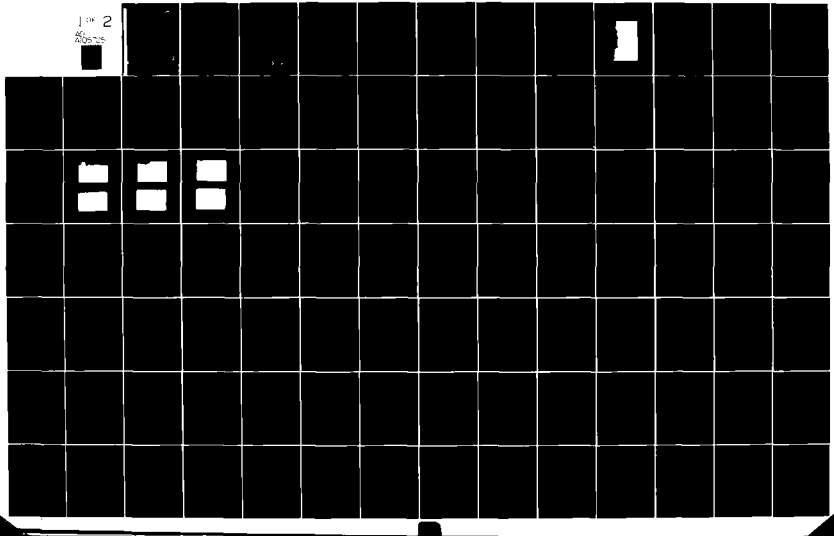
AD-A105 725 BAKER (MICHAEL) JR INC BEAVER PA F/G 13/13
NATIONAL DAM SAFETY PROGRAM. POTAKE LAKE DAM (INVENTORY NUMBER --ETC(U)
AUG 81 G KESTER DACW51-81-C-0010
UNCLASSIFIED NL



PASSAIC RIVER BASIN
LOWER HUDSON RIVER AREA

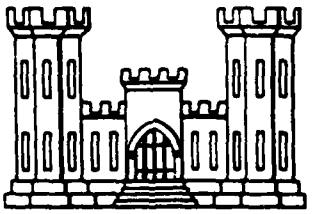
4

LEVEL II

POTAKE LAKE DAM

ROCKLAND COUNTY, NEW YORK
INVENTORY NO. N.Y. 970

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM



NEW YORK DISTRICT CORPS OF ENGINEERS

AUGUST 1981

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE	READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO. AD-A105795	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Phase I Inspection Report Potake Lake Dam Passaic River Basin, Rockland County, NY Inventory No. 970	5. TYPE OF REPORT & PERIOD COVERED Phase I Inspection Report National Dam Safety Program
	6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) GRANVILLE K[illegible]ESTER, JR. (15)	8. CONTRACT OR GRANT NUMBER(s) DACW51-81-C-0010
9. PERFORMING ORGANIZATION NAME AND ADDRESS Michael Baker, Jr. Inc. 4301 Dutch Ridge Road Box 280 Beaver, PA 15009	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS (11)
11. CONTROLLING OFFICE NAME AND ADDRESS Department of the Army 26 Federal Plaza New York District, CofE New York, New York 10287	12. REPORT DATE 14 August 1981 13. NUMBER OF PAGES
14. MONITORING AGENCY NAME & ADDRESS (If different from Controlling Office) Department of the Army 26 Federal Plaza New York District, CofE New York, NY 10287 (12) 97	15. SECURITY CLASS. (of this report) UNCLASSIFIED
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

(10) G[illegible]ville K[illegible]ester Jr

Approved for public release; Distribution unlimited.

17. DISTRIBUTION STATEMENT (6)

National Dam Safety Program. Potake Lake Dam (Inventory Number NY. 970), Passaic River Basin, Lower Hudson River Area, Rockland County, New York. Phase I Inspection Report,

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dam Safety
National Dam Safety Program
Visual Inspection
Hydrology, Structural Stability
Potake Lake Dam
Rockland County
Passaic River Basin

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.

Examination of available documents and a visual inspection of the dam and appurtenant structures did not reveal any conditions which constitute an immediate hazard to human life or property.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

410795

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

Using the Corps of Engineers screening criteria, it has been determined that the dam would be overtopped for all storms exceeding approximately 56 percent of the Probable Maximum Flood (PMF). The spillway is, therefore, adjudged as "inadequate".

Current inspection and maintenance procedures by the owner are adequate, but need to be documented. Monitoring of the reservoir levels should be expanded to include readings during peak flow periods. A warning system and emergency action plan should be developed and put into operation to notify residents downstream in the event of an impending dam failure.

The following remedial measures must be completed within one year:

1. The spillway approach and discharge channels are restricted enough to limit the full capacity of the spillway and should have all trees, boulders, and areas of high ground removed to facilitate the discharge of storm flows.

2. The animal burrows, depressions, and tire ruts on the crest of the dam should be filled, compacted and seeded.

3. All brush should be cut over the entire dam. All trees on the embankment should be cut at ground level. All trees with a trunk diameter greater than 3 inches should have their root systems removed. All resultant areas of erosion and cavities should be filled, graded, compacted, and seeded.

4. The 3-foot diameter culvert in the discharge channel should be sloped correctly.

5. The spalling and deterioration of the low section of the concrete weir should be repaired.

6. Install a staff gage to monitor reservoir levels above normal pool.

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. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a 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 frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

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. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide 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
POTAKE LAKE DAM
I.D. No. NY 970
DEC DAM No. 196A-307 PASSAIC RIVER BASIN
LOWER HUDSON RIVER AREA
ROCKLAND COUNTY, NEW YORK

TABLE OF CONTENTS

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam:	Potake Lake Dam (I.D. No. NY 970)
State:	New York
County:	Rockland
Dates of Inspection:	6 March 1981 9 March 1981

ASSESSMENT

Examination of available documents and a visual inspection of the dam and appurtenant structures did not reveal any conditions which constitute an immediate hazard to human life or property.

Using the Corps of Engineers screening criteria, it has been determined that the dam would be overtopped for all storms exceeding approximately 56 percent of the Probable Maximum Flood (PMF). The spillway is, therefore, adjudged as "inadequate".

Current inspection and maintenance procedures by the owner are adequate, but need to be documented. Monitoring of the reservoir levels should be expanded to include readings during peak flow periods. A warning system and emergency action plan should be developed and put into operation to notify residents downstream in the event of an impending dam failure.

The following remedial measures must be completed within one year:

1. The spillway approach and discharge channels are restricted enough to limit the full capacity of the spillway and should have all trees, boulders, and areas of high ground removed to facilitate the discharge of storm flows.

2. The animal burrows, depressions, and tire ruts on the crest of the dam should be filled, compacted, and seeded.

3. All brush should be cut over the entire dam. All trees on the embankment should be cut at ground level. All trees with a trunk diameter greater than 3 inches should have their root systems removed. All resultant areas of erosion and cavities should be filled, graded, compacted, and seeded.

4. The 3-foot diameter culvert in the discharge channel should be sloped correctly.

5. The spalling and deterioration of the low section of the concrete weir should be repaired.

6. Install a staff gage to monitor reservoir levels above normal pool.

SUBMITTED: _____
Granville Kester, Jr., P.E.
Vice President
MICHAEL BAKER, JR. of New York, INC.

APPROVED: _____
Colonel W.M. Smith, Jr.
New York District Engineer

DATE: 14 Aug 81

Overall View of Dam
Potake Lake Dam
I.D. No. NY 970
9 March 1981

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
POTAKE LAKE DAM
I.D. No. NY 970
DEC DAM No. 196A-307
PASSAIC RIVER BASIN
LOWER HUDSON RIVER AREA
ROCKLAND COUNTY, NEW YORK

SECTION 1: PROJECT INFORMATION

1.1 GENERAL

a. Authority - The Phase I Inspection reported herein was authorized by the Department of the Army, New York District, Corps of Engineers, to fulfill the requirements of the National Dam Inspection Act, Public Law 92-367.

b. Purpose of Inspection This inspection was conducted to evaluate the existing conditions of the dam, to identify deficiencies and hazardous conditions, to determine if these deficiencies constitute hazards to life and property, and to recommend remedial measures where required.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam - Potake Lake Dam is an earthfill dam with a height of 11.4 feet and a total length of 350 feet. The embankment has an average crest width of 20 feet. The average side slope of the upstream face of the dam is 1V:1.6H (Vertical to Horizontal) and the average side slope of the downstream face of the dam is 1V:2.9H. The upstream face of the dam is protected by riprap from below the water line to the crest of the dam. Plans for reconstruction of the dam prepared by Hazen and Sawyer, Engineers, dated 23 September 1968, show a rock corewall with a clay membrane and rockfill on the downstream side of the dam. The spillway, which has a crest length of 154 feet, is a broad-crested weir on natural ground at the left side of the dam.

The outlet from the reservoir consists of a 12-inch cast iron water supply line with valves on the upstream and downstream side of the dam. A tee and valve at the toe of the dam comprise the blow-off line which provides the means to draw down the reservoir.

b. Location - Potake Lake Dam is 1 mile southwest of Sloatsburg, New York. The dam is in Rockland County, New York. The reservoir is in Rockland County, New York and Passaic County, New Jersey. The coordinates of the dam are N 41° 08.5' and W 74° 12.7'. The dam can be found on the Sloatsburg, New York, USGS 7.5 minute topographic quadrangle. A location map is included in Appendix E.

c. Size Classification - Potake Lake Dam is 11.4 feet high and the reservoir storage capacity at the crest of the dam (elevation 618.8 feet M.S.L.) is 1149 acre-feet. Therefore, the dam is in the "intermediate" size category as defined by the Recommended Guidelines for Safety Inspection of Dams (Reference 13, Appendix D).

d. Hazard Classifications - Cranberry Lake Dam is one mile downstream from Potake Lake Dam. Sloatsburg, New York is 3500 feet downstream from Cranberry Lake Dam. Cranberry Lake Dam has previously been classified as a "high" hazard dam. There is danger of loss of life from large flows downstream from both dams. Potake Lake Dam is, therefore, considered in the "high" hazard category as defined by the Recommended Guidelines for Safety Inspection of Dams.

e. Ownership - The dam and reservoir are owned and operated by the Ramapo Land Company, Inc., P.O. Box 45, Sloatsburg, New York, 10974. The contact person is Mr. Scott Vanderhoff (telephone 914-753-5228).

f. Purpose of the Dam - The dam and reservoir are used as a water supply source for Sloatsburg, New York.

g. Design and Construction History - No specific design and construction history is available. The dam was originally built in the early 1800's. The designer and contractor are unknown.

The dam was reconstructed in 1974. Hazen and Sawyer, Engineers, 360 Lexington Avenue, New York City, New York, designed a new spillway and widened the embankment with a 2.0-foot thick clay membrane next to the existing stone wall with rockfill on the downstream side of the dam. The contractor is unknown.

h. Normal Operating Procedures - The reservoir level is normally maintained at the spillway crest. The dam and reservoir are visually inspected daily. Maintenance is performed as needed.

1.3 PERTINENT DATA

a. Drainage Area (acres) - 532.0

b. Discharge at Dam (c.f.s.) -

Spillway Capacity (at Minimum Top of Dam Elev. 618.8 ft. M.S.L.)	863.0
Reservoir Drain at Normal Pool	5.0

c. Elevation (Feet Above M.S.L.)[1] -

Minimum Top of Dam	618.8
Normal Pool (Spillway Crest)	616.6
Streambed at Toe of Dam	607.4

d. Reservoir Surface (Acres) -

Top of Dam (Elev. 618.8 ft. M.S.L.)	95.5
Spillway Crest (Elev. 616.6 ft. M.S.L.)	87.2

e. Reservoir Storage Capacity (Acre-Feet) -

Top of Dam (Elev. 618.8 ft. M.S.L.)	1149.0
Spillway Crest (Elev. 616.6 ft. M.S.L.)	948.0

f. Dam -

Type: Earth fill	
Length (Feet)	350.0
Height (Feet)	11.4
Average Top Width (Feet)	20.0
Side Slopes - Upstream	1V:1.6H
Downstream	1V:2.9H
Core Wall - Masonry with clay membrane	

g. Spillway -

Type: Broad-crested concrete weir	
Crest Length Perpendicular to Flow (Feet)	154.0
Crest Width Parallel to Flow (Feet)	6.0
Crest Elevation (Feet M.S.L.)	616.6

[1]All elevations are referenced to the spillway crest, elev. 616.6 ft. M.S.L., as shown on material obtained from the owner and included in Appendix E.

h. Reservoir Drain -

Type: 12" Cast iron water supply line with a tee and valve at the toe of the dam for a blow-off line.

Control: Manual control valves on upstream and downstream sides of dam.

SECTION 2: ENGINEERING DATA

2.1 GEOLOGY

Potake Lake Dam is located in the Hudson Highlands section of the New England Uplands physiographic province. The Hudson Highlands are characterized by strong topographic linearity in which the majority of the ridges and valleys follow the northwest-southwest strike of the metamorphosed rock.

Bedrock in the dam area is described on the Geologic Map of New York (Reference 2, Appendix D) as quartz plagioclase gneiss and subordinate biotite mesoperthite gneiss, locally interlayered with amphibolite. Although these metamorphic rocks are of uncertain origin, they are of the Middle Proterozoic Era. The bedrock is blanketed with deposits of glacial till as the result of Wisconsin glaciation.

The geologic map does not indicate any faulting at the dam site. However, there are two subparallel northeast-southwest trending faults within 3 miles of Potake Lake Dam; the closest fault is located about 2 miles to the northwest, whereas the other is about 3 miles to the southeast.

2.2 SUBSURFACE INVESTIGATION

No site specific subsurface information was available for this investigation. Because the dam site is covered by glacial till, no bedrock outcrops were observed during the inspection. However, according to the Interim Soil Survey for Rockland County (Reference 3, Appendix E), soils of the Hollis-Charlton Association normally range in thickness from less than 1 foot up to 10 feet; therefore, the depth to bedrock is anticipated to be relatively shallow at the dam site. The soil cover is well drained, sandy, and extremely stony. (Numerous glacial boulders were observed in the emergency spillway.)

2.3 DAM AND APPURTENANT STRUCTURES

A sketch of the dam, prepared for the owners by Hazen and Sawyer Engineers, was available for review during these investigations. The sketch illustrates the

original dam features as well as improvements to increase its stability, completed in 1974. This sketch is included in Appendix F. The dam was originally built in the 1800's.

The structure consists of an earth embankment. The origional structure consisted of an earth embankment with a near-vertical masonry wall on the downstream slope. In 1974, a 2-foot thick clay membrane was placed next to the masonry wall, and a rock with soil cover embankment was placed to form a new downstream slope. A concrete spillway is located to the left[1] of the embankment. A 12-inch inside diameter pipe serves as the dam outlet. Two valves, one on the upstream side and one on the downstream side of the dam, control flow in the pipe. The pipe outlets at the water plant near Sloatsburg. The existing dam is illustrated in a Field Sketch, included in Appendix F.

2.4 CONSTRUCTION RECORDS

No information concerning construction of the structure is available other than the 1974 sketch for improvements as discussed above.

2.5 OPERATION RECORDS

Water levels are measured daily from a ramp extending from the upstream face near the center of the dam. The readings are recorded by Ramapo Land Company personnel to monitor water availability. While water readings are made, a visual inspection of the dam is also made. The valves controlling discharges through the 12-inch pipe are checked periodically. Maintenance is performed as needed.

2.6 EVALUATION OF DATA

The background information collected during the investigation was obtained from Mr. C. Scott Vanderhoff of the Ramapo Land Company, Inc. Though limited, the available engineering data are considered adequate and reliable for Phase I Inspection purposes with the exception that foundation characteristics are not well known.

[1]Looking downstream.

SECTION 3: VISUAL INSPECTION

3.1 FINDINGS

a. General - The visual inspection was performed on 6 March 1981. The weather was sunny, and the temperature was in the mid 30's. The water surface was 2.0 feet below the spillway crest. There were 2 to 3 inches of snow on the dam. A follow-up inspection was made on 9 March 1981 to take photographs and observe conditions without snow cover. Deficiencies found during the inspection will require remedial treatment. A Field Sketch of conditions found during the inspection is included in Appendix F. The complete Visual Inspection Checklist is presented as Appendix B.

b. Spillway - The spillway is on natural ground at the left side of the dam. The spillway has a small amount of spalling and deterioration on the center low flow section. The approach channel has large rocks and brush upstream from the spillway. The flow capacity of the concrete weir is reduced by natural ground that encroaches upon and is higher than the spillway crest, large boulders, and trees (Photo 6, Appendix A). Downstream, 150 feet from the spillway, the discharge channel passes through two culverts under a road. These culverts consist of a 3-foot by 4-foot box culvert and a 3-foot diameter culvert with a reverse grade.

c. Embankment - No evidence of sloughing or subsidence was observed on the upstream or downstream slopes. On the upstream face, riprap was in place and no problems were observed. No seepage was observed on the downstream side of the dam.

During the visual inspection of the embankment:

1. One animal burrow and three depressions were found on the crest of the dam (see Field Sketch Appendix E).

2. Tire tracks 0.4 feet deep were found along the crest on the left side of dam.

3. On the downstream face of the embankment are three 3-inch diameter trees, a 12-inch diameter tree, and a 24-inch diameter stump. Near the

left abutment on the crest of the dam is a 36-inch diameter stump. Brush was growing on the upstream and downstream faces of the dam.

d. Outlet Works - The outlet works consist of a 12-inch water supply line with upstream and downstream valves. The upstream valve is located at the end of a foot walk which extends into in the reservoir. The downstream valve is at the toe of the embankment. A blow-off line and valve are set off from the water supply line with a tee. The valves were reported to be operable.

e. Downstream Channels - The spillway discharge channel flows down a narrow, rocky creek bed to Cranberry Lake 1 mile downstream from Potake Lake. The town of Sloatsburg, New York is 3500 feet downstream from Cranberry Lake.

f. Reservoir - The reservoir slopes are steep and wooded. There are no signs of instability and sedimentation was not reported to be a problem.

3.2 EVALUATION

Visual inspection revealed several deficiencies in this structure. The following items were noted:

1. There are three depressions and an animal burrow on the crest of the dam;
2. Trees and brush are growing on the upstream and downstream face of the dam;
3. The spillway discharge channel has trees, boulders, and natural ground which restricts flow over the spillway weir.
4. A 3-foot diameter culvert in the discharge channel has the downstream end higher than the upstream end;
5. There are tire ruts 0.4 foot deep on the crest of the dam;
6. There is a small amount of spalling and deterioration of the low section of the concrete weir.

SECTION 4: OPERATION AND MAINTENANCE PROCEDURES

4.1 PROCEDURES

There are no formal written instructions for operating the reservoir. A watchman who lives in a home adjacent to the dam checks the reservoir level and visually inspects the dam daily.

The reservoir is normally maintained at the spillway crest, but due to the season, it was 2.0 feet below the crest at the time of inspection.

4.2 MAINTENANCE OF THE DAM

Maintenance of the dam is the responsibility of the Ramapo Land Company, Inc.; it is considered fair and performed as needed. The grass on the crest is mowed regularly, and the downstream slope is mowed once a year. The valve on the water supply line is operated periodically. No records of examinations or maintenance are maintained.

4.3 WARNING SYSTEM

At the time of the inspection, there was no warning system or emergency action plan in operation.

4.4 EVALUATION

Maintenance and operating procedures for Potake Lake Dam are considered adequate, but the past activities have not been documented. A checklist should be compiled by the owner or the owner's representative to document the findings made during periodic inspections and the completed maintenance items. A warning system and emergency action plan should be developed and put into operation to notify residents downstream of an impending dam failure. A staff gage should be installed to monitor reservoir levels above normal pool.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 DRAINAGE AREA CHARACTERISTICS

Delineation of the watershed of Potake Lake Dam was made using the USGS quadrangles for Sloatsburg and Ramsey, New York. The drainage basin consists of moderate to steep slopes, well covered by forests and ground vegetation. The total drainage area is 532 acres.

5.2 ANALYSIS CRITERIA

A hydrologic analysis of the watershed and hydraulic analysis of the dam was conducted using the U.S. Army Corps of Engineers' Flood Hydrograph Package HEC-1 DB computer program (Reference 11, Appendix D). The unit hydrograph was defined using the Snyder's Unit Hydrograph Method. Estimates of Snyder's hydrograph coefficients were developed from average coefficients from the Hydrologic Flood Routing Model for Lower Hudson River Basin (Reference 14, Appendix D). Precipitation data was taken from Hydrometeorological Report No. 33 (Reference 7, Appendix D). Rainfall losses were estimated at an initial loss of 1.0 inch and a constant loss rate of 0.1 inch per hour thereafter. The hydraulic capacity of the dam, reservoir and spillway was determined by incorporating the Modified Puls Routing Method. All flood routings were begun with the reservoir at normal pool level. Outlet discharge capacity was computed by hand. The Probable Maximum Flood (PMF) and 1/2 Probable Maximum Flood (1/2 PMF) were developed and routed through the reservoir.

5.3 SPILLWAY CAPACITY

The spillway is on natural ground at the left side of the dam. The flow capacity of the spillway weir is presently reduced by natural ground at each end of, and immediately downstream of, the spillway. This area at the ends of the spillway is higher than the spillway crest (Photo 6, Appendix A). All calculations are based on the assumption that these areas of high ground have been removed to allow the free discharge of flows from the spillway.

The spillway capacity at the minimum top of the dam is 863 c.f.s. There is no auxiliary or emergency spillway at Potake Lake Dam.

5.4 RESERVOIR CAPACITY

The storage capacity of Potake Lake Dam at normal pool is 948 acre-feet. The storage capacity of the reservoir at the minimum top of dam is 1149 acre-feet. Therefore, the flood control storage of the reservoir between the spillway crest and the top of the dam is 201 acre-feet. This volume represents a total runoff of 4.5 inches from the drainage area.

5.5 FLOODS OF RECORD

On 30 May 1968, after a 6-inch rainfall, the dam was nearly overtopped and the culverts in the discharge channel were washed out. As a result of this rainfall, the spillway was changed to its present configuration.

5.6 OVERTOPPING POTENTIAL

The maximum capacity of the spillway is 863 c.f.s. to the minimum top of dam. The peak outflows of the PMF and 1/2 PMF are 1727 c.f.s. and 740 c.f.s., respectively. Therefore, the spillway is capable of passing 56 percent of the PMF before overtopping would occur.

5.7 RESERVOIR EMPTYING POTENTIAL

The reservoir can be drawn down by means of a 12-inch cast iron blow-off line at the toe of the embankment. Neglecting inflow, the reservoir can be drawn down from normal pool in approximately 103 days. This is equivalent to an approximate drawdown rate of 0.1-foot per day, based on the hydraulic height measured from normal pool divided by the time to dewater the reservoir.

5.8 EVALUATION

Potake Lake Dam is an "intermediate" size - "high" hazard dam requiring the spillway to pass the PMF. The PMF and 1/2 PMF were routed through the watershed and dam.

It was determined that the spillway weir section is capable of passing 56 percent of the PMF before overtopping the dam. The spillway is, therefore, judged to be "inadequate." However, the flow capacity of the concrete weir is presently reduced by natural ground in the approach and discharge channels that encroaches upon and is higher than the spillway crest. The downstream channel was evaluated and found to pass flood flows from the 1/2 PMF but not the PMF.

Conclusions pertain to present conditions and the effect of future development on the hydrology has not been considered.

SECTION 6: EMBANKMENT STABILITY

6.1 EVALUATION OF EMBANKMENT STABILITY

a. Visual Observations - No signs of potential instability were observed during the visual inspection of Potake Lake Dam. Minor problems which could affect the stability of the structure include:

1. Three depressions and an animal burrow were found on the embankment crest.

2. Four trees, larger than 3 inches in diameter, and two stumps located on the embankment and the left[1] abutment and should be removed.

3. While the downstream face of the embankment was uneven, it appeared to be the result of poor grading or possible settlement of the soil cover into voids in the rock embankment, and not a sign of potential instability.

The owner reported that some seepage occurred before the reconstruction work was performed in 1974. No seepage was observed by the owner since then or by the inspection team at the time of the inspection.

b. Design and Construction Data - No design information regarding the stability of the structure was available.

c. Operating Records - The valves controlling flow through the 12-inch pipes are periodically operated. The structure is visually inspected, usually every day by the watchman living next to the dam. A rainfall of 6 inches occurred on May 30, 1968 and, reportedly, almost overtopped the dam due to insufficient spillway capacity, with no apparent adverse effects on the dam. The spillway capacity has since been increased.

d. Post Construction Changes - The structure was built during the early 1800's. In 1974, the spillway capacity was increased and the downstream face was reconstructed by decreasing the slope and the addition of a 2-foot thick clay membrane.

[1]Looking downstream.

6.2 STABILITY ANALYSIS

The results of previous stability analyses, if any, were not available for Potake Lake Dam.

The original dam appears to be a relatively homogeneous embankment composed largely of sandy, silty clay (estimated to be ML-CL Group Soils - Unified Classification System). Potake Lake Dam is 11.4 feet high with an average crest width of 20 feet. The upstream slope of the embankment is 1V:1.6H, while the downstream slope is 1V:2.9H. The upstream slope is protected by riprap from below the water line to the crest. The reconstruction plans, prepared by Hazen and Sawyer Engineers, indicate that the dam contains a masonry wall on the downstream side of the crest, covered by a clay membrane and a rock fill. The dam is not subject to rapid drawdown (greater than a 0.5-foot drop in the reservoir level per day) as determined by hydraulic calculations made during these investigations.

There are no signs of major instability, based on the visual inspection. Therefore, based on the overall condition of the dam as observed during the visual inspection, a stability analysis is not considered necessary.

6.3 SEISMIC STABILITY

The dam is located in Seismic Zone 1, which presents no hazard from earthquakes according to the Recommended Guidelines for Safety Inspection of Dams. This determination is contingent on the requirements that static stability conditions are satisfactory, and conventional safety margins exist.

SECTION 7: ASSESSMENT/RECOMMENDATIONS

7.1 ASSESSMENT

a. Safety - In the Phase I Inspection of Potake Lake Dam, the hydrologic and hydraulic analysis revealed that outflows from any storm in excess of 56 percent of the PMF will overtop the dam. Therefore, the spillway is "inadequate," based on Corps of Engineers' screening criteria.

b. Adequacy of Information - The information available and the observations and measurements made during the visual inspection are considered sufficient for this Phase I Inspection Report.

c. Need for Additional Information - No additional investigations are considered necessary at this time.

d. Urgency - The problem areas listed below must be corrected within one year of notification.

7.2 RECOMMENDED MEASURES

The regular inspections and maintenance procedures presently being conducted appear to be adequate, although some form of documentation is needed. A thorough checklist should be compiled by the owner or the owner's representative, and completed during each inspection. Maintenance items should be completed annually. A warning system and emergency action plan should be developed and put into operation to notify residents downstream of an impending dam failure.

The following remedial measures must be completed within one year:

1. The spillway and discharge channels are restricted enough to limit the full capacity of the spillway and should have all trees, boulders, and areas of high ground removed to facilitate the discharge of storm flows.

2 The animal burrows, depressions, and tire ruts on the crest of the dam should be filled, compacted, and seeded.

3. All brush covering the embankment should be removed. All trees on the embankment should be cut at ground level. All trees with a trunk diameter greater than 3 inches should have their root systems removed. All resultant areas of erosion and cavities should be filled, graded, compacted, and seeded.

4. The 3-foot diameter culvert in the discharge channel should be sloped correctly.

5. The spalling and deterioration of the low section of the concrete weir should be repaired.

6. Install a staff gage to monitor reservoir levels above normal pool.

APPENDIX A

PHOTOGRAPHS

CONTENTS

Note: Photographs were taken on 9 March 1981.

POTAKE LAKE DAM

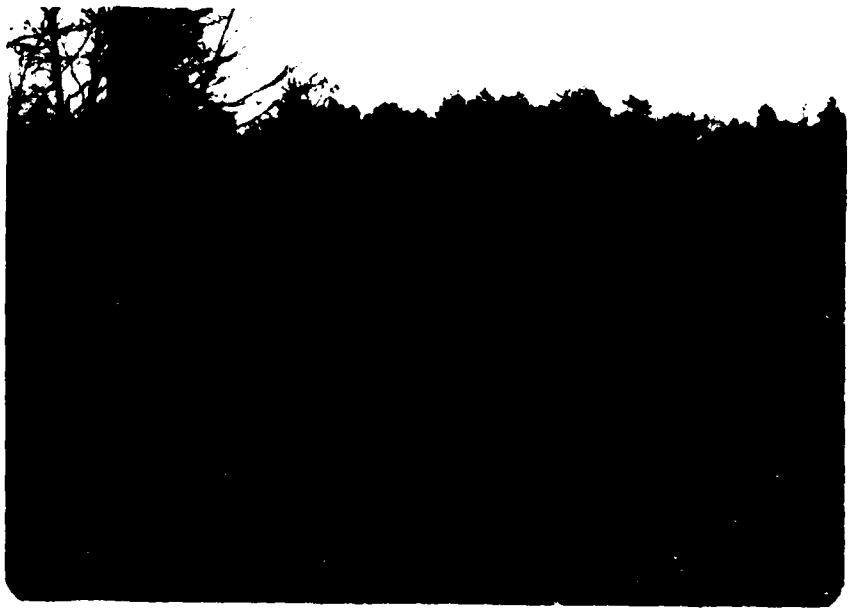


Photo 1. Downstream Face of Dam from Left Abutment
9 March 1981

Photo 2. Crest of Dam from Right Abutment
9 March 1981

Photo 3. Spillway from Left Abutment
9 March 1981

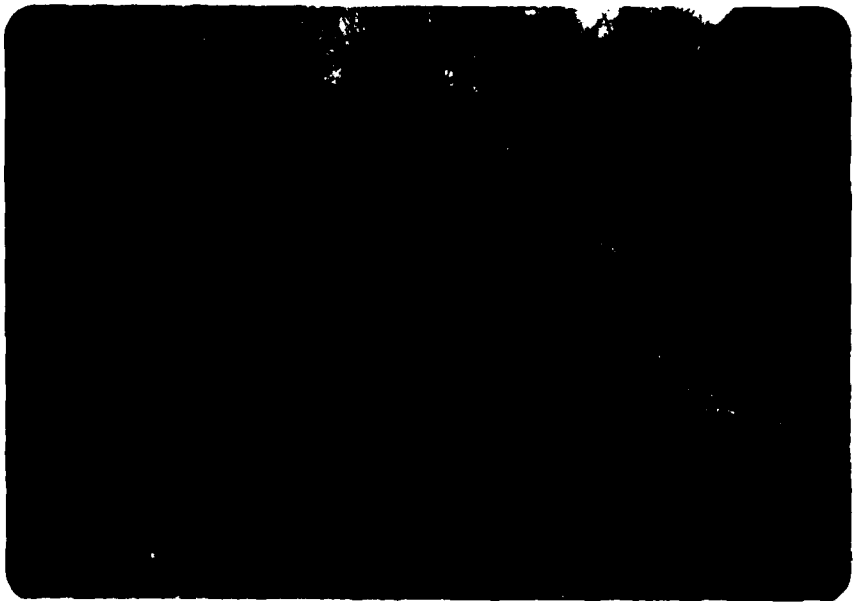


Photo 4. Spillway Discharge Channel from Spillway
9 March 1981

Photo 5. Spillway Discharge Channel from
100 feet Downstream of Spillway
9 March 1981

Photo 6. Natural Ground Restricting Spillway
Weir Flow Capacity
9 March 1981

APPENDIX B

VISUAL INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST

1) Basic Data

a. General

Name of Dam Potake Lake Dam

Fed. I.D. # NY 970 DEC Dam No. 196A-307

River Basin Passaic River Basin

Location: Town Sloatsburg County Rockland

Stream Name None

Tributary of Ramapo River

Latitude (N) 41° 08.5' Longitude (W) 74° 12.7'

Type of Dam earth dam

Hazard Category High

Date(s) of Inspection 6 March 1981 and 9 March 1981

Weather Conditions clear, 35°F

Reservoir Level at Time of Inspection 614.8 Ft.

b. Inspection Personnel Terry S. Hawk, Gary W. Todd, Larry A. Diday

c. Persons Contacted (Including Address & Phone No.) 914-753-5228

Scott Vanderhoff

Ramapo Land Company, Inc.

P. O. Box 45

Sloatsburg, New York 10974

d. History:

Date Constructed about 1800 Date(s) Reconstructed 1974

Designer unknown

Constructed By unknown

Owner Ramapo Land Company, Inc.

2) Embankment

a. Characteristics

(1) Embankment Material earth core

Upstream slope is rock lined, downstream is rock covered with topsoil.

(2) Cutoff Type unknown

(3) Impervious Core Clay blanket installed in 1974 along downstream face.

(4) Internal Drainage System none observed

(5) Miscellaneous Covered with 2" to 3" of snow on 6 March, reinspected on 9 March 1981 at which time the snow was melted.

b. Crest

(1) Vertical Alignment good

(2) Horizontal Alignment fair to good

(3) Surface Cracks None observed at time of inspection

(4) Miscellaneous Three depressions and one animal burrow were found on the crest. A large stump is located on the left end of the crest. A set of tire ruts are near the center of the crest.

c. Upstream Slope

(1) Slope (Estimate) (V:H) 1 : 1.6

(2) Undesirable Growth or Debris, Animal Burrows Brush was growing on some areas of the slope, mostly near the crest.

(3) Sloughing, Subsidence, or Depressions Some minor erosion was observed at the top of slope.

(4) Slope Protection The rip rap areas observed were in good condition.

(5) Surface Cracks or Movement at Toe Unobservable at time of inspection.

d. Downstream Slope

(1) Slope (Estimate - V:H) 1 : 2.9

(2) Undesirable Growth or Debris, Animal Burrows Three trees over 3" in dia. and brush are growing on the slope.

(3) Sloughing, Subsidence or Depressions None observed at time of inspection. Slope was uneven but appeared to be the result of poor grading.

(4) Surface Cracks or Movement at Toe None observed at time of inspection.

(5) Seepage None was observed at time of inspection.

(6) External Drainage System (Ditches, Trenches, Blanket) none

(7) Condition Around Outlet Structure No outlet structure.

(8) Seepage Beyond Toe None was observed at time of inspection.

e. Abutments - Embankment Contact Appeared good at time of inspection. There is a tree and an old stump on the left abutment and a stump on the right abutment.

(1) Erosion at Contact None was observed at time of inspection.

(2) Seepage Along Contact None was observed at time of inspection.

3) Drainage System

a. Description of System None

b. Condition of System

c. Discharge from Drainage System

4) Instrumentation (Monumentation/Surveys, Observation Wells, Weirs, Piezometers, Etc.) None

5) Reservoir

a. Slopes Slopes are steep and wooded.

b. Sedimentation Owner stated that there have been no problems with sedimentation.

c. Unusual Conditions Which Affect Dam None observed at time of inspection.

6) Area Downstream of Dam

a. Downstream Hazard (No. of Homes, Highways, etc.) Cranberry Lake Dam is located one mile downstream of Potake Lake Dam. Sloatsburg is 3500 ft. downstream of Cranberry Lake Dam.

b. Seepage, Unusual Growth None observed at time of inspection.

c. Evidence of Movement Beyond Toe of Dam None observed at time of inspection.

d. Condition of Downstream Channel Channel is filled with brush, trees, and rocks.

7) Spillway(s) (Including Discharge Conveyance Channel)

a. General Concrete spillway is spalling and the upstream side is blocked by some brush, rocks, and natural ground.

b. Condition of Service Spillway The flow capacity of the concrete weir is reduced by natural ground that encroaches upon and is higher than the spillway crest, large boulders, and trees.

c. Condition of Auxiliary Spillway none

d. Condition of Discharge Conveyance Channel Large boulders and trees are located in the channel. A dirt road passes over the channel and has two culverts underneath, one with a reverse slope.

8) Reservoir Drain/Outlet

Type: Pipe X Conduit _____ Other _____

Material: Concrete _____ Metal X Other _____

Size: 12" Length over 1300' (runs to water plant).

Invert Elevations: Entrance unknown

Exit unknown

Physical Condition (Describe): Unobservable X

Material: _____

Joints: _____ Alignment _____

Structural Integrity: _____

_____

_____

Hydraulic Capability: _____

_____

Means of Control: Gate _____ Valve X Uncontrolled _____

Operation: Operable X Inoperable _____ Other _____

Present Condition (Describe): Both downstream and upstream valves appear ok and are operated by the owner to assure their working condition. The blow-off pipe outlet could not be located.

_____

_____

9) Structural - Not Applicable

a. Concrete Surfaces _____

_____

_____

_____

b. Structural Cracking _____

_____

_____

c. Movement - Horizontal & Vertical Alignment (Settlement) _____

_____

_____

d. Junctions with Abutments or Embankments _____

_____

_____

e. Drains - Foundation, Joint, Face _____

f. Water Passages, Conduits, Sluices _____

g. Seepage or Leakage _____

h. Joints - Construction, etc. _____

i. Foundation _____

j. Abutments _____

k. Control Gates _____

l. Approach & Outlet Channels _____

_____

_____

_____

m. Energy Dissipators (Plunge Pool, etc.) _____

_____

_____

n. Intake Structures _____

_____

_____

_____

o. Stability _____

_____

p. Miscellaneous _____

_____

_____

10) Appurtenant Structures (Power House, Lock, Gatehouse, Other)

a. Description and Condition none

_____

_____

_____

_____

APPENDIX C

HYDROLOGIC/HYDRAULIC DATA AND COMPUTATIONS

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject POTAKE LAKE DAM — S.O. No. ____
APPENDIX C - HYDROLOGIC — Sheet No. ____ of ____
AND HYDRAULIC CALC. — Drawing No. ____
Computed by ____ Checked by ____ Date ____

SUBJECT	PAGE

CHECK LIST FOR DAMS
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

AREA-CAPACITY DATA:

		Elevation (ft.)	Surface Area (acres)	Storage Capacity (acre-ft.)
1)	Top of Dam	618.8	95.5	1,149
2)	Design High Water (Max. Design Pool)	--	--	--
3)	Auxiliary Spillway Crest	--	--	--
4)	Pool Level with Flashboards	--	--	--
5)	Service Spillway Crest	616.6	87.2	948

DISCHARGES

		Volume (cfs)
1)	Average Daily	0
2)	Spillway @ Maximum High Water - Top of Dam -	863
3)	Spillway @ Design High Water	--
4)	Spillway @ Auxiliary Spillway Crest Elevation	--
5)	Low Level Outlet	5.4
6)	Total (of all facilities) @ Maximum High Water	868
7)	Maximum Known Flood	Unknown
8)	At Time of Inspection	0

CREST: ELEVATION: 618.8 ft.

Type: Earth embankment

Width: 20 ft. Length: 350 ft.

Spillover Broad-crested weir.

Location On natural ground on left bank

SPILLWAY:

SERVICE		AUXILIARY
616.6 ft.	Elevation	--
Concrete weir	Type	--
6 ft.	Width	--
	Type of Control	
X	Uncontrolled	--
	Controlled:	
--	Type (Flashboards; gate)	--
--	Number	--
--	Size/Length	--
	Invert Material	--
	Anticipated Length of Operating Service	--
--	Chute Length	--
0.5 ft.	Height Between Spillway Crest & Approach Channel Invert (Weir Flow)	--

DRAINAGE AREA: 532 acres

DRAINAGE BASIN RUNOFF CHARACTERISTICS:

Land Use - Type: Wooded with good vegetation

Terrain - Relief: Moderate to steep

Surface - Soil: Well-drained

Runoff Potential (existing or planned extensive alterations to existing surface or subsurface conditions)

There were no known plans for altering the existing runoff patterns at the time of the inspection.

Potential Sedimentation problem areas (natural or man-made; present or future)

None observed. All slopes well-vegetated.

Potential Backwater problem areas for levels at maximum storage capacity including surcharge storage:

None observed at the time of inspection.

Dikes - Floodwalls (overflow & non-overflow) - Low reaches along the Reservoir perimeter:

Location: None

Elevation:

Reservoir:

Length @ Maximum Pool 5,050 ft.

Length of Shoreline (@ Spillway Crest) 11,550 ft. (2.19 mi.)

HYDROMETEROLOGICAL GAGES:

Type: None

Location: _____

Records:

Date: _____

Max. Reading: _____

FLOOD WATER CONTROL SYSTEM:

Warning System: None

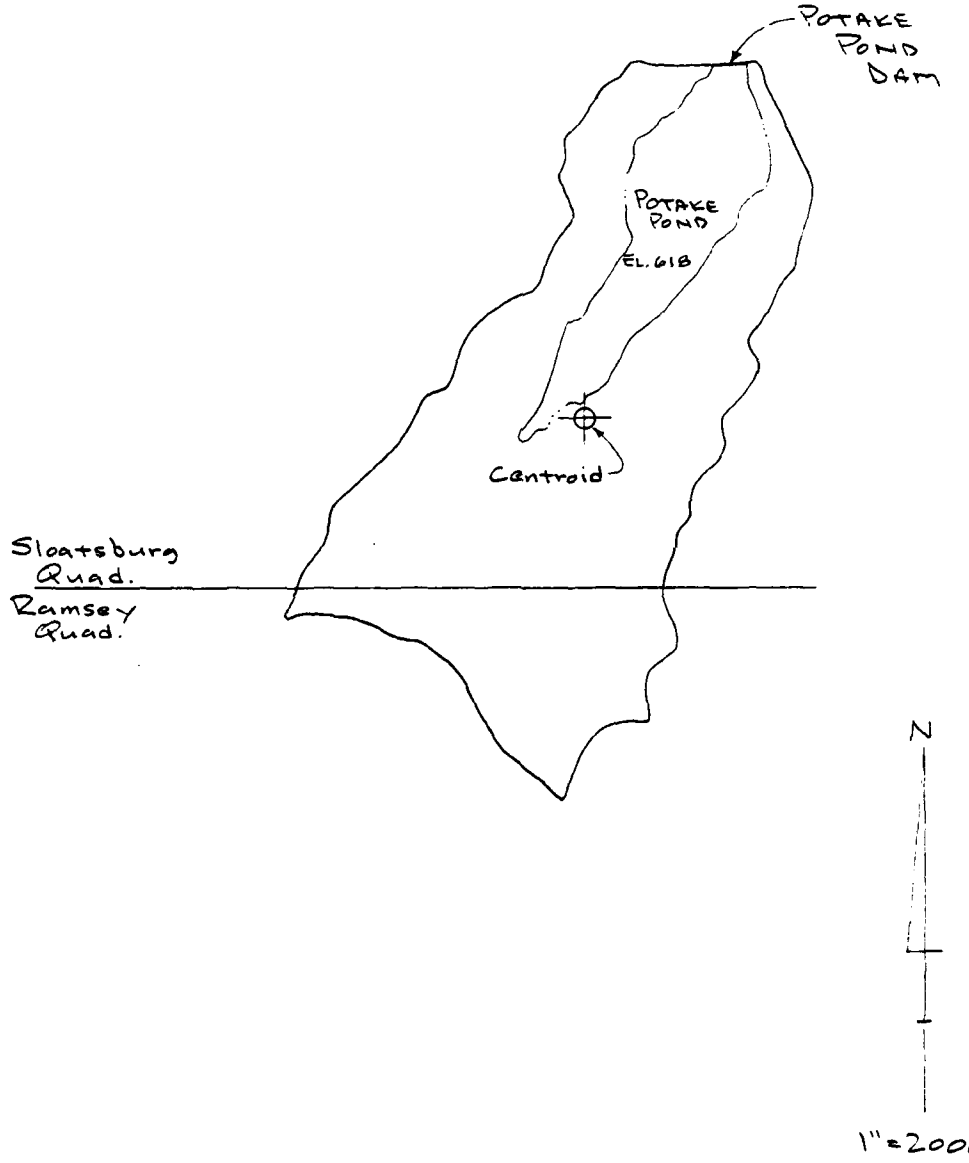
_____

Method of Controlled Releases (mechanisms):

12" dia. cast iron pipe at toe of the embankment.

_____

_____



POTAKE POND DAM
DRAINAGE AREA MAP

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject N.Y. Dam Insp. S.O. No. 13888-00-ARA-14
Potake Pond Dam Sheet No. 6 of 31
Hydraulic Data Drawing No.
Computed by [illegible] Checked by [illegible] Date 1/13/81

Drainage Area

Ramsey Quad. - 3.72
Sloatsburg Quad. - 13.65
$\rightarrow 17.37/3 = 5.79\ in^2 = 531.7\ Ac. = 0.83\ mi^2$

Surface Areas

Lake Surface @ el. 616.6 $- 2.84/3 = 0.95\ in^2 = 87.2\ Ac. = 0.14\ mi^2$
el. 620 $- 3.26/3 = 1.09\ in^2 = 100.1\ Ac. = 0.16\ mi^2$
el. 640 $- 4.30/3 = 1.46\ in^2 = 134.1\ Ac. = 0.21\ mi^2$

Watershed Lengths

$L = 9,750'$ ft. $= 1.85$ mi.
$L_c = 4,350'$ ft. $= 0.82$ mi.

$C_t = 2.0 \quad C_p = 0.63$
$T_p = C_t (L \times L_{CA})^{0.3}$
$= 2.0 (1.85 \times .82)^{0.3}$
$T_p = 2.27$
$t_p = 2.27/5.5 = 0.413$
USE .5 HR
ADJUSTMENT FOR .5 HR

$T_{pR} = T_p + \frac{T_L - t_R}{4}$

$= 2.27 + \frac{.50 - .413}{4}$

$T_{pR} = 2.29$

Precipitation Data

HMR-33 Zone 1

PMP 24hr - $200 mi^2$ = 21.9 inches
D.A. Less than $10 mi^2$

Duration	% of $200 mi^2$	inches
6 hr PMP	111	24.3
12 hr PMP	123	26.9
24 hr PMP	133	29.1
48 hr PMP	142	31.1

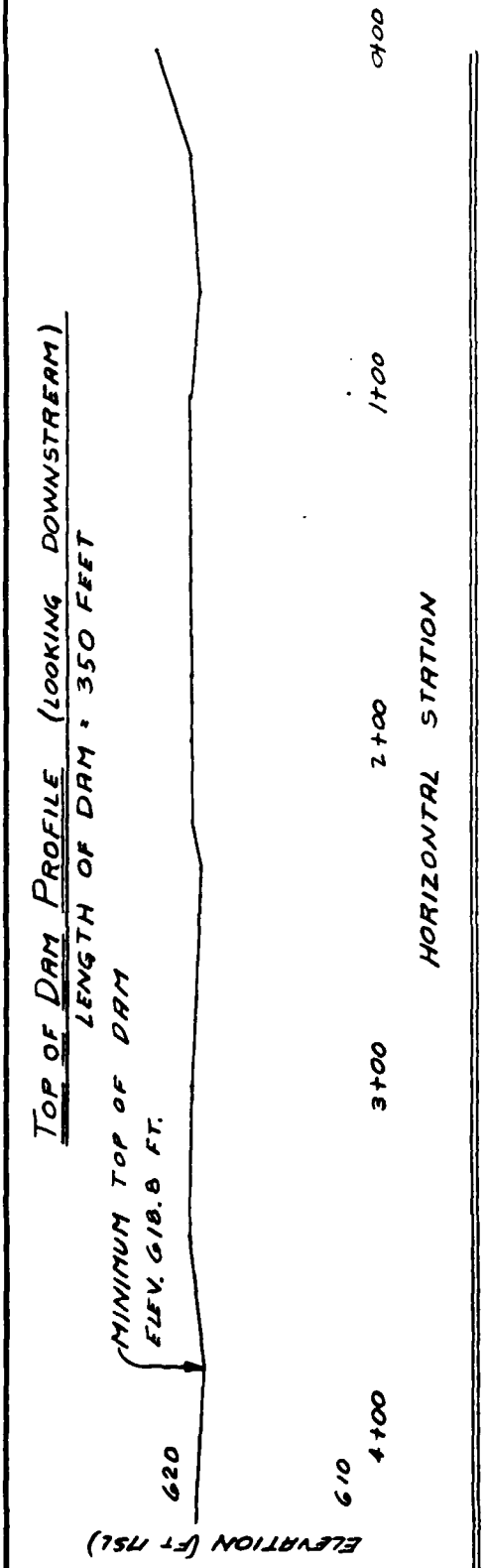
TP-40

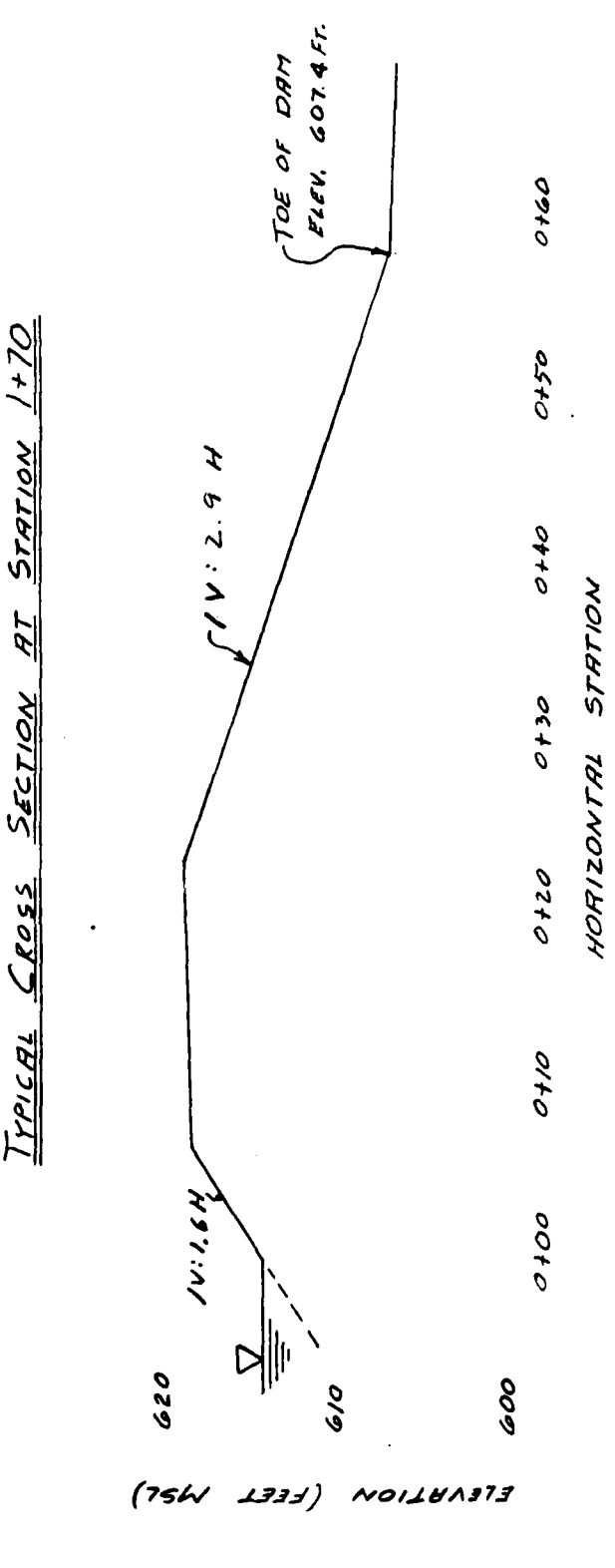
100 YR - 24 hr. Rainfall = 7.5 inches
" 12 hr. " = 6.4 "
" 6 hr. " = 5.3 "

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject POTAKE LAKE DAM — S.O. No.
TOP OF DAM PROFILE AND — Sheet No. 7 of 21
TYPICAL CROSS SECTION — Drawing No.
Computed by GWT — Checked by LAD — Date 3-12-81



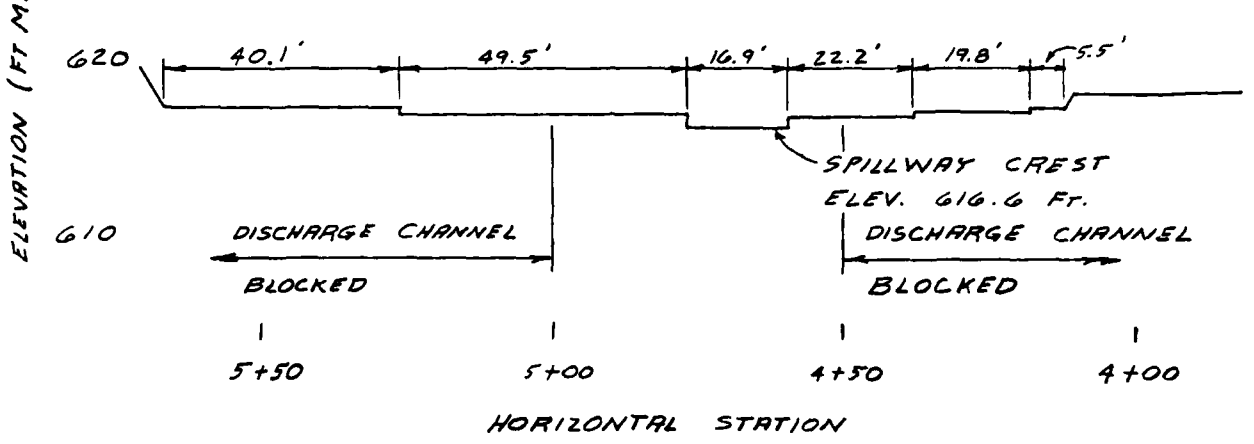


MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

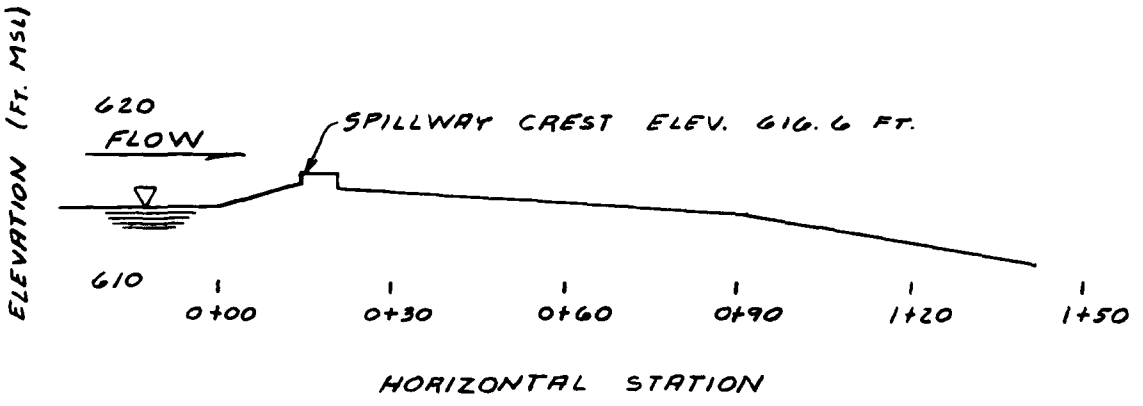
Box 280
Beaver, Pa. 15009

Subject POTAKE LAKE DAM S.O. No.
SPILLWAY PROFILE AND Sheet No. 8 of 31
CROSS SECTION Drawing No.
Computed by GWT Checked by LAD Date 3-12-81

SPILLWAY PROFILE



SPILLWAY CROSS SECTION

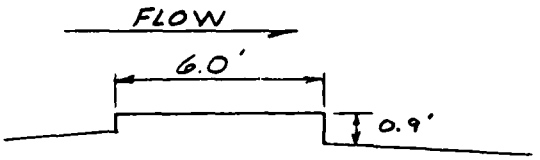


MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

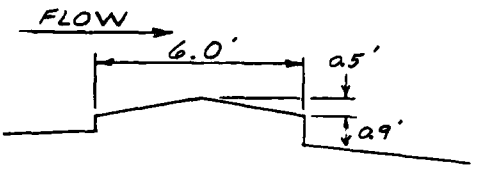
Box 280
Beaver, Pa. 15009

Subject POTAKE LAKE DAM S.O. No.
SPILLWAY RATING Sheet No. 9 of 31
Drawing No.
Computed by GWT Checked by CAD Date 3-12-81

TYPICAL WEIR CROSS SECTIONS



STA. 4+60.5 TO STA. 4+77.4
AND
STA. 4+13 TO STA. 4+18.5



STA. 4+18.5 TO STA. 4+60.5
AND
STA. 4+77.4 TO STA. 5+67

SPILLWAY RATING

$Q = CLH^{3/2}$ /

/C VARIES WITH H AND IS AN ESTIMATE TAKEN FROM COMPARISONS WITH A BROAD-CRESTED WEIR TABLE 5-3 AND FIG. No. 5-16 TABLE 5-13, BRATER & KING.

/L VARIES WITH SECTION

/H VARIES FROM 0 FT. TO 4.4 FT.

STA. 4+13 TO STA 4+18.5 (1)

ELEVATION, (FT)	C /	L, (FT) /	H (FT) /	Q (CFS)
617.7	0	5.5	0	0 /
618.0	2.60	5.5	0.3	2.3 /
618.5	2.65	5.5	0.8	10.4 /
619.0	2.65	5.5	1.3	21.6 /
619.5	2.65	5.5	1.8	35.2 /
620.0	2.66	5.5	2.3	51.0 /
621.0	2.66	5.5	3.3	87.7 /

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject POTAKE LAKE DAM — S.O. No.
SPILLWAY RATING — Sheet No. 10 of 31
(CONTINUED) — Drawing No.
Computed by GWT — Checked by LAD — Date 3-12-81

STA. 4+18.5 TO STA. 4+38.3 ②				
ELEVATION, (FT)	C ✓	L (FT) ✓	H (FT) ✓	Q (CFS)
617.5	0	19.8	0	0 ✓
618.0	2.90	19.8	0.5	20.3 ✓
618.5	2.95	19.8	1.0	58.4 ✓
619.0	2.98	19.8	1.5	108.4 ✓
619.5	3.00	19.8	2.0	168.0 ✓
620.0	3.03	19.8	2.5	237.2 ✓
621.0	3.08	19.8	3.5	399.3 ✓

STA. 4+38.3 TO STA. 4+60.5 ③				
ELEVATION, (FT)	C ✓	L (FT) ✓	H (FT) ✓	Q (CFS)
617.1	0	22.2	0	0 ✓
617.5	2.9	22.2	0.4	16.3 ✓
618.0	2.95	22.2	0.9	55.9 ✓
618.5	2.98	22.2	1.4	109.6 ✓
619.0	3.00	22.2	1.9	174.4 ✓
619.5	3.03	22.2	2.4	250.1 ✓
620.0	3.04	22.2	2.9	333.3 ✓
621.0	3.11	22.2	3.9	531.8 ✓

STA. 4+60.5 TO STA. 4+77.4 ④				
ELEVATION, (FT)	C ✓	L (FT) ✓	H (FT) ✓	Q (CFS)
616.6	0	16.9	0	0
617.0	2.60	16.9	0.4	11.1 ✓
617.5	2.67	16.9	0.9	38.5 ✓
618.0	2.65	16.9	1.4	74.2 ✓
618.5	2.65	16.9	1.9	117.3 ✓
619.0	2.66	16.9	2.4	167.1 ✓
619.5	2.66	16.9	2.9	222.0 ✓
620.0	2.68	16.9	3.4	283.9 ✓
621.0	2.74	16.9	4.4	427.4 ✓

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject POTAKE LAKE DAM S.O. No.
SPILLWAY RATING Sheet No. 11 of 31
(CONTINUED) Drawing No.
Computed by GWT Checked by LAD Date 3-12-81

STA. 4+77.4 TO STA. 5+26.9 ⑤				
ELEVATION, (FT)	C ✓	L (FT) ✓	H (FT) ✓	Q (CFS)
617.2	0	49.5	0	0 ✓
617.5	2.9	49.5	0.3	23.6 ✓
618.0	2.95	49.5	0.8	104.5 ✓
618.5	2.98	49.5	1.3	218.6 ✓
619.0	3.00	49.5	1.8	358.6 ✓
619.5	3.03	49.5	2.3	523.2 ✓
620.0	3.04	49.5	2.8	705.0 ✓
621.0	3.11	49.5	3.8	1,140.4 ✓

STA. 5+26.9 TO STA. 5+67 ⑥				
ELEVATION (FT)	C ✓	L (FT) ✓	H (FT) ✓	Q (CFS)
617.6	0	40.1	0	0
618.0	2.90	40.1	0.4	29.4 ✓
618.5	2.95	40.1	0.9	101.0 ✓
619.0	2.98	40.1	1.4	197.9 ✓
619.5	3.00	40.1	1.9	315.1 ✓
620.0	3.03	40.1	2.4	451.8 ✓
621.0	3.08	40.1	3.4	774.3 ✓

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject POTAKE LAKE DAM S.O. No.
SPILLWAY RATING SUMMARY Sheet No. 12 of 31
Drawing No.
Computed by GWT Checked by LAD Date 3-12-81

SPILLWAY RATING

ELEVATION, (FT)	① (CFS)	② (CFS)	③ (CFS)	④ (CFS)	⑤ (CFS)	⑥ (CFS)	TOTAL Q (CFS)
616.6				0			0
617.0				11.1			11 ✓
617.5			16.3	38.5	23.6		78 ✓
618.0	2.3	20.3	55.9	74.2	104.5	29.4	287 ✓
618.5	10.4	58.4	109.6	117.3	218.6	101.0	615 ✓
619.0	21.6	108.4	174.4	167.1	358.6	197.9	1,028 ✓
619.5	35.2	168.0	250.1	222.0	523.2	315.1	1,514 ✓
620.0	51.0	237.2	333.3	283.9	705.0	451.8	2,062 ✓
621.0	87.7	399.3	531.8	427.4	1,140.4	774.3	3,361 ✓

NOTE: THE CONTROLLING SECTION OF THE DISCHARGE CHANNEL IS 73 FEET DOWNSTREAM FROM THE DAM. THE CONTROLLING SECTION IS A TRAPEZOIDAL CHANNEL WITH A BOTTOM WIDTH OF 20 FEET, SIDE SLOPES OF 1V:3H AND A DEPTH OF 4 FEET. THE SLOPE OF THE DISCHARGE CHANNEL IS 0.024 FT/FT. CALCULATIONS MADE, SHOW THAT THE DISCHARGE CHANNEL WILL PASS STORM FLOWS FROM THE SPILLWAY.

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject POTAKE LAKE DAM S.O. No.
12" DIA. PIPE OUTFLOW RATING Sheet No. 13 of 31
Drawing No.
Computed by GWT Checked by LAD Date 3/13/81

PIPE FLOW

$$Q = \frac{A\,(2gH)^{1/2}}{[1 + K_e + K_b + K_c(L)]^{1/2}}$$

$$= \frac{0.79\,(2 \times 32.2 \times H)^{1/2}}{[1 + 0.78 + 0 + .0363\ (360)]^{1/2}}$$

$$Q = 1.645\,H^{1/2}$$

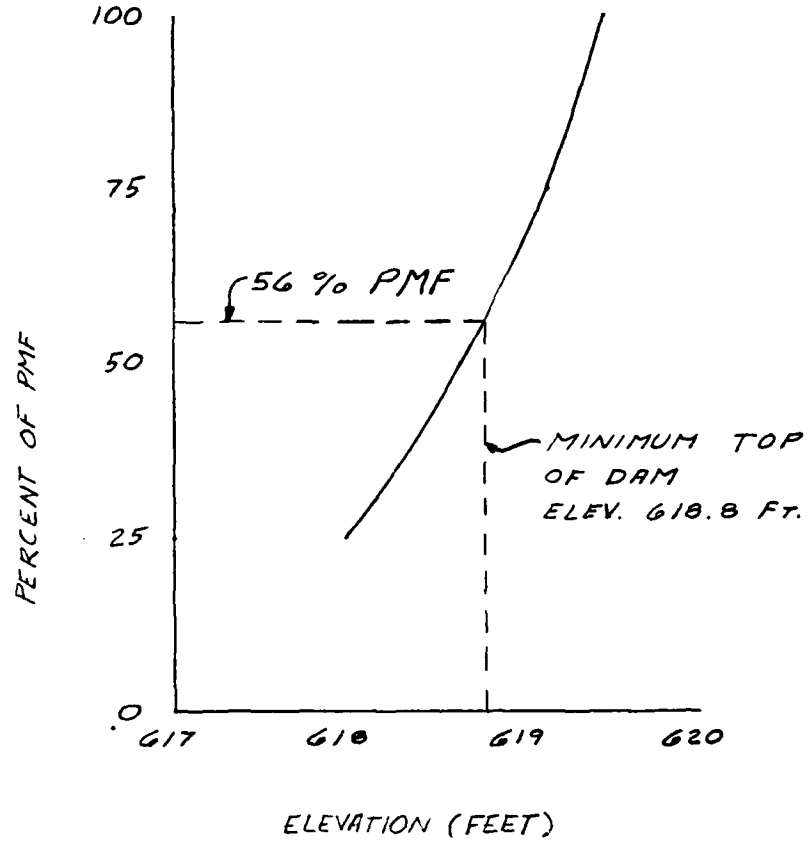
/ PIPE IS 12" DIA. CAST IRON PIPE
/ $A = \pi R^2 = \pi (.5)^2 = 0.79$ FT^2
/ $g = 32.2$ FT/SEC^2
/ H = HEAD MEASURED FROM THE TOP OF PIPE @ OUTLET (EST. @ 607.0 FT)
/ L = 360 FT (ESTIMATED)
/ $K_e = 0.78$ PG. 5.5-6 SCS NEH-5
/ $K_b = 0$ PG. 5.5-10 SCS NEH-5
/ $K_c = 0.0363$ PG. 5.5-6 SCS NEH-5
/ "n" = 0.014 (UNCOATED CAST IRON PIPE)

ELEVATION (FT)	H (FT)	Q (CFS)
608.0	0	0
609.0	1.0	1.64
610.0	2.0	2.33
611.0	3.0	2.85
612.0	4.0	3.29
613.0	5.0	3.68
614.0	6.0	4.03
615.0	7.0	4.35
616.0	8.0	4.65
616.6	8.6	4.82

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject POTAKE LAKE DAM S.O. No.
SPILLWAY CAPACITY ANALYSIS Sheet No. 14 of 31
Drawing No.
Computed by GWT Checked by LAD Date 3/13/81



```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
  MBJ UPDATE         04 JUN 79
**********
    1          A1       NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS
    2          A2       HYDROLOGIC AND HYDRAULIC ANALYSIS OF PUTAKE LAKE DAM
    3          A3       UNIT HYDROGRAPH BY SNYDERS METHOD
    4          B     300        0       30        0        0        0        0        0       -4        6
    5          B1      5
    6          J       1        4        1
    7          J1    1.0     0.75      0.5     0.25
    8          K       0        1                                           1
    9          K1       RUNOFF HYDROGRAPH TO DAM
   10          P       1        1    0.83
   11          P              21.9      111      123      133      142
   12          T                                                    1.0     0.10              0.124
   13          M     2.29     0.63
   14          X     -1.5    -0.05      2.0
   15          K       1        2                                           1
   16          K1       ROUTING FOR PUTAKE POND DAM
   17          Y                                        1        1
   18          Y1      1                                                -616.6       -1
   19          Y4  616.6    617.0    617.5    618.0    618.5    619.0    619.5    620.0    621.0
   20          Y5      0       11       78      287      615     1028     1514     2062     3361
   21          $A   83.7     87.2    100.1    134.1
   22          $E  605.5    616.6      620      640
   23          $$  616.6
   24          $D  618.8      2.7      1.5      418
   25          $L      0      105      420      425      440
   26          $V  618.8    619.0    619.5      620      625
   27          K      99
```

```
**************************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION       JULY 1978
  LAST MODIFICATION  26 FEB 79
  MBJ UPDATE         04 JUN 79
**************************************

RUN  DATE 05/19/81
     TIME    11.56

                  NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS
                  HYDROLOGIC AND HYDRAULIC ANALYSIS OF PLIAKE LAKE DAM
                  UNIT HYDROGRAPH BY SNYDERS METHOD

                                    JOB SPECIFICATION
       NQ    NHR    NMIN   IDAY    IHR    IMIN   METRC   IPLT   IPRT   NSTAN
      300      0      30      0      0      0       0      0     -4      0
                           JOPER   NWT   LROPT   TRACE
                               5     0       0       0      0

                          MULTI-PLAN ANALYSES TO BE PERFORMED
                             NPLAN= 1 NRTIO= 4 LRTIO= 1
              RTIOS=   1.00   0.75   0.50   0.25

   *********       *********       *********       *********       *********

                           SUB-AREA RUNOFF COMPUTATION

              RUNOFF HYDROGRAPH TO DAM

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

                                    HYDROGRAPH DATA
       IHYDG   IUHG   TAREA   SNAP   TRSDA   TRSPC   RATIO   ISNOW   ISAME   LOCAL
           1      1    0.83    0.0    0.83     0.0     0.0       0       0       0

                                      PRECIP DATA
              SPFE     PMS      R6      R12      R24      R48     R72     R96
               0.0   21.90  111.00   123.00   133.00   142.00     0.0     0.0
TRSPC COMPUTED BY THE PROGRAM IS 0.800

                                     LOSS DATA
     LROPT   STRKR   DLTKR   RTIOL   ERAIN   STRKS   RTIOK   STRTL   CNSTL   ALSMX   RTIMP
         0     0.0     0.0    1.00     0.0     0.0    1.00    1.00    0.10     0.0    0.10

                               UNIT HYDROGRAPH DATA
                          TP=  2.29   CP=0.63    NTA=  0

                                  RECESSION DATA
                  STRTQ=   -1.50    QRCSN=   -0.05    RTIOR=  2.00

       UNIT HYDROGRAPH 26 END-OF-PERIOD ORDINATES, LAG=   2.30 HOURS, CP= 0.63  VOL= 1.00
      13.      48.      93.     130.     146.     134.     108.      85.      67.      53.
      41.      33.      26.      20.      16.      13.      10.       8.       6.       5.
       4.       3.       2.       2.       1.       1.
```

SHEET 16 OF 31

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	24.88	21.79	3.09	24287.
										(632.31	553.31	78.31	687.733

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTING FOR PUTAHE POND DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	1	0	0	0	0	1	0	0

ROUTING DATA

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

NSTPS	NSTOL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.0	0.0	0.0	-617.	-1

STAGE	616.00	617.00	617.50	618.00	618.50	619.00	619.50	620.00	621.00
FLOW	0.0	11.00	78.00	287.00	615.00	1028.00	1514.00	2062.00	3362.00
SURFACE AREA=	84.	87.	100.	134.					
CAPACITY=	0.	548.	1267.	3600.					
ELEVATION=	606.	617.	620.	640.					

CREL	SPWID	CCOM	EXPW	ELEVL	COOL	CAREA	EXPL
616.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
618.8	2.7	1.5	418.

CREST LENGTH	0.	105.	420.	425.	440.
AT CR BELOW ELEVATION	618.8	619.0	619.5	620.0	625.0

PEAK OUTFLOW IS 1717. AT TIME 43.00 HOURS

PEAK OUTFLOW IS 1200. AT TIME 43.00 HOURS

PEAK OUTFLOW IS 735. AT TIME 43.50 HOURS

PEAK OUTFLOW IS 282. AT TIME 44.00 HOURS

********** ********** ********** ********** **********

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIO 1 1.00	RATIO 2 0.75	RATIO 3 0.50	RATIO 4 0.25
				RATIOS APPLIED TO FLOWS			
HYDROGRAPH AT	1	0.83	1	1855.	1421.	947.	474.
	(	2.15)	(	53.651)	40.243)	26.828)	13.414)
ROUTED TO	2	0.83	1	1717.	1200.	735.	282.
	(	2.15)	(	48.621)	33.978)	20.827)	7.993)

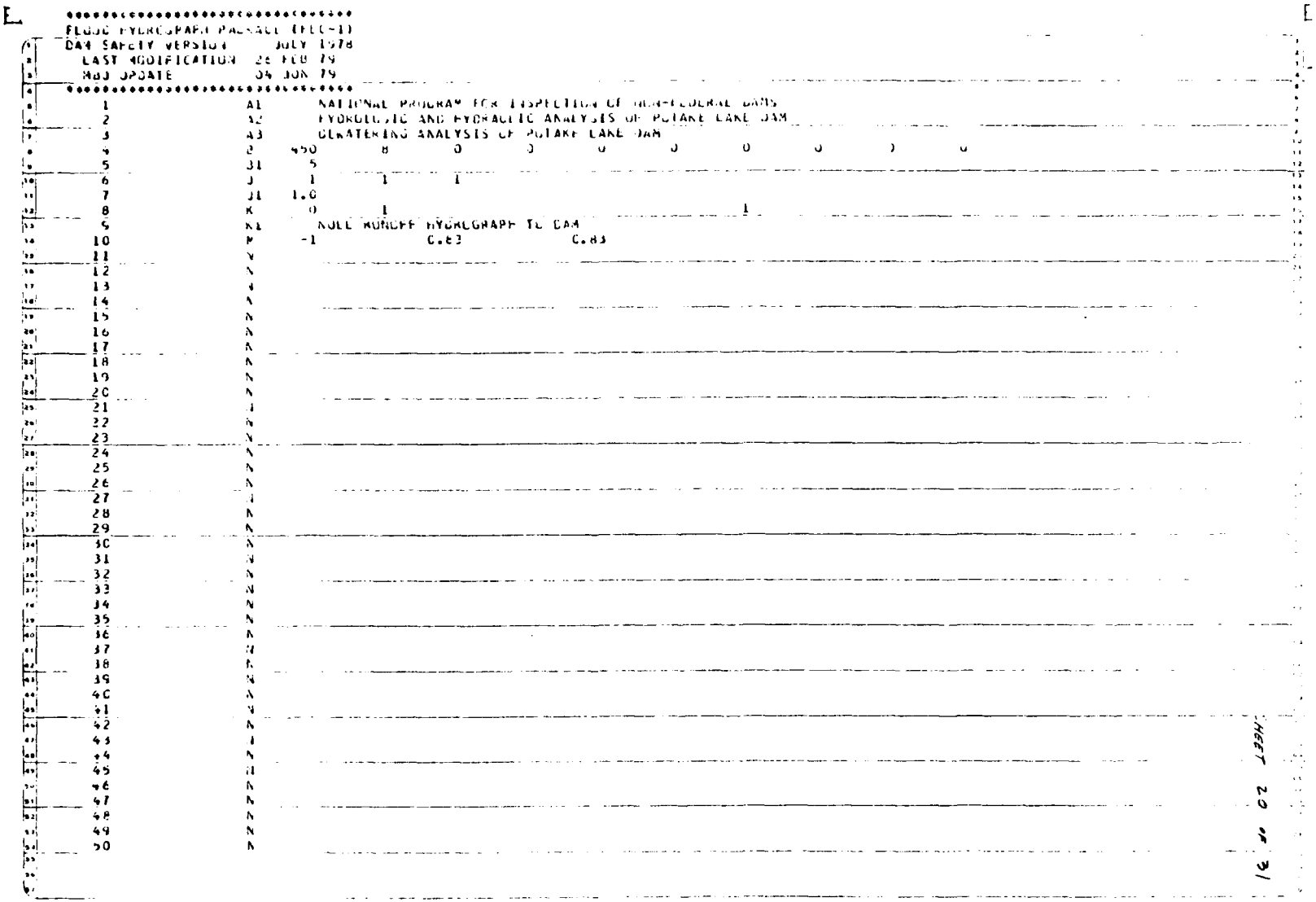
SHEET 8 OF 31

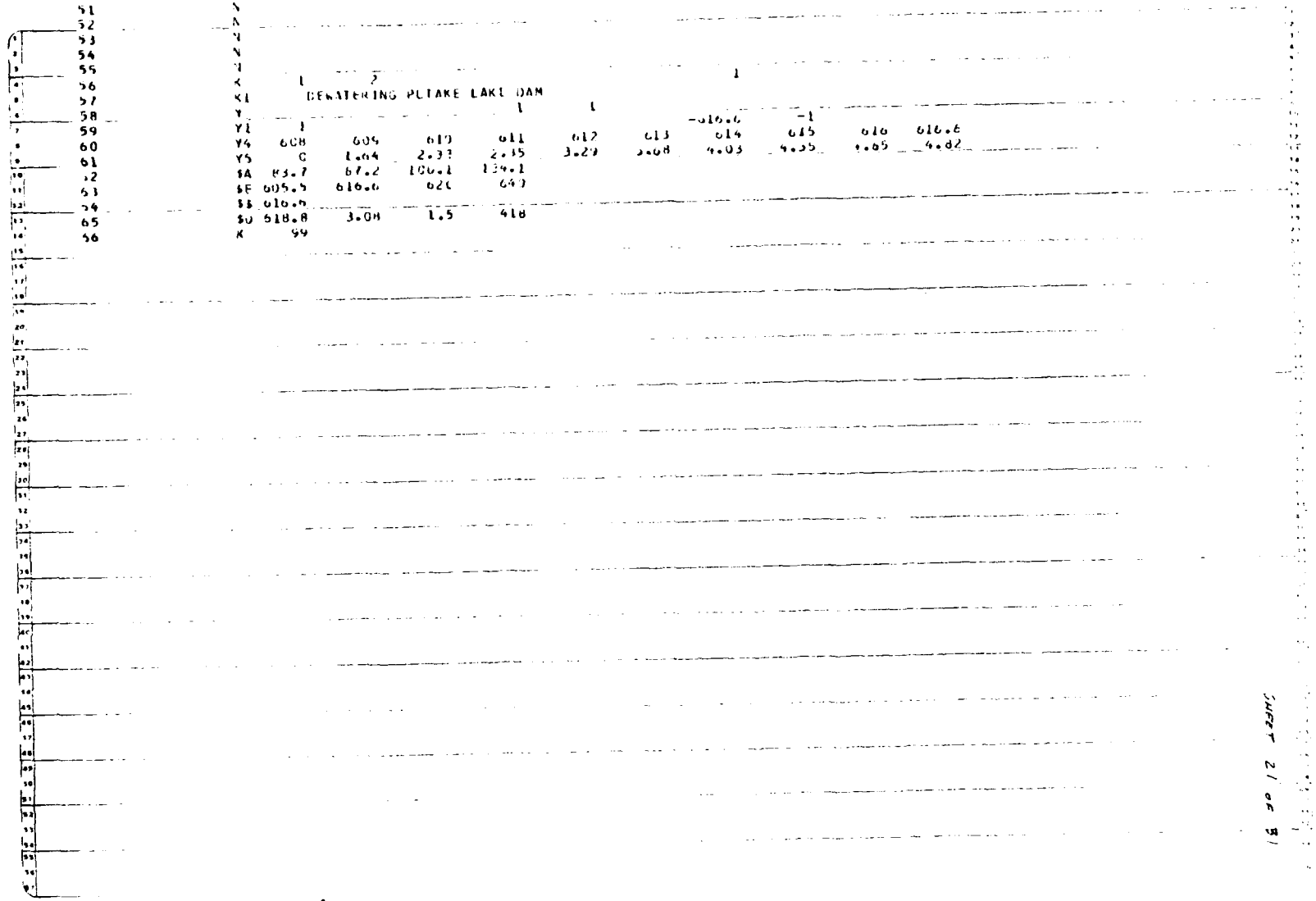
SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

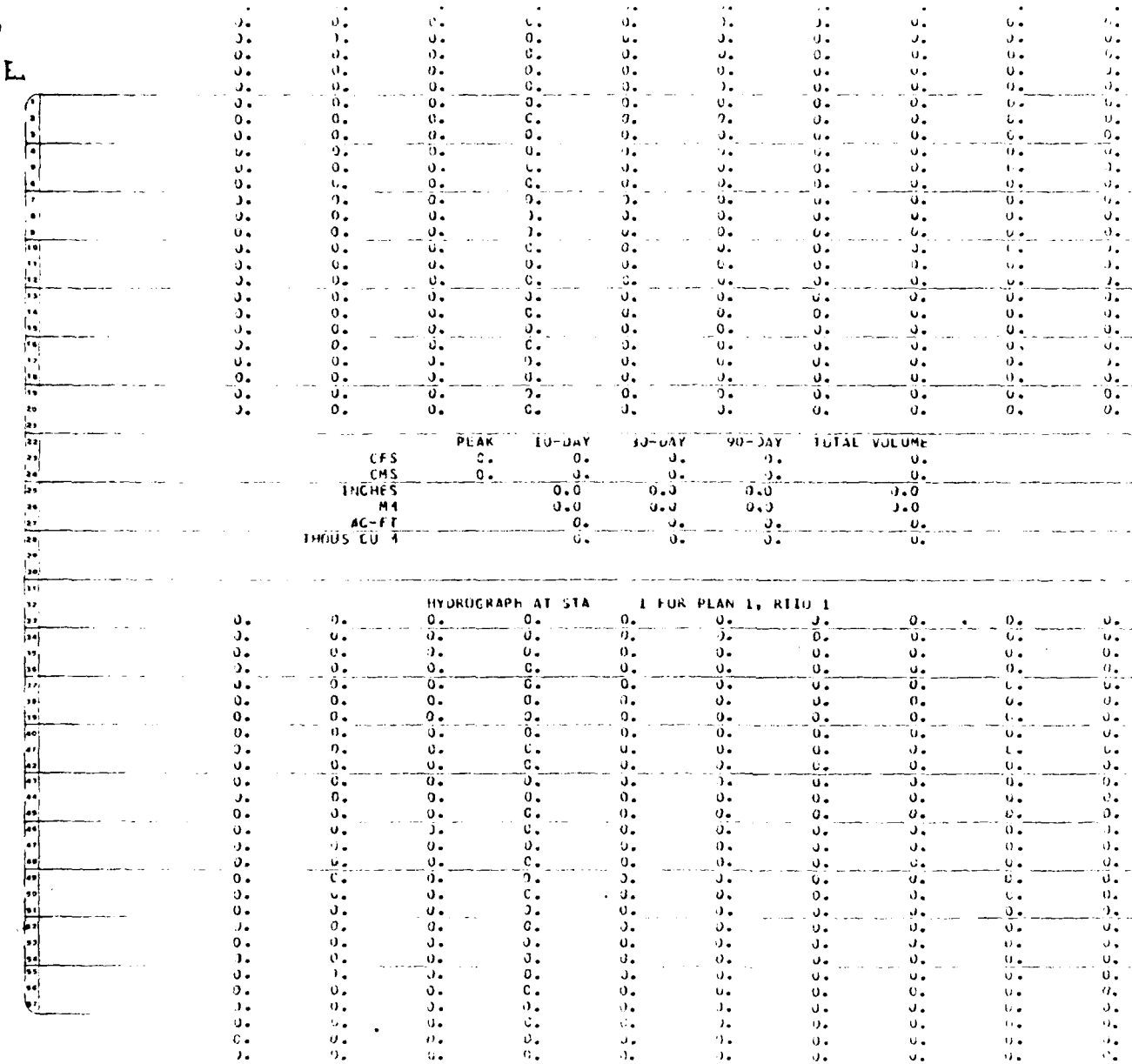
	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	616.00	616.00	618.00
STORAGE	948.	948.	1199.
OUTFLOW	0.	0.	863.

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
1.00	619.46	0.66	1213.	1717.	5.00	43.00	0.0
0.75	619.13	0.33	1181.	1200.	3.50	43.00	0.0
0.50	618.65	0.0	1135.	735.	0.0	43.50	0.0
0.25	617.99	0.0	1073.	282.	0.0	44.00	0.0


FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 28 FEB 79
RUN UPDATE 04 JUN 79
A1 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS
A2 HYDROLOGIC AND HYDRAULIC ANALYSIS OF POTAKE LAKE DAM
A3 DEWATERING ANALYSIS OF POTAKE LAKE DAM
J 450 8 0 0 0 0 0 0 0
J1 5
J 1 1 1
J1 1.0
K 0 1 1
K1 RUNOFF HYDROGRAPH TO DAM
M -1 0.83 0.83
SHEET 20 OF 31


DEWATERING PUTAKE LAKE DAM
608 609 610 611 612 613 614 615 616 616.6
0 1.04 2.33 2.45 3.28 3.68 4.03 4.35 4.65 4.82
85.7 87.2 100.1 134.1
605.5 616.6 620 640
616.8 3.08 1.5 418
99

```
**********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION        JULY 1978
  LAST MODIFICATION  26 FEB 79
  MOD UPDATE          0? JUN 79
**********************************

RUN  DATE 79/2?/31
     TIME    14.41

               NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS
               HYDROLOGIC AND HYDRAULIC ANALYSIS OF PUTAKE LAKE DAM
               DEWATERING ANALYSIS OF PUTAKE LAKE DAM

                                  JOB SPECIFICATION
      NQ    NHR   NMIN   IDAY   IHR   IMIN   METRC   IPLT   IPRT   NSTAN
     450      8      0      0     0      0       0      0      0       0
                        JOPER   NWT   LROPT   TRACE
                            5     0       0       0      0

                      MULTI-PLAN ANALYSES TO BE PERFORMED
                         NPLAN= 1 NRTIO= 1 LRTIO= 1
      RTIOS=   1.00

**********     **********     **********     **********     **********

                          SUB-AREA RUNOFF COMPUTATION

      NULL RUNOFF HYDROGRAPH TO DAM

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

                                  HYDROGRAPH DATA
  IHYDG   IUHG   TAREA   SNAP   TRSDA   TRSPC   RATIO   ISNOW   ISAME   LOCAL
     -1      0    0.83    0.0    0.83     0.0     0.0       0       0       0

                                  INPUT HYDROGRAPH
   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
   0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
```



	PEAK	10-DAY	30-DAY	90-DAY	TOTAL VOLUME
CFS	0.	0.	0.	0.	0.
CMS	0.	0.	0.	0.	0.
INCHES		0.0	0.0	0.0	0.0
MM		0.0	0.0	0.0	0.0
AC-FT		0.	0.	0.	0.
THOUS CU M		0.	0.	0.	0.

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 1

	PEAK	10-DAY	30-DAY	90-DAY	TOTAL VOLUME
CFS	0.	0.	0.	0.	0.
CMS	0.	0.	0.	0.	0.
INCHES		0.0	0.0	0.0	0.0
MM		0.0	0.0	0.0	0.0
AC-FT		0.	0.	0.	0.
THOUS CU FT		0.	0.	0.	0.

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

DEWATERING INTAKE LAKE CAM

ISTAQ	ICLMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	1	0	0	0	0	1	0	0

ROUTING DATA

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

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.0	0.0	0.0	-227.	-1

STAGE	608.00	609.00	610.00	611.00	612.00	613.00	614.00	615.00	616.00	616.80
FLOW	0.0	1.94	2.33	2.83	3.24	3.68	4.03	4.35	4.65	4.82
SURFACE AREA=	84.	87.	100.	134.						
CAPACITY=	0.	948.	1267.	3600.						
ELEVATION=	606.	617.	620.	640.						

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
616.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

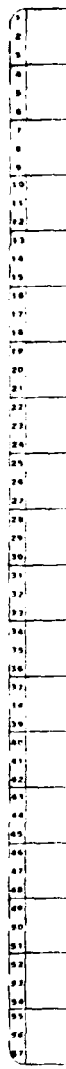
DAM DATA

TOPEL	COQD	EXPD	DAMWID
618.8	3.1	1.5	418.

STATION 2, PLAN 1, RATIO 1

END-OF-PERIOD HYDROGRAPH ORDINATES

SHEET 24 OF 31



1.01	8.00	1	8.00	0.	5.	945.	616.6
1.01	16.00	2	16.00	0.	5.	942.	616.5
1.02	0.0	3	24.00	0.	5.	939.	616.5
1.02	8.00	4	32.00	0.	5.	936.	616.5
1.02	16.00	5	40.00	0.	5.	933.	616.4
1.03	0.0	6	48.00	0.	5.	929.	616.4
1.03	8.00	7	56.00	0.	5.	926.	616.3
1.03	16.00	8	64.00	0.	5.	923.	616.3
1.04	0.0	9	72.00	0.	5.	920.	616.3
1.04	8.00	10	80.00	0.	5.	917.	616.2
1.04	16.00	11	88.00	0.	5.	914.	616.2
1.05	0.0	12	96.00	0.	5.	911.	616.2
1.05	8.00	13	104.00	0.	5.	907.	616.1
1.05	16.00	14	112.00	0.	5.	904.	616.1
1.06	0.0	15	120.00	0.	5.	901.	616.1
1.06	8.00	16	128.00	0.	5.	898.	616.0
1.06	16.00	17	136.00	0.	5.	895.	616.0
1.07	0.0	18	144.00	0.	5.	892.	616.0
1.07	8.00	19	152.00	0.	5.	889.	615.9
1.07	16.00	20	160.00	0.	5.	886.	615.9
1.08	0.0	21	168.00	0.	5.	883.	615.8
1.08	8.00	22	176.00	0.	5.	880.	615.8
1.08	16.00	23	184.00	0.	5.	877.	615.8
1.09	0.0	24	192.00	0.	5.	874.	615.7
1.09	8.00	25	200.00	0.	5.	871.	615.7
1.09	16.00	26	208.00	0.	5.	868.	615.7
1.10	0.0	27	216.00	0.	5.	865.	615.6
1.10	8.00	28	224.00	0.	5.	862.	615.6
1.10	16.00	29	232.00	0.	5.	859.	615.6
1.11	0.0	30	240.00	0.	5.	856.	615.5
1.11	8.00	31	248.00	0.	4.	853.	615.5
1.11	16.00	32	256.00	0.	4.	850.	615.5
1.12	0.0	33	264.00	0.	4.	847.	615.4
1.12	8.00	34	272.00	0.	4.	844.	615.4
1.12	16.00	35	280.00	0.	4.	841.	615.4
1.13	0.0	36	288.00	0.	4.	838.	615.3
1.13	8.00	37	296.00	0.	4.	835.	615.3
1.13	16.00	38	304.00	0.	4.	832.	615.3
1.14	0.0	39	312.00	0.	4.	829.	615.2
1.14	8.00	40	320.00	0.	4.	826.	615.2
1.14	16.00	41	328.00	0.	4.	823.	615.2
1.15	0.0	42	336.00	0.	4.	820.	615.1
1.15	8.00	43	344.00	0.	4.	817.	615.1
1.15	16.00	44	352.00	0.	4.	814.	615.1
1.16	0.0	45	360.00	0.	4.	811.	615.0
1.16	8.00	46	368.00	0.	4.	809.	615.0
1.16	16.00	47	376.00	0.	4.	806.	615.0
1.17	0.0	48	384.00	0.	4.	803.	614.9
1.17	8.00	49	392.00	0.	4.	800.	614.9
1.17	16.00	50	400.00	0.	4.	797.	614.9
1.18	0.0	51	408.00	0.	4.	794.	614.8
1.18	8.00	52	416.00	0.	4.	791.	614.8
1.18	16.00	53	424.00	0.	4.	789.	614.8
1.19	0.0	54	432.00	0.	4.	786.	614.7
1.19	8.00	55	440.00	0.	4.	783.	614.7
1.19	16.00	56	448.00	0.	4.	780.	614.7
1.20	0.0	57	456.00	0.	4.	777.	614.6
1.20	8.00	58	464.00	0.	4.	775.	614.6
1.20	16.00	59	472.00	0.	4.	772.	614.6
1.21	0.0	60	480.00	0.	4.	769.	614.5
1.21	8.00	61	488.00	0.	4.	766.	614.5
1.21	16.00	62	496.00	0.	4.	763.	614.5
1.22	0.0	63	504.00	0.	4.	761.	614.4
1.22	8.00	64	512.00	0.	4.	758.	614.4
1.22	16.00	65	520.00	0.	4.	755.	614.4

1.23	8.00	87	536.00	0.	4.	739.	614.2
1.23	16.00	88	544.00	0.	4.	742.	614.2
1.24	0.0	89	552.00	0.	4.	744.	614.2
1.24	8.00	90	560.00	0.	4.	741.	614.2
1.24	16.00	91	568.00	0.	4.	738.	614.2
1.25	0.0	92	576.00	0.	4.	736.	614.2
1.25	8.00	93	584.00	0.	4.	733.	614.1
1.25	16.00	94	592.00	0.	4.	731.	614.1
1.26	0.0	95	600.00	0.	4.	728.	614.1
1.26	8.00	96	608.00	0.	4.	725.	614.0
1.26	16.00	97	616.00	0.	4.	723.	614.0
1.27	0.0	98	624.00	0.	4.	720.	614.0
1.27	8.00	99	632.00	0.	4.	717.	613.9
1.27	16.00	80	640.00	0.	4.	715.	613.9
1.28	0.0	81	648.00	0.	4.	712.	613.9
1.28	8.00	82	656.00	0.	4.	709.	613.8
1.28	16.00	83	664.00	0.	4.	707.	613.8
1.29	0.0	84	672.00	0.	4.	704.	613.8
1.29	8.00	85	680.00	0.	4.	701.	613.8
1.29	16.00	86	688.00	0.	4.	699.	613.7
1.30	0.0	87	696.00	0.	4.	696.	613.7
1.30	8.00	88	704.00	0.	4.	694.	613.7
1.30	16.00	89	712.00	0.	4.	691.	613.6
1.31	0.0	90	720.00	0.	4.	688.	613.6
1.31	8.00	91	728.00	0.	4.	686.	613.6
1.31	16.00	92	736.00	0.	4.	683.	613.5
2.01	0.0	93	744.00	0.	4.	681.	613.5
2.01	8.00	94	752.00	0.	4.	678.	613.5
2.01	16.00	95	760.00	0.	4.	676.	613.5
2.02	0.0	96	768.00	0.	4.	673.	613.4
2.02	8.00	97	776.00	0.	4.	670.	613.4
2.02	16.00	98	784.00	0.	4.	668.	613.4
2.03	0.0	99	792.00	0.	4.	665.	613.3
2.03	8.00	100	800.00	0.	4.	663.	613.3
2.03	16.00	101	808.00	0.	4.	660.	613.3
2.04	0.0	102	816.00	0.	4.	658.	613.2
2.04	8.00	103	824.00	0.	4.	655.	613.2
2.04	16.00	104	832.00	0.	4.	653.	613.2
2.05	0.0	105	840.00	0.	4.	650.	613.2
2.05	8.00	106	848.00	0.	4.	648.	613.1
2.05	16.00	107	856.00	0.	4.	645.	613.1
2.06	0.0	108	864.00	0.	4.	643.	613.1
2.06	8.00	109	872.00	0.	4.	641.	613.0
2.06	16.00	110	880.00	0.	4.	638.	613.0
2.07	0.0	111	888.00	0.	4.	636.	613.0
2.07	8.00	112	896.00	0.	4.	633.	613.0
2.07	16.00	113	904.00	0.	4.	631.	612.9
2.08	0.0	114	912.00	0.	4.	628.	612.9
2.08	8.00	115	920.00	0.	4.	626.	612.9
2.08	16.00	116	928.00	0.	4.	624.	612.8
2.09	0.0	117	936.00	0.	4.	621.	612.8
2.09	8.00	118	944.00	0.	4.	619.	612.8
2.09	16.00	119	952.00	0.	4.	616.	612.8
2.10	0.0	120	960.00	0.	4.	614.	612.7
2.10	8.00	121	968.00	0.	4.	612.	612.7
2.10	16.00	122	976.00	0.	4.	609.	612.7
2.11	0.0	123	984.00	0.	4.	607.	612.7
2.11	8.00	124	992.00	0.	4.	605.	612.6
2.11	16.00	125	1000.00	0.	4.	602.	612.6
2.12	0.0	126	1008.00	0.	4.	600.	612.6
2.12	8.00	127	1016.00	0.	4.	598.	612.5
2.12	16.00	128	1024.00	0.	3.	595.	612.5
2.13	0.0	129	1032.00	0.	3.	593.	612.5
2.13	8.00	130	1040.00	0.	3.	591.	612.5
2.13	16.00	131	1048.00	0.	3.	589.	612.4

[illegible]	0.0	[illegible]	0.	3.	[illegible]	[illegible]
3.07	8.00	1991592.00	0.	3.	448.	610.8
3.07	16.00	2001600.00	0.	3.	446.	610.8
3.08	0.0	2011608.00	0.	3.	444.	610.8
3.08	8.00	2021616.00	0.	3.	443.	610.7
3.08	16.00	2031624.00	0.	3.	441.	610.7
3.09	0.0	2041632.00	0.	3.	439.	610.7
3.09	8.00	2051640.00	0.	3.	437.	610.7
3.09	16.00	2061648.00	0.	3.	436.	610.7
3.10	0.0	2071656.00	0.	3.	434.	610.6
3.10	8.00	2081664.00	0.	3.	432.	610.6
3.10	16.00	2091672.00	0.	3.	430.	610.6
3.11	0.0	2101680.00	0.	3.	428.	610.6
3.11	8.00	2111688.00	0.	3.	427.	610.6
3.11	16.00	2121696.00	0.	3.	425.	610.5
3.12	0.0	2131704.00	0.	3.	423.	610.5
3.12	8.00	2141712.00	0.	3.	422.	610.5
3.12	16.00	2151720.00	0.	3.	420.	610.5
3.13	0.0	2161728.00	0.	3.	418.	610.4
3.13	8.00	2171736.00	0.	3.	416.	610.4
3.13	16.00	2181744.00	0.	3.	415.	610.4
3.14	0.0	2191752.00	0.	3.	413.	610.4
3.14	8.00	2201760.00	0.	3.	411.	610.4
3.14	16.00	2211768.00	0.	3.	410.	610.4
3.15	0.0	2221776.00	0.	3.	408.	610.3
3.15	8.00	2231784.00	0.	2.	406.	610.3
3.15	16.00	2241792.00	0.	2.	405.	610.3
3.16	0.0	2251800.00	0.	2.	403.	610.3
3.16	8.00	2261808.00	0.	2.	401.	610.3
3.16	16.00	2271816.00	0.	2.	400.	610.2
3.17	0.0	2281824.00	0.	2.	398.	610.2
3.17	8.00	2291832.00	0.	2.	397.	610.2
3.17	16.00	2301840.00	0.	2.	395.	610.2
3.18	0.0	2311848.00	0.	2.	393.	610.2
3.18	8.00	2321856.00	0.	2.	392.	610.1
3.18	16.00	2331864.00	0.	2.	390.	610.1
3.19	0.0	2341872.00	0.	2.	388.	610.1
3.19	8.00	2351880.00	0.	2.	387.	610.1
3.19	16.00	2361888.00	0.	2.	385.	610.1
3.20	0.0	2371896.00	0.	2.	384.	610.0
3.20	8.00	2381904.00	0.	2.	382.	610.0
3.20	16.00	2391912.00	0.	2.	381.	610.0
3.21	0.0	2401920.00	0.	2.	379.	610.0
3.21	8.00	2411928.00	0.	2.	378.	610.0
3.21	16.00	2421936.00	0.	2.	376.	610.0
3.22	0.0	2431944.00	0.	2.	375.	609.9
3.22	8.00	2441952.00	0.	2.	373.	609.9
3.22	16.00	2451960.00	0.	2.	372.	609.9
3.23	0.0	2461968.00	0.	2.	370.	609.9
3.23	8.00	2471976.00	0.	2.	369.	609.9
3.23	16.00	2481984.00	0.	2.	367.	609.8
3.24	0.0	2491992.00	0.	2.	366.	609.8
3.24	8.00	2502000.00	0.	2.	364.	609.8
3.24	16.00	2512008.00	0.	2.	363.	609.8
3.25	0.0	2522016.00	0.	2.	361.	609.8
3.25	8.00	2532024.00	0.	2.	360.	609.8
3.25	16.00	2542032.00	0.	2.	358.	609.7
3.26	0.0	2552040.00	0.	2.	357.	609.7
3.26	8.00	2562048.00	0.	2.	355.	609.7
3.26	16.00	2572056.00	0.	2.	354.	609.7
3.27	0.0	2582064.00	0.	2.	353.	609.7
3.27	8.00	2592072.00	0.	2.	351.	609.7
3.27	16.00	2602080.00	0.	2.	350.	609.6
3.28	0.0	2612088.00	0.	2.	[illegible]	[illegible]
3.28	8.00	[illegible]	0.	2.	347.	[illegible]
3.28	16.00	[illegible]	0.	2.	346.	609.6

3.29	0.0	2642112.00	0.	2.	344.	609.6
3.29	8.00	2652120.00	0.	2.	343.	609.6
3.29	16.00	2662128.00	0.	2.	342.	609.6
3.30	0.0	2672136.00	0.	2.	340.	609.5
3.30	8.00	2682144.00	0.	2.	339.	609.5
3.30	16.00	2692152.00	0.	2.	338.	609.5
3.31	0.0	2702160.00	0.	2.	336.	609.5
3.31	8.00	2712168.00	0.	2.	335.	609.5
3.31	16.00	2722176.00	0.	2.	334.	609.5
4.01	0.0	2732184.00	0.	2.	332.	609.4
4.01	8.00	2742192.00	0.	2.	331.	609.4
4.01	16.00	2752200.00	0.	2.	330.	609.4
4.02	0.0	2762208.00	0.	2.	329.	609.4
4.02	8.00	2772216.00	0.	2.	327.	609.4
4.02	16.00	2782224.00	0.	2.	326.	609.4
4.03	0.0	2792232.00	0.	2.	325.	609.4
4.03	8.00	2802240.00	0.	2.	323.	609.3
4.03	16.00	2812248.00	0.	2.	322.	609.3
4.04	0.0	2822256.00	0.	2.	321.	609.3
4.04	8.00	2832264.00	0.	2.	320.	609.3
4.04	16.00	2842272.00	0.	2.	319.	609.3
4.05	0.0	2852280.00	0.	2.	317.	609.3
4.05	8.00	2862288.00	0.	2.	316.	609.3
4.05	16.00	2872296.00	0.	2.	315.	609.2
4.06	0.0	2882304.00	0.	2.	314.	609.2
4.06	8.00	2892312.00	0.	2.	313.	609.2
4.06	16.00	2902320.00	0.	2.	311.	609.2
4.07	0.0	2912328.00	0.	2.	310.	609.2
4.07	8.00	2922336.00	0.	2.	309.	609.2
4.07	16.00	2932344.00	0.	2.	308.	609.2
4.08	0.0	2942352.00	0.	2.	307.	609.1
4.08	8.00	2952360.00	0.	2.	306.	609.1
4.08	16.00	2962368.00	0.	2.	304.	609.1
4.09	0.0	2972376.00	0.	2.	303.	609.1
4.09	8.00	2982384.00	0.	2.	302.	609.1
4.09	16.00	2992392.00	0.	2.	301.	609.1
4.10	0.0	3002400.00	0.	2.	300.	609.1
4.10	8.00	3012408.00	0.	2.	299.	609.0
4.10	16.00	3022416.00	0.	2.	298.	609.0
4.11	0.0	3032424.00	0.	2.	297.	609.0
4.11	8.00	3042432.00	0.	2.	295.	609.0
4.11	16.00	3052440.00	0.	2.	294.	609.0
4.12	0.0	3062448.00	0.	2.	293.	609.0
4.12	8.00	3072456.00	0.	2.	292.	609.0
4.12	16.00	3082464.00	0.	2.	291.	609.0
4.13	0.0	3092472.00	0.	2.	290.	608.9
4.13	8.00	3102480.00	0.	2.	289.	608.9
4.13	16.00	3112488.00	0.	2.	288.	608.9
4.14	0.0	3122496.00	0.	1.	287.	608.9
4.14	8.00	3132504.00	0.	1.	286.	608.9
4.14	16.00	3142512.00	0.	1.	285.	608.9
4.15	0.0	3152520.00	0.	1.	284.	608.9
4.15	8.00	3162528.00	0.	1.	283.	608.9
4.15	16.00	3172536.00	0.	1.	282.	608.9
4.16	0.0	3182544.00	0.	1.	281.	608.8
4.16	8.00	3192552.00	0.	1.	280.	608.8
4.16	16.00	3202560.00	0.	1.	279.	608.8
4.17	0.0	3212568.00	0.	1.	279.	608.8
4.17	8.00	3222576.00	0.	1.	278.	608.8
4.17	16.00	3232584.00	0.	1.	277.	608.8
4.18	0.0	3242592.00	0.	1.	276.	608.8
4.18	8.00	3252600.00	0.	1.	275.	608.8
4.18	16.00	3262608.00	0.	1.	274.	608.8
4.19	0.0	3272616.00	0.	1.	273.	608.7
4.19	8.00	3282624.00	0.	1.	273.	608.7

4.20	8.00	3312048.00	0.	1.	270.	[illegible]
4.20	16.00	3322656.00	0.	1.	270.	608.7
4.21	0.0	3332664.00	0.	1.	269.	608.7
4.21	8.00	3342672.00	0.	1.	268.	608.7
4.21	16.00	3352680.00	0.	1.	267.	608.7
4.22	0.0	3362688.00	0.	1.	267.	608.7
4.22	8.00	3372696.00	0.	1.	266.	608.7
4.22	16.00	3382704.00	0.	1.	265.	608.6
4.23	0.0	3392712.00	0.	1.	264.	608.6
4.23	8.00	3402720.00	0.	1.	264.	608.6
4.23	16.00	3412728.00	0.	1.	263.	608.6
4.24	0.0	3422736.00	0.	1.	262.	608.6
4.24	8.00	3432744.00	0.	1.	262.	608.6
4.24	16.00	3442752.00	0.	1.	261.	608.6
4.25	0.0	3452760.00	0.	1.	260.	608.6
4.25	8.00	3462768.00	0.	1.	260.	608.6
4.25	16.00	3472776.00	0.	1.	259.	608.6
4.26	0.0	3482784.00	0.	1.	258.	608.6
4.26	8.00	3492792.00	0.	1.	258.	608.6
4.26	16.00	3502800.00	0.	1.	257.	608.6
4.27	0.0	3512808.00	0.	1.	257.	608.5
4.27	8.00	3522816.00	0.	1.	256.	608.5
4.27	16.00	3532824.00	0.	1.	255.	608.5
4.28	0.0	3542832.00	0.	1.	255.	608.5
4.28	8.00	3552840.00	0.	1.	254.	608.5
4.28	16.00	3562848.00	0.	1.	254.	608.5
4.29	0.0	3572856.00	0.	1.	253.	608.5
4.29	8.00	3582864.00	0.	1.	253.	608.5
4.29	16.00	3592872.00	0.	1.	252.	608.5
4.30	0.0	3602880.00	0.	1.	251.	608.5
4.30	8.00	3612888.00	0.	1.	251.	608.5
4.30	16.00	3622896.00	0.	1.	250.	608.5
5.01	0.0	3632904.00	0.	1.	250.	608.5
5.01	8.00	3642912.00	0.	1.	249.	608.5
5.01	16.00	3652920.00	0.	1.	249.	608.5
5.02	0.0	3662928.00	0.	1.	248.	608.5
5.02	8.00	3672936.00	0.	1.	248.	608.4
5.02	16.00	3682944.00	0.	1.	247.	608.4
5.03	0.0	3692952.00	0.	1.	247.	608.4
5.03	8.00	3702960.00	0.	1.	246.	608.4
5.03	16.00	3712968.00	0.	1.	246.	608.4
5.04	0.0	3722976.00	0.	1.	245.	608.4
5.04	8.00	3732984.00	0.	1.	245.	608.4
5.04	16.00	3742992.00	0.	1.	245.	608.4
5.05	0.0	3753000.00	0.	1.	244.	608.4
5.05	8.00	3763008.00	0.	1.	244.	608.4
5.05	16.00	3773016.00	0.	1.	243.	608.4
5.06	0.0	3783024.00	0.	1.	243.	608.4
5.06	8.00	3793032.00	0.	1.	242.	608.4
5.06	16.00	3803040.00	0.	1.	242.	608.4
5.07	0.0	3813048.00	0.	1.	241.	608.4
5.07	8.00	3823056.00	0.	1.	241.	608.4
5.07	16.00	3833064.00	0.	1.	241.	608.4
5.08	0.0	3843072.00	0.	1.	240.	608.4
5.08	8.00	3853080.00	0.	1.	240.	608.4
5.08	16.00	3863088.00	0.	1.	240.	608.3
5.09	0.0	3873096.00	0.	1.	239.	608.3
5.09	8.00	3883104.00	0.	1.	239.	608.3
5.09	16.00	3893112.00	0.	1.	238.	608.3
5.10	0.0	3903120.00	0.	1.	238.	608.3
5.10	8.00	3913128.00	0.	1.	238.	608.3
5.10	16.00	3923136.00	0.	1.	237.	608.3
5.11	0.0	3933144.00	0.	1.	237.	608.3
5.11	8.00	3943152.00	0.	1.	237.	608.3
5.11	16.00	3953160.00	0.	1.	236.	608.3

5.12	0.0	[illegible]	0.	0.	236.	608.3
5.12	8.00	3973176.00	0.	0.	236.	608.3
5.12	16.00	3983184.00	0.	0.	235.	608.3
5.13	0.0	3993192.00	0.	0.	235.	608.3
5.13	8.00	4003200.00	0.	0.	235.	608.3
5.13	16.00	4013208.00	0.	0.	234.	608.3
5.14	0.0	4023216.00	0.	0.	234.	608.3
5.14	8.00	4033224.00	0.	0.	234.	608.3
5.14	16.00	4043232.00	0.	0.	233.	608.3
5.15	0.0	4053240.00	0.	0.	233.	608.3
5.15	8.00	4063248.00	0.	0.	233.	608.3
5.15	16.00	4073256.00	0.	0.	232.	608.3
5.16	0.0	4083264.00	0.	0.	232.	608.3
5.16	8.00	4093272.00	0.	0.	232.	608.3
5.16	16.00	4103280.00	0.	0.	232.	608.3
5.17	0.0	4113288.00	0.	0.	231.	608.2
5.17	8.00	4123296.00	0.	0.	231.	608.2
5.17	16.00	4133304.00	0.	0.	231.	608.2
5.18	0.0	4143312.00	0.	0.	230.	608.2
5.18	8.00	4153320.00	0.	0.	230.	608.2
5.18	16.00	4163328.00	0.	0.	230.	608.2
5.19	0.0	4173336.00	0.	0.	230.	608.2
5.19	8.00	4183344.00	0.	0.	229.	608.2
5.19	16.00	4193352.00	0.	0.	229.	608.2
5.20	0.0	4203360.00	0.	0.	229.	608.2
5.20	8.00	4213368.00	0.	0.	229.	608.2
5.20	16.00	4223376.00	0.	0.	228.	608.2
5.21	0.0	4233384.00	0.	0.	228.	608.2
5.21	8.00	4243392.00	0.	0.	228.	608.2
5.21	16.00	4253400.00	0.	0.	228.	608.2
5.22	0.0	4263408.00	0.	0.	227.	608.2
5.22	8.00	4273416.00	0.	0.	227.	608.2
5.22	16.00	4283424.00	0.	0.	227.	608.2
5.23	0.0	4293432.00	0.	0.	227.	608.2
5.23	8.00	4303440.00	0.	0.	227.	608.2
5.23	16.00	4313448.00	0.	0.	226.	608.2
5.24	0.0	4323456.00	0.	0.	226.	608.2
5.24	8.00	4333464.00	0.	0.	226.	608.2
5.24	16.00	4343472.00	0.	0.	226.	608.2
5.25	0.0	4353480.00	0.	0.	226.	608.2
5.25	8.00	4363488.00	0.	0.	225.	608.2
5.25	16.00	4373496.00	0.	0.	225.	608.2
5.26	0.0	4383504.00	0.	0.	225.	608.2
5.26	8.00	4393512.00	0.	0.	225.	608.2
5.26	16.00	4403520.00	0.	0.	225.	608.2
5.27	0.0	4413528.00	0.	0.	224.	608.2
5.27	8.00	4423536.00	0.	0.	224.	608.2
5.27	16.00	4433544.00	0.	0.	224.	608.2
5.28	0.0	4443552.00	0.	0.	224.	608.2
5.28	8.00	4453560.00	0.	0.	224.	608.2
5.28	16.00	4463568.00	0.	0.	223.	608.2
5.29	0.0	4473576.00	0.	0.	223.	608.2
5.29	8.00	4483584.00	0.	0.	223.	608.2
5.29	16.00	4493592.00	0.	0.	223.	608.1
5.30	0.0	4503600.00	0.	0.	223.	608.1

PEAK OUTFLOW IS 5. AT TIME 0.0 HOURS

	PEAK	10-DAY	30-DAY	90-DAY	TOTAL VOLUME
CFS	5.	5.	4.	3.	1087.
CMS	0.	0.	0.	0.	31.
INCHES		2.09	5.34	13.74	16.24
MM		53.01	135.46	348.93	412.43
AC-FT		32.	253.	633.	716.
[illegible]		[illegible]	[illegible]	[illegible]	[illegible]

APPENDIX D

REFERENCES

REFERENCES

1. University of the State of New York, Geology of New York, Education Leaflet 20, 1966.

2. Broughton, John G. and others, "Geologic Map of New York - Lower Hudson Sheet," New York State Museum and Science Service, Map and Chart Series No. 15, 1970.

3. Soil Conservation Service, Soil Inventory and Their Interpretations for Specific Uses (Interim Report), Rockland County, New York, U.S. Department of Agriculture, August 1970.

4. Bureau of Reclamation, U.S. Dept. of the Interior, Design of Small Dams, A Water Resources Technical Publication, 1977.

5. Chow, Ven Te, Handbook of Applied Hydrology, McGraw - Hill Book Company, New York, 1964.

6. Chow, Ven Te, Open Channel Hydraulics, McGraw - Hill Book Company, New York, First Edition, 1959.

7. HMR 33, "Seasonal Variations of Probable Maximum Precipitation, East of the 105th Meridian for Areas 10 to 1000 Square Miles and Durations of 6 to 48 Hours," (1956).

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

9. Soil Conservation Service, "National Engineering Handbook - Section 4, Hydrology," U.S. Department of Agriculture, 1964.

10. Soil Conservation Service, "National Engineering Handbook - Section 5, Hydraulics," U.S. Department of Agriculture.

11. U.S. Army, Hydrological Engineering Center, "Flood Hydrograph Package (HEC-1), Dam Safety Investigations, Users Manual," Corps of Engineers, Davis, California, September 1978.

12. U.S. Army, "Inventory of United States Dams," Corps of Engineers, 9 September 1978.

13. U.S. Army, Office of the Chief of Engineers, "Appendix D, Recommended Guidelines for Safety Inspection of Dams," National Program of Inspection of Dams, Volume 1, Corps of Engineers, Washington, D.C., May 1975.

14. George, Thomas S. and Taylor, Robert S., Hydrologic Flood Routing Model For Lower Hudson River Basin, Water Resources Engineers, Inc., 8001 Forbes Place, Suite 312, Springfield, Virginia, January 1977.

15. U.S. Army, Office of the Chief of Engineers, Engineering Circular EC-1110-2-163 (Draft Engineering Manual), "Spillway and Freeboard Requirements for Dams, Appendix C, Hydrometeorological Criteria and Hyetograph Estimates," (August 1975).

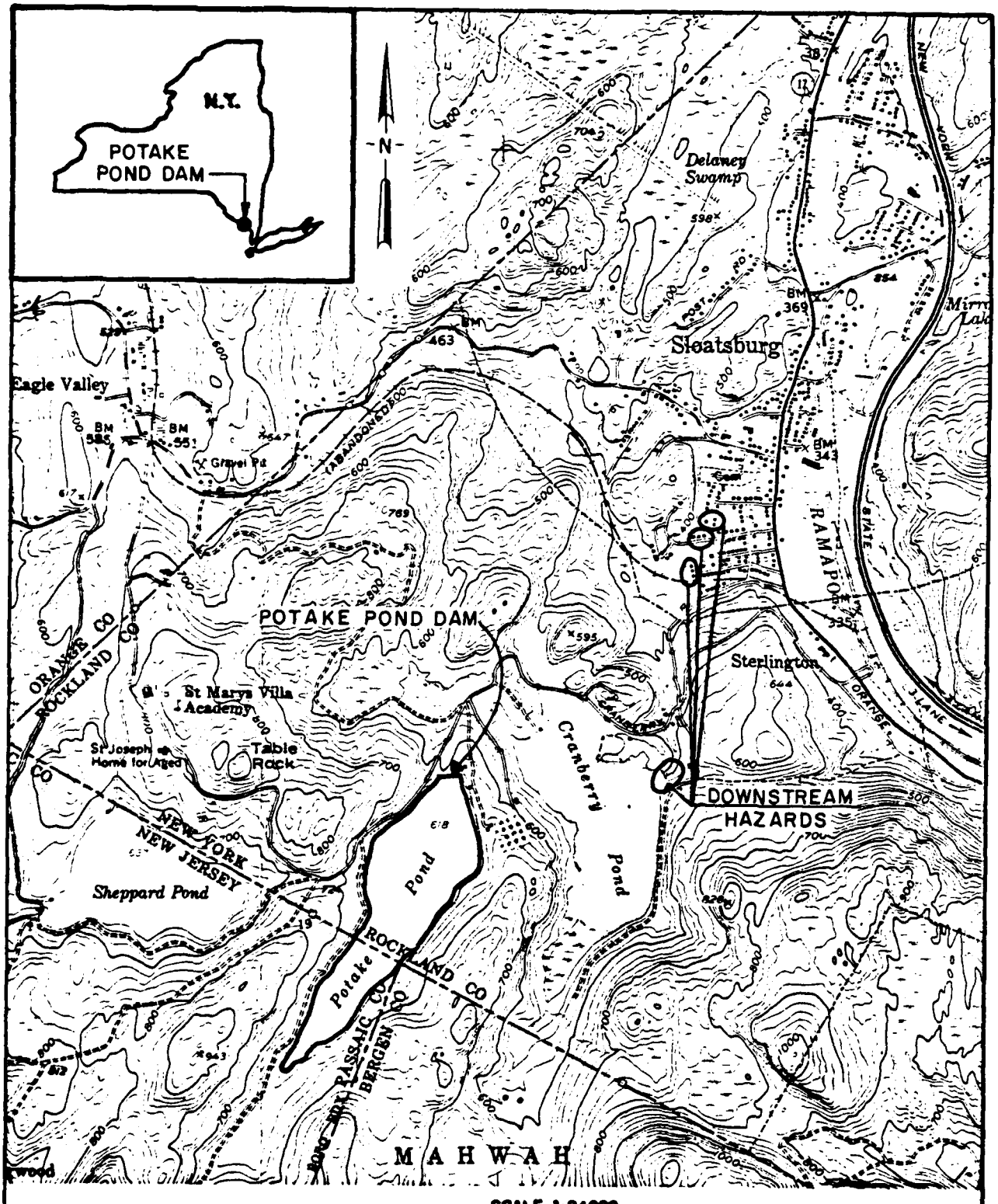
16. U.S. Army, Office of the Chief of Engineers, Engineering Circular EC-1110-2-188, "Engineering and Design, National Program of Inspection of Non-Federal Dams," Corps of Engineers, Washington, D.C., 30 December 1977.

17. U.S. Army, Office of the Chief of Engineers, Engineer Technical Letter No. ETL 1110-2-234, "Engineering and Design, National Program of Inspection of Non-Federal Dams, Review of Spillway Adequacy," Corps of Engineers, Washington, D.C., 10 May 1978.

APPENDIX E

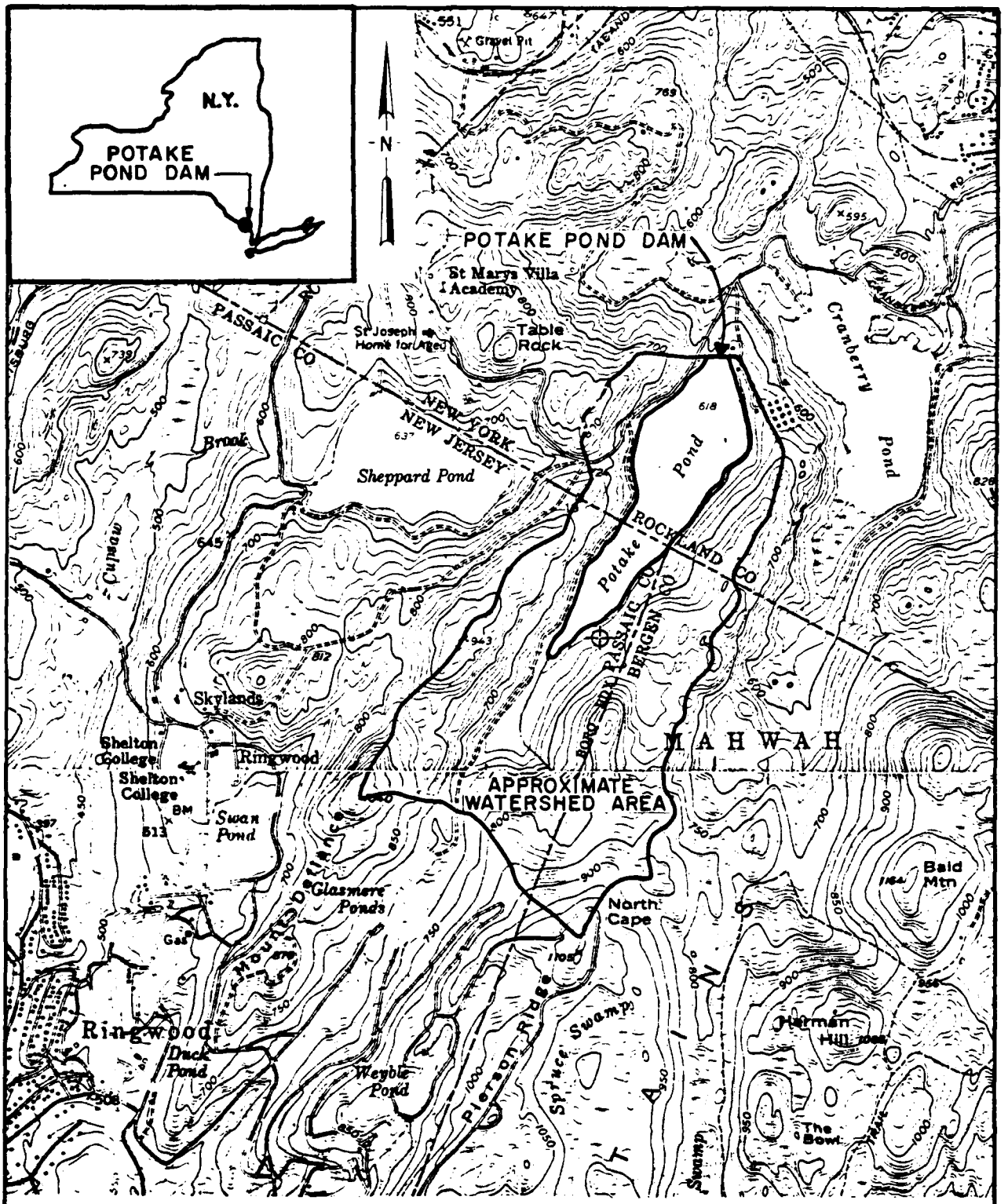
DRAWINGS

CONTENTS



REFERENCES:
I. U.S.G.S. 7.5' SLOATSBURG, N.Y., N.J. QUADRANGLE. 1955

LOCATION PLAN
POTAKE POND DAM



REFERENCES:
1. U.S.G.S. 7.5' SLOATSBURG, N.Y.-N.J. QUADRANGLE. 1955
2. U.S.G.S. 7.5' RAMSEY, N.J.-N.Y. QUADRANGLE. 1955

WATERSHED MAP
POTAKE POND DAM

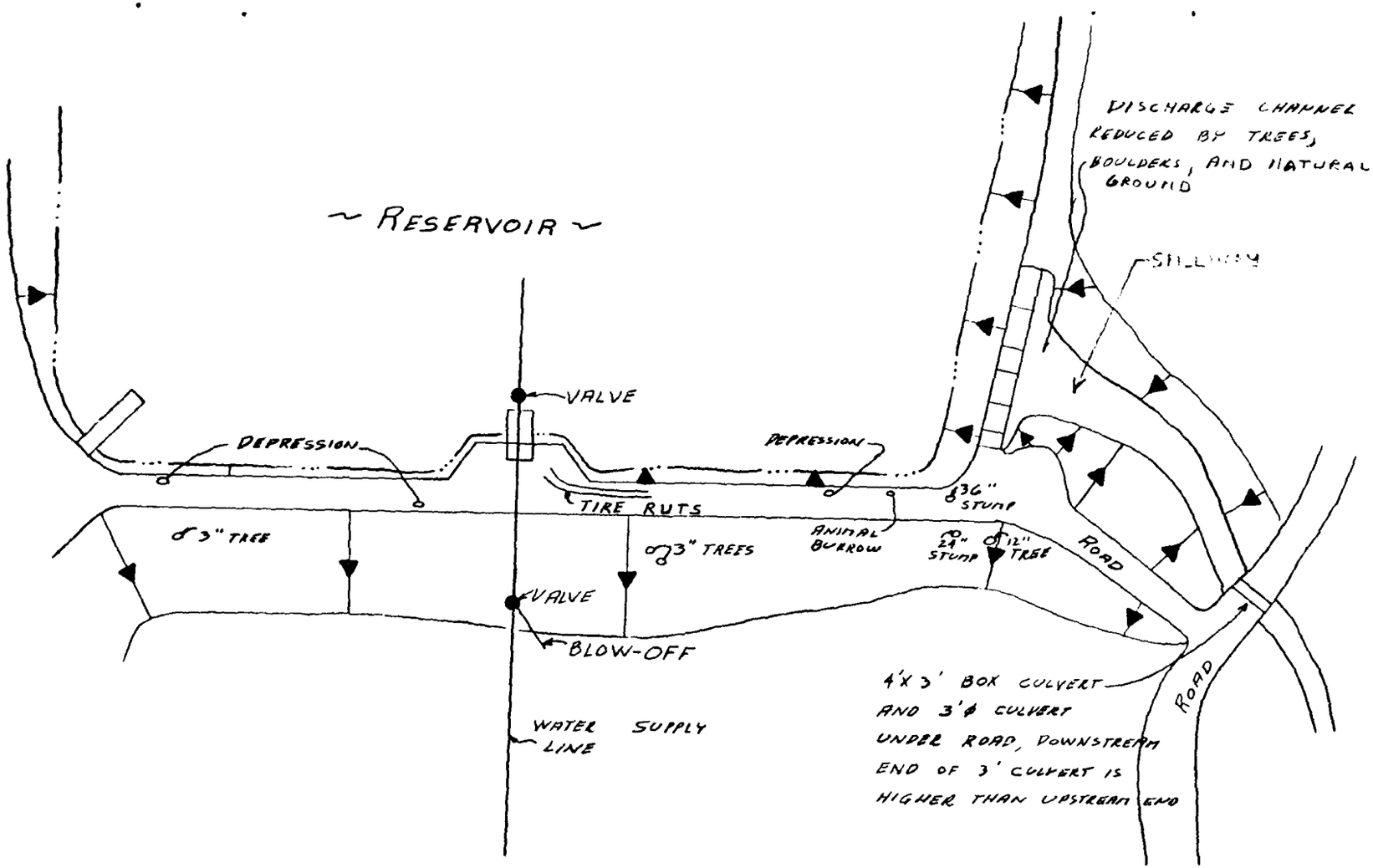


PLATE 1

POTAKE LAKE DAM

FIELD SKETCH

APPENDIX F

BACKGROUND DOCUMENTS

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DAM INSPECTION REPORT
(By Visual Inspection) Pothat Lake

Dam Number	River Basin	Town	County	Hazard Class*	Date & Inspector
307	L Hudson	Ramapo	Rockland	B-C	1/8/75 Greiki.

Type of Construction

- [X] Earth w/concrete spillway
- [ ] Earth w/drop inlet pipe
- [ ] Earth w/stone or riprap spillway
- [ ] Concrete
- [ ] Stone
- [ ] Timber

Use

- [ ] Water Supply
- [ ] Power
- [X] Recreation
- [ ] Fish and Wildlife
- [ ] Farm Pond
- [ ] No Apparent Use-Abandoned

Estimated Impoundment Size

- [ ] 1-5 acres
- [ ] 5-10 acres
- [X] Over 10 acres

Estimated Height of Dam above Streambed

- [ ] Under 10 feet
- [X] 10-25 feet
- [ ] Over 25 feet

Condition of Spillway

- [X] Service satisfactory
- [ ] In need of repair or maintenance
- [X] Auxiliary satisfactory
- [ ] In need of repair or maintenance

Explain: new valve placed upstream
new concrete on open Spillway

Condition of Non-Overflow Section

- [X] Satisfactory
- [ ] In need of repair or maintenance Explain: embankment widened

Condition of Mechanical Equipment

- [X] Satisfactory
- [ ] In need of repair or maintenance Explain: new valve

Evaluation (From Visual Inspection)

- [X] No defects observed beyond normal maintenance
- [ ] Repairs required beyond normal maintenance

Hazard Class, if Necessary Development Potential - Repaired in 1974
upstream - widened earth embankment - new concrete spillway

[illegible]
(By Visual Inspection)

[illegible] Lake

Dam Number	River Basin	Town	County	Hazard Class	Date & Inspector
307	L.H.	[illegible]	[illegible]	B-C	[illegible]

Stream = [illegible] To Ram[illegible] Owner = [illegible]

Type of Construction

- [x] Earth w/Concrete Spillway
- [ ] Earth w/Drop Inlet Pipe
- [ ] Earth w/Stone or Riprap Spillway
- [ ] Concrete
- [ ] Stone
- [ ] Timber
- [ ] Other ______________________

Use

- [x] Water Supply
- [ ] Power
- [x] Recreation - [ ] High Density
- [ ] Fish and Wildlife
- [ ] Farm Pond
- [ ] No Apparent Use-Abandoned
- [ ] Flood Control
- [ ] Other ______________________

Estimated Impoundment Size 100± Acres Estimated Height of Dam above Streambed 10 Ft.

Condition of Spillway

- [x] Service satisfactory
- [ ] In need of repair or maintenance
- [ ] Auxiliary satisfactory
- [ ] In need of repair or maintenance

Explain: ______________________

Condition of Non-Overflow Section

- [x] Satisfactory
- [ ] In need of repair or maintenance

Explain: [illegible] ft long, [illegible] 160 ft [illegible]

Condition of Mechanical Equipment

- [x] Satisfactory
- [ ] In need of repair or maintenance

Explain: [illegible] Valves on bottom [illegible]

Siltation [ ] High [ ] Low

Explain: ______________________

Remarks: ______________________

Evaluation (From Visual Inspection)

- [ ] Repairs req'd. beyond normal maint.
- [x] No defects observed beyond normal maint.

Po Lake

18-20-11-3000 (16-10658)

Fill out a form as complete as possible for each dam in your district and send to State Conservation Commission, Albany, N. Y.

1. Name and address of owners Ramapo Mfg. Co.

2. Date of construction about 1800

3. Uses of impounded water as a Lake and reservoir; for use if needed

4. Character of foundation bed rock

5. Material of waste spill no spill - runs out at brook outlet

6. Length of waste and depth below dam some distance from dam

7. Total length of dam including waste about 300 feet

8. Material of dam rock & earth no waste except gate about

9. Discharges, size and location 3 ft. diameter other than brook outlet

Below sketch section of waste and section of dam, with greatest heights and top thickness and bottom thickness. On opposite side sketch general plan of dam and give distance from a bridge or from a tributary stream.

The water runs out of brook outlet so that is the waste - The earth dam is about 10 feet and very wide being a roadway and stone walls on both sides - Has been as now for over a hundred years

Nearest town Sloatsburg

Apl 20 - 1912 Ramapo Mfg Co. Ramapo Rockland Co. N.Y.

(Signature, address and date.)

307.

L 11

W TER AND SEWAGE WORKS INDUSTRIAL WASTE DISPOSAL DRAINAGE AND FLOOD CONTROL FINANCIAL STUDIES

HAZEN AND SAWYER
ENGINEERS
360 LEXINGTON AVENUE
NEW YORK, N.Y. 10017
Cable HAZANSAW, NEWYORK
(212) 986-0033

RICHARD HAZEN
H E HUDSON, JR
C RICHARD WALTER
FRANCIS P COUGHLAN, JR
WALTER B SINNOTT
ROBERT H STEWART
DAVID WALRATH
SHELDON YUAN

REMIG A PAPP
CONSULTANT

ASSOCIATES
ALFRED A BRUNO
ALFRED A GILBERT
ROBERT J HAEFELI
BURTON A SEGALL
GORDON D SHAUB
JACQUES P WOLFNER

September 23, 1968

Mr. S.A. Wyle
Ramapo Land Co., Inc.
Sloatsburg, New York 10974

Potague Dam; Cranberry Dam

Dear Mr. Wyle:

Referring to your letters of June 11 and June 25, 1968, we have inspected the dam twice at Potague Lake and once the spillway and dam at Cranberry Reservoir in Sloatsburg. The scope of our assignment, as confirmed in our letter of August 1, 1968, is to investigate the conditions of the Potague and Cranberry dams from point of view of safety, and to suggest improvements, if necessary. Our findings and suggestions are condensed as follows:

a) Potague Dam and Spillway

The dam is a low earth dam of about 14 to 15 feet of maximum height and with 14 feet of crown width. Length of the dam is about 350 feet. The upstream side of the dam is sloping and has a rip-rap protection with about 1 to 1 slope.

The downstream side of the dam is nearly vertical, perhaps a slope of 1 horizontal to 8 to 10 vertical, and is retained by a rubble wall with large, open joints.

In the middle of this dam a 14" diameter intake pipe penetrates the dam. Intake valve in the lake is not accessible and is inoperable. A second valve downstream could be closed,

if necessary. Two 10 to 12" thick concrete walls around the intake pipe serve as water stops or collars to prevent seepage along the pipe. Actually, there is a certain seepage which could be observed and which make the vicinity of the intake pipe swampy, but it could not be observed whether this seepage come through the dam or from the leaking intake pipe or leaky drain valve.

On both sides of the dam causeway 10 to 12 large tree trunks could be seen. The top of the dam was decorated with trees and only a few years ago, these trees were cut down. It was feared that the dam would be broken if a storm would fell one of these trees. The tree trunks, however, could not be grabbed because this would mean the destruction of the dam. On the other hand, the remaining large tree roots will decay sooner or later, and form natural seepage tubes which could cuase the failure of the dam.

The reservoir has a 10 ft± long spillway which was barely sufficient to prevent from overflowing of the dam on May 30, 1968, after a 6" rain. The top of the spillway is about two feet lower than the crown of the dam.

The tailrace of this spillway seems to be a former creek bed towards Beaver Pond. A dirt road crosses this creek bed about 50 feet downstream from spillway. The road has a crude culvert formed from large stones. This culvert has a waterway section of 4'x 4'- 6" or about 18 square feet area, and may have a maximum capacity of 300 to 400 cfs. The road was washed out on May 30, 1968 here as well as at the outlet of the Beaver Pond.

The spillway length and capacity has a theoretical value only, because the vicinity of the concrete spillway is low and as the water level rises, more and more width is used for overflowing, and on May 30, 1968 probably 100 to 120 feet wide overflow has alleviated the precarious plight of the dam.

The capacity of this natural, additional spillway is probably not very much because part of its length is almost as high as the dam and because this additional length was grown full with weeds and bushes. As the cheapest means of increasing the spillway overflow capacity, it was suggested to clear the vicinity of the existing spillway, and this was also done.

The drainage area of the Potague Lake is small, somewhat less than one square mile. Almost one third of this drainage area is the lake itself where no percolation may occur, the runoff on the lake area equals with the precipitation.

Various hydrological handbooks give runoff figures for a one square mile area as 1,400 to 4,500 cfs. Our hydrological analysis shows that much greater storms and runoff discharges may occur in the future than the torrential strom of May 29,30, 1968 has produced. Our reduced, less than maximum, computed runoff figure is 3,750 cubic feet per secundum.

We have worked out a computer program for reservoir routing for another dam and reservoir, and this program could be applied to Potague Lake as well.

Reservoir routing means that a storm runoff must fill up the lake first, and if a rain storm is not of long duration, the outflow from the lake will be much smaller, more evenly distributed in time, than the inflow from the lake is. Condition is, that the spillway capacity must be adequate.

We have assumed a stepped-up spillway, as it is shown on Sketch No. 473-1, with a total length of 150 feet. We have also assumed, that the top of the existing spillway is 2'- 0" below the top of the dam crest.

A theoretical runoff hydrograph was computed and it was assumed that the storm duration will be six hours.

We could measure the lake area at Elevation 618 and 620 from the blown-up print of the U.S.G.S. map which you have loaned to us, and have assumed - for the sake of computation - that the increase in lake surface area is directly proportional with the elevation increase.

Since there is no detailed topographical map or plan available around the Potague dam and vicinity, we have assumed that the top of the existing spillway is at El. 618.0, and the crest of the dam at El. 620.0.

The flood routing (Exhibit "2") for Spillway Type "A" shows that, after the assumed six hours of torrential rain, the lake level would rise 1.62 feet to El. 619,62. The maximum inflow of 3,750 cfs was assumed to occur after two hours and the maximum outflow on the spillway would be 560 cfs after six and a half hours.

The dampening effect of the large reservoir is clearly noticeable. The dam would have a 0.4 ft. (about 4-1/2") free-board, which is very little, but still better than it had on May 30, 1968.

We have tried a 150 feet long spillway which had a level crest at assumed elevation 618,0 and have let run our flood routing computation with this increased spillway capacity. The lake level rose only to elevation 619.22 but the maximum outflow was 711 cfs.

Since our aim is to preserve the dam with the least possible inconvenience for the downstream areas, we suggest to use the first, stepped-up spillway. The maximum discharge over this new spillway will presumably be much larger than it is now, but this must be taken in consideration if the overtopping of the dam must be prevented.

As far as the dam stability is concerned, the present earth dam with the rubble stone facing is standing up since several decades, since sixty years as we were told. The remaining tree roots, however, after they decay, will form tubes across the dam and this may become a dangerous situation.

The tree trunks with their roots cannot be excavated without lowering the lake level below intake pipe, and even then it would mean almost the total destruction of the present dam. For this reason, another method must be found to make the dam safe after the decayed tree trunks will form many pipes across the dam.

It would be difficult and costly to install a waterproof membrane in the front of the dam, in water, we would not recommend it.

We propose to place rock fill on the dry side face of the dam, which would greatly increase its stability. Since, hower, this rockfill would not be stable without the existing dam,

the existing earth dam must be preserved. In order to prevent piping or washing out earth material from the existing dam, a min. 2 ft. thick clay membrane may be placed and compacted between the old stone face and new rock fill, if clay is readily available.

The proposed section of the new spillway is shown on Sketch No. 473-1. Salvage of the existing broken, cracked, short spillway slab is not warranted.

b) Tailrace between Potague Lake and Beaver Pond.

The tailrace is basically a dry creek bed, with a culvert as a bottleneck at a road crossing. It would be advisable to install one 3' diameter culvert, at a suitable location on one side of the existing culvert, at the upper end of the road, near Potague Lake. Otherwise the road will be washed out again as on May 30, 1968.

c) Beaver Pond

The Beaver Pond forms an intermediate strorage between Potague and Cranberry Lakes. The pond is shallow, grown full with reeds, weeds, water lilies. Because of its size, no improvement of the storage capacity is warranted. However, some thoughts should be given to the improvement of outflow conditions towards the new, proposed culverts, towards Cranberry Lake. At this road crossing, new culverts are proposed and will be constructed soon.

d) Cranberry Lake

Our office has already investigated Cranberry Dam back in 1960. The report of Mr. William J. Stein, dated of October 20, 1960, recommends to repair the underside beams of the reinforced concrete Amburssen type dam deck and the clearing and repair of the existing spillway.

In the meantime, about half of the spillway was cleared from trees and bushes but the dam itself was not repaired. The corrosion of exposed reinforcing bars is getting worse from year to year, and the failure of these horizontal beams may mean the failure of the dam. The repair and patching up of these beams is urgently needed. In Appendix "6" we have drafted a specification for this repair work.

The spillway of Cranberry Lake is 205 ft. long and seems to be adequate. It would be necessary to clear the other half of the spillway crest as well.

At one place, the concrete weir of the spillway is broken and a large piece of concrete has fallen out. This portion should also be repaired.

Conclusions

For the Potague Reservoir a new spillway of much larger capacity is needed. In addition, the existing earthfill dam should be reinforced with a downstream rock fill. The area of the future rockfill must be cleared of all trees, fallen, cut-off or still-standing trees. Existing intake pipe must be protected from overload.

An additional culvert is required at the upper end of the road between Potague Lake and Beaver Pond.

Rehabilitation of the Beaver Pond outlet. Culverts below road are assumed to be in process towards installation by the Walsh Construction Company.

Repair of six spalling reinforced concrete beams at underside of Cranberry Dam.

Repair of the Cranberry Lake Spillway.

While there is no emergency which would require an immediate, crash repair program, the proposed improvements and repairs cannot be postponed indefinitely. Torrential rains, as the May 29-30, 1968 was, may occur in any season and the repetition of such a storm would find Potague Dam unprepared. All the proposed repairs and improvements should be executed within two years, or at the latest, until December 31, 1970.

A great impediment of proper planning is that there exists no detailed topographical survey, neither from the Potague Dam vicinity nor from Cranberry Dam and spillway. The proposed

improvements actually could be executed from our sketches with on-the-spot instructions and improvisations. However, the task of preserving two dams from catastrophy is a very important one. Moreover, the most appropriate structures could be designed only if their surroundings are surveyed, and when their proper adaptation into the environments is made possible. The relative elevations of the structures and of the water levels is very important at every hydraulic structure complex. For these reasons, we recommend you to order a surveying of the relevant areas and to order a proper design at least of the Potague Lake spillway.

We have deliberately omitted the question of relocating the supply water intake in front of the dam into a deeper position because this is not connected with the safety of the dam. It was also endeavored to improve the safety of the dams with the least unavoidable aggravation of the tailrace conditions.

Although it is impossible to make a design and quantity take-off without a topographical map of suitable scale, we have tried to estimate the cost of the proposed improvements as follows:

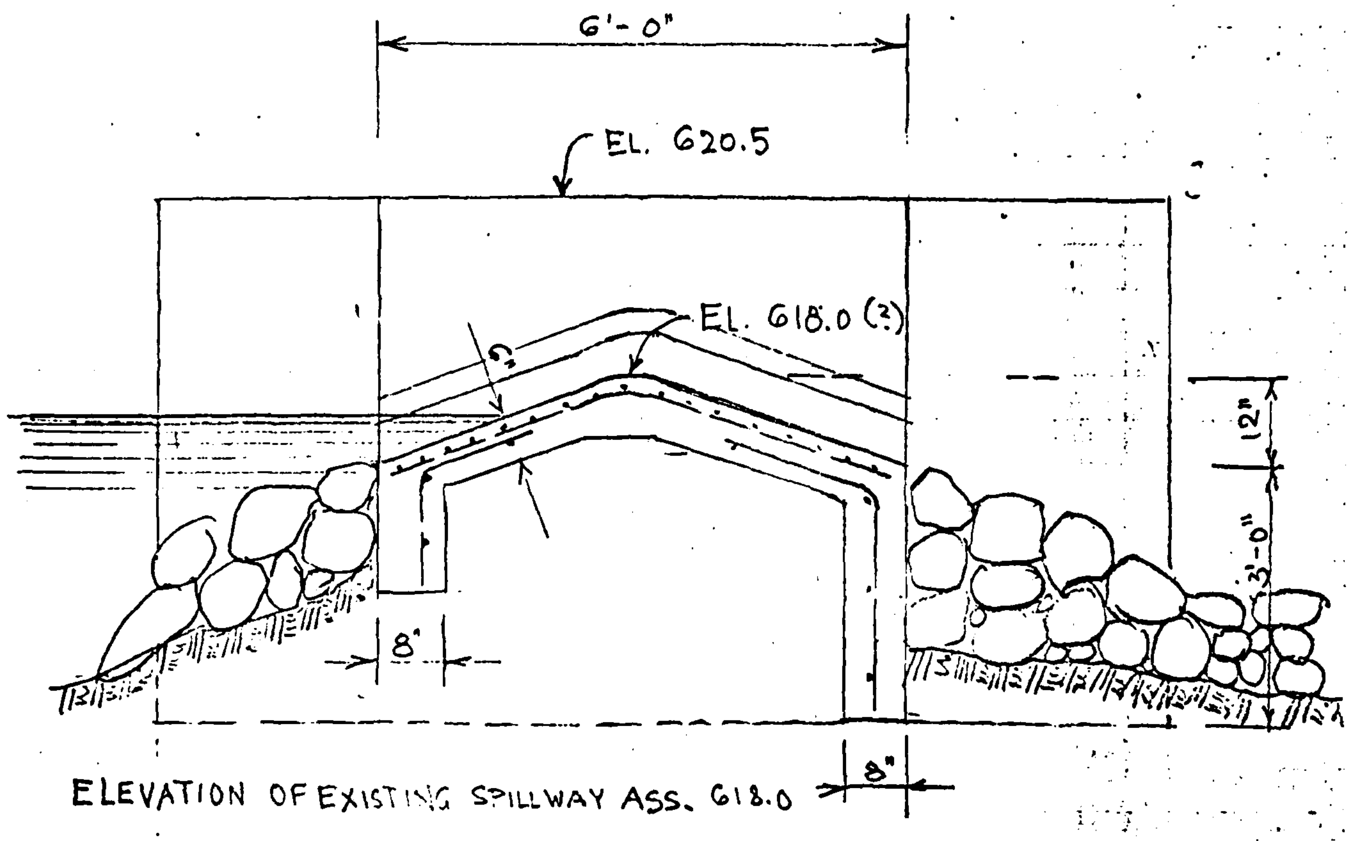
1.	New spillway at Potague Dam, 150 feet long, @ 25.00	$ 3,750
2.	Rockfill addition to dam:	
	840 cy. @ 8.00	6,720
	240 cy. clay core @ 10.00	2,400
3.	One additional culvert, 36"	800
4.	Rehabilitation of Beaver Pond Outlet (estimated)	2,000
5.	Repair of the reinforced beams	800
6.	Repair of Cranberry Lake Spillway	2,000
	Cleaning of spillway vicinity	530
	Total	$19,000
	Survey and engineering	2,000
	Contingencies	1,000
		$22,000

Engineers
360 Lexington Ave.
New York 17, N.Y.

(Ramapo Land Co.)
Sloatsburg, New York.

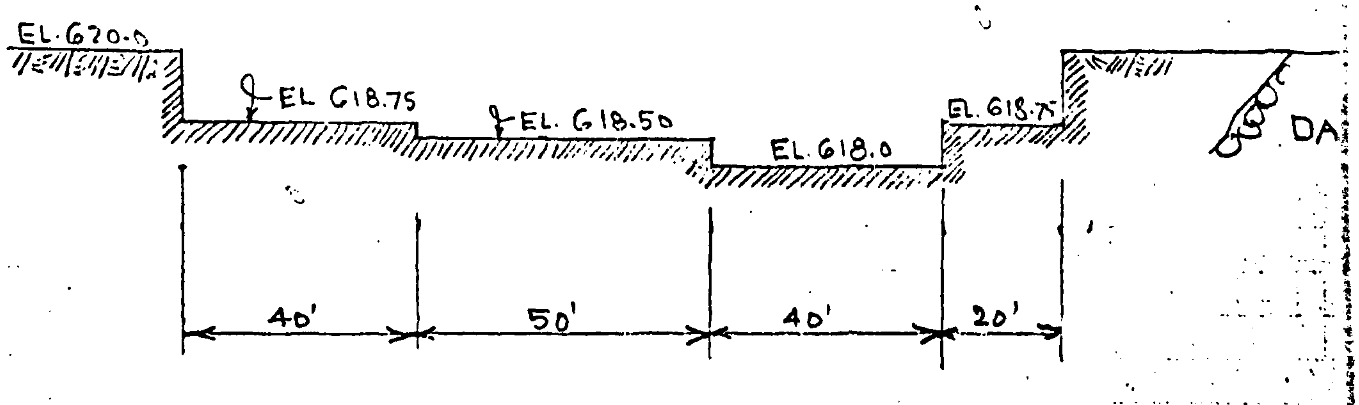
By R.A.P. chkd.
Job #473.

EXHIBIT 1.



TYPICAL SPILLWAY SECTION.

SCALE = 1/2" : 1'-0"



SPILLWAY OVERFLOW WEIR,

SCAEE HORIZONTAL 1" : 30'
Vertical 1" : 3'

Sketch No.
473-1

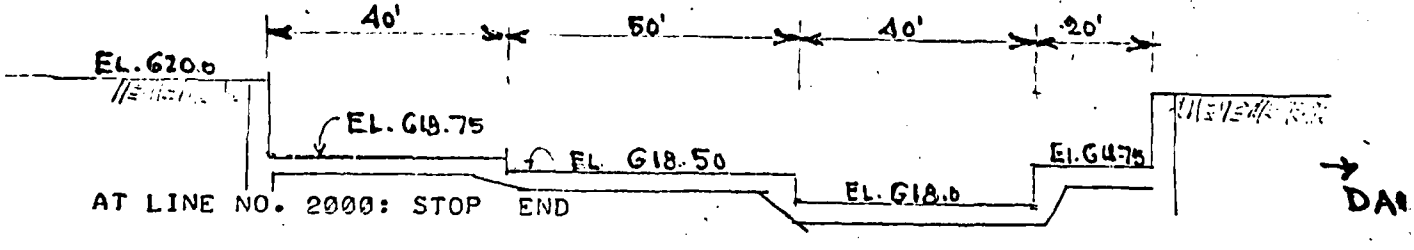
FLOOD 15:52 G FRI 09/20/68

EXHIBIT 2

Spillway Type "A".

SPILLWAY LENGTH = 150.00 FT
CREST ELEVATION = 618.00 FT

TIME(HR)	ELEVATION(FT)	INFLOW(CFS)	OUTFLOW(CFS)
.50000	618.00224	20.00000	.14322
1.00000	618.00890	40.00000	.57005
1.50000	618.07133	519.99999	4.56497
2.00000	618.54238	3749.99990	39.27266
2.50000	619.11482	1750.00010	215.11700
3.00000	619.34048	920.00011	341.52793
3.50000	619.43598	730.00003	406.46497
4.00000	619.49904	720.00000	449.35081
4.50000	619.55017	710.00000	496.15685
5.00000	619.58431	640.00002	527.56573
5.50000	619.60391	620.00001	545.60324
6.00000	619.61621	600.00001	556.91519
6.50000	619.61952	550.00003	559.95658
7.00000	619.60271	400.00009	544.49698
7.50000	619.56501	300.00007	509.81443
8.00000	619.50474	100.00015	454.36269



AT LINE NO. 2000: STOP END

SPILLWAY LOOKING WEST

RAN 18.50 SEC
SAVE

TOP OF PRESENT SPILLWAY ASSUMED AT EL. 618.0

READY.

BYE

*** OFF AT 15:56 ELAPSED TERMINAL TIME = 15 MIN.

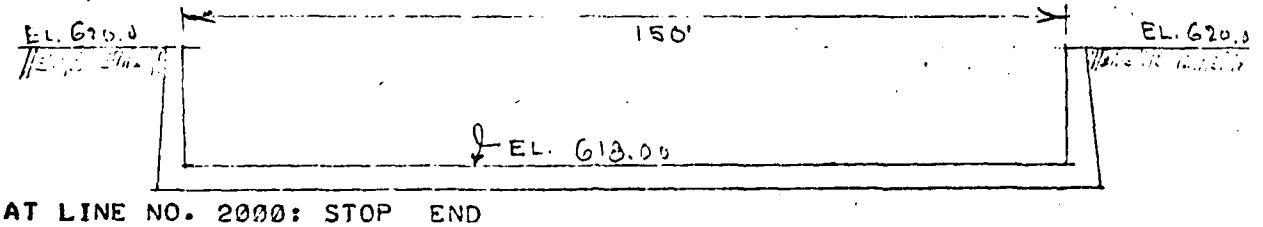
FLOOD 16:03 G FRI 09/20/68 Sloatsburg, New York. EXHIBIT 3

POTHAT WATER CO Potagus Reservoir RB Flood SET B

Routing

SPILLWAY LENGTH = 150.00 FT
CREST ELEVATION = 618.00 FT

TIME(HR)	ELEVATION(FT)	INFLOW(CFS)	OUTFLOW(CFS)
.50000	618.00221	20.00000	.47728
1.00000	618.00869	40.00000	1.87821
1.50000	618.06999	519.99999	15.11847
2.00000	618.52888	3749.99990	182.90438
2.50000	619.04150	1750.00010	551.52187
3.00000	619.19206	920.00011	634.01472
3.50000	619.21897	730.00003	707.69214
4.00000	619.22231	720.00000	710.63604
4.50000	619.22313	710.00000	711.35684
5.00000	619.21581	640.00002	704.91190
5.50000	619.20112	620.00001	691.98428
6.00000	619.18504	600.00001	677.83587
6.50000	619.16478	550.00003	660.00896
7.00000	619.12811	400.00009	627.73956
7.50000	619.07340	300.00007	579.59690
8.00000	618.99829	100.00015	513.66721



AT LINE NO. 2000: STOP END

Top of present spillway assumed at El. 618.0

RAN 17.33 SEC
BYE

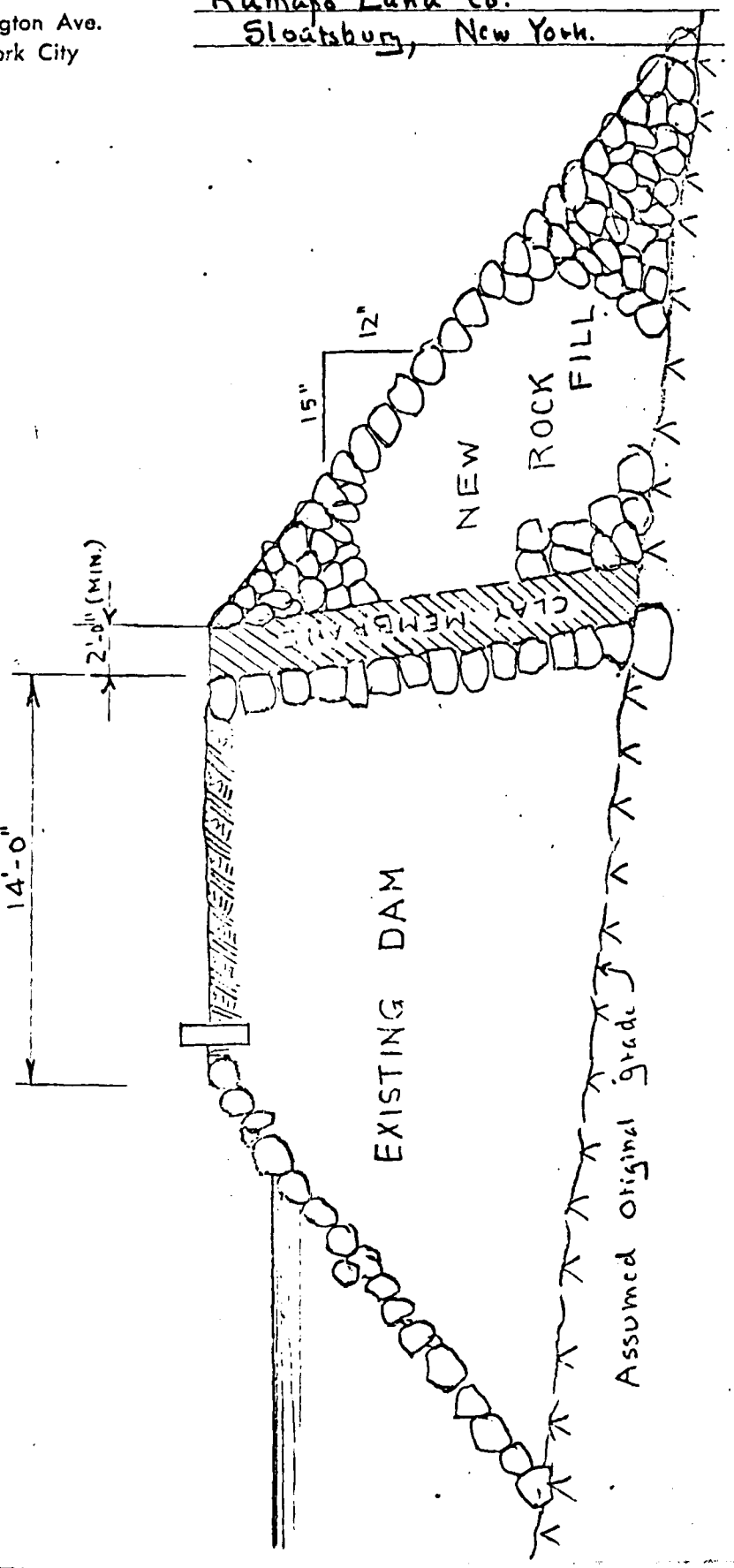
*** OFF AT 16:06 ELAPSED TERMINAL TIME = 5 MIN.

HAZEN AND SAWYER
Engineers
360 Lexington Ave.
New York City

POTHAT WATER CO.
Ramapo Land Co.
Sloatsburg, New York.

Date Sept. 23'68
By R.A.P. Chkd. .....
Job # 473.

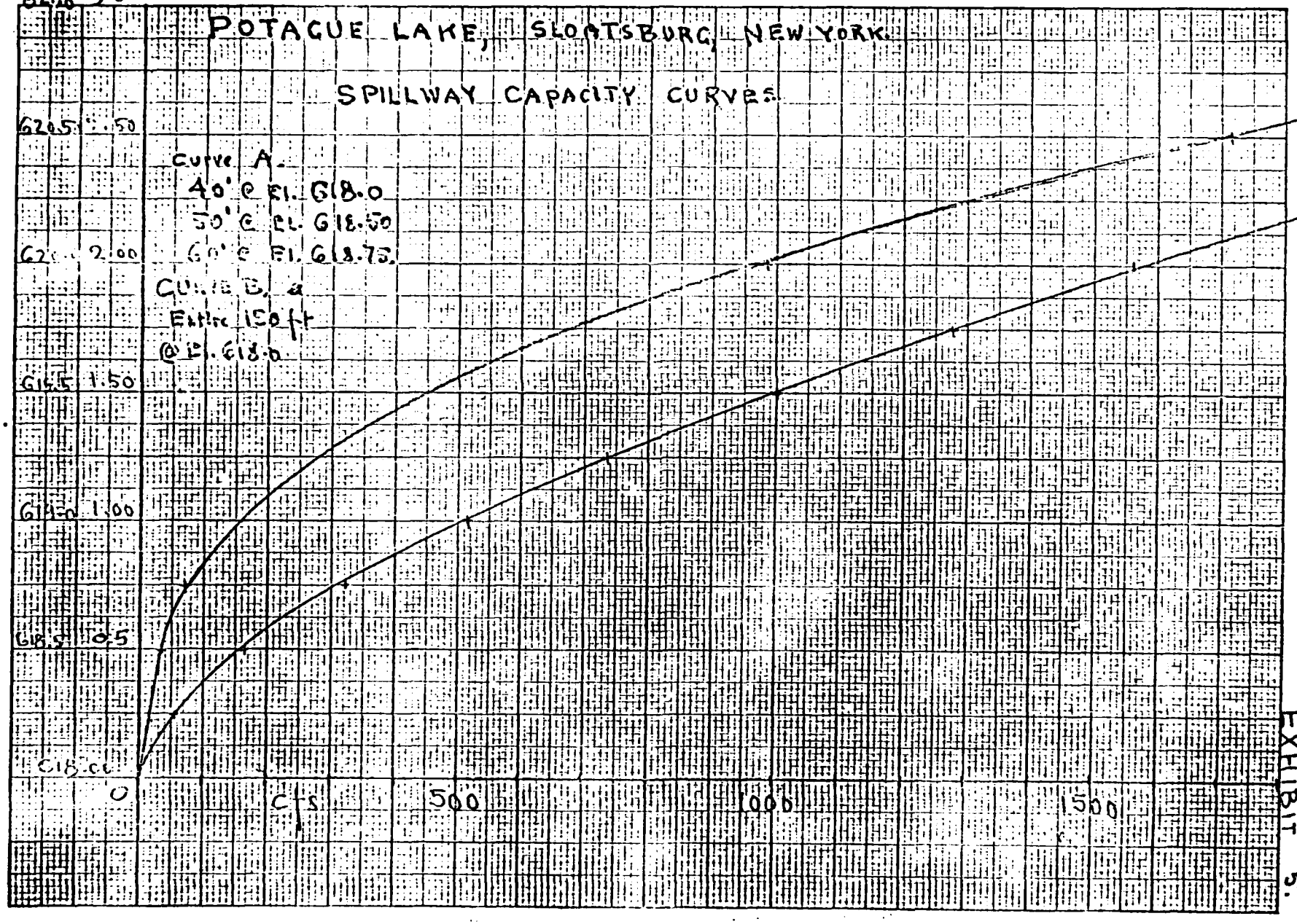
EXHIBIT 4.



PROPOSED REINFORCEMENT
OF THE POTAGUE DAM.

SCALE: 3/16" : 1'-0"

AD-A105 725 BAKER (MICHAEL) JR INC BEAVER PA F/G 13/13
NATIONAL DAM SAFETY PROGRAM. POTAKE LAKE DAM (INVENTORY NUMBER --ETC(U)
AUG 81 G KESTER DACW51-81-C-0010
UNCLASSIFIED NL




ATE
LMED
8