OHIO RIVER BASIN

BRANCH SEWICKLEY CREEK, WESTMORELAND COUNTY

PENNSYLVANIA

LEVEL II

MARGUERITE DAM

NDI ID NO. PA-455

DER ID NO. 65-16

~~GERTRUDE GALLAGHER~~

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

Prepared By

L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
EBENSBURG, PENNSYLVANIA
15931

FOR

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

"Original contains color plates: All DTIC reproductions will be in black and white"

JUNE, 1981

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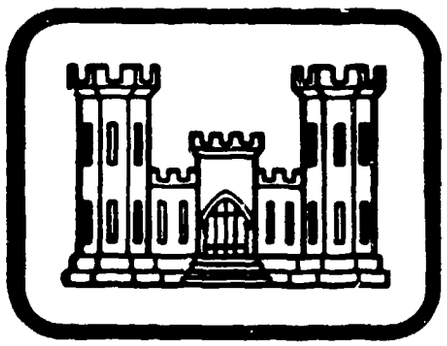

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Contract DACW31-81-C-0012

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PREFACE

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

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in detemining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I REPORT
NATIONAL DAM INSPECTION REPORT

NAME OF DAM	Marguerite Dam
STATE LOCATED	Pennsylvania
COUNTY LOCATED	Westmoreland
STREAM	Branch of Sewickley Creek
DATES OF INSPECTION	March 26, 1981 and May 12, 1981
COORDINATES	Lat: 40° 15.8' Long: 79° 28.3'

ASSESSMENT

The assessment of Marguerite Dam is based upon visual observations made at the time of inspection, review of available records and data, hydraulic and hydrologic computations and past operational performance.

Marguerite Dam appears to be in fair condition and poorly maintained. The stability of the structure is questionable due to the steep downstream slope and the existance of seepage on the downstream slope adjacent to the right spillway wall (left abutment).

The masonry wall located along the upstream face of the dam is collapsing in sections and falling into the reservoir. Cracking of the masonry wall at the right of the approach to the spillway is occurring, and should be repaired. Brush and small trees have been allowed to grow unchecked along the entire downstream slope of the dam.

The entire area along the downstream toe of the dam is wet, and ponding is occuring in the area of the valve pit at the downstream toe. Positive drainage for the ponding should be provided. Seepage noted during the inspection was measured to range from 10 to 15 gallons per minute. The drainline valve is located at the downstream toe of the dam which is considered a deficiency.

The Marguerite Dam is a high hazard-small size dam. The recommended spillway design flood (SDF) for a dam of this size and classification, is in the range of 1/2 PMF to PMF. Since the Marguerite Dam just meets the minimum size criteria; and since the dam is located in a rural area suggesting only appreciable economic loss; compliance with current practice of the Baltimore District Corps of Engineers leads to the selection of the 1/2 PMF as the Spillway Design Flood (SDF). The dam breach analysis, and the downstream routing of the flood wave indicate that the downstream potential for loss of life is not significantly increased from that which existed just prior to failure. The spillway and reservoir are capable of controlling approximately 14% of the PMF, without overtopping the embankment low spot. Based on criteria established by the Corps of Engineers, the spillway is termed inadequate, but not seriously inadequate.

The following recommendations and remedial measures should be instituted immediately.

1. The seepage measured during the inspection ranged from 10 to 15 gallons per minute. A past history of seepage exists for this dam, and the seepage should be monitored for a sufficient period to determine a present day pattern for the seepage. Monitoring should be compared to past recorded data to determine whether seepage has increased from previously recorded data. Seepage data should be reported to a registered professional engineer for analysis and recommendations. If the seepage is assessed as significantly affecting the stability of the structure, a detailed stability and seepage analysis should be conducted by a registered professional engineer knowledgeable in dam design and analysis. Modifications should be completed as required by the analysis.

2. A detailed hydrologic and hydraulic analysis should be conducted by a registered professional engineer knowledgeable in dam design and analysis to increase the spillway capacity.

3. Positive usptream closure should be provided for the drainline, or the line should be plugged and some other means devised to drain the reservoir.

4. The masonry retaining wall along the upstream face of the dam and the masonry walls along the spillway discharge channel should be repaired.

5. The brush and trees should be cleared from the slopes and should be removed in a controlled manner under the direction of a registered professional engineer knowledgeable in dam design and construction.

6. A regularly scheduled maintenance and operating plan should be prepared and implemented to insure the continued safe operation of the structure.

7. A warning system should be developed to warn downstream residents of large spillway discharges or imminent failure of the dam.

8. A safety inspection program should be implemented with inspection at regular intervals by qualified personnel.

MARGUERITE DAM
PA 455

SUBMITTED BY:

L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS AND ARCHITECTS

JUNE 15, 1981
Date

R. Jeffrey Kimball
R. Jeffrey Kimball, P.E.

APPROVED BY:

7 July 81
Date

James W. Peck
JAMES W. PECK
Colonel, Corps of Engineers
Commander and District Engineer

Overview of Marguerite Dam.

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PHASE I
NATIONAL DAM INSPECTION PROGRAM

MARGUERITE DAM
NDI. I.D. NO. PA 455
DER I.D. NO. 65-16

SECTION 1
PROJECT INFORMATION

1.1 General.

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

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

1.2 Description of Project.

a. Dam and Appurtenances. The Marguerite Dam is an earthfill dam, 300 feet long and 18 feet high. The crest of the dam is 14 feet wide. A 4 foot wide bench exists along the upstream edge of the crest. The bench is approximately 1.3 feet lower than the crest elevation. The portion of the crest above the bench area is 10 feet wide. A rubble masonry wall exists along the entire upstream face of the dam. The wall is vertical along the exposed portion. The downstream slope is 1H:1V.

The spillway for the reservoir is located at the left abutment. The spillway is 62 feet wide at the entrance, and reduces to a distance of 34 feet at the outlet. The spillway discharge channel walls are constructed of rubble masonry and the channel bottom consists of concrete.

b. Location. The dam is located on a branch of the Sewickley Creek, approximately 5 miles southwest of Latrobe in Unity Township, Westmoreland County, Pennsylvania. The Marguerite Dam can be located on the Latrobe, U.S.G.S. 7.5 minute quadrangle.

c. Size Classification. The Marguerite Dam is a small size dam (18 feet high, 86 acre-feet).

d. Hazard Classification. The Marguerite Dam is a high hazard dam. Downstream conditions indicate that the loss of more than a few lives and property damage is probable should the structure fail. Several homes are located approximately 1 mile downstream of the dam.

One home is located approximately on the 1020 contour. An additional home is located within two miles of the dam adjacent to the stream.

e. Ownership. The Marguerite Dam is owned by Mrs. Gertrude Gallagher. Correspondence should be addressed to:

Mrs. Gertrude Gallagher
R.D. #5 Box 204
Greensburg, Pennsylvania 15601
412/423-2683

f. Purpose of Dam. The dam was originally constructed for the purpose of supplying water for industrial purposes at the Marguerite Coke Plant of the H.C. Frick Coke Company. Ownership of the dam changed in 1948, and since that time, the dam has been used for recreation.

g. Design and Construction History. Based on information contained in the PennDER files, the dam was constructed around 1900. The contractor was Mr. Patrick Reagan. The construction of the dam was supervised by Mr. J.P. Miller, Chief Engineer of the H.C. Frick Coke Company. Information in the DER files suggest that several extensive modifications were made relatively soon after construction of the dam was completed.

Information in the DER files report that late in 1901, the dam was slightly damaged by a severe rainstorm. The dam was not overtopped, but the embankment was damaged due to wave action. As a result, the top of dam was raised 3 feet the following year, making it 5 feet above the spillway. In July 1903, the dam was overtopped. The dam, puddle core, and part of the spillway channel were damaged. Information suggests that the reservoir was practically emptied, but there was no record of downstream damage. Subsequent to the 1903 failure, the puddle wall and dam were repaired, and correspondence suggests that the downstream portion of the embankment was increased by 25%. The length of the spillway was also increased approximately 50%. At that time, the channel was paved, grouted, and masonry walls were built. Information in the DER files suggest that the work was completed under the direction of the Chief Engineer for the H.C. Frick Coke Company, and the reconstruction of the dam was completed by a contractor from Fairchance, Pennsylvania. The present dam appears to resemble the 1903 modifications. However, no information is available as to the reference datum used in the 1915 spillway drawings included in the Appendix of this report.

h. Normal Operating Procedures. The reservoir is no longer used as a water supply. No operations have been conducted at the dam for many years. The dam is presently used as a fee fishing pond.

1.3 Pertinent Data.

a. Drainage Area. 1.8 square miles

b. Discharge at Dam Site (cfs).

Maximum known flood at dam site	Unknown
Drainline capacity at normal pool	Unknown
Spillway capacity at top of dam	853

c. Elevation (M.S.L.) (feet). - Field survey based on an assumed spillway crest elevation, 1064 from U.S.G.S. quadrangle.

Top of dam - low point	1066.7
Top of dam - design height	Unknown
Pool at time of inspection	1064
Spillway crest	1064.0
Maximum pool - design surcharge	Unknown
Normal pool	1064.0
Upstream portal - 8" cast iron pipe	Unknown
Downstream portal - 8" cast iron pipe	1049.0
Streambed at centerline of dam	Unknown
Maximum tailwater	Unknown
Toe of dam	1048.3

d. Reservoir (feet).

Length of maximum pool	2500
Length of normal pool	1500

e. Storage (acre-feet).

Normal pool	48
Top of dam	86

f. Reservoir Surface (acres).

Top of dam	16
Normal pool	12
Spillway crest	12

g. Dam.

Type	Earthfill
Length (including spillway)	300 feet
Height	18 feet
Top width	14 feet
Side slopes - upstream	Vertical Masonry wall (exposed portion)
- downstream	1H:1V

Zoning	Unknown
Impervious core	4 foot wide puddle core
Cutoff	Yes
Grout curtain	Unknown

h. Reservoir Drain.

Type	8" cast iron pipe
Length	Approximately 70 feet
Closure	Gate valve
Access	Valve near downstream toe
Regulating facilities	8" gate valve

i. Spillway.

Type	Concrete lined broad crest
Length of crest	62 feet
Crest elevation	1064.0
Upstream channel	Lake (unrestricted)
Downstream channel	Branch of Sewickley Creek

SECTION 2
ENGINEERING DATA

2.1 Design. Review of available information in the files of the Commonwealth of Pennsylvania, Department of Environmental Resources, revealed that some correspondence, permit information, pictures, and one drawing of the spillway modifications were available. The design of the dam was completed by Mr. J.K. Miller, Chief Engineer of the H.C. Frick Coke Company. No additional information was available from the owner.

2.2 Construction. Only limited information is available relative to the construction of the dam. The dam was constructed of earthfill, and incorporated a 4' thick puddle trench through the centerline of the dam. An 8" cast iron pipe exists through the embankment, and information in the DER files suggest that the pipe was surrounded with concrete in the area of the puddle core. A brick headwall was constructed at the upstream end of the pipe. The original construction of the dam was completed by Mr. Patrick Reagan. The construction associated with the 1903 modifications was completed by Ramage of Fairchance, Pennsylvania. The 1903 modifications included raising the dam and lengthening the spillway weir length to increase the discharge potential of the structure. The spillway was paved and grouted.

2.3 Operation. No operations are presently conducted at the dam. The dam is presently utilized as a fee fishing pond.

2.4 Evaluation.

a. Availability. Engineering data were provided by the PennDER, Bureau of Dams and Waterway Management. The owner of the dam was unable to supply any additional information.

b. Adequacy. This Phase I Report is based on the visual inspection and hydrologic and hydraulic analysis. Sufficient information exists to complete a Phase I Report.

SECTION 3
VISUAL INSPECTION

3.1 Findings.

a. General. The onsite inspection of Marguerite Dam was conducted by personnel of L. Robert Kimball and Associates on March 26, 1981, and May 12, 1981. Mr. Thomas D'Alfonso, representing the Carnegie Regional Office of the Bureau of Dams and Waterway Management, accompanied the inspection team during the March 26, 1981 inspection. The inspection consisted of:

1. Visual inspection of the retaining structure, abutments and toe.
2. Examination of the spillway facilities, exposed portion of any outlet works and other appurtenant works.
3. Observations affecting the runoff potential of the drainage basin.
4. Evaluation of the downstream area hazard potential.

b. Dam. The dam appeared to be in fair condition. From a brief survey conducted during the inspection, it was noted that the low spots on the crest of the dam were located 90 feet from the left abutment and approximately 40 feet from the right abutment. A masonry wall was observed along the upstream face of the dam and portions of the wall were caving into the reservoir near the spillway approach. A 4' wide bench exists along the upstream face of the dam and abuts a second masonry retaining wall ranging from 1.5 to 2 feet in height above the bench. The crest of the dam along the exposed portion of the second retaining wall was measured to be approximately 10 feet. The exposed portions of the masonry walls appeared to be in a deteriorating condition. Portions of the upstream wall had cracked and fallen away from the face of the dam. The crest of the dam was grass covered.

The downstream slope of the dam was measured to be 1H:1V. Brush and trees exist along the entire downstream slope of the embankment. During the inspection of the downstream slope and toe area, it was observed that the entire toe area was wet. A concentrated seepage point was located at the toe near the junction of the embankment and the spillway discharge channel. The measured seepage ranged from 10 to 15 gallons per minute. The seepage caused ponding to occur near the toe of the dam in the area of the drainline outlet. The valve at the end of the drainline was partially submerged. An abandoned weir was located near the outlet for the ponded area. A wet and swampy area exists along the entire downstream toe between the area of the valve and the right abutment.

A township road exists at the right abutment of the dam. Portions of the foundation of an abandoned ice house were visible beyond the downstream toe of the dam near the right abutment contact.

c. Appurtenant Structures. The spillway for the Marguerite Dam is located at the left abutment. The spillway is a concrete paved channel with masonry retaining walls. The channel at the entrance to the spillway was measured to be 62 feet in length. The channel curves around the left abutment of the embankment and the width of the channel at the outlet was measured to be 34 feet. The concrete channel bottom and the masonry channel walls appeared to be in fair condition. Some deterioration of the masonry walls was observed at the approach to the spillway. An open pipe was observed to the left of the outlet for the spillway. No information is available regarding the purpose of the pipe. The pipe was most likely used to supply water to the town of Marguerite, located just east of the Marguerite Reservoir. No deficiencies were observed relative to the pipe and at the time it was not considered a problem.

d. Reservoir Area. The watershed is covered almost equally with forested areas and farmland. The reservoir slopes are moderate and do not appear to be susceptible to landslides, which would affect the storage volume of the reservoir or overtopping of the dam by displacing water.

e. Downstream Channel. The downstream channel for the Marguerite Dam consists of a branch to the Sewickley Creek. The channel is relatively wide for a distance of approximately 1/2 mile downstream of the dam. Approximately 5,000 feet downstream of the dam, one home is located along the right bank of the stream. Several homes are located within 2 miles downstream of the dam which are located adjacent to the stream, within the flood plain.

3.2 Evaluation. In general, the dam and appurtenant structures appear to be in fair condition and poorly maintained. No information was available regarding the last time the drainline valve was operated. The growth of brush and small trees on the downstream slope of the dam have gone unchecked. The brush and trees should be removed from the slope in a controlled manner.

The concentrated seepage area observed during the May 12, 1981 inspection appeared to be discharging approximately the same volume of water as that observed during the March 26, 1981 inspection. A wooden walkway had been placed in the spillway and was observed during the May 12, 1981 inspection. The wooden walkway was not in place during the previous inspection. It is apparent that the walkway was placed in the spillway to allow fisherman to cross the spillway area.

The deteriorating condition of the masonry wall along the upstream face of the dam should be repaired to insure that erosion

along the upstream face of the dam does not occur. The cracks in the masonry wall along the concrete paved waste channel should also be repaired.

The location of the drainline valve (on downstream end of pipe) is considered a deficiency. A positive upstream shut-off should be provided for the drainline. The ponding of water, due to seepage, in the area of the drainline valve has existed since construction of the dam. Positive drainage should be provided for the area. A weir was located at the outlet of the seepage to measure seepage in past years. The weir no longer exists, although the abandoned weir location is readily distinguishable. The seepage should be monitored for a sufficient time to establish the present pattern for seepage and compared with past results on record in the DER files. The monitoring should be completed to determine any change relative to past data.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Procedures. The reservoir is maintained at the spillway crest elevation. The reservoir is no longer used as a water supply dam. No regular operating and maintenance procedures are conducted at the dam.

4.2 Maintenance of the Dam. No planned maintenance schedule exists for the dam.

4.3 Maintenance of Operating Facilities. No operations are conducted at the dam. The dam has not been used as a water supply facility for many years. No planned maintenance schedule exists for the spillway or drainline valve.

4.4 Warning System in Effect. There is no warning system in effect to warn downstream residents of large spillway discharges or imminent failure of the dam.

4.5 Evaluation. Maintenance of the dam and operating facilities is considered poor. A maintenance and operation schedule should be prepared and implemented to insure that continued deterioration of the structure does not occur.

An emergency action plan should be available for every dam in the high and significant category. Such plans should outline actions to be taken by the operator to minimize downstream effects of an emergency, and should include an effective warning system. No emergency action plan has been developed, and the owner should develop such an action plan.

SECTION 5
HYDRAULICS AND HYDROLOGY

5.1 Evaluation of Features.

a. Design Data. Limited information relative to the hydraulic design of the spillway were available. Available information discussed the original design, and references exist concerning only the 1903 modifications.

b. Experience Data. No rainfall, runoff or reservoir level data were available. The dam has apparently experienced at least two damaging storms. Reports indicate that the dam was overtopped during the 1903 storm. No rainfall data was available relative to the past storms.

c. Visual Observations. The spillway appeared to be in fair condition and poorly maintained. No obstructions were observed at the approach to the spillway or in the channel which were considered as being capable of affecting the discharge potential of the spillway.

The low spot elevations on the crest of the dam were determined to be at elevation 1066.7, based on a survey conducted during the inspection. The low spots are located at approximately either end of the earthen embankment section. The location of the low spots can be observed on the planview drawing, located in Appendix A of this report (See Appendix A, A-12).

d. Overtopping Potential. Overtopping potential was investigated through the development of the probable maximum flood (PMF) for the watershed and the subsequent routing of the PMF and fractions of the PMF through the reservoir and spillway.

The Corps of Engineers, Baltimore District, has directed that the HEC-1 Dam Safety Version systemized computer program be utilized. The program was prepared by the Hydrologic Engineering Center (HEC), U.S. Army Corps of Engineers, Davis, California, July 1978. The major methodologies or key input data for this program are discussed briefly in Appendix D.

5.2 Evaluation Assumptions. To enable completion of the hydraulic and hydrologic analysis for this structure, it was necessary to make the following assumptions.

1. The pool elevation in the reservoir prior to the storm was considered to be at the spillway crest elevation, 1064.0.

2. The top of dam was considered to be the low spot elevation, 1066.7.

3. The spillway crest was assumed to be at a constant elevation along the entire crest. The control for the spillway was assumed to be in the location of the entrance to the spillway.

5.3 Summary of Overtopping Analysis. Complete summary sheets for the computer output are presented in Appendix D.

Peak inflow (PMF)	6270 cfs
Peak inflow (1/2 PMF)	3135 cfs
Spillway capacity	835 cfs

a. Spillway Adequacy Rating. The Spillway Design Flood (SDF) is based on the hazard and size classification of the dam. The recommended spillway design flood for a dam of this size and hazard classification is the range of 1/2 PMF to PMF.

No definitive criteria exists to assist the evaluating engineer in selecting a SDF within the given range. The current practice adopted by the Baltimore District Corp of Engineers relates the selection of a Spillway Design Flood to the size and storage potential of the dam.

The Baltimore District Corps of Engineers has determined that the SDF be selected at the lesser value (1/2 PMF) of the 1/2 PMF to PMF range for high hazard dams which barely meet the minimum storage or height criteria (size classification), and which are located in rural areas.

Since the Marguerite Dam just meets the minimum size criteria; and since the dam is located in a rural area suggesting only appreciable economic loss; compliance with current practice of the Baltimore District Corps of Engineers leads to the selection of the 1/2 PMF as the Spillway Design Flood (SDF).

Based on the following definition provided by the Corps of Engineers, the spillway is rated as inadequate as a result of our hydrologic analysis.

Inadequate - All high hazard dams which do not pass the spillway design flood (1/2 PMF).

The spillway and reservoir are capable of controlling approximately 14% of the PMF, without overtopping the embankment.

5.4 Summary of Dam Breach Analysis. As the subject dam cannot satisfactorily pass 50% of the PMF, it was necessary to perform a dam breach analysis, and downstream routing of the flood wave. This analysis determined the degree of increased flooding due to dam failure. A pool elevation of 1067.5, representing 0.80 foot of overtopping, was considered sufficient to cause failure of the dam due to overtopping.

The results of the dam breach analysis indicate that the downstream potential for loss of life and property damage is not significantly increased by dam failure. Therefore, the spillway is rated as inadequate, but not seriously inadequate. Details of the downstream routing of the flood wave are included in the Appendix D.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations. A concentrated seepage point was observed near the downstream toe, at the junction of the embankment and the right spillway channel wall. The seepage was measured to be in the range of 10 to 15 gallons per minute. The top elevation of the seepage was determined to be at elevation 1051.8. Information in the DER files suggest that seepage has existed since construction of the dam was completed around 1900. Owners of the dam at that time were required to submit information to the Water Supply Commission regarding seepage measurements taken at the dam. The monitoring program began sometime during 1915, and was discontinued on January 1, 1917. A 1919 dam inspection report completed by the state contained remarks relative to the seepage. Remarks in the inspection report estimate the seepage during the period of inspection at approximately 100,000 gallons per day (approximately 69 gallons per minute). The estimated seepage reportedly represented a marked increase over the seepage, as measured and reported during the period 1915 through 1916. The Standard Water Company was again required to submit measurements to the Commission, as indicated by a July 22, 1919 letter to the Standard Water Company. Records of the seepage measurements are contained in the DER files and represent a period of measurement from August 1, 1919 through December 1, 1919. The highest seepage value recorded occurred on December 1, 1919. The seepage was measured to be 185 gallons per minute. The average seepage through the period, based on available data, appears to have been approximately 30 gallons per minute.

No major erosion areas were observed during the inspection. Portions of the masonry retaining wall located along the upstream face of the dam have fallen into the reservoir. Portions of the masonry retaining wall along the spillway channel are cracked.

Ponding of water, due to seepage at the downstream toe of the dam, should be allowed to drain from the area. The seepage should be monitored for sufficient duration in order to compare the seepage to past data on record.

b. Design and Construction Data. Limited information on the original design of the dam was available in the DER files. The existing dam appears to have been the result of the modifications made to the dam in 1903. The spillway was widened at that time.

A 4' wide puddle trench was constructed along the centerline of the embankment, and founded on relatively stiff gravel material. The construction of the 8" line through the embankment included the encasement of the pipe in concrete through the puddle trench.

The dam was designed by the Chief Engineer for the Standard Water Company. Original construction was completed in 1900 by Mr. Patrick Reagan, Contractor. 1903 modifications made to the dam were designed by the same engineer, and the construction was reportedly completed by Ramage of Fairchance, Pennsylvania.

c. Operating Records. No operating records exist for this dam.

d. Post Construction Changes. Based on information contained in the DER files, modifications were made to the dam in 1903. The modifications to the dam reportedly included raising the dam and increasing the spillway discharge capacity. The modifications to the dam were required due to damage to the structure from overtopping of the dam, resulting from a July 1903 storm.

e. Evaluation. The steep downstream slope of the dam, general wet condition of the toe and observed seepage at the left abutment of the dam tend to make the static stability of the structure questionable. No slumping or sliding of the embankment was observed during the inspection which would indicate any immediate structural deficiency. A final assessment of the static stability of the structure should be made if the observed seepage is judged to be a critical factor affecting the stability. If the seepage is not considered as seriously affecting the structure, the static stability should not be questioned based on the condition.

f. Seismic Stability. The dam is located in seismic zone 1. No known seismic stability analyses have been performed. Due to the relatively steep downstream slope of the dam, the observed seepage, and general wet condition of the toe area, the stability of the structure, based on current guidelines, is questionable. Therefore, no assessment of the seismic stability of the structure can be made at this time.

SECTION 7
ASSESSMENT AND RECOMMENDATIONS/REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety. The Marguerite Dam appears to be in fair condition and poorly maintained. The steep downstream slope of the dam, the observed seepage, and general wet condition of the toe area indicates the stability of the structure is questionable.

The shutoff for the drainline valve is located at the downstream toe of the dam. This is considered a deficiency. Positive closure should be provided for the drainline. The valve at the downstream toe of the dam is partially submerged due to seepage occurring approximately 50 feet left of the valve, near the downstream toe of the dam.

The Marguerite Dam is a high hazard-small size dam. The recommended spillway design flood (SDF) for a dam of this size and classification, is in the range of 1/2 PMF to PMF. Since the Marguerite Dam just meets the minimum size criteria; and since the dam is located in a rural area suggesting only appreciable economic loss; compliance with current practice of the Baltimore District Corpsof Engineers leads to the selection of the 1/2 PMF as the Spillway Design Flood (SDF).

The visual observations, review of available data, hydrologic and hydraulic calculations and past operational performance indicate that the Marguerite Dam is capable of controlling approximately 14% of the PMF. The breach analysis and downstream routing of the flood wave did not indicate an increased potential for loss of life from that which existed just prior to failure of the dam. Therefore, the spillway is termed inadequate, but not seriously inadequate.

b. Adequacy of Information. Sufficient information is available to complete a Phase I report.

c. Urgency. The recommendations suggested below should be implemented immediately.

d. Necessity for Further Investigation. In order to accomplish some of the recommendations/remedial measures outlined below, further investigations will be required.

7.2 Recommendations/Remedial Measures.

1. The seepage measured during the inspection ranged from 10 to 15 gallons per minute. A past history of seepage exists for this dam, and the seepage should be monitored for a sufficient period to determine a present day pattern for the seepage. Monitoring should be

compared to past recorded data to determine whether seepage has increased from previously recorded data. Seepage data should be reported to a registered professional engineer for analysis and recommendations. If the seepage is assessed as significantly effecting the stability of the structure, a detailed stability and seepage analysis should be conducted by a registered professional engineer knowledgeable in dam design and analysis. Modifications should be completed as required by the analysis.

2. A detailed hydrologic and hydraulic analysis should be conducted by a registered professional engineer knowledgeable in dam design and analysis to increase the spillway capacity.

3. Positive upstream closure should be provided for the drainline, or the line should be plugged and some other means devised to drain the reservoir.

4. The masonry retaining wall along the upstream face of the dam and the masonry walls along the spillway discharge channel should be repaired.

5. The brush and trees should be cleared from the slopes and should be removed in a controlled manner under the direction of a registered professional engineer knowledgeable in dam design and construction.

6. A regularly scheduled maintenance and operating plan should be prepared and implemented to insure the continued safe operation of the structure.

7. A warning system should be developed to warn downstream residents of large spillway discharges or imminent failure of the dam.

8. A safety inspection program should be implemented with inspection at regular intervals by qualified personnel.

APPENDIX A
CHECKLIST, VISUAL INSPECTION, PHASE I

CHECK LIST
VISUAL INSPECTION
PHASE I

NAME OF DAM Marguerite Dam COUNTY Westmoreland STATE Pennsylvania ID# 455

TYPE OF DAM Earthfill HAZARD CATEGORY High

DATE(s) INSPECTION March 26, 1981 WEATHER Overcast and cold TEMPERATURE 35°
May 12, 1981 Clear and warm 60°

POOL ELEVATION AT TIME OF INSPECTION 1064.1 M.S.L. TAILWATER AT TIME OF INSPECTION 1050.9 M.S.L.

A-1

INSPECTION PERSONNEL:

R. Jeffrey Kimball, P.E. - L. Robert Kimball and Associates

James T. Hockensmith - L. Robert Kimball and Associates

O.T. McConnell - L. Robert Kimball and Associates

Mr. Thomas D'Alphonso - Carnegie Regional Office, Bureau of Dams and Waterway Management

O.T. McConnell
RECORDER

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	Minor cracks in area of caving of upstream masonry wall.	The masonry wall along the upstream face of the dam should be repaired.
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None noted.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Portions of the embankment are exposed due to caving in of the masonry wall along the upstream face of the dam.	Masonry wall should be repaired, thus protecting the exposed embankment.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Appears to be all right.	
RIPRAP FAILURES	Not applicable.	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
VEGETATION	Brush and small trees exist on the entire downstream slope of the dam.	The brush and trees should be removed in a controlled manner.
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Concentrated seepage point observed at junction of embankment and right spillway wall. Seepage measured to range from 10 to 15 gallons per minute.	Seepage should be monitored.
ANY NOTICEABLE SEEPAGE	10 to 15 gallons per minute.	See Appendix A, [A-12].
STAFF GAUGE AND RECORDER	None.	
DRAINS	None.	

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE	Not applicable.	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	Not applicable.	
DRAINS	Not applicable.	
WATER PASSAGES	Not applicable.	
FOUNDATION	Not applicable.	

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	Not applicable.	
STRUCTURAL CRACKING	Not applicable.	
VERTICAL AND HORIZONTAL ALIGNMENT	Not applicable.	
MONOLITH JOINTS	Not applicable.	
CONSTRUCTION JOINTS	Not applicable.	
STAFF GAUGE OR RECORDER	Not applicable.	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Not applicable.	
INTAKE STRUCTURE	Not observed.	
OUTLET STRUCTURE	None. Valve at downstream end of pipe.	
OUTLET CHANNEL	No defined channel.	
EMERGENCY GATE	Valve on downstream end of 8" cast iron pipe.	Positive upstream closure should be provided for the 8" line, or the pipe should be plugged and some other means to devised to drain the reservoir.

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Concrete appears to be in fair condition. Spillway discharge channel consists of concrete paved channel bottom, with masonry channel walls.	The masonry channel wall should be repaired. The wall shows signs of deterioration along the right channel wall at the approach to the spillway.
APPROACH CHANNEL	Lake [unrestricted].	
DISCHARGE CHANNEL	Concrete lined discharge channel, with masonry spillway walls. Discharges from the spillway outlet beyond the toe of the dam.	
BRIDGE AND PIERS	None.	

GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	Not applicable.	
APPROACH CHANNEL	Not applicable.	
DISCHARGE CHANNEL	Not applicable.	
BRIDGE AND PIERS	Not applicable.	
GATES AND OPERATION EQUIPMENT	Not applicable.	

DOWNSTREAM CHANNEL

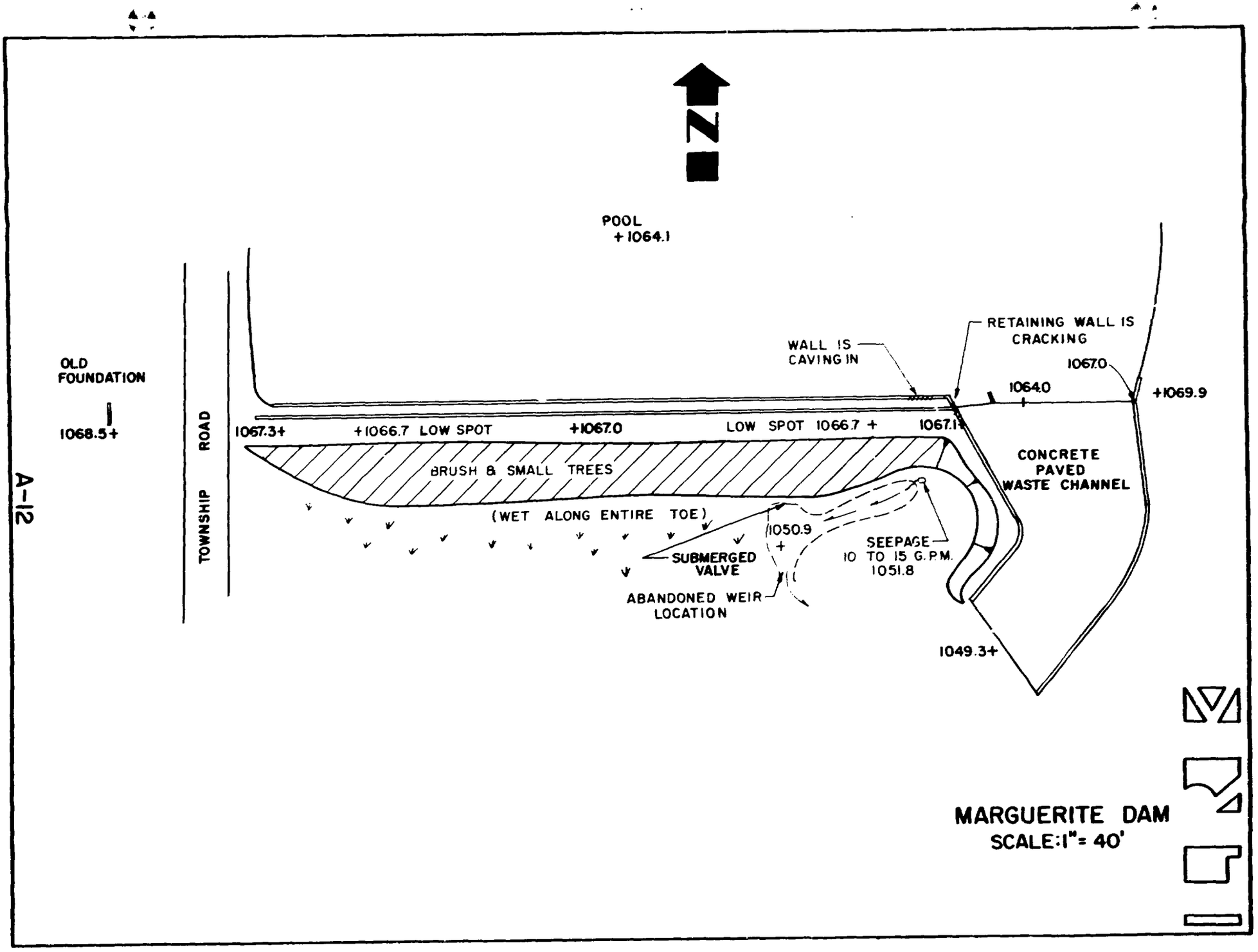
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	The spillway discharge channel for the Marguerite Dam consists of a concrete lined discharge channel, with masonry channel walls. Flows through the spillway discharge beyond the downstream toe of the dam, into a branch of Sewickley Creek. No major obstructions noted in the downstream channel.	
SLOPES	Appear to be stable.	
APPROXIMATE NO. OF HOMES AND POPULATION	One home located 5,000 feet downstream of the dam. Residents of the home estimated at 4 people.	The house is located about five feet above the streambed. The foundation elevation is located approximately on the 1020 contour.

RESERVOIR

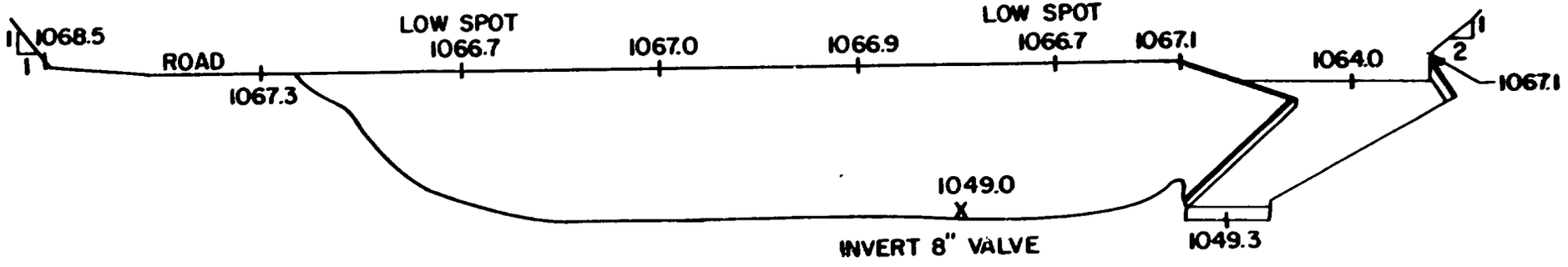
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Moderate.	
SEDIMENTATION	Unknown.	

INSTRUMENTATION

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None.	
OBSERVATION WELLS	None.	
WEIRS	Abandoned weir observed at outlet of ponding beyond downstream toe of dam.	Past records of monitoring available in DER files.
PIEZOMETERS	None.	
OTHER	None.	


N
POOL
+1064.1
OLD
FOUNDATION
1068.5+
TOWNSHIP ROAD
WALL IS
CAVING IN
RETAINING WALL IS
CRACKING
1067.0
1064.0
+1069.9
1067.3+
+1066.7 LOW SPOT
+1067.0
LOW SPOT 1066.7 +
1067.1+
BRUSH & SMALL TREES
CONCRETE
PAVED
WASTE CHANNEL
(WET ALONG ENTIRE TOE)
1050.9
+
SUBMERGED
VALVE
SEEPAGE
10 TO 15 G.P.M.
1051.8
ABANDONED WEIR
LOCATION
1049.3+
MARGUERITE DAM
SCALE: 1" = 40'

A-12



PROFILE
LOOKING UPSTREAM
SCALE: HORIZ. 1" = 40'
VERT. 1" = 20'

MARGUERITE DAM

APPENDIX B
CHECKLIST, ENGINEERING DATA, DESIGN, CONSTRUCTION, OPERATION, PHASE I

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM Marguerite Dam

ID# PA 455

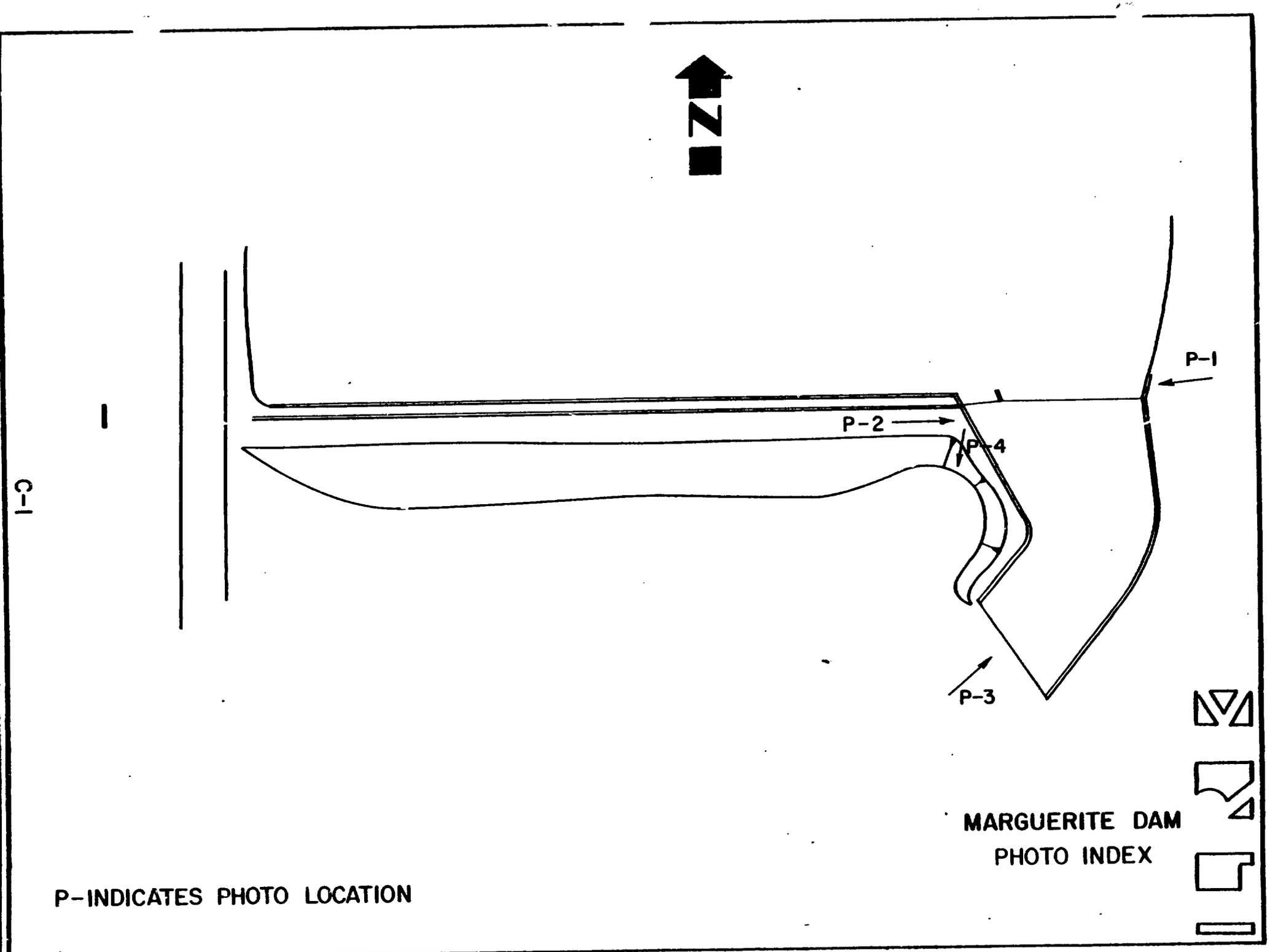
ITEM	REMARKS
AS-BUILT DRAWINGS	None.
REGIONAL VICINITY MAP	U.S.G.S. quadrangle.
CONSTRUCTION HISTORY	Information available in DER files.
TYPICAL SECTIONS OF DAM	Available in DER files.
OUTLETS - PLAN - DETAILS - CONSTRAINTS - DISCHARGE RATINGS RAINFALL/RESERVOIR RECORDS	None. None. None. Limited data in DER files. None.

ITEM	REMARKS
DESIGN REPORTS	None.
GEOLOGY REPORTS	None.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None. Limited data in DER files. None.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None.
POST-CONSTRUCTION SURVEYS OF DAM	None.
BORROW SOURCES	Unknown.

ITEM	REMARKS
MONITORING SYSTEMS	None.
MODIFICATIONS	Structure modified shortly after construction. Modifications to dam and spillway occurred in 1903.
HIGH POOL RECORDS	None.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	Limited references to modifications in DER files.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	Failure of the dam occurred in 1903. Information in DER files suggest that the dam was damaged due to overtopping. The spillway was destroyed. No information relative to significant downstream damage.
MAINTENANCE OPERATION RECORDS	None.

ITEM	REMARKS
SPILLWAY PLAN SECTIONS DETAILS	See Appendix E.
OPERATING EQUIPMENT PLANS & DETAILS	None.

APPENDIX C
PHOTOGRAPHS



MARGUERITE DAM
PHOTO INDEX

P-INDICATES PHOTO LOCATION

MARGUERITE DAM
PA 455

Sheet 1

Front

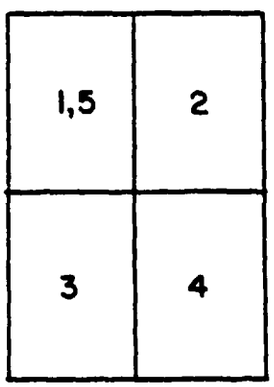
1. Upper left - Overview of crest, right spillway approach wall and partial view of masonry wall at upstream face of dam. View towards the right abutment.
2. Upper right - Spillway crest.
3. Lower left - Spillway discharge channel outlet.
4. Lower right - Seepage area as viewed from crest.

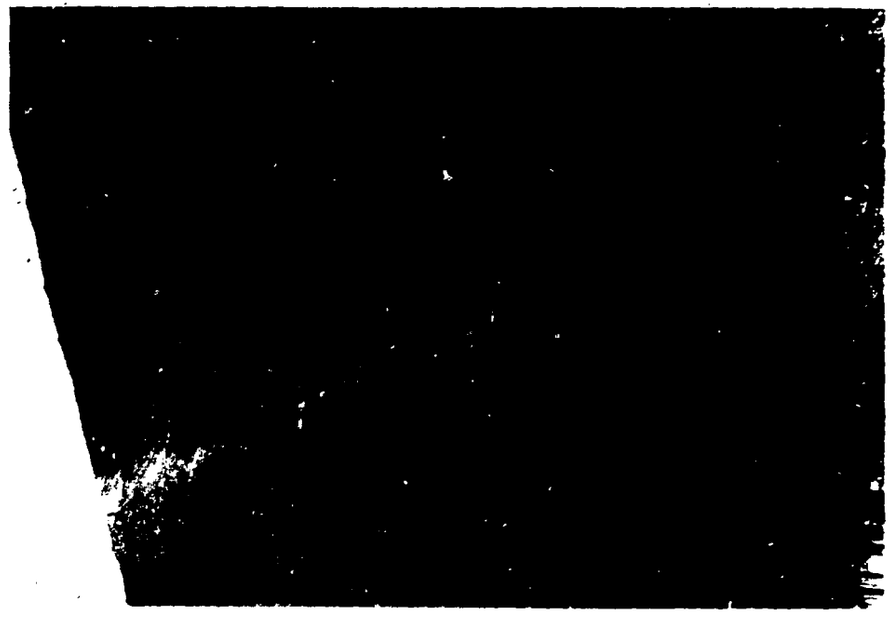
Sheet 1

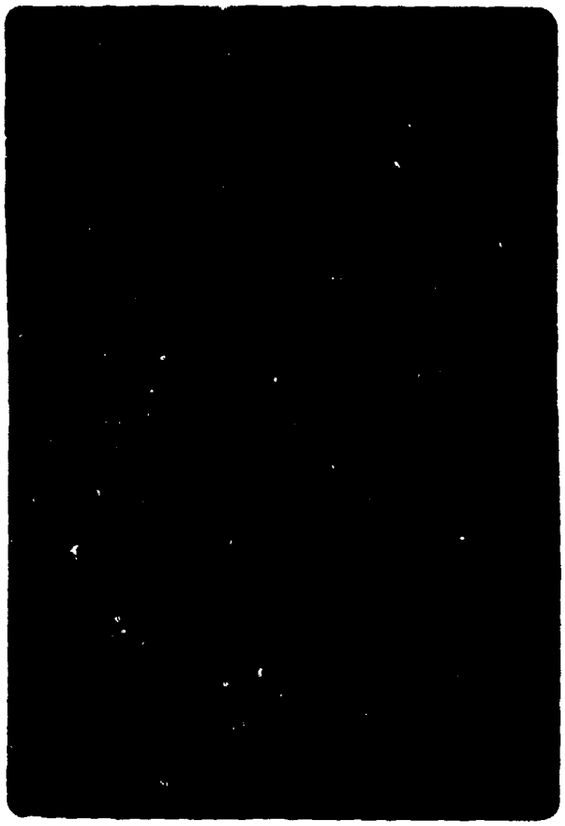
Back

5. Upper left - Downstream exposure.

TOP OF PAGE







APPENDIX D
HYDROLOGY AND HYDRAULICS

APPENDIX D
HYDROLOGY AND HYDRAULICS

Methodology. The dam overtopping and breach analyses were accomplished using the systemized computer program HEC-1 (Dam Safety Investigation), September, 1978, prepared by the Hydrologic Engineering Center, U.S. Army Corps of Engineers, Davis, California. A brief description of the methodology used in the analysis is presented below.

1. Precipitation. The Probable Maximum Precipitation (PMP) is derived and determined from regional charts prepared from past rainfall records including "Hydrometeorological Report No. 33" prepared by the U.S. Weather Bureau.

The index rainfall may be reduced from 10% to 20% depending on watershed size by utilization of what is termed the HOP Brook adjustment factor. Distribution of the total rainfall is made by the computer program using distribution methods developed by the Corps.

2. Inflow Hydrograph. The hydrologic analysis used in development of the overtopping potential is based on applying a hypothetical storm to a unit hydrograph to obtain the inflow hydrograph for reservoir routing.

The unit hydrograph is developed using the Snyder method. This method requires calculation of several key parameters. The following list gives these parameters their definition and how they were obtained for these analysis.

Parameter	Definition	Where Obtained
Ct	Coefficient representing variations of watershed	From Corps of Engineers*
L	Length of main stream channel miles	From U.S.G.S. 7.5 minute topgraphic
Lca	Length on main stream to centroid of watershed	From U.S.G.S. 7.5 minute topographic
Cp	Peaking coefficient	From Corps of Engineers*
A	Watershed size	From U.S.G.S. 7.5 minute topographic

*Developed by the Corps of Engineers on a regional basis for Pennsylvania.

3. Routing. Reservoir routing is accomplished by using Modified Plus routing techniques where the flood hydrograph is routed through reservoir storage. Hydraulic capacities of the outlet works, spillways and the crest of the dam are used as outlet controls in the routing.

The hydraulic capacity of the outlet works can either be calculated and input, or sufficient dimensions input, and the program will calculate an elevation discharge relationship.

Storage in the pool area is defined by an area - elevation relationship from which the computer calculates storage. Surface areas are either planimetered from available mapping or U.S.G.S. 7.5 minute series topographic maps or taken from reasonably accurate design data.

4. Dam Overtopping. Using given percentages of the PMF, the computer program will calculate the percentage of the PMF, which can be controlled by the reservoir and spillway without the dam overtopping.

5. Dam Breach and Downstream Routing. The computer program is equipped to determine the increase in downstream flooding due to failure of the dam caused by overtopping. This is accomplished by routing both the pre-failure peak flow and the peak flow through the breach (calculated by the computer with given input assumptions) at a given point in time and determining the water depth in the downstream channel. Channel cross-sections taken from U.S.G.S. 7.5 minute topographic maps were used in the downstream flood wave routing. Pre and post failure water depths are calculated at locations where cross-sections are input.

HYDROLOGY AND HYDRAULICS ANALYSIS
DATA BASE

NAME OF DAM: Marguerite Dam

PROBABLE MAXIMUM PRECIPITATION (PMP) = 24.3 inches

STATION	1	2	3
Station Description	Marguerite		
Drainage Area (square miles)	1.8		
Cumulative Drainage Area (square miles)	1.8		
Adjustment of PMF for Drainage Area (%)(1)			
6 hours	102		
12 hours	120		
24 hours	130		
48 hours	140		
72 hours	N/A		
Snyder Hydrograph Parameters			
Zone (2)	25		
Cp (3)	0.40		
Ct (3)	1.0		
L (miles) (4)	1.52		
Lca (miles) (4)	0.57		
tp = Ct(LxLca) 0.3 hrs.	0.96		
Spillway Data			
Crest Length (ft)	62		
Freeboard (ft)	2.7		
Discharge Coefficient	3.1		
Exponent	1.5		

(1) Hydrometeorological Report 33 (Figure 1), U.S. Weather Bureau and U.S. Army Corps of Engineers, 1956.
(2) Hydrological zone defined by Corps of Engineers, Baltimore District, for determining Snyder's coefficients (C_p and C_t).
(3) Snyder's Coefficients.
(4) L=Length of longest water course from outlet to basin divide. L_{ca}=Length of water course from outlet to point opposite the centroid of drainage area.

HYDROLOGY AND HYDRAULICS ANALYSIS
DATA BASE

NAME OF DAM: Marguerite Dam

PROBABLE MAXIMUM PRECIPITATION (PMP) = 24.3 inches

STATION	1	2	3
Station Description	Marguerite		
Drainage Area (square miles)	1.8		
Cumulative Drainage Area (square miles)	1.8		
Adjustment of PMF for Drainage Area (%)(1)	(Zone 7)		
6 hours	102		
12 hours	120		
24 hours	130		
48 hours	140		
72 hours	N/A		
Snyder Hydrograph Parameters			
Zone (2)	25		
C_p (3)	0.40		
C_t (3)	1.0		
L (miles) (4)	1.52		
Lca (miles) (4)	0.57		
$t_p = C_t(L \times L_{ca})^{0.3}$ hrs.	0.96		
Spillway Data			
Crest Length (ft)	62		
Freeboard (ft)	2.7		
Discharge Coefficient	3.1		
Exponent	1.5		

(1) Hydrometeorological Report 33 (Figure 1), U.S. Weather Bureau and U.S. Army Corps of Engineers, 1956.
(2) Hydrological zone defined by Corps of Engineers, Baltimore District, for determining Snyder's coefficients (C_p and C_t).
(3) Snyder's Coefficients.
(4) L=Length of longest water course from outlet to basin divide. L_{ca}=Length of water course from outlet to point opposite the centroid of drainage area.

CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 1.8 sq.mi.

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 1064.0 [48 ac-ft]

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): 1066.7 [86 ac-ft]

ELEVATION MAXIMUM DESIGN POOL: Unknown

ELEVATION TOP DAM: 1066.7 [low spot]

SPILLWAY CREST:

a. Elevation 1064.0
b. Type Broad crest
c. Width Crest length = 62 feet
d. Length Approximately 100 feet
e. Location Spillover Left abutment
f. Number and Type of Gates None

OUTLET WORKS:

a. Type One 8" cast iron pipe
b. Location Maximum section
c. Entrance inverts Unknown
d. Exit inverts 1049.0
e. Emergency drawdown facilities 8" cast iron pipe

HYDROMETEOROLOGICAL GAUGES:

a. Type None
b. Location None
c. Records None

MAXIMUM NON-DAMAGING DISCHARGE: Unknown

NOTE: Elevations referenced to M.S.L.

L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
EBENSBURG PENNSYLVANIA

NAME MARGUERITE DAM
NUMBER PA-455
SHEET NO. 1 OF 4
BY OTM DATE MAY, 1981

LOSS RATE AND BASE FLOW PARAMETERS

STRTL = 1 INCH
CNSTL = 0.05 IN/HR
STRTQ = 1.5 cfs/mi²
QRCSN = 0.05 (5% OF PEAK FLOW)
RTIOR = 2.0

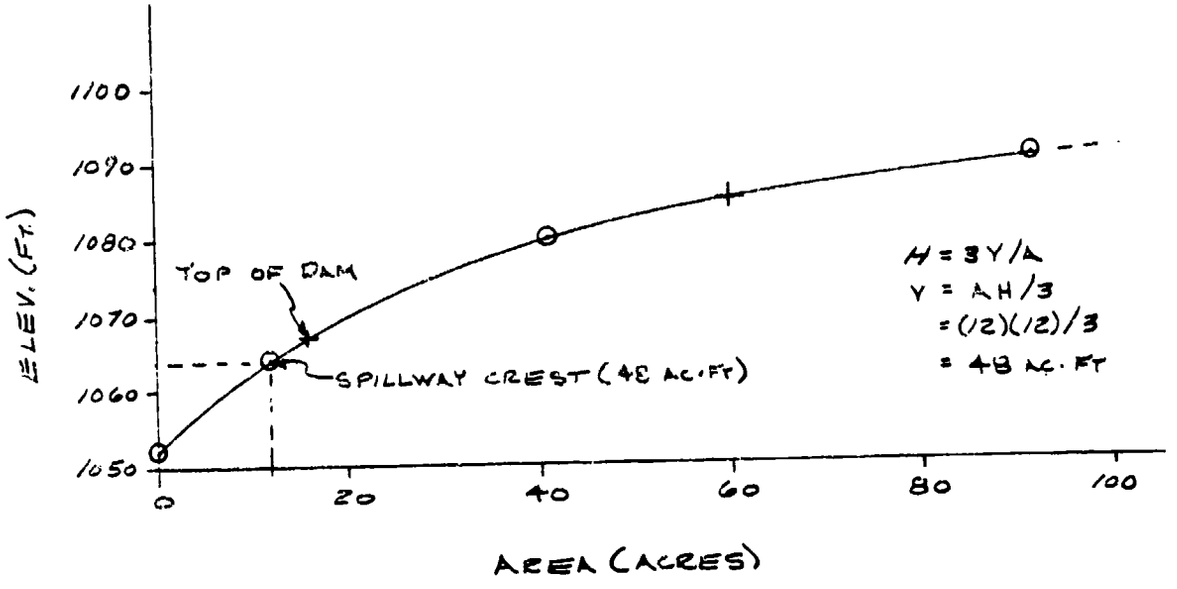
AS RECOMMENDED BY THE BALTIMORE DISTRICT CORPS OF ENGINEERS.

ELEVATION - AREA - CAPACITY RELATIONSHIPS

FROM U.S.G.S. 7.5-MIN. QUAD., D.E.R. FILES, AND FIELD INSPECTION DATA.

SPILLWAY CREST AT ELEVATION = 1064.0
POOL AREA AT SPILLWAY CREST = 12 AC.
ELEVATION WHERE AREA EQUALS ZERO = 1052.0

AT ELEV. 1080, AREA = 40 ACRES
AT ELEV. 1100, AREA = 92 ACRES



AREA (Ac.)	0	12	16	40	60	92
ELEV. (Ft.)	1052	1064	1066.7	1080	1085	1100

DISCHARGE RATING

TO BE DETERMINED BY (HEC-1).

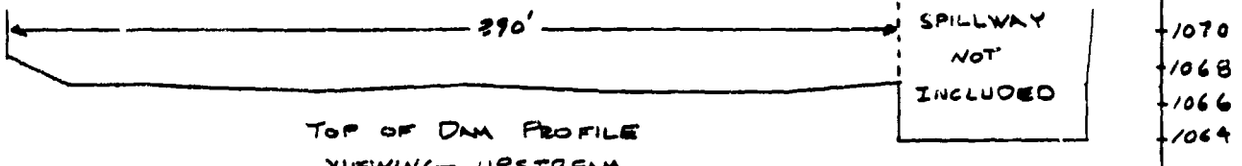
SPILLWAY CREST AT ELEV. 1064.0
COEFFICIENT OF DISCHARGE (C) = USE 3.1
CREST LENGTH = 62'

$$Q_{MAX} = c l h^{3/2}$$
$$= (3.1)(62)[1066.7 - 1064.0]^{3/2}$$
$$= 853 \text{ cfs}$$

OVERTOPPING PARAMETERS

TOP OF DAM (LOW SPOT) = 1066.7
COEFFICIENT OF DISCHARGE (C) = USE 2.9
l VARIES WITH h

SCALE: HOR 1"=60'
VER 1"=10'



TOP OF DAM PROFILE
VIEWING UPSTREAM

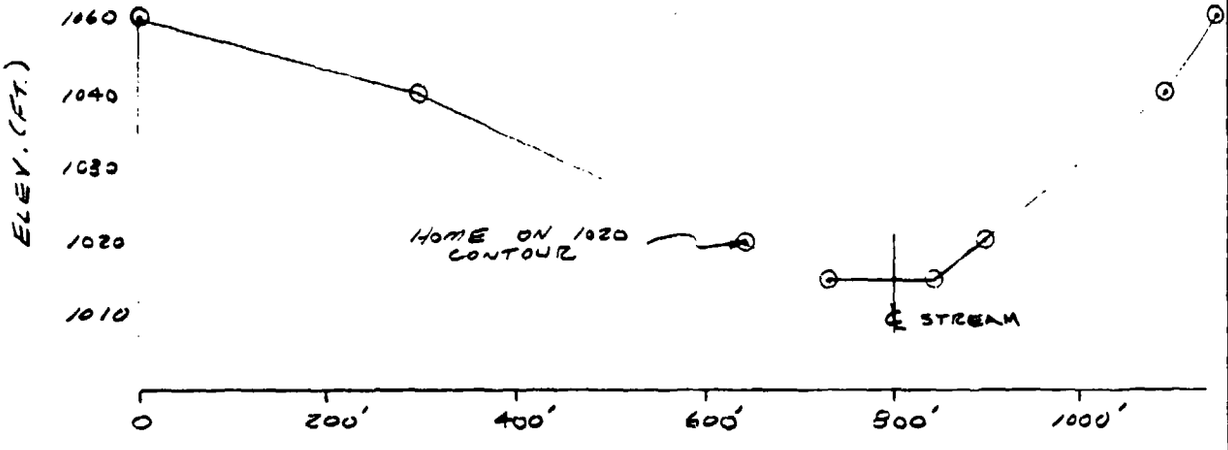
(ELEV)	(l)	(ELEV)	(l)
1066.7	150'	1068.0	285'
1067.0	260'	1069.0	290'
1067.5	280'	1070.0	290'

L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
EBENSBURG PENNSYLVANIA

NAME
NUMBER PA-455
SHEET NO. 3 OF 4
BY OTM DATE MAY, 1981

LENGTH (FT)	150	260	280	285	290	290
ELEVATION (FT)	1066.7	1067	1067.5	1068	1069	1070

DAM BREACH AND FLOOD ROUTING



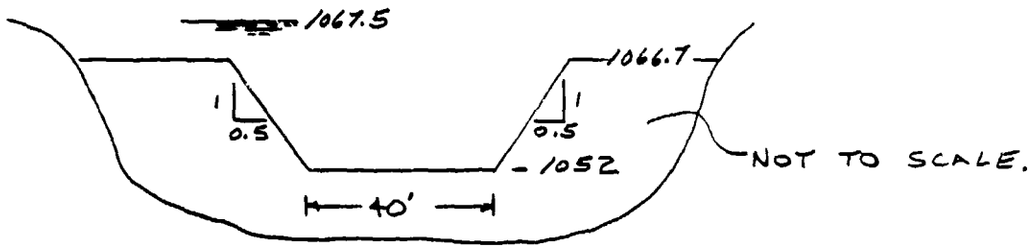
DOWNSTREAM PROFILE
VIEWING DOWNSTREAM
REACH NO. 1

REACH CROSS-SECTION LOCATED APPROXIMATELY 5000 FEET DOWNSTREAM OF DAM. CROSS-SECTION DATA FROM U.S.G.S. 7.5-MIN. QUAD.

CHANNEL MANNING'S (n) ASSUMED TO EQUAL 0.05.
OVERBANK MANNING'S (n) ASSUMED TO EQUAL 0.06.
REACH LENGTH = 5000'
AVERAGE SLOPE = 0.01

L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
EBENSBURG PENNSYLVANIA

NAME
NUMBER PA-455
SHEET NO. 4 OF 4
BY OTM DATE MAY, 1981



BRWID = 40 FT.
Z = 0.5
ELBM = 1052
TFAIL = 2
WSEL = 1064
FAILEL = 1067.5

CONSIDER 0.8 FT. OR 9.6 INCHES OF OVERTOPPING FOR APPROX. 4 HRS. SUFFICIENT TO CAUSE FAILURE OF THE STRUCTURE.

RATIO OF PMF = 0.30

```
********  ********************
FLOOD HY  DROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  01 APR 80
********************************
    1              A1       ANALYSIS OF DAM OVERTOPPING USING RATIOS OF THE PMF
    2              A2       HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF MARGUERITE DAM
    3              A3       RATIOS OF PMF ROUTED THROUGH THE RESERVOIR (PA-455)
    4              B    288        0       10        0        0        0        0        0       -4        0
    5              B1     5
    6              J      1        4        1
    7              J1    .2       .3       .5        1
    8              K      0        1                                    1
    9              K1       INFLOW
   10              M      1        1      1.8                    1                                 1
   11              P               24.3     102      120      130      140
   12              T                                                          1.0     0.05
   13              W   0.96     0.40
   14              X   -1.5     -.05        2
   15              K      1        2                                    1
   16              K1       ROUTE
   17              Y                                        1        1
   18              Y1     1                                                  -1064
   19              $A     0       12       16       40       60       92
   20              $E  1052     1064   1066.7     1080     1085     1100
   21              $$  1064       62      3.1      1.5
   22              $D1066.7      2.9      1.5      150
   23              $L   150      260      280      285      290
   24              $V1066.7     1067   1067.5     1068     1069
   25              K     99
```

```
*******  ************************
FLOOD H   .OGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  01 APR 80
*********************************

RUN  DATE= 81/05/19.
     TIME= 09.29.09.
```

ANALYSIS OF DAM OVERTOPPING USING RATIOS OF THE PMF
HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF MARGUERITE DAM
RATIOS OF PMF ROUTED THROUGH THE RESERVOIR (PA-455)

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
288	0	10	0	0	0	0	0	-4	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 4 LRTIO= 1

RTIOS= .20 .30 .50 1.00

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INFLOW

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	1.80	0.00	1.80	1.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	24.30	102.00	120.00	130.00	140.00	0.00	0.00

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	.OK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA

TP= .96 CP= .40 NTA= 0

RECESSION DATA

STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

UNIT HYDROGRAPH 62 END-OF-PERIOD ORDINATES, LAG= .96 HOURS, CP= .40 VOL= 1.00

30.	113.	230.	351.	443.	480.	462.	422.	385.	352.
321.	293.	268.	245.	223.	204.	186.	170.	155.	142.
129.	118.	108.	99.	90.	82.	75.	69.	63.	57.
52.	48.	44.	40.	36.	33.	30.	28.	25.	23.

21.	19.	18.	16.	15.	13.	12.	11.	10.	9.	
8.	8.	7.	6.	6.	5.	5.	4.	4.	4.	
3.	3.									

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	END-OF-PERIOD FLOW COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	34.02	31.54	2.48	214263.
										(864.)(	801.)(	63.)(	6067.25)

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTE

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTOL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1064.	0

SURFACE AREA=	0.	12.	16.	40.	60.	92.
CAPACITY=	0.	48.	84.	446.	694.	1826.
ELEVATION=	1052.	1064.	1067.	1080.	1085.	1100.

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
1064.0	62.0	3.1	1.5	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
1066.7	2.9	1.5	150.

CREST LENGTH	150.	260.	280.	285.	290.
AT OR BELOW ELEVATION	1066.7	1067.0	1067.5	1068.0	1069.0

PEAK OUTFLOW IS 1221. AT TIME 40.83 HOURS

PEAK OUTFLOW IS 1860. AT TIME 40.67 HOURS

PEAK OUTFLOW IS 3116. AT TIME 40.67 HOURS

PEAK OUTFLOW IS 6246. AT TIME 40.67 HOURS

********** ********** ********** ********** **********

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .20	RATIO 2 .30	RATIO 3 .50	RATIO 4 1.00
HYDROGRAPH AT	1	1.80 (4.66)	1	1254. (35.50)	1881. (53.25)	3134. (88.76)	6269. (177.52)
ROUTED TO	2	1.80 (4.66)	1	1221. (34.57)	1860. (52.67)	3116. (88.23)	6246. (176.86)

SUMMARY OF DA SAFETY ANALYSIS

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1064.00	1064.00	1066.70
STORAGE	48.	48.	86.
OUTFLOW	0.	0.	853.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.20	1067.11	.41	92.	1221.	2.50	40.83	0.00
.30	1067.55	.85	100.	1860.	4.17	40.67	0.00
.50	1068.21	1.51	111.	3116.	6.83	40.67	0.00
1.00	1069.45	2.75	135.	6246.	9.50	40.67	0.00

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**********
FLOOD HY  GRAPH PACKAGE (HEC-1)
DAM SAFE.. VERSION     JULY 1978
  LAST MODIFICATION  01 APR 80
**********
    1          A1       RATIOS OF PMF ROUTED THROUGH THE RESERVOIR AND DOWNSTREAM
    2          A2       DOWNSTREAM CONDITION DUE TO OVERTOPPING OF MARGUERITE DAM
    3          A3       PLAN 1 ASSUMES BREACH, PLAN 2 ASSUMES NO BREACH (PA-455)
    4          B    288       0       10        0        0        0        0        0        0        0
    5          B1     5
    6          J      2       1        1
    7          J1   0.3
    8          K      0       1                                                  1
    9          K1       INFLOW
   10          M      1       1      1.8                                         1                 1
   11          P              24.3     102      120      130      140
   12          T                                                                1.0     0.05
   13          W   0.96    0.40
   14          X   -1.5    -.05       2
   15          K      1       2                                                  1
   16          K1       ROUTE
   17          Y                                         1        1
   18          Y1     1                                                                  F1064
   19          SA     0      12       16       40       60       92
   20          SE  1052    1064   1066.7     1080     1085     1100
   21          SS  1064      62      3.1      1.5
   22          SD1066.7     2.9      1.5      150
   23          SL   150     260      280      285      290
   24          SV1066.7    1067   1067.5     1068     1069
   25          SB    40     0.5     1052        2     1064   1067.5
   26          SB    40     0.5     1052        2     1064     1070
   27          K      1       3                                                  1
   28          K1       REACH NO. 1
   29          Y                                         1        1
   30          Y1     1
   31          Y6  0.06    0.05     0.06     1015     1060     5000     0.01
   32          Y7     0    1060      300     1040      650     1020      740     1015      850     1015
   33          Y7   900    1070     1100     1040     1150     1060
   34          K     99
```

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIO 1 .30
				RATIOS APPLIED TO FLOWS
HYDROGRAPH AT	1	1.80 (4.66)	1	1881. (53.25)
			2	1881. (53.25)
ROUTED TO	2	1.80 (4.66)	1	2633. (74.56)
			2	1860. (52.67)
ROUTED TO	3	1.80 (4.66)	1	2527. (71.55)
			2	1816. (51.42)

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ..... ELEVATION STORAGE OUTFLOW

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
	1064.00	1064.00	1066.70
	48.	48.	86.
	0.	0.	853.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.30	1067.54	.84	100.	2634.	2.13	42.13	40.50

PLAN 2 ..... ELEVATION STORAGE OUTFLOW

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
	1064.00	1064.00	1066.70
	48.	48.	86.
	0.	0.	853.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.30	1067.55	.85	100.	1860.	4.17	40.67	0.00

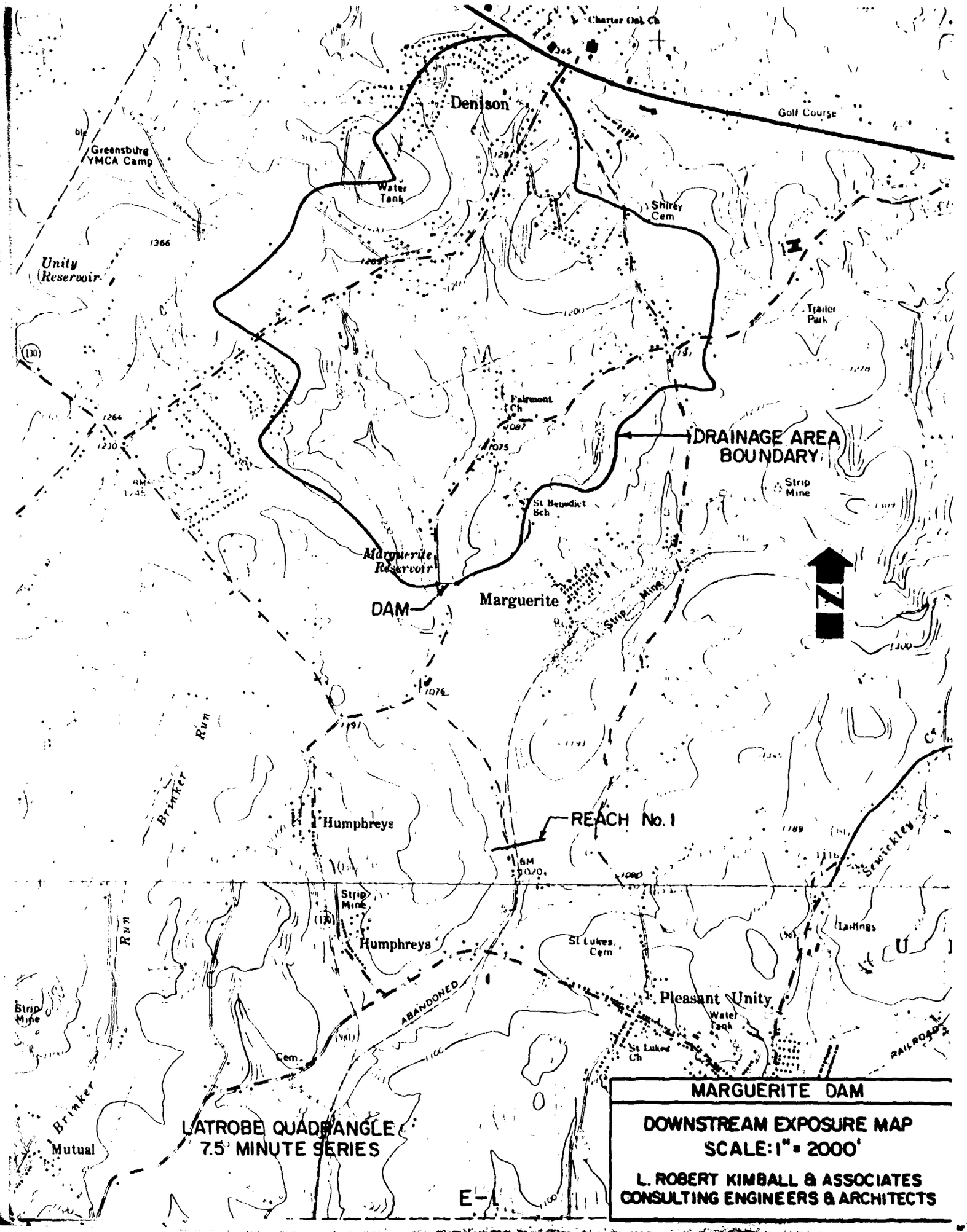
PLAN 1 STATION 3

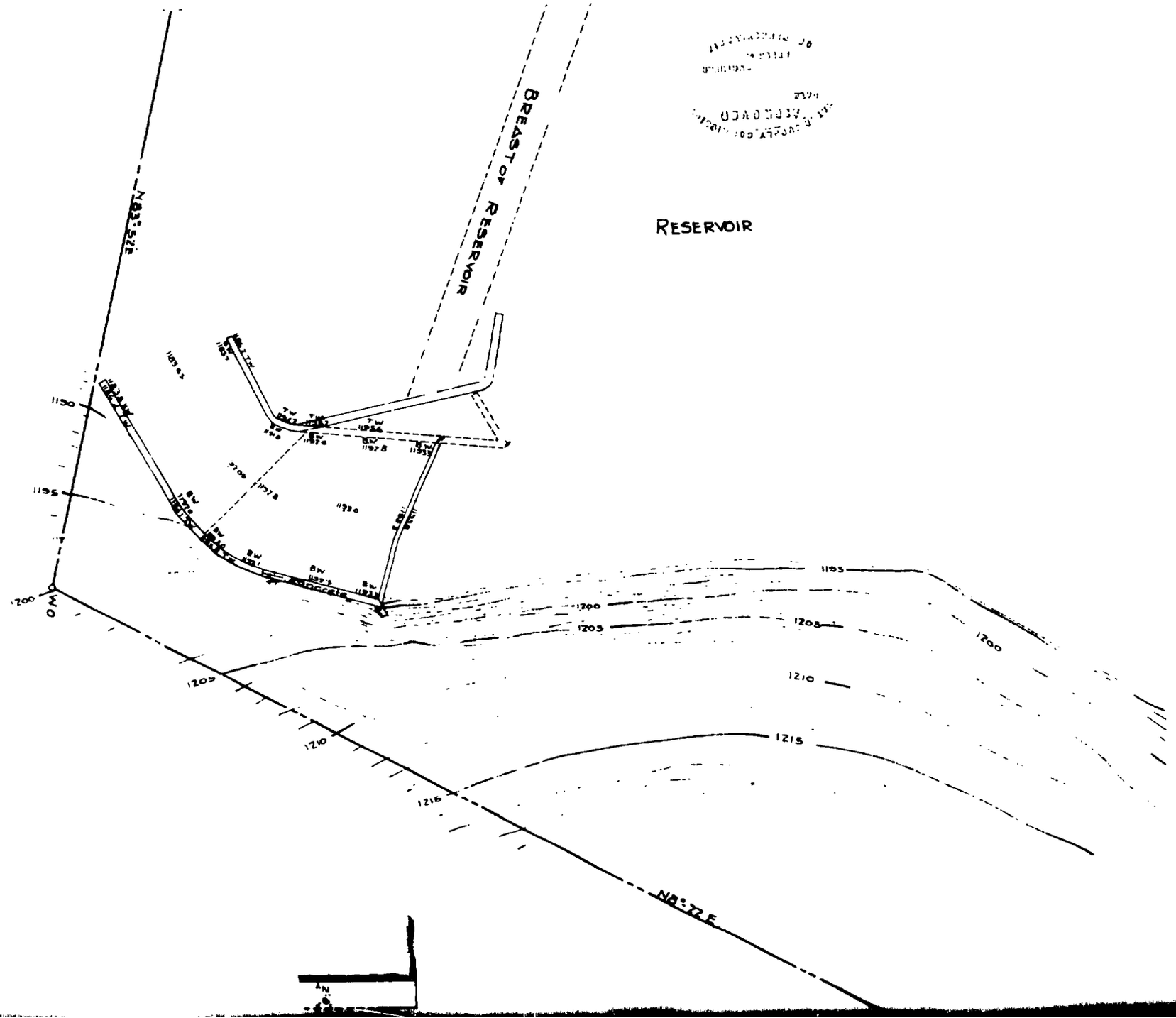
RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.30	2527.	1017.9	42.17

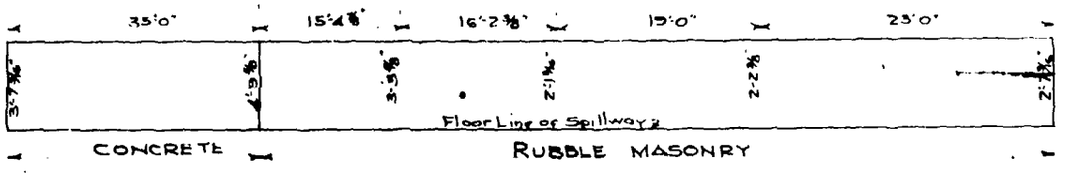
PLAN 2 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.30	1816.	1017.5	41.00

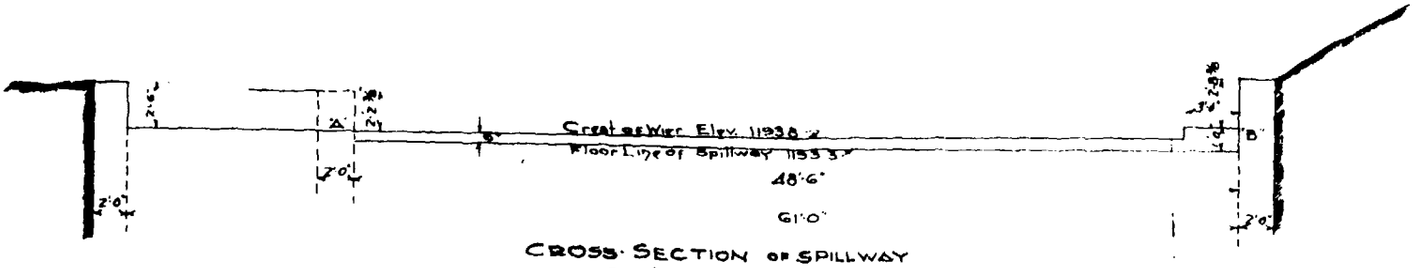
APPENDIX E
DRAWINGS


Charter Oak Ch
Denison
Golf Course
Greensburg YMCA Camp
Water Tank
Shirey Cem
Unity Reservoir
Trailer Park
Fairmont Ch
DRAINAGE AREA BOUNDARY
Strip Mine
St Benedict Sch
Marguerite Reservoir
DAM
Marguerite
Strip Mine
N
Brinker Run
Humphreys
REACH No. 1
Sewickley
Strip Mine
Humphreys
St Lukes Cem
Laurings
Strip Mine
ABANDONED
Pleasant Unity
Water Tank
St Lukes Ch
RAILROAD
Cem.
Brinker Run
Mutual
LATROBE QUADRANGLE
7.5' MINUTE SERIES
E-1
MARGUERITE DAM
DOWNSTREAM EXPOSURE MAP
SCALE: 1" = 2000'
L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS


BREASTOP RESERVOIR
RESERVOIR
N83°52E
N83°52E
1150
1195
1200
1205
1210
1215
1216
1200
1195
1205
1210
1200
N



SKETCH SHOWING HEIGHT of WALL - EAST SIDE of SPILLWAY
Not drawn to Scale



CROSS-SECTION of SPILLWAY
Scale 1"=5'

H.C. FRICK COKE CO.
SCOTTDALE, PA.

PLAN of SPILLWAY & CONTOURS ON EAST SIDE of RESERVOIR of STANDARD WATER CO. AT MARGUERITE, Pa.

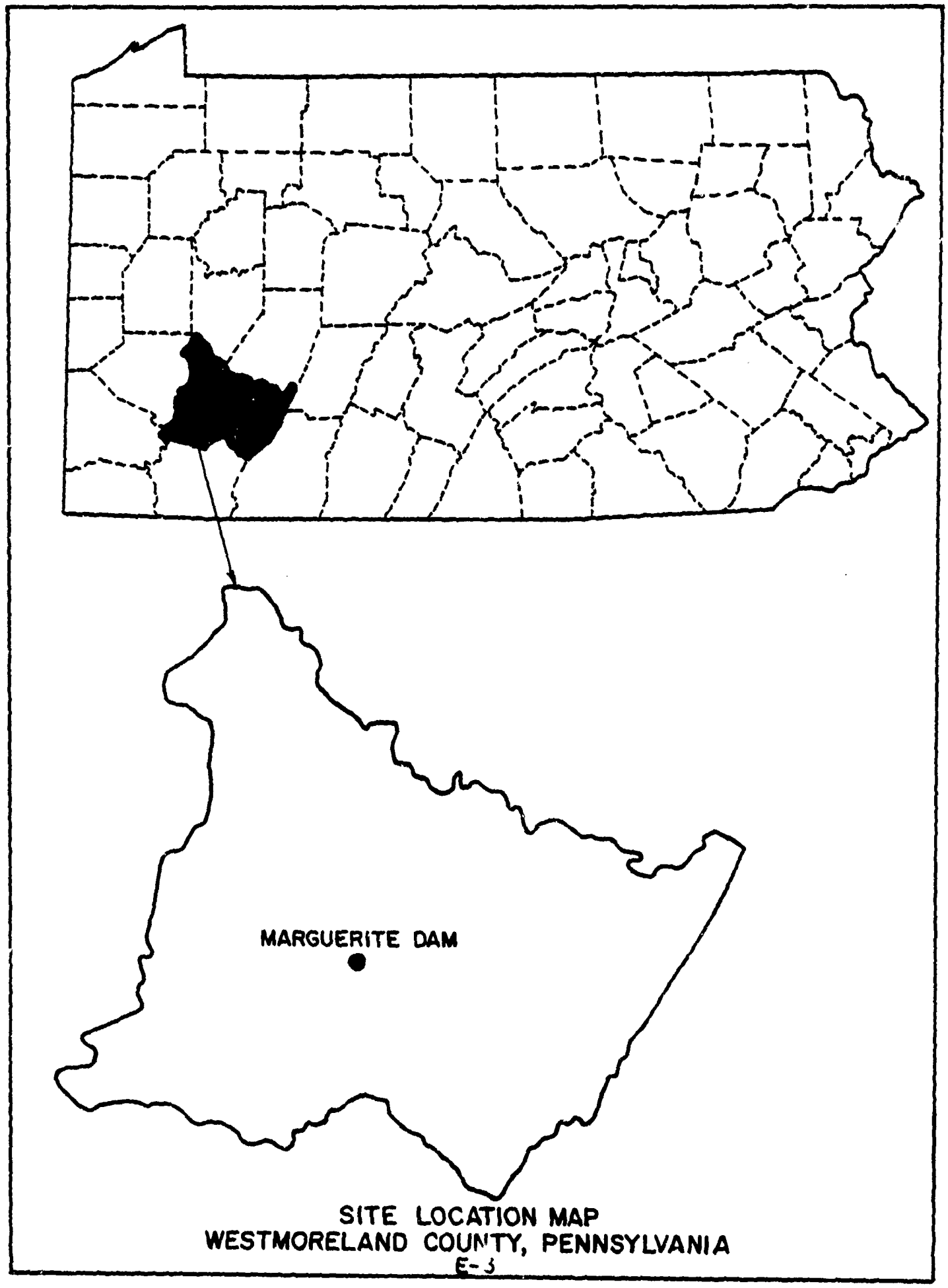
MADE BY C.E.Z.
CHECKED BY E.C.A.
CHECKED FOR SAFETY DEVICES
APPROVED CHIEF ENG'R
SCALE 1"=20' DATE 5-25-15
DRAWING No. 10-Q-21A.
No. OF SHEETS 1 SHEET No. 1

No.	REVISION	DATE	CH'K'D BY

DESTROY ALL COPIES OF PREVIOUS DATE

E 2

1 2



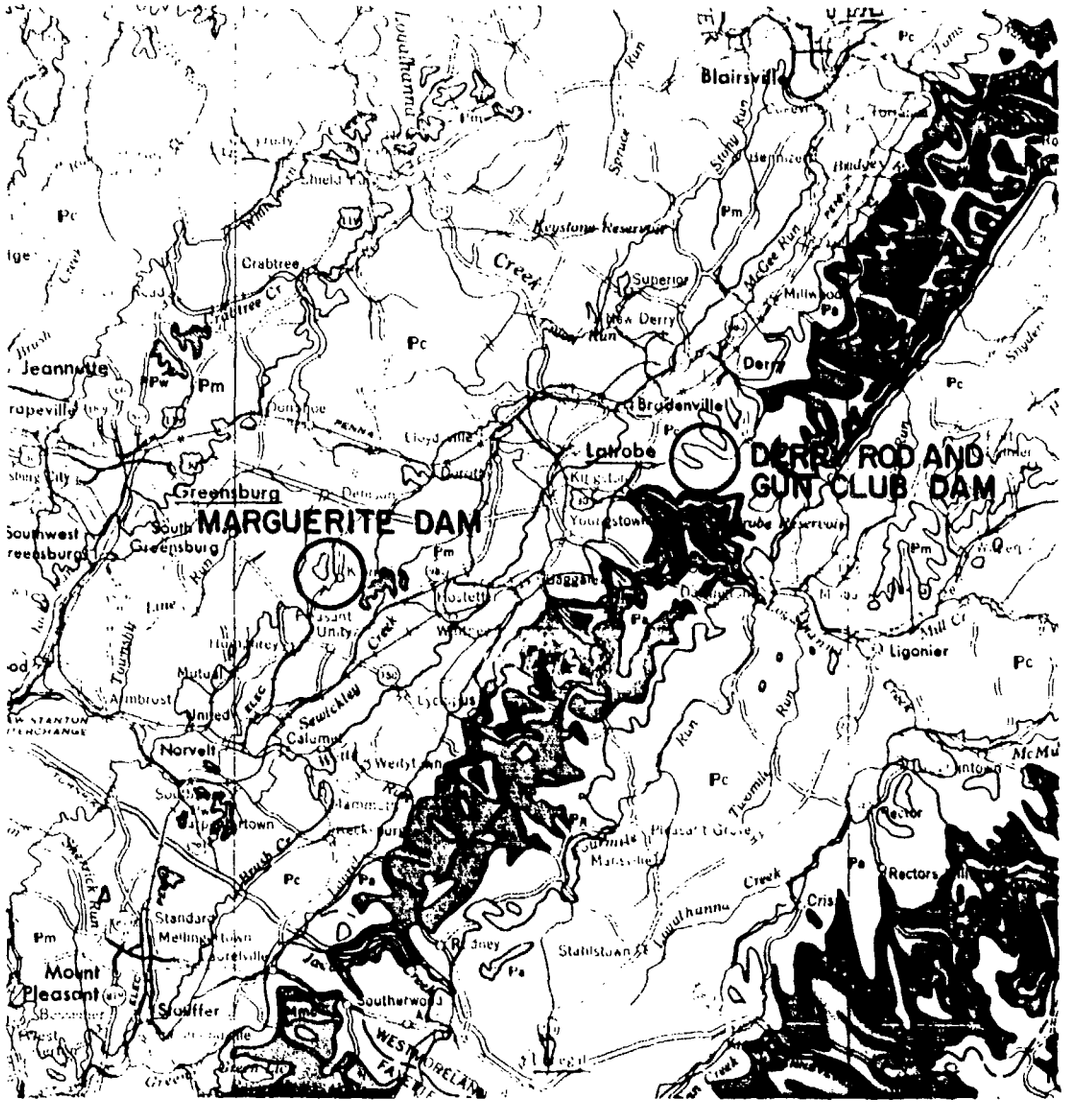
SITE LOCATION MAP
WESTMORELAND COUNTY, PENNSYLVANIA

APPENDIX F
GEOLOGY

General Geology

The Marguerite Dam is located in the Pittsburgh Plateaus Section of the Appalachian Plateau Province. This section typically consists of rounded hills and ridges formed by stream erosion of a former plainlike area. The sediments are deformed by several sub-parallel secondary folds which are superimposed upon a major spoon-shaped trough of first magnitude in southwestern Pennsylvania and adjacent regions. The axes of these broad folds trend northeast and plunge gently southward. The Marguerite Dam lies on the western limb of the Latrobe Syncline; the common flank of the Fayette Anticline to the west. The strata beneath and in the vicinity of the dam strike about N45°E and dip about 4° to the southeast. No major faulting is noted in the vicinity of the dam.

The rock underlying the dam belongs to the Conemaugh Formation of Pennsylvanian Age. It consists of sandstone, shale, a small amount of limestone and a few small coal beds, exclusive of the Saltsburg Sandstone member. The extent of this formation is from the roof of the Upper Freeport coal bed at the bottom, and the floor of the Pittsburgh coal seam at the top. The dam is located in the Main Bituminous Coal Field. Thin coal beds lie within the Conemaugh Formation which may be of slight economic importance locally. However, the first major coal bed, the Upper Freeport seam, is over 500 feet below the surface in the area of the Marguerite Dam.



GEOLOGIC MAP OF THE AREA AROUND MARGUERITE DAM, AND THE DERRY ROD AND GUN CLUB DAM

SCALE 1:250,000

PENNSYLVANIAN

APPALACHIAN PLATEAU

Pm — **Monongahela Formation**

Cyclic sequences of sandstone, shale, limestone and coal. Limestone prominent in southern outcrop areas; shale and sandstone increase southward. Commercial coals present near base at the bottom of the Pittsburgh Coal.

Pc — **Conemaugh Formation**

Cyclic sequences of red and gray shales and siltstones with thin limestones and coals; massive Mahoning Sandstone commonly present at base. Ames Limestone present in middle of section. Brush Creek Limestone in lower part of section.

Pa — **Allegheny Group**

Cyclic sequences of sandstone, shale, limestone and coal; numerous commercial coals; limestones thicken westward. Vanport Limestone in lower part of section; includes Freeport, Kittanning, and Clarion Formations.

Pp — **Pottsville Group**

Predominantly sandstones and conglomerates with clay shales and coals. Some units mineable for coal.