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NATIONAL DAM INSPECTION REPORT. KAERCHER CREEK DAM (PA-00722), --ETC(U)
JUL 78 J H FREDERICK, W S GARDNER DACW31-78-C-0048
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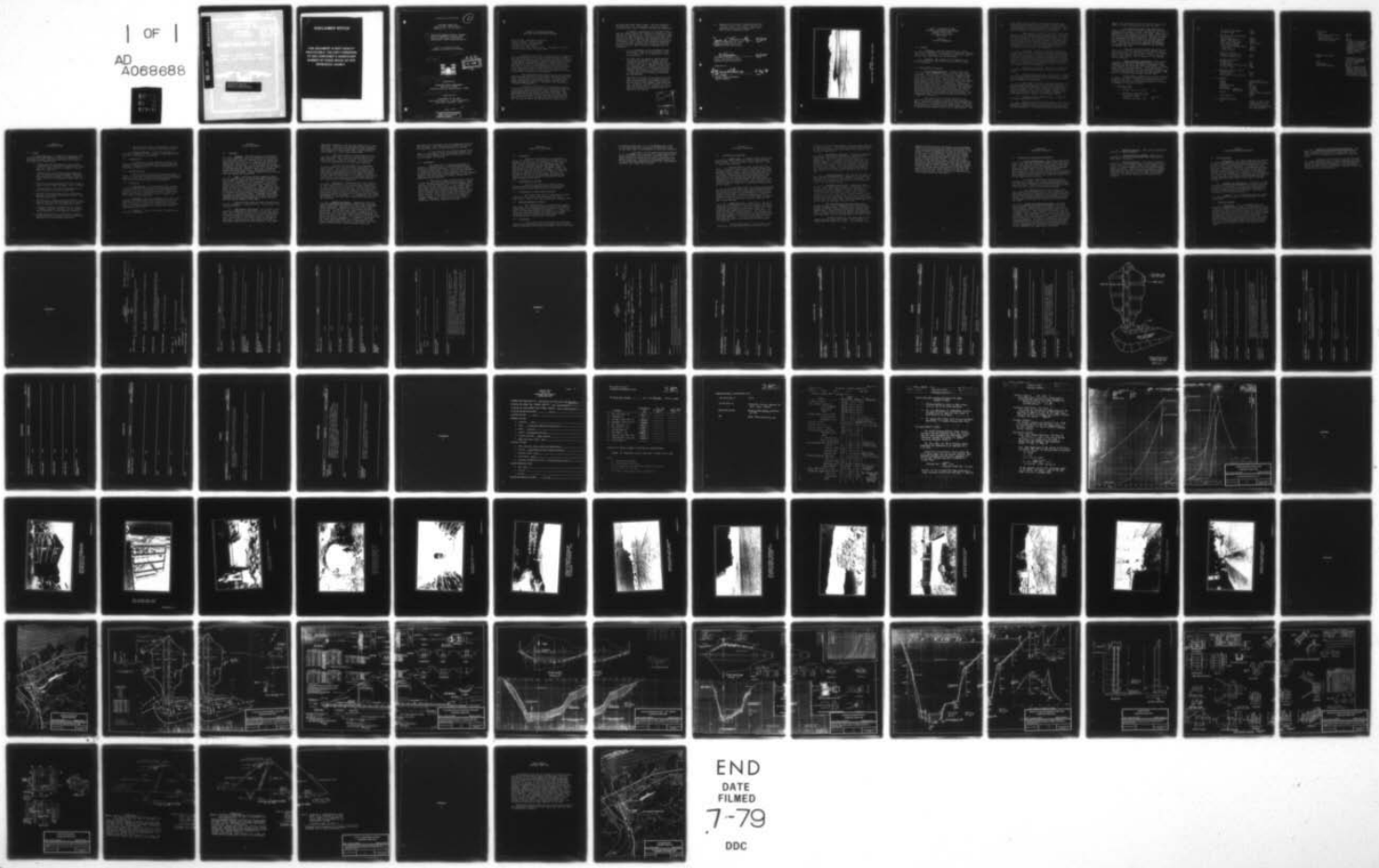

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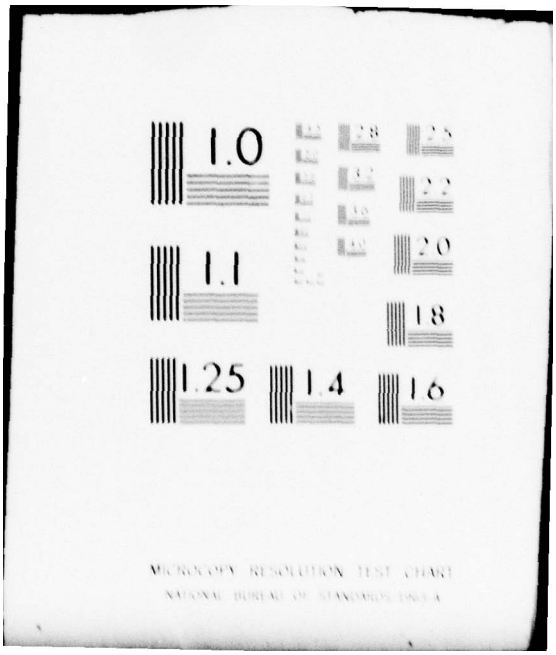
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SCHUYLKILL RIVER BASIN

(1)

KAERCHER CREEK DAM
BERKS COUNTY, PENNSYLVANIA
NATIONAL I.D. NO. PA 00722

(6) National Dam Inspection Report. Kaercher Creek Dam (PA-00722), Schuylkill River Basin, Kaercher Creek, Berks County, Pennsylvania. Phase I Inspection Report.

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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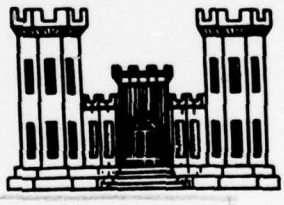

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(15) DACW31-78-C-0048

Submitted to:

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

JULY, 1978

394 157

JOB

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

Name of Dam: Kaercher Creek Dam
County Located: Berks County
State Located: Pennsylvania
Stream: Kaercher Creek
Coordinates: Latitude 40° 33.4' Longitude 75° 58.2'
Date of Inspection: 18 July 1978

Kaercher Creek Dam is owned by Berks County and was designed by the Soil Conservation Service in 1965. The dam is located on Kaercher Creek in Windsor Township, Berks County, Pennsylvania, approximately 3/4 mile east-northeast of Hamburg, Pennsylvania. The facility is considered to be in good condition and well maintained. The dam is considered a "High" hazard potential structure consistent with its potential for extensive property damage and loss of life along Kaercher Creek and in the town of Hamburg, Pennsylvania.

The design data was comprehensive and included hydrology and hydraulic calculations together with structural calculations and geologic data. Kaercher Creek Dam was designed to pass the probable maximum flood (PMF) without overtopping. Therefore, the spillway is considered "Adequate".

A visual inspection of the dam and reservoir facilities detected no symptoms of uncontrolled seepage, instability, deterioration or other conditions that would suggest an impending hazardous condition. The pond drain valve was locked and a key was unavailable. The exterior portions of the valve were inspected and observed to be clean, painted and well lubricated. A wet area was noted on the downstream toe left of the

principal spillway impact basin. This wet condition was assessed to be a topographic low that collects rainfall runoff and not seepage through the embankment.

In summary, examination of available records and the visual inspection revealed no evidence or conditions detrimental to the integrity of Kaercher Creek Dam and its appurtenances. Considering the good condition of the dam, recommendations presented below are suggested to insure that the dam continues to function as designed, and to insure that residents downstream are notified when impending high flows are expected along the creek. The following recommendations are presented.

1. It is recommended that the Borough of Hamburg obtain a key to the pond drain valve in the event that it is necessary to drain the reservoir.

2. The owner and the operator should develop a maintenance procedure together with an inspection checklist, to insure that all critical items are inspected and maintained on a periodic basis. Because of the location downstream of a highly populated area, Hamburg, Pennsylvania, a formal procedure of observation and warning during periods of high precipitation should be developed and implemented.

3. Although not related to the function of the dam, the flood plain and channel, particularly along Kaercher Creek between the dam and the tunnel under Hamburg Plow Works factory, should be cleaned of debris to minimize the possibility of clogging the tunnel. The tunnel obstructions could result in damage to the factory.

4. Hamburg City Officials should be aware of the possibility that property damage and possible loss of life could result from high flows in Kaercher Creek.

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8/24/78
Date

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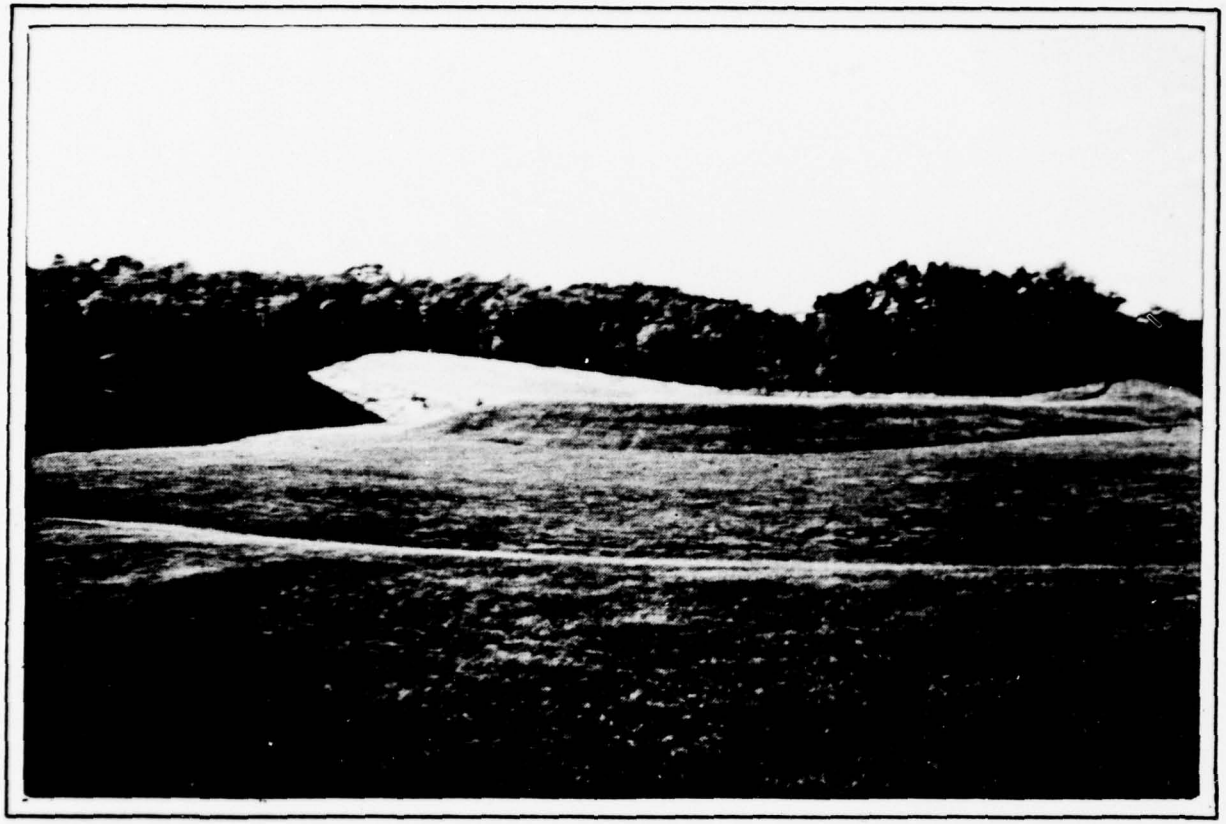
Date

APPROVED BY:

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

11 Sep 78
Date



OVERVIEW
KAERCHER CREEK DAM, BERKS COUNTY, PENNSYLVANIA

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
KAERCHER CREEK DAM
NATIONAL ID #PA 00722
DER #6-462

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. Kaercher Creek Dam is a zoned earth embankment with a 10 foot wide transition zone. See Plate 10. The dam has a maximum height of 56 feet; a crest width of 16± feet; a length of 680 feet; and a cutoff trench excavated into rock just upstream of the center-line. The 157,000 cubic yard embankment impounds a 484 acre-feet reservoir forming a 1.39 square mile drainage basin. The dam has a downstream drainage blanket with two collector pipes which discharge on either side of the principal spillway. The upstream slope is 1.92:1(H:V) with a bench at elevation 446.8. The upstream slope is protected with riprap over a 12-inch filter bed between elevations 446.8 and 450.8. The downstream slope is Crownvetch covered and inclined at a slope of 2.43:1(H:V).

The intake riser, located upstream of the centerline, has an intake weir with a crest elevation of 447.8. An 18-inch diameter pond drain pipe extends from the reservoir to the base of the intake riser. The pond drain and the principal spillway water discharges through a common 24-inch diameter pipe into an impact basin. The

water flows over an 18-foot long riprap channel and through an abandoned railroad culvert into the natural stream channel. The invert elevations of the riser weir and pond drain are 447.8 and 403.7, respectively. The invert elevation of the impact basin is 402.9.

The emergency spillway, located in the right abutment, was excavated into decomposed rock. It has a 100 foot wide grass-lined channel with a control section at elevation 542.8. The downstream section slopes at 3 percent into the valley below the dam. A dike was constructed between the right abutment of the dam and the left abutment of the emergency spillway to protect the embankment. A plan of the dam and appurtenances is located on Plates 2 and 3 in Appendix E.

b. Location. Kaercher Creek Dam is located across Kaercher Creek in Windsor Township, Berks County, Pennsylvania. The site is located approxumately 3/4 of a mile east-northeast of Hamburg, Pennsylvania with the reservoir approximately parallel to Route 22. The dam site and reservoir are shown on USGS Quadrangle entitled "Hamburg, Pennsylvania" at coordinates N40° 33.4', E75° 58.2'. A regional location plan of Kaercher Creek Dam is enclosed as Plate 1 Appendix E.

c. Size Classification. The dam is classified as an "Intermediate" dam consistent with its 56 foot height.

d. Hazard Classification. This dam has a "High" hazard classification because of the potential for extensive property damage and loss of life downstream in the town of Hamburg, Pennsylvania.

e. Ownership. The dam is mutiply owned by Berks County, Windsor Township and the Borough of Hamburg. Copies of the report should be sent to the County Recreation Department, Court House, Reading, Pennsylvania; Windsor Township Supervisors, RD Hamburg, Windsor Township, Pennsylvania, 19526; and Borough of Hamburg, 31 North Third Street, Hambrug, Pennsylvania, 19526.

f. Purpose of Dam. The reservoir is used for recreation and flood control.

g. Design and Construction History. The dam was designed in 1965 by the Soil Conservation Service. Construction inspection was performed by Soil Conservation Service personnel. A "Sedimentation and Erosion Control

Report" was prepared by McCloud, Scatchard, Derck and Edson of Lititz, Pennsylvania on July 14, 1976.

The application Report was submitted on March 3, 1969 and the Permit was issued by the State of Pennsylvania on March 6, 1969. "The Report Upon the Application" was issued on 23 April 1969. Cutoff trench excavation into decomposed rock was completed on April 22, 1971 and approved for backfill. By July 29, 1971 the embankment was approximately 50 percent complete and was within 15 feet of the crest by September 22, 1971. The dam was officially completed on November 8, 1971 and the final State inspection was performed on November 22, 1971.

Construction records submitted by the Soil Conservation Service reported that all density tests were greater than the specified 90 percent of the Standard Proctor density (ASTM D-698). Most of the test results were greater than 95 percent of the Standard Proctor density.

h. Normal Operating Procedures. Under normal conditions, there is no dam tender required as both principal and emergency spillways are ungated. Water is maintained at the normal pool elevation by the intake riser weir at elevation 447.8. It was reported by County representatives that the pond drain is exercised at least once per year to flush out pond sediment. The valve is lubricated and cleaned once per year.

The emergency spillway has a crest elevation of 452.8. To date, the emergency spillway has not discharged flood water. Typical cross sections of the principal spillway and emergency spillway are enclosed in Appendix E as plates 3 and 6.

1.3 Pertinent Data

a.	Drainage Area (sq. miles)	1.39
b.	Discharge at Dam Site (cfs)	
	Max. Known Flood at Site (June 22, 1972)	87 (est.)
	At Emerg. Spillway Crest	88

	At Design High Water	2670
	At Top of Dam	6700
c.	Elevation (feet above MSL)	
	Top of Dam	461.2
	Design High Water	457.9
	Emerg. Spillway Crest	452.8
	Max. Pool of Record	450.2 (est)
	Principal Spillway	
	Weir Crest (Normal Pool)	447.8
	Pond Drain	403.7
	Outlet Invert	402.0
d.	Reservoir (miles)	
	Length at Normal Pool	0.6
	Fetch at Normal Pool	0.6
e.	Storage (acre-feet)	
	Sediment Pool	23
	Normal Pool	484
	To Emergency Spillway Crest	665
	To Top of Dam	1089
f.	Reservoir Surface (acres)	
	Sediment Pool	4.0
	Normal Pool	31.8
	Flood Water (Elev. 457.9)	52.0
g.	Dam Data	
	Type	zoned earth fill
	Volume	157,000 cubic yards
	Length	680
	Maximum Height	56 feet
	Top Width	18 feet
	Side Slope - Upstream	2.92H:1V
	- Downstream	2.43H:1V
	Cutoff	Trench into decomposed rock
	Grout Curtain	None
h.	Principal Spillway	
	Type	3 feet x 3 feet x 45 feet concrete riser discharging into a 24-inch concrete pipe and impact basin.

Elevations	
Weir	447.8
Pond Drain (119 feet of 18-inch pipe)	403.7
Impact Basin End Still	402.0
Downstream Channel	18 feet of riprapped channel discharging through a railroad embankment tunnel. In Hamburg, the stream passes under factories through tunnels.

i. Emergency Spillway

Type	trapezoidal channel cut through decomposed rock; grass lined.
Size	100 feet wide
Side Slopes	3H:1V
Downstream Channel	Channel passes around end of railroad embankment and through a dense stand of conifers before entering the natural streambed.

SECTION 2
ENGINEERING DATA

2.1 Design

a. Data Available. A summary of engineering data is presented in the checklist attached as Appendix A. Principal documents containing pertinent data used for this report are listed below.

1. "Report Upon the Application of the Borough of Hamburg" by the State of Pennsylvania, dated April 23, 1969, prepared by Joseph J. Ellam, Hydraulic Engineer.

2. "Sedimentation and Erosion Control Report and Plan for Kaercher Creek Watershed", Dam #PA-478, prepared by McCould, Scatchard, Derck and Edson, of Lititz, Pennsylvania, dated July 14, 1976.

3. As-built drawings prepared by the Soil Conservation Service, dated December, 1965, 18 sheets.

4. "Design Report", Dam #PA-476 prepared by the Soil Conservation Service, dated 1965.

5. Kaercher Creek Watershed Design Calculations, prepared by the Soil Conservation Service, Dam #PA-478, dated 1965.

6. "SCS Status of Construction Work Reports", prepared in 1970 and 1971 by Frederick H. Schuetz, Project Engineer, Soil Conservation Service.

7. "Inspection Reports", prepared by Mr. Joseph J. Ellam, Hydraulic Engineer, for the Pennsylvania Department of Environmental Resources.

8. "Inspection Reports", prepared by Mr. Walter Leidig, Hydraulic Engineer for the Pennsylvania Department of Environmental Resources.

9. Miscellaneous memos, correspondence and other pertinent data included in the State files.

b. Design Features. A complete description of the design features of this project is discussed in Section 1.2, "Description of Project".

2.2 Construction

A description of the available construction history as determined from DER files; discussions with Borough of Hamburg and Berks County representatives is described in Section 1.2.

2.3 Operational Data

There are no operational records maintained. There are no minimum flow requirements for the downstream channel. There are no water level measurements or rainfall records maintained within this watershed.

2.4 Evaluation

a. Availability. All engineering data produced in this report and studied for this investigation was provided by either the Department of Environmental Resources or the Soil Conservation Service. Verbal information was received from the Borough of Hamburg and Berks County representatives.

b. Adequacy. The data included in the State files together with supplemental data received from the Soil Conservation Service and verbal information received from the Borough of Hamburg and Berks County representatives is considered adequate to evaluate the dam and appurtenant structures.

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

SECTION 3
VISUAL INSPECTION

3.1 Findings

a. General. The observations and comments of the field inspection team are contained in the checklist contained herein as Appendix B and are summarized and evaluated as follows. In general, the dam and its appurtenant facilities are in good condition and reasonably well maintained. It is noted that the Borough of Hamburg, who was indicated as the Owner on the "Report of the Application", does not have a key to open and operate the pond drain valve. Therefore, the valve could not be exercised. County representatives now maintain and operate the facilities.

b. Dam. During the visual inspection there were no indications or evidence observed of distortions in alignment or grade that would be indicative of movement of the embankment or the foundation. A careful inspection of the downstream slope and adjacent downstream areas disclosed no seepage flows. However, as shown on sheet 5a of Appendix B, a topographic low was noted to the left of the principal spillway impact basin. There were no signs of vegetation changes in this area to indicate that the moisture noted during the inspection was of a permanent nature. Although the as-built drawings indicate a crest width of 18 feet, field measurements of the width ranged from 15-1/2 to 18 feet with an overall average of 16± feet.

Upstream there were no signs of riprap distortion, movement, or deterioration. The quality of the riprap was good.

c. Appurtenant Structures. At the time of the inspection water was at the crest of the primary spillway. The accessible portions of the intake tower were thoroughly inspected and observed to be in good condition with no signs of distress, concrete spalling or other indications of poor construction or movement of the riser. The pond drain sluice gate could not be exercised because a key was not available. The impact

basin was thoroughly inspected and found to be in good condition. Similarly, the discharge channel between the impact basin and the abandoned railroad tunnel was also found to be quite stable and in good condition. Photographs No. 3 and 4 show these areas.

The grass channel of the emergency spillway side slopes were inspected and observed to be in good condition. There were no signs of significant deterioration, erosion or movement. The grass was lush, well maintained and in very good condition.

As shown in Photograph 5, an abandoned railroad tunnel is located 18 feet downstream of the impact basin. This tunnel can pass the maximum flow that could be discharged through the principal spillway without impounding water. The tunnel is stable without excessive deterioration or signs of instability. In the event of dam failure, it is believed that the railroad fill and tunnel would afford some detention and attenuation of the flood wave.

d. Reservoir. Reconnaissance of the reservoir disclosed no evidence of siltation, slope instability or other features that would significantly affect flood storage capacity of the reservoir. The drainage basin surrounding the reservoir was inspected and assessed to be quite stable and well vegetated or recently seeded. Residential areas are beginning to develop near the downstream portions of the basin. It is expected that future development of the basin will continue for the life of the reservoir.

e. Downstream Channel. Immediately below the railroad embankment the channel flows through a marshy, narrow flood plain bounded on each side with timber and dense underbrush. Approximately one-half mile downstream from the dam there are three houses adjacent to the stream. The stream passes under a bridge 0.3 miles downstream. This location is shown on Photograph No. 10. Before Kaercher Creek flows under Hamburg Plow Works factory, the channel narrows. The flood plain is covered with debris and factory equipment. At Hamburg Plow Works, the creek flows underneath the factory and under the city for approximately one block. Thereafter, the flow passes through another channel between houses and

businesses and discharges into the Schuylkill River via the old canal. The channel slope between the dam and the Schuylkill River is approximately one percent.

In the event of the probable maximum flood (PMF) or even lesser floods, damage and possible loss of life at the Hamburg Plow Works factory and in the city of Hamburg is expected.

3.2 Evaluation.

The inspection of the dam disclosed no evidence of apparent past or present movement that indicates existing instability of the dam, emergency or principal spillways. Since a key was not available to unlock the pond drain gate, the gate could not be exercised and could not be confirmed that it was operable. However, the gate system was cleaned, greased and in apparently good condition.

There was no debris noted in the reservoir or near the principal and emergency spillways. Downstream, significant debris and factory storage areas were noted on the flood plain. It is judged that, in the event of high flows along Kaercher Creek, debris would most likely be floated down the channel and would probably clog either the entrance to the tunnel or at the bend in the tunnel under the Hamburg Plow Works factory. This would store water eventually causing damage to the factory and to the homes in Hamburg. Additional evaluations of the flooding potential in Hambrug should be performed.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Procedures

Operational procedures are discussed in detail in Section 1.2. As stated in Section 1.2, the operation of this dam does not require a dam tender. Under normal conditions, flow discharges over the weir of the principal spillway and excess water is stored up to elevation 452.8. Thereafter, water is discharged over the emergency spillway. In the event that it is necessary to drain the reservoir, this can be done by opening the sluice gate. The valve is located at the top of the principal spillway riser. There are no written procedures describing how and when to operate this valve.

4.2 Maintenance of the Dam

The dam is maintained by Berks County. County personnel periodically check the structures, mow the grass and perform repairs, as necessary.

4.3 Maintenance of Operating Facilities

The sluice gate valve is exercised at least once per year; cleaned and painted and the gears lubricated. This is the only mechanically operated item.

4.4 Warning Systems in Effect

The representative for the Borough reported that there are no formal warning systems or procedures established to be followed during periods of heavy rainfall. If hazardous conditions develop, or if high flow conditions are anticipated, the local Civil Defense authority would be notified by either Berks County representatives or the Borough of Hamburg.

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 Kaercher Creek Dam. It is recommended that a key for the pond drain be retained at the Borough offices in the event that it is necessary to drain the reservoir.

Since there are no formal warning procedures, it is recommended that a procedure be developed so downstream residents, including the industrial areas, be amply warned of possible high flows or potentially hazardous conditions. Operational procedures should also be formalized and documented together with a maintenance procedure and inspection checklist.

SECTION 5
HYDROLOGY/HYDRAULICS

5.1 Evaluation of Features

a. Design Data. A complete Design Report prepared by the Soil Conservation Service was available and reviewed. Also contained in the files was a copy of the SCS calculations.

The watershed is long, narrow and fairly small, 1.39 square miles, with elevations ranging from a high of 800 to a low of 448 at normal pool elevation. The hydrological design considered the watershed to be 79 percent open/farmland; 18 percent woods and 3 percent urban. These percentages are approximately the same according to current USGS maps and the visual inspection of the drainage basin. The 3 percent urbanization value is judged low for future conditions because the basin is expected to experience rapid growth in the future.

In accordance with the criteria established by the Federal (OCE) guidelines, the recommended spillway design flood for this "Intermediate" size dam and "High" hazard potential classification is the probable maximum flood (PMF). The Soil Conservation Service classified this dam as a "C" structure which is equivalent to a Corps of Engineers structure requiring the dam to pass the PMF.

b. Experience Data. There are no records of reservoir water levels or rainfall records. Kaercher Creek Dam is located in an area that experienced heavy rainfalls from Tropical Storm Agnes, June, 1972. This structure was inspected on June 27, 1972 by Mr. C. R. Kirk, SCS District Conservationist. The maximum pool elevation of 450.2 was estimated from high water marks. This corresponds to a discharge of 87 cfs through the principal spillway. It is not known whether or not the reservoir was at the normal pool elevation prior to the storm.

c. Visual Observations. On the date of the inspection, no conditions were observed that would

indicate that the outlet capacity would be reduced during a flood occurrence. Observations regarding the condition of the downstream channel, spillways, and reservoir are located in Appendix B.

d. Overtopping Potential. The dam was designed to pass the PMF without overtopping. The PMF inflow hydrographs and flood routing are presented in Appendix C. These calculations were reviewed and are judged adequate. In summary, the peak inflow was computed as 8800 cfs resulting from a six-hour storm with 29 inches of rainfall. This was computed to produce a runoff of 24.8 inches. This storm was routed through the reservoir to produce a peak discharge of 6700 cfs at a maximum water elevation of 461.2, to top of the dam.

e. Spillway Adequacy. The spillway systems for this dam are considered to be "Adequate" as the dam has been designed to pass the PMF without overtopping. The tailwater is estimated to be 50 feet or more below the top of the dam during the PMF.

f. Downstream Conditions. Immediately downstream of the impact basin, water is discharged over an 18 foot long riprap channel and passes through an abandoned railroad embankment tunnel. The tunnel has 7 feet vertical walls with a circular roof having a radius of 7.5 feet. The tunnel is constructed of stone and mortar and is assessed to be stable and capable of passing all flows discharged from the principal spillway. In the event of failure, this tunnel and embankment would retard flow and attenuate the flood wave.

The emergency spillway discharges water around the end of this embankment before entering the natural streambed below. Approximately 0.6 miles downstream of the dam, Kaercher Creek enters Hamburg and passes under a tunnel below the Hamburg Plow Works factory. At this point the stream enters the tunnel which is 8 feet high, 12 feet wide and has an "S" curve in it.

A rough estimate has only been made of the tunnel capacity under the factory. The capacity is estimated to be 1300 cfs or less. In any event, it is

judged that debris along the channel and the equipment stored in the flood plain area above this tunnel would float downstream and possibly block the entrance to the tunnel or form a blockage at the bend in the tunnel. At the time of the inspection, debris was collecting at the bend, including a long tree limb and a ladder. It is assessed that extreme damage would occur as a result of blocking this tunnel. In the event that Kaercher Creek Dam failed, water would back up behind the factory and would probably collapse the tunnel and produce excessive property damage. In summary, damage, including loss of life, would be significantly greater if the dam failed during the passing of the PMF, than damage resulting from large flows if the dam did not fail during the PMF. Thus, the dam is classified as a "High" hazard potential structure.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations. The visual observations did not indicate any existing embankment stability problems. The upstream riprap was stable and in good condition. The quality of the rock was accessed to be quite good. The downstream slope was densely vegetated with Crownvetch and is thick, evenly distributed and well maintained. There were no exterior signs indicating that internal drainage systems were operating improperly. Water emanating from blanket drain pipes on either side of the impact basin was clear.

A careful inspection of the marshy area located to the right of the impact basin revealed that the zone was a topographic low which temporarily retains rainfall runoff. There was no evidence to indicate that this area was a source of uncontrolled seepage.

The exposed portions of the intake riser were inspected and judged to be in good condition. The emergency spillway was assessed to be in good condition. The channel and side slopes are well vegetated and maintained. The downstream channels of both the principal and emergency spillways were inspected and observed to be stable.

b. Design and Construction Data. Available design documentation included preliminary and final design reports together with the results of the soil and foundation investigation performed by the Soil Conservation Service. Also contained in the DER file was a complete set of as-built plans. All of this data was reviewed. Input parameters for slope stability were also included in the files and assessed. It was judged that these numbers and the methods of computations are reasonable and adequate. The design calculations and design recommendations were compared to the as-built drawings and no significant deviations were noted between the design recommendations and the as-constructed features of the embankment and appurtenant facilities.

c. Operating Records. There are no operational records for this structure.

d. Post-Construction Changes. There are no reports nor is there any evidence that modifications were made to this dam.

e. Seismic Stability. This dam is located in Seismic Zone I, 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. Since the static stability analyses indicates that the dam is stable under static loading conditions, by definition of the Corps of Engineers criteria, the seismic stability of the dam is also adequate.

SECTION 7
ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessments

a. Evaluation. The visual inspection and review of the design and as-built documentation indicates that the dam, foundation and appurtenant structures of Kaercher Creek Dam are in good condition. The hydrologic and hydraulic computations presented in the design documents and shown in Appendix C, indicate that the dam will pass the PMF without overtopping. Therefore, the spillway systems of the structure are considered to be "Adequate". It is noted that, although the structure has been designed to pass the PMF, significant property damage would be likely downstream with flows on the order of one half the PMF.

b. Adequacy of Information. The design information available for this inspection was adequate and comprehensive. The summary of construction data prepared by Soil Conservation Service inspectors confirmed that the dam and appurtenant structures were constructed in accordance with the specifications.

c. Urgency. It is recommended that the suggestions presented in Section 7.2 be implemented as soon as practical.

7.2 Remedial Measures

a. Facilities. It is recommended that the Borough of Hamburg obtain a key to the pond drain valve in the event that it is necessary to drain the reservoir. Although not related with the function of the dam, downstream conditions, particularly along the channel between the dam and the tunnel at the Hamburg Plow Works should be cleaned of debris to minimize the possibility of clogging this tunnel during periods of high flow. Hamburg City Officials should also be aware of the possibility of extreme property damage and possible loss of life during the passage of high flows along Kaercher Creek.

b. Operation and Maintenance Procedures. The Owner should develop a maintenance procedure together with an inspection checklist to insure that all critical items are inspected and maintained on a periodic basis.

Because of the location of the dam upstream of a highly populated area, 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 or possibly evacuating downstream homes and industries.

APPENDIX

A

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM *Kaercher Creek Dam*

ID # *PA 00722*

ITEM	REMARKS
AS-BUILT DRAWINGS	*No. One set of 1/2 size drawings prepared by the Soil Conservation Service (SCS) was enclosed in DER files (Design Drawings).*
REGIONAL VICINITY MAP	*Yes. Data located on SCS drawings and on USGS Quadrangle entitled "Hamburg, Pennsylvania".*
CONSTRUCTION HISTORY	*There were no formal construction history documents but some of the work was reconstructed from progress reports, inspection reports and miscellaneous letters of correspondence.*
TYPICAL SECTIONS OF DAM	*Yes. Data located on SCS design drawings.*
OUTLETS - PLAN	*Data located on SCS design drawings.*
DETAILS	
CONSTRAINTS	*Complete flood routing data was included in DER files as prepared by SCS.*
DISCHARGE RATINGS	
RAINFALL/RESERVOIR RECORDS	*None available.*

ITEM	REMARKS
DESIGN REPORTS	*Yes. A complete SCS design report was available in DER files and reviewed.*
GEOLOGY REPORTS	*Yes. A geologic section was incorporated in the SCS design report.*
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	*All of this data was included in the SCS design report.*
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	*The results of these analyses was incorporated in the design report prepared by the SCS.*
POST-CONSTRUCTION SURVEYS OF DAM	*None known.*
BORROW SOURCES	*Material sources recommended by SCS were used for construction.*

ITEM	REMARKS
MONITORING SYSTEMS	*None*
MODIFICATIONS	*None*
HIGH POOL RECORDS	*None*
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	*None known*
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	*None*
MAINTENANCE OPERATION RECORDS	*None*

ITEM	REMARKS
SPILLWAY PLAN SECTIONS DETAILS	Details are included on the SCS drawings.
OPERATING EQUIPMENT PLANS & DETAILS	Details are included on the SCS drawings.
MISCELLANEOUS	1. Construction Specifications as prepared by the Soil Conservation Service. 2. Design computations for hydrology, hydraulics, slope stability, soil strength, permeability and some geologic data. 3. "Design Report for Site PA-478", Kaercher Creek Dam, prepared by SCS includes hydraulics, hydrology, geologic data, soils, structural computations, quantities and specifications. 4. "Sedimentation and Erosion Control Report and Plan for Kaercher Creek Watershed" for Recreation Facilities of dam site PA-478, prepared by McCloud, Scatchard, Derck and Edson of Lititz, Pennsylvania. 5. "Report Upon the Application of the Borough of Hamburg" dated April 23, 1969.

APPENDIX

B

CHECK LIST
VISUAL INSPECTION
PHASE I

Name Dam *Kaercher Creek Dam* County *Berks* State *Pennsylvania* National ID # *PA 00722*

Type of Dam *Rolled Earth* Hazard Category *I (High)*

Date(s) Inspection *18 July 1978* Weather *Partly cloudy, warm, humid* Temperature *80's*

Pool Elevation at Time of Inspection *447.0* M.S.L. Tailwater at Time of Inspection *402.4* M.S.L.

Inspection Personnel:

Brady Bisson *Vince McKeever* *John H. Frederick, Jr.*

Mary Beck *John Boschuk, Jr.*

John Boschuk, Jr. Recorder

Remarks:

The Owner's representative was not on site during the field inspection. The valve could not be exercised because it was locked and the Municipal Authority did not have the key.

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

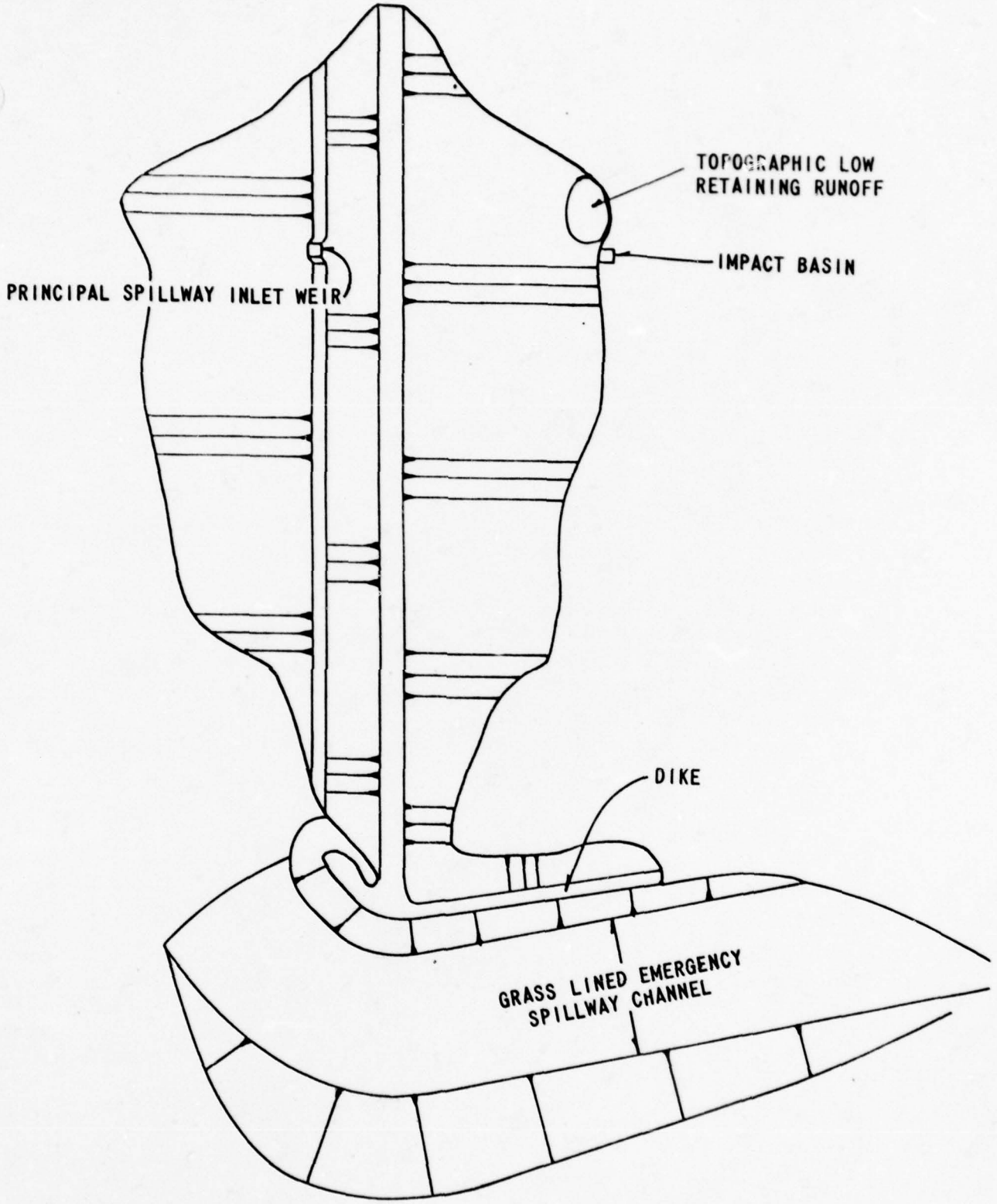
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	*N/A*	
STRUCTURAL CRACKING	*N/A*	
VERTICAL AND HORIZONTAL ALIGNMENT	*N/A*	
MONOLITH JOINTS	*N/A*	
CONSTRUCTION JOINTS	*N/A*	

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	*None observed upstream or downstream. Some woody vegetation is beginning to grow on the slope and should be removed.*	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	*The vertical and horizontal alignment is very good. The width of the crest varies form 16 feet to 20 feet and averages a little more than 16 feet.*	
RIPRAP FAILURES	*None observed. Riprap was of excellent quality and of good gradation.*	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	*No seeps, sloughing, erosion or other discontinuities observed.*	
ANY NOTICEABLE SEEPAGE	*None observed on downstream side of the dam or around outlet works. Some standing water was observed just left of the impact basin. The area is a topographic low approximately 15 feet in diameter. There was no evidence to indicate the area was a source of seepage. See sheet 5a for the specific location.*	
STAFF GAGE AND RECORDER	*None*	
DRAINS	*Two 12" CMP drains (one on each side of the outlet wall) were observed, and flowing with one inch of water. All seepage was clear.*	



SEEPAGE LOCATION PLAN
KAERCHER CREEK DAM

SHEET 5a OF 11

OUTLET WORKS

(INTAKE RISER)

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	*None could be observed because the conduit is buried under the embankment.*	
INTAKE STRUCTURE	*No cracks, spalling, movements, or deterioration observed.*	
OUTLET STRUCTURE	*No cracks, spalling. deterioration or movements observed.*	
OUTLET CHANNEL	*The channel is rock lined and side slopes are stable. The outlet channel enters a tunnel 17 feet-4inches downstream of the wingwall. The tunnel has the following dimensions: The circular roof has a seven foot radius and the vertical walls extend six feet from the channel. The tunnel is constructed of stone.*	
EMERGENCY GATE	*None*	
CONTROL GATE	*The gate was locked and could not be exercised. A key was not available from the Hamburg Municipal Authority.* *Gate Specifications: Rodney Hunt Valve, Orange, Mass., Serial No. BS-2600, Valve No. 14675-2.*	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	*None. Grass channel. Control section is 100 feet wide. Side slopes are rock and the crest elevation is 452.8. Further downstream, the side slopes are 3:1 (H:V).*	
APPROACH CHANNEL	*Grass lined. Channel is 190 feet long.*	
DISCHARGE CHANNEL	*Grass lined. 300 foot long channel at a 3.0 % slope with 3:1 (H:V) side slopes which transition to the natural topography.*	
BRIDGE AND PIERS	*None*	

GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	*None*	
APPROACH CHANNEL	*None*	
DISCHARGE CHANNEL	*None*	
BRIDGE AND PIERS	*None*	
GATES AND OPERATION EQUIPMENT	*None*	

INSTRUMENTATION

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	*None*	
OBSERVATION WELLS	*None*	
WEIRS	*None*	
PIEZOMETERS	*None*	
OTHER	*None*	

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	*Side slopes were moderate, stable, well vegetated with grass on right side of reservoir and trees to water's edge on left side of reservoir. No debris evident.*	
SEDIMENTATION	*Minimal sedimentation at upper end, no effect on flood storage.*	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	*Immediately below the dam the channel flows through marshy, narrow flood plain, boarded on each side with timber and dense underbrush. Before Kaercher Creek flows under Hamburg Plow Works, the banks are approximately 15 feet high and much debris is in the channel which tends to obstruct flow at the bend in the channel under the Hamburg Plow Works.*	
SLOPES	*The channel slope is approximately one percent.*	
APPROXIMATE NO. OF HOMES AND POPULATION	*Approximately 0.5 mile downstream three houses are built adjacent to the stream. Approximately 0.4 mile further downstream the channel goes under the Hamburg Plow Works.*	

APPENDIX

C

KAERCHER CREEK
CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: *Predominantly open farm land, less than 10% residential.*

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): *447.8 (484 Acre-Feet)*

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): *461.2 (1089 Acre feet)*

ELEVATION MAXIMUM DESIGN POOL: *457.84*

ELEVATION TOP DAM: *461.2*

EMERGENCY SPILLWAY:

a. Elevation *452.8*

b. Type *Trapezoidal channel cut through rock.*

c. Width *100 feet.*

d. Length *Approximately 470 feet.*

e. Location Spillover *Right abutment.*

f. Number and Type of Gates *None*

PRINCIPAL SPILLWAY:

a. Type *Drop inlet riser, conduit and impact basin.*

b. Location *Approximately 180 feet from left abutment.*

c. Entrance inverts *447.8*

d. Exit inverts *402.0*

e. Emergency draindown facilities *18 inch pond drain at 403.7*

HYDROMETEOROLOGICAL GAGES:

a. Type *None*

b. Location

c. Records

MAXIMUM NON-DAMAGING DISCHARGE: *1300 cfs.*

DAM SAFETY ANALYSIS
HYDROLOGIC/HYDRAULIC DATA

Date: 7/29/78
By: MFB
Sheet: 2 of 7

DAM Kaercher Creek Nat. ID No. PA00722 DER No. 6-462

	ITEM/UNITS	Permit/Design Files (A)	Calc. from Files/Other (B)	Calc. from Observations (C)
1.	Min. Crest Elev., ft.	461.2		
2.	Freeboard, ft.	0		
3.	Spillway(1) Crest Elev, ft.	442.8		
3a.	Secondary(2) Crest Elev, ft.	452.8		
4.	Max. Pool Elev., ft.	461.2		
5.	Max. Outflow(3), cfs	6700		
6.	Drainage Area, mi^2	1.99		
7.	Max. Inflow(4), cfs	8800		
8.	Reservoir Surf. Area, Acre	31.8		
9.	Flood Storage(5), Acre-Feet	605.0		
10.	Inflow Volume, ft^3	-		

Reference all figures by number or calculation on attached sheets:

Example: 3A - Drawing No. xxx by J. Doe, Engr., in State File No. yyyy.

NOTES:

(1) Main emergency spillway.

(2) Secondary ungated spillway.

(3) At maximum pool, with freeboard, ungated spillways only.

(4) For columns B, C, use PMF.

(5) Between lowest ungated spillway and maximum pool.

Date: 7/29/78
By: MFB
Sheet: 3 of 7

HYDROLOGIC/HYDRAULIC CALCULATIONS (cont.)

Item (from Sheet 2)	Source
1A, 3A, 3aA, 6A	Construction Drawings stamped 'As-Built', dated '65 & '66
2A, 4A, 5A, 7A, 9A	Freeboard Flood Routing performed by SCS
8A	Design Book prepared by SCS

Pennsylvania — Kaercher Creek Watershed

E Thomas 5/3/65 JMR 5-3-65 PA-478

Design + Work Plan Comparison

Item	Unit	Work Plan	Design	Remarks.
Drainage Area	Sq.Mi.	1.39	1.39	
Stor Capacity: Sediment	Ac-ft.	22.0	23.0.	
Fish + Wildlife	Ac-ft.	461.2	461.2	
Floodwater	Ac-ft.	181.2	181.2	
total	Ac-ft.	664.4	665.4	
Surface Area: Sediment Pool	Ac	3.0	4.0	
: Fish + Wildlife	Ac	30.0	31.8	a similar
Floodwater Pool	Ac	45.0	52.0	D.H.W is higher in design.
Volume of fill	Cu Yd.	99,000	~~122,500~~ 143,120	Top of dam is higher in design
Elevation top of dam	feet	456.3	461.2	Diff. in Stage-Storage
Maximum height of dam	feet	51	56	" " " "
Emerg. Spillway: Crest Elev.	feet	449.0	452.8	" " " "
: Bottom width	feet	100	100	
: type	—	rock	rock	
% Chance of Use	-	1	1	
Avg. Curve No. Cond II	-	72	72	
Emerg. SW Hydrograph: Rainfall (6 hr.)	in	13.8	14.5	Fletcher curve reduction was used in planning but not in design
Runoff	in	12.28	12.71	
Velocity of flow	fps.	9.6	9.3	
Discharge rate	cfs.	2,790	2710	
Max. WS Elev	ft.	453.2	457.9	Higher Em. SW Crest in design. Fletcher curve used
Freeboard Hydrograph: Rainfall	in	27.60	29.0	In planning, not in design
Runoff	in	23.42	24.80	" " "
Velocity of flow	fps	12.6	12.7	
Discharge rate	cfs	6,290	6700	
Max. WS Elev	feet	456.3	461.2	Higher crest used in design
Princ. SW. Cap Low Stage	cfs	104	88	24" pipe used in design
Capacity Equivalents: Sed Vol.	in.	0.29	0.31	
Det. Vol.	in	2.94	2.94	
Spill. Stor	in	4.71	5.66	
Class	-	C	C	

Ref: Kaercher Creek Watershed PA 478 Design Folder prepared by SCS, 1965

BY MFB DATE 7/29/78 SUBJECT Kaercher Creek Hydrology/Hydraulics SHEET 5 OF 7

CHKD. BY DATE JOB No.

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

1. The hazard potential is rated as HIGH as there would be loss of life if the dam failed.

2. The size classification is INTERMEDIATE based on its height of 56 ft. height and total storage of 1089 Ac-Ft (to top of dam).

3. The spillway design flood, based on size and hazard classification, is probable maximum flood (PMF).

Hydrologic/Hydraulic Analysis

The complete hydrologic/hydraulic design package prepared by the Soil Conservation Service was reviewed. The PMF inflow hydrograph and flood routing were determined according to procedures in National Engineering Handbook, Section 4.

The peak inflow rate for the freeboard (PMF) hydrograph was determined to be 8,800 cfs for a 6 hr. storm.

Contact with C of E, Baltimore District indicated that if no original design data was available, Kaercher Creek Watershed should be compared with a watershed of 4.0 sq. miles, estimated peak PMF of 6180 cfs on Furnace Creek.

$$\text{Estimated PMF} = \left(\frac{1.39}{4.0}\right)^{0.8} 6180$$

$$= 2453 \text{ cfs} < 8,800 \text{ cfs} - \text{SCS value}$$

Therefore, the SCS computed PMF inflow hydrograph is judged reasonable and the peak PMF inflow is 8,800 cfs

Spillway Capacity (See sheet 7)
Calculations were reviewed and judged adequate.
During the PMF, water at top of dam, discharges are:
Emergency Spillway ~ 6600 cfs
Principal Spillway ~ 100 cfs

Freeboard (PMF) Routing (see sheet 7)
The routing was reviewed and judged adequate. The structure was designed to pass the PMF (peak inflow 8800 cfs) without over-topping (peak out flow 7700 cfs), therefore, the spillway is "Adequate".

Tailwater Elevation
The tailwater elevation was estimated to be 50 ft or more below the top of the dam during passing of the PMF, therefore, will have no effect on emergency spillway discharge.

Downstream Conditions
Tunnel under Hamberg Plow Works (see Photo 12)
The entrance is about 12 ft. wide by 8 ft. high, the tunnel is 'S' shaped and the outlet is smaller than the entrance, the downstream channel is shown in Photo 13.

As a rough approximation of the capacity of the tunnel, open channel flow for the following section was computed

$A = 12 \times 8 \text{ ft}^2$

$n = 0.025$

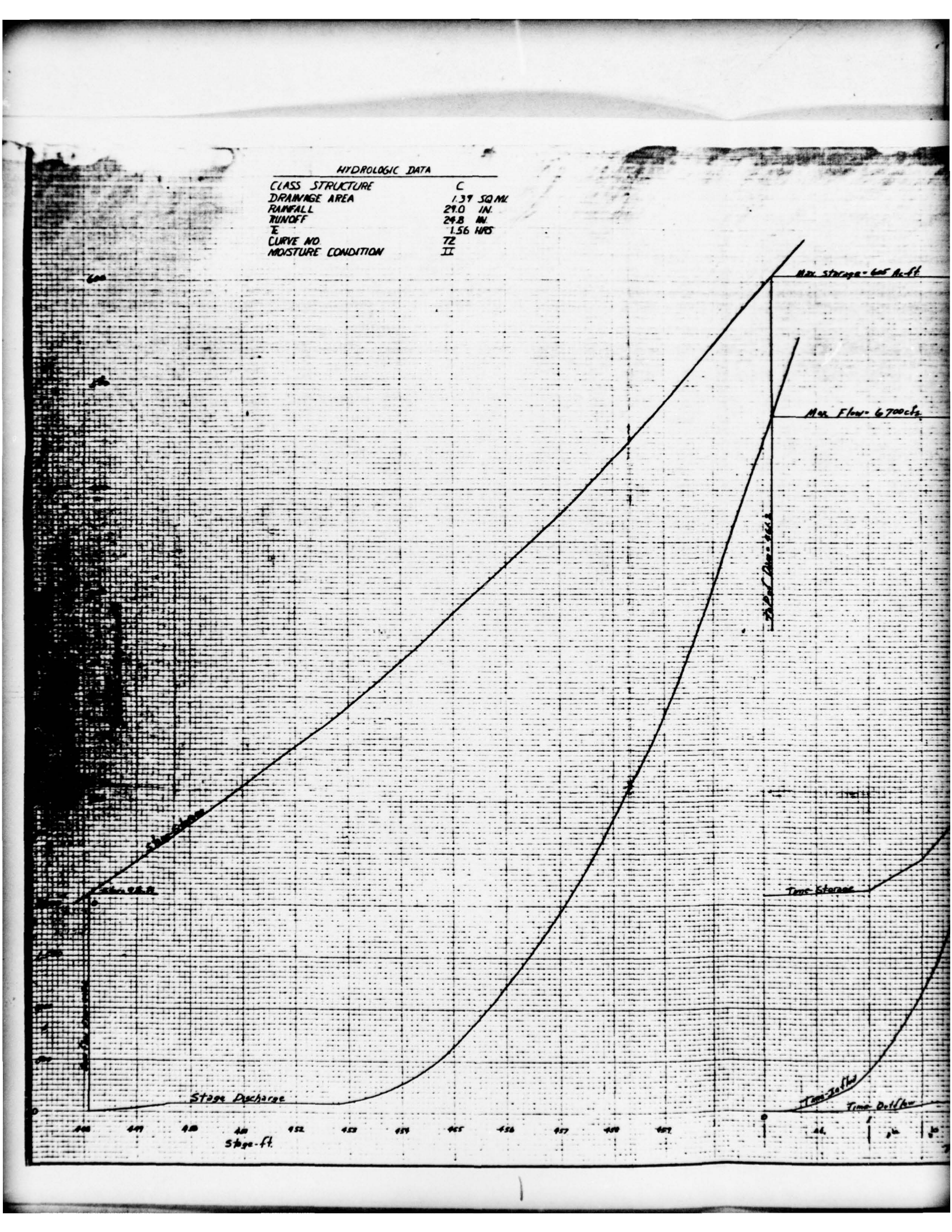
$s = 0.01$

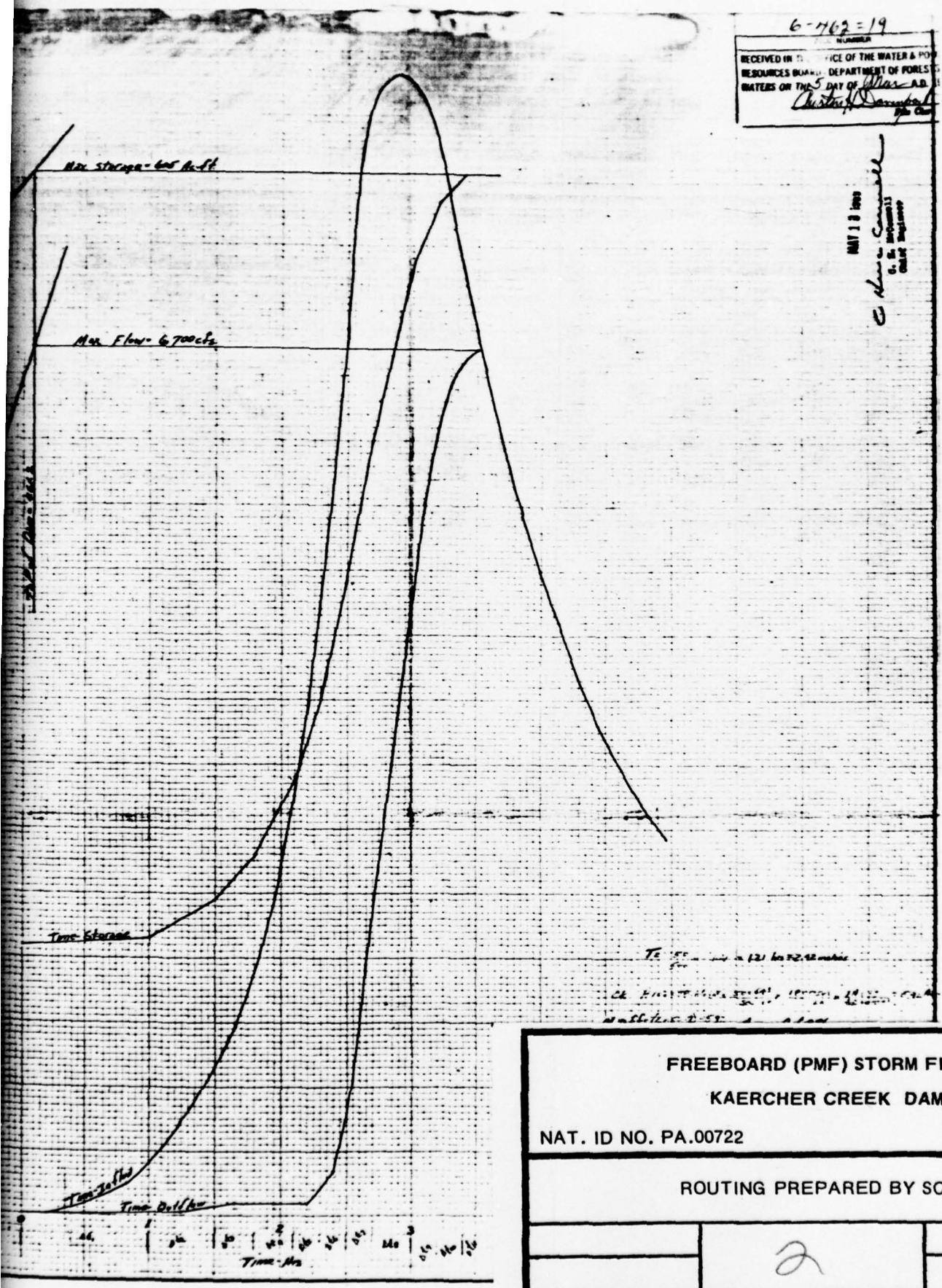
$w.p. = 12 + 2 \times 8 = 28 \text{ ft}$

$$Q = 12 \times 8 \cdot \frac{1.486}{0.025}\left(\frac{12 \cdot 8}{28}\right)^{2/3} 0.01^{1/2}$$

≈ 1300 cfs without backing up

As the approach channel has considerable debris on the banks, and debris clogs at the first bend, 1300 cfs is probably high


HYDROLOGIC DATA
CLASS STRUCTURE C
DRAINAGE AREA 1.39 SQ MI.
RAINFALL 29.0 IN.
RUNOFF 24.8 IN.
TE 1.56 HRS
CURVE NO. 72
MOISTURE CONDITION II
Max. Storage - 605 Ac-ft.
Max Flow - 6,700 cfs
Stage Discharge
Time Storage
Time Inflow
Time Outflow
Stage-ft.



6-462-19

RECEIVED IN THE OFFICE OF THE WATER & POWER RESOURCES BOARD, DEPARTMENT OF FORESTS AND WATERS ON THE 5 DAY OF Mar A.D.

MAY 18 1959

	2	SHEET 7 OF 7

FREEBOARD (PMF) STORM FLOOD

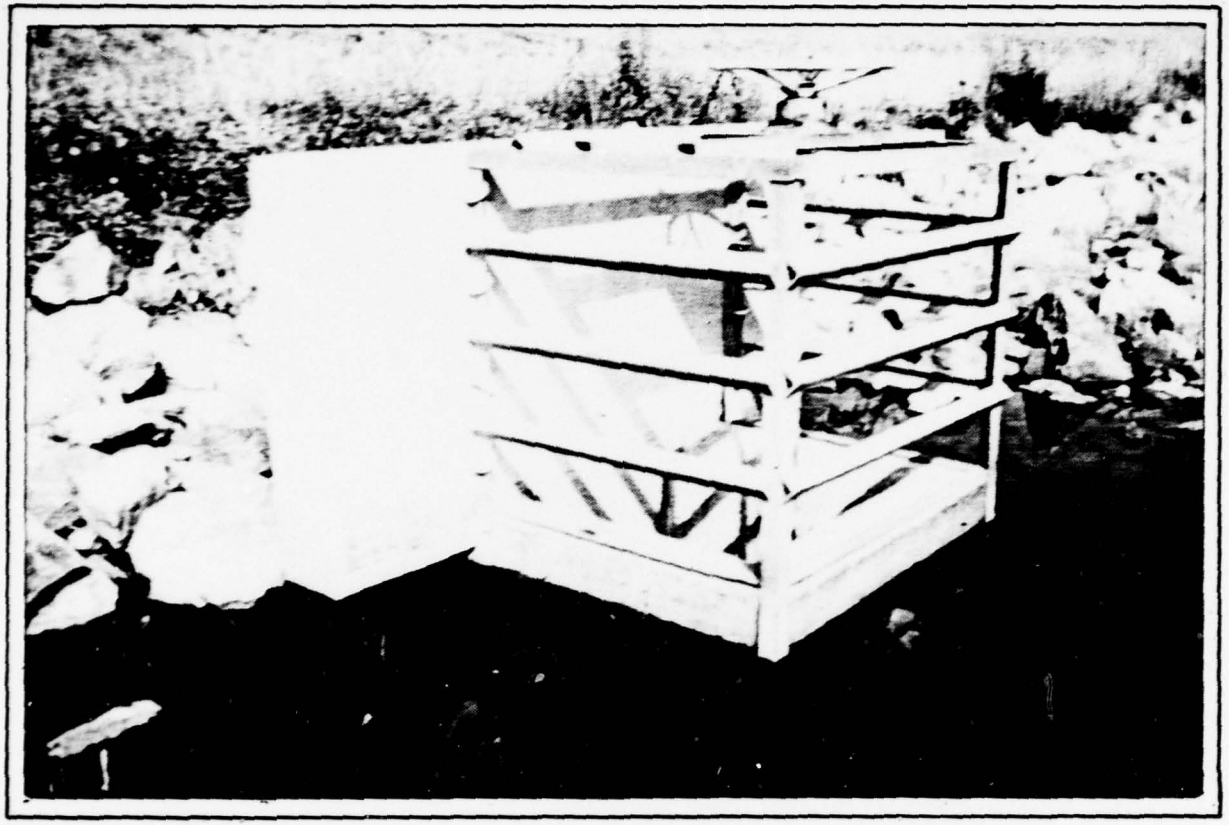
KAERCHER CREEK DAM

NAT. ID NO. PA.00722 BERKS COUNTY

ROUTING PREPARED BY SCS

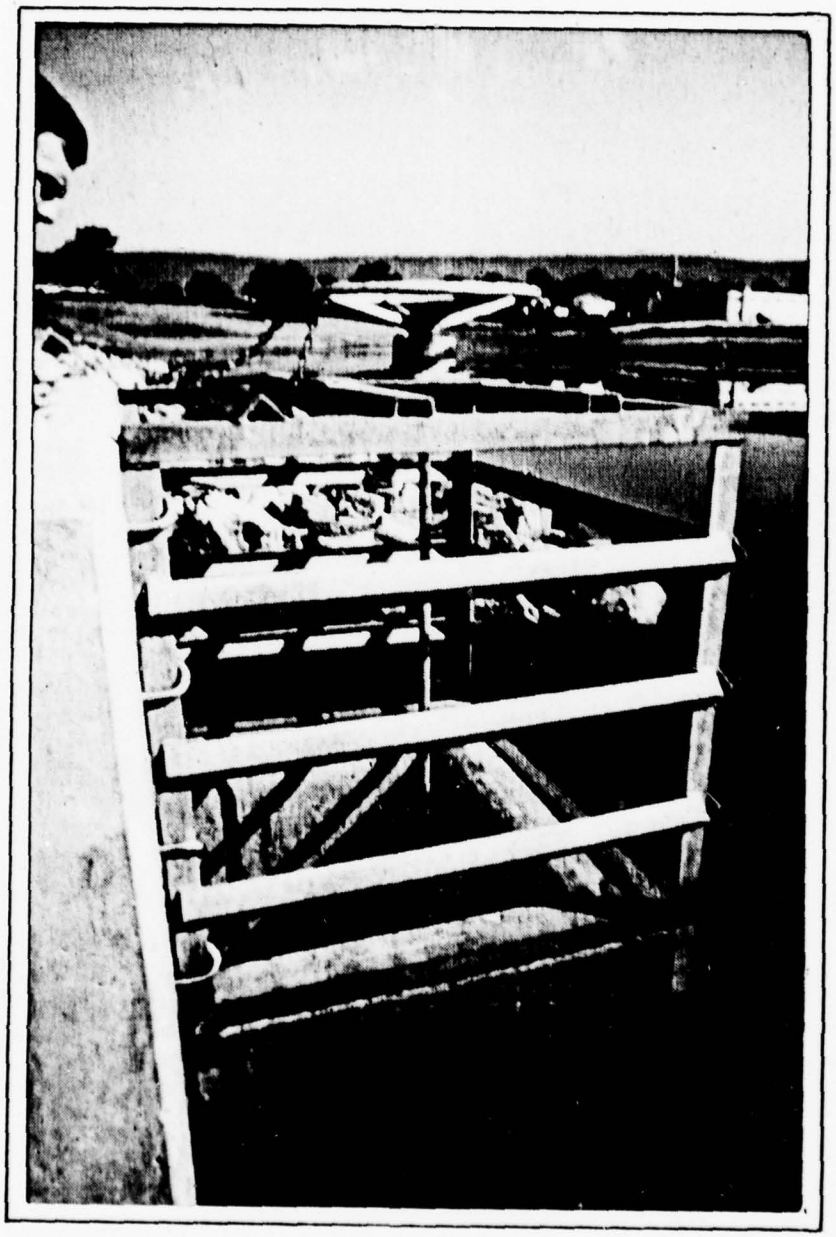
APPENDIX

D



RISER STRUCTURE ON UPSTREAM SIDE OF DAM. NOTE 4 FT X 4 FT OVERFLOW WEIR AND POND DRAIN VALVE.

PHOTOGRAPH NO. 1



VIEW OF INTAKE RISER, TRASH
RACKS AND POND DRAIN VALVE.

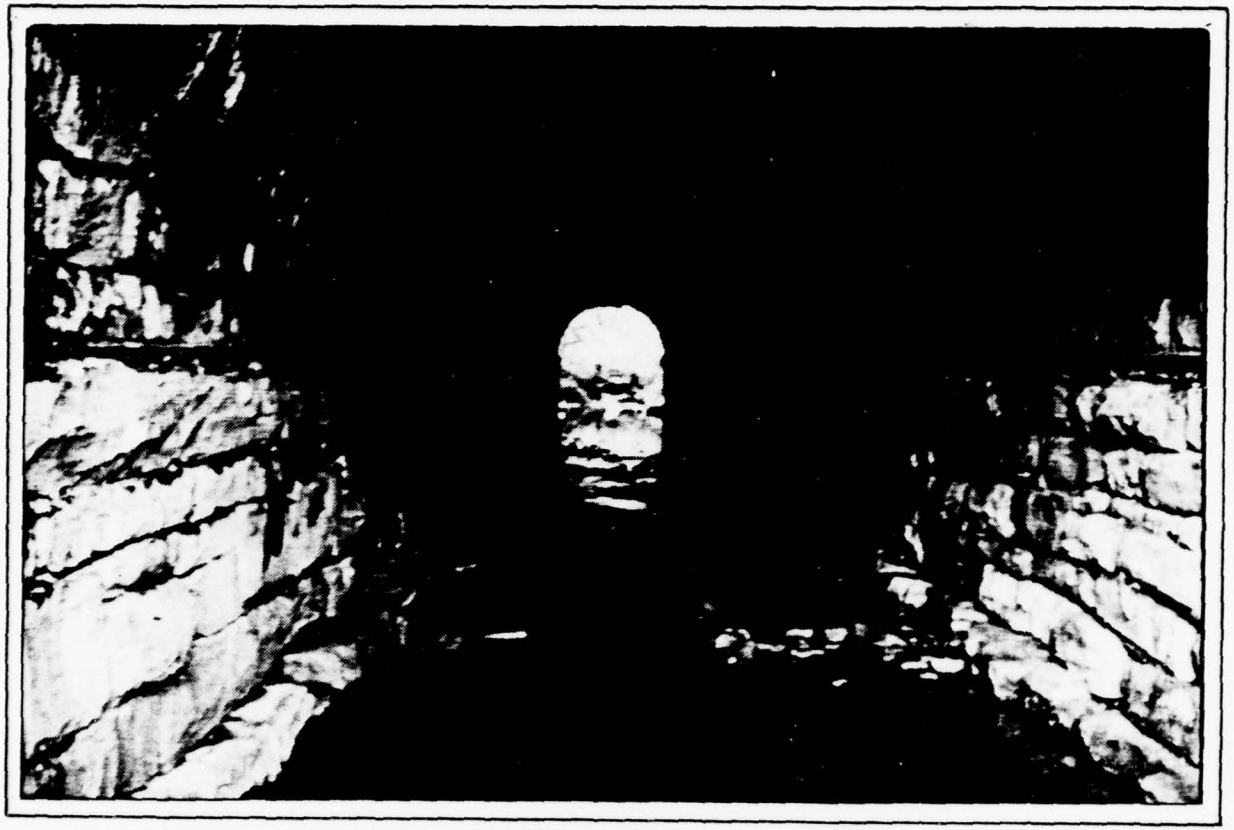
PHOTOGRAPH NO. 2

VIEW OF PRINCIPAL SPILLWAY OUTFALL
AND IMPACT BASIN

PHOTOGRAPH NO. 3

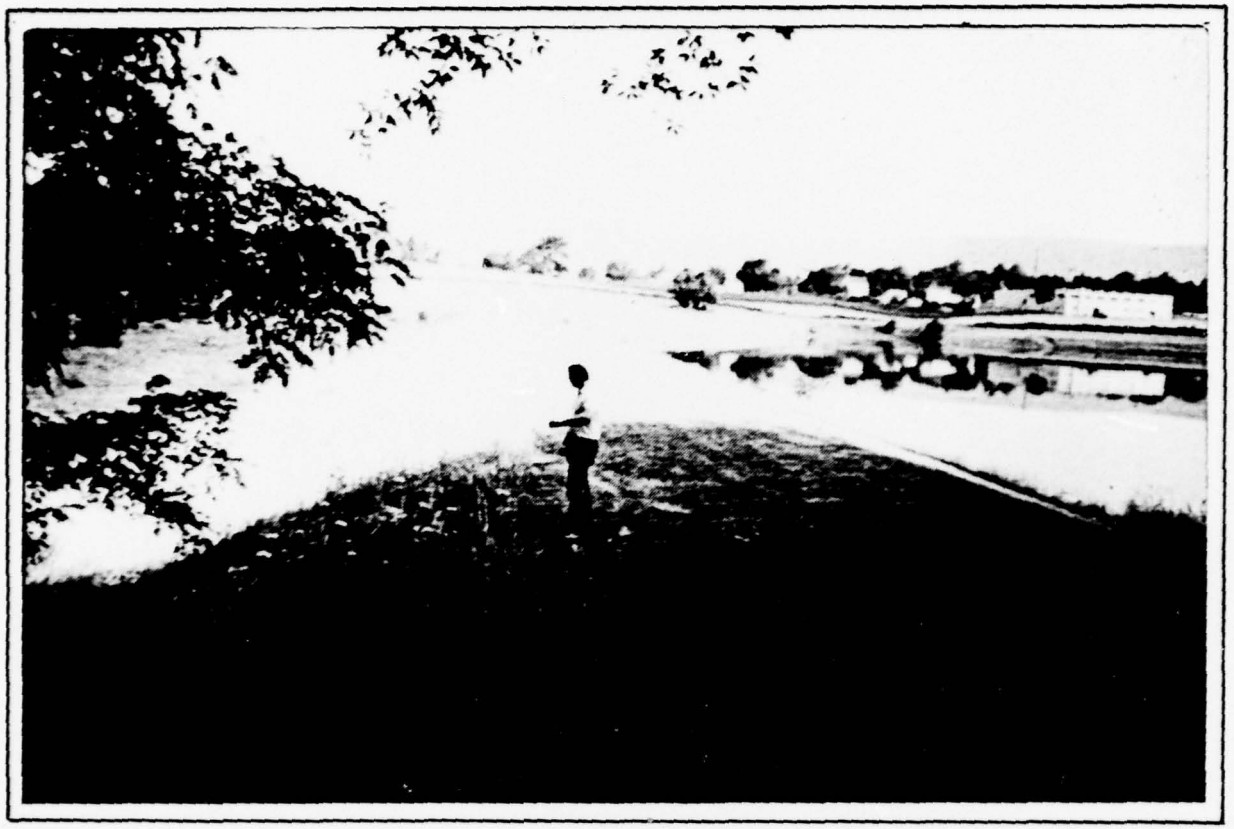
ARCH TUNNEL FROM AN ABANDONED RAIL-
ROAD EMBANKMENT APPROXIMATELY 18
FEET DOWN STREAM OF OUTFALL STRUC-
TURE. TUNNEL IS 14 FEET HIGH.

PHOTOGRAPH NO. 4



VIEW THROUGH TUNNEL DESCRIBED ON
PHOTOGRAOH NO. 4.

PHOTOGRAPH NO. 5

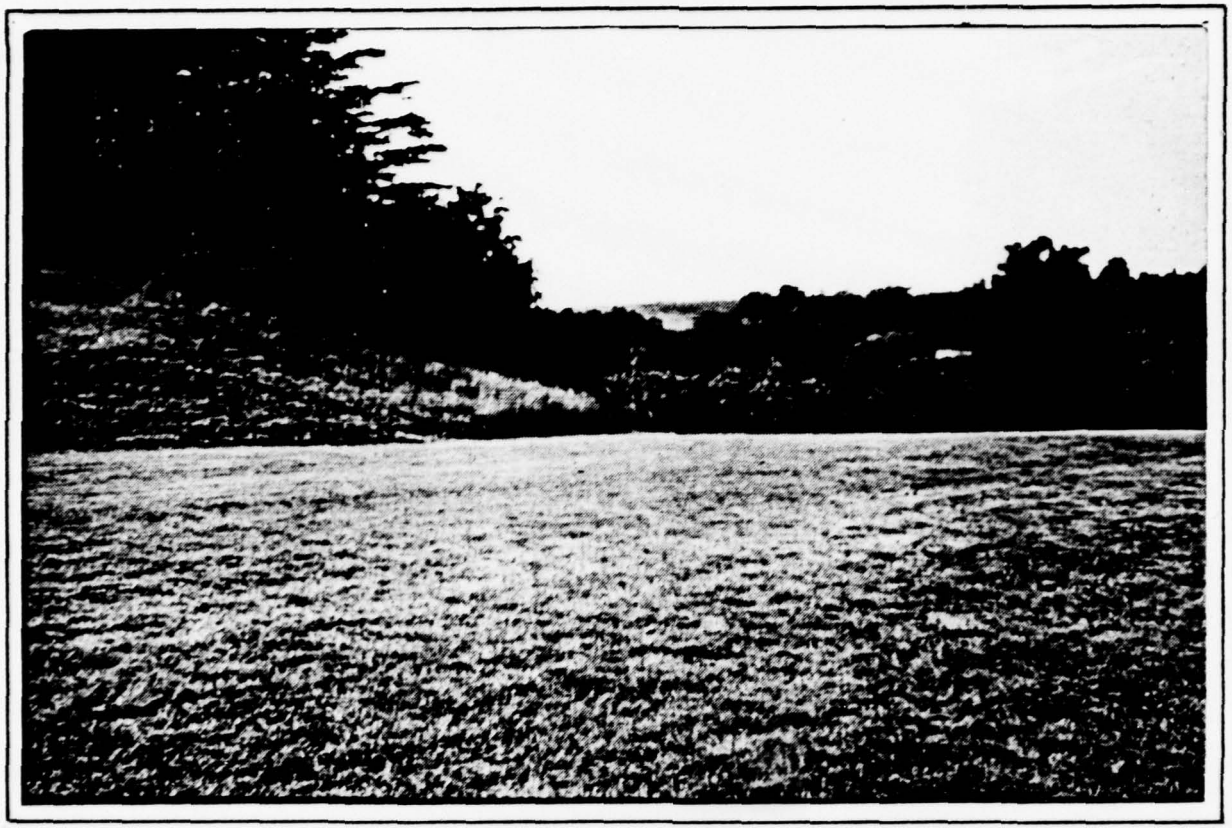


OVERVIEW OF EMBANKMENT FROM THE LEFT ABUTMENT. THE GRASS LINED EMERGENCY SPILLWAY IS IN THE BACKGROUND. CENTER OF PHOTOGRAPH.

PHOTOGRAPH NO. 6

EMERGENCY SPILLWAY LOOKING DOWNSTREAM
JUST UPSTREAM OF CONTROL SECTION.

PHOTOGRAPH NO. 7

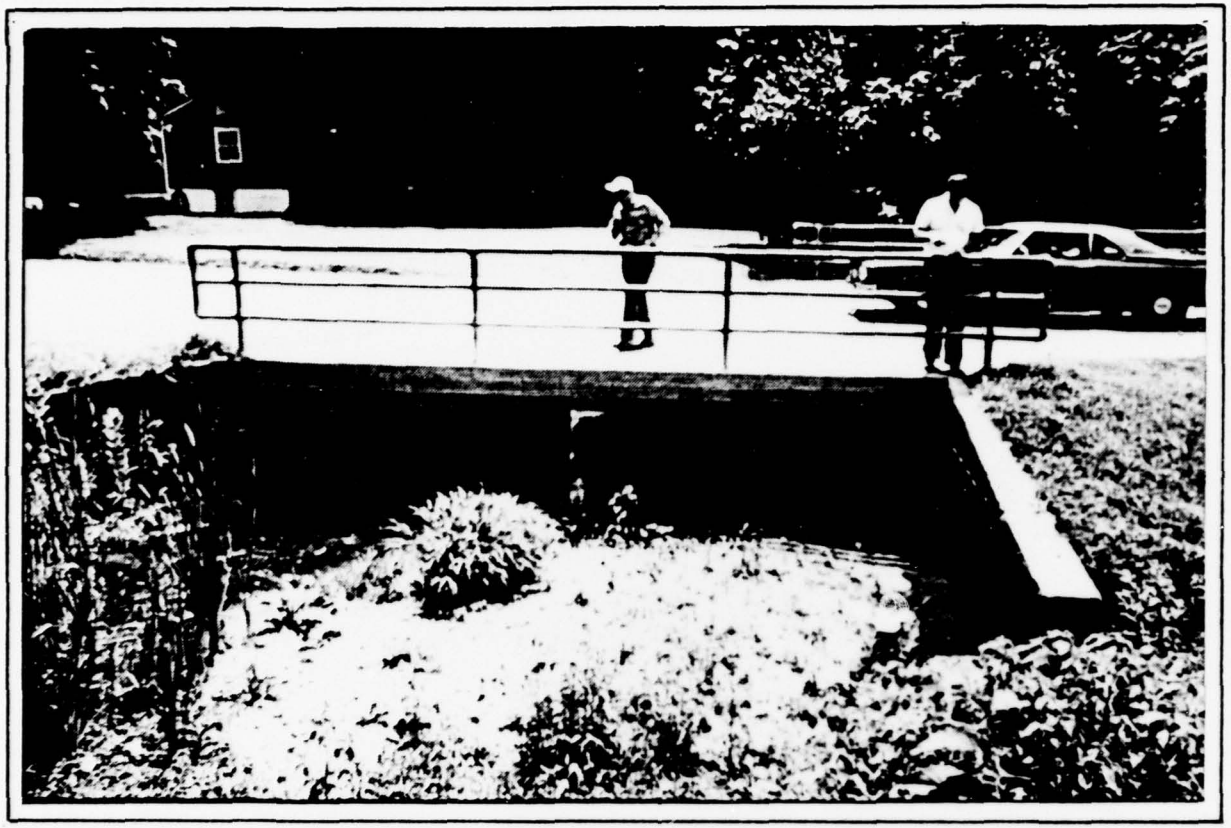


VIEW LOOKING TOWARDS DISCHARGE AREA
OF EMERGENCY SPILLWAY. THE STREAM CHAN-
NEL IS IN THE TREE LINED VALLEY.

PHOTOGRAPH NO. 8

VIEW OF UPSTREAM RIPRAPPED SLOPE LOOKING
TOWARDS LEFT ABUTMENT.

PHOTOGRAPH NO. 9



FIRST BRIDGE DOWNSTREAM OF THE DAM.
HOMES ARE ON THE LEFT AND RIGHT.

PHOTOGRAPH NO. 10

VIEW OF INDUSTRIAL AREA (HAMBURG PLOW FACTORY) WHERE STREAM FLOWS VIA A CONDUIT BENEATH THE FACTORY.

PHOTOGRAPH NO. 11

VIEW OF STONE CONDUIT LOOKING DOWNSTREAM
AT THE HAMBURG PLOW FACTORY.

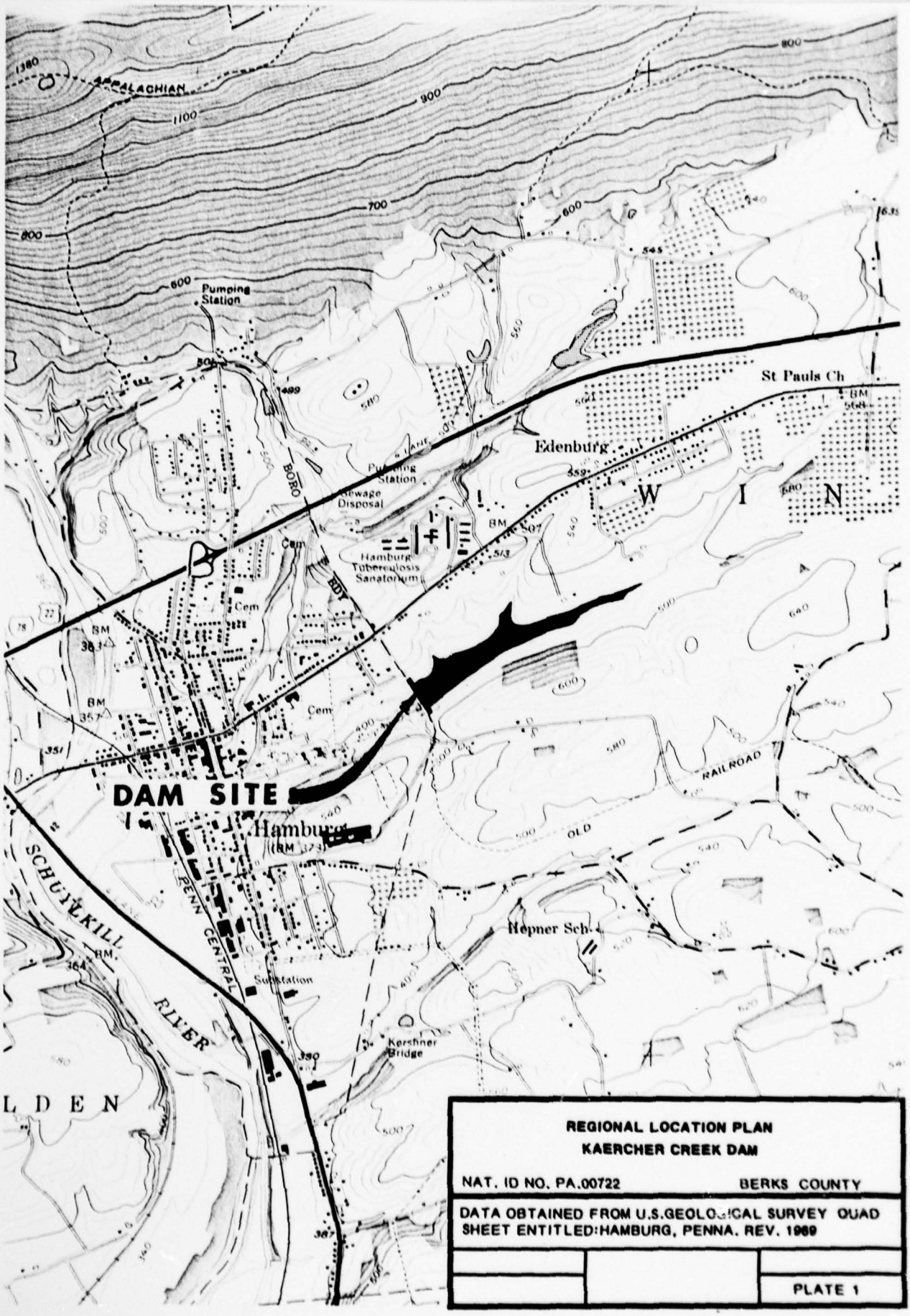
PHOTOGRAPH NO. 12

KAERCHER CREEK STREAM CHANNEL THROUGH
THE TOWN OF HAMBURG, PENNSYLVANIA.

PHOTOGRAPH NO. 13

APPENDIX

E

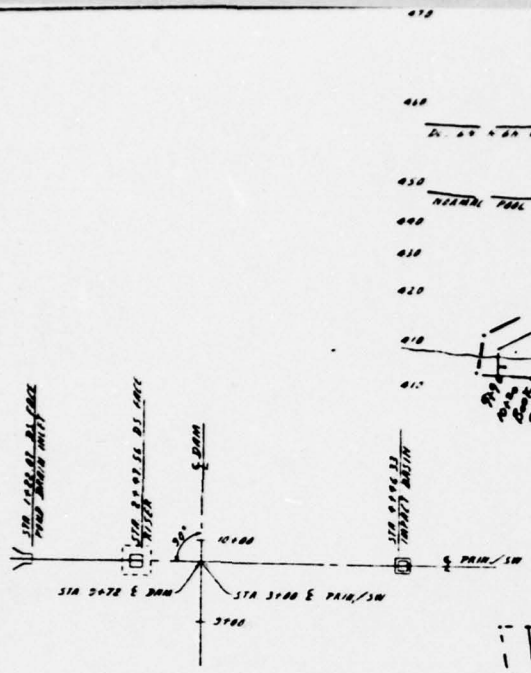


REGIONAL LOCATION PLAN
KAERCHER CREEK DAM

NAT. ID NO. PA.00722 BERKS COUNTY

DATA OBTAINED FROM U.S.GEOLOGICAL SURVEY QUAD SHEET ENTITLED:HAMBURG, PENNA. REV. 1969

PLATE 1



LAYOUT OF PRINCIPAL SPILLWAY
NOT TO SCALE

EMERGENCY SPILLWAY
℄ CURVE DATA

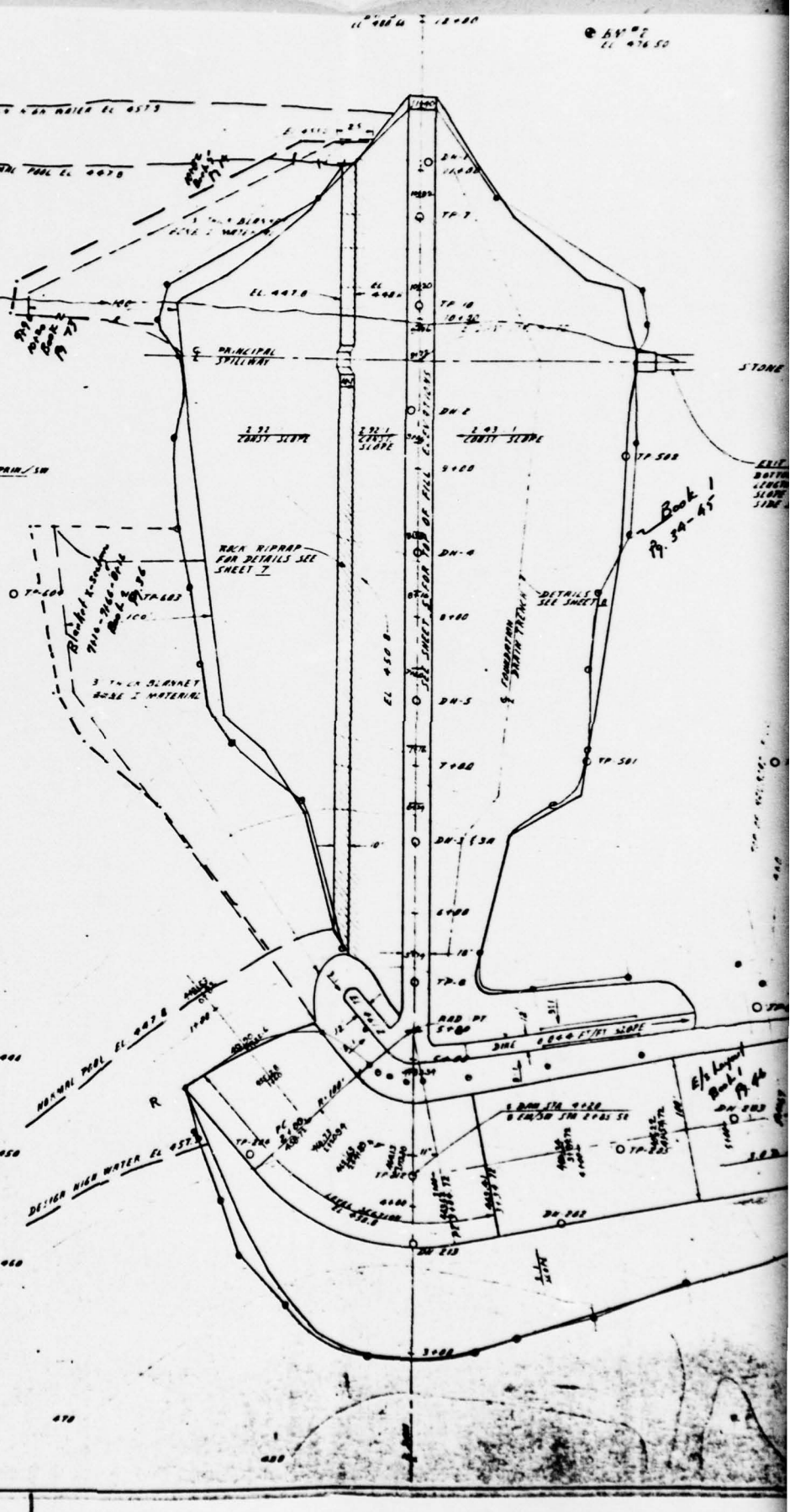
I = 60°-00'
R = 100'
T = 57.74'
Lc = 109.72'
CH = 100'
M = 13.39'
E = 15.98'
PC = 2+00
PT = 3+00.72

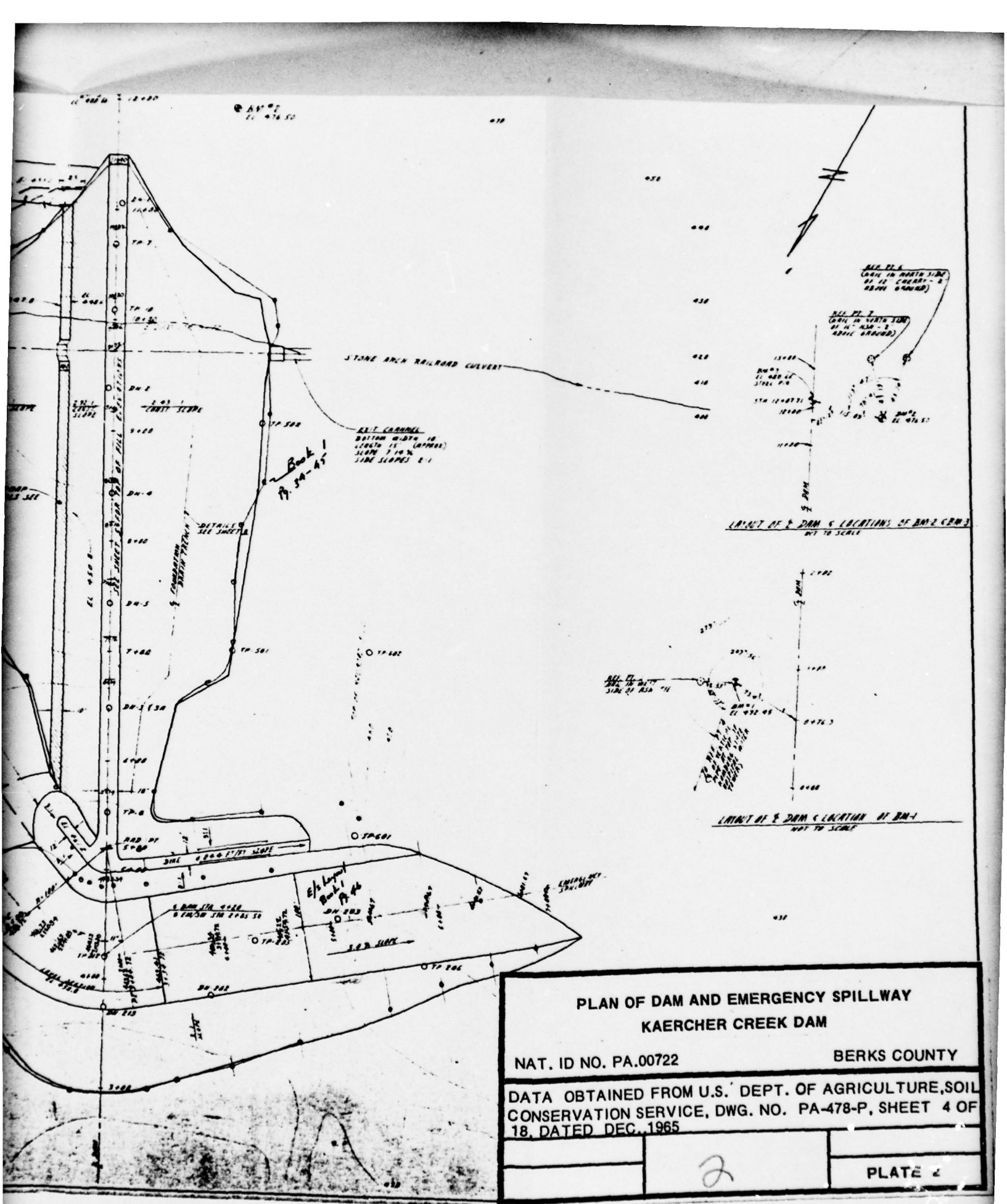
STATION	DEFLECTION	CHORD
PC 2+00	0°00'	—
2+10.97	3°-00'	10.97'
2+20.90	6°-00'	10.97'
2+31.92	9°-00'	10.97'
2+42.83	12°-00'	10.97'
2+53.36	15°-00'	10.97'
2+62.83	18°-00'	10.97'
2+73.36	21°-00'	10.97'
2+83.78	24°-00'	10.97'
2+94.23	27°-00'	10.97'
PT 3+00.72	30°-00'	10.97'

○ TP - SOIL TEST PIT

○ DH - SOIL DRILL HOLE

SEE SHEETS 16 AND 17 FOR SOIL LOGS





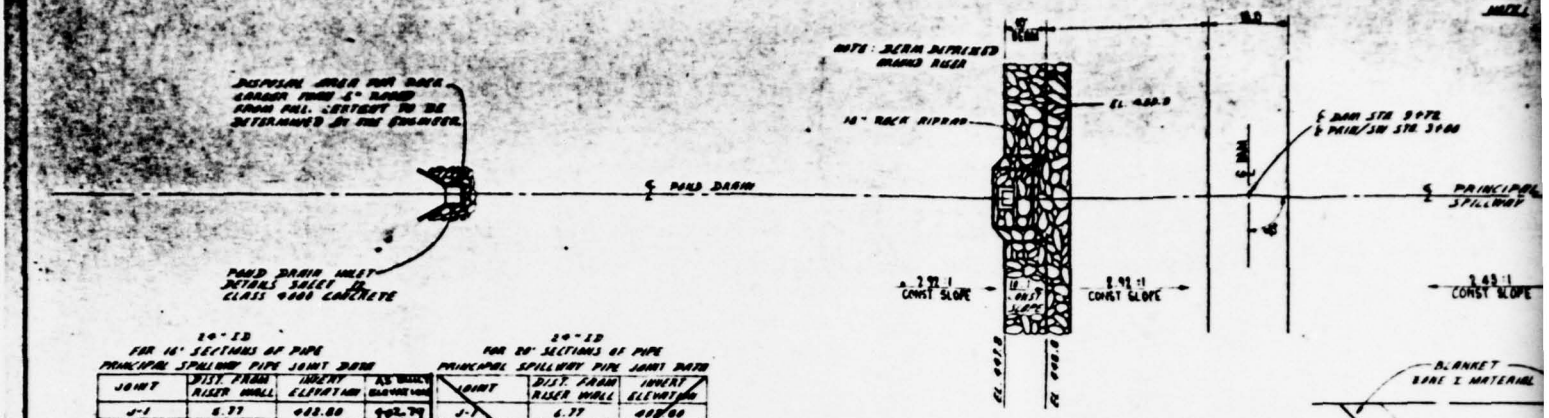
PLAN OF DAM AND EMERGENCY SPILLWAY
KAERCHER CREEK DAM

NAT. ID NO. PA.00722 BERKS COUNTY

DATA OBTAINED FROM U.S. DEPT. OF AGRICULTURE, SOIL CONSERVATION SERVICE, DWG. NO. PA-478-P, SHEET 4 OF 18, DATED DEC. 1965

2

PLATE 2



20" I.D.
FOR 16' SECTIONS OF PIPE
PRINCIPAL SPILLWAY PIPE JOINT DATA

JOINT	DIST. FROM RISER WALL	INVERT ELEVATION	AS BUILT ELEVATION
J-1	6.77	402.80	402.79
J-2	22.77	402.73	402.76
J-3	38.77	402.67	402.67
J-4	54.77	402.60	402.60
J-5	70.77	402.53	402.58
J-6	86.77	402.47	402.49
J-7	102.77	402.40	402.46
J-8	118.77	402.33	402.38
J-9	134.77	402.27	402.34
J-10	150.77	402.20	402.32
J-11	166.77	402.13	402.13
J-12	182.77	402.07	402.07
OUTLET	198.77	402.00	402.00

20" I.D.
FOR 20' SECTIONS OF PIPE
PRINCIPAL SPILLWAY PIPE JOINT DATA

JOINT	DIST. FROM RISER WALL	INVERT ELEVATION
J-1	6.77	402.80
J-2	26.77	402.72
J-3	38.77	402.67
J-4	58.77	402.58
J-5	78.77	402.50
J-6	98.77	402.42
J-7	118.77	402.33
J-8	138.77	402.25
J-9	158.77	402.17
J-10	178.77	402.08
OUTLET	198.77	402.00

Book 2 Pg. 49, 50

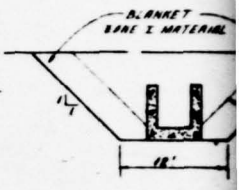
NOTE: DIMENSIONS OF PIPE ARE BASED ON NOMINAL SIZE AND DO NOT INCLUDE CREEP.

PRINCIPAL SPILLWAY ANTI-SEEP COLLAR DATA

COLLAR	DIST. FROM RISER WALL	INVERT ELEVATION	AS BUILT ELEVATION
I	19	402.75	401.92
II	43	402.65	401.82
III	66	402.55	402.00
IV	90	402.45	401.80
V	113	402.36	400.800

Page 81 Book #2

PLAN VIEW
NOT TO SCALE



POND DRAIN
NOT TO SCALE

16" I.D.
FOR 16' SECTIONS OF PIPE
POND DRAIN PIPE JOINT DATA

JOINT	DIST. FROM RISER WALL	INVERT ELEVATION	AS BUILT ELEVATION
WALL PIECE	0	406.8	403.70
P-1	16	406.8	403.70
P-2	24	406.8	403.70
P-3	40	406.8	403.70
P-4	56	406.8	403.70
P-5	72	406.8	403.70
P-6	88	406.8	403.70
P-7	104	406.8	403.70
P-8	120	406.8	403.70

16" I.D.
FOR 20' SECTIONS OF PIPE
POND DRAIN PIPE JOINT DATA

JOINT	DIST. FROM RISER WALL	INVERT ELEVATION
WALL PIECE	0	406.8
P-1	20	406.8
P-2	40	406.8
P-3	60	406.8
P-4	80	406.8
P-5	100	406.8
P-6	120	406.8

Book 2 Pg. 57, 60, 63

POND DRAIN ANTI-SEEP COLLAR DATA

COLLAR	DIST. FROM RISER WALL	INVERT ELEVATION	AS BUILT ELEVATION
A	11	406.8	403.27
B	33	406.8	403.27
C	51	406.8	403.27
D	69	406.8	403.27
E	90	406.8	403.27

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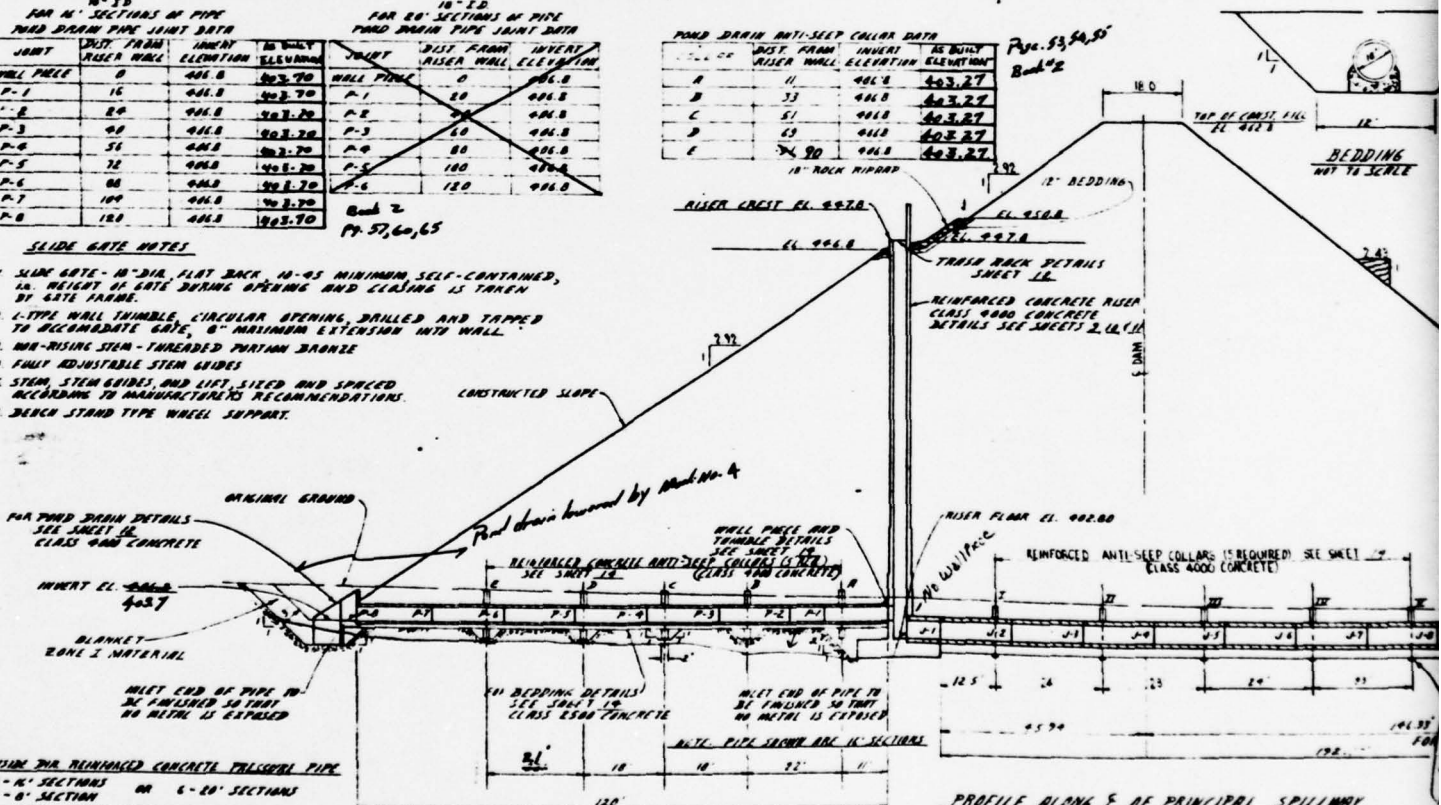
SLIDE GATE NOTES

1. SLIDE GATE - 18"DIA. FLAT BACK 10-GS MINIMUM SELF-CONTAINED, i.e. WEIGHT OF GATE DURING OPENING AND CLOSING IS TAKEN BY GATE FRAME.
2. L-TYPE WALL THIMBLE, CIRCULAR OPENING, DRILLED AND TAPPED TO ACCOMODATE GATE, 8" MAXIMUM EXTENSION INTO WALL.
3. NON-RISING STEM - THREADED PUTMAN BRONZE
4. FULLY ADJUSTABLE STEM GUIDES
5. STEM, STEM GUIDES, AND LIFT SIZED AND SPACED ACCORDING TO MANUFACTURER'S RECOMMENDATIONS.
6. BENCH STAND TYPE WHEEL SUPPORT.



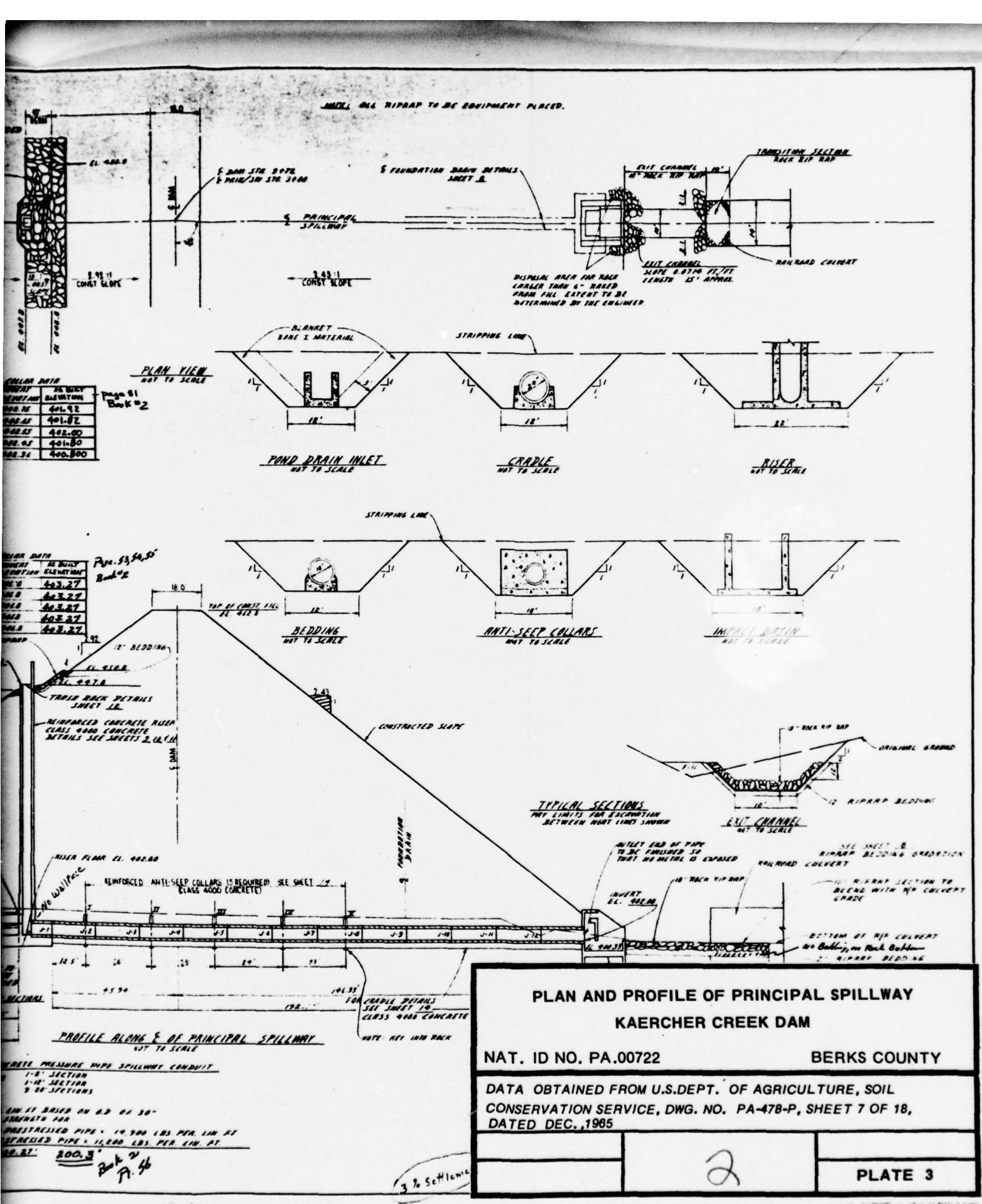
PROFILE ALONG ℄ OF PRINCIPAL SPILLWAY
NOT TO SCALE

16" INSIDE DIA. REINFORCED CONCRETE PRESSURE PIPE
7 - 16' SECTIONS OR 6 - 20' SECTIONS
1 - 8' SECTION
1 - BELL WALL PIECE FOR 10" WALL
PRESSURE HEAD 53'
LOAD = 28,700 LBS PER LIN FT BASED ON O.D. OF 24"
MIN. 3 EDGE BEARING STRENGTH FOR:
0.01" CRACK NON-PRESTRESSED PIPE = 10,000 LBS PER LIN FT
0.001" CRACK PRESTRESSED PIPE = 7,000 LBS PER LIN FT
TOTAL LENGTH 121.6' 121'

Book 2 Pg. 61

20" INSIDE DIA. REINFORCED CONCRETE PRESSURE PIPE SPILLWAY CONDUIT
12 - 16' SECTIONS OR 1 - 8' SECTION
1 - 12' SECTION
9 - 20' SECTIONS
PRESSURE HEAD 60'
LOAD 43,000 LBS PER LIN FT BASED ON O.D. OF 30"
MIN 3 EDGE BEARING STRENGTH FOR
0.01" CRACK NON-PRESTRESSED PIPE = 14,900 LBS PER LIN FT
0.001" CRACK PRESTRESSED PIPE = 11,200 LBS PER LIN FT
TOTAL LENGTH 200.27' 200.3'

Book 2 Pg. 46



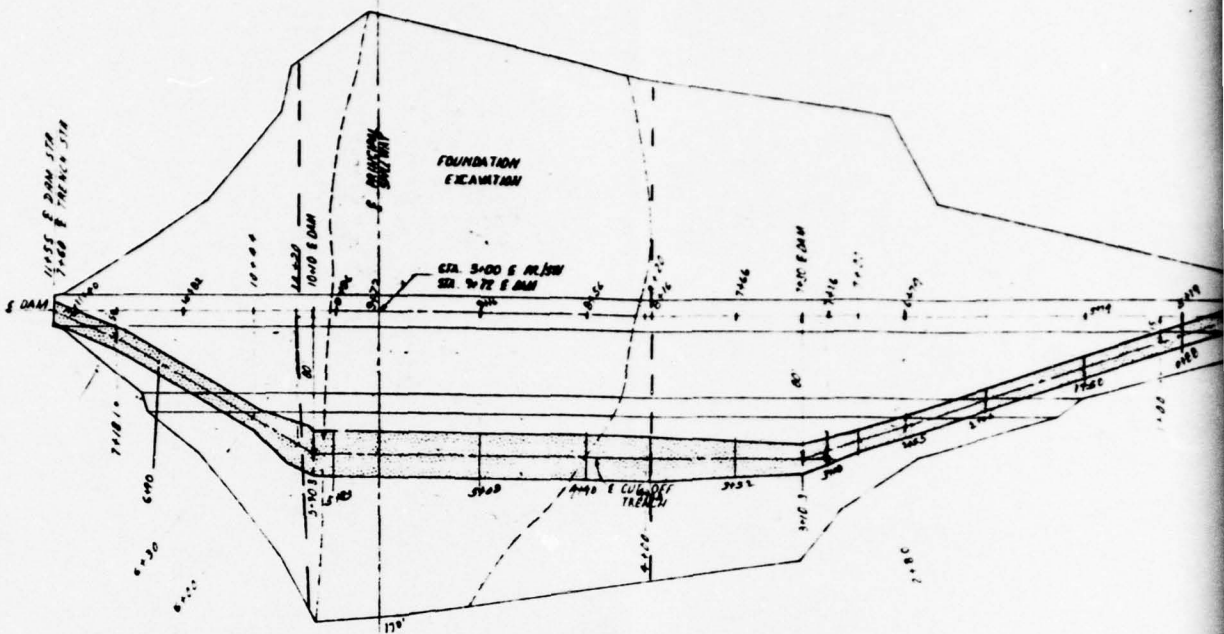
PLAN AND PROFILE OF PRINCIPAL SPILLWAY
KAERCHER CREEK DAM

NAT. ID NO. PA.00722 — BERKS COUNTY

DATA OBTAINED FROM U.S.DEPT. OF AGRICULTURE, SOIL CONSERVATION SERVICE, DWG. NO. PA-478-P, SHEET 7 OF 18, DATED DEC., 1965

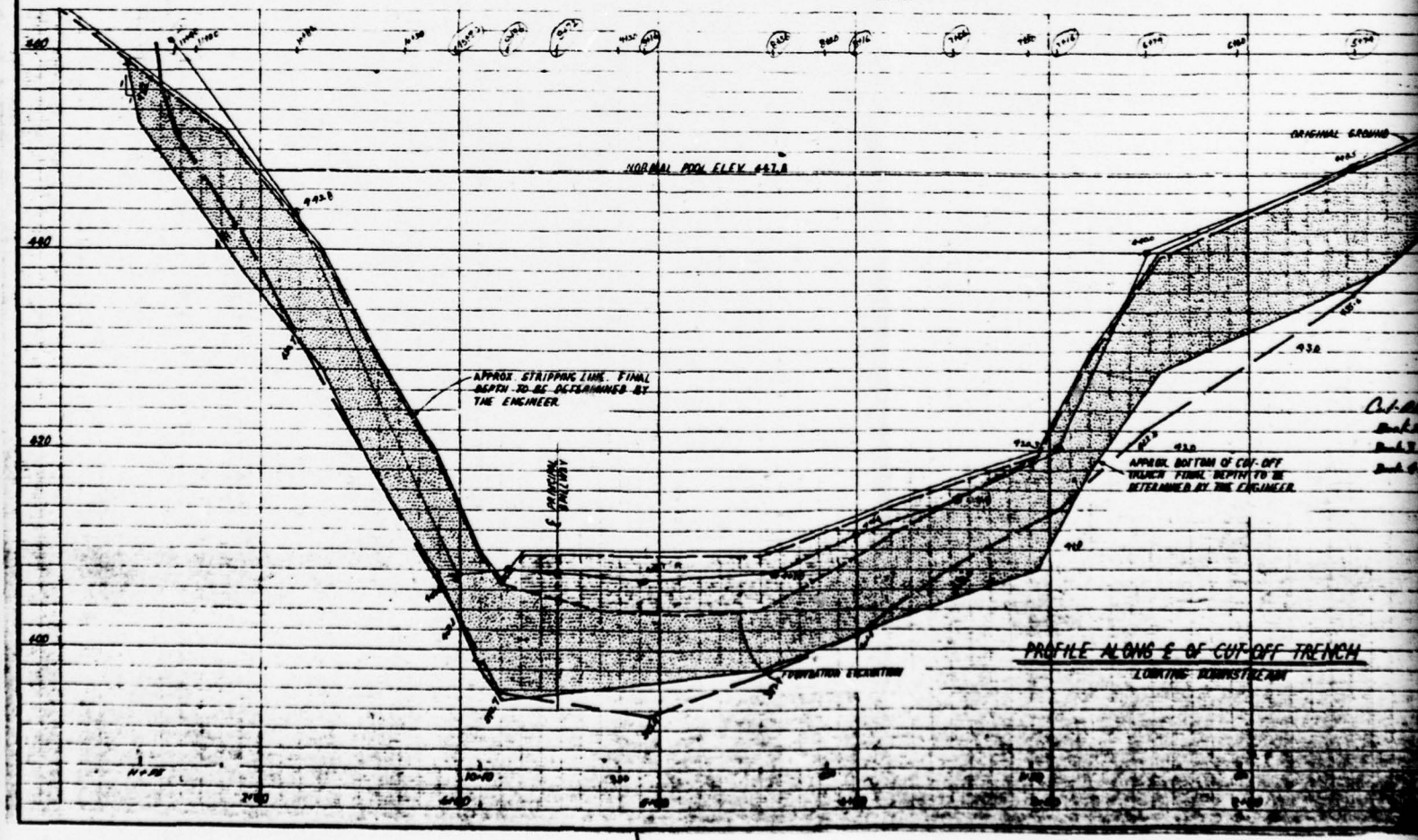
2

PLATE 3



PLAN VIEW OF CUT OFF TRENCH AND FOUNDATION EXCAVATION

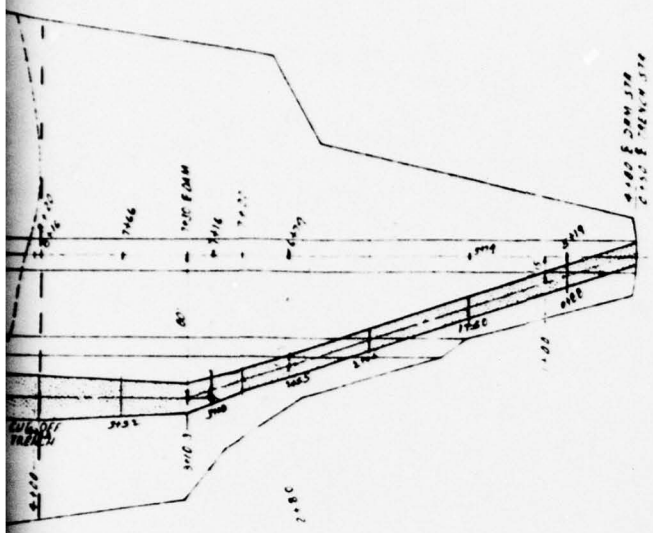
0 10 20 50 100 FEET
SCALE

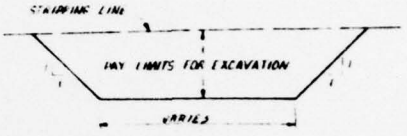


PROFILE ALONG ℄ OF CUT-OFF TRENCH
LOOKING DOWNSTREAM

CUT-OFF TRENCH BOTTOM WIDTH

℄ TRENCH STATION			℄ DAM STATION			WIDTH
0+50	TO	2+80	4+80	TO	7+00	12
2+80	TO	4+50	7+00	TO	8+20	TRANSITION
4+50	TO	6+25	8+20	TO	11+20	25
6+25	TO	6+55	11+20	TO	11+44	TRANSITION
6+55	TO	7+60	11+44	TO	12+55	12

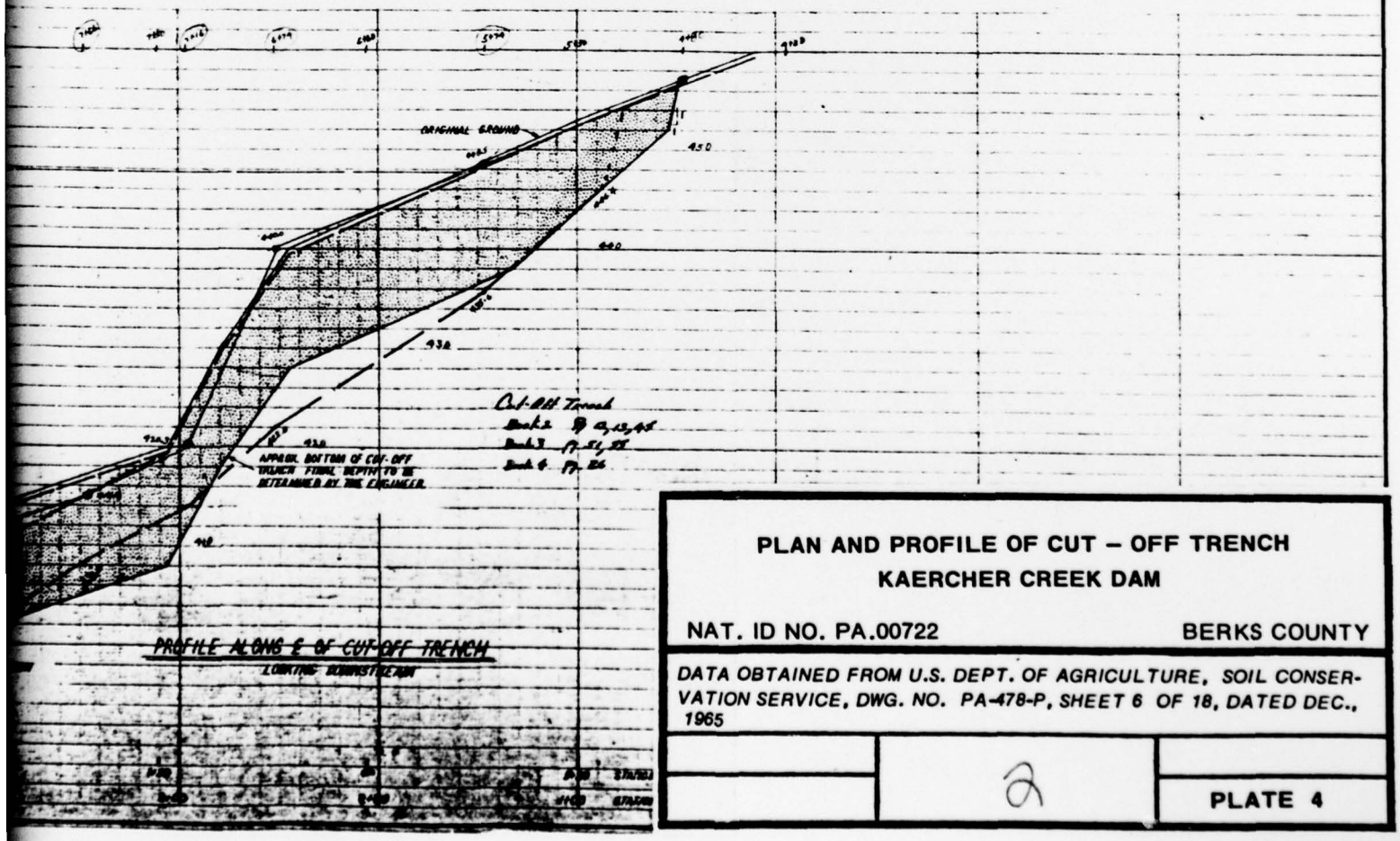




TYPICAL SECTION OF CUT OFF TRENCH
NOT TO SCALE

OF CUT OFF TRENCH
ATION EXCAVATION

50 100 FEET
SCALE



PROFILE ALONG ℄ OF CUT-OFF TRENCH
LOOKING DOWNSTREAM

PLAN AND PROFILE OF CUT – OFF TRENCH
KAERCHER CREEK DAM

NAT. ID NO. PA.00722 BERKS COUNTY

DATA OBTAINED FROM U.S. DEPT. OF AGRICULTURE, SOIL CONSERVATION SERVICE, DWG. NO. PA-478-P, SHEET 6 OF 18, DATED DEC., 1965

2

PLATE 4

12" DIA FILTER DRAIN PIPE (PERFORATED)

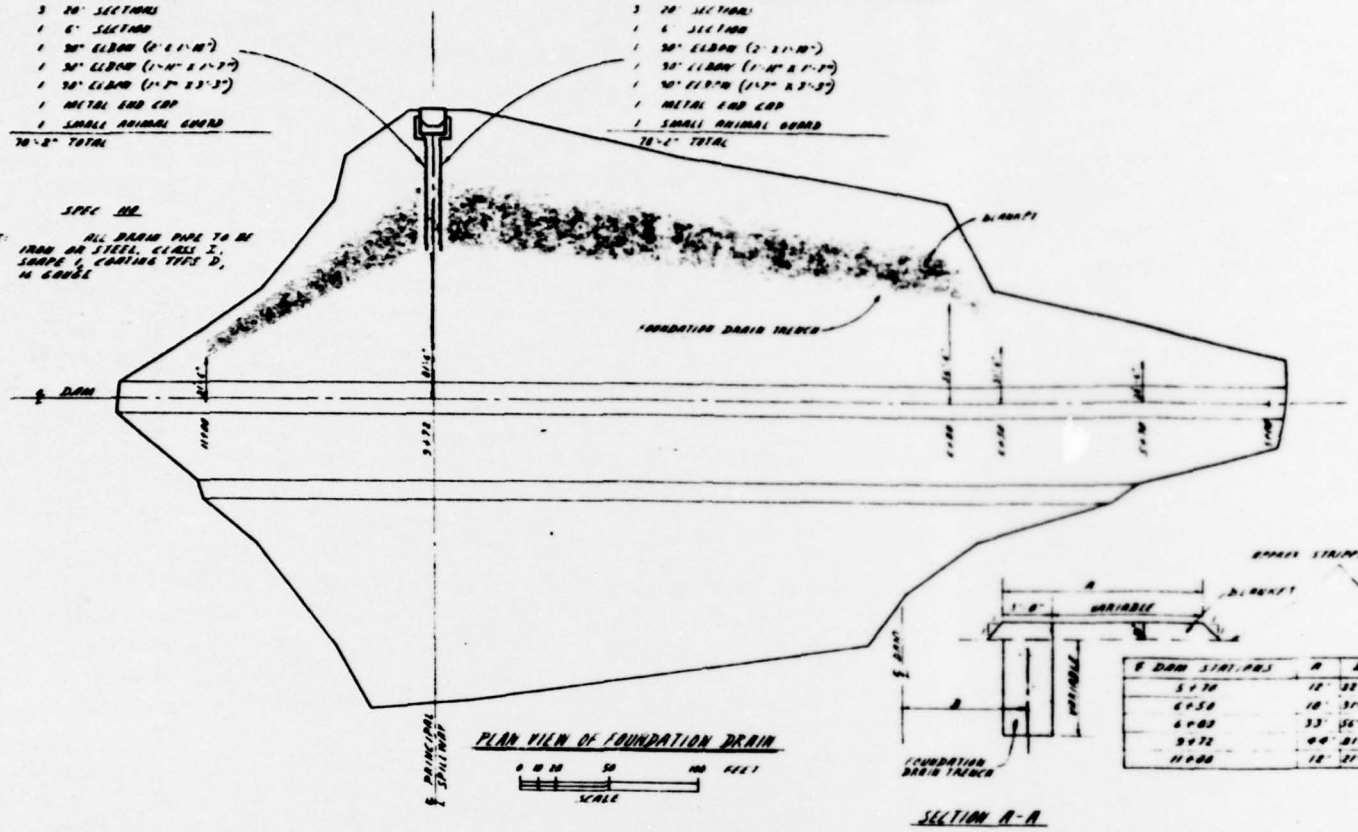
3 20' SECTIONS
1 6' SECTION
1 30° ELBOW (2'-6" x 2'-6")
1 30° ELBOW (1'-6" x 1'-7")
1 90° ELBOW (1'-7" x 2'-3")
1 METAL END CAP
1 SMALL ANIMAL GUARD
70'-2" TOTAL

12" DIA FILTER DRAIN PIPE (PERFORATED)

3 20' SECTIONS
1 6' SECTION
1 30° ELBOW (2'-6" x 2'-6")
1 30° ELBOW (1'-6" x 1'-7")
1 90° ELBOW (1'-7" x 2'-3")
1 METAL END CAP
1 SMALL ANIMAL GUARD
70'-2" TOTAL

SPEC REF

NOTE: ALL DRAIN PIPE TO BE IRON OR STEEL, CLASS I, SHAPE 1, COATING TYPE 'D', 16 GAUGE

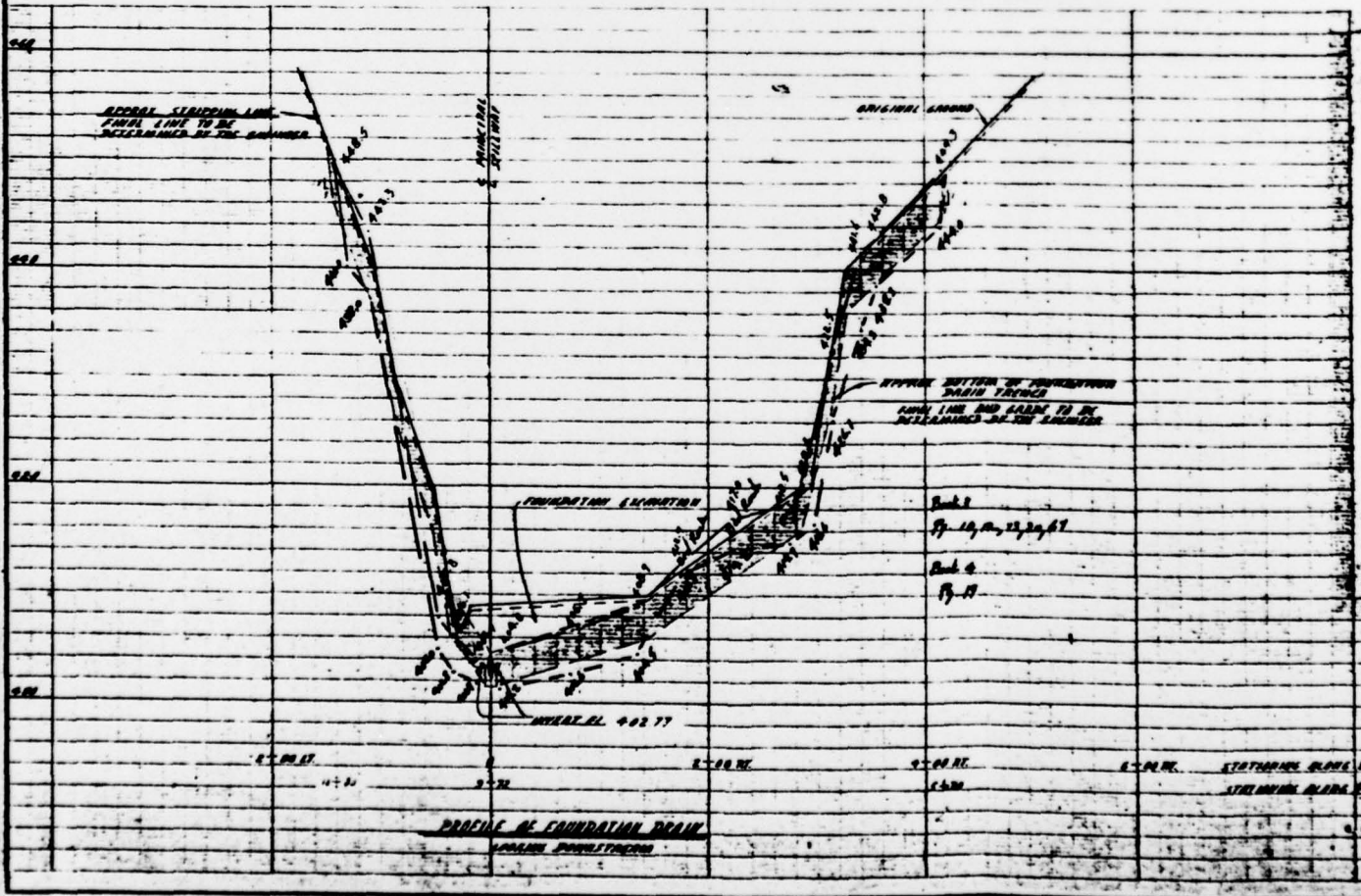


PLAN VIEW OF FOUNDATION DRAIN

SCALE 0 10 20 50 100 FEET

℄ DAM STATIONS	A	B
5+70	12'	33'-6"
6+50	10'	31'-6"
6+82	33'	54'-6"
9+72	44'	81'-6"
11+88	12'	27'-6"

SECTION A-A



PROFILE OF FOUNDATION DRAIN

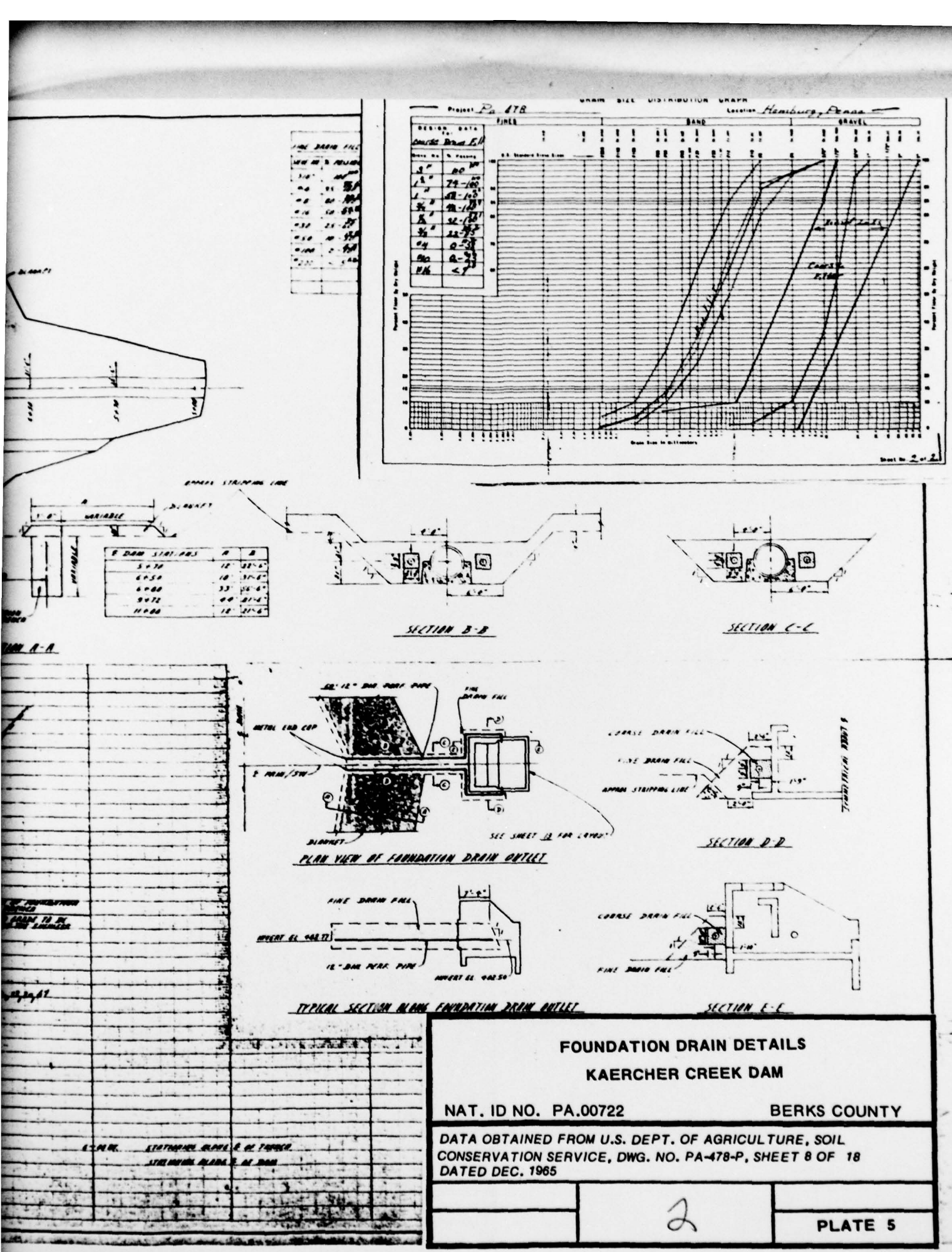
METAL END CAP

℄ PRIN. SPW.

PLAN VIEW

INVERT EL 402.77

TYPICAL



FOUNDATION DRAIN DETAILS

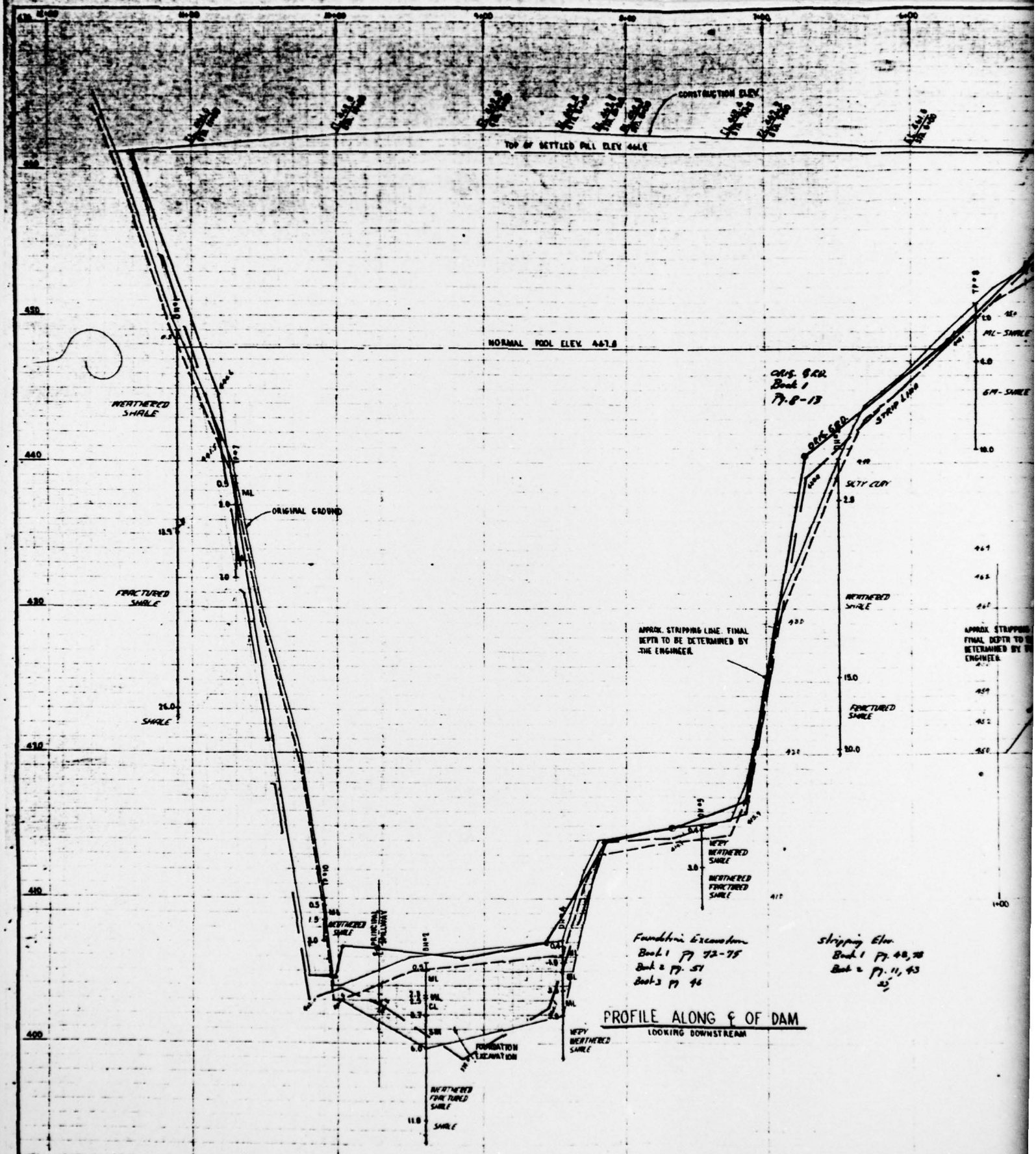
KAERCHER CREEK DAM

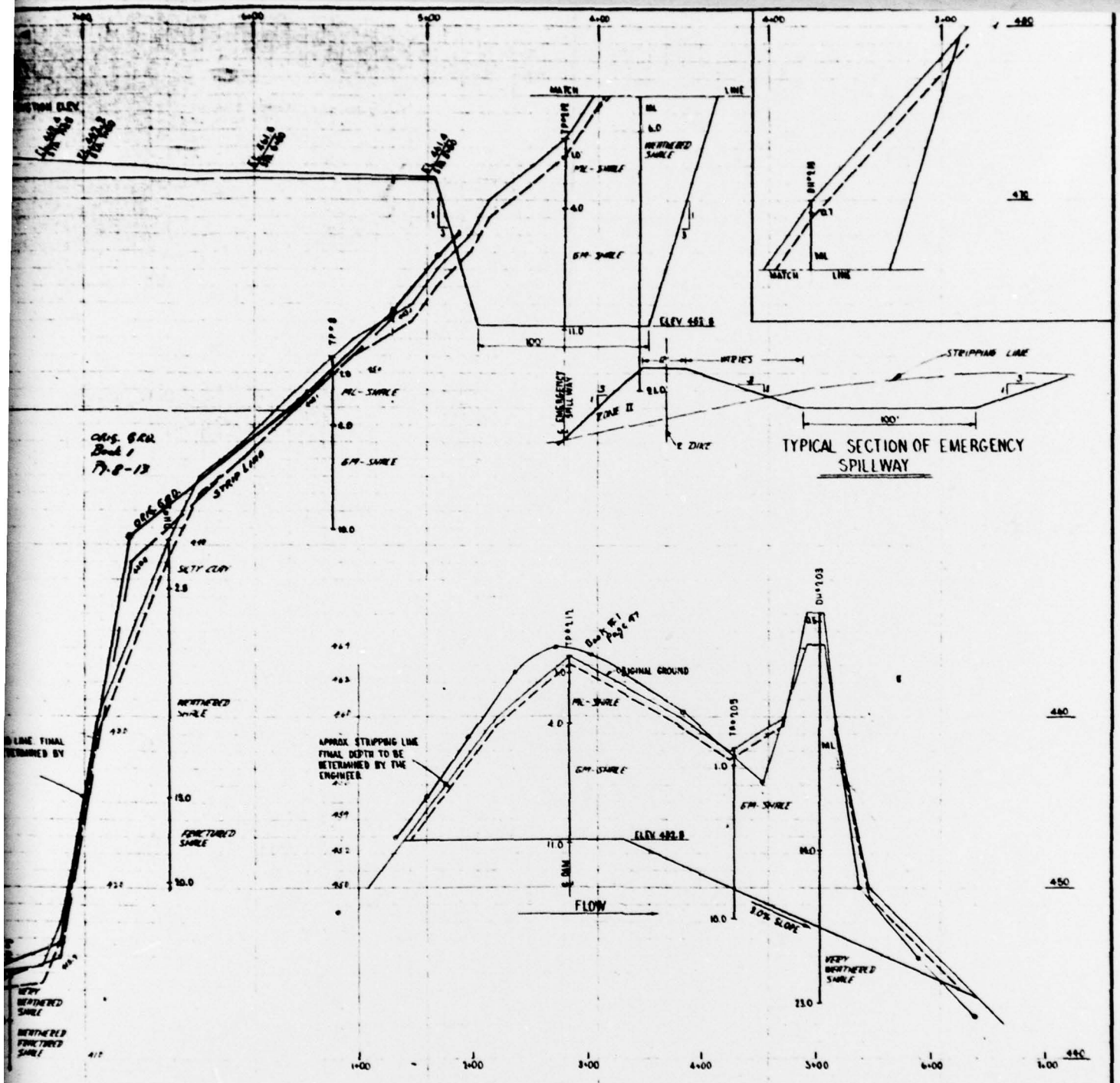
NAT. ID NO. PA.00722 **BERKS COUNTY**

DATA OBTAINED FROM U.S. DEPT. OF AGRICULTURE, SOIL CONSERVATION SERVICE, DWG. NO. PA-478-P, SHEET 8 OF 18 DATED DEC. 1965

2

PLATE 5


CONSTRUCTION ELEV.
TOP OF SETTLED FILL ELEV. 466.8
NORMAL POOL ELEV. 467.8
WEATHERED SHALE
ORIGINAL GROUND
FRACTURED SHALE
SHALE
SILTY CLAY
VERY WEATHERED SHALE
WEATHERED FRACTURED SHALE
APPROX. STRIPPING LINE. FINAL DEPTH TO BE DETERMINED BY THE ENGINEER.
FOUNDATION EXCAVATION
Foundation Excavation
Book 1 Pg 72-75
Book 2 Pg. 51
Book 3 Pg 46
Stripping Elev.
Book 1 Pg. 48, 78
Book 2 Pg. 11, 43
PROFILE ALONG ℄ OF DAM
LOOKING DOWNSTREAM



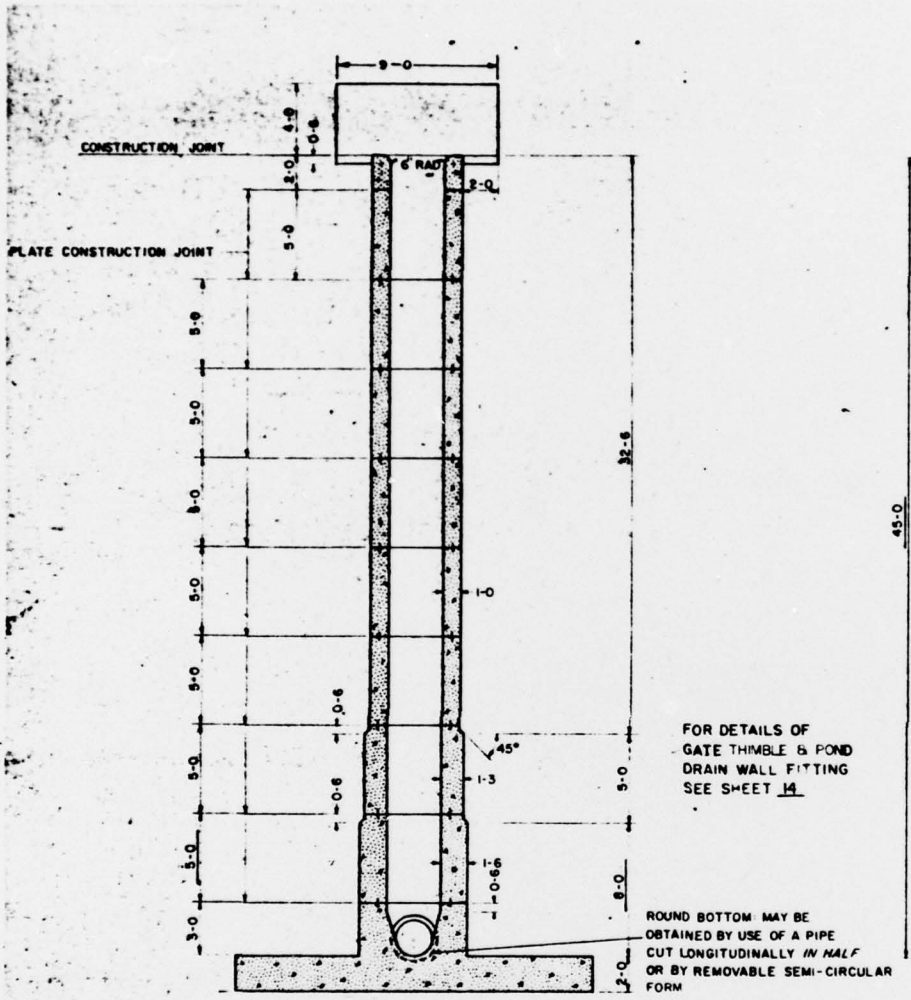
PROFILE OF DAM AND EMERGENCY SPILLWAY
KAERCHER CREEK DAM

NAT. ID NO. PA.00722 — BERKS COUNTY

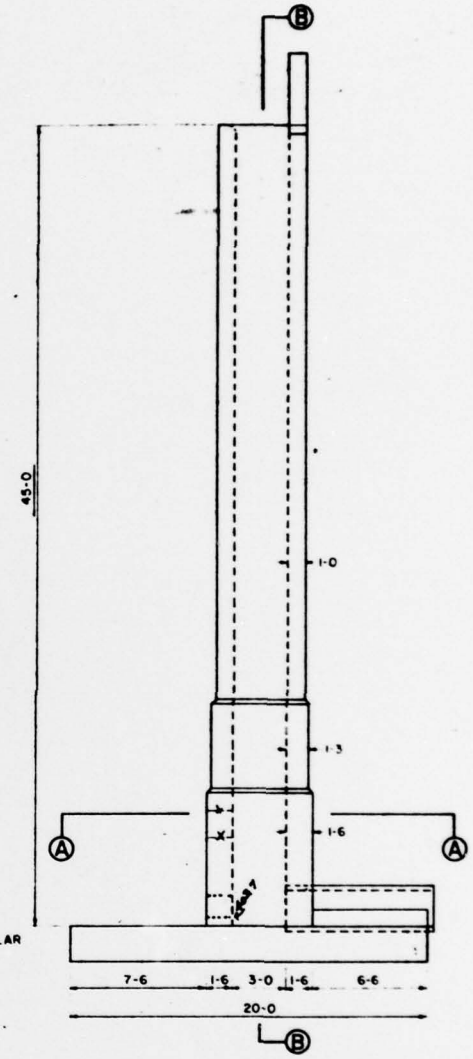
DATA OBTAINED FROM U.S. DEPT. OF AGRICULTURE, SOIL CONSERVATION SERVICE, DWG. NO. PA-478-P, SHEET 5 OF 18 DATED DEC.,1965

2

PLATE 6



SECTION B-B



SIDE WALL ELEVATION

RISER DETAILS

KAERCHER CREEK DAM

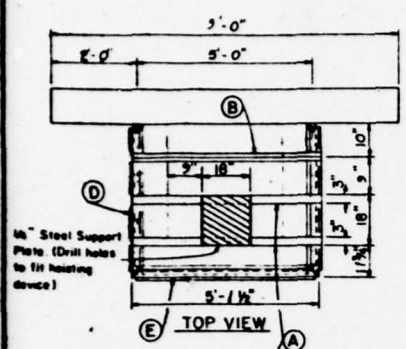
NAT. ID NO. PA.00722 BERKS COUNTY

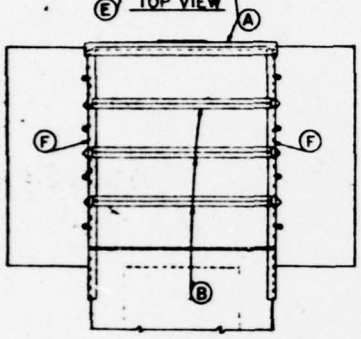
DATA OBTAINED FROM U.S. DEPT. OF AGRICULTURE, SOIL CONSERVATION SERVICE, DWG. NO. PA-478-P, SHEET 9 OF 18 DATED DEC.,1965

PLATE 7

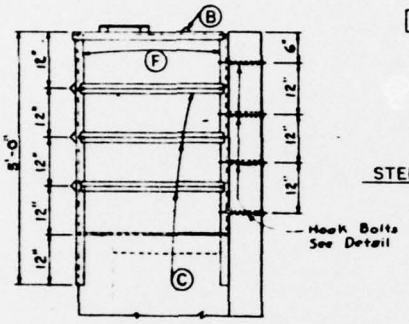
BILL OF MATERIAL

LOCATION	ITEM	SIZE	LENGTH	QUAN
RISER	CHANNEL IRON Ⓐ	3" x 1⅛" x ¼"	5'-1⅛"	2
TRASH RACK	ANGLE IRON Ⓑ	2½" x 2½" x ⅜"	5'-1⅛"	4
	ANGLE IRON Ⓒ	"	3'-10"	6
	ANGLE IRON Ⓓ	"	4'-0"	2
	ANGLE IRON Ⓔ	"	5'-1½"	1
	ANGLE IRON Ⓕ	"	5'-0"	4 *
	STEEL BEARING PLATE	⅜" x 2½"	5'-0"	1
	STEEL BEARING PLATE	⅜" x 2½"	3'-1⅛"	2
	STEEL PLATE	¼" THICK	18" X 18"	1
	S S HOOK BOLTS	⅝" DIA	1'-5"	8
	GALV STEEL PIPE SLEEVES	3½" DIA	1'-0"	8



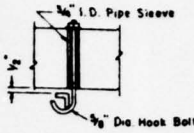


UPSTREAM ELEVATION

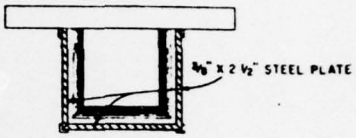


SIDE VIEW

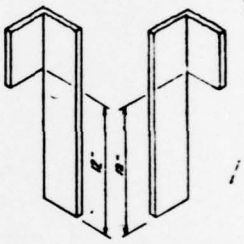
RISER TRASH RACK DETAILS



HOOK BOLT DETAIL

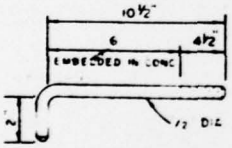


STEEL BEARING PLATE DETAIL



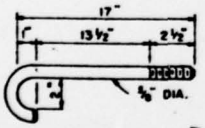
* 2 ANGLE IRONS TO BE CUT AS SHOWN

ANGLE IRON Ⓕ



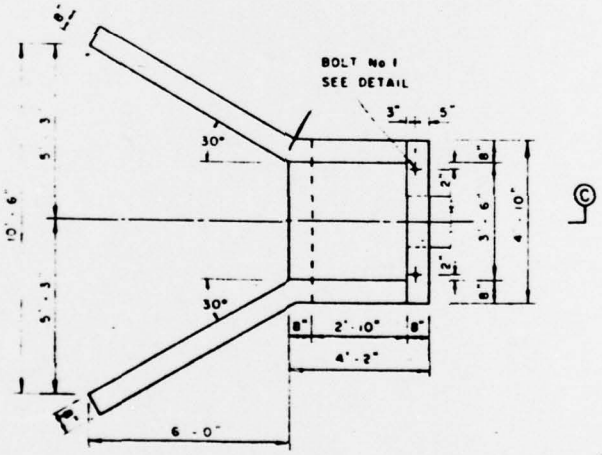
BOLT DETAIL No 1

STAINLESS STEEL, SUPPLY W/ NUT & WASHER

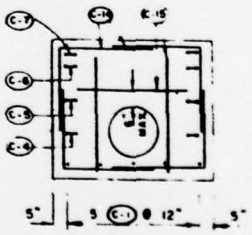


HOOK BOLT DETAIL

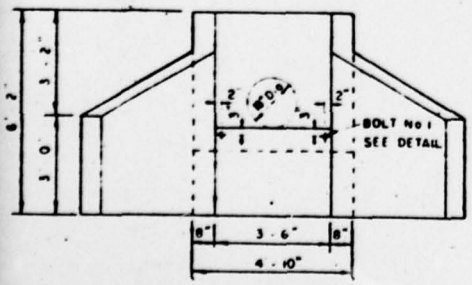
STAINLESS STEEL, SUPPLY W/ NUT & WASHER



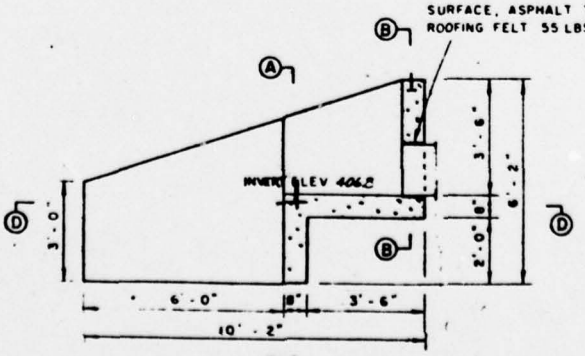
PLAN



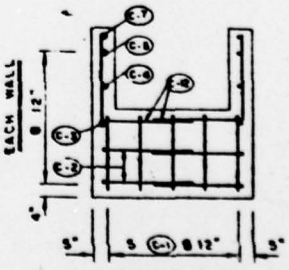
SECTION B-B



UPSTREAM ELEVATION

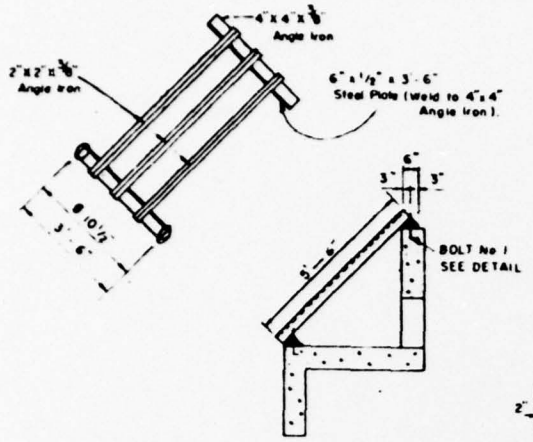


SECTION ALONG CENTERLINE



SECTION A-A

POND DRAIN INLET DETAILS

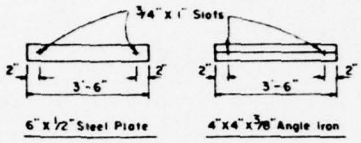


BILL OF MATERIAL

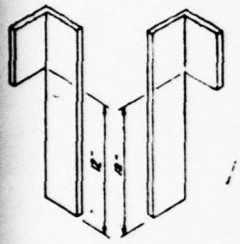
LOCATION	ITEM	SIZE	LENGTH	QUAN
POND DRAIN INLET TRASH RACK	STEEL PLATE	1/2" THICK	6" x 3'-6"	2
	ANGLE IRON	2"x2"x3/16"	5'-6"	3
	ANGLE IRON	4"x4"x3/8"	3'-6"	2
	BOLT No 1	1/2" Dia	2" x 10 1/2"	4

NOTES

1. TRASH RACK TO BE GALVANIZED (AFTER ASSEMBLY)
2. WELD ALL POINTS OF CONTACT BETWEEN ANGLE IRON.
3. FOR GENERAL NOTES SEE SHEET 19



POND DRAIN INLET TRASH RACK DETAIL

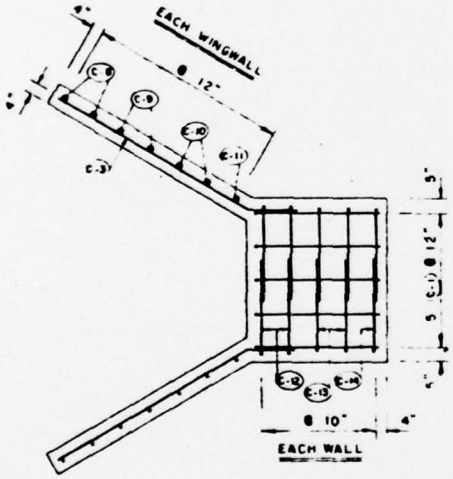


ANGLE IRON (F)

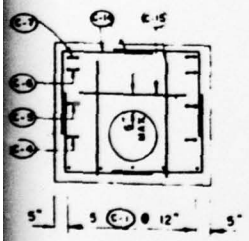
As Built

STEEL SCHEDULE

MARK	LOCATION	QUAN	SIZE	LENGTH	TYPE	A	B	HOOK	TOTAL FT
C-1	POND	5	4	5-9	2	2-2	3-7		28.75
C-2	DRAIN	4	4	9-5	3	6-8	2-9		37.67
C-3	INLET	2	4	8-0	4	6-8	1-4		16.00
C-4		2	4	9-0	5	4-10	3-10	0-4	18.00
C-5		2	4	5-6	5	1-4	3-10	0-4	11.00
C-6		2	4	2-4	6	2-0		0-4	4.67
C-7		2	4	11-3	5	6-11	4-0	0-4	22.50
C-8		4	4	2-8	1				10.00
C-9		4	4	3-2	1				12.67
C-10		4	4	3-9	1				15.00
C-11		2	4	4-3	1				8.50
C-12		4	4	5-6	2	2-9	2-9		22.00
C-13		4	4	5-11	2	2-9	3-2		23.67
C-14		4	4	5-4	2	2-9	2-7		21.33
C-15		3	4	3-6	1				10.50

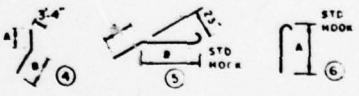


SECTION D-D



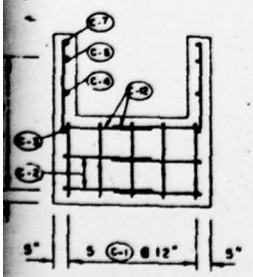
SECTION B-B

BAR TYPES

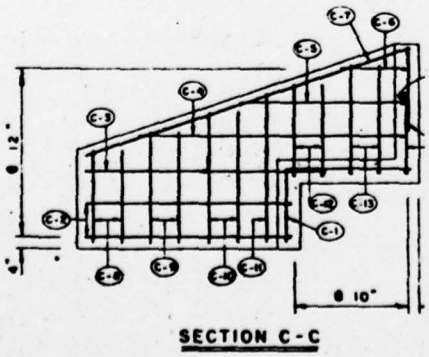


STEEL QUAN POND DRAIN INLET

No 4 BARS 262.25 LIN FT 175.2 LBS.



SECTION A-A



SECTION C-C

ETAILS

POND DRAIN INLET AND TRASH RACK DETAILS
KAERCHER CREEK DAM

NAT. ID NO. PA.00722 BERKS COUNTY

DATA OBTAINED FROM U.S. DEPT. OF AGRICULTURE, SOIL CONSERVATION SERVICE, DWG. NO. PA-478-P, SHEET 12 OF 18, DATED DEC., 1965

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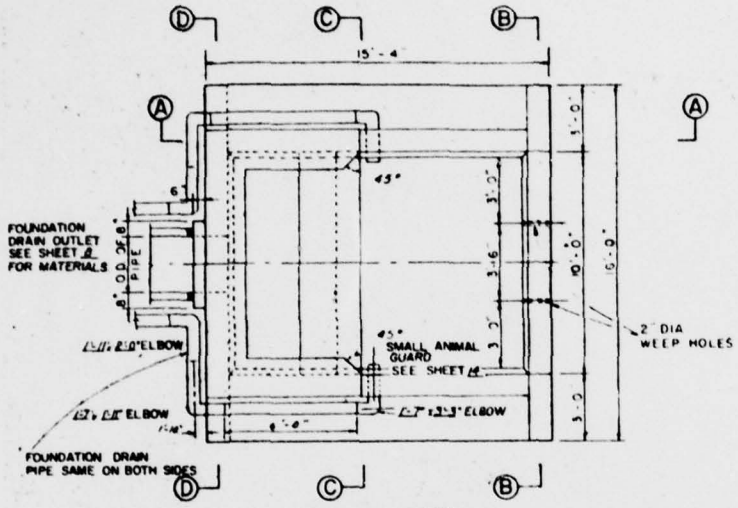
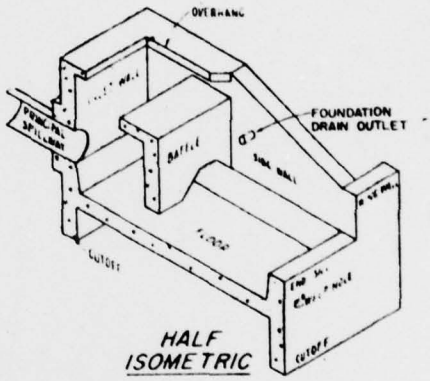
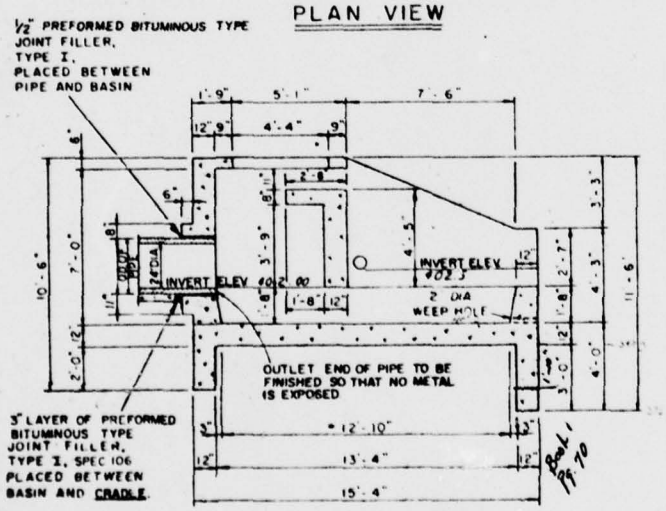
PLATE 8



PLAN VIEW



HALF ISOMETRIC



SECTION ON ℄

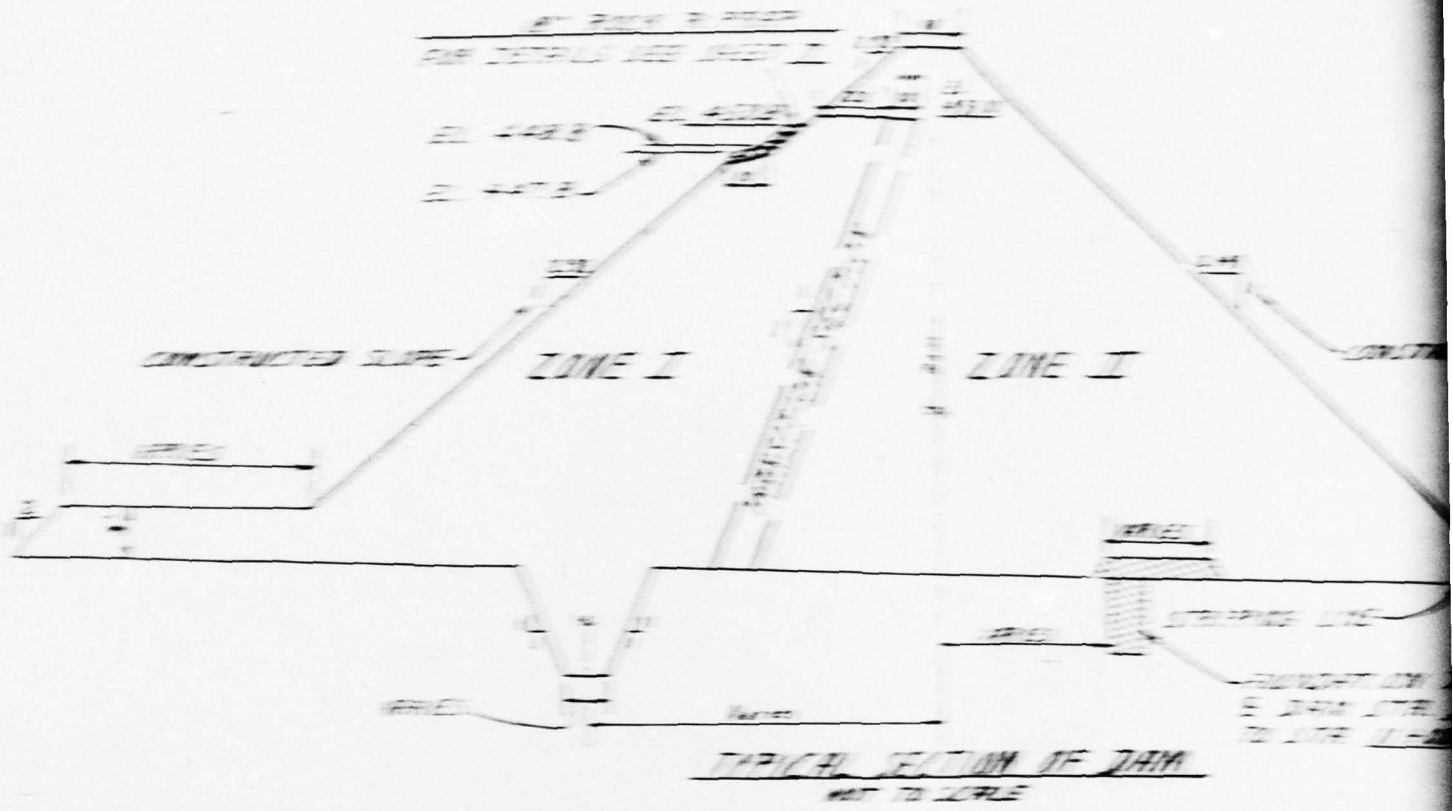
IMPACT BASIN DETAILS

KAERCHER CREEK DAM

NAT. ID NO. PA.00722 BERKS COUNTY

DATA OBTAINED FROM U.S. DEPT. OF AGRICULTURE, SOIL CONSERVATION SERVICE, DWG. NO. PA-478-P, SHEET 13 OF 18, DATED DEC., 1965

PLATE 9



TYPICAL SECTION OF DAM
NOT TO SCALE

EARTH FILL

ZONE I MATERIAL IS REPRESENTED BY TP-20, DEPTH 2'-3.5', CLASSIFIED AS ML AND TP-16 DEPTH 1'-6", CLASSIFIED AS SC

ZONE II SHALL BE REPRESENTED BY TP-19 DEPTH 10" TO 11.5' SHALL BE SELECTIVELY PLACED IN A 10' WIDE TRANSITION SECTION AT THE INTERFACE OF ZONE I AND ZONE II AS DIRECTED BY THE ENGINEER.

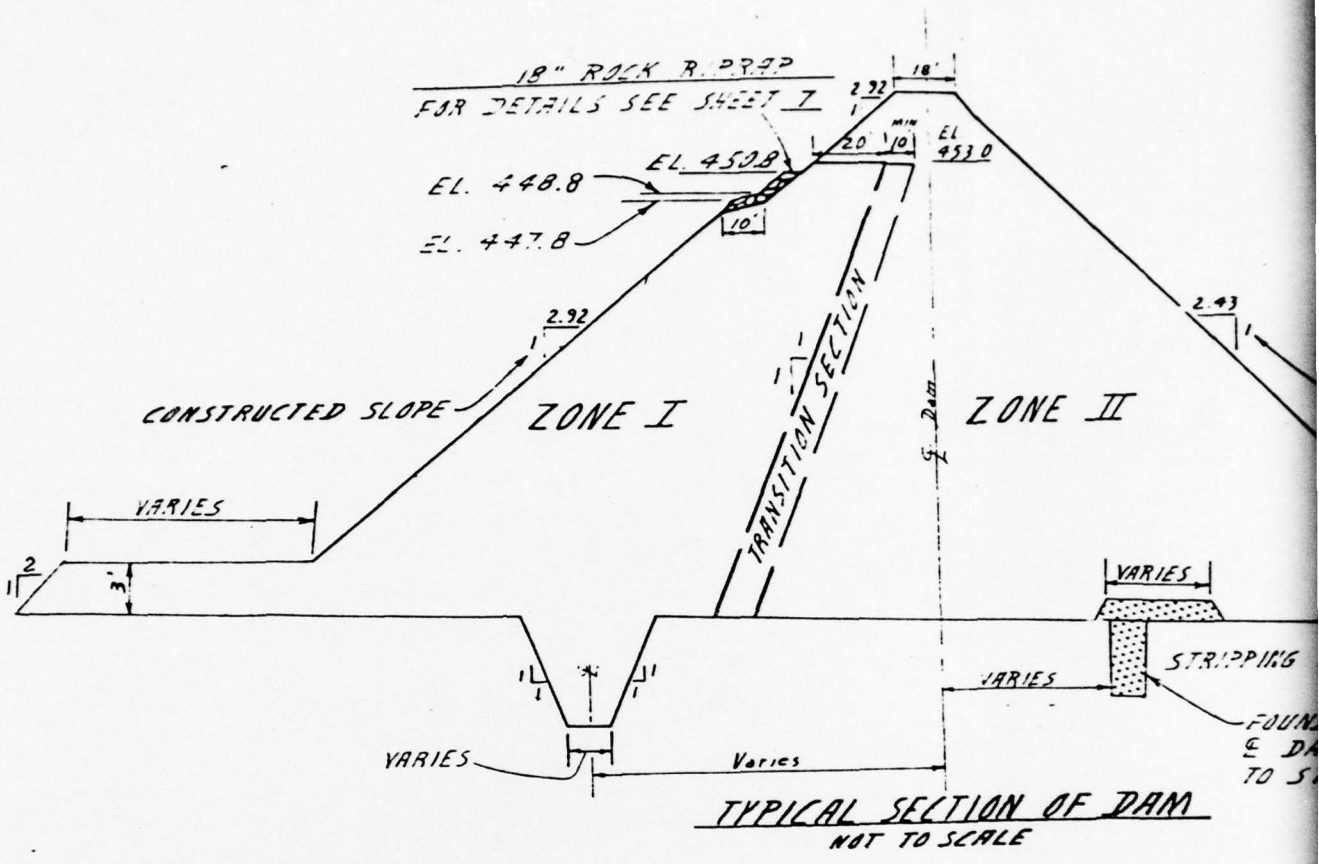
COMPACTION SHALL BE CLASS "B" THE FILL MATRIX SHALL BE COMPACTED TO AT LEAST 95% OF THE MAXIMUM DENSITY OBTAINED IN COMPACTION TESTS OF THE FILL MATERIALS, PERFORMED BY METHOD B, ASTM D-698.

WATER CONTENT OF FILL MATRIX AT TIME OF COMPACTION SHALL BE 0.5% OF OPTIMUM

ZONE I MATERIAL IS TE
DEPTH 1.5'-6', CLA
TP-21 DEPTH 5'
SM-SC, AND TP-
CLASSIFIED AS SC

COMPACTION SHALL

MAXIMUM LAYER THIC
MAXIMUM SIZE OF



EARTH FILL

ZONE I MATERIAL AS REPRESENTED BY TP-301, DEPTH 2'-3.5', CLASSIFIED AS ML, AND TP-105 DEPTH 1'-4'; CLASSIFIED AS GC.

SHALE AS REPRESENTED BY TP-602 FROM 10' TO 11.5' SHALL BE SELECTIVELY PLACED IN A 10' WIDE TRANSITION SECTION AT THE INTERFACE OF ZONE I, AND ZONE II AS DIRECTED BY THE ENGINEER.

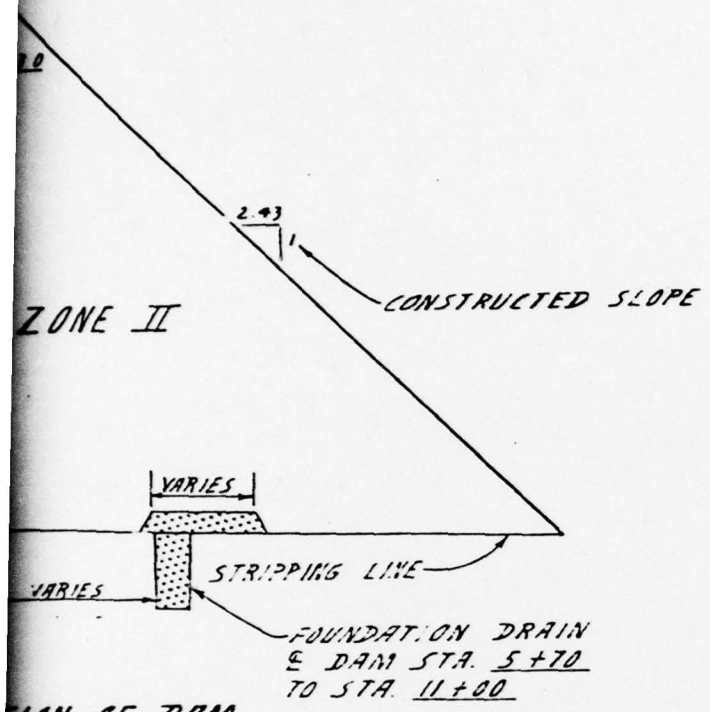
COMPACTION SHALL BE CLASS "A", THE FILL MATRIX SHALL BE COMPACTED TO AT LEAST 95 % OF THE MAXIMUM DENSITY OBTAINED IN COMPACTION TESTS OF THE FILL MATERIALS, PERFORMED BY METHOD A, ASTM D-698.

WATER CONTENT OF FILL MATRIX AT TIME OF COMPACTION SHALL BE ±3.5 % OF OPTIMUM.

ZONE II MATERIA
DEPTH 1.
TP-212,
GW-GC,
CLASSIFIE

COMPACT

MAXIMUM LA
MAXIMUM SIZ



ION OF DAM
CALE

ZONE II MATERIAL AS REPRESENTED BY TP-104, DEPTH 1.5'-6', CLASSIFIED AS GW-GM, TP-212, DEPTH 5'-11'; CLASSIFIED AS GW-GC, AND TP-602, DEPTH 10'-11.5'; CLASSIFIED AS GC-GM.

COMPACTION SHALL BE CLASS T.

MAXIMUM LAYER THICKNESS IS 9" (BEFORE COMPACTION)
MAXIMUM SIZE OF ROCK FRAGMENTS IS 6"

TYPICAL EMBANKMENT SECTION
KAERCHER CREEK DAM

NAT. ID NO. PA.00722 BERKS COUNTY

DATA OBTAINED FROM U.S. DEPT. OF AGRICULTURE, SOIL CONSERVATION SERVICE, DRAWING NO. PA-478-P, SHEET 2 OF 18, DATED SEPT., 1965

2

PLATE 10

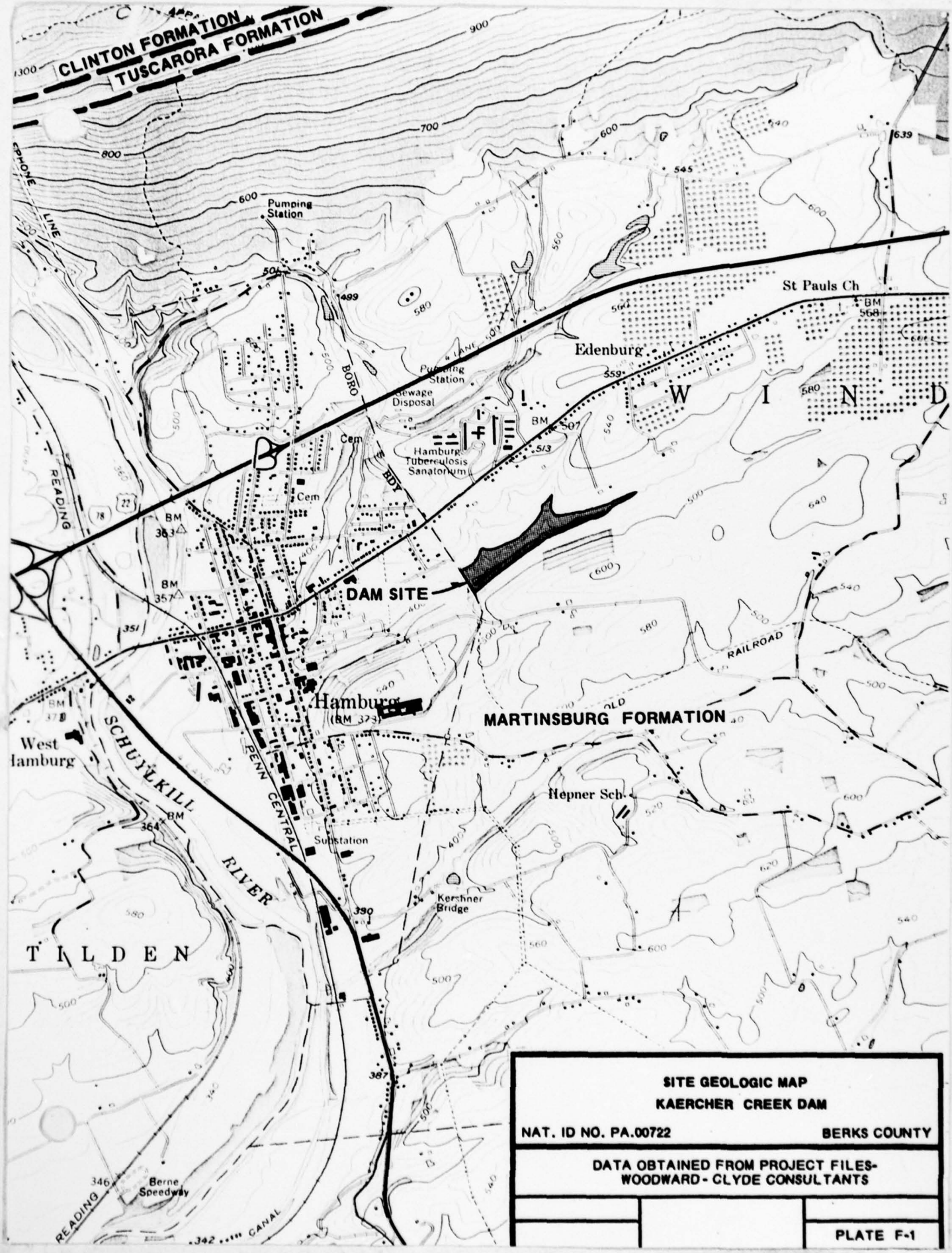
APPENDIX

F

SITE GEOLOGY
KAERCHER CREEK DAM

The Kaercher Creek Dam is located in the Great Valley Section of the Valley and Ridge Physiographic Province. The bedrock at the site consists of the shales and sandstones of the Martinsburg Formation of Upper Ordovician age (see Plate F-1). At the site area, the Martinsburg Formation is bounded to the north-northwest by the sandstones and conglomerates of the Clinton and Tuscarora Formations. Bedding in the Martinsburg Formation is strongly deformed, forming a series of tight, asymmetrical folds Trending approximately N70°E through the site area. Two prominent sets of joints have been observed in the Martinsburg Formation. The dominent set strikes N70°E and dips 60° to 70° SE, and is generally parallel to bedding. The weaker set strikes N10°W and dips nearly vertical, generally normal to bedding. Joint spacing tends to be variable, ranging from a few inches to several feet. No significant faulting has been observed in the area.

Downstream seepage should not be a major problem unless the major N70°E joint set is well developed, and is a zone of groundwater transport.



SITE GEOLOGIC MAP

KAERCHER CREEK DAM

NAT. ID NO. PA.00722 **BERKS COUNTY**

DATA OBTAINED FROM PROJECT FILES-
WOODWARD - CLYDE CONSULTANTS

PLATE F-1