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NATIONAL DAM INSPECTION PROGRAM, KEPHART DAM (NDS ID NUMBER PA---ETC(U)
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SUSQUEHANNA RIVER BASIN
BLACK MOSHANNON CREEK, CENTRE COUNTY

PENNSYLVANIA

LEVEL

KEPHART DAM
NDS I.D. No. PA-00447
PENNDER I.D. No. 14-89

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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Contract No. DACW31-79-C-0013

PREPARED FOR

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

PREPARED BY

GAI CONSULTANTS, INC.
570 BEATTY ROAD
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MARCH 1979

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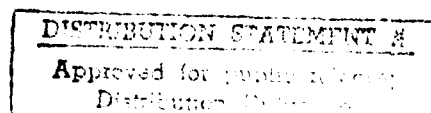
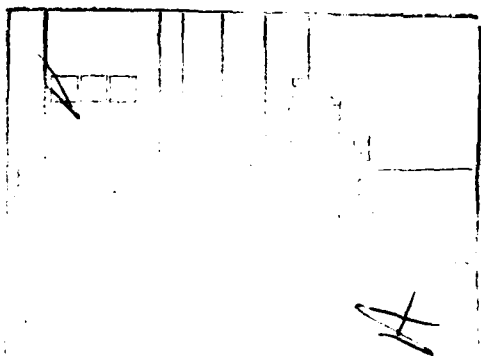
PREFACE

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.



PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

ABSTRACT

Kephart Dam: NDS I.D. No. PA-00447

Owner: Pennsylvania Department of Environmental Resources (PennDER)
State Located: Pennsylvania (PennDER I.D. No. 14-89)
County Located: Centre County
Stream: Black Moshannon Creek
Inspection Date(s): 13, 14 November 1978
Inspection Team: GAI Consultants, Inc.
570 Beatty Road
Monroeville, Pennsylvania 15146

Based on a visual inspection, past performance, and available engineering data, the facility is considered to be in good condition. The facility is capable of passing and/or storing the flow resulting from a flood of PMF intensity without overtopping, consequently, the spillway is considered adequate.

It is recommended that the owner:

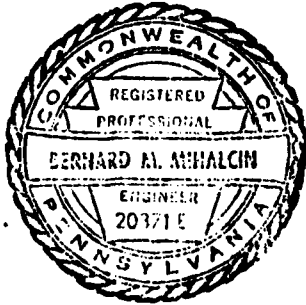
- (a) Have the embankment crest surveyed and infill any low spots to restore the embankment section to its design elevation (1874.0).
- (b) Extend the riprap protection to the top of the dam along the emergency spillway-embankment junction to provide slope protection in the event the emergency spillway should discharge at or near full capacity.
- (c) Develop a warning system to provide for the notification of temporary downstream residents should hazardous conditions develop.

GAI Consultants, Inc.

Approved by:

Bernard M. Mihalcin
Bernard M. Mihalcin, P.E.

G. R. Withers
G. R. WITHERS
Colonel, Corps of Engineers
District Engineer



15) DACW 31-79-C-0013
11 Mar 79
12 79

Date 16 March 79

Date 8 Apr 79

6) National Dam Inspection Program
Keppert Dam (NDI-ID# 11-0044)
Elm Creek (ID# 14-87) Susquehanna
River Basin Black Moshannon
Creek, Centre County, Pennsylvania.
Phase I Inspection Report.

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PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
KEPHART DAM
NDI# PA-447, PENNDR# 14-89

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. Kephart Dam is a combination earth and concrete structure approximately 350 feet in length with a maximum height of 20 feet. The facility has been constructed with a concrete, ogee-shaped weir section at the center flanked by earth embankment sections to either side. The concrete weir section has a 100-foot long crest and is designed to function as a service spillway. An emergency spillway is provided along the right (east) abutment and is partially comprised of the 40-foot wide bituminous surfaced park roadway. Lake drawdown is provided through a 48-inch square slide gate at the base of a concrete control tower located adjacent to the right service spillway wingwall.

b. Location. The dam is located just north of Route 504, about 7.2 miles east of Philipsburg in Rush Township, Centre County, Pennsylvania (see Figure 2, Appendix F). The dam and reservoir are contained within the Black Moshannon, Pennsylvania 7.5 minute U.S.G.S. topographic quadrangle (see Appendix G). The coordinates of the dam are N40° 55' 5" and W78° 3' 20".

c. Size Classification. Intermediate (20 feet high, greater than 1,000 acre-feet storage at maximum pool).

d. Hazard Classification. Significant (see Section 3.1.c.5).

e. Ownership. Samual R. Reed
Director of Bureau of Operations
Office of Resources Management
Pennsylvania Department of Environmental
Resources
P.O. Box 1467
Harrisburg, Pennsylvania 17120

f. Purpose of Dam. Recreation.

g. Historical Data. According to data contained in PennDER files, the existing Kephart Dam was constructed in 1974 replacing a deteriorated structure previously situated about 150 feet upstream whose origin dated back to 1926. The new facility was designed by Berger Associates of Harrisburg, Pennsylvania, and was constructed by the Bear Creek Construction Company of Landisville, Pennsylvania.

1.3 Pertinent Data.

a. Drainage Area. 15.4 square miles.

b. Discharge at Dam Site.

Maximum Known Flood at Dam Site - Not known.

Outlet Works Conduit at Operating Pool Elevation (1865) - Drawdown rating curve contained in Figure 3, Appendix F.

Ungated Service Spillway Capacity at Maximum Pool Elevation (1874) $\approx$ 10,670 cfs.

Ungated Emergency Spillway Capacity at Maximum Pool Elevation (1874) $\approx$ 2,020 cfs.

Combined Ungated Spillway Capacities at Maximum Pool (1874) $\approx$ 12,690 cfs.

c. Elevation (feet above mean sea level).

Top of Dam $\approx$ 1874 (design crest of embankment).

Maximum Pool Design Surcharge $\approx$ 1871.

Maximum Pool of Record - Not known.

Normal Pool $\approx$ 1865.

Upstream Portal Invert Outlet Conduit $\approx$ 1853.5.

Downstream Portal Invert Outlet Conduit $\approx$ 1853.5.

Streambed at Centerline of Dam $\approx$ 1853.

Maximum Tailwater - Not known.

d. Reservoir Length (miles).

Maximum Pool $\approx$ 3.4.

Normal Pool $\approx$ 2.3.

e. Reservoir Storage (acre-feet).

Service Spillway Crest $\approx$ 730 (elevation 1865).

Emergency Spillway Crest $\approx$ 3210 (elevation 1870).

Top of Dam $\approx$ 5830 (elevation 1874).

Design Surcharge $\approx$ 2055.

f. Reservoir Surface (acres).

Service Spillway Crest $\approx$ 235 (elevation 1865).

Emergency Spillway Crest $\approx$ 535 (elevation 1870).

Top of Dam $\approx$ 775 (elevation 1874).

Maximum Design Pool $\approx$ 595 (elevation 1871).

g. Dam.

Type - Earth and concrete.

Length of Embankment $\approx$ 350 feet (including emergency spillway section).

Height $\approx$ 20 feet.

Top Width $\approx$ 12.5 feet.

Side Slopes - upstream: 2H:1V
downstream: 2H:1V

Zoning (earth section) - None; homogeneous earth, rolled embankment with upstream rock riprap.

Impervious Core - None; homogeneous earth section.

Cutoff - A cutoff trench 3 feet deep and 8 feet wide (at the base) with 1H:1V side slopes was provided between Stations 1+36 and 2+05 and from Station 3+33 to 3+94 (see Figure 4, Appendix F).

Grout Curtain - None.

h. Outlet Conduits.

Type - 48-inch square sluice gate housed in the concrete control structure located at the right side of the concrete ogee spillway.

Access - Top of dam (see Figure 3).

Outlet Chamber - Reinforced concrete riser with a trash rack at the base of the upstream end and a sluice gate on the downstream end. The chamber also contains stop logs and a ladder (see Figure 7).

Regulating Facility - Crank operated floor stand hoist for the sluice gate.

i. Service Spillway.

Type - Ogee-crested, reinforced concrete weir (see Photograph 1 and Figure 6).

Crest Width $\approx$ 100 feet.

Crest Elevation $\approx$ 1865.

Stilling Basin $\approx$ 34 feet by 107 feet.

Upstream Channel - Not applicable.

Downstream Channel - Riprap-lined trapezoidal channel.

j. Emergency Spillway.

Type - Earth; partially comprised of a bituminous paved park roadway (see Figure 3).

Crest Width $\approx$ 40 feet (design); 60 feet (measured).

Crest Elevation $\approx$ 1870.

Stilling Basin - Not applicable.

Upstream Channel - Not applicable.

Downstream Channel - Earth with some trees (see Photograph 5).

k. Regulating Outlets. 48-inch square sluice gate operated from atop the concrete riser chamber.

SECTION 2 ENGINEERING DATA

2.1 Design.

a. Design Data Availability and Sources.

1. Hydrology and Hydraulics. Hydrologic and hydraulic design calculations are available from PennDER files. A reservoir drawdown curve is contained on the contract drawings (see Figure 3). A spillway rating curve and the reservoir drawdown curve are also contained in the Operation and Maintenance Manual for Kephart Dam.

2. Embankment. No calculations are available concerning the design of the earth embankment section. Subsurface details are provided on "as-built" drawings available in PennDER files (see Figure 5).

3. Appurtenant Structures. Detailed design data are available from PennDER files concerning the outlet works and concrete gravity spillway section. Calculations and reinforcing details for the spillway, spillway wingwalls, and stilling basin slab are also available.

b. Design Features.

1. Embankment. Contract drawings indicate that the dam is a concrete gravity spillway structure flanked by rolled earth embankments on each end. The side slopes are 2H:1V on each face with a crest width of 12.5 feet. The embankments contain a key trench 3 feet deep and 8 feet wide at their bases with 1H:1V side slopes (see Figure 4). Riprap (12 inches thick) is provided on the upstream face to elevation 1871.

2. Appurtenant Structures.

a) Spillways. The service spillway is a 100-foot wide concrete gravity structure with an ogee-shaped crest. A concrete apron is provided for a distance of approximately 30 feet below the crest. A riprap-lined channel extends 50 feet beyond the apron before emptying into the natural stream channel.

The emergency spillway is located on the right abutment of the dam. For design purposes, the 40-foot wide roadway was considered as a broad-crested weir with a crest elevation of 1869.5. The actual width of the emergency spillway

channel more closely approximates 60 feet, while the crest elevation was measured at 1870 feet. Riprap protects the right side of the dam from erosion by emergency spillway discharges as shown on Figures 3 and 4.

b) Outlet Works. The facility is provided with a 48-inch square sluice gate opening on the right side of the service spillway. Discharge through the outlet is controlled via a system of stop logs and a manually operated gate located atop the concrete chamber.

c. Design Data and Procedures.

1. Hydrology and Hydraulics. Procedures used by the design engineers included the development of a "C" curve hydrograph for the Kephart Dam watershed. The inflow hydrograph was developed based on 15.3 square miles of drainage area and peak runoff of 681 cfs per square mile. Using the 100-foot wide service spillway and a 40-foot wide emergency spillway, an outflow hydrograph with a peak of 5800 cfs was developed. When storage was considered, this resulted in a maximum pool level of 1870.9 feet. Three feet of freeboard was provided above the design pool and the top of the dam was established at 1874.0 feet.

2. Embankment. No information relative to design data and/or procedures were available.

3. Appurtenant Structures. Detailed calculations are available from PennDER files for the design of the concrete spillway section (including sliding and overturning), the spillway wingwalls, control tower walls, and the gate hoisting mechanism.

Sliding analysis of the spillway section dictated the installation of a cut-off wall extending 10 feet below the spillway base slab. Seepage analysis indicated that flow gradients were in an acceptable range.

2.2 Construction Records.

The only construction records available from PennDER files are periodic progress reports. "As-built" drawings were also prepared. Bi-weekly construction progress reports are available at the park office.

2.3 Operational Records.

No operational records are available, although the Operation and Maintenance Manual for the facility indicates that readings should be recorded, particularly during major storms.

2.4 Other Investigations.

PennDER files contain annual inspection reports through 1977.

2.5 Evaluation.

Sufficient data are available to indicate that the facility was formally designed in accordance with accepted engineering practice. Operational records should be maintained as directed in the Operation and Maintenance Manual for the facility.

SECTION 3
VISUAL INSPECTION

3.1 Observations.

a. General. The visual inspection of the structure and related appurtenances indicates that the facility is in good condition.

b. Embankment. The embankment conforms with the lines and grades depicted on the as-built drawings supplied by PennDER. No signs of slope distress or seepage were observed in the earth section at the time of inspection.

Upstream slope protection is provided by a durable limestone to elevation 1871. Riprap is also provided on the extreme right section of the dam where the embankment forms the left side of the emergency spillway.

Both the upstream and downstream faces of the dam are covered with crown vetch. Minor settlement was noted on the dam crest along both sides of the spillway. The maximum settlement noted at the time of inspection was approximately 0.6 feet below the designed crest elevation of 1874.0 feet.

c. Appurtenant Structures.

1. Service Spillway. The visual inspection of the service spillway indicated that the structure was in excellent condition. No evidence of concrete deterioration was observed at the time of inspection.

2. Emergency Spillway. The visual inspection of the emergency spillway revealed that it was unobstructed and in good condition. The calculations indicate that the emergency spillway design was prepared based on a crest width of 40 feet. Field measurements indicate that the actual width is approximately 60 feet.

3. Outlet Works. The only portions of the outlet works visible at the time of inspection were the manual gate control, the sluice gate, and the gate chamber. Although the sluice gate was not operated in our presence, it is reportedly opened twice yearly and no conditions were observed which would indicate that the gate could not function properly.

4. Reservoir Area. The slopes surrounding the reservoir are gentle to moderate and wooded. No evidence of slope distress was observed at the time of inspection.

5. Downstream Channel. Flow from Black Moshannon Reservoir passing over the Kephart Dam spillway enters Black Moshannon Creek. The stream gradient below the dam averages about 50 feet per mile and flow passes beneath Interstate 80 approximately 6 miles downstream of the dam. The downstream valley in this reach is characterized as a narrow V-shaped valley with densely wooded slopes. At least 3 temporary dwellings are located within the valley in this reach. Considering the proximity of the camps to the creek and the Interstate highway located downstream (see Appendix G - Regional Vicinity Map), the site was assigned a "significant" hazard rating.

3.2 Evaluation.

Observations made during the visual inspection indicate that the overall condition of the facility is good. Minor settlement of the embankment crest was noted. The crest should be surveyed and low spots filled in.

SECTION 4 OPERATIONAL PROCEDURES

4.1 Normal Operational Procedures.

An Operation and Maintenance Manual for Kephart Dam details normal and emergency operational procedures. The manual is available at the park office and from PennDER files.

4.2 Maintenance of Dam.

The dam is inspected twice yearly by the park superintendent. It is also inspected on a yearly basis by an engineer of the PennDER. Formal records are kept in Harrisburg detailing required maintenance and date of completion.

4.3 Maintenance of Operating Facilities.

Maintenance of the operating facilities is detailed in the Operation and Maintenance Manual. The sluice gate is operated during each of the bi-annual inspections.

4.4 Warning Systems.

No formal warning system is in effect at the facility.

4.5 Evaluation.

The dam is well maintained and in good condition. The facility is inspected at least twice yearly and maintenance records are kept at the site as well as in Harrisburg, Pennsylvania. The park superintendent has radio contact with an FAA approved weather station located at Mid-State Airport, on the southwest side of the reservoir. A warning system should be implemented during periods of heavy rainfall to notify temporary downstream residents should the need arise.

SECTION 5 HYDRAULIC/HYDROLOGIC EVALUATION

5.1 Design Data.

Review of calculations contained in PennDER files indicates that the designer sized the spillway system by routing through the reservoir a 6-hour storm that would yield the peak inflow consistent with the Pennsylvania "C" Curve. This was done by developing a 1-hour unit hydrograph via McSparran's Method for the watershed and subsequently an inflow hydrograph for a 6-hour storm. The peak inflow for the above design storm was 8251 cfs as compared to 10,438 cfs peak inflow determined from the Pennsylvania "C" Curve criteria. Therefore, the values of the design storm hydrograph were increased by the ratio $10,438/8251$ or 1.265 to develop the design "C" Curve inflow hydrograph. This hydrograph was then routed through the reservoir to set the spillway dimensions and top of dam elevation.

5.2 Experience Data.

No records of discharge are available for the facility. The park superintendent indicated that only small fluctuations in overflow have been observed. The emergency spillway has not functioned since construction.

5.3 Visual Observations.

On the date of inspection, no conditions were observed that would indicate that the facility would not operate satisfactorily during a flood event. Minor crest settlement (on the order of 0.6 feet) was noted. A survey should be conducted and the low spots in the crest raised to the design elevation.

5.4 Method of Analysis.

The facility has been analyzed in accordance with the 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 the procedures and guidelines contained in the National Guidelines for Safety Inspection of Dams for Phase I investigations, the SDF for Kephart Dam ranges between the 1/2 PMF (Probable Maximum Flood) and the PMF. This classification is based on the relative size of the dam (intermediate), and the potential hazard of dam failure on downstream developments (significant). Since a major highway (Interstate Route 80) is located about 6.5 miles downstream from the dam, and a few non-permanent dwellings are located near the stream between the dam and the major highway, the SDF for this facility is considered to be the PMF.

b. Results of Analysis. Kephart Dam was evaluated under normal operating conditions. That is, the Kephart Dam Reservoir was initially at its normal pool or service spillway elevation of 1865.0 feet with the lake-drawdown slide gate closed. Design information concerning the reservoir's storage-elevation relationship and the service spillway's discharge-elevation relationship were available and used in the analysis. Although a major local highway (PA Route 504) crosses the reservoir at a point located about 1,300 feet upstream from the dam embankment (see Figure 2) and could help to further delay and thereby further attenuate a sudden large inflowing floodwave (since the highway embankment could act as an upstream dam with high tailwater), it was ignored in this evaluation. It was felt that the surface area of the reservoir was so large that the inflowing PMF would probably gradually raise the reservoir water level such that any beneficial effects of the highway embankment on the PMF inflows would be minimal. All pertinent engineering calculations relative to the analysis of Kephart Dam are provided in Appendix C.

Overtopping analysis (using the Modified HEC-1 Computer Program) showed that the discharge/storage capacity of Kephart Dam could safely accommodate the PMF. That is, the peak PMF inflow of about 17,100 cfs (Appendix C, Summary Input/Output Sheets, Sheet B) should be discharged and/or stored by Kephart Dam without overtopping the earth embankment sections. The peak PMF outflow of about 12,400 cfs raised the reservoir water level to approximately elevation 1873.9 feet (Summary Input/Output Sheets, Sheet C), or to within 0.1 foot of overtopping the dam at the design crest elevation. As noted in Section 5.3, embankment crest settlement on the order of 0.6 feet was measured during the field

inspection indicating that the embankment would be locally overtopped. Thus, an accurate survey is recommended with ensuing remedial work as required.

5.6 Spillway Adequacy.

Since the spillways of Kephart Dam (in combination with the potential reservoir storage) can safely pass a flood of PMF magnitude, the spillway system is deemed adequate.

SECTION 6 EVALUATION OF STRUCTURAL INTEGRITY

6.1 Visual Observations.

a. Embankment. Based on visual observations, the embankment appeared in good condition. No signs of slope distress or seepage were observed. Minor settlement was noted on the crest of the dam. The largest measured settlement was approximately 0.6 feet below the design crest elevation of 1874.0. A survey is recommended and the crest should be brought to the design elevation.

b. Appurtenant Structures. Both the service and emergency spillways were in good condition. No signs of serious concrete deterioration were observed on the ogee spillway, sidewalls, or apron. The emergency spillway was unobstructed and generally conformed to details shown on the contract drawings. The hydrologic and hydraulic analysis indicates that a storm of PMF magnitude will cause the emergency spillway to flow at near capacity with the water level elevation exceeding the top elevation of the riprap that protects the right embankment. As a result it is apparent the riprap layer in this area should be extended to the top of the dam.

The 48-inch square sluice gate was not operated during the inspection; however, it is understood that the gate is opened at least twice a year. No conditions were observed which indicated that the gate could not function properly.

6.2 Design and Construction Techniques.

a. Earth Section. No data is available concerning the design and/or construction techniques used on the earth portion of the embankment.

b. Spillway Sections. Design data are available from PennDER files concerning the spillways and outlet works design. Structural analysis included a check of sliding, overturning, and piping potential. In addition, these design data indicate that the structure was designed to pass and/or store the runoff associated with a storm based on the Pennsylvania "C" curve criteria with three feet of additional freeboard provided.

6.3 Past Performance.

The facility has reportedly functioned as designed during its brief history.

6.4 Seismic Stability.

The dam is located within Seismic Zone No. 1 and it is thought that it is sufficiently stable to withstand minor earthquake induced dynamic forces. However, no calculations or investigations were performed to confirm this belief.

SECTION 7
ASSESSMENT AND RECOMMENDATIONS FOR REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety. The visual inspection, operational history, and available engineering data suggest that the facility is in good condition.

The project is capable of passing the flow resulting from a storm of PMF magnitude without overtopping the dam; therefore, the spillway is considered adequate.

The only items of concern noted during the inspection were some low areas of the embankment crest and an apparent lack of adequate riprap protection at the emergency spillway-embankment junction.

b. Adequacy of Information. The available information is considered adequate to make an accurate Phase I assessment of the facility.

c. Urgency. The recommendations listed below should be implemented as soon as practical.

d. Necessity for Additional Investigations. No additional investigations are considered necessary at this time.

7.2 Recommendations/Remedial Measures.

It is recommended that the owner:

a. Have the embankment crest accurately surveyed and infill any low spots to restore the embankment crest to its design elevation (1874.0 msl).

b. Extend the riprap protection to the top of the dam along the emergency spillway-embankment junction to provide slope protection in the event the emergency spillway should discharge at or near full capacity.

c. Develop a warning system to provide for the notification of temporary downstream residents should hazardous conditions develop.

APPENDIX A

CHECK LIST - ENGINEERING DATA

CHECK LIST
ENGINEERING DATA
PHASE I

NAME OF DAM: Kephart Lake Dam
NDI#: PA-447 PENNDR#: 14-89

PAGE 1 OF 5

ITEM	REMARKS	NDI# PA - 447
PERSONS INTERVIEWED AND TITLE	Charles Rea - Park Superintendent	
REGIONAL VICINITY MAP	U.S.G.S. 7.5 minute topographic quadrangle, Black Moshannon, Pennsylvania (Regional Vicinity Map, Appendix G) and Vicinity Plan (Figure 2, Appendix C).	
CONSTRUCTION HISTORY	1. Designed by Berger Associates, Inc., Harrisburg, PA, in 1973. 2. Constructed by Bear Creek Construction Company, Landisville, PA, 1974-1975. 3. Bi-weekly construction reports prepared by Berger Associates are contained in the park office files.	
AVAILABLE DRAWINGS	Complete set of "As-built" drawings are available from PennDR.	
TYPICAL DAM SECTIONS	See Figure 4, Appendix C.	
OUTLETS: PLAN DETAILS DISCHARGE RATINGS	See Figure 7, Appendix C. See Figure 7, Appendix C. Available in PennDR files and displayed on Figure 2, Appendix C.	

ENGINEERING DATA (CONTINUED)

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ITEM	REMARKS	NDI# PA - 447
SPILLWAY: PLAN SECTION DETAILS	See Figure 6, Appendix C. See Figure 6, Appendix C. See Figure 6, Appendix C.	
OPERATING EQUIPMENT PLANS AND DETAILS	See Figure 7, Appendix C. A description of the workings of the operating mechanisms is contained in the Operation and Maintenance Manual for Kephart Dam, Black Moshannon State Park, available at the park office and from PennDER.	
DESIGN REPORTS	None available.	
GEOLOGY REPORTS	None available.	
DESIGN COMPUTATIONS: HYDROLOGY AND HYDRAULICS STABILITY ANALYSES SEEPAGE ANALYSES	Some design data available in PennDER files. Some design data available in PennDER files. Some design data available in PennDER files.	
MATERIAL INVESTIGATIONS: BORING RECORDS LABORATORY TESTING FIELD TESTING	See Figure 5, Appendix C. None available. None available.	

ENGINEERING DATA (CONTINUED)

PAGE 3 OF 5

ITEM	REMARKS	NDI# PA - 447
BORROW SOURCES	Not known.	
POST CONSTRUCTION DAM SURVEYS	None.	
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	1. One year guarantee inspection on August 3, 1976 - minor seepage through form tie above sluice gate - otherwise excellent condition. 2. Park superintendent inspects twice yearly. 3. PennDER inspects yearly.	
HIGH POOL RECORDS	Not known.	
MONITORING SYSTEMS	1. Staff gage on spillway sidewall - not read on regular or scheduled basis. 2. Rainfall gage at sewage plant below dam (1972). 3. FAA approved weather station at Mid-State Airport located atop the highlands southwest of the reservoir.	
MODIFICATIONS	1. Slopes seeded with crown vetch.	

ENGINEERING DATA (CONTINUED)

PAGE 4 OF 5

ITEM	REMARKS	NDI# - PA - 447
PRIOR ACCIDENTS OR FAILURES	None.	
MAINTENANCE: RECORDS MANUAL	R - Formal (written) records of maintenance requirements and completion of required items. M - Operations and Maintenance Manual for Kephart Dam by PennDER (office of Engineering and Construction).	
OPERATION: RECORDS MANUAL	R - Operational records are not available. M - Operations and Maintenance Manual kept at Park Office.	
OPERATIONAL PROCEDURES	Operational procedures detailed in manual.	
WARNING SYSTEM AND/OR COMMUNICATION FACILITIES	FAA weather station at airport. No other warning systems.	
MISCELLANEOUS	Sluice gate operated twice yearly. Painted all metal works in May 1978.	

CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

NDI ID # PA-447
PENN DER ID # 14-89
PAGE 5 OF 5

SIZE OF DRAINAGE AREA: 15.3 square miles.
ELEVATION TOP NORMAL POOL: 1865 STORAGE CAPACITY: 730
ELEVATION TOP FLOOD CONTROL POOL: 1870 STORAGE CAPACITY: 3210
ELEVATION MAXIMUM DESIGN POOL: 1871 STORAGE CAPACITY: 3775
ELEVATION TOP DAM: 1874.0 STORAGE CAPACITY: 5830

SPILLWAY DATA

CREST ELEVATION: Service (1865); Emergency (1870)
TYPE: Service (concrete ogee); Emergency (earth)
WIDTH: Service (100 feet); Emergency ($\approx$ 60 feet)
LENGTH: Service (30 feet); Emergency
SPILLOVER LOCATION: Service (near dam center); Emergency (right
abutment)
NUMBER AND TYPE OF GATES: None

OUTLET WORKS

TYPE: 48-inch square sluice gate
LOCATION: right side of service spillway
ENTRANCE INVERTS: 1853.5
EXIT INVERTS: 1853.5
EMERGENCY DRAWDOWN FACILITIES: Manually controlled gate

HYDROMETEOROLOGICAL GAGES

TYPE: FAA approved weather station
LOCATION: Southwest side of reservoir (Mid-State Airport)
RECORDS: Available from weather bureau

MAXIMUM NON-DAMAGING DISCHARGE: Not known

APPENDIX B

CHECK LIST - VISUAL INSPECTION

CHECK LIST
VISUAL INSPECTION
PHASE 1

PAGE 1 OF 8

NAME OF DAM Kephart Dam STATE Pennsylvania COUNTY Centre
 NDI# PA - 447 PENNDR# 14-89
 TYPE OF DAM Earth and concrete SIZE Intermediate HAZARD CATEGORY Significant
 DATE(S) INSPECTION 13, 14 November 1978 WEATHER cold with rain TEMPERATURE 35° @ 11:00 AM
 POOL ELEVATION AT TIME OF INSPECTION 1865 M.S.L.
 TAILWATER AT TIME OF INSPECTION 1855 M.S.L.

INSPECTION PERSONNEL	OWNER REPRESENTATIVES	OTHERS
<u>B. M. Mihalcin</u>	<u>Charles Rae (Park Superintendent)</u>	
<u>J. P. Nairn</u>		
<u>W. J. Veon</u>		
<u>E. J. Mannella</u>		

RECORDED BY B. M. Mihalcin

EMBANKMENT

PAGE 2 OF 8

ITEM	OBSERVATIONS AND/OR REMARKS	NDI# PA - 447
SURFACE CRACKS	None observed.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	None observed.	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Horizontal alignment - good. Slight vertical misalignment - 0.6 feet low in two areas.	
RIPRAP FAILURES	None observed.	
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Good.	

EMBANKMENT

PAGE 3 OF 8

ITEM	OBSERVATIONS AND/OR REMARKS	NDI# PA - 447
DAMP AREAS IRREGULAR VEGETATION (LUSH OR DEAD PLANTS)	None observed.	
ANY NOTICEABLE SEEPAGE	None observed.	
STAFF GAGE AND RECORDER	Staff gage on left sidewall of spillway.	
DRAINS	None observed.	

OUTLET WORKS

ITEM	OBSERVATIONS AND/OR REMARKS	NDI# PA - 447
INTAKE STRUCTURE	Submerged.	
OUTLET CONDUIT (CRACKING AND SPALL- ING OF CONCRETE SURFACES)	Not applicable.	
OUTLET STRUCTURE	Control tower in excellent condition.	
OUTLET CHANNEL	Outlet discharges in stilling basin before water passes into riprap-lined channel.	
GATE(S) AND OPERATIONAL EQUIPMENT	Gate appeared in good order. Hoisting mechanism in excellent condition. Not operated during field inspection.	

EMERGENCY SPILLWAY

PAGE 5 OF 8

ITEM	OBSERVATIONS AND/OR REMARKS	NDI# PA - 447
TYPE AND CONDITION	Open channel overflow around right abutment and over park road. Good condition.	
APPROACH CHANNEL	Natural embankment - unobstructed.	
SPILLWAY CHANNEL AND SIDEWALLS	Natural channel with bituminous roadway. Embankment riprap lined. Good condition.	
STILLING BASIN PLUNGE POOL	Not applicable.	
DISCHARGE CHANNEL	Over natural ground at the right abutment and then into Black Moshannon Creek (See Figure 4, Appendix C).	
BRIDGE AND PIERS	Bridge over Black Moshannon Creek 140 feet downstream.	
EMERGENCY GATES	None.	

SERVICE SPILLWAY

PAGE 6 OF 8

ITEM	OBSERVATIONS AND/OR REMARKS	NDI# PA -447
TYPE AND CONDITION	100-foot wide concrete ogee-shaped crest in excellent condition (See Figure 6, Appendix C).	
APPROACH CHANNEL	Not applicable.	
OUTLET STRUCTURE	Not applicable.	
DISCHARGE CHANNEL	Discharge empties into a stilling basin before entering a riprap-lined channel and Black Moshannon Creek (See Figure 3, Appendix C).	

INSTRUMENTATION

ITEM	OBSERVATIONS AND/OR REMARKS	NDI# PA - 447
MONUMENTATION SURVEYS	None observed. Plan indicates two monuments installed.	
OBSERVATION WELLS	None.	
WEIRS	None.	
PIEZOMETERS	None.	
OTHERS	None.	

RESERVOIR AREA AND DOWNSTREAM CHANNEL

PAGE 8 OF 8

ITEM	OBSERVATIONS AND/OR REMARKS	NDI# PA - 447
SLOPES: RESERVOIR	Gentle to moderate and wooded.	
SEDIMENTATION	Sedimentation is not likely a problem since the reservoir slopes are gentle and covered with vegetation.	
DOWNSTREAM CHANNEL (OBSTRUCTIONS, DEBRIS, ETC.)	Bridge located 140 feet downstream of stilling basin. Culvert Beneath Interstate 80, 6 miles downstream.	
SLOPES: CHANNEL VALLEY	Steep and heavily wooded downstream of dam.	
APPROXIMATE NUMBER OF HOMES AND POPULATION	At least three cabins or temporary residences are located between the dam and Interstate 80 - temporary population ~9.	

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) 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 shown 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 specified 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 elevations of failure hydrographs for each location.

SUBJECT DAM SAFETY INSPECTION
KEPHART DAM
BY DLB DATE 2-19-79 PROJ. NO. 78-617-447
CHKD. BY WJV DATE 3-3-79 SHEET NO. 1 OF 14



DAM STATISTICS

HEIGHT OF DAM $\approx$ 20 FEET (FIELD MEASURED)

MAXIMUM POOL STORAGE CAPACITY $\approx$ 5830 AC-FT (SEE NOTE 1)
@ TOP OF DAM

NORMAL POOL STORAGE CAPACITY $\approx$ 730 AC-FT (SEE NOTE 1)

DRAINAGE AREA $\approx$ 15.4 SQ. MI

PLANIMETERED OFF U.S.G.S. 7.5
MINUTE SERIES TOPOGRAPHIC
QUADRANGLES BLAIR MCHANNON,
PORT MATILDA, AND BEAR KNOB

NOTE 1: VALUES OBTAINED FROM KEPHART DAM DESIGN
CALCULATIONS AS PREPARED BY BERGER ASSOCIATES
OF HARRISBURG, PENNSYLVANIA AND CONTAINED
IN PENNDER FILES (SEE SHEETS 4, 5 & 6)

DAM CLASSIFICATION

DAM SIZE - INTERMEDIATE (REF 1, TABLE 1)

HAZARD CLASSIFICATION - SIGNIFICANT (FIELD OBSERVATION)

REQUIRED SDF - $\frac{1}{2}$ PMF TO PMF (REF 1, TABLE 2)

SUBJECT DAM SAFETY INSPECTION

KEPHART DAM

BY DLB DATE 3-1-79 PROJ. NO. 78-617-447

CHKD. BY WJV DATE 3-3-79 SHEET NO. 2 OF 14



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HYDROGRAPH PARAMETERS

LENGTH OF LONGEST WATERCOURSE ≈ 5.8 MILES

$L_{CA} \approx 2.0$ MILES

[MEASURED ALONG THE LONGEST WATERCOURSE
FROM THE CREST OF THE DAM TO THE CENTROID
OF THE DRAINAGE BASIN]

LENGTH OF RESERVOIR ≈ 2.1 MILES (ALONG THE LONGEST WATERCOURSE)

NOTE 2: VALUES OF L , L_{CA} , AND RESERVOIR LENGTH MEASURED FROM
U.S.G.S. 7.5 MINUTE SERIES QUADS PORT MATILDA, BEAR KNOB,
AND BLACK MOSHANNON, PA.

$C_e = 2.10$

$C_p = 0.40$

[SUPPLIED BY COFE ;
ZONE 20, SUSQUEHANNA
RIVER BASIN]

SINCE RESERVOIR LENGTH $> L_{CA}$

$$* t_p = \text{SNYDER'S STANDARD LAG} = 2.10 (L')^{0.6}$$

where $L' =$ LENGTH ALONG LONGEST WATERCOURSE FROM
THE RESERVOIR INLET TO THE DRAINAGE DIVIDE

$$t_p = (2.10) [(5.8 - 2.1)]^{0.6} = 4.60 \text{ HR}$$

* AS PER BALTIMORE DISTRICT CORPS OF ENGINEERS FOR
CASES WHERE THE LENGTH OF RESERVOIR IS $\geq L_{CA}$

SUBJECT DAM SAFETY INSPECTION
KEPHART DAM
BY DLB DATE 3-1-79 PROJ. NO. 28-617-447
CHKD. BY WJV DATE 3-2-79 SHEET NO. 3 OF 14



RESERVOIR SURFACE AREAS

S. A. (SURFACE AREA) @ NORMAL POOL EL 1865.0 $\approx$ 235 ACRES (SEE NOTE 3)

S. A. @ EL 1880.0 $\approx$ 1140 ACRES

(REF. FIGURE 4, APPENDIX F FOR ELEVATIONS)

PLANIMETERED OFF U.S.G.S.
7.5 MINUTE SERIES QUADS
PORT MATILDA, BEAR KNOB,
AND BLACK MOSHANNON, PA.

RATE OF AREA CHANGE PER FOOT OF RISE $\left[\frac{\Delta A}{\Delta h} \right] \approx \frac{1140 - 235}{1880 - 1865} \approx 60 \text{ AC/FT}$

S. A. @ Top of DAM EL 1874.0 $\approx (60 \text{ AC/FT})(1874 - 1865) + 235 \text{ ACRES}$

$\approx 775 \text{ ACRES}$

NOTE 3: NORMAL POOL SURFACE AREA OBTAINED FROM "OPERATION AND MAINTENANCE MANUAL FOR KEPHART DAM, BLACK MOSHANNON STATE PARK" PREPARED BY PENNDER AND AVAILABLE FROM THEIR FILES

STORAGE - ELEVATION RELATIONSHIP

A STORAGE-ELEVATION RELATIONSHIP AS DEVELOPED BY BERGER ASSOCIATES OF HARRISBURG, PA. IS AVAILABLE FROM PENNDER FILES AND IS REPRODUCED FOR THIS REPORT ON SHEETS 4 & 5. SHEET 4 REPRESENTS THE CALCULATED RELATIONSHIP FOR ELEVATION 1854 (ZERO STORAGE) TO ELEVATION 1865 (NORMAL POOL) WHEREAS, SHEET 5 GRAPHICALLY ILLUSTRATES THE RELATIONSHIP BETWEEN ELEVATION 1865 AND ELEVATION 1870 (EMERGENCY SPILLWAY CREST).

SUBJECT DAM SAFETY INSPECTION
KEPHART DAM
 BY DLB DATE 3-6-79 PROJ. NO. 78-617-447
 CHKD. BY WJV DATE 3-6-79 SHEET NO. 4 OF 14



BY T.M. DATE BERGER ASSOCIATES SHEET NO. 8 OF 12
 CHKD. BY DATE PROJECT
 SUBJECT Kephart Dam - Black Marshannon State Park

*Determination of reservoir capacities between elevations
 1854 & 1865. (Approximate)*

1. Assume that the reservoir or lake has a parabolic cross section throughout & the area of the section decreases to zero at the end of the res.
 $A = \frac{1}{3} D W / 2$
2. Assume that total reservoir length decreases proportionately with decreasing depth (D)
3. Assume that the average width (W) also decreases proportionately with height
4. $V = \frac{1}{3} D \times \frac{W}{2} \times \frac{L}{2} = \frac{1}{3} D W L$
 $\rightarrow \pm 43560 = \text{ac. ft}$

Elev.	D(ft)	W(ft)	L(ft)	V acft
1854.0	0	0	0	0
1855.0	1 (0.091)	41	1,757	0.55
1856.0	2 (0.182)	82	3,514	4.41
1857.0	3 (0.273)	123	5,270	14.87
1858.0	4 (0.364)	164	7,030	35.25
1859.0	5 (0.455)	205	8,790	68.88
1860.0	6 (0.545)	245	10,520	118.22
1861.0	7 (0.636)	286	12,280	187.94
1862.0	8 (0.727)	327	14,040	280.78
1863.0	9 (0.818)	368	15,800	400.04
1864.0	10 (0.909)	409	17,550	548.73
1865.0	11	450	19,310	730.71

* Total length of lake including fingers. (See attached location plan)
 ** Est. Average width

ELEVATION

vs

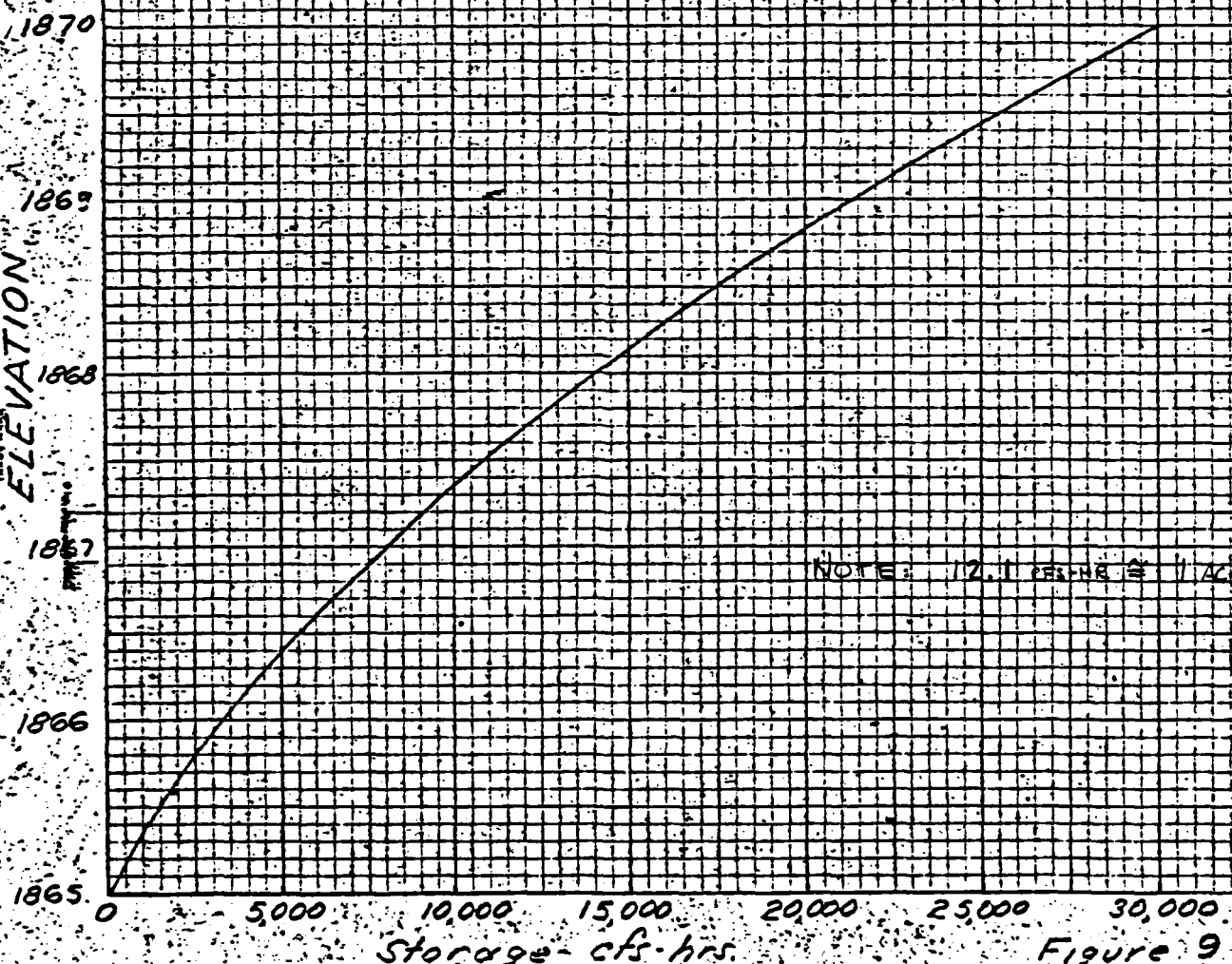
STORAGE

ABOVE SPILLWAY CREST

EL. 1865 MSL

(FROM DESIGN CALCULATIONS
BY BERGER ASSOCIATES)

ELEVATION
 1865
 1866
 1867
 1868
 1869
 1870



NOTE: 12.1 CFS/INCH @ 1 ACFT

Storage - cfs-hrs

Figure 9

SUBJECT DAM SAFETY INSPECTION

KEPHART DAM

BY DLB DATE 3-2-79 PROJ. NO. 78-617-447

CHKD. BY WJV DATE 3-3-79 SHEET NO. 6 OF 14



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ASSUME THE MODIFIED PRISMOIDAL EQUATION IS AN
ACCEPTABLE REPRESENTATION OF THE STORAGE INCREMENTS
ABOVE ELEVATION 1870.

$$\Delta V_{1-2} = \frac{h}{3} (A_1 + A_2 + \sqrt{A_1 A_2})$$

where ΔV_{1-2} = INCREMENTAL VOLUME BETWEEN AREAS 1 & 2

A_1 = SURFACE AREA AT ELEVATION 1

A_2 = SURFACE AREA AT ELEVATION 2

h = (ELEVATION 2 - ELEVATION 1)

ALSO SURFACE AREA IS DEFINED BY

$$A_i = A_0 + h \left(\frac{\Delta A}{\Delta h} \right)$$

where A_i = S.A. @ ELEVATION i

A_0 = S.A. @ ELEVATION 1865 = 235 ACRES (SHEET 3)

h = ELEVATION i - ELEVATION 1865 FT

$\frac{\Delta A}{\Delta h}$ = 60 AC-FT (SHEET 3)

ELEVATION (FT)	h (FT)	A_i (ACRES)	ΔV (AC-FT)	CUMULATIVE VOLUME (AC-FT)
1870	1	535	565	3210*
1871	1	595	625	3775
1872	1	655	685	4400
1873	1	715	745	5085
1874	1	775	805	5830
1875	1	835	865	6635
1876	1	895	925	7500
1877	1	955		8425

* 2480 AC-FT @
EL 1870 (SHEET 5)
+ 730 AC-FT @
EL 1865 (SHEET 4)

SUBJECT DAM SAFETY INSPECTION
KEPHART DAM
 BY DLB DATE 2-19-79 PROJ. NO. 78-617-447
 CHKD. BY WJV DATE 3-3-79 SHEET NO. 7 OF 14



PMP CALCULATIONS

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

GEOGRAPHIC ADJUSTMENT FACTOR = 103% (REF 9, FIG. 1)
 (CORRESPONDING TO A LONGITUDE OF 78° 3'
 AND A LATITUDE OF 40° 55')

CORRECTED RAINFALL INDEX = (103)(22.2) = 22.9 INCHES

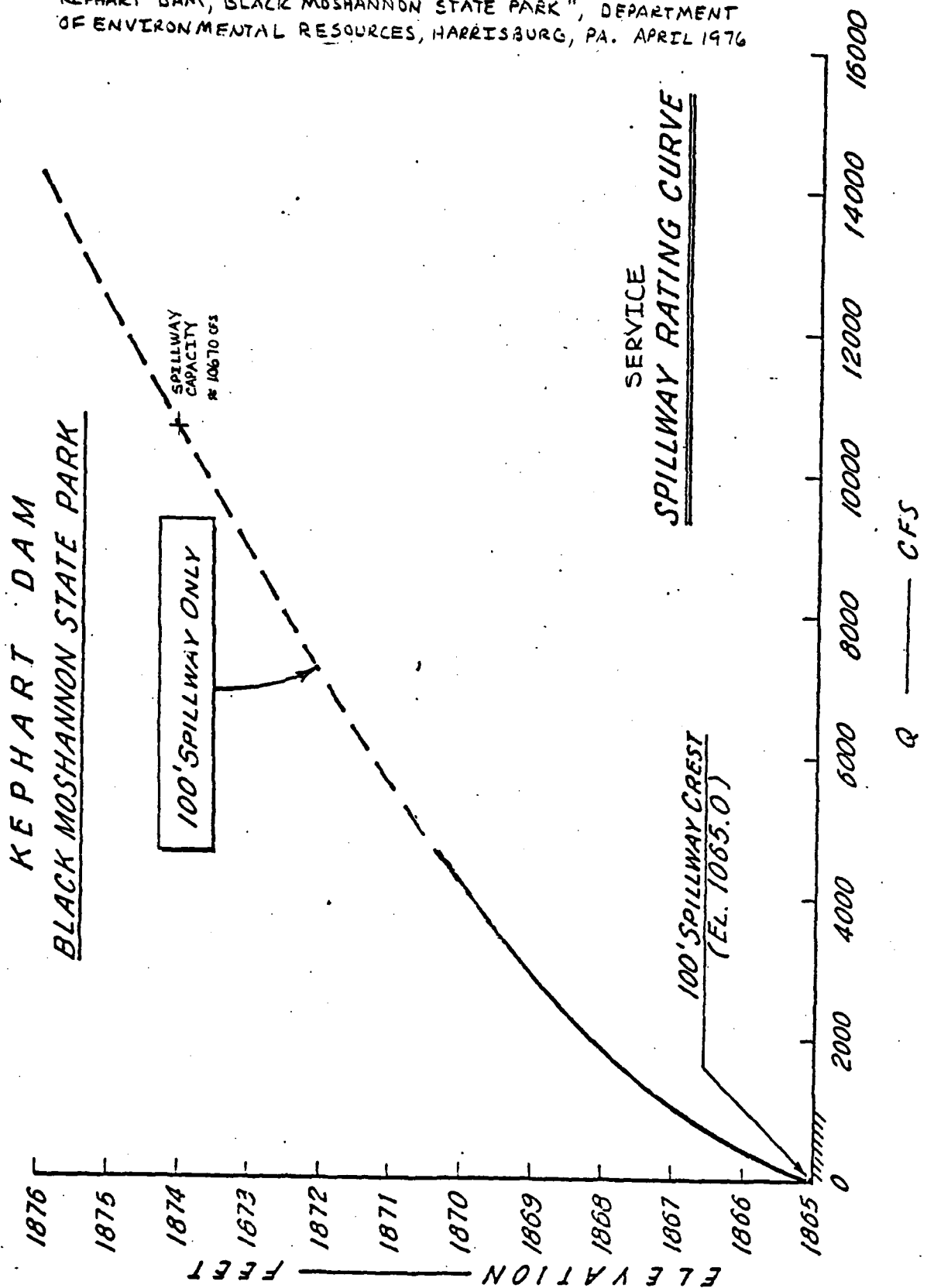
DURATION (HOURS)	PERCENT OF INDEX RAINFALL (%)
6	113.0
12	122.5
24	132.0
48	138.0
72	141.5

- HOP BROOK FACTOR (ADJUSTMENT FOR BASIN SHAPE, AS WELL
 AS FOR THE LESSEER LIKELIHOOD OF A SEVERE STORM CENTERING
 OVER A SMALLER AREA) CORRESPONDING TO A D.A. = 15.4 sq. mi. = .815
 (AS COMPUTED BY HEC-1 PROGRAM)

SERVICE SPILLWAY CAPACITY AND RATING CURVE :

SHEET 6 OF 14

OBTAINED FROM THE "OPERATION AND DESIGN MANUAL FOR
KEPHART DAM, BLACK MOSHANNON STATE PARK", DEPARTMENT
OF ENVIRONMENTAL RESOURCES, HARRISBURG, PA. APRIL 1976

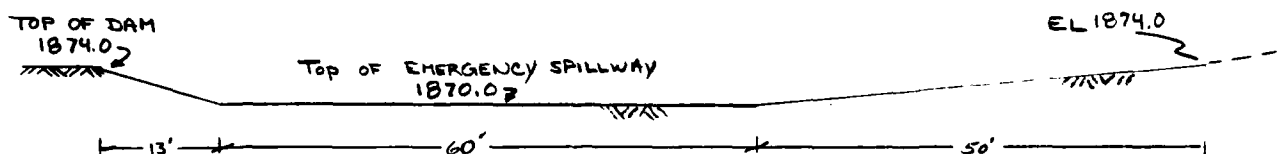


SUBJECT DAM SAFETY INSPECTION
KEPHART DAM
 BY DLB DATE 2-19-79 PROJ. NO. 78-617-447
 CHKD. BY WJV DATE 3-3-79 SHEET NO. 9 OF 14

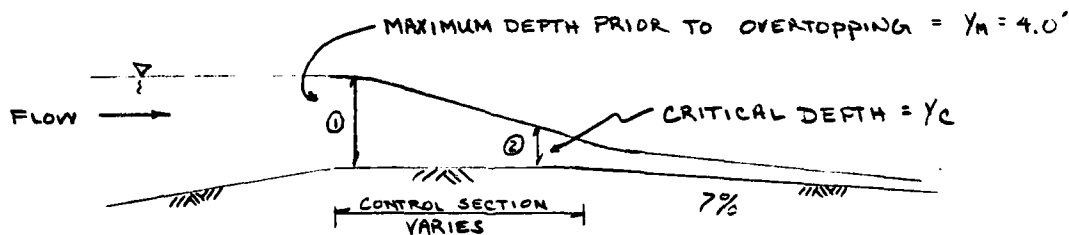
gai
 CONSULTANTS,
 Engineers • Geologists • Planners
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EMERGENCY SPILLWAY CAPACITY & RATING CURVE

NOTE: ALTHOUGH THE DESIGN EMERGENCY SPILLWAY RATING CURVE IS ALSO AVAILABLE, IT IS BASED ON A SECTION WITH A BOTTOM WIDTH OF 40 FT AND A CREST ELEVATION AT 1869.5 FT. FIELD MEASUREMENTS INDICATE THAT THE ACTUAL SECTION HAS A BOTTOM WIDTH OF ABOUT 60 FT AND A CREST ELEVATION AT ABOUT 1870 FT. THE FOLLOWING IS BASED ON THESE FIELD MEASUREMENTS AND THE GIVEN RATING CURVE HAS BEEN DISCARDED.



EMERGENCY SPILLWAY CROSS-SECTION (FIELD MEASURED)
 SCALE 1 in = 20 ft



EMERGENCY SPILLWAY PROFILE
 (NOT TO SCALE)

$$Y_m + \frac{V_r^2}{2g} = Y_c + \frac{V_c^2}{2g} + H_L$$

ENERGY BALANCE BETWEEN
 SECTIONS @ ① & ② (REF 7, pg 40)

where

H_L = HEAD LOSS BETWEEN ① AND ② ≈ 0

V_r = APPROACH VELOCITY OF RESERVOIR (ASSUMED NEGLIGIBLE)

V_c = CRITICAL VELOCITY

SUBJECT DAM SAFETY INSPECTION

KEPHART DAM

BY DLB DATE 2-19-79 PROJ. NO. 78-617-447

CHKD. BY WJV DATE 3-3-79 SHEET NO. 10 OF 14



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$$4.0' = y_c + \frac{V_c^2}{2g}$$

AT CRITICAL DEPTH $\frac{V_c^2}{2g} = \frac{\Delta_c}{2}$ (REF 7, pg 55)

$$\Delta_c = \text{HYDRAULIC DEPTH} = \frac{\text{AREA OF FLOW}}{\text{TOP WIDTH}} = \frac{A_c}{W_c} \quad (\text{REF 7, pg 23})$$

$$A_c = 60y_c + \frac{1}{2}(12.5y_c)y_c + \frac{1}{2}(3.25y_c)y_c = 60y_c + 7.9y_c^2$$

$$W_c = 60 + 12.5y_c + 3.25y_c = 15.8y_c + 60$$

$$\therefore 4.0' = y_c + \frac{60y_c + 7.9y_c^2}{2(15.8y_c + 60)} = y_c + \frac{60y_c + 7.9y_c^2}{31.6y_c + 120}$$

$$126.4y_c + 480 = 31.6y_c^2 + 120y_c + 60y_c + 7.9y_c^2$$

$$0 = 39.5y_c^2 + 53.6y_c - 480 = ay_c^2 + by_c - c$$

$$\therefore y_c = 2.87' \quad \left[\text{AS PER QUADRATIC EQUATION } \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \right]$$

SINCE $\frac{V_c^2}{2g} = \frac{60y_c + 7.9y_c^2}{2(15.8y_c + 60)}$

$$V_c = \left[\frac{(32.2)(60)(2.87) + (7.9)(2.87)^2}{(15.8)(2.87) + (60)} \right]^{1/2} = 8.52 \text{ FPS}$$

FROM CONTINUITY $Q = VA$

(REF 7, pg 5)

$$Q = (8.52)[(60)(2.87) + (7.9)(2.87)^2] = 2022 \text{ CFS}$$

MAXIMUM EMERGENCY SPILLWAY CAPACITY $\approx 2020 \text{ CFS}$

SUBJECT DAM SAFETY INSPECTION

KEPHART DAM

BY DLB DATE 3-2-79 PROJ. NO. 78-617-447

CHKD. BY WJV DATE 3-3-79 SHEET NO. 11 OF 14



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CHECK TO SEE IF CRITICAL FLOW CONTROLS :

$$\text{CRITICAL SLOPE } (S_c) \approx \left[\frac{n V_c}{1.49 R_c^{2/3}} \right]^2 \quad (\text{REF 13, pg 143})$$

where $R_c = \text{HYDRAULIC RADIUS} = \frac{\text{AREA OF FLOW}}{\text{WETTED PERIMETER}}$

$$R_c \approx \frac{(60)(2.87) + (2.87)(7.9)}{60 + [(2.87)^2 + [(2.87)(3.25)]^2]^{1/2} + [(2.87)^2 + [(2.87)(12.5)]^2]^{1/2}} \approx 2.24 \text{ FT}$$

$n = \text{MANNING'S ROUGHNESS COEFFICIENT}$

$$n (\text{AREA WEIGHTED}) \approx \frac{(51)n_1 + (172)n_2 + (13)n_3}{236}$$

* where $n_1 \approx 0.10$ (RIGHT BANK; MEDIUM TO DENSE BRUSH AND TREES)
 $n_2 \approx 0.02$ (CENTER OF CHANNEL; GRAVEL & CONCRETE ROAD SURFACE)
 $n_3 \approx 0.04$ (LEFT BANK; RIPRAP & GRASS)

* BASED ON THE JUDGEMENT AND EXPERIENCE OF A/E AS WELL AS
 REFERENCE 7, PGS 111-113

$$\therefore n \approx 0.038$$

$$\therefore S_c \approx \left[\frac{(0.038)(8.52)}{1.49(2.24)^{2/3}} \right]^2 \approx 0.02$$

$$S_c \approx 0.02 < 0.07 (\text{ACTUAL SLOPE})$$

$\therefore$ SUPERCRITICAL FLOW BELOW SECTION (a) & CRITICAL FLOW
 @ SECTION (b)

SUBJECT DAM SAFETY INSPECTION
KEPHART DAM
 BY DLB DATE 2-19-79 PROJ. NO. 78-617-447
 CHKD. BY WJV DATE 3-3-79 SHEET NO. 12 OF 14



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BASED ON CALCULATIONS CONTAINED ON SHEETS 9, 10, AND 11, THE
 FOLLOWING RATING TABLE WAS DEVELOPED FOR THE EMERGENCY
 SPILLWAY

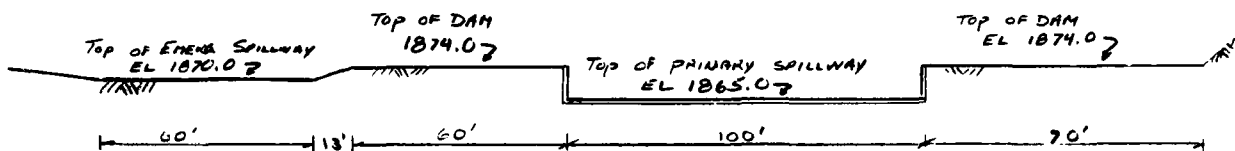
	ELEVATION (FEET)	H _c (FEET)	Q (CFS)
	1870.0	0	0
	1871.0	1	200
	1872.0	2	620
	1873.0	3	1230
Top of DAM	1874.0	4	2020
	1875.0	5	3030
	1876.0	6	4230

SUBJECT DAM SAFETY INSPECTION
KEPHART DAM
 BY DLB DATE 2-19-79 PROJ. NO. 78-617-447
 CHKD. BY WJV DATE 3-3-79 SHEET NO. 13 OF 14



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EMBANKMENT RATING CURVE



EMBANKMENT CROSS-SECTION
 SCALE 1 in = 50 ft

DISCHARGES DEFINED BY $Q = CLH_e^{3/2}$

ASSUME EMBANKMENT ACTS LIKE A BROAD CRESTED WEIR
 WHEN OVERTOPPED: CREST LENGTH (W/O SPILLWAYS) ≈ 130 FT
 CREST BREADTH = 12.5 FT = l
 CREST ELEVATION = 1874.0 FT

ELEVATION (FT)	H (FT)	H/l (FT/FT)	* C	Q (CFS)
1874.0	0	-	-	-
1875.0	1	0.08	3.03	390
1876.0	2	0.16	3.06	1130

* VALUES OF C OBTAINED FROM REF 12, pg 46

SUBJECT DAM SAFETY INSPECTION
KEPHART DAM
 BY DLB DATE 2-21-79 PROJ. NO. 78-617-447
 CHKD. BY WJV DATE 3-3-79 SHEET NO. 14 OF 14



TOTAL DISCHARGE RATING CURVE

COMBINED RATING CURVES FOR SERVICE SPILLWAY,
 EMERGENCY SPILLWAY, AND DAM EMBANKMENT.

	ELEVATION (FT)	① SERVICE SPILLWAY Q (CFS)	② EMERGENCY SPILLWAY Q (CFS)	③ EMBANKMENT Q (CFS)	TOTAL DISCHARGE Q (CFS)
CREST OF SERVICE SPILLWAY →	1865.0	—	—	—	—
	1866.0	400	—	—	400
	1867.0	1030	—	—	1030
	1868.0	1810	—	—	1810
	1869.0	2880	—	—	2880
CREST OF EMERGENCY SPILLWAY →	1870.0	4230	—	—	4230
	1871.0	5560	200	—	5760
	1872.0	7140	620	—	7760
	1873.0	8910	1230	—	10140
TOP OF DAM →	1874.0	10670	2020	—	12690
	1875.0	12320	3030	390	15740
	1876.0	14210	4230	1130	19570

- ① SHEET 8
 ② SHEET 12
 ③ SHEET 13

SUBJECT DAM SAFETY INSPECTION

KEPHART DAM

BY DLE DATE 3-6-79

PROJ. NO. 78-617-447

CHKD. BY WJV DATE 3-6-79

SHEET NO. A OF C



**Engineers • Geologists • Planners
Environmental Specialists**

THE SAFETY INSPECTOR
CONFIDENTIAL ***
OVERFLOWING ANALYSIS
CONCLUDE THE STEP AND 72-HOUR STORM DURATION

JOB SPECIFICATION		TPRT	USTAR
NOB	0	0	0
EXP	15	0	0
IOA	0	0	0
GROUP	0	0	0
W*1	0	0	0
W*2	0	0	0
W*3	0	0	0
W*4	0	0	0
W*5	0	0	0
W*6	0	0	0
W*7	0	0	0
W*8	0	0	0
W*9	0	0	0
W*10	0	0	0
W*11	0	0	0
W*12	0	0	0
W*13	0	0	0
W*14	0	0	0
W*15	0	0	0
W*16	0	0	0
W*17	0	0	0
W*18	0	0	0
W*19	0	0	0
W*20	0	0	0
W*21	0	0	0
W*22	0	0	0
W*23	0	0	0
W*24	0	0	0
W*25	0	0	0
W*26	0	0	0
W*27	0	0	0
W*28	0	0	0
W*29	0	0	0
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W*31	0	0	0
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W*33	0	0	0
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W*40	0	0	0
W*41	0	0	0
W*42	0	0	0
W*43	0	0	0
W*44	0	0	0
W*45	0	0	0
W*46	0	0	0
W*47	0	0	0
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W*70	0	0	0
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W*78	0	0	0
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W*91	0	0	0
W*92	0	0	0
W*93	0	0	0
W*94	0	0	0
W*95	0	0	0
W*96	0	0	0
W*97	0	0	0
W*98	0	0	0
W*99	0	0	0
W*100	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED

$$A_1^{\alpha} A_2^{\beta} = \frac{1}{\sqrt{2}} [A_1^{\alpha+\beta} + (-1)^{\alpha+\beta} A_1^{\alpha-\beta}]$$

DATE	DESCRIPTION	AMOUNT	BALANCE
1950	1.00	1.00	1.00
1951	1.00	1.00	2.00
1952	1.00	1.00	3.00
1953	1.00	1.00	4.00
1954	1.00	1.00	5.00
1955	1.00	1.00	6.00
1956	1.00	1.00	7.00
1957	1.00	1.00	8.00
1958	1.00	1.00	9.00
1959	1.00	1.00	10.00
1960	1.00	1.00	11.00
1961	1.00	1.00	12.00
1962	1.00	1.00	13.00
1963	1.00	1.00	14.00
1964	1.00	1.00	15.00
1965	1.00	1.00	16.00
1966	1.00	1.00	17.00
1967	1.00	1.00	18.00
1968	1.00	1.00	19.00
1969	1.00	1.00	20.00
1970	1.00	1.00	21.00
1971	1.00	1.00	22.00
1972	1.00	1.00	23.00
1973	1.00	1.00	24.00
1974	1.00	1.00	25.00
1975	1.00	1.00	26.00
1976	1.00	1.00	27.00
1977	1.00	1.00	28.00
1978	1.00	1.00	29.00
1979	1.00	1.00	30.00
1980	1.00	1.00	31.00
1981	1.00	1.00	32.00
1982	1.00	1.00	33.00
1983	1.00	1.00	34.00
1984	1.00	1.00	35.00
1985	1.00	1.00	36.00
1986	1.00	1.00	37.00
1987	1.00	1.00	38.00
1988	1.00	1.00	39.00
1989	1.00	1.00	40.00
1990	1.00	1.00	41.00
1991	1.00	1.00	42.00
1992	1.00	1.00	43.00
1993	1.00	1.00	44.00
1994	1.00	1.00	45.00
1995	1.00	1.00	46.00
1996	1.00	1.00	47.00
1997	1.00	1.00	48.00
1998	1.00	1.00	49.00
1999	1.00	1.00	50.00
2000	1.00	1.00	51.00
2001	1.00	1.00	52.00
2002	1.00	1.00	53.00
2003	1.00	1.00	54.00
2004	1.00	1.00	55.00
2005	1.00	1.00	56.00
2006	1.00	1.00	57.00
2007	1.00	1.00	58.00
2008	1.00	1.00	59.00
2009	1.00	1.00	60.00
2010	1.00	1.00	61.00
2011	1.00	1.00	62.00
2012	1.00	1.00	63.00
2013	1.00	1.00	64.00
2014	1.00	1.00	65.00
2015	1.00	1.00	66.00
2016	1.00	1.00	67.00
2017	1.00	1.00	68.00
2018	1.00	1.00	69.00
2019	1.00	1.00	70.00
2020	1.00	1.00	71.00
2021	1.00	1.00	72.00
2022	1.00	1.00	73.00
2023	1.00	1.00	74.00
2024	1.00	1.00	75.00
2025	1.00	1.00	76.00
2026	1.00	1.00	77.00
2027	1.00	1.00	78.00
2028	1.00	1.00	79.00
2029	1.00	1.00	80.00
2030	1.00	1.00	81.00
2031	1.00	1.00	82.00
2032	1.00	1.00	83.00
2033	1.00	1.00	84.00
2034	1.00</		

[illegible]

5115-AREA ROUTE COMPUTATION

Western Life Reserve

ISTAU	ICOMP	RECON	LTAPF	JPCT	JPRC	INACT	ISTAGE	IAUTO
1	0	0	0	0	0	1	0	0

HYDROGRAPHIC DATA

DATE	LSHOW	ISANT.	LOCAL
0-000	0	1	0

RECEIVED MAY 1964

3425

1
5044.

22. 00.00

15. 115

DATE	INITIAL AND CONSTANT RAINFALL LOSS PAVES, OBTAINED FROM BALTIMORE DISTRICT CCE
0.00	141.50
0.00	0.00

1000

LOSS DATA				
LOSS	EXP	ACT	EXP	ACT
0	0.00	0.00	0.00	0.00
1	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00
11	0.00	0.00	0.00	0.00
12	0.00	0.00	0.00	0.00
13	0.00	0.00	0.00	0.00
14	0.00	0.00	0.00	0.00
15	0.00	0.00	0.00	0.00
16	0.00	0.00	0.00	0.00
17	0.00	0.00	0.00	0.00
18	0.00	0.00	0.00	0.00
19	0.00	0.00	0.00	0.00
20	0.00	0.00	0.00	0.00
21	0.00	0.00	0.00	0.00
22	0.00	0.00	0.00	0.00
23	0.00	0.00	0.00	0.00
24	0.00	0.00	0.00	0.00
25	0.00	0.00	0.00	0.00
26	0.00	0.00	0.00	0.00
27	0.00	0.00	0.00	0.00
28	0.00	0.00	0.00	0.00
29	0.00	0.00	0.00	0.00
30	0.00	0.00	0.00	0.00
31	0.00	0.00	0.00	0.00
32	0.00	0.00	0.00	0.00
33	0.00	0.00	0.00	0.00
34	0.00	0.00	0.00	0.00
35	0.00	0.00	0.00	0.00
36	0.00	0.00	0.00	0.00
37	0.00	0.00	0.00	0.00
38	0.00	0.00	0.00	0.00
39	0.00	0.00	0.00	0.00
40	0.00	0.00	0.00	0.00
41	0.00	0.00	0.00	0.00
42	0.00	0.00	0.00	0.00
43	0.00	0.00	0.00	0.00
44	0.00	0.00	0.00	0.00
45	0.00	0.00	0.00	0.00
46	0.00	0.00	0.00	0.00
47	0.00	0.00	0.00	0.00
48	0.00	0.00	0.00	0.00
49	0.00	0.00	0.00	0.00
50	0.00	0.00	0.00	0.00
51	0.00	0.00	0.00	0.00
52	0.00	0.00	0.00	0.00
53	0.00	0.00	0.00	0.00
54	0.00	0.00	0.00	0.00
55	0.00	0.00	0.00	0.00
56	0.00	0.00	0.00	0.00
57	0.00	0.00	0.00	0.00
58	0.00	0.00	0.00	0.00
59	0.00	0.00	0.00	0.00
60	0.00	0.00	0.00	0.00
61	0.00	0.00	0.00	0.00
62	0.00	0.00	0.00	0.00
63	0.00	0.00	0.00	0.00
64	0.00	0.00	0.00	0.00
65	0.00	0.00	0.00	0.00
66	0.00	0.00	0.00	0.00
67	0.00	0.00	0.00	0.00
68	0.00	0.00	0.00	0.00
69	0.00	0.00	0.00	0.00
70	0.00	0.00	0.00	0.00
71	0.00	0.00	0.00	0.00
72	0.00	0.00	0.00	0.00
73	0.			

THE UNIVERSITY OF CHICAGO

BASE FLOW GENERATION PARAMETERS,
OBTAINED FROM BALTIMORE
DISTRICT COE

APPROXIMATE CLASS COMPLETED FROM
 GIVEN NUMBER OF AREAS (E=14, H) AND R=14.20 INTERVALS
 DISTRICT CODE.

RECLASSIFIED DATA		
NUMBER	GROUP	PERCENT
51000	-1.50	0.05
		PERCENT = 2.00

[illegible]

SUBJECT DAM SAFETY INSPECTION

KEPHART DAM

BY DLB DATE 3-6-79 PROJ. NO. 78-617-447

CHKD. BY WJV DATE 3-6-79 SHEET NO. B OF C



Engineers • Geologists • Planners
Environmental Specialists

PERIOD-PERIOD FLOW
NO. DA
CUM. U
LOSS
FACS
RAJW
PERIOD
SUM
26.40
23.72
(671.) (603.)
2.68
(68.) (24713.36)

PMF
TOTAL VOLUME
6726.48
24711.
21.96
551.87
18030.
22240.

HYDROGRAPH ROUTING

ROUTE THROUGH RESERVOIR

RESERVOIR
IN-LOW
HYDROGRAPH
(THOUS CU M)

DATE	IN-LOW	PERIOD	NO. DA	CUM. U	LOSS	FACS	RAJW	PERIOD	SUM	26.40	23.72	(671.) (603.)	2.68	(68.) (24713.36)
1975	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
1976	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
1977	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
1978	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
1979	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
1980	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
1981	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
1982	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
1983	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
1984	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
1985	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
1986	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
1987	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
1988	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
1989	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
1990	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
1991	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
1992	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
1993	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
1994	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
1995	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
1996	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
1997	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
1998	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
1999	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
2000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000

DAM DATA
TUNNEL
1874.0
0.0
0.0
0.0

SUBJECT DAM SAFETY INSPECTION
KEPHART DAM
 BY DLB DATE 3-6-79 PROJ. NO. 7A-617-447
 CHKD. BY WJV DATE 3-6-79 SHEET NO. C OF C



RESERVOIR OUTFLOW HYDROGRAPH (PMF)

MAX OUTFLOW IS 12431. AT TIME 48.00 HOURS

	PEAK	0-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	12431.	11902.	7794.	2879.	629241.
CFS	352.	337.	220.	62.	23401.
1000000		7.19	18.01	20.87	20.87
AC-FT		102.02	477.70	530.12	530.12
1000000		5702.	45439.	17133.	17133.
1000000		7260.	19044.	21133.	21133.

SUMMARY OF DAM SAFETY ANALYSIS

	ELEVATION	INITIAL VALUE	SPIGWAY GUEST	TOP OF DAM
STORAGE		1865.00	1865.00	1874.00
OUTFLOWS		131.	731.	5830.
		0.	0.	12690.

	MAXIMUM	MAXIMUM	DURATION	TIME OF
RESERVOIR	DEPTH	OUTFLOW	OVER TOP	MAX OUTFLOW
1000000	0.00	5500.	0.00	48.75
1000000	0.00	9700.	0.00	48.75
1000000	0.00	11073.	0.00	48.75
1000000	0.00	12431.	0.00	48.00

	MAXIMUM	MAXIMUM	DURATION	TIME OF
RESERVOIR	DEPTH	OUTFLOW	OVER TOP	MAX OUTFLOW
1000000	0.00	5500.	0.00	48.75
1000000	0.00	9700.	0.00	48.75
1000000	0.00	11073.	0.00	48.75
1000000	0.00	12431.	0.00	48.00

LIST OF REFERENCES

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

PHOTOGRAPH 1 Overview of Kephart Dam from a point just downstream from the crest on the left abutment. Note the emergency spillway at the right abutment (left center of photograph).

PHOTOGRAPH 2 View of the upstream portion of the dam, showing the low spot on the right abutment which serves as the emergency spillway.

PHOTOGRAPH 3 View from the dam centerline showing the discharge area of the emergency spillway.



3

2



1



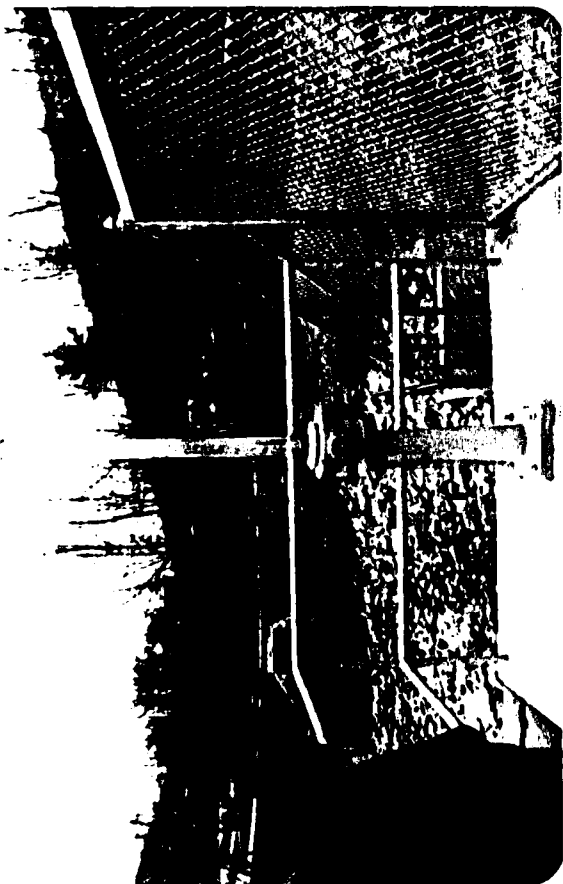
PHOTOGRAPH 4 View of the manually operated gate control for the sluice gate located adjacent the right spillway wingwall.

PHOTOGRAPH 5 View of the riprap-lined channel and the bridge culvert 140 feet downstream of the stilling basin.

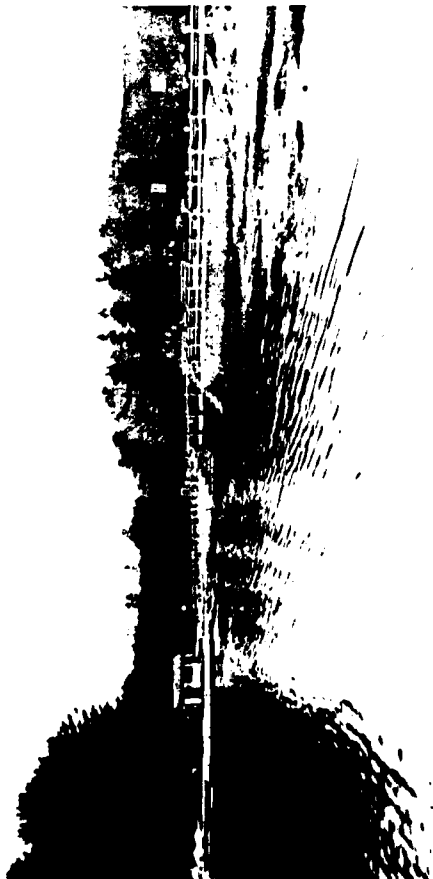
PHOTOGRAPH 6 View of a bridge over Kephart Lake approximately 1/4 mile upstream of the dam.



5



4



6

APPENDIX E

GEOLOGY

Geology

Kephart Dam is located approximately 4 miles west of the Allegheny Topographic Front within the Allegheny Mountain Section of the Appalachian Plateaus Physiographic Province. The Allegheny Mountain Section in this part of Pennsylvania is characterized by gently folded sedimentary rock strata of Pennsylvanian and Mississippian age. Major structural axes strike from southwest to northeast with flanking strata generally dipping from northwest to southeast.

The structural geology of the area has not been well studied; however, sufficient data is available to present the major features which characterize the area. South of the dam site are two high angle strike-slip faults (wrench faults) striking between N60°W and N70°W. The Shawville-Inburne fault which is the larger of the two cuts across the reservoir approximately 1,500 feet upstream of the dam. This fault can be traced eastward approximately four miles to near the edge of the Allegheny Topographic Front. Westward, the fault can be projected over the Hannah Furnace anticline northeast of Philipsburg where the fault trace continues to the northwest. The Shawville-Winburne fault is one of the longest traceable wrench faults in the area. The total length of this fault in the Appalachian Plateau is on the order of 22 miles.

Several miles southeast of the dam lies the Black Moshannon syncline. This structure seems to be of very

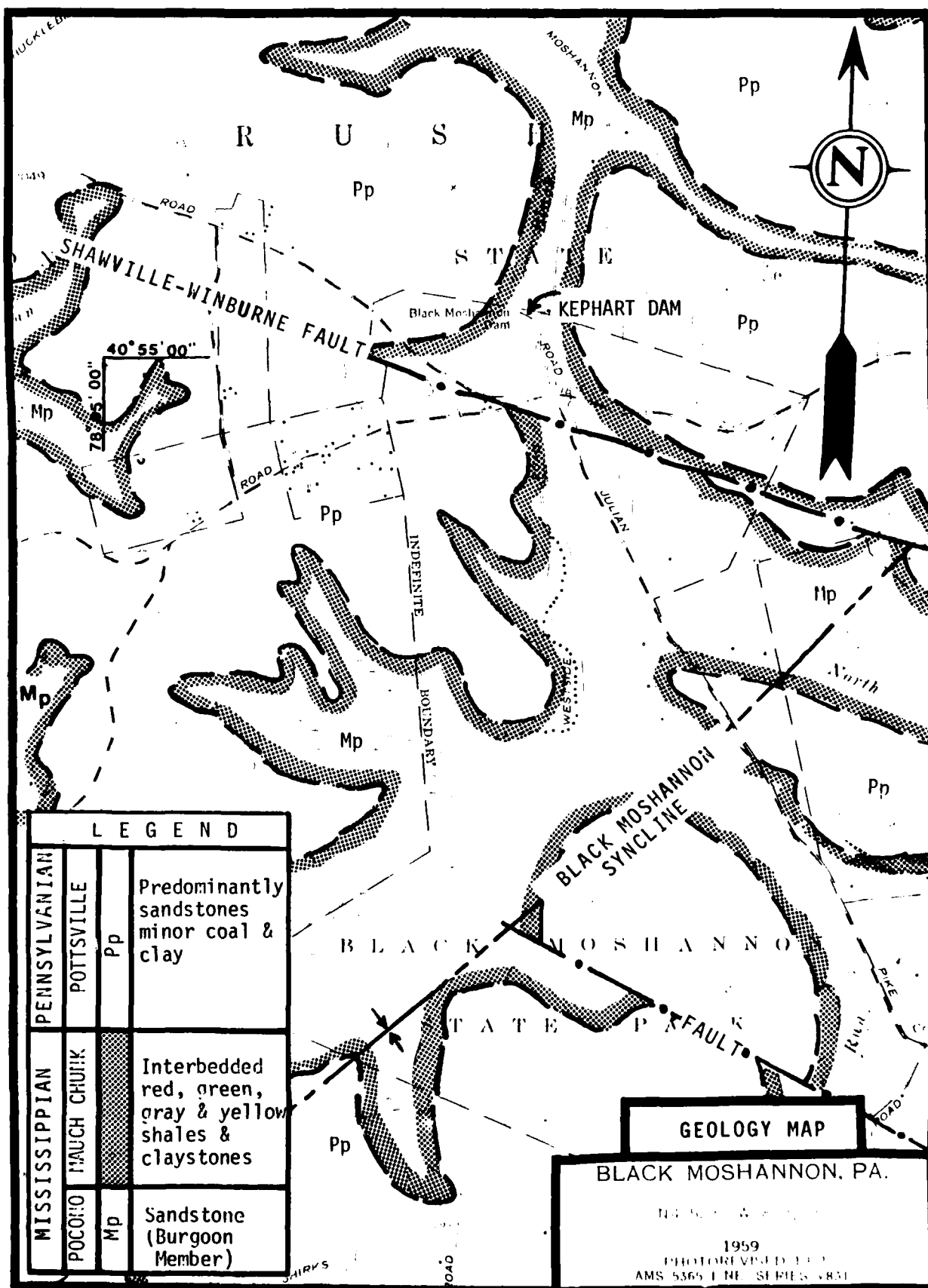
low amplitude and trends in a southwest-northeast direction. The structure may terminate at the Shawville-Winburne fault southeast of the dam (see Geology Map).

The bedrock geology in the immediate vicinity of the dam and reservoir consists of the Pottsville Group of lower Pennsylvanian age in the higher elevations and the Mauch Chunk and Pocono Formations of upper Mississippian age at lower elevations. The dam and reservoir are located entirely on the Pocono Formation. The Pottsville Group in this area is composed almost entirely of sandstone with some minor coal and clay. The Mauch Chunk is largely composed of red, green, gray, and yellow shales with some claystone and sandstone. The upper portion of the Pocono Formation consists of massive sandstone.

A series of core borings was provided along the dam centerline. They disclosed silty clays and silty sands overlying a sandstone (Pocono Formation). The depth to bedrock is approximately 17 to 20 feet below original ground.²

¹Glass, Gary B, "Geology and Mineral Resources of the Philipsburg 7.5 Minute Quadrangle, Centre and Clearfield Counties, Pennsylvania," Harrisburg: Bureau of Topographic and Geologic Survey, Atlas 95a, 1972.

²Ellam, Joseph J., "Report Upon the Application of the Bureau of State Parks, Department of Environmental Resources," Harrisburg: DER I.D. No. 14-89-A, 1974.



APPENDIX F

FIGURES

LIST OF FIGURES

<u>Figure</u>	<u>Description/Title</u>
1	General Plan - Field Inspection Notes
2	Vicinity Plan
3	General Plan
4	Embankment Sections
5	Test Boring Results
6	Ogee Spillway Plan and Sections
7	Wall and Control Tower Details
8	Modification of Utilities

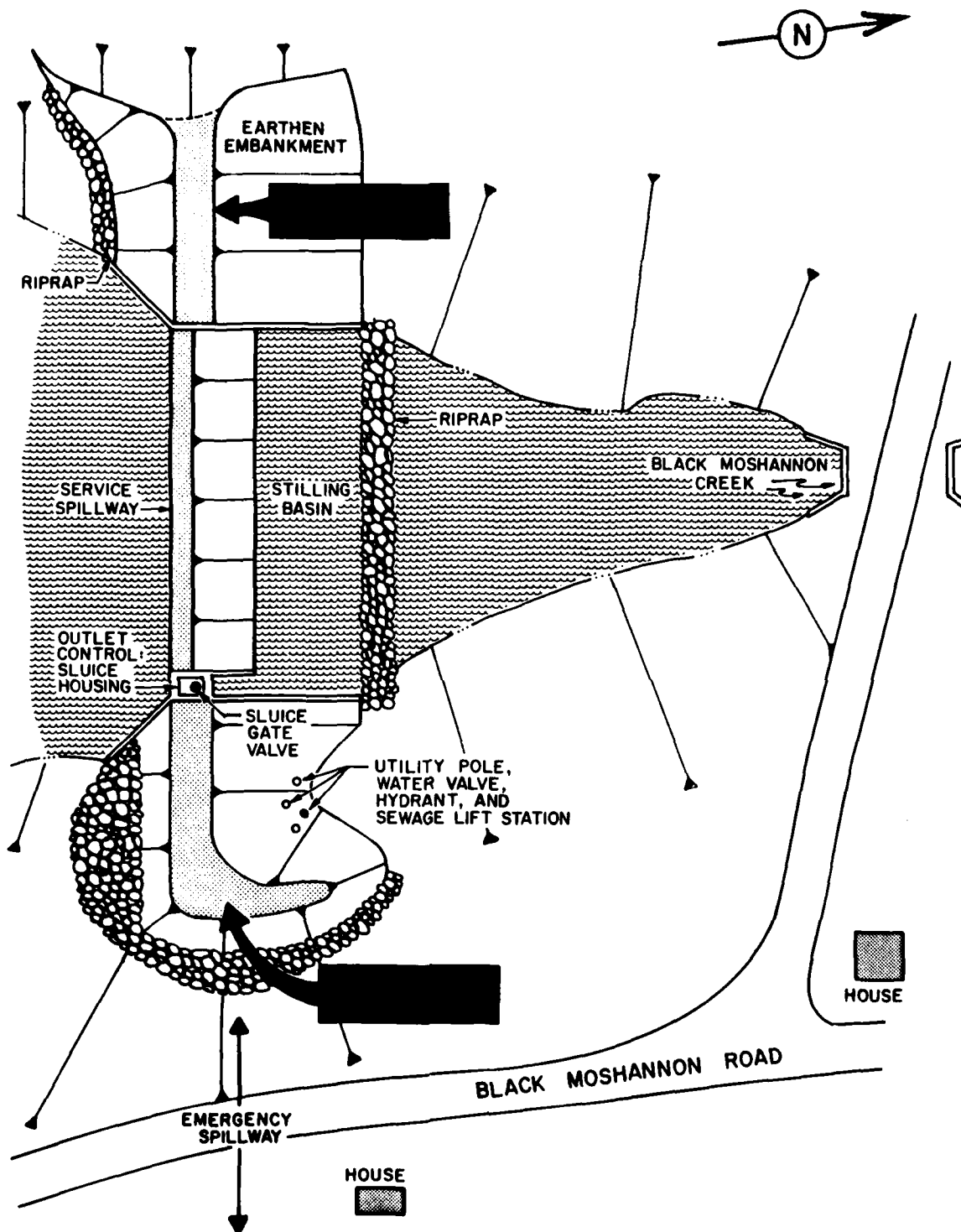
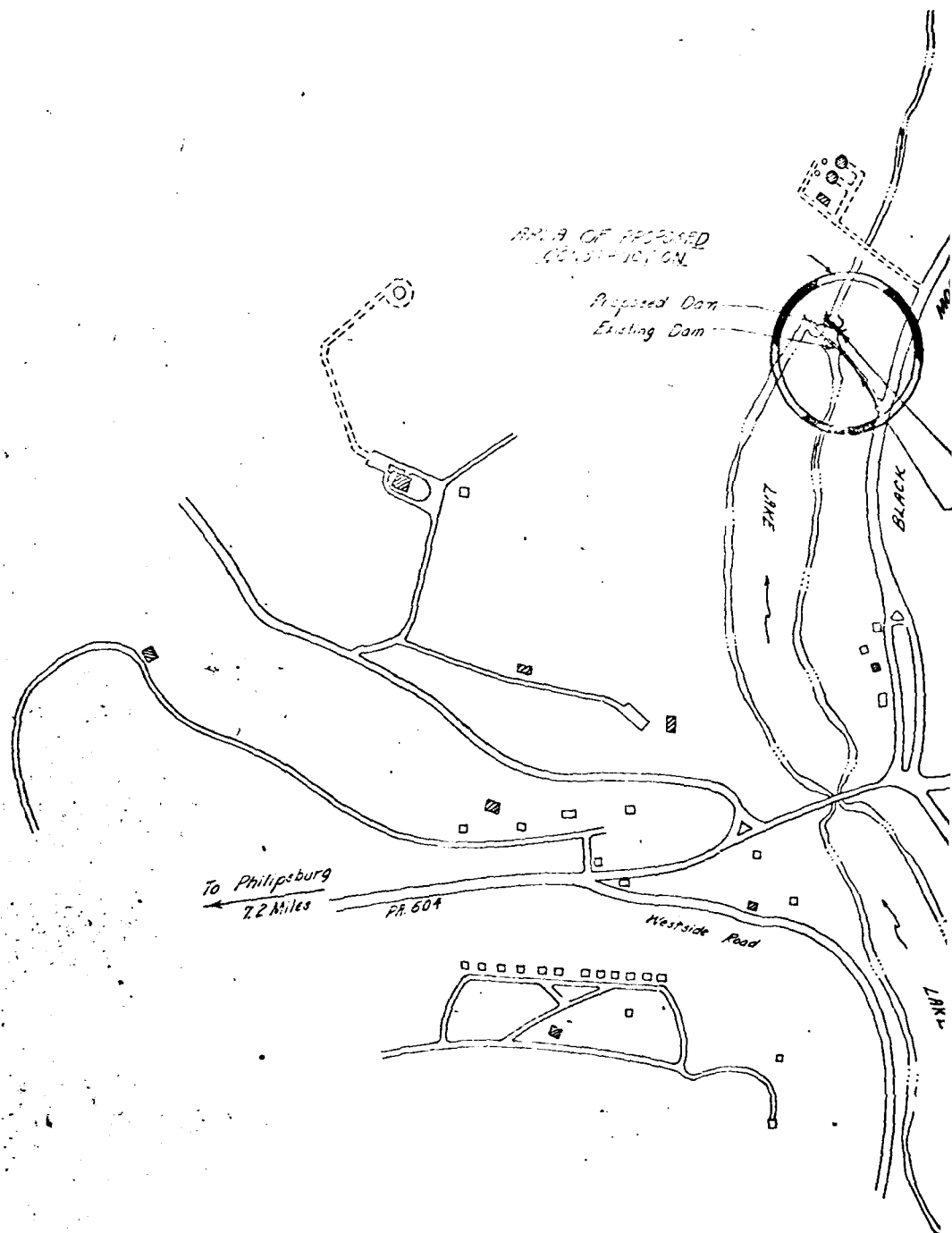
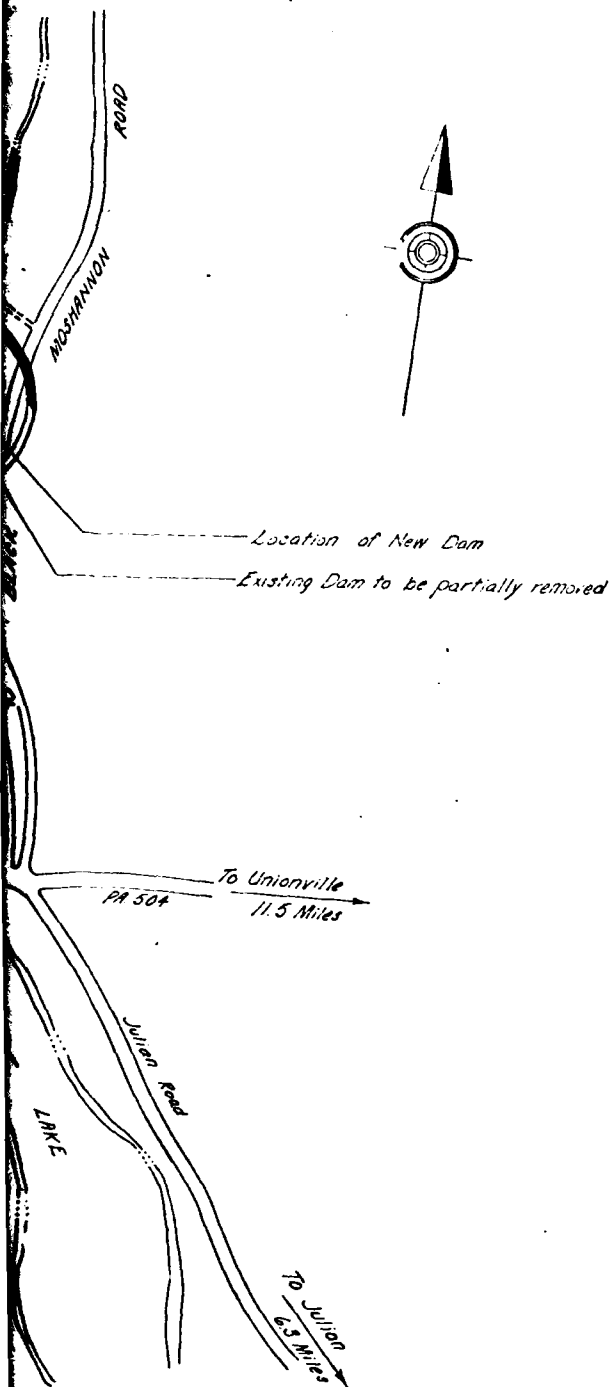


FIGURE 1 - KEPHART DAM
GENERAL PLAN
FIELD INSPECTION NOTES



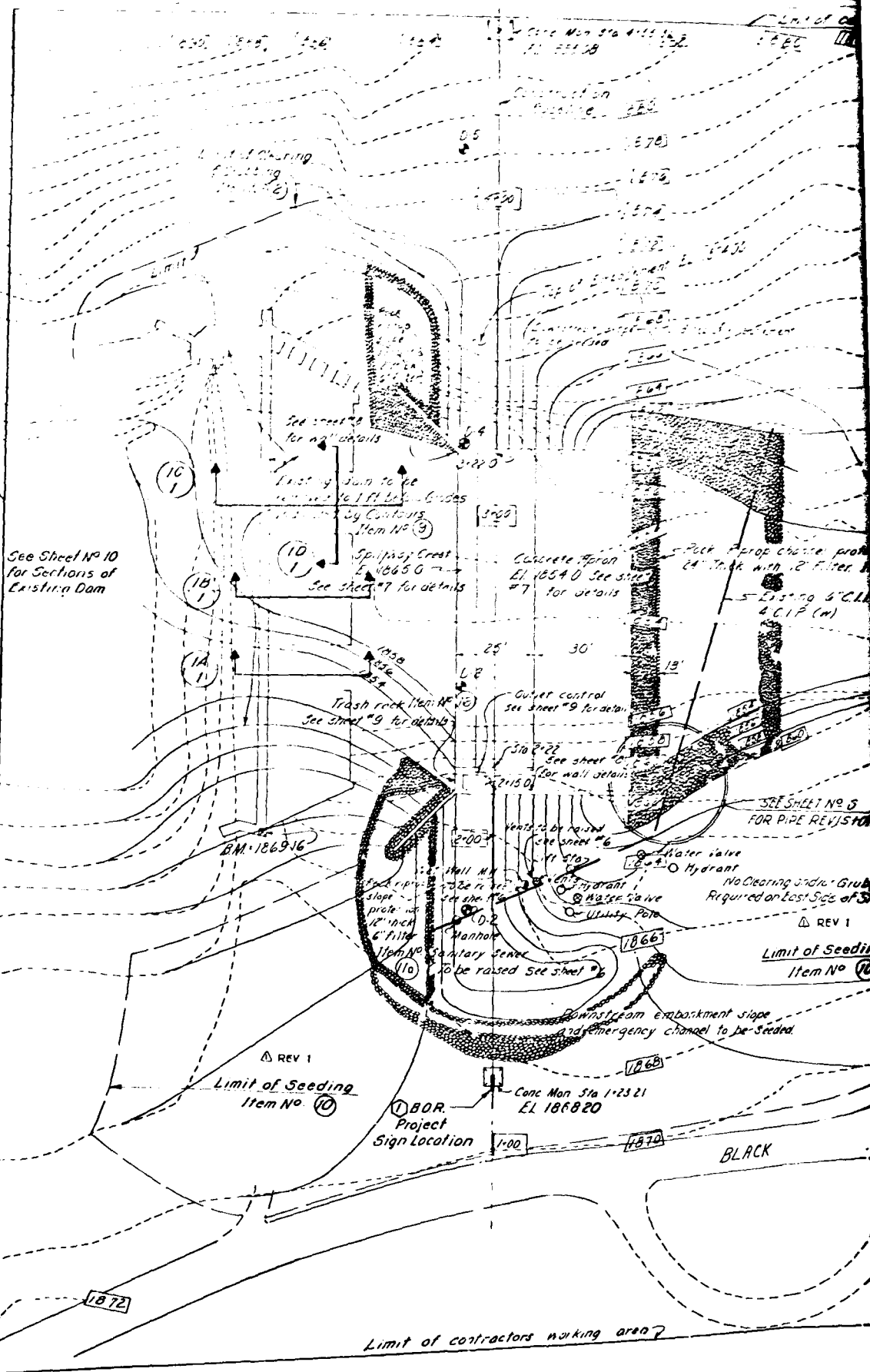


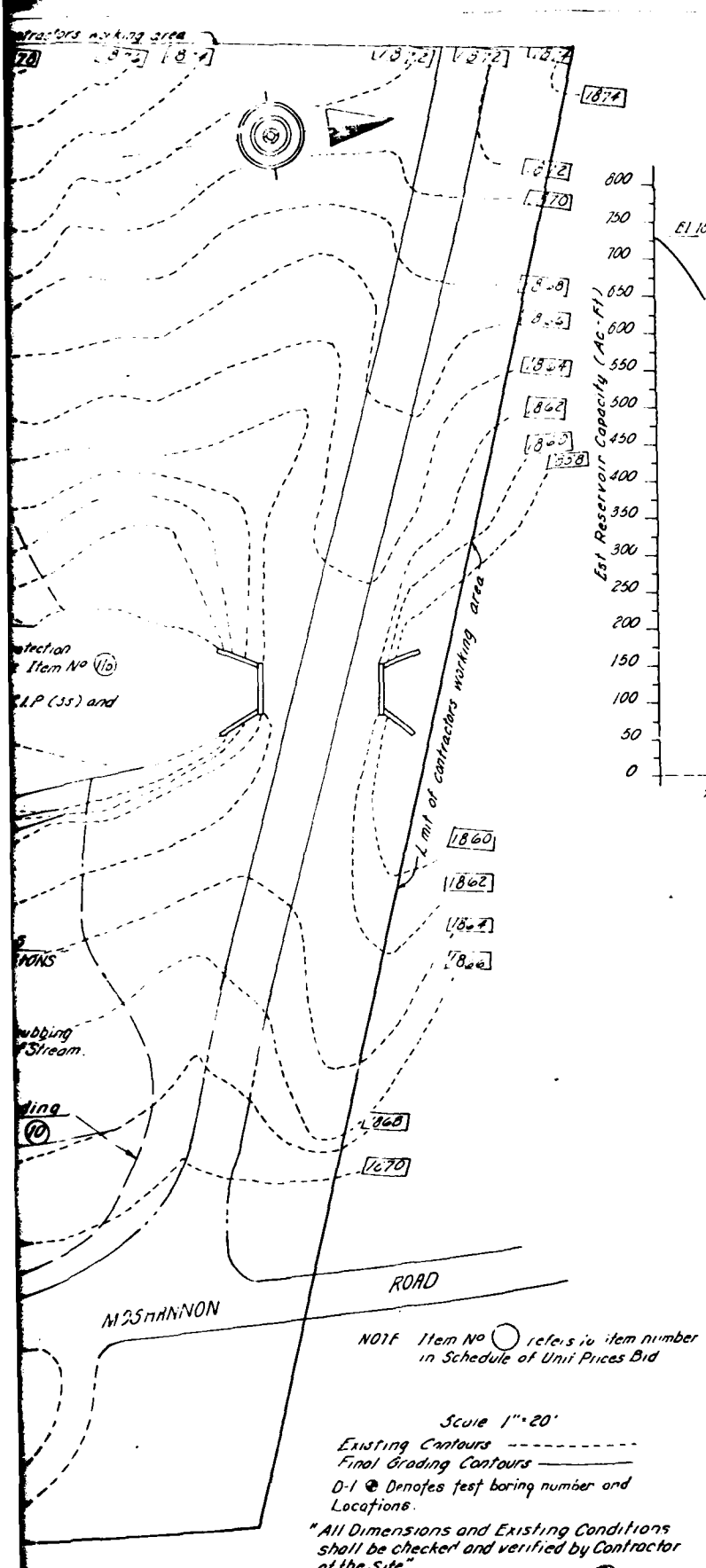
"All Dimensions and Existing Conditions
shall be checked and verified by Contractor
at the Site."

NO. 17.18		"AS-BUILT"		Date	
NO.		DATE		REVISION	
SUBMITTED		APPROVED		APPROVED	
 Rodney W. Brubaker PROFESSIONAL		 J. K. McHenry CHIEF OF DIVISION OF RECREATIONAL FACILITIES		 DuPuy DIRECTOR - BUREAU OF DESIGN	
COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL RESOURCES OFFICE OF RESOURCES MANAGEMENT					
PROJECT NO. R14:3.1					
KEPHART DAM BLACK MOSHANNON STATE PARK CONSTRUCTION BLACK MOSHANNON CREEK - CENTRE COUNTY					
BERGER ASSOCIATES, INC. Consulting Engineers P.O. Box 1943 Harrisburg, Pa.					
VICINITY PLAN					
DRAWN BY J.H.H. CHECKED BY E.M.L.		DATE Dec 1973 SCALE As shown		FIGURE 2	

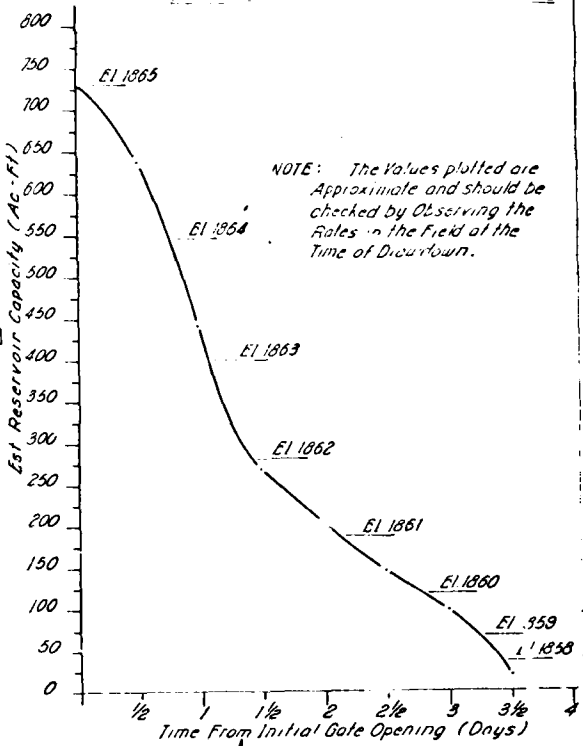
1850
 1852
 1854
 1856
 1858
 1860
 1862
 1864
 1866
 1868
 1870
 1872

Limit of contractor working area





WS ELEV & RESERVOIR CAPACITY vs TIME
For
LOWERING RESERVOIR USING 41.4' SLUICE GATE
AT THE FULLY OPEN POSITION



① 10-1775 Sign Location "AS-BUILT" 214

② 3174 Revisions as per Bulletin No 1

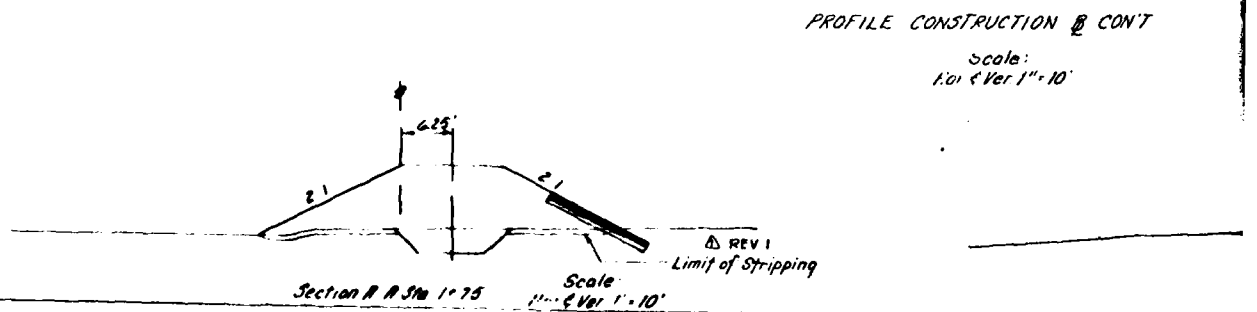
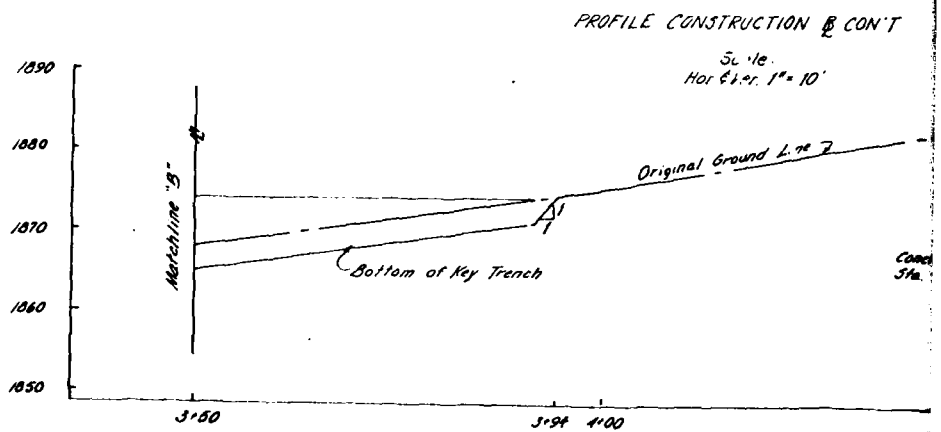
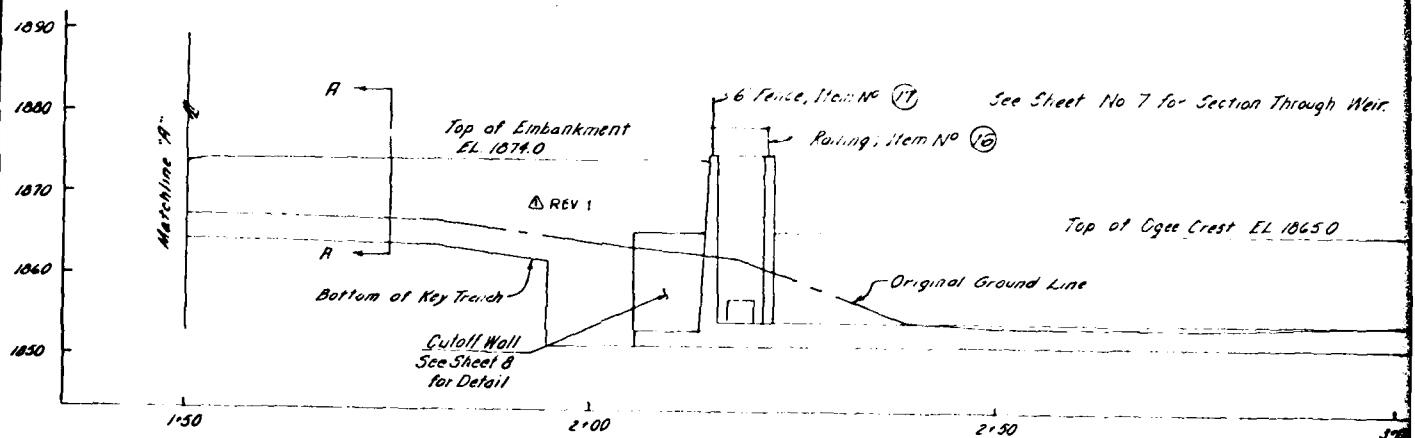
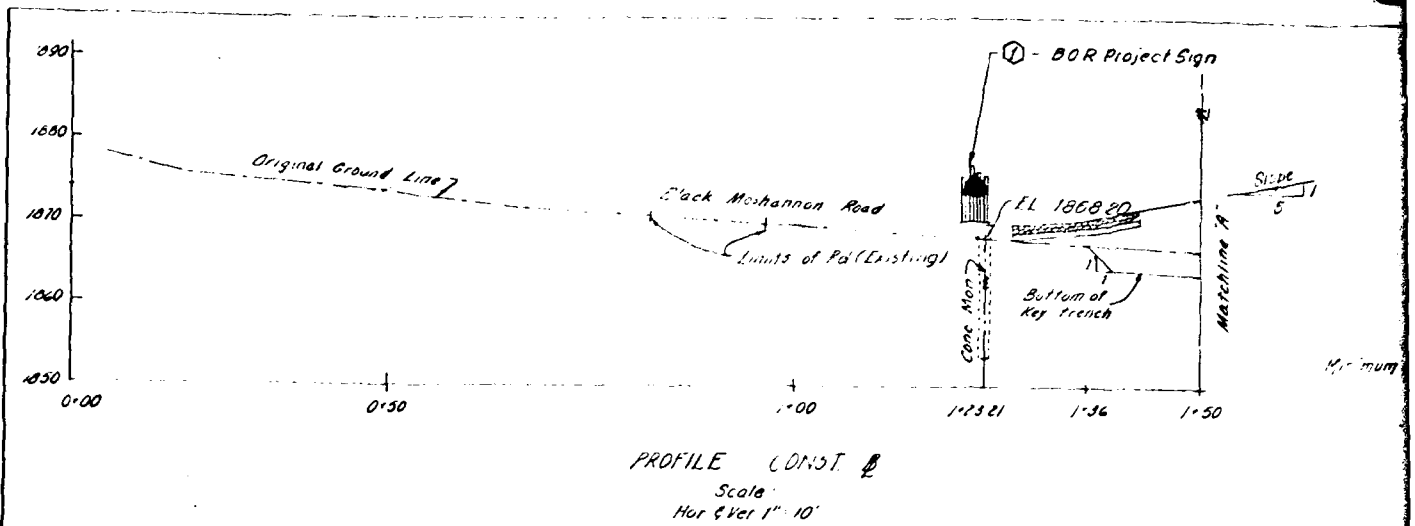
J. L. McNamee

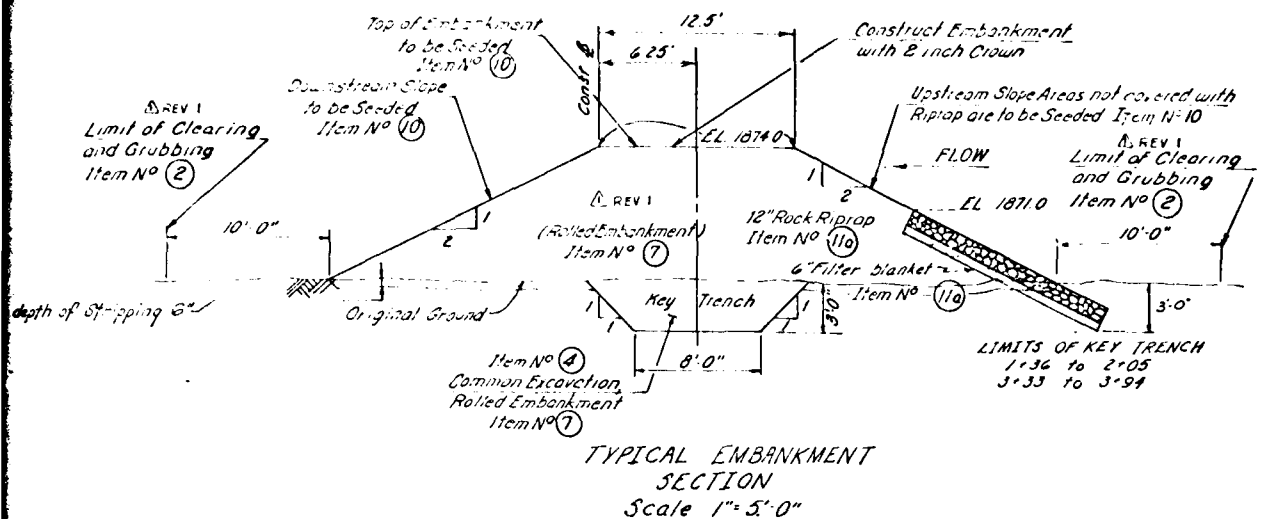


PROJECT NO R14'31
KEPHART DAM
BLACK MOSHANNON STATE PARK
CONSTRUCTION
BLACK MOSHANNON CREEK, CENTRE COUNTY
BERGER ASSOCIATES, INC

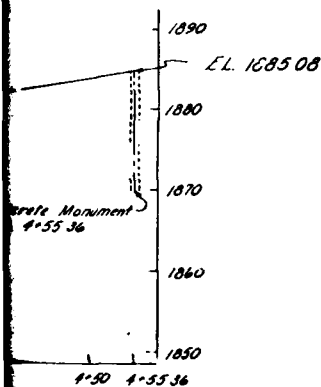
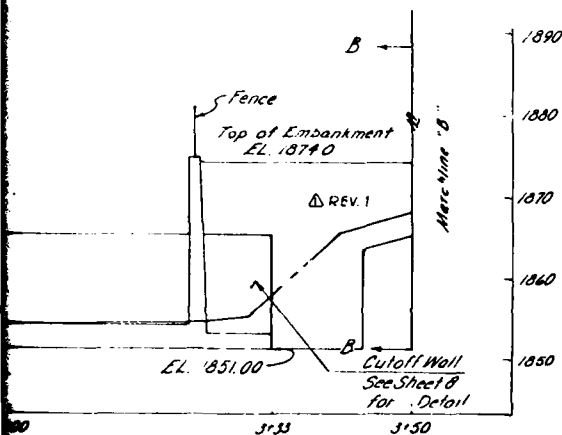
GENERAL PLAN

JHH Dec. 1973
EML
FIGURE 3

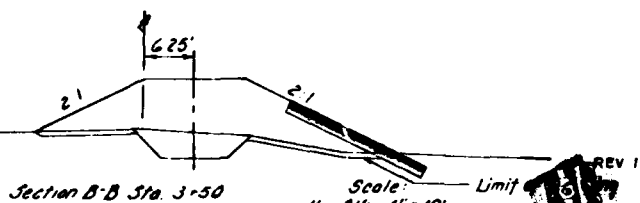




NOTE: Item No 10 refers to item number in Schedule of Unit Prices Bid



"All Dimensions and Existing Conditions shall be checked and verified by Contractor at the Site."



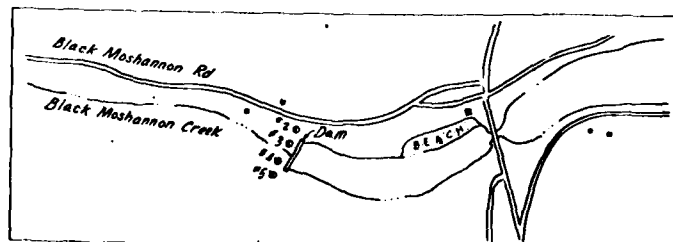
① 10/17/73	BOR Project Sign "AS-BUILT"		6/11
Δ 9-1-74 Revisions as per Bulletin No 1 JIM			
NO	DATE	REVISION	APPR
SUBMITTED			
APPROVED <i>Andrew V. Howard</i>			
APPROVED <i>J. L. M. Hines</i>			
APPROVED <i>DePerego</i>			
COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL RESOURCES OFFICE OF RESOURCES MANAGEMENT			
PROJECT NO. R14:3.1			
KEPHART DAM BLACK MOSHANNON STATE PARK CONSTRUCTION BLACK MOSHANNON CREEK - CENTRE COUNTY			
BERGER ASSOCIATES, INC. Consulting Engineers PO Box 1943 Harrisburg, Pa			
LONGITUDINAL SECTION EMBANKMENT CROSS SECTIONS TYPICAL SECTION			
DESIGNED BY J/H	DATE Dec. 1973	FIGURE 4	
CHECKED BY E.M.L.	SCALE As shown		

BORING NO D-2

BORING NO D-3

BORING NO D-4

A	B	EL 1866.5	A	B	EL 1854.1	A	B	EL 1855.0
1	10	Topsoil	1	6	Sand and cobbles	1	14	Grayish brown clayey silty sand
2	10	Lt. Brown silty fine sand damp	2	7		2	31	with rock fragments - moist
3	10		3	6	Grayish brown sand and rock	3	24	
4	12	Lt Brown silty fine sand	4	4	fragments - wet silty	4	34	
5	18	trace of fine gravel -	5	18		5	28	Grayish brown silty sand and rock
6	19	moist	6	16		6	43	fragments - moist
7	19	Lt. Brown fine sandy	7	10	Grayish brown sand and rock	7	33	
8	20	clayey silt - trace of gravel moist	8	20	fragments - wet	8	34	
9	18		9	21		9	29	Lt. brown and red silty sand with
10	50		10	27		10	56	rock fragments - moist
11	59		11	52		11	22	Grayish brown silty clay and sand
12	59	Lt reddish brown silty	12	39		12	40	with rock fragments - very moist
13	36	sand and rock fragments	13	37		13	37	
14	64	very moist	14	36	Grayish brown and red sand	14	22	
15	29		15	31	and rock fragments - traces	15	15	
16	28		16	23	of silt - wet	16	22	
17	19		17	17		17	65	
18	24		18	39		18	47	
19	52		19	16		19	31	Lt brown and red silty sand and
20	70	Multi-colored sand	20	47		20	37	rock fragments - moist to very moist
21	43	and rock fragments	21	51		21	40	
22	56	very moist	22	58		22	53	
23	40		23	37	Grayish brown and red sand and	23	52	
24	51		24	61	rock fragments - little clayey	24	92	
25	45		25	54	silt - wet	25	52	
26	130	Multi-colored highly decomposed	26	48		26	93	
27	35	sandstone	27	39	Grayish brown and red clayey	27	125	Red sandstone - moderately broken
28	67		28	51	silty sand and rock fragments	28		
29	53		29	60	With rounded gravel - very moist	29	97%	
30	78		30	76		30		
31	48		31	69		31		Gray sandstone with shale - few
32	81	Lt. brown and red sand	32	61		32		pyrite cavities
33	147	rock fragments - moist	33	750	Lt reddish gray sandstone -	33		
34	69		34	69/1	badly to moderately broken	34		Red sandstone moderately to badly
35	81		35	86%		35	89%	broken with pyrite cavities
36	177		36			36		Gray sandstone with streaks of shale
37	73		37			37		and red sandstone - moderately
38	159		38			38		broken
39	46		39	98%	Gray sandstone moderately	39		
40	50		40		broken with badly broken zones	40		
41	61		41			41	100%	
42	83		42			42		Gray sandstone moderately broken
43	67		43			43		(43.8 - 44.1 sandstone cong. with
44	246.5		44	94%		44		pyrite - badly weathered)
45		Gray sandstone boulder	45			45		
46		Gray silty sandy clay and rock	46		Gray sandstone - Slightly to	46	98%	Red sandstone conglomerate
47		fragments	47		moderately broken	47		
48	6	Light brown silty sand and	48			48		
49	33	rock fragments - wet	49	49%	Gray sandstone and shale cong. mod. to	49		
50	69		50		badly broken	50		
51	123		51		Gray sandstone and shale cong. -	51	100%	Gray sandstone slightly broken
52			52		badly broken with and seamy	52		
53	95%	Gray sandstone moderately	53	55%		53		
54		broken - hard	54		Gray sandstone and shale cong.	54		
55			55		moderately broken	55		
56			56			56	100%	Gray sandstone and shale cong.
57	100%		57	95%	Gray sandstone - moderately broken	57		moderately to badly broken
58		Gray sandstone - badly to	58		and seamy	58		
59		moderately broken - hard	59			59		
60			59	100%		60	95%	Gray sandy shale mod. broken and seamy
61	95%		61					



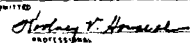
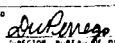
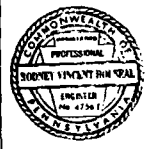
Boring Location Sketch

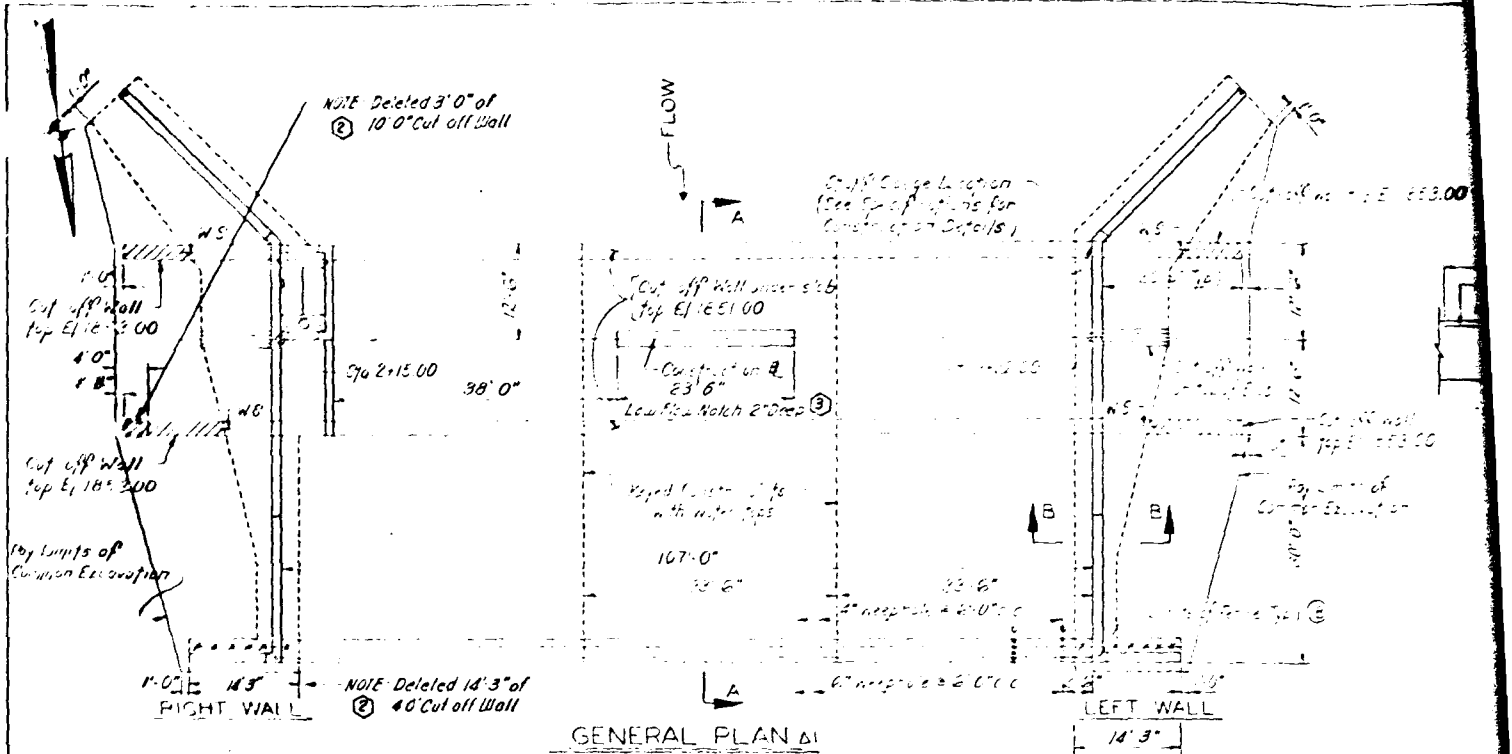
BORING NO D-5

1855.0	A	B	FL 1878.6
sand	1	2	Topsoil EL 1878.1
	2	23	Lt Brown clayey silt little sand
4.0	3	45	and rock fragments moist 1876.6
rock	4	51	
	5	47	Lt brown and reddish gray silty
12.0	6	91	sand and rock fragments damp
with	7	54	
15.0	8	102	
sand	9	118	
moist	10	88	1868.6
	11	42	Lt brown and reddish gray clayey
	12	42	silty sand and rock fragments
	13	85	very moist 1865.1
	14	103	
18.0	15		Brown sandstone boulder
	16		
	17		1861.6
sand	18	15	Lt brown and reddish gray clayey
very moist	19	17	silty sand with rock frags very moist
	20	91/3	1859.1
	21		
	22		
	23	71/2	Red and gray sandstone moderately
	24		to badly broken and seamy
	25	100%	
28.0	26		
water	27		
	28		
32.7	29		
	30	54%	1848.6
	31		Brown sandstone badly broken
32.9	32	53%	Seamy 1847.1
	33		Gray sandstone with shale and
34.8	34		pyrite moderately broken 1844.4
shale	35		
	36		Red sandstone moderately broken
	37	100%	
	38		1841.4
34.0	39		Lt Gray sandstone moderately to
water	40		badly broken and seamy
	41		
	42	84%	1837.1
	43		
	44		Gray sandstone slightly broken
38.5	45		and seamy
	46		
	47	96%	
46.1	48		
	49		Los' drill water at 51.0'
	50		
	51		
	52	100%	1822.1
5	53		Gray sandstone broken
	54		
	55		
	56		
	57	100%	1822.1
5	58		Gray sandstone
	59		
	60	100%	1818.6

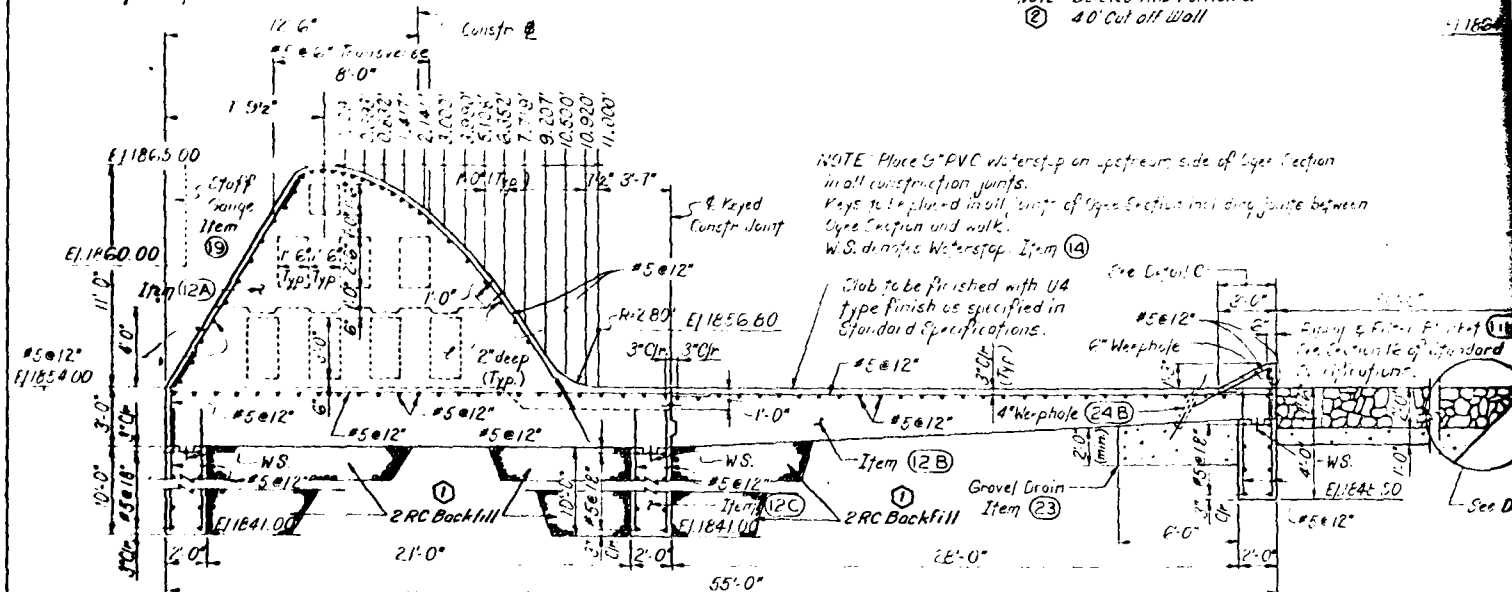
Column A denotes depth in feet
Column B denotes number of blows per foot on Sample
Spoon or percentage of core recovery.

"All Dimensions and Existing Conditions
shall be checked and verified by Contractor
at the Site."

D 1175		"AS-BUILT"		W/S
NO	DATE	REVISION	APPR	
SUBMITTED				
 Rodney T. Howard PROFESSIONAL				
APPROVED				
 J. L. McNamee CHIEF DIVISION OF RECREATION FACILITIES				
APPROVED				
 J. L. McNamee DIRECTOR BUREAU OF DESIGN				
				
COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL RESOURCES OFFICE OF RESOURCES MANAGEMENT				
PROJECT NO. R14.3.1				
KEPHART DAM BLACK MOSHANNON STATE PARK CONSTRUCTION BLACK MOSHANNON CREEK - CENTRE COUNTY				
BERGER ASSOCIATES, INC. Consulting Engineers PO Box 1943 Harrisburg, Pa				
TEST BORING RESULTS				
DRAWN BY JRH	DATE Dec. 1973	FIGURE 5		
CHECKED BY E.M.L.	SCALE As shown			

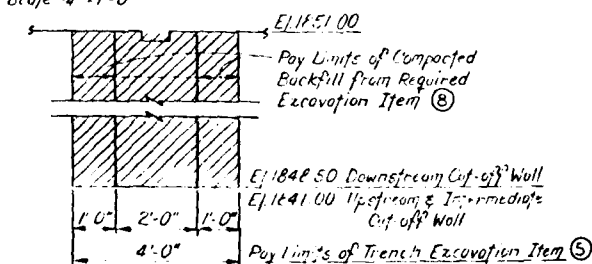


NOTE: All Keys in Type are 3" x 1' 6".

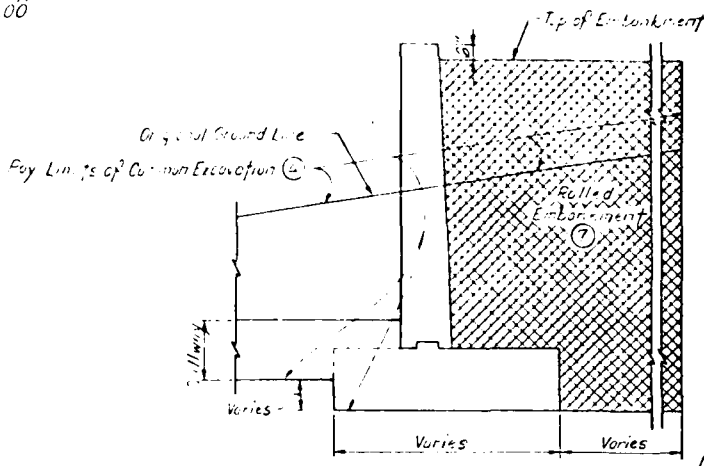


CONCRETE ITEMS A1

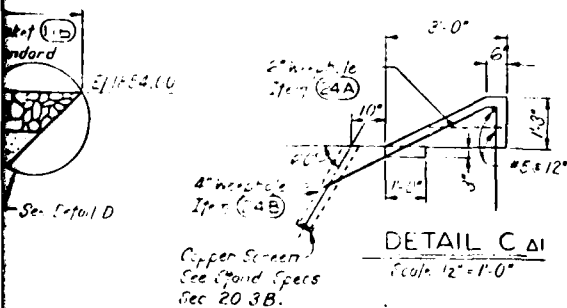
- 12A - OGEE SECTION
- 12B - SLAB
- 12C - CUT-OFF WALLS
- 12D - SPILLWAY WALLS & FOOTINGS



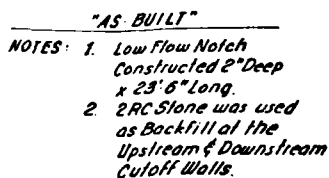
- All canteens to be Class A Concrete (if 4-5, 200 cpsi) ⑩.
- All reinforcing steel to be A 615 30 ⑪.
- All structural steel to be A 36 except as noted.
- Buckling of columns will be supported directly before slab is poured.
- Minimum cover on reinforcing steel to be 3" except as noted.
- All concrete surfaces shall be finished and cured in accordance with FDOT Practices specified in Standard Specifications.
- All exposed concrete shall be a 32" chipper.
- ○ Concrete bid items to include the full range of life of process.



No Scale See General Plan
this Drawing.

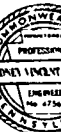


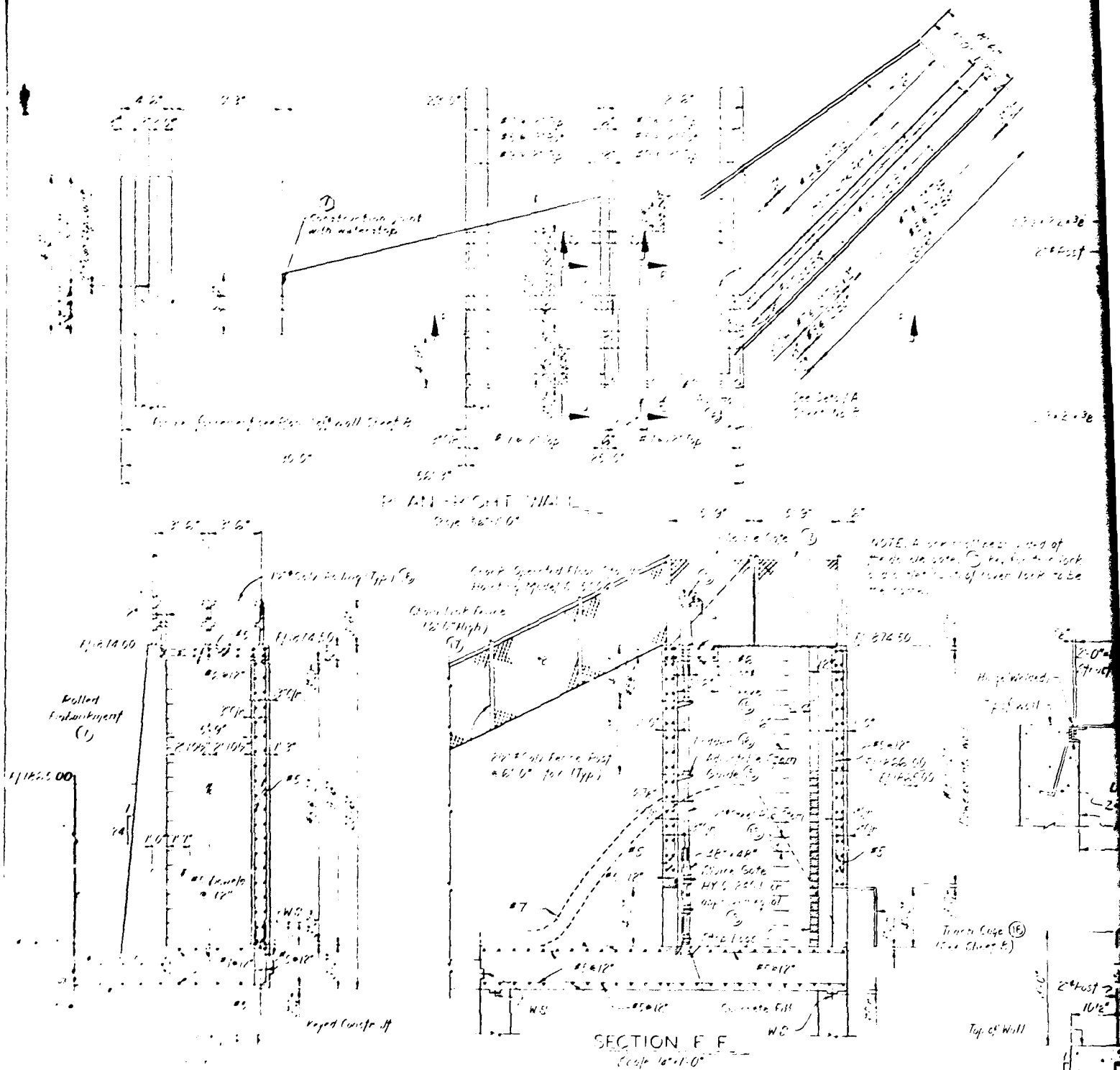
Sculp. 12" = 1'-0"



"AS BUILT"

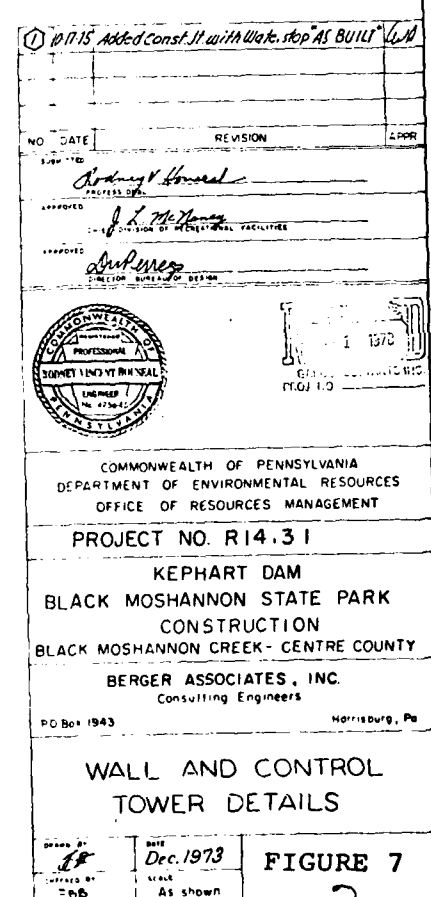
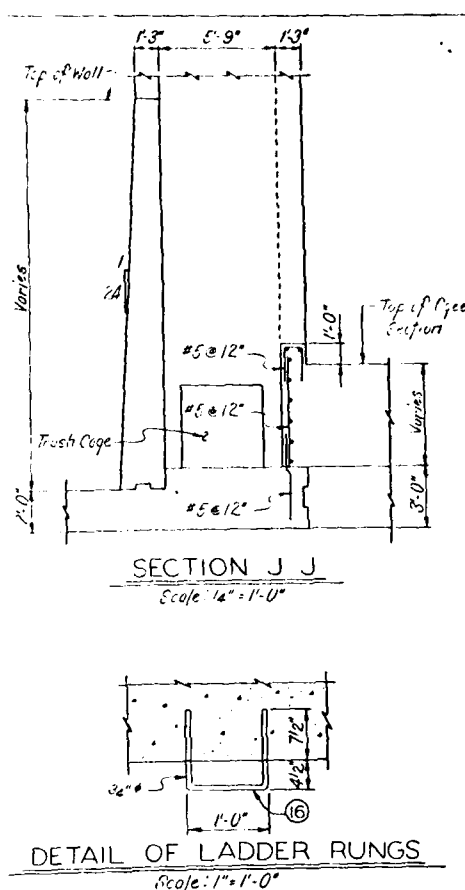
NOTES: 1. Low Flow Notch
Constructed 2" Deep
x 23' 6" Long.
2. 2RC Stone was used
as Backfill at the
Upstream & Downstream
Cutoff Walls.

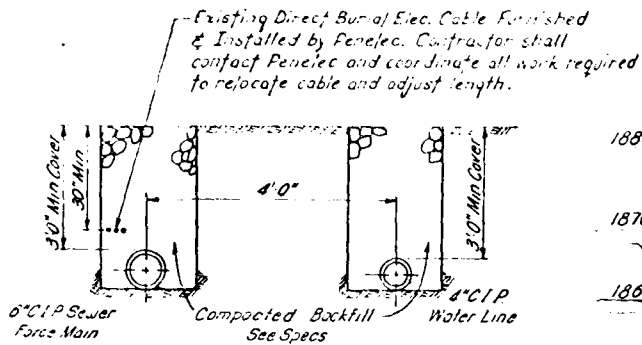
①	10/17/75	Added 2RC Backfill "AS-BUILT"	JLM
②	10/17/75	Deleted Cut off Wall as Noted "AS-BUILT"	JLM
③	10/17/75	Added Low Flow Natch "AS-BUILT"	JLM
NO. 311174 Revised as per Bulletin No. 1			JLM
DATE	REVISION		APPR
SUBMITTED BY: <i>Robert W. Townsend</i> TITLE: <i>Chief, Division of Recreation Facilities</i> APPROVED: <i>J. L. McHenry</i> TITLE: <i>Chief, Division of Recreation Facilities</i> APPROVED: <i>Don Puzigo</i> TITLE: <i>Director, Bureau of Design</i>			
			
COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL RESOURCES OFFICE OF RESOURCES MANAGEMENT PROJECT NO. R14 3.1 KEPHART DAM BLACK MOSHANNON STATE PARK CONSTRUCTION BLACK MOSHANNON CREEK - CENTRE COUNTY BERGER ASSOCIATES, INC. Consulting Engineers PO Box 1943 Harrisburg, Pa			
Ogee Spillway Plan and Sections			



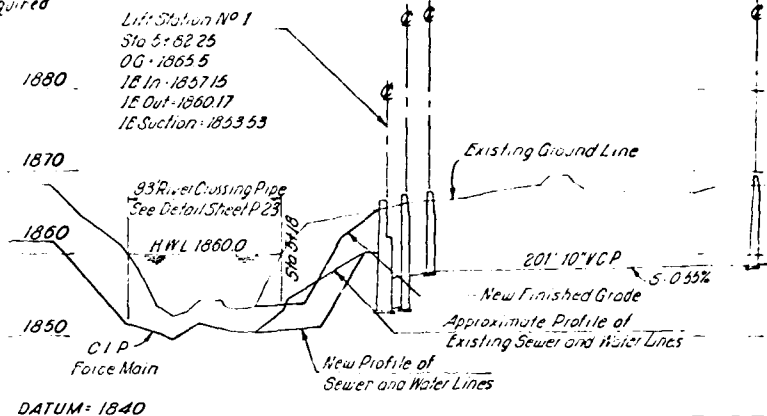
NOTES

- For General Structural Notes see Sheet 7.
- Legend: W.S. denotes Waterstop
- For Section 101 see Sheet 6.
- Detail not given for splice, yoke and twist are by the Fisker Hunt Company

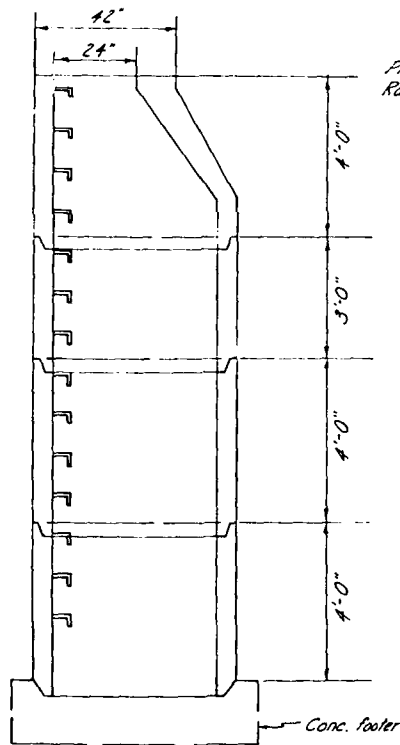




LAKE AND STREAM CROSSING DETAIL
No Scale



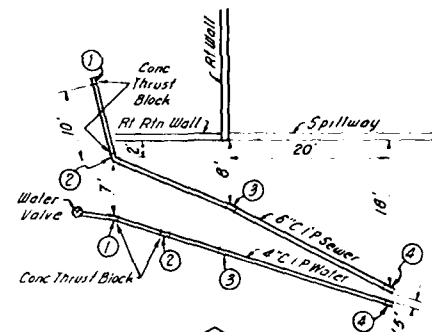
PROFILE - SEWER "MAIN LINE"
See "As Built" Detail below for new profile of sewer and water lines



SECTION ELEVATION - MANHOLE M-2
STATION 1+73, 12' Lt. of Const. B

Present EL 1867.6
Raise to EL 1874.1

(X) "Sika Seal" As m
by Sika Chemical Co
Passaic, New Jersey
Contractor

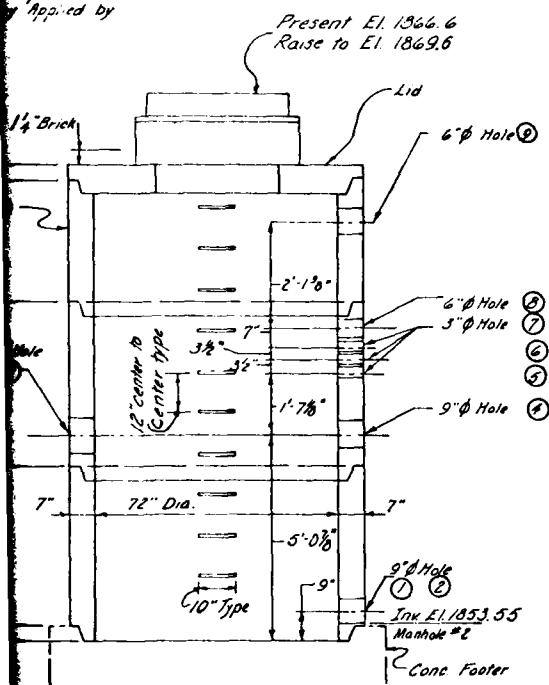
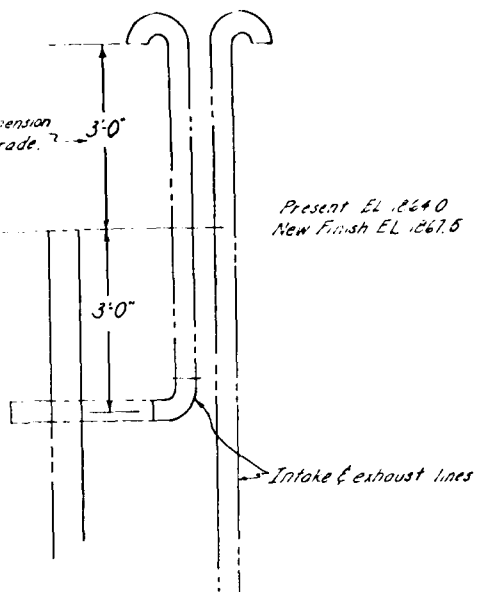
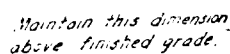
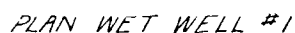


PLAN
"AS BUILT" RELOCATION OF SEWER & WATER LINES (East Slope - Downstream from Spillway) Not to Scale

- ITEMS
- 6" CIP SEWER LINE
- 1 - Vert. Bend - Elev 1858.5
 - 2 - Elbow - Elev 1855
 - 3 - Splice - Elev 1851
- 4" CIP WATER LINE
- 1 - Vert. Bend - Elev 1861
 - 2 - Vert. Bend - Elev 1853
 - 3 - Splice - Elev 1851

Standard Manhole Supplier
Warren Concrete Products, Inc.
1911 Pennsylvania Avenue West
Warren, Pennsylvania 16365
Keystone Monobase Precast
Concrete Manholes
A.S.T.M. C-478

All Work shown on this Drawing
to be paid for under Item No 18.



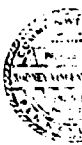
SECTION ELEVATION EXISTING WET WELL

STATION 1+85, 10' Rt. of Const. B

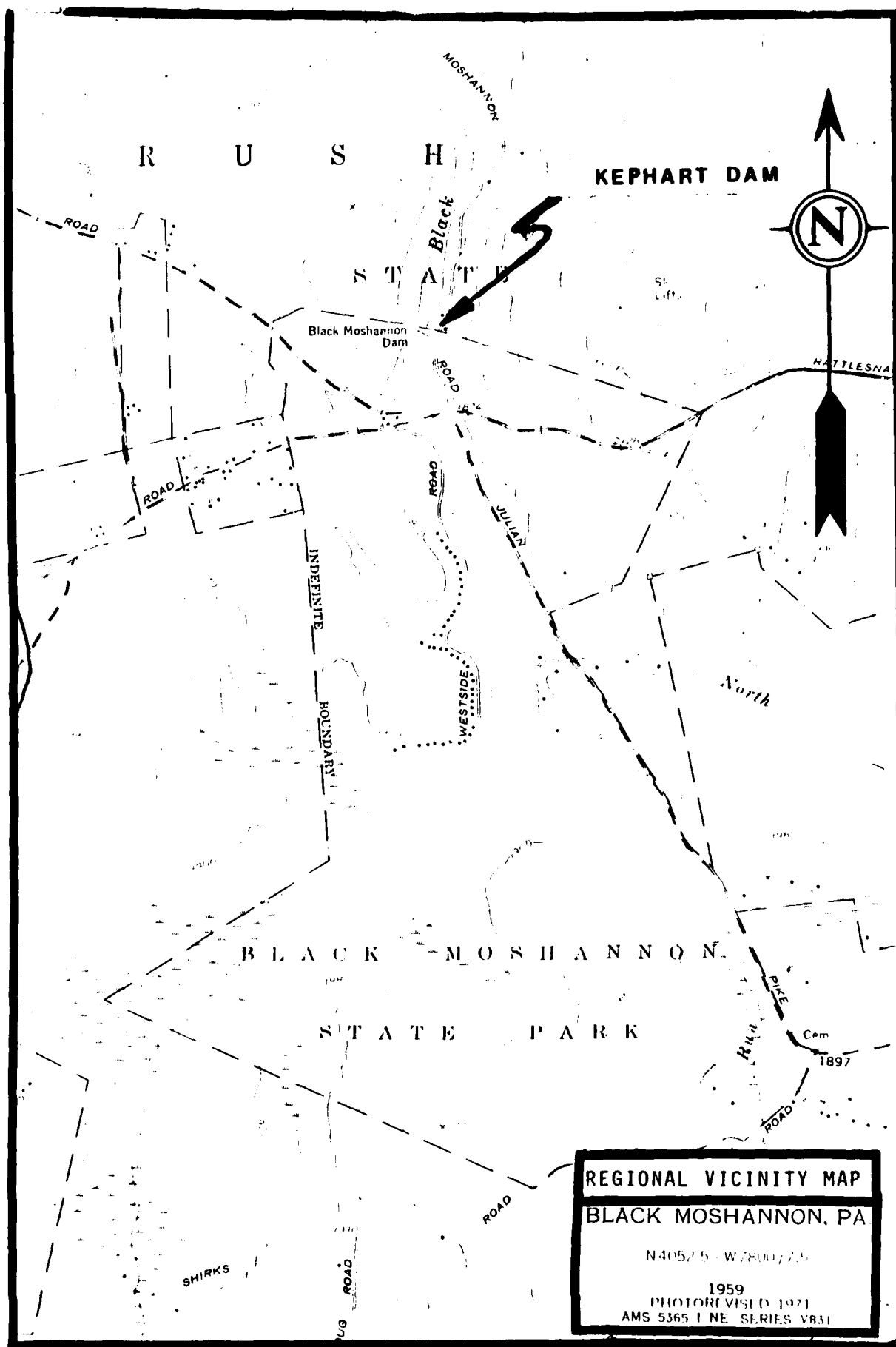
Wet Well Supplier
New Enterprise Stone & Lime Co., Inc.
Concrete Products Division
Manufactured to meet A.S.T.M. Spec. C-478

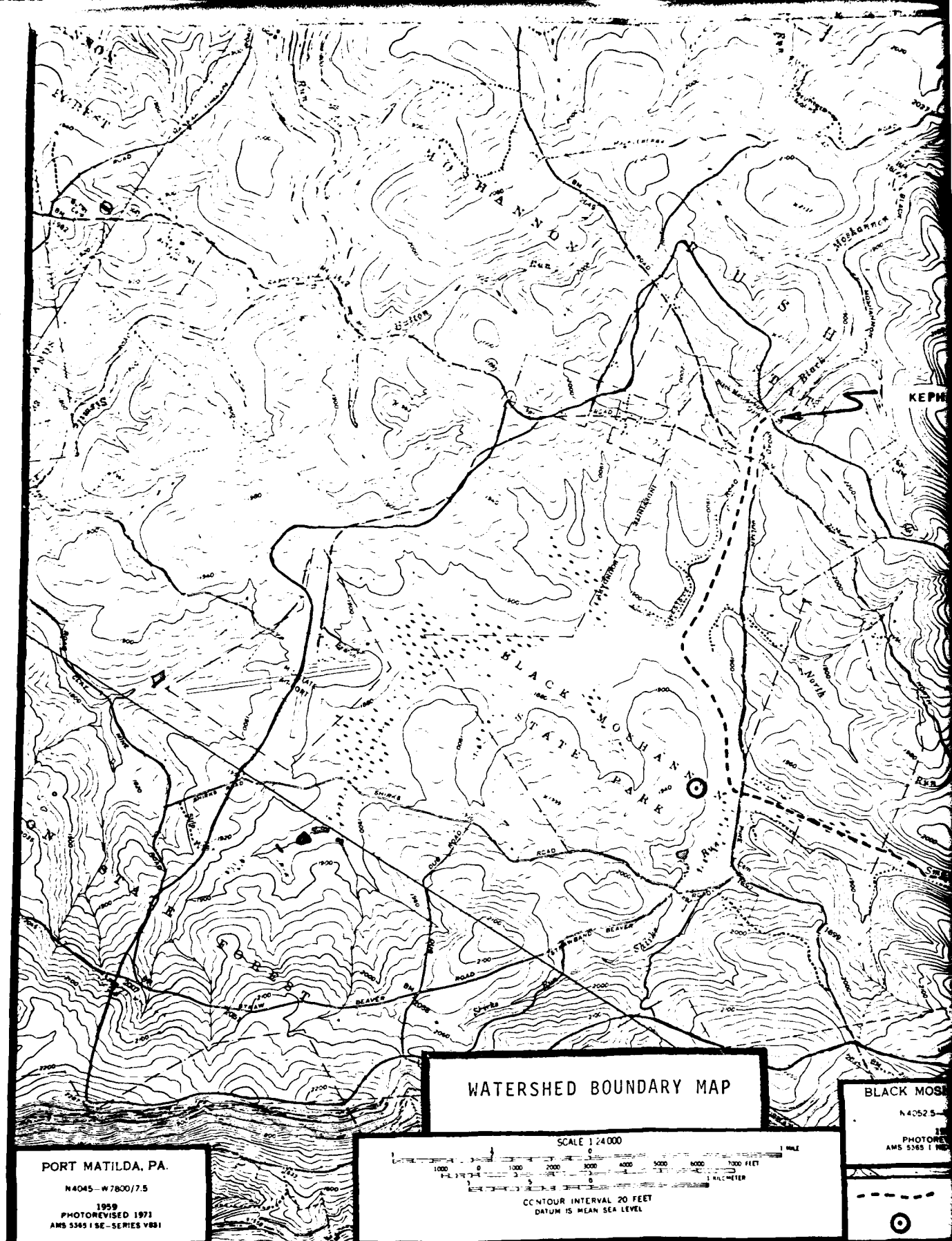
"All Dimensions and Existing Conditions shall be checked and verified by Contractor at the Site."

WET WELL VENT PIPES
Station 1+86.14 Rt. Const. B

① 10.17.15 Plan Sewer & Water Line Reloc. "AS BUILT" 10/17/15	
NO.	DATE
SUBMITTED	
<i>Anthony M. Lisciani</i> PROFESSIONAL	
APPROVED	
<i>J. L. McManus</i> CHIEF, DIVISION OF RECREATIONAL FACILITIES	
APPROVED	
<i>Don Ruggie</i> DIRECTOR, BUREAU, DESIGN	
	
COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL RESOURCES OFFICE OF RESOURCES MANAGEMENT	
PROJECT NO. R14:3.1	
KEPHART DAM BLACK MOSHANNON STATE PARK CONSTRUCTION BLACK MOSHANNON CREEK - CENTRE COUNTY	
BERGER ASSOCIATES, INC. Consulting Engineers	
PO Box 1943	Harrisburg, Pa
DRAWN BY <i>JHM</i> CHECKED BY <i>E.M.L.</i>	
DATE <i>Dec. 1973</i> SCALE As shown	
FIGURE 8 	

APPENDIX G
REGIONAL VICINITY MAP
AND
WATERSHED BOUNDARY MAP





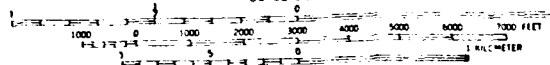
PORT MATILDA, PA.

N4045-W7800/7.5

1959
PHOTOREVISED 1973
AMS 5365 I SE-SERIES V881

WATERSHED BOUNDARY MAP

SCALE 1:24,000



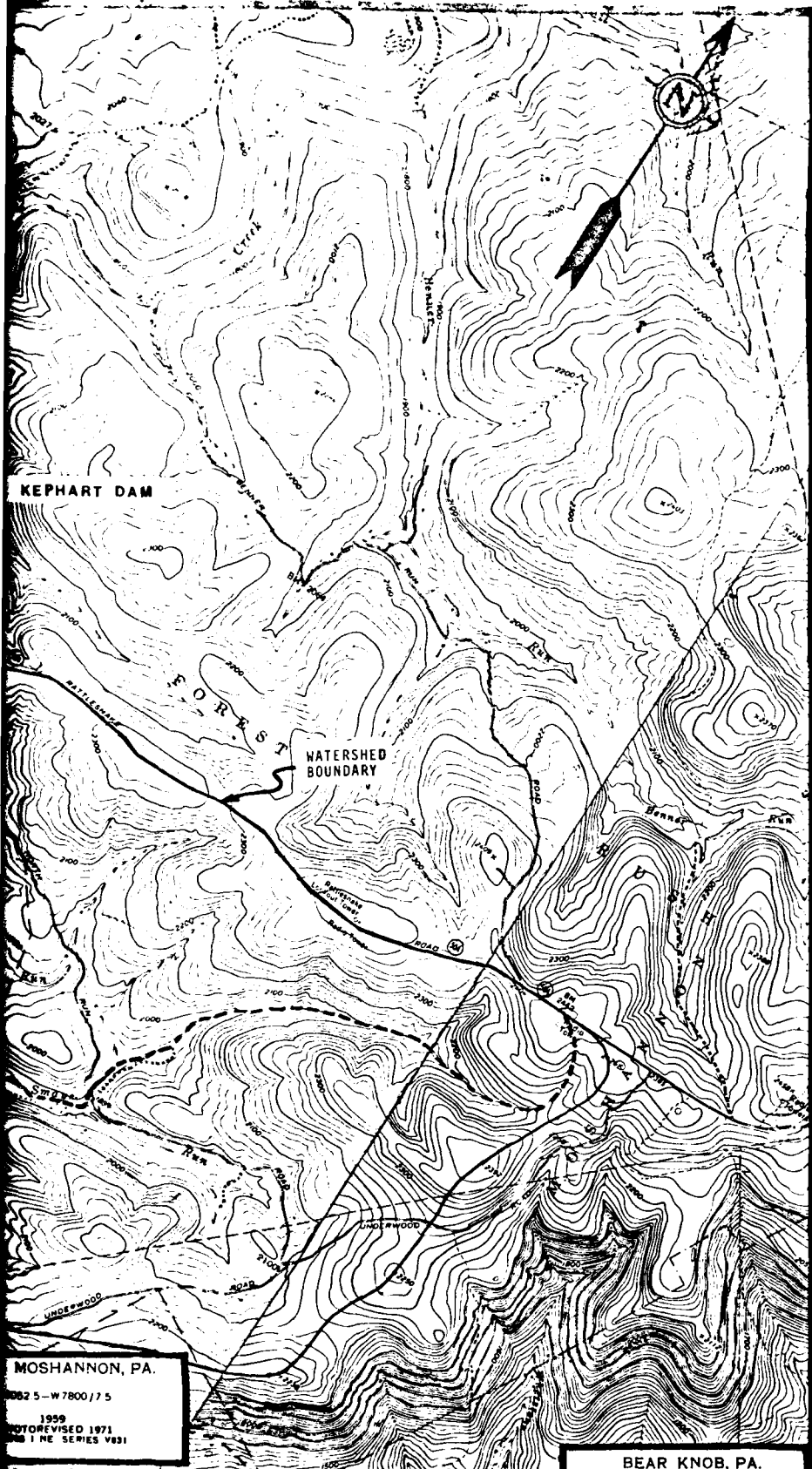
CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

BLACK MOSHANNON

N4052 S-

PHOTOREVISED
AMS 5365 I SE-SERIES V881





LONGEST WATERCOURSE
CENTROID OF DRAINAGE AREA