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NATIONAL DAM INSPECTION PROGRAM. BLAIR GAP DAM (NDI 521), SUSQU--ETC(U)
JUL 78 DACW31-78-C-0049

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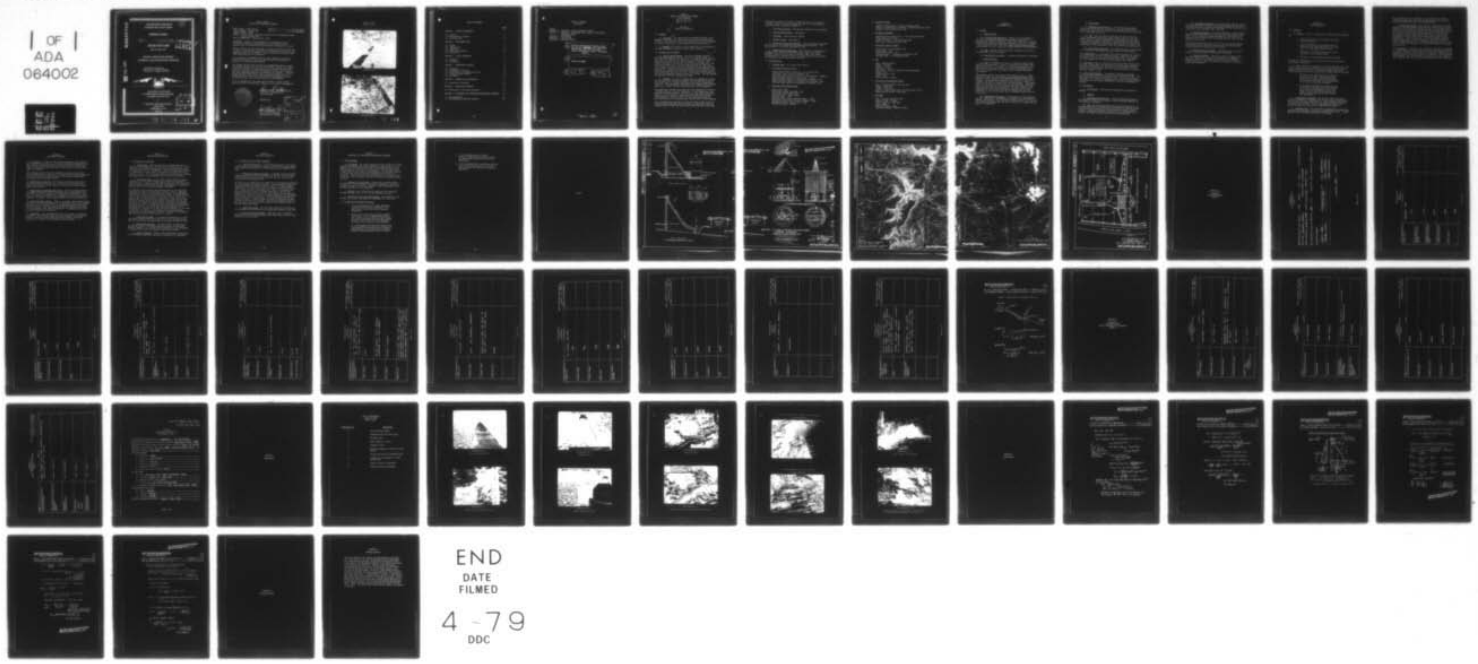

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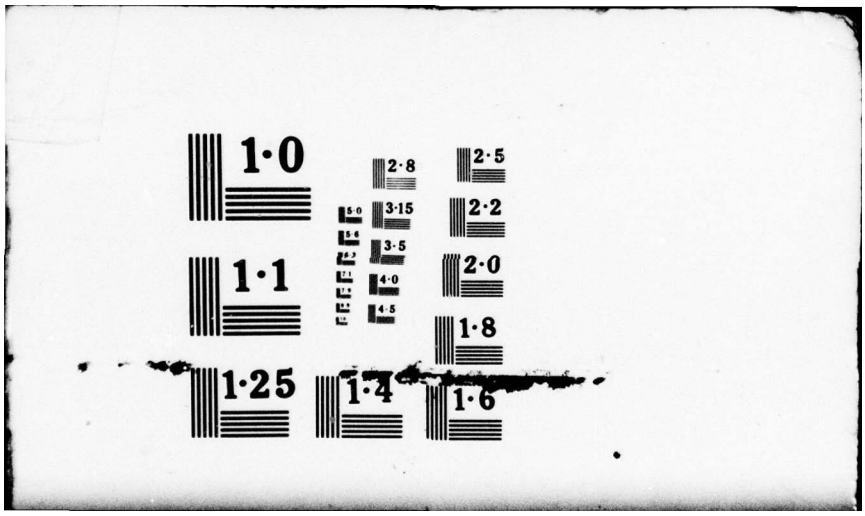
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SUSQUEHANNA RIVER BASIN
BLAIR GAP RUN, BLAIR COUNTY

PENNSYLVANIA

BLAIR GAP DAM

NDI I.D. NO: 521

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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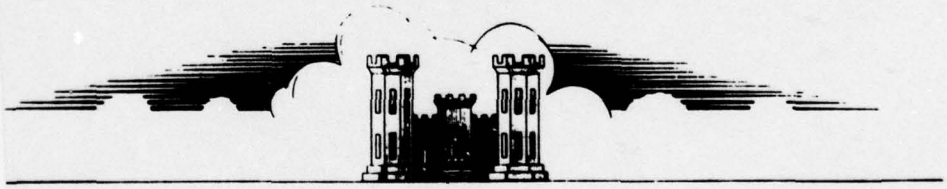


PREPARED FOR

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

BY

D'APPOLONIA CONSULTING ENGINEERS
10 DUFF ROAD
PITTSBURGH, PA. 15235

JULY 1978

PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

NAME OF DAM: Blair Gap Dam
STATE LOCATED: Pennsylvania
COUNTY LOCATED: Blair
STREAM: Blair Gap Run, secondary tributary of the Frankstown Branch of the Juniata River
DATE OF INSPECTION: June 9 and 12, 1978

ASSESSMENT: Based on the evaluation of the conditions as they existed on the dates of inspection and as revealed by visual observations, the condition of Blair Gap Dam is assessed to be good.

However, because the owner declined to operate the blow-off valve for the dam, the operational condition of the drawdown facilities for the reservoir could not be assessed. Visual observations indicated that these facilities are not maintained.

It is therefore recommended that the owner immediately assess the functional condition of the operating facilities and adequately maintain all operating appurtenances.

The primary spillway does not have the recommended capacity to pass the probable maximum flood without overtopping. However, the dam is a masonry structure, and overtopping by the probable maximum flood would not significantly affect the stability of the dam. Therefore, the flood discharge capacity is considered to be adequate. However, during unusually heavy runoff, when overtopping might occur, an around-the-clock surveillance plan should be implemented to detect possible problems, such as rapid erosion of the abutments.

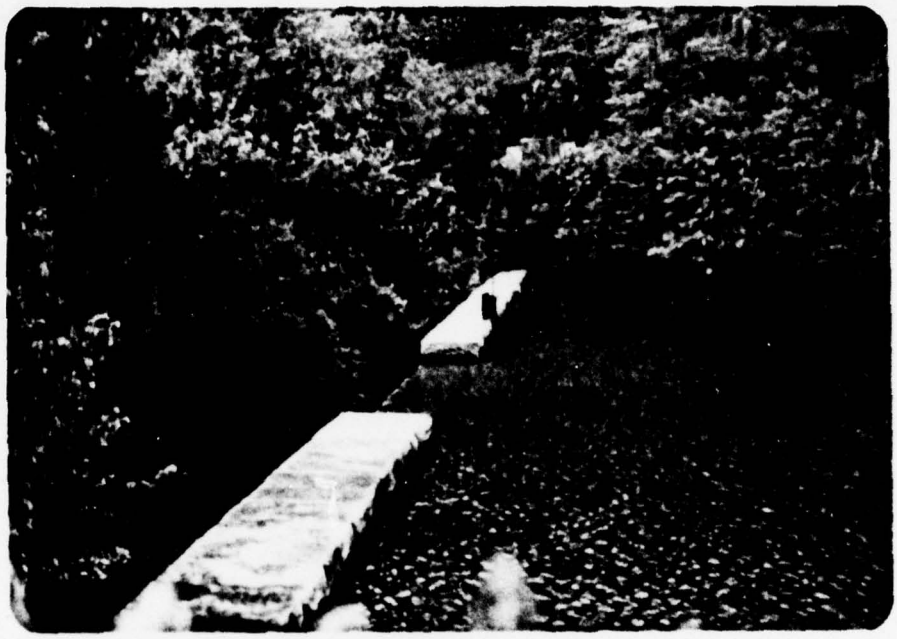
It is recommended that the owner should develop a formal warning system to alert the downstream residents in the event of emergencies.

Lawrence D. Andersen, P.E.
Vice President

APPROVED BY:

JOHN H. KENWORTHY
LTC, Corps of Engineers
Acting District Engineer

BLAIR GAP DAM
JUNE 9, 1978



Upstream Face

Downstream Face

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(6) National Dam Inspection Program. Blair Gap Dam (NDI ID Number 521), Susquehanna River Basin, Blair Gap Run, Blair County, Pennsylvania. Phase I Inspection Report.

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PHASE I
NATIONAL DAM INSPECTION PROGRAM
BLAIR GAP DAM
NDI I.D. NO. 521
DER I.D. NO. 7-6

ABSTRACT

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.

ABSTRACT

1.2 Description of Project

a. Dam and Appurtenances. The dam is a masonry gravity structure approximately 316 feet long with a maximum height of 47 feet from the downstream toe (Plate 1). A 53-foot-long section two feet below the crest is the overflow section of the dam. This section discharges down the face of the dam to a plunge pool. The outlet works consist of a 24-inch cast-iron blow-off pipe and a 16-inch cast-iron supply line, both located near the right side of the spillway. Discharge through these pipes is controlled by sluice gates on the upstream face of the dam and by valves located in the valve house near the toe of the dam. The 24-inch blow-off pipe constitutes the emergency drawdown system for the dam. The dam impounds 92 acre-feet of water at normal pool level.

b. Location. The dam is located near the headwaters of Blair Gap Run which is a secondary tributary of the Frankstown Branch of the Juniata River in Juniata Township, Blair County, Pennsylvania (Plate 2). The impoundment lies between the eastbound and westbound lanes of U.S. Route 22 about seven miles west of Hollidaysburg.

Downstream from the dam, Blair Gap Run flows along Route 22 through a narrow valley for about two miles where it discharges into the reservoir of Plain Nine Dam. In this reach, the stream flows under Route 22 at two locations. Below Plain Nine Dam, Blair Gap Run flows through an inhabited valley for five miles and joins the Beaverdam Branch of the Juniata River one mile west of Hollidaysburg.

It is estimated that because the flood surcharge storage volume of Plain Nine Dam downstream (224 acre-feet) is larger than the total storage volume of Blair Gap Dam (90 acre-feet) failure of Blair Gap

Dam would not result in failure of Plain Nine Dam. In the event of a failure, Route 22 would be damaged and loss of life is possible from the vehicles traveling on Route 22.

c. Size Classification. Intermediate (Based on 47-foot height).

d. Hazard Classification. Significant.

e. Ownership. Blair Gap Water Company.

f. Purpose of Dam. Water Supply.

g. Design and Construction History. Blair Gap Dam was designed and constructed by the American Pipe Manufacturing Company. The construction of the dam was completed in 1907.

h. Normal Operating Procedure. The reservoir is maintained at spillway level, Elevation 1780 (USGS Datum), leaving two feet of freeboard to the top of the dam at Elevation 1782. All inflow occurring when the reservoir level is at the spillway crest or above is discharged over the uncontrolled spillway.

1.3 Pertinent Data

a. Drainage Area - 3.7 square miles (Plate 2)

b. Discharge at Dam Site (cfs)

Maximum known flood at dam site - 465 in March 1936
Warm water outlet at pool elevation - N/A
Diversion tunnel low pool outlet at pool elevation - Unknown
Gated spillway capacity at pool elevation - N/A
Gated spillway capacity at maximum pool elevation - N/A
Ungated spillway capacity at maximum pool elevation - 465
Total spillway capacity at maximum pool elevation - 465

c. Elevation (USGS Datum) (feet)

Top of dam - 1782
Maximum pool-design surcharge - N/A
Full flood control pond - N/A
Recreation pool - 1780 (normal)
Spillway crest - 1780
Upstream portal invert diversion tunnel - 1736±
Downstream portal invert diversion tunnel - 1731±
Streambed at center line of dam - 1730±
Maximum tailwater - Unknown

d. Reservoir (feet)

Length of maximum pool - 1000± at Elevation 1782
Length of recreation pool (normal) - 1000± at Elevation 1780
Length of flood control pool - N/A

e. Storage (acre-feet)

Recreation pool (normal pool) - 92 at Elevation 1780
Flood control pool - N/A
Design surcharge - 100 at Elevation 1782
Top of dam - 100 at Elevation 1782

f. Reservoir Surface (acres)

Top of dam - 4+ at Elevation 1782
Maximum pool - N/A
Flood control pool - N/A
Recreation pool - 4 (normal) at Elevation 1780
Spillway crest - 4 at Elevation 1780

g. Dam

Type - Masonry gravity
Length - 316 feet
Height - 47 feet
Top width - 5 feet
Side slopes - Vertical upstream; 2H:3V downstream
Zoning - N/A
Impervious core - N/A
Cutoff - N/A
Grout curtain - Unknown

h. Diversion and Regulating Tunnel

Type - 24-inch-diameter cast-iron pipe
Length - 200± feet
Closure - Gate valve
Access - Center of dam crest and valve house at toe
Regulating facilities - Gate valve

i. Spillway

Type - Overflow section of dam
Length of weir - 53 feet
Crest elevation - 1780 feet
Gates - None
Upstream channel - Lake
Downstream channel - Natural stream

SECTION 2
ENGINEERING DATA

2.1 Design

a. Data Available

(1) Hydrology and Hydraulics. Review of the information in the files of the Commonwealth of Pennsylvania, Department of Environmental Resources (PennDER), showed that there are no original hydrology and hydraulic design data available for the dam. However, a state inspection report entitled, Report Upon the Blair Gap Dam, dated October 13, 1914, states the criteria used to size the spillway.

(2) Dam. The 1914 inspection report includes the results of an independent stability analysis.

(3) Appurtenant Structures. No design information is available.

b. Design Features

(1) Dam. As designed, the dam is a "boulder concrete" wall faced with rubble masonry. Plate 1 illustrates the typical cross section of the dam. It consists of a vertical upstream face and a two horizontal to three vertical (2:3) sloping downstream face. The crest is capped with cut stones 5 feet 5 inches long and 18 inches thick.

The drawings indicate that the dam was founded on rock. A state inspection report entitled, Report Upon the Blair Gap Dam, dated October 22, 1914, describes the foundation condition of the dam as follows: "The geological formation at the dam site consists of sandstone and shale, in practically horizontal strata. The foundations for the dam were carried down to good sandstone. Where the ends of the dam abut into the hillsides alternate layers of sandstone and soft shale were encountered. This soft shale was all tunnelled out, so that the concrete dam extends well into the hillsides at various elevations, and is thoroughly bonded into the solid rock."

(2) Appurtenant Structures. The spillway is a low section of the dam. The crest of the spillway is capped with rounded hand-cut stones, approximately 5 feet wide and 18 inches thick. The flow from the spillway discharges down the face of the dam to a masonry apron, then to a plunge pool.

d. Design Data

(1) Hydrology and Hydraulics. The 1914 inspection report states that the spillway of the dam was designed to discharge a flow of 165 cubic feet per second (cfs) per square mile of watershed, for a total flow of 475 cfs.

(2) Dam. The 1914 report states that the factor of safety of the dam against overturning ranges between 1.63 to 2.23. The higher factor of safety corresponds to the assumption of no hydrostatic uplift pressure at the base of the dam, and the lower factor of safety corresponds to hydrostatic uplift pressure of zero at the downstream toe and two-thirds of the total head at the upstream toe.

(3) Appurtenant Structures. No design data were found relative to the design of appurtenant structures except as stated above.

2.2 Construction. No information was found concerning the construction of the dam. The 1914 inspection report states that the construction of the dam was under the direction of Mr. J. W. Ledoux, the Chief Engineer of the American Pipe Manufacuring Company.

2.3 Operation. There are no formal operating records available for this dam. As designed, the dam serves as a water supply reservoir. The water company personnel reported that the reservoir has been abandoned for several years and is not supplying water to the Blair Gap Water Company system.

2.4 Other Investigations. The available information includes various periodic inspections conducted by the state since 1914. The last state inspection was conducted in 1976. In 1972, the dam was inspected by U.S. Bureau of Reclamation personnel, following tropical storm Agnes, and the general appearance of the dam was assessed to be good.

2.5 Evaluation

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

b. Adequacy

(1) Hydrology and Hydraulics. Available engineering data are not adequate to assess the structure. Only the design capacity of the spillway is reported.

(2) Dam. The 1914 inspection report states the results of an independent stability analysis which considered the stability of the structure against overturning with and without hydrostatic uplift pressure. Associated available calculations were reviewed and, in general, the design procedure was found to be satisfactory.

(3) Appurtenant Structures. Design drawings indicate that the flow from the blow-off and the supply lines through the dam can be controlled by valves located at the downstream valve house and by the sluice gate on the upstream side of the dam.

c. Operating Records. To the best knowledge of water company personnel, no operating difficulties have been encountered in the past. A state inspection report dated May 14, 1936, states that during the flood in March 1936 the maximum depth of flow over the spillway was 2.0 feet.

A state inspection conducted on July 18, 1972, following tropical storm Agnes, reports that the depth of water over the spillway section during that flood was about 9 inches.

d. Post-Construction Changes. There have been no reported significant modifications to the original dam design.

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

SECTION 3
VISUAL INSPECTION

3.1 Findings

a. General. The on-site inspection of Blair Gap Dam consisted of:

1. Visual inspection of the retaining structure, abutments, and toe.

2. Visual examination of the spillway and its components, the downstream end of the outlet pipe, and other appurtenant features.

3. Observation of factors affecting the runoff potential of the drainage basin.

4. Evaluation of downstream area hazard potential.

The specific observations are illustrated in Plate 3 and in the photographs in Appendix C.

b. Dam. The general inspection of the retaining structure consisted of searching for indications of structural distress, such as cracks and deterioration of rock surfaces, seepage areas, and observing general maintenance conditions and other surficial features.

1. Portions of the downstream face of the dam were found to be wet. Several seeps were located on the right side of the spillway. The discharge from these seeps was estimated to be one to two gallons per minute.

2. A concentrated seepage was found at the toe of the dam on the left side of the spillway. The discharge was estimated to be in the range of 5 to 10 gallons per minute. The seepage surface was covered with "yellow-boy" precipitate.

c. Appurtenant Structures. The spillway crests and plunge pools were examined for deterioration or other signs of distress and obstructions that would limit flow. No signs of apparent distress or erosion were observed. Water company personnel declined to operate the blow-off valve so its condition is not known.

d. Reservoir Area. The watershed is predominantly covered with woodlands and infiltration capacity is estimated to be good. A small portion of the drainage basin has been strip mined.

The shorelines are not considered to be susceptible to massive landslides which would affect the storage volume of the reservoir or cause overtopping of the dam by displaced water.

e. Downstream Channel. Blair Gap Run, downstream of the dam, flows about one and one-half miles through a narrow valley and discharges into the reservoir of Plain Nine Dam. In the upper half of this reach, the stream flows adjacent to the westbound lane of Route 22, where the valley bottom is approximately 80 to 100 feet wide. Two bridges cross over the stream in this reach. Sketches and photographs of these bridges are included in Appendices A and C, respectively. For the lower half of the reach between Blair Gap and Plain Nine Dams, the stream flows at a level 40 to 60 feet below the grade of Route 22. No inhabited structures exist in this reach. Further description of the downstream condition is included in Section 1.2.

3.2 Evaluation. In general, the condition of the dam is considered to be good. However, because the water company declined to operate the blow-off valve for the reservoir, the operative condition of the drawdown facility of the dam could not be assessed. Visual observations indicate that the operating facilities are in poor condition, and it appears that they have not been maintained in the recent past.

SECTION 4
OPERATIONAL FEATURES

4.1 Procedures. A review of the design drawings and field observations indicates that there are no formal procedures for operating the dam. The only operational feature of the dam which may affect the safety of the dam is the outlet pipe valve, in case it is required to lower the reservoir.

The clearing of debris from the spillway and removal of the brush from the downstream toe area as it is required and continued inspection of the facilities by the dam tender are the principal maintenance operations which would affect safety.

4.2 Maintenance of the Dam. The overall maintenance conditions of the dam are considered to be fair. Removal of the brush from the downstream toe area would be required to facilitate adequate inspection of the toe area.

4.3 Maintenance of Operating Facilities. The water company declined to operate the blow-off valve for the dam without compensation for this service plus any damages due to operation of the valves. Therefore, the operative condition of the drawdown facilities could not be assessed. In general, the equipment appears to be in poor condition.

4.4 Warning System in Effect. There is no formal flood warning system in effect. The dam is maintained by the personnel of the water company, operating from the company office in Altoona approximately ten miles from the dam site. The water company personnel reported that the dam is visited during severe weather conditions. No communication facilities are available at the dam site.

4.5 Evaluation. The operational condition of the dam is considered to be poor. The operative condition of the drawdown facility was not observed. The dam is accessible from Route 22 under all weather conditions for inspection and emergency action purposes.

SECTION 5
HYDRAULICS AND HYDROLOGY

5.1 Evaluation of Features

a. Design Data. Blair Gap Dam has a watershed area of 3.7 square miles and impounds a reservoir with a surface area of 4 acres. A 53-foot-wide spillway flowing over the dam constitutes the flood discharge system for the impoundment. The flow through the spillway is controlled by a stone weir at an elevation two feet below the crest of the dam. As it presently exists, the spillway has a maximum discharge capacity of approximately 465 cfs with no freeboard.

b. Experience Data. As previously stated, Blair Gap Dam is classified to be an "intermediate" size dam in the "significant" hazard category. Under the recommended criteria for evaluating emergency spillway discharge capacity, such impoundments are required to pass one half to full probable maximum flood (PMF).

The adequacy of the spillway was analyzed based on the simplified procedure developed by the Baltimore District, Corps of Engineers (Appendix D). Based on this analysis procedure, it was determined that the PMF inflow hydrograph would have a peak of 10,900 cfs and a total volume of approximately 4715 acre-feet. These values are greater than the overflow section capacity (465 cfs) and the reservoir flood storage volume (8 acre-feet). Therefore, the overflow section is not capable of passing the PMF flow without overtopping the entire structure. Further analysis, according to the procedure, indicated that the overflow section can pass a maximum flow of approximately 5 percent of the PMF without overtopping. In the event of full PMF, the depth of overtopping over the entire dam was determined to be approximately 4.6 feet. The depth of overtopping over the entire dam for one-half PMF is 2.7 feet.

c. Visual Observations. On the date of inspection, no conditions were observed which would indicate that the spillway of the dam could not operate satisfactorily in the event of a major flood.

d. Overtopping Potential. As stated above, the dam will be overtopped during a flood whose magnitude exceeds 5 percent PMF. However, because it is a masonry dam, overtopping is not considered to significantly affect the overall stability of the dam.

e. Spillway Adequacy. Based on the observations stated above, flood discharge capacity of the dam is considered to be adequate.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations. As discussed in Section 3, the field observations did not reveal any signs of distress that would significantly affect the stability of the dam and none were reported in the past.

b. Design and Construction Data. It appears that the original design incorporated stability analyses for the dam. Visual observations and past inspection reports indicate that the structure was constructed with reasonable care.

As a part of this inspection, the stability of the dam was reevaluated by an independent approximate analysis. This conservative stability analysis (Appendix D) indicated that the factor of safety against overturning is 1.4 when pool level is at the crest level of the dam and 1.2 when the dam is overtopped by 4.6 feet. The analysis was based on hydrostatic uplift pressure assumption of zero at the downstream toe and two-thirds of the total head at the upstream toe. Sliding shear stresses for the two loading conditions were determined to be 17 and 18 psi, respectively. The sliding shear stresses are within the range of allowable shear strength of sandstones on which the dam is reported to be founded. This analysis indicates that the dam is stable, concurring with the results of an analysis noted in the 1914 inspection report.

c. Operating Records. The structural stability of the dam is not considered to be affected by the operational features of the dam.

d. Post-Construction Changes. There have been no reported modifications to the original design that would affect the structural stability of the structure.

SECTION 7
ASSESSMENT AND RECOMMENDATIONS/REMEDIAL MEASURES

7.1 Dam Assessment

a. Assessment. The visual observations and review of available information indicate that Blair Gap Dam is in good condition. It appears that the structure was built with reasonable care with the means available at the time of construction. The capacity of the overflow section was found to be inadequate (5 percent PMF) relative to the spillway capacity criteria established by the Corps of Engineers. However, because an overtopping would not cause failure of the dam, flood discharge capacity of the dam is considered to be adequate.

b. Adequacy of Information. Although the available design information is very limited, a reasonable assessment of the dam can be made on visual observations, reports of past observations, and previous experience of the inspectors.

c. Urgency. The recommendations suggested below should be implemented immediately or on a continuing basis, as noted.

d. Necessity for Further Investigation. The condition of the dam does not require more detailed investigation at this time.

7.2 Recommendations/Remedial Measures

1. It is recommended that the owner immediately evaluate the operational condition of the lake blow-off valve and perform necessary maintenance.

2. Because the dam may overtop during unusually high runoff, it is recommended that during such periods the owner should provide around-the-clock surveillance for early detection of problems, such as erosion of the abutments.

3. It is recommended that brush and trees in the toe area should be cleared over a distance of approximately 20 feet from the toe to permit adequate future inspection of the toe area.

4. It is recommended that the owner develop a formal warning system to alert the downstream residents in the event of emergencies.

5. It is recommended that the owner be advised that the dam and appurtenant structures should be inspected regularly and properly maintained.

PLATES

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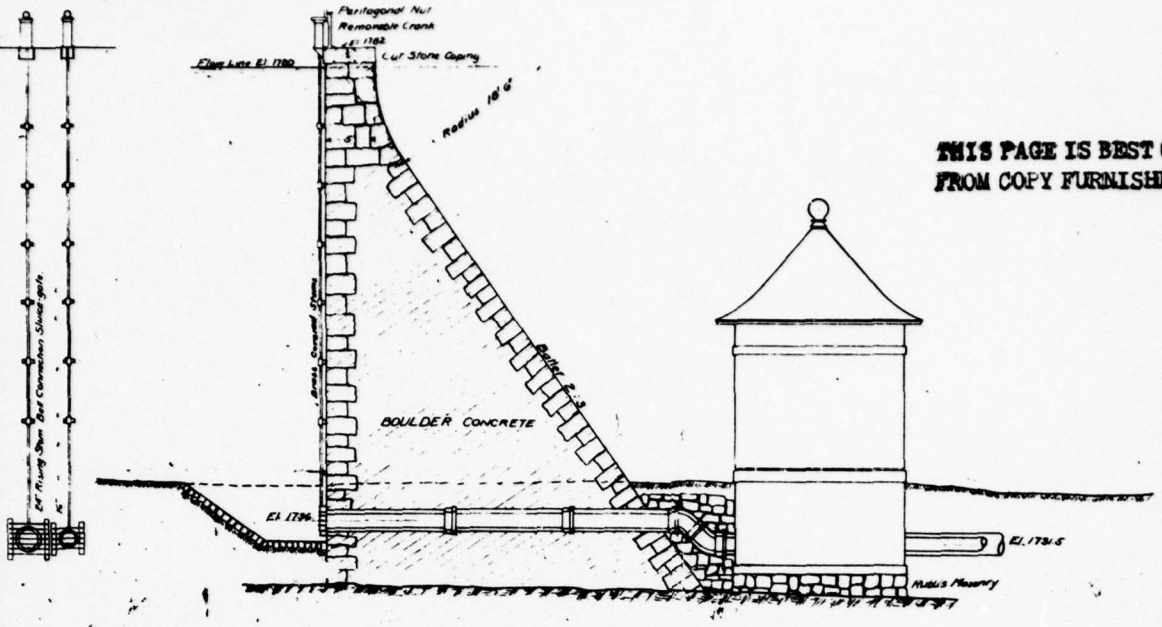
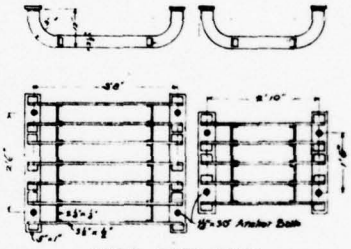
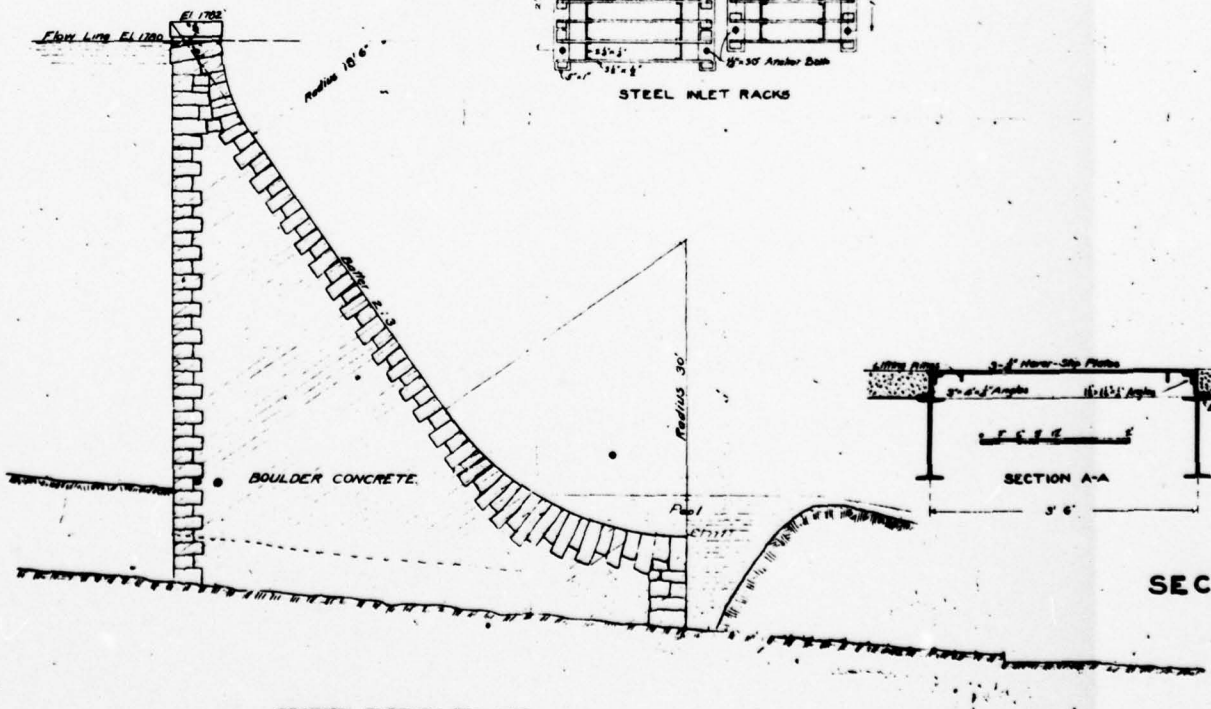


SECTION THROUGH GATE HOUSE.





SECTION THROUGH SPILLWAY.

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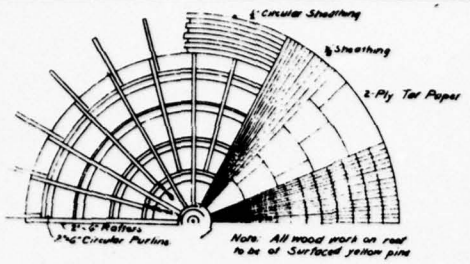
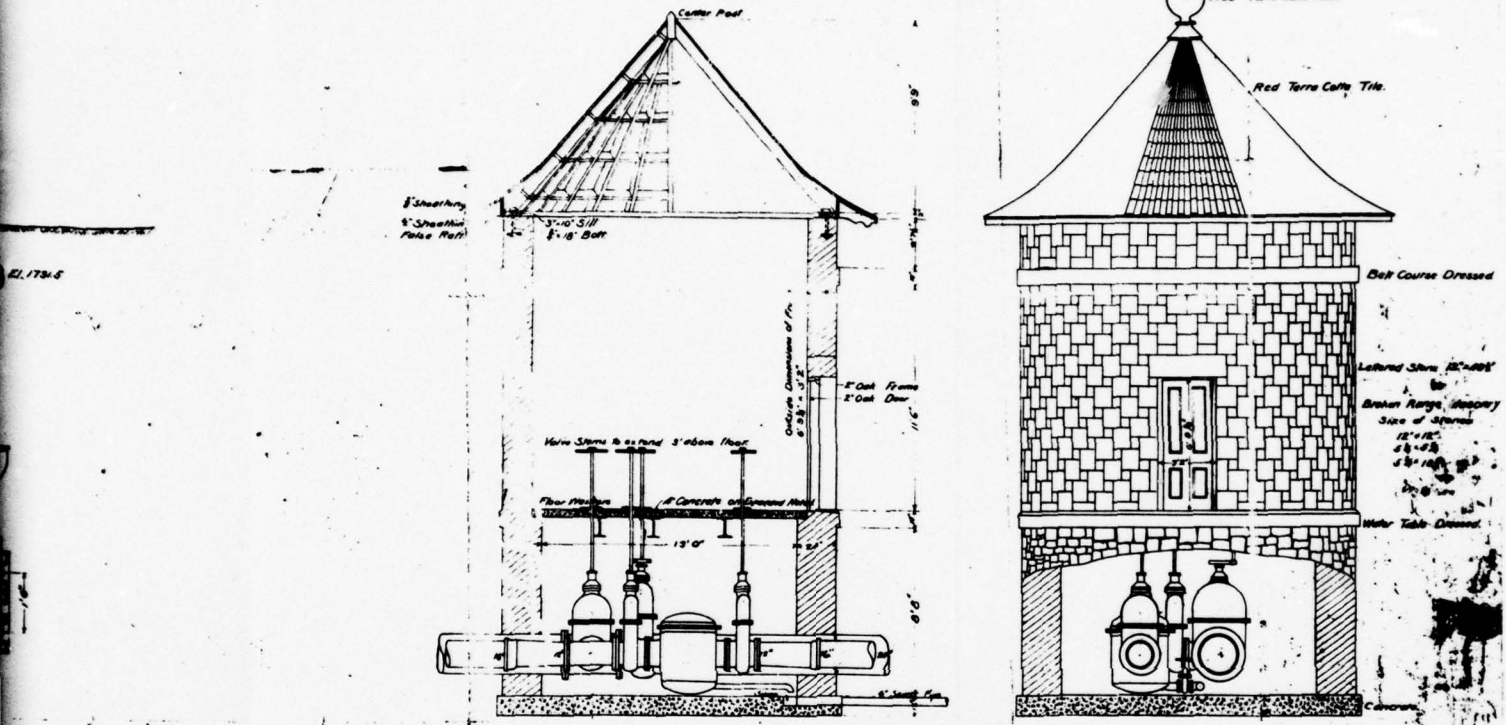
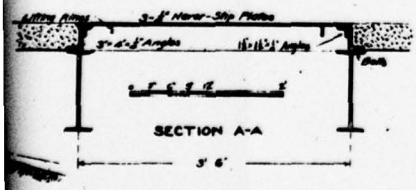
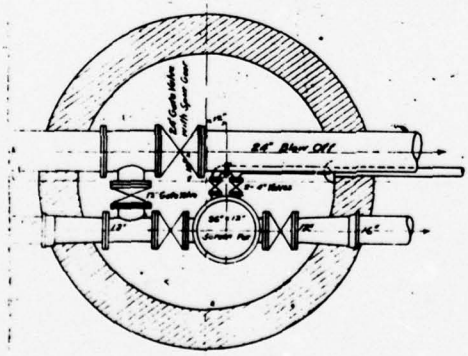
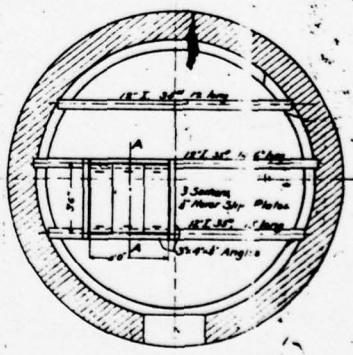










SECTIONS OF DAM & DETAILS OF GATE-HOUSE
STORAGE RESERVOIR
BLAIR GAP WATER SUPPLY CO.

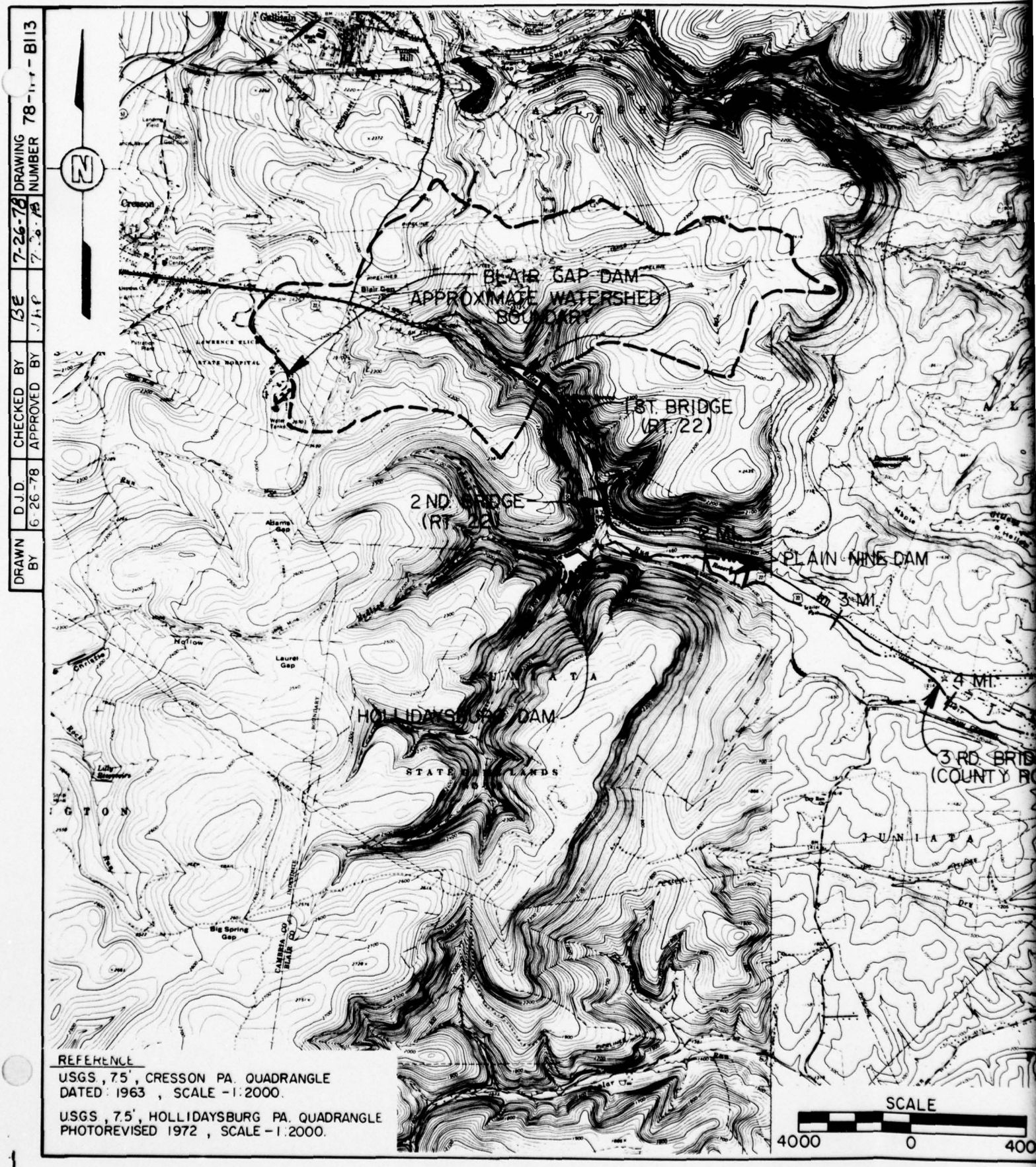
NORTH BRANCH BLAIR GAP RUN
JUNIATA TWP BLAIR CO PA
CAPACITY 30,000,000 GALS.

THE AMERICAN PIPE MFG CO
ENGINEERS & CONTRACTORS
1 BROAD ST PHILA PA

APPROVED _____
Chief Engineer P.R.R. Co.
APPROVED _____
Chief Engineer M. & W. Dept. P.R.R. Co.
Aug. 31. 1905.

PLATE I

D'APPOLONIA



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	6-26-78	APPROVED BY	JHP	7-26-78	

REFERENCE

USGS, 7.5', CRESSON PA. QUADRANGLE
DATED: 1963, SCALE - 1:2000.

USGS, 7.5', HOLLIDAYSBURG PA. QUADRANGLE
PHOTOREVISED 1972, SCALE - 1:2000.

PLATE 2

BLAIR GAP DAM
VICINITY, FLOOD PLAIN AND WATERSHED MAP

DAYTON, OHIO

PLATE 3

BLAIR GAP DAM NDI ID: 521
GENERAL PLAN
FIELD INSPECTION NOTES
FIELD INSPECTION DATE : JUNE 9 , 1978

D'APPOLONIA

APPENDIX A

CHECKLIST
VISUAL INSPECTION
PHASE I

CHECKLIST
VISUAL INSPECTION
PHASE I

NAME OF DAM Blair Gap Dam COUNTY Blair STATE PA. ID# NDI: 521 DER: 7-6

TYPE OF DAM Masonry - Gravity HAZARD CATEGORY Significant

DATE(S) INSPECTION June 9, 1978 WEATHER Prtly Cloudy TEMPERATURE 70's

POOL ELEVATION AT TIME OF INSPECTION 1780 M.S.L. TAILWATER AT TIME OF INSPECTION 1735 ± M.S.L.

INSPECTION PERSONNEL:

Bilgin Erel	Review Inspection By (June 12, 1978)	Elio D'Appolonia
Wah-Tak Chan		Larry Andersen
		James Poellot

Bilgin Erel RECORDER

VISUAL INSPECTION
PHASE I
EMBANKMENT

NAME OF DAM Eldred Corp Dam
ID# NDI: 521 DER: 7-6

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	MASONRY DAM ∴ N/A.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	N/A.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	N/A.	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	N/A	
RIPRAP FAILURES	N/A	

VISUAL INSPECTION
PHASE I
EMBANKMENT

NAME OF DAM Eldridge Gate Dam
ID# NDI: 521 DER: 7-6

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	MASONRY DAM ∴ N/A	
ANY NOTICEABLE SEEPAGE	N/A.	
STAFF GAGE AND RECORDER	N/A	
DRAINS	N/A.	

VISUAL INSPECTION
PHASE I
CONCRETE/MASONRY DAMS

NAME OF DAM Blair Gap Dam
ID# NDI 521 DER: 7-6

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE	At two locations through the dam see plate 3 for location.	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	No signs of distress or seepage.	
DRAINS	None found.	
WATER PASSAGES		
FOUNDATION	No signs of distress.	

VISUAL INSPECTION
PHASE I
CONCRETE/MASONRY DAMS

NAME OF DAM ELAIR GAP DAM
ID# NDI : 521 DER: 7-6

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	NONE	
STRUCTURAL CRACKING	NONE	
VERTICAL AND HORIZONTAL ALIGNMENT	NO PERCEIVABLE MISALIGNMENT.	
MONOLITH JOINTS	NONE	
CONSTRUCTION JOINTS	NONE	
STAFF CAGE OF RECORDER:	NONE	

VISUAL INSPECTION
PHASE I
OUTLET WORKS

NAME OF DAM BLAIR GAP DAM
ID# NDI: 521 DER: 7-6

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	ONLY THE DOWNSTREAM END OF THE OUTLET PIPE IS VISIBLE. (OUT LET PIPE IS 24-INCH CAST IRON)	
INTAKE STRUCTURE	NONE	
OUTLET STRUCTURE	OUT LET CONDUIT WOULD DIRECTLY DISCHARGE INTO THE STREAM.	
OUTLET CHANNEL	NATURAL STREAM.	
EMERGENCY GATE	OUT LET PIPE VALVE WAS NOI OPERATED. (WATER COMPANY DECLINED TO OPERATE THE VALVE WITHOUT COMPENSATION FOR SERVICES PLUS ANY DAMAGES DUE TO THE OPERATION)	

VISUAL INSPECTION
PHASE I
UNGATED SPILLWAY

NAME OF DAM Elbir Gap Dam
ID# NDI: 521 DED: 7-6

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	CUT-STONE, GOOD CONDITION	
APPROACH CHANNEL	LAKE (NO APPROACH CHANNEL)	
DISCHARGE CHANNEL	WATER FLOWS OVER THE FACE OF THE DAM INTO A PLUNGE POOL,	
BRIDGE AND PIERS	NONE	

VISUAL INSPECTION
PHASE I
GATED SPILLWAY

NAME OF DAM BLAND GAP DAM
ID# NDI : 521 DER: 7-6

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	NO GATED SPILLWAY ∴ N/A.	
APPROACH CHANNEL	N/A	
DISCHARGE CHANNEL	N/A.	
BRIDGE PIERS	N/A	
GATES AND OPERATION EQUIPMENT	N/A	

VISUAL INSPECTION
PHASE I
INSTRUMENTATION

NAME OF DAM Eagle Gap Dam

ID# NDI: 521 DER: 7-6

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

VISUAL INSPECTION
PHASE I
RESERVOIR

NAME OF DAM BLAIR GAP DAM
ID# NDI: 521 DER: 7-6

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	WOODED, NO SIGNS OF EROSION	
SEDIMENTATION	UNKNOWN.	

VISUAL INSPECTION
PHASE I
DOWNSTREAM CHANNEL

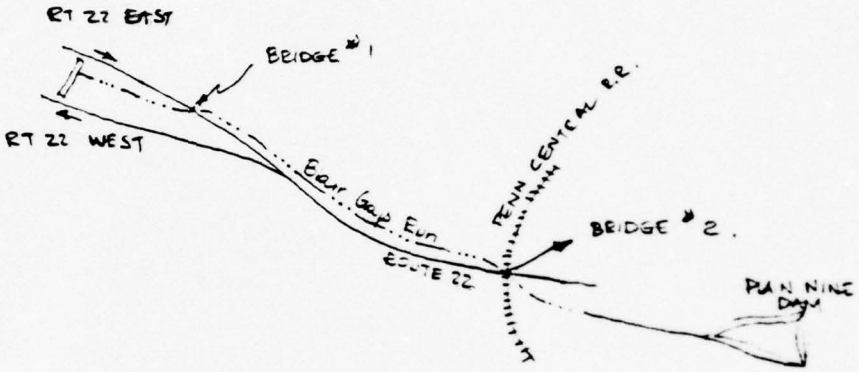
NAME OF DAM BLAIR GAP DAM
ID# NDI: 521 DER: 7-6

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	STEEP ROCKY CHANNEL. STREAM FLOWS UNDER TWO HIGHWAY BRIDGES BEFORE DISCHARGING INTO THE PLAIN NINE DAM RESERVOIR.	
SLOPES	TYPICAL NATURAL STREAM CHANNEL NO NOTICABLE EROSION.	
APPROXIMATE NUMBER OF HOMES AND POPULATION	APPROXIMATELY 200 HOMES IN FOOT OF TEN. (MAIN IMPACT AREA OF FLOOD) POPULATION ≈ 800	

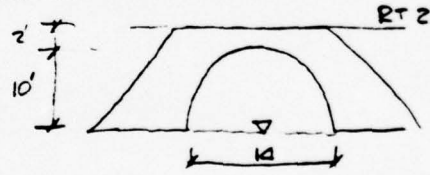
D'APPOLONIA
CONSULTING ENGINEERS, INC

By EE Date 6-9-78 Subject BLAIR GAP DAM Sheet No 1 of 1
Chkd By WJS Date 7-27-78 FIELD INSPECTION SKETCH Proj No 78-116-1

STREAM CROSS SECTION @ BRIDGE LOCATIONS

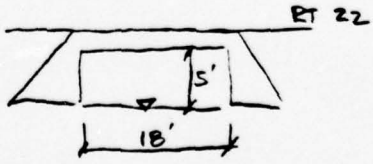


BRIDGE # 1



WATER DEPTH ≈ 4' TO 6"

BRIDGE # 2



WATER DEPTH ≈ 4' TO 6"

APPENDIX B

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE 1

NAME OF DAM BLAIR GAP DAM
ID# NDI 521 DER: 7-6

ITEM	REMARKS
AS-BUILT DRAWINGS	AVAILABLE IN STATE FILES.
REGIONAL VICINITY MAP	SEE PLATE 2
CONSTRUCTION HISTORY	DESIGNED AND BUILT BY AMERICAN PIPE MANUFACTURING CO. (CONSTRUCTION COMPLETED IN 1907)
TYPICAL SECTIONS OF DAM	SEE PLATE 1
OUTLETS - PLAN - DETAILS - CONSTRAINTS - DISCHARGE RATINGS	SEE PLATE 1

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM Bixio Gulp Dam
ID# NDI 521 DER: 7-6

ITEM	REMARKS
RAINFALL/RESERVOIR RECORDS	NO RECORDED.
DESIGN REPORTS	NONE FOUND
GEOLOGY REPORTS	NONE FOUND
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	A STABILITY CALCULATION IS INCLUDED IN AVAILABLE INFORMATION.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	NONE FOUND.

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM BLAIR GAP DAM
ID# NDI: 521 DER: 7-6

ITEM	REMARKS
POST CONSTRUCTION SURVEYS OF DAM	NONE
BORROW SOURCES	UNKNOWN
MONITORING SYSTEMS	NONE
MODIFICATIONS	NONE REPORTED.
HIGH POOL RECORDS	NOT RECORDED.

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM Elmir Gap Dam
ID# NDI: 521 DER: 7-6

ITEM	REMARKS
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	NONE OTHER THAN THE PERIODIC INSPECTIONS CONDUCTED BY THE STATE.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	NONE REPORTED.
MAINTENANCE OPERATION RECORDS	NOT AVAILABLE
SPILLWAY PLAN SECTIONS DETAILS	SEE PLATE 1
OPERATING EQUIPMENT PLANS AND DETAILS	SEE PLATE 1

NAME OF DAM BLAIR GAP DAM

ID# NDI: 621 COE: 7-6

CHECKLIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: WOODED (3.7 SQ. MILES)

ELEVATION; TOP NORMAL POOL AND STORAGE CAPACITY: 92 AC-FT @ EL 1780

ELEVATION; TOP FLOOD CONTROL POOL AND STORAGE CAPACITY: SAME AS ABOVE

ELEVATION; MAXIMUM DESIGN POOL: EL 1780 (SPILLWAY CREST EL)

ELEVATION; TOP DAM: EL 1782

CREST: (SPILLWAY)

a. Elevation 1780

b. Type CUT-STONE

c. Width 5 FT

d. Length 53 FT

e. Location Spillover

f. Number and Type of Gates NONE

OUTLET WORKS:

a. Type 24-INCH CAST IRON BLOW-OFF PIPE.

b. Location RIGHT OF SPILLWAY

c. Entrance Inverts EL. 1736

d. Exit Inverts EL 1730 (ESTIMATED)

e. Emergency Draindown Facilities 24-INCH BLOW-OFF PIPE.

HYDROMETEOROLOGICAL GAGES:

a. Type NONE

b. Location NONE

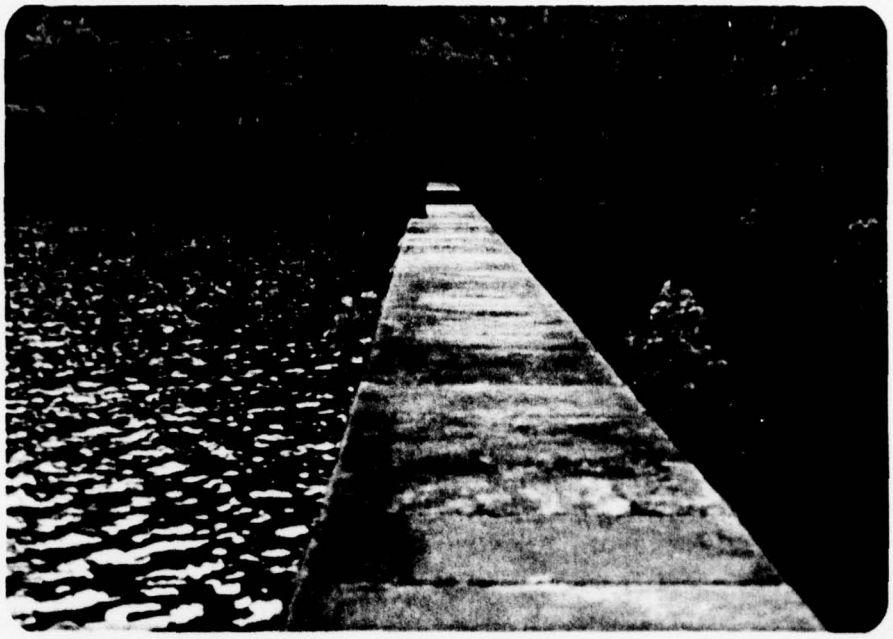
c. Records NONE

MAXIMUM NONDAMAGING DISCHARGE: ABOUT 500 CFS.

APPENDIX C
PHOTOGRAPHS

LIST OF PHOTOGRAPHS
BLAIR GAP DAM
JUNE 9, 1978

PHOTOGRAPH NO.	DESCRIPTION
1	Crest (looking south).
2	Downstream face and valve house.
3	Spillway crest.
4	Valve controls on crest.
5	"Blow-off" pipe.
6	Drainpipe adjacent to "blow-off" pipe outlet.
7	Typical wet areas in downstream face.
8	Seepage on left abutment toe (note yellow boy).
9	Bridge on Route 22 westbound.
10	Bridge on Route 22 westbound.

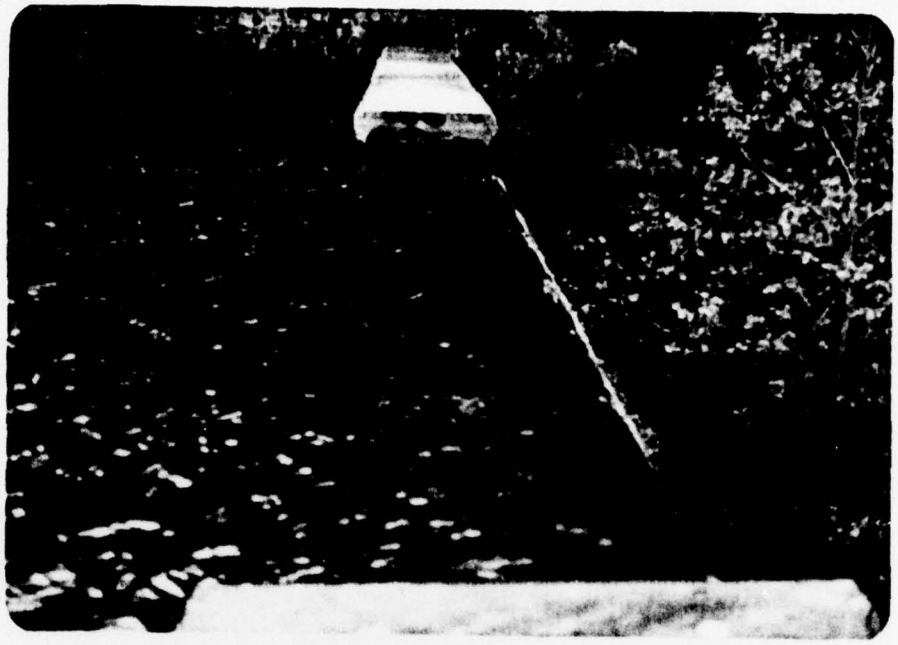


Photograph No. 1

Crest (looking south).

Photograph No. 2

Downstream face and valve house.

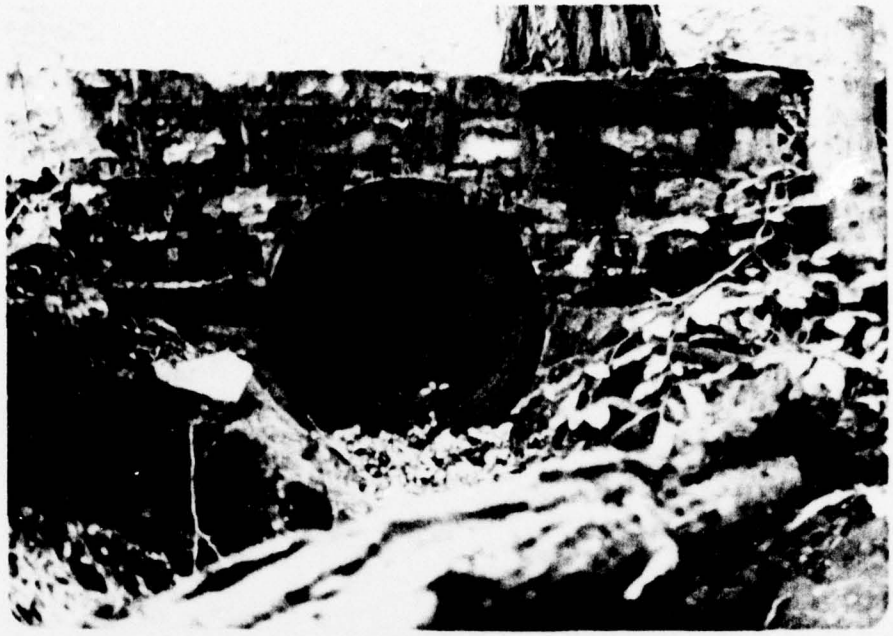


Photograph No. 3

Spillway crest.

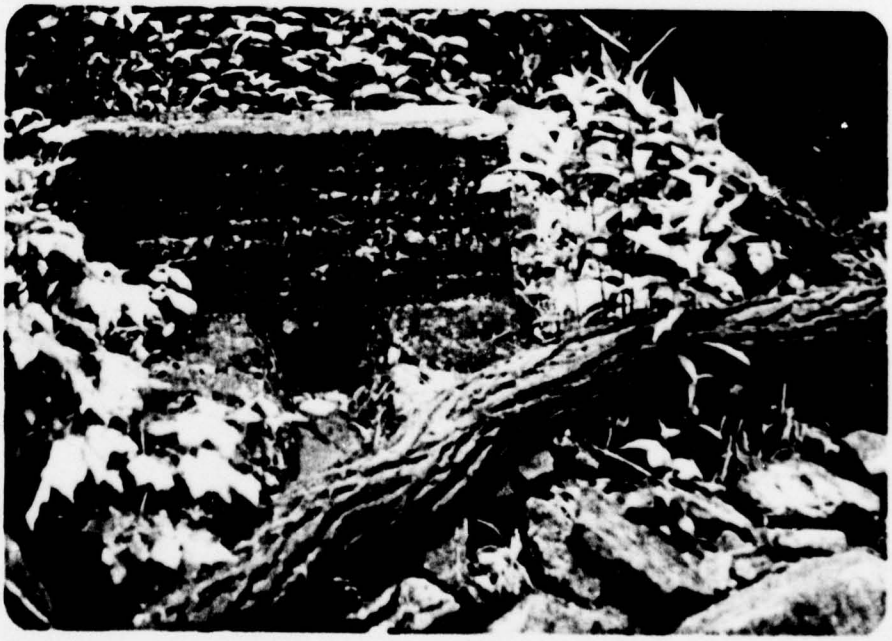
Photograph No. 4

Valve controls on crest.



Photograph No. 5

"Blow-off" pipe.

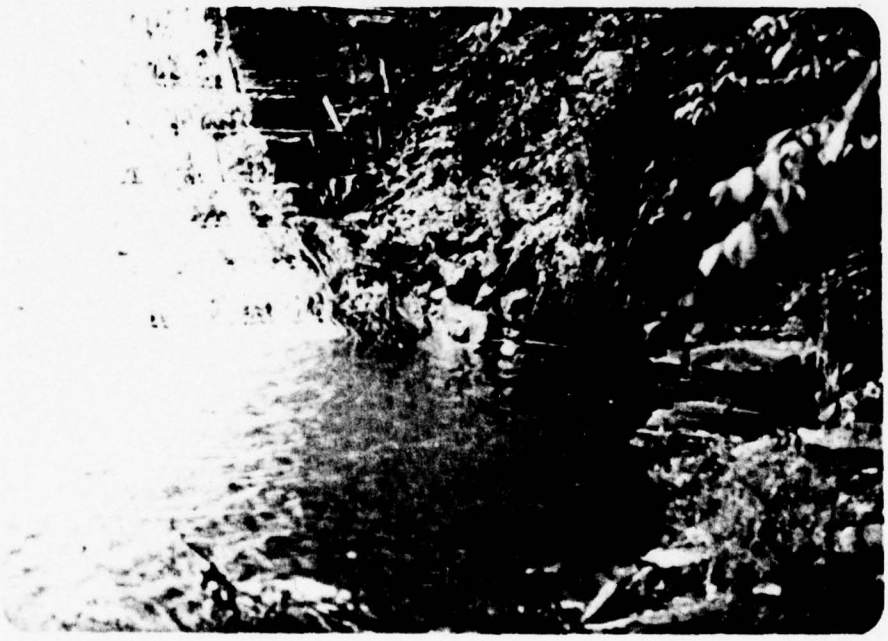


Photograph No. 6

Drainpipe adjacent to "blow-off" pipe outlet.

Photograph No. 7

Typical wet areas in downstream face.



Photograph No. 8

Seepage on left abutment toe (note yellow boy).

Photograph No. 9

Bridge on Route 22 westbound.

Photograph No. 10

Bridge on Route 22 westbound. (Note abutment of railroad bridge on upper left corner.)

APPENDIX D
CALCULATIONS

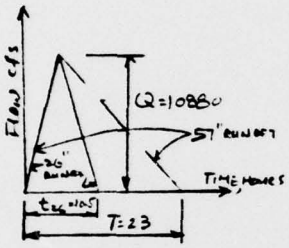
D'APPOLONIA
CONSULTING ENGINEERS, INC

By JNTC Date 6-20-78 Subject BLAIR GAP DAM Sheet No 1 of 2
Chkd By EE Date 7-27-78 HYDROLOGY & HYDRAULIC Proj No 78-19-19

DAM BLAIR GAP DAM

WATERSHED AREA, A = 3.4 SQ MILE

INFLOW HYDROGRAPH: BASIN = SUSQUEHANNA BASIN REGION 1



TOTAL TIME = T = 23 HOURS

PMF PEAK DISCHARGE: $q = 3200$ cfs/SQ.Mi

$Q = qA = 10880$ cfs

VOLUME OF HYDROGRAPH
$= 1800 \cdot T \cdot Q \times \frac{1}{43560}$
$= 10340$ ac-ft

EQUAL TO RUNOFF (INCH) $= \frac{10340 \times 43560}{3.4 \times (5280)^2} \times 12 = 57"$

RE CALC Time t_{26} for 26" RUNOFF

$V_1 = \frac{26}{12}(3.4)(5280)^2 \times \frac{1}{43560} = 4715$ ac-ft

$t_{26} = \frac{V_1 \times 43560}{1800 \times 1088} = 10.5$ Hours

RESERVOIR V_R = 4 ac (NORMAL POOL AREA) x 2 FT (BETWEEN CREST) = 8 ac-ft

SPILLWAY CAPACITY

Type: OVERFLOW WEIR

L = 53' (Field measurement)

$Q_s = (3.1)(53)(2)^{1.5} = 465$ cfs

ACTUALLY THE DAM CREST COULD BE A OVERFLOW WEIR
DAM LENGTH = 180 + 83 = 263 FT (Less Spillway)

$$Q_s = (3.1)(263)(h)^{1.5} + (3.1)(53)(2+h)^{1.5}$$

$$= 815.3\, h^{1.5} + 164.3\,(2+h)^{1.5} \text{ cfs}$$

ESTIMATE WATER DEPTH OVER DAM CREST UNDER PMF

$$\frac{815.3\, h^{1.5} + 164.3\,(2+h)^{1.5}}{10880} + \frac{4^{ac} \times (h+2)}{4715} = 1$$

(4ac ← NORMAL POOL AREA(:))

$h = 4.62$ FT above Dam Crest

$Q_s = 10878$ cfs (ENTIRE LENGTH OF DAM)

PERCENT OF PMF WITHOUT OVER TOPPING :-

$$\left(\frac{465}{10,880} + \frac{8}{4715}\right) 100\,\% = 4.4\,\% \quad \text{SAY } 5\,\%$$

OVER TOPPING DURING 50% PMF

$$\frac{815.3\, h^{1.5} + 164.3\,(2+h)^{1.5}}{\frac{10880}{2}} + \frac{4(h+2)}{\frac{4715}{2}} = 1$$

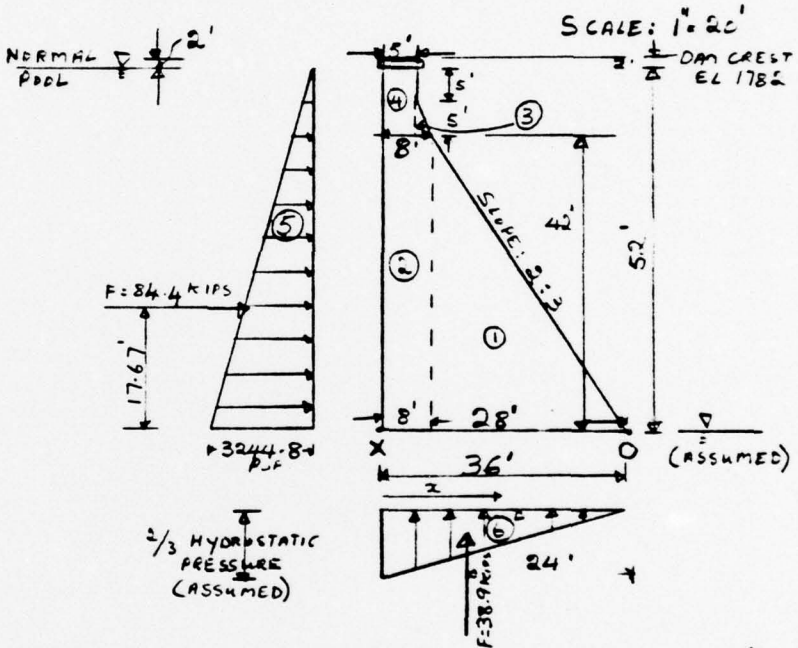
$h = 2.74$ FT above Dam Crest

$Q_s = 5400$ cfs

D'APPOLONIA
CONSULTING ENGINEERS, INC

By ESA Date 6-19-78 Subject STABILITY ANALYSIS Sheet No. 1 of 4
Chkd By WTC Date 7-6-78 BLAIR GAP DAM Proj No 72-114-14

STABILITY ANALYSIS — NORMAL POOL



PRESSURE AT UPSTREAM END (FULL HYDROSTATIC PRESSURE)
$= \gamma_w h = 62.4 \text{ LBS}/\text{FT}^3 \times 52' = 3244.8 \text{ PSF}$
TOTAL FORCE $= \frac{1}{2}(3244.8 \times 52) = 84.4 \text{ KIPS/FT}$

F = 84.4 KIPS FOR A ONE FOOT SECTION OF DAM

UPLIFT PRESSURE AT BASE OF DAM = $\frac{2}{3}(3307.2)$

TOTAL FORCE = $\left[\frac{2}{3}(3244.8)\right] \times 0.5 \times 36 \times \frac{1}{1000}$

= 38.9 KIPS

STABILITY WITH RESPECT TO OVERTURNING

RESISTING MOMENTS : MOMENTS ABOUT O

① $\left[\frac{1}{2}(\underbrace{28}_{88.2\ \text{KIPS}}) \times 42 \times 0.150\right] \times \frac{2}{3}(28)$ = 1646.4 K-FT

② $\left[\underbrace{8 \times 42 \times 0.150}_{50.4}\right] \times 32$ = 1612.8 K-FT

③ $\left[\frac{1}{2}(\underbrace{3}_{1.1}) \times 5 \times 0.150\right] \times 30$ = 33.8 K-FT

④ $\left[\underbrace{5 \times 10 \times 0.150}_{7.5}\right] \times 33.5$ = 251.3 K-FT

3544.3 K-FT

OVERTURNING MOMENTS :

⑤ $84.4 \times 5\frac{2}{3}$ = 1462.9 K-FT

⑥ $38.9 \times \frac{36}{3} \times 2$ = 933.6 K-FT

2396.5 K-FT

D'APPOLONIA
CONSULTING ENGINEERS INC

By ESA Date 6-19-78 Subject STABILITY ANALYSIS Sheet No 3 of 4
Chkd By WJK Date 7-6-78 CLAIR GAP DAM Proj. No 78-114-14

$$FS = \frac{3544.3}{2396.5} = \boxed{1.48} \quad \text{SAY } \boxed{FS \geq 1.5}$$

FOUNDATION SHEAR STRESS $= \frac{84.4}{36 \times 144} = 0.016 \text{ K/IN}$

$= \boxed{16 \text{ PSI}}$

OK BY INSPECTION

NET MOMENT $= 3544.3 - 2396.5 = 1147.8$ K-FT

NET VERTICAL LOAD: $147.2 - 38.9 = 108.3$ KIPS

$$\bar{x}_{\text{FROM TOE}} = \frac{1147.8}{108.3} = 10.60'$$

∴ RESULTANT IS OUTSIDE THE MIDDLE THIRD

∴ $e = 18 - 10.60 = 7.4'$

PRESSURE DISTRIBUTION $= 3 \times 10.60 = 31.8'$

$$q_{MAX} \text{ @ TOE} = \frac{\Sigma V \times 2}{B \times 31.8} = \frac{108.3 \times 2}{31.8 \times 1}$$

$= \boxed{6.81 \text{ KSF}} = \boxed{47.3 \text{ PSI}}$

q_{MIN} (@ 31.8' FROM TOE) $= \boxed{0 \text{ KSF}}$

OK. BY INSPECTION

D'APPOLONIA
CONSULTING ENGINEERS, INC

By ESA Date 6-19-78 Subject STABILITY ANALYSIS Sheet No 4 of 4
Chkd By WJC Date 7-6 78 BLAIR GAP DAM Proj. No 78-114-14

FACTOR OF SAFETY AGAINST OVERTURNING :-
(DAM OVERTOPPING BY 4.62')

HYDROSTATIC PRESSURE $= (52' + 6.62') \times 0.062.4 \frac{K}{FT^3} = 3.66 \frac{K}{FT^2}$

TOTAL FORCE $= \frac{1}{2}(3.66)(52+6.62) = 107.3$ KIPS
(CONSERVATIVE)

RESISTING MOMENT = 3544.3 K-FT (SAME AS FOR NORMAL POOL)

OVERTURNING MOMENT:

① DUE TO SIDE PRESSURE:

$$107.3 \times \frac{58.62}{3} = 2096.6 \text{ K-FT}$$

② DUE TO 2/3 HYDROSTATIC PRESSURE UPLIFT (UNCHANGE)

$$= 38.9^{K} \times (36 \times 2/3) = 933.6 \text{ K-FT}$$

∴ Σ OVERTURNING MOMENTS = ① + ② = 3030.2 K-FT

$$FS = \frac{3544.3}{3030.2} = 1.17 \quad \text{SAY } \boxed{FS = 1.2}$$

FOUNDATION SHEAR STRESS

$$= \frac{107.3^{K}}{36 \times 144} = 0.021 \ K/IN^2$$

$$= 20.7 \text{ PSI} \quad \text{SAY } \boxed{21 \text{ PSI}}$$

OK By inspection

APPENDIX E

REGIONAL GEOLOGY

APPENDIX E

REGIONAL GEOLOGY

The three reservoir dams (Blair Gap, Hollidaysburg, and Plain Nine) are located on or near the Allegheny Front, which marks the topographic and geologic change from the relatively flat-lying rocks of the Appalachian Plateau to the folded rock strata of the Appalachian Mountains. Strata of the Pocono Group (Mississippian Age) are present in the slopes and under Blair Gap and Hollidaysburg dams. The Pocono Group strata in the vicinity of the dams consist of thin to thick-bedded hard gray micaceous sandstone with some interbedded shale. The strata are moderately fractured. The sandstone is resistant to weathering and forms steep slopes, usually steeper than two to one. Coal is being strip mined in the vicinity. The beds being mined are the Mercer Coal (Pottsville Group, Lower Pennsylvanian Age) and the Kittanning and Freeport coals of the Pennsylvanian Age Allegheny Group. These coal seams are stratigraphically higher than the Pocono Group. The Pocono Group rocks are flat lying or dip gently to the west.