

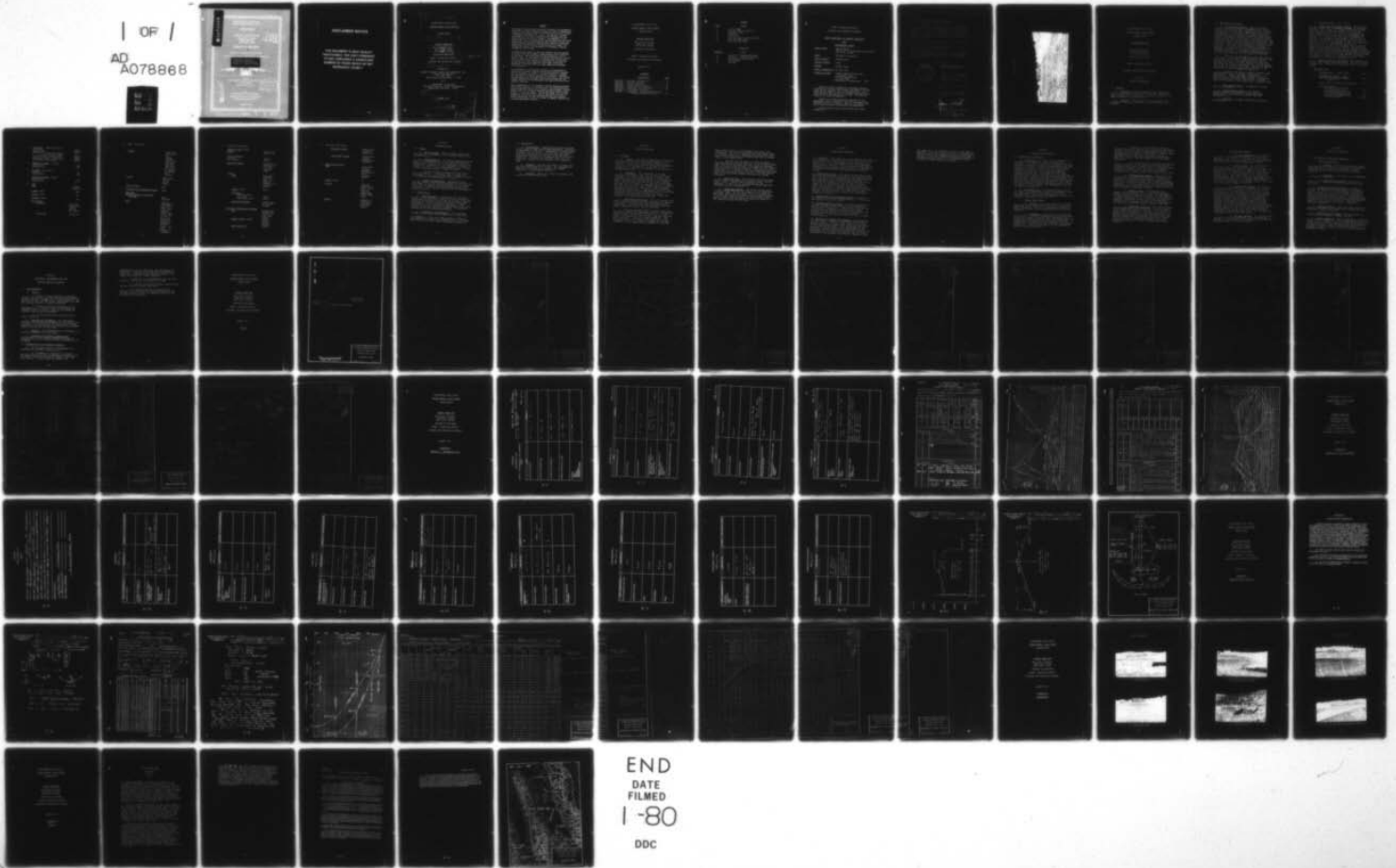
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GANNETT FLEMING CORDDRY AND CARPENTER INC HARRISBURG PA F/G 13/13
NATIONAL DAM INSPECTION PROGRAM. KELSEY CREEK DAM (NDI I.D. NUM--ETC(U)
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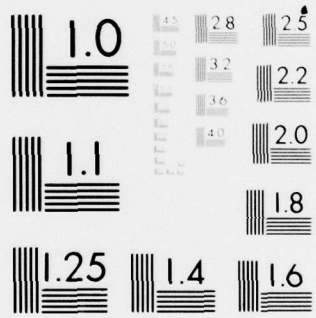
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MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963-A

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PREFACE

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

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. 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.

SUSQUEHANNA RIVER BASIN
KELSEY CREEK, TIOGA COUNTY
PENNSYLVANIA

KELSEY CREEK DAM

NDI ID No. PA-00031
DER ID No. 59-64
SCS ID No. PA-600

BOROUGH OF WELLSBORO

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

AUGUST 1979

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PLATES

<u>Plate</u>	<u>Title</u>
1	Location Map.
2	Plan and Typical Section.
3	Alignment Plan.
4	Profiles.
5	Drain Plan.
6	Main Spillway and Outlet Works.
7	Main Spillway Riser.
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APPENDICES

<u>Appendix</u>	<u>Title</u>
A	Checklist - Engineering Data.
B	Checklist - Visual Inspection.
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PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

BRIEF ASSESSMENT OF GENERAL CONDITION

AND

RECOMMENDED ACTION

Name of Dam: Kelsey Creek
NDI ID No. PA-00031/DER ID No. 59-64
SCS ID No. PA-600

Owner: Borough of Wellsboro

State Located: Pennsylvania

County Located: Tioga

Stream: Kelsey Creek

Date of Inspection: 26 July 1979

Inspection Team: Gannet Fleming Corddry and
Carpenter, Inc.
Consulting Engineers
P.O. Box 1963
Harrisburg, Pennsylvania 17105

[cont'd from
p. 2.]

Based on visual inspection, available records, calculations and past operational performance, Kelsey Creek Dam is judged to be in good condition. The existing spillway can pass the Probable Maximum Flood (PMF) without overtopping of the dam. The spillway capacity is rated as adequate.

There is a slope stability analysis for the embankment, and it indicates that the embankment has adequate factors of safety. There is no evidence of significant problems threatening the embankment.

No deficiencies were noted during the visual inspection.

The following measure is recommended to be undertaken by the Owner, without delay:

(1) Implement an inspection of the main spillway conduit and riser to determine if separation of the conduit joints and cavitation damage to the riser have occurred. If pool conditions prevent the implementation of the inspection, the pool should be drawn down as required to provide the opportunity for inspection. This may require removing riprap at the impact basin endsill to lower tailwater.

In addition, it is recommended that the Owner modify his operational procedures as follows:

(1) Develop a detailed emergency operation and warning system for Kelsey Creek Dam.

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

Submitted by:

GANNETT FLEMING CORDDRY
AND CARPENTER, INC.,



Frederick Futchko

FREDERICK FUTCHKO
Project Manager, Dam Section

Date: 17 September 1979

Approved by:

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF
ENGINEERS

James W. Peck

JAMES W. PECK
Colonel, Corps of Engineers
District Engineer

Date: 25 Sep 79

KELSEY CREEK DAM



Overview

SUSQUEHANNA RIVER BASIN
KELSEY CREEK, TIOGA COUNTY
PENNSYLVANIA

KELSEY CREEK DAM

NDI ID No. PA-00031
DER ID No. 59-64
SCS ID No. PA-600

BOROUGH OF WELLSBORO

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

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. Kelsey Creek Dam consists of a zoned, earthfill embankment that is 860 feet long and 66 feet high at maximum section. The main spillway is a drop spillway located near the center of the embankment. It consists of a concrete riser that connects to a 36-inch diameter reinforced concrete pipe under the embankment. One 2-foot by 2.25-foot orifice is located in the front of the riser. The orifice crest is 39.2 feet below the design top of the dam elevation. The top of the riser is 19.7 feet below the design top of dam elevation. A platform and trashrack are provided above the riser. The outlet works is located at the main spillway. It consists of a 21-inch diameter steel pipe extending upstream from the main spillway riser. A 21-inch sluice gate is provided at the downstream end of the pipe, which outlets into the bottom of the riser.

The auxiliary spillway is at the right abutment of the dam. It is a grass-lined excavation in earth. At the control section, the auxiliary spillway has an earthen crest that is 250 feet long and 6.2 feet below the design top elevation of the dam and 13.5 feet above the top of the main spillway riser. The various features of the dam are shown on the Plates at the end of the report and on the Photographs in Appendix D.

b. Location. The dam is located on Kelsey Creek, approximately 1.0 mile southwest of Wellsboro, Pennsylvania. Kelsey Creek Dam is shown on the 1971 photorevision to USGS Quadrangle, Antrim, Pennsylvania, with coordinates N41°44'05" - W77°18'50", in Tioga County, Pennsylvania. The location map is shown on Plate 1.

c. Size Classification. Intermediate (66 feet high, 795 acre-feet).

d. Hazard Classification. High hazard. Downstream conditions indicate that a high hazard classification is warranted for Kelsey Creek Dam (Paragraph 5.1c.).

e. Ownership. Borough of Wellsboro, Wellsboro, Pennsylvania.

f. Purpose of Dam. Flood control.

g. Design and Construction History. Kelsey Creek Dam was planned under an agreement between the Borough of Wellsboro (Owner), the Soil Conservation Service of the U.S. Department of Agriculture (SCS), and the Tioga County Commissioners (TCC). Under this agreement, the Owner acquired title to the land, the SCS designed the dam, and the TCC supervised construction and maintains the dam. The dam was designed between 1964 and 1965 by the SCS. The permit to construct the dam was issued in 1965 and construction was started in 1965. The Contractor was C. Davis, Inc., Conshohocken, Pennsylvania. Construction of the dam under the supervision of Raymond Tipple, contracting officer for the TCC. The Chief SCS inspector was Frederick Schuetz. Harlan Kemmerer, Jerome Ogden, and Floyd Graham were the Resident Inspectors for the SCS. In August 1966, the Contractor was declared in default. A contract to complete the dam was awarded in October, 1966 to Schwartz and Baker, Inc., Contractors, Clarks Summit, Pennsylvania. The dam was completed in 1967.

h. Normal Operational Procedure. The reservoir is normally maintained at the crest of the orifice in the main spillway riser. The gate on the outlet works is normally closed.

1.3 Pertinent Data.

a. <u>Drainage Area.</u> (square miles)	3.14
b. <u>Discharge at Damsite.</u> (cfs.)	
Maximum known flood at damsite (June 1972)	190
Outlet works at normal pool elevation	80
Spillway capacity.	
Orifice with pool at main spillway riser crest	100
Main spillway with pool at auxiliary spillway crest	160
Auxiliary spillway with pool at top of dam	10,480

c.	<u>Elevation.</u> (feet above msl.)	
	Top of dam	1440.2
	Maximum pool	1440.2
	Normal pool (crest of orifice in main spillway riser)	1401.0
	Upstream invert outlet works	1383.0
	Downstream invert outlet works	1382.0
	Streambed at toe of dam	1374.5
d.	<u>Reservoir Length.</u> (miles)	
	Normal pool	0.24
	Maximum pool	0.71
e.	<u>Storage.</u> (acre-feet)	
	Normal pool	40
	Maximum pool	795
f.	<u>Reservoir Surface</u> (acres)	
	Normal pool	5
	Maximum pool	37.7
g.	<u>Dam.</u>	
	<u>Type</u>	Zoned earthfill
	<u>Length</u> (feet)	860
	<u>Height</u> (feet)	66
	<u>Topwidth</u> (feet)	20
	<u>Side Slopes</u>	
	Upstream	1V on 3H. There is a 10-foot berm at El. 1401.0
	Downstream	1V on 3H.

g. Dam. (Continued)

Zoning

Impervious core up to el. 1408.0. Semipervious fill surrounding core. More pervious fill at outside of embankment section.

Cutoff

Impervious fill in cutoff trench.

Grout Curtain

None

h. Diversion and Regulating Tunnel

None

i. Spillway.
Main (Principal or Service)
Spillway

Drop spillway

Type

Vertical rectangular riser 3.0 feet by 9.0 feet, with rounded crest. One 2-foot high by 2.25 foot long orifice is located in the front of the riser. The riser connects to a conduit.

i. Spillway (continued)

Length of Weir (feet)

Orifice

One at 2.25

Riser

Two at 9.0

Crest Elevation

Orifices

1401.0

Top of Riser

1420.5

Upstream Channel

Reservoir, a platform is 1.5 feet above the riser.

Conduit

Type

Reinforced concrete pipe, 3.0 feet in diameter, on concrete cradle.

Length (feet)

314.3

Elevation

Upstream invert
at riser

1380.0

Downstream invert

1374.5

Downstream Channel

Impact basin at natural stream.

Auxiliary (Emergency) Spillway

Type

Grass-lined earthen cut with 1V on 2.5H side slopes.

Length of Weir (feet)

250 at earthen control section.

Crest Elevation

1434.0

i. Spillway (continued)

Upstream Channel

Grass-lined channel to reservoir.

Downstream Channel

Grass-lined channel extending to overbank.

j. Regulating Outlets.

Type

Steel pipe, 21-inch diameter, extending to main spillway riser.

Length (feet).

53

Closure

21-inch, unseating head, sluice gate in riser at downstream end of steel pipe.

Access

Operator on platform above main spillway riser.

SECTION 2
ENGINEERING DATA

2.1 Design.

a. Data Available. Almost complete design data are available. A summary of the available data is in Appendices A and C.

b. Design Features. The dam and appurtenances are described in Paragraph 1.2a. The design features are shown on the Plates at the end of the report and on the Photographs in Appendix D. The embankment is shown on Plates 2, 3, and 4, and on Photographs A and B. A plan of the subdrainage system is shown on Plate 5.

The main spillway is shown on Plates 6 and 7, and on Photograph C. The impact basin is shown on Photograph D. The auxiliary spillway is shown on Plates 2, 3, and 8 and on Photographs C, E, and F.

c. Design Considerations. Although the main spillway design has been used successfully by the SCS for many years, it appears that the entrance to the conduit could possibly develop cavitation during certain flow conditions. Other design considerations are discussed in Sections 5 and 6.

2.2 Construction.

a. Data Available. Construction data available consist of the construction specifications, construction photographs, and reports both from the resident inspector and from the periodic construction inspections by the Commonwealth. The only adverse item noted in these reports was the poor construction management by the first contractor, who was declared in default. No technical problems were noted during construction.

b. Construction Considerations. The available information indicates that the dam is well constructed.

2.3 Operation. There are formal records of operation maintained by the Tioga County Commissioners. All items noted therein are minor annual maintenance operations.

2.4 Evaluation.

a. Availability. Engineering data were provided by the Bureau of Dams and Waterway Management, Department of Environmental Resources, Commonwealth of Pennsylvania (PennDER), and by the SCS. The SCS made available the District Conservationist and the TCC made available maintenance personnel for information during the visual inspection. The SCS also researched their files for additional information upon request of the inspection team.

b. Adequacy. The type and amount of design data and other engineering data is good. The assessment is based on the combination of design data, visual inspection, and performance history.

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

SECTION 3
VISUAL INSPECTION

3.1 Findings

a. General. The overall appearance of the dam is good with a few deficiencies as noted herein. The locations of deficiencies are shown in Appendix B on Plate B-1. Survey data acquired during this inspection are presented in Appendix B. On the day of the inspection, the pool was at the crest of the orifice in main spillway riser.

b. Embankment. The embankment is in good condition. The grass cover is in excellent condition. The grass is at least 3 feet high in all areas. The upstream slope is protected by grass. A foot trail is worn in the berm at Elevation 1401.0 on the upstream slope. An area about 200 feet to the left of the main spillway riser is eroded to a maximum depth of 3 inches. The area is 12 feet wide and 20 feet long; it is about 2 feet above normal pool. The grass is not completely established in this area. A survey performed for this inspection reveals that the embankment is at or above the design top elevation and that the slopes are in accordance with the design drawings. No seepage was observed at or downstream from the dam.

c. Appurtenant Structures. The outlet works is in good condition, however its functioning was not observed on the day of the inspection. The SCS Representative stated that it had been previously operated during the annual inspection with no observed problems.

The main spillway riser is in good condition. The conduit beneath the embankment could not be inspected because it was flowing about one half full. A minor amount of debris was at the orifice of the main spillway riser. The impact basin is in good condition. Very minor spalling, of no concern, was observed at a few localized areas of the concrete. Because of the high tailwater, it was impossible to determine if the drain

pipes, which extend to the embankment toe drain, were discharging. The riprap downstream from the impact basin is in good condition. It appeared that someone had piled some of the riprap across the impact basin sill to create a pool at the impact basin.

The auxiliary spillway is in good condition, The grass cover is in good condition; it is at least 3 feet high. The survey performed for this inspection revealed that the control section invert is between 0.6 foot below to 0.5 foot above the design elevation. Because of the tall grass cover, it is uncertain that the measurements were made along the crest of the control section. This may explain part of the difference between the actual and design elevation.

d. Reservoir Area. The reservoir has fairly steep wooded slopes. The watershed is mostly wooded, rolling hills. There is minor rural development in the watershed. A small dam is upstream of Kelsey Creek Dam. Pertinent data are in Appendix C.

e. Downstream Channel. The stream extends about 1.0 mile through Wellsboro and beyond, to its confluence with Marsh Creek. In this reach there are at least 30 dwellings. The County Courthouse is also located adjacent to the stream along this reach. The access road to the dam is a public road extending far above and parallel to the reservoir along the left bank.

SECTION 4

OPERATIONAL PROCEDURES

4.1 Procedure. The reservoir is maintained at the crest of the orifice in the main spillway riser, Elevation 1401.0, with excess inflow discharging over the crest and into Kelsey Creek. A 21-inch diameter steel pipe discharges water from the reservoir. Since the outlet works pipe is intended only for drawing down the reservoir, the gate on the Kelsey Creek Dam water discharge line is usually closed.

4.2 Maintenance of Dam. The dam is visited every three months by the caretakers who observe the condition of the dam. During periods of precipitation, the dam is visited more frequently. The caretakers are responsible for reporting any changes or deficiencies to the SCS. The TCC, with the assistance of the SCS, make a formal inspection of the dam each year, and the records are filed. Maintenance deficiencies are corrected shortly after the inspection. Informal inspections are also made when the SCS representative is on the site for other reasons. Mowing and brush cutting on the embankment is accomplished annually.

4.3 Maintenance of Operating Facilities. The gate on the outlet works pipe is operated annually. This policy was adopted by the SCS in 1978.

4.4 Warning Systems in Effect. The SCS Representative and the caretaker stated that there was no emergency operation and warning plan. They did note that the dam is monitored continuously during periods of heavy precipitation by members of the Local Fire Company, who maintain contact with the Local Civil Defense organization. The Borough has this policy for all dams in the vicinity.

4.5 Evaluation of Operational Adequacy. Maintenance of the dam is good. However, if the grass were allowed to grow much higher, it could become a hazard to the dam, because significantly higher grass could obstruct flows in the auxiliary spillway. Also, high grass has the potential to obscure deficiencies that might develop. Maintenance of the operating facilities is also good. The procedures used to inspect the dam are good, as is the correction of maintenance deficiencies. Because of the

low normal pool, the schedule of visits to the dam is adequate. It would be better practice to visit the dam more frequently. An emergency operation and warning system is a necessary safeguard to improve the safety of the dam and prevent loss of life downstream, should evidence of stress develop at the dam.

SECTION 5

HYDROLOGY AND HYDRAULICS

5.1 Evaluation of Features.

a. Design Data. The hydrology and hydraulics of the design of the dam were based on standard SCS criteria. The crest of the orifice in the main spillway riser was determined by sediment requirements. The crest elevation of the main spillway riser was determined by routing the 100-year, 1-hour storm. The crest of the auxiliary spillway was set by routing the maximum 100-year, 6-hour storm. The design high water was determined by routing a storm equal to 1.25 times the above 100-year, 6-hour storm. The design high water storm was not used to determine the size of structures at the dam. The top of dam elevation and auxiliary spillway size were determined by routing the "Freeboard" storm, which is equal to twice the design high water storm (2.5 times the 100-year, 6-hour storm). The "Freeboard" storm is discussed in Paragraph 5.1d.

b. Experience Data. The maximum known flood at the damsite occurred during Tropical Storm Agnes in June 1972, when water was 2.0 feet below the auxiliary spillway crest. Using the design discharge ratings, the outflow is estimated at about 190 cfs.

c. Visual Observations.

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

(2) Embankment. The erosion on the upstream slope is minor. The SCS Representative reported that the erosion was caused by surface runoff immediately after construction, before the grass cover was established. The erosion has not progressed since the grass cover was established. The erosion is not considered a deficiency because it is slight and because it has not progressed since the dam was completed.

Using grass cover instead of riprap as slope protection for dams is not a universally used design criteria, but it is a standard SCS design criteria. Any potential erosion hazard is considered to be offset by the good maintenance at the dam. Any erosion of the embankment would be detected and repaired immediately after it occurred. This would make the erosion hazard negligible.

The conduit has not been inspected since the dam was completed. As the joints of concrete conduits founded on earth tend to spread apart, an inspection would be prudent. However, since the as-built information indicates that each conduit joint has an allowable elongation of at least 3 inches, the concern is only minor.

(3) Appurtenant Structures. The gate for the outlet works is located sufficiently far upstream to be considered an upstream closure facility. The riprap at the endsill of the impact basin raises tailwater slightly. This is not a hazard to the dam, but it does hinder visual inspection. The crest elevation of the auxiliary spillway indicates that the spillway capacity is slightly greater than the design computations indicate.

(4) Reservoir Area. No conditions were observed in the reservoir area or watershed that might present significant hazard to the dam. The assessment of the dam is based on existing conditions, and the effects of future development are not considered. Calculations in Appendix C concerning the small dam in the watershed indicate that the storage is small and its failure would not present a significant hazard to Kelsey Creek Dam.

(5) Downstream Conditions. No conditions were observed immediately downstream from the dam that would create significant hazard to the dam. If the dam should fail, a hazard to dwellings in Wellsboro would exist. Because of the possibility of flooding dwellings, a high hazard classification is warranted for Kelsey Creek Dam. The SCS designed the dam assuming that it was a Class C structure. This is essentially equivalent to a high hazard classification. Access to Kelsey Creek Dam is excellent.

d. Overtopping Potential.

(1) Spillway Design Flood. According to the criteria established by the Office of the Chief of Engineers (OCE) for the size (Intermediate) and hazard potential (High) of Kelsey Creek Dam, the Spillway Design Flood (SDF) is the Probable Maximum Flood (PMF).

(2) Design Storm. The SCS "Freeboard" storm, which was used to determine the size of the auxiliary spillway and the top elevation of the dam, was not developed from PMF methods. However, the total rainfall of 20.5 inches is equivalent to a PMF rainfall for this area. The assumed losses of 3.5 inches are slightly higher than those established by criteria for the Susquehanna River Basin. The unit hydrograph used by the SCS is conservative. The computed peak inflow of 10,940 cfs is equivalent to a PMF peak inflow. The storm is an acceptable estimate of the PMF.

(3) Design Storm Routing. The design storm routing computations are in Appendix C. It should be noted that the SCS assumed the main spillway to be functional up to the top elevation of the dam. As the main spillway is not vented and as there is a potential of debris blocking the trashrack, it is uncertain that the main spillway could discharge at this capacity. However, the main spillway capacity is minimal when compared to the auxiliary spillway capacity, and any reduction would have a negligible effect on the PMF routing. It should be noted that the crest of the main spillway riser is 2 feet higher than the elevation in the design computations. Also, both the auxiliary spillway crest and the top of dam are 1 foot higher than the elevations in the design computations. The changes have a negligible effect on the PMF routing.

(4) Spillway Adequacy. The criteria used to rate the spillway adequacy of a dam are described in Appendix C. Since Kelsey Creek Dam can pass the PMF, the spillway capacity is rated as adequate.

SECTION 6

STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations.

(1) General. The visual inspection of Kelsey Creek Dam, which is described in Section 3, resulted in some observations relevant to structural stability. These observations are evaluated herein for various features.

(2) Embankment. The erosion on the embankment is evaluated in Section 5.

(3) Appurtenant Structures. There are no observations relevant to structural stability at these structures.

b. Design and Construction Data. A stability analysis was performed by the SCS during the design of the dam. The stability analysis resulted in a minimum factor of safety of 1.43 on the upstream slope for the sudden drawdown condition and 1.55 on the downstream slope for the steady seepage condition. The design shear strength was based on the consolidated-undrained strength obtained from a triaxial shear test. These factors of safety are considered to be adequate. A summary is included in Appendix A.

c. Operating Records. There are formal records of operation. No stability problems have occurred over the operational history of the dam.

d. Postconstruction Changes. There have been no postconstruction changes to Kelsey Creek Dam.

e. Seismic Stability. Kelsey Creek Dam is located in Seismic Zone 1. Normally it can be considered that if a dam in this zone has adequate factors of safety under static loading conditions, it can be assumed safe for any expected earthquake loading. Since the factors of safety are adequate, the dam is assumed to be stable for any expected earthquake loading.

SECTION 7
ASSESSMENT, RECOMMENDATIONS, AND
PROPOSED REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety.

(1) Based on visual inspection, available records, calculations, and past operational performance, Kelsey Creek Dam is judged to be in good condition. The spillway can pass the PMF without overtopping of the dam. The spillway capacity is rated as adequate.

(2) There is a stability analysis for the embankment, and it indicates that the embankment has adequate factors of safety. There is no evidence of problems threatening the embankment.

(3) No deficiencies were noted during the visual inspection.

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

c. Urgency. The recommendations in Paragraph 7.2 should be implemented without delay.

d. Necessity for Further Investigations. Accomplishment of the remedial measures outlined in Paragraph 7.2 will not require further investigations by the Owner.

7.2 Recommendations and Remedial Measures.

a. The following measure is recommended to be undertaken by the Owner, without delay:

(1) Implement an inspection of the main spillway conduit and riser to determine if separation of the conduit joints and cavitation damage to the riser have occurred. If pool conditions prevent the

implementation of the inspection, the pool should be drawn down as required to provide the opportunity for inspection. This may require removing riprap at the impact basin endsill to lower tailwater.

b. In addition, it is recommended that the Owner modify his operational procedures as follows:

(1) Develop a detailed emergency operation and warning system for Kelsey Creek Dam.

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

SUSQUEHANNA RIVER BASIN
KELSEY CREEK, TIOGA COUNTY
PENNSYLVANIA

KELSEY CREEK DAM

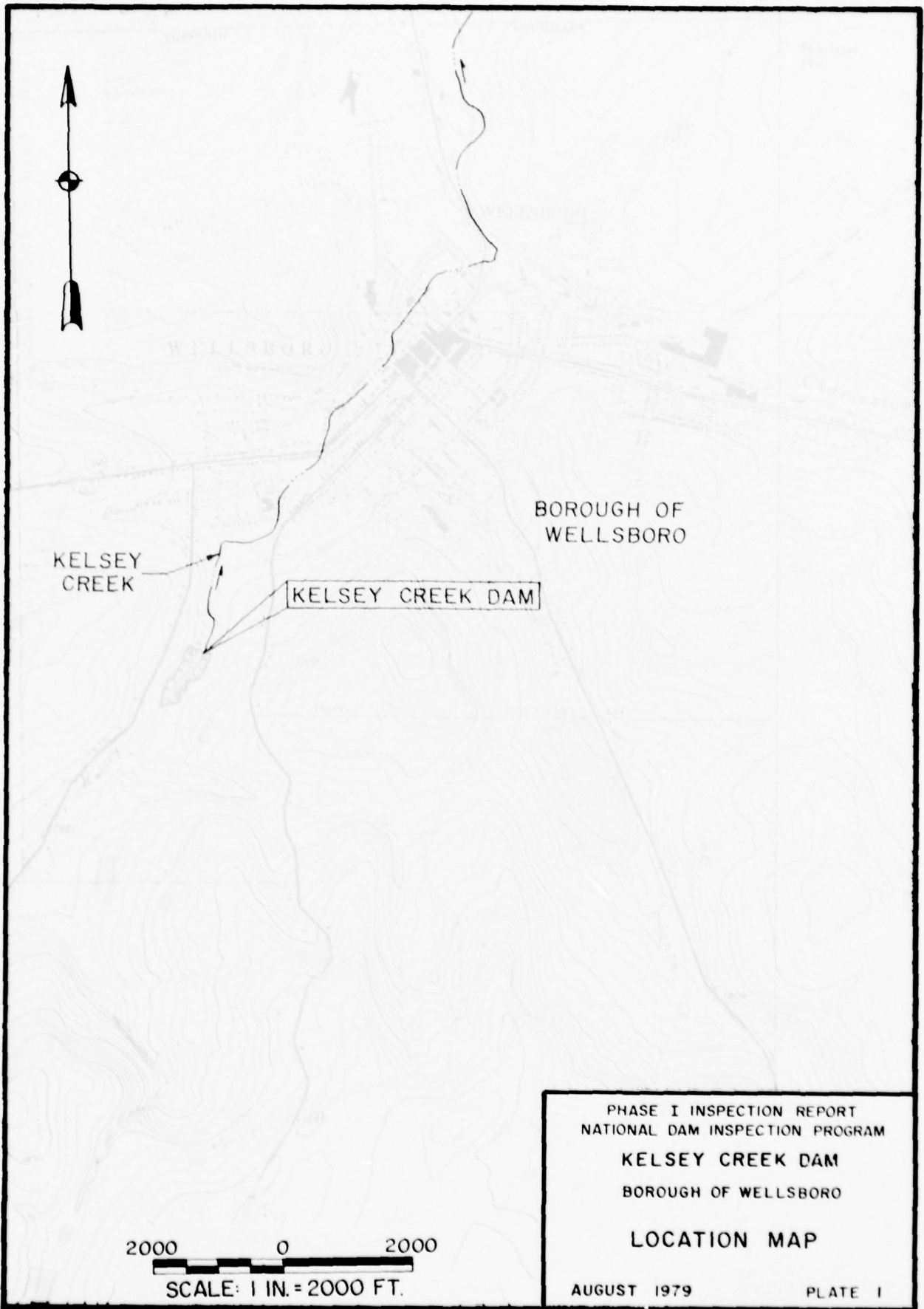
NDI ID No. PA-00031
DER ID No. 59-64
SCS ID No. PA-600

BOROUGH OF WELLSBORO

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

AUGUST 1979

PLATES



KELSEY CREEK

KELSEY CREEK DAM

BOROUGH OF WELLSBORO

2000 0 2000

SCALE: 1 IN. = 2000 FT.

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

KELSEY CREEK DAM
BOROUGH OF WELLSBORO

LOCATION MAP

AUGUST 1979

PLATE I

THIS RIVER LINE TO BE
REMOVED BY OTHERS



EARTH FILL

- ZONE I - MATERIAL AS SPECIFIED BY TABLE, DEPTH AS TO 1 FOOT, REMOVED IN FIELD AS SH.
- ZONE II - MATERIAL AS SPECIFIED BY TABLE, DEPTH AS TO 1 FOOT, REMOVED IN FIELD AS TO BE REMOVED IN FIELD AS SH.
- ZONE III - MATERIAL AS SPECIFIED BY TABLE, DEPTH AS TO 1 FOOT, REMOVED IN FIELD AS TO BE REMOVED IN FIELD AS SH.



CONSTRUCTION OF THIS EARTH FILL SHALL BE IN ACCORDANCE WITH THE
 SPECIFICATIONS AND DETAILS OF THE CONTRACT DOCUMENTS AND THE
 STANDARD SPECIFICATIONS FOR PUBLIC WORKS, LATEST EDITION.

FIG. NO. _____
 SEE REPORT NO. _____
 Div. Data _____

59-14-2
 RECEIVED IN THE OFFICE OF THE WATER & POWER RESOURCES BOARD, DEPARTMENT OF FORESTS & WATERS ON THE DAY OF JUL 12 AD 1955
 File Clerk _____

NOTE: AREAS TO BE CLEARED BEFORE ANY DAM OR FLOOD CONTROL STRUCTURE IS CONSTRUCTED IN THESE AREAS



- AREA TO BE CLEARED AND REVEGGED - 1.2 ACRES
- AREA TO BE CLEARED - 1.1 ACRES

FOR LIST OF TEST PITS AND SPILLWAYS SEE SHEETS 1, 2, 3, 4, 5

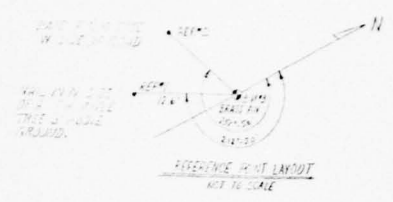


JUL 12 1955
 C. H. ...
 State Engineer

2

MARSH CREEK WATERSHED
 FLOODWATER RETARDING DAM PA-600
 TIOGA COUNTY, PENNSYLVANIA
 PLAN OF STORAGE AREA
 U.S. DEPARTMENT OF AGRICULTURE
 SOIL CONSERVATION SERVICE

PHASE I INSPECTION REPORT
 NATIONAL DAM INSPECTION PROGRAM
 KELSEY CREEK DAM
 BOROUGH OF WELLSBORO
 PLAN AND TYPICAL SECTION

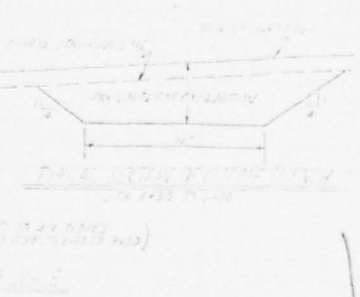
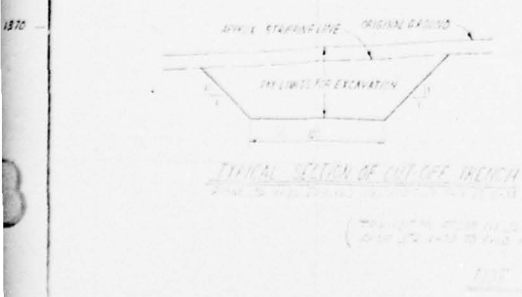
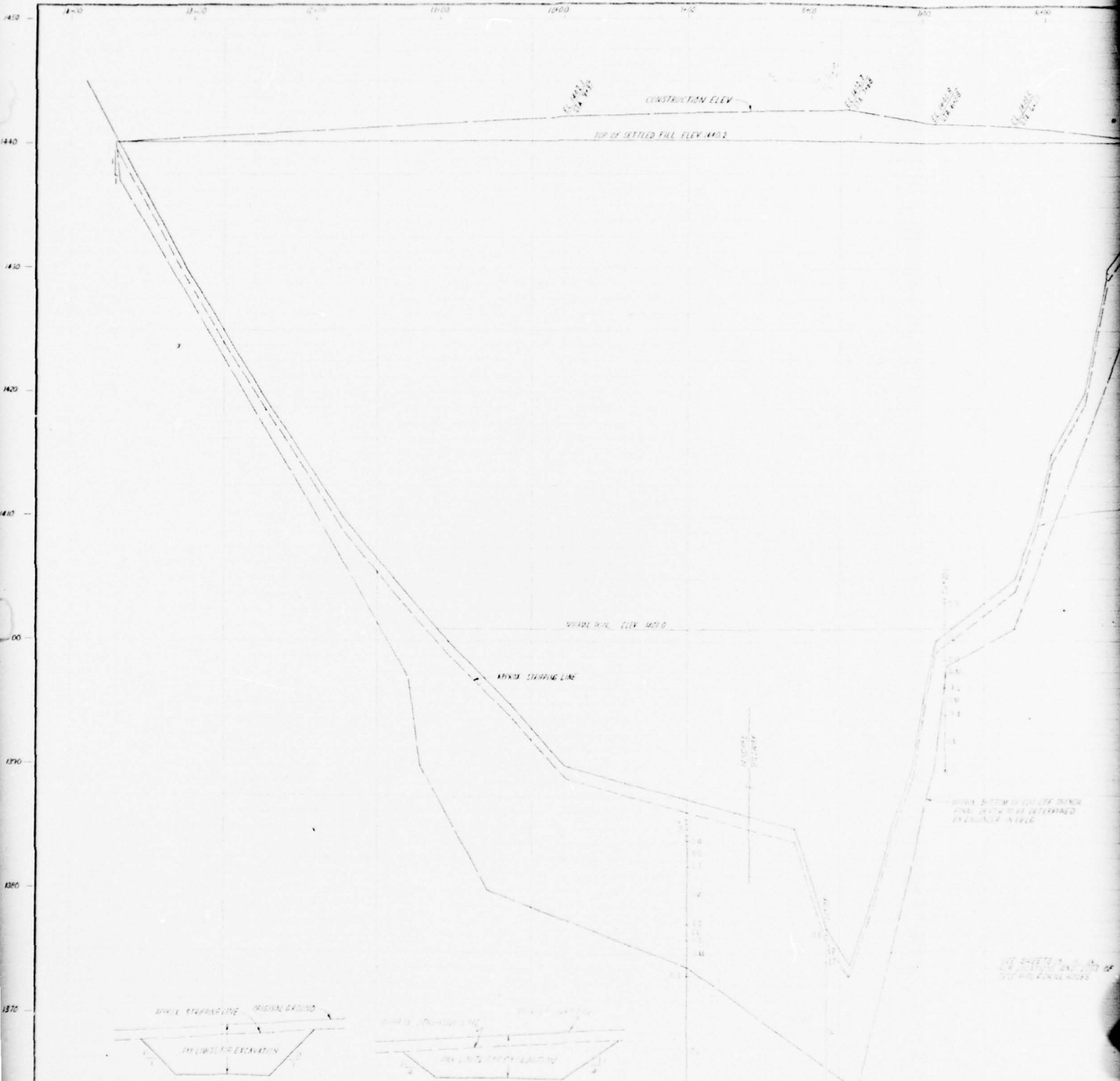


EMERGENCY SPILLWAY CURVE DATA
UPSTREAM CURVE

STATION	S. CURVE DATA	CHORD	
1+00.00	0+00.00	11.21	
1+05.22	0+05.00	11.21	
1+10.44	0+10.00	11.21	
1+15.66	0+15.00	11.21	
1+20.88	0+20.00	11.21	
1+26.10	0+25.00	11.21	
1+31.32	0+30.00	11.21	
1+36.54	0+35.00	11.21	
1+41.76	0+40.00	11.21	
1+46.98	0+45.00	11.21	
1+52.20	0+50.00	11.21	
1+57.42	0+55.00	11.21	
1+62.64	0+60.00	11.21	
1+67.86	0+65.00	11.21	
1+73.08	0+70.00	11.21	
1+78.30	0+75.00	11.21	
1+83.52	0+80.00	11.21	
1+88.74	0+85.00	11.21	
1+93.96	0+90.00	11.21	
1+99.18	0+95.00	11.21	
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2+09.62	1+05.00	11.21	
2+14.84	1+10.00	11.21	
2+20.06	1+15.00	11.21	
2+25.28	1+20.00	11.21	
2+30.50	1+25.00	11.21	
2+35.72	1+30.00	11.21	
2+40.94	1+35.00	11.21	
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2+98.36	1+90.00	11.21	
3+03.58	1+95.00	11.21	
3+08.80	2+00.00	11.21	
3+14.02	2+05.00	11.21	
3+19.24	2+10.00	11.21	
3+24.46	2+15.00	11.21	
3+29.68	2+20.00	11.21	
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4+02.76	2+90.00	11.21	
4+07.98	2+95.00	11.21	
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4+18.42	3+05.00	11.21	
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7+15.96	5+90.00	11.21	
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8+36.02	7+05.00	11.21	
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8+46.46	7+15.00	11.21	
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8+62.12	7+30.00	11.21	
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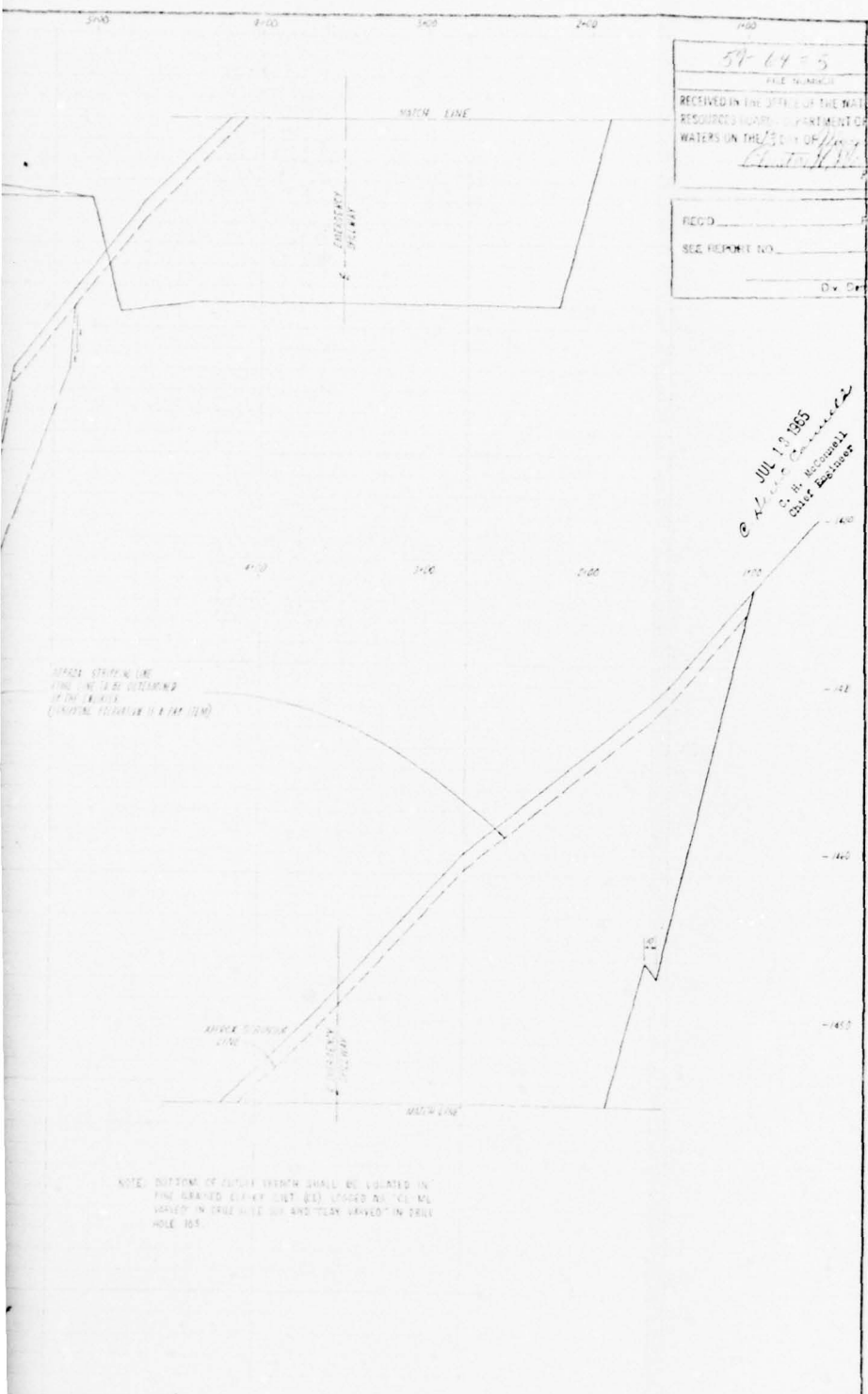
EMERGENCY SPILLWAY CURVE DATA
DOWNSTREAM CURVE

STATION	S. CURVE DATA	CHORD	
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1+10.44	0+10.00	11.21	
1+15.66	0+15.00	11.21	
1+20.88	0+20.00	11.21	
1+26.10	0+25.00	11.21	
1+31.32	0+30.00	11.21	
1+36.54	0+35.00	11.21	
1+41.76	0+40.00	11.21	
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1+52.20	0+50.00	11.21	
1+57.42	0+55.00	11.21	
1+62.64	0+60.00	11.21	
1+67.86	0+65.00	11.21	
1+73.08	0+70.00	11.21	
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1+88.74	0+85.00	11.21	
1+93.96	0+90.00	11.21	
1+99.18	0+95.00	11.21	
2+04.40	1+00.00	11.21	
2+09.62	1+05.00	11.21	
2+14.84	1+10.00	11.21	
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2+40.94	1+35.00	11.21	
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2+72.26	1+65.00	11.21	
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6+89.86	5+65.00	11.21	
6+95.08	5+70.00	11.21	
7+00.30	5+75.00	11.21	
7+05.52	5+80.00	11.21	
7+10.74	5+85.00	11.21	



ENGINE DRAWING
 1912

THE SHEET IS ONE OF SEVEN SHEETS



58-64-5
 FILE NUMBER
 RECEIVED IN THE OFFICE OF THE WATER & POWER
 RESOURCES BOARD, DEPARTMENT OF FORESTS &
 WATERS ON THE 13th of July, A.D. 1965
 [Signature]
 REC'D _____
 SEC. PERMIT NO. _____
 Div. Drain

MARSH CREEK WATERSHED
 FLOODWATER RETARDING DAM PA-600
 TIOGA COUNTY, PENNSYLVANIA
 PROFILE ALONG C OF DAM
 U.S. DEPARTMENT OF AGRICULTURE
 SOIL CONSERVATION SERVICE
 [Signature]

PHASE I INSPECTION REPORT
 NATIONAL DAM INSPECTION PROGRAM
 KELSEY CREEK DAM
 BOROUGH OF WELLSBORO
 PROFILES
 AUGUST 1979

2

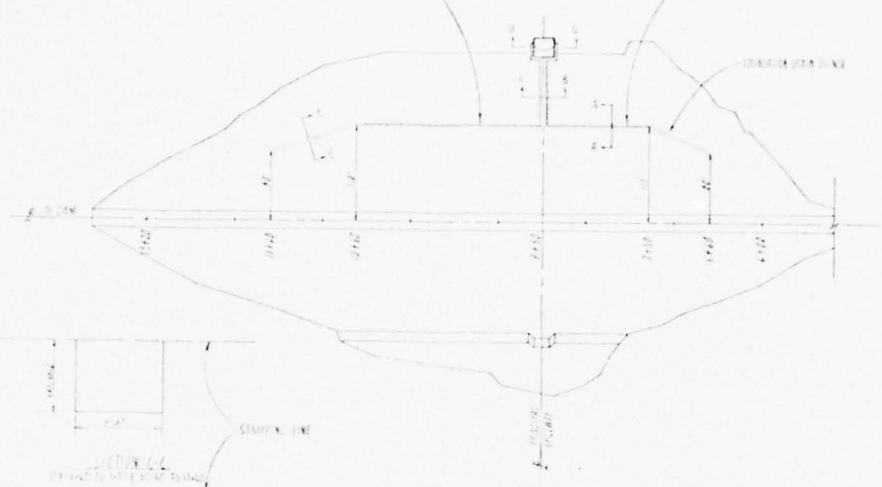
- 1" DIA FILTER SAND PIPE (CONTINUED)
- 1) 20' SECTION
 - 1) 18' SECTION
 - 1) 8' SECTION
 - 2) 20' ELBOW (12x12)
 - 1) 20' ELBOW (12x12)
 - 1) 20' ELBOW (12x12)
 - 1) WELD END CAP
 - 1) SMALL ANCHOR CLAMP (SEE SHEET 12)
- 200' TOTAL (SEE STANDARD COPIES TO S&D)

MATERIALS SEE 12
CONSTRUCTION SPEC 12

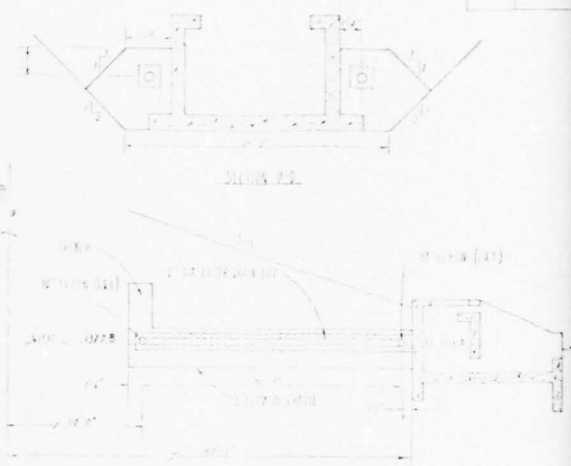
NOTE:
ALL FILTER SAND PIPE TO BE MADE OF STEEL
CLASS II, TYPE B, LACING 100% R, 4' GAUGE

- 1" DIA FILTER SAND PIPE (CONTINUED)
- 8) 20' SECTION
 - 1) 18' SECTION
 - 1) 14' SECTION
 - 1) 8' SECTION
 - 2) 20' ELBOW (12x12)
 - 1) 20' ELBOW (12x12)
 - 1) 20' ELBOW (12x12)
 - 1) WELD END CAP
 - 1) SMALL ANCHOR CLAMP (SEE SHEET 12)
- 200' TOTAL (SEE STANDARD COPIES TO S&D)

FINE FILTER	
NO. OF	IN. PER MIN.
1/4"	100
3/8"	100
1/2"	100
5/8"	100
3/4"	100
7/8"	100
1"	100
1 1/8"	100
1 1/4"	100
1 1/2"	100
1 3/4"	100
2"	100

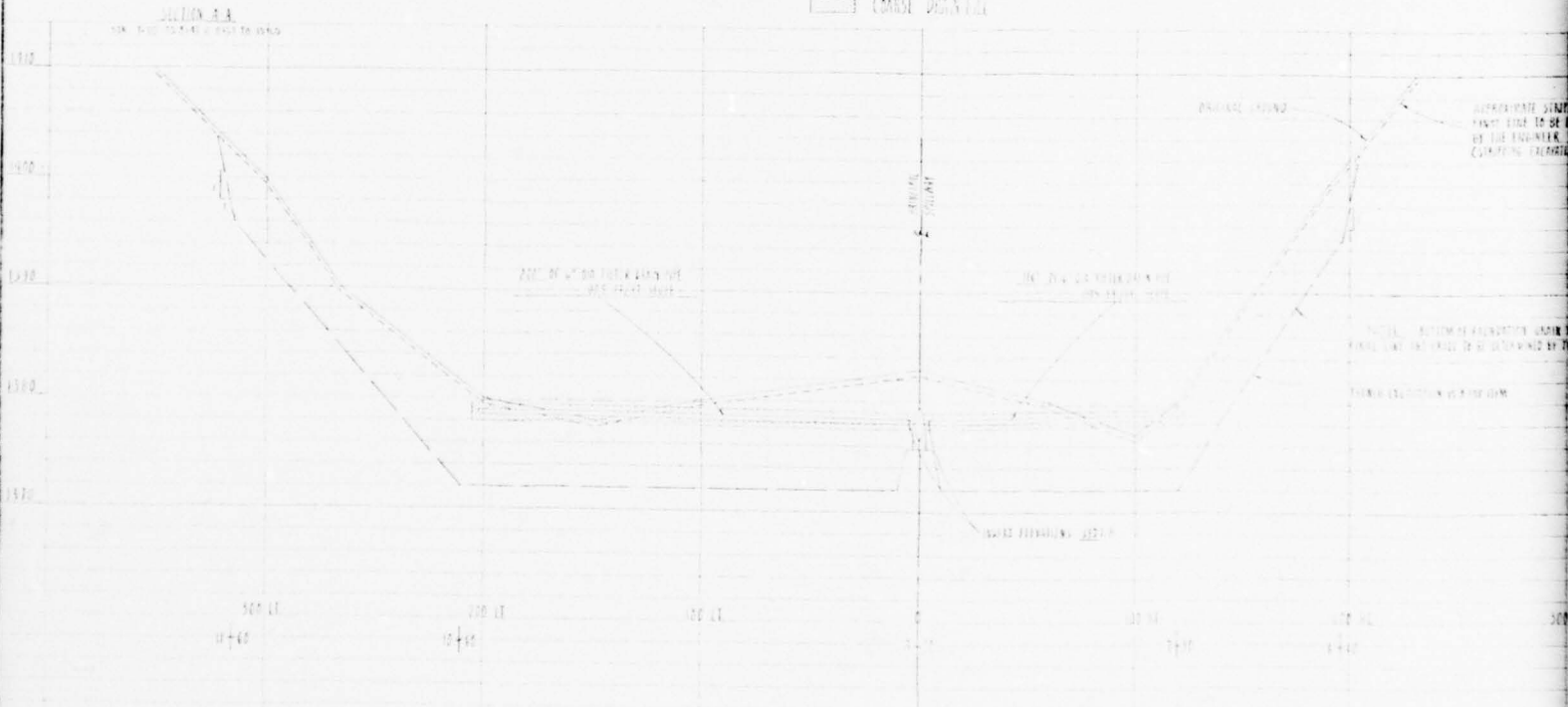


PLAN VIEW OF FOUNDATION DRAIN
NOT TO SCALE



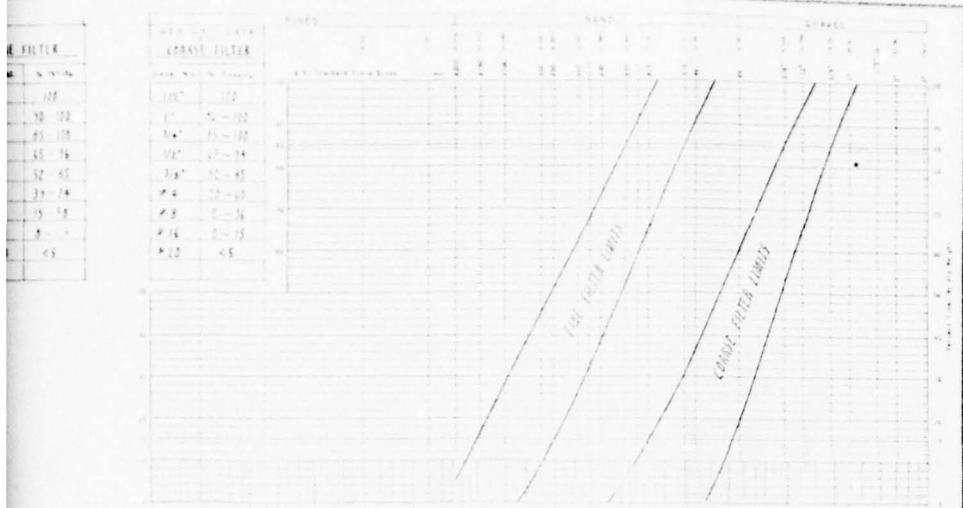
FOUNDATION DRAIN PROFILE

□ FINE DRAIN - 1/2"
□ COARSE DRAIN - 1/4"

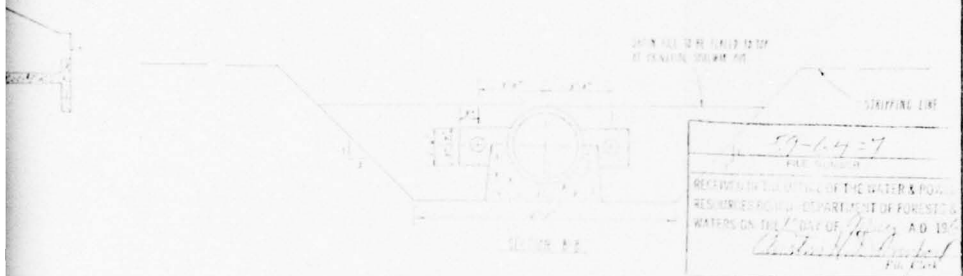


PROFILE OF FOUNDATION DRAIN
NOT TO SCALE

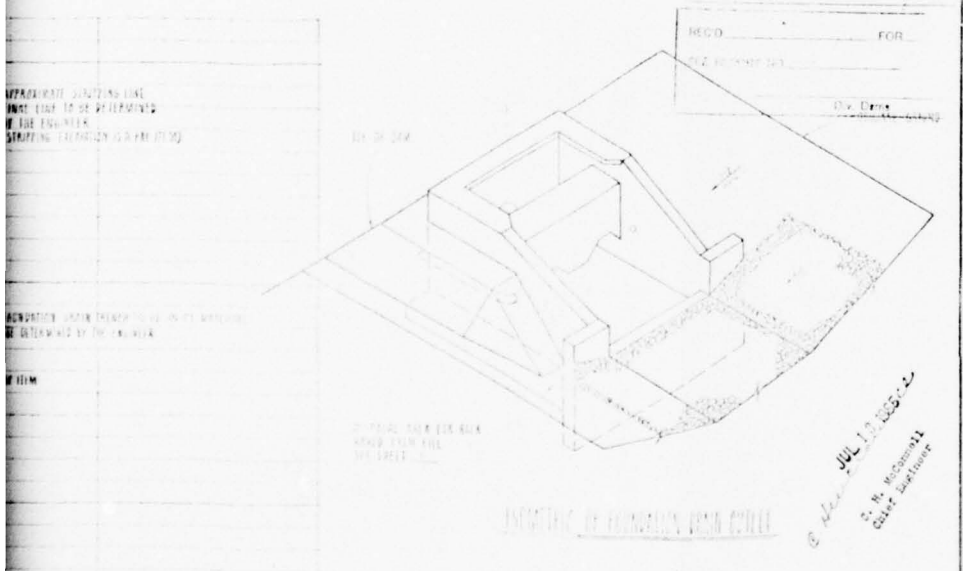
1



(SPEC. 105) GRADATION LIMITS FOR ALL DRAIN FILL



59-64-7
 FILE NUMBER
 RESURVEYED BY OFFICE OF THE WATER & POWER RESOURCES DIVISION, DEPARTMENT OF FORESTRY & WATERS ON THE 2 DAY OF July, A.D. 1979
 Charles W. [Signature]
 P. E. [Signature]



FOUNDATION DRAIN SYSTEM

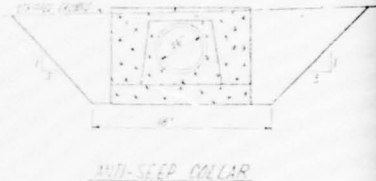
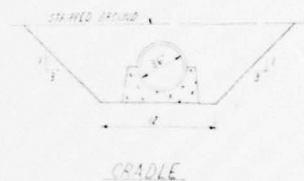
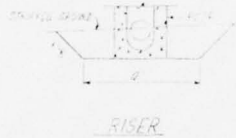
MARSH CREEK WATERSHED
 FLOODWATER RETARDING DAM, FA-600
 TIOGA COUNTY, PENNSYLVANIA
 FOUNDATION DRAIN DETAILS
 U.S. DEPARTMENT OF AGRICULTURE
 SOIL CONSERVATION SERVICE

PHASE I INSPECTION REPORT
 NATIONAL DAM INSPECTION PROGRAM
 KELSEY CREEK DAM
 BOROUGH OF WELLSBORO
 DRAIN PLAN
 AUGUST 1979 PLATE 5

2

DH*301

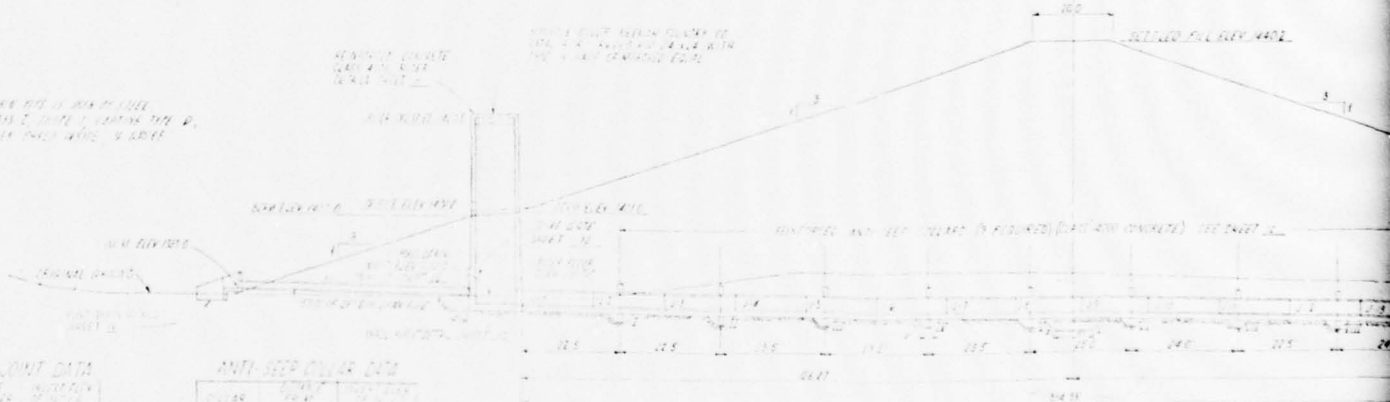
DH*303



TYPICAL SECTIONS -
FOR LAYOUT FOR CALCULATION BETWEEN
NEXT LINES



NOTE: DRAIN PIPE IS 12" DIA. 1/2" WALL
CLASS I DRAIN & CLASS III DRAIN
WITH 1/2" WALL THICKNESS & 1/2" DIA.



PROFILE VIEW E OF TRINITY SULLY
(NOT TO SCALE)

PIPE JOINT DATA

PIPE DIA.	PIPE WALL THICKNESS	PIPE WEIGHT
12	1/2	10.00
14	1/2	12.00
16	1/2	14.00
18	1/2	16.00
20	1/2	18.00
22	1/2	20.00
24	1/2	22.00
26	1/2	24.00
28	1/2	26.00
30	1/2	28.00
32	1/2	30.00
34	1/2	32.00
36	1/2	34.00
38	1/2	36.00
40	1/2	38.00
42	1/2	40.00
44	1/2	42.00
46	1/2	44.00
48	1/2	46.00
50	1/2	48.00
52	1/2	50.00
54	1/2	52.00
56	1/2	54.00
58	1/2	56.00
60	1/2	58.00
62	1/2	60.00
64	1/2	62.00
66	1/2	64.00
68	1/2	66.00
70	1/2	68.00
72	1/2	70.00
74	1/2	72.00
76	1/2	74.00
78	1/2	76.00
80	1/2	78.00
82	1/2	80.00
84	1/2	82.00
86	1/2	84.00
88	1/2	86.00
90	1/2	88.00
92	1/2	90.00
94	1/2	92.00
96	1/2	94.00
98	1/2	96.00
100	1/2	98.00

ANTI-SEEP COLLAR DATA

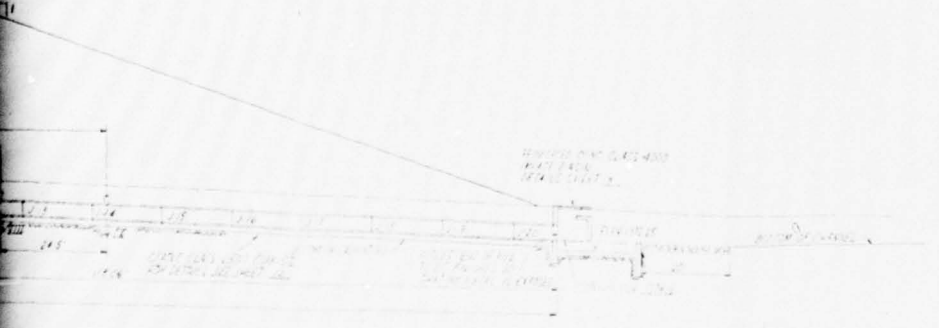
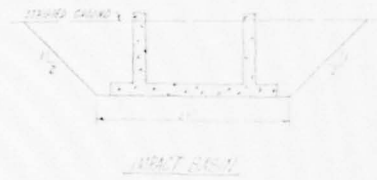
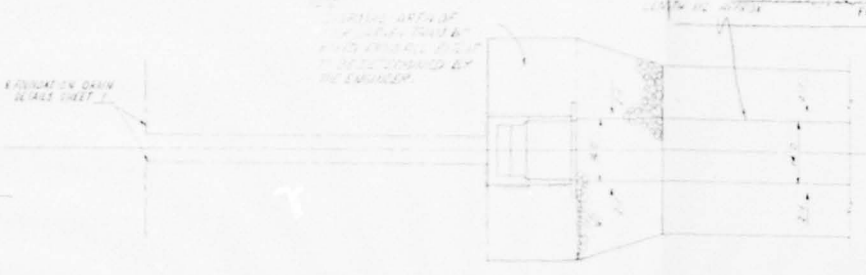
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16	1/2	14.00
18	1/2	16.00
20	1/2	18.00
22	1/2	20.00
24	1/2	22.00
26	1/2	24.00
28	1/2	26.00
30	1/2	28.00
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78	1/2	76.00
80	1/2	78.00
82	1/2	80.00
84	1/2	82.00
86	1/2	84.00
88	1/2	86.00
90	1/2	88.00
92	1/2	90.00
94	1/2	92.00
96	1/2	94.00
98	1/2	96.00
100	1/2	98.00

NOTE: DIMENSIONS OF PIPE JOINT DATA
ARE BASED ON 1/2" WALL THICKNESS
UNLESS NOTED OTHERWISE

FIELD _____ FOR _____
 INS. REPORT NO. _____
 DATE _____

RECEIVED IN THE OFFICE OF THE WATER & POWER RESOURCES DIVISION, U.S. DEPARTMENT OF FORESTS, WASHINGTON, D.C. JUL 13 1965
 RECEIVED IN THE OFFICE OF THE DISTRICT ENGINEER, U.S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, WASHINGTON, D.C. JUL 13 1965

JUL 13 1965
 G. R. McCOMBS
 Chief Engineer



36" DIA. 2' DIA. REINFORCED CONCRETE PILES
 (1) 36" DIA. PILES
 (2) 24" DIA. PILES
 (3) 18" DIA. PILES
 (4) 12" DIA. PILES

36" DIA. REINFORCED CONCRETE PILES
 (1) 36" DIA. PILES
 (2) 24" DIA. PILES
 (3) 18" DIA. PILES
 (4) 12" DIA. PILES

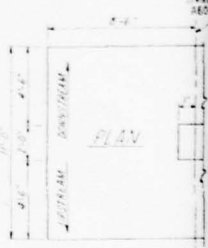
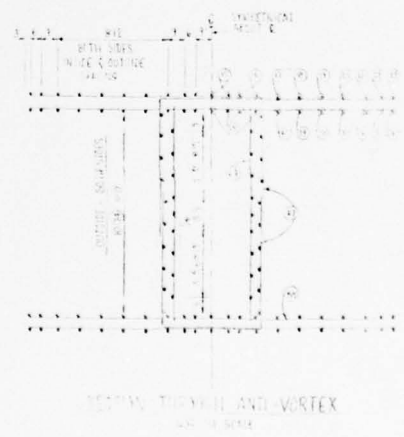
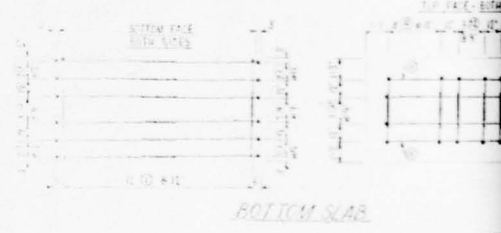
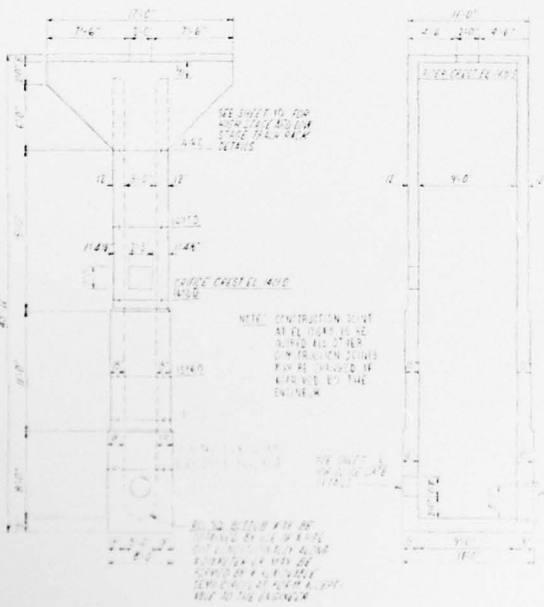
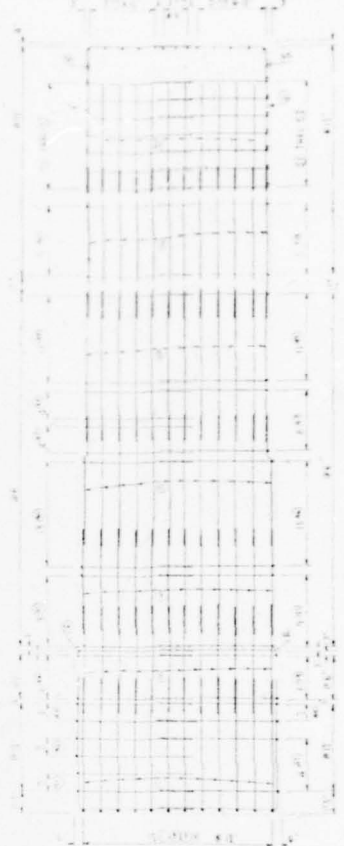
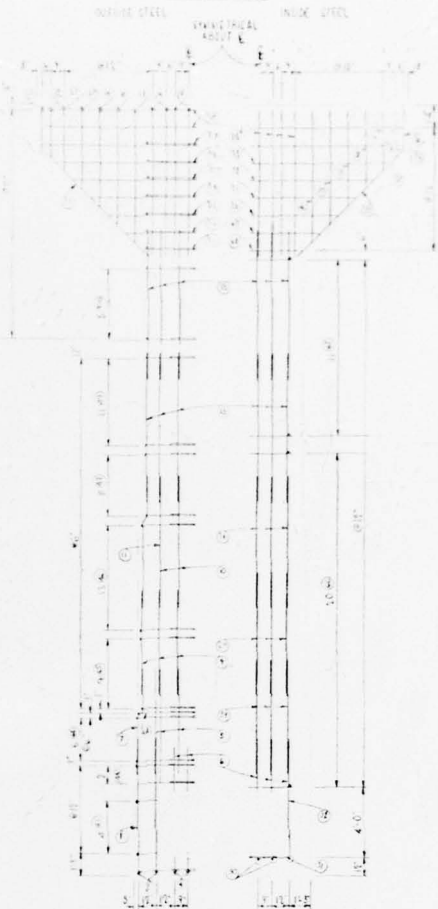
MARSH CREEK WATERSHED
 FLOODWATER RETARDING DAM PA-600
 TIOGA COUNTY, PENNSYLVANIA
 PLAN-PROFILE OF PRINCIPAL SPILLWAY
 U. S. DEPARTMENT OF AGRICULTURE
 SOIL CONSERVATION SERVICE

PHASE I INSPECTION REPORT
 NATIONAL DAM INSPECTION PROGRAM
 KELSEY CREEK DAM
 BOROUGH OF WELLSBORO
 MAIN SPILLWAY AND
 OUTLET WORKS
 AUGUST 1979 PLATE 6

FRONT WALL

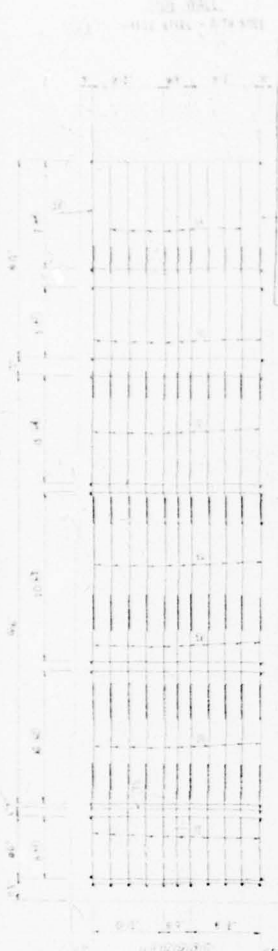
REAR WALL

SIDE WALL



DETAILS OF REINFORCED CONCRETE PIER

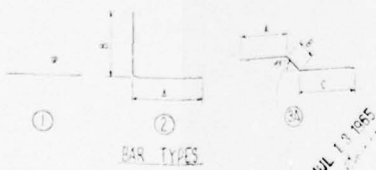
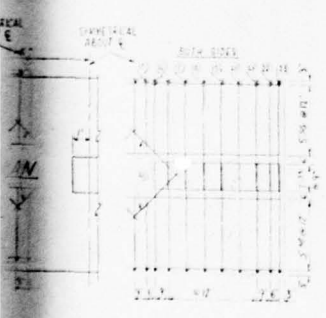
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NO. 96
NO. 97
NO. 98
NO. 99
NO. 100
TOTAL



FILE NUMBER
 RECEIVED IN THE OFFICE OF THE NATIONAL
 RESOURCES BOARD, DEPARTMENT OF AGRICULTURE
 WASHINGTON, D.C. DATE OF RECEIPT

REC'D FOR
 SEE REPORT NO.
 D. S. DANK

NO.	TYPE	LENGTH	WIDTH	THICKNESS	WEIGHT	NO.	TYPE	LENGTH	WIDTH	THICKNESS	WEIGHT
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BAR TYPES
 SEE SHEET 12 FOR GENERAL NOTES

JUL 1 1979
 G. R. HERRICK
 CIVIL ENGINEER

MARSH CREEK WATERSHED
 FLOODWATER RETARDING DAM PA-600
 TOGA COUNTY, PENNSYLVANIA

STRUCTURAL DETAILS

U. S. DEPARTMENT OF AGRICULTURE
 SOIL CONSERVATION SERVICE

Drawn by: R. A. STALTER
 Title: PA-600-P

Date: _____
 Approved by: _____
 Title: _____

Sheet No. 7 of 10

PHASE I INSPECTION REPORT
 NATIONAL DAM INSPECTION PROGRAM

KELSEY CREEK DAM
 BOROUGH OF WELLSBORO

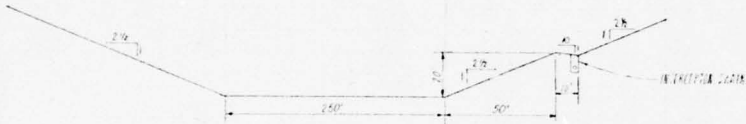
MAIN SPILLWAY RISER

AUGUST 1979

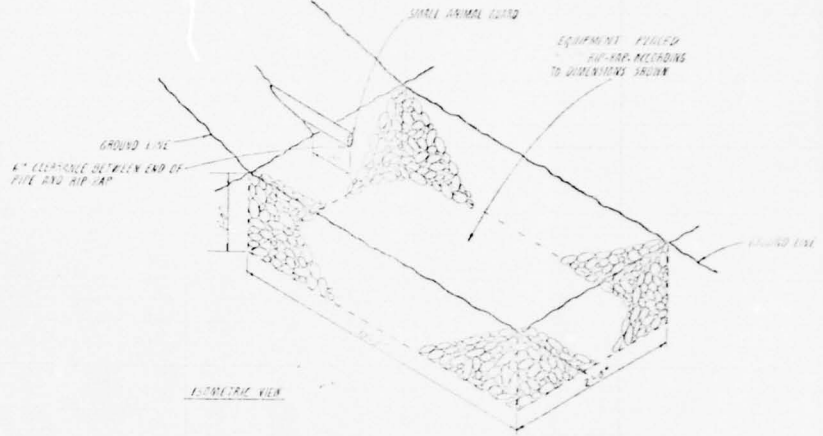
PLATE 7



TYPICAL SECTION OF EMERGENCY SPILLWAY
WITHOUT BERM
LOOKING DOWNSTREAM

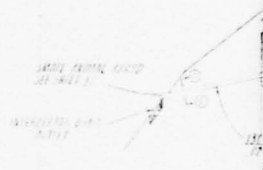


TYPICAL SECTION OF EMERGENCY SPILLWAY
WITH BERM
LOOKING DOWNSTREAM

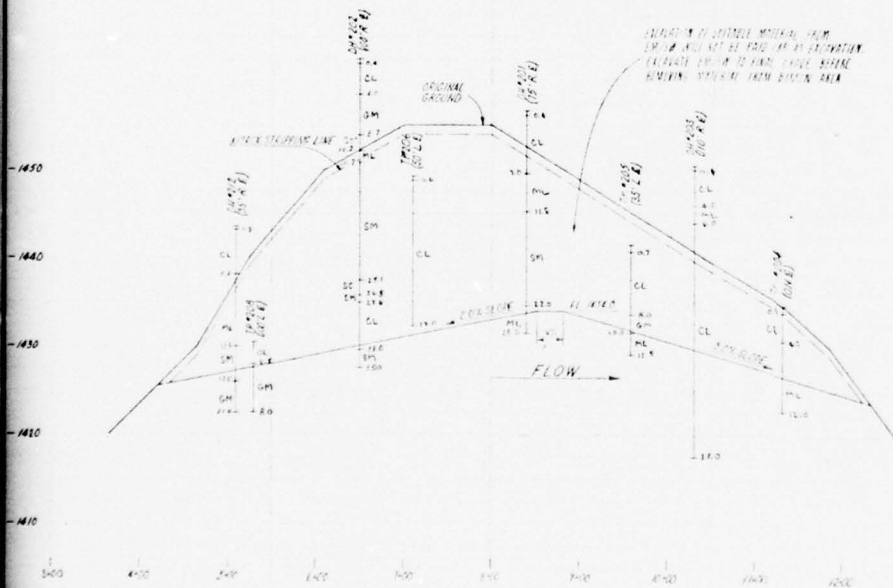


ISOMETRIC VIEW

INTERLOCKING DRAIN OUTLET
10\"/>



2:1	3:1	4:1
2:1	3:1	4:1



PROFILE ALONG E OF EMERGENCY SPILLWAY

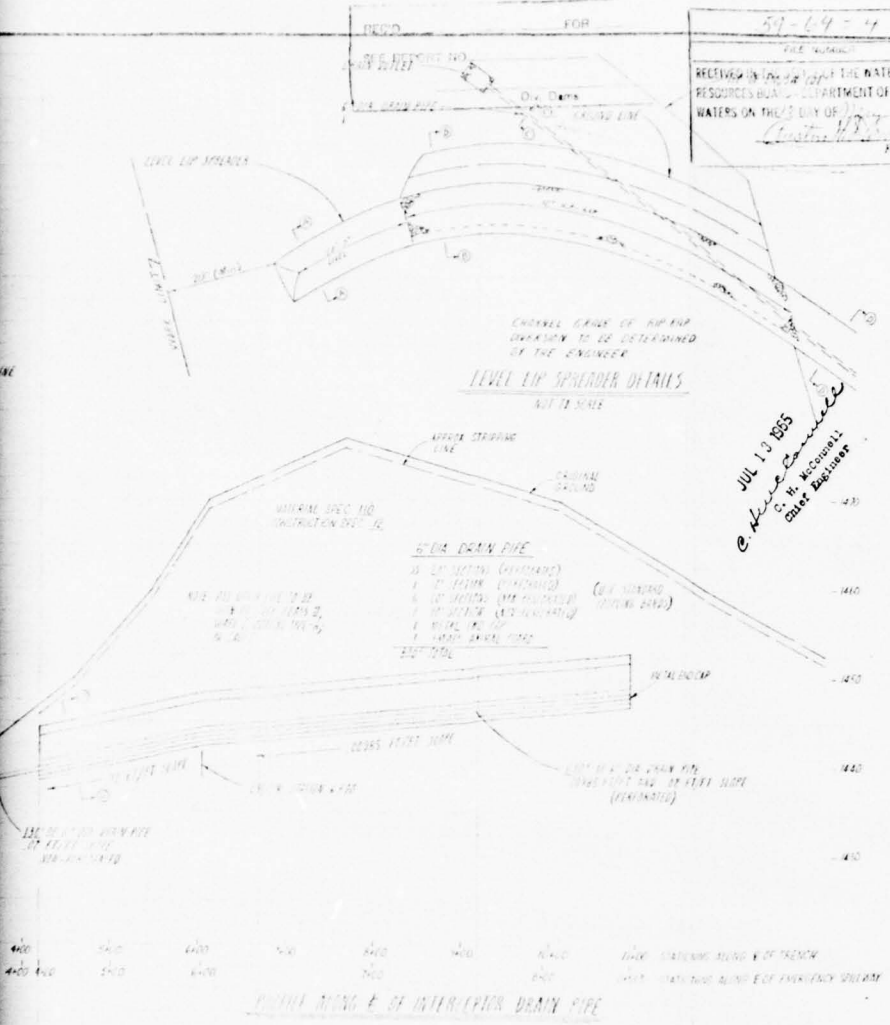
SCALE 1\"/>



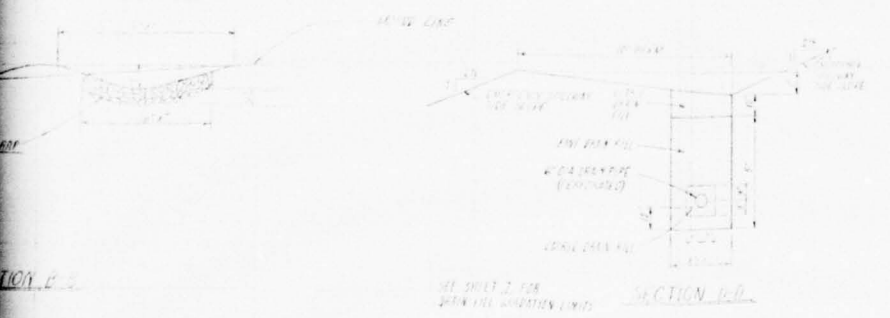
SECTION A-A

SEE SHEETS OF THIS PROJECT FOR
GENERAL NOTES AND SPECIFICATIONS

DESIGN NO.	FOR	59-69-4
DATE		
RECEIVED BY THE STATE DEPT. OF AGRICULTURE & FORESTRY		
RESOURCES DIVISION		
WATERS ON THE 31st DAY OF JULY 1935		
A.D. 1935		



JUL 13 1935
C. H. McConnell
 Chief Engineer



MARSH CREEK WATERSHED FLOODWATER RETARDING DAM PA-600 TIOGA COUNTY, PENNSYLVANIA	
PROFILES AND INTERCEPTOR DRAIN DETAILS	
U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE	
DESIGNED BY <i>Joseph Thomas</i>	CHECKED BY
DATE	

PHASE I INSPECTION REPORT NATIONAL DAM INSPECTION PROGRAM
KELSEY CREEK DAM BOROUGH OF WELLSBORO
AUXILIARY SPILLWAY
AUGUST 1935
PLATE B

2

SUSQUEHANNA RIVER BASIN
KELSEY CREEK, TIOGA COUNTY
PENNSYLVANIA

KELSEY CREEK DAM

NDI ID No. PA-00031
DER ID No. 59-64
SCS ID No. PA-600

BOROUGH OF WELLSBORO
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

AUGUST 1979

APPENDIX A

CHECKLIST - ENGINEERING DATA

CHECKLIST

NAME OF DAM: KELSEY CREEK
 NDI ID NO.: PA-00168 DER ID NO.: 59-64
 SCSD NO.: PA-600

DESIGN, CONSTRUCTION, AND OPERATION
 PHASE I

Sheet 1 of 4

ITEM	REMARKS
AS-BUILT DRAWINGS	AVAILABLE IN SCS FILES.
REGIONAL VICINITY MAP	SEE PLATE 1
CONSTRUCTION HISTORY	BUILT 1965 TO 1967
TYPICAL SECTIONS OF DAM	SEE PLATE 2
OUTLETS: Plan Details Constraints Discharge Ratings	NO DISCHARGE RATINGS

ITEM	REMARKS
RAINFALL/RESERVOIR RECORDS	NONE
DESIGN REPORTS	COMPLETE DESIGN REPORT AVAILABLE IN SCS FILES.
GEOLOGY REPORTS	SEE APPENDIX E
DESIGN COMPUTATIONS: Hydrology and Hydraulics (HAH) Dam Stability (STAB) Seepage Studies	NO SEEPAGE STUDIES FOR HAH SEE APPENDIX C FOR STAB SEE END OF THIS APPENDIX
MATERIALS INVESTIGATIONS: Boring Records Laboratory Field	COMPLETE ANALYSIS IN SCS FILES
POSTCONSTRUCTION SURVEYS OF DAM	NONE OTHER THAN AS-BUILT DRAWINGS

ENGINEERING DATA

ITEM	REMARKS
BORROW SOURCES	RESERVOIR AREA
MONITORING SYSTEMS	NONE
MODIFICATIONS	NONE
HIGH POOL RECORDS	TROPICAL STORM AGNES JUNE 1972 POOL 2' below AUX SPILLWAY CREST
POSTCONSTRUCTION ENGINEERING STUDIES AND REPORTS	NONE
PRIOR ACCIDENTS OR FAILURE OF DAM: Description Reports	NONE

ENGINEERING DATA

ITEM	REMARKS
<p>MAINTENANCE AND OPERATION RECORDS</p>	<p>IN TIOGA COUNTY FILES ONLY MINOR MAINTENANCE OPERATIONS.</p>
<p>SPILLWAY: Plan Sections Details</p>	<p>SEE PLATES 7 & 8</p>
<p>OPERATING EQUIPMENT: Plans Details</p>	<p>DATA AVAILABLE IN SCS FILES.</p>
<p>PREVIOUS INSPECTIONS Dates Deficiencies</p>	<p>1965 by REMINDER - UNDER CONSTRUCTION 1972 - STONE IN OUTLET CHANNEL. 1975 - NO DEFICIENCIES 1977 - NO DEFICIENCIES 1978 - NO DEFICIENCIES</p>

SUMMARY - SLOPE STABILITY ANALYSIS

State Pennsylvania Project Marsh Creek Site PA-600

Date 11-20-64 Analysis Made By T.C.H. & G.N. Checked By T.C.H. & G.N.G.

Method of Analysis Swedish Circle

Location of Material	Found		Found		Emb.		Emb.		Emb.	
	CL		CL		SM		CL		CL or CL-MI	
Sample No.	65W903		65W905		65W910		65W911		65W912	
γ_d	105.7		98.4		121.0		94.5		108.3	
γ_m					132.0		114.5		123.0	
γ_s	130.5		126.0		137.5		122.0		130.0	
γ_b	68.0		63.5		75.0		59.5		67.5	
Condition	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.
ϕ		12.5°	13.5°	14.5°		33.5°		23.0°		23.0°
Tan ϕ		0.222	0.240	0.259		0.662		0.424		0.424
k										
c		1000	1300	1000		150		425		500

UPSTREAM SLOPE			
Trial	Slope	Conditions	Fs
1	3:1	Full draw down - 10' berm - Arc cut from opp side thru * zoned emb only Sat shear values only	1.43
8	3:1	Full draw down - 10' berm - Arc cut from opp side thru * zoned emb only Sat. shear values only	1.47

DOWNSTREAM SLOPE			
Trial	Slope	Conditions	Fs
2	3:1	No drain - No berm - Arc cut from opp side thru * zoned emb only Sat. shear values only	1.55
2A	3:1	Same as # 2 except drain @ 96 = 0.6	2.0
* Emb zoning: CL or CL-MI upstream CL in core SM downstream see sketch.			

From sheet 1 of 5 form 357
 Marsh Creek S. to PA-600
 Pennsylvania

#2

$R=185.0'$

Maximum Section
 Sta 5+70

3:1
 SIM
 (33.50-150)

4:1

CL (530
 -1125)

1440.0

57.8'

$c=114.3'$

126.0'

$b=190.5'$

#1

#8

$R=134.0'$

1434.0

3:1
 CL or CL-ML
 (232.500)

130.0'

100.0'

1401.0

1376.7

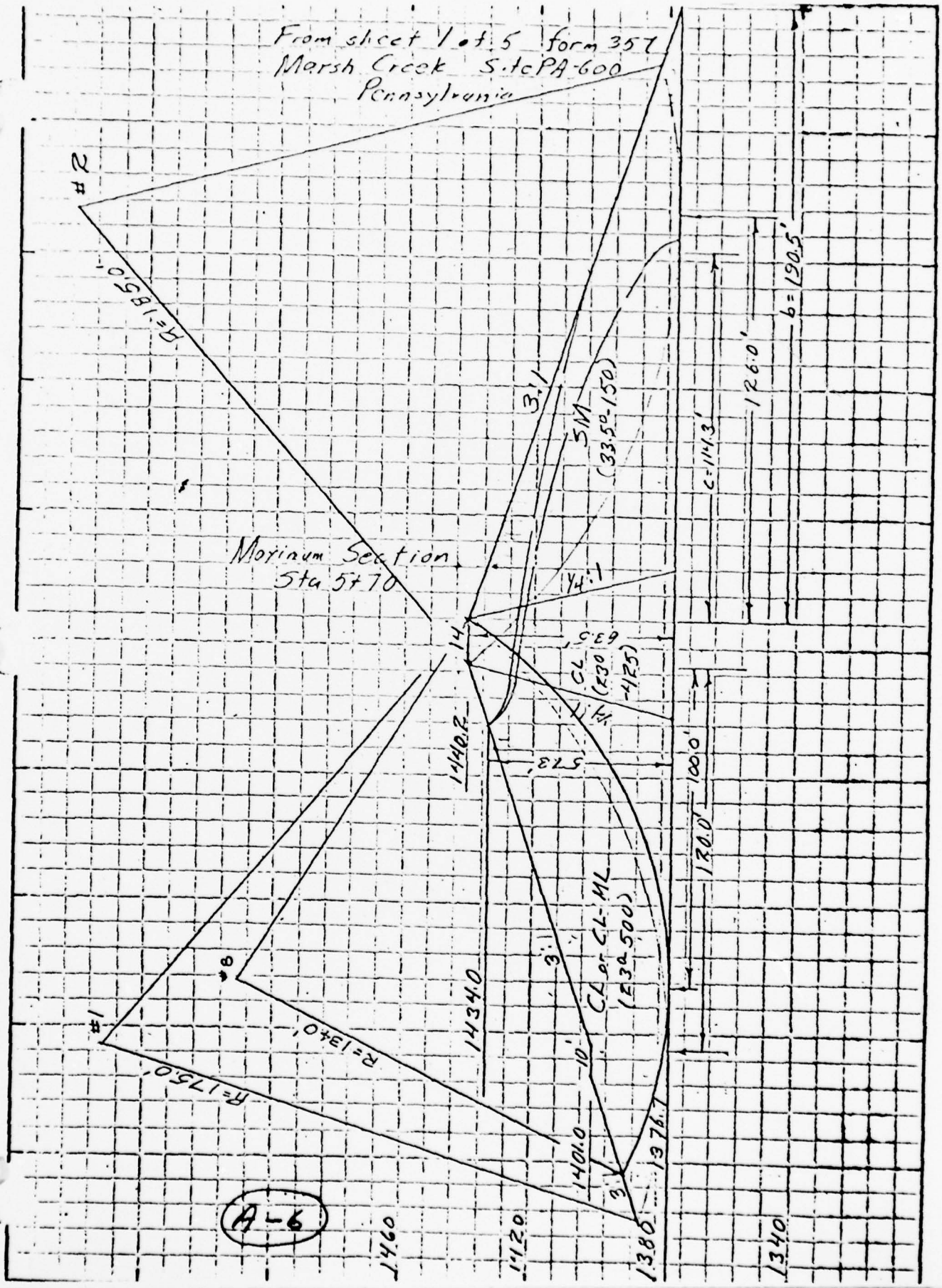
(A-6)

1460

1420

1380

1340



10-58

 SOIL MECHANICS LABORATORY
 SUMMARY - SLOPE STABILITY ANALYSIS

11000 TRAIN SECTION

Sta 5100

State Pennsylvania Project Marsh Creek Site PA-600Date 11-20-64 Analysis Made By ICH J AVL Checked By _____Method of Analysis Swedish Circle

Location of Material										
Sample No.										
γ_d										
γ_m										
γ_s										
γ_b										
Condition	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.
ϕ										
Tan ϕ										
K										
C										

UPSTREAM SLOPE			
Trial	Slope	Conditions	Fs
3A	3:1	Full drawdown - 10' berm @ El. 1401 - Arc From opp sh'd'r Thru Zoned Emb #26' Found. (13 $\frac{1}{2}$ $^\circ$ -1300) - Sat Shear Values	1.75
4A	3:1	Same Conditions As Trial 3A Except The Arc Was Cut To A 34' Depth in The Foundation	1.71
5A	3:1	Same Conditions As Trial 3A Except A 13 Foot Foundation Depth Was Used	1.95
6A	3:1	Same Conditions As Trial 3A Except The Failure Arc Penetrated the Foundation To A 53 ft. Depth	1.70

DOWNSTREAM SLOPE			
Trial	Slope	Conditions	Fs
7D	3:1	No Drain - No Berm - Arc Cut From opp sh'd'r Thru Zoned Emb. And 34' Foundation (13 $\frac{1}{2}$ $^\circ$ -1300)	1.66
8	3:1	No Drain - No Berm - Arc Cut From Same sh'd'r Thru Emb (33 $\frac{1}{2}$ $^\circ$ -150) & 34' Foundation (13 $\frac{1}{2}$ $^\circ$ -1300)	1.52
9	3:1	No Drain - No Berm - Arc Cut From Same sh'd'r Thru Emb (33 $\frac{1}{2}$ $^\circ$ -150) & 26' Foundation (13 $\frac{1}{2}$ $^\circ$ -1300)	1.60
10	3:1	No Drain - No Berm - Arc Cut From Same sh'd'r Thru Emb (33 $\frac{1}{2}$ $^\circ$ -150) & 42' Found. (13 $\frac{1}{2}$ $^\circ$ -1300)	1.64
(A-7)			

To be used to report to field offices data used for slope stability analyses and the results of the analyses. The right side of the form will be used for a sketch of the embankment on which the analyses have been made.

SUSQUEHANNA RIVER BASIN
KELSEY CREEK, TIOGA COUNTY
PENNSYLVANIA

KELSEY CREEK DAM

NDI ID No. PA-00031
DER ID No. 59-64
SCS ID No. PA-600

BOROUGH OF WELLSBORO

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

AUGUST 1979

APPENDIX B

CHECKLIST - VISUAL INSPECTON

CHECKLIST

VISUAL INSPECTION

PHASE I

Name of Dam: KELSEY CREEK County: TIOGA State: PENNSYLVANIA
NDI ID No.: PA-00168 DER ID No.: 59-64
Type of Dam: ZONED EARTHILL Hazard Category: HIGH
Date(s) Inspection: 26 JULY 1979 Weather: INTERMITTENT RAIN Temperature: 65°F
SCS ID No. PA-600
Soil Conditions Moist to Wet
Pool Elevation at Time of Inspection: 1401.0 msl/Tailwater at Time of Inspection: 1375.1 msl


Inspection Personnel:

LINDSEY (SCS) D. EBERSOLE (GFCC)
J. ZAGINAYLO (SCS)
D. WOLF (GFCC)

A. WHITMAN (GFCC) Recorder

EMBANKMENT

Sheet 1 of 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None	
SLOUGHING OR EROSION: Embankment Slopes Abutment Slopes	ERODED AREA 200' LT OF RISER	 <p>20' LONG 12' MINOR - SEE REPORT'S SECTION FROM SOURCE BEFORE STARTING</p>
CREST ALIGNMENT: Vertical Horizontal	VERTICAL - SEE SURVEY DATA FOLLOWING INSPECTION TAKING HORIZONTAL - OK	
RIPRAP FAILURES	None	

EMBANKMENT

Sheet 2 of 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT WITH: Abutment Spillway Other Features	NONE	
ANY NOTICEABLE SEEPAGE	NONE	
STAFF GAGE AND RECORDER	NONE	
DRAINS	NONE	
VEGETAL COVER	GRASS GOOD - ABOUT 3 FEET HIGH	

B-3

OUTLET WORKS

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	About 1/2 FULL NOT INSPECTED	
INTAKE STRUCTURE	Submerged	
OUTLET STRUCTURE	Very minor spalling	
OUTLET CHANNEL	Dredged - in good condition	
EMERGENCY GATE	SCS REPORTS GATE OPENED DURING ANNUAL INSPECTION WITH NO PROBLEMS.	

MAIN
UNGATED SPILLWAY

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Good Condition	Because of location, close inspection not possible.
APPROACH CHANNEL	Reservoir	
DISCHARGE CHANNEL	SEE OUTLET WORKS CONDUIT	
BRIDGE AND PIERS	NONE	

Auxiliary ~~GATED~~ SPILLWAY

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE-SILL EARTHEN	No deficiencies	A →
APPROACH CHANNEL	No deficiencies	GRASS ABOUT 3' HIGH
DISCHARGE CHANNEL	No deficiencies	←
BRIDGE AND PIERS	None	
GATES AND OPERATION EQUIPMENT	None	

INSTRUMENTATION

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None	
OBSERVATION WELLS	None	
WEIRS	None	
PIEZOMETERS	None	
OTHER	N/A	

DOWNSTREAM CHANNEL

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION: Obstructions Debris Other	CLEAR	
SLOPES	FAIRLY STEEP	
APPROXIMATE NUMBER OF HOMES AND POPULATION	AT LEAST 40 IN WELLSBORO ALONE	

RESERVOIR AND WATERSHED

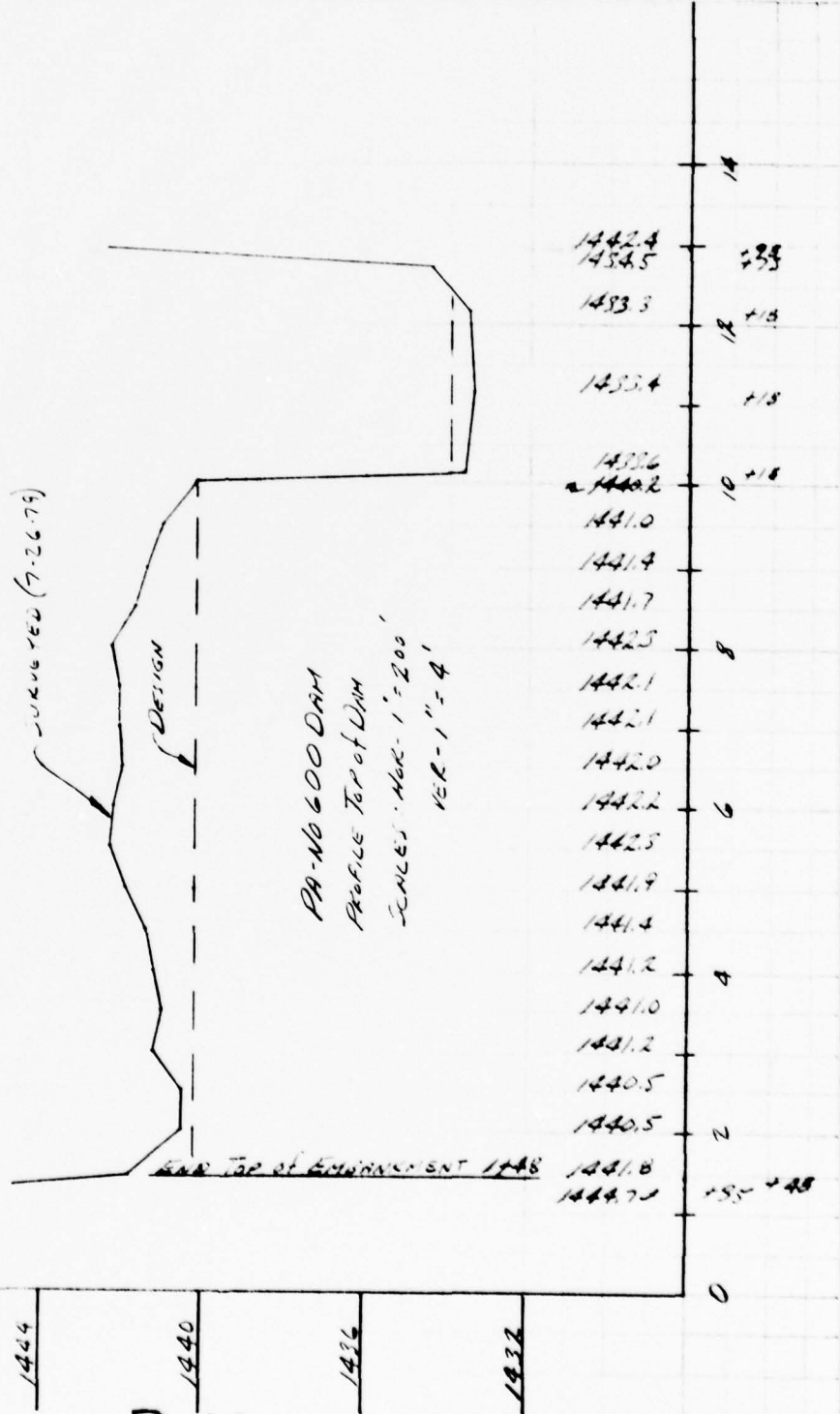
Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	FAIRLY STEEP	
SEDIMENTATION	NO OBSERVED OR REPORTED PROBLEMS	
WATERSHED DESCRIPTION	WOODED ROLLING HILLS WITH MINOR DEVELOPMENT.	

B-9

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

SUBJECT PA 600 DAM FILE NO. _____
KELSEY CREEK SHEET NO. _____ OF _____ SHEETS
FOR _____
COMPUTED BY _____ DATE _____ CHECKED BY _____ DATE _____



B-10

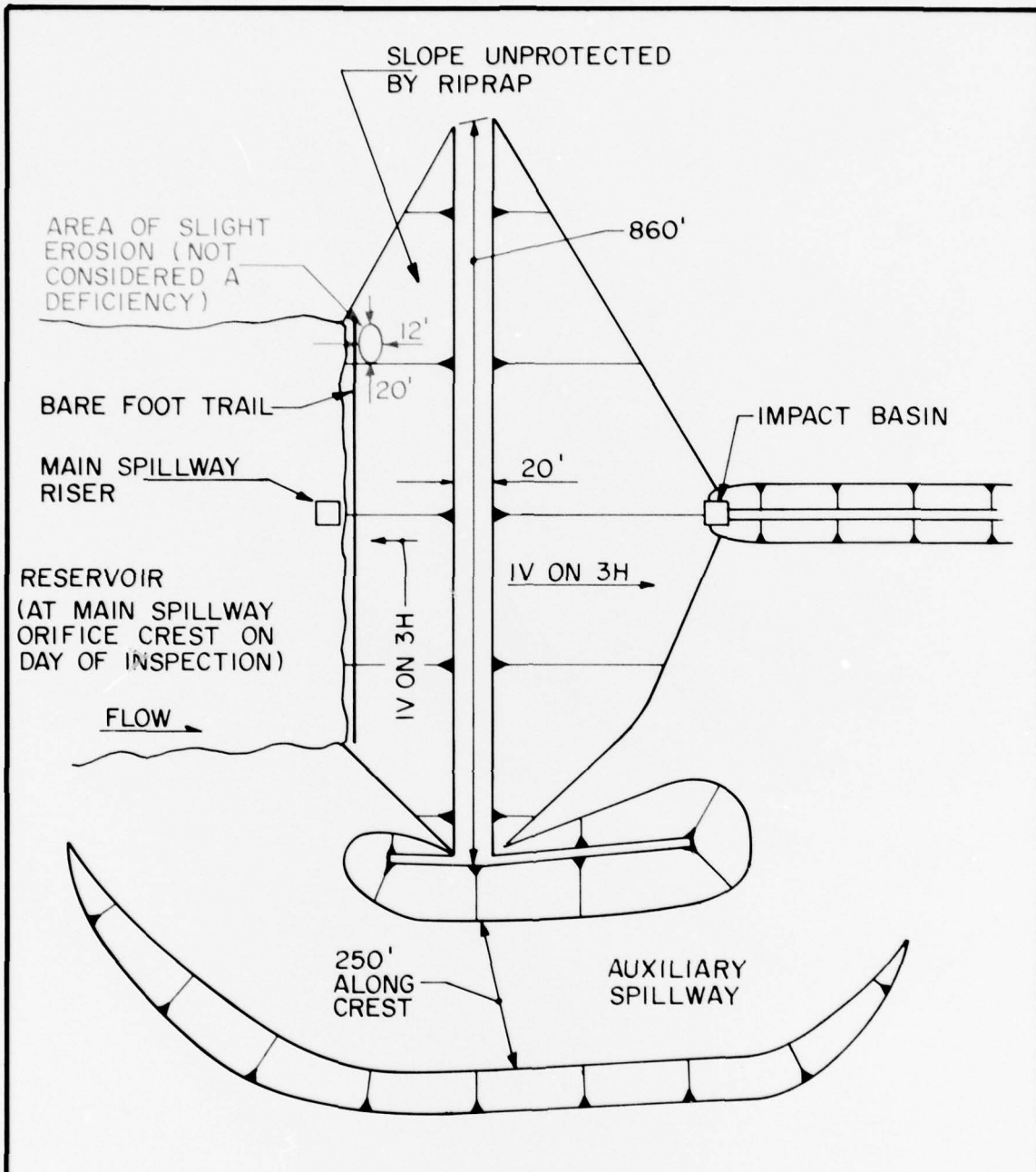
GANNETT FLEMING CORDRY
AND CARPENTER, INC.
HARRISBURG, PA.

SUBJECT PH 600 DAM FILE NO. _____
KELSEY CREEK SHEET NO. _____ OF _____ SHEETS
 FOR _____
 COMPUTED BY _____ DATE _____ CHECKED BY _____ DATE _____



PH-NO-600 DAM
 ENHANCEMENT SECTION
 @ MAIN SPILLWAY
 SCALE 1" = 40'

B-11



NOT TO SCALE

PHASE I INSPECTION REPORT
 NATIONAL DAM INSPECTION PROGRAM
 KELSEY CREEK DAM
 BOROUGH OF WELLSBORO
 RESULTS OF VISUAL INSPECTION
 AUGUST 1979
 PLATE B-1

SUSQUEHANNA RIVER BASIN
KELSEY CREEK, TIOGA COUNTY
PENNSYLVANIA

KELSEY CREEK DAM

NDI ID No. PA-00031

DER ID No. 59-64

SCS ID No. PA-600

BOROUGH OF WELLSBORO

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

AUGUST 1979

APPENDIX C

HYDROLOGY AND HYDRAULICS

APPENDIX C

HYDROLOGY AND HYDRAULICS

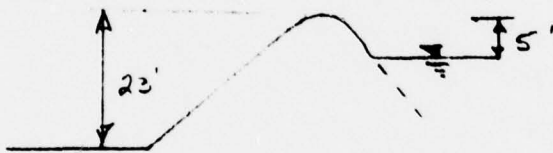
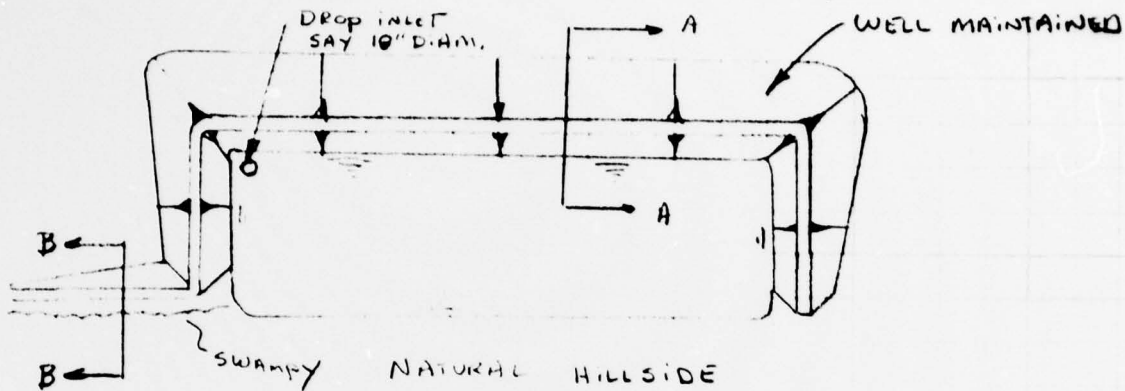
In the recommended Guidelines for Safety Inspection of Dams, the Department of the Army, Office of the Chief of Engineers (OCE), established criteria for rating the capacity of spillways. The recommended Spillway Design Flood (SDF) for the size (small, intermediate, or large) and hazard potential (low,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

- (a) There is a high hazard to loss of life from large flows downstream of the dam.
- (b) Dam failure resulting from overtopping would significantly increase the hazard to loss of life downstream from the dam from that which would exist just before overtopping failure.
- (c) The dam and spillway are not capable of passing one-half of the PMF without overtopping failure.

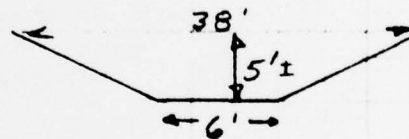
GANNETT FLEMING CORDRY
AND CARPENTER, INC.
HARRISBURG, PA.

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

IMPOUNDMENT IN KELSEY CREEK
DAM WATERSHED: (0.4 MI. UPSTREAM FROM RESERVOIR)



SECTION A



SECTION B

DRAINAGE AREA: 36 ACRES = .056 MI²
NORMAL POOL SURFACE AREA: 5.6 ACRES

$$S_{NORMAL} = \frac{HEIGHT \times NORMAL POOL AREA}{3} = 33.6 \text{ ACRE-FT}$$

TOP OF DAM SURFACE AREA: 6.0 ACRES

TOP OF DAM STORAGE: 62.6 ACRE-FT.

1/13/59

15 FEBRUARY 11 11 11



HYDROGRAPH COMPUTATION FORM

Watershed MARSH CREEK State PA

Structure Site or Sub-area #1 KEISEY

Storm Distribution Curve B Hydrograph Family 1

D. A. 3.14 sq. mi., Pt. Rainfall ^{8.9 X 2.5} 22.3 inches, Aerial Rainfall ^{21.31 X 2} 20.5 inches

R. O. Condition II, R. O. Curve No. 75, Storm Duration or Freq. 6 HR

$T_c = 1.78$ hrs., $Q = 16.98$ inches, $T_p = 0.686$ $T_c = 1.22$, $T_o = 553$ ft.

$T_p^{T_o}$ Computed = 4.53 $T_p^{T_o}$ used: 4 Revised $T_p = 1.38$ hr.

$q_p = \frac{484 A}{\text{Rev. } T_p} = 11.01$ c.f.s. $q_p \times Q = 18,695$ c.f.s.

T (column) = $\frac{t}{T_p} \times \text{Rev. } T_p$ q (column) = $\frac{q_c}{q_p} (q_p Q)$

Check: $Q = \frac{(t)(2q)}{695 A}$

Table 3.21-7 (sheet 25 of 52)

Line No.	$\frac{t}{T_p}$	$\frac{q_c}{q_p}$	T hours	q c.f.s.	Line No.	$\frac{t}{T_p}$	$\frac{q_c}{q_p}$	T hours	q c.f.s.
1	0	0	0	0	21	7.00	.006	9.660	112
2	0.55	.003	0.493	56	22	7.55	.004	10.143	75
3	0.70	.015	0.966	280	23	7.70	.003	10.626	56
4	1.05	.049	1.449	916	24	8.55	.002	11.109	37
5	1.40	.122	1.932	2280	25	8.90	.001	11.592	19
6	1.75	.298	2.415	5571	26	8.75	.000	12.075	0
7	2.10	.528	2.898	9871	27				
8	2.45	.585	3.381	10937	28		.24	7.274	
9	2.80	.518	3.864	9684	29				
10	3.15	.413	4.347	7721	30		$q = 17.00$		
11	3.50	.334	4.830	6244	31		$\% \text{ error} = \frac{0.12}{1.00} = .12\%$		
12	3.85	.273	5.313	5104	32				
13	4.20	.231	5.796	4319	33				
14	4.55	.185	6.279	3459	34				
15	4.90	.128	6.762	2393	35				
16	5.25	.090	7.245	1496	36				
17	5.60	.047	7.728	879	37				
18	5.85	.028	8.211	523	38				
19	6.30	.017	8.694	318	39				
20	6.65	.010	9.177	187	40				

C-3

2-17-64

763-PA-S.

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

SUBJECT SCS FILE NO. _____
FREE BOARD STORM SHEET NO. _____ OF _____ SHEETS
FOR KELSEY CREEK DAM
COMPUTED BY _____ DATE _____ CHECKED BY _____ DATE _____

SCS DATA (6 HR STORM)
RAINFALL = 20.5"
RUNOFF = 16.98"
Q PEAK INFLOW = 10,937 CFS

PMF DATA
SUCQUEHANNA BASIN

DISTRIBUTION

6 HR	118%	INDEX RAINFALL = 22.15" ADJUSTMENT = 99%
12 HR	127	
24 HR	136	
48 HR	142	
72 HR	145	

(FROM HYDROMET 40)

Revised INDEX = $22.15 \times .99 \times .8$ = 17.54"
Hop Brook Factor \uparrow

TOTAL 6 HR RAINFALL = $1.18 \times 17.54 = 20.70''$

As small (e.g. 3.14 mi²) WATERSHEDS ARE ONLY SENSITIVE TO INTENSE (e.g. PEAK) RAINFALL PERIODS, THE SCS 6-HR RAINFALL IS SUFFICIENTLY CLOSE TO THE PMF

SINCE THE INITIAL ABSTRACTION OF 1.0" IS ASSUMED TO HAVE BEEN ABSORBED BY THE EARLY PART OF THE PMF; FOR THE 6-HR PEAK: RUNOFF = $20.70 - 6 \times .05$ INCHES/HR = 20.40". THIS IS SLIGHTLY GREATER THAN THE SCS RUNOFF OF 17.4". HOWEVER, THE PEAK FLOW IS CONSERVATIVE BECAUSE THE UNIT HYDROGRAPH IS CONSERVATIVE.

C-4

MARSH CREEK WATERSHED PA-600

STAGE-DISCHARGE CALCULATIONS 2-18-64 LET

Elev	H ₀	H ₀ ^{1/2}	Q ₀	H _w	H _w ^{3/2}	Q _w	H ₀	Q ₀	Q ₀ + Q _w	Q _c	H ₀
1401.0	0	0	0						0		
1405.6	2	1.41	33.2	Base flow elev = H ^{1/2} = 16 = 68					33.2		
1405.0	4	2	47.0				23.5		47.0		
1408.3	7	2.65	62.3	H ₀ = .83; Base flow elev = 1401.83					62.3		
1410.8	9	3	79.5						79.5		
1415.0	14	3.74	88.0						88.0		
1416.5	16.7	4.09	96	0					96		
1419.0	17.2	4.15	98	0.5	0.354	19.8	36.5	158.5	117.8		
1420.0	18.2	4.27	100	1.5	1.83	102	37.5	160.5	160.5		
1425.0	23.2	4.82	113	6.5	14.71	820 ²²⁶	42.5	171.0	171.0		
1428.0							45.5	177.0	177.0		
1430.0							47.5	181.0	181.0		
1433							50.5	186.0	186.0	0	
1434.76							52.26	190.0	190.0	5	1.76
1435.65							53.15	192.0	192.0	10	2.65
1436.39							53.89	192.5	192.5	15	3.39
1437.04							54.54	194.0	194.0	20	4.04
1438.14							55.64	196.0	196.0	30	5.14
1439.14							56.64	197.0	197.0	40	6.14
1440.00							57.5	199	199	50	7.0
1440.83										60	7.83
1441.0	0.5	0.707	17	Base flow elev							

E C-2

NOTES ADDED
by GFCC:

State
1401.0
1403.8
1405.0
1408.8
1410.8
1415.8
1418.5
1419.0
1420.0
1425.0
1428.0
1435.0
1433.0
1434.76
1
1435.65
1436.39
1437.04
1438.14
1439.19
1440.00
1440.83
1402.3

← ORIFICE CREST

← RISER CREST *

← AUXILIARY SPILLWAY *
CREST

* NOTE:
ELEVATIONS CHANGED
AFTER ROUTINGS
COMPUTED.

3

← EL. 1439.2 = TOP OF DAM *

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

KELSEY CREEK DAM

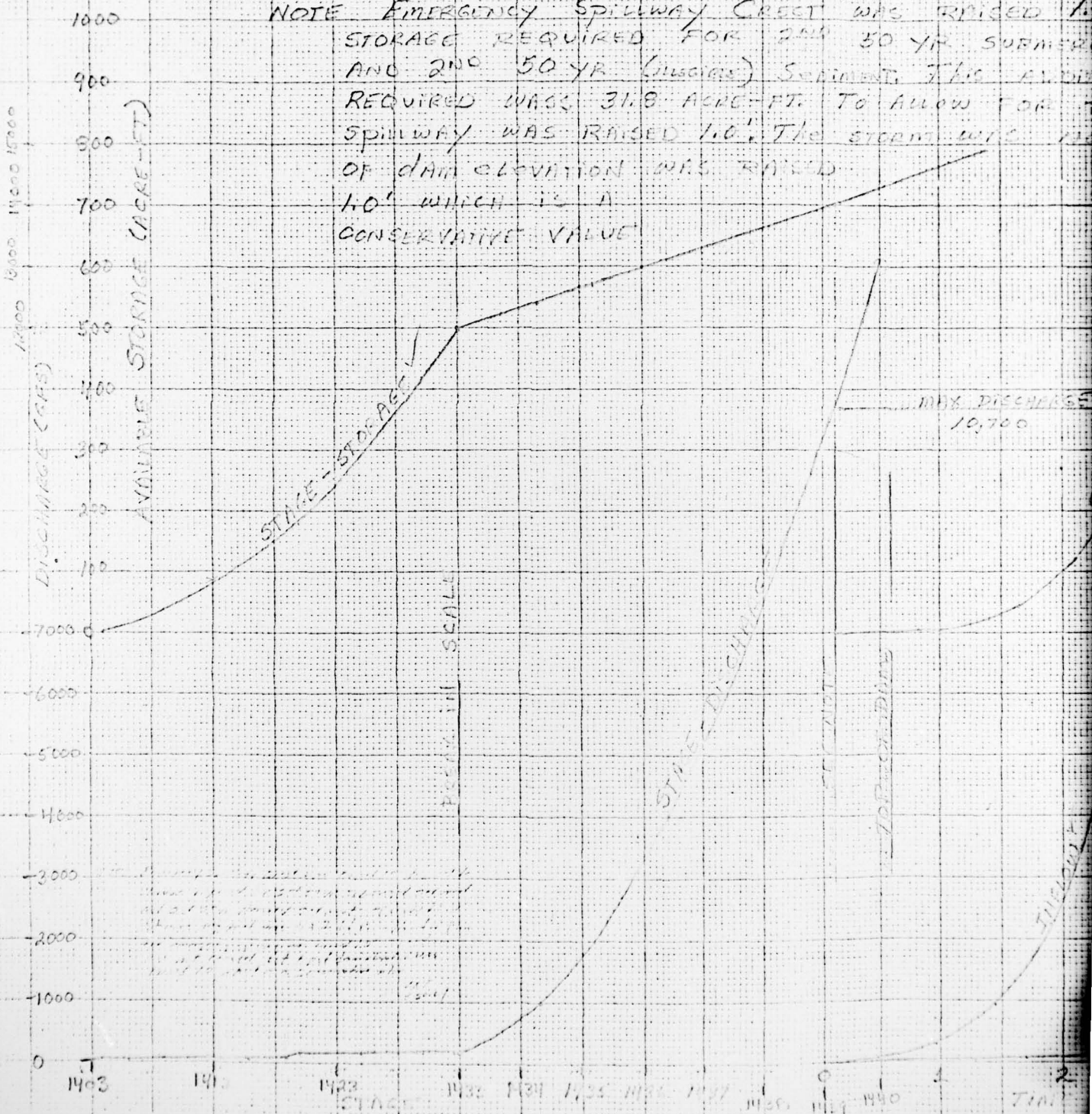
BOROUGH OF WELLSBORO

HYDRAULIC COMPUTATIONS

AUGUST 1979

PLATE C-1

NOTE EMERGENCY SPILLWAY CREST WAS RAISED 1.0' STORAGE REQUIRED FOR 2ND 50 YR SURMERE AND 2ND 50 YR (USGAS) SURMERE. THE AMOUNT REQUIRED WAS 31.8 ACRE-FT. TO ALLOW FOR IT SPILLWAY WAS RAISED 1.0'. THE STORM WAVE OF DAM ELEVATION WAS RAISED 1.0' WHICH IS A CONSERVATIVE VALUE



Handwritten note in the bottom left corner of the graph area, partially illegible due to fading and handwriting. It appears to contain technical details or calculations related to the spillway design.

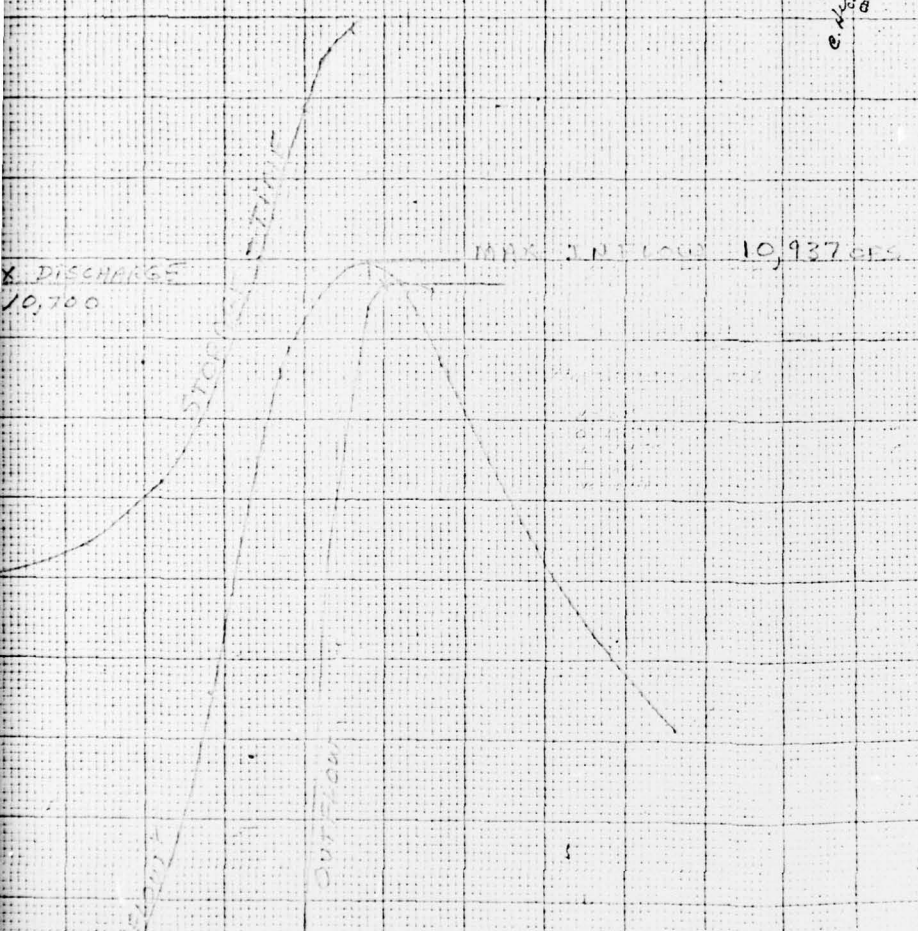
DESIGNED 1.0' TO INCLUDE
SUBMERGED SEDIMENT
AS ADDITIONAL STORAGE.
NOW FOR THIS THE EMERGENCY
WAS NOT REROUTED BUT TOP

60-14 A
FILE NUMBER

RECEIVED IN THE OFFICE OF THE WATER & POWER
RESOURCES BOARD, DEPARTMENT OF FOREST
WATERSON TOWNSHIP OF PENNSYLVANIA, AUG 1979
Christine

HWDO _____ FOR _____
SEE REPORT NO. _____
Div. Dir.

JUL 13 1985
E. A. ...
Chief Engineer



FREEBOARD HYDROGRAPH

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

DESIGNED	DATE	APPROVED BY
DATE		TITLE
TITLE		TITLE
DRAWN BY	SHEET NO.	TOTAL SHEETS

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
KELSEY CREEK DAM
BOROUGH OF WELLSBORO
FREEBOARD STORM ROUTING
AUGUST 1979
PLAT

2
TIAL (HOURS)

B-10

144

1444

1440

1436

1432

0813

207-14-1A
 FILE NUMBER
 IN THE OFFICE OF THE W
 RESOURCES DEPARTMENT
 FOR THE STATE OF
 NEW YORK
 DIVISION OF
 FOREST
 PLANTING
 REPORT NO.
 DATE

MIL 12 1955
 C. K. ...
 Chief Engineer

937 CFS

HYDROGRAPH

RICULTURE SERVICE

PHASE I INSPECTION REPORT
 NATIONAL DAM INSPECTION PROGRAM
 KELSEY CREEK DAM
 BOROUGH OF WELLSBORO
 FREEBOARD STORM ROUTING
 AUGUST 1979 PLATE C-2

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SCS ID No. PA-600

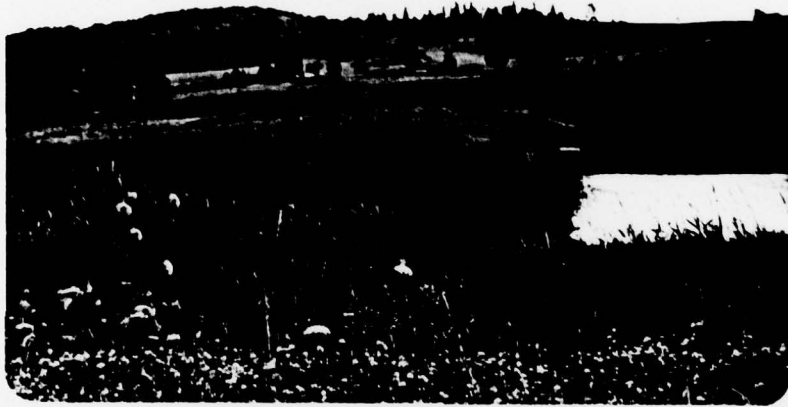
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KELSEY CREEK DAM



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KELSEY CREEK DAM



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APPENDIX E

GEOLOGY

KELSEY CREEK DAM

APPENDIX E

GEOLOGY

1. General Geology. The Damsite and Reservoir are located in Tioga County. With the exception of the southwest corner the entire county was glaciated during the Wisconsin glacial advance. Glacial features such as lakes, marshes, moraines, and terraces are almost lacking in the uplands of Tioga County. However, in the valleys, abundant evidence of glaciation has been preserved, particularly in the valleys of the Tioga and Cowanesque Rivers and along Marsh Creek, Crooked Creek, and Upper Pine Creek. Drainage from glacial lakes in these valleys resulted in what is called the Pine Creek Gorge. A geologic map is presented on Plate E-1.

The rock formations exposed in Tioga County range in age from the Chemung Formation of Upper Devonian age to the Allegheny Formation of Pennsylvanian age. The oldest rocks crop out in three broad anticlinal folds in the north, central, and southern parts of the county. The youngest rocks are exposed in the Blossburg Coal Basin. Most of the plateau remnants are capped by the Pocono Formation, with smaller remnants of the Pottsville Formation. The intermediate slopes are underlain by the Cattaraugus and Oswayo Formations.

The geologic structure of Tioga County displays a series of well defined folds with marked continuity trending east-northeast. Evidence of doming is observed on the Sabinsville, Wellsboro, and Towanda anticlines. In all the domed areas the south limb is appreciably steeper than the north limb. The regional plunge of the folds is to the southwest and generally they decrease in amplitude with distance from the Allegheny Front. Surface evidence of faulting is observed on the south flank of the Sabinsville Anticline in Tioga Township, on the Wellsboro Anticline southeast of Wellsboro, and on the Towanda Anticline in Union Township. Subsurface faults have been noted during drilling of some deep wells in the area.

2. Site Geology. The dam is founded on marine beds of Devonian age. The dam is situated in the Allegheny High Plateau Province. Structure in the area is primarily that of a dissected plateau of moderate relief and gently sloping hills. Rock strata in the area are essentially horizontal. The marine beds are composed chiefly of fine-grained sandstone and siltstone with some interbedded shale. Bedding is generally well developed and thin. Joint systems are usually regularly spaced and dip steeply. The dam is founded on overburden. Excerpts from the design analysis for the foundation materials are attached hereafter.

DETAILED GEOLOGIC INVESTIGATION OF DAM SITES

State Florida County Tiwa Watershed Marsh Creek Subwatershed Kelsey
Site number 21-600 Site group I Structure class C Investigated by _____
(Signature and title) Dated 1964

INTERPRETATIONS AND CONCLUSIONS

The major problem in design and construction on this site appears to be the unstable nature of the material in the upstream portion of the emergency spillway. Ground water in some of the S1 and G1 strata is under pressure and rises when capping horizons are penetrated with drill holes. Some type of drainage probably can be installed to create stable slopes, but such drainage is certain to effect the two domestic water wells located uphill from the spillway. The two wells were described by one of the landowners as being barely adequate under present conditions. Also the wet nature of these S1 and G1 soils will present some construction problems in excavation and in compaction in the fill.

The discharge from several small springs and seeps traverse the surface of the emergency spillway and these small streams have created areas of wet OL soils ranging from 0.5 to 2.0 feet thick on the surface. This condition is related to the water bearing S1 and G1 strata described in the first paragraph.

A second possible problem is a differential settlement between the varved lacustrine deposit and the very dense S1 and G1 interglacial alluvium found in the right abutment. It is hoped that an analysis of this can be made at the Soils Mechanics Laboratory using

three Shelby samples and standard penetration data found in the logs of test holes.

If this differential proves to be a major problem, the structure could be moved downstream on the right side of the valley so that the interglacial alluvium would not be in the foundation.

Borrow material as described under the discussion of the emergency spillway is of three general types: (1) Lacustrine (CL and some ML); (2) Glacial till (CL and some GC); and (3) Interglacial alluvium which consists of interbedded G1, S1 and ML. The lacustrine is being proposed for the core zone of the fill and the till and interglacial alluvium are proposed for the shell portion. All of the materials appear to have adequate properties for use as proposed. Soils Mechanics Tests will be made on samples of each material to verify this conclusion.

The emergency spillway excavation will supply approximately 80% of the needed fill. Similar soils are available in sufficient quantity and can be borrowed from the pool area or between the pool area and the inlet to the emergency spillway.

Another possible problem is the termination of the permeable interglacial alluvium within the foundation. Water from the pool area will have an inlet into this horizon but there is no outlet downstream from the dam. This could cause critical uplift pressure within the foundation. Again the solution for this problem if it exists is to move the right end of the structure downstream so that the interglacial alluvium will be located entirely upstream from the structure.

No problems are anticipated in the construction and operation of the principal spillway. The foundation will have some settlement which can be predicted after testing the undisturbed samples. It should be mentioned here that a hole was drilled at station 5+00--130 ft. upstream but was not logged due to inadequate samples. Some piping was noted during the drilling of hole 302 and the one just mentioned so that the foundation may be disturbed as much as 20 feet away from these holes. It is suggested that the axis of the spillway be moved at least 20 feet left of its proposed location so that the riser will be on undisturbed soil. There will be no other significant differences between the foundation at this new location and the location that was investigated.

