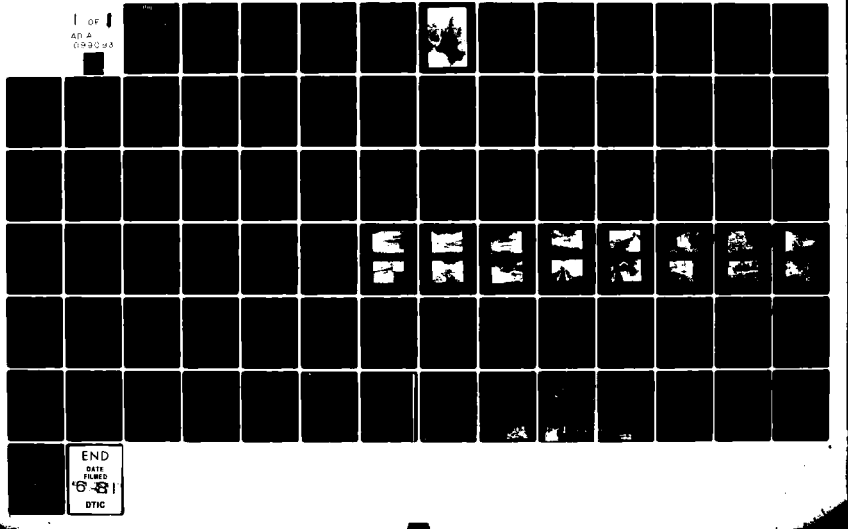
AD-A099 083 BAKER (MICHAEL) JR INC BEAVER PA F/G 13/13
NATIONAL DAM INSPECTION PROGRAM. DUBOIS CREEK DAM, (NDI NUMBER --ETC(U)
FEB 81 J A DZIUBEK DACW31-81-C-0011
UNCLASSIFIED NL



END
DATE FILMED
6-81
DTIC

SUSQUEHANNA RIVER BASIN

DuBOIS CREEK, SUSQUEHANNA COUNTY

PENNSYLVANIA

DuBOIS CREEK DAM

NDI No. PA 00064

PennDER NO. 58-8

Dam Owner: Keystone Water Company

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

DACW31-81-C-0011

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

SUSQUEHANNA RIVER BASIN

DuBOIS CREEK DAM
SUSQUEHANNA COUNTY, COMMONWEALTH OF PENNSYLVANIA
NDI No. PA 00064
PennDER No. 58-8

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM.

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

Feb[redacted]81

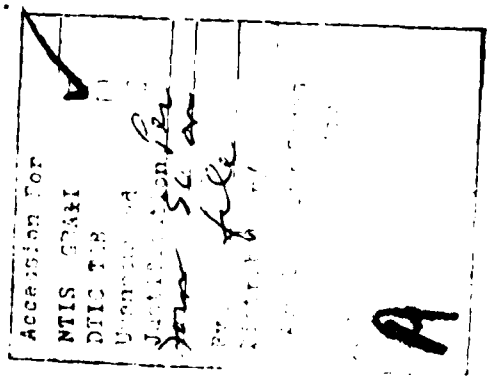
PREFACE

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.



PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

DuBois Creek Dam, Susquehanna County, Pennsylvania
NDI No. PA 00064, PennDER No. 58-8
DuBois Creek
Inspected 28 October 1980

ASSESSMENT OF GENERAL CONDITIONS

DuBois Creek Dam is a "Significant" hazard - "Small" size dam owned and operated by the Keystone Water Company, Hallstead District. The dam was found to be in poor overall condition at the time of inspection.

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 spillway design flood (SDF) without overtopping the dam. An SDF in the range of the 100-year flood to the 1/2 Probable Maximum Flood (1/2 PMF) is required for DuBois Creek Dam. The 100-year flood was chosen because the dam is on the low end of the "Small" size category based on storage capacity. During the 100-year flood, the dam is overtopped by a maximum depth of 0.86 feet for a total duration of 4.50 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.

The inspection revealed certain items of remedial work which should be immediately performed by the owner. Items 1 and 2 below should be completed under the direction of a qualified professional engineer experienced in the design and construction of earth dams and appurtenant structures. These include:

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

2) Provide upstream closure for the intake.

3) Repair the spalled and deteriorated portions of the concrete core wall.

4) Repair the spillway structure to prevent seepage and undermining.

5) Fill the erosion gullies on the dam and reseed the areas.

6) Remove the debris and sediment at the left side of the spillway approach channel.

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

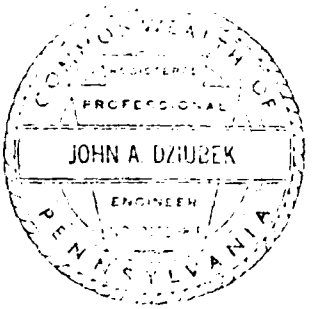
1) Develop a detailed emergency operation and warning system.

2) During periods of unusually heavy rainfall, 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 operational procedures and records be developed and implemented. An emergency drawdown plan should be developed in case emergency drawdown of the reservoir 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, P.E.
Engineering Manager-Geotechnical

Date: 19 February 1981

Approved by:

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS

JAMES W. PECK
COL, Corps of Engineers
District Engineer

Date: 13 MAR 81

DuBOIS CREEK DAM

Overall View of Dam from Left Abutment

TABLE OF CONTENTS

APPENDICES

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
DuBOIS CREEK DAM
NDI No. PA 00064, PennDER No. 58-8

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 - DuBois Creek Dam is a diaphragm earthfill embankment 321 feet long and 22 feet high. The embankment has a side slope of 3H:1V (Horizontal to Vertical) downstream and 3H:1V upstream. The upstream face of the embankment is protected with riprap. The top of the core wall is 3 feet wide and increases in width to the base which is socketed 5 feet into the foundation. The base width is shown on Plate 5 (Appendix E) to be 6 feet. The top of the core wall extends 3 feet and 5 feet above the upstream and downstream crests of the embankment, respectively. The crest of the dam is 8 feet wide.

The spillway is located at the left abutment and consists of a broad crested concrete weir. The weir is 113.5 feet long perpendicular to the direction of flow. The spillway training walls extend approximately 3.5 feet above the crest of the spillway and are constructed of both concrete and stone. The floor of the spillway channel consists of large stones grouted in place and extends 64 feet downstream of the crest of the weir.

The outlet works for the dam consist of a submerged intake, a 12 inch cast-iron pipe through the embankment to the chlorinator building at the downstream toe of the embankment, a 10 inch service

line, and a 20 inch blow-off pipe. Both the 10 and 20 inch lines are operated by gate valves housed in the chlorinator building.

b. Location - DuBois Creek Dam is located on DuBois Creek, approximately 2.1 miles southwest of Hartford, Pennsylvania. The structure is located in Liberty Township, Susquehanna County, Pennsylvania and the coordinates of the dam are N 41° 56.4' and W 75° 46.2'. The dam can be located on Franklin Forks, Pennsylvania USGS 7.5 minute topographic quadrangle.

c. Size Classification - The height of the dam is 22 feet. Storage at the top of the dam (Elevation 1085.4 feet Mean Sea Level [ft. M.S.L.]) is 78.0 acre-feet. The dam is therefore in the "Small" size category.

d. Hazard Classification - Loss of life is not likely in the event of failure of DuBois Creek Dam. However, damage will likely occur to one home located 1,000 feet downstream and two additional homes located 3,000 feet downstream of the dam. Therefore, DuBois Creek Dam is classified in the "Significant" hazard category.

e. Ownership - The dam is owned and operated by the Keystone Water Company, Hallstead District, 216 Willow Avenue, Susquehanna, Pennsylvania 18847. Mr. Wallace E. Rhodes is the District Manager.

f. Purpose of Dam - The impoundment created by the dam serves as a water supply source for the Keystone Water Company.

g. Design and Construction History - DuBois Creek Dam was designed by Dunning Engineering Company of Scranton, Pennsylvania in 1905. The contractor and date of construction are not known.

h. Normal Operational Procedures - The reservoir is typically maintained at the spillway crest during the fall, winter and spring, and is drawn down several feet during the summer. The dam is visited every day during fall, winter and spring, and is visited in the summer twice a week.

1.3 PERTINENT DATA

a.	Drainage Area (square miles) -	7.77

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

Maximum Known Flood - (Tropical Storm Agnes, 1972)	540
Spillway Capacity at Maximum Pool (El. 1085.4 ft. M.S.L.) -	2200

c. Elevation (feet above M.S.L.)* -

Design Top of Dam -	Unknown
Minimum Top of Dam -	1085.4
Maximum Design Pool -	Unknown
Spillway Crest -	1082.0
Streambed at Toe of Dam -	1063.8
Maximum Tailwater of Record -	Unknown

d. Reservoir (feet) -

Length of Maximum Pool (El. 1085.4 ft. M.S.L.) -	1065
Length of Normal Pool (El. 1082.0 ft. M.S.L.) -	890

e. Storage (acre-feet)

Top of Dam (El. 1085.4 ft. M.S.L.) -	78
Normal Pool (El. 1082.0 ft. M.S.L.) -	50

f. Reservoir Surface (acres) -

Top of Dam (El. 1085.4 ft. M.S.L.) -	7.4
Normal Pool (El. 1082.0 ft. M.S.L.) -	7.35

g. Dam -

Type - Diaphragm earthfill with concrete core wall	
Total Length (feet) -	321
Height (feet) - Design -	Unknown
Field -	22
Top Width (feet) -	8.0
Side Slopes - Upstream -	3H:1V
Downstream -	3H:1V

*All elevations referenced to the spillway crest, El. 1082.0 ft. M.S.L., as estimated from Franklin Forks, Pennsylvania USGS 7.5 minute topographic quadrangle map.

Zoning - None
Impervious Core - Concrete Core Wall

Cut-off - According to the original report on the dam (dated 11 May 1917), the concrete core wall was extended 5 feet lower than the original streambed.

Drains - None

h. Diversion and Regulating Tunnel - None

i. Spillway -

Type - Broad crested weir
Location - Left abutment
Length of Crest Perpendicular to Flow (feet) - 113.5
Width of Crest Parallel to Flow (feet) - 3
Crest Elevation (ft. M.S.L.) - 1082.0
Gates - None
Downstream Channel - Rectangular channel with stone and concrete walls. The channel bottom consists of large stones concreted in place.

j. Outlet Works - The outlet works consist of a submerged intake with a 12 inch cast-iron pipe (C.I.P.) through the embankment to the chlorinator building at the downstream toe of the embankment. There is a 20 inch ductile iron pipe blow-off line and a 10 inch C.I.P. service line which lead out of the chlorinator building. The gate valves for both these lines are located in the chlorination building.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

The information reviewed consisted of the Pennsylvania Department of Environmental Resources' (PennDER, File No. 58-8. This file contained the following information:

1) Drawing of the dam by Dunning Engineering Company, dated 1905 (Plate 5).

2) The earliest inspection report by the Office of the Water Supply Commission of Pennsylvania, dated 13 July 1916.

3) A directive from the Water Supply Commission directing the Hallstead & Great Bend Water Company to improve the spillway to handle a higher discharge rate.

4) Plans showing the spillway to be widened from 50 feet to 115 feet, dated 1919 (Plate 3). During the field inspection conducted on 28 October 1980, the spillway was measured to be 113.5 feet wide.

5) Post Construction inspection reports and photos. The latest inspection, dated 8 August 1965, reported no serious problems. Several earlier inspection reports indicated problems with the spillway channel collapsing, deterioration of the exposed sections of the concrete core wall, and some seepage along the chlorination building.

2.2 CONSTRUCTION

There is no information available regarding construction of the dam from either the owner or PennDER File 58-8.

2.3 OPERATION

The Keystone Water Company is responsible for all operations and maintenance on the dam.

2.4 EVALUATION

a. Availability - The information used is readily available from PennDER File 58-8.

b. Adequacy - The information available is adequate for a 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 inspection was performed on 28 October 1980. A light rain was falling at the time of inspection. The dam and appurtenant structures were found to be in poor overall condition at the time of inspection. Noteworthy deficiencies observed during the visual inspection are described in the following paragraphs. The complete visual inspection check list, field sketch, top of dam profile and typical cross-section are presented in Appendix A.

b. Dam - Seepage was observed at three locations passing through deteriorated portions of the concrete core wall. The most severe of these locations was near Station 2+85 (see Field Sketch in Appendix A) where approximately 10 gallons per minute (g.p.m.) of seepage was occurring. These seepage areas are the result of progressive deterioration of the exposed areas of the concrete core wall. The seepage has caused erosion gullies and slight irregularities on the downstream face of the dam.

c. Appurtenant Structures - Seepage was observed and heard passing under the weir and spillway channel slab on the left side of the spillway. Progressive undermining and future wash-out of portions of this structure may occur if it is not properly repaired. Seepage was observed exiting from the right spillway training wall at the toe of the embankment. This seepage is presumably from flow in or under the spillway channel slab. Some debris and sediment was present at the left side of the spillway approach channel.

The intake structure was submerged during the inspection. No upstream closure is provided for the outlet pipe which passes through the embankment.

d. Reservoir Area - The reservoir side slopes are relatively steep and heavily wooded. No signs of instability were observed. The watershed is primarily forested. The owner's representative indicated that, at the present time, sedimentation has reduced the reservoir storage volume by approximately one-third.

e. Downstream Channel - The downstream channel has mild slopes through a wide forested valley. Several small wooden bridges are located over the channel but these bridges should not significantly restrict flow. One home is located 1,000 feet downstream of the dam. Two additional homes are located 3,000 feet downstream of the dam. DuBois Creek flows along the northwest edge of Hallstead, Pennsylvania before its confluence with the Susquehanna River.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

There are no formal procedures for lowering 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

Generally, the maintenance procedures followed are adequate; however, a more formal maintenance program and procedures should be developed.

4.3 MAINTENANCE OF OPERATING FACILITIES

The spillway channel is repaired and the blow-off line is cleaned every year. Maintenance is performed on an as-needed basis. It is recommended that a formal operation and preventive maintenance schedule be developed and implemented. An emergency drawdown plan should be developed in case emergency drawdown of the reservoir 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 DuBois Creek Dam.

b. Experience Data - The maximum flood of record occurred during Tropical Storm Agnes in 1972, at which time a depth of 1.0 feet over the spillway was reported. This depth gives a calculated flow of approximately 540 c.f.s. through the spillway.

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.

d. Overtopping Potential - DuBois Creek Dam is a "Small" size - "Significant" hazard dam requiring evaluation for a spillway design flood (SDF) in the range of the 100-year flood to the 1/2 Probable Maximum Flood (1/2 PMF). Because the dam is on the low end of the "Small" size category in terms of storage capacity, the 100-year flood was chosen as the SDF.

Using material from "The Hydrologic Study - Tropical Storm Agnes" prepared by the Special Studies Branch, Planning Division, North Atlantic Division, Corps of Engineers, in New York City, December 1975, the peak inflow to the impoundment for the 100-year flood was calculated to be 3750 c.f.s. The hydraulic characteristics of the basin, specifically, the Snyder's unit hydrograph parameters, were obtained from a regionalized analysis conducted by the Baltimore District of the U.S. Army Corps of Engineers. Using these parameters and 1.0 inches initial loss and a constant loss of 0.05 inches/hour, a peak inflow of 3690 c.f.s. was obtained for the 100-year flood. This peak flow is within 2 percent of the peak flow computed previously; therefore, this hydrograph was used for the hydraulic analysis.

The hydraulic capacity of the dam, reservoir, and spillway was then assessed by utilizing the U.S. Army Corps of Engineers' Hydrograph Package, HEC-1 DB.

Analyses of the dam and spillway shows that the dam will be overtopped during the 100-year flood by a maximum depth of 0.86 feet for a total duration of 4.50 hours.

e. Spillway Adequacy - As outlined in the above analyses, 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 - The seepage observed passing through the deteriorated portions of the core wall indicate that repair of the exposed portions of the core wall should be accomplished. Also, the seepage and undermining of the spillway structure is a long-term progressive type problem which should be corrected.

b. Design and Construction Data - Calculations of slope and structural stability were not available for review. The slopes have had a history of satisfactory performance, including occasional drawdown of the reservoir during the summer season. In view of the modest height of the dam and a history of satisfactory performance of its moderate slopes, no further stability analysis is deemed necessary.

c. Operating Records - Nothing in the procedures described by the owner's representative indicates concern relative to 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 - DuBois Creek Dam was found to be in poor overall condition at the time of inspection. DuBois Creek Dam is a "Significant" hazard - "Small" size dam requiring an SDF in the range of the 100-year flood to 1/2 PMF. The 100-year flood was chosen as the SDF because the dam is on the low side of the "Small" size category. As presented in Section 5, the spillway and reservoir are not adequate to pass the 100-year flood without overtopping the dam. During the 100-year flood, the dam is overtopped by a maximum depth of 0.86 feet for a total duration of 4.50 hours. Therefore, the spillway is considered "Inadequate."

   The core wall, where the seepage was observed exiting through it, should be repaired. Also, the seepage and undermining of the spillway structure will become progressively worse with time and the spillway structure should be repaired.

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

c. Urgency - The owner should immediately initiate the action discussed in paragraph 7.1.d.

d. Necessity for Additional Data/Evaluation - The hydraulic/hydrologic analysis performed for this dam has indicated the need for additional spillway capacity. It is recommended that the owner of DuBois Creek Dam immediately initiate an engineering study to further evaluate the spillway capacity and to develop recommendations for reducing the overtopping potential of the dam.

7.2 RECOMMENDATIONS/REMEDIAL MEASURES

The inspection and review of information revealed certain items of work which should be performed immediately by the owner. Items 1 and 2 should be designed and completed under the guidance of a qualified professional engineer experienced in the design of earth dams and appurtenant structures.

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

2) Provide upstream closure for the intake.

3) Repair the spalled and deteriorated portions of the concrete core wall.

4) Repair the spillway structure to prevent seepage and undermining.

5) Fill the erosion gullies on the dam and reseed the areas.

6) Remove the debris and sediment at the left side of the spillway approach 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 rainfall, 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 operational procedures and records be developed and implemented. An emergency drawdown plan should be developed in case emergency drawdown of the reservoir 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 DuBois Creek Dam County Susquehanna State PA **Coordinates** Lat. N 41°56.4'

Long. W 75°46.2'

NDI # PA 00064
PennDER # 58-8

Date of Inspection 28 October 1980 Weather Rainy Temperature 35° F.

Pool Elevation at Time of Inspection 1082.0 ft.* M.S.L. Tailwater at Time of Inspection 1063.83 ft.* M.S.L.

*All elevations referenced to assume datum for reservoir level from Franklin Forks, PA U.S.G.S. 7.5 minute topographic quadrangle map.

Inspection Personnel:

Michael Baker, Jr., Inc.:

James G. Ulinski
Wayne D. Lasch
Jeff S. Maze

Owner's Representatives:

Bruce Juergens, American Water Works Service Co., Inc.
Wallace E. Rhodes, Keystone Water Co.
William E. Hutcheson, Keystone Water Co.

James G. Ulinski Recorder

CONCRETE/MASONRY DAMS - Not Applicable

Name of Dam: DUBOIS CREEK DAM

NDI # PA 00064

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
LEAKAGE		
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS		
DRAINS		
WATER PASSAGES		
FOUNDATION		

CONCRETE/MASONRY DAMS - Not Applicable

Name of Dam: DUBOIS CREEK DAM

NDI # PA 00064

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES		
STRUCTURAL CRACKING		
VERTICAL AND HORIZONTAL ALIGNMENT		
MONOLITH JOINTS		
CONSTRUCTION JOINTS		

EMBANKMENT

Name of Dam DUBOIS CREEK DAM

NDI # PA 00064

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None observed	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Downstream slope is slightly irregular, probably the result of erosion caused by seepage through the core wall.	Fill in erosion gullies and reseed.

EMBANKMENT

Name of Dam DUBOIS CREEK DAM

NDI # PA 00064

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Good horizontal and vertical alignment, however, concrete core wall is cracking and spalling. Some voids are present in the concrete core wall.	Repair spalled concrete and fill voids in core wall.
RIPRAP FAILURES	None observed	

EMBANKMENT

Name of Dam DUBOIS CREEK DAM
NDI # PA 00064

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Small amount of erosion along abutments of dam and training wall, along the embankment and abutment, and where water seeps through core wall.	Fill in erosion gullies and seed areas.
ANY NOTICEABLE SEEPAGE	Seepage was observed at the following locations and at the approximate rates: Sta. 1+25 at toe of dam 1.0 g.p.m. Sta. 2+20 at core wall 0.25 g.p.m. Sta. 2+45 at core wall 0.50 g.p.m. Sta. 2+85 at core wall 10.0 g.p.m.	 Repair spillway channel. Repair core wall. Repair core wall. Repair core wall.
STAFF GAGE AND RECORDER	None observed	
DRAINS	One drain was observed to the left of the outlet pipe. This drain exits from the chlorinator building. No drains for the embankment were observed.	

OUTLET WORKS

Name of Dam: DUBOIS CREEK DAM

NDI # PA 00064

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	None observed	
INTAKE STRUCTURE	The intake structure was submerged at the time of inspection. No upstream closure was provided for the 12 in. cast iron pipe which passes through the embankment.	Provide upstream closure for the intake pipe.
OUTLET STRUCTURE	A 12 in. cast iron pipe runs to a chlorinator building and valve system downstream. A 20 in. ductile iron pipe blow-off exits into the natural streambed and a 10 in. service line feeds the water distribution system. No problems observed.	
OUTLET CHANNEL	Natural stream channel is in good condition.	
EMERGENCY GATE	None observed	

UNGATED SPILLWAY

Name of Dam: DUBOIS CREEK DAM

NDI # PA 00064

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Top of weir varies in height by ± 8 in. Seepage passes under weir at the left side.	The weir should be repaired to prevent seepage and undermining.
APPROACH CHANNEL	Some debris and sediment is located in the left side of spillway channel.	Remove debris and sediment.
DISCHARGE CHANNEL	Water is seeping through the concrete and stone channel floor and undermining the structure.	The structure should be repaired to prevent seepage and undermining.
BRIDGE AND PIERS	None	

GATED SPILLWAY - Not Applicable

Name of Dam: DUBOIS CREEK DAM

NDI # PA 00064

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL		
APPROACH CHANNEL		
DISCHARGE CHANNEL		
BRIDGE AND PIERS		
GATES AND OPERATION EQUIPMENT		

INSTRUMENTATION

Name of Dam: DUBOIS CREEK DAM

NDI # PA 00064

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

RESERVOIR

Name of Dam: DUBOIS CREEK DAM

NDI # PA 00064

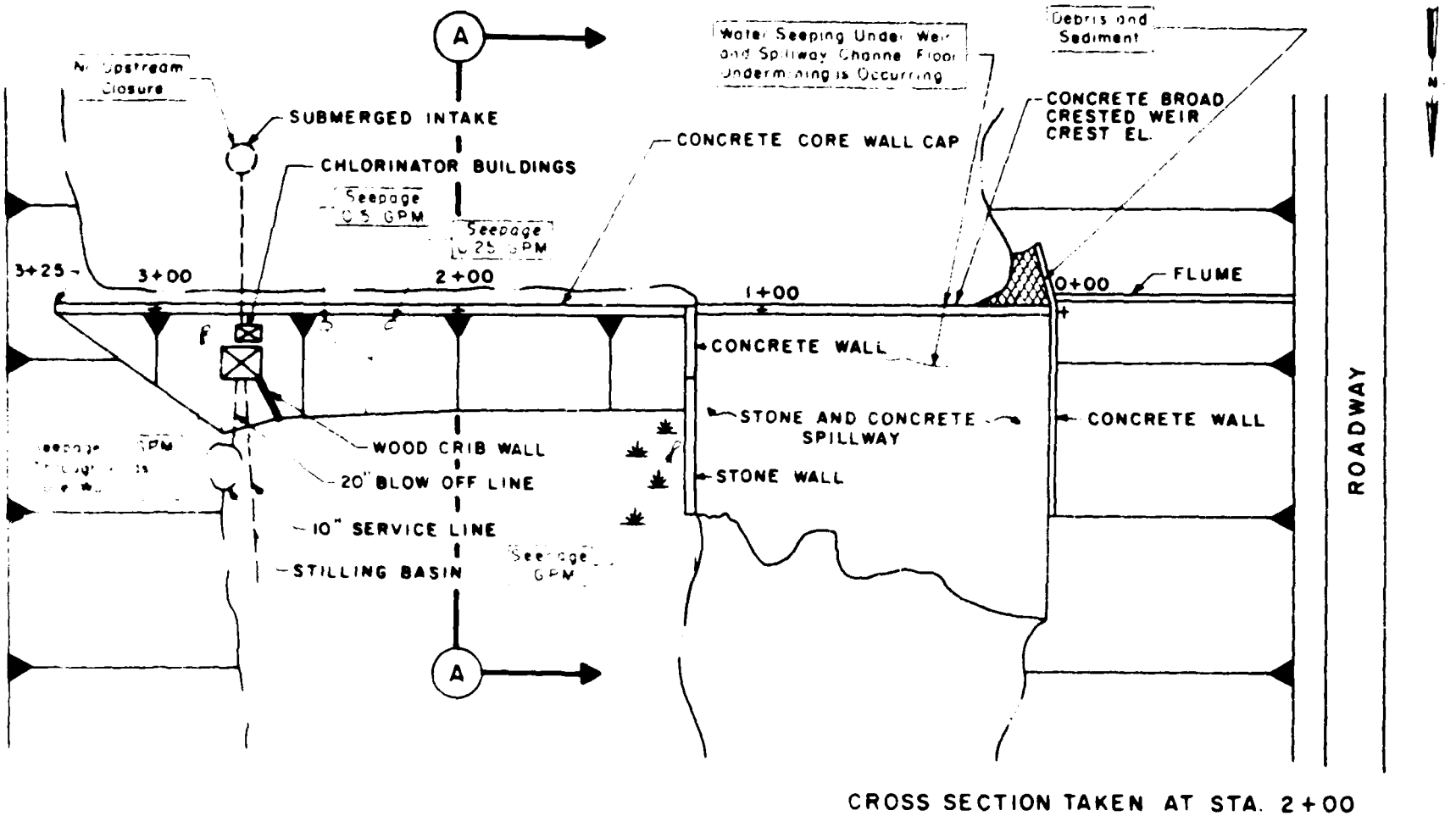
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	The reservoir side slopes are fairly steep (15°-45°), but no signs of instability were observed.	
SEDIMENTATION	The average depth of the reservoir according to the owner is 6 ft. According to the owner's representative, approximately one-third of the original storage volume has been filled in by sedimentation.	

DOWNSTREAM CHANNEL

Name of Dam: DUBOIS CREEK DAM

NDI # PA 00064

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	No debris was present in the channel. Several small wooden bridges located on the channel will not restrict heavy flows.	
SLOPES	The downstream channel has mild slopes through a wide valley.	
APPROXIMATE NO. OF HOMES AND POPULATION	One home is located 1,000 ft. downstream of the dam. Two additional homes are located 3,000 ft. downstream of the dam.	



CROSS SECTION TAKEN AT STA. 2+00

FIELD SKETCH

DUBOIS CREEK DAM

NDI NO. PA00064
PennDER NO. 58-8
SCHEMATIC – NOT TO SCALE
INSPECTED 28 OCTOBER 1980

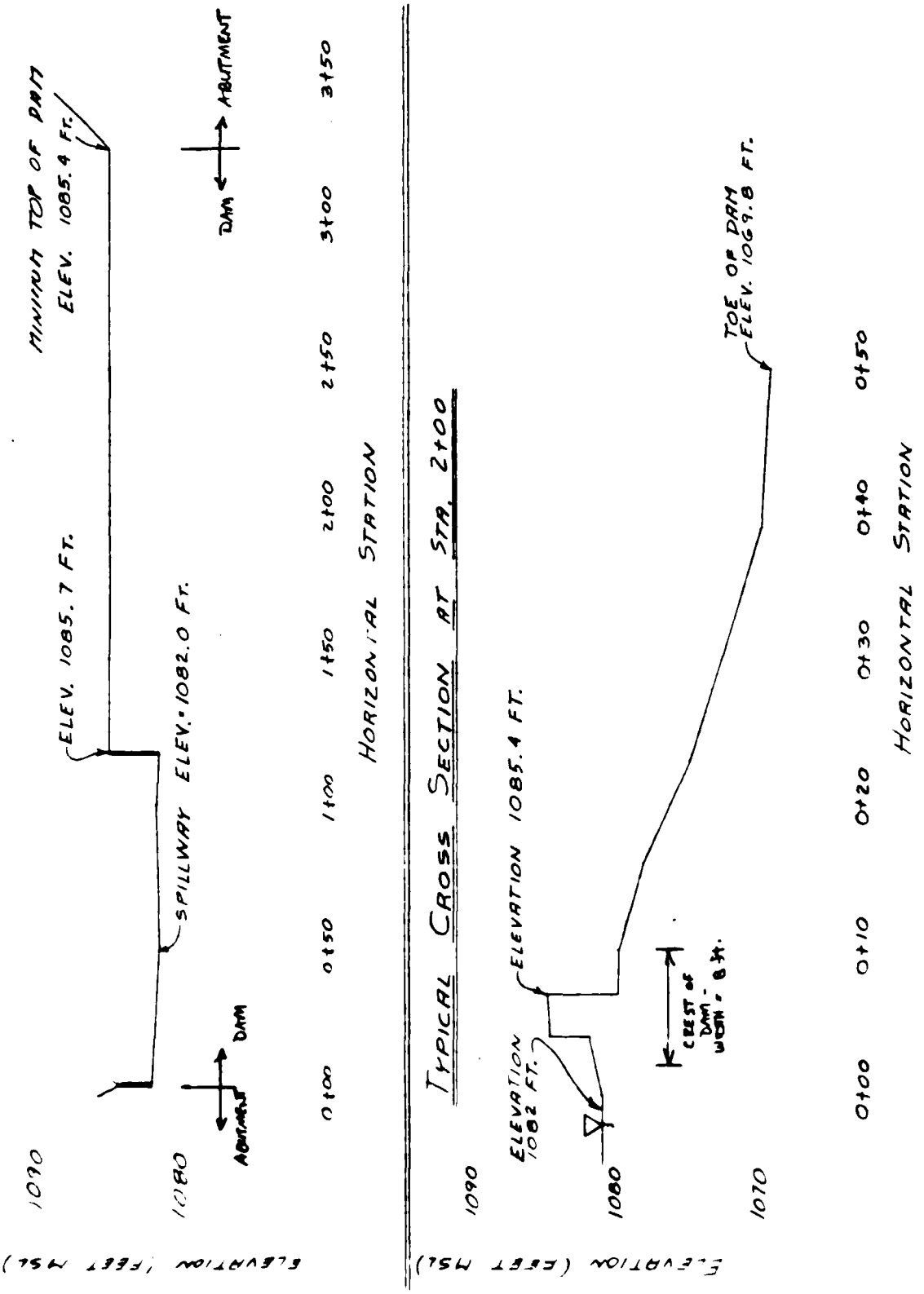
MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

DUBOIS CREEK DAM

TOP OF DAM PROFILE
TYPICAL CROSS-SECTION

DATE OF INSPECTION: 28 October 1980



APPENDIX B

ENGINEERING DATA CHECK LIST

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

Name of Dam: DUBOIS CREEK DAM
NDI # PA 00064

ITEM	REMARKS
PLAN OF DAM	See Plates 3 and 5 and the Field Sketch (page A-13) of this report.
REGIONAL VICINITY MAP	A USGS 7.5 minute topographic quadrangle, Franklin Forks, Pennsylvania, was used to prepare the vicinity map which is enclosed in this report as the Location Plan (Plate 1).
CONSTRUCTION HISTORY	No construction information available.
TYPICAL SECTIONS OF DAM	See Plate 5 and Typical Cross Section (page A-14).
HYDROLOGIC/HYDRAULIC DATA	No information available
OUTLETS - PLAN	See Plate 3 and the Field Sketch (page A-13) of this report.
- DETAILS	No information available
- CONSTRAINTS	No information available
- DISCHARGE RATINGS	No information available
RAINFALL/RESERVOIR RECORDS	The owner keeps weekly pumpage and reservoir level records.

Name of Dam: DUBOIS CREEK DAM

NDI # PA 00064

ITEM	REMARKS
DESIGN REPORTS	No information available
GEOLOGY REPORTS	No information was 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

ITEM	REMARKS
MONITORING SYSTEMS	None
MODIFICATIONS	The spillway was enlarged in 1919. Various post-construction repairs of the spillway have been performed on an as-needed basis, including the right side of the spillway in 1928 and the modifications to the lower right training wall in 1937. In 1941, repairs were performed to portions of the exposed core wall of the dam.
HIGH POOL RECORDS	One of the operators of the dam reported during the visual inspection that the reservoir level had come to within one foot of the top of the core wall in the 1940's.
POST-CONSTRUCTION ENGINEERING STUDIES AND REPORTS	No detailed engineering reports other than the 13 July 1916 Water Supply Commission Inspection are available. A number of inspection reports are available in the PennDER file, including the latest recorded inspection on 8 August 1965 by PennDER.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None reported
MAINTENANCE OPERATION RECORDS	No formal records are maintained.

Name of Dam: DUBOIS CREEK DAM

ITEM	REMARKS
SPILLWAY PLAN, SECTIONS, and DETAILS	See Plates 3, 4, and 5 and the Field Sketch (page A-13) of this report.
OPERATING EQUIPMENT PLANS & DETAILS	No information available

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 7.77 sq.mi. (primarily forested)

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 1082.0 ft. M.S.L. (50 ac.-ft.)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): 1085.4 ft. M.S.L. (78 ac.-ft.)

ELEVATION MAXIMUM DESIGN POOL: Unknown

ELEVATION TOP DAM: 1085.4 ft. M.S.L. (minimum top of dam)

SPILLWAY: Rectangular channel

a. Crest Elevation 1082.0 ft. M.S.L.
b. Type Concrete broad-crested weir
c. Width of Crest Parallel to Flow 3 ft.
d. Length of Crest Perpendicular to Flow 113.5 ft.
e. Location Spillover Left abutment
f. Number and Type of Gates None

OUTLET WORKS: 12 in. C.I.P. through embankment with 10 in. service line and 20 in. blow-off at downstream toe.

a. Type
b. Location Near right end of dam
c. Entrance Inverts Unknown
d. Exit Inverts 1063.83 ft.
e. Emergency Drawdown Facilities 20 in. ductile iron blow-off pipe

HYDROMETEOROLOGICAL GAGES: None

a. Type
b. Location
c. Records

MAXIMUM NON-DAMAGING DISCHARGE 540 c.f.s.

APPENDIX C

PHOTOGRAPH LOCATION PLAN AND PHOTOGRAPHS

DETAILED PHOTOGRAPH DESCRIPTIONS

Overall View of Dam - View of Dam from Left Abutment

Photograph Location Plan

Photo 1 - View of Spillway from Left Abutment

Photo 2 - View of Crest of Spillway from Left Abutment

Photo 3 - View of Spillway Chute and Downstream Channel from Left Training Wall

Photo 4 - View of Spillway Outlet Channel from End of Spillway Chute

Photo 5 - View Looking Upstream at Left Half of Spillway Chute

Photo 6 - View Looking Upstream at Right Half of Spillway Chute

Photo 7 - View of Upstream Face of Dam from Left Shoreline of Reservoir

Photo 8 - View Along Crest of Dam from Right Training Wall of Spillway

Photo 9 - View of Downstream Face of Dam from Right Training Wall of Spillway

Photo 10 - View Along Crest of Dam from Right Abutment

Photo 11 - Close-up of Hole in Upstream Side of Concrete Core Wall

Photo 12 - View of Downstream Side of Hole in Concrete Core Wall

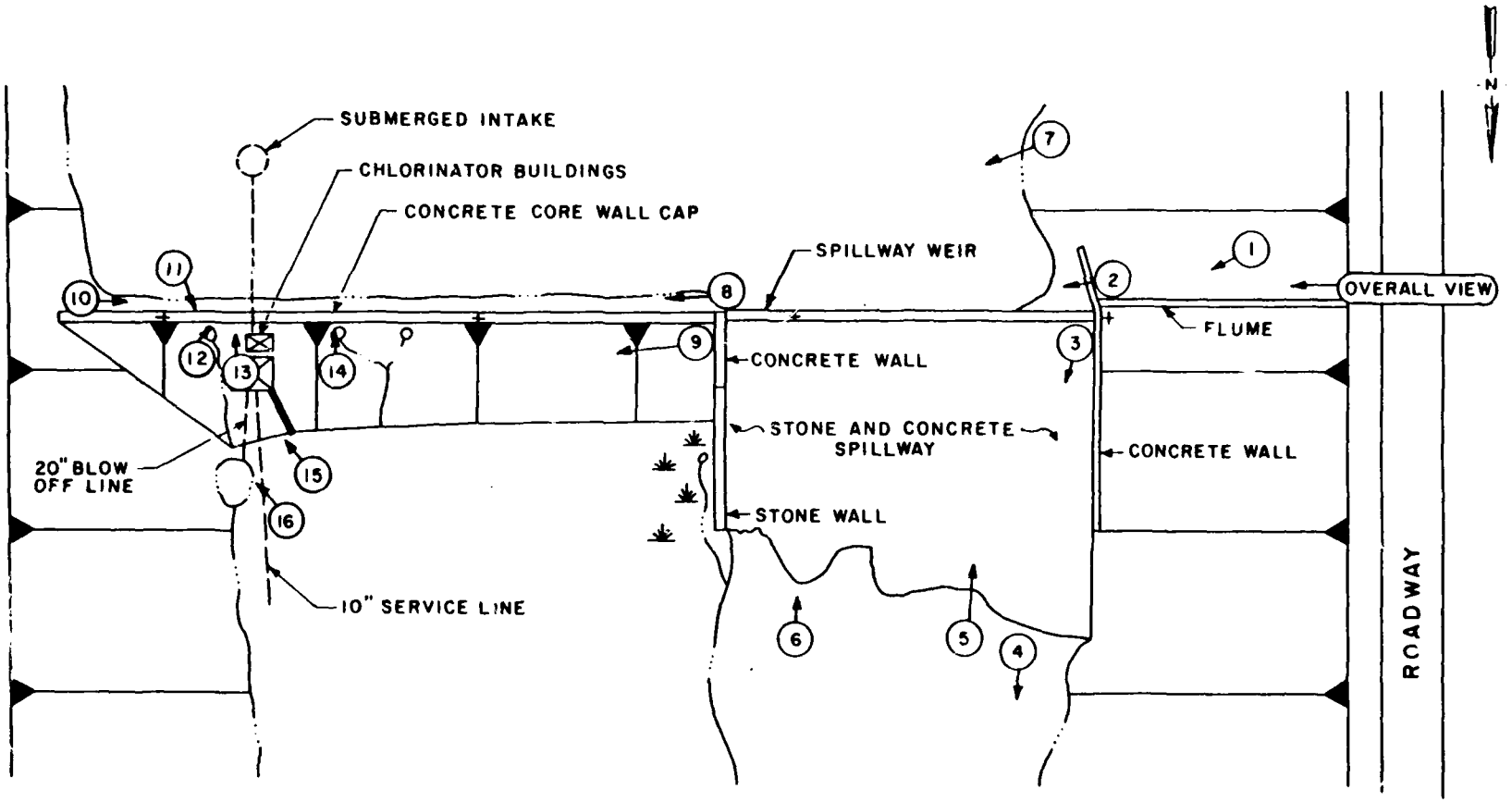
Photo 13 - View of Seepage Exiting from Hole in Concrete Core Wall

Photo 14 - View of Seep Located in Concrete Core Wall to Left of Valve House Structure

Photo 15 - View of Outlet Conduit Valve House Structure from Downstream

Photo 16 - View of Downstream End of Outlet Conduit

Note: Photographs were taken on 28 October 1980.



PHOTOGRAPH LOCATION PLAN

DUBOIS CREEK DAM
NDI NO. PA00064
PennDER NO. 58-8
Photographs Taken 28 October 1980

PHOTO 1. View of Spillway from Left Abutment

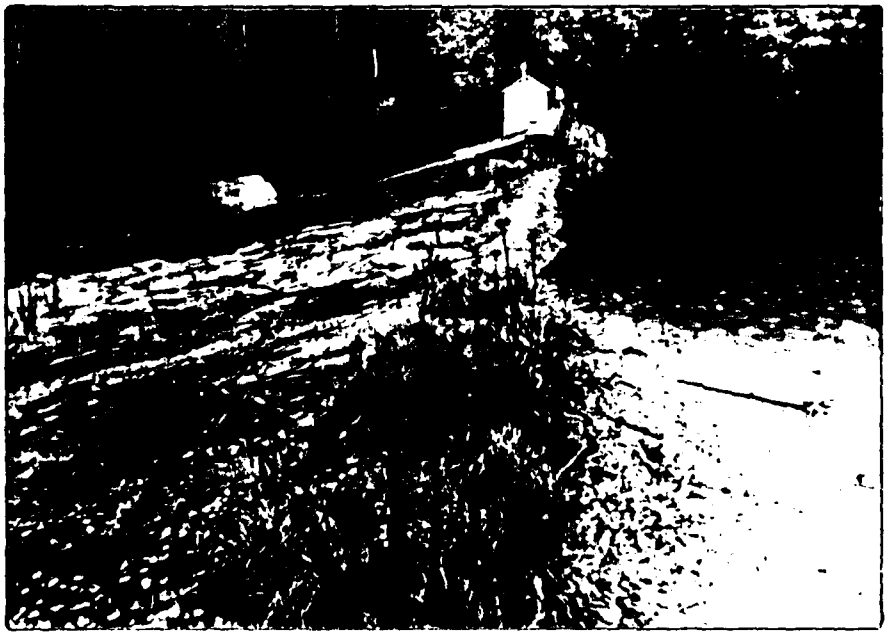


PHOTO 2. View of Crest of Spillway from Left Abutment

PHOTO 3. View of Spillway Chute and Downstream Channel from Left Training Wall

PHOTO 4. View of Spillway Outlet Channel from End of Spillway Chute

PHOTO 5. View Looking Upstream at Left Half of Spillway Chute

PHOTO 6. View Looking Upstream at Right Half of Spillway Chute

PHOTO 7. View of Upstream Face of Dam from Left Shoreline of Reservoir

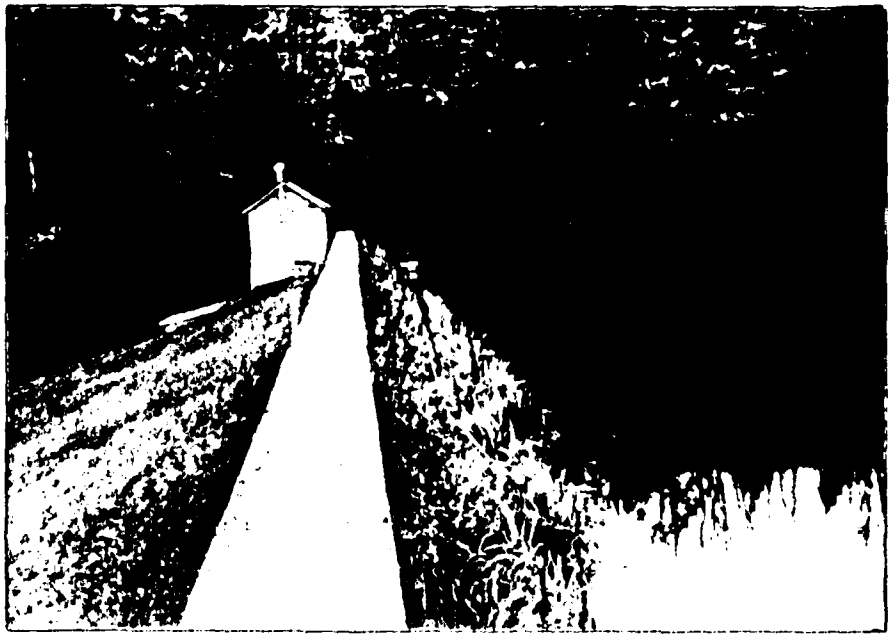


PHOTO 8. View Along Crest of Dam from Right Training Wall of Spillway

PHOTO 9 View of Downstream Face of Dam from Right Training Wall of Spillway

PHOTO 10 View Along Crest of Dam from Right Abutment

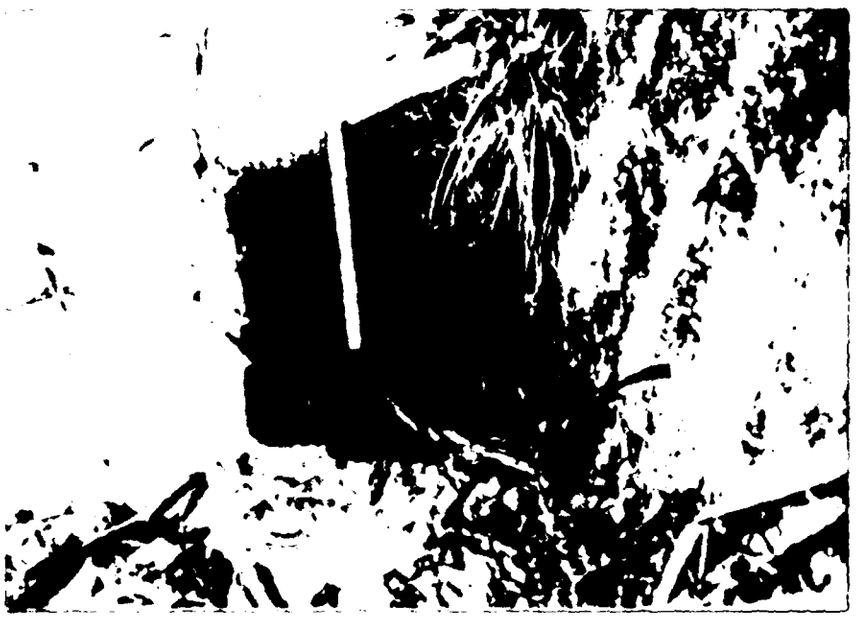


PHOTO 11 - Close up of Hole in Upstream Side of Concrete Core Wall

PHOTO 12 - View of Downstream Side of Hole in Concrete Core Wall

PHOTO 13. View of Seepage Exiting from Hole in Concrete Core Wall

PHOTO 14. View of Seep Located in Concrete Core Wall to left of Valve House Structure

PHOTO 15. View of Outlet Conduit Valve Structure from Downstream

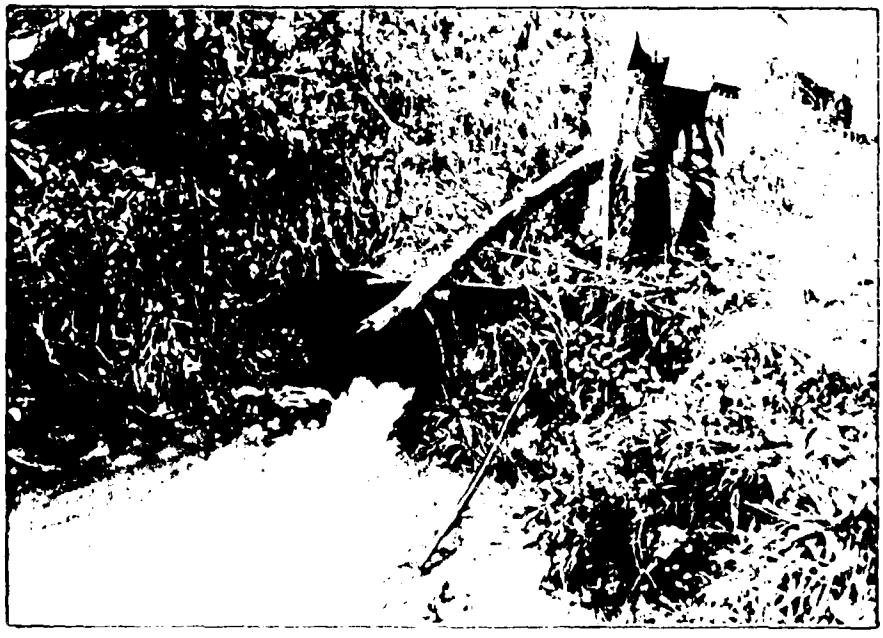


PHOTO 16. View of Downstream End of Outlet Conduit

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject DUBOIS CREEK DAM S.O. No.
APPENDIX D - HYDROLOGIC Sheet No. of
AND HYDRAULIC COMPUTATIONS Drawing No.
Computed by GWT Checked by Date 2-16-81

SUBJECT	PAGE

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: DUBOIS CREEK DAM

100-YEAR 24 HOUR RAINFALL = 6.4 INCHES[1]

STATION	1	2	3	4	5
Station Description	DUBOIS CREEK DAM				
Drainage Area (square miles)	7.77				
Cumulative Drainage Area (square miles)	7.77				
Adjustment of PMF for Drainage Area (%)[1]					
6 Hours	100-YEAR STORM DISTRIBUTION ON SHEET 6				
12 Hours					
24 Hours					
48 Hours					
72 Hours					
Snyder Hydrograph Parameters					
Zone [2]	11A				
C_p/C_t [3]	0.62/1.50				
L (miles) [4]	5.19				
L_{ca} (miles) [4]	2.27				
$t_p = C_t (L \cdot L_{ca})^{0.3}$ (hours)	3.14				
Spillway Data					
Crest Length (ft)	113.5				
Freeboard (ft)	2.7				
Discharge Coefficient	RATING CURVE DEVELOPED ON SHEET 5				
Exponent					

[1] Technical Paper No. 40, Cooperative Studies Section, U.S. Weather Bureau, Washington, D.C., 1961.

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

[3] Snyder's Coefficients.

[4] 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.

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject Davis Creek Dam — S.O. No.
Hydraulic Data — Sheet No. 2 of 12
Drawing No.
Computed by GMT — Checked by WDS — Date 12-2-80

Storage Calculations

Area vs. Elevation Data (measured from quad)

Elevation (ft.)	Surface Area (acres)
1082	7.35
1100	18.37
1120	54.18

Normal Pool Storage

Storage Volume = $V_{NP} = \frac{h}{3}\left(A_1 + A_2 + \sqrt{A_1 A_2}\right)$

h = estimated average depth = 7 Ft.
A_1 = surface area of normal pool = 7.35 Ac.
A_2 = surface area of reservoir bottom = 7.03 Ac. (estimated from average depth and reservoir side slopes)

Normal Pool Storage = $V_{NP} = \frac{7}{3}\left(7.35 + 7.03 + \sqrt{(7.35)(7.03)}\right)$

$V_{NP} = 50.32$ Ac.-Ft.

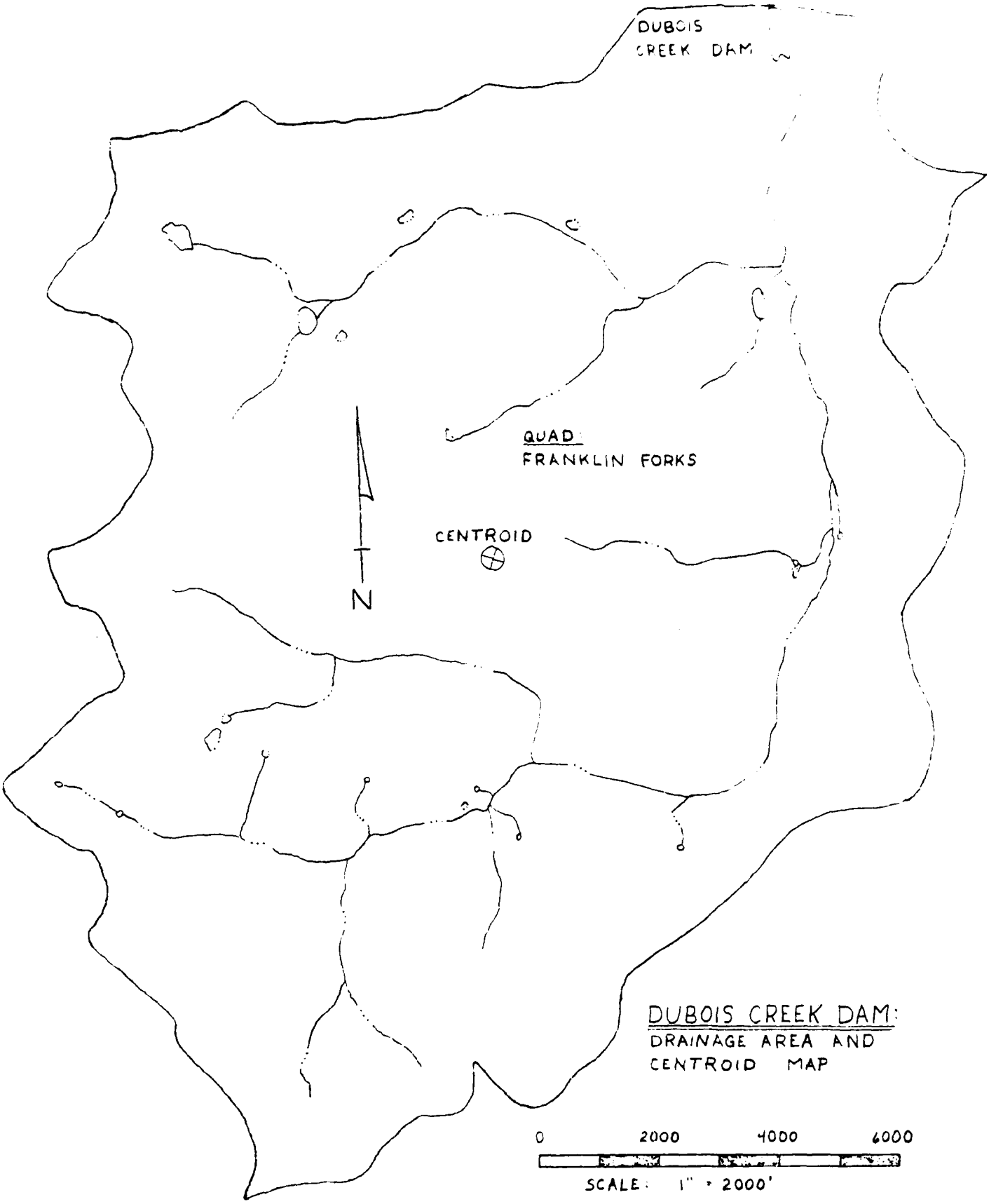
Top of Dam Storage

78 Ac.-Ft. (from HEC-1 analysis)

Snyder's Unit Hydrograph Parameters

$L = 5.19$ Mi., $L_{CA} = 2.27$ Mi.
Watershed is in Zone IIA
$C_p = 0.62$, $C_t = 1.50$
$t_p = 1.50\,(L \times L_{CA})^{0.3} = 3.14$ Hr.

Drainage Area = 7.77 Sq. Mi.

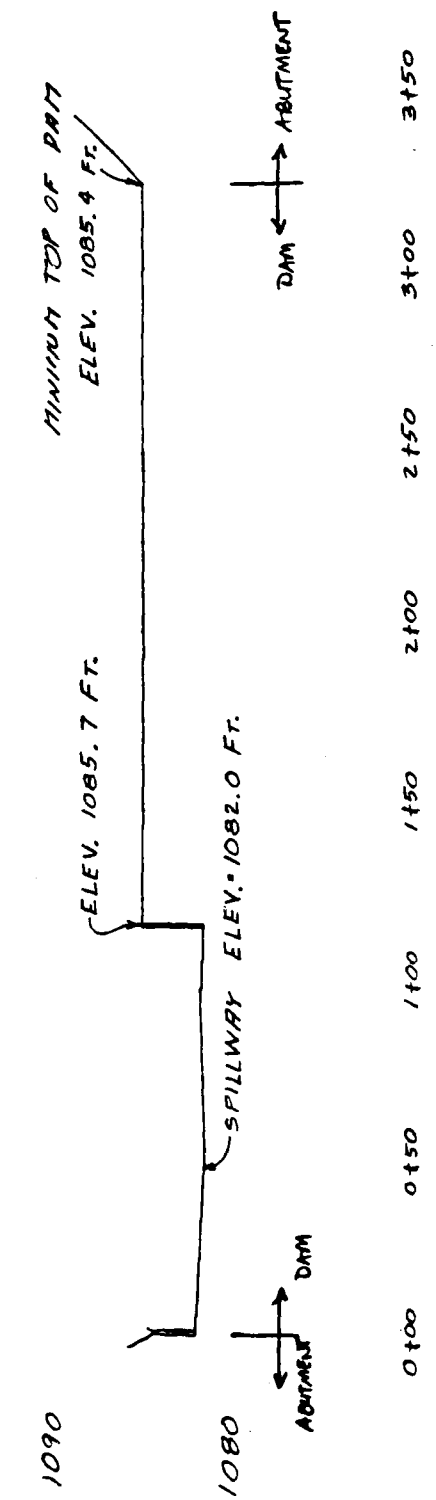


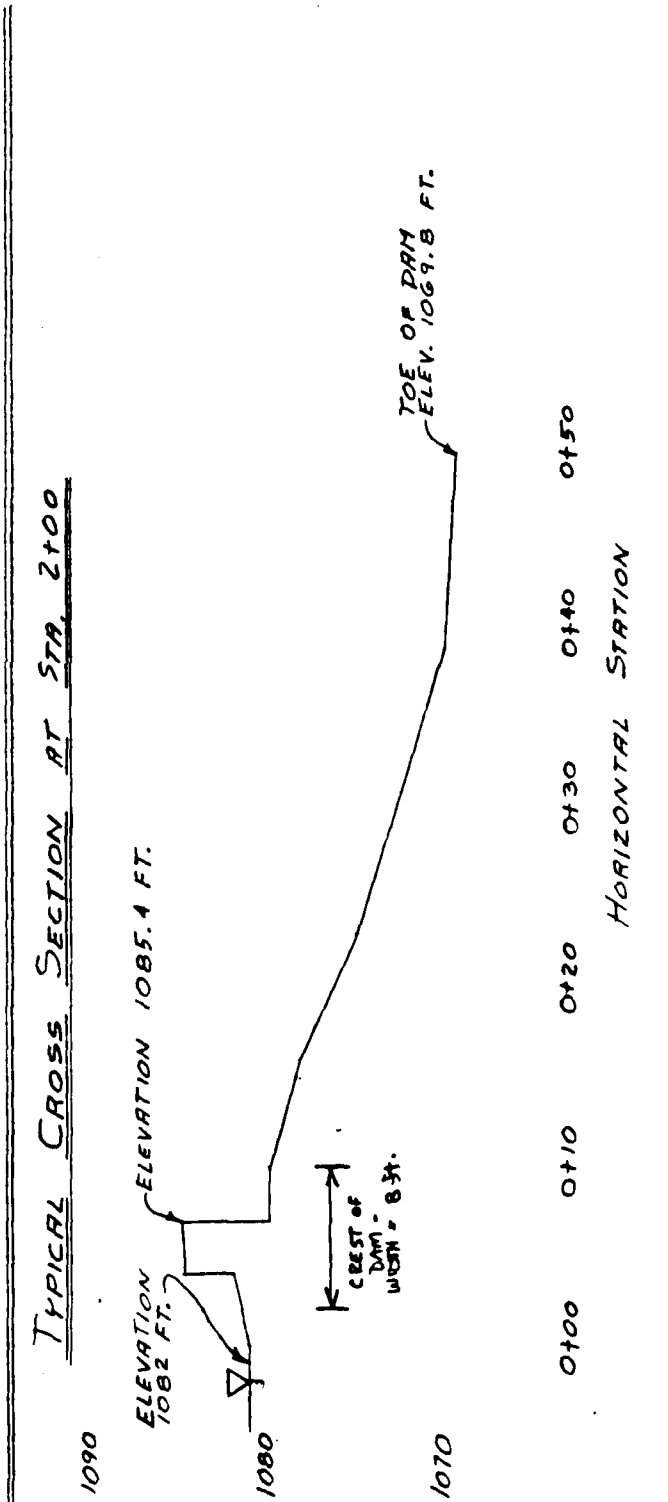
DUBOIS CREEK DAM:
DRAINAGE AREA AND
CENTROID MAP

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject DUBOIS CREEK DAM — S.O. No. 13837-00-AAA-02
TOP OF DAM PROFILE — Sheet No. 4 of 12
TYPICAL CROSS SECTION — Drawing No.
Computed by GWT — Checked by AAB — Date 11/14/80



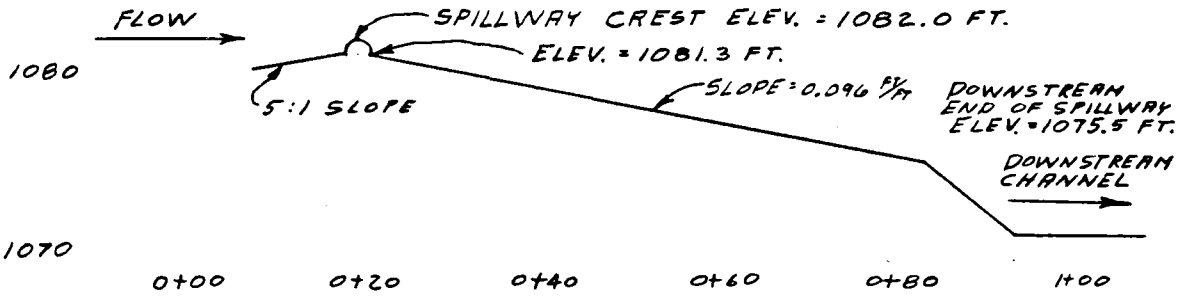


MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject DUBOIS CREEK DAM S.O. No. 13837-00-AAA-02
SPILLWAY DISCHARGE RATING Sheet No. 5 of 12
Drawing No.
Computed by GWT Checked by AWR Date 11-20-80

SPILLWAY PROFILE



DEVELOP RATING CURVE BASED UPON CRITICAL FLOW OVER SPILLWAY:

$V = \sqrt{gD}$ (CHOW, OPEN CHANNEL HYDRAULICS P. 43

$g = 32.2$ FT/SEC.^{2}

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

V = MEAN FLOW VELOCITY

$Q = AV$

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.
1082.0	0	0	0	0	0	0	0	1082.00
1082.5	0.5	43.75	107.5	.41	3.63	158.81	0.20	1082.70
1083.0	1.0	100.50	113.5	.89	5.35	537.68	0.44	1083.44
1083.5	1.5	157.25	113.5	1.38	6.66	1,047.29	0.69	1084.19
1084.0	2.0	214.00	113.5	1.88	7.78	1,664.92	0.94	1084.94
1084.5	2.5	270.75	113.5	2.38	8.75	2,369.06	1.19	1085.69
1084.7	2.7	327.50	113.5	2.89	9.65	3,160.38	1.45	1086.15
1085.2	3.2	384.63	115.0	3.34	10.37	3,988.61	1.67	1086.87
1085.7	3.7	442.63	117.0	3.78	11.03	4,882.21	1.89	1087.59
1086.0	4.0	501.63	119.0	4.22	11.66	5,849.01	2.11	1088.11
1086.5	4.5	561.63	121.0	4.64	12.22	6,863.12	2.32	1088.82
1087.5	5.5	684.63	123.0	5.57	13.39	9,168.78	2.78	1090.28
1088.5	6.5	809.63	125.0	6.48	14.44	11,695.05	3.24	1091.74

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

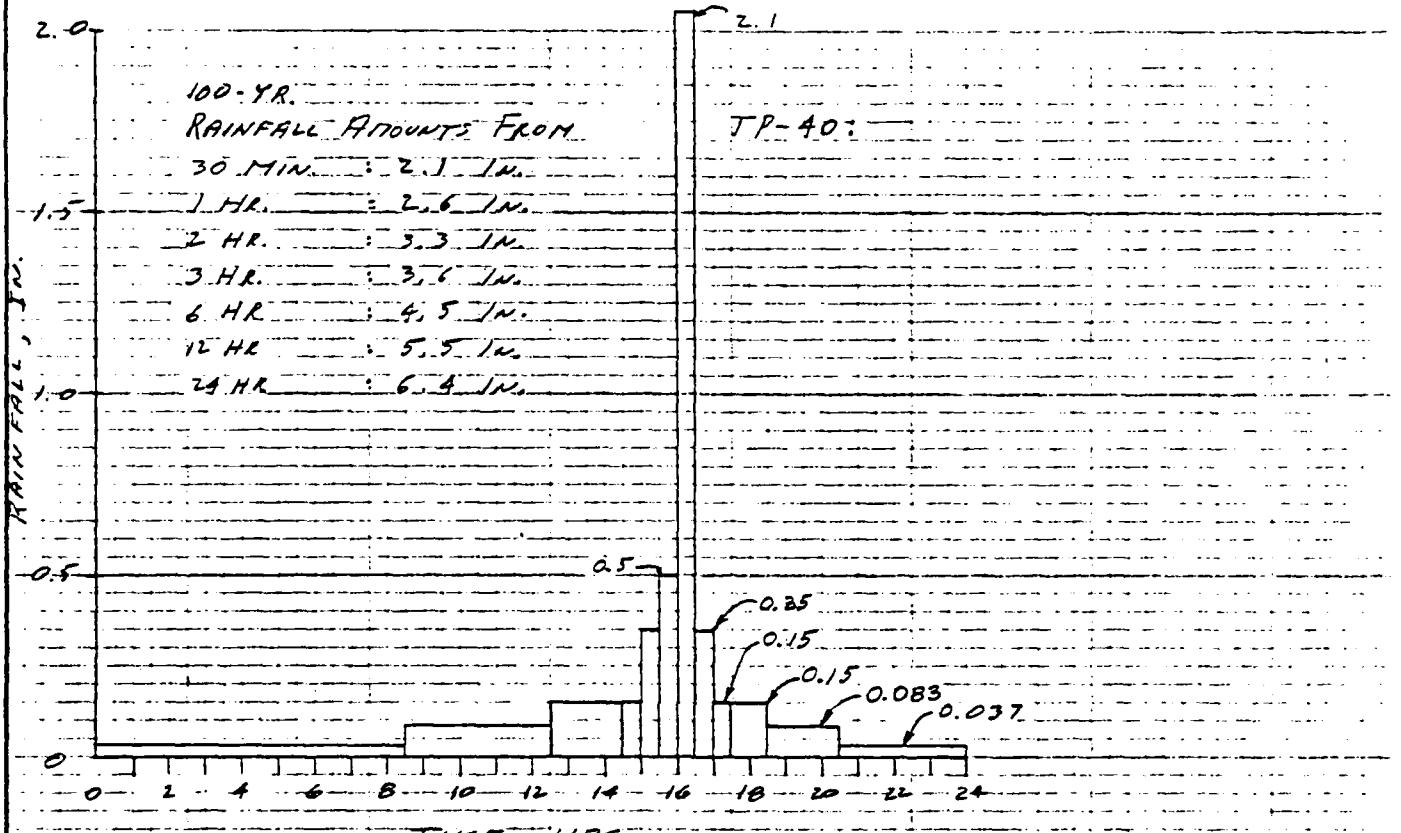
Box 280
Beaver, Pa. 15009

Subject DUBOIS CREEK DAM S.O. No. _____

100-YEAR STORM DISTRIBUTION Sheet No. 6 of 12

_____ Drawing No. _____

Computed by GWT Checked by WDL Date 11-25-80



100-YR. RAINFALL AMOUNTS FROM TP-40:

30 MIN.	2.1 IN.
1 HR.	2.6 IN.
2 HR.	3.3 IN.
3 HR.	3.6 IN.
6 HR	4.5 IN.
12 HR	5.5 IN.
24 HR	6.4 IN.

RAINFALL DISTRIBUTION:
(30 MINUTE INTERVALS)

INTERVAL NUMBERS	% TOTAL RF OCCURING IN EACH INTERVAL
1-17	0.6
18-25	1.3
26-29	2.3
30	2.3
31	5.4
32	7.8
33	32.8
34	5.4
35	2.3
36-37	2.4
38-41	1.3
42-48	0.6

TOTAL = 100 %

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject DUBOIS CREEK DAM S.O. No.
100-YEAR DISCHARGE CALCULATION Sheet No. 7 of 12
Drawing No.
Computed by GWT Checked by W.K. Date 11-26-80

THE INFLOW TO THE IMPOUNDMENT FOR THE 100-YEAR FLOOD WAS CALCULATED USING MATERIAL FROM "THE HYDROLOGIC STUDY - TROPICAL STORM AGNES" PREPARED BY THE SPECIAL STUDIES BRANCH, PLANNING DIVISION, NORTH ATLANTIC DIVISION, CORPS OF ENGINEERS, IN NEW YORK CITY.

DRAINAGE AREA - 7.77 SQ. MI.

① COMPUTE THE MEAN LOGARITHM

$$\log(q_m) = C_m + 0.75 \log A$$

$\log(q_m)$ = MEAN LOGARITHM OF ANNUAL FLOOD PEAKS
A = DRAINAGE AREA, SQ. MI = 7.77 SQ. MI.
C_m = MAP COEFFICIENTS FOR MEAN LOG OF ANNUAL PEAKS FROM FIG. 21 = 2.15

$$\log(q_m) = 2.15 + 0.75(\log 7.77)$$

$$= 2.818$$

② COMPUTE STANDARD DEVIATION

$$S = C_s - 0.05(\log A)$$

S = STANDARD DEVIATION OF THE LOGARITHMS OF THE ANNUAL PEAKS.
C_s = MAP COEFFICIENT FOR STANDARD DEVIATION FROM FIG. 22 = 0.349
A = DRAINAGE AREA, SQ. MI., = 7.77 SQ. MI.

$$S = 0.349 - 0.05(\log 7.77)$$

$$= 0.305$$

③ SELECT SKEW COEFFICIENT FROM FIG. 23 = +0.20

④ $\log(q_{100}) = \log(q_m) + K(P,g)S$

$K(P,g)$ = STANDARD DEVIATE FOR A GIVEN EXCEEDENCE FREQUENCY PERCENTAGE (P) AND SKEW COEFFICIENT (g) FROM EXHIBIT 39 OF BEARD'S "STATISTICAL METHODS IN HYDROLOGY"

$$\log(q_{100}) = 2.818 + 2.48(0.305)$$

q_{100} = 3,755 CFS

USING THE SNYDER'S UNIT HYDROGRAPH PARAMETERS DERIVED FOR THIS BASIN PRODUCED A PEAK FLOW OF 3690 CFS. THIS VALUE IS WITHIN 2 % OF THE PREVIOUSLY COMPUTED PEAK FLOW OF 3755 CFS AND IS WITHIN THE 10 % LIMIT SUGGESTED BY CORPS GUIDLINES.

RATIO OF 100-YEAR FLOOD

```
**********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
   MBJ UPDATE         04 JUL 79
**********************************
           A1      NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS
           A2      HYDROLOGIC AND HYDRAULIC ANALYSIS OF DUBOIS CREEK DAM
           A3      UNIT HYDROGRAPH BY SNYDERS METHOD
           B    300       0      30       0       0       0       0       0      -4       0
           B1     5
           J      1       1       1
           J1     1
           K      0       1                                       1
           K1      RUNOFF HYDROGRAPH TO DAM
           M      0       1    7.77                                                       1
           O     48     6.4
           O1 0.033   0.036   0.006   0.006   0.006   0.006   0.006   0.006   0.006   0.006
           O1 0.036   0.036   0.006   0.006   0.006   0.006   0.006   0.013   0.013   0.013
           O1 0.013   0.013   0.013   0.013   0.013   0.023   0.023   0.023   0.023   0.023
           O1 0.054   0.078   0.328   0.054   0.023   0.024   0.024   0.013   0.013   0.013
           O1 0.013   0.035   0.006   0.006   0.006   0.006   0.006   0.006
           T                                                    1.0    0.05
           W   3.14    0.62
           X   -1.5   -0.05     2.0
           K      1       2                                       1
           K1      ROUTING FOR DUBOIS CREEK DAM
           Y                              1       1
           Y1     1                                         -1082.0      -1
           Y4  1082  1082.7  1083.4  1084.2  1064.9  1085.7  1086.1  1086.9  1087.6  1088.1
           Y5     0  158.81  537.68 1047.29 1664.92 2369.06 3160.38 3988.16 4882.21 5849.01
           $A  7.33    7.35   18.37   54.18
           $E  1075    1082    1100    1120
           $$1082.0
           $D1035.4    2.83     1.5     321
           $L     0     150     208     210     216     220     224
           $V1085.4  1085.6  1085.8  1086.0  1087.0  1088.0  1089.0
           K     99
```

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

RUN  DATE 12/01/80
     TIME    11.19

            NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS
            HYDROLOGIC AND HYDRAULIC ANALYSIS OF DUBOIS CREEK 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= 1  LRTIO= 1
      RTIOS=   1.00

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

                       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
        0      1    7.77    0.0    7.77     0.0     0.0       0       1       0

                                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    0.05     0.0     0.0

                            UNIT HYDROGRAPH DATA
                       TP=  3.14     CP=0.62     NTA=  0

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

     UNIT HYDROGRAPH 35 END-OF-PERIOD ORDINATES, LAG=   3.13 HOURS, CP= 0.63  VOL= 1.00
      54.      211.      419.      647.      846.      970.     1006.      929.      790.      663.
     557.      463.      393.      333.      278.      233.      196.      165.      136.      116.
      98.       82.       69.       58.       49.       41.       34.       29.       24.       20.
      17.       14.       12.       10.        9.

0                                END-OF-PERIOD FLOW
 MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS   COMP Q      MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS   COMP Q
```

```
                                                                                  SUM     6.40     4.73     1.67      47135.
                                                                                      ( 163.)( 120.)(  42.)( 1334.72)

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

                                              HYDROGRAPH ROUTING

                              ROUTING FOR DUBOIS CREEK 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   NSTDL     LAG   AMSKK       X     TSK   STORA  ISPRAT
                                       1       0       0     0.0     0.0     0.0  -1082.      -1

   STAGE     1082.00    1082.70    1083.40    1084.20    1084.90    1085.70    1086.10    1086.90    1087.60    1088.10

    FLOW         0.0     158.31     537.68    1047.29    1664.92    2369.06    3160.38    3988.16    4882.21    5849.01

  SURFACE AREA=       7.         7.        18.        54.

     CAPACITY=        0.        50.       274.       968.

    ELEVATION=     1075.      1082.      1100.      1120.

                                    CREL    SPWID    COQW    EXPW   ELEVL    COQL   CAREA    EXPL
                                  1082.0      0.0     0.0     0.0     0.0     0.0     0.0     0.0

                                                              DAM DATA
                                                       TOPEL    COQD    EXPD   DAMWID
                                                      1085.4     2.8     1.5     321.

    CREST LENGTH         0.       150.       208.       210.       216.       220.       224.
    AT OR BELOW
    ELEVATION       1085.4     1085.6     1085.8     1086.0     1087.0     1088.0     1089.0

  PEAK OUTFLOW IS     3705. AT TIME  19.50 HOURS

          **********          **********          **********          **********          **********
```

Sheet 10 of 12

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
HYDROGRAPH AT	1	7.77	1	3691.
		(20.12)		(104.52)
ROUTED TO	2	7.77	1	3705.
		(20.12)		(104.92)

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1082.00	1082.00	1089.40
STORAGE	50.	50.	78.
OUTFLOW	0.	0.	2105.

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	1088.26	0.86	86.	1705.	4.50	19.50	0.0

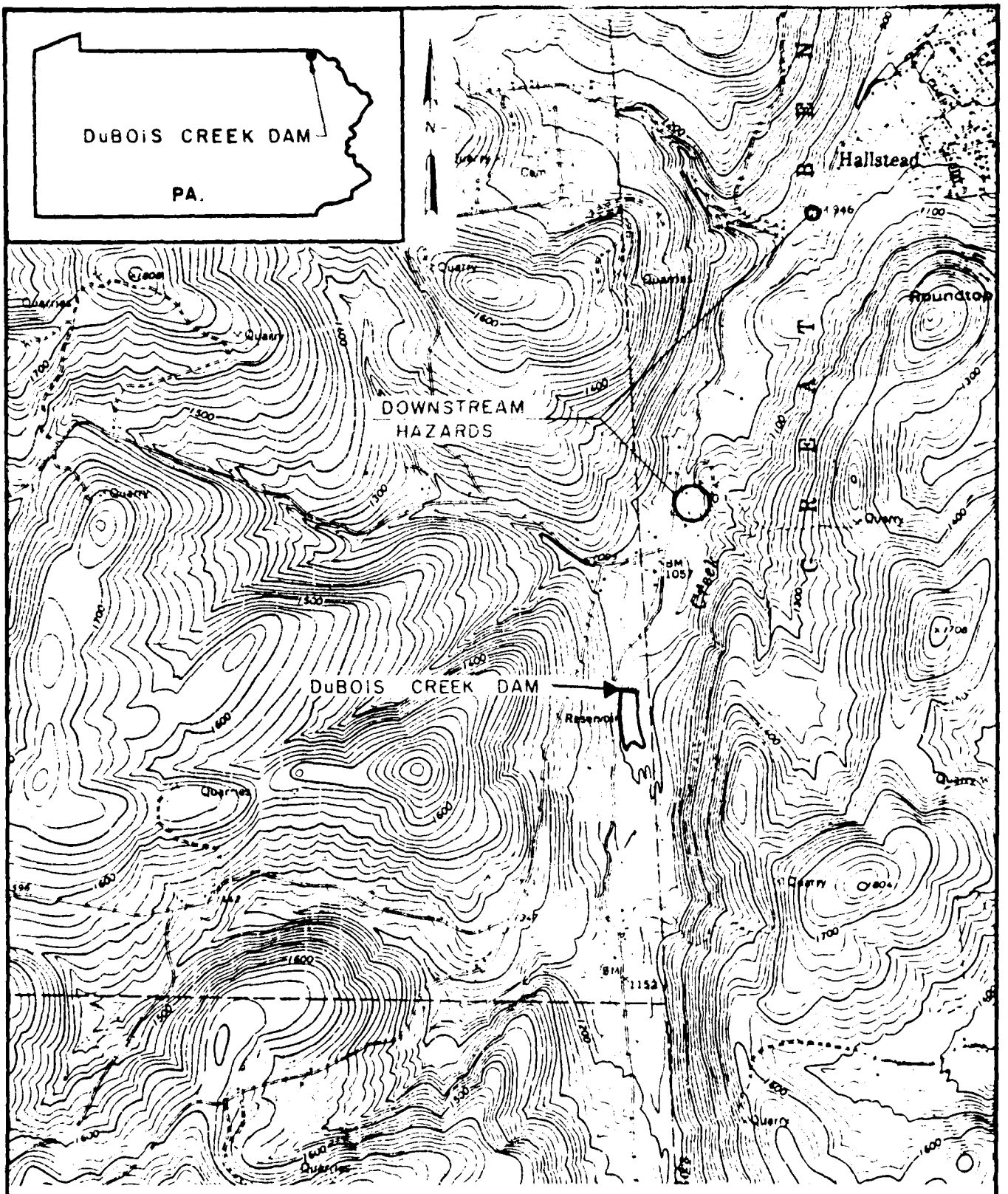
RATIO OF 100-YEAR FLOOD

SHEET 12 OF 12

APPENDIX E

PLATES

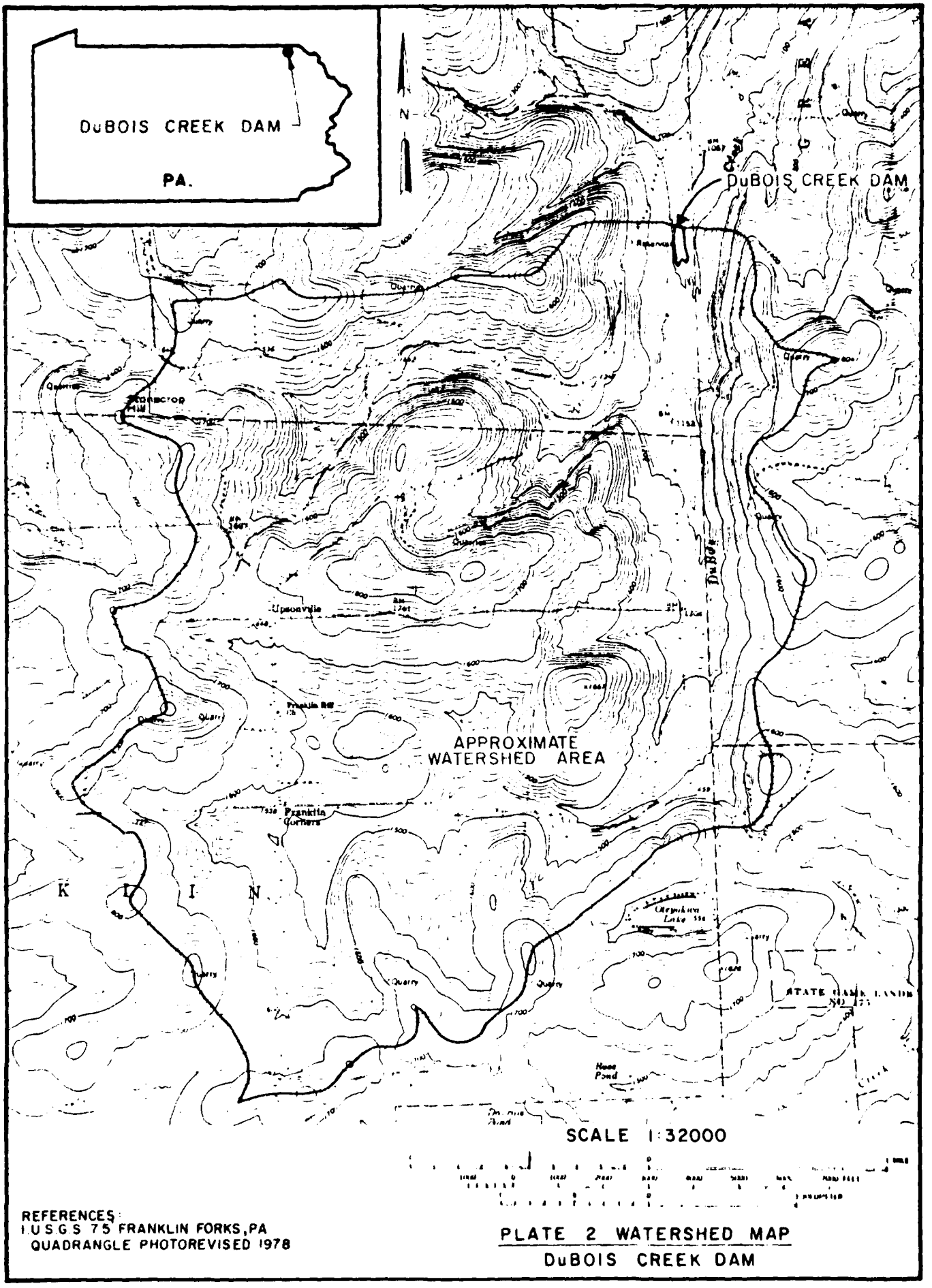
CONTENTS



REFERENCES:
1. U.S.G.S. 7.5 FRANKLIN FORKS, PA. QUADRANGLE. PHOTOREVISED 1978

PLATE 1 LOCATION PLAN

DuBOIS CREEK DAM



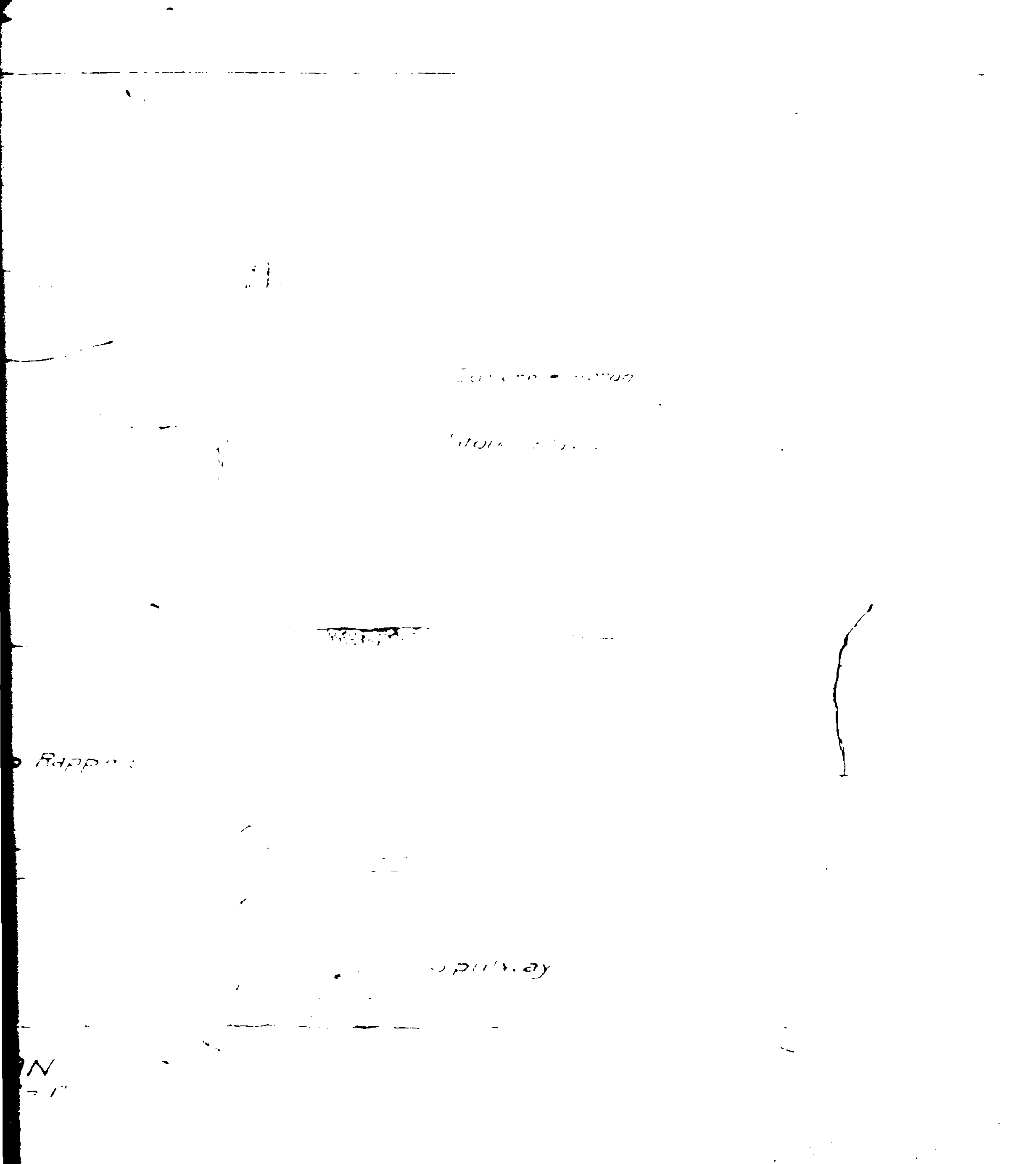
REFERENCES:
1. U.S.G.S. 7.5 FRANKLIN FORKS, PA
QUADRANGLE PHOTOREVISED 1978

PLATE 2 WATERSHED MAP
DuBOIS CREEK DAM

ELEVATION

PLAN

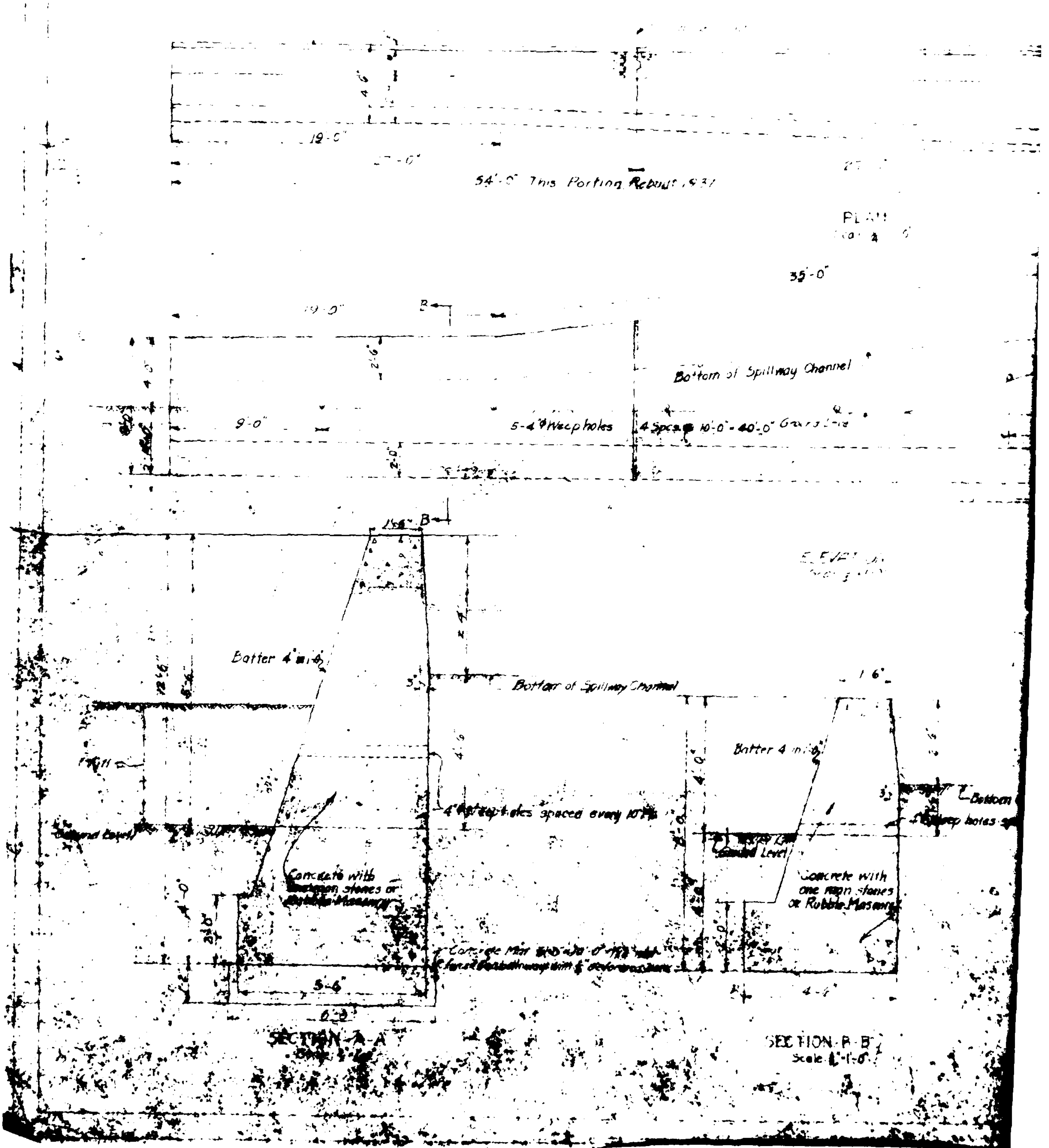
HALLSTEAD AND GREAT BE
DuBOIS DA



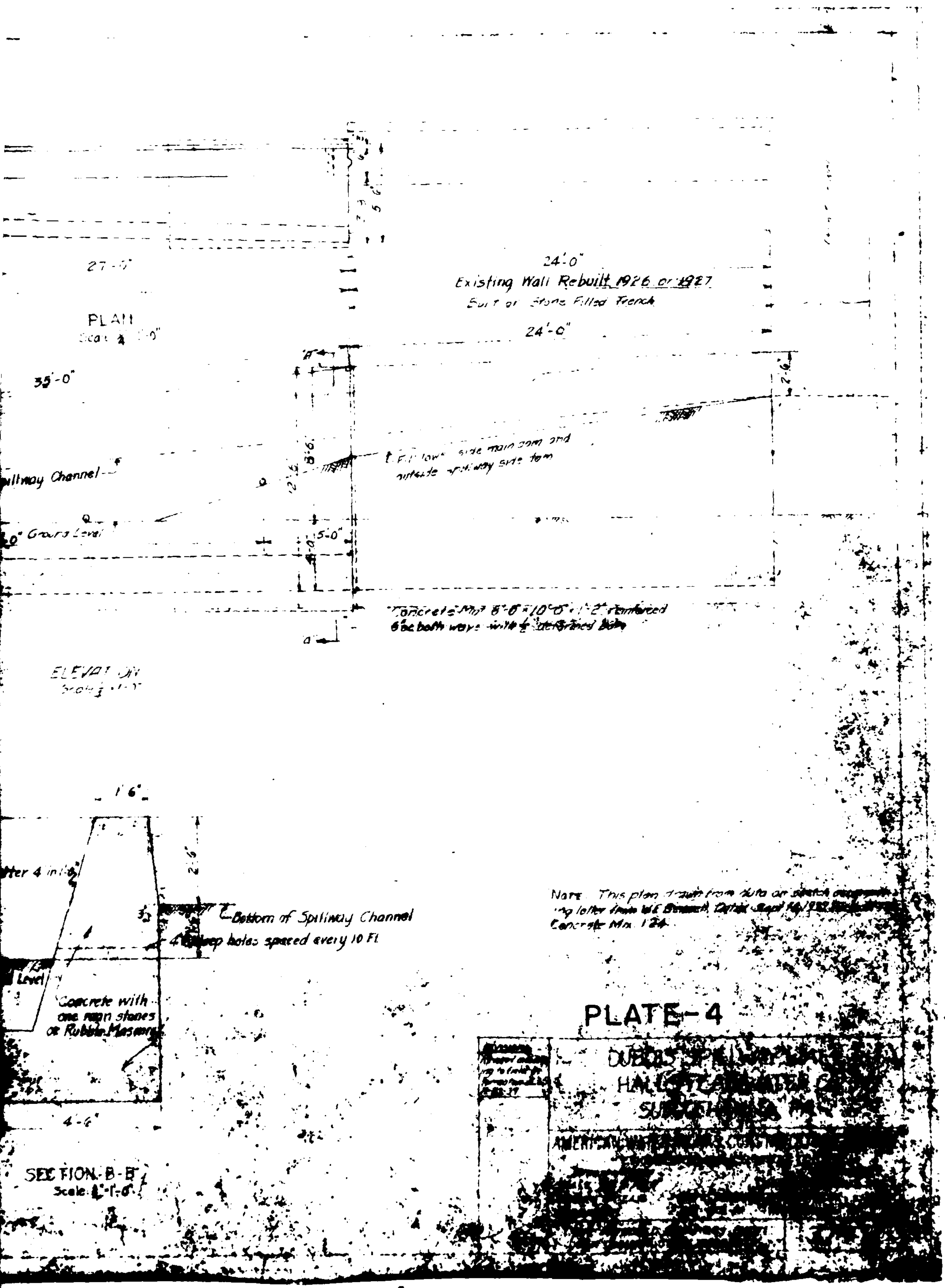
T BEND WATER CO.
DAM

PLATE - 3

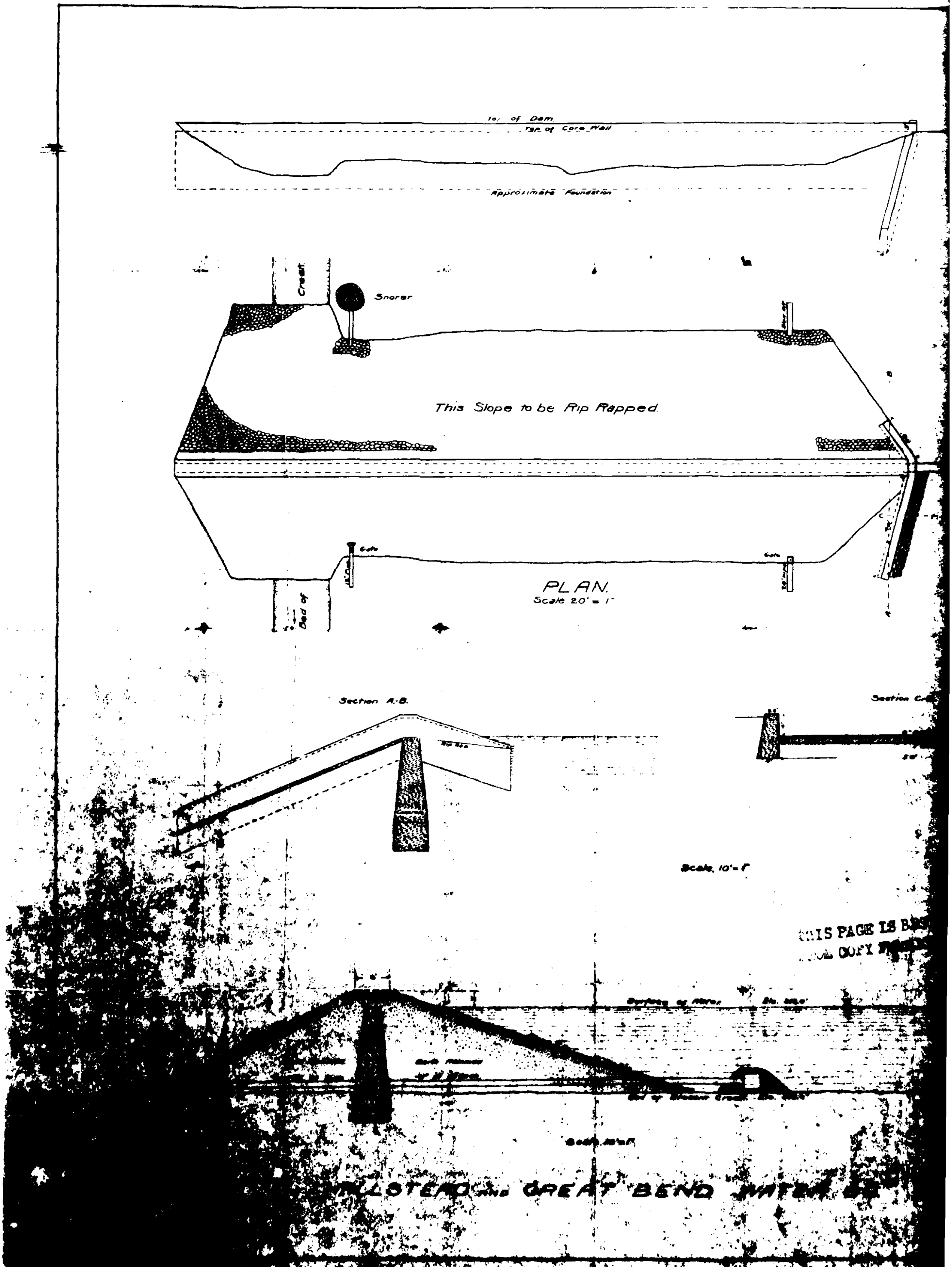
Scranton Pa File 234 8/16/19



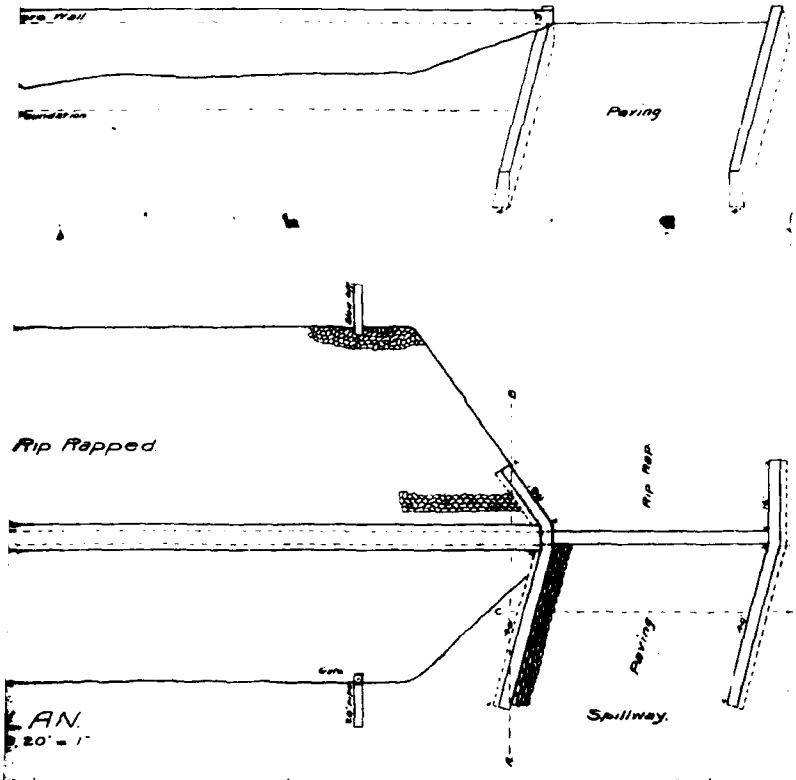
19'-0"
27'-0"
54'-0" This Portion Rebuilt 1937
35'-0"
19'-0"
2'-6"
Bottom of Spillway Channel
9'-0"
5-4"Ø Weep holes
4 Spcs @ 10'-0" = 40'-0"
2'-0"
Batter 4" in 1'
Bottom of Spillway Channel
1'6"
Batter 4" in 1'
Fill
Ground Level
Concrete with one man stones or Rubble Masonry
Concrete with one man stones or Rubble Masonry
5'-6"
4'-4"
SECTION A-A
SECTION B-B



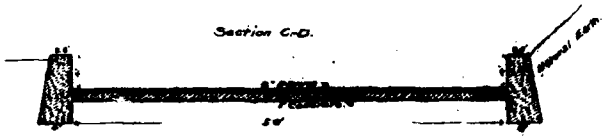
2



Top of Dam
Top of Core Wall
Approximate Foundation
Crest
Snorer
This Slope to be Rip Rapped
PLAN.
Scale 20' = 1"
Gate
Bed of
Section A-B
Rip Rap
Scale 10' = 1"
Surface of Water
GREAT BEND



AN.
20' = 1'



Scale, 10' = 1'

AT BEND WATER CO.

APPENDIX F

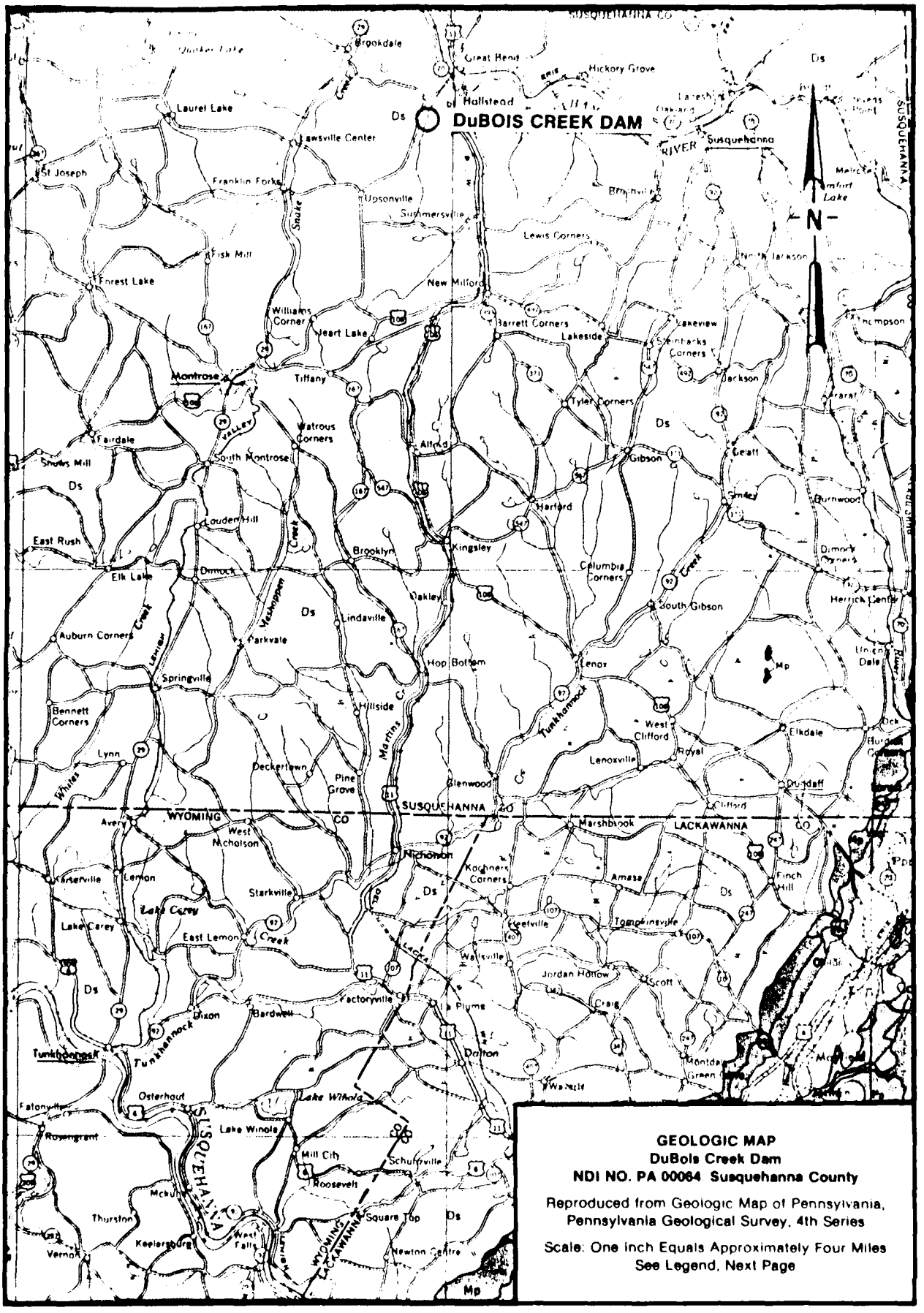
REGIONAL GEOLOGY

DuBOIS CREEK DAM
NDI No. PA 00064, PennDER No. 58-8

REGIONAL GEOLOGY

DuBois Creek Dam is in a steep walled valley located in the Glaciated Low Plateaus physiographic province. The area has undergone glaciation at least three times 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 very stoney, silt loams of the Mardin-Volusia-Oquaga association. No test boring data were available for review, thus, the thickness of this overburden is difficult to ascertain.

Geologic references indicate bedrock in the vicinity of the dam to be composed of the lower members of the Catskill Formation and the upper members of the Chemung Formation; both belonging to the Susquehanna Group. The dam lies near the contact between the Catskill, which outcrops in the upper reaches of the valley as red and gray shales and sandstones, and the Chemung, which underlies most of the valley floor downstream of the dam. The Chemung Formation consists of prodelta, fossiliferous, gray, sandy shales and gray to olive green sandstones of Upper Devonian age. A bedrock sample obtained from the valley floor downstream of the dam was a hard, olive green fine to medium grained sandstone, probably of the Chemung Formation. The strata underlying the dam may be dipping slightly to the southeast on the southern limb of the Rome Anticline which extends northeast from Friendsville and fades out near Hallstead.



GEOLOGIC MAP
DuBois Creek Dam
NDI NO. PA 00064 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

Oswayo Formation
Greenish gray to gray shales, siltstones and sandstones becoming increasingly shaly westward, considered equivalent to type Oswayo Knoxville Formation Ut in Erie and Crawford Counties probably not distinguishable north of Corry

Cattaraugus Formation
Red, gray and brown shale and sandstone with the proportion of red decreasing westward, includes Venango sands of drillers and Salamanca sandstone and conglomerate, some limestone in Crawford and Erie counties

Conneaut Group
Alternating gray, brown, greenish and purplish shales and siltstones, includes "pink rock" of drillers and "Chemung" and "Girard" Formations of northwestern Pennsylvania.

Canadaway Formation
Alternating brown shales and sandstones, includes "Portage" Formation of northwestern Pennsylvania.

CENTRAL AND EASTERN PENNSYLVANIA

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 eastward. Relation to type Oswayo not proved

Catskill Formation
Chiefly red to brownish shales and sandstones, includes gray and greenish sandstone tongues named Elk Mountain, Honesdale, Shohola, and Delaware River in the east.

Susquehanna Group
Barbed line is "Chemung-Catskill" contact of Second Pennsylvania Survey County reports barbs on "Chemung" side of line

Marine beds
Gray to olive brown shales, graywackes, and sandstones, contains "Chemung" beds and "Portage" beds including Burket, Brallier, Harrell, and Trimmers Rock, Tully Limestone at base

MIDDLE AND LOWER

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, fissile, 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 Selinsgrove Limestone and Needmore Shale in central Pennsylvania and Buttermilk Falls Limestone and Esopus Shale in easternmost Pennsylvania, in Lehigh Gap area includes Palmerton Sandstone and Bowmanstown Chert

Oriskany Formation
White to brown, fine to coarse grained, partly calcareous, locally conglomeratic, fossiliferous sandstone (Ridgeley) at the top, dark gray, cherty limestone with some interbedded shales and sandstones below (Shriver).

Helderberg Formation
Dark gray, calcareous, thin bedded shale (Mandata) at the top, equivalent to Port Ewen Shale and Becraft 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 (Coeymans), sandy and shaly in places with some chert nodules.

END

DATE
FILMED

6-81

DTIC