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NATIONAL DAM INSPECTION PROGRAM. HOLLIDAYSBURG RESERVOIR (NDI 5--ETC(U)
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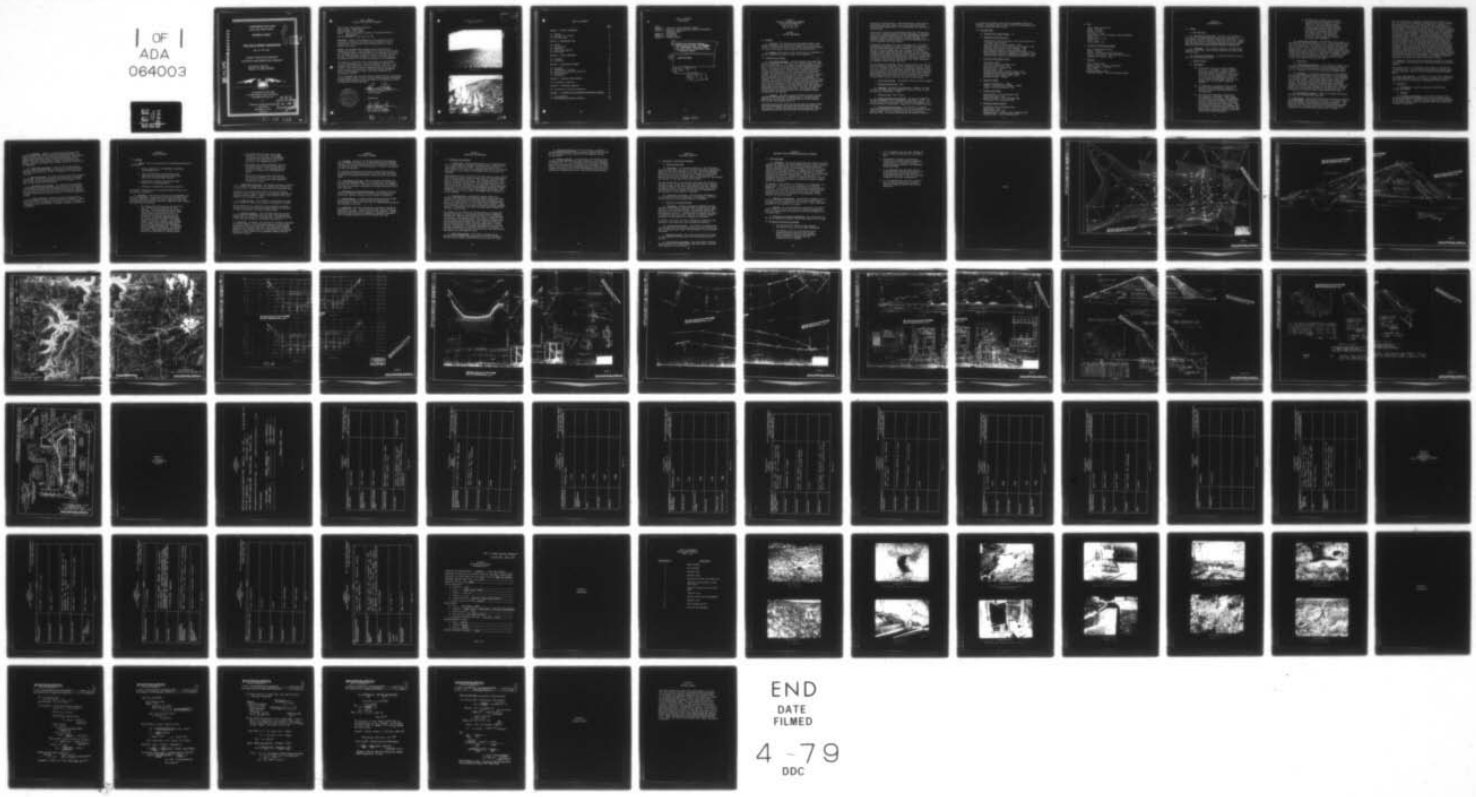

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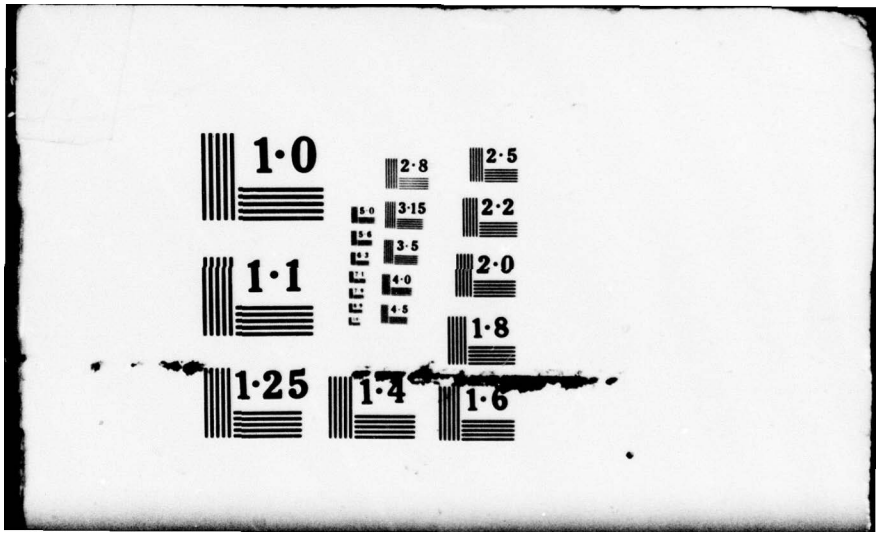
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SUSQUEHANNA RIVER BASIN
BLAIR RUN, BLAIR COUNTY

PENNSYLVANIA

LEVEL II

HOLLIDAYSBURG RESERVOIR

NDI I.D. NO: 522

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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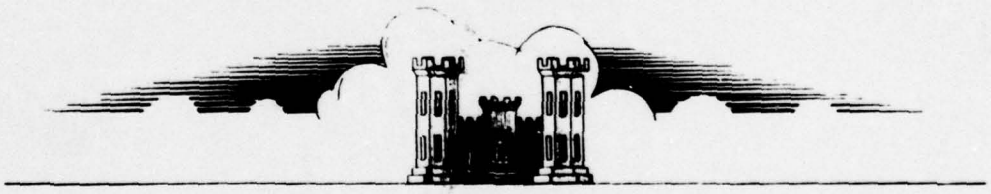

PREPARED FOR

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS
BALTIMORE, MARYLAND 21203

BY

D'APPOLONIA CONSULTING ENGINEERS
10 DUFF ROAD
PITTSBURGH, PA. 15235

JULY 1978

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PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

NAME OF DAM: Hollidaysburg Reservoir
STATE LOCATED: Pennsylvania
COUNTY LOCATED: Blair County
STREAM: Blair Run, tertiary tributary of Frankstown Branch of Juniata River
DATE OF INSPECTION: June 9 and 12, 1978

ASSESSMENT: Based on the evaluation of the conditions as they existed on the dates of inspection and as revealed by visual observations, the condition of Hollidaysburg Reservoir Dam is assessed to be good.

However, the nonfunctional drainpipe sluice gate should be immediately repaired. Other conditions that require attention are: (1) providing riprap on the embankment at the entrance of the spillway, (2) evaluating the adequacy of riprap on the upstream face of the dam, (3) monitoring of seeps at the toe of the dam, and (4) evaluating the need for installing piezometers in the embankment.

The spillway is classified to be "inadequate" (31 percent PMF). It is not considered to be "seriously inadequate" because it is estimated that overtopping of the dam would not result in a total failure. Because the rock-fill downstream slope of the dam can resist erosion and the backwater behind the railroad embankment would rise approximately 40 feet, the failure potential is substantially reduced.

It is recommended that the owner provide around-the-clock surveillance during unusually heavy runoff to detect possible problems and develop a formal warning system to alert the owner of the downstream dam and the residents further downstream.

Lawrence D. Andersen, P.E.
Vice President

APPROVED BY:

JOHN H. KENWORTHY
LTC, Corps of Engineers
Acting District Engineer

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HOLLIDAYSBURG RESERVOIR
JUNE 9, 1978

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Upstream Face

Downstream Face

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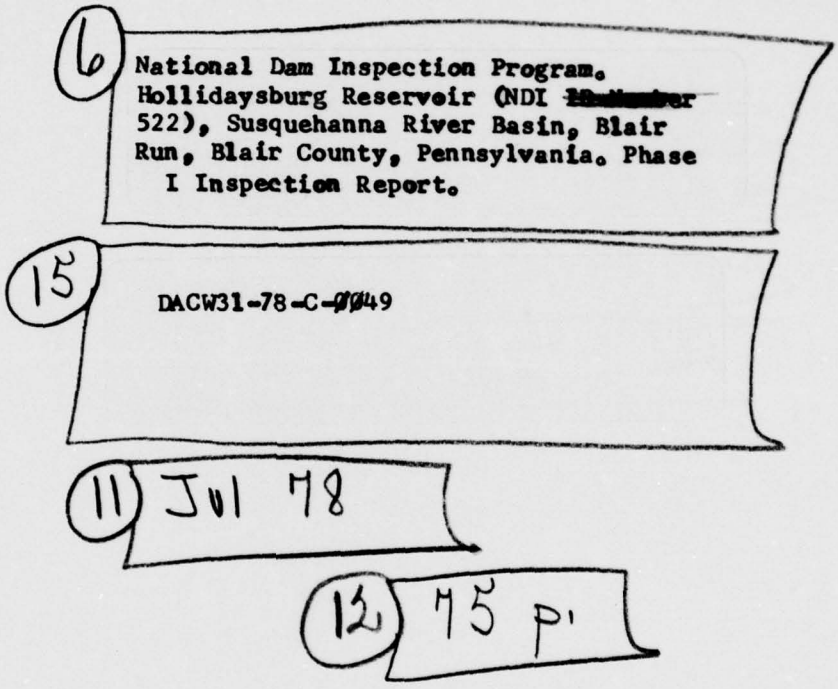

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PHASE I
NATIONAL DAM INSPECTION PROGRAM
HOLLIDAYSBURG RESERVOIR
NDI I.D. NO. 522
DER I.D. NO. 7-83

SECTION 1
PROJECT INFORMATION

1.1 General

a. Authority. The inspection 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 inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project

a. Dam and Appurtenances. The dam consists of an earth- and rock-fill embankment 520 feet long, with a maximum height of 66 feet from the downstream toe. The combined primary and emergency spillway is located on the right abutment (looking downstream) (Plates 1 and 2). The spillway structures consist of a concrete overflow section, discharging into a curved concrete channel terminating at a plunge pool approximately 100 feet downstream from the toe of the dam. The outlet works for the dam consist of a 30-inch concrete encased corrugated metal drainpipe and a 16-inch cast-iron supply line located near the right abutment through the embankment. As designed, flow through the drainpipe was controlled by a gate located at the downstream end of the pipe. However, the dam tender reported that after the completion of the dam a hydraulically controlled sluice gate was installed on the upstream end of the pipe controlled from a valve house located on the crest of the dam. The drainpipe discharges into the spillway plunge pool. The drainpipe and a 12-inch supply line blow-off pipe are the two emergency drawdown facilities for the reservoir.

b. Location. The dam is located on Blairs Run about 500 feet upstream of the embankment of Muleshoe Curve of the Penn Central Railroad and six miles west of Hollidaysburg in Juniata Township, Blair County, Pennsylvania (Plate 3).

Downstream from the dam, Blair Run flows through the culverts under the railroad embankment and joins Blair Gap Run about 1500 feet below the dam. Further downstream, Blair Gap Run follows a narrow, uninhabited valley for less than a mile and discharges into the

reservoir of Plain Nine Dam. Below Plain Nine Dam, Blair Gap Run goes through the towns of Foot of Ten and Duncansville before joining the Beaverdam Branch of the Juniata River one mile west of Hollidaysburg.

In the event of failure of Hollidaysburg Reservoir, flow from the dam would be impounded behind the railroad embankment, subsequently overtop the railroad embankment near its right abutment and flow downgrade along the railroad towards the Plain Nine Dam. The temporary storage capacity between the railroad embankment and the dam is estimated to be 124 acre-feet.

Depending on the sequence of events that might lead to failure of Hollidaysburg Reservoir, the failure consequences at Plain Nine Dam and further downstream could be different. For example, if the dam were to fail at normal pool level (storage 230 acre-feet), storage provided behind the railroad embankment and the surcharge storage volume of Plain Nine Dam (224 acre-feet) would be sufficient to prevent overtopping of Plain Nine Dam. However, if the dam were to fail at or just before overtopping when the storage volume is at its maximum (420 acre-feet), this failure would cause overtopping and probably failure of Plain Nine Dam.

For the purpose of assigning a hazard classification to the dam, the second alternative is the more critical sequence of events. Therefore, it is estimated that failure of Hollidaysburg Reservoir would also cause failure of Plain Nine Dam, causing large loss of life and property damage in Foot of Ten, Duncansville, and further downstream. Approximately 200 homes within the first three-mile reach of Blair Gap Run downstream from Plain Nine Dam are considered to be within the main impact area of a flood in the event of dam failure.

c. Size Classification. Intermediate (based on 66-foot height).

d. Hazard Classification. High.

e. Ownership. Borough of Hollidaysburg. (Address: Mr. Roy E. Davis, Borough Manager, Hollidaysburg Borough, 401 Blair Street, Hollidaysburg, Pennsylvania 16648).

f. Purpose of Dam. Water supply.

g. Design and Construction History. The dam was designed by The Neilan Engineers, Inc., of Somerset, Pennsylvania in 1955. The dam was constructed by New Enterprise Stone and Lime Company, Inc., of New Enterprise, Pennsylvania. Construction was completed in 1957.

h. Normal Operating Procedure. The reservoir is normally maintained at Elevation 1576, the level of the uncontrolled spillway crest, leaving 10 feet of freeboard to the top of the dam at Elevation 1586. All inflow occurring when the reservoir level is

at or above the spillway crest level is discharged through the spillway. The supply water is taken through a 16-inch supply line controlled downstream from the dam.

1.3 Pertinent Data

a. Drainage Area (square miles) - 7.2

b. Discharge at Dam Site (cfs)

Maximum known flood at dam site - 350 (1.5 feet over the spillway crest in 1972)
Warm water outlet at pool elevation - N/A
Diversion tunnel low pool outlet at pool elevation - N/A
Diversion tunnel outlet at pool elevation - N/A
Gated spillway capacity at pool elevation - N/A
Gated spillway capacity at maximum pool elevation - N/A
Ungated spillway capacity at maximum pool elevation - 5600
Total spillway capacity at maximum pool elevation - 5600

c. Elevation (USGS Datum) (feet)

Top of dam - 1586
Maximum pool-design surcharge - N/A
Full flood control pool - N/A
Recreation pool - (normal) 1576
Spillway crest - 1576
Upstream portal invert diversion tunnel - N/A
Downstream portal invert diversion tunnel - N/A
Streambed at center line of dam - 1520±
Maximum tailwater - Unknown

d. Reservoir (feet)

Length of maximum pool - 1600±
Length of recreation pool (normal) - 1400±
Length of flood control pool - N/A

e. Storage (acre-feet)

Recreation pool - 230 at Elevation 1576
Flood control pool - N/A
Design surcharge - 420 at Elevation 1586
Top of dam - 420 at Elevation 1586

f. Reservoir Surface (acres)

Top of Dam - 18± at Elevation 1586
Maximum pool - N/A
Flood control pool - N/A
Recreation pool - (normal) 13.8 at Elevation 1576
Spillway crest - 13.8 at Elevation 1576

g. Dam

Type - Earth and rock fill
Length - 520 feet
Height - 66 feet
Top width - 15 feet
Side slopes - 2.5H:1V upstream; 1.5H:1V downstream
Zoning - Yes
Impervious core - Yes
Cutoff - Yes
Grout curtain - Yes

h. Diversion and Regulating Tunnel

Type - 30-inch-diameter pipe
Length - 290 feet
Closure - Upstream and downstream valves
Access - Valve house on the crest and at the toe
Regulating facilities - None

i. Spillway

Type - Overflow weir
Length of weir - 60 feet (as measured)
Crest elevation - 1576 feet
Gates - None
Upstream channel - Lake
Downstream channel - Concrete discharge channel

SECTION 2
ENGINEERING DATA

2.1 Design

a. Data Available

(1) Hydrology and Hydraulics. Review of the information in the files of the Commonwealth of Pennsylvania, Department of Environmental Resources (PennDER) showed that there are no original hydrology and hydraulic design data available for the dam. Report Upon the Application of Hollidaysburg Borough Authority, dated August 24, 1955, includes the design capacity of the spillway.

(2) Embankment. The available information includes design drawings, boring logs, slope stability analyses, and construction specifications.

(3) Appurtenant Structures. No design information is available other than design drawings.

b. Design Features

(1) Embankment:

(a) As designed, the dam is a zoned embankment (Plate 2). It includes a central compacted shale zone underlain by a blanket of free draining alluvium. Upstream is a filter zone, clay core, and a pervious zone. Downstream is a rock-fill zone grading from finer to coarser toward the downstream. The clay core extends into a cutoff trench founded on bedrock.

(b) The embankment was designed to have one and one-half to one (horizontal to vertical) downstream slope and two and one-half to one upstream slope.

(c) The subsurface investigation consisted of 33 borings and 2 test pits. Plate 1 shows the locations of the borings. The subsurface profile at the dam site (Plate 4) shows 10 to 30 feet of talus and colluvium on the valley walls and alluvium on the valley floor. This is underlain by sandstone, red claystone, and shale layers. The rock formations at the site dip toward the northwest direction by one foot vertical per 10 feet horizontal.

(d) The dam design included a grout curtain extending the entire length of the cutoff trench and below the spillway section (Plate 5). The specifications required a three-stage grouting scheme consisting of 10-foot-deep holes on 5-foot centers, followed by 25-foot-deep holes on 15-foot centers, and 60-foot-deep holes on 30-foot centers. The deep grout holes were only required at the middle one third of the embankment.

(2) Appurtenant Structures. The appurtenant structures of the dam consist of a spillway and outlet works. Flow through the spillway located around the right abutment is controlled by an overflow weir at Elevation 1576. The details of the spillway are shown in Plates 5 and 6. The outlet works include a 30-inch corrugated metal drainpipe and 16-inch cast-iron supply pipe, both encased in concrete through the embankment (Plate 7). The concrete encasement includes cutoff collars for seepage control (Plate 5). As designed, flow through these pipes is controlled by manually operated valves located at the downstream end of the pipes.

c. Design Data

(1) Hydrology and Hydraulics. In the 1955 state report, it is stated that the discharge capacity of the spillway was estimated to be 5100 cubic feet per second with two feet of freeboard, equivalent to a discharge of 704 cfs per square mile of drainage basin.

(2) Embankment. The stability calculations for the embankment are included with design drawings (Plates 8 and 9). The stability of the steeper downstream slope was analyzed for circular and wedge-type sliding surfaces. The minimum computed safety factors were 1.76 for the circular sliding surface and 1.3 for a wedge-type failure. The analysis was based on assumed angles of internal friction of 30 degrees between the rock fill and alluvium based, 40 degrees for rock fill and 35 degrees for the shale fill. The unit weight of all the material was taken as 100 pounds per cubic foot. No reference to through or under seepage analyses was found.

(3) Appurtenant Structures. There are no design calculations available for the appurtenant structures

2.2 Construction. Construction drawings and specifications prepared by Neilan Engineers were available for review. To the extent that can be determined, the construction of the dam was apparently conducted in accordance with the specifications as prepared by Neilan Engineers, Inc. No reference was found to indicate any unusual problems were encountered during construction of the dam.

In a U.S. Army Corps of Engineers' inspection report dated July 12, 1977, it is stated that following the completion of the dam, seepages were observed at the toe of the dam and weirs were installed to monitor the seepage quantities. Records of these measurements are not available. In the above-referenced report, it is further reported that according to the owner's engineer's account, a sinkhole developed in 1961 in the upstream slope of the dam and the lake was drawn down to Elevation 1561 for repairs. The Chester Engineers of Coraopolis, Pennsylvania, were contacted to obtain more information on the extent of the 1961 repairs. Mr. William Rice of Chester Engineers, who was the field engineer at the time of the repairs, reported that sheet piles were driven around the depressed area which was located near the left abutment. The area inside the sheet piling was excavated to a depth of 15 to 20 feet to investigate the cause of the depression. No apparent cause was discovered, and the embankment showed no signs of piping. The excavation was backfilled with the clay that had been used as core material for the dam. He further stated that although the seepages that existed prior to the lowering of the lake for repairs dried up when the pool level was lowered, the seepage resumed when the pool level was raised after the repairs. No perceivable change was observed in the amount of seepage following the repairs.

2.3 Operation. There are no formal operating procedures for the dam. The spillway of the impoundment is uncontrolled and has no operational features.

The blow-off pipe for the impoundment as designed is controlled by a downstream valve. The dam tender reported that an upstream sluice gate was installed; however, it has not been functional for several years.

2.4 Other Investigations. In addition to periodic state inspections, the dam was inspected by the U.S. Bureau of Reclamation on July 18, 1972, and by the U.S. Army Corps of Engineers on July 12, 1977.

2.5 Evaluation

a. Availability. Available engineering information was provided by PennDER.

b. Adequacy

(1) Hydrology and Hydraulics. The reported results of the hydrology and hydraulics analyses indicate that the design capacity of the spillway was in conformance with the applicable state criteria at the time of design. However, engineering data are not available to assess the structures.

(2) Embankment. Review of the geotechnical aspects of the design indicates that although the design generally followed currently accepted practice for subsurface investigations, the stability analyses were apparently based on assumed soil strength values rather than actual strength values obtained from laboratory test results. However, the assumed soil strength values are considered to be reasonable.

(3) Appurtenant Structures. Review of the design drawings indicates that as designed there are no significant design deficiencies that should affect the overall performance of the appurtenant structures.

c. Operating Records. No formal operating records are available for the dam. To the best knowledge of the dam tender, the maximum flow through the dam occurred during Tropical Storm Agnes in 1972, when 1.5 feet flowed over the spillway.

d. Post-Construction Changes. As reported by the dam tender, a hydraulically operated sluice gate was installed on the upstream end of the blow-off pipe after the completion of the dam. Controls for this gate are located on the crest of the dam near the spillway. No other information was available relative to this post-construction change.

e. Seismic Stability. The dam is located in Seismic Zone 1 and static stability of the dam is considered to be adequate. Therefore, based on the recommended criteria for evaluation of seismic stability of dams, the structure is assumed to present no hazard from earthquakes.

SECTION 3
VISUAL INSPECTION

3.1 Findings

a. General. The on-site inspection of Hollidaysburg Reservoir consisted of:

1. Visual inspection of the embankment, abutments, and embankment toe.

2. Visual examination of the spillway and its components, the downstream end of the outlet pipe, and other appurtenant features.

3. Observation of factors affecting the runoff potential of the drainage basin.

4. Evaluation of downstream area hazard potential.

The specific observations are illustrated in Plate 10 and in the photographs in Appendix C.

b. Embankment. The general inspection of the embankment consisted of searching for indications of structural distress, such as cracks, subsidence, bulging, wet areas, seeps and boils, and observing general maintenance conditions, vegetative cover, erosion, and other surficial features.

1. Two seepage areas were found at the toe of the dam. The first was located near the left abutment. The seepage quantity was estimated to be about 5 to 10 gallons per minute. This seepage flowed along the toe for 15 to 20 feet and percolated back into the rock toe of the dam. The second seepage area along the toe was located to the left of the valve chamber at the toe of the dam. This seepage formed a swampy area extending along the side of the spillway plunge pool and discharging into the stream and plunge pool. The quantity of this seepage was estimated to be 5 gallons per minute. Both seeps were observed to be clear with no indication of internal erosion.

2. One seepage area was found on the right abutment at the toe level. This seepage is located on the left side of the spillway channel and was estimated to be 5 gallons per minute. The seepage was clear.

3. Two springs were found approximately 200 feet downstream from the toe on the left side of the stream channel. Total discharge from the springs was estimated to be 100 gallons per minute.

4. Riprap on the upstream slope of the dam was significantly weathered. No riprap was found on a portion of the upstream slope immediately adjacent the spillway.

c. Appurtenant Structures. The spillway structures, spillway crest, channels and plunge pools were examined for deterioration or other signs of distress and obstructions that would limit flow.

In general, the structures were found to be in good condition, except for erosion along the side of the plunge pool opposite the spillway discharge channel. However, this condition is not considered to be a problem at present.

d. Reservoir Area. The watershed is predominantly covered with woodlands and infiltration capacity is estimated to be good.

The shorelines are not considered to be susceptible to massive landslides which would affect the storage volume of the reservoir or cause overtopping of the dam by displaced water.

e. Downstream Channel. Blair Run downstream from the dam flows through an uninhabited valley for about two miles and discharges into the reservoir of Plain Nine Dam. Further description of the downstream conditions is included in Section 1.2.

3.2 Evaluation. In general, the condition of the dam is considered to be good. However, continued monitoring and recording of the seepage quantities will be required to determine if the seepage quantities are increasing with time. Also, additional riprap is required on the upstream slope of the dam adjacent to the spillway entrance, to avoid erosion of the embankment during high flows through the spillway.

SECTION 4
OPERATIONAL FEATURES

4.1 Procedure. Review of the design drawings and field observations indicates that there are no formal procedures for operating the dam. The only operational feature of the dam which may affect the safety of the dam is the drainpipe gate, in case it is required to lower the reservoir.

The clearing of debris from the primary spillway inlet structure as required and continued inspection of the facilities by the dam tender are the principal maintenance operations which would affect safety.

4.2. Maintenance of the Dam. While the general maintenance condition of the embankment appears to be satisfactory, the seepage weir which was reported to have been installed after the completion of the dam is no longer in existence and seepage quantities are not being monitored.

4.3 Maintenance of Operating Facilities. As reported by the dam tender, the hydraulic control for the blow-off pipe gate is not functional; therefore, the gate cannot presently be operated.

4.4 Warning System. No formal warning system exists for the dam. The dam is maintained by borough personnel operating from Hollidaysburg, 5 miles east of the dam. No communication facilities are available at the site.

4.5 Evaluation. The overall maintenance condition of the dam is considered to be fair. The blow-off pipe gate controls should be immediately repaired to permit lowering of the reservoir. Channelization and monitoring of the seepages are required to determine that the seepage quantities are not increasing with time.

SECTION 5
HYDRAULICS AND HYDROLOGY

5.1 Evaluation of Features

a. Design Data. Hollidaysburg Reservoir has a watershed area of 7.2 square miles and impounds a reservoir with a surface area of 13.8 acres at normal pool level. The spillway located on the right abutment is the only flood discharge facility for the reservoir. The capacity of the spillway is estimated to be 5600 cfs with no freeboard.

Approximately 500 feet downstream of the dam, Blair Run flows through three 48-inch-diameter culverts located below a 47-foot-high embankment of the Penn Central Railroad. The discharge capacity of the culverts under maximum head (water level at Elevation 1560) is estimated to be 1300 cfs (Appendix D). The discharge capacity of the culverts is smaller than the discharge capacity of the spillway which could result in the formation of an impoundment behind the railroad embankment in the event of large flows through the spillway. The storage capacity of this potential impoundment area is estimated to be 124 acre-feet.

b. Experience Data. As previously stated, since it is estimated that failure of Hollidaysburg Reservoir would result in failure of the downstream Plain Nine Dam, which consequently could cause large damage and loss of life downstream, the Hollidaysburg Reservoir is classified to be in the "high" hazard category. Under the recommended criteria for evaluating emergency spillway discharge capacity, "intermediate" size dams in the high hazard category are required to pass the PMF.

The adequacy of the spillway was analyzed based on the simplified procedure developed by the Baltimore District Corps of Engineers (Appendix D). Based on this analysis procedure, it was determined that the PMF inflow hydrograph will have a peak of 19,500 cfs and a total volume of 10,000 acre-feet. These values are greater than the maximum spillway discharge capacity of 5600 cfs and 190 acre-feet surcharge storage volume of the dam, respectively. Further analysis, according to the procedure, indicates that the spillway can pass a maximum flow of 31 percent PMF without overtopping. In the event of full PMF, the depth of overflow over the entire dam was determined to be approximately 3 feet.

c. Visual Observations. On the date of inspection, no conditions were observed that would indicate that the spillway of the dam could not operate satisfactorily in the event of a flood.

d. Overtopping Potential. The calculations, according to the recommended procedure referred to above, indicate that the dam will be overtopped during a flood where the magnitude exceeds 31 percent PMF.

e. Spillway Adequacy. As stated above, the capacity of the spillway is less than 50 percent PMF; therefore, it is classified as "inadequate." It is not considered to be "seriously inadequate" since it is estimated that overtopping would not result in a total failure since the rock-fill downstream slope of the dam can resist erosion and backwater from the railroad embankment would raise the tailwater by approximately 40 feet, reducing the breach potential.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

(1) Embankment. As discussed in Section 3, the field observations did not reveal any signs of distress that would significantly affect the short-term stability of the dam. The various seepages observed at the toe of the dam are not considered to significantly affect stability as they presently exist. These seeps should be monitored and recorded to document that the conditions are not changing. The turbidity of the seeps should also be noted.

The reported sinkhole on the upstream face of the dam, which was repaired in 1961, raised some initial concerns as to its cause and its ramifications on the overall performance of the dam. However, information obtained from the engineers who conducted the investigation and repair work suggests no indications of weaknesses in the embankment, such as piping or sloughing.

(2) Appurtenant Structures. The structural performance of the spillway structures is considered to be adequate. The structural condition of the drainpipe could not be assessed.

b. Design and Construction Data

(1) Embankment. Available information indicates that the stability of the steeper downstream slope was analyzed for wedge-type and circular sliding surfaces. The reported minimum safety factors were 1.76 for the circular sliding surface and 1.3 for the wedge-type failures. It appears that the analyses were based on assumed strength parameters. However, the adapted strength parameters are considered to be reasonably conservative.

The design incorporated such basic components as impervious core extending to the foundation rock and foundation grouting.

(2) Appurtenant Structures. The review of the design drawings indicates that there are no apparent structural deficiencies that would significantly affect the performance of the appurtenant structures.

c. Operating Records. The structural stability of the dam is not considered to be affected by the operational features of the dam.

d. Post-Construction Changes. There have been no reported modifications to the original design that would affect the structural stability of the structure.

SECTION 7
ASSESSMENT AND RECOMMENDATIONS/REMEDIAL MEASURES

7.1 Dam Assessment

a. Assessment: The visual observations and review of available information indicate that the Hollidaysburg Dam is in good condition. However, the drainpipe gate was found to be nonfunctional and requires immediate repair, and the seepages at the toe of the dam should be monitored and recorded. It appears that the dam was constructed with reasonable care and the design generally followed currently accepted engineering practice. However, since the original design did not include a seepage analysis for the dam, it is considered advisable for the owner to evaluate the need to install piezometers into the embankment to determine the phreatic surface through the embankment.

The capacity of the spillway is classified to be "inadequate" (31 percent PMF). However, it is not considered to be seriously inadequate. It is estimated that overtopping of the dam would not result in a total failure, because the rock-fill downstream slope of the dam can resist erosion and backwater from the railroad embankment would raise the backwater by approximately 40 feet, reducing the breach potential.

b. Adequacy of Information. The available information in conjunction with visual observations and the previous experience of the inspectors are considered to be sufficient to make a reasonable assessment of the condition of the dam.

c. Urgency. Of the recommendations listed above, the repair of the outlet pipe sluice gate should be implemented immediately, while the others should be considered as soon as practicable or on a continued basis.

d. Necessity for Further Investigation. The condition of the dam is not considered to require further investigation at this time.

7.2 Recommendations/Remedial Measures

1. The owner should be advised to make appropriate repairs to the outlet pipe gates immediately.

2. The seepage at the toe of the dam and on the abutments should be monitored and recorded. Marshy areas below the toe of the dam should also be observed to determine that the conditions are not changing.

3. It is recommended that the owner evaluate the need to install piezometers into the embankment.

4. The adequacy of riprap at the entrance channel of the spillway should be evaluated to determine if it provides sufficient protection against erosion of the embankment during high flows.

5. It is recommended that the owner provide around-the-clock surveillance during periods of unusually heavy runoff and develop a formal warning system to alert the downstream residents in the event of emergencies.

6. It is recommended that the owner be advised that the dam and appurtenant structures should be inspected regularly and properly maintained.

PLATES

DRAWN BY	D.J.D.	CHECKED BY	BJE	7-26-78	DRAWING NUMBER
	7-20-78	APPROVED BY	[illegible]	7-26-78	78-114-B88

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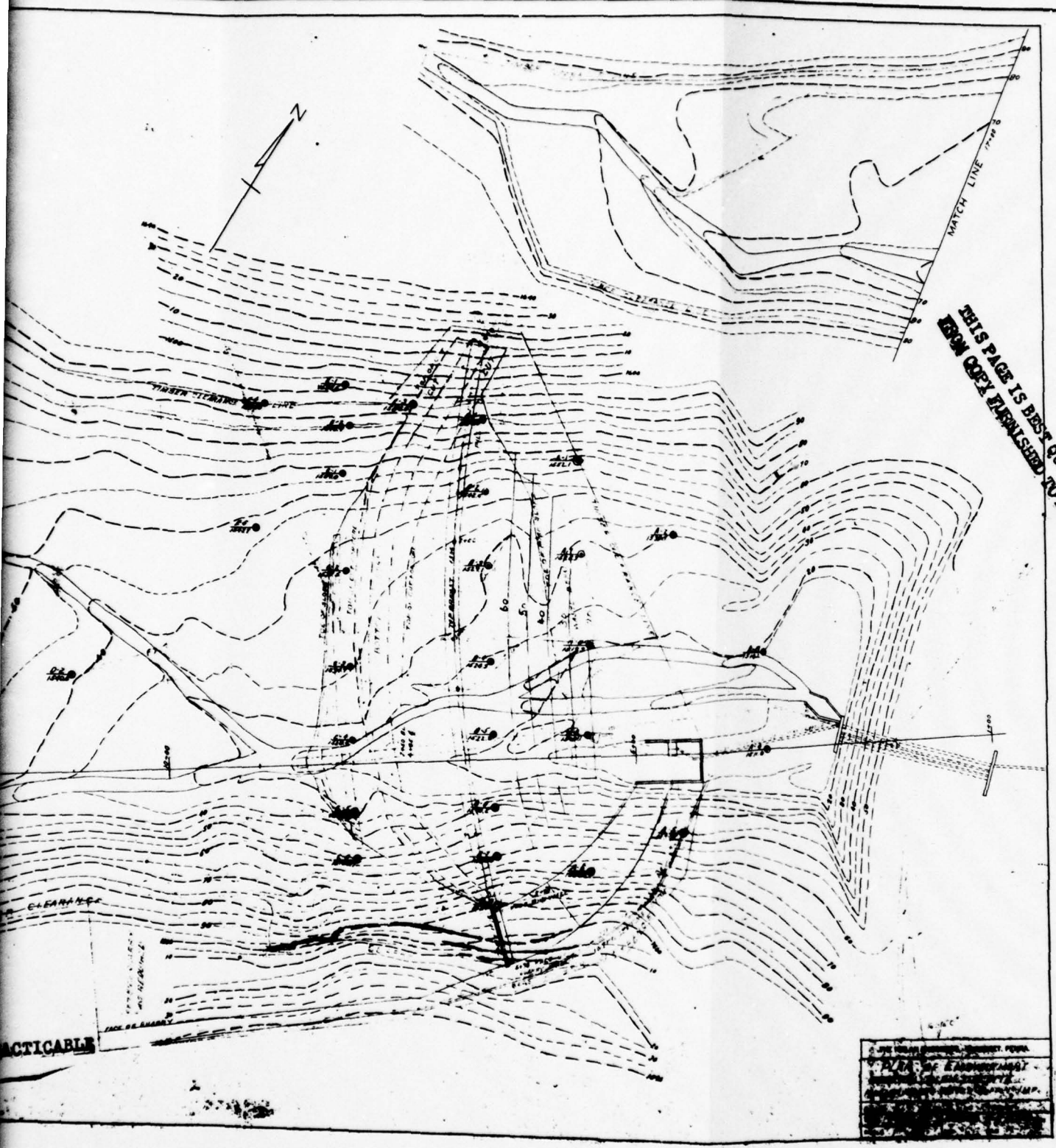

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PLATE I

D'APPOLONIA

DRAWN BY	D.J.D.	CHECKED BY	[illegible]	7-26-78	DRAWING NUMBER
	7-20-78	APPROVED BY	J.H.P.	7-26-78	78-114-B82

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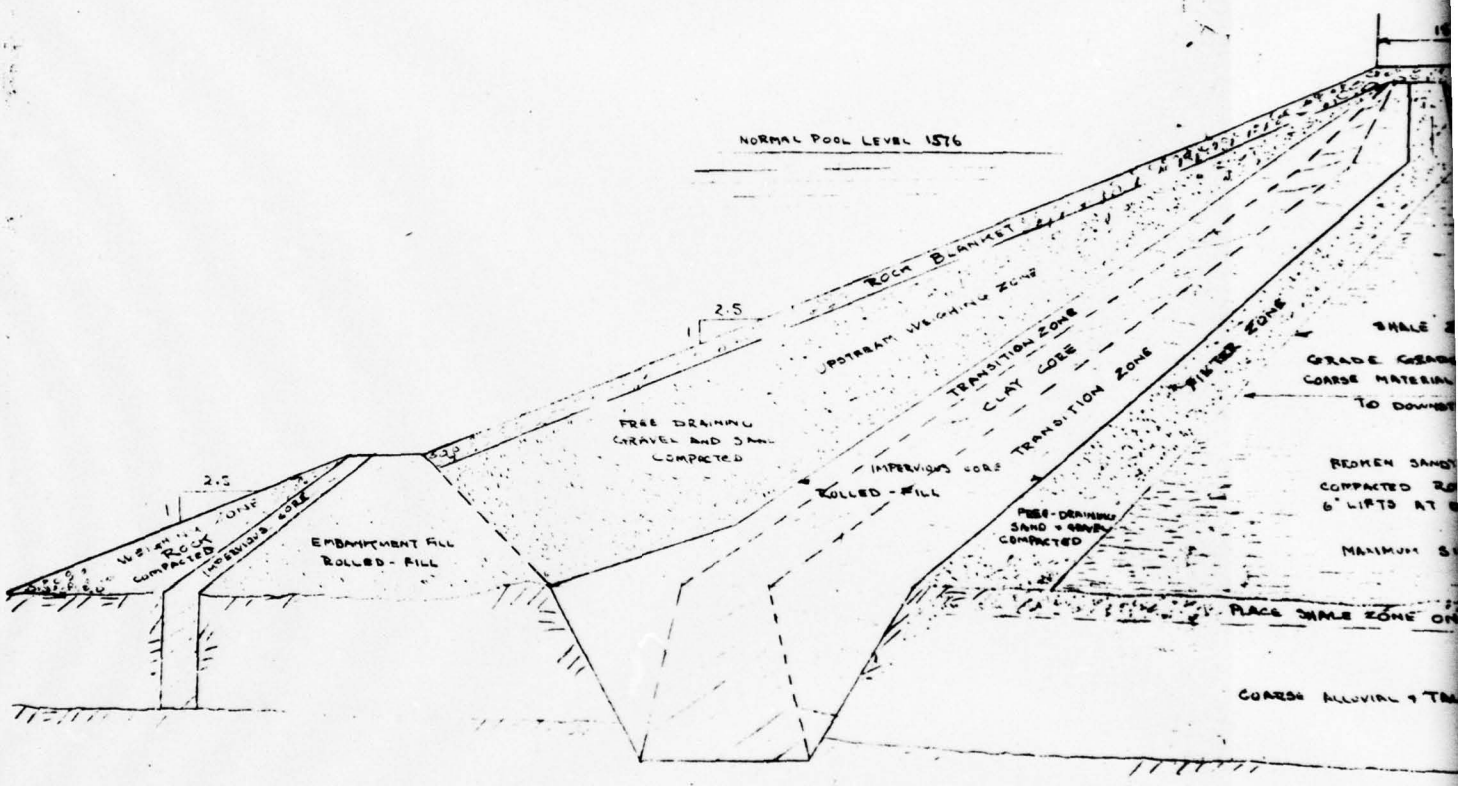

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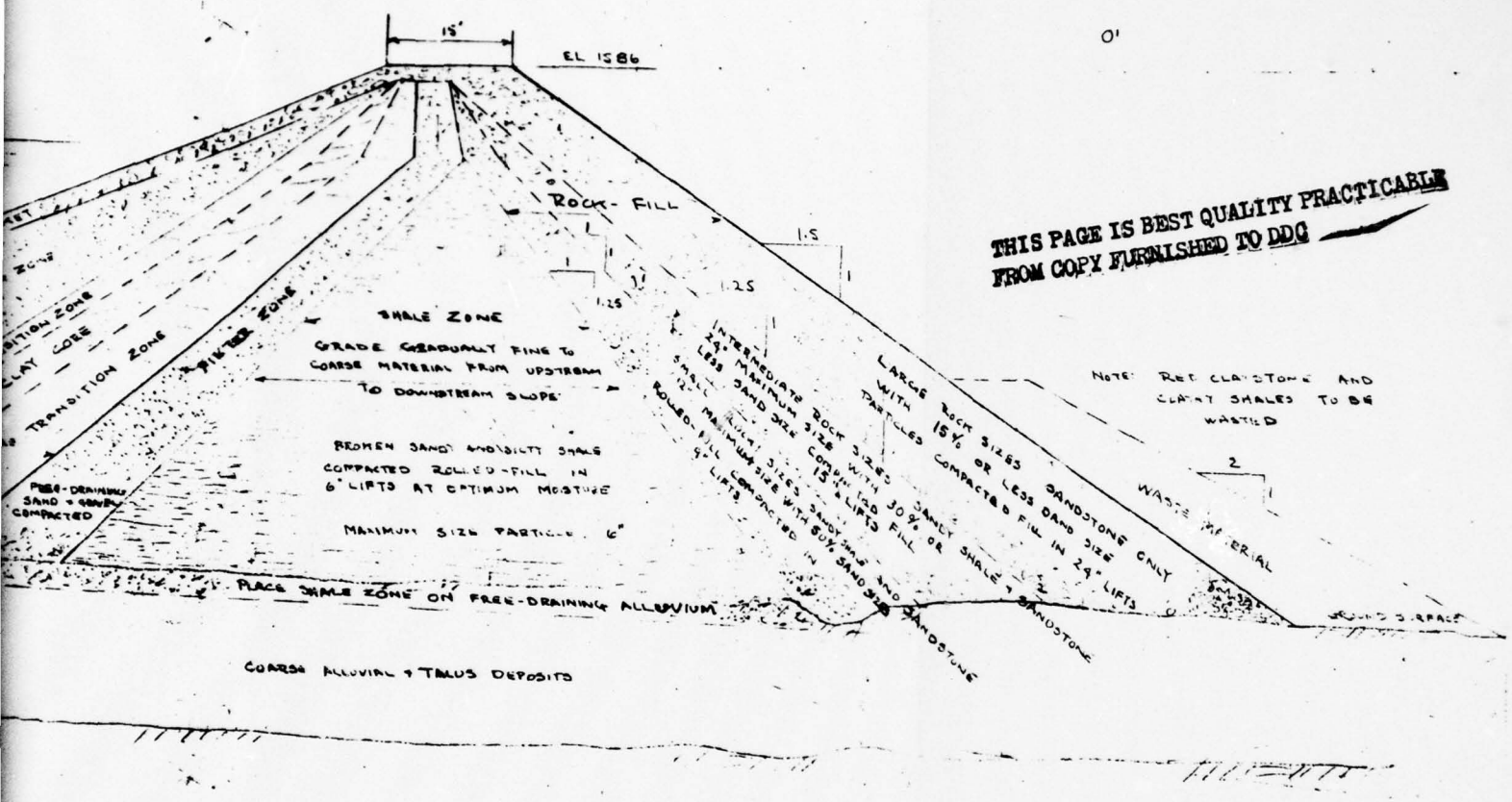

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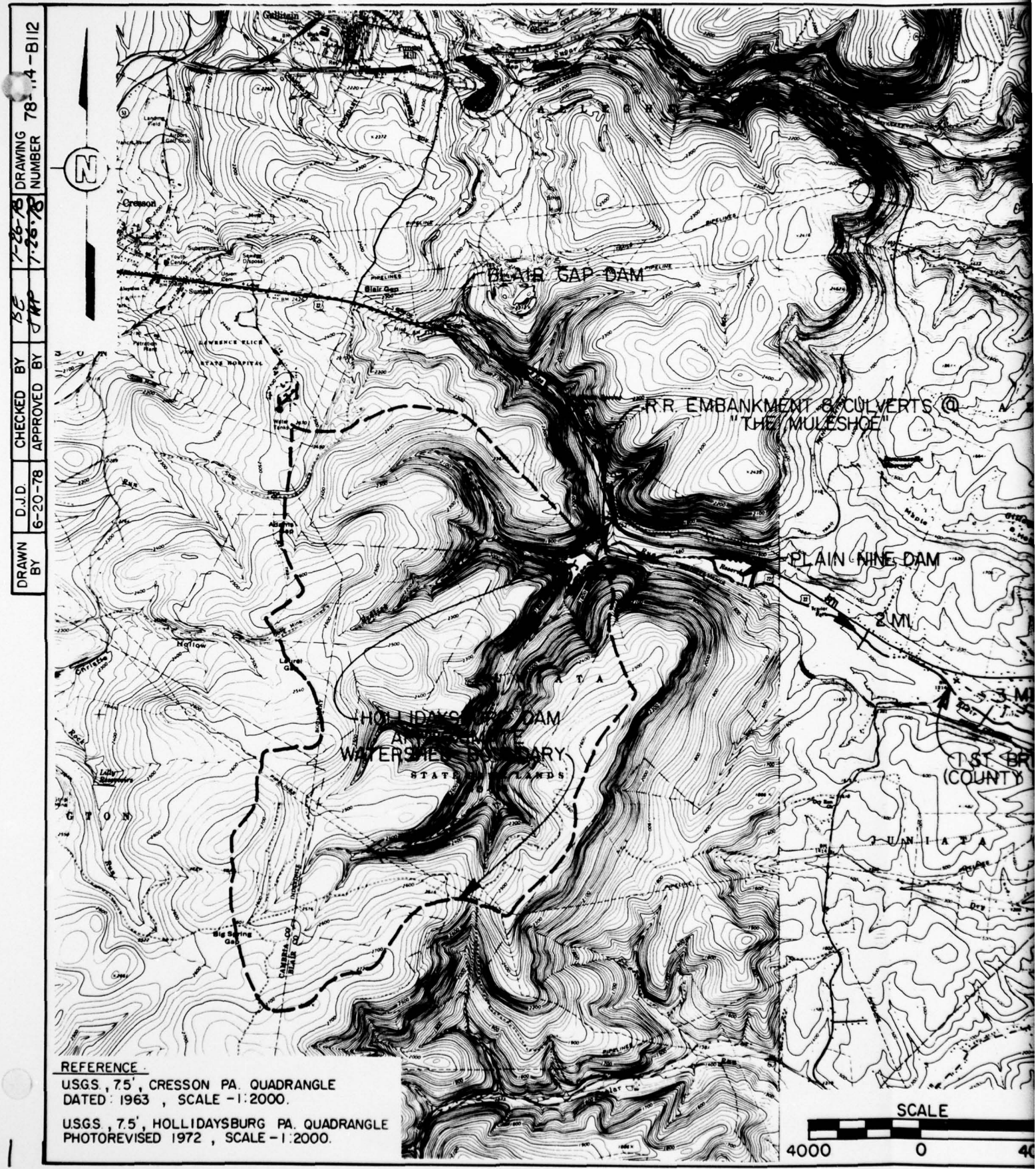
REVISED SECTION ROCK-FILL DAM
BLAIR RUN RESERVOIR
HOLLIDAYSBURG WATER SUPPLY
SCALE 1"=10' 1-14-56

PLATE 2

D'APPOLONIA

2



REFERENCE

USGS, 7.5', CRESSON PA. QUADRANGLE
DATED: 1963, SCALE - 1:2000.

USGS, 7.5', HOLLIDAYSBURG PA. QUADRANGLE
PHOTOREVISED 1972, SCALE - 1:2000.

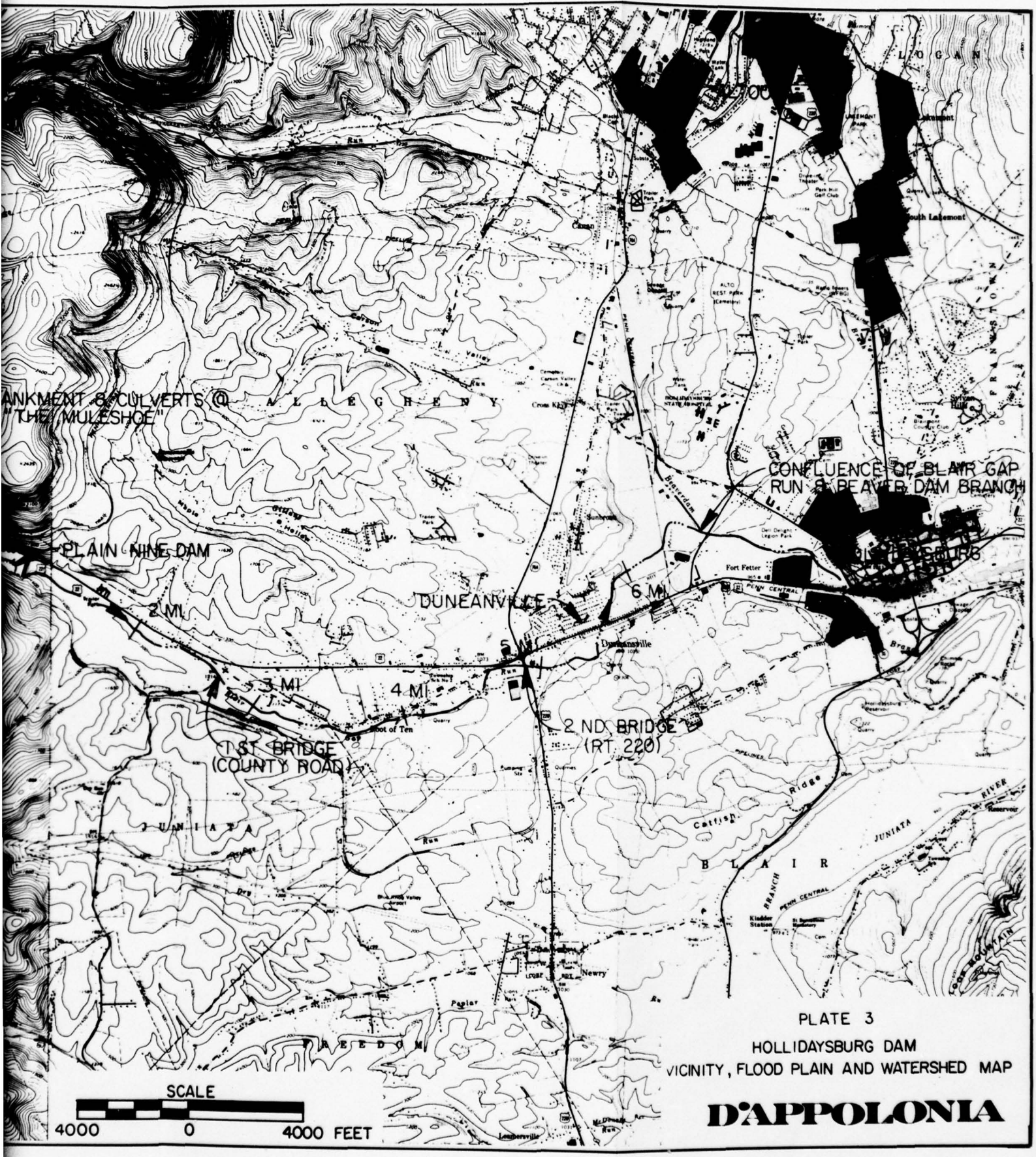


PLATE 3

HOLLIDAYSBURG DAM

VICINITY, FLOOD PLAIN AND WATERSHED MAP

D'APPOLONIA

2

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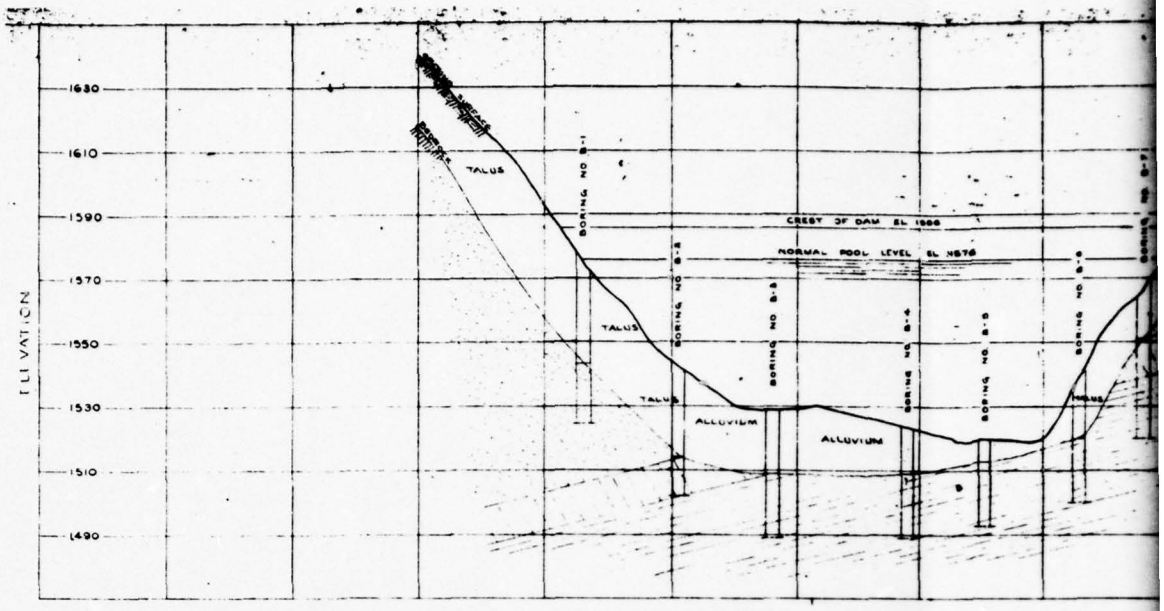
	7-20-78	APPROVED BY		12-26-78	



SECTION A-A

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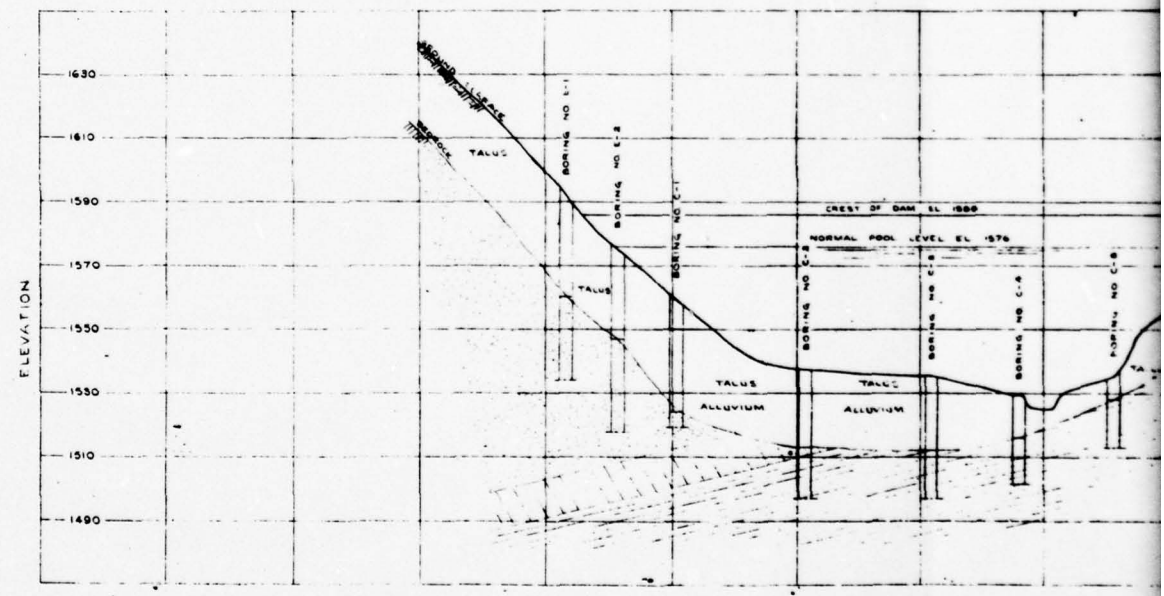
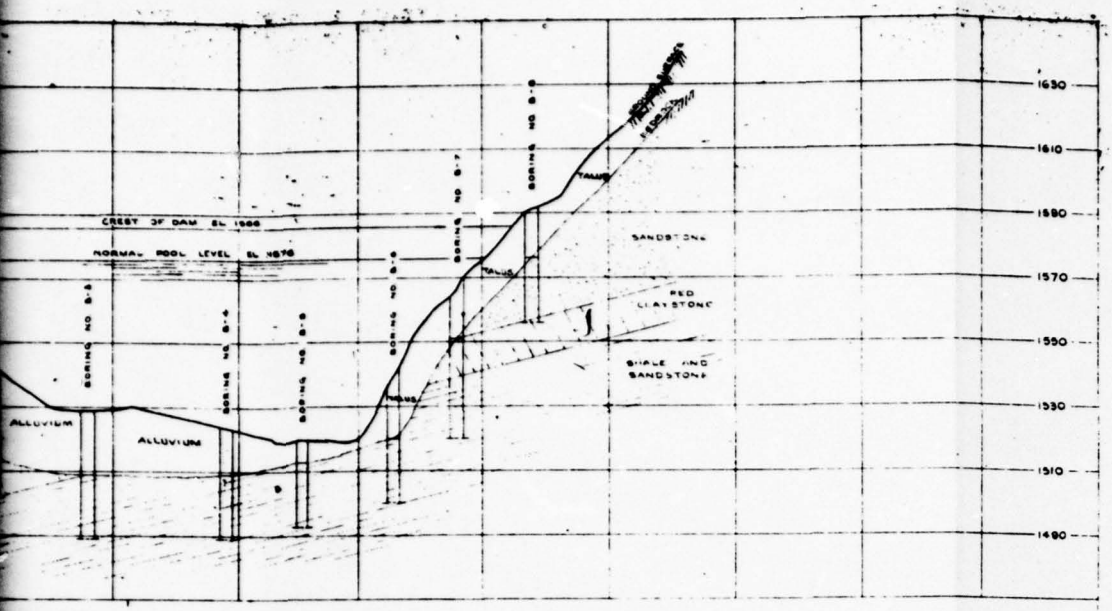
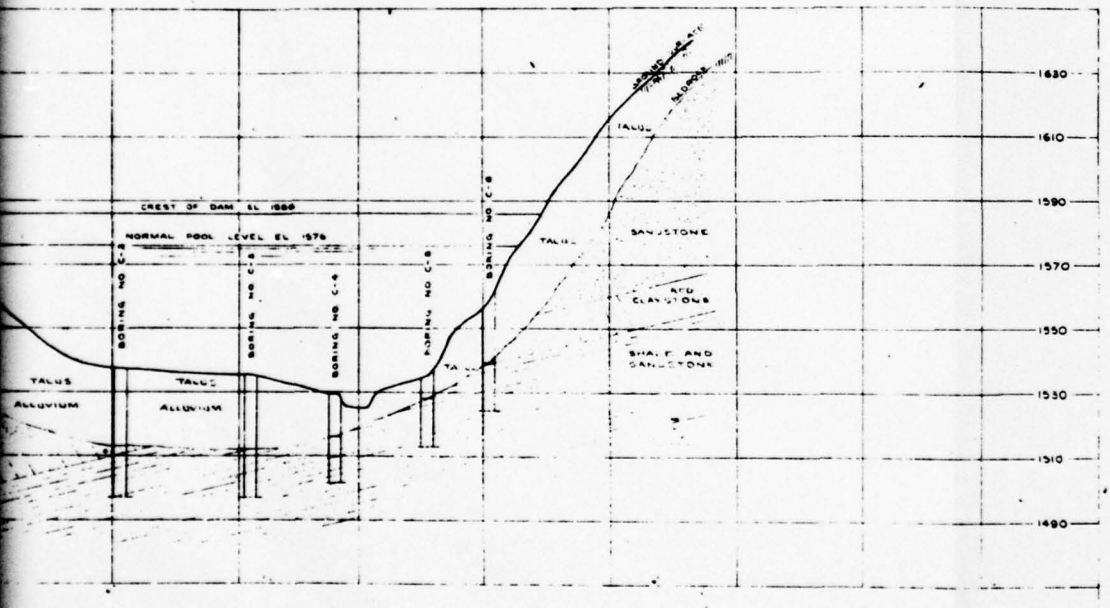


SECTION B-B

LEGEND
Sandstone
Red Claystone
Sandstone & Shale



SECTION A-A



SECTION B-B

THE NEILAN ENGINEERS, BOOKBRET, PENNA.

HOLLIDAYSBURG (RESERVE ALTITUDE) RESERVOIR

CROSS-SECTIONS OF SITE

SURVEY [illegible]	PLAN [illegible]	CHECK [illegible]
DATE 7-22-58	APPROVED [illegible]	
SCALE 1"=100'	NO.	FILE B-1-5

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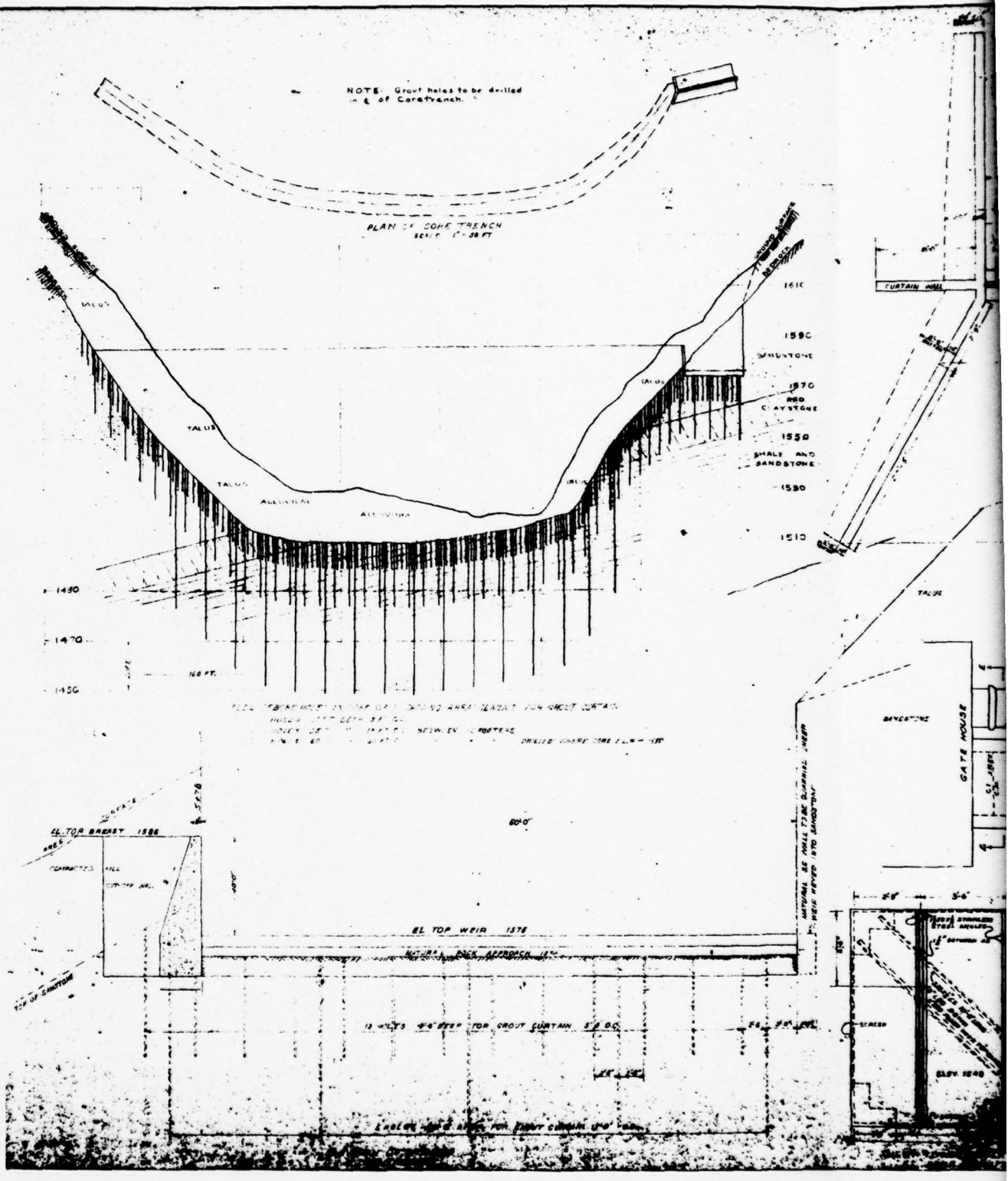
PLATE 4

D'APPOLONIA

2

DRAWN BY	D.J.D.	CHECKED BY	KE	7-26-78	DRAWING NUMBER	78-14-B84
	7-20-78	APPROVED BY	JHP	7-26-78		



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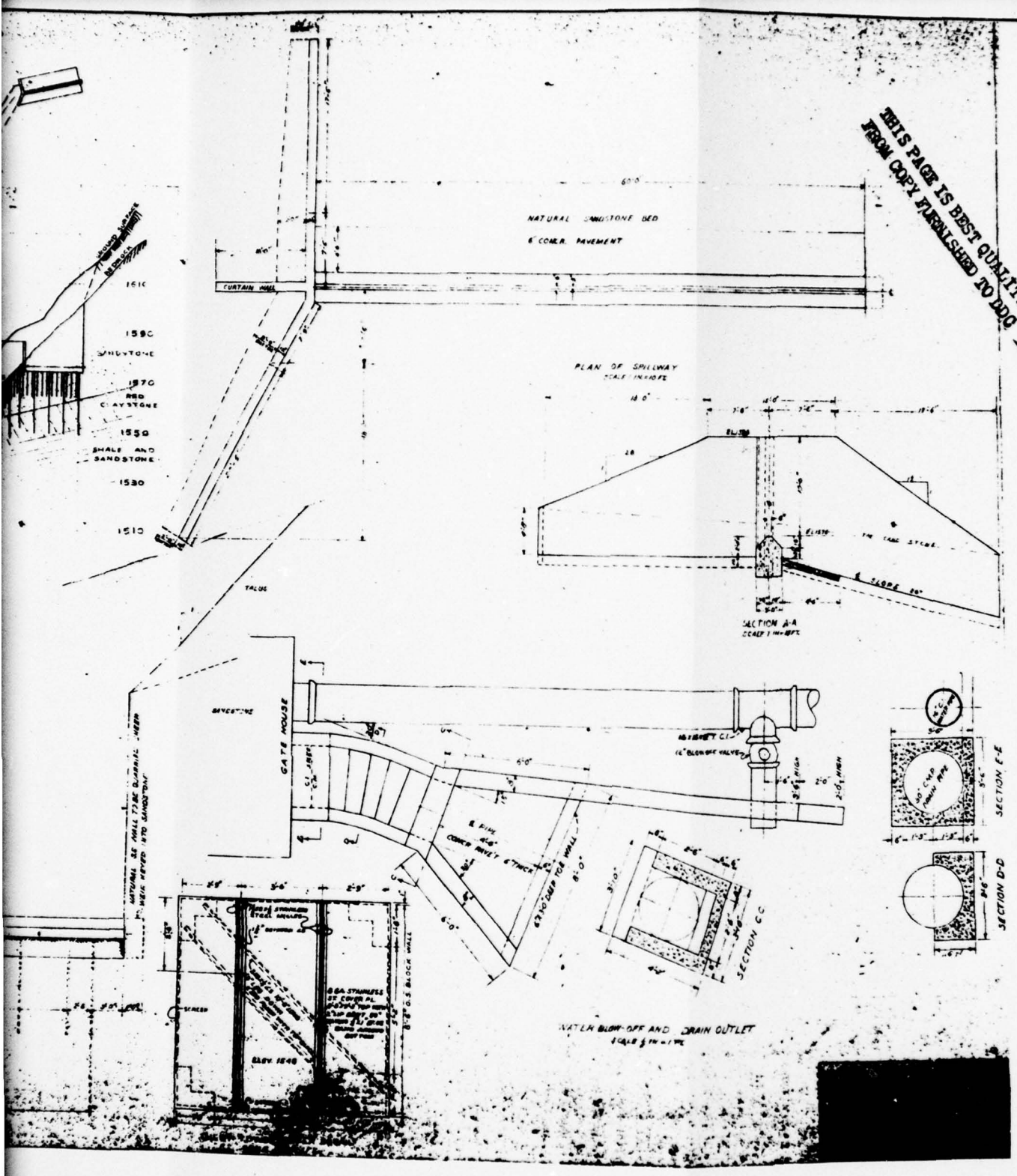

PLATE 5

D'APPOLONIA

2

DRAWN BY	D.J.D.	CHECKED BY	BC	7-26-78	DRAWING NUMBER	78 114-B87
	7-20-78	APPROVED BY	LHP	7-26-78		

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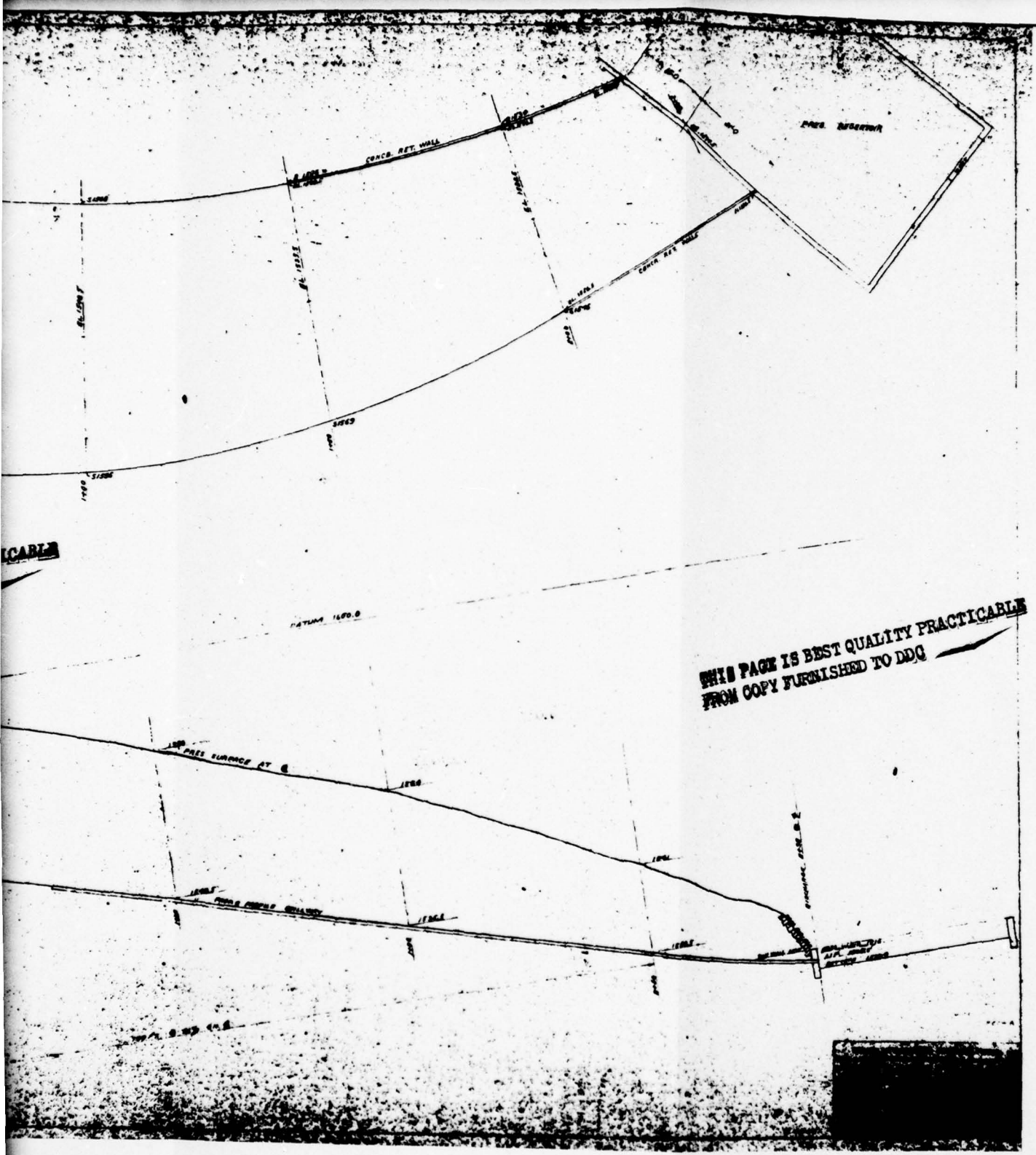

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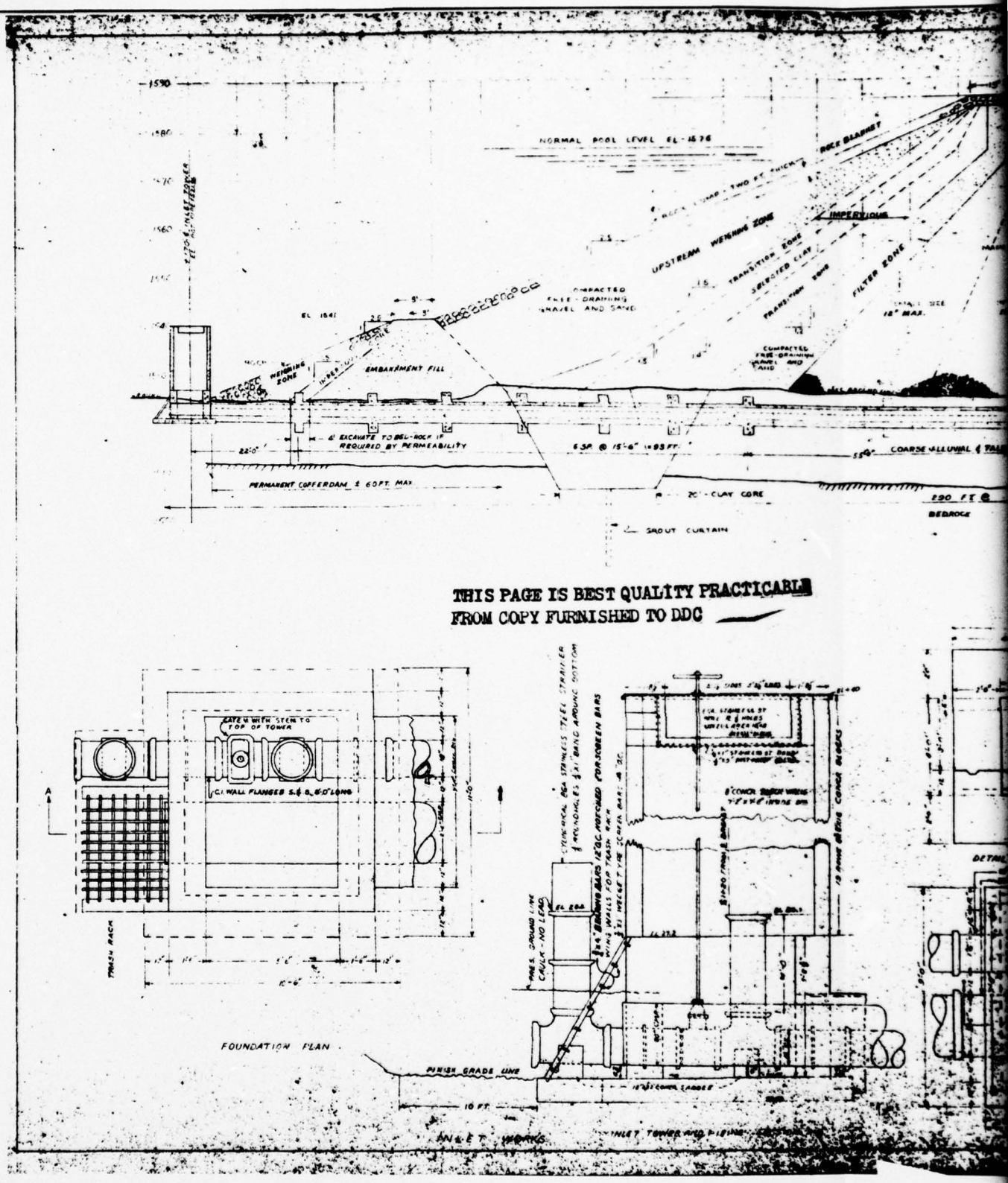
PLATE 6

D'APPOLONIA

DRAWN BY	D.J.D.	CHECKED BY	BJC	7-26-78	DRAWING NUMBER 78-114-B86
	7-20-78	APPROVED BY	JMP	7-26-78	



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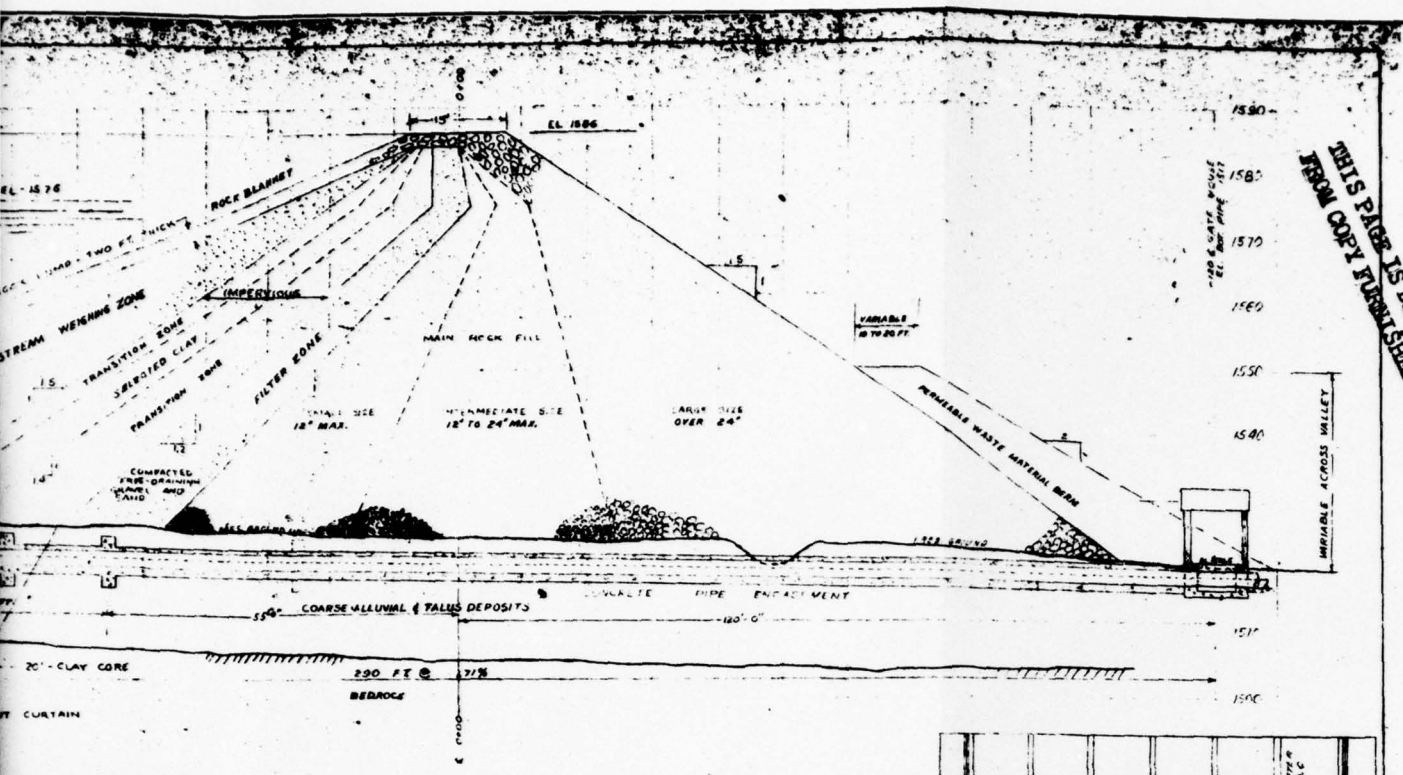

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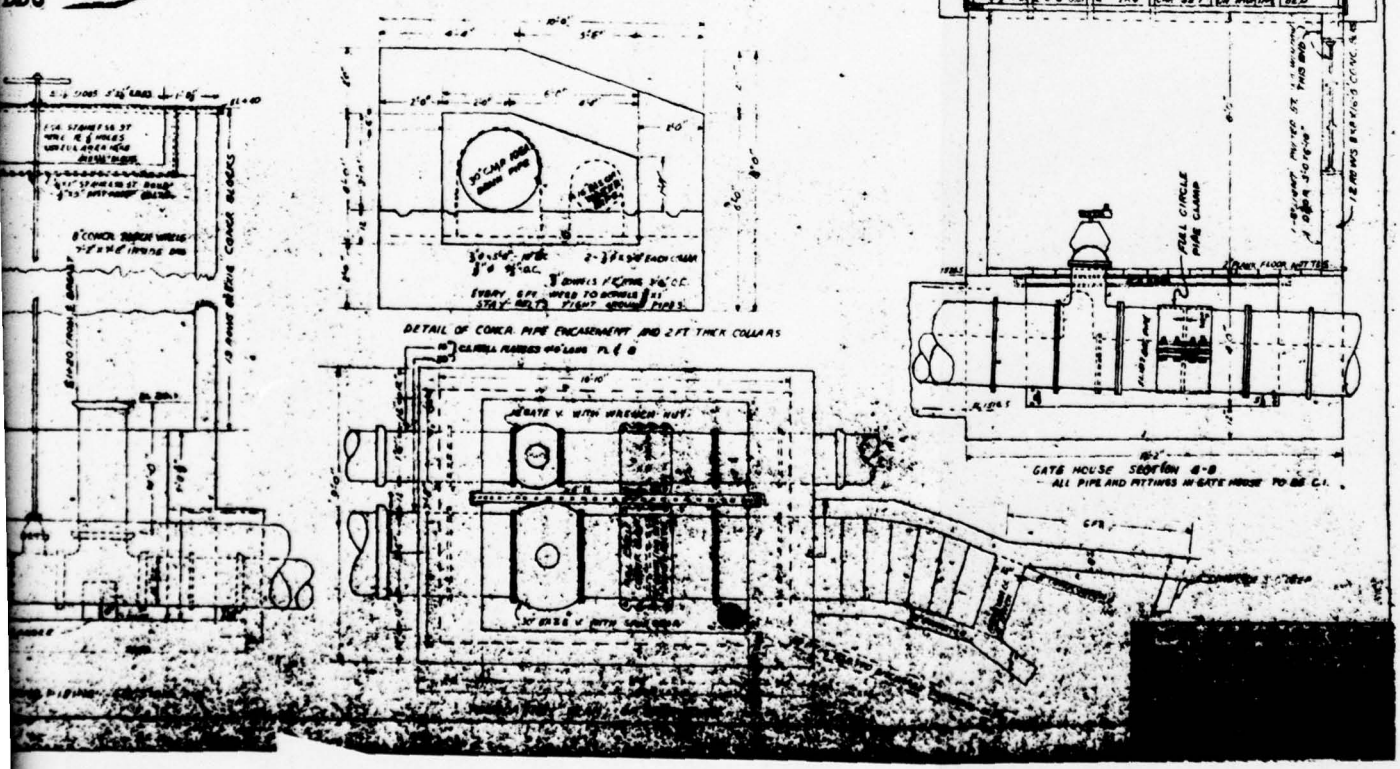
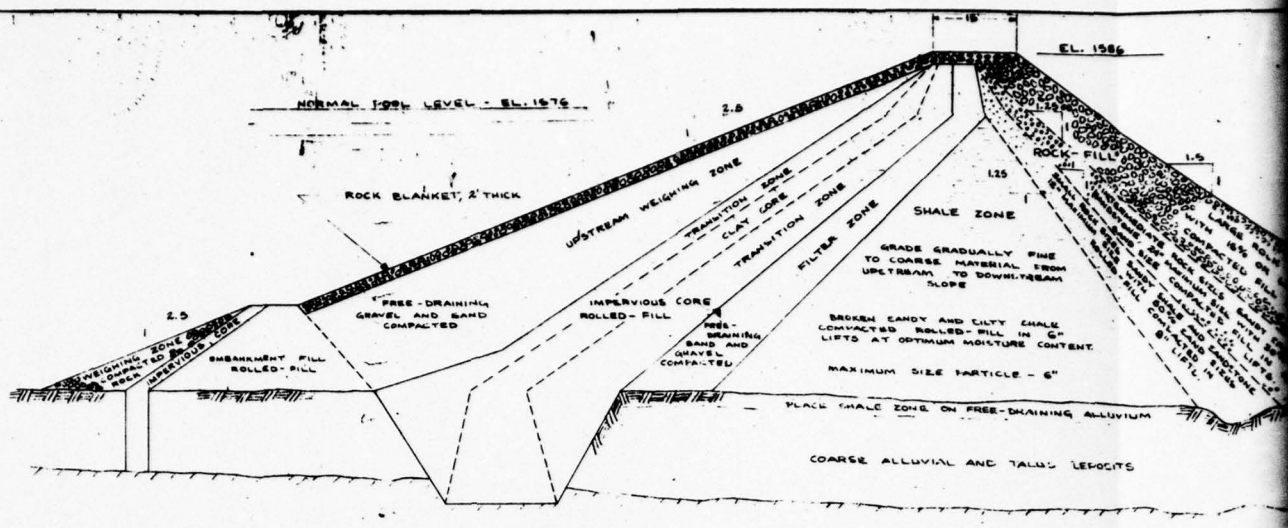


PLATE 7

D'APPOLONIA

DRAWN BY	D.J.D.	CHECKED BY	BE	7-26-78	DRAWING NUMBER	78-114-B90
	7-25-78	APPROVED BY	JHP	7-26-78		



— REVISED SECTION OF ROCK-FILL DAM —
BLAIR RUN RESERVOIR
HOLLIDAYSBURG WATER SUPPLY
SCALE 1" = 10' JAN. 14, 1956

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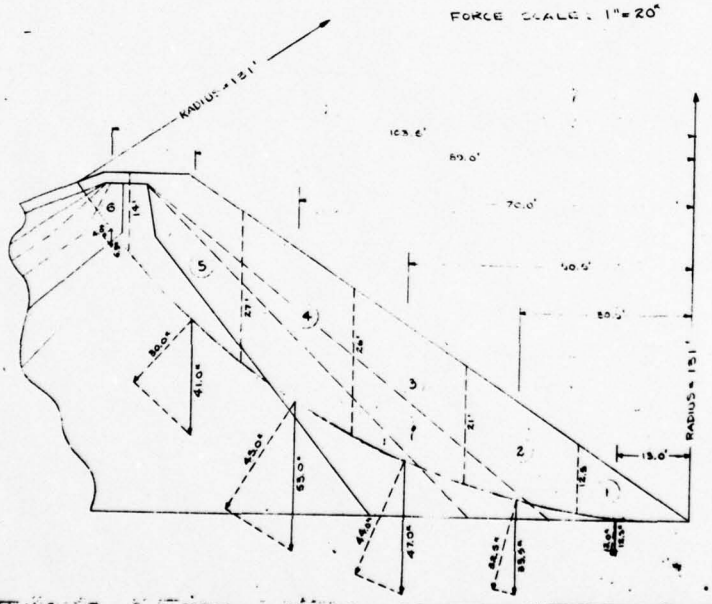
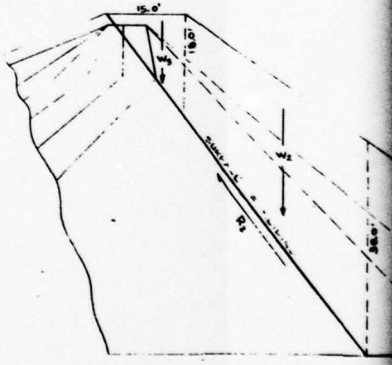
STABILITY CALCULATIONS USING CIRCULAR SURFACES OF SLIDING.



STABILITY CALCULA
PLANE SURFACES



$W_1 = \frac{(38.0 + 56.5)}{2} \times 0.100 = 107.2^k$

$W_2 = \frac{(38.0 + 18.0)}{2} \times 0.100 = 18.8^k$

$W_3 = \frac{(18.0 + 18.0)}{2} \times 0.100 = 18.0^k$

$R_1 = N_1 \cdot \tan \phi_1 = (107.2) \tan 30°$

$R_1 = 62.0^k$

DISTURBING FORCE = 46.0^k

RESTORING FORCE = $N_{2-3} \cdot \tan \phi_3 + C \cdot L$

$= (67^k \cdot \tan 35°) + (C \cdot L)$

$= 46.8 + 57.7$

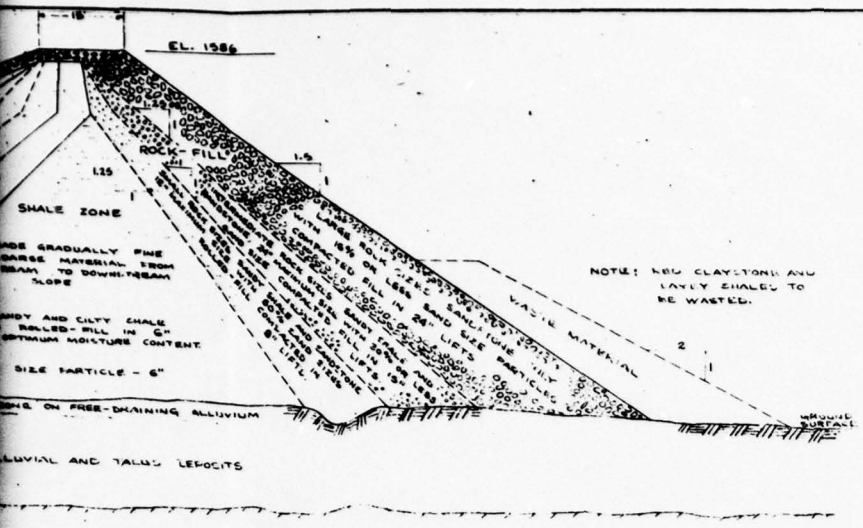
$= 104.5^k$

F.S. = REST. / DIST.

F.S. = 2.

SECTION	AREA		UNIT WEIGHT	WEIGHT	MT. ARM	DIST. MOMENT		NORMAL LOAD	SHEAR FORCE		RADIUS	REST. MOMENT	
		TOTAL SQ. FT.	KIPS/CU. FT.	KIPS	FT.	(KIP-FT.	KIP-FT.)	KIPS	S=N tan φ	S=C·L	FT.	(KIP-FT.	KIP-FT.)
1	$\frac{1}{2}$·12.5·20	125.0	0.100	12.5	13.0	162.5		12.0	10.1		131		1322.0
2	20·$\frac{38.5}{2}$	385.0	0.100	38.5	30.5	1004.0		32.5	27.5		131		3570.0
3	20·$\frac{47}{2}$	470.0	0.100	47.0	50.5	2375.0		44.0	37.0		131		4840.0
4	20·$\frac{55}{2}$	550.0	0.100	55.0	70.0	3710.0		45.0	51.5	4.5	131		4720.0
5	20·$\frac{41}{2}$	410.0	0.100	41.0	89.0	3650.0		30.0	21.0	21.0	131		5500.0
6	9·$\frac{14}{2}$	63.0	0.100	6.3	103.5	652.0		4.0	2.8	9.4	131		1608.0
						11,553.5							21,552.0

F.S. = $\frac{21,552.0}{11,553.5} = 1.86$



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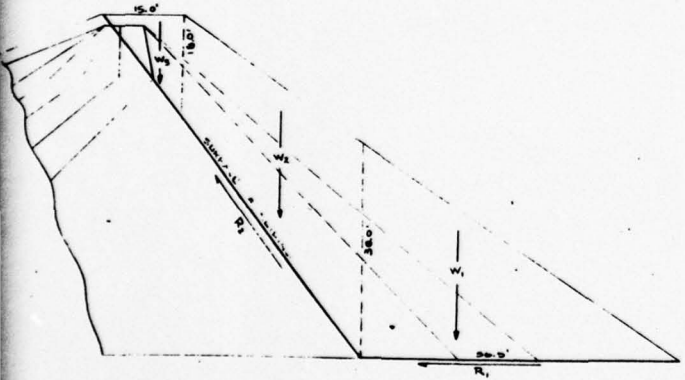
CTION OF ROCK-FILL DAM—
ON RESERVOIR
SBURG WATER SUPPLY
JAN. 14, 1956

STABILITY CALCULATIONS USING
PLANE SURFACES OF SLIDING.

Y PRACTICABLE

FORCE SCALE : 1" = 30^k



$W_1 = \frac{(38.0 + 56.5)}{2} \times 0.100 = 107.2^k$

$W_2 = 93.7^k$

$W_3 = \frac{(15.0 + 18.0)}{2} \times 0.100 = 16.5^k$

$R_1 = N_1 \cdot \tan \phi_1 = (107.2) \tan 30°$

$R_1 = 62.0^k$

DISTURBING FORCE $= 46.0^k$

RESTORING FORCE $= N_{2-3} \tan \phi_3 + C \cdot L$

$= (67^k \cdot \tan 35°) + (0.150 \times 77)$

$= 46.8 + 57.7$

$= 104.5^k$

$F.S. = \frac{\text{RESTORING FORCE}}{\text{DISTURBING FORCE}} = \frac{104.5^k}{46.0^k}$

$F.S. = 2.27$

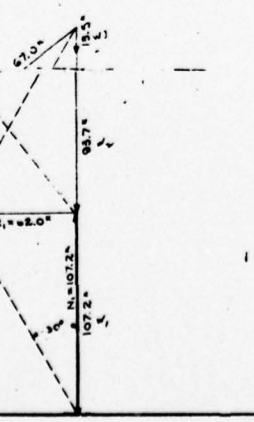


PLATE 8

D'APPOLONIA

2

DRAWN BY	D.J.D.	CHECKED BY	BG	7-26-78	DRAWING NUMBER 78-114-B91
	7-25-78	APPROVED BY	JAS	7.26.78	

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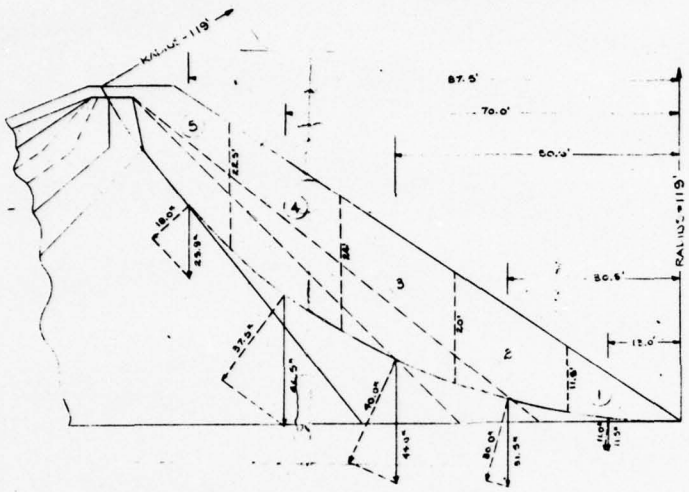

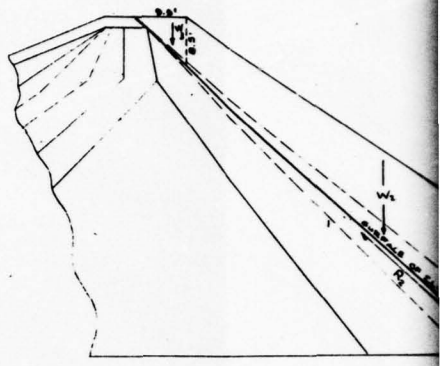

SECTION	AREA	TOTAL SQ. FT.	UNIT WEIGHT KIPS/CU.FT.	WEIGHT KIPS	MT. ARM FT.	DIST. MOMENT (KIP-FT.)	DIST. MOMENT (KIP-FT.)	NORMAL LOAD KIPS	SHEAR FORCE S=N TAN φ	SHEAR FORCE S=C·L	RADIUS FT.	REST. MOMENT (KIP-FT.)	REST. MOMENT (KIP-FT.)
1	11.5 × 20 / 2	115.0	0.100	11.5	18.0	1495		11.0	9.2		119		1095.0
2	20 × 61.5 / 2	315.0	0.100	31.5	28.5	900.0		30.0	25.2		119		3000.0
3	20 × 44 / 2	440.0	0.100	44.0	58.5	2220.0		40.0	33.6		119		4000.0
4	20 × 46.5 / 2	465.0	0.100	46.5	70.0	3285.0		37.5	31.5		119		3750.0
5	25 × 22.0 / 2	259.0	0.100	25.9	87.6	2265.0		18.0	12.6	16.5	119		3463.0
						9819.5							15,303.0

$$F.S. = \frac{15,305.0}{8,849.5} = 1.73 = \frac{\text{RESTORING MOMENT}}{\text{DISTURBING MOMENT}}$$

$W_1 = \frac{(21.5 \times 32.5)}{2} \times 0.100 = 35.0^{K}$ ✓

$W_2 = \frac{(21.5 + 8.5)}{2} \times 67.0 \times 0.100 = 85.5^{K}$ ✓

$W_3 = \frac{(8.5 \times 8.5)}{2} \times 0.100 = 4.0^{K}$

$R_1 = N_1 \cdot \tan \phi_1 = (35)(\tan 20°)$

$R_1 = 21.0^{K}$

DISTURBING FORCE = 44.0^{K} on 60.5

RESTORING FORCE = $(N_{2-3}) \tan \phi_2$

" " = $(68.5) \tan 40°$

" " = 57.0^{K} on $R_1 + R_2 = 75.2$

$F.S. = \frac{\text{RESTORING FORCE}}{\text{DISTURBING FORCE}} = \frac{57.0}{44.0} = 1.3$

F.S. = 1.30

F.S. (with tail) = $\frac{80}{60.5}$

~ WORKING VALUES ~

γ_F = 100 LBS. PER CU. FT. = FIELD UNIT WEIGHT OF ROCK-FILL

ϕ_1 = 30° = ANGLE OF INTERNAL FRICTION BETWEEN ROCK-FILL AND ALLUVIAL BASE.

ϕ_2 = 40° = ANGLE OF INTERNAL FRICTION FOR ROCK-FILL.

ϕ_3 = 35° = ANGLE OF INTERNAL FRICTION FOR SHALE-FILL.

E. D. Appleman
1-30-80
PE-7772-E

FIG. REVISED CROSS-SECTION
TIONS FOR DOWNSTREAM SLO

CABLE

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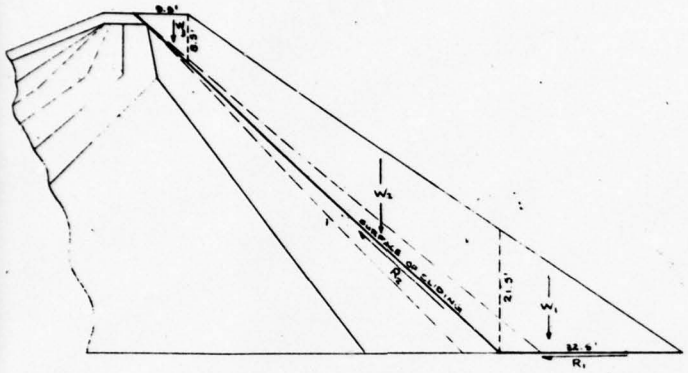


$W_1 = \frac{(21.5 \times 32.5)}{2} \times 0.100 = 35.0^k$

$W_2 = \frac{(21.5 + 8.5)}{2} \times 67.0 \times 0.100 = 85.5^k$

$W_3 = \frac{(8.5 \times 8.5)}{2} \times 0.100 = 4.0^k$

$R_1 = N_1 \cdot \tan \phi_1 = (35)(\tan 20°)$

$R_1 = 21.0^k$

DISTURBING FORCE = 44.0^k at 60.5

RESTORING FORCE = $(N_{2-3}) \tan \phi_2$

" " = $(60) \tan 40°$

" " = 57.0^k at $R_1 + R_2 = 75.2$

$F.S. = \frac{\text{RESTORING FORCE}}{\text{DISTURBING FORCE}} = \frac{57.0}{44.0} = 1.30$

F.S. = 1.30

F.S. (with full base) $= \frac{75.2}{60.0} = 1.25$

WORKING VALUES ~

CU. FT. = FIELD UNIT WEIGHT OF ROCK-FILL.
OF INTERNAL FRICTION BETWEEN
FILL AND ALLUVIAL BASE.
OF INTERNAL FRICTION FOR ROCK-FILL.
OF INTERNAL FRICTION FOR SHALE-FILL.

REVISED CROSS-SECTION AND STABILITY CALCULATIONS FOR DOWNSTREAM SLOPE OF ROCK-FILL DAM.

PLATE 9

D'APPOLONIA

2

DRAWN BY	G.J.G.	CHECKED BY	F.L.	7-26-78	DRAWING NUMBER 78 4-A15
	6-20-78	APPROVED BY	J.A.P.	7-26-78	

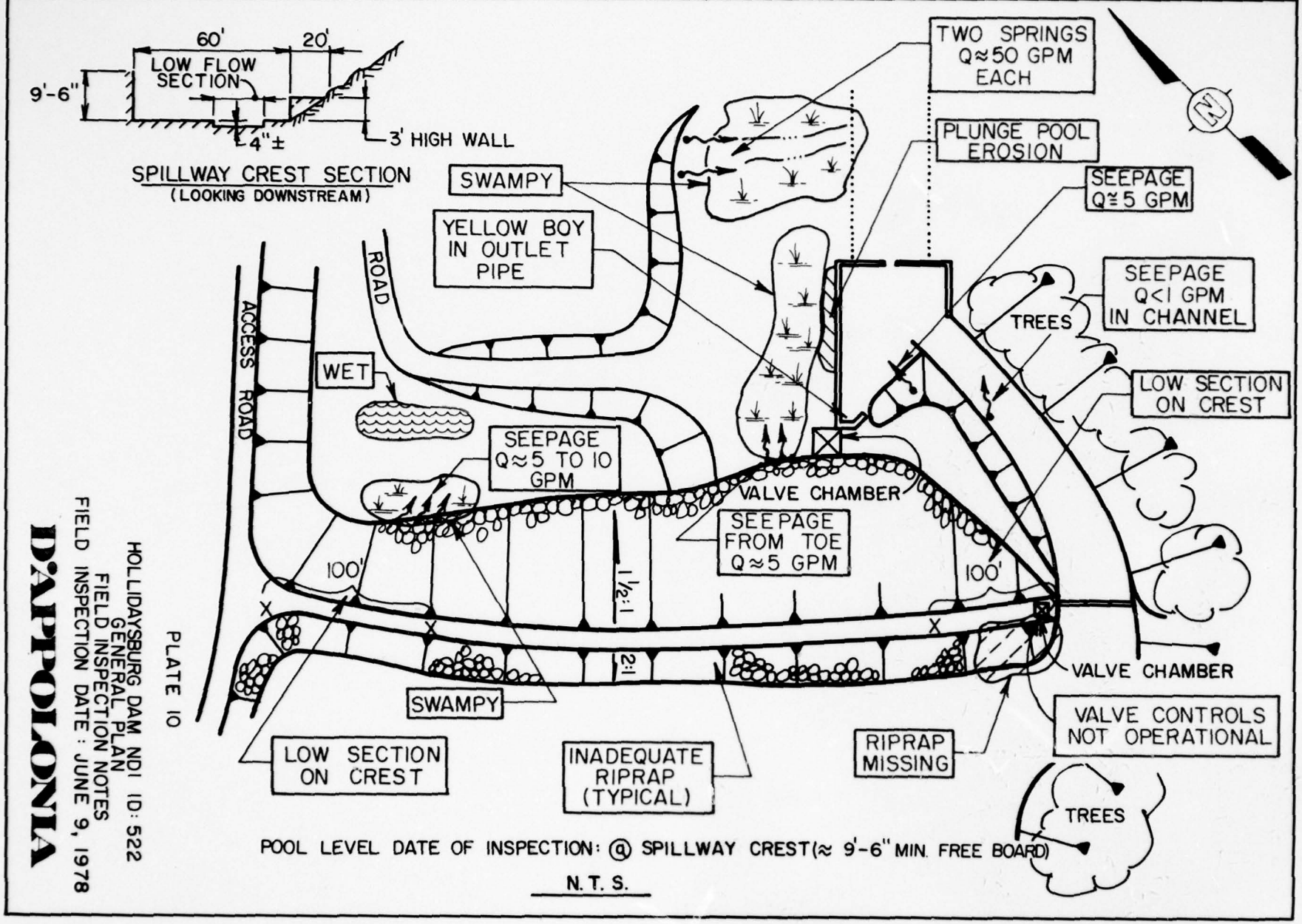


PLATE 10

HOLLIDAYSBURG DAM NDI ID: 522
GENERAL PLAN
FIELD INSPECTION NOTES
FIELD INSPECTION DATE: JUNE 9, 1978

D'APPOLONIA

APPENDIX A

CHECKLIST
VISUAL INSPECTION
PHASE I

CHECKLIST
VISUAL INSPECTION
PHASE I

NAME OF DAM HOLLIDAYSBURG RESERVOIR COUNTY BLAIR CO. STATE PA. ID# NOI: 522 DER: 7-83

TYPE OF DAM EARTH FILL HAZARD CATEGORY HIGH.

DATE(S) INSPECTION JUNE 9, 1978 WEATHER PRTLY CLOUDY TEMPERATURE 70's

POOL ELEVATION AT TIME OF INSPECTION 1576 M.S.L. TAILWATER AT TIME OF INSPECTION _____ M.S.L.

INSPECTION PERSONNEL:

BILGIN EREL
WAH-TAK CHAN

REVIEW INSPECTION BY: (JUNE 12, 1978)

ELIO D'APPOLONIA.
LARRY ANDERSEN
JAMES POELLOT

BILGIN EREL RECORDER

VISUAL INSPECTION
PHASE I
EMBANKMENT

NAME OF DAM HOLLIDAYSBURG RESERVOIR
ID# NDI : 522 OER : 7-83

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	NONE FOUND	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	NONE FOUND.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	NONE FOUND.	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	APPROXIMATELY 2 FT CROWN CREST MIN FREE BOARD ≈ 9'-6"	
RIPRAP FAILURES	RIPRAP ON UPSTREAM SLOPE NEAR SPILLWAY ENTRANCE IS MISSING. UPSTREAM SLOPE RIPRAP WEATHERED, INADEQUATE.	REPAIR RIPRAP.

VISUAL INSPECTION
PHASE I
EMBANKMENT

NAME OF DAM HOLLIDAYSBURG RESERVE
ID# NDI: 522 DER: 7-83

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	NO SIGNS OF DISTRESS OR SEEPAGE	
ANY NOTICEABLE SEEPAGE	TWO SEEPS AT TOE LEVEL. SEE PLATE 10 FOR LOCATION.	
STAFF GAGE AND RECORDER	NONE	
DRAINS	NONE	

VISUAL INSPECTION
PHASE I
CONCRETE/MASONRY DAMS

NAME OF DAM Hollidaysburg Reservoir
ID# NDI 522 DEG 7-83

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

VISUAL INSPECTION
PHASE I
CONCRETE/MASONRY DAMS

NAME OF DAM HOLLIDAYSBURG RESERVOIR
ID# NOT 522 DEC 7-83

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	EARTHFILL DAM ∴ N/A.	
STRUCTURAL CRACKING	N/A	
VERTICAL AND HORIZONTAL ALIGNMENT	N/A	
MONOLITH JOINTS	N/A	
CONSTRUCTION JOINTS STAFF GAGE OF RECORDER:	N/A	

VISUAL INSPECTION
PHASE I
OUTLET WORKS

NAME OF DAM Hollidaysburg Reservoir
ID# NDI: 522 DEC: 7-83

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	OUTLET PIPE: 30-INCH CORRUGATED METAL PIPE. ONLY DISCHARGE END IS VISIBLE.	
INTAKE STRUCTURE	SUBMERGED NOT VISIBLE.	
OUTLET STRUCTURE	DRAIN PIPE DIRECLY DISCHARGES INTO SPILLWAY PLUNGE POOL.	
OUTLET CHANNEL	NONE.	
EMERGENCY GATE	DAM TENDER REPORTED THAT THE OUTLET PIPE VALVE IS NOT FUNCTIONAL	

VISUAL INSPECTION
PHASE I
UNGATED SPILLWAY

NAME OF DAM HOLLIDAYSBURG RESERVOIR
ID# NDI 522 DER: 7-83

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	GOOD CONDITION. MINOR SEEPAGE ON LEFT SIDE.	
APPROACH CHANNEL	NO SIGNIFICANT OBSTRUCTION TO FLOW.	
DISCHARGE CHANNEL	CONCRETE CHANNEL - GOOD CONDTION.	
BRIDGE AND PIERS	NONE	

VISUAL INSPECTION
PHASE I
GATED SPILLWAY

NAME OF DAM Hollidaysburg Reservoir
ID# NOI: 522 DEG 7-83

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	No GATED SPILLWAY. N/A	
APPROACH CHANNEL	N/A	
DISCHARGE CHANNEL	N/A	
BRIDGE PIERS	N/A	
GATES AND OPERATION EQUIPMENT	N/A.	

VISUAL INSPECTION
PHASE I
INSTRUMENTATION

NAME OF DAM HOLLIDAYSBURG RESERVOIR
ID# NDI: 522 DER. 7-83

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	NONE FOUND	
OBSERVATION WELLS	NONE FOUND	
WEIRS	NONE FOUND	
PIEZOMETERS	NONE FOUND OR REPORTED.	
OTHER	NONE	

VISUAL INSPECTION
PHASE I
RESERVOIR

NAME OF DAM HALLIDAYSBURG RESERVOIR

ID# NDI 522 DER. 7-83

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	WOODED.	
SEDIMENTATION	UNKNOWN.	

VISUAL INSPECTION
PHASE I
DOWNSTREAM CHANNEL

NAME OF DAM HOLLIDAYSBURG RESERVOIR
ID# NDI. 522 DER 7-83

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	STREAM FLOWS THROUGH 3 - 48-INCH CULVERT UNDER A 50 FT HIGH RAILROAD EMBANKMENT, 500 FT. DOWNSTREAM FROM THE DAM.	
SLOPES	NO MAJOR EROSION.	
APPROXIMATE NUMBER OF HOMES AND POPULATION	APPROXIMATLY 200 HOMES IN FOOT OF TEN - DOWNSTREAM FROM PLAIN NINE DAM. POPULATION ≈ 800	

APPENDIX B

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM Hollidaysburg Reservoir
ID# NDI 522 OER 7-83

ITEM	REMARKS
AS-BUILT DRAWINGS	AVAILABLE IN STATE FILES.
REGIONAL VICINITY MAP	SEE PLATE 3
CONSTRUCTION HISTORY	DESIGNED BY THE NEILAN ENGINEER INC OF SOMERSET PA. IN 1955. CONSTRUCTION COMPLETED IN 1957.
TYPICAL SECTIONS OF DAM	SEE PLATE 2 - ZONED EARTH FILL DAM.
OUTLETS - PLAN - DETAILS - CONSTRAINTS - DISCHARGE RATINGS	SEE PLATES 5 & 7

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM Hollidaysburg Reservoir
ID# NDI: 522 DER 7-83

ITEM	REMARKS
RAINFALL/RESERVOIR RECORDS	NOT AVAILABLE.
DESIGN REPORTS	NEILAN ENGINEERS REPORT NOT AVAILABLE. OTHER REPORTS: FOUNDATION INVESTIGATION OF PROPOSED ROCKFILL DAM FOR HOLLIDAYSBURG WATER AUTHORITY BY E.D'APPOLONIA PGH, PA AUGUST 1955
GEOLOGY REPORTS	IN ENGINEERS REPORT
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	HYDROLOGY & HYDRAULIC CALCULATIONS NOT AVAILABLE SEE PLATES 8 & 9 FOR STABILITY CALCULATIONS.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	AVAILABLE IN ENGINEER REPORT.

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM HOLLIDAYSBURG RESERVOIR
ID# NDI 522 DER 7-83

ITEM	REMARKS
POST CONSTRUCTION SURVEYS OF DAM	NONE REPORTED.
BORROW SOURCES	UNKNOWN
MONITORING SYSTEMS	NONE.
MODIFICATIONS	NONE REPORTED.
HIGH POOL RECORDS	NOT AVAILABLE

CHECKLIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM Hollidaysburg Reservoir
ID# NDI: 522 DEC: 7-83

ITEM	REMARKS
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	NONE OTHER THAN THE PERIODIC STATE INSPECTION REPORTS.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	1961 A SINK HOLE WAS DISCOVERED ON THE UPSTREAM FACE OF THE DAM, NEAR LEFT ABUTMENT AND BELOW WATER LEVEL. EXTENT OF REPAIRS IS DISCUSSED IN THE REPORT SECTION 2.2
MAINTENANCE OPERATION RECORDS	NOT AVAILABLE.
SPILLWAY PLAN SECTIONS DETAILS	SEE PLATE 6
OPERATING EQUIPMENT PLANS AND DETAILS	SEE PLATE 7

NAME OF DAM HOLLIDAYSBURG RESERVOIR

ID# NDI 522 OER 7-82

CHECKLIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: WOODED (7.2 SQ. MILES)

ELEVATION; TOP NORMAL POOL AND STORAGE CAPACITY: 230 AC-FT @ EL 1576

ELEVATION; TOP FLOOD CONTROL POOL AND STORAGE CAPACITY: SAME AS ABOVE

ELEVATION; MAXIMUM DESIGN POOL: EL. 1576

ELEVATION; TOP DAM: EL 1586

CREST: (SPILLWAY)

a. Elevation 1576

b. Type OVER FLOW WEIR

c. Width 60 FT

d. Length —

e. Location Spillover AROUND RIGHT ABUTMENT

f. Number and Type of Gates NONE

OUTLET WORKS:

a. Type 30-INCH CMP.

b. Location NEAR RIGHT ABUTMENT, THROUGH EMBANKMENT

c. Entrance Inverts 1516

d. Exit Inverts 1510 (ESTIMATED)

e. Emergency Draindown Facilities 30-INCH CMP.

HYDROMETEOROLOGICAL GAGES:

a. Type NONE

b. Location NONE

c. Records NONE

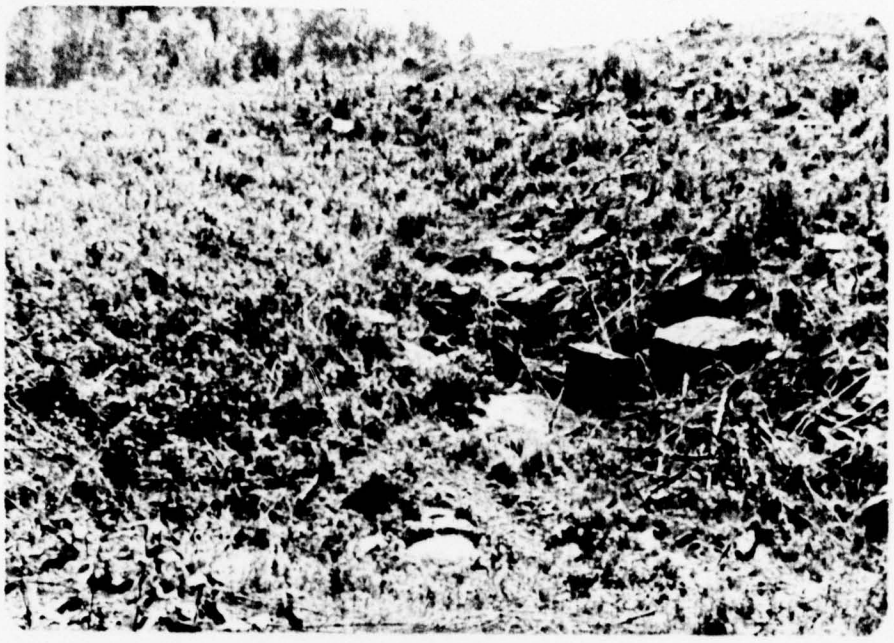
MAXIMUM NONDAMAGING DISCHARGE: N/A.

APPENDIX C

PHOTOGRAPHS

LIST OF PHOTOGRAPHS
HOLLIDAYSBURG RESERVOIR
JUNE 9, 1978

PHOTOGRAPH NO.	DESCRIPTION
1	Right abutment.
2	Left abutment.
3	Spillway chute.
4	Spillway crest.
5	Spillway and outlet pipe plunge pool.
6	"Blow-off" pipe controls on crest valve house.
7	"Blow-off" pipe valve in toe valve house.
8	"Blow-off" pipe.
9	Culverts under railroad embankment.
10	Seepage at toe.
11	Total seepage from toe.
12	Spring on left abutment.



Photograph No. 1

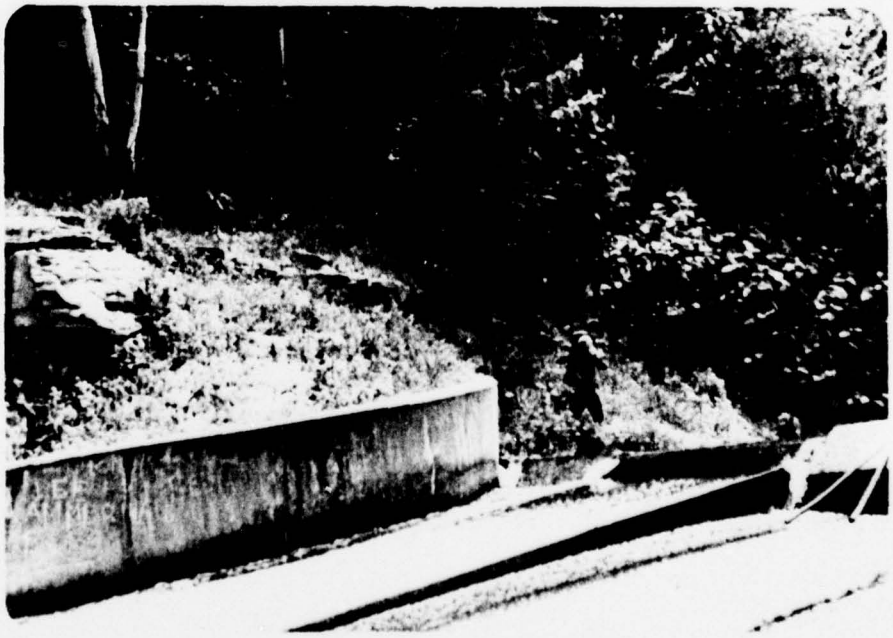
Right abutment.

Photograph No. 2

Left abutment.

Photograph No. 3

Spillway chute. (Note valve house on crest.)

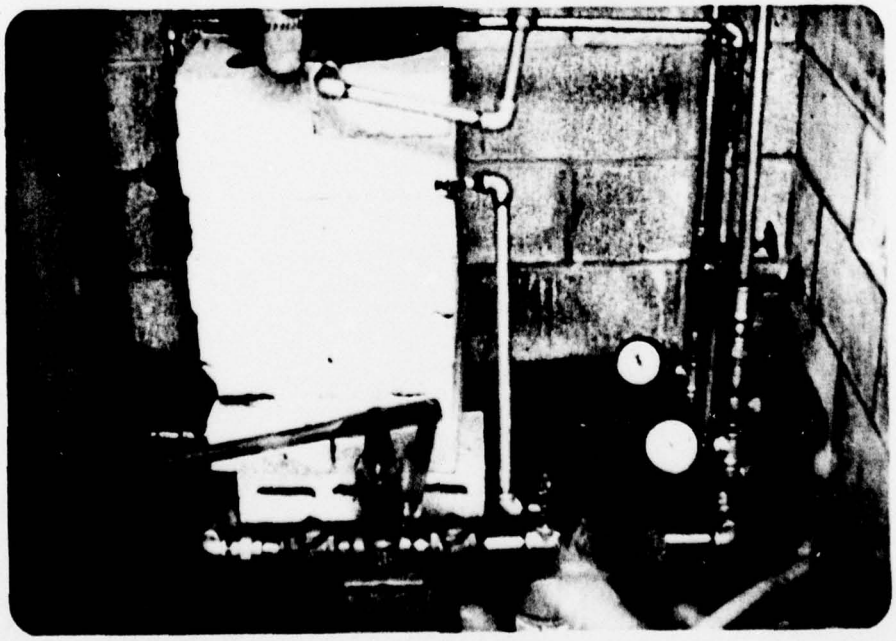


Photograph No. 4

Spillway crest.

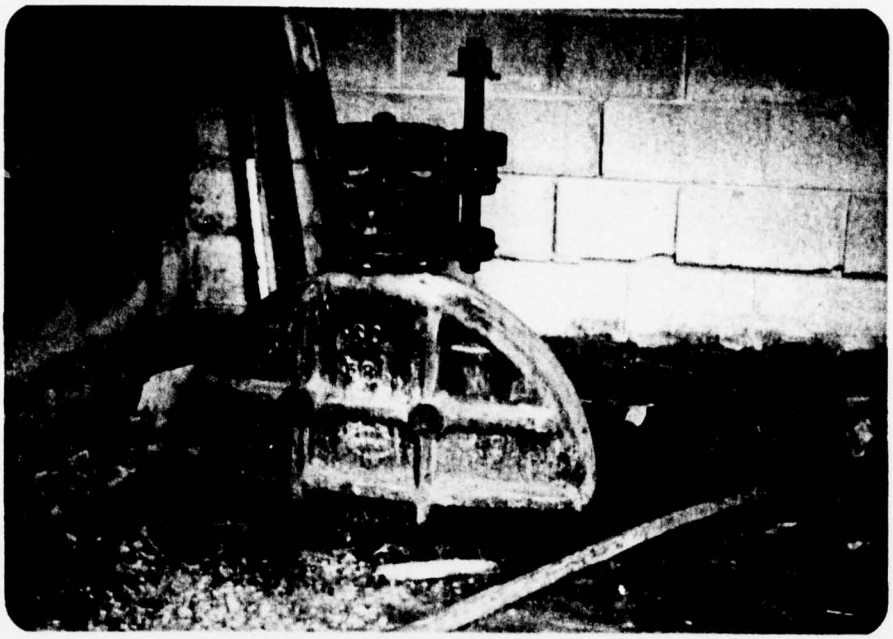
Photograph No. 5

Spillway and outlet pipe plunge pool.
(Note valve house.)



Photograph No. 6

"Blow-off" pipe controls on crest valve house.



Photograph No. 7

"Blow-off" pipe valve in toe valve house.

Photograph No. 8

"Blow-off" pipe.

Photograph No. 9

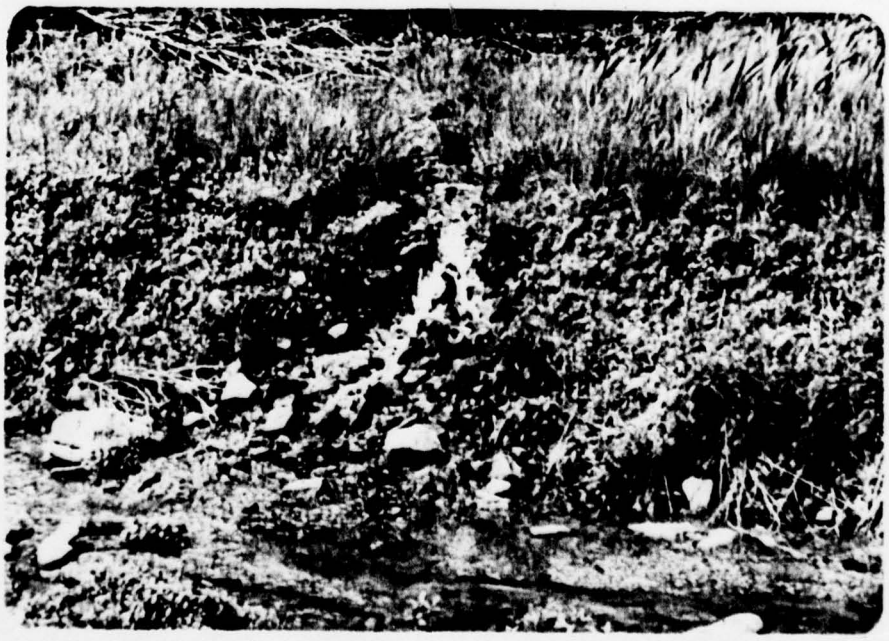
Culverts under railroad embankment
(500 feet downstream).

Photograph No. 10

Seepage at toe.

Photograph No. 11

Total seepage from toe.



Photograph No. 12

Spring on left abutment.

APPENDIX D
CALCULATIONS

D'APPOLONIA
CONSULTING ENGINEERS, INC

By WTC Date 6-22-78 Subject HOLLIDAYSBURG DAM Sheet No 1 of 5
Chkd. By BE Date 7-27-78 HYDROLOGY & HYDRAULIC Proj. No 78-114-15

DAM HOLLIDAYSBURG DAM,
JUNIATA TOWNSHIP, BLAIR COUNTY
WATERSHED AREA, A = 7.2 SQ MILE

INFLOW HYDROGRAPH: SUSQUEHANNA RIVER BASIN, REGION #1
BLAIRS RUN OF BLAIR GRD RUN.

TOTAL TIME, T, = 26 HOURS

PMF PEAK FLOW, q = 2700 cfs/SQ MILE

$Q = 2700 \times 7.2 = 19440$ cfs
say 19500 cfs

VOLUME OF INFLOW
$V_i = \frac{1}{2} T \cdot Q$
$= (\frac{1}{2})(26 \times 3600)(19440)(\frac{1}{43560})$
$= 20886$ Ac-ft
WHICH IS EQUAL TO
$\text{RUNOFF} = \frac{18565}{7.2 \times 640} \times 12 = 54.4"/26$ hour

REVISE RUNOFF TO 26" (Per Baltimore Dist Agmt)
$V_i = \frac{26}{12}(7.2 \times 640) = 9984$ AC-FT
say 10,000 AC-ft

RECALC Time, t_{26}
$t_{26} = \frac{9984 \times 43560}{(\frac{1}{2})19440(3600)} = 12.4$ Hours

RESERVOIR STORAGE ABOVE SPILLWAY CREST
lake area
EL 1600 Area = 13.8 acres
Area = 23.9 acres
> Area (AVG) = 18.85 acres

SURCHARGE VOL = $18.85 \times \Delta H = 18.85 \times (1586 - 1576) = 189$ ac-ft

SPILLWAY DISCHARGE

TYPE: OVERFLOW WEIR,
LENGTH. 60
DAM CREST EL 1586
SPILLWAY CREST EL 1576
$\Delta H = 10'$ (USE FIELD MEASUREMENT MIN FREEBOARD 9'-6")

$Q_s = (3.2)(60)(H)^{1.5} = 192 H^{1.5}$
$= 5622$ cfs
say 5600 cfs

REQ'D RESERVOIR STORAGE CAPACITY FOR PMF

$= \left(1 - \frac{\text{MAX SPILLWAY CAPACITY } Q_s}{\text{PMF PEAK FLOW } Q}\right)$ (VOL OF INFLOW)

$= \left(1 - \frac{5600}{19500}\right)(10.000)$

$= 7128$ ac-ft $>>$ 189 ac-ft

THE OVERTOPPING WILL OCCUR DUE TO PMF

PRECENT PMF WITHOUT OVERTOPPING

$= \left(\frac{5600}{19500} + \frac{189}{10000}\right)(100\%) = 30.6\%$ Say 31% PMF

DETERMINE WATER DEPTH h OVERTOP DAM CREST DUE PMF

$$\frac{192 H^{1.5} + (2.6)(580)(h-35)^{1.5}}{19500} + \frac{18.9 \times h}{10.000} = 1$$

$h = 1300$ or 3 ft OVER DAM CREST

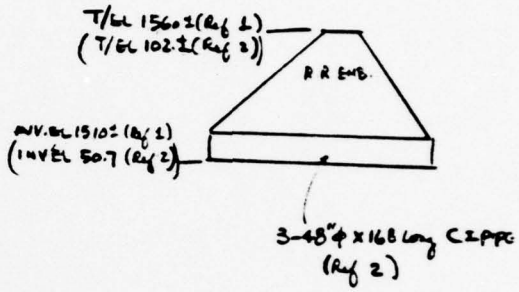
$Q_s \cong 19000$ cfs

D'APPOLONIA
CONSULTING ENGINEERS, INC

By WJTC Date 6-26-78 Subject HOLLIDAYSBURG DAM Sheet No. 3 of 5
Chkd. By RE Date 7-27-78 HYDROLOGY & HYDRAULIC Proj. No. 78-119-15

DISCHARGE CAPACITY OF THREE 48"ϕ CAST IRON PIPE UNDER RAILROAD EMBANKMENT

REFERENCE
(1) Dwg. 'PLAN OF EMBANKMENT GENERAL PLAN OF SITE HOLLIDAYSBURG WATER SUPPLY IMP.' By NEILAN ENGR 7-30-55 (NO. H-1-9), Scale 1"=50'



(2) Dwg 24079 The Pennsylvania R R Co Central Region, W Pa Div. Pgh Div. New Portage Branch Val. Sect 18. Pa, Duncansville West of Trash Rack at Mile Post No 41 To Prevent Blocking of Pipes Culvert Oct 3, 1938 scale 1"=40'

TOTAL HEAD = H = 1560 − 1510 = 50± (Ref 1)

OR = 102 − 50.7 = 51.3± (Ref 2)

Use H = 50 FT.

Ref (3) Design of Small Dam 2nd EDITION P. 567

$$H_T = \left[\frac{2.5204\,(1+K_e)}{D^4} + \frac{466.18\,n^2 L}{D^{16/3}}\right]\left(\frac{Q}{10}\right)^2$$

ASSUME $K_e = 0.5$ FOR SQUARE-CORNERED ENTRANCE FLUSH w/wall
$n = 0.011$ to 0.035 Use 0.015 FOR Cast-iron
$L = 168$ FT, $D = 4$ FT
$H_T = 50 - 0.85\,D = 46.6$ FT.

$$46.6 = \left[\frac{(2.5204)(1.5)}{(4)^4} + \frac{(466.18)(0.015)^2(168)}{(4)^{1\frac{1}{3}}}\right]\left(\frac{Q}{10}\right)^2$$

$$= [0.014768 + 0.01084]\left(\frac{Q}{10}\right)^2$$

$$= (0.02561)\left(\frac{Q}{10}\right)^2$$

then $Q = 10\sqrt{\frac{46.6}{0.02561}}$ cfs

$Q = 427$ cfs

Total: $3Q = 3 \times 427 = 1281$ cfs

Say 1300 cfs

THE PIPES HAVE MUCH LESS CAPACITY (1300 cfs) THAN THE SPILLWAY CAPACITY (5600 cfs) THEREFORE THE AREA BETWEEN R.R & DAM WILL BE FLOODED WHEN SPILLWAY DISCHARGE MORE THAN 1300 cfs

CONSIDER STORAGE BETWEEN R.R & DAM (Vol = 124 ac-ft)

Total storage = 189 + 124 = 313 ac-ft

PERCENT OF PMF WITHOUT OVERTOP R.R EMBANKMENT

$= \left(\frac{1300}{19500} + \frac{313}{10.000}\right)(100\%) = 9.8\%$ PMF

say 10% PMF < 31%

THEREFORE THE MAX. TAILWATER DEPTH FOR DAM IS HIGHER THAN R.R EMBANKMENT EL 1560 ±

D'APPOLONIA
CONSULTING ENGINEERS, INC

By WTC Date 6-26-78 Subject HOLLIDAYSBURG DAM Sheet No. 5 of 5
Chkd. By ___ Date ___ HYDROLOGY & HYDRAULIC Proj. No 76-114-15

DETERMINE WATER DEPTH, h, OVER TOP R.R EMBANKMENT (EL 1560)

Q_s = Discharge Rate ≈ pipe Discharge + Topping Discharge

$$Q_s = 10\sqrt{\frac{46.6+h}{0.02561}} + (2.6)(600)(h)^{1.5} \text{ cfs}$$

(600 assumed)

STORAGE = DAM + R.R EMBANKMENT

= (18.9 x 13) + (129 ac-ft + 15 ac x h)

(18.9 x 13) ← See p.2; (129 ac-ft) ← VOL BELOW 1560; (15 ac) ← approximate area @ 1560

$$= 245.7 + 124 + 15h$$
$$= 369.7 + 15h$$

Say $V_{storage} = 370 + 15h$ ac-ft

Q_{peak} = Dam max discharge = 19000 cfs (From P2.)

V_1 = 26" Runoff = 10,000 ac-ft (unchange)

Then

$$\frac{Q_s}{Q_{peak}} + \frac{V_{storage}}{V_1} = 1$$

$$\frac{10\sqrt{\frac{46.6+h}{0.02561}} + 1560h^{1.5}}{19000} + \frac{370+15h}{10,000} = 1$$

$$\frac{62.49\sqrt{46.6+h} + 1560h^{1.5}}{19000} + \frac{370+15h}{10000} = 1$$

h = 5.05 FT ABOVE R.R. EMBANKMENT (EL 1560')

$Q_s \cong$ 18180 cfs ≈ 96% OF INFLOW RATE

FOR ALL PRACTICAL PURPOSES THE INFLOW Q FOR PLAIN NINE SHOULD HAVE NO REDUCTION UNDER PMF DESIGN STORM.

APPENDIX E

REGIONAL GEOLOGY

APPENDIX E

REGIONAL GEOLOGY

The three reservoir dams (Blair Gap, Hollidaysburg, and Plain Nine) are located on or near the Allegheny Front, which marks the topographic and geologic change from the relatively flat-lying rocks of the Appalachian Plateau to the folded rock strata of the Appalachian Mountains. Strata of the Pocono Group (Mississippian Age) are present in the slopes and under Blair Gap and Hollidaysburg dams. The Pocono Group strata in the vicinity of the dams consist of thin to thick-bedded hard gray micaceous sandstone with some interbedded shale. The strata are moderately fractured. The sandstone is resistant to weathering and forms steep slopes, usually steeper than two to one. Coal is being strip mined in the vicinity. The beds being mined are the Mercer Coal (Pottsville Group, Lower Pennsylvanian Age) and the Kittanning and Freeport coals of the Pennsylvanian Age Allegheny Group. These coal seams are stratigraphically higher than the Pocono Group. The Pocono Group rocks are flat lying or dip gently to the west.