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NATIONAL DAM SAFETY PROGRAM. LAKE MARBURG (NDS PA-869), SUSQUEH--ETC(U)
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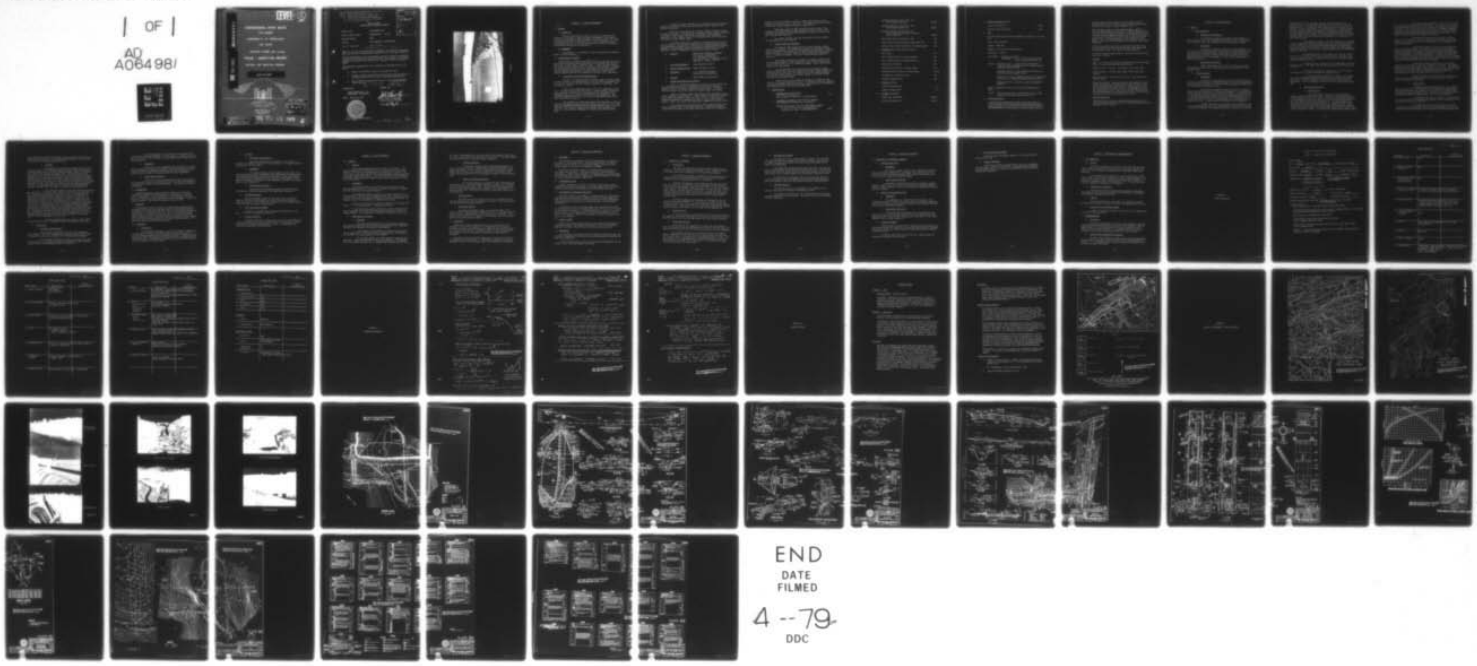

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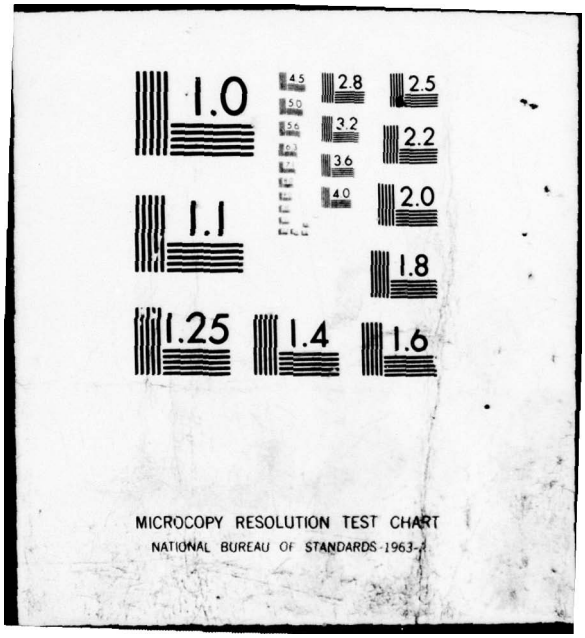
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SUSQUEHANNA RIVER BASIN

LAKE MARBURG

COMMONWEALTH OF PENNSYLVANIA

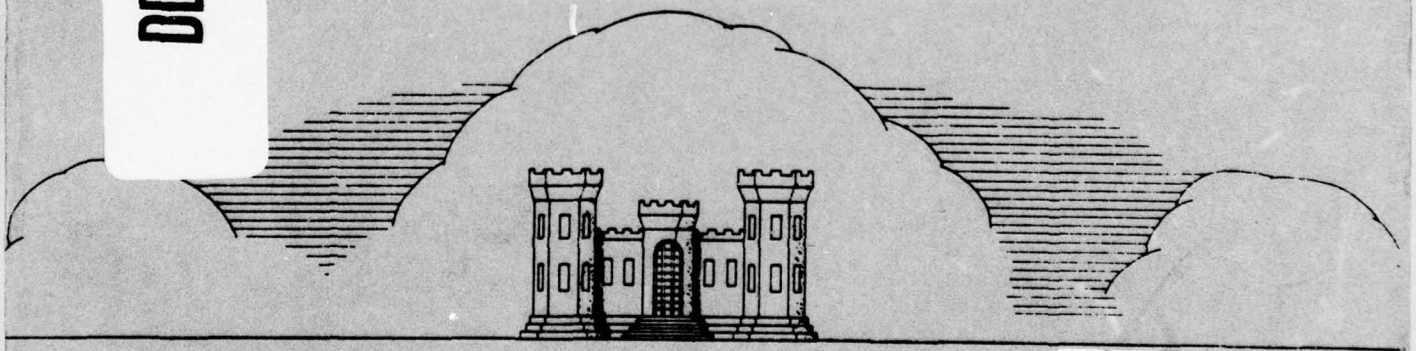
YORK COUNTY

INVENTORY NUMBER NDS PA-869

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

DACW31-78-C-0044



Prepared For
DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland
by
BERGER ASSOCIATES, INC
CONSULTING ENGINEERS
HARRISBURG, PA.

AUGUST 1978

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PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

Name of Dam: LAKE MARBURG DAM

State & State Number: PENNSYLVANIA - 67-489

County Located: YORK

Stream: WEST BRANCH OF CODORUS CREEK

Date of Inspection: July 12, 1978

(15) DACW31-78-C-0044

Based on a visual inspection, past performance and available engineering data, the dam and its appurtenances appear to be in very good condition.

The spillway capacity plus the available reservoir storage is sufficient to pass the PMF without overtopping the dam. The spillway is considered adequate in accordance with the Corps of Engineers criteria and guidelines.

The following recommendations are presented for implementation by the owner:

1. Repair the displaced riprap on the upstream slope.
2. Develop a formal surveillance and downstream warning system to be used during periods of high or prolonged precipitation.
3. That a qualified operator be on duty at the dam during major flood events.

(11) 25 Aug 78 (12) 61 p.

SUBMITTED BY:

BERGER ASSOCIATES, INC.
HARRISBURG, PENNSYLVANIA

DATE: August 25, 1978

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL ENGINEER
RODNEY VINCENT HOUSEAL
No. 4756-E

Rodney V. Houseal

APPROVED BY:

John H. Kenworthy

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

DATE: 25 Aug 78

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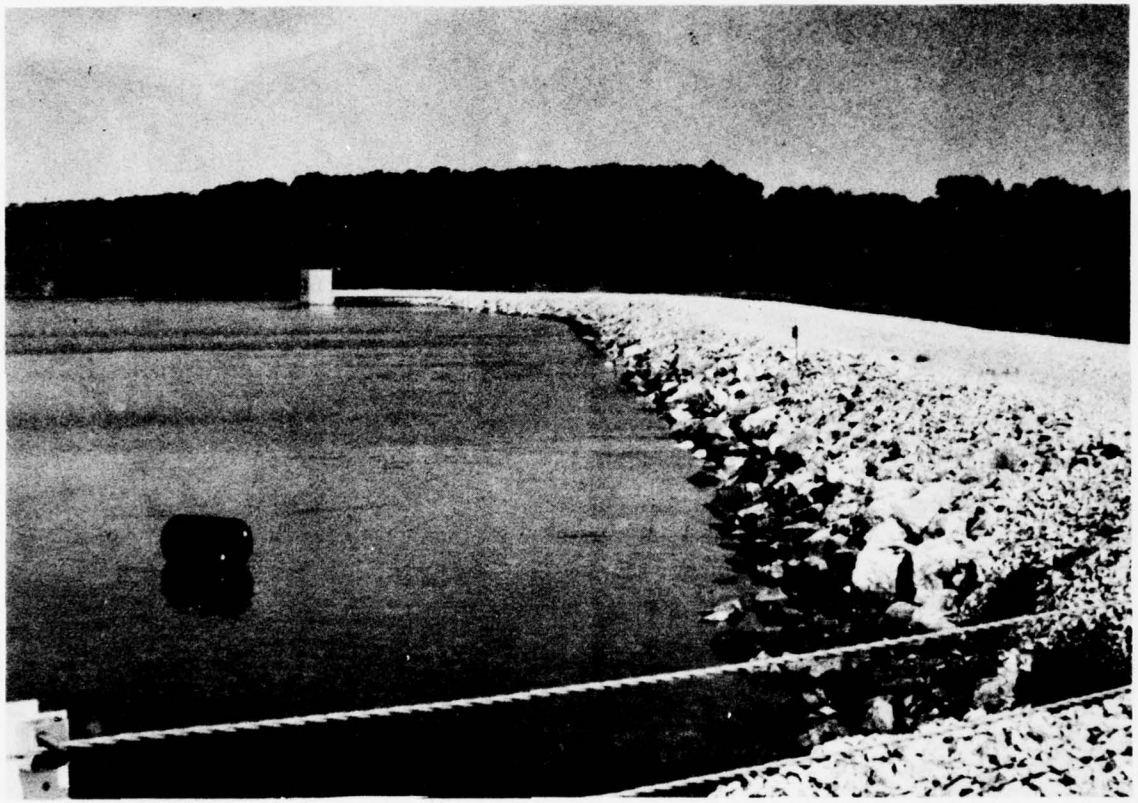

OVERVIEW

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SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

A. Authority

The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspections of dams throughout the United States. The Phase I Inspection and Report are limited to a review of available data, a visual inspection of the dam site and basic calculations to determine the hydraulic adequacy of the spillway.

B. Purpose

The purpose is to determine if the dam constitutes a hazard to human life and property.

1.2 DESCRIPTION OF PROJECT

The reservoir is impounded by construction of an earthen dam in the West Branch of Codorus Creek, upstream of its confluence with the East Branch of the West Branch of Codorus Creek. A gated spillway controls the normal reservoir water level. The project also includes a diversion dam and pumping facilities for diverting some flow into the reservoir from the adjacent East Branch of the West Branch of Codorus Creek. Complete physical details are contained in Section 1.3 of this report.

A. Description of Dam and Appurtenances

The dam is a zoned earthfill structure across the West Branch of Codorus Creek. The maximum height of the fill above streambed is 107 feet and the length of the crest between abutments is 1690 feet. The top width is 25 feet.

There are two impervious zones in the fill (Appendix D, Plate VII). The major zone is the core area. A cutoff trench is excavated into rock with its centerline coinciding with the centerline of the embankment and a grout curtain is provided in the foundation. The upstream embankment slope is 4H to 1V and the downstream slope varies from 2.5H to 1V to 3H to 1V.

The spillway is a gated side channel structure with a concrete weir and a discharge channel, partially lined with concrete. Two 7-feet high by 106.5-foot-long Bascule gates provide discharge control over the spillway. The total net length of the spillway weir opening is 213 feet. The side channel is composed of concrete slabs and vertical walls.

A control structure adjacent to the spillway houses the pressure piping, motor operated valves and recording and control equipment for reservoir operation.

The outlet works consist of a 54-inch diameter conduit through the base of the dam. A 126-foot-high reinforced concrete control structure is located on the conduit, some 85 feet upstream of the embankment centerline. Three intakes located on the upstream face of the structure feed water into the control tower.

A terminal structure is provided at the downstream end of the 54-inch conduit. This structure consists of an energy dissipator device and stilling basin topped with a control house containing valve operating equipment for regulating reservoir discharge and pumped flow into the reservoir. Refer to Appendix D, Plates VI, VII, VIII, IX and X.

B.	Location:	Manheim and Heidleberg Townships York County, Pennsylvania U.S. Quadrangle, Hanover, Pa. Latitude 39°-48.6', Longitude 76°-52.9' (Appendix D, Plates I and II
C.	Size Classification:	Large (Height 107 feet)
D.	Hazard Classification:	High (See Section 3.1.E)
E.	Ownership:	P. H. Glatfelter Company Spring Grove, Pennsylvania
F.	Purpose:	Water Supply and Recreation

G. Design and Construction History

The P. H. Glatfelter Company of Spring Grove, York County and the PennDER (formerly known as Department of Forests and Waters) joined in 1965 to construct a combination water supply - recreation reservoir project on the West Branch of Codorus Creek, York County.

Gannett, Fleming, Corddry and Carpenter were selected as the design engineers for the project. Plans and specifications were prepared and a permit was issued on April 13, 1965. The S. J. Groves & Sons Company was awarded the construction contract and the work began in August of 1965. The project was essentially completed on June 30, 1967.

The construction proceeded without major problems which would alter the design plans in any significant way. Regularly scheduled inspections were made by the design consultant as well as an inspection

from the offices of PennDER. Reports of these observations and the progress of the project are in the file. The design consultant provided a full time resident engineer during the construction.

Conditions of note include the discovery of a fault in the foundation rock underlying the right abutment in October, 1965. This condition was improved with the construction of a grout cap across this area and additional grouting.

The records indicate that the construction of this facility was conducted under close control.

H. Normal Operating Procedures

The reservoir was constructed for the dual purpose of water supply and recreation. The recreation area known as the Codorus State Park is maintained and operated by the Pennsylvania Department of Environmental Resources. The water supply is used for industrial purposes by the P. H. Glatfelter Company. The dam is controlled and operated by this firm.

Semi-annual inspections are made of the bascule gates by the Allis Chalmers Company. Annual inspections and reports of the entire facility are made by the P. H. Glatfelter Company. Their files contain copies of all such reports.

The spillway gates are controlled by an automatic sensing mechanism which lowers the gate discharge level when a head of about six inches flows over the gate. The system can also be operated manually. The automatic system includes two backup systems in the event of malfunction of the primary system.

Water for use in the industrial operation is taken from the lake and is released downstream to the P. H. Glatfelter plant as required. An auxiliary pumping system is available to pump water into the reservoir from downstream, but this system is seldom used.

1.3 PERTINENT DATA

A. Drainage Area (square miles
From U.S.G.S. Publication 23.2
(The designer of dam used 24.3 square miles)

B. Discharge at Dam Site (cubic feet per second)
See Appendix B for hydraulic calculations

Maximum known flood, June 1972, Estimated on basis of records for U.S.G.S. gaging station at Spring Grove, about 7 miles downstream 7,500

Spillway capacity at pool Elev. 627 (top of dam) gates down	29,600
Spillway capacity at pool Elev. 623 (normal pool) gates down	15,000
Spillway capacity at pool Elev. 627 (top of dam) should gates be stuck in the up position	5,620
Warm water outlet at pool Elev. 584	43
Outlet works low pool outlet at pool Elev. 525	30
Outlet works at pool level Elev. 623 (normal pool)	120

C. Elevation (feet above mean sea level)

Top of dam	627
Top of Bascule Gates in normal position	623
Top of Bascule Gates in lowered position	616
Normal pool elevation	623
Upstream portal invert of outlet tunnel	521
Downstream portal invert of outlet tunnel	515.67
Streambed at centerline of dam	520
Maximum tailwater about	530

D. Reservoir (miles)

Length of maximum pool	4.3
Length of normal pool	4.1

E. Storage (acre-feet)

Normal pool (Elev.623)	48,500
Top of dam (Elev.627)	53,100

F. Reservoir Surface (acres)

Top of dam (Elev.627)	1,360
Spillway crest (Elev.623)	1,275

G. Dam

For plan and sections refer to Appendix D, Plates VI, VII and VIII.

Type: Zoned Earthfill

Length: 1690 feet.

Height: 107 feet from stream bottom.

Top Width: 25 feet.

Side Slopes: Upstream - 4H to 1V
Downstream - 2.5H to 1V from top to Elev.590
3H to 1V from Elev.590 to toe

Zoning: Impervious fill I - sandy material containing a relatively high percentage of silt or clays is more sandy and heavier weight.

Impervious fill II - sandy material with more clay and less sand and lighter than I.

Random fill - soil, decomposed rock or soft weathered rock and can be broken down under normal rolling.

Random rock fill - relatively sound run-of-quarry material.

Refer to Appendix D, Plate VII for section showing zoned areas.

Cutoff: Trench, 30-feet wide at bottom with 1H to 1V side slopes and sitting on grout curtain cap.

H. Outlet Facilities

A 126-foot-high reinforced concrete control structure is located some 85 feet upstream from the embankment centerline. Water is admitted to the structure through a 100-foot-long, 30-inch-diameter cast-iron pipe at invert elevation 581.25, a

210-foot-long, 30-inch-diameter cast-iron pipe at invert elevation 551.25, and a 310-foot-long, 54-inch-diameter reinforced concrete pipe at invert elevation 521.0.

From the intake tower all flow passes through a 380-foot-long, 54-inch-diameter, steel-lined, reinforced-concrete pipe to a ground-level terminal structure at the downstream toe of the dam. At the terminal structure the 54-inch pipe is reduced to an 18-inch pipe, which is fitted with an 18-inch "Howell Bunger" valve. Fine adjustments of the discharge rate are made on this valve which discharges into an impact type energy dissipator.

Flow in the control structure is controlled by means of two 24-inch butterfly valves, one 24-inch gate valve and one 48-inch butterfly valve. All valves are motor operated.

A 60-foot bridge provides access to the control structure from the top of the dam.

I. Spillway

Type: Two 7-foot by 106.5-foot automatic Bascule gates release water to a reinforced concrete side channel.

Length of weir: 213 feet. (two gates - 106.5 feet each).

Crest elevation: 623 feet when raised and 616 feet when lowered.

Upstream channel: 60 feet by 220 feet by 4 feet deep, excavated in rock.

Downstream channel: The concrete-lined side channel is trapezoidal in shape with a bottom width of about 30 feet, and a depth ranging between 18 and 30 feet. Beyond the end of the weir, the chute is concrete lined for an additional 330 feet. The remaining 260 feet of the chute is unlined excavation in rock and terminates in a 40-foot by 40-foot by 2-foot stilling basin which is also unlined excavation in rock.

J. Regulating Outlets

Releases from the reservoir are regulated by means of an 18-inch Howell-Bunger valve located in a terminal structure at the downstream toe of the dam.

Section 2 - Engineering Data

2.1 DESIGN

A. Data Available

1. Hydrology and Hydraulics

The hydraulic information available from PennDER was quite complete. The file contained area-capacity curves, rating curves for the outlet works, and a complete set of construction drawings.

2. Embankment

The design information available for the embankment is limited to the construction plans and the project specifications. Both are included in the PennDER files. Summaries of design calculations regarding slope stability, consolidation, and flow nets as well as general soil test data are included in a report which accompanied the permit application.

3. Appurtenant structures

Design information for the inlet and outlet structures are contained on the plans. Calculations were not available in the PennDER files.

B. Design Features

1. Embankment

The dam is a zoned earthfill structure across the West Branch of Codorus Creek. The maximum height of the fill above streambed is 107 feet and the length of the crest between abutments is 1690 feet. The top width of the dam is 25 feet.

There are two impervious zones in the fill. The major zone is the core area (Fill II, Plate VII, Appendix D). This zone has a top elevation of 590.0 and a top width of 45 feet. The upstream face of this zone has a slope of 4H to 1V and the downstream face is on 1 to 1. A cutoff trench is excavated into rock with its centerline coinciding with the centerline of the embankment. The bottom width of the trench is 30 feet. A grout curtain is provided in the foundation.

Another impervious zone is located on the upstream side of the aforementioned zone. The top elevation of this zone is carried to the top of the dam. The upstream face has a slope of 4H to 1V from

the upstream toe up to permanent spillway crest elevation 616.0. A slope of 2.5H to 1V is provided from this point to the top of the dam elevation 627.0. A blanket of rock covers the entire upstream face of the dam. From the upstream toe up to elevation 555.0, a 12-inch thickness of rock on a 6-inch filter material is provided. From elevation 555.0 to elevation 590.0, the slope has an 18-inch thickness of rock on a 12-inch thick filter blanket. From elevation 590.0 to the top of dam elevation 627.0, the rock thickness is increased to 24 inches on a 12-inch filter blanket.

The downstream portion of the dam consists of an inclined drain, a random fill zone and a random rock fill. The inclined drain is a 10-foot wide zone of filter material placed against the downstream face of the inner impervious zone. The top elevation of this drain is 620.0 and connects to a horizontal drainage blanket under the downstream portion of the fill.

The downstream face of the random fill zone has a slope of 2.5H to 1V from the top of dam to elevation 597.0. From this elevation to the point where it intersects the horizontal drainage blanket, the zone slope is 2.25 to 1.

A rock fill zone is provided on the downstream face below elevation 590.0. The downstream face below elevation 597.0 has a slope of 3 to 1.

All faces of the dam not covered with rock are seeded. Concrete gutters are provided along the downstream toe.

An extensive grouting program was carried out throughout the entire embankment foundation and also in the spillway weir foundation area. The detailed grout curtain consisted of three lines of grout holes. Refer to Appendix D, Plate No. VII for section of embankment.

2. Appurtenant Structures

a. Outlet Works

The outlet works consist of a 54-inch-diameter conduit through the base of the dam. A 126-foot high reinforced concrete control structure is located on the conduit, some 85 feet upstream of the embankment centerline. There are three intakes feeding water into the control tower on the upstream face. The upper intake is at elevation 581.25 and the middle intake is at elevation 551.25. Each intake has a 30-inch diameter cast iron pipe leading from the upstream face to the control tower. The lower intake is the conduit itself. Its intake elevation is 521.00. All intakes have headwalls and trash screens.

The 54-inch conduit upstream of the control structure is an unlined reinforced concrete structure. The length of this section of the conduit is 285.0 feet. Cutoff collars are provided at intervals of 25 feet. They are provided at the joints on the concrete monoliths. Downstream of the control structure, the conduit is a 54-inch diameter reinforced concrete structure lined with a 3/8-inch steel liner. The length of this section of the conduit is 366 feet.

The control structure has a base width along the profile of the conduit of 40 feet. This structure houses the pressure piping, motor operated valves and recording and control equipment for reservoir operation.

A terminal structure is located at the downstream end of the 54-inch conduit. This consists of an energy dissipator device and stilling basin topped with a control house containing valve operating equipment for regulating reservoir discharge and pumped flow into the reservoir. The energy dissipator is an impact type stilling basin in which dissipation is accomplished by the impact of the incoming jet on a vertical hanging baffle, and by the eddies formed by the changed direction of the jet after it strikes the baffle.

The wasteway channel downstream of the terminal structure is excavated in rock for a distance of 170 feet. The channel bottom width is 12 feet and the side slopes are 1H to 4V. The remaining distance to where the wasteway channel meets the existing channel of the West Branch of Codorus Creek is a trapezoidal earth channel with a bottom width of 22 feet and side slopes of 1.5H to 1V.

An access bridge is provided from the crest of the earth dam to the operating chamber of the outlet control structure. Refer to Appendix D, Plate No.X.

b. Diversion Dam

A diversion dam and pumping station is an integral part of this project. The diversion dam is located just downstream of the confluence of the East Branch of the West Branch of Codorus Creek and the West Branch of Codorus Creek. The site of this diversion dam is approximately 3000 feet downstream of the site of the reservoir.

An impounding basin was excavated in the flood plain at this point where the streams come together. The total length of the dam across the plain was 419 feet.

A pumping station on the left bank of the creek consists of a reinforced concrete dry well housing pumps, motors, and associated operating equipment and a centrally located instrument panel

with indicating and recording equipment used to operate and monitor the facilities of the project. The design pumping capacity of the station is 50 cfs or 32.4 million gallons per day.

c. Spillway

The spillway is a gated side channel structure with a concrete weir and a discharge channel, partially lined with concrete. Two 7-foot-high by 106.5 foot-long modified bascule gates of fabricated steel control the spillway discharge level. The gates lower as the flood pool rises to allow flood waters to pass and the gates rise automatically as the flood waters recede so that storage above the permanent spillway crest is not lost. The crest elevation of the dam is 627; the top of spillway gate elevation is 623; the top of spillway crest elevation, gate down, is 616. The total net length of the spillway weir opening is 213 feet. The discharge capacity of the spillway at maximum design flood as calculated for this report is 29,600 cfs (See Appendix B).

The discharge channel is partially lined with concrete. The upper end of the channel has a width of 34 feet and its elevation is 599. Permanent spillway crest elevation is 616. The channel has a slope of 8% in the direction of flow for a distance of 200 feet. At this point the channel width decreases to 26 feet. The next 50 foot length has a slope of 3.5% in direction of flow to a point where a 60-foot vertical curve starts. The termination of the vertical curve is at the start of a channel grade of 16%. The channel length at this grade is 165 feet. A vertical curve of 50 feet brings the concrete lined portion of the discharge channel to its termination at elevation 543.17. Side slopes of the channel through the concrete lined section are 1H to 2V. The channel floor slab is 2 feet thick for the initial 310 feet. The remaining 215 feet of channel was a floor thickness of 1 foot. All concrete is anchored firmly in rock, both on the floor and the side slopes. Refer to Appendix D, Plate No. IX.

From the termination of the concrete lined channel, the discharge flows in a trapezoidal channel excavated in solid rock.

C. Design Data

1. Hydrology and Hydraulics

The hydraulic information available from PennDER was quite complete. The file contained area-capacity curves, rating curves for the outlet works, and a complete set of construction drawings.

The available hydrologic information included the results of calculations by the design engineer which indicated a PMF inflow of 36,000 cfs and a corresponding outflow of 27,400 cfs.

The design engineer also included the information that the spillway would pass PennDER's "C" curve inflow of 13,900 cfs with an outflow of 6,750 cfs in the event that the Bascule gates became stuck in the up position.

2. Embankment

Design data for the embankment are presented in a report which accompanied the permit application. These data include soil test summaries, flow net development, consolidation test information and slope stability analyses for numerous types of slope conditions.

3. Appurtenant Structures

There were no design calculations in the files relative to the spillway, intake or outlet structures. Available information is contained in the details of the design plans. The plans were extensive and complete.

2.2 CONSTRUCTION

Regularly scheduled inspections were conducted by the design engineer and PennDER. Detailed reports are contained in the files. With the exception of fault encountered in the foundation rock formation, the construction proceeded with no special problems. The project began in August of 1965 and was completed in June of 1967.

2.3 OPERATION

Considerable records are available regarding the measurements of discharges from the dam in compliance with the Commonwealths minimum flow criteria. Beyond these records, there is little information on the operation of the facility in the file. The P. H. Glatfelter Company files contain an inspection report annually for this dam as well as others operated by them. The gates are well maintained and are operated twice each year by the manufacturer, the Allis Chalmers Company. The gates were operated during this inspection.

2.4 EVALUATION

A. Availability

The information available in the files includes a complete set of construction drawings, and specifications, description report of project including operations and hydrology, pertinent information accompanying the permit application with frequency curves, hydrographs, soil test information on consolidation testing, and slope stability analyses. A flow net analysis is also included.

B. Adequacy

1. Hydrology and Hydraulics

Sufficient information is available in the files to evaluate the hydraulic behavior of the facilities. For further reference see Section 5 of this report.

2. Embankment

The design drawings and the summary of soil tests, stability analyses, flow net development and consolidation information show that detailed engineering studies have been made. These data together with the excellent appearance of the structure provide adequate information for making an assessment of the embankment to satisfy the requirements of this inspection.

3. Appurtenant Structures

Examination of the design drawings provides sufficient information to judge the adequacy of the appurtenant structures.

C. Operating Records

The most abundant records in the files refer to the weir readings relative to maintaining the minimum flow to the downstream area. Information on the operation of the facility was obtained during interviews with the owner's representative.

D. Post Construction Changes

There are no records of post construction changes for this dam. It has been in operation since 1967.

E. Seismic Stability

The dam is located in Seismic Zone 1 and it is considered that the static stability with normal safety factors is sufficient to withstand minor earthquake induced dynamic forces. No calculations or studies have been made to confirm this.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

A. General

The general appearance of this facility is excellent. The records indicate close control during the construction of the project which is reflected in the appearance of all features of the dam. The inspections by the owner and the continual maintenance program contribute to the good conditions observed. The visual checklist is in Appendix A. Photographs taken during the inspection are shown in Appendix D, Plates Nos. III, IV and V.

B. Embankment

With the exception of three disturbed riprap areas on the upstream slope located to the left of the intake structure, the embankment was observed to be in good condition.

The downstream slope is covered with a heavy grass mat with some patches of flowers and an occasional small bush. Inspection of the slope did not reveal any signs of seepage on the slope or along the toe. Sloughs, cracks, or erosion were not detected in any area.

The top of the dam forms an access roadway and is covered with stone. It is in good condition. Abutments are sound.

It was reported that heavy wave action on the upstream slope near the spillway has caused some maintenance problem as a result of riprap movement. This condition is attended to regularly by the owner.

C. Appurtenant Structures

1. Spillway

The entire spillway facility is in excellent condition. The mechanical gates and their controls are painted and well maintained. The gates were operated for inspection observations.

The approach to the spillway is directly from the lake and is unobstructed. Plastic barrels are strung across the approach to the spillway as a safety measure to warn boaters.

The spillway channel is a side channel of concrete walls and slabs. These were observed to be in good condition. Two bridges cross the spillway channel; one, a roadway bridge leading directly from

the top of the embankment to the right side of the spillway channel and the other, leading from the right wall of the channel to the pier between the two bascule gates. Both are in good condition.

2. Control Structure

The control structure and the footbridge leading to it are in excellent condition. Observations inside the structure did not detect any leakage. There are three intake levels identified as high, middle and the bottom. All intake is carried to the control at the outlet structure downstream of the embankment through a 54-inch diameter pipe.

3. Outlet or Terminal Structure

The outlet structure is located 386 feet downstream from the intake tower. The flow of water through the conduit is controlled with an 18-inch Howell Bunger valve. This structure contains an impact wall for energy dissipation of the discharge. The outlet channel is excavated into rock. All features of this structure were found to be in good condition.

D. Reservoir Area

The reservoir area is under the control of PennDER who operates the Codorus State Park recreational facilities. The entire area is well maintained and in good condition.

E. Downstream Channel

The downstream channel leads to a lower pond then to the natural stream. Approximately 20 homes and the P. H. Glatfelter Company plant are in the downstream area within eight miles of the dam. The hazard classification on the basis of this population and the potential loss of life and property is "High".

3.2 EVALUATION

Based upon the observations made during this inspection, this facility is in excellent condition. The displacement of riprap at several locations on the upstream slope appears to develop occasionally as a result of wave action. The owner is aware of this condition and has remarked that their maintenance operation provides repairs as necessary.

The owner initiates an annual inspection of the dam at which time the bascule gates are operated. A semi-annual inspection by the gate manufacturer tests the entire gate system for response and performance.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

This facility is operated as a water supply source for industrial use and as a recreational area. The actual operation of the dam is under the control of the P. H. Glatfelter Company, while the recreational aspect of the area is controlled by PennDER.

Controlled discharge is made to the downstream channel and is eventually used at the P. H. Glatfelter plant for their industrial processing. Minimum flows required by the Commonwealth of Pennsylvania are maintained and recorded. Reports are submitted regularly to PennDER to verify compliance with the regulation.

4.2 MAINTENANCE OF DAM

Regular attendance at the dam on a daily basis assures current remedial maintenance as necessary. The annual inspection of the entire facility by the owner also indicates good maintenance procedures.

4.3 MAINTENANCE OF OPERATING FACILITIES

The outlet control is attended on a regular basis to insure proper downstream discharge control. Pumping facilities located downstream from the dam as a standby system for reservoir water level maintenance during prolonged dry periods, are operated monthly to insure proper performance.

As reported earlier the spillway gates are inspected twice yearly by the manufacturer and at least one other time by the owner at the time of their annual inspection. A standby generator is a part of the operating system. It is operated once a week to assure readiness in the event of an emergency. Heaters are provided to prevent freezing of the gates to the spillway.

4.4 WARNING SYSTEM

There is no formal warning system to alert downstream residents of impending problems. The signal for concern at the P. H. Glatfelter plant is the level of water in the mill pond at the plant site.

4.5 EVALUATION

The information obtained during this inspection indicates that this dam and its appurtenant structures are in good operational condition and very well maintained.

A formal warning system should be developed and implemented for the benefit of all life and property downstream.

SECTION 5 - HYDROLOGY/HYDRAULICS

5.1 EVALUATION OF FEATURES

A. Design Data

The hydraulic information available from PennDER was quite complete. The file contained area-capacity curves, rating curves for the outlet works, and a complete set of construction drawings.

The available hydrologic information included the results of calculations by the design engineer which indicated a PMF inflow of 36,000 cfs and a corresponding outflow of 27,400 cfs.

Detailed calculations by the design engineer were not available but there was an indication that he developed a flood-frequency curve using the mean-annual flood method set forth in USGS Water Supply Paper 1543-A. The PMF peak inflow discharge of 36,000 cfs has a recurrence interval of 2,000 years on that curve. He also made some calculations involving the Snyder Method unit hydrograph and the probable maximum 6-hour precipitation excess of 23.2 inches, which produced the same result.

The design engineer also included the information that the spillway would pass PennDER's "C" curve inflow of 13,900 cfs with an outflow of 6,750 cfs in the event that the Bascule gates became stuck in the up position. Calculations made for this report indicate the maximum spillway capacity with gates up to be 5,620 cfs (See Appendix B).

B. Experience Data

In the period that the dam has been in existence, from 1967 to the present, the maximum flood was that of June 22, 1972, when the flow was about 7,500 cfs. The spillway passed that flood without distress.

C. Visual Observations

On the date of the inspection, no conditions were observed that would indicate that the appurtenant structures of the dam could not operate satisfactorily during a flood event, until the dam is overtopped.

The automatic gates have two back-up features which should make it reasonably certain that they will operate during a flood event. On the other hand, it is possible for any automatic device to fail. For this reason, it is recommended that a qualified operator be on duty at the dam during any future major flood event. At the time of the June 1972 flood, the gates were unattended.

D. Overtopping Potential

This dam has a size classification of "Large" (107 feet high and 53,100 acre-feet of storage) and a hazard potential classification of "High" (a large paper factory and about 20 low-lying homes within eight miles downstream).

The Recommended Spillway Design Flood (SDF) for a dam with the above classifications is the Probable Maximum Flood (PMF). The PMF peak flow for this site is 36,000 cfs and the spillway capacity at top of dam level (Elev. 627) is about 29,600 cfs or 82 percent of PMF peak inflow.

An estimate of the storage effect of the reservoir made by the design engineer shows Lake Marburg does have the storage available that is necessary to pass the PMF without overtopping (see Appendix B).

E. Spillway Adequacy

The spillway capacity is considered to be adequate as the project will pass the PMF without overtopping the dam.

The hydrologic analysis for this investigation was based upon existing conditions of the watershed. The effects of future development were not considered.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

A. Visual Observations

1. Embankment

There were no visual indications of embankment distress such as sloughage, displacement or seepage. The structure, with the exception of the previously described small riprap displacement areas, is in very good condition and appears stable.

2. Appurtenant Structures

Appurtenant structures including the spillway, spillway channel, intake structure, outlet structure and the accessory bridges are all in sound condition. There is no reason to consider any of these features unstable.

B. Design and Construction Data

1. Embankment

The embankment is a zoned earthfill structure. The construction plans, the soil test results and the calculation summaries indicate that adequate calculations and studies were performed in accordance with good engineering practice.

2. Appurtenant Structures

Although design calculations were not available in the files, a review of the detailed construction plans indicates that the appurtenant structures are well designed and on the basis of the visual inspection are in stable condition.

C. Operating Records

Formal records of operations of the dam were not available for examination during this inspection. The owners representative indicated that there has been no special problems of operation since the dam was completed in 1967.

Records of downstream flow are kept on a regular basis and submitted to PennDER for their files.

D. Post Construction Changes

There have been no reported changes to the original dam as constructed in 1967.

E. Seismic Stability

This dam is located in Seismic Zone 1 and it is considered that the static stability is sufficient to withstand minor earthquake induced dynamic forces. No studies or calculations have been made to confirm this assumption.

SECTION 7 - ASSESSMENT AND RECOMMENDATIONS

7.1 DAM ASSESSMENT

A. Safety

The visual inspection, the review of the files and the operational history indicates that this dam is in very good condition and that it has been designed in accordance with acceptable engineering practice.

The spillway has the capacity to pass 82 percent of the PMF peak inflow. This capacity, together with the storage available in the lake, is sufficient to pass the PMF in accordance with the Corps of Engineers' guidelines without overtopping the dam. The spillway capacity is, therefore, considered to be adequate.

B. Adequacy of Information

The available files including design drawings, engineering data summaries and construction reports are considered to be adequate for making an assessment of this dam.

C. Urgency

The items mentioned in this report are regarded as regular maintenance and should be cared for within a reasonable period of time.

D. Necessity for Additional Studies

A need for additional studies at this time is not indicated as a result of this inspection.

7.2 RECOMMENDATIONS

A. Facilities

The dam is considered to be in very good condition. The only recommendation presented regards the repair to the displaced riprap at three locations on the upstream slope in the area between the left abutment and the intake structure. As indicated above, this can be included in the regular maintenance activities of the facility.

B. Operation and Maintenance Procedures

The owner should develop a formal surveillance and downstream warning system to be used during periods of high or prolonged precipitation. It is recommended that a qualified operator be on duty at the dam during a major flood event.

APPENDIX A

VISUAL INSPECTION

CHECK LIST - DAM INSPECTION PROGRAM

PHASE I - VISUAL INSPECTION REPORT

NAD NO. 869

PA. ID # 67-489 NAME OF DAM Lake Marburg HAZARD CATEGORY High

TYPE OF DAM: Earthfill

LOCATION: Heidelberg TOWNSHIP York COUNTY, PENNSYLVANIA

INSPECTION DATE 7/12/78 WEATHER Sunny TEMPERATURE 70's

INSPECTORS: H. Jongsma, R. Houseal — P. H. Glatfelter Company
Dr. Jon Myers
A. Bartlett, R. Steacy

NORMAL POOL ELEVATION: 623.0 AT TIME OF INSPECTION:

BREAST ELEVATION: 627.0 POOL ELEVATION: 622.

SPILLWAY ELEVATION: 616.0 TAILWATER ELEVATION:

MAXIMUM RECORDED POOL ELEVATION: 1972 (Est. Bascule Gates 1/2 open).
No elevation known.

GENERAL COMMENTS:

Three intake valves - take water mostly from middle valves.

Diversion dam downstream from bascule gate with pumping station. Used on only one occasion since being used to fill the dam.

Bascule gates are automatically controlled.

Allis Chalmers inspection of gates twice each year.
P. H.G. inspects once each year.

Flood control plan based on water level over P.H.G. mill dam at plant (12"±) activates plan.

Bascule 7' Gates are operated (other than the automatic control) during the Allis Chalmers inspection.

DAM NO. NAD 869

VISUAL INSPECTION

EMBANKMENT	OBSERVATIONS	REMARKS & RECOMMENDATIONS
A. SURFACE CRACKS	None	
B. UNUSUAL MOVEMENT BEYOND TOE	None	
C. SLOUGHING OR EROSION OF EMBANKMENT OR ABUTMENT SLOPES	None	
D. VERTICAL & HORIZONTAL ALIGNMENT OF CREST	Horizontal alignment is curved as designed. No vertical displacement or distress observed.	
E. RIPRAP FAILURES	One slight upstream slough 200'± left of the intake tower not serious except for loss of roadway support near edge. About 10' wide others at 100' left and at 50'± left.	
F. JUNCTION EMBANKMENT & ABUTMENT OR SPILLWAY	Good	
G. SEEPAGE	None observed on downstream slope or along downstream toe.	
H. DRAINS	Rock toe.	
J. GAGES & RECORDER	none	
K. COVER(GROWTH)	Downstream: heavy grass mat - some patches of flowers. occasional small bush or tree - some vine growth. Upstream: dumped rock. Top: stone roadway.	

DAM NO. NAD 869

VISUAL INSPECTION

OUTLET WORKS	OBSERVATIONS	REMARKS & RECOMMENDATIONS
A. INTAKE STRUCTURE	Concrete tower No leakage Good condition	
B. OUTLET STRUCTURE	Concrete with impact wall at end of Bunger Valve.	
C. OUTLET CHANNEL	Sloped and rock lines sides - stone bottom. Grass and evergreen trees.	
D. GATES	18" Bunger valve in terminal structure. Refer to Appendix D, Plate X.	
E. EMERGENCY GATE	48" gate to outlet through 18" Bunger valve for control of discharge.	
F. OPERATION & CONTROL	Operated regularly. Most control by Bunger valve.	
G. BRIDGE (ACCESS)	Steel bridge to intake tower - good access	

DAM NO. NAD 869

VISUAL INSPECTION

SPILLWAY	OBSERVATIONS	REMARKS & RECOMMENDATIONS
A. APPROACH CHANNEL	The approach to the bascule gates is directly from the lake perpendicular to the embankment on the right side. Small cable with floating barrels acts as a safety barrier to boaters.	
B. WEIR: Crest Condition Cracks Deterioration Foundation Abutments	Bascule gates - 2 All concrete support and walls in excellent condition.	
C. DISCHARGE CHANNEL Lining Cracks Spilling Basin	Side channel - sloped walls Weep holes in bottom slabs. Stilling basin excavated in natural rock at end of spillway channel. Some rock has fallen into the channel near its lower end.	
D. BRIDGE & PIERS	Steel footbridge across side channel to center pier of bascule gates. Roadway bridge across side channel from embankment.	
E. GATES & OPERATION EQUIPMENT	Bascule gates Hydraulic cylinders with oil pressure. Nitrogen and a generator backup.	
F. CONTROL & HISTORY	Always on automatic. Can be operated by manual control.	

DAM NO. NAD 869

VISUAL INSPECTION

MISCELLANEOUS	OBSERVATIONS	REMARKS & RECOMMENDATIONS
INSTRUMENTATION		
Monumentation		
Observation Wells	None	
Weirs	None	
Piezometers	None	
Other	None	
RESERVOIR		
Slopes	Excellent	
Sedimentation	None observed	
DOWNSTREAM CHANNEL		
Condition	Good	
Slopes	Light brush and trees in overbanks.	
Approximate Population	80	
No. Homes	Approximately 20 homes and a paper manufacturing plant.	

APPENDIX B

HYDROLOGY/HYDRAULICS

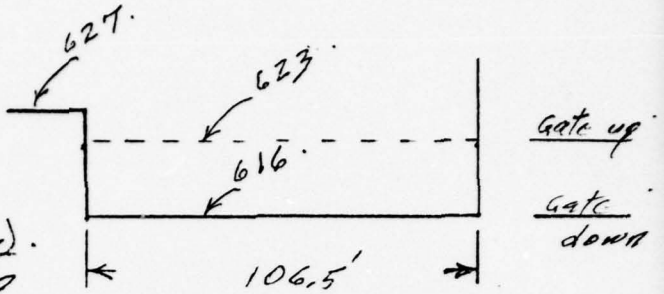
PROJECT Low Emergency Dam SHEET NO. 1 OF 3

SUBJECT Lake Charcoal Dam ID No. 569

COMPUTED BY RES DATE 7-14-78 CHECKED BY JJP 7-19-78

Spillway Rating

Two 7' x 106.5' automatic Bascule gates move up or down so as to keep pool at elev. 623



Pool at 627 (top of dam).
Gates all the way down

$Q = CLH^{3/2}$

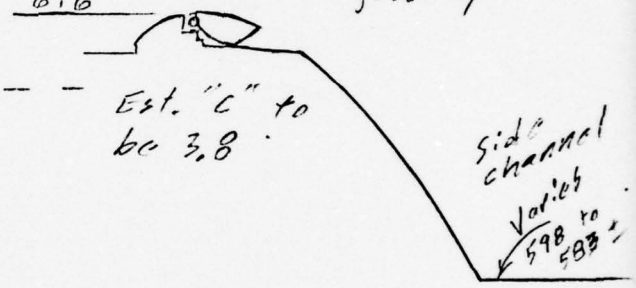
$= 3.8 \times 106.5 \times (11)^{3/2}$

$= 14,800$ cfs

2 gates $= 29,600$ cfs

½ of spillway opening. with gate down

623 with gate up



Pool at 623
Gates all the way down

$Q = CLH^{3/2}$

$= 3.8 \times 106.5 \times (7)^{3/2}$

$= 7,500$ cfs

2 gates $= 15,000$ cfs

Pool at 627, Gates stuck in up position

$Q = CLH^{3/2} = 3.3 \times 106.5 \times (4)^{3/2}$

$= 2,810$

2 gates $= 5,620$ cfs

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Side channel capacity check

Assume water surface slope is equal to bottom slope (0.035)

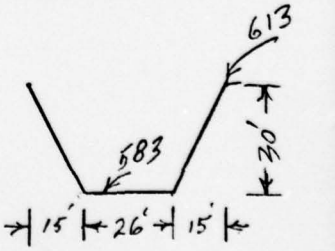
$V = \frac{1.486}{n} \times r^{2/3} \times S^{1/2}$

$n = 0.014$, $r = \frac{1230}{93.08} = 13.21$ ft.

$S = 0.035$.

$V = \frac{1.486}{0.014} \times (13.21)^{2/3} \times (0.035)^{1/2}$

$= 106.1 \times 5.59 \times 0.187 = 111$ ft/sec



Side channel at downstream end of weir

$Q = VA = 111 \times 1230 = 137,000$ cfs

Capacity of side channel appears to be adequate.

PROJECT [illegible] SHEET NO. 2 OF 3

SUBJECT Lake Marburg Dam ID No. 869

COMPUTED BY RES DATE 7-17-78 CHECKED BY JJF 7-19-78

Maximum known flood.

Drainage area at dam 23.2 sq mi.

Drainage area at USGS gaging station about 7 miles downstream 75.5 sq. mi.

Max. flood known at gaging station, 1929 to present June 22, 1972 19,400 cfs.

$\left(\frac{23.2}{75.5}\right)^{0.8} \times 19{,}400 = 7{,}500$ cfs Estimated peak discharge at dam for June 22, 1972 flood.

Storage in Lake Marburg is not a factor since automatic Bascule gates maintain Lake level at elev. 623 until their capacity is exceeded.

Warm water outlet at pool El. 584

30" dia pipe 100 ft. long admits water to intake tower. Invert at 580

From designers rating curve 43 cfs.

Outlet works low pool outlet at pool elev. 525

54" dia. pipe with 18" Howell-Bunger Valve on outlet at invert elev. 516.

From designers rating curve 30 cfs.

Outlet works at pool elev. 623 (Normal pool)

54" dia. pipe with 18" Howell-Bunger valve on outlet at invert elev. 516.

From designers rating curve 120 cfs.

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PROJECT Dam Investigation SHEET NO. 3 OF 3

SUBJECT Lake Clarkson Dam ID No. 867

COMPUTED BY RCC DATE 7-18-78 CHECKED BY JJP 7-19-78

PMF

From C. of E. curves → Drainage area = 23.2 sq. mi.
PMF = 1,800 cfs/sq. mi.
= 23.2 × 1800 = 41,800 cfs.
From relation curves furnished by Baltimore Dist. Corps of Eng.

From Design Engr. → PMF = 36,000 cfs
From calculations of design engineer.

From Indian Rock Dam → $PMF = \left(\frac{23.2}{93.7}\right)^{.8} \times 128{,}000 = 41{,}900$ cfs
From PMF used for Indian Rock Reservoir located about 10 miles downstream

Design Engineer's figures of 36,000 cfs inflow and 27,400 cfs outflow have been examined and are considered to be valid. The inflow figure is based on the Snyder method unit hydrograph and on a 6-hour probable maximum precipitation rainfall excess totals 23.2 inches.

Spillway Adequacy

Since the calculated PMF peak outflow is 27,400 cfs and the ultimate spillway capacity is calculated to be 29,600 cfs, the spillway is considered to be adequate.

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APPENDIX C

GEOLOGIC REPORT

GEOLOGIC REPORT

Bedrock - Dam

Formation Name" Harpers Phyllite.

Lithology: Gray-green, finely crystalline phyllite composed of muscovite, chlorite, albite and quartz. Has interbeds of gray phyllitic quartzite, especially in its upper part. Phyllite is a medium grade metamorphic rock with strong slaty cleavage which obscures bedding in most exposures. At least two generations of cleavage are usually present.

Bedrock - Reservoir

Formation Names: Marburg Schist, Chickies Quartzite, Harpers Phyllite, Antietam Quartzite, and the Conestoga Formation.

Lithologies: The Marburg Schist is a bluish gray to silvery green, fine grained schist, composed of muscovite, chlorite, albite and quartz. The Chickies Quartzite is a light gray to white, massive bedded quartzite, with some dark gray slate interbeds in its upper part. The Harpers Phyllite, described above, grades upward into the Antietam Quartzite, which is composed of gray quartzite, with gray phyllite interbeds. The Conestoga is a medium to dark gray, crystalline, marble with dark greenish gray phyllitit laminae and interbeds.

Structure

The rocks of southern York County have been extensively folded, faulted, and metamorphosed several times in their long histories. The reservoir is traversed by a major discontinuity, shown as a thrust fault on the Geologic Map. This feature has been variously interpreted as a major thrust fault, an unconformity, or, a change in metamorphic grade. If, it is a fault, it is old and has long since been refolded and healed, and is of no importance to the engineering geology of the site. The bedding in most of the formation of the area has been largely obscured by metamorphism. The bedrock, and particularly, the Harpers Formation splits along two or more generations of cleavage. The average trend of the cleavage is about N60°E and dips are steep NW to steep SE. Air photofracture traces in the area have the following trends: N65°-70°E, N20°W, N50°W and N70°W.

Overburden

The Harpers Phyllite is generally quite deeply weathered, especially along the fracture zones which control the valley topography. The upper zone of weathering, logged as overburden in the core borings, is five to ten feet thick as a rule - locally as much as twenty feet. This consists of soil and saprolite. Below this, the fractured slate shows weathering and to depths as much as 1.0 feet, the average being perhaps 50 feet.

Aquifer Characteristics

The Harpers Phyllite is an essentially impermeable rock. Ground water movement is entirely along cleavage and other fracture zones. In the upper part of the weathered zone, where fractures are more open, there is moderately free movement of water. At depth, the fractures are tight, and thre is little water movement. The minerals of the Harpers Formation are insoluble, and there is almost no modification of the fractures by ground water movement.

The Conestoga Formation which underlies part of the reservoir is an impure carbonate rock. Some melargement of fractures by solution occurs in this formation, but it is inhibited by the presence of the phyllitic interbeds. The Conestoga outcrops in the upper part of the reservoir only and is not involved in the dam foundations.

The dam was constructed with a cutoff trench excavated to "rock". Correspondence and photographs in the file indicate that this rock was made fractured and presented a very uneven surface. This was probably due to the intersection of two, or more, steeply dipping cleavages. In spite of practical difficulties the grouting program was very thorough, and the fractures below the embankment were apparently, effectively sealed, as no leaks have been reported.

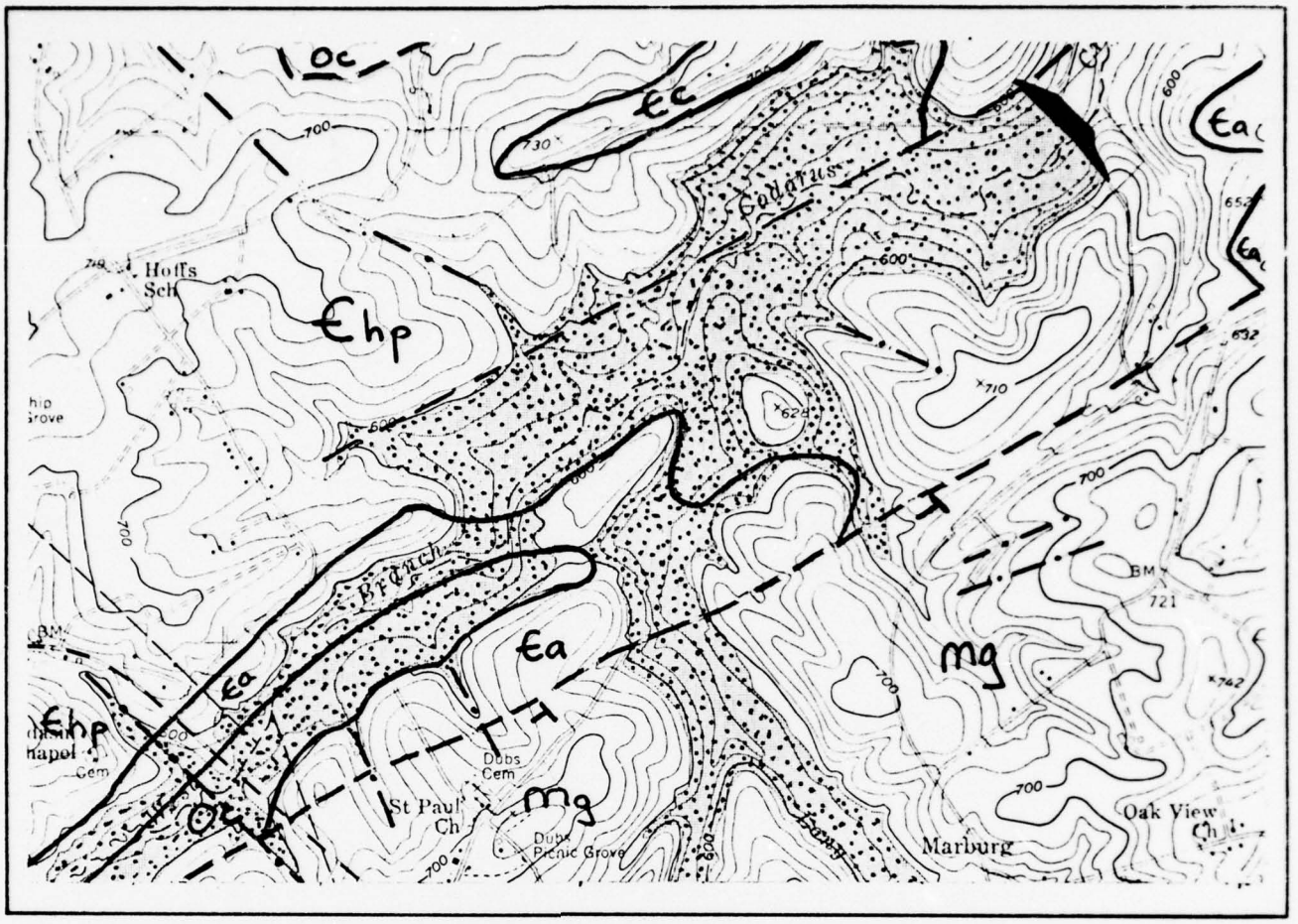
The Harpers is a sound rock, unlikely to be altered by ground water movement. The chance of developing leaks through the bedrock is remote.

Sources of Information

1. Stose, G.W. and Jonas, A.U. (1939) "The Geology and Mineral Resources of York County, Pa.", Pa. Geological Survey, County Report, C67.

2. Air Photographs, scale 1:24,000 dated, 1968.

3. Logs of Foundation Borings in file.



(Geology from Stose and Jonas, 1939)

KEY

Oc — Conestoga Fm.	——— high angle fault
Ea — Antietam Fm.	——— thrust fault
Ehp — Harpers Fm.	—.—.— air photo fracture trace
Ec — Chickies Fm.	
mg — Marburg Schist	

N

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SCALE 1:24 000

1 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

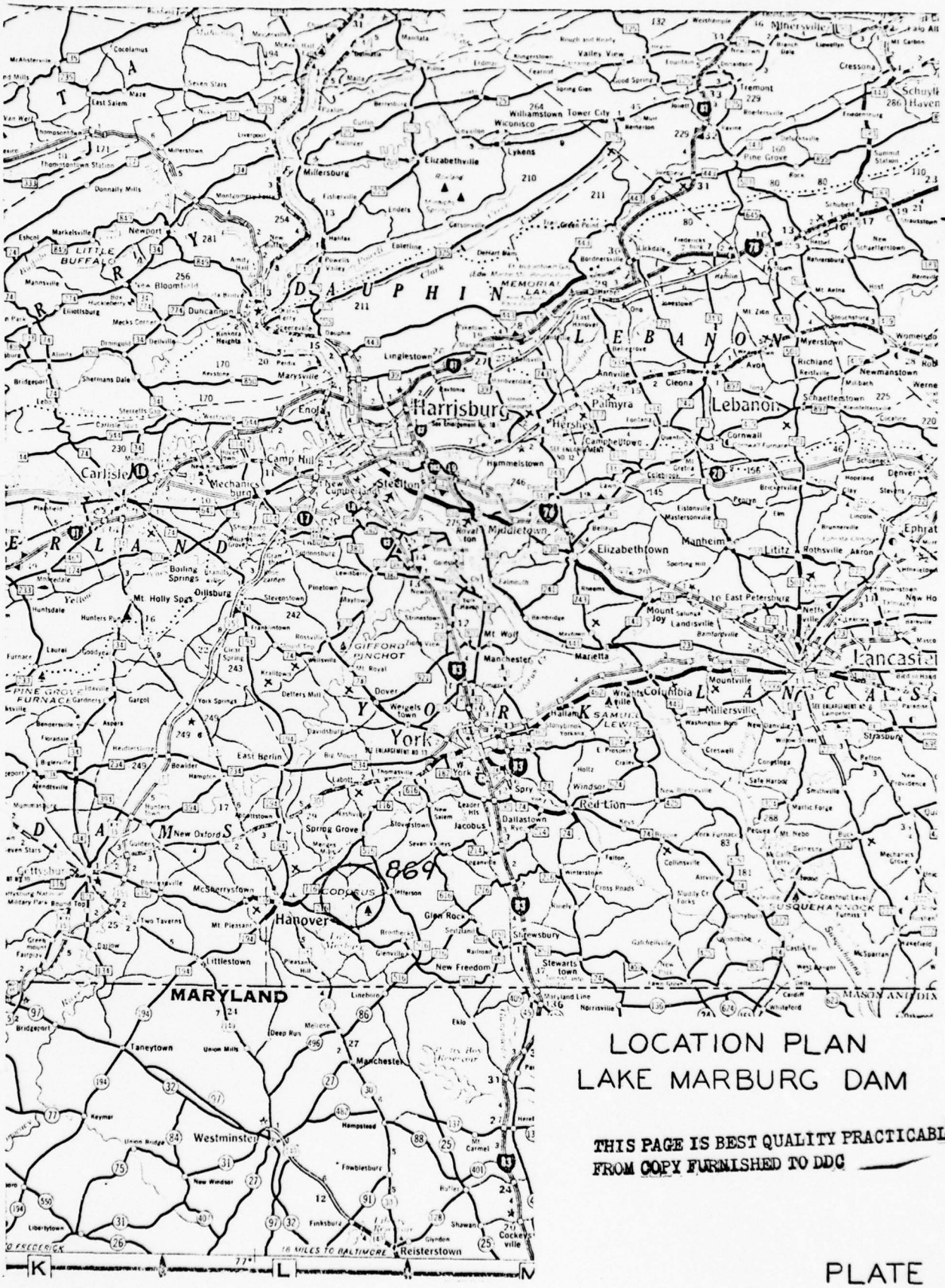
1 5 0 1 KILOMETER

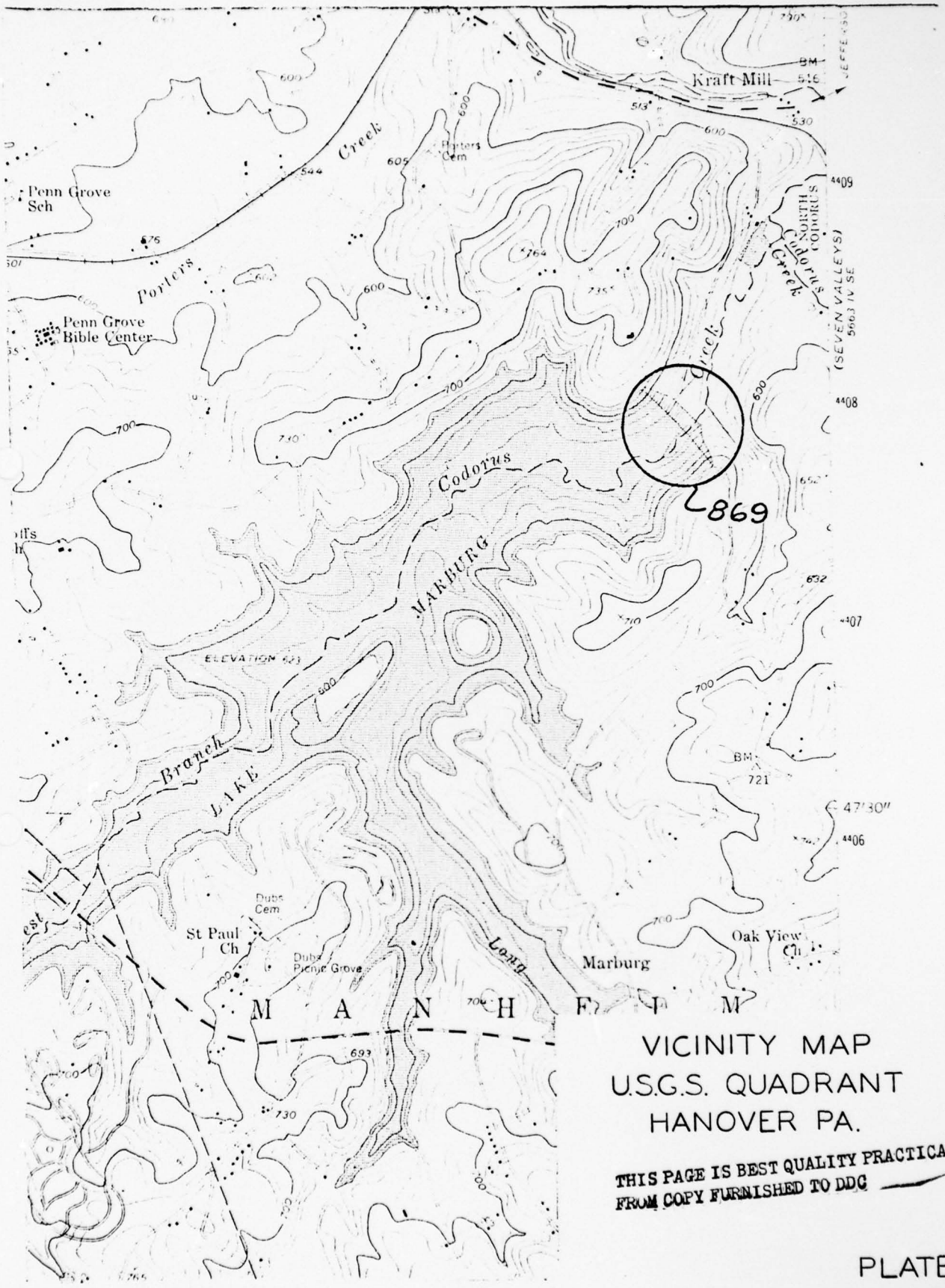
CONTOUR INTERVAL 20 FEET

DOTTED LINES REPRESENT INTERMEDIATE CONTOURS

APPENDIX D

LOCATION, PHOTOGRAPHS & DESIGN DRAWINGS


Harrisburg
Lebanon
Carlisle
Hanover
York
Lancaster
Middletown
Elizabethtown
Mechanicsburg
Camp Hill
Enola
Steelton
Hummelstown
Palmyra
Hershey
Millersburg
Elizabethville
Williamstown
Tower City
Pine Grove
Tremont
Schuylkill Haven
Cressona
Myerstown
Newmanstown
Schaefferstown
Cleona
Annville
Cornwall
Lititz
Manheim
Rothsville
Akron
Ephrata
Denver
Mount Joy
Landisville
East Petersburg
Columbia
Millersville
Strasburg
Red Lion
Spry
Windsor
Dallastown
Jacobus
Spring Grove
New Oxford
McSherrystown
Littlestown
New Freedom
Shrewsbury
Glen Rock
Stewartstown
Mt. Wolf
Manchester
Marietta
Dover
Weigelstown
East Berlin
Boiling Springs
Mt. Holly Spgs
Oilsburg
Duncannon
Newport
Mifflintown
Thompsontown
Liverpool
Markelsville
Donnally Mills
Maze
East Salem
Cocolamus
Seven Stars
Valley View
Wiconisco
Lykens
Linglestown
Marysville
Sherman's Dale
Bridgeport
Elliottsburg
Mechanicsburg
Yellow Breeches
Pine Grove Furnace
Gifford Pinchot
Samuel Lewis
Susquehanna
Appalachian Trail
Maryland
Taneytown
Westminster
Manchester
Hampstead
Fowblesburg
New Windsor
Union Bridge
Union Mills
Deep Run
Eklo
Keymar
Finksburg
Glyndon
Cockeysville
Reisterstown
Liberty Reservoir
Liberty Dam
Liberty Lake
Liberty Tunnel
Patapsco River
Patapsco Valley State Park
Baltimore
18 MILES TO BALTIMORE
Maryland Line
Mason and Dixon
Codorus
Codorus State Park
Codorus Furnace
Pine Grove Furnace
Susquehanna River
Conestoga River
Little Buffalo Creek
Dauphin Memorial Lake
Gifford Pinchot
Samuel Lewis
Appalachian Trail
Mason and Dixon
Lancaster
Dauphin
Lebanon
York
Adams
Cumberland
Perry
Juniata
Mifflin
Northumberland
Snyder
Union
Carroll
Frederick
Baltimore
Harford
Cecil
Chester
Lancaster
Berks
Lebanon
Schuylkill
Columbia
Montour
Lycoming
Clinton
Centre
Huntingdon
Bedford
Fulton
Franklin
Washington
Allegheny
Westmoreland
Fayette
Somerset
Cambria
Blair
Indiana
Armstrong
Butler
Clarion
Jefferson
Clearfield
McKean
Potter
Tioga
Bradford
Sullivan
Wyoming
Luzerne
Carbon
Monroe
Pike
Wayne
Lackawanna
Susquehanna
Erie
Crawford
Mercer
Venango
Forest
Warren
Elk
Cameron
Lawrence
Beaver
Washington
Greene
Fayette
Somerset
Bedford
Blair
Cambria



VICINITY MAP
U.S.G.S. QUADRANT
HANOVER PA.

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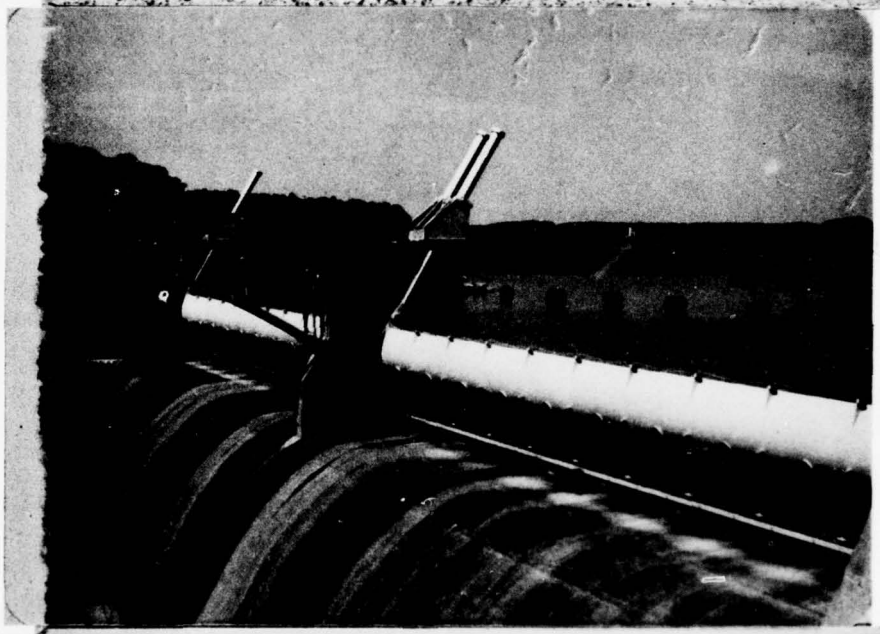
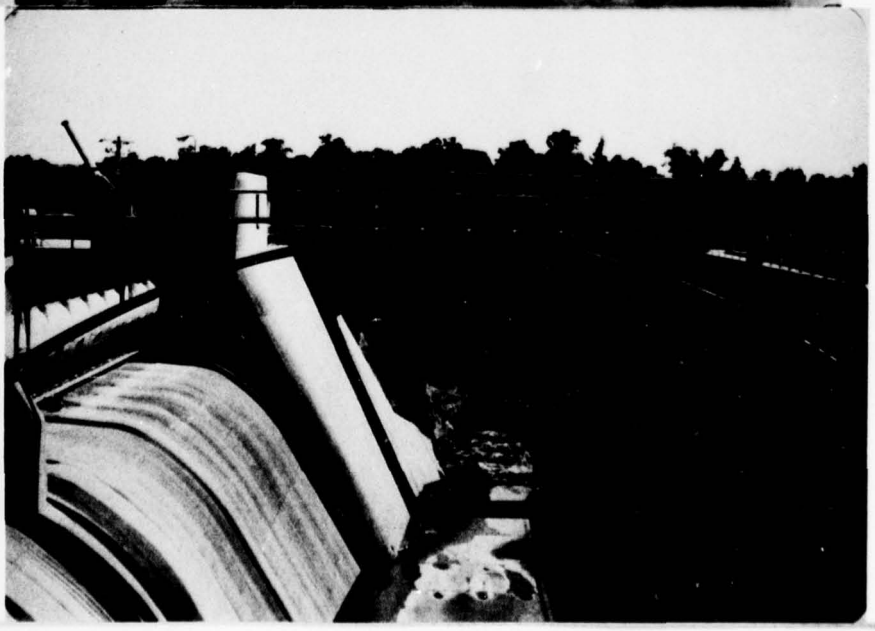
PLATE II

Upstream View
Of Spillway



Bascule Gates



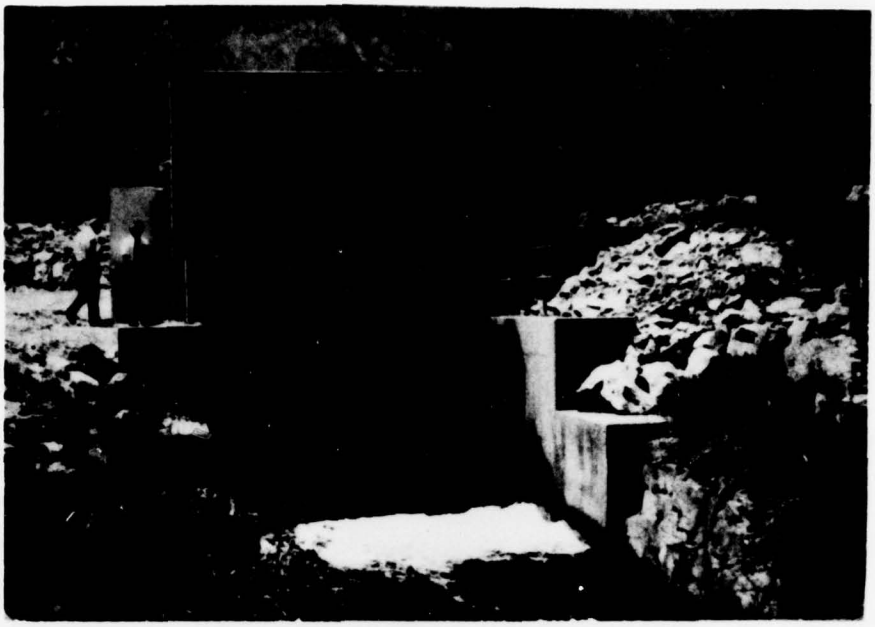
Spillway Chute

PLATE III

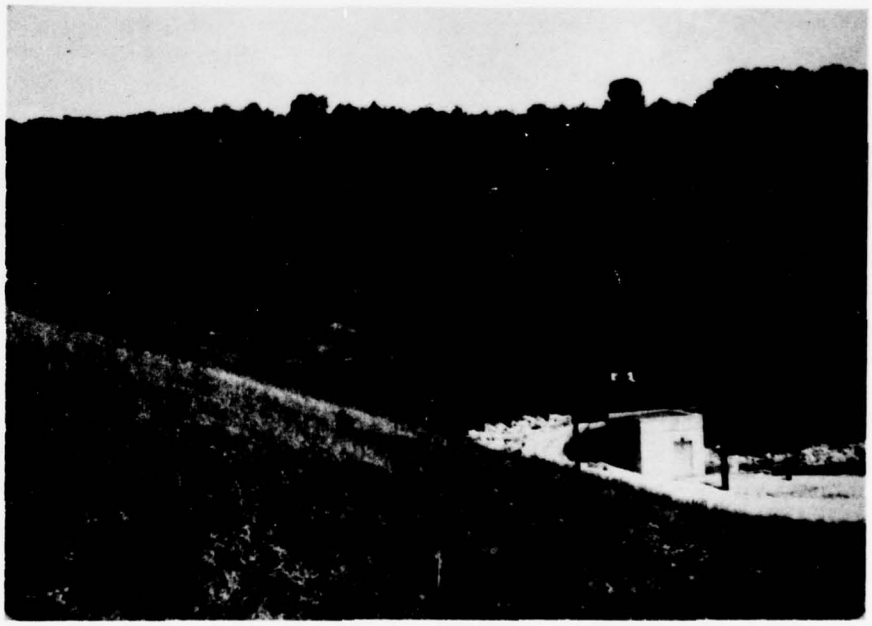
Spillway Chute & Bridge

Outlet Channel

PLATE IV



Conduit Baffle Dissipator



Downstream Slope

PLATE V

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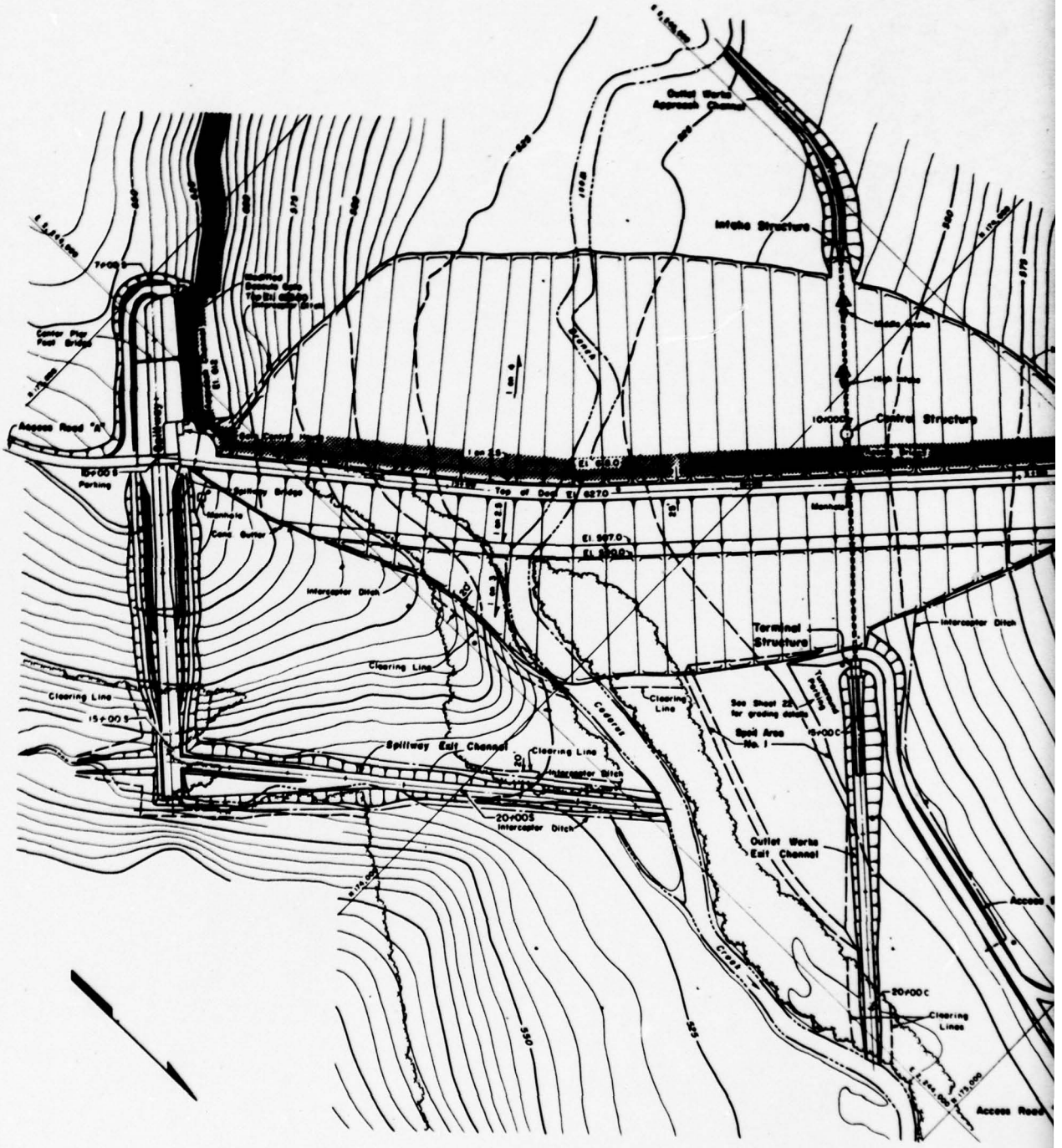

GENERAL PLAN

100' 0 100 200

SCALE: 1" = 100'

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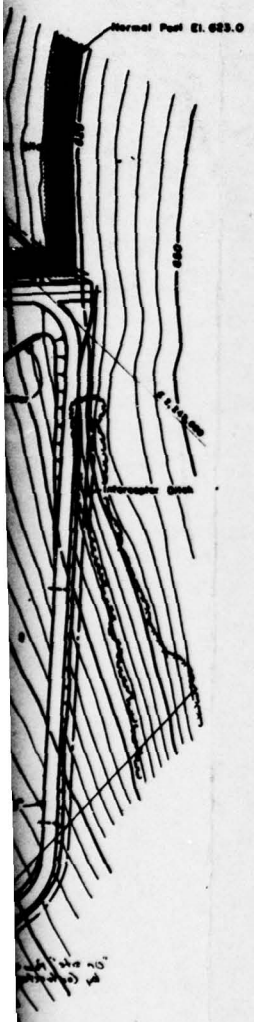


GENERAL NOTES

1. All clearing will be done by others.
2. Unless otherwise shown, clearing lines shall be 20' from construction limits.
3. Sections are indicated thus (A), the number indicates the sheet on which the plan or section is shown.
4. Payment Item Numbers are indicated thus (22)
5. For additional General Notes see Sheet 1.
6. For Project Layout see Sheet 3

REFERENCES

Project Plan	Sheet No. 1
Project Layout	3
Embankment	16
Spillway	31
Outlet Works	52
Pumping Station	90
Electrical	95

PLATE VI

P.H. GLATFELTER CO. SPRING GROVE, PA.

P. H. GLATFELTER DAM
WEST BRANCH CODORUS CREEK, PA.

GENERAL PLAN

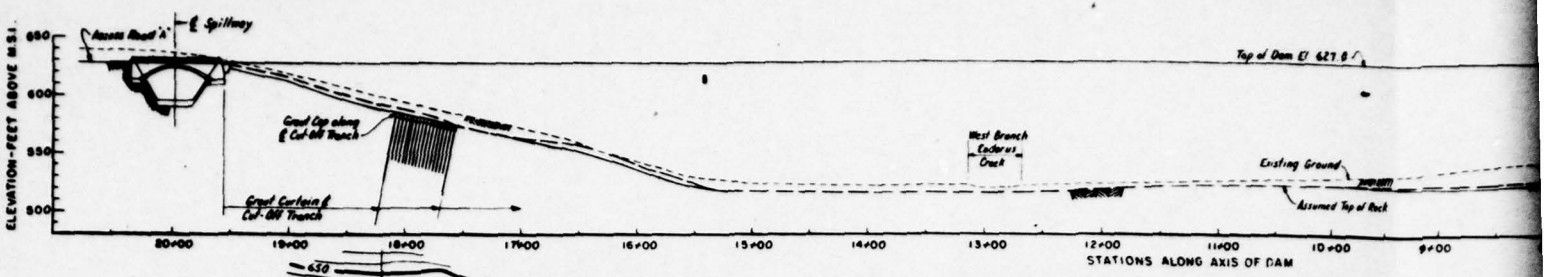
Sheet No. 2
Job No. 5222
Date 12-1-64

REVISIONS

DESCRIPTION	DATE	BY

GANNETT FLEMING CORDDRY & CARPENTER, INC.
ENGINEERS
[illegible] N. SECOND ST. HARRISBURG, PENNA.

2



PROFILE ALONG AXIS OF DAM

(LOOKING UPSTREAM)

60' 30' 0 60' 100'

SCALE 1" = 60'

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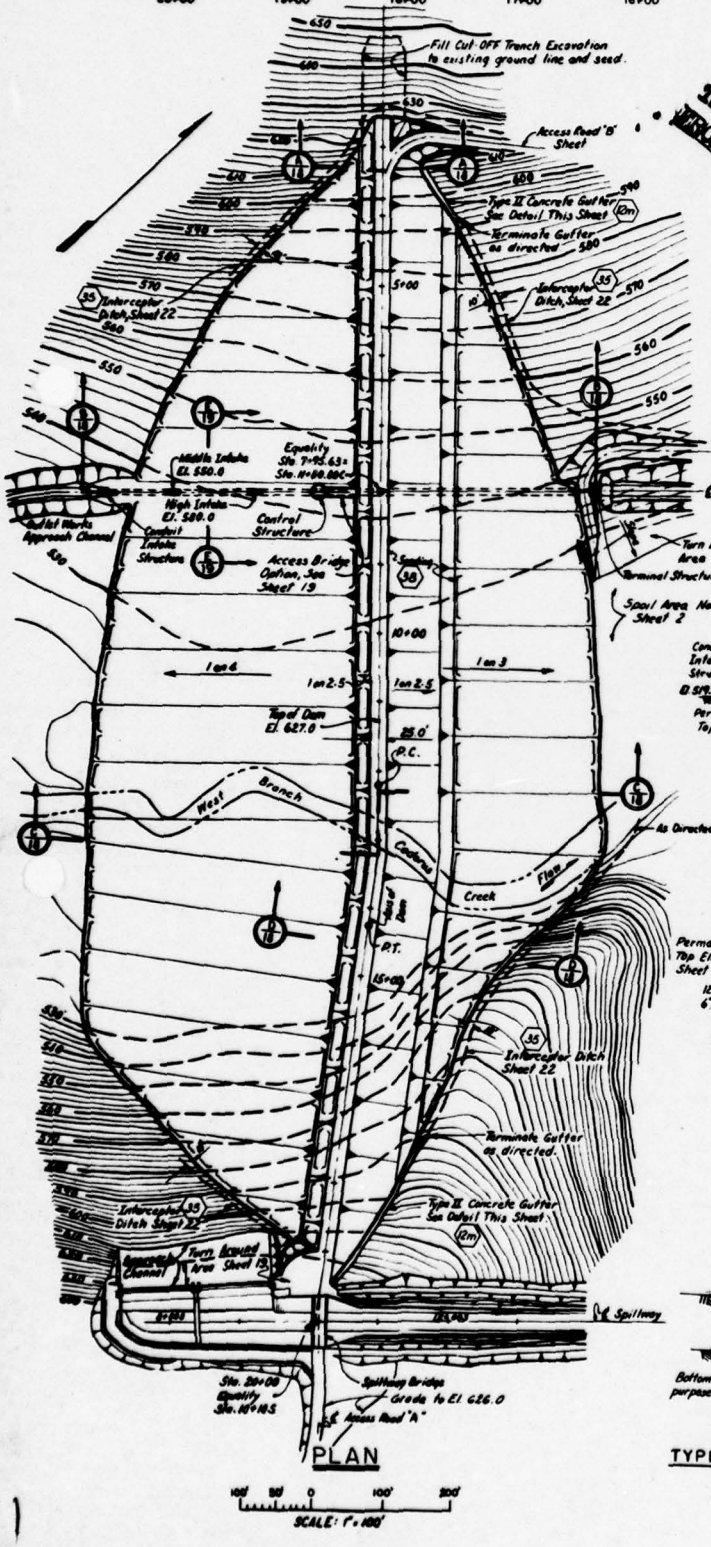
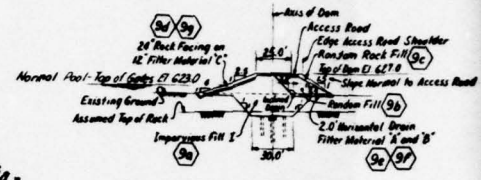
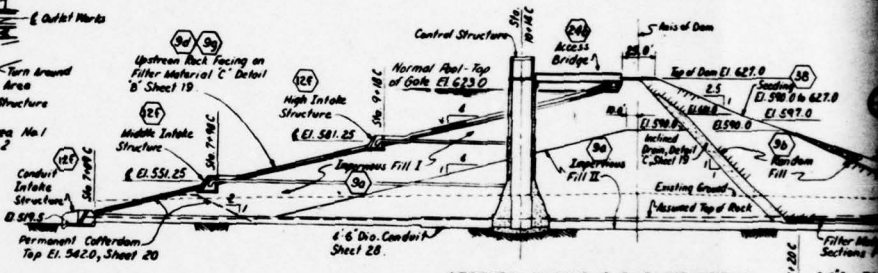




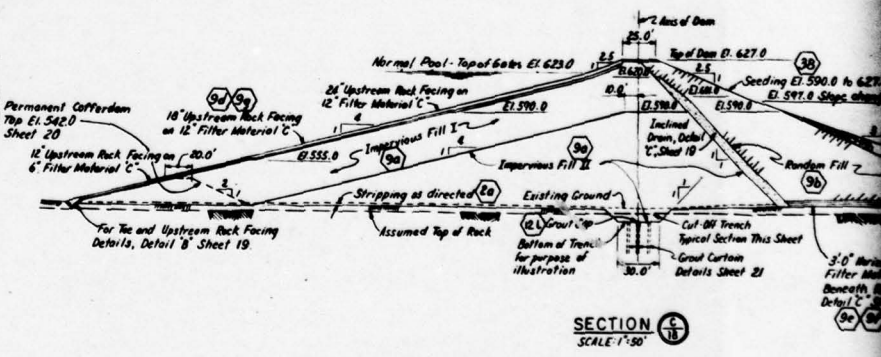
SECTION ⑯
SCALE: 1"=50'

NOTE: Access Bridge option See sheets 19, 22, 46.

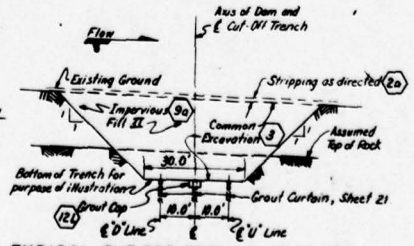


SECTION ALONG ℄ OUTLET WORKS

SECTION ⑰
SCALE: 1"=50'



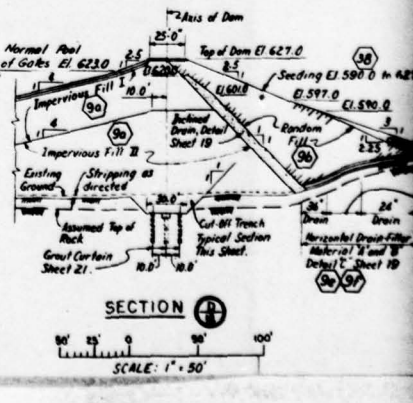
SECTION ⑱
SCALE: 1"=50'



TYPICAL CUT-OFF TRENCH SECTION

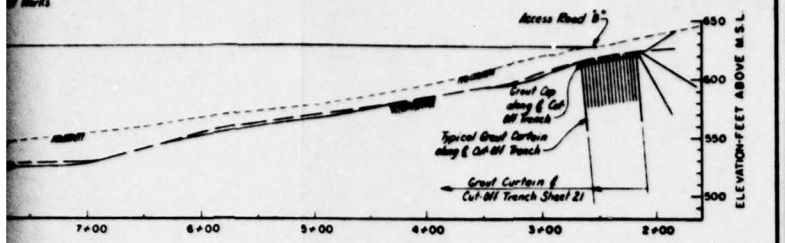
DETAIL "E"

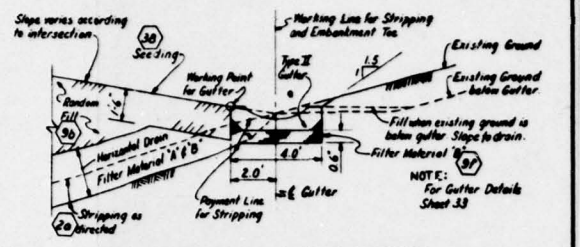
NO SCALE



SECTION ⑲
SCALE: 1"=50'

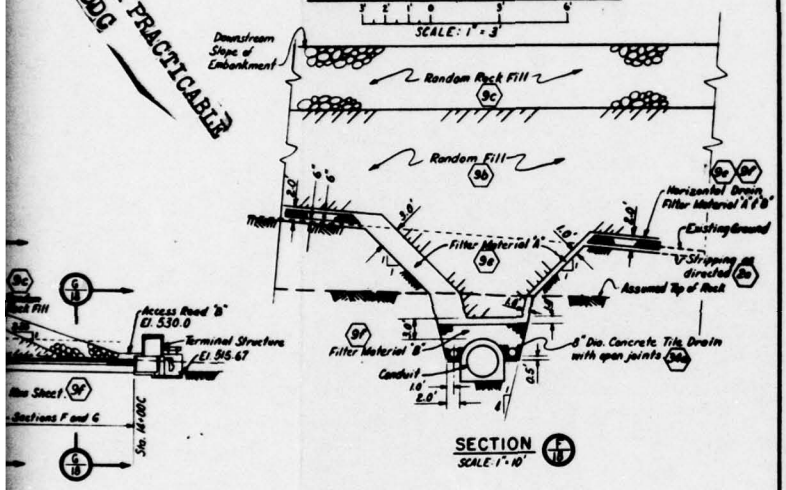
869

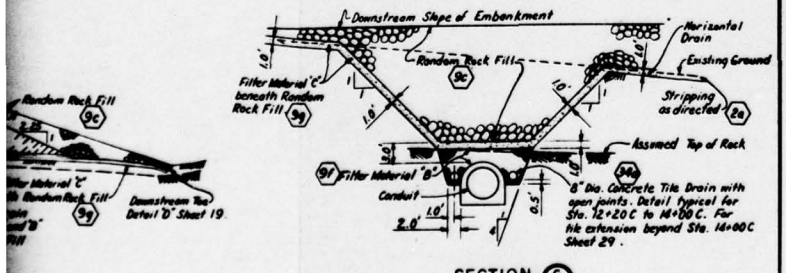




TYPE II CONCRETE GUTTER 10m

EMBANKMENT TOE DETAIL





GENERAL NOTES

1. Elevations shown are ultimate elevations. See Sheet 20 for embankment surcharge data.
2. For additional General Notes see sheets 2 and 3.

PLATE VII

P.H. GLATFELTER CO. SPRING GROVE, PA.

P. H. GLATFELTER DAM
WEST BRANCH CODORUS CREEK, PA.

EMBANKMENT
PLAN, PROFILE AND SECTIONS

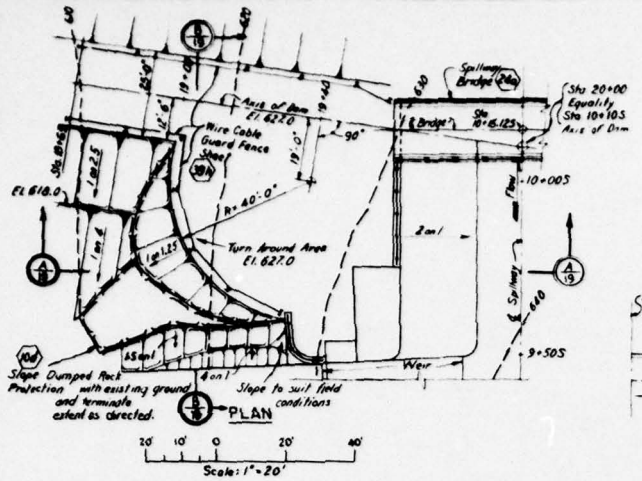
DRAWN	GV/FF
TRACED	DMU
CHECKED	GV/FF
APPROVED	
DRAWING No.	10
JOB No.	3222
DATE	12-1-84

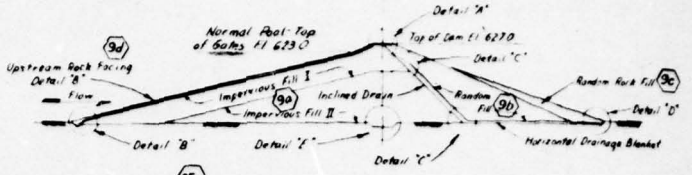
REVISIONS

NO.	DESCRIPTION	DATE	BY

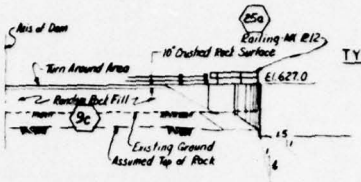
GARRETT FLEMING GODDARD & CARPENTER, INC.
ENGINEERS

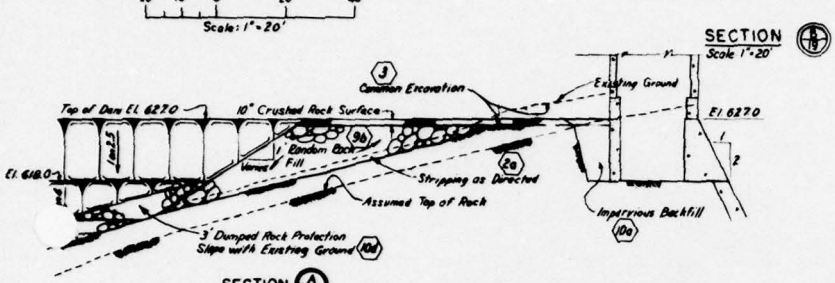
2



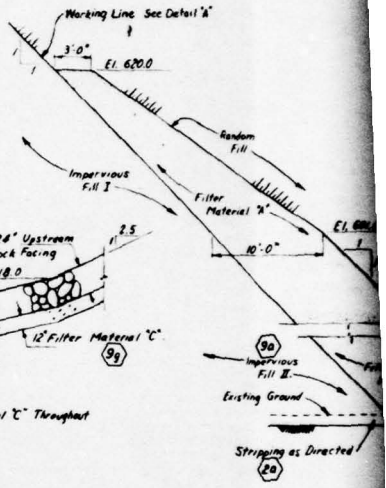


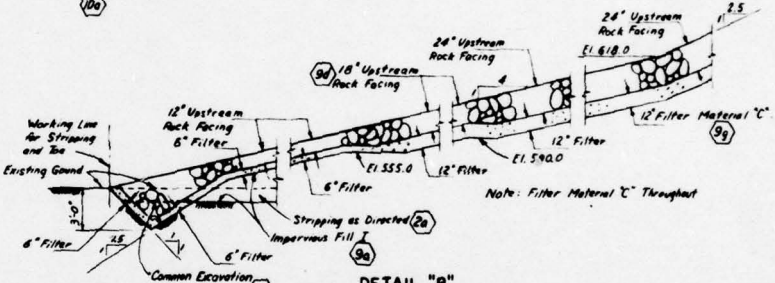
TYPICAL EMBANKMENT SECTION
No Scale





SPILLWAY TURN-AROUND AREA
Scale as Shown





DETAIL "B"
No Scale

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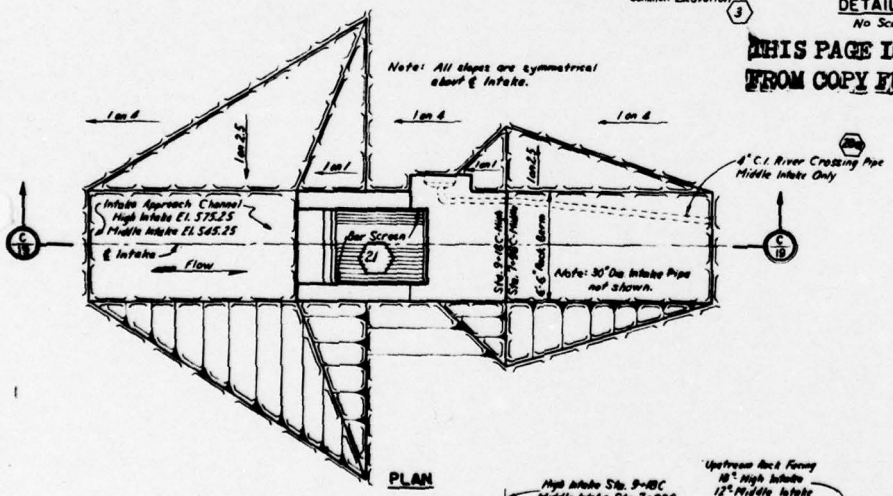
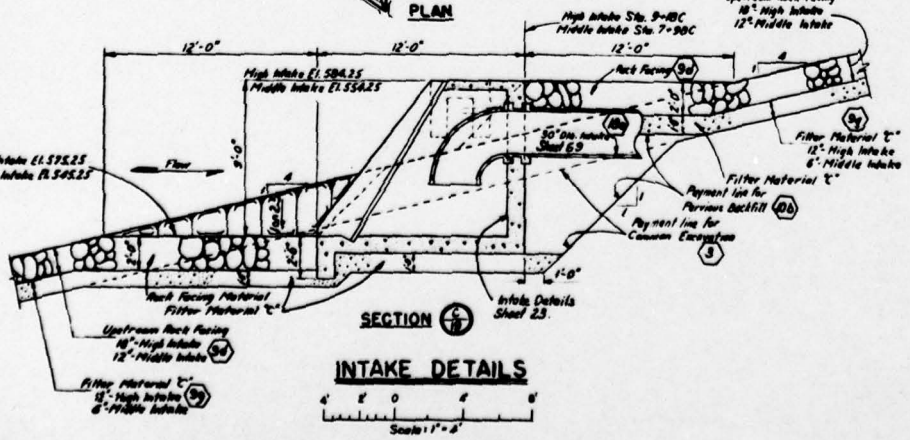
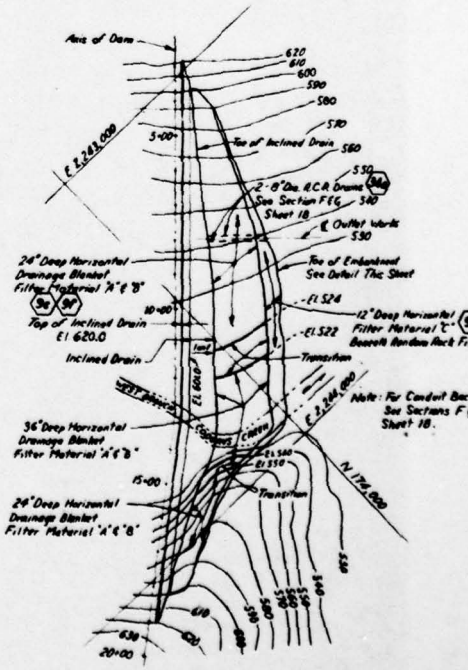
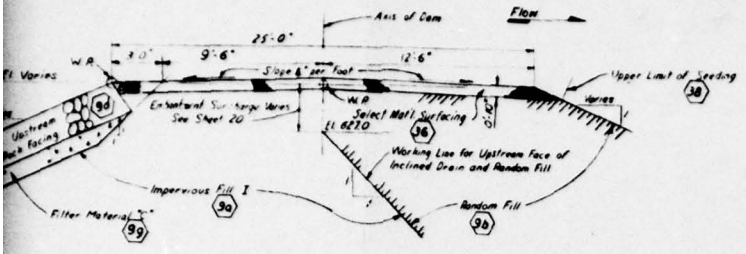




INTAKE DETAILS
Scale: 1" = 8'



PLAN OF EMBANKMENT DRAINAGE DETAILS
Scale: 1" = 200'



DETAIL "A"
TYPICAL TOP OF DAM SECTION

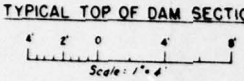


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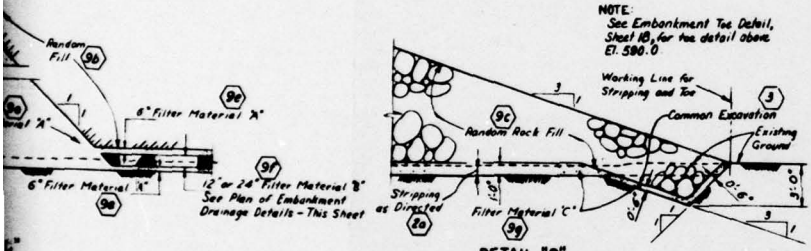
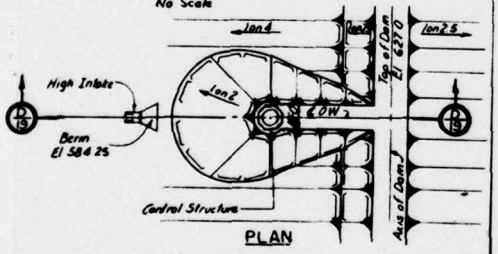
PLATE VIII

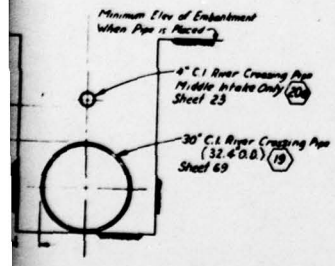


DETAIL "D"
No Scale

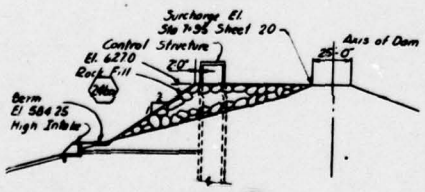
DETAILS



PLAN



THRU INTAKE PIPE
No Scale



SECTION

OPTION
ROCK FILL CONTROL STRUCTURE
BRIDGE
Scale 1"=30'

GENERAL NOTES
1. For General Notes see sheet 18.
2. See Sheet 46 for Access Bridge Option notes and bidding instructions on pay Items and

P.H. GLATFELTER CO. SPRING GROVE, PA.

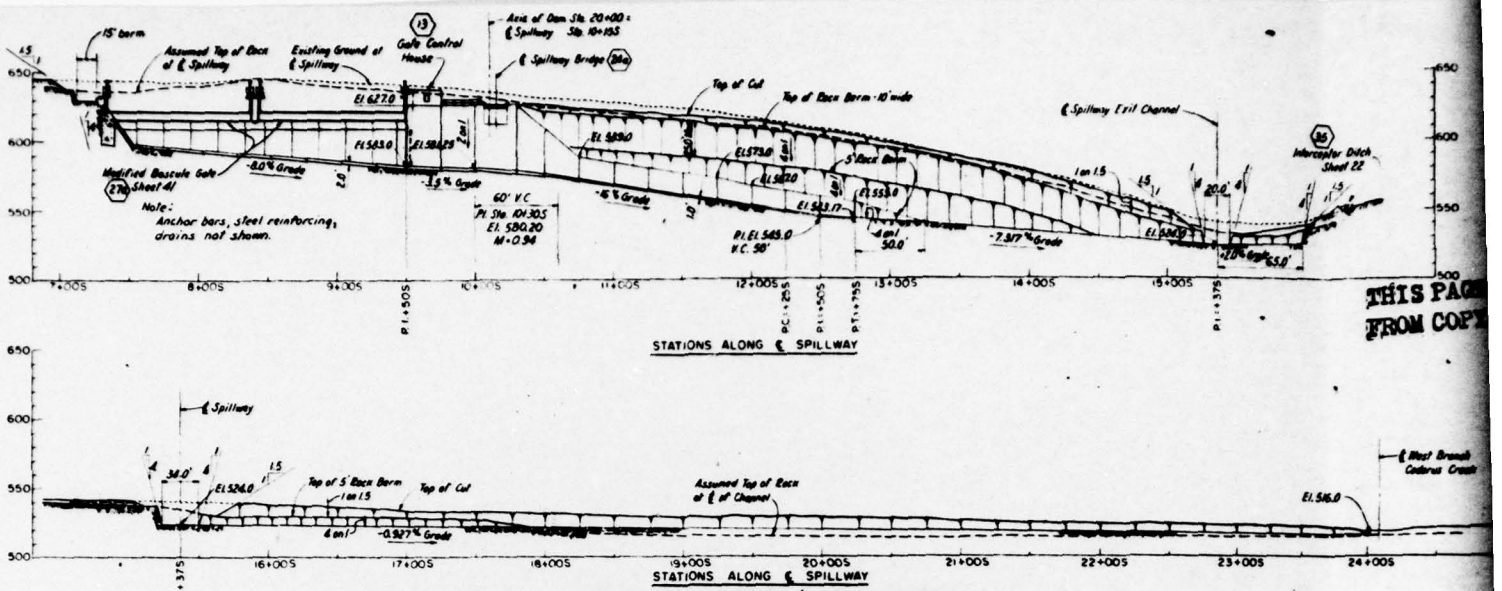
P. H. GLATFELTER DAM
WEST BRANCH CODORUS CREEK, PA.

EMBANKMENT
SECTIONS AND DETAILS

DRWG. NO. 19
JOB NO. 5822
DATE 12-1-64

REVISIONS

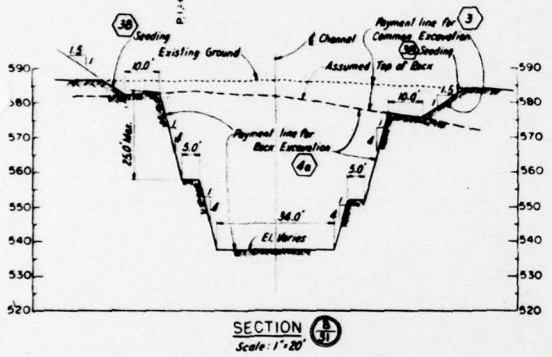
GARRETT FLEMING GODSEY & CARPENTER, INC.
ENGINEERS
600 N. SECOND ST. HARRISBURG, PENNA.



PROFILE ALONG ℄ SPILLWAY

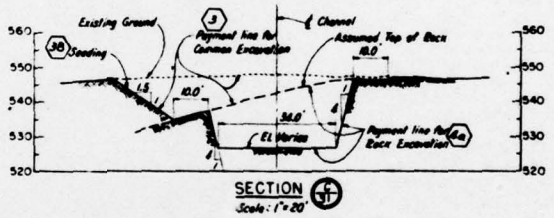
Scale: 1" = 50'

ELEVATION - FEET ABOVE MEAN SEA LEVEL



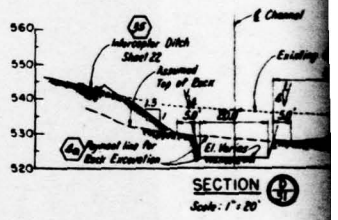
SECTION

Scale: 1" = 20'



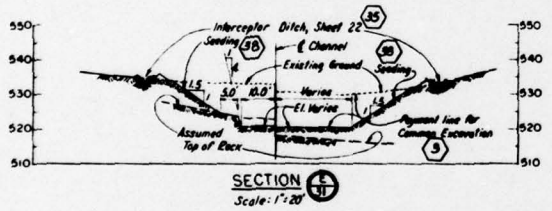
SECTION

Scale: 1" = 20'



SECTION

Scale: 1" = 20'



SECTION

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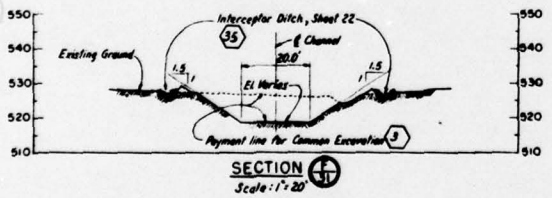

SECTION

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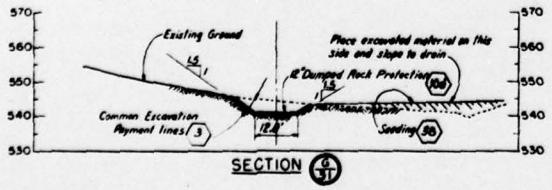

SECTION

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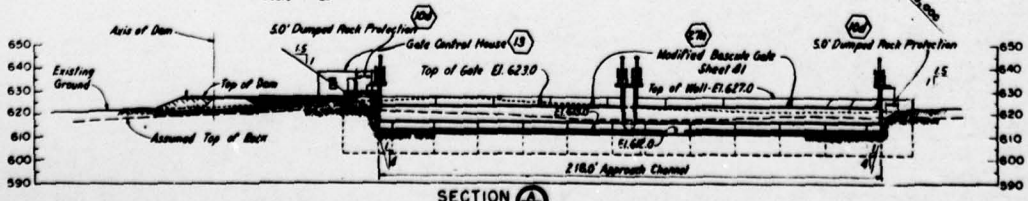
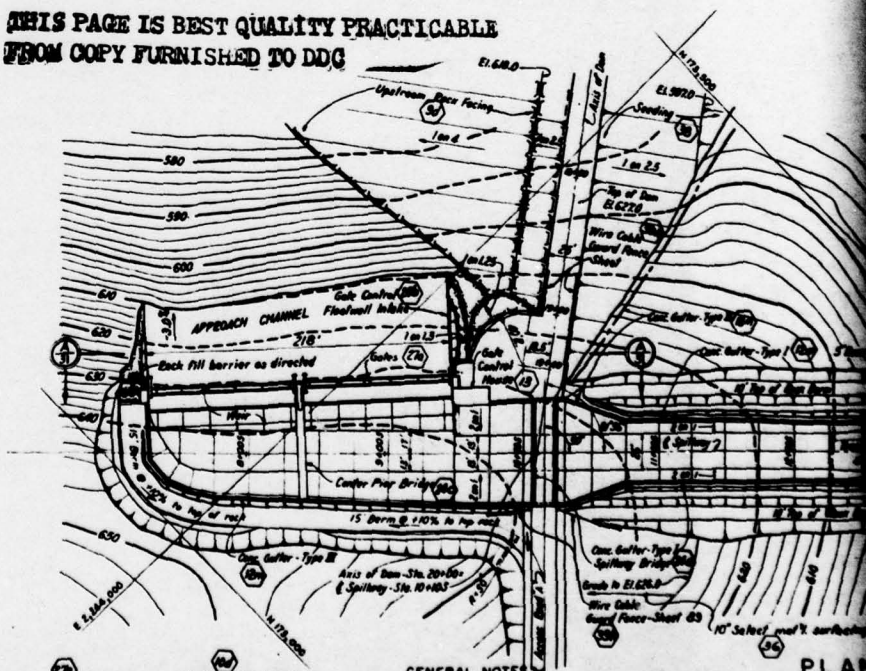


SECTION

Scale: 1" = 50'



PLAN

Scale: 1" = 50'

GENERAL NOTES

1. References:

Layout and Control	Sheet 3
Spillway - Concrete details	Sheets 33 to 40
Embankment	Sheets 18, 19 and 20
Grouting	Sheets 21, 32
Spillway Bridge	Sheets 47, 48
Pier Access Bridge	Sheet 49
Modified Bascule Gates	Sheets 41, 45
Access Road "A"	Sheet 89, 90
Spillway Gate Installation	Sheet 42

2. For additional general notes see Sheet 1, 55, 86, 88

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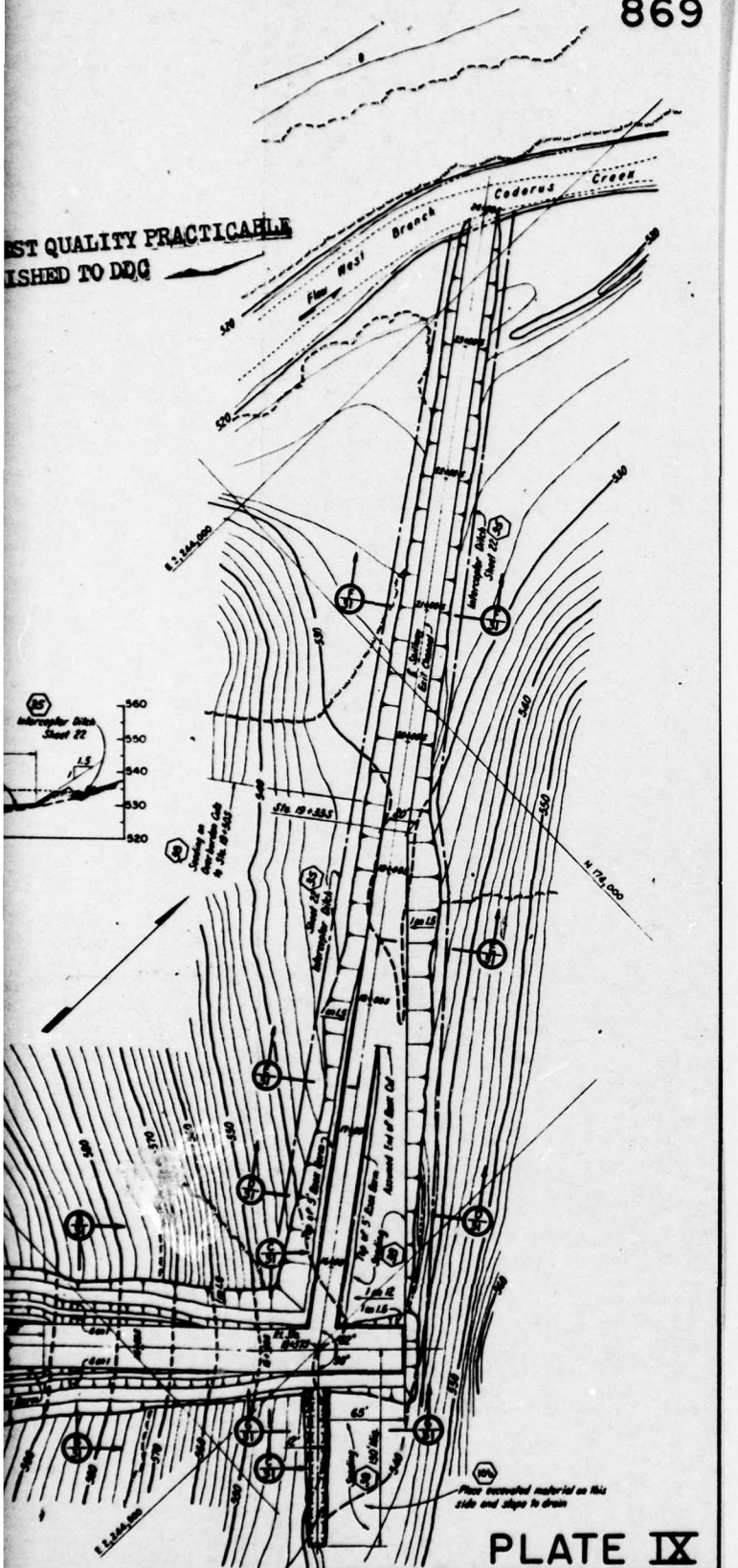


PLATE IX

(5) Grade Channel down to Top of Rock Berm. Final location to be determined by the Resident Engineer.

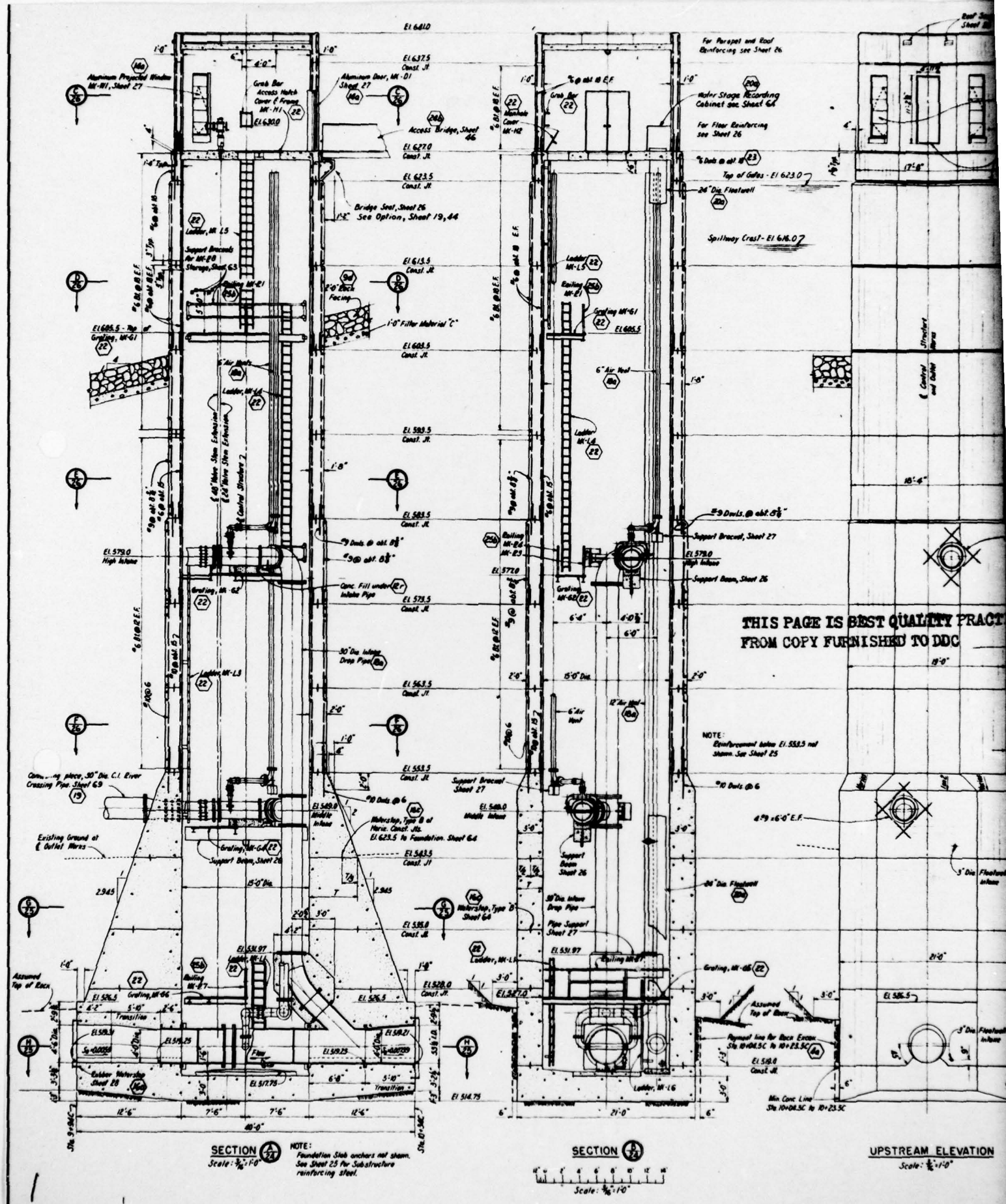
(10A) Rock protection as directed.

DESIGN M.L.G.	P. H. GLATFELTER DAM WEST BRANCH CODORUS CREEK, PA.		SHEET NO. 31
TRACED M.L.G.	SPILLWAY GENERAL PLAN PROFILE AND SECTIONS		JOB NO. 3222
CHECKED S.G.H./C.W.P.			DATE 12-1-64
APPROVED			

REVISIONS

NO.	DESCRIPTION	DATE	BY

GANNETT FLEMING CORDDRY & CARPENTER, INC.
ENGINEERS
600 N. SECOND ST. HARRISBURG, PENNA.



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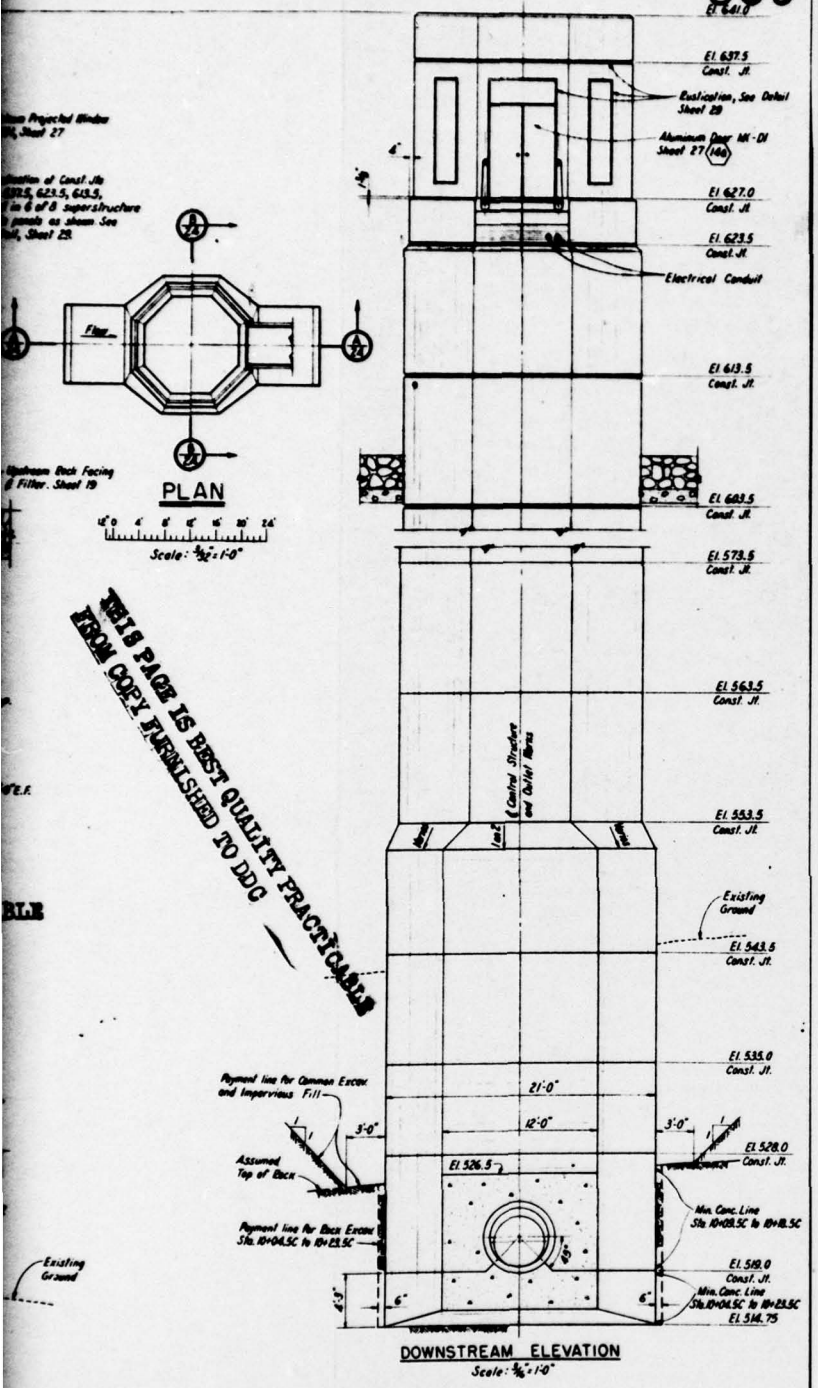

DOWNSTREAM ELEVATION

Scale: 1/8" = 1'-0"

PLAN

Scale: 1/32" = 1'-0"

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GENERAL NOTES:

1. Unless otherwise noted the clear distance between steel reinforcing and the face of concrete shall be as follows:
   Substructure floor slab 4"
   Substructure 3"
   Superstructure above El 627.0 - 2"
2. For additional General Notes see Sheets 22 & 23.
3. Piping, pipe support, electrical details not shown. See referenced sheets, Sheet 22.

PLATE X

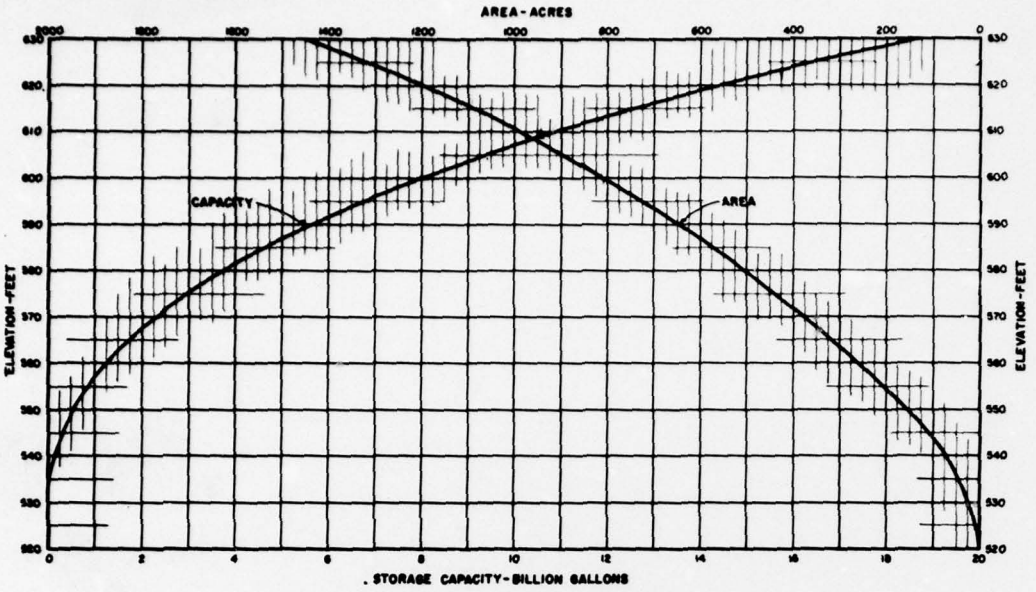
P.H. GLATFELTER CO. SPRING GROVE, PA.

DESIGN D.M.U.	P. H. GLATFELTER DAM	STUDY No. 24
DRAWN D.M.U.	WEST BRANCH CODORUS CREEK, PA.	
CHECKED C.W.P.	OUTLET WORKS CONTROL STRUCTURE ELEVATIONS AND SECTIONAL ELEVATIONS	JOB No. 3222
APPROVED		DATE 12-1-64

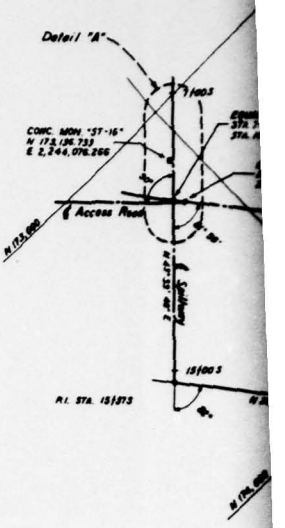
GARRETT FLEMING GODSEY & CARPENTER, INC.
ENGINEERS
600 N. SECOND ST. HARRISBURG, PENNA.

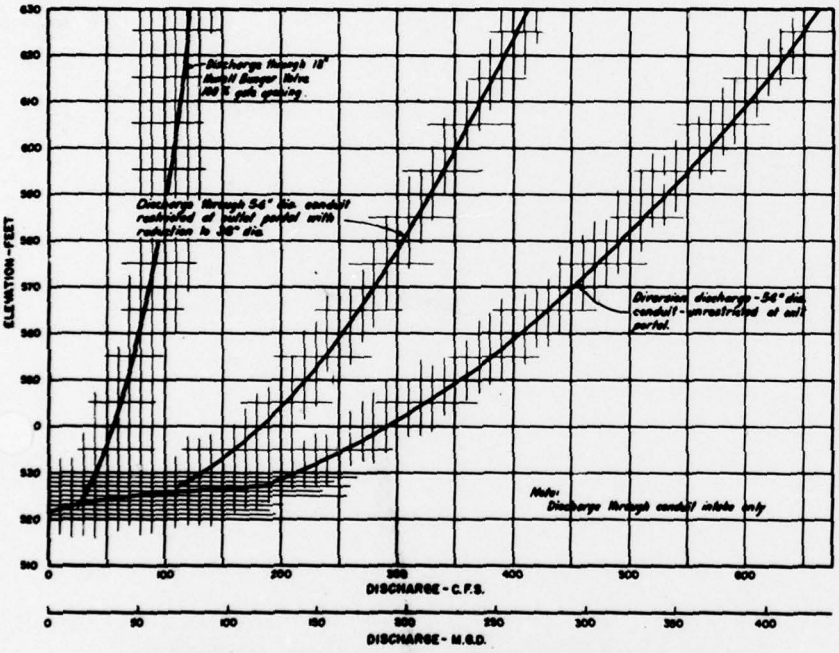
REVISIONS

NO.	DESCRIPTION	DATE	BY

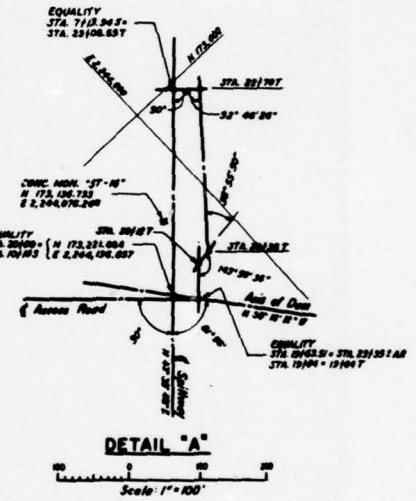


AREA-CAPACITY CURVES

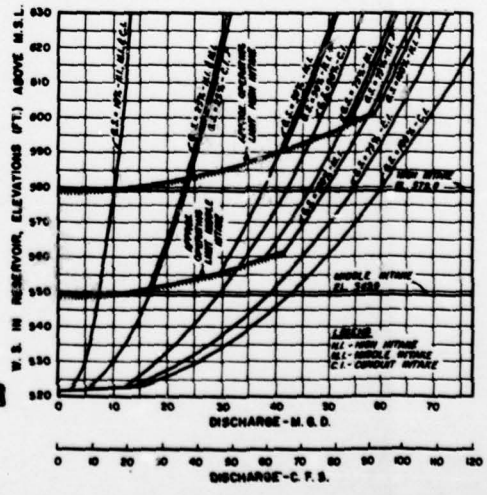




UNCONTROLLED OUTLET WORKS DISCHARGE RATING



DETAIL "A"



RATING CURVE 18" "HOWELL BUNGER" VALV

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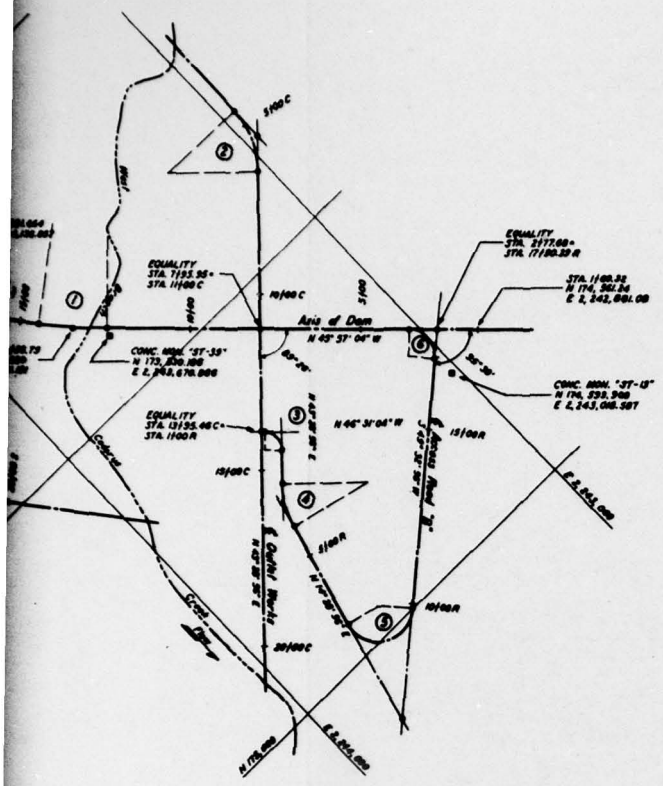

CURVE DATA							
No.	P.C. Sta.	P.I. Sta.	P.T. Sta.	Δ	R	T	L
①	12+29.09	13+28.79	14+28.79	7° 41'	1480.13	100.00	199.70
②	4+50	5+50	6+40.95	42° 09'	300.51	100.00	190.95
③	11+05.50 R	11+98.50 R	11+88.47 R	50° 00'	49.00	49.00	70.30
④	2+82.64 R	3+47.46 R	4+09.35 R	29° 00'	250.00	64.65	126.63
⑤	7+31.88 R	10+48.40 R	9+84.83 R	144° 06'	100.00	316.52	252.98
⑥	17+07.75 R	17+30.39 R	18+32.76 R	58° 39'	75.00	82.64	125.01

PROJECT LAYOUT

Scale: 1" = 200'

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GENERAL NOTE

1. Hydraulic data is presented for information purposes only. Owner is not responsible for the accuracy of the rating relationships.
2. See Sheet 2 for General Notes.

PLATE XI

P.H. GLATFELTER CO. SPRING GROVE, PA.

DESIGNED G.Y./M.L.G.	P. H. GLATFELTER DAM WEST BRANCH CODORUS CREEK, PA.	SHEET NO. 1
DRAWN M.L.G.	PROJECT LAYOUT AREA CAPACITY AND RATING CURVES	SCALE 1"=200'
CHECKED R.F.		DATE 1-10-68

GARRETT FLEMING GODDARD & CARPENTER, INC. 2
ENGINEERS
600 N. SECOND ST. HARRISBURG, PENNA.

REVISIONS

NO.	DESCRIPTION	DATE	BY

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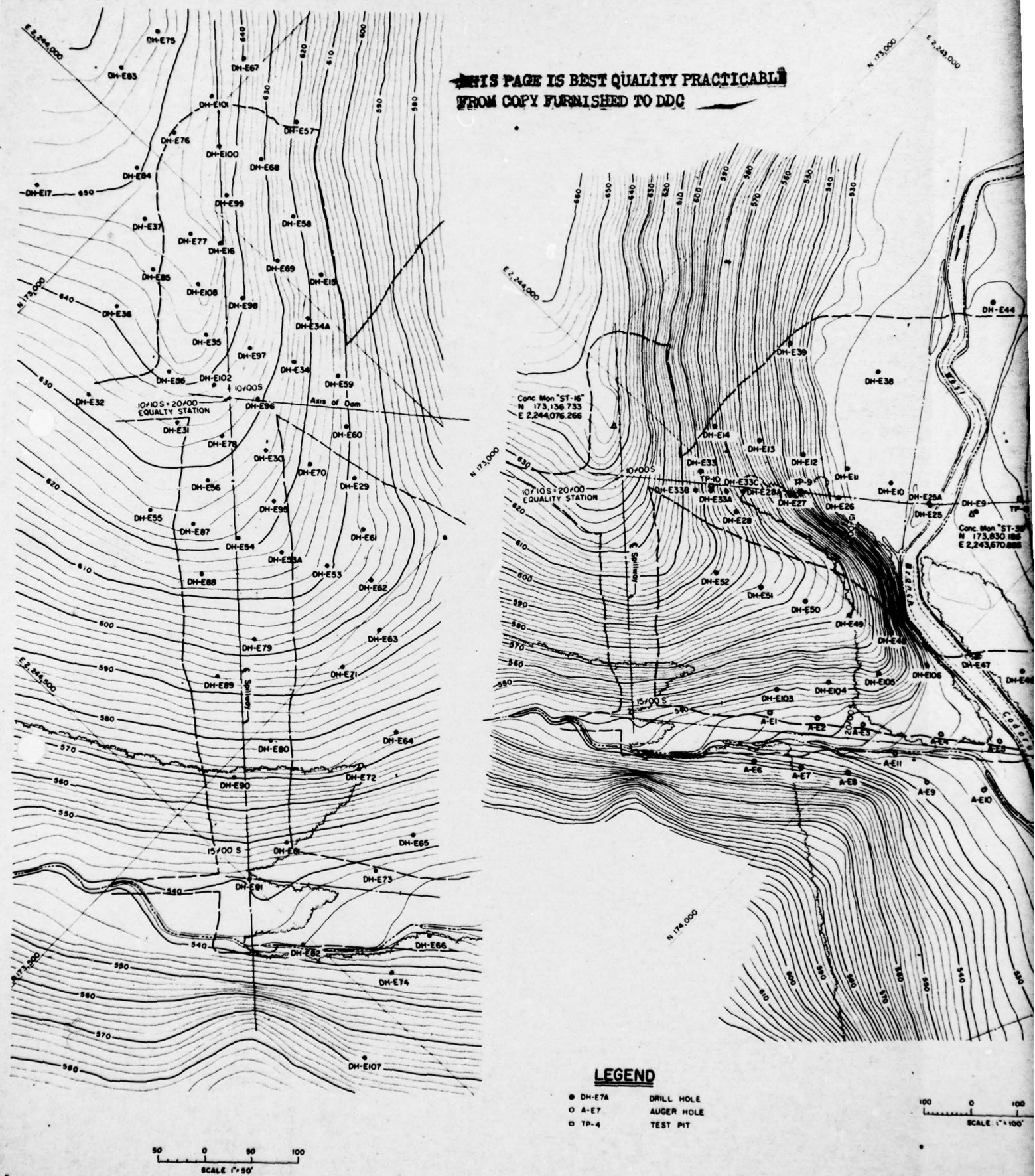

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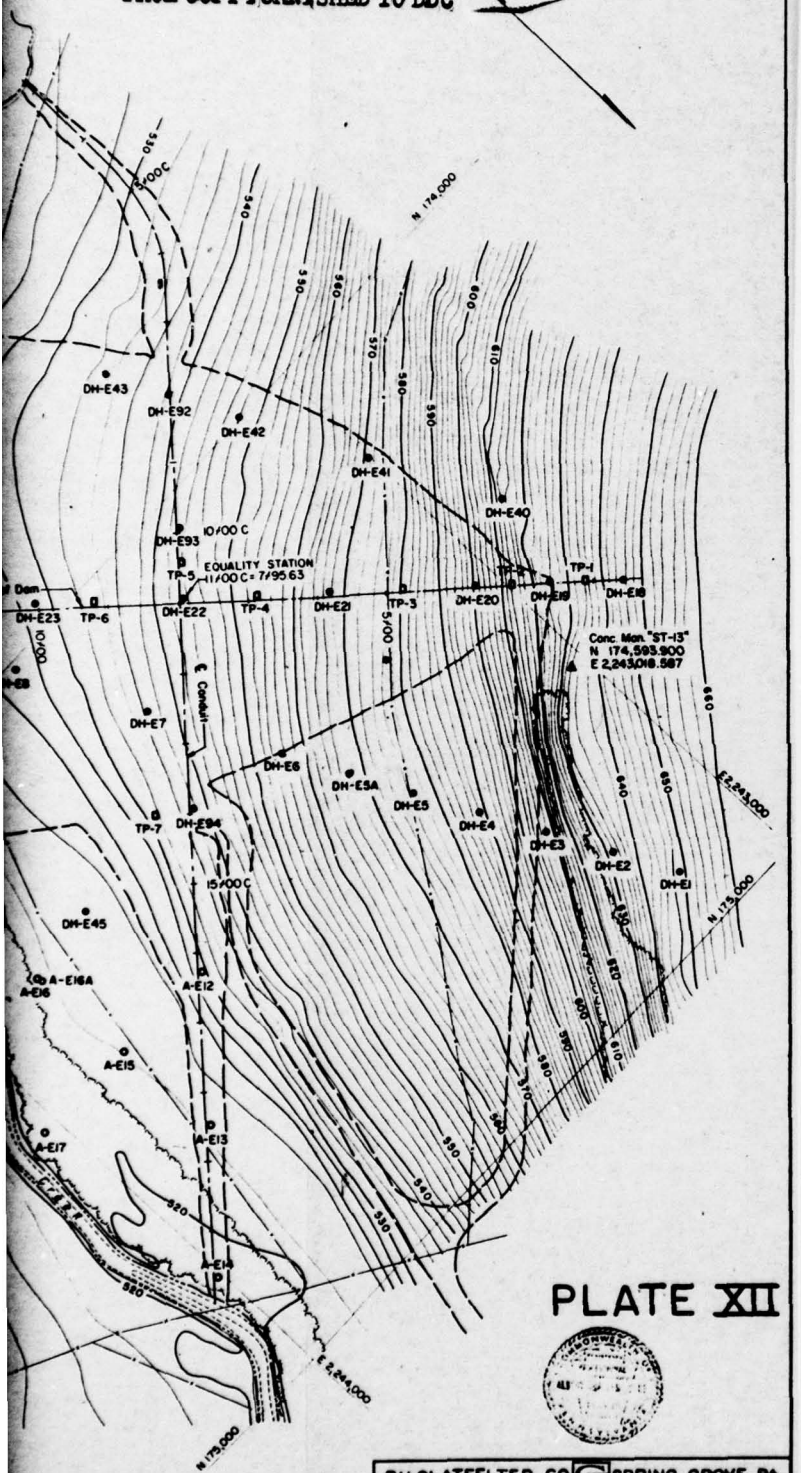

PLATE XII

GENERAL NOTES

1. Topography from Stadia survey, March & April, 1960
2. Logs of core borings and test pits, Sheets 5-13.
3. For other General Notes, see Sheet 1.

REVISIONS			
NO.	DESCRIPTION	DATE	BY

P.H. GLATFELTER CO. SPRING GROVE, PA.

DRAWN M.L.G.	P. H. GLATFELTER DAM WEST BRANCH CODORUS CREEK, PA.	SHEET NO. 4
TRACED M.L.G.		JOB NO. 3222
CHECKED C.W.P.	PLAN FOUNDATION EXPLORATION	DATE 12-1-62
APPROVED		

GANNETT FLEMING CORDDRY & CARPENTER, INC.
ENGINEERS
320 N. SECOND ST. HARRISBURG, PENNA.

DH-E1
EL. 648.9

648.9	TOPSOIL		
642.9	Brown weathered PHYLLITE (GP-GM).	T.R.	
	PHYLLITE, gray; ferruginous, coarse grained, massive, embedded limonite nodules at 9; vertical bedding planes, and seams along vertical bedding planes 11-13; badly weathered 13-14.5 and 18; surface smooth and argillaceous 22.5-22.7; massive greywacke with limonite inclusions, 22.7-27.	19	
		75	
		66	
		100	
		80	64.5/25
621.8	PHYLLITE, brown; argillaceous, soft; vertical bedding planes.		
619.8	PHYLLITE, gray, soft.	100	98.1/30
	PHYLLITE, gray; massive, quartz.	98	57/35
607.6			4/20
	PHYLLITE, brown and gray; vertical bedding planes 41-44; slatey, quartz, soft 44.0-52.0, argillaceous 48-52; micaceous, solid core 53-60.		0/25
598.6		100	30/30
596.6	PHYLLITE, brown; argillaceous.		
594.6	PHYLLITE, gray; micaceous; vertical bedding planes.		0/35
580.6		88	

DH-E2
EL. 632.6

634.6	TOPSOIL		
625.6	Brown sandy SILT, micaceous, with phyllite fragment (ML).	TR	
	PHYLLITE, weathered. casing driven to 17, drilled with shale bit to 17.0.	0	
615.4		50	
	PHYLLITE, brown; badly weathered, and seams 20-21, 31-31.5, thin and seams throughout, bedding planes 50° from vertical 21-25; horizontal at 30; gray phyllite pieces at 27-30 and 32; quartz fragments 35-36.	33	
		75	
		34	
		36	
		17	
592.1		60	
	PHYLLITE, gray; brown streaks 40.5-47; limonite adhesions 48; dark seams 47-58, bedding planes 45-66, change to 30° from vertical at 66; weathered and soft 58-66; badly fractured 70.5-71.	100	13.9/75
			17.5/45
			68.6/25
		67	T.R.
		100	
		75	
558.1		100	
550.1		B.B.	

DH-E3
EL. 609.3

609.3	TOPSOIL		
600.3	Light brown silty SAND (fine to coarse) with quartzite pebbles (SM).		
	Reddish brown sandy SILT with phyllite and quartzite fragments (ML).		
589.3			
	Decomposed PHYLLITE, predominately red (GP-GM).		
576.3			T.R.
573.8			
6-18-62	PHYLLITE, brown; dark deposits, badly weathered 35-39.	60	
569.8	PHYLLITE, quartz and micaceous.	25	
566.3			16.7/25
	PHYLLITE, gray; quartz with granular surface; turning brown at 46; soft, brown laminations 54-57.	100	16.7/30
545.5	PHYLLITE, gray; micaceous, smooth soapy surface.		
543.9			
539.9	PHYLLITE, brown; fractured, and seams	69	
537.9	PHYLLITE, gray.	B.B.	

DH-E5A
EL. 666.4

666.4	TOPSOIL		
662.4	Brown sandy SILT (ML).		
	Reddish brown sandy SILT with rock fragments (ML).		
551.4		T.R.	
548.1	PHYLLITE, gray; fractured top 5, solid core 29-30; bedding planes vertical 15-20, 30° from vertical 24; quartz, dark brown and granular 20-21, quartzite veinlet 27.		3/15
537.6			
534.6		100	2/20
	PHYLLITE, dark gray; micaceous, vertical bedding planes; quartzite spots 32.5-36.		
511.4		B.B.	

DH-E6
EL. 594.9

603.5	TOPSOIL		
	Brown sandy SILT with decomposed red ROCK (ML).		
595.5		T.R.	
591.7	PHYLLITE, gray; brown weathered streak quartzitic veinlets, mud seam at 14, vertical bedding planes, folded bedding planes 18-22 10° from vertical 22-25, last drill water 21 micaceous 22-25.	76	
6-22-62		66	
		96	45.4/20
579.5	PHYLLITE, dark gray; micaceous, 25-30, quartz 28.5-30, quartzite veinlets 29-33, 37-40, 44-50, bedding planes 30° from vertical, 90-60, folded bedding 46-50.	100	0/25
564.5		B.B.	

DH-E7
EL. 639.4

634.4	TOPSOIL		
	Light brown sandy SILT with gray phyllite fragments (ML).		
624.9			
	Decomposed gray PHYLLITE (ML).	T.R.	
621.9	PHYLLITE, gray; soft, micaceous, mud seam at 8 badly weathered, vertical bedding plane	78	14.4/45
617.6	PHYLLITE, gray and green; brown weathered streaks and dark seams, fractured at 22 and 24, bedding planes 15° from vertical. Occasional quartzite veinlets 21.5-30, quartz laminations 41.5-42, folded bedding planes to 45, last water at 26.	100	
591.4			
585.0	PHYLLITE, dark gray; micaceous, hard solid core.	B.B.	

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DH-E10
EL. 523.2

521.2	TOPSOIL, organic (OL).		
6-23-62	Mottled brown and gray sandy SILT (MH) phyllite fragments still increase in depth.	T.R.	
516.2		90	
	PHYLLITE, gray; micaceous, bedding planes vertical 7-11, 30° from vertical 11-20, 10° from vertical 20-25, parting along bedding planes, quartzite veinlets.		
498.2		100	
	PHYLLITE, dark gray; micaceous; bedding planes 20° from vertical, parting along bedding, quartzite veinlets 25-26, quartz interbeds 31-32, 34.5-36.5.		0/15
486.7			
483.2	PHYLLITE, light gray, micaceous, fractured.	71	
	PHYLLITE, light and dark gray; fine quartzite veinlets to 52, micaceous, fractured to 48, parting along bedding planes which are 15° from vertical.	100	
		80	
		100	
464.2		B.B.	

DH-E11
EL. 523.7

522.7	TOPSOIL, organic (OL).		
6-23-62	Mottled brown and gray sandy SILT (SM) phyllite fragments with increase in depth.	T.R.	
517.7	Weathered ROCK (GP-GM).	90	
506.7			1.2/15
	PHYLLITE, gray; micaceous; badly weathered top 2, clay seams 7.2-9.5, weathered, fractured 9.5-13.0, quartz interbeds 9.5-28.5, 39-41.5, bedding planes vertical 9-14.5, 30° from vertical 14.5-41.5, partings along bedding planes 13-62.	100	0/15
481.7			
	QUARTZ, horizontal concheidal fractures.		
475.7			
471.7	PHYLLITE, gray; micaceous, and QUARTZ with quartz vertical bedding plane.		
458.7	PHYLLITE, gray; micaceous.	B.B.	

DH-E12
EL. 539.4

539.4	TOPSOIL, organic (OL).		
	Greyish brown silty SAND with fine rock fragments (SM).		
532.4		T.R.	
530.4		69	
6-23-62	PHYLLITE, gray; weathered 7-16, 20.5-28, micaceous 10-44, 47-57, fractured along bedding planes 10-57, bedding planes 30° from vertical 7-37, vary from vertical to 30° from vertical 37-42, 30° from vertical 42-45.5, vary from 10° to 30° from vertical 45.5-57.	83	0/18
	Quartz interbedded 10-16.5, 29.8-30.6, 36-42, 46-49, 49-57.	100	
		87	0/15
		80	
		88	
		90	
		100	
482.4		B.B.	

LEGEND

DEPTH IN FEET	ELEVATION	SYMBOL	DESCRIPTION	CORE % RECOVERY	PRESSURE TESTS
	648.9		TOPSOIL		
	641.7		Brown sandy SILT (ML).		
	634.7		Light brown sandy SILT with rock fragments (ML).		
	624.2		Decomposed brown PHYLLITE (GP-GM).	T.R.	
			PHYLLITE, gray, soft, weathered, thin clay seams at 12.0, vertical bedding planes 12.5-21.5, quartz vainlet at 22.0, highly weathered and fractured 28.0-30.0, last drill water at horizontal clay seam at 29.0.	33	2/15
	609.1			60	2/15
	596.7			0	0/20
				40	19/25
				B.B.	

Ground Water Elevation Date of Reading

Quartz Vertical Clay Seam

Top of Rock

Average water loss in gpm for 5 minutes

Pressure in P.S.I.

Core recovery; indicates a 2 foot recovery from a 5 foot pull or, 0% recovery.

Bottom of Boring

Note: Where no ground water or data is shown, none are available.

SYMBOLS

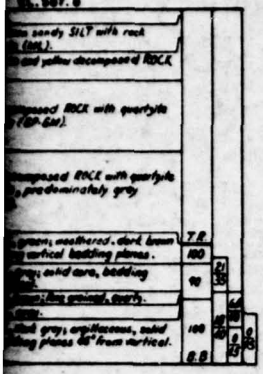
OVERBURDEN

- TOPSOIL
- Organic TOPSOIL or organic SILT (OL)
- Silty or sandy CLAY (CL)
- Gravelly, sandy, or clayey SILT Decomposed ROCK or PHYLLITE (ML)
- Mottled sandy or clayey SILT (MH)
- Silty SAND or silty and gravelly SAND Decomposed PHYLLITE (SM)
- Gravelly SAND (SW)
- Silty GRAVEL or sandy and silty GRAVEL Decomposed PHYLLITE or ROCK fragments (GM)
- Silty GRAVEL or sandy and silty GRAVEL weathered, decomposed or disintegrated ROCK or PHYLLITE ROCK or QUARTZ fragments (GP-GM).
- Sandy GRAVEL (GP)

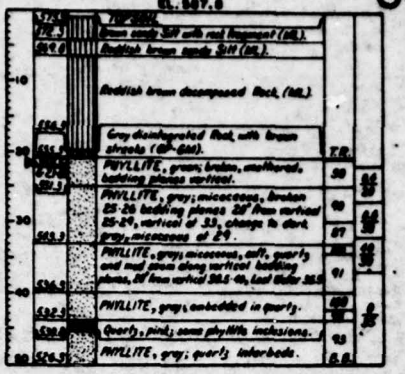
ROCK

- PHYLLITE
- QUARTZ
- PHYLLITE with quartz interbeds, laminations
- PHYLLITE with clay seams.

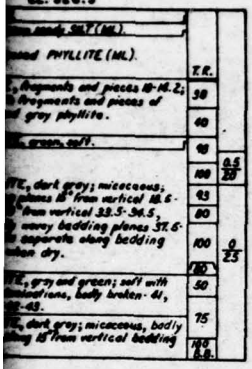
DH-E4
EL. 987.0



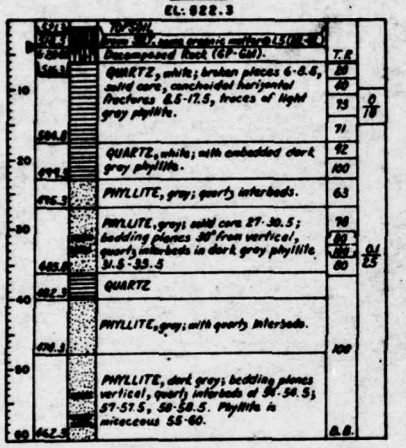
DH-E5
EL. 987.0



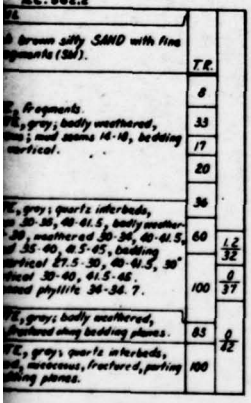
DH-E8
EL. 986.3



DH-E9
EL. 822.3



DH-E13
EL. 862.2



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GENERAL NOTE
1. See sheet 4 for location of holes.

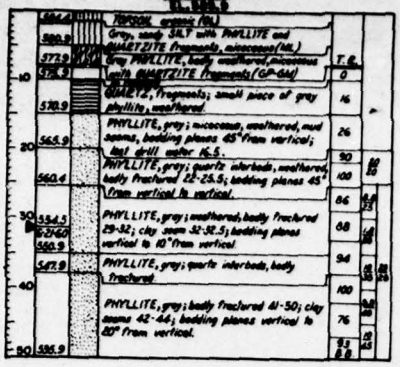
PLATE XIII

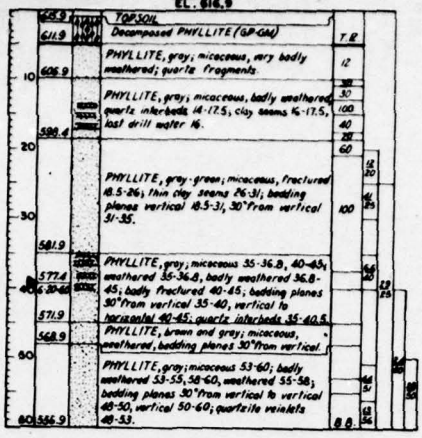
P.H. GLATFELTER CO. SPRING GROVE, PA.

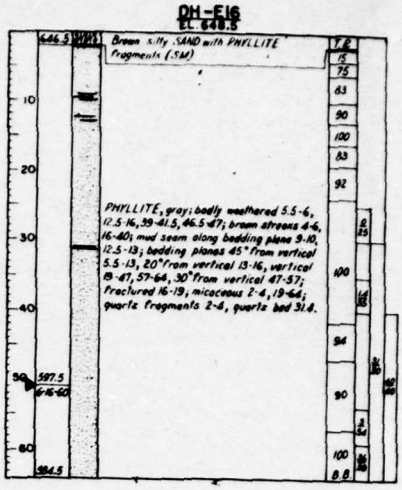
DESIGN G.Y.	P. H. GLATFELTER DAM	SHEET NO. 6
TRACED D.M.M.	WEST BRANCH CODORUS CREEK, PA.	JOB NO. 5822
CHECKED J.D./G.Y.	FOUNDATION EXPLORATION LOGS OF CORE BORINGS - NO. 1	DATE 12-1-62
APPROVED G.Y.		
APPROVED [illegible]		

GARRETT FLEMING GOODELL & SHEPHERD, INC.
ENGINEERS
600 N. SECOND ST. HARRISBURG, PENNA.

REVISIONS			
NO.	DESCRIPTION	DATE	BY







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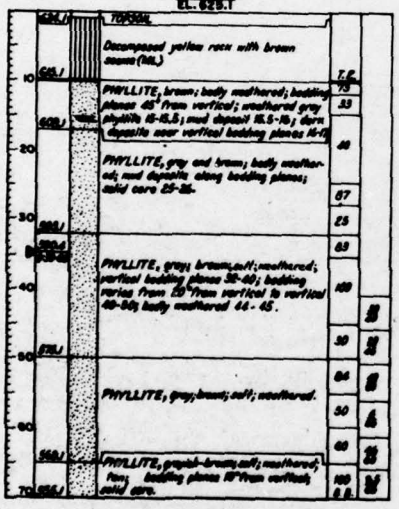

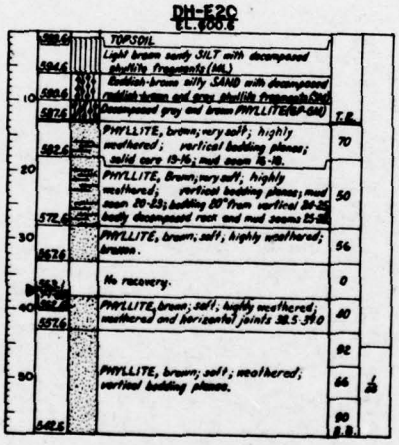

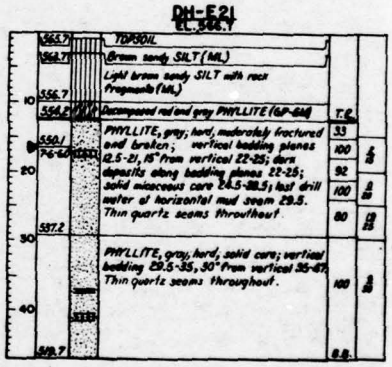

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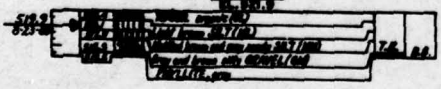
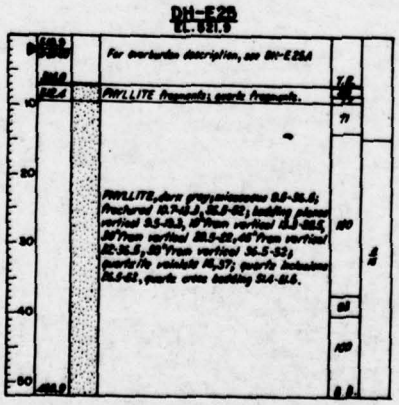
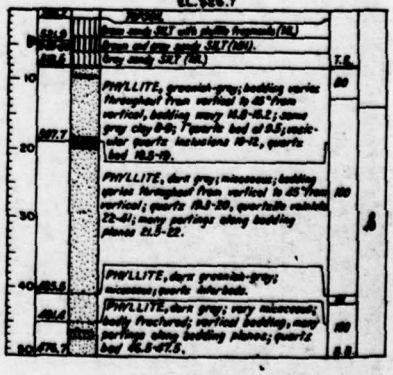


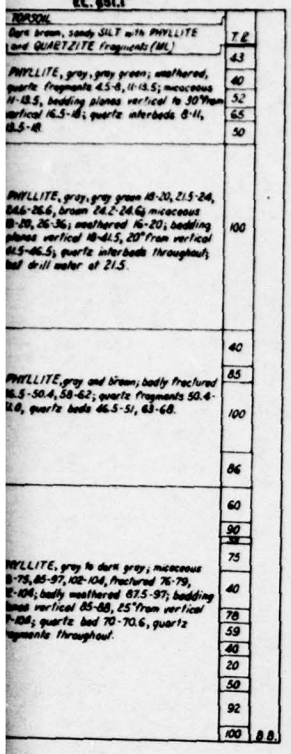




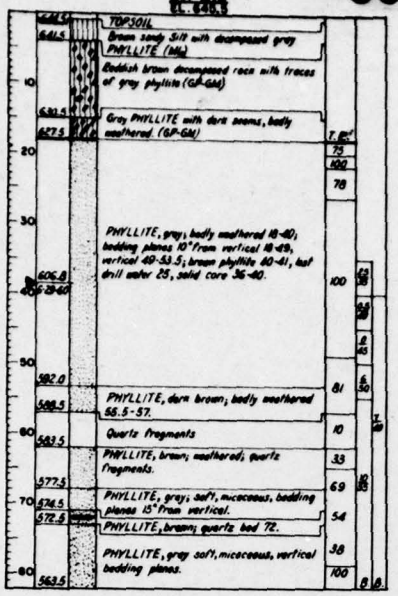
GENERAL NOTE

1. See sheet 5 for legend and sheet 6 for location of drill holes.

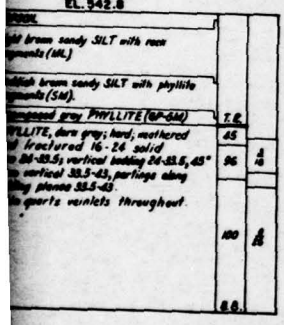
DH-E17
EL. 691.1



DH-E18
EL. 648.5



DH-E22
EL. 542.8



DH-E23
EL. 526.4

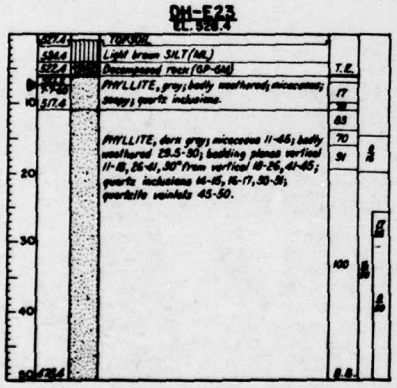


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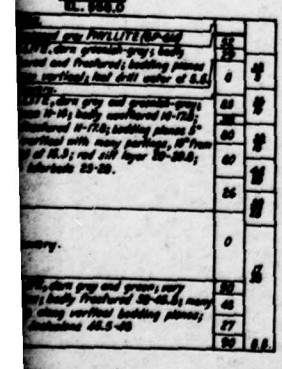
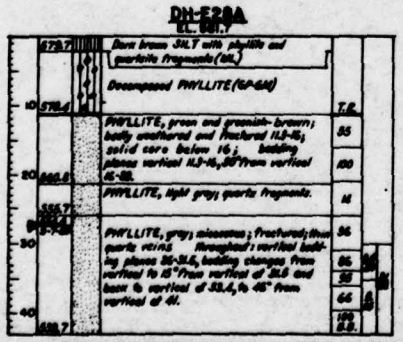
PLATE XIV

DH-E27
EL. 568.0



DH-E28A
EL. 681.7



DESIGN G.V.	P. H. GLATFELTER DAM	DRAWING NO. 6
DRAWN D.M.W.	WEST BRANCH CODORUS CREEK, PA.	JOB NO. 5222
CHECKED J.B./GV	FOUNDATION EXPLORATION LOGS OF CORE BORINGS - NO. 2	DATE 12-1-62
APPROVED [illegible]		

REVISIONS

NO.	DESCRIPTION	DATE	BY

GANNETT FLEMING CORDDRY & CARPENTER, INC.
ENGINEERS
600 N. SECOND ST. HARRISBURG, PENNA.