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NATIONAL DAM INSPECTION PROGRAM. COWANS GAP DAM (NDI ID NUMBER. --ETC(U)
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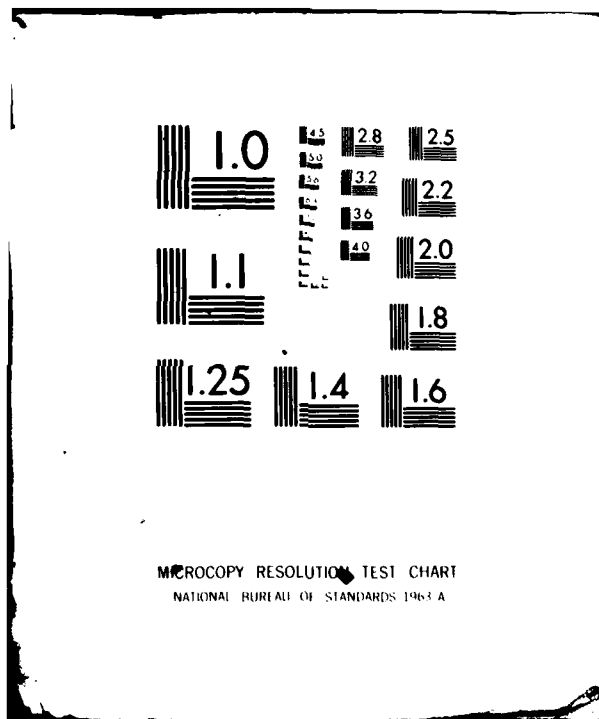
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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase 1 investigations. Copies of these guidelines may be obtained from the Department of the Army, Office of Chief of Engineers, Washington, D.C. 20314.

The purpose of a Phase 1 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 visual observations and review of available data. Detailed investigation and analyses involving topographic mapping, subsurface investigations, material testing, and detailed computational evaluations are beyond the scope of a Phase 1 investigation; however, the inspection is intended to identify any need for such studies which should be performed by the owner.

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 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 the dam depends on numerous and constantly changing internal and external factors which are 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 1 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" (PMF) 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.

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PHASE 1 INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

SYNOPSIS OF ASSESSMENT AND RECOMMENDATIONS

NAME OF DAM:	Cowans Gap Dam
STATE LOCATION:	Pennsylvania
COUNTY LOCATION:	Fulton
STREAM:	Little Aughwick Creek
DATES OF INSPECTIONS:	November 21, 1979, and March 5, 1980, May 4, 1980
COORDINATES:	Lat. 40° 00', Long. 78° 55.5'

ASSESSMENT

Cowans Gap Dam is classified as an "intermediate" size, "high" hazard dam in accordance with U. S. Army Corps of Engineers dam safety criteria.

Based on the evaluation of available design information and visual observations of conditions as they existed on the dates of the field reconnaissances, the general condition of Cowans Gap Dam is considered to be good. A wet zone, located 150 feet downstream from the dam, is not considered significant relative to dam stability at the present time. However, the cause and origin of the wet zone could not be conclusively established by visual observation and review of design documents. Therefore, periodic monitoring of the wet zone is recommended. The presence of eroded footpaths on embankment slopes and wood debris in the spillway channel and splash crib are considered minor deficiencies in need of maintenance.

Guideline criteria recommends a PMF spillway design flood for "intermediate" size, "high" hazard dams. Analysis, utilizing the HEC-I Dam Safety computer program, indicates the spillway can pass a maximum of 61 percent PMF without overtopping the embankment crest. Therefore, spillway discharge capacity is assessed inadequate, but not seriously inadequate, in accordance with guideline criteria.

RECOMMENDATIONS

The following recommendations should be implemented as soon as possible:

1. Develop and institute a flood surveillance, warning, and evacuation plan.
2. Monitor wet zone located downstream from dam embankment. If increased flow quantity or evidence of erosion is observed, immediately notify the Department of Environmental Resources, Dam Safety Division.

Cowans Gap Dam
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3. Repair, mulch, and seed eroded footpaths on embankment slopes and abutments.
4. Locate and periodically monitor observation wells installed in dam embankment.
5. Remove wood and sediment debris from spillway channel and splash crib.



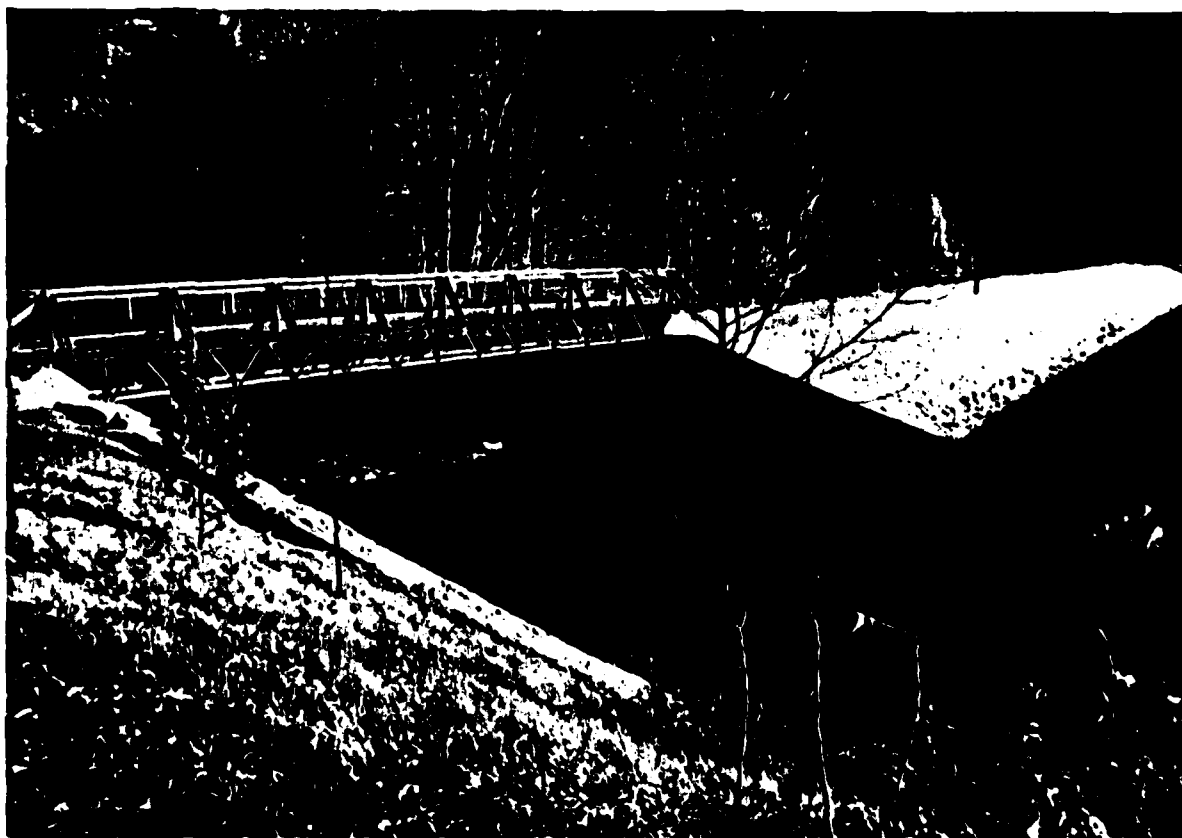
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COWANS GAP DAM



OVERVIEW OF DAM

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PHASE 1 REPORT
NATIONAL DAM INSPECTION PROGRAM
COWANS GAP DAM
NATIONAL I.D. NO. PA 187

SECTION 1
PROJECT INFORMATION

1.1 GENERAL

- A. AUTHORITY: This study was performed pursuant to the authority granted by the National Dam Inspection Act, Public Law 92-367, to the Secretary of the Army, through the Corps of Engineers, to conduct inspections of dams throughout the United States.
- B. PURPOSE: The purpose of this study is to evaluate if the dam constitutes a hazard to human life or property.

1.2 DESCRIPTION OF PROJECT

A. DAM AND APPURTENANCES

1. Embankment: Cowans Gap Dam was constructed as a zoned earthfill structure. The dam embankment is approximately 600 ft. long, has a maximum toe to crest height of 32.3 ft., and a crest width of 12 ft. The upstream embankment slope is protected by rock riprap from crest to toe and has an inclination of 2.5H:1V. The downstream embankment slope inclines at 2H:1V, and riprap covers about 8 ft. of the slope along the embankment toe. (Refer to Field Profile and Embankment Section, A-11 and Plate No. 2.)

2. Seepage Control Provisions: According to design drawings, a cutoff trench, located at the dam centerline, extends 6 ft. below the dam foundation and is backfilled with select soil materials. The trench is continuous from the right abutment to the spillway channel.

According to design drawings, the concrete spillway weir extends 7 ft. below its crest to form a cutoff wall across the spillway channel. Two additional concrete cutoff walls were constructed across the spillway channel. These walls are located 40 ft. and 130 ft. downstream from the weir. (Refer to Plate Nos. 1 and 6A.)

3. Flood Discharge Facilities: Flood discharge facilities consist of an ungated, 60 ft. wide spillway channel and a 30 in. corrugated metal reservoir drain conduit controlled by a sluice gate.

The spillway channel is located at the left (west) dam abutment and consists of a 50 ft. long, concrete approach channel, a round-crested concrete weir, a 220 ft. grouted stone spillway channel, and a 40 ft. square splash crib. (Refer to Plate Nos. 1 and 1A.)

The reservoir drain conduit is located about 170 ft. from the right (east) dam abutment. The 30 in. dia. corrugated metal drain conduit is encased in concrete and extends 112 ft. to a grouted stone headwall at the downstream embankment toe.

- B. LOCATION: Cowans Gap Dam is located in Cowans Gap State Park, Fulton County, Pennsylvania, approximately 6 miles northeast of McConnellsburg. The dam was constructed across the south branch of the Little Aughwick Creek, a northward flowing tributary of the Little Aughwick Creek and the Juniata River.
- C. SIZE CLASSIFICATION: The dam has a maximum (top of dam) storage capacity of 1,030 ac.-ft. and a toe to crest height of 32.3 ft. Based on maximum storage capacity, the dam is classified as an "intermediate" size structure.
- D. HAZARD CLASSIFICATION: Cowans Gap Dam is classified as a "high" hazard structure. In the event of dam failure approximately eight (8) inhabited structures located within an 8.6 mile downstream channel reach would be subject to substantial damage and loss of life. Additional property damage would be expected to occur to state and township roads and bridges.
- E. OWNERSHIP: Cowans Gap Dam is owned by the Commonwealth of Pennsylvania. As a State Park facility, its operation and maintenance are the responsibility of the Bureau of State Parks. All correspondence concerning maintenance and operation procedures should be directed to the Department of Environmental Resources, Office of Resources Management, Bureau of Operations, P. O. Box 1467, Harrisburg, PA 17120.
- F. PURPOSE OF DAM: The dam was constructed for use as a recreational facility and to a lesser extent to provide a limited water supply for fire fighting purposes.
- G. DESIGN AND CONSTRUCTION HISTORY: The dam was designed by the Pennsylvania Department of Forests and Waters and was constructed by the Civilian Conservation Corps in 1936. The original design plan included the construction of a wooden foot bridge between the embankment crest and gate tower to provide access to the sluice gate and lift mechanisms. The foot bridge was removed for the safety of park users. A foot bridge, located across the spillway channel at the embankment centerline, was designed by The Neilan Engineers, Inc., Somerset, Pennsylvania, in 1963. (Refer to Plate No. 5.) Reportedly the bridge was constructed in the mid-1960's, however, the exact date is unknown.
- H. NORMAL OPERATING PROCEDURE: Cowans Gap Dam normally operates as an uncontrolled structure with the reservoir drain sluice gate closed. Pool elevation is maintained at El. 1220.0 by the concrete weir of the spillway channel.

1.3 PERTINENT DATA

A.	<u>DRAINAGE AREA</u>	5.3 sq. mi.
B.	<u>DISCHARGE AT DAM FACILITY</u>	
	Maximum discharge at dam facility	Unknown
	Maximum ungated spillway channel capacity	5,480 cfs
C.	<u>ELEVATION (FEET ABOVE MSL)</u>	
	Constructed top of dam	E1. 1228.8
	Spillway channel weir crest	E1. 1220.0
	Normal pool	E1. 1220.0
	Maximum tailwater	Unknown
	Invert of reservoir drain inlet	E1. 1200.0+
	Invert of reservoir drain outlet	E1. 1198.0+
	Streambed at dam centerline	E1. 1196.5+
D.	<u>RESERVOIR LENGTH</u>	
	Length of maximum pool	0.8 mi.
	Length of normal pool	0.6 mi.
E.	<u>STORAGE CAPACITY</u>	
	Constructed top of dam	1030 ac.-ft.
	Spillway channel crest	500 ac.-ft.
	Normal pool	500 ac.-ft.
F.	<u>RESERVOIR SURFACE</u>	
	Constructed top of dam	68 acres
	Spillway crest	54 acres
	Normal pool	54 acres
	Sediment pool	Unknown
G.	<u>DAM EMBANKMENT</u>	
	Type	Zoned earthfill
	Length	600 ft.
	Height	32.3 ft.
	Crest width	12 ft.
	Side slopes	
	Upstream	2.5H:1V
	Downstream	2H:1V
	Impervious core	Yes
	Core cutoff trench	Yes
	Grout curtain	None

H. SPILLWAY CHANNEL

Type

Grouted stone channel with
round-crested concrete weir

Cross section

Rectangular

Width

60.0 ft.

Crest elevation

1,220.0 ft.

Gate

None

Length of channel

220 ft.

Sidewall height above weir crest

9.4 ft.

I. RESERVOIR DRAIN

Type

30 in. dia. corrugated
metal pipe

Conduit length

112 ft.

Slope

1.8 percent

Gate

Sluice gate located in
upstream section of intake
tower

SECTION 2 ENGINEERING DATA

2.1 DESIGN

A. DATA AVAILABLE: The following available data was obtained from the Pennsylvania Department of Environmental Resources, Dam Safety Division, Harrisburg, Pennsylvania.

1. Hydrology and Hydraulics: No design reports were available for Cowans Gap Dam.
2. Embankment: Design drawings were prepared by the Pennsylvania Department of Forests and Waters from 1934 to 1936. They include plans, profiles, sections, and test pit logs.
3. Appurtenances: The drawings identified above include plan, profile, and section views of the reservoir drain conduit, gate tower, spillway channel, and splash crib. A foot bridge design drawing, prepared by The Neilan Engineers, Inc., Somerset, Pennsylvania, in June 1963, was also available.

B. DESIGN FEATURES: Illustrations of principal design features are shown on Plate Nos. 1 through 6A.

1. Embankment: The embankment clay core, located at dam centerline, tapers on a 1H:3.5V slope from a base of varied width to a 10 ft. width at the top (3 ft. below the dam crest). Upstream and downstream embankment shells are constructed of clay, sand, and gravel soil mixtures. Riprap on the upstream slope is approximately 18 in. thick and is underlain by a 6 in. gravel blanket. On the downstream slope, riprap covers about 8 ft. of the slope along the embankment toe.

According to test pit logs, the zoned earthfill embankment rests on hard yellow clay and gravel west of the original streambed and on red clay and shale on the east side.

2. Seepage Control Provisions: According to the design drawings, a cutoff trench was constructed as a continuation of the embankment core with a bottom width of 12 ft. and 1.5H:1V side slopes. The cutoff trench apparently extends to impervious material. The gravel zone of the downstream embankment toe has a 20 ft. base in cross section and inclines on a 1H:2V slope against the adjacent soil zone.

Sand and gravel filter drains have been constructed along both spillway channel sidewalls. The filter drains extend

to the depth of the channel floor, where 6 in. dia. clay pipes with open joints were installed to collect seepage and to divert it to the downstream endwalls of the spillway channel.

3. Flood Discharge Facilities: Details of the spillway channel and reservoir drain conduit are shown on Plate Nos. 1, 1A, 2, 6, and 6A.

The spillway channel consists of a round-crested weir (contrary to the trapezoidal weir shown on Plate 1A), an open channel, and a splash crib. Grouted stone sidewalls are 9.4 ft. high at the weir and extend the full length of the approach and exit spillway channels. The 50 ft. long, concrete approach channel has been constructed at right angles to the embankment centerline contrary to a skewed alignment shown on Plate No. 1. According to design drawings, the grouted stone spillway channel floor is underlain by a 6 in. concrete slab and gravel blanket. No steel reinforcement is shown. The spillway channel extends 220 ft. downstream from the weir crest on an approximate grade of 7 percent and tapers to a 40 ft. width at the splash crib. The 40 ft. square splash crib was constructed with logs and stone and has riprap banks on a 2H:1V side slope. (Refer to Plate No. 1A.)

According to design drawings, the 30 in. reservoir drain conduit has a 1 ft. thick concrete encasement and three anti-seep collars spaced at 15 ft. intervals upstream from the embankment centerline. The concrete collars extend 1 ft. outward from the encasement. The concrete collar located at dam centerline extends 1 ft. below the cutoff trench. (Refer to Plate No. 2.) The reservoir drain conduit is supported by grouted stone through the embankment core and by natural ground through embankment shell sections.

Flow through the drain conduit is controlled by an inlet sluice gate located about 50 ft. upstream from the dam centerline inside a grouted stone gate tower. Manual lift mechanisms used to raise and lower the sluice gate are also housed in the gate tower. Interior walls of the gate tower are lined with mortar. A trashrack with 6 in. square openings was installed to protect the tower orifice, located 5 ft. upstream from the sluice gate.

Access to the interior of the gate tower is made through a 5 ft. square opening at the top. This opening is normally covered by wooden planks. Access to the top of the tower is made by use of a portable extension ladder.

Flow from the reservoir drain exits at a grouted stone headwall at the downstream toe of the embankment. Riprap has been placed on the floor and side slopes of the trapezoidal-shaped channel for a distance of 30 ft. downstream from the headwall.

2.2 CONSTRUCTION: Field observations indicate that the dam was constructed in general accordance with available design drawings. There is no record of any additional modifications made to the dam after construction of the spillway foot bridge in the 1960's.

2.3 OPERATION: The Commonwealth of Pennsylvania, Bureau of State Parks, is responsible for the operation of Cowan's Gap Dam. The dam is generally operated as an uncontrolled structure, and no performance records are maintained. The only operational feature is the manually-operated sluice gate, used to draw down the reservoir. The gate was not operated during the field reconnaissances, but was reported to be operational. According to the park superintendent, the gate is exercised biannually.

2.4 EVALUATION

- A. AVAILABILITY: All available construction information and drawings were provided by the Pennsylvania Department of Environmental Resources, Dam Safety Division.
- B. ADEQUACY: The construction drawings and design data provided are reasonably documented and are considered adequate to evaluate the dam and appurtenant structures in accordance with the scope of a Phase 1 study. Based on the review of this data, the dam and appurtenant structures are considered to have been designed in general conformance with accepted engineering practice.
- C. VALIDITY: At this time, there is no observable evidence or reason to question the validity of the available construction information and drawings with the exception of those changes previously noted.

SECTION 3
VISUAL INSPECTION

3.1 FINDINGS

A. GENERAL: The on-site reconnaissance of Cowan's Gap Dam consisted of:

1. Visual observation of the earth embankment, abutments, and spillway channel.
2. Visual examination of exposed portions of the reservoir drain conduit, gate tower, spillway foot bridge, reservoir, and downstream channel.
3. Visual search for hazardous conditions and safety deficiencies.
4. Stadia survey of relative elevations along the embankment crest centerline, spillway weir, and across embankment slopes.
5. Evaluation of the downstream hazard potential.

Visual surveys were performed during periods when reservoir and tailwater were at normal pool levels. An observation check list and field sketch are given in Appendix A. Specific observations are illustrated in photographs of Appendix C.

B. EMBANKMENT

1. Embankment Surface: The downstream embankment slope has a dense grass covering and hand-placed riprap covering about 8 ft. of the slope along the embankment toe. Eroded footpaths were observed at the right abutment, 300 ft. west of the right abutment, and 10 ft. east of the right spillway channel sidewall. Field survey measurements indicate the downstream slope is inclined 2H:1V, whereas the riprap-covered upstream slope is inclined 2.5H:1V. A sand and gravel access road extends along the dam crest over the full embankment length. The access road is frequently used as a footpath by park visitors and campers.
2. Wet Zone: A shallow depression with ponded water was observed about 150 ft. from the downstream embankment toe in the vicinity of the original streambed. This wet zone has been observed and monitored by the Park Superintendent for at least 10 years. During this period its size has remained constant, and outflow from the area has been observed only in the springtime.

C. APPURTENANT STRUCTURES

1. Spillway Channel: The concrete weir and approach channel appear to be structurally sound. No significant cracking or spalling was observed on exposed concrete surfaces. The grouted stone channel floor and sidewalls also appeared to be in good condition.

Wood debris was observed in the spillway channel. The wood debris is not considered to significantly affect hydraulic performance or structural stability of the spillway channel at the present time. Reportedly, debris is removed periodically by park maintenance personnel.

2. Reservoir Drain: The exposed sections of the grouted stone gate tower appeared to be in good condition. The reservoir drain sluice gate and lift mechanisms were not operated during the field reconnaissances, but they were reported to have been exercised by Park personnel about two weeks before the November field reconnaissance. The reservoir drain inlet was submerged and could not be observed. The 30 in. drain pipe was rusted at the outlet but appears to be structurally sound at the present time.
3. Observation Wells: An effort was made to locate and monitor the previously abandoned observation wells installed in the dam embankment. Observation wells numbered 1, 2, 3, 4, 5, 9, 10, and 12 were located and an attempt made to remove the threaded cap covers with pipe wrenches. Cap covers were rusted tight and could not be removed. Observation wells numbered 6, 7, 8, and 11 could not be located and are believed buried under embankment vegetation cover and/or fill.

- D. RESERVOIR AREA: Reservoir slopes are gentle to moderate and are predominately vegetated by forest. State Park shoreline facilities include picnic and camping areas and a beach for swimming. Reservoir banks are generally well vegetated with trees and grasses. Some surface erosion caused by foot traffic of park users was observed but no evidence of significant slope instability was discernible during the field reconnaissances. Significant amounts of sediment from stream bank erosion were observed at the lake inlet. Reportedly, this erosion was initiated by storm runoff from Hurricane Agnes (June 1972) and has persisted with succeeding storms. In 1977, sediment was removed in the vicinity of the spillway approach channel.

- E. DOWNSTREAM CHANNEL: The streambed of the south branch of the Little Aughwick Creek is cobble-lined downstream from the dam. Stream banks are vegetated with trees and brush and appear stable. The splash crib discharges into a 40 ft. wide channel that narrows to 25 ft. at a point 6,000 ft. downstream from the dam. Approximately 8 inhabited structures are located within an

estimated 10 ft. elevation range above the streambed in the 8.6 mile channel reach between the dam and the point of confluence with the Little Aughwick Creek.

3.2 EVALUATION

A. EMBANKMENT

1. Embankment Surface: In general, the dam embankment is adequately maintained and appears to be in good condition. The eroded footpaths on the downstream embankment slope and junctions are surficial deficiencies and are not considered to represent a significant hazard to the dam. However, remedial repairs should be made as soon as possible.
2. Wet Zone: The cause and origin of the ponded water located downstream from the dam could not be conclusively determined by visual observation and review of the design drawings. However, at the present time this condition does not appear to represent a significant hazard to the dam. Periodic monitoring of the wet zone by the dam owner is recommended and adverse changes in conditions should be reported immediately to the Department of Environmental Resources, Dam Safety Division, Harrisburg, Pennsylvania.

- B. APPURTENANT STRUCTURES: Spillway channel, reservoir drain, and flow control structures appeared to be functioning as designed and are considered to be in good condition.

SECTION 4 OPERATIONAL FEATURES

- 4.1 PROCEDURE: The reservoir level is normally maintained at El. 1220.0 by passage of base flow over the round-crested weir of the spillway channel. Since the dam routinely operates as an uncontrolled structure, a dam tender is not required. The only control feature of the dam is a sluice gate used to regulate the reservoir drain conduit. This gate is infrequently operated, and is normally closed. Access to the gate tower is made with a portable extension ladder, leaned against the tower and rested on the upstream embankment slope.
- 4.2 MAINTENANCE OF DAM: Dam embankment and appurtenant structures are maintained by the Pennsylvania Bureau of State Parks. Normal maintenance usually includes mowing the downstream embankment slope, applying seed and fertilizer, servicing the gate and lift mechanisms, and removing debris from the spillway channel. Maintenance is reportedly performed on an "as-needed" basis.
- 4.3 INSPECTION OF DAM: Inspections of the dam are conducted monthly by the Cowans Gap State Park staff and annually by the Bureau of Operations. Inspections generally consist of visual observations of the embankment and appurtenant structures and making repair recommendations.
- 4.4 MAINTENANCE OF OPERATING FACILITIES: The reservoir drain sluice gate is the only operational feature of the dam. This gate is normally inspected and exercised biannually by State Park personnel. The sluice gate was found closed and was not operated during field reconnaissances made prior to this report. However, the gate is reported to have been exercised by Park personnel two weeks before the November field reconnaissance.
- 4.5 WARNING SYSTEM: The Park Superintendent reportedly monitors the dam facility during periods of unusually heavy rainfall and alerts Civil Defense authorities as required. However, no formal flood warning plan is presently in effect.
- 4.6 EVALUATION: With the exception of not having a formal flood warning plan, the current operational and maintenance procedures at Cowans Gap Dam are considered to be adequate. A formal flood warning and evacuation plan is needed for the protection of park users and downstream residents.

SECTION 5
HYDROLOGY/HYDRAULICS

5.1 EVALUATION OF FEATURES

- A. DESIGN DATA: The Cowans Gap Dam watershed has an area of approximately 3,400 acres and ranges in topographic relief from normal pool El. 1220 to El. 2450. Watershed cover complex consists predominately of forest, with little open pasture.

At normal pool, Cowans Gap Dam impounds a reservoir with a surface area of 54 acres and a storage volume of about 500 ac.-ft. Top of dam storage capacity is approximately 1,030 ac.-ft.

- B. EXPERIENCE DATA: Local rainfall amounts have been measured at the State park by a precipitation gauge since 1968. Readings are made every 24 hours, and records are kept at the park office.

Reservoir stages are not routinely measured, and stage records are not kept.

Locally recorded rainfall of 6.0 inches in 18 hours during Tropical Storm David (September 1979) reportedly produced a reservoir stage about 2 ft. above normal pool. There is no report of the dam embankment ever having been overtopped.

As previously stated, Cowans Gap Dam is classified as an "intermediate" size, "high" hazard dam. According to guidelines established by the U. S. Army Corps of Engineers, the required spillway design flood (SDF) for this dam facility is the Probable Maximum Flood (PMF).

The PMF inflow hydrograph for Cowans Gap Dam was modeled using the HEC-1 Dam Safety Version computer program. This hydrograph was routed through the reservoir and dam spillway and produced a calculated PMF peak outflow rate of 9,364 cfs. Computer input data and summary of output are presented in Appendix D.

- C. VISUAL OBSERVATIONS: No serious deficiencies or other adverse conditions were observed during the field reconnaissances that would significantly reduce spillway discharge capacity or prevent the channel from functioning as designed.
- D. OVERTOPPING POTENTIAL: Various percentages of PMF were routed through the reservoir to estimate the percent PMF outflow that the spillway can adequately pass without overtopping the dam embankment. Computer analyses indicate that the spillway channel can hydraulically pass a maximum of 61 percent without overtopping. The analyses also indicate that Cowans Gap Dam is overtopped for a period of 5.75 hours with a maximum depth of 2.75 ft. for 100 percent PMF conditions.

- E. ADEQUACY OF SPILLWAY CHANNEL: Spillway adequacy was evaluated in accordance with procedures and guidelines established by the U. S. Army Corps of Engineers for Phase 1 hydraulic and hydrologic studies. The recommended spillway design flood (SDF) is 100 percent PMF.

Data previously developed in the overtopping analysis indicates the spillway channel has a maximum discharge capacity of 5,480 cfs, or about 61 percent PMF. Therefore, the spillway channel is assessed as inadequate, but not seriously inadequate.

- F. DOWNSTREAM CHANNEL: Outflow from the spillway channel is discharged into the natural stream channel of the south branch of the Little Aughwick Creek about 220 ft. downstream from the centerline of the dam embankment. The creek has a natural channel gradient of approximately 1.5 percent and a width varying between 40 ft. and 25 ft. The creek meanders approximately 8.6 miles to its confluence with the Little Aughwick Creek, about 2 miles downstream from Burnt Cabins, Pennsylvania. Approximately eight (8) inhabited structures, located in the flood plain of the south branch of the Little Aughwick Creek, are expected to suffer damage and loss of life in the event of a dam failure.

SECTION 6 STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

A. VISUAL OBSERVATIONS

1. Embankment: Surficial embankment deficiencies identified in Section 3.1-B1 are not considered to have a significant effect on dam stability. The observed wet zone, located 150 ft. downstream from the embankment toe, is not considered to represent a significant hazard to the dam, at this time. This wet zone has been observed by the Park Superintendent for at least 10 years, during which time the areal extent of the zone has remained constant, and outflow from the area has been observed to occur only in the springtime. However, the cause and origin of the surface water could not be conclusively determined by visual observation and review of the design drawings. Therefore, it is recommended Park personnel continue their observation of the wet zone as a precautionary measure.
2. Appurtenant Structures: No significant evidence of structural distress was observed during the field reconnaissances that would significantly affect hydraulic performance or the structural stability of the spillway channel or reservoir drain conduit.

B. DESIGN AND CONSTRUCTION DATA

1. Subsurface Exploration: Twenty-three (23) test pits were excavated along the dam centerline and reservoir area to depths ranging from 4 to 10 ft. Test pit logs indicate the left dam abutment and the spillway channel are underlain by hard yellow clay. Near the center of the dam and west of the original streambed, the yellow clay was found to be mixed with gravel. The right abutment is underlain by a 1 ft. thick layer of red clay above yellow clay containing shale. Near the center of the dam, and east of the original streambed, the red clay layer is about 5 ft. thick and contains shale. Test pit logs show no evidence of ground water levels. (Refer to Plate No. 3.)
2. Laboratory Testing: No laboratory test reports were available, nor was any reference made to laboratory testing in the available information.
3. Slope Stability Analysis: No calculations or references to slope stability analyses were found in the available source material. Based upon embankment geometry, visual observations, and performance history, the static slope stability of the embankment is presumed to be adequate.

4. Seepage Analysis: Reportedly, observation wells were installed at several locations on the dam embankment. However, no seepage study reports were available and the wells reportedly have not been monitored since 1940.
- C. OPERATING RECORDS: The only operating feature is the reservoir drain sluice gate. Operating records are not maintained at the dam facility. The sluice gate is normally closed and is inspected and exercised biannually. The Park Superintendent reports that the gate is presently operational.
- D. POST-CONSTRUCTION CHANGES: The wooden foot bridge between the embankment crest and the gate tower has been removed. A wooden foot bridge, supported by steel trusses, spans across the spillway channel at the embankment centerline. This foot bridge was designed by The Neilan Engineers, Inc., Somerset, Pennsylvania in 1963. (Refer to Plate No. 5.) and was constructed sometime during the mid 1960's.
- E. SEISMIC STABILITY: The dam is located in Seismic Zone 1 (low seismic probability). No calculations or references of embankment stability were found. Based upon this low seismic probability and the recommended criteria for evaluating the seismic stability of dams, the seismic stability of the embankment is presumed to be adequate under these earthquake conditions.

SECTION 7
ASSESSMENT AND RECOMMENDATIONS

7.1 DAM ASSESSMENT

A. EVALUATION

1. Embankment: The eroded footpaths observed on the downstream embankment slope are surficial deficiencies, and are not considered to represent a significant hazard to the dam. However, remedial repairs are recommended. The cause and origin of the wet zone located 150 ft. downstream of the dam could not be conclusively established by visual observation and review of the design drawings. Although the wet zone is not considered to represent a significant hazard relative to dam stability at this time, it is recommended Park personnel continue their observation of the wet zone as a precautionary measure. In general, the dam embankment is adequately maintained and appears to be in good condition.
 2. Appurtenant Structures: Spillway channel and flow control structures appeared to be functioning as designed and are assessed to be in good condition.
 3. Overtopping Potential: U. S. Army Corps of Engineers dam safety criteria recommends a PMF spillway design flood for "intermediate" size, "high" hazard dams. HEC-I Dam Safety Version computer analyses indicate the spillway channel can pass approximately 61 percent PMF without overtopping the dam. Analysis also indicates PMF inflow will cause a 2.75 ft. overtopping for an estimated flow duration of 5.75 hours.
 4. Spillway Adequacy: Based on the above developed data, spillway discharge capacity is assessed inadequate in accordance with U. S. Army Corps of Engineers dam safety criteria.
- B. ADEQUACY OF INFORMATION: The design drawings available for this review were of sufficient detail to adequately conduct a Phase I study.
- C. NECESSITY FOR FURTHER INVESTIGATION: The observed condition of Cowans Gap Dam, as it presently exists, does not require additional investigation.
- D. URGENCY: The recommendations/remedial measures presented in this report should be implemented as soon as possible.

- 7.2 RECOMMENDATIONS: The following recommendations are presented based on the data obtained:

A. DAM AND APPURTENANT STRUCTURES

1. Monitor wet zone located downstream of the dam for change in conditions. If increase flow quantity or evidence of erosion is observed, immediately notify Department of Environmental Resources, Dam Safety Division.
2. Repair, mulch, and seed eroded footpaths and surface erosion on embankment slopes and abutments.
3. Remove wood and sediment debris from spillway channel and splash crib.

B. OPERATION AND MAINTENANCE PROCEDURES

1. Develop a formal flood surveillance and warning plan. Plan to include, but not limited to, the following:
 - a) Surveillance: Around-the-clock surveillance of spillway channel discharge and overtopping of dam during periods of unusually heavy rainfall.
 - b) Warning System: Formal warning procedures to alert downstream residents in the event of expected high flood flows.
 - c) Evacuation Plans: Adequate emergency contingency plans to evacuate downstream residents in the event or threat of a dam failure.
2. Locate and periodically monitor observation wells installed in dam embankment. Submit obtained water level readings to Bureau of State Parks, Regional Engineer and the Department of Environmental Resources, Dam Safety Division for review.
3. Periodically observe wet zone located downstream from the dam embankment.

APPENDIX A
VISUAL OBSERVATIONS CHECK LIST AND FIELD SKETCH

Name Dam Cowans Gap County Fulton State Pennsylvania National ID # PA 187
 Type of Dam Earthfill Hazard Category Class I-High Hazard
 Date(s) Inspection 05/03/80 11/21/79 Weather Clear Temperature 45°
 Inspection Review Date 3/4/80
 Pool Elevation at Time of Inspection 1220 Tailwater at Time of Inspection Normal M.S.L. _____
 Inspection Personnel: Ackenheil & Associates Bureau of State Parks
 Timothy Debes Harold Chriswell
 Rick Gabell Richard Fuller

Ackenheil & Associates

Timothy Debes
Rick Gabell
James Hainley
Michael McCarthy
John Schultz

Bureau of State Parks

Harold Chriswell
Richard Fuller

Recorder Timothy Debes

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS*
SURFACE CRACKS	None observed. Upstream embankment slope covered with hand-placed rock riprap. Downstream embankment slope has a dense grass covering and a gravel toe.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Eroded footpaths are located at both downstream embankment junctions and at mid-dam. Footpaths generally extend from dam crest to toe.	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	No significant vertical or horizontal misalignment observed.	
RIPRAP FAILURES	None observed.	

*REFER TO REPORT SECTIONS 3 AND 7

EMBANKMENT

<u>VISUAL EXAMINATION OF</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
SETTLEMENT	None observed.	
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Eroded footpaths located at both downstream embankment junctions.	
ANY NOTICEABLE SEEPAGE	Ponded water observed 150 ft. downstream of embankment toe. This wet zone is located in the vicinity of the old stream channel.	
STAFF GAGE AND RECORDER	None.	
DRAINS	Weep hole outlet pipes were observed along spillway channel sidewalls, about 6 inches above channel floor. A clay pipe outlet (6 in. dia.) is located at each downstream endwall of the spillway channel. These pipes provide drainage for the granular material backfilled behind the spillway sidewalls.	

OUTLET WORKS

(Pond Drain)

<u>VISUAL EXAMINATION OF</u>		<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT		No evidence of significant spalling or cracking was observed.	
INTAKE STRUCTURE		Submerged.	
OUTLET STRUCTURE		Corrugated metal outlet pipe (30 in. dia.) exiting at grouted stone headwall at downstream embankment toe. The pipe is rusted but appears to be structurally sound. Headwall is in good condition.	
OUTLET CHANNEL		Trapezoidal channel (30 ft. long) with riprap floor and side slopes. Channel observed free of debris and flow obstructions.	
EMERGENCY GATE		None.	

UNGATED SPILLWAY

<u>VISUAL EXAMINATION OF</u>		<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
CONCRETE WEIR		Round-crested weir appeared to be in good condition.	
APPROACH CHANNEL		Approach channel is rectangular in shape, with a concrete apron extending about 50 ft. upstream to the end of the spillway channel wing walls. Grouted stone walls appear to be in good condition.	
DISCHARGE CHANNEL		Grouted stone walls and floor observed to be in good condition. Some wood debris was observed in the spillway channel and splash crib.	
BRIDGE AND PIERS		A steel truss, wood plank foot bridge spans the spillway at the location of the weir crest. Free flow clearance is approximately 9 ft.	

GATED SPILLWAY (NOT APPLICABLE)

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

INSTRUMENTATION

<u>VISUAL EXAMINATION OF</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
MONUMENTATION/SURVEYS	A U.S.G.S. Azimuth marker is located on the bath house step near the beach, on the east side of the lake.	
OBSERVATION WELLS	Observation wells are reportedly installed at twelve (12) locations on the dam embankment. These wells have not been monitored in recent years.	
WEIRS	None.	
PIEZOMETERS	None.	
OTHER	Rain gauge located at park office. Readings made at 24-hour intervals.	

RESERVOIR

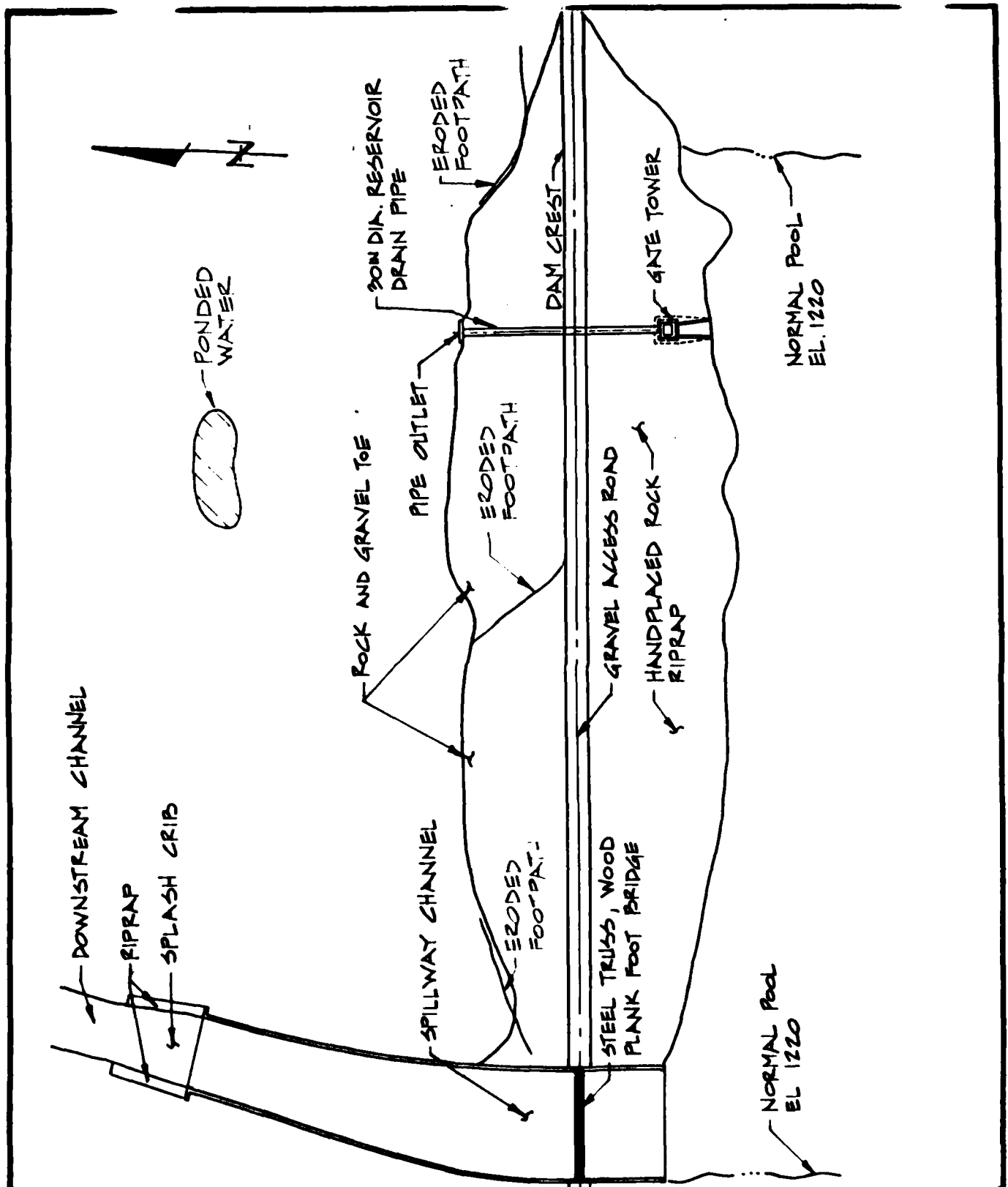
<u>VISUAL EXAMINATION OF</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
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SLOPES	Foot traffic has eroded surface areas of some shoreline banks. However, most shoreline banks are well vegetated and appear stable.	
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SEDIMENTATION	Significant quantities of sediment were observed deposited at the lake inlet. A small quantity of sediment was observed at the spillway entrance.	
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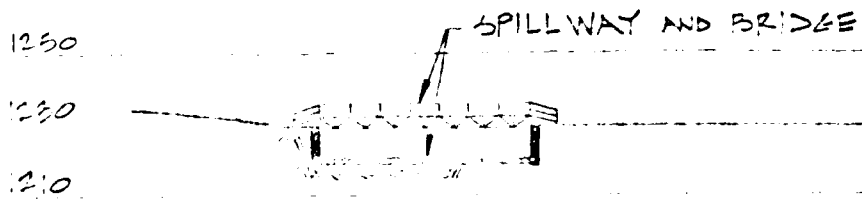
DOWNSTREAM CHANNEL

<u>VISUAL EXAMINATION OF</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	No significant amount of debris was observed.	
SLOPES	Channel side slopes appear stable and are well vegetated with trees and brush.	
APPROXIMATE NO. OF HOMES AND POPULATION	Approximately eight (8) inhabited structures are located within the estimated downstream floodplain between the dam site and the point of confluence with the Little Aughwick Creek.	



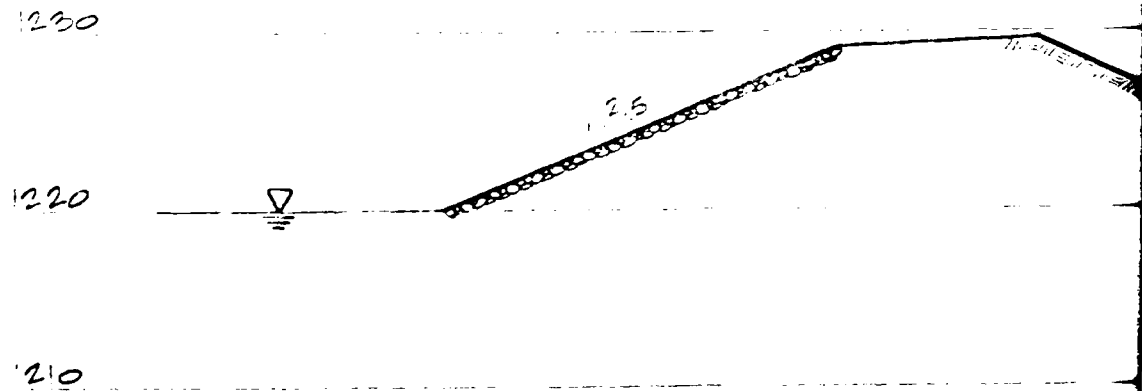
DATE: MAY 2, 1980	NATIONAL DAM INSPECTION PROGRAM		COWANS GAP DAM SITE
SCALE: NONE			
DR: JLM	CK: TED	ACKENHEIL & ASSOCIATES CONSULTING ENGINEERS BALTIMORE, MD.	FIELD SKETCH
DWG. NO.	A-10		

ELEV. (FT.)



DAM CRES
1" = 50'

ELEV. (FT.)

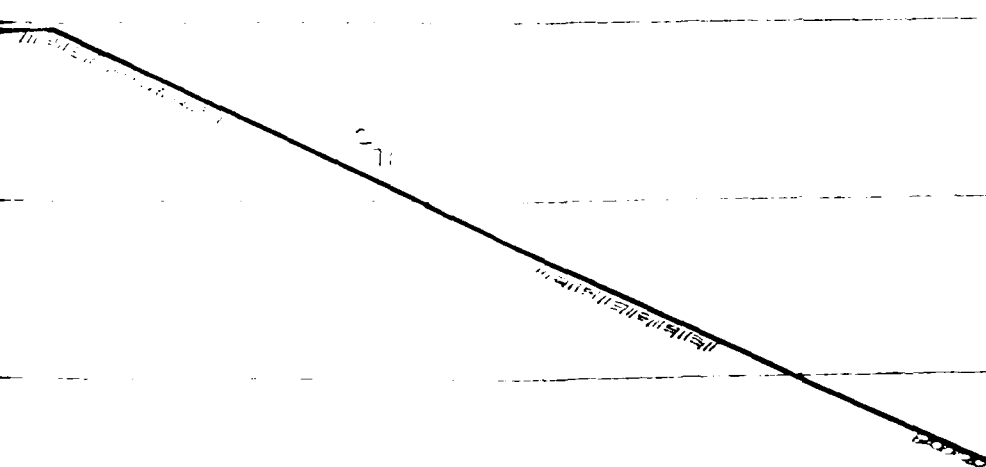


SECTION
1" = 10'

NOTE:
ASSIGNED DATUM ELEV. 220
TOP OF WER.

A
A

CREST PROFILE



SECTION A-A

2

DATE: MAY 2, '80	NATIONAL DAM INSPECTION PROGRAM	COWAN'S GAP DAM
SCALE: AS SHOWN		
DR: JLM CK: ED	ACKENHEIL & ASSOCIATES CONSULTING ENGINEERS BALTIMORE, MD.	
DWG. NO. A-11		

APPENDIX B

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE 1

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE 1

NAME OF DAM Cowans Gap Dam

ID # PA 187

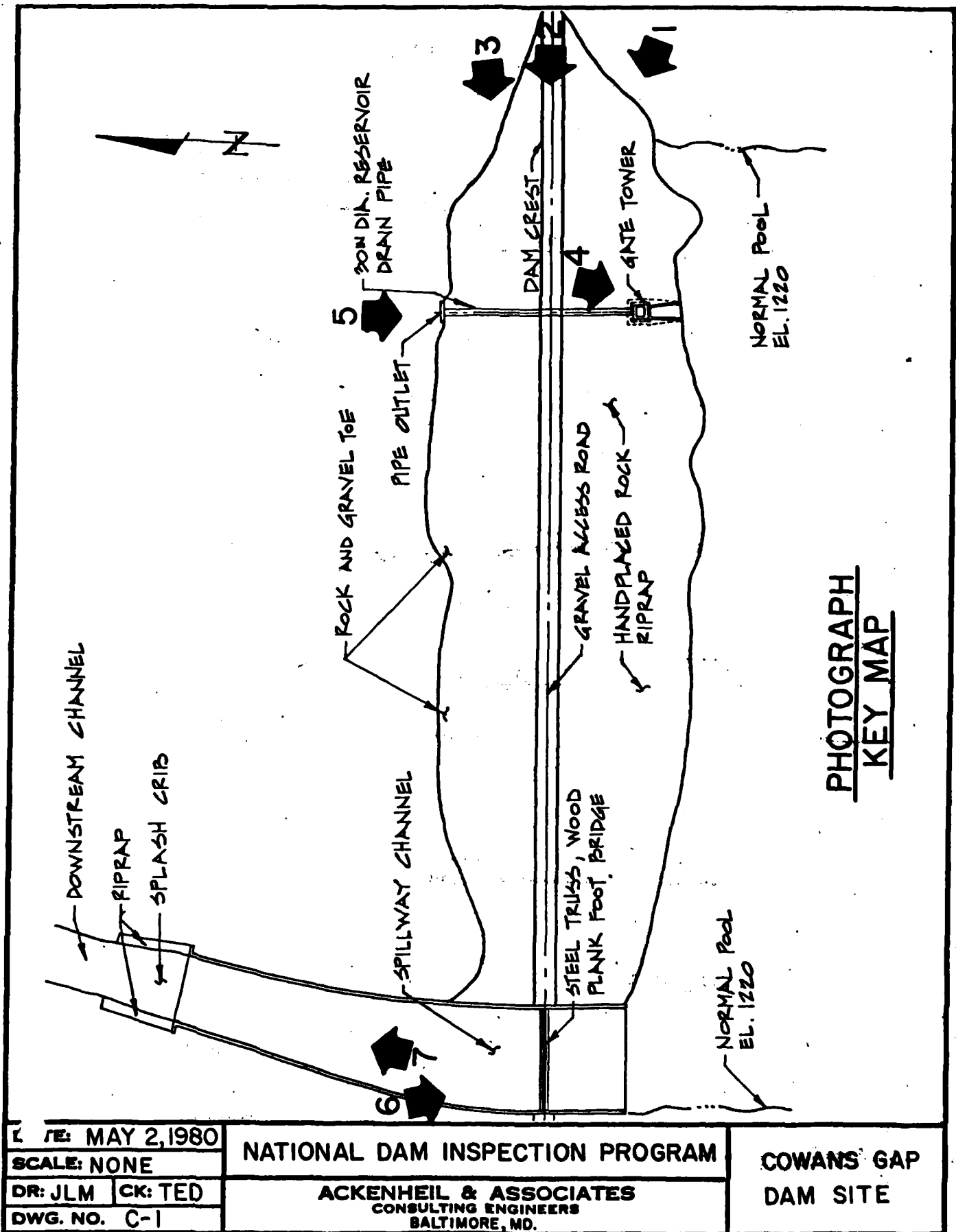
ITEM	REMARKS
AS-BUILT DRAWINGS	No as-built drawings were available. Design drawings were provided by the Pennsylvania Department of Environmental Resources, Dam Safety Division, Harrisburg, Pennsylvania. (See Plate Nos. 1 through 6A.)
REGIONAL VICINITY MAP	See Appendix E, sections of two (2) U.S.G.S. 7.5 minute quadrangle maps showing dam site location.
CONSTRUCTION HISTORY	Construction drawings were prepared by the Pennsylvania Department of Forests and Waters (various dates between 1934 and 1936). The dam was constructed in 1936 by the Civilian Conservation Corps. A construction drawing for a foot bridge across the spillway channel was prepared by The Neilan Engineers, Inc., Somerset, PA, dated June 1963.
TYPICAL SECTIONS OF DAM	See Plate Nos. 2, 5, and 6A and Dwg. No. A-11.
OUTLETS - PLAN DETAILS CONSTRAINTS DISCHARGE RATINGS	Reservoir drain and spillway channel - see Plate Nos. 1, 2, and 6. Highway bridges located downstream from the dam at 2.4, 6.0, 6.3, 6.5, 6.8, 7.0 miles, respectively. None available.
RAINFALL/RESERVOIR RECORDS	Local rainfall amounts have been measured by State Park personnel since 1968. Readings are made every 24 hours, and records are kept at the park office.

ITEM	REMARKS
DESIGN REPORTS	None available.
GEOLOGY REPORTS	None available. Test pit locations and logs shown on Plate No. 3.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None available.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None available. See Plate No. 3. None available. None available.
POST-CONSTRUCTION SURVEYS OF DAM	None available.
BORROW SOURCES	Unknown.

ITEM	REMARKS
MONITORING SYSTEMS	Reportedly, observation wells were installed at twelve locations on the dam embankment. However, no seepage study reports were available, and the wells have not been monitored recently.
MODIFICATIONS	The wooden foot bridge previously located between the dam crest and the gate tower was removed (date unknown) for the safety of park users. A steel-truss, wood plank foot bridge located across the spillway channel was designed by The Neilan Engineers, Inc., Somerset, Pennsylvania dated 1963.
HIGH POOL RECORDS	No records were available, but six inches of rainfall in 18 hours during Tropical Storm David (September 1979) reportedly produced a reservoir stage about 2 ft. above normal pool.
POST-CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None available.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None reported.
MAINTENANCE OPERATION RECORDS	None available.

ITEM	REMARKS
SPILLWAY PLAN	See Plate No. 1.
SECTIONS	See Plate No. 1A.
DETAILS	See Plate No. 1A.
OPERATING EQUIPMENT PLANS & DETAILS	See Plate Nos. 2 and 6A.
SPECIFICATIONS	None available.
MISCELLANEOUS	A blueprint of the drawings shown as Plates 6 and 6A in this report was dated January 1936. This drawing was superseded by Plate No. 2, dated March 4, 1936, but was included in this report to provide additional clarity. Assumed datum El. 1220.0 on top of weir crest.

APPENDIX C
PHOTOGRAPHS



PHOTOGRAPH 1

View of upstream embankment slope from right abutment.

PHOTOGRAPH 2

View of embankment crest (foot bridge in background) from right abutment.

PHOTOGRAPH 3

View of downstream embankment slope from right abutment. Note riprap cover at location of outlet pipe.

PHOTOGRAPH 4

View of gate tower from the embankment crest.



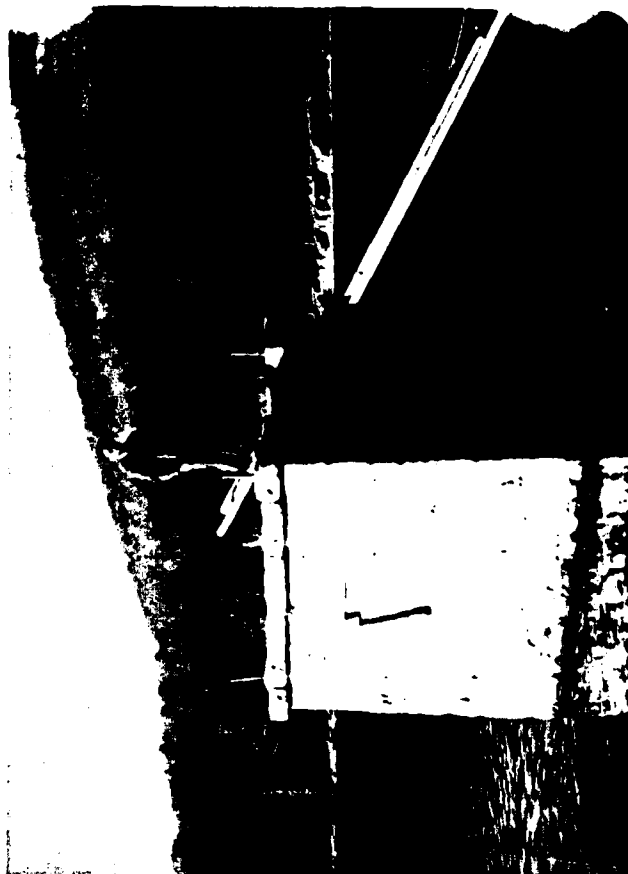
1



3



2



4

PHOTOGRAPH 5

Reservoir drain conduit outlet at downstream embankment toe.

PHOTOGRAPH 6

View of spillway channel and foot bridge looking upstream.

PHOTOGRAPH 7

View of spillway channel and the south branch of the Little Aughwick Creek looking downstream.

PHOTOGRAPH 8

View of houses in Burnt Cabins looking westward from bridge over the south branch of the Little Aughwick Creek (6.5 miles downstream from dam).



5



6



7



8

APPENDIX D

HYDROLOGIC AND HYDRAULIC
ENGINEERING AND
COMPUTER DATA

HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: Predominately forest, little open
pasture

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 1220.0 ft. (500 ac.-ft.)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): 1228.8 ft. (1,030 ac.-ft.)

ELEVATION MAXIMUM DESIGN POOL: 1228.8 ft.

ELEVATION TOP DAM: 1228.8 ft.

SPILLWAY CHANNEL

- a. Elevation Rounded weir crest at El. 1220.0
- b. Type Rectangular shaped, grouted stone floor and sidewalls
- c. Width 60 ft. at weir crest
- d. Length 220 ft.
- e. Location Spillover Left abutment
- f. Number and Type of Gates None

RESERVOIR DRAIN

- a. Type 30 in. dia. corrugated metal pipe encased in concrete
- b. Location 170 ft. from right abutment
- c. Entrance Inverts El. 1200.0
- d. Exit Inverts El. 1198.0
- e. Emergency Drawdown Facilities Manually-operated sluice gate
housed in stone control tower on upstream embankment slope, 170 ft.
from right abutment.

HYDROMETEOROLOGICAL GAGES

- a. Type Precipitation gauge (since 1968)
- b. Location Cowans Gap State Park
- c. Records Cowans Gap State Park office

MAXIMUM NON-DAMAGING DISCHARGE 5,480 cfs

HEC-1-DAM SAFETY VERSION
HYDROLOGY AND HYDRAULIC ANALYSIS
DATA BASE

NAME OF DAM:	Cowans Gap Dam
Probable Maximum Precipitation (PMP)	23.8 in.*
Drainage Area	5.3 sq. mi.
Reduction of PMP Rainfall for Data Fit Reduce by 20%, therefore PMP rainfall =	19.0 in.
Adjustments of PMF for Drainage Area	
6 hrs.	113%
12 hrs.	123%
24 hrs.	132%
48 hrs.	142%
Snyder Unit Hydrograph Parameters	
Zone	21**
C _p	0.55
C _t	1.5
L	5.8 mi.
L _{ca}	2.9 mi.
t _p = C _t (L + L _{ca}) 0.3 =	3.5 hrs.
Loss Rates	
Initial Loss	1.0 in.
Constant Loss Rate	0.05 in./hr.
Base Flow Generation Parameters	
Flow at Start of Storm	1.5 cfs/sq. mi. = 8 cfs
Base Flow Cutoff	0.05 Q _p
Recession Ratio	2.0
Spillway Channel Data	
Crest Length	60 ft.
Sidewall height above weir crest	9.4 ft.
Discharge Coefficient	3.5
Exponent	1.5
Discharge Capacity	5,480 cfs

*Hydrometeorological Report 33

**Hydrological zone defined by Corps of Engineers, Baltimore District,
for determining Snyder's Coefficients (C_p and C_t).

ED
DATE 5-21-80
CHECKED JOS
DATE 5-21-80

ACKENHEIL & ASSOCIATES
CONSULTING ENGINEERS
BALTIMORE, MARYLAND

PROJECT NO. 79061

SUBJECT: COWANS GAP DAM

SHEET NO. D3 OF

ELEVATION - AREA - CAPACITY RELATIONSHIPS

- 1) LAKE SURFACE AREAS OBTAINED BY PLANIMETER OF CONTOURS FROM PLATE NO. 3, (APPENDIX E). AND 7 1/2 MIN. U.S. G.S. QUADRANGLE SHEET.
- 2) ZERO AREA ELEVATION OBTAINED FROM PLATE NO. 3, WHERE AREA = 0 AT W.S. EL. 1196.
- 3) RESERVOIR STORAGE AT NORMAL POOL ELEVATION WAS DETERMINED USING CONIC SECTION METHOD FOR RESERVOIR VOLUME: FLOOD HYDROGRAPH PACKAGE, (HEC-1), DAM SAFETY VERSION COMPUTER PROGRAM.

$$\Delta V = \frac{h}{3} (A_1 + \sqrt{A_1 A_2} + A_2)$$

where $h = (WSEL)_2 - (WSEL)_1$

NORMAL POOL STORAGE =

$$\sum \Delta V$$

WSEL 1196 TO WSEL 1220

- 4) REFER TO PAGE D-4 FOR SUMMARY OF ELEVATION-AREA INPUT DATA.

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

NON-BREACH ANALYSIS OF COWANS GAP DAM		TODD TWP.		FULTON CO., PA.		SNYDER UH., RATIOS OF PMF, & MOD PULS ROUTING		COMPUTATION OF INFLOW HYDROGRAPH TO COWANS GAP LAKE		MOD PULS ROUTING OF FLOW THROUGH COWANS GAP DAM	
1	A1	0	15	0	0	0	0	0	0	0	0
2	A2	0	0	0	0	0	0	0	0	0	0
3	A3	0	0	0	0	0	0	0	0	0	0
4	B	300	0	0	0	0	0	0	0	0	0
5	B1	5	0	0	0	0	0	0	0	0	0
6	J	1	1	0	0	0	0	0	0	0	0
7	J1	0.3	0.5	0.60	0.61	0.62	0.63	0.64	0.7	1.0	0
8	K	0	LAKE								
9	K1	1	1	5.3	0	0	0	0	0	0	0
10	M	0	23.8	113	123	132	142	0	0	0	0
11	P	0	0	0	0	0	0	1.0	0.05	0	0
12	T	0	0	0	0	0	0	0	0	0	0
13	W	3.5	0.55	0	0	0	0	0	0	0	0
14	X	-1.5	-0.05	2.0	0	0	0	0	0	0	0
15	K	1	DAM								
16	K1	0	0	0	1	1	0	0	0	0	0
17	Y	0	0	0	0	0	0	-1220	0	0	0
18	Y1	1	0	0	0	0	0	21.30	40.4	54.2	87.2
19	\$A	0	0.17	0.90	4.74	9.53	15.92	1208	1217	1220	1240.
20	\$E	1196	1198	1200	1202	1204	1206	0	0	0	0
21	\$S	1220	60	3.5	1.5	0	0	0	0	0	0
22	\$D1228.8	3.1	1.5	0	0	0	0	0	0	0	0
23	\$L	0	7	14	30	101	360	0	0	0	0
24	\$V1228.8	1229.5	1229.6	1229.7	1230.0	1232.4	0	0	0	0	0
25	K	99									
26	A										
27	A										
28	A										
29	A										
30	A										

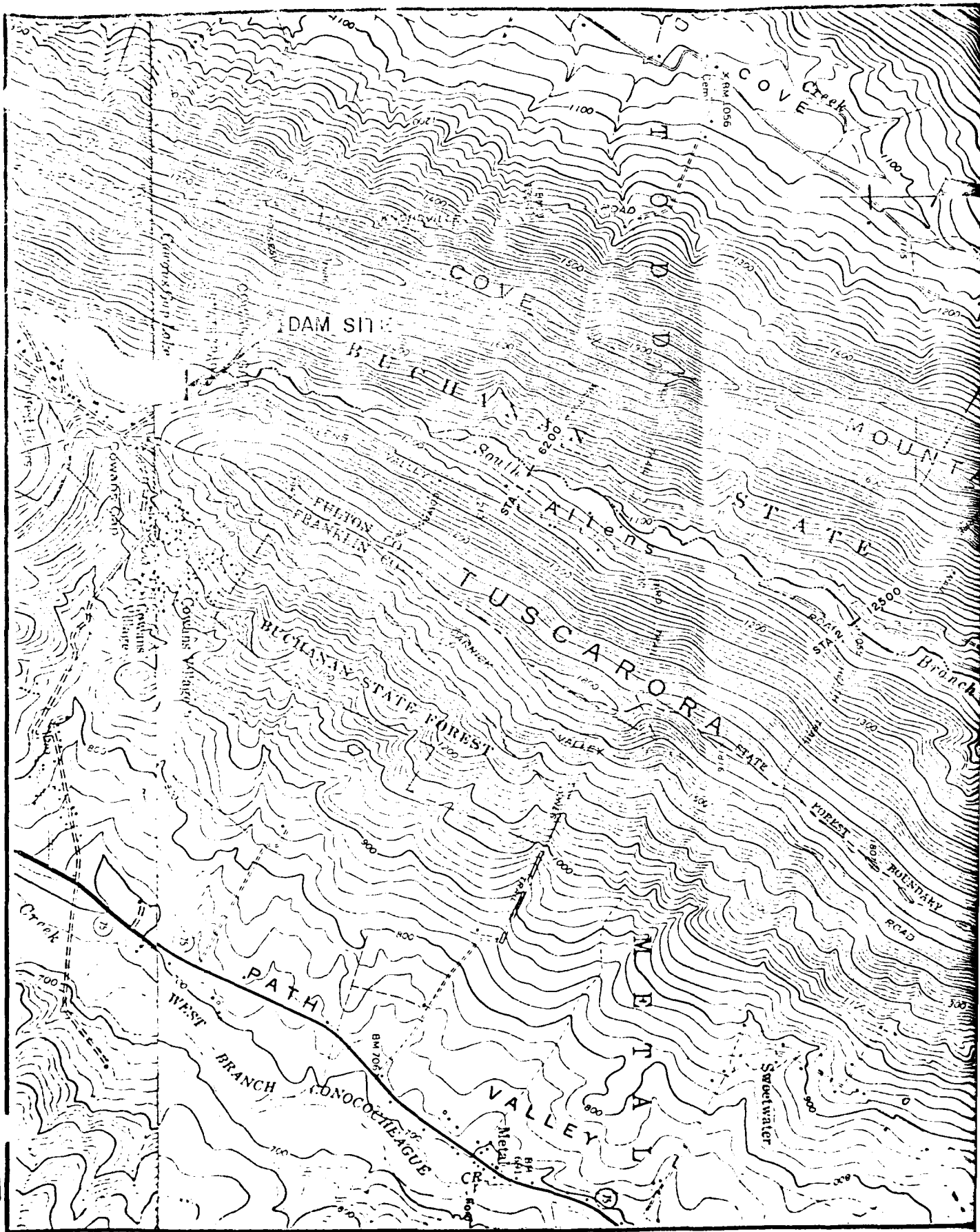
COMPUTER INPUT - OVERTOPPING ANALYSIS

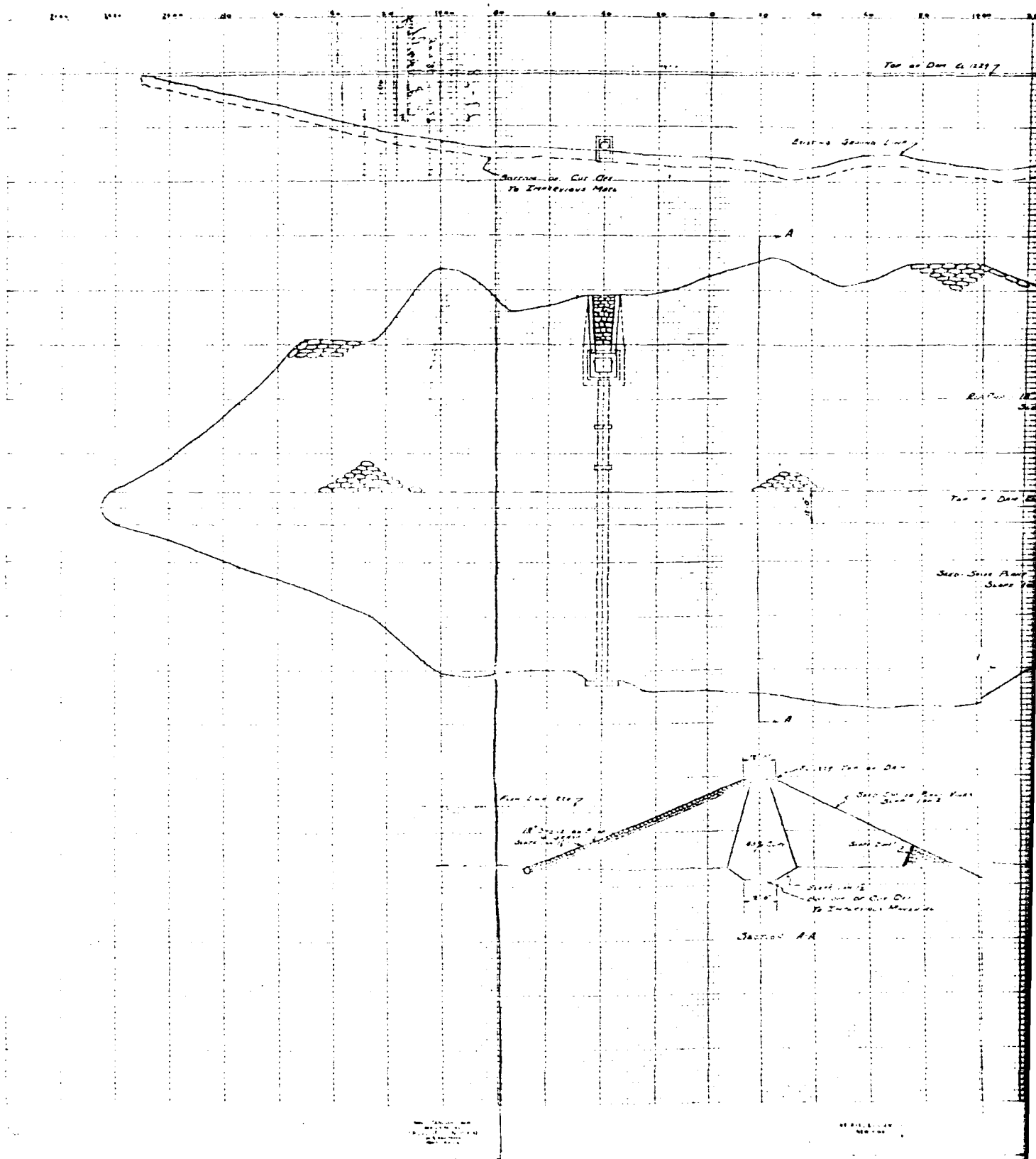
SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1	ELEVATION STORAGE OUTFLOW	INITIAL VALUE 1220.00 497. 0.	SPILLWAY CREST 1220.00 497. 0.	TOP OF DAM 1228.80 1032. 5482.	RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
					0.30	1225.39	0.0	811.	2628.	0.0	44.00	0.0
					0.50	1227.66	0.0	957.	4455.	0.0	44.00	0.0
					0.60	1228.68	0.0	1024.	5370.	0.0	44.00	0.0
					0.61	1228.78	0.0	1031.	5461.	0.0	44.00	0.0
					0.62	1228.88	0.08	1038.	5553.	0.75	44.00	0.0
					0.63	1228.97	0.17	1044.	5644.	1.25	44.00	0.0
					0.64	1229.07	0.27	1051.	5736.	1.75	44.00	0.0
					0.70	1229.63	0.83	1090.	6288.	2.75	44.00	0.0
					1.00	1231.55	2.75	1225.	9364.	5.75	43.50	0.0

COMPUTER OUTPUT - SUMMARY OF OVERTOPPING ANALYSIS

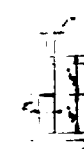
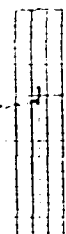
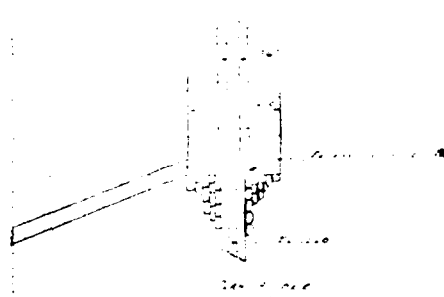
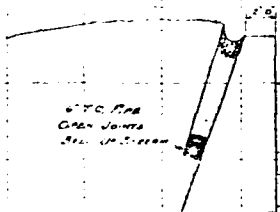
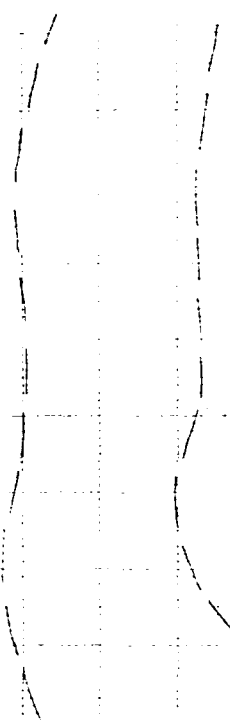
APPENDIX E
LOCATION PLAN AND PLATES







MATCH LINE



SECTION B-B

NOTES

NOTES

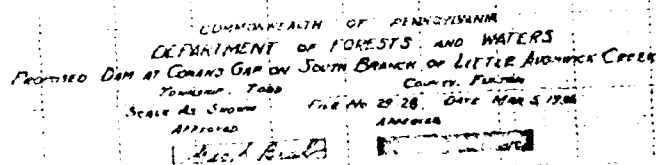
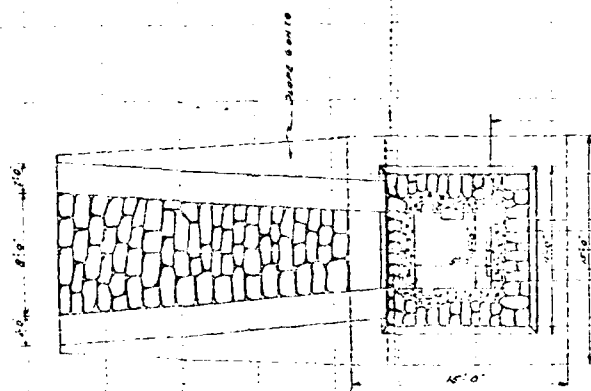
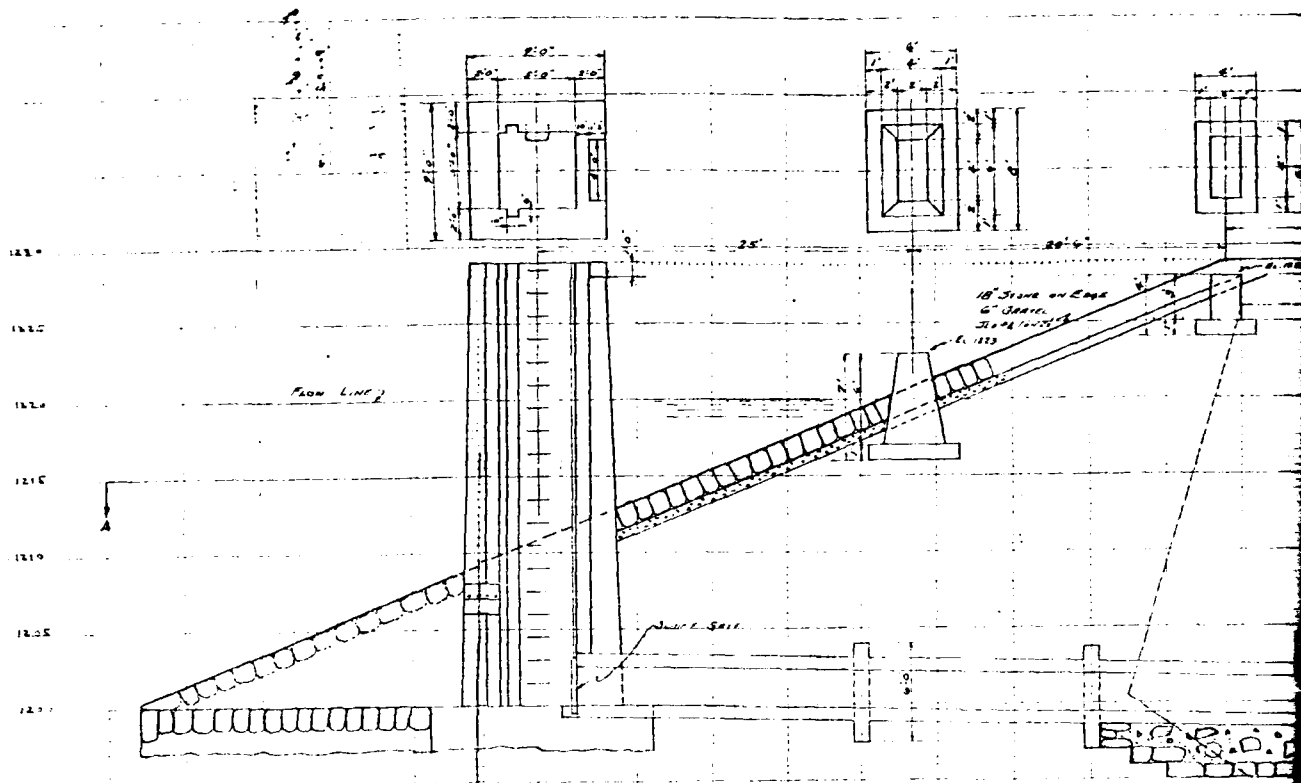
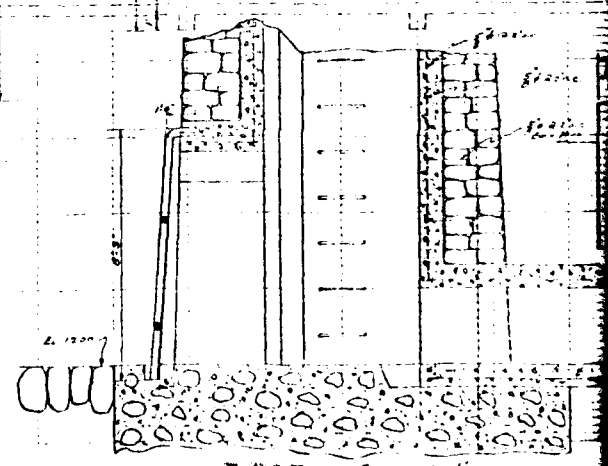


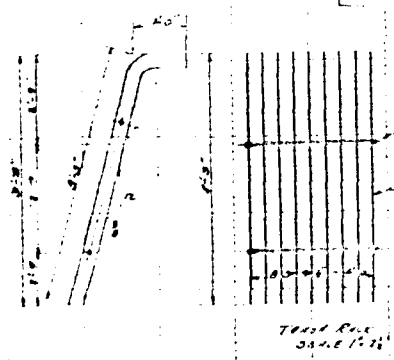
PLATE NO. TA



SCALE 1/8\"/>



SCALE 1/8\"/>



SCALE 1/8\"/>

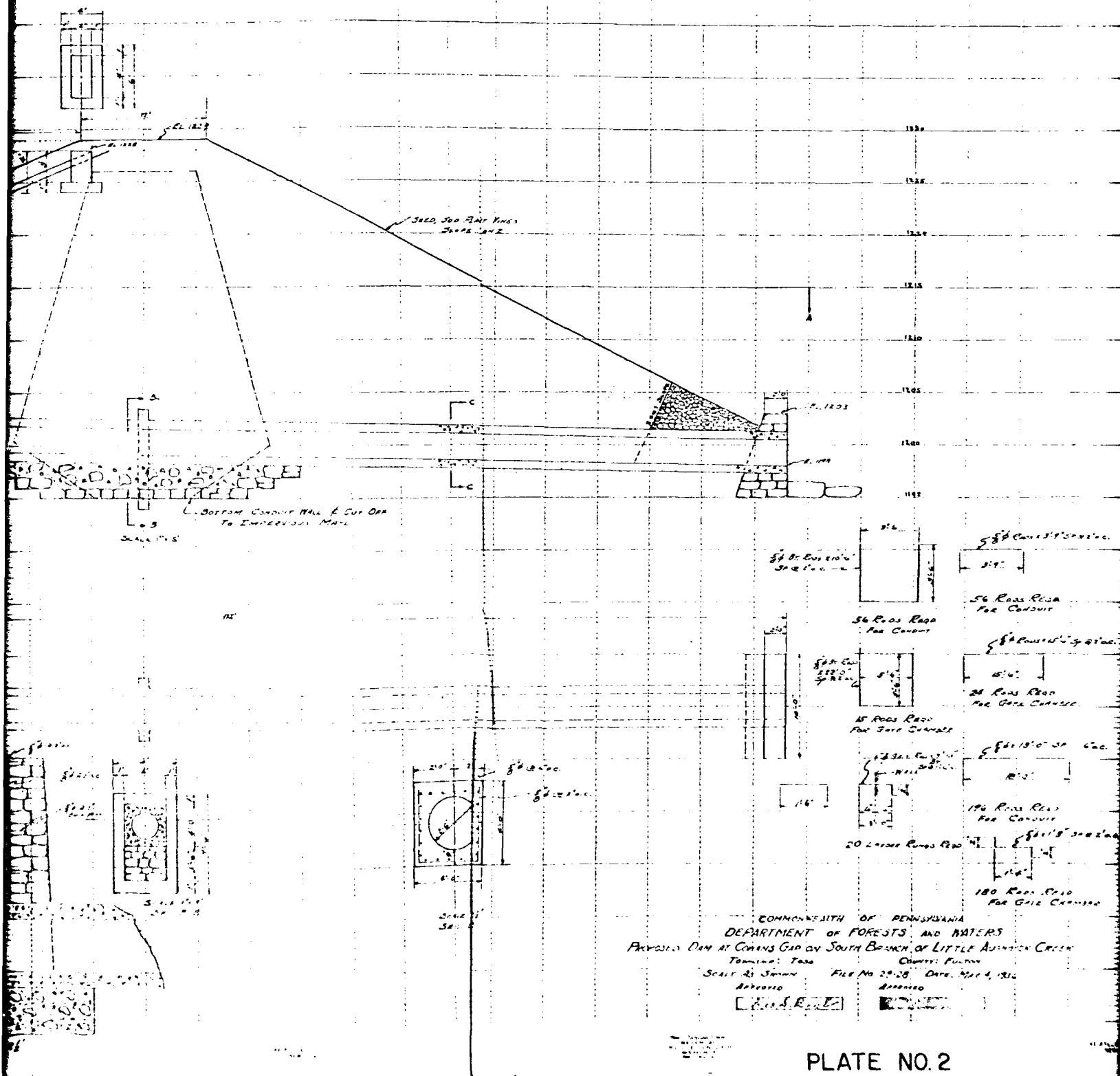
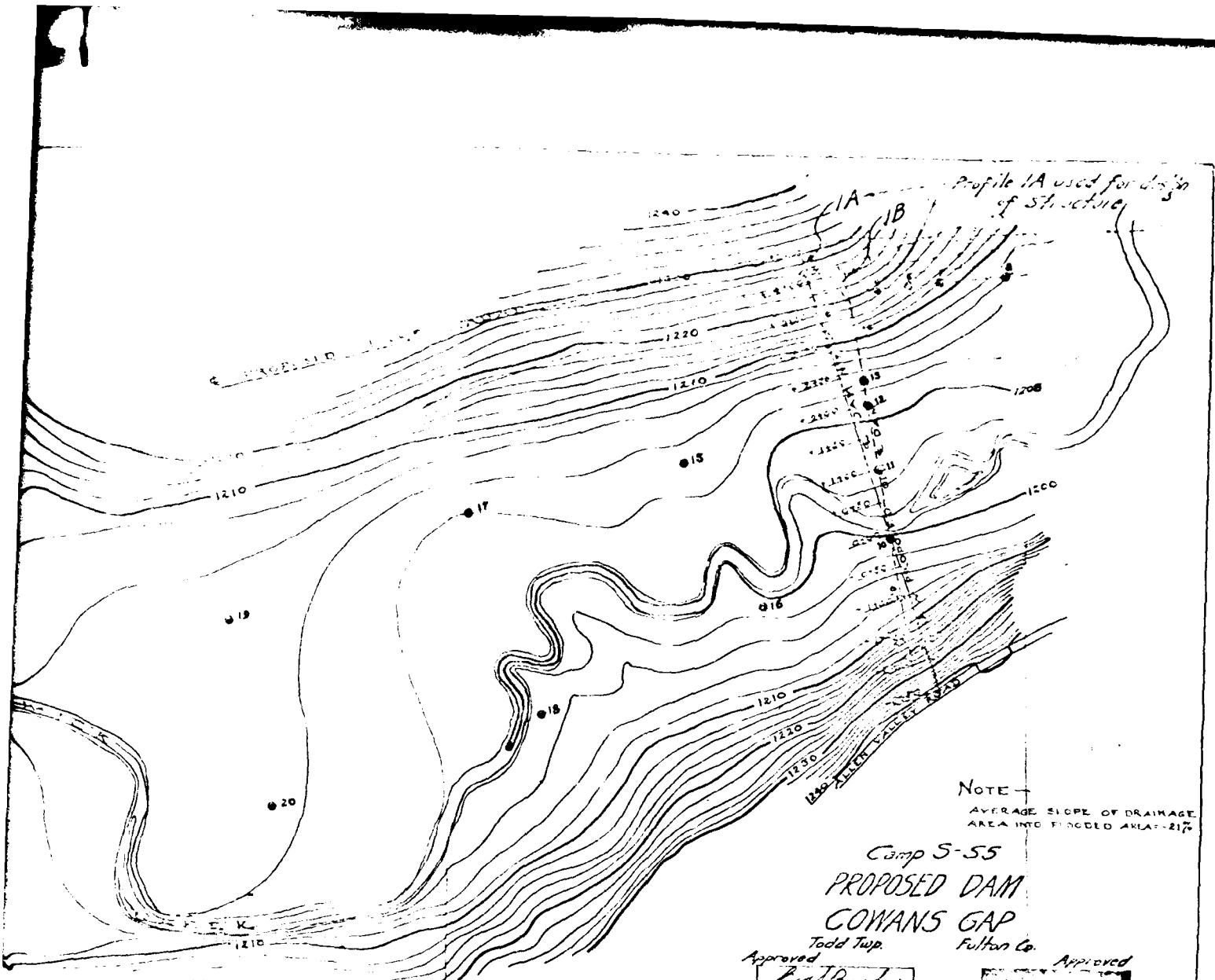


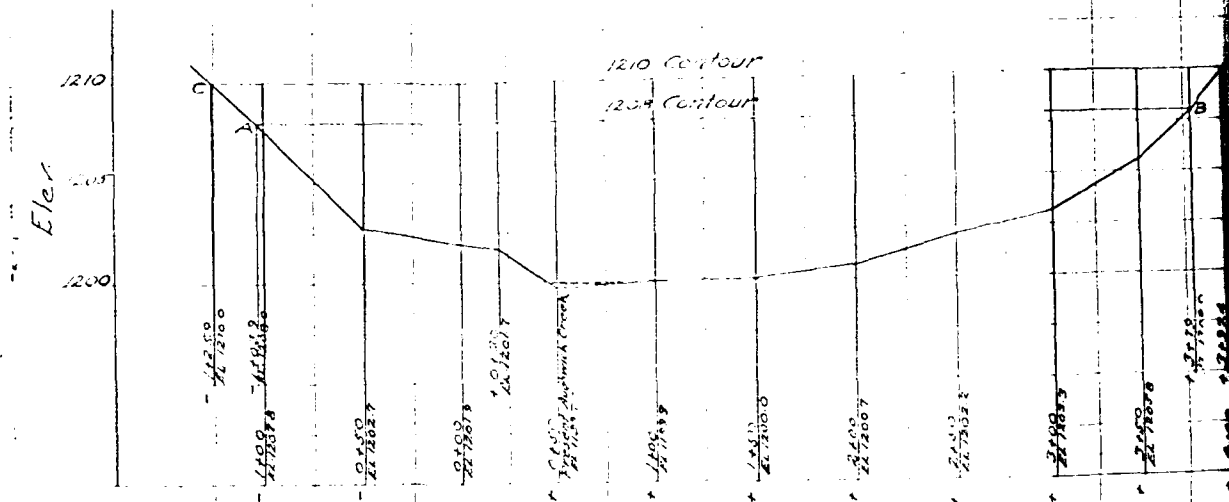
PLATE NO. 2



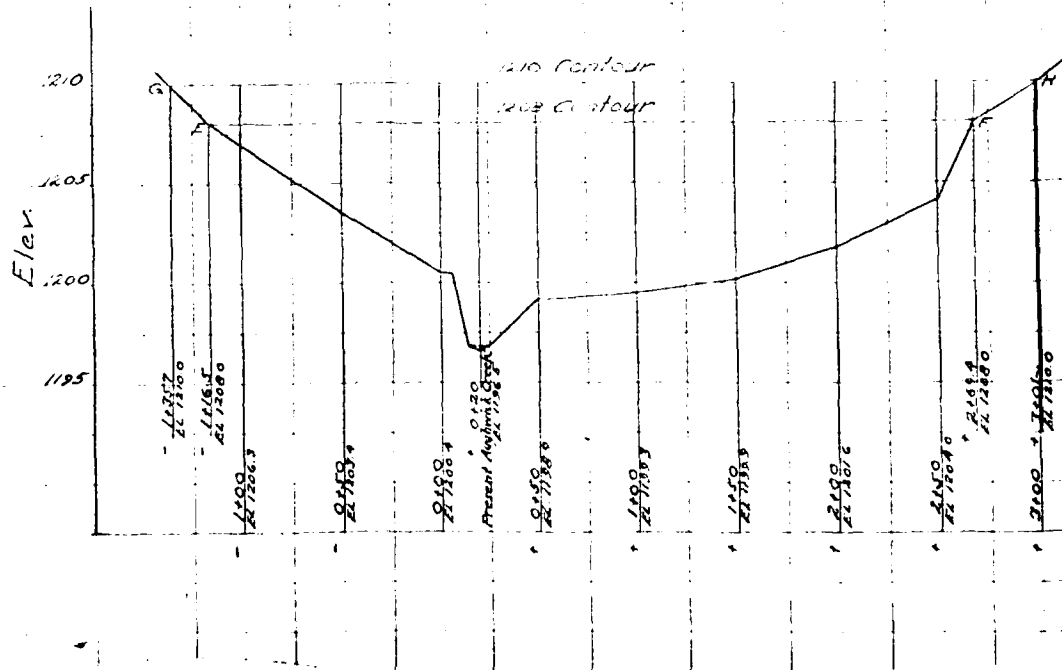
FILE 19-28

TEST PIT NO. 4 (SPILLWAY) <table><tr><th>DEPTH</th><th>ELEV.</th></tr><tr><td>10</td><td>12210</td></tr><tr><td>30</td><td>12200</td></tr><tr><td>40</td><td>12170</td></tr></table> TOP SOIL YELLOW CLAY (HARD)	DEPTH	ELEV.	10	12210	30	12200	40	12170	TEST PIT NO. 5 (SPILLWAY) <table><tr><th>DEPTH</th><th>ELEV.</th></tr><tr><td>10</td><td>12190</td></tr><tr><td>50</td><td>12180</td></tr><tr><td>60</td><td>12130</td></tr></table> TOP SOIL YELLOW CLAY	DEPTH	ELEV.	10	12190	50	12180	60	12130	TEST PIT NO. 6 (SPILLWAY) <table><tr><th>DEPTH</th><th>ELEV.</th></tr><tr><td>10</td><td>12150</td></tr><tr><td>2-5</td><td>12140</td></tr><tr><td>1-5</td><td>12115</td></tr><tr><td>3-0</td><td>12100</td></tr><tr><td>8-0</td><td>12070</td></tr></table> TOP SOIL YELLOW CLAY (HARD) GRAY CLAY YELLOW CLAY	DEPTH	ELEV.	10	12150	2-5	12140	1-5	12115	3-0	12100	8-0	12070	TEST PIT NO. 7 (SPILLWAY) <table><tr><th>DEPTH</th><th>ELEV.</th></tr><tr><td>10</td><td>12120</td></tr><tr><td>9-0</td><td>12110</td></tr><tr><td>100</td><td>12020</td></tr></table> TOP SOIL YELLOW CLAY (HARD)	DEPTH	ELEV.	10	12120	9-0	12110	100	12020	TEST PIT NO. 8 (SPILLWAY) <table><tr><th>DEPTH</th><th>ELEV.</th></tr><tr><td>10</td><td>12060</td></tr><tr><td>1-5</td><td>12050</td></tr><tr><td>3-5</td><td>12035</td></tr><tr><td>6-0</td><td>12000</td></tr></table> TOP SOIL YELLOW CLAY (HARD) YELLOW & GRAY CLAY	DEPTH	ELEV.	10	12060	1-5	12050	3-5	12035	6-0	12000
DEPTH	ELEV.																																																	
10	12210																																																	
30	12200																																																	
40	12170																																																	
DEPTH	ELEV.																																																	
10	12190																																																	
50	12180																																																	
60	12130																																																	
DEPTH	ELEV.																																																	
10	12150																																																	
2-5	12140																																																	
1-5	12115																																																	
3-0	12100																																																	
8-0	12070																																																	
DEPTH	ELEV.																																																	
10	12120																																																	
9-0	12110																																																	
100	12020																																																	
DEPTH	ELEV.																																																	
10	12060																																																	
1-5	12050																																																	
3-5	12035																																																	
6-0	12000																																																	
TEST PIT NO. 12 (OLD STA. 12+10) ORIGINAL GROUND ELEV. 12010 PRESENT " " 12000 <table><tr><th>DEPTH</th><th>ELEV.</th></tr><tr><td>11</td><td>12016</td></tr><tr><td>32</td><td>12005</td></tr><tr><td>66</td><td>11970</td></tr></table> TOP SOIL YELLOW CLAY, SLIGHT GRAVEL (HARD)	DEPTH	ELEV.	11	12016	32	12005	66	11970	TEST PIT NO. 13 (OLD STA. 12+10) ORIGINAL GROUND ELEV. 12020 PRESENT " " 12010 <table><tr><th>DEPTH</th><th>ELEV.</th></tr><tr><td>10</td><td>12035</td></tr><tr><td>32</td><td>12025</td></tr><tr><td>65</td><td>11970</td></tr></table> TOP SOIL YELLOW CLAY, SLIGHT GRAVEL (HARD)	DEPTH	ELEV.	10	12035	32	12025	65	11970	TEST PIT NO. 14 (OLD STA. 12+12) ORIGINAL GROUND ELEV. 12120 PRESENT " " 12080 <table><tr><th>DEPTH</th><th>ELEV.</th></tr><tr><td>10</td><td>12120</td></tr><tr><td>8-0</td><td>12110</td></tr><tr><td>9-0</td><td>12090</td></tr></table> TOP SOIL YELLOW CLAY, SLIGHT GRAVEL (HARD)	DEPTH	ELEV.	10	12120	8-0	12110	9-0	12090	TEST PIT NO. 15 <table><tr><th>DEPTH</th><th>ELEV.</th></tr><tr><td>10</td><td>12050</td></tr><tr><td>4-0</td><td>12040</td></tr><tr><td>5-0</td><td>11980</td></tr></table> TOP SOIL YELLOW & GRAY CLAY (HARD)	DEPTH	ELEV.	10	12050	4-0	12040	5-0	11980	TEST PIT NO. 16 <table><tr><th>DEPTH</th><th>ELEV.</th></tr><tr><td>10</td><td>12010</td></tr><tr><td>4-0</td><td>12000</td></tr><tr><td>5-0</td><td>11960</td></tr></table> TOP SOIL RED CLAY (HARD)	DEPTH	ELEV.	10	12010	4-0	12000	5-0	11960						
DEPTH	ELEV.																																																	
11	12016																																																	
32	12005																																																	
66	11970																																																	
DEPTH	ELEV.																																																	
10	12035																																																	
32	12025																																																	
65	11970																																																	
DEPTH	ELEV.																																																	
10	12120																																																	
8-0	12110																																																	
9-0	12090																																																	
DEPTH	ELEV.																																																	
10	12050																																																	
4-0	12040																																																	
5-0	11980																																																	
DEPTH	ELEV.																																																	
10	12010																																																	
4-0	12000																																																	
5-0	11960																																																	
TEST PIT NO. 20 <table><tr><th>DEPTH</th><th>ELEV.</th></tr><tr><td>8-0</td><td>12040</td></tr><tr><td>10</td><td>12035</td></tr><tr><td>2-0</td><td>12025</td></tr><tr><td>10</td><td>12000</td></tr><tr><td>10</td><td>11990</td></tr><tr><td>20</td><td></td></tr></table> TOP SOIL GRAY CLAY, SLIGHT YELLOW SAND "	DEPTH	ELEV.	8-0	12040	10	12035	2-0	12025	10	12000	10	11990	20																																					
DEPTH	ELEV.																																																	
8-0	12040																																																	
10	12035																																																	
2-0	12025																																																	
10	12000																																																	
10	11990																																																	
20																																																		

Vertical scale 1" = 5'

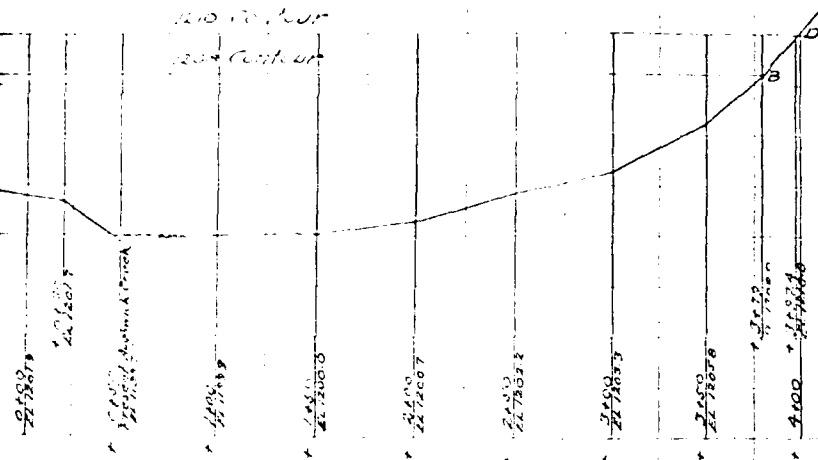


Vert. scale 1" = .5"



Profile Dam Site I
 Hor scale 1" = 50'
 Vert scale 1" = 5'

1210 Contour
 1200 Contour

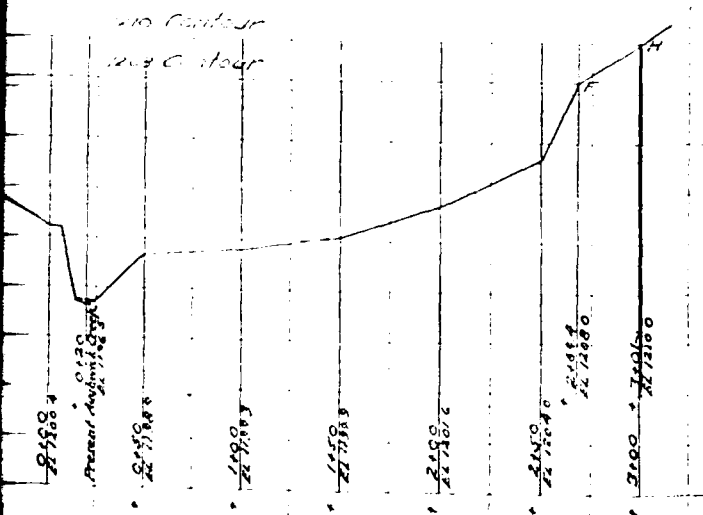


TEST SOUNDINGS TAKEN AS FOLLOWS-

STA	Below Grade
- 1213.9	Good Clay 3'
0+00	Mud 2'
	Gravel & Clay 3'
+ 0+50	Mud 3'
	Gravel & Clay 4'
+ 2+00	Mud 3'
	Good clay clay 4'
+ 2+50	Mud 3'
	Gravel & clay 4'
+ 2+50	" " 2'

Profile Dam Site II
 Hor scale 1" = 50'
 Vert scale 1" = 5'

1210 Contour
 1200 Contour

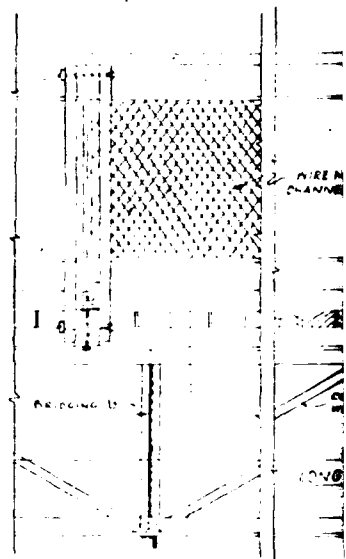


TEST SOUNDINGS TAKEN AS FOLLOWS-

STA	Below Grade
- 1+55	Shale & clay 2'
- 1+00	" " 2'
0+00	" " 2'
+ 0+20	" " 2'
+ 1+00	Mud 3.5'
	Gravel & clay 6'
+ 2+00	Gravel & Hard clay 3'
+ 3+00	" " 3'

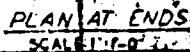
NOTE: Site II has been selected
 with flow line at 1210 contour.

Plotted Aug 31, 1924
 J. Egan, Jr., Eng'g Corp.



ELEVATION E-B

SCALE: 0.1-1.0

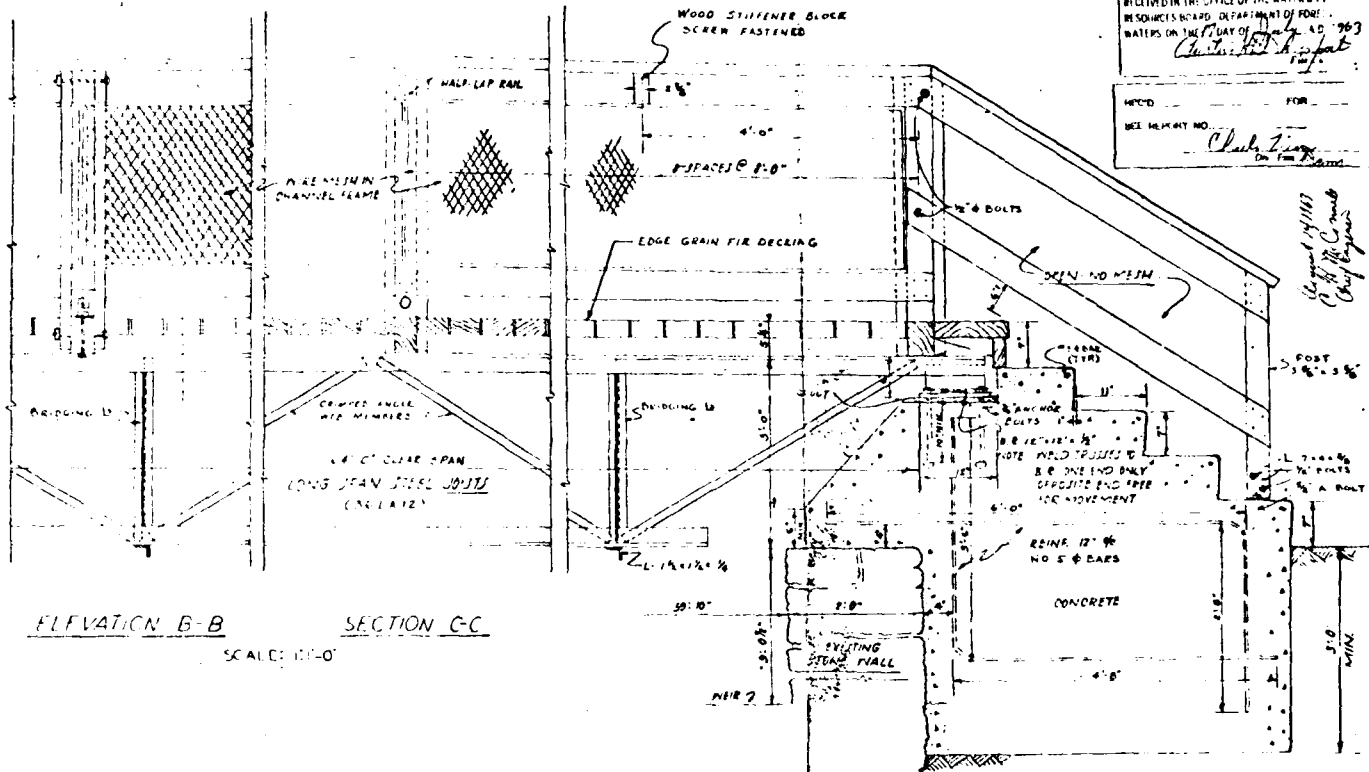


39-25-A-2

RECEIVED IN THE OFFICE OF THE WATER RESOURCES BOARD, DEPARTMENT OF FOREWATERS ON THE 12th DAY OF AUGUST 1963
Charles E. Neilan

PROJECT NO. 39-25-A-2
 SHEET NO. 1 OF 1
Charles E. Neilan
 ENGINEER

Approved 11/1/63
John W. Conrad
 Chief Engineer



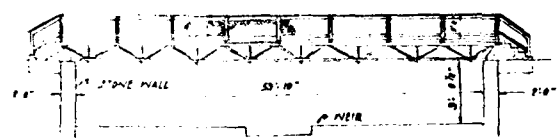
ELEVATION B-B

SECTION C-C

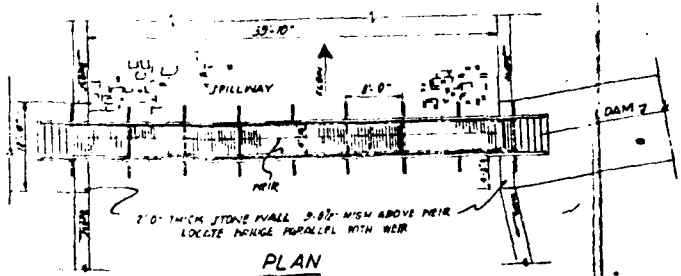
SCALE: 1/2"=1'-0"

SECTION D-D

NOTE:
 MINIMUM END REACTION FOR EACH JOIST
 SHALL BE NOT LESS THAN 11,546 LBS

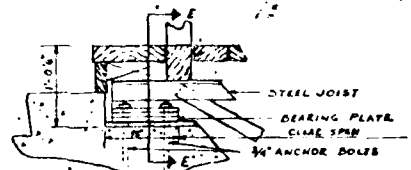


ELEVATION



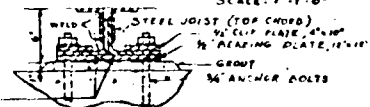
PLAN

SCALE: 1/2"=1'-0"



SLIP-END JOIST CONNECTION

SCALE: 1/2"=1'-0"



SECTION E-E



THE GENERAL STATE AUTHORITY HARRISBURG, PENNSYLVANIA			
PROJECT NO. G.S.A. 193-3			
PARK IMPROVEMENTS			
COWANS GAP STATE PARK			
PLATON & FRANKLIN COUNTY, PENNSYLVANIA			
THE NEILAN ENGINEERS INC.			
REGISTERED ENGINEERS			
BOMERSET, PENNSYLVANIA			
BRIDGE			
DESIGNED BY	DATE	SCALE	BY
NEILAN	11/1/63	1/2"=1'-0"	NEILAN
CHECKED BY	DATE	SCALE	BY
NEILAN	11/1/63	1/2"=1'-0"	NEILAN

Scale 1" = 5'

Embankment and Gate Tower

12' Elev. 1229 Top of dam

Core of Selected materials at least 40% clay

Masonry support for blow off

Toe of slope

8'

25'

MATCH LINE

Gate tower steps
19 Required $\frac{3}{4}"$ round

Wall Ties
210 Required $\frac{1}{2}"$ Round

$\frac{5}{8}" \times 4"$ Steel bars

$\frac{5}{8}"$ Rods Thread both ends

$\frac{3}{4}"$ Pipe spacers

Slope 1 on 2
Protect slope by planting seed, sodding or planting vines

30" Corrugated pipe

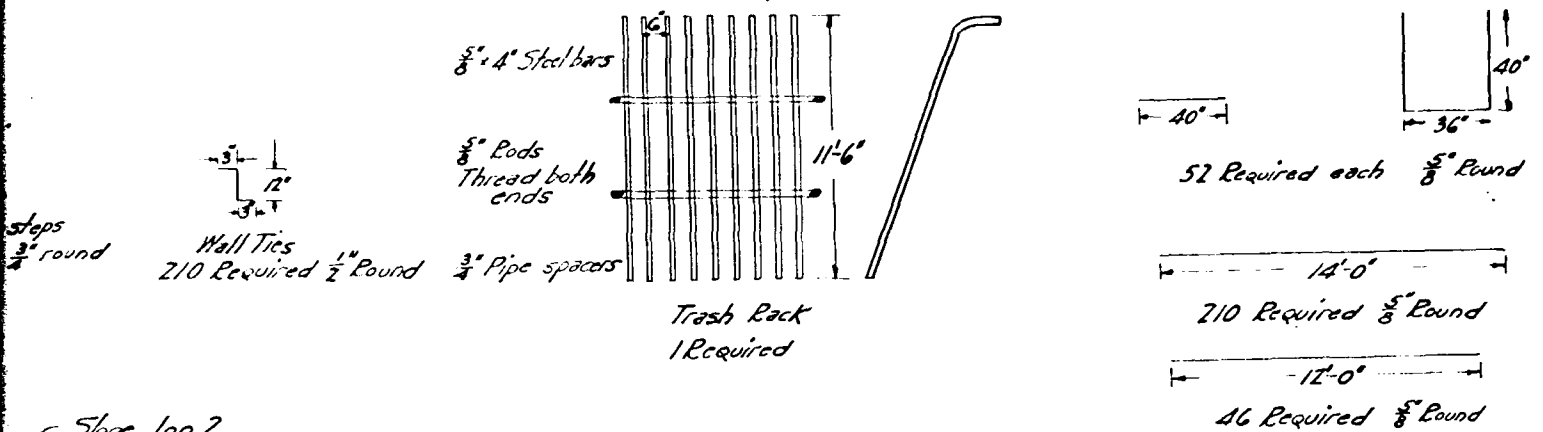
$\frac{5}{16}"$ rods

15'0"
11'0"
9'0"
5'0"
9'11"
15'

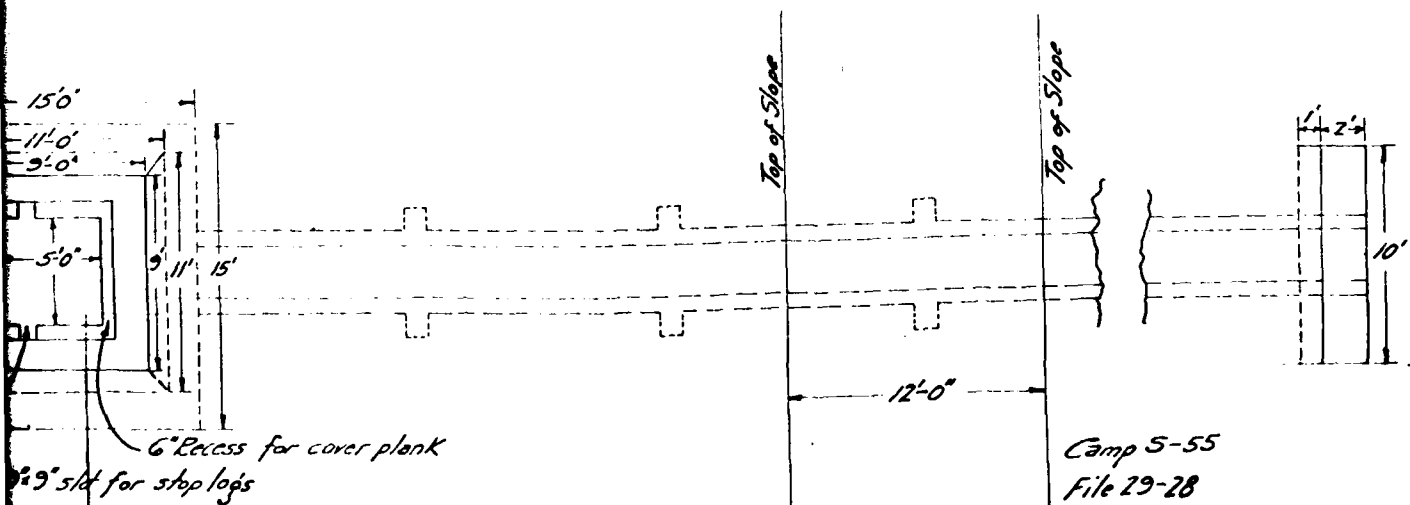
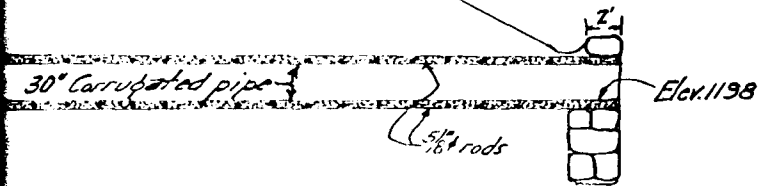
6" Recess for cover plank
3' x 3' s/d for stop logs

NOTE: ORIGINAL DESIGN DRAWING
PREPARED JANUARY 1936

List of Steel Required



Slope 1 on 2
Protect slope by planting seed, sodding or planting vines



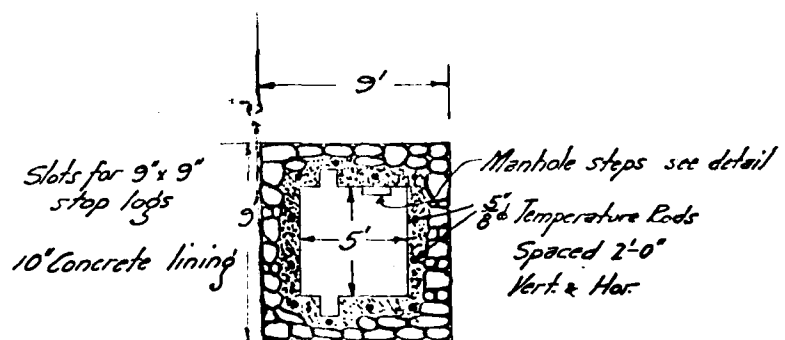
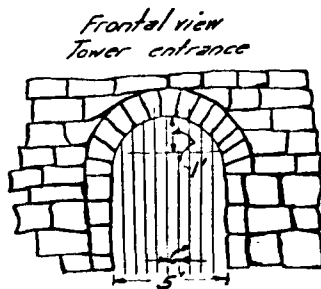
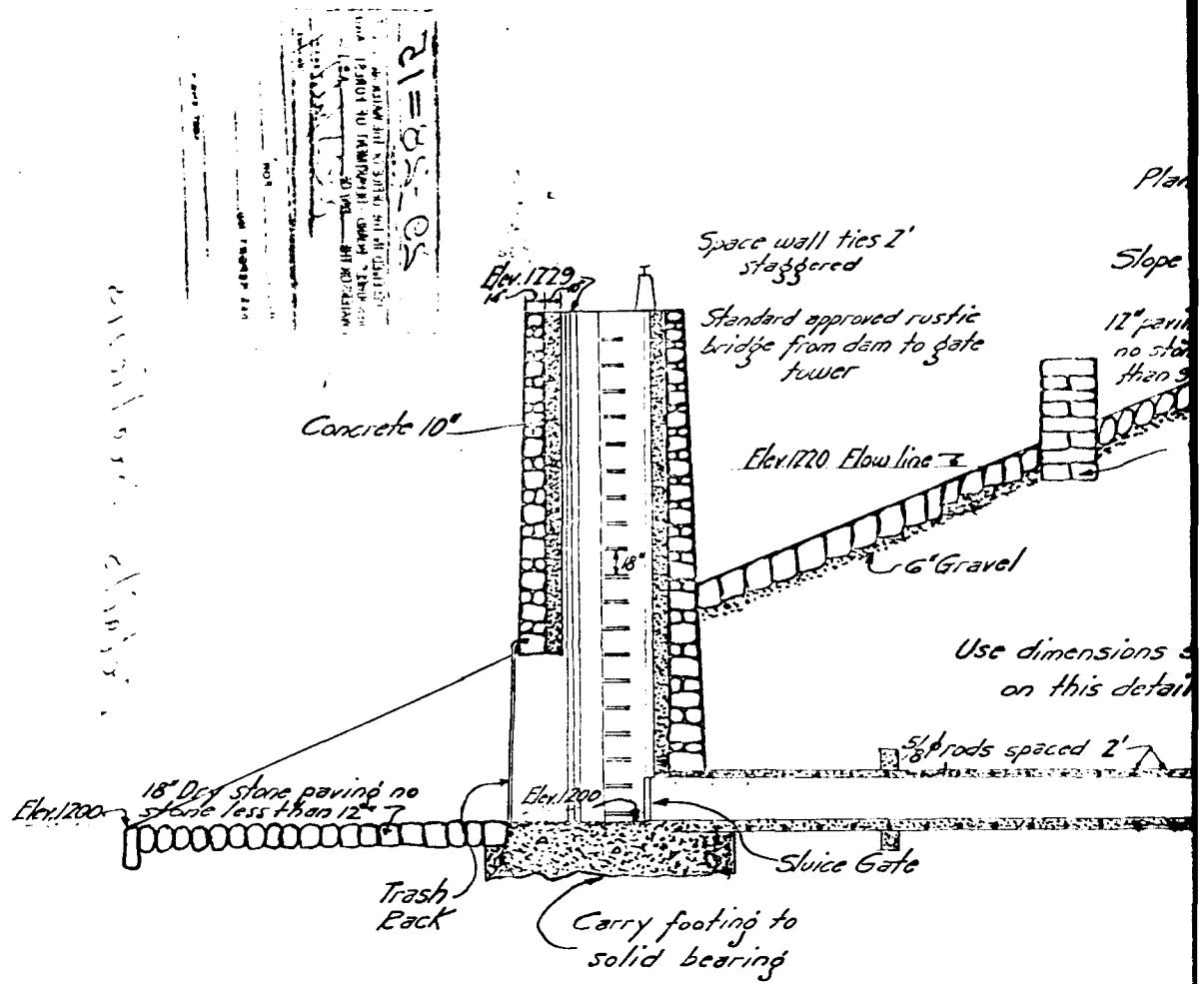
Camp 5-55
File 29-28

CONAN'S GAP DAM
Approved Sheet #4
Leah Beak

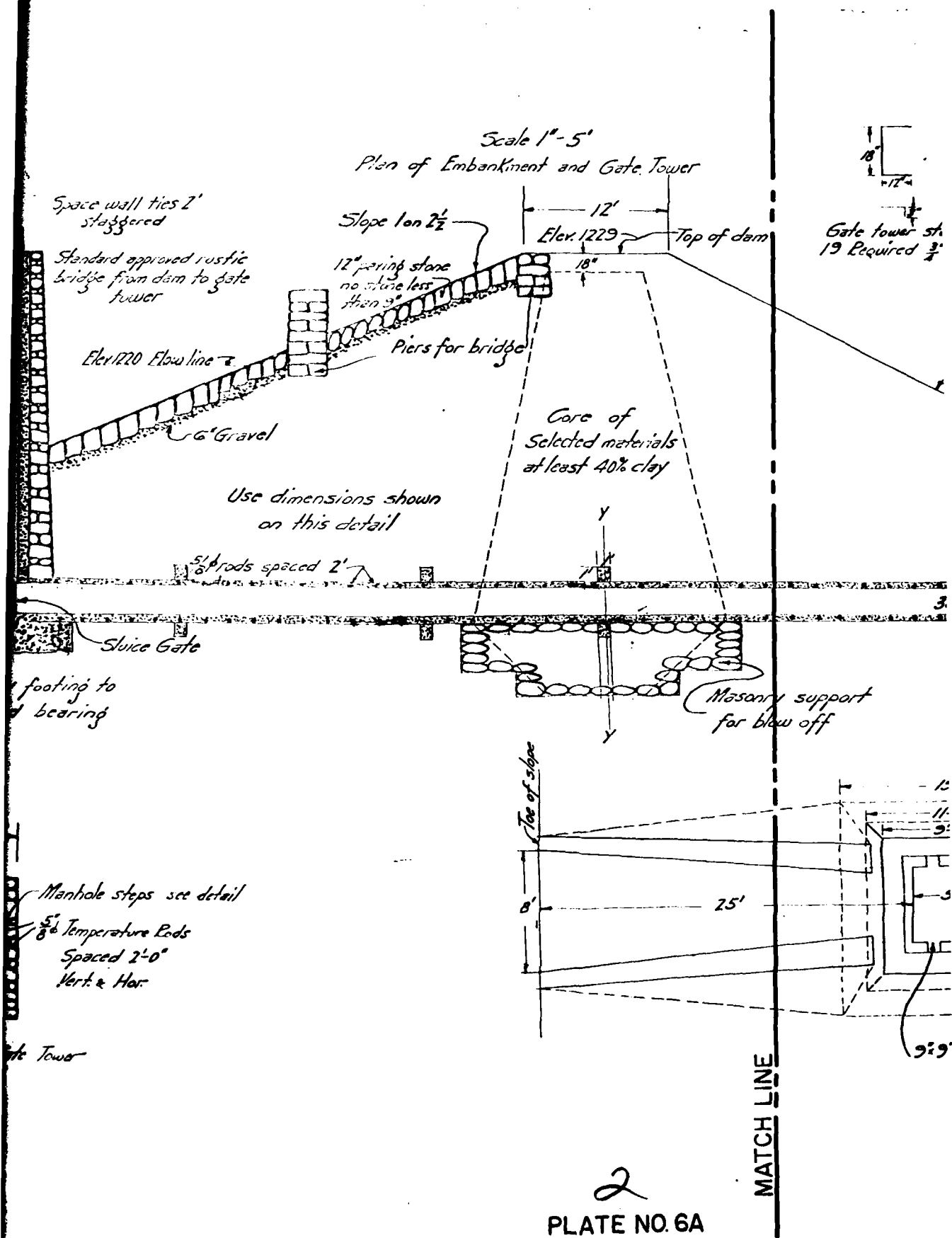
NOTE: ORIGINAL DESIGN DRAWING
PREPARED JANUARY 1936

PLATE NO. 6

2



Section thru Gate Tower
Scale 1" = 4'



APPENDIX F
REGIONAL GEOLOGY

COWANS GAP DAM
NDI ID. NO. PA 187
REGIONAL GEOLOGY

REGIONAL GEOLOGY

Cowans Gap Dam is located in the Valley and Ridge Physiographic Province, in a region of concentric folding, approximately 9 miles west of the mid-province structural front. East of this front lies the Great Valley and South Mountain belts where similar folding becomes predominate. Numerous large faults are mapped in the vicinity of the McConnellsburg quadrangle. Formation of most of the faults and folds of rocks occurred during the Appalachian Orogeny, toward the end of the Paleozoic era.

SITE GEOLOGY

Cowans Gap Dam is underlain by the undivided Mifflintown and Bloomsburg Formations. These formations consist of red and green mudstone, underlain by dark shale and limestone, which overlies the light gray to light brown quartzitic Keefer Sandstone Member. The Mifflintown-Bloomsburg-Rosehill contact is located approximately 500 ft. west of the left abutment. The Rosehill Formation consists of olive to medium gray (and locally red) shale with minor beds of siltstone and sandstone.

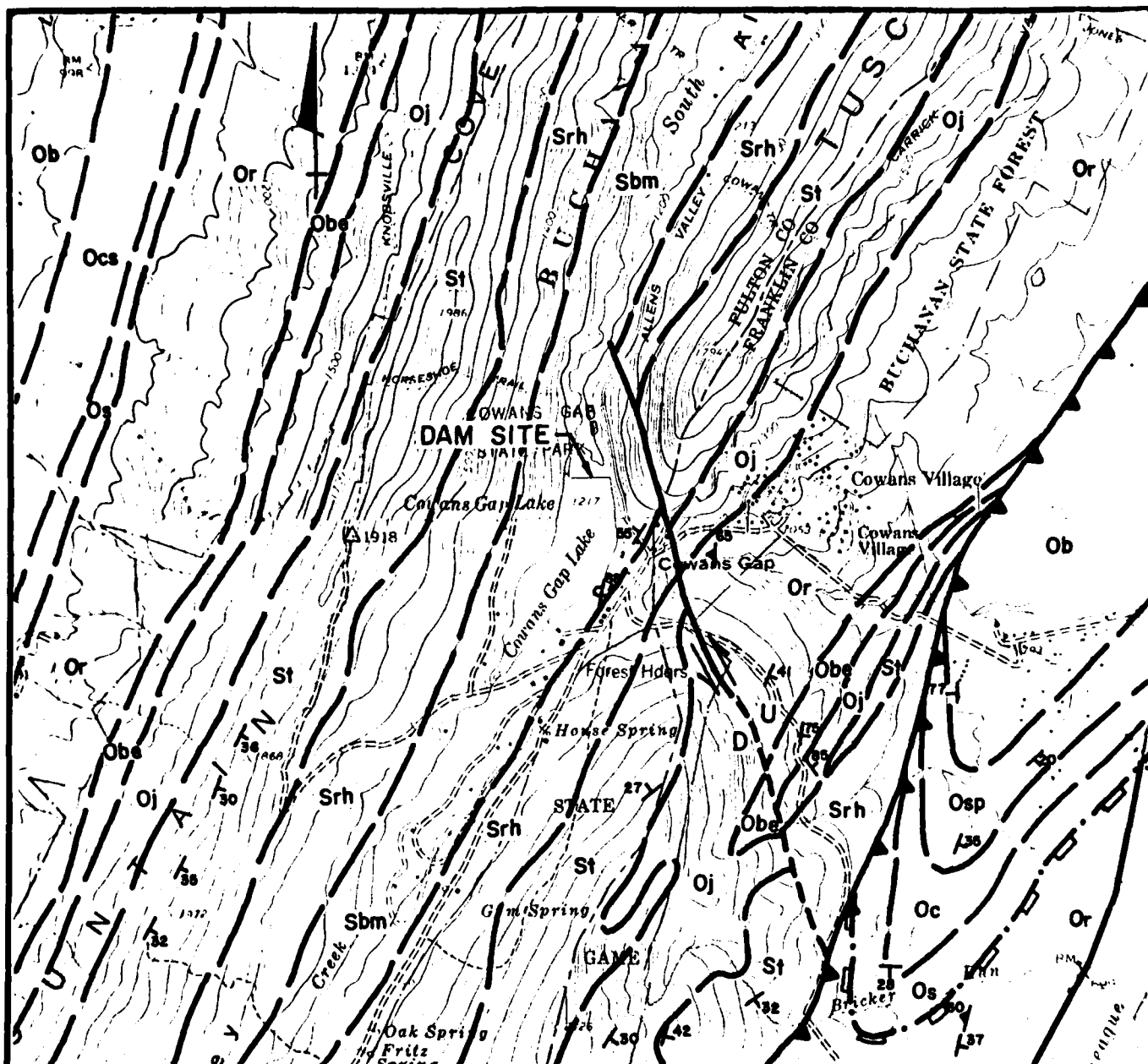
The Cowan Gap cross fault is located approximately 600 ft. east of the right abutment. The fault has dip-slip and strike-slip movement such that the northeast block has moved about 1,500 ft. up and 2,500 ft. northwest relative to the southwest block. The Path Valley high-angle thrust fault is located approximately 5,500 ft. east of the right abutment. This fault has a dip-slip movement of 4,000 ft., and has broken up and thinned the sandstones of the Taconic clastic wedge to less than half their normal thickness near Cowans Gap. The Tuscarora bedding plane fault is located approximately 9,000 ft. east of the right abutment. This fault has a mylonite zone ranging in thickness from 5 to 20 ft. which by analogy may have been formed by miles of movement.

Two earthquakes have been recorded in Fulton County on September 7, 1963, and October 10, 1963. The intensity of seismic activity was small, less than three on the Modified Mercalli scale. An index value of three, based on a scale range of 12, corresponds to seismic activity resembling vibrations caused by heavy traffic.

References

Kenneth L. Pierce, Pennsylvania Geological Survey, 1966, Atlas 109a, Bedrock and Surficial Geology of the McConnellsburg Quadrangle Pennsylvania.

Dr. B. F. Howell, Jr., Earth and Mineral Sciences Bulletin, Pennsylvania State University College of Earth and Mineral Sciences, Volume 48, No. 8, May 1979, Earthquake Risk in Eastern Pennsylvania.



BURNT CABINS & McCONNELLSBURG QUADRANGLES, FULTON COUNTY, PENNSYLVANIA

SCALE: 0 1/2 MILE 1: 24000

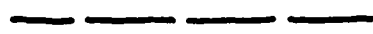
CONTOUR INTERVAL 20 FT. DATUM IS MEAN SEA LEVEL

FOR LEGEND SEE DWG. NO. F-3

DATA OBTAINED FROM PENNSYLVANIA GEOLOGICAL SURVEY'S GEOLOGIC MAP OF FULTON COUNTY, 1966
 REISED 1973

DATE: MAY 2, 1980	NATIONAL DAM INSPECTION PROGRAM	SITE GEOLOGY OF COWANS GAP DAM
SCALE: AS SHOWN		
DR: JLM CK: MLM	ACKENHEIL & ASSOCIATES CONSULTING ENGINEERS BALTIMORE, MD.	
DWG. NO. F-2		

LEGEND

	High-angle thrust fault
	Tuscarora bedding plane fault (markings on upper plate)
	Accurately located fault showing relative movement and upthrown and downthrown blocks
	Approximately located fault
	Well located contact
	Strike and dip of bedding
	Strike and dip of overturned beds
	Strike and dip of slaty cleavage
Sbm	Mifflintown and Bloomsburg Formations undivided
Srh	Rosehill Formation
St	Tuscarora Formation
Oj	Juniata Formation
Obe	Bald Eagle Formation
Or	Reedsville Formation
Os	Salona Formation
Oc	Chambersburg Formation
Osp	Saint Paul Group
Ob	Bellefonte Formation
Ocs	Chambersburg & Saint Paul Group undifferentiated

DATE
FILMED
9-8