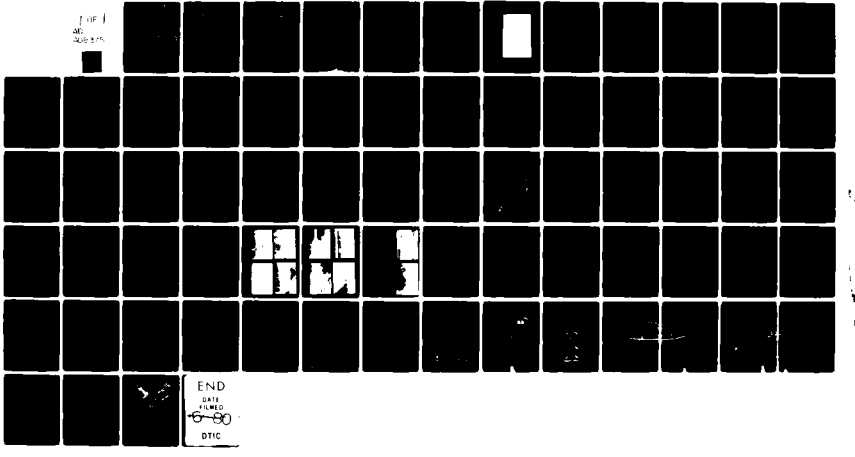
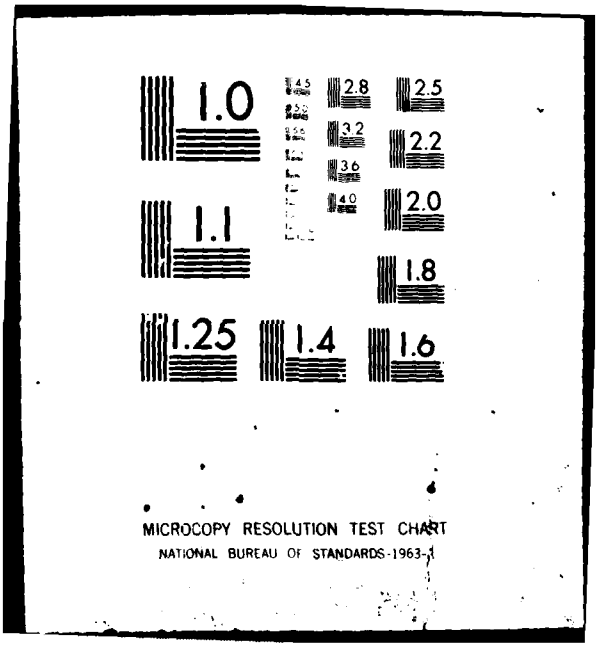
AD-A083 751 KIMBALL (L ROBERT) AND ASSOCIATES EBENSBURG PA F/G 13/13
NATIONAL DAM INSPECTION PROGRAM. RAVEN RUN DAM NUMBER 3 (NDS ID--ETC(U)
MAR 80 R J KIMBALL DACW31-80-C-0020

UNCLASSIFIED NL



END
DATE FILMED
DTIC


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
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

SUSQUEHANNA RIVER BASIN
LOST CREEK, SCHUYLKILL COUNTY

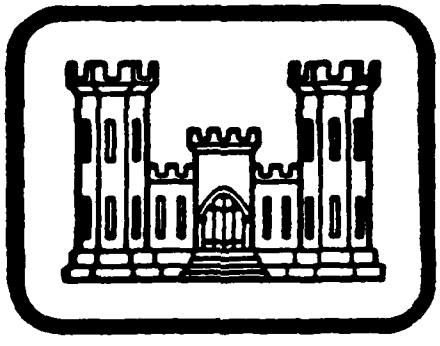
PENNSYLVANIA

RAVEN RUN DAM NO. 3

NDS ID NO. PA-656
DER ID NO. 54-8

SHENANDOAH MUNICIPAL AUTHORITY

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



Prepared By
L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
EBENSBURG, PENNSYLVANIA
15931

FOR

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

MARCH, 1980

DISCLAIMER NOTICE

THIS DOCUMENT IS BEST QUALITY PRACTICABLE. THE COPY FURNISHED TO DTIC CONTAINED A SIGNIFICANT NUMBER OF PAGES WHICH DO NOT REPRODUCE LEGIBLY.

SUSQUEHANNA RIVER BASIN

LOST CREEK, SCHUYLKILL COUNTY

PENNSYLVANIA

National Dam Inspection Program.

RAVEN RUN DAM NO. 3

(NDS ID NO. PA-656

DER ID NO. 54-8)

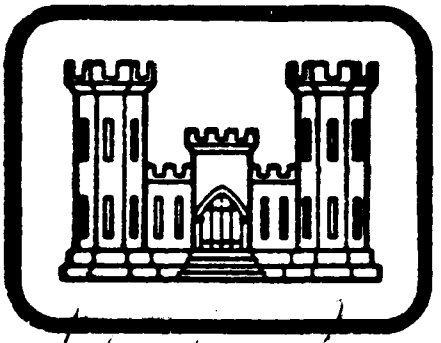
Susquehanna River Basin, Lost Creek,

SHENANDOAH MUNICIPAL AUTHORITY

Schuylkill County, Pennsylvania.

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM



Prepared By

L. ROBERT KIMBALL & ASSOCIATES

CONSULTING ENGINEERS & ARCHITECTS

EBENSBURG, PENNSYLVANIA

15931

DACW31-80-C-0024

FOR

DEPARTMENT OF THE ARMY

BALTIMORE DISTRICT CORPS OF ENGINEERS

BALTIMORE, MARYLAND

21203

MARCH 1980

411059

PREFACE

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

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

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

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

PHASE I REPORT
NATIONAL DAM INSPECTION REPORT

NAME OF DAM	Raven Run Dam No. 3
STATE LOCATED	Pennsylvania
COUNTY LOCATED	Schuylkill
STREAM	Lost Creek
DATE OF INSPECTION	November 6 and 16, 1979

ASSESSMENT

The assessment of Raven Run Dam No. 3 is based upon visual observations made at the time of inspection, review of available records and data, hydraulic and hydrologic computations and past operational performance.

The inspection and review of data of Raven Run Dam No. 3 did not reveal any problems which require emergency action. The dam appears to be in fair condition but poorly maintained and operated.

Raven Run Dam No. 3 is a high hazard-small size dam. Because of the downstream exposure the Spillway Design Flood was selected as the PMF (Probable Maximum Flood). The spillway and reservoir are capable of controlling approximately 58% of the PMF. Based on criteria established by the Corps of Engineers, the spillway is termed inadequate. The spillway capacity should be increased.

The following recommendations and remedial measures should be instituted immediately.

1. A detailed hydraulic and hydrologic study should be conducted by a professional engineer knowledgeable in dam design to increase spillway capacity. Studies and corrective measures should be implemented to increase spillway capacity.

2. A stability analysis should be performed by a registered professional engineer knowledgeable in dam design and construction.

3. A mine subisdence investigation should be performed by the owner or his engineer to determine the effects of present and past deep mining.

4. Seepage areas should be monitored on a regular basis and after periods of heavy precipitation for quantity and turbidity.

5. All brush and trees should be removed from the slopes and crest.

6. The valves and the valve house should be repaired.

7. Some means of positive upstream closure of the drainline should be developed in case of emergencies.

8. During periods of low water level in Raven Run Reservoir No. 2 the toe of Raven Run Dam No. 3 should be inspected.

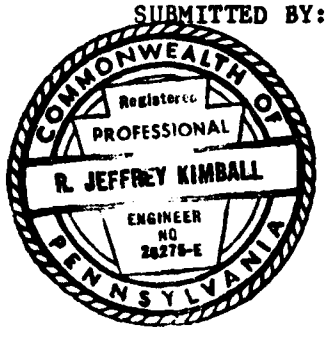
9. All valves should be exercised at regular intervals.

10. A formal safety inspection program should be conducted in accordance with provisions stipulated by the Commonwealth of Pennsylvania regarding inspection of dams.

11. A warning system should be installed to warn downstream residents of high water levels or imminent failure of the dam.

SUBMITTED BY:

L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS AND ARCHITECTS



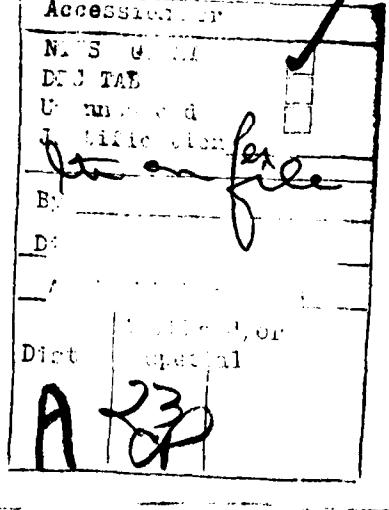
March 18, 1980 — R Jeffry Kimball

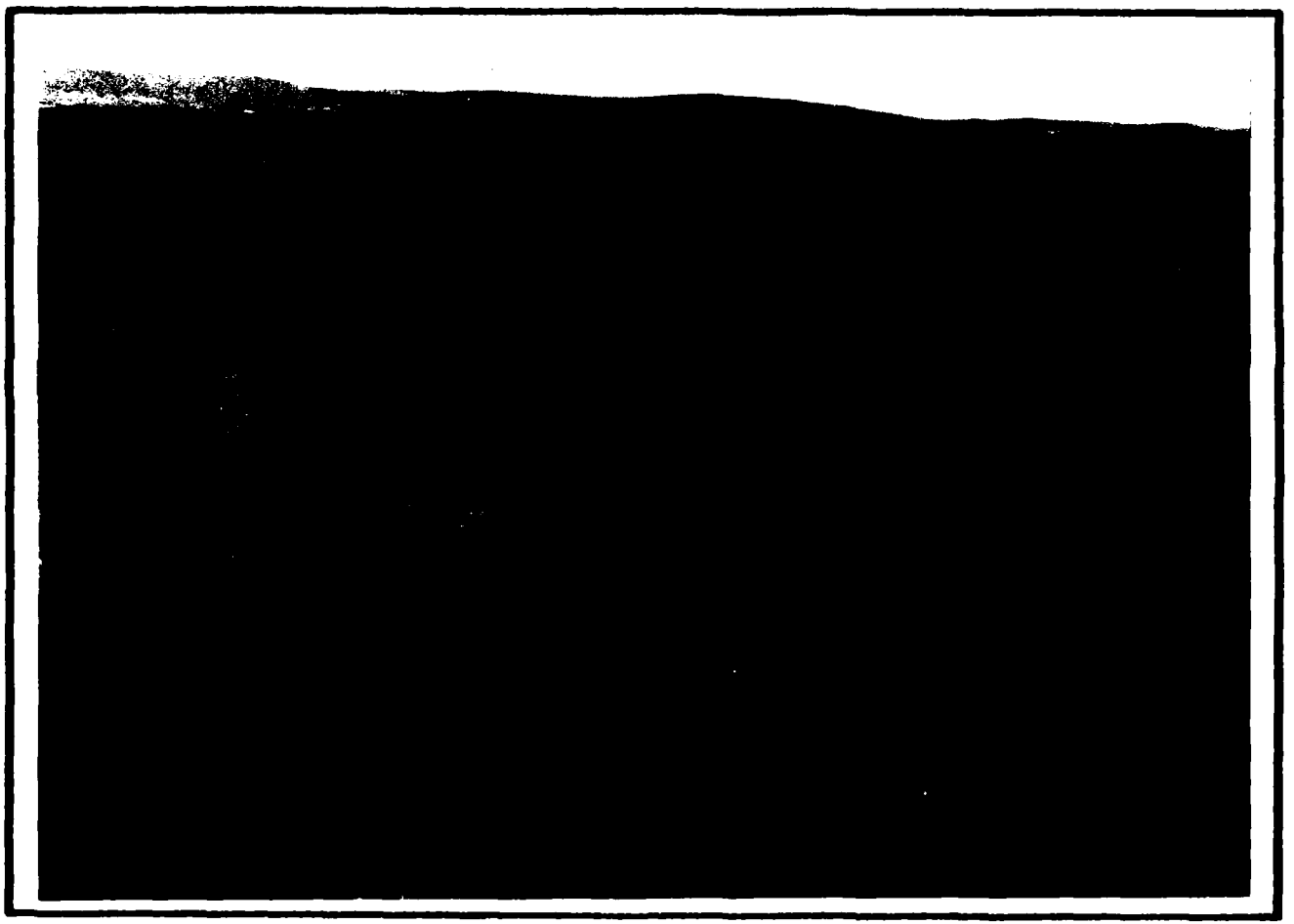
Date — R. Jeffrey Kimball, P.E.

APPROVED BY:

25 March 1980 — James W. Peck

Date — JAMES W. PECK
Colonel, Corps of Engineers
District Engineer





Overview of Raven Run Dam No. 3. Raven Run Reservoir No. 2 (left) forms tailwater.

TABLE OF CONTENTS

APPENDICES

PHASE I
NATIONAL DAM INSPECTION PROGRAM
RAVEN RUN DAM NO. 3
NDI. I.D. NO. PA 656
DER I.D. NO. 54-8

SECTION 1
PROJECT INFORMATION

1.1 General.

a. Authority. The National Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

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

1.2 Description of Project.

a. Dam and Appurtenances. Raven Run Dam No. 3 is an earth and rockfill dam 1,080 feet long and 40 feet high. The crest width of the dam varies from 10 feet wide to 24 feet wide. The upstream slope above the water level is measured to be approximately 3H:1V and the downstream slope is 1.5H:1V. The embankment consists of a center puddle core constructed of selected impervious material with both upstream and downstream rockfill zones with the exposed surfaces hand placed. The clay puddle core was constructed from the original ground surface to the conglomerate rock for the entire length of the dam.

A secondary embankment (Right Arm) is located north of the main embankment. This embankment is 320 feet long and 7 feet high. The crest width is 8 feet. Both the upstream and downstream slopes are 2H:1V. The upstream slope is protected with riprap. The embankment is constructed of a selected material with a puddle cutoff wall extending from the original ground surface into the conglomerate rock.

The spillway is located on the main embankment 780 feet from the left abutment. The spillway is rectangular shaped with stone masonry retaining walls forming the sides. The weir length is 40 feet long. The spillway discharges into a gully created by erosion and eventually flows into Raven Run No. 2 Reservoir. Beneath the spillway is a stone masonry cutoff wall in the puddle trench.

A 16" cast iron pipe passes beneath the dam at approximately original ground surface. The pipe is supported on a dry laid wall extending down to the sandstone strata. In the reservoir the pipe passes through a vertical masonry cutoff wall near the upstream toe of the embankment. The entrance to the pipe is screened with a loosely laid dry masonry wall. No cutoff collars are constructed along the pipe. Below the dam the pipe passes through a 10' x 16' masonry gate structure housing a 16" x 6" tee. The main 16" pipe serves as a blow off for draining the reservoir. Water is ordinarily discharged into the No. 2 Reservoir through the 6" pipe.

b. Location. The dam is located on Lost Creek, two miles west of Shenandoah, Schuylkill County, Pennsylvania. Raven Run Dam No. 3 can be located on the Shenandoah, U.S.G.S. 7.5 minute quadrangle.

c. Size Classification. Raven Run Dam No. 3 is a small size structure (40 feet high, 278 acre-feet).

d. Hazard Classification. Raven Run Dam No. 3 is a high hazard dam. Downstream conditions indicate that loss of more than a few lives is probable should the structure fail. One thousand feet downstream of the dam is Raven Run Dam No. 2. Approximately 4,000 downstream Lost Creek flows under a railroad embankment and through a culvert. Ten dwellings are located immediately downstream of this culvert.

e. Ownership. Raven Run Dam No. 3 is owned by the Shenandoah Municipal Authority. Correspondence should be addressed to:

Charles Dallazia, Manager
Shenandoah Municipal Authority
26 West Lloyd Street
Shenandoah, PA 17976
717-462-1904

f. Purpose of Dam. Raven Run Dam No. 3 is used for water supply .

g. Design and Construction History. The dam was designed and construction was supervised by Heber S. Thompson, Engineer for the Girard Water Company. The dam was constructed in 1884 to 1885 by Thomas H. Rickert, a contractor located in Pottsville, Pennsylvania. The dam was originally built to impound the waters of Lost Creek, but the stream was first contaminated and finally destroyed by the mining operation of the Locust Mountain Coal Company. The Little Buck Mountain coal seam outcrops in the north arm of the reservoir and mining operations reached close to the water surface. A cave-in or crop fall occurred and water from the reservoir was lost to the mine at one point in time. In 1918 the right (north) arm embankment was constructed.

The height of the main embankment was increased by 2.5 feet in 1897.

h. Normal Operating Procedures. The north arm of the reservoir partially blocks flow into the reservoir. Water is pumped from the Ringtown reservoir into Raven Run No. 3 reservoir through a cast iron pipe. A small amount of water is drawn off the No. 3 reservoir to a small village. Excess water flows into Raven Run No. 2 Reservoir through the 6" water supply line.

1.3 Pertinent Data.

a. Drainage Area. 0.70 square miles

b. Discharge at Dam Site (cfs).

Maximum known flood at dam site	Unknown
Spillway capacity at top of dam	847
Reservoir drain	Unknown

c. Elevation (U.S.G.S. Datum) (feet). - Field survey based on assumed pool elevation of 1610.0' as shown on U.S.G.S. 7.5 minute quadrangle.

Top of dam - low point	1613.9
Top of dam - Original design height	1608.0
Maximum pool - (PMF)	1614.6
Normal pool	1610.3
Emergency spillway crest	1610.3
Streambed at centerline of dam	Approximately 1574
Maximum tailwater	1580.5
Toe of dam	Approximately 1574

d. Reservoir (feet).

Length of maximum pool (PMF)	2000
Length of normal pool	1100

e. Storage (acre-feet).

Normal pool	215
Top of dam	278

f. Reservoir Surface (acres).

Top of dam	16.8
Normal pool	14
Spillway crest	14

g. Dam.

Type	Earthfill
Length	1080'
Height	40'
Top width	10'-24'
Side slopes - upstream	3H:1V
- downstream	1.5H:1V
Zoning	Yes
Impervious core	Center section
Cutoff	Clay puddle cutoff
Grout curtain	None

h. Reservoir Drain.

Type	16" C.I. pipe
Length	Approximately 180'
Closure	Valve downstream toe
Access	Upstream toe (only)
Regulating facilities	Valve downstream toe

i. Spillway.

Type	Rectangular
Length	40'
Crest elevation	1610.3'
Upstream channel	Unrestricted (lake)
Downstream channel	Open channel (gully)

SECTION 2
ENGINEERING DATA

2.1 Design. Review of information in the files of the Commonwealth of Pennsylvania, Department of Environmental Resources revealed that several construction drawings were available for review. In addition, design summary reports, inspection reports, permit, photographs and correspondence were available for review. These data were reviewed for this study.

2.2 Construction. No information other than construction drawings were available on the original dam. Construction drawings and site visit reports are available on the construction of the North Arm. No other data were available on the construction.

2.3 Operation. No operating records are maintained.

2.4 Evaluation.

a. Availability. Engineering data were provided by PennDER, Bureau of Dams and Waterway Management. No engineering data were provided by the owner. A representative of the owner accompanied the inspection team to answer questions on operation and maintenance of the dam. The owner did not provide any information on past deep mining activities in the area of the dam and reservoir.

b. Adequacy. The type and amount of design data and other engineering information are sketchy. The Phase I Report is prepared based on observed conditions, review of the available data and hydrologic and hydraulic analysis.

SECTION 3
VISUAL INSPECTION

3.1 Findings.

a. General. The onsite inspection of Raven Run Dam No. 3 was conducted by personnel of L. Robert Kimball and Associates accompanied by a representative of the Shenandoah Municipal Authority on November 16, 1979. The inspection consisted of:

1. Visual inspection of the retaining structure, abutments and toe.
2. Examination of the spillway facilities, exposed portion of any outlet works and other appurtenant structures.
3. Observations affecting the runoff potential of the drainage basin.
4. Evaluation of the downstream area hazard potential.

b. Dam. The dam appears to be in fair condition. From a brief survey conducted during the inspection, it was noted that the elevation of the crest of the dam varies considerably (see page A-12). The upstream slope of the main embankment above the water level is measured to be 3H:1V. However, the construction drawings show the downstream slope to be 2H:1V. The downstream slope was measured to be 1.5H:1V. The crest width varied from 10 feet to 24 feet wide. A power line crosses the main embankment crest. Trees and brush are growing on both the upstream and downstream slopes and the crest. Some riprap is missing from the upstream slope. The laid rock on the downstream slope near the maximum section of the main embankment show some signs of movement. The toe shows some signs of bulging. Tailwater is present from the Raven Run No. 2 Reservoir and made examination of the toe below this tailwater impossible. Along the left abutment near the toe of the dam a seepage area was present. At the time of inspection less than 1 gallon per minute of flow was measured.

The right arm embankment has a crest width of 8 feet and the upstream and downstream slopes are 2H:1V. Considerable growth of trees and small brush is present on both slopes and the crest. Standing water was present along the toe of the embankment. This water appears to be trapped against the toe.

c. Appurtenant Structures. The water level at the time of inspection was just below the spillway crest (elevation 1610.0). The spillway appeared to be in good condition. Several of the masonry stones forming the sidewalls of the spillway need to be repaired.

The valve house at the toe of the main embankment is in a very deteriorated condition. The valves in the valve house are leaking and the condition of the valves is questionable. The reservoir drain contains no upstream shutoff.

d. Reservoir Area. The watershed is covered partially with timber land and strip mines. The reservoir slopes are gentle to moderate and are not susceptible to massive landslides which would effect the storage volume of the reservoir or overtopping of the dam by displacing water.

e. Downstream Channel. Immediately downstream of Raven Run Dam No. 3 is Raven Run Dam No. 2. Downstream of Raven Run Dam No. 2 Lost Creek is narrow and steep. Approximately 10 dwellings are located 4,000 feet downstream of Raven Run Dam No. 3.

3.2 Evaluation. In general, the embankment appeared to be in fair condition and the appurtenant structures in poor condition. The seepage area and apparent slow movement of the rock on the downstream slope are of concern and should be monitored at regular intervals. The spillway and reservoir drain should be repaired and maintained. An upstream shutoff should be provided on the drainline.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Procedures. Water is pumped from the Ringtown Reservoir into Raven Run Dam No. 3. A minor amount of water is drawn off the reservoir to a small village. The reservoir is maintained at the spillway crest. Water is drawn off the reservoir through the 16" and 6" lines into Raven Run Reservoir No. 2. Excess water is discharged through the spillway.

4.2 Maintenance of the Dam. No planned maintenance schedule exists. Maintenance of the dam is performed by the Municipal Authority staff. Maintenance of the dam is considered poor.

4.3 Maintenance of Operating Facilities. Maintenance of the valve house and valves has been severely lacking. No maintenance schedule exists. Maintenance of the operating facilities is considered poor.

4.4 Warning System in Effect. All reservoirs in the Shenandoah Municipal Authorities system are checked daily. However, there is no official system to warn downstream residents of large spillway discharges or imminent failure of the dam.

4.5 Evaluation. Maintenance of the dam and operating facilites is considered poor. There is no warning system in effect to warn downstream residents.

SECTION 5
HYDRAULICS AND HYDROLOGY

5.1 Evaluation of Features.

a. Design Data. No calculations or design data pertaining to hydrology were available.

b. Experience Data. No rainfall, runoff or reservoir level data were available. The spillway reportedly has functioned adequately in the past.

c. Visual Observations. The spillway appeared to be in fair condition but poorly maintained.

A low spot was noted on the dam embankment between the right abutment and the spillway wingwall. This area could easily be filled to the top of dam elevation.

d. Overtopping Potential. Overtopping potential was investigated through the development of the probable maximum flood (PMF) for the watershed and the subsequent routing of the PMF and fractions of the PMF through the reservoir and spillway.

The Corps of Engineers, Baltimore District, has directed that the HEC-1 Dam Safety Version systemized computer program be utilized. The program was prepared by the Hydrologic Engineering Center (HEC), U.S. Army Corps of Engineers, Davis, California, July, 1978. The major methodologies or key input data for this program are discussed briefly in Appendix D.

5.2 Evaluation Assumptions. To enable us to complete the hydraulic and hydrologic analysis for this structure, it was necessary to make the following assumptions.

1. The potential for runoff losses into mine openings was not considered.

2. The right arm of the embankment, which was constructed in 1917 to reduce storage losses into a mine cave, was not considered in our analyses. Its effects on inflow and storage would require a detailed investigation beyond the scope of this report.

5.3 Summary of Overtopping Analysis. Complete summary sheets for the computer output are presented in Appendix D.

Peak inflow (PMF)	1502 cfs
Spillway capacity	847 cfs

a. Spillway Adequacy Rating. The Spillway Design Flood (SDF) for this dam is the PMF. The SDF is based on the hazard and size classification of the dam. Based on the following definition provided by the Corps of Engineers, the spillway is rated as inadequate as a result of our hydrologic analysis.

> Inadequate - For all high hazard dams which do not safely pass the SDF (PMF).

The spillway and reservoir are capable of controlling approximately 58% of the PMF without overtopping the embankment at elevation 1613.9 (low spot). A computer printout of the hydrology is included in Appendix D.

5.4 Summary of Dam Breach Analysis. As the subject dam can satisfactorily pass 50% of the PMF without failure (based on our analysis) it was not necessary to perform a breach analysis and downstream routing of the flood wave.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations. The rockfill on the downstream slope of the main embankment showed some evidence of minor movement. The downstream slope of the dam is very steep (1.5H:1V). In addition, a bulge appeared to be present near the toe of the dam. Some slow movement of the downstream slope was in evidence from the bending of trees. The downstream below the tailwater could not be examined because of the tailwater condition. Seepage was present on the right abutment near the toe of dam. This seepage was measured to be less than 1 gallon per minute.

b. Design and Construction Data. No stability analyses were conducted for the design of this dam. No other design or construction data are available on the structural stability of the dam.

c. Operating Records. No operating records are maintained.

d. Post Construction Changes. In 1897 the main embankment was raised 2 1/2 feet. No information is available on this modification. In 1918 the north arm embankment was constructed to eliminate loss of water into mine workings.

e. Seismic Stability. The dam is located in seismic zone 1. No seismic stability analyses has been performed. Normally, it can be considered that if a dam in this zone is stable under static loading conditions, it can be assumed safe for any expected earthquake loading.

SECTION 7
ASSESSMENT AND RECOMMENDATIONS/REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety. The dam appears to be in fair condition. Considerable maintenance needs to be conducted on the dam and appurtenant structures. The seepage and evidence of slope movement needs to be monitored. The spillway is capable of controlling only 58% of the PMF without overtopping the earth embankment. According to the Corps of Engineers definitions the spillway is considered inadequate. The spillway capacity should be increased. No adequate stability analyses have been performed for this structure. A stability analysis of the dam should be conducted because of the apparent slope movement, steep downsream slope, tailwater condition and seepage.

b. Adequacy of Information. Sufficient information is available to complete a Phase I Report.

c. Urgency. The recommendations suggested below should be implemented immediately.

d. Necessity for Further Investigation. In order to accomplish some of the recommendations/remedial measures outlined below, further investigations will be required.

7.2 Recommendations/Remedial Measures.

1. A detailed hydraulic and hydrologic study should be conducted by a professional engineer knowledgeable in dam design to increase spillway capacity. Studies and corrective measures should be implemented to increase spillway capacity.

2. A stability analysis should be performed by a registered professional engineer knowledgeable in dam design and construction.

3. A mine subisdence investigation should be performed by the owner or his engineer to determine the effects of present and past deep mining.

4. Seepage areas should be monitored on a regular basis and after periods of heavy precipitation for quantity and turbidity.

5. All brush and trees should be removed from the slopes and crest.

6. The valves and the valve house should be repaired.

7. Some means of positive closure on the upstream end of the drainline should be developed in case of emergencies.

8. During periods of low water level in Raven Run Reservoir No. 2 the toe of Raven Run Dam No. 3 should be inspected.

9. All valves should be exercised at regular intervals.

10. A formal safety inspection program should be conducted in accordancane with provisions stipulated by the Commonwealth of Pennsylvania regarding inspection of dams.

11. A warning system should be installed to warn downstream residents of high water levels or imminent failure of the dam.

APPENDIX A
CHECKLIST, VISUAL INSPECTION, PHASE I

CHECK LIST
VISUAL INSPECTION
PHASE I

NAME OF DAM Raven Run Dam No. 3 COUNTY Schuylkill STATE Pennsylvania ID# PA 656

TYPE OF DAM Earth and rock fill HAZARD CATEGORY High

DATE(s) INSPECTION Nov. 6 and 16, 1979 WEATHER Cloudy and warm TEMPERATURE 50°

POOL ELEVATION AT TIME OF INSPECTION 1610.0 M.S.L. TAILWATER AT TIME OF INSPECTION 1580.5 M.S.L.

INSPECTION PERSONNEL:

R. Jeffrey Kimball, P.E. - L. Robert Kimball and Associates

James T. Hockensmith - L. Robert Kimball and Associates

O.T. McConnell - L. Robert Kimball and Associates

James T. Hockensmith RECORDER

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None noted.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	The laid rock on the downstream slope appears to be slowly moving downslope. A slight buldge appeared to be present at the toe of the dam.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	None.	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Several turns were constructed in the main embankment. The vertical alignment varies considerably - see page A-12.	
RIPRAP FAILURES	Additional riprap needs to be placed on portions of the upstream slope.	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
VEGETATION	Considerable vegetation on both upstream and downstream slopes and the crest.	
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Appears to be good.	
ANY NOTICEABLE SEEPAGE	Seepage located at the toe of dam near the left abutment. This seepage was measured to be less than 1 gallon per minute. A ponded area of water is present at the toe of the right arm embankment.	
STAFF GAUGE AND RECORDER	None.	
DRAINS	None.	

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE	Not applicable.	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	Not applicable.	
DRAINS	Not applicable.	
WATER PASSAGES	Not applicable.	
FOUNDATION	Not applicable.	

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	Not applicable.	
STRUCTURAL CRACKING	Not applicable.	
VERTICAL AND HORIZONTAL ALIGNMENT	Not applicable.	
MONOLITH JOINTS	Not applicable.	
CONSTRUCTION JOINTS	Not applicable.	
STAFF GAUGE OR RECORDER	Not applicable.	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	The valves located in the valve house at the toe of dam are leaking.	
INTAKE STRUCTURE	Unobservable.	
OUTLET STRUCTURE	Valve house in a severely deteriorated condition. Valves are leaking.	
OUTLET CHANNEL	None.	
EMERGENCY GATE	The drainline does not contain an upstream shutoff.	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	The weir is in fair condition, constructed of masonry block.	
APPROACH CHANNEL	Lake.	
DISCHARGE CHANNEL	Spillway discharges into a gully which eventually discharges into Raven Run Reservoir No. 2.	
BRIDGE AND PIERS	None.	

GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	Not applicable.	
APPROACH CHANNEL	Not applicable.	
DISCHARGE CHANNEL	Not applicable.	
BRIDGE AND PIERS	Not applicable.	
GATES AND OPERATION EQUIPMENT	Not applicable.	

DOWNSTREAM CHANNEL

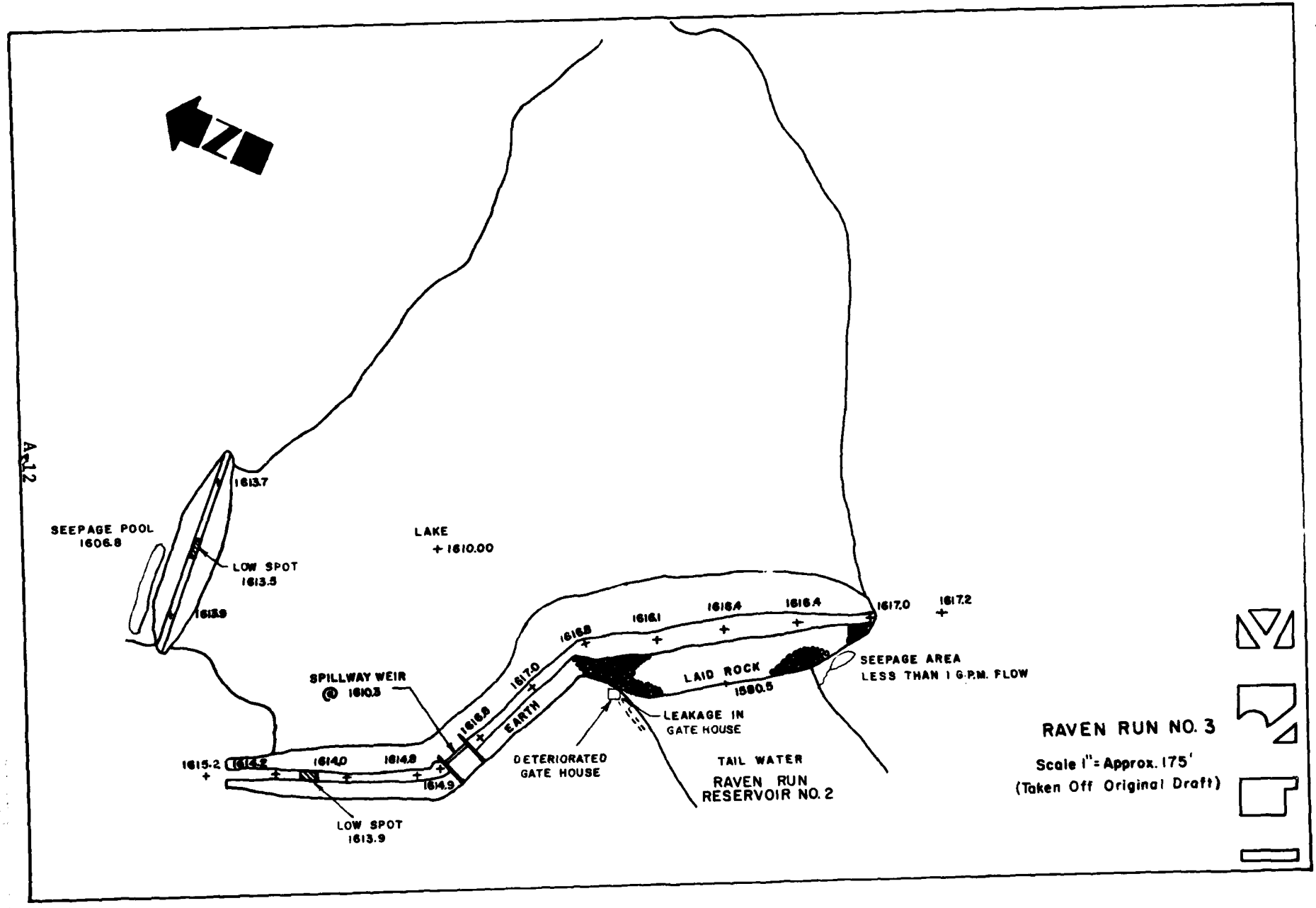
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Raven Run Dam No. 2 immediately downstream. Lost Creek downstream of Raven Run Dam No. 2 is narrow and steep.	
SLOPES	Appear to be stable.	
APPROXIMATE NO. OF HOMES AND POPULATION	Approximately 10 homes, 50 people, within 4,000 feet of the dam.	

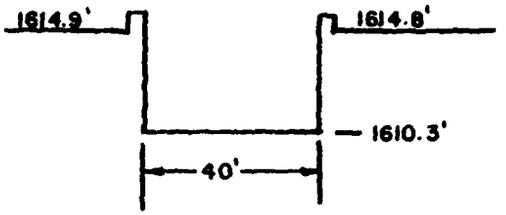
RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Gentle to moderate.	
SEDIMENTATION	Does not appear to be excessive.	

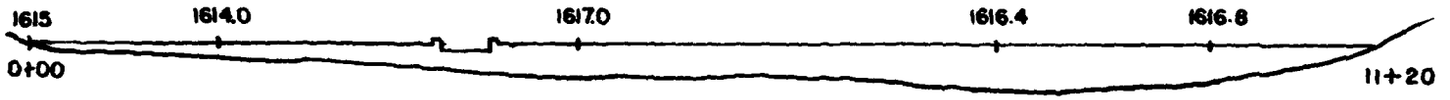
INSTRUMENTATION

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


N
1613.7
SEEPAGE POOL
1606.8
LOW SPOT
1613.5
1613.9
LAKE
+ 1610.00
1616.8
1616.1
1616.4
1616.4
1617.0
1617.2
SPILLWAY WEIR
@ 1610.3
1617.0
1616.8
EARTH
LAID ROCK
1580.5
SEEPAGE AREA
LESS THAN 1 G.P.M. FLOW
LEAKAGE IN
GATE HOUSE
1615.2
1614.2
1614.0
1614.8
1614.9
DETERIORATED
GATE HOUSE
TAIL WATER
RAVEN RUN
RESERVOIR NO. 2
LOW SPOT
1613.9
RAVEN RUN NO. 3
Scale 1" = Approx. 175'
(Taken Off Original Draft)



SPILLWAY PROFILE
(Not to Scale)



PROFILE
LOOKING UPSTREAM

RAVEN RUN NO. 3
Scale 1"=150'

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

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM Raven Run Dam No. 3

ID# 656

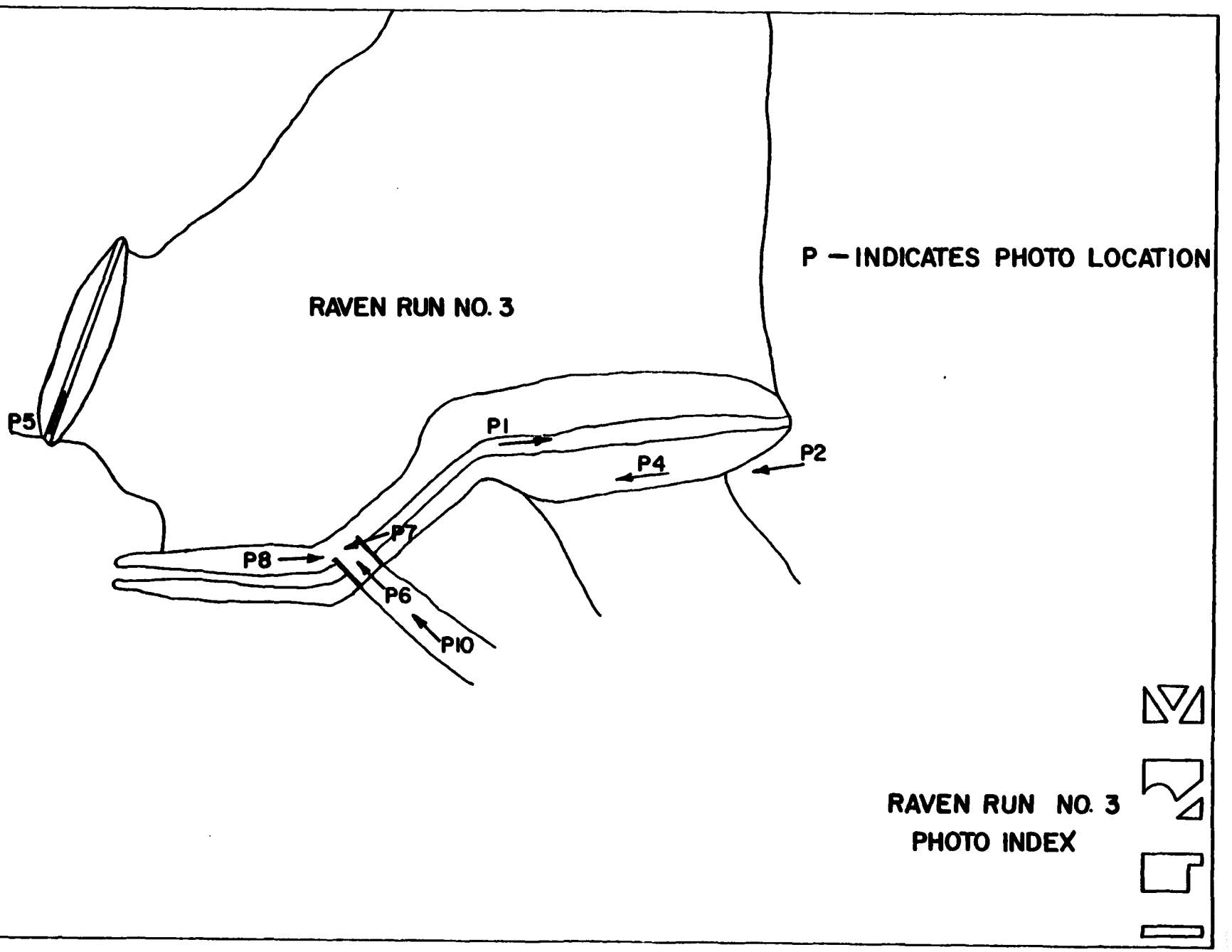
ITEM	REMARKS
AS-BUILT DRAWINGS	One drawing made in 1919. Regional vicinity map U.S.G.S. quadrangle.
REGIONAL VICINITY MAP	DER files.
CONSTRUCTION HISTORY	DER files.
TYPICAL SECTIONS OF DAM	Construction drawings in DER files.
OUTLETS - PLAN - DETAILS - CONSTRAINTS - DISCHARGE RATINGS RAINFALL/RESERVOIR RECORDS	Construction drawings DER files DER files DER files None.

ITEM	REMARKS
DESIGN REPORTS	None.
GEOLOGY REPORTS	None.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	Unknown.
POST-CONSTRUCTION SURVEYS OF DAM	Unknown.
BORROW SOURCES	Unknown.

ITEM	REMARKS
MONITORING SYSTEMS	None.
MODIFICATIONS	Dam raised in 1897 by 2 1/2 feet. Right arm constructed in 1918.
HIGH POOL RECORDS	None.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	Unknown.
MAINTENANCE OPERATION RECORDS	None.

ITEM	REMARKS
SPILLWAY PLAN SECTIONS DETAILS	DER files.
OPERATING EQUIPMENT PLANS & DETAILS	None.

APPENDIX C
PHOTOGRAPHS


P – INDICATES PHOTO LOCATION
RAVEN RUN NO. 3
P5
P1
P2
P4
P7
P8
P6
P10
RAVEN RUN NO. 3
PHOTO INDEX

RAVEN RUN DAM NO. 3

Photograph Descriptions

Sheet 1. Front

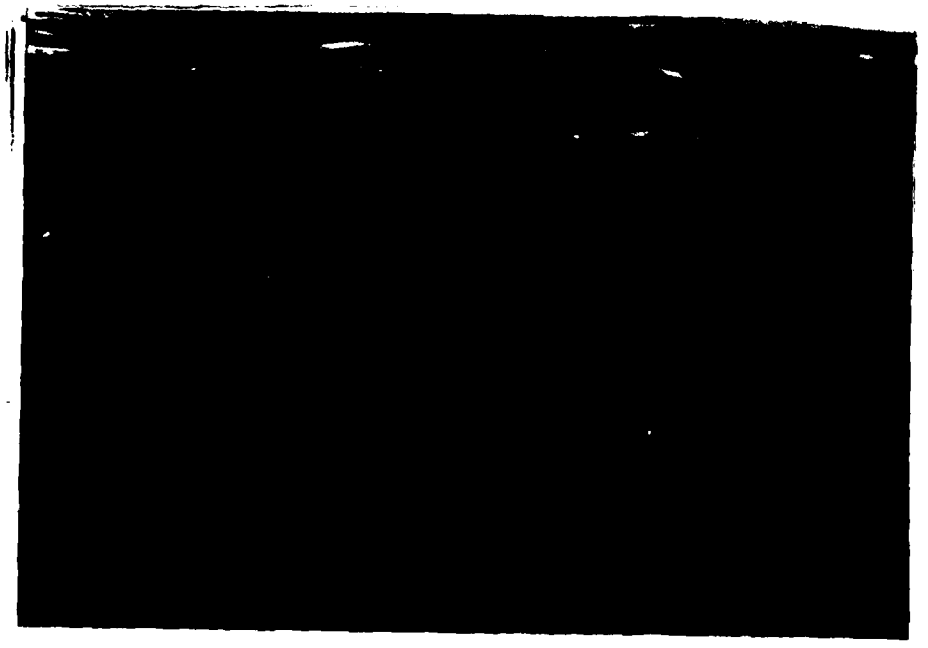
(1) Upper left - Crest of main embankment.
(2) Upper right - Downstream slope view from left abutment.
(3) Lower left - View of Raen Run Dam No. 2 and Raven Run Dam No. 3.
(4) Lower right - Downstream slope at maximum section. Note deteriorated valve house at toe.

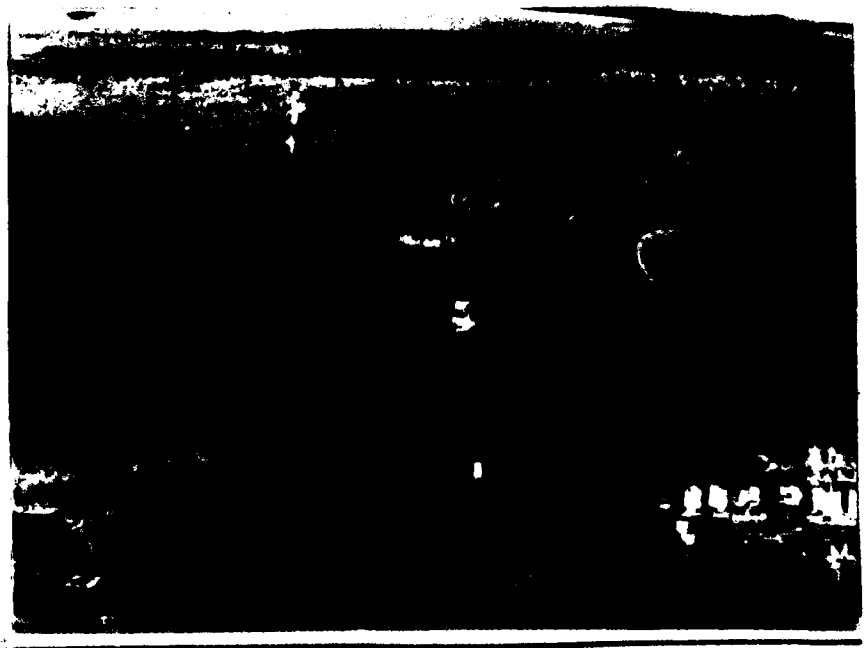
Sheet 1. Back

(5) Upper left - Upstream slope and crest of right arm embankment.
(6) Upper right - Spillway.
(7) Lower left - Upstream slope of dam to the right of the spillway.
(8) Lower right - Spillway weir.

Sheet 2. Front

(9) Upper right - Downstream exposure below Raven Run Dam No. 2. Dams in upper right corner.
(10) Lower right - Vegetation in spillway discharge channel looking towards weir.





APPENDIX D
HYDROLOGY AND HYDRAULICS

APPENDIX D
HYDROLOGY AND HYDRAULICS

Methodology. The dam overtopping and breach analyses were accomplished using the systemized computer program HEC-1 (Dam Safety Investigation), September, 1978, prepared by the Hydrologic Engineering Center, U.S. Army Corps of Engineers, Davis, California. A brief description of the methodology used in the analysis is presented below.

1. Precipitation. The Probable Maximum Precipitation (PMP) is derived and determined from regional charts prepared from past rainfall records including "Hydrometeorological Report No. 40" prepared by the U.S. Weather Bureau.

The index rainfall is reduced from 10% to 20% depending on watershed size by utilization of what is termed the HOP Brook adjustment factor. Distribution of the total rainfall is made by the computer program using distribution methods developed by the Corps.

2. Inflow Hydrograph. The hydrologic analysis used in development of the overtopping potential is based on applying a hypothetical storm to a unit hydrograph to obtain the inflow hydrograph for reservoir routing.

The unit hydrograph is developed using the Snyder method. This method requires calculation of several key parameters. The following list gives these parameters their definition and how they were obtained for these analysis.

Parameter	Definition	Where Obtained
Ct	Coefficient representing variations of watershed	From Corps of Engineers*
L	Length of main stream channel miles	From U.S.G.S. 7.5 minute topgraphic
Lca	Length on main stream to centroid of watershed	From U.S.G.S. 7.5 minute topographic
Cp	Peaking coefficient	From Corps of Engineers*
A	Watershed size	From U.S.G.S. 7.5 minute topographic

*Developed by the Corps of Engineers on a regional basis for Pennsylvania.

3. Routing. Reservoir routing is accomplished by using Modified Plus routing techniques where the flood hydrograph is routed through reservoir storage. Hydraulic capacities of the outlet works, spillways and the crest of the dam are used as outlet controls in the routing.

The hydraulic capacity of the outlet works can either be calculated and input or sufficient dimensions input and the program will calculate an elevation discharge relationship.

Storage in the pool area is defined by an area - elevation relationship from which the computer calculates storage. Surface areas are either planimetered from available mapping or U.S.G.S. 7.5 minute series topographic maps or taken from reasonably accurate design data.

4. Dam Overtopping. Using given percentages of the PMF the computer program will calculate the percentage of the PMF which can be controlled by the reservoir and spillway without the dam overtopping.

5. Dam Breach and Downstream Routing. The computer program is equipped to determine the increase in downstream flooding due to failure of the dam caused by overtopping. This is accomplished by routing both the pre-failure peak flow and the peak flow through the breach (calculated by the computer with given input assumptions) at a given point in time and determining the water depth in the downstream channel. Channel cross-sections taken from U.S.G.S. 7.5 minute topographic maps were used in the downstream flood wave routing. Pre and post failure water depths are calculated at locations where cross-sections are input.

HYDROLOGY AND HYDRAULICS ANALYSIS
DATA BASE

NAME OF DAM: Raven Run Dam No. 3

PROBABLE MAXIMUM PRECIPITATION (PMP) = 22.2 (1.005) = 22.3"

STATION	1	2	3
Station Description	Raven Run No. 3		
Drainage Area (square miles)	0.7		
Cumulative Drainage Area (square miles)	0.7		
Adjustment of PMF for Drainage Area (%)(1)			
6 hours	117		
12 hours	127		
24 hours	136		
48 hours	143		
72 hours	145		
Snyder Hydrograph Parameters			
Zone (2)	13		
Cp (3)	0.50		
Ct (3)	1.85		
L (miles) (4)	1.9		
Lca (miles) (4)	0.95		
tp = Ct(LxLca) 0.3 hrs.	2.21		
Spillway Data			
Crest Length (ft)	40		
Freeboard (ft)	3.60		
Discharge Coefficient	3.1		
Exponent	1.5		

(1) Hydrometeorological Report 40 (Figure 1), U.S. Army Corps of Engineers, 1965.

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

(3) Snyder's Coefficients.

(4) L=Length of longest water course from outlet to basin divide. L_{ca}=Length of water course from outlet to point opposite the centroid of drainage area.

CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: D.A.=0.7 mi^2 Wooded, Large Strip Area

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 215 Ac.ft.

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): 278 ac.ft.

ELEVATION MAXIMUM DESIGN POOL: Unknown

ELEVATION TOP DAM: 1613.9 feet

SPILLWAY CREST:

a. Elevation 1610.3 feet
b. Type Rectangular
c. Width 40 feet
d. Length Unknown
e. Location Spillover Right abutment
f. Number and Type of Gates None

OUTLET WORKS:

a. Type 16" CIP
b. Location Through maximum section
c. Entrance inverts Unknown
d. Exit inverts Unknown
e. Emergency draindown facilities 16" CIP

HYDROMETEOROLOGICAL GAUGES:

a. Type None
b. Location None
c. Records None

MAXIMUM NON-DAMAGING DISCHARGE: Unknown

L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
EBENSBURG PENNSYLVANIA

DAM NAME RAVEN RUN No. 3
I.D. NUMBER 54-8
SHEET NO. 1 OF 2
BY OTM DATE 1-25-80

LOSS RATE AND BASE FLOW PARAMETERS

AS RECOMMENDED BY CORPS OF ENGINEERS, BALTIMORE DISTRICT.

STRTL = 1 INCH
CNSTL = 0.05 IN/HR
STRTQ = 1.5 cfs/mi²
QRCSN = 0.05 (5% OF PEAK FLOW)
RTIOR = 2.0

ELEVATION - AREA - CAPACITY RELATIONSHIPS

FROM U.S.G.S. 7.5-MIN. QUAD., DER FILES AND FIELD INSPECTION DATA.

AT SPILLWAY CREST ELEV. = 1610.3'
INITIAL STORAGE = 215 AC.FT
POND SURFACE AREA = 14 Ac.

AT ELEV. 1620', AREA = 37 AC.

FROM CONIC METHOD FOR RESERVOIR VOLUME. FLOOD HYDROGRAPH PACKAGE (HEC-1), DAM SAFETY VERSION (USERS MANUAL).

$H = 3V/A$
$= 3(215)/14$
$= 645/14$
$= 46.07'$

ELEVATION WHERE AREA EQUALS ZERO;

$1610.3' - 46.07' = 1564.2'$

AREA	#A	0	14	37
ELEV	#E	1564.2	1610.3	1620

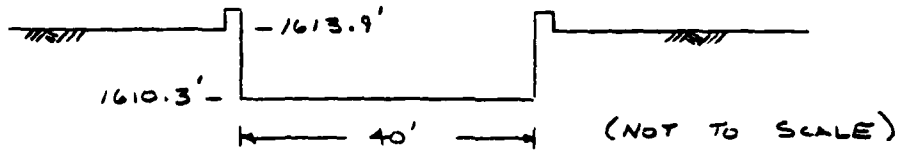
L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
EBENSBURG PENNSYLVANIA

DAM NAME RAVEN RUN No. 3
I.D. NUMBER 54-8
SHEET NO. 2 OF 2
BY OTM DATE 1-25-80

DISCHARGE RATING CURVE

DETERMINED BY (HEC-1).

SPILLWAY CREST ELEV. = 1610.3'
WEIR LENGTH = 40'
COEFFICIENT OF DISCHARGE (c) = 3.1



OVERTOP PARAMETERS

TOP OF DAM ELEV. (LOW SPOT) = 1613.9'
LENGTH OF DAM (EXCLUDING SPILLWAY) = 1080'
COEFFICIENT OF DISCHARGE (c) = 3.0 (BROAD CREST)
#L MAX. = 1080'
#V MAX. = 1617'

```
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION:  JULY 1978
LAST MODIFICATION  26 FEB 79
```

```
    1     A1       ANALYSIS OF DAM OVERTOPPING USING RATIOS OF PMF
    2     A2       HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF RAVEN RUN NO. 3
    3     A3       RATIOS OF PMF ROUTED THROUGH THE RESERVOIR  PA. 54-8
    4     B   .288      0      15       0       0       0       0       0       0       0
    5     B1    5
    6     J     1       4       1
    7     J1   .5      .7      .9       1
    8     K     0       1                                       1
    9     K1       INFLOW TO RESERVOIR
   10     M     1       1     0.7                                                       1
   11     P           22.3     117     127     136     143     145
   12     T                                                   1.0    0.05
   13     W  2.71    0.50
   14     X  -1.5    -.05     2.0
   15     K     1       2                                       1
   16     K1       ROUTE THRU RESERVOIR
   17     Y                                       1       1
   18     Y1    1       -                                          -1610.3
   19     SA    0      14      37
   20     SP1584.2  1610.3  1620
   21     SS1610.3      40     3.1     1.2
   22     SD1613.9     3.0     1.5    1080
   23     SL   10     200     350     660    1080
   24     SV1613.9    1614    1615    1616    1617
   25     K    99
```

FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
EASY MODIFICATION 26 FEB 79

RUN DATE= 80/02/25.
TIME= 06.09.21.

ANALYSIS OF DAM OVERTOPPING USING RATIOS OF PMF
HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF RAVEN RUN NO. 3
RATIOS OF PMF ROUTED THROUGH THE RESERVOIR PA. 54-8

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= 4 LRTIO= 1

RTIOS= .50 .70 .90 1.00

SUB-AREA RUNOFF COMPUTATION

INFLOW TO RESERVOIR

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

HYDROGRAPH DATA

JHYDG	JUNG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	.70	0.00	.70	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	22.30	117.00	127.00	136.00	143.00	145.00	0.00

TRSPC 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= 2.21 CP= .50 NTA= 0

RECESSION DATA

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

APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC= 9.49 AND R=12.07 INTERVALS

UNIT HYDROGRAPH 69 END-OF-PERIOD ORDINATES, LAG= 2.23 HOURS, CP= .50 VOL= 1.00

		27.	43.	60.			59.				
96.	81.	80.	74.	68.	62.	57.					

HYDROGRAPH ROUTING

ROUTE THRU RESERVOIR

ISTAO	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	1	0	0	0	0	1	0	0

ROUTING DATA

CLOSS	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	[illegible]	0

SURFACE AREA=	0.	14.	37.
CAPACITY=	0.	215.	454.
ELEVATION=	[illegible]	1610.	1620.

CREL	SPWID	COOW	EXPW	ELEVL	COOL	CAREA	EXPL
1610.3	40.0	3.1	1.5	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COOD	EXPD	DAMWID
1613.9	3.0	1.5	10804

CREST LENGTH	10.	200.	450.	660.	1080.
AT OR BELOW ELEVATION	[illegible]	1614.0	1615.0	1616.0	1617.0

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

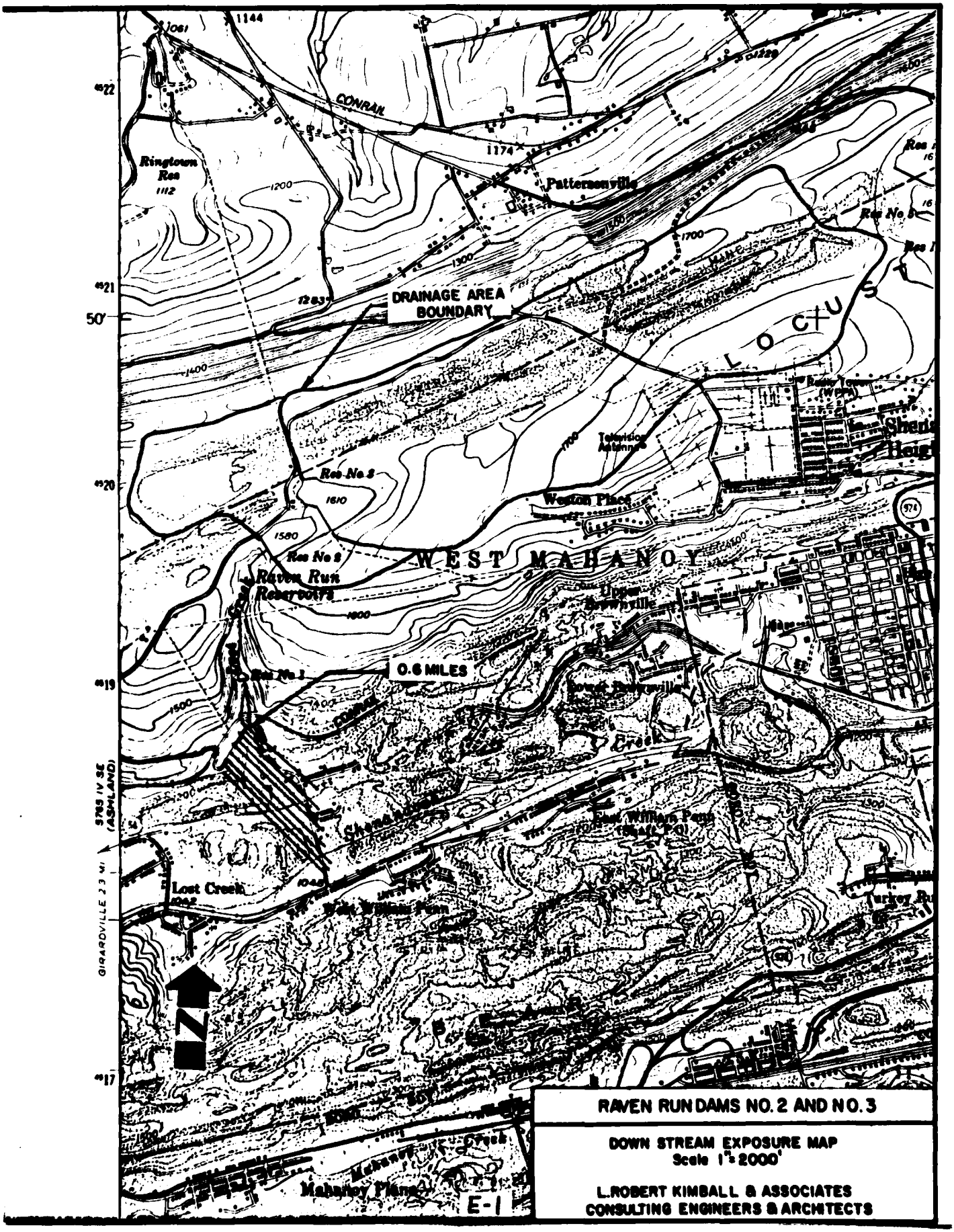
OPERATION	STATION	AREA	PLAN	RATIO 1 .50	RATIO 2 .70	RATIO 3 .90	RATIO 4 1.00
				RATIOS APPLIED TO FLOWS			
HYDROGRAPH AT	1	.70 (1.81)	1	751. (21.27)	1051. (29.77)	1352. (38.28)	1502. (42.53)
ROUTED TO	2	.70 (1.81)	1	701. (19.86)	1017. (28.79)	1338. (37.89)	1489. (42.17)

SUMMARY OF DAM SAFETY ANALYSIS

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1610.50	1610.50	1613.90
STORAGE	215.	215.	278.
OUTFLOW	0.	0.	847.

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	1613.47	0.00	269.	701.	0.00	42.75	0.00
.70	1614.18	.28	284.	1017.	2.25	42.50	0.00
[illegible]	1614.49	.59	291.	1338.	4.00	42.25	0.00
1.00	1614.61	.71	294.	1489.	4.50	42.25	0.00

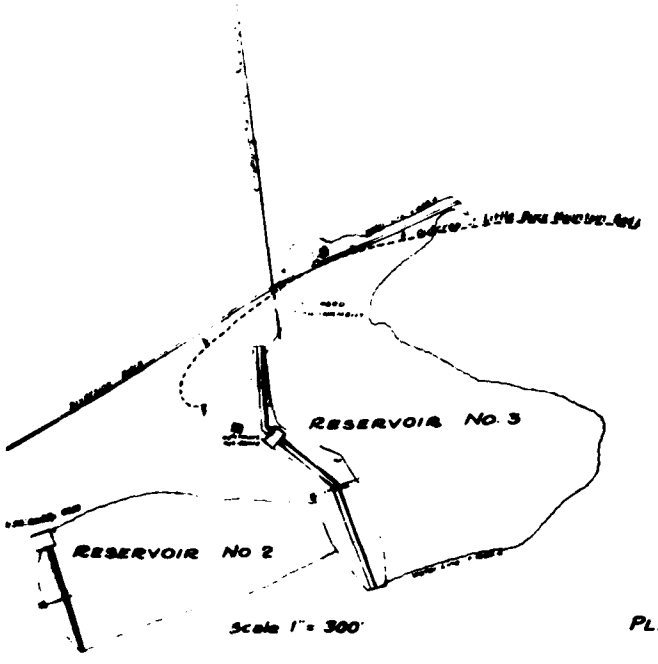
APPENDIX E
DRAWINGS



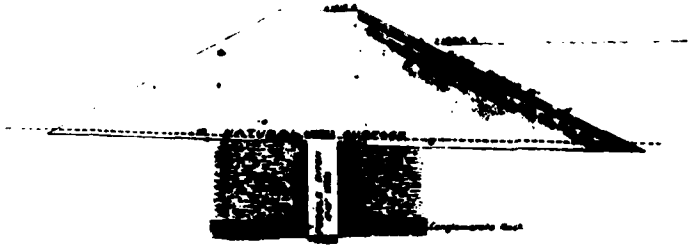
RAVEN RUN DAMS NO. 2 AND NO. 3

DOWN STREAM EXPOSURE MAP
Scale 1"=2000'

L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS

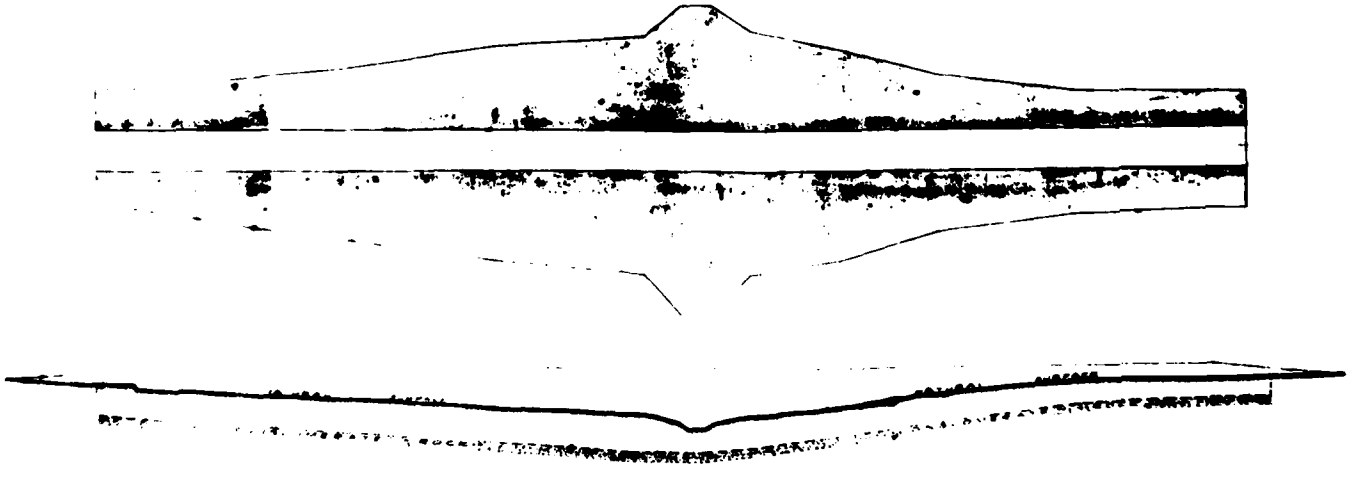


Scale 1" = 300'



Cross Section of Embankment
Scale 1" = 10'

Plan of Embankment
Scale 1" 20'

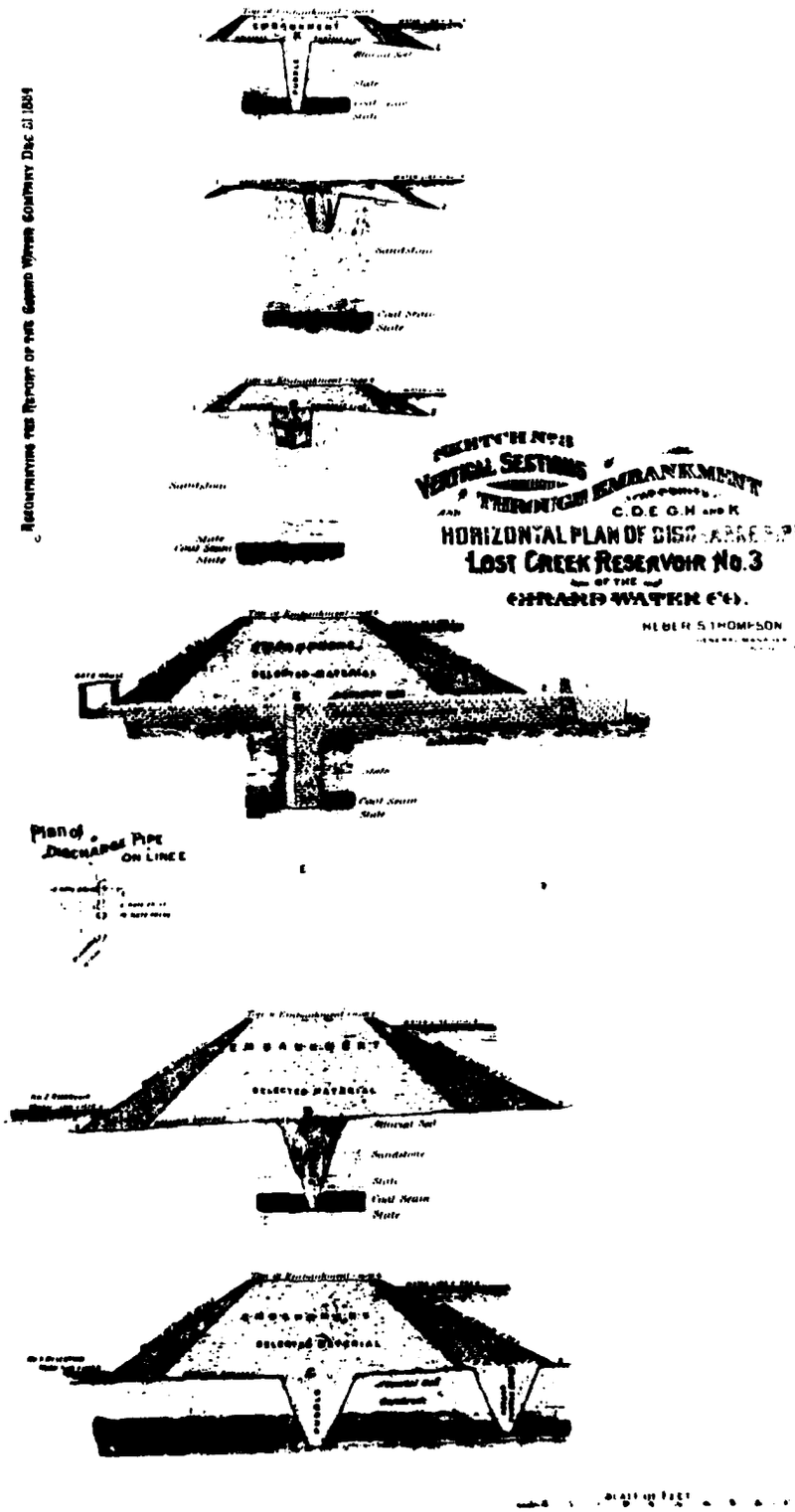


Longitudinal Section
Scale 1" = 20'

PLANS FOR EMBANKMENT
ACROSS NORTH ARM OF RESERVOIR No 3
THE GIRARD WATER COMPANY

Pottsville Pa July 14 1911 James Archbald

L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS


Plan of Discharge Pipe on Line E
C.D.E G.H and K
HORIZONTAL PLAN OF DISCHARGE PIPE
Lost Creek Reservoir No.3
HEBER S THOMPSON

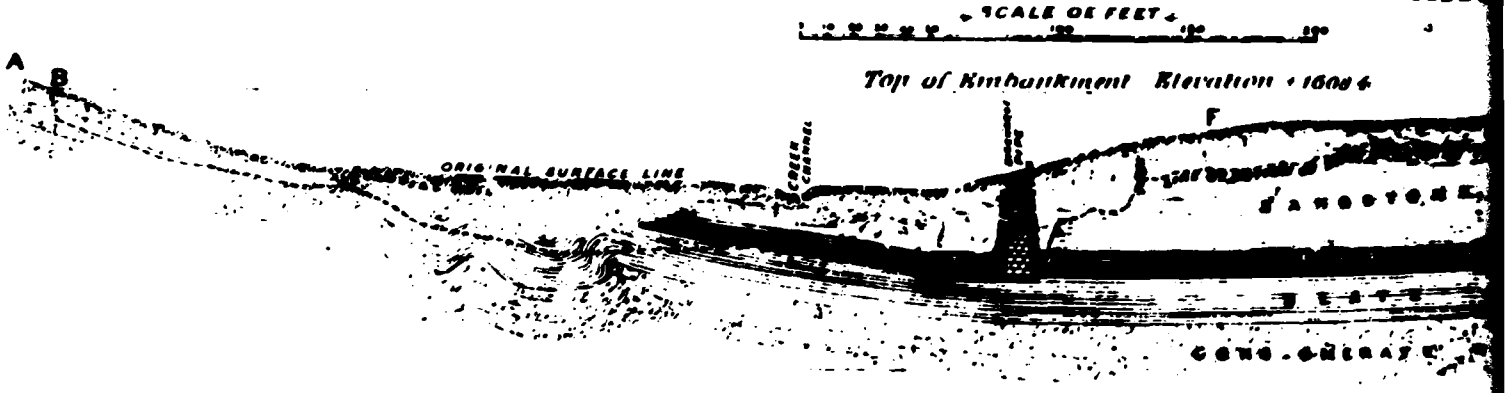
SKETCH No 2

VERTICAL SECTION

THROUGH C

LOST CREEK RESERVOIR N

GIR



Accompanying the Report of the Girard Water Company Dec 31 1884.

CENTRE LINE
OF
PUDDLE DITCH
No 3

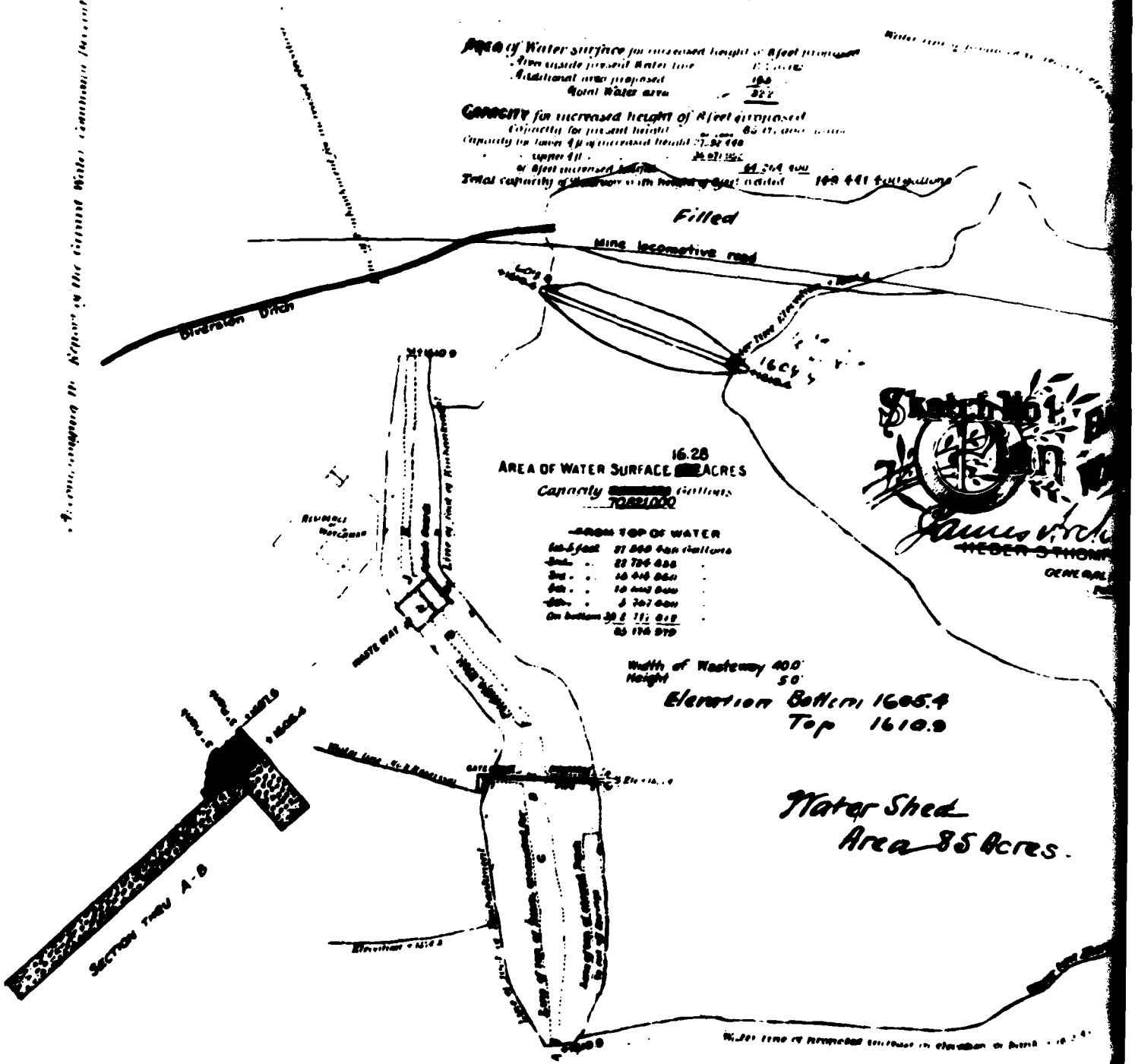
RARD WATER CO.

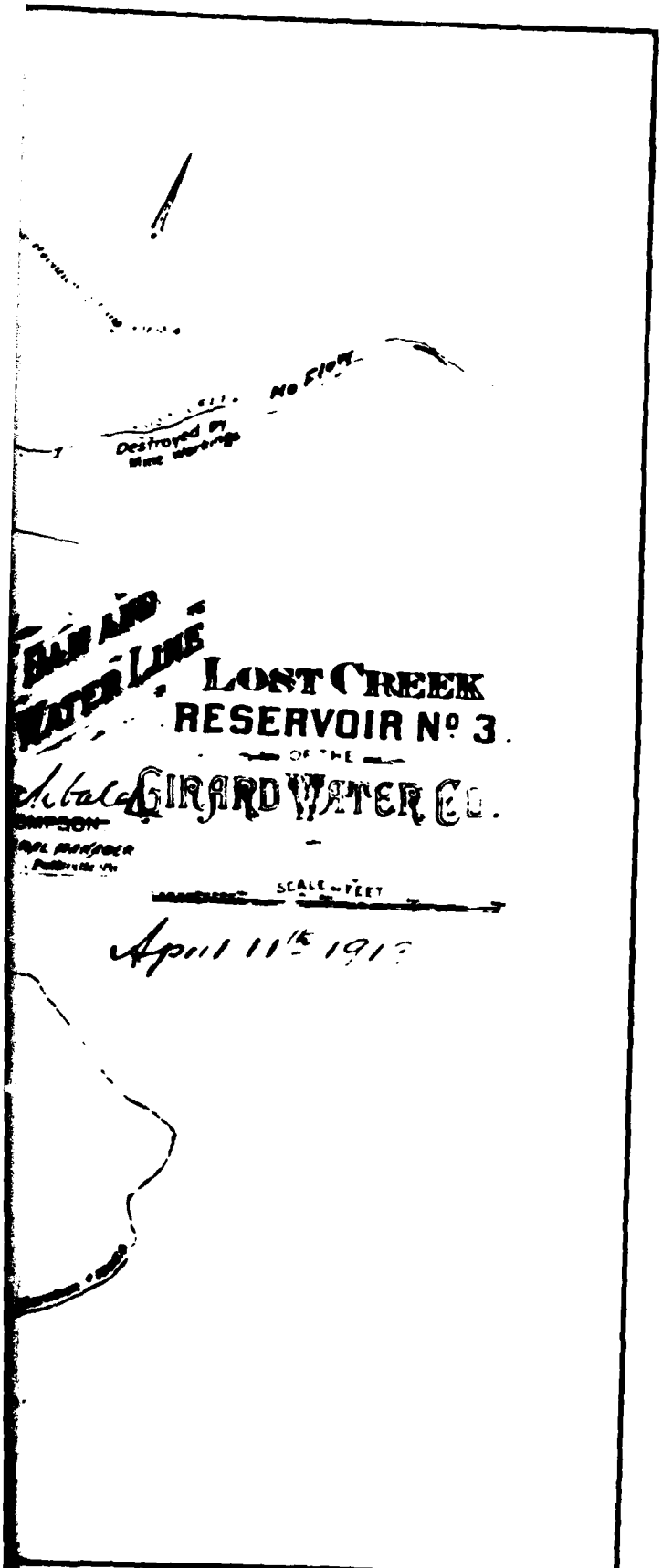
Datum line 1500 feet above mean tide

HEBER S THOMPSON.
GENERAL MANAGER

L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS

2


Filled
Mine locomotive road
Diversion Ditch
16.28
AREA OF WATER SURFACE ACRES
Capacity
70821000
FROM TOP OF WATER
Width of Waste way 400'
Height 50'
Elevation Bottom 1605.4
Top 1610.0
Water Shed
Area 85 Acres.
SECTION THRU A-B



L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS

APPENDIX F
GEOLOGY

Raven Run Dam No. 3 - General Geology

Raven Run Dam No. 3 is located in the Appalachian Mountain Section of the Valley and Ridge Physiographic Province. This province is typified by numerous synclinal and anticlinal features. Some minor faulting is indicated less than a mile to the south of the dam. The bedrock underlying the reservoir consists of the Pennsylvania aged Pottsville Group and Post-Pottsville formation.

The Pottsville Group consists of light to dark gray, fine grained to conglomeratic sandstone, with lesser amounts of shale, siltstone, coal and underclay. The bedding is generally well-developed with sandstones and siltstones often cross-bedded. Joints are usually regular and moderately well formed. The Post-Pottsville formation consists of light gray to brown, medium to coarse-grained interbedded sandstone and conglomerate. The bedding is moderately well developed while the joints are regular and moderately developed.

Both deep mining and surface mining of anthracite coal has taken place in the vicinity of this dam. The extent of any deep mining is unknown without extensive research.

GEOLOGIC MAP OF THE AREA SURROUNDING RAVEN RUN DAMS NO. 2 AND 3, KEHLY RUN DAMS NO. 3 AND 5, BRANDONVILLE PUMPING STATION RESERVOIR

Pottsville Group
Predominantly sandstones and conglomerates with thin shales and coals, some coals minable locally.

ANTHRACITE REGION

Ppp

Post-Pottsville Formations
Brown or gray sandstones and shales with some conglomerate and numerous minable coals

Pottsville Group
Light gray to white, coarse-grained sandstones and conglomerates with several minable coal beds. Sharp, Mammoth, Schuylkill, and Tumbling Run Formations

MISSISSIPPIAN

Mmc

Mauch Chunk Formation
Red shale with lenses of gray sandstone. Limestone in Fayette, Westmoreland, and Somerset Counties, Pennsylvania, at the base in southern New York.

F-2

SCALE 1:250,000