

(5) The pin-hole leak in the wall of the right mill building should be repaired.

d. 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 Congressman Courter of the Thirteenth 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.

NAPEN-N
Honorable Brendan T. Byrne

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

1 Incl
As stated

JAMES G. TON
Colonel, Corps of Engineers
District Engineer

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

CLINTON MILLS DAM (NJ00122)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 19 and 28 November 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.

Clinton Mills 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 five 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 six months 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 owners should, within six months from the date of approval of this report, 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.

c. The following remedial measures should be initiated within six months from the date of approval of this report:

(1) The low level outlet should be investigated and if found to be insufficient to achieve a draw down of the impoundment, should be replaced by a suitable outlet facility designed by a professional consultant engaged by the owner.

(2) The spillway should be thoroughly inspected with the impoundment drawn down. During the inspection, special care should be taken to observe any indication of seepage under the spillway. The spillway should then be renovated in accordance with the findings of the inspection.

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

(4) The training wall at the left end of the spillway should be repaired and the adjacent area suitably filled and stabilized.

(5) The pin-hole leak in the wall of the right mill building should be repaired.

d. 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: 24 Jul '80

PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam:	Clinton Mills Dam, NJ00122
State Located:	New Jersey
County Located:	Hunterdon
Drainage Basin:	Raritan River
Stream:	South Branch of Raritan River
Dates of Inspections:	November 19, 1979
	November 28, 1979

Assessment of General Condition of Dam

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

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

Hydraulic and hydrologic analyses indicate that the spillway is inadequate. 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 Clinton Mills Dam is equal to one-half the probable maximum flood.) The spillway is capable of passing approximately 2 percent of the probable maximum flood or 4 percent of the SDF. Therefore, the owners should engage a professional engineer experienced in the design and construction of dams in the near 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.

The owners should, in the near future, 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.

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

1) The low level outlet should be investigated and if found to be insufficient to achieve a drawdown of the impoundment, should be replaced by a suitable outlet facility designed by a professional engineer experienced in the design and construction of dams.
2) The spillway should be thoroughly inspected with the impoundment drawn down. During the inspection, special care should be taken to observe any indications of seepage under the spillway. The spillway should then be renovated in accordance with the findings of the inspection.
3) The channel bottom immediately downstream from the spillway apron should be filled and suitably stabilized.
4) The training wall at the left end of the spillway should be repaired and the adjacent area suitably filled and stabilized.
5) The pin-hole leak in the wall of the right mill building should be repaired.

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.

In addition to Clinton Mills Dam, an upstream dike, located along the east bank, impounds the river. The dike is referred to as Clinton Mills Dike. Remedial measures to correct the inadequate condition of

the spillway of Clinton Mills Dam should be performed in conjunction with remedial measures for the dike as specified in "Clinton Mills Dike, NJ00564, Phase I Inspection Report, National Dam Safety Program," dated March 1980.

Richard J. McDermott, P.E.

John E. Gribbin, P.E.

OVERVIEW - CLINTON MILLS DAM

28 DECEMBER 1979

TABLE OF CONTENTS

TABLE OF CONTENTS (cont.)

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.

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

CLINTON MILLS DAM, I.D. NJ00122

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 inspections of Clinton Mills Dam were made on November 19 and 28, 1979. The purpose of the inspections 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

Clinton Mills Dam is a run of the river concrete dam across the South Branch Raritan River in Clinton, New Jersey. The 170 foot long overflow portion of the dam forms the spillway while a stone masonry training wall on the left side of the spillway forms the remainder of the dam. The top of the training wall is taken to be the top of dam with elevation 190.3 National Geodetic Vertical Datum (N.G.V.D.). The elevation of the spillway crest is 188.0 and that of the stream bed at the spillway apron is 176.5. The height of the dam is 13.8 feet. The spillway is composed of a concrete slab resting on earth fill and the remains of an old stone rubble dam. The slab forms upstream and downstream faces and a downstream apron. The spillway abuts stone masonry training walls at both ends.

Former mill buildings are located at each end of the dam, the right building now housing the Clinton Historic Museum and the left building now housing the Hunterdon Art Center.

The outlet works is located at the upstream end of the mill race adjacent to the right mill building and consists of two gated cast iron pipes. One pipe is a low level outlet having a diameter of 36 inches while the other pipe, having a diameter of 24 inches is used to operate a water wheel associated with the mill. A trash rack composed of steel pipes is located immediately upstram from the outlet works. A hydro-electric turbine is located in the mill race adjacent to the water wheel. Reportedly, the turbine was installed early in the 1900's and was never operated.

The mill race for the left mill building is currently abandoned and partially filled with concrete rubble.

b. Location

Clinton Mills Dam is located in the Town of Clinton, Hunterdon County, New Jersey. Constructed across the South Branch Raritan River, it forms one of the focal points of historic interest in the commercial center of Clinton.

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

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

HAZARD POTENTIAL CLASSIFICATION

Category	Loss of Life (Extent of Development)	Economic Loss (Extent of Development)
Low	None expected (no permanent structures for human habitation	Minimal (Undeveloped to 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 Clinton Mills Dam have been obtained for this Phase I assessment:

Storage: 50 Acre-feet

Height: 13.8 feet

Potential Loss of Life:

An urban area of Clinton containing commercial and residential development is located on both sides of the downstream channel. Failure of the dam could possibly cause loss of life.

Potential Economic Loss:

A steel road bridge (Main Street) is located 120 feet from the dam. The Route 173 (old Route 22) bridge is located 400 feet from the dam. Failure of the dam could cause damage to these bridges and to the urban development located in the downstream flood plain.

Therefore, Clinton Mills Dam is classified as "Small" size and "Significant" hazard potential.

d. Ownership

The dam is reportedly owned jointly by the Clinton Historical Museum Village on the right, or west bank, and the Hunterdon Arts Center on the left, or east bank.

e. Purpose of Dam

The original purpose of the dam was to generate power for the mills in the early 1900's. The dam currently serves aesthetic and historic purposes.

f. Design and Construction History

Clinton Mills Dam was reportedly constructed in the 1800's. No description of original construction is available. In 1907 it was reconstructed following a washout. No information concerning the reconstruction in 1907 is available. The spillway and left training wall were again reconstructed in 1950. Design for the reconstruction was prepared by John E. Studer, P.E., Clinton and construction was performed by William Schaaf, Baptistown.

g. Normal Operational Procedures

The dam and appurtenances are operated and maintained by the Town of Clinton. Repairs are made on an "as needed" basis. Reportedly, the outlet works is not opened during heavy rainstorms or to drain the lake.

1.3 Pertinent Data

a. Drainage Area	111 sq. miles
b. Discharge at Damsite	
Maximum known flood at damsite	8080 c.f.s. (Aug. 19, 1955)
Outlet works at pool elevation	75 c.f.s.
Spillway capacity at top of dam	1906 c.f.s.
c. Elevation (N.G.V.D.)	
Top of dam	190.3
Maximum pool-design surcharge	200.4
Spillway crest	188.0
Stream bed at toe of dam	176.5
Maximum tailwater	185.0 (Estimated)

d. Reservoir

Length of maximum pool	5000 Feet ± (Impoundment is a reach of the South Branch Raritan River)

e. Storage (Acre-feet)

Normal pool	21 Acre-feet
Design surcharge	820 Acre-feet
Top of dam	50 Acre-feet

f. Reservoir Surface (Acres)

Top of dam	32 Acres ±
Maximum pool-design surcharge	154 Acres ±
Normal pool	10 Acres ±

g. Dam

Type	Earthfill & Masonry
Length	218 feet
Height	13.8 feet
Sideslopes - Upstream	1 vert. to 6 horiz.
- Downstream	1 vert. to 1 horiz.
Zoning	Unknown
Impervious core	Unknown
Cutoff	None
Grout curtain	Unknown

h. Diversion and Regulating Tunnel N.A.

i. Spillway

Type	Free overflow weir
Length of weir	170 feet

Crest elevation	188.0
Gates	None
Approach channel	N.A.
Discharge channel	Spillway discharges directly into downstream channel

j. Regulating Outlet

Low level outlet: 36-inch diameter cast iron pipe with gate at upstream end. (Invert elevation 181.9)
High level outlet: 24-inch diameter cast iron pipe with gate at upstream end. (Used to operate water wheel. Approximate invert elevation 185.)

SECTION 2: ENGINEERING DATA

2.1 Design

No plans or calculations pertaining to the original design of the dam could be obtained. Construction drawings for the 1950 reconstruction of the spillway and left training wall are available in the NJDEP file. The drawings, prepared by John E. Studer, include the following two sheets:

1. Topographic and Pertinent Data Pertaining to Repair of Dam.
2. Plans for Repairs of Dam Across the South Branch of Raritan.

Hydraulic and hydrologic computations for the 1950 reconstruction are available in the NJDEP file. The computations indicate that the spillway was designed to pass a 50-year frequency flood. Discharge was computed for the main spillway section and for the left millrace, assumed to function as an auxiliary spillway.

2.2 Construction

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

Monthly construction progress reports for the reconstruction during 1950 are available in the NJDEP file. An inspection report dated February 6, 1951 indicated that the project had been completed satisfactorily.

2.3 Operation

An inspecton report by the State of New Jersey dated November 27, 1967 indicated that the left millrace had been filled without permission and had been eliminated as an auxiliary spillway.

An inspection report by the State of New Jersey dated September 18, 1975 indicated that "the upstream side of the dam is silted and has minimal storage capacity and retention."

The 1975 inspection report also indicated that leakage was observed in the left training wall. According to the report, mortar and stones were loose and needed to be repaired.

2.4 Evaluation

a. Availability

Available engineering data is limited to that which is on file at the NJDEP. The data consists of plans, inspection reports, computations, specifications, correspondence and newspaper articles concerning the reconstruction in 1950 and flooding incidents in the vicinity of the dam.

b. Adequacy

Available engineering data pertaining to the reconstruction of Clinton Mills Dam is of limited assistance in the performance of a Phase I evaluation. A list of absent information is included in paragraph 7.1.b.

c. Validity

Most engineering data that could be verified was found to be accurate within a reasonable allowance for error. However, one discrepancy was noted: whereas the New Jersey State Water Policy Commission, Report on Dam Application, 1950, indicates outlet works consisting of 3 gates at the left end and 4 gates at the right end of the dam, field inspection revealed no gates at the left end and two gates at the right end.

The 50-year frequency design storm used at the time of the 1950 reconstruction is inadequate in relation to criteria currently used for Phase I evaluations.

SECTION 3: VISUAL INSPECTION

3.1 Findings

a. General

The inspections of Clinton Mills Dam were performed on November 19 and 28, 1979 by staff members 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 spillway of the dam, appurtenant structures and adjacent areas were examined.
2) The dam and accessible appurtenant structures were measured and key elevations determined by surveyor's level.
3) The spillway, appurtenant structures and adjacent areas were photographed.
4) Depths of water were measured at various locations in the river.

b. Dam

The crest of the spillway appeared to be straight and horizontal. Although most of the spillway could not be closely observed due to overflow, a crack was observed near the left end about one foot beneath the crest on the downstream side running a length of approximately 30 feet. At the midpoint of the spillway, some deterioration was observed at the crest. A piece of concrete, approximately 2 inches thick and 2 feet in diameter was observed to have broken away at that point. The training wall at the left end of the dam is stone masonry with a concrete cap. Cracks and minor leakage were observed in the wall. The concrete cap was in generally satisfactory

condition. The area adjacent to the downstream side of the wall was partially filled with large pieces of concrete rubble. The training wall on the west side of the dam was in satisfactory condition.

c. Appurtenant Structures

The outlet works operating mechanisms consist of steel stems mounted on steel frames. The stems and frames were rusted and were not tested at the time of inspection. The low level outlet pipe appeared to be in satisfactory condition while the high level outlet pipe contained several pin-hole leaks. The concrete wall through which the outlet pipes penetrate appeared to be in good condition. The trash rack was in generally satisfactory condition.

A pin-hole leak was observed in the mill building wall discharging into the outlet raceway. The source of the leak could not be determined.

d. Reservoir Area

Clinton Mills Dam impounds a reach of the South Branch Raritan River downstream from its confluence with the discharge channel of Spruce Run Dam. The right bank was swampy and wooded with generally flat slopes. The left bank consisted of a dike running for a distance of 320 feet from the mill building to a point approximately 150 feet south of the Halstead Street Bridge.

e. Downstream Channel

The downstream channel is the South Branch Raritan River which is a wide and well defined natural stream. Some trees and rocks were observed immediately downstream of the spillway on the right side of the channel, although the majority

of the channel width contained no significant obstructions. The channel bottom immediately downstream from the spillway apron was scoured to a depth of approximately 3 feet.

SECTION 4: OPERATIONAL PROCEDURES

4.1 Procedures

The level of water in the impoundment of Clinton Mills Dam is regulated naturally by discharge over the spillway of the dam. The outlet gates are normally not opened at times of heavy storms. At present, no formal or informal procedure for operating the dam and appurtenances is employed by the owners or the Town of Clinton.

According to the Town of Clinton, the impoundment has not been drawn down recently.

4.2 Maintenance of Dam

Reportedly, the most recent maintenance of the dam was the reconstruction of the spillway and left training wall in 1950. No regular maintenance of the dam is performed. According to the Town of Clinton, several years ago, chunks of concrete were placed in the abandoned raceway of the left mill building to stabilize the area behind the left training wall.

4.3 Maintenance of Operating Facilities

The outlet works for the dam is maintained on an "as needed" basis. It is not known when the outlet works was last serviced.

4.4 Description of Warning System

No warning system is currently in use for the subject dam.

4.5 Evaluation of Operational Adequacy

The operation of the dam has not been successful to the extent that the dam has been overtopped often and the left training wall has been washed out at least three times.

Maintenance documentation is poor and the maintenace program for the dam is not adequate in the following areas:

1) Cracks and deterioration on the spillway not repaired.
2) Deterioration of left training wall not repaired.
3) Area behind left training wall not properly stabilized.
4) Pin-hole leaks in high level outlet pipe and in the wall of the right mill building not repaired.

SECTION 5: HYDRAULIC/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 return 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 Clinton Mills 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 urban nature of the area downstream from the dam.

The SDF peak computed for Clinton Mills Dam is 59,500 c.f.s. This value is derived from the PMF hydrograph supplied by the Corps of Engineers in "Raritan River Report, 1971, by N.Y. District." Hydrologic computations and computer output are contained in Appendix 4.

The spillway discharge rates were computed by the use of a weir formula appropriate to the configuration of its overflow section (See Appendix 4). Spillway discharge with lake level equal to the top of dam was computed to be 1906 c.f.s.

A 320-foot long dike is located along the left bank of the impoundment. The elevation of the top of the dike is 191.8. Calculation of the stage discharge curve for the dam includes overtopping of the dike, as well as a portion of the right bank of the impoundment. The crest of dam was assumed to be the top of the left training wall (elevation 190.3).

The SDF was routed through the dam by the use of HEC-1-DB computer program using the modified Puls method. The routing resulted in an overtopping of the dam by 10 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

According to the NJDEP files, the dam had been overtopped many times in the past. Reportedly, the left training wall was washed out in 1907, 1940 and 1949. Further overtopping was reported in 1967 but damage was reportedly limited to the abandoned raceway.

Also, according to Town of Clinton maintenance personnel, the Main Street and Center Street area of the commercial center of Clinton is frequently flooded during heavy storms.

c. Visual Observations

Evidence of past overtopping was observed adjacent to the left end of the dam and along the upstream dike.

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 height of 10 feet above the top of dam. The spillway is capable of passing approximately 4 percent of the SDF with impoundment level equal to the top of dam.

e. Drawdown Time

Drawdown of the impoundment is accomplished by opening the gate in the 36-inch low level outlet. However, hydraulic computations indicate that the outlet is of insufficient capacity to achieve a full drawdown under low flow conditions of the river.

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

The dam appeared, at the time of inspection, to be structurally sound. A crack was observed at the left end approximately one foot beneath the crest for a length of approximately 30 feet and was about 1/2 to 3/4 inches wide and 2 inches deep. Also, cracks and minor leakage were observed in the left training wall.

b. Generalized Soils Description

The generalized soils description of the dam site consists of recent alluvium composed of stratified materials deposited by streams overlying silty clays and silts. These soils overlie limestone bedrock identified as Kittatiny limestone.

c. Design and Construction Data

No data relating to the original construction is available. Plans for reconstruction of the spillway and left training wall are available in the NJDEP file.

d. Operating Records

An inspection report by the State of New Jersey in 1975 indicated that the left training wall should be repaired. Inspection of the wall for the current Phase I evaluation confirmed the need for repair of the wall.

e. Post Construction Changes

Since the reconstruction of the dam in 1950, the following changes to the dam and surrounding area have taken place:

1) Concrete rubble fill placed behind the left training wall.
2) Three of the four obstructing islands formed by rock and earth shown on the plans prepared by John E. Struder have been eliminated.

f. Seismic Stability

Clinton Mills 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. Clinton Mills Dam appeared to be stable under static 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 Clinton Mills Dam is assessed as being inadequate. The spillway is not able to pass the SDF designated for the dam without an overtopping of the left training wall and the dike upstream from the dam.

The dam appeared to be outwardly stable at the time of inspection. The observed cracks and deterioration in the spillway and left training wall are not considered an indication of immediate instability.

b. Adequacy of Information

Information sources for this study include: 1) field inspection, 2) plans, calculations, correspondence and inspection reports in the NJDEP file, 3) USGS quadrangle, 4) aerial photograph from Hunterdon County, 5) consultation with maintenance personnel of the Town of Clinton. The information obtained 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) As-built drawings.
2) Structural design computations and report.
3) Maintenance documentation.
4) Soils report for the site.

c. Necessity for Additional Data/Evaluation

Although some data pertaining to Clinton Mills 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 near future to perform more accurate hydraulic and hydrologic analyses. Based on the findings of these analyses, the need for and type of remedial measures should be determined and then implemented.

The owners should, in the near future, 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.

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

1) The low level outlet should be investigated and if found to be insufficient to achieve a drawdown of the impoundment, should be replaced by a suitable outlet facility designed by a professional engineer experienced in the design and construction of dams.
2) The spillway should be thoroughly inspected with the impoundment drawn down. During the inspection, special care should be taken to observe any indications

of seepage under the spillway. The spillway should then be renovated in accordance with the findings of the inspection.

3) The channel bottom immediately downstream from the spillway apron should be filled and suitably stabilized.
4) The training wall at the left end of the spillway should be repaired and the adjacent area suitably filled and stabilized.
5) The pin-hole leak in the wall of the right mill building should be repaired.

In addition to Clinton Mills Dam, an upstream dike located along the east bank, impounds the river. The dike is referred to as Clinton Mills Dike. Remedial measures to correct the inadequate condition of the spillway of Clinton Mills Dam should be performed in conjunction with remedial measures for the dike as specified in "Clinton Mills Dike, NJ00564, Phase I Inspection Report, National Dam Safety Program," dated March 1980.

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.

c. Additional Studies

A detailed topographic survey of the dam and area around the dam based on N.G.V.D. should be undertaken by a qualified licensed land surveyor or professional engineer in the near future. The survey map should be related to existing construction drawings and should become part of the permanent record mentioned in paragraph 7.2.b.

PLATES

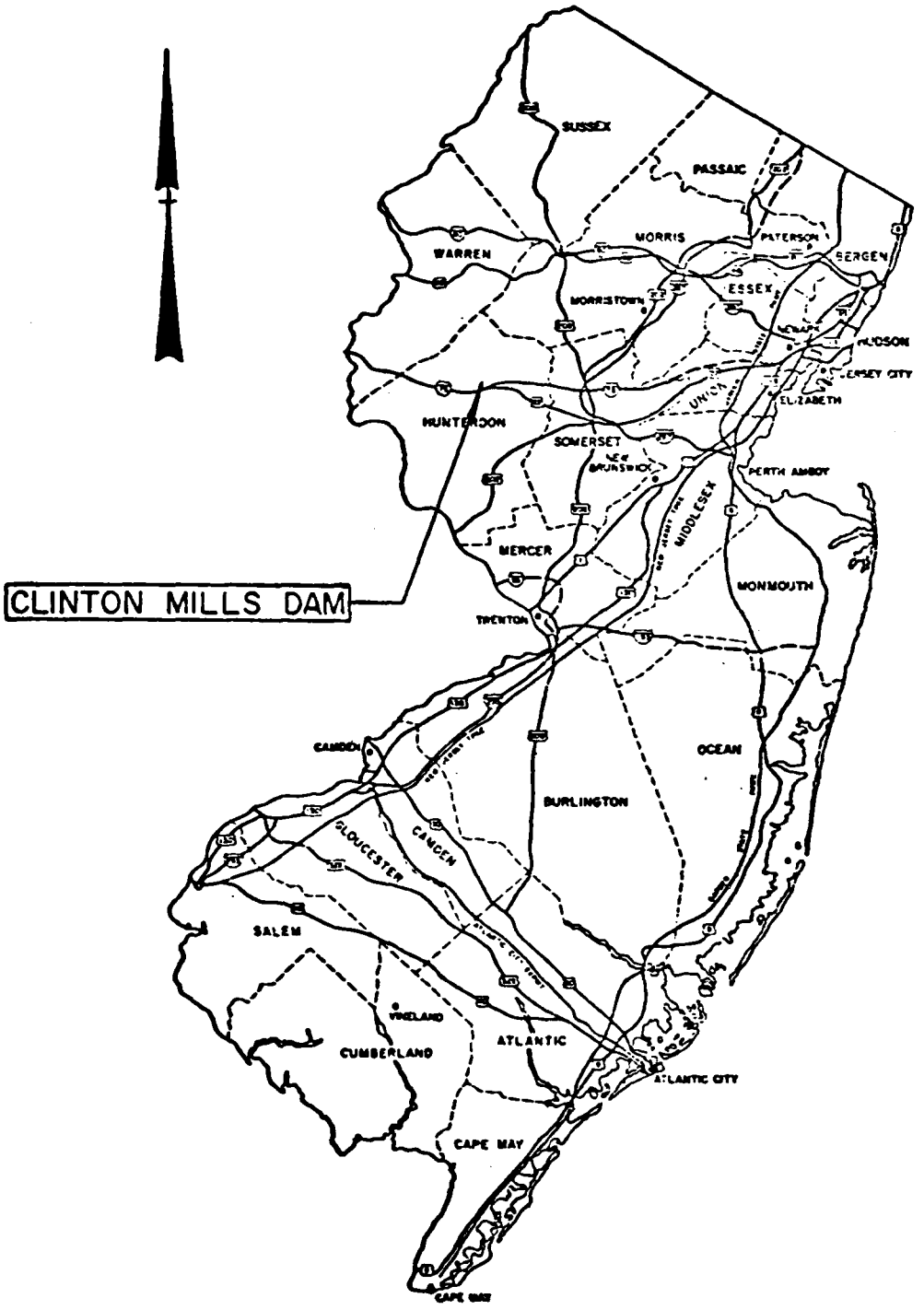


PLATE 1

STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	INSPECTION AND EVALUATION OF DAMS KEY MAP CLINTON MILLS DAM
DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY	I.D. N.J. 00122 | SCALE: NONE DATE: NOV., 1979

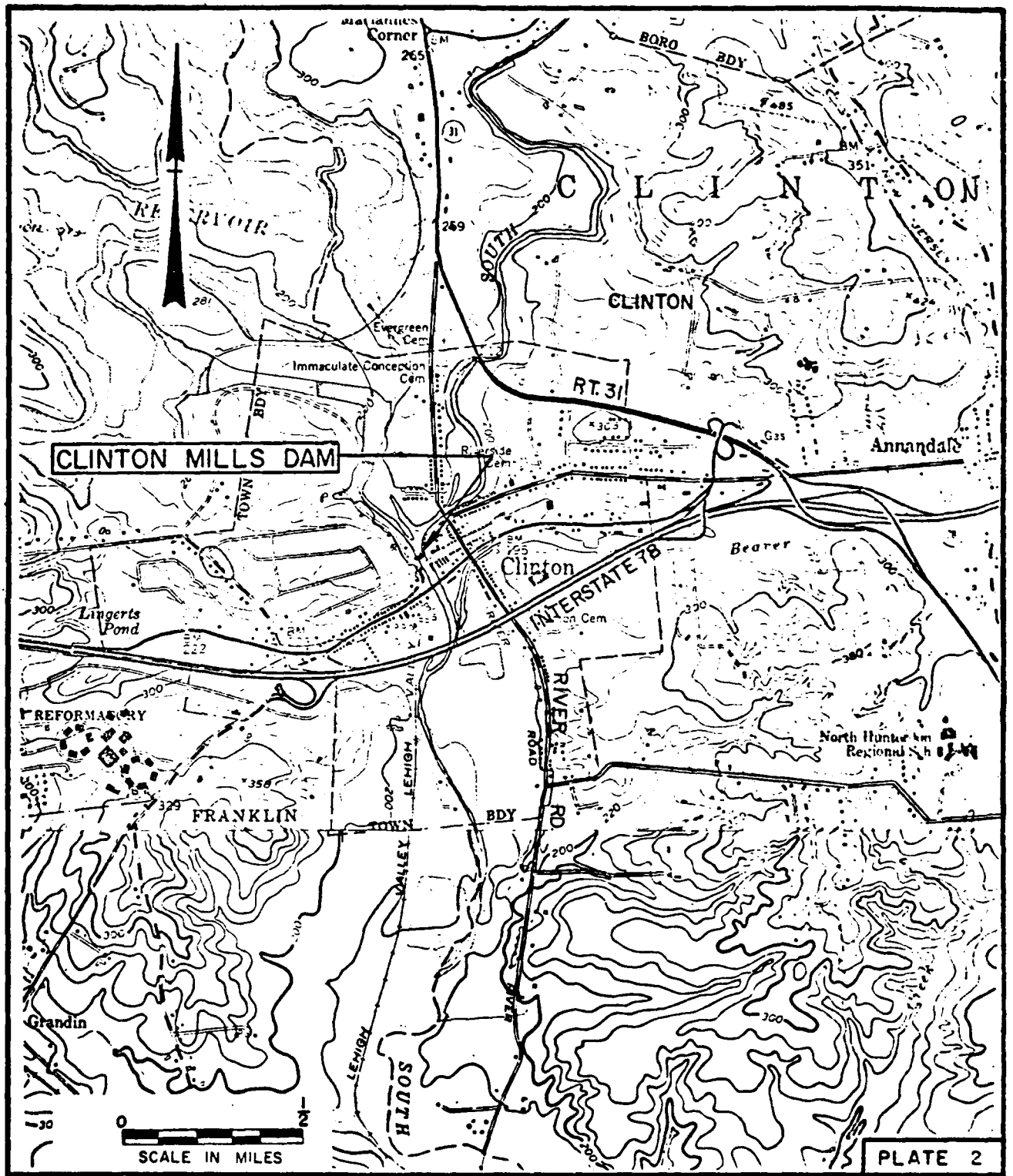


PLATE 2

STORCH ENGINEERS
FLORHAM PARK, NEW JERSEY

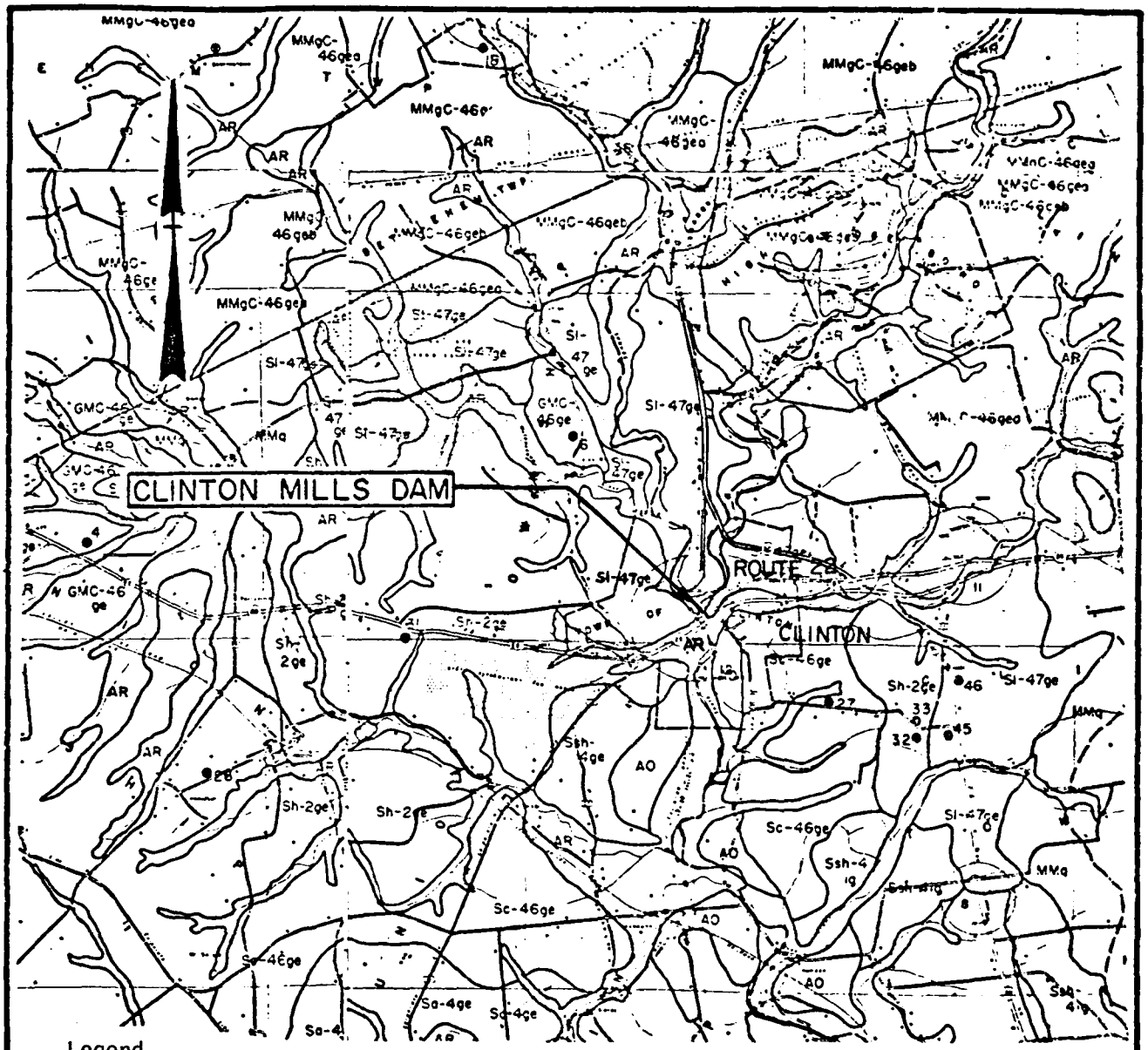
DIVISION OF WATER RESOURCES
N.J. DEPT. OF ENVIR. PROTECTION
TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS

VICINITY MAP

CLINTON MILLS DAM

I.D. N.J. 00122	SCALE: AS SHOWN
	DATE: NOV., 1979



Legend

AR	Recent alluvium composed of stratified materials deposited by streams.
Sl-47	Silty clays and silts overlying limestone bedrock identified as Kittatiny limestone.
NOTE:	Information taken from Rutgers University Soil Survey of New Jersey, Report No. 6, Hunterdon 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

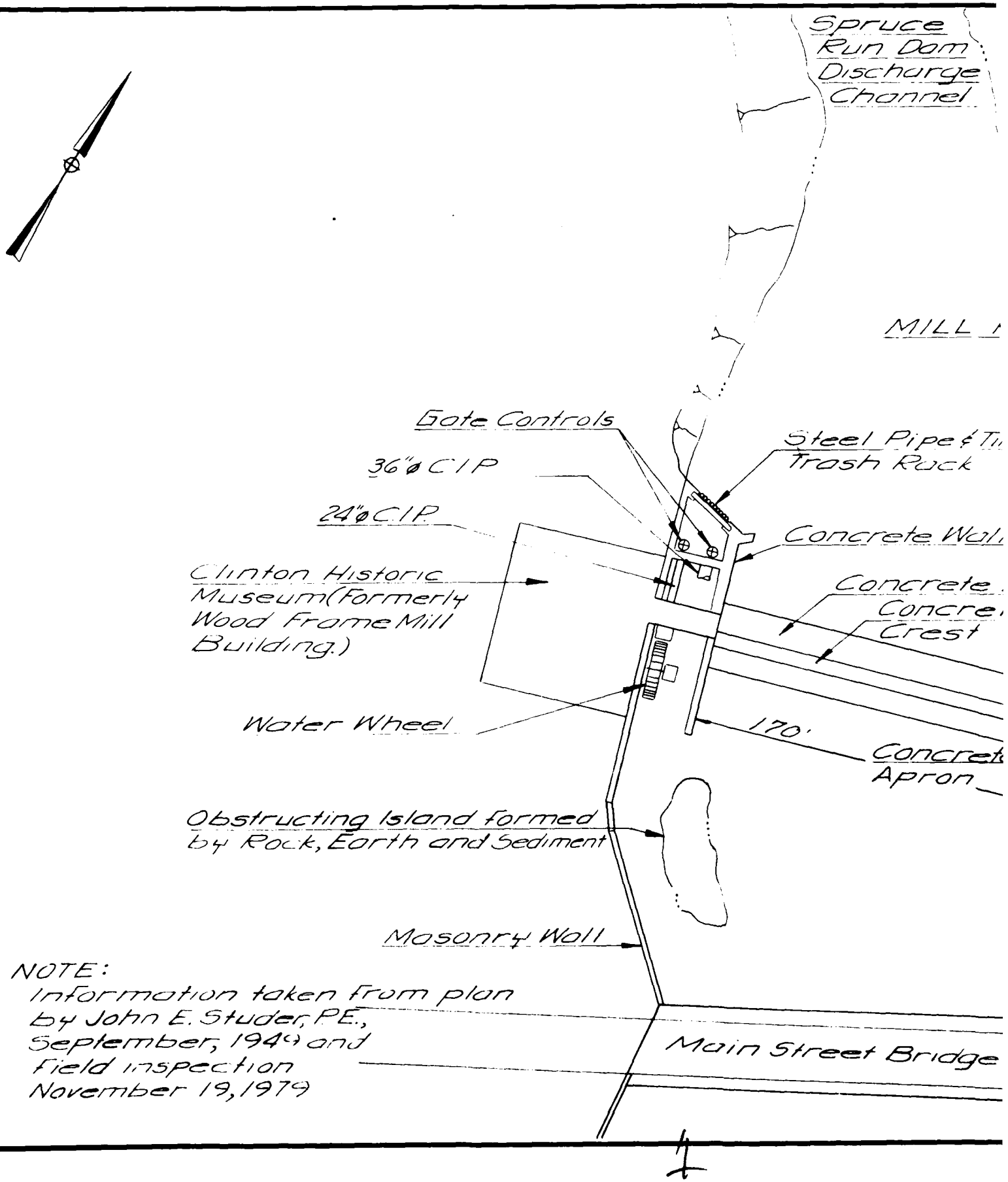
SOIL MAP

CLINTON MILLS DAM

I.D. NJ00122

SCALE: NONE

DATE: NOV., 1979



NOTE:
Information taken from plan by John E. Studer, P.E., September, 1949 and field inspection November 19, 1979

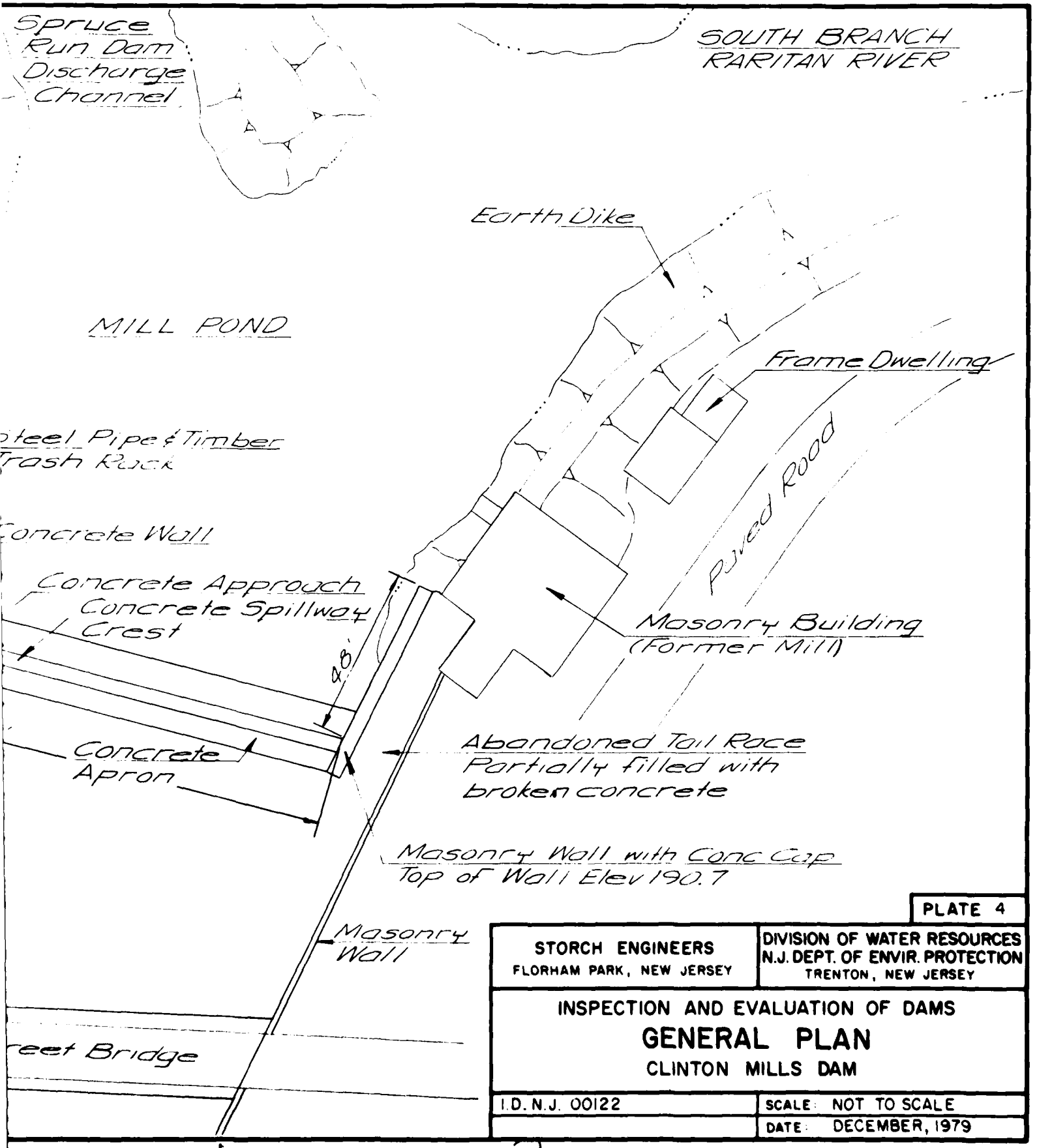


PLATE 4

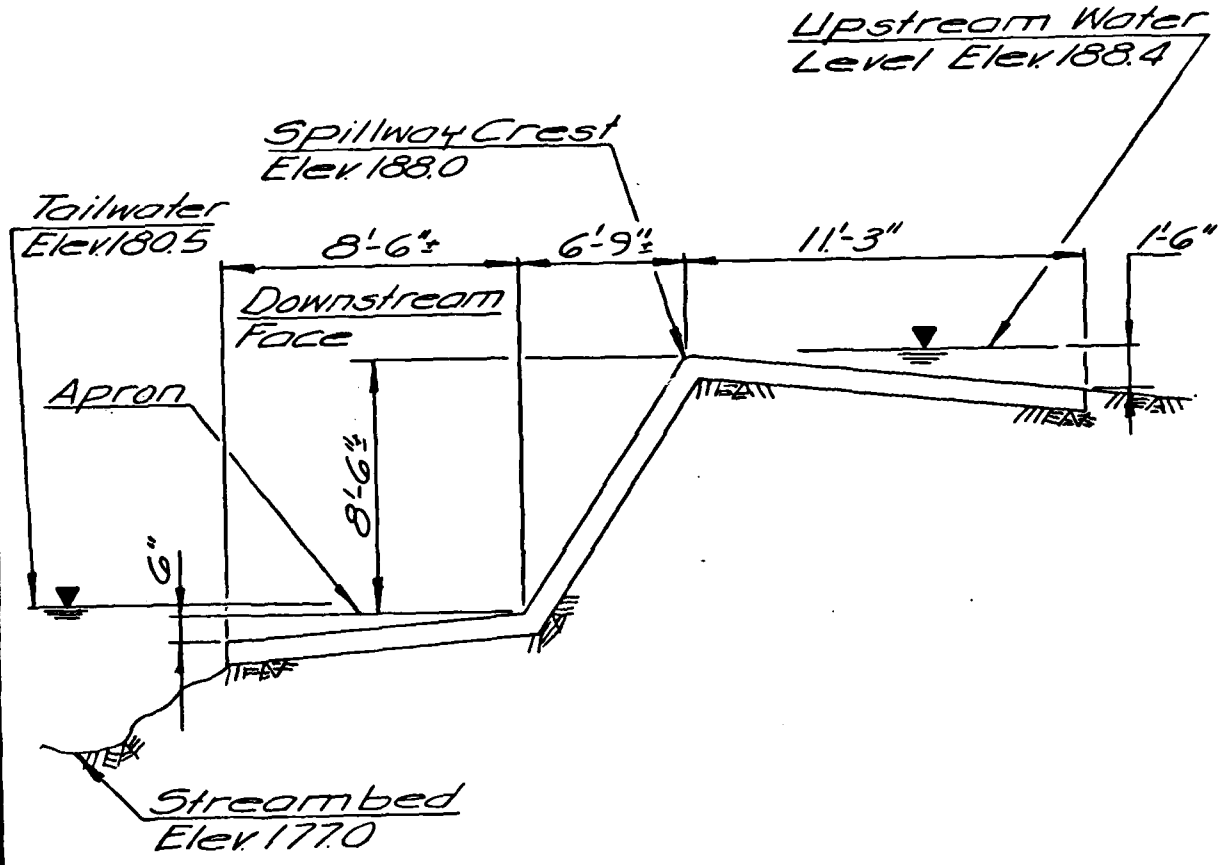
STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS

GENERAL PLAN

CLINTON MILLS DAM

I.D. N.J. 00122	SCALE: NOT TO SCALE
	DATE: DECEMBER, 1979



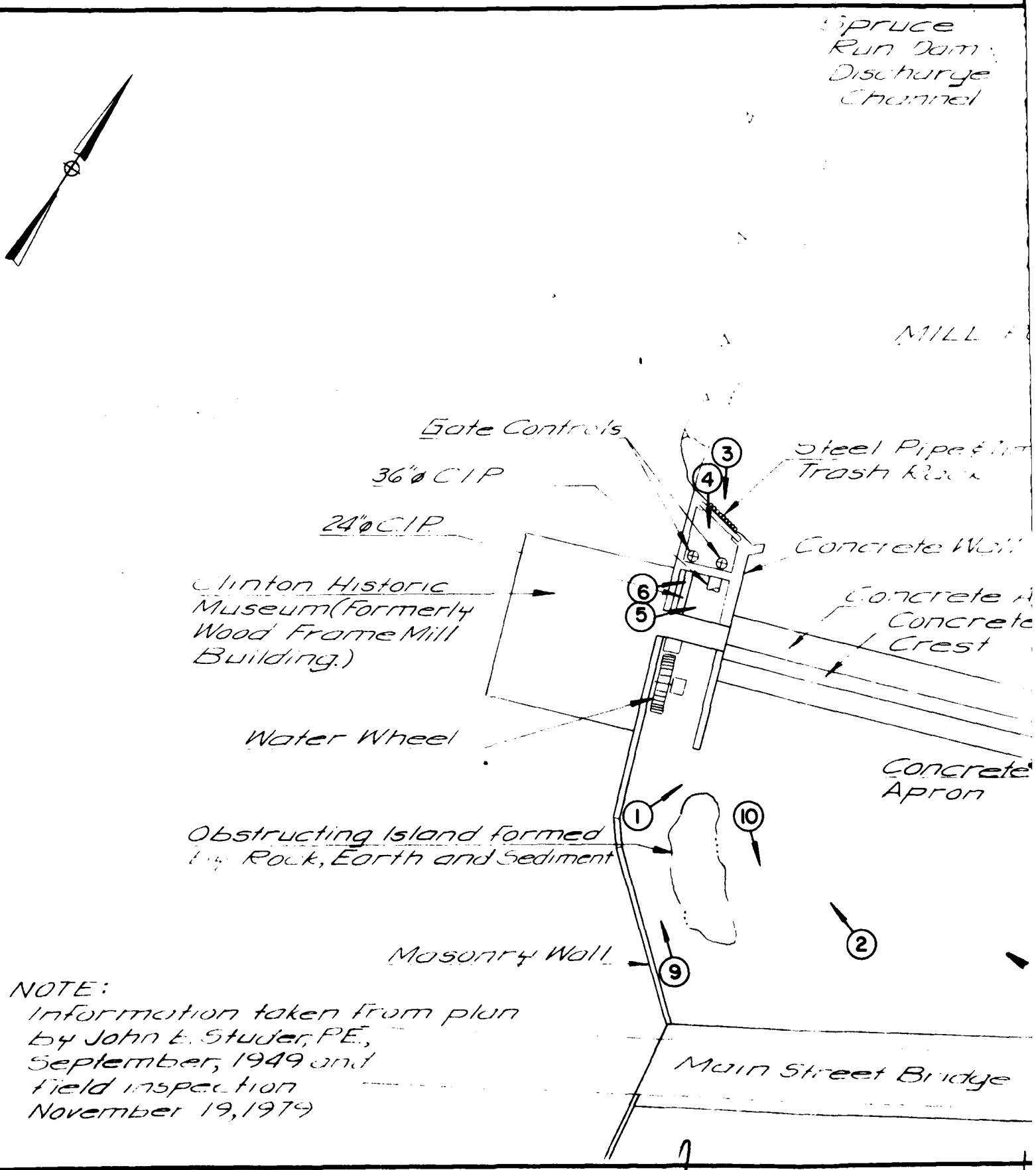
NOTES:

1. Information taken from plan by John E. Studer September, 1949 and field inspection November 19, 1979

2. Elevations based on N.G.V.D. estimated from U.S.G.S. quadrangle

PLATE 5

STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	INSPECTION AND EVALUATION OF DAMS DAM SECTION CLINTON MILLS DAM
DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY	I.D. N.J. 00122 — SCALE: NOT TO SCALE DATE: DECEMBER, 1979



NOTE:
Information taken from plan by John E. Studer, P.E., September, 1949 and field inspection November 19, 1979

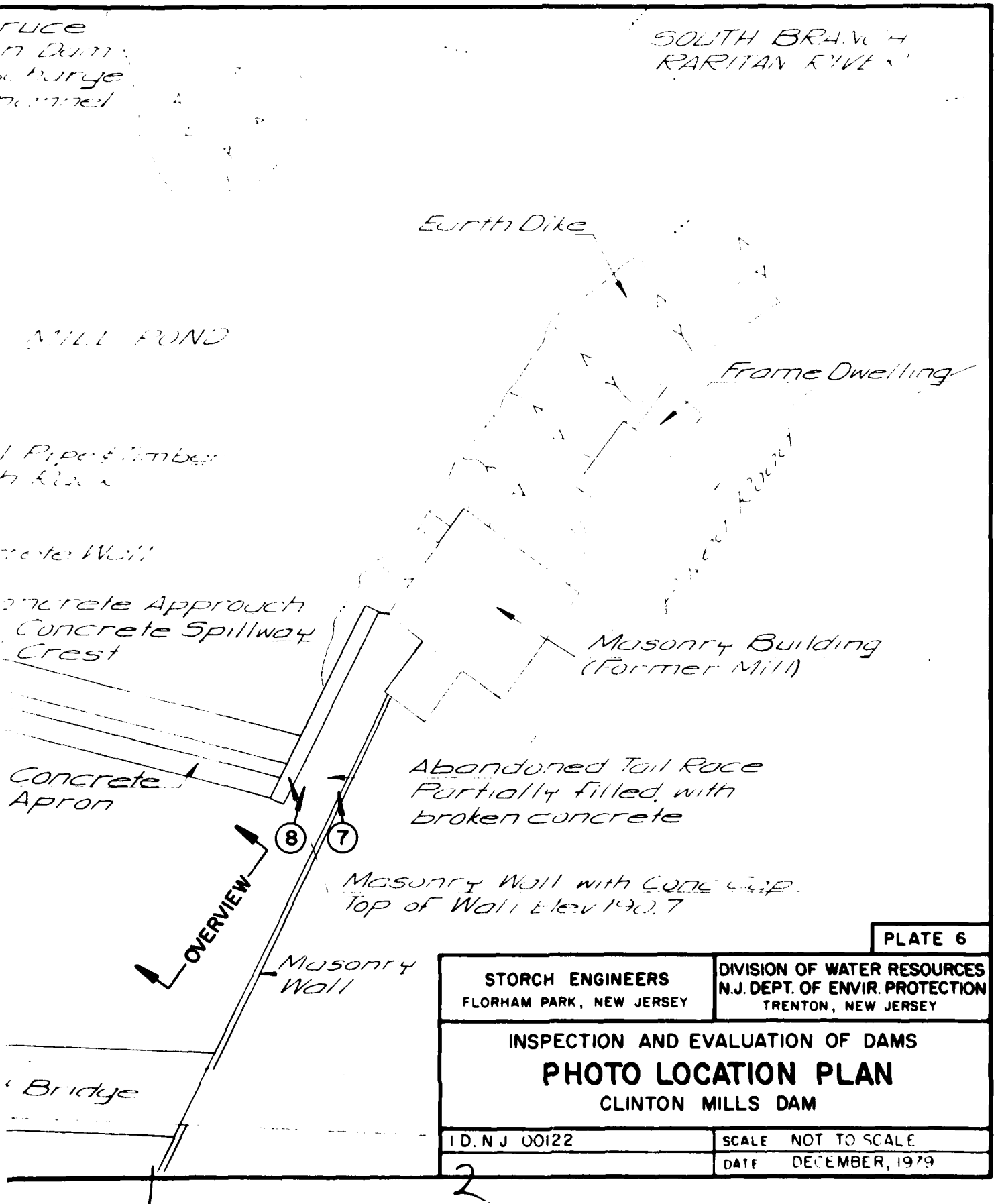


PLATE 6

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

CLINTON MILLS DAM

I.D. N J 00122	SCALE NOT TO SCALE
	DATE DECEMBER, 1979

APPENDIX 1

Check List - Visual Inspection
Check List - Engineering Data

Check List
Visual Inspection
Phase I

Name of Dam Clinton Mills Dam County Hunterdon State New Jersey Coordinators NJDEP

Date(s) Inspection 11/19/79 Weather Sunny Temperature 60°F

Pool Elevation at Time of Inspection 188.4 M.S.L. Tailwater at Time of Inspection 180.5 M.S.L.

Inspection Personnel:

John Gribbin Alan Volle

Ronald Lai Thomas Miller

Richard McDermott

J. Gribbin Recorder

Present: Tom Tharp, Water Superintendent, Town of Clinton
Phillip Schuyler, Clinton Historical Museum Village

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
GENERAL	Right stone masonry training wall was in satisfactory condition. Left stone masonry training wall was in deteriorated condition with cracks and loss of mortar observed.	Area along downstream side of left training wall formerly was mill race. It was partially filled with concrete rubble at time of inspection.
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	Junction between concrete overflow section and stone masonry training walls at each end appeared to be generally sound.	
DRAINS	None observed.	
WATER PASSAGES	N.A.	
APRON	Apron obscured by overflow for its entire length - although it appeared to be generally sound.	
VERTICAL AND HORIZONTAL ALIGNMENT	Vertical: level Horizontal: straight	

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	Some deterioration of the crest was observed at the approx. center of the overflow section of the dam. A piece of concrete about 2 inches thick was broken away. The affected area was about 2 feet wide.	Recommend renovation of spillway.
STRUCTURAL CRACKING	A longitudinal crack was observed near the left end of the dam on the downstream face about 1 foot below the crest. The crack was approx. 30 feet long, 3/4" wide and as much as 2 inches deep.	Recommend renovation of spillway.
CONSTRUCTION JOINTS	None observed	
MONOLITH JOINTS	None observed	
LEAKAGE	Some minor leakage observed on downstream side of stone masonry wall at left end of dam. Pin-hole leak observed in wall of mill building adjacent to outlet raceway.	Source of pin-hole leak could not be determined.
SEEPAGE	None observed	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SURFACES IN OUTLET CONDUIT	N.A.	Outlet works consists of two gated pipes at upstream end of mill race at right side of dam.
INTAKE STRUCTURE	Trash rack constructed of timber and steel pipes upstream from outlet gates appeared to be in generally satisfactory condition.	
OUTLET STRUCTURE	Gates are mounted on vertical concrete wall constructed between mill building and right training wall of dam. The wall appeared to be in good condition. Low level outlet pipe was in satisfactory condition. High level outlet pipe contained several pin-hole leaks.	High level outlet appeared to be used to operate water wheel associated with mill. It may also have been intended to operate hydro-electric turbine.
OUTLET CHANNEL	Outlet channel consists of mill race formed by mill building and stone masonry training wall. Path of outlet discharge appeared to pass beneath a stone masonry wall immediately upstream from the water wheel.	
GATE AND GATE HOUSING	Gates were submerged and not observed. Operating mechanisms were rusted and not tested at the time of inspection.	Mechanisms should be tested and made operational.

SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
WEIR	See "Concrete/Masonry Dams" above.	Spillway consists of overflow section of dam. Dam is a run-of-the-river type.
APPROACH CHANNEL	N.A.	
DISCHARGE CHANNEL	Spillway discharges directly into downstream channel.	

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	The right bank was swampy and wooded with generally flat slopes. The left bank consisted of a dike running from the mill building to a point approx. 120 feet south of the Halstead St. bridge. The dike slope was 2 horiz. to 1 vert.	Impoundment consists of the South Branch Raritan River.
SEDIMENTATION	Soundings in the impoundment in the vicinity of the dam indicated the accumulation of approx. 1 to 2 feet of sediment.	
STRUCTURES ALONG BANKS	Mill buildings are located on the banks of the river at each end of the dam. A dwelling and a small office building are located along the dike. Two other dwellings are located along the left bank between the dike and a road bridge located 630 feet upstream from the dam.	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	An obstructing island formed by rock, earth and sediment is located in the channel immediately downstream from the dam near the right end. The majority of the channel width contains no significant obstructions.	
SLOPES	Bank slopes are generally steep.	
STRUCTURES ALONG BANKS	A steel road bridge is located 120 feet from the dam. The Route 22 bridge is located 400 feet from the dam. A developed area of Clinton lies on both sides of the channel within 1300 feet of the dam. The Route 78 bridge is located 1300 feet from the dam.	

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
DAM - PLAN SECTIONS	Available in plans titled "Plans For Repair of Dam Across The South Branch of Raritan" (2 sheets) by John E. Studer, P.E., Clinton, N. J., Dated Sept. 5, 1949. NJDEP file in Trenton, N. J.
SPILLWAY - PLAN SECTIONS DETAILS	Available - Studer drawings
OPERATING EQUIPMENT PLANS & DETAILS	Not available
OUTLETS - PLAN DETAILS CONSTRAINTS DISCHARGE RATINGS	Not available
HYDRAULIC/HYDROLOGIC DATA	PMF provided by Corps of Engineers from "Raritan River Report" 1971, N.Y. District. Also, gaging data available for South Branch Raritan River.
RAINFALL/RESERVOIR RECORDS	Not available
CONSTRUCTION HISTORY	Limited, available in NJDEP file, Trenton Office, N. J.
LOCATION MAP	Available

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

ITEM	REMARKS
MONITORING SYSTEMS	Stream gages in South Branch Raritan River upstream and downstream from dam. Upstream: near High Bridge, about 4 miles upstream Downstream: at Stanton, about 6 miles downstream
MODIFICATIONS	Modifications to the east wall available in Plans by John E. Studer.
HIGH POOL RECORDS	Not Available
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	Limited information in NJDEP file, Trenton Office, N.J.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	Description of damages to east wall from flood in 1949 and description of damages to banks from flood in 1940 available in NJDEP file.
MAINTENANCE OPERATION RECORDS	Not available

APPENDIX 2

Photographs

PHOTO 1 28 DECEMBER 1979

SPILLWAY

PHOTO 2 19 NOVEMBER 1979

MILL RACE AT WEST END OF DAM

CLINTON MILLS DAM

PHOTO 3

TRASH RACK AT UPSTREAM END OF MILL RACE

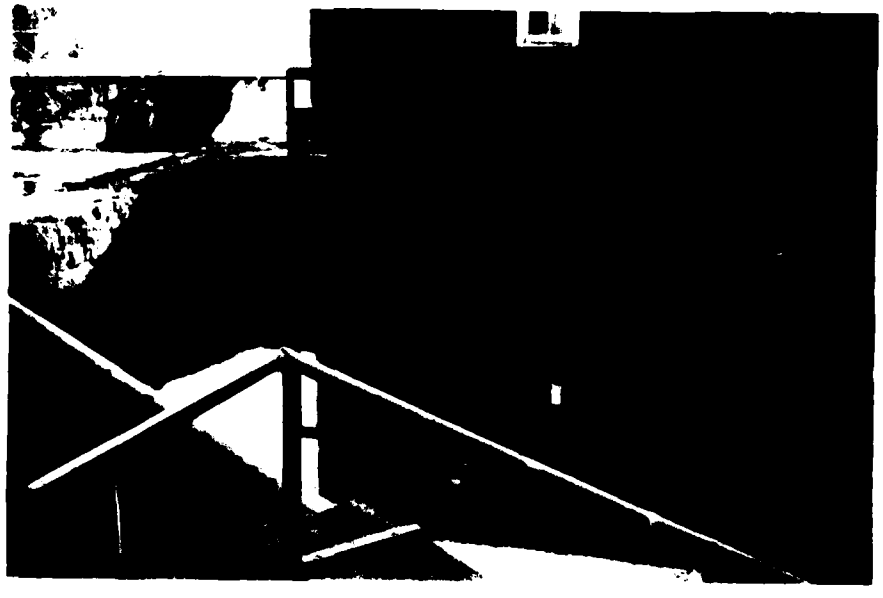


PHOTO 4

GATE OPERATING MECHANISMS

CLINTON MILLS DAM
19 NOVEMBER 1979

PHOTO 5

LOW LEVEL OUTLET PIPE

PHOTO 6

OUTLET PIPE USED TO SUPPLY FLOW TO WATER WHEEL

CLINTON MILLS DAM
19 NOVEMBER 1979

PHOTO 7

DUMPED FILL ADJACENT TO WALL AT EAST END OF DAM

PHOTO 8

CRACKS AND LEAKAGE IN WALL AT EAST END OF DAM

CLINTON MILLS DAM
19 NOVEMBER 1979

28 NOVEMBER 1979

PHOTO 9

TRAINING WALL ALONG WEST EDGE OF DOWNSTREAM CHANNEL

19 NOVEMBER 1979

PHOTO 10

DOWNSTREAM CHANNEL

CLINTON MILLS DAM

APPENDIX 3

Engineering Data

CHECK LIST

HYDROLOGIC AND HYDRAULIC DATA

ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: Hilly and wooded with limited development

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 188.4 (21 acre-feet)

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

ELEVATION MAXIMUM DESIGN POOL: 200.4

ELEVATION TOP DAM: 190.3

SPILLWAY CREST:

a. Elevation 188.0
b. Type Free overflow weir
c. Width 11 feet
d. Length 170 feet
e. Location Spillover Spillway is overflow portion of dam
f. Number and Type of Gates N.A.

OUTLET WORKS:

a. Type Gated 36-inch pipe
b. Location Upstream end of right millrace
c. Entrance inverts 181.9
d. Exit inverts 181.9
e. Emergency draindown facilities: Pipe is of insufficient capacity to lower impoundment.

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) 1906 c.f.s.

APPENDIX 4

Hydraulic/Hydrologic Computations

HYDROLOGY

THE PEAK PMF INFLOW, Q_{PMF}, WILL BE DETERMINED BY ADJUSTING THE VALUE FOR Q_{PMF} FOR THE SOUTH BRANCH RARITAN RIVER AT STANTON, NEW JERSEY. (RE. RARITAN RIVER SURVEY REPORT, MARCH 1971, N.Y. DISTRICT, CORPS OF ENGINEERS)

SOUTH BRANCH RARITAN RIVER AT CLINTON MILLS
DRAINAGE AREA, D.A. = 111 SQ. MI.

SOUTH BRANCH RARITAN RIVER AT STANTON
DRAINAGE AREA, D.A. = 147 SQ. MI.

USING THE RELATIONSHIP, $\frac{Q_1}{Q_2} = \left(\frac{DA_1}{DA_2}\right)^{0.75}$, Q_{PMF} AT CLINTON MILLS IS COMPUTED AS FOLLOWS:

$$Q_{PMF} = \left(\frac{111}{147}\right)^{.75} (146{,}000)$$

$$Q_{PMF} = 119{,}000 \text{ CFS}$$

$$Q_{\frac{1}{2}\,PMF} = 59{,}500 \text{ CFS}$$

SINCE THIS PEAK INFLOW IS GREATER THAN THE MAXIMUM DISCHARGE, A ROUTING WILL BE PERFORMED BY THE MODIFIED PULS METHOD.

INFLOW HYDROGRAPH

THE PMF HYDROGRAPH, DETERMINED BY ADJUSTING THE PMF HYDROGRAPH, SUPPLIED BY THE U.S. ARMY CORPS OF ENGINEERS, IS AS FOLLOWS:

DAY	HOUR	INFLOW (CFS)	DAY	HOUR	INFLOW (CFS)
0	1	4800	0	23	51800
	2	3200	1	0	42200
	3	3200		1	35600
	4	4800		2	30800
	5	4800		3	24100
	6	64000		4	17800
	7	82000		5	16200
	8	10400		6	13000
	9	14600		7	11400
	10	19400		8	10600
	11	32400		9	9800
	12	48600		10	9000
	13	71200		11	8200
	14	89200		12	7200
	15	107000		13	6400
	16	119000		14	5600
	17	107000		15	4800
	18	97200		16	4800
	19	89200		17	4800
	20	81000		18	4000
	21	71200		19	3200
	22	60000			

STORCH ENGINEERS

Sheet 3 of 9

Project CLINTON MILLS DAM

Made By STO Date 1/2/80

Chkd By JG Date 1/15/80

LAKE STORAGE VOLUME

ELEVATION	SURFACE AREA (ACRES)
182.0	0
188.4	10*
200	144
220	329
240	562
260	820

HEC-1-DB PROGRAM WILL DEVELOP STORAGE CAPACITY FROM SURFACE AREAS & ELEVATIONS

INFORMATION FROM USGS. QUADRANGLE

* Taken from "Report on Dam Application" dated 1/27/50 in NJDEP file.

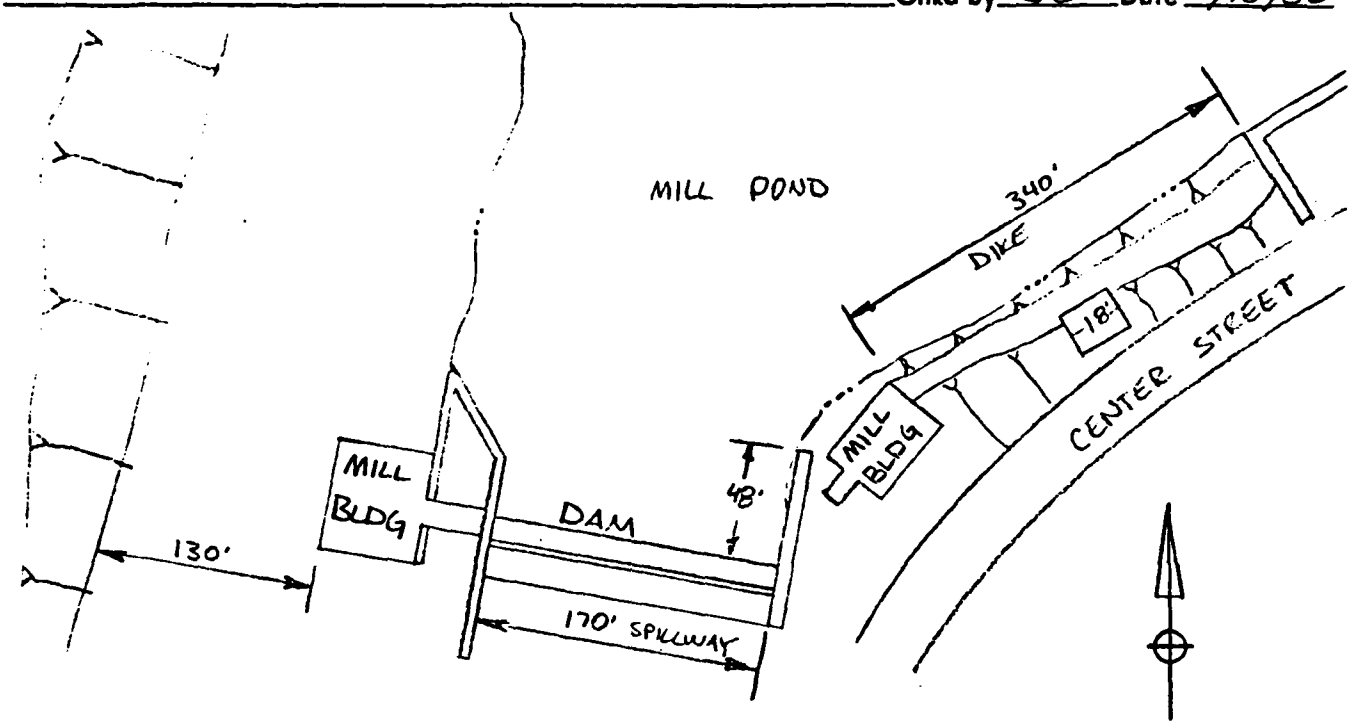
STORCH ENGINEERS

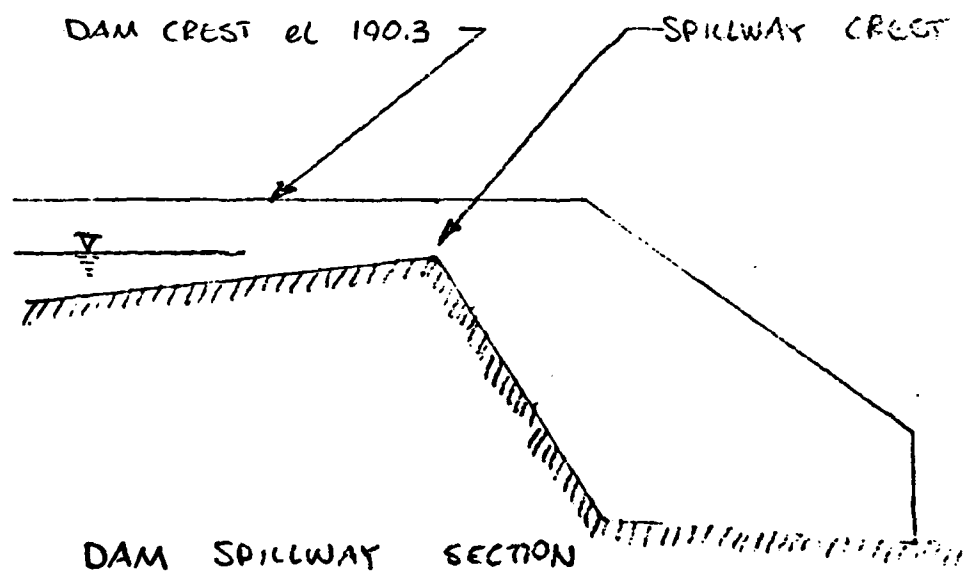
Sheet 4 of 9

Project CLINTON MILLS DAM

Made By STO Date 1/10/80

Chkd By JG Date 1/15/80





DAM SPILLWAY SECTION

HYDRAULICS

STAGE DISCHARGE CALCULATION - DISCHARGE

WILL BE CALCULATED BY THE FORMULA

$Q = CLH^{3/2}$; WHERE:

Q= DISCHARGE IN CFS
C= COEFFICIENT OF DISCHARGE
L= EFFECTIVE LENGTH OF CREST
H= TOTAL HEAD ON CREST

THE COEFFICIENTS OF DISCHARGE ARE TAKEN FROM "THE HANDBOOK OF HYDRAULICS" BY KING AND BRATER.

TAILWATER HAS BEEN DETERMINED TO HAVE NO EFFECT ON DISCHARGE UNTIL RIVER STAGE (TAILWATER) REACHES 190.0 FEET. THEREFORE, DISCHARGE COEFFICIENTS WILL NOT BE ADJUSTED FOR SUBMERGED CONDITIONS.

THE DISCHARGE CALCULATION FOR THE DAM INCLUDES: OVERTOPPING OF THE SPILLWAY CREST AT STAGE 188.0, OVERTOPPING OF THE CLINTON MILLS DIKE AT STAGE 191.8 & OVERTOPPING OF THE AREA WEST OF THE WEST MILL BUILDING.

FOR THE PURPOSES OF COMPUTER INPUT THE TOP OF DAM ELEVATION IS ASSUMED TO BE 190.3, LENGTH = 48', COEFFICIENT OF DISCHARGE FOR FLOW OVER DAM = 2.63

STAGE DISCHARGE CALCULATION (con't)

SPILLWAY

CREST ELEVATION = 188.
EFFECTIVE LENGTH = 170.'
AVERAGE "C" = 3.3

DIKE

CREST ELEVATION = 191.8
EFFECTIVE LENGTH = 452.
AVERAGE "C" = 2.63

WATER SURFACE ELEVATION	DISCHARGE OVER SPILLWAY Q_1 (cfs)	DISCHARGE OVER DIKE Q_2 (cfs)	TOTAL DISCHARGE $Q_T = Q_1 + Q_2$
188	0	0	0
189	561	0	561
190.3	1906	0	1906
191.	2915	0	2915
191.8	4156	0	4156
192.	4488	106	4594
193	6272	1563	7835
194	8245	3880	12125
195	10390	6806	17197
196	12694	10234	22928
198	17740	18352	36092
200	23320	27914.	51234
202	29387	38725.	68112

STORCH ENGINEERS

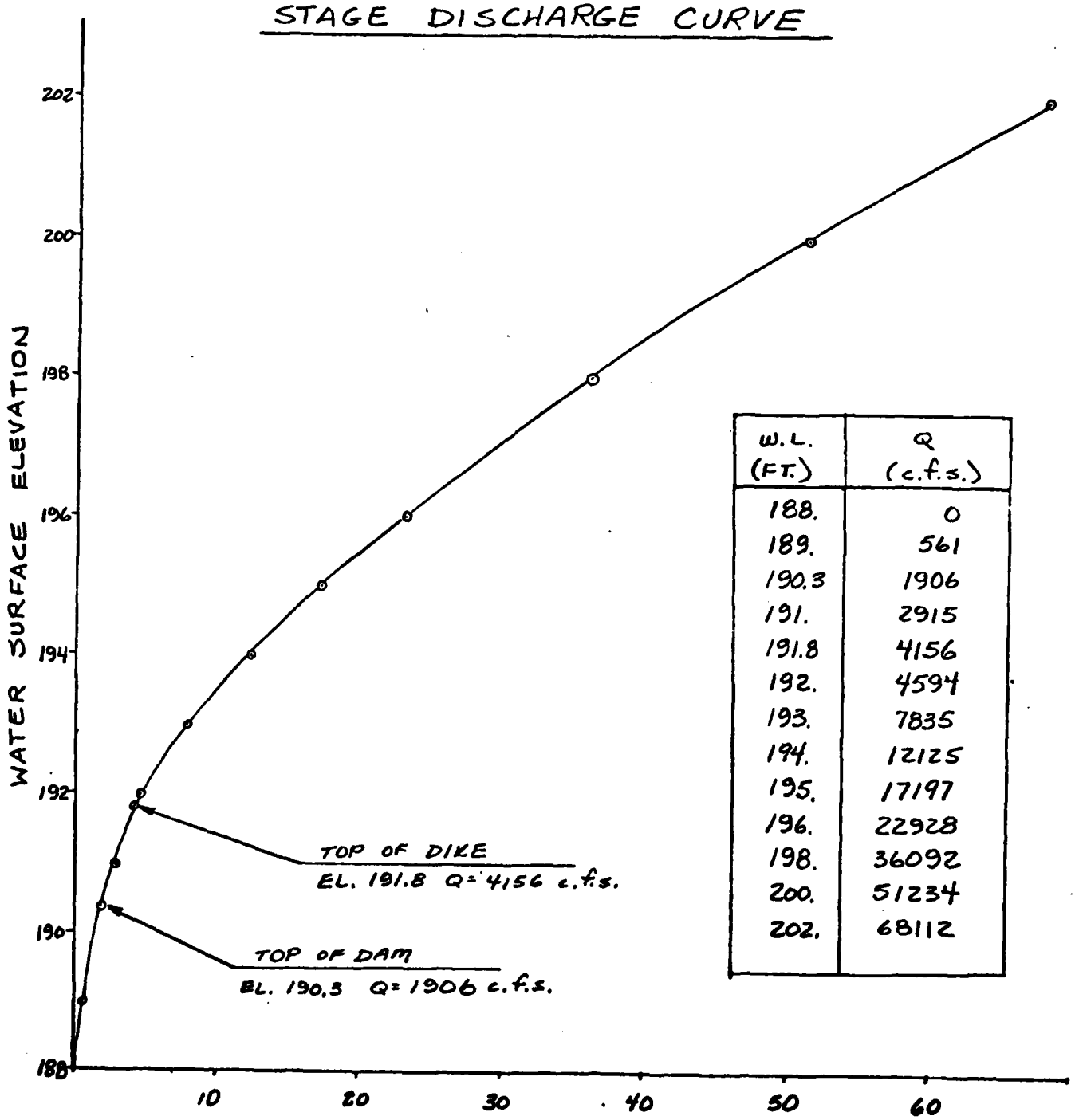
Project CLINTON MILLS DAM.

Sheet 7 of 9

Made By CLO Date 4/3/80

Chkd By JG Date 4/9/80

STAGE DISCHARGE CURVE



W.L. (FT.)	Q (c.f.s.)
188.	0
189.	561
190.3	1906
191.	2915
191.8	4156
192.	4594
193.	7835
194.	12125
195.	17197
196.	22928
198.	36092
200.	51234
202.	68112

OUTLET WORKS CAPACITY

THE OUTLET WORKS FOR CLINTON MILLS DAM CONSIST OF A THREE FOOT DIAMETER CAST IRON PIPE, APPROXIMATELY FIVE FEET LONG

FROM "HYDRAULIC CHARTS FOR THE SELECTION OF HIGHWAY CULVERTS", INLET CONTROL

DISCHARGE WITH WL AT SPILLWAY CREST = 75 CFS
AVERAGE DISCHARGE = 37 CFS ($H_w/D = 2.1$)

TIME REQUIRED FOR TOTAL DRAWDOWN

$$T = \frac{\text{STORAGE}}{\text{AVE. DRAWDOWN DISCHARGE - NORMAL INFLOW}}$$

MINIMUM NORMAL INFLOW = 100 CFS
Ref.: STATISTICAL SUMMARIES OF NEW JERSEY STREAMFLOW RECORDS (- WATER RESOURCES CIRCULAR 23)

∴ OUTLET NOT SUFFICIENT TO ALLOW DRAWDOWN

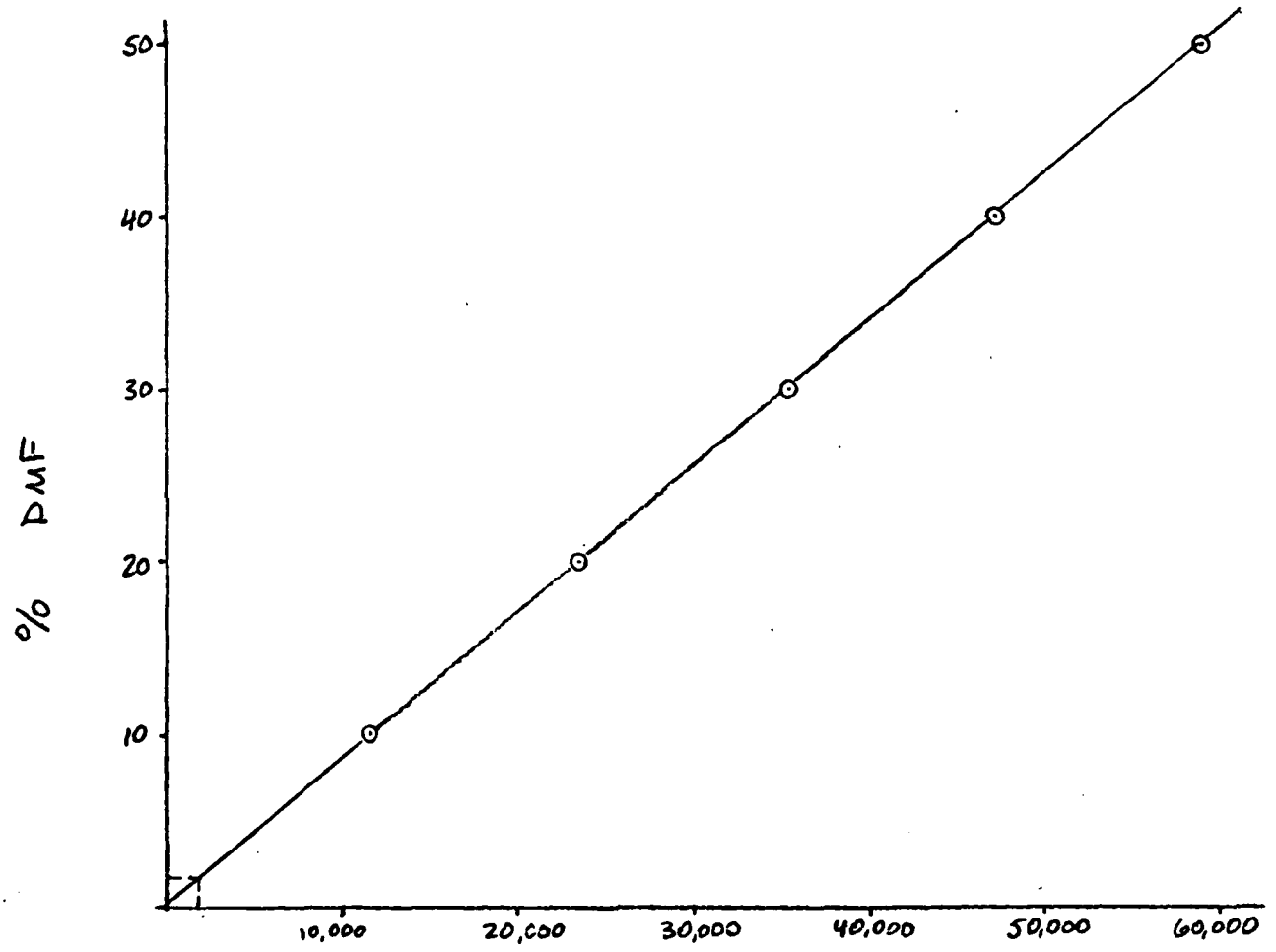
(OUTLET REGULATION OF SPRUCE RUN NOT CONSIDERED)

STORCH ENGINEERS Sheet 9 of 9

Project CLINTON MILLS DAM Made By STD Date 1/10/80

Chkd By JG Date 1/15/80

OVERTOPPING POTENTIAL



OVERTOPPING OF THE DAM OCCURS AT ELEVATION 190.3 WITH Q = 1906 CFS ∴ DAM CAN PASS APPROXIMATELY 3.2% SDF OR 1.6% PMF

HEC-1-DB COMPUTATIONS

```
A1
A2                                  NATIONAL DAM SAFETY PROGRAM
A3                          CLINTON MILLS DAM, CLINTON, NEW JERSEY
                                    MULTI RATIO PMF ROUTING
B       43         1         0                                                    3
B1       5
J        1         5         1
J1     0.5       0.4       0.3       0.2       0.1
K        0      LAKE                                                1
K1                          INFLOW HYDROGRAPH TO CLINTON MILLS DAM
M       -1                   111                 111                 0
N     4800      3200      3200      4800      4800      6400      8200     10400     14600     19400
N    32400     48600     71200     89200    107100    119000    107000     97200     89200     81000
N    71200     60000     51800     42200     35600     30800     24100     17800     16200     13000
N    11400     10600      9800      9000      8200      7200      6400      5600      4800      4800
N     4800      4000      3200                                                                    1
K        1       DAM
K1                                                                          1
Y                                   ROUTE DISCHARGE THRU DAM
Y1       1                          1         1
Y4     188       189     190.3       191     191.8       192    -188.4       193        -1
Y4     198       200       202                                      193       194       195       196
Y5       0       561      1906      2915      4156      4594      7835     12125     17197     22928
Y5   36092     51234     68112
$A       0        10       144       329       562       820
$E     182     188.4       200       220       240       260
$$     188
$D   190.3      2.63       1.5        48
K       99
A
A
A
A
A
```

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  [illegible] MODIFICATION  26 FEB 79
**********

 ST = 80/04/08.
 TIME 11.56.20.
```

NATIONAL DAM SAFETY PROGRAM
CLINTON MILLS DAM, CLINTON, NEW JERSEY
MULTI RATIO PMF ROUTING

JOB SPECIFICATION

NO	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
43	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 CLINTON MILLS DAM

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

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
-1	0	111.00	0.00	111.00	0.00	0.000	0	1	0

INPUT HYDROGRAPH

4800.	3200.	3200.	4800.	4800.	6400.	8200.	10400.	14600.	19400.
32400.	48600.	71200.	89200.	107100.	119000.	107000.	97200.	89200.	81000.
71200.	60000.	51800.	42200.	35600.	30800.	24100.	17800.	16200.	13000.
11400.	10600.	9800.	9000.	8200.	7200.	6400.	5600.	4800.	4800.
4800.	4000.	3200.							

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	119000.	100767.	52521.	31865.	1370200.
CMS	3370.	2853.	1487.	902.	38800.
INCHES		8.44	17.61	19.14	19.14
MM		214.50	447.19	486.11	486.11
AC-FT		49967.	104174.	113240.	113240.
THOUS CU M		61633.	128496.	139679.	139679.

HYDROGRAPH AT STA LAKE FOR PLAN 1, RTIO 1

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	59500.	50383.	26260.	15933.	685100.
CMS	1685.	1427.	744.	451.	19400.
INCHES		4.22	8.80	9.57	9.57
MM		107.25	223.60	243.06	243.06
AC-FT		24983.	52087.	56620.	56620.
THOUS CU M		30817.	64248.	69840.	69840.

HYDROGRAPH ROUTING

ROUTE DISCHARGE THRU DAM

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

ROUTING DATA

[illegible]	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	-188.	-1

[illegible]	189.00	190.30	191.00	191.80	192.00	193.00	194.00	195.00	196.00
[illegible]	200.00	202.00							
[illegible]	561.00	1906.00	2915.00	4156.00	4594.00	7835.00	12125.00	17197.00	22928.00
[illegible]	51234.00	68112.00							
[illegible]	0.	10.	144.	329.	562.	820.			
[illegible]	0.	21.	764.	5368.	14175.	27914.			
ELEVATION=	182.	188.	200.	220.	240.	260.			

CREL	SPWID	COQW	EXPW	ELEVL	COOL	CAREA	EXPL
188.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWIC
190.3	2.6	1.5	48.

STATION DAM, PLAN 1, RATIO 1

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

3337.	1422.	1669.	2[illegible].	2523.	2923.	3962.	4965.	7004.	9361.
15050.	23165.	33558.	43[illegible].	51689.	58585.	55586.	49136.	45456.	41165.
36549.	30942.	26346.	21[illegible]8.	18044.	15790.	12518.	9281.	8038.	6891.
5641.	5417.	4908.	4595.	4170.	3721.	3263.	2884.	2474.	2366.
2415.	2099.	1678.							

STORAGE

73.	41.	46.	54.	60.	66.	83.	99.	120.	147.
208.	303.	434.	574.	706.	820.	772.	664.	606.	543.
477.	399.	341.	288.	243.	216.	181.	146.	133.	119.
105.	103.	98.	94.	87.	79.	71.	65.	59.	57.
56.	53.	46.							

STAGE

191.2	189.8	190.1	190.5	190.7	191.0	191.6	192.0	192.6	193.2
194.4	195.8	197.3	198.6	199.6	200.4	200.1	199.3	198.8	198.3
197.7	196.9	196.2	195.6	194.9	194.5	193.9	193.2	192.9	192.6
192.2	192.2	192.0	191.9	191.7	191.4	191.2	190.9	190.7	190.6
190.6	190.4	190.1							

PEAK OUTFLOW IS 58585. AT TIME 16.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	58585.	50444.	26258.	15940.	685424.
CMS	1659.	1428.	744.	451.	19409.
INCHES		4.23	8.80	9.57	9.57
MM		107.38	223.58	243.17	243.17
AC-FT		25014.	52082.	56647.	56647.
THOUS CU M		30854.	64243.	69873.	69873.

SUMMARY OF DAM SAFETY ANALYSIS

.....		INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
	ELEVATION	188.40	188.00	190.30
	STORAGE	21.	18.	50.
	OUTFLOW	224.	0.	1906.

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	200.39	10.09	820.	58585.	40.00	16.00	0.00
.40	199.01	8.71	630.	47003.	37.00	16.00	0.00
.30	197.50	7.20	458.	35269.	32.00	16.00	0.00
.20	195.83	5.53	308.	23580.	26.00	16.00	0.00
.10	193.73	3.43	172.	11776.	17.00	16.00	0.00

APPENDIX 5

Bibliography

1. "Recommended Guidelines for Safety Inspection of Dams," Department of the Army, Office of the Chief of Engineers, Washington, D.C. 20314.

2. Design of Small Dams, Second Edition, United States Department of the Interior, Bureau of Reclamation, United States Government Printing Office, Washington, D.C., 1973.

3. Holman, William W. and Jumikis, Alfreds R., Engineering Soil Survey of New Jersey, Report No. 6, Hunterdon County, Rutgers University, New Brunswick, N.J., 1953.

4. "Geologic Map of New Jersey," prepared by J. Volney Lewis and Henry B. Kummel, dated 1910 - 1912.

5. Herr, Lester A., Hydraulic Charts for the Selection of Highway Culverts, U.S. Department of Transportation, Federal Highway Administration, 1965.

6. Safety of Small Dams, Proceedings of the Engineering Foundation Conference, American Society of Civil Engineers, 1974.

7. King, Horace Williams and Brater, Ernest F., Handbook of Hydraulics, Fifth Edition, McGraw-Hill Book Company, 1963.

END

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