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NATIONAL DAM INSPECTION PROGRAM. PAGE'S LAKE DAM NOI NUMBER PA --ETC(U)
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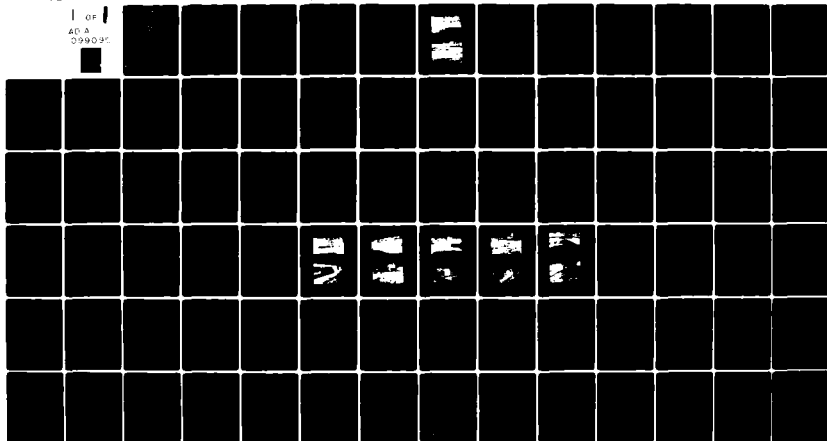
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SUSQUEHANNA RIVER BASIN,
SALT LICK CREEK, SUSQUEHANNA COUNTY,
PENNSYLVANIA

② National Dam Inspection Program

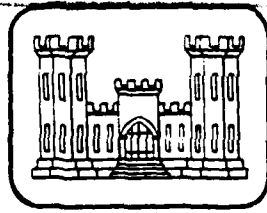
PAGE'S LAKE DAM

Number (NDI No. PA 00062
PennDER No. 58-5)
~~Dam Owner: Lakeside Outing Club.~~

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PHASE I INSPECTION REPORT NATIONAL DAM INSPECTION PROGRAM

⑮ DACW 31-81-C-00117



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prepared for

DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

prepared by

MICHAEL BAKER, JR., INC.
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4301 Dutch Ridge Road
Beaver, Pennsylvania 15009

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SUSQUEHANNA RIVER BASIN

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PAGE'S LAKE DAM
SUSQUEHANNA COUNTY, COMMONWEALTH OF PENNSYLVANIA
NDI No. PA 00062
PennDER No. 58-5

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DIC
MAY 18 1981

Prepared for: DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

Prepared by: MICHAEL BAKER, JR., INC.
Consulting Engineers
4301 Dutch Ridge Road
Beaver, Pennsylvania 15009

February, 1981

DISTRICT ENGINEER
Approved for Release;
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PREFACE

This report is prepared under guidance contained in the "Recommended Guidelines for Safety Inspection of Dams," for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. 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 design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

Page's Lake Dam, Susquehanna County, Pennsylvania
NDI No. PA 00062, PennDER No. 58-5
Salt Lick Creek
Inspected 27 October 1980

ASSESSMENT OF
GENERAL CONDITIONS

Page's Lake Dam is owned and operated by the Lakeside Outing Club and is classified as a "Significant" hazard - "Intermediate" size dam. The dam was found to be in good overall condition on 27 October 1980.

Hydraulic/hydrologic evaluations, performed in accordance with procedures established by the Baltimore District, Corps of Engineers, for Phase I Inspection Reports, revealed that the spillway will not pass the 1/2 Probable Maximum Flood (1/2 PMF) without overtopping the dam. A spillway design flood (SDF) in the range of the 1/2 PMF to the Probable Maximum Flood (PMF) is required for Page's Lake Dam. The 1/2 PMF was chosen as the SDF because the dam is on the low end of the "Intermediate" size category in terms of storage. During the 1/2 PMF, the dam is overtopped by a maximum depth of 3.34 feet for a total duration of 11.83 hours. The spillway is therefore considered "Inadequate." It is recommended that the owner immediately initiate an engineering study to further evaluate the spillway capacity and develop recommendations for remedial measures to reduce the overtopping potential of the dam.

Several items of remedial work should be performed by the owner without delay. Item 1 below should be completed by a qualified professional engineer experienced in the design of hydraulic structures for dams. These include:

- 1) Initiate an engineering study to further evaluate the spillway capacity and develop recommendations for remedial measures to reduce the overtopping potential of the dam.
- 2) Fill the erosion gully located to the left of the spillway and reseed the area.
- 3) Remove the brush below the downstream face of the dam.
- 4) Remove the debris and obstructive vegetation from the downstream channel.

PAGE'S LAKE DAM

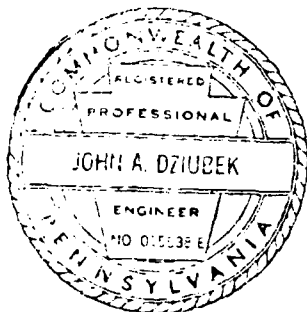
In addition, the following operational measures are recommended to be undertaken by the owner:

- 1) Develop a detailed emergency operation and warning system.
- 2) During periods of unusually heavy rain, provide around-the-clock surveillance of the dam.
- 3) When warning of a storm of major proportions is given by the National Weather Service, activate the emergency operation and warning system.

It is further recommended that formal inspection, maintenance, and operation procedures and records be developed and implemented. A plan for emergency drawdown of the reservoir should be prepared in case an emergency drawdown should become necessary. These should be included in a formal maintenance and operations manual for the dam.

Submitted by:

MICHAEL BAKER, JR., INC.



John A. Dziubek
John A. Dziubek, P.E.
Engineering Manager-Geotechnical

Date: 19 February 1981

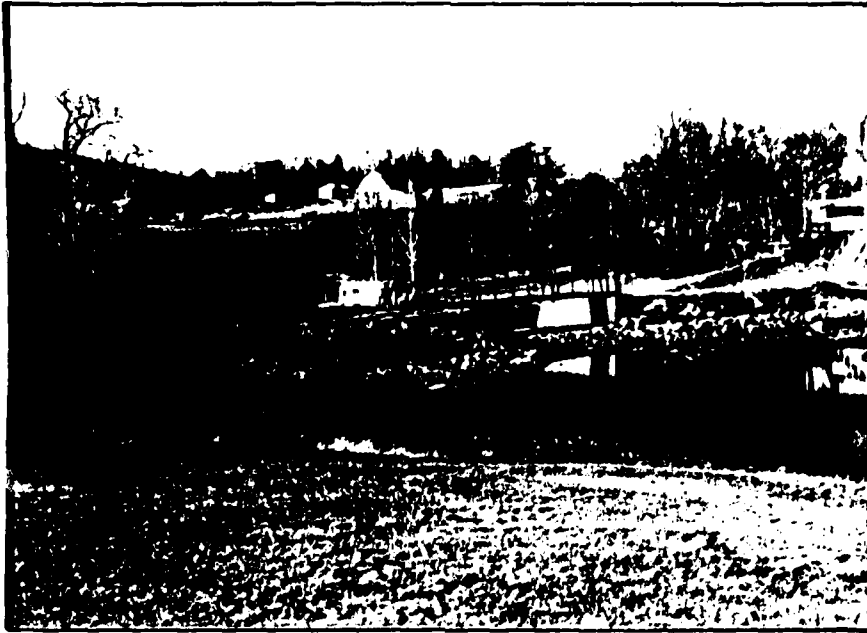
Approved by:

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS

James W. Peck
JAMES W. PECK
COL, Corps of Engineers
District Engineer

Date: 13 MAR 81

PAGE'S LAKE DAM



OVERALL VIEW OF UPSTREAM FACE OF DAM FROM LEFT ABUTMENT



OVERALL VIEW OF DOWNSTREAM FACE OF DAM FROM RIGHT ABUTMENT

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PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
PAGE'S LAKE DAM
NDI No. PA 00062, PennDER No. 58-5

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

- a. Authority - The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.
- b. Purpose of Inspection - The purpose of the inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 DESCRIPTION OF PROJECT

- a. Description of Dam and Appurtenances - Page's Lake Dam is a dry masonry dam with a concrete core wall. The embankment is 162 feet long and 15 feet high. The embankment has a crest width of 13 feet and an upstream slope of 1.5H:1V (Horizontal to Vertical). The downstream face is a vertical stone wall. The dam has a concrete core wall which extends the entire length of the embankment.

The spillway, located in the center of the dam, consists of a concrete broad crested weir. The weir is 40 feet long perpendicular to the direction of flow. The spillway training walls are concrete and extend 4.5 feet above the crest of the spillway. At the downstream face of the embankment, the discharge falls 9.0 feet into a rock-lined plunge pool. A small pedestrian bridge with no piers in the spillway channel crosses over the spillway.

The outlet works for the dam are located at the left abutment. The intake consists of a concrete box with stop logs and a trash rack. It discharges into a 24 inch reinforced concrete pipe which conveys the water to a riprap-lined ditch on the downstream side of the dam.

- b. Location - Page's Lake Dam is located on Salt Lick Creek, approximately 3.75 miles east-southeast of New Milford, Pennsylvania. The structure is

located in New Milford Township, Susquehanna County, Pennsylvania. The coordinates of the dam are N 41° 51.5' and W 75° 39.5'. The dam can be found on USGS 7.5 minute topographic quadrangle, Harford, Pennsylvania.

- c. Size Classification - The height of the dam is 15 feet. Storage at the top of the dam [Elevation 1436.2 feet Mean Sea Level (ft. M.S.L.)] is 1,430 acre-feet. The dam is therefore in the "Intermediate" size category.
- d. Hazard Classification - Three structures, one home and three garages, and two roads are located 1,000 feet and 700 feet downstream of the dam, respectively. There would be economic damage to these structures and roads if the dam were to fail; however, no loss of life is believed likely to occur. Purdy Dam, which is classified as "Significant" hazard, is located 1,400 feet downstream of Page's Lake. In the event of a failure, Purdy Dam would be overtopped. Therefore, Page's Lake Dam is considered to be in the "Significant" hazard category.
- e. Ownership - The dam is owned and operated by the Lakeside Outing Club, Mr. David Mowry, President, R.D. 2, New Milford, Pennsylvania 18834.
- f. Purpose of Dam - The impoundment created by the dam was originally used for water power but is now used for recreation.
- g. Design and Construction History - Page's Lake Dam was originally constructed sometime in the 1860's. The dam was reconstructed in 1922 as a dry masonry dam. Later (date unknown) a concrete core wall was constructed in the earthfill upstream slope. Additional information concerning repairs made to the dam is contained in Section 2 of this report.
- h. Normal Operational Procedures - The reservoir is typically maintained at the spillway crest elevation (Elevation 1433.0 ft. M.S.L.) during the summer. In the early fall, the lake is drawn down 3 to 4 feet to allow for boat dock repairs.

1.3 PERTINENT DATA

- a. Drainage Area (square miles) - 4.78

- b. Discharge at Dam Site (c.f.s.) -
- | | |
|--|---------|
| Maximum Flood - | Unknown |
| Spillway Capacity at Maximum Pool
(El. 1436.2 ft. M.S.L.) - | 710 |
- c. Elevation (feet above M.S.L.)* -
- | | |
|-------------------------------|---------|
| Design Top of Dam - | Unknown |
| Minimum Top of Dam - | 1436.2 |
| Maximum Design Pool - | Unknown |
| Spillway Crest - | 1433.0 |
| Streambed at Toe of Dam - | 1421.5 |
| Maximum Tailwater of Record - | Unknown |
- d. Reservoir (feet) -
- | | |
|---|------|
| Length of Maximum Pool
(El. 1436.2 ft. M.S.L.) - | 8800 |
| Length of Normal Pool
(El. 1433.0 ft. M.S.L.) - | 6600 |
- e. Storage (acre-feet) -
- | | |
|---------------------------------------|------|
| Top of Dam (El. 1436.2 ft. M.S.L.) - | 1430 |
| Normal Pool (El. 1433.0 ft. M.S.L.) - | 970 |
- f. Reservoir Surface (acres) -
- | | |
|---------------------------------------|-----|
| Top of Dam (El. 1436.2 ft. M.S.L.) - | 110 |
| Normal Pool (El. 1433.0 ft. M.S.L.) - | 100 |
- g. Dam -
- Type - Dry masonry dam with a concrete core wall in earthfill upstream section
- | | |
|--------------------------|--------------------------|
| Total Length (feet) - | 162 |
| Height (feet) - Design - | Unknown |
| Field - | 15 |
| Top Width (feet) - | 13 |
| Side Slopes - Upstream - | 1.5H:1V |
| Downstream - | Vertical
(stone wall) |
- Zoning - The upstream slope is earth and rockfill. A concrete core wall is located upstream of the centerline of the dam. Downstream of the core wall the dam consists of dry masonry stone except for the top 3 feet which is earthfill.

*All elevations are referenced to the spillway crest of the dam, Elevation 1433.0 ft. M.S.L., as measured on the available plans for the dam (Plate 4, Appendix E).

Impervious Core -	Concrete core wall
Cut-off -	Concrete core wall
Drains -	None
h. <u>Diversion and Regulating Tunnels</u> -	None
i. <u>Spillway</u> -	
Type - Broad crested concrete weir	
Location - Center of dam	
Width of Crest Parallel to	
Flow (feet) -	17
Length of Crest Perpendicular	
to Flow (feet) -	40
Crest Elevation (ft. M.S.L.) -	1433.0
Gates -	None
Downstream Channel - Riprapped plunge pool	
j. <u>Outlet Works</u> - The outlet works for the dam are	
located at the left abutment. The intake consists	
of a concrete box with stop logs and a trash rack.	
It discharges into a 24 inch reinforced concrete	
pipe which conveys the water to a riprap-lined	
ditch on the downstream side of the dam.	

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

The information reviewed consisted of File 18-5 of the Pennsylvania Department of Environmental Resources (PennDER). This file contained the following information:

- 1) A letter, dated 29 May 1913, from the Burgess of New Milford, Pennsylvania, informing the Pennsylvania State Water Commission of the dangerous condition of the Page's Lake Dam.
- 2) A report, dated 6 August 1913, written by the Water Supply Commission of Pennsylvania, describing the history and condition of the Page's Lake Dam.
- 3) A directive, dated 14 November 1913, to the New Milford Light and Power Company, directing them to secure the services of an engineer to reconstruct the spillway and repair where the dam was breached in the 1890's.
- 4) Various correspondence between the Water Supply Commission and the Susquehanna County Electric Company who purchased the New Milford Light and Power Company, concerning the required repairs on the dam.
- 5) An application submitted by the Susquehanna County Electric Company, dated 17 December 1913, to the Water Supply Commission of Pennsylvania for repairs to the dam. Also included was the subsequent approval given by the Water Supply Commission of Pennsylvania, dated 4 February 1914.
- 6) An inspection report on the repairs to the Page's Lake Dam filed by the Water Supply Commission on 14 December 1914, stating that the repairs to the dam were inadequate and not according to plans submitted to the Commission. A letter from the Water Supply Commission, dated 16 December 1914, directed the Susquehanna County Light & Power Company to make corrective repairs.
- 7) Various memorandum and letters between the Water Supply Commission of Pennsylvania and the Susquehanna County Light & Power Company, regarding repairs of breaching of the dam.

- 8) A letter, dated 3 November 1921, from the Lakeside Outing Club, informing the Water Supply Commission of Pennsylvania that they had purchased the dam and would like to start repairs at once.
- 9) The last post-construction inspection made by PennDER on 17 August 1965. It reported no major problems.

2.2 CONSTRUCTION

The information reviewed consisted of File 58-5 of the Pennsylvania Department of Environmental Resources (PennDER). The contractor responsible for construction of the original dam in the 1860's is not known. The file contained the following information:

- 1) A letter, dated 17 August 1922, to the Water Supply Commission of Pennsylvania from the Lakeside Outing Club, stating that they would be starting repairs immediately. The contractor making the repairs was Mr. Will Kenyor.
- 2) A letter, dated 15 September 1922, from the Lakeside Outing Club to the Water Supply Commission, stating that the dam was nearing completion of repairs.
- 3) Directive from the Water Supply Commission, dated 15 November 1935, to the Lakeside Outing Club, directing them to remove the fish screens in front of the spillway.
- 4) The Lakeside Outing Club replaced the spillway with a 4 inch reinforced concrete spillway in October 1946.
- 5) The Water and Power Resources Board granted a permit to the Lakeside Outing Club on 18 May 1950 to construct a foot bridge over the spillway.
- 6) In October 1964 the concrete wing walls on the spillway were replaced.
- 7) A drawdown control structure was constructed in May 1975 in the left abutment of the dam. A 24 inch reinforced concrete pipe runs through the dam.

2.3 OPERATION

The Lakeside Outing Club is responsible for all operation and maintenance.

2.4 EVALUATION

- a. Availability - The information reviewed is readily available from PennDER's File No. 58-5.
- b. Adequacy - The information available is adequate for Phase I Inspection of this dam.
- c. Validity - There is no reason at the present time to doubt the validity of the available engineering data.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

- a. General - The dam and its appurtenant structures were found to be in good overall condition on 27 October 1980. No unusual weather conditions were experienced during the inspection. Noteworthy deficiencies observed during the visual inspection are described briefly in the following paragraphs. The complete visual inspection check list, field sketch, top of dam profile, and typical cross-section are given in Appendix A.
- b. Dam - A small erosion gully has formed at the junction of the left spillway training wall and embankment. Brush was present immediately below the downstream face of the dam.
- c. Appurtenant Structures - The lake was drawn down for seasonal repair of the boat docks. No significant problems in the outlet works were observed.
- d. Reservoir Area - The reservoir slopes are gentle on the left side and moderate on the right. The majority of the shoreline has been developed with recreational cottages. The average depth of the reservoir is approximately 10 feet.

Fuller's Lake Dam (NDI No. PA 00073, PennDER No. 58-121) is located 9300 feet upstream from Page's Lake. Fuller's Lake Dam is a 143 feet long, 9 feet high, earthfill embankment. This dam controls 0.95 square miles of the drainage area which is a tributary to Page's Lake Dam. A Phase I Inspection Report is currently being prepared for this dam.

- e. Downstream Channel - The downstream channel contains some debris and obstructive vegetation which should be removed. The channel is moderately sloped and passes under a township road approximately 800 feet downstream of the dam. A 7 foot diameter corrugated metal pipe (C.M.P.) is the culvert under this first road. The channel then passes under PA Route 492, 500 feet further downstream, through a 5 foot high by 18 foot wide concrete culvert. In addition to possible economic damage to these two roads, one home and several (3) barns and garages could be damaged in the event of failure of the dam. Purdy (Stump Pond) Dam (NDI No. PA 00063, PennDER No. 58-11) is located 1,400 feet downstream. A Phase I Inspection Report is currently being prepared for this dam.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

There are no formal procedures for operating the reservoir or evacuating the downstream area in case of an impending failure of the dam. It is recommended that formal emergency procedures be adopted, prominently displayed, and furnished to all operating personnel.

4.2 MAINTENANCE OF DAM

Maintenance of the dam is performed by the owner on an as-needed basis. Generally, the maintenance procedures followed are adequate.

4.3 MAINTENANCE OF OPERATING FACILITIES

The stop logs are removed from the drawdown control structure every fall and the trash rack and spillway are cleaned of debris as required. A plan for emergency drawdown of the reservoir should be prepared in case emergency drawdown should become necessary.

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT

There is no warning system in the event of a dam failure. An emergency warning system should be developed.

4.5 EVALUATION OF OPERATIONAL ADEQUACY

The current operational features are adequate for the purpose they serve. However, it is recommended that a formal maintenance and operations manual be prepared for the dam.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

- a. Design Data - No hydrologic or hydraulic design calculations are available for Page's Lake Dam.
- b. Experience Data - No information concerning the effects of significant floods on the dam is available.
- c. Visual Observations - During the visual inspection, no problems were observed which would indicate that the dam and appurtenant facilities could not perform satisfactorily during a flood event.

The right spillway training wall has cracks and spalling on the downstream face. However, this is not considered significant enough at this time to require repair.

Fuller's Lake Dam (NDI No. 00073) is 9300 feet upstream from Page's Lake. Fuller's Lake Dam is an earthfill dam 143 feet long and 9 feet high, with a trapezoidal earth spillway.

- d. Overtopping Potential - Page's Lake Dam is an "Intermediate" size - "Significant" hazard dam requiring evaluation for a spillway design flood (SDF) in the range of the 1/2 Probable Maximum Flood (1/2 PMF) to the Probable Maximum Flood (PMF). Because the dam is on the low end of the "Intermediate" size category in terms of storage capacity, the 1/2 PMF was chosen as the SDF.

The hydraulic capacity of the dam, reservoir, and spillway was assessed by utilizing the U.S. Army Corps of Engineers' Flood Hydrograph Package, HEC-1 DB. The hydrologic characteristics of the basin, specifically, the Snyders' unit hydrograph parameters, were obtained from a regionalized analysis conducted by the Baltimore District of the U.S. Army Corps of Engineers. The hydrograph from Fuller's Lake Dam was routed downstream to Page's Lake, combined with the runoff hydrograph for Page's Lake, and then routed through Page's Lake Dam.

The spillway is capable of passing only 15 percent of the PMF before overtopping begins. Analysis of the dam and spillway shows that the dam will be overtopped by a maximum depth of 3.34 feet for a total duration of 11.83 hours by the SDF.

- e. Spillway Adequacy - As outlined in the above analysis, the spillway will not pass the SDF without overtopping the dam; therefore, the spillway is considered "Inadequate."

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

- a. Visual Observations - There were no structural inadequacies noted during the visual inspection that cause concern for the structural stability of the dam.
- b. Design and Construction Data - No design or construction data were available for review. Generally, for this type of dam, if the ratio of the width of the stonewall portion of the dam is greater than 0.5 times the height of the dam (0.5 w/h), then stability of the dam due to overturning or sliding is not a problem. (Reference: "Evaluation and Repair of Stonewall-earth Dams," by Kent A. Healy, Proceedings of "Safety of Small Dams" conference, New England College, Henniker, New Hampshire, August 4-9, 1974, pp. 149-178). The w/h ratio for this dam is estimated at slightly less than one and no signs of instability were observed during the visual inspection, therefore, further assessments of the structural stability are not considered necessary.
- c. Operating Records - No operating records are available. Nothing in the procedures described by the owner's representative indicates concern for the structural stability of the dam.
- d. Post-Construction Changes - No changes adversely affecting the structural stability of the dam have been performed.
- e. Seismic Stability - The dam is located in Seismic Zone 1 of the "Seismic Zone Map of the Contiguous United States," Figure 1, page D-30, "Recommended Guidelines for Safety Inspection of Dams." This is a zone of minor seismic activity. Therefore, further consideration of the seismic stability is not warranted.

SECTION 7 - ASSESSMENT, RECOMMENDATIONS/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

- a. Safety - Page's Lake Dam was found to be in good overall condition at the time of inspection. Page's Lake Dam is a "Significant" hazard - "Intermediate" size dam requiring a spillway capacity in the range of the 1/2 PMF to the PMF. Because the dam is on the low end of the "Intermediate" size category in terms of storage capacity, the 1/2 PMF was chosen as the SDF. As presented in Section 5, the spillway and reservoir are not capable of passing the 1/2 PMF without overtopping the dam. During the 1/2 PMF, the dam is overtopped by a maximum depth of 3.34 feet for a total duration of 11.83 hours. Therefore, the spillway is considered "Inadequate."
- b. Adequacy of Information - The information available and the observations made during the visual inspection are considered sufficient for this Phase I Inspection Report.
- c. Urgency - The owner should immediately initiate the further evaluation discussed in paragraph 7.1.d.
- d. Necessity for Additional Data/Evaluation - The hydraulic/hydrologic analysis performed in connection with this Phase I Inspection Report has indicated the need for additional spillway capacity. It is recommended that the owner immediately initiate an engineering study to further evaluate the spillway capacity and develop recommendations for remedial measures to reduce the overtopping potential of the dam.

7.2 RECOMMENDATIONS/REMEDIAL MEASURES

The inspection revealed certain items of remedial work which should be performed by the owner without delay. Item 1 below should be completed by a qualified professional engineer experienced in the design of hydraulic structures for dams. These include:

- 1) Initiate an engineering study to further evaluate the spillway capacity and develop recommendations for remedial measures to reduce the overtopping potential of the dam.

- 2) Fill the erosion gully located to the left of the spillway and reseed the area.
- 3) Remove the brush below the downstream face of the dam.
- 4) Remove the debris and obstructive vegetation from the downstream channel.

In addition, the following operational measures are recommended to be undertaken by the owner:

- 1) Develop a detailed emergency operation and warning system.
- 2) During periods of unusually heavy rain, provide around-the-clock surveillance of the dam.
- 3) When warning of a storm of major proportions is given by the National Weather Service, activate the emergency operation and warning system.

It is further recommended that formal inspection, maintenance, and operation procedures and records be developed and implemented. A plan for emergency draw-down of the reservoir should be prepared in case an emergency drawdown should become necessary. These should be included in a formal maintenance and operations manual for the dam.

APPENDIX A

VISUAL INSPECTION CHECK LIST, FIELD SKETCH,
TOP OF DAM PROFILE, AND TYPICAL CROSS-SECTION

Check List
Visual Inspection
Phase 1

Name of Dam Page's Lake Dam County Susquehanna State PA Coordinates Lat. N 41°51.5'
NDI # PA 00062 Long. W 75°39.5'
PENNDER # 58-5
Date of Inspection 27 October 1980 Weather Sunny Temperature 40° F.

Pool Elevation at Time of Inspection 1430.23 ft.* M.S.L. Tailwater at Time of Inspection 1421.51 ft.* M.S.L.

*Datum Elevation 1433.0 ft. M.S.L. for the spillway crest taken from plans of the dam, Plate 4.

Inspection Personnel:

Michael Baker, Jr., Inc.:

James G. Uliniski
Wayne D. Lasch
Jeffrey S. Maze

Owner's Representatives:

Lakeside Outing Club
Mrs. Margaret Ward, Secretary
(interviewed 31 October 1980)

James G. Uliniski Recorder

MASONRY DAMS

Name of Dam: PAGE'S LAKE DAM
NDI # PA 00062

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
LEAKAGE	None observed	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	Small erosion gully along left training wall and embankment.	Fill in gully and reseed area.
DRAINS	None observed	
WATER PASSAGES	None observed	
FOUNDATION	No problems observed	

MASONRY DAMS

Name of Dam: PAGE'S LAKE DAM
NDI # PA 00062

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	No problems observed	
STRUCTURAL CRACKING	No problems observed	
VERTICAL AND HORIZONTAL ALIGNMENT	Good	
MONOLITH JOINTS	Not Applicable	
CONSTRUCTION JOINTS	Not Applicable	

EMBANKMENT - Not Applicable

Name of Dam PAGE'S LAKE DAM

NDI # PA 00062

VISUAL EXAMINATION OF OBSERVATIONS REMARKS OR RECOMMENDATIONS

SURFACE CRACKS

UNUSUAL MOVEMENT OR
CRACKING AT OR BEYOND
THE TOE

SLOUGHING OR EROSION OF
EMBANKMENT AND ABUTMENT
SLOPES

EMBANKMENT - Not Applicable

Name of Dam PAGE'S LAKE DAM
NDI # PA 00062

VISUAL EXAMINATION OF OBSERVATIONS REMARKS OR RECOMMENDATIONS

VERTICAL AND HORIZONTAL
ALIGNMENT OF THE CREST

RIPRAP FAILURES

EMBANKMENT - Not Applicable

Name of Dam PAGE'S LAKE DAM
NDI # PA 00062

VISUAL EXAMINATION OF OBSERVATIONS REMARKS OR RECOMMENDATIONS

JUNCTION OF EMBANKMENT
AND ABUTMENT, SPILLWAY
AND DAM

ANY NOTICEABLE SEEPAGE

STAFF GAGE AND RECORDER

DRAINS

OUTLET WORKS

Name of Dam: PAGE'S LAKE DAM
NDI # PA 00062

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	None observed	
INTAKE STRUCTURE	Good condition	
OUTLET STRUCTURE	Good condition	
OUTLET CHANNEL	Good condition	
EMERGENCY GATE	The stop logs had been removed prior to the inspection. The stop logs are removed approximately one month each year to allow for boat dock repair.	

UNGATED SPILLWAY

Name of Dam: PAGE'S LAKE DAM
NDI # PA 00062

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Good condition	
APPROACH CHANNEL	Good condition	
DISCHARGE CHANNEL	Good condition. The right spillway training wall has cracks and spalling on the downstream face.	This is not considered significant enough to require repair at this time.
BRIDGE AND PIERS	No problems observed for pedestrian foot bridge and piers.	

GATED SPILLWAY - Not Applicable

Name of Dam: PAGE'S LAKE DAM
NDI # PA 00062

VISUAL EXAMINATION OF OBSERVATIONS REMARKS OR RECOMMENDATIONS

CONCRETE SILL

APPROACH CHANNEL

DISCHARGE CHANNEL

BRIDGE AND PIERS

GATES AND OPERATION
EQUIPMENT

INSTRUMENTATION

Name of Dam: PAGE'S LAKE DAM

NDI # PA 00062

VISUAL EXAMINATION OBSERVATIONS REMARKS OR RECOMMENDATIONS

MONUMENTATION/SURVEYS None observed

OBSERVATION WELLS None observed

WEIRS None observed

PIEZOMETERS None observed

OTHER

RESERVOIR

Name of Dam: PAGE'S LAKE DAM
NDI # PA 00062

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	The reservoir slopes are gentle on the left side and moderate on the right side. No signs of instability were observed. The majority of the shoreline has been developed with recreational cottages.	
SEDIMENTATION	The average reservoir depth is 10 ft. There is no indication that sedimentation is a significant problem.	
UPSTREAM DAM	Fuller's Lake Dam (NDI # PA 00073, PennDER # 58-121) is located upstream. A Phase I Inspection Report is currently being prepared by Michael Baker, Jr., Inc.	

DOWNSTREAM CHANNEL

Name of Dam: PAGE'S LAKE DAM

NDI # PA 00062

VISUAL EXAMINATION OF

OBSERVATIONS

REMARKS OR RECOMMENDATIONS

CONDITION
(OBSTRUCTIONS,
DEBRIS, ETC.)

Some vegetation and debris is located in the downstream channel.

Remove debris and obstructive vegetation.

SLOPES

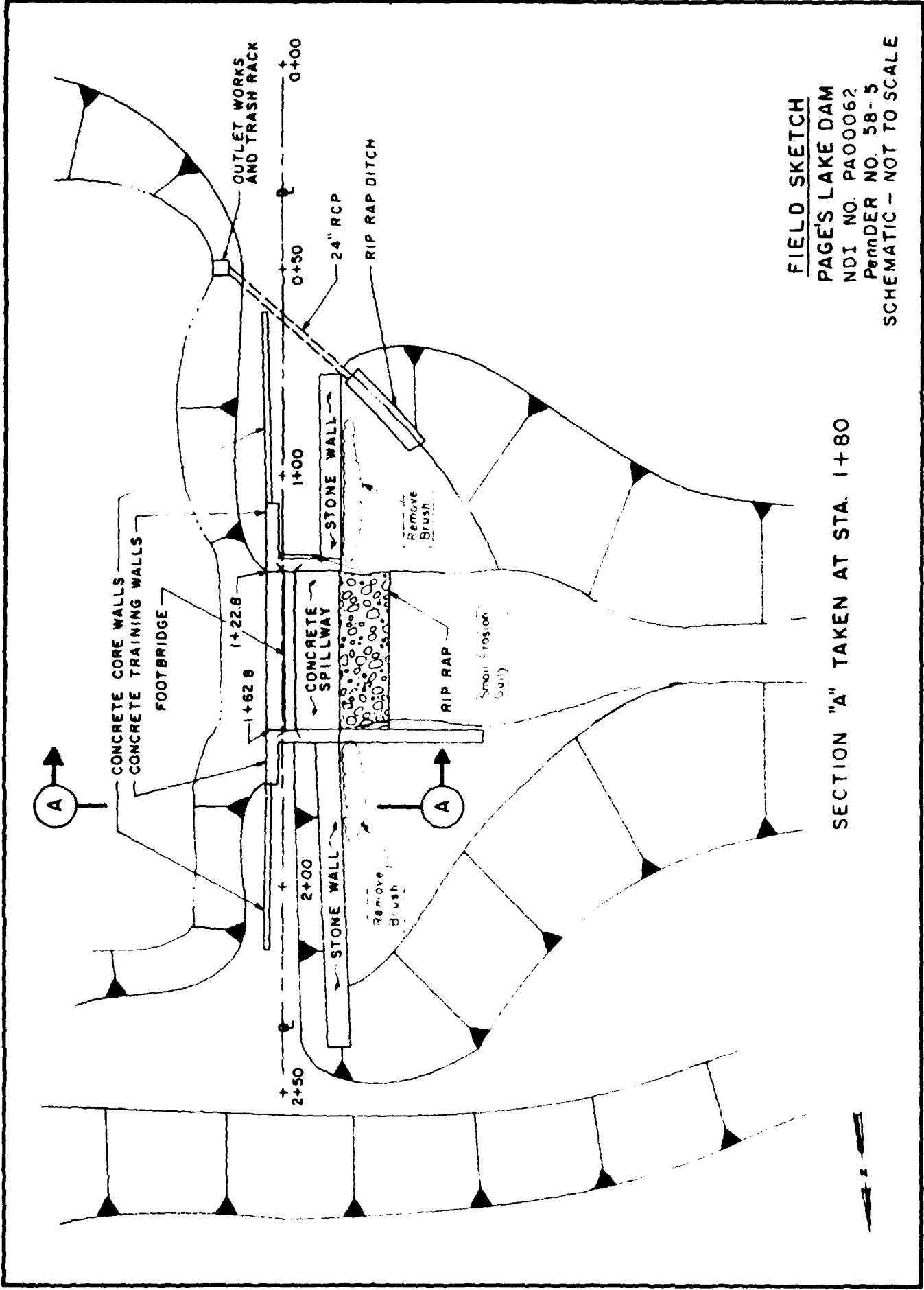
The downstream channel is moderately sloped.

APPROXIMATE NO.
OF HOMES AND
POPULATION

There is one township road approximately 800 ft. downstream. PA Route 492 is approximately 1300 ft. downstream. There are one home and several (3) barns and garages which may be damaged in the event of failure of the dam.

DOWNSTREAM DAM

Purdy (Stump Pond) Dam (NDI # PA 00063, PENNDEER # 58-11) is located downstream. A Phase I Inspection Report is currently being prepared by Michael Baker, Jr., Inc.



FIELD SKETCH

PAGE'S LAKE DAM
 NDI NO. PA00062
 PERMIDR NO. 58-5
 SCHEMATIC - NOT TO SCALE

SECTION "A" TAKEN AT STA. 1+80

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THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

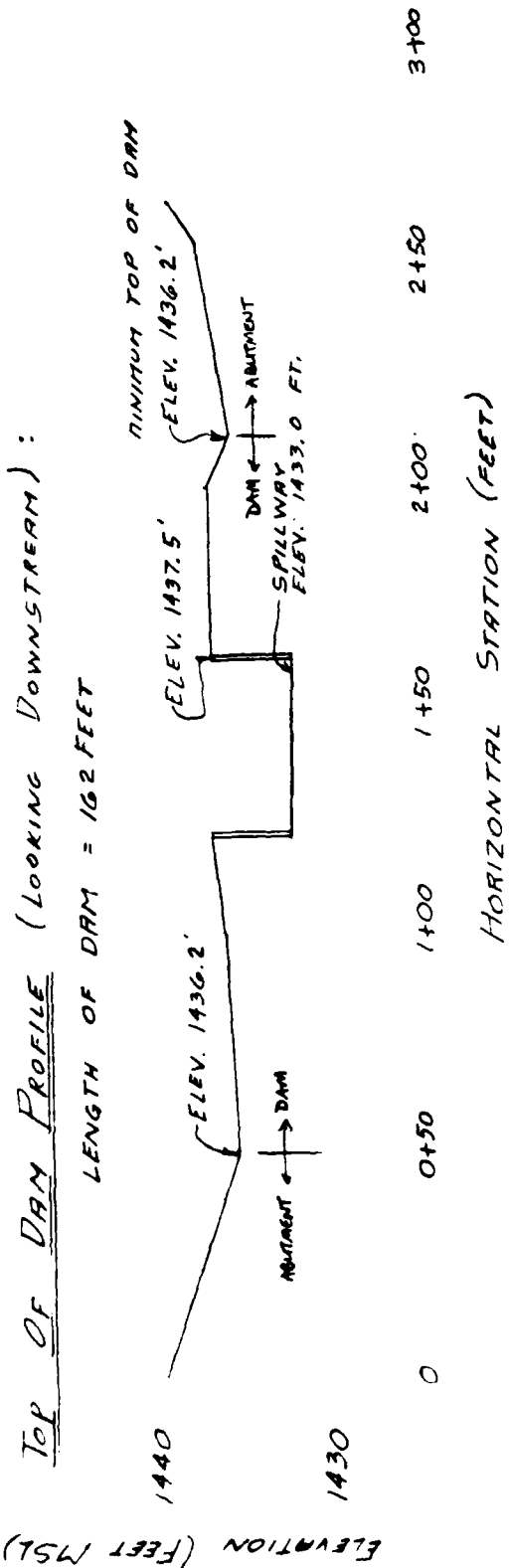
PAGE'S LAKE DAM

TOP OF DAM PROFILE
TYPICAL CROSS-SECTION

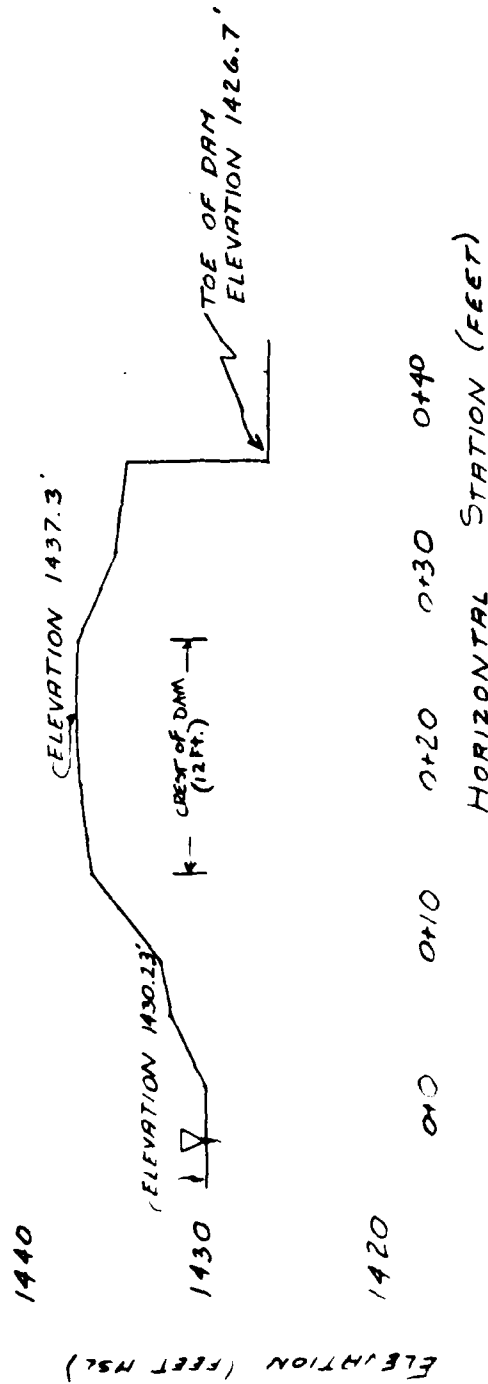
DATE OF INSPECTION: 27 October 1980

TOP OF DAM PROFILE (LOOKING DOWNSTREAM):

LENGTH OF DAM = 162 FEET



TYPICAL CROSS SECTION AT STA. 1780



APPENDIX B

ENGINEERING DATA CHECK LIST

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

Name of Dam: PAGE'S LAKE DAM
NDI # PA 00062

ITEM _____ REMARKS _____

PLAN OF DAM

See Plate 4 of this report.

REGIONAL VICINITY MAP

A USGS 7.5 minute topographic quadrangle, Harford, Pennsylvania, was used to prepare the vicinity map which is enclosed in this report as Location Plan (Plate 1).

CONSTRUCTION HISTORY

No construction history is known other than the dam was constructed in 1863.

TYPICAL SECTIONS OF DAM

No information available

HYDROLOGIC/HYDRAULIC DATA

No information available

OUTLETS - PLAN

See Plate 4

- DETAILS

See Plate 4

- CONSTRAINTS

No information available

- DISCHARGE RATINGS

No information available

RAINFALL/RESERVOIR RECORDS

None available

Name of Dam: PAGE'S LAKE DAM

NDI # PA 00062

ITEM	REMARKS
DESIGN REPORTS	No information available
GEOLOGY REPORTS	No information available. The Regional Geology is presented as Appendix F of this report.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	No information available
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	No information available
POST-CONSTRUCTION SURVEYS OF DAM	None
BORROW SOURCES	No information available

Name of Dam: PAGE'S LAKE DAM
NDI # PA 00062

B-3

ITEM REMARKS

MONITORING SYSTEMS

None

MODIFICATIONS

The dam was reconstructed in 1922. The spillway was replaced in 1972 and the drawdown structure was constructed in 1975.

HIGH POOL RECORDS

No information available

**POST-CONSTRUCTION ENGINEERING
STUDIES AND REPORTS**

No detailed engineering reports other than the August 16, 1913 Water Supply Commission Inspection are available. A number of inspection reports are available in the PennDER File, including the latest recorded inspection on August 17, 1965 by PennDER.

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

The only known accident at the dam was on March 23, 1913 when the attendant for the New Milford Light and Power Company failed to remove the flashboards in the spillway and the dam was overtopped and partially breached. The provisions for flashboards have been removed and flashboards should not be used in the future.

**MAINTENANCE
OPERATION
RECORDS**

No formal maintenance records are maintained.

Name of Dam: PAGE'S LAKE DAM
NDI # PA 00062

B-4

ITEM	REMARKS
SPILLWAY PLAN,	See Plate 4
SECTIONS, and DETAILS	None available
OPERATING EQUIPMENT PLANS & DETAILS	No information available

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 4.78 sq.mi., primarily wooded with
mild to steep slopes

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 1433.0 ft. M.S.L.
(970 ac.-ft.)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): 1436.2 ft. M.S.L.
(1430 ac.-ft.)

ELEVATION MAXIMUM DESIGN POOL: Unknown

ELEVATION TOP DAM: 1436.2 ft. M.S.L. (minimum top of dam)

SPILLWAY: Rectangular channel

- a. Crest Elevation 1433.0 ft. M.S.L.
- b. Type Rectangular channel (concrete)
- c. Width of Crest Parallel to Flow 17 ft.
- d. Length of Crest Perpendicular to Flow 40 ft.
- e. Location Spillover Center of dam
- f. Number and Type of Gates None

OUTLET WORKS: Concrete box intake with stop logs and trash rack -

- a. Type discharge into 24 in. concrete pipe
- b. Location Left abutment
- c. Entrance Inverts 1428.69 ft. M.S.L.
- d. Exit Inverts 1428.01 ft. M.S.L.
- e. Emergency Drawdown Facilities The outlet works are the
only drawdown facilities

HYDROMETEOROLOGICAL GAGES: None

- a. Type _____
- b. Location _____
- c. Records _____

MAXIMUM NON-DAMAGING DISCHARGE Unknown

APPENDIX C

PHOTOGRAPH LOCATION PLAN AND PHOTOGRAPHS

DETAILED PHOTOGRAPH DESCRIPTIONS

Overall View of Dam

Top Photo - Overall View of Upstream Face of Dam from
(OV-T) Left Abutment

Bottom Photo - Overall View of Downstream Face of Dam
(OV-B) from Right Abutment

Photograph Location Plan

Photo 1 - View of Spillway Entrance

Photo 2 - Close-up of Spillway Crest

Photo 3 - View of Downstream Side of Spillway

Photo 4 - Oblique View of Downstream Side of Spillway and
Dam from Left Abutment

Photo 5 - View of Intake for Outlet Conduit

Photo 6 - Close-up View of Intake for Outlet Conduit

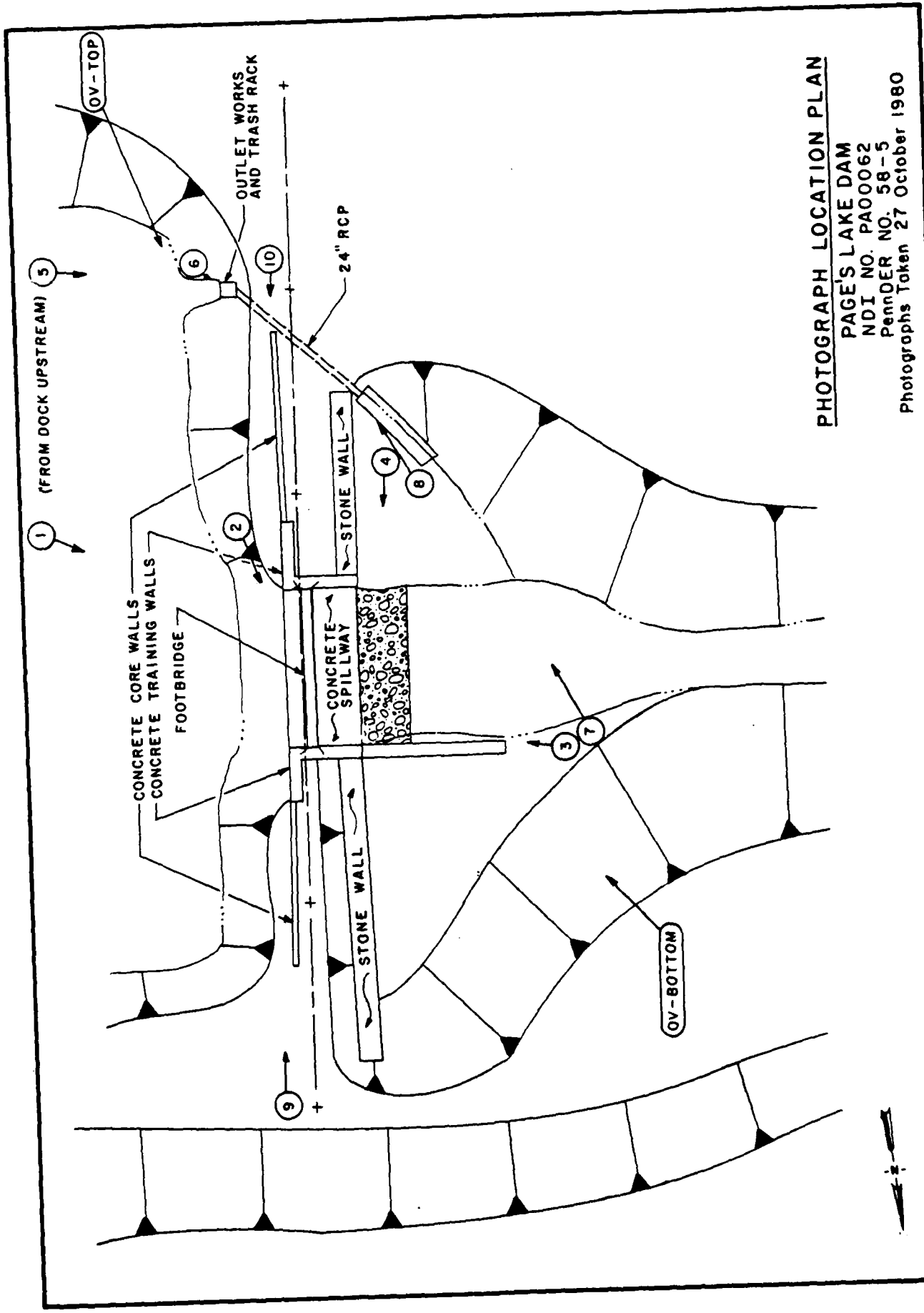
Photo 7 - View of Discharge Channel of Outlet Conduit

Photo 8 - Close-up View of Downstream End of Outlet Conduit

Photo 9 - View Along Axis of Dam from Right Abutment

Photo 10 - View of Crest of Dam from Left Abutment

Note: Photographs were taken on 27 October 1980.



PHOTOGRAPH LOCATION PLAN

PAGE'S LAKE DAM
 NDI NO. PA00062
 PENN DER NO. 58-5
 Photographs Taken 27 October 1980

PAGE'S LAKE DAM



PHOTO 1. View of Spillway Entrance

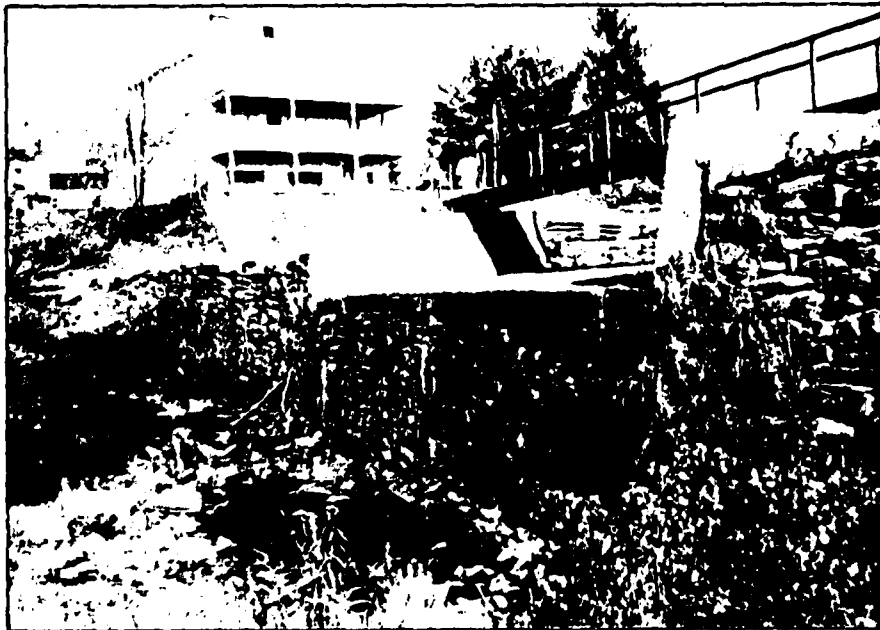


PHOTO 2. Close-up of Spillway Crest

PAGE'S LAKE DAM



PHOTO 3. View of Downstream Side of Spillway



**PHOTO 4. Oblique View of Downstream Side of Spillway and Dam from
Left Abutment**

PAGE'S LAKE DAM

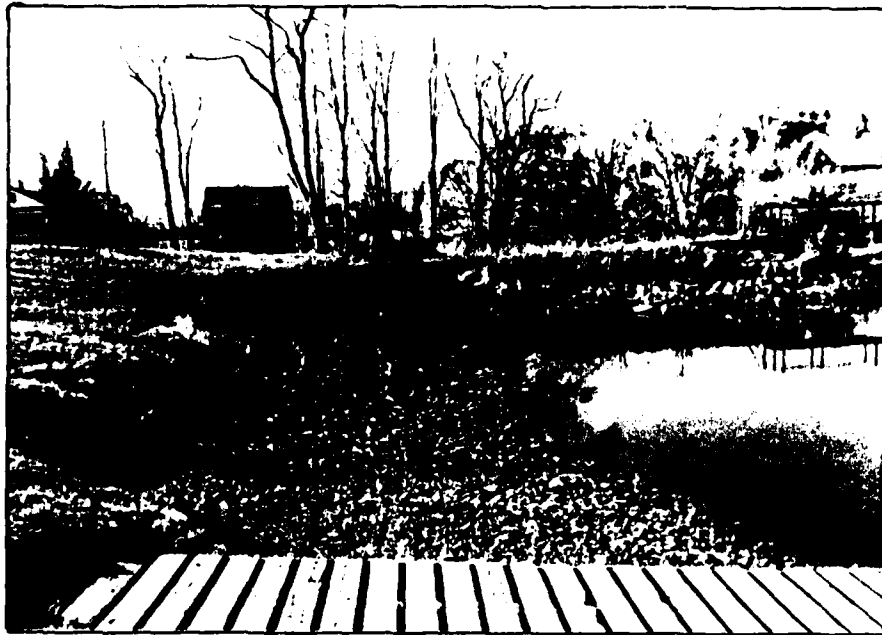


PHOTO 5. View of Intake for Outlet Conduit

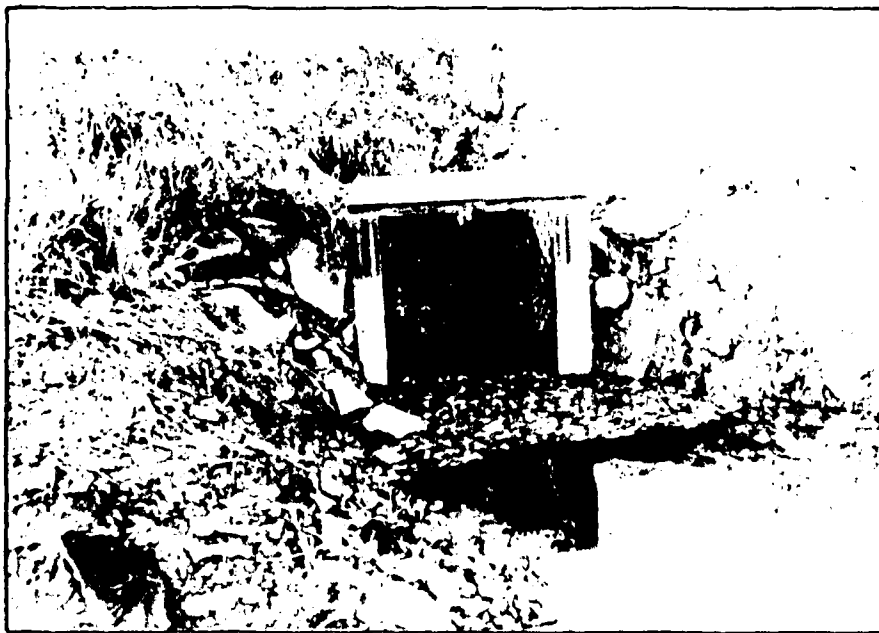


PHOTO 6. Close-up View of Intake for Outlet Conduit

PAGE'S LAKE DAM



PHOTO 7. View of Discharge Channel of Outlet Conduit



PHOTO 8. Close-up View of Downstream End of Outlet Conduit

PAGE'S LAKE DAM



PHOTO 9. View Along Axis of Dam from Right Abutment



PHOTO 10 View of Crest of Dam from Left Abutment

APPENDIX C

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

PROJECT NO. _____
DRAWING NO. _____
DATE _____

SUBJECT PAGE'S LAKE DAM S.C. No. _____
APPENDIX E - HYDROLOGIC AND Sheet No. _____ of _____
HYDRAULIC COMPUTATIONS Drawing No. _____
Checked by _____ Checked by _____ Date _____

<u>SUBJECT</u>	<u>PAGE</u>
PREFACE	i
HYDROLOGY AND HYDRAULIC DATA BASE	1
HYDRAULIC DATA	2
DRAINAGE AREA AND CENTROID MAP	3
TOP OF DAM PROFILE AND CROSS SECTION	4
SPILLWAY DISCHARGE RATING	5
SPILLWAY CAPACITY	6
ROUTING SUMMARY	7
HEC-1 SPILLWAY ANALYSIS	8

PREFACE

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

The hydrologic determinations presented in this Phase I Inspection Report are based on the use of a Snyder's unit hydrograph developed by the U.S. Army Corps of Engineers. Due to the limited number of gaging stations available in this hydrologic region and the wide variations of watershed slopes, the Snyder's coefficients may yield results of limited accuracy for this watershed. As directed however, a further refinement of these coefficients is beyond the scope of this Phase I Investigation.

In addition, the conclusions presented pertain to present conditions, and the effect of future development on the hydrology has not been considered.

HYDROLOGY AND HYDRAULIC ANALYSIS
DATA BASE

NAME OF DAM: PAGE'S LAKE DAM

PROBABLE MAXIMUM PRECIPITATION (PMF) = 21.0 INCHES/24 HOURS⁽¹⁾

STATION	1	2	3	4	5
Station Description	FULLER'S LAKE DAM	PAGE'S LAKE DAM			
Drainage Area (square miles)	0.95	3.83			
Cumulative Drainage Area (square miles)	0.95	4.78			
Adjustment of PMF for Drainage Area (%) ⁽²⁾	ZONE 1	ZONE 1			
6 Hours	111	111			
12 Hours	123	123			
24 Hours	133	133			
48 Hours	142	142			
72 Hours	---	---			
Snyder Hydrograph Parameters					
Zone ⁽³⁾	11A	11A			
C_p/C_t ⁽⁴⁾	0.62/1.50	0.62/1.50			
L (miles) ⁽⁵⁾	1.48	3.41			
L_{ca} (miles) ⁽⁵⁾	0.61	1.48			
$t_p = C_t (L \cdot L_{ca})^{0.3}$ (hours)	1.45	2.44			
Spillway Data	TRAPEZOIDAL SPILLWAY	SPILLWAY RATING			
Crest length (ft)	RATING CURVE FROM	CURVE DEVELOPED			
Freeboard (ft)	FULLER'S LAKE DAM	ON SHEET 5			
Discharge Coefficient dependent	INSPECTION REPORT				

(1) Hydro-meteorological Report 33 (Figure 1), U.S. Army, Corps of Engineers, 1956.

(2) Hydro-meteorological Report 33 (Figure 2), U.S. Army, Corps of Engineers, 1956.

(3) Hydrological zone defined by Corps of Engineers, Baltimore District, for determining Snyder's Coefficients (C_p and C_t).

(4) Snyder's Coefficients.

(5) L = Length of longest water course from outlet to basin divide.

L_{ca} = Length of water course from outlet to point opposite the centroid of drainage area.

STORAGE CALCULATIONS

AREA VS. ELEVATION DATA : (MEASURED FROM QUADS)

<u>ELEVATION (FT.)</u>	<u>SURFACE AREA (ACRES)</u>
1433	102.85
1440	175.39
1460	273.65

NORMAL POOL STORAGE

$$\text{STORAGE VOLUME} = V_{NP} = \frac{h}{3} (A_1 + A_2 + \sqrt{A_1 A_2})$$

h = ESTIMATED FROM FIELD NOTES = 9.7 FT.

A_1 = SURFACE AREA OF NORMAL POOL = 102.85 AC.

A_2 = SURFACE AREA OF RESERVOIR BEYOND = 97.41 AC.
(ESTIMATED FROM AVERAGE DEPTH AND
RESERVOIR SIDE SLOPES)

$$\text{NORMAL POOL STORAGE} = V_{NP} = \frac{9.7}{3} (102.85 + 97.41 + \sqrt{(102.85)(97.41)})$$

$$V_{NP} = 971.14 \text{ AC.-FT.}$$

TOP OF DAM STORAGE

1431 AC.-FT (FROM HEC-1 ANALYSIS)

SNYDER'S UNIT HYDROGRAPH PARAMETERS

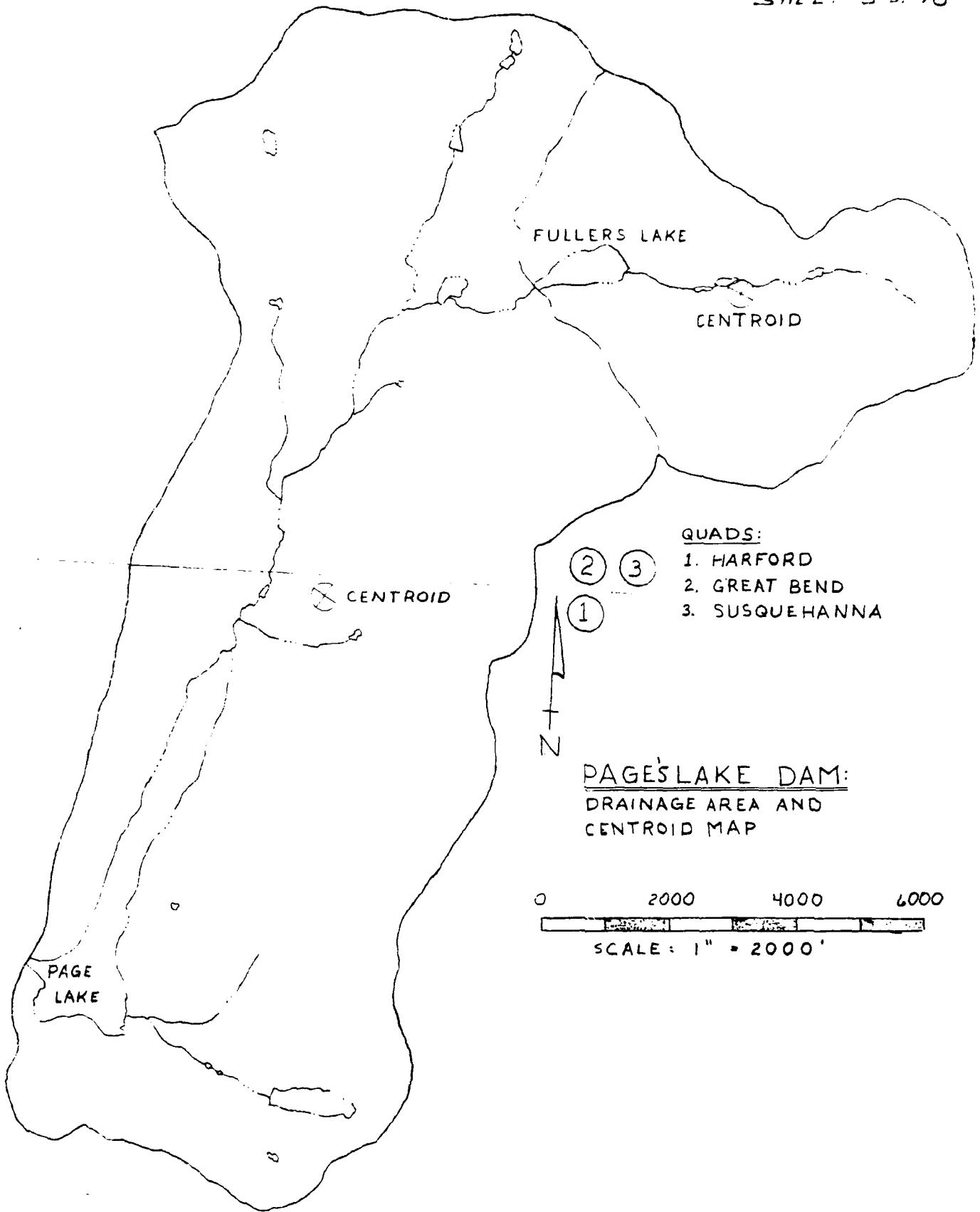
$$L = 3.41 \text{ MI.}, \quad L_{CP} = 1.48 \text{ MI.}$$

WATERSHED IS IN ZONE II A

$$C_p = \text{PLATE E} \quad C_p = 0.62$$

$$T_p = 1.50 (L/L_{CP})^{0.7} = 2.44$$

DRAINAGE AREA ABOVE DAM = 4.78 SQ MI.



FULLERS LAKE

CENTROID

CENTROID

PAGE LAKE

QUADS:

- 1. HARFORD
- 2. GREAT BEND
- 3. SUSQUEHANNA

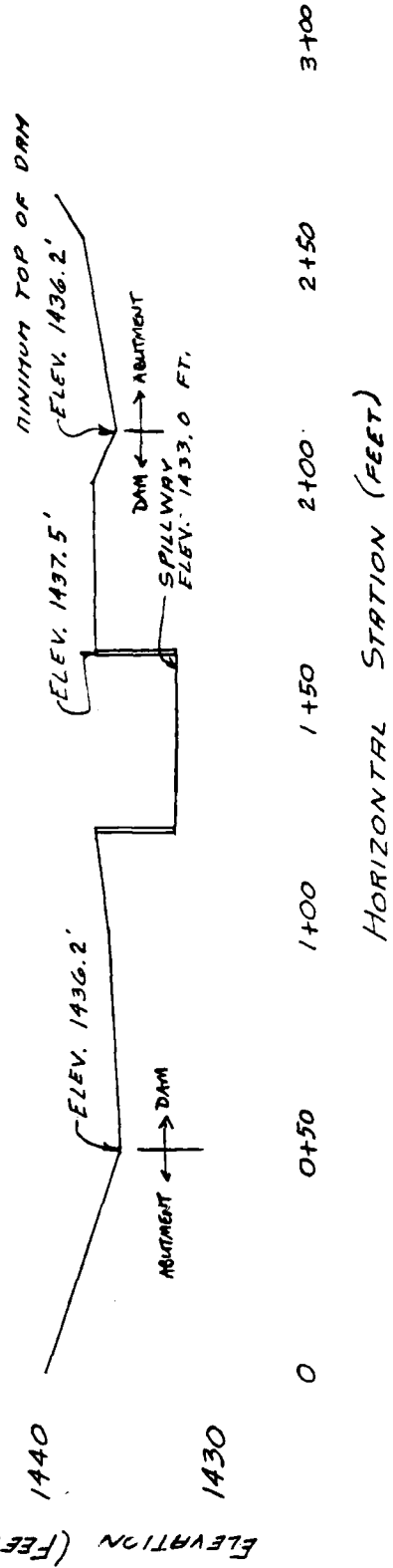
PAGE'S LAKE DAM:
DRAINAGE AREA AND
CENTROID MAP



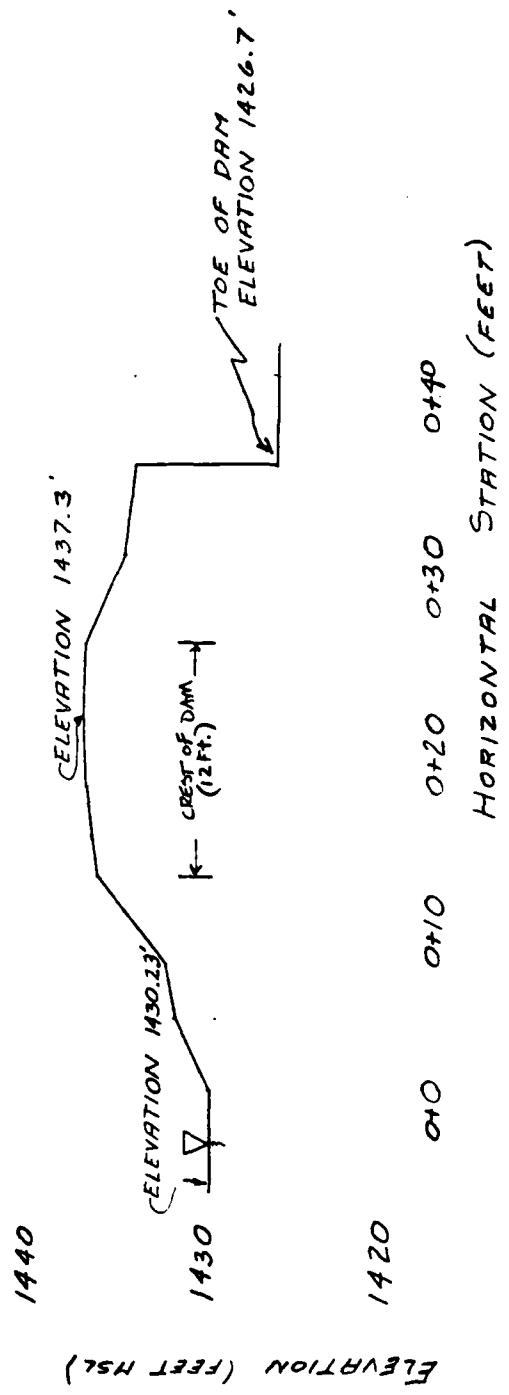
SCALE: 1" = 2000'

TOP OF DAM PROFILE (LOOKING DOWNSTREAM):

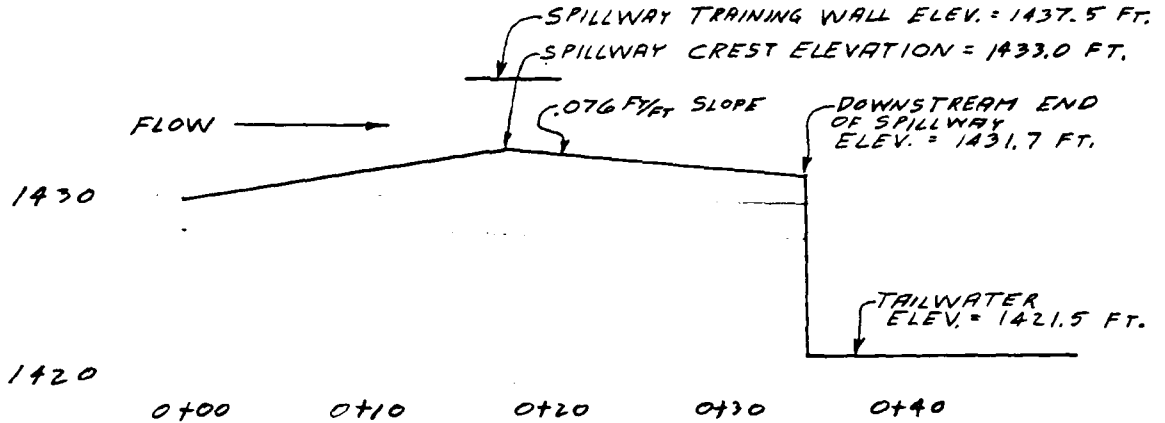
LENGTH OF DAM = 162 FEET



TYPICAL CROSS SECTION AT STA. 1+80



SPILLWAY PROFILE



SPILLWAY SLOPE IS GREATER THAN CRITICAL SLOPE

DEVELOP RATING CURVE BASED ON CRITICAL FLOW OVER SPILLWAY :

$$V = \sqrt{g D} \quad (\text{CHOW, OPEN CHANNEL HYDRAULICS, P. 43})$$

$$g = 32.2 \text{ FT/SEC}^2$$

$$D = \text{MEAN HYDRAULIC DEPTH} = \frac{\text{FLOW AREA}}{\text{FREE SURFACE TO } \infty \text{ WIDTH}} = \frac{A}{T}$$

$$V = \text{MEAN FLOW VELOCITY}$$

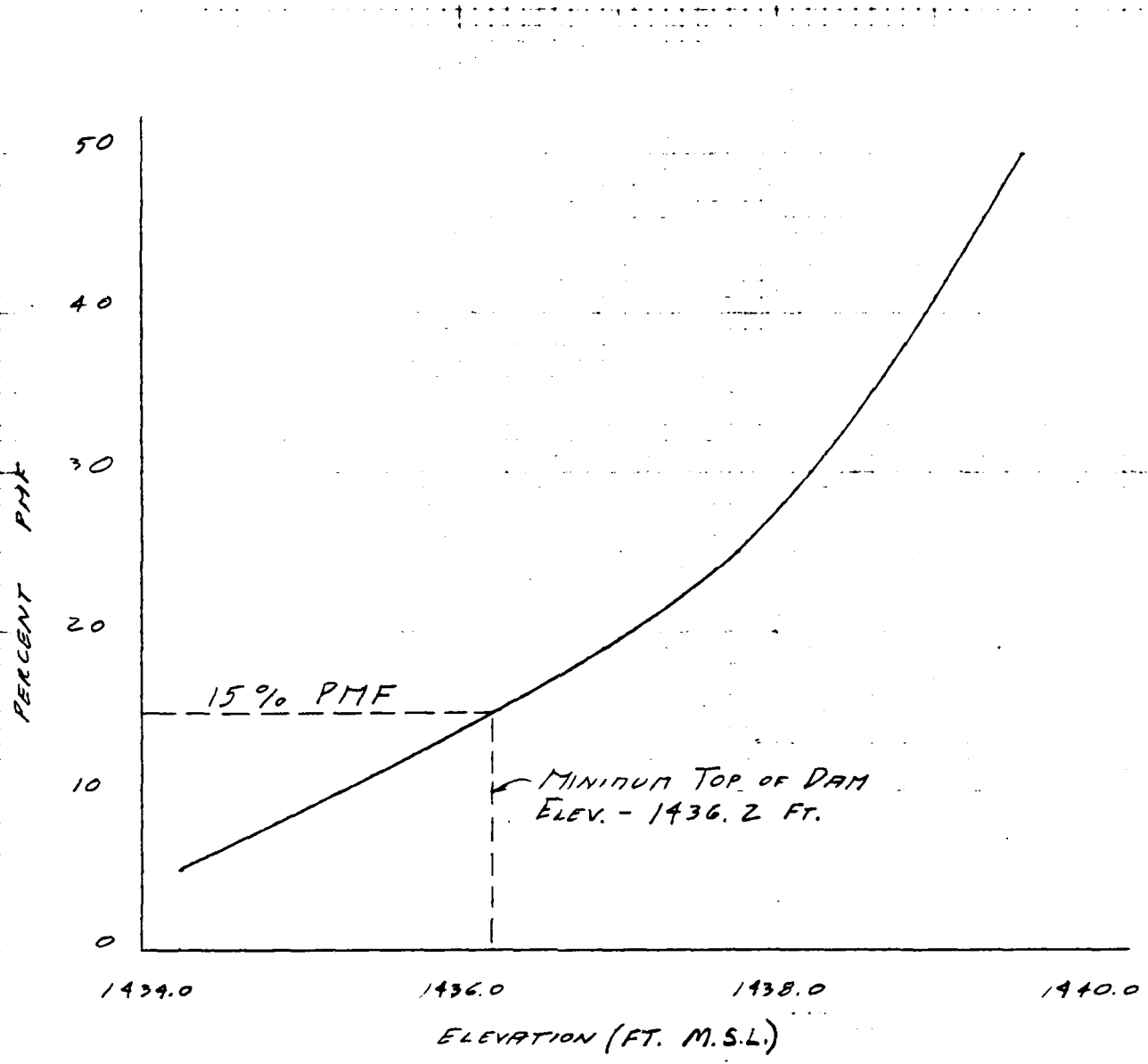
$$Q = VA$$

SPILLWAY ELEVATION, FT.	FLOW DEPTH, FT.	AREA, FT ²	TOP WIDTH, FT.	A/T	V, FT/SEC.	Q, CFS	V ² /2g	RESERVOIR SURFACE, FT.
1433.0	0	0	0	0	0	0	0	1433.0
1433.5	0.5	20.0	40	0.5	4.01	80.20	0.25	1433.75
1434.0	1.0	40.0	40	1.0	5.67	226.80	0.50	1434.50
1434.5	1.5	60.0	40	1.5	6.95	417.00	0.75	1435.25
1435.0	2.0	80.0	40	2.0	8.02	641.60	1.00	1436.00
1436.0	3.0	120.0	40	3.0	9.83	1176.60	1.50	1437.50
1436.5	3.5	140.0	40	3.5	10.62	1486.80	1.75	1438.25
1437.0	4.0	160.0	40	4.0	11.35	1816.00	2.00	1439.00
1437.5	4.5	180.0	40	4.5	12.04	2,167.20	2.25	1439.75
1438.0	5.0	200.0	40	5.0	12.69	2,538.00	2.50	1440.50
1438.5	5.5	220.0	40	5.5	13.31	2,928.20	2.75	1441.25

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject PAGE'S LAKE DAM S.O. No. _____
SPILLWAY CAPACITY Sheet No. 6 of 18
Drawing No. _____
Computed by GWT Checked by _____ Date 1-27-81



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THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject PAGE'S LAKE DAM

ROUTING SUMMARY

S.O. No. _____

Sheet No. 7 of 18

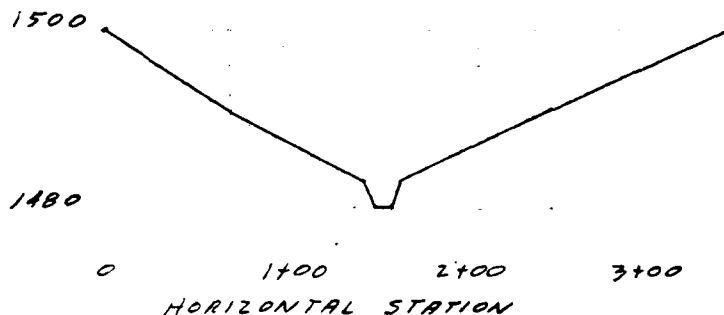
Drawing No. _____

Computed by GWT Checked by _____ Date 1-20-81

NAME	LENGTH OF DAM	HEIGHT OF DAM	NORMAL POOL STORAGE	TOP OF DAM STORAGE	ROUTING LENGTH OF CHANNEL
PAGE'S LAKE	162 FT.	15 FT.	971.1 AC-FT AT 1433.0 FT.	1431 AC-FT AT 1436.2 FT.	
FULLER'S LAKE	143 FT.	9.0 FT.	60.7 AC-FT AT 1537.0 FT.	89 AC-FT. AT 1539.6 FT.	9300 FT.

TYPICAL ROUTING CHANNEL

FULLER'S LAKE TO PAGE'S LAKE



 FLOJJ HYDROGRAPH PACKAGE (REV. 11)
 DAM SAFETY VERSION JULY 1973
 LAST MODIFICATION 26 FEB 79
 M8J UPDATE 04 JUN 79

LINE	PARAMETER	VALUE	UNIT	DESCRIPTION
1	A1	NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS		
2	A2	HYDRAULIC AND HYDRAULIC ANALYSIS OF PAGE LAKE DAM		
3	A3	UNIT HYDROGRAPH BY SCS METHOD		
4	B	0	10	0 0 0 0 0 0 0 0
5	B1	5		
6	J	1		
7	J1	0.25	0.05	
8	J	1		
9	K1	RUNOFF HYDROGRAPH TO DAM		
10	M	1	0.95	
11	P	21	111	123 133 142 1.0 0.05
12	Y			
13	X	1.45	0.62	
14	X	-1.5	-0.05	2.0
15	K	1	2	
16	K1	RUNOFF FOR FULLERS LAKE DAM		
17	Y	1		
18	VI	1		
19	Y6	1537	1537.7	1538.3 1539 1539.6 1540.2 1540.3 -1537.0
20	Y5	J	29.5	100.3 225.7 370.8 635.8 674.1
21	8A	13.88	16.33	25.71 38.57
22	8E	1533	1537	1540
23	8E	1537		
24	8D1539.5	3.33	1.5	99
25	8E	J	1.5	29 54 71 84 97
26	8V1539.5	1533	1540.5	1541 1541.5 1542 1542.5 1543
27	K	1	3	
28	K1	RUNOFF THRU CHANNEL TO PAGE LAKE		
29	Y	1		
30	VI	1		
31	Y6	0.06	0.06	1433 1500 9300 0.01
32	Y7	J	1533	70 1491 144 1483 150 1480 173 1480
33	Y7	153	1483	250 1491 350 1500
34	K	1	6	
35	K1	RUNOFF HYDROGRAPH TO PAGE LAKE		
36	M	1	3.83	
37	P	21	111	123 133 142 1.0 0.05
38	Y			
39	Z	2.83	0.82	
40	X	-1.5	-0.05	2.0
41	K	2	5	
42	K1	CGAINE HYDROGRAPHS FROM STATIONS 3 AND 4		
43	K	1	6	
44	K1	RUNOFF FOR PAGE LAKE DAM		
45	Y	1		
46	Y6	1433	1433.7	1434.5 1435.2 1436.0 1437.5 1438.2 1439.0 1439.7 1440.5
47	Y5	J	80.2	226.8 417.0 641.6 1176.6 1400.6 1616.0 2167.2 2536.0
48	8A	97.01	132.05	175.39 273.65
49	8E1423.1	1433	1440	

SHEET B OF 13

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

1 RUNOFF HYDROGRAPH AT
2 ROUTE HYDROGRAPH TO
3 ROUTE HYDROGRAPH TO
4 RUNOFF HYDROGRAPH AT
5 COMBINE 2 HYDROGRAPHS AT
6 ROUTE HYDROGRAPH TO
END OF NETWORK

 FLJUD HYDROGRAPH PACKAGE (REC-1)
 DAM SAFETY VERSION JULY 1978
 LAST MODIFICATION 26 FEB 79
 MOD UPDATE 04 JUN 79

RUN DATE 02/17/81
 TIME 19.15

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

JOB SPECIFICATION

NO 400 NMR J TDAY 10 NMIN 0 THR 0 IMIN 0 METRC 0 IPLT 0 IPRT -4 INSTAN 0
 JUPER 5 LRUPI 0 TRACE 0

MULTI-PLAN ANALYSES TO BE PERFORMED

RTIUS= 0.50 0.25 0.05
 MPLAN= 1 NR10= 3 LR10= 1

SUB-AREA RUNOFF COMPUTATION

RUNOFF HYDROGRAPH TO DAM

ISTAQ 1 ICOMP 0 IECOR 0 ITAPE 0 JPLT 0 JPRT 1 IRAME 1 ISTAGE 1 AUTO 0

HYDROGRAPH DATA

IHYD 1 LJHG 1 TAREA 0.95 SNAP 0.0 TRSDA 0.95 TRSPL 0.0 RATIO 0.0 ASNUM 0 ISAME 0 LCALL 0

PRECIP DATA

SPEE 0.7 PMS 21.00 R6 111.00 R12 123.00 R24 133.00 R48 142.00 R72 0.0 R96 0.0

TRSPC COMPUTED BY THE PROGRAM IS 0.000

LOSS DATA

LROPT 0 STRAK 0.0 DLKTR 0.0 RTIOL 1.00 ERAIN 0.0 STRKS 0.0 RTIUK 1.00 SKIKL 1.00 CNSTL 0.05 ALSMA 0.0 KTIEM 0.0

UNIT HYDROGRAPH DATA

TP= 1.45 CP=0.62 NIA= 0

RECESSION DATA
 STRIU= -1.50 QKCSN= -0.05 RTIUR= 2.00

UNIT HYDROGRAPH 49 END-OF-PERIOD URINATES, LAU= 1.45 HOURS, CP= 0.62 VUL= 1.00

10.	37.	74.	116.	161.	204.	238.	259.	268.	260.
237.	237.	185.	164.	145.	128.	113.	100.	89.	78.
69.	51.	54.	48.	42.	38.	33.	29.	26.	23.
20.	13.	16.	14.	12.	11.	10.	9.	8.	7.

0. 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12. 13. 14. 15. 16. 17. 18. 19. 20. 21. 22. 23. 24. 25. 26. 27. 28. 29. 30. 31. 32. 33. 34. 35. 36. 37. 38. 39. 40. 41. 42. 43. 44. 45. 46. 47. 48. 49. 50. 51. 52. 53. 54. 55. 56. 57. 58. 59. 60. 61. 62. 63. 64. 65. 66. 67. 68. 69. 70. 71. 72. 73. 74. 75. 76. 77. 78. 79. 80. 81. 82. 83. 84. 85. 86. 87. 88. 89. 90. 91. 92. 93. 94. 95. 96. 97. 98. 99. 100.

SUN 23.86 21.47 2.39 79038.
 1 006.01 545.01 61.01 2230.110

HYDROGRAPH ROUTING

ROUTING FOR FULLERS LAKE DAM
 I STAQ ICOMP IECUN ITAPE JPLI JPRI INAME ISTAGE IAU1U
 2 0 0 0 0 0 1 0 0
 ROUTING DATA
 LOSS LOSS AVG IRES ISAME IUPT IPMP LSTR
 0.0 0.0 0.0 1 1 0 0 0
 NSTPS NSTDL LAG ANSKK X ISK SIURA ISPKRAI
 1 0 0 0.0 0.0 0.0 0.0 -1537.0 -1

STAGE 1537.00 1537.70 1538.30 1539.00 1539.60 1540.20 1540.80
 FLOW 0.0 29.90 100.30 224.70 370.80 635.80 874.10
 SURFACE AREA= 14. 17. 26. 39.
 CAPACITY= 0. 61. 124. 762.
 ELEVATION= 1533. 1537. 1540. 1560.

UREL SPWID CUM EXPW ELEVEL COOL CAREA EXPL
 1537.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
 DAM DATA
 TOPEL CUDD EXPD DAMHID
 1539.6 3.1 1.5 99.

CREST LENGTH 0. 16. 29. 45. 54. 71. 84. 97.
 AT OR BELOW ELEVATION 1539.6 1540.0 1540.5 1541.0 1541.5 1542.0 1542.5 1543.0

PEAK OUTFLOW IS 1202. AT TIME 41.50 HOURS

PEAK OUTFLOW IS 573. AT TIME 41.67 HOURS

PEAK OUTFLOW IS 85. AT TIME 42.67 HOURS

HYDROGRAPH ROUTING

ROUTING THRU CHANNEL TO PAGE LAKE

I STAQ ICOMP IECUN ITAPE JPLI JPRI INAME ISTAGE IAU1U
 3 1 0 0 0 0 0 0 0

ROUTING DATA
 LOSS LOSS AVG PRES ISAME IUPF IJPM IJIR U
 0.0 0.0 0.0 1 1 0 0
 NSTPS NSTOL LAG AMSKR U A ISR SLIKA ISPKAF U
 1 0 0.0 0.0 0.0 0.0

NORMAL DEPTH CHANNEL ROUTING

QNI1 QNI2 QI13 ELAVI ELMAX ALNH SEL
 0.0600 0.0400 0.0000 1433.0 1500.0 9300. 0.01000

CROSS SECTION COORDINATES--STA+ELEV,STA+ELEV--ETC
 0.0 1500.00 70.00 1491.00 144.00 1483.00 150.00 1400.00 153.00 1480.00
 159.00 1483.00 250.00 1491.00 350.00 1500.00

| | | | | | | | | | | | |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|----------|----------|----------|
| STORAGE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3.90 | 33.44 | 117.01 | 253.63 | 492.00 | 601.00 |
| OUTFLOW | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 83.09 | 965.82 | 4098.98 | 10387.77 | 21401.00 | 27400.00 |
| STAGE | 1433.00 | 1436.33 | 1440.05 | 1443.58 | 1447.10 | 1450.63 | 1454.16 | 1457.69 | 1461.21 | 1464.74 | 1468.26 |
| FLUM | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 83.09 | 965.82 | 4098.98 | 10387.77 | 21401.00 | 27400.00 |

MAXIMUM STAGE IS 1486.1

MAXIMUM STAGE IS 1488.2

MAXIMUM STAGE IS 1482.3

SUB-AREA RUNOFF COMPUTATION

RJHUFF HYDROGRAPH 10 PAGE LAKE

| | | | | | | | | | |
|-------|------|-------|------|-------|-------|-------|-------|-------|-------|
| INUDG | IJHG | TAKEA | SNAP | TRSDA | TRSPC | KATIU | ESHRU | ESAME | ESCAL |
| 1 | 1 | 3.83 | 0.0 | 3.83 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

HYDROGRAPH DATA
 PRECIP DATA
 SNPE PMS R6 R12 R24 R48 R72 R96
 0.0 21.00 111.00 133.00 147.00 147.00 0.0 0.0
 TRSPC COMPUTED BY THE PROGRAM IS 0.300

LOSS DATA

| | | | | | | | | | |
|--------|-------|-------|-------|-------|-------|-------|------|-------|-------|
| LDROPT | STAKR | ULTRK | KTIDR | FRAIN | STAKS | KTIDK | STPL | MSJDK | MSJDK |
| 0 | 0.0 | 0.0 | 1.00 | 0.0 | 1.00 | 1.00 | 0.0 | 0.0 | 0.0 |

UNIT HYDROGRAPH DATA
 EP= 2.94 CP=0.02 NI= 0

RECESSION DATA
 STRIQ= -1.50 CMLSH= -0.05 MFIUR= 2.00

| UNIT | HYDROGRAPH | J1 | END-OF-PERIOD | ORDINATES | LAG= | 2.43 | HOURS | CP= | 0.02 | VAL= | 1.00 |
|------|------------|------|---------------|-----------|------|------|-------|------|------|------|------|
| 12. | 41. | 89. | 142. | 204. | 204. | 370. | 405. | 549. | | | |
| 572. | 637. | 636. | 651. | 655. | 643. | 610. | 567. | 490. | | | |
| 655. | 422. | 192. | 364. | 339. | 314. | 292. | 271. | 252. | | | |
| 217. | 202. | 188. | 174. | 162. | 150. | 140. | 130. | 121. | | | |
| 106. | 77. | 90. | 83. | 77. | 72. | 67. | 62. | 58. | | | |
| 50. | 46. | 43. | 40. | 37. | 34. | 32. | 30. | 28. | | | |
| 24. | 22. | 21. | 19. | 18. | 16. | 15. | 14. | 13. | | | |
| 11. | 10. | 9. | 8. | 8. | 7. | 7. | 7. | 6. | | | |
| 5. | | | | | | | | | | | |

40. JA HR. MN PERIOD RAIN EXCS LOSS CUMP C MU. DA HK. MN PERIOD RAIN EXCS LOSS CUMP W

SUM 23.86 21.47 2.39 3183.1.
 1 006.31 345.11 61.31 9013.861

COMBINE HYDROGRAPHS

COMBINE HYDROGRAPHS FROM STATIONS 3 AND 4

ISTAO 5 ICOMP 2 IEGON 0 ITAPE 0 JPLT 0 JPRY 0 INAME 1 ISTAGE 1 IAUU 0

HYDROGRAPH ROUTING

ROUTING FOR PAGE LAKE DAM

ISTAO 6 ICOMP 1 IELON 0 ITAPE 0 JPLJ 0 JPRY 0 INAME 1 ISTAGE 1 IAUU 0

JLOS 0.0 CLOSS 0.0 AVG 0.0 IRES 1 ISAME 1 IUPI 0 JPPM 0 LSTR 0

4STPS 1 MSTDL 0 LAG 0.0 AMSKK 0 X 0.0 STOMA 1 SPRAJ 1

| STAGE | 1433.00 | 1433.70 | 1434.50 | 1435.20 | 1436.00 | 1437.50 | 1438.20 | 1439.00 | 1439.70 | 1440.50 |
|--------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| FLUM | 0.0 | 80.20 | 226.80 | 417.00 | 641.00 | 1176.00 | 1406.00 | 1816.00 | 2107.20 | 2538.00 |
| SURFACE AREA | 97. | 103. | 175. | 274. | | | | | | |

CAPACITY= 0. 771. 1934. 6388.
 ELEVATION= 1423. 1433. 1466. 1460.

CREL SPWID 0.0 COUW EXPW ELEV COUL LAREA EXPL
 1433.0 0.0 0.0 0.0 0.0 0.0 0.0

DAM DATA
 TUPEL 1436.2
 CAPP 3.1
 UAMTU 1.5
 102.

CREST LENGTH 0. SJ. 86. 125. 185. 197. 205. 213.
AT OR BELOW 1436.2 1435.5 1437.0 1438.0 1438.5 1439.0 1439.5
ELEVATION

PEAK OUTFLOW IS 435% AT TIME 43-17 HOURS

PEAK OUTFLOW IS 1649% AT TIME 46-17 HOURS

PEAK OUTFLOW IS 198% AT TIME 45-50 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)

RATIOS APPLIED TO FLOWS

| OPERATION | STATION | AREA | PLAN | RATIO 1 | RATIO 2 | RATIO 3 |
|---------------|---------|-----------------|------|---------|---------|---------|
| | | | | 0.50 | 0.25 | 0.05 |
| HYDROGRAPH AT | 1 | 3.92
(2.46) | 1 | 1328. | 664. | 133. |
| | | | | 37.60 | 18.80 | 3.76 |
| ROUTED TO | 2 | 3.95
(2.46) | 1 | 1202. | 573. | 85. |
| | | | | 34.03 | 16.22 | 2.42 |
| ROUTED TO | 3 | 3.92
(2.46) | 1 | 1165. | 552. | 84. |
| | | | | 32.58 | 15.23 | 2.34 |
| HYDROGRAPH AT | 4 | 3.83
(2.42) | 1 | 4125. | 2063. | 413. |
| | | | | 116.82 | 58.41 | 11.68 |
| 2 COMBINED | 5 | 4.73
(2.38) | 1 | 5290. | 2611. | 483. |
| | | | | 149.79 | 73.94 | 13.68 |
| ROUTED TO | 6 | 4.73
(2.38) | 1 | 4354. | 1649. | 178. |
| | | | | 123.30 | 46.70 | 5.59 |

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 *Fouquier's Lake Dam*
 ELEVATION STORAGE 1537.00
 STORAGE 61.0
 UOIFLUM 0.0
 INITIAL VALUE 1537.00
 SPILLWAY CREST 1537.00
 TUP OF DAM 1539.60
 119.0
 371.0

| RATIO OF PNE | MAXIMUM DEPTH OVER DAM | MAXIMUM STORAGE AC=FT | MAXIMUM UOIFLUM CFS | DURATION OVER TUP HOURS | TIME OF MAX UOIFLUM HOURS | TIME OF FAILURE HOURS |
|--------------|------------------------|-----------------------|---------------------|-------------------------|---------------------------|-----------------------|
| 0.50 | 1.68 | 157. | 1202. | 5.83 | 41.20 | 0.0 |
| 0.25 | 0.44 | 123. | 573. | 3.00 | 41.87 | 0.0 |
| 0.05 | 0.0 | 82. | 85. | 0.0 | 42.61 | 0.0 |

PLAN 1 STATION 3

| RATIO | MAXIMUM FLUM,CFS | MAXIMUM STAGE,FT | TIME HOURS |
|-------|------------------|------------------|------------|
| 0.50 | 1165. | 1486.1 | 42.00 |
| 0.25 | 552. | 1484.2 | 42.17 |
| 0.05 | 83. | 1482.3 | 43.33 |

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 PASS...LARGE...DAM

| | | | |
|-----------|---------------|----------------|------------|
| ELEVATION | INITIAL VALUE | SPILLWAY CREST | TOP OF DAM |
| STORAGE | 1433.00 | 1433.00 | 1436.20 |
| OUTFLOW | 971. | 971. | 1348. |
| | 0. | 0. | 113. |

| RATIO OF PRF | 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 |
|--------------|-----------------------------|------------------------|-----------------------|---------------------|-------------------------|---------------------------|-----------------------|
| 0.50 | 1439.54 | 3.34 | 1854. | 4354. | 11.83 | 43.17 | 0.0 |
| 0.25 | 1437.74 | 1.54 | 1566. | 1649. | 8.17 | 48.17 | 0.0 |
| 0.05 | 1434.34 | 0.0 | 1117. | 198. | 0.0 | 45.50 | 0.0 |

APPENDIX E

PLATES

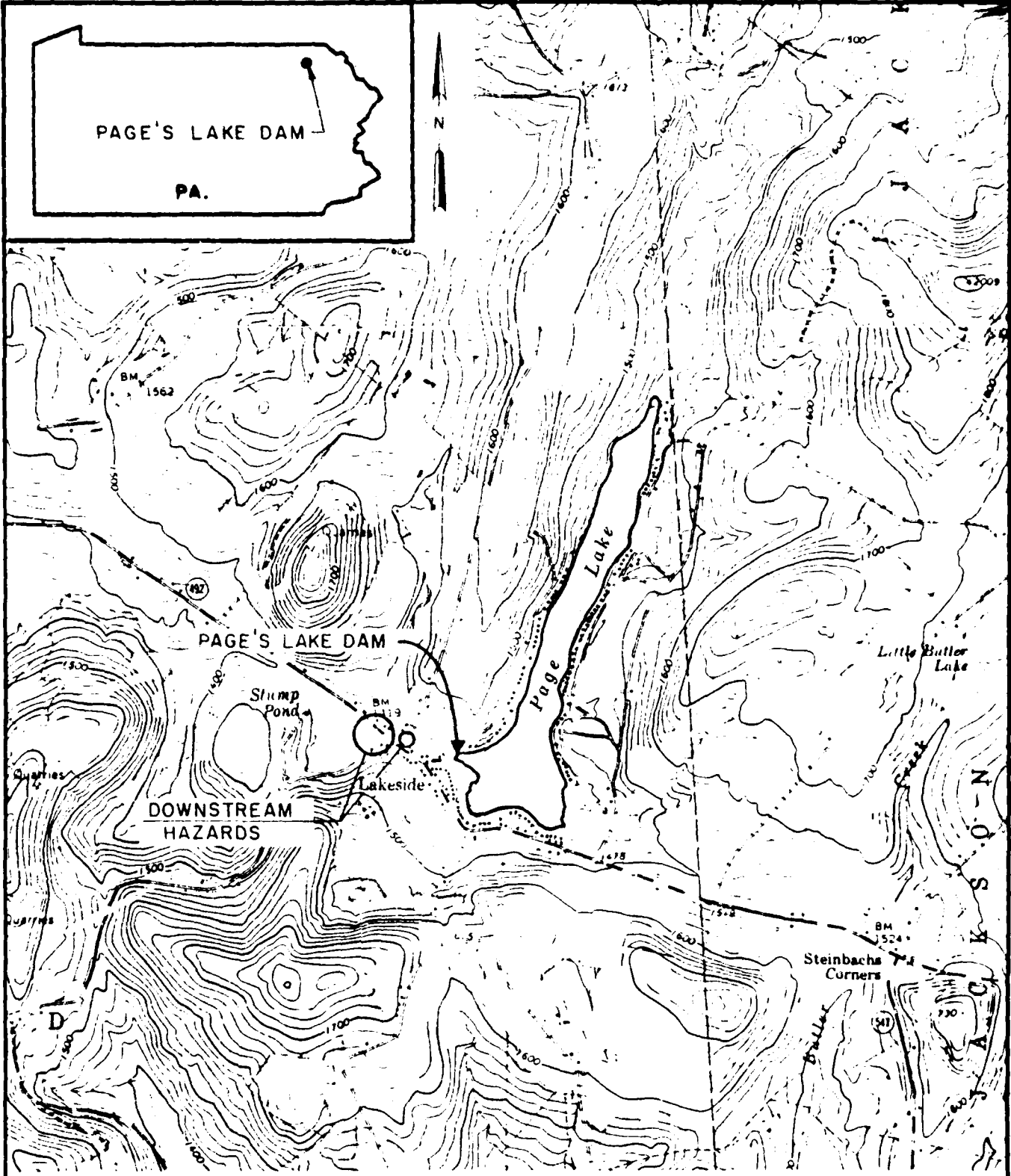
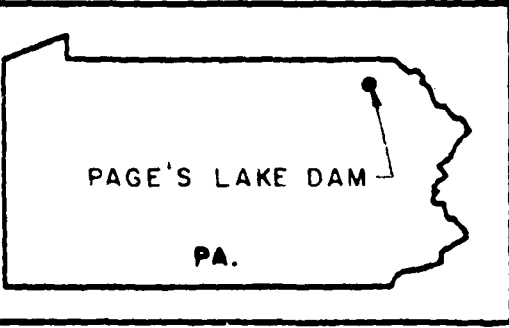
CONTENTS

Plate 1 - Location Plan

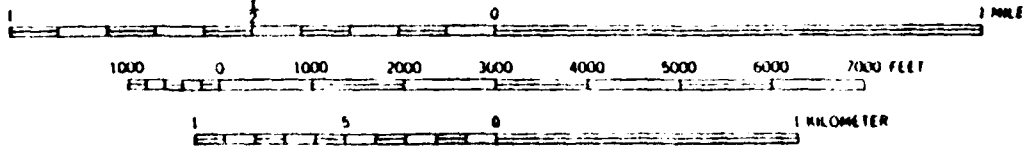
Plate 2 - Watershed Map

Plate 3 - 1913 Drawing Showing Profile and Cross Section
of Dam

Plate 4 - Drawdown Control Structure



SCALE 1:24000

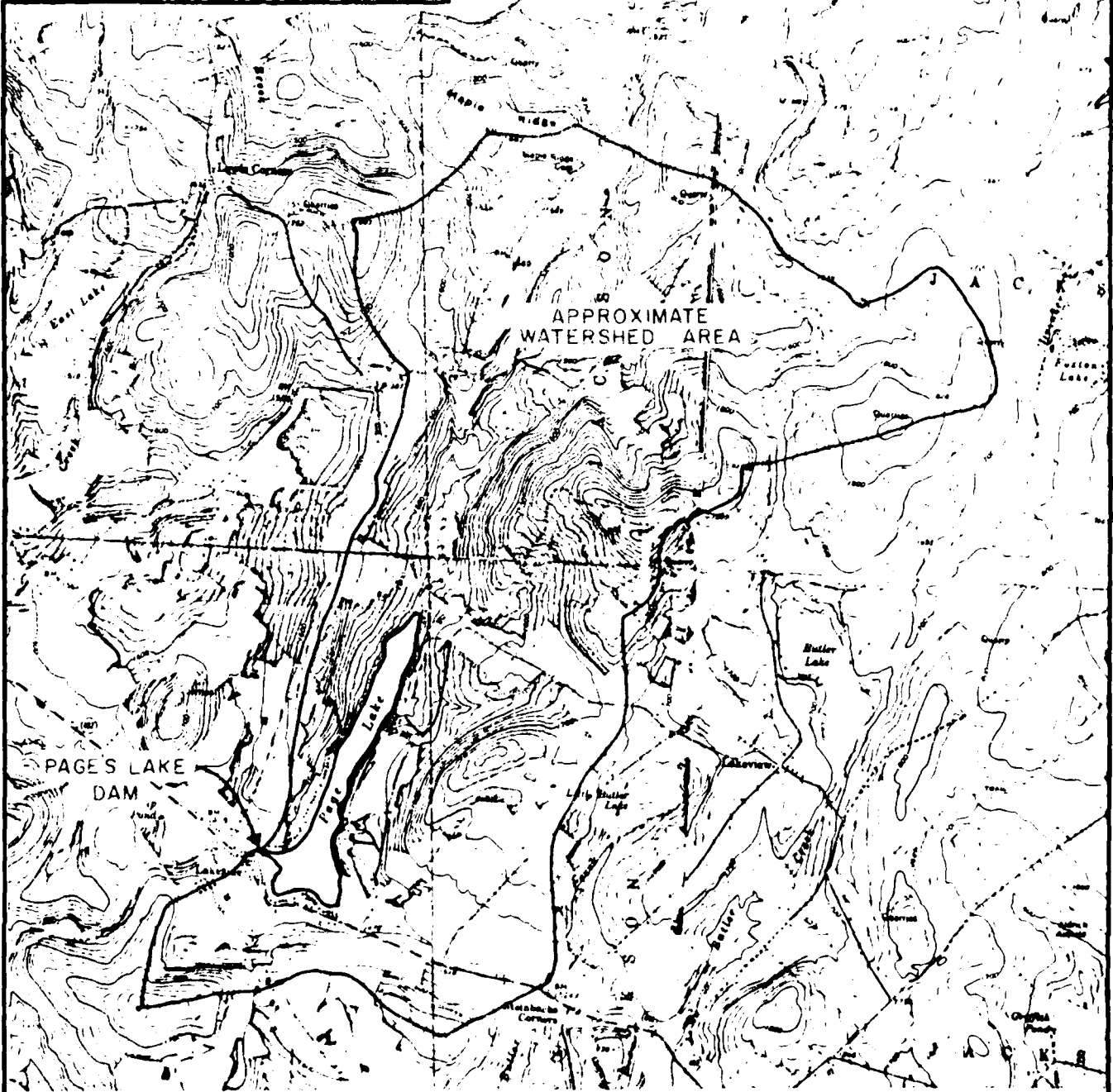
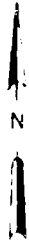


- REFERENCES:
 1. U.S.G.S. 7.5' HARFORD, PA. QUADRANGLE PHOTOREVISED 1978
 2. U.S.G.S. 7.5' GREAT BEND, PA. QUADRANGLE PHOTOREVISED 1978

PLATE 1 LOCATION PLAN
 PAGE'S LAKE DAM

PAGE'S LAKE DAM

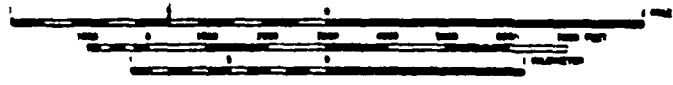
PA.



APPROXIMATE
WATERSHED AREA

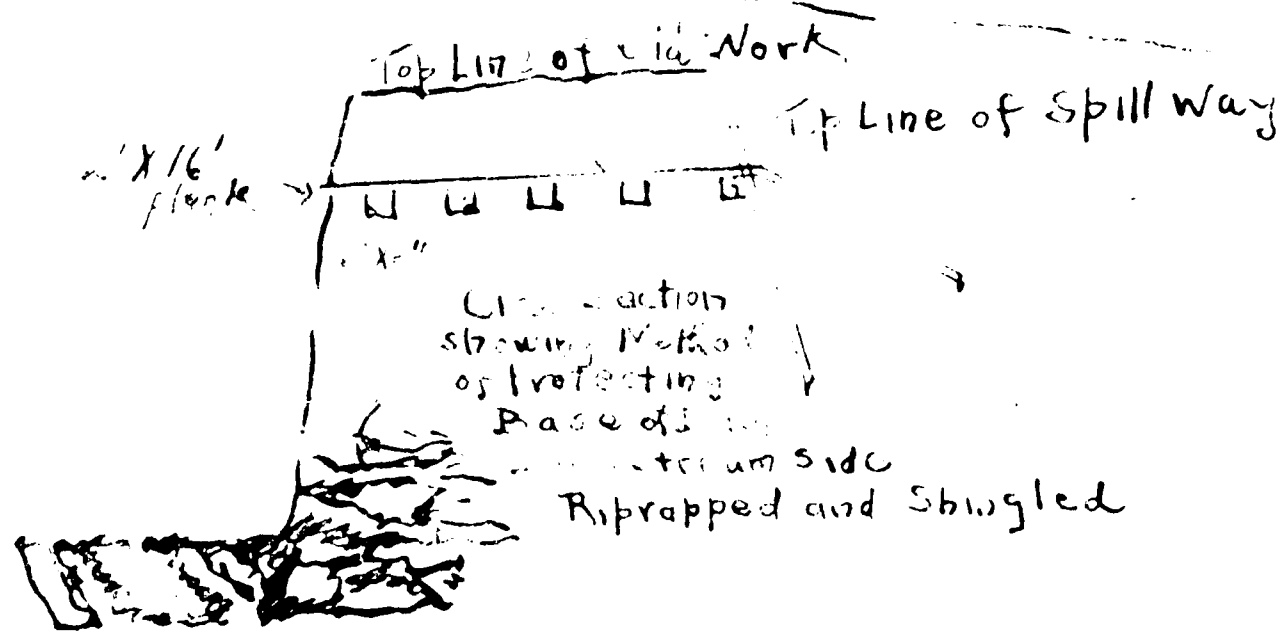
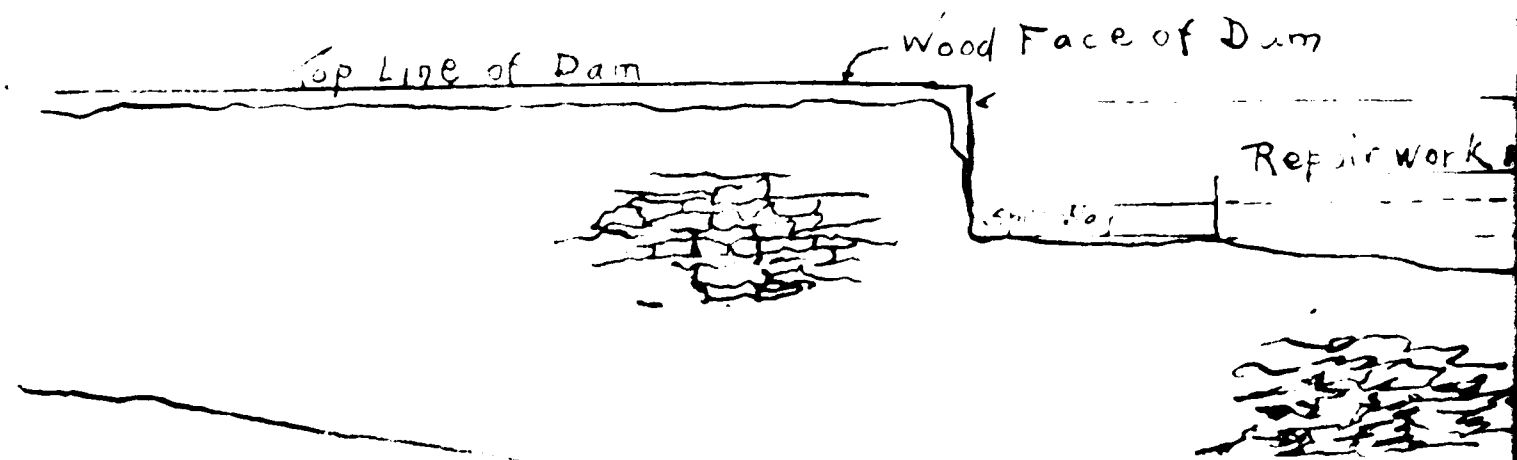
PAGE'S LAKE
DAM

SCALE 1:32,640



- REFERENCES:
1. U.S.G.S. 75 SUSQUEHANNA, PA
QUADRANGLE 1968
 2. U.S.G.S. 75 THOMPSON, PA
QUADRANGLE PHOTOREVISED 1978
 3. U.S.G.S. 75 HARFORD, PA
QUADRANGLE PHOTOREVISED 1978
 4. U.S.G.S. 75 GREAT BEND, PA
QUADRANGLE PHOTOREVISED 1978

PLATE 2 WATERSHED MAP
PAGE'S LAKE DAM



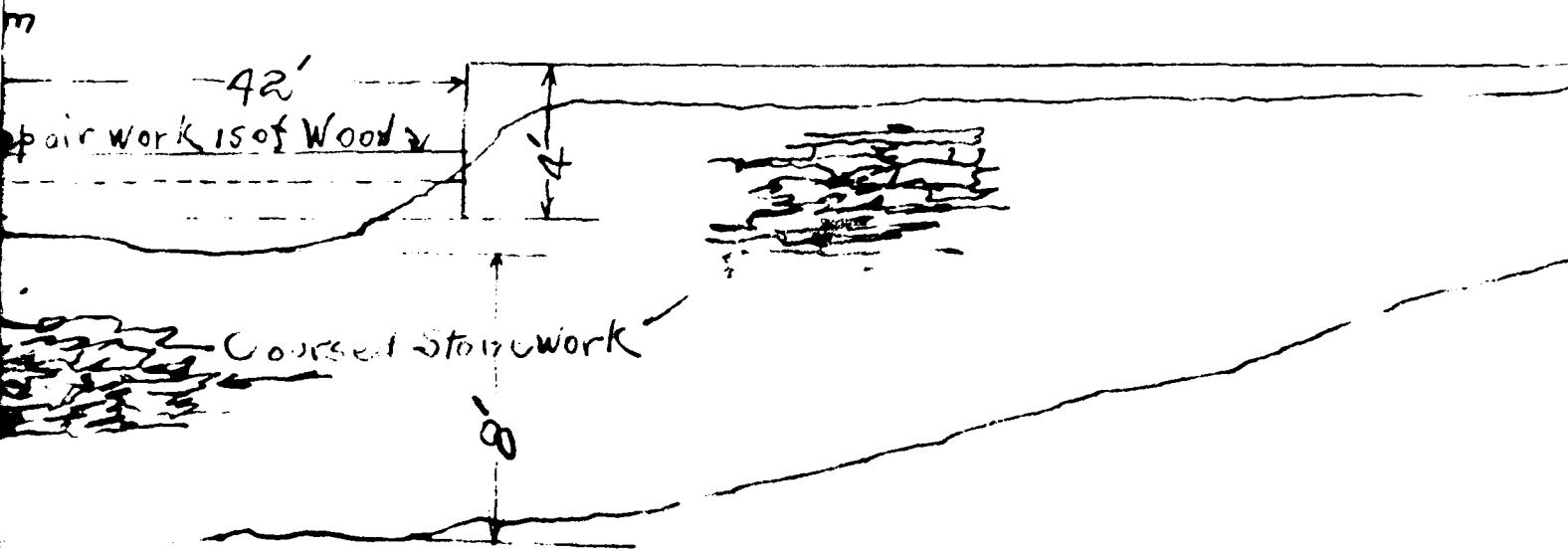


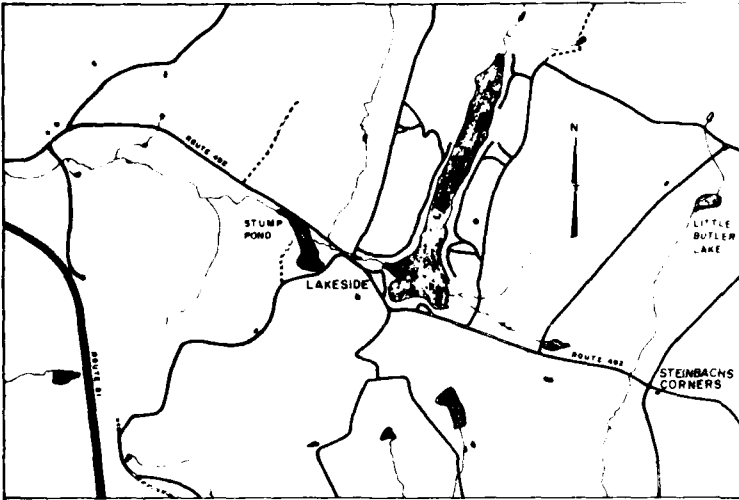
PLATE-3

DAM at PAGES POND showing present condition
and Proposed Crest of Dam.

December 23rd 1913.

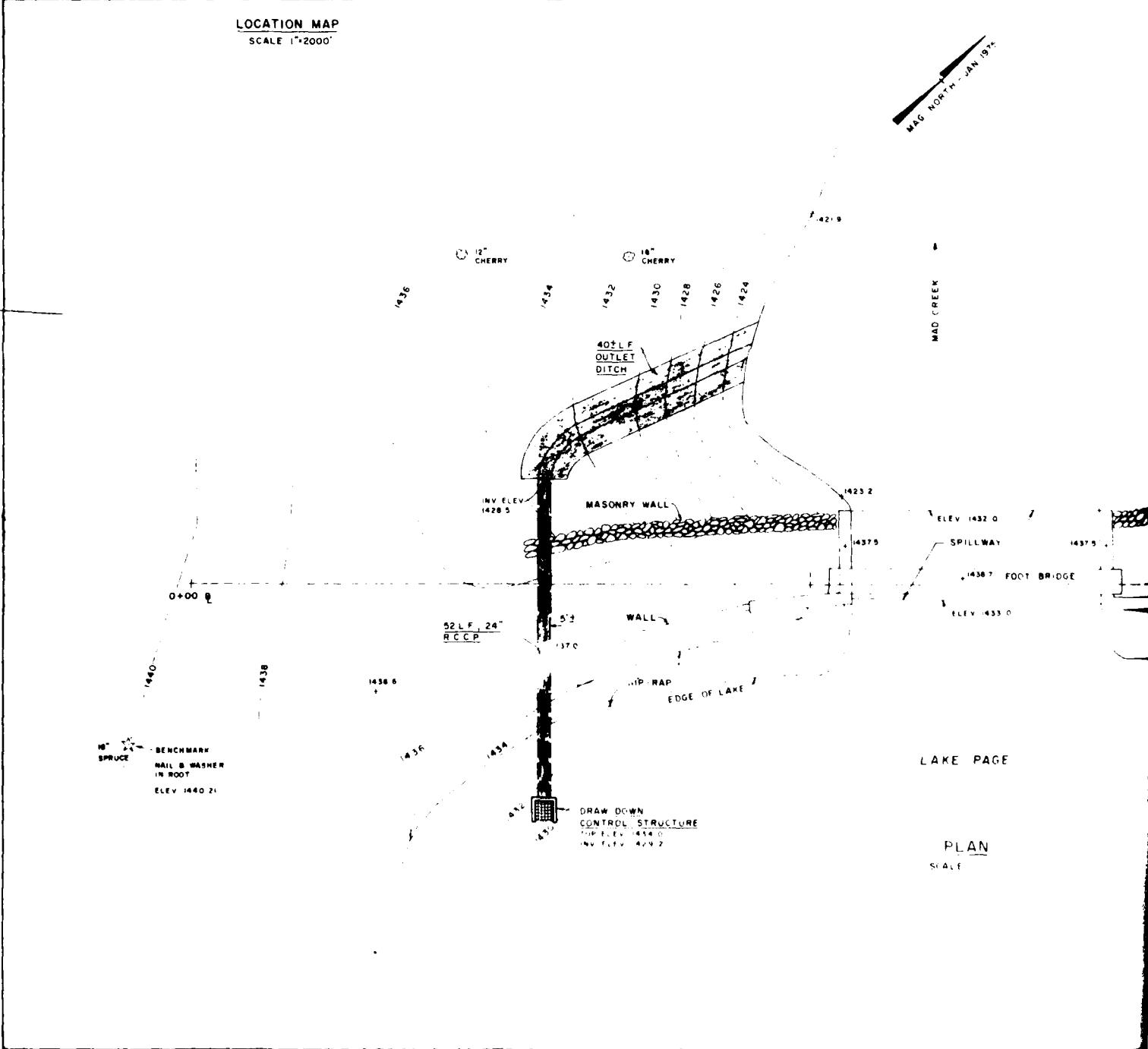
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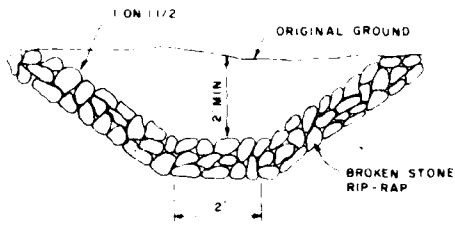
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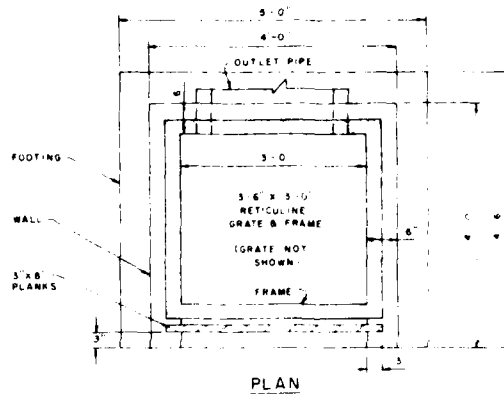
LOCATION MAP
SCALE 1"=2000'

MAG NORTH - JAN 1977

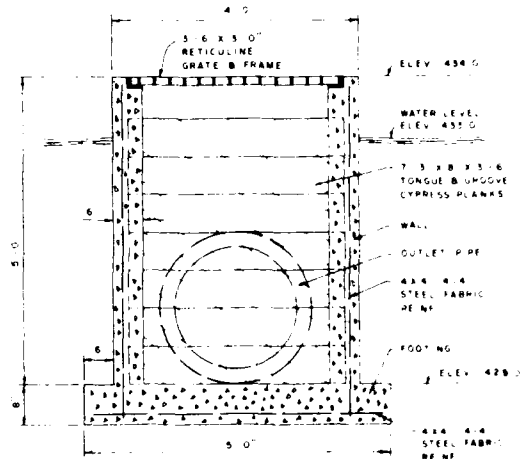




OUTLET DITCH
SCALE 1/2" = 1'-0"

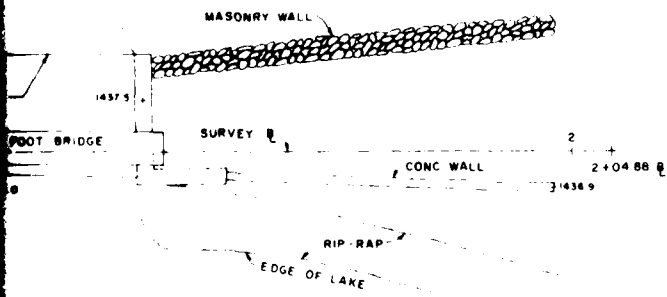


PLAN



SECTION

**PRE-CAST CONCRETE
DRAW-DOWN CONTROL STRUCTURE**
SCALE 3/4" = 1'-0"



NOTES

- 1 NAME & ADDRESS OF LAKE OWNER & OPERATOR
LAKESIDE OUTING CLUB
RD #2
NEW MILFORD, PENN 18834
- 2 ELEVATIONS ARE REFERENCED TO U.S.G.S DATUM
- 3 ALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE APPLICABLE REQUIREMENTS OF THE COMMONWEALTH OF PENNSYLVANIA, DEPARTMENT OF ENVIRONMENTAL RESOURCES
- 4 THE PIPE BACKFILL THROUGH THE DAM SHALL BE MADE WITH IMPERVIOUS MATERIAL AND SHALL BE THOROUGHLY COMPACTED SO AS TO BE IMPERVIOUS

PLATE - 4

DRAW-DOWN CONTROL STRUCTURE

LAKE PAGE

NEW MILFORD TOWNSHIP
SUSQUEHANNA COUNTY
PENNSYLVANIA

C.J. WINTERBERGER - CIVIL ENGR - SURVEYOR
VESTAL, NY MAY 9, 1975



APPENDIX F

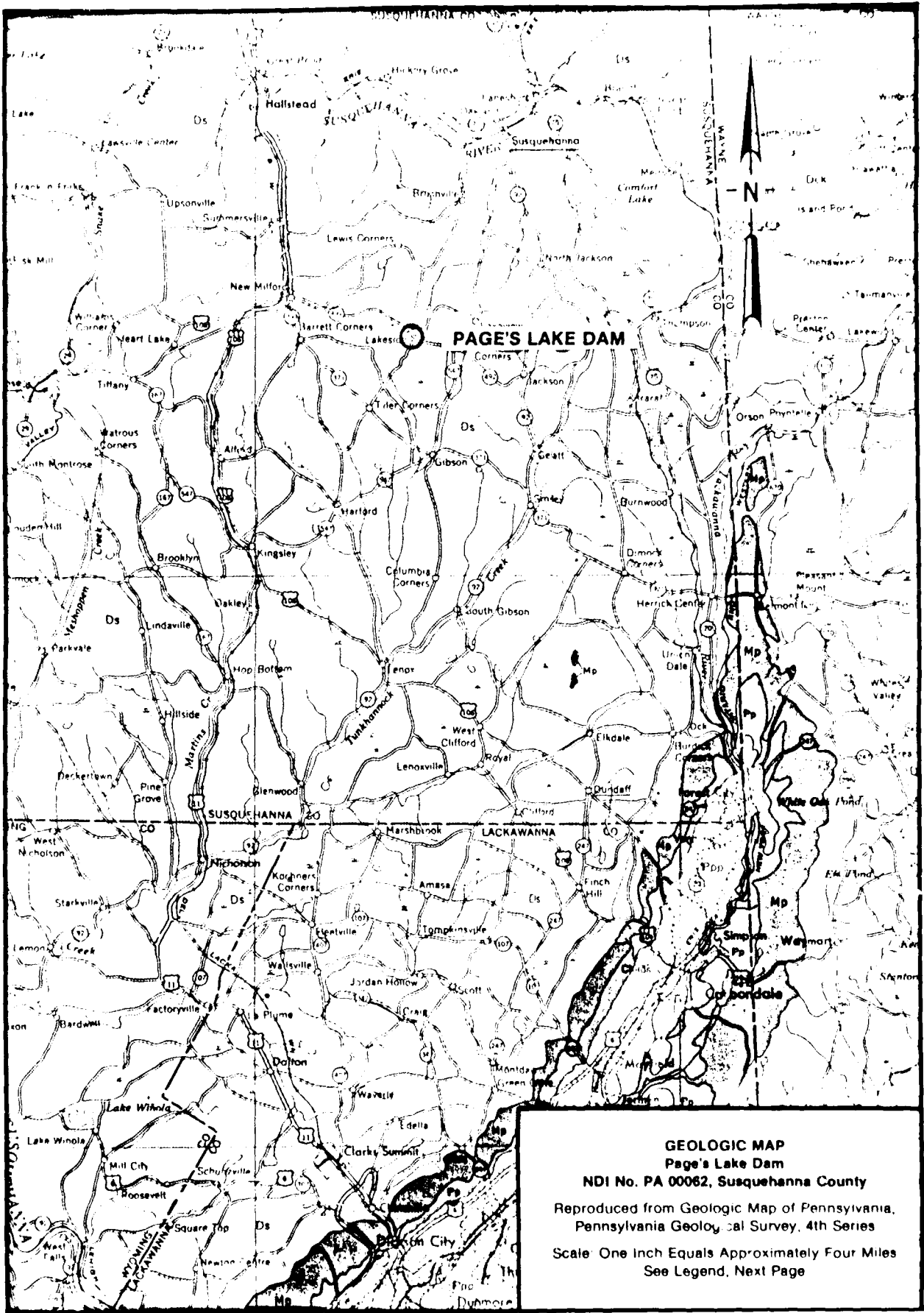
REGIONAL GEOLOGY

PAGE'S LAKE DAM
NDI No. PA 00062, PennDER No. 58-5

REGIONAL GEOLOGY

Page's Lake Dam is situated in the Glaciated Low Plateaus physiographic province. The area has undergone at least three stages of glaciation and is presently covered with Wisconsin Stage glacial deposits. According to the Soil Conservation Service's Soil Survey for Susquehanna County, the surface soils consist primarily of stoney, silt loams of the Morris-Wellsboro-Volusia association. No test boring data were available for review on this project, thus, the thickness of this overburden could not be ascertained.

Geologic references indicate that the bedrock in the vicinity of the dam consists primarily of members of the Catskill Formation in the Susquehanna Group. These are chiefly red and gray shales and sandstones of Upper Devonian age. The formation may also contain scattered, thin streaks of coal and scattered fish remains. The strata in the Page's Lake area were deposited in a bay or delta front environment and remain essentially horizontal after the Appalachian Uplift.



GEOLOGIC MAP
Page's Lake Dam
NDI No. PA 00062, Susquehanna County





Reproduced from Geologic Map of Pennsylvania,
 Pennsylvania Geological Survey, 4th Series

Scale One Inch Equals Approximately Four Miles
 See Legend, Next Page





GEOLOGY MAP LEGEND

DEVONIAN UPPER









WESTERN PENNSYLVANIA

- 
Doe Dr
Oswayo Formation
Greenish gray to gray shales, sandstones and siltstones becoming increasingly shaly westward, considered equivalent to type Oswayo, Riverside Formation (in Erie and Crawford Counties, probably not distinguishable north of Corry.
- 
Ocr
Cattaraugus Formation
Red, gray and brown shales and sandstones with the proportion of red decreasing westward, includes Venango, mass of shales and Salamanca sandstone and conglomerate, some limestone in Crawford and Erie counties.
- 
Dcl
Conneaut Group
Alternating gray, brown, greenish and purplish shales and siltstones, includes "pink rock" of shales and "Chemung" and "Lizard" Formations of northwestern Pennsylvania.
- 
Dcr
Canadaway Formation
Alternating brown shales and sandstones, includes "Potage" Formation of northwestern Pennsylvania.

CENTRAL AND EASTERN PENNSYLVANIA

- 
Doe
Oswayo Formation
Brownish and greenish gray, fine and medium grained sandstones with some shales and scattered calcareous lenses, includes red shales which become more numerous toward Relation to type Oswayo not proved.
- 
Dck
Catskill Formation
Chiefly red to brownish shales and sandstones in later gray and greenish siltstone, limestones named Elk Mountain, Haverhill, Shabola, and Delaware River in the east.
- 
Dm
Marine beds
Gray to olive brown shales, graywackes, and sandstones, contains "Chemung" beds and "Potage" beds, including Buckle, Buller, Haverhill, and Trimmers Rock, Tully Limestone at base.
- 
Ds
Susquehanna Group
Barbed line in "Chemung Catskill" contact of Second Pennsylvania Survey County reports barbed "Chemung" side of line.

MIDDLE AND LOWER

- 
Dh
Hamilton Group

- 
Mahantango Formation
Brown to olive shale with interbedded sandstones which are dominant in places (Montebello), highly fossiliferous in upper part, contains "Centerfield coral bed" in eastern Pennsylvania.
- 
Marcellus Formation
Black, fossiliferous, carbonaceous shale with thick brown sandstone (Turkey Ridge) in parts of central Pennsylvania.
- 
Onondaga Formation
Greenish blue, thin bedded shale and dark blue to black, medium bedded limestone with shale predominant in most places, includes Selin Grove Limestone and Needmore Shale in central Pennsylvania, Butterfield Falls Limestone and Ewings Shale in easternmost Pennsylvania, in Lehigh Gap area includes Palmerton Sandstone and Howmanstown Chert.
- 
Oriskany Formation
White to brown, fine to coarse grained, partly calcareous, locally conglomeric, fossiliferous sandstone (Ridgely) at the top, dark gray, cherty limestone with some interbedded shales and sandstones below (Shreves).
- 
Helderberg Formation
Dark gray, calcareous, thin bedded shale (Mandata) at the top, equivalent to Port Ewen Shale and Haverhill Limestone in the east, dark gray, cherty, thin bedded, fossiliferous limestone (New Scotland) with some local sandstones in the middle and, at the base, dark gray, medium to thick bedded, crystalline limestone (Cumant) sandy and shaly in places with some chert nodules.
- 
Dmo