

**LEVEL II**

LOWER HUDSON RIVER BASIN

3<sub>nu</sub>

MUSCOUT DAM

WESTCHESTER COUNTY  
NEW YORK

INVENTORY NO 61

DDC  
MAR 20 1979  
C

AD A0 65979

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

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NEW YORK DISTRICT CORPS OF ENGINEERS

AUGUST 1978

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report provides information and analysis on the physical condition of the dam as of the report date. Information and analysis are based on visual inspection of the dam by the performing organization. Muscout Dam was judged to be safe.		

393 970

JOB

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PHASE I REPORT  
NATIONAL DAM SAFETY PROGRAM

Name of Dam Muscoot Dam NY61

State Located New York  
County Located Westchester  
Stream Croton River  
Date of Inspection July 27, 1978

ASSESSMENT OF  
GENERAL CONDITIONS

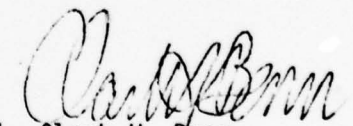
The Muscoot Dam is a partially submerged masonry structure which rises 29 feet high above the reservoir bottom. The dam is located in the middle of the New Croton Reservoir and was constructed in 1906. Nothing has been determined to deem this dam unsafe under normal operating conditions.

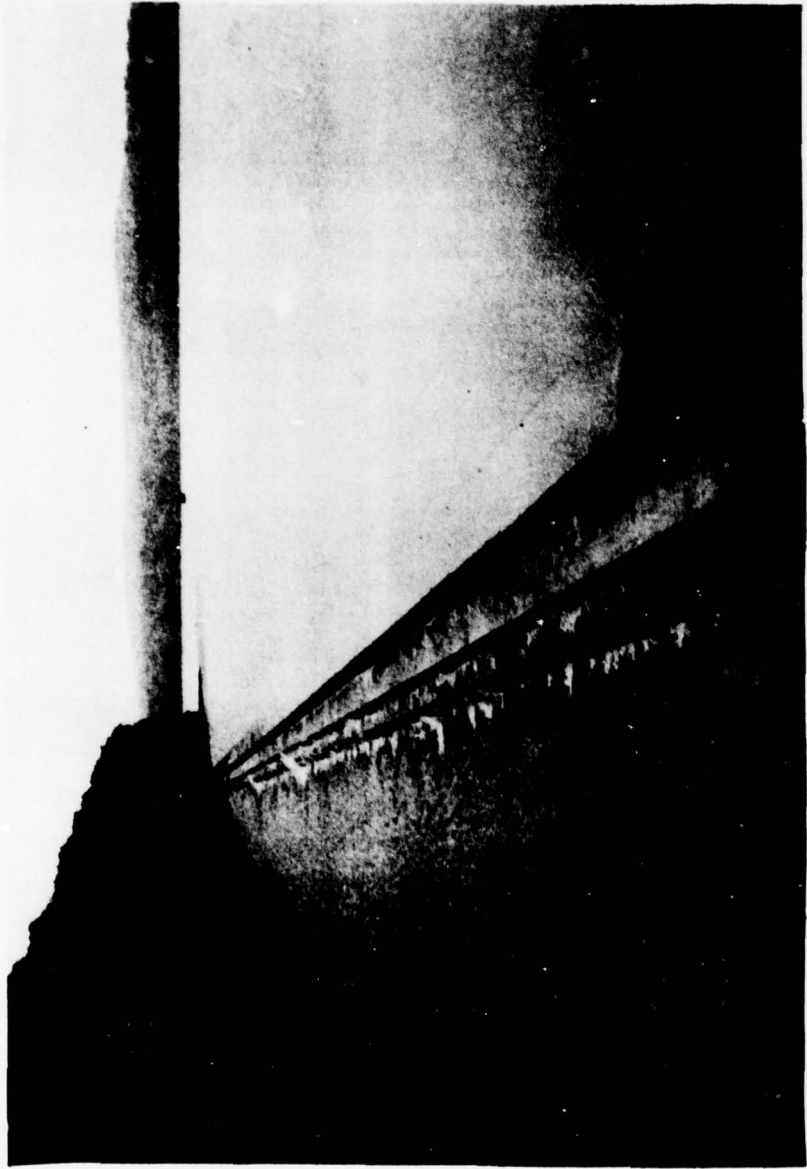


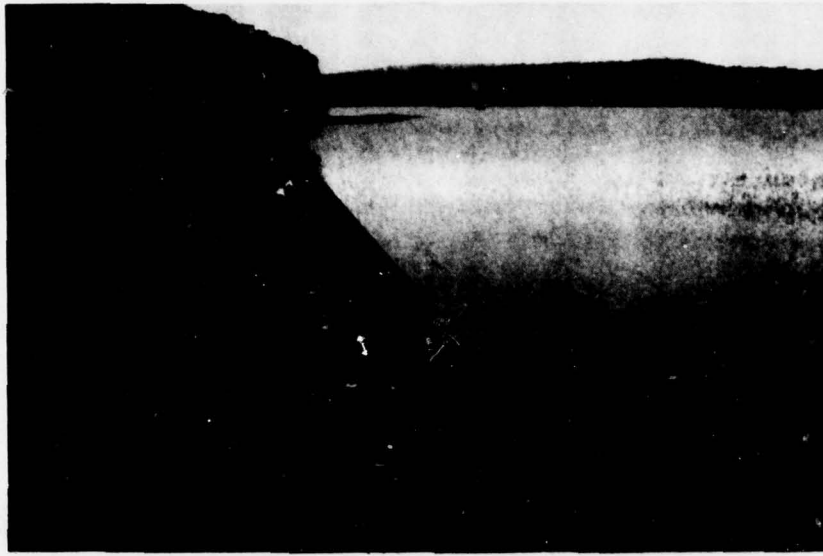
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Date:


Dale Engineering Company

  
John B. Stetson, President

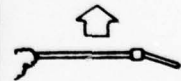
  
Col. Clark H. Benn  
New York District Engineer  
19 September 1978





UPSTREAM  
  
DOWNSTREAM

1. View across weir dam.



2. View of reservoir above dam.



3. Closeup of flow over dam.



4. View from below dam.

PHASE I INSPECTION REPORT  
NATIONAL DAM SAFETY PROGRAM  
NAME OF DAM - MUSCOOT ID# - NY61

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority

Authority for this report is provided by the National Dam Inspection Act, Public Law 92-367 of 1972. It has been prepared in accordance with a contract for professional services between Dale Engineering Company and The New York State Department of Environmental Conservation.

b. Purpose of Inspection

The purpose of this inspection is to evaluate the structural and hydraulic condition of the Muscoot Dam and appurtenant structures, owned by New York City, and to determine if the dam constitutes a hazard to human life or property and to transmit findings to the State of New York.

This Phase I inspection report does not relieve an owner or operator of a dam of the legal duties, obligations or liabilities associated with the ownership or operation of the dam. In addition, due to the limited scope of services for these Phase I investigations, the investigators had to rely upon the data furnished to them. Therefore, this investigation is limited to visual inspection, review of data prepared by others, and simplified hydrologic, hydraulic and structural stability evaluations where appropriate. The investigators do not assume responsibility for defects or deficiencies in the dam or in the data provided.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances

The Muscoot Dam is a masonry dam with a maximum height of 55 feet. The maximum height above the downstream river bed is approximately 29 feet. The dam is 1,130 feet long and has a thickness at the base of 38-1/2 feet. The width at the top of the dam is 5 feet.

The entire top length of the dam serves as a spillway to allow flow from the impoundment into the New Croton Reservoir which is located at the downstream face of the dam. A gate house is located at the southern end of the dam and controls the flow from the Muscoot impoundment into the New Croton Reservoir. Flow is controlled through six 2 foot by 8 foot sluice gates which operate from the gate house.

b. Location

Muscoot Dam is located in the Town of Bedford and in the Town of Somers in Westchester County, New York.

c. Size Classification

The maximum height of the dam is approximately 29 feet above finished grade of the reservoir. The storage volume of the dam is approximately 10,750 acre feet. Therefore, the dam is in the intermediate size category as defined by the Recommended Guidelines for Safety Inspection of Dams.

d. Hazard Classification

The New Croton Reservoir which receives flow from the impoundment of the Muscoot Dam has a pool elevation four feet lower than the impoundment of the Muscoot Dam. The New Croton Dam discharges into the Croton River. The failure of the Muscoot Dam could cause excessive flows into the New Croton Dam, which if it failed, it would cause flows in the Croton River and severe damage to residential and industrial development along the Croton River. Under normal conditions however, there is little head in the reservoir with little threat to the New Croton Dam. Therefore, the dam is in the significant hazard category as defined by the Recommended Guidelines for Safety Inspection of Dams.

e. Ownership

The dam is owned by the City of New York, Bureau of Water Supply.

f. Purpose of Dam

The dam is an integral part of the Water Supply System of the City of New York. Water from the Croton System is used by the City for drinking water purposes. The Muscoot Dam was originally constructed to maintain water levels in the shallow portions of the reservoir upstream from the New Croton Dam. Prior to its construction, water level fluctuations provided breeding places for mosquitos. The Muscoot Dam was constructed to eliminate this Public Health hazard.

g. Design and Construction History

Construction of the Muscoot Dam began in May of 1901. Work progressed very slowly and construction period was extended many times. On January, 1904, the Contractor stopped all work for the winter. In February, the Aqueduct Commissioners declared the contract abandoned and stopped the remaining work. Bids were received for finishing the dam in April, 1904 and work was completed in January, 1906. The dam was completely constructed of masonry except for a short section, 68 feet long, south of the gate house which was built on the bank of the river. This portion consisted of a masonry core wall and an earth bank on each side sloping towards the river. The dam was founded on rock with the exception

of a stretch of about 55 lineal feet which was founded on hard pan. Each of the coping stones was anchored to the masonry by twisted steel rods. The whole dam from the northerly end to the gate house acts as an overflow weir. Its crest is 6 feet below the assumed highest water level in the reservoir (Ref. 3). During the construction of the Muscoot Dam, the Croton River Valley was widened from 300 feet to 400 feet wide at a point just below the Muscoot Dam. This was done to improve the hydraulics in this section of the Reservoir.

h. Normal Operational Procedures

The Muscoot Dam is visited periodically by employees of the New York City Bureau of Water Supply. The gate house is used to control flow into the New Croton Reservoir. At present, copper sulphate is being added at the gate house to control algae growth in the New Croton Reservoir. Water levels in both the New Croton Reservoir and the Muscoot impoundment are manipulated during the winter months to kill plant life which flourishes in the shallow areas of the impoundments.

1.3 PERTINENT DATA

a. Drainage Area

The drainage area of the Muscoot is 316 square miles.

b. Discharge at Dam Site

No discharge records are available at this site.

Computed Discharges: (Dam acts as weir)

Ungated spillway, PMF	182,000 cfs
Ungated spillway, 1/2 PMF	96,000 cfs

c. Elevation (feet above MSL)

Top of dam (at gate house)	210
1/2 PMF discharge	209
Maximum pool - PMF discharge	214
Spillway crest	200
Stream bed at centerline of dam	169

d. Reservoir

Length of normal pool	Not computed
-----------------------	--------------

e. Storage (Above Spillway)

Top of dam	10750 acre feet
1/2 PMF surcharge	10000 acre feet
PMF surcharge	16000 acre feet

f. Reservoir Surface

Spillway pool	1266 acre
---------------	-----------

g. Dam

Type - Masonry.

Length - 1130 feet.

Height - 29 feet (53 feet to foundation).

Freeboard between normal reservoir and top of dam - 0.0 feet.  
10.0 feet at gate house.

Top width - 5 feet.

Side slopes - 1 horizontal to 2 vertical.

Zoning - Not applicable.

Impervious core - None. See Section 1.2.g.

Grout curtain - No information.

## SECTION 2 - ENGINEERING DATA

### 2.1 DESIGN

The information available for review of the Muscoot Dam included:

- 1) References 2, 3 and 5 in Appendix E.
- 2) Plans and maps in Figures 1 through 4.
- 3) Sheet Table No. 7, File 149, entitled "Data Pertaining to Storage Reservoirs of New York City Water Works - Croton System".

### 2.2 CONSTRUCTION

Information on construction can be obtained from New York City Board of Water Supplies Archives and to a limited extent, References 2, 3 and 5 of Appendix E. Salient points on the construction activities are described in Section 1.2 of this report.

### 2.3 OPERATION

See Section 4.

### 2.4 EVALUATION

The engineering data and references reviewed indicate the New York City structures built during this period were designed and constructed very carefully.

## SECTION 3 - VISUAL INSPECTION

### 3.1 SUMMARY

#### a. General

The visual inspection of Muscoot Dam took place on July 27, 1978. The dam is a partially submerged masonry dam structure that visually looks like a weir across the total reservoir width.

#### b. Dam

Due to the fact the dam was largely submerged and that the spillway was discharging across the total length of the dam, the inspection team could not get out on the dam to inspect the dam surface. The top of the dam appears to have maintained its alignment. The exposed portion of the dam visually conforms to the plans.

#### c. Spillway

The entire top of the dam is the spillway. Portions visible to the inspection team (see Photographs 1 and 3) did not exhibit any problems. Photograph 3 suggests that the masonry joints on top of the dam may need some pointing and/or grouting.

#### d. Appurtenant Structures

The gate house was inspected (the structure can be seen in the right position of Photograph 4). Six sluice gates control the flow. One of the gates is jammed in the open position. The other five gates are operable.

#### e. Downstream Channel

The downstream channel is in the waters of the New Croton Reservoir.

## SECTION 4 - OPERATIONAL PROCEDURES

### 4.1 PROCEDURES

Operational procedures were not observed by the inspection team. The dam and reservoir are owned by the New York City Bureau of Water Supply and are maintained by the staff of the Croton Division located in Katonah, New York which is nearby the dam. It is the staff's responsibility to maintain and operate the facility under the direction of the central office in New York City. During normal condition, the water surface elevation of the reservoir is at the spillway crest. Flow through the structure (below the dam crest) is controlled through six 2 foot by 8 foot sluice gates which operate from the gate house. At present, copper sulphate is being added at the gate house to control algae growth below in the New Croton Reservoir. Water levels are lowered in the winter to kill plant life which flourishes in the upper shallow impoundment areas.

### 4.2 MAINTENANCE OF DAM

The dam is maintained by the Croton Divisions full-time maintenance staff which has full capability in operation and maintenance engineering for the facility.

## SECTION 5 - HYDROLOGY AND HYDRAULICS

### 5.1 EVALUATION OF FEATURES

#### a. Design Data

For this report, no information relevant to the hydrologic and/or hydraulic design for the dam was available. Analysis provided in Appendix C was performed utilizing information obtained from construction documents and other general sources of information listed in the reference section of this report.

Visually the dam appears as a simple weir structure across the New Croton Reservoir. The spillway elevation for Muscoot is 4 feet above that of New Croton Dam and Reservoir downstream. The dam, which is approximately 29 feet high (53 feet in height structurally to its foundation) was built in the early 1900's to control mosquitoes in the upper reaches of the Croton Reservoir near the Village of Katanoh. The drainage area contributing to the reservoir is approximately 316 square miles including controlled upland drainage from a large number of water supply reservoirs. Under normal hydrologic conditions, the volume of the impounded water is more a function of the inflow from the upland reservoirs than a function of the natural watershed contributing to the reservoir. The reservoir is the source of water supply for the downstream New Croton Reservoir.

For the purpose of this investigation, the dam spillway was analyzed with respect to its performance under severe flood discharges. Overtopping is not a significant concern since the structure performs as a weir. The peak flood stage is also of little concern since the dam's tailwater elevation will follow the peak discharge stage and this will not create additional head in the structure. The flood event rainfall was developed for the condition of the Probable Maximum Flood (PMF) for the watershed. The PMF is that hypothetical flow induced by the most critical combination of precipitation, minimum infiltration losses, and concentration of runoff at a specific location, that is considered reasonably possible for a particular drainage area.

The hydrologic analysis was performed using the unit hydrograph method to develop the flood hydrograph. Both Clark and Snyder parameters were evaluated. For the Clark Method, values of  $T_c = 17.5$  and  $R = 7.5$  were computed. For the Snyder Method, values of  $T_{pr} = 11.60$  and  $C_p$  of 0.6 were used. Two unit hydrographs and two flood hydrographs were derived and compared with the intention of evaluating the more severe discharge from the flood hydrographs in the spillway analysis.

The Probable Maximum Flood (PMF) hydrograph was determined using Probable Maximum Precipitation rainfall data obtained in Hydro-meteorological Report No. 51. An index rainfall of 24.1 inches for a 200 square mile area for a period of 24 hours was adopted for

the analysis. Both the PMF and 1/2 PMF (SPF) were evaluated. The 1/2 PMF was assumed to be approximately the Standard Project Flood (SPF) in utilizing the U.S. Army Corps of Engineers Hydrologic Engineering Center's Computer Program UHCOMP. The peak discharges for the Clark Method were 96,850 cfs for the 1/2 PMF (SPF) and 182,441 cfs for the PMF. The peak discharges for the Snyder Method were 96,300 cfs for the 1/2 PMF (SPF) and 184,000 cfs for the PMF.

The flood hydrographs derived using the Snyder parameters were routed over the structure using the U.S. Army Corps of Engineers Hydrologic Engineering Center's Program HEC-1 using the Modified Puls Method. An attempt was made to evaluate the upstream reservoirs' combined effect by lumping the stage-storage relationship in the analysis. Assuming 3 feet of head in each reservoir, this provides 17,500 acre feet of storage prior to any flood discharge at Muscoot. Additional runs were made considering only the Muscoot Reservoir's effect. It was determined in both types of analysis the reservoir's storage had an insignificant effect on the discharge over the structure. The depth of flow over the spillway was computed to be 10 feet for the 1/2 PMF (SPF) and 14 feet for the PMF.

## SECTION 6 - STRUCTURAL STABILITY

### 6.1 EVALUATION OF STRUCTURAL STABILITY

#### a. Visual Observations And Data Review

The dam was almost completely submerged at the time of the inspection; the headwaters were overtopping the weir type dam by a few inches. None of the dam structure could be examined.

#### b. Geology and Seismic Stability

There were no outcrops of rock seen in the vicinity of the south end of the dam. The northern end of the dam was not seen. According to the original State report concerned with the dam, presented prior to its construction, the north bank was gneiss and schist and the south bank was gneiss, etc. overlain by sand and gravel. The New York State Geologic Map (1970) shows both banks as well as the rock beneath the dam to be the Inwood Marble. Prucha (1959) shows on his map that the dam is sited partly on the Fordham Gneiss but mainly on the Inwood Marble. The trend of the steeply dipping foliation is easterly.

The marble is subject to solution and the gneiss often contains layers and lenses which weather in time thereby yielding rotted seams which would permit seepage. There is no evidence of this having occurred in the area of this dam.

Relative to the dam site, the closest known faults are approximately two miles distant. One fault lies northwest of the dam and trends northeast. The other is to the southwest with a northwest trend.

Information on some of the earthquakes for the area is tabulated below:

<u>Date</u>	<u>Intensity-Modified Mercalli</u>	<u>Location Relative to Dam</u>
1885	III	6 mi. NW
1937	II	6 mi. SW
1938 (2X)	III	4 mi. SSE
1938	II	6 mi. SE
1964 (2X)	II	4 mi. SSE
1964	V	4 mi. SSE
1967	V	6 mi. SW

The dam is located in an area designated Zone 1 on the Seismic Probability Map. Convention assumes no earthquake hazard for this designation.

c. Data Review and Stability Evaluation

Design drawings applicable to stability evaluations made available for this study are limited to dam cross-sections. Soil/rock properties and upstream/downstream water conditions utilized for the dams design are not known. As part of the present study, stability evaluations have been performed. Actual properties of the sites foundation soils and rock have not been determined; where data was lacking, simplifying assumptions felt to be conservative have been applied. The conditions for (1) an upstream water level at the damtop elevation, with ice acting, and a downstream water level at the downstream ground elevation; and (2) an upstream water level five feet below the top of the dam, with ice, and a downstream water level at the downstream ground elevation; and (3) an upstream water level at the damtop elevation, with ice acting, and a downstream water level 10 feet below the top of the dam, have been studied.

The analysis performed (See Appendix D) indicates marginal but satisfactory stability against overturning for combinations of upstream and downstream water levels and ice loadings. Generally, the computed factors of safety become lower as the difference between headwater and tailwater elevations increase.

Critical to the analysis and resulting indication of stability are the items of uplift water pressures acting on the base of the dam and relative permeabilities of the sites foundation soil and rock. The analysis uplift force was based on a full headwater hydrostatic pressure acting on the dams upstream corner and a full tailwater hydrostatic pressure acting at the dams downstream corner. Uplift pressures were assumed to vary linearly between the dams upstream and downstream corners, and act upon 100 percent of the dam base. For the combinations of upstream/downstream water levels studied, the uplift represents a condition of low factors of safety against overturning.

The assigned uplift force is conservative but may also be too great. The prediction of uplift acting on the base of a gravity dam supported on rock, without having information on the permeability/seepage properties of the foundation rock stratum, represents an engineering analysis area of great uncertainty. If the permeability of the rock stratum foundation is very high, the uplift pressure on the dams upstream corner could be less than a hydrostatic pressure computed on the basis of a full headwater elevation. The full headwater hydrostatic pressure is felt to be reasonable where the permeability of the rock foundation is very low compared to the permeability of soil in back of the dam (upstream side). If the rock is layered and jointed, the uplift computed assuming a linear variation of pressure and a resulting force acting only on an area equal to the dam base could be too low. However, if the rock is very sound and impermeable, seepage would be

very low, and uplift pressures of significance would require a long period of time to develop. Similarly, within the masonry itself (say near the base of the dam) hydrostatic pressures from permeating headwater potentially causing the same effect as uplift at the base of the dam could require a considerable period of time before reaching a significant magnitude. A conclusion drawn from these latter conditions is that the computed uplift utilized in this reports stability analysis may not exist at present and may only develop at some future time. Without a high uplift force acting, the factor of safety for stability against overturning and sliding would be at a level considered acceptable for design.

The dam has a proven record on stability for conditions where the difference between the upstream and downstream reservoir levels is not great. Desirably, future water level differences will not vary greatly from past practice. Any future requirement for significant lowering of the downstream reservoir while maintaining a full or near-full upstream reservoir or applying loading conditions not considered herein should be accompanied by proper engineering studies to assure adequate stability for the dam. For such studies, reliable data on uplift pressures will be important.

## SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

### 7.1 DAM ASSESSMENT

On the basis of the Phase I visual examination and engineering analysis pertained herein, the Muscoot Dam appears to be adequate for normal operation. Since the dam was largely submerged (see overview photograph) a substantial portion of the inspection criteria (Ref. 1) could not be applied in the inspection and report effort. However, it is not recommended that the reservoir be lowered at this time to be inspected further.

From the stability analysis, it is generally recommended that future water level differences should not vary greatly from past practices. While the factor of safety in stability is marginal but satisfactory, future requirements for significant lowering of the downstream reservoir while maintaining a full or near full upstream reservoir or applying loading conditions not considered herein should be accompanied by proper engineering studies to assure adequate stability for the dam. For such studies, reliable field data on uplift pressures are important.

### 7.2 REMEDIAL MEASURES

No remedial measures relative to dam safety can be recommended at this time. Further stability evaluations are recommended prior to lowering the downstream reservoir levels significantly below the upstream level.

## SECTION 7 - ASSESSMENT /REMEDIAL MEASURES

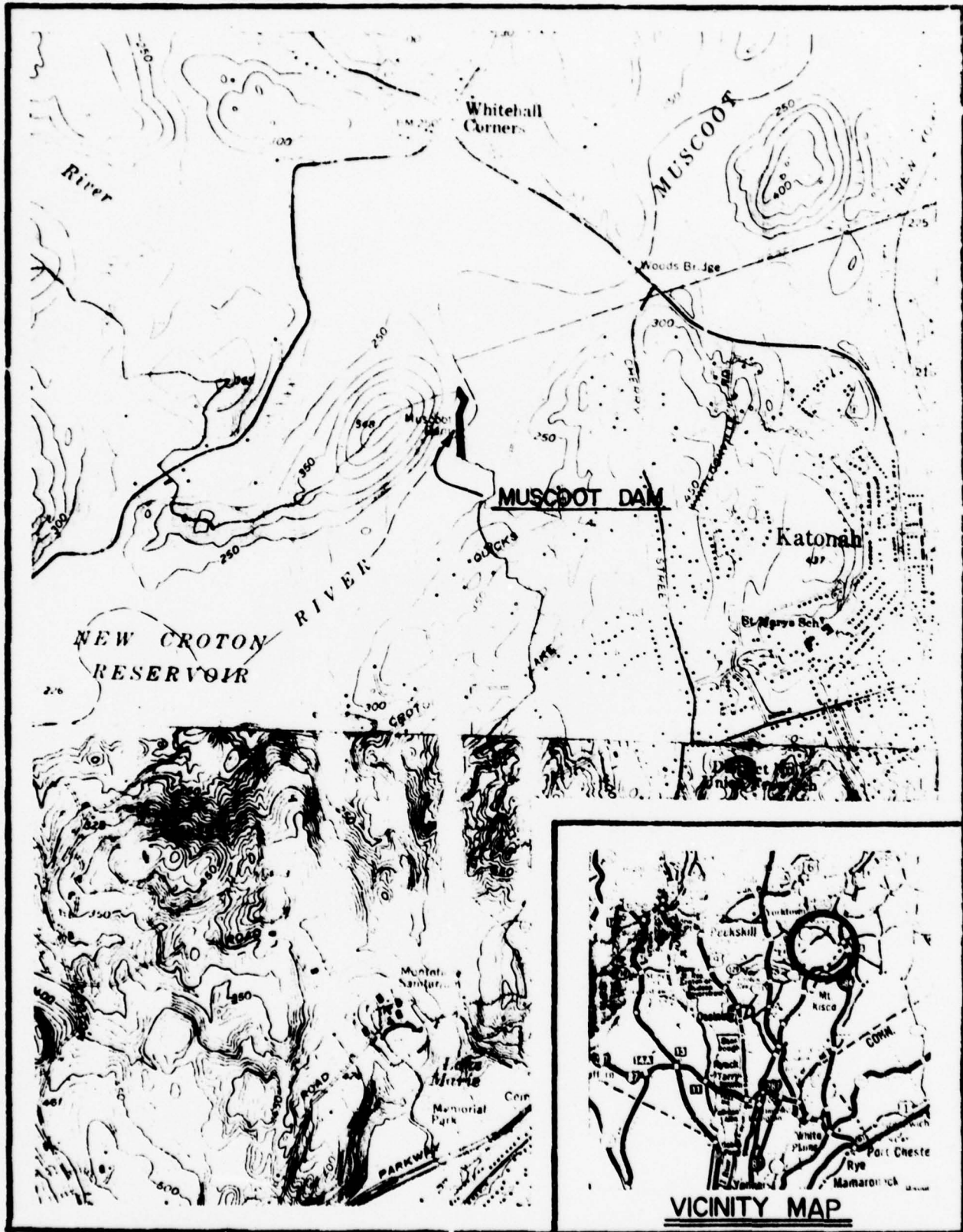
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From the stability analysis, it is concluded and recommended that future water level differences should not vary greatly from past practices. Any future requirement for significant lowering of the downstream reservoir while maintaining a full or near full upstream reservoir should be accompanied by proper engineering studies to assure adequate stability for the dam. For such studies, reliable field data on uplift pressures will be important.

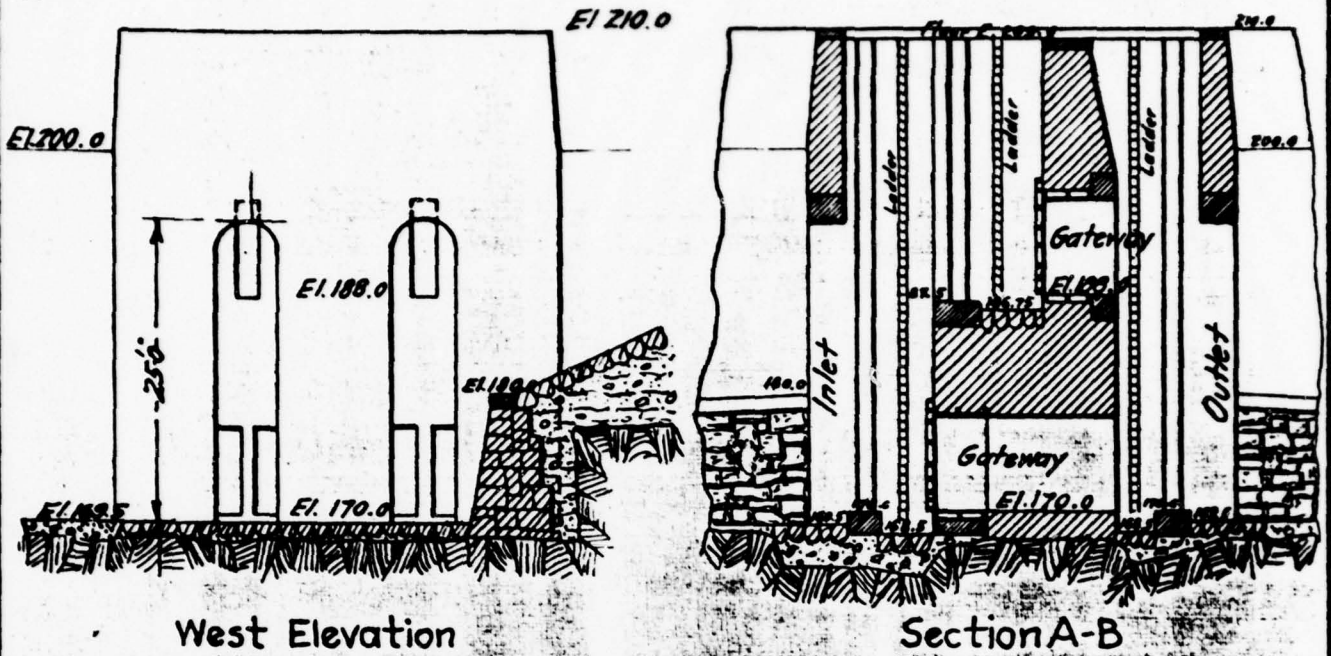
### 7.2 REMEDIAL MEASURES

No remedial measures relative to dam safety can be recommended at this time. As mentioned above, pursuant to lowering the downstream reservoir while maintaining head in the upper further stability, further evaluations are recommended.



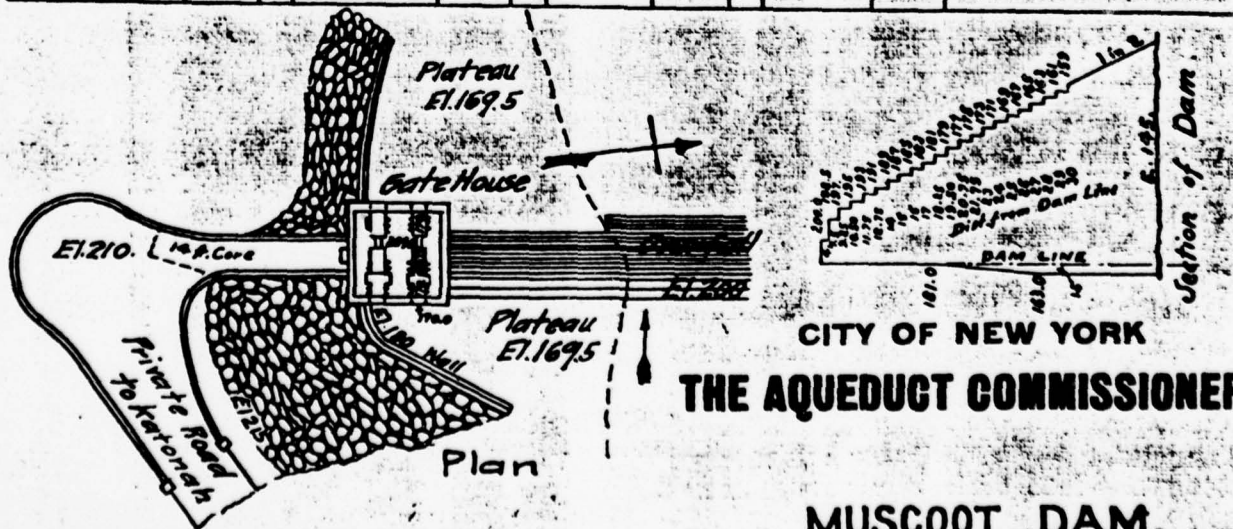
# LOCATION PLAN

FIGURE 1



Inlets			Outlets			Gates		Stopcocks		Remarks	
Number	Shape and Dimension	Elevation of Invert	Number	Shape and Dimension	Elevation of Invert	Number	Size	Elevation of Invert	Number		Diam.
2		169.5	2		169.5	2	2'-8"	188.0			
						4	2'-8"	170.0			

Abut'm't N. of Spillway 75 ft.  
 Spillway 950  
 Gate House 37  
 14 ft. core S. of G.H. 68  
 Total length of Dam 1130 ft.  
 Elevation of Spillway 200.0  
 Elevation of Flashboards 202.0



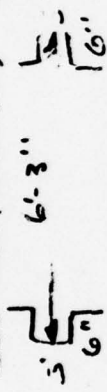
Survey of Case System  
Miscellaneous

9

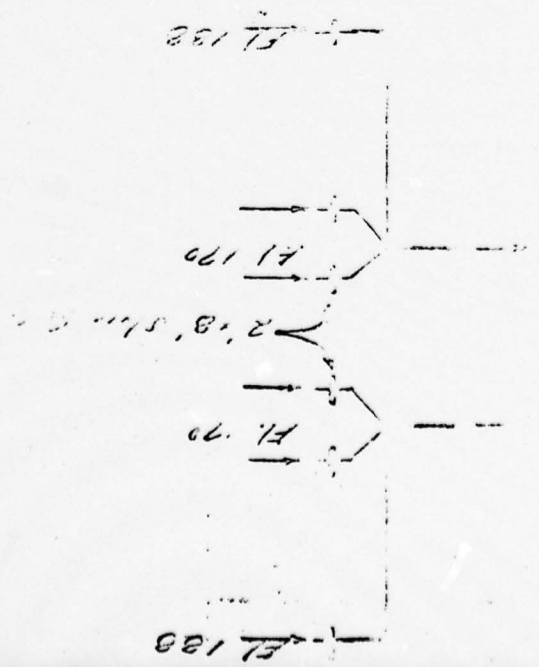
C. P. ...

10/1/77

SLURFLOW DIMENSIONS W 6' 3" D 6" T = 5"



Stop Structures 44- 4' x 6'-2" x 4 1/2" non-emersion



Channel Diagram

FIGURE 3

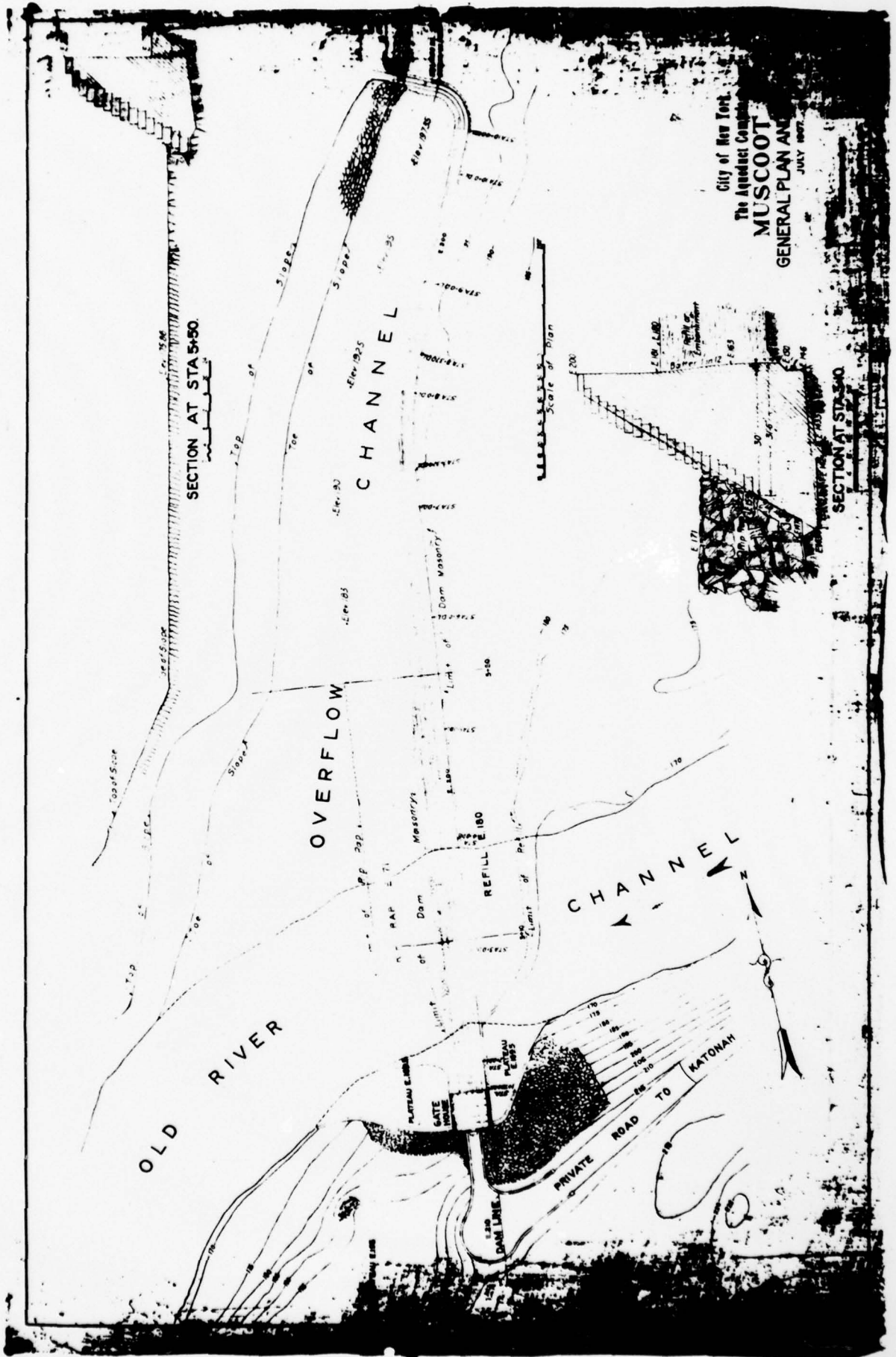


FIGURE 7

APPENDIX A  
FIELD INSPECTION REPORT

CHECK LIST  
VISUAL INSPECTION

PHASE 1

Name Dam MUSCOOT DAM County WESCHESTER State NEW YORK ID # NY 33  
Type of Dam MASONRY Hazard Category ---  
Date(s) Inspection JULY 27, 1978 Weather CLOUDY Temperature 75°

Pool Elevation at Time of Inspection 200 M.S.L. Tailwater at Time of Inspection 196 ESTIMATED

Inspection Personnel:

N. F. DUNLEVY DALE ENGINEERING COMPANY  
F. W. BYSZEWSKI DALE ENGINEERING COMPANY  
D. F. MCCARTHY DALE ENGINEERING COMPANY  
H. S. MUSKATT DALE ENGINEERING COMPANY  
JOHN BYRNES, KATONAH SECTION ENGR., N.Y.C. BOARD OF WATER SUPPLY

N. F. DUNLEVY Recorder

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE	N/A	Reservoir was spilling over dam which has a spillway along it, total length.
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	N/A	
DRAINS	None observed.	
WATER PASSAGES	N/A	
FOUNDATION	Not observable.	

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	None observed.	Entire spillway was spilling.
STRUCTURAL CRACKING	None observed.	Entire spillway was spilling.
VERTICAL & HORIZONTAL ALIGNMENT	As viewed, no noticeable problems.	
MONOLITH JOINTS	None observed.	
CONSTRUCTION JOINTS	None observed.	
STAFF GAGE OF RECORDER	None.	

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	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	N/A	
NOT NOTICEABLE SEEPAGE	N/A	
STAFF GAGE AND RECORDER	N/A	
DRAINS	N/A	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR MASONRY	Entire dam acts as weir and was spilling. No noticeable problems.	
APPROACH CHANNEL	None.	
DISCHARGE CHANNEL	Discharges into Croton Dam Reservoir at downstream face of Muscoot.	
BRIDGE AND PIERS	None.	

GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	None.	
APPROACH CHANNEL	None.	
DISCHARGE CHANNEL	None.	
BRIDGE AND PIERS	None.	
GATES AND OPERATION EQUIPMENT	None.	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	None observed.	
INTAKE STRUCTURE	6 sluice gates control flows. Upper gate is open and is jammed open. The two lower gates were closed and operable.	
OUTLET STRUCTURE	Set plans. Same as intake.	
OUTLET CHANNEL	Empties into Croton Dam Reservoir.	
EMERGENCY GATE	None.	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Croton Reservoir.	
SLOPES	N/A	
APPROXIMATE NO. OF HOMES AND POPULATION	None immediately downstream. Croton Reservoir is downstream. Hazard lies below Croton.	

INSTRUMENTATION

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

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	No significant slopes above reservoir observed.	
SEDIMENTATION	No problems observed.	

**CHECK LIST**  
**ENGINEERING DATA**  
DESIGN, CONSTRUCTION, OPERATION  
PHASE 1

NAME OF DAM MUSCOOT

ID # NY 33

ITEM	REMARKS
AS-BUILT DRAWINGS	None.
REGIONAL VICINITY MAP	See this report.
CONSTRUCTION HISTORY	See this report.
TYPICAL SECTIONS OF DAM	See this report.
OUTLETS - PLAN - DETAILS - CONSTRAINTS - DISCHARGE RATINGS	See this report.
RAINFALL/RESERVOIR RECORDS	None.

ITEM	REMARKS
DESIGN REPORTS	None available.
GEOLOGY REPORTS	None available.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None available.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None available.
POST-CONSTRUCTION SURVEYS OF DAM	None available.
BORROW SOURCES	No data available.

ITEM	REMARKS
MONITORING SYSTEMS	None.
MODIFICATIONS	None.
HIGH POOL RECORDS	No data available.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	No data available.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None disclosed.
MAINTENANCE OPERATION: RECORDS	See N.Y.C. Board of Water Supply.

ITEM	REMARKS
SPILLWAY PLAN  SECTIONS DETAILS	See plans this report.
OPERATING EQUIPMENT PLANS & DETAILS	See data this report.

CHECK LIST  
HYDROLOGIC & HYDRAULIC  
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 82.13 sq. miles

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 196.40

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): 196.40

ELEVATION MAXIMUM DESIGN POOL: 196.40

ELEVATION TOP DAM: 196.40

CREST:

a. Elevation 196.40

b. Type Weir crest

c. Width 4.00 feet

d. Length 1130.0 feet

e. Location Spillover Entire length of dam.

f. Number and Type of Gates None.

OUTLET WORKS:

a. Type Gated masonry conduits (see this report).

b. Location Gate house.

c. Entrance Inverts 170.00

d. Exit Inverts 170.00

e. Emergency Draindown Facilities None

HYDROMETEOROLOGICAL GATES:

a. Type None

b. Location None

c. Records None

MAXIMUM NON-DAMAGING DISCHARGE: ----

APPENDIX B  
PREVIOUS INSPECTION REPORTS

State Engineer and Surveyor

Report of a Structure Impounding Water

To assist in carrying out the provisions of Section 10 of the Conservation Law, being Chapter LXV of the Consolidated Laws of New York State, relating to safeguarding life and property and the erection, reconstruction, or maintenance of structures for impounding water, owners of such structures are requested to fill out as completely as possible this report form for each such dam or reservoir owned within the State of New York for which no plans or reports relative thereto are on file in this Department, and to return this report form, together with prints or photographs explanatory thereof to this department.

1. The structure is on the Croton river flowing into the Hudson river in the Town of Cortland County of Columbia County and New York

It is about three quarters of a mile from Wood's Bridge  
(Give exact distance and direction from a well-known bridge, or, in village, main cross-street or mouth of a stream)

2. Is any part of the structure built upon or does its pond flood any State lands? No

3. The name and address of the owner is City of New York

4. The structure is used for maintaining a certain elevation of the water above the dam, for sanitary reasons

5. The material of the right bank, in the direction with the current, is rock (gneiss, schist, etc.) the hillway crest elevation this material has a top slope of \_\_\_\_\_ inches vertical to a foot horizontal on the center line of the structure, a vertical thickness at this elevation of \_\_\_\_\_ feet, and the top surface extends for a vertical height of \_\_\_\_\_ feet above the spillway crest

6. The material of the left bank is gneiss, overlain by sand and gravel has a top slope of \_\_\_\_\_ inches to a foot horizontal, a thickness of \_\_\_\_\_ feet and a height of \_\_\_\_\_ feet.

7. The natural material of the bed on which the structure rests is (sandstone, rock, etc.) a bastard gravel, like gneiss

8. State the character of the bed and the banks in respect to the hardness, perviousness, water bearing, effect of exposure to air and to water, uniformity, etc. rock is near the surface in most places. bed is overlain by sand and gravel. The rock is hard and impervious to water except in some narrow fissures.

9. If the bed is in layers, are the layers horizontal or inclined? ..... If inclined what is the direction of the horizontal outcropping relative to the axis of the main structure and the inclination and direction of the layers in a plane perpendicular to the horizontal outcropping? .....

10. What is the thickness of the layers? .....

11. Are there any porous seams or fissures? .....

12. The watershed at the above structure and draining into the pond formed thereby is 315.73 square miles.

13. The pond area at the spillway crest elevation is 1136 acres and the pond impounds 657 million cubic feet of water.

14. The maximum known flow of the stream at the structure was ..... cubic feet per second on  
(1929)

15. Has the spillway capacity ever been exceeded by a high flow? .....

Can any possible flood flow from the pond otherwise than through the wastes noted under 17 and 18 of this report? ..... If so, give the location, the length and the elevation relative to the spillway crest and the character and slopes of the ground of such possible wastes. ....

16. State if any damage to life or to any buildings, roads or other property could be caused by any possible failure of the above structure. Describe the location, the character and the use of buildings below the structure which might be damaged by any failure of the structure. If roads adjacent to or crossing the stream below the structure, giving the lowest elevation of the roadway above the stream bed and giving the slope, the height and the width of stream openings; and of any embankments or steep slopes that any flood could pass over. Also indicate the character and use made of the ground below the structure. ....

17. WASTES. The spillway of the above structure is 812 feet long in the clear; the waters are held at the right end by a rocky hill the top of which is ..... feet above the spillway crest, and has a top width of ..... feet; and at the left end by a gate house, the top of which is 10 feet above the spillway crest, and has a top width of 35 feet.

18. There is also for flood discharge a pipe ..... inches inside diameter, and the bottom is ..... feet below the spillway crest; and ~~2~~ <sup>3</sup> 3 gates on it ..... 2 feet wide in the clear by 3 feet high, and the bottom is 30.5 feet below the spillway crest.

19. APRON. Below the spillway there is a <sup>17.5 ft</sup> ~~17.5 ft~~ <sup>17.5 ft</sup> built on ~~the~~ <sup>the</sup> ~~downstream~~ <sup>downstream</sup> ~~side~~ <sup>side</sup> ~~of~~ <sup>of</sup> ~~the~~ <sup>the</sup> ~~spillway~~ <sup>spillway</sup> ~~is~~ <sup>is</sup> ~~17.5~~ <sup>17.5</sup> ~~feet~~ <sup>feet</sup> wide and ~~17.5~~ <sup>17.5</sup> ~~feet~~ <sup>feet</sup> thick. The downstream side of the apron has a thickness of ~~17.5~~ <sup>17.5</sup> ~~feet~~ <sup>feet</sup> for a width of ~~17.5~~ <sup>17.5</sup> ~~feet~~ <sup>feet</sup>.

20. Has the structure any weaknesses which are liable to occur in high flows? ~~None~~ <sup>None</sup>

21. SECTIONS. On the back of this report make a sketch to scale for each different cross-section of the above structure at the greatest depth; giving the height and the depth from the surface of the foundation, the bottom width, the top width (for a concrete or masonry spillway at two feet below the crest, the elevation of the top in reference to the spillway crest, the length of the section, and the material of which the section is constructed; on the spillway section show a cross section of the apron, giving its width, thickness and material, and show the abutment or wash wall at the end of the spillway, giving its heights and thickness. Mark each section with a capital letter. Also sketch a plan; show the above sections by their top lines, giving the mark and the length of each; the openings by their horizontal dimensions; the abutments by their top width and top lengths from the upstream face of the spillway section; and outline the apron. Also sketch an elevation of each end of the structure with a cross section of the banks, giving the depth and width excavated into the banks.

22. WATER SUPPLY. The waters impounded by the above structure have ~~not~~ <sup>not</sup> been used for a public water supply since ~~1905~~ <sup>1905</sup> by ~~the City of New York~~ <sup>the City of New York</sup>

For the plans, profiles, etc. of the Dam see Report of the Aqueduct  
Commissioners for 1895 to 1907, plates 91 to 93 inclusive.

The above information is correct to the best of my knowledge and belief.

Manhattan Building, New York, C. O. *[Signature]*  
(Address of signer) *[Title]*

February - 1925

*[Signature]*  
This report is part of the New York City  
B-4

APPENDIX C

HYDROLOGIC AND HYDRAULIC COMPUTATIONS



STETSON • DALE

HANKERS TRUST BUILDING  
111 CALIFORNIA • NEW YORK • 10001  
TEL 315-797-1800

DESIGN BRIEF

PROJECT NAME NY DAM INSPECTION DATE 8.7.78  
SUBJECT MUSCOUT DAM PROJECT NO. 2210  
DRAWN BY NFO

NORTH ATLANTIC DIV WATER RESOURCES STUDY (FEB 72)

Plot  $T_c + R$ 's

$DA/S$  vs  $T_c + R$

$$S = 10 \text{ FT/MI}$$

$$DA = 316 \text{ MI}^2$$

$$DA/S = 316/10 = 31.6$$

$$T_c + R = 25 \text{ HRS}$$

$$R/(T_c + R) = 0.30$$

$$R = 7.5$$

$$T_c = 17.5$$

**DALE**

**DESIGN BRIEF**

DESIGNED BY NFO

DATE 8.7.78

CHECKED BY \_\_\_\_\_

PAGE \_\_\_\_\_ OF \_\_\_\_\_

PROJECT NO. 2210 SHORT TITLE NY DAM INSPECTION

SIGN SUBJECT MUSCOUT DAM

REF. DWGS. \_\_\_\_\_

ESTIMATE OF SNYDER'S PARAMETER

$$\begin{aligned}
 \text{GAD } C_p &= \\
 C_p &= 2.68 \text{ (assumed)} \\
 C_T &= 1.00 \text{ (assumed)}
 \end{aligned}$$

$$\begin{aligned}
 t_p &= C_T (L \times L_c)^{0.3} \\
 &= 2.0 (26 \times 12.25) \\
 &= 11.34
 \end{aligned}$$

$$t_r = t_p / 5.5 = 11.34 / 5.5 = 2$$

$$t_{pr} = t_p + 0.25 (t_r - t_p) = 11.34 + 0.25 (2 - 11.34) = 11.60$$

SUMMARY OF PARAMETERS

CLARK'S

SNYDER'S

~~BRR~~ —————  $T_c =$   
~~SCS (EN Method)~~ —  $T_c =$   
 NORTH ATLANTIC DIV  $T_c = 17.5$

$t_{pr} = 11.60$   
 $C_p = 0.60$

$$\begin{aligned}
 R / (T_c + R) &= 0.3 \\
 &= 7.5
 \end{aligned}$$



STETSON • DALE

BANKERS TRUST BUILDING  
UTICA • NEW YORK • 13501  
TEL 315-797-5800

DESIGN BRIEF

PROJECT NAME NY DAM INSPECT. ON DATE 8.7.76  
 SUBJECT MUSCOUT DAM PROJECT NO. 2210  
 DRAWN BY JPG

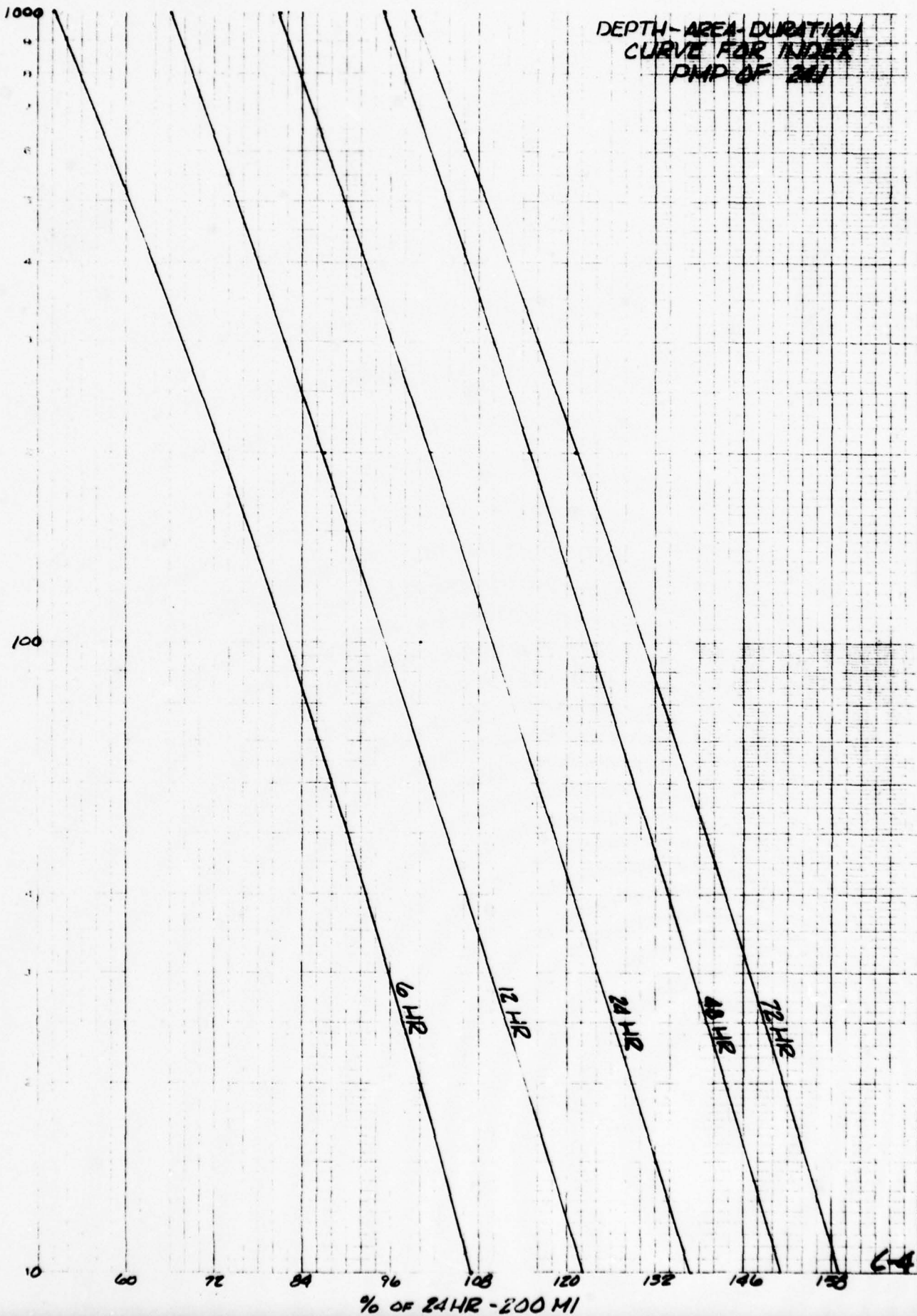
D-A-D RELATIONSHIP \*\*  
 \*\* PMP HYDROMETEOROLOGICAL REPORT NO 51

AREA	DURATION	DEPTH	% OF INDEX
10 MI <sup>2</sup>	6 Hr	25.8	107
10 MI <sup>2</sup>	12 Hr	29.5	122
10 MI <sup>2</sup>	24 Hr	32.9	137
10 MI <sup>2</sup>	48 Hr	36.5	151
10 MI <sup>2</sup>	72 Hr	38.3	159
200 MI <sup>2</sup>	6 Hr	17.7	73
200 MI <sup>2</sup>	12 Hr	21.1	87
* 200 MI <sup>2</sup>	24 Hr	24.	100
200 MI <sup>2</sup>	48 Hr	27.8	115
200 MI <sup>2</sup>	72 Hr	29.1	121
1000 MI <sup>2</sup>	6 Hr	12.5	52
1000 MI <sup>2</sup>	12 Hr	15.9	66
1000 MI <sup>2</sup>	24 Hr	19.6	81
1000 MI <sup>2</sup>	48 Hr	22.9	95
1000 MI <sup>2</sup>	72 Hr	23.	99

\* PMP INDEX RAIN ALL 24.1

DURATION	
6 Hr	67.0
12 Hr	81.0
24 Hr	95.7
48 Hr	109.5
72 Hr	115.5

DEPTH-AREA-DURATION  
CURVE FOR INDEX  
DMP OF 241



DRAINAGE AREA (50 MI)

64

# MUSCOUT DAM STAGE - STORAGE Plot

220

216

212

208

204

200

Elevation (ft)

WITHOUT EFFECT OF UPSTREAM RESERVOIR

WITH UPSTREAM RESERVOIR STORAGE IN ALL DAMAGES

10000

20000

30000

Storage (Acres-Ft)

**DALE**

**DESIGN BRIEF**

DESIGNED BY NFD

DATE 8.11.78

CHECKED BY \_\_\_\_\_

PAGE 6-6 OF \_\_\_\_\_

PROJECT NO. 2210

SHORT TITLE NY DAM INSPECTION

DESIGN SUBJECT UHCMP COMPUTER RUNS SUMMARY

REF. DWGS. \_\_\_\_\_

SIF	CLARK PARAMETERS	96,850	CFS
	SNYDER PARAMETERS	94,300	CFS
DMF	CLARK PARAMETERS	182,441	CFS
	SNYDER PARAMETERS	184,000	CFS

UNIT GRAPH AND HYDROGRAPH COMP. JULY 1966 (REVISED AUGUST 1974)  
HYDROLOGIC ENGINEERING CENTER (HEC)  
DAVIS, CA

--- OPERATIONS AVAILABLE ---

TIME INT = SET TIME INTERVAL OF ALL COMPUTATIONS  
UNIT H = COMPUTE UH BY INPUT, CLARK, OR SNYDER  
RAIN = INPUT RAIN AND LOSS RATE DATA  
RUNOFF = INPUT BASEFLOW, COMPUTE & PRINT HYDROGRAPH  
PNT = PRINT UNIT HYDROGRAPH ONLY  
STOP = STOP EXECUTION OF PROGRAM

USER MUST SELECT OPERATION DESIRED  
MAY RETURN TO ANY OPERATION

SELECT 1-6 (1=TIME INT, 2=UNIT H, 3=RAIN, 4=RUNOFF, 5=PNT, 6=STOP) 1  
ENTER TIME INTERVAL (MIN) = 180.

SELECT 1-6 (1=TIME INT, 2=UNIT H, 3=RAIN, 4=RUNOFF, 5=PNT, 6=STOP) 2  
ENTER DRAINAGE AREA (SQMI) = 15.00  
SELECT 1-3 (1=INPUT UH, 2=CLARK, 3=SNYDER) 2  
ENTER NUMBER OF TIME-AREA ORDINATES (0=NONE) = 0  
ENTER CLARKS TC AND R (HRS) = 17.50 7.50

TP	CP	TC	R
13.60	0.759	17.50	7.50

SELECT 1-6 (1=TIME INT,2=UNIT H,3=RAIN,4=RUNOFF,5=PNT,6=STOP) 3  
 ENTER RATIO IMPERVIOUS = 0.00  
 SELECT 1-3 (1=RAIN,2=SPS,3=PMS) 2  
 ENTER SPS INDEX RAINFALL (IN) = 12.00  
 ENTER TRSIC AND TRSDA (SQMI) = 1.00 315.00  
 SELECT 1-3 (1=INIT+CONST,2=ACUM LOSS,3=SCS) 1  
 ENTER INITIAL LOSS(IN), CONSTANT LOSS(IN/HR) = 1.00 0.10

SELECT 1-6 (1=TIME INT,2=UNIT H,3=RAIN,4=RUNOFF,5=PNT,6=STOP) 4  
 ENTER A TITLE PLEASE - MUSCOOT DAM SPS  
 ENTER STRTG,GRCSN,AND RTIOR = 630.00 630.00 1.00

HR	MIN	RAIN	LOSS	EXCESS	UNIT HG	RECSN	FLOW
3	0	0.01	0.01	0.00	1133.	630.	630.
6	0	0.01	0.01	0.00	3961.	630.	630.
9	0	0.03	0.03	0.00	7391.	630.	630.
12	0	0.03	0.03	0.00	10198.	630.	630.
15	0	0.10	0.10	0.00	11341.	630.	630.
18	0	0.20	0.20	0.00	10373.	630.	630.
21	0	0.02	0.02	0.00	7777.	630.	630.
24	0	0.02	0.02	0.00	5185.	630.	630.
27	0	0.05	0.05	0.00	3457.	630.	630.
30	0	0.05	0.05	0.00	2305.	630.	630.
33	0	0.13	0.13	0.00	1537.	630.	630.
36	0	0.13	0.13	0.00	1025.	630.	630.
39	0	0.45	0.37	0.08	683.	630.	721.
42	0	0.91	0.30	0.61	45.	630.	1638.
45	0	0.08	0.08	0.00	30.	630.	3637.
48	0	0.08	0.08	0.00	202.	630.	5955.
51	0	0.30	0.30	0.00	135.	630.	7758.
54	0	0.30	0.30	0.00	90.	630.	8378.
57	0	0.79	0.30	0.49		630.	8135.
60	0	0.79	0.30	0.49		630.	8285.
63	0	2.77	0.30	2.47		630.	12430.
66	0	5.65	0.30	5.35		630.	27363.
69	0	0.49	0.30	0.19		630.	52294.
72	0	0.49	0.30	0.19		630.	77842.
75	0	0.02	0.02	0.00		630.	94727.
78	0	0.02	0.02	0.00		630.	96843.
81	0	0.05	0.05	0.00		630.	83758.
84	0	0.05	0.05	0.00		630.	62042.
87	0	0.17	0.17	0.00		630.	42271.
90	0	0.35	0.30	0.05		630.	28613.
93	0	0.03	0.03	0.00		630.	19442.
96	0	0.03	0.03	0.00		630.	13374.
99	0					630.	9391.

102	0				630.	6699.
105	0				630.	4818.
108	0				630.	3467.
111	0				630.	2493.
114	0				630.	1844.
117	0				630.	1291.
120	0				630.	750.
123	0				630.	698.
126	0				630.	664.
129	0				630.	653.
132	0				630.	645.
135	0				630.	640.
138	0				630.	637.
141	0				630.	635.
144	0				630.	630.
147	0				630.	630.
TOTAL		14.58	4.68	9.90	67555.	30270. 699647.

SELECT 1-6 (1=TIME INT,2=UNIT H,3=RAIN,4=RUNOFF,5=PNT,'6=STOP) 1  
 ENTER TIME INTERVAL(MIN)= 100.

SELECT 1-6 (1=TIME INT,2=UNIT H,3=RAIN,4=RUNOFF,5=PNT,'6=STOP) 2  
 ENTER DRAINAGE AREA (SQMI) = 315.00  
 SELECT 1-3 (1=INPUT UH, 2=CLARK, 3=SNYDER ) 3  
 ENTER SNYDERS CP AND TP (HRS) = 0.62 11.60  
 ENTER INITIAL EST. CLARKS TO K (HRS) (0=DEFAULT)= 0.00 0.00

TP	CP	TC	R
9.82	0.591	13.71	8.77
11.41	0.660	13.94	9.26
11.59	0.642	13.94	9.52
11.63	0.634	13.94	9.65
11.64	0.629	13.94	9.65

SELECT 1-6 (1=TIME INT,2=UNIT H,3=RAIN,4=RUNOFF,5=PNT,'6=STOP) 3  
 ENTER RATIO IMPERVIOUS = 0.00  
 SELECT 1-3 ( 1=RAIN, 2=SFS, 3=PMS ) 2  
 ENTER SPS INDEX RAINFALL (IN) = 12.00  
 ENTER TRSPC AND TRSDA (SQMI) = 1.00 315.00  
 SELECT 1-3 (1=INIT+CONST, 2=ACUM LOSS, 3=SCS) 1  
 ENTER INITIAL LOSS(IN), CONSTANT LOSS(IN/HR) = 1.00 0.10

SELECT 1-6 (1=TIME INT,2=UNIT H,3=RAIN,4=RUNOFF,5=PNT,'6=STOP) 4  
 ENTER A TITLE PLEASE - MUSCOG<sup>U</sup> SPF  
 ENTER STRTQ,QRCSN,AND RTIOR = 630.00 630.00 1.00

FR	MIN	RAIN	LOSS	EXCESS	UNI	HG	RECSN	FLOW
3	0	0.01	0.01	0.00	12	.	630.	630.
6	0	0.01	0.01	0.00	45	7.	630.	630.
9	0	0.03	0.03	0.00	84	53.	630.	630.
12	0	0.03	0.03	0.00	10	983.	630.	630.
15	0	0.10	0.10	0.00	10	747.	630.	630.
18	0	0.20	0.20	0.00	8	525.	630.	630.
21	0	0.02	0.02	0.00	6	231.	630.	630.
24	0	0.02	0.02	0.00	4	555.	630.	630.
27	0	0.05	0.05	0.00	3	329.	630.	630.
30	0	0.05	0.05	0.00	2	43.	630.	630.
33	0	0.13	0.13	0.00	1	79.	630.	630.
36	0	0.13	0.13	0.00	1	3.	630.	630.
39	0	0.45	0.37	0.08	9	.	630.	733.
42	0	0.91	0.30	0.61	6	.	630.	1781.
45	0	0.08	0.08	0.00	5	0.	630.	4099.
48	0	0.08	0.08	0.00	3	1.	630.	6665.
51	0	0.30	0.30	0.00	2	2.	630.	1189.
54	0	0.30	0.30	0.00	1	7.	630.	7868.
57	0	0.79	0.30	0.49	1	5.	630.	6959.
60	0	0.79	0.30	0.49	1	0.	630.	7669.
63	0	2.77	0.30	2.47			630.	13237.
66	0	5.63	0.30	5.33			630.	30545.
69	0	0.49	0.30	0.19			630.	58433.
72	0	0.49	0.30	0.19			630.	84560.
75	0	0.02	0.02	0.00			630.	96289.
78	0	0.02	0.02	0.00			630.	88582.
81	0	0.05	0.05	0.00			630.	69916.
84	0	0.05	0.05	0.00			630.	51917.
87	0	0.17	0.17	0.00			630.	38244.

90	0	0.35	0.30	0.05	630.	28188.
93	0	0.03	0.03	0.00	630.	20956.
96	0	0.03	0.03	0.00	630.	15743.
99	0				630.	11911.
102	0				630.	8965.
105	0				630.	6757.
108	0				630.	5110.
111	0				630.	3905.
114	0				630.	3025.
117	0				630.	2344.
120	0				630.	1846.
123	0				630.	1327.
126	0				630.	725.
129	0				630.	685.
132	0				630.	655.
135	0				630.	649.
138	0				630.	644.
141	0				630.	640.
144	0				630.	637.
147	0				630.	635.
150	0				630.	630.
153	0				630.	630.
TOTAL		14.58	4.68	9.90	67447.	32130. 699851.

SELECT 1-6 (1=TIME INT,2=UNIT H,3=RAIN,4=RUNOFF,5=PNT,'6=STOP) 1  
 ENTER TIME INTERVAL(MIN)= 180.

SELECT 1-6 (1=TIME INT,2=UNIT H,3=RAIN,4=RUNOFF,5=PNT,'6=STOP) 2  
 ENTER DRAINAGE AREA (SQMI) = 315.00  
 SELECT 1-3 (1=INPUT UH, 2=CLARK, 3=SNYDER ) 2  
 ENTER NUMBER OF TIME-AREA ORDINATES (0=NONE)= ( )  
 ENTER CLARKS TC AND R (HRS) = 17.50 7.50

TP	CP	TC	R
13.60	0.759	17.50	7.50

SELECT 1-6 (1=TIME INT,2=UNIT H,3=RAIN,4=RUNOFF,5=PNT,'6=STOP) 3  
 ENTER RATIO IMPERVIOUS = 0.00  
 SELECT 1-3 ( 1=RAIN, 2=SPS, 3=PMS ) 3  
 ENTER PMS INDEX RAINFALL (IN) = 24.18  
 ENTER R6,R12,R24,R48,R72,R96 = 67.00 81.00 95.70 109.70 115.50 0.00  
 ENTER TRSFC AND TRSDA (SQMI) = 0.00 315.00  
 SELECT 1-3 (1=INIT+CONST, 2=ACUM LOSS, 3=SCS) 1  
 ENTER INITIAL LOSS(IN), CONSTANT LOSS(IN/HR) = 1.00 0.10

SELECT 1-6 (1=TIME INT,2=UNIT H,3=RAIN,4=RUNOFF,5=PNT,'6=STOP) 4  
 ENTER A TITLE PLEASE - MUSCOGOT FMF  
 ENTER STRTQ,GRCSN,AND RTIOR = 630.00 630.00 1.00

HR	MIN	RAIN	LOSS	EXCESS	UNIT HG	RECSN	FLOW
3	0	0.09	0.09	0.00	1133.	630.	630.
6	0	0.09	0.09	0.00	3961.	630.	630.
9	0	0.22	0.22	0.00	7391.	630.	630.
12	0	0.22	0.22	0.00	10198.	630.	630.
15	0	0.69	0.51	0.18	11341.	630.	834.
18	0	1.41	0.30	1.11	10372.	630.	2601.
21	0	0.14	0.14	0.00	7777.	630.	6357.
24	0	0.14	0.14	0.00	5182.	630.	10670.
27	0	0.63	0.30	0.33	3457.	630.	14365.
30	0	0.63	0.30	0.33	2302.	630.	16766.
33	0	1.50	0.30	1.20	1537.	630.	18650.
36	0	1.50	0.30	1.20	1025.	630.	22113.
39	0	4.75	0.30	4.45	683.	630.	32780.
42	0	9.64	0.30	9.34	456.	630.	61361.
45	0	0.95	0.30	0.65	304.	630.	105920.
48	0	0.95	0.30	0.65	203.	630.	150581.
51	0	0.04	0.04	0.00	135.	630.	179616.
54	0	0.04	0.04	0.00	90.	630.	182441.
57	0	0.09	0.09	0.00		630.	158323.
60	0	0.09	0.09	0.00		630.	118592.

63	0	0.29	0.29	0.00	630.	81663.
66	0	0.50	0.50	0.28	630.	55533.
69	0	0.06	0.06	0.00	630.	38122.
72	0	0.06	0.06	0.00	630.	26891.
75	0				630.	19616.
78	0				630.	14562.
81	0				630.	10689.
84	0				630.	7560.
87	0				630.	5181.
90	0				630.	3594.
93	0				630.	2340.
96	0				630.	1207.
99	0				630.	976.
102	0				630.	821.
105	0				630.	758.
108	0				630.	715.
111	0				630.	687.
114	0				630.	668.
117	0				630.	655.
120	0				630.	630.
123	0				630.	630.
TOTAL		24.80	5.08	19.72	67553.	25830. 1357981.

SELECT 1-6 (1=TIME INT,2=UNIT H,3=RAI,4=RUNOFF,5=PNT,'6=STOP) 1  
 ENTER TIME INTERVAL(MIN)= 180.

SELECT 1-6 (1=TIME INT,2=UNIT H,3=RAI,4=RUNOFF,5=PNT,'6=STOP) 2  
 ENTER DRAINAGE AREA (SQMI) = 315.00  
 SELECT 1-3 (1=INPUT UH, 2=CLARK, 3=SNYDER ) 3  
 ENTER SNYDERS CP AND TP (HRS) = 0.62 11.20  
 ENTER INITIAL EST. CLARKS TO K (HRS) (0=DEFAULT)= 0.00 0.00

TP	CP	TC	R
9.35	0.575	13.41	8.24
11.14	0.677	13.41	8.93
11.28	0.650	13.41	9.37
11.35	0.642	13.23	9.63
11.30	0.635	13.23	9.78
11.32	0.630	13.08	9.78
11.25	0.630	13.08	9.78

SELECT 1-6 (1=TIME INT,2=UNIT H,3=RAI,4=RUNOFF,5=PNT,'6=STOP) 3  
 ENTER RATIO IMPERVIOUS = 0.00  
 SELECT 1-3 ( 1=RAIN, 2=SFS, 3=PMS ) 3  
 ENTER PMS INDEX RAINFALL (IN) = 24.10  
 ENTER R6,R12,R24,R48,R72,R96 = 67.00 81.00 95.70 109.70 115.50 0.00  
 ENTER TRSFC AND TRSDA (SQMI) = 0.00 315.00  
 SELECT 1-3 (1=INIT+CONST, 2=ACUM LOSS, 3=SCS) 1  
 ENTER INITIAL LOSS(IN), CONSTANT LOSS(IN/HR) = 1.00 0.10

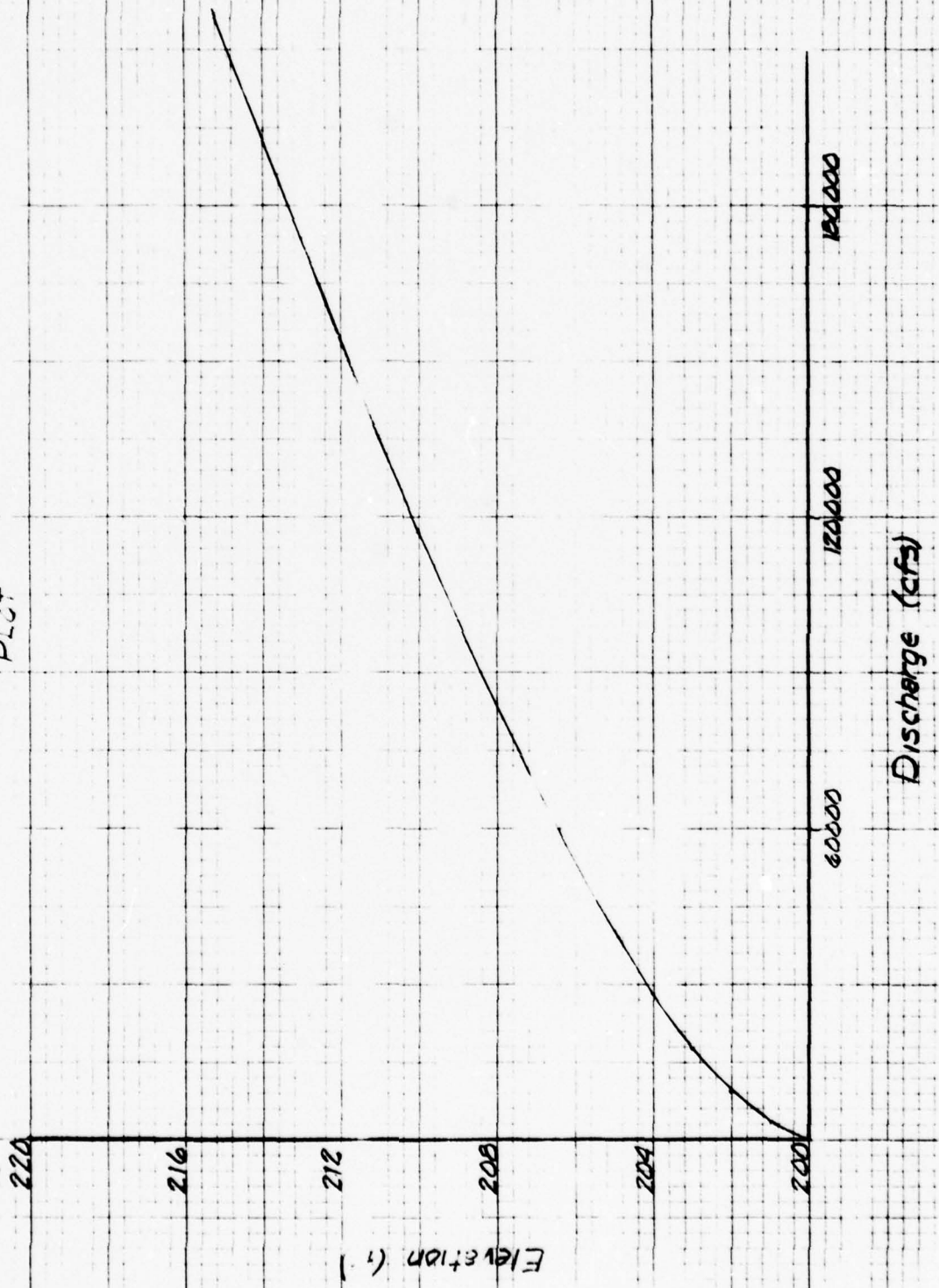
SELECT 1-6 (1=TIME INT,2=UNIT H,3=RAI,4=RUNOFF,5=PNT,'6=STOP) 4  
 ENTER A TITLE PLEASE - MUSCOOT P.  
 ENTER STRIQ,QPCSN,AND RTIOR = 630 00 30.00 1.00

HR	MIN	RAIN	LOSS	EXCESS	UNIT HG	RECSN	FLOW
3	0	0.09	0.09	0.00	1398.	630.	630.
6	0	0.09	0.09	0.00	4983.	630.	630.
9	0	0.22	0.22	0.00	9045.	630.	630.
12	0	0.22	0.22	0.00	11387.	630.	630.
15	0	0.69	0.51	0.18	10579.	630.	882.
18	0	1.41	0.30	1.11	8069.	630.	3079.
21	0	0.14	0.14	0.00	5923.	630.	7789.
24	0	0.14	0.14	0.00	4348.	630.	12719.
27	0	0.63	0.30	0.33	3191.	630.	15635.
30	0	0.63	0.30	0.33	2343.	630.	15931.
33	0	1.50	0.30	1.20	1720.	630.	16960.
36	0	1.50	0.30	1.20	1262.	630.	22387.
39	0	4.75	0.30	4.45	927.	630.	36335.
42	0	9.64	0.30	9.34	680.	630.	70500.
45	0	0.95	0.30	0.65	500.	630.	122211.
48	0	0.95	0.30	0.65	367.	630.	167828.
51	0	0.04	0.04	0.00	269.	630.	184024.
54	0	0.04	0.04	0.00	198.	630.	163933.
57	0	0.09	0.09	0.00	145.	630.	127866.

60	0	0.09	0.09	0.00	107.	630.	95667.
63	0	0.29	0.29	0.00		630.	70588.
66	0	0.58	0.30	0.28		630.	52574.
69	0	0.06	0.06	0.00		630.	39721.
72	0	0.06	0.06	0.00		630.	30834.
75	0					630.	24118.
78	0					630.	18408.
81	0					630.	13767.
84	0					630.	10275.
87	0					630.	7686.
90	0					630.	5786.
93	0					630.	4322.
96	0					630.	3248.
99	0					630.	2204.
102	0					630.	1053.
105	0					630.	890.
108	0					630.	770.
111	0					630.	733.
114	0					630.	705.
117	0					630.	685.
120	0					630.	671.
123	0					630.	660.
126	0					630.	630.
129	0					630.	630.
TOTAL		24.80	5.08	19.72	6744	27.90.	1:57018.

# MUSCOUT DAM

## STAGE - DISCHARGE PLOT



00100 A MUSCOOT DAM  
 0110 A RESERVOIR ROUTING OVER STRUCTURE OF  
 0120 A INCLUDES MUSCOOT RESERVOIR EFFECT PLUS EST. STORAGE OF UPSTREAM IMPOUNDMENTS

0130 B	37		3							
0140 I	3									
0150 K	0									
00160 M	-1		315							
0170 N	630	834	2601	6357	10670	14365	16766	18650	22113	32780
0180 N	61361	105920	150581	179616	18244	158323	118592	81663	55533	38122
0190 N	26891	19616	14562	10689	7580	5181	3594	2340	1207	976
0200 N	821	758	715	687	680	655	630			
0210 K	1									
0220 Y				1						
0230 I	1						-1			
0240 Z	17500	18766	19932	21098	22264	23530	26928	29260	31592	33924
0250 3	0	3040	9140	17770	28120	54450	83834	117160	154010	194000
0260 K	99									
0270 A										
0280 A										
0290 A										

00100 A MUSCOOT DAM  
 0110 A RESERVOIR ROUTING OVER STRUCTURE OF  
 0120 A INCLUDES MUSCOOT RESERVOIR EFFECT PLUS EST. STORAGE OF UPSTREAM IMPOUNDMENTS

0130 B	37		3							
0140 I	3									
0150 K	0									
00160 M	-1		315							
0170 N	630	721	1638	3637	5955	7758	8378	8135	8285	12430
0180 N	27363	52294	77842	94727	96843	83758	62042	42271	28613	19442
0190 N	13374	9391	6699	4818	3467	2493	1844	1291	750	698
0200 N	664	653	645	640	637	635	630			
0210 K	1									
0220 Y				1						
0230 I	1						-1			
0240 Z	17500	18766	19932	21098	22264	23530	26928	29260	31592	33924
0250 3	0	3040	9140	17770	28120	54450	83834	117160	154010	194000
0260 K	99									
0270 A										
00280 A										
0290 A										

\*\*\*\*\*  
 EC-1 VERSION DATED JAN 1973  
 PDATED AUG 74  
 RANGE NO. #1  
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 EC-1 VERSION DATED JAN 1973  
 PDATED AUG 74  
 RANGE NO. #1  
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MUSCOOT DAM  
 RESERVOIR ROUTING OVER STRUCTURE OF SPF  
 INCLUDES MUSCOOT RESERVOIR

JOB SPECIFICATION

NO	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
37	3	0	0	0	0	0	0	0	0
		JOPER		NMT					
		3		0					

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SUB-AREA RUNOFF COMPUTATION

ISTAQ	ICOMP	IECON	ITAPE	ILT	JPRT	INAME
0	0	0	0	0	0	0

HYDROGRAPH DATA

IHYDC	IUGC	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
-1	0	315.00	0.0	0.0	0.0	3.0	0	0	0

INPUT HYDROGRAPH

630.	721.	1638.	3637.	5955.	7758.	8378.	8135.	8285.	12430.
27363.	52294.	77842.	94727.	96843.	83758.	62042.	42271.	28613.	19442.
13374.	9391.	6699.	4818.	3467.	2493.	1844.	1291.	750.	698.
664.	653.	645.	640.	637.	635.	630.			

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	96043.	95795.	67299.	28411.	692091.
INCHES		2.83	7.95	10.07	10.22
AC-FT		47521.	10554.	169143.	171681.

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HYDROGRAPH ROUTING

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
0	1	0	0	0	0	0

ROUTING DATA

QLOSS	CLOSS	AVC	IRES	ISAME
0.0	0.0	0.0	1	0

NSTPS	NSTBL	LAG	AMSKK	X	TSK	STORA
1	0	0	0.0	0.0	0.0	-1.

STORAGE#	0.	1266.	2432.	3598.	4764.	6030.	9428.	10760.	14092.	16420.
OUTFLOW#	0.	3040.	9140.	17770.	28120.	54450.	83834.	117160.	154010.	1940000.

TIME	EOP STOR	AVG IN	EOP OUT
1	262.	630.	630.
2	271.	676.	651.
3	372.	1180.	893.
4	705.	2638.	1694.
5	1291.	4796.	3172.
6	1845.	6857.	6071.
7	2146.	8068.	7642.
8	2238.	8257.	8126.
9	2251.	8210.	8192.
10	2556.	10358.	10059.
11	3008.	19897.	19635.
12	5602.	39829.	45551.
13	7626.	65068.	68255.
14	9600.	86285.	88331.
15	10058.	95785.	99604.
16	9496.	90301.	85533.
17	8051.	72900.	71924.
18	5830.	52157.	50299.
19	4801.	35442.	28889.
20	4253.	24028.	23585.
21	3388.	16400.	16213.
22	2763.	11383.	11590.
23	2284.	8045.	8365.
24	1892.	5759.	6314.
25	1565.	4143.	4606.
26	1321.	2980.	3327.
27	1114.	2169.	2676.
28	903.	568.	2167.
29	683.	921.	1641.
30	508.	724.	1220.
31	405.	681.	973.
32	345.	659.	829.
33	311.	649.	746.
34	291.	643.	699.
35	270.	639.	671.
36	273.	636.	655.
37	268.	633.	645.

SUM 692073.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	99604.	93968.	67298.	28339.	692073.
INCHES		2.77	7.95	10.04	10.22
AC-FT		46620.	133553.	168713.	171677.

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RUNOFF SUMMARY, AVERAGE FLOW

HYDROGRAPH AT	0	PEAK	6-HOUR	24-HOUR	72-HOUR	AREA
ROUTED TO	0	96843.	95785.	67299.	28411.	315.00
	0	99604.	93968.	67298.	28339.	315.00

C-19

FORMER NO. 1  
 CHANGE NO. 01

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MUSCOOT DAM  
 RESERVOIR ROUTING OVER STRUCTURE OF SPF  
 INCLUDES MUSCOOT RESERVOIR EFFECT PLUS EST. STORAGE OF UPSTREAM IMPOUNDMENTS

JOB SPECIFICATION

NO	MHR	MMIN	IDAY	IHR	ININ	METRC	IPLT	IPRT	NSTAN
37	3	0	0	0	0	0	0	0	0
		JOPER		NMT					
		3		0					

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SUB-AREA RUNOFF COMPUTATION

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
0	0	0	0	0	0	0

HYDROGRAPH DATA

INHYC	IUGC	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
-1	0	315.00	0.0	0.0	0.0	0.0	0	0	0

INPUT HYDROGRAPH

630.	721.	1630.	3637.	5955.	7758.	8378.	8135.	8285.	12430.
27363.	52294.	77842.	94727.	96843.	83758.	62042.	42271.	28613.	19442.
13374.	9391.	6699.	4818.	3467.	2493.	1844.	1291.	750.	698.
664.	653.	645.	640.	637.	635.	630.			

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	96843.	95785.	67299.	28411.	692091.
INCHES		2.83	7.95	10.07	10.22
AC-FT		47521.	133554.	169143.	171681.

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HYDROGRAPH ROUTING

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
0	1	0	0	0	0	0

ROUTING DATA

LOSS	CLOS	AVG	IRES	ISAME
0.0	0.0	0.0	1	0

NSTPS	NSTDL	LAG	ANSK	X	TSK	STORA
1	0	0	0.0	0.0	0.0	-1.

STORAGE#	17500.	18766.	19932.	21098.	22264.	23530.	24928.	29260.	31592.	33924.
OUTFLOW#	0.	3040.	9140.	17770.	28120.	54450.	83834.	117160.	154010.	194000.

TIME	EOP STOR	AVG IN	EOP OUT
1	17762.	630.	630.
2	17771.	676.	651.
3	17872.	1180.	893.
4	18205.	2638.	1694.
5	18791.	4796.	3172.
6	19345.	6857.	6071.
7	19646.	8068.	7642.
8	19738.	8257.	8126.
9	1975.	8214.	8192.

10	20056.	10350.	10059.
11	21300.	19897.	19635.
12	23102.	39829.	45550.
13	25126.	65068.	68255.
14	27194.	86285.	87635.
15	27923.	95785.	98054.
16	27229.	90301.	88142.
17	25507.	72900.	71549.
18	23331.	52157.	50317.
19	22301.	35442.	28881.
20	21753.	24028.	23588.
21	20888.	16400.	16213.
22	20263.	11383.	11590.
23	19784.	8045.	8365.
24	19392.	5759.	6314.
25	19065.	4143.	4605.
26	18821.	2980.	3327.
27	18614.	2169.	2676.
28	18403.	1568.	2167.
29	18183.	1021.	1641.
30	18008.	724.	1220.
31	17905.	681.	973.
32	17845.	659.	829.
33	17811.	649.	746.
34	17791.	643.	699.
35	17779.	639.	671.
36	17773.	636.	655.
37	17768.	633.	645.

SUM 692072.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	98054.	93098.	67298.	28339.	692072.
INCHES		2.75	7.95	10.04	10.22
AC-FT		46198.	133553.	168713.	171677.

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RUNOFF SUMMARY, AVERAGE FLOW

	PEAK	6-HOUR	24-HOUR	72-HOUR	AREA
HYDROGRAPH AT	0 96845.	95785.	67299.	28411.	315.00
ROUTED TO	0 98054.	93098.	67298.	28339.	315.00

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 EC-1 VERSION DATED JAN 1973  
 PDATED AUG 74  
 RANGE NO. 01  
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MUSCOOT DAM  
 RESERVOIR ROUTING OVER STRUCTURE OF PMF  
 INCLUDES MUSCOOT RESERVOIR EFFECT PLUS EST. STORAGE OF UPSTREAM IMPOUNDMENTS

JOB SPECIFICATION  
 NO NHR NNIN IDAY INR ININ METRC IPLT IPRT NSTAN  
 37 3 0 0 0 0 0 0 0 0  
 JOPER NMT  
 3 0

\*\*\*\*\*

SUB-AREA RUNOFF COMPUTATION  
 ISTAQ ICOMP IECON ITAPE JPLT JPRT INAME  
 0 0 0 0 0 0 0

HYDROGRAPH DATA  
 IHYDC IUNG TAREA SNAP TRSDA TRSPC RATIO ISNOW ISAME LOCAL  
 -1 0 315.00 0.0 0.0 0.0 0.0 0 0 0

INPUT HYDROGRAPH  
 636. 834. 2601. 6357. 10670. 14365. 16766. 18650. 22113. 32700.  
 61361. 105920. 150501. 179616. 182441. 158323. 118592. 81663. 55533. 38122.  
 26891. 19616. 14562. 10689. 7560. 5101. 3794. 2340. 1207. 976.  
 821. 750. 715. 687. 68. 655. 630.

PEAK 6-HOUR 24-HOUR 72-HOUR TOTAL VOLUME  
 CFS 182441. 181029. 129812. 55914. 1353468.  
 INCHES 5.35 15.33 19.81 20.01  
 AC-FT 89813. 257611. 332885. 336240.

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HYDROGRAPH ROUTING  
 ISTAQ ICOMP IECON ITAPE JPLT JPRT INAME  
 0 1 0 0 0 0 0

ROUTING DATA  
 GLOSS CLOSS AVG IRES ISAME  
 0.0 0.0 0.0 1 0

NSTPS NSTBL LAG ANSKX X TSK STORA  
 1 0 0 0.0 0.0 0.0 -1.

STORAGE# 17500. 18766. 19932. 21098. 22264. 23530. 26928. 29260. 31592. 33924.  
 OUTFLOW# 0. 3040. 9140. 17770. 28120. 54450. 83834. 117160. 154010. 194000.

TIME EOP S R AVG IN EOP OUT  
 1 1776. 630. 630.  
 2 17702. 732. 677.  
 3 17981. 1718. 1154.  
 4 18616. 4479. 2680.  
 5 19525. 8514. 7012.  
 6 20220. 12510. 11020.  
 7 20770. 15366. 15404.  
 8 21070. 17700. 17609.

9	21.05.	20382.	20499.
10	222.5.	27447.	27779.
11	236.3.	47071.	55169.
12	26.97.	83641.	84817.
13	307.9.	128251.	141170.
14	32719.	165099.	173379.
15	33.25.	181029.	183790.
16	32263.	170382.	165541.
17	30033.	138458.	129367.
18	27469.	100128.	91566.
19	24903.	68598.	66326.
20	22974.	46828.	42891.
21	22248.	32507.	27979.
22	21690.	23254.	23028.
23	20979.	17089.	16889.
24	20428.	12626.	12009.
25	19951.	9125.	9283.
26	19516.	6371.	6966.
27	19129.	4388.	4937.
28	1883.	2967.	3387.
29	1854.	1774.	2502.
30	1827.	1092.	1855.
31	1809.	899.	1416.
32	1797.	790.	1129.
33	1789.	737.	949.
34	1784.	701.	835.
35	1781.	678.	763.
36	1779.	662.	716.
37	1778.	643.	682.

SUN 1355395.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	183790.	178585.	129495.	55809.	1355395.
INCHES		5.27	15.30	19.78	20.01
AC-FT		88600.	256981.	332256.	336222.

\*\*\*\*\*

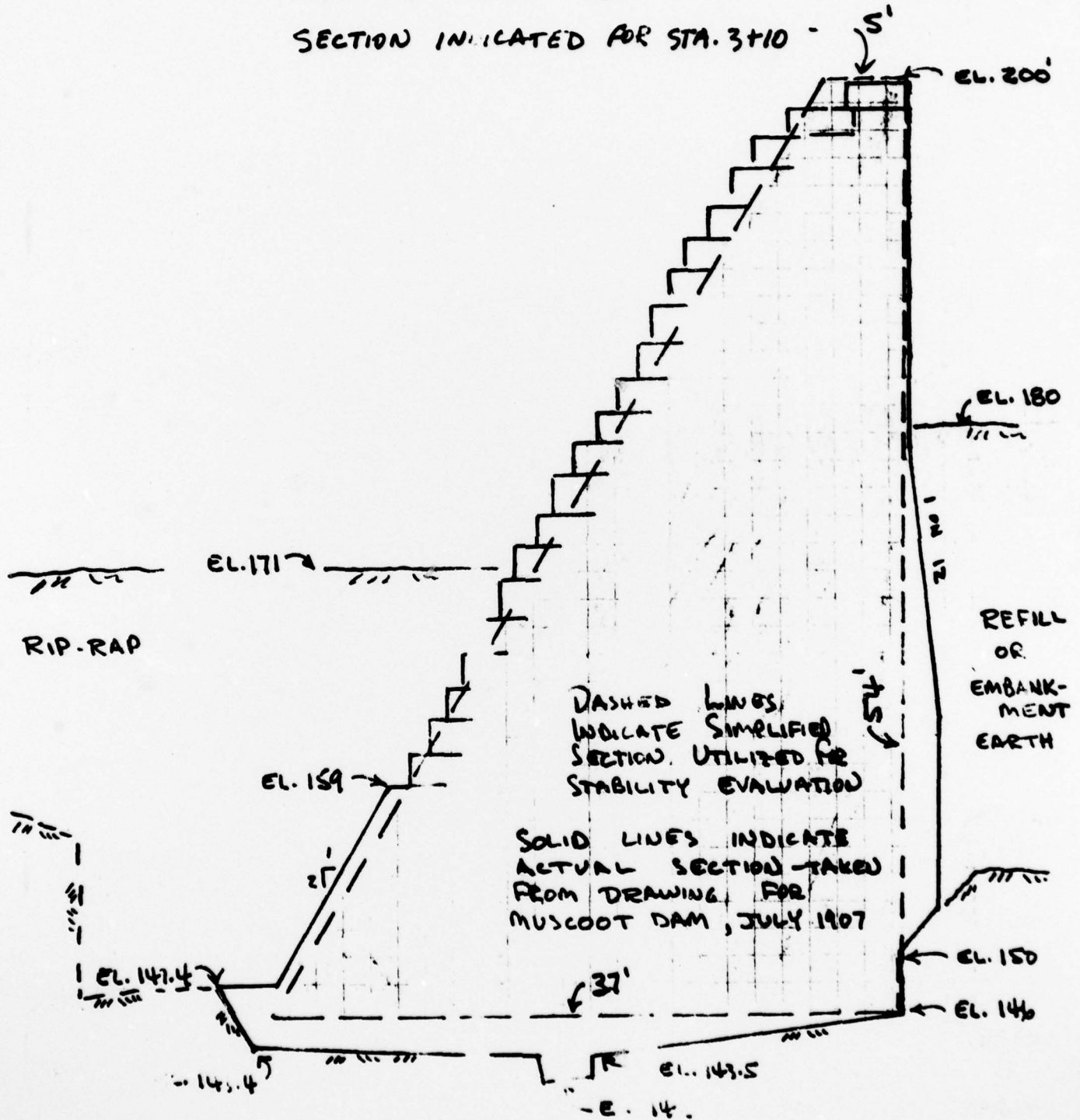
RUNOFF SUMMARY, AVERAGE FLOW

	PEAK	6-HOUR	24-HOUR	72-HOUR	AREA
HYDROGRAPH AT	0 182441.	181029.	129812.	55914.	315.00
ROUTED TO	0 183790.	178585.	129495.	55809.	315.00



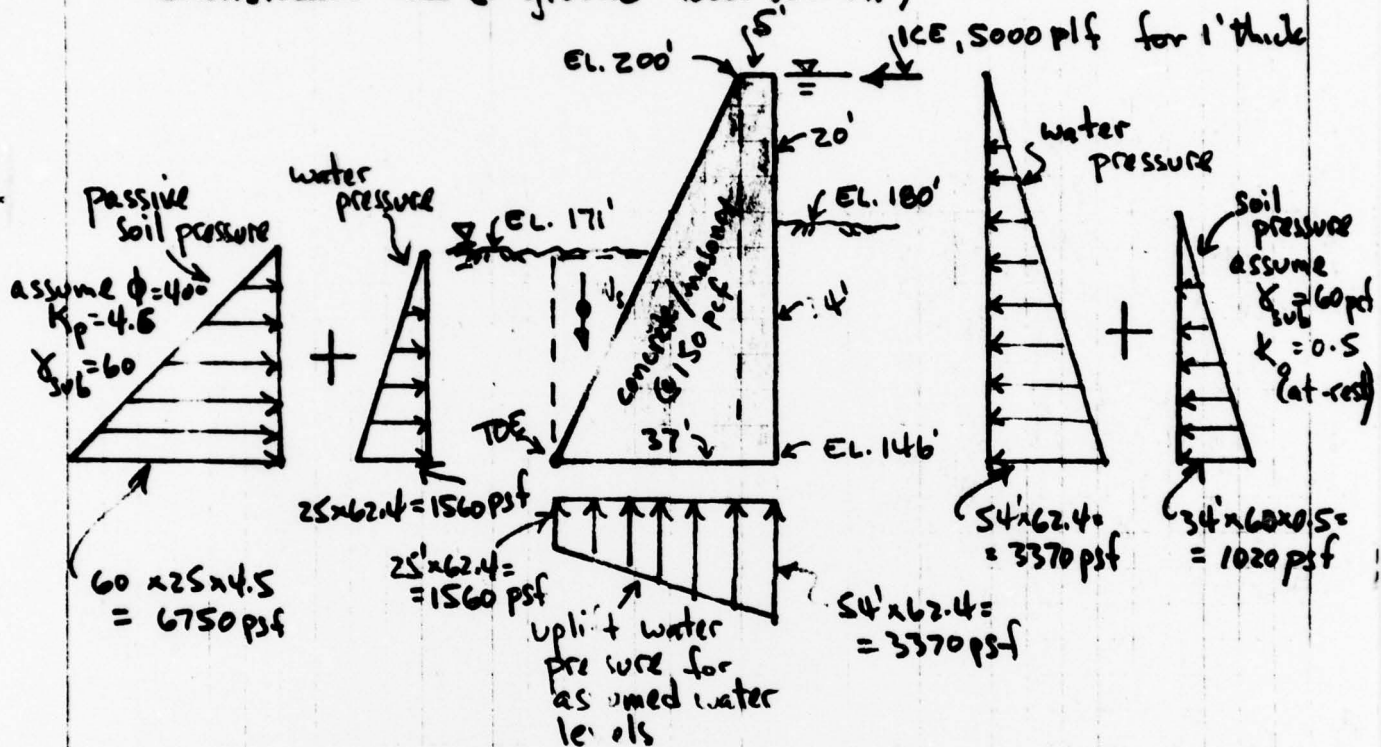
MUSCOOT DAM - SECTION TAKEN FROM  
 GENERAL PLAN & SECTIONS  
 DATED : JULY 1907

SECTION INDICATED FOR STA. 3+10



# STABILITY - OVERTURNING & SLIDING

- I. Assume following conditions (severe)
- WL and ice at top of dam (EL. 200')
  - downstream WL @ ground level (EL. 171')



## A. OVERTURNING

Forces causing overturn about toe ~ horiz. water pressure + horiz. soil pressure + ice + uplift pressure.

Moments about toe:

$$\text{Soil pressure} = \left( 34 \times 60 \times 0.5 \times \frac{34}{2} \times \frac{34}{3} \right) = 197,000 \text{ ft}$$

$$\text{horiz. water press.} = \left( 54 \times 62.4 \times \frac{54}{2} \times \frac{54}{3} \right) = 1,634,000 \text{ ft}$$

$$\text{ice} = (5,000 \text{ ft} \times 54') = 270,000 \text{ ft}$$

$$\text{uplift water press.} = \left( 1560 \times 7 \times \frac{37}{2} \right) + \left( 1810 \times \frac{37}{2} \times \frac{2}{3} \times 37 \right) = 1,894,000 \text{ ft}$$

$$\text{Total} = 3,995,000 \text{ ft} \quad (\text{causing overturning})$$

D-2

(CONTD)

Forces resisting overturning about toe ~ mass of dam +  
 horiz. water pressure (downstream) + horiz. soil pressure +  
 weight soil above toe of dam

Moments about toe:

$$\text{mass of dam} = (32 \times 54 \times \frac{1}{2} \times 150 \text{ pcf} \times \frac{2}{3} \times 32) +$$

$$+ (5 \times 54 \times 150 \text{ pcf} \times 34.5) = 4,162,000 \text{ \#}$$

$$\text{soil above toe} = (15' \times 25' \times \frac{1}{2} \times 60 \text{ pcf} \times 5') = 56,300 \text{ \#}$$

$$\text{horiz. soil pressure (passive)} = (25' \times 60 \text{ pcf} \times \frac{1}{2} \times 25 \times 4.5 \times 4.6) = 703,000 \text{ \#}$$

$$\text{horiz. water press.} = (25 \times 62.4 \times \frac{25}{2} \times \frac{25}{3}) = 168,000 \text{ \#}$$

$$\text{Total} = 5,097,300 \text{ \# (resisting out)}$$

$$\text{FS against overturning} = \frac{5097300}{3990000} = 1.27 \text{ \# (with uplift)}$$

$$= \frac{5097300}{2115000} = 2.40 \text{ \# (no uplift)}$$

B. SLIDING

Forces causing sliding ~ horiz. soil press. + water pressure

$$= (34 \times 60 \times 0.5 \times \frac{34}{2}) + (54 \times 62.4 \times \frac{54}{2}) = 108,300 \text{ \#}$$

Forces resisting sliding ~ soil and water press. acting horizontally +  
 friction along base of dam

$$\text{horiz. soil press.} = (25 \times 60 \times 4.6 \times \frac{25}{2}) = 85,000 \text{ \#}$$

$$\text{horiz. water press.} = (62.4 \times 25 \times \frac{25}{2}) = 19,400 \text{ \#}$$

friction at base =  $f$  (downward weight - uplift) =

$$= (0.6) \left[ (32 \times 54 \times \frac{1}{2} \times 150 \text{ pcf}) + (5 \times 54 \times 150) + (15 \times 25 \times \frac{1}{2} \times 60) - \right. \\ \left. - (91,000 \text{ \# uplift}) \right] = (0.6) [90,000 \text{ \#}] = 54,000$$

$$\text{FS against sliding} = \frac{85.0 + 19.4 + 54.0}{108.3} = 1.5 \text{ \# (no ice)}$$

$$= \frac{158.4}{113.3} = 1.4 \text{ \# (with ice)}$$

(CONT'D) D-3

C. OVERTURNING (NO UPLIFT, OTHER CONDITIONS AS BEFORE)

$$\text{moment causing overturning} = 195 \text{ }^{\text{K}} + 1,650 \text{ }^{\text{K}} + 270 \text{ }^{\text{K}} = 2,115 \text{ }^{\text{K}}$$

$$\text{moment resisting overturning} = 5000 \text{ }^{\text{K}}$$

$$\text{FS against overturning} = \frac{5000}{2115} = 2.4 \pm$$

II. Stability for condition where upstream reservoir is drawn-down 5 ft. in winter, with ice and uplift acting

A. OVERTURNING

Overturning moments:

$$\text{soil pressure behind dam} = 197,000 \text{ }^{\text{ft}}$$

$$\text{horiz. water pressure} = \left( 9 \times 62.4 \times \frac{49}{2} \times \frac{49}{3} \right) = 1,224,000 \text{ }^{\text{ft}}$$

$$\text{ice} = 5000 \text{ }^{\text{ft}} \times 49 \text{ }^{\text{ft}} = 245,000 \text{ }^{\text{ft}}$$

$$\text{uplift water pressure} = \left( 1560 \times 37 \times \frac{37}{2} \right) + \left( 1500 \times 37 \times \frac{2}{3} \times 37 \right) = 1,751,000$$

$$\text{Total} = 3,417,000 \text{ }^{\text{ft}}$$

Resisting Moments:

$$\text{as for (I)} = 5000 \text{ }^{\text{ft}}$$

$$\text{FS against overturning} = \frac{5000}{3,417,000} = 1.49 \pm \text{ (with uplift)}$$

$$= \frac{5000}{1,660,000} = 3.01 \pm \text{ (no uplift)}$$

III. Overturning Stability for condition where downstream reservoir is 10' below top of dam, upstream reservoir to top of dam

### Overturning Moments

$$\text{soil pressure behind dam} = 195,000 \text{ l}\#$$

$$\text{horiz. water pressure} = 1,650,000 \text{ l}\#$$

$$\text{ice} = 270,000 \text{ l}\#$$

$$\text{uplift pressure} = (2740 \times 37 \times \frac{37}{2}) + (630 \times \frac{37}{2} \times \frac{2}{3} \times 37) = 2,070,000 \text{ l}\#$$

$$\text{Total} = 4,185,000 \text{ l}\#$$

### Resisting Moments

$$\text{mass of dam} = 4,162,000 \text{ l}\#$$

$$\text{soil above toe} = 56,500 \text{ l}\#$$

$$\text{horiz. soil pressure (passive)} = 703,000 \text{ l}\#$$

$$\text{horiz. water press} = (6.4 \times 44 \times \frac{44}{2} \times \frac{44}{3}) = 886,000 \text{ l}\#$$

$$\text{Total} = 1,815,010 \text{ l}\#$$

FS against overturning

$$= \frac{5.8}{4.185} = 1.4 \pm \quad (\text{with uplift})$$

$$= \frac{5.8}{2.115} = 2.75 \pm \quad (\text{no uplift})$$

APPENDIX E

REFERENCES

## APPENDIX E

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