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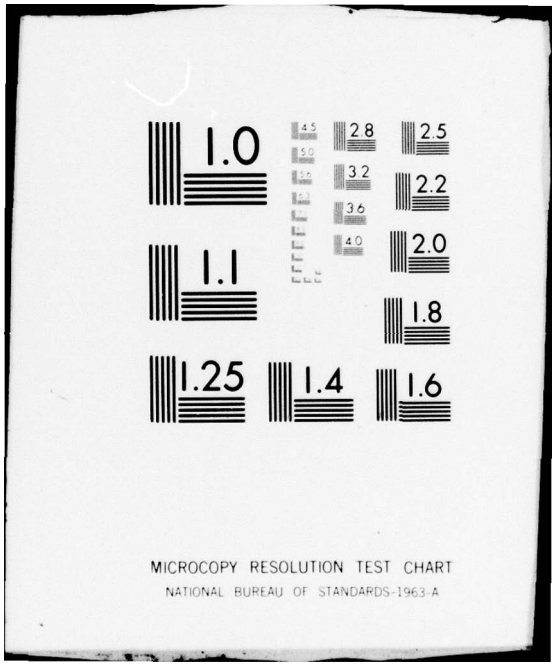
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SUSQUEHANNA RIVER BASIN

KETTLE CREEK, BLAIR COUNTY

PENNSYLVANIA

LEVEL II

POTTSGROVE DAM

NDI I.D. No. PA - 00527

PENNDER I.D. No. 7 - 19

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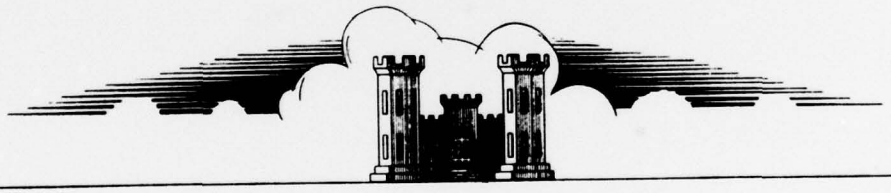
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



ORIGINAL CONTAINS COLOR PLATES: ALL DDC REPRODUCTIONS WILL BE IN BLACK AND WHITE

PREPARED FOR

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

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PREPARED BY

GAI CONSULTANTS, INC.
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JUNE 1979

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PREFACE

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

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition, and the downstream damage potential.

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PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

ABSTRACT

Pottsgrove Dam: NDI I.D. No. PA-00527

Owner:	Blair Gap Water Supply Company
State Located:	Pennsylvania (PennDER I.D. No. 7-19)
County Located:	Blair
Stream:	Kettle Creek
Inspection Date:	18 May 1979
Inspection Team:	GAI Consultants, Inc. 570 Beatty Road Monroeville, Pennsylvania 15146

Based on the visual inspection, operational history, and available engineering data, the dam is considered to be in fair condition.

The size classification of the facility is small and its hazard classification is considered to be high. In accordance with the recommended guidelines, the spillway design flood for this facility is the Probable Maximum Flood (PMF). Results of the hydrologic and hydraulic analysis indicate that the facility is capable of passing and/or storing only 26 percent of the PMF without overtopping the embankment. Overtopping and embankment failure is also anticipated under floods of less than 1/2 PMF magnitude and would result in an increase in the potential for loss of life downstream from the dam. Thus, based on criteria contained in the recommended guidelines, the spillway is considered seriously inadequate.

Structural deficiencies noted by the inspection team included minor erosion of the downstream slope near the embankment crest, and deteriorated concrete associated with both the spillway weir and wingwalls and the upstream embankment slope. In addition, there are no provisions for controlling flow at the inlets to the outlet conduits.

Due to the seriously inadequate spillway classification, the facility is considered unsafe but non-emergency as failure is not considered imminent. However, it is recommended that the owner immediately develop a warning system to notify

(15) DACW31-79-C-0013

downstream residents should hazardous conditions develop. Included in the plan should be provisions for around-the-clock surveillance of the facility during periods of unusually heavy precipitation.

In addition, it is recommended that the owner:

a. Have the facility studied by a registered professional engineer experienced in the hydraulics and hydrology of dams, and implement measures necessary to make the facility hydraulically adequate.

b. Repair the deteriorated concrete portions of the upstream slope protection and the spillway system. (Repairs to the spillway may be inherent to the results of the above recommended study.)

c. Provide a means for controlling flow at the inlets of the outlet conduits should an emergency situation develop.

d. Seed the areas of minor erosion along the downstream embankment slope near the crest level or reset the stone slope protection.

e. Develop a formal operation and maintenance manual to ensure the continued proper care of the facility.

(6) National Dam Inspection Program. Pottsgrove Dam (NDI I.D. Number PA-00507, Pennder I.D. Number 7-19) Susquehanna River Basin, Kettle Creek, Blair County, Pennsylvania. Phase I Inspection Report.

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GAI Consultants, Inc.

Bernard M. Mihalcin

Bernard M. Mihalcin, P.E.

Date 19 July 1979

Approved by:

JAMES W. PECK
Colonel, Corps of Engineers
District Engineer

Date 13 August 1979

OVERVIEW PHOTOGRAPH

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PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
POTTSGROVE DAM
NDI# PA-527, PENNDER# 7-19

SECTION 1
GENERAL INFORMATION

1.0 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.

1.1 Purpose.

The purpose is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project.

a. Dam and Appurtenances. Pottsgrove Dam is a 37-foot high earth embankment approximately 900 feet long. The embankment is comprised of three sections of which the center section is about 560 feet long. The left and right sections are approximately 90 and 250 feet long (including spillway), respectively, and each form an angle of about 60 degrees with the center section.

The facility is served by a concrete and masonry chute channel spillway with an uncontrolled concrete, ogee-shaped weir located within the right embankment section. The spillway has a crest length of 64 feet and is 4.6 feet deep (below wingwall level). In addition, the facility is equipped with a 16-inch diameter cast iron pipe (C.I.P.) blowoff line, and 10- and 12-inch diameter C.I.P. supply lines controlled by gate valves housed within a structure located at the downstream toe of the embankment.

b. Location. Pottsgrove Dam is located on Kettle Creek in Logan Township, Blair County, Pennsylvania. The city of Altoona, Pennsylvania, is located about three miles southwest of the facility. The dam, reservoir, and watershed are located on the Bellwood and Frankstown, Pennsylvania, 7.5 minute topographic quadrangles (see Appendix G). The coordinates of the dam are N40° 31.5' and W78° 21.4'.

c. Size Classification. Small (37 feet high, 142 acre-feet storage capacity at top of dam).

d. Hazard Classification. High (see Section 3.1.e).

e. Ownership. Blair Gap Water Supply Company
Box 20 Greenwood Road
Altoona, Pennsylvania 16602

f. Purpose. Water supply.

g. Historical Data. A detailed report dated October 8, 1914, available in PennDER files, indicates that the Pottsgrove Dam was originally constructed in 1879 and served to supply water for the shops and steam locomotives of the Pennsylvania Railroad (P.R.R.) in Altoona. Property and water rights for the dam site were originally secured by the P.R.R. from the Altoona Water and Gas Company in 1857, at which time a small earth embankment was located at the site.

The present facility was designed by the P.R.R. Engineering Department and was constructed by Campbell Brothers, who was reported to be a leading contractor in the region during that era.

Near the turn of the century, ownership of the facility was transferred to the Blair Gap Water Supply Company, a subsidiary of the P.R.R. with main offices in Philadelphia.

As a result of a serious seepage problem caused by extensive root decay within the embankment, major modifications were made to the facility in 1918 (see Figure 2). The modifications resulted in the embankment being raised approximately 2 feet, the addition of an impervious upstream facing, the apparent flattening of the downstream slope which was reportedly 1-1/4H:1V, and the construction of a new and larger spillway (see Figures 3 and 4).

The new spillway channel was damaged by high water resulting from the flood of March 1936, which measured 1.7 feet below the top of dam or 2.3 feet above the spillway crest. The spillway crest was subsequently lowered by about 7 inches to its present elevation (see Figure 5). Also in 1936, a small grouting program was implemented at the left abutment that successfully stopped seepage in that area.

There have been no other major modifications to the facility in the 61 years since the 1918 rehabilitation. Correspondence contained in PennDER files document a history of continued maintenance and care with very few deficiencies cited. The latest correspondence available, dated 1972, however, describes a deteriorated spillway condition that still exists today.

The present owner remains the Blair Gap Water Supply Company; however, its parent firm is the General Waterworks Corporation which is a subsidiary of International Utility Conversion Systems (IUCS).

1.3 Pertinent Data.

a. Drainage Area (square miles). 0.9 (local)
3.1 (total)

b. Discharge at Dam Site.

Discharge Capacity of the Outlet Conduits - Discharge curves are not available.

Discharge Capacity of Spillway at Maximum Pool - 2160 cfs (see Appendix C, Sheet 7).

c. Elevation (feet above mean sea level). The following elevations were obtained through field measurements based on the elevation of the emergency spillway crest at 1328.8 feet.

Top of Dam	1333.3 (design) 1333.0 (field)
Downstream Toe of Dam	1296
Maximum Design Pool	Not known
Maximum Pool of Record	Not known
Normal Pool	1328.8
Spillway Crest	1328.8
Upstream Inlet Invert	1290
Downstream Outlet Invert	1288
Streambed at Dam Centerline	1289
Maximum Tailwater	Not known

d. Reservoir Length (feet).

Top of Dam	800
Normal Pool	750

e. Storage (acre-feet).

Top of Dam	142
Normal Pool	104
Design Surcharge	Not known

f. Reservoir Surface (acres).

Top of Dam	10
Normal Pool	8
Maximum Design Pool	Not known

g. Dam.

Type	Rolled earth with concrete and masonry slope protection.
Length	900 feet (including spillway)
Height	37 feet (field measured - crest to downstream toe)
Top Width	11 feet (field)
Upstream Slope	2H:1V (field)
Downstream Slope	1.75H:1V (field)
Zoning	Upstream slope protected by concrete and mortared stone underlain by 3 to 4 feet of compacted clay. Embankment reportedly rolled impervious fill on upstream side and rolled coarse fill on downstream side. Downstream slope covered with loose, well graded stone.
Impervious Core	Concrete and mortared stone facing on upstream slope underlain by 3 to 4 feet of compacted clay.
Cutoff	5-foot wide cutoff trench constructed on upstream side as part of 1918 renovation. Consists of 2-foot thick concrete wall backed by 3 feet of clay

		puddle. Both carried to impervious stratum (hard shale).
	Grout Curtain	Left abutment reportedly grouted in 1936 to check seepage. Program apparently successful.
h.	Diversion and Regulating Tunnels.	None
i.	Spillway.	
	Type	Concrete and masonry chute channel with an uncontrolled, concrete, ogee-shaped weir crest located along right embankment.
	Crest Elevation	1328.8
	Crest Length	64 feet
j.	Outlet Conduit.	
	Supply Pipe	16-inch diameter C.I.P. through dam. 10- and 12-inch diameter C.I.P.'s from gate house.
	Blowoff	16-inch diameter C.I.P.
	Conduit Lengths	Approximately 150 feet from inlet to valves in gate house.
	Closure and Regulating Facilities	Controlled by gate valves located in gate house at downstream toe.
	Access	Gate house accessible from downstream toe of dam.

SECTION 2
ENGINEERING DATA

2.1 Design.

a. Design Data Availability and Sources. No design reports or calculations are available concerning any aspect of the facility. Design drawings and one as-built for the present facility are available in PennDER files; however, some drawings which were referenced in the old state inspection reports are not available. Correspondence and old state inspection reports available in PennDER files contain numerous design references and details.

b. Design Features.

1. Embankment. Information contained in PennDER files indicates that the embankment is a rolled earth structure composed primarily of two distinct materials. The upstream side is reportedly constructed with "selected material, free from stones, placed in horizontal layers and rolled;" whereas "rough material, stones, etc., placed in thin layers, harrowed, and sprinkled" comprises the downstream side. In 1918, the embankment was raised approximately 2 feet and the upstream slope was covered with a 3- to 4-foot layer of clay behind a 2-foot thick concrete facing (see Figure 3). Much of the concrete facing deteriorated and was eventually replaced in the early 1950's with a facing constructed of stone masonry (see Photographs 1 and 2). The downstream face is covered with a layer of loose stone on a 1.75H:1V slope (as per field measurement), while the upstream face slopes at 2H:1V.

Little information is available relative to the embankment foundation; however, data contained in PennDER files indicate that no separate core or cutoff walls were associated with the original facility. The 1918 renovation, however, included the construction of a 5-foot thick cutoff along the upstream toe composed of 3 feet of clay behind 2 feet of concrete carried to hard shale stratum (see Figures 3 and 4).

2. Appurtenant Structures.

a) Spillway. The spillway is a concrete and masonry chute channel with an uncontrolled concrete, ogee-shaped weir crest located along the right embankment, approximately 90 feet from the right abutment. The weir crest is 64 feet long and is flanked by concrete wingwalls which reach a height of 4.6 feet above the weir crest. The weir discharges directly into a rectangular, masonry-lined

channel; and then into a masonry-lined channel that curves downstream at an angle approximately parallel to the right embankment (see Figures 2, 4, and 5).

b) Outlet Works. Information contained in PennDER files indicates that the outlet works at Pottsgrove Dam consists of two 16-inch diameter pipes contained in a rubble masonry tunnel that leads through the dam. Both conduits are valved at the gate house which is located at the downstream toe of the embankment. At the gate house, the two 16-inch pipes are separated into a 16-inch blowoff line, a 10-inch diameter supply line and a 12-inch diameter supply line. Water company personnel stated that a 14-foot high, 16-inch diameter riser pipe was added to the supply line inlet in 1976 to reduce sediment intake. No drawings or correspondence were available from the water company or in PennDER files concerning this modification.

c. Design Data and Procedures.

1. Embankment. No design data or information relative to design procedures are available.

2. Appurtenant Structures. No design data or information relative to design procedures are available.

2.2 Construction Records.

No records pertaining to the construction of the original facility in 1879 are available. Semi-monthly progress reports and miscellaneous correspondence available in PennDER files provide some record of the rehabilitation construction that occurred in 1918.

2.3 Operating Records.

No pool level, rainfall, or spillway discharge records are available for the facility on a regular basis. Rainfall and spillway discharge data for the major flood of April 1936 are available in PennDER files. Daily rainfall in the Altoona area for the period of April 16 through 19, 1936 was 0.65, 4.10, 1.16, and 0.65 inches, respectively. The maximum discharge over the spillway was reported to be 2.32 feet and the 16-inch diameter blowoff was opened with an estimated discharge of 16 cfs.

During the Hurricane Agnes flood of June 1972, discharges of 8 and 5 inches over the spillway were reported to have occurred on June 24 and 25, respectively. Reports relative to maintenance, valve adjustments, and water quality data are prepared daily and are available from the owner.

2.4 Other Investigations.

Two reports dated October 8, 1914, and October 16, 1918, are available in PennDER files which provide historical documentation, design and construction information, and performance details for the original and rehabilitated facilities. PennDER files also contain approximately ten brief inspection reports for the period 1918 through 1971.

2.5 Evaluation.

Historical reports indicate the facility was originally constructed in 1879 and was of questionable design having a downstream slope of 1-1/4H:1V. Leakage (reportedly caused by root decay) prompted substantial modifications in 1918, details of which are verified by correspondence and by at least one as-built drawing. PennDER inspection reports and general correspondence indicate the facility has performed adequately, with concrete deterioration being the most significant problem.

The available data, although limited, are considered sufficient to make a reasonable Phase I assessment of the facility.

SECTION 3
VISUAL INSPECTION

3.1 Observations.

a. General. The general appearance of the overall facility suggests that it is in fair condition.

b. Embankment. Observations made during the visual inspection indicate the embankment to be in good condition. Minor deficiencies include conditions observed on both the upstream and downstream faces. The downstream face is protected with a layer of loose, well graded rock. Field measurements indicated that this face was sloped at roughly 1.75H:1V. The steepness of the slope has apparently caused some movement of the loose rock facing near the crest of the embankment, leaving the area unprotected and prone to minor erosion. No seepage through the embankment face or at the downstream toe was observed. The portion of the upstream embankment slope faced with concrete was found to be in poor condition. The concrete was extensively cracked and spalled. On the other hand, that portion of the slope faced with mortared stone masonry was observed to be in excellent condition, with no signs of any deterioration evident (see Photographs 1 and 2). Aside from the above deficiencies, the embankment appears to be well maintained.

c. Appurtenant Structures.

1. Spillway. The visual inspection revealed the spillway to be in fair condition. The ogee-shaped weir crest and wingwalls are extensively cracked and spalled (see Photographs 5 and 6). The deteriorated condition of the weir is in contrast to the overall good condition of the spillway discharge channel (see Photographs 7 and 8).

2. Outlet Works. The outlet works at Pottsgrove Dam are functional, well maintained, and in good condition (see Photographs 3 and 4). The blowoff was operated in the presence of the inspection team while the remaining valves were all reported to be operable. There are no apparent upstream controls and the function and condition of the masonry tunnel (see Photograph 3) are unknown. No leakage was observed near the tunnel entrance.

d. Reservoir Area. The general area surrounding the reservoir is heavily forested with steep slopes. No signs of slope distress were observed.

e. Downstream Channel. The stream into which the spillway chute channel discharges flows in a northwesterly direction through a residential valley. The first downstream residence is located approximately 580 feet downstream from the dam (see Photograph 10). Within the next 1,500 or so feet, approximately 10 homes are located adjacent the stream before Kettle Creek passes beneath U. S. Route 220. Development along Kettle Creek is such that a sudden breach of the embankment could possibly result in a substantial loss of life and extensive property damage.

3.2 Evaluation.

The overall condition of the facility is considered to be fair. Deficiencies noted by the inspection team included minor erosion of the downstream slope near the embankment crest and deteriorated concrete associated with both the spillway weir and upstream embankment slope. In addition, there are no provisions for controlling conduit flow at the intakes.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Normal Operating Procedure.

The manager of the water company stated that under normal operating conditions, the supply valves are open. The blowoff is opened every spring to insure its operability, or as needed. The facility is otherwise self-regulating.

4.2 Maintenance of Dam.

No formal maintenance program exists at this facility. Maintenance is performed on an unscheduled basis. The dam is visited daily to take equipment readings, and a weekly report is prepared concerning the operation and maintenance of the facility which primarily deals with water supply aspects.

4.3 Maintenance of Operating Facilities.

See Section 4.2 above.

4.4 Warning System.

No formal warning system is in effect; however, the owner currently is attempting to develop a plan in conjunction with the local Civil Defense and neighboring communities.

4.5 Evaluation.

No formal operations or maintenance manuals are available for the facility although weekly records of operation and maintenance (if performed) are prepared. No formal warning system exists but the owner is attempting to formulate a plan in conjunction with the Civil Defense and neighboring communities. Formal manuals are recommended to ensure continued maintenance and safety.

SECTION 5
HYDROLOGIC/HYDRAULIC EVALUATION

5.1 Design Data.

No pertinent design data, calculations, or reports are available. Information relative to the design of the facility is limited to that which can be inferred from the several drawings and state inspection reports available in PennDER files.

5.2 Experience Data.

Daily records of rainfall or spillway discharge have never been maintained at this facility. Information is contained in PennDER files which pertains to conditions observed during the flood of March 1936. Limited data are also available for the flood of June 1972, from the owner.

5.3 Visual Observations.

Based on visual observations, the spillway is in fair condition, but requires remedial work to repair the deteriorated condition of the spillway weir and sidewall concrete. At this time the above condition does not appear to threaten the stability of the structure and, consequently, the spillway will likely operate satisfactorily, within the limits of its design, during a flood event.

5.4 Method of Analysis.

The facility has been analyzed in accordance with procedures and guidelines established by the U. S. Army, Corps of Engineers, Baltimore District, for Phase I hydrologic and hydraulic evaluations. The analysis has been performed utilizing a modified version of the HEC-1 program developed by the U. S. Army, Corps of Engineers, Hydrologic Engineering Center, Davis, California. Analytical capabilities of the program are briefly outlined in the preface contained in Appendix C.

5.5 Summary of Analysis.

a. Spillway Design Flood (SDF). In accordance with procedures and guidelines contained in the National Guidelines for Safety Inspection of Dams for Phase I Investiga-

tions, the Spillway Design Flood (SDF) for Pottsgrove Dam ranges between the 1/2 PMF (Probable Maximum Flood) and the PMF. This classification is based on the relative size of the dam (small), and the potential hazard of dam failure to downstream developments (high). Due to the high potential for damage to many residences as well as to the presence of an upstream impoundment, the SDF for this facility is considered to be the PMF.

b. Results of Analysis. Pottsgrove Dam was analyzed under normal operating conditions. That is, the reservoir was initially at its normal pool or spillway elevation of approximately 1328.8 feet (MSL) with the low-level blowoff line closed. The spillway is a combination concrete and masonry chute channel with an uncontrolled, concrete, ogee-shaped weir. The upstream Brush Mountain Dam was also evaluated, in this analysis, to assess its impact on the Pottsgrove Dam. It too was investigated under normal operating conditions. That is, the Brush Mountain Dam reservoir was initially at its normal pool or spillway elevation of approximately 1718.3 feet (MSL) with its low-level blowoff line closed. The Brush Mountain Dam spillway is a combination concrete and masonry chute channel with discharges regulated via a rectangular, concrete, critical flow section. Necessary downstream channel routing was done under the assumption that the stream was dry prior to the inflow of dam outflows. Although a small fire dam is located about midway between the Pottsgrove and Brush Mountain Dams, the reservoir area of this facility is almost totally silted in, and thus, was neglected in this analysis. All pertinent engineering calculations relative to the evaluations of Pottsgrove and Brush Mountain Dams are provided in Appendices C and C-1, respectively.

Overtopping analysis (using the Modified HEC-1 computer program) indicated that the discharge/storage capacity of Pottsgrove Dam can accommodate only about 26 percent of the PMF (the SDF) prior to the overtopping of its embankment, while the discharge/storage capacity of Brush Mountain Dam can accommodate about 46 percent of the PMF before embankment overtopping (Appendix C, Summary Input/Output Sheets, Sheets O and P). The low top of dam of Pottsgrove Dam was inundated by depths of water of 1.3 and 2.4 feet under the 1/2 PMF and PMF events, respectively (Summary Input/Output Sheets, Sheet P). On the other hand, the Brush Mountain Dam was inundated by water depths of 0.1 and 1.1 feet under the 1/2 PMF and PMF events, respectively (Summary Input/Output Sheets, Sheet O). Therefore, since the SDF of each of these facilities is the PMF, both the Pottsgrove and Brush Mountain Dams have a high potential for overtopping, and thus, for breaching under floods of less than SDF magnitude.

Since the Pottsgrove Dam facility cannot safely handle a flood of at least 1/2 PMF magnitude, the possibility of embankment failure under floods of 1/2 PMF intensity or less was investigated (in accordance with ETL-1110-2-234). Several feasible alternatives were analyzed since it is difficult, if not impossible, to determine exactly how or if a specific dam will fail. The major concern of the breaching evaluations is with the impact of the various breach discharges on increasing downstream water surface elevations above those to be expected if breaching did not occur.

The Modified HEC-1 computer program was used for the breaching analysis with the assumption that the breaching of a dam would begin once its reservoir's water level reached the low top of dam elevation.

Two sets of breach geometry were evaluated for the Pottsgrove Dam for each of two failure times (Appendix C, Sheet 9). The two sets of breach sections chosen were considered to be the minimum and maximum probable failure sections. The two failure times (total time for each breach section to reach its final dimensions) under which the two breach sections were investigated were assumed to be a moderately rapid time (0.75 hours) and a prolonged time (4.0 hours), so that the possible upper and lower limits of this most sensitive variable might be examined. In addition, an average or more probable set of breach conditions was analyzed, with a failure time of 2.0 hours.

The Pottsgrove Dam peak breach outflows (resulting from a 0.3 PMF overtopping) ranged from about 2690 cfs for the minimum section-prolonged fail time scheme, to about 6940 cfs for the maximum section-minimum fail time scheme (Appendix C, Sheet 11). The outflow for the average breach condition was about 4180 cfs, compared to the non-breach 0.3 PMF peak facility outflow of about 2590 cfs (Summary Input/Output Sheets, Sheet P). The water surface elevation corresponding to the non-breach 0.3 PMF peak discharge at a section (Section 5) located 580 feet downstream from the dam was approximately 1281.8 feet (MSL), and approximately 1262.0 feet (MSL) at a section (Section 6) located 1,020 feet downstream from the dam (Summary Input/Output Sheets, Sheet P). The water surface elevations corresponding to the average condition peak breach outflow at the two above-mentioned downstream sections were 1282.5 feet (MSL) and 1263.1 feet (MSL), respectively (Summary Input.Output Sheets, Sheet U). The approximate elevation of the first house located at Section 5 is about 1282.5 feet (MSL). The approximate elevations of the two houses located at Section 6 are about 1261.0 feet (MSL) and 1262.5 feet (MSL) (field measured). Therefore, the increase in the water surface at Section 5 caused by the

Pottsgrove Dam was about 0.7 feet, with the breach water surface just at the damage level of the house. The increase in the water surface at Section 6, caused by the failure of the dam, was about 1.1 feet, with the breach water surface above the damage levels of both houses (although one of the two houses would experience flooding even without breaching).

In addition to the failure of Pottsgrove Dam alone under 0.3 PMF conditions, the possibility of the failures of both Pottsgrove and Brush Mountain Dams under 1/2 PMF conditions exists. The Brush Mountain Dam was evaluated according to its average set of breach conditions including a failure time equal to 2.0 hours (Appendix C-1, Sheet 11), as was Pottsgrove Dam. The peak breach outflow from Brush Mountain Dam was about 11260 cfs with a routed contribution to the Pottsgrove Dam reservoir inflow of about 10660 cfs (Summary Input/Output Sheets, Sheet BB). The peak breach outflow from Pottsgrove Dam was then about 12350 cfs, which resulted in water surface elevations of approximately 1285.1 feet (MSL) and 1266.7 feet (MSL) at Sections 5 and 6, respectively (Summary Input/Output Sheets, Sheet BB). The non-breach 1/2 PMF water surface elevations at Sections 5 and 6 were approximately 1282.7 feet (MSL) and 1263.4 feet (MSL), respectively, corresponding to a peak non-breach outflow of about 4530 cfs (Summary Input/Output Sheets, Sheet P). This indicates that all of the houses would experience some flooding even without dam failure. Nonetheless, the increases in the downstream water surfaces (above the base elevations) caused by the failures of both the Pottsgrove and Brush Mountain Dams were significant with a 2.4-foot increase at Section 5 and a 3.3-foot increase at Section 6.

The consequences of dam failure can be better envisioned if not only the increase in the height of the floodwave is considered, but also the great increase in the momentum that the larger and probably swifter moving volume of water will possess. Therefore, the failure of Pottsgrove Dam caused by either a flood or the failure of the upstream Brush Mountain Dam is quite possible, and will most probably lead to increased property damage and loss of life in the downstream community.

5.6 Spillway Adequacy.

As presented previously, under existing conditions Pottsgrove Dam can accommodate only about 26 percent of the PMF (the SDF) prior to the overtopping of its embankment. Should an 0.3 PMF or larger event occur, the dam will be overtopped and will possibly fail, endangering many residences in the immediate downstream area. Therefore, the spillway of Pottsgrove Dam is considered to be seriously inadequate.

SECTION 6
EVALUATION OF STRUCTURAL INTEGRITY

6.1 Visual Observations.

a. Embankment. Based on visual observations, the embankment appeared to be in good condition. The downstream slope at 1.75H:1V is steeper than that which would likely be considered acceptable by modern engineering standards; however, its apparent zoning and lack of seepage are favorable factors indicating adequate design. Minor erosion was observed near the embankment crest where some of the rock slope protection has been lost due to apparent movement. Nevertheless, no seepage was observed through the embankment face or along the downstream toe. The concrete that protects a portion of the upstream face is badly deteriorated and should be repaired promptly.

b. Appurtenant Structures.

1. Spillway. The spillway is in fair condition. Immediate attention should be given to repairing deteriorated portions of the spillway weir and wingwalls before the condition advances to a state that would threaten the stability of the structure.

2. Outlet Works. The outlet works are in good condition. The blowoff valve was operated in the presence of the field team and all other operating mechanisms are reported to be functional. A means of controlling flow at the inlet is not available and should be provided.

6.2 Design and Construction Techniques.

No information is available that details the methods of design. Historical reports indicate that embankment materials were placed in thin layers and compacted. The structure is, in essence, a zoned embankment.

6.3 Past Performance.

Information contained in PennDER files indicates that the facility was constructed in 1879, and modified substantially in 1918. In March 1936 after flood waters rose to within a foot of the embankment crest, the spillway crest was lowered by seven inches. Documented data indicate adequate past performance with minor deficiencies related to seepage and concrete deterioration.

6.4 Seismic Stability.

The dam is located in Seismic Zone No. 1 and is thus subject to minor earthquake induced dynamic forces. As the overall stability of the embankment appears adequate and the embankment is primarily constructed of compacted residual soils, it is thought that the facility can withstand such minor earthquake induced dynamic forces. However, no calculations and/or investigations were performed to confirm this opinion.

SECTION 7
ASSESSMENT AND RECOMMENDATIONS FOR REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety. Visual observations indicate the overall facility to be in fair condition. Hydrologic and hydraulic calculations performed during this investigation indicate that the facility will pass and/or store only 26 percent of the Probable Maximum Flood (PMF) prior to overtopping. Based on screening criteria supplied by the Department of the Army, Office of Chief of Engineers, the spillway is deemed to be "seriously inadequate" and the facility is considered "unsafe, non-emergency."

Structural deficiencies noted by the inspection team included minor erosion of the downstream slope near the embankment crest and deteriorated concrete associated with both the spillway weir and wingwalls and the upstream embankment slope. Additionally, there are no provisions for controlling flow at the inlets to the outlet conduits.

b. Adequacy of Information. The available information is considered sufficient to make a general assessment of the facility.

c. Urgency. Because of the seriously inadequate spillway, a formal warning system should be immediately implemented. Other studies and remedial action, as recommended below, should be implemented without undue delay.

d. Necessity For Additional Investigations. Additional investigations to more accurately ascertain the hydraulic adequacy of the facility are considered necessary.

7.2 Recommendations/Remedial Measures.

Due to the seriously inadequate spillway classification, the facility is considered unsafe. Failure is not considered imminent; however, it is recommended that the owner immediately develop a warning system to notify downstream residents should hazardous conditions develop. Included in the plan should be provisions for around-the-clock surveillance of the facility during periods of unusually heavy precipitation.

In addition, it is recommended that the owner:

a. Have the facility studied by a registered professional engineer experienced in hydraulics and hydrology of

dams, and implement measures necessary to make the facility hydraulically adequate.

b. Repair the deteriorated concrete portions of the upstream slope protection and the spillway system. (Repairs to the spillway may be inherent to the results of the above recommended study.)

c. Provide a means for controlling flow at the inlets of the outlet conduits should an emergency condidion develop.

d. Seed the areas of minor erosion along the downstream embankment slope near the crest level or reset the stone slope protection.

e. Develop a formal operation and maintenance manual to ensure the continued proper care of the facility.

APPENDIX A

CHECK LIST - ENGINEERING DATA

NAME OF DAM: Pottsgrove Dam

NDI#: PA-00527 PENNDER#: 7-19

CHECK LIST
ENGINEERING DATA
PHASE I

ITEM	REMARKS NDI# PA - 527
PERSONS INTERVIEWED AND TITLE	Mr. James Dodson - Manager, Blair Gap Water Supply Company.
REGIONAL VICINITY MAP	See Appendix G (U.S.G.S. 7.5 minute topographic quadrangles Bellwood and Frankstown, Pennsylvania).
CONSTRUCTION HISTORY	Detailed in two reports by PennDER predecessors dated October 8, 1914 and October 16, 1918. Both available in PennDER files.
AVAILABLE DRAWINGS	PennDER files contain four drawings (one an as-built) of 1918 renovation.
TYPICAL DAM SECTIONS	Figure 3 - Proposed 1918 renovation. Figure 4 - As-built 1918 section.
OUTLETS: PLAN DETAILS DISCHARGE RATINGS	No drawings available. Descriptions contained in state inspection reports. Available from PennDER files.

ITEM	REMARKS NDI# PA - 527
SPILLWAY: PLAN SECTION DETAILS	See Figures 2, 4 and 5.
OPERATING EQUIPMENT PLANS AND DETAILS	None available.
DESIGN REPORTS	None available.
GEOLOGY REPORTS	None available.
DESIGN COMPUTATIONS: HYDROLOGY AND HYDRAULICS STABILITY ANALYSES SEEPAGE ANALYSES	None available.
MATERIAL INVESTIGATIONS: BORING RECORDS LABORATORY TESTING FIELD TESTING	

ITEM	REMARKS NDI# PA - 527
BORROW SOURCES	Not known. Probably from within reservoir.
POST CONSTRUCTION DAM SURVEYS	None of record.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	About ten state inspection reports available since 1918.
HIGH POOL RECORDS	PennDER files have data from 1936 flood. Blair Gap (Altoona Office) records show 8" over spillway on June 24, 1972; 5" over spillway on June 25, 1972. Not necessairly maxium flow during storm.
MONITORING SYSTEMS	Flow meters on supply lines and other water quality devices only. No staff or rain gages.
MODIFICATIONS	Facility completely rehabilitated in 1918 (See Figures 2, 3 and 4). Spillway crest lowered in 1936 (See Figure 5). Added 16-inch diameter riser (14-foot high), with top screen, to intake pipe in 1975 or 1976. Reservoir drained and showed little sediment.

ITEM	REMARKS . NDI# PA 527
PRIOR ACCIDENTS OR FAILURES	Spillway channel scoured severely during 1936 flood.
MAINTENANCE: RECORDS MANUAL	No formal manual or program. Maintained on unscheduled basis. Weekly reports submitted related to water supply but have maintenance items included if any performed.
OPERATION: RECORDS MANUAL	Same as above. Valve adjustments indicated on weekly report.
OPERATIONAL PROCEDURES	Supply line valves always open. Open blowoff line valve every spring to clean out sediment. Otherwise, self-regulating.
WARNING SYSTEM AND/OR COMMUNICATION FACILITIES	In process. Working with Civil Defense and neighboring communities to set up system. Civil Defense called manager during storm of June 1972 and personnel were dispatched to dam.
MISCELLANEOUS	Future plans may call for abandonment of three Blair Gap Water Supply Dams: Pottsgrove Dam, Fire Dam and Brush Mountain Dam (Kettle Dam).

CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

NDI ID # PA-00527
PENN DER ID # 7-19

SIZE OF DRAINAGE AREA: 0.9 square miles (local); 3.1 square miles (total)

ELEVATION TOP NORMAL POOL: 1328.8 STORAGE CAPACITY: 104 acre-feet

ELEVATION TOP FLOOD CONTROL POOL: - STORAGE CAPACITY: -

ELEVATION MAXIMUM DESIGN POOL: - STORAGE CAPACITY: -

ELEVATION TOP DAM: 1333.0 STORAGE CAPACITY: 142 acre-feet

SPILLWAY DATA

CREST ELEVATION: 1328.8

TYPE: Concrete and masonry chute channel with an uncontrolled concrete ogee-shaped weir crest.

CREST LENGTH: 64 feet

CHANNEL LENGTH: about 400 feet

SPILLOVER LOCATION: Near right abutment

NUMBER AND TYPE OF GATES: None

OUTLET WORKS

TYPE: 16-inch diameter supply intake; 16-inch diameter blowoff

LOCATION: Near center of embankment.

ENTRANCE INVERTS: Approximately 1290

EXIT INVERTS: Approximately 1288 feet at downstream valve

EMERGENCY DRAWDOWN FACILITIES: 16-inch diameter blowoff pipe valved on downstream toe. Functiona

HYDROMETEOROLOGICAL GAGES

TYPE: None

LOCATION: -

RECORDS: -

MAXIMUM NON-DAMAGING DISCHARGE: 2.23 feet over spillway, April 1936

APPENDIX B

CHECK LIST - VISUAL INSPECTION

CHECK LIST
VISUAL INSPECTION
PHASE 1

NAME OF DAM Pottsgrove Dam STATE Pennsylvania COUNTY Blair

NDI# PA - 527 PENNDER# 7-19

TYPE OF DAM earth SIZE small HAZARD CATAGORY high

DATE(S) INSPECTION 18 May 1979 WEATHER clear TEMPERATURE 70° @ 5:00 PM

POOL ELEVATION AT TIME OF INSPECTION 1328.8 M.S.L.

TAILWATER AT TIME OF INSPECTION N/A M.S.L.

INSPECTION PERSONNEL	OWNER REPRESENTATIVES	OTHERS
B. M. Mihalcin	John Davinizer (water	
W. J. Veon	company employee)	
D. L. Bonk		

RECORDED BY D. L. Bonk

ITEM	OBSERVATIONS AND/OR REMARKS NDI# PA - 527
SURFACE CRACKS	None observed.
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Minor sloughing along the downstream face immediately below the crest. Stone slope protection is sparse along this area.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Horizontal - good Vertical - good
RIPRAP FAILURES	No loose stone riprap. Upstream slope is protected by a combination of concrete and mortared stone. Cracking evident especially in concrete areas.
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Good.

ITEM	OBSERVATIONS AND/OR REMARKS NDI# PA - 527
DAMP AREAS IRREGULAR VEGETATION (LUSH OR DEAD PLANTS)	None observed along embankment or immediate downstream toe.
ANY NOTICEABLE SEEPAGE	Small seep (possibly drainage) discharging into the plunge pool approximately 150 feet from downstream toe.
STAFF GAGE AND RECORDER	None observed.
DRAINS	Weep holes observed in spillway wingwalls. Not discharging during inspection.

OUTLET WORKS

ITEM	OBSERVATIONS AND/OR REMARKS	NDI# PA - 527
INTAKE STRUCTURE	Submerged, not observed.	
OUTLET CONDUIT (CRACKING AND SPALLING OF CONCRETE SURFACES)	Cast iron conduit blowoff whose visible portions appear to be in good condition.	
OUTLET STRUCTURE	Masonry structure housing the valves on the blowoff and supply lines. The facility appears to be adequately maintained and in good condition.	
OUTLET CHANNEL	Unlined, vegetated channel of varying cross-section located about 50 feet downstream of the gate house. The outlet channel converges with the spillway discharge channel about 300 feet below the downstream embankment toe.	
GATE(S) AND OPERATIONAL EQUIPMENT	a) Blowoff operated during inspection. b) All valves associated with the distribution system are reported operable. c) Aeration and chlorination equipment observed in separate structure located at the downstream toe.	

ITEM	OBSERVATIONS AND/OR REMARKS NDI# PA -
TYPE AND CONDITION	Chute channel spillway with uncontrolled ogee-crested weir located at right abutment. Weir is constructed of concrete. Concrete is cracked and deteriorated and presently in poor condition.
APPROACH CHANNEL	Not applicable.
SPILLWAY CHANNEL AND SIDEWALLS	Mortared stone channel and sidewalls in good condition.
STILLING BASIN PLUNGE POOL	Two small, hand-placed, rock dam structures form two small pools that act as plunge pools approximately 150 feet downstream of the spillway crest.
DISCHARGE CHANNEL	Natural stream and channel.
BRIDGE AND PIERS	None
EMERGENCY GATES	None

ITEM	OBSERVATIONS AND/OR REMARKS NDI# PA - 527
TYPE AND CONDITION	N/A
APPROACH CHANNEL	N/A
OUTLET STRUCTURE	N/A
DISCHARGE CHANNEL	N/A

ITEM	OBSERVATIONS AND/OR REMARKS NDI# PA - 527
MONUMENTATION SURVEYS	None observed.
OBSERVATION WELLS	None observed.
WEIRS	Remnants of two small weirs located upstream at the point of inflow were observed and are currently non-functional.
PIEZOMETERS	None observed.
OTHERS	

ITEM	OBSERVATIONS AND/OR REMARKS NDI# PA - 527
SLOPES: RESERVOIR	Steep and heavily forested.
SEDIMENTATION	None observed directly; however, discharge through the blowoff conduit was sediment laden.
DOWNSTREAM CHANNEL (OBSTRUCTIONS, DEBRIS, ETC.)	Several wooden foot bridges cross the stream channel between the embankment and U. S. Route 220 located about 2,000 feet downstream.
SLOPES: CHANNEL VALLEY	Moderately sloping terrain with a combination of residential and wooded ground cover.
APPROXIMATE NUMBER OF HOMES AND POPULATION	Within 2000 feet of the dam, approximately 12 homes could possibly be affected by a sudden failure of the dam (estimated population 30-40). Many more homes could possibly be affected further downstream as the channel crosses through the commmunity of Greenwood.
UPSTREAM IMPOUNDMENTS	An intermediate size dam (Brush Mountain Dam) is located about 1.6 miles upstream from the Pottsgrove Dam, and could have a significant impact on the evaluation of Pottsgrove Dam. A small fire dam is located about midway betwwn Pottsgrove and Brush Mountain Dams, but should have no impact on the Pottsgrove analysis, since its reservoir is virtually silted in.

APPENDIX C

HYDRAULICS/HYDROLOGY

PREFACE

The modified HEC-1 program is capable of performing two basic types of hydrologic analyses: (1) the evaluation of the overtopping potential of the dam; and (2) the estimation of the downstream hydrologic-hydraulic consequences resulting from assumed structural failures of the dam. Briefly, the computational procedures typically used in the dam overtopping analysis are as follows:

a. Development of an inflow hydrograph(s) to the reservoir.

b. Routing of the inflow hydrograph(s) through the reservoir to determine if the event(s) analyzed would overtop the dam.

c. Routing of the outflow hydrograph(s) from the reservoir to desired downstream locations. The results provide the peak discharge(s), time(s) of the peak discharge(s), and the maximum stage(s) of each routed hydrograph at the downstream end of each reach.

The evaluation of the hydrologic-hydraulic consequences resulting from an assumed structural failure (breach) of the dam is typically performed as outlined below.

a. Development of an inflow hydrograph(s) to the reservoir.

b. Routing of the inflow hydrograph(s) through the reservoir.

c. Development of a failure hydrograph(s) based on specific breach criteria and normal reservoir outflow.

d. Routing of the failure hydrograph(s) to desired downstream locations. The results provide estimates of the peak discharge(s), time(s) to peak, and maximum water surface elevation(s) of the failure hydrograph(s) for each location.

SUBJECT DAM SAFETY INSPECTION
POTTSGROVE DAM

BY WJV DATE 6-11-79 PROJ. NO. 78-611-527

CHKD. BY DLB DATE 6-19-79 SHEET NO. 1 OF 12

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DAM STATISTICS

HEIGHT OF DAM ≈ 37 FT (FIELD MEASURED)

MAXIMUM POOL STORAGE CAPACITY ≈ 142 AC-FT (FROM HEC-1) @ TOP OF DAM

NORMAL POOL STORAGE CAPACITY ≈ 104 AC-FT (SEE NOTE 1)

DRAINAGE AREA ≈ 0.9 SQ MI (LOCAL)
3.1 SQ MI (TOTAL)

[PLANIMETERED OFF USGS 7½ MINUTE BELLWOOD AND FRANKSTOWN, PA QUADS]

NOTE 1: STORAGE CAPACITY VALUE OBTAINED FROM "REPORT UPON THE APPLICATION OF THE BLAIR GAP WATER SUPPLY COMPANY FOR THE MAKING A CHANGE IN THE SPILLWAY OF THE POTTSGROVE DAM ON KETTLE CREEK, LOGAN TOWNSHIP, BLAIR COUNTY, PENNSYLVANIA", AS FOUND IN PENN DER FILES. THE ACTUAL REPORTED VALUE WAS 34 MILLION GALLONS.

DAM CLASSIFICATION

DAM SIZE - SMALL (REF 1, TABLE 1)

HAZARD CLASSIFICATION - HIGH (FIELD OBSERVATION)

REQUIRED SDF - ½ PMF TO PMF (REF 1, TABLE 3)

SUBJECT DAM SAFETY INSPECTION
POTTSGROVE DAM

BY WJV DATE 6-11-79 PROJ. NO. 79-617-527

CHKD. BY DLB DATE 6-19-79 SHEET NO. 2 OF 12

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HYDROGRAPH PARAMETERS

LENGTH OF LONGEST WATERCOURSE ≈ 2.0 MI

L_{CA} ≈ 0.8 MI (MEASURED ALONG LONGEST WATERCOURSE FROM DAM TO CENTROID OF BASIN)

NOTE 2: VALUES OF L AND L_{CA} ARE MEASURED FROM USGS 7.5 MINUTE BELLWOOD AND FRANKSTOWN, PA QUADS. ALL VARIABLES ARE DEFINED IN REF 2 IN THE SECTION ENTITLED, "SNYDER SYNTHETIC UNIT HYDROGRAPH".

C_t ≈ 1.5
C_p ≈ 0.55

[SUPPLIED BY COE; ZONE 21 SUSQUEHANNA RIVER BASIN]

t_p = SNYDER'S STANDARD LAG ≈ $1.5 (L * L_{CA})^{0.3}$

∴ $t_p \approx 1.5 (2.0 * 0.8)^{0.3} \approx 1.73$ HR

RESERVOIR SURFACE AREAS

SURFACE AREA (SA) @ NORMAL POOL EL 1328.8 ≈ 8 AC

NOTE 3: NORMAL POOL EL 1328.8 OBTAINED FROM APPENDIX F, FIG 5 (PROPOSED CREST). NORMAL POOL SURFACE AREA OF 8 AC FOUND IN RENDER FILES AND CHECKED BY ESTIMATION FROM FIG 2.

SA @ EL 1340 ≈ 13.7 AC

[PLANIMETERED OFF USGS 7.5 MINUTE BELLWOOD, PA QUAD]

SUBJECT DAM SAFETY INSPECTION
POTTSGROVE DAM

BY WJV DATE 6-11-79 PROJ. NO. 78-617-527

CHKD. BY DLB DATE 6-19-79 SHEET NO. 3 OF 12

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RATE OF SA INCREASE PER FOOT OF RESERVOIR RISE:

$\Delta A/\Delta H \approx (13.7-9)\,AC/(1340-1329.8) \approx 0.51\ AC/FT$

SA @ LOW TOP OF DAM EL 1333.0 $\approx$ 10.1 AC (ROUGHLY CHECKED VIA FIG 2, APPEN. F)

RESERVOIR ELEVATION @ "0" STORAGE

NORMAL POOL VOLUME $\approx$ 1/3 HA $\approx$ 104 AC-FT (CONIC METHOD)

SA @ NORMAL POOL EL 1329.8 $\approx$ 9 AC (NOTE 3)

$\therefore H \approx (104\ AC\text{-}FT)(3)/(9\ AC) \approx 39.0\ FT$

ZERO VOLUME ELEVATION $\approx$ 1329.8 - 39 $\approx$ 1291.8 FT
(CORRESPONDS TO INFORMATION AVAILABLE ON FIG 2, APPEN. F)

RESERVOIR ELEVATION - STORAGE RELATIONSHIP:

COMPUTED INTERNALLY VIA THE HEC-1 PROGRAM BASED ON GIVEN SURFACE AREA VS ELEVATION INFORMATION. (SEE SUMMARY INPUT/OUTPUT SHEETS).

SUBJECT DAM SAFETY INSPECTION
POTTSGROVE DAM

BY WJV DATE 6-11-79 PROJ. NO. 78-617-527

CHKD. BY DLB DATE 6-19-79 SHEET NO. 4 OF 12

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PMP CALCULATIONS

- STANDARD RAINFALL INDEX = 22.2 INCHES (REF 9, FIG 2)
  (CORRESPONDING TO A DURATION OF 24 HOURS AND AN AREA OF 200 SQ. MI.)

- GEOGRAPHIC ADJUSTMENT FACTOR = 105 % (REF 9, FIG 1)
  (CORRESPONDING TO A LONGITUDE OF 78° 21' AND A LATITUDE OF 40° 31')

- CORRECTED RAINFALL INDEX ≈ (22.2 IN)(1.05) ≈ 23.3 IN.

- LOCAL DRAINAGE AREA ≈ 0.9 SQ MI. HOWEVER, THE STORM WILL BE CENTERED OVER THE TOTAL DA ABOVE POTTSGROVE DAM ≈ 3.1 SQ. MI ⇒ ASSUME THAT THE 10 SQ. MI VALUES CAN EFFECTIVELY REPRESENT THE 3.1 SQ MI. AREA :

DURATION (HR)	PERCENT OF INDEX RAINFALL
6	117.5
12	127.0
24	136.0
48	142.5
72	145.0

- HOR BROOK FACTOR (ADJUSTMENT FOR BASIN SHAPE AS WELL AS FOR THE LESSER LIKELIHOOD OF A SEVERE STORM CENTERING OVER A SMALLER BASIN) CORRESPONDING TO A DA ≈ 3.1 SQ MI (< 10 SQ. MI) ⇒ 0.90 (REF 4, P. 45

SUBJECT DAM SAFETY INSPECTION
POTTSGROVE DAM

BY WJV DATE 6-12-79 PROJ. NO. 79-617-527

CHKD. BY DLB DATE 6-19-79 SHEET NO. 5 OF 12

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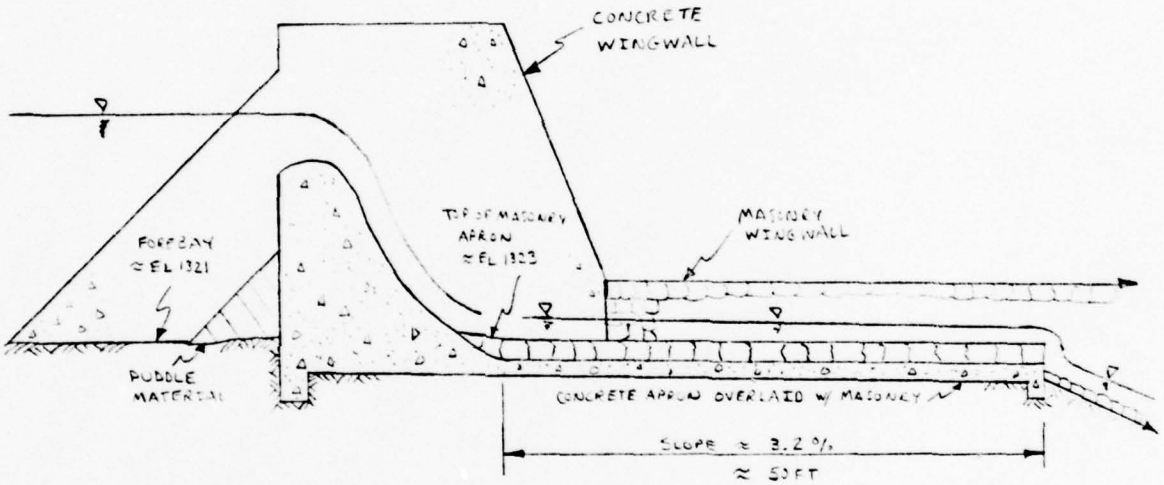
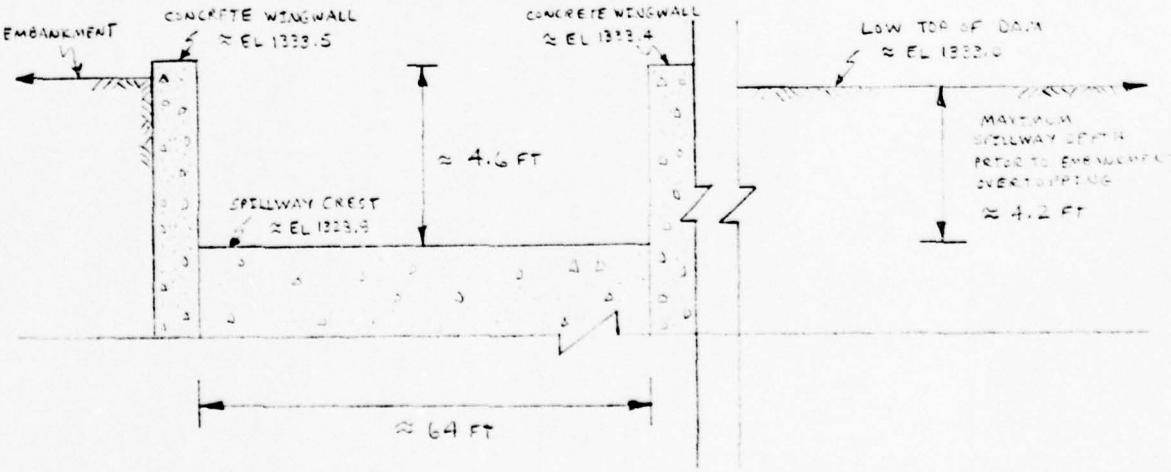
SPILLWAY CAPACITY

- PROFILE OF SPILLWAY : (NOT TO SCALE)
(FROM FIELD MEASUREMENT AND OBSERVATION, AND FIGS 4 AND 5, APPENDIX F)



- CROSS-SECTION OF SPILLWAY : (NOT TO SCALE)
(FROM FIELD MEASUREMENT AND OBSERVATION; AND FIGS 4 AND 5, APPENDIX F)



SECTION TAKEN LOOKING U/S TOWARD SPILLWAY

SUBJECT DAM SAFETY INSPECTION
POTTSGROVE DAM

BY WJV DATE 6-12-79 PROJ. NO. 78-617-527

CHKD. BY DLB DATE 6-19-79 SHEET NO. 6 OF 12

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- DISCHARGES OVER THE OGEE-CRESTED WEIR OF THE SPILLWAY ARE DEFINED BY:

$$Q = C L H^{3/2} \qquad \text{(REF 4, PG 373)}$$

WHERE Q = DISCHARGE, IN CFS;
L = LENGTH OF WEIR CREST ≈ 64 FT;
H = HEAD ABOVE WEIR CREST ≈ 4.2 FT PRIOR TO EMBANKMENT OVERTOPPING; AND
C = DISCHARGE COEFFICIENT = f (FOREBAY DEPTH, APRON ELEVATION, APPROACH CHANNEL LOSSES, AND DESIGN HEAD).

- DETERMINATION OF "C" COEFFICIENT:

a) FOREBAY DEPTH = 1329.0 - 1321 ≈ 7.8 FT (SHEET 5)
ASSUME DESIGN HEAD ≈ 4.2 FT

∴ FOREBAY DEPTH / DESIGN HEAD = $P/H_0 \approx 7.8/4.2 \approx 1.86$

⇒ $C_0 \approx 3.93$ (REF 4, PG 373, FIG 7-17)

b) UPSTREAM FACE OF WEIR IS VERTICAL ⇒ $C_L/C_0 = 1.0$
⇒ $C_L = C_L/C_0 \times C_0 = 1.0 \times 3.93 \approx 3.93$ (REF 4, PG 371)

c) DOWNSTREAM APRON ELEVATION ≈ 1323 FT
⇒ $H_0 + d$ (TOTAL DISTANCE OF APRON BELOW DESIGN HEAD ELEVATION) ≈ 1333.0 - 1323 ≈ 10 FT

⇒ $(H_0+d)/H_0 \approx 10\text{FT}/4.2\text{FT} \approx 2.4$
⇒ $C_S/C_L = 1.0$ (REF 4, PG 381, FIG 7-23)
∴ $C_S = C_S/C_L \times C_L \approx 1.0 \times 3.93 \approx 3.93$

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D) APPROACH CHANNEL LOSSES ⇒ NO ACTUAL APPROACH CHANNEL
⇒ NEGLECT LOSSES

E) SUBMERGENCE EFFECTS ⇒ SUBMERGENCE NOT LIKELY

$\therefore \quad C_s = C \approx 3.93$

$\Rightarrow \quad Q = CLH^{3/2} \approx 3.93\ (64\text{ FT})(4.2\text{ FT})^{3/2}$
≈ 2160 CFS (≈ 2134 AS COMPUTED BY HEC-1 DUE TO COMPUTER ACCURACY)

SPILLWAY RATING CURVE

COMPUTED INTERNALLY BY HEC-1 VIA THE OGEE RATING CURVE ROUTINE, BASED ON THE SPILLWAY GEOMETRY PRESENTED ON SHEET 5. THE OGEE ROUTINE CALCULATES WEIR DISCHARGES IN A WAY SIMILAR TO THAT OUTLINED ON SHEETS 6 AND 7.

DAM EMBANKMENT RATING CURVE

- COMPUTED INTERNALLY BY HEC-1 VIA THE ASSUMPTION THAT CRITICAL DEPTH ON THE CREST CONTROLS OVERTOPPING FLOWS, W/ THE CREST PROFILE REPRESENTED BY A SERIES OF TRAPEZOIDS (SEE SUMMARY INPUT/OUTPUT SHEETS FOR RATING INFORMATION)

- INPUT INFORMATION: (BASED ON FIELD MEASUREMENT)

RESERVOIR ELEVATION (FT)	DEPTH ABOVE CREST (FT)	INUNDATED CREST LENGTH (FT)	RESERVOIR ELEVATION (FT)	DEPTH ABOVE CREST (FT)	INUNDATED CREST LENGTH (FT)	RESERVOIR ELEVATION (FT)	DEPTH ABOVE CREST (FT)	INUNDATED CREST LENGTH (FT)
1333.0	0	100	1333.3	0.3	640	1335.0	2.0	*750
1333.1	0.1	200	1333.4	0.4	740	1336.0	3.0	*755
1333.2	0.2	500	1334.0	1.0	*745	1337.0	4.0	*760

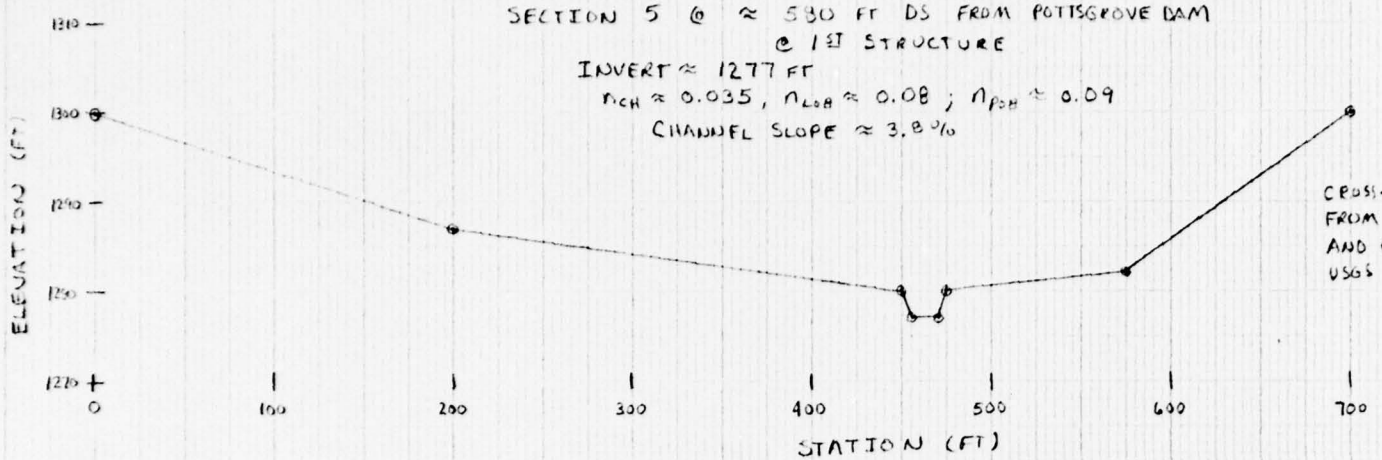
* ASSUMED LENGTH

SECTION 5 @ ≈ 530 FT DS FROM POTTSGROVE DAM
@ 1ST STRUCTURE

INVERT ≈ 1277 FT

$n_{CH} \approx 0.035$, $n_{LOB} \approx 0.08$; $n_{ROB} \approx 0.09$

CHANNEL SLOPE ≈ 3.8%



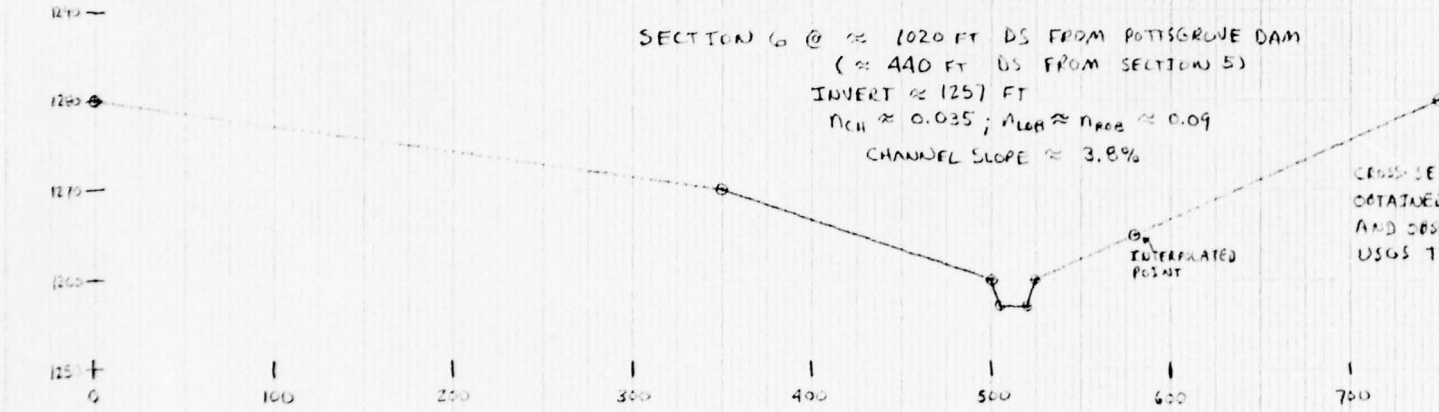
CROSS-SECTION INFORMATION FROM FIELD MEASUREMENT AND OBSERVATION; AND USGS TOPO MAP

SECTION 6 @ ≈ 1020 FT DS FROM POTTSGROVE DAM
(≈ 440 FT DS FROM SECTION 5)

INVERT ≈ 1257 FT

$n_{CH} \approx 0.035$; $n_{LOB} \approx n_{ROB} \approx 0.09$

CHANNEL SLOPE ≈ 3.8%



CROSS-SECTION INFORMATION OBTAINED FROM FIELD MEASUREMENT AND OBSERVATION; AND USGS TOPO MAP

SUBJECT DAM SAFETY INSPECTION
POTTSGROVE DAM

BY WJV DATE 6/22/79 PROJ. NO. 79-617-527

CHKD. BY DLB DATE 6-23-79 SHEET NO. 9 OF 12

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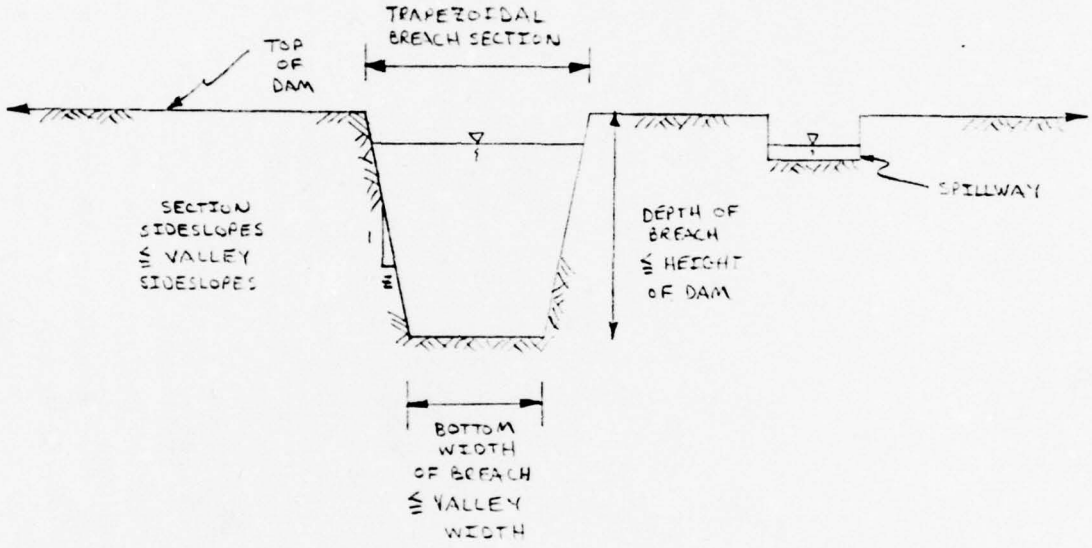
BREACH ASSUMPTIONS

- TYPICAL BREACH SECTION:



- HEC-1-DAM BREACHING ANALYSIS INPUTS:

(ALL BREACHING WILL BEGIN WHEN THE RESERVOIR LEVEL REACHES THE TOP OF DAM ELEVATION)

PLAN NUMBER AND COMMENT	BREACH BOTTOM WIDTH (FT)	MAX. BREACH DEPTH (FT)	SECTION SIDESLOPES	* BREACH TIME (HR)	WSEL @ START OF FAILURE (FT)
① MIN. BREACH SECT; MIN FAIL TIME	0	37	¼ TO 1	0.75	1888.0
② MAX. BREACH SECT; MIN FAIL TIME	300	37	4 TO 1	0.75	1888.0
③ MIN. BREACH SECT; MAX FAIL TIME	0	37	¼ TO 1	4.0	1888.0
④ MAX. BREACH SECT; MAX FAIL TIME	300	37	4 TO 1	4.0	1888.0
⑤ AVERAGE POSSIBLE CONDITIONS	100	37	2 TO 1	2.0	1888.0
** ⑥ AVERAGE POSSIBLE CONDITIONS	100	37	2 TO 1	2.0	1888.0

* BREACH TIME = TOTAL TIME NECESSARY TO REACH FINAL BREACH DIMENSIONS

** PLANS ① → ⑤ WILL BE UNDER 0.8 PMF CONDITIONS, PLAN ⑥ WILL BE UNDER 0.5 PMF CONDITIONS

SUBJECT DAM SAFETY INSPECTION
POTTSGROVE DAM

BY WJV DATE 6-21-79 PROJ. NO. 79-617-527

CHKD. BY DLB DATE 6-23-79 SHEET NO. 10 OF 12

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- THE BREACH ASSUMPTIONS LISTED ON SHEET 9 ARE BASED SOMEWHAT ON INFORMATION CONCERNING EARTH DAM BREACHING PROVIDED BY THE COE, BALTIMORE DISTRICT; AND ALSO ON THE PHYSICAL CONSTRAINTS OF THE DAM AND SURROUNDING TERRAIN:

CONSTRAINT	VALUE	
- HEIGHT OF EMBANKMENT	≈ 37 FT	(FIELD MEASURED)
- EMBANKMENT CREST LENGTH:		
EFFECTIVE LENGTH TO LEFT OF SPWY	≈ 700 FT	FIELD MEASURED
EFFECTIVE LENGTH TO RIGHT OF SPWY	≈ 40 FT	FIELD MEASURED
TOTAL LENGTH	900+ FT	FIELD MEASURED
- VALLEY BOTTOM WIDTH	≈ 300 FT	(USGS TOPO)
- VALLEY SIDESLOPES ADJACENT TO DAM:		
RIGHT WALL	5 TO 1	USGS TOPO
LEFT WALL	5 TO 1	USGS TOPO

SUBJECT DAM SAFETY INSPECTION
POTTSGROVE DAM
BY WTV DATE 6-24-79 PROJ. NO. 78-077-527
CHKD. BY DLB DATE 6-29-79 SHEET NO. 11 OF 12

HEC-1 - DAM BREACHING ANALYSIS OUTPUT :

RESERVOIR DATA

UNDER 0.3 PMF BASE FLOW CONDITIONS (W/ BRUSH MOUNTAIN DAM ABLE TO PASS THE ENTIRE FLOOD WITHOUT BREACHING) -

*PLAN NUMBER	VARIABLE BREACH BOTTOM WIDTH (FT)	ACTUAL MAX FLOW DURING FAIL TIME (CFS)	CORRESPONDING TIME OF FLOW (HR)	INTERPOLATED OR HEC-1 ROUTED MAX FLOW DURING FAIL TIME (CFS)	CORRESPONDING TIME OF FLOW (HR)	ACTUAL PEAK FLOW THROUGH DAM (CFS)	CORRESPONDING TIME OF PEAK (HR)	TIME OF INITIAL BREACH (HR)
①	0	5637	42.00	5637	42.00	5637	42.00	41.25
②	300	6736	41.44	6556	41.50	6936	41.44	41.25
③	0	2693	42.50	2693	42.50	2693	42.50	41.25
④	300	3108	42.08	3110	42.00	3105	42.08	41.25
⑤	100	4179	41.88	4066	42.00	4179	41.88	41.25

UNDER 0.3 PMF BASE FLOW CONDITIONS (W/ BRUSH MOUNTAIN DAM FAILED ACCORDING TO ITS AVERAGE BREACH CONDITIONS; APPENDIX C-1, SHEET 11) -

*PLAN NUMBER	VARIABLE BREACH BOTTOM WIDTH (FT)	ACTUAL MAX FLOW DURING FAIL TIME (CFS)	CORRESPONDING TIME OF FLOW (HR)	INTERPOLATED OR HEC-1 ROUTED MAX FLOW DURING FAIL TIME (CFS)	CORRESPONDING TIME OF FLOW (HR)	ACTUAL PEAK FLOW THROUGH DAM (CFS)	CORRESPONDING TIME OF PEAK (HR)	TIME OF INITIAL BREACH (HR)
⑥	100	12351	42.04	12190	42.00	12351	42.04	40.25

* SEE TABLE 10 SHEET 1

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SUBJECT DAM SAFETY EVALUATION
POTTSGROVE DAM
BY WJV DATE 6-24-79 PROJ. NO. 79-077-527
CHKD. BY DLB DATE 6-29-79 SHEET NO. 12 OF 13

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HEC-1 DAM BREACHING ANALYSIS OUTPUT :

DOWNSTREAM ROUTING DATA

UNDER 0.5 PMF BASE FLOW CONDITIONS (W/ BRUSH MOUNTAIN DAM ABLE TO PASS THE ENTIRE FLOOD WITHOUT BREACHING)-

PLAN NUMBER [1]	VARIABLE BREACH BOTTOM WIDTH (FT)	OUTPUT @ SECTION 5 LOCATED 5900 FT DS OF DAM: PEAK FLOW (CFS)	CORRESPONDING WSEL [2] (FT)	WSEL [3] W/O BREACH (FT)	ΔELEV [4] (FT)	OUTPUT @ SECTION 6 LOCATED 10200 FT DS OF DAM: PEAK FLOW (CFS)	CORRESPONDING WSEL [2] (FT)	WSEL [3] W/O BREACH (FT)	ΔELEV [4] (FT)
①	0	5531	1293.2	1291.8	+1.4	5491	1264.0	1262.0	+2.0
②	300	6066	1293.3	1291.8	+1.5	5824	1264.2	1262.0	+2.2
③	0	2673	1291.9	1291.8	0.0	2668	1262.1	1262.0	+0.1
④	300	3461	1292.2	1291.8	+0.4	3477	1262.8	1262.0	+0.8
⑤	100	3982	1292.5	1291.8	+0.7	4028	1263.1	1262.0	+1.1

UNDER 0.5 PMF BASE FLOW CONDITIONS (W/ BRUSH MOUNTAIN DAM FAILED ACCORDING TO ITS AVERAGE BREACH CONDITIONS; APPENDIX C-1, SHEET 11)-

⑥	100	12213	1295.1	1292.7	+2.4	12246	1266.7	1263.4	+3.3

1. SEE TABLE (A) SHEET 9.
2. WATER SURFACE ELEVATIONS CORRESPONDING TO BREACH FLOWS, FROM SUMMARY INPUT/OUTPUT SHEETS.
3. BASE FLOW ELEVATIONS CORRESPONDING TO THE PEAK 0.5 PMF FOR PLANS ① → ⑤, AND CORRESPONDING TO THE PEAK 0.5 PMF FOR PLAN ⑥; FROM EVENT SPECIFIC ANALYSES, SUMMARY INPUT/OUTPUT
4. ΔELEV = CORRESPONDING WSEL - WSEL W/O BREACH.

SUBJECT DAM SAFETY INSPECTION

POTTSGROVE DAM

WJV DATE 6-26-79 PROJ. NO. 79-617-527

CHKD. BY DLB DATE 6-29-7 SHEET NO. A OF PP

OVERTOPPING ANALYSIS

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SUMMARY INPUT/OUTPUT SHEETS

DAM SAFETY INSPECTION
POTTSGROVE DAM W/ UPSTREAM BRUSH MOUNTAIN DAM *** OVERTOPPING ANALYSIS ***
15-MINUTE TIME STEP AND 72-HOUR STORM DURATION

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
288	0	15	0	0	0	0	0	0	0
			JOPER	NWT	LROPT	TRACE			
			5	0	0	0			

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 5 LRTIO= 1
RTIOS= .20 .30 .40 .50 1.00

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

SUB-AREA RUNOFF COMPUTATION

LOCAL INFLOW INTO BRUSH MOUNTAIN DAM RESERVOIR

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

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	2.20	0.00	3.10	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	23.30	117.50	127.00	136.00	142.50	145.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

INITIAL AND CONSTANT RAINFALL LOSSES AS PER COE

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA
TP= 1.29 CP= .55 NTA= 0

BASE FLOW PARAMETERS AS PER COE

RECESSION DATA
STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC= 5.88 AND R= 5.88 INTERVALS

UNIT HYDROGRAPH 35 END-OF-PERIOD ORDINATES, LAG= 1.29 HOURS, CP= .55 VOL= 1.00

11.	102.	422.	478.	582.	605.	546.	461.	388.	327.
276.	233.	196.	165.	140.	118.	99.	84.	71.	59.
50.	42.	35.	30.	25.	21.	18.	15.	13.	11.

SUBJECT DAM SAFETY INSPECTION

POTTSGROVE DAM

WJV DATE 6-26-79 PROJ. NO. 78-617-527

CHKD. BY DLB DATE 6-29-79 SHEET NO. 8 OF 82

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MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	END-OF-PERIOD FLOW COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	27.03	24.37	2.66	140570.
										(687.)	(619.)	(68.)	(3980.50)

BROSH MOUNTAIN DAM RESERVOIR LOCAL INFLOW HYDROGRAPHS

PMF

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	7096.	4425.	1426.	488.	140567.
CMS	201.	125.	40.	14.	3980.
INCHES		18.71	24.12	24.77	24.77
MM		475.28	612.68	629.03	629.03
AC-FT		2194.	2829.	2904.	2904.
THOUS CU M		2707.	3489.	3582.	3582.

0.2 PMF

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1419.	885.	285.	98.	28113.
CMS	40.	25.	8.	3.	796.
INCHES		3.74	4.82	4.95	4.95
MM		95.06	122.54	125.81	125.81
AC-FT		439.	566.	581.	581.
THOUS CU M		541.	698.	716.	716.

0.3 PMF

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2129.	1328.	428.	146.	42170.
CMS	60.	38.	12.	4.	1194.
INCHES		5.61	7.24	7.43	7.43
MM		142.58	183.80	188.71	188.71
AC-FT		658.	849.	871.	871.
THOUS CU M		812.	1047.	1075.	1075.

0.5 PMF

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3548.	2213.	713.	244.	70283.
CMS	100.	63.	20.	7.	1990.
INCHES		9.36	12.06	12.38	12.38
MM		237.64	306.34	314.52	314.52
AC-FT		1097.	1414.	1452.	1452.
THOUS CU M		1353.	1745.	1791.	1791.

HYDROGRAPH ROUTING

ROUTE LOCAL HYDROGRAPH THROUGH BROSH MOUNTAIN DAM RESERVOIR

ISTAO	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
101	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	ISK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1718.	-1

STAGE	1718.30	1719.30	1720.30	1721.30	1722.30	1723.30	1723.80	1724.80	1725.80
FLOW	0.00	200.00	620.00	1160.00	1840.00	2590.00	3020.00	6390.00	12030.00

SURFACE AREA=	0.	29.	36.	39.	53.
CAPACITY=	0.	580.	635.	777.	1518.
ELEVATION=	1698.	1718.	1723.	1724.	1740.

CREL	SPWID	COGW	EXPW	ELEVL	COOL	CAREA	EXPL
1718.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COOD	EXPD	DAMWID
1723.8	0.0	0.0	0.

PEAK OUTFLOW IS 7093. AT TIME 41.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	7093.	4355.	1424.	488.	140462.
CMS	201.	123.	40.	14.	3977.
INCHES		18.41	24.08	24.75	24.75
MM		467.70	611.61	628.57	628.57
AC-FT		2159.	2824.	2902.	2902.
THOUS CU M		2664.	3483.	3580.	3580.

PMF

PEAK OUTFLOW IS 1230. AT TIME 41.75 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1230.	845.	285.	98.	28098.
CMS	35.	24.	8.	3.	796.
INCHES		3.57	4.82	4.95	4.95
MM		90.75	122.30	125.74	125.74
AC-FT		419.	565.	581.	581.
THOUS CU M		517.	697.	716.	716.

0.2 PMF

PROSH MOUNTAIN DAM RESERVOIR OUTFLOW HYDROGRAPHS

PEAK OUTFLOW IS 1882. AT TIME 41.50 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1882.	1280.	427.	146.	42145.
CMS	53.	36.	12.	4.	1193.
INCHES		5.41	7.22	7.43	7.43
MM		137.49	183.46	188.60	188.60
AC-FT		635.	847.	871.	871.
THOUS CU M		783.	1045.	1074.	1074.

0.3 PMF

OVERTOPPING @ ~0.46 PMF

PEAK OUTFLOW IS 3404. AT TIME 41.25 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3404.	2154.	712.	244.	70234.
CMS	96.	61.	20.	7.	1989.
INCHES		9.11	12.04	12.37	12.37
MM		231.31	305.76	314.30	314.30
AC-FT		1068.	1412.	1451.	1451.

0.5 PMF

SUBJECT DAM SAFETY INSPECTION

POTTSGROVE DAM

CHKD. BY WJV DATE 6-26-79 PROJ. NO. 78-617-527

DLB DATE 6-29-79 SHEET NO. C OF 88

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SUBJECT DAM SAFETY INSPECTION

POTTSGROVE DAM

WJV DATE 6-26-79 PROJ. NO. 78-617-527

CHKD. BY DLB DATE 6-29-79 SHEET NO. D OF 68

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HYDROGRAPH ROUTING

ROUTE FROM BRUSH MOUTAIN DAM TO SECTION 1 + 3060 FT DS FROM BRUSH MTN DAM

ISTAO	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
102	1	0	0	0	0	1	0	0

ROUTING DATA

OLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP		LSTR
0.0	0.000	0.00	1	1	0	0		0
	NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
	1	0	0	0.000	0.000	0.000	-1.	0

NORMAL DEPTH CHANNEL ROUTING

QR(1)	QR(2)	QR(3)	ELRVT	ELMAX	RLNTH	SEL
.1200	.0400	.1200	1517.0	1560.0	3060.	.05500

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
0.00 1560.00 50.00 1540.00 100.00 1520.00 102.00 1517.00 106.00 1517.00
108.00 1520.00 250.00 1540.00 300.00 1560.00

STORAGE	0.00	.48	2.91	8.24	17.02	29.26	44.95	64.09	86.69
	142.25	174.63	208.83	244.83	282.63	322.23	363.63	406.83	451.82
OUTFLOW	0.00	131.10	537.78	1419.77	2952.54	5295.01	8589.76	12968.66	18555.64
	33819.45	44429.54	56668.74	70398.22	85633.31	102394.00	120703.58	140587.74	162073.89
STAGE	1517.00	1519.26	1521.53	1523.79	1526.05	1528.32	1530.58	1532.84	1535.11
	1539.63	1541.89	1544.16	1546.42	1548.68	1550.95	1553.21	1555.47	1557.74
FLOW	0.00	131.10	537.78	1419.77	2952.54	5295.01	8589.76	12968.66	18555.64
	33819.45	44429.54	56668.74	70398.22	85633.31	102394.00	120703.58	140587.74	162073.89

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	7035.	4354.	1424.	488.	140457.
CMS	199.	123.	40.	14.	3977.
INCHES		18.41	24.08	24.75	24.75
MM		467.61	611.61	628.54	628.54
AC-FT		2159.	2824.	2902.	2902.
THOUS CU M		2663.	3483.	3580.	3580.

MAXIMUM STORAGE = 38.

MAXIMUM STAGE IS 1529.5

Flow + 30 cfs is from Brush Mountain Dam

PMF

SUBJECT DAM SAFETY INSPECTION

POTTSGROVE DAM

WJV DATE 6-26-79 PROJ. NO. 79-617-527

CHKD. BY DLB DATE 6-29-79 SHEET NO. E OF 8.2

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	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1231.	845.	285.	98.	28097.
CMS	35.	24.	8.	3.	796.
INCHES		3.57	4.82	4.95	4.95
MM		90.76	122.30	125.73	125.73
AC-FT		419.	565.	581.	581.
THOUS CU M		517.	697.	716.	716.

0.2 PMF

MAXIMUM STORAGE = 7.

MAXIMUM STAGE IS 1523.3

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1882.	1279.	427.	146.	42144.
CMS	53.	36.	12.	4.	1193.
INCHES		5.41	7.22	7.42	7.42
MM		137.40	183.46	188.59	188.59
AC-FT		634.	847.	871.	871.
THOUS CU M		782.	1045.	1074.	1074.

FLOWS 7360 FT DS FROM BRUSH MOUNTAIN DAM

0.3 PMF

MAXIMUM STORAGE = 11.

MAXIMUM STAGE IS 1524.5

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3385.	2154.	712.	244.	70232.
CMS	96.	61.	20.	7.	1989.
INCHES		9.11	12.04	12.37	12.37
MM		231.34	305.76	314.29	314.29
AC-FT		1068.	1412.	1451.	1451.
THOUS CU M		1317.	1741.	1790.	1790.

0.5 PMF

MAXIMUM STAGE IS 1526.5

HYDROGRAPH ROUTING

ROUTE FROM SECTION 1 TO SECTION 2 = 7460 FT DS FROM BRUSH MTN DAM

ISTAO	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
203	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1.	0

SUBJECT DAM SAFETY INSPECTION

POTTS-GROVE DAM

WJV DATE 6-26-79 PROJ. NO. 78-617-527

CHKD. BY DLB DATE 6-29-79 SHEET NO. F OF 88

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NORMAL DEPTH CHANNEL ROUTING

QR(1)	QR(2)	QR(3)	ELNVI	ELMAX	RLNTH	SEL
.1200	.0400	.1200	1333.0	1360.0	4400.	.03500

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
0.00 1360.00 150.00 1340.00 200.00 1336.00 202.00 1333.00 206.00 1333.00
208.00 1336.00 275.00 1340.00 400.00 1360.00

STORAGE	0.00	.71	1.69	5.20	14.63	30.08	49.58	71.93	97.10
	155.83	189.41	225.79	264.98	306.97	351.76	399.36	449.77	502.98
OUTFLOW	0.00	47.28	156.15	401.28	934.01	1901.88	3474.09	5560.56	8161.69
	15134.86	19524.66	24562.61	30278.19	36700.63	43858.85	51791.38	60496.40	70031.67
STAGE	1333.00	1334.42	1335.84	1337.26	1338.68	1340.11	1341.53	1342.95	1344.37
	1347.21	1348.63	1350.05	1351.47	1352.89	1354.32	1355.74	1357.16	1358.58
FLOW	0.00	47.28	156.15	401.28	934.01	1901.88	3474.09	5560.56	8161.69
	15134.86	19524.66	24562.61	30278.19	36700.63	43858.85	51791.38	60496.40	70031.67

FLOW 2746 CFS FROM BROSH MOUNTAIN DAM

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	7030.	4349.	1424.	488.	140444.
CMS	199.	123.	40.	14.	3977.
INCHES		18.39	24.08	24.74	24.74
MM		467.07	611.61	628.49	628.49
AC-FT		2156.	2824.	2902.	2902.
THOUS CU M		2660.	3483.	3579.	3579.

PMF

MAXIMUM STORAGE = 86.

MAXIMUM STAGE IS 1349.7

SUBJECT DAM SAFETY INSPECTION
POTTSGROVE DAM
WJV DATE 6-26-79 PROJ. NO. 78-617-527
CHKD. BY DLR DATE 6-29-79 SHEET NO. G OF 8P

		PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME	
	CFS	1221.	844.	285.	98.	28095.	
	CMS	35.	24.	8.	3.	796.	
	INCHES		3.57	4.81	4.95	4.95	
	MM		90.60	122.30	125.72	125.72	
	AC-FT		418.	565.	580.	580.	
	THOUS CU M		516.	697.	716.	716.	0.2 PMF

MAXIMUM STORAGE = 19.

MAXIMUM STAGE IS 1339.1

		PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME	
	CFS	1864.	1277.	427.	146.	42140.	
	CMS	53.	36.	12.	4.	1193.	
	INCHES		5.40	7.22	7.42	7.42	
	MM		137.18	183.45	188.58	188.58	
	AC-FT		633.	847.	871.	871.	0.3 PMF
	THOUS CU M		781.	1045.	1074.	1074.	

FLOWS
7460 FT
S FROM
BRUSH
MOUNTAIN
DAM

MAXIMUM STORAGE = 29.

MAXIMUM STAGE IS 1340.1

		PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME	
	CFS	3312.	2150.	712.	244.	70225.	
	CMS	94.	61.	20.	7.	1989.	
	INCHES		9.09	12.04	12.37	12.37	
	MM		230.93	305.75	314.26	314.26	
	AC-FT		1066.	1412.	1451.	1451.	0.5 PMF
	THOUS CU M		1315.	1741.	1790.	1790.	

MAXIMUM STORAGE = 48.

MAXIMUM STAGE IS 1341.4

SUB-AREA RUNOFF COMPUTATION

LOCAL INFLOW INTO POTTSGROVE DAM RESERVOIR

ISTAO	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
4	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	.90	0.00	3.10	0.00	0.000	0	1	0

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SUBJECT DAM SAFETY INSPECTION
POTTSGROVE DAM
WJV DATE 6-26-79 PROJ.NO. 78-617-527
CHKD. BY DLB DATE 6-29-79 SHEET NO. H OF 88

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PRECIP DATA

SPEE	PMS	R6	R12	R24	R48	R72	R96
0.00	23.30	117.50	127.00	136.00	142.50	145.00	0.00

INSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA
TP= 1.73 CP= .55 NTA= 0

RECESSION DATA
STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC= 7.66 AND R= 8.02 INTERVALS

UNIT HYDROGRAPH 47 END-OF-PERIOD ORDINATES, LAG= 1.75 HOURS, CP= .55 VOL= 1.00

9.	34.	68.	107.	144.	171.	186.	183.	167.	147.
130.	115.	101.	89.	79.	70.	61.	54.	48.	42.
37.	33.	29.	26.	23.	20.	18.	16.	14.	12.
11.	9.	8.	7.	6.	6.	5.	4.	4.	3.
3.	3.	2.	2.	2.	2.	1.			

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	27.03	24.37	2.66	57353.
										(687.)	(619.)	(68.)	(1624.06)

POTTSGROVE DAM LOCAL INFLOW HYDROGRAPHS

PMF

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2479.	1702.	582.	199.	57353.
CMS	70.	48.	16.	6.	1624.
INCHES		17.59	24.04	24.70	24.70
MM		446.82	610.72	627.38	627.38
AC-FT		844.	1154.	1185.	1185.
THOUS CU M		1041.	1423.	1462.	1462.

0.2 PMF

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	496.	345.	116.	40.	11471.
CMS	14.	10.	3.	1.	325.
INCHES		3.52	4.81	4.94	4.94
MM		89.36	122.14	125.48	125.48
AC-FT		169.	231.	237.	237.
THOUS CU M		208.	285.	292.	292.

0.3 PMF

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	744.	511.	174.	60.	17206.
CMS	21.	14.	5.	2.	487.
INCHES		5.28	7.21	7.41	7.41
MM		134.05	183.22	188.21	188.21
AC-FT		253.	346.	355.	355.
THOUS CU M		312.	427.	438.	438.

SUBJECT DAM SAFETY INSPECTION

POTTSGROVE DAM

WJV DATE 6-26-79 PROJ. NO. 79-617-527

CHKD. BY DCB DATE 6-29-79 SHEET NO. I OF [illegible]

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POTTSGROVE DAM
LOCAL INFLOW
HYDROGRAPH

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME	
CFS	1240.	851.	291.	100.	28677.	
CMS	35.	24.	8.	3.	812.	
INCHES		8.80	12.02	12.35	12.35	0.5 PMF
MM		223.41	305.36	313.69	313.69	
AC-FT		422.	577.	592.	592.	
THOUS CU M		520.	711.	731.	731.	

COMBINE HYDROGRAPHS

COMBINE LOCAL INFLOW W/ BRUSH MOUNTAIN DAM ROUTED OUTFLOWS

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
4	2	0	0	0	0	1	0	0

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME	
CFS	9506.	6047.	2005.	687.	197797.	
CMS	269.	171.	57.	19.	5601.	
INCHES		18.14	24.07	24.73	24.73	
MM		460.86	611.30	628.16	628.16	PMF
AC-FT		2998.	3977.	4087.	4087.	
THOUS CU M		3698.	4906.	5041.	5041.	

POTTSGROVE DAM TOTAL INFLOW HYDROGRAPHS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME	
CFS	1690.	1180.	401.	137.	39565.	
CMS	48.	33.	11.	4.	1120.	
INCHES		3.54	4.81	4.95	4.95	0.2 PMF
MM		89.92	122.24	125.65	125.65	
AC-FT		585.	795.	817.	817.	
THOUS CU M		722.	981.	1008.	1008.	

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME	
CFS	2584.	1763.	601.	206.	59346.	
CMS	73.	50.	17.	6.	1680.	
INCHES		5.35	7.22	7.42	7.42	
MM		135.90	183.36	188.47	188.47	0.3 PMF
AC-FT		884.0	1193.	1226.	1226.	
THOUS CU M		1091.0	1471.	1512.	1512.	

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME	
CFS	4551.	2996.	1002.	343.	98902.	
CMS	129.	85.	28.	10.	2801.	
INCHES		8.99	12.03	12.37	12.37	
MM		228.38	305.59	314.09	314.09	0.5 PMF
AC-FT		1486.	1988.	2043.	2043.	
THOUS CU M		1833.	2452.	2521.	2521.	

SUBJECT DAM SAFETY INSPECTION

POTTSGROVE DAM

CHKD. BY WJV DATE 6-26-79 PROJ. NO. 79-617-527

DATE 6-29-79 SHEET NO. 7 OF 88

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HYDROGRAPH ROUTING

ROUTE TOTAL INFLOW HYDROGRAPH THROUGH POTTSGROVE DAM RESERVOIR

ISTAO	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
404	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP		LSTR
0.0	0.000	0.00	1	1	0	0		0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1329.	2

SURFACE AREA=	0.	8.	10.	14.
CAPACITY=	0.	104.	142.	225.
ELEVATION=	1290.	1329.	1333.	1340.

CREL	SPWID	COOW	EXPW	ELEVL	COOL	CAREA	EXPD
1328.8	64.0	0.0	0.0	0.0	0.0	0.0	0.0

IADCOA	ISPITW	ISPCTW
10	10	10

SS	NGATES	DESHD	APEL	APWID	APLOSS	PDPTH
0.00	1	4.2	1323.0	64.0	0.0	7.8

1289.80	0.	0.	0.0	0.	0.	0.0	0.	0.	0.
1328.80	104.	0.	0.0	0.	0.	0.0	0.	0.	0.
1333.00	142.	2190.	1324.6	2184.	0.	0.0	0.	2184.	2184.

DAM DATA

TOPEL	COOD	EXPD	DAMWID
1333.0	0.0	0.0	0.

CREST LENGTH	100.	200.	500.	640.	740.	745.	750.	755.	760.
AT OR BELOW ELEVATION	1333.0	1333.1	1333.2	1333.3	1333.4	1334.0	1335.0	1336.0	1337.0

POTTSGROVE DAM OUTFLOW HYDROGRAPH

PEAK OUTFLOW IS 9496. AT TIME 41.25 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	9496.	6048.	2005.	667.	197783.
CMS	269.	171.	57.	19.	5601.
INCHES		18.15	24.07	24.73	24.73
MM		460.98	611.29	628.12	628.12
AC-FT		2999.	3977.	4086.	4086.
THOUS CU M		3699.	4905.	5041.	5041.

PMF

SUBJECT DAM SAFETY INSPECTION
POTTSGROVE DAM
WJV DATE 6-26-79 PROJ. NO. 79-617-527
CHKD. BY DLB DATE 6-29-79 SHEET NO. K OF 82

POTTSGROVE DAM OUTFLOW HYDROGRAPHS

OVERTOPPING @ 0.2 PMF

PEAK OUTFLOW IS 1675. AT TIME 42.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME	
CFS	1675.	1178.	401.	137.	39563.	
CMS	47.	33.	11.	4.	1120.	0.2 PMF
INCHES		3.53	4.81	4.95	4.95	
MM		89.77	122.23	125.64	125.64	
AC-FT		584.	795.	817.	817.	
THOUS CU M		720.	961.	1008.	1008.	

PEAK OUTFLOW IS 2588. AT TIME 41.75 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME	
CFS	2588.	1760.	601.	206.	59343.	
CMS	73.	50.	17.	6.	1680.	
INCHES		5.34	7.22	7.42	7.42	0.3 PMF
MM		135.65	183.36	188.46	188.46	
AC-FT		882.	1193.	1226.	1226.	
THOUS CU M		1089.	1471.	1512.	1512.	

PEAK OUTFLOW IS 4526. AT TIME 41.50 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME	
CFS	4526.	2991.	1002.	343.	98895.	
CMS	128.	85.	28.	10.	2800.	
INCHES		8.97	12.03	12.36	12.36	0.5 PMF
MM		227.96	305.59	314.07	314.07	
AC-FT		1483.	1988.	2043.	2043.	
THOUS CU M		1829.	2452.	2520.	2520.	

HYDROGRAPH ROUTING

ROUTE FROM POTTSGROVE DAM TO SECTION 5 * 580 FT DS FROM POTTSGROVE DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
405	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELEVT	ELMAX	RLNTH	SEL
.0600	.0350	.0900	1277.0	1300.0	580.	.03800

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SUBJECT DAM SAFETY INSPECTION

POTTSGROVE DAM

BY WJV DATE 6-26-79 PROJ. NO. 78-617-527

CHKD. BY DLB DATE 6-29-79 SHEET NO. L OF 66

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CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
0.00 1300.00 200.00 1287.00 450.00 1280.00 455.00 1277.00 470.00 1277.00
975.00 1260.00 575.00 1282.00 700.00 1300.00

STORAGE	0.00	.21	.61	1.24	3.35	6.81	11.12	16.26	22.23		
	30.07	43.65	51.66	60.11	69.00	78.32	88.08	98.27	108.90		
OUTFLOW	0.00	176.09	584.18	1289.02	2676.81	5210.24	8934.50	13927.75	20295.47		
	38224.08	49418.87	62073.90	76211.93	91859.47	109046.24	127804.03	148166.02	170166.34		
STAGE	1271.00	1278.41	1279.42	1280.63	1281.84	1283.05	1284.26	1285.47	1286.68		
	1289.11	1290.32	1291.53	1292.74	1293.95	1295.16	1296.37	1297.58	1298.79		
FLOW	0.00	176.09	584.18	1289.02	2676.81	5210.24	8934.50	13927.75	20295.47		
	38224.08	49418.87	62073.90	76211.93	91859.47	109046.24	127804.03	148166.02	170166.34		

FLOOD @ SOUTH FORK DAM (SECTION 5) - 1ST RIDGE

MAXIMUM STAGE IS 1284.4

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	9501.	6048.	2005.	687.	197782.
CMS	269.	171.	57.	19.	5601.
INCHES		18.15	24.07	24.73	24.73
MM		460.99	611.29	628.11	628.11
AC-FT		2999.	3977.	4086.	4086.
THOUS CU M		3699.	4905.	5040.	5040.

PMF

MAXIMUM STORAGE = 12.

MAXIMUM STAGE IS 1281.0

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1070.	1178.	401.	137.	39562.
CMS	47.	33.	11.	4.	1120.
INCHES		3.53	4.81	4.95	4.95
MM		89.77	122.23	125.64	125.64
AC-FT		584.	795.	817.	817.
THOUS CU M		720.	981.	1008.	1008.

0.2 PMF

MAXIMUM STORAGE = 2.

MAXIMUM STAGE IS 1281.0

SUBJECT DAM SAFETY INSPECTION

POTTSGROVE DAM

CHKD. BY WJV DATE 6-26-79 PROJ. NO. 78-617-527

DATE 6-29-79 SHEET NO. M OF [illegible]

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2600.	1780.	601.	206.	59342.
CMS	74.	50.	17.	6.	1680.
INCHES		5.34	7.22	7.42	7.42
MM		135.66	183.36	188.46	188.46
AC-FT		883.	1193.	1226.	1226.
THOUS CU M		1089.	1471.	1512.	1512.

0.3 PMF

MAXIMUM STORAGE = 3.

Flows @ 590 FT DS from Pottsgrove Dam (Section 5) @ 1st House

MAXIMUM STAGE IS 1281.8

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	4540.	2991.	1002.	343.	98894.
CMS	129.	85.	28.	10.	2800.
INCHES		8.97	12.03	12.36	12.36
MM		227.94	305.59	314.07	314.07
AC-FT		1483.	1988.	2043.	2043.
THOUS CU M		1829.	2452.	2520.	2520.

0.5 PMF

MAXIMUM STORAGE = 6.

MAXIMUM STAGE IS 1282.7

HYDROGRAPH ROUTING

ROUTE FROM SECTION 5 TO SECTION 6 @ 10201 DS FROM POTTSGROVE DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
506	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1.	0

NORMAL DEPTH CHANNEL ROUTING

QA(1)	QA(2)	QA(3)	ELNVT	ELMAX	RLNTH	SEL
.0900	.0350	.0900	1257.0	1260.0	440.	.03800

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SUBJECT DAM SAFETY INSPECTION

POTTSGROVE DAM

BY WJV DATE 6-26-79 PROJ. NO. 79-617-527

CHKD. BY DLB DATE 6-29-79 SHEET NO. 1 OF 3P

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CROSS SECTION CORDINATES--STA,ELEV,STA,ELEV--ETC
0.00 1280.00 350.00 1270.00 500.00 1260.00 505.00 1257.00 520.00 1257.00
525.00 1260.00 580.00 1265.00 750.00 1280.00

STORAGE	0.00	.21	.47	.82	1.52	2.60	4.07	5.92	8.17
	11.82	17.24	21.27	25.98	31.38	37.47	44.24	51.69	59.83
DISCHARGE	0.00	176.09	584.18	1269.86	2343.95	3874.55	5949.77	8646.74	12039.16
	21194.37	26901.41	33246.04	40926.27	50023.66	60636.08	72866.18	86817.03	102590.49
STAGE	1257.00	1258.21	1259.42	1260.63	1261.84	1263.05	1264.26	1265.47	1266.68
	1269.11	1270.32	1271.53	1272.74	1273.95	1275.16	1276.37	1277.58	1278.79
FLOW	0.00	176.09	584.18	1269.86	2343.95	3874.55	5949.77	8646.74	12039.16
	21194.37	26901.41	33246.04	40926.27	50023.66	60636.08	72866.18	86817.03	102590.49

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME	
CFS	9493.	6048.	2005.	687.	197781.	
CMS	269.	171.	57.	19.	5601.	
INCHES		18.15	24.07	24.73	24.73	
MM		460.99	611.29	628.11	628.11	
AC-FT		2999.	3977.	4086.	4086.	PMF
THOUS CU M		3699.	4905.	5040.	5040.	

MAXIMUM STORAGE = 6.

FLOWS @ DS FROM POTTSGROVE DAM (SECTION 10)

MAXIMUM STAGE IS 1265.8

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME	
CFS	1675.	1178.	401.	137.	39562.	
CMS	47.	33.	11.	4.	1120.	
INCHES		3.53	4.81	4.95	4.95	
MM		89.77	122.23	125.64	125.64	
AC-FT		584.	795.	817.	817.	
THOUS CU M		720.	981.	1008.	1008.	0.2 PMF

MAXIMUM STORAGE = 1.

MAXIMUM STAGE IS 1261.1

SUBJECT DAM SAFETY INSPECTION

POTTSGROVE DAM

BY WJV DATE 6-26-79 PROJ. NO. 78-617-527

CHKD. BY DLB DATE 6-29-79 SHEET NO. 0 OF 88

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Flows @ 1620 FT DS from Pottsgrove Dam (Spec. No. 6)

0.3 PMF

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2602.	1780.	601.	206.	59342.
CMS	74.	50.	17.	6.	1680.
INCHES		5.34	7.22	7.42	7.42
MM		135.66	183.36	188.46	188.46
AC-FT		883.	1193.	1226.	1226.
THOUS CU M		1089.	1471.	1512.	1512.

MAXIMUM STORAGE = 2.

MAXIMUM STAGE IS 1262.0

0.5 PMF

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	4544.	2990.	1002.	343.	98893.
CMS	129.	85.	28.	10.	2800.
INCHES		8.97	12.03	12.36	12.36
MM		227.92	305.59	314.07	314.07
AC-FT		1483.	1988.	2043.	2043.
THOUS CU M		1829.	2452.	2520.	2520.

MAXIMUM STORAGE = 3.

MAXIMUM STAGE IS 1263.4

SUMMARY OF DAM SAFETY ANALYSIS

POTTSGROVE DAM

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1718.30	1718.30	1723.80
STORAGE	580.	580.	777.
OUTFLOW	0.	0.	3020.

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
.20	1721.38	0.00	685.	1230.	0.00	41.75	0.00
.30	1722.36	0.00	722.	1882.	0.00	41.50	0.00
.40	1723.24	0.00	755.	2545.	0.00	41.50	0.00
.50	1723.91	.11	782.	3404.	.75	41.25	0.00
1.00	1724.92	1.12	821.	7093.	4.00	41.00	0.00

SUBJECT DAM SAFETY INSPECTION

POTTSGROVE DAM

WJV DATE 6-26-79 PROJ. NO. 79-617-527

CHKD. BY DLB DATE 6-29-79 SHEET NO. P OF 82

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PLAN 1 STATION 102

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.20	1231.	1523.3	41.75
.30	1882.	1524.5	41.75
.40	2536.	1525.4	41.50
.50	3385.	1526.5	41.50
1.00	7035.	1529.5	41.00

PLAN 1 STATION 203

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.20	1221.	1339.1	42.00
.30	1864.	1340.1	42.00
.40	2531.	1340.7	41.75
.50	3312.	1341.4	41.50
1.00	7030.	1343.7	41.25

SUMMARY OF DAM SAFETY ANALYSIS

POTTSGROVE DAM

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1328.80	1328.80	1333.00
STORAGE	104.	104.	142.
OUTFLOW	0.	0.	2184.

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
.20	1332.02	0.00	132.	1675.	0.00	42.00	0.00
.30	1333.54	.54	147.	2588.	2.25	41.75	0.00
.40	1333.93	.93	152.	3491.	3.50	41.75	0.00
.50	1334.27	1.27	155.	4526.	4.25	41.50	0.00
1.00	1335.44	2.44	168.	9496.	7.00	41.25	0.00

SECTION 5

PLAN 1 STATION 405

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.20	1676.	1281.0	42.00
.30	2600.	1281.8	41.75
.40	3520.	1282.2	41.75
.50	4540.	1282.7	41.75
1.00	9501.	1284.4	41.25

SECTION 6

PLAN 1 STATION 506

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.20	1675.	1261.1	42.00
.30	2602.	1262.0	41.75
.40	3527.	1262.8	41.75
.50	4544.	1263.4	41.75
1.00	9493.	1265.8	41.25

DAM SAFETY INSPECTION
POTTSGROVE DAM #7 UPSTREAM BRUSH MOUNTAIN DAM *** BREACHING ANALYSIS ***
15-MINUTE TIME STEP AND 72-HOUR STORM DURATION

JOB SPECIFICATION

NO	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
200	0	15	0	0	0	0	0	0	0
			JOPER	NWT	LROPT	TRACE			
			5	0	0	0			

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 5 NRTIO= 1 LRTIO= 1

RTIOS= .30

HYDROGRAPH ROUTING

ROUTE TOTAL INFLOW HYDROGRAPH THROUGH POTTSGROVE DAM RESERVOIR

PLAN

DAM DATA

	TOPEL	COOD	EXPD	DAMWID
	1333.0	0.0	0.0	0.

CREST GEOGR AT OR BELOW ELEVATION	100.	200.	500.	640.	740.	745.	750.	755.	760.
①	1333.0	1333.1	1333.2	1333.3	1333.4	1334.0	1335.0	1336.0	1337.0

DAM BREACH DATA

BRWID	Z	ELBM	TFAIL	WSEL	FAILEL
0.	.50	1296.00	.75	1328.80	1333.00

BEGIN DAM FAILURE AT 41.25 HOURS

PEAK OUTFLOW IS 5637. AT TIME 42.00 HOURS

DAM BREACH DATA

BRWID	Z	ELBM	TFAIL	WSEL	FAILEL
300.	4.00	1296.00	.75	1328.80	1333.00

②

BEGIN DAM FAILURE AT 41.25 HOURS

PEAK OUTFLOW IS 6936. AT TIME 41.44 HOURS

DAM BREACH DATA

BRWID	Z	ELBM	TFAIL	WSEL	FAILEL
0.	.50	1296.00	4.00	1328.80	1333.00

③

BEGIN DAM FAILURE AT 41.25 HOURS

PEAK OUTFLOW IS 2693. AT TIME 42.50 HOURS

BREACHING OF POTTSGROVE DAM ONLY, SINCE BRUSH MOUNTAIN DAM WILL NOT BE OVERTOPPED BY THE 0.3 PMF EVENT.
(SAME INPUT DATA AS FOR THE OVERTOPPING ANALYSIS W/ THE ADDITION OF THE BREACH DATA GIVEN HERE)

BREACHING ANALYSIS

SUBJECT DAM SAFETY INSPECTION
POTTSGROVE DAM
BY WJV DATE 6-26-79 PROJ. NO. 79-617-527
CHKD. BY DLB DATE 6-29-79 SHEET NO. Q OF 32

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PLAN

DAM BREACH DATA

BRWID	Z	ELBM	TFAIL	WSEL	FAILEL
300.	4.00	1296.00	4.00	1328.80	1333.00

(4)

BEGIN DAM FAILURE AT 41.25 HOURS

PEAK OUTFLOW IS 3408. AT TIME 42.08 HOURS

DAM BREACH DATA

BRWID	Z	ELBM	TFAIL	WSEL	FAILEL
100.	2.00	1296.00	2.00	1328.80	1333.00

(5)

BEGIN DAM FAILURE AT 41.25 HOURS

PEAK OUTFLOW IS 4179. AT TIME 41.88 HOURS

THE DAM BREACH HYDROGRAPH WAS DEVELOPED USING A TIME INTERVAL OF .042 HOURS DURING BREACH FORMATION.
DOWNSTREAM CALCULATIONS WILL USE A TIME INTERVAL OF .250 HOURS.
THIS TABLE COMPARES THE HYDROGRAPH FOR DOWNSTREAM CALCULATIONS WITH THE COMPUTED BREACH HYDROGRAPH.
INTERMEDIATE FLOWS ARE INTERPOLATED FROM END-OF-PERIOD VALUES.

(5)

TIME (HOURS)	TIME FROM BEGINNING OF BREACH (HOURS)	INTERPOLATED BREACH HYDROGRAPH (CFS)	-	COMPUTED BREACH HYDROGRAPH (CFS)	=	ERROR (CFS)	ACCUMULATED ERROR (CFS)	ACCUMULATED ERROR (AC-FT)
41.250	0.000	2191.		2191.		0.	0.	0.
41.292	.042	2449.		2449.		-1.	-1.	-0.
41.333	.083	2707.		2836.		-130.	-130.	-0.
41.375	.125	2965.		3223.		-259.	-389.	-1.
41.417	.167	3223.		3448.		-226.	-615.	-2.
41.458	.208	3481.		3618.		-137.	-752.	-3.
41.500	.250	3739.		3739.		0.	-752.	-3.
41.542	.292	3758.		3817.		-59.	-811.	-3.
41.583	.333	3778.		3861.		-83.	-894.	-3.
41.625	.375	3798.		3881.		-82.	-976.	-3.
41.667	.417	3818.		3883.		-65.	-1041.	-4.
41.708	.458	3838.		3874.		-36.	-1077.	-4.
41.750	.500	3858.		3858.		0.	-1077.	-4.
41.792	.542	3893.		4041.		-149.	-1226.	-4.

SUBJECT DAM SAFETY INSPECTION
POTTSGROVE DAM
CHKD. BY DLB DATE 6-29-79 SHEET NO. R OF 82
WJV DATE 6-26-79 PROJ. NO. 79-617-527

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SUBJECT DAM SAFETY INSPECTION

POTTSGROVE DAM

WJV DATE 6-26-79 PROJ. NO. 78-617-527

CHKD. BY DLB DATE 6-29-79 SHEET NO. 5 OF 88

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TIME (HOURS)	TIME FROM BEGINNING OF BREACH (HOURS)	INTERPOLATED BREACH HYDROGRAPH (CFS)	- COMPUTED BREACH HYDROGRAPH (CFS)	= ERROR (CFS)	ACCUMULATED ERROR (CFS)	ACCUMULATED ERROR (AC-FT)
41.833	.583	3927.	4141.	-220.	-1446.	-5.
41.875	.625	3962.	4179.	-218.	-1663.	-6.
41.917	.667	3996.	4166.	-169.	-1833.	-6.
41.958	.708	4031.	4124.	-93.	-1925.	-7.
42.000	.750	4066.	4066.	0.	-1925.	-7.
42.042	.792	3990.	3997.	-7.	-1932.	-7.
42.083	.833	3915.	3923.	-8.	-1940.	-7.
42.125	.875	3840.	3845.	-5.	-1945.	-7.
42.167	.917	3764.	3767.	-3.	-1948.	-7.
42.208	.958	3689.	3690.	-1.	-1949.	-7.
42.250	1.000	3614.	3614.	0.	-1949.	-7.
42.292	1.042	3541.	3538.	2.	-1946.	-7.
42.333	1.083	3467.	3463.	5.	-1942.	-7.
42.375	1.125	3394.	3388.	6.	-1935.	-7.
42.417	1.167	3321.	3315.	6.	-1929.	-7.
42.458	1.208	3248.	3244.	4.	-1925.	-7.
42.500	1.250	3175.	3175.	0.	-1925.	-7.
42.542	1.292	3109.	3106.	3.	-1922.	-7.
42.583	1.333	3043.	3037.	6.	-1917.	-7.
42.625	1.375	2977.	2970.	7.	-1909.	-7.
42.667	1.417	2912.	2905.	7.	-1903.	-7.
42.708	1.458	2846.	2842.	4.	-1898.	-7.
42.750	1.500	2780.	2780.	0.	-1898.	-7.
42.792	1.542	2722.	2719.	3.	-1895.	-7.
42.833	1.583	2664.	2658.	6.	-1889.	-7.
42.875	1.625	2606.	2598.	7.	-1882.	-6.
42.917	1.667	2548.	2541.	7.	-1875.	-6.
42.958	1.708	2490.	2485.	4.	-1870.	-6.
43.000	1.750	2432.	2432.	0.	-1870.	-6.
43.042	1.792	2381.	2378.	3.	-1867.	-6.
43.083	1.833	2331.	2324.	7.	-1860.	-6.
43.125	1.875	2280.	2273.	8.	-1853.	-6.
43.167	1.917	2230.	2223.	7.	-1846.	-6.
43.208	1.958	2179.	2175.	4.	-1841.	-6.
43.250	2.000	2129.	2129.	0.	-1841.	-6.

SUBJECT DAM SAFETY INSPECTION

POTTSGROVE DAM

WJV DATE 6-26-79 PROJ. NO. 78-617-527

CHKD. BY DLB DATE 6-29-79 SHEET NO. 7 OF BB

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(*) POINTS AT NORMAL TIME INTERVAL

(U) INTERPOLATED BREACH HYDROGRAPH
(B) COMPUTED BREACH HYDROGRAPH

TIME (HRS.)	2000.	2200.	2400.	2600.	2800.	3000.	3200.	3400.	3600.	3800.	4000.	4200.
41.25	1.	*										
41.29	2.		B									
41.33	3.			U	B	U						
41.38	4.						B	U				
41.42	5.								B	U		
41.46	6.										B	
41.50	7.									U	B	
41.54	8.									U	B	
41.58	9.										B	
41.62	10.										U	B
41.67	11.										U	B
41.71	12.										U	B
41.75	13.										U	*
41.79	14.										U	B
41.83	15.										U	B
41.87	16.										U	B
41.92	17.										U	B
41.96	18.										U	B
42.00	19.										U	*
42.04	20.										B	
42.08	21.										B	
42.12	22.										B	
42.17	23.										B	
42.21	24.										B	
42.25	25.										B	
42.29	26.										B	
42.33	27.										B	
42.37	28.										BD	
42.42	29.										B	
42.46	30.										B	
42.50	31.										*	
42.54	32.										B	
42.58	33.										B	
42.62	34.										B	
42.67	35.										BD	
42.71	36.										B	
42.75	37.										*	
42.79	38.										B	
42.83	39.										B	
42.87	40.										B	
42.92	41.										B	
42.96	42.										B	
43.00	43.										*	
43.04	44.										B	
43.08	45.										BD	
43.12	46.										B	
43.17	47.										B	
43.21	48.										B	
43.25	49.										*	

(5)

SUBJECT DAM SAFETY INSPECTION
POTTSGROVE DAM

WJV DATE 6-26-79 PROJ. NO. 78-617-527

CHKD. BY DLB DATE 6-29-79 SHEET NO. U OF BB

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FLOWS @ TAGG FT DS FROM BRUSH MOUNTAIN DAM

SUMMARY OF DAM SAFETY ANALYSIS

BRUSH MOUNTAIN DAM

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1718.30	1718.30	1723.80
STORAGE	580.	580.	771.
OUTFLOW	0.	0.	3020.

FOR ALL PLANS

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
.50	1722.36	0.00	722.	1882.	0.00	41.50	0.00

ROUTED BRUSH MOUNTAIN DAM OUTFLOW PRTOR TO INFLOW INTO POTTSGROVE DAM RESERVOIR, FOR ALL PLANS

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.30	1864.	1340.1	42.00	0.00	41.50	0.00

POTTSGROVE DAM

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1328.80	1328.80	1333.00
STORAGE	104.	104.	142.
OUTFLOW	0.	0.	2184.

PLAN	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	.30	1333.35	.35	145.	5637.	.54	42.00	41.25
2	.30	1333.12	.12	143.	6936.	.26	41.44	41.25
3	.30	1333.50	.50	147.	2693.	1.42	42.50	41.25
4	.30	1333.12	.12	143.	3408.	.33	42.08	41.25
5	.30	1333.10	.10	143.	4119.	.33	41.98	41.25

DOWNSTREAM ROUTING RESULTS

PLAN	RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS	SECTION 5	RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
1	.30	5539.	1283.2	42.00		.30	5491.	1264.0	42.00
2	.30	6066.	1283.3	41.50		.30	5824.	1264.2	41.50
3	.30	2673.	1281.8	42.50	SECTION 6	.30	2668.	1262.1	42.50
4	.30	3461.	1282.2	41.75		.30	3497.	1262.8	41.75
5	.30	3982.	1282.5	41.75		.30	4028.	1263.1	41.75

SUBJECT DAM SAFETY INSPECTION
POTTSGROVE DAM

BY WJV DATE 6-26-79 PROJ. NO. 78-617-527

CHKD. BY DLB DATE 6-29-79 SHEET NO. V OF PP

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BREACHING OF BOTH
BRUSH MOUNTAIN DAM
AND POTTSGROVE DAM
UNDER ½ PMF CONDITIONS

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DAM SAFETY INSPECTION
POTTSGROVE DAM W/ UPSTREAM BRUSH MOUNTAIN DAM *** BREACHING ANALYSIS ***
15-MINUTE TIME STEP AND 72-HOUR STORM DURATION

                    JOB SPECIFICATION
 NRD   NHR   NMIN   IDAY   IHR   METRC   IPLT   IPRT   USTAN
  1     0     15      0     0       0      0      0       0
                     JOPER  NWT   LROPT  TRACE
                       5     0      0      0

          MULTI-PLAN ANALYSES TO BE PERFORMED
               NPLAN= 1 RATIO= 1

 RTIOS=   .50

                HYDROGRAPH ROUTING

ROUTE LOCAL HYDROGRAPH THROUGH BRUSH MOUNTAIN DAM RESERVOIR

                                  DAM DATA
                              TOPEL   COOD   EXPD   DAMWID
                             1723.0    0.0    0.0       0.

                            DAM BREACH DATA
                    BRWID      Z    ELBRM   TFAIL    WSEL  FAILED
                      100.  2.00  1670.80    2.00  1718.30 1723.80

 BEGIN DAM FAILURE AT 41.25 HOURS

 FAILURE IS   1123. AT TIME  41.96 HOURS
```

PLAN (6)

THE DAM BREACH HYDROGRAPH WAS DEVELOPED USING A TIME INTERVAL OF .042 HOURS DURING BREACH FORMATION.
DOWNSTREAM CALCULATIONS WILL USE A TIME INTERVAL OF .250 HOURS.
THIS TABLE COMPARES THE HYDROGRAPH FOR DOWNSTREAM CALCULATIONS WITH THE COMPUTED BREACH HYDROGRAPH.
INTERMEDIATE FLOWS ARE INTERPOLATED FROM END-OF-PERIOD VALUES.

TIME (HOURS)	TIME FROM BEGINNING OF BREACH (HOURS)	INTERPOLATED BREACH HYDROGRAPH (CFS)	-	COMPUTED BREACH HYDROGRAPH (CFS)	=	ERROR (CFS)	ACCUMULATED ERROR (CFS)	ACCUMULATED ERROR (AC-FT)
41.250	0.000	3410.		3410.		0.	0.	0.
41.292	.042	4025.		3757.		269.	269.	1.
41.333	.083	4641.		4233.		408.	677.	2.
41.375	.125	5256.		4856.		400.	1077.	4.
41.417	.167	5872.		5619.		253.	1330.	5.
41.458	.208	6487.		6368.		120.	1450.	5.
41.500	.250	7103.		7103.		0.	1450.	5.
41.542	.292	7638.		7779.		-141.	1309.	5.
41.583	.333	8174.		8393.		-219.	1090.	4.
41.625	.375	8709.		8955.		-246.	843.	3.
41.667	.417	9244.		9452.		-207.	636.	2.
41.708	.458	9780.		9897.		-117.	519.	2.

(6)

SUBJECT DAM SAFETY INSPECTION
POTTSGROVE DAM

BY WJV DATE 6-26-79 PROJ. NO. 78-617-527

CHKD. BY DLB DATE 6-29-79 SHEET NO. W OF PP

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TIME (HOURS)	TIME FROM BEGINNING OF BREACH (HOURS)	INTERPOLATED BREACH HYDROGRAPH (CFS)	- COMPUTED BREACH HYDROGRAPH (CFS)	= ERROR (CFS)	ACCUMULATED ERROR (CFS)	ACCUMULATED ERROR (AC-FT)
41.750	.500	10315.	10315.	-0.	519.	2.
41.792	.542	10462.	10639.	-178.	341.	1.
41.833	.583	10609.	10879.	-271.	71.	0.
41.875	.625	10755.	11109.	-354.	-283.	-1.
41.917	.667	10902.	11230.	-328.	-611.	-2.
41.958	.708	11049.	(11255)	-206.	-817.	-3.
42.000	.750	(11195)	11195.	0.	-817.	-3.
42.042	.792	10947.	11064.	-117.	-934.	-3.
42.083	.833	10699.	10874.	-174.	-1109.	-4.
42.125	.875	10451.	10633.	-182.	-1290.	-4.
42.167	.917	10203.	10353.	-150.	-1440.	-5.
42.208	.958	9955.	10042.	-87.	-1527.	-5.
42.250	1.000	9707.	9707.	0.	-1527.	-5.
42.292	1.042	9340.	9355.	-15.	-1542.	-5.
42.333	1.083	8973.	8992.	-18.	-1560.	-5.
42.375	1.125	8606.	8621.	-15.	-1575.	-5.
42.417	1.167	8239.	8247.	-8.	-1583.	-5.
42.458	1.208	7872.	7875.	-2.	-1585.	-5.
42.500	1.250	7505.	7505.	0.	-1585.	-5.
42.542	1.292	7162.	7141.	21.	-1564.	-5.
42.583	1.333	6819.	6784.	35.	-1529.	-5.
42.625	1.375	6476.	6434.	42.	-1487.	-5.
42.667	1.417	6133.	6094.	39.	-1448.	-5.
42.708	1.458	5790.	5765.	25.	-1423.	-5.
42.750	1.500	5446.	5446.	0.	-1423.	-5.
42.792	1.542	5168.	5139.	29.	-1394.	-5.
42.833	1.583	4889.	4843.	47.	-1348.	-5.
42.875	1.625	4611.	4558.	53.	-1295.	-4.
42.917	1.667	4332.	4285.	48.	-1247.	-4.
42.958	1.708	4054.	4024.	30.	-1217.	-4.
43.000	1.750	3775.	3775.	0.	-1217.	-4.
43.042	1.792	3568.	3539.	29.	-1187.	-4.
43.083	1.833	3361.	3313.	47.	-1140.	-4.
43.125	1.875	3153.	3100.	53.	-1087.	-4.
43.167	1.917	2946.	2899.	47.	-1040.	-4.
43.208	1.958	2739.	2709.	30.	-1010.	-3.
43.250	2.000	2531.	2531.	0.	-1010.	-3.

SUBJECT DAM SAFETY INSPECTION
POTTSGROVE DAM

BY WJV DATE 6-26-79 PROJ. NO. 78-617-527

CHKD. BY DLB DATE 6-29-79 SHEET NO. X OF 88

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(6)

(*) POINTS AT NIKMAL FINE INTERVAL
(U) INTERPOLATED BREACH HYDROGRAPH
(B) COMPUTED BREACH HYDROGRAPH

TIME (HRS)	3000.	4000.	5000.	6000.	7000.	8000.	9000.	10000.	11000.	12000.
1.25	1.	*								
1.29	2.	B	U							
1.33	3.		B	U						
1.38	4.			B	U	B	U			
1.42	5.				B	U	B	U		
1.46	6.					B	U	B	U	
1.50	7.						B	U	B	U
1.54	8.							B	U	B
1.58	9.								B	U
1.62	10.									B
1.67	11.									
1.71	12.									
1.75	13.									
1.79	14.									
1.83	15.									
1.87	16.									
1.92	17.									
1.96	18.									
2.00	19.									
2.04	20.									
2.08	21.									
2.13	22.									
2.17	23.									
2.21	24.									
2.25	25.									
2.29	26.									
2.33	27.									
2.37	28.									
2.42	29.									
2.46	30.									
2.50	31.									
2.54	32.									
2.58	33.									
2.62	34.									
2.67	35.									
2.71	36.									
2.75	37.									
2.79	38.									
2.83	39.									
2.87	40.									
2.92	41.									
2.96	42.									
3.00	43.									
3.04	44.									
3.08	45.									
3.12	46.									

SUBJECT DAM SAFETY INSPECTION
POTTSGROVE DAM
WJV DATE 6-26-79 PROJ. NO. 79-617-527
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HYDROGRAPH ROUTING

ROUTE TOTAL INFLOW HYDROGRAPH THROUGH POTTSGROVE DAM RESERVOIR

PLAN (6)

DAM DATA

TOPEL	COOD	EXPD	DAM#ID
1333.0	0.0	0.0	0.

DAM BREACH DATA

BWID	Z	ELBM	TFAIL	WSEL	FAILEL
100.	2.00	1670.80	2.00	1718.30	1723.80

BEGIN DAM FAILURE AT 40.25 HOURS

PEAK OUTFLOW IS 12351. AT TIME 42.04 HOURS

THE DAM BREACH HYDROGRAPH WAS DEVELOPED USING A TIME INTERVAL OF .042 HOURS DURING BREACH FORMATION.
DOWNSTREAM CALCULATIONS WILL USE A TIME INTERVAL OF .250 HOURS.
THIS TABLE COMPARES THE HYDROGRAPH FOR DOWNSTREAM CALCULATIONS WITH THE COMPUTED BREACH HYDROGRAPH.
INTERMEDIATE FLOWS ARE INTERPOLATED FROM END-OF-PERIOD VALUES.

(6)

TIME (HOURS)	TIME FROM BEGINNING OF BREACH (HOURS)	INTERPOLATED BREACH HYDROGRAPH (CFS)	-	COMPUTED BREACH HYDROGRAPH (CFS)	=	ERROR (CFS)	ACCUMULATED ERROR (CFS)	ACCUMULATED ERROR (AC-FT)
40.250	0.000	2251.		2251.		0.	0.	0.
40.292	.042	2564.		2564.		0.	0.	0.
40.333	.083	2878.		2972.		-94.	-94.	-0.
40.375	.125	3192.		3382.		-191.	-285.	-1.
40.417	.167	3505.		3762.		-257.	-542.	-2.
40.458	.208	3819.		3968.		-150.	-691.	-2.
40.500	.250	4132.		4132.		-0.	-691.	-2.
40.542	.292	4224.		4264.		-40.	-731.	-3.
40.583	.333	4316.		4373.		-57.	-788.	-3.
40.625	.375	4409.		4466.		-58.	-846.	-3.
40.667	.417	4501.		4547.		-46.	-892.	-3.
40.708	.458	4593.		4619.		-26.	-919.	-3.
40.750	.500	4685.		4685.		0.	-919.	-3.
40.792	.542	4796.		4744.		52.	-866.	-3.

SUBJECT DAM SAFETY INSPECTION

POTTSGROVE DAM

BY WJV DATE 6-26-79 PROJ. NO. 78-617-527

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TIME (HOURS)	TIME FROM BEGINNING OF BREACH (HOURS)	INTERPOLATED BREACH HYDROGRAPH (CFS)	- COMPUTED BREACH HYDROGRAPH (CFS)	= ERROR (CFS)	ACCUMULATED ERROR (CFS)	ACCUMULATED ERROR (AC-FT)
40.833	.583	4907.	5003.	-95.	-962.	-3.
40.875	.625	5019.	5165.	-146.	-1108.	-4.
40.917	.667	5130.	5261.	-132.	-1240.	-4.
40.958	.708	5241.	5318.	-77.	-1317.	-5.
41.000	.750	5352.	5352.	0.	-1317.	-5.
41.042	.792	5364.	5373.	-9.	-1326.	-5.
41.083	.833	5376.	5386.	-10.	-1336.	-5.
41.125	.875	5388.	5396.	-8.	-1343.	-5.
41.167	.917	5400.	5404.	-5.	-1348.	-5.
41.208	.958	5412.	5414.	-2.	-1350.	-5.
41.250	1.000	5424.	5424.	0.	-1350.	-5.
41.292	1.042	5601.	5494.	107.	-1243.	-4.
41.333	1.083	5778.	5652.	126.	-1117.	-4.
41.375	1.125	5955.	5847.	108.	-1009.	-3.
41.417	1.167	6132.	6056.	76.	-932.	-3.
41.458	1.208	6309.	6270.	39.	-893.	-3.
41.500	1.250	6487.	6487.	0.	-893.	-3.
41.542	1.292	6993.	6829.	164.	-729.	-3.
41.583	1.333	7500.	7335.	164.	-565.	-2.
41.625	1.375	8006.	7879.	127.	-437.	-2.
41.667	1.417	8513.	8429.	84.	-353.	-1.
41.708	1.458	9019.	8978.	41.	-312.	-1.
41.750	1.500	9526.	9526.	-0.	-312.	-1.
41.792	1.542	9970.	10020.	-50.	-362.	-1.
41.833	1.583	10414.	10456.	-42.	-405.	-1.
41.875	1.625	10858.	10890.	-32.	-437.	-2.
41.917	1.667	11302.	11323.	-21.	-458.	-2.
41.958	1.708	11746.	11757.	-11.	-469.	-2.
42.000	1.750	12190.	12190.	0.	-469.	-2.
42.042	1.792	12176.	12351.	-175.	-644.	-2.
42.083	1.833	12161.	12268.	-106.	-751.	-3.
42.125	1.875	12146.	12230.	-84.	-835.	-3.
42.167	1.917	12132.	12185.	-53.	-888.	-3.
42.208	1.958	12117.	12143.	-26.	-914.	-3.
42.250	2.000	12103.	12103.	0.	-914.	-3.

SUBJECT DAM SAFETY INSPECTION

POTTSGROVE DAM

WJV DATE 6-26-79 PROJ. NO. 78-617-527

CHKD. BY DLB DATE 6-29-79 SHEET NO. AA OF BB

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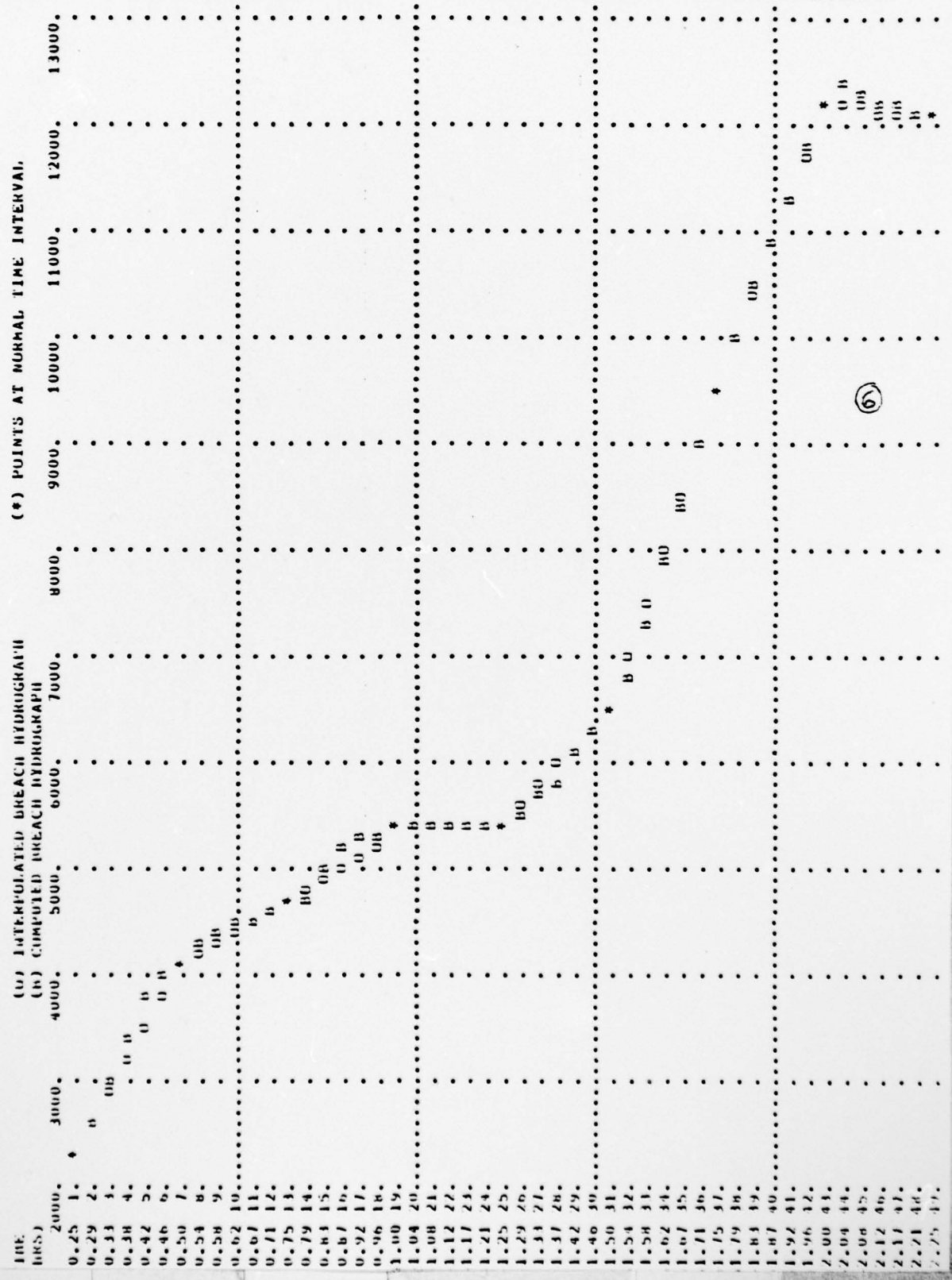

(6)

SUBJECT DAM SAFETY INSPECTION

POTTSGROVE DAM

BY WJV DATE 6-26-79 PROJ. NO. 79-617-527

CHKD. BY DLB DATE 6-29-79 SHEET NO. A2 OF A2

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SUMMARY OF DAM SAFETY ANALYSIS

BROSH MOUNTAIN DAM

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1718.30	1718.30	1723.80
STORAGE	580.	580.	777.
OUTFLOW	0.	0.	3020.

PLAN	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
6	.50	1723.91	.11	781.	11255.	.33	41.96	41.25

PLAN	RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
6	.50	10661.	1345.5	42.25

ROUTED BROSH MOUNTAIN DAM BREACH OUTFLOW PRIOR TO INFLOW INTO POTTSGROVE DAM RESERVOIR

POTTSGROVE DAM

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1328.80	1328.80	1333.00
STORAGE	104.	104.	142.
OUTFLOW	0.	0.	2184.

PLAN	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
6	.50	1331.31	.31	145.	12351.	.38	42.04	40.25

SECTION 5

PLAN	RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
6	.50	12213.	1285.1	42.25

SECTION 6

	RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
6	.50	12246.	1266.7	42.25

DOWNSTREAM ROUTING RESULTS

LIST OF REFERENCES

1. "Recommended Guidelines for Safety Inspection of Dams," prepared by Department of the Army Office of the Chief of Engineers, Washington, D. C. (Appendix D).

2. "Unit Hydrograph Concepts and Calculations," by Corps of Engineers, Baltimore District (L-519).

3. "Seasonal Variation of Probable Maximum Precipitation East of the 105th Meridian for Areas from 10 to 1,000 Square Miles and Duration of 6, 12, 24, and 48 Hours," Hydrometeorological Report No. 33, prepared by J. T. Riedel, J. F. Appleby and R. W. Schloemer Hydrologic Service Division Hydrometeorological Section, U. S. Department of the Army, Corps of Engineers, Washington, D. C., April 1956.

4. Design of Small Dams, U. S. Department of the Interior, Bureau of Reclamation, Washington, D. C., 1973.

5. Handbook of Hydraulic, H. W. King and E. F. Brater, McGraw-Hill, Inc., New York, 1963.

6. Standard Handbook for Civil Engineers, F. S. Merritt McGraw-Hill, Inc., New York, 1968.

7. Open-Channel Hydraulics, V. T. Chow, McGraw-Hill, Inc., New York, 1959.

8. Weir Experiments, Coefficients, and Formulas, R. E. Horton, Water Supply and Irrigation Paper No. 200, Department of the Interior, United States Geological Survey, Washington, D. C., 1907.

9. "Probable Maximum Precipitation Susquehanna River Drainage Above Harrisburg, Pennsylvania," Hydrometeorological Report 40, prepared by H. V. Goodyear and J. T. Riedel, Hydrometeorological Branch Office of Hydrology, U. S. Weather Bureau, U. S. Department of Commerce, Washington, D. C., May 1965.

10. Flood Hydrograph Package (HEC-1) Dam Safety Version, Hydrologic Engineering Center, U. S. Army Corps of Engineers, Davis, California, July 1978.

11. "Simulation of Flow Through Broad Crest Navigation Dams with Radial Gates," R. W. Schmitt, U. S. Army Corps of Engineers, Pittsburgh District.

12. "Hydraulics of Bridge Waterways," BPR, 1970, Discharge Coefficient Based on Criteria for Embankment Shaped Weirs, Figure 24, page 46.

13. Applied Hydraulics in Engineering, Morris, Henry M. and Wiggert, James N., Virginia Polytechnic Institute and State University, 2nd Edition, The Ronald Press Company, New York, 1972.

14. Standard Mathematical Tables, 21st Edition, The Chemical Rubber Company, 1973, page 15.

15. Engineering Field Manual, U. S. Department of Agriculture, Soil Conservation Service, 2nd Edition, Washington, D. C. 1969.

APPENDIX C-1

SUPPLEMENTAL CALCULATIONS

SUBJECT DAM SAFETY INSPECTION
POTTSGROVE DAM

BY WJV DATE 6-12-79 PROJ. NO. 73-617-527

CHKD. BY DLB DATE 6-19-79 SHEET NO. 1 OF 13

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BRUSH MOUNTAIN DAM (KETTLE DAM)

DAM STATISTICS

HEIGHT OF DAM ≈ 53 FT (FIELD MEASURED)

MAXIMUM POOL STORAGE CAPACITY ≈ 780 AC-FT (FROM HEC-1) @ TOP OF DAM

NORMAL POOL STORAGE CAPACITY ≈ 580 AC-FT (SEE NOTE 1)

DRAINAGE AREA ≈ 2.2 SQ MI. [PLANIMETERED OFF USGS 7.5 MINUTE BELLWOOD AND FRANKLINTOWN, PA QUADS]

NOTE 1: STORAGE VALUE OBTAINED FROM "DAMS, RESERVOIRS, AND NATURAL LAKES", WATER RESOURCES BULLETIN Nº 5, COMMONWEALTH OF PENNSYLVANIA, DEPARTMENT OF FORESTS AND WATER, HARRISBURG, PA. THE REPORTED VALUE WAS 189 MILLION GALLONS.

DAM CLASSIFICATION

DAM SIZE - INTERMEDIATE (REF 1, TABLE 1)

HAZARD CLASSIFICATION - HIGH (FIELD OBSERVATION)

REQUIRED SDF - PMF (REF 1, TABLE 3)

SUBJECT DAM SAFETY INSPECTION
POTTSGROVE DAM

BY WJV DATE 6-12-79 PROJ. NO. 79-617-527

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BRUSH MOUNTAIN DAM (KETTLE DAM)

HYDROGRAPH PARAMETERS

LENGTH OF LONGEST WATERCOURSE ≈ 1.5 MI

L_{CA} ≈ 0.4 MI (MEASURED ALONG LONGEST WATERCOURSE FROM THE DAM TO THE CENTROID OF THE BASIN)

NOTE 2: VALUES OF L AND L_{CA} ARE MEASURED FROM USGS 7.5 MINUTE BELLWOOD AND FRANKSTOWN, PA QUADS. ALL VARIABLES ARE DEFINED IN REF 2 IN THE SECTION ENTITLED, "SNYDER SYNTHETIC UNIT HYDROGRAPH".

C_t ≈ 1.5
C_p ≈ 0.55

[SUPPLIED BY COE; ZONE 21 SUSQUEHANNA RIVER BASIN]

t_p = SNYDER'S STANDARD LAG = $1.5 (L \times L_{CA})^{0.3}$

$\therefore t_p \approx 1.5 (1.5 \times 0.4)^{0.3} \approx 1.29$ HR

RESERVOIR SURFACE AREAS

SURFACE AREA (SA) @ NORMAL POOL EL 1718.3 ≈ 29 AC

NOTE 3: NORMAL POOL EL 1718.3 OBTAINED FROM DESIGN DRWGS AS FOUND IN PENNDER FILES. NORMAL POOL SURFACE AREA OF 29 AC FOUND IN THE REFERENCE OF NOTE 1, AND ROUGHLY CHECKED BY PLANIMETERING THE LAKE AREA AS SHOWN ON THE USGS BELLWOOD QUAD.

SUBJECT DAM SAFETY INSPECTION
POTTSGROVE DAM

BY WJV DATE 6-13-79 PROJ. NO. 79-617-527

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BRUSH MOUNTAIN DAM (KETTLE DAM)

SA @ EL 1720 ≈ 35.8 AC

SA @ EL 1740 ≈ 52.8 AC

[PLANIMETERED OFF THE USGS 7.5 MINUTE BELLWOOD, PA QUAD]

RATE OF SA INCREASE PER FOOT OF RESERVOIR RISE BETWEEN ELEVATIONS 1720 AND 1740 :

$$\Delta SA/\Delta H \approx (52.8 - 35.8)\,AC/(1740-1720)\,FT \approx 0.85\ AC/FT$$

SA @ TOP OF DAM EL 1723.8 (FIELD MEASURED) $\approx 35.8\,AC + [0.85\ \frac{AC}{FT} \times (1723.8 - 1720)]$
$\approx 39.0\ AC$

RESERVOIR ELEVATION @ "0" STORAGE

NORMAL POOL VOLUME $\approx \frac{1}{3} HA \approx 580$ AC-FT (CONIC METHOD)

SA @ NORMAL POOL ≈ 29 AC (SEE NOTE 3)

$\therefore H = 3V/A \approx 3(580\,AC\text{-}FT)/(29\,AC) \approx 60\,FT$

ZERO VOLUME ELEVATION ≈ 1719.3 - 60 ≈ 1659.3 FT

NOTE 4: ALTHOUGH THE ACTUAL MINIMUM RESERVOIR ELEVATION IS PROBABLY HIGHER THAN THE ABOVE COMPUTED VALUE, IN ORDER TO CALCULATE A STORAGE-ELEVATION RELATIONSHIP AND STILL MAINTAIN A STORAGE OF 580 AC-FT @ EL 1719.3 THE ABOVE "0" STORAGE ELEVATION MUST BE INPUT INTO THE HEC-1 PROGRAM

SUBJECT DAM SAFETY INSPECTION
POTTSGROVE DAM

BY WJV DATE 6-13-79 PROJ. NO. 78-617-527

CHKD. BY DLB DATE 6-19-79 SHEET NO. 4 OF 13

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BRUSH MOUNTAIN DAM (KETTLE DAM)

ELEVATION-STORAGE RELATIONSHIP

COMPUTED INTERNALLY BY THE HEC-1 PROGRAM BASED ON THE GIVEN SURFACE AREA VS ELEVATION INFORMATION (SEE SUMMARY INPUT/OUTPUT SHEETS)

PMP CALCULATIONS

- STANDARD RAINFALL INDEX = 22.2 INCHES (REF 9, FIG 2)
  (CORRESPONDING TO A DURATION OF 24 HOURS AND AN AREA OF 200 SQ.MI.)

- GEOGRAPHIC ADJUSTMENT FACTOR ≈ 105% (REF 9, FIG 1)
  (CORRESPONDING TO A LONGITUDE OF 78°21' AND A LATITUDE OF 40°30')

- CORRECTED RAINFALL INDEX ≈ (22.2 IN)(1.05) ≈ 23.3 IN

- LOCAL DRAINAGE AREA ≈ 2.2 SQ.MI. HOWEVER, THE STORM WILL BE CENTERED OVER THE TOTAL DA ABOVE POTTSGROVE DAM ≈ 3.1 SQ.MI. ⇒ ASSUME THAT THE 10 SQ. MI. VALUES CAN EFFECTIVELY REPRESENT THE 3.1 SQ.MI. AREA:

DURATION (HR)	PERCENT OF INDEX RAINFALL (%)	DURATION (HR)	PERCENT OF INDEX RAINFALL (%)
6	117.5	48	142.5
12	127.0	72	145.0
24	136.0		

- HOP BROOK FACTOR (ADJUSTMENT FOR BASIN SHAPE AS WELL AS FOR THE LESSER LIKELIHOOD OF A SEVERE STORM CENTERING OVER A SMALLER BASIN) CORRESPONDING TO A DA ≈ 3.1 SQ.MI. (< 10 SQ.MI.) ⇒ 0.80 (REF 4, P

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POTTSGROVE DAM

BY WJV DATE 6-13-79 PROJ. NO. 78-617-527

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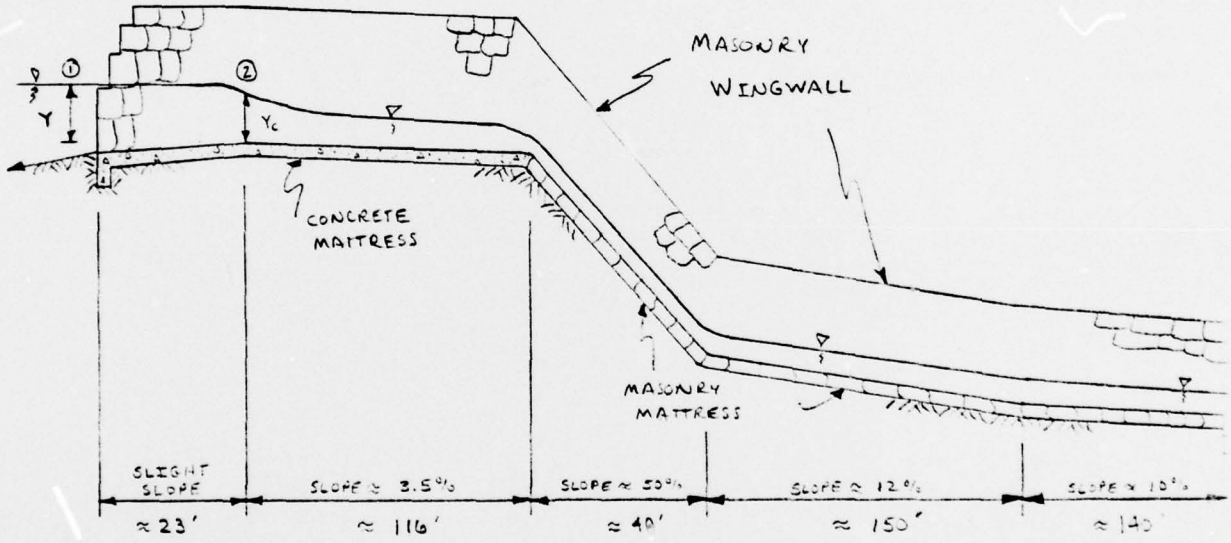
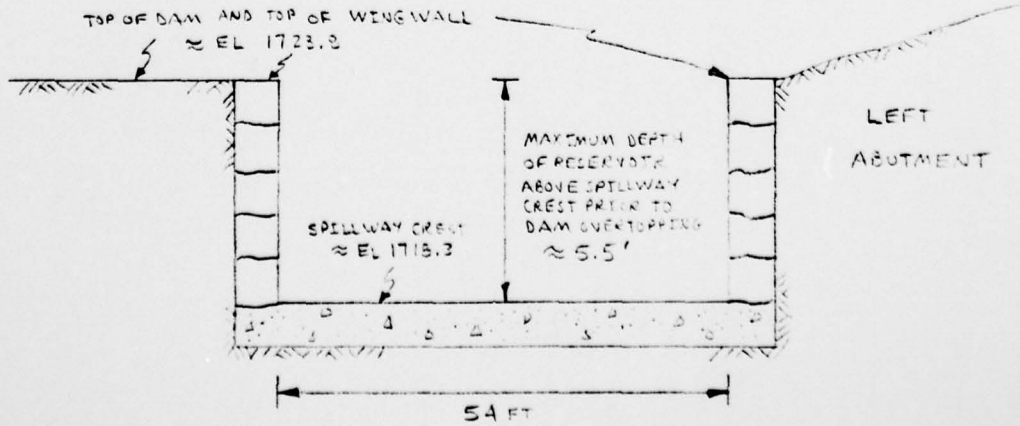
BRUSH MOUNTAIN DAM (KETTLE DAM)

SPILLWAY CAPACITY

- PROFILE OF SPILLWAY : (NOT TO SCALE)
(FROM FIELD MEASUREMENT AND OBSERVATION ; AND AVAILABLE DESIGN DRWGS)



- CROSS-SECTION OF SPILLWAY : (NOT TO SCALE)
(FROM FIELD MEASUREMENT AND OBSERVATION ; AND AVAILABLE DESIGN DRWGS)



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BEECH MOUNTAIN DAM (KETTLE DAM)

- THE CRITICAL FLOW CONTROL CHUTE CHANNEL SPILLWAY HAS DISCHARGE DICTATED BY CRITICAL DEPTH @ SECTION ② (SEE SKETCH ON SHEET 5). CRITICAL DEPTH WILL OCCUR @ ② DUE TO THE ABRUPT CHANGE FROM AN UPSTREAM ADVERSE SLOPE TO A DOWNSTREAM SUPERCRITICAL SLOPE. THE MAXIMUM RESERVOIR DEPTH (ABOVE THE SPILLWAY CREST) PRIOR TO EMBANKMENT OVERTOPPING ($Y_m \approx 5.5$ FT) OCCURS @ SECTION ①

- ENERGY BALANCE BETWEEN ① AND ②

$$Y_m + v_1^2/2g + Z_1 = Y_c + v_c^2/2g + Z_2 + H_L \qquad \text{(REF 7, PG 40)}$$

WHERE v_1 = VELOCITY OF APPROACH CHANNEL, IN FPS;
Z_1 = ELEVATION DATUM = ELEVATION OF SPILLWAY CREST ($Z_1 - Z_2 = 0$);
v_c = CRITICAL VELOCITY, IN FPS; AND
H_L = TOTAL HEAD LOSS BETWEEN ① AND ② = ENTRANCE LOSS + FRICTION LOSS.

$$\therefore Y_m + v_1^2/2g = 5.5 + v_1^2/2g = Y_c + v_c^2/2g + H_L$$

- $v_1 = Q/A_1 = Q/(54\text{ FT} \times 5.5\text{ FT}) = Q/297\text{ FT}^2$

$v_c^2/2g = Y_c/2$ FOR RECTANGULAR, CRITICAL FLOW CHANNEL (REF 13, PG 14

H_L = CHANNEL FRICTION LOSS + ENTRANCE LOSS
$= \underbrace{S_f L + 0.1\, v_1^2/2g}_{\text{(REF 4, PG 379)}}$ (WHERE S_f = FRICTION SLOPE
L = APPROACH CHANNEL LENGTH ≈ 23 FT

$$S_f = \left(Qn/1.49 A R^{2/3} \right)^2$$ WHERE n = CHANNEL ROUGHNESS FACTOR ≈ 0.02 (CONCRETE BOTTOM W/ DRESSED STONE IN MORTAR, PG 7, PG 111). AND

SUBJECT DAM SAFETY INSPECTION
POTTSGROVE DAM

BY WJV DATE 6-13-79 PROJ. NO. 79-617-527

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BRUSH MOUNTAIN DAM (KETTLE DAM)

$R = \frac{\text{APPROACH CHANNEL FLOW AREA}}{\text{APPROACH CHANNEL WETTED PERIMETER}}$

$\approx A_1/(54\text{ FT} + 5.5\text{ FT})$

$\approx 297/59.5 \approx 4.99\text{ FT}$

$$S_f \approx \left[Q(0.02)/1.49(297)(4.99)^{2/3} \right]^2 \approx (2.39 \times 10^{-10})\, Q^2$$

- THEREFORE:

$$5.5 + Q^2/2g(297)^2 = 3/2\, Y_c + [23 \times (2.39 \times 10^{-10} \times Q^2)] + 0.1\, Q^2/2g(297)^2$$

$$5.5 = 3/2\, Y_c - (1.54 \times 10^{-7})\, Q^2$$

ALSO, CRITICAL FLOW IN A RECTANGULAR CHANNEL CAN BE DEFINED BY: (REF 13, PG 143)

$$Y_c = \sqrt[3]{q^2/g} \qquad \text{WHERE } q = Q/54\text{ FT}$$

$$Y_c = \sqrt[3]{(1.07 \times 10^{-5})\, Q^2}$$

- BY TRIAL AND ERROR $\Rightarrow$ $Q \approx 3020$ CFS
$Y_c \approx 4.60$ FT

(SINCE THE DS CHANNEL SLOPE $\approx 3.5\% \Rightarrow$ CRITICAL FLOW WILL CONTROL)

SPILLWAY RATING CURVE

THE SPILLWAY RATING CURVE IS BASED ON THE PROCEDURE OF SHEETS 6 AND 7, AND THE EQUATIONS

$$Y + Q^2/2g(54Y)^2 = 3/2\, Y_c + 23\, S_f + 0.1\, Q^2/2g(54Y)$$

SUBJECT DAM SAFETY INSPECTION
POTTSGROVE DAM

BY WJV DATE 6-14-79 PROJ. NO. 78-617-527

CHKD. BY DLB DATE 6-19-79 SHEET NO. 9 OF 12

gai CONSULTANTS.
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Environmental Specialists

BRUSH MOUNTAIN DAM (KETTLE DAM)

$$S_f = \left[Q(0.02) / 1.49 (54Y) \left(\frac{54Y}{54+Y} \right)^{2/3} \right]^2$$

$$Y_c = \sqrt[3]{(1.07 \times 10^{-5}) Q^2}$$

WHERE Y = RESERVOIR DEPTH (ABOVE SPILLWAY CREST) @ THE ASSUMED ELEVATION

ELEVATION (FT)	Y (FT)	FINAL ASSUMED Y_c (FT)	FINAL ASSUMED Q (CFS)	
1719.3	0	-	0	ROUNDED FLOW VALUES
1719.3	1.0	0.76	200	
1720.3	2.0	1.60	620	
1721.3	3.0	2.46	1190	
1722.3	4.0	3.31	1940	
1723.3	5.0	4.16	2590	
LOW TOP OF DAM ELEVATION 1723.5	5.5	4.60	3020	
1724.3	6.5	5.44	3990	
1725.3	7.5	6.29	4920	

EMBANKMENT RATING CURVE

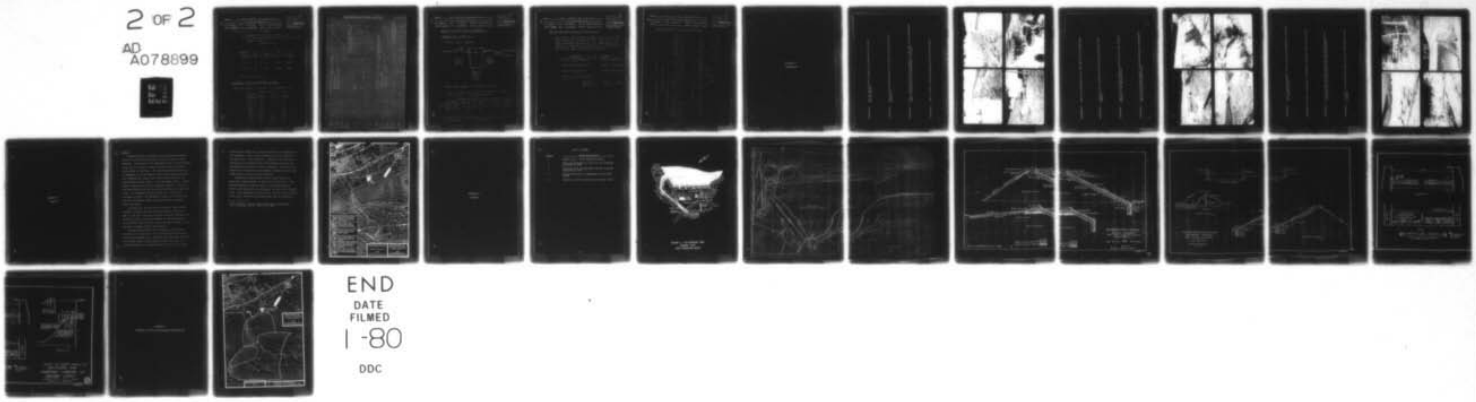
ASSUME THAT THE EMBANKMENT ACTS LIKE A BROAD-CRESTED WEIR WHEN OVERTOPPED. THEREFORE, DISCHARGE IS DEFINED BY:

$$Q = CLH^{3/2} \qquad \text{(REF 5, PG 5-3)}$$

WHERE Q = DISCHARGE, IN CFS;
L = LENGTH OF EMBANKMENT ≈ 530 FT (FIELD MEASURE
H = HEIGHT OF RESERVOIR ABOVE EMBANKMENT CREST

AD-A078 899 GAI CONSULTANTS INC MONROEVILLE PA F/G 13/13
NATIONAL DAM INSPECTION PROGRAM. POTTSGROVE DAM (NDI I.D. NUMBE--ETC(U)
JUN 79 DACW31-79-C-0013
UNCLASSIFIED NL

2 OF 2
AD A078899



END
DATE FILMED
1-80
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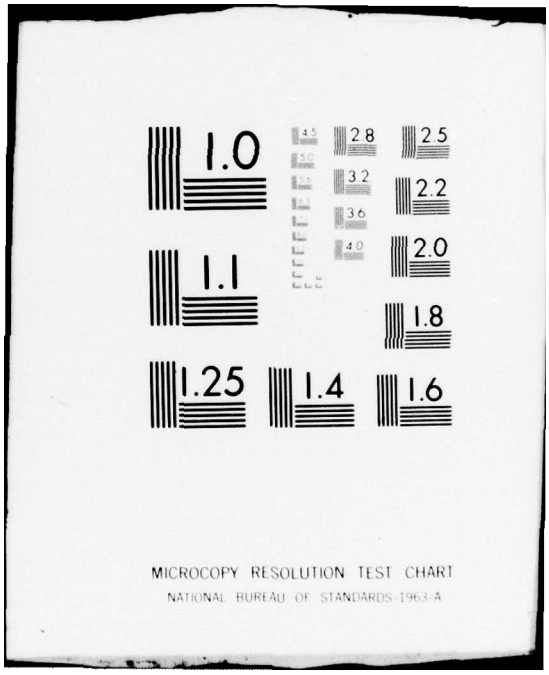
1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

SUBJECT DAM SAFETY INSPECTION
POTTSGROVE DAM

BY WJV DATE 6-14-79 PROJ. NO. 79-617-527

CHKD. BY DLB DATE 6-19-79 SHEET NO. 9 OF 13

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BRUSH MOUNTAIN DAM (KETTLE DAM)

ELEVATION OF 1723.8 FT, IN FT; AND
C = DISCHARGE COEFFICIENT ≈ f(H/ℓ, w/ ℓ = CREST WIDTH ≈ 10 FT)
↳ FIELD MEASURED

ELEVATION (FT)	H (FT)	H/ℓ (FT/FT)	C*	Q (CFS)
1723.8	0	0	-	0
1724.8	1	0.1	3.03	2510
1725.8	2	0.2	3.07	7210

* FROM REF 12, PG 46

TOTAL FACILITY RATING CURVE

TOTAL DISCHARGE = SPILLWAY Q + EMBANKMENT Q

ELEVATION (FT)	SPILLWAY Q (CFS)	EMBANKMENT Q (CFS)	TOTAL Q (CFS)
1718.3	0	-	0
1719.3	200	-	200
1720.3	620	-	620
1721.3	1180	-	1180
1722.3	1840	-	1840
1723.3	2590	-	2590
1723.8	3020	0	3020
1724.8	3980	2510	6490
1725.8	4920	7210	12130

DOWNSTREAM ROUTING SECTIONS

SUBJECT DAM SAFETY INSPECTION
POTTSGROVE DAM

BY WJV DATE 6-21-79 PROJ. NO. 78-617-527

CHKD. BY DLB DATE 6-23-79 SHEET NO. 11 OF 13

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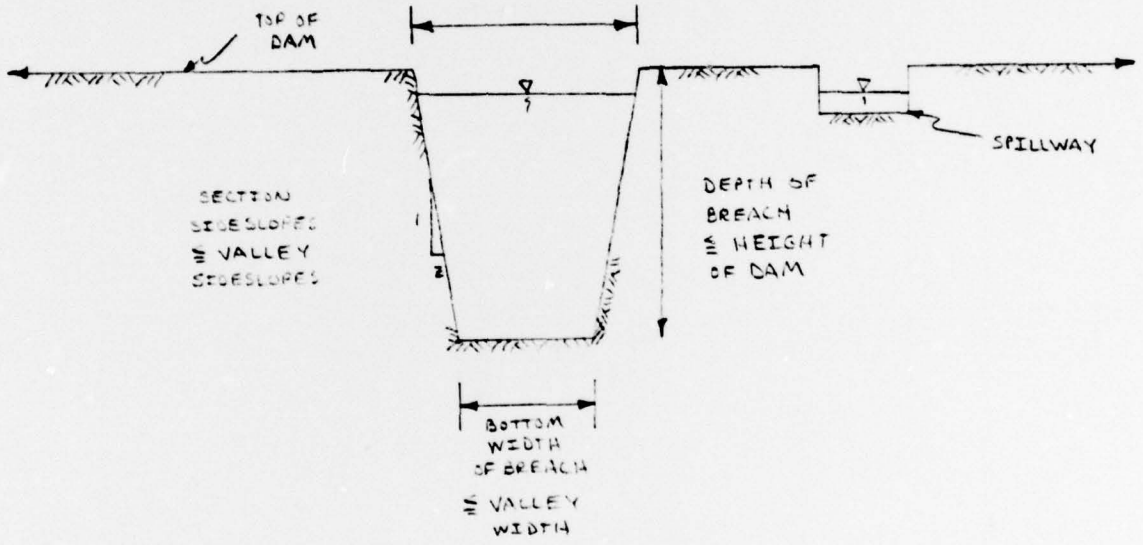
BRUSH MOUNTAIN DAM (KETTLE DAM)

BREACH ASSUMPTIONS

- TYPICAL BREACH SECTION



- HEC-1 - DAM BREACHING ANALYSIS INPUTS :

(BREACHING WILL BEGIN WHEN THE RESERVOIR LEVEL REACHES THE TOP OF DAM ELEVATION)

PLAN NUMBER AND COMMENT	BREACH BOTTOM WIDTH (FT)	MAX. BREACH DEPTH (FT)	SECTION SIDESLOPES	* BREACH TIME (HR)	WSEL @ START OF FAILURE (FT)
** ② AVERAGE POSSIBLE CONDITIONS	100	53	2 to 1	2.0	1723.8

* BREACH TIME = TOTAL TIME NECESSARY TO REACH FINAL BREACH DIMENSIONS

** PLAN ② WILL BE UNDER 0.5 PMF CONDITIONS

SUBJECT DAM SAFETY INSPECTION
POTTSGROVE DAM

BY WJV DATE 6-21-79 PROJ. NO. 78-617-527

CHKD. BY DLB DATE 6-23-79 SHEET NO. 12 OF 13

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BRUSH MOUNTAIN DAM (KETTLE DAM)

- THE BREACH ASSUMPTIONS LISTED ON SHEET 11 ARE BASED SOMEWHAT ON INFORMATION CONCERNING EARTH DAM BREACHING PROVIDED BY THE COE, BALTIMORE DISTRICT; AND ALSO ON THE PHYSICAL CONSTRAINTS OF THE DAM AND SURROUNDING TERRAIN:

CONSTRAINT	VALUE
- HEIGHT OF EMBANKMENT	≈ 53 FT (FIELD MEASURED)
- EMBANKMENT CREST LENGTH	≈ 930 FT (FIELD MEASURED)
- VALLEY BOTTOM WIDTH	≈ 300 FT (FIELD MEASURED)
- VALLEY SIDESLOPES ADJACENT TO DAM	
RIGHT WALL	3.5 TO 1 } FIELD MEASURED
LEFT WALL	5.5 TO 1 }

SUBJECT DAM SAFETY INSPECTION
POTTSGROVE DAM

BY WJV DATE 6-24-79 PROJ. NO. 79-617-527

CHKD. BY _____ DATE _____ SHEET NO. 13 OF 13

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BRUSH MOUNTAIN DAM (KETTLE DAM)

HEC-1-DAM BREACHING ANALYSIS OUTPUT:

RESERVOIR DATA

UNDER 0.5 PMF BASE FLOW CONDITIONS -

* PLAN NUMBER	VARIABLE BREACH BOTTOM WIDTH (FT)	ACTUAL MAX FLOW DURING FAIL TIME (CFS)	CORRESPONDING TIME OF FLOW (HR)	INCREMENTAL DATA FLOW DURING TIME (CFS)	CORRESPONDING TIME OF FLOW (HR)	ACTUAL PEAK FLOW THROUGH DAM (CFS)	CORRESPONDING TIME OF PEAK (HR)	TIME OF MAX FLOW DURING TIME (HR)
(6)	100	11255	42.00	11195	42.00	11255	41.96	41.25

DOWNSTREAM ROUTING DATA

RESULTANT ROUTED BRUSH MOUNTAIN DAM BREACH CONTRIBUTION TO POTTSGROVE DAM TOTAL INFLOW, UNDER 0.5 PMF CONDITIONS -

* PLAN NUMBER	PEAK BREACH INFLOW (CFS)	
(6)	10404	@ SECTION 2 LOCATED 7460 FT DS FROM BRUSH MOUNTAIN DAM

* SEE TABLE ON SHEET 11

APPENDIX D

PHOTOGRAPHS

PHOTOGRAPH 1 View of the upstream concrete face along the left side of the embankment.

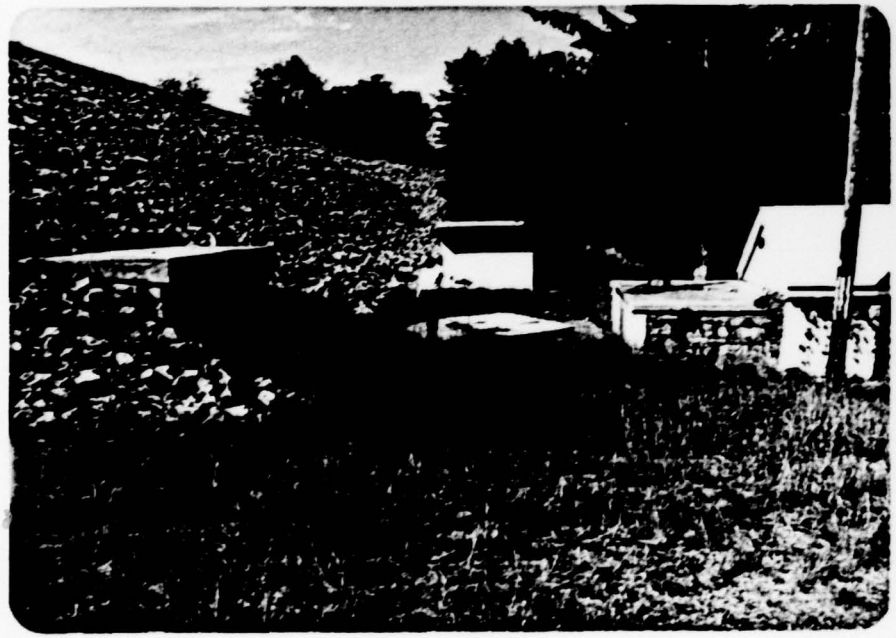
PHOTOGRAPH 2 View of the upstream masonry face along the right side of the embankment.

PHOTOGRAPH 3 View, looking toward the left abutment, of the rock covered downstream slope of Pottsgrove Dam and appurtenant structures.

PHOTOGRAPH 4 View of control valves and screen pots within gate house.

1

2



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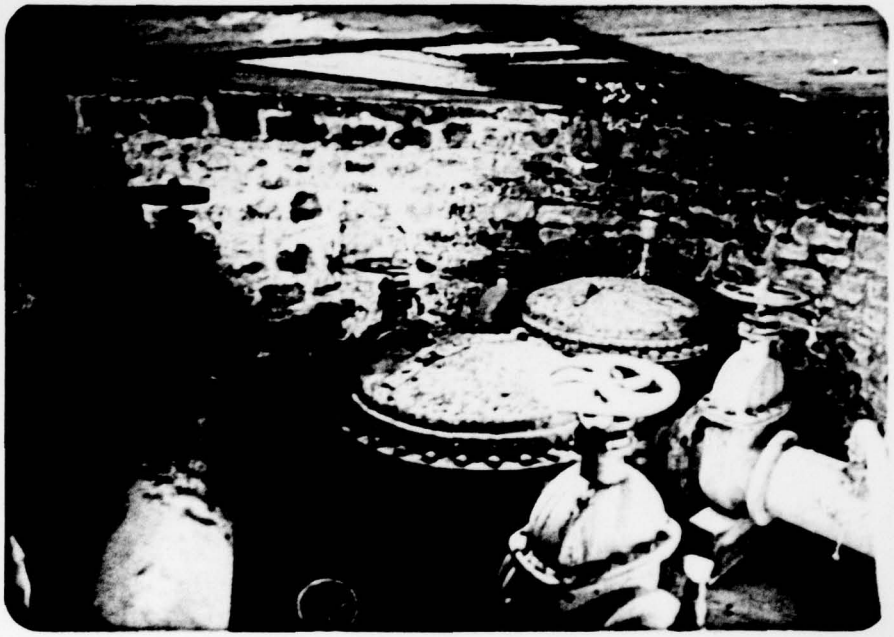


4

PHOTOGRAPH 5 View of the spillway as seen from about 50 feet downstream.

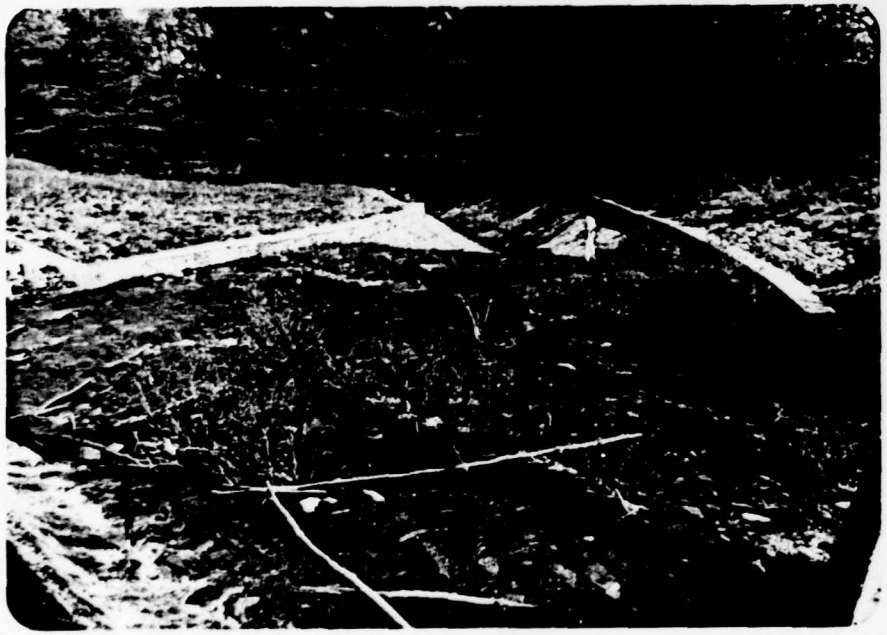
PHOTOGRAPH 6 Close-up view of concrete deterioration spillway crest and wingwall.

PHOTOGRAPH 7 View of the spillway channel as seen from the right wingwall adjacent to the spillway crest.

PHOTOGRAPH 8 View of the spillway channel, looking downstream, approximately 150 feet from the spillway crest.

5

6



7

8

PHOTOGRAPH 9 View, from the embankment crest, of the area immediately downstream of Pottsgrove Dam.

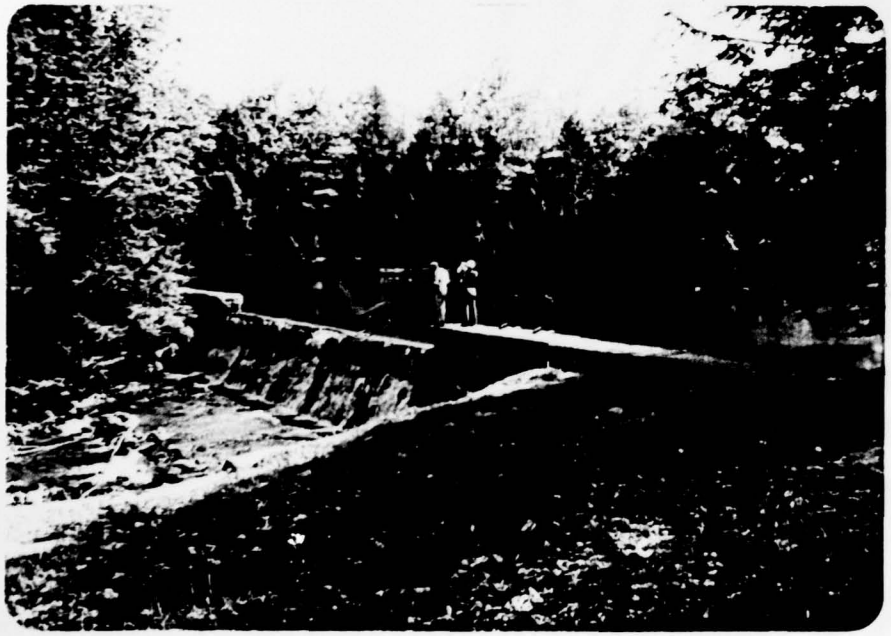
PHOTOGRAPH 10 View of the stream in residential area about 1000 feet from dam.

PHOTOGRAPH 11 View of defunct fire dam located upstream about midway between Pottsgrove Dam and Brush Mountain Dam (Kettle Reservoir).

PHOTOGRAPH 12 Overview of upstream Brush Mountain Dam as viewed from the right abutment.

9

10



11

12

APPENDIX E

GEOLOGY

GEOLOGY

Pottsgrove Dam is located in the Appalachian Mountain Section of the Valley and Ridge Province of Central Pennsylvania. This section lies immediately east of the Allegheny Front and is a region in sharp contrast with the plateau country west of the Front. The Appalchian Mountain Section is composed of a broad band of long, narrow mountain ridges and intermountain valleys which cross the state from the south-central border nearly to the northeast corner. Intense lateral compression from the southeast produced a series of high amplitude anticlines and synclines whose axes generally trend in a southwest-northeast direction. Folding was followed by uplift, and subsequent erosion cut valleys into the soft nonresistant beds, leaving the hard, resistant strata as ridges.

Structurally, the site lies on the west flank of the southwest plunging Sinking Valley Anticline. North and east of the site, the Sinking Valley Anticline continues its structural rise to form the backbone of the Nittany Arch, an area where lower Paleozoic rocks have been brought to the surface by intense folding and faulting.

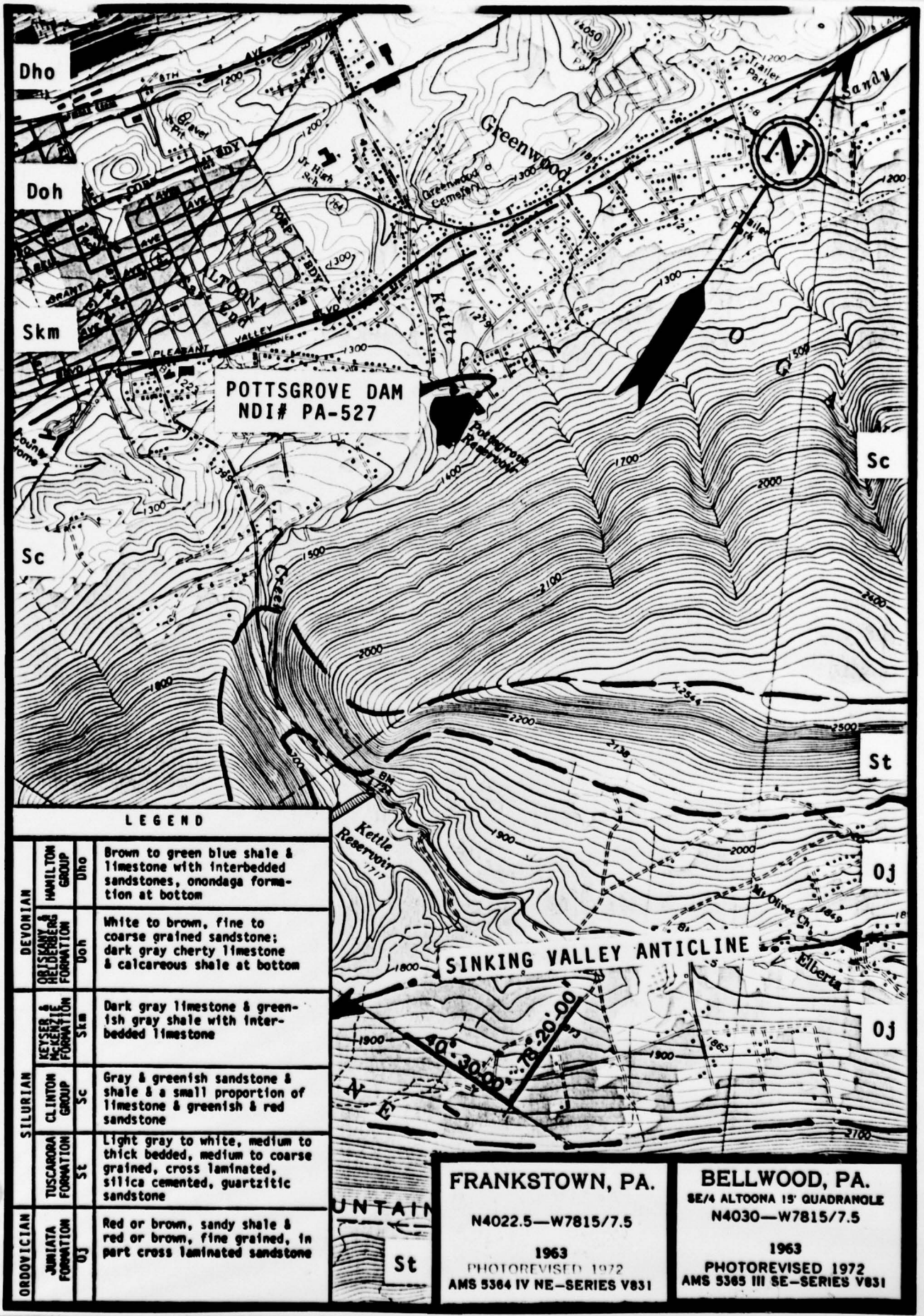
The dam and reservoir are developed on the Clinton Formation of Silurian age. The Clinton Formation overlies the Tuscarora Formation, a quartzite sandstone that outcrops on the west flank of Brush Mountain above the dam. The Clinton Formation is composed chiefly of gray and greenish

sandstone and shales and a small proportion of limestone and red sandstone. Most of the limestone is in thin layers in the upper part of the formation. Bedrock at the dam site is reported to be stratified shale and sandstone dipping in a southwesterly direction at about 15 degrees. The shale and sandstone at the dam site are probably representative of the middle portion of the Clinton formation.

Immediately below the dam, Kettle Creek flows on a moderately steep gradient of about 160 feet per mile. The gradient abruptly flattens about 0.5 mile downstream as Kettle Creek approaches the floodplain of the Little Juniata River. The confluence of Kettle Creek and the Little Juniata River occurs about one mile downstream from the reservoir.

---

[1] Butts, Charles, "Hollidaysburg-Huntingdon Quadrangles." U.S. Geological Survey. Folio 227, 1946.



FRANKSTOWN, PA.
N4022.5—W7815/7.5
1963
PHOTOREVISED 1972
AMS 5364 IV NE—SERIES V831

BELLWOOD, PA.
SE/4 ALTOONA 15' QUADRANGLE
N4030—W7815/7.5
1963
PHOTOREVISED 1972
AMS 5365 III SE—SERIES V831

APPENDIX F

FIGURES

LIST OF FIGURES

Figure	Description/Title
1	General Plan - Field Inspection Notes
2	Plan and Topography of Facility with Proposed Revisions of 1918
3	Cross-sections of Embankment Showing Proposed Revisions of 1918
4	As-Built Sections of Embankment and Spillway (1918)
5	Details of 1936 Alterations to Spillway Crest

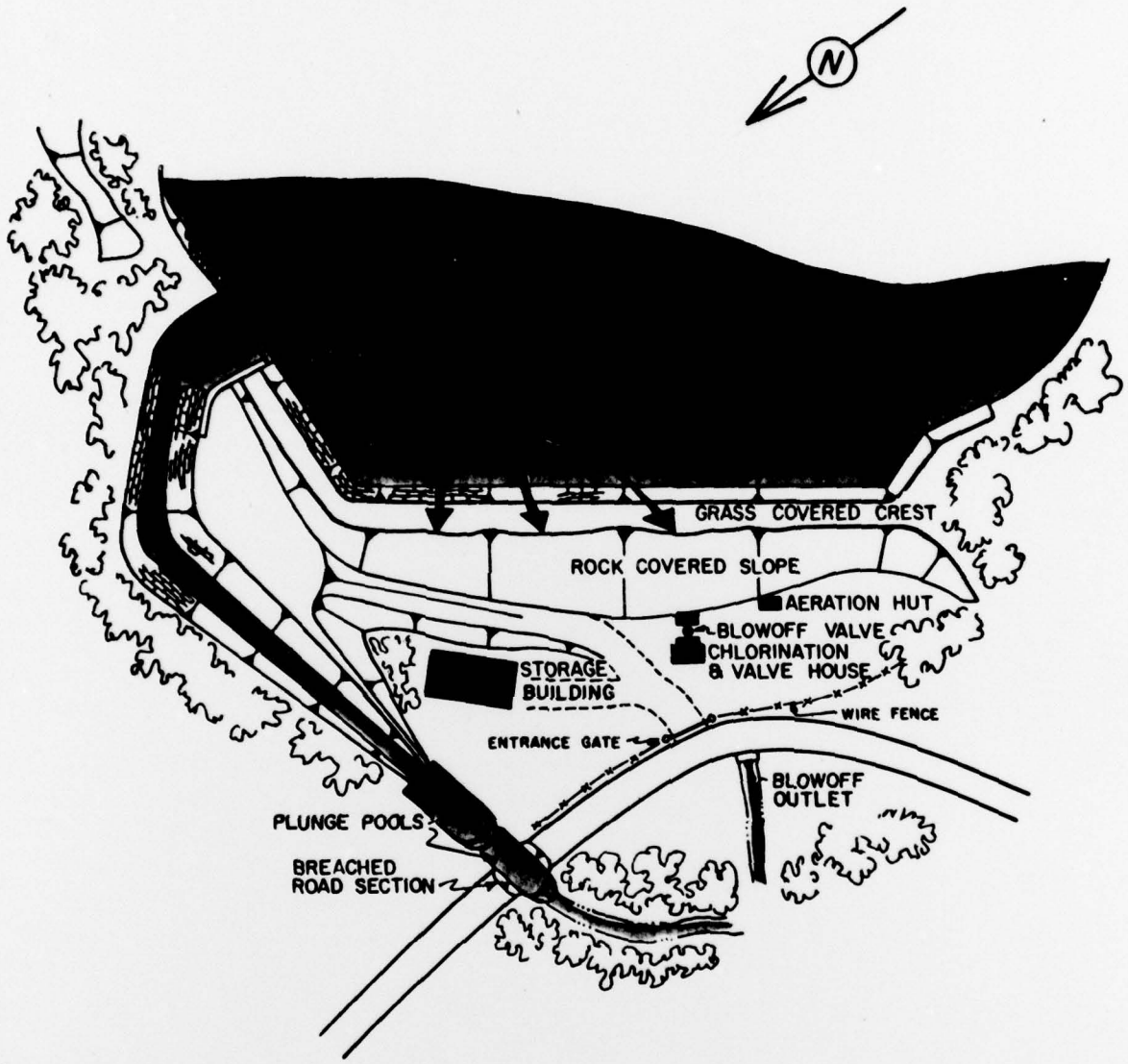
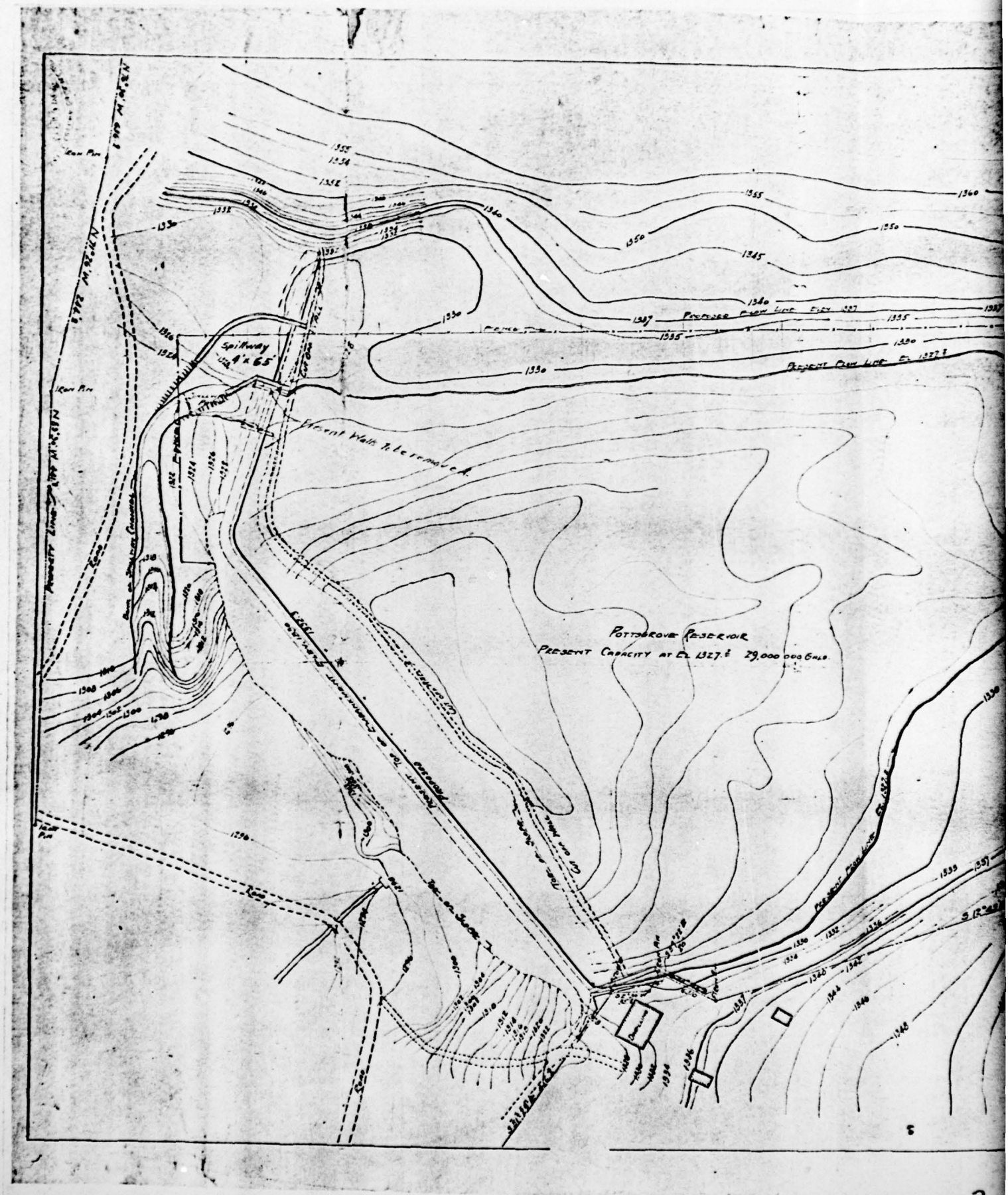


FIGURE 1 - POTTSGROVE DAM
GENERAL PLAN
FIELD INSPECTION NOTES


Spillway
Lip 4'x 6.5'
Present Flow Line El. 1327.5
Proposed Flow Line El. 1337
Present Wall to be removed
POTTSGROVE RESERVOIR
PRESENT CAPACITY AT EL. 1327.5 29,000,000 GALS.
Present Contour El. 1327.5
Proposed Contour El. 1337
Top of Slope
Iron Pin

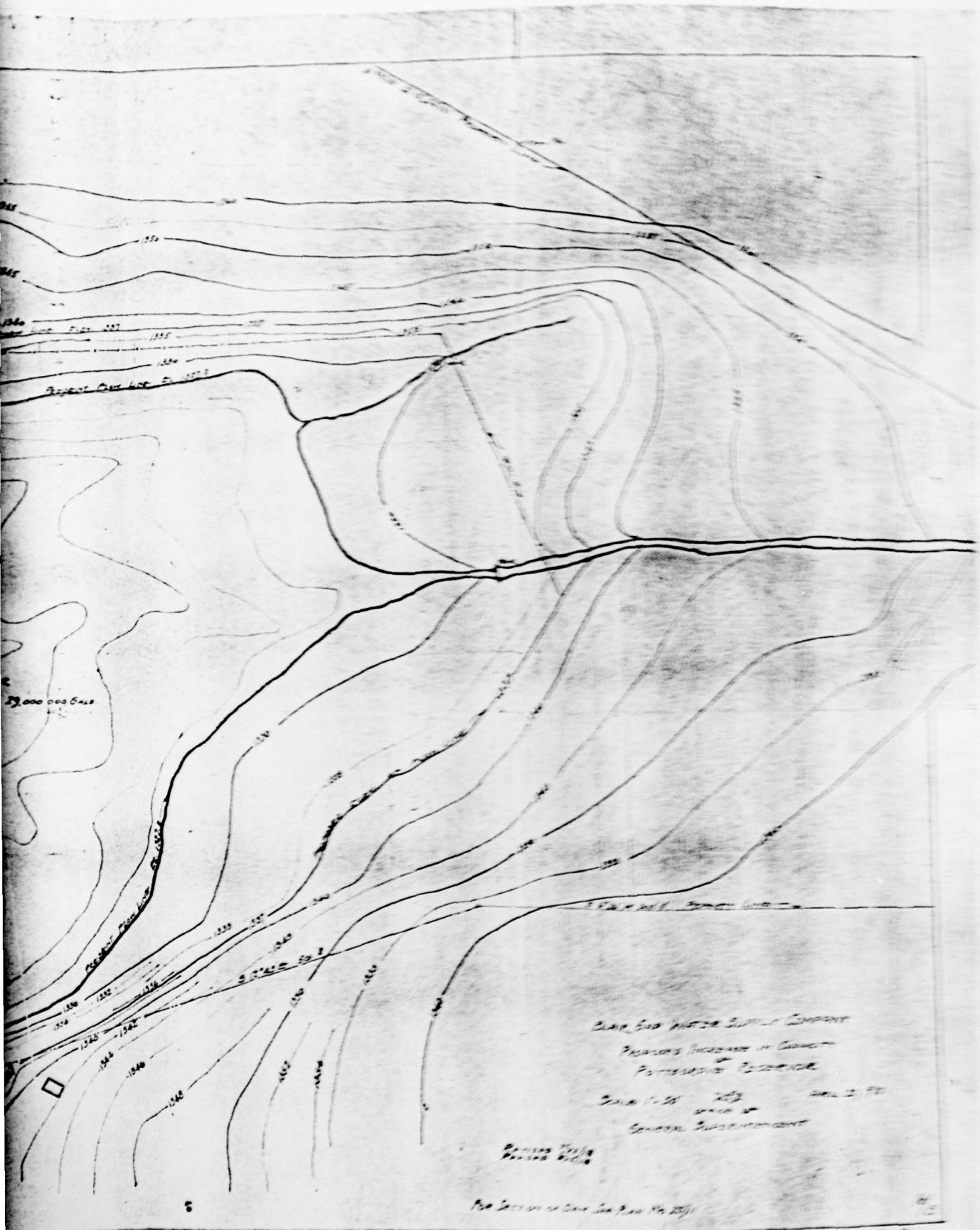
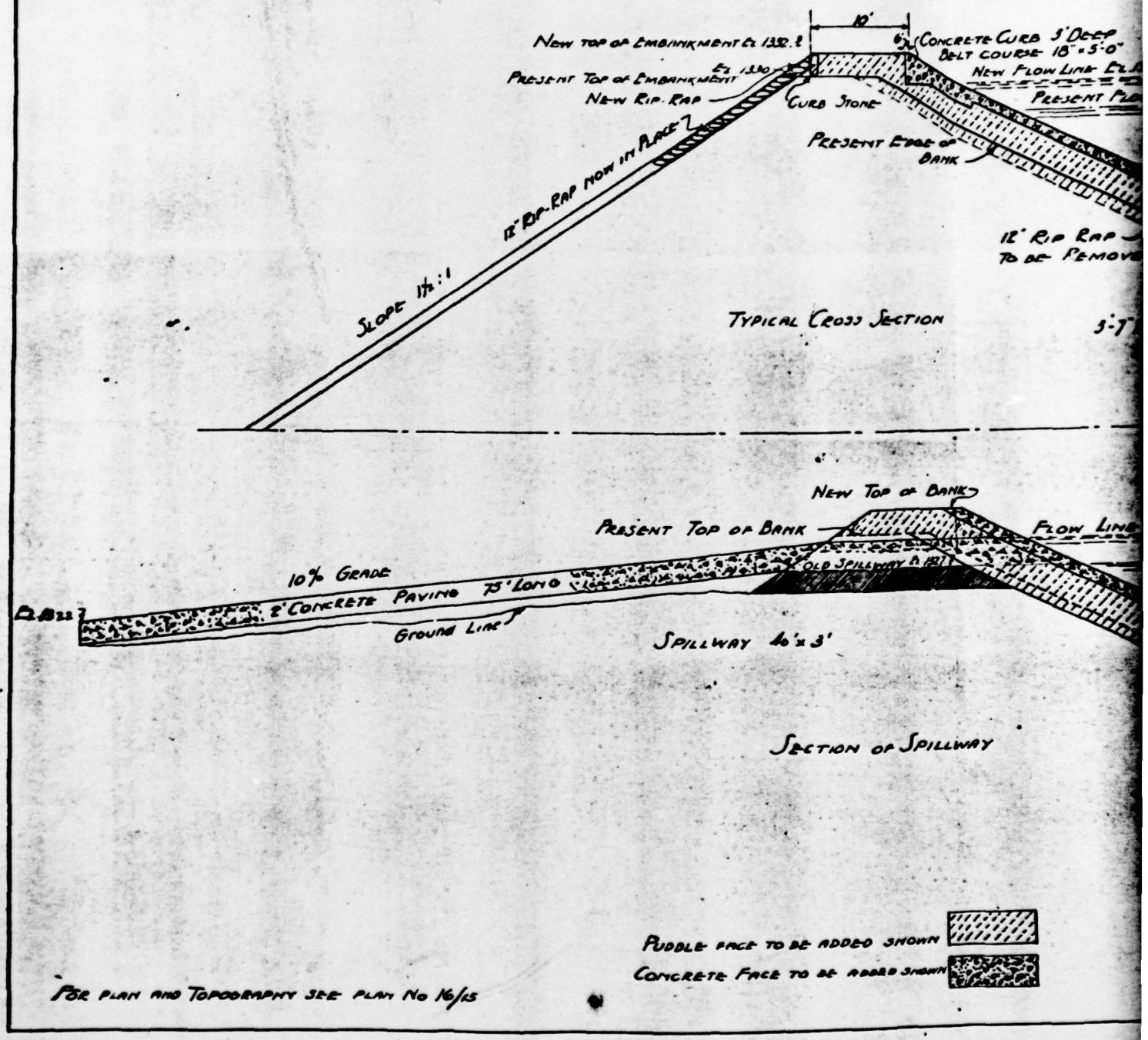

Clear Spring Water Supply Company
Property Included in Change
of
Pittsburgh Zoning
Scale 1" = 200'
Date
Source of
Topographical Information

FIGURE 2


10'
New Top of Embankment El 1332.8
Concrete Curb 3' Deep
Belt Course 18" x 5'-0"
New Flow Line El
Present Top of Embankment El 1330
New Rip-Rap
Curb Stone
Present Flo
Present Edge of Bank
12" Rip-Rap now in Place
12" Rip Rap
To be Remove
Slope 1½:1
Typical Cross Section
3'-7
New Top of Bank
Present Top of Bank
Flow Line
Old Spillway El 1321
10% Grade
2' Concrete Paving 75' Long
El 1322
Ground Line
Spillway 40' x 3'
Section of Spillway
Puddle face to be added shown
Concrete face to be added shown
For plan and Topography see plan No 16/15

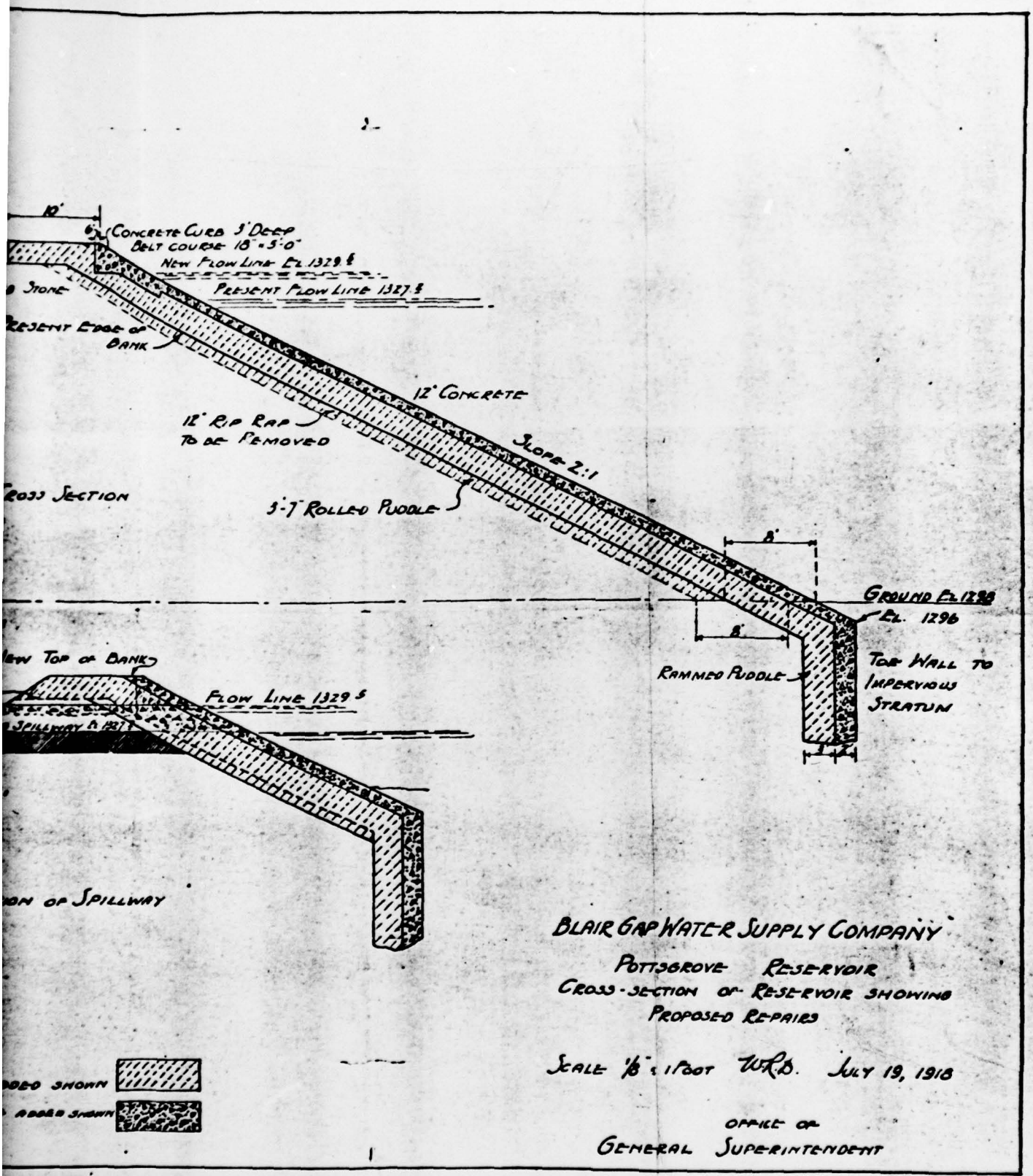
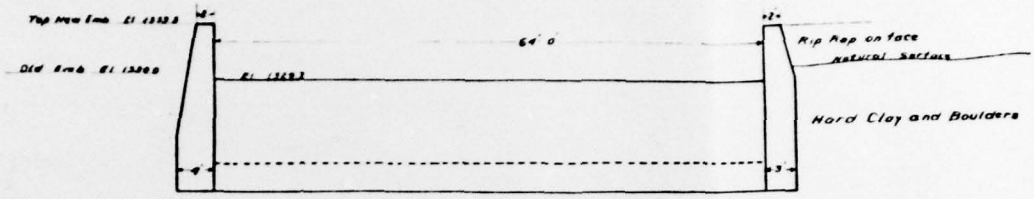
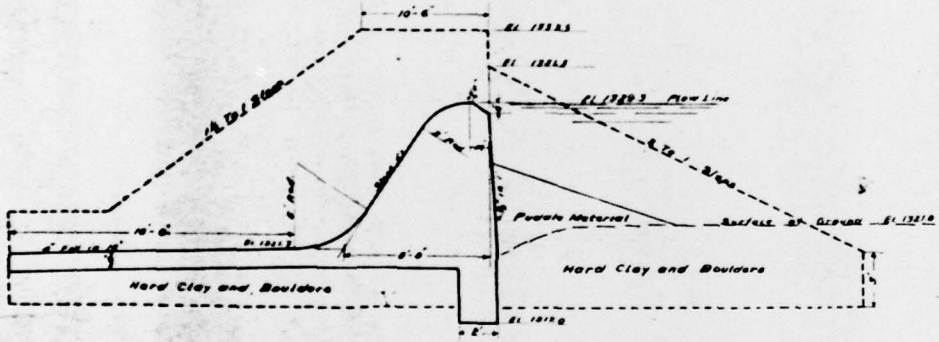


FIGURE 3

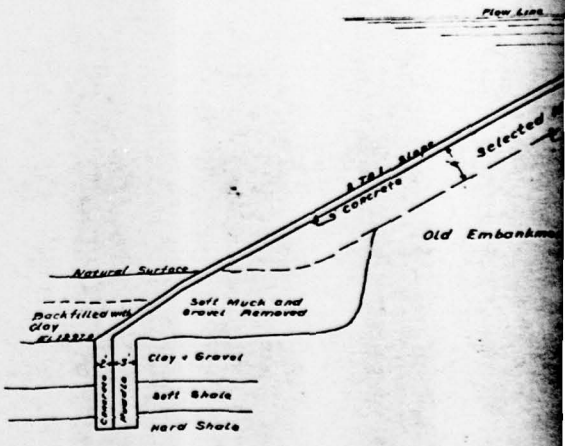
25/11



ELEVATION OF SPILLWAY
Scale ⅛" = 1'



SPILLWAY SECTION
Scale ⅛" = 1'

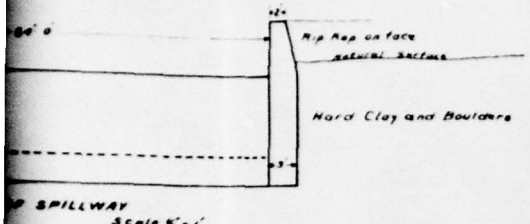


BLAIR GAP WATER SUPPLY COMPANY

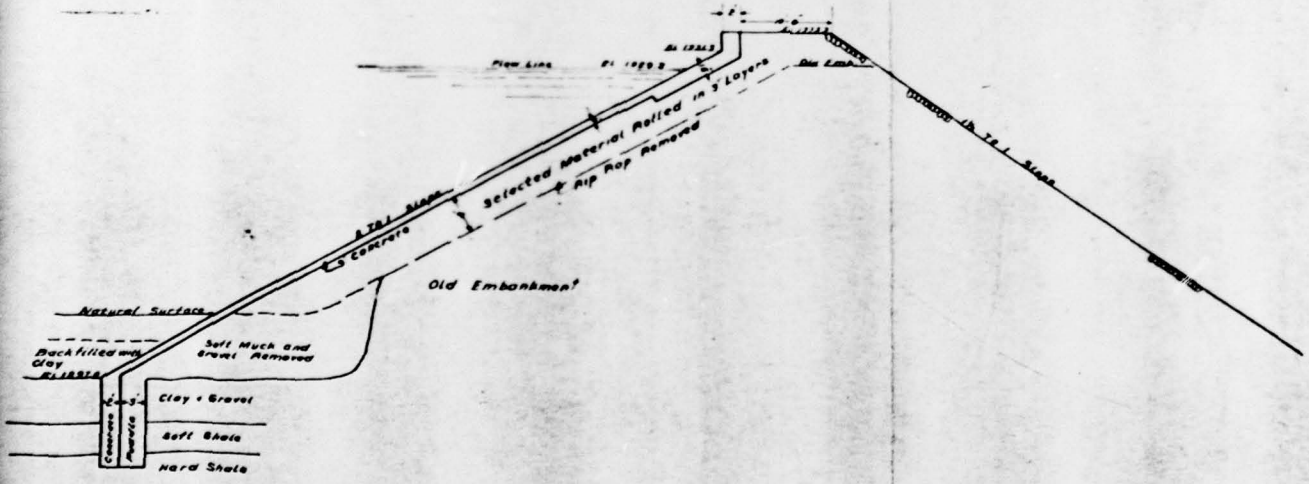
POTTSGROVE RESERVOIR

OFFICE OF GENERAL SUPERINTENDENT
OF
WATER COMPANIES

REVISED AS CONSTRUCTED
October 17, 1919



SPILLWAY
Scale 1/8" = 1'

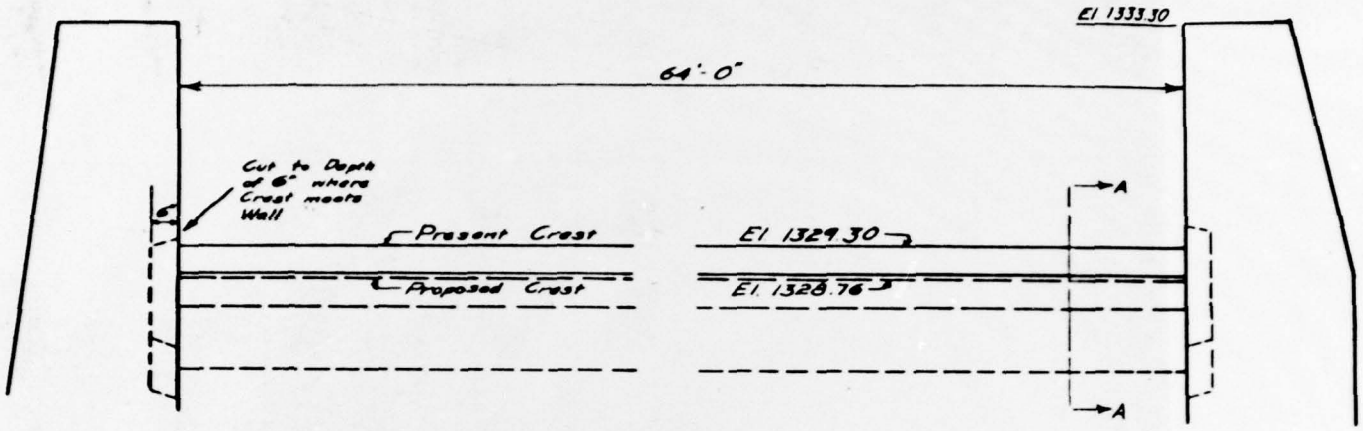


EMBANKMENT SECTION
Scale 1/8" = 1'

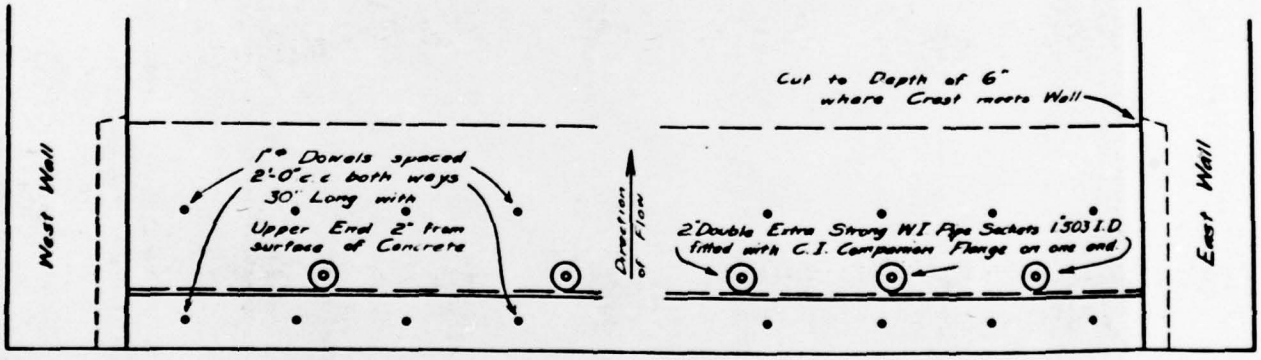
16/24

FIGURE 4

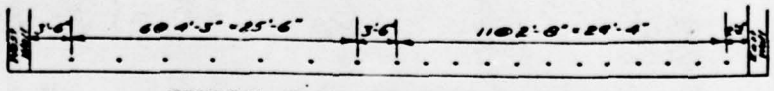
2.



ELEVATION

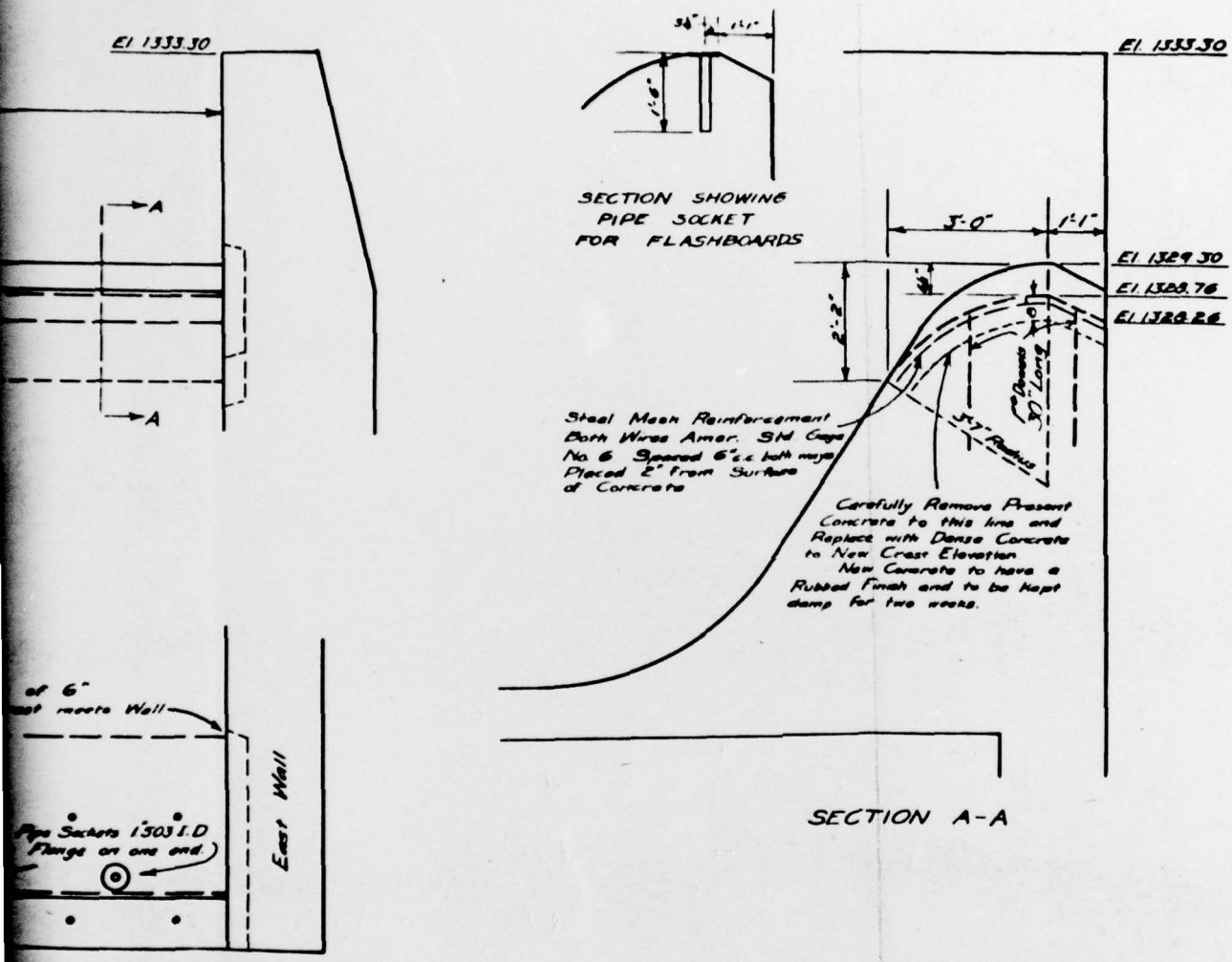


PLAN



GENERAL PLAN OF PIPE SOCKETS
SCALE: 1" = 10'-0"

Note:
No Flashboards to be installed at this time



Note:
No Flashboards to
be installed at
this time

BLAIR GAP WATER SUPPLY CO.
POTTSGROVE DAM
PROPOSED LOWERING OF SPILLWAY CREST

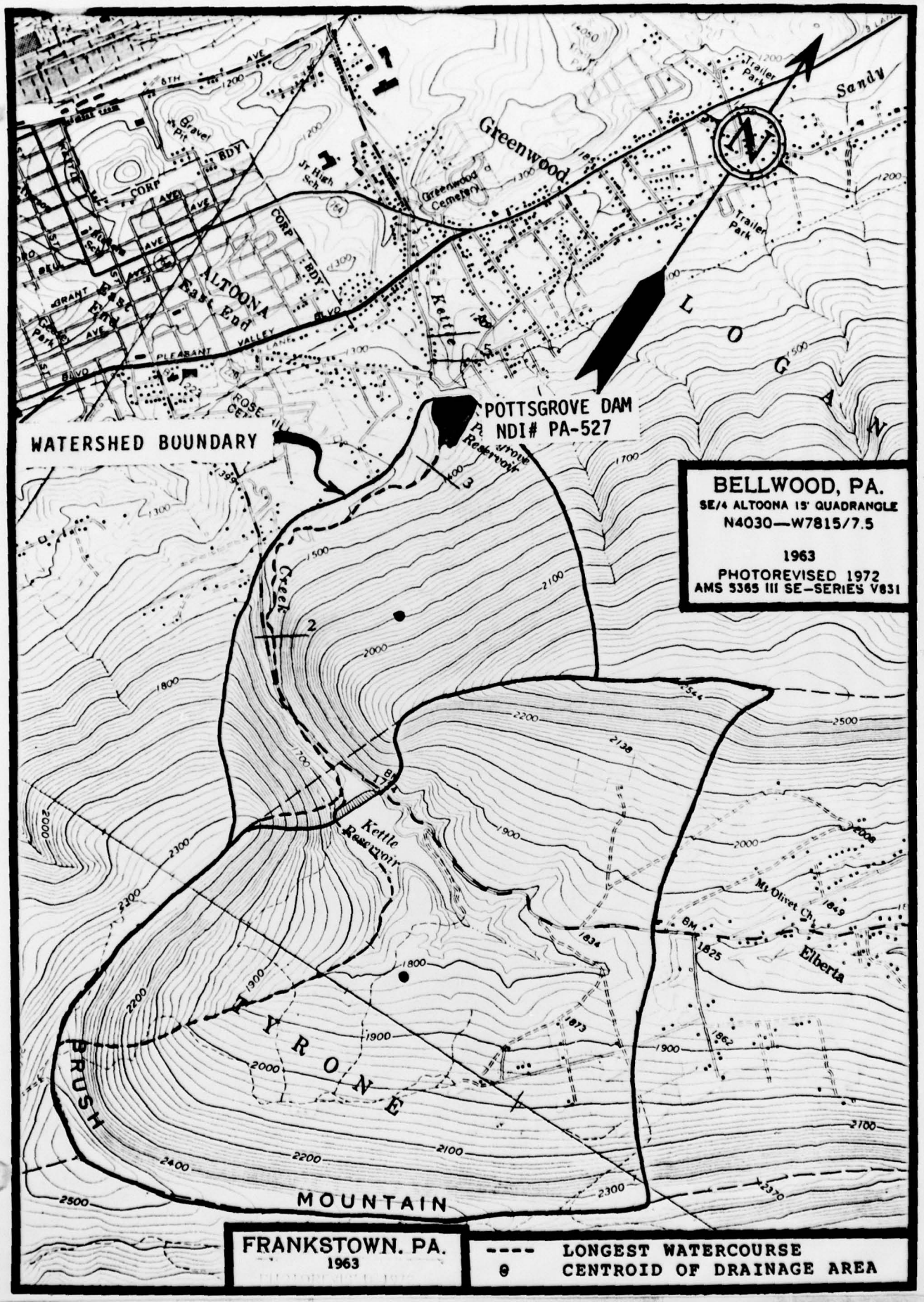
SCALE: 1" = 2'-0" J.F. 7-13-36
OFFICE OF MANAGER

25/03

FIGURE 5

APPENDIX G

REGIONAL VICINITY AND WATERSHED BOUNDARY MAP


POTTSGROVE DAM
PA NDI# PA-527
WATERSHED BOUNDARY
Pottsgrove Reservoir
Kettle Reservoir
Kettle Creek
Greenwood
Greenwood Cemetery
Sandy
Trailer Park
ALTOONA
East End
LOGAN
TYRONE
BRUSH MOUNTAIN
Mt Olivet Ch
Elberta
BM
1825
1834
1873
1862
1849
2128
2544
2370
1
2
3
BELLWOOD, PA.
SE/4 ALTOONA 15' QUADRANGLE
N4030—W7815/7.5
1963
PHOTOREVISED 1972
AMS 5365 III SE—SERIES V831
FRANKSTOWN. PA.
1963
---- LONGEST WATERCOURSE
⊕ CENTROID OF DRAINAGE AREA