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D'APPOLONIA CONSULTING ENGINEERS INC PITTSBURGH PA F/8 13/13  
NATIONAL DAM INSPECTION PROGRAM. BIG ELK LAKE DAM (NDI I.D. PA--ETC(U)  
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SUSQUEHANNA RIVER BASIN  
ELK LAKE STREAM, SUSQUEHANNA COUNTY

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National Dam Inspection Program

**BIG ELK LAKE DAM**

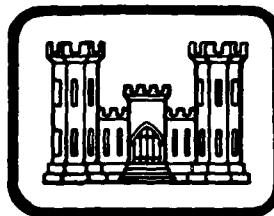
(NDI I.D. PA-0056)

DER I.D. 058-019)

~~OWNER: MR. EDGAR SAUER~~  
Susquehanna River Basin, Elk Lake  
Stream, Susquehanna County, Pennsylvania  
PHASE I INSPECTION REPORT

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NATIONAL DAM INSPECTION PROGRAM



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PREPARED FOR

DEPARTMENT OF THE ARMY  
BALTIMORE DISTRICT, CORPS OF ENGINEERS  
BALTIMORE, MARYLAND 21203

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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 Department of the Army, 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 visual observations and review of available data. Detailed investigations and analyses involving topographic mapping, subsurface investigations, material testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the inspection is intended to identify any need for such studies which should be performed by the owner.

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 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 the dam depends on numerous and constantly changing internal and external factors which are 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.

The assessment of the conditions and recommendations was made by the consulting engineer in accordance with generally and currently accepted engineering principles and practices.

DISTRIBUTION STATEMENT A  
Approved for Distribution  
Date: 10/1/61

PHASE I REPORT  
NATIONAL DAM INSPECTION PROGRAM

NAME OF DAM: Big Elk Lake Dam  
STATE LOCATED: Pennsylvania  
COUNTY LOCATED: Susquehanna  
STREAM: Elk Lake Stream, tributary of Susquehanna River  
SIZE CLASSIFICATION: Small  
HAZARD CLASSIFICATION: Significant  
OWNER: Mr. Edgar Baker  
DATE OF INSPECTION: November 13, 1980 and February 4, 1981

ASSESSMENT: Based on the evaluation of the existing conditions, the condition of Big Elk Lake Dam is considered to be good.

The flood discharge capacity of the dam was evaluated according to the recommended criteria and it was found that the dam cannot pass the recommended spillway design flood (100-year flood) without overtopping the dam. Therefore, flood discharge capacity of the dam is classified to be inadequate.

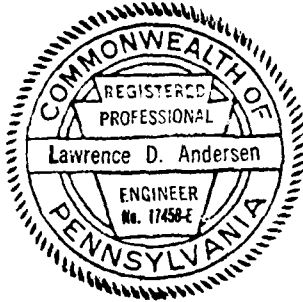
The following recommendations should be implemented as soon as possible or on a continuing basis.

1. The owner should determine the nature and extent of improvements required to provide adequate spillway capacity.
2. The owner should investigate the need to install low level outlet facilities or prepare plans to lower the lake in the event of an emergency.
3. Around-the-clock surveillance should be provided during unusually heavy runoff and a formal warning system developed to alert the downstream residents in the event of emergencies.
4. The owner should develop a formal operating and maintenance plan and inspect the dam regularly and perform necessary maintenance.

Acceptance Form  
NTIS  
JAN 1981  
John S. Baker  
6/12/81

A

Assessment - Big Elk Lake Dam

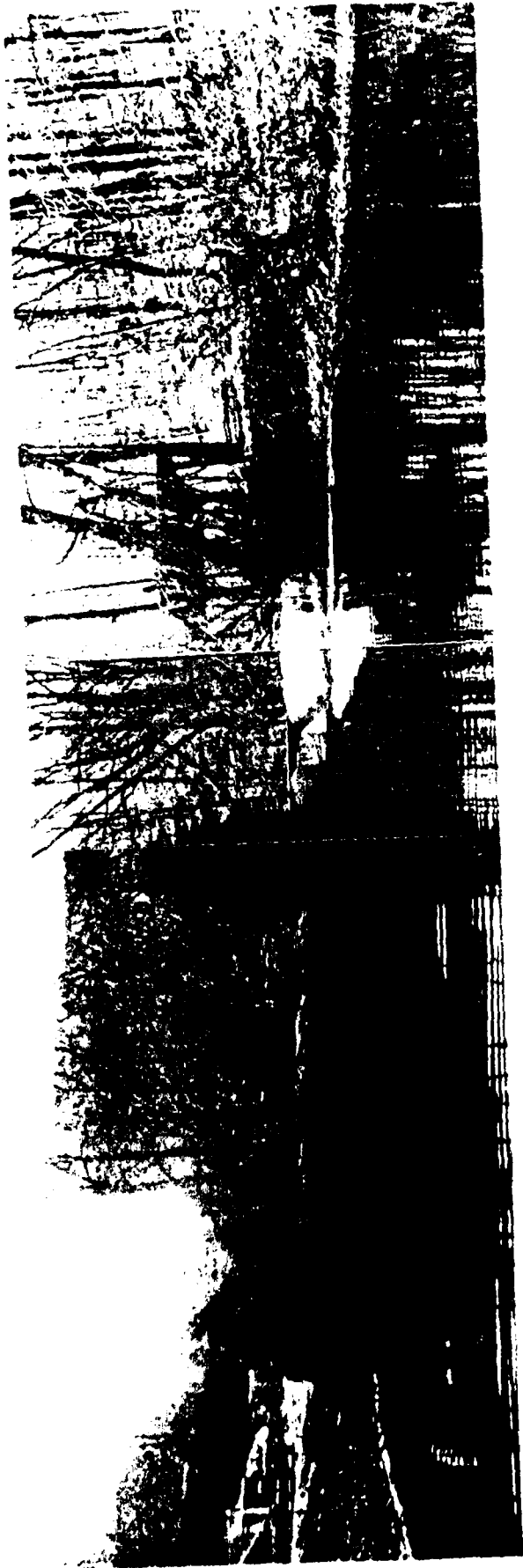


*Lawrence D. Andersen*  
\_\_\_\_\_  
Lawrence D. Andersen, P.E.  
Vice President

March 19, 1981  
\_\_\_\_\_  
Date

Approved by:

*James W. Peck*  
\_\_\_\_\_  
JAMES W. PECK  
Colonel, Corps of Engineers  
District Engineer  
22 APR 81  
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Date



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LOOKING DOWN STREET

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PHASE I REPORT  
NATIONAL DAM INSPECTION PROGRAM  
BIG ELK LAKE DAM  
NDI I.D. PA-0056  
DER I.D. 058-019

SECTION 1  
PROJECT INFORMATION

1.1 General

a. Authority. The inspection was performed pursuant to the authority granted by The National Dam Inspection Act, Public Law 92-367, to the Secretary of the Army, through the Corps of Engineers, to conduct inspections of dams throughout the United States.

b. Purpose. The purpose of this inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project

a. Dam and Appurtenances. Big Elk Lake Dam consists of an earth and dry masonry structure approximately 76 feet long with a maximum height of 12 feet. A dry masonry wall forms the downstream face of the dam. The crest width is 40 feet. The upstream face above the normal pool level has a slope of 2 horizontal to 1 vertical (2:1) and is covered with grass. The downstream dry masonry wall is essentially vertical. Flood discharge facilities for the reservoir consist of a 12-foot-wide, 3-foot-deep rectangular concrete overflow channel located near the right abutment (looking downstream).

It appears that this dam was constructed at the outlet of a natural lake to raise the lake level.

b. Location. Big Elk Lake Dam is located (N41° 45.2, W75° 57.3') Elk Lake Stream, approximately three miles west of the town of Dimock in Dimock Township, Susquehanna County, Pennsylvania. (Plate 1 illustrates the location of the dam.)

c. Size Classification. Small (based on 12-foot height and 750 acre-feet storage capacity).

d. Hazard Classification. The dam is classified to be in the significant hazard category. Immediately downstream from the dam, the stream flows through a 12-foot-high arch under a highway embankment then continues through a narrow valley and flows under a highway one-quarter mile from the dam. About one mile further downstream, it again passes under the highway. There are two houses near the stream at the second underpass and one house near the third underpass. Another

house within the potential floodplain of Elk Lake Stream is located about six miles downstream from the dam near the confluence of Elk Lake Stream and the east branch of Wyalusing Creek. These areas and the highway constitute the main impact area of a flood in the event of a dam failure. Based on these downstream conditions, the loss of a few lives is considered possible.

e. Ownership. Mr. Edgar Baker, County National Bank, Montrose, Pennsylvania 18801.

f. Purpose of Dam. Recreation and water supply.

g. Design and Construction History. Available records indicate that the dam was constructed in 1860, but no other design or construction history information is available.

h. Normal Operating Procedure. The reservoir is normally maintained at the crest level of the uncontrolled spillway. The inflow occurring when the lake is at or above the spillway crest level is discharged through the uncontrolled spillway.

1.3 Pertinent Data. Elevations referred to in this and subsequent sections of the report were calculated based on field measurements assuming the spillway crest to be at Elevation 1339 (USGS Datum), which is shown to be the normal pool elevation on the USGS 7.5-minute, Montrose West quadrangle.

a. <u>Drainage Area</u>	2.88 square miles <sup>(1)</sup>
b. <u>Discharge at Dam Site (cfs)</u>	
Maximum known flood at dam site	Unknown
Outlet conduit at maximum pool	Not applicable
Gated spillway capacity at maximum pool	Not applicable
Ungated spillway capacity at maximum pool	164
Total spillway capacity at maximum pool	164
c. <u>Elevation (USGS Datum) (feet)</u>	
Top of dam	1341.7
Maximum pool	1341.7
Normal pool	1339.0
Upstream invert outlet works	Unknown
Downstream invert outlet works	1330
Maximum tailwater	Unknown
Toe of dam	1330+

<sup>(1)</sup>planimetered from USGS topographic maps.

- d. Reservoir Length (feet)
- |                    |                               |
|--------------------|-------------------------------|
| Normal pool level  | 2600                          |
| Maximum pool level | 2700 <sup>±</sup> (estimated) |
- e. Storage (acre-feet)
- |                    |                 |
|--------------------|-----------------|
| Normal pool level  | 500 (estimated) |
| Maximum pool level | 740             |
- f. Reservoir Surface (acres)
- |                    |    |
|--------------------|----|
| Normal pool level  | 79 |
| Maximum pool level | 97 |
- g. Dam
- |                 |   |
|-----------------|---|
| Type            | Dry masonry wall with earth embankment on upstream side |
| Length          | 76 feet   |
| Height          | 12 feet   |
| Top width       | 40 feet   |
| Side slopes     | Downstream: Vertical<br>Upstream: 2H:1V                 |
| Zoning          | Unknown   |
| Impervious core | Unknown   |
| Cutoff          | Unknown   |
| Grout curtain   | Unknown   |
- h. Regulating Outlet
- The dam has no functional outlet facilities
- i. Spillway
- |                    |                              |
|--------------------|------------------------------|
| Type               | Rectangular concrete channel |
| Length             | 12 feet                      |
| Crest elevation    | 1339 feet                    |
| Upstream channel   | Lake                         |
| Downstream channel | Earth channel                |

SECTION 2  
DESIGN DATA

2.1 Design

a. Data Available. The available data consist of files provided by the Commonwealth of Pennsylvania, Department of Environmental Resources (PennDER), which contain correspondence and inspection reports.

- (1) Hydrology and Hydraulics. No design information is available.
- (2) Embankment. No design information is available.
- (3) Appurtenant Structures. No design information is available.

b. Design Features

(1) Embankment. According to a state report entitled, "Report Upon the Big Elk Lake Outlet Dam of W. H. Tanner," dated July 6, 1915, the dam was constructed in 1860. In addition, the report states that the dam was originally a rock-filled timber crib structure until earth fill was placed over the old crib on the upstream side and a dry masonry wall was constructed along the downstream side to give the present embankment configuration.

(2) Appurtenant Structures. The appurtenant structures consist of the spillway located at the top of the embankment near the right abutment. The spillway is comprised of a rectangular concrete overflow channel 3 feet deep, 12 feet wide at the upstream control section, and 10 feet wide at the downstream end. The 1915 state report indicates that the dam included a 30-inch by 18-inch box culvert through its base as an outlet conduit. The manner in which flow through this culvert was controlled was not indicated.

c. Design Data

- (1) Hydrology and Hydraulics. No design data are available.
- (2) Embankment. No engineering data are available on the design of the embankment.
- (3) Appurtenant Structures. No design information is available on the appurtenant structures.

2.2 Construction. Other than the information referred to in Section 2.1 b, no construction information is available.

2.3 Operation. There are no formal operating records maintained for the dam.

2.4 Other Investigations. None.

2.5 Evaluation

a. Availability. The available information was provided by PennDER.

b. Adequacy

(1) Hydrology and Hydraulics. No information is available.

(2) Embankment. No design and construction information is available to assess the adequacy of the design of the embankment.

(3) Appurtenant Structures. No design information is available for the appurtenant structures.

SECTION 3  
VISUAL INSPECTION

3.1 Findings

a. General. The onsite inspection of Big Elk Lake Dam consisted of:

1. Visual inspection of the embankment, abutments, and embankment toe.
2. Visual examination of the spillway.
3. Evaluation of the downstream area hazard potential.

The specific observations are illustrated in Plate 2.

b. Embankment. The general inspection of the embankment consisted of searching for indications of structural distress, such as cracks, subsidence, bulging, wet areas, seeps and boils, and observing general maintenance conditions, vegetative cover, erosion, and other surficial features.

In general, the condition of the dam is considered to be good. The crest of the dam is covered with a well-developed grass cover and some pine trees. The upstream face of the dam is also covered with grass and was found to be in good condition with no signs of significant shoreline erosion. The dry masonry wall was found to be in good condition; no signs of bulging or other structural distress were noted.

The crest of the dam was surveyed relative to the spillway crest elevation and it was found to be relatively uniform. The dam crest profile is illustrated in Plate 3.

c. Appurtenant Structures. The spillway structure was examined for deterioration or other signs of distress that would limit flow. In general, the spillway structure which consists of a concrete overflow channel was found to be in good condition. An opening was observed at the toe of the stone wall which may be the low level outlet culvert referred to in the 1915 state report.

d. Reservoir Area. A map review indicates that the watershed is predominantly covered by woodlands. A review of the regional geology (Appendix F) indicates that the shoreline of the reservoir is gentle and not likely to be susceptible to large landslides.

e. Downstream Channel. A description of the downstream condition is included in Section 1.2 d.

3.2 Evaluation. The condition of Big Elk Lake Dam is considered to be good. The only condition noted which requires further attention is

the lack of a functional low level outlet facility. The owner should evaluate the need to provide for installation of an outlet facility or prepare plans to drain the lake in case of emergency.

SECTION 4  
OPERATIONAL FEATURES

4.1 Procedure. There are no formal operating procedures for the dam. The reservoir is normally maintained at the uncontrolled spillway crest level with excess inflow discharging over the spillway.

4.2 Maintenance of the Dam. The maintenance of the dam is considered to be good. The crest of the dam is covered with grass and appears to be frequently mowed. There is some debris in the downstream earth channel, but this would not affect the hydraulic performance of the spillway. The dry masonry wall is in fair condition with no obvious signs of distress.

4.3 Maintenance of Operating Facilities. The dam has no operating facilities.

4.4 Warning System. No formal warning system exists for the dam. Telephone communication facilities are available via several residences next to the dam and along the reservoir shoreline.

4.5 Evaluation. The maintenance condition of the dam is considered to be good. The owner should evaluate the need to provide low level outlet facilities or prepare plans to drain the lake in the event of an emergency.



SECTION 5  
HYDRAULICS AND HYDROLOGY

5.1 Evaluation of Features

a. Design Data. Big Elk Lake Dam has a watershed area of 2.88 square miles and impounds a reservoir with a surface area of 78.9 acres at normal pool level. The flood discharge facilities consist of a concrete overflow channel located near the right abutment. The capacity of the spillway was determined to be 164 cfs, based on the available 2.7-foot freeboard relative to the crest of the embankment.

The Big Elk Lake watershed includes two upstream impoundments, the Little Elk Lake located northeast of Big Elk Lake and an unnamed lake near the headwater of Elk Lake Stream. The unnamed lake was found to be a marshland without significant storage under normal conditions. The effect of this marsh on the hydrologic analysis of Big Elk Lake was neglected. The effect of Little Elk Lake, which discharges into Big Elk Lake over a natural saddle point, was included in the hydrologic analysis of the watershed.

b. Experience Data. As previously stated, Big Elk Lake Dam is classified as a small dam in the significant hazard category. Under the recommended criteria for evaluating emergency spillway discharge capacity, such impoundments are required to pass at least the 100-year flood and up to one-half PMF. In view of the 12-foot height and because the dam was found to be at the lower limit of the significant hazard classification, the 100-year flood was selected as the spillway design flood.

The inflow hydrograph for the reservoir was determined utilizing the Dam Safety Version of the HEC-1 computer program developed by the Hydrologic Engineering Center of the U.S. Army, Corps of Engineers. Data used for the computer analysis are presented in Appendix D. The 100-year flood, determined according to the recommended procedure, was found to have a peak of 2290 cfs. Computer input and summary of computer output are also included in Appendix D.

c. Visual Observations. On the date of inspection, no conditions were observed that would indicate that the capacity of the spillway would be significantly reduced in the event of a flood.

d. Overtopping Potential. The 100-year flood was routed through the dam and it was found that the dam crest would be overtopped for a duration of 28.0 hours at a maximum depth of 1.9 feet over the dam crest.

e. Spillway Adequacy. Since the spillway cannot pass the 100-year flood without overtopping the dam, the spillway is classified to be inadequate.

SECTION 6  
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

(1) Embankment. As discussed in Section 3, the field observations did not reveal any signs of distress that would significantly affect the stability of the dam at this time and none were reported in the past.

(2) Appurtenant Structures. The structural performance of the spillway facility appears to be satisfactory.

b. Design and Construction Data

(1) Embankment. No quantitative design and construction data are available for this dam. However, as previously noted, no signs of distress were noted at this time. Therefore, the static stability of the dam is considered to be adequate, based on visual observations.

(2) Appurtenant Structures. No design and construction data are available for the appurtenant structures.

c. Operating Records. No operating records are maintained.

d. Postconstruction Changes. As discussed in Section 2.1 b, the embankment was originally a rock-filled timber crib structure until earth fill was placed over the old crib on the upstream side and a dry masonry wall was constructed along the downstream face to give the present embankment configuration.

e. Seismic Stability. The dam is located in Seismic Zone 1 and based on visual observations, the static stability of the dam is considered to be adequate. Therefore, based on the recommended criteria for the evaluation of seismic stability of dams, the structure is presumed to present no hazard from earthquakes.

SECTION 7  
ASSESSMENT AND RECOMMENDATIONS/PROPOSED REMEDIAL MEASURES

7.1 Dam Assessment

a. Assessment. The visual observations indicate that the Big Elk Lake Dam is in good condition. No conditions were observed that would significantly affect the overall performance of the structure and none have been reported. To the extent that can be determined, it appears the dam was constructed with reasonable care.

The dam has no functional low level outlet facilities. Therefore, the owner should investigate the need to install low level outlet facilities or prepare plans to drain the lake in the event of an emergency.

The spillway capacity was evaluated according to the recommended procedure and it was found that the dam cannot pass the recommended spillway design flood (100-year flood) without overtopping the dam. Therefore, the spillway capacity is classified to be inadequate.

b. Adequacy of Information. The available information, in conjunction with the visual observations, is considered to be sufficient to make a Phase I evaluation.

c. Urgency. The following recommendations should be implemented as soon as possible or on a continuing basis.

d. Necessity for Additional Investigations. The owner should determine the extent of improvements required to provide adequate spillway capacity and investigate the need to install low level outlet facilities or prepare plans to drain the lake in the event of an emergency.

7.2 Recommendations/Remedial Measures. It is recommended that:

1. The owner should determine the nature and extent of improvements required to provide adequate spillway capacity.
2. The owner should investigate the need to install low level outlet facilities or prepare plans to lower the lake in the event of an emergency.
3. Around-the-clock surveillance should be provided during unusually heavy runoff and a formal warning system developed to alert the downstream residents in the event of emergencies.
4. The owner should develop a formal operating and maintenance plan and inspect the dam regularly and perform necessary maintenance.

APPENDIX A  
CHECKLIST  
VISUAL INSPECTION  
PHASE I

APPENDIX A

CHECKLIST  
VISUAL INSPECTION  
PHASE I

NDI: PA-0056  
ID# DER: 058-019

NAME OF DAM Big Elk Lake COUNTY Susquehanna STATE Pennsylvania  
Dry masonry wall with  
TYPE OF DAM earth embankment on upstream side HAZARD CATEGORY Significant  
DATE(S) INSPECTION November 13, 1980 WEATHER Sunny TEMPERATURE 50's

POOL ELEVATION AT TIME OF INSPECTION 1338.7 M.S.L. TAILWATER AT TIME OF INSPECTION No tail- M.S.L.  
water

INSPECTION PERSONNEL: REVIEW INSPECTION PERSONNEL:  
(February 4, 1981)

Douglas Cosler Lawrence D. Andersen  
Arthur Smith James H. Poellot  
Bilgin Erel Bilgin Erel

Owner's Representative: Bilgin Erel RECORDER

None

VISUAL INSPECTION  
 PHASE I  
 EMBANKMENT

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	None observed.	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	See Plate 3 for dam crest profile.	
RIPRAP FAILURES	None observed.	

VISUAL INSPECTION  
 PHASE I  
 EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	No problems observed.	
ANY NOTICEABLE SEEPAGE	None	
STAFF GAGE AND RECORDER	None	
DRAINS	None	

VISUAL INSPECTION  
 PHASE I  
 CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE	No noticeable seepage.	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	No visual signs of distress. No seepage.	
DRAINS	None found.	
WATER PASSAGES	None	
FOUNDATION	No perceivable sign of distress.	



VISUAL INSPECTION  
 PHASE I  
 CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	Masonry dam: N/A	
STRUCTURAL CRACKING	Masonry dam: N/A	
VERTICAL AND HORIZONTAL ALIGNMENT	No perceivable misalignment.	
MONOLITH JOINTS	Masonry dam: N/A	
CONSTRUCTION JOINTS  STAFF GAGE OF RECORDER:	Masonry dam: N/A  None found.	

VISUAL INSPECTION  
 PHASE I  
 OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Dam has no outlet facilities.	The owner should provide for installation of outlet facilities or prepare plans to drain the lake in case of emergency.
INTAKE STRUCTURE	N/A	
OUTLET STRUCTURE	N/A	
OUTLET CHANNEL	N/A	
EMERGENCY GATE	N/A	See above comments.

VISUAL INSPECTION  
 PHASE I  
 UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Rectangular concrete channel in good condition.	
APPROACH CHANNEL	Lake. Channel is approximately 12 feet wide with no obstructions.	
DISCHARGE CHANNEL	Earth channel flowing into corrugated steel road culvert. Debris in channel; culvert in good condition.	
BRIDGE AND PIERS	None	

VISUAL INSPECTION  
 PHASE I  
 GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	The dam has no gated spillway.	
APPROACH CHANNEL	N/A	
DISCHARGE CHANNEL	N/A	
BRIDGE PIERS	N/A	
GATES AND OPERATION EQUIPMENT	N/A	

VISUAL INSPECTION  
 PHASE I  
 INSTRUMENTATION

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

VISUAL INSPECTION  
 PHASE I  
 RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	No problems observed.	
SEDIMENTATION	Unknown	
UPSTREAM RESERVOIRS	None	

VISUAL INSPECTION  
 PHASE I  
 DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Debris in channel; good condition otherwise.	
SLOPES	Steep slopes, but no problems observed.	
APPROXIMATE NUMBER OF HOMES AND POPULATION	3 Homes; approximate population = 12.	

APPENDIX B  
CHECKLIST  
ENGINEERING DATA  
DESIGN, CONSTRUCTION, OPERATION  
AND HYDROLOGIC AND HYDRAULIC  
PHASE I



APPENDIX B  
 CHECKLIST  
 ENGINEERING DATA  
 DESIGN, CONSTRUCTION, OPERATION  
 PHASE I

NAME OF DAM Big Elk Lake

ID# NDI: PA-0056

DER: 058-019

ITEM	REMARKS
AS-BUILT DRAWINGS	None available.
REGIONAL VICINITY MAP	See Plate 1.
CONSTRUCTION HISTORY	Constructed in 1860. No other information is available.
TYPICAL SECTIONS OF DAM	Not available.
OUTLETS - PLAN - DETAILS - CONSTRAINTS - DISCHARGE RATINGS	No functioning outlet facilities.

CHECKLIST  
ENGINEERING DATA  
DESIGN, CONSTRUCTION, OPERATION  
PHASE I

ITEM	REMARKS
RAINFALL/RESERVOIR RECORDS	None reported.
DESIGN REPORTS	None available.
GEOLOGY REPORTS	No geology information reported.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None available.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None available.

CHECKLIST  
 ENGINEERING DATA  
 DESIGN, CONSTRUCTION, OPERATION  
 PHASE I

ITEM	REMARKS
POST CONSTRUCTION SURVEYS OF DAM	None available.
BORROW SOURCES	Unknown
MONITORING SYSTEMS	No existing monitoring systems.
MODIFICATIONS	None reported.
HIGH POOL RECORDS	None available.

CHECKLIST  
ENGINEERING DATA  
DESIGN, CONSTRUCTION, OPERATION  
PHASE I

ITEM	REMARKS
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None reported.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None available.
MAINTENANCE OPERATION RECORDS	None available.
SPILLWAY PLAN SECTIONS DETAILS	None available.
OPERATING EQUIPMENT PLANS AND DETAILS	No operating equipment.

CHECKLIST  
ENGINEERING DATA  
HYDROLOGIC AND HYDRAULIC

DRAINAGE AREA CHARACTERISTICS: 2.88 square miles (wooded)  
ELEVATION, TOP OF NORMAL POOL AND STORAGE CAPACITY: 1339 (513 acre-feet)  
ELEVATION, TOP OF FLOOD CONTROL POOL AND STORAGE CAPACITY: 1341.7 (750 acre-feet)  
ELEVATION, MAXIMUM DESIGN POOL: 1341.7 (design pool unknown)  
ELEVATION, TOP OF DAM: 1341.7

SPILLWAY:

- a. Elevation 1339
- b. Type Rectangular concrete channel
- c. Width 12 feet (perpendicular to flow)
- d. Length 37 feet
- e. Location Spillover None observed
- f. Number and Type of Gates None

OUTLET WORKS:

- a. Type Dam has no outlet facilities.
- b. Location N/A
- c. Entrance Inverts N/A
- d. Exit Inverts N/A
- e. Emergency Drawdown Facilities None

HYDROMETEOROLOGICAL GAGES:

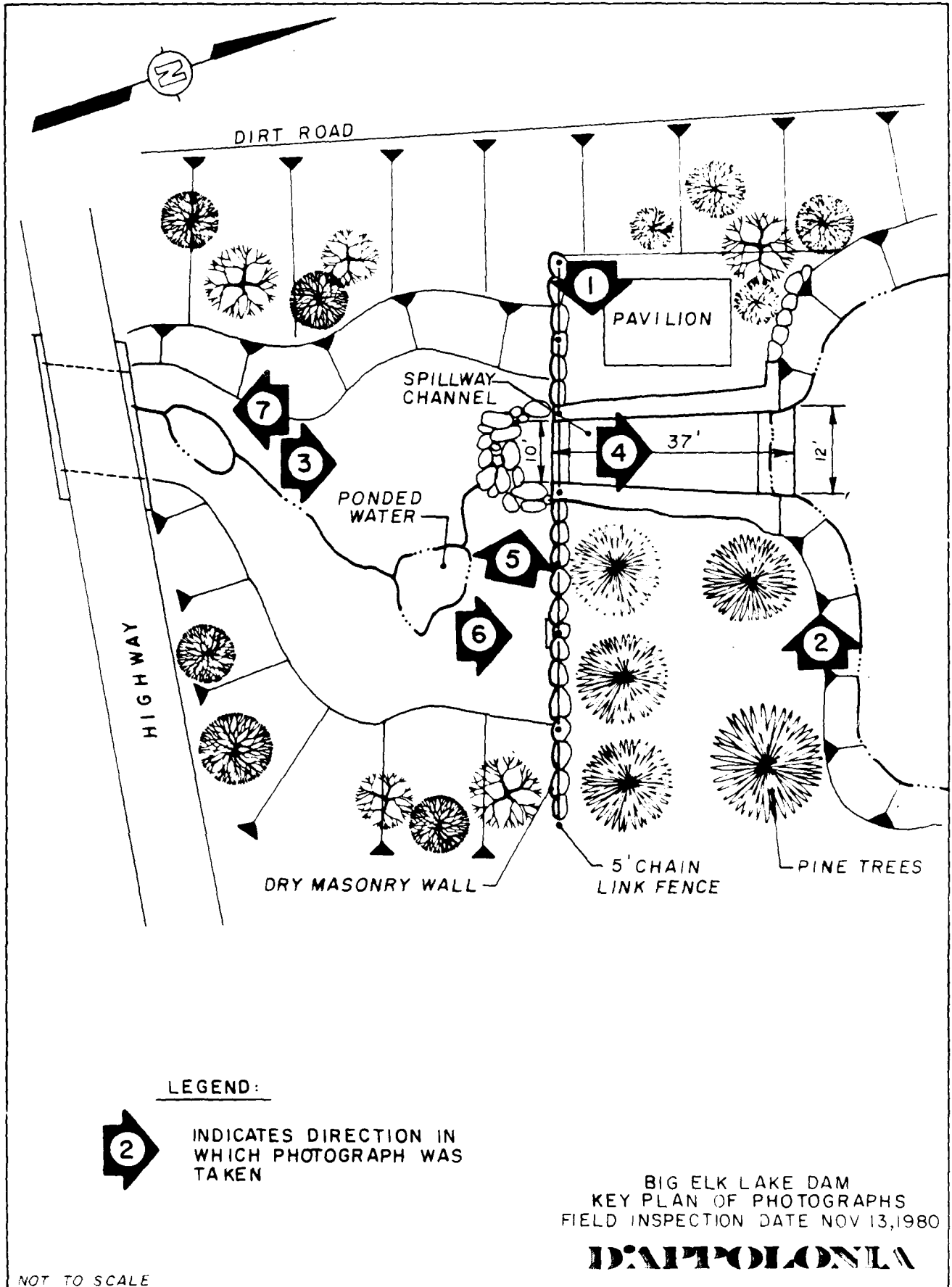
- a. Type None
- b. Location N/A
- c. Records None

MAXIMUM NONDAMAGING DISCHARGE: Spillway capacity (164 cfs)

APPENDIX C  
PHOTOGRAPHS

LIST OF PHOTOGRAPHS  
BIG ELK LAKE DAM  
NDI I.D. NO. PA-0056  
NOVEMBER 13, 1980

<u>PHOTOGRAPH NO.</u>	<u>DESCRIPTION</u>
1	Crest (looking east).
2	Upstream face.
3	Downstream face.
4	Spillway channel (looking upstream).
5	Dam (looking west).
6	Outlet conduit (downstream end).
7	Highway (approximately 100 feet downstream).
8	House (mile 3.2).



**LEGEND:**



INDICATES DIRECTION IN WHICH PHOTOGRAPH WAS TAKEN

BIG ELK LAKE DAM  
 KEY PLAN OF PHOTOGRAPHS  
 FIELD INSPECTION DATE NOV 13, 1980

**D'APOLONIA**

NOT TO SCALE





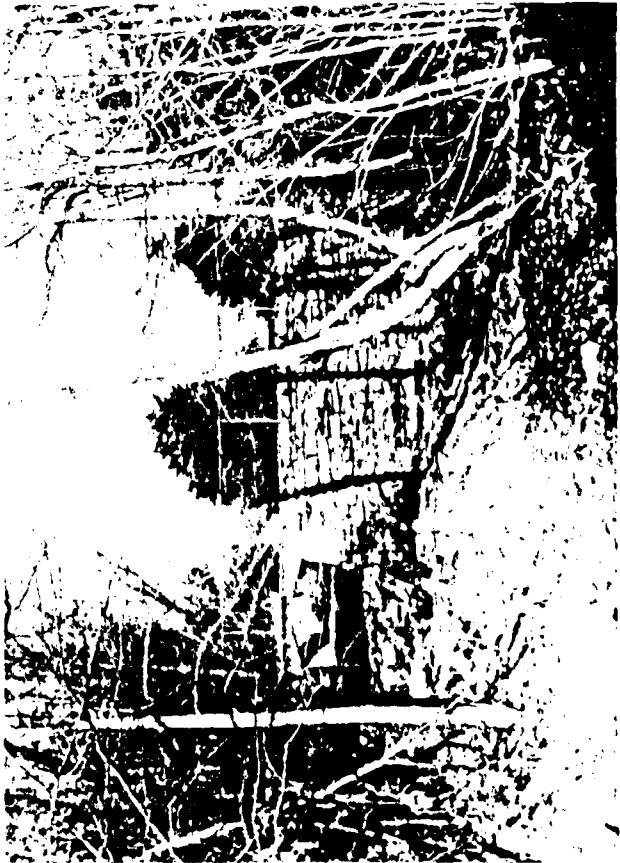
PHOTOGRAPH NO 2



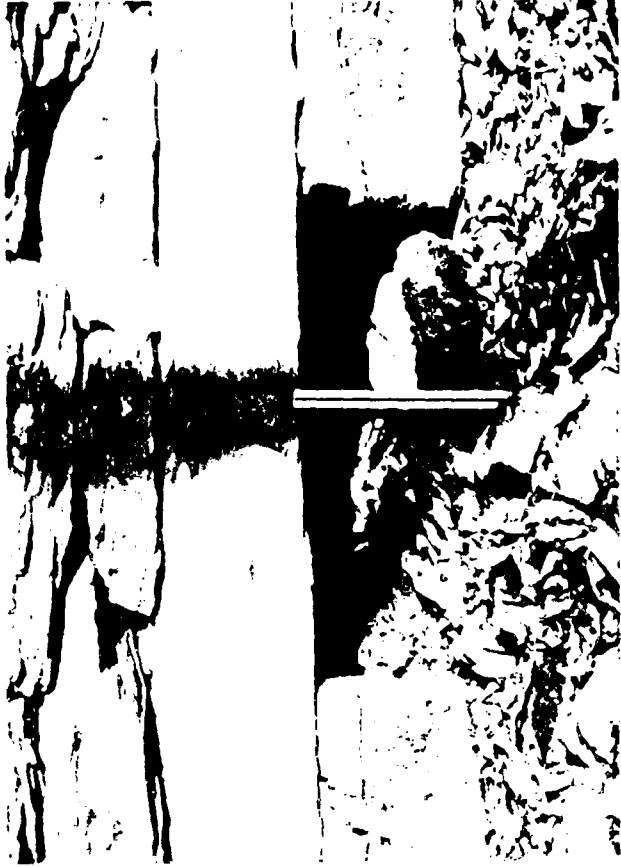
PHOTOGRAPH NO 4



PHOTOGRAPH NO 1



PHOTOGRAPH NO 3



PHOTOGRAPH NO 6



PHOTOGRAPH NO 8



PHOTOGRAPH NO 5



PHOTOGRAPH NO 7

APPENDIX D  
HYDROLOGY AND HYDRAULICS ANALYSES

HYDROLOGY AND HYDRAULIC ANALYSIS  
DATA BASE

NAME OF DAM: Big Elk Lake Dam

PROBABLE MAXIMUM PRECIPITATION (PMP) = N/A INCHES/24 HOURS

STATION	1	2	3	4	5
Station Description	Little Elk Lake Reservoir	Little Elk Lake Overflow Section	Big Elk Lake Reservoir	Big Elk Lake Dam	
Drainage Area (square miles)	0.77	-	2.11	-	
Cumulative Drainage Area (square miles)	0.77	0.77	2.11	2.88	
Adjustment of PMF for Drainage Area (%) <sup>(1)</sup>					
6 Hours	N/A	-	N/A	-	
12 Hours	N/A	-	N/A	-	
24 Hours	N/A	-	N/A	-	
48 Hours	N/A	-	N/A	-	
72 Hours	N/A	-	-	-	
Snyder Hydrograph Parameters					
Zone <sup>(2)</sup>	11	-	11	-	
C <sub>p</sub> /C <sub>t</sub> <sup>(3)</sup>	0.62/1.5	-	0.62/1.5	-	
L (miles) <sup>(4)</sup>	1.42	-	2.90	-	
L <sub>ca</sub> (miles) <sup>(4)</sup>	0.66	-	1.42	-	
t <sub>p</sub> = C <sub>t</sub> (L·L <sub>ca</sub> ) <sup>0.3</sup> (hours)	1.47	-	2.29	-	
Spillway Data					
Crest Length (ft)	-	200	-	12	
Freeboard (ft)	-	-	-	2.6	
Discharge Coefficient	-	2.65	-	3.08	
Exponent	-	1.5	-	1.5	

(1) Hydrometeorological Report 40, U.S. Weather Bureau, 1965.

(2) Hydrological zone defined by Corps of Engineers, Baltimore District, for determining Snyder's Coefficients (C<sub>p</sub> and C<sub>t</sub>).

(3) Snyder's Coefficients.

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

L<sub>ca</sub> = Length of water course from outlet to point opposite the centroid of drainage area.

STORAGE VS. ELEVATION

ELEVATION	ΔH, FEET	AREA (acres) <sup>(1)</sup>	ΔVOLUME (acre-feet) <sup>(2)</sup>	STORAGE (acre-feet)
1360	20	198.3	2780.0	3376.0
1340		87.2		596.0
1339	1	78.9	83.0	513.0
(Normal pool elevation)				
Reservoir Bottom	-	-	513.0 <sup>(3)</sup>	0

(1) Planimetered from USGS maps.

(2) ΔVolume = ΔH/3 (A<sub>1</sub> + A<sub>2</sub> + √A<sub>1</sub>A<sub>2</sub>).

(3) Estimated from available information.

\*\*\*\*\*  
 DAM SAFETY EVALUATION  
 LAST MODIFICATION 01 APR 80  
 \*\*\*\*\*

SNYDER DAM HYDROGRAPH, SPILLWAY AND DAM OVERTOPPING ANALYSES  
 BIG ELK LAKE, (DER 58-19), SUSHUEHANNA COUNTY, PROJECT NO 80-556-11  
 FOR 100 YEAR STORM (140%, 150%, AND 160%)

LINE	NO	VAL	UNIT	DESCRIPTION	VAL	UNIT	DESCRIPTION
1	300	0		100 YEAR STORM HYDROGRAPH TO LITTLE ELK LAKE	0		
2	1	1.40	3		1		
3	1	1.50	1		1		
4	0			CALCULATION OF 100 YEAR STORM HYDROGRAPH TO LITTLE ELK LAKE	1		
5	144	0	77		0	77	
6	0	0.12			0	0.12	
7	0	0.13			0	0.13	
8	0	0.13			0	0.14	
9	0	0.14			0	0.15	
10	0	0.15			0	0.17	
11	0	0.17			0	0.19	
12	0	0.19			0	0.22	
13	0	0.25			0	0.25	
14	0	0.30			0	0.30	
15	0	0.35			0	0.35	
16	0	0.50			0	0.40	
17	0	0.70			0	0.60	
18	0	1.190			0	1.100	
19	1.47	0.62			1	0.5	
20	-1.5	-0.02	2.0		1	0.5	
21	1			ROUTING FLOW THROUGH LITTLE ELK LAKE	1		
22	1				1		
23	1				1		
24	1				1		
25	1	124.0			1		
26	1360.0				1		
27	200.0				1		
28	0.01	1.5			1		
29	0	0.010			1		
30	0			CALCULATION OF 100 YEAR STORM HYDROGRAPH TO BIG ELK LAKE, (DER 58-19)	1		
31	144	0	11		0	11	
32	0	0.12			0	0.12	
33	0	0.13			0	0.13	
34	0	0.13			0	0.14	
35	0	0.14			0	0.15	
36	0	0.15			0	0.17	
37	0	0.17			0	0.19	
38	0	0.19			0	0.22	
39	0	0.25			0	0.25	
40	0	0.30			0	0.30	
41	0	0.35			0	0.35	
42	0	0.50			0	0.40	
43	0	0.70			0	0.60	
44	0	1.190			0	1.100	
45	1.47	0.62			1	0.5	
46	-1.5	-0.02	2.0		1	0.5	
47	1			ROUTING FLOW THROUGH LITTLE ELK LAKE	1		
48	1				1		
49	1				1		
50	1				1		



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	RATIOS APPLIED TO PRECIPITATION		
				RATIO 1 1.40	RATIO 2 1.50	RATIO 3 1.60
HYDROGRAPH AT	1	1.77	1	705	767	828
ROUTED TO	2	1.99	1	19,981	21,711	23,431
HYDROGRAPH AT	3	2.11	1	537	591	646
2 COMBINED	3	5.46	1	15,201	16,741	18,291
ROUTED TO	4	2.88	1	1503	1638	1775
		7.46	1	42,541	46,391	50,261
			1	2039	2229	2421
			1	57,741	63,131	68,551
			1	1225	1385	1555
			1	34,711	39,251	44,041

100-Year  
Flood

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1	ELEVATION STORAGE OUTFLOW	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM						
		1342.00	1342.00	1342.00						
		0.	0.	0.						
		0.	0.	0.						
	RATIO OF PMF	MAXIMUM RESERVOIR W.S. ELEV	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS			
100-Year Flood	1.40	1343.01	46.	537.	50.00	25.83	0.00			
	1.50	1343.08	49.	591.	50.00	25.83	0.00			
	1.60	1343.14	53.	646.	50.00	25.83	0.00			



SUMMARY OF DAM SAFETY ANALYSIS

PLAN	RATIO OF PMF	ELEVATION STORAGE OUTFLOW	INITIAL VALUE	SPILLWAY GRESI	TOP OF DAM	TIME OF FAILURE HOURS
			1339.00	1339.00	1341.70	
			0	0	1.48	0.00
			0	0	1.65	0.00
		MAXIMUM RESERVOIR W. S. ELEV	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS
100-year flood	1.40	1343.38	404	810	11.33	28.17
	1.50	1343.62	429	951	11.67	28.00
	1.60	1343.86	454	1097	12.17	27.83



By BE Date 3-18-81 Subject PIG ELK LAKE Sheet No 1 of 1  
 Chkd. By MS Date 3/18/81 00-TR FLOOD PEAK Proj No 80-556

100-YEAR FLOOD PEAK CALCULATION:

REF: "Hydrologic Study Tropical Storm Opnes"  
 by Army Corps of Engineers 1975

$$\log(F) = \log(Q_m) + K(P, g) S$$

where

$\log(P)$  = flood peak in cfs for given  
 exceedence frequency  $P$ .

$\log(Q_m)$  = mean log of annual flood peaks

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

$C_m$  = a map coefficient (Ref Fig 21)

$A$  = drainage area in sq miles

$K(P, g)$  = standard deviate for given  $P$   
 and skew coefficient  $g$ .

$S$  = standard deviation

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

$C_s$  = a map coefficient (Ref Fig 22)

$g$  = skew coefficient (Ref Fig. 23)



By BE Date 3-18-81 Subject RIG ELK LAKE Sheet No 2 of 2  
Chkd By MB Date 3/18/81 100-7E FLOOD PEAK Proj No 80-556

RIG ELK LAKE 100-7E FLOOD P = 0.01

Drainage Area = 2.9 sq. miles

$$C_m = 2.15 \quad (\text{Ref Fig 21})$$

$$C_s = 0.36 \quad (\text{Ref Fig 22})$$

$$g = +0.30 \quad (\text{Ref Fig 23})$$

$$\therefore \log(Q_m) = 2.15 + 0.75 \log(2.9) = 2.50$$

$$S = 0.36 - 0.05 \log(2.9) = 0.34$$

$$K(T, g) = K(0.01, 0.3) = 2.544''$$

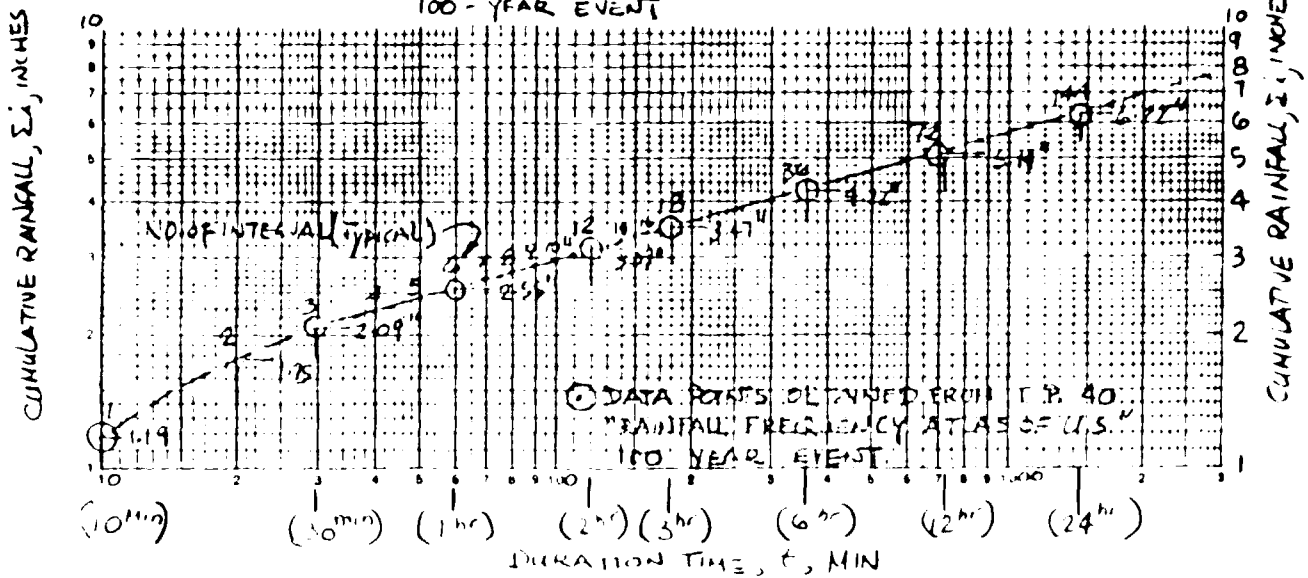
$$\therefore \log(Q_{0.01}) = 2.50 + 2.544 \times 0.34 = 3.36$$

$$Q_{100-7E} = 10^{3.36} = 2,290 \text{ cfs.}$$

(1) Ref: Hydrology for Engineers & Planners by A.T Hjelmfelt  
& J.W Cassidy Iowa State pg. 30

# HDM P & D CONSULTING ENGINEERS INC

By WTC Date 1/21/81 Subject BIG ELK LAKE (DER 58-19) Sheet No 1 of 1  
 Chkd By MB Date 1/22/81 CUMULATIVE RAINFALL Vs DURATION TIME Proj No 80556-11  
100-YEAR EVENT



END OF 10 MINUTES INTERVALS	$\Sigma i$ INCHES	$\Delta i$ PER INTERVAL INCHES	END OF 10 MINUTES INTERVALS	$\Sigma i$ INCHES	$\Delta i$ PER INTERVAL INCHES
1	1.19	1.19	16	3.35	0.06
2	1.75	0.56	17	3.41	0.06
3	2.09	0.34	18	3.47	0.06
4	2.27	0.18	19 to 24	3.77	0.05
5	2.42	0.15	25 to 30	4.01	0.04
6	2.55	0.13	31 to 36	4.22	0.035
7	2.66	0.11	37 to 48	4.58	0.030
8	2.76	0.10	49 to 60	4.88	0.025
9	2.85	0.09	61 to 72	5.144	0.022
10	2.94	0.09	73 to 84	5.372	0.019
11	3.02	0.08	85 to 96	5.576	0.017
12	3.09	0.07	97 to 108	5.756	0.015
13	3.16	0.07	109 to 120	5.924	0.014
14	3.23	0.07	121 to 132	6.08	0.013
15	3.29	0.06	133 to 144	6.224	0.012

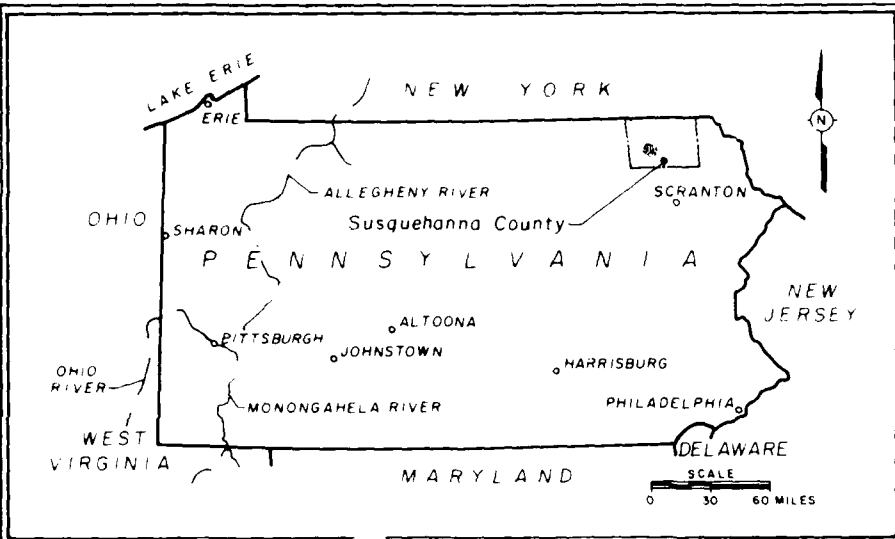
0.57 of  $\Sigma i$   
at 30 minutes

LEGEND: (12): DATA POINTS OBTAINED FROM TECHNICAL PAPER NO. 40 (T.P. 40)  
 "RAINFALL FREQUENCY ATLAS OF THE U.S. FOR DURATION FROM 30 MIN.  
 TO 24 HOURS" 100-YEAR EVENT,

APPENDIX E

PLATES

DRAWN BY: ACS 12-5-80  
 CHECKED BY: SC 2-17-82  
 APPROVED BY: JHO 7-7-82  
 DRAWING NUMBER 80-556-B9



KEY PLAN

APPROXIMATE  
 WATERSHED BOUNDARY



REFERENCES

- 1 USGS LAWTON, PA QUADRANGLE  
 PHOTOREVISED 1978, SCALE 1:24000
- 2 USGS AUBURN CENTER PA QUADRANGLE  
 PHOTOREVISED 1969, SCALE 1:24000
- 3 USGS SPRINGVILLE, PA QUADRANGLE  
 PHOTOREVISED 1969, SCALE 1:24000
- 4 U S G S MONTROSE WEST, PA QUADRANGLE  
 PHOTOREVISED 1978, SCALE 1:24000

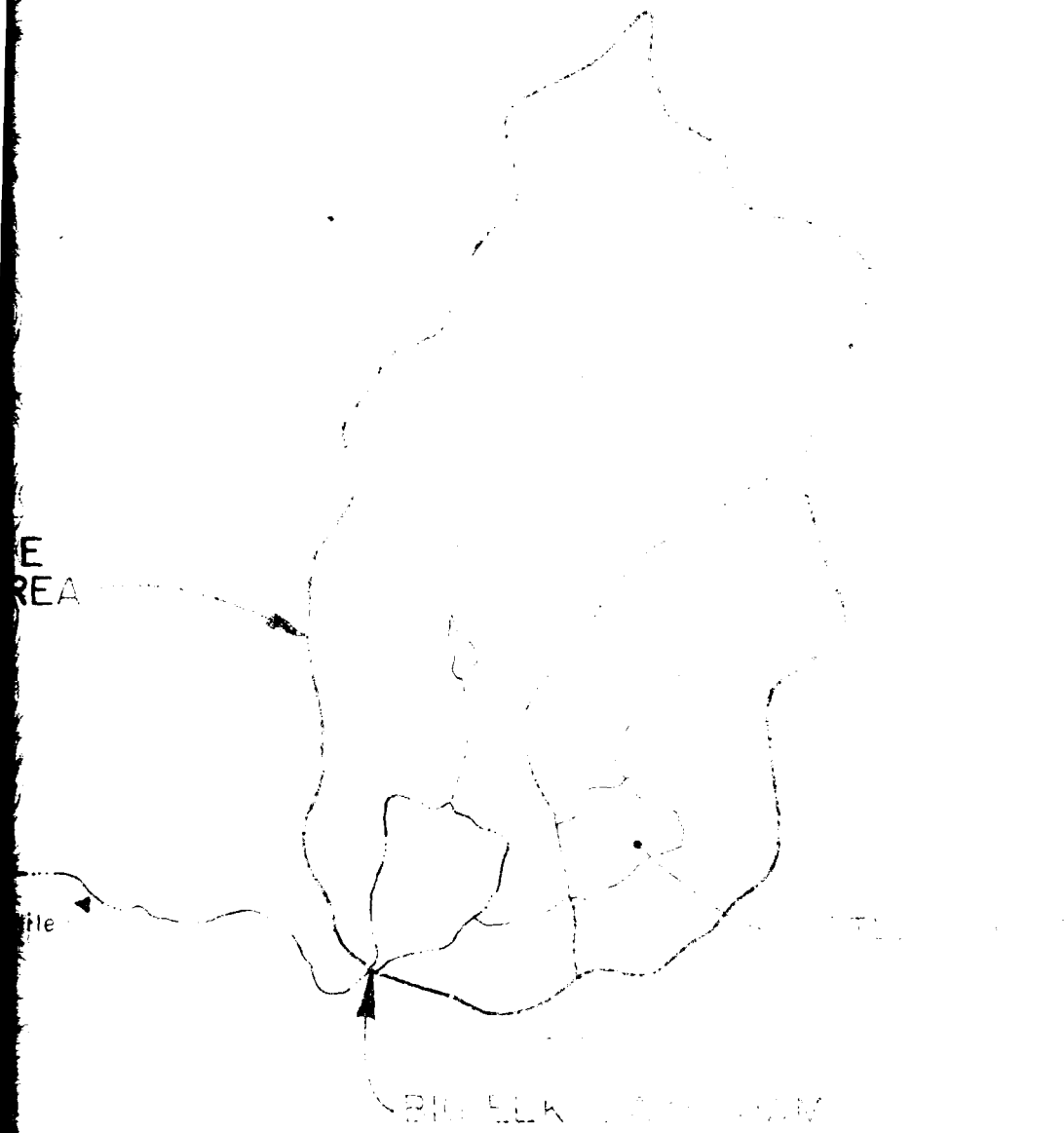
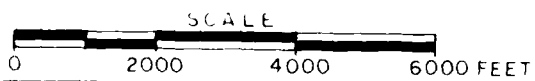


PLATE I  
BIG ELK LAKE DAM  
VICINITY FLOOD PLAIN & WATERSHED MAP



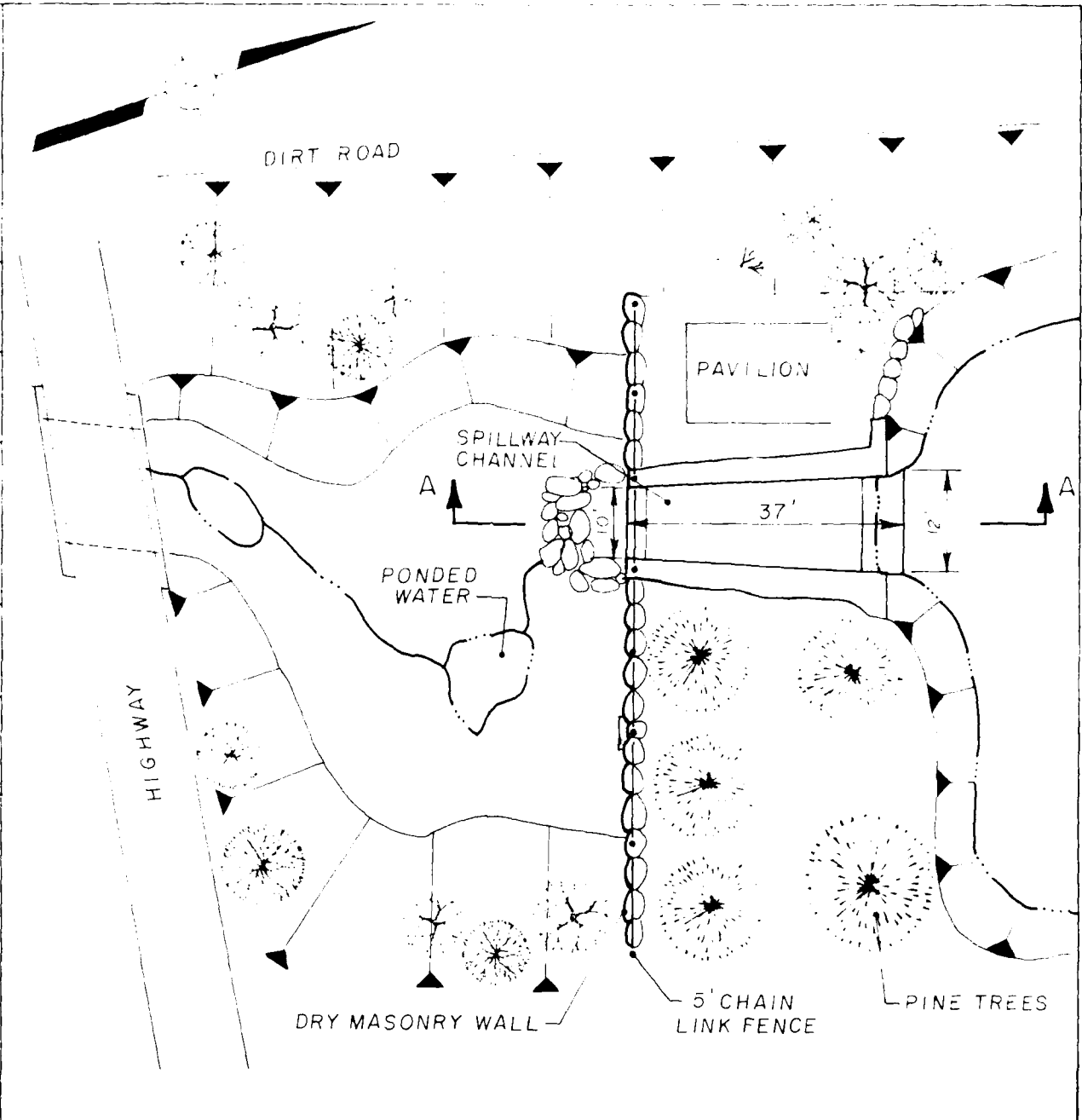
IDAHO POWER CO.

DRAWING NUMBER 80-556-A17

CHECKED BY APPROVED BY

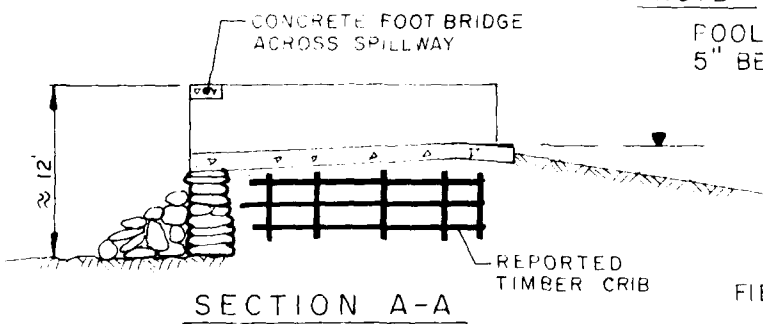
DATE 2/3/80

DRAWN BY



NOTE

POOL LEVEL AT DATE OF INSPECTION  
5" BELOW SPILLWAY CREST



SECTION A-A

PLATE 2

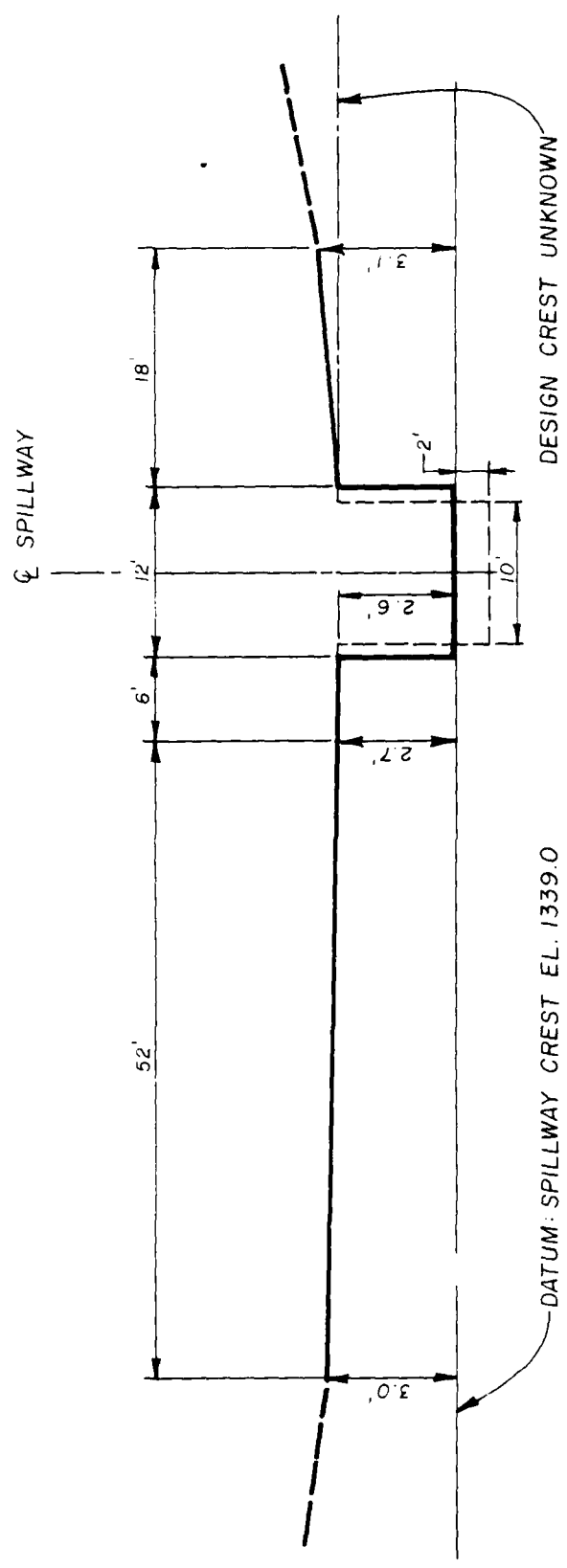
BIG ELK LAKE DAM  
GENERAL PLAN  
FIELD INSPECTION NOTES  
FIELD INSPECTION DATE NOV 13, 1980

D:\NIPUD\ADN\LA

NOT TO SCALE



DRAWN BY	MBM	CHECKED BY	DRAWING NUMBER
12 23 80	80	1171	80-556-A18



**DAM CREST PROFILE**  
(LOOKING DOWNSTREAM)

NOTES

1. DAM CREST WAS SURVEYED RELATIVE TO SPILLWAY CREST LEVEL
2. DATUM ELEVATION PER U.S.G.S MAP

PLATE 3

BIG ELK LAKE DAM  
DAM CREST SURVEY  
FIELD INSPECTION DATE NOV. 11, 1980

**INDIANAPOLIS**

APPENDIX F  
REGIONAL GEOLOGY

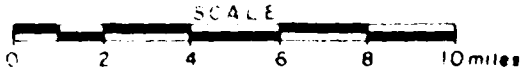
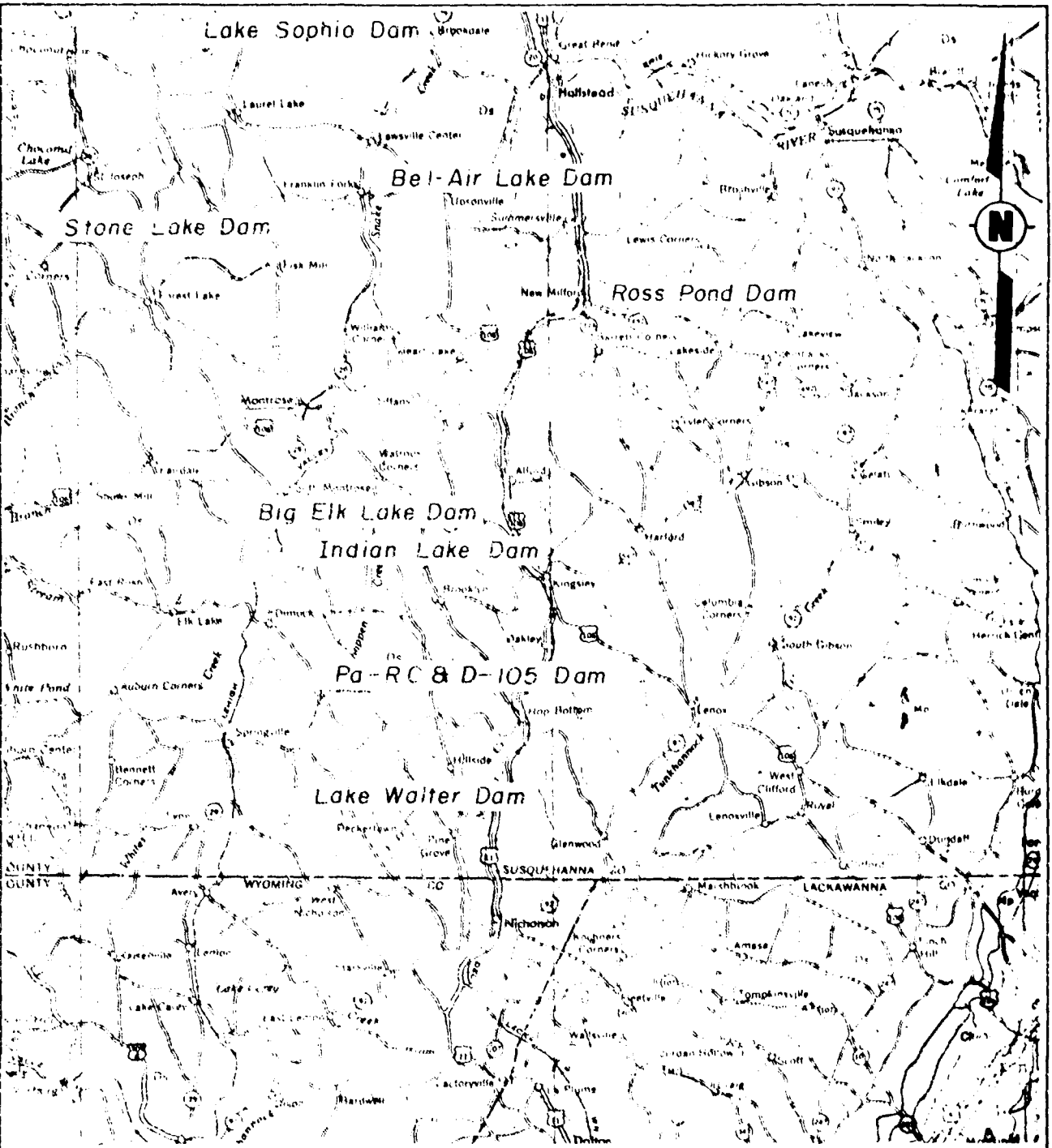
REGIONAL GEOLOGY  
BIG ELK LAKE AND INDIAN LAKE DAMS

The Big Elk Lake and Indian Lake dams are located in the glaciated low plateaus section of the Appalachian Plateau physiographic province, characterized as a mature glaciated plateau of moderate relief.

The geologic structure consists of a series of northeast trending folds (approximately  $N70^{\circ}E$ ) which plunge gently to the southwest. The dip of the limbs of the folds in the vicinity of the dams is less than two degrees, with the southeast limb steeper than the northwest limb. The dams are located near the axis of a small syncline between the Wilmot and Towanda anticlines. In general, the discontinuity trends are northeast and northwest.

The stratigraphy consists of glacial till which will range in thickness from very thin to approximately 200 feet. The glacial till is underlain by the Devonian Catskill Formation, which is approximately 1,800 feet thick in this area. The Catskill Formation is continental in origin, consisting of red shale, cross-bedded red and green sandstone and siltstone. The shale strata tend to weather rapidly when exposed.

DRAWN BY ACS CHECKED BY JRP APPROVED BY JRP  
 1-2-81 1-17-81 2-17-81  
 DRAWING NUMBER 80 556-A2



GEOLOGY MAP

REFERENCE  
 GEOLOGIC MAP OF PENNSYLVANIA PREPARED  
 BY COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF  
 ENVIRONMENTAL RESOURCES DATED 1960  
 SCALE 1:250,000

**D'ARNO**

DRAWN BY  
1-2-81  
CHECKED BY  
7SC  
APPROVED BY  
SJC  
2-17-81  
2-17-81  
DRAWING NUMBER  
80-556-A4

**PENNSYLVANIAN**

**APPROACH AN PLATEAU**

**Pa**  
Allegheny Group  
The Allegheny Group consists of the Allegheny, West Allegheny, and North Allegheny Formations. It is a sequence of sandstone, shale, and conglomerate. The Allegheny Formation is the basal member and is characterized by its massive, blocky sandstone. The West Allegheny Formation is a shale with thin sandstone partings. The North Allegheny Formation is a conglomerate with sandstone and shale. The Allegheny Group is 100-150 feet thick and is overlain by the Pottsville Group.

**Pp**  
Pottsville Group  
The Pottsville Group consists of the Pottsville, Conemaugh, and Smithburg Formations. It is a sequence of sandstone, shale, and limestone. The Pottsville Formation is the basal member and is characterized by its massive, blocky sandstone. The Conemaugh Formation is a shale with thin sandstone partings. The Smithburg Formation is a limestone with sandstone and shale. The Pottsville Group is 200-300 feet thick and is overlain by the Anthracite Region.

**ANTHRACITE REGION**

**Pp**  
Pottsville Group  
The Pottsville Group consists of the Pottsville, Conemaugh, and Smithburg Formations. It is a sequence of sandstone, shale, and limestone. The Pottsville Formation is the basal member and is characterized by its massive, blocky sandstone. The Conemaugh Formation is a shale with thin sandstone partings. The Smithburg Formation is a limestone with sandstone and shale. The Pottsville Group is 200-300 feet thick and is overlain by the Devonian.

**MISSISSIPPIAN**

**Mmc**  
Monaca Group  
The Monaca Group consists of the Monaca, Conemaugh, and Smithburg Formations. It is a sequence of sandstone, shale, and limestone. The Monaca Formation is the basal member and is characterized by its massive, blocky sandstone. The Conemaugh Formation is a shale with thin sandstone partings. The Smithburg Formation is a limestone with sandstone and shale. The Monaca Group is 200-300 feet thick and is overlain by the Devonian.

**DEVONIAN**

**UPPER**

**CENTRAL AND EASTERN PENNSYLVANIA**

**Dsk**  
Oswayo Formation  
The Oswayo Formation is a sandstone with greenish shale and thin shales and shaly partings. It is a sequence of sandstone, shale, and limestone. The Oswayo Formation is 100-150 feet thick and is overlain by the Onondaga Formation.

**Onk**  
Onondaga Formation  
The Onondaga Formation is a sandstone with greenish shale and thin shales and shaly partings. It is a sequence of sandstone, shale, and limestone. The Onondaga Formation is 100-150 feet thick and is overlain by the Genesee Formation.

**Mmt**  
Mantua Formation  
The Mantua Formation is a sandstone with greenish shale and thin shales and shaly partings. It is a sequence of sandstone, shale, and limestone. The Mantua Formation is 100-150 feet thick and is overlain by the Allegheny Group.

**Onk**  
Onondaga Formation  
The Onondaga Formation is a sandstone with greenish shale and thin shales and shaly partings. It is a sequence of sandstone, shale, and limestone. The Onondaga Formation is 100-150 feet thick and is overlain by the Genesee Formation.

**Onk**  
Onondaga Formation  
The Onondaga Formation is a sandstone with greenish shale and thin shales and shaly partings. It is a sequence of sandstone, shale, and limestone. The Onondaga Formation is 100-150 feet thick and is overlain by the Genesee Formation.

**GEOLOGY MAP LEGEND**

REFERENCE

GEOLOGIC MAP OF PENNSYLVANIA PREPARED BY COMMONWEALTH OF PENNA DEPARTMENT OF ENVIRONMENTAL RESOURCES, DATED 1960  
SCALE 250,000

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