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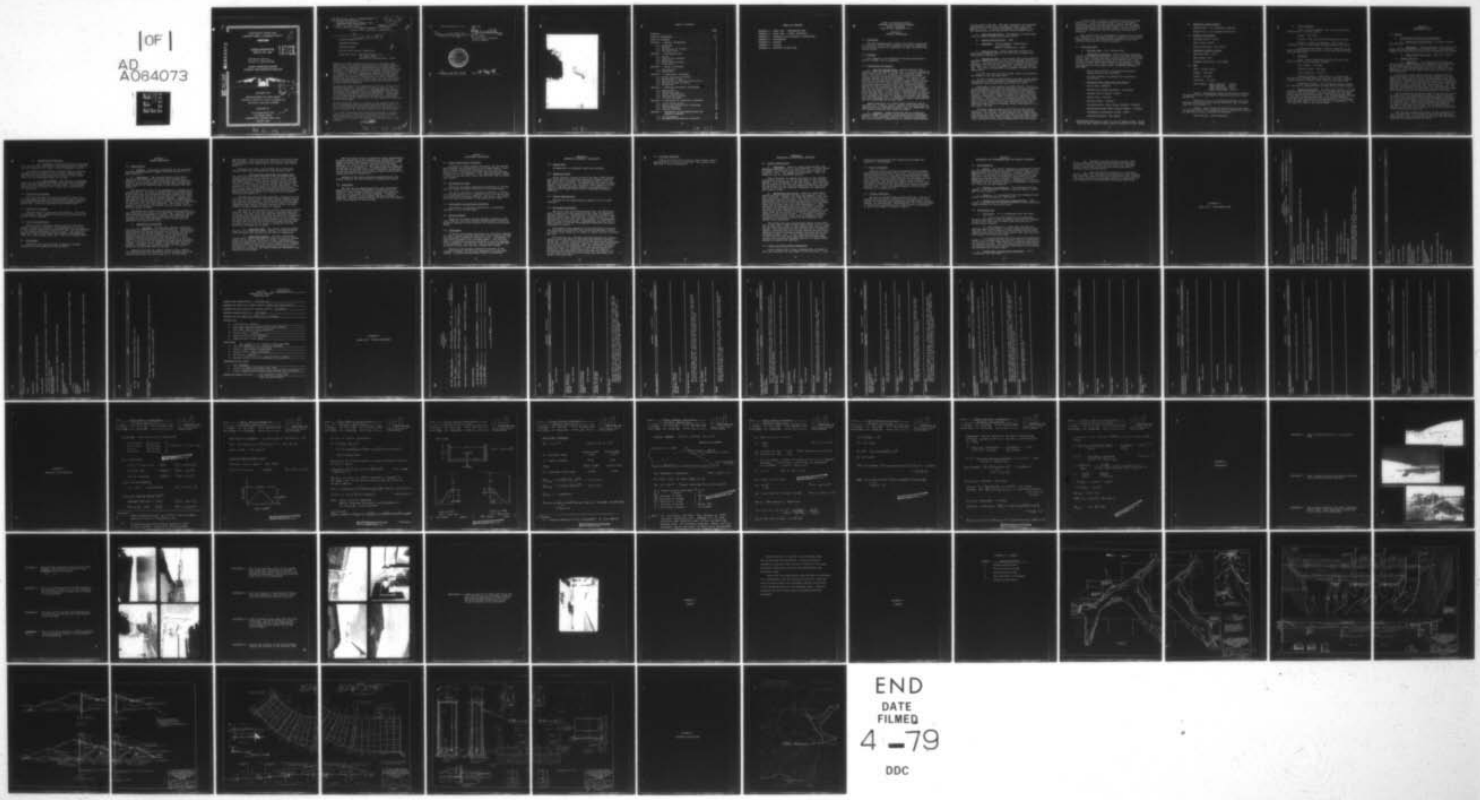

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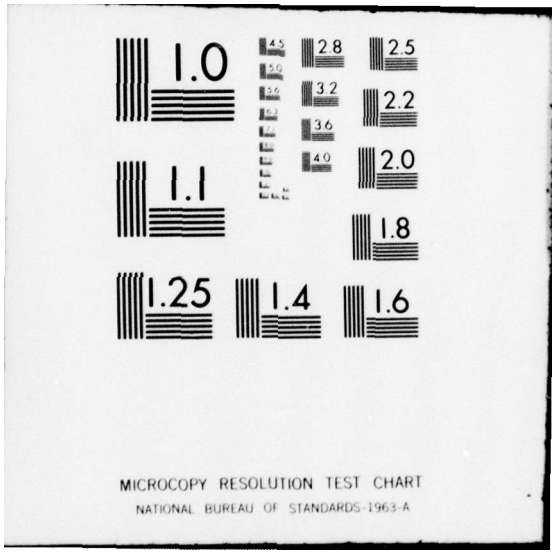
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SUSQUEHANNA RIVER BASIN
ANDERSON CREEK, CLEARFIELD COUNTY

PENNSYLVANIA

DuBOIS RESERVOIR
NDI No. Pa. - 424

LEVEL II

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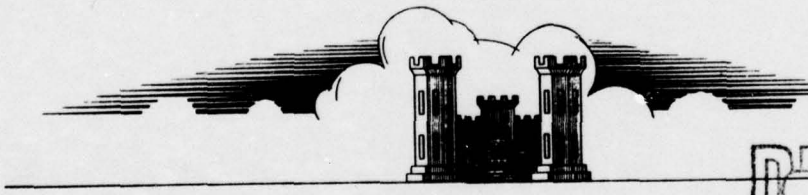
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



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PREPARED FOR

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

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AUGUST 1978

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(6) National Dam Inspection Program. DuBois Reservoir Dam (NDI-PA-424), Susquehanna River Basin, Anderson Creek, Clearfield County, Pennsylvania. Phase I Inspection Report.

(11) Aug 78

(12) 75p.

PHASE I REPORT
National Dam Inspection Program

DuBois Reservoir

(15) DACW31-78-C-0052

Pennsylvania

Clearfield County

Anderson Creek

28 June 1978 (visual inspection)

Inspection Team - GAI Consultants, Inc.
570 Beatty Road
Monroeville, Pennsylvania 15146

Based on a visual inspection, as well as available engineering data, the dam is considered to be in good condition but in need of additional investigation and some repair. Hydraulic and hydrologic calculations also indicate that the spillway is inadequate since it is capable of passing only 57 percent of the PMF (recommended spillway design flood). Consequently, it is recommended that the owner undertake a hydrologic and hydraulic investigation to more accurately assess the adequacy of the outlet works and make any modifications deemed necessary to insure that the structure will be hydraulically adequate.

Seepage was noted at the downstream toe about 110 feet from the right abutment. Although it does not appear to be a serious problem, presently, it is recommended that observation wells be installed within the embankment in this area to establish and monitor the phreatic surface. The results of this investigation should be evaluated by a registered professional engineer experienced in the design and construction of earth dams.

General surficial repair is needed on the exposed concrete. It is recommended that particular attention be given to prevent the spillway flow from eroding into the construction joint connecting the spillway sidewalls and spillway apron.

It is also recommended that the owner establish a warning system to protect downstream inhabitants should hazardous conditions develop and that the dam be inspected on a regular basis to check for hazardous conditions which might develop.

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GAI Consultants, Inc.

Bernard M. Mihalcin

Bernard M. Mihalcin, P.E.

Date August 28, 1978

Approved

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

Date 10 Sep 78

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Overview Photograph of DuBois Reservoir

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PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
DUBOIS RESERVOIR
NDI# PA-424, PENNDER# 17-5

SECTION 1
GENERAL INFORMATION

1.0 Authority.

The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

1.1 Purpose.

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

1.2 Description of Project.

a. Dam and Appurtenances. DuBois Reservoir Dam (locally known as Anderson Creek Dam) is an earth embankment approximately 650 feet in length with a maximum height of 38 feet. The facility is served by an uncontrolled ogee-crested concrete spillway discharging into a multi-tiered concrete channel in the left abutment. In addition, the facility is equipped with a 36-inch diameter cast iron pipe that serves as a low flow regulating conduit (blow-off). Available drawings indicate this line originates approximately 100 feet upstream of the center of the embankment. The line is gated and controlled from a gate house situated atop the dam crest. At this point, approximately 45 feet below the dam crest, a gate valve is located that is electrically operated from the gate house. The conduit continues in a straight line until it emerges from beneath the embankment and discharges into a trapezoidal channel approximately 100 feet downstream of the dam crest.

DuBois Reservoir is a water supply reservoir and is equipped with a supply system, however, this system and its appurtenances are separated entirely from the embankment and are located along the east reservoir shore.

b. Location. DuBois Reservoir Dam is located on Anderson Creek, a tributary of the West Branch Susquehanna River, in Union Township, Clearfield County, Pennsylvania. The city of DuBois, Pennsylvania, is situated approximately

8 miles west of the dam. The dam, reservoir, and watershed are contained within the Luthersburg, Elliot Park, and Sabula U.S.G.S. 7.5 minute quadrangles (see Appendix G). The coordinates of the dam are N41° 05.8' and W78° 38.0'.

c. Size Classification. Intermediate (38 feet high, 1,845 acre-feet storage at spillway crest).

d. Hazard Classification. High.

e. Ownership. City of DuBois, Pennsylvania.
P. O. Box 408
DuBois, Pennsylvania 15801

f. Purpose of Dam. DuBois Reservoir serves as a water supply storage facility for the City of DuBois and surrounding communities.

g. Historical Data. The original dam across Anderson Creek was constructed at the site of the present facility in 1902-03. As originally built, the dam consisted of an earth embankment 320 feet at the right end, a masonry spillway 70 feet long, and an earth embankment 60 feet long at the left end. The design contemplated an increase in height at some future date.

In 1910, the flow line was raised 2 feet by increasing the height of the spillway crest.

In 1925, extensive improvements were made to the supply line system at DuBois Reservoir including the erection of flashboards which raised the water level by 3 feet.

Work began on the present facility in 1936. It is an earth embankment with steel and concrete core walls designed by Morris Knowles Engineers of Pittsburgh, Pennsylvania. This structure incorporated the original dam into upstream section. The present reservoir covers 212 acres and has a capacity (estimated in 1936) of 600 million gallons (1,845 acre-feet). The reservoir is irregular in shape with three major streams discharging into it; Montgomery Run from the east, Muzz Run, about a mile upstream from the dam, and Anderson Creek from the northeast, about three-quarters of a mile above the dam.

Available reports dating as far back as 1917 and as recent as 1966 indicate the facility was well maintained throughout its history. Slight seepage and a swampy condition along the right abutment near the toe have been consistently reported since 1940; however, aside from this condition, the dam has been nearly problem free over the years.

In June 1972, 16 inches of rainfall resulted in heavy damage to the lower wasteway channel and the streambed downstream. Whole sections of the concrete channel floor were dislodged and carried downstream while the streambed immediately beyond was severely eroded. Repairs had to be implemented immediately and the spillway has since been restored.

The construction of Interstate 80 north of the reservoir has resulted in a siltation problem, according to Tom Dusch, Superintendent of the DuBois Water Authority, which has steadily decreased its overall capacity.

1.3 Pertinent Data.

a. Drainage Area. 26.5 square miles.

b. Discharge at Dam Site. Daily spillway discharge records are compiled and kept on file at the east shore gate house. These records date back to the original facility and include daily rainfall data from 1928 through 1972. The maximum recorded spillway discharge at the present facility occurred in June 1972, when a head of approximately 4 feet was measured at the spillway crest (estimated discharge = 3070 CFS).

Outlet Works Conduit at Operating Elevation - Discharge curve not available.

Spillway Capacity at Maximum Pool Elevation ≈ 13,500 cfs.

c. Elevation (feet above mean sea level).*

Top of Dam - 1686.32.

Maximum Pool Design Surcharge - Not known.

Maximum Pool of Record ≈ 1679.

Normal Pool - 1675.32.

Spillway Crest - 1675.32

Upstream Portal Invert Outlet Conduit ≈ 1650.32.

Downstream Portal Invert Outlet Conduit - 1648.82.

Streambed at Centerline of Dam ≈ 1645.

Maximum Tailwater - Not known.

*Elevations on drawings refer to city of DuBois datum. 20.32 feet has been added to DuBois datum to obtain U.S.G.S. datum.

d. Reservoir Length (miles).

Maximum Pool ≈ 3.0 (elevation 1686.32).

Normal Pool ≈ 2.4 (elevation 1675.32).

e. Storage (acre-feet).

Spillway Crest - 1,845.

Top of Dam ≈ 5,468.

Design Surcharge - Not known.

f. Reservoir Surface (acres).

Spillway Crest - 212.

Top of Dam ≈ 435.

Maximum Design Pool - Not known.

g. Dam.

Type - Rolled earth.

Length - 650 feet.

Height - 38 feet.

Top width - 12 feet.

Side Slopes - upper upstream 2.5H:1V
lower upstream 2H:1V
upper downstream 2H:1V
lower downstream 2.5H:1V

Zoning - Homogeneous earth; 6-inch concrete paving on upstream face as indicated by drawings serves as riprap protection.

Impervious Core - A reinforced concrete core wall extends from the top of the dam at elevation 1686 to elevation 1642 (see Figure 3).

Cutoff - Steel sheet piling extends from the base of concrete core wall at elevation 1642 to impervious stratum at elevation 1617± as indicated by drawings.

Grout Curtain - None indicated.

h. Outlet Conduit.

Type - 36-inch diameter cast iron blow-off pipe supported in a concrete cradle.

Length ≈ 200 feet.

Closure Gate valve located beneath dam center.

Access - Intake is submerged. Gate valve is accessible from the gate house located atop the dam crest.

Regulating Facilities - Flow is regulated by the electrically operated gate valve in the gate house located atop the dam crest.

i. Spillway.

Type - Uncontrolled ogee-crested spillway with multi-tiered concrete wasteway channel.

Weir Length - 100 feet.

Channel Length ≈ 270 feet.

Crest Elevation - 1675.32.

Upstream Channel - Right half is a natural bed channel with a forebay depth of 10 feet; left half contains a concrete apron located 1 foot below the spillway crest.

Downstream Channel - The discharge channel beyond the spillway is characterized by steep heavily wooded slopes.

j. Regulating Outlets. The drawings indicate a 36-inch diameter cast iron blow-off line with intake located approximately 100 feet upstream of dam and controlled at the gate house located atop the dam crest. The field measured diameter at the exit of the blow-off pipe is 42 inches; however, since the inlet end could not be measured and it is possible that the pipe diameter can vary beneath the embankment, a 36-inch pipe was used in the calculations.

SECTION 2
ENGINEERING DATA

2.1 Design.

a. Design Data Availability and Sources.

1. Hydrology and Hydraulics. No design reports are available.

2. Embankment. Design drawings (pre-construction) dated 1935 are available from PennDER files. The contract proposal and specifications were also provided by the PennDER.

3. Appurtenant Structures. Same as 2 (above).

b. Design Features.

1. Embankment. Pre-construction drawings and specifications indicate that the embankment was constructed of "selected material composed of earth or clay, sand, gravel, and small boulders not over six (6) inches in any dimension, free from perishable materials and other unsuitable materials".

Interlocking steel sheetpiling was reportedly driven within a trench (varying 10 to 30 feet in depth) and into impervious materials to a depth not exceeding 30 feet below the trench. The sheetpiling was then tied into a reinforced concrete core wall (12 inches thick) which extends vertically through the dam to elevation 1686 (see Figure 3). The core wall was constructed near the toe of the original dam. The original structure was incorporated into the existing embankment forming a portion of the upstream part of the dam.

The upstream and downstream faces of the dam are sloped at 2.5H to 1V, the former being sloped at 2H to 1V below elevation 1673 (upstream face of old embankment) (see Figure 3). The upstream slope is faced with 12-inch stone riprap to elevation 1673. Above this elevation, the upstream face is provided with 6-inch thick concrete paving which is carried to the crest of the dam. The downstream slope of the dam is provided with a network of the drains which carry runoff away from the dam face.

The spillway wingwalls and apron of the original structure, located just to the right of the existing spillway, were removed prior to construction; however, the old masonry spillway was apparently left in place.

2. Appurtenant Structures.

a) Spillway. The DuBois Reservoir spillway is a concrete structure with an ogee-shaped crest located at the left abutment (see Figure 4 and Photographs 7 and 8).

Available pre-construction drawings indicate that the spillway was to measure 72 feet in width; however, some modifications were apparently made prior to construction, since the field measured width is 100 feet.

b) Outlet Works. The facility is equipped with a 36-inch diameter cast iron blow-off which discharges about 100 feet downstream of the dam crest. Flow through the blow-off is regulated via a gate valve controlled in the gate house.

2.2 Construction Records.

The only available construction records consist of a few photographs as well as a few progress reports and other correspondence between the engineer and the Water Supply Commission. These are available from PennDER files.

2.3 Operational Records.

The pool level is read daily and recorded. This data is compiled in water company files and is available for the period ≈1928 to present.

2.4 Other Investigations.

Several state inspection reports are available from PennDER. Since the raising of the embankment in 1936, all of the reports concerning the structure have been satisfactory and the general appearance rated as "good". The last five inspection reports concerning the structure are dated May 1942, July 1944, August 1948, April 1964, and December 1966.

2.5 Evaluation.

Sufficient data are available to make an accurate assessment of the condition of the facility.

SECTION 3
VISUAL INSPECTION

3.1 Observations.

a. General. The general appearance of the structure and related appurtenances suggest that the facility is in good condition.

b. Embankment. The upstream slope of the dam is faced with a 6-inch concrete paving which extends from elevation 1673 to 1681. Below elevation 1673 the upstream slope of the dam is protected by 12-inch thick riprap which once served as the upstream slope of the original dam (see Figure 3).

The downstream slope of the embankment is seeded and is mowed regularly. No trees or bushes have become established on the slope and the downstream face was in excellent condition except that some of the tile drains which divert runoff from the face of the dam had become clogged. A swampy area was noted at and just above the toe along the right abutment at elevation ≈1675 (approximately 110 feet from the intersection of the crest with the right abutment). The origin of the seepage is not readily discernable and the present condition does not appear serious.

Settlement was noted in the concrete paving adjacent to the right spillway wingwall and gate house. Vertical displacements measured approximately 6 inches. The condition may be a result of poor compaction around the gate house and the old spillway which was apparently left in place when the embankment was modified in 1936.

c. Appurtenant Structures.

1. Spillway. The spillway, spillway sidewalls, and apron all appeared to be in fair condition. Some scaling was observed over the entire structure; however, the deterioration was not considered excessive. Some etching of the construction joint at the intersection of the apron and spillway wingwall was evident (see Photograph 9). This condition is considered deleterious since there is no water stop at this joint and the reinforcing steel could eventually corrode. According to Mr. Hoffer (city engineer) they are planning to gunnite the spillway as well as the concrete paving on the upstream face of the dam.

Reportedly during the "Agnes" storm of 1972, some of the concrete slabs were washed out of the spillway apron and carried downstream into the plunge pool. At that time,

approximately 4 feet of water was measured discharging over the spillway. Some erosion also took place in the natural stream channel just downstream of the spillway (see Photograph 5).

Following the storm, the spillway apron slabs were replaced and tied into adjoining slabs by steel rods.

2. Gate Controls, Blow-off, and Supply Line. The supply line at DuBois Reservoir has its source at an intake, controlled at two levels in a gate house, located approximately 500 upstream of the juncture of the dam and the right abutment. The pipeline extends upstream an additional 2,500 feet where it enters another gate house (the location of the original inlet for DuBois Reservoir). From this point, water is conveyed via gravity flow through a brick-lined tunnel beneath the divide separating the Susquehanna and Ohio River Basins and finally to the treatment facility (see Figure 1).

The blow-off pipe at DuBois Reservoir consists of a 42-inch cast iron pipe, atop a concrete cradle, passing through the dam near its midpoint. Pre-construction drawings indicate that the blow-off pipe was to be 36 inches in diameter suggesting that either a change was made or that the pipe diameter changes somewhere along its length.

The blow-off is controlled in a brick gate house located atop the crest of the dam (see Figure 3 and Photograph 12). Initially, the gate valve was regulated manually, however, in recent years the water authority has installed a motorized system which can reportedly open the valve in 20 minutes. Mr. Dusch (water authority superintendent and dam caretaker) reported that the gate valve cannot be closed entirely and at least 1/4 to 1/2 cfs of water is discharged into the downstream drainage at all times.

3. Reservoir Area. The slopes adjoining DuBois Reservoir are steep and heavily wooded. No indications of slope distress were observed at the time of inspection.

4. Downstream Channel. The area immediately downstream of DuBois Reservoir is characterized as a narrow, wooded valley containing Anderson Creek. Approximately 8,000 feet downstream, just prior to Anderson Creek passing beneath a bridge on Route 322, a small community is situated containing at least two homes which could potentially be effected by a breach of the DuBois Reservoir embankment (see Regional Vicinity Map).

The next major group of residences occurs approximately 10 miles downstream at the community of Curwensville. Many houses and other improvements are located along the stream banks at this point; however, because of the distance involved, it is difficult to gauge the potential effects of dam failure on Curwensville. It appears that the magnitude of the failure and the water level in Anderson Creek prior to failure, would have an overriding effect on the extent of damage suffered at Curwensville.

Because of the above mentioned considerations, the hazard category for the facility is deemed to be "high".

3.2 Evaluation.

The dam and its appurtenances are well maintained permitting an accurate assessment of condition of the facility. Some seepage requiring further evaluation was noted at the toe along the right abutment. A general surficial treatment of the exposed concrete surfaces is required. Special attention should be given to the wingwall, floor slab juncture of the spillway.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Normal Operational Procedure.

According to water company personnel, the dam and its appurtenances are maintained on an as-needed basis. There are no formal operational procedures at the facility. Excess water is discharged over the ogee-crested spillway located on the left abutment. When the water depth reaches 6 inches at the spillway crest, the blow-off pipe is reportedly opened.

4.2 Maintenance of Dam.

There are no formal maintenance procedures at the dam. Grass is mowed and brush cleared on an as-needed basis.

The water authority is reportedly planning to gunnite the concrete paving on the upstream side of the dam as well as the spillway, spillway sidewall, and apron. The completion date for this project is not known at this time.

4.3 Maintenance of Operating Facilities.

Maintenance of operating facilities is reportedly provided on an as-needed basis.

4.4 Warning System.

There are no formal warning systems in effect at the site; however, the water company superintendent resides on property adjacent to the reservoir and visits the structure daily.

4.5 Evaluation.

No formal operational procedures are available, however, the water company superintendent who is well acquainted with the operational procedures resides on-site. Maintenance is reportedly provided on an as-needed basis. The blow-off pipe is considered functional although it was not operated in our presence. The blow-off line is normally opened when the depth of flow over the weir reaches six inches.

Except for the general weathered condition of the concrete surfaces, the facility appeared to be well maintained. A formal warning system should be developed.

SECTION 5
HYDROLOGIC/HYDRAULIC EVALUATION

5.1 Design Data.

No hydrologic or hydraulic data are available.

5.2 Experience Data.

Daily rainfall records covering the years 1928 through 1972 along with daily spillway discharge records covering the years 1928 to present are compiled and kept on file at the east shore gate house. Conversations with Marlin Hoffer, DuBois, City Engineer, and Tom Dusch, Chief Operator of the facility revealed extensive damage to the spillway as a result of the "Agnes" flood of 1972 (estimated discharge = 3070 CFS).

5.3 Visual Observations.

The dam and its appurtenances appeared to be in good condition.

5.4 Overtopping Potential.

The ratio "PMF Peak Flow/Drainage Area" was determined from an empirical curve supplied by the Corps of Engineers, Baltimore District. Based on this curve and a drainage area of 26.5 square miles, Peak PMF Q/A = 1,100 cfs/sq. mi., and Peak PMF A = 29,150 cfs. The size category is "intermediate" and the hazard rating "high". Consequently, the SDF used in this analysis is the PMF ("Recommended Guidelines for Safety Inspection of Dams").

Calculations (see Appendix C) were performed to evaluate the overtopping potential of the dam during the PMF in which an inflow volume based on 26 inches of runoff (36,747 acre-feet) was used.

The spillway has a maximum discharge capacity of approximately 13,534 cfs which is less than the PMF Peak inflow of 29,150 cfs. Excess inflow must be stored while being discharged if the dam is not to overtop. Based on normal pool elevation 1675 and top of dam elevation 1686, the available storage at DuBois Reservoir is calculated to equal approximately 3623 acre-feet. This is considerably less than the computed storage volume required of 19,476 acre-feet and thus it can be concluded that the dam will overtop when subjected to a storm of PMF magnitude.

5.5 Spillway Adequacy.

DuBois Reservoir Dam is able to pass and/or contain approximately 57 percent of the PMF. As a result, the spillway is deemed inadequate.

SECTION 6
EVALUATION OF STRUCTURAL INTEGRITY

6.1 Visual Observations.

a. Embankment. Based on visual observations, the embankment appeared to be in good condition. A small amount of seepage was observed near the toe of the structure at elevation ≈1675. The seepage was negligible. Thus, the condition was not considered serious.

Some settlement (6 inches) was noted in the concrete paving atop the crest of the dam adjacent to the spillway wingwall (see Photograph 6) and gate house. This condition may be related to the fact that they incorporated the original spillway into the existing embankment when the dam was raised in 1936 and the inherent difficulty in compacting soil against walls.

b. Appurtenant Structures. Based on visual observations and past history, the spillway appeared to be in fair condition. However, two major detrimental items were noted concerning the spillway. The first is that water discharging through the spillway has etched its way behind the construction joint at the intersection of the spillway apron and spillway side wall (see Photograph 9). This condition is considered serious in that water stops may not have been provided during construction; thus, the reinforcing steel connecting the spillway sidewalls to the floor slabs may be subject to corrosion (particularly if exposed by the etching action). If unchecked, corrosion of the connecting steel could lead to undesirable wall movements or structural failure of the sidewalls from lateral earth pressures.

The second less than satisfactory aspect of the spillway is that under 4 feet of head (Agnes storm 1972) at least six concrete apron slabs in the spillway were carried downstream. This condition may have resulted from a number of factors including drag on the rough concrete surface and/or hydrostatic uplift pressures beneath the slabs due to poor drainage systems, etc. If the slabs which did not move in 1972 are not tied down, they could be dislodged under similar flow conditions exposing materials of questionable durability beneath the spillway.

6.2 Design and Construction Techniques.

Actual design data, design computations, or reports were not available for any aspect of this facility. A few

construction photographs were supplied by PennDER (see Appendix D, Photographs).

6.3 Past Performance.

Reservoir level records are available from the water company which date back to the 1920's. During periods of heavy rainfall (1936, 1972) water company personnel gauged the water levels in the spillway on a 24-hour basis; therefore detailed high pool level records are available for the last 50 years. The record pool level at the facility reportedly occurred during the "Agnes" storm of 1972, when the depth of flow over the spillway crest measured approximately 4 feet. This flow caused damage to the spillway referred to in Section 6.1.b.

6.4 Seismic Stability.

The dam is located within Seismic Zone No. 1 and it is thought that the static stability of the structure is sufficient to withstand minor earthquake induced dynamic forces. However, no calculations, investigations, etc., were performed to confirm this conclusion since this type of investigation is out of the scope of a Phase I report.

SECTION 7
ASSESSMENT AND RECOMMENDATIONS FOR REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety. The visual inspection, operational history, and available engineering data suggest that the dam and its appurtenances are in good condition. However, hydraulic and hydrologic calculations made during our investigation indicate that the spillway is inadequate (the facility is only capable of passing and/or storing 57 percent of the PMF - Recommended Spillway Design Flood). Consequently, it can be concluded that the structure would be overtopped if subjected to a flood of the PMF magnitude.

b. Adequacy of Information. The available data was thought to be sufficient to make an accurate Phase I assessment of the facility.

c. Urgency. It is suggested that the recommendations listed below be implemented immediately.

d. Necessity for Additional Investigations. Additional investigations are deemed necessary to more accurately assess adequacy of the outlet works.

7.2 Recommendations.

a. Facilities. It is recommended that the owner:

1) have a detailed hydraulic and hydrologic analysis performed to more accurately ascertain the adequacy of the outlet works and to ensure that the facility is hydraulically adequate.

2) take measures to insure that the concrete spillway apron slabs remain in place during periods of high flow and seal the construction joints between the spillway sidewalls and apron so that water cannot flow into the joint and corrode the reinforcing steel.

3) install monitoring wells within the downstream slope on a line approximately 110 feet from the intersection of the crest and the right abutment to establish and monitor the phreatic surface. This data should then be evaluated by a registered professional engineer experienced in the design and construction of earth dams.

b. Maintenance and Operating Procedures. It is recommended that the owner:

1) develop a warning system to protect downstream inhabitants should hazardous conditions develop. Included in the plan should be provisions for round-the-clock surveillance of the facility during periods of unusually heavy precipitation.

2) have the facility inspected on a periodic basis to check for hazardous conditions which might develop. The inspection should include an assessment of the siltation within the reservoir and dredging should be implemented if silt deposition is observed above the normal pool level.

APPENDIX A

CHECK LIST - ENGINEERING DATA

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM DuBois Reservoir

ID # PA-424 PennDer 17-5

ITEM	REMARKS	SHEET 1

AS-BUILT DRAWINGS

None available.

Pre-construction drawings available from PennDer files and owner.

REGIONAL VICINITY MAP

See 7.5 minute Luthersburg Quadrangle.

CONSTRUCTION HISTORY

Prepared from PennDer files

TYPICAL SECTIONS OF DAM

Shown on preconstruction drawings (Appendix F)

OUTLETS - PLAN see Figure 5.

- DETAILS see Figure 5.

- DISCHARGE RATINGS none available

RAINFALL/RESERVOIR RECORDS

Weather Station @ dam abandoned in 1972.
Daily rainfall records available from owner between 1928-1972.
After 1972 rainfall records kept @ sewage treatment plant (DuBois)

ITEM	REMARKS	ID #	SHEET 2

DESIGN REPORTS

None available.

GEOLOGY REPORTS

None available.

DESIGN COMPUTATIONS
HYDROLOGY & HYDRAULICS
DAM STABILITY
SEEPAGE STUDIES

None available.

MATERIALS INVESTIGATIONS
BORING RECORDS
LABORATORY
FIELD

None available.

POST-CONSTRUCTION SURVEYS OF DAM

None available.

BORROW SOURCES

Not known.

ITEM	REMARKS	ID #	SHEET 3

MONITORING SYSTEMS

None.

MODIFICATIONS

Embankment raised in 1936, new spillway constructed.

HIGH POOL RECORDS

Spillway flow level records available from 1928 to present - High flow measured as 4 feet during "Agnes" storm in 1972.

POST CONSTRUCTION ENGINEERING
STUDIES AND REPORTS

Octocsin Report by State (Goddard) - Not available from owner.

PRIOR ACCIDENTS OR FAILURE OF DAM
DESCRIPTION
REPORTS

Concrete apron slabs on spillway lifted and washed down stream during "Agnes" storm in 1972.

MAINTENANCE
OPERATION
RECORDS

Open blow-off when flow depth in spillway equals 6 inches. Embankment slope mowed twice per summer.

ITEM	REMARKS	ID #	SHEET 4

SPILLWAY PLAN

SECTIONS — See preconstruction drawings Figures 2 and 4.

DETAILS — See preconstruction drawings Figure 4.

OPERATING EQUIPMENT PLANS & DETAILS — See Photograph 11 and Figure 5 - Electric motor now operates gate valve on blow-off. Maintained on an as-needed basis.

NDI# PA-424

CHECK LIST ID # PennDER# 17-5
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 26.5 mi. sq.

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 1675.3 ft; 1845 acre-ft.

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): Not known.

ELEVATION MAXIMUM DESIGN POOL: Not known.

ELEVATION TOP DAM: 1686.3 ft; 5468 acre-ft (storage).

SPILLWAY DATA:

a. Crest Elevation 1675.3.
b. Type ogee crest with multi-stage outlet channel.
c. Weir Length 100 ft. (field measured).
d. Channel Length 270 ft.
e. Location Spillover Left abutment.
f. Number and Type of Gates None.

OUTLET WORKS:

a. Type 42" diameter C.I.P. blow-off (field measured)
36" diameter C.I.P. (contract drawings)
b. Location near center of embankment.
c. Entrance Inverts ≈1650 (estimated).
d. Exit Inverts ≈1649 ft
e. Emergency Draindown Facilities Blow-off (see a above).

HYDROMETEOROLOGICAL GAGES:

a. Type Raingage
b. Location at stone gate house until 1972.
c. Records rainfall and spillway level records 1928 to present.

MAXIMUM NON-DAMAGING DISCHARGE: 4 ft recorded in June 1972.
(some spillway damage).

APPENDIX B

CHECK LIST - VISUAL INSPECTION

CHECK LIST
VISUAL INSPECTION
PHASE 1

NDI PA-424

DAM NAME DuBois Reservior COUNTY Clearfield STATE PA ID # PennDer 17-5

TYPE OF DAM Earth HAZARD CATEGORY High

DATE(S) INSPECTION 28 June, 1978 WEATHER Few Clouds TEMPERATURE 70° to 80°

POOL ELEVATION AT TIME OF INSPECTION 1675.2 M.S.L. TAILWATER AT TIME OF INSPECTION N/A M.S.L.

INSPECTION PERSONNEL:

B. M. Mihalcin (GAI)	Chandu Patell (PennDer)	Tom Dusch (City of DuBios)
J. P. Nairn (GAI)		
D. L. Bonk (GAI)		

D. L. Bonk RECORDER

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None observed.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	None observed.	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Good.	
RIPRAP FAILURES	Rip-rap consists of concrete slabs which originate below the water level and continue up to the concrete cut-off wall at the dam crest. Visual inspection revealed this concrete face to be in fair condition with spalling and cracking evident. In addition, considerable settlement (approx. 6 in) is visible in the slab located adjacent to the spillway.	

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Good condition.	
ANY NOTICEABLE SEEPAGE	Very slight seepage centered around area between gage house and right abutment at the extreme base of toe. This water may be associated with a toe drain or could be a direct result of runoff from the adjacent hillside.	
STAFF GAGE AND RECORDER	None observed.	
DRAINS	Drains visible discharging into outlet channel. Origin of drains not determined during inspection but are likely to drain the rock toe. Estimated discharge of drains to be 3 GPM to 4 GPM.	

CUT-OFF WALL AND UPSTREAM FACING ID # PA-424 SHEET 2a

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	Hairline pattern cracking prevalent along exposed surface of concrete cut-off wall. Spalling and pop-outs are numerous over all concrete surfaces especially at corners and along joints.	
STRUCTURAL CRACKING	End slab adjacent to spillway is cracked probably from settlement and rotation of endwall.	
VERTICAL AND HORIZONTAL ALIGNMENT	Satisfactory.	
MONOLITH JOINTS	None observed.	
CONSTRUCTION JOINTS	Vegetation growing in most joints along upstream slope. Some deterioration evident characterized by spalling and cracking of bitumen seals.	
STAFF GAGE OF RECORDER:	None observed.	

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	None observed.	
INTAKE STRUCTURE	Gate house atop dam crest as well as supply line gate house along left (looking upstream) shoreline are in excellent condition.	
OUTLET STRUCTURE	Forty-two inch diameter cast iron pipe with discharge depth at 4 inches during inspection.	
OUTLET CHANNEL	Trapezoidal masonry channel carries flow from point of discharge to natural channel approximately 100 feet downstream. Forty-two inch cast iron pipe is supported by concrete endwall at point of discharge.	
EMERGENCY GATE	Located in gate house atop crest. Equipped with a motorized valve operated electrically. Valve is incapable of closing completely and consequently some flow is constant. (1.5 to 2) cfs discharging during inspection, however, valve can close further until only (0.25 to 0.5) cfs discharges.	

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Fair condition with moderate to severe scaling along surface and spalling at construction joints. Slight erosion at junction of wingwalls and floor slab providing a channel for flow beneath walls.	
APPROACH CHANNEL	Natural rock lined channel from center of ogee to right wingwall. Concrete apron from center of ogee to left wingwall.	
DISCHARGE CHANNEL	Severe scaling along concrete surface of spillway floor. Plunge pool is a natural channel with large broken up concrete slabs evident. Plunge pool was severely eroded by the spillway discharge resulting from Agnes in 1972. Left bank of downstream channel also damaged by this storm.	
BRIDGE AND PIERS	Downstream bridge approximately 500 ft from base of spillway. Top of bridge opening is 17 ft above channel floor.	

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

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS

MONUMENTATION/SURVEYS

U. S. G. S. bench mark 1679.0 at step of supply line gate house along east shore.

OBSERVATION WELLS

None observed.

WEIRS

None observed.

PIEZOMETERS

None observed.

OTHERS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Gentle to moderate with both wooded and clear areas visible.	
SEDIMENTATION	None observed but considered a significant problem since the construction of I-80 according to conversations with dam personnel.	

DOWNSTREAM CHANNEL ID # PA-424 SHEET 8

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Satisfactory with erosion damage from the Agnes storm of June 1972 still evident.	
SLOPES	Steep and heavily wooded.	
APPROXIMATE NO. OF HOMES AND POPULATION	At least two homes located on right bank of stream approximately 8,000 feet downstream. Town of Curwensville approximately 10 miles downstream. Tens of homes near stream at this point.	

APPENDIX C

HYDROLOGY AND HYDRAULICS

SUBJECT DAM SAFETY INSPECTION
DUBOIS RESERVOIR

BY DLB DATE 7-11-78 PROJ. NO. 78-501-424

CHKD. BY JTS DATE 7-26-78 SHEET NO. 1 OF 10

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LOCATION (DAM, RESERVOIR, AND WATERSHED)

LUTHERSBURG QUADRANGLE
ELLIOT PARK QUADRANGLE
SAGULA QUADRANGLE
PENFIELD QUADRANGLE
} U.S.G.S. 7.5 MINUTE MAPS

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DAM STATISTICS

MAXIMUM HEIGHT OF DAM - 38 FT (FIELD MEASURED)

DRAINAGE AREA - 26.5 SQ. MI. (REF 1: pg 59)

STORAGE CAPACITY - 1,886 AC-FT (REF 1: pg 59)

SIZE CLASSIFICATION

DAM SIZE - INTERMEDIATE (REF 2, TABLE 1)

SPILLWAY DESIGN FLOOD (SDF)

HAZARD RATING — HIGH (REF 2, TABLE 2)

REQUIRED SDF — PMF (REF 2, TABLE 3)

REFERENCES:

1 "WATER RESOURCES BULLETIN" by PA. DEPT. OF FORESTS AND WATERS PREPARED BY BUREAU OF ENGINEERING 1970

2 "RECOMMENDED GUIDELINES FOR SAFETY INSPECTION OF DAMS" by DEPT OF THE ARMY - OFFICE OF THE CHIEF ENGINEER

SUBJECT DAM SAFETY INSPECTION
DuBOIS RESERVOIR

BY DLB DATE 7-11-78 PROJ. NO. 78-501-424

CHKD. BY JTS DATE 7-26-78 SHEET NO. 7 OF 10

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PMF (PEAK FLOW)/AREA = 1,100 CFS/SQ. MI (REF: CofE CURVE OHIO)

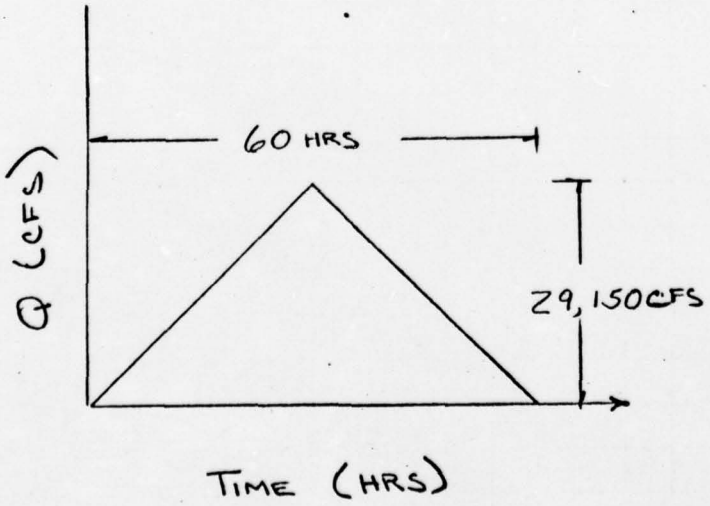
PMF = (1,100 CFS/SQ. MI.)(26.5 SQ. MI.) = 29,150 CFS

SDF = PMF = 29,150 CFS

DEVELOP INFLOW HYDROGRAPH

MAXIMUM INFLOW Q_{IMAX} = 29,150 CFS

TOTAL TIME OF FLOW = 60 HRS. (REF: CofE CURVE OHIO)



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SUBJECT DAM SAFETY INSPECTION
DUBOIS RESERVOIR

BY DLB DATE 7-11-78 PROJ. NO. 78-501-424

CHKD. BY JTS DATE 7-26-78 SHEET NO. 3 OF 10

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VOLUME OF INFLOW HYDROGRAPH

$V = \frac{1}{2}(Q_{I_{MAX}})(TIME)$

$= \frac{1}{2}(29{,}150 CFS)(60 HRS)(3600 SEC/HR)(1 ACRE/43{,}560 FT^2)$

$= 72{,}273$ ACRE-FEET

DETERMINE THE AVERAGE RAINFALL IN INCHES REQUIRED TO PRODUCE THE VOLUME ABOVE.

$\frac{(72{,}273 AC-FT)}{(26.5 SQ. MI.)}(1 SQ. MI./640 ACRES)(12 IN/FT) = 51.1$ INCHES

VOLUMES PRODUCED BY PMF RAINFALLS IN EXCESS OF 26 INCHES ARE TO BE RECALCULATED USING 26 INCHES AS AN UPPER BOUND.

$(26 INCHES)(26.5 SQ. MI.)(640 ACRES/SQ. MI.)(1 FT/12 IN) = 36{,}747$ AC-FT

VOLUME OF INFLOW (RECALCULATED) $= 36{,}747$ AC-FT

NOTE: $Q_{I_{MAX}}$ REMAINS CONSTANT.
STORM DURATION DECREASES IN ACCORDANCE WITH THE DECREASE IN INFLOW VOLUME.

EQUIVALENT
STORM DURATION $= (36{,}747 AC-FT)(2)(43{,}560 FT^2/AC)/(3600 SEC/HR)(29{,}150 CFS)$

$= 30.5$ HRS

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SUBJECT DAM SAFETY INSPECTION
DuBOIS RESERVOIR

BY DLB DATE 7-11-78 PROJ. NO. 78-501-474

CHKD. BY JTS DATE 7-26-78 SHEET NO. 4 OF 10

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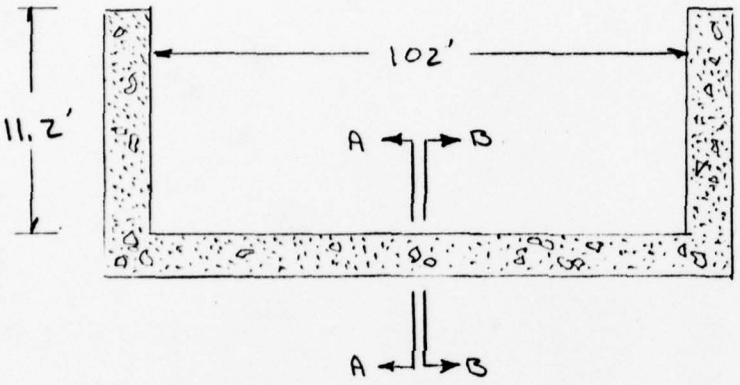
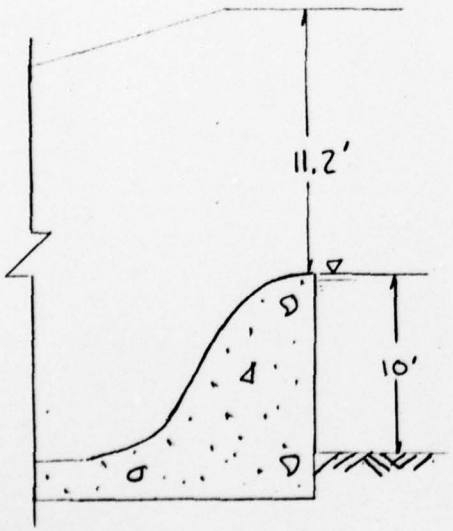
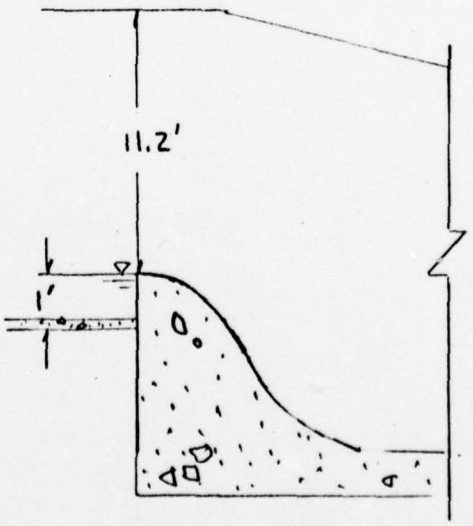
SPILLWAY



(FIELD MEASURED)



SECTION AA
RIGHT WING-WALL
(REF DRWG , DETAIL)



SECTION BB
LEFT WING-WALL
(REF DRWG , DETAIL)

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SUBJECT DAM SAFETY INSPECTION
DUBOIS RESERVOIR

BY DLB DATE 7-11-78 PROJ. NO. 78-501-424

CHKD. BY JTS DATE 7-26-78 SHEET NO. 5 OF 10

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SPILLWAY CAPACITY

$Q = C L H^{3/2}$ (REF 3, EQ 21-121)

	SECTION A-A	SECTION B-B
H = MAXIMUM HEAD	11.2 FT	11.2 FT
L = CREST LENGTH	51 FT	51 FT
P/H_D	$10/11.2 = 0.89$	$1.0/11.2 = 0.09$
C = DISCHARGE COEFFICIENT	3.88	3.20

$Q_{IMAX\ AA} = (3.88)(51)(11.2)^{3/2} = 7,417$ CFS

$Q_{IMAX\ BB} = (3.20)(51)(11.2)^{3/2} = 6,117$ CFS

$Q_{TOTAL} = 13,534$ CFS

PEAK INFLOW (29,150 CFS) > MAXIMUM SPILLWAY DISCHARGE (13,534 CFS)

(SHEET 2)

REFERENCES:

3 "STANDARD HANDBOOK FOR CIVIL ENGINEERS" by F.S. MERRITT

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SUBJECT DAM SAFETY INSPECTION
DuBois RESERVOIR

BY DLB DATE 7-11-78 PROJ. NO. 78-501-474

CHKD. BY JTS DATE 7-26-78 SHEET NO. 6 OF 10

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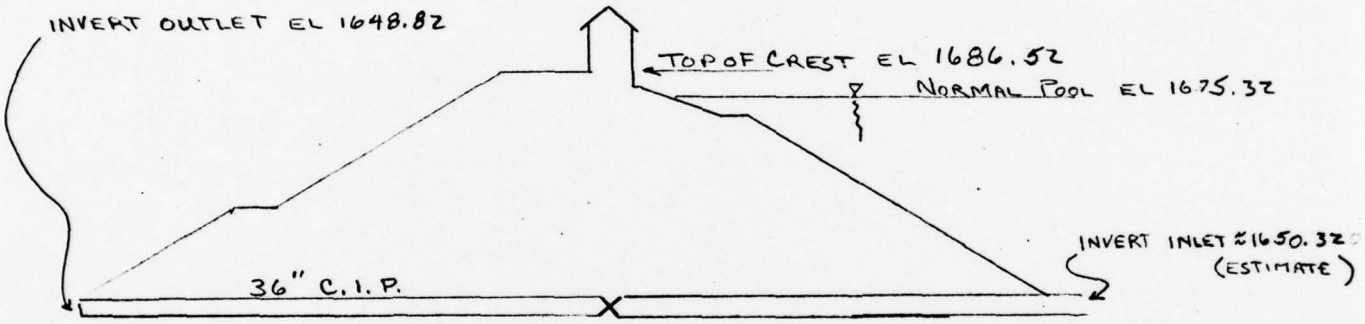
OUTLET WORKS (36 INCH DIAMETER BLOW-OFF)

DATUM EL 1648.82



USE BERNOULLI'S EQUATION (REF 3, EQ 21-12)

$$Z_1 + P_1/\omega + V_1^2/2g = Z_2 + P_2/\omega + V_2^2/2g + h_f + h_e$$

FOR 36" C.I.P. (UNDER MAXIMUM POOL CONDITIONS)

Z_1 = HEIGHT OF INLET ABOVE DATUM ≈ 1.5 FT
Z_2 = " " OUTLET " " = 0
P_1/ω = PRESSURE AT INLET = 36 FT
P_2/ω = PRESSURE AT OUTLET = 0
V_1 = VELOCITY AT INLET = 0
V_2 = VELOCITY AT OUTLET = SOLVE FOR
g = GRAVITATIONAL CONSTANT = 32.2 FT/SEC²

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NOTE: ALL ELEVATIONS ARE TAKEN FROM DRAWINGS BY MORRIS KNOWLES ENGINEERS, INC. (DRWG 4 OF 11). SOME DIMENSIONS AND ELEVATIONS USED IN THIS ANALYSIS VARY SLIGHTLY FROM THE AVAILABLE DRAWINGS. THESE SEEMINGLY AMBIGUOUS VALUES ARE BASED ON ACTUAL FIELD MEASUREMENTS

SUBJECT DAM SAFETY INSPECTION
DUBOIS RESERVOIR

BY DLB DATE 7-11-78 PROJ. NO. 78-501-424

CHKD. BY JTS DATE 7-26-78 SHEET NO. 7 OF 10

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h_f = HEAD LOSS DUE TO FRICTION

$$h_f = f\frac{LV^2}{2gD}$$ (REF 3: EQ 21-30)

L = LENGTH OF PIPE $\cong$ 205' (REF: CONTRACT DRAWINGS, 4 OF 11)
D = DIAMETER OF PIPE = 3.0

f = FRICTION FACTOR - BASED ON TURBULENT FLOW WITH A REYNOLD'S NUMBER = 1.0×10^7 AND A COEFFICIENT OF ROUGHNESS $\epsilon = 0.00085$ (REF 3: TABLE 21-3)

f = 0.017 (REF 3: FIG 21-19)

h_e = HEAD LOSS AT INLET

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$$h_e = K_E\frac{V^2}{2g}$$ (REF 3: EQ 21-42)

K_E = COEFFICIENT OF FRICTION = 0.50 (REF 3, TABLE 21-7)

SOLVE BERNOULLI'S EQUATION

$$1.5' + 36' + 0 = 0 + 0 + \frac{V_2^2}{2(32.2)} + \frac{(0.017)(205)V_2^2}{(2)(32.2)(3.0)} + \frac{(0.5)V_2^2}{2(32.2)}$$

$$37.5' = (0.016 + 0.018 + 0.008)V_2^2$$

SUBJECT DAM SAFETY INSPECTION
DUBOIS RESERVOIR

BY DLB DATE 7-11-78 PROJ. NO. 78-501-474

CHKD. BY JTS DATE 7-26-78 SHEET NO. 8 OF 10

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$37.5'/0.042 = V_2^2$

$V_2 = 30$ FT/SEC

$Q = VA = (30 \text{ FT/SEC})(\pi)(1.5 \text{ FT})^2$

$Q = 212$ CFS

TOTAL DISCHARGE (SPILLWAY AND BLOW-OFF) = (13,534 + 212) CFS

= 13,746 CFS

PEAK INFLOW (29,450 CFS) > TOTAL DISCHARGE (13,746 CFS)

(SHEET 2)

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SUBJECT DAM SAFETY INSPECTION
DuBois Reservoir

BY DLB DATE 7-11-78 PROJ. NO. 78-501-424

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CONSIDER INFLOW RELATIVE TO BOTH OUTFLOW AND STORAGE USING SHORT CUT METHOD AS RECOMMENDED BY NAD.

$$P = \frac{\text{MAXIMUM DISCHARGE}}{\text{PMF PEAK INFLOW}} = \frac{13,746 \text{ CFS}}{29,150 \text{ CFS}} = 0.47$$

$$(1-P) = \frac{\text{REQUIRED RESERVOIR STORAGE}}{\text{VOLUME OF HYDROGRAPH}} = (1-0.47) = 0.53$$

REQ'D STORAGE = $(0.53)(36,747 \text{ AC-FT}) = 19,476 \text{ AC-FT}$

(SHEET 3)

CALCULATE STORAGE AVAILABLE

SURFACE AREA (@ NORMAL POOL EL 1675.32) = 212 ACRES
SURFACE AREA (@ TOP OF SPILLWAY WALL EL 1686.52) ≃ 435 ACRES
(PLANIMETED OFF U.S.G.S.

AVAILABLE FREEBOARD = 11.2 FEET

STORAGE AVAILABLE = $[(212 + 435) \text{ ACRES}/2](11.2 \text{ FEET})$

≃ 3623 AC-FT

REQUIRED STORAGE (19,476 AC-FT) > STORAGE AVAILABLE (3623 AC-FT)

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SUBJECT DAM SAFETY INSPECTION
DuBois Reservoir Dam

BY DLB DATE 7-13-78 PROJ. NO. 78-501-387

CHKD. BY JTS DATE 7-26-78 SHEET NO. 10 OF 10

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ESTABLISH WHAT PERCENT PMF WILL BE CONTAINED AND/OR PASSED.

$$P = \frac{\text{MAXIMUM DISCHARGE RATE}}{Q_{I_{MAX}}} = \frac{13,746 \text{ CFS}}{Q_{I_{MAX}}}$$ (SHEET 5)

$$(1-P) = \frac{\text{AVAILABLE STORAGE}}{\text{VOLUME OF HYDROGRAPH}}$$ (SHEET 9)

$$1 - \frac{13,746 \text{ CFS}}{Q_{I_{MAX}}} = \frac{3623}{\frac{1}{2}(Q_{I_{MAX}})(30.5 \text{ HRS})(3600 \text{ SEC/HR})(1 \text{ ACRE}/43,560 \text{ FT}^2)}$$

$$1 - \frac{13,746}{Q_{I_{MAX}}} = \frac{3623}{1.26\, Q_{I_{MAX}}}$$

$$1.26\, Q_{I_{MAX}} - 17320 = 3623$$

$$1.26\, Q_{I_{MAX}} = 20943$$

$$Q_{I_{MAX}} = 16,621 \text{ CFS}$$

PMF (PEAK INFLOW) = 29,150 CFS

$$Q_{I_{MAX}} = 57\% \text{ PMF}$$

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APPENDIX D

PHOTOGRAPHS

PHOTOGRAPH 1 View of DuBois Reservoir as it appeared in 1919.

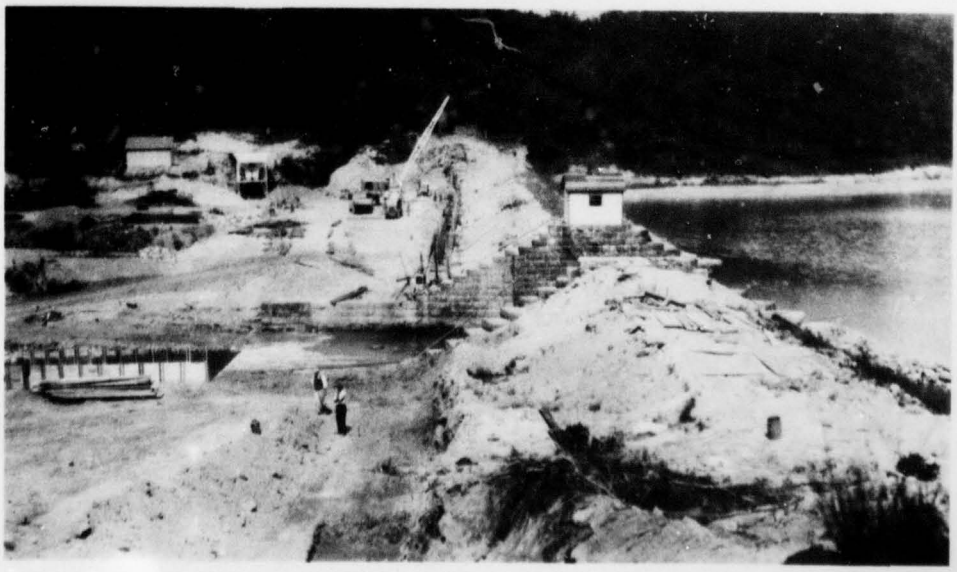
PHOTOGRAPH 2 View of DuBois Reservoir Dam showing temporary flume used during reconstruction.

PHOTOGRAPH 3 View of DuBois Reservoir Dam under reconstruction in 1936. Note cutoff wall construction in the center of the photograph.

1

2

3



PHOTOGRAPH 4 View of DuBois Reservoir taken from the right abutment. The spillway is visible in the background of the photograph.

PHOTOGRAPH 5 View of the upstream face of DuBois Reservoir. The spillway is visible on the left abutment. The brick gate house is shown near the center of the photograph.

PHOTOGRAPH 6 Close-up view of cracking and settlement on the crest of the dam near the right wingwall of the spillway.

PHOTOGRAPH 7 View of the chute spillway at DuBois Reservoir. The ogee crest is visible in the background of the photograph.

4

5

6

7

PHOTOGRAPH 8 View of the spillway outlet and the wooded area immediately downstream of the dam. A concrete bridge (which represents the first downstream improvement) can be seen near the right center of the photograph.

PHOTOGRAPH 9 View of scaling at a construction joint on the right sidewall of the spillway. Water could be seen passing behind the joint.

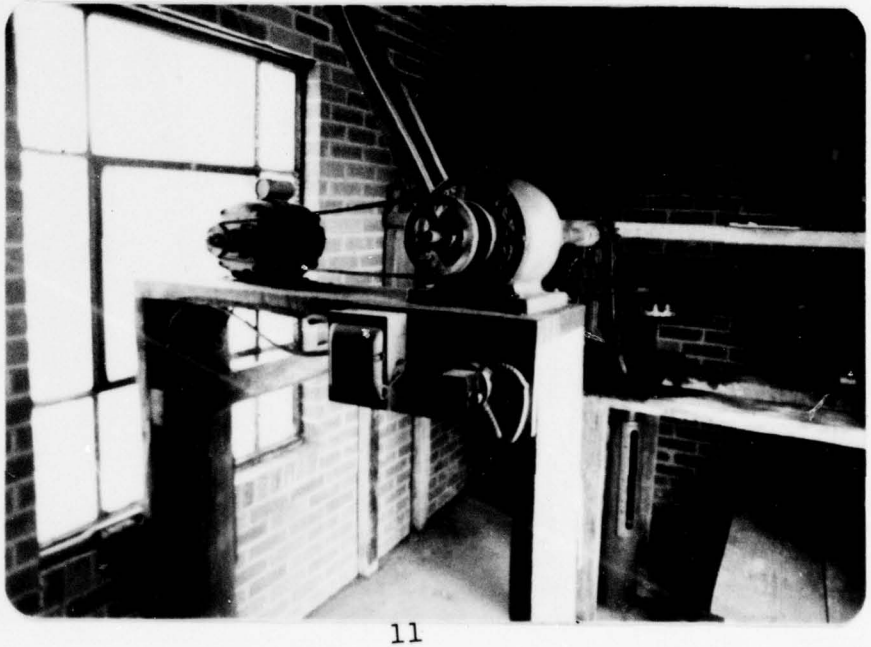
PHOTOGRAPH 10 View of reservoir area taken from the crest of the dam. The brick structure in the left center portion of the photograph is a gate house for the supply line to the city of DuBois.

PHOTOGRAPH 11 View of the interior of the brick building housing the controls on the blow-off line.

8

9

10



11

PHOTOGRAPH 12 Close-up view of the outlet end of the 42-inch blow-off pipe at the DuBois Reservoir. The previous photograph was taken within the brick building shown atop the dam in the background of the photograph.

APPENDIX E

GEOLOGY

DuBois Reservoir is located in the Allegheny High Plateau Province of Pennsylvania. Available geologic information indicates that the dam is founded on the nearly horizontal sedimentary strata of the Pennsylvanian age Pottsville Group.

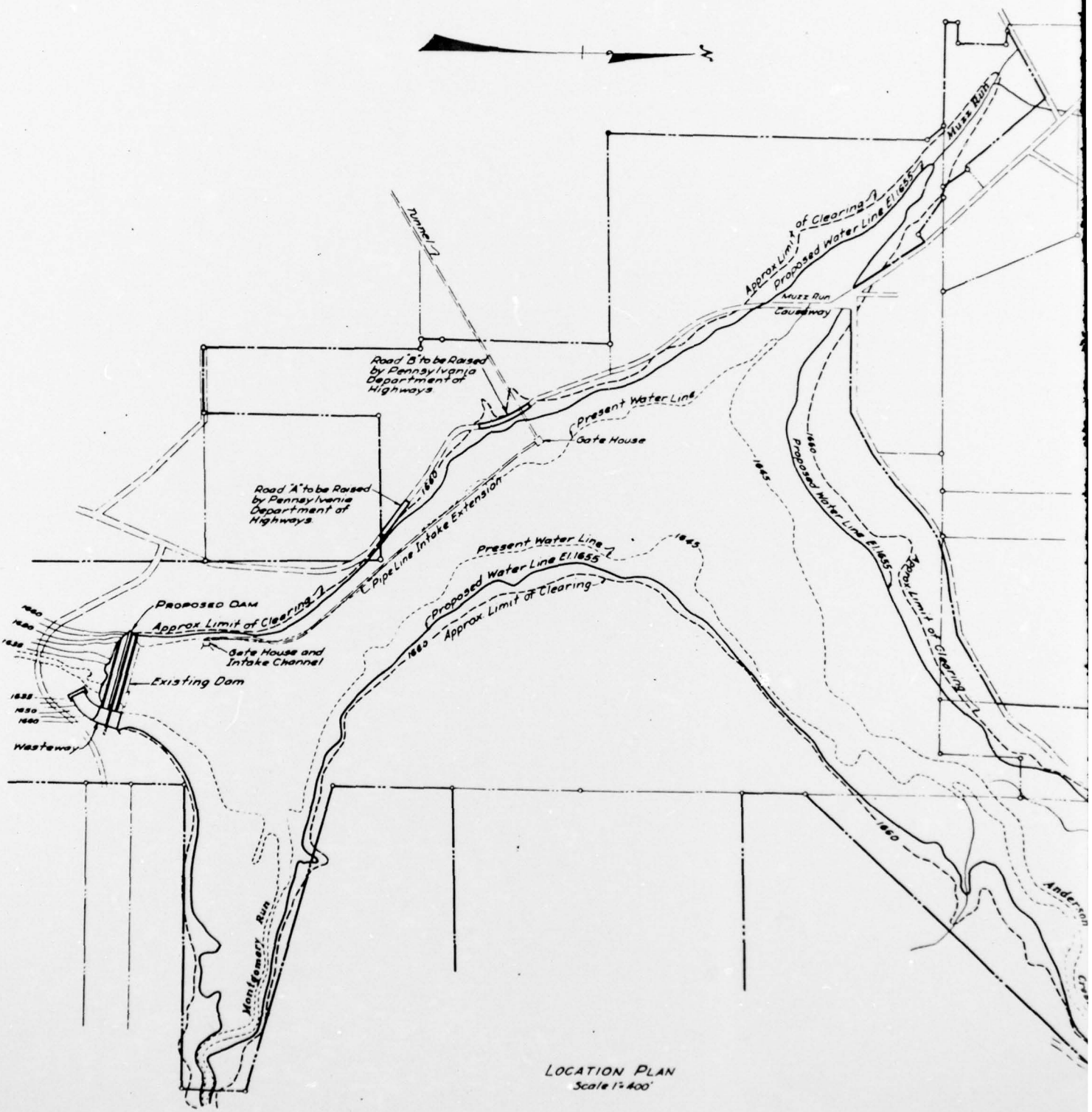
These units are predominantly characterized as sandstones and conglomerates with thin shales and coalbeds. Some coal units are mined within the watershed; however, most belong to the overlying strata of the Allegheny Group. Numerous gas wells are also located within the DuBois Reservoir watershed.

APPENDIX F

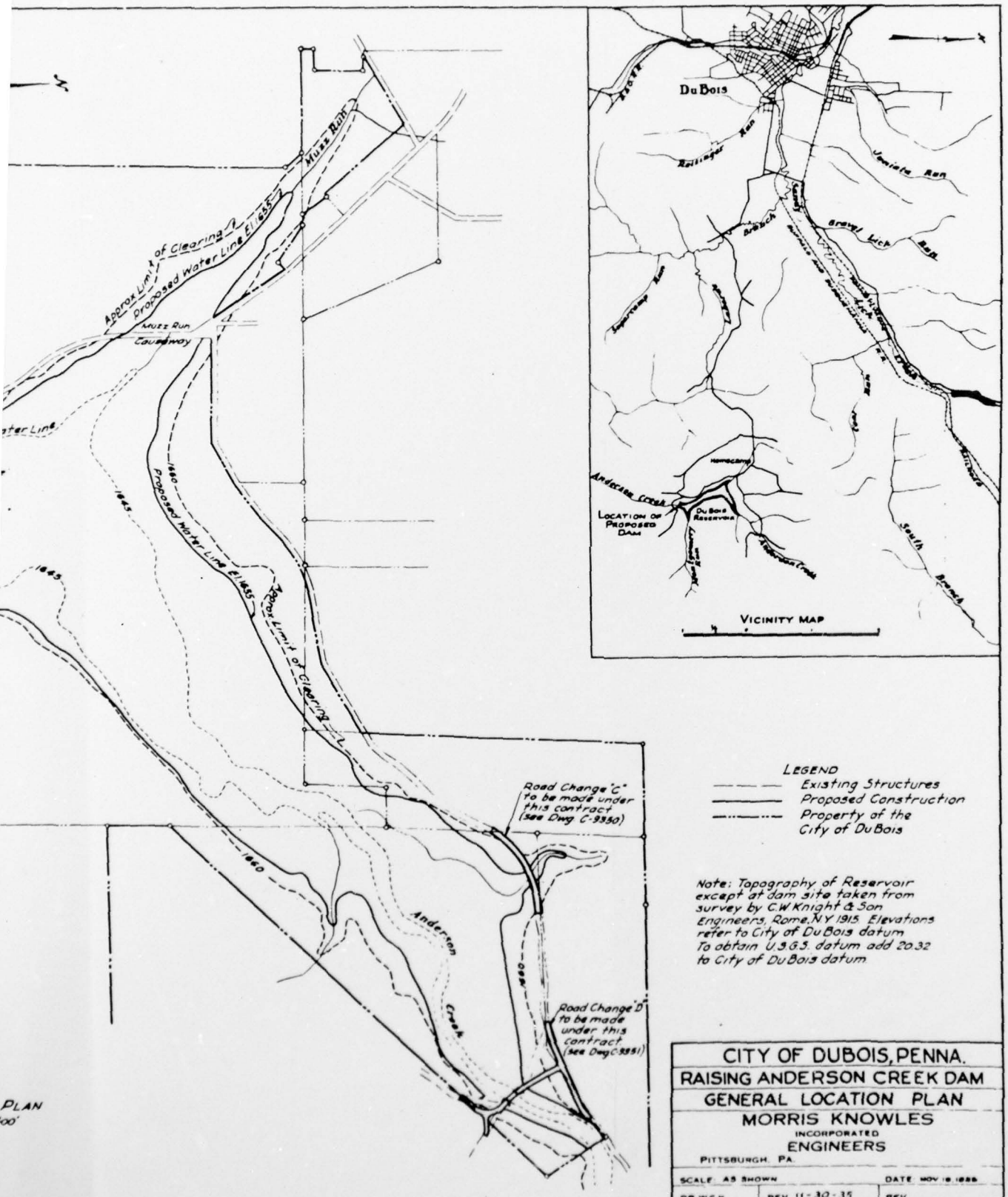
FIGURES

APPENDIX F - FIGURES

Figure	Description/Title
1	General Location Plan
2	Plan and Profile of Dam
3	Cross Sections of Dam
4	Plan and Profile of Wasteway
5	Details of Gate House



LOCATION PLAN
Scale 1"=400'



CITY OF DUBOIS, PENNA.

RAISING ANDERSON CREEK DAM

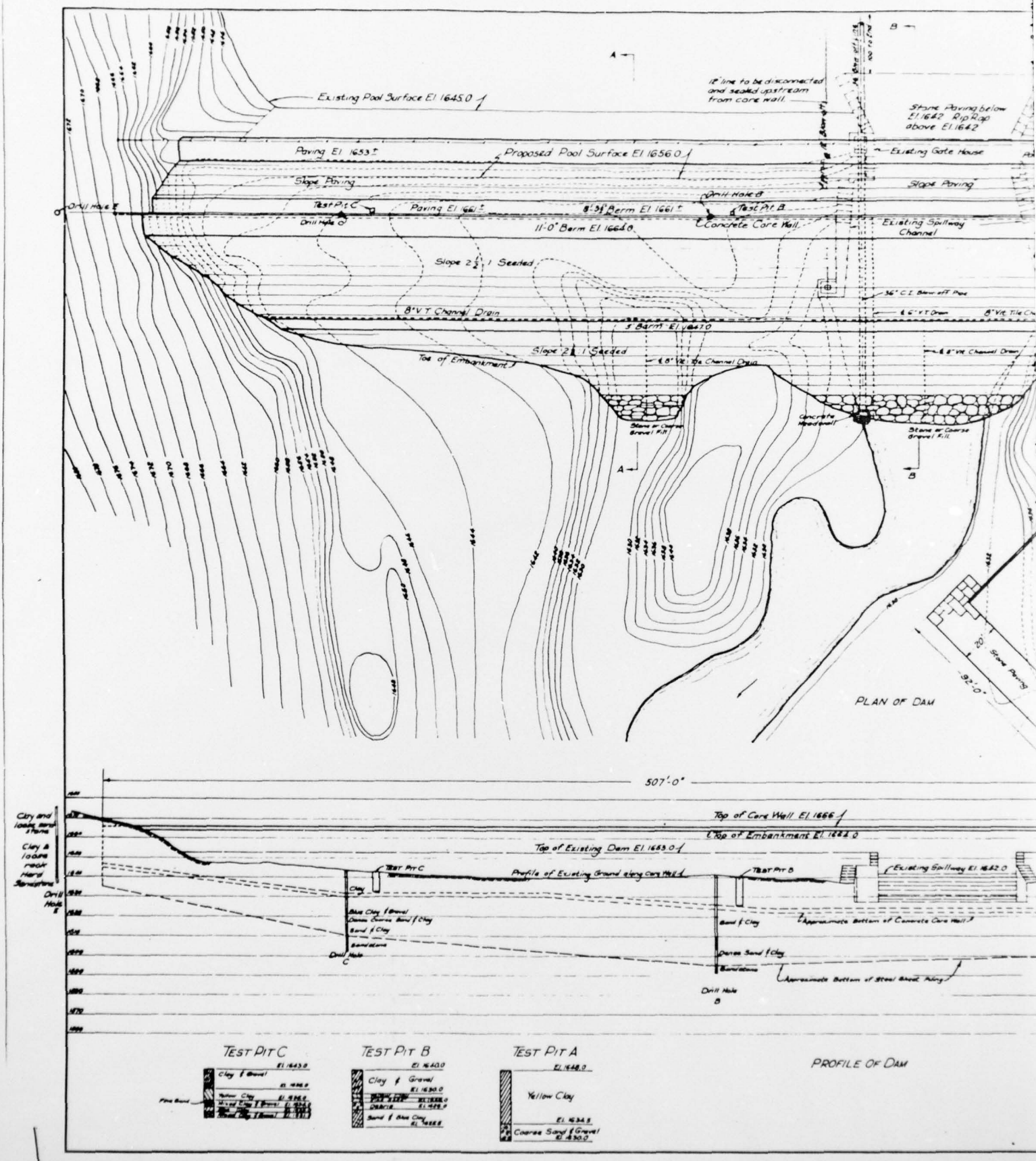
GENERAL LOCATION PLAN

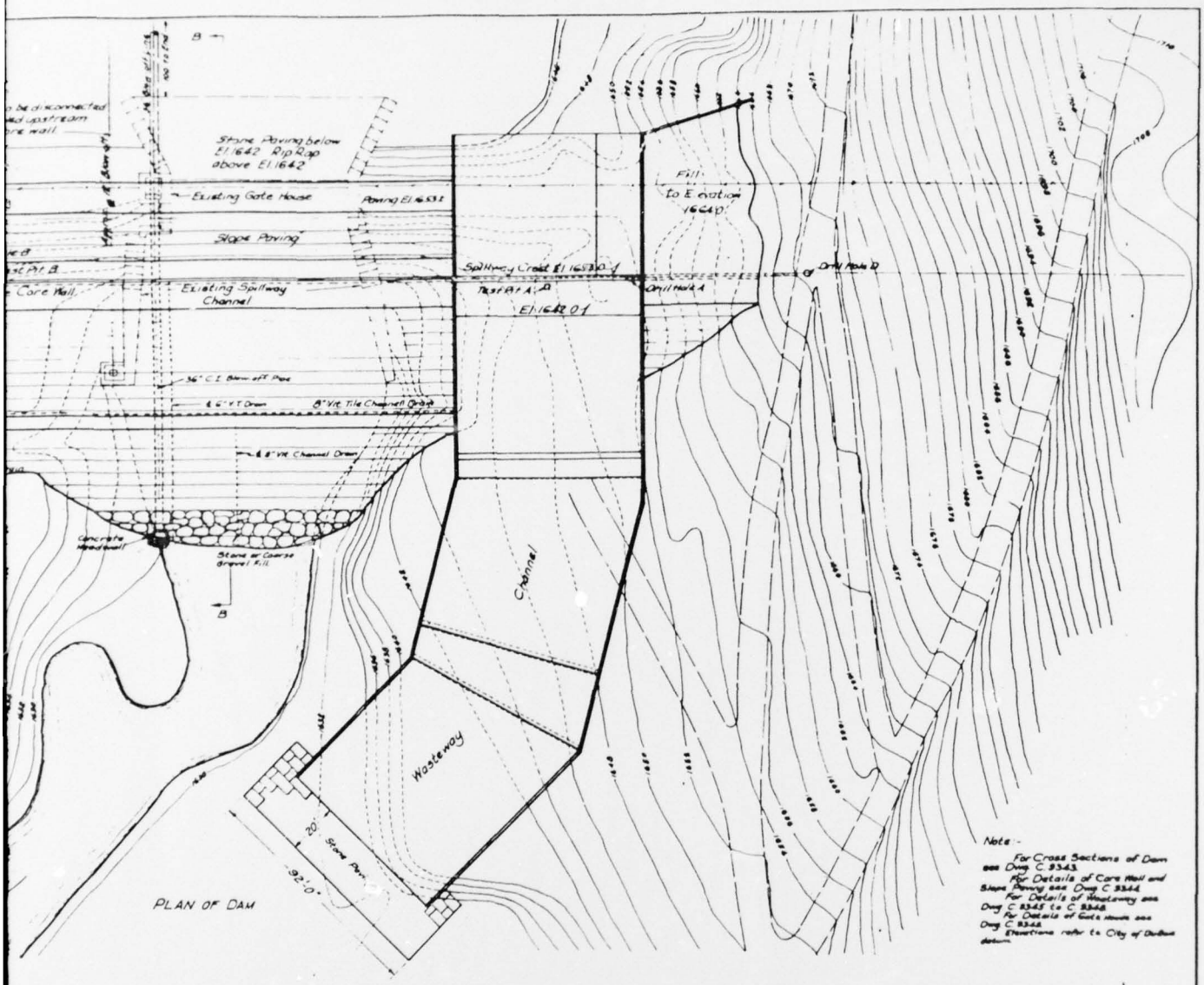
MORRIS KNOWLES
INCORPORATED
ENGINEERS
PITTSBURGH, PA.

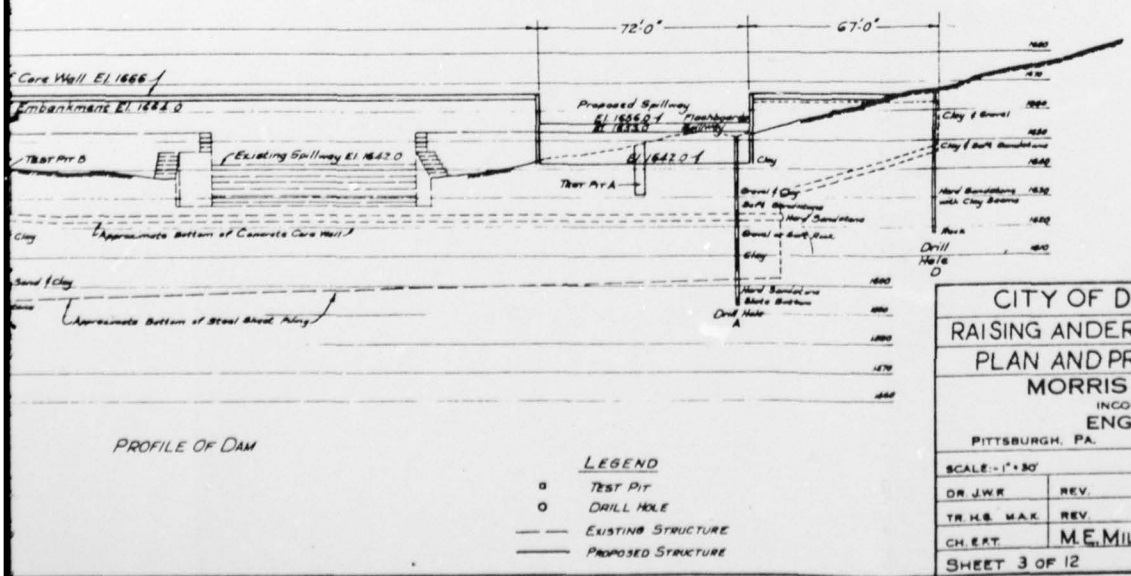
SCALE AS SHOWN		DATE NOV 18 1935
DR W.C.K.	REV 11-30-35	REV
TR W.C.K.	REV	REV
CH'D F.T.	M.E. MILLIREN-CITY ENGINEER	
SHEET 2 OF 11		C-9341

2

FIGURE 1


Existing Pool Surface El 1645.0
Paving El 1653 ±
Proposed Pool Surface El 1656.0
Slope Paving
Drill Hole E
Test Pit C
Drill Hole C
Paving El 1661 ±
8'-3½" Berm El 1661 ±
Drill Hole B
Test Pit B
Concrete Core Wall
11'-0" Berm El 1664.0
Existing Spillway Channel
Existing Gate House
Slope 2½:1 Seeded
8'V.T. Channel Drain
5' Berm El 1667.0
Toe of Embankment
8'Vit. Tile Channel Drain
Stone or Coarse Gravel Fill
Concrete Headwall
36" C.I. Blow-off Pipe
8'Vit. Tile Ch
Stone Paving below El 1642 Rip Rap above El 1642
It line to be disconnected and sealed upstream from core wall.
20'
Stone Paving
92'-0"
PLAN OF DAM
507'-0"
Clay and loose sand stone
Clay & loose rock Hard Sandstone
Drill Hole E
Top of Core Wall El 1666
Top of Embankment El 1662.0
Top of Existing Dam El 1653.0
Test Pit C
Profile of Existing Ground along Core Wall
Test Pit B
Existing Spillway El 1652.0
Clay
Blue Clay & Gravel
Coarse Coarse Sand & Clay
Sand & Clay
Sand & Stone
Drill Hole C
Sand & Clay
Coarse Sand & Clay
Sand & Stone
Approximate Bottom of Concrete Core Wall
Approximate Bottom of Steel Sheet Piling
Drill Hole B
TEST PIT C
El 1643.0
Clay & Gravel
El 1636.0
Yellow Clay
El 1634.8
Fine Sand
TEST PIT B
El 1640.0
Clay & Gravel
El 1630.0
Sand & Blue Clay
El 1628.8
TEST PIT A
El 1648.0
Yellow Clay
El 1634.8
Coarse Sand & Gravel
El 1630.0
PROFILE OF DAM





LEGEND

- ▫ TEST PIT
- ○ DRILL HOLE
- —— EXISTING STRUCTURE
- ——— PROPOSED STRUCTURE

CITY OF DUBOIS PENNA.

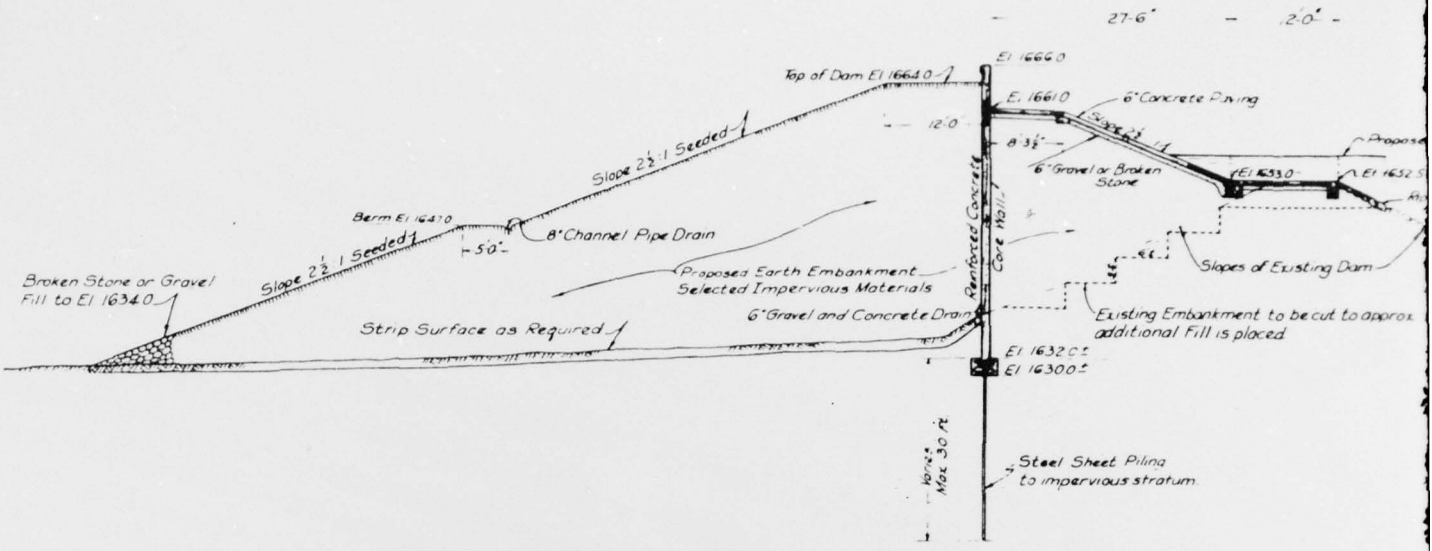
RAISING ANDERSON CREEK DAM.

PLAN AND PROFILE OF DAM.

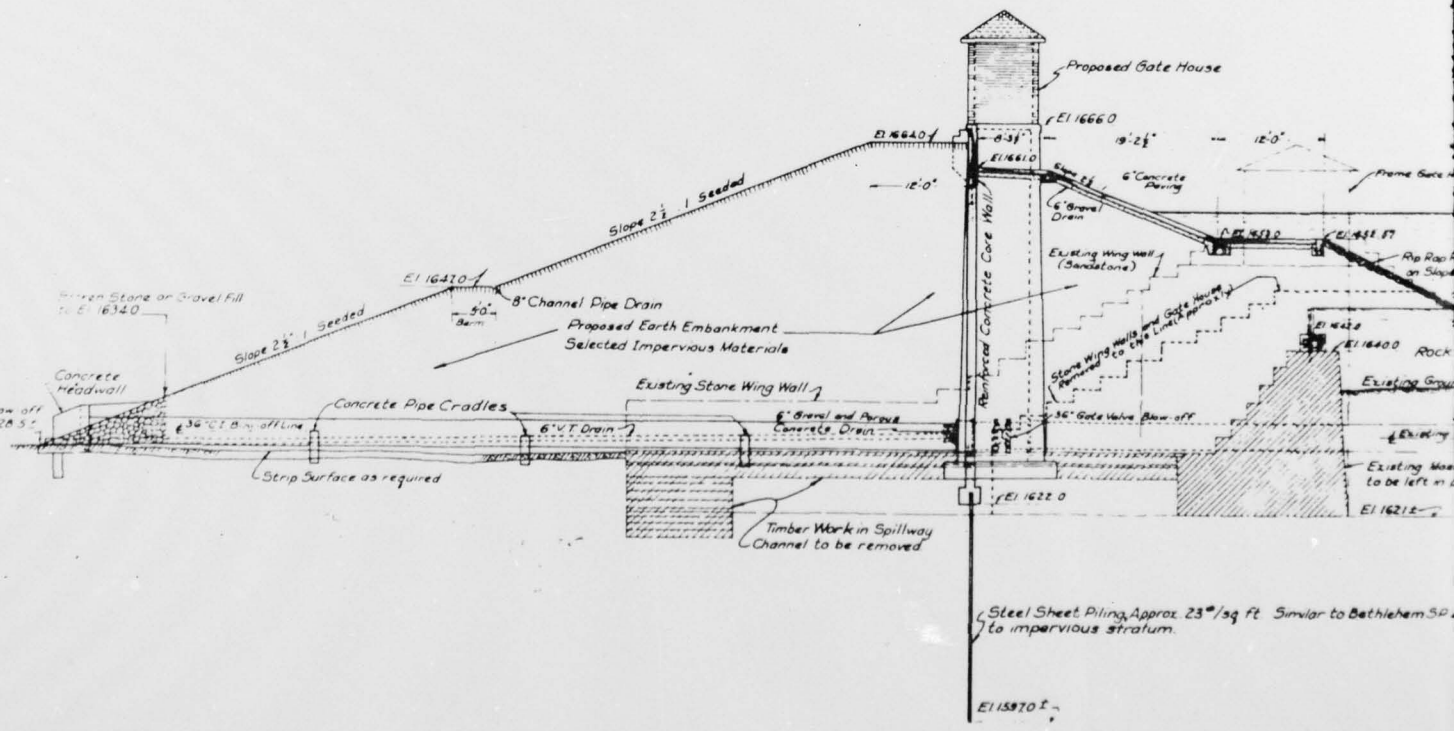
MORRIS KNOWLES
INCORPORATED
ENGINEERS
PITTSBURGH, PA.

SCALE - 1" = 30'		DATE: NOV. 19, 1938
DR. J.W.R.	REV.	REV.
TR. H.S. M.A.K.	REV.	REV.
CH. E.R.T.	M.E. MILLIREN-CITY ENGINEER	
SHEET 3 OF 12		C-9342

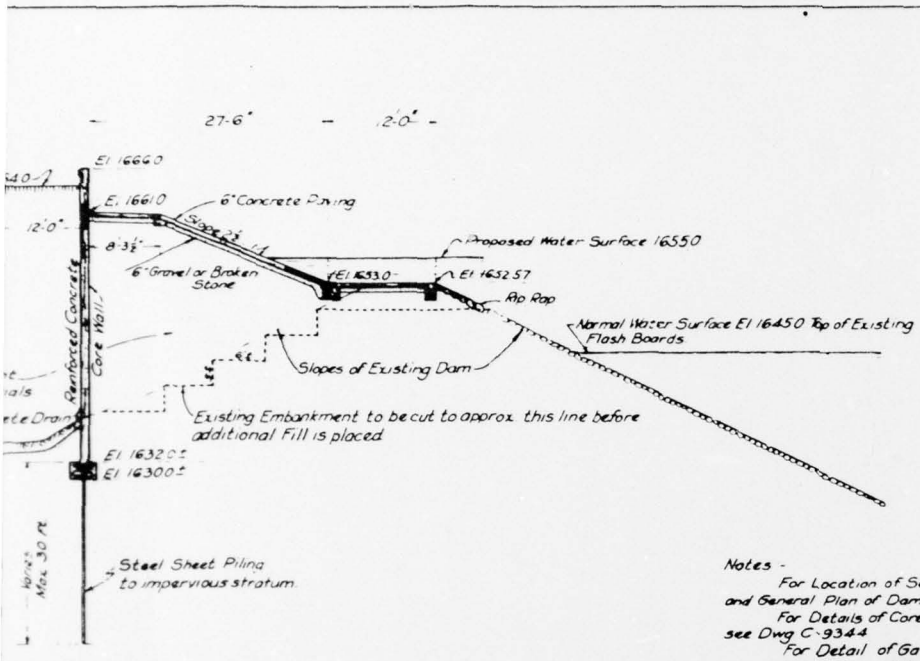
FIGURE 2



TYPICAL SECTION A-A
Scale - 1"=10'-0"

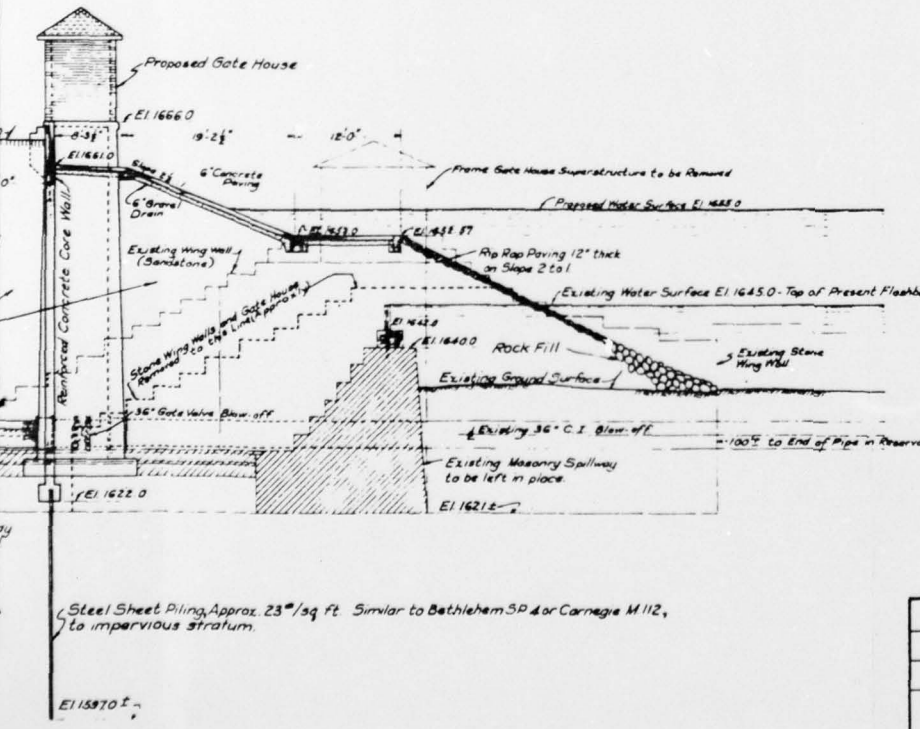


SECTION B-B THROUGH EXISTING SPILLWAY
Scale - 1"=10'-0"



YPICAL SECTION A-A
Scale - 1"=10'-0"

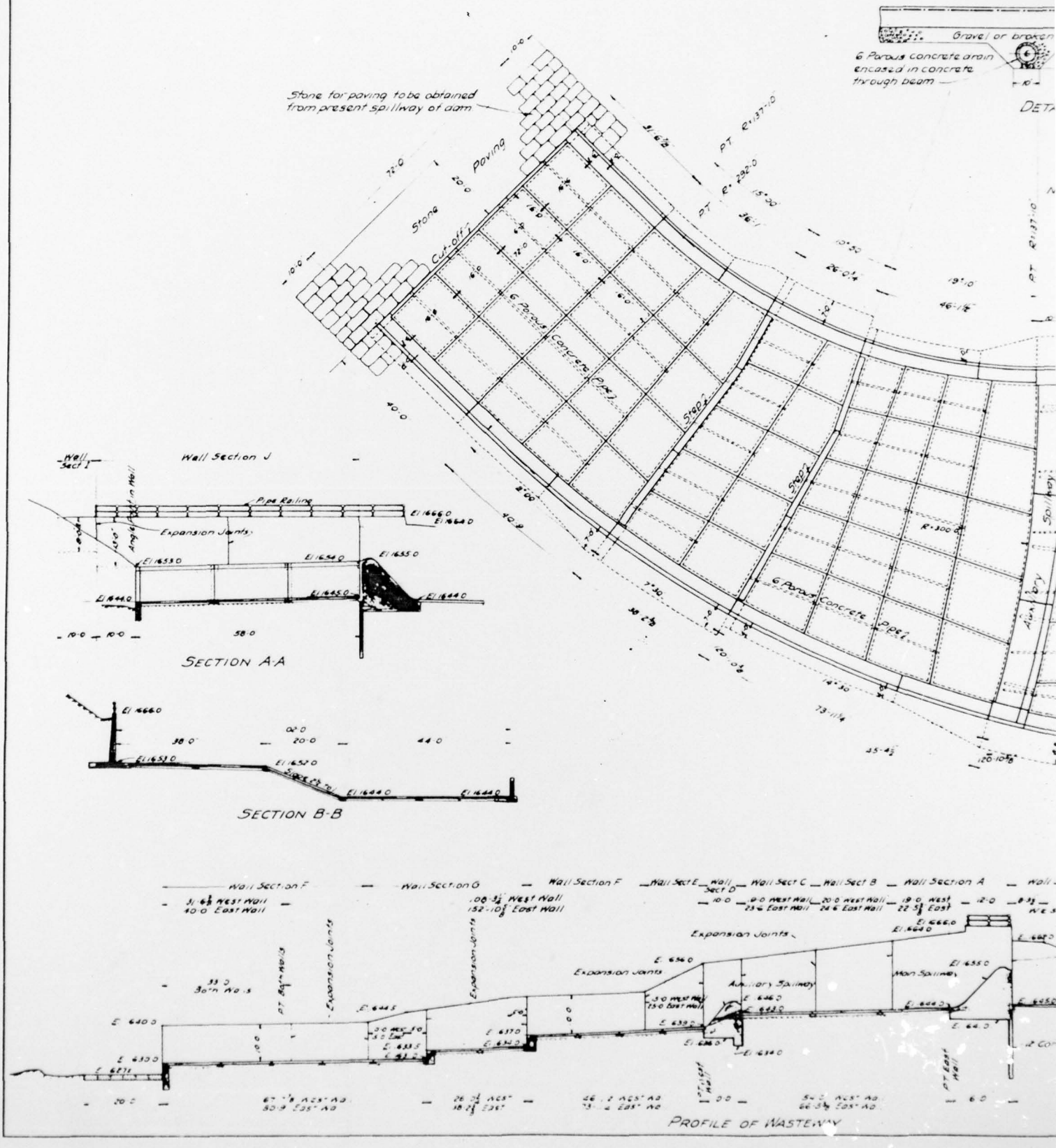
Notes -
For Location of Sections A-A and B-B and General Plan of Dam see Dwg. C-9342
For Details of Core Wall and Slope Paving see Dwg C-9344
For Detail of Gate House see Dwg C-9349
For Details of Spillway and Wasteway see Dwgs C 9345 C 9347 and C 9348

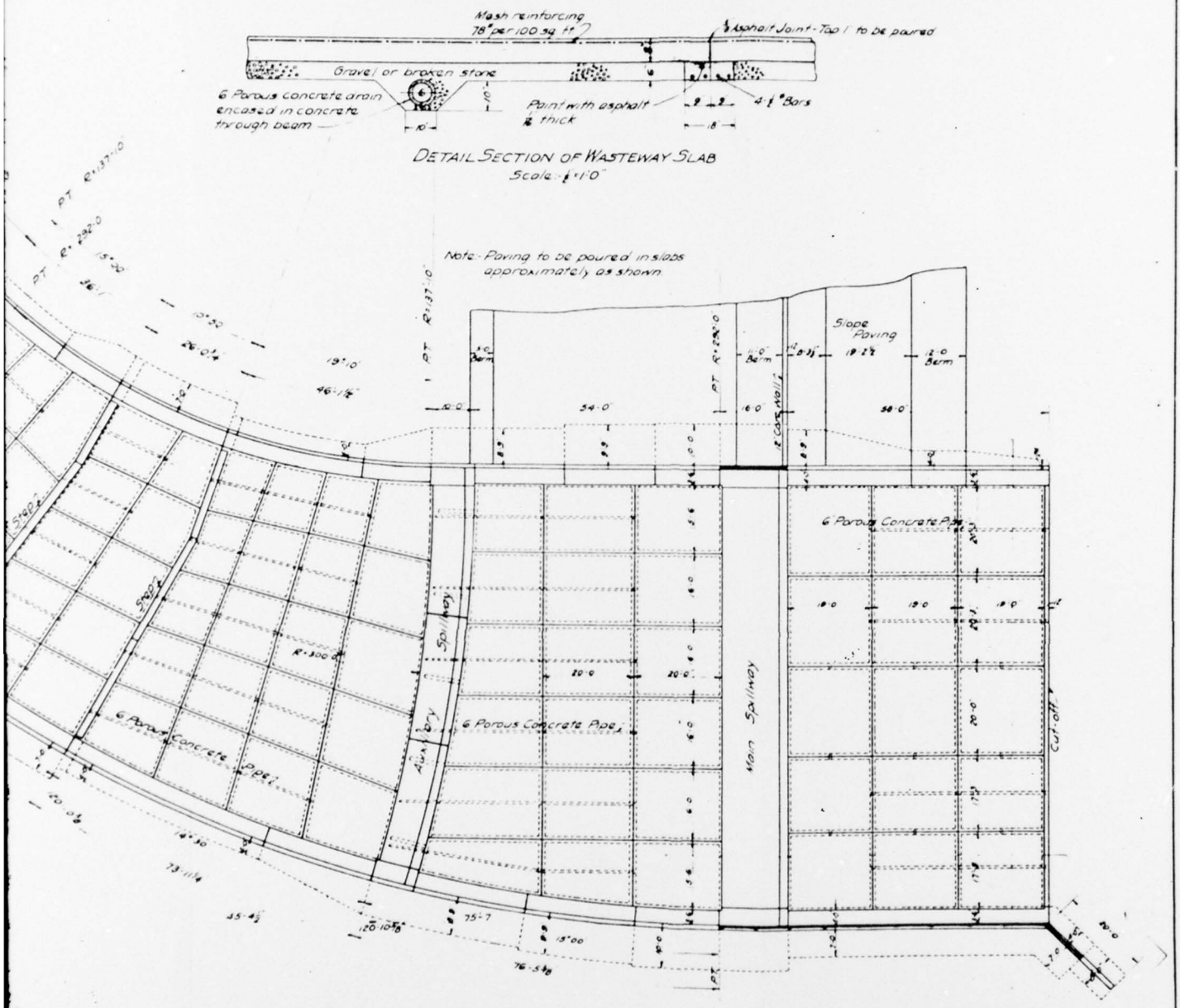


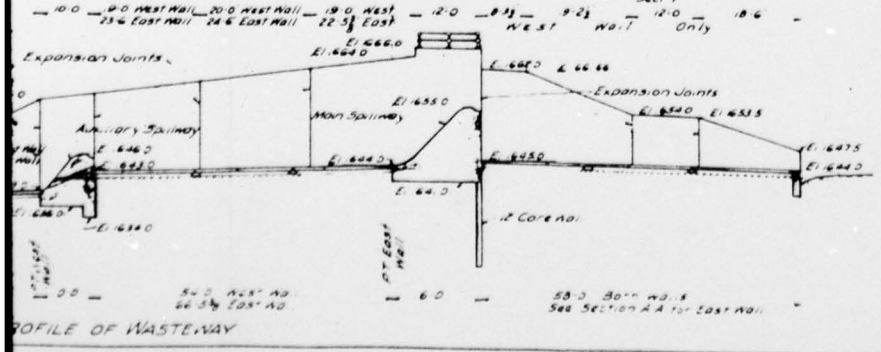
ON B-B THROUGH EXISTING SPILLWAY
Scale - 1"=10'-0"

CITY OF DUBOIS PENNA.		
RAISING ANDERSON CREEK DAM.		
CROSS SECTIONS OF DAM		
MORRIS KNOWLES INCORPORATED ENGINEERS PITTSBURGH, PA.		
SCALE: 1"=10'		DATE: NOV. 15, 1935.
DR. H.G.	REV. 11-30-35	REV.
TR. J.J.C. M.A.K.	REV.	REV.
CH. E.F.T.	M.E. MILLIREN - CITY ENGINEER	
SHEET 4 OF 11		C-9343

FIGURE 3


Gravel or broken
6 Porous concrete drain encased in concrete through beam
Stone for paving to be obtained from present spillway of dam
Paving
Stone
Cut-off
6 Porous Concrete Pipe
Steps
Auxiliary Spillway
Main Spillway
PT R=137.0
PT R=282.0
R=300.0
Wall Sect I
Wall Section J
Pipe Railing
Expansion Joints
El 1666.0
El 1664.0
El 1653.0
El 1654.0
El 1655.0
El 1644.0
El 1645.0
SECTION A-A
El 1660
El 1652.0
SECTION B-B
Wall Section F
Wall Section G
Wall Section E
Wall Sect D
Wall Sect C
Wall Sect B
Wall Section A
Expansion Joints
Auxiliary Spillway
Main Spillway
PROFILE OF WASTEWAY



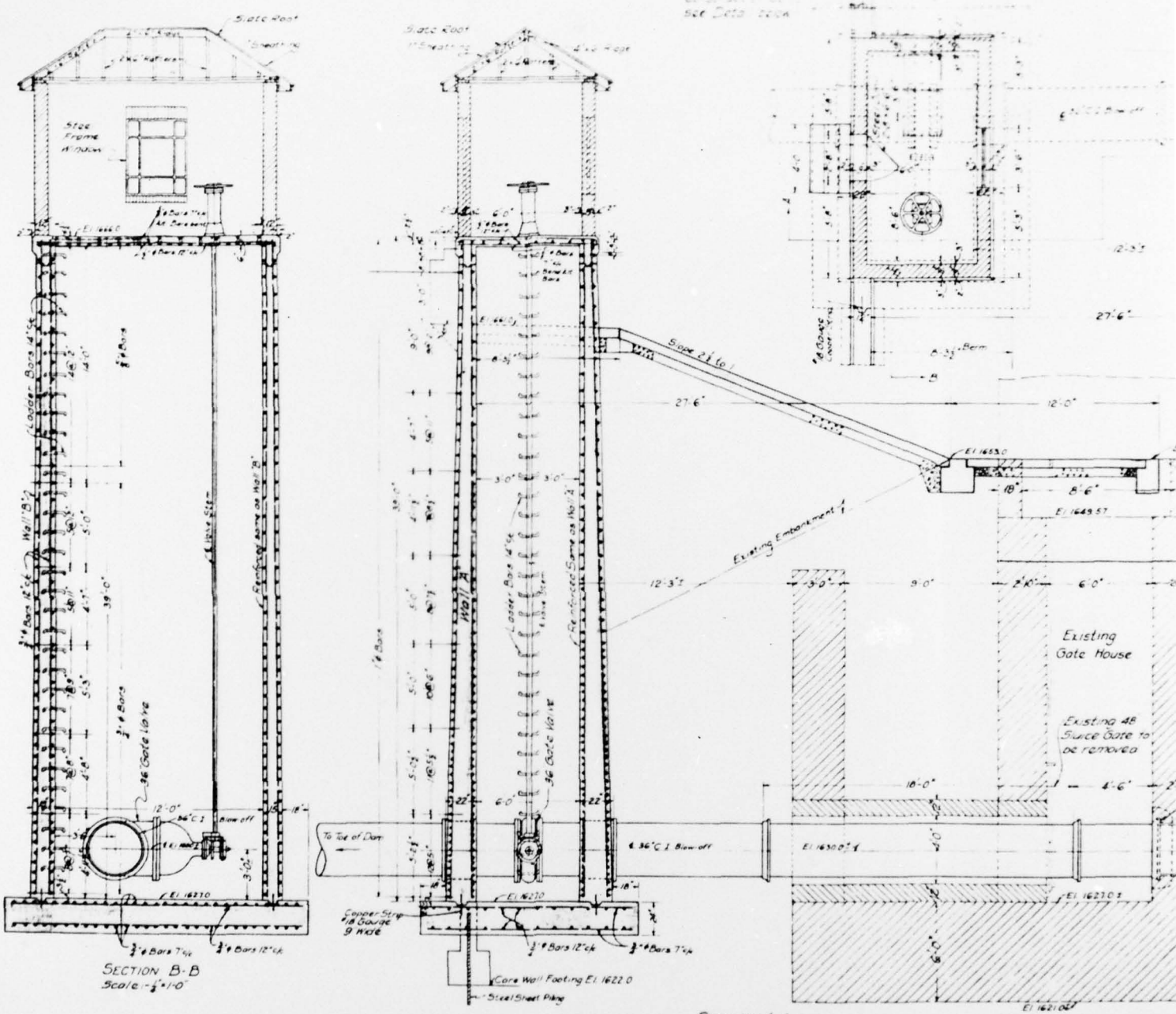


Note:- For location of wasteway see Dwg C-9342
For concrete details of walls, weirs, paving etc, see Dwgs C-9347 and C-9348

CITY OF DUBOIS, PENNA.
RAISING ANDERSON CREEK DAM
PLAN AND PROFILE OF WASTEWAY
MORRIS KNOWLES
INCORPORATED
ENGINEERS
PITTSBURGH PA

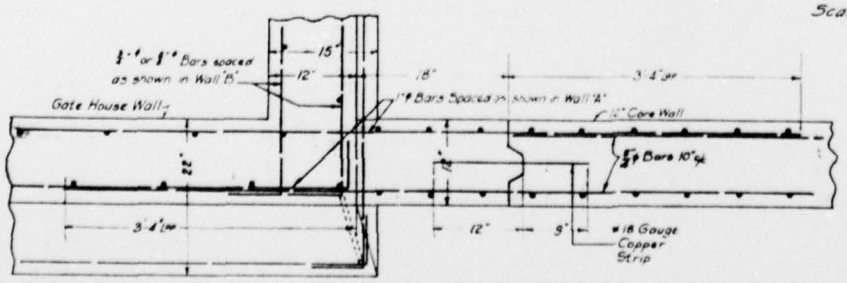
SCALE 1"=10'	DATE NOV. 9, 1935
DRAWING REV 11-30-35	REV
TRACING REV	REV
SHEET	M.E. MILLIREN - CITY ENGINEER
SHEET 6 OF 11	C-9345

FIGURE 4

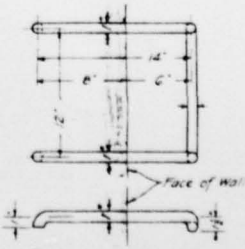


SECTION B-B
Scale: ½"=1'-0"

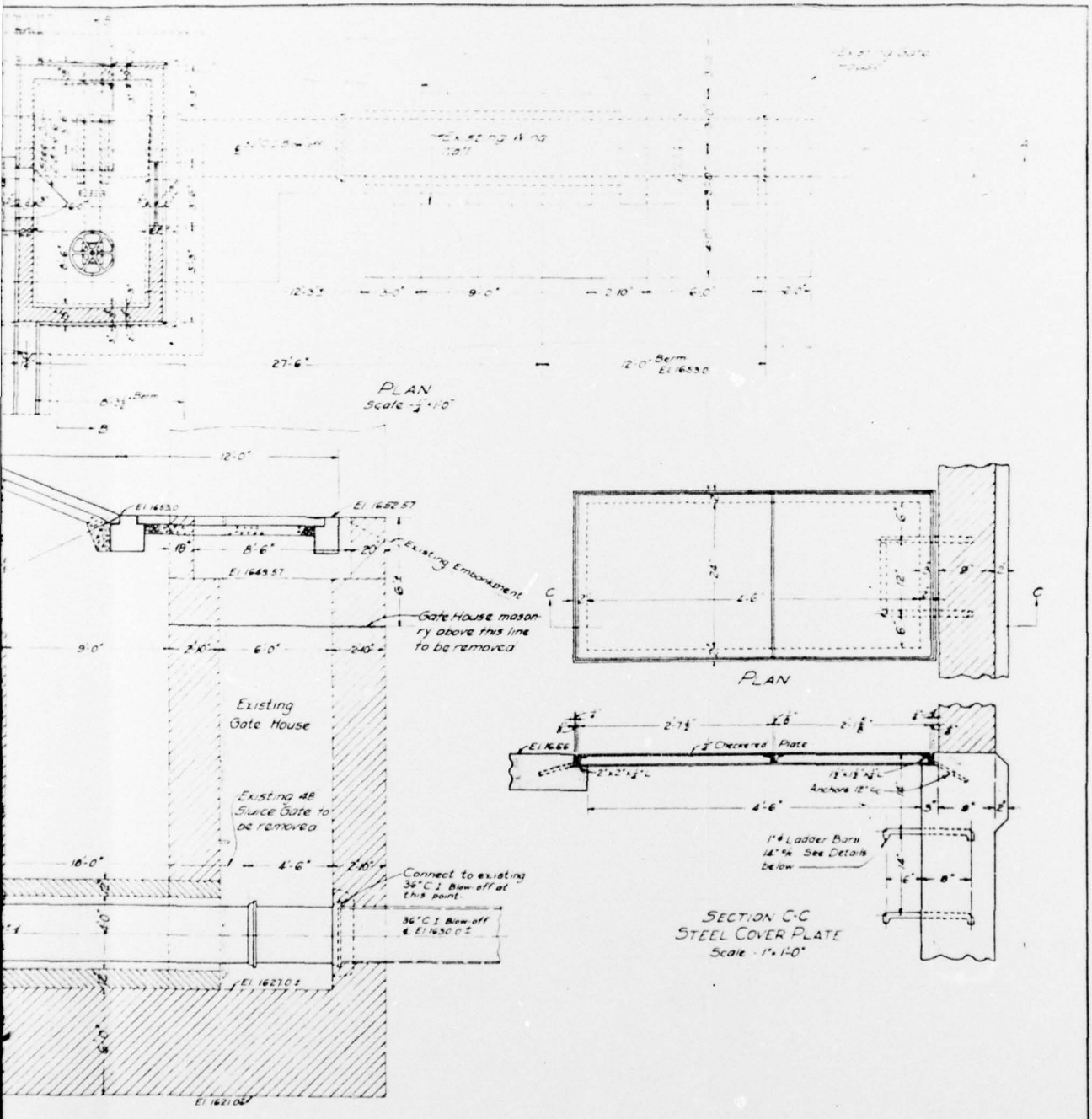
SECTION A-A
Scale: ½"=1'-0"



CORE WALL CONSTRUCTION JOINT AT GATE HOUSE
Scale: 1"=1'-0"



GALV. W1 LADDER BAR
Scale 1½"=1'-0"



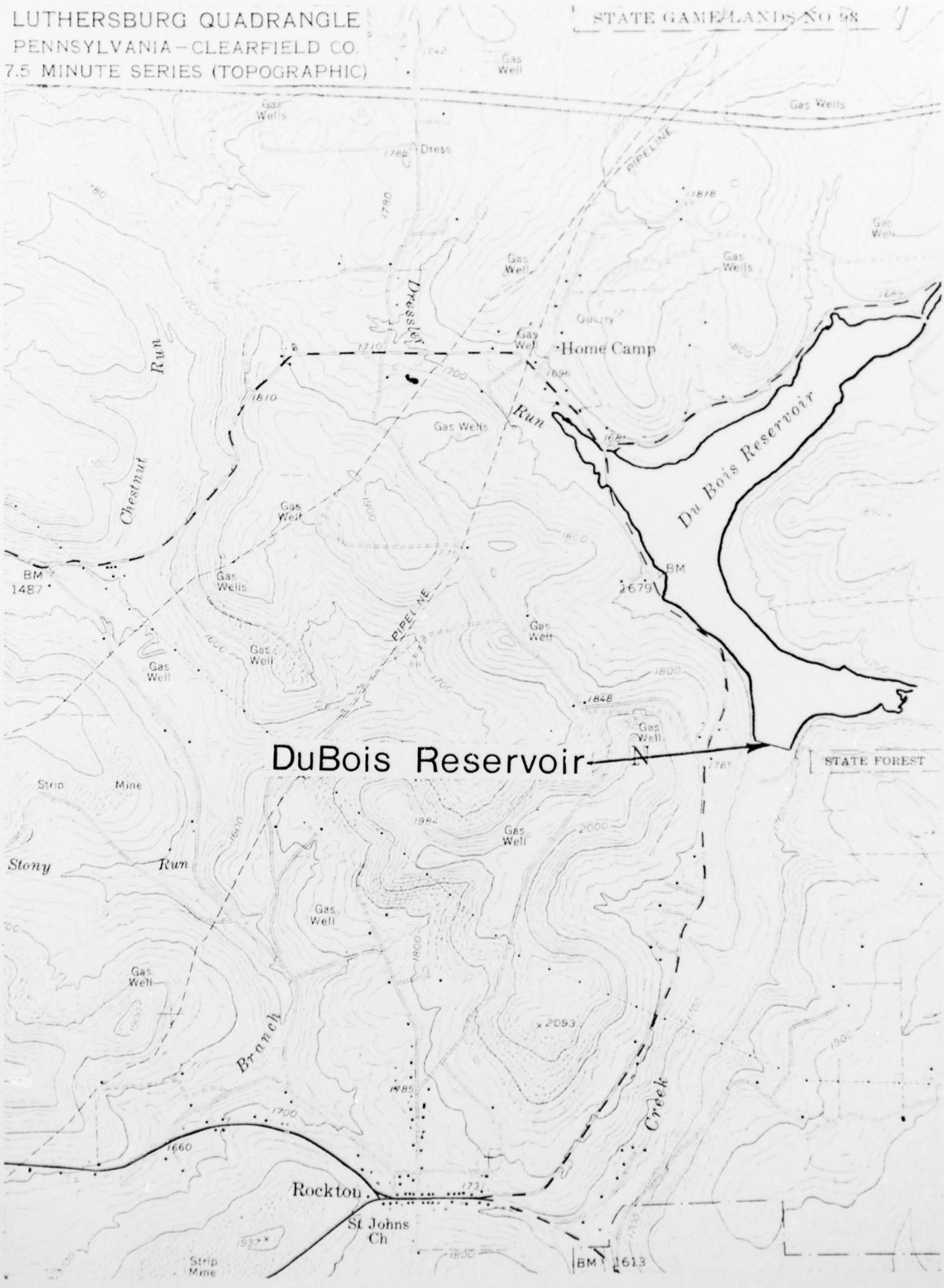
Note - For Location of Gate House see Dwg C-9342.

CITY OF DUBOIS PENNA.		
RAISING ANDERSON CREEK DAM.		
DETAILS OF GATE HOUSE		
MORRIS KNOWLES INCORPORATED ENGINEERS PITTSBURGH, PA.		
SCALE: As shown		DATE: NOV 19, 1935
DR. H.B.	REV. 11-30-35	REV.
TR. J.J.C. - M.A.K.	REV.	REV.
CH. E'ER.	M.E. MILLIREN - CITY ENGINEER	
SHEET 7 OF 11		C-9349

FIGURE 5

APPENDIX G

REGIONAL VICINITY MAP


LUTHERSBURG QUADRANGLE
PENNSYLVANIA – CLEARFIELD CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
STATE GAME LANDS NO 98
DuBois Reservoir
STATE FOREST
Home Camp
Dressler Run
Chestnut Run
Stony Run
Branch
Creek
PIPELINE
Dress
Quarry
Strip Mine
Rockton
St Johns Ch
BM 1487
BM 1679
BM 1613
Gas Well
Gas Wells