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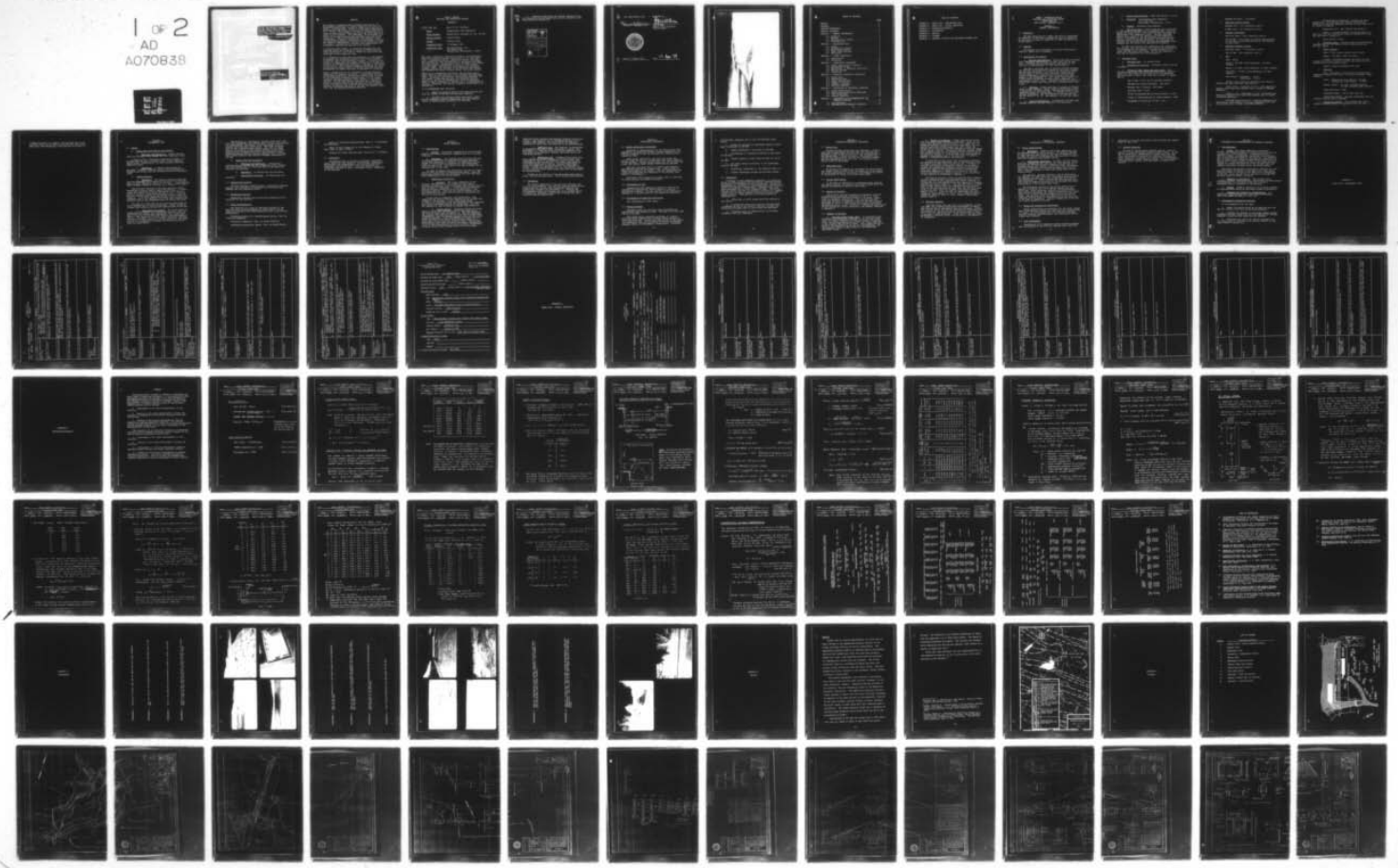

LEVEL II

AD A070838

SUSQUEHANNA RIVER BASIN
SINKING CREEK, CENTRE COUNTY
PENNSYLVANIA

National Dam Inspection Program. Colyer Lake Dam (NDS ID Number PA-00448, PennDER ID Number 14-112), Susquehanna River Basin, Sinking Creek, Centre County, Pennsylvania.

Phase I Inspection Report.

COLYER LAKE DAM
NDS I.D. No. PA-00448
PENNDER I.D. No. 14-112

(11) Apr 79

(12) 201 p

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

Distribution Unlimited
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Contract No. DACW31-79-C-0013

(15)

PREPARED FOR

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

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PREPARED BY

GAI CONSULTANTS, INC.
570 BEATTY ROAD
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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 resonably 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

Colyer Lake Dam — NDS I.D. No. PA-00448

Owner: Pennsylvania Fish Commission

State Located: Pennsylvania (PennDER I.D. No. 14-112)

County Located: Centre County

Stream: Sinking Creek

Inspection Date: 13 November 1978

Inspection Team: GAI Consultants, Inc.
570 Beatty Road
Monroeville, Pennsylvania 15146

[CONT'D FROM P. 1]

The visual inspection, operational history, and hydrologic/hydraulic analysis indicate the facility is in good condition. A maintenance manual, operations manual, and emergency operations plan are available or are being developed for the facility. The emergency plan reviewed by the inspection team appears insufficient in that it lacks several critical items. Deficiencies noted during the inspection include cracking and spalling in the spillway weir section and sidewalls and minor cracking within the outlet conduit.

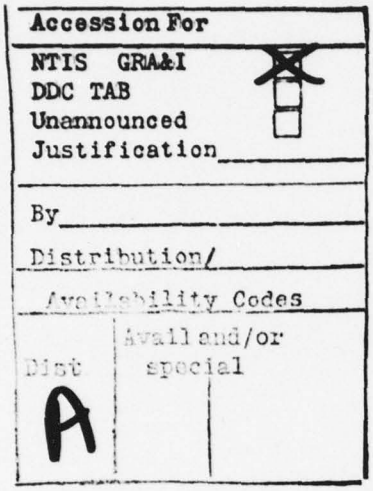
Based on the recommended guidelines, the Spillway Design Flood (SDF) for this facility is the Probable Maximum Flood (PMF). Hydrologic and hydraulic calculations performed for this Phase I study indicate that the discharge/storage capacity of the dam can accommodate a flood of magnitude equal to about 77 percent of the PMF prior to overtopping of the dam. Therefore, the spillway system is considered to be inadequate.

It is recommended that the owner:

a. Repair the spalled areas of the spillway weir and seal all cracks in the weir and spillway sidewalls.

b. Evaluate the cracking within the outlet conduit during subsequent periodic inspections and take remedial action if deteriorating conditions are observed.

c. Reevaluate and revise the present emergency plan for Colyer Lake in accordance with, but not limited to, the items listed in Section 4.5.



GAI Consultants, Inc.

Bernard M. Mihalcin, P.E.

Date 22 MARCH 79

Approved by:

G. K. WITHERS
Colonel, Corps of Engineers
District Engineer

Date 17 Apr 79

OVERVIEW PHOTOGRAPH

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PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION REPORT
COLYER LAKE DAM
NDI# PA-448, PENNDER# 14-112

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. Colyer Lake Dam is a zoned earth embankment approximately 38 feet high and 700 feet long. Including the spillway system, the length of the facility is approximately 780 feet. (see Figure 1).

The dam is provided with an ungated concrete rectangular spillway and plunge pool located on the right abutment. The spillway consists of a 69-foot wide trapezoidal weir section aside a 10-foot wide rectangular flume section (inside dimensions), separated by a concrete wall (see Figure 10 and Photograph 6). The outlet works consist of a 4-foot square reinforced concrete outlet connected to a rectangular vertical riser. Discharge through the outlet is controlled by stop logs that are set in grooves within the riser.

[CONT'D ON P. ii]

b. Location. Colyer Lake Dam is located on Sinking Creek, Potter Township, Centre County, Pennsylvania, about 11 miles east of State College. The dam and reservoir are contained within the Centre Hall, 7.5 minute U.S.G.S. topographic quadrangle. The coordinates of the dam are N40° 46' 50" and W77° 40' 50" (see Regional Vicinity Map, Appendix G).

c. Size Classification. Intermediate (38 feet high; maximum reservoir storage capacity 1,730 acre-feet).

d. Hazard Classification. High (see Section 3.1.c.4).

e. Ownership. Pennsylvania Fish Commission
P. O. Box 1673
Harrisburg, Pennsylvania 17120

f. Purpose. Recreation and research.

g. Historical Data. Colyer Lake Dam was constructed in the period of October 1964 to September 1966. Both the design and construction of the facility were undertaken by Pennsylvania Fish Commission staff. Periodic progress reports were issued by the Pennsylvania Fish Commission, Office of Engineering, and the construction site was frequently visited by PennDER personnel. No indications of problems are contained within the available PennDER correspondence and the project was completed as scheduled.

In 1968, the concrete wall separating the trapezoidal weir section from the by-pass canal section was replaced as it was damaged by ice pressure. Current practice is to lower the lake level each winter (as was the condition at the time of inspection) for ice protection.

1.3 Pertinent Data.

a. Drainage Area. 8.4 square miles.

b. Discharge at Dam Site. Discharge records are not available.

c. Elevation (feet above mean sea level). The following elevations were obtained through field measurements that were based on the elevation of the emergency spillway crest at 1244.0 feet (see note on Sheet 3, Appendix C).

Top of Dam ≈ 1252 (top of spillway wingwall).

Maximum Pool Design Surcharge - Not known.

Maximum Pool of Record - Not known.

Spillway Crest ≈ 1244.

Invert of Upstream End of Outlet Conduit ≈ 1211.

Invert of Downstream End of Outlet Conduit ≈ 1209.

Streambed at Centerline of Dam ≈ 1211.

Maximum Tailwater - Not known.

d. Reservoir Length (miles).

Maximum Pool ≈ 0.8 (elevation 1252.0)

Normal Pool ≈ 0.6 (elevation 1244.0)

e. Storage (acre-feet).

Spillway Crest ≈ 1010 (elevation 1244.0)

Top of Dam ≈ 1730 (does not include approximately 18 acre-feet of storage provided by the adjacent by-pass canal).

f. Reservoir Surface (acres).

Spillway Crest ≈ 77 (elevation 1244.0)

Top of Dam ≈ 105 (elevation 1252.0)

g. Dam.

Type - Earth.

Length ≈ 700 feet (field measured); 740 feet (design).

Height ≈ 38 feet (field measured); 45 feet (design).

Top Width ≈ 15 feet (field measured); 18 feet (design).

Side Slopes - Upstream: 3H:1V
Downstream: 2.5H:1V

Zoning - Four zones are denoted on the contract drawings and specifications (see Figure 6).

Class A Fill - Upstream of core - semi-impervious material free from rocks greater than 6 inches in maximum dimension.

Class B Fill - Downstream of core - selected semi-impervious material free from rocks greater than 12 inches in maximum dimension.

Selected Impervious Fill - Selected impervious and structurally sound material free from vegetable matter and rock greater than 4 inches in maximum dimension.

Selected Pervious Material - Mantles the downstream face - selected pervious material sufficiently pervious to drain the embankment and may contain rocks up to 12 inches in diameter.

Impervious Core - See "Zoning" and Figure 6.

Cutoff - A cutoff extending a minimum depth of 4 feet into rock was constructed along the centerline of the dam (see Note 8, Figure 6).

Grout Curtain - None.

h. Diversion Canal. By-pass canal constructed along the east side of the reservoir which combines with the spillway system.

i. Outlet Conduit.

Type - 4-foot square concrete box culvert.

Length ≈ 216 feet, inlet to outlet.

Closure - Discharge through the outlet is controlled by 6-inch by 6-inch by 5-foot oak stop logs set in grooves within the concrete riser.

Access - Riser accessible from crest.

j. Spillway.

Type - Rectangular concrete chute channel with trapezoidal-shaped crest aside a 10-foot rectangular flume section.

Width - Trapezoidal weir section: 69 feet
Rectangular flume section: 10 feet

Channel Length ≈ 142 feet (channel section)
45 feet (stilling basin section)

Crest Elevation ≈ 1244.

Upstream Channel - Cut in soil and rock.

Downstream Channel - Spillway discharges into the original Sinking Creek streambed.

k. Regulating Outlets. Flow through the 4-foot square discharge conduit is regulated with stop logs. A

flashboard system is located at the upstream end of the reservoir which can be used to regulate flow into the by-pass canal (see Photograph 9 and "Log Dam" on Figure 2).

SECTION 2
ENGINEERING DATA

2.1 Design.

a. Design Data Availability and Sources.

1. Hydrology and Hydraulics. Design calculations are available from PennDER and Fish Commission files.

A report titled, "Engineering Feasibility Report of a Proposed Dam and Lake on Sinking Creek, Potter Township, Centre County, Pennsylvania," is also available from Fish Commission files.

2. Embankment. No design calculations are available. Contract drawings contain some subsurface information and boring logs are available from Fish Commission files.

b. Design Features.

1. Embankment. The contract drawings indicate that the embankment is a zoned earth structure 45 feet high having a total embankment length of 740 feet. (Field measurements yielded a length of 700 feet and a height of 38 feet.)

The structure consists of two semi-impervious zones surrounding a zone of select impervious material. A cutoff trench was excavated along the centerline of the dam to a depth of at least 4 feet below the top of rock. A zone of pervious material mantles the downstream slope as shown on Figure 6. A toe drain comprised of sand, gravel, fine rock fragments, and 6-inch diameter perforated pipe underlies the pervious material and discharges near the outlet structure.

The dam is 15 feet wide at the crest and has slopes of 3H:1V upstream and 2-1/2H:1V downstream. Dumped riprap on crushed stone bedding protects the upstream face of the dam.

2. Appurtenant Structures. The outlet works at Colyer Lake Dam consist of a reinforced concrete riser and horizontal box culvert which discharges into a fish catch basin at the toe of the dam (see Figure 9 and Photographs 5 and 8). The culvert is a 4-foot square reinforced concrete structure with seep collars at 25-foot intervals. The riser portion is a rectangular structure containing grooves for stop log installation.

The spillway is a rectangular concrete chute with a 69-foot wide trapezoidal weir section and a 10-foot wide rectangular flume section (see Figure 10 and Photograph 6) which accepts flow from the by-pass canal. The right retaining wall of the trapezoidal weir section (left wall of flume section) will act as a side channel spillway during flood flows and will discharge flow into the rectangular flume. Ungated discharge from the spillway empties into a stilling basin before entering the original streambed downstream of the dam.

c. Design Data and Procedures.

1. Hydrology and Hydraulics. Calculations contained within PennDER and Fish Commission files indicate that the Pennsylvania "C" Curve was used as the basis for designing the spillway.

2. Embankment. No design data are available.

3. Appurtenant Structures. No design data are available.

2.2 Construction Records.

Contract drawings, specifications, construction progress reports, and construction photographs are available from PennDER and Fish Commission files.

2.3 Operational Records.

Operational records such as spillway discharge are not available for the facility.

2.4 Other Investigations.

The following is a list of additional studies of the facility prior to and subsequent to construction, all of which are available from Fish Commission Files in Bellefonte, Pennsylvania.

Preliminary Report of a Reconnaissance Survey, 1954, by O'Hara and Trembley.

Biological Inspection, 1953, by Arthur Bradford.

Engineering Feasibility Report, 1964, by Edward Miller.

Results of Subsurface Explorations, 1964, F. J. Kitlinski and Associates.

Report on Wall Damage Due to Ice Pressure at Colyer Lake, 1968, by Ray R. Frank.

Analysis of Colyer Lake Spillway, 1974, by E. J. Grindall.

2.5 Evaluation.

Engineering data in the form of drawings, specifications, hydrologic and hydraulic calculations, construction photographs, and correspondence are available from Fish Commission and PennDER files. The data available are considered adequate to make a reasonable Phase I assessment of the facility.

SECTION 3
VISUAL INSPECTION

3.1 Observations.

a. General. The general appearance of the structure, based on the visual inspection, suggests that it is in good condition.

b. Embankment. The upstream face of Colyer Lake Dam is sloped at 3H:1V and is protected by durable sandstone riprap (see Photograph 2); whereas, the downstream face is sloped at 2.5H:1V and is protected by a well established cover of crown vetch. The crest of the dam is seeded and is approximately 15 feet wide.

No signs of seepage were observed at the time of inspection nor were any signs of slope distress noted. Both toe drains were functioning and discharging into the fish catch basin downstream of the outlet conduit.

c. Appurtenant Structures.

1. Spillway. The visual inspection of the spillway revealed that it is in need of minor repair. Cracking and spalling of the trapezoidal weir section was evident as shown in Photograph 7. Cracking and efflorescence were particularly associated with the weep holes in the spillway sidewalls. There was also minor cracking in the wall separating the flume section from the trapezoidal weir section of the spillway.

At the time of inspection, the Pennsylvania Fish commission was drawing down the reservoir so as to drain the forebay of the spillway. This is done every winter to reduce ice pressures on the wall separating the trapezoidal weir section and flume section of the spillway. The wall was replaced in 1968 following ice damage (see Figure 11).

2. Outlet Conduit. Discharge through the outlet works at Colyer Lake Dam controlled by stop logs within the vertical riser (see Photograph 4). The Fish Commission was lowering the reservoir level at the time of inspection; consequently, only the exposed portion of the vertical riser could be inspected. Field team members did enter the horizontal portion of the 4-foot square outlet conduit to a point about 10 feet from the vertical riser. Cracking and efflorescence were observed within the conduit approximately 10 to 15 feet downstream of the riser (Figure 7 indicates a concrete cutoff collar extends into rock in this area).

Additional minor cracking was observed elsewhere within the conduit. The condition is not considered serious in its present state; however, the outlet should be inspected regularly to insure that the condition is not deteriorating.

3. Reservoir Area. The reservoir is surrounded by forested slopes which range from steep to gentle (see Photograph 3). Some surficial sliding was observed on the west side of the reservoir; however, the condition is not considered serious.

4. Downstream Area. Discharge from Colyer Lake flows through the broad floodplain of Sinking Creek (see Photograph 8) which is surrounded by gently rolling hills used primarily for agriculture. At a point approximately 2,500 feet downstream of the dam, Sinking Creek passes beneath a bridge on a secondary road in the community of Colyer. A home (see Photograph 10) and a church are located in this area with first floor levels less than 10 feet above the stream bottom.

Because of the position of the above-mentioned improvements, the facility was given a "high" hazard classification.

3.2 Evaluation.

The overall appearance of the facility indicates that it is in good condition. The spillway requires repair on the trapezoidal weir section where significant spalling and cracking has occurred (see Photograph 7). Cracking and efflorescence within the spillway and outlet conduit should be observed in subsequent inspections to insure that the condition does not deteriorate.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Normal Operational Procedures.

According to representatives of the Pennsylvania Fish Commission, an operations manual is being prepared for the facility although it was not available for review by the inspection team.

Under normal conditions, the stop logs within the control tower are set at 4 inches above the crest elevation of the spillway. Excess inflow passes over the spillway and enters the Sinking Creek channel downstream of the dam.

Each fall the water level is lowered approximately 4 feet thereby draining the forebay area. This is done to reduce the chance of ice damage to the wall separating the flume and trapezoidal weir sections of the spillway (see Section 3 for details).

Continuous flow through the by-pass canal is regulated for water quality and research purposes.

4.2 Maintenance of Dam.

Pennsylvania Fish Commission personnel indicate the standard Soil Conservation Service Manual is used as a maintenance guideline. Written records of maintenance are prepared on a routine basis by Fish Commission personnel.

4.3 Maintenance of Operating Facilities.

See "Maintenance of Dam" above.

4.4 Warning Systems.

Emergency plans are currently being developed for Pennsylvania Fish Commission dams. The plan for Colyer Lake Dam is as follows:

The Centre County waterways patrolman or a deputy patrolman shall observe this structure during periods of heavy precipitation. Should they observe any of the following conditions, they are instructed to notify the PennDER Regional Office at Williamsport, Pennsylvania, (telephone

717/326-2681, Extension 258 or call 717/326-9787 after hours).

a. Sliding of upstream or downstream slopes or abutments contiguous to the dam;

b. Sudden subsidence of the crest of the dam;

c. Longitudinal or transverse cracking of the crest of the dam;

d. Unusual release of water from the face or toe of the dam;

e. Any other unusual conditions at the downstream slope of the dam;

f. Significant landslides in the reservoir area; or

g. Unusual discharges through the spillway system.

4.5 Evaluation.

According to Fish Commission personnel, an operations manual is being prepared and the facility receives periodic maintenance in accordance with SCS guidelines. Records of maintenance are available at the Pennsylvania Fish Commission office in Bellefonte, Pennsylvania. Emergency plans are being developed for all Fish Commission dams. The current plan for Colyer Lake Dam as presented in Section 4.4 appears insufficient in several aspects and should be given additional scrutiny. Some specific items which should be addressed are:

a. Definition of alert stages which are related to pool level.

b. A mechanical/electrical device at the dam which is operable at any or all hours of the day to signal the designated patrolmen that an alert stage has developed.

c. Alternate means of communication in the event telephone lines are inoperable.

SECTION 5
HYDROLOGIC/HYDRAULIC EVALUATION

5.1 Design Data.

Minimal spillway design data are available. Calculations and correspondence indicate that the spillway was designed to pass a peak flow of 6,872 cfs as determined by the Pennsylvania "C" Curve criteria. The combined flow through the canal section and over the trapezoidal-shaped weir was determined to be 6,973 cfs. No routing of the design flood was performed.

5.2 Experience Data.

No records of discharge are available for this facility. The "Agnes" storm of June, 1972, is thought to be the greatest storm experienced by the facility and damage was limited to dislocation of riprap in the fish catch basin.

5.3 Visual Observations.

On the date of inspection, no conditions were observed that would indicate the spillway and outlet system would not perform satisfactorily during a flood event.

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 procedures and guidelines contained in the National Guidelines for Safety Inspection of Dams for Phase I investigations, the Spillway Design Flood (SDF) for Colyer Lake Dam is the Probable Maximum Flood (PMF). This classification is based on the relative size of the dam (intermediate), and the potential hazard of dam failure to the downstream residences (high).

b. Results of Analysis. Colyer Lake Dam was evaluated under near normal operating conditions. That is, the Colyer Lake Reservoir was initially at its normal pool or emergency spillway elevation of 1244.0 feet (MSL), but the usually operational 4-foot square low level outlet was assumed to be non-functional for purposes of analysis (Appendix C, Sheets 9 and 10). Potential reservoir storage values were estimated based on the available 5-foot contour map of the facility (Figure 2). The spillway weir crest-shape was assumed to approximate that of an ogee crest in order to develop a discharge-elevation relationship.

A 2,400-foot by-pass canal with significant discharge and moderate storage capacities aids in the drainage of the 8.4 square mile basin above Colyer Lake Dam. In order to consider its effects on reservoir inflows, the potential storage and corresponding discharge values of the by-pass canal were added to the reservoir values at appropriate elevations (Appendix C, Sheets 11-17, and 19). All pertinent engineering calculations relative to the evaluation of this facility are provided in Appendix C.

Overtopping analysis (using the Modified HEC-1 Computer Program) indicated that the discharge/storage capacity of Colyer Lake Dam could accommodate only about 77 percent of the PMF prior to overtopping of the dam (Appendix C, Summary Input/Output Sheets, Sheet D). The peak PMF inflow of about 9720 cfs was attenuated by the discharge/storage capabilities of the dam and reservoir such that the resulting peak outflow was about 9650 cfs (Summary Input/Output Sheets, Sheets B and C). Under the PMF, the embankment was overtopped for approximately 5.3 hours, with a maximum depth of inundation equal to about 0.7 feet (Summary Input/Output Sheets, Sheet D).

5.6 Spillway Adequacy

Although Colyer Lake Dam could not accommodate its SDF (the PMF), the possible downstream consequences of embankment failure due to overtopping were not evaluated. Breaching analysis of the dam was not performed in accordance with ETL-1110-2-234, since the facility can safely pass a flood of at least 1/2 PMF magnitude. Since Colyer Lake Dam cannot accommodate a PMF-size flood, its spillway is considered to be inadequate.

SECTION 6
EVALUATION OF STRUCTURAL INTEGRITY

6.1 Visual Observations.

a. Embankment. Based on the visual inspection, the dam appeared to be in good condition. No signs of seepage or slope distress were noted at the time of inspection nor is there any record of problems with the structure in available Fish Commission and PennDER records.

b. Appurtenant Structures. In 1968, the wall separating the trapezoidal weir section and flume section of the spillway was replaced following damage incurred from ice pressures within the forebay. Since that time, the Pennsylvania Fish Commission has lowered the water level about 4 feet in the late autumn to drain the forebay prior to the winter season.

The spillway, spillway sidewalls, and stilling basin are generally in good condition, one notable exception being the cracking and spalling on the trapezoidal weir section (see Photograph 7). Minor cracking and efflorescence were also noted at numerous locations on the spillway side walls particularly at the sidewall weep holes.

The horizontal portion of the outlet conduit was inspected by entering the 4-foot square conduit from the outlet end. Minor cracking, staining, and efflorescence were observed throughout the conduit particularly at a point about 10 to 15 feet from the connection with the vertical riser. The vertical riser and impact area could not be inspected because water was discharging over the stop logs at the time of inspection. Periodic inspections of the outlet conduit should be continued.

6.2 Design and Construction Techniques.

Design computations are available for the outlet system which indicate the spillway was sized using the Pennsylvania "C" Curve. No other design data are available although contract drawings, specifications, and construction photographs were reviewed.

6.3 Past Performance.

Pennsylvania Fish Commission records indicate adequate past performance of the facility although some riprap was

displaced in the fish catch basin area following the "Agnes" storm in June, 1972.

6.4 Seismic Stability.

The dam is located within Seismic Zone No. 1 and is subject to minor earthquake induced dynamic forces. As the dam is broad based, constructed of rolled earth and rock-fill, and contains provisions for internal drainage, the static stability is thought to be sufficient to withstand minor earthquake induced dynamic forces. No calculations or investigations, however, were performed to confirm this opinion.

SECTION 7
ASSESSMENT AND RECOMMENDATIONS FOR REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety The visual inspection, operational history, and hydrologic/hydraulic analysis indicate that the structure is in good condition. A maintenance manual, operations manual, and emergency operations plan are available or are being developed for the facility. The emergency plan reviewed by the inspection team appears insufficient in that in lacks critical items, several of which are listed in Section 4.5. Deficiencies noted curing the inspection were limited to cracking and spalling of the spillway weir and sidewalls and minor cracking within the outlet conduit.

Hydrologic and hydraulic calculations indicate that the spillway system (including by-pass canal) will pass and/or store only about 77 percent of the PMF prior to overtopping of the dam. Since the SDF of the facility is the PMF, the spillway system is deemed inadequate.

b. Adequacy of Information. The available data (contract drawings, specifications, photographs and miscellaneous correspondence) are considered sufficient to make a reasonable Phase I evaluation of the facility.

c. Urgency. Remedial repairs to the spillway surfaces as indicated below should be performed as soon as practical.

d. Necessity for Additional Investigations. No additional investigations other than routine maintenance checks are deemed necessary at this time.

7.2 Recommendations/Remedial Measures.

It is recommended that the owner:

a. Repair the spalled areas on the spillway weir and seal all cracks in the weir and spillway sidewalls.

b. Evaluate the cracking in the outlet conduit during subsequent periodic inspections and take appropriate remedial measures if deteriorating conditions are observed.

c. Reevaluate and revise the present emergency plan for Colyer Lake in accordance with, but not limited to, the items listed in Section 4.5.

APPENDIX A

CHECK LIST - ENGINEERING DATA

NAME OF DAM: Colyer Lake Dam

NDI#: PA-448 PENNDER#: 14-112

CHECK LIST
ENGINEERING DATA
PHASE I

ITEM	REMARKS NDI# PA - 448
PERSONS INTERVIEWED AND TITLE	1. Dan O'Neill - Chief of Property Maintenance Branch, Pennsylvania Fish Commission (at dam). 2. Charles Hess - Area 5 Maintenance Supervisor (at dam). 3. John Grindall - Engineer Pennsylvania Fish Commission (at Bellefonte Office).
REGIONAL VICINITY MAP	U.S.G.S. 7.5 minute series topographic quadrangle Centre Hall, Pennsylvania (see Regional Vicinity Map, Appendix G).
CONSTRUCTION HISTORY	Built in 1966 by PFC (force account); supervised by Gene Smith (P.E.) of PFC (Chief of Construction and Maintenance). PFC has construction photographs, specifications, engineering feasibility report, and progress reports.
AVAILABLE DRAWINGS	Set of 12 as-built drawings available from the Bellefonte office of the Pennsylvania Fish Commission.
TYPICAL DAM SECTIONS	See Figure 6, Appendix F.
OUTLETS: PLAN DETAILS DISCHARGE RATINGS	See Figures 7 and 8, Appendix F. Discharge ratings not indicated.

ENGINEERING DATA (CONTINUED)

ITEM	REMARKS	NDI# PA - 448
SPILLWAY: PLAN SECTION DETAILS	 See Figures 3 and 10, Appendix F. See Figure 10, Appendix F. See Figures 10 and 11, Appendix F.	
OPERATING EQUIPMENT PLANS AND DETAILS	Controlled via stop logs, see Figure 7, Appendix F.	
DESIGN REPORTS	The following reports are available at PFC Bellefonte Office: 1. Preliminary Report of a Reconnaissance Survey (O'Hara & Trembley) 2. Biological Inspection, Arthur Bradford, 1953. 3. Engineering Feasibility Report, Edward Miller, 1964. 4. Analysis of Colyer Lake Spillway, E. J. Grindall, 1974.	
GEOLOGY REPORTS	Geology mentioned briefly in Engineering Feasibility Report (see 3 above).	
DESIGN COMPUTATIONS: HYDROLOGY AND HYDRAULICS STABILITY ANALYSES SEEPAGE ANALYSES	 Available from PennDER and PFC files. None available. None available.	
MATERIAL INVESTIGATIONS: BORING RECORDS LABORATORY TESTING FIELD TESTING	Kitlinski and Associates drilled 14 borings, 2 field perm. tests, 6 borings pressure tested. (Logs available at PFC, Bellefonte Office.) No compaction tests of record.	

ITEM	REMARKS NDI# PA - 448
BORROW SOURCES	Within reservoir - See Figure 2, Appendix F.
POST CONSTRUCTION DAM SURVEYS	None.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	Report on diversion wall damage by R. R. Frank (PFC). Analysis of Colyer Lake Spillway, E. J. Grindall (PFC).
HIGH POOL RECORDS	Not known - High pool to date most probably occurred in June 1972 according to PFC personnel.
MONITORING SYSTEMS	None.
MODIFICATIONS	Re-built center wall in spillway and deleted stop plank opening (1968).

ITEM	REMARKS NDI# - PA - 448
PRIOR ACCIDENTS OR FAILURES	1. Diversion wall severely damaged by ice in 1968 - wall completely replaced; reservoir now drawn down in winter months to keep ice out of forebay. 2. Cold water outlet valve broke-off by ice - always open. 3. Riprap displaced in outlet channel after "Agnes" storm of June 1972.
MAINTENANCE: RECORDS MANUAL	R - Written records of maintenance by PFC personnel - routine. M - Available at PFC Office (Pleasant Gap). 1. Use Standard Manual by SCS for guidance. 2. Have developed inspection checklist.
OPERATION: RECORDS MANUAL	R - No spillway discharge or outflow records. M - Available at PFC Office (Pleasant Gap).
OPERATIONAL PROCEDURES	1. Minimum flow maintained in diversion channel by stop log mechanism near upstream end of reservoir. 2. Top of stop logs in outlet works are generally kept ≈ 4 inches above spillway weir elevation. 3. Reservoir is drawn down 4 feet below spillway crest in winter as a precaution to protect against ice damage.
WARNING SYSTEM AND/OR COMMUNICATION FACILITIES	Emergency plan recently developed by PFC for all PFC dams.
MISCELLANEOUS	1. Recreational facility with experimental functions (reason for the existence of the by-pass canal). 2. PFC in process of developing regional notebooks which define pertinent details for all dams including M&O manual, checklists, outlet works, etc.

CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

NDI ID # PA-00448
PENN DER ID # 14-112

SIZE OF DRAINAGE AREA: 8.4 square miles

ELEVATION TOP NORMAL POOL: 1244 STORAGE CAPACITY: 1,010 acre-feet

ELEVATION TOP FLOOD CONTROL POOL: - STORAGE CAPACITY: -

ELEVATION MAXIMUM DESIGN POOL: - STORAGE CAPACITY: -

ELEVATION TOP DAM: 1252 STORAGE CAPACITY: 1,730 acre-feet (excluding by-pass canal)

SPILLWAY DATA

CREST ELEVATION: 1244

TYPE: Rectangular concrete chute with trapezoidal-shaped weir crest.

WIDTH: 69 feet

LENGTH: 142 feet from base of weir to stilling basin.

SPILLOVER LOCATION: right abutment

NUMBER AND TYPE OF GATES: ungated

OUTLET WORKS

TYPE: Reinforcement concrete box culvert and control tower

LOCATION: near embankment center

ENTRANCE INVERTS: elevation 1211

EXIT INVERTS: elevation 1209

EMERGENCY DRAWDOWN FACILITIES: Stop logs in control tower

HYDROMETEOROLOGICAL GAGES

TYPE: None

LOCATION: -

RECORDS: -

MAXIMUM NON-DAMAGING DISCHARGE: Not known

APPENDIX B

CHECK LIST - VISUAL INSPECTION

CHECK LIST
VISUAL INSPECTION
PHASE 1

NAME OF DAM Colyer Dam STATE Pennsylvania COUNTY Centre

NDI# PA - 488 PENNDER# 14-112

TYPE OF DAM Earth SIZE Intermediate HAZARD CATAGORY High

DATE(S) INSPECTION 13 November 1978 WEATHER Cool with rain TEMPERATURE 45° @ 9:00 AM ~~XXX~~

POOL ELEVATION AT TIME OF INSPECTION 1235.5 M.S.L.

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

INSPECTION PERSONNEL	OWNER REPRESENTATIVES	OTHERS
B. M. Mihalcin	D. O'Neill (PA Fish Comm.)	
E. J. Mannella	C. Hess (PA Fish Comm.)	
W. Veon		
J. P. Nairn		

RECORDED BY J. P. Nairn

ITEM	OBSERVATIONS AND/OR REMARKS NDI# PA - 448
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	Good.
RIPRAP FAILURES	None observed (well graded durable sandstone riprap - five feet above normal pool).
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Good.

ITEM	OBSERVATIONS AND/OR REMARKS NDI# PA - 448
DAMP AREAS IRREGULAR VEGETATION (LUSH OR DEAD PLANTS)	No damp areas or irregular vegetation observed on the downstream face or at the toe. Swampy area ≈ 100 feet downstream of the toe due to poor drainage. Not considered significant.
ANY NOTICEABLE SEEPAGE	None.
STAFF GAGE AND RECORDER	None.
DRAINS	Toe drains discharge into outlet channel - Flow estimated at 8 GPM from the right drain and 10 GPM from the left drain.

OUTLET WORKS

ITEM	OBSERVATIONS AND/OR REMARKS	NDI# PA - 448
INTAKE STRUCTURE	Not observed (inundated).	
OUTLET CONDUIT (CRACKING AND SPALLING OF CONCRETE SURFACES)	No spalling. Cracking observed within the outlet conduit in the horizontal portion approximately 10 to 15 feet downstream of the intake riser. Efflorescence and iron staining occur with the cracking.	
OUTLET STRUCTURE	Interior of the vertical riser above pool level in good condition. Exterior portion in good condition.	
OUTLET CHANNEL	Riprap-lined channel from the discharge end to the end of the fish catch basin.	
GATE(S) AND OPERATIONAL EQUIPMENT	None. Pool level regulated by stop logs.	

ITEM	OBSERVATIONS AND/OR REMARKS NDI# PA - 448
TYPE AND CONDITION	Concrete rectangular channel with a trapezoidal-shaped weir crest. Both end sections of the weir display numerous transverse and longitudinal cracks. Spalling observed on the downstream weir section as well. Pop-outs observed on the spillway apron.
APPROACH CHANNEL	Cut into rock.
SPILLWAY CHANNEL AND SIDEWALLS	Minor cracking and efflorescence observed on the spillway sidewalls particularly associated with the sidewall weep holes.
STILLING BASIN PLUNGE POOL	Partially filled with debris.
DISCHARGE CHANNEL	Natural stream channel - unobstructed.
BRIDGE AND PIERS	First downstream obstruction is a two-lane bridge located ≈ 0.5 mile downstream.
EMERGENCY GATES	None.

NDI# PA - 448

ITEM	OBSERVATIONS AND/OR REMARKS
TYPE AND CONDITION	See "Outlet Works", Page 4 of 8.
APPROACH CHANNEL	See "Outlet Works", Page 4 of 8.
OUTLET STRUCTURE	See "Outlet Works", Page 4 of 8.
DISCHARGE CHANNEL	See "Outlet Works", Page 4 of 8.

NDI# PA - 448

ITEM	OBSERVATIONS AND/OR REMARKS
MONUMENTATION SURVEYS	None
OBSERVATION WELLS	None
WEIRS	None
PIEZOMETERS	None
OTHERS	

ITEM	OBSERVATIONS AND/OR REMARKS NDI# PA - 448
SLOPES: RESERVOIR	Steep and heavily wooded.
SEDIMENTATION	None evident.
DOWNSTREAM CHANNEL (OBSTRUCTIONS, DEBRIS, ETC.)	Natural unobstructed stream located in a wide trapezoidal shaped valley. Slope of valley bottom is relatively flat.
SLOPES: CHANNEL VALLEY	Valley slopes confining the channel are primarily gentle and used for agricultural purposes.
APPROXIMATE NUMBER OF HOMES AND POPULATION	One trailer and a home are located within 2,500 feet of the dam. First floor elevations are approximately 10 feet above the base of the stream. Downstream population ≈ 6.

APPENDIX C

HYDRAULICS/HYDROLOGY

PREFACE

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

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

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

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

The evaluation of the hydrologic-hydraulic consequences resulting from an assumed structural failure (breach) of the dam is typically performed as 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
COLYER LAKE DAM

BY DLB DATE 2-20-79 PROJ. NO. ZE-617-448

CHKD. BY WJV DATE 3-6-79 SHEET NO. 1 OF 20

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DAM STATISTICS

DAM HEIGHT ≃ 38 FEET (FIELD MEASURED)

MAXIMUM POOL STORAGE CAPACITY @ TOP OF DAM ≃ 1730 AC-FT (SEE SHEET 3)

NORMAL POOL STORAGE CAPACITY ≃ 1010 AC-FT " " "

DRAINAGE AREA ≃ 8.4 sq.mi [PLANIMETERED OFF U.S.G.S. 7.5 MINUTE SERIES QUADS CENTRE HALL, BARRVILLE, AND McALEVYS FORT, PA

DAM CLASSIFICATION

DAM SIZE - INTERMEDIATE (REF 1, TABLE 1)

HAZARD CLASSIFICATION - HIGH (FIELD OBSERVATION)

REQUIRED SDF - PMF (REF 1, TABLE 3)

SUBJECT DAM SAFETY INSPECTION
COLYER LAKE DAM

BY WJV DATE 2-20-79 PROJ. NO. 78-617-448

CHKD. BY DLB DATE 3-7-79 SHEET NO. 2 OF 20

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HYDROGRAPH PARAMETERS

LENGTH OF LONGEST WATERCOURSE (L) ≈ 7.5 MILES

L_{CA} ≈ 3.8 MILES [MEASURED ALONG THE LONGEST WATERCOURSE TO THE CENTROID OF THE DRAINAGE AREA]

NOTE: VALUES OF L AND L_{CA} ARE MEASURED FROM USGS 7.5 MINUTE QUADS - CENTER HALL, BARRVILLE, AND McALEVYS FORT, PA. ALSO, ALL VARIABLES ARE DEFINED IN REFERENCE 2 IN THE SECTION ENTITLED " SNYDER SYNTHETIC UNIT HYDROGRAPH ".

C_t ≈ 2.10
C_p ≈ 0.50
} [SUPPLIED BY COE; ZONE 19, SUSQUEHANNA RIVER BASIN]

t_p = SNYDER'S STANDARD LAG ≈ $2.10 (L * L_{CA})^{0.3}$

∴ $t_p \approx 2.10 (7.5 \times 3.8)^{0.3} \approx 5.74$ HRS.

RESERVOIR SURFACE AREAS AND STORAGE VOLUMES

IN ORDER TO DEVELOP A STAGE - STORAGE RELATIONSHIP AVAILABLE SURFACE CONTOURS WERE PLANIMETERED FROM FIGURE 2, "GENERAL PLAN" APPENDIX F, RESULTING IN RESERVOIR SURFACE AREAS AT 5-FOOT INTERVAL ELEVATIONS

AN ESTIMATION OF THE INCREMENTAL INCREASE IN STORAGE BETWEEN CONTOUR INTERVALS WAS COMPUTED UTILIZING THE MODIFIED PRISMOIDAL FORMULA PRESENTED BELOW:

$$\Delta V_{A-B} = \frac{Y}{3} \left(A_A + A_B + \sqrt{(A_A)(A_B)} \right) \qquad \text{(REF 14, pg 15)}$$

RESULTS ARE TABULATED ON THE FOLLOWING PAGE.

SUBJECT DAM SAFETY INSPECTION
COLYER LAKE DAM

BY DLB DATE 2-22-79 PROJ. NO. 78-617-448

CHKD. BY WJV DATE 3-6-79 SHEET NO. 3 OF 20

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	ELEVATION FROM FIG. 2, APP F	ELEVATION U.S.G.S. (FT)	SURFACE AREA (ACRES)	ΔV (ACRE-FT)	CUMULATIVE VOLUME (ACRE-FT)
	99.0	1211.0	0	0	0
	105.0	1217.0	2.6	5.2	5.2
	110.0	1222.0	13.4	36.5	41.7
	115.0	1227.0	26.2	97.2	138.9
	120.0	1232.0	40.1	164.5	303.4
	125.0	1237.0	56.9	241.3	544.7
	130.0	1242.0	70.5	317.9	862.6
NORMAL POOL →	132.0	1244.0	77.0	147.5	1010.1
	135.0	1247.0	86.6	245.3	1255.4
TOP OF DAM →	140.0	1252.0	104.6	477.3	1732.7
	145.0	1257.0	117.5	554.9	2287.6

NOTE: THE SURFACE AREA OF COLYER LAKE AS DEPICTED ON U.S.G.S. 7.5 MINUTE TOPOGRAPHIC QUADRANGLE CENTRE HALL, PA., WAS MEASURED BY PLANIMETER AND FOUND TO APPROXIMATELY EQUAL 77 ACRES. SIMILARLY AT ELEVATION 132 (RELATIVE) SHOWN ON FIGURE 2, APPENDIX F, THE SURFACE AREA WAS MEASURED TO APPROXIMATELY EQUAL 77 ACRES. THE TOPOGRAPHIC MAP SETS THIS AREA AT ELEVATION 1244 FT MSL WHILE FIGURE 2 SETS IT AT ELEVATION 1225 FT MSL. SINCE CROSS-REFERENCING COULD NOT CONFIRM EITHER ELEVATION, IT WAS ARBITRARILY DECIDED TO SET NORMAL POOL AT ELEVATION 1244 FT MSL IN ACCORDANCE WITH THE U.S.G.S. FOR THE PURPOSE OF THIS ANALYSIS.

SUBJECT DAM SAFETY INSPECTION
COLYER LAKE DAM

BY WJY DATE 3-6-79 PROJ. NO. 78-617-443

CHKD. BY DLB DATE 3-7-79 SHEET NO. 4 OF 20

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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 77°41' AND A LATITUDE OF 40° 47')

- CORRECTED RAINFALL INDEX = (22.2 IN)(1.03) ≅ 22.9 IN

- LOCAL DRAINAGE AREA ≅ 9.4 SQ MI : ASSUME THAT DATA CORRESPONDING TO A 10 SQ MI AREA IS REPRESENTATIVE OF THIS BASIN :

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

- HOP BROOK FACTOR (ADJUSTMENT FOR BASIN SHAPE, AS WELL AS FOR THE LESSER LIKELIHOOD OF A SEVERE STORM CENTERING OVER A SMALLER AREA) CORRESPONDING TO A DA = 9.4 SQ MI (10 SQ MI) ≅ 0.80 (REF 4, PG 19).

SUBJECT DAM SAFETY INSPECTION
COLYER LAKE DAM

BY DLB DATE 2-22-79 PROJ. NO. 78-617-448

CHKD. BY WJV DATE 3-6-79 SHEET NO. 5 OF 20

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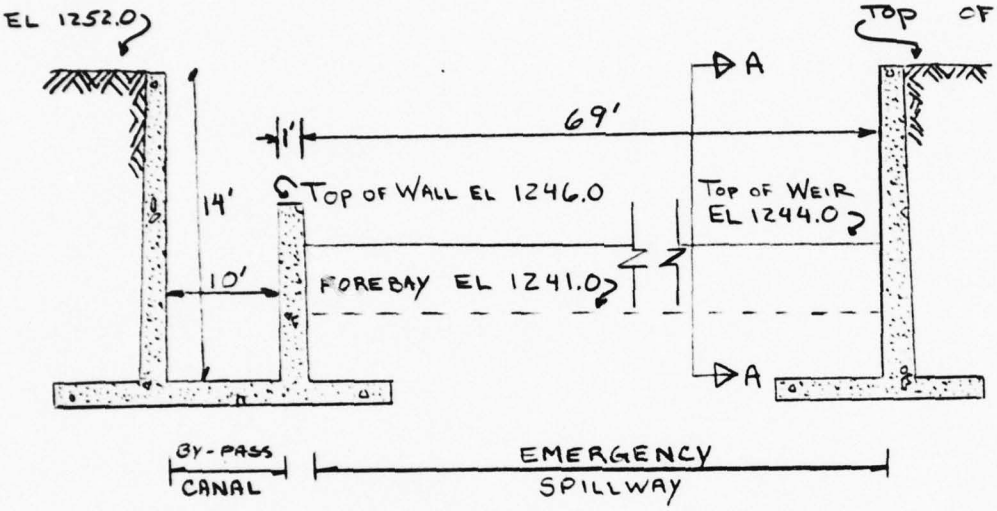
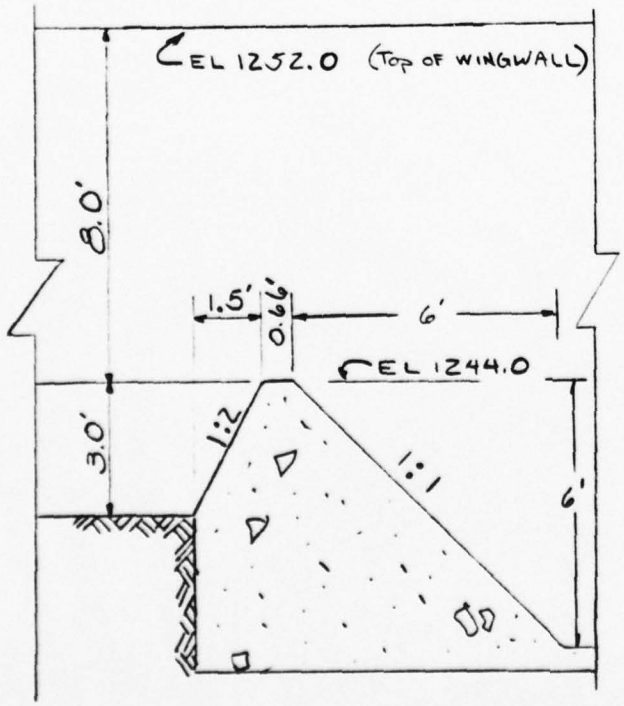
SPILLWAY CAPACITY AND RATING CURVE



SPILLWAY CROSS-SECTION
(NOT TO SCALE)



SECTION A-A
(SCALE 1IN=4FT)

NOTE: DIMENSIONS AND ELEVATIONS ARE TAKEN FROM AVAILABLE DRAWINGS DATED 6-4-64 ENTITLED "SINKING CREEK DAM", PREPARED BY E. R. MILLER (REG. ENG., STATE COLLEGE, PA.). ALL DIMENSIONS SHOWN HAVE BEEN ROUGHLY VERIFIED BY FIELD MEASUREMENTS.

SUBJECT DAM SAFETY INSPECTION
COLYER LAKE DAM

BY DLB DATE 2-22-79 PROJ. NO. 78-617-448

CHKD. BY WJV DATE 3-6-79 SHEET NO. 6 OF 20

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ALTHOUGH THE SPILLWAY WEIR IS ACTUALLY TRAPEZOIDAL IN CROSS-SECTION (SEE SKETCH ON PREVIOUS SHEET), ASSUME THAT ITS ELEVATION-DISCHARGE RELATIONSHIP CAN BE APPROXIMATED BY THAT FOR AN OGEE-CRESTED WEIR W/ DISCHARGE DEFINED BY:

$$Q = CLH_e^{3/2}$$

where L = LENGTH OF CREST = 69 FT (SHEET 4)
C = COEFFICIENT OF DISCHARGE (FOR AN OGEE-WEIR)
H_e = HEAD ON CREST

THE DISCHARGE COEFFICIENT (C) CORRESPONDING TO THE MAXIMUM SPILLWAY DISCHARGE CAPACITY PRIOR TO THE EMBANKMENT OVERTOPPING IS FOUND BY THE FOLLOWING PROCEDURE:

- H_o = DESIGN HEAD = 8.0 FT (SHEET 4)
  P = DEPTH OF FOREBAY = 3.0 FT

$P/H_o = 3.0'/8.0' = 0.38$

$\therefore C_{INITIAL} = 3.75$ @ DESIGN HEAD (REF 4, pg 378)

- CONSIDER THE EFFECT OF A SLOPING UPSTREAM FACE @ 1H:2V OR 26.6°

$C_{INCLINED}/C_{VERTICAL} = 1.015$ [INTERPOLATED BETWEEN VALUES OF THE SLOPE ANGLE OF 18.4° AND 33.7°]

$\therefore C_i = (3.75)(1.015) = 3.81$ @ DESIGN HEAD

- CONSIDER APPROACH CHANNEL LOSSES

$q = CH_o^{3/2} = (3.81)(8)^{3/2} = 86.2$ CFS/FT (FLOW PER FOOT OF WEIR LENGTH)

APPROXIMATE VELOCITY OF APPROACH $V_a = \frac{q}{H_o + P} = \frac{86.2}{8.0+3.0} = 7.84$ FPS

APPROACH VELOCITY HEAD $(h_a) = \frac{V_a^2}{2g} = (7.84)^2/2(32.2) = 0.95$ FT

SUBJECT DAM SAFETY INSPECTION
COLYER LAKE DAM

BY DLB DATE 2-22-79 PROJ. NO. 78-617-448

CHKD. BY WJV DATE 3-7-79 SHEET NO. 7 OF 20

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APPROACH CHANNEL FRICTION LOSS $(h_f) = (L)\left[\frac{V_a\, n}{1.49\, R^{2/3}}\right]^2$ (REF 4, pg 379)

L = CHANNEL LENGTH ≅ 100 FEET

n = MANNING'S COEFFICIENT = 0.04 (FIG 3, APPENDIX F)
[EXCAVATED CHANNEL, COBBLE BOTTOM AND CLEAN SIDES, REF 7, pg 112]

$R = \frac{\text{AREA OF FLOW}}{\text{WETTED PERIMETER}} = \frac{(69)(11)}{(69+5+5.5)} = 9.55\,\text{FT}$ (FIG 12, APPENDIX F)

$h_f = (100)\left[\frac{(7.8)(0.04)}{(1.49)(9.55^{2/3})}\right]^2 = 0.22\,\text{FT}$

ASSUMING AN ENTRANCE LOSS INTO THE CHANNEL EQUAL TO $0.1(h_a)$ =

$= 0.1(0.95\,\text{FT}) = 0.095\,\text{FT} \approx 0.1\,\text{FT}$ (REF 4, pg 379)

TOTAL APPROACH LOSS = $(0.22+0.1)\,\text{FT} = 0.32\,\text{FT}$

ACTUAL EFFECTIVE HEAD = DESIGN HEAD - LOSSES = $(8.0-0.32)\,\text{FT} = 7.68\,\text{FT}$

$P/H_e = 3.0/7.68 = 0.39$

$\therefore C = 3.75$ (REF 4, pg 378)

$C_{\text{INCLINED}}/C_{\text{VERTICAL}} = (3.75)(1.015) = 3.81$ (NO CHANGE FROM THAT SHOWN ON SHEET 5)

CONSIDER SUBMERGENCE EFFECTS (SEE NOTE BELOW)

NOTE! DUE TO THE ELEVATION OF THE SPILLWAY STILLING BASIN RELATIVE TO THE CREST OF THE WEIR ($\Delta H = 37\,\text{FT}$) IT CAN BE ASSUMED THAT THE WEIR WILL NOT BE SUBMERGED UNDER LESS THAN (AT LEAST) DESIGN TO SLIGHTLY GREATER THAN DESIGN HEADS

SUBJECT DAM SAFETY INSPECTION — Coyer Lake Dam

BY DLB DATE 2-23-79 PROJ. NO. 28-617-448

CHKD. BY WJV DATE 3-6-79 SHEET NO. 8 OF 25

H_e (FT)	H_e/H_o	C_o	C_i/C_o (A)	C_i	ESTIMATED FLOW PER FOOT OF WEIR LENGTH $q = C_i H_e^{3/2}$ (CFS/FT)	DEPTH OF APPROACH CHANNEL $H_e + P$ (FT)	ESTIMATED APPROACH VELOCITY V_a (FPS) (B)	ENTRANCE LOSS $(0.1)h_a$ (FT) (C)	FRICTION SLOPE S (FT/FT) (D)	TOTAL APPROACH LOSS H_L (FT) (E)	EFFECTIVE HEAD H (FT) (F)	DISCHARGE $Q = CLH^{3/2}$ (CFS)
0*	-	-	-	-	-	3	-	-				
1	0.13	3.81	0.835	3.18	3.2	4	0.8	.001	.0001	0.01	1.0	220
2	0.25	3.81	0.865	3.30	9.3	5	1.86	.005	.0003	0.04	2.0	640
3	0.38	3.81	0.900	3.43	17.8	6	2.97	.014	.0007	0.08	2.9	1170
4	0.50	3.81	0.920	3.51	28.1	7	4.01	.025	.0010	0.13	3.9	1870
5	0.63	3.81	0.945	3.60	40.2	8	5.03	.039	.0013	0.17	4.8	2610
6	0.75	3.81	0.965	3.68	54.1	9	6.01	.056	.0017	0.23	5.8	3550
7	0.88	3.81	0.985	3.75	69.5	10	6.95	.075	.0019	0.27	6.7	4490
8	1.00	3.81	1.000	3.81	86.2	11	7.84	.095	.0022	0.32	7.7	5620
9	1.13	3.81	1.015	3.87	104.5	12	8.71	.118	.0024	0.36	8.6	6370
10	1.25	3.81	1.030	3.92	124.0	13	9.54	.141	.0026	0.40	9.6	8050
11	1.38	3.81	1.050	4.00	145.9	14	10.42	.169	.0029	0.46	10.5	9390

A. C_i/C_o = CORRECTION TO $C_o = 3.81$ FOR HEADS OTHER THAN DESIGN ($H_e = 8.0$ FT), (REF 4, pg 378)
NOTE: C_o HAS BEEN CORRECTED FOR UPSTREAM SLOPE INCLINATION BY MULTIPLYING THE VALUE FOR $C = 3.75$ (REF 4, FIG 249, pg 378) BY 1.015 (REF 4, FIG 251, PG 379) SEE SHEET 5

B. $V_a = q/(H_e + P)$ (REF 4, pg 379)

C. 0.1 (VELOCITY HEAD) VELOCITY HEAD $(h_a) = \frac{V_a^2}{2g}$

D. $S = \left(V_a n / 1.49 R^{2/3}\right)^2$ where $n = 0.04$ SEE SHEET 6

E. $H_L = 0.1(h_a) + 100(S)$

F. $H = H_o - H_L$

*NOTE: $H_e = 0$ IS ESTABLISHED AT SPILLWAY CREST ELEVATION 1244.0

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SUBJECT DAM SAFETY INSPECTION
COLYER LAKE DAM

BY DLB DATE 2-23-79 PROJ. NO. 78-617-448

CHKD. BY WJV DATE 3-7-79 SHEET NO. 9 OF 20

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OUTLET CONDUIT CAPACITY

REFER TO FIGURE 7, APPENDIX F FOR PLAN AND CROSS-SECTION

TYPE OF CONDUIT - 4' by 4' REINFORCED CONCRETE BOX CONDUIT
LENGTH - 215.5' (INLET TO OUTLET)
INLET INVERT ELEVATION - 1211.0 FT
OUTLET INVERT ELEVATION - 1209.2 FT

ASSUME FULL-BARREL FLOW WITH OUTLET CONTROL AND ALL STOP-LOGS REMOVED FROM TOWER

** OUTLET CONTROL DISCHARGES ARE ESPECIALLY DEPENDENT ON TAILWATER LEVEL, ALONG WITH ALL OTHER CHARACTERISTICS OF THE CULVERT BARREL. OUTLET CONTROL CAN OCCUR IF $H > 0.75D$ (H = HEADWATER DEPTH, D = CULVERT DEPTH) WITH DISCHARGE DEFINED BY ITS RELATIONSHIP TO HEADWATER AS SHOWN IN THE EQUATION BELOW.

$$HW = \left[1 + K_e + \frac{29 n^2 L}{R^{1.33}}\right] \frac{Q^2}{2gA^2} + TW - LS_o$$

where
- HW = WATER SURFACE ELEVATION @ INLET (FT)
- K_e = ENTRANCE LOSS COEFFICIENT
- n = MANNING'S ROUGHNESS COEFFICIENT
- R = HYDRAULIC RADIUS (FT) = $\frac{\text{AREA OF FLOW}}{\text{WETTED PERIMETER}}$
- L = CULVERT LENGTH (FT)
- TW = WATER SURFACE ELEVATION @ OUTLET (FT)
- g = GRAVITATIONAL CONSTANT (32 FT/SEC^2)
- A = CROSS-SECTIONAL AREA OF CULVERT (FT^2)
- S = SLOPE OF CULVERT (FT/FT)

** INFORMATION OBTAINED FROM: "HYDRAULIC CHARTS FOR THE SELECTION OF HIGHWAY CULVERTS", U.S. DEPT OF COMMERCE, BUREAU OF PUBLIC ROADS

SUBJECT DAM SAFETY INSPECTION
COLVER LAKE DAM

BY DLB DATE 2-26-79 PROJ. NO. 78-617-448

CHKD. BY WJV DATE 3-7-79 SHEET NO. 10 OF 20

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DETERMINE THE CAPACITY OF THE CULVERT UNDER MAXIMUM HEADWATER CONDITIONS, THAT IS; HW = EL 1252.0 FT (TOP OF DAM)

ASSUME TAILWATER JUST SUBMERGES THE OUTLET (TW = EL 1213.2 FT)

NEGLECT HEAD LOSSES DUE TO THE TRASHRACK

$K_e \simeq 0.4$ (WINGWALL @ 30° TO 75° TO CULVERT) (SEE NOTE AT THE BOTTOM OF PRECEDING PA

$n \simeq 0.011$ (AVERAGE VALUE FOR CONCRETE PIPE OR CAST-IN-PLACE CONDUIT (REF 4, PG 471)

$A = 16\ FT^2$

$S = (1211.0 - 1209.2)/(215.5) \simeq 0.008$

$R = 16\ FT^2/16\ FT = 1\ FT$

$HW - TW = H = (1252.0 - 1213.2)\ FT = 38.8\ FT$

$$38.8\ FT = \left[1 + 0.4 + \frac{29(0.011)^2(215.5)}{1}\right]\frac{Q^2}{2(32.2)(16)^2} - (215.5)(0.008)$$

$$38.8 + 1.7 \quad (1.4 + 0.76)\frac{Q^2}{16486}$$

$Q_{MAX} \simeq 560$ CFS (SEE NOTE BELOW)

NOTE: THE MAXIMUM DISCHARGE CAPACITY OF THE OUTLET CONDUIT REPRESENTS LESS THAN 5% OF THE TOTAL COMBINED CAPACITIES OF THE SPILLWAY AND ADJACENT DIVERSION CANAL (SEE SHEET 19). FURTHERMORE, THERE IS MUCH DOUBT AS TO WHETHER THE MAXIMUM CAPACITY COULD BE ACHIEVED IN AN EMERGENCY SITUATION DUE TO THE PRESENT OPERATING MODE THAT INCLUDES MANUALLY INSTALLED STOP-LOGS WHICH CONTROL DISCHARGES FROM THE RISER LOCATED ABOUT MIDWAY ALONG THE CONDUIT. THEREFORE, THE ADDITIONAL FLOW CAPACITY THROUGH THIS LOW LEVEL OUTLET WILL BE IGNORED.

SUBJECT DAM SAFETY INSPECTION
COLYER LAKE DAM

BY WJV DATE 3-1-79 PROJ. NO. 79-617-419

CHKD. BY DLB DATE 3-8-79 SHEET NO. 11 OF 26

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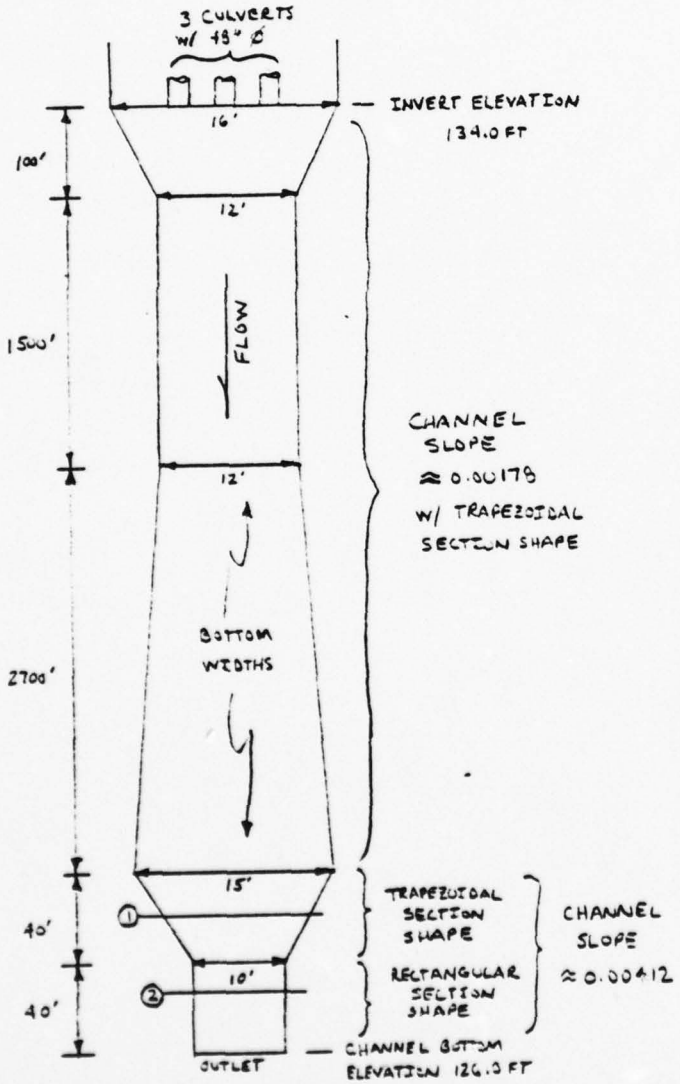
BY-PASS CANAL

- A 4400 FOOT LONG MAN-MADE CHANNEL DIVERTS A PORTION OF THE RESERVOIR INFLOWS AT A POINT ABOUT 300 FT UPSTREAM FROM THE RESERVOIR (AT NORMAL POOL ELEVATION).

- DEFINITION SKETCH OF CANAL (AS OBTAINED FROM ORIGINAL DESIGN CALCULATIONS CONTAINED IN PENNDER FILES):



(NOT TO SCALE)

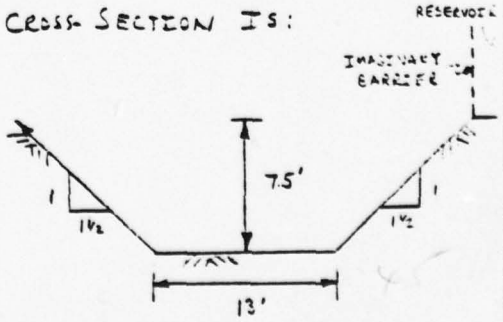
- CANAL IS COMPOSED MOSTLY OF TRAPEZOIDAL SECTIONS W/ SIDE SLOPES OF 1½ H to 1V AND A REPRESENTATIVE DEPTH OF ABOUT 7.5 FT (APPENDIX F, FIGURE 12)

- AVERAGE SECTION BOTTOM WIDTH

$$\approx \left[\left(\frac{16+12}{2} \times 100'\right) + (12' \times 1500') + \left(\frac{12+15}{2} \times 2700'\right) + \left(\frac{15+10}{2} \times 40'\right) + (10' \times 40')\right] / 4390'$$

$$\approx 12.9^{+}\ \text{FT} \approx 13\ \text{FT}$$

- THEREFORE, A REPRESENTATIVE CROSS-SECTION IS:



(NOT TO SCALE)

SUBJECT DAM SAFETY INSPECTION
COLYER LAKE DAM

WJV DATE 3-6-79 PROJ. NO. 78-617-449

CHKD. BY DLB DATE 3-8-79 SHEET NO. 12 OF 20

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- ASSUME THAT POTENTIAL RESERVOIR INFLOWS ARE DIVIDED 50-50 AT THE CONFLUENCE OF THE NATURAL STREAM AND THE BY-PASS CANAL. HOWEVER, DUE TO THE ROAD EMBANKMENT THAT CROSSES BOTH CHANNELS (APPENDIX F, FIGURE 2) THE ACTUAL INFLOWS INTO THE RESERVOIR AND BY-PASS CANAL ARE CONTROLLED AT THESE ROAD CROSSINGS BY A 10' BY 30' BOX CULVERT AND BY 3 - 48" DIAMETER CMP CULVERTS, RESPECTIVELY. BASED "ROUGHLY" ON CONVEYANCE:

$$K = \frac{1.49}{n} A R^{2/3} \qquad \text{(REF 7, PG 128)}$$

WHERE A = AREA OF OPENING IN FT^2; R = $\frac{\text{AREA OF OPENING}}{\text{PERIMETER OF OPENING}}$; AND $n \approx 0.035$ FOR THE LARGE BOX CULVERT, AND $n \approx 0.024$ FOR THE CMP CULVERTS (FIELD INSPECTION AND REF 7, PGS 110 AND 112)

($K_{\text{BOX CULVERT}} \approx 30930$; $K_{\text{CMP CULVERTS}} \approx 2360$) THE BOX CULVERT CAN PASS ABOUT 13 TIMES AS MUCH FLOW AS THE CMP CULVERTS. FURTHER, ASSUME THAT THIS RATIO APPROXIMATELY HOLDS WHEN CONSIDERING A VOLUME RELATIONSHIP RATHER THAN A FLOW RELATIONSHIP BETWEEN THE RESERVOIR AND THE BY-PASS CANAL. THEREFORE, THE POTENTIAL RESERVOIR STORAGE SHOULD DECREASE BY 13 A-F FOR EVERY 1 A-F DECREASE IN THE POTENTIAL BY-PASS CANAL STORAGE.

- APPROXIMATE MAXIMUM BY-PASS CANAL STORAGE: (BASED ON THE AVERAGE SECTION SHEET 11)

$$V = (\text{X-SECTIONAL AREA}) \times (\text{LENGTH OF CANAL})$$

$$V = [(13' \times 7.5') + 2(1.5 \times 7.5')(7.5')/2] \times (4380') / (43{,}560 \text{ FT}^2/\text{ACRE})$$

$$V \approx 18.3 \text{ A-F}$$

SUBJECT DAM SAFETY INSPECTION
COLYER LAKE DAM

BY WJV DATE 3-6-79 PROJ. NO. 79-617-449
CHKD. BY DLB DATE 3-8-79 SHEET NO. 13 OF 20

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- BY-PASS CANAL : DEPTH-STORAGE RELATIONSHIP

DEPTH (FT)	AREA (FT^2)	VOLUME (A-F)
0	0	0
2	32.0	3.2
3	52.5	5.3
4	76.0	7.6
5	102.5	10.3
6	132.0	13.3
7	164.5	16.5
7.5	181.9	18.3

- ASSUME THAT THE CRITICAL SECTION @ THE CANAL OUTLET CONTROLS OUTFLOWS (DUE TO THE CHANNEL CONSTRICTION AND/OR THE ABRUPT CHANGE FROM A SUBCRITICAL SLOPE TO A SUPERCRITICAL SLOPE), SINCE THE FLOWS AT THE REPRESENTATIVE SECTION COMPUTED VIA THE MANNING EQUATION (REF 7, PG 99) WERE LARGER THAN THOSE THAT COULD BE ACCOMMODATED AT THE CRITICAL SECTION. FOR EXAMPLE : THE MANNING FLOW @ THE REPRESENTATIVE SECTION CORRESPONDING TO A 3' DEPTH IS GIVEN BY

$$Q = \left(1.49/n\right) A R^{2/3} S^{1/2}$$

WHERE $n \approx 0.030$ (EARTH BOTTOM W/ RUBBLE SIDES ; REF 7, PG 112);
$A \approx (13' \times 3') + [(1.5 \times 3')(3')] \approx 52.5\,FT^2$; $R \approx \frac{52.5\,FT^2}{13 + 2\sqrt{(1.5\times3)^2+(3)^2}} \approx 2.$
$S \approx \frac{134\,FT - 126\,FT}{4320\,FT} \approx 0.00193$

$\therefore Q \approx 199$ CFS,

WHILE THE OUTFLOW @ THE CRITICAL SECTION CORRESPONDING TO A 3FT DEPTH IN THE UPSTREAM REPRESENTATIVE SECTION IS

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ABOUT $Q = 160$ CFS (SEE COMPUTATION EQUATIONS BELOW AND SHEET 16)

- CRITICAL SECTION FLOWS ARE BASED ON AN ENERGY BALANCE BETWEEN SECTIONS @ ① AND ② AS LOCATED ON SKETCH ON SHEET 11.

APPLYING THE ENERGY EQUATION (REF 7, P640):

$$Y_1 + \frac{v_1^2}{2g} + Z_1 = Y_2 + \frac{v_2^2}{2g} + Z_2 + h_L$$

WHERE Y_1 = DEPTH OF FLOW @ SECTION ①, v_1 = ESTIMATED VELOCITY @ ①, AND Z_1 = CHANNEL ELEVATION @ ①; Y_2 = DEPTH OF FLOW @ SECTION ② (CRITICAL DEPTH), v_2 = VELOCITY @ ② (CRITICAL VELOCITY), Z_2 = CHANNEL ELEVATION @ ②, AND h_L = HEAD LOSS BETWEEN ① AND ② = LOSS DUE TO CONTRACTION ONLY $\approx 0.2 \frac{\Delta v^2}{2g}$ (REF 13, PG 185) SINCE h_f = FRICTION LOSS IS NEGLIGIBLE.

SINCE $Z_1 - Z_2 \approx 0 \Rightarrow$

$$Y_1 + \frac{v_1^2}{2g} = Y_2 + \frac{v_2^2}{2g} + 0.2\left(\frac{v_2^2}{2g} - \frac{v_1^2}{2g}\right)$$

ALSO, SINCE THE CRITICAL SECTION (SECTION ②) IS RECTANGULAR (SEE SKETCHES ON SHEETS 11 AND 15):

$$Y_2 = Y_c = \sqrt[3]{q^2/g} \qquad \text{(REF 13, PG 142)}$$

WHERE $q = Q/\text{BOTTOM WIDTH} = Q/10FT$

- VELOCITIES @ SECTION ① WILL BE ESTIMATED BY MANNING'S EQUATION w/ REPRESENTATIVE SECTION GEOMETRY, $n \approx 0.030$ AND $S \approx 0.00193$ (AS GIVEN ON SHEET 13):

SUBJECT DAM SAFETY INSPECTION
COLYER LAKE DAM

WJV DATE 3-6-79 PROJ. NO. 78-617-449

CHKD. BY DLB DATE 3-8-79 SHEET NO. 15 OF 20

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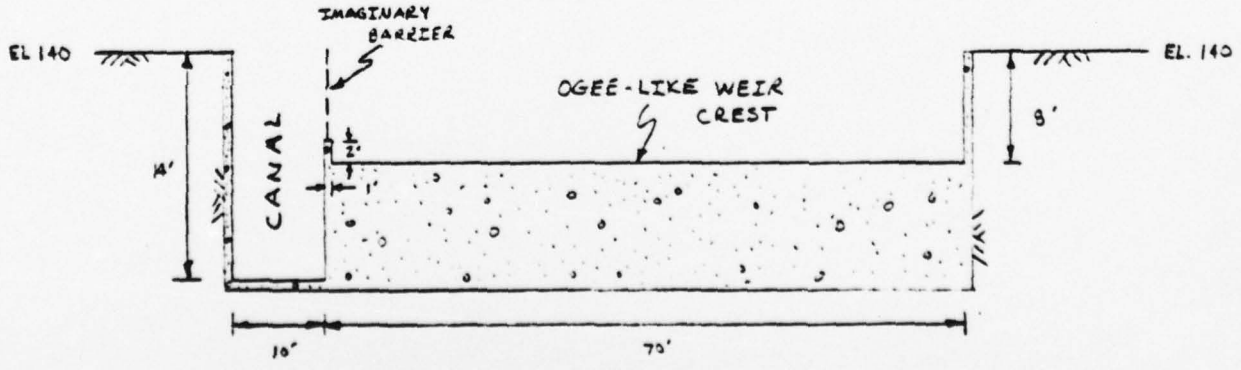
	FLOW DEPTH Y_1 (FT)	A (FT^2)	$R^{2/3}$ (FT)	$*V_1$ (FPS)	$V_1^2/2g$ (FT)
	0	0	0	0	0
	2	32.0	1.36	2.99	0.13
	3	52.5	1.69	3.59	0.20
	4	76.0	1.97	4.19	0.27
	5	102.5	2.22	4.72	0.35
	6	132.0	2.44	5.18	0.42
	7	164.5	2.65	5.63	0.49
TOP OF CANAL	- 7.5	181.9	2.74	5.82	0.53
	9	236.8	3.13	6.65	0.69
	10	275.3	3.37	7.16	0.80
	11	315.3	3.59	7.63	0.90
	12	356.8	3.80	8.07	1.01
	13	399.8	4.00	8.50	1.12
	14	444.3	4.19	8.90	1.23
	15	490.3	4.38	9.31	1.34
	16	537.8	4.55	9.67	1.45
	17	586.8	4.72	10.03	1.56

* $V = Q/A$ FROM CONTINUITY

- DEFINITION SKETCH OF SPILLWAY CREST SECTION : (SEE ALSO SHEET 4)



(NOT TO SCALE)

SUBJECT DAM SAFETY INSPECTION
COLYER LAKE DAM

WJV DATE 3-6-79 PROJ. NO. 78-617-448

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- FLOW VS DEPTH RELATIONSHIP FOR BY-PASS CANAL
(BASED ON TRIAL & ERROR SOLUTION OF EQUATIONS ON SHEET 14)

Y_1 (FT)	(A) $v_1^2/2g$ (FT)	(B) Q (CFS)	(C) Y_2 (FT)	(D) A_2 (FT)	(E) $v_2^2/2g$ (FT)	$0.2\left(\frac{v_1^2}{2g} - \frac{v_1^2}{2g}\right)$ (FT)	(G) $Y_1 + \frac{v_1^2}{2g}$ (FT)
0	0	0	0	0	0	0	0
2	0.13	90	1.36	13.6	0.68	0.11	2.15
3	0.20	160	2.00	20.0	1.00	0.16	3.16
4	0.27	250	2.69	26.9	1.34	0.21	4.24
5	0.35	360	3.43	34.3	1.71	0.27	5.41
6	0.42	470	4.09	40.9	2.05	0.33	6.47
7	0.49	580	4.71	47.1	2.35	0.37	7.43
(H) 7.5	0.53	650	5.09	50.9	2.54	0.40	8.02
(H) 9	0.69	960	6.12	61.2	3.06	0.47	9.65
10	0.80	1020	6.86	68.6	3.43	0.53	10.92
11	0.90	1180	7.56	75.6	3.78	0.58	11.92
12	1.01	1340	8.23	82.3	4.12	0.62	12.97
13	1.12	1520	8.95	89.5	4.48	0.67	14.10
14	1.23	1700	9.65	96.5	4.82	0.72	15.19
15	1.34	1900	10.39	103.9	5.19	0.77	16.35
16	1.45	2100	11.11	111.1	5.55	0.82	17.48
17	1.56	2300	11.80	118.0	5.90	0.87	18.57

(A) FROM SHEET 15

(B) FINAL ASSUMED Q

(C) FROM EQUATION ON SHEET 14 : $Y_2 = Y_c = \sqrt[3]{q^2/g}$

(D) $A_2 = 10\ Y_2$ (RECTANGULAR SECTION AS ON SKETCH ON SHEET 15)

(E) $v_2 = Q/A_2$

(G) CHECK ON T & E ASSUMATIONS

(H) ASSUME THAT THE CONSTRICTED CHANNEL SECTION CHOKES BETWEEN THESE DEPTHS SUCH THAT THE BY-PASS CANAL WSEL'S ARE DICTATED BY THE RESERVOIR ($Y_1 = 9$ FT => EL 1247 (MSL) IN BOTH THE RESERVOIR AND CANAL). CRITICAL CONTROL THEN MOVES TO OUTLET. $Y_1 = 10$ FT => EL 1248, $Y_1 = 11$ FT => EL 1249, etc (SEE SHEET 19 FOR BY-PASS Q VS RES. EL.)

SUBJECT DAM SAFETY INSPECTION
COLYER LAKE DAM

BY WJV DATE 3-6-79 PROJ. NO. 78-617-448

CHKD. BY DLB DATE 3-8-79 SHEET NO. 17 OF 20

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TOTAL RESERVOIR STORAGE - ELEVATION RELATIONSHIP

TOTAL STORAGE = RESERVOIR STORAGE + BY-PASS CANAL STORAGE

ASSUME AVAILABLE RESERVOIR STORAGE DECREASES BY 12 A-F AS THE BY-PASS CANAL DECREASES BY 1 A-F (SHEET 12)

ASSUMED USGS ELEVATION (FT)	RELATIVE ELEVATION FROM DRAWINGS (FT)	① RESERVOIR STORAGE (A-F)	② BY-PASS CANAL STORAGE (A-F)	② BY-PASS CANAL DEPTH (FT)	TOTAL STORAGE
1244	132	1010.1	0	0	1010.1
1245	133	* 1091.9	6.3	3.4	1098.2
1246	134	* 1173.6	12.6	5.3	1186.2
1247	135	1255.4	18.3	7.5 +	1273.7
1248	136	* 1350.9	18.3	"	1369.2
1249	137	* 1446.3	18.3	"	1464.6
1250	139	* 1541.8	18.3	"	1560.1
1251	139	* 1637.2	18.3	"	1655.5
1252	140	1732.7	18.3	"	1751.0
1253	141	* 1843.7	18.3	"	1962.0
1254	142	* 1954.7	18.3	"	1973.0
1255	143	* 2065.6	18.3	"	2093.9
1256	144	* 2176.6	18.3	"	2194.9
1257	145	2287.6	18.3	"	2305.9

* INTERPOLATED

① RESERVOIR VOLUMES FROM SHEET 3

② BY-PASS CANAL STORAGE VALUES BASED ON Δ VOLUME OF RESERVOIR AND INTERPOLATED FROM SHEET 12

SUBJECT DAM SAFETY INSPECTION
COLYER LAKE DAM

BY WJV DATE 3-6-79 PROJ. NO. 79-617-448

CHKD. BY DLB DATE 3-8-79 SHEET NO. 18 OF 20

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DAM EMBANKMENT RATING CURVE

ASSUME THAT THE EMBANKMENT ACTS LIKE A BROAD-CRESTED WEIR WHEN OVERTOPPED. DISCHARGES ARE DEFINED BY

$$Q = CLH^{3/2}$$

WHERE Q = DISCHARGE IN CFS, L = EMBANKMENT LENGTH ≈ 700 FT (FIELD MEASURED), H = DEPTH OF WATER OVER DAM IN FT, AND C = DISCHARGE COEFFICIENT = $f(H/\ell)$ w/ ℓ = BREADTH OF CREST ≈ 15 FT (FIELD MEASURED)

ELEVATION		H	H/ℓ	* C	Q
USGS (FT)	RELATIVE (FT)	(FT)	(FT/FT)		(CFS)
1252	140	0	–	–	0
1253	141	1	0.07	3.03	2120
1254	142	2	0.13	3.05	6040
1255	143	3	0.20	3.07	11170

* VALUES OBTAINED FROM REF 12, PG 46.

SUBJECT DAM SAFETY INSPECTION
COLYER LAKE DAM

BY WJV DATE 3-6-79 PROJ. NO. 78-617-443

CHKD. BY DLB DATE 3-8-79 SHEET NO. 19 OF 20

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TOTAL RESERVOIR DISCHARGE RATING CURVE

TOTAL DISCHARGE = SPILLWAY Q + BY-PASS CANAL Q + EMBANKMENT Q

ASSUME THAT THE CONSTRICTED CHANNEL LENGTH NEAR THE MOUTH OF THE BY-PASS CANAL BECOMES CHOKED BY THE TIME THE RESERVOIR REACHES EL. 135.0 SO THAT THE BY-PASS CANAL BECOMES PART OF THE RESERVOIR WITH WATER SURFACE DICTATED BY THE RESERVOIR. THE CRITICAL CONTROL SECTION WILL THEN BECOME THE OUTFLOW SECTION @ THE TOP OF THE SPILLWAY CHUTE

ELEVATION		SPILLWAY Q	BY-PASS CANAL Q	EMBANKMENT Q	TOTAL Q
USGS (FT)	RELATIVE (FT)	(CFS)	(CFS)	(CFS)	(CFS)
1244	132	0	0	–	0
1245	133	220	200	–	420
1246	134	640	450	–	1090
12469	134.9	* 1120	650	–	1770
1247	135	1170	960	–	2130
1248	136	1970	1020	–	2990
1249	137	2610	1180	–	3790
1250	138	3550	1340	–	4890
1251	139	4490	1520	–	6010
1252	140	5620	1700	0	7320
1253	141	6730	1900	2120	10750
1254	142	8050	2100	6040	16190
1255	143	9390	2300	11170	22960

* INTERPOLATED

SUBJECT DAM SAFETY INSPECTION
COLYER LAKE DAM

BY WJV DATE 3-14-79 PROJ. NO. 79-617-448
CHKD. BY DLB DATE 3-15-79 SHEET NO. 20 OF 20

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SENSITIVITY OF WEIR COEFFICIENTS

THE TRAPEZOIDAL-SHAPED SPILLWAY WEIR WAS ASSUMED TO BE APPROXIMATED BY AN OGEE-SHAPED WEIR FOR THE PURPOSE OF COMPUTING APPROPRIATE WEIR ("C") COEFFICIENTS.

However: IF THE INITIAL "C" COEFFICIENT @ DESIGN HEAD WAS ASSUMED TO BE 3.33 (ACCORDING TO THE FRANCIS FORMULA FOR SHARP-CRESTED WEIRS: REF 9, PG. 25) RATHER THAN THE ACTUAL ASSUMED VALUE OF 3.75 (SHEET 6), THE SPILLWAY CAPACITY WOULD BE ABOUT:

$$Q \approx (3.33 \times 1.015)(69\,FT)(7.8\,FT)^{1.5}$$

(1.015: correction for sloping US face from sheet 6; exponent: corrected for approach losses as on sheets 6 & 7)

$$Q \approx 5080\ CFS$$

TOTAL DISCHARGE SYSTEM CAPACITY BELOW THE TOP OF DAM ELEVATION WOULD BE: $Q_T = 5080\ CFS + 1700\ CFS$ (FROM THE BY-PASS CANAL @ EL 1252, SHEET 19).

$Q_T = 6780\ CFS$

(THE ACTUAL ASSUMED DISCHARGE SYSTEM CAPACITY @ EL 1252 IS ABOUT $Q_T = 7320\ CFS$ (SHEET 19) ⇒ 8% INCREASE OVER ABOVE VALUE)

IF $Q_T = 6780\ CFS$ ⇒ COLYER LAKE DAM COULD HANDLE MORE THAN 70 PER CENT OF THE PMF (SINCE THE RESERVOIR INFLOW FOR 0.7 PMF = 6906; SUMMARY INPUT/OUTPUT SHEETS, SHEET 8).

FOR $Q_T = 7320\ CFS$ ⇒ COLYER LAKE DAM CAN HANDLE ABOUT 77 PERCENT OF THE PMF AS STATED IN SECT. 5.5.

THE ABOVE COMPARISON INDICATES THAT EITHER "C"-COEFFICIENT ASSUMPTION WOULD LEAD TO ABOUT THE SAME RESULTS. HOWEVER, $C_{INITIAL} = 3.75$ IS FELT TO BE MORE REPRESENTATIVE OF ACTUAL CONDITIONS BASED ON REF 5, SECT 5.

SUMMARY INPUT/OUTPUT SHEETS

SUBJECT DAM SAFETY INSPECTION
COLYER LAKE DAM
BY WJV DATE 3-7-79 PROJ. NO. 79-617-449
CHKD. BY DLB DATE 3-8-79 SHEET NO. 4 OF D

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DAM SAFETY INSPECTION
COLYER LAKE DAM ********* OVERTOPPING *********
15-MINUTE TIME STEP AND 72-HOUR STORM DURATION

                              JOB SPECIFICATION
 NO      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 NRTIU= 5 LRTIO= 1
          RTIOS=     .50      .70      .80      .90     1.00

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

                              SUB-AREA RUNOFF COMPUTATION

     INFLOW INTO RESERVOIR

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

                                    HYDROGRAPH DATA
     IHYDG      IUHG     TAREA      SNAP     TRSDA     TRSPC     RATIO    ISNOW    ISAME    LOCAL
         1         1      8.40      0.00      8.40      0.00     0.000        0        0        0

                                      PRECIP DATA
                    SPFE      PMS       R6      R12      R24      R48      R72      R96
                    0.00    22.90   117.50   127.00   136.00   142.50   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=  5.74    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=23.89 AND R=31.10 INTERVALS
```

SUBJECT DAM SAFETY INSPECTION
COLYER LAKE DAM
BY WJV DATE 3-7-79 PROJ. NO. 79-617-443
CHKD. BY DLB DATE 3-8-79 SHEET NO. 8 OF 9

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UNIT HYDROGRAPH100 END-OF-PERIOD ORDINATES, LAG= 5.74 HOURS, CP= .50 VOL= .94

4.	16.	33.	53.	76.	102.	129.	158.	188.	219.
252.	285.	318.	349.	377.	403.	425.	444.	460.	473.
483.	489.	490.	485.	473.	458.	444.	430.	416.	403.
390.	378.	366.	354.	343.	332.	322.	312.	302.	292.
283.	274.	265.	257.	249.	241.	233.	226.	219.	212.
205.	199.	192.	186.	180.	175.	169.	164.	159.	154.
149.	144.	139.	135.	131.	127.	123.	119.	115.	111.
108.	104.	101.	98.	95.	92.	89.	86.	83.	81.
78.	76.	73.	71.	69.	67.	64.	62.	60.	59.
57.	55.	53.	51.	50.	48.	47.	45.	44.	42.

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	END-OF-PERIOD FLOW COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	26.56	23.91	2.65	488877.
										(675.)	(607.)	(67.)	(13843.46)

RESERVOIR INFLOW HYDROGRAPHS

PMF

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	9723.	8737.	4783.	1697.	488845.
CMS	275.	247.	135.	48.	13843.
INCHES		9.68	21.19	22.56	22.56
MM		245.76	538.12	572.94	572.94
AC-FT		4332.	9486.	10100.	10100.
THOUS CU M		5344.	11701.	12458.	12458.

0.7 PMF

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	6806.	6116.	3348.	1188.	342191.
CMS	193.	173.	95.	34.	9690.
INCHES		6.77	14.83	15.79	15.79
MM		172.03	376.68	401.05	401.05
AC-FT		3033.	6640.	7070.	7070.
THOUS CU M		3741.	8191.	8721.	8721.

0.5 PMF

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	7778.	6990.	3826.	1358.	391076.
CMS	220.	198.	108.	38.	11074.
INCHES		7.74	16.95	18.05	18.05
MM		196.61	430.49	458.35	458.35
AC-FT		3466.	7589.	8080.	8080.
THOUS CU M		4275.	9361.	9967.	9967.

HYDROGRAPH ROUTING

ROUTE THROUGH RESERVOIR

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

ROUTING DATA

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

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	1010.	-1

SUBJECT DAM SAFETY INSPECTION — COLYER LAKE DAM

BY WJV DATE 2-7-79

CHKD. BY DLB DATE 3-8-79

PROJ. NO. 79-617-449

SHEET NO. C OF D

STAGE *	132.00	133.00	134.00	134.90	135.00	136.00	137.00	138.00	139.00
	141.00	142.00	143.00						
FLOW	0.00	420.00	1090.00	1770.00	2030.00	2890.00	3790.00	4890.00	6010.00
	10750.00	16190.00	22860.00						
CAPACITY=	1010.	1098.	1186.	1274.	1369.	1465.	1560.	1656.	1751.	1862.
	1973.	2084.	2195.	2306.					
ELEVATION= *	132.	133.	134.	135.	136.	137.	138.	139.	140.	141.
	142.	143.	144.	145.					

	CREL	SPWID	COOW	EXPW	ELEVL	COOL	CAREA	EXPL
* RELATIVE EL. 132.0 FT	132.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

≈ USGS EL 1244.0 FT (MSL)

DAM DATA

TOPEL	COOD	EXPD	DAMWID
140.0	0.0	0.0	0.

RESERVOIR OUTFLOW HYDROGRAPHS

PEAK OUTFLOW IS 9654. AT TIME 45.50 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME	
CFS	9654.	8565.	4756.	1692.	487304.	
CMS	273.	243.	135.	48.	13799.	
INCHES		9.49	21.07	22.49	22.49	PMF
MM		240.93	535.16	571.13	571.13	
AC-FT		4247.	9434.	10068.	10068.	
THOUS CU M		5239.	11637.	12419.	12419.	

PEAK OUTFLOW IS 6549. AT TIME 46.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME	
CFS	6549.	5936.	3325.	1184.	341049.	
CMS	185.	168.	94.	34.	9657.	
INCHES		6.57	14.73	15.74	15.74	0.7 PMF
MM		166.96	374.16	399.72	399.72	
AC-FT		2943.	6596.	7046.	7046.	
THOUS CU M		3630.	8136.	8692.	8692.	

PEAK OUTFLOW IS 7607. AT TIME 45.75 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME	
CFS	7606.	6799.	3802.	1353.	389799.	
CMS	215.	193.	108.	38.	11038.	
INCHES		7.53	16.84	17.99	17.99	0.8 PMF
MM		191.24	427.80	456.85	456.85	
AC-FT		3371.	7542.	8054.	8054.	
THOUS CU M		4159.	9302.	9934.	9934.	

SUBJECT DAM SAFETY INSPECTION

COLYER LAKE DAM

WJV DATE 3-7-79 PROJ. NO. 79-617-443

CHKD. BY DLB DATE 3-8-79 SHEET NO. D OF D

GAI CONSULTANTS, INC

Engineers • Geologists • Planners
Environmental Specialists

SUMMARY OF DAM SAFETY ANALYSIS

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	132.00	132.00	140.00
STORAGE	1010.	1010.	1751.
OUTFLOW	0.	0.	7320.

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	137.76	0.00	1537.	4629.	0.00	46.25	0.00
.70	139.41	0.00	1695.	6549.	0.00	46.00	0.00
.80	140.08	.08	1760.	7606.	1.50	45.75	0.00
.90	140.39	.39	1795.	8671.	3.75	45.50	0.00
1.00	140.68	.68	1827.	9654.	5.25	45.50	0.00

* THESE OUTFLOWS ARE DEPENDENT ON THE ASSUMPTION THAT THE DISCHARGES OVER THE EXISTING TRAPEZOIDAL-SHAPED SPILLWAY WEIR CAN BE APPROXIMATED BY COMPUTING FLOWS OVER AN OGEE-SHAPED WEIR CREST. HOWEVER, EVEN IF LOWER WEIR COEFFICIENTS WERE USED, THE ABOVE RESULTS WOULD BE ABOUT THE SAME (SEE SHEET 20).

LIST OF REFERENCES

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

APPENDIX D

PHOTOGRAPHS

PHOTOGRAPH 1 Overview of Colyer Lake Dam as seen from the right abutment.

PHOTOGRAPH 2 Close-up view of the sandstone riprap on the upstream face of the dam.

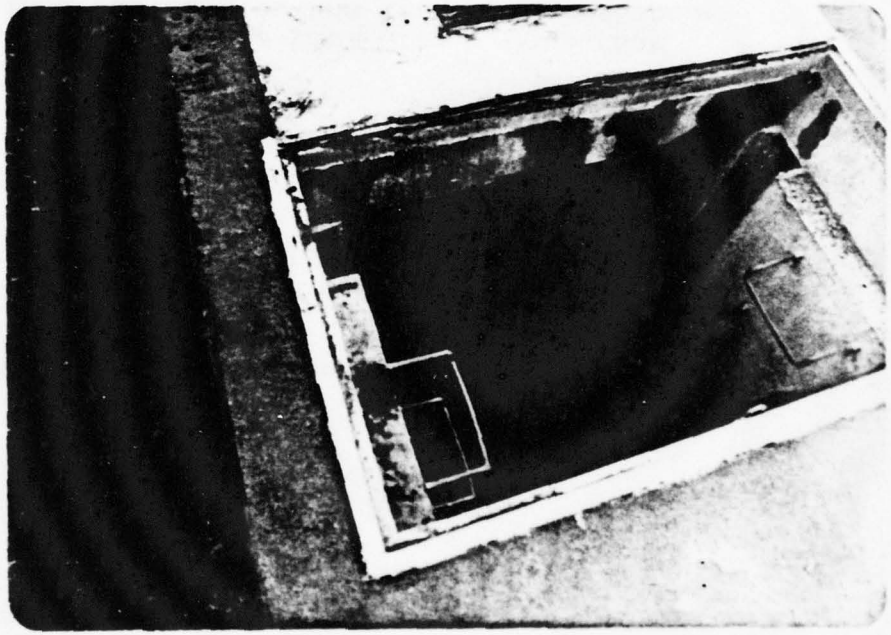
PHOTOGRAPH 3 View of the reservoir and surrounding slopes at Colyer Lake Dam.

PHOTOGRAPH 4 Close-up view of the concrete vertical riser portion of the outlet works. Note the stop logs laying to the left of the riser.

1

2

3



4

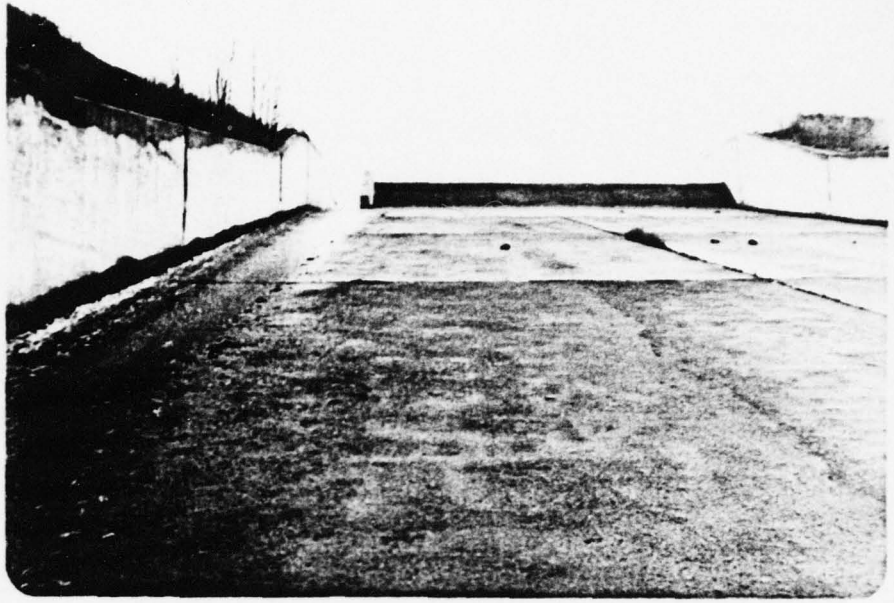
PHOTOGRAPH 5 View of the discharge end of the outlet works and the downstream face of the dam.

PHOTOGRAPH 6 View of the spillway as seen from the plunge pool area. Note that the spillway consists of combined rectangular and trapezoidal-shaped weir sections.

PHOTOGRAPH 7 Close-up view of cracking and spalling on the trapezoidal-shaped weir portion of the spillway.

PHOTOGRAPH 8 View looking downstream from the crest of the dam.

5



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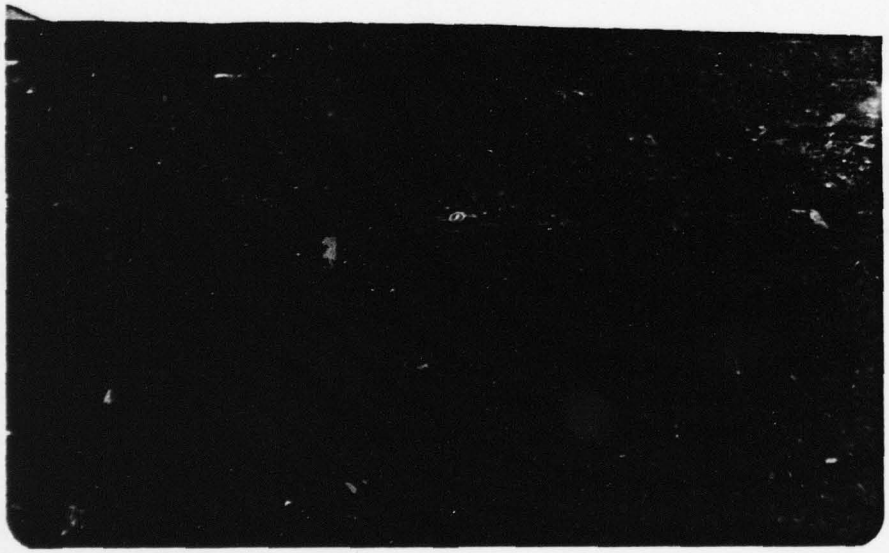


7

8

PHOTOGRAPH 9 View of a bifurcation in the stream, upstream of Colyer Lake where flow can either be directed into the reservoir (left channel) or into the by-pass canal (right channel).

PHOTOGRAPH 10 View of a bridge over Sinking Creek located approximately 2,500 feet downstream of the dam. The bridge represents the first downstream obstruction. Note the home in the left center portion of the photograph.

9

10

APPENDIX E

GEOLOGY

GEOLOGY

Colyer Lake is located approximately 8.5 miles east of State College in the Appalachian Mountain section of the Valley and Ridge Province of central Pennsylvania. The Appalachian Mountain section is characterized by interbedded hard and soft sedimentary rocks that have been strongly folded into tight, high amplitude anticlines and synclines by compressional forces from the southeast. The folded structures trend in a southwest-northeast direction and plunge in both directions along the axial strike. The Bear Meadows anticline, plunging to the southwest, passes through a portion of Colyer Lake.

The surface sedimentary rocks exposed in the general area range in age from the Lower Silurian (youngest) to the Lower Ordovician (oldest). Underlying the dam and most of the reservoir area are sedimentary rocks of the Reedsville Formation (Ordovician). The Reedsville Formation consists almost entirely of shale with thin silty and sandy interbeds. An exposure of the upper portion of the Reedsville Formation on the right abutment consists chiefly of brown, greenish, and black clayey to sandy shale with thin limestone beds or concretions. The shales gradually grade into a sandstone of the Bald Eagle Formation which occurs above the dam in the surrounding hillsides.

Test borings at the dam site reveal that in the valley rock lies at a depth of about 10 feet below the ground

surface. The underlying rock consists essentially of shale with the uppermost 5 to 10 feet being broken. The degree of brokenness decreases with depth. The alluvial and residual soils underlying the dam and the reservoir area consist of a mantle of impervious clay.[3]

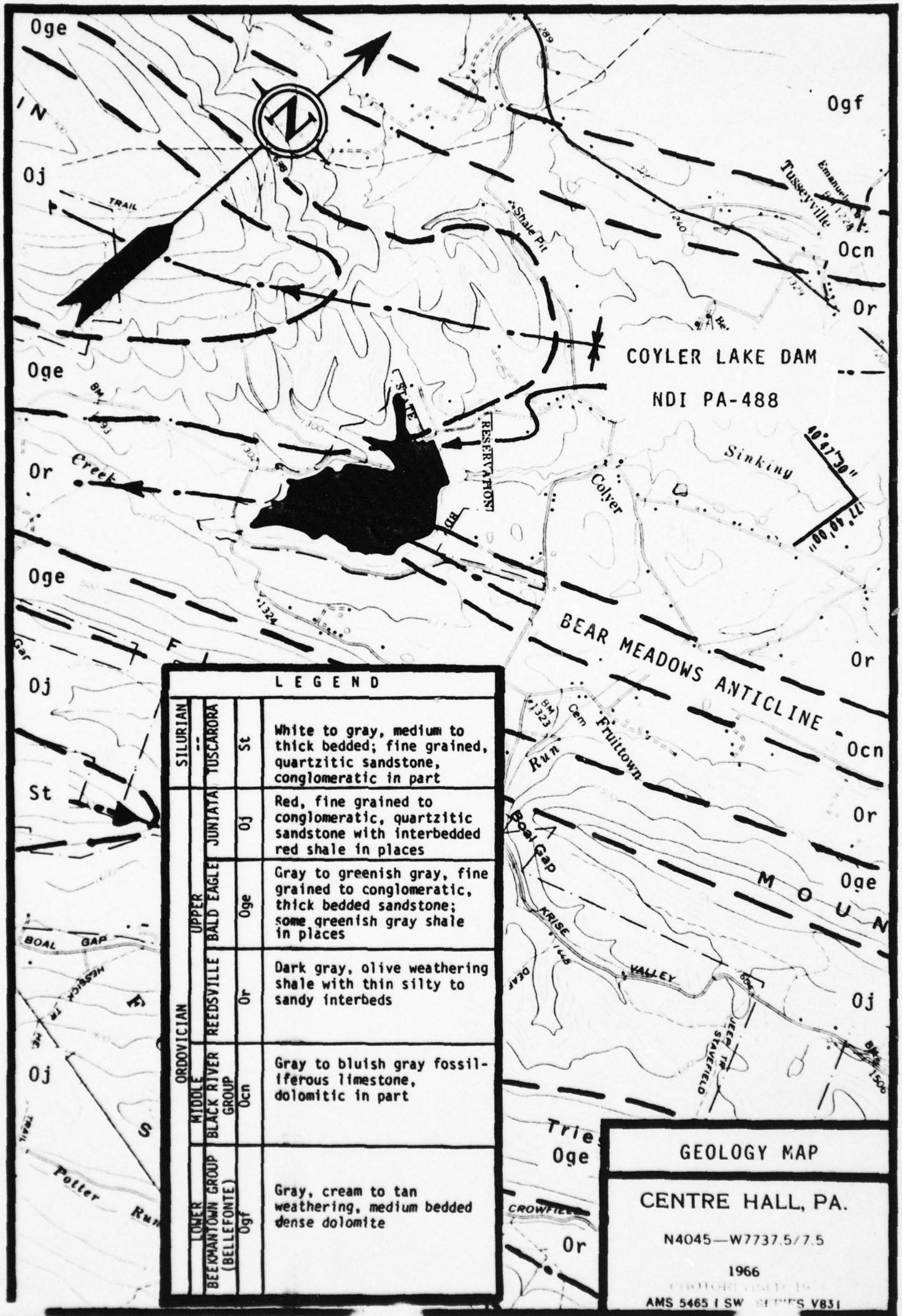
Water well data indicates that the transmissibility of the Reedsville Formation is low, particularly in the lower portions of the formation.[2]

---

[1] Geologic Map of Pennsylvania, Harrisburg: Bureau of Topographic and Geologic Survey, 1960.

[2] Lohman, Stanley W., "Ground Water in South-Central Pennsylvania," Harrisburg: U. S. Geological Survey and the Pennsylvania Geologic Survey, Water Resources Report 5, 1938.

[3] Miller, Edward R., "Engineering Feasibility Report of a Proposed Dam and Lake on Sinking Creek, Potter Township, Centre County, Pennsylvania," Harrisburg: Pennsylvania Fish Commission, May 27, 1964.



COYLER LAKE DAM
NDI PA-488
BEAR MEADOWS ANTICLINE
Oge
Oj
Or
Ocn
Ogf
St
Shale Pit
Tusseyville
Emanuel
Sinking
Colyer
Creek
STATE
RESERVATION
Fruittown
Run
Boal Gap
BOAL GAP
KRISE
VALLEY
STAVEFIELD
Potter
TRAIL
40°47'30"
77°40'00"
LEGEND
SILURIAN
TUSCARORA
St
White to gray, medium to thick bedded; fine grained, quartzitic sandstone, conglomeratic in part
ORDOVICIAN
UPPER
JUNIATA
Oj
Red, fine grained to conglomeratic, quartzitic sandstone with interbedded red shale in places
BALD EAGLE
Oge
Gray to greenish gray, fine grained to conglomeratic, thick bedded sandstone; some greenish gray shale in places
REEDSVILLE
Or
Dark gray, olive weathering shale with thin silty to sandy interbeds
MIDDLE
BLACK RIVER GROUP
Ocn
Gray to bluish gray fossiliferous limestone, dolomitic in part
LOWER
BEEKMANTOWN GROUP (BELLEFONTE)
Ogf
Gray, cream to tan weathering, medium bedded dense dolomite
GEOLOGY MAP
CENTRE HALL, PA.
N4045—W7737.5/7.5
1966
AMS 5465 I SW SERIES V831

APPENDIX F

FIGURES

LIST OF FIGURES

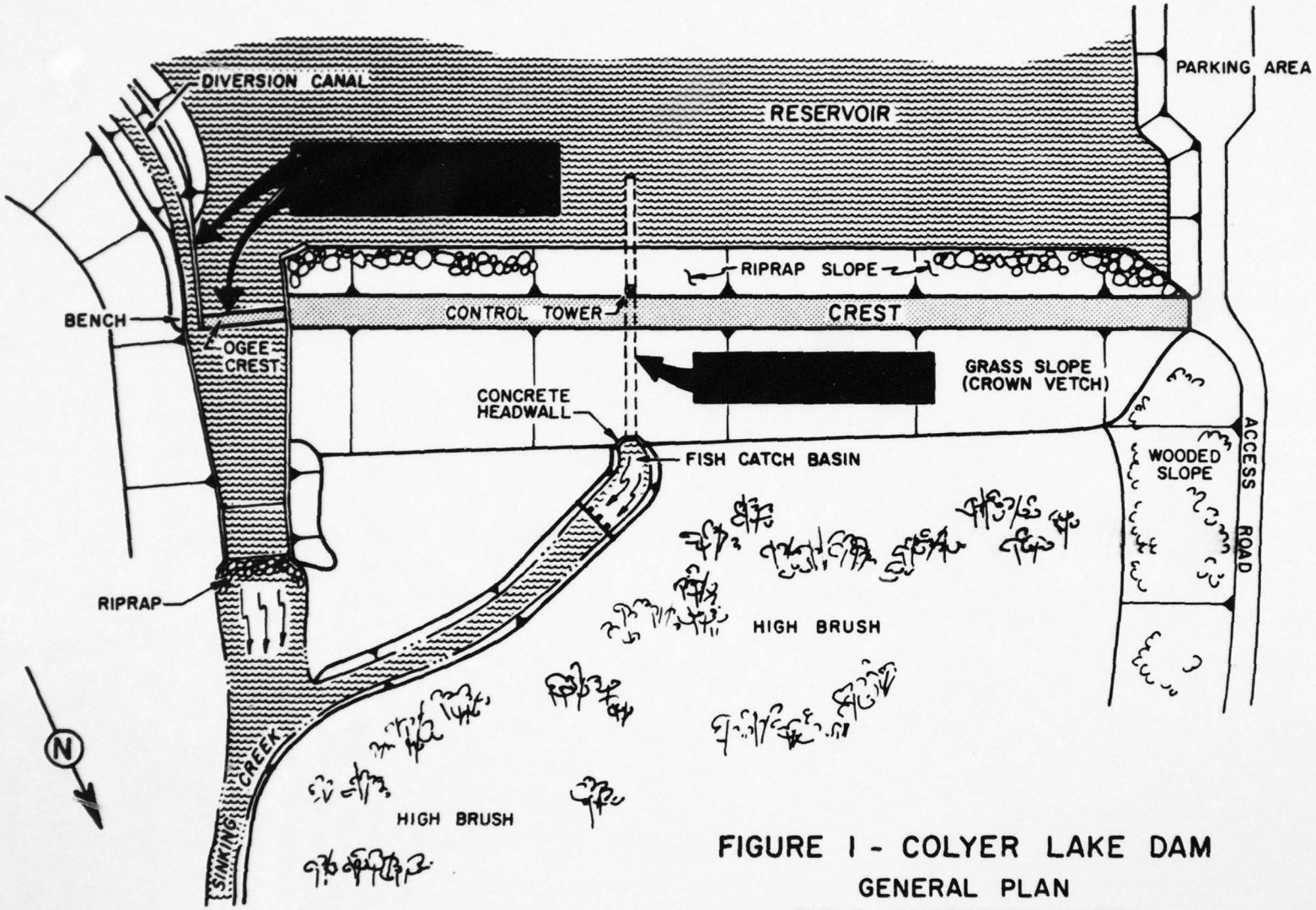
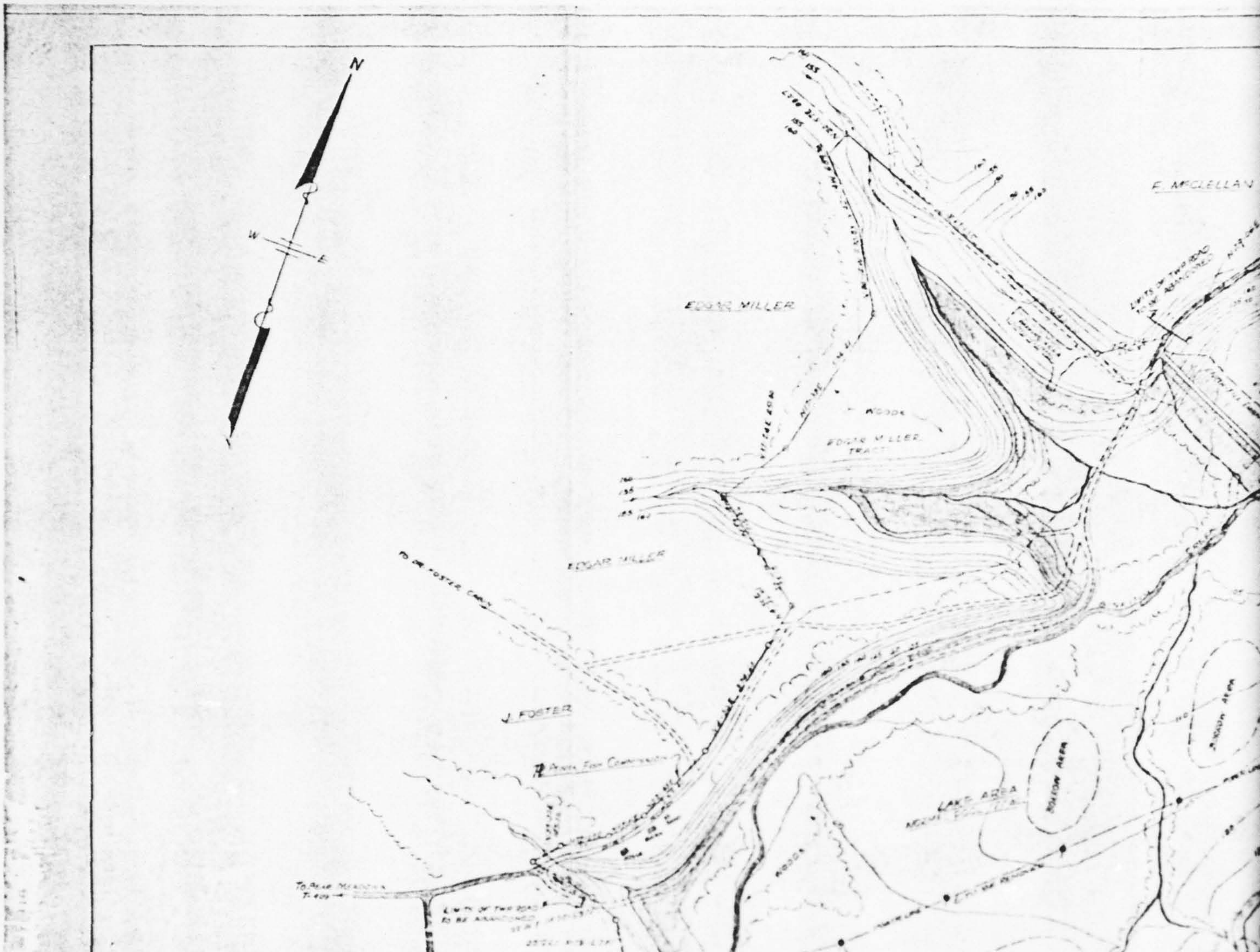
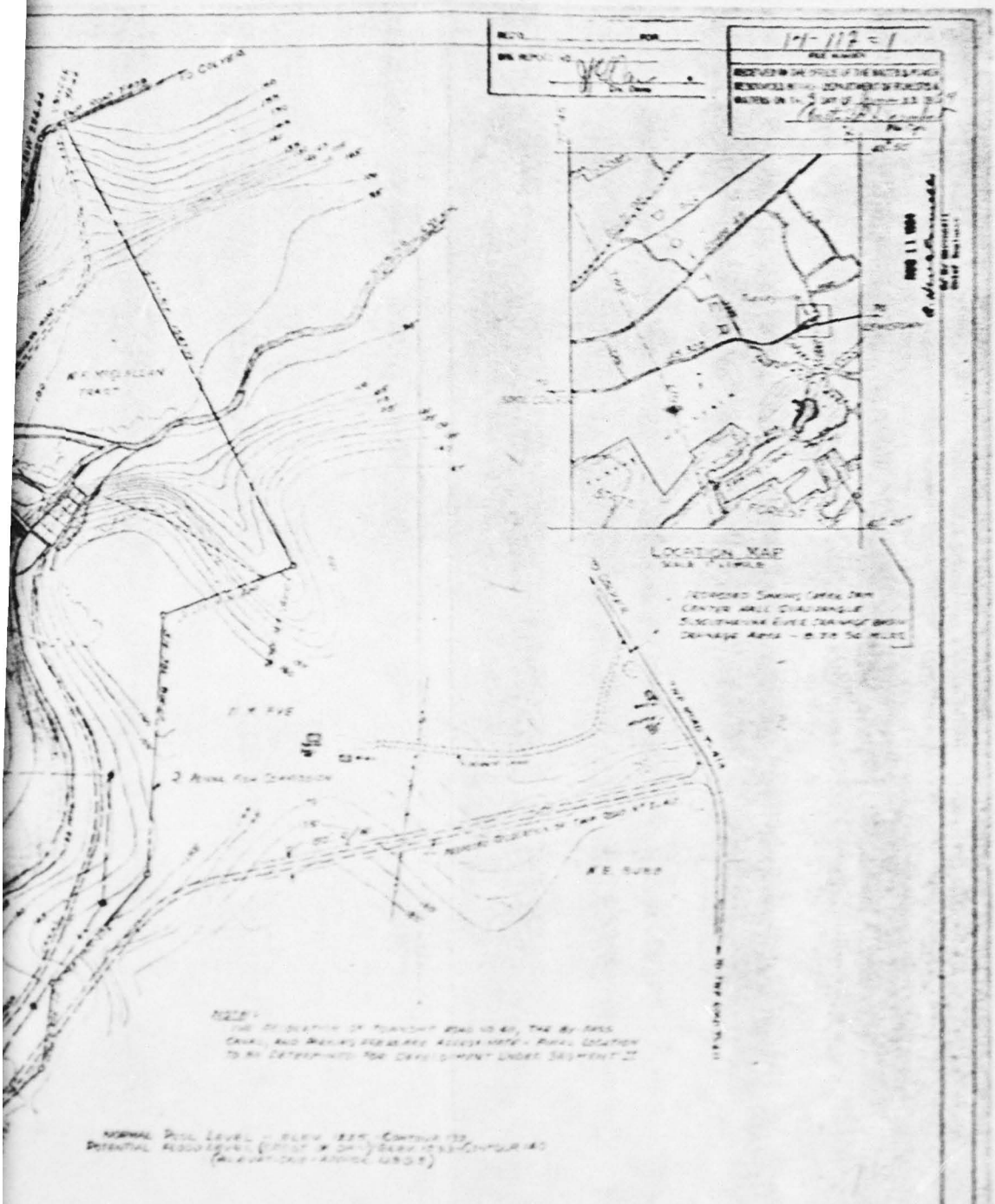


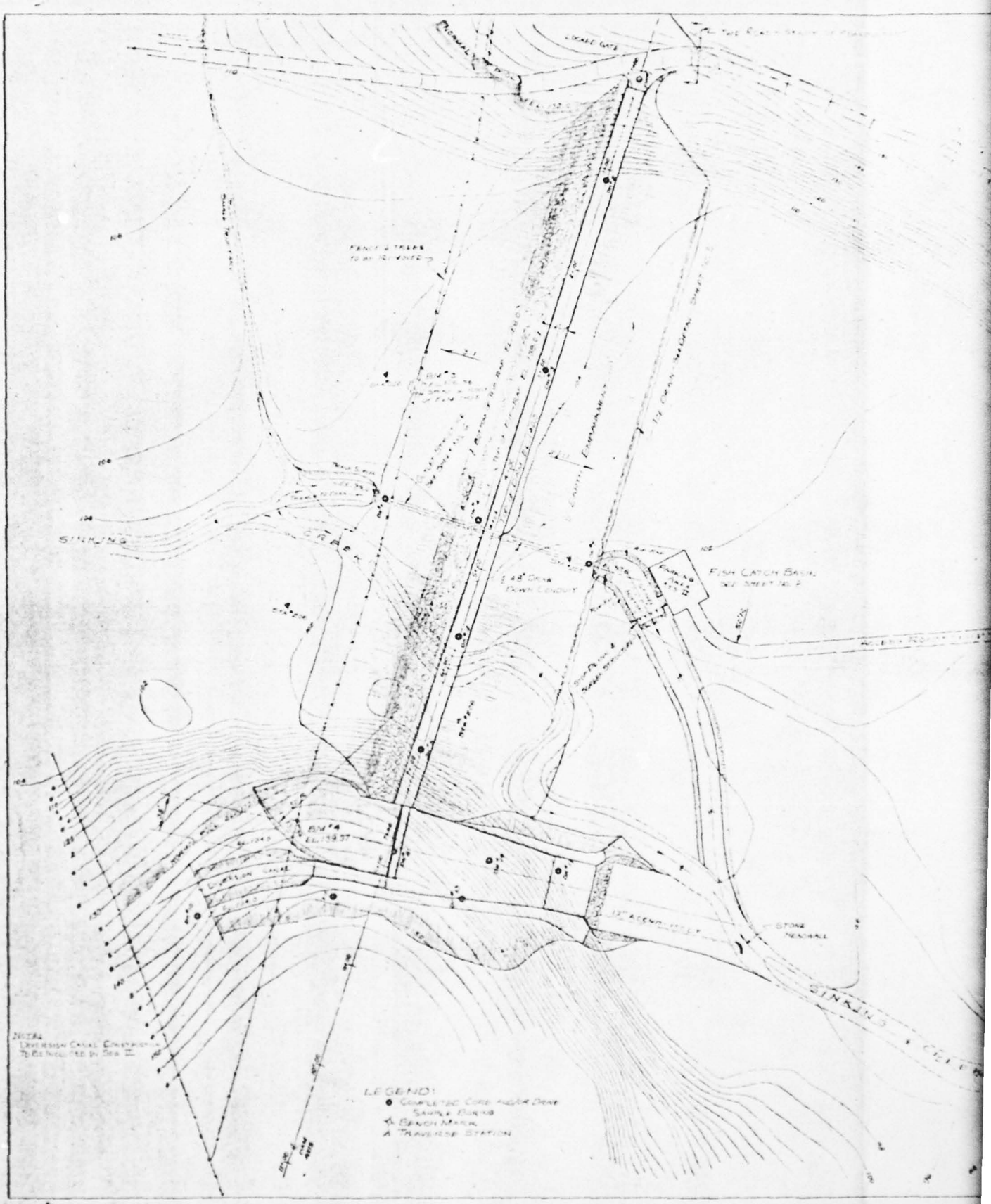
FIGURE 1 - COLYER LAKE DAM
GENERAL PLAN
FIELD INSPECTION NOTES

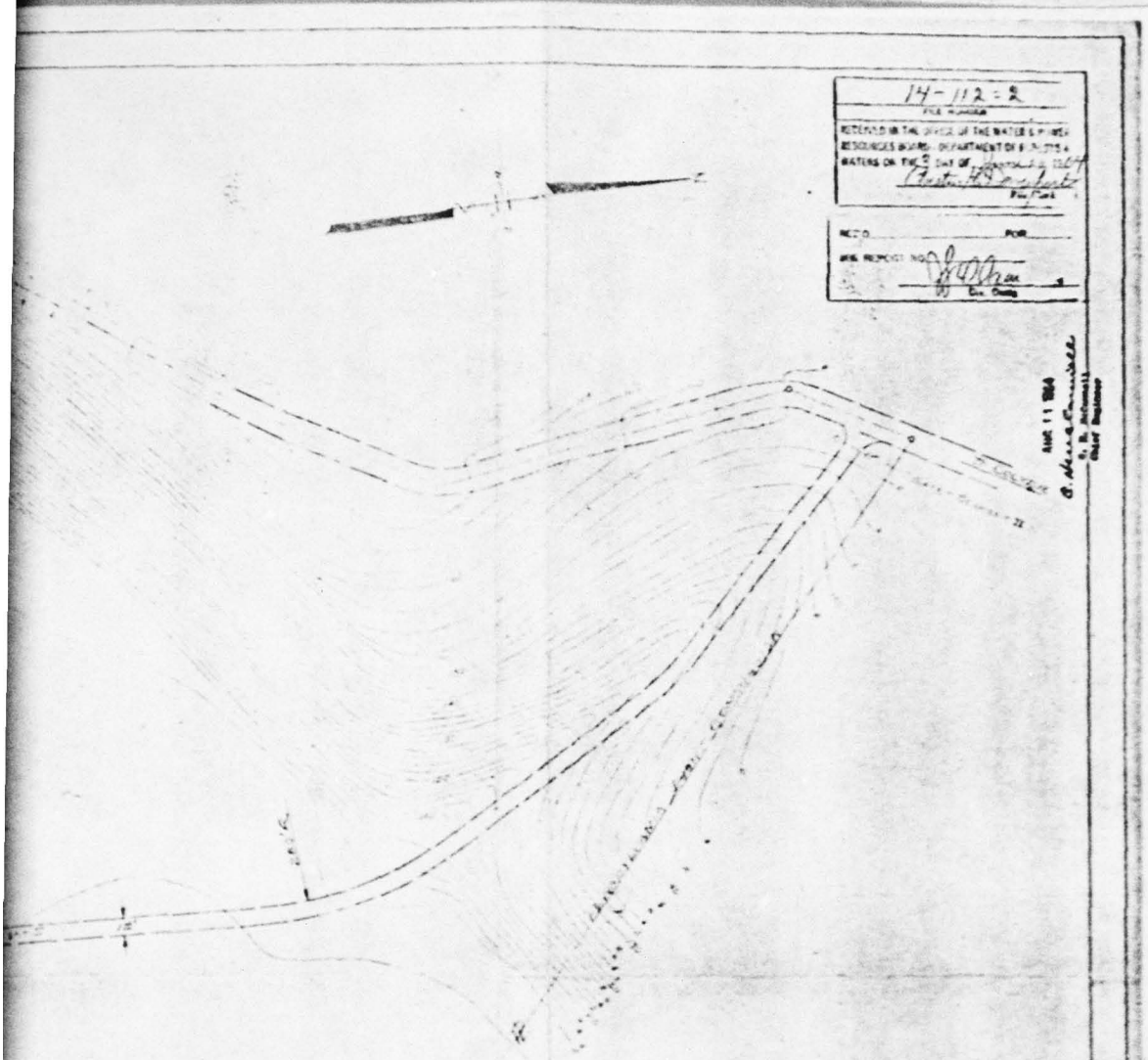

N
W
E
EDGAR MILLER
E. MCCLELLAN
WOODS
EDGAR MILLER TRACT
EDGAR MILLER
J. FOSTER
LAKE AREA
J. FOSTER
E. MCCLELLAN
J. BURD
PLAN



REVISED	APPROVALS	PROJECT Nº FC 4903-R
		GENERAL PLAN
		SINKING CREEK DAM AND APPURTENANCES - SEGMENT I
		BOTTS AND CENTRE CO. PENNA.
		EDWARD R. MILLER - REG. ENGINEER STATE COLLEGE, PENNA.
		DATE 1/7/64
		SCALE 1" = 200'
		FIGURE 2

2


SINKING CREEK
SINKING CREEK
LEGEND:
Completed Core Hole or Drive Sample Boring
Bench Mark
Traverse Station



REVISED	APPROVALS

PROJECT Nº FC 4903-R

EMBANKMENT PLAN

SIMONS CREEK DAM AND APPURTENANCES - SEGMENT I

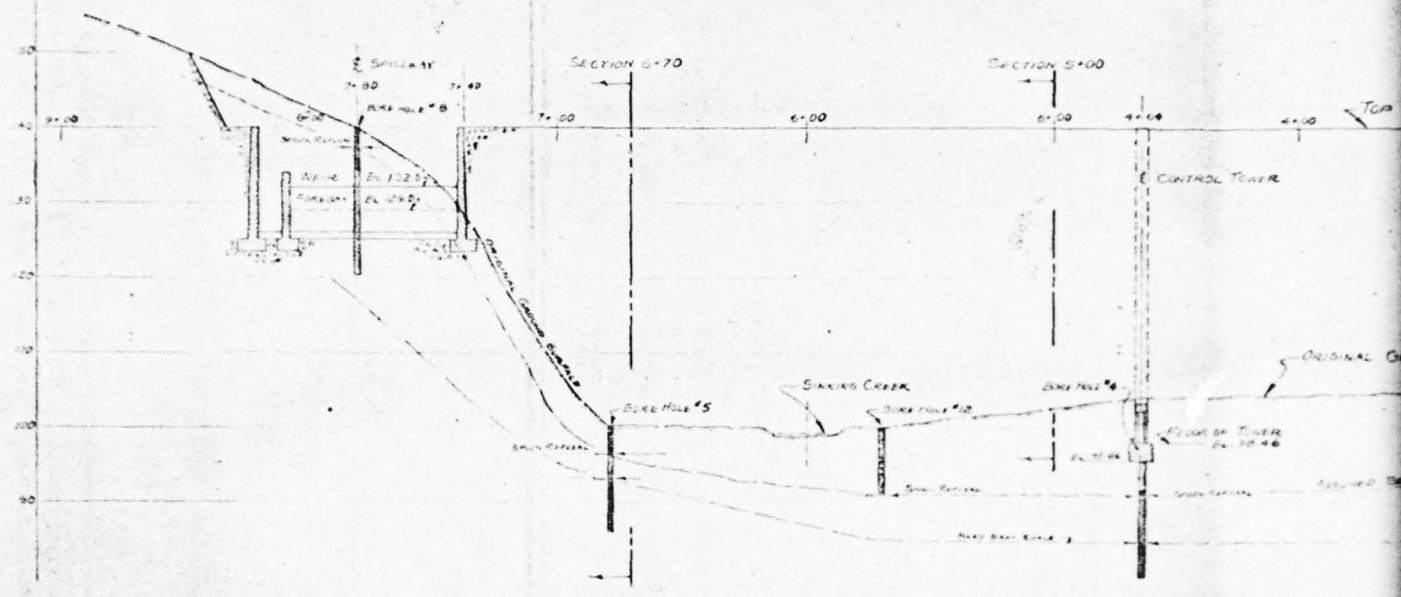
POTTER TWP., CENTRE CO., PENNA.

EDWARD J. WILLIAMS - REG. ENGINEER
STATE COLLEGE, PENNA.

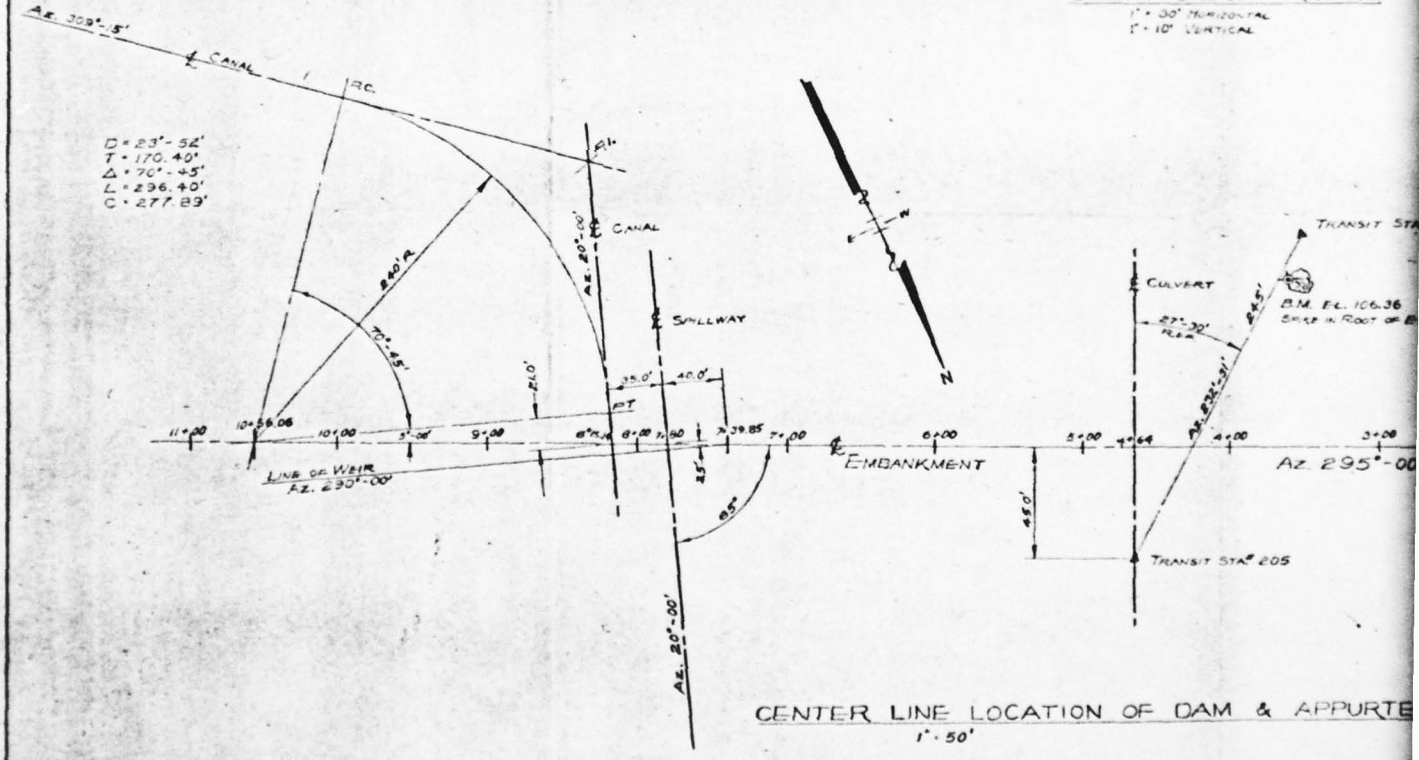
DATE 4/16/64
SCALE 1"=50'

FIGURE 3

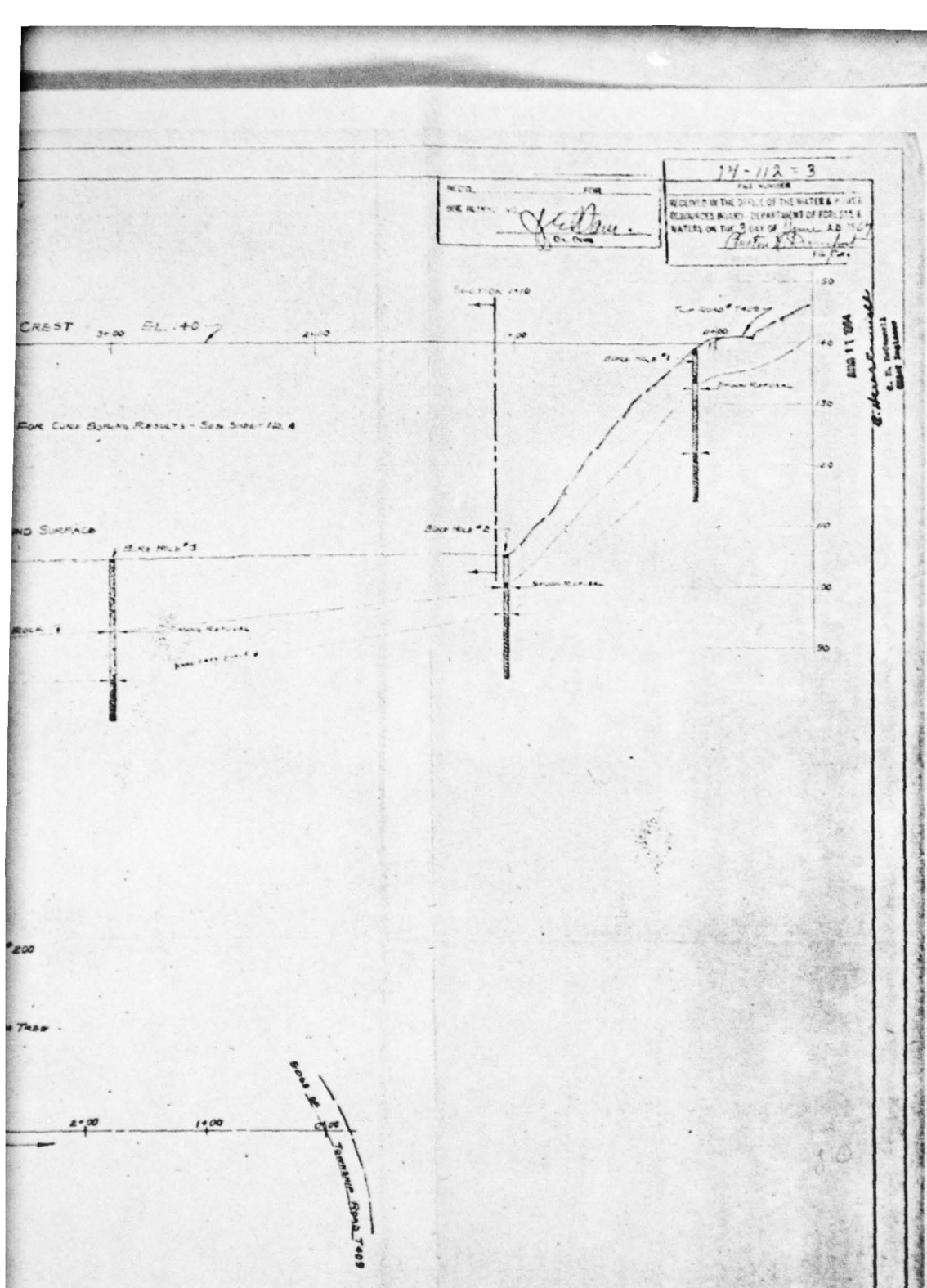
3



EMBANKMENT PROFILE
1" = 30' HORIZONTAL
1" = 10' VERTICAL

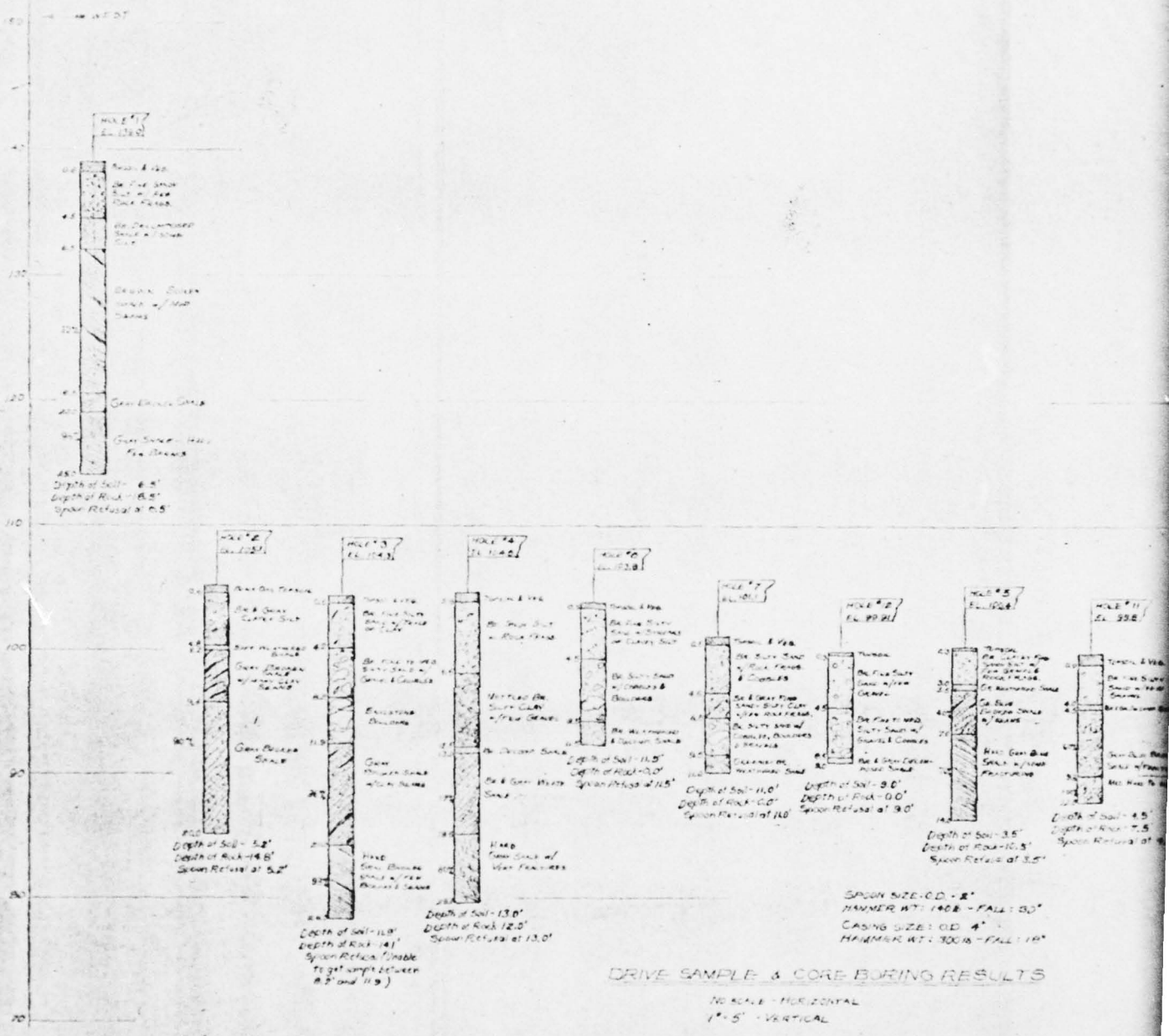


CENTER LINE LOCATION OF DAM & APPURTE
1" = 50'



REVISED	APPROVALS	PROJECT Nº FC 4903-R
	APPROVED CHIEF OF BUR. OF ENGINEERING & CONSTRUCTION ACCEPTANCE RECOMMENDED SUPERVISING ENGINEER - BUREAU OF CONSTRUCTION APPROVED FOR DEPT. PENNA. FISH COMMISSION EXEC. DIRECTOR SUBMITTED BY ENGINEER ACCEPTED BY CONTRACTOR BY BUREAU OF ENGINEERING & CONSTRUCTION CHECKED BY ARCH. | STRUCT. | MECH. | ELEC.	℄-EMBANKMENT PROFILE SINKING CREEK DAM AND APPURTENANCES - SEGMENT I POTTER TWP., CENTRE CO., PENNA. EDWARD R. MILLER - REG. ENGINEER STATE COLLEGE, PENNA. DATE SCALE NOTED FIGURE 4 HARRISBURG, PENNSYLVANIA

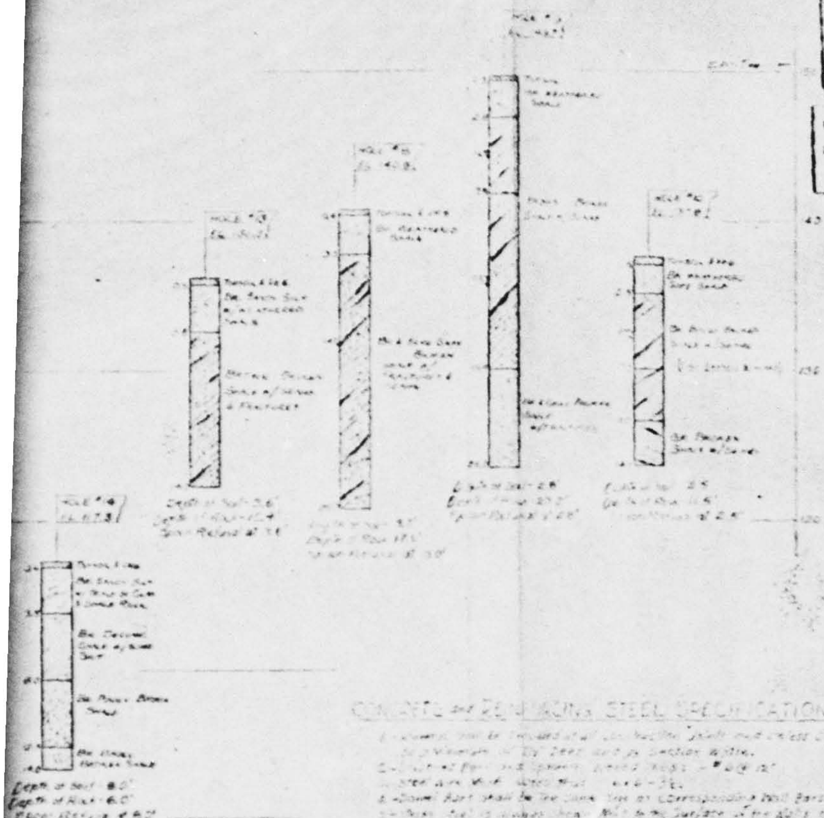
EDWARD R. MILLER
REGISTERED PROFESSIONAL ENGINEER
COMMONWEALTH OF PENNSYLVANIA



DRIVE SAMPLE & CORE BORING RESULTS

NO SCALE - HORIZONTAL

1" = 5' - VERTICAL



CONCRETE and REINFORCING STEEL SPECIFICATIONS:

1.- [illegible] Shall be Provided at all Construction Joints and Unless Otherwise Noted Shall be [illegible] Bars [illegible] Section Width.
2.- [illegible]
3.- [illegible]
4.- Dowel Bars Shall be the Same Size as Corresponding Wall Bars Unless Otherwise Noted.
5.- [illegible] Surface of the Walls or Slabs, and Shall Have the Following Cover From Center of Steel Bar to the Surface.
[illegible]
[illegible] Than 5/8" in Diameter [illegible]
[illegible] in Diameter.
6.- [illegible] Construction Joints and For a Distance [illegible] for a Lapped Splice.
7.- [illegible] Shall be Made and Located [illegible] Least [illegible] of the Structure.
8.- All Bars Where [illegible] Shall be Lapped 24 x Diameter of Bars.
9.- [illegible] Reinforcing Steel Shall be Bent as Noted in Accordance With A.C.I. Building Code Requirements - A.C.I. 318-56.
10.- All Reinforcing Bars Shall Conform To Standard Specification of The American Society for Testing Materials - A15-54T, A16-54T, and A305-53T.
11.- All Reinforcing Wire Fabric Shall Conform To The Requirements of A.S.T.M. Designation A 85-54T.
12.- Ready Mixed Concrete Shall be Mixed and Delivered in Accordance With the Requirements Set Forth in "Specifications for Ready-Mixed Concrete" A.S.T.M. - C94 and Shall Conform To The "American Concrete Institute" Standards A.C.I. 318-56
13.- All Expansion or Contraction Joints Where Concrete Joins Concrete Surfaces Shall be Painted With Asphalt Paint.

REVISED	APPROVALS
	APPROVED [illegible] ENGINEERING & CONSTRUCTION
	APPROVAL RECOMMENDED [illegible]
	APPROVED FOR [illegible] DIRECTOR
	SUBMITTED BY ____ ENGINEER
	ACCEPTED BY ____ CONTRACTOR
	BY
	BUREAU OF ENGINEERING & CONSTRUCTION CHECKED BY: ARCH. / STRUCT. / MECH. / ELEC.

PROJECT No FC-4903-R

BORING LOGS

SINKING CREEK DAM AND APPURTENANCES - SEGMENT I
POTTER TWP, CENTRE CO., PENNA.

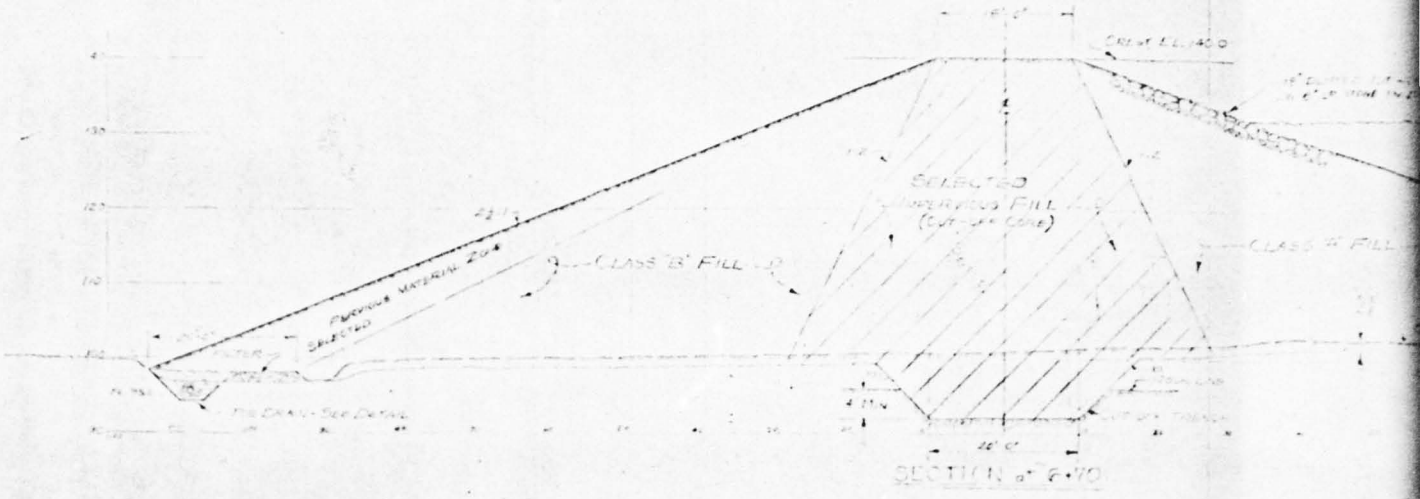
EDWARD R. MILLER - REG. ENGINEER
STATE COLLEGE, PENNA.

DATE 4/30/64
SCALE NOTED

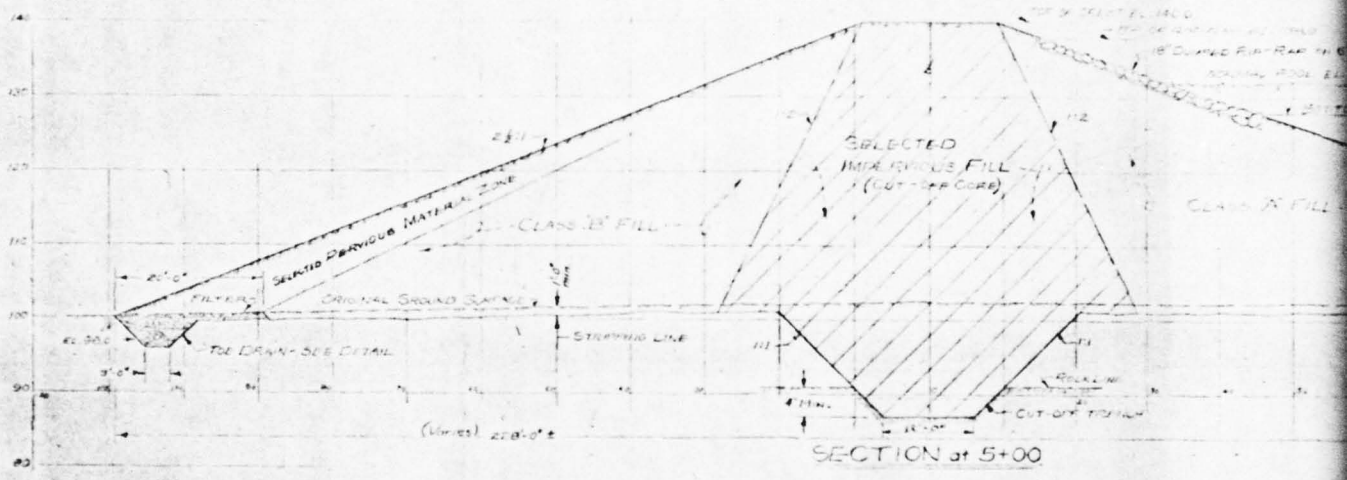
FIGURE 5

HARRISBURG, PENNSYLVANIA

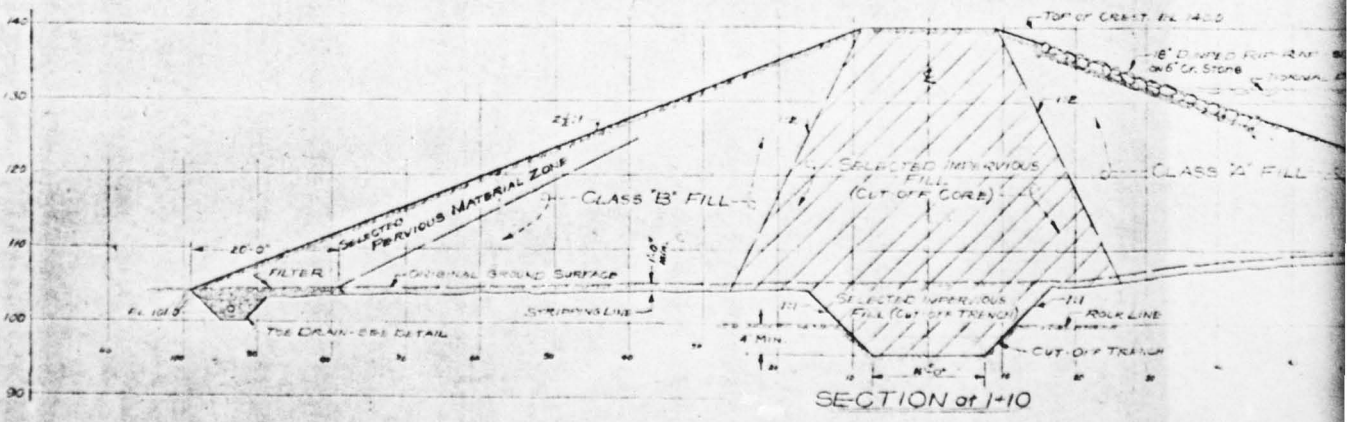
2



SECTION at 6+70



SECTION at 5+00



SECTION at 1+10

CROSS-SECTIONS OF EMBANKMENT

1"=10FT HORIZONTAL
1"=10FT VERTICAL

TOE DRAIN DETAIL

NOTES:

1. SELECTED IMPERVIOUS FILL: Shall be selected impervious and structurally sound material free from vegetable matter and rock greater than six (6) inches in maximum dimensions.

2. CLASS 'A' FILL: Shall be selected semi-impervious and structurally sound material free from vegetable matter and rock greater than six (6) inches in maximum dimensions.

3. CLASS 'B' FILL: Shall be selected semi-pervious and structurally sound material free from vegetable matter, but may contain rock with a maximum dimension of twelve (12) inches. No pockets or concentration of rock shall be permitted.

4. SELECTED PERVIOUS MATERIAL: Shall be composed of structurally sound material sufficiently pervious to drain the compacted soil free from vegetable matter, but may contain rock with a maximum dimension of twelve (12) inches.

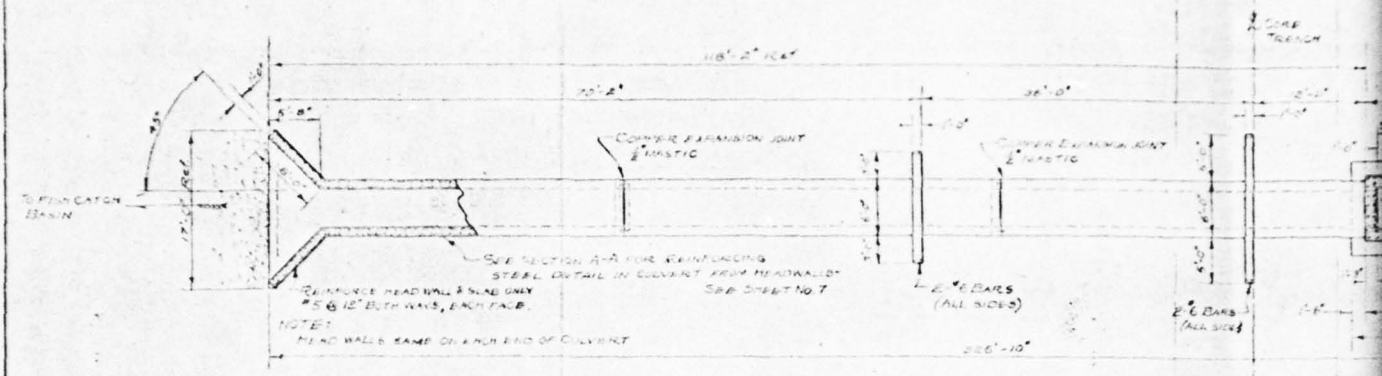
5. STONE FOR RIP-RAP: Shall be eighteen (18) inches in thickness, dumped on a six (6) inch layer of No. 2-B crushed stone graded to a uniform surface.

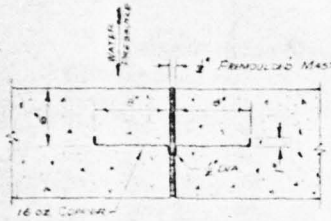
6. EMBANKMENT CONSTRUCTION DETAILS: See written specifications.

7. All dimensions and measurements shall be checked and verified by the Contractor at the site.

8. Dimensions shown for Cut-off Trench are minimum. Final position shall be determined during excavation by the Engineer and Bureau.

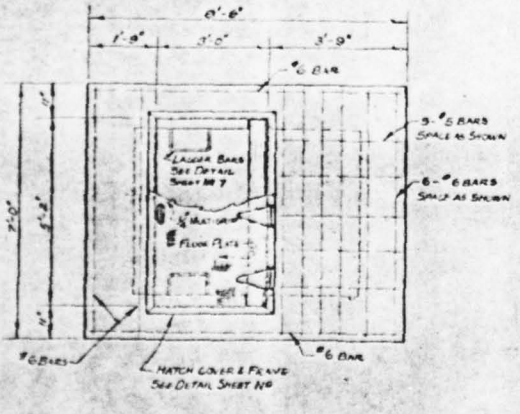
REVISED	APPROVALS	PROJECT No. FC-4903-R
	APPROVED APPROVED APPROVED FOR DRAFT ACCEPTED BY ADJUSTED BY BY BUREAU OF ENGINEERING AND CONSTRUCTION CHECKED BY ARCH. | STRUCT. | MECH. | ELEC.	EMBANKMENT CROSS SECTIONS SINKING CREEK DAM AND APPURTENANCES - SEGMENT I BUTLER TWP. CENTRE CO., PENNA. EDWARD R. MILLER — REG. ENGINEER STATE COLLEGE, PENNA. DATE SCALE FIGURE 6



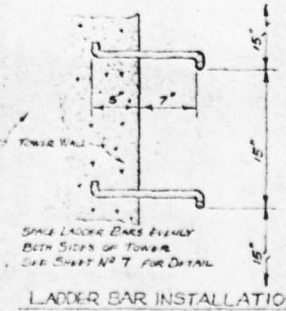


COPPER EXPANSION JOINT
1½" = 1'-0"

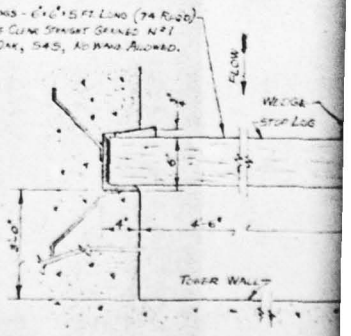
ELEVATION
1" = 1'-0"



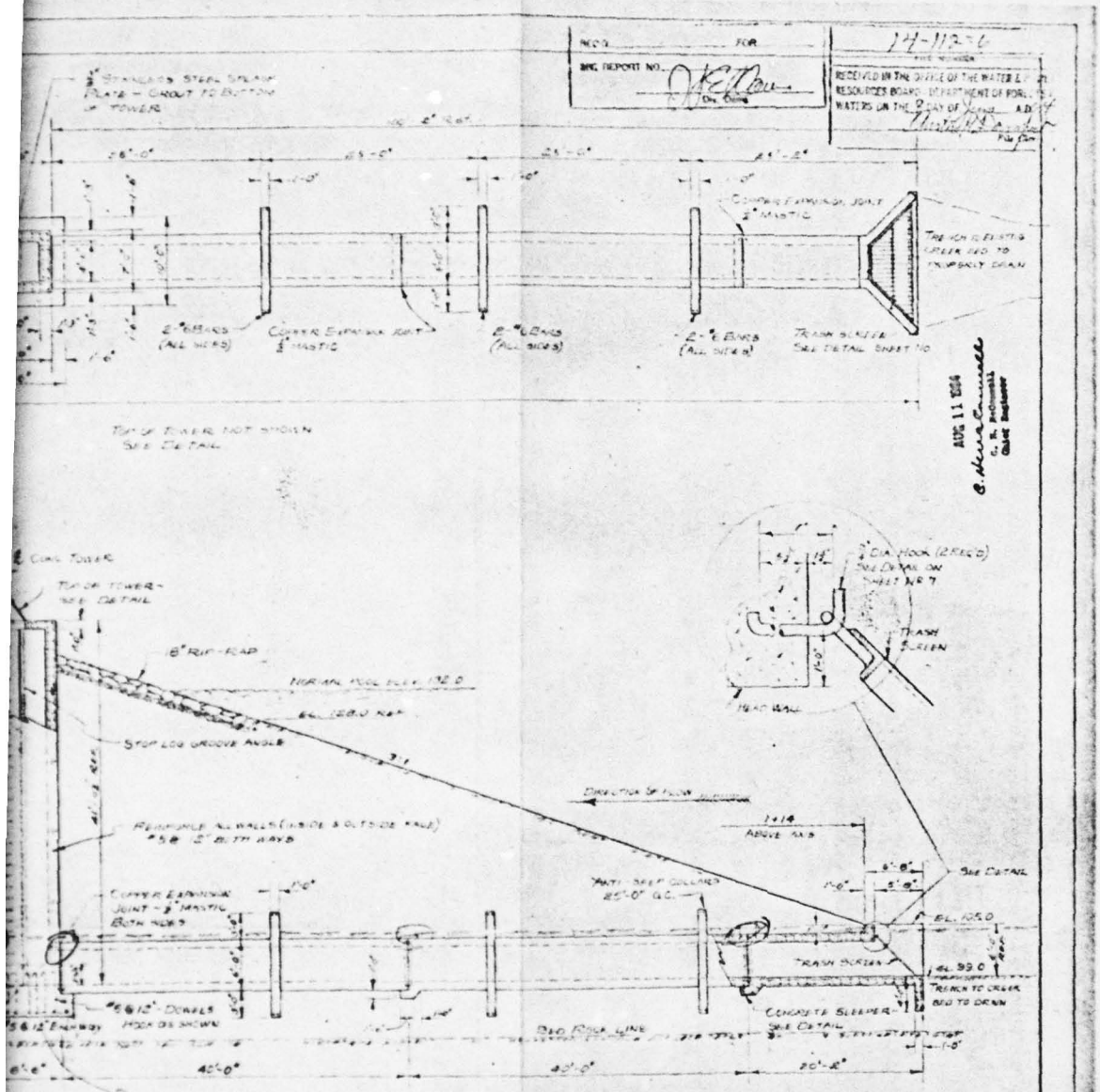
TOP OF TOWER
1" = 1'-0"

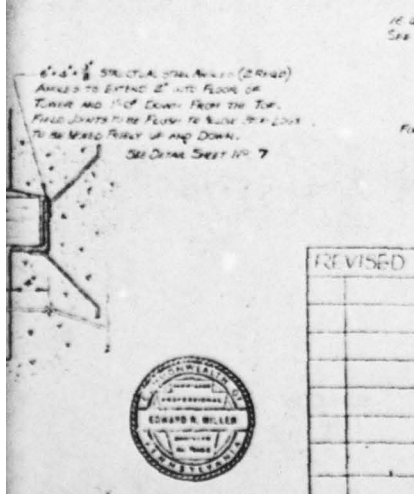


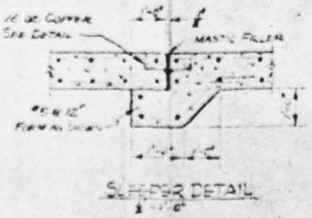
LADDER BAR INSTALLATION
1½" = 1'-0"



STOP LOG GROOVE
1½" = 1'-0"



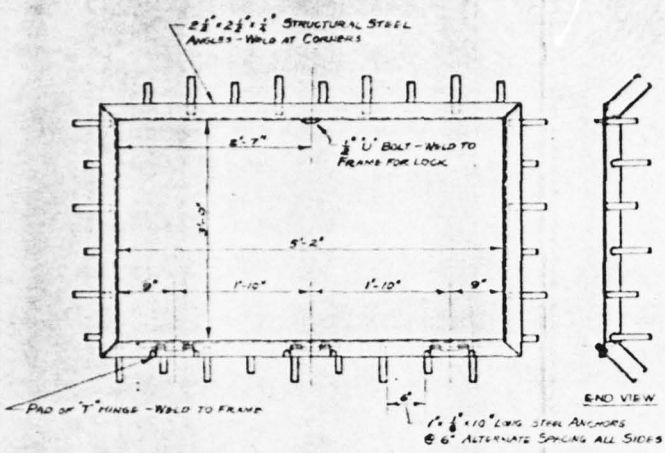




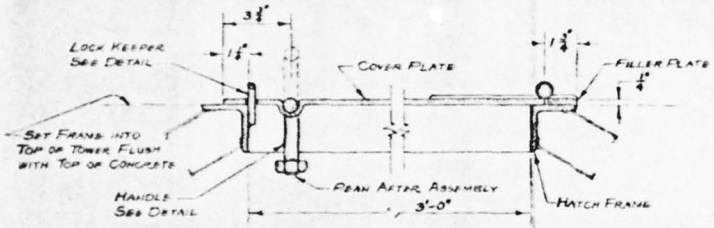
NOTE:—
All Dimensions and Measurements Shall be Checked and Verified by the Contractor at the Site.

For Concrete and Reinforcing Steel Schedules See Sheet No. 4

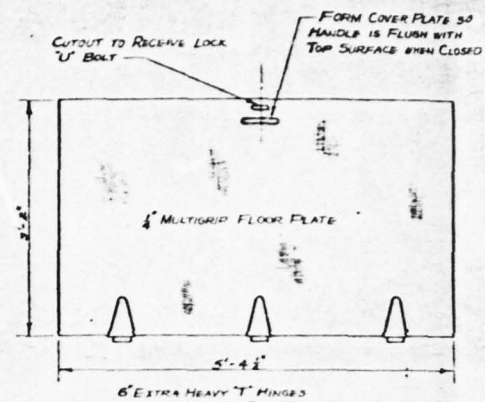
REVISED	APPROVALS	PROJECT No FC 4903-R
	APPROVED CHIEF, BUREAU OF ENGINEERING & CONSTRUCTION APPROVED CHIEF, BUREAU OF ENGINEERING & CONSTRUCTION APPROVED FOR DEPT. FLOOD PROTECTION COMMISSION EXEC. DIRECTOR SUBMITTED BY ENGINEER ACCEPTED BY CONTRACTOR BY BUREAU OF ENGINEERING & CONSTRUCTION CHECKED BY ARCH. STRUCT. MECH. ELEC.	CONTROL TOWER & CONDUIT SINKING CREEK DAM AND APPURTENANCES-SEGMENT I POTTER TWP, CENTRE CO., PENNA. EDWARD R. MILLER — REG. ENGINEER STATE COLLEGE, PENNA. DATE 5/12/64 SCALE NOTED HARRISBURG, PENNSYLVANIA FIGURE 7



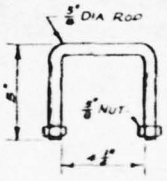
HATCH FRAME ASSEMBLY
1"=1'-0"



CROSS SECTION
3"=1'-0"

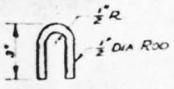


HATCH COVER PLATE
1"=1'-0"



HANDLE
3"=1'-0"

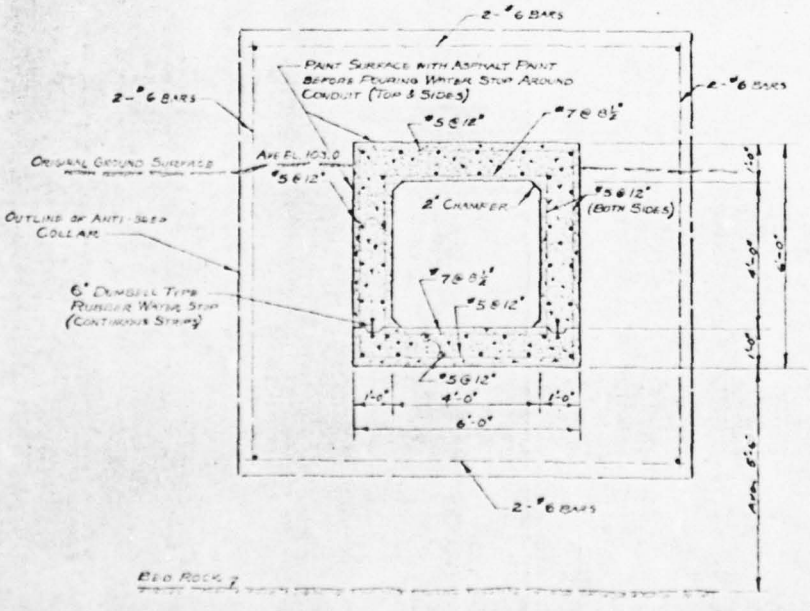
NOTE:
AFTER FABRICATION - PAINT WITH ONE (1) SHOP COAT METAL PRIMER.



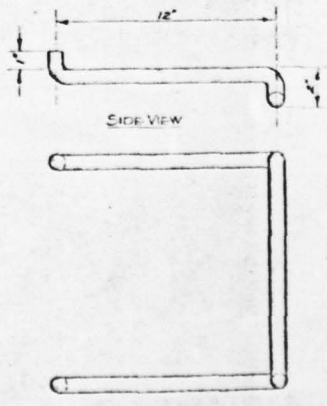
LOCK KEEPER
3"=1'-0"

NOTE:
AFTER
SHOP C

HATCH COVER AND FRAME DETAILS

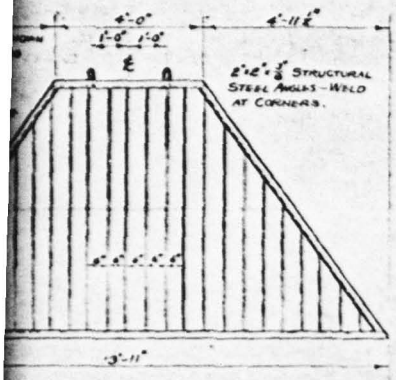


SECTION A-A - CONCRETE CONDUIT
½"=1'-0"
SEE SHEET NO 6



PLAN

LADDER BAR
3"=1'-0"



14-117-7
File Number

Received in the Office of the Water & Power Resources Board, Department of Forests, Waters on [illegible] A.D. 1954

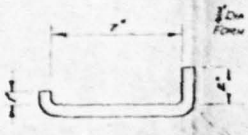
Approved _____ For _____

Date Report No. _____ For _____

AUG 11 1954

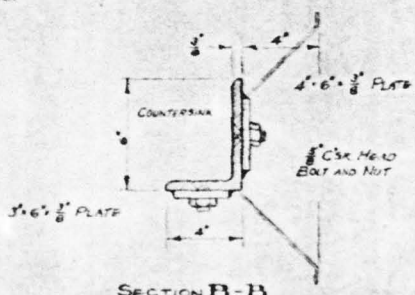
Screen
2'-1'-3"

Fabrication - Paint with One (1) Coat of Metal Primer.

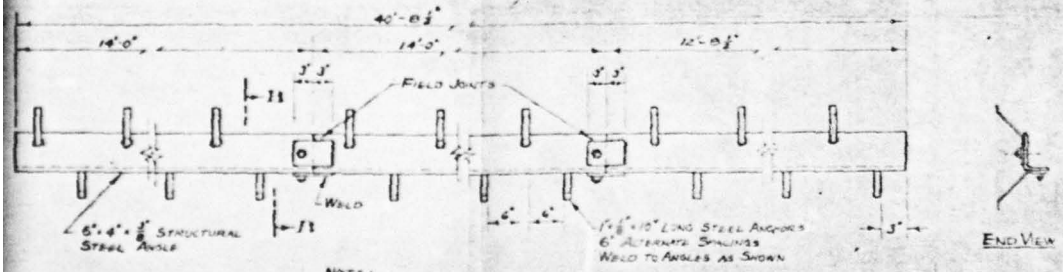


Hook Detail
3"=1'-0"

ASH SCREEN & HOOK

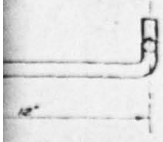


Section B-B
3"=1'-0"



NOTE:
After Fabrication - Paint with One (1) Shop Coat of Metal Primer.

2 - Complete Assemblies Req'd.



STOP LOG GROOVE ANGLE
1"=1'-0"

ND View

BAR BENDING

Req'd.

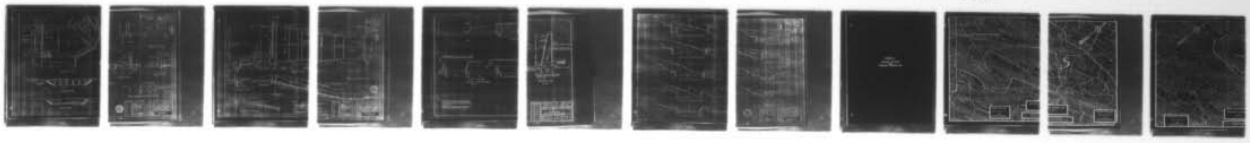
ETAIL

REVISED	APPROVALS	PROJECT Nº FC4903-R
	APPROVED _____ DIRECTOR OF ENGINEERING & CONSTRUCTION	FABRICATED STEEL DETAILS
	APPROVED _____ CHIEF ENGINEER - BOARD OF CONSERVATION & WATER RESOURCES	SINKING CREEK DAM AND APPURTENANCES-SEGMENT I POTTER TWP., CENTRE CO., PENNA.
	APPROVED FOR DEPT. _____ PENNSYLVANIA WATER & POWER RESOURCES BOARD	EDWARD R. MILLER — REG. ENGINEER STATE COLLEGE, PENNA.
	SUBMITTED BY _____ ENGINEER	DATE 5-19-54
	ACCEPTED BY _____ CONTRACTOR	SCALE NOTED
	BY _____	FIGURE 8
	BUREAU OF ENGINEERING & CONSTRUCTION CHECKED BY _____ ARCH. STRUCT MECH. ELEC.	HARRISBURG, PENNSYLVANIA

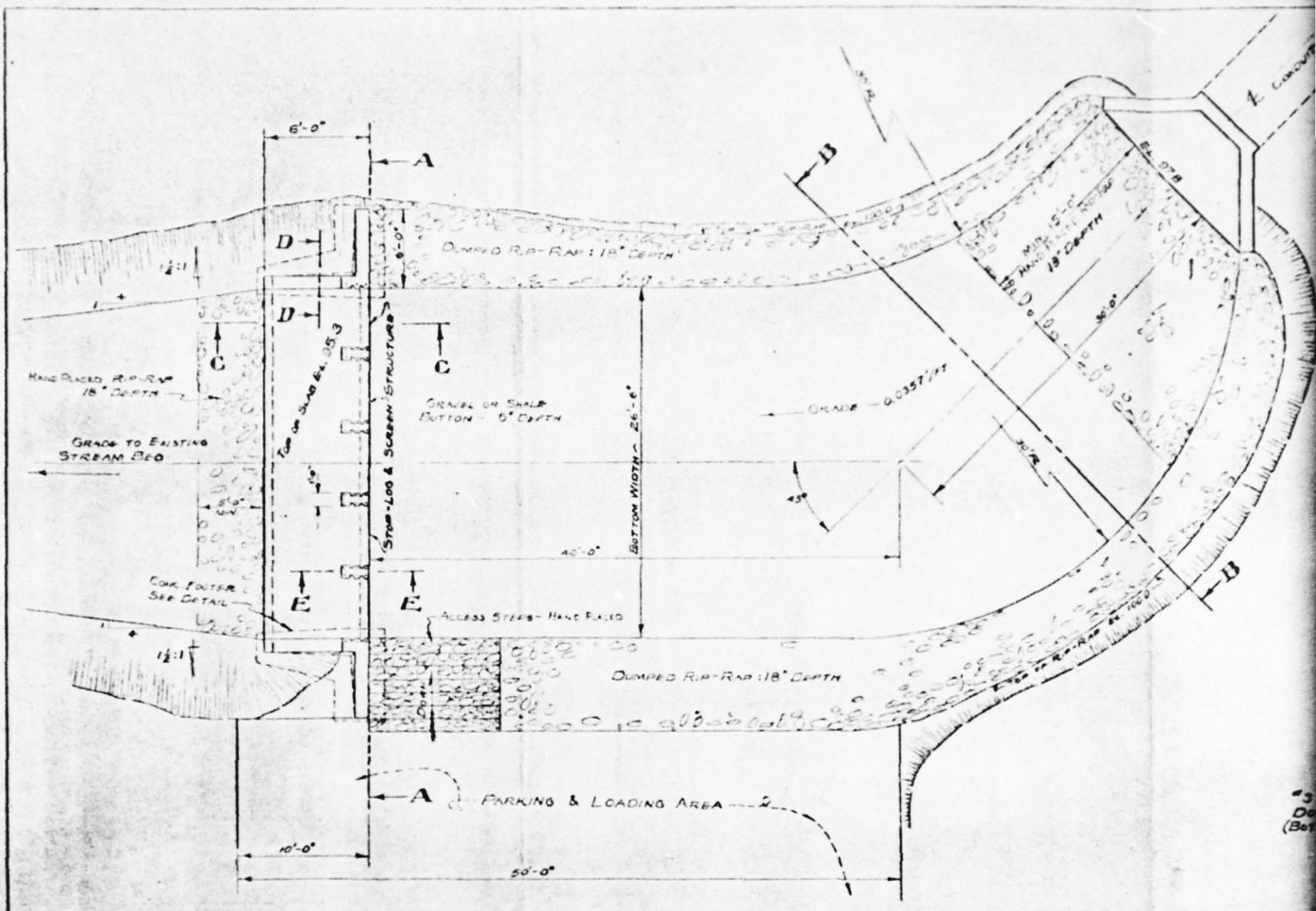
1 2

AD-A070 838 GAI CONSULTANTS INC MONROEVILLE PA F/G 13/2
NATIONAL DAM INSPECTION PROGRAM. COLYER LAKE DAM (NDS ID NUMBER--ETC(U)
APR 79 DACW31-79-C-0013
UNCLASSIFIED NL

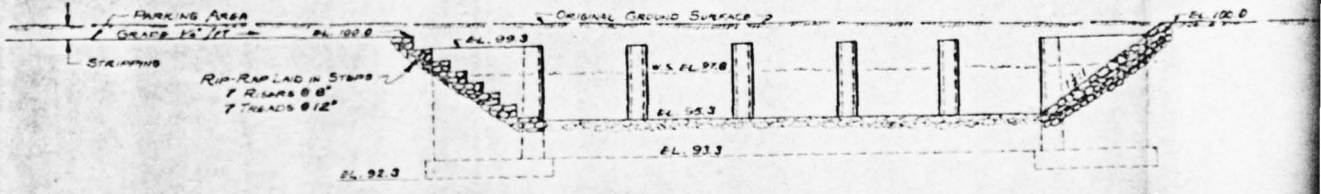
2 OF 2
AD
A070838



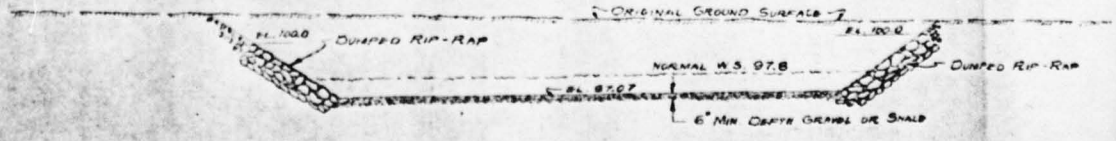
END
DATE FILMED
8 79
DDC



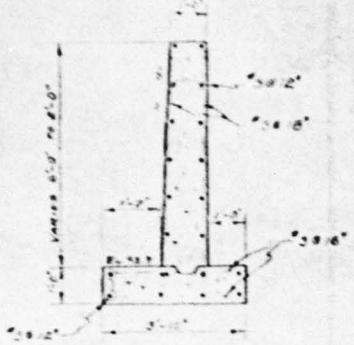
GENERAL PLAN
1/4" = 1'-0"



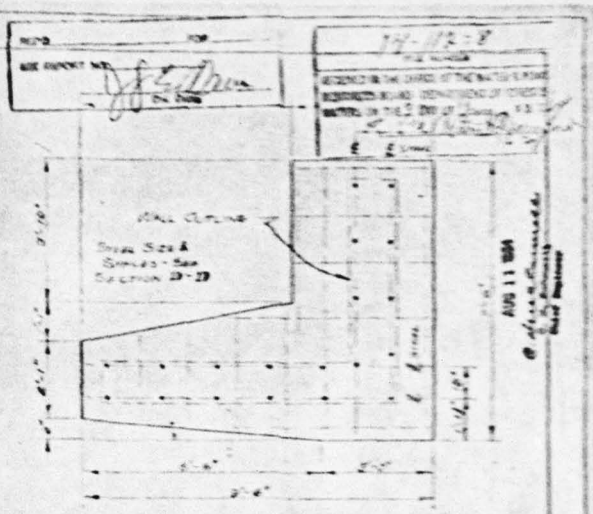
SECTION A-A
1/4" = 1'-0"



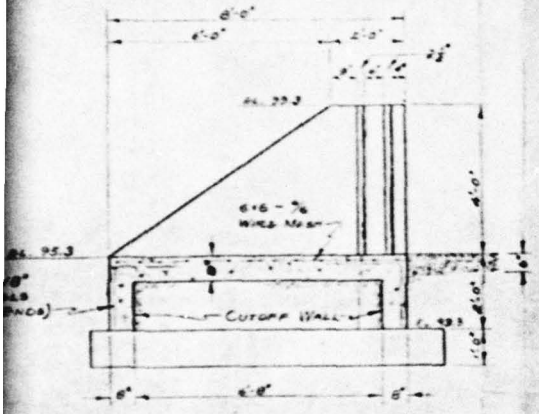
SECTION B-B
1/4" = 1'-0"



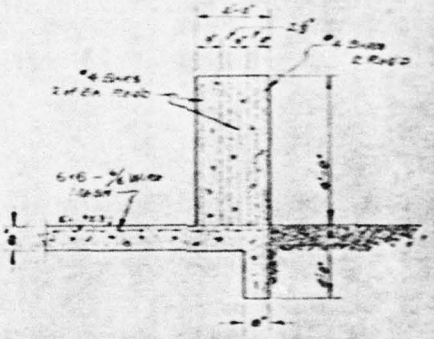
SECTION D-D



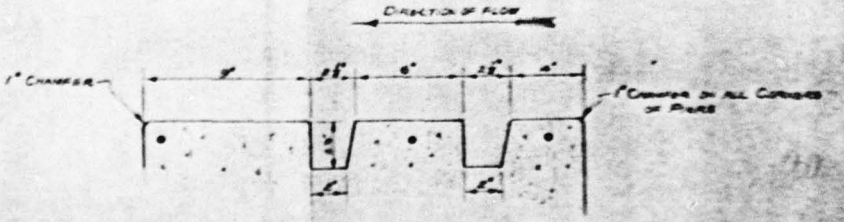
PLAN OF FOOTER



SECTION C-C



SECTION E-E

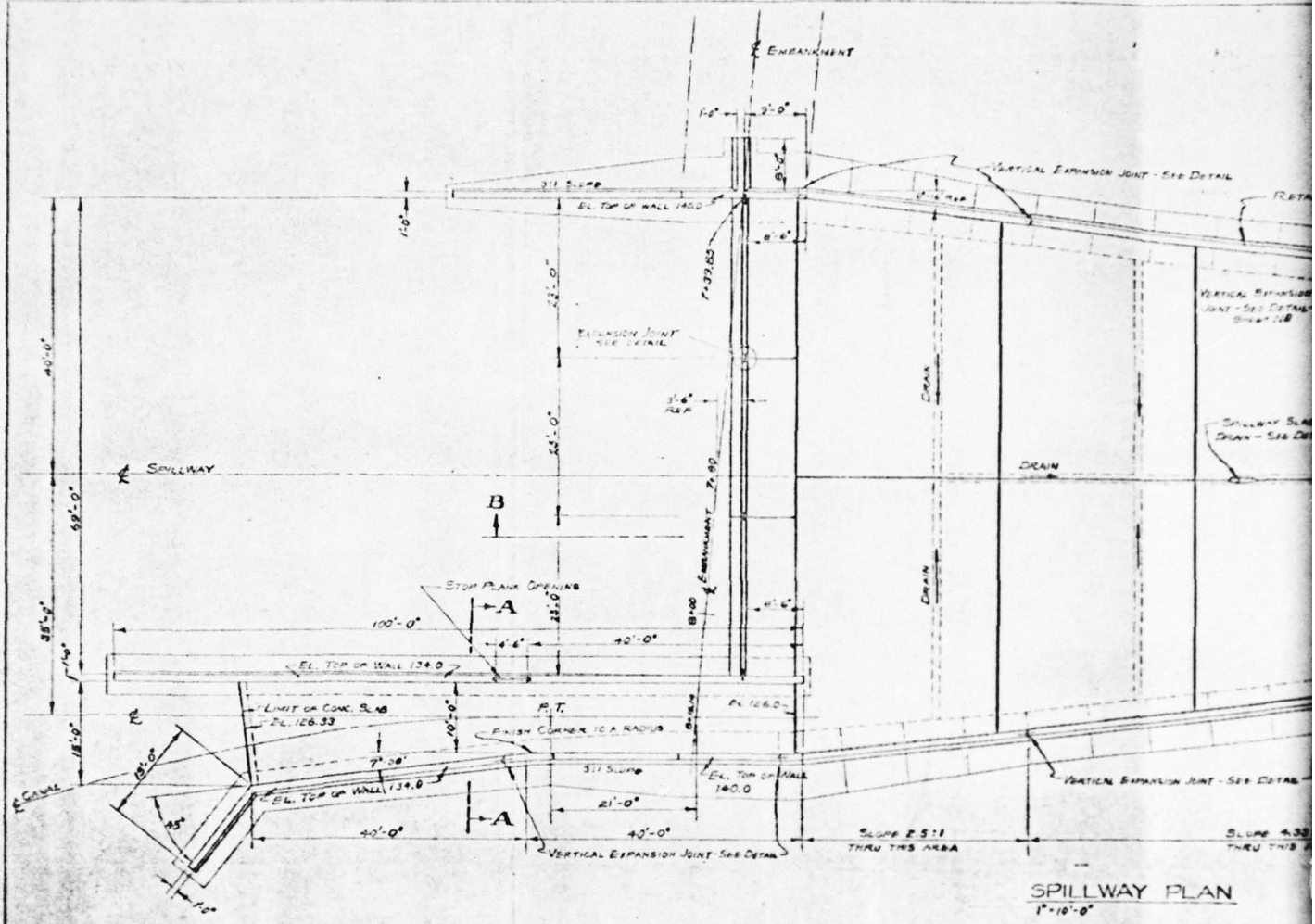


TYPICAL SCREEN & STOP PLANK GROOVES

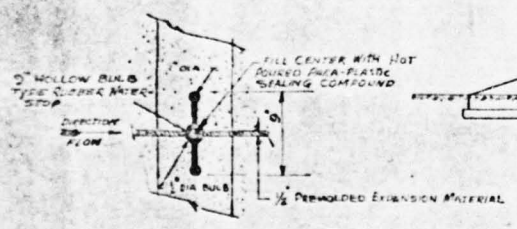
REVISED	APPROVALS	PROJECT Nº FC4903-R
	APPROVED	FISH CATCH BASIN
	APPROVED FOR DEPT.	SINKING CREEK DAM AND APPURTENANCES - SEGMENT I
	SUBMITTED BY	POTTER TWP., CENTRE CO., PENNA.
	ACCEPTED BY	EDWARD R. MILLER — REG. ENGINEER, STATE COLLEGE, PENNA.
	BY	DATE: 5/24/60
	BUREAU OF ENGINEERING & CONSTRUCTION CHECKED BY	SCALE:
	ARCH. / STRUCT. / MECH. / ELEC.	NOTED

FIGURE 9

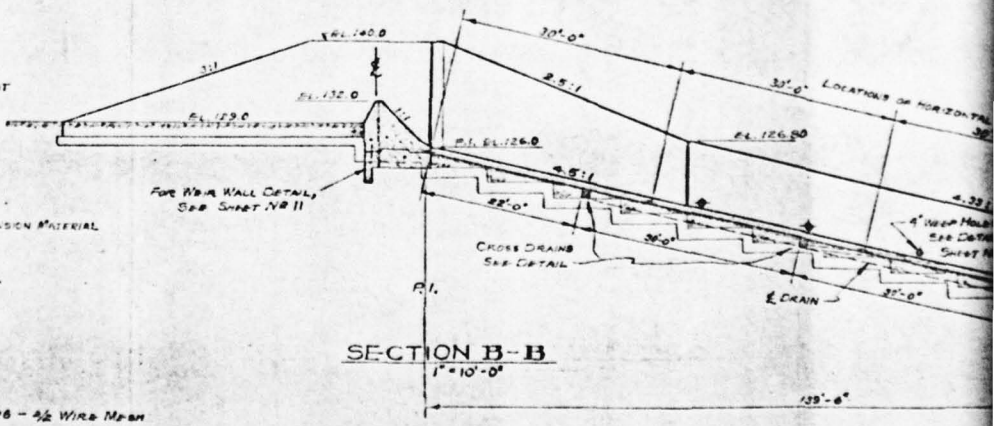
2



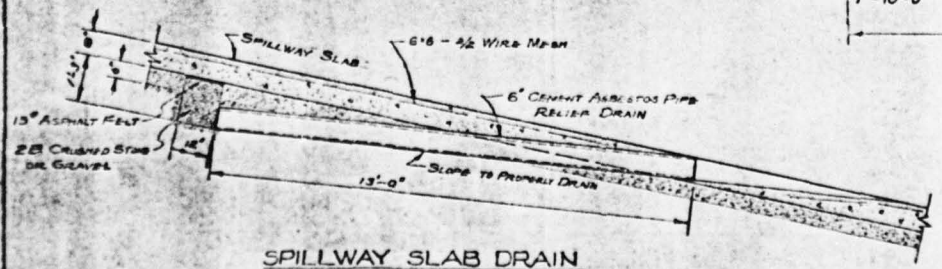
SPILLWAY PLAN
1" = 10'-0"



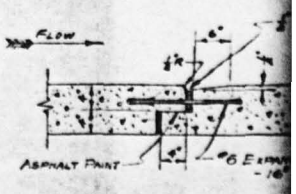
WEIR EXPANSION JOINT DETAIL
1½" = 1 FT.



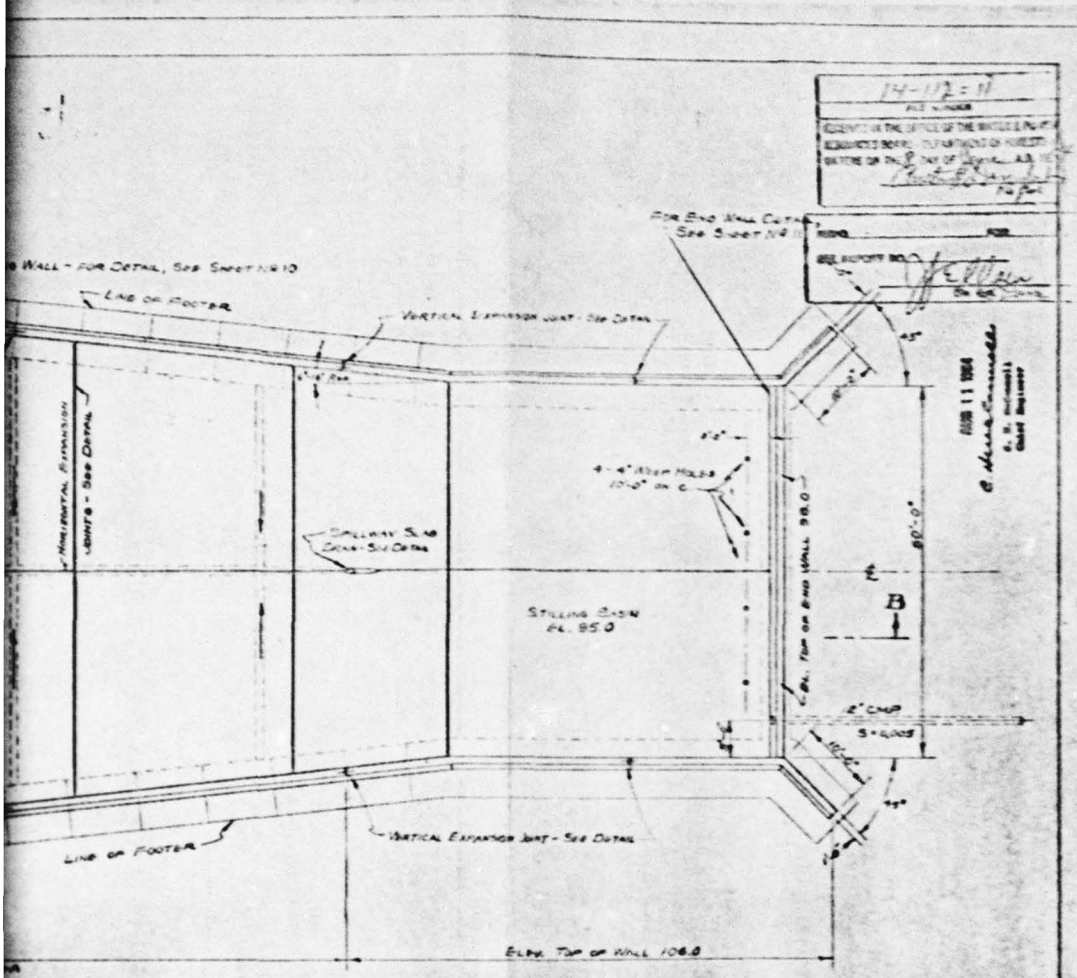
SECTION B-B
1" = 10'-0"



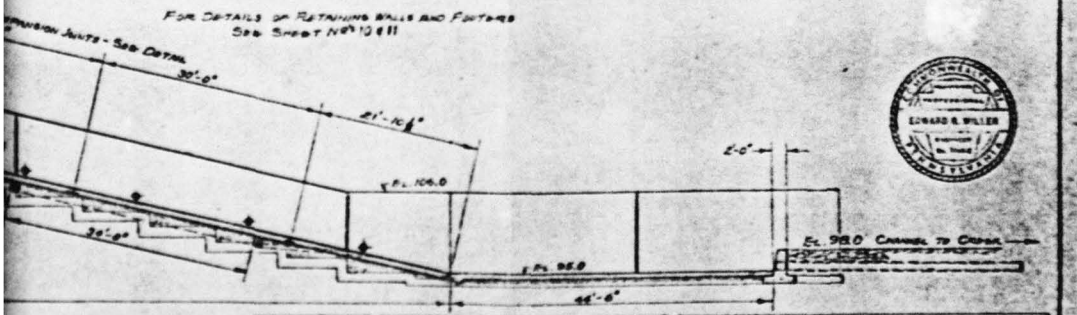
SPILLWAY SLAB DRAIN
½" = 1'-0"



TYPICAL EXPANSION
1" = 1'-0"

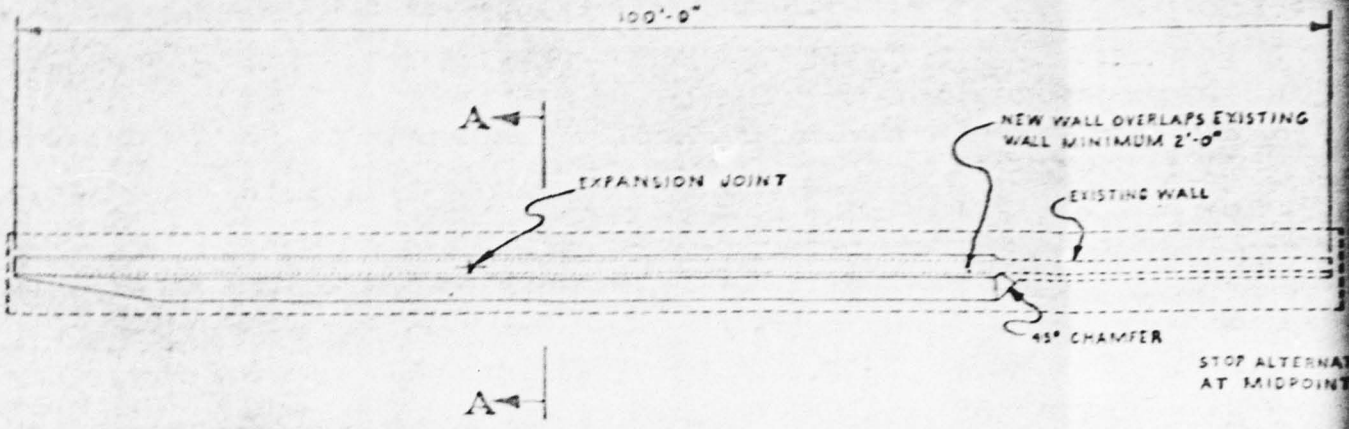


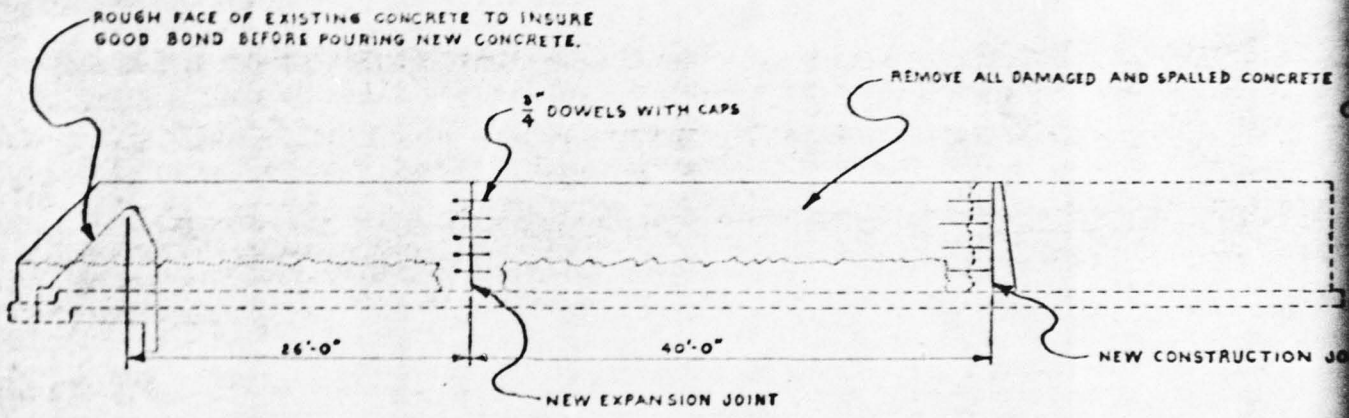
NOTES:
ALL DIMENSIONS AND MEASUREMENTS SHALL BE CHECKED AND VERIFIED BY THE CONTRACTOR AT THE SITE.



REVISED	APPROVALS	PROJECT Nº FC 4903-R
	APPROVED Director of Engineering & Construction RECOMMENDED Superintending Engineer, Bureau of Construction APPROVED FOR DEPT Penna. Fish Commission — Exec. Director SUBMITTED BY — Engineer ACCEPTED BY — Contractor BY BUREAU OF ENGINEERING & CONSTRUCTION CHECKED BY ARCH. | STRUCT. | MECH. | ELEC.	SPILLWAY - PLAN & PROFILE SINKING CREEK DAM AND APPURTENANCES - SEGMENT I POTTER TWP., CENTRE CO. PENNA. EDWARD R. MILLER — Registered Engineer STATE COLLEGE, PENNA. DATE 6/6/60 SCALE NOTED FIGURE 10

NT - HORIZONTAL





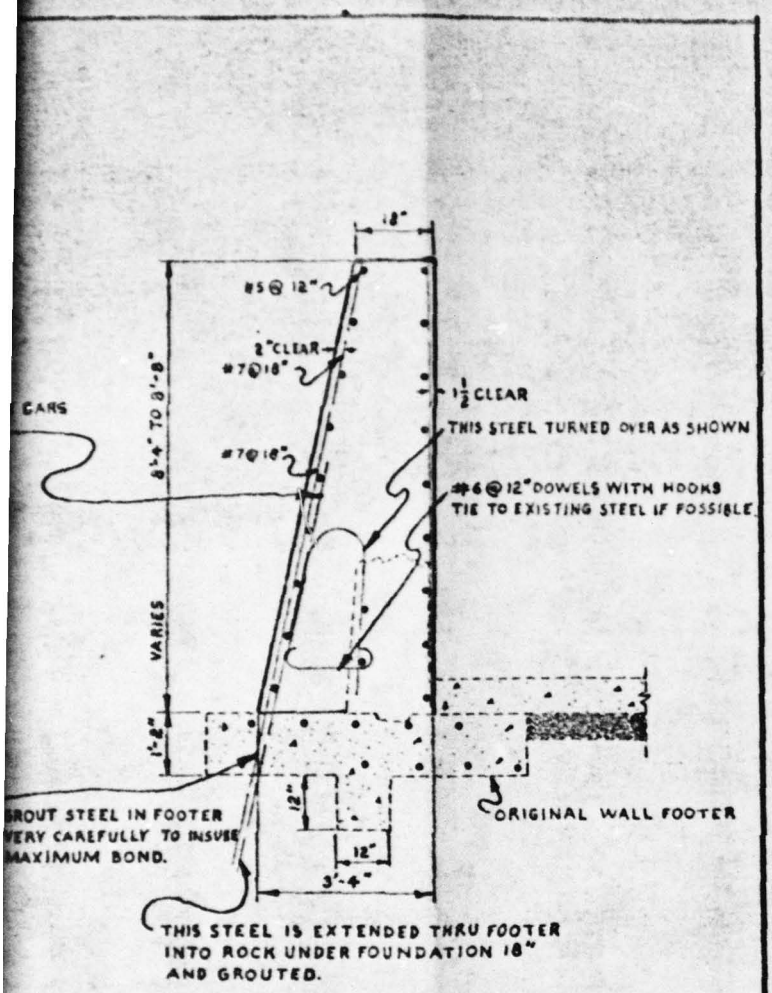
DETAIL - CENTER WALL

⅛" = 1'-0"

NOTE:

ALL DOWELS AND RODS WERE GROUTED WITH "POR-ROK" A FAST SETTING CEMENT AS MANUFACTURED BY HALLEMITE MANUFACTURING CO. BEFORE NEW CONCRETE WALL WAS POURED.

MAKE SURE ALL EXPOSED CONCRETE IS CLEAN AND WET DOWN BEFORE POURING NEW CONCRETE.



SECTION A-A

½" = 1'-0"

NT

REVISED	

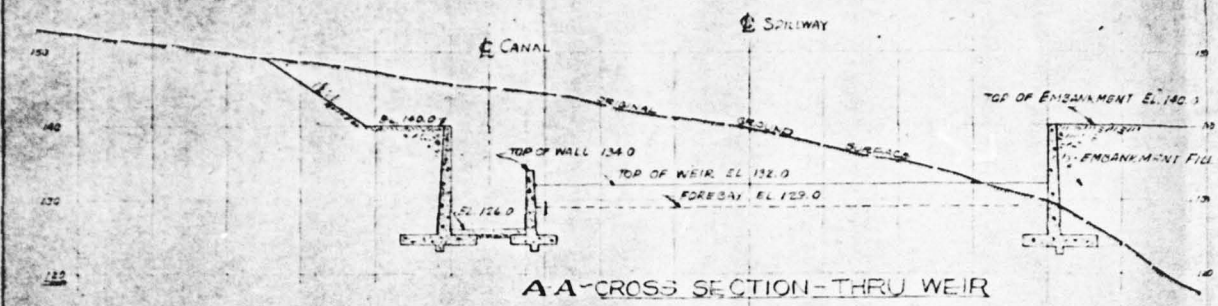
COMMONWEALTH OF PENNSYLVANIA
PENNSYLVANIA FISH COMMISSION
ENGINEERING DIVISION ~ BELLEFONTE R.D.3, PA.

REPAIRS TO CENTER WALL AT SPILLWAY
AT
COLYER DAM
POTTER TWP. - CENTER CO., PENNA.

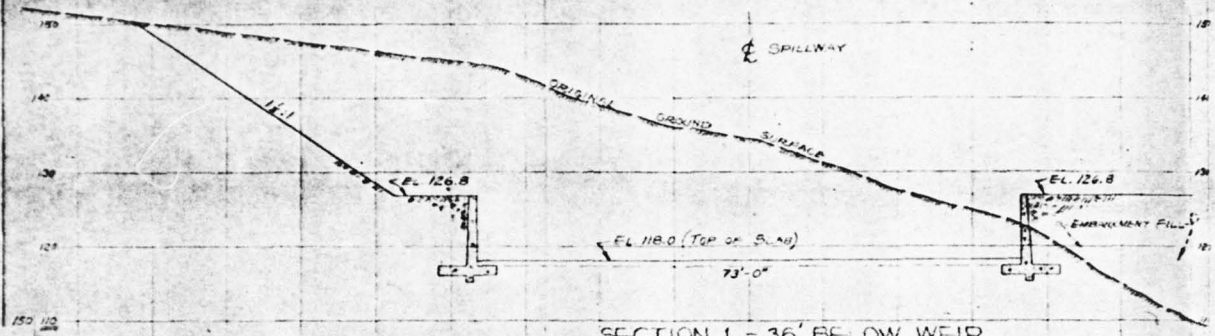
DRAWN BY: R.W.B.
DATE: 5-7-68
APPROVED BY: R.R.F.
DATE: 5-10-68

SCALE: AS NOTED

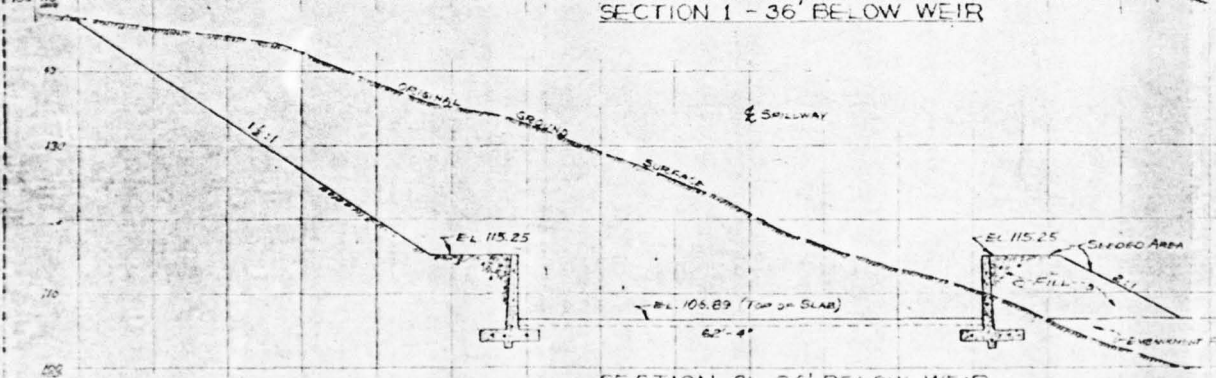
FIGURE 11



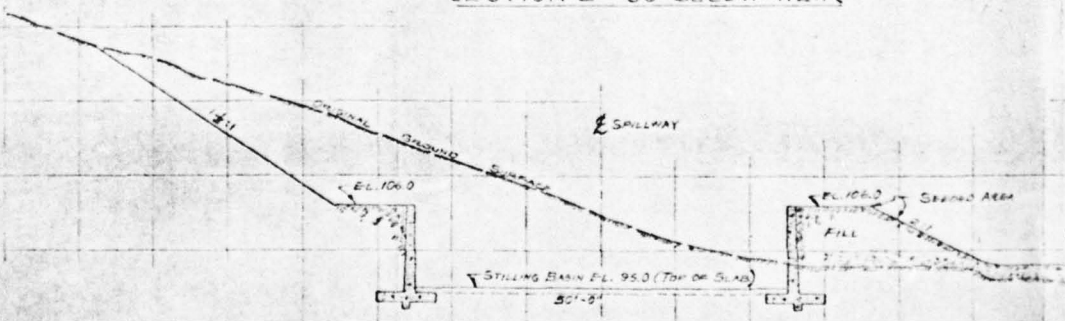
A-A - CROSS SECTION - THRU WEIR



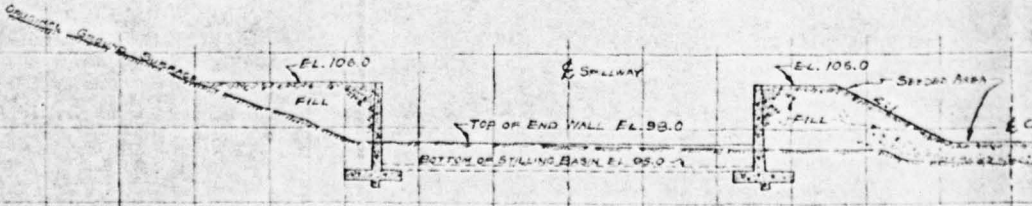
SECTION 1 - 36' BELOW WEIR



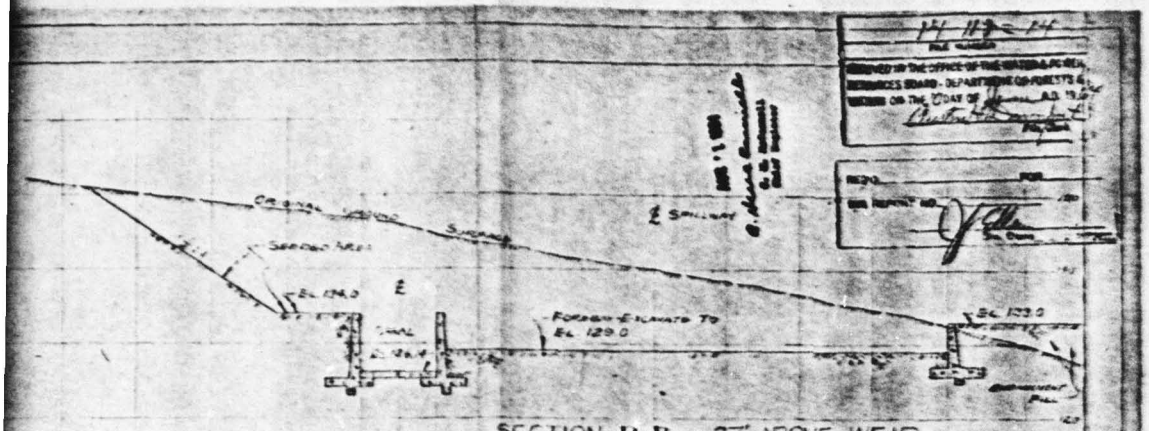
SECTION 2 - 86' BELOW WEIR

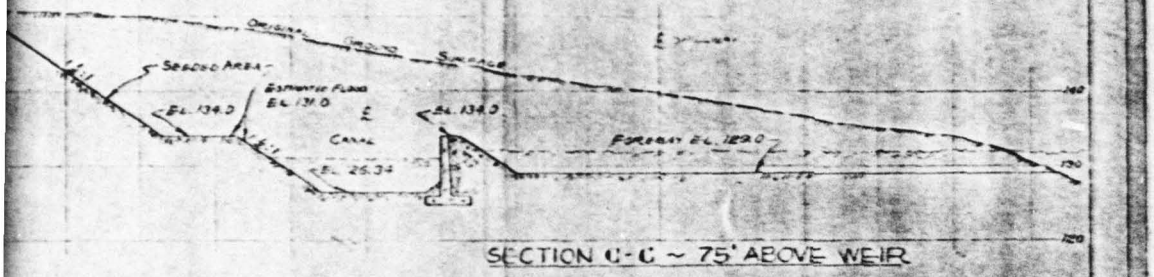


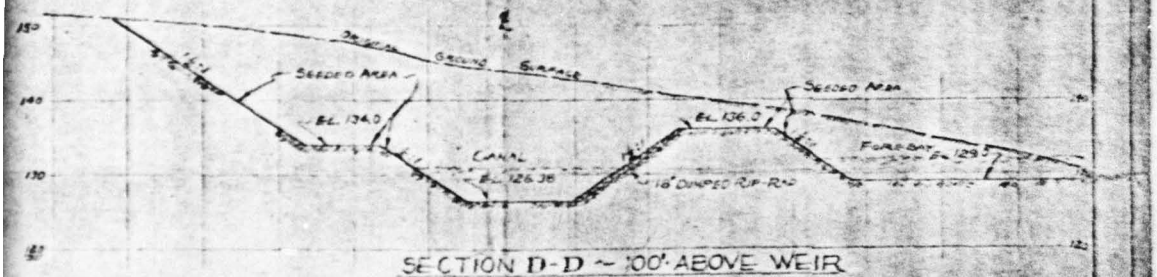
SECTION 3 - 144' BELOW WEIR

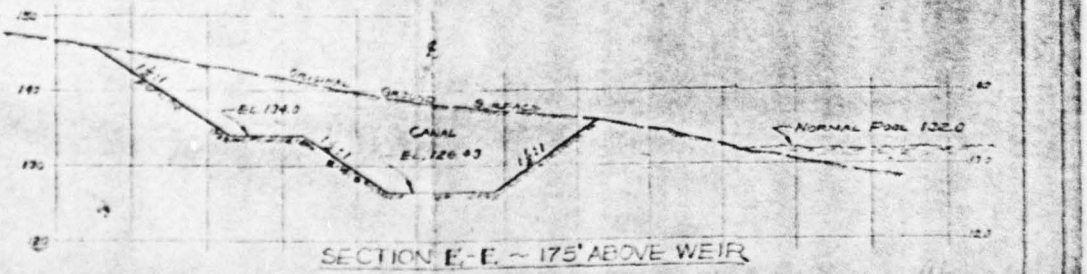


SECTION 4 - 184' BELOW WEIR









NOTE:—
ALL DIMENSIONS AND MEASUREMENTS SHALL BE CHECKED AND VERIFIED BY THE CONTRACTOR AT THE SITE.

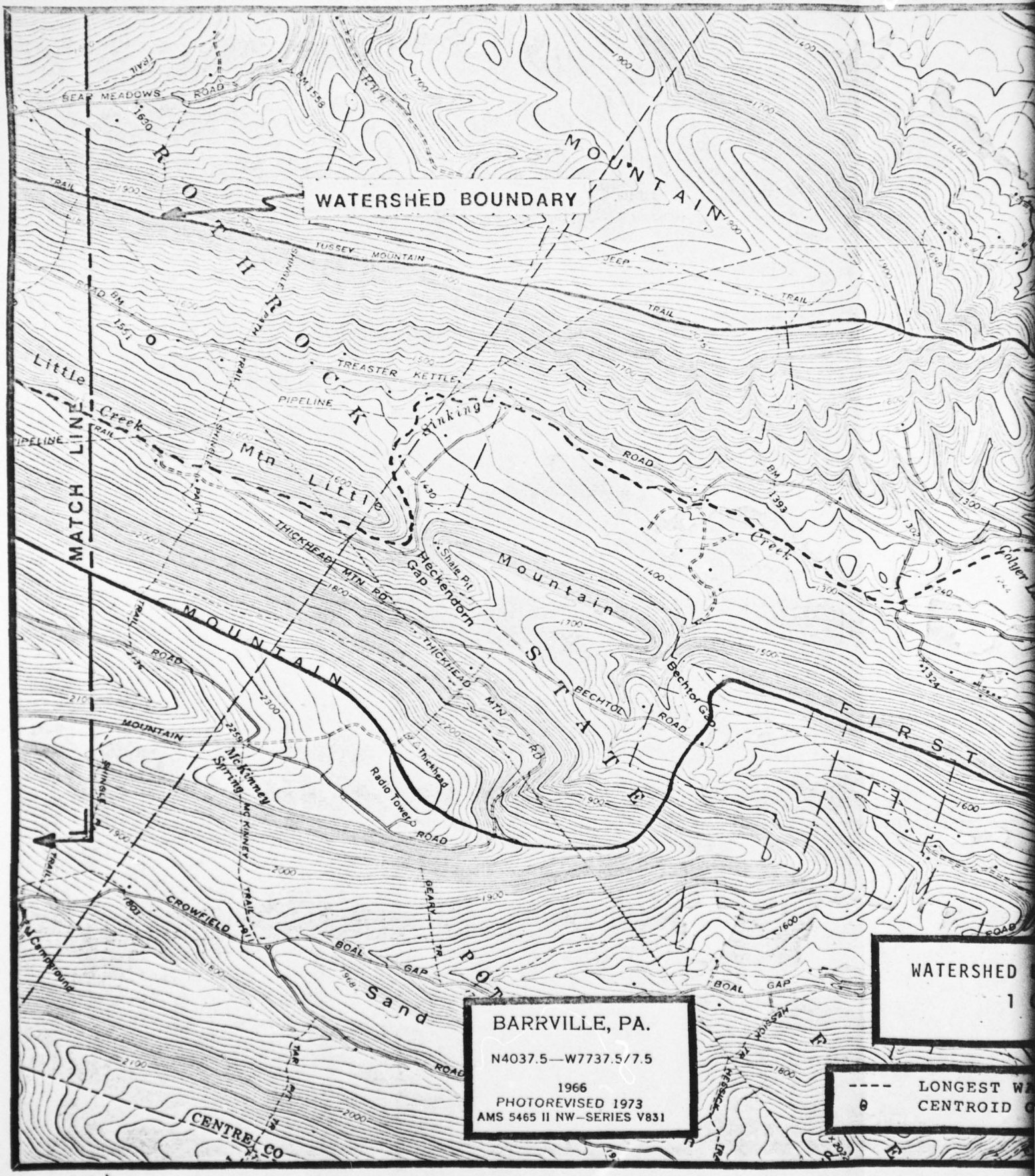
REVISED	APPROVALS	PROJECT Nº FC 4903-R
	APPROVED APPROVED AS CORRECTED APPROVED FOR DEPT. SUBMITTED BY ACCEPTED BY CONTRACTOR BY BUREAU OF ENGINEERING CONSULTATION CHECKED BY ARCH. STRUCT. M'ECH. ELEC.	SPILLWAY – CROSS SECTIONS SINKING CREEK DAM AND APPURTENANCES – SEGMENT I POTTER TWP. CENTRE CO., PENNA. EDWARD R. MILLER – REG. ENGINEER STATE COLLEGE, PENNA. DATE 4/9/48 SCALE 1"=10' FIGURE 12

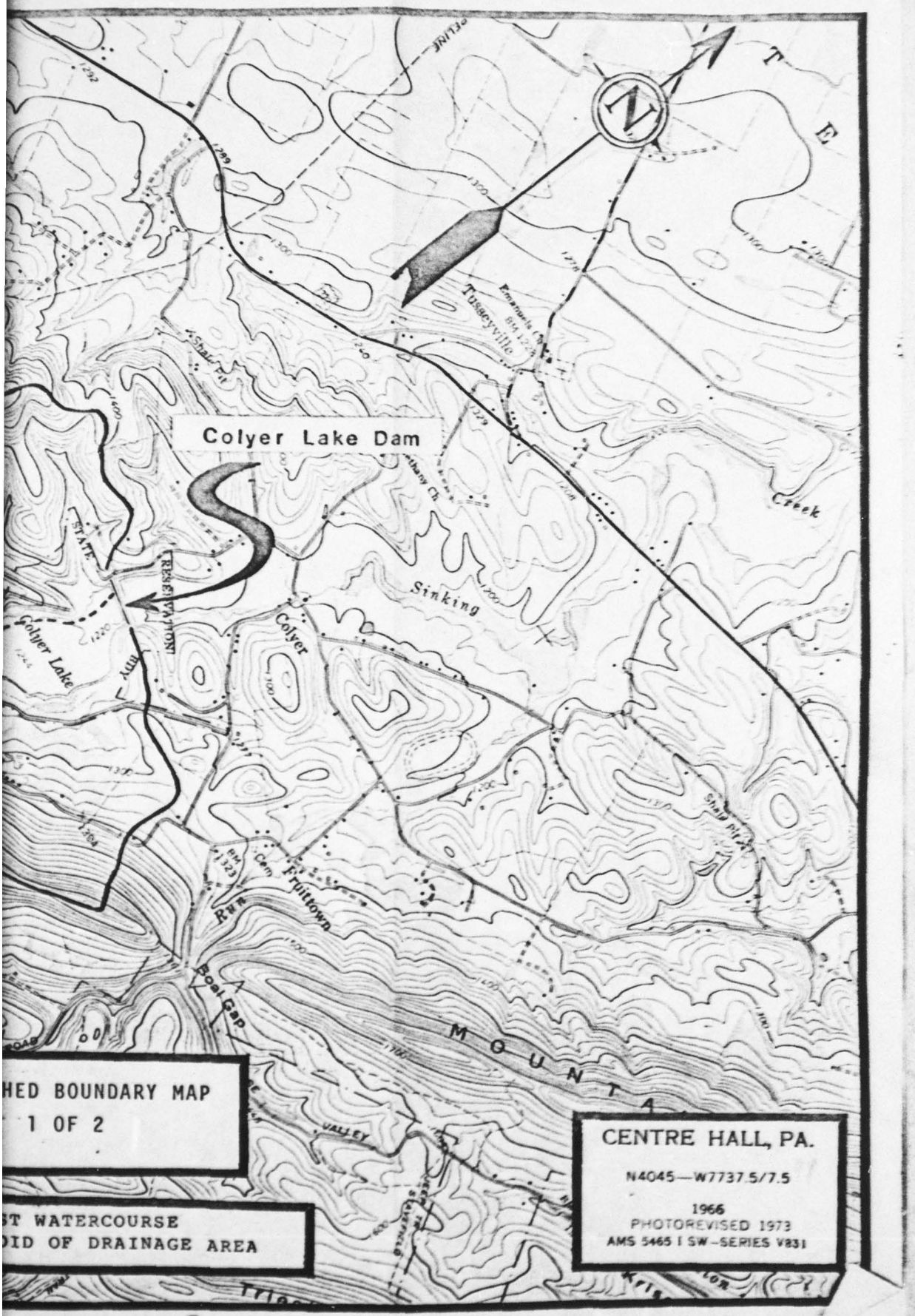
EDWARD R. MILLER

12

APPENDIX G

REGIONAL VICINITY
AND
WATERSHED BOUNDARY MAP

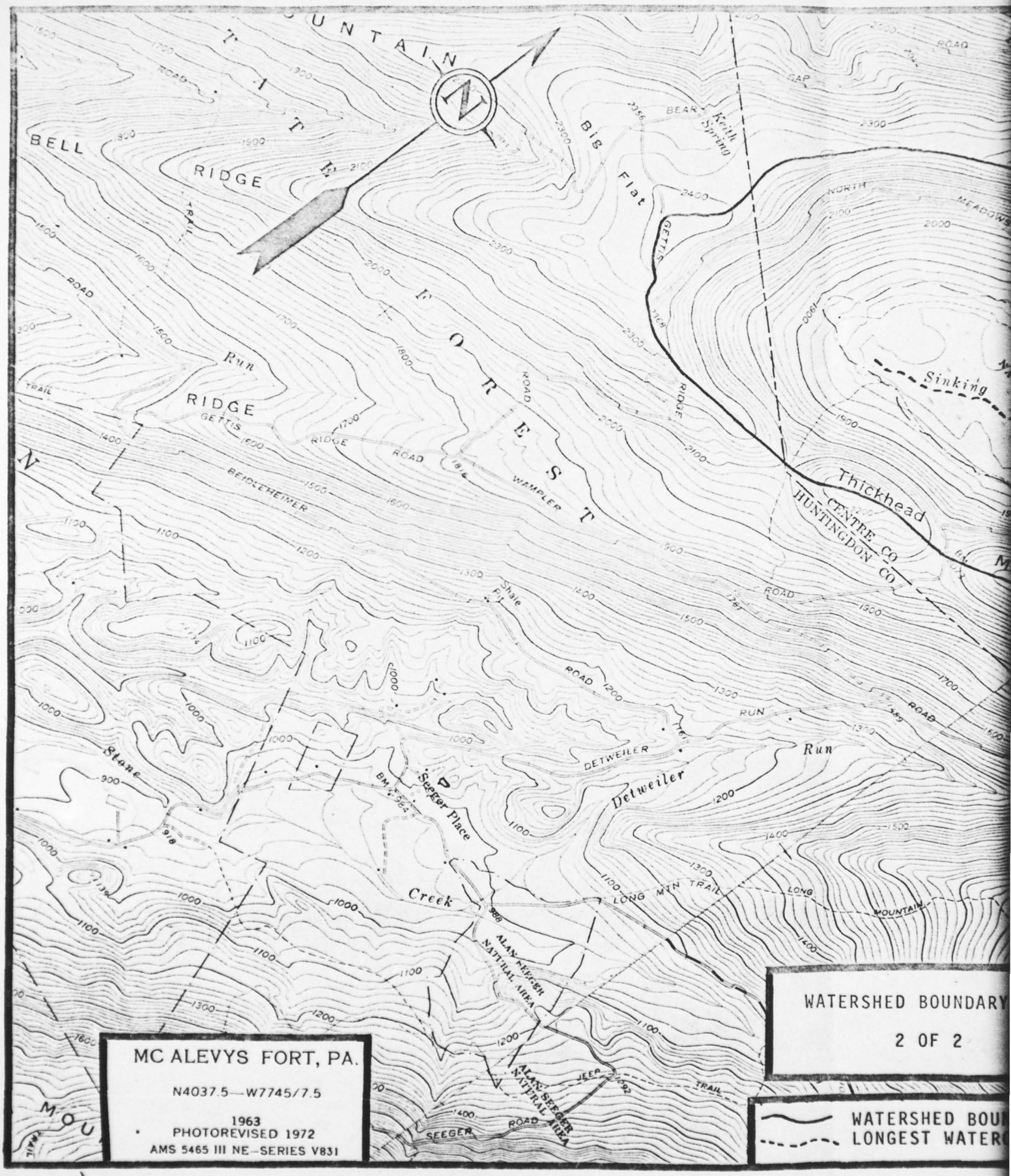

WATERSHED BOUNDARY
BEAR MEADOWS ROAD
TUSSEY MOUNTAIN
TRAIL
ROAD
JEEP
TREASTER KETTLE
PIPELINE
Little Creek
Mtn
Little
Shingle
Shale Pit
Heckendorn Gap
THICKHEAD MTN RD
THICKHEAD MTN
MOUNTAIN
MATCH LINE
Mountain
STATE
FIRST
BECHTOL ROAD
Bechtol Gap
McKinney Spring
McKINNEY TRAIL
Radio Tower Rd
Thickhead
MOUNTAIN
CROWFIELD
BOAL GAP
GEARY TR
Sand
CENTRE CO
Creek
Gohger
BARRVILLE, PA.
N4037.5—W7737.5/7.5
1966
PHOTOREVISED 1973
AMS 5465 II NW—SERIES V831
WATERSHED
1
LONGEST W
CENTROID



HED BOUNDARY MAP
1 OF 2

ST WATERCOURSE
OID OF DRAINAGE AREA

12



MC ALEVYS FORT, PA.

N4037.5—W7745/7.5

1963

PHOTOREVISED 1972

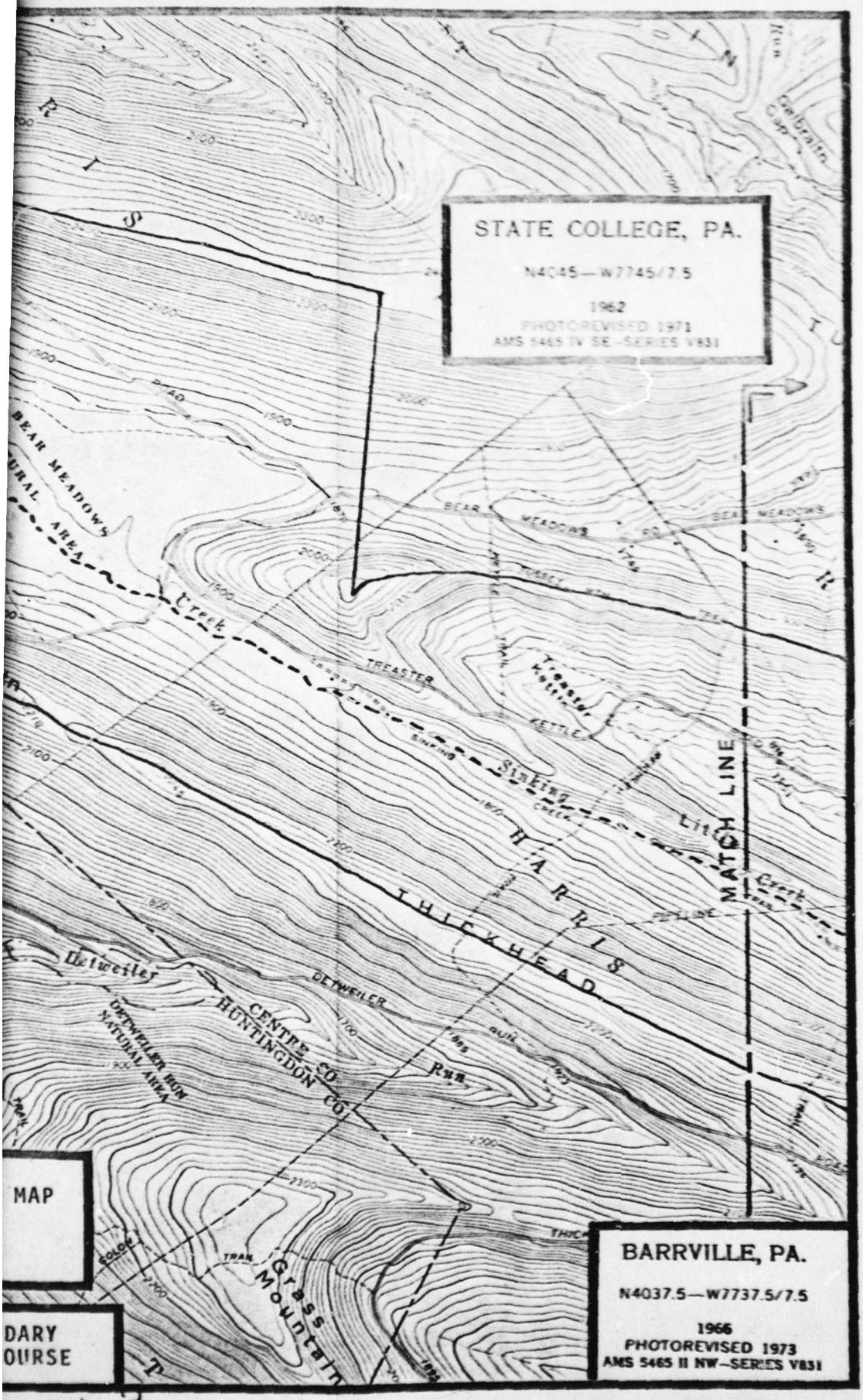
AMS 5465 III NE—SERIES V831

WATERSHED BOUNDARY

2 OF 2

WATERSHED BOU

LONGEST WATER


STATE COLLEGE, PA.
N4045—W7745/7.5
1962
PHOTOREVISED 1971
AMS 5465 IV SE—SERIES V831
MATCH LINE
BARRVILLE, PA.
N4037.5—W7737.5/7.5
1966
PHOTOREVISED 1973
AMS 5465 II NW—SERIES V831
BEAR MEADOWS
Creek
TREASTER
KETTLE
Sinking
Creek
HARRIS
THICKHEAD
Detweiler
CENTRE CO.
HUNTINGDON CO.
Grass
Mountain
MAP
DARY
OURSE