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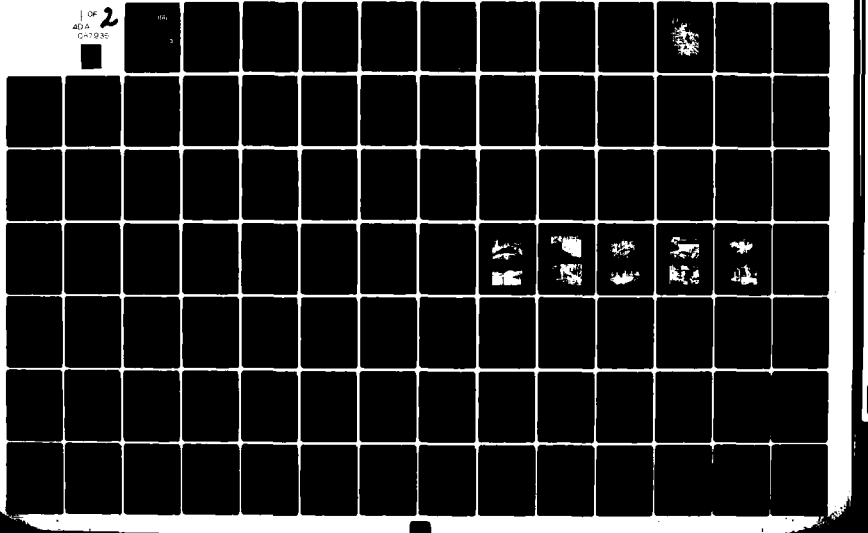

DELAWARE RIVER BASIN
MEADOW RUN, LUZERNE COUNTY

PENNSYLVANIA

LEVEL II

MEADOW RUN DAM

NDI ID NO. PA-00555
DER ID NO. 40-51

MRS. ELEANOR TAYLOR

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

Prepared by
GANNETT FLEMING CORDDRY AND CARPENTER, INC.
Consulting Engineers
Harrisburg, Pennsylvania 17105

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

JUNE 1980

GANNETT FLEMING CORDDRY AND CARPENTER, INC
DACW31-80-C-0017

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DELAWARE RIVER BASIN

MEADOW RUN, LUZERNE COUNTY

PENNSYLVANIA

(11) Jun 80

MEADOW RUN DAM

NDI ID No. PA-00555
DER ID No. 40-51

MRS. ELEANOR TAYLOR

PHASE I INSPECTION REPORT

(6) NATIONAL DAM INSPECTION PROGRAM. Meadow Run Dam (NDI ID Number PA-00555, DER ID Number 40-51), Delaware River Basin, Meadow Run, Luzerne County, Pennsylvania. Phase I Inspection Report.

Prepared by

GANNETT FLEMING CORDDRY AND CARPENTER, INC.
Consulting Engineers
P.O. Box 1963
Harrisburg, Pennsylvania 17105

For

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

JUNE 1980

PREFACE

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

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

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

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

DELAWARE RIVER BASIN

MEADOW RUN, LUZERNE COUNTY

PENNSYLVANIA

MEADOW RUN DAM

NDI ID No. PA-00555
DER ID No. 40-51

MRS. ELEANOR TAYLOR

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

JUNE 1980

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PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

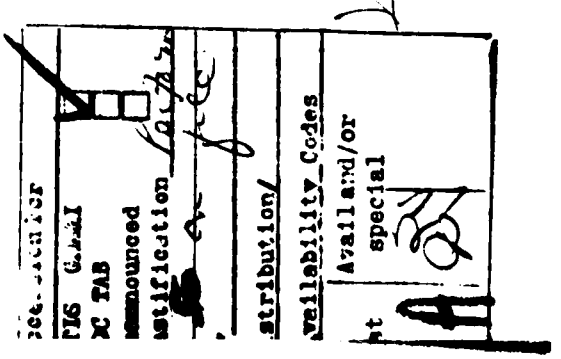
BRIEF ASSESSMENT OF GENERAL CONDITION

AND

RECOMMENDED ACTION

Name of Dam:	Meadow Run Dam NDI ID NO. PA-00555 DER ID No. 40-51
Size:	Small (15 feet high; 567 acre-ft)
Hazard Classification:	High
Owner:	Mrs. Eleanor Taylor 1360 Jack Road Monterey, California 93940 c/o Corresponding Agent Mr. Lee Sweinburg 589 Wyoming Ave. Wyoming, Pennsylvania 18644
State Located:	Pennsylvania
County Located:	Luzerne
Stream:	Meadow Run
Date of Inspection:	16 April 1980

Based on criteria established for these studies, Meadow Run Dam is judged to be unsafe, nonemergency, because the spillway capacity is seriously inadequate. The recommended Spillway Design Flood (SDF) for the size and hazard category of the dam varies between 1/2 of the



Probable Maximum Flood (PMF) and the PMF. Based on the criteria and the downstream conditions, the selected SDF is the PMF. Based on existing conditions, the spillway will pass about 13 percent of the PMF before overtopping of the dam occurs. Failure of the dam would increase the hazard to loss of life downstream. If the dam were raised to its design elevation, the spillway would pass about 35 percent of the PMF. The spillway capacity would still be rated as seriously inadequate. As a whole, the dam is judged to be in poor condition.

Because of the nature of its construction, the steep downstream slope, and cracks that have developed on the top of the embankment, the stability of the embankment is considered marginal.

There is no evidence to suggest that the emergency drawdown facility is operational. It is in poor condition. Maintenance at the dam is inadequate.

The following studies and remedial measures are recommended to be undertaken by the Owner, in approximate order of priority, immediately:

(1) Remove the steel I-beams lying near the spillway weir.

(2) Perform additional studies to more accurately ascertain the spillway capacity required for Meadow Run Dam as well as the nature and extent of measures required to provide adequate spillway capacity. The studies should also assess the need for an improved outlet channel for the existing spillway and the erosion potential at the spillway. Take appropriate action as required.

(3) Perform comprehensive investigations and studies as required to assess the structural stability for the dam. The investigations and studies should address conditions within the dam and foundation. Take appropriate action as required. These studies should also address the slope protection required to prevent erosion. The final top of dam elevation should be coordinated with the spillway study recommended above. Until the studies are complete and any necessary remedial action taken, the Owner should monitor the condition of the dam. If any changes occur, immediate remedial action should be taken.

(4) Provide whatever measures are necessary to make the outlet works operational. Once operational, it should be maintained and operated on a regular basis. Also provide an upstream closure facility for the outlet works and assess the need for a structure around the gate valve to protect it from freezing.

(5) Remove trees and brush growing on or near the embankment.

All investigations, studies, designs, and inspection of construction should be performed by a professional engineer experienced in the design and construction of dams. Tree removal should also be guided by a professional engineer.

In addition, the Owner should institute the following operational and maintenance procedures:

(1) Develop a detailed emergency operation and warning system for Meadow Run Dam.

(2) During periods of unusually heavy rains, provide round-the-clock surveillance of Meadow Run Dam. Have sufficient personnel available to clear any debris that might collect at the spillway bridge.

(3) When warnings of a storm of major proportions are given by the National Weather Service, the Owner should activate his emergency operation and warning system.

(4) Institute an inspection program at the dam such that the dam is inspected frequently. As presently required by the Commonwealth, the inspection program should include a formal annual inspection by a professional engineer experienced in the design and construction of dams. Utilize the inspection results to determine if remedial measures are necessary.

(5) Institute a maintenance program such that all features of the dam are properly maintained.

MEADOW RUN DAM

Submitted by:

GANNETT FLEMING CORDDRY
AND CARPENTER, INC.

FREDERICK FUTCHKO
Project Manager, Dam Section

Date: 27 June 1980

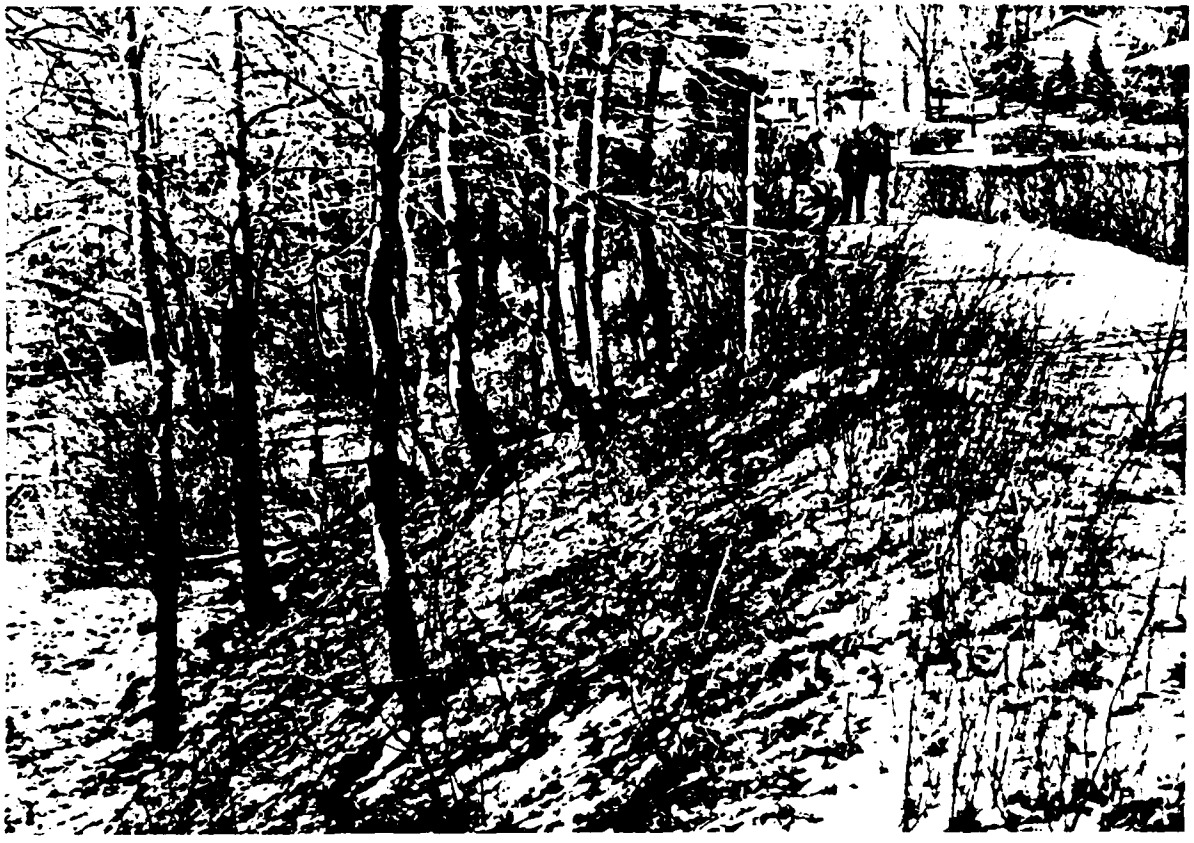
Approved by:

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS

JAMES W. PECK
Colonel, Corps of Engineers
District Engineer

Date: 14 July 1980

MEADOW RUN DAM



Overview

DELAWARE RIVER BASIN

MEADOW RUN, LUZERNE COUNTY

PENNSYLVANIA

MEADOW RUN DAM

NDI ID No. PA-00555
DER ID No. 40-51

MRS. ELEANOR TAYLOR

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

JUNE 1980

SECTION 1

PROJECT INFORMATION

1.1 General.

a. 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.

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

1.2 Description of Project.

a. Dam and Appurtenances. Meadow Run Dam is a homogeneous earthfill embankment with a timber corewall. The dam is 577 feet long and is 15 feet high at maximum section.

The spillway is located near the right abutment of the dam. It is a 25-foot long broad-crested, concrete weir. The crest is 3.5 feet below the design top of the dam. A concrete deck bridge with steel girders spans the spillway.

The outlet works is located near the center of the embankment. It consists of a 24-inch diameter cast-iron pipe with a gate valve at the downstream end. It is not known if there is an intake structure.

The various features of the dam are shown on the Photographs in Appendix C and on the Plates in Appendix E. A description of the geology is included in Appendix F.

b. Location. Meadow Run Dam is located on Meadow Run in Bear Creek Township, Luzerne County, Pennsylvania, approximately 5 miles northeast of the community of Bear Creek. Meadow Run Dam is shown on USGS Quadrangle, Pleasant View Summit, Pennsylvania, at latitude N 41° 13' 10" and longitude W 75° 40' 05". A location map is shown on Plate E-1.

c. Size Classification. Small (15 feet high, 567 acre-feet).

d. Hazard Classification. High hazard. Downstream conditions indicate that a high hazard classification is warranted for Meadow Run Dam (Paragraphs 3.1e and 5.1c (5)).

e. Ownership. Mrs. Eleanor Taylor, 1360 Jack Road, Monterey, California 93940; c/o Corresponding Agent, Mr. Lee Sweinburg, 589 Wyoming Ave., Wyoming, Pennsylvania 18644.

f. Purpose of Dam. Recreation.

g. Design and Construction History. Meadow Run Dam was originally an ice dam. It was constructed in 1909 under force account for the Bear Creek Ice Company by George Aeslin. The Pennsylvania Water Supply Commission described Mr. Aeslin as "an 'old time' surveyor who furnished the lines and grades during the progress of construction". The dam was originally known as the No. 5 Dam of the Bear Creek Ice Company. The ice company ceased using the dam about 1930; apparently the shores of the lake began to be developed around this time.

A temporary bridge was placed across the spillway at various times by the ice company. By 1965, a timber bridge across the spillway had become a semi-permanent feature of the dam. By this time, the concrete at the spillway was severely deteriorated.

A bridge with a concrete deck and steel girders was constructed in 1978 during the construction of a new spillway, which was of similar dimensions to the old one. The contractor was Charles Malpass and Sons of Forty Fort, Pennsylvania.

h. Normal Operational Procedure. The pool is maintained at the spillway crest level with excess inflow discharging over the spillway. The emergency drawdown facilities are not used. Spillway discharge flows to Mountain Lake Dam, which is immediately downstream.

1.3 Pertinent Data.

a. Drainage Area. (square miles)	1.7
b. Discharge at Damsite. (cfs.)	
Maximum known flood at damsite	Unknown
Outlet works at maximum pool elevation	60
Spillway capacity at maximum pool elevation	
Design conditions	440
Existing conditions	140
c. Elevation. (feet above msl.)	
Top of dam	
Design conditions	2003.6
Existing conditions	2001.7
Maximum pool	
Design conditions	2003.6
Existing conditions	2001.7
Normal pool (spillway crest)	2000.1
Upstream invert outlet works	Not available
Downstream invert outlet works	1986.3
Streambed at toe of dam	1986.3
d. Reservoir Length. (miles)	
Normal pool	0.89
Maximum pool (design)	0.92

e.	Storage. (acre-feet)	
	Normal pool	418
	Maximum pool (design)	754
	Maximum pool (existing)	567
f.	Reservoir Surface. (acres)	
	Normal pool	90
	Maximum pool (design)	102
g.	Dam.	
	Type	Earthfill with timber corewall.
	Length (feet)	577
	Height (feet)	
	Design	17
	Existing	15
	Topwidth (feet)	
	Design	16
	Existing	11
	Side Slopes	
	Upstream	
	Design	1V on 2H
	Existing	Varies, about 1V on 2.8H
	Downstream	
	Design	1V on 2H
	Existing	Varies, about 1V on 1.6H
	Zoning	Corewall.
	Cut-off	Corewall founded in cutoff trench
	Grout Curtain	None.
h.	Diversion and Regulating Tunnel.	None
i.	Spillway.	
	Type.	Broad-crested, concrete weir.
	Length of Weir (feet)	25

i.	Spillway. (Cont'd.) Crest Elevation	2000.1
	Upstream Channel	Reservoir.
	Downstream Channel	Excavated, earthen slope channel parallel to toe of embankment.
j.	Regulating Outlets. Type	One 24-inch dia. CIP.
	Length (feet)	80
	Closure	Gate Valve at downstream end.
	Access	At toe of embankment.

SECTION 2

ENGINEERING DATA

2.1 Design.

a. Data Available. No design data are available for the original dam. In 1915, the Pennsylvania Water Supply Commission (PWSC) prepared a report on the dam. As noted in Paragraph 1.2g, the design was apparently performed as the dam was constructed. All the design data available for the 1978 modifications are shown on Plate E-3 in Appendix E.

b. Design Features. The project is described in Paragraph 1.2a. The various features of the dam are shown on the Photographs in Appendix C and on the Plates in Appendix E.

c. Design Considerations. There is insufficient data to assess the design.

2.2 Construction.

a. Data Available. The only construction data available are reported in the PWSC Report of 1915; an excerpt follows:

> "Prior to the placing of the embankment, the surface material was removed for a depth of from 18 inches to 2 feet, after which selected material was placed in thin layers and compacted by means of the teams and scrapers during the progress of the work. The boulders were thrown out as encountered and afterward used in connection with others in paving both the up and downstream sides of the embankment. Within the embankment there was constructed a cut-off trench, in the bottom of which was placed a concrete base. Extending into this concrete and well up into the embankment was placed a double thickness of timber sheet piling."

b. Construction Considerations. Based on the PWSC data, the construction methods used were adequate.

2.3 Operation. There are no formal records of operation. A record of operation does exist in the form of inspection reports prepared by the Commonwealth between 1920 and 1965.

The previous inspections note maintenance discrepancies, some of which were fairly serious.

2.4 Evaluation.

a. Availability. Engineering data were provided by the Bureau of Dams and Waterway Management, Department of Environmental Resources, Commonwealth of Pennsylvania (PennDER). The Owner made available her agent for information during the visual inspection. Her agent stated that some information was available for the 1978 spillway modifications; the information supplied is shown on Plate E-3.

b. Adequacy. The type and amount of available design data and other engineering data are limited, and the assessment must be based on the combination of available data, visual inspection, performance history, hydrologic assumptions, and hydraulic assumptions.

c. Validity. There is no reason to question the validity of the available data. However, some of the data in the PWSC Report of 1915 is in conflict with the existing data. As there was apparently no design drawing then available to the PWSC, it is surmised that their data was based on rough measurements.

SECTION 3

VISUAL INSPECTION

3.1 Findings.

a. General. The overall appearance of the dam is fair. Deficiencies were observed as noted below. A sketch of the dam with the locations of deficiencies is presented on Exhibit B-1 in Appendix B. Survey information acquired for this Report is summarized in Appendix B. Datum for the survey was taken at a USGS horizontal control point at Mountain Lake Dam, Elevation 1989.0, as shown on USGS mapping. The Owner uses a different datum. To convert the elevations on the Plate E-3 in Appendix E, 1900.9 feet must be added to the elevations on that plate. On the day of the inspection, the pool was 0.2 foot above the spillway crest level.

b. Embankment. The upstream slope of the embankment is covered by sparsely-growing, high brush (Photograph A, B and C). There are some eroded areas on the upstream slope. They are typically 10 to 15 feet long (Photograph C). Parts of the upstream slope above normal pool elevation are near-vertical. The top of the dam is curved in plan, with the part to the left of the outlet works deflecting downstream. Near the point of deflection, which is the highest section of the embankment, there are narrow cracks on the top of the dam that are parallel to the axis of the dam. One 8-foot long crack near the upstream edge of the top and two 3-foot long cracks near the downstream edge were observed. The cracks are hairline in width and their depth could not be probed.

There is a minor surface runoff swale eroded into the downstream edge of the top near the outlet works (Photograph D). The downstream slope is covered with mature trees and brush growing through the stone cover (Photograph E). The downstream slope is uneven, with minor ripples in the stone covering the slope. About 25 feet to the left of the outlet works, the downstream toe is about 6 feet further downstream than at adjacent sections. This appeared to be an as-constructed condition. Tailwater at the dam is caused by Mountain Lake; the upstream end of Mountain Lake is at the toe of the dam (Photograph H). No seepage was observed at the dam.

The survey performed for this inspection reveals that the upstream slope is flatter than the reported design

slope, the downstream slope is steeper than the reported design slope, and the top of the embankment to the left of the spillway is low. The lowest area is at the left abutment and it is 1.9 feet below its design elevation. A section and profile are in Appendix B.

c. Appurtenant Structures. The spillway and spillway bridge are, structurally, in good condition (Photographs F and G). No wingwalls are provided on the structure and the adjacent fill encroaches on the approach channel for 2.5 feet on each side. Two steel I-beams are lying adjacent to the crest. Just downstream of the crest, the spillway walls, which were constructed in 1978, join the remains of the old spillway. The new left wall ends and a short riprap section deflects about 3 feet inward to meet the old spillway wall. The new right wall ends at a short length of earthen slope. The remains of the old spillway extend downstream of the earthen slope. The remains of the old spillway are in very poor condition. Some of the remains are tilting; other parts have wide structural cracks. The channel extends downstream from the spillway in an unprotected earthen channel parallel to the toe of the embankment. There is a minor amount of brush and debris in the channel, which otherwise is in good condition.

The outlet works is in poor condition. The timber frame gate house is capsized downstream of the gate valve (Photograph I). The gate valve itself has a 1.5-foot long crack through the gate housing. The nuts securing the gate housing are so rusted that only a small portion remains. The Owner's agent offered to operate the valve until he discovered that there was no operating mechanism. He did not recall the valve ever being operated.

d. Reservoir Area. The watershed area is mostly wooded, with only an insignificant amount of rural development adjacent to the lake. At the reservoir, the slopes are mild and mostly wooded. There is a beaver dam at the upstream end of the reservoir.

e. Downstream Channel. Immediately downstream of the outlet works and spillway channel is Mountain Lake. A further description is in Section 5.

SECTION 4

OPERATIONAL PROCEDURES

4.1 Procedure. The reservoir is maintained at spillway crest, with excess inflow discharging over the spillway and into Mountain Lake. The emergency drawdown facilities are not used.

4.2 Maintenance of Dam. The dam is visited at irregular intervals, except during the winter, by the Owner's agent. The dam is not visited in winter. The agent, who is a professional engineer and who is related to the Owner, stated that the association between himself and the Owner is informal and uncompensated. He gives verbal reports to the Owner. Formal inspections are not made. Brush was reportedly being cut 2 years ago.

4.3 Maintenance of Operating Facilities. The outlet works is not maintained. It has not been operated recently.

4.4 Warning Systems in Effect. The Owner's agent stated that there is no emergency operation and warning system.

4.5 Evaluation of Operational Adequacy. The maintenance of the dam is inadequate. Inspections are necessary to detect hazardous conditions at the dam. A detailed emergency operation and warning system is necessary to reduce the risk of dam failure should adverse conditions develop and to prevent loss of life should the dam fail.

SECTION 5

HYDROLOGY AND HYDRAULICS

5.1 Evaluation of Features.

a. Design Data. No design data are available for the hydraulics of the original structure. The Pennsylvania Water Supply Commission analyzed the hydraulics as part of their 1915 Report. They used a discharge coefficient of 2.6. A discharge coefficient of 2.7 is used in the analysis described hereafter. The effects of the spillway bridge, which did not exist in 1915, have also been used in the analysis described hereafter. The drainage area of 1.7 square miles that is used in this Report was based on recent USGS mapping. The drainage area of 1.4 square miles that is in the records was probably based on mapping current before 1915.

b. Experience Data. The Owner's agent surmised that Tropical Storm Agnes in June 1972 was the flood of record. There is no pool data to estimate the flow.

c. Visual Observations.

(1) General. The visual inspection of Meadow Run Dam, which is described in Section 3, resulted in a number of observations relevant to hydrology and hydraulics. These observations are evaluated herein for the various features.

(2) Embankment. The low areas on the top of the embankment limit the existing spillway capacity to much less than the design capacity.

(3) Appurtenant Structures. There is no evidence to suggest that the outlet works is operational. There are no upstream closure facilities for the outlet works. The severely-rusted, securing nuts and the cracked gate housing could cause the valve to jam, if it were to be operated. If the outlet works is not operational, there would be no means to draw down the lake in case of an emergency. It is surmised that the timber frame gate house overturned during a strong wind; no means of securing it to the concrete foundation was observed. Even in place, it probably provided only marginal protection against the elements.

The underside of the spillway bridge and the I-beams lying near the crest both have the potential to collect debris. This would reduce the spillway capacity; these effects have not been included in the analysis described hereafter. The effects of the possible pressure flow under the spillway bridge have been included. Although the geometry of the spillway channel immediately downstream of the weir is undesirable because it creates poor flow characteristics, it is estimated that these effects on the spillway capacity would be minor. However, the lack of a wingwall on the upstream side and at the right downstream side of the weir provide an erosion hazard. The deterioration of the remains of the old spillway are not of concern because they are no longer a functional part of the dam. The spillway channel is estimated to be capable of adequately conveying the spillway discharge with the pool at existing top of dam. If the dam were at its design elevation or if the spillway capacity were increased, the spillway channel could overtop and erosion could occur in the channel itself. The brush and debris that is presently in the channel are minor at present but an increase of brush and debris would decrease the conveyance of the channel.

(4) Reservoir Area. The amount of development in the reservoir area is negligible at present. No conditions were observed in the reservoir that might present a hazard to the dam.

(5) Downstream Conditions. A failure of Meadow Run Dam would cause the failure of Mountain Lake Dam, which is immediately downstream. Depending on the rate of dam failure, if Meadow Run Dam failed, it is conceivable that the surge could flood some dwellings along the shore of Mountain Lake. A Phase I National Dam Inspection Program Report is concurrently being prepared for Mountain Lake Dam, which is a small size, high hazard dam with a seriously inadequate spillway capacity. There are 4 dwellings downstream from Mountain Lake Dam that would be flooded by a failure of either Mountain Lake Dam or Meadow Run Dam, with the resulting potential for loss of life. In addition, further downstream is Bear Creek Lake Dam, for which a Phase I Report has previously been prepared. Bear Creek Lake Dam is a small size, high hazard dam with a seriously inadequate spillway. Failure of Meadow Lake Dam could cause the overtopping of Bear Creek Lake Dam. The downstream conditions indicate that a high hazard classification is warranted for Meadow Run Dam.

d. Overtopping Potential.

(1) Spillway Design Flood. According to the criteria established by the Office of the Chief of Engineers (OCE), the Spillway Design Flood (SDF) for the size (Small) and hazard potential (High) of Meadow Run Dam is between 1/2 of the Probable Maximum Flood (PMF) and the PMF. Because of the downstream conditions, the PMF is selected as the SDF for Meadow Run Dam. The watershed was modeled with the HEC-1DB computer program. A description of the model is included in Appendix D. The assessment of hydrology and hydraulics is based on existing conditions, and the effects of future development are not considered.

(2) Summary of Results. Pertinent results are tabulated at the end of Appendix D. The analysis reveals that Meadow Run Dam can pass about 13 percent of the PMF before overtopping of the dam occurs. The dam is rated at its existing top elevation. At its design top elevation, the dam could pass about 35 percent of the PMF.

(3) Spillway Adequacy. The criteria used to rate the spillway adequacy of a dam are described in Appendix D. Because Meadow Run Dam cannot pass the 1/2 PMF, a further analysis was performed. For both the 50 percent and 20 percent PMF, analyses were performed assuming that Meadow Run Dam fails with and without the resulting failure of Mountain Lake Dam. The results indicate that for the 20 percent PMF, even without the failure of Mountain Lake Dam, the stream would rise near the dwellings to a level that is 9.5 feet above the level that would exist if the dam were not to fail. During the 50 percent PMF, the failure of Meadow Run Dam by itself would just overtop Bear Creek Lake Dam, assuming no other inflow to Bear Creek Lake. There is an increased hazard to loss of life; the spillway capacity of Meadow Run Dam is rated as seriously inadequate.

SECTION 6

STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations.

(1) General. The visual inspection of Meadow Run Dam, which is described in Section 3, resulted in a number of observations relevant to structural stability. These observations are evaluated herein for the various features.

(2) Embankment. The growth of trees and brush on the slopes is a hazard to the dam. Root systems of trees and brush can loosen embankment material, displace slope protection, and create paths along which seepage and piping (internal erosion) might occur.

As noted in Paragraph 2.4c, the record design data may not actually reflect the as-built condition of the dam. Therefore, no particular significance is attached to the variation between the design data and the existing conditions. The variations in the downstream slope and the ripples in the stone cover are not of major concern because they could reflect an as-built condition. The erosion at the top near the downstream edge is caused by poor control of surface runoff. The erosion on the upstream slope is probably caused by waves; this latter erosion was probably exacerbated by the steep upper portion of the slope. Neither condition is particularly serious at present, but further erosion would be a hazard.

Although no seepage was observed at the dam, the upper end of Mountain Lake could have obscured seepage areas. The downstream slope is steeper than normal for a dam of this type. The timber corewall, even if it were in good condition, could not be relied upon to add significant shear strength to the embankment. The cracks on the top of the dam indicate that at least the upper portions of the embankment are slightly separated, thus providing no shear resistance. The depths of the existing cracks, as well as the reason for their development, are unknown. The stability of the existing embankment is considered marginal.

(3) Appurtenant Structures. No structural deficiencies were observed at the spillway. The outlet works is assessed in Section 5.

b. Design and Construction Data. No stability analyses were available for the embankment. The existing conditions are assessed in Paragraph 6.1a.

c. Operating Records. There are no formal records of operation. According to available records, no stability problems have occurred over the operational history of the dam.

d. Post-construction Changes. Post-construction changes are described in Paragraph 1.2g. The modifications to the spillway do not affect the stability of the embankment. Although Plate E-3 does not indicate that a new weir was constructed when the spillway bridge was replaced, the weir appeared to be of recent construction.

e. Seismic Stability. Meadow Run Dam is located in Seismic Zone 1. Earthquake loadings are not considered to be significant for small dams located in Seismic Zone 1 when there are no readily apparent stability problems. However, since the stability of the embankment is deemed marginal, the ability of the embankment to withstand an earthquake is also considered marginal.

SECTION 7

ASSESSMENT, RECOMMENDATIONS, AND PROPOSED REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety.

(1) Based on available records, visual inspection, calculations, and past operational performance, Meadow Run Dam is judged to be in poor condition. The recommended SDF for the size and hazard category of the dam varies between the 1/2 PMF and the PMF. Based on the criteria and the downstream conditions, the selected SDF at the dam is the PMF. Based on existing conditions, the spillway will pass about 13 percent of the PMF before overtopping of the dam occurs. Failure of the dam would cause an increased hazard to loss of life downstream. If the low area on the top of the embankment were filled to the design elevation, the spillway would pass about 35 percent of the PMF. For either condition, the spillway capacity is rated as seriously inadequate. According to criteria established for these studies, the dam is considered to be unsafe, nonemergency, because the spillway capacity is seriously inadequate.

(2) Because of the nature of its construction, the steep downstream slope, and cracks that have developed on the top of the embankment, the stability of the embankment is considered marginal.

(3) There is no evidence to suggest that the emergency drawdown facility is operational. It is in poor condition.

(4) Maintenance at the dam is inadequate.

(5) A summary of the features and observed deficiencies is listed below:

Feature and Location	Observed Deficiency
Embankment:	Low areas; mature trees and brush on slopes; cracks in top; eroded areas.
Spillway:	Debris near weir; minor debris in spillway channel, erosion potential due to lack of wingwalls.
Outlet Works:	No upstream closure facilities; almost certainly inoperable; cracked casing; severely rusted securing nuts.

b. Adequacy of Information. The information available is such that a preliminary assessment of the condition of the dam can be inferred from the combination of visual inspection, past performance, and computations performed prior to and as part of this study.

c. Urgency. The recommendations in Paragraph 7.2 should be implemented immediately.

d. Necessity for Further Investigations. In order to accomplish some of the remedial measures outlined in Paragraph 7.2, further investigations by the Owner will be required.

7.2 Recommendations and Remedial Measures.

a. The following studies and remedial measures are recommended to be undertaken by the Owner, in approximate order of priority, immediately:

(1) Remove the steel I-beams lying near the spillway weir.

(2) Perform additional studies to more accurately ascertain the spillway capacity required for Meadow Run Dam as well as the nature and extent of measures required to provide adequate spillway capacity. The studies should also assess the need for an improved outlet channel for the existing spillway and the erosion potential at the spillway. Take appropriate action as required.

(3) Perform comprehensive investigations and studies as required to assess the structural stability for the dam. The investigations and studies should address conditions within the dam and foundation. These studies should also address the slope protection required to prevent erosion. The final top of dam elevation should be coordinated with the spillway study recommended above. Until the studies are complete and any necessary remedial action taken, the Owner should monitor the condition of the dam. If any changes occur, immediate remedial action should be taken.

(4) Provide whatever measures are necessary to make the outlet works operational. Once operational, it should be maintained and operated on a regular basis. Also provide an upstream closure facility for the outlet works and assess the need for a structure around the gate valve to protect it from freezing.

(5) Remove trees and brush growing on or near the embankment.

All investigations, studies, designs, and inspection of construction should be performed by a professional engineer experienced in the design and construction of dams. Tree removal should also be guided by a professional engineer.

b. In addition, the Owner should institute the following operational and maintenance procedures:

(1) Develop a detailed emergency operation and warning system for Meadow Run Dam.

(2) During periods of unusually heavy rains, provide round-the-clock surveillance of Meadow Run Dam. Have sufficient personnel available to clear any debris that might collect at the spillway bridge.

(3) When warnings of a storm of major proportions are given by the National Weather Service, the Owner should activate his emergency operation and warning system.

(4) Institute an inspection program at the dam such that the dam is inspected frequently. As presently required by the Commonwealth, the inspection program should include a formal annual inspection by a professional engineer experienced in the design and construction of

dams. Utilize the inspection results to determine if remedial measures are necessary.

(5) Institute a maintenance program such that all features of the dam are properly maintained.

APPENDIX A

CHECKLIST - ENGINEERING DATA

CHECKLIST

ENGINEERING DATA

DESIGN, CONSTRUCTION, AND OPERATION
PHASE I

NAME OF DAM: MEADOW RUN

NDI ID NO.: PA-00555 DER ID NO.: 40-51

Sheet 1 of 4

ITEM	REMARKS
AS-BUILT DRAWINGS	NONE
REGIONAL VICINITY MAP	SEE PLATE E-1
CONSTRUCTION HISTORY	BUILT 1909
TYPICAL SECTIONS OF DAM	NONE
OUTLETS: Plan Details Constraints Discharge Ratings	NONE

A-1

ENGINEERING DATA

ITEM	REMARKS
RAINFALL/RESERVOIR RECORDS	NONE
DESIGN REPORTS	NONE
GEOLOGY REPORTS	NONE
DESIGN COMPUTATIONS: Hydrology and Hydraulics Dam Stability Seepage Studies	NONE
MATERIALS INVESTIGATIONS: Boring Records Laboratory Field	NONE
POSTCONSTRUCTION SURVEYS OF DAM	1915 Report by Pennsylvania Water Supply Commission

ENGINEERING DATA

ITEM	REMARKS
BORROW SOURCES	NOT KNOWN
MONITORING SYSTEMS	NONE
MODIFICATIONS	SPILLWAY COMPLETELY REBUILT 1978
HIGH POOL RECORDS	NONE
POSTCONSTRUCTION ENGINEERING STUDIES AND REPORTS	NONE
PRIOR ACCIDENTS OR FAILURE OF DAM: Description Reports	NONE

ENGINEERING DATA

ITEM	REMARKS
MAINTENANCE AND OPERATION RECORDS	None
SPILLWAY: Plan Sections Details	
OPERATING EQUIPMENT: Plans Details	None
PREVIOUS INSPECTIONS Dates Deficiencies	1920 - Brush on downstream slope 1923 - 1' high wall across spillway crest, right side of spillway lower than left. 1924 - by Owner - No deficiencies 1925 - per 1923 and spillway apron undermined 1927 - per 1925 1928 - some wave erosion, brush, seepage under spillway, and per 1923.
CONTINUED	1930 - Light brush on downstream slope. Top of dam apparently raised to 3.5' above spillway crest but spillway walls are only 1.25' above crest.

4-b

ENGINEERING DATA

ITEM	REMARKS
PREVIOUS INSPECTIONS (CONTINUED)	1934 - GATE CRACKED - LEAKS, SPILLWAY WALLS CRACKED, CONCRETE PIER IN SPILLWAY, SPILLWAY WALLS STILL LOW, BRUSH ON DOWNSTREAM SLOPE. 1935 - LEAKAGE AT BOTH ENDS OF SPILLWAY
(CONTINUED)	WEIR BENEATH THE "ABUTMENTS" OF THE SPILLWAY, WHICH ARE "BROKEN"! CONCRETE BLOCKS ON SPILLWAY WEIR. SPILLWAY ABUTMENTS STILL LOW. 1944 - BRUSH AND WEEDS ON BOTH
	SLOPES, LEFT AND RIGHT SPILLWAY WALLS BROKEN AND TILTING INWARD. SPILLWAY APRON BADLY DETERIORATED. 1965 - TREES AND BRUSH ON DOWNSTREAM SLOPE AND IN SPILLWAY EXIT
	CHANNEL, SPILLWAY WALLS BROKEN AND DISPLACED.

APPENDIX B

CHECKLIST - VISUAL INSPECTION

CHECKLIST

VISUAL INSPECTION

PHASE I

Name of Dam: MEADOW RUN **County:** LUZERNE **State:** PENNSYLVANIA

NDI ID No.: PA-00555 **DER ID No.:** 40-51

Type of Dam: EARTHFILL **Hazard Category:** HIGH

Date(s) Inspection: 16 APRIL 1980 **Weather:** WINDY **Temperature:** 35-40°F

SOIL CONDITIONS: VERY MOIST

Pool Elevation at Time of Inspection: 2000.3 msl/**Tailwater at Time of Inspection:** 1987.1 msl

Inspection Personnel:

D. WILSON (GFCC)

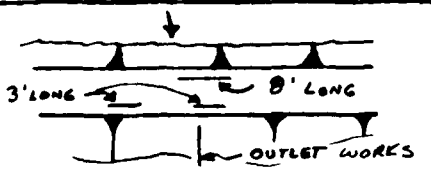
D. EBERSOLE (GFCC)

A. WHITMAN (GFCC) **Recorder**

B-1

EMBANKMENT

Sheet 1 of 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS		CRACKS ARE VERY NARROW.
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	DOWNSTREAM SLOPE IS UNEVEN AND HAS LOW RIPPLES ON SURFACE.	DOWNSTREAM TOE 25' LEFT OF OUTLET WORKS IS ABOUT 6' FURTHER DOWNSTREAM THAN ADJACENT TOE.
SLOUGHING OR EROSION: Embankment Slopes Abutment Slopes	MINOR EROSION ON UPSTREAM SLOPE SURFACE RUNOFF EROSION ON TOP AT DOWNSTREAM SLOPE	ERODED AREAS ARE TYPICALLY 10' TO 15' LONG
CREST ALIGNMENT: Vertical Horizontal	HORIZONTAL - OK - ARCHED IN PLAN VERTICAL - SEE SURVEY DATA FOLLOWING INSPECTION FORMS	
RIPRAP FAILURES	UPPER 2'± OF UPSTREAM SLOPE NEAR VERTICAL.	

EMBANKMENT

Sheet 2 of 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT WITH: Abutment Spillway Other Features	No deficiencies	
ANY NOTICEABLE SEEPAGE	None	
STAFF GAGE AND RECORDER	None	
DRAINS	None	
VEGETATION	MATURE TREES IN DOWNSTREAM SLOPE	BRUSH ON BOTH SLOPES

OUTLET WORKS

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	CAST-IRON-PIPE (CIP)	GATE VALVE HOUSING CRACKED, CRACK IS 1.5' LONG
INTAKE STRUCTURE	SUBMERGED - NOT VISIBLE	
OUTLET STRUCTURE	CONCRETE FOUNDATION	WOOD-FRAME SUPERSTRUCTURE CAPSIZED ABOUT 20' DOWNSTREAM.
OUTLET CHANNEL	MOUNTAIN LAKE POOL.	
EMERGENCY GATE	NO OPERATING MECHANISM. BOLTS ON VALVE HOUSING ALMOST RUSTED OFF.	

UNGATED SPILLWAY

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	GOOD COND.	
APPROACH CHANNEL	FILL AT SIDES OF SPILLWAY WALLS PROTRUDES ABOUT 25' INTO APPROACH CHANNEL.	
DISCHARGE CHANNEL	I-BEAM LYING IN CHANNEL. NEW SPILLWAY does NOT COINCIDE WITH OUTLET CHANNEL	SEE DOWNSTREAM CHANNEL
BRIDGE AND PIERS	BRIDGE - GOOD COND. NO PIERS	

S-8

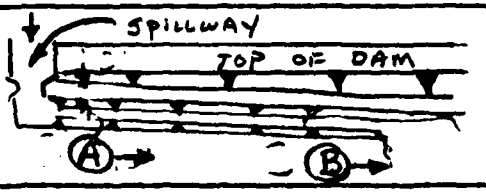
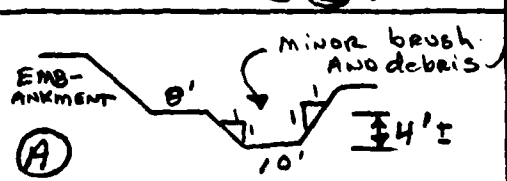
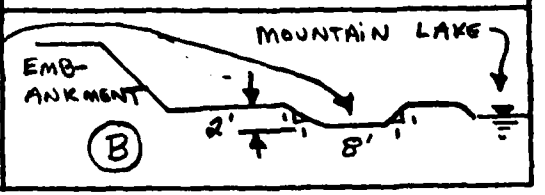
INSTRUMENTATION

Sheet 1 of 1

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

DOWNSTREAM CHANNEL

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION: Obstructions Debris Other	MOUNTAIN LAKE RESERVOIR	
SLOPES	RELATIVELY MILD	
APPROXIMATE NUMBER OF HOMES AND POPULATION	4 DWELLINGS ABOUT 0.5 MILE DOWNSTREAM	ALSO BEAR CREEK LAKE - SEE APPENDIX D.
SPILLWAY CHANNEL:		SIDE SLOPES 1V ON 1H
SPILLWAY CHANNEL SECTIONS:		

B-7

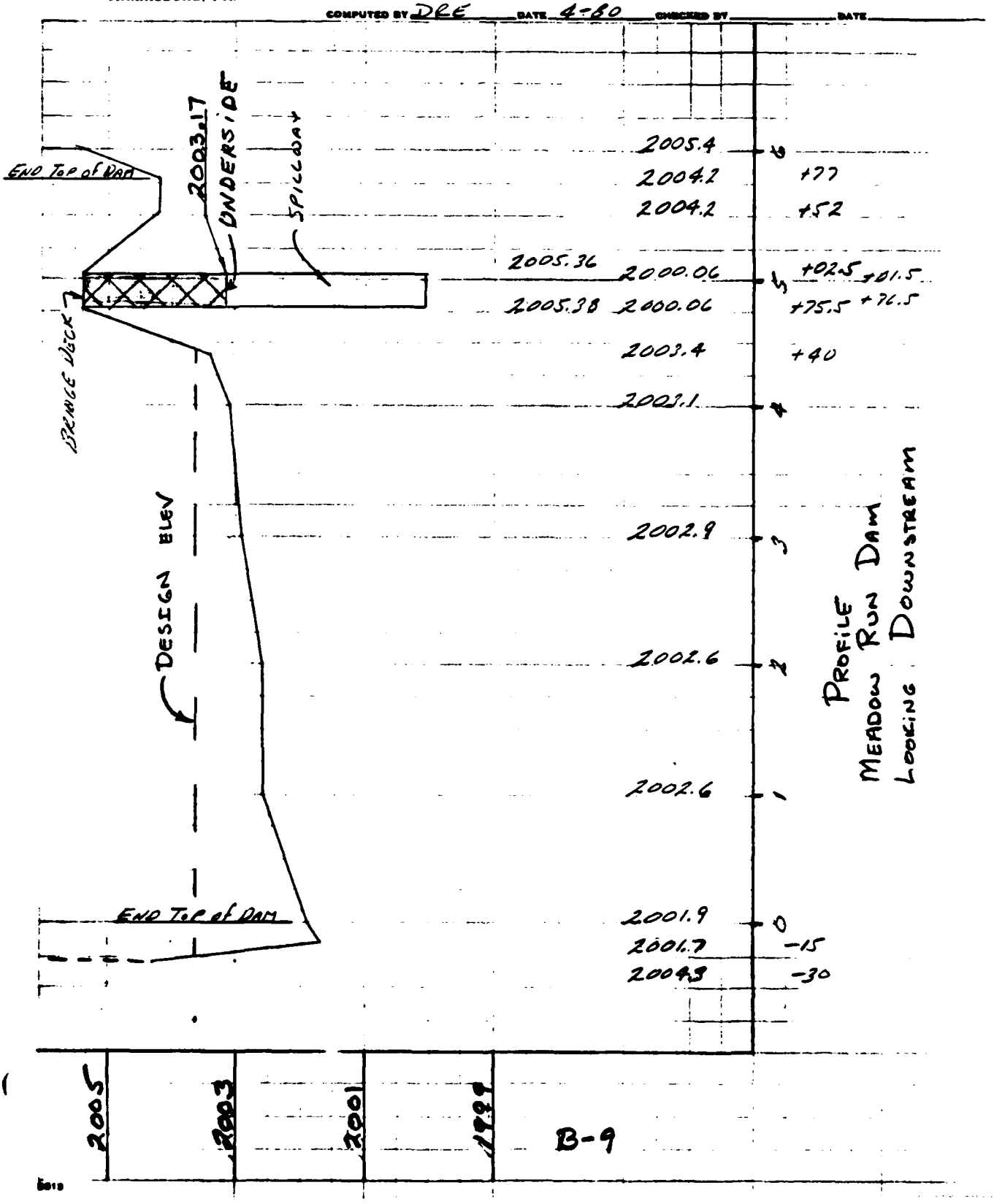
RESERVOIR AND WATERSHED

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	IN GENERAL - MILD	
SEDIMENTATION	No observed problems	
WATERSHED DESCRIPTION	ALMOST ENTIRELY WOODED. 30 ACRE SWAMP NEAR HEADWATERS.	

GANNETT FLEMING CORDDRY AND CARPENTER, INC.
HARRISBURG, PA.

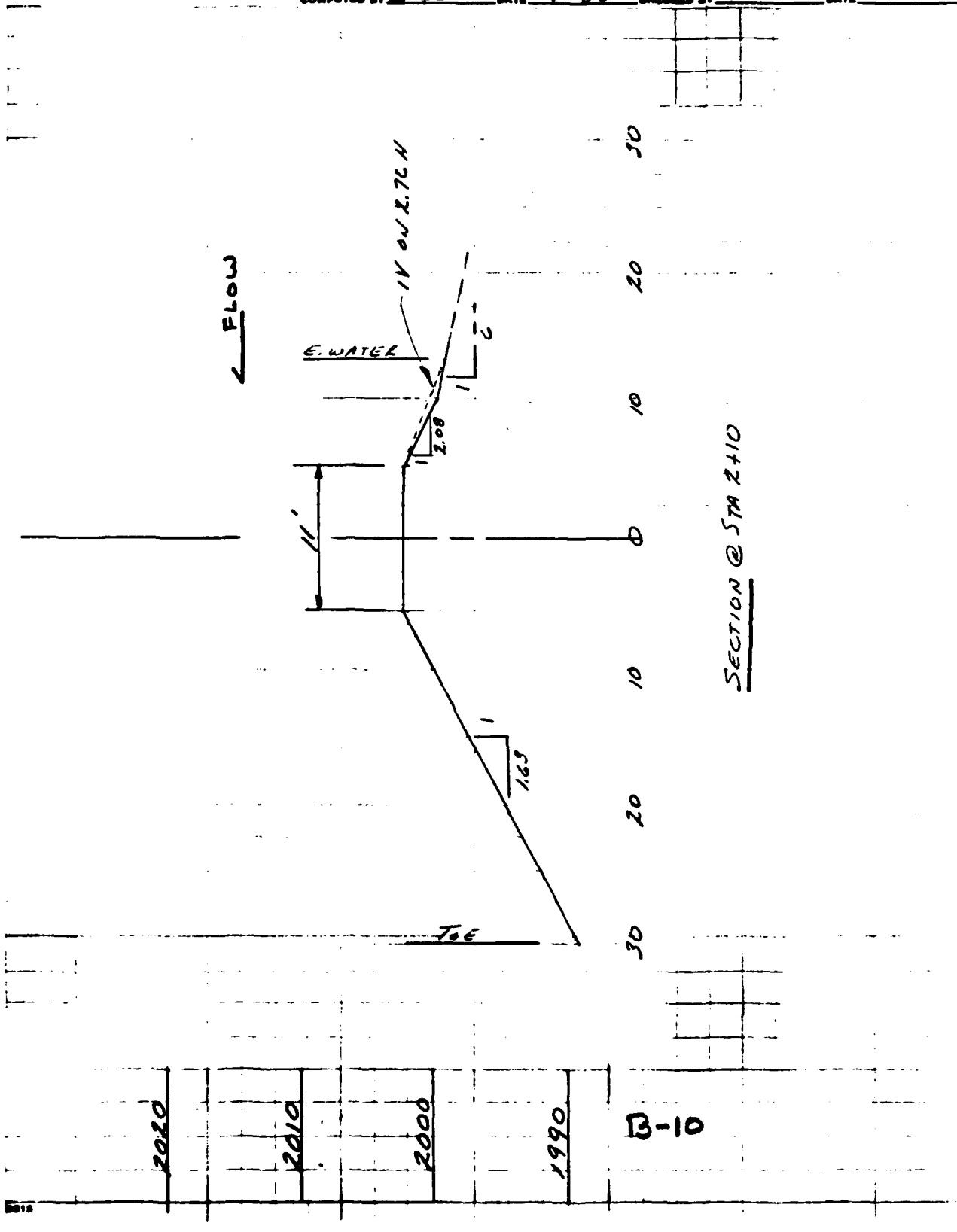
SUBJECT MEADOW RUN DAM — FILE NO. 8202
PROFILE - TOP of DAM — SHEET NO. 1 OF ___ SHEETS
FOR
COMPUTED BY DRE — DATE 4-60 — CHECKED BY ___ — DATE



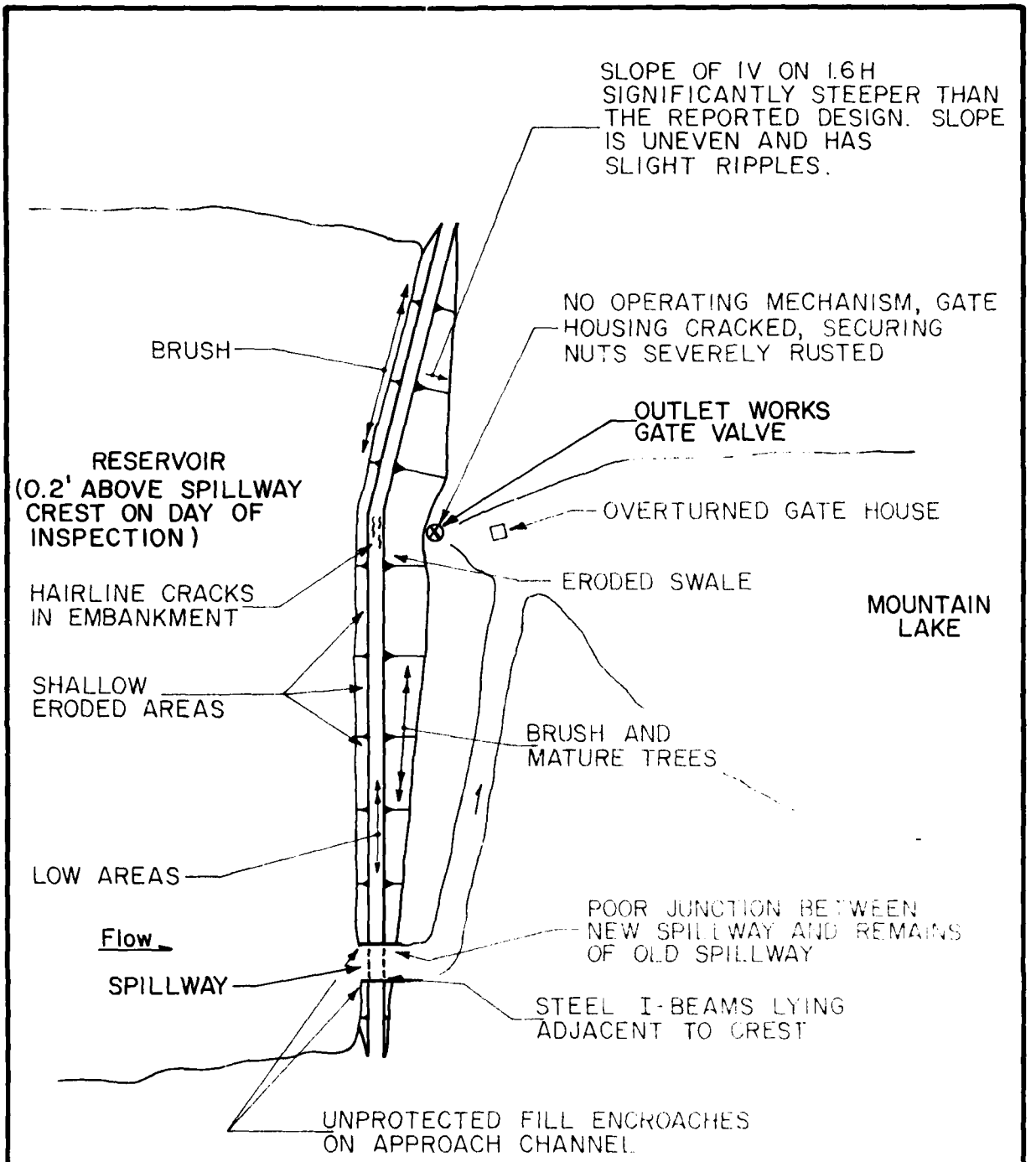
B-9

GANNETT FLEMING CORDDRY AND CARPENTER, INC.
HARRISBURG, PA.

SUBJECT Meadow Run Dam FILE NO. 82 02
Cross Section of Embankment SHEET NO. 2 OF ____ SHEETS
FOR
COMPUTED BY DRE DATE 4-80 CHECKED BY ____ DATE ____



B-10



PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

MEADOW RUN DAM

ELEANOR TAYLOR

RESULTS OF VISUAL INSPECTION

JUNE 1980 EXHIBIT B-1

APPENDIX C

PHOTOGRAPHS

MEADOW RUN DAM

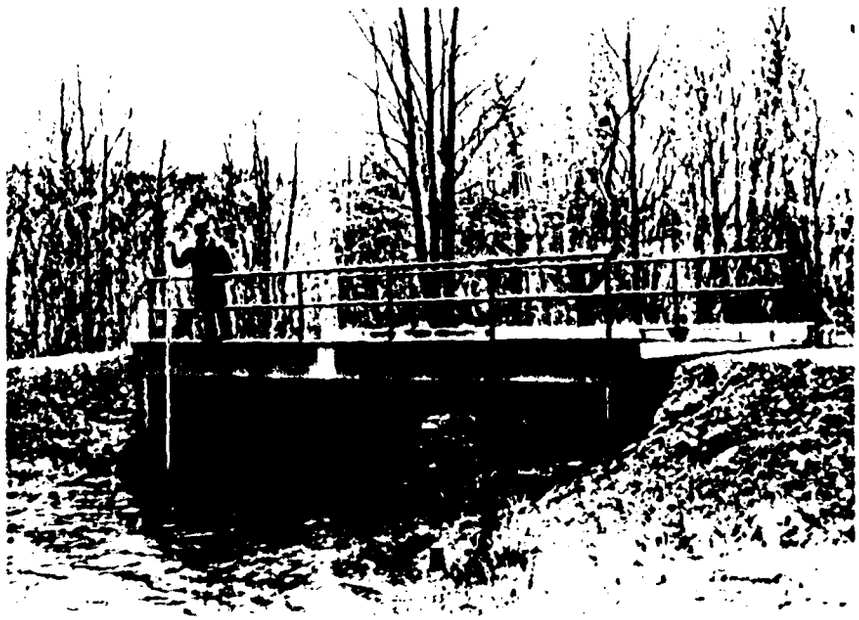
A. Top of Dam

B. Upstream Slope

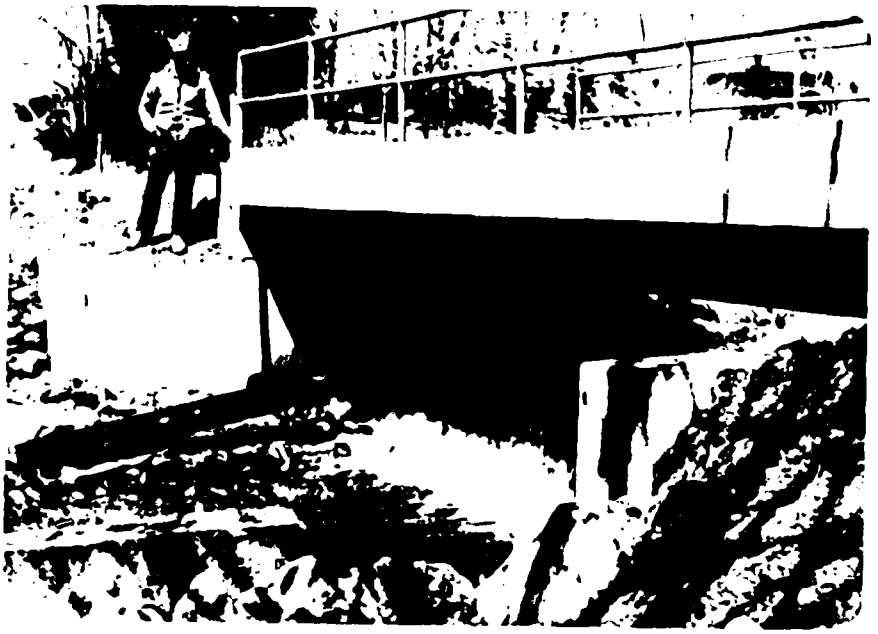
C. Upstream Slope

D. Top of Dam and Downstream Slope

E. Downstream Slope



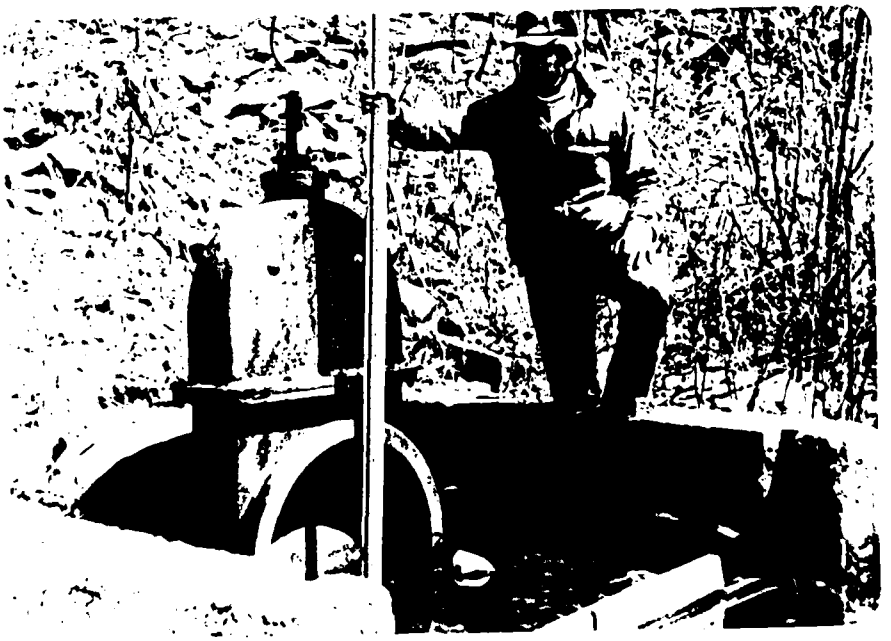
F. Spillway Approach



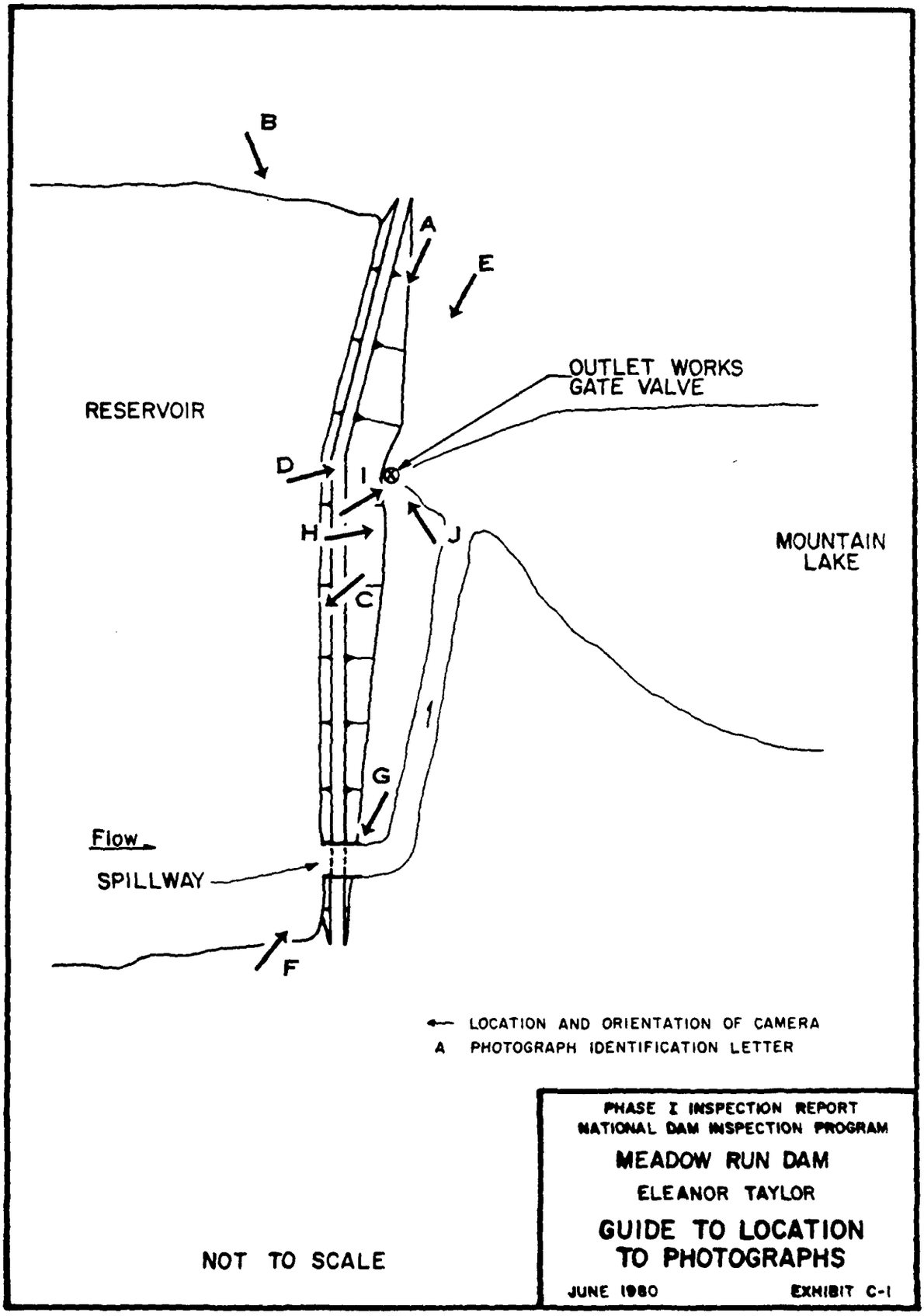
i. Spillway

ii. Downstream Toe (Mountain Lake)

I. Outlet Works



J. Outlet Works Valve



NOT TO SCALE

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

MEADOW RUN DAM

ELEANOR TAYLOR

GUIDE TO LOCATION
TO PHOTOGRAPHS

JUNE 1980 EXHIBIT C-1

APPENDIX D

HYDROLOGY AND HYDRAULICS

APPENDIX D

HYDROLOGY AND HYDRAULICS

Spillway Capacity Rating:

In the recommended Guidelines for Safety Inspection of Dams, the Department of the Army, Office of the Chief of Engineers (OCE), established criteria for rating the capacity of spillways. The recommended Spillway Design Flood (SDF) for the size (small, intermediate, or large) and hazard potential (low, significant, or high) classification of a dam is selected in accordance with the criteria. The SDF for those dams in the high hazard category varies between one-half of the Probable Maximum Flood (PMF) and the PMF. If the dam and spillway are not capable of passing the SDF without overtopping failure, the spillway capacity is rated as inadequate. If the dam and spillway are capable of passing one-half of the PMF without overtopping failure, or if the dam is not in the high hazard category, the spillway capacity is not rated as seriously inadequate. A spillway capacity is rated as seriously inadequate if all of the following conditions exist:

(a) There is a high hazard to loss of life from large flows downstream of the dam.

(b) Dam failure resulting from overtopping would significantly increase the hazard to loss of life downstream from the dam from that which would exist just before overtopping failure.

(c) The dam and spillway are not capable of passing one-half of the PMF without overtopping failure.

Description of Model:

If the Owner has not developed a PMF for the dam, the watershed is modeled with the HEC-1DB computer program, which was developed by the U.S. Army Corps of Engineers. The HEC-1DB computer program calculates a PMF runoff hydrograph (and percentages thereof) and routes the flows through both reservoirs and stream sections. In addition, it has the capability to simulate an overtopping dam failure. By modifying the rainfall criteria, it is also possible to model the 100-year flood with the program.

APPENDIX D

DELAWARE River Basin
Name of Stream: MEADOW RUN
Name of Dam: MEADOW RUN
NDI ID No.: PA-00555
DER ID No.: 40-51
Latitude: N 41° 13' 10" Longitude: W 75° 40' 05"
Top of Dam Elevation: 2001.7 (EXISTING)
Streambed Elevation: 1986.3 Height of Dam: 15 ft
Reservoir Storage at Top of Dam Elevation: 567 acre-ft
Size Category: SMALL
Hazard Category: HIGH (see Section 5)
Spillway Design Flood: VARIES 1/2 PMF TO PMF
SELECT PMF

UPSTREAM DAMS

Name	Distance from Dam (miles)	Height (ft)	Storage at top of Dam Elevation (acre-ft)	Remarks
NONE				

DOWNSTREAM DAMS

MOUNTAIN LAKE	0.5			(1) NDI PA-00546 DER 40-50
BEAR CREEK LAKE		17	765	(2) NDI PA 00545 DER 40-47

(1) PHASE I REPORT being PREPARED CONCURRENTLY
(2) PHASE I REPORT PREVIOUSLY PREPARED

DELAWARE River Basin

Name of Stream: MEADOW RUN

Name of Dam: MEADOW RUN

DETERMINATION OF PMF RAINFALL & UNIT HYDROGRAPH

UNIT HYDROGRAPH DATA:

Sub-area	Drainage Area (square miles)	Cp (1)	Ct (2)	L miles (3)	L_{ca} miles (4)	L' miles (5)	Tp hours (6)	Map Area (7)	Plate (8)
A-1	1.67	0.45	2.1	2.27	.795	N/A	2.51	2	B
Total	1.67								

(See Sketch on Sheet D-4)

(1) & (2): Snyder Unit Hydrograph coefficients supplied by Baltimore District, Corps of Engineers on maps and plates referenced in (7) & (8)

The following are measured from the outlet of the subarea:

(3): Length of main watercourse extended to divide

(4): Length of main watercourse to the centroid

The following is measured from the upstream end of the reservoir at normal pool:

(5): Length of main watercourse extended to divide

(6): $Tp=C_t \times (L \times L_{ca})^{0.3}$, except where the centroid of the subarea is located in the reservoir. Then $Tp=C_t \times (L')^{0.6}$

Initial flow is assumed at 1.5 cfs/sq. mile

Computer Data: QRCSN = -0.05 (5% of peak flow)
RTIOR = 2.0

RAINFALL DATA:

PMF Rainfall Index= 22.0 in., 24 hr., 200 sq. mile

	Hydromet. 40 (Susquehanna Basin)	Hydromet. 33 (Other Basins)
Zone:	N/A	1
Geographic Adjustment Factor:	N/A	1.0
Revised Index Rainfall:	N/A	22.0

RAINFALL DISTRIBUTION (percent)

Time	Percent
6 hours	111
12 hours	123
24 hours	132
48 hours	142
72 hours	
96 hours	

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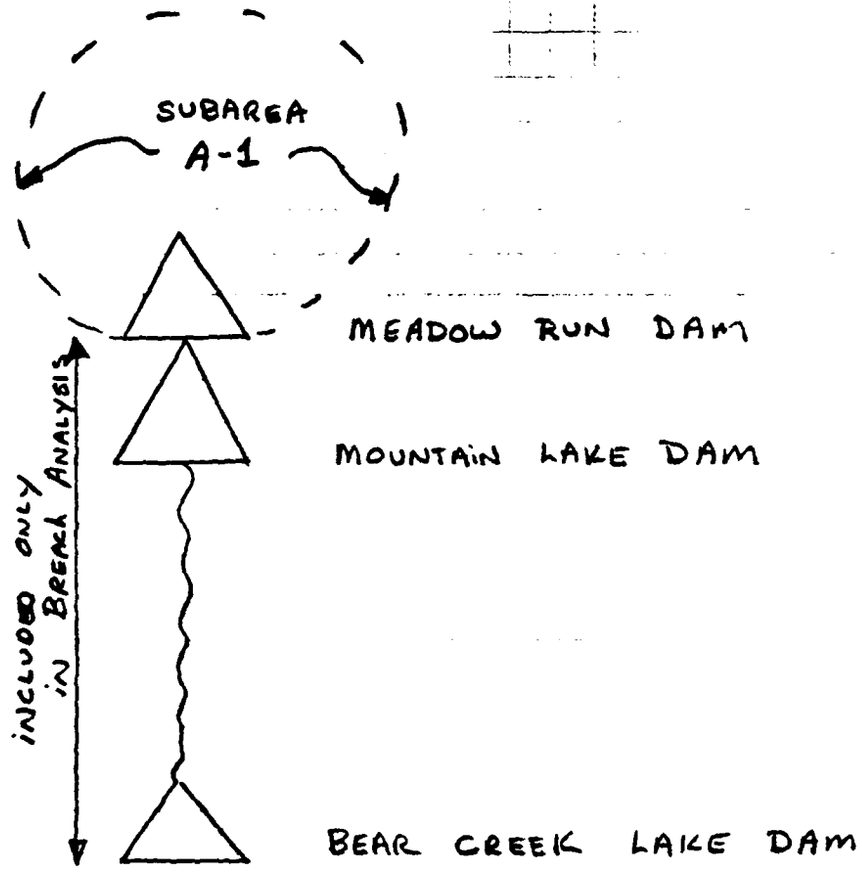
HARRISBURG, PA.

SUBJECT _____ FILE NO. _____
SHEET NO. ____ OF ____ SHEETS
FOR _____
COMPUTED BY _____ DATE _____ CHECKED BY _____ DATE _____



SKETCH OF SYSTEM

Data for Dam at Outlet of Subarea A-1 (See sketch on Sheet D-4)

Name of Dam: MEADOW RUN

STORAGE DATA: DATA IN DER FILES described as "ESTIMATE," IT does NOT CORRELATE well with OTHER DATA

Elevation	Area (acres)	Storage million gals	Storage acre-ft	Remarks
1986.3 =ELEVO*	0	0	0	STREAMBED AT TOE
2000.1 =ELEV1	90 =A1		418 =S1	SPILLWAY CREST
2001.7	95		567	EXISTING TOP
2003.6	102		754	DESIGN TOP
2020 **	167			

* ~~ELEVO = ELEV1 = (3B1/A1)~~ $S_1 = (ELEV1 - ELEVO) \times A1/3$

** Planimetered contour at least 10 feet above top of dam

Reservoir Area at Normal Pool is 8 percent of subarea watershed.

BREACH DATA:

See Appendix B for sections and existing profile of the dam.

Soil Type from Visual Inspection: SHALE FILL = SMALL GRAVEL

Maximum Permissible Velocity (Plate 28, EM 1110-2-1601) 3 fps
(from $Q = CLH^{3/2} = V \cdot A$ and depth = (2/3) x H) & A = L·depth

HMAX = $(4/9\ V^2/C^2)$ = 0.4 ft., C = 3.1 Top of Dam El.= 2001.7

HMAX + Top of Dam El. = 2002.1 = FAILEL
(Above is elevation at which failure would start)

Dam Breach Data:

BRWID = 80 ft (width of bottom of breach)
Z = 1 (side slopes of breach)
ELBM = 1986.3 (bottom of breach elevation, minimum of zero storage elevation)
WSEL = 2000.1 (normal pool elevation)
T FAIL = 6 mins = 0.1 hrs (time for breach to develop)

Data for Dam at Outlet of Subarea A-1

Name of Dam: MEADOW RUN

SPILLWAY DATA:	Existing Conditions	Design Conditions
Top of Dam Elevation	2001.7	2003.6
Spillway Crest Elevation	2000.1	2000.1
Spillway Head Available (ft)	1.6	3.5
Type Spillway	BROAD-CRESTED WEIR	
"C" Value - Spillway	2.7	2.7
Crest Length - Spillway (ft)	25	25
Spillway Peak Discharge (cfs)	137	442
Auxiliary Spillway Crest Elev.	N/A	N/A
Auxiliary Spill. Head Avail. (ft)		
Type Auxiliary Spillway		
"C" Value - Auxiliary Spill. (ft)		
Crest Length - Auxil. Spill. (ft)		
Auxiliary Spillway Peak Discharge (cfs)	N/A	N/A
Combined Spillway Discharge (cfs)	≈ 140	≈ 440

Spillway Rating Curve: SEE NEXT SHEET $Q = 2.7 \times 25 \times H^{1.5}$

Elevation	Q Spillway (cfs)	Q Auxiliary Spillway (cfs)	Combined (cfs)

OUTLET WORKS RATING:	Outlet 1	Outlet 2	Outlet 3
Invert of Outlet	1986.3		
Invert of Inlet	NOT AVAILABLE		
Type	CIP		
Diameter (ft) = D	2		
Length (ft) = L (Approx).	80		
Area (sq. ft) = A	3.14		
N	.013		
K Entrance	0.5		
K Exit	1.0		
K Friction $=29.1 N^2 L/R^{4/3}$	.99		
Sum of K	2.49		
$(1/K)^{0.5} = C$	0.63		
Maximum Head (ft) = HM	15+/-		
$Q = CA\sqrt{2g(HM)}$ (cfs)	61.5		
Q Combined (cfs) ≈	60		

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HARRISBURG, PA.

SUBJECT _____ FILE NO. _____
SHEET NO. ____ OF ____ SHEETS
FOR _____
COMPUTED BY _____ DATE _____ CHECKED BY _____ DATE _____

MEADOW RUN DAM
SPILLWAY RATING

FREE OVERFLOW $Q = 2.7 \times 25 (POOL - 2000.1)^{1.5}$

ORIFICE FLOW $Q = CA\sqrt{2g\left(POOL - \left[\frac{2003.2 + 2000.1}{2}\right]\right)}$

$A = 25(2003.2 - 2000.1)$
$C = 0.7$

POOL	Q FREE OVERFLOW	Q ORIFICE	Q CONTROL
2000.1	0	N/A	0
2000.5	17	N/A	17
2001.0	58	N/A	58
2001.5	112	N/A	112
2002.0	177	N/A	177
2002.5	251	N/A	251
2003.0	333	N/A	333
2003.5	423	592	423
2004.0	520	667	520
2005.0	732	797	732
2006.0	967	908	908
2007.0	1,223	1,007	1,007

SWITCH CONTROL

DAM WOULD HAVE LONG SINCE OVERTOPPED BEFORE A SWITCH IN CONTROL OCCURS

Data for Dam at Outlet of Subarea — (See sketch on Sheet D-4)

Name of Dam: MOUNTAIN LAKE

STORAGE DATA: FROM PHASE I REPORT

Elevation	Area (acres)	Storage million gals	Storage acre-ft	Remarks
1974.5 =ELEVO*	0	0	0	STREAM BED
1986.6 =ELEV1	37 =A1		152 =S1	
1989.5	46		271	EXISTING TOP
1990.1	47		299	DESIGN TOP
2000 **	84			

* ~~ELEVO = ELEV1 - (3S$_T$/A$_T$)~~ S1 = (ELEV1 - ELEVO) x A1/3

** Planimetered contour at least 10 feet above top of dam

Reservoir Area at Normal Pool is N/A percent of subarea watershed.

BREACH DATA: FROM PHASE I REPORT

See Appendix B for sections and existing profile of the dam.

Soil Type from Visual Inspection: SAND

Maximum Permissible Velocity (Plate 28, EM 1110-2-1601) 2 fps
(from Q = $CLH^{3/2}$ = V·A and depth = (2/3) x H) & A = L·depth

HMAX = ($4/9\ V^2/C^2$) = .2 ft., C = 3.1 Top of Dam El.= 1989.5

HMAX + Top of Dam El. = 1989.7 = FAILEL
(Above is elevation at which failure would start)

Dam Breach Data:

BRWID = 75 ft (width of bottom of breach)
Z = 1 (side slopes of breach)
ELBM = 1986.6 (bottom of breach elevation, minimum of zero storage elevation)
WSEL = 1989.5 (normal pool elevation)
T FAIL = 6 mins = 0.1 hrs (time for breach to develop)

Data for Dam at Outlet of Subarea —

Name of Dam: MOUNTAIN LAKE

SPILLWAY DATA: FROM PHASE I REPORT	Existing Conditions	Design Conditions
Top of Dam Elevation	1989.1'	NOT PERTINENT TO THIS REPORT
Spillway Crest Elevation	1986.6	
Spillway Head Available (ft)	2.5	
Type Spillway	BROAD-CRESTED WEIR	
"C" Value - Spillway	2.7	
Crest Length - Spillway (ft)	22	
Spillway Peak Discharge (cfs)	235	
Auxiliary Spillway Crest Elev.	N/A	
Auxiliary Spill. Head Avail. (ft)		
Type Auxiliary Spillway		
"C" Value - Auxiliary Spill. (ft)		
Crest Length - Auxil. Spill. (ft)		
Auxiliary Spillway Peak Discharge (cfs)	N/A	
Combined Spillway Discharge (cfs)	≈ 240	

Spillway Rating Curve: $Q = 2.7 \times 22 \times H^{1.5}$

Elevation	Q Spillway (cfs)	Q Auxiliary Spillway (cfs)	Combined (cfs)

OUTLET WORKS RATING:	Outlet 1	Outlet 2	Outlet 3
Invert of Outlet	NOT PERTINENT TO THIS REPORT		
Invert of Inlet			
Type			
Diameter (ft) = D			
Length (ft) = L			
Area (sq. ft) = A			
N			
K Entrance			
K Exit			
K Friction=$29.1 N^2 L/R^{4/3}$			
Sum of K			
$(1/K)^{0.5} = C$			
Maximum Head (ft) = HM			
$Q = CA\sqrt{2g(HM)}$ (cfs)			
Q Combined (cfs)			

Data for Dam at Outlet of Subarea — (See sketch on Sheet D-4)

Name of Dam: Bear Creek Lake

STORAGE DATA: From Phase I Report

Elevation	Area (acres)	Storage million gals	Storage acre-ft	Remarks
1512 =ELEVO*	0	0	0	
1521 =ELEV1	=A1		490 =S1	
1524			765	
1540			4,109	

~~* ELEVO = ELEV1 - (3S1/A1)~~
~~** Planimetered contour at least 10 feet above top of dam~~

Reservoir Area at Normal Pool is N/A percent of subarea watershed.

BREACH DATA: Not Used

See Appendix B for sections and existing profile of the dam.

Soil Type from Visual Inspection: _____

Maximum Permissible Velocity (Plate 28, EM 1110-2-1601) _____ fps
(from $Q = CLH^{3/2} = V \cdot A$ and depth = (2/3) x H) & A = L·depth

HMAX = $(4/9\ V^2/C^2)$ = _____ ft., C = ____ Top of Dam El.= ____

HMAX + Top of Dam El. = _____ / _____ = FAILEL
(Above is elevation at which failure would start)

Dam Breach Data:

BRWID = _____ ft (width of bottom of breach)
Z = _____ (side slopes of breach)
ELBM = _____ (bottom of breach elevation, minimum of zero storage elevation)
WSEL = _____ (normal pool elevation)
T FAIL = _____ mins = _____ hrs (time for breach to develop)

Data for Dam at Outlet of Subarea —

Name of Dam: Bear Creek Lake

SPILLWAY DATA: From Phase I Report	Existing Conditions	Design Conditions
Top of Dam Elevation		
Spillway Crest Elevation		
Spillway Head Available (ft)		
Type Spillway		
"C" Value - Spillway		
Crest Length - Spillway (ft)		
Spillway Peak Discharge (cfs)		
Auxiliary Spillway Crest Elev.		
Auxiliary Spill. Head Avail. (ft)		
Type Auxiliary Spillway		
"C" Value - Auxiliary Spill. (ft)		
Crest Length - Auxil. Spill. (ft)		
Auxiliary Spillway Peak Discharge (cfs)		
Combined Spillway Discharge (cfs)		

Spillway Rating Curve:

Elevation	Q Spillway (cfs)	Q Auxiliary Spillway (cfs)	Combined (cfs)
1521.0			0
1521.5			190
1522.0			537
1522.5			987
1523.0			1,519
1523.5			2,123
1524.0			2,791
1525.0			4,298
1530.0			14,504
1540.0			44,490

OUTLET WORKS RATING:	Outlet 1	Outlet 2	Outlet 3
Invert of Outlet	Not Pertinent to		
Invert of Inlet	This Report		
Type			
Diameter (ft) = D			
Length (ft) = L			
Area (sq. ft) = A			
N			
K Entrance			
K Exit			
K Friction $=29.1 N^2 L/R^{4/3}$			
Sum of K			
$(1/K)^{0.5} = C$			
Maximum Head (ft) = HM			
$Q = CA\sqrt{2g(HM)}$ (cfs)			
Q Combined (cfs)			

SELECTED COMPUTER OUTPUT

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**********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  01 APR 80
**********************************
    1                A1                                NATIONAL DAM INSPECTION PROGRAM
    2                A2                                        MEADOW RUN
    3                A3                                   MEADOW RUN DAM
    4                B     300       0      15       0       0       0       0       0      -4       0
    5                B1      5
    6                J       1       9       1
    7                J1      1      .8      .7      .6      .5      .4      .3      .2      .1
    8                K       0       1                                               1
    9                K1          RUNOFF INTO MEADOW RUN DAM
   10                M       1       1    1.67            1.67                               1
   11                P               22     111     123     132     142
   12                T                                                       1     .05             .08
   13                W    2.51     .65
   14                X    -1.5   -0.05     2.0
   15                K       1       1                                               1
   16                K1          ROUTE THROUGH MEADOW RUN LAKE
   17                Y                                       1
   18                Y1      1                                                -2000.1       0
   19                $A      0      90     167
   20                $E1986.3  2000.1    2020
   21                $$2000.1       25     2.7     1.5
   22                $02001.7
   23                $L      1      15     120     225     320     425     465     490     600     630
   24                $V2001.7  2001.9  2002.6 2002.61  2002.9  2003.1  2003.4  2004.2  2005.4  2006.0
   25                K      99
```

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

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS								
				RATIO 1 1.00	RATIO 2 .80	RATIO 3 .70	RATIO 4 .60	RATIO 5 .50	RATIO 6 .40	RATIO 7 .30	RATIO 8 .20	RATIO 9 .10
HYDROGRAPH AT	1	1.67	1	2907.	2326.	2035.	1744.	1454.	1163.	872.	381.	291.
	(	4.33)	(	82.32)(	65.85)(	57.62)(	49.39)(	41.16)(	32.93)(	24.70)(	16.46)(	8.23)
ROUTED TO	1	1.67	1	2822.	2235.	1935.	1626.	1303.	959.	594.	274.	101.
	(	4.33)	(	79.92)(	63.29)(	54.79)(	46.04)(	36.90)(	27.15)(	16.81)(	7.77)(	2.87)

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SUMMARY OF DAM SAFETY ANALYSIS

MEADOW RUN DAM

PLAN 1 ••••••••••••••••

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	2000.10	2000.10	2001.70
STORAGE	414.	414.	562.
OUTFLOW	0.	0.	137.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	2004.02	2.32	792.	2822.	24.00	42.75	0.00
.80	2003.79	2.09	769.	2235.	22.50	43.00	0.00
.70	2003.66	1.96	756.	1935.	21.50	43.00	0.00
.60	2003.52	1.82	742.	1626.	20.50	43.25	0.00
.50	2003.36	1.66	726.	1303.	19.25	43.50	0.00
.40	2003.17	1.47	706.	959.	18.00	44.00	0.00
.30	2002.89	1.19	678.	594.	16.00	44.75	0.00
.20	2002.36	.66	626.	274.	12.50	46.50	0.00
.10	2001.41	0.00	535.	101.	0.00	47.75	0.00

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E

MEADOW BR.

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**********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  01 APR 80
**********************************
    1              A1                                NATIONAL DAM INSPECTION PROGRAM
    2              A2                                        MEADOW RUN
    3              A3                                     MEADOW RUN DAM
    4              B    300        0        6        0        0        0        0        0       -4        0
    5              B1     5
    6              J      3        2        1
    7              J1    .5       .2
    8              K      0        1                                                   1
    9              K1       RUNOFF INTO MEADOW RUN DAM
   10              M      1        1     1.67                1.67                                1
   11              P               22      111      123      132
   12              T                                                                   1      .05                .08
   13              W   2.51      .45
   14              X   -1.5    -0.05      2.0
   15              K      1        1                                                   1
   16              K1       ROUTE THROUGH MEADOW RUN LAKE
   17              Y                                        1        1
   18              Y1     1                                                        -2000.1        0
   19              $A     0       90      167
   20              $E1986.3  2000.1     2020
   21              $$2000.1        25      2.7      1.5
   22              $D2001.7
   23              $L     1       15      120      225      320      425      465      490      600      630
   24              $V2001.7  2001.9  2002.6 2002.61  2002.9  2003.1  2003.4  2004.2  2005.4  2006.0
   25              $B    80        1  1986.3       .1  2000.1     2040
   26              $B    80        1  1986.3       .1  2000.1  2002.1
   27              $B    80        1  1986.3       .1  2000.1  2002.1
   28              K      1        2                                                   1
   29              K1       ROUTE THROUGH MOUNTAIN LAKE
   30              Y                                        1        1
   31              Y1     1                                                        -1986.6        0
   32              $A     0       37      84
   33              $E1974.5  1986.6     2000
   34              $$1986.6        22      2.7      1.5
   35              $D1989.1
   36              $L     1       10      115      155      190      260      400      530
   37              $V1989.1  1989.5  1989.6  1989.7  1989.8     1990  1990.4     2000
   38              $B    75        1  1974.5       .1  1986.6     2020
   39              $B    75        1  1974.5       .1  1986.6     2020
   40              $B    75        1  1974.5       .1  1986.6  1989.4
   41              K      1        3                                                   1
   42              K1       DAMAGE CENTER
   43              Y                                        1        1
   44              Y1     1                                                          -1
   45              Y6   .09      .07      .09     1948     1970     2000     .009
   46              Y7     0     1980      250     1960      300     1952      304     1948      324     1948
   47              Y7   328     1952      650     1960      820     1980
   48              K      1        4                                                   1
   49              K1       STREAM SECTION
   50              Y                                        1        1
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51    Y1    1                                                    -1
52    Y6   .09      .07      .09     1647     1875     7850    .0105
53    Y7    0      1900      250     1880      560     1860      750     1847      760     1847
54    Y7 1000      1860     2150     1880     2650     1900
55    K     1         5                                           1
56    K1       STREAM SECTION
57    Y                                    1        1
58    Y1    1                                                    -1
59    Y6   .09      .07      .09     1803     1830     2200    .017
60    Y7    0      1840      250     1840      410     1820      620     1803      630     1803
61    Y7 1150      1820     2300     1820     2400     1840
62    K     1         6                                           1
63    K1       STREAM SECTION
64    Y                                    1        1
65    Y1    1                                                    -1
66    Y6   .09      .07      .09     1677     1720     5850    .021
67    Y7    0      1720       80     1700      100     1680      130     1677      140     1677
68    Y7  160      1680      400     1700      800     1720
69    K     1         7                                           1
70    K1       STREAM SECTION(BEAR CREEK)
71    Y                                    1        1
72    Y1    1                                                    -1
73    Y6   .09      .07      .09     1573     1620    13300    .013
74    Y7    0      1620      310     1600      700     1580      710     1573      790     1573
75    Y7  800      1580     1300     1600     1400     1620
76    K     1         8                                           1
77    K1       BEAR CREEK LAKE DAM
78    Y                                    1        1
79    Y1    1                                                -1521      -1
80    Y4 1521   1521.5   1522.0   1522.5   1523.0   1523.5   1524.0     1525      1530      1540
81    Y5    0      190      537      987     1519     2123     2791     4298     14504     44490
82    SS    0      490      765     4109
83    SE 1512     1521     1524     1540
84    SS 1521
85    SD 1524      3.1      1.5      167
86    K    99
```

E

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

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .50	RATIO 2 .20
HYDROGRAPH AT	1	1.67	1	1437.	575.
		(4.33)		(40.69)(	16.28)(
			2	1437.	575.
				(40.69)(	16.28)(
			3	1437.	575.
				(40.69)(	16.28)(
ROUTED TO	1	1.67	1	1251.	252.
		(4.33)		(35.42)(	7.13)(
			2	17490.	17295.
				(495.25)(	489.74)(
			3	17490.	17295.
				(495.25)(	489.74)(
ROUTED TO	2	1.67	1	1144.	179.
		(4.33)		(32.40)(	5.08)(
			2	9662.	9336.
				(273.59)(	264.37)(
			3	21135.	21196.
				(598.49)(	600.20)(
ROUTED TO	3	1.67	1	1138.	179.
		(4.33)		(32.22)(	5.08)(
			2	9178.	8831.
				(259.98)(	250.08)(
			3	17443.	17619.
				(493.94)(	498.92)(
ROUTED TO	4	1.67	1	1073.	178.
		(4.33)		(30.37)(	5.04)(
			2	6627.	6206.
				(187.66)(	175.73)(
			3	11700.	11587.
				(331.12)(	328.10)(
ROUTED TO	5	1.67	1	1070.	179.
		(4.33)		(30.31)(	5.04)(
			2	6524.	6056.
				(184.77)(	171.48)(
			3	11574.	11359.
				(327.75)(	321.79)(
ROUTED TO	6	1.67	1	1061.	179.
		(4.33)		(30.05)(	5.08)(
			2	6124.	5614.
				(173.40)(	158.98)(
			3	10938.	10684.

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				(309.73)(	302.55)(
ROUTED TO	7	1.67	1	977.	175.
	(	4.33)	(	27.68)(	4.96)(
			2	4787.	4236.
			(	135.56)(	119.94)(
			3	8247.	7863.
			(	233.52)(	222.66)(
ROUTED TO	8	1.67	1	801.	146.
	(	4.33)	(	22.68)(	4.12)(
			2	2816.	2295.
			(	79.74)(	64.98)(
			3	4355.	3923.
			(	123.33)(	111.08)(

SUMMARY OF DAM SAFETY ANALYSIS

MEADOW RUN DAM

PLAN 1 ••••••••••••••••

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	2000.10	2000.10	2001.70
STORAGE	414.	414.	562.
OUTFLOW	0.	0.	137.

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	2003.34	1.64	723.	1251.	13.50	19.60	0.00
.20	2002.29	.59	619.	252.	10.10	22.50	0.00

PLAN 2 ••••••••••••••••

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	2000.10	2000.10	2001.70
STORAGE	414.	414.	562.
OUTFLOW	0.	0.	137.

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	2002.17	.47	607.	17490.	.71	17.20	17.10
.20	2002.12	.42	602.	17295.	1.60	20.50	20.40

PLAN 3 ••••••••••••••••

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	2000.10	2000.10	2001.70
STORAGE	414.	414.	562.
OUTFLOW	0.	0.	137.

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	2002.17	.47	607.	17490.	.71	17.20	17.10
.20	2002.12	.42	602.	17295.	1.60	20.50	20.40

SUMMARY OF DAM SAFETY ANALYSIS

Mountain Lake Dam

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1986.60	1986.60	1989.10
STORAGE	149.	149.	251.
OUTFLOW	0.	0.	235.

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	1990.50	1.60	316.	1144.	11.20	20.60	0.00
.20	1988.69	0.00	233.	179.	0.00	26.60	0.00

PLAN 2 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1986.60	1986.60	1989.10
STORAGE	149.	149.	251.
OUTFLOW	0.	0.	235.

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	1993.43	4.33	473.	9662.	10.10	17.60	0.00
.20	1993.35	4.25	468.	9336.	5.20	20.90	0.00

PLAN 3 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1986.60	1986.60	1989.10
STORAGE	149.	149.	251.
OUTFLOW	0.	0.	235.

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	1992.29	3.19	408.	21135.	.40	17.40	17.30
.20	1992.33	3.23	411.	21196.	.50	20.70	20.60

PLAN 1 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	1138.	1954.2	20.80
.20	179.	1950.4	26.70

PLAN 2 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	[illegible]	[illegible]	17.70

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.20	8831.	1959.9	21.00

PLAN 3 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	17443.	1962.6	17.50
.20	17619.	1962.7	20.80

PLAN 1 STATION 4

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	1073.	1850.9	21.40
.20	178.	1848.7	27.50

PLAN 2 STATION 4

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	6627.	1855.1	18.00
.20	6206.	1854.9	21.30

PLAN 3 STATION 4

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	11799.	1857.1	17.90
.20	11587.	1857.0	21.20

PLAN 1 STATION 5

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	1070.	1806.2	21.50
.20	178.	1804.5	27.60

PLAN 2 STATION 5

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	6524.	1809.6	18.10
.20	6056.	1809.4	21.40

PLAN 3 STATION 5

	MAXIMUM	MAXIMUM	TIME

RATIO	FLOW,CFS	STAGE,FT	HOURS
.50	11574.	1811.3	18.00
.20	11399.	1811.3	21.20

PLAN 1 STATION 6

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	1061.	1680.9	21.80
.20	178.	1678.6	28.10

PLAN 2 STATION 6

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	6124.	1685.6	18.30
.20	5648.	1685.2	21.50

PLAN 3 STATION 6

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	10938.	1688.1	18.10
.20	10684.	1688.0	21.40

PLAN 1 STATION 7

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	977.	1575.6	22.70
.20	175.	1573.5	29.10

PLAN 2 STATION 7

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	4747.	1579.7	18.70
.20	4226.	1579.2	21.90

PLAN 3 STATION 7

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	9247.	1581.6	18.50
.20	7961.	1581.7	21.70

E

SUMMARY OF DAM SAFETY ANALYSIS

BEAR CREEK LAKE DAM

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1521.00	1521.00	1524.00
STORAGE	490.	490.	765.
OUTFLOW	0.	0.	2791.

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	1522.29	0.00	609.	801.	0.00	24.50	0.00
.20	1521.38	0.00	525.	146.	0.00	30.00	0.00

PLAN 2 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1521.00	1521.00	1524.00
STORAGE	490.	490.	765.
OUTFLOW	0.	0.	2791.

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	1524.02	.02	769.	2816.	.40	19.50	0.00
.20	1523.63	0.00	721.	2295.	0.00	22.70	0.00

PLAN 3 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1521.00	1521.00	1524.00
STORAGE	490.	490.	765.
OUTFLOW	0.	0.	2791.

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	1524.79	.79	931.	4355.	2.30	19.20	0.00
.20	1524.59	.59	889.	3923.	1.60	22.40	0.00

D-24

GANNETT FLEMING CORDDRY AND CARPENTER, INC.
HARRISBURG, PA.

SUBJECT _____ FILE NO. _____
SHEET NO. ____ OF ____ SHEETS
FOR _____
COMPUTED BY _____ DATE _____ CHECKED BY _____ DATE _____

Summary of Pertinent Data

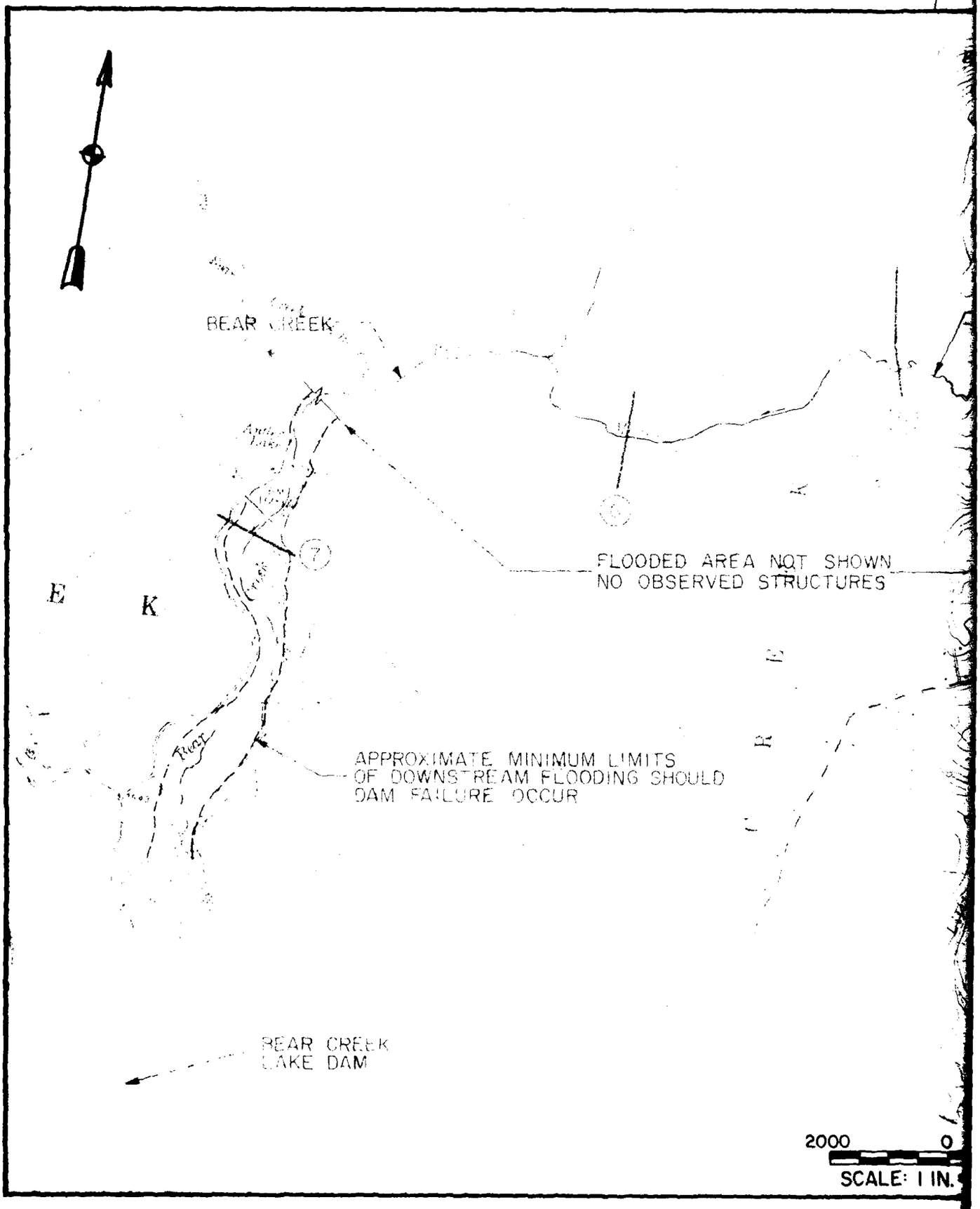
PMF Rainfall = 24.99"

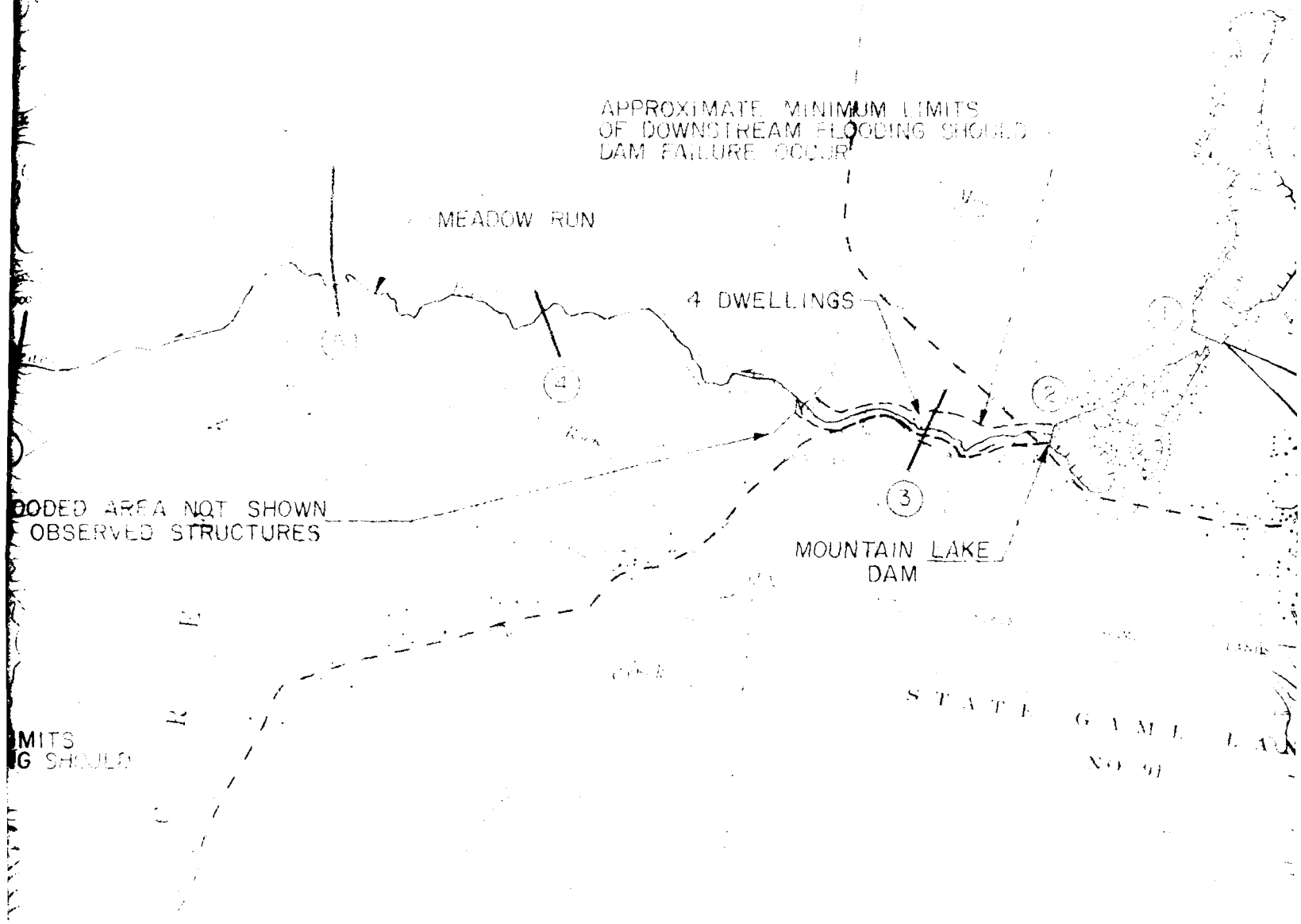
Multi-Ratio Analysis:	PMF	0.5 PMF	0.2 PMF
Runoff (inches)	22.79	11.40	4.56
Meadow Lake Dam			
Peak inflow (cfs)	2,907	1,454	581
Peak outflow (cfs)	2,822	1,303	274
Depth of overtopping (ft)	2.32	1.66	.66
Duration of overtopping (hrs)	24.00	19.25	12.50

Breach Analysis
For Description of Plans, see page D-12

At Section 3, near dwellings			
① Plan 1 } Water surface elevation		1954.2	1950.4
② Plan 2 } Water surface elevation		1960.0	1959.9
③ Plan 3 } Water surface elevation		1962.6	1962.7
② - ① } Net rise in water surface (ft)		5.8	9.5
③ - ① } Net rise in water surface (ft)		8.4	12.3

At Bear Creek Lake Overtopping (+ ft) or Freeboard (- ft)		
Plan 1	-1.71	-2.62
Plan 2	+.02	-.37
Plan 3	+.79	+.59


BEAR CREEK
FLOODED AREA NOT SHOWN
NO OBSERVED STRUCTURES
APPROXIMATE MINIMUM LIMITS
OF DOWNSTREAM FLOODING SHOULD
DAM FAILURE OCCUR
BEAR CREEK
LAKE DAM
2000
0
SCALE: 1 IN.



NOTES:

1. LIMITS OF DOWNSTREAM FLOODING ARE ESTIMATES BASED ON VISUAL OBSERVATIONS.
2. CIRCLED NUMBERS INDICATE STATIONS USED IN COMPUTER ANALYSIS.
3. THIS MAP SHOULD NOT BE USED IN CONNECTION WITH THE EMERGENCY OPERATION AND WARNING PLAN.

2000 0 2000

SCALE: 1 IN. = 2000 FT.

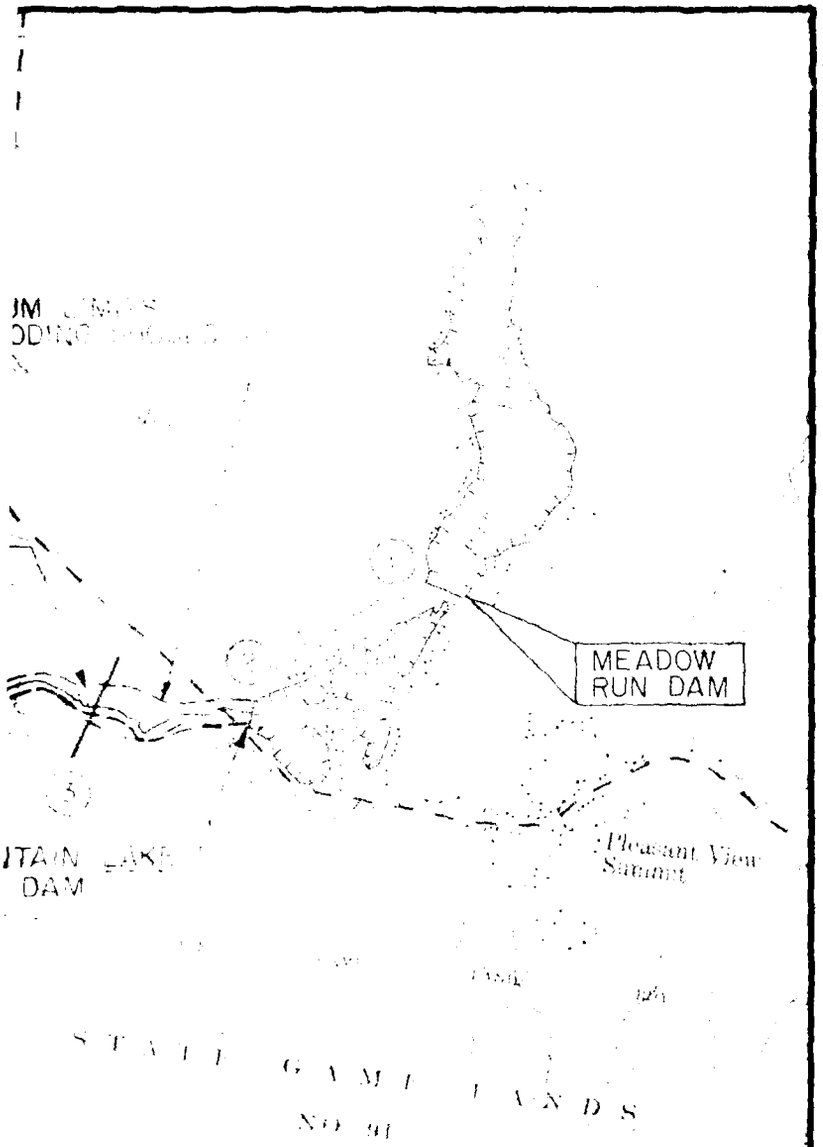
PHASE I INSP
NATIONAL DAM IN

MEADOW

ELEANOR

DOWNS
DEVELOPI

JUNE 1980



PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

MEADOW RUN DAM

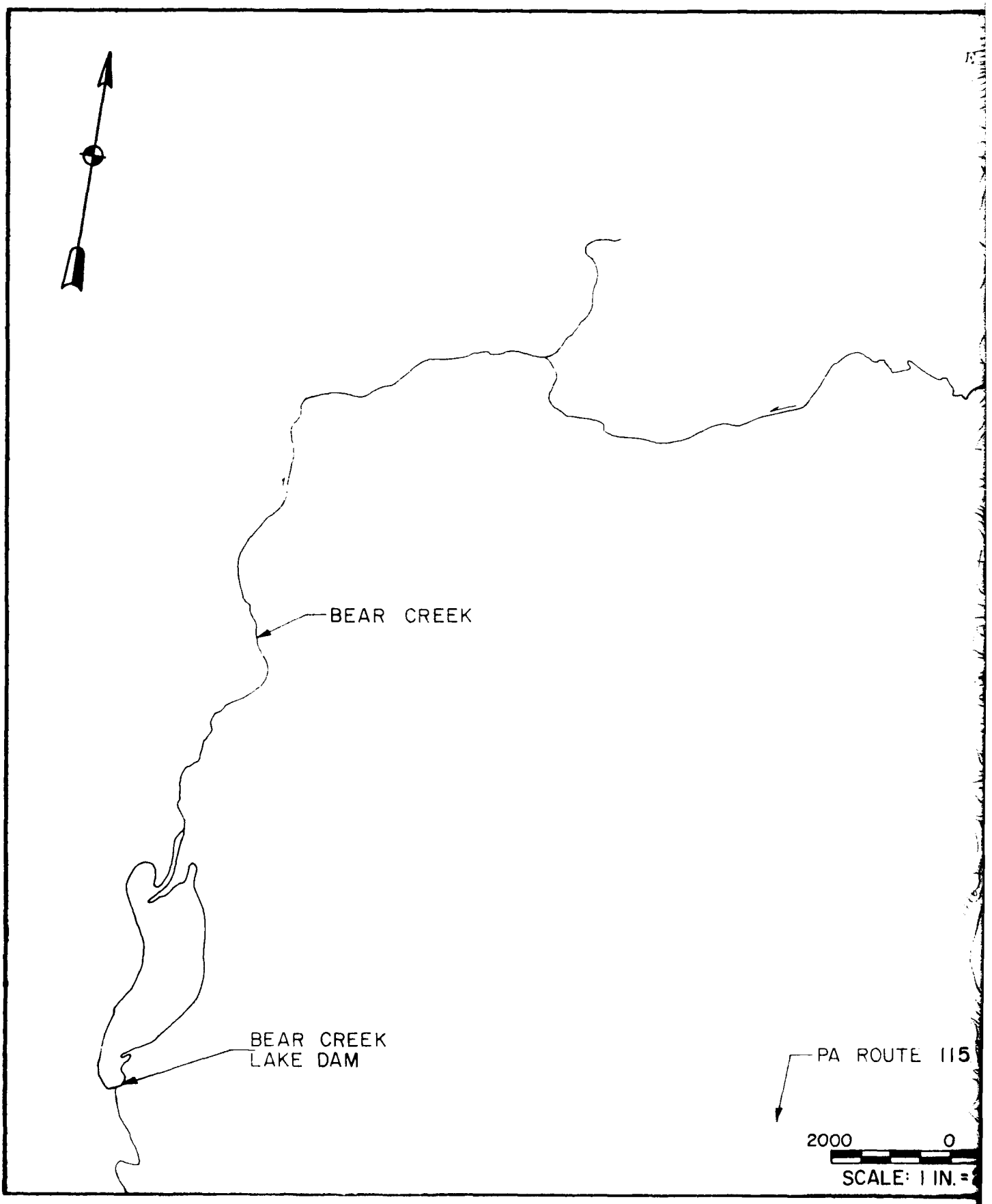
ELEANOR TAYLOR

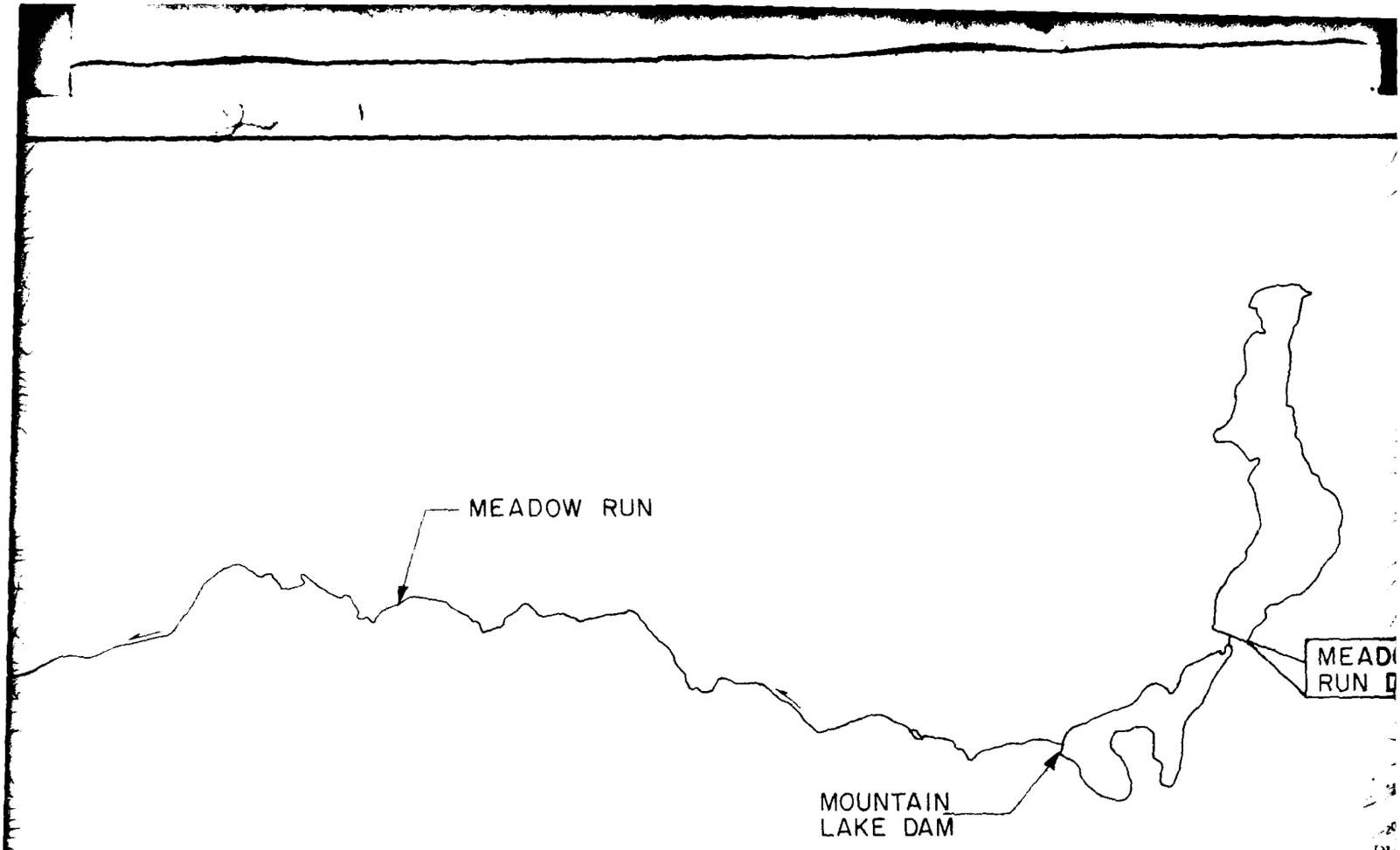
DOWNSTREAM
DEVELOPMENT MAP

EXHIBIT D-1

APPENDIX E

PLATES


BEAR CREEK
BEAR CREEK
LAKE DAM
PA ROUTE 115
2000
0
SCALE: 1 IN. =



PA ROUTE 115

2000 0 2000

SCALE: 1 IN. = 2000 FT.

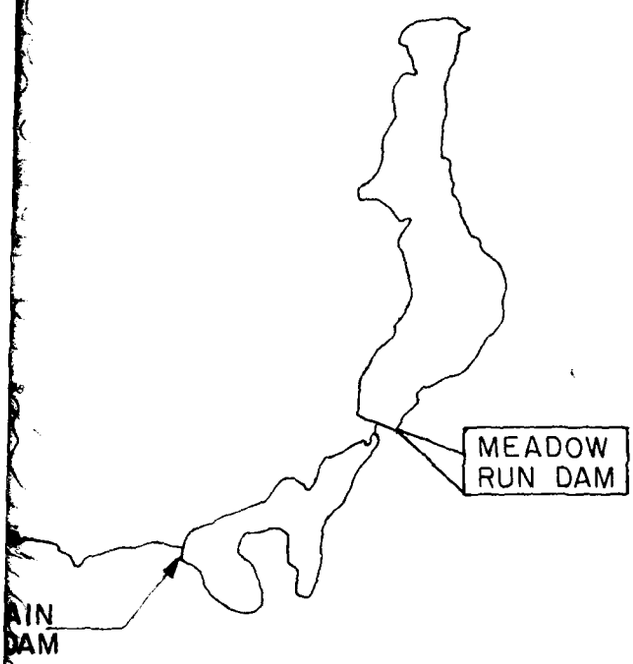
PHASE I INSPECTIO
NATIONAL DAM INSPECT

MEADOW RUN

ELEANOR TA

LOCATION

JUNE 1980



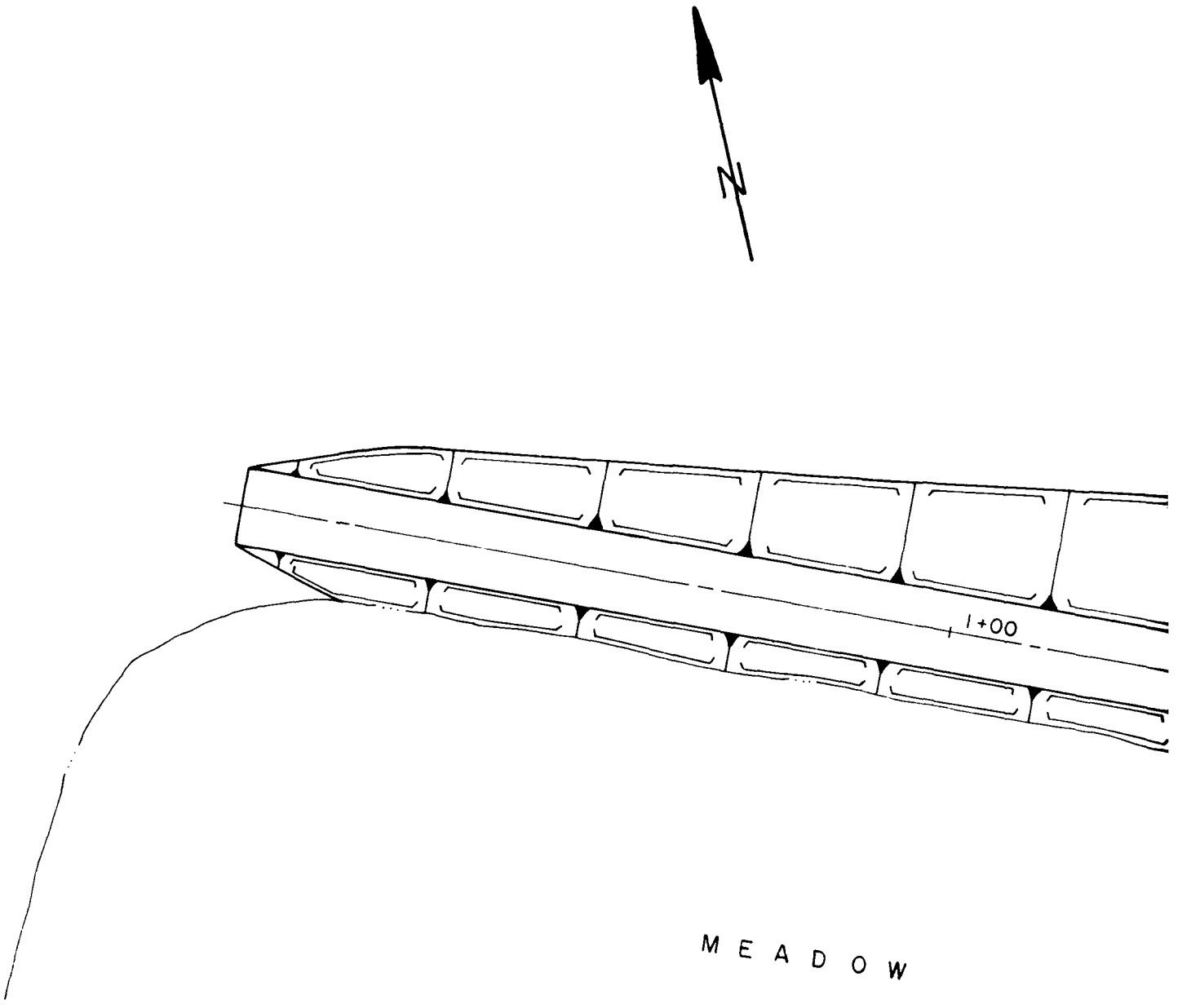
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

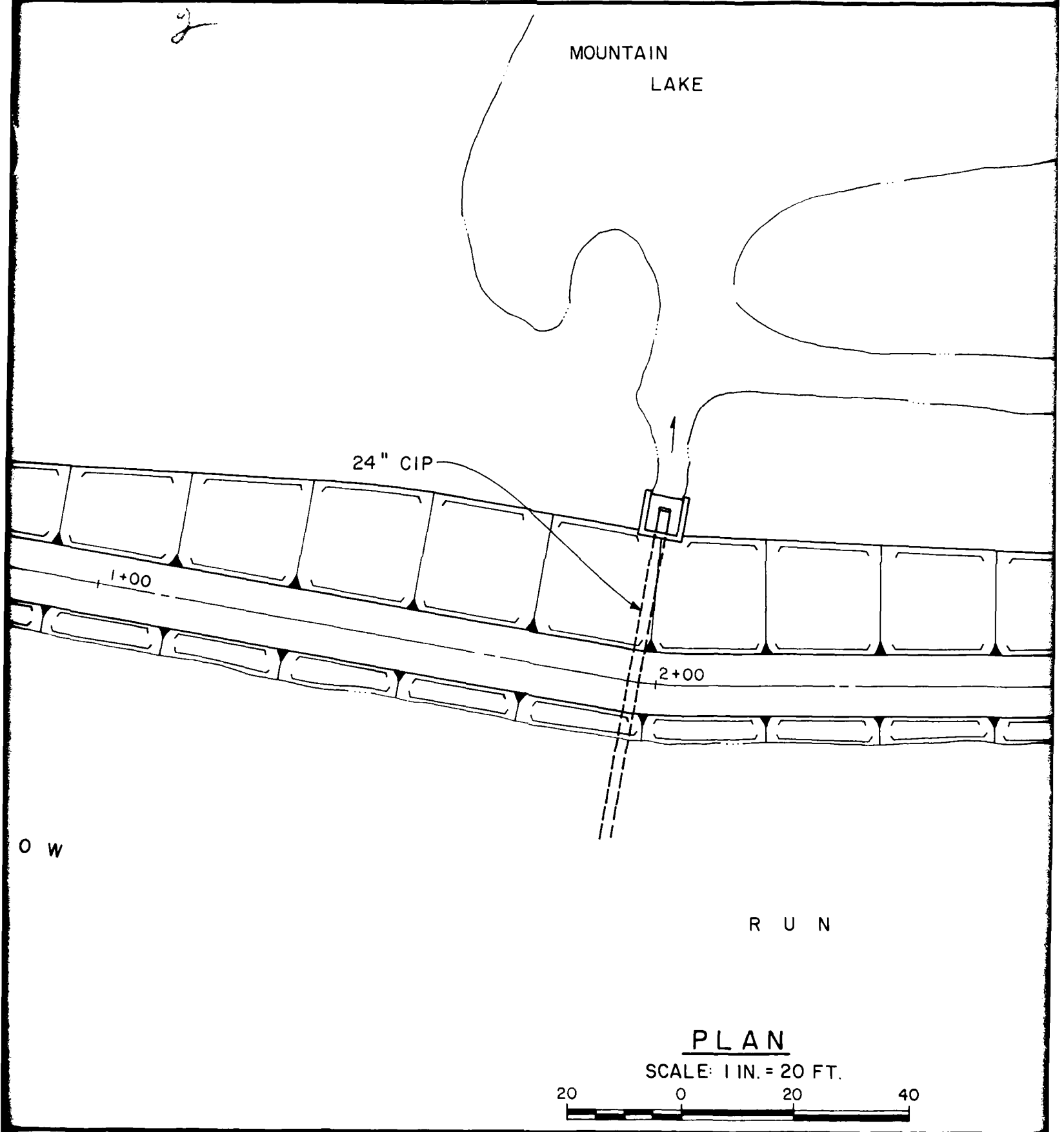
MEADOW RUN DAM

ELEANOR TAYLOR

LOCATION MAP

JUNE 1980 PLATE E-1


N
1+00
MEADOW

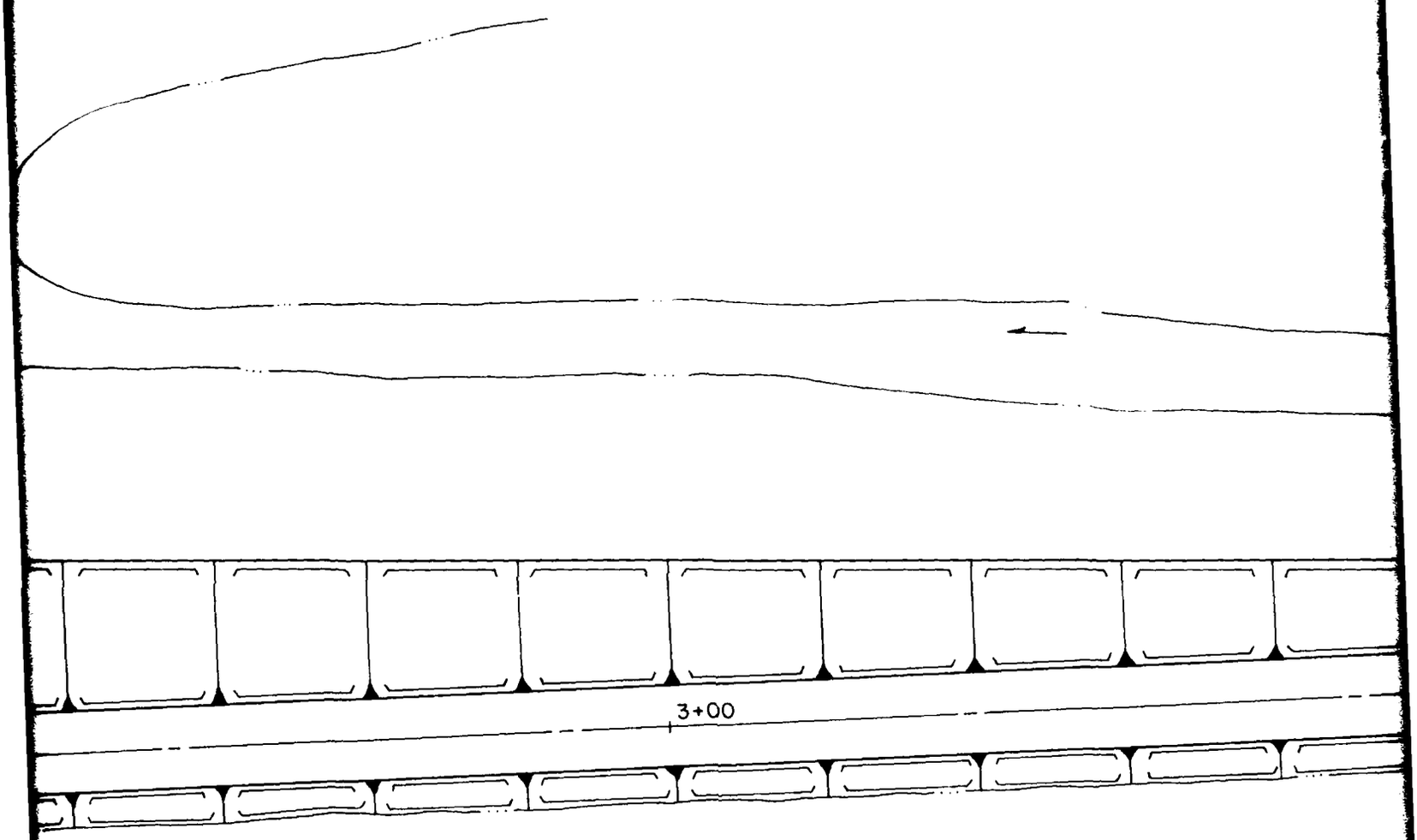


PLAN

SCALE: 1 IN. = 20 FT.

20 0 20 40

3



LAKE

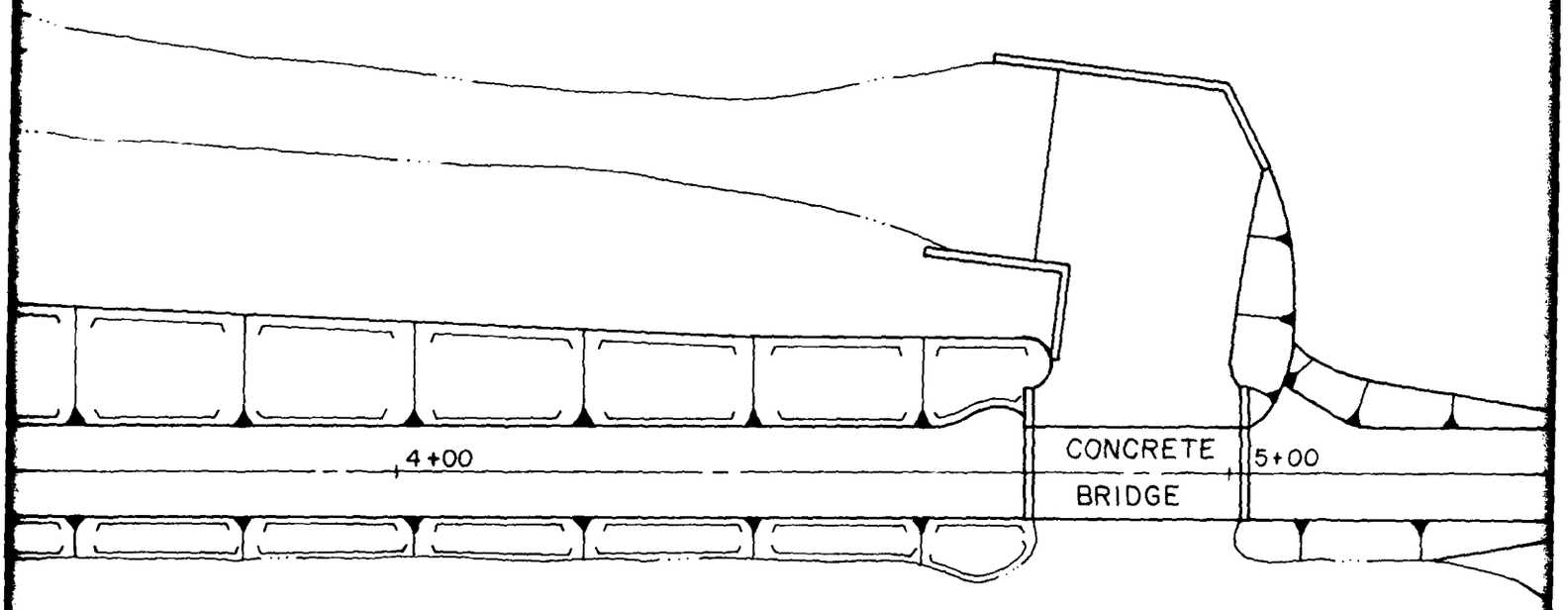
RUN

AN

IN. = 20 FT.

20 40

4



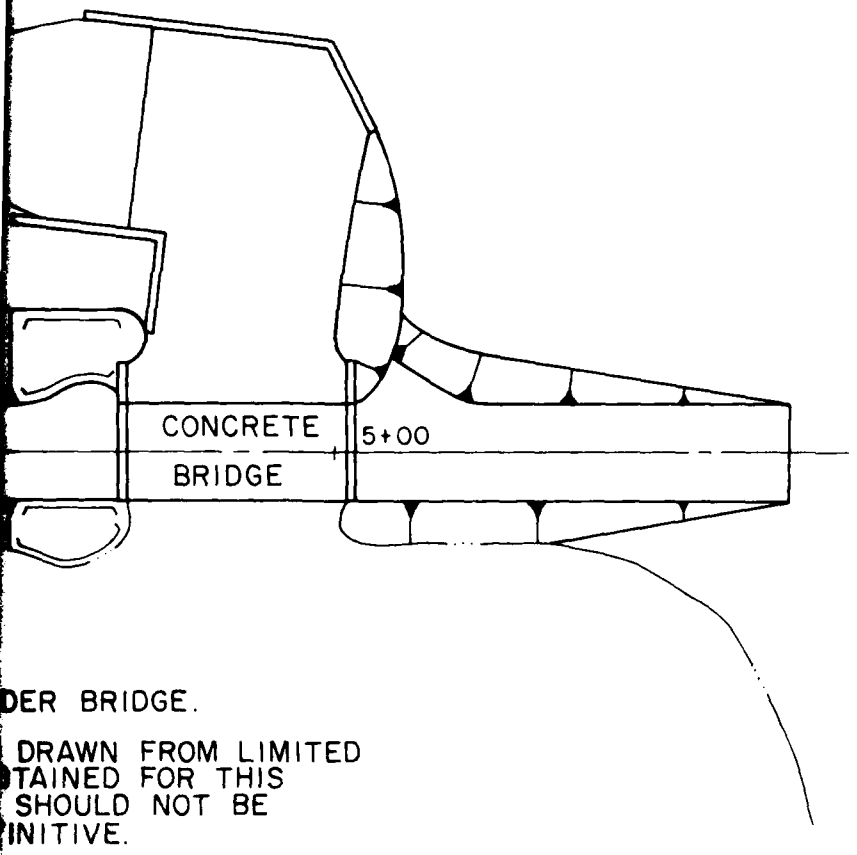
NOTES:

1. SPILLWAY IS UNDER BRIDGE.
2. THIS PLAN WAS DRAWN FROM LIMITED SURVEY DATA OBTAINED FOR THIS INSPECTION. IT SHOULD NOT BE CONSIDERED DEFINITIVE.

A K E

PHASE I INSP
NATIONAL DAM IN
MEADOW
ELEANOR
PL
JUNE 1980

5



DER BRIDGE.

DRAWN FROM LIMITED
TAINED FOR THIS
SHOULD NOT BE
INITIVE.

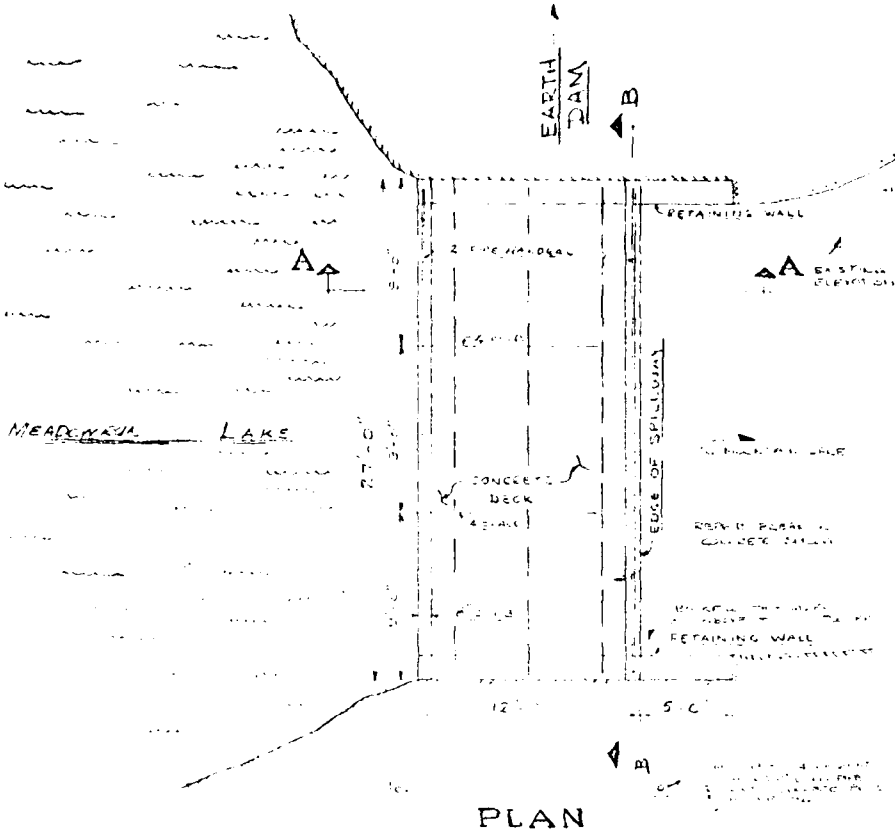
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

MEADOW RUN DAM

ELEANOR TAYLOR

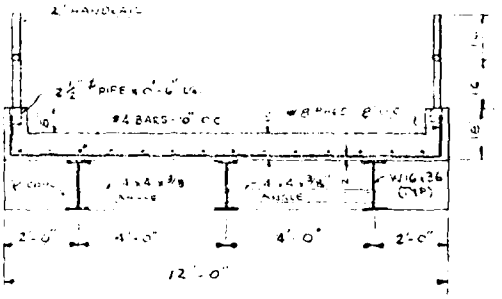
PLAN

JUNE 1980 PLATE E-2



PLAN

1/4" = 1'-0"



SECTION A-A

½" = 1'-0"

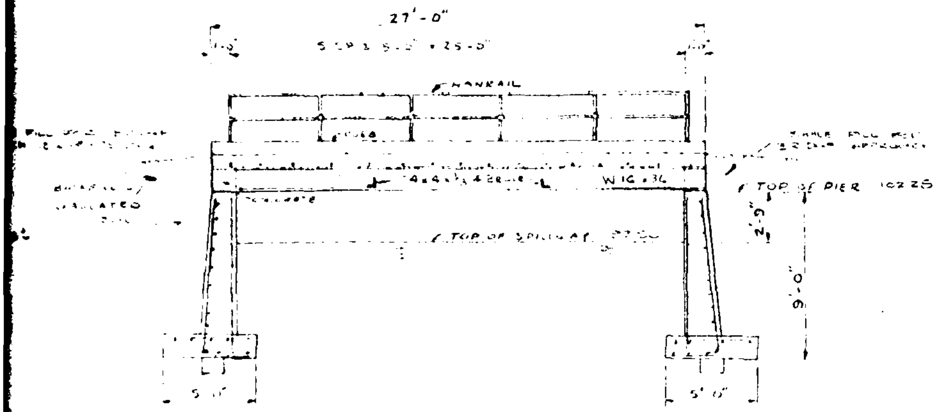
SECTION

¼" =

SPECIFICATIONS

1. CONCRETE f'_c = 3,000 PSI

2. ALL REINFORCING DETAILED & BAR STEEL

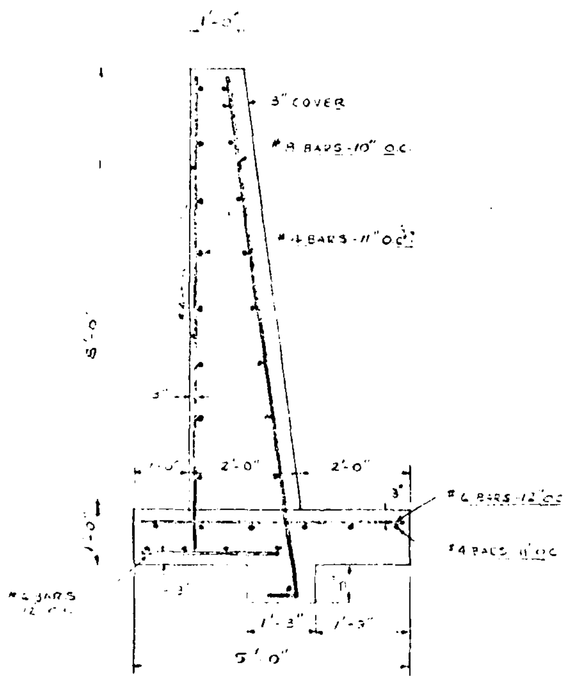


SECTION B-B

1/4" = 1'-0"

BILL OF MATERIALS

QTY.	DESCRIPTION	TOTAL QTY.	
3	W 16 x 36 x 27'-0"	2916 #	
4	∠ 4 x 4 x 3/8 x 4'-0"	151 #	
132'	2" DIA PIPE HANDRAIL	132 [illegible]	
12	2 1/2" DIA PIPE [illegible]	[illegible]	
1	[illegible] DECK	10 YD³	
[illegible]	[illegible]	15 YD³	
[illegible]	[illegible]	7.5 YD³	
[illegible]	#4 [illegible] BARS	[illegible]	
—	#6 [illegible] BARS	[illegible]	
—	#8 [illegible] BARS	[illegible]	
[illegible]	[illegible]		[illegible]
4	[illegible]		
	[illegible]		[illegible]



DETAIL
RETAINING WALL

3/4" = 1'-0"

SPECIFICATIONS

1. [illegible] f'_c = 3,000 psi
2. RE[illegible] DEFORMED A36 STEEL

BRIDGE
[illegible]
[illegible]
[illegible] TOWNSHIP
LUZERNE COUNTY, PA
SEPT. 6, 1977

BILL OF MATERIALS

DESCRIPTION	TOTAL QTY.
[illegible] x 36 x 2'-0"	2316#
[illegible] x 3/8 x 4'-0"	151#
[illegible] PIPE [illegible]	132 [illegible]
[illegible] PIPE SLEEVES	[illegible]
[illegible]	10 [illegible]
[illegible]	15 YD³
[illegible]	15 YD³
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

MEADOW RUN DAM

ELEANOR TAYLOR

SPILLWAY DETAILS

JUNE 1980 PLATE E-3

APPENDIX F

GEOLOGY

AD-A087 935 GANNETT FLEMING CORDDRY AND CARPENTER INC HARRISBURG PA F/G 13/13
NATIONAL DAM INSPECTION PROGRAM. MEADOW RUN (DAM NDI ID NUMBER --ETC(U)
JUN 80 F FUTCHKO DACW31-80-C-0017

UNCLASSIFIED NL

2 OF 2
AD A087935

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MEADOW RUN DAM

APPENDIX F

GEOLOGY

Meadow Run Dam is located in Luzerne County within the Appalachian Plateau Physiographic Province. The most pronounced topographic feature in the area is Camelback Mountain, which is part of the Pocono Plateau Escarpment. This escarpment has a well-defined southwestward trend from Camelback Mountain, but is irregular between Camelback Mountain and Mt. Pocono, which lies to the north. Streams east of the escarpment drain directly to the Delaware River, while those to the west drain to the Lehigh River.

The Pocono Plateau Section lies to the west of the escarpment. This area is relatively flat, with local relief seldom exceeding 100 feet. The topography has been greatly influenced by continental glaciation. Many features were created by deposition of glacial materials. The entire plateau lacks well-developed drainage.

East of the escarpment is the Glaciated Low Plateaus Section of the province. This area is characterized by pre-glacial erosional topography with locally-thick, glacial deposits. Local relief is generally 100 to 300 feet.

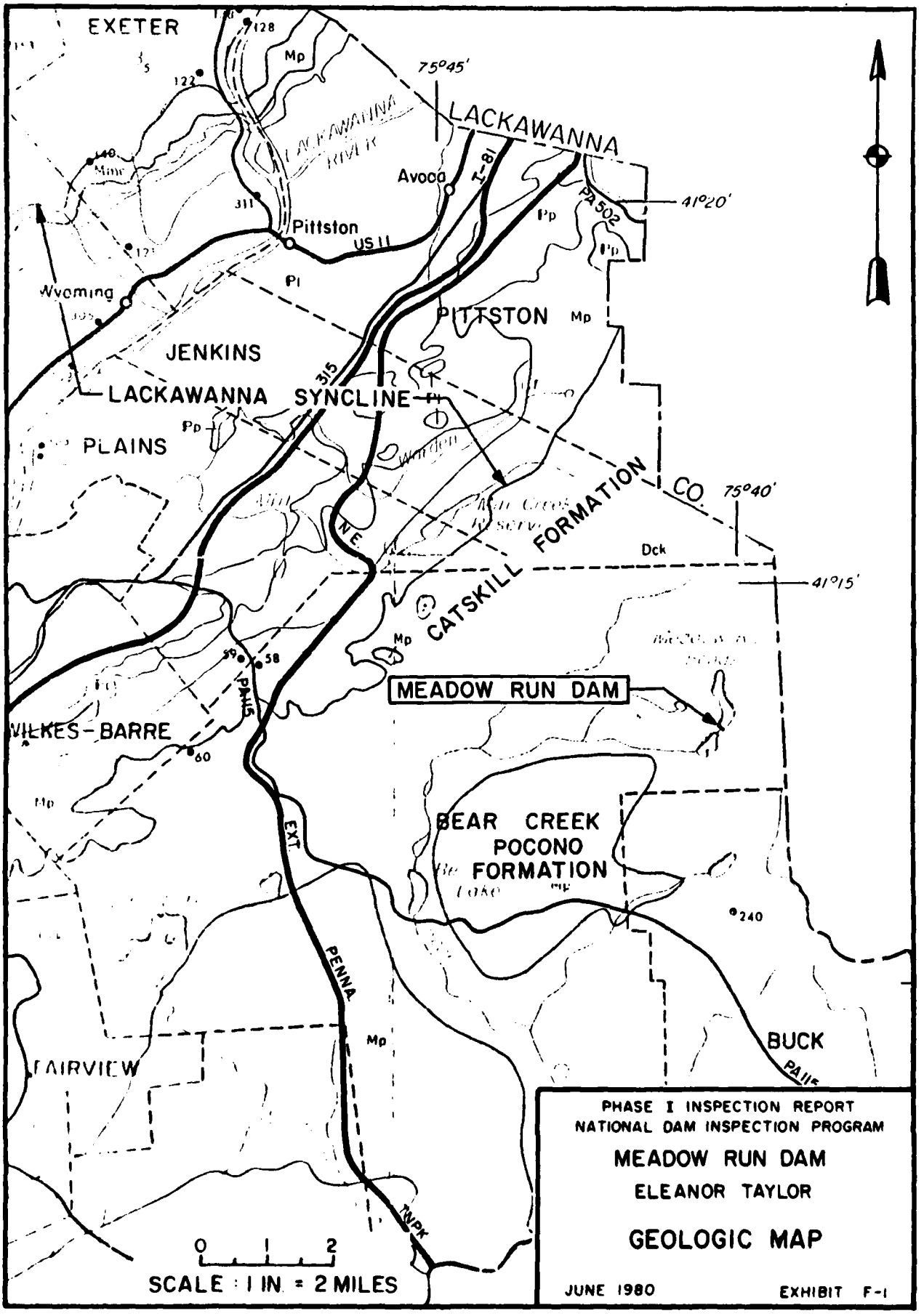
Bedrock units of the sections described above are the lithified sediments of offshore marine, marginal marine, deltaic, and fluvial environments associated with the Devonian Period. These units include siltstones of the Mahantango Formation, siltstones and shales of the Trimmers Rock Formation, and seven mapped members of the Catskill Formation. These members include sandstones, siltstones, and shales of the Towamensing Member; sandstone, siltstone and shales of the Walcksville Member; sandstones, siltstones and shale of the Beaverdam Run Member; sandstone and shale in the Long Run Member; sandstones and conglomerates in the Packerton Member; sandstone and some conglomerates in the Poplar Gap Member; and sandstones and conglomerates in the Duncannon Member.

Meadow Run Dam is underlain by the Duncannon Member of the Catskill Formation. The Duncannon Member is predominantly a conglomerate and sandstone unit with some

red siltstone and shale. Conglomerates present are generally thick-bedded with subangular to well-rounded quartz pebbles in a coarse-grained sandstone matrix. They are very well indurated and have low porosity due to silica cementation. The sandstones are predominantly fine-to medium-grained, thin-to thick-bedded and well-indurated with a clay and silica cement. Red sandstones near the top of the unit grade into red siltstone and shale, marking the contact with the Spechty Kopf Formation.

The Duncannon Member maintains very steep cut slopes. It is reported to be an excellent foundation for heavy structures. Bedrock is almost entirely overlain by till of Late Wisconsin Age. This till is basically an unsorted mixture of clay, silt, sand, and gravel. It is moderately cohesive and is generally derived locally from the sandstones of the Catskill Formation. Thickness of the till varies from 3 to 100 feet.

Available information, which is scant, indicates that the dam is probably founded on this till.


EXETER
LACKAWANNA
75°45'
41°20'
Avoca
I-81
PA502
Pittston
US11
Wyoming
PITTSTON
JENKINS
LACKAWANNA SYNCLINE
315
PLAINS
CATSKILL FORMATION
CO
75°40'
NE
Dck
41°15'
MEADOW RUN DAM
WILKES-BARRE
PA115
EXT
PENNA
BEAR CREEK
POCONO
FORMATION
BUCK
FAIRVIEW
TNPK
0 1 2
SCALE : 1 IN. = 2 MILES
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
MEADOW RUN DAM
ELEANOR TAYLOR
GEOLOGIC MAP
JUNE 1980
EXHIBIT F-1