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NATIONAL DAM INSPECTION PROGRAM. DEER LAKE DAM. NDI NUMBER PA-0--ETC(U)

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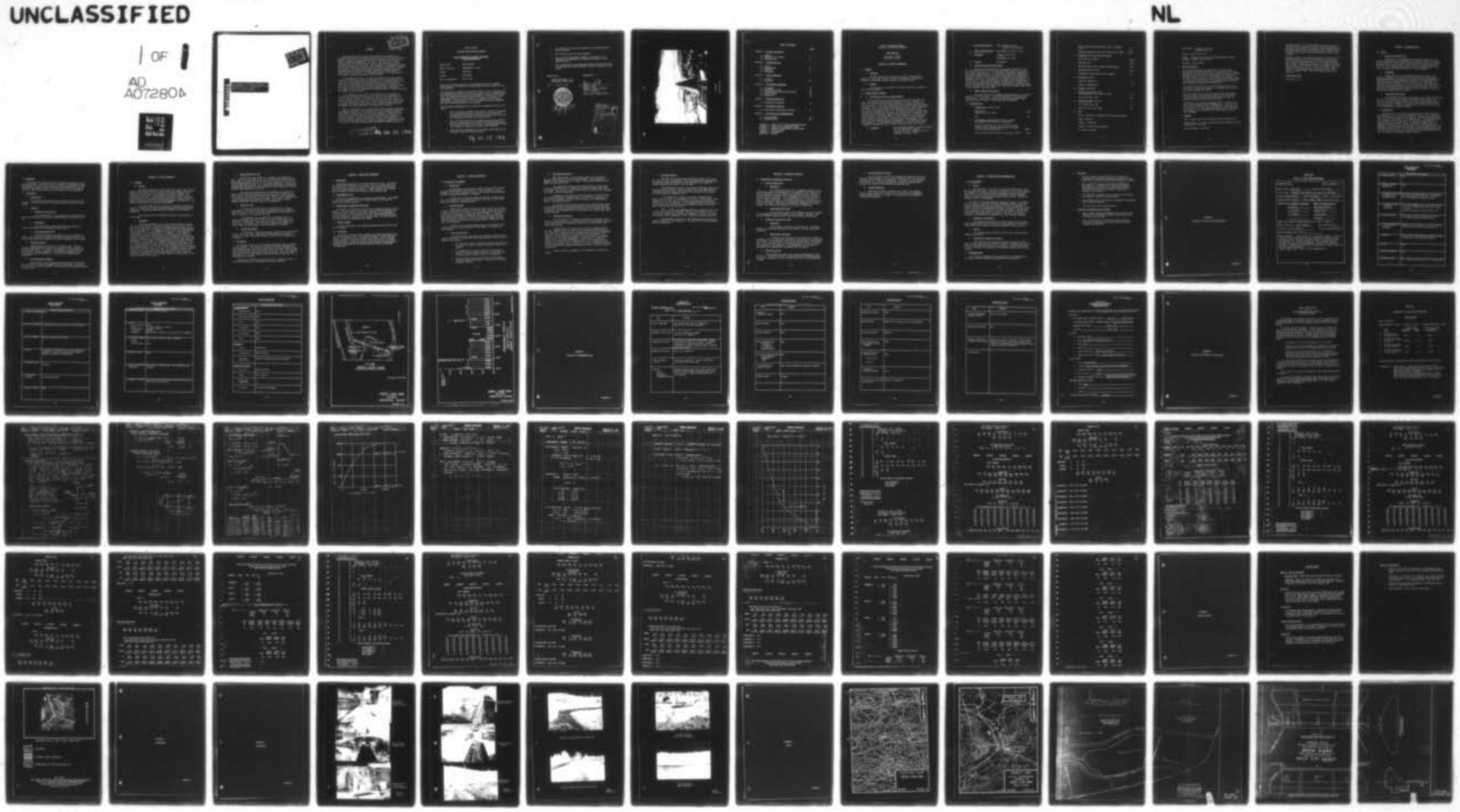

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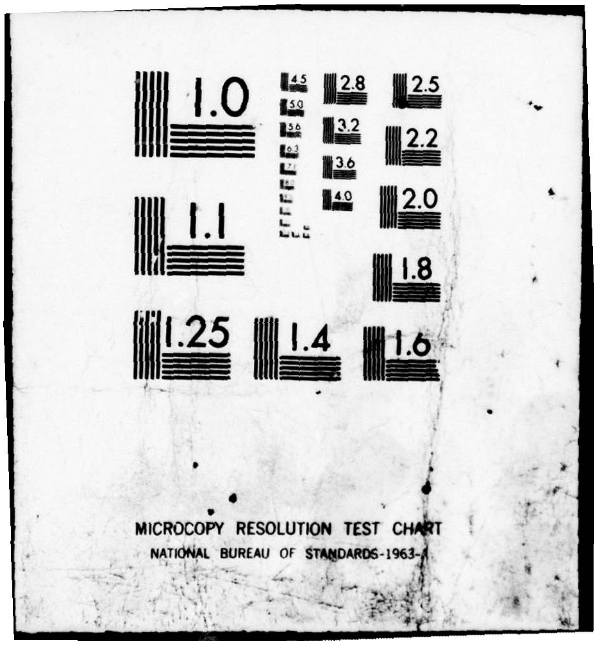
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Deer Lake Dam. NDI Number PA-00834.
DER Number 54-112. Delaware River Basin.
Schuylkill County, Pennsylvania.
Phase I Inspection Report.

PREFACE

This report has been 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.

PHASE I REPORT

NATIONAL DAM INSPECTION PROGRAM

BRIEF ASSESSMENT OF GENERAL CONDITIONS AND RECOMMENDATIONS

Name of Dam:	DEER LAKE DAM
State & State No:	PENNSYLVANIA, 54-112
County:	SCHUYLKILL
Stream:	PINE CREEK
Date of Inspection:	MAY 9, 1979

Based on the visual inspection, past performance and the available engineering data, the dam and its appurtenant structures appear to be in poor condition.

The hydrologic and hydraulic calculations indicate that the spillway for this dam has the capacity for passing 24 percent of the Probable Maximum Flood (PMF) without overtopping the embankment. Although 1/2 PMF will cause overtopping and possible failure of the dam, the hazard to life downstream of the dam is not significantly increased due to failure. The spillway, while inadequate, is not considered seriously inadequate. This dam is considered unsafe, non-emergency.

The following recommendations are presented for immediate action by the owner:

1. That the spillway abutment walls and box culvert be redesigned by a professional engineer experienced in the design and construction of dams and that these structures, after approval by the appropriate authority, be constructed.

2. That a detailed hydrologic and hydraulic engineering investigation be conducted by a professional engineer experienced in the design and construction of dams, to determine what measures can be taken to improve the capacity of the spillway.

3. That additional embankment fill be placed to the right of the spillway to provide a uniform height.

4. That adequate protection be provided on the upstream slope to prevent erosion.

5. That the sluice gates be made operable.

6. That a regular maintenance schedule of the slopes of the embankment be established to include the cutting of trees, brush and weeds.

7. That a surveillance and downstream warning system be developed for implementation during periods of high or prolonged precipitation.

SUBMITTED BY:

BERGER ASSOCIATES, INC.
HARRISBURG, PENNSYLVANIA

DATE: July 13, 1979

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
HENDRIK JONGSMA
ENGINEER
No. 5557E

APPROVED BY:

James W. Peck

JAMES W. PECK
Colonel, Corps of Engineers
District Engineer

DATE 28 July 1979

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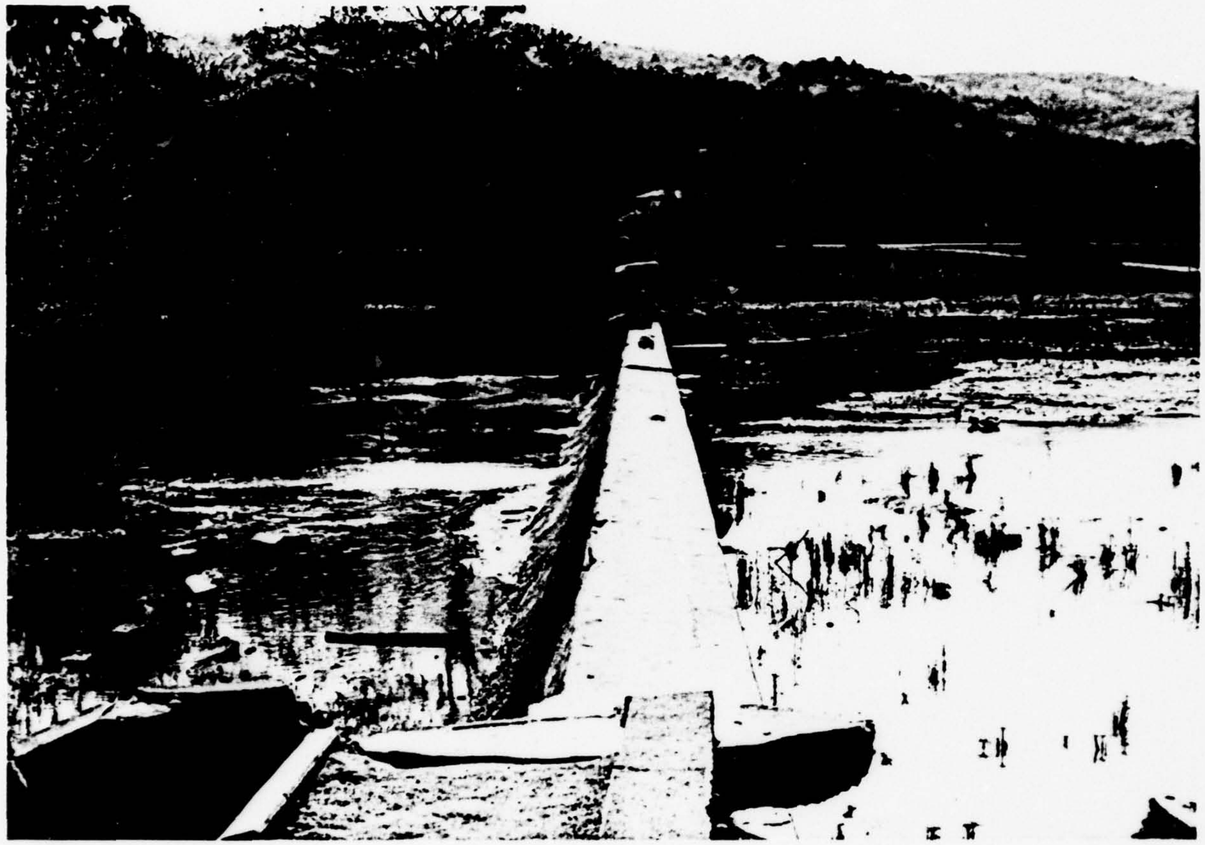

OVERVIEW

DEER LAKE DAM

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PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DEER LAKE DAM

NDI-ID NO. PA-00834
DER-ID NO. 54-112

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 inspections of dams throughout the United States.

B. Purpose

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

1.2 DESCRIPTION OF PROJECT

A. Description of Dam and Appurtenances

ABSTRACT

Deer Lake Dam is an earthfill structure with a concrete core wall. The length of the earthfill structure is about 1,430 feet of which 630 feet crosses the valley and 800 feet is along the right bank of the reservoir. A 245 foot long spillway is located across the original streambed. The concrete gravity spillway section has a crest elevation of 3 feet below the low point of the embankment and contains three sluice gates (Appendix F, Plate IV). The lake was used as a recreational facility, but considerable siltation has occurred in the reservoir. Two sluice gates are partially opened to permit drying out of the silt for future removal. To increase flow in the left corner of the reservoir, and to prevent stagnant water in this area used for swimming, a box culvert was constructed through the embankment. This culvert is in very poor condition. The embankment crest elevation is about 12 feet above streambed, although most of the length is not more than 8 or 9 feet. ABSTRACT

B. **Location:** West Brunswick Township, Schuylkill County
U.S.G.S. Quadrangle - Auburn
Latitude 40°-37.3', Longitude 76°-03.4'
Appendix F, Plates I & II

C. Size Classification: Small (Height 12 feet)
(Storage 120 acre-feet)

D. Hazard Classification: High (Refer to Section 3.1.E)

E. Ownership: Borough of Deer Lake
R. D. #1
Orwigsburg, PA 17961

F. Purpose: Recreation

G. Design and Construction History

The permit for construction was approved on April 17, 1925, and construction of the core wall was under way in May of that year. Mr. George H. Steidel, P.E., of Pottsville, Pennsylvania, prepared the design and conducted some of the supervision during the construction. The heavy concrete spillway section was constructed with field stones embedded in concrete. The contractor for the structure is unknown. An inspection by a state representative in November, 1925 indicates that the dam was not constructed as shown on the drawings. The crest was uneven, the upstream slope did not have riprap protection and was eroded and the spillway crest was capped with a cap stone 12 inches wide on top of the original 4-foot wide crest.

H. Normal Operating Procedures

Deer Lake was used for swimming and fishing and as a supply of water for the fire company. A housing development is located on the eastern shore. There are no formal operating procedures for these facilities and all inflow is discharged over the spillway.

1.3 PERTINENT DATA

A. Drainage Area (square miles)

From files:	13.6
Computed for this report:	14
Use:	14

B. Discharge at Dam Site (cubic feet per second)
See Appendix C for hydraulic calculations

Maximum known flood, June 22, 1972 from records for the U.S.G.S. gaging station which is located 14 miles downstream from dam	3,200
Outlet works low-pool outlet at pool Eleve. 476.0	110

Outlet works at pool level Elev. 481.0 (spillway crest)	230
Spillway capacity at pool Elev. 484.0 (top of dam)	4,200

C. Elevation (feet above mean sea level)

Top of dam (low point)	484.0
Spillway crest	481.0
Upstream portal invert (Sluice Gate Openings)	472.7
Downstream portal invert	472.7
Streambed at centerline of dam - estimate	472

D. Reservoir (miles)

Length of normal pool	0.3
Length of maximum pool	0.5

E. Storage (acre-feet)

Spillway crest (Elev. 481) (Plus estimated 25 Acre-Feet of silt)	30
Top of dam (Elev. 484)	120

F. Reservoir Surface (acres)

Top of dam (Elev. 484)	51
Spillway crest (Elev. 481)	22

G. Dam

Refer to Plate III in Appendix F for plan and section.

Type: Earthfill.

Length: 1,430 feet.

Height: 12 feet above streambed.

Top Width: 10 feet.

Side Slopes: Upstream - 2H to 1V
Downstream 2H to 1V

Zoning: Concrete core wall.

Cutoff: Concrete core wall trench was excavated to solid foundation through gravel layers.

Grouting: None reported.

H. Outlet Facilities

The lake may be drained by opening the 2 foot by 3 foot sluice gates which are installed at the upstream end of three openings of the same size that pass through the gravity concrete spillway section of the dam. The openings are located near the ends and at the center of the 245-foot-long spillway. At the time of the inspection, the left opening was not discharging any water and it was reported by representatives of the owner to be completely plugged with drift and mud.

The center and right tunnels were discharging water at about 25 percent of their full capacity. It appeared that they too were partly plugged with drift.

The owners have tried to keep the lake drained since August 1978, but because of the limited capacity of the openings, the lake fills to spillway crest level whenever there is a moderate increase in the flow of the creek.

In addition to the spillway openings, there is a 3 foot by 3 foot culvert through the earth embankment at a point 345 feet to the left of the left end of the spillway. The invert of the culvert is 7.5 feet higher than the inverts of the spillway openings. The top and sides of this concrete culvert have collapsed.

I. Spillway

Type: Uncontrolled, broad crested reinforced concrete weir.

Length of Weir: 245 feet long with vertical reinforced concrete side walls 3.8 feet high.

Crest Elevation: 481.0 feet.

Upstream Channel: The concrete gravity spillway section of the dam is in the channel of the creek which was originally 9 feet below the crest of the spillway. At the present time the upstream channel bottom is covered with about 5 feet of mud, so the top of the mud is about 4 feet below the crest of the spillway.

Downstream Channel: The downstream side of the gravity spillway section has a slope of 1.6V to 1H with a 5-foot radius curve at the bottom leading into a 15-foot-long area paved with concrete. Beyond the paved area, the channel narrows to about 15 feet and the banks are about 3 feet high. The floodplain is about 200 feet wide. There is no sign of erosion. Apparently the paved area forms a stilling basin at high flows. A highway bridge 1,000 feet downstream forms a constriction.

J. Regulating Outlets

See Section 1.3.H.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

A. Hydrology and Hydraulics

Design data for the hydrologic and hydraulic design of this dam were not located in the PennDER files or with the Owner. The report on application for construction of these facilities, by the Pennsylvania Water and Power Resources Board, states that the spillway capacity is 4,400 cfs. This capacity was based on a 245 foot long spillway, with a crest elevation three feet below the top of the embankment.

B. Embankment

Design criteria for the embankment were not located. The information available in the files of the Pennsylvania Department of Environmental Resources (PennDER) was limited to the plans reproduced in Appendix F and the construction specifications. The embankment was constructed with a concrete core wall in its center. The trench for this wall was to be excavated to at least three feet below the existing ground to an impervious layer as directed by the Engineer. The core wall was to be reinforced with vertical #6 bars at ten foot centers and horizontal #6 bars at two foot centers.

C. Appurtenant Structures

The spillway is located in the center of the valley and consists of a 245 foot long concrete masonry broadcrested weir section. The previously mentioned report indicates that the spillway crest was about 8.5 feet above the streambed. The gravity type spillway section has three sluice gates. Stability analysis for the section were not located in the PennDER files or with the Owner.

2.2 CONSTRUCTION

Representatives of the Water and Power Resources Board inspected the foundation of the core wall and spillway in June, 1925, and reported that the foundation in general was adequate. Additional excavation was to be done for the spillway in the creek channel. An inspection report, dated December, 1925, states that the final construction was not in accordance with the approved plans. An as-built drawing (Plate IV, Appendix F) indicates that a cap was added to the spillway weir crest. Although the spillway abutment walls were increased an equal amount, the embankment was not raised. The protection on the upstream slope to two feet above the flow line was not installed and the paved apron below the weir was changed from embedded stones to concrete.

2.3 OPERATION

The reservoir was constructed for recreational purposes by a real estate developer. The lake was used for boating, swimming and fishing. Considerable siltation of this shallow reservoir occurred and the lake was drawn down several times to ascertain the feasibility of removing the silt. Operational records for the reservoir are not maintained.

2.4 EVALUATION

A. Availability

The available engineering data is contained in the files of PennDER. The owners stated that no design data was available in their offices.

B. Adequacy

1. Hydrology and Hydraulics

The available data is not considered to be sufficient to review the hydrologic and hydraulic engineering analysis made for this dam.

2. Embankment

The files did not contain sufficient information to review the adequacy of the embankment design criteria.

3. Appurtenant Structures

Design analysis for the spillway are not available for review. The files did not contain sufficient information of the foundation material under the spillway to review the adequacy of the section.

C. Operating Records

Formal records of operation are not maintained. The only available information was obtained from inspection reports written by State representatives. It appears that maintenance of the facilities has been poor. Repeated requests for raising the embankment to its design height were not followed up. Brush and tree growth was not controlled.

D. Post Construction Changes

In the 1950's, a box culvert was installed near the left abutment to provide an outlet for stagnent water in this area. A piece of the concrete core wall was removed. This structure has collapsed (Appendix E, Plate E-IV).

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

A. General

The general appearance of Deer Lake Dam is poor. The lake was drained last fall and two of the sluice gates are partially open in an effort to dry the silt in the reservoir for possible removal. This relatively low dam with a large drainage area is for the most part filled with silt (up to 4.3 feet below the spillway crest). The spillway training walls are broken and have fallen over. Sections of the adjacent embankment fill have been eroded (Appendix E, Plate E-II). The entire dam shows years of neglected maintenance.

The visual check list is presented in Appendix A, which also contains a profile of the dam and a general plan as surveyed during the inspection. Photographs taken during the inspection are included in Appendix E.

The inspectors were accompanied by several representatives of the Borough.

B. Embankment

The earth embankment of this long and low dam has a concrete core wall in its center. The main portion of the dam is built in an east to west direction and begins at a roadway which parallels the left side of the reservoir. The length of the left end of the dam embankment is about 500 feet. It is reasonably level and is in fair condition. The reservoir in this area was used for swimming. A fire house is located just beyond the downstream toe of the embankment in this area (Plate E-I, Section E). The next section of the dam is a 245 feet long concrete spillway section, followed by another 130 foot long section of embankment. At this point, the embankment turns and follows a roadway in a northerly direction over a length of approximately 800 feet. The top of the core wall is visible at several locations along this road. The maximum height of fill is about 12 feet, although most of the embankment has fill heights from 6 to 9 feet. The embankment section from the spillway to the west bend has the core wall exposed over most of its length and the upstream and downstream slopes are in poor condition (Plate E-II, Appendix E). The surveyed profile was taken on top of the core wall where it was visible.

C. Appurtenant Structures

The 245 foot long spillway is a gravity type broadcrested weir. This weir was topped at the time of construction with an 8-inch high corbel to increase the normal pool depth. Most of this corbel has been dislodged from the top of the weir (see photographs). The gravity section and downstream apron are in reasonably good shape, although some deterioration has occurred. Some seepage is coming through the concrete spillway (See Appendix E, Plate E-I).

The vertical upstream side of the spillway has three sluice gates, two of which were partially open at the time of inspection. A small culvert was constructed near the left abutment of the embankment to increase the flow of water in this area. This concrete structure has totally disintegrated and should be removed or restored to prevent washouts behind the core wall (Plate E-II, Appendix E).

D. Reservoir Area

Deer Lake was constructed as an attraction for a housing development. The reservoir was used for recreation and as a supply of water in case of a fire. Considerable siltation has occurred and the lake is useless as a recreational facility.

To investigate the possibilities of removing the silt, a permit was obtained to drain the lake. The west (right) side of the reservoir is undeveloped. The east (left) side of the reservoir has many houses. This area is flat and has the typical development of trees, lawns and brush growth. All banks appear to be stable.

E. Downstream Channel

The downstream channel is a natural stream with several houses located near the stream. About 900 feet downstream, State Route 61 crosses the stream. The hazard category for this dam is considered to be "High".

3.2 EVALUATION

The overall evaluation of the facilities indicates that the dam is in poor condition. The spillway wingwalls are severely damaged and a large discharge over the spillway could erode the downstream fill behind the core wall which could cause failure of the core wall. The upstream slope protection has deteriorated over large areas. The sluice gates on the spillway are in poor condition and the box culvert near the left embankment has collapsed.

Considerable maintenance and repair work is required in order to bring this facility to a satisfactory and usable condition.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

Operational procedures for Deer Lake Dam do not exist. All inflow was normally discharged over the spillway. Due to the heavy siltation in the reservoir, the sluice gates are in open position at the present but are partially plugged with debris. A heavy rainfall will, however, fill the reservoir due to the relatively large drainage area.

4.2 MAINTENANCE OF DAM

Little or no maintenance has occurred at this facility. The slopes are not well maintained and the fill height along the core wall is irregular at several locations.

4.3 MAINTENANCE OF OPERATING FACILITIES

The corbel on the spillway weir has been dislodged over most of its length. This has resulted in an actual height difference between crest of dam and crest of weir of three feet, which was the design height. The sluice gates on the spillway are in poor maintenance condition and one is not operable. Two gates are partially open. The box culvert at the east end of the embankment needs repair.

4.4 WARNING SYSTEM

A formal surveillance and downstream warning system does not exist at the present.

4.5 EVALUATION

Operational and maintenance procedures for these facilities do not exist at the present time. A considerable amount of repair and maintenance is required to place the dam and reservoir again in an operational condition. Failure of the dam could occur and it is strongly recommended that a formal surveillance and downstream warning system be developed immediately for use during periods of heavy or prolonged precipitation.

SECTION 5 - HYDROLOGY/HYDRAULICS

5.1 EVALUATION OF FEATURES

A. Design Data

The hydrologic and hydraulic analysis available from PennDER for Deer Lake Dam was not very extensive. No area-capacity curve, frequency curve, unit hydrograph, design storm, design flood hydrograph, nor flood routings were found in the files.

A review of the project prepared by the State in 1925 stated that "The capacity of this spillway is about 4,400 cfs, or 325 cfs per square mile, which is considered ample".

B. Experience Data

There were no records available for past floods, but a local resident recalled that the flood of June 22, 1972, raised the pool level to within six inches of the top of the earth embankment. The project passed that flood without a disastrous failure. There are, however, some structural failures which may have been caused by the 1972 flood. These include the collapse of a section of spillway wingwall and the partial collapse of the concrete box culvert which is 345 feet to the left of the spillway.

Because of the wide and shallow nature of the reservoir, the velocities are slow and the lake has filled almost to spillway level with sediment.

C. Visual Observations

On the date of the inpsection, the following conditions were observed that might interfere with the proper operation of the structure during a flood event.

1. The left sluice gate is completely plugged with drift and the other two operate at about 25 percent of their full capacity.

2. The wingwalls at the ends of the spillway should be restored to their original condition, so that they will properly protect the ends of the earth embankment.

3. The box culvert 345 feet to the left of the spillway should be removed and should be replaced with a properly designed structure.

D. Overtopping Potential

Deer Lake Dam has a total storage capacity of 120 acre-feet and an overall height of 12 feet above streambed. These dimensions indicate a size classification of "Small". The hazard classification is "High" (see Section 3.1.E).

The recommended Spillway Design Flood (SDF) for a dam having the above classifications is one-half the Probable Maximum Flood (PMF) to the PMF. For this dam, the PMF peak inflow is 17,400 cfs (see Appendix C for HEC-1 inflow computations).

Comparison of the estimated PMF peak inflow of 17,400 cfs with the estimated spillway discharge capacity of 4,160 cfs, using the low point in the embankment indicates that a potential for overtopping of the Deer Lake Dam does exist.

An estimate of the storage effect of the reservoir and routing of the computed inflow hydrograph through the reservoir shows that this dam does not have the necessary storage available to pass the PMF without overtopping. The spillway-reservoir system can pass a flood event equal to 24% of a PMF.

E. Dam Break Evaluation

The calculations to determine the behavior of the dam in the event of an overtopping and a resulting breach of the embankment indicates that there will be only a moderate increase in the water levels downstream from the dam.

Several houses are located about 4,000 feet downstream from the dam. Examination of the results of a dam break analysis using the U.S. Army Corps of Engineers HEC-1 programs indicates that the difference (increase) in the water surface level 4,000 feet downstream as the result of a breach failure as compared to that just prior to a breach failure is 0.6 foot when considering a 15 minute time to complete the breach and 0.1 foot when considering a 2-hour time to complete the breach. On the basis of this information, it is concluded that while slightly more property will be exposed to flooding, a breach of this dam will not significantly increase the hazard to loss of life in the downstream area.

Refer to Table 1, Appendix C, for comparison of flood water levels.

F. Spillway Adequacy

The small size category and high hazard category, in accordance with the Corps of Engineers criteria and guidelines, indicates that the Spillway Design Flood (SDF) for this dam should be one-half the Probable Maximum Flood (PMF) to the full PMF.

The calculations show that the spillway discharge capacity and reservoir storage capacity combine to handle 24% of the (PMF) without overtopping the dam. These calculations have considered the existing low point along the embankment crest.

It is judged that a breach in an earth embankment dam is likely to occur when it is overtopped by 0.5 foot or more of flow. Even though there is a core wall in this dam, the broken and deteriorated condition of the walls adjacent to the spillway minimizes the benefit of the core wall and a breach will in all probability occur in this area with a one-half PMF flow (0.9 feet).

With a 1/2 PMF, the embankment will be overtopped by more than 0.5 foot and a breach is indicated. However, since hazard to loss of life is not significantly increased as a result of a breach, the spillway capacity, while inadequate, is not considered seriously inadequate.

The hydrologic analysis for this investigation was based upon existing conditions of the watershed. The effects of future development were not considered.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

A. Visual Observations

1. Embankment

The visual observation of the embankment indicates that a considerable amount of maintenance work is required. The concrete core wall is exposed at several locations and backfill should be placed on the upstream and downstream sides to support the wall and to prevent erosion during overtopping. It is recommended to fill the crest of the dam to a uniform elevation. The upstream slope has to be protected against erosion with riprap and the downstream slopes should be cleared of brush and weeds. There was no indication of seepage or wet areas, however, the reservoir was drained at the time of inspection.

2. Appurtenant Structures

The box culvert near the left abutment has to be repaired or the embankment should be restored to its original condition. The spillway abutment walls should be repaired and properly backfilled.

B. Design and Construction Data

1. Embankment

The available information is very limited. The design, however, is considered adequate for the height of the dam with proper maintenance.

2. Appurtenant Structures

A review of the spillway section indicates an adequately designed section for stability and sliding. The details of the wingwalls are limited. It appears that they were constructed without reinforcing steel. The existing failure of these walls indicates that the design and construction was inadequate. The downstream apron is still in reasonably good condition and undermining was not evident.

C. Operating Records

Formal operating records have not been maintained for these facilities. Inspection reports by representatives of PennDER indicate that poor maintenance has been a problem since the dam was constructed in 1925.

D. Post Construction Changes

The box culvert near the left abutment was added in the 1950's. The total disintegration of this structure indicates that the design and detailing of this culvert was inadequate. It probably was supported on the concrete core wall and provisions were not made to prevent undermining of the slabs at the downstream and upstream ends.

E. Seismic Stability

This dam is located in Seismic Zone 1 and it is considered that the static stability is sufficient to withstand minor earthquake induced dynamic forces. No studies or calculations have been made to confirm this assumption.

SECTION 7 - ASSESSMENT AND RECOMMENDATIONS

7.1 DAM ASSESSMENT

A. Safety

Deer Lake Dam, on the basis of the visual inspections, available drawings and historic records, is considered to be in poor condition. The failure of the spillway abutment walls and the failure of the box culvert near the left abutment of the embankment calls for immediate repair to prevent serious problems during a large outflow. The dam is considered unsafe, non-emergency.

The results of the hydrologic and hydraulic studies, in accordance with the Corps of Engineers' evaluation guidelines indicates that the spillway discharge and reservoir storage do not have the capacity for passing the PMF without overtopping the dam. The data shows the capacity to be 24 percent of the PMF without causing overtopping. Although one-half of PMF could cause failure of the dam, the hazard to loss of life downstream is not significantly increased. Therefore, the spillway capacity is considered to be inadequate, but not seriously inadequate.

B. Adequacy of Information

The information available for review together with the observations made during the visual inspection are considered to be sufficiently adequate for making a reasonable assessment of this facility.

C. Urgency

The recommendations presented in this report should be given immediate attention.

D. Necessity for Additional Studies

The results of this inspection indicate the need for additional detailed hydrologic and hydraulic studies to determine the requirements for improving the capacity of the spillway. Studies should also be made to evaluate the redesign of the spillway abutment walls and box culvert.

7.2 RECOMMENDATIONS

The following recommendations are presented for consideration by the owner in order to improve the condition of this facility.

A. Facilities

1. That the spillway abutment walls and box culvert be redesigned by a professional engineer experienced in the design and construction of dams and appurtenant structures.

2. That a detailed hydrologic and hydraulic engineering investigation be conducted by a professional engineer experienced in the design and construction of dams, to determine what measures can be taken to improve the capacity of the spillway.

3. That additional embankment fill be placed to the right of the spillway to provide a uniform height.

4. That adequate riprap protection be provided on the upstream slope to prevent erosion.

5. That the sluice gates be made operable.

B. Operation and Maintenance Procedures

1. That a regular maintenance schedule of the slopes of the embankment be established that will include the cutting of trees, brush and weeds.

2. That a surveillance and downstream warning system be developed for implementation during periods of high or prolonged precipitation.

APPENDIX A

CHECKLIST OF VISUAL INSPECTION REPORT

CHECK LIST

PHASE I - VISUAL INSPECTION REPORT

PA DER # 54-112 NDI NO. PA-00 834

NAME OF DAM Deer Lake HAZARD CATEGORY High

TYPE OF DAM Earthfill with concrete core wall over full height

LOCATION West Brunswick TOWNSHIP Schuylkill COUNTY, PENNSYLVANIA

INSPECTION DATE 5/9/79 WEATHER Sunny - Warm TEMPERATURE 70's

INSPECTORS:	OWNER'S REPRESENTATIVE(s):
R. Houseal (Recorder)	Mrs. Harry Mehlman
R. Steacy	Kenneth Behler
A. Bartlett	Jack McCallus
H. Jongsma	Art Nagle

NORMAL POOL ELEVATION: 481.0 (U.S.G.S.) AT TIME OF INSPECTION:

BREAST ELEVATION: 484.0 (Design) POOL ELEVATION: 477.5

SPILLWAY ELEVATION: 481.0 TAILWATER ELEVATION: 472

MAXIMUM RECORDED POOL ELEVATION:

GENERAL COMMENTS: This facility is in very poor condition. The lake has been drained completely with only a meandering channel flowing through the area. The entire reservoir area is covered with a heavy silt deposit. The concrete spillway is in fair condition and the spillway abutments are nearly destroyed. The walls are broken and displaced. Considerable repairs will be necessary in order to put this dam into useable condition.
Drained August, 1978 - before in 1939 (Sedimentation)

NDI NO. PA-00 834

VISUAL INSPECTION
EMBANKMENT

	OBSERVATIONS AND REMARKS
A. SURFACE CRACKS	None.
B. UNUSUAL MOVEMENT BEYOND TOE	None.
C. SLOUGHING OR EROSION OF EMBANKMENT OR ABUTMENT SLOPES	The slope on the upstream side was faced with hand laid riprap and cemented. This surface has been damaged at several locations.
D. ALIGNMENT OF CREST: HORIZONTAL: VERTICAL:	Horizontal alignment good, with a sharp angle at right abutment where core wall is under roadway. Vertical alignment see profile Plate A-II.
E. RIPRAP FAILURES	Some riprap has been displaced at random locations along the upstream slope.
F. JUNCTION EMBANKMENT & ABUTMENT OR SPILLWAY	Abutments with spillway are in poor condition. Concrete walls are broken and displaced.
G. SEEPAGE	None observed along embankment section because because the lake has been drawndown.
H. DRAINS	None.
J. GAGES & RECORDER	None.
K. COVER (GROWTH)	Top - exposed concrete core wall and some grass.

VISUAL INSPECTION
OUTLET WORKS

	OBSERVATIONS AND REMARKS
A. INTAKE STRUCTURE	None.
B. OUTLET STRUCTURE	A collapsed concrete box near the left abutment.
C. OUTLET CHANNEL	Natural stream below spillway.
D. GATES	On spillway - 3 gates - one on each end and one in center. Two partially opened for drawdown. Operable condition is questionable.
E. EMERGENCY GATE	As above.
F. OPERATION & CONTROL	No operational plan.
G. BRIDGE (ACCESS)	None.

NDI NO. PA-00 834

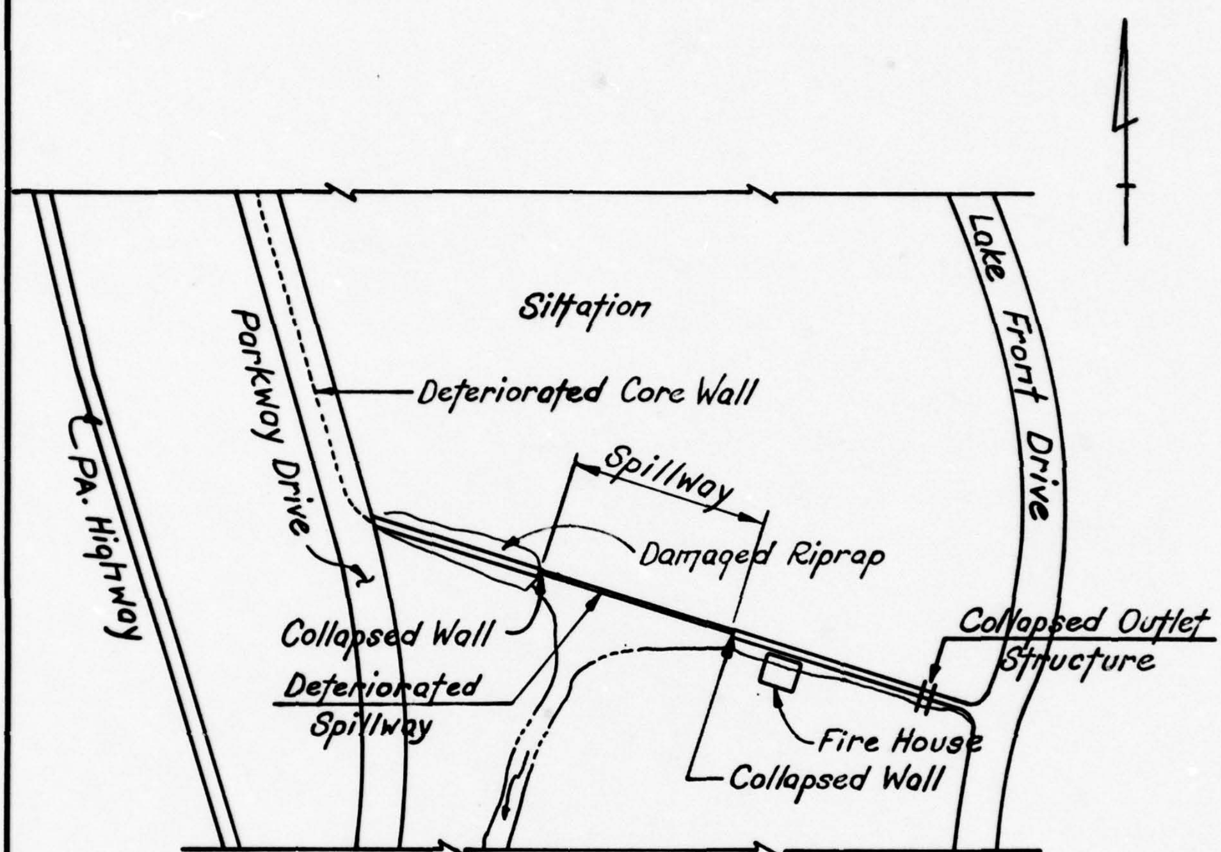
VISUAL INSPECTION
SPILLWAY

	OBSERVATIONS AND REMARKS
A. APPROACH CHANNEL	Directly from reservoir.
B. WEIR: Crest Condition Cracks Deterioration Foundation Abutments	 Fair. No major cracks on concrete. Concrete surface. Unknown. Badly broken portions of the walls have collapsed.
C. DISCHARGE CHANNEL: Lining Cracks Stilling Basin	Small apron, appears in good condition. None.
D. BRIDGE & PIERS	None.
E. GATES & OPERATION EQUIPMENT	None except 3 sluice ways. Two in partial open position.
F. CONTROL & HISTORY	With heavy rain the reservoir fills and the water flows over the spillway.

NDI NO. PA-00 834

VISUAL INSPECTION

	OBSERVATIONS AND REMARKS
INSTRUMENTATION	
Monumentation	None.
Observation Wells	None.
Weirs	None.
Piezometers	None.
Staff Gauge	None.
Other	None.
RESERVOIR	
Slopes	Residential.
Sedimentation	Major problem.
Watershed Description	Partially wooded, partially developed.
DOWNSTREAM CHANNEL	
Condition	Natural stream.
Slopes	Flat, stable.
Approximate Population	10
No. Homes	Few homes plus highway.

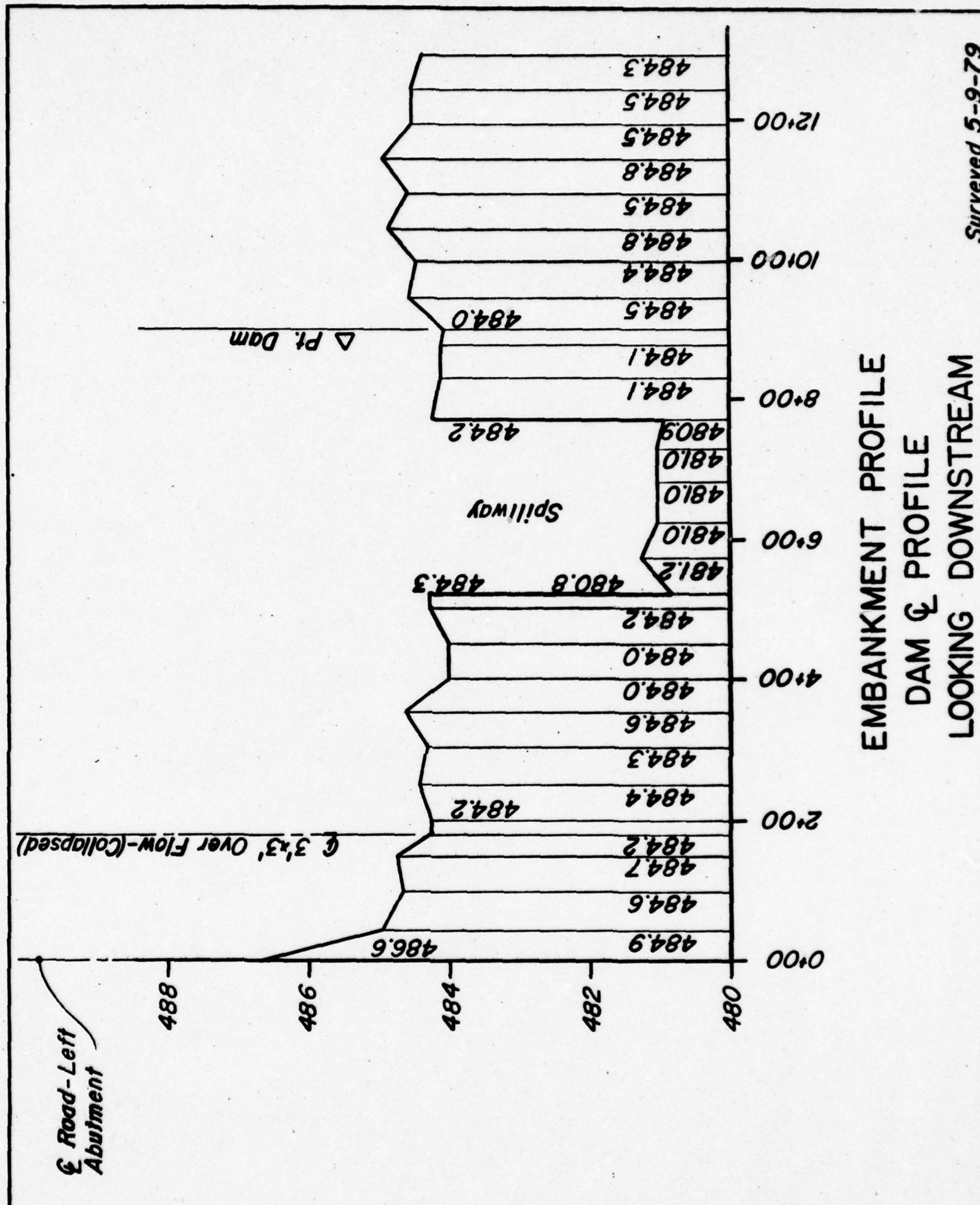


PLAN
DEER LAKE DAM

Surveyed 5/9/79

DEER LAKE DAM
PA.834
INSPECTION SURVEY

PLATE A-I



DEER LAKE DAM
PA-834
INSPECTION SURVEY

PLATE A-II

APPENDIX B

CHECKLIST OF ENGINEERING DATA

CHECK LIST
ENGINEERING DATA

PA DER # 54-112 NDI NO: PA-00834

NAME OF DAM Deer Lake Dam

ITEM	REMARKS
AS-BUILT DRAWINGS	For spillway see Plate IV, Appendix F. None of core wall and embankment.
REGIONAL VICINITY MAP	U.S.G.S. Quadrangle, Auburn See Plate II, Appendix F
CONSTRUCTION HISTORY	Constructed in 1925 for a development company. No records of depth of core wall. Inspection indicates that crest of earthfill was not at elevation of spillway abutment walls. Upstream slope unprotected.
GENERAL PLAN OF DAM	Plate III, Appendix F.
TYPICAL SECTIONS OF DAM	Plate III, Appendix F. Length of dam about 1,600 feet and 9 feet high.
OUTLETS: PLAN DETAILS CONSTRAINTS DISCHARGE RATINGS	Spillway drawing indicates 3 sluice gates on a gravity type spillway. Spillway crest is 245 feet long with a reported discharge in 1925 of 4,400 cfs.

NDI NO. PA-00 834

ENGINEERING DATA

ITEM	REMARKS
RAINFALL & RESERVOIR RECORDS	None.
DESIGN REPORTS	None.
GEOLOGY REPORTS	None.
DESIGN COMPUTATIONS: HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None.
MATERIALS INVESTIGATIONS: BORING RECORDS LABORATORY FIELD	None.
POST CONSTRUCTION SURVEYS OF DAM	None, except inspection reports by PennDER.
BORROW SOURCES	Unknown.

ENGINEERING DATA

ITEM	REMARKS
MONITORING SYSTEMS	None.
MODIFICATIONS	Added outlet structure near left abutment.
HIGH POOL RECORDS	Unknown.
POST CONSTRUCTION ENGINEERING STUDIES & REPORTS	None.
PRIOR ACCIDENTS OR FAILURE OF DAM Description: Reports:	None.
MAINTENANCE & OPERATION RECORDS	None.
SPILLWAY PLAN, SECTIONS AND DETAILS	Plate IV, Appendix F.

ENGINEERING DATA

ITEM	REMARKS
OPERATING EQUIPMENT, PLANS & DETAILS	Three sluice gates.
CONSTRUCTION RECORDS	None.
PREVIOUS INSPECTION REPORTS & DEFICIENCIES	Inspection reports by PennDER. These reports indicate low crest elevations, serious deterioration of spillway and spillway abutment walls. Trees on earthfill embankment.
MISCELLANEOUS	

CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: Mostly agriculture and some housing developments.

ELEVATION:

TOP NORMAL POOL & STORAGE CAPACITY: Elev. 481 30 Acre-Feet

TOP FLOOD CONTROL POOL & STORAGE CAPACITY: Elev. 484 120 Acre-Feet

MAXIMUM DESIGN POOL: Elev. 484

TOP DAM: Elev. 484

SPILLWAY:

a. Elevation 481

b. Type Uncontrolled broadcrested weir.

c. Width 245

d. Length 4

e. Location Spillover Right side of valley.

f. Number and Type of Gates 3 sluice gates below weir.

OUTLET WORKS:

a. Type 3 sluice gates.

b. Location One in center and one at each end of spillway.

c. Entrance inverts 472.7

d. Exit inverts 472.7

e. Emergency drawdown facilities Three sluice gates not accessible during flow over spillway.

HYDROMETEOROLOGICAL GAGES:

a. Type None.

b. Location

c. Records

MAXIMUM NON-DAMAGING DISCHARGE: Unknown.

APPENDIX C

HYDROLOGY AND HYDRAULIC CALCULATIONS

SUMMARY DESCRIPTION
OF
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION

The hydrologic and hydraulic evaluation for this inspection report has employed computer techniques using the Corps of Engineers computer program identified as the Flood Hydrograph Package (HEC-1) Dam Safety Version.

The program has been designed to enable the user to perform two basic types of hydrologic analyses: (1) the evaluation of the overtopping potential of the dam, and (2) the capability to estimate the downstream hydrologic-hydraulic consequences resulting from assumed structural failures of the dam. A brief summary of the computation procedures typically used in the dam overtopping analysis is shown below.

- Development of an inflow hydrograph to the reservoir.

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

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

The output data provided by this program permits the comparison of downstream conditions just prior to a breach failure with that after a breach failure and the determination as to whether or not there is a significant increase in the hazard to loss of life as a result of such a failure.

The results of the studies conducted for this report are presented in Section 5.

For detailed information regarding this program refer to the Users Manual for the Flood Hydrograph Package (HEC-1) Dam Safety Version prepared by the Hydrologic Engineering Center, U. S. Army Corps of Engineers, Davis, California.

TABLE NO.1

COMPARISON OF WATER SURFACE ELEVATIONS

DEER LAKE DAM

PMF = 17,400 cfs

Crest Eelvation - 484.0   Low Point - 484.0   Spillway Elevation - 481.0

	STAGE	CREST OF DAM ELEVATION	CREST OF DAM DEPTH	4,000' D/S of DAM* ELEVATION
A.	At Low Point in Embankment Crest	484.0	0	469.3
B.	36% PMF Overtopping No Breach	484.52	.52	470.7
C.	36% PMF Overtopping (15 Min. Breach)	484.5	.5	471.3
D.	36% PMF Overtopping (2 Hour Breach)	484.5	.5	470.8

*Several houses located about 4,000 feet downstream of Deer Lake Dam.

Condition C: (Time refers to elapsed time after start of storm).
Time to reach breach elevation 484.5 at dam = 43.25 Hours.
Water level 4,000' downstream at 43.25 Hours = 470.7.
Duration of breach = 15 Minutes.
Time for Breach to peak 4,000' downstream = .5 Hours.
Peak elevation 4,000' downstream due to breach = 471.3.
Rate of increase in water level = 0.6' in 15 Minutes.

PROJECT Dam Investigation SHEET NO. ___ OF ___
SUBJECT Deer Lake Dam, ID No. PA-834
COMPUTED BY RES DATE May 21, 1979 CHECKED BY JJPJr

Estimate of Maximum Known Flood

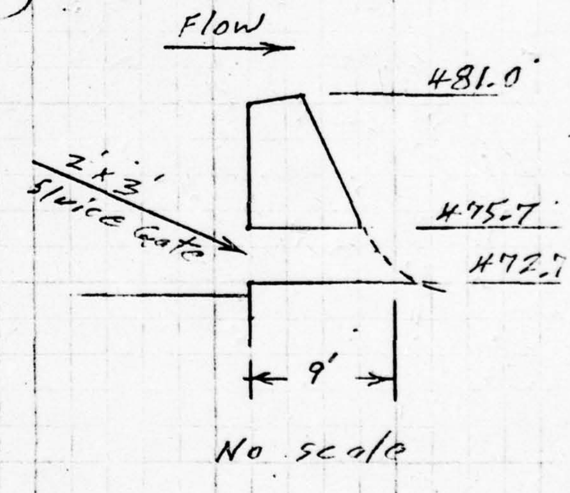
Deer Lake Dam is on Pine Creek which is tributary to Schuylkill River. USGS gaging station, Schuylkill River at Berne is 14 miles downstream from the dam.

Flood of record at Berne gage (1947 to 1976) 42,800 cfs June 22, 1972 (355 mi²)

$$\left(\frac{14}{355}\right)^{0.8} \times 42{,}800 = 3200 \text{ cfs}$$

Outlet works This dam has a concrete gravity spillway section 245 feet long located in the original channel of Pine Creek. The gravity section is provided with three sluice gates, each 2 ft wide and 3 ft high. One sluice gate is in the center of the gravity section, and there is one gate at each end. The spillway crest is at elev. 481 and the inverts of the gates are at elev. 472.7.

There is also a culvert-type 3 ft x 3 ft gated opening thru the embankment 345 ft to the left of the left end of the spillway. Invert Elev. 480.2; It needs repairs.



Pool Elev. 481.0

Each sluice gate

$Q = ca\sqrt{2gh}$ $c = 0.6$, $a = 2 \times 3 = 6 \text{ ft}^2$

$$h = 481 - \left(\frac{475.7 + 472.7}{2}\right) = 6.8 \text{ ft}$$

$$Q = 0.6 \times 6 \times \sqrt{64.3 \times 6.8} = 75.3 \text{ cfs}$$

culvert $Q = CL(H)^{3/2}$ $c = 2.67$, $L = 3$

$$H = 481 - 480.2 = 0.8$$

$$Q = 2.67 \times 3 \times (0.8)^{3/2} = 5.7 \text{ cfs}$$

PROJECT Dam Investigation SHEET NO. [illegible] OF [illegible]
SUBJECT Deer Lake Dam, ID No. PA-834
COMPUTED BY RES DATE May 23, 1979 CHECKED BY JJP Jr.

Outlet Works (Cont.)
Pool Elev. 481.0 (Cont.)

3 sluice gates @	75.3	=	225.9
1 culvert @	5.7	=	5.7
	Total		231.6

Use 230 cfs.

Pool Elev. 476.0
Each Sluice Gate

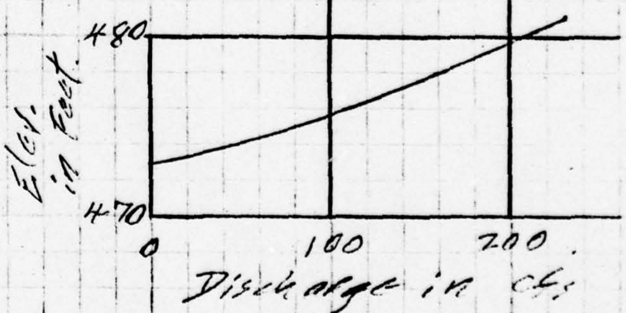
$Q = ca\sqrt{2gh}$ $c = 0.6$, $a = 2 \times 3 = 6\ ft^2$

$h = 476 - \left(\frac{475.7 + 472.7}{2}\right) = 1.8$

$Q = 0.6 \times 6 \times \sqrt{64.3 \times 1.8} = 38.7$ cfs

3 sluice Gates @	38.7	=	116.1
culvert			None
	Total		116.1

Say 110 cfs.



Outlet works

PROJECT Dam Investigation SHEET NO. 2 OF 9

SUBJECT Deer Lake Dam, ID No. PA-834

COMPUTED BY RES DATE May 22, 1979 CHECKED BY JJP/R

Spillway Rating

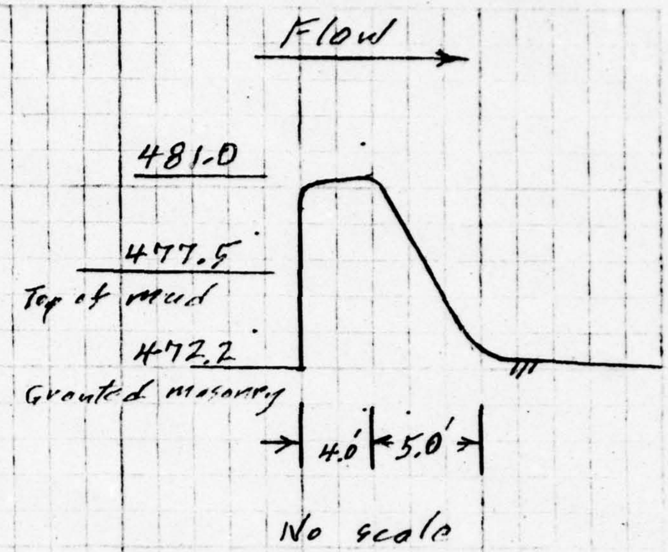
$Q = CLH^{3/2}$

$C = 3.27$ at $h = 3.0'$

$C = 3.54$ at $h = 1.0'$

Ref. Brater + King 6th Edition

Fig. 5-22.

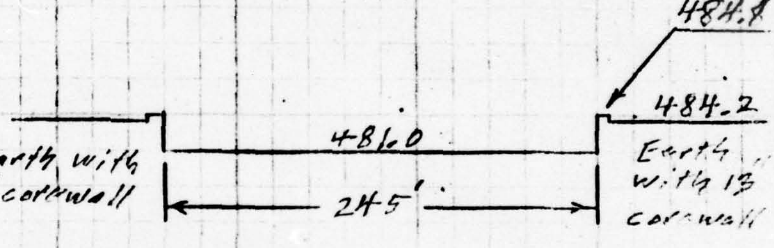


Pool Elev. 484

$Q = CLH^{3/2}$

$= 3.27 \times 245 \times (3)^{3/2}$

$= 4,160$ cfs



Pool Elev. 482

$Q = CLH^{3/2}$

$= 3.54 \times 245 \times (1)^{3/2}$

$= 870$ cfs

Pool Elev. 485

Est. Creek Slope = 0.0029

C for dike = 2.68

Ref. Brater + King, 6th Edition Table 5-3

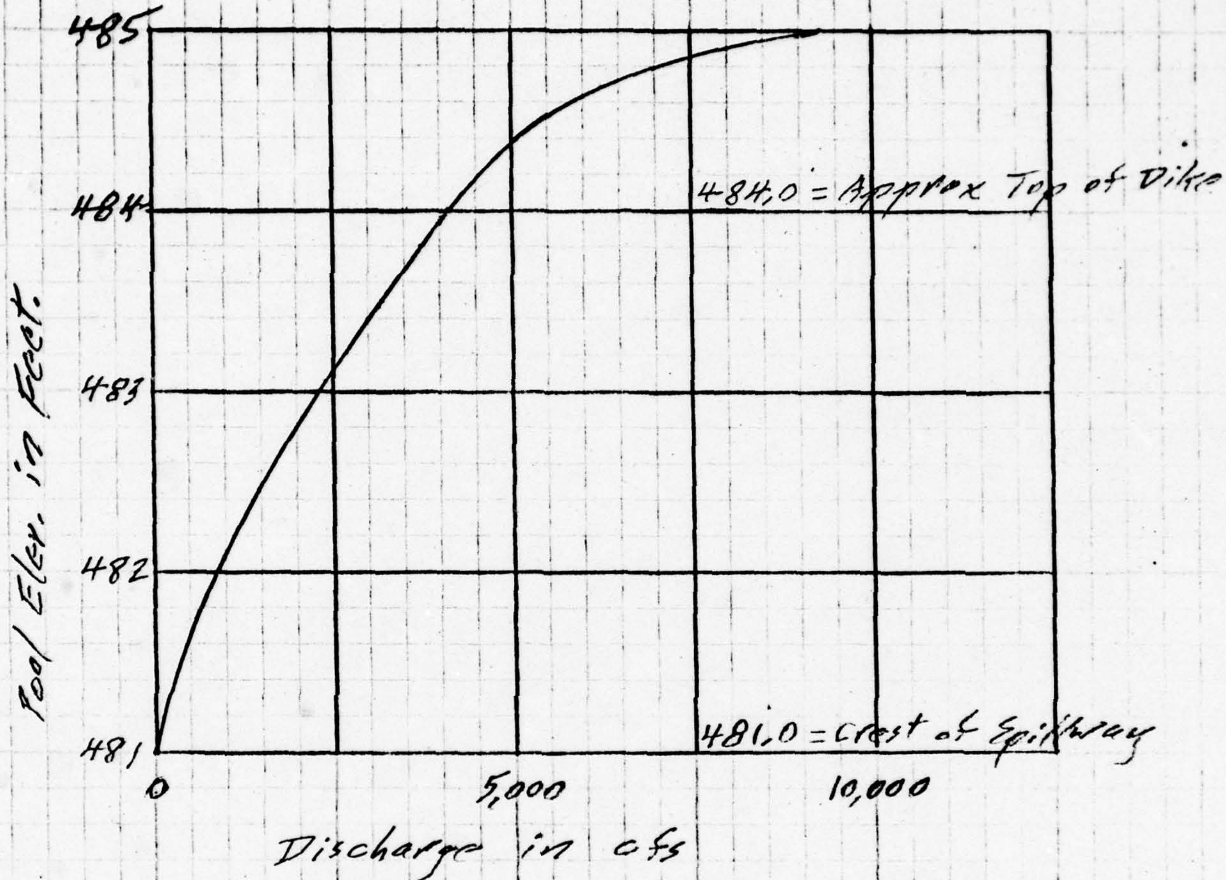
Sta.	Crest Elev.	Wat. Surf.	H	L	C	Q	W. AT. SURF. 486 H	Q
0+00 to 1+00	485.4	485.0	0	100	—	—	.6	125
1+00 to 3+00	484.4	485.0	0.6	200	2.68	249	1.6	1085
3+00 to 5+20	484.2	485.0	0.8	220	2.68	422	[illegible]	1424
5+20 to 7+65	481.0	485.0	4.0	245	3.25	6370	5	8902
7+65 to 9+00	484.1	485.0	0.9	135	2.68	309	1.9	998
9+00 to 10+40	484.4	485.2	0.8	140	2.68	268	1.8	906
10+40 to 12+90	484.6	485.8	1.2	250	2.68	881	2.2	2186
12+90 to 16+00	—	486.6	1.0*	310	2.68	831	2.0	[illegible]
				Total		9,200		[illegible]

PROJECT Dam Investigation SHEET NO. 4 OF 8

SUBJECT Deer Lake Dam, I.D. No. PA-834

COMPUTED BY RES DATE May 23, 1979 CHECKED BY JJP Jr.

Spillway Rating, (Cont.)



SIZE CLASSIFICATION:

MAXIMUM STORAGE = 120 ACRE-FEET

MAXIMUM HEIGHT = 12 FEET

SIZE CLASSIFICATION IS "SMALL"

HAZARD CLASSIFICATION:

SEVERAL HOUSES ARE LOCATED NEAR THE DOWNSTREAM CHANNEL AND A STATE HIGHWAY CROSSES THE STREAM. USE HIGH.

RECOMMENDED SPILLWAY DESIGN FLOOD.

THE ABOVE CLASSIFICATIONS INDICATE USE OF AN SDF EQUAL TO ONE HALF THE PROBABLE MAXIMUM FLOOD TO THE PROBABLE MAXIMUM FLOOD.

HEC-1 DATA

DRAINAGE AREA = 14 SQ. MI.

DELAWARE BASIN REGION 6

$C_P = 0.40$

$C_T = 1.35$

LONGEST WATERCOURSE = 7.76 MI.

L TO CENTROID = 4.17 MI.

$$T_P = C_T \, (L \times L_{CA})^{.3}$$

$$T_P = 3.8$$

RAINFALL (HMR-33)

INDEX (200 SQ. MI. - 24 HR.) = 22.8"

ZONE 6

INCREMENTAL RAINFALL

6 HR = 110 %

12 HR = 120 %

24 HR = 129 %

48 HR = 140 %

PLANIMETERED AREAS (FROM QUAD SHEETS)

ELEV. 481 = 22 ACRES

ELEV. 500 = 203 ACRES

ZERO STORAGE ELEVATION

ELEV. = 481 - (STORAGE × 3/AREA)

= 476.9

BREACH ASSUMPTIONS

BREACH WIDTH = 50' = BOTTOM WIDTH OF LOW AREA

SIDE SLOPES (EARTH EMBANKMENT) = 1:1

FAILURE TIME (EARTH EMBANKMENT) =
BETWEEN 15 MIN. AND 2 HR.
USE: .25 HR, .5 HR., 1.0 HR., 2.0 HR.

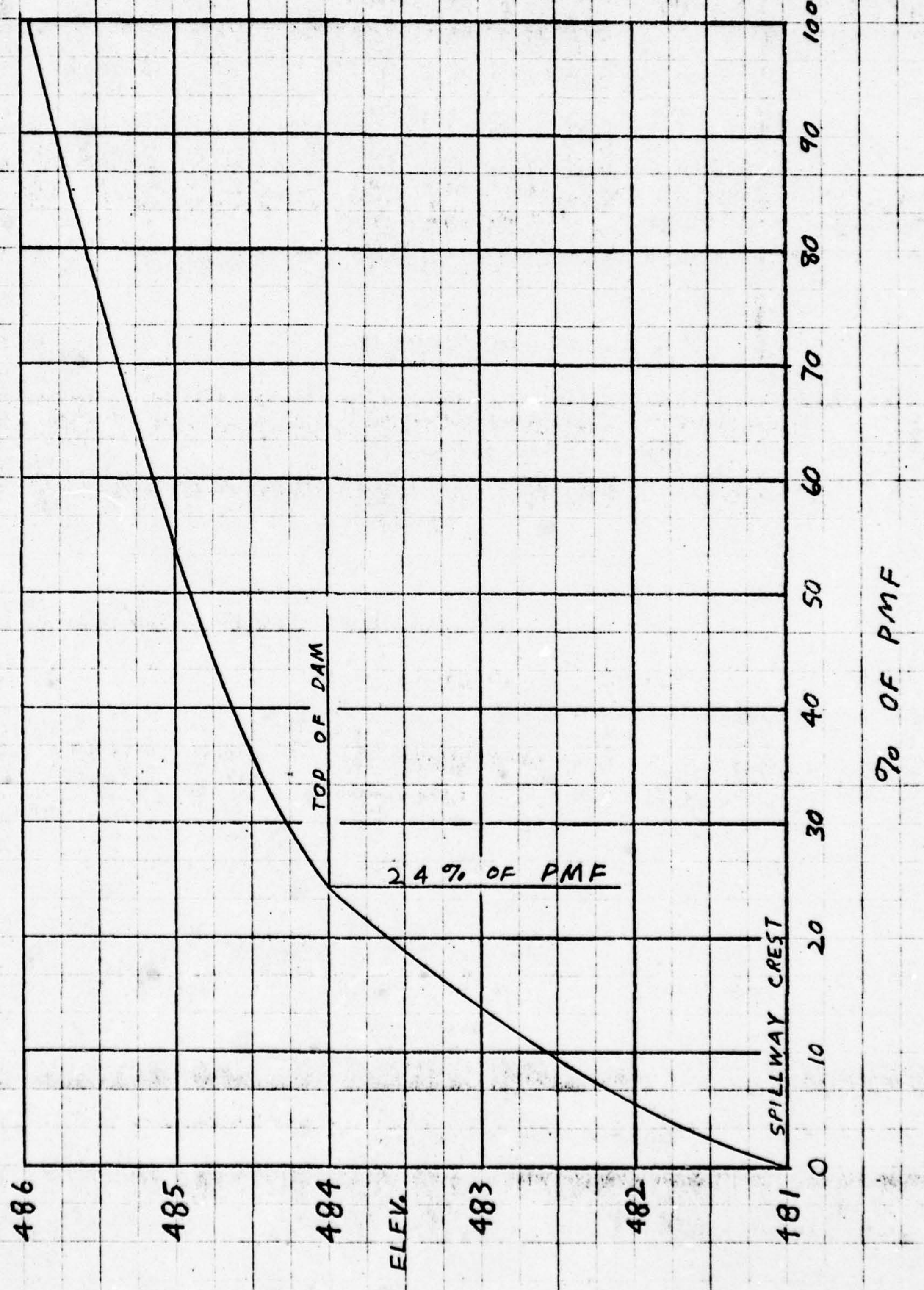
POOL LEVEL AT FAILURE: EARTH EMBANKMENT WITH CONCRETE CORE WALL. CORE WALL IS NOT REINFORCED AND IS IN POOR CONDITION.
USE: 0.5 FOOT OVER TOP OF DAM

BY RLS DATE 6/7/79 **BERGER ASSOCIATES** SHEET NO. 8 OF 8

CHKD. BY DATE PROJECT D8490

SUBJECT DEER LAKE DAM

SPILLWAY CAPACITY CURVE



LAST MODIFICATION 26 FEB 79
********************************* 1/4

```
A1      DEER LAKE  DAM    ****    PINE CREEK
A2      WEST BRUNSWICK TWP., SCHUYLKILL COUNTY, PA.
A3      NDI # PA-00834     PA DER # 54-112
B    300      0     15      0      0      0      0      0     -4      0
B1     5
J      1      9      1
J1     1    .85     .7     .6     .5     .4     .3     .2     .1
K             1                                  1
K1                 INFLOW  HYDROGRAPH
M      1      1     14                                                1
P          22.8    110    120    129    140
T                                                1    .05
W    3.8     .4
X   -1.5   -.05      2
K      1      2                                  1
K1                 RESERVOIR  ROUTING
Y                           1      0
Y1     1                                        30     -1
Y4   481  481.5    482  482.5    483  483.5    484  484.5    485  485.4
Y4   486
Y5     0    305    867   1598   2425   3244   4160   6167   9300  12421
Y5 17926
$A     0     22    203
$E 476.9    481    500
$$   481
$D   484
K     99
```

1 PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

RUNOFF HYDROGRAPH AT 1
ROUTE HYDROGRAPH TO 2
END OF NETWORK

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

RUN DATE* 79/06/07.
TIME* 07.17.18.

DEER LAKE DAM **** PINE CREEK
WEST BRUNSWICK TWP., SCHUYLKILL COUNTY, PA.
NDI # PA-00834 PA DER # 54-112

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
300	0	15	0	0	0	0	0	-4	0
			JOPER	NWT	LROPT	TRACE			
			5	0	0	0			

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 9 LRTIO= 1
RTIOS= 1.00 .85 .70 .60 .50 .40 .30 .20 .10

WEST BRUNSWICK TWP., SCHUYLKILL COUNTY, PA.
NDI # PA-00834 PA DER # 54-112

2/4

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
300	0	15	0	0	0	0	0	-4	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 9 LRTIO= 1
RTIOS= 1.00 .85 .70 .60 .50 .40 .30 .20 .10

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

SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH

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	14.00	0.00	14.00	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	22.80	110.00	120.00	129.00	140.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .812

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= 3.80 CP= .40 NTA= 0

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

UNIT HYDROGRAPH100 END-OF-PERIOD ORDINATES, LAG= 3.83 HOURS, CP= .40 VOL= .96

14.	55.	113.	184.	264.	351.	445.	543.	641.	730.
806.	871.	922.	959.	980.	975.	947.	915.	883.	852.
822.	794.	766.	740.	714.	689.	665.	642.	620.	598.
577.	557.	538.	519.	501.	484.	467.	451.	435.	420.
405.	391.	378.	365.	352.	340.	328.	317.	306.	295.
285.	275.	265.	256.	247.	239.	230.	222.	215.	207.
200.	193.	186.	180.	174.	168.	162.	156.	151.	145.
140.	135.	131.	126.	122.	118.	114.	110.	106.	102.
99.	95.	92.	89.	86.	83.	80.	77.	74.	72.
69.	67.	64.	62.	60.	58.	56.	54.	52.	50.

0 END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP

SUM 25.90 23.49

HYDROGRAPH ROUTING

RESERVOIR ROUTING

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

ROUTING DATA

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

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	30.	-1

STAGE	481.00	481.50	482.00	482.50	483.00	483.50	484.00	484.50	485.00	485.40	486.00
FLOW	0.00	305.00	867.00	1598.00	2425.00	3244.00	4160.00	6167.00	9300.00	12421.00	17926.00

SURFACE AREA=	0.	22.	203.
CAPACITY=	0.	30.	1878.
ELEVATION=	477.	481.	500.

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
481.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
484.0	0.0	0.0	0.

PEAK OUTFLOW IS 17391. AT TIME 43.50 HOURS

PEAK OUTFLOW IS 14783. AT TIME 43.50 HOURS

PEAK OUTFLOW IS 12171. AT TIME 43.50 HOURS

PEAK OUTFLOW IS 10433. AT TIME 43.50 HOURS

PEAK OUTFLOW IS 8690. AT TIME 43.50 HOURS

PEAK OUTFLOW IS 6953. AT TIME 43.50 HOURS

PEAK OUTFLOW IS 5209. AT TIME 43.75 HOURS

PEAK OUTFLOW IS 3464. AT TIME 43.75 HOURS

PEAK OUTFLOW IS 1733. AT TIME 43.75 HOURS

1

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	RATIO 2	RATIO 3	RATIO 4	RATIO 5	RATIO 6	RATIO 7	RATIO 8	RATIO
				1.00	.85	.70	.60	.50	.40	.30	.20	.1
HYDROGRAPH AT	1	14.00	1	17403.	14792.	12182.	10442.	8701.	6961.	5221.	3481.	1740
		(36.26)		(492.78)(	418.87)(	344.95)(	295.67)(	246.39)(	197.11)(	147.84)(	98.56)(	49.2[illegible]
ROUTED TO	2	14.00	1	17391.	14783.	12171.	10433.	8690.	6953.	5209.	3464.	173[illegible]
		(36.26)		(492.45)(	418.61)(	344.64)(	295.43)(	246.06)(	196.89)(	147.49)(	98.08)(	49.0[illegible]

1 SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	480.99	481.00	484.00
STORAGE	30.	30.	120.
OUTFLOW	0.	0.	4160.

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	485.94	1.94	207.	17391.	15.75	43.50	0.00
.85	485.66	1.66	192.	14783.	14.25	43.50	0.00
.70	485.37	1.37	178.	12171.	12.50	43.50	0.00
.60	485.15	1.15	168.	10433.	11.00	43.50	0.00
.50	484.90	.90	157.	8690.	9.50	43.50	0.00
.40	484.63	.63	145.	6953.	7.25	43.50	0.00
.30	484.26	.26	130.	5209.	4.00	43.75	0.00
.20	483.62	0.00	105.	3464.	0.00	43.75	0.00
.10	482.58	0.00	71.	1733.	0.00	43.75	0.00

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1**********************************
 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION    JULY 1978
  LAST MODIFICATION  26 FEB 79
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1*****************************************
 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION       JULY 1978
  LAST MODIFICATION  26 FEB 79
*****************************************
         1              A1      DEER LAKE  DAM     ****    PINE CREEK
         2              A2      WEST BRUNSWICK TWP.,  SCHUYLKILL COUNTY, PA.
         3              A3      NDI #  PA-00834     PA DER #  54-112
         4              B    300       0      15       0       0       0       0       0      -4       0
         5              B1     5
         6              J      1       1       1
         7              J1   .36
         8              K              1                                       1
         9              K1                    INFLOW  HYDROGRAPH
        10              M      1       1      14                                                       1
        11              P           22.8     110     120     129     140
        12              T                                                      1     .05
        13              W    3.8      .4
        14              X   -1.5    -.05       2
        15              K      1       2                                       1
        16              K1                    RESERVOIR  ROUTING
        17              Y                              1       1
        18              Y1     1                                              30      -1
        19              Y4   481   481.5     482   482.5     483   483.5     484   484.5     485   485.4
        20              Y4   486
        21              Y5     0     305     867    1598    2425    3244    4160    6167    9300   12421
        22              Y5 17926
        23              $A     0      22     203
        24              $E 476.9     481     500
        25              $$   481
        26              $D   484
        27              K      1       3                                       1
        28              K1                 REACH 2 - 3
        29              Y                              1       1
        30              Y1     1
        31              Y6    .1     .04      .1     469     520    1000    .003
        32              Y7     0     520     100     500     300     480     380     469     400     469
        33              Y7   500     475     800     480    1200     500
        34              K      1       4                                       1
        35              K1                 REACH 3 - 4
        36              Y                              1       1
        37              Y1     1
        38              Y6    .1     .06      .1     462     520    3000  .00233
        39              Y7     0     520     350     500     700     480    1100     462    1110     462
        40              Y7  1550     480    1700     500    1900     520
        41              K     99
1                                 PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

                                          RUNOFF HYDROGRAPH AT            1
                                          ROUTE HYDROGRAPH TO             2
                                          ROUTE HYDROGRAPH TO             3
                                          ROUTE HYDROGRAPH TO             4
                                          END OF NETWORK
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1*****************************************
 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION       JULY 1978
  LAST MODIFICATION  26 FEB 79
*****************************************
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WEST BRUNSWICK TWP., SCHUYLKILL COUNTY, PA.
NDI # PA-00834 PA DER # 54-112

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JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
300	0	15	0	0	0	0	0	-4	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 1 LRTIO= 1
RTIOS= .36

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SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH

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	14.00	0.00	14.00	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	22.80	110.00	120.00	129.00	140.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .812

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= 3.80 CP= .40 NTA= 0

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

UNIT HYDROGRAPH100 END-OF-PERIOD ORDINATES, LAG= 3.83 HOURS, CP= .40 VOL= .96

14.	55.	113.	184.	264.	351.	445.	543.	641.	730.
806.	871.	922.	959.	980.	975.	947.	915.	883.	852.
822.	794.	766.	740.	714.	689.	665.	642.	620.	598.
577.	557.	538.	519.	501.	484.	467.	451.	435.	420.
405.	391.	378.	365.	352.	340.	328.	317.	306.	295.
285.	275.	265.	256.	247.	239.	230.	222.	215.	207.
200.	193.	186.	180.	174.	168.	162.	156.	151.	145.
140.	135.	131.	126.	122.	118.	114.	110.	106.	103.
99.	95.	92.	89.	86.	83.	80.	77.	74.	72.
69.	67.	64.	62.	60.	58.	56.	54.	52.	50.

0 END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	25.90	23.49	2.42	[illegible]

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HYDROGRAPH ROUTING

RESERVOIR ROUTING

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

ROUTING DATA

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

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	30.	-1

STAGE	481.00	481.50	482.00	482.50	483.00	483.50	484.00	484.50	485.00	485.40
	486.00									
FLOW	0.00	305.00	867.00	1598.00	2425.00	3244.00	4160.00	6167.00	9300.00	12421.00
	17926.00									

SURFACE AREA=	0.	22.	203.
CAPACITY=	0.	30.	1878.
ELEVATION=	477.	481.	500.

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
481.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
484.0	0.0	0.0	0.

PEAK OUTFLOW IS 6261. AT TIME 43.50 HOURS

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HYDROGRAPH ROUTING

REACH 2 - 3

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
3	1	0	0	0	0	1	0	0

ROUTING DATA

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

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

NOR[illegible]DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.1000	.0400	.1000	469.0	520.0	1000.	.00300

0.00	520.00	100.00	500.00	300.00	480.00	380.00	469.00	400.00	469.00
500.00	475.00	800.00	480.00	1200.00	500.00				

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STORAGE	0.00	3.21	10.38	23.61	47.77	80.54	118.31	161.04	208.73	261.38
	319.00	381.58	448.70	517.27	586.66	656.89	727.94	799.82	872.52	946.05
OUTFLOW	0.00	399.52	1934.53	5509.31	11558.61	21404.64	34332.22	50250.52	69216.29	91309.21
	116620.87	145249.36	178693.41	217259.01	259135.94	304232.40	352472.95	403794.55	458143.74	515474.81
STAGE	469.00	471.68	474.37	477.05	479.74	482.42	485.11	487.79	490.47	493.16
	495.84	498.53	501.21	503.89	506.58	509.26	511.95	514.63	517.32	520.00
FLOW	0.00	399.52	1934.53	5509.31	11558.61	21404.64	34332.22	50250.52	69216.28	91309.21
	116620.87	145249.36	178693.41	217259.01	259135.94	304232.40	352472.95	403794.55	458143.74	515474.81

MAXIMUM STAGE IS 477.4

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HYDROGRAPH ROUTING

REACH 3 - 4

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

ROUTING DATA

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

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

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.1000	.0600	.1000	462.0	520.0	3000.	.00233

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

0.00	520.00	350.00	500.00	700.00	480.00	1100.00	462.00	1110.00	462.00
1550.00	480.00	1700.00	500.00	1900.00	520.00				

STORAGE	0.00	17.08	64.10	141.08	248.01	334.88	551.63	740.01	944.44	1164.91
	1401.43	1653.99	1922.59	2207.49	2509.87	2829.90	3167.57	3522.90	3895.88	4286.50
OUTFLOW	0.00	410.84	2399.25	6869.73	14575.80	26189.85	42797.47	68466.36	99208.41	134987.56
	175796.95	221653.62	272591.77	328575.58	389730.92	456219.24	528127.57	605546.51	688569.09	777289.95
STAGE	462.00	465.05	468.11	471.16	474.21	477.26	480.32	483.37	486.42	489.47
	492.53	495.58	498.63	501.68	504.74	507.79	510.84	513.89	516.95	520.00
FLOW	0.00	410.84	2399.25	6869.73	14575.80	26189.85	42797.47	68466.36	99208.41	134987.56
	175796.95	221653.62	272591.77	328575.58	389730.92	456219.24	528127.57	605546.51	688569.09	777289.95

MAXIMUM STAGE IS 470.7

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1

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)

RATIOS APPLIED TO FLOWS

OPERATION	STATION	AREA	PLAN	RATIO 1 .36
HYDROGRAPH AT	1	14.00	1	6265.
		(36.26)		(177.40)(
ROUTED TO	2	14.00	1	6261.
		(36.26)		(177.30)(
ROUTED TO	3	14.00	1	6256.
		(36.26)		(177.15)(
ROUTED TO	4	14.00	1	6231.
		(36.26)		(176.45)(

1 SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	480.99	481.00	484.00
STORAGE	30.	30.	120.
OUTFLOW	0.	0.	4160.

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
.36	484.52	.52	140.	6261.	6.00	43.50	0.00

PLAN 1 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.36	6256.	477.4	43.75

PLAN 1 STATION 4

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.36	6231.	470.7	43.75

1**********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 26 FEB 79
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DAM SAFETY VERSION      JULY 1978
 LAST MODIFICATION  26 FEB 79
********************************
        A1      DEER LAKE  DAM     ****    PINE CREEK
        A2      WEST BRUNSWICK TWP., SCHU''KILL COUNTY, PA.
        A3      NDI #  PA-00834     PA DER #  54-112
        B    300      0      15      0      0      0      0      0     -4      0
        B1     5
        J      4      1       1
        J1   .36
        K             1                                     1
        K1                INFLOW  HYDROGRAPH
        M      1      1      14                                           1
        P          22.8     110    120    129    140
        T                                                   1    .05
        W    3.8     .4
        X   -1.5   -.05       2
        K      1      2                                     1
        K1                RESERVOIR  ROUTING  **  BREACH
        Y                             1      1
        Y1     1                                           30     -1
        Y4   481  481.5     482  482.5    483  483.5    484  484.5    485  485.4
        Y4   486
        Y5     0    305     867   1598   2425   3244   4160   6167   9300  12421
        Y5 17926
        $A     0     22     203
        $E 476.9    481     500
        $$   481
        $D   484
        $B    50      1   476.9    .25    481  484.5
        $B    50      1   476.9     .5    481  484.5
        $B    50      1   476.9      1    481  484.5
        $B    50      1   476.9      2    481  484.5
        K      1      3                                     1
        K1             REACH 2 - 3
        Y                             1      1
        Y1     1
        Y6    .1    .04      .1    469    520   1000   .003
        Y7     0    520     100    500    300    480    380    469    400    469
        Y7   500    475     800    480   1200    500
        K      1      4                                     1
        K1              REACH 3 - 4
        Y                             1      1
        Y1     1
        Y6    .1    .06      .1    462    520   3000 .00233
        Y7     0    520     350    500    700    480   1100    462   1110    462
        Y7  1550    480    1700    500   1900    520
        K     99
1                  PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

                      RUNOFF HYDROGRAPH AT          1
                      ROUTE HYDROGRAPH TO           2
                      ROUTE HYDROGRAPH TO           3
                      ROUTE HYDROGRAPH TO           4
                      END OF NETWORK


1********************************
 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
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JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
300	0	15	0	0	0	0	0	-4	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 4 NRTIO= 1 LRTIO= 1

RTIOS= .36

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SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH

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	14.00	0.00	14.00	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	22.80	110.00	120.00	129.00	140.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .812

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= 3.80 CP= .40 NTA= 0

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

UNIT HYDROGRAPH100 END-OF-PERIOD ORDINATES, LAG= 3.83 HOURS, CP= .40 VOL= .96

14.	55.	113.	184.	264.	351.	445.	543.	641.	730.
806.	871.	922.	959.	980.	975.	947.	915.	883.	852.
822.	794.	766.	740.	714.	689.	665.	642.	620.	598.
577.	557.	538.	519.	501.	484.	467.	451.	435.	420.
405.	391.	378.	365.	352.	340.	328.	317.	306.	295.
285.	275.	265.	256.	247.	239.	230.	222.	215.	207.
200.	193.	186.	180.	174.	168.	162.	156.	151.	145.
140.	135.	131.	126.	122.	118.	114.	110.	106.	102.
99.	95.	92.	89.	86.	83.	80.	77.	74.	72.
69.	67.	64.	62.	60.	58.	56.	54.	52.	50.

0 END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	25.90	23.49	2.42	822759.

HYDROGRAPH ROUTING

RESERVOIR ROUTING ** BREACH

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

ALL PLANS HAVE SAME
ROUTING DATA

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

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	30.	-1

STAGE	481.00	481.50	482.00	482.50	483.00	483.50	484.00	484.50	485.00	485.40
	486.00									
FLOW	0.00	305.00	867.00	1598.00	2425.00	3244.00	4160.00	6167.00	9300.00	12421.00
	17926.00									

SURFACE AREA=	0.	22.	203.
CAPACITY=	0.	30.	1878.
ELEVATION=	477.	481.	500.

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
481.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
484.0	0.0	0.0	0.

DAM BREACH DATA

BRWID	Z	ELBM	TFAIL	WSEL	FAILEL
50.	1.00	476.90	.25	481.00	484.50

BEGIN DAM FAILURE AT 43.25 HOURS

PEAK OUTFLOW IS 7841. AT TIME 43.50 HOURS

DAM BREACH DATA

BRWID	Z	ELBM	TFAIL	WSEL	FAILEL
50.	1.00	476.90	.50	481.00	484.50

BEGIN DAM FAILURE AT 43.25 HOURS

PEAK OUTFLOW IS 7267. AT TIME 43.75 HOURS

DAM BREACH DATA

BRWID	Z	ELBM	TFAIL	WSEL	FAILEL
50.	1.00	476.90	1.00	481.00	484.50

BEGIN DAM FAILURE AT 43.25 HOURS

PEAK OUTFLOW IS 6841. AT TIME 44.25 HOURS

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                                 BRWID       Z    ELBM    TFAIL    WSEL   FAILEL
                                   50.    1.00  476.90     2.00  481.00   484.50
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BEGIN DAM FAILURE AT 43.25 HOURS

PEAK OUTFLOW IS      6382. AT TIME  43.79 HOURS


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

                                        HYDROGRAPH ROUTING

                     REACH 2 - 3

                        ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                            3       1       0       0       0       0       1       0       0

                                         ALL PLANS HAVE SAME
                                             ROUTING DATA
                  QLOSS   CLOSS     AVG    IRES   ISAME    IOPT    IPMP            LSTR
                    0.0   0.000    0.00       1       1       0       0               0

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


N   DEPTH CHANNEL ROUTING
----------------------------


     QN(1)   QN(2)   QN(3)   ELNVT   ELMAX   RLNTH     SEL
     .1000   .0400   .1000   469.0   520.0   1000.  .00300


     CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
         0.00  520.00  100.00  500.00  300.00  480.00  380.00  469.00  400.00  469.00
       500.00  475.00  800.00  480.00 1200.00  500.00
```

STORAGE	0.00	3.21	10.38	23.61	47.77	80.54	118.31	161.04	208.73	261.3
	319.00	381.58	448.70	517.27	586.66	656.89	727.94	799.82	872.52	946
OUTFLOW	0.00	399.52	1934.53	5509.31	11558.61	21404.64	34332.22	50250.52	69216.28	91309.2
	116620.87	145249.36	178693.41	217259.01	259135.94	304232.40	352472.95	403794.55	458143.74	515474.
STAGE	469.00	471.68	474.37	477.05	479.74	482.42	485.11	487.79	490.47	493.
	495.84	498.53	501.21	503.89	506.58	509.26	511.95	514.63	517.32	520.0
FLOW	0.00	399.52	1934.53	5509.31	11558.61	21404.64	34332.22	50250.52	69216.28	91309.2
	116620.87	145249.36	178693.41	217259.01	259135.94	304232.40	352472.95	403794.55	458143.74	515474.

```
MA   UM STAGE IS      477.9

MAXIMUM STAGE IS      477.8

MAXIMUM STAGE IS      477.6

MAXIMUM STAGE IS      477.4
```

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

B
5/8

HYDROGRAPH ROUTING

REACH 3 - 4

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

ALL PLANS HAVE SAME
ROUTING DATA

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

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

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.1000	.0600	.1000	462.0	520.0	3000.	.00233

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

```
   0.00  520.00  350.00  500.00  700.00  480.00 1100.00  462.00 1110.00  462.00
1550.00  480.00 1700.00  500.00 1900.00  520.00
```

STORAGE	0.00	17.08	64.10	141.08	248.01	384.88	551.63	740.01	944.44	1164.91
	1401.43	1653.99	1922.59	2207.49	2509.87	2829.90	3167.57	3522.90	3895.68	4286.5
OUTFLOW	0.00	410.84	2399.25	6869.73	14575.80	26189.85	42797.47	68466.36	99208.41	134987.56
	175796.95	221653.62	272591.77	328575.58	389730.92	456219.24	528127.57	605546.51	688569.09	777289.95
STAGE	462.00	465.05	468.11	471.16	474.21	477.26	480.32	483.37	486.42	489.47
	492.53	495.58	498.63	501.68	504.74	507.79	510.84	513.89	516.95	520.00
FLOW	0.00	410.84	2399.25	6869.73	14575.80	26189.85	42797.47	68466.36	99208.41	134987.56
	175796.95	221653.62	272591.77	328575.58	389730.92	456219.24	528127.57	605546.51	688569.09	777289.95

MAXIMUM STAGE IS 471.3

MAXIMUM STAGE IS 471.2

MAXIMUM STAGE IS 471.0

MAXIMUM STAGE IS 470.8

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

1

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)

1 ********** ********** ********** ********** **********

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)

RATIOS APPLIED TO FLOWS

OPERATION	STATION	AREA	PLAN	RATIO 1 .36
HYDROGRAPH AT	1	14.00	1	6265.
		(36.26)		(177.40)(
			2	6265.
				(177.40)(
			3	6265.
				(177.40)(
			4	6265.
				(177.40)(
ROUTED TO	2	14.00	1	7841.
		(36.26)		(222.03)(
			2	7267.
				(205.79)(
			3	6841.
				(193.70)(
			4	6381.
				(180.70)(
ROUTED TO	3	14.00	1	7391.
		(36.26)		(209.29)(
			2	7223.
				(204.53)(
			3	6782.
				(192.04)(
			4	6385.
				(180.82)(
ROUTED TO	4	14.00	1	7127.
		(36.26)		(201.80)(
			2	6926.
				(196.13)(
			3	6663.
				(188.67)(
			4	6358.
				(180.04)(

1 SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	481.00	481.00	484.00
STORAGE	30.	30.	120.
OUTFLOW	0.	0.	4160.

7/8

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	481.00	481.00	484.00
STORAGE	30.	30.	120.
OUTFLOW	0.	0.	4160.

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
.36	484.50	.50	140.	7841.	2.03	43.50	43.25

PLAN 2 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	481.00	481.00	484.00
STORAGE	30.	30.	120.
OUTFLOW	0.	0.	4160.

		RATIO OF OVER DAM	MAXIMUM RESERVOIR AC-FT	MAXIMUM DEPTH CFS	MAXIMUM STORAGE HOURS	MAXIMUM OUTFLOW HOURS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW	TIME OF FAILURE
F	W.S.ELEV								
		.36	484.50	.50	140.	7267.	2.22	43.75	43.25

PLAN 3 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	481.00	481.00	484.00
STORAGE	30.	30.	120.
OUTFLOW	0.	0.	4160.

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
.36	484.50	.50	140.	6841.	2.58	44.25	43.25

PLAN 4 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	481.00	481.00	484.00
STORAGE	30.	30	120.
OUTFLOW	0.	0.	4160.

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
.36	484.50	.50	140.	6382.	3.21	43.79	43.25

PLAN 1 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.36	7391.	477.9	43.50

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RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.36	7391.	477.9	43.50

PLAN 2 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.36	7223.	477.8	43.75

PLAN 3 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.36	6782.	477.6	44.25

PLAN 4 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.36	6385.	477.4	43.75

PLAN 1 STATION 4

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.36	7127.	471.3	43.75

PLAN 2 STATION 4

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.36	6926.	471.2	44.00

PLAN 3 STATION 4

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.36	6663.	471.0	44.25

PLAN 4 STATION 4

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.36	6358.	470.8	44.00

1*************************************

APPENDIX D

GEOLOGIC REPORT

GEOLOGIC REPORT

Bedrock - Dam and Reservoir

Formation Name: Manhantango and Marcellus Formations, undivided.

Lithology: Medium to dark gray, brownish gray and olive brown shale, interbedded with silty shale, and fine sandstone. Sandstone is generally thin bedded, two to four inches thick.

Structure

The dam is located in an area of rather intense small scale folding which has not been mapped in detail. The strike here is generally N70° to 80°E. Small faults commonly accompany the tight folding but have not been mapped in this area. No air photo fracture traces are visible in the area because of the residential development and alluvial cover in the valley.

Overburden

No foundation boring information is available for this dam which was built in 1925. Plans show a concrete core wall which was apparently founded in weathered shale. The alluvium in the valley is probably only a few feet thick.

Aquifer Characteristics

Ground water movement in the Mahantango Formation is almost entirely along bedding planes and fractures. Movement can be fairly free in the weathered zone, and decreases with depth.

Discussion

Some leakage through the weathered shale beneath the core wall is possible. Breakdown of the clay minerals of the shale is a slow process, and in the absence of evidence of extensive leakage, the foundation is probably sound enough for this small dam.

Sources of Information

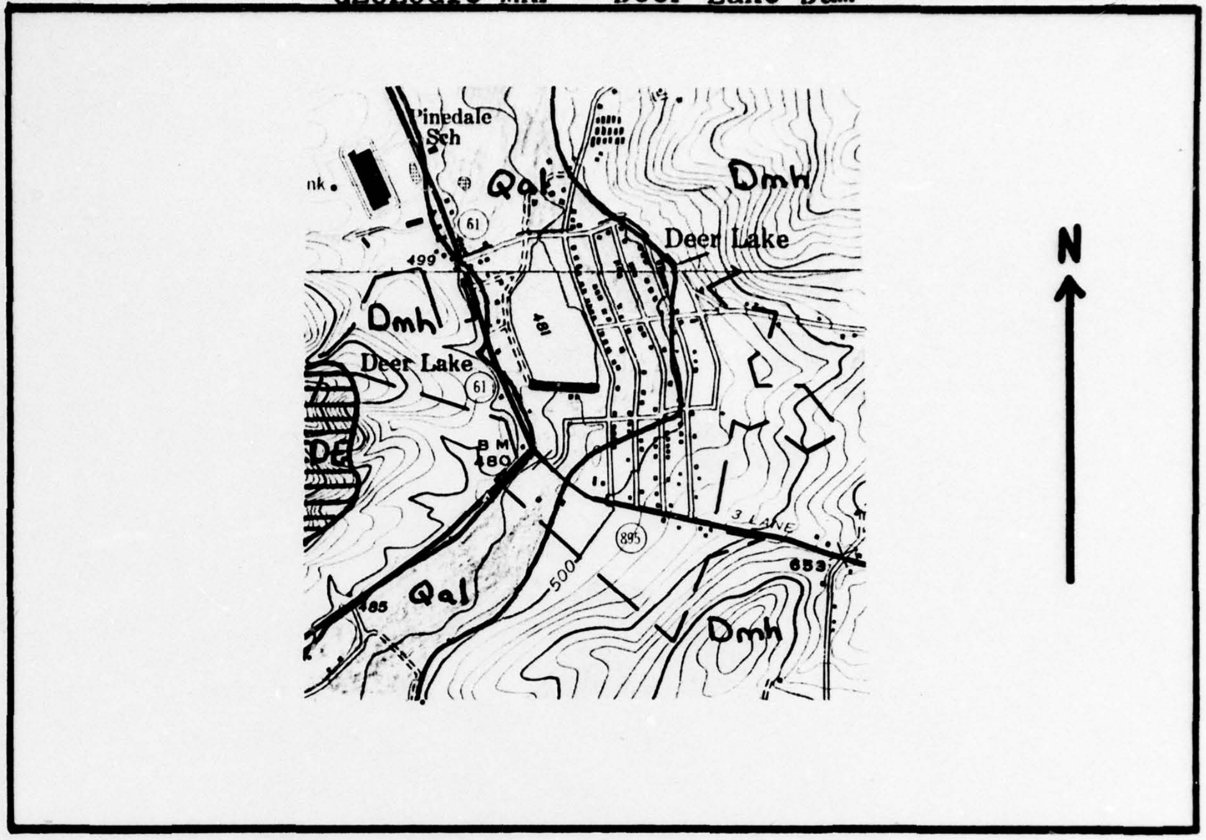
1. Wood, G.H., Jr. (1973) "Geologic Map of the Orwigsburg Quadrangle, Schuylkill County, Pa." U.S. Geological Survey Map GQ 1029.

2. Wood, G.H., Jr., Troxler, J.P., and Kehn, T.M. (1969) "Geology of the West Central Part of the Southern Anthracite Field, and Adjoining Areas". U.S. Geological Survey, Prof. Pap. 602.

3. Geologic Map of the Auburn Quadrangle, Pa. Geological Survey. Open file. Harrisburg, 1977.

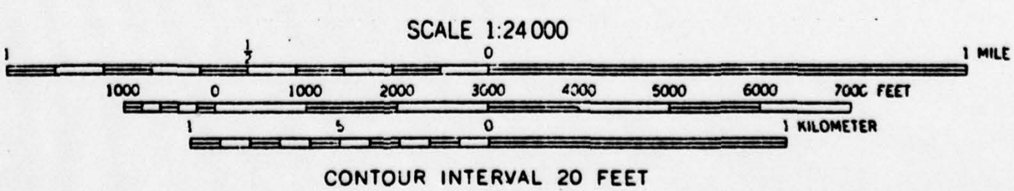
4. Air Photographs. Scale 1:20,000. Dates 1968.

GEOLOGIC MAP - Deer Lake Dam



(geology from Pa. Geol. Surv. open file)

Qal	alluvium
Dt	Trimmers Rock Sandstone
Dmh	Mahantango Fm. and Marcellus Fm.



APPENDIX E

PHOTOGRAPHS

APPENDIX E

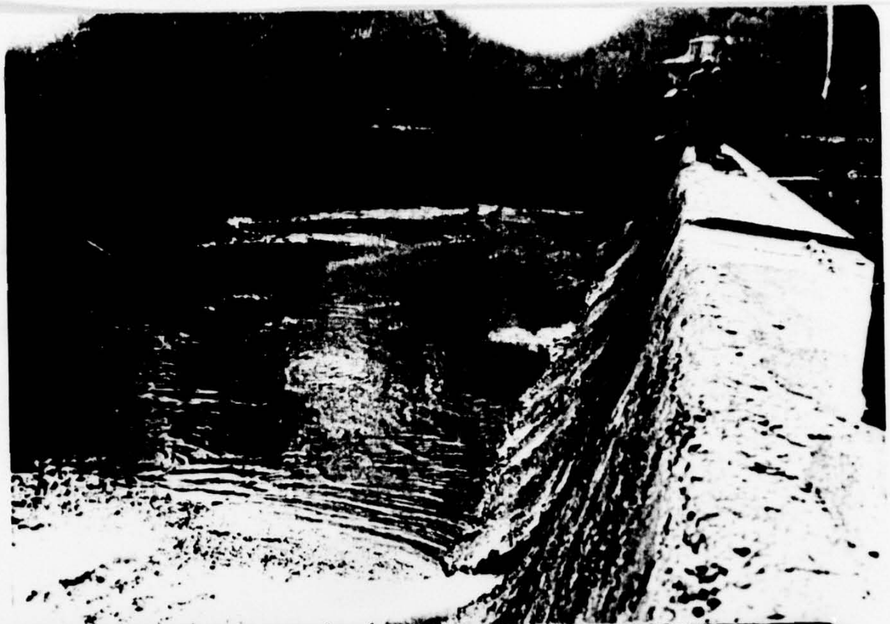
PHOTOGRAPHS

Left End of
Embankment
With Fire House

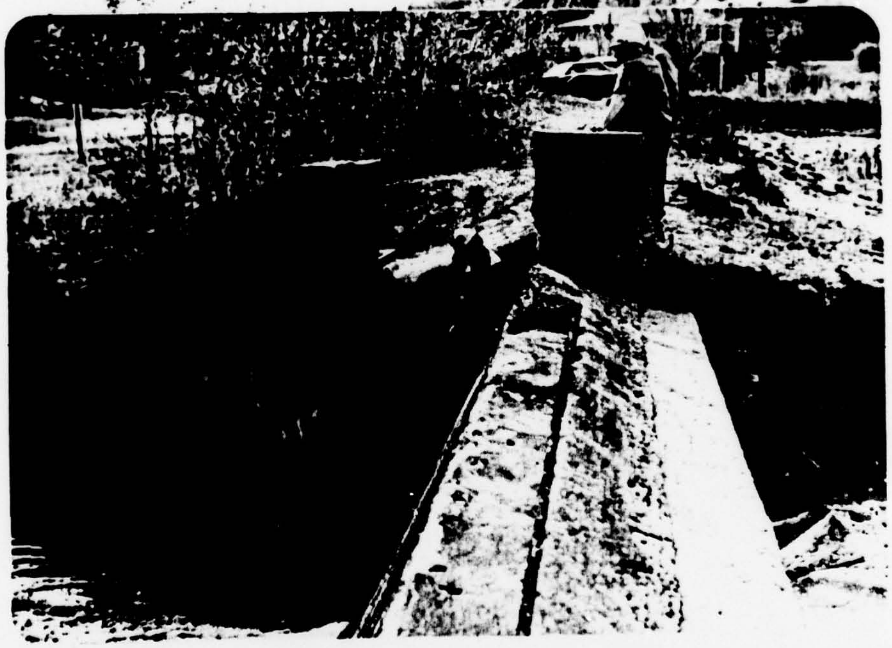
Left Spillway
Abutment Wall

Downstream Side
of Spillway
At Left Abutment

PA-834
PLATE E-I



Spillway Towards
Right Abutment



Right Spillway
Wall

Right End of
Embankment

PA-834
PLATE E-II

Detail of Upstream Slope at Right End

Protective Dike Right Side of Reservoir

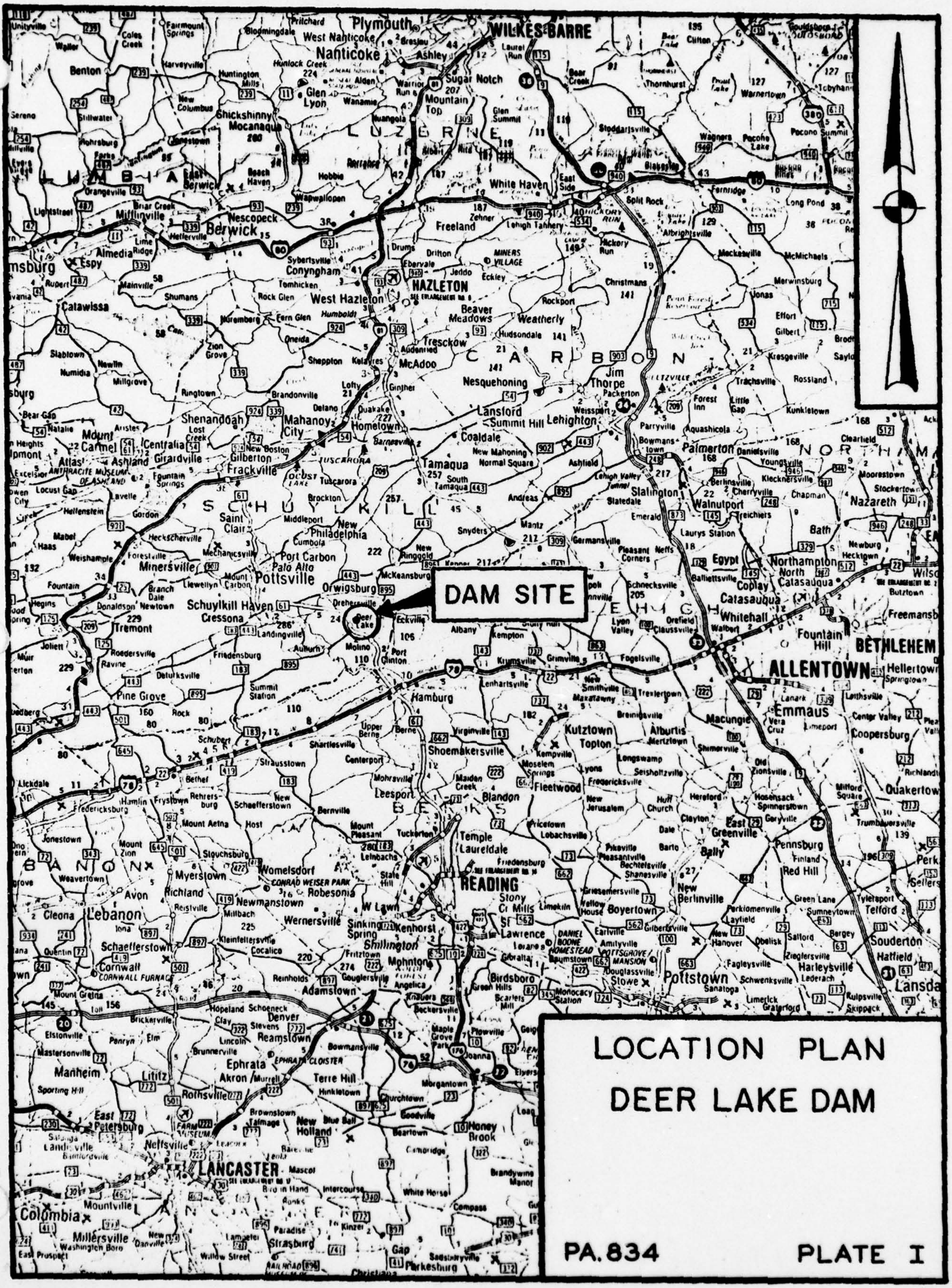
PA-834
PLATE E-III

Outlet Structure
Left End of Embankment

Drained Reservoir
(Note Siltation)

APPENDIX F

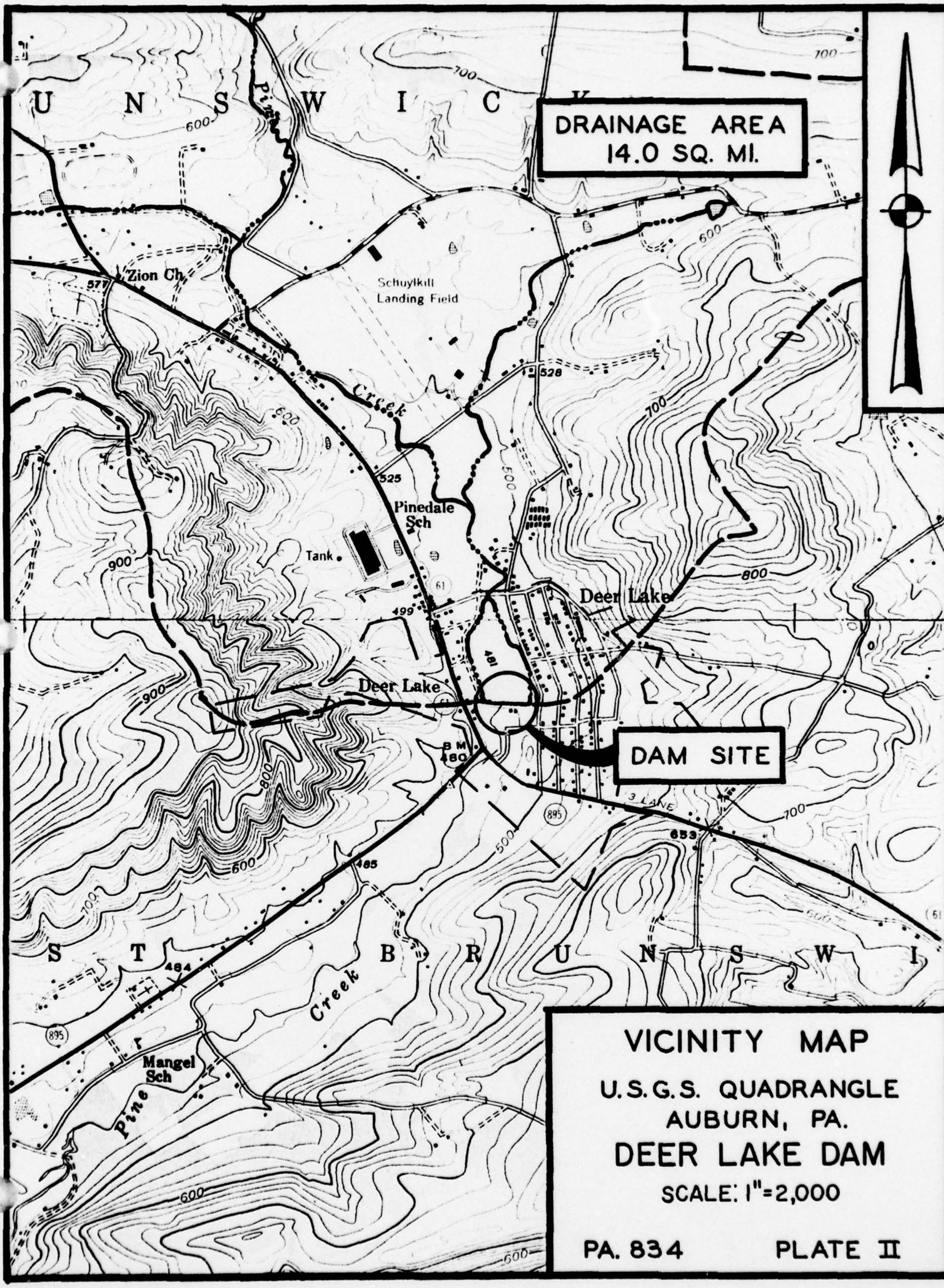
PLATES



LOCATION PLAN

DEER LAKE DAM

PA.834 PLATE I



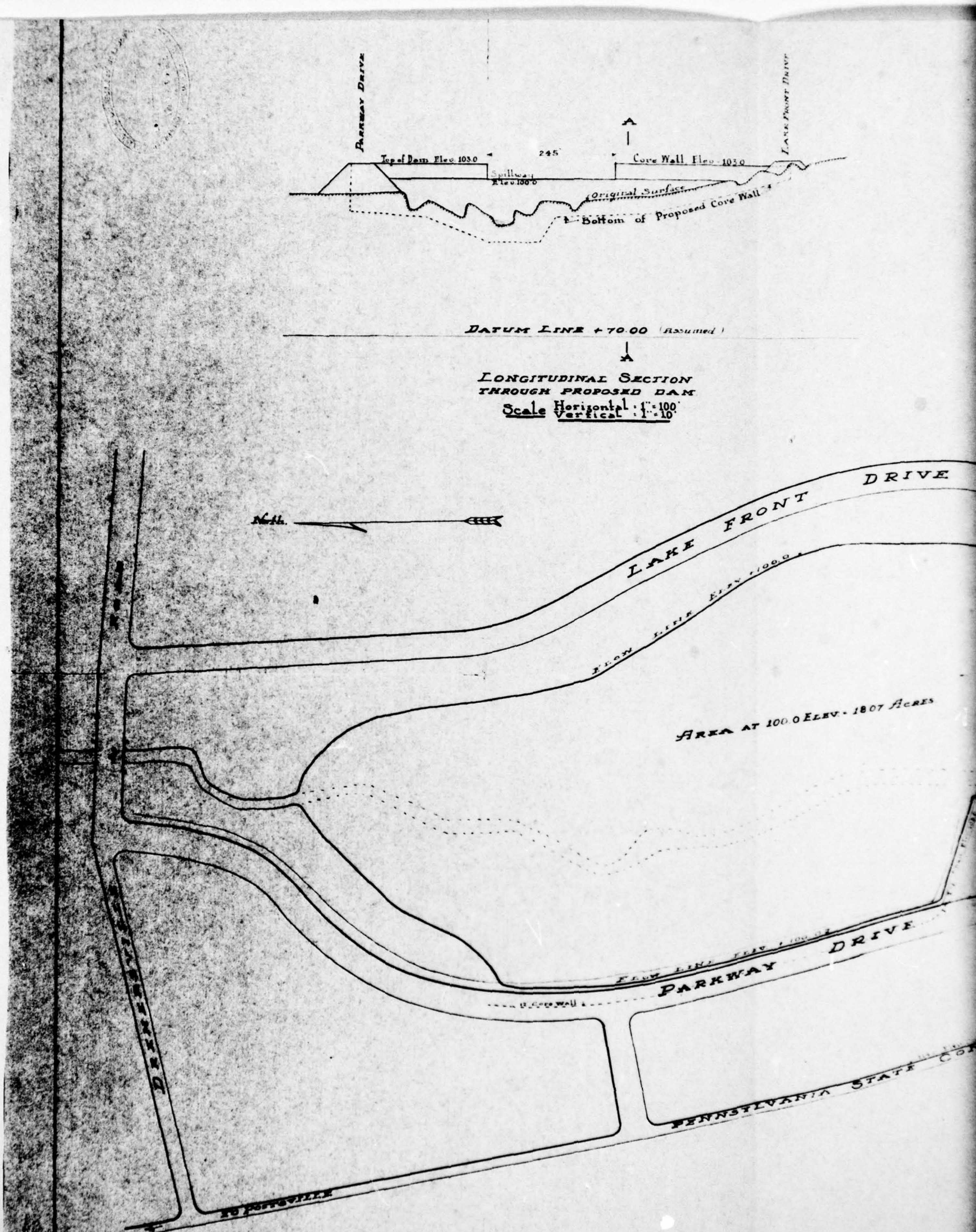
VICINITY MAP

U.S.G.S. QUADRANGLE
AUBURN, PA.

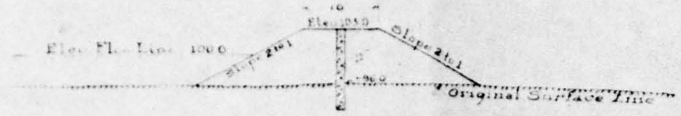
DEER LAKE DAM

SCALE: 1"=2,000

PA. 834 PLATE II

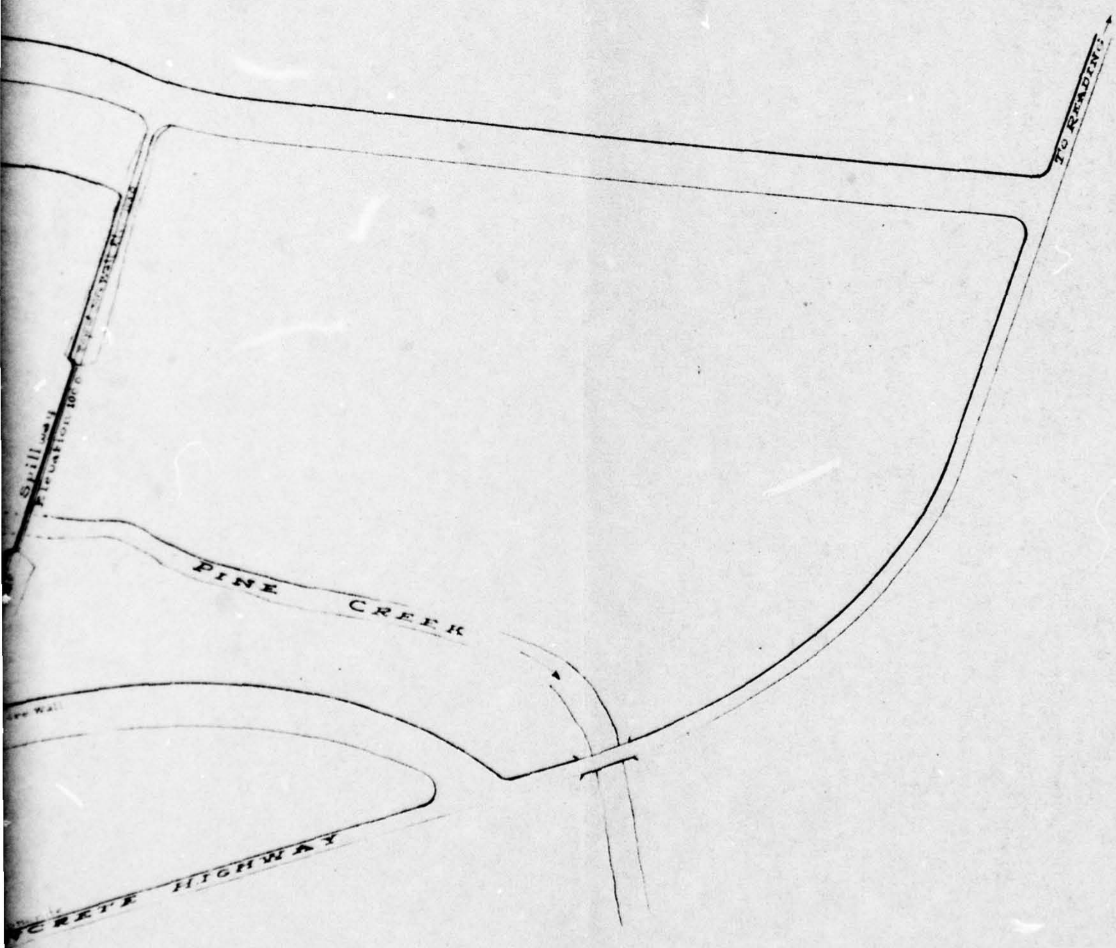


Parkway Drive
Lake Front Drive
Top of Dam Elev. 103.0
245'
Core Wall Elev. 103.0
Spillway Elev. 100.0
Original Surface
Bottom of Proposed Core Wall
A
DATUM LINE + 70.00 (Assumed)
A
LONGITUDINAL SECTION THROUGH PROPOSED DAM
Scale Horizontal : 1" = 100' Vertical : 1" = 10'
LAKE FRONT DRIVE
FLOW LINE ELEV. 100.0
AREA AT 100.0 ELEV. - 1807 ACRES
FLOW LINE ELEV. 100.0
PARKWAY DRIVE
Core Wall
PENNSYLVANIA STATE
TO POTTSVILLE



DATUM LINE + 70.00 (Assumed)

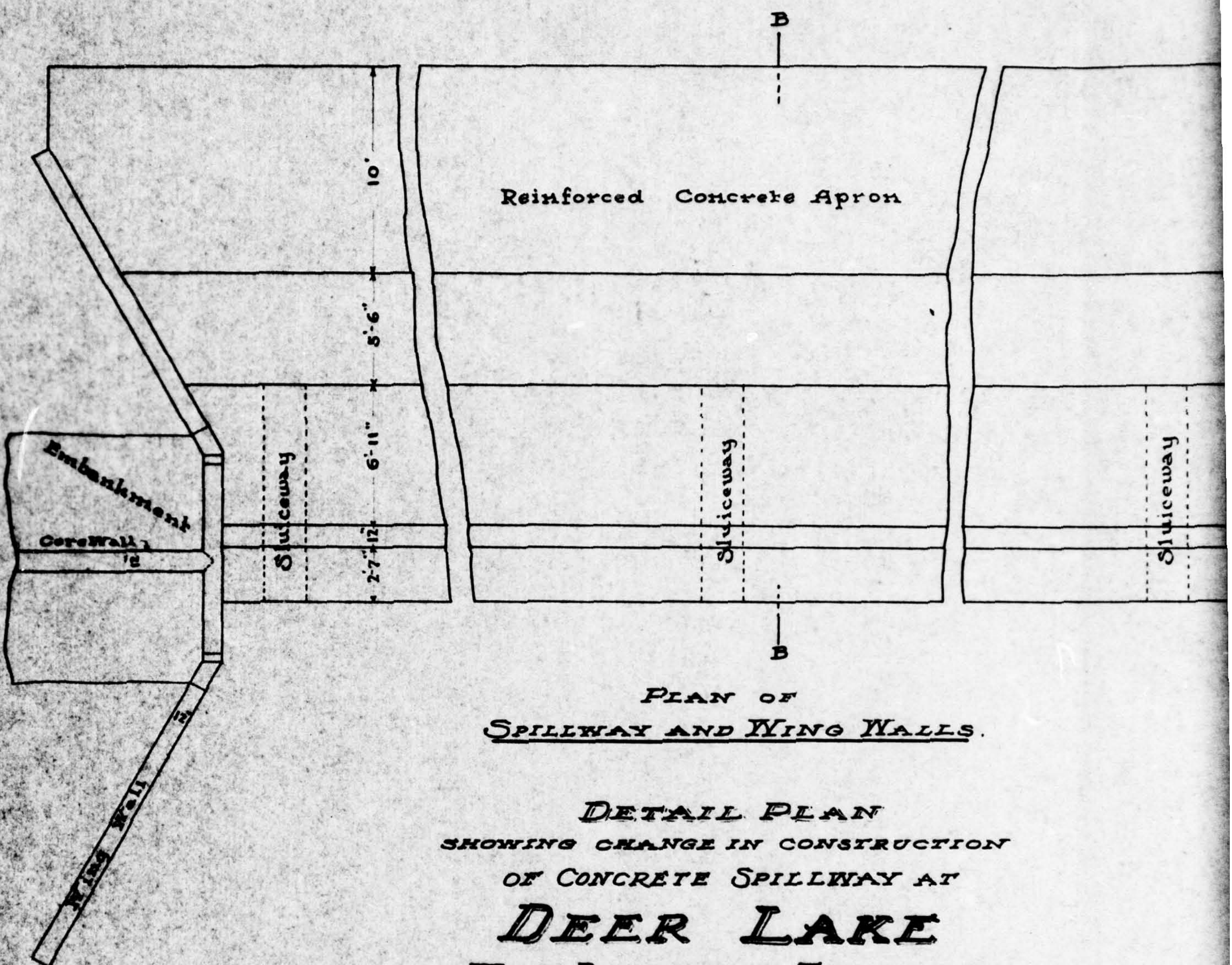
CROSS SECTION A-A
THROUGH PROPOSED DAM
Scale 1 inch 10 feet.



GENERAL PLAN
SHOWING PROPOSED DAM
AT
DEER LAKE
WEST BRUNSWICK TOWNSHIP
SCHUYLKILL COUNTY, PA.
E P Kingsbury Manager
POTTSVILLE, PA

Scale 1" 100' - April 1925 - Geo H Steidel
Engineer & Surveyor
POTTSVILLE, PA

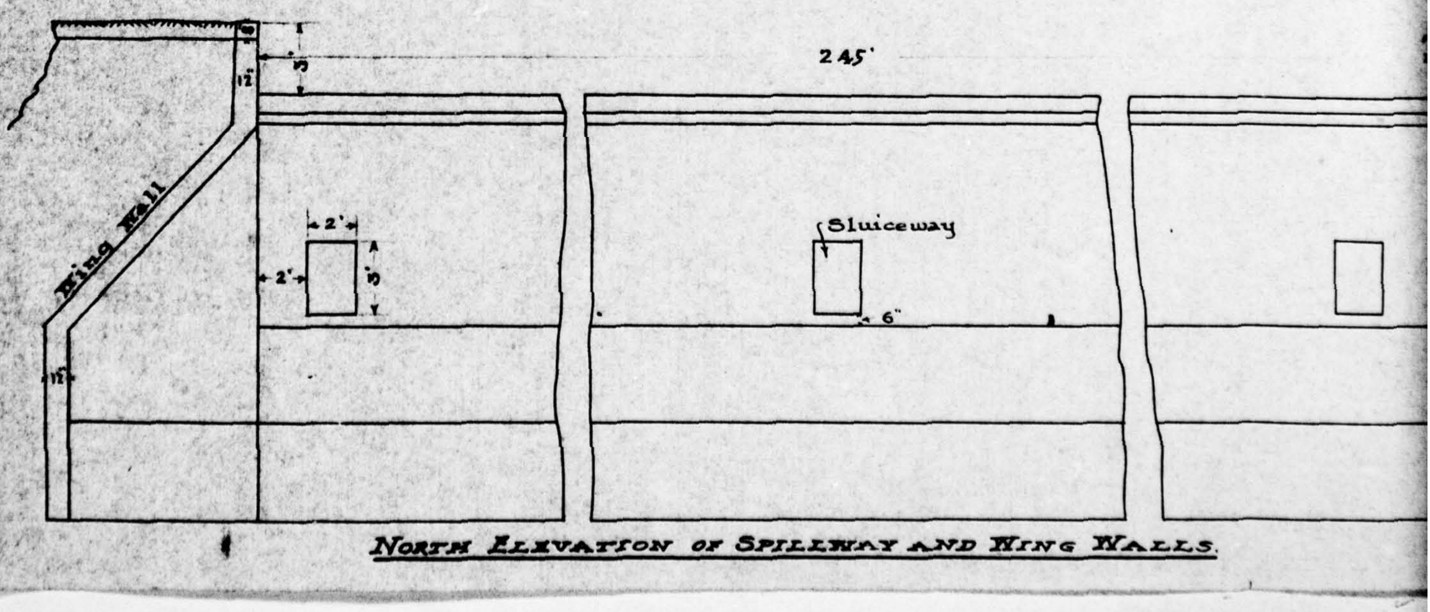
PA. 834
PLATE III



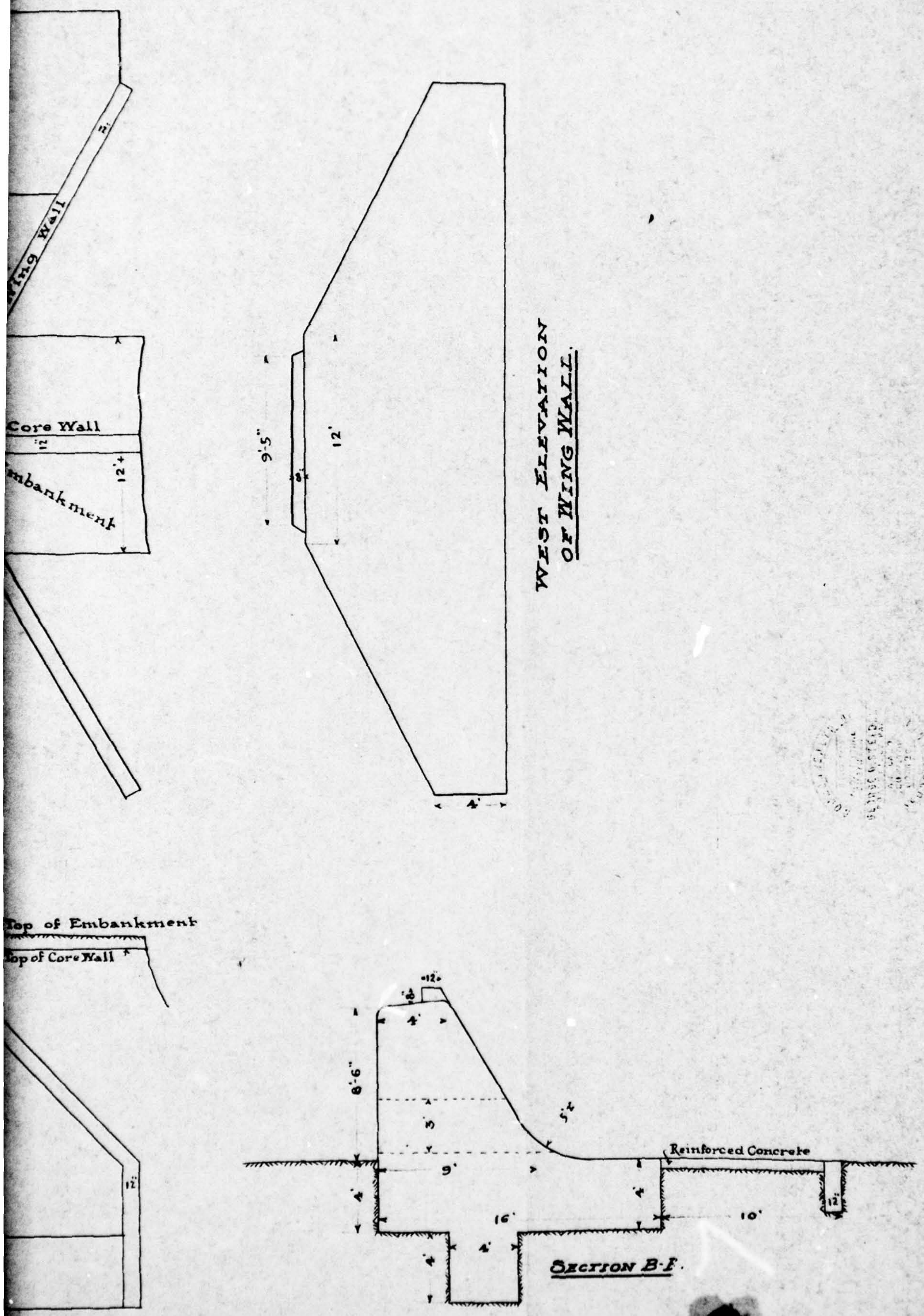
PLAN OF
SPILLWAY AND WING WALLS.

DETAIL PLAN
SHOWING CHANGE IN CONSTRUCTION
OF CONCRETE SPILLWAY AT
DEER LAKE
WEST BRUNSWICK TOWNSHIP,
SCHUYLKILL COUNTY, PA.

Scale ¼" = 1ft. Dec. 1925. Geo. H. Steidel,
Engineer & Surveyor,
POTTSVILLE, PA.



NORTH ELEVATION OF SPILLWAY AND WING WALLS.



PA. 834
PLATE IV