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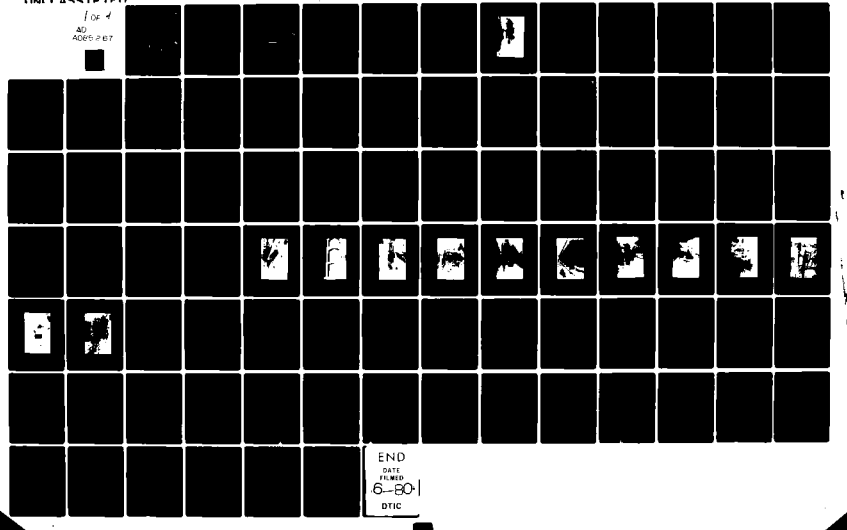


DELAWARE RIVER BASIN

DEEP CREEK, MONTGOMERY COUNTY

PENNSYLVANIA

NDS ID PA. 00200

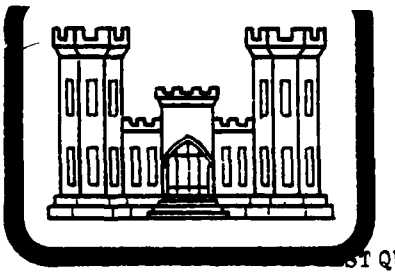
DER ID 46-8

DEEP CREEK DAM

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

WOODWARD-CLYDE CONSULTANTS

DACW31-80-C-0018



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

APRIL 1980

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DELAWARE RIVER BASIN

DEEP CREEK

DEEP CREEK DAM, ~~MONTGOMERY COUNTY, PENNSYLVANIA~~

(NDS I.D. [redacted] PA ØØ2ØØ,
DER I.D. [redacted] 46-8)

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DACW31-80-C-0018

Prepared by:

WOODWARD-CLYDE CONSULTANTS
5120 Butler Pike
Plymouth Meeting, Pennsylvania 19462

Submitted to:

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

APR[redacted]98Ø

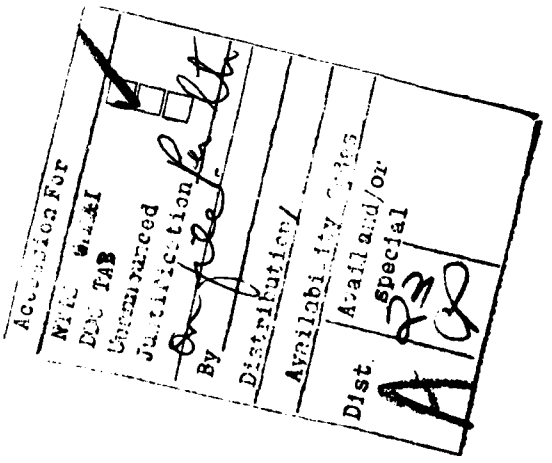
PREFACE

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 the Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to expeditiously identify 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 investigations, testing and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify the need for more detailed 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 INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

Name of Dam:	Deep Creek Dam
County Located:	Montgomery County
State Located:	Pennsylvania
Stream:	Deep Creek
Coordinates:	Latitude 40° 20.0'
	Longitude 75° 28.8'
Date of Inspection:	November 19, 1979

Deep Creek Dam is owned by the Montgomery County Commissioners and maintained by the Parks Department. The dam and reservoir are used for recreational purposes. The dam and its appurtenant facilities are considered to be in fair condition. The dam is classified as a "Small" size structure with a "High" hazard classification consistent with its potential in the event of sudden failure for extensive property and loss of life downstream along Perkiomen Creek.

In accordance with criteria established by Federal (OCE) Guidelines, the spillway design flood for this "Small" size dam and "High" hazard classification is 0.5 to the full Probable Maximum Flood (PMF). As the total storage capacity is nearer the lower limit for the "Small" size classification, and as the watershed controlled by Deek Creek Dam is small compared to the watershed controlled by downstream Knight Dam, the selected spillway design flood is 0.5 PMF.

Hydrologic and hydraulic calculations indicate that the spillway structure is capable of discharging about 0.21 PMF without overtopping the embankment at the right abutment. If the right abutment and embankment were raised to the original design elevation, the spillway would be capable of discharging about 0.38 PMF without overtopping. The 0.4 PMF is judged to cause failure of the embankment by overtopping, but failure does not significantly increase the danger to human life or property; thus, the spillway rating for this structure is considered to be "Inadequate" but not "Seriously Inadequate".

a. Facilities. It is recommended that the following measures be undertaken as soon as practical. Items (1) through (4) should be performed under the supervision of a registered professional engineer experienced in the design and construction of dams.

(1) A detailed hydrologic/hydraulic study should be made to determine the best method of increasing spillway capacity to meet current hydrologic/hydraulic criteria.

(2) The embankment crest should be restored to its original elevation and crowned to allow surface drainage.

(3) The right abutment should be raised to the embankment elevation.

(4) The drainage swale at the left end of the embankment and the downstream slope should be frequently monitored, at least visually, for evidence of uncontrolled seepage through the dam or turbidity in the seepage, and for evidence of rotting timbers within the older timber crib dam.

(5) The minor erosion under the footbridge to the intake tower should be repaired. Any large stones blocking the pond drain outlet should be removed.

Because of the location of the dam and the potential for heavy property damage and possible loss of life in the event of failure, a formal procedure of observation and warning during periods of high precipitation should be developed and implemented. This procedure should include a method of warning downstream residents along Perkiomen Creek that high flows are expected and provisions for evacuating these people in the event of an emergency. An operation and maintenance procedure should also be developed to insure that all pertinent items are carefully inspected on a regular basis and maintained in the best possible condition.

Mary F. Beck — 5/20/80

Mary E. Beck, P.E. — Date
Pennsylvania Registration 27447E
Woodward-Clyde Consultants

5/2/80

John H. Frederick, Jr., P.E. — Date
Maryland Registration 7301
Woodward-Clyde Consultants

APPROVED BY:

21 MAY 1980

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

OVERVIEW
DEEP CREEK DAM, MONTGOMERY COUNTY, PENNSYLVANIA

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PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
DEEP CREEK DAM
NATIONAL ID NO. PA 00200
DER NO. 46-8

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. Deep Creek Dam is an earth fill dam constructed over a preexisting rockfill timber crib dam. The dam is about 19 feet high and 610 feet long. The upstream slope is 2.5H:1V (design), and is protected with stone over gravel below the water level and gravel above water level to an elevation of about 226.3. Between the gravel and the dam crest, the upstream slope is protected with grass. A 15 foot wide crest at elevation 229.5 is protected by a gravel foot road. The downstream slope is 2H:1V (design), and the upper portion is protected with grass. The lowest portion of the slope is protected by rock; see Photograph 6. According to Plate 4, Appendix E, the downstream slope is stone and is believed to be covered with sod. The dam crest is not straight, but about 225 feet left of the spillway, the dam curves, deflecting about 30 degrees upstream. The plans show a relatively impervious cutoff trench under the new upstream zone. The cutoff trench is 10 feet wide at the bottom and both side slopes are 1H:1V. The trench is shown to extend to impervious material and to be backfilled with the same impervious materials as used to construct the upstream zone.

The spillway is located at the right end of the embankment, as shown in Photograph 1. The concrete ogee weir is about 90 feet long and has a design crest elevation of 224.5. A bridge crosses the spillway and is supported by two piers, each one being one foot ten inches thick. Flow over

the ogee weir discharges into a stilling basin immediately under the foot bridge and into the backwater from downstream Knight Dam. The stilling basin discharge elevation is 212.5. Spillway retaining walls are concrete faced with stone.

A pond drain is located about 200 feet left of the left edge of the spillway. The pond drain design inlet elevation is 210, and the outlet design elevation is 208. A stone faced concrete gate house is located midway between the upstream edge of the crest and the upstream toe. Flow through the pond drain conduit is controlled by a sluice gate at its upstream end. The pond drain outlet is under the backwater from Knight Dam. The pond drain conduit is a 25 inch diameter steel pipe encased in reinforced concrete, and there are two anti-seep collars constructed around the conduit, as shown on Plate 4, Appendix E.

b. Location. The dam is located across Deep Creek, immediately upstream of its confluence with the Perkiomen Creek, in Upper Frederick Township, Montgomery County, Pennsylvania. The dam site is located about 800 feet west of the intersection of Snyder Road and U.S. Route 29, near Green Lane, Pennsylvania. The dam site and reservoir are located on the USGS Quadrangle map entitled "Perkiomenville, Pennsylvania", at coordinates N 40° 20.0' W 75° 28.8'. A regional location plan of Deep Creek Dam and reservoir is enclosed as Plate 1, Appendix E.

c. Size Classification. The dam is classified as a "Small" size dam by virtue of its 19 foot height and estimated total capacity of 250 acre-feet.

d. Hazard Classification. A "High" hazard classification is assigned consistent with the dam's location above an urban area and the potential to cause extensive property damage and possible loss of life downstream along the creek.

e. Ownership. The dam is located within the Upper Perkiomen Valley County Park, and is owned by the Montgomery County Commissioners. All correspondence should be addressed to Mr. A. Russell Parkhouse, Chairman, Montgomery County Commissioners, Court House, Norristown, Pennsylvania 19401.

f. Purpose of Dam. The dam is used for recreational purposes.

g. Design and Construction History. The original rockfill timber crib dam at the site was believed to have been built about 1902 or 1903. In 1912, the dam, then belonging to the American Ice Company of Philadelphia, Pennsylvania, was first inspected by the state. At that time, the dam was about

400 feet long and 14 or 15 feet high, and there was a spillway at the right end. The downstream face had a batter of 1H:6V, and the upstream face was vertical. The base of the crib was 20 feet wide at the maximum section, and clay fill was placed against the upstream side. The dam was built directly on the meadow, and no attempt was made to secure a good foundation. The cribbing and deck were noted to be badly rotted and a portion had collapsed due to a breach. Department of Environmental Resources files contain numerous inspection reports, memos and correspondence concerning the dam and its condition, which was generally poor. Over the course of years, the earth was extended to cover the crest, and the downstream side was covered with stone. In 1927, a letter from the American Ice Company informed the state that they had breached the dam as they no longer required the reservoir behind it. The property was sold to the Christian Association of the University of Pennsylvania in 1929, who never raised sufficient money to repair the dam.

In the early part of 1936, the property came into the possession of the Montgomery County Commissioners. April 9, 1936, the County Commissioners made application to construct a new dam. The old, or preexisting, dam was to be incorporated into the downstream section of the new dam. The old sluiceway was to be removed and a new reinforced concrete intake and control tower and a new spillway were to be constructed. In June 1939, the county engineers submitted plans for the new structure, and a permit was issued June 6, 1939. Memoranda in the state files indicate that the foundations for the spillway and outlet control works were satisfactory, and the dam was completed in November 1939. In 1960, the downstream Knight Dam was constructed with a design spillway crest elevation of 213.

h. Normal Operating Procedures. Reservoir flows are normally discharged over the ogee weir at the right end of the dam.

1.3 Pertinent Data.

A summary of pertinent data for Deep Creek Dam is presented as follows.

a.	Drainage Area (square miles)	5.6
b.	Discharge at Dam Site (cfs)	
	Maximum Known Flood at Dam Site (August 9, 1942)	1,540
	At Top of Dam	2,136

c.	Elevation (feet above MSL)	
	Top of Dam (design)	229.5
	Minimum Top of Dam (existing)	228.0
	Spillway Weir (left side)[1] (normal pool)	224.5
	Pond Drain Inlet (design)	210.0
	Pond Drain Outlet (design)	208.0
	Pond Drain Outlet (measured)	209.0
	Tailwater	212.6
d.	Reservoir (feet)	
	Length at Normal Pool	2,700
	Length at Maximum Pool	3,000
	Fetch at Normal Pool	1,300
e.	Estimated Storage (acre-feet)	
	To Spillway	95
	To Top of Dam	250
f.	Reservoir Surface Area (acres)	
	Normal Pool	27
g.	Dam Data	
	Type	Earth fill over older timber crib
	Length	610 feet
	Maximum Height	19 feet
	Top Width	15 feet
	Volume	11,700 cubic yards
	Side Slopes	
	Upstream (design)	2.5H:1V
	Upstream (existing)	1.6H:1V to 3.8H:1V
	Downstream (design)	2 H:1V
	Downstream (existing)	2.1H:1V
	Cutoff	Cutoff trench to impervious material w/10 foot bottom width
	Grout Curtain	None
h.	Spillway	
	Type	Concrete ogee weir
	Elevations (feet)	
	Weir	224.5
	Energy Dissipator	Stilling basin

(1) Assumed elevation of left side of spillway weir is 224.5. All other elevations are relative.

i.	Outlet Works	
	Type	25 inch steel pipe encased in concrete; upstream sluice gate
	Elevations	
	Inlet Invert (design)	210.0
	Outlet Invert (design)	208.0

SECTION 2
ENGINEERING DATA

2.1 Design.

a. Data Available. The data available for review from Department of Environmental Resources (DER) files include correspondence, memoranda, black-and-white photographs and design drawings of Deep Creek Dam. Available engineering analysis for this dam was limited to a stability analysis of the spillway section.

b. Design Features. The principal design features of Deep Creek Dam are illustrated on the plans and cross-sections enclosed in Appendix E. Data for these sections were obtained from DER files.

2.2 Construction.

Beyond the limited information given in Section 1.2, there are no data available concerning the construction history of this dam and reservoir.

2.3 Operational Data.

There are no operational records maintained. There are no minimum flow requirements downstream of this dam.

2.4 Evaluation.

a. Availability. Information presented herein was obtained from records located in DER files in Harrisburg, Pennsylvania, and from conversations with the Owner's representative.

b. Adequacy. The available data included in the state files are not adequate to evaluate the engineering aspects of the dam and appurtenant structures.

c. Validity. There is no reason to question the validity of the limited available data.

SECTION 3
VISUAL INSPECTION

3.1 Findings.

a. General. Observations and comments of the field inspection team are contained in the checklist enclosed herein as Appendix A, and are summarized and evaluated in the following subsections. In general, the appearance of the facility in November 1979, indicates that the spillway is in good condition and the embankment is in fair condition. The overall evaluation of the condition of the dam is fair. A plan and cross-section of the dam are shown in Plates 3 through 5, Appendix E.

b. Dam. The vertical alignment of the dam was checked, and the profile is shown on sheet 5B, Appendix A. The low point is to the right of the spillway, in the abutment area. No discernible horizontal displacement or bulging was noted along the crest. A gravel protected pedestrian roadway crosses the dam breast, about 13 to 14 feet in width. The surface of the roadway is up to six inches lower than the edge of the grass portions of both the upstream and downstream slopes of the dam. Rock is apparent on the upstream slope under the waterline. Between the upstream waterline and about 22 inches above the waterline, the slope is protected with coarse sand, and by grass between the sand and the crest. Minor erosion has occurred under the left side of the footbridge to the intake tower. Stones have been placed under the right side of the bridge, forming a gutter. The embankment between the waterline and the crest is uneven, with upstream slopes ranging from 1.6H:1V to nearly 4H:1V. The upstream slope and crest are shown in Photograph 5.

The downstream slope was constructed over the preexisting rockfill timber crib dam and is protected by grass, with riprap along the waterline, as shown in Photograph 6. The downstream slope is approximately 2.1H:1V. On the downstream side near the spillway are holes in the sod over the rock, as shown on sheet 5A of Appendix A and Photograph 10. The embankment deflects upstream, forming a swale between the embankment and the natural ground at the left end of the dam. On the date of the inspection, the area was saturated and very soft. The embankment also had holes less than two inches in diameter through the sod in this area, giving the appearance of animal burrows.

c. Appurtenant Structures.

1. Spillway. The spillway weir, shown in Photograph 1, was not faced with stone, as shown on the enclosed plans. However, the concrete retaining walls are faced with stone. Another slight difference between the existing spillway and the design is that two bridge piers were built instead of one. The 89 foot 11 inch weir is divided into three sections by the two one foot, ten inch piers. Each weir section has a notch at its midpoint. The weir apparently was not constructed level. No water was flowing over the left end of the weir, and most of the water flowing over the weir was flowing over the right end of the weir. The uneven weir elevation was noted in a state inspection report dated September 16, 1942. The stone faced retaining walls appear to be in good condition, with no noticable settlement, cracking or rotation. The right spillway wall was stained with leachate deposits, as shown in Photograph 11, indicating water seepage through the wall. The mortar joints have experienced some deterioration, which does not appear to be significant at this time. The bridge end posts appear to be constructed solely of masonry, and deterioration of these mortar joints has been more extensive, as shown in Photograph 9.

2. Outlet Works. A stone faced reinforced concrete intake tower is located within the upstream embankment; see Photograph 3. As shown on Plate 4, Appendix E, an intake channel has been constructed from the upstream toe to the intake tower. The pond drain is a 25 inch diameter steel concrete encased pipe at the base of the dam. The outlet of the conduit was under water at the time of the inspection; see Photograph 4. The outlet headwall appeared to be rotated. The design top of the headwall, elevation 213, is the same as the design weir crest elevation at the downstream Knight Dam. However, the top of the headwall was not submerged at the time of the inspection. Inspection of the interior of the intake tower disclosed diagonal cracking at one upper corner. Horizontal cracks with leachate deposits were also observed on the inside of the tower. The cracking is not considered significant.

The design drawings, Plate 4, Appendix E, indicate stone pavement at the outlet of the pond drain conduit. Inspection disclosed apparent boulders dumped at the outlet end, perhaps partially blocking the pipe. The sluice gate at the upstream end of the conduit operated smoothly and seats completely.

d. Reservoir. The reservoir slopes are flat to moderate and vegetated to the water's edge with grass or trees, except where a swimming beach is located. A considerable amount of sediment has accumulated within the upper end

of the reservoir. No debris was noted around the reservoir edge.

e. Downstream Channel. The design elevation of the outlet of the spillway bucket is 212.5 feet (Plate 4), one-half foot below the weir elevation of downstream Knight Dam on Perkiomen Creek. Thus, there is no downstream channel and the toe of the dam is submerged by the tailwater of downstream Knight Dam. Knight Dam is located about 600 feet below Deep Creek Dam and, as shown in Photograph 7, is a run-of-the-river dam across Perkiomen Creek. The first major downstream damage point is about 0.7 mile downstream of Deep Creek Dam, and is shown in Photograph 8. At that point, there are seven houses and an old mill with at least one apartment on its upper floors. Brey Dam is immediately downstream of the mill. Part of the flow from Perkiomen Creek still flows through the mill race under the mill building. The first floor of at least three of the houses appear to be less than six feet above the creek bank. All along the Perkiomen Creek to its confluence with the Schuylkill River are scattered houses and businesses built in the floodplain.

3.2 Evaluation.

Inspection of the dam and appurtenant facilities disclosed no evidence of apparent past or present movement that would indicate existing instability of the dam, spillway or outlet structure. The dam crest should be brought to design elevation and crowned to allow surface drainage. Considering the fact that the downstream portion of the embankment is the preexisting rockfill timber crib, the holes through the sod are not considered significant. However, the downstream slopes should be frequently monitored, at least visually, for evidence of uncontrolled seepage through the dam or turbidity in the seepage. Seepage in the swale between the embankment and the natural ground can be attributed at least in part to hillside seepage. The exposed interior and exterior portions of the intake tower were inspected and assessed to be in good condition. The pond drain conduit is underground and the outlet is underwater, and therefore cannot be inspected. The spillway was inspected and appears to be in good condition, with some deterioration of the mortar joints of the stone facing and bridge posts. Considering the condition of the embankment crest (lower elevation than the top of the embankment slopes) and the inclusion of the preexisting rockfill timber crib dam within the existing embankment resulting in holes through the sod on the downstream slope, the embankment is assessed to be in fair condition, and the overall condition of the dam is considered to be fair.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Procedures.

Operation of the dam does not require a dam tender. Under normal conditions, the pond drain valve is closed, and water discharges over the spillway at the right end. Backwater from downstream Knight Dam submerges the downstream toe of Deep Creek Dam.

4.2 Maintenance of the Dam.

Upper Perkiomen Valley Park employees provide routine maintenance to the dam. Foot traffic damage is routinely repaired. Every spring, the reservoir is lowered to make repairs to the beach, at which time, the dam is inspected.

4.3 Maintenance of Operating Facilities.

The pond drain sluice gate is operated in the spring, when the reservoir is lowered and the dam is inspected.

4.4 Warning Systems In Effect.

There is no written warning system in effect for this dam.

4.5 Evaluation.

It is judged that the current operating procedure, which does not require a dam tender, is a realistic means of operating the relatively simple control facilities of Deep Creek Dam. It is noted that formal operational, maintenance and warning procedures should be developed and implemented. Maintenance procedures should include an inspection checklist which would include a listing of items to be checked during each inspection and repaired as necessary to insure proper performance of the structure.

SECTION 5
HYDROLOGY/HYDRAULICS

5.1 Evaluation of Features.

a. Design Data. There is no original design data available for this dam. Subsequent evaluation data is limited to an estimate of the spillway capacity. The watershed is about 3.7 miles long and averages about 1.7 miles wide, having a total drainage area of 5.62 square miles. Elevations within the watershed range from about 600 feet in the upper reaches to 224.5 feet at normal pool elevation. The watershed is approximately 70 percent wooded, with 30 percent residential development. It is expected that residential development will continue within the watershed. There are no significant upstream dams or structures.

In accordance with criteria established by Federal (OCE) Guidelines, the spillway design flood for this "Small" size dam and "High" hazard classification is 0.5 to the full Probable Maximum Flood (PMF). As the total storage capacity is nearer the lower limit for the "Small" size classification, and as the watershed controlled by Deep Creek Dam is small compared to the watershed controlled by downstream Knight Dam, the selected spillway design flood is 0.5 PMF.

b. Experience Data. There are no records of reservoir levels or rainfall kept for this dam. Present park employees estimate that the maximum water over the weir has been in the range of 15 to 18 inches. State records indicate that the maximum depth of water over the weir was 34 inches on August 9, 1942. This corresponds to a discharge of about 1,540 cfs.

c. Visual Observations. On the date of the inspection, there were no conditions observed that might indicate a possible reduction in spillway capacity during an extreme event. The underside of the bridge crossing the spillway is about 2.5 feet above the spillway crest elevation; see Photograph 1, Appendix C. As the spillway is about 5.4 feet upstream of the bridge, no reduction in spillway capacity is expected as a result of the bridge. Observations regarding the condition of the downstream channel, spillway and reservoir are located in Appendix A and are discussed in greater detail in Section 3.

d. Overtopping Potential. The overtopping potential of this dam was estimated using the HEC-1, Dam Safety Version, computer program. A brief description of the program is included in Appendix D.

Calculations for this investigation estimate a spillway discharge of about 2,136 cfs when the reservoir level is at the minimum embankment elevation of 228.0, which is in the right abutment area. The HEC-1 program computed the peak one-half PMF inflow to be about 5,180 cfs. The spillway is capable of passing about 0.21 PMF without overtopping the right abutment. If the embankment and abutment were raised to the minimum design elevation of 229.5, the spillway would be capable of discharging about 0.38 PMF without overtopping the embankment.

e. Spillway Adequacy. A spillway that will not pass 0.5 PMF without overtopping the dam is rated as "Seriously Inadequate", provided two other conditions are present. One is failure of the dam by overtopping. The dam is judged capable of withstanding overtopping of up to one foot for about an hour. The abutment area to the right of the spillway is assumed capable of withstanding a greater depth of overtopping for a longer period of time. It is estimated that 0.4 PMF will cause failure by overtopping. The second condition required to assess a spillway as "Seriously Inadequate" is a significant increase in the downstream hazard potential as a result of failure. As discused in Appendix D, the increase in Knight Lake outflow at the time of assumed Deep Creek failure is about two percent. Therefore, Deep Creek spillway is rated as "Inadequate" but not "Seriously Inadequate".

f. Downstream Conditions. It is assessed that the first major downstream damage center is approximately 0.7 mile below the dam at the intersection of Route 29 and Perkiomenville Road, as shown on Plate 1. At that point, there are three houses which are less than six feet above the bank of the Perkiomen Creek. The structure closest to the Brey Dam, which is shown on Plate 1, is an old mill. Only three of the seven houses between Route 29 and Perkiomen Creek are shown on Plate 1. Water is still diverted from Perkiomen Creek through the building. All along the Perkiomen Creek to its confluence with the Schuylkill River are scattered homes and businesses built in the floodplain.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations. Visual observations detected no evidence of existing deep seated embankment stability problems. Although unprotected by riprap above the waterline, the upstream embankment appears stable and in good condition. The existing downstream slope was constructed over the preexisting rockfill timber crib dam. Holes through the sod are not considered significant. However, the downstream slope should be frequently monitored, at least visually, for evidence of uncontrolled seepage through the dam or turbidity in the seepage, and for evidence of rotting timbers within the older timber crib structure. The reservoir of the downstream Knight Dam could mask seepage through or under the dam.

b. Design and Construction Data. Design and construction documentation is described in Section 1.2. A summary of the spillway stability analysis is presented on Plate 6, Appendix E. Analysis of the embankment sections could not be located. Therefore, the embankment stability evaluation is based on an assessment of the geometric configuration and obvious performance history. The embankment stability for this structure is qualitatively assessed to be adequate.

c. Operating Records. There are no written operational procedures for this structure.

d. Post-Construction Changes. There is no evidence to suggest that modifications were made to this dam since it was constructed in November 1939.

e. Seismic Stability. The dam is located in Seismic Zone 1. Normally it can be considered that if a dam in this zone is stable under static loading conditions, it can be assumed safe for any expected earthquake conditions. As the dam is qualitatively assessed to be stable under present static loading conditions, it can reasonably be assumed to be stable under seismic loading conditions.

SECTION 7
ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment.

a. Evaluation. Visual inspection indicates that the embankment is in fair condition, and the spillway is in good condition, with an overall rating of fair. In accordance with criteria established by Federal (OCE) Guidelines, the spillway design flood for this "Small" size dam and "High" hazard classification is one-half to the full Probable Maximum Flood (PMF). As the total storage capacity is nearer the lower limit for the "Small" size classification, and as the watershed controlled by Deep Creek Dam is small compared to the watershed controlled by downstream Knight Dam, the selected spillway design flood is one-half the PMF. Calculations presented in Appendix D indicate that the spillway is capable of discharging about 0.21 PMF without overtopping the embankment at the right abutment. If the right abutment and embankment were raised to the original design elevation, the spillway would be capable of discharging about 0.38 PMF without overtopping. Under existing conditions, the embankment to the left of the spillway is assessed capable of withstanding overtopping of about one foot for about an hour. Overtopping the dam by more than one foot during a 0.4 PMF event is judged to cause failure. As failure does not significantly increase the danger to human life or property, the spillway rating for this structure is considered to be "Inadequate" but not "Seriously Inadequate".

b. Adequacy of Information. The combined visual inspection, documentation in Department of Environmental Resources files and simplified calculations presented in Appendix D were sufficient to determine that further investigations are required for this structure.

c. Urgency. It is recommended that the measures presented in Section 7.2 be implemented as specified.

7.2 Remedial Measures.

a. Facilities. It is recommended that the following measures be undertaken as soon as practical. Items (1) through (4) should be performed under the supervision of a registered professional engineer experienced in the design and construction of dams.

(1) A detailed hydrologic/hydraulic study should be made to determine the best method of increasing

spillway capacity to meet current hydrologic/hydraulic criteria.

(2) The embankment crest should be restored to its original elevation and crowned to allow surface drainage.

(3) The right abutment should be raised to the embankment elevation.

(4) The drainage swale at the left end of the embankment and the downstream slope should be frequently monitored, at least visually, for evidence of uncontrolled seepage through the dam or turbidity in the seepage, and for evidence of rotting timbers within the older timber crib dam.

(5) The minor erosion under the footbridge to the intake tower should be repaired. Any large stones blocking the pond drain outlet should be removed.

b. Operation and Maintenance Procedures. Because of the location of the dam and the potential for heavy property damage and possible loss of life in the event of failure, a formal procedure of observation and warning during periods of high precipitation should be developed and implemented. This procedure should include a method of warning downstream residents along Perkiomen Creek that high flows are expected and provisions for evacuating these people in the event of an emergency. An operation and maintenance procedure should also be developed to insure that all pertinent items are carefully inspected on a regular basis and maintained in the best possible condition.

APPENDIX

A

CHECK LIST
VISUAL INSPECTION
PHASE I

Name Dam *Deep Creek Dam* County *Montgomery* State *Pennsylvania* National ID # *PA 00200*

Type of Dam *Earth* Hazard Category *High*

Date(s) Inspection *11/19/1979* Weather *Sunny* Temperature *60's*

Pool Elevation at Time of Inspection *224.5* M.S.L. Tailwater at Time of Inspection *212.6* M.S.L.

Inspection Personnel:

Mary F. Beck (Hydrologist)
Vincent McKeever (Hydrologist) *9/13/1979*
John H. Frederick, Jr. (Geotechnical) *(4/8/1980)*
Arthur H. Dvinoff (Geotechnical/Civil)
Raymond S. Lambert (Geologist)

Mary F. Beck Recorder

Remarks:

Mr. Otto Quinque, Upper Perkiomen Valley Park Superintendent and Park employees were on site and provided assistance to the inspection team.

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE	*N/A*	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	*N/A*	
DRAINS	*N/A*	
WATER PASSAGES	*N/A*	
FOUNDATION	*N/A*	

CONCRETE/MASONRY DAMS

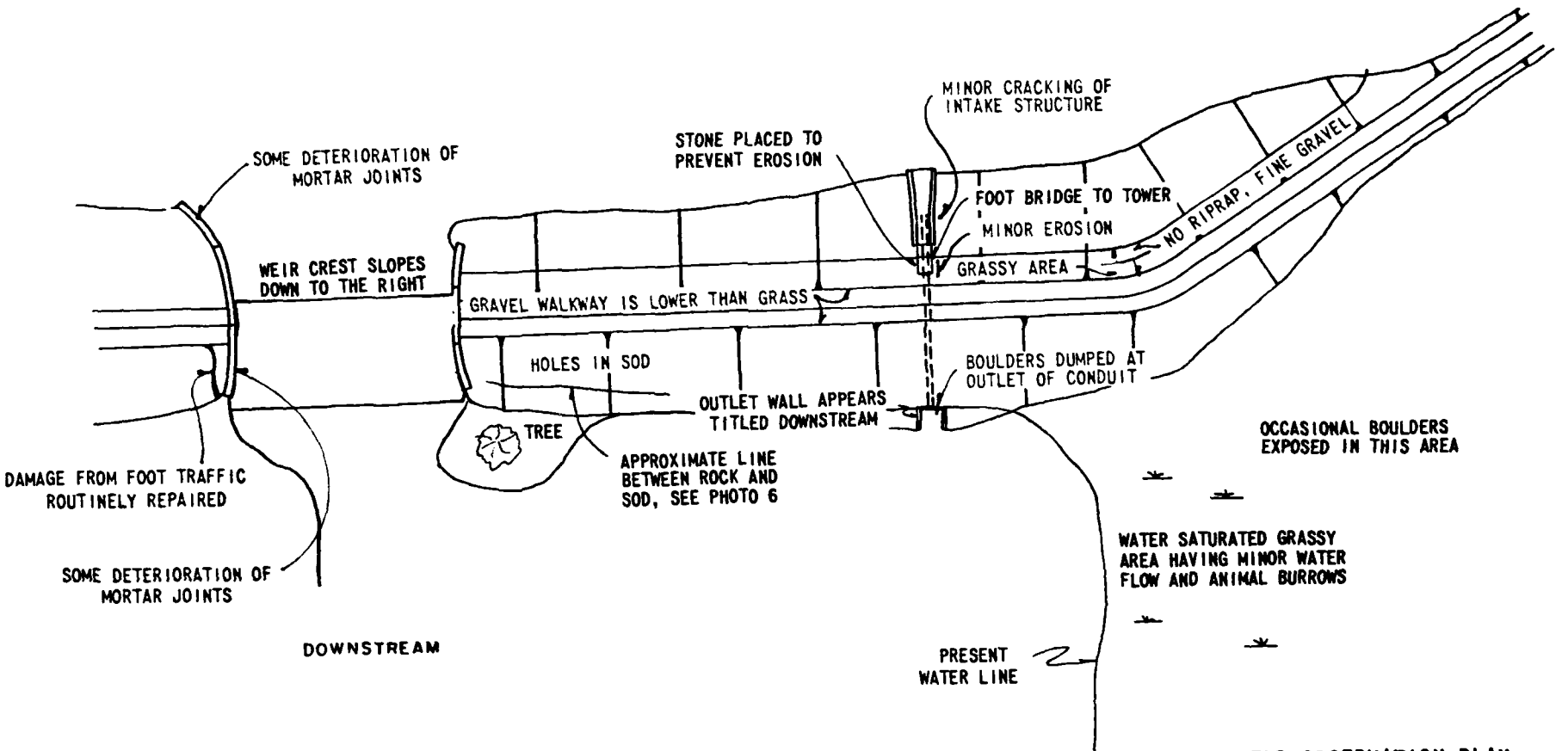
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	*N/A*	
STRUCTURAL CRACKING	*N/A*	
VERTICAL AND HORIZONTAL ALIGNMENT	*N/A*	
MONOLITH JOINTS	*N/A*	
CONSTRUCTION JOINTS	*N/A*	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	*None observed.*	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	*None observed.*	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	*A small area on the downstream slope near the spillway has several holes (see Photographs, Appendix D) and cracks through sod. "Minor erosion noted under footbridge to intake tower."*	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	*The horizontal alignment appears to be satisfactory. The vertical alignment is shown on Sheet 5B.*	
RIPRAP FAILURES	*None observed.*	

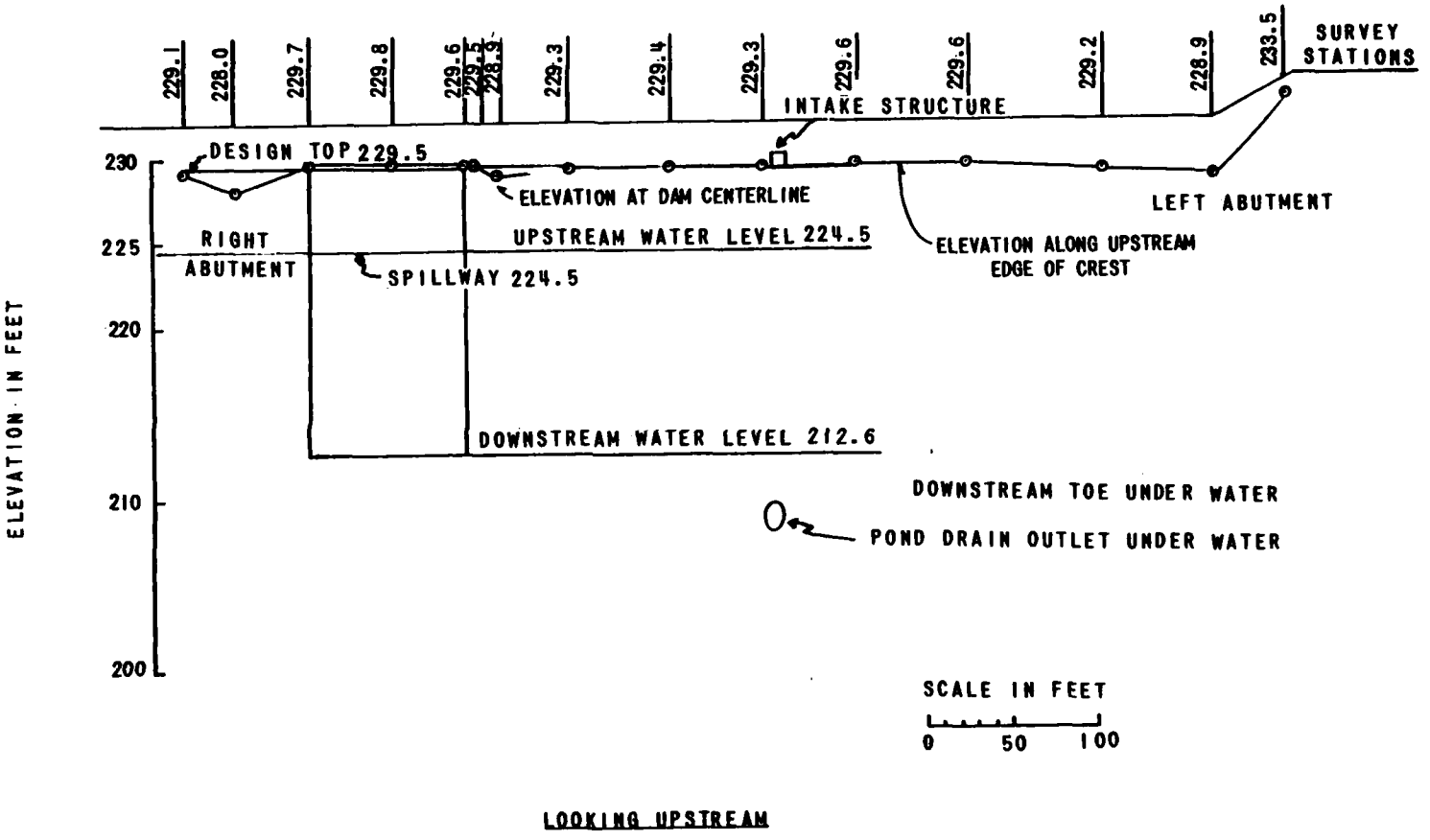
EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	*Right junction in good condition, damage from foot traffic routinely repaired. Left junction very soft and wet. Several holes noted in embankment.*	
ANY NOTICEABLE SEEPAGE	*Seepage noted at left downstream junction, see Sheet 5a of 11.*	
STAFF GAGE AND RECORDER	*None*	
DRAINS	*None located.*	



FIELD OBSERVATION PLAN
DEEP CREEK DAM

SHEET 5A OF 11



LOOKING UPSTREAM

FIELD OBSERVATION PROFILE
DEEP CREEK DAM

SHEET 5B OF 11

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	*Conduit underground, could not be inspected.*	
INTAKE STRUCTURE	*The stone faced concrete intake appears in generally good condition. Diagonal cracking at one upper corner and horizontal cracks with leachate deposits were observed on inside of tower.*	
OUTLET STRUCTURE	*Under water, it appears large rocks have been dumped at the outlet of the conduit, these sh be removed. The outlet end wall is slightly tilted downstream.*	
OUTLET CHANNEL	*N/A, conduit outlets under water.*	
EMERGENCY GATE	*The gate operated smoothly and seats completely.*	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	*The weir appeared in good condition. The weir crest sloped uniformly with the right end about 1.3 inches below the left end.*	
APPROACH CHANNEL	*N/A, the stone walls appear in fairly good condition with some deterioration of the mortar joints.*	
DISCHARGE CHANNEL	*N/A. spillway discharges directly into downstream lake. The stone masonry shows some joint deterioration. Note: the spillway walls are stone faced concrete.*	
BRIDGE AND PIERS	*The bridge is supported on two piers and appears in good condition.*	

GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	*N/A*	
APPROACH CHANNEL	*N/A*	
DISCHARGE CHANNEL	*N/A*	
BRIDGE AND PIERS	*N/A*	
GATES AND OPERATION EQUIPMENT	*N/A*	

INSTRUMENTATION

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	*None*	
OBSERVATION WELLS	*Design drawings indicate 8 observation pipes in spillway, these were not located.*	
WEIRS	*None*	
PIEZOMETERS	*None*	
OTHER	*None*	

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	*The reservoir side slopes are flat and well vegetated to the water's edge with grass.*	
SEDIMENTATION	*Sedimentation at upper end has little effect on flood water storage.*	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	*The reservir formed by Knight Dam is immediately downstream of Deep Creek Dam.*	
SLOPES	*The valley gradient below Knight Dam is approximately 0.016.*	
APPROXIMATE NO. OF HOMES AND POPULATION	*About 0.8 mile below the dam are four houses and an old mill with at least one apartment on its upper floors. Part of the flow from Perkiomen Creek still flows through the race under the mill building. The first floor of at least three of the houses appear to be less than six feet above the creek bank, All along Perkiomen Creek are homes built in the flood plain.*	

APPENDIX

B

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM *Deep Creek Dam*

ID # *PA 00200*

ITEM	REMARKS
AS-BUILT DRAWINGS	*None available.*
REGIONAL VICINITY MAP	*Plate 1, Appendix E.*
CONSTRUCTION HISTORY	*See text, Section 1.2 paragraph g.*
TYPICAL SECTIONS OF DAM	*See Appendix E.*
OUTLETS - PLAN	*Appendix E.*
DETAILS	
CONSTRAINTS	
DISCHARGE RATINGS	*Appendix D.*
RAINFALL/RESERVOIR RECORDS	*None*

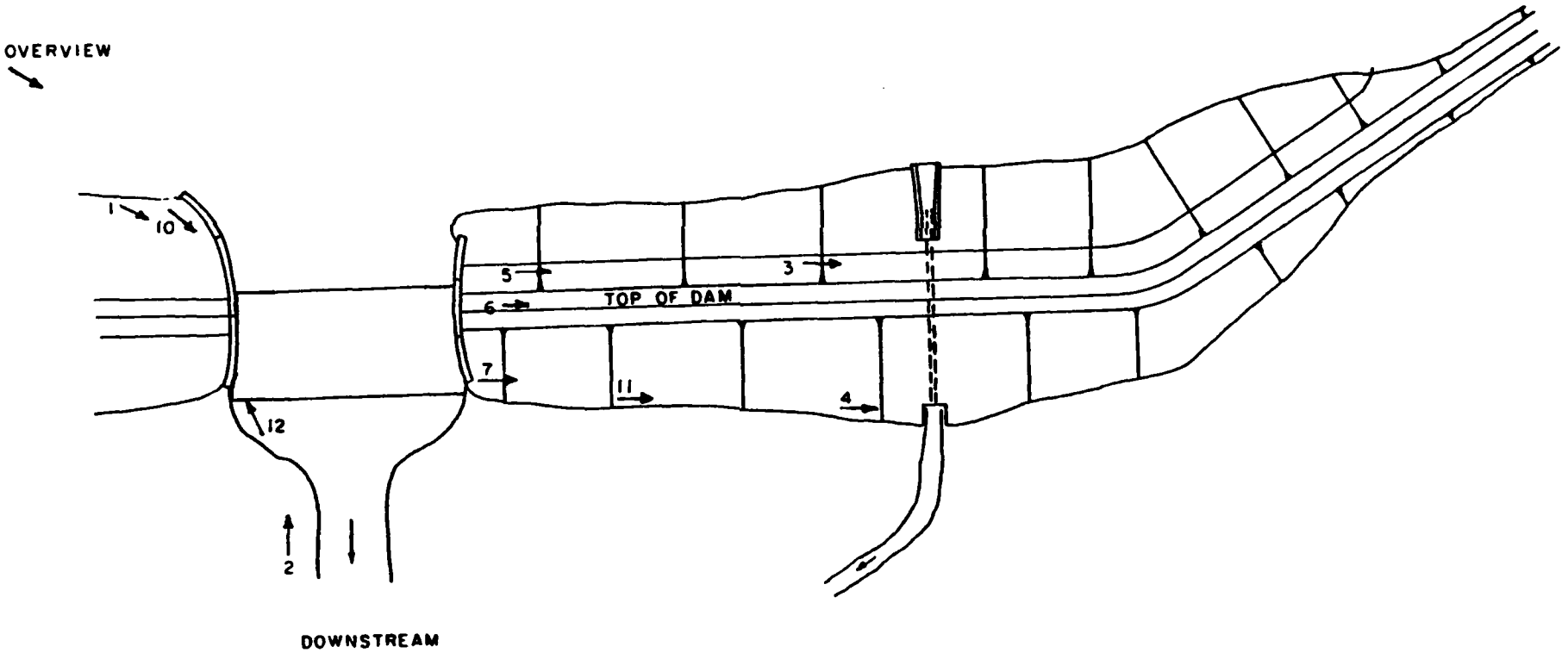
ITEM	REMARKS
DESIGN REPORTS	*None available.*
GEOLOGY REPORTS	*See Appendix F.*
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	*None available.*
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	*None available.*
POST-CONSTRUCTION SURVEYS OF DAM	*See Appendix E.*
BORROW SOURCES	*Impervious material obtained from park property*

ITEM	REMARKS
MONITORING SYSTEMS	*Plate 5, Appendix E indicates 8 observation wells installed in spillway section.*
MODIFICATIONS	*None, since reconstruction in 1939.*
HIGH POOL RECORDS	*September 15, 1942, maximum depth of 34 inches over the weir was reported. (DER files.)*
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	*None known.*
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	*None since 1939.*
MAINTENANCE OPERATION RECORDS	*None*

ITEM	REMARKS
SPILLWAY PLAN SECTIONS DETAILS	*See Appendix E.*
OPERATING EQUIPMENT PLANS & DETAILS	*Rodney Hunt sluice gate.*
MISCELLANEOUS	*Files maintained by Dept. of Environmental Resources include:* 1. *Dam Inspection Reports from 1912 to 1965.* 2. *Reports Upon Applications for Permits to rebuild the dam.* 3. *Copies of correspondence, memorandum, and permits.* 4. *Design plans.* 5. *26 black and white photographs.*

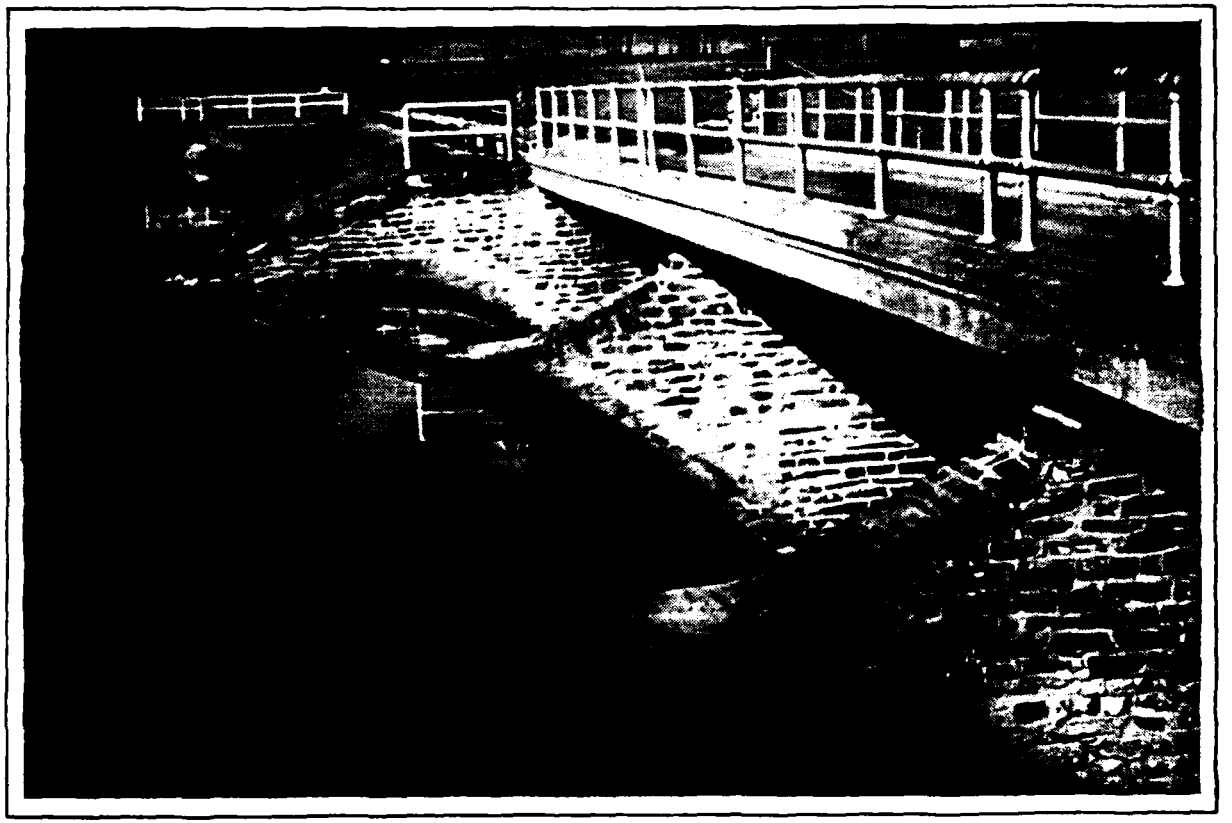
APPENDIX

C



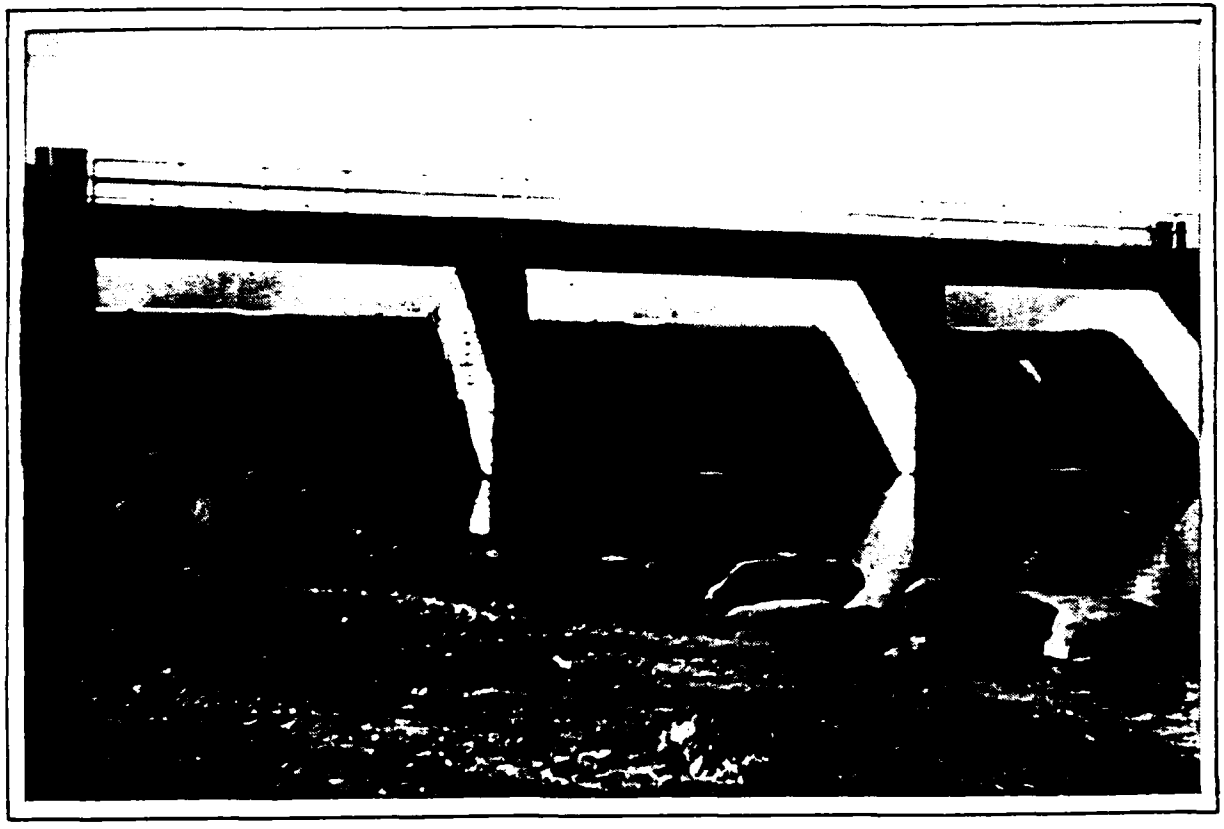
PHOTOGRAPH LOCATION PLAN
DEEP CREEK DAM

PLATE C-I



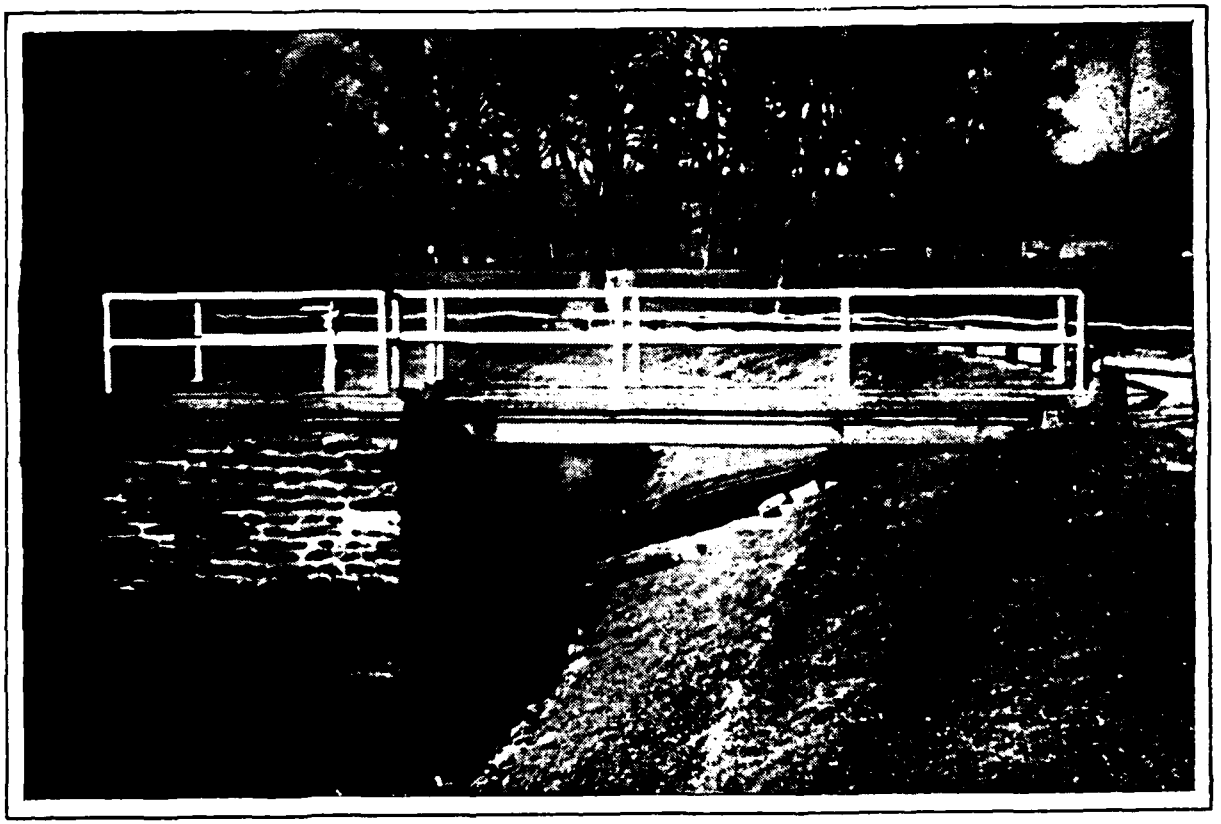
SPILLWAY CREST.

PHOTOGRAPH NO. 1



VIEW OF SPILLWAY FROM DOWNSTREAM.

PHOTOGRAPH NO. 2

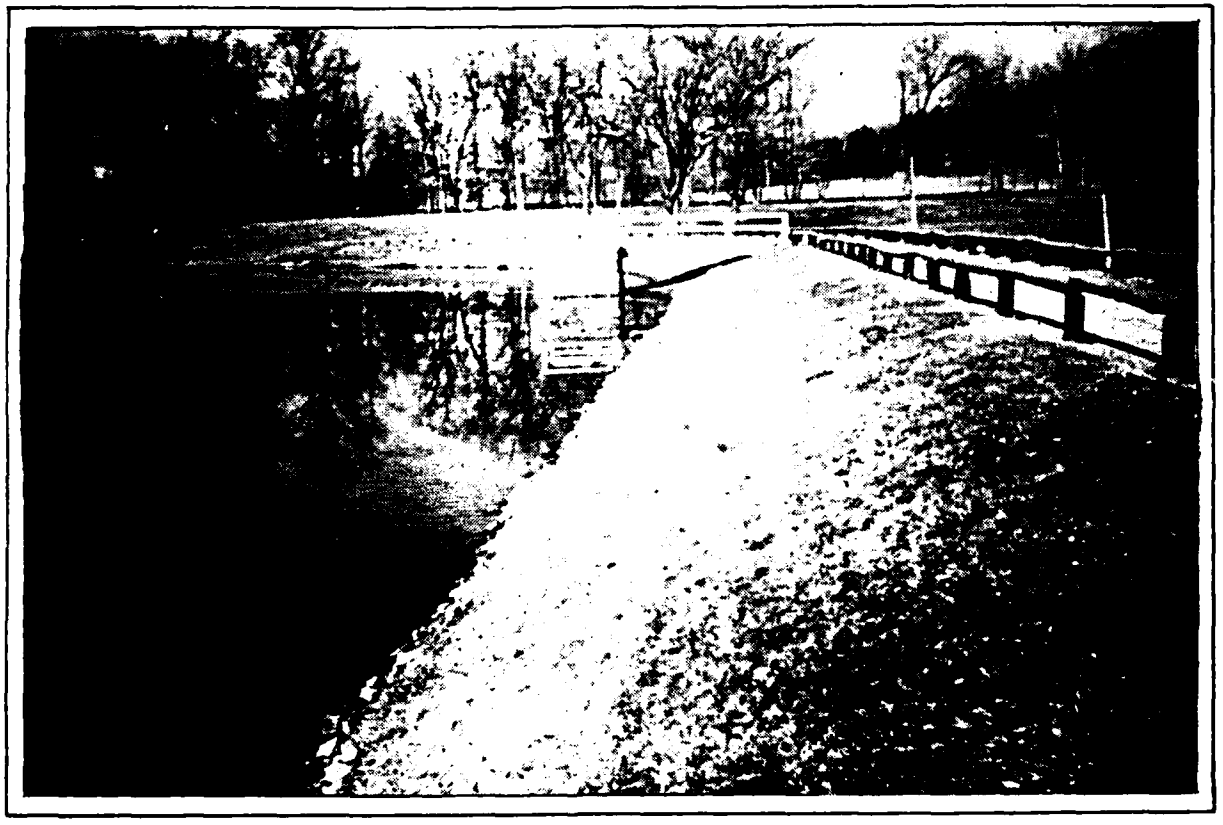


INTAKE TOWER.

PHOTOGRAPH NO. 3

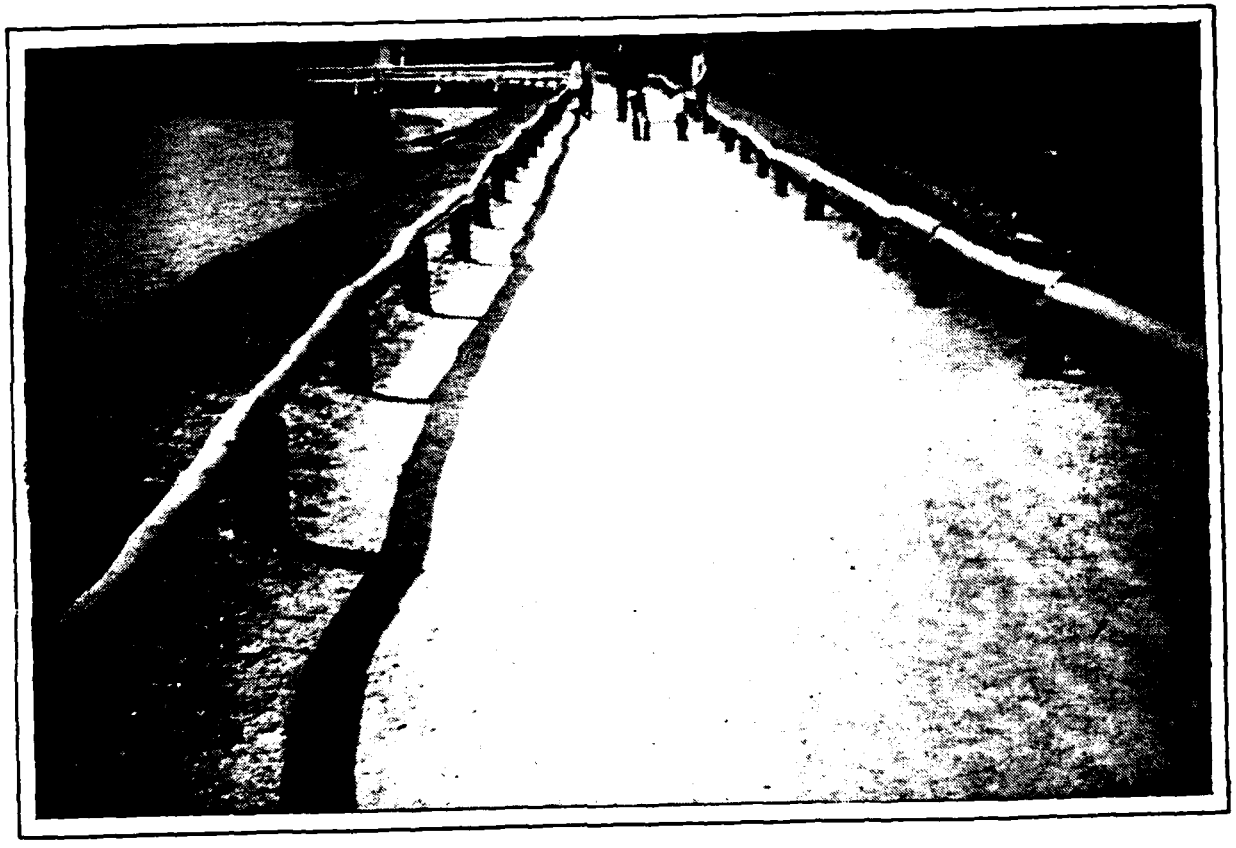
UNDERWATER OUTLET.

PHOTOGRAPH NO. 4



OVERVIEW OF UPSTREAM SLOPE AND
CREST.

PHOTOGRAPH NO. 5



VIEW OF CREST TAKEN WHERE UPSTREAM EDGE IS ABOUT SIX INCHES ABOVE CREST CENTERLINE.

PHOTOGRAPH NO. 6

OVERALL VIEW OF DOWNSTREAM SLOPE.

PHOTOGRAPH NO. 7

KNIGHTS LAKE DAM, 600 FEET
BELOW DEEP CREEK DAM.

PHOTOGRAPH NO. 8

DAMAGE CENTER ABOUT 0.7 MILE
DOWNSTREAM.

PHOTOGRAPH NO. 9

DETERIORATION OF MOTARED JOINTS.

PHOTOGRAPH NO. 10

DAMAGE TO EMBANKMENT SURFACE.

PHOTOGRAPH NO. 11

SPILLWAY WALL SHOWING
LEACHATE ON STONE
FACING.

PHOTOGRAPH NO. 12

APPENDIX

D

DEEP CREEK DAM
CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: *About 70% wooded with 30% residential development.*

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): *224.5 feet (141 Acre-Feet).*

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): *228.0 feet (250 Acre-Feet).* *(right abutment)*

ELEVATION MAXIMUM DESIGN POOL: -----

ELEVATION TOP DAM: *229.0 feet existing, 229.5 feet design.*

SPILLWAY

a. Elevation *224.5 feet.*

b. Type *Concrete ogee weir.*

c. Width *89 feet, 11 inches including 2 bridge piers, (each 1'10" wide).*

d. Length ------

e. Location Spillover *Right end of embankment.*

f. Number and Type of Gates *None*

OUTLET WORKS:

a. Type *25 inch steel pipe through embankment.*

b. Location *200 feet left of spillway.*

c. Entrance inverts *210 feet.*

d. Exit inverts *208.0 feet.*

e. Emergency draindown facilities *The outlet works.*

HYDROMETEOROLOGICAL GAGES:

a. Type *None within watershed.*

b. Location *N/A*

c. Records *N/A*

MAXIMUM NON-DAMAGING DISCHARGE: *Not determined.*

HYDROLOGIC AND HYDRAULIC BASE DATA

DRAINAGE AREA:(1) *5.62 square miles.*

PROBABLE MAXIMUM PRECIPITATION (PMP) FOR 10 SQ. MILES IN 24 HOURS:(2) *23.0 inches.*

ADJUSTMENT FACTORS FOR DRAINAGE AREA (%):(3)

Zone *6*

6 Hours *113*

12 Hours *123*

24 Hours *132*

48 Hours *143*

SNYDER HYDROGRAPH PARAMETERS:(4)

Zone *

C_p, C_t *0.625, 2.0*

L(5) *3.98 miles.*

Lca (6) *2.08 miles.*

$tp=C_t\ (L \cdot Lca)^{0.3}$ *3.77*

SPILLWAY CAPACITY AT MAXIMUM WATER LEVEL(7) *2136 cfs.*

---

(1) Measured from USGS maps.
(2) Hydrometerological Report No. 33, Figure 1.
(3) Hydrometerological Report No. 33, Figure 2.
(4) Information received from Corps of Engineers, Baltimore District.
(5) Length of longest water course from outlet to basin divide, measured from USGS maps.
(6) Length of water course from outlet to point opposite the centroid of drainage area, (see Plate 1, Appendix E) measured from USGS maps.
(7) See Sheet 4.9 of this Appendix.

* *Parameters determined from analysis of flood records at downstream Gratersford gaging station on Perkiomen Creek. Calculations, dated 1950-53, by Philadelphia Suburban Water Company were used in the design of Green Lane Dam on the Perkiomen Creek. In 1973, the original analysis was reviewed by Woodward-Clyde Consultants and judged adequate.*

HEC-1, REVISED
FLOOD HYDROGRAPH PACKAGE

The original "Flood Hydrograph Package" (HEC-1), developed by the Hydrologic Engineering Center, Corps of Engineers, has been modified for use under the National Dam Inspection Program. The "Flood Hydrograph Package (HEC-1), Dam Safety Version", hereinafter referred to as, HEC-1, Rev., has been modified to require less detailed input and to include a dam breach analysis. The required input is obtained from the field inspection of a dam, any available design/evaluation data, relatively simple hydraulic calculations, or information from the USGS Quandrangle maps. The input format is flexible in order to reflect any unique characteristics of an individual dam.

HEC-1, Rev. computes a reservoir inflow hydrograph based on individual watershed characteristics such as: area, percentage of impervious surface area, watershed shape, and hydrograph characteristics determined from regional correlation studies by the Corps of Engineers, Baltimore District. The inflow is routed through the reservoir using spillway discharge data obtained from the field inspection or design data. Flood storage capacity is determined from USGS maps or design information and verified by the field inspection. In the event a spillway cannot discharge 0.5 PMF without overtopping and failure of the dam, downstream channel characteristics obtained from the field inspection and USGS maps are inputed and flows are routed downstream to the damage center and a dam breach analysis is performed.

Included in this Appendix are the HEC-1, Rev. pertinent input values and a summary print-out tables.

BY MFB DATE 3/18/80 SUBJECT Deep Creek Dam Hydrology / Hydraulics SHEET 4 OF 12

CHKD. BY AHD DATE 4/10/80 JOB No.

Classification (Ref. - Recommended Guidelines for Safety Inspections of Dams)

1. The hazard classification is rated as "High" as there would be economic loss and possible loss of life in the event of failure not as a result of a wide-area storm.

2. The size classification is "Small" based on its total capacity of 250 Ac-Ft.

3. The selected spillway design flood, based on size and hazard classification, is 0.5 Probable Maximum Flood (PMF).

Hydrology and Hydraulic Analysis

1. Original data is limited to the State's evaluation of spillway capacity 3720 cfs, probably considering one bridge pier.

2. Evaluation Data

Inflow hydrograph parameters are shown on sheet 2.

Elevation - storage data. Surface areas were measured from the reservoir drawing enclosed as Plate 2, Appendix E. Flood water storage was estimated from USGS map. See sheet 8.

Elevation - discharge data. The original weir design head, H_o, is 5 ft. From design drawings the upstream height of weir, P, is 8.5 ft. The measured weir length, L, is 86.2 ft.
$P/H_o = 1.7$ ✓ ; $C_o = 3.92$ ✓ ; Ref. Design of Small Dams Bureau of Reclamation 2nd ed. 1973

W.S.	H_e	H_e/H_o	C/C_o	C_o	L	Q
224.5	0	-		3.92 ✓	86.2 ✓	0
225.5	1	0.2	0.85			287 cfs ✓
226.5	2	0.4	0.90			860 ✓
227.5	3	0.6	0.94			1650 ✓
228.5	4	0.8	0.97			2622 ✓
229.5	5	1.0	1.00			3773 ✓ ~ 3720 cfs in
230.5	6	1.2	1.02			5065 ✓ No. 1 above
232.5	8	1.6	1.07			8181 ✓

BY MFB DATE 4/3/80 Rev. 4/24/80 SUBJECT Deep Creek Hydrology / Hydraulics SHEET 5 OF 12

CHKD. BY DATE JOB No.

Spillway Adequacy - The spillway will discharge about 0.21 PMF without overtopping the low point at the right abutment. The dam is assumed to fail if the main embankment (left of the spillway) is overtopped by more than one foot for more than one hour. As shown on sheet 9, overtopping of the main embankment without failure results in a "Duration Over Top" of nearly 8 hours. Therefore, a failure elevation of 229.4 is used to estimate failure. Normal procedure is to consider the storm centered over the watershed only, and the peak discharge from Deep Creek Dam would increase from 4118 cfs to 9687 cfs (135%) during the 0.4 PMF (SH.10). However, it is reasonable to assume that the storm would extend beyond the 5.62 sq. miles of Deep Creek Watershed. A storm centered over the 94.5 sq. mile watershed of downstream Knight Dam was considered. Knight Dam is also the subject of a Phase I investigation and watershed and dam data can be obtained from that report. Summary tables and a portion of Knight Dam outflow hydrograph are shown on sheets 10, 11 for "no-failure" of Deep Creek Dam. If Deep Creek is considered to fail during a wide area storm, the peak discharge from Knight Dam does not increase and the discharge from Knight Dam during failure is expected to increase from (SH.11) about 18,200 cfs to about 18,550 cfs, an increase of about 2%, not considered significant. Therefore, Deep Creek Spillway is considered "Inadequate" but not "Seriously Inadequate".

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

 RUN  DATE* 80/04/05.
      TIME* 08.57.58.
```

DEEP CREEK DAM
NAT ID NO. PA 00200 DER NO. 46-8
OVERTOPPING ANALYSIS

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
150	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= 5 LRTIO= 1

RTIOS= .20 .30 .40 .50 1.00

SHEET 6 OF 12

SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH

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

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	5.62	0.00	5.62	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	23.00	113.00	123.00	132.00	142.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA

TP= 3.77 CP= .63 NTA= 0

RECESSION DATA

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

UNIT HYDROGRAPH 84 END-OF-PERIOD ORDINATES, LAG= 3.81 HOURS, CP= .63 VOL= 1.00

10.	39.	80.	128.	182.	239.	299.	360.	423.	479.
526.	564.	592.	611.	619.	615.	594.	559.	520.	485.
451.	420.	392.	365.	340.	316.	295.	274.	256.	238.
222.	206.	192.	179.	167.	155.	145.	135.	125.	117.
109.	101.	94.	88.	82.	76.	71.	66.	62.	57.
53.	50.	46.	43.	40.	37.	35.	32.	30.	28.
26.	24.	23.	21.	20.	18.	17.	16.	15.	14.
13.	12.	11.	10.	10.	9.	8.	8.	7.	7.
6.	6.	5.	5.						

0 END-OF-PERIOD FLOW

NO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	NO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	26.13	23.73	2.40	288527.
										(664.)	(603.)	(61.)	(8170.17)

SHEET 7 OF 12

HYDROGRAPH ROUTING

OUTFLOW HYDROGRAPH

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
OUT	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	-225.	-1

STAGE	224.50	225.50	226.50	227.50	228.50	229.50	230.50	232.50
FLOW	0.00	287.00	860.00	1650.00	2622.00	3778.00	5065.00	8187.00
SURFACE AREA=	0.	5.	14.	25.	99.			
CAPACITY=	0.	10.	55.	141.	1039.			
ELEVATION=	210.	215.	220.	225.	240.			

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
224.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
228.0	0.0	0.0	0.

CREST LENGTH	0.	85.	330.	660.
AT OR BELOW ELEVATION	228.0	229.0	229.5	230.0

SHEET 8 OF 12

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)

NO FAILURE ASSUMED

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .20	RATIO 2 .30	RATIO 3 .40	RATIO 4 .50	RATIO 5 1.00
HYDROGRAPH AT	IN	5.62	1	2073.	3109.	4146.	5182.	10364.
		(14.56)		(58.69)(	88.04)(	117.39)(	146.73)(	293.47)(
ROUTED TO	OUT	5.62	1	2035.	3066.	4118.	5165.	10339.
		(14.56)		(57.62)(	86.82)(	116.59)(	146.25)(	292.75)(

SUMMARY OF DAM SAFETY ANALYSIS

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	224.50	224.50	228.00
STORAGE	141.	141.	250.
OUTFLOW	0.	0.	2136.

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
.20	227.90	0.00	246.	2035.	0.00	43.75	0.00
.30	228.83	.83	282.	3066.	4.50	43.50	0.00
.40	229.49	1.49	310.	4118.	6.25	43.50	0.00
.50	229.89	1.89	327.	5165.	7.75	43.50	0.00
1.00	231.05	3.05	383.	10339.	9.00	43.25	0.00

SUMMARY OF DAM SAFETY ANALYSIS
FAILURE ASSUMED - Storm Centered Over Deep Creek Watershed

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	224.50	224.50	228.00
STORAGE	141.	141.	250.
OUTFLOW	0.	0.	2136.

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
.20	227.90	0.00	246.	2035.	0.00	43.75	0.00
.30	228.83	.83	282.	3066.	4.50	43.50	0.00
.40	229.44	1.44	307.	9687.	2.60	43.50	43.00
.50	229.53	1.53	311.	10349.	2.13	42.50	42.00
1.00	229.49	1.49	310.	11112.	1.65	40.75	40.25

DAM BREACH DATA

BRWID	Z	ELBM	TFAIL	WSEL	FAILEL
50.	1.00	213.00	.50	224.50	229.40

Storm Centered Over Knight Dam Watershed

SUMMARY OF DAM SAFETY ANALYSIS
GREEN LANE DAM

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	286.00	286.00	297.00
STORAGE	13398.	13398.	25114.
OUTFLOW	0.	0.	60323.

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
.40	291.65	0.00	18870.	20285.	0.00	51.00	0.00

SUMMARY OF DAM SAFETY ANALYSIS
DEEP CREEK DAM -No Failure Assumed

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	224.50	224.50	228.00
STORAGE	141.	141.	250.
OUTFLOW	0.	0.	2136.

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
.40	229.13	1.13	294.	3484.	5.00	44.00	0.00

SUMMARY OF DAM SAFETY ANALYSIS
KNIGHT DAM

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	213.00	213.00	220.00
STORAGE	170.	170.	479.
OUTFLOW	0.	0.	30449.

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
.40	219.27	0.00	427.	25745.	0.00	50.00	0.00

STATION KNOUT, PLAN 1, RATIO 1

KNIGHT DAM - Outflow Hydrograph
END-OF-PERIOD HYDROGRAPH ORDINATES

NO.DA	HR.MN	PERIOD	HOURS	INFLOW	OUTFLOW	STORAGE	STAGE
1.01	1.00	1	1.00	17.	21.	171.	213.0
1.01	2.00	2	2.00	20.	18.	171.	213.0
1.02	16.00	40	40.00	5378.	5122.	253.	215.3
1.02	16.00	40	40.00	5378.	5122.	253.	215.3
1.02	17.00	41	41.00	7931.	7568.	278.	216.0
1.02	18.00	42	42.00	11150.	10822.	307.	216.7
1.02	19.00	43	43.00	15053.	14640.	338.	217.4
1.02	20.00	44	44.00	18425.	18192.	364.	218.1 ←
1.02	21.00	45	45.00	21185.	20934.	384.	218.5
1.02	22.00	46	46.00	23184.	23018.	402.	218.8
1.02	23.00	47	47.00	24506.	24376.	414.	219.1
1.03	0.00	48	48.00	25300.	25232.	422.	219.2
1.03	1.00	49	49.00	25774.	25723.	427.	219.3
1.03	2.00	50	50.00	25700.	25745.	427.	219.3
1.03	3.00	51	51.00	25131.	25212.	422.	219.2
1.03	4.00	52	52.00	24065.	24212.	412.	219.0
1.03	5.00	53	53.00	22615.	22777.	400.	218.8
1.03	6.00	54	54.00	20954.	21123.	386.	218.5
1.03	6.00	54	54.00	20954.	21123.	386.	218.5
1.03	7.00	55	55.00	19231.	19381.	373.	218.3
1.03	8.00	56	56.00	17613.	17738.	361.	218.0
1.03	9.00	57	57.00	16065.	16221.	350.	217.7
1.03	10.00	58	58.00	14581.	14705.	338.	217.5
1.03	11.00	59	59.00	13179.	13310.	328.	217.2

STATION KNOUT, PLAN 1, RATIO 1

KNIGHT DAM - Outflow Hydrograph
END-OF-PERIOD HYDROGRAPH ORDINATES

Failure of Deep Creek Assumed. Based on previous hydrograph bottom of breach is considered to be at 218.

NO.DA	HR.MN	PERIOD	HOURS	INFLOW	OUTFLOW	STORAGE	STAGE
1.01	1.00	1	1.00	17.	21.	171.	213.0
1.01	2.00	2	2.00	20.	18.	171.	213.0
1.01	3.00	3	3.00	23.	22.	171.	213.0
1.01	4.00	4	4.00	25.	24.	171.	213.0
1.01	5.00	5	5.00	26.	26.	171.	213.0
1.01	6.00	6	6.00	27.	27.	171.	213.0
1.01	7.00	7	7.00	27.	27.	171.	213.0
1.01	8.00	8	8.00	27.	27.	171.	213.0
1.01	9.00	9	9.00	27.	27.	171.	213.0
1.01	10.00	10	10.00	27.	27.	171.	213.0
1.02	17.00	41	41.00	7931.	7568.	278.	216.0
1.02	18.00	42	42.00	11150.	10822.	307.	216.7
1.02	19.00	43	43.00	15054.	14641.	338.	217.4
1.02	20.00	44	44.00	18836.	18545.	367.	218.1 ←
1.02	21.00	45	45.00	21074.	20938.	384.	218.5
1.02	22.00	46	46.00	23197.	22934.	401.	218.8
1.02	23.00	47	47.00	24490.	24427.	414.	219.1
1.03	0.00	48	48.00	25285.	25175.	421.	219.2
1.03	1.00	49	49.00	25744.	25722.	427.	219.3
1.03	2.00	50	50.00	25684.	25709.	427.	219.3
1.03	3.00	51	51.00	25105.	25201.	422.	219.2
1.03	4.00	52	52.00	24035.	24174.	412.	219.0
1.03	5.00	53	53.00	22594.	22760.	399.	218.8
1.03	6.00	54	54.00	20942.	21107.	386.	218.5
1.03	7.00	55	55.00	19210.	19364.	373.	218.3

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)

Abutment & Embankment raised to 229.5

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .20	RATIO 2 .30	RATIO 3 .40	RATIO 4 .50	RATIO 5 1.00
HYDROGRAPH AT	IN	5.62	1	2073.	3109.	4146.	5182.	10364.
		(14.56)	(	58.69)(	88.04)(	117.39)(	146.73)(	293.47)(
ROUTED TO	OUT	5.62	1	2035.	3058.	4110.	5165.	14015.
		(14.56)	(	57.63)(	86.60)(	116.37)(	146.27)(	396.85)(

SUMMARY OF DAM SAFETY ANALYSIS

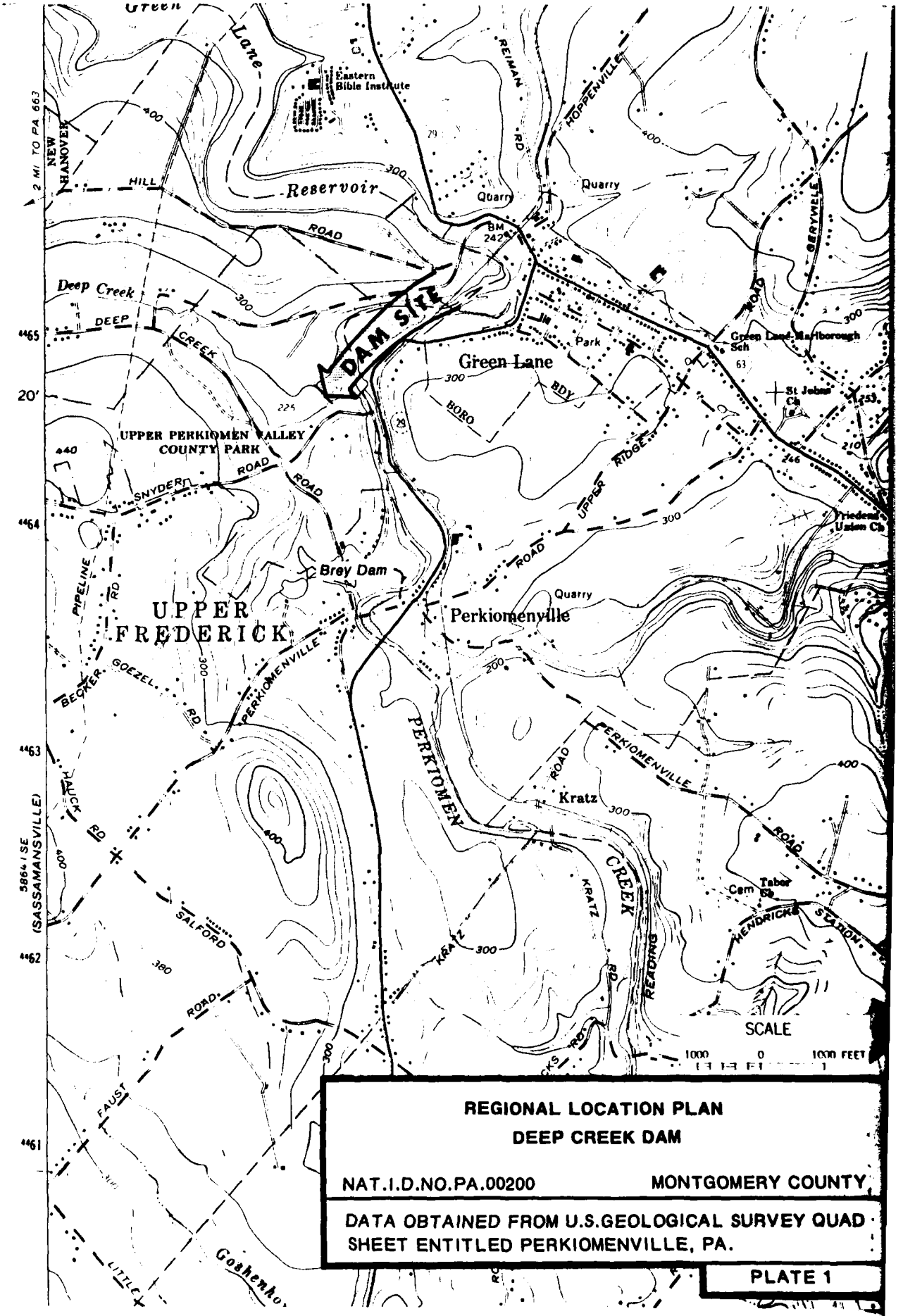
	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	224.50	224.50	229.50
STORAGE	141.	141.	310.
OUTFLOW	0.	0.	3778.

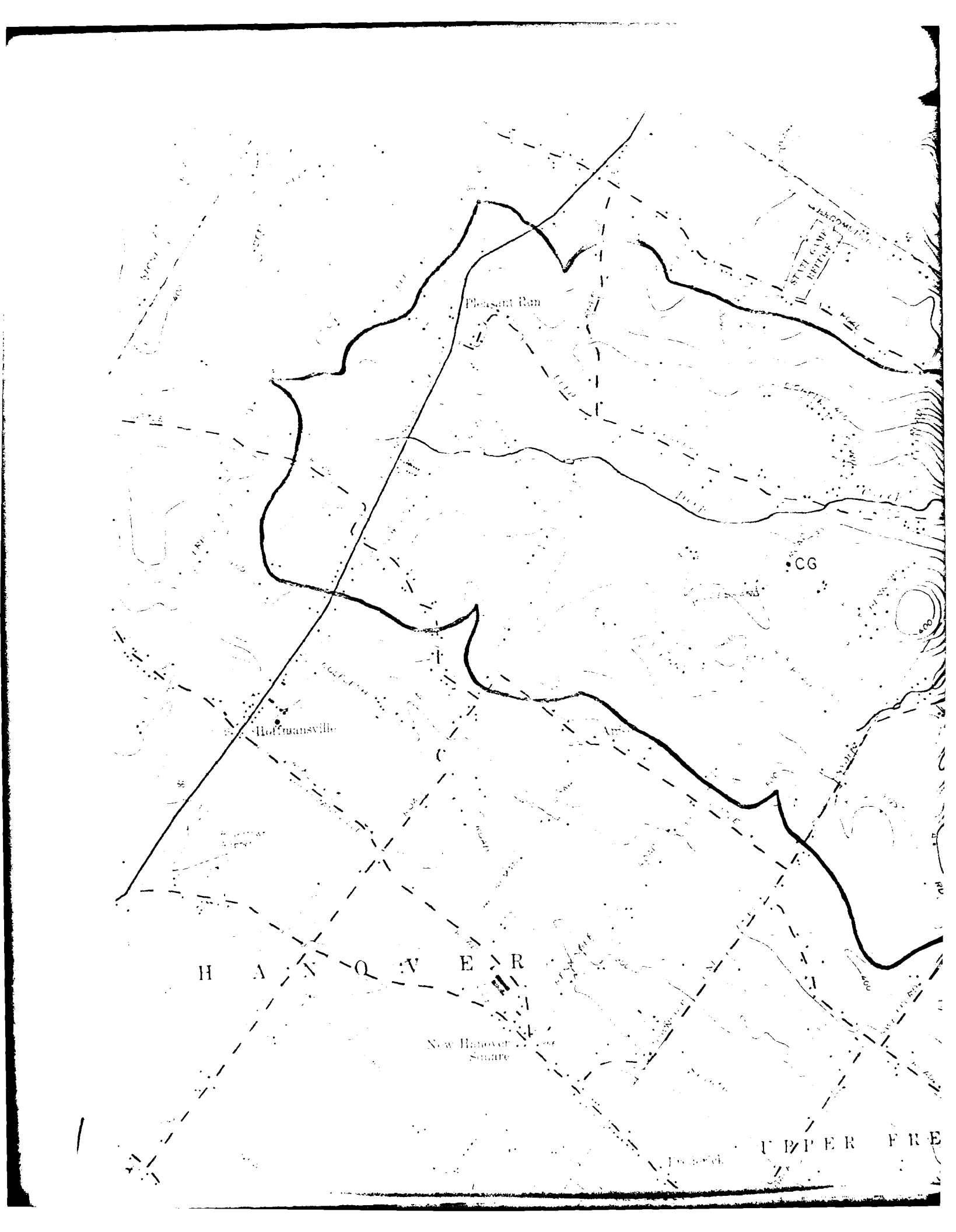
RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.20	227.90	0.00	246.	2035.	0.00	43.75	0.00
.30	228.88	0.00	284.	3058.	0.00	43.75	0.00
.40	229.69	.19	318.	4110.	2.00	43.50	0.00
.50	230.08	.58	336.	5165.	3.75	43.50	0.00
1.00	230.55	1.05	359.	14015.	1.62	41.75	41.25

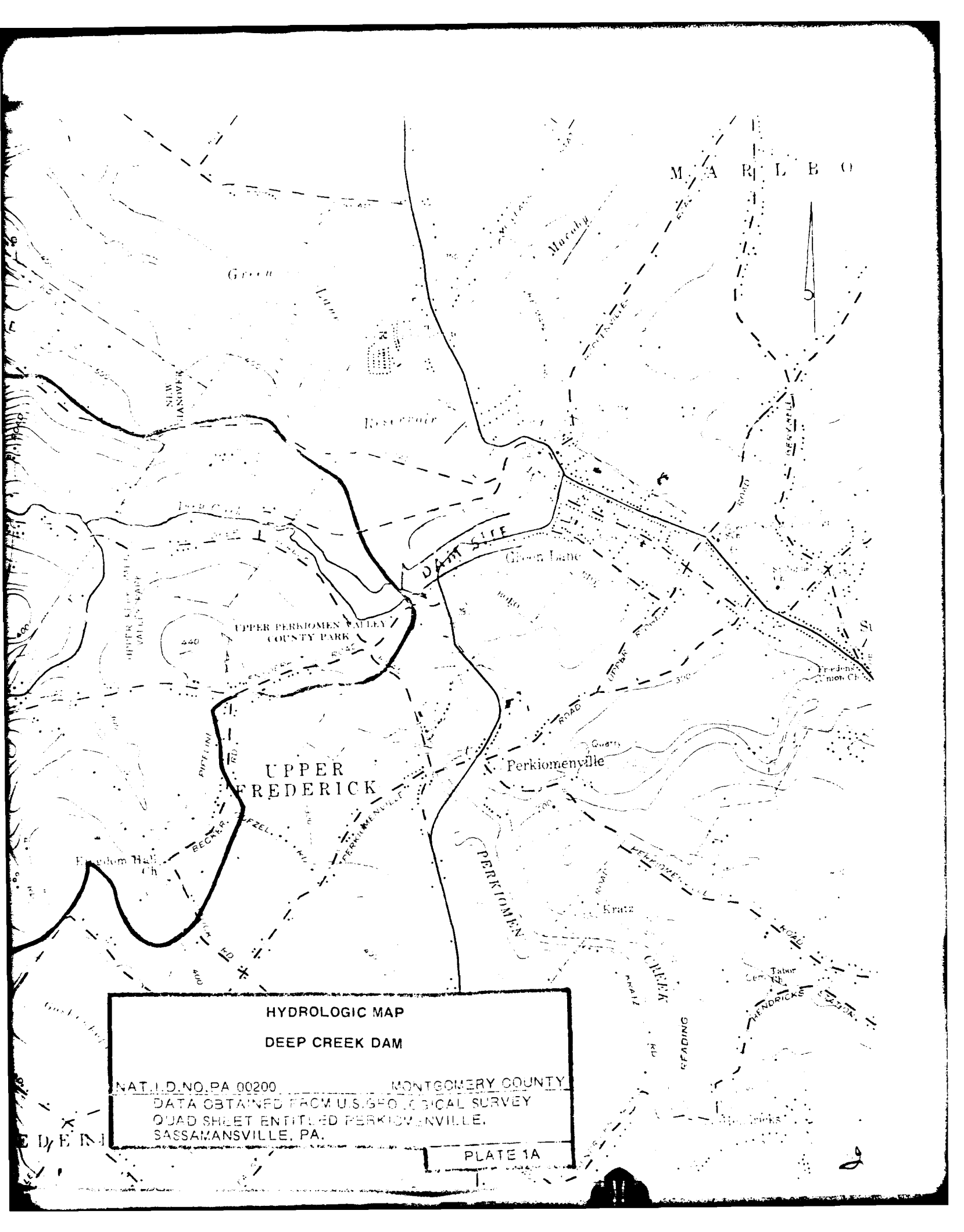
SHEET 12 OF 12

APPENDIX

E


Eastern Bible Institute
Reservoir
Quarry
Quarry
BM 242
DAM SITE
Deep Creek
DEEP CREEK
Green Lane
Park
Green Land-Marlborough Sch
St Johns Ch
UPPER PERKIOMEN VALLEY COUNTY PARK
Brey Dam
UPPER FREDERICK
Perkiomenville
Quarry
Kratz
Tabor Ch
Cem
HENDRICKS STATION
SCALE
1000 0 1000 FEET
REGIONAL LOCATION PLAN
DEEP CREEK DAM
NAT.I.D.NO.PA.00200
MONTGOMERY COUNTY
DATA OBTAINED FROM U.S.GEOLOGICAL SURVEY QUAD SHEET ENTITLED PERKIOMENVILLE, PA.
PLATE 1


Pleasant Run
CG
Hoffmansville
H A N O V E R
New Hanover Square
UPPER FRE



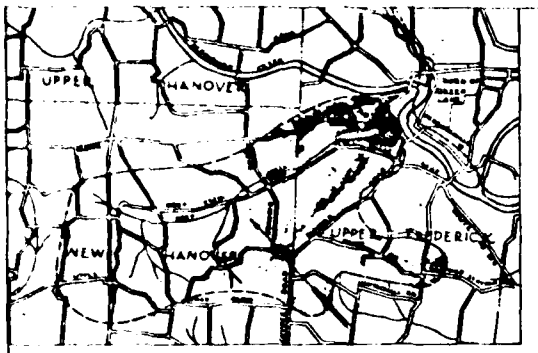
HYDROLOGIC MAP

DEEP CREEK DAM

NAT.I.D.NO.PA 00200 MONTGOMERY COUNTY

DATA OBTAINED FROM U.S.GEOLOGICAL SURVEY QUAD SHEET ENTITLED PERKIOMENVILLE, SASSAMANSVILLE, PA.

PLATE 1A



· LOCATION PLAN ·

SCALE

· DRAINAGE AREA 6.2 SQ. MILES ·

· PARK PROPERTY ·

PROPERTY LINE

GREEN LANE

TRINITY ROAD

CHRISTIAN ASSO. OF UNIVERSITY OF PA.

PROPOSED WATER LINE

DEEP CREEK

CHRISTIAN ASSO OF UNIVERSITY OF PA.

GREEN LANE ROAD

CHRISTIAN ASSO. OF UNIVERSITY OF PA.

- PARK PROPERTY

· GENERAL PLAN SHOWING

· ON · DEEP

· UPPER FREDE

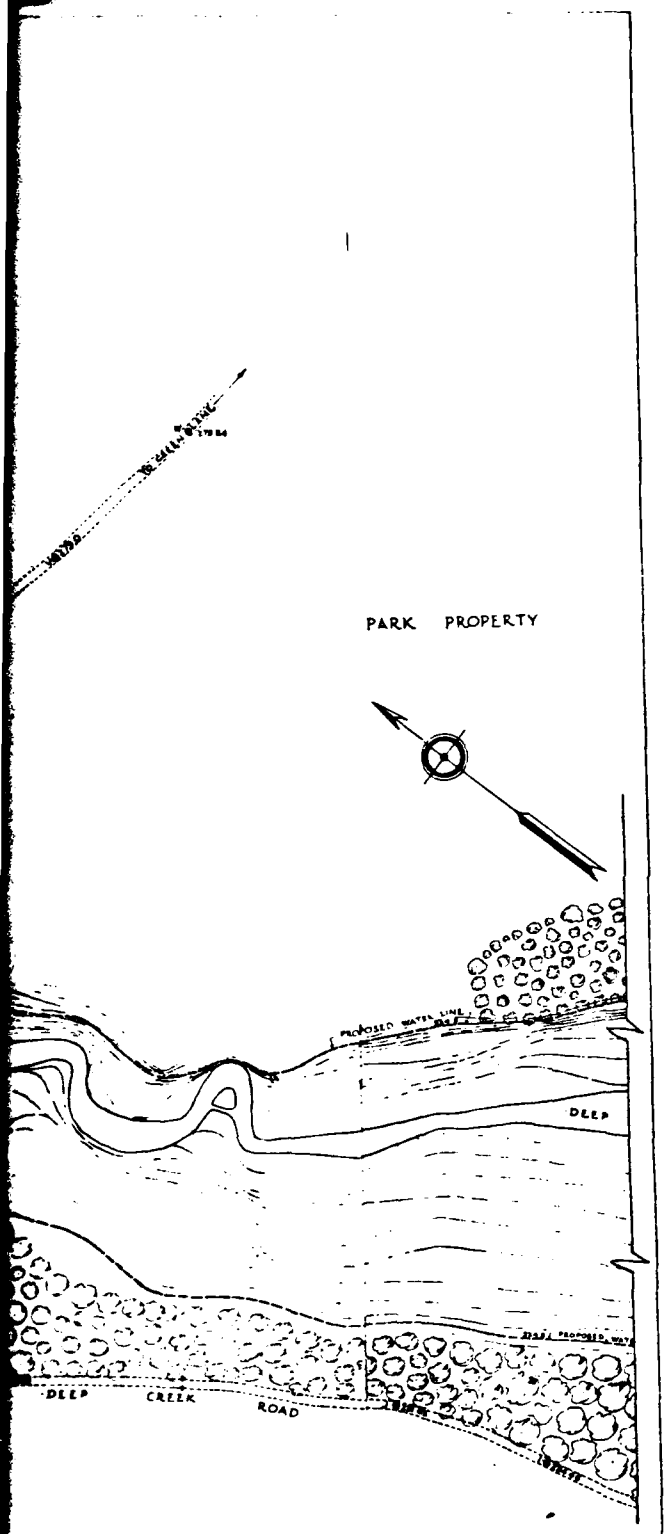
· MONTGOMERY CO

· UPPER PERKIOM

· SCALE-ONE

· AREA 27.3 ACRES ·

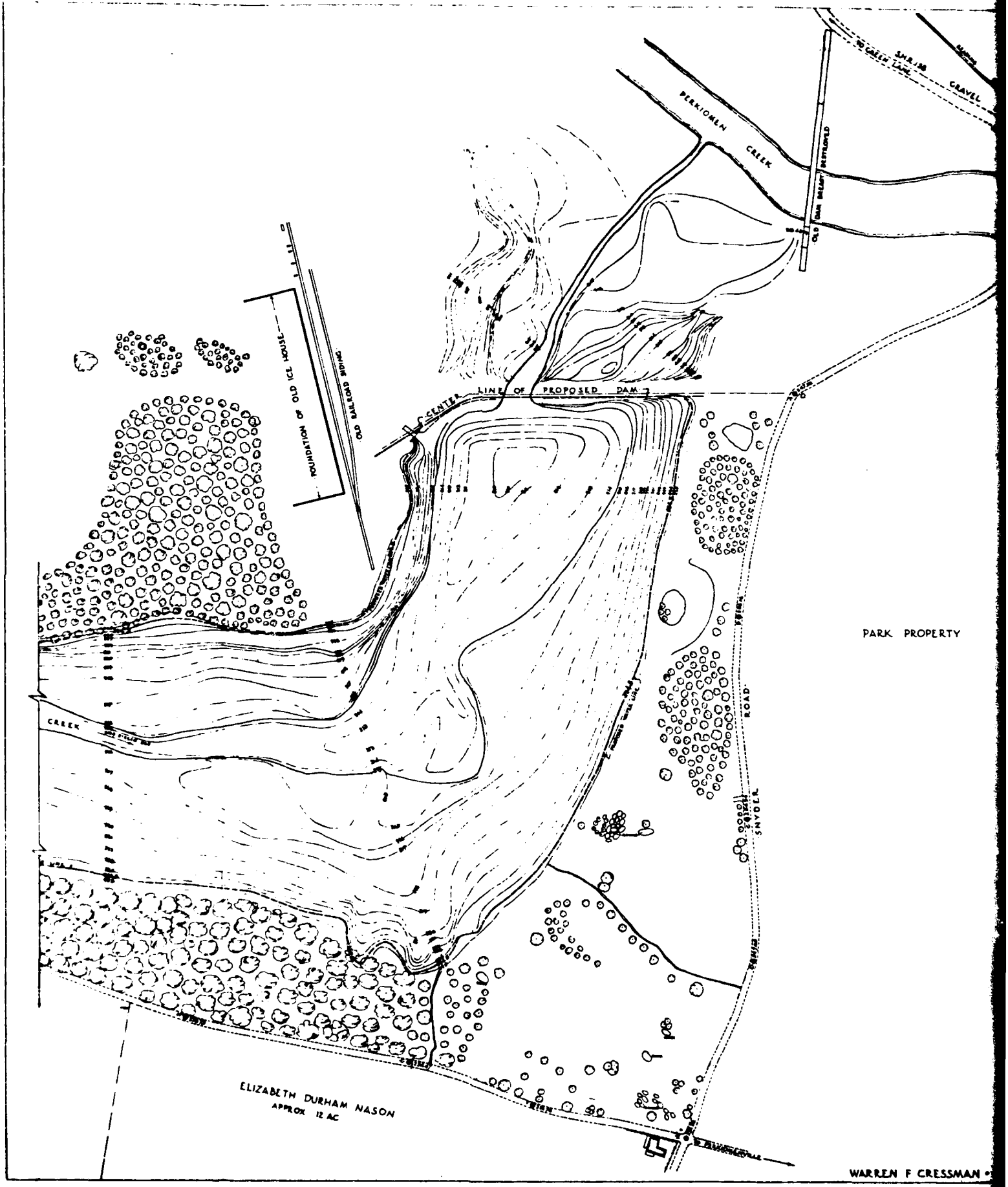
SHEET NO 1 OF 5 SHEETS · MAY

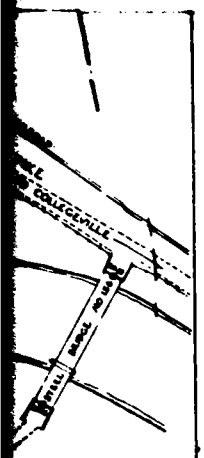


LOCATION OF PROPOSED DAM.
CREEK. IN.
UCK TOWNSHIP.
UNTY PARK SYSTEM.
N VALLEY PARK.
NCH = 60 FEET.
. CAPACITY 31,000,000 GALLONS.
1939.

PLATE 2A

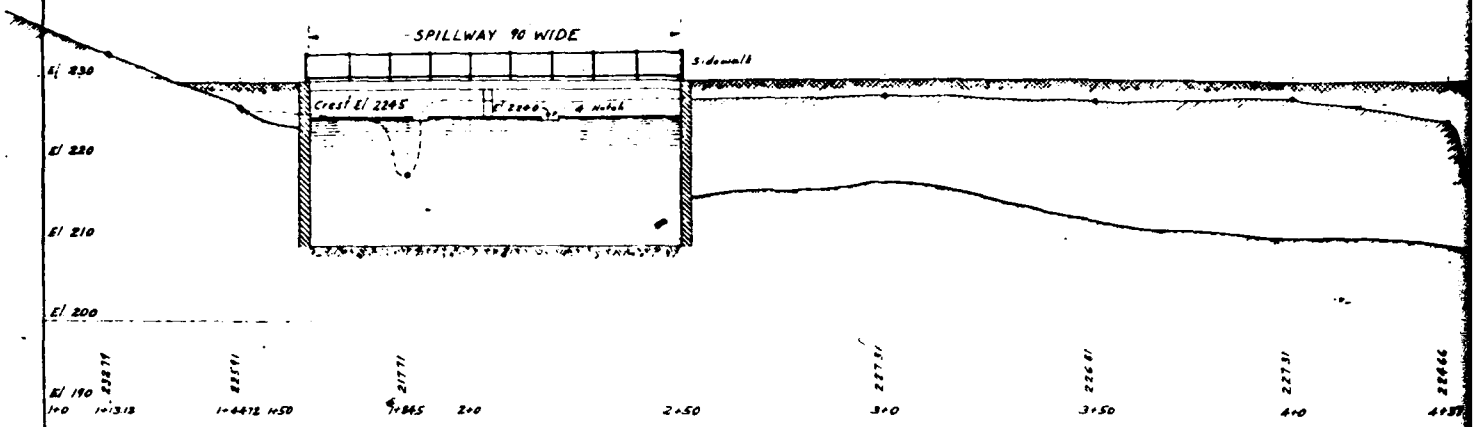
2


PERKIOMEN CREEK
SUMNEYTOWN PIKE
OLD DAM BRIDGE DESTROYED
GRAVEL
CENTER LINE OF PROPOSED DAM
FOUNDATION OF OLD ICE HOUSE
OLD RAILROAD BRIDGE
PARK PROPERTY
CREEK
SCHWENKSVILLE ROAD
ELIZABETH DURHAM NASON
APPROX 12 AC
WARREN F CRESSMAN

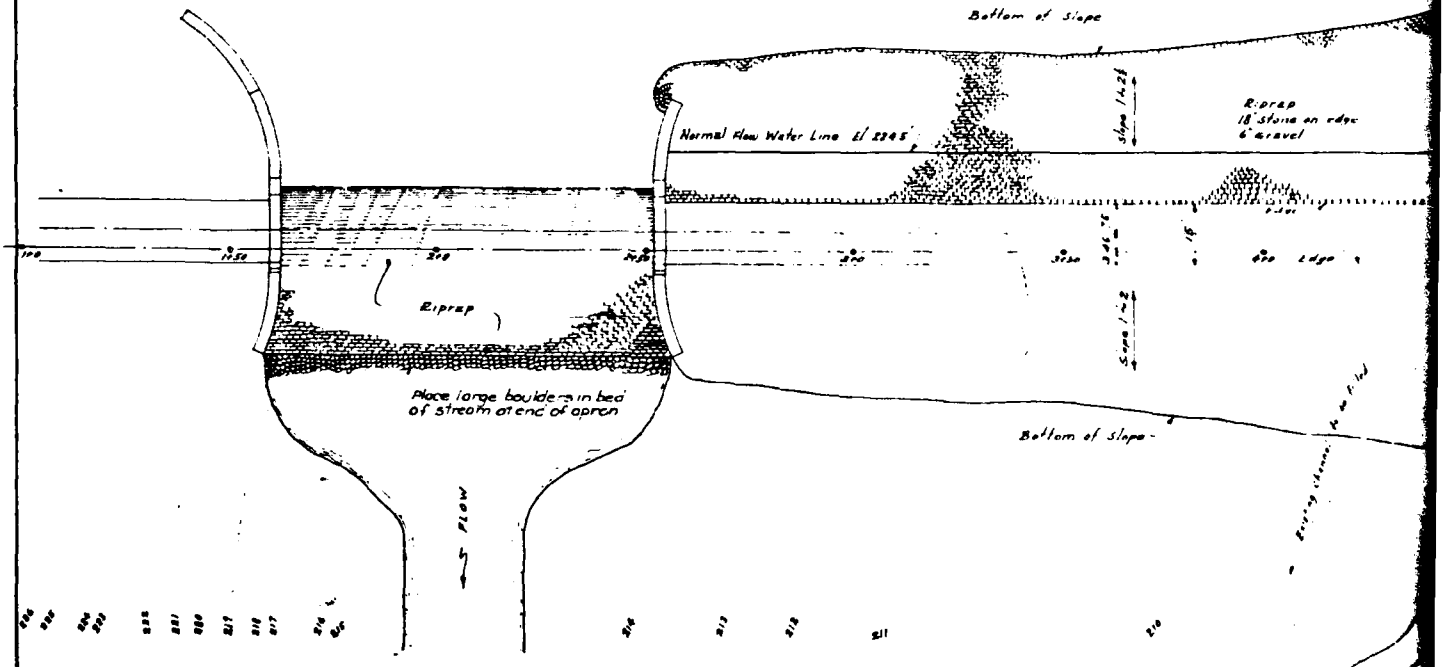


TY ENGINEER.

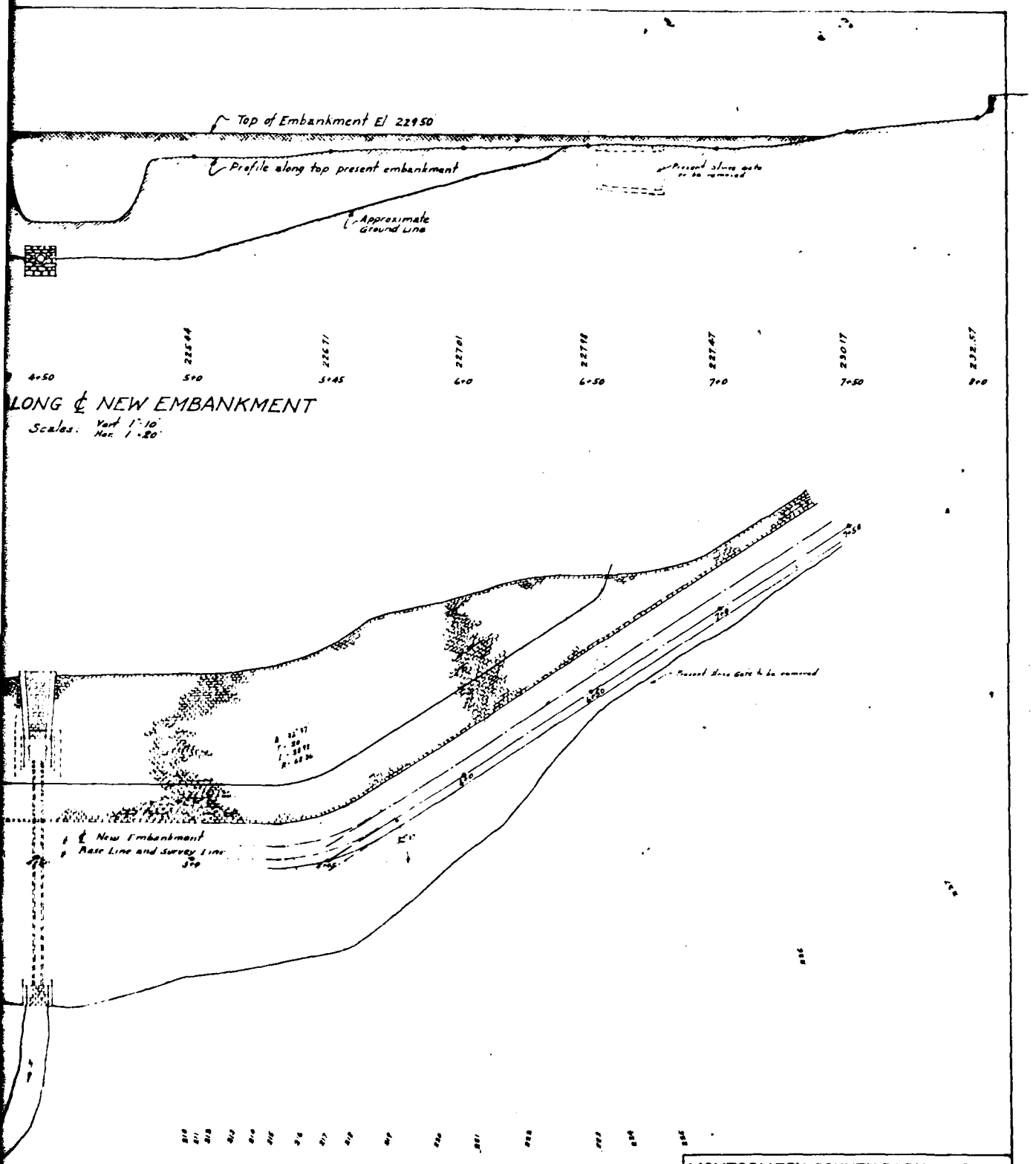
PLATE 2B 2



PROFILE A



PLAN OF



LONG ℄ NEW EMBANKMENT

Scales: Vert 1"=10'
Hor. 1"=20'

NEW EMBANKMENT

Scale 1"=20

MONTGOMERY COUNTY PARK SYSTEM

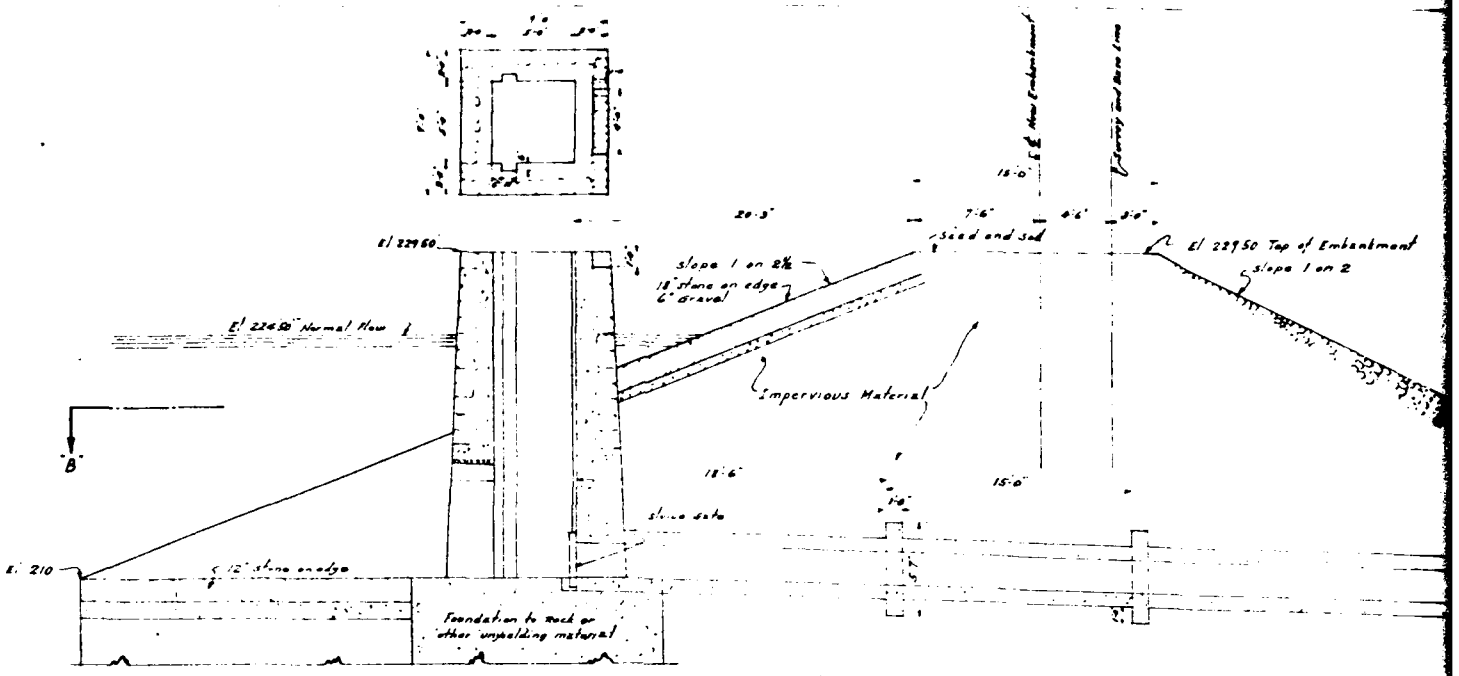
PLAN & PROFILE OF
EARTH EMBANKMENT & SPILLWAY
UPPER PERKIOMEN VALLEY PARK
UPPER FREDERICK TOWNSHIP

SCALE - AS NOTED MAY 1939

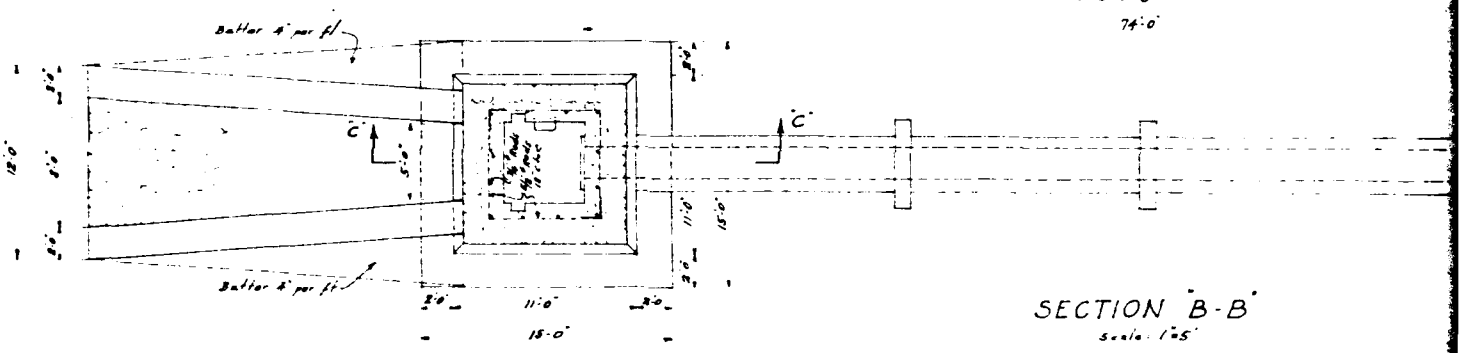
OFFICE OF COUNTY ENGINEER

SHEET No 2 OF 5 SHEETS

PLATE 3

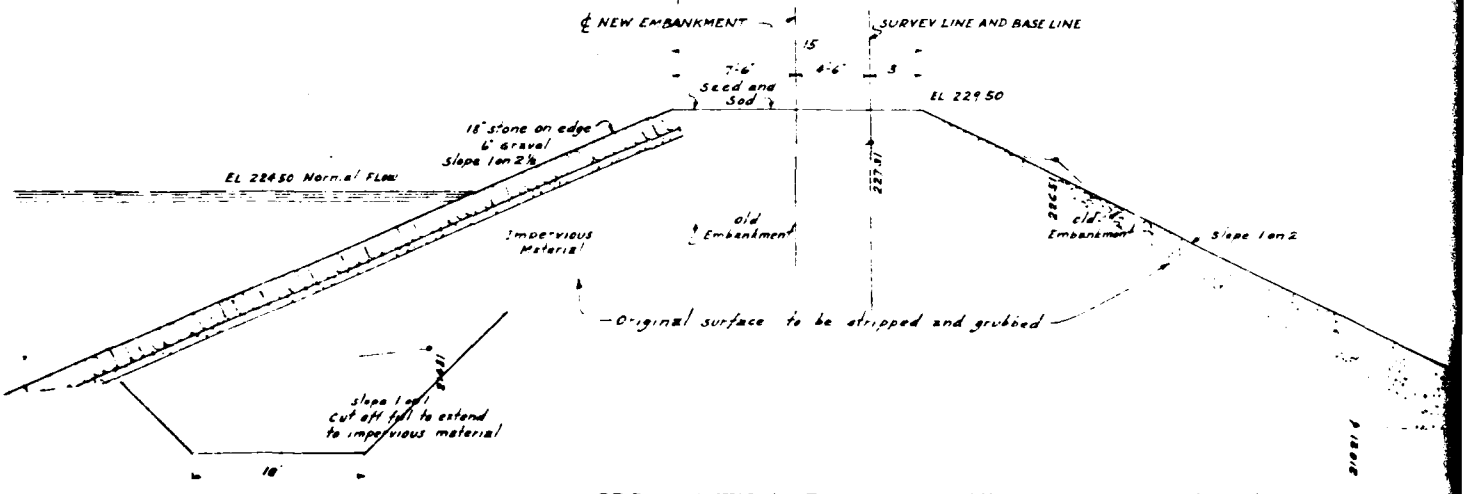


CROSS SECTION OF EMBANKMENT AT GATE CHAMBER
Scale 1"=5'



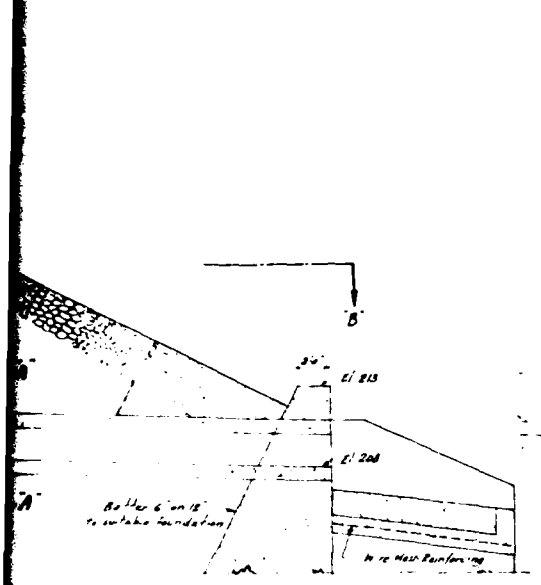
74'-0"

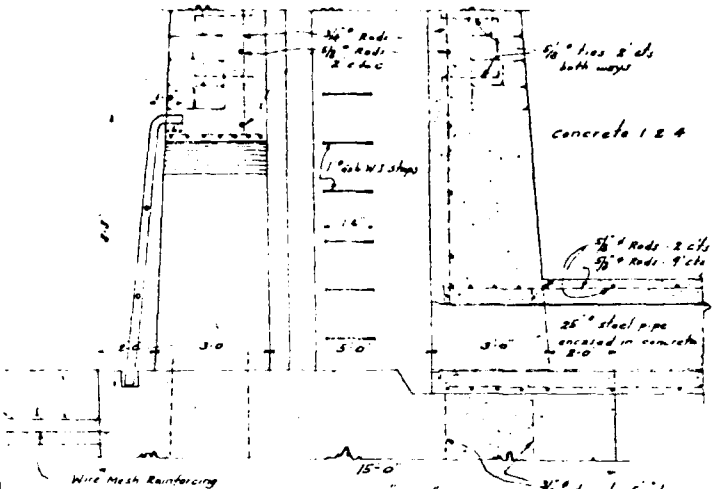
SECTION B-B
Scale 1"=5'



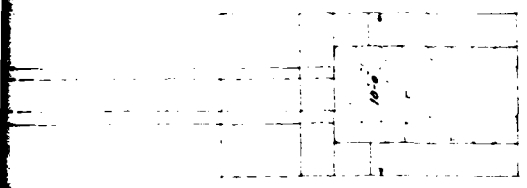
CROSS SECTION OF EMBANKMENT
Scale 1"=5'

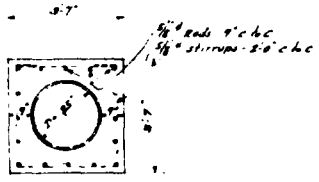
All projecting and rotten cribbing stream side to be removed and with stones carefully placed and interstices filled with selected
All excavated space around the and outlet pipe and the Gate filled with clay, carefully ram compacted in place



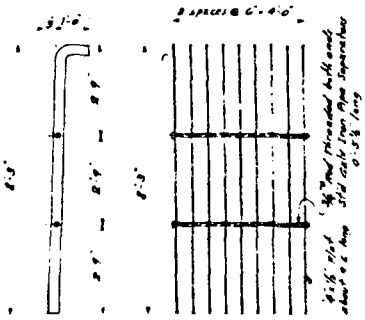


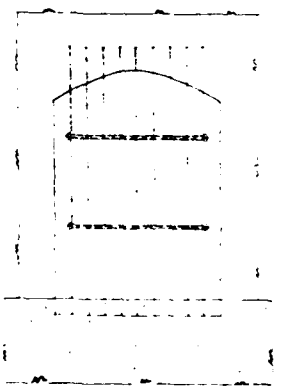
SECTION C-C
Scale 1" = 2½'





SECTION A-A
Scale 1" = 2½'



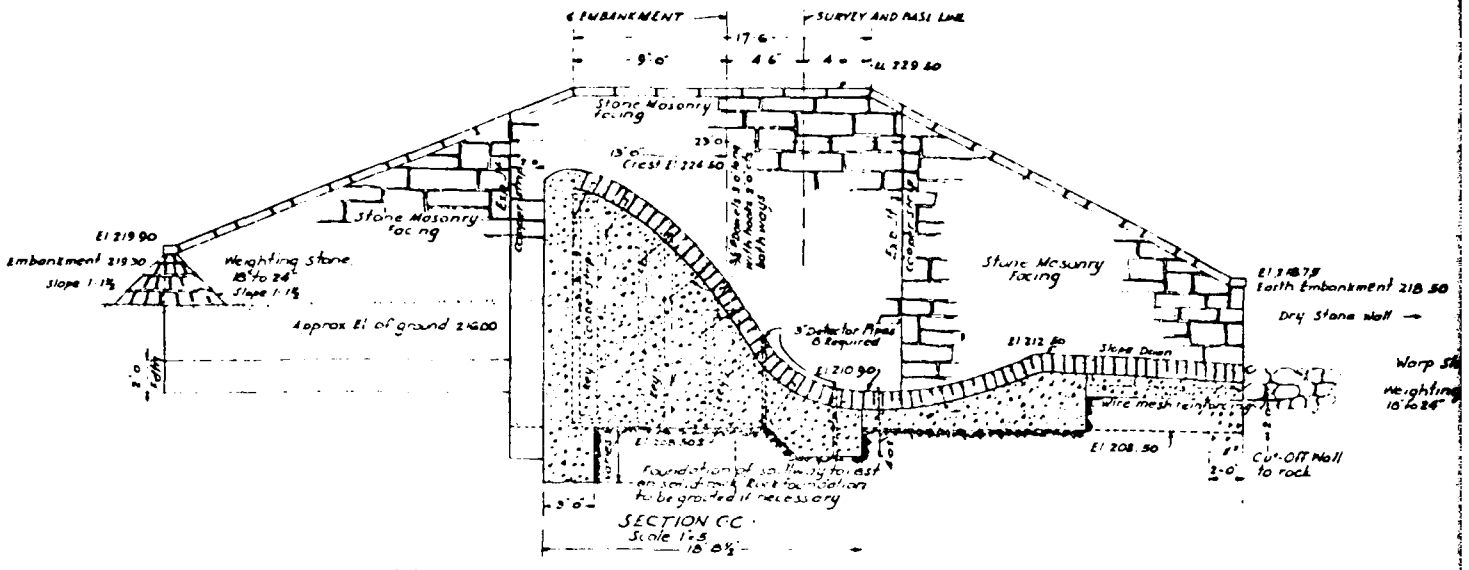


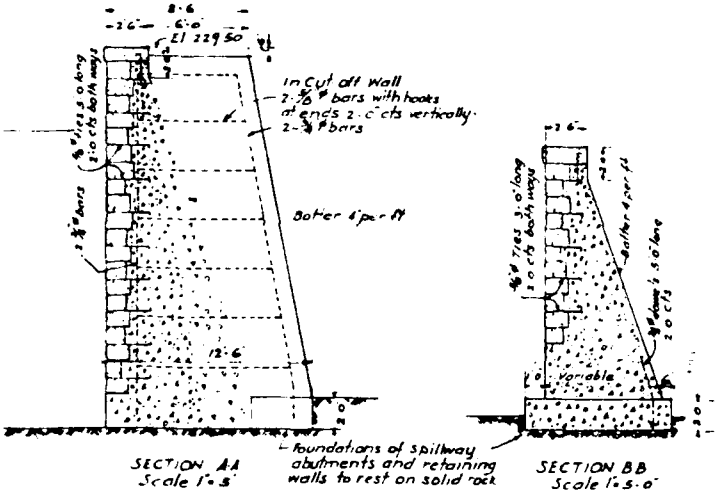
DETAILS OF TRASH RACK
Scale 1" = 2½'

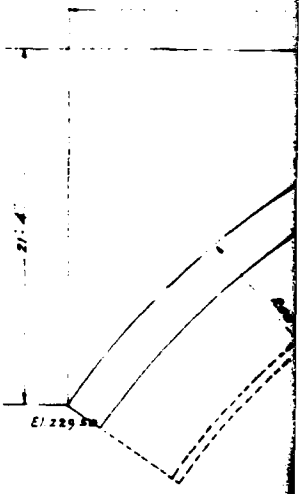
NOTES :-
Earth fill to be spread evenly in 8" layers and rolled - 6 passes by 10 ton roller
To be moistened by sprinkling to secure fill of maximum weight or density but shall not be plastic
After discontinuance of filling for a considerable period, the surface of the embankment shall be roughened and loosened by harrowing to secure proper bond between old and new fill
All grass roots defective material and mud to be removed to good materials a trench to be excavated to good foundation as shown on plans
The trench and new embankment to be composed of selected material from the Park Property

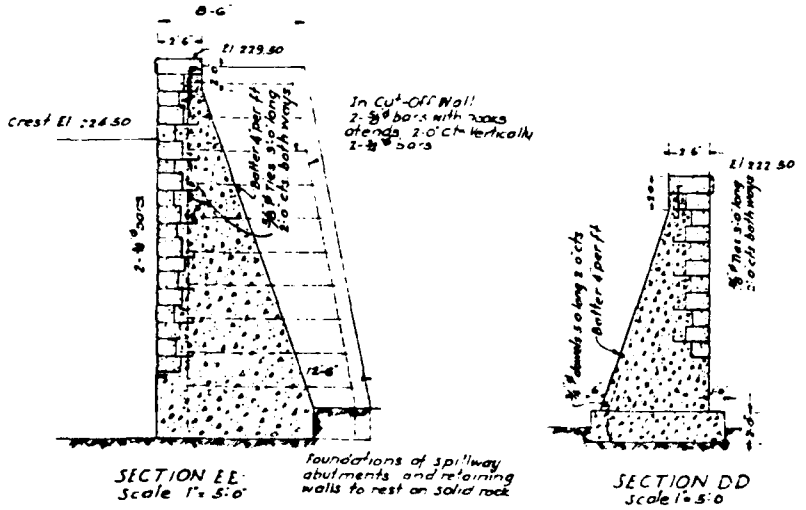
MONTGOMERY COUNTY PARK SYSTEM	
DETAILS OF GATE CHAMBER AND EMBANKMENT UPPER PERKIOMEN VALLEY PARK UPPER FREDERICK TOWNSHIP	
SCALE - AS NOTED	MAY 1939
SHEET No 5 OF 5 SHEETS	OFFICE OF COUNTY ENGINEER

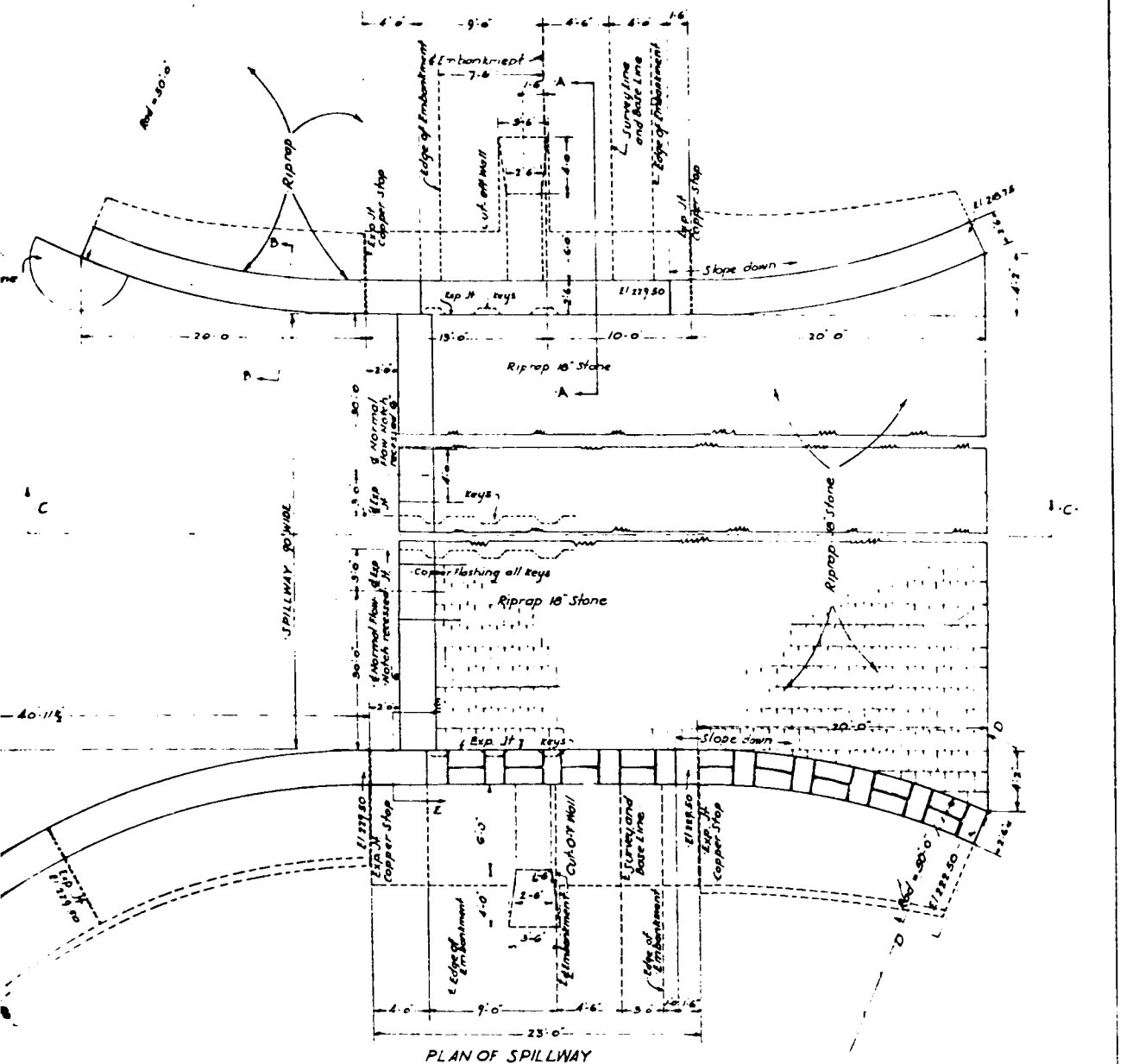
PLATE 42


℄ EMBANKMENT
SURVEY AND BASE LINE
17'6"
9'0"
4'6"
EL 229.50
Stone Masonry facing
23'0"
13'0" Crest EL 224.50
Stone Masonry facing
EL 219.90
Embankment 219.30
Weighting Stone 18" to 24"
Slope 1:1½
Slope 1:1½
Approx El of ground 216.00
Stone Masonry facing
EL 218.78
Earth Embankment 218.50
Dry Stone Wall
EL 212.50
Stone Down
EL 210.90
3" Deflector Pipes as Required
Wire mesh reinforcement
EL 208.50
Warp Sl
weighting
18" to 24"
Cut-Off Wall to rock
2'0"
Foundations of spillway to rest on solid rock. Rock foundation to be grouted if necessary
SECTION CC
Scale 1"=5'
18'8½"


8'6"
2'6"
6'0"
EL 229.50
In Cut off Wall
2-⅝" ϕ bars with hooks at ends 2'0" cts vertically
2-¾" ϕ bars
¾" ϕ ties 3'0" long 2'0" cts both ways
¾" ϕ bars 2'0" cts both ways
Batter 4" per ft
12'6"
2'0"
Foundations of spillway abutments and retaining walls to rest on solid rock
SECTION AA
Scale 1"=5'
2'6"
¾" ϕ ties 3'0" long 2'0" cts both ways
Batter 4" per ft
¾" ϕ bars 3'0" long 2'0" cts
Variable
2'0"
SECTION BB
Scale 1"=5'-0"


21'4"
EL 229.50


8'6"
2'6"
EL 229.50
Crest EL 224.50
In Cut-Off Wall
2-⅝" ϕ bars with hooks at ends 2'0" cts vertically
2-¾" ϕ bars
Batter 4" per ft
¾" ϕ ties 3'0" long 2'0" cts both ways
2-¾" ϕ bars
12'6"
Foundations of spillway abutments and retaining walls to rest on solid rock
SECTION EE
Scale 1"=5'0"
2'6"
EL 222.50
¾" ϕ bars 3'0" long 2'0" cts both ways
Batter 4" per ft
¾" ϕ bars 3'0" long 2'0" cts
2'0"
SECTION DD
Scale 1"=5'0"



PLAN OF SPILLWAY
Scale 1" = 5'-0"

NOTES

...mixture, one part cement, two parts sand and four parts stone.
...stones are to be deposited as concreting advances.
...constructed of good hard local stone, mortar one part cement, two parts sand.
...as indicated for all exposed work. Face appearance of this masonry
...Stone masonry facing in spillway and all walls to be
...which is deposited between masonry and boat form
...to be constructed in accordance with County
...construction
...this sheet are to rest on a solid unyielding
...dimensions and elevations to secure a
...with 3 coats of Asphaltic Emulsion
...of the

MONTGOMERY COUNTY PARK SYSTEM

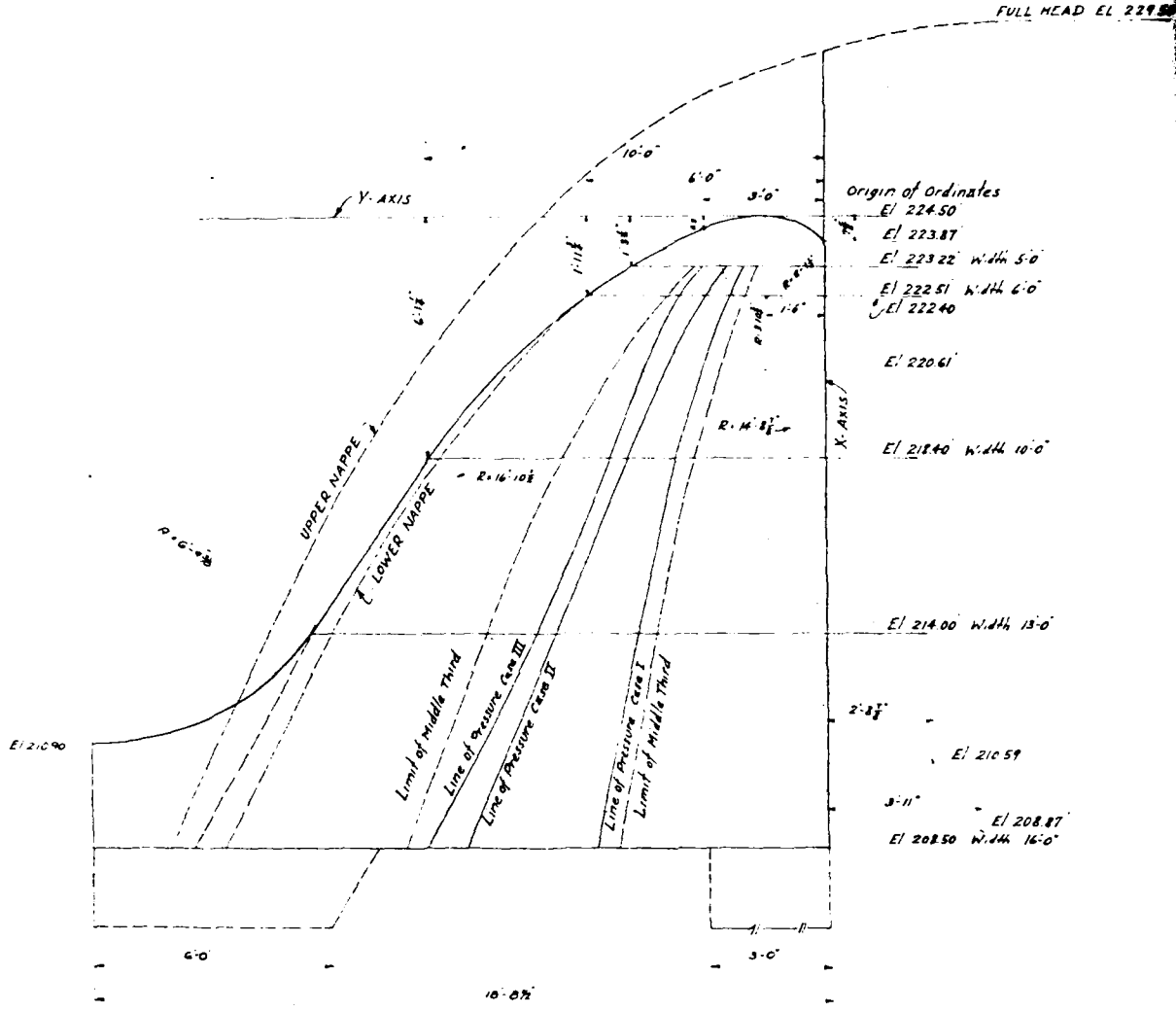
DETAILS OF SPILLWAY AND WING WALLS
UPPER PERKIOMEN VALLEY PARK
UPPER FREDERICK TOWNSHIP

SCALE - AS NOTED MAY 1939

OFFICE OF COUNTY ENGINEER

SHEET NO 3 OF 5 SHEETS

PLATE 5



SPILLWAY SECTION

Scale ½" = 1'-0"

CASE I LAKE EMPTY MASONRY AT 165 #/FT³

BLOCK	WT. TONS	DISTANCE H FROM U/STR FACE OF SECTION	WIDTH OF SECTION	INSIDE MIDDLE THIRD
El 224.50-El 223.22	0.31	2.06	5-0	.44
" - 222.51	0.59	2.41	6-0	.41
" - 218.40	3.49	3.81	10-0	.53
" - 214.00	7.20	4.83	13-0	.50
" - 208.50	12.90	5.90	16-0	.57

NEGLECT WEIGHT OF TAILWATER
NEGLECT WEIGHT OF WATER ON CREST AND DOWNSTREAM FACE

FLOOD FLOW Q
= 6.2 SQ MI AT 600 SEC FT./SQ MILE = 3720 SEC FT.
C L H^3/2 = 3.88 · 90 · 11.180 = 3900 " "

CASE II LAKE AT HIGH WATER NO UPLIFT

BLOCK	W WT. TONS	X DISTANCE H FROM U/STR FACE OF SECTION	WIDTH OF SECTION	HORIZ WATER PRESSURE P	POINT APPLIED X	OVERTURNING MOMENT	P X / W	DISTANCE FROM FACE	INSIDE MIDDLE THIRD
El 224.50-El 223.22	0.31	2.06	5	0.225 TONS	0.615	0.138 FT TONS	0.445	2.505	0.629
" - 222.51	0.59	2.41	6	0.372 "	0.940	0.350 "	0.593	3.003	0.997
" - 218.40	3.49	3.81	10	1.534 "	2.66	4.08 " "	1.169	4.979	1.667
" - 214.00	7.20	4.83	13	3.386 "	4.37	14.80 "	2.055	6.885	1.781
" - 208.50	12.90	5.90	16	6.50 "	6.36	41.34 " "	3.204	9.104	1.562

WATER UPLIFT

BLOCK	WT TONS	DISTANCE FROM U/STR FACE
El 224.50-El 223.22	0.13	1.67
-El 222.51	0.22	2.0
" 218.40	0.37	3.33
" 214.00	1.05	4.33
208.50	3.87	6.72

WITHIN MASONRY - FROM FULL HEAD AT HEEL TO ZERO AT TOE
ACTING ON ONE-THIRD AREA
AT FOUNDATION FULL HEAD AND TAIL WATER ACTING ON ONE-HALF AREA

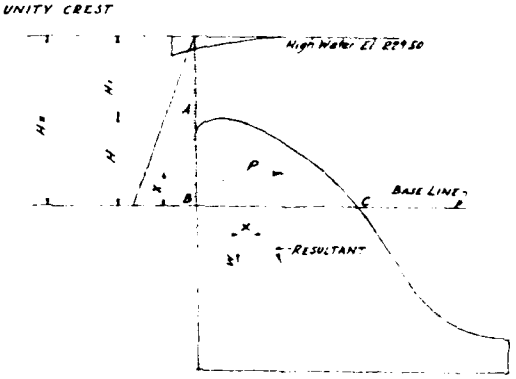
CASE III LAKE AT HIGH WATER UPLIFT ALLOWED

BLOCK	W WT. TONS	X DISTANCE H FROM U/STR FACE OF SECTION	WIDTH OF SECTION	HORIZ WATER PRESSURE P	POINT APPLIED X	OVERTURNING MOMENT	P X / W	DISTANCE FROM FACE	INSIDE MIDDLE THIRD
El 224.50-El 223.22	0.18	2.34	5	0.225 Tons	0.615	0.138 Ft Tons	0.76	3.10	0.23
-El 222.51	0.37	2.65	6	0.372 "	0.940	0.350 "	0.94	3.59	0.41
-El 218.40	2.92	3.90	10	1.534 "	2.66	4.08 " "	1.40	5.30	1.36
-El 214.00	6.15	4.91	13	3.386 "	4.37	14.80 " "	2.40	7.31	1.35
-El 208.50	9.03	5.55	16	6.50 "	6.86	61.34 " "	4.57	10.12	.54

MASONRY AND NAPPE PROFILE

FROM WM P CREAGER - ENGINEERING FOR MASONRY DAMS UNITY CREST
CO ORDINATES FOR 5 FOOT HEAD OF DAM

Y	MASONRY LINE	X THEORETICAL SHEET UPPER NAPPE	LOWER NAPPE
0.0	0.63	-0.155	0.63
0.5	0.18	-0.015	0.18
1.0	0.035	-0.360	0.035
1.5	0.0	0.370	0.0
2.0	0.035	-0.31	0.035
3.0	0.300	-0.310	0.815
4.0	0.710	-0.555	0.765
5.0	1.285	-0.190	1.395
6.0	1.985	0.105	2.05
7.0	2.825	0.015	2.95
8.5	4.35	0.525	4.69
10.0	6.10	0.446	6.55
12.5	9.80	0.60	10.50
15.0	14.10	0.50	15.55
17.5	19.10	0.30	21.50



FORCE SYSTEM FOR BLOCK ABC
HORIZ PRESS P = 62.5/2 (H'² - H²) IN TONS
POINT OF APPLICATION X = (3H'H - H²)/(6H + 3H)

MONTGOMERY COUNTY PARK SYSTEM

STABILITY COMPUTATIONS

UPPER PERKIOMEN VALLEY PARK
UPPER FREDERICK TOWNSHIP

SCALE - AS NOTED MAY 1939
OFFICE OF COUNTY ENGINEER

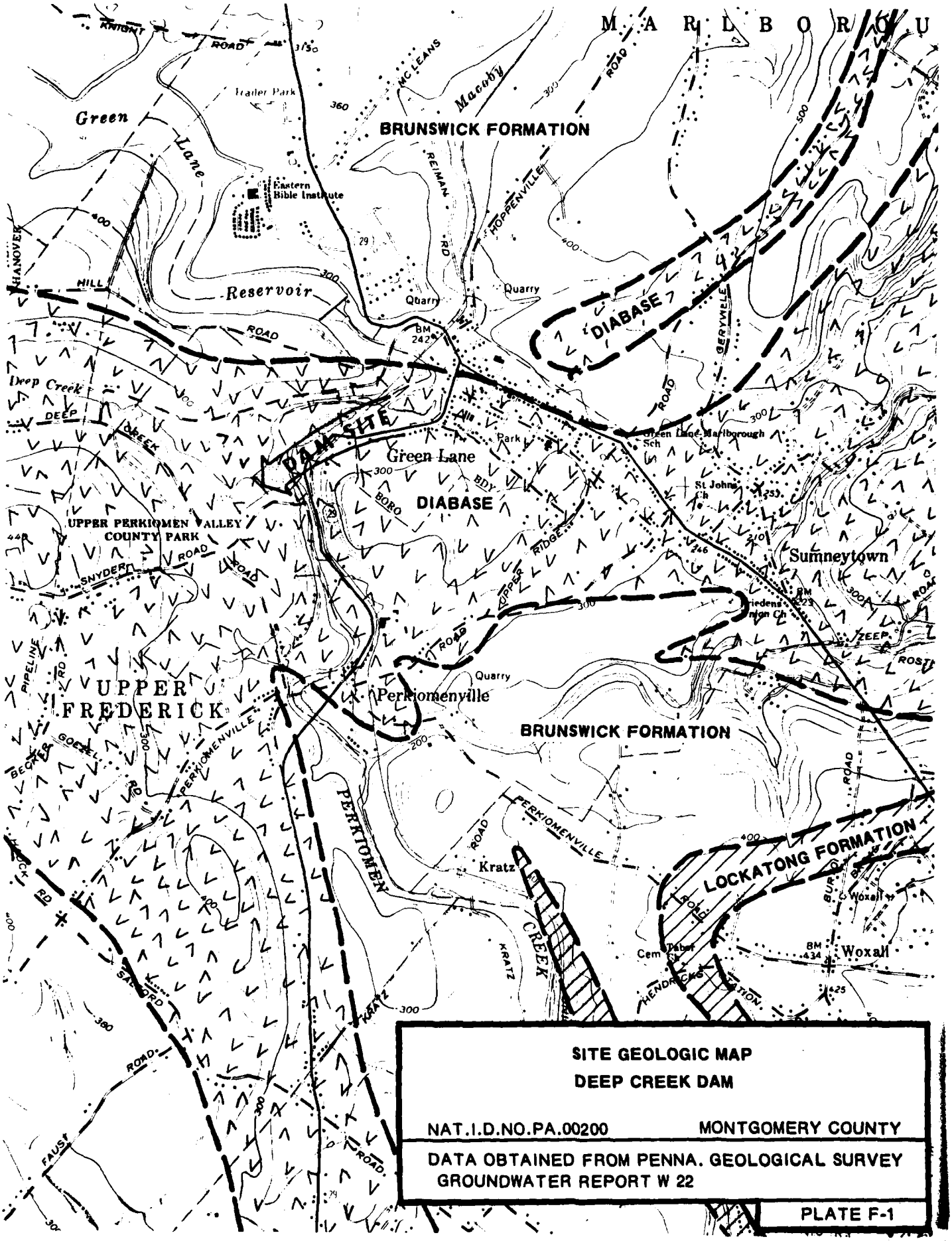
SHEET No 4 OF 5 SHEETS

APPENDIX

F

SITE GEOLOGY
DEEP CREEK DAM

Deep Creek Dam is located in the Triassic Lowland Section of the Piedmont Physiographic Province. As shown in Plate F-1, the dam is underlain by diabase bedrock of Triassic age which has intruded the Brunswick and Lockatong shale formations. The surrounding region has experienced folding resulting in broad west-northwest trending anticlines and synclines. The dam is situated within an anticline or upfold. Rock jointing observed in exposures to the right of the spillway strike north-northeast and west-northwest having dips generally greater than 70 degrees. The dense diabase bedrock occurs at relatively shallow depth as indicated by the spheroidal boulders common in the area and the exposures present in the Perkiomen Creek. The seepage observed in the water saturated area adjacent to the toe of the dam in the left abutment area may be in part influenced by the apparently shallow dense diabase bedrock underlying the dam.

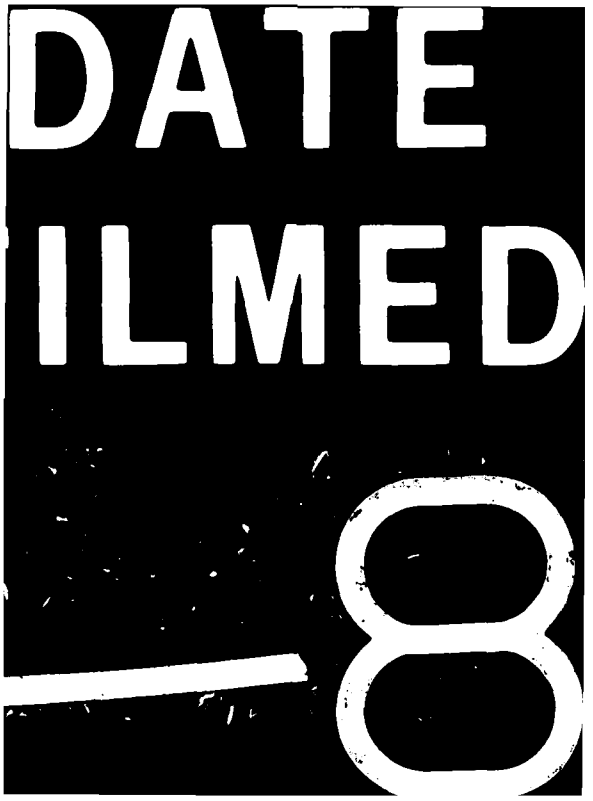


SITE GEOLOGIC MAP
DEEP CREEK DAM

NAT.I.D.NO.PA.00200 MONTGOMERY COUNTY

DATA OBTAINED FROM PENNA. GEOLOGICAL SURVEY
GROUNDWATER REPORT W 22

PLATE F-1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