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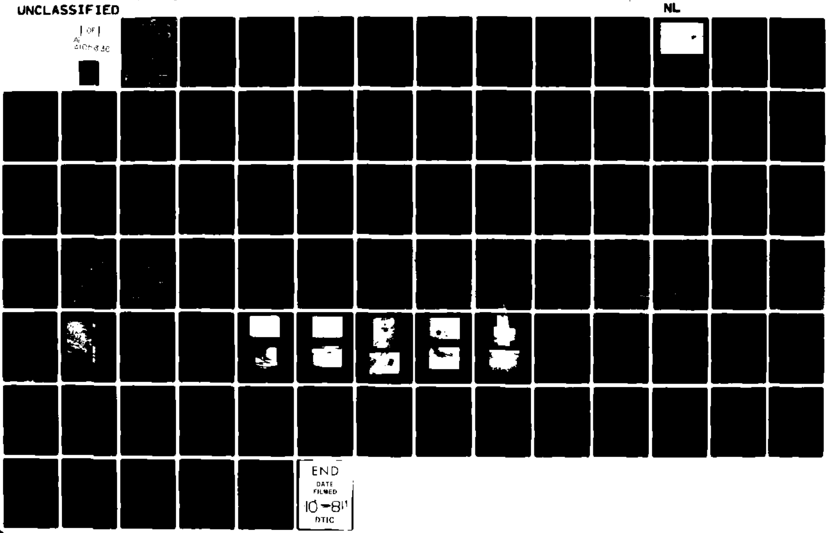

LEVEL II

WHITE RIVER BASIN

AD A105336

OZARK LEAD TAILINGS DAM
REYNOLDS COUNTY, MISSOURI
MO 30166

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PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY INSPECTION

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This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.

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DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 TUCKER BOULEVARD, NORTH
ST. LOUIS, MISSOURI 63101

REPLY TO
ATTENTION OF

SUBJECT: Ozark Lead Tailings Dam, MO 30166

This report presents the results of field inspection and evaluation of the Ozark Lead Tailings Dam. It was prepared under the National Program of Inspection of Non-Federal Dams.

SUBMITTED BY: SIGNED — 14 JUL 1981
Chief, Engineering Division — Date

APPROVED BY: SIGNED — 15 JUL 1981
Colonel, CE, Commanding — Date

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OZARK LEAD TAILINGS DAM

Reynolds County, Missouri

Missouri Inventory No. 30166

Phase I Inspection Report

National Dam Safety Program

Prepared by

Woodward-Clyde Consultants

Chicago, Illinois

Under Direction of

St Louis District, Corps of Engineers

for

Governor of Missouri

April 1981

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 the Chief of Engineers, Washington, D. C., 20314. The purpose of a Phase I investigation is not to provide a complete evaluation of the safety of the structure nor to provide a guarantee on its future integrity. Rather the purpose of the program is to identify potentially hazardous conditions to the extent they can be identified by a visual examination. The assessment of the general condition of the dam is based upon available data (if any) and visual inspections. Detailed investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify the need for more detailed studies. In view of the limited nature of the Phase I studies no assurance can be given that all deficiencies have been identified.

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 any data which may be available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action removes the normal load on the structure, as well as the reservoir head along with seepage pressures, 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, so that corrective action can be taken. Likewise continued care and maintenance are necessary to minimize the possibility of development of unsafe conditions.

PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam	Ozark Lead Tailings Dam
State Located	Missouri
County Located	Reynolds
Stream	Adair Creek
Date of Inspection	24 February 1981

Ozark Lead Tailings Dam, Missouri Inventory Number 30166, was inspected by Richard Berggreen (engineering geologist), Pierre Mallard (geotechnical engineer), Jean-Yves Perez (geotechnical engineer), and Sean Tseng (hydrologist). The dam consists of sand tailings and a compacted earth embankment constructed for the purpose of impounding lead tailings produced at the adjacent Ozark Lead Co mine and mill.

The dam inspection was made following the guidelines presented in the "Recommended Guidelines for Safety Inspection of Dams." These guidelines were developed by the Chief of Engineers, US Army, Washington, DC, with the help of federal and state agencies, professional engineering organizations, and private engineers. The resulting guidelines represent a concensus of the engineering profession. These guidelines are intended to provide for an expeditious identification of those dams which may pose hazards to human life or property, based on available data and a visual inspection. In view of the limited scope of the study, no assurance can be given that all deficiencies have been identified.

The St Louis District (SLD), Corps of Engineers, has classified this dam as having a high hazard potential. The SLD estimated damage zone length extends approximately 10 mi downstream. Within this estimated damage zone are numerous occupied dwellings, a church, and several Missouri State Highways. The contents of the downstream damage zone were verified by aerial reconnaissance.

Ozark Lead Tailings Dam is classified intermediate size based on its height of approximately 87 ft and storage capacity of approximately 17,500 ac-ft. The guideline criteria for the intermediate size dam classification are: height between 40 and 100 ft, or storage capacity between 1000 and 50,000 ac-ft.

Our inspection and evaluation of available data indicate the dam is in generally good condition. The slopes of the dam showed no evidence of slope instability such as cracking or slumping. The vertical and horizontal alignment of the dam crest appeared undisturbed. No evidence was noted of significant erosion, animal burrows, sinkhole development, detrimental settlement or detrimental vegetation on the dam. Uncontrolled seepage at the toe of the dam appeared relatively minor, estimated at ¼ gal/min, and was not transporting any soil at the time of the inspection.

A pipe identified at the toe of the left abutment was bent and leaking and appeared to be carrying water under pressure. This pipe is thought to be the discharge for the drainfield upstream of the starter dam. The pressure evidenced by the leak in the pipe suggests the pipe is partially or completely blocked or the valve, reported to be at the downstream end, is partially or completely closed. Partial obstruction of this outlet could impact the effectiveness of the drainfield.

Hydraulic/hydrologic analyses indicate the reservoir and spillway can store and pass 100 percent of the Probable Maximum Flood (PMF) without overtopping the embankment. The PMF is defined as the flood event that may be expected to occur from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible for the region. The guidelines require intermediate size, high hazard potential dams to pass a spillway design flood of 100 percent of the PMF. The analyses also indicate that the 1 percent probability-of-occurrence flood (100 year flood) will be stored in the reservoir and passed through the storm drain and decant line.

Seepage and stability analyses for this dam were reported to be on file but were not made available for review.

Based on our inspection and evaluation of available data on Ozark Lead Tailings Dam, it is recommended that the following topics be addressed as soon as practical.

1. Seepage and stability analyses reported to be on file for this dam should be reviewed to verify conformance of the design to as-built configurations of the slopes, design and actual discharge from the drains, and location of the phreatic surface within the embankment. These analyses should consider all appropriate loading conditions, including seismic loading, and should be performed by an engineer experienced in the design and construction of tailings dam.

2. Repairs should be made to the bent and leaking drain discharge pipe at the toe of the left abutment. These remedial measures should include routing discharge

from this pipe away from the toe of the dam to prevent erosion, and monitoring discharge from the pipe to identify soil or tailings in the discharged water.

It is recommended that a program of periodic inspections and maintenance be developed and initiated for this facility. This program should include, but not be limited to, the following items.

1. Continue efforts to vegetate the downstream slope of the embankment. Replacement of the mulch will likely be necessary.

2. Inspect the embankment for evidence of slope instability such as cracking or slumping, detrimental settlement or piping.

3. Inspect discharge from the various drain outlets to identify turbidity (soil or tailings) in the water. This should include any areas of seepage identified along the toe of the slope or in the abutments.

4. Maintain the decant inlet, storm drain inlet, and spillway channel free of obstructions to flow.

5. Inspect the 60-in. diameter storm drain beneath the dam for evidence of settlement, cracking or leakage.

All remedial measures and maintenance should be performed by or under the guidance of an engineer experienced in the design, construction, and maintenance of tailings dams.

It is recommended that the owner take action on these items as soon as practical.

WOODWARD-CLYDE CONSULTANTS

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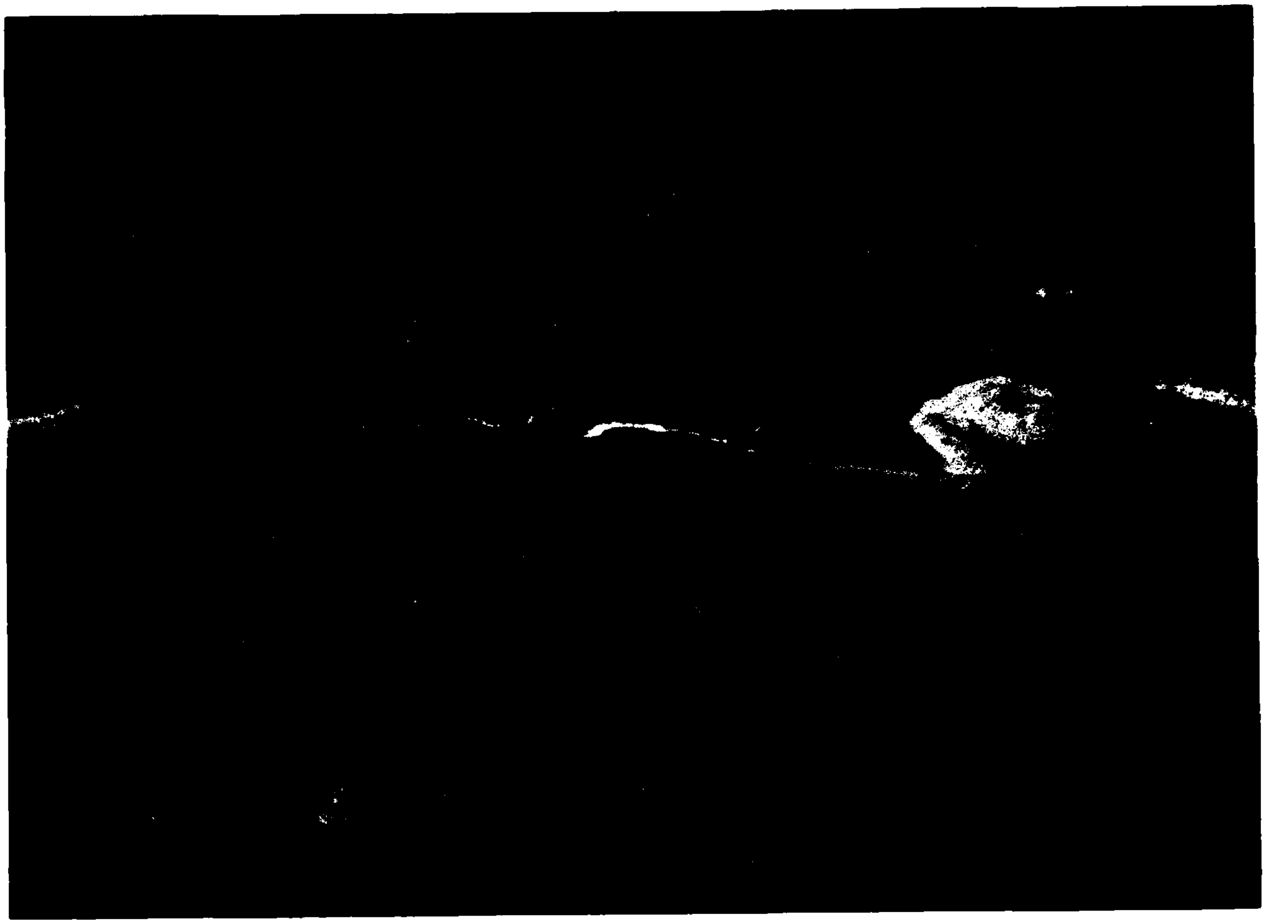

OVERVIEW

OZARK LEAD TAILINGS DAM

MISSOURI INVENTORY NUMBER 30166

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

OZARK LEAD TAILINGS DAM - MISSOURI INVENTORY NO. 30166

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PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
OZARK LEAD TAILINGS DAM, MISSOURI INVENTORY NO. 30166

SECTION 1
PROJECT INFORMATION

1.1 General

a. **Authority.** The National Dam Inspection Act, Public Law 92-367, provides for a national inventory and inspection of dams throughout the United States. Pursuant to the above, an inspection was conducted of Ozark Lead Tailings Dam, Missouri Inventory Number 30166.

b. **Purpose of investigation.** "The primary purpose of the Phase I investigation program is to identify expeditiously those dams which may pose hazards to human life or property... The Phase I investigation will develop an assessment of the general condition with respect to safety of the project based upon available data and a visual inspection, determine any need for emergency measures, and conclude if additional studies, investigations and analyses are necessary and warranted" (Chapter 3, "Recommended Guidelines for Safety Inspection of Dams").

c. **Evaluation criteria.** The criteria used to evaluate the dam were established in the "Recommended Guidelines for Safety Inspection of Dams," and Engineering Regulation No. 1110-2-106 and Engineering Circular No. 1110-2-188, "Engineering and Design National Program for Inspection of Non-Federal Dams," prepared by the Office of Chief of Engineers, Department of the Army; and "Hydrologic/Hydraulic Standards Phase I Safety Inspection of Non-Federal Dams," prepared by the St Louis District (SLD), Corps of Engineers. These guidelines were developed with the help of several federal agencies and many state agencies, professional engineering organizations, and private engineers.

1.2 Description of Project

a. **Description of dam and appurtenances.** Ozark Lead Tailings Dam is an active lead tailings dam. Although its construction and usage are generally typical of other lead tailings dams in the area, it is atypical of dams constructed for the impoundment of water. The unique nature of these lead tailings dams has a significant impact on their evaluation. A brief description of their construction and usage is necessary to distinguish the differences between these dams and conventional water-retaining dams.

The lead tailings dams in southeastern Missouri have been constructed over a long period of time and include dams ranging from very old dams constructed in the 1800's to new dams still under construction. Although some construction techniques have changed, these dams have many similarities.

At the beginning of a mining operation, a starter dam is frequently constructed of waste rock and residual soil. This dam impounds surface runoff and mine water pumped from the underground workings. The water is used in the ore processing and transport of the tailings waste.

The tailings are the waste material produced by the beneficiation and processing of the lead ore to form a high-grade lead concentrate. The coarse tailings fraction (medium to fine sand) is used to construct the dam embankment; the fine fraction (silt and fine sand) is deposited in the reservoir area. Separation of the coarse and fine fractions usually is done by a cyclone separator or by a series of cyclones on the crest of the dam. The underflow or coarse fraction is deposited on the dam and the overflow or fine fraction is deposited in the reservoir.

Ozark Lead Tailings Dam was constructed using the upstream method. That is, as the tailings are added to the dam, they are deposited upstream of the crest of the starter dam. As a result, the centerline of the dam crest migrates upstream as the dam embankment is progressively raised.

Frequently the dam has a drainage system built into the foundation to aid in lowering the phreatic surface (water table) within the embankment. Water enters the dam both at the crest from the cyclone-deposited tailings and from the upstream face where the dam is in contact with the reservoir. At the Ozark Lead Tailings Dam there are two drainage systems. A drainfield was constructed on the floor of the reservoir immediately upstream from the starter dam to aid is draining the tailings embankment. Later, during modifications to the dam, a blanket drain, consisting of a filter fabric and gravel blanket, was built within the embankment to prevent the phreatic surface (water table) from encroaching on the downstream face of the dam.

A decant or water disposal system is typically constructed beneath the dam. At Ozark Lead, this decant system consists of a vertical tower within the reservoir which decants or draws water from near the surface at the upstream end of the reservoir where the water contains the least sediment. This water is then carried in a pipe beneath the reservoir and dam and exits at the toe of the dam. From there, it may be recycled or released to the natural stream drainage. The intake level of the decant tower or structure is regulated as the tailings and reservoir level rise to maintain a balanced system of inflow and outflow. The decant system also serves as additional discharge in the event of heavy precipitation. A 60-in. diameter storm drain outlet is also available at this dam for discharge of storm runoff when the reservoir elevation is below the spillway crest.

Two characteristics are noteworthy regarding the silt and sand tailings used in the construction of these dams. First, the very uniform grain size and lack of clay or other binder makes this material extremely susceptible to erosion by flowing water. It is unlikely this material could survive any significant overtopping without dam failure. Second, the finely-ground limestone and dolomite tailings are almost barren of nutrients necessary to support vegetation. It is frequently necessary to import topsoil or fertilizer in order to successfully vegetate the dam embankment. This difficulty in vegetating the surface of the dam contributes to the potential for surface erosion of the dam. At the Ozark Lead Tailings Dam, this problem has been mitigated by the construction of an earth cover for the crest and slopes of the dam. Once vegetation becomes established on this soil cover, potential for erosion will be decreased somewhat.

The spillway is about 650 ft northeast of the dam and consists of a broad trapezoidal cut through the ridge which forms the east side of the reservoir and left abutment of the dam. The excavation for the spillway extends into weathered bedrock and only minor erosion in the spillway is anticipated during flood flows. The distance from the spillway to the embankment precludes any hazard to the dam resulting from possible erosion of the spillway.

b. Location. Ozark Lead Tailings Dam is located on Adair Creek, about 4 mi southwest of the town of Reynolds in Reynolds County, Missouri (Fig. 1). The dam is in Section 15, T31N, R2W, on the USGS Midridge, Missouri, 7.5-minute quadrangle map (1966).

c. Size classification. The dam is classified intermediate size based on its height of approximately 87 ft, and storage capacity of approximately 17,500 ac-ft. The guideline criteria for the intermediate size dam classification are: height between 40 and 100 ft, or storage capacity between 1000 and 50,000 ac-ft.

d. Hazard classification. The St Louis District (SLD), Corps of Engineers, has classified this dam as having a high hazard potential; we concur with this classification. The SLD estimated damage zone length extends approximately 10 mi downstream. Within this estimated damage zone are numerous occupied dwellings, a church, and several Missouri State Highways. The contents of the downstream damage zone were verified by aerial reconnaissance (Photo 1). The potential for loss of life and property is high in the event of sudden failure of the dam.

e. Ownership. We understand the dam is owned by Ozark Lead Co, Rural Branch, Sweetwater, Missouri, 63680. Correspondence should be sent to the attention of Mr Terry Maio.

f. Purpose of dam. The dam was constructed to impound tailings produced in the milling and processing of lead ore mined in the vicinity.

g. Design and construction history. Information on the design and construction history of this dam was obtained from interviews with Mr Terry Maio of Ozark Lead Co, and from maps and plans of the dam and reservoir supplied by Ozark Lead Co.

The design and construction history of this dam has progressed in several stages. The starter dam was designed and constructed by Arthur G. McKee & Company, San Francisco, California as part of the initial plant design and construction. The tailings portion of the embankment was constructed by Ozark Lead Co. Recent modifications to the dam were designed by Dames & Moore, and constructed by Quadri Contractors.

The starter dam and appurtenant structures designed and built by Arthur G. McKee and Co included a 42-ft high earth dam, settling basin, 60-in. diameter storm water outlet, 24-in. diameter decant line, and drainfield upstream of the starter dam. The design plans are dated 1967; the plant went into operation in 1968. A slurry trench and cutoff trench were excavated at the centerline of the starter dam. Available design documents stated that the depth of these trenches was to be determined in the field. Upstream and downstream slopes of the starter dam were designed at 2.5(H) to 1(V).

The tailings portion of the dam was constructed by Ozark Lead Co, using cyclone separators located on the starter dam crest. As material was deposited on the upstream slope of the starter dam, the centerline of the embankment migrated upstream. The cyclones were periodically raised to continue raising the dam crest. The crest of the tailings portion of the dam at the time of the visual inspection was at about elevation 1080 to 1090 ft. The cyclone separators were not in place or operating at the time of the visual inspection.

Recent modifications to the dam and appurtenant structures were designed by Dames & Moore, Denver, Colorado, in 1977 and 1978. These modifications included design of an emergency spillway through the left abutment, rehabilitation of the 24-in. diameter decant line, and the addition of an earth embankment and blanket drain over the tailings embankment and starter dam. This new earth embankment was constructed downstream of the crest of the tailings dam.

The actual construction of these modifications was performed by Quadri Contractors, Perrysville, Missouri in 1979 and 1980.

Further raising of the tailings portion may be performed by Ozark Lead Co in the future. The original plans indicate that the tailings embankment would eventually be raised to elevation 1110 ft, approximately 13 ft higher than the dam crest elevation at the time of the visual inspection.

h. **Normal operating procedures.** The only facility requiring operation that was identified during the visual inspection was at the inlet tower for the decant line. The inlet elevation can be raised using a moveable weir as the tailings and lake levels rise.

1.3 Pertinent Data

a. **Drainage area.** 6.1 mi^2

b. **Discharge at damsite.**

Maximum known flood at damsite	Reservoir level rose 5 ft above inlet elevation for 60-in. diameter storm drain in winter 1968. Inlet elevation at that time unknown.
Warm water outlet at pool elevation	N/A (Not applicable)
Diversion tunnel low pool outlet at pool elevation	N/A
Diversion tunnel outlet at pool elevation	N/A
Gated spillway capacity at pool elevation	N/A
Gated spillway capacity at maximum pool elevation	N/A
Ungated spillway capacity at maximum pool elevation	21,500 ft^3/sec*
Total spillway capacity at maximum pool elevation	21,500 ft^3/sec*

*(Includes storm drain and decant line discharge capacity of approximately 330 ft^3/sec)

c. **Elevation (ft above MSL).**

Top of dam	1097
Maximum pool-design surcharge	N/A
Full flood control pool	N/A
Recreation pool	N/A
Spillway crest (gated)	N/A
Upstream portal invert diversion tunnel	N/A

Downstream portal invert diversion tunnel	N/A
Streambed at centerline of dam	1014
Maximum tailwater	Unknown
Toe of dam at maximum section	1010

d. **Reservoir.**

Length of maximum pool	11,000 ft
Length of recreation pool	N/A
Length of flood control pool	N/A

e. **Storage (acre-feet).**

Recreation pool	N/A
Flood control pool	N/A
Design surcharge	N/A
Top of dam	17,500 (At time of visual inspection, approximately 8000 occupied by tailings)

f. **Reservoir Surface (acres).**

Top of dam	540
Maximum pool	540
Flood control pool	N/A
Recreation pool	N/A
Spillway crest	380

g. **Dam.**

Type	Lead tailings and earth, see Fig. 3-E.
Length	1165 ft
Height	87 ft
Top width	20 ft
Side slopes	Upstream 2.5 (H) to 1(V), from Plans, Fig. 3-E. Downstream 2(H) to 1(V)

Zoning	Compacted earth starter dam; cyclone deposited sand embankment upstream of starter dam; gravel blanket drain through embankment; compacted earth embankment overlying and downstream of tailings embankment. See Fig. 3E.
Impervious core	Starter dam and earth embankment modification to dam are impervious. Sloping blanket drain separates these two impervious zones. See Fig. 3E.
Cutoff	10 ft wide cutoff trench with 3 ft wide slurry trench at bottom. Cutoff trench averages 7 ft deep, slurry trench 6 to 15 ft deep, depth determined during construction. See Fig. 3-C.
Grout curtain	None

h. **Diversion and regulating tunnel.**

Type	None
Length	N/A
Closure	N/A
Access	N/A
Regulating Facilities	N/A

i. **Spillway.**

Type	Ungated trapezoidal cut in soil and weathered bedrock through hillside along east side of reservoir. Side slopes 2(H) to 1(V).
Length of weir	110 ft
Crest elevation	1083 ft
Gates	None
Downstream channel	Unimproved natural stream channel in drainage basin east of Adair Creek.

j. **Regulating outlets.** 24 in. diameter decant line with adjustable inlet weir; weir at elevation 1061 at time of visual inspection. 60 in. diameter storm drain. Inlet elevation 1078 ft at time of visual inspection. Combined discharge capacity with reservoir at spillway crest elevation approximately 330 ft^3/sec.

SECTION 2
ENGINEERING DATA

2.1 Design

Design information supplied by Ozark Lead Co to the inspection team consisted of the following:

Design plans and drawings

"Tailings Dam and Stilling Pool Soil Data," 1967, Arthur G. McKee and Co.

"Tailings Dam Plans and Sections," 1967, Arthur G. McKee and Co.

"General Project Plan and Index, Decant System Rehabilitation," 1978, Dames & Moore.

"General Project Plan, Dam and Spillway Rehabilitation," 1978, Dames & Moore.

"Dam and Spillway Plan, Dam and Spillway Rehabilitation," 1978, Dames & Moore.

"Dam Sections and Details, Dam and Spillway Rehabilitation," 1978, Dames & Moore.

"Spillway Profile and Sections, Dam and Spillway Rehabilitation," 1978, Dames & Moore.

Construction Specifications

"Work Specifications" for Dam and Spillway Rehabilitation, undated, Dames & Moore.

Test data on filter fabric used in blanket drain, September 1979, Celanese Fibers Marketing Company.

Other information was obtained through interviews with Mr Terry Maio, concentrator superintendent, Ozark Lead Co, and from a paper by M. A. Lagergren and

A. W. Griffith, "Ozark Lead Company's Tailings Disposal System," in Tailing Disposal Today, Proceedings of the International Tailing Symposium, 1973, pages 714-733.

2.2 Construction

The construction history presented below is based on interviews with Mr Maio of Ozark Lead Co, and review of the plans provided to the inspection team. See Figs. 3A-3F.

The construction of this dam has progressed in several stages. The starter dam and appurtenant structures were designed and constructed by Arthur G. McKee and Co in 1967-1968. A 10-ft wide, 7-ft deep cutoff trench with a 3-ft wide, 6 to 15-ft deep slurry trench was excavated at the centerline of the starter dam (Fig. 3B and 3C). The starter dam was constructed of locally obtained clay soil to a crest elevation of 1052 ft.

A drainfield was installed upstream of the starter dam with the discharge exiting the downstream toe of the dam at the left abutment. No information was available on this drainfield other than the configuration of the layout. The 60-in. diameter storm drain and 24-in. diameter decant line were also constructed by McKee during the starter dam construction phase.

Following startup of operations at the mine and mill, a sand tailings embankment was constructed upstream from the starter dam. This embankment was built with the coarse fraction of the tailings obtained from a series of cyclone separators installed on the crest of the starter dam. As the embankment rose, the cyclones were moved to the new crest, upstream, and began depositing a new lift. Construction of the tailings portion of the dam was performed by Ozark Lead Co.

Recent modifications to the facility were designed by Dames & Moore, Denver, Colorado, and constructed by Quadri Contractors, Perryville, Missouri. These modifications consisted of rehabilitation of the 24-in. diameter decant line, construction of an emergency spillway, and addition of an earth embankment and a blanket drain downstream of the tailings embankment.

Rehabilitation of the decant system consisted of constructing a vertical concrete tower, with trash racks, and a moveable weir to allow raising the inlet elevation as the lake and tailings level rises. A new 24-in. diameter line replaced the decant line that had become obstructed beneath the tailings reservoir.

The emergency spillway was cut through the hill east of the reservoir to provide for flood discharge. Normal operating flows are carried through the decant line and recycled to the plant.

Construction of the new earth embankment included a sloping blanket drain over the tailings embankment and starter dam (Fig. 3E). A fabric filter was laid over the existing dam and a 3-ft thick layer of river alluvium was placed over the fabric to act as a drain (Photo 2). This blanket drain has 3 discharge pipes at the downstream toe of the dam. Weir boxes are used to measure flow from the pipes, which was reported to be fairly constant at approximately 45 gal/min total.

The new earth embankment was constructed using the spoil from the spillway excavation and other local borrow sites. The downstream slope was built at 2(H) to 1(V), the upstream slope at 2.5(H) to 1(V) according to design plans from Dames & Moore. The crest of the dam is approximately 20 ft wide at elevation 1097 ft. We understand that Ozark Lead Co intends to continue depositing coarse tailings upstream of the new earth embankment crest. The tailings embankment may eventually rise to elevation 1110 ft.

A plan to vegetate the embankment to help control surface erosion was hampered by an extended period of drought in the summer of 1980. The upstream slope developed a good cover of grass, but the crest and downstream slope did not. Much of the mulch cover on the downstream slope has been lost and will need to be replaced in order to successfully vegetate the dam.

2.3 Operation

At the time of the visual inspection there were no operating facilities at this dam. The inlet elevation for the decant line can be adjusted, but does not require operation per se.

During the visual inspection, a 6-in. diameter steel pipe was observed on the left side of the downstream toe of the dam. The pipe was probably the discharge line from the drainfield initially constructed upstream of the starter dam. The pipe was bent and punctured. Water was squirting out of the pipe indicating the pipe was under pressure. No operating valve was found on that pipe, although a valve was reported by Lagergren and Griffith in their 1973 paper. The apparent pressure in the pipe indicates the pipe is either obstructed or the valve, if it exists, is partially or completely closed.

2.4 Evaluation

a. **Availability.** Engineering design and construction data supplied to the inspection team are listed in Section 2.1. We understand that additional design information, consisting of seepage and stability analyses, exists in project files at the office of Dames & Moore, Denver. Copies of these documents were requested but Ozark Lead Co decided not to release the information at this time. Correspondence related to the additional information is attached as Appendix C to this report.

b. **Adequacy.** The information made available to the inspection team is incomplete and insufficient to enable a complete evaluation of the design of Ozark Lead Tailings Dam. Seepage and stability analyses are apparently on record. However, it is not known if these are comparable to the requirements of the guidelines. If they are not, this would constitute a deficiency which should be rectified. In that case, the required seepage and stability analyses should be performed for appropriate loading conditions (including earthquake loads) and made a matter of record. These analyses should be performed by a professional engineer experienced in the design and construction of tailings dams.

c. **Validity.** The information consulted by the inspection team and the field observations indicate that the dam design was generally well documented and that the actual construction generally appears to have complied with design drawings and specifications.

However, many design features cannot be observed at present (configuration of the starter dam, cutoff and slurry trenches, upstream drainfield, filter fabric and blanket drain) and therefore could not be directly verified during the field inspection. One deviation from design was noted concerning the drain discharging from the new drain blanket. Design drawings show only one 6-in. diameter PVC drain pipe; three such pipes were observed in the downstream toe of the dam.

2.5 Project Geology

The dam is located on the southwestern flank of the Ozark structural dome. Bedding in the area is nearly horizontal, with a slight regional dip toward the southwest.

The bedrock at the damsite is mapped on the Geologic Map of Missouri (1979) as Potosi and Eminence Dolomite formations (Fig. 4). The Potosi Dolomite consists of light gray, medium- to finely-crystalline siliceous dolomite and typically contains an abundance of quartz druse characteristic of chert-bearing formations. The Eminence Dolomite conformably overlies the Potosi Dolomite, is similar in appearance, but contains less chert and quartz. Some large springs and caves have been noted in the Eminence Dolomite in parts of Missouri; however, no evidence of springs or significant solution activity was noted during the visual inspection.

The soil exposed at the damsite is a gravelly light brown to red-brown plastic residual clay (CL-CH) characteristically developed on the chert-bearing carbonate bedrock in this area. Boring logs done by Arthur G. McKee and Co for the starter dam design and construction indicate the weathered profile extends nearly 50 ft deep in some areas. Alluvial soils consisting of fairly clean sand (SP) and chert gravel (GP) were noted in borings in the valley bottom, extending nearly 20 ft deep locally. The soil in the area is mapped on the General Soils Map of Missouri (1979) as Needleye-Captina-Clarksville-Doniphan Soil Association.

The dam is located approximately 4 mi northeast of the Ellington Fault. This fault is mapped as approximately 22 mi long, trending northwest-southeast, with displacement mapped as northeast side up.

The Black Fault is mapped about 16 mi northeast of the dam, and has a mapped length of about 16 mi, on a northwest-southeast trend. Displacement on this fault is also mapped as northeast side up.

These faults, like most other faults in the Ozark area, are within the Paleozoic bedrock and are not considered seismically active. They are not considered to pose an unusual hazard to the dam.

The dam is located approximately 90 miles northwest of the line of epicenters for the very large New Madrid earthquakes which occurred in 1811 and 1812. A recurrence of an earthquake of the magnitude of the New Madrid events could cause significant damage to the dam, but an assessment of this risk is beyond the scope of this Phase I investigation.

SECTION 3
VISUAL INSPECTION

3.1 Findings

a. General. A visual inspection was made of Ozark Lead Tailings Dam on 23 February 1981. The inspection team was accompanied by Mr Terry Maio, concentrator superintendent, and Mr Rod Snow, metallurgical engineer, of Ozark Lead Co.

b. Dam. The dam consists of a zoned tailings and earth embankment, constructed in an arc, concave downstream. The crest of the dam is essentially level at elevation 1097 and is approximately 20 ft wide. The downstream slope is approximately 2(H) to 1(V). A program to vegetate the slope was hampered by a drought during the summer of 1980 and surface erosion has removed much of the slope cover (Photo 3). This area is to be reseeded, according to Ozark Lead Co personnel. The upstream slope is approximately 2.5(H) to 1(V) and has a well developed grassy vegetation cover (Photo 4). No other erosion protection was noted on the upstream slope.

Abutment drain trenches have been excavated along parts of the junction of the embankment and abutments. No significant erosion was noted in these areas.

No evidence was noted of disruption of the vertical or horizontal alignment of the dam crest. No evidence was noted of cracks, slumps, animal burrows sinkhole development or detrimental settlement on the embankment.

Three outlet pipes for a blanket drain system were noted near the toe of the embankment. These consisted of 6-in. diameter PVC pipes, and were each flowing at an estimated rate of 15 gal/min (Photo 5). The pipes discharged into wooden weir boxes to allow measurement of flow. The total flow was described by Ozark personnel as being nearly constant at the observed rate.

One area of seepage and spongy ground was noted near the center drain (Photo 6). Seepage was estimated at approximately ¼ gal/min and was not transporting any soil.

Piezometers were identified on the upstream slope, crest and downstream slope of the dam (Photo 7). Measurements were not being taken during the field inspection and water level records were not readily available to the inspection team. However, it was reported by Mr Maio that water level measurements are taken regularly and plotted against the designed phreatic surface profile.

A bent and punctured steel pipe was noted at the toe of the dam near the left abutment. The pipe was leaking water under some pressure. It was described as a drain pipe which discharges into the stilling pool at the toe of the dam. This pipe appears to be the outlet pipe for the drainfield upstream of the starter dam. The apparent pressure of leakage through the puncture in the pipe suggests the valve, described as being at the downstream end but not found during the inspection, might be closed or damaged. The condition of this pipe and valve should be further evaluated.

c. <u>Appurtenant structures.</u>

1. <u>Spillway</u>. A broad, unlined, uncontrolled open channel spillway has been cut through the hillside northeast of the dam (Photo 8). The floor of this spillway cut is approximately 110 ft wide; the sides of the trapezoidal cut are approximately 2(H) to 1(V). The excavation was made in soil and weathered bedrock. Attempts to vegetate this area were hampered by a period of drought in 1980. Some erosion may occur in this area during high flood flows, but will not pose a hazard to the dam due to the distance from the embankment.

2. <u>Storm drain</u>. A 60-in. diameter corrugated metal pipe acts as a storm drain outlet from the reservoir. The inlet elevation was approximately 3 ft above the tailings surface at the time of the visual inspection. The inlet tower was described as extending down a steep hillside, approximately 60 percent grade, to a 1400-ft long outlet pipe which exits at the toe of the dam.

Discharge at this point also includes flow from the decant line. Discharge was estimated at the time of the visual inspection to be 2500 gal/min. Most of this was assumed to be from the decant line inflow.

3. Decant line. A 24-in. diameter decant line runs from an upstream arm of the reservoir approximately 3250 ft to the junction with the 60-in. diameter storm drain pipe. The present decant line replaces an earlier 24-in. diameter pipe which became obstructed beneath the tailings reservoir. The inlet tower for this decant line is a vertical concrete tower (Photo 9). The inlet elevation has an adjustable weir and is fitted with trash racks to prevent obstruction. At this time of our visual inspection, the inlet weir was reported to be at elevation 1061 ft.

4. Stilling pool-settling basin. At the toe of the embankment is a small pool which collects the discharge from the storm water overflow pipe and decant line. Surface area of this pool is approximately 8000 ft^2. A pump house adjacent to the pool pumps water from the pool through a 16-in. diameter water line to the mill. A spillway discharges overflow into a second small pond which flows into Adair Creek.

d. **Reservoir area.** The reservoir for this dam is nearly filled with fine sandy to silty tailings (Overview Photo). Portions of the reservoir at the upstream end have water covering the tailings deposits. The tailings appear quite soft when first deposited. In the area of the reservoir adjacent to the spillway, some of the spillway excavation spoil was pushed out onto the tailings surface. A crater-like feature, approximately 6 ft in diameter was noted, apparently where a boulder in the spoil material sank into the unconsolidated tailings (Photo 10).

The slopes surrounding the reservoir are generally less than about 4(H) to 1(V) and are heavily wooded. Siltation in the reservoir from the drainage basin will be insignificant relative to the tailings deposited in the reservoir. No evidence of unstable slopes immediately adjacent to the reservoir were noted during the field inspection.

e. Downstream channel. The channel downstream of the spillway flows in an unimproved natural stream bed in a valley east of the dam. During significant flood flows through the spillway, some erosion could occur in this area, but the ridge separating the dam from this valley precludes any impact on the safety of the dam.

3.2 Evaluation

The visual inspection of the dam and appurtenant structures indicate the dam is in generally good condition. No evidence of cracking or slumping, indicating slope instability, was noted on the dam. Erosion control on the upstream slope is limited to a well developed grass cover. Vegetation for erosion control on the downstream slope was hampered by a period of drought. Other than the loss of ground cover on the downstream slope of the dam, no significant erosion was noted at this facility. No evidence was noted of disruption of the vertical or horizontal alignment of the dam crest, sinkhole development, detrimental settlement, or animal burrows on the dam. Seepage was limited to a small area at the toe, with the seepage estimated at ¼ gal/min.

The steel pipe near the left toe of the dam is apparently the discharge for the drainfield upstream of the starter dam, as interpreted from drawings in the paper by Lagergren and Griffith (1973). However, this pipe and drainfield are not shown on any of the design drawings supplied by Ozark Lead Co. The pipe was apparently damaged during construction of the dam modifications in 1979-1980. Leakage from the damaged pipe indicates the flow is under some pressure and deterioration of this pipe could result in internal erosion of the dam. An assessment of this pipe should be made to identify if damage or obstruction of the pipe has resulted in the observed pressure within the pipe, or if the valve, described as being at the downstream end, is closed. Appropriate remedial measures should be taken to allow unimpaired discharge from the drainfield.

The other possible item of concern is the crater-like feature noted on the spoil pushed onto the tailings surface adjacent to the spillway excavation. It appears this crater-like depression is where a boulder in the spoil sank into the unconsolidated tailings. However, the 60-in. diameter storm drain pipe runs along the floor of the reservoir in this area. If settlement, corrosion or overburden pressure has deformed or damaged this pipe, some loss of material could be occurring in the overlying tailings. Some sedimentation was described by Lagergren and Griffith in the settling pond - stilling basin at the discharge end of this pipe at the downstream toe of the dam. Loss of materials in the tailings reservoir would not represent an immediate hazard to the dam but could indicate this conduit is deteriorating which could affect the dam. Periodic inspection of this 60-in. diameter pipe is recommended to assess its condition and any necessary remedial measures.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Procedures

The inlet elevation for the decant line is controlled by an adjustable weir in the inlet tower. This weir is periodically raised as the reservoir and tailings level rises. At the time of the visual inspection, the inlet elevation was reported to be 1061 ft.

Piezometers on the dam are checked periodically and the data are plotted to monitor the piezometric surface within the embankment.

Weir boxes were recently placed at the blanket drain outlets. These weir boxes are used to periodically check the amount of discharge, which was reported to be fairly constant at approximately 45 gal/min, total for all three drains.

4.2 Maintenance of Dam

No formal maintenance program was identified at this facility. Modification of the dam has only recently been completed, summer 1980. The sand portion of the embankment may continue to be raised. A program to vegetate the crest and slopes of the earth embankment was hampered by an extended period of drought during the summer of 1980. A significant portion of the ground cover mulch has been washed from the downstream slope. This should be replaced in order to successfully vegetate these slopes.

4.3 Maintenance of Operating Facilities

No records were available of maintenance performed on the operating facilities. All facilities appeared to be in generally good condition. The weir boxes recently installed at the blanket drain outlets are made of wood, and will probably require fairly frequent replacement.

4.4 Description of Any Warning System in Effect

The visual inspection did not identify any warning system at this facility.

4.5 Evaluation

There is no formal maintenance program in effect at this dam. However, the facilities appear to be in generally good condition. It is recommended that a formal program of maintenance be developed to assure continued necessary maintenance is performed on a regular basis. The feasibility of a practical and effective warning system should be evaluated to alert downstream residents and traffic in the event hazardous conditions develop at this dam.

SECTION 5
HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design data. No hydrologic or hydraulic information was available for evaluation of the dam or reservoir; however, design and construction drawings of the dam and appurtenant structures were provided by Ozark Lead Co. Other relevant data were measured during the visual inspection or estimated from topographic maps. The maps used in the analyses were the USGS Midridge and Bunker, Missouri, 7.5-minute quadrangle maps (1967).

b. Experience data. The reservoir level was reported to have risen 5 ft above the inlet elevation of the 60-in. diameter storm drain in the winter of 1968 (Lagergren and Griffith, 1973). The inlet elevation at that time is not known. No other recorded rainfall, runoff, discharge or pool stage historical data were found for this reservoir.

c. Visual observation.

1. Watershed. The watershed is covered with dense forest. The area of the reservoir is approximately 10 percent of the total drainage area of 6.1 square miles.

2. Reservoir. The reservoir and dam are described in Section 3 of this report and by the maps and photographs enclosed herewith. The primary use of this impoundment is for storage of lead tailings.

3. Spillway. The open channel earthen spillway is located well away from the dam. The discharge channel has 0.4 percent slope, according to design plans, and drops into a separate drainage east of the dam and reservoir. A 60-in. diameter pipe is present as a storm drain outlet below the spillway crest.

d. **Overtopping potential.** One of the primary considerations in the evaluation of Ozark Lead Tailings Dam is the assessment of the potential for overtopping and consequent failure by erosion of the embankment. Since the spillway of this dam is soil and weathered bedrock, erosion at the control section of the spillway due to high velocity discharge may occur. However, the distance between the spillway and embankment precludes any unusual hazard to the dam from erosion of the spillway.

Hydrologic analysis of this dam for the 1 and 10 percent probability-of-occurrence floods were based on initial water surface elevation equal to the observed water surface elevation at the time of visual inspection. The initial water surface elevations for the Probable Maximum Floods (PMF) were determined by antecedent storm conditions. The results of the analyses indicate that the PMF will not overtop the dam. The PMF is defined as the flood event that may be expected to occur from the most severe combination of critical meteorologic or hydrologic conditions that are reasonably possible in the region. The guidelines require high hazard potential, intermediate size dams to pass a spillway design flood of 100 percent of the PMF. The analyses also indicate that the 1 percent probability-of-occurrence flood event (100 year flood) will be stored in the reservoir and passed through the storm drain and decant line. The 1 percent probability-of-occurrence flood event is the flood event that has a 1 percent chance of occurring in any year, or occurs on the average once every 100 years. The total spillway capacity at maximum pool elevation (top of dam) is approximately 21,500 ft^3/sec, including a discharge of approximately 330 ft^3/sec through the decant and storm drain lines.

The following overtopping data for various flood events were computed for the dam assuming no erosion of the spillway.

Precipitation Event	Maximum Reservoir Elevation, ft, (MSL)	Maximum Depth Over Dam, ft	Maximum Outflow, ft^3/sec	Duration of Overtopping, hrs
1% Prob	1080.3	0	200	0
50% PMF	1088.4	0	5,000	0
100% PMF	1093.4	0	13,300	0

Input data and output summaries for hydrologic and hydraulic analyses are presented in the attached Appendix B.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. **Visual inspection.** The visual inspection of Ozark Lead Tailings Dam indicated the dam is in generally good condition. No evidence was noted of displacement of the vertical or horizontal alignment of the dam crest, or other signs of slope instability, settlement, significant erosion, or animal burrows. A crater-like feature identified in the spoil area between the spillway and embankment is probably the result of the sinking of a large boulder from the spoil into the underlying unconsolidated tailings.

Seepage was limited to a small area adjacent to one of the outlets for the blanket drain. The seepage did not appear to be carrying any soil and did not appear to be a hazard to the dam at the time of the visual inspection.

The spillway is in good condition. The distance from the embankment indicates potential erosion in the spillway will not impact the stability of the dam.

b. **Design and construction data.** Information regarding the design and construction of this dam which was supplied to the inspection team is listed in Section 2.1. A summary of the construction history is presented in Section 2.2.

A request for additional design, construction, seepage and stability analysis information was made to Dames & Moore, Denver, Colorado, the firm who designed the recent modifications to the dam. However, Ozark Lead Company did not feel it appropriate for Dames & Moore to release the requested information (see Correspondence, Appendix C).

c. **Operating records.** No water level or discharge records were available for this facility. It was reported that records are maintained on discharge from the blanket drain outlets and on piezometer readings. No other operating records were found for this dam.

d. <u>Post construction changes.</u> The dam was constructed in several phases. The most recent construction was completed in the summer of 1980. A summary of the construction history is presented in Section 2.2.

No changes were identified following the completion of this latest embankment construction.

e. <u>Seismic stability.</u> The dam is located approximately 90 miles northwest of the line of epicenters for the 1811-1812 New Madrid Earthquakes. This places the dam in Seismic Zone 2, to which the guidelines assign a moderate damage potential.

Static and seismic stability analyses were reported to have been performed by Dames & Moore for this dam, but were not released for review by the inspection team. Liquefaction resulting from seismic shaking should be a major consideration in the analysis of the stability of this dam. However, without review of the stability analyses, knowledge of the soil properties or of the position of the phreatic surface, the seismic stability cannot be assessed.

SECTION 7
ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment

a. Safety. Based on our visual inspection and analysis of available data, the dam appears to be in generally good condition.

The slopes of the dam showed no signs of instability or significant erosion. Seepage at the toe of the dam appeared relatively minor and was not transporting any soil or tailings. Hydraulic/hydrologic analyses indicate the reservoir and spillway will store and pass 100 percent of the Probable Maximum Flood (PMF) without overtopping the embankment. These analyses also indicate the 1 percent probability-of-occurrence flood (100 year flood) will be stored in the reservoir and passed through the storm drain and decant line. The spillway is excavated in soil and weathered rock and may be subject to some erosion during flood flows, but the distance from the embankment precludes this erosion from posing a hazard to the stability of the dam.

It was reported that seepage and stability analyses were prepared for the dam, but these analyses were not made available for review.

b. Adequacy of information. The visual inspection and other information obtained for this dam provided sufficient information to support the conclusions presented in this Phase I inspection report.

The conditions observed in the field inspection appear to be in general agreement with the design plans supplied by Ozark Lead Co.

Seepage and stability analyses, including static and seismic stability, were not supplied for review, although they were reported to be on file. See Appendix C.

c. <u>Urgency.</u> The deficiencies described in this report, while not serious at present, could affect the long term stability of the dam. Remedial measures should be initiated as soon as practical.

d. <u>Necessity for Phase II.</u> In accordance with the "Recommended Guidelines for Safety Inspection of Dams," the subject investigation was a minimum study. Information regarding the seepage and stability analyses should be obtained in order to complete the assessment of the safety of this dam. It is our understanding from discussions with the SLD that any additional investigations are the responsibility of the owner.

7.2 Remedial Measures

a. <u>Alternatives.</u> There are several general options which may be considered to reduce the possibility of dam failure or to diminish the harmful consequences of such a failure. Some of these general options are listed below.

1. Remove the dam, or breach it to prevent storage of water.

2. Purchase downstream land that would be adversely impacted by dam failure and restrict human occupancy.

3. Provide a highly reliable flood warning system (generally does not prevent damage but diminishes chances for loss of life).

b. <u>Recommendations.</u> Based on our inspection and evaluation of available data on Ozark Lead Tailings Dam, it is recommended that the following topics be addressed as soon as practical.

1. Seepage and stability analyses reported to be on file for this dam should be reviewed to verify conformance of the design to as-built configurations of the slopes, design and actual discharge from the drains, and location of the phreatic surface within the embankment. These analyses should consider all appropriate loading conditions, including seismic loading, and should be performed by an engineer experienced in the design and construction of tailings dams.

2. Repairs should be made to the bent and leaking drain discharge pipe at the toe of the left abutment. These remedial measures should include routing discharge from this pipe away from the toe of the dam to prevent erosion, and monitoring discharge from the pipe to identify soil or tailings in the discharged water.

c. **O & M procedures.** It is recommended that a program of periodic inspections and maintenance be developed and initiated for this facility. This program should include, but not be limited to, the following items.

1. Continue efforts to vegetate the downstream slope of the embankment. Replacement of the mulch will likely be necessary.

2. Inspect the embankment for evidence of slope instability such as cracking or slumping, detrimental settlement or piping.

3. Inspect discharge from the various drain outlets to identify turbidity (soil or tailings) in the water. This should include any areas of seepage identified along the toe of the slope or in the abutments.

4. Maintain the decant inlet, storm drain inlet, and spillway channel free of obstructions to flow.

5. Inspect the 60-in. diameter storm drain beneath the dam for evidence of settlement, cracking or leakage.

All remedial measures and maintenance should be performed by or under the guidance of an engineer experienced in the design, construction and maintenance of tailings dams.

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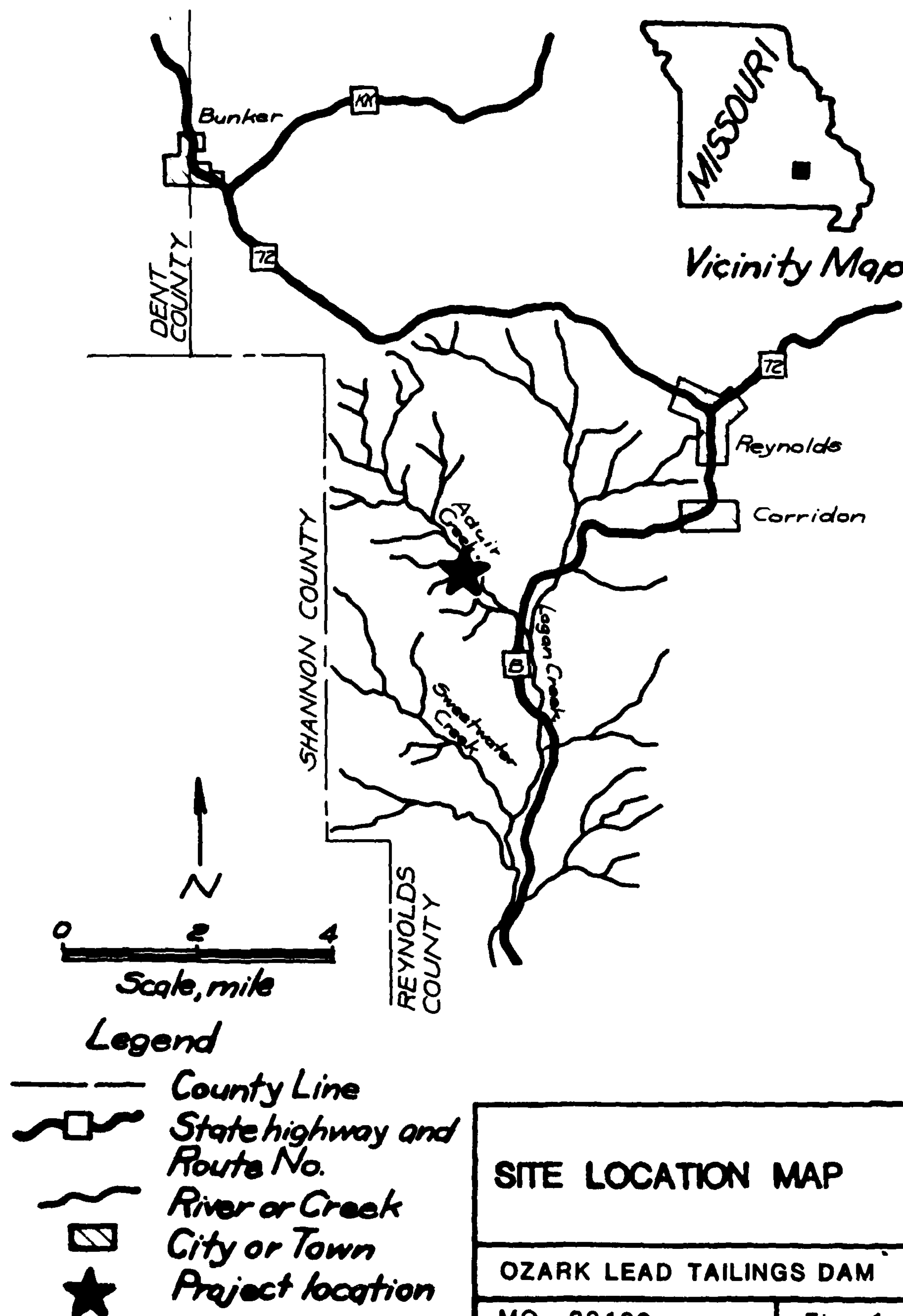
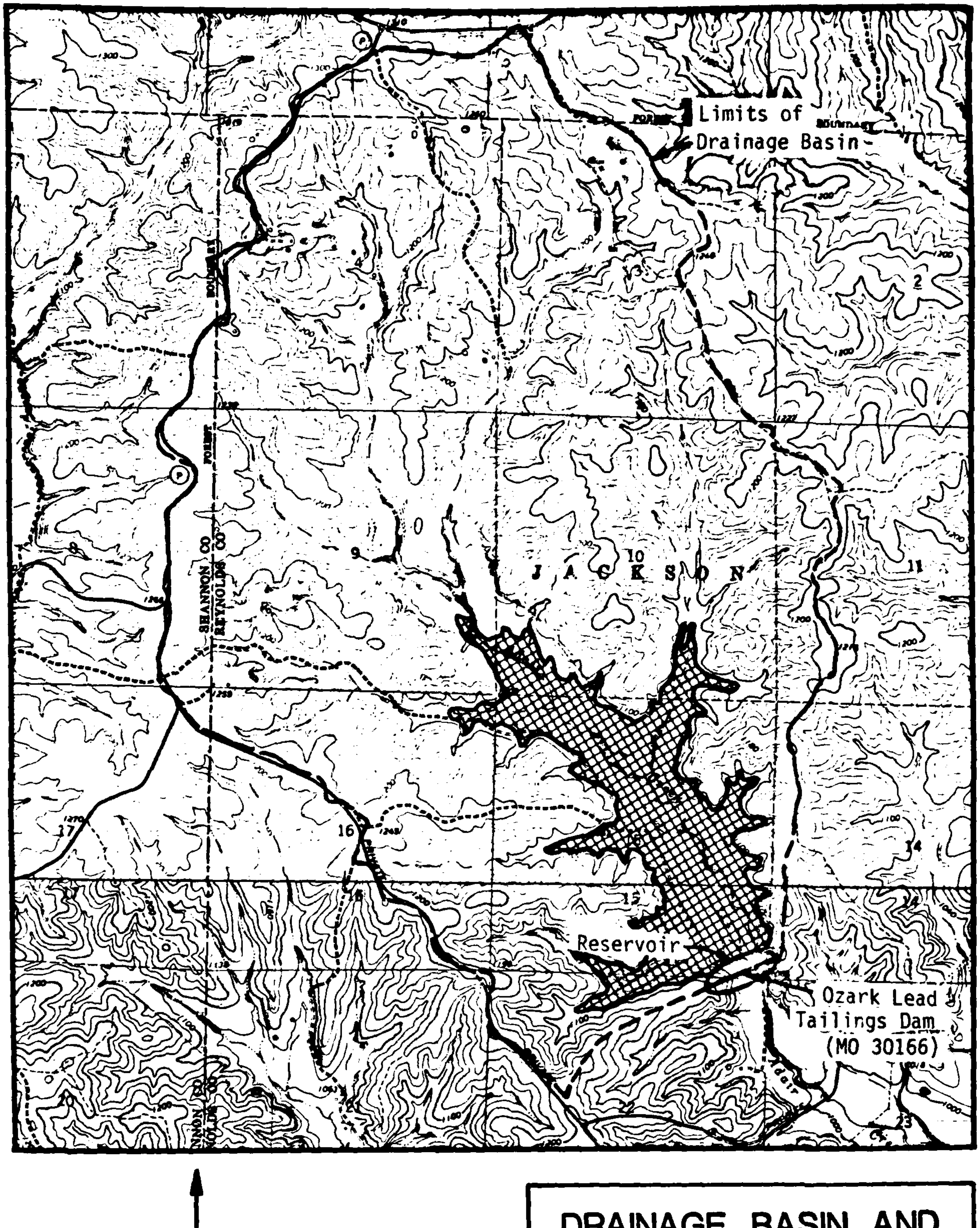


SITE LOCATION MAP

OZARK LEAD TAILINGS DAM

MO. 30166 Fig. 1

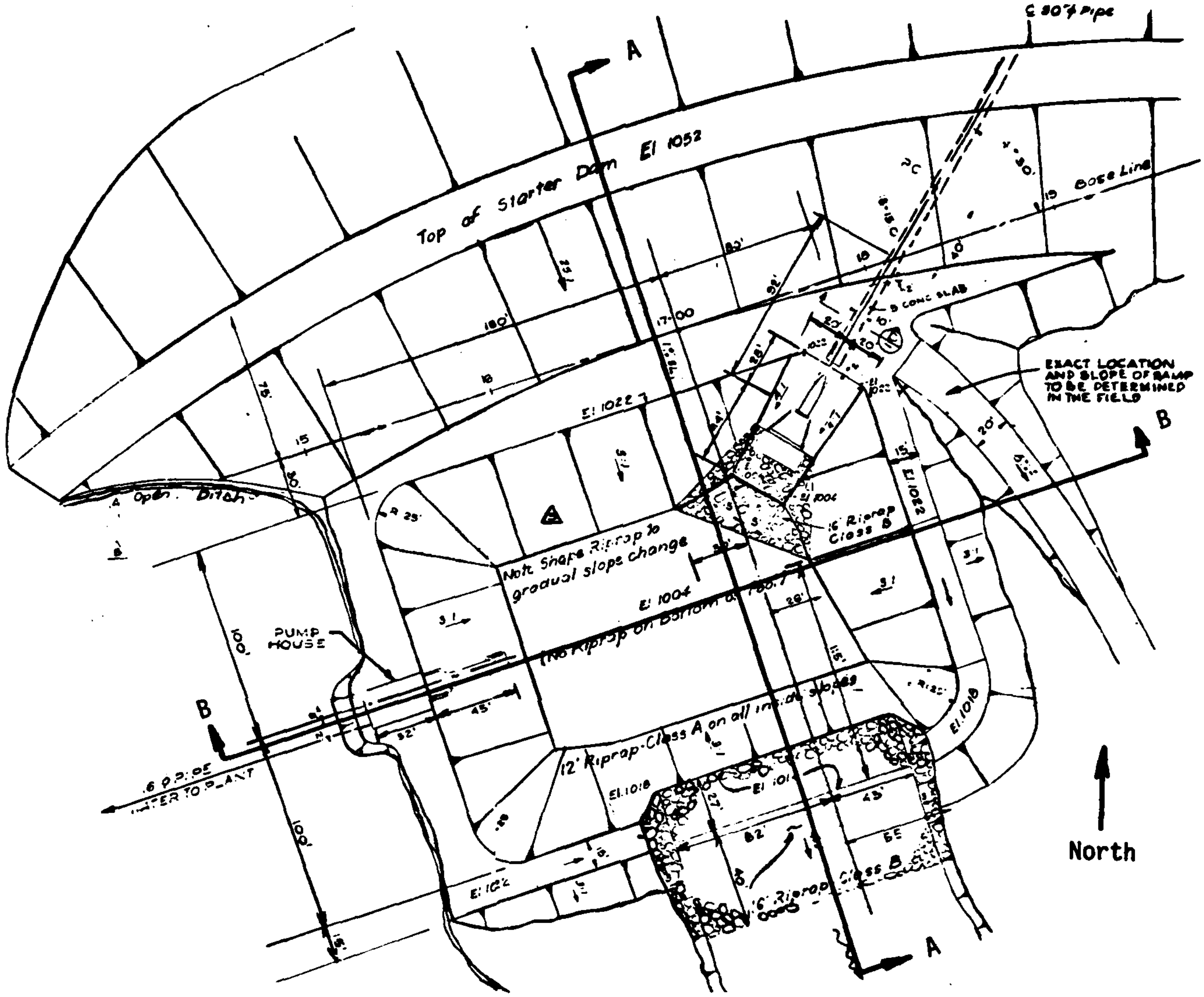


Note: Topography from USGS Midridge (1966) and Bunker (1967) 7.5-minute quadrangle maps.

DRAINAGE BASIN AND SITE TOPOGRAPHY

OZARK LEAD TAILINGS DAM

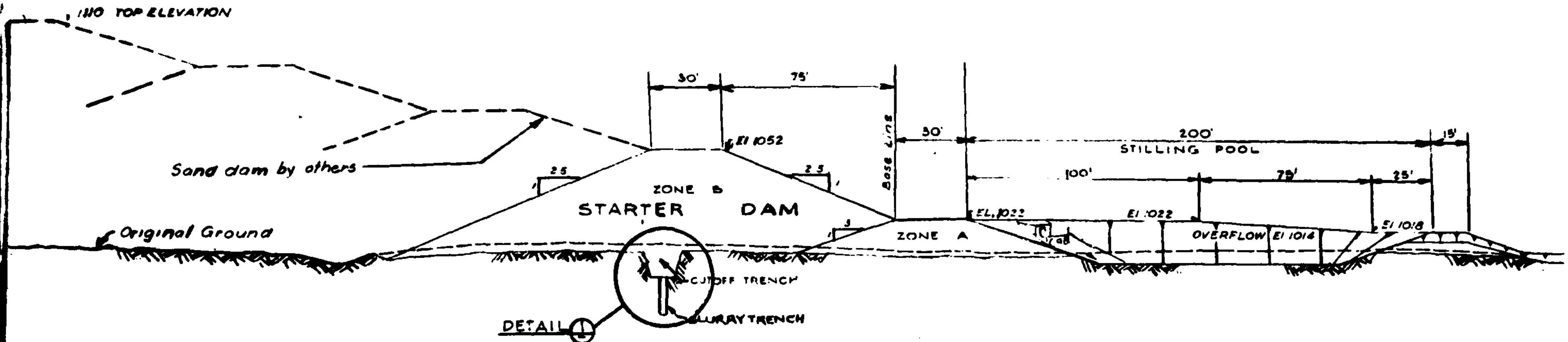
MO. 30166 | **Fig. 2**



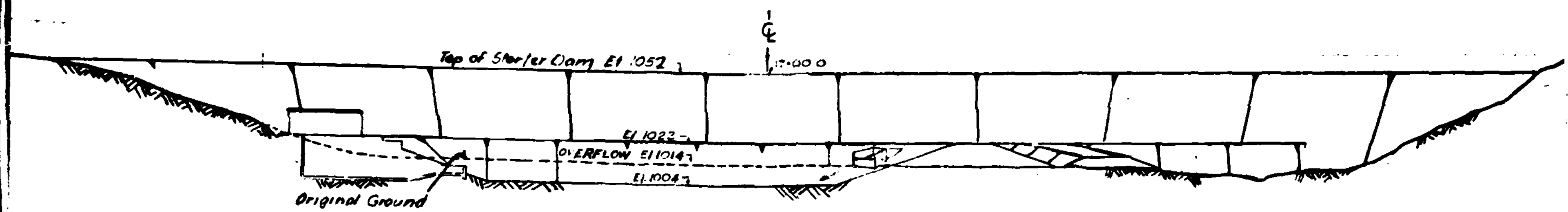
PLAN OF STARTER DAM AND STILLING POOL
Scale:1-in. = 80-ft

Note: From drawing 949-442G "Tailing Dam Plans and Sections", Arthur G. McKee & Company, San Francisco, California, Final approval date, 7-18-67. Reduced 50% from original. Scale shown reflects reduction.

PLAN OF STARTER DAM AND STILLING POOL	
OZARK LEAD TAILINGS DAM	
MO 30166	Fig. 3-A



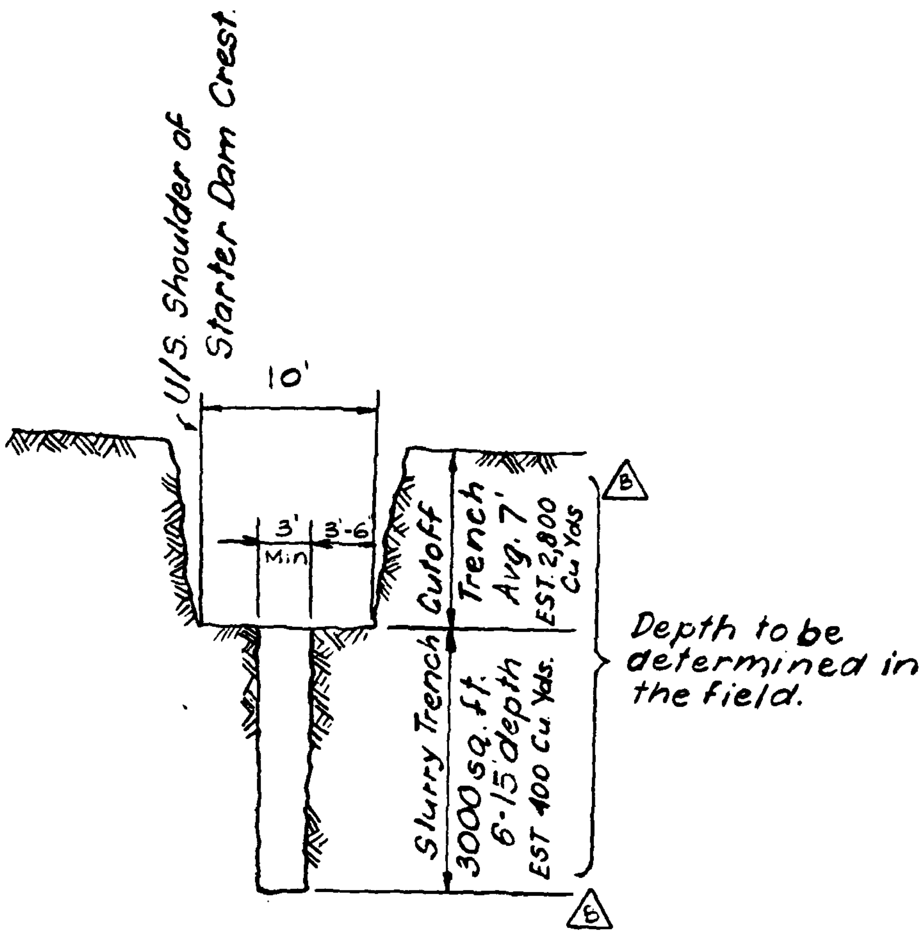
SECTION A
Scale:1-in. = 60-ft



SECTION B
Scale:1-in. = 60-ft

Note: From drawing 949-442G
"Tailing Dam Plans and Sections",
Arthur G. McKee & Company,
San Francisco, California,
Final approval date, 7-18-67.
Reduced 50% from original.
Scale shown reflects reduction.

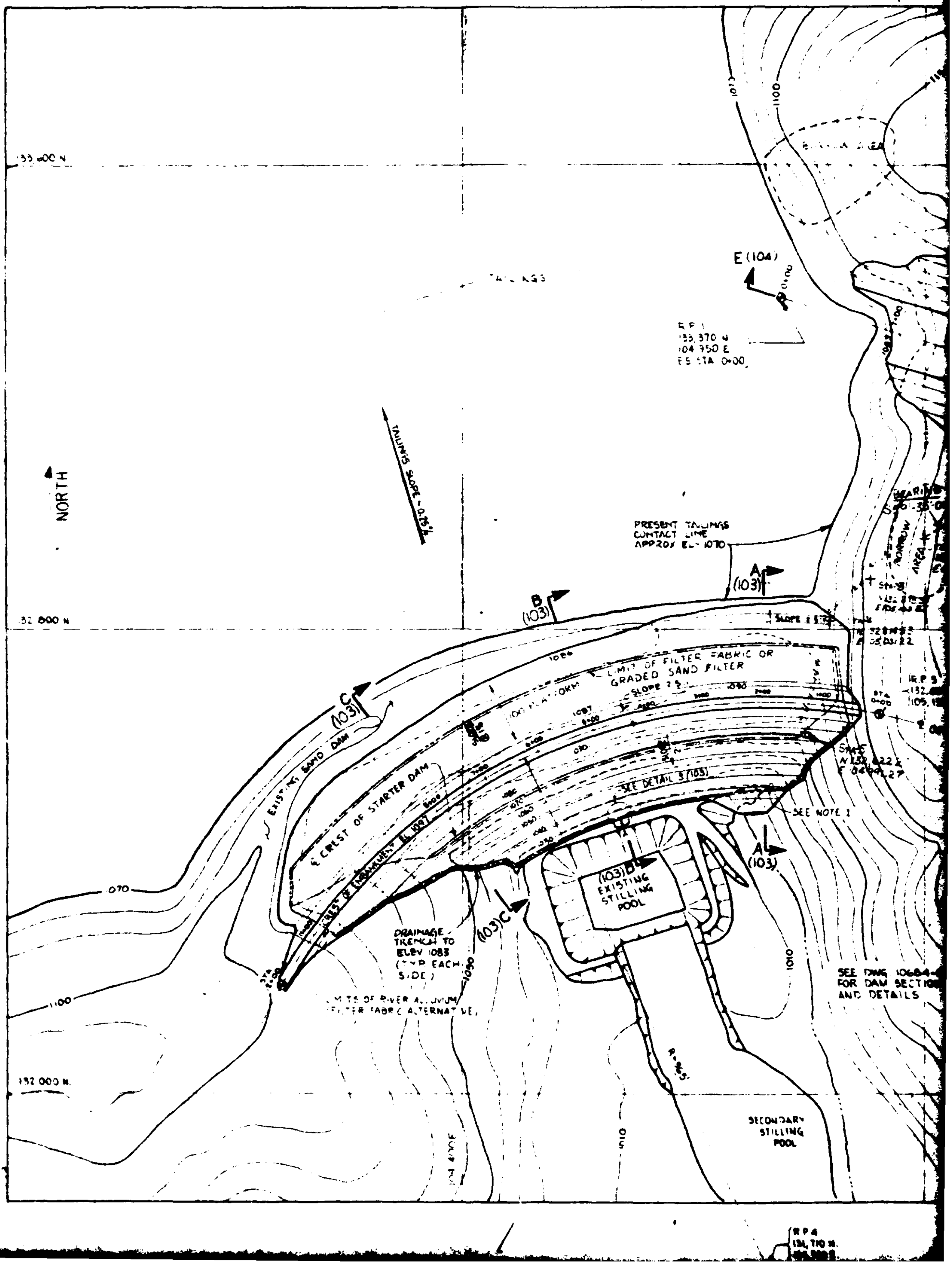
SECTION AND PROFILE OF STARTER DAM	
OZARK LEAD TAILINGS DAM	
MO 30166	Fig. 3-B



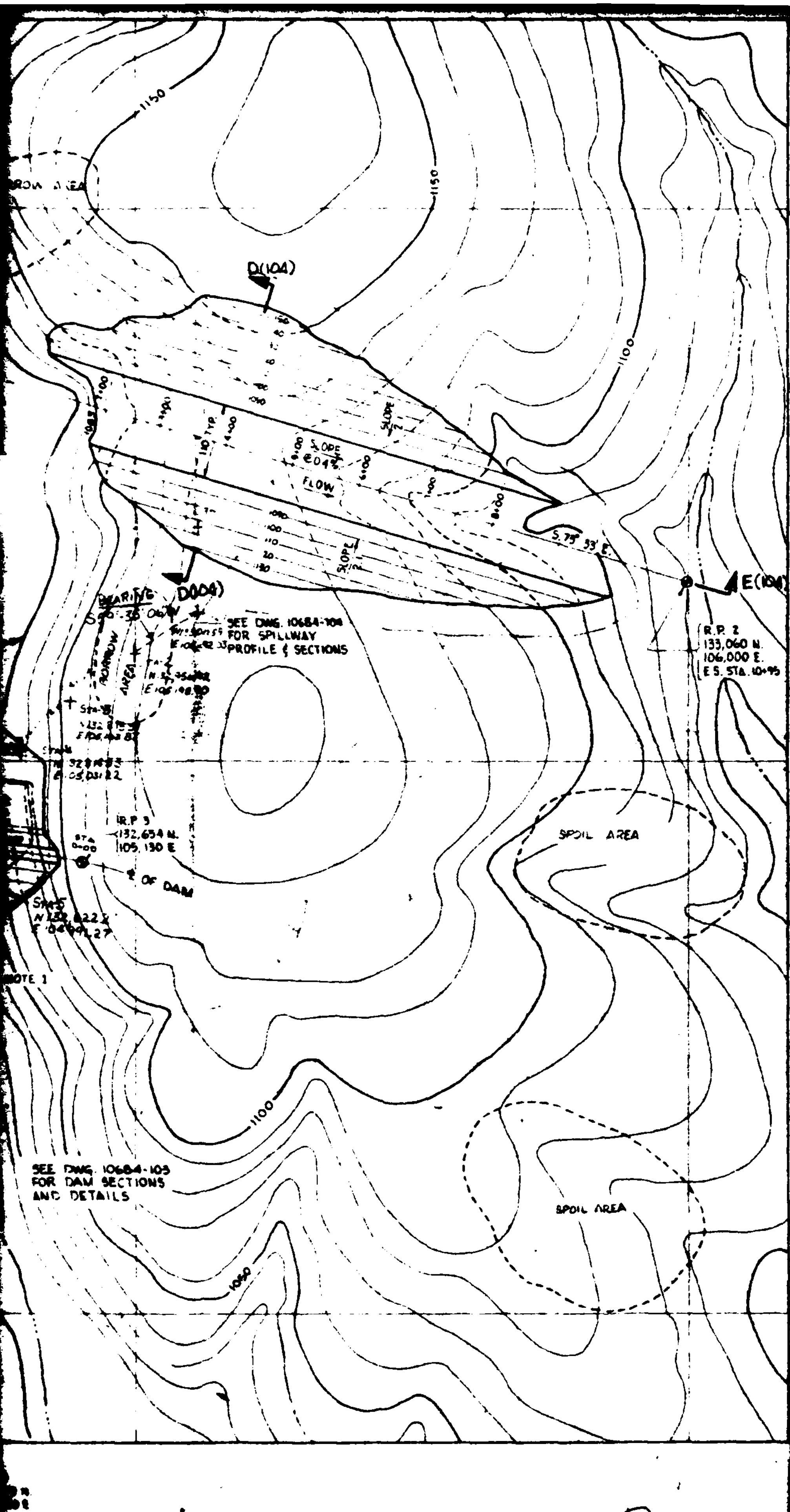
DETAIL 1
Scale:1-in. = 10-ft

Note: From drawing 949-442G "Tailing Dam Plans and Sections", Arthur G. McKee & Company, San Francisco, California, Final approval date, 7-18-67.

CUT-OFF AND SLURRY TRENCH DETAIL	
OZARK LEAD TAILINGS DAM	
MO 30166	Fig. 3-C



133,600 N
132,800 N
132,000 N
NORTH
TAILINGS
TAILINGS SLOPE 0.25%
E (104)
R.P. 1
133,370 N
104,950 E
ES STA 0+00
PRESENT TAILINGS
CONTACT LINE
APPROX EL 1070
A (103)
B (103)
C (103)
D (103)
LIMIT OF FILTER FABRIC OR
GRADED SAND FILTER
SLOPE 2:1
CREST OF STARTER DAM
EXISTING SAND DAM
SEE DETAIL 3 (103)
SEE NOTE 1
EXISTING
STILLING
POOL
DRAINAGE
TRENCH TO
ELEV 1083
(TYP EACH
SIDE)
LIMITS OF RIVER ALLUVIUM
FILTER FABRIC ALTERNATIVE
SEE DWG 10684-
FOR DAM SECTIONS
AND DETAILS
SECONDARY
STILLING
POOL
BORROW AREA
1100
1010
1070
1090
1086



NOTE

1. SLOPE TOE OF DRAINAGE BLANKET CONTINUOUSLY TOWARD PIPE OUTLET. AVOID ISOLATED LOW SP

REVISIONS			
NC	BY	DATE	REMARKS

ØZARK LEAD COMPANY

PROJECT: DAM & SPILLWAY REHABILITATION

PREPARED BY: DAMES & MOORE
DENVER

DRAWING TITLE: DAM AND SPILLWAY P

REFERENCE DRAWINGS	
	SCALE HORIZ. 1" =
	VERT.
	DESIGNED BY R. A
	DRAWN BY
	INITIAL CK BY
	FINAL CK BY
	APPROV. BY
	JOB NO.
	DWG. NO.

16631.

NOTE

1. SLOPE TOE OF DRAINAGE BLANKET CONTINUOUSLY TOWARD PIPE OUTLET. AVOID ISOLATED LOW SPOTS.

REVISIONS			
NO.	BY	DATE	REMARKS

OZARK LEAD COMPANY

PROJECT: DAM & SPILLWAY REHABILITATION

PREPARED BY: [illegible] — DENVER, COLORADO

DRAWING TITLE: DAM AND SPILLWAY PLAN

SCALE	HORIZ. 1" = 100'; VERT.
DESIGNED BY R.J.N./R.A.U.	DATE 7-[illegible]
DRAWN BY D.D.C.	DATE 7-7-[illegible]
INITIAL CK BY M.L.B.	DATE 7-[illegible]
FINAL CK BY [signature]	DATE [illegible]
APPROV BY [signature]	DATE [illegible]
JOB NO. [illegible]-001-14	SHEET NO.
DWG NO. [illegible]-102	2 of [illegible]

REFERENCE DRAWINGS

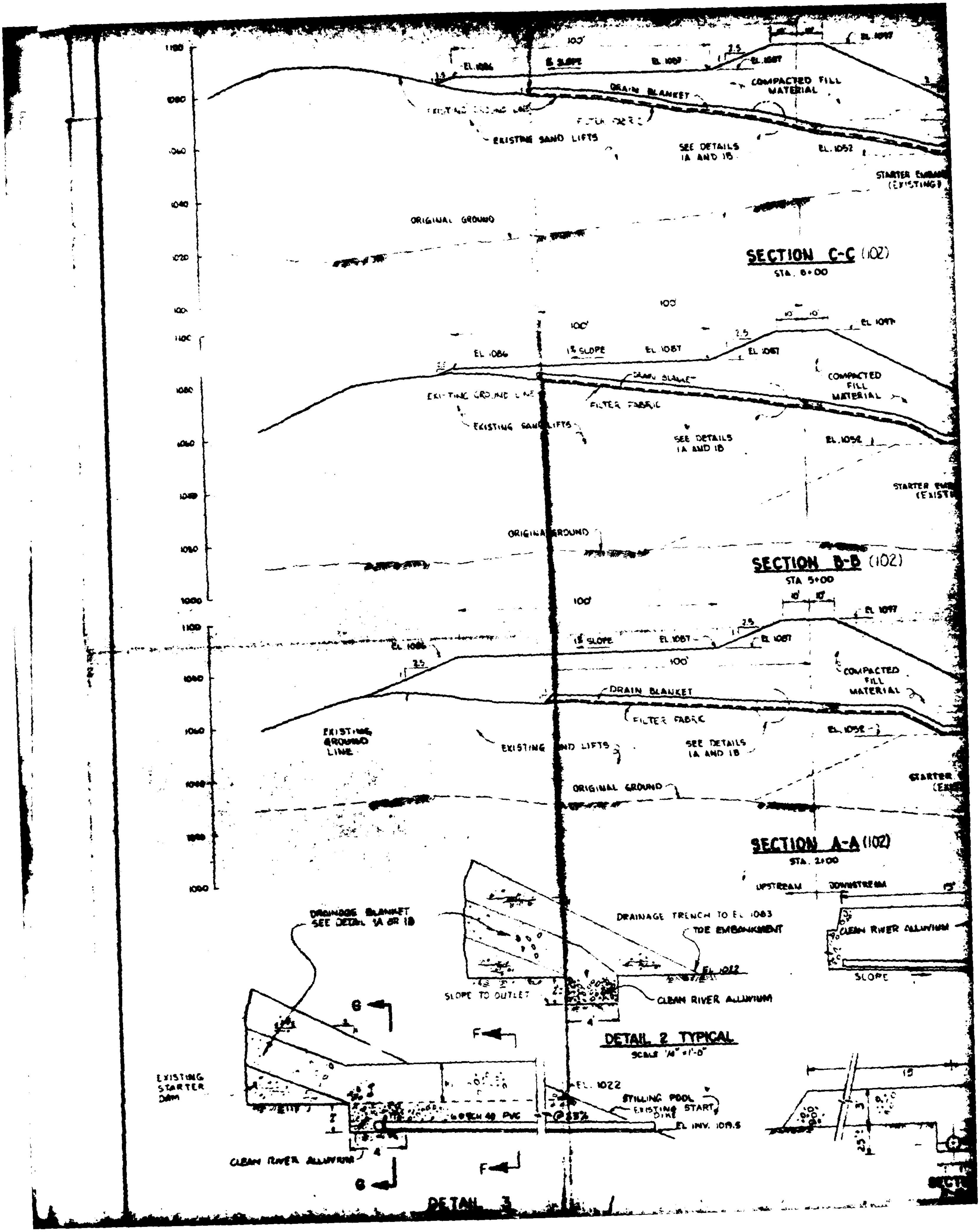
1663.

NOTE:
This copy is a 50% reduction of the original drawing.

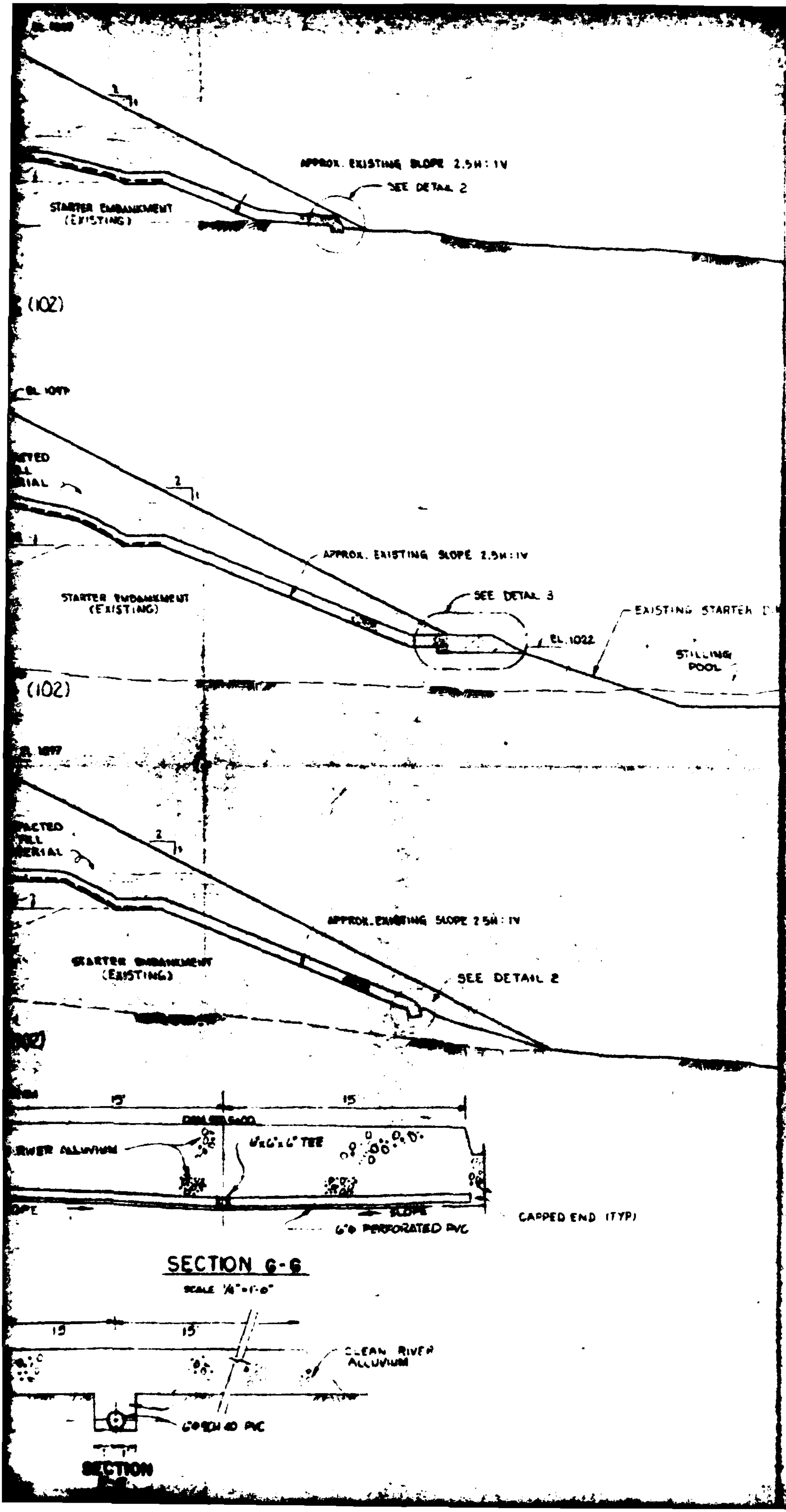
DAM AND SPILLWAY PLAN

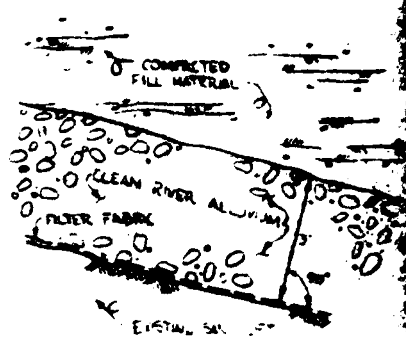
OZARK LEAD TAILINGS DAM

MO 30166	**Fig. 3-D**

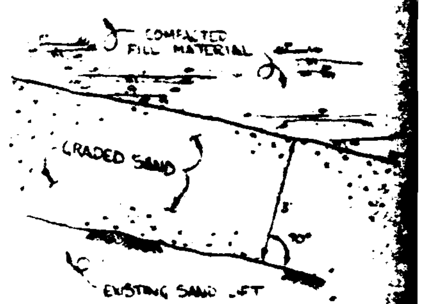


EL 1086
1% SLOPE
EL 1087
EL 1097
COMPACTED FILL MATERIAL
DRAIN BLANKET
EXISTING GROUND LINE
FILTER FABRIC
EXISTING SAND LIFTS
SEE DETAILS 1A AND 1B
EL 1052
STARTER EMBANKMENT (EXISTING)
ORIGINAL GROUND
SECTION C-C (102)
STA. 6+00
SECTION B-B (102)
STA. 5+00
SECTION A-A (102)
STA. 2+00
UPSTREAM
DOWNSTREAM
DRAINAGE TRENCH TO EL 1083
TOE EMBANKMENT
EL 1022
CLEAN RIVER ALLUVIUM
SLOPE TO OUTLET
DETAIL 2 TYPICAL
SLOPE
DRAINAGE BLANKET SEE DETAIL 1A OR 1B
EXISTING STARTER DAM
EL 1022
STILLING POOL
EXISTING STARTER DIKE
EL INV. 1019.5
CLEAN RIVER ALLUVIUM
DETAIL 3





DETAIL 1A



DETAIL 1B

DRAIN BLANKET WITH GRADED SAND

REVISIONS			
NO	BY	DATE	REMARKS

OZARK LEAD COMPANY

PROJECT: DAM & SPILLWAY REHABILITATION

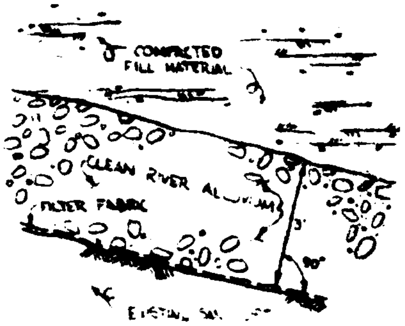
PREPARED BY: DENVER

DRAWING TITLE: DAM SECTIONS & DETAILS

REFERENCE DRAWINGS

NG STARTER

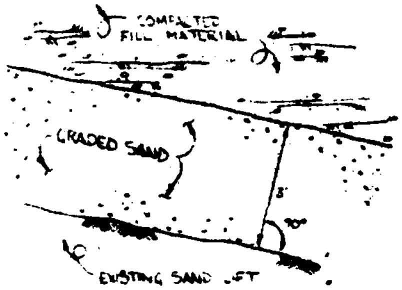
STILLING POOL



DETAIL 1A

SCALE

DRAIN BLANKET WITH FILTER FABRIC



DETAIL 1B

SCALE

DRAIN BLANKET WITH GRADED SAND FILTER

REVISIONS NO	BY	DATE	REMARKS

OZARK LEAD COMPANY

PROJECT: DAM & SPILLWAY REHABILITATION

PREPARED BY: DAMES & MOORE, DENVER, COLORADO

DRAWING TITLE: DAM SECTIONS & DETAILS

SCALE: HORIZ. AS SHOWN; VERT.

DESIGNED BY R J N — DATE 7-6
DRAWN BY J P T — DATE 7-7
INITIAL CK BY M L B — DATE 7-15
FINAL CK BY — DATE
APPROV. BY — DATE
JOB NO 10684-001-10 — SHEET NO
DWG NO 10684-100 — 4 OF 4

REFERENCE DRAWINGS

1 23.5

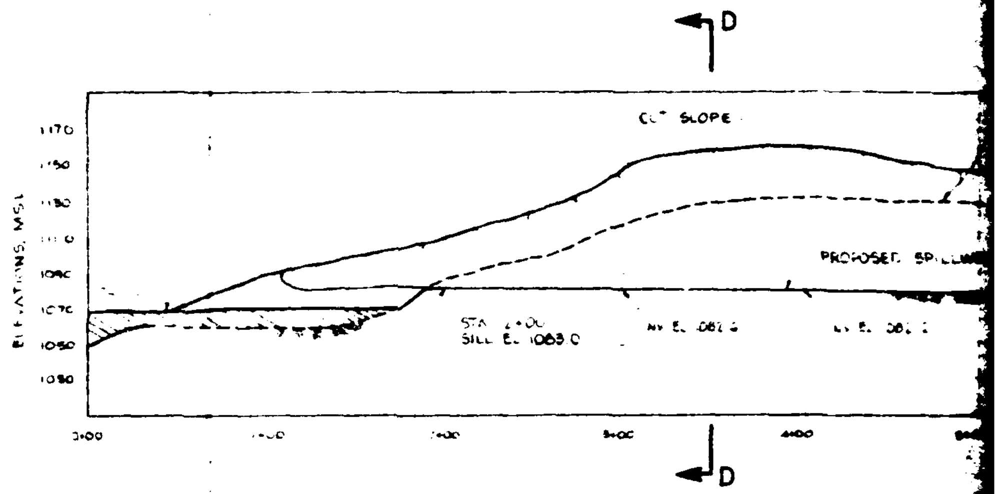
NOTE:
This copy is a 50% reduction of the original drawing.

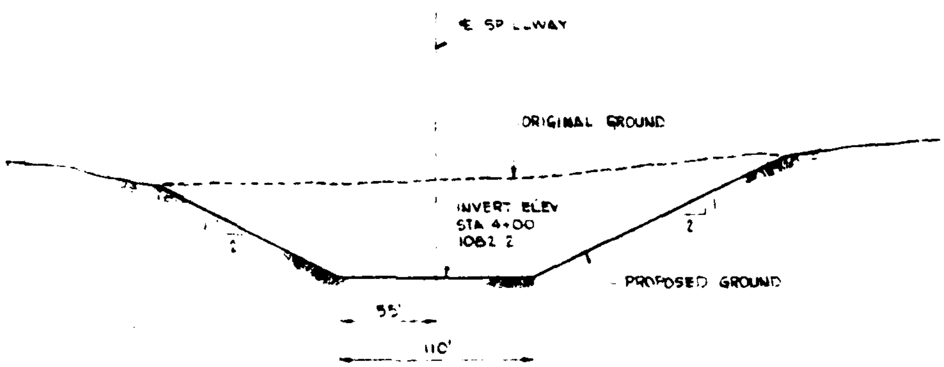
DAM SECTIONS AND DETAILS

OZARK LEAD TAILINGS DAM

MO 30166	Fig. 3-E

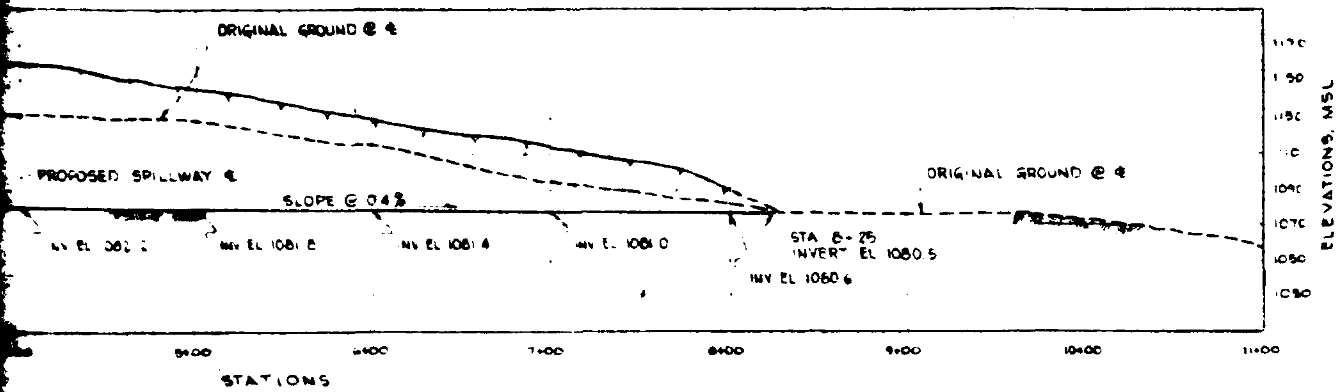
3





SECTION D-D

LOOKING UPSTREAM
SCALE 1" = 50'



SECTION E-E (102)

SPILLWAY PROFILE
SCALE 1" = 50'

REVISIONS			
NO	BY	DATE	REM

ØZARK LEAD COMP

PROJECT: DAM B SPILLWAY REHABILITATION

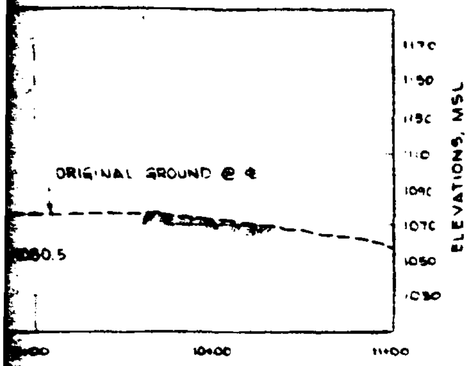
PREPARED BY
DENVER

DRAWING TITLE: SPILLWAY PROFILE &

REFERENCE DRAWINGS

SCALE: HORIZ / VERT

DESIGNED BY
DRAWN BY
INITIAL CK BY
FINAL CK BY
APPROVED BY



NO	BY	DATE	REMARKS

REVISIONS

ØZARK LEAD CØMPANY

PROJECT: DAM & SPILLWAY REHABILITATION

PREPARED BY: DAMES & MOORE, DENVER, COLORADO

DRAWING TITLE: SPILLWAY PROFILE & SECTIONS

REFERENCE DRAWINGS

SCALE: HORIZ / VERT

DESIGNED BY	RJN	DATE	7-10-7[illegible]
DRAWN BY	DDC	DATE	7-1[illegible]
INITIAL CK BY	MLB	DATE	[illegible]
FINAL CK BY	[illegible]	DATE	[illegible]
APPROV BY	[illegible]	DATE	[illegible]

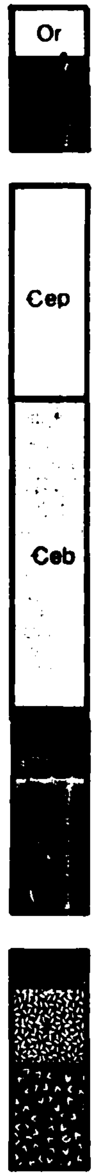
NOTE:
This copy is a 50% reduction of the original drawing.

SPILLWAY PROFILE AND SECTIONS

OZARK LEAD TAILINGS DAM

MO 30166 | Fig. 3-F

Legend



Roubidoux Formation

Gasconade Dolomite
Gunter Sandstone Member

Eminence Dolomite

Potosi Dolomite

Derby-Doerun Dolomite

Davis Formation

Bonneterre Formation
Whetstone Creek Member
Sullivan Siltstone Member

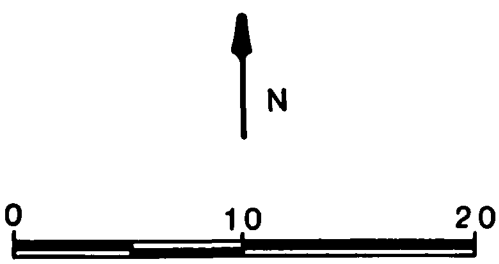
Reagan Sandstone
(subsurface, western Missouri)

Lamotte Sandstone

Diabase (dikes and sills)

St. Francois Mountains Intrusive Suite

St. Francois Mountains Volcanic Supergroup



Scale, mile

REGIONAL GEOLOGIC MAP	
OZARK LEAD TAILINGS DAM	
MO 30166	Fig. 4

APPENDIX A

Photographs

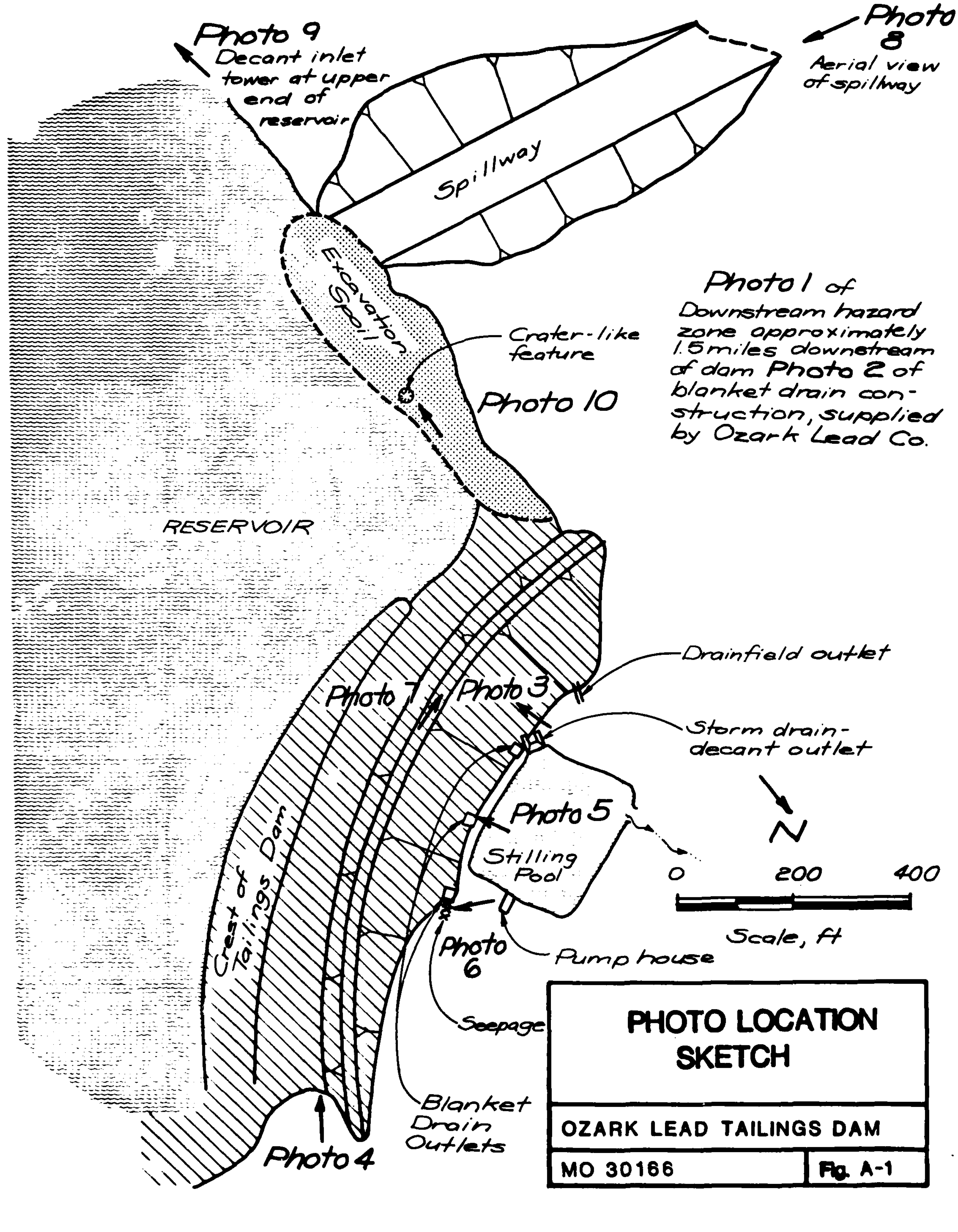


PHOTO LOCATION SKETCH

OZARK LEAD TAILINGS DAM

MO 30166 | Fig. A-1

1. Typical contents of downstream hazard zone. Dam is approximately 1.5 miles upstream, out of picture to the upper right.

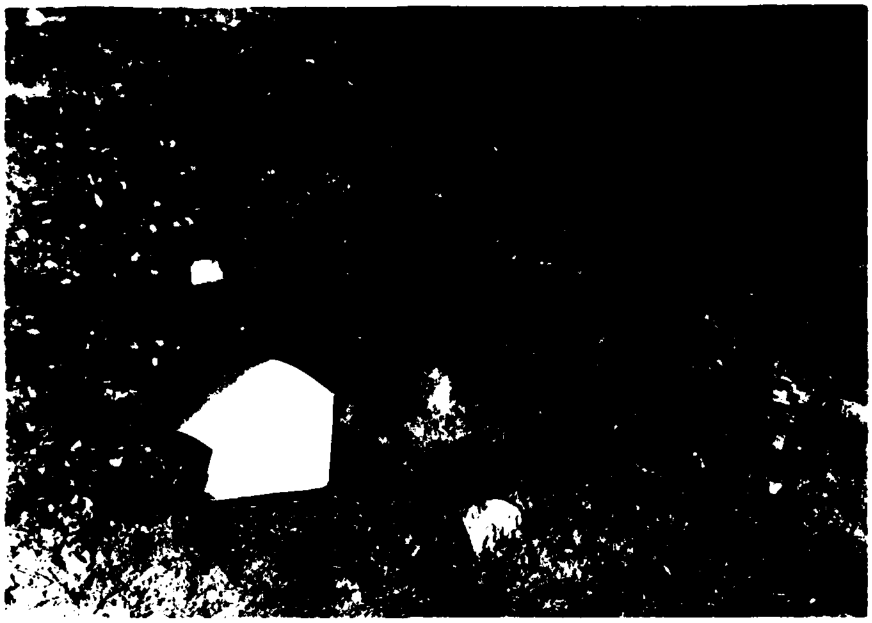
2. Filter fabric and gravel drain being installed during modifications to dam. Note abundant seepage (dark area below fabric) and erosion due to seepage water. Looking east from right abutment. Photo by Ozark Lead Company (1979 or 1980).

3. Minor surface erosion on downstream slope of dam. Looking north, upstream, from toe of dam.

4. Upstream slope showing well developed vegetation cover. Spillway in the distance. Looking east from right abutment.

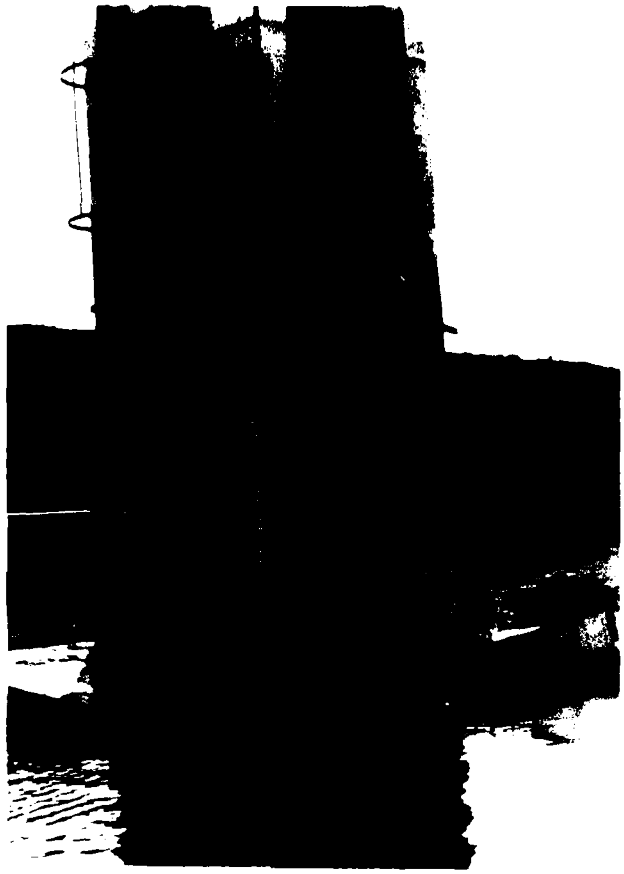
5. Discharge pipe and weir box for blanket drain. Flow estimated at 15 gal/min at time of inspection.

6. Seepage area near toe of right abutment. Flow estimated at less than ¼ gal/min.

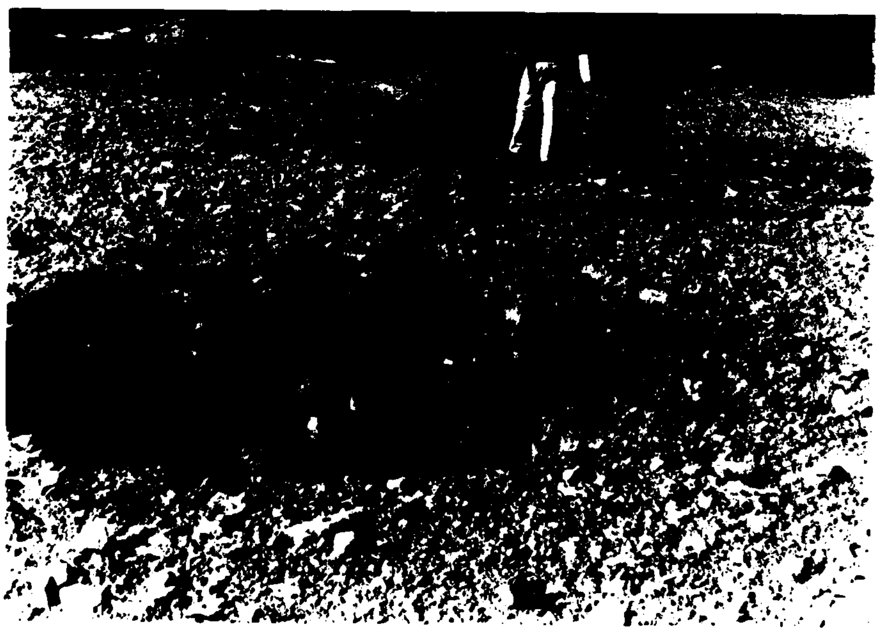


7. Piezometer installed at crest of dam. Similar piezometers are installed on upstream and downstream slopes.

8. Spillway cut through hillside east of reservoir. Floor of spillway is 110-ft wide. Looking west.



9. Inlet tower for decant line.



10. Crater-like feature on surface of spoil from spillway excavation. Apparently a result of boulder in spoil sinking into soft tailings underneath. Located about half of the way between left end of dam and spillway.

APPENDIX B

Hydraulic/Hydrologic Data and Analyses

APPENDIX B
Hydraulic/Hydrologic Data and Analyses

B.1 Procedures

a. General. The hydraulic/hydrologic analyses were performed using the "HEC-1, Dam Safety Version (1 Apr 80)" computer program. The inflow hydrographs were developed for various precipitation events by applying them to a synthetic unit hydrograph. The inflow hydrographs were subsequently routed through the reservoir and appurtenant structures by the modified Puls reservoir routing option.

b. Precipitation events. The Probable Maximum Precipitation (PMP) and the 1 and 10 percent probability-of-occurrence events were used in the analyses. The total rainfall and corresponding distributions for the 1 and 10 percent probability events were provided by the St. Louis District, Corps of Engineers. The Probable Maximum Precipitation (PMP) was determined from regional curves prepared by the US Weather Bureau (Hydrometeorological Report Number 33, 1956). The PMP distribution was computed by the HEC-1 program using the standard EM-1110-2-1411 method.

c. Unit hydrograph. The Soil Conservation Services (SCS) Dimensionless Unit Hydrograph method (SCS, 1971, Hydrology: National Engineering Handbook, Section 4) was used in the analysis. This method was selected because of its simplicity, applicability to drainage areas less than 10 mi^2, and its easy availability within the HEC-1 computer program.

The watershed was divided into three sub-basins. The sub-basin lag time was computed using the SCS "curve number method" by an empirical relationship as follows:

$$L = \frac{\ell^{0.8} (s+1)^{0.7}}{1900\ Y^{0.5}} \qquad \text{(Equation 15-4)}$$

where: L = lag in hours

ℓ = hydraulic length of the watershed in feet = 14,600 (upper sub-basin); 9,900 (lower east sub-basin); 7,800 (lower west sub-basin).

$s = \frac{1000}{CN} - 10 = 3.7$

CN = 73 (using AMC II)

Y = average watershed land slope in percent = 1.8 (upper); 2.1 (lower east); 2.6 (lower west).

This empirical relationship accounts for the soil cover, average watershed slope and hydraulic length.

With the lag time thus computed, another empirical relationship is used to compute the time of concentration as follows:

$$T_c = \frac{L}{0.6} \qquad \text{(Equation 15-3)}$$

where: T_c = time of concentration in hours

L = lag in hours.

Subsequent to the computation of the time of concentration, the unit hydrograph duration was approximated utilizing the following relationship:

$$\Delta D = 0.133T_c \qquad \text{(Equation 16-12)}$$

where: ΔD = duration of unit excess rainfall
T_c = time of concentration in hours.

The final duration was selected to provide at least three discharge ordinates prior to the peak discharge ordinate of the unit hydrograph. For this dam, a unit hydrograph duration of 15 minutes for probability floods and 20 minutes for PMF Events was used.

d. Infiltration losses. The infiltration losses were computed by the HEC-1 computer program internally using the SCS loss function. The curve number of SCS loss rate procedure was established taking into consideration the variables of: (a) antecedent moisture condition, (b) hydrologic soil group classification, (c) vegetative cover and (d) present land usage in the watershed. In addition the computed basin loss was reduced proportional to the impervious area in the drainage basin.

Antecedent moisture condition III (AMC III) was used for the PMF events and AMC II was used for the 1 and 10 percent probability events, in accordance with the guidelines. The remaining variables are defined in the SCS procedure and judgements in their selection were made on the basis of visual field inspection.

e. Starting elevations. Reservoir starting water surface elevations for this dam were set as follows:

(1) 1 and 10 percent probability events - observed water surface elevation of 1075 ft

(2) Probable Maximum Storm - determined by antecedent storm conditions

f. Spillway Rating Curve. The HEC-2 computer program was used to compute the spillway rating curve using discharge channel cross sections and conveyance characteristics. Flow through the 60-in. diameter storm drain was calculated and added to the spillway rating curve. The results were entered on the Y4 and Y5 cards to the HEC-1 program.

B.2 Pertinent Data

a. Drainage area. 6.1 mi^2

b. Storm duration. A unit hydrograph was developed by the SCS method option of HEC-1 program. The design storm of 48 hours duration was divided into 15 minute intervals for the probability storms and 20 minute intervals for the PMF storms in order to develop the inflow hydrograph.

c. Lag time. 2.5 hr (upper sub-basin); 1.7 (lower east); 1.2 (lower west).

d. Hydrologic soil group. C.

e. SCS curve numbers.

1. For PMF- AMC III - Curve Number 87
2. For 1 and 10 percent probability-of-occurrence events - AMC II - Curve Number 73

f. Storage. Elevation-area data were developed by planimetering areas at various elevation contours on the USGS Midridge and Bunker, Missouri (1967) 7.5 minute quadrangle maps. The data were entered on the $A and $E cards so that the HEC-1 program could compute storage volumes.

g. Outflow over dam crest. The profile of the dam crest is level; the crest length-elevation data and hydraulic constants were entered on the $D card.

h. Outflow capacity. The spillway rating curve was developed from the cross section data of the spillway and the downstream channel, using the HEC-2 backwater program. Flow through the 60-in. diameter storm drain was also calculated and combined with the spillway rating curve. (The 60-in. diameter storm drain was analysed as a "morning glory spillway". Crest control to elevation 1081, $Q = CLH^{3/2}$, C = 3.8, L = circumference of pipe. Orifice control to elevation 1086, $Q = A \sqrt{2gh}\ 0.9$. Pipe controlled above elevation 1086, friction factor = 0.024, Length = 1640, Manning's N for HEC-2 spillway analysis = 0.02.) The results of the above were entered on the Y4 and Y5 cards of the HEC-1 program.

i. Reservoir elevations. For the 50 and 100 percent of the PMF events, the starting reservoir elevation was set, based on antecedent storm condition, at 1080 and 1081 ft, respectively. For the 1 and 10 percent probability-of-occurrence events, the starting reservoir elevation was 1075 ft, the observed water surface.

B.3 Results

The results of the analyses as well as the input values to the HEC-1 program follow in this Appendix. Only the results summaries are included, not the intermediate output. Complete copies of the HEC-1 output are available in the project files.

```
**********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
 LAST MODIFICATION  01 APR 80
**********************************
A1      ADAIR CREEK DAM (OZARK LEAD CO.), NO. 30166, REYNOLDS COUNTY, MISSOURI.
A2      WOODWARD-CLYDE CONSULTANTS, HOUSTON JOB 80C224-T100.
A3      PROBABLE MAXIMUM FLOODS. ( THREE SUBBASINS )
B    192       0      20       0       0       0       0       0       0       0
B1     5
J      1       1       1
J1   1.0
K      0   AREA1                                       1
K1 FLOOD HYDROGRAPH FOR UPPER AREA
M      1       2    2.66                     1.0
P      0      26     102     120     130     140
T                                                     -1     -87               0.0
W2          2.50
X     -1    -.05       5
K      0   AREA2                                       1
K1      FLOOD HYDROGRAPH FOR LOWER EAST HALF AREA
M      1       2    1.64                     1.0
P      0      26     102     120     130     140
T                                                     -1     -87              0.15
W2          1.69
X     -1    -.05       5
K      0   AREA3                                       1
K1      FLOOD HYDROGRAPH FOR LOWER WEST HALF AREA
M      1       2    1.81                     1.0
P      0      26     102     120     130     140
T                                                     -1     -87              0.14
W2          1.25
X     -1    -.05       5
K      3   LAKE                                        1
K1      COMBINE ALL THE THREE INFLOW FLOOD HYDROGRAPHS
K      1     DAM                                       1
K1      FLOOD ROUTING AND OVERTOPPING ANALYSES
Y                                1       1
Y1     1                                         -1081.0      -1
Y41078.0  1078.5  1079.0  1080.0  1080.6  1082.0  1083.0  1084.0  1086.0  1088.0
Y41090.0  1092.0  1094.0  1096.0  1098.0  1100.0
Y5    0.    20.0    60.0   160.0   240.0   300.0   330.0   670.0  2300.0  4440.0
Y57350.0 10450.0 14460.0 18960.0 23970.0 29470.0
$A    0.    21.6     53.     97.    155.    227.    290.    354.    435.    590.
$E 1010.   1020.   1030.   1040.   1050.   1060.   1070.   1080.   1090.   1100.
$$1083.0
$D1097.0     2.8     1.5  1200.0
K     99
```

Input Data
100% PMF Event
Ozark Lead Tailings Dam
MO 30166
B4

Output Summary
100% PMF Event
Ozark Lead Tailings Dam
MO 30166
B5

```
*******************************
RUN DA. / 81/04/23.
    TIME? 13.06.10.

                    ADAIR CREEK DAM (OZARK LEAD CO.), NO. 30166, REYNOLDS COUNTY, MISSOURI.
                    WOODWARD-CLYDE CONSULTANTS, HOUSTON JOB 80C224-T100.
                    PROBABLE MAXIMUM FLOODS. ( THREE SUBBASINS )

                                          JOB SPECIFICATION
                   NQ    NHR   NMIN   IDAY   IHR   IMIN  METRC   IPLT   IPRT  NSTAN
                  192      0     20      0     0      0     0      0      0      0
                                      JOPER   NWT  LROPT  TRACE
                                          5     0      0      0

                                    MULTI-PLAN ANALYSES TO BE PERFORMED
                                        NPLAN= 1 NRTIO= 1 LRTIO= 1
                     RTIOS=   1.00

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

                                       SUB-AREA RUNOFF COMPUTATION

                 FLOOD HYDROGRAPH FOR UPPER AREA

                             ISTAQ   ICOMP   IECON   ITAPE   JPLT   JPRT  INAME ISTAGE  IAUTO
                             AREA1       0       0       0      0      0      1      0      0

                                              HYDROGRAPH DATA
                  IHYDG   IUHG   TAREA   SNAP   TRSDA   TRSPC   RATIO   ISNOW   ISAME   LOCAL
                      1      2    2.66   0.00    2.66    1.00   0.000       0       0       0

                                              PRECIP DATA
                          SPFE    PMS     R6     R12     R24     R48     R72     R96
                          0.00  26.00 102.00  120.00  130.00  140.00    0.00    0.00

                                               LOSS DATA
              LROPT  STRKR  DLTKR  RTIOL  ERAIN  STRKS  RTIOK  STRTL  CNSTL  ALSMX  RTIMP
                  0   0.00   0.00   1.00   0.00   0.00   1.00  -1.00 -87.00   0.00   0.00

                 CURVE NO =  -87.00  WETNESS =   -1.00  EFFECT CN =   87.00

                                         UNIT HYDROGRAPH DATA
                                      TC=  0.00     LAG=  2.50

                                            RECESSION DATA
                               STRTQ=   -1.00    QRCSN=    -.05    RTIOR= 5.00

                UNIT HYDROGRAPH 40 END OF PERIOD ORDINATES, TC=    0.00 HOURS, LAG=   2.50  VOL= 1.00
                 23.      70.     135.     226.     337.     422.     470.     482.     470.     431.
                385.     328.     258.     205.     166.     135.     113.      93.      74.      61.
                 50.      41.      33.      26.      22.      18.      15.      12.      10.       8.
                  7.       5.       5.       4.       3.       2.       2.       1.       1.       0.

      0                                      END-OF-PERIOD FLOW
  MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS    COMP Q       MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS     COMP Q

   1.01    .20       1    .00   0.00    .00        2.        1.02   8.20      97    .26    .25    .01    [illegible]
   1.01    .40       2    .00   0.00    .00        2.        1.02   8.40      98    .26    .25    .01    [illegible]
   1.01   1.00       3    .00   0.00    .00        2.        1.02   9.00      99    .26    .25    .01    [illegible]
```

Output Summary
100% PMF Event
Ozark Lead Tailings Dam
MO 30166
B6

7. 5. 5. 4. 3. 2. 2. 1. 1.

0 MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	END-OF-PERIOD FLOW COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	.20	1	.00	0.00	.00	2.	1.02	8.20	97	.26	.25	.01	[illegible]
1.01	.40	2	.00	0.00	.00	2.	1.02	8.40	98	.26	.25	.01	[illegible]
1.01	1.00	3	.00	0.00	.00	2.	1.02	9.00	99	.26	.25	.01	[illegible]
1.01	1.20	4	.00	0.00	.00	1.	1.02	9.20	100	.26	.25	.01	[illegible]
1.01	1.40	5	.00	0.00	.00	1.	1.02	9.40	101	.26	.25	.01	[illegible]
1.01	2.00	6	.00	0.00	.00	1.	1.02	10.00	102	.26	.25	.01	[illegible]
1.01	2.20	7	.00	0.00	.00	1.	1.02	10.20	103	.26	.25	.01	[illegible]
1.01	2.40	8	.00	0.00	.00	1.	1.02	10.40	104	.26	.25	.01	[illegible]
1.01	3.00	9	.00	0.00	.00	1.	1.02	11.00	105	.26	.25	.01	[illegible]
1.01	3.20	10	.00	0.00	.00	1.	1.02	11.20	106	.26	.25	.01	[illegible]
1.01	3.40	11	.00	0.00	.00	0.	1.02	11.40	107	.26	.25	.01	1177.
1.01	4.00	12	.00	0.00	.00	0.	1.02	12.00	108	.26	.25	.01	[illegible]
1.01	4.20	13	.00	0.00	.00	0.	1.02	12.20	109	.88	.86	.02	1231.
1.01	4.40	14	.00	0.00	.00	0.	1.02	12.40	110	.88	.87	.02	[illegible]
1.01	5.00	15	.00	0.00	.00	0.	1.02	13.00	111	.88	.87	.01	[illegible]
1.01	5.20	16	.00	0.00	.00	0.	1.02	13.20	112	1.06	1.05	.01	[illegible]
1.01	5.40	17	.00	0.00	.00	0.	1.02	13.40	113	1.06	1.05	.01	[illegible]
1.01	6.00	18	.00	0.00	.00	0.	1.02	14.00	114	1.06	1.05	.01	[illegible]
1.01	6.20	19	.02	0.00	.02	0.	1.02	14.20	115	1.33	1.31	.01	[illegible]
1.01	6.40	20	.02	0.00	.02	0.	1.02	14.40	116	1.33	1.32	.01	[illegible]
1.01	7.00	21	.02	0.00	.02	0.	1.02	15.00	117	1.33	1.32	.01	[illegible]
1.01	7.20	22	.02	0.00	.02	0.	1.02	15.20	118	2.32	2.31	.01	[illegible]
1.01	7.40	23	.02	0.00	.02	0.	1.02	15.40	119	6.35	6.33	.02	[illegible]
1.01	8.00	24	.02	0.00	.02	0.	1.02	16.00	120	1.41	1.41	.00	[illegible]
1.01	8.20	25	.02	0.00	.02	0.	1.02	16.20	121	1.24	1.23	.00	[illegible]
1.01	8.40	26	.02	0.00	.02	0.	1.02	16.40	122	1.24	1.23	.00	[illegible]
1.01	9.00	27	.02	0.00	.02	0.	1.02	17.00	123	1.24	1.23	.00	[illegible]
1.01	9.20	28	.02	0.00	.02	0.	1.02	17.20	124	.97	.97	.00	[illegible]
1.01	9.40	29	.02	.00	.02	0.	1.02	17.40	125	.97	.97	.00	[illegible]
1.01	10.00	30	.02	.00	.02	0.	1.02	18.00	126	.97	.97	.00	[illegible]
1.01	10.20	31	.02	.00	.02	0.	1.02	18.20	127	.09	.09	.00	[illegible]
1.01	10.40	32	.02	.00	.02	0.	1.02	18.40	128	.09	.09	.00	[illegible]
1.01	11.00	33	.02	.00	.02	0.	1.02	19.00	129	.09	.09	.00	[illegible]
1.01	11.20	34	.02	.00	.02	1.	1.02	19.20	130	.09	.09	.00	[illegible]
1.01	11.40	35	.02	.00	.02	1.	1.02	19.40	131	.09	.09	.00	[illegible]
1.01	12.00	36	.02	.00	.02	2.	1.02	20.00	132	.09	.09	.00	[illegible]
1.01	12.20	37	.07	.01	.05	3.	1.02	20.20	133	.09	.09	.00	[illegible]
1.01	12.40	38	.07	.02	.05	5.	1.02	20.40	134	.09	.09	.00	[illegible]
1.01	13.00	39	.07	.02	.05	8.	1.02	21.00	135	.09	.09	.00	[illegible]
1.01	13.20	40	.08	.03	.05	13.	1.02	21.20	136	.09	.09	.00	[illegible]
1.01	13.40	41	.08	.03	.05	20.	1.02	21.40	137	.09	.09	.00	[illegible]
1.01	14.00	42	.08	.04	.04	29.	1.02	22.00	138	.09	.09	.00	[illegible]
1.01	14.20	43	.10	.05	.05	41.	1.02	22.20	139	.09	.09	.00	[illegible]
1.01	14.40	44	.10	.06	.05	56.	1.02	22.40	140	.09	.09	.00	[illegible]
1.01	15.00	45	.10	.06	.04	74.	1.02	23.00	141	.09	.09	.00	[illegible]
1.01	15.20	46	.18	.11	.06	95.	1.02	23.20	142	.09	.09	.00	[illegible]
1.01	15.40	47	.49	.35	.14	127.	1.02	23.40	143	.09	.09	.00	[illegible]
1.01	16.00	48	.11	.08	.03	167.	1.03	0.00	144	.09	.09	.00	[illegible]
1.01	16.20	49	.10	.07	.02	216.	1.03	.20	145	0.00	0.00	0.00	[illegible]
1.01	16.40	50	.10	.08	.02	273.	1.03	.40	146	0.00	0.00	0.00	[illegible]
1.01	17.00	51	.10	.08	.02	334.	1.03	1.00	147	0.00	0.00	0.00	[illegible]
1.01	17.20	52	.07	.06	.01	384.	1.03	1.20	148	0.00	0.00	0.00	[illegible]
1.01	17.40	53	.07	.06	.01	421.	1.03	1.40	149	0.00	0.00	0.00	[illegible]
1.01	18.00	54	.07	.06	.01	443.	1.03	2.00	150	0.00	0.00	0.00	[illegible]
1.01	18.20	55	.01	.01	.00	451.	1.03	2.20	151	0.00	0.00	0.00	[illegible]
1.01	18.40	56	.01	.01	.00	445.	1.03	2.40	152	0.00	0.00	0.00	[illegible]
1.01	19.00	57	.01	.01	.00	429.	1.03	3.00	153	0.00	0.00	0.00	[illegible]
1.01	19.20	58	.01	.01	.00	400.	1.03	3.20	154	0.00	0.00	0.00	[illegible]
1.01	19.40	59	.01	.01	.00	361.	1.03	3.40	155	0.00	0.00	0.00	222.

Output Summary
100% PMF Event
Ozark Lead Tailings Dam
MO 30166
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[illegible]	15.20	46	.14	.11	[illegible]	[illegible]							
[illegible]	15.40	47	.49	.35	.14	127.	1.02	23.40	143	[illegible]	[illegible]	[illegible]	[illegible]
1.01	16.00	48	.11	.08	.03	167.	1.03	0.00	144	.09	.09	.00	[illegible]
1.01	16.20	49	.10	.07	.02	216.	1.03	.20	145	0.00	0.00	0.00	[illegible]
1.01	16.40	50	.10	.08	.02	273.	1.03	.40	146	0.00	0.00	0.00	[illegible]
1.01	17.00	51	.10	.08	.02	334.	1.03	1.00	147	0.00	0.00	0.00	[illegible]
1.01	17.20	52	.07	.06	.01	384.	1.03	1.20	148	0.00	0.00	0.00	[illegible]
1.01	17.40	53	.07	.06	.01	421.	1.03	1.40	149	0.00	0.00	0.00	[illegible]
1.01	18.00	54	.07	.06	.01	443.	1.03	2.00	150	0.00	0.00	0.00	[illegible]
1.01	18.20	55	.01	.01	.00	451.	1.03	2.20	151	0.00	0.00	0.00	[illegible]
1.01	18.40	56	.01	.01	.00	445.	1.03	2.40	152	0.00	0.00	0.00	[illegible]
1.01	19.00	57	.01	.01	.00	429.	1.03	3.00	153	0.00	0.00	0.00	[illegible]
1.01	19.20	58	.01	.01	.00	400.	1.03	3.20	154	0.00	0.00	0.00	[illegible]
1.01	19.40	59	.01	.01	.00	361.	1.03	3.40	155	0.00	0.00	0.00	222.
1.01	20.00	60	.01	.01	.00	321.	1.03	4.00	156	0.00	0.00	0.00	[illegible]
1.01	20.20	61	.01	.01	.00	282.	1.03	4.20	157	0.00	0.00	0.00	[illegible]
1.01	20.40	62	.01	.01	.00	244.	1.03	4.40	158	0.00	0.00	0.00	[illegible]
1.01	21.00	63	.01	.01	.00	209.	1.03	5.00	159	0.00	0.00	0.00	[illegible]
1.01	21.20	64	.01	.01	.00	178.	1.03	5.20	160	0.00	0.00	0.00	99.
1.01	21.40	65	.01	.01	.00	150.	1.03	5.40	161	0.00	0.00	0.00	[illegible]
1.01	22.00	66	.01	.01	.00	127.	1.03	6.00	162	0.00	0.00	0.00	[illegible]
1.01	22.20	67	.01	.01	.00	109.	1.03	6.20	163	0.00	0.00	0.00	[illegible]
1.01	22.40	68	.01	.01	.00	94.	1.03	6.40	164	0.00	0.00	0.00	[illegible]
1.01	23.00	69	.01	.01	.00	82.	1.03	7.00	165	0.00	0.00	0.00	[illegible]
1.01	23.20	70	.01	.01	.00	72.	1.03	7.20	166	0.00	0.00	0.00	[illegible]
1.01	23.40	71	.01	.01	.00	64.	1.03	7.40	167	0.00	0.00	0.00	[illegible]
1.02	0.00	72	.01	.01	.00	58.	1.03	8.00	168	0.00	0.00	0.00	27.
1.02	.20	73	.06	.05	.01	54.	1.03	8.20	169	0.00	0.00	0.00	[illegible]
1.02	.40	74	.06	.05	.01	52.	1.03	8.40	170	0.00	0.00	0.00	[illegible]
1.02	1.00	75	.06	.05	.01	55.	1.03	9.00	171	0.00	0.00	0.00	[illegible]
1.02	1.20	76	.06	.05	.01	62.	1.03	9.20	172	0.00	0.00	0.00	[illegible]
1.02	1.40	77	.06	.05	.01	74.	1.03	9.40	173	0.00	0.00	0.00	[illegible]
1.02	2.00	78	.06	.05	.01	90.	1.03	10.00	174	0.00	0.00	0.00	[illegible]
1.02	2.20	79	.06	.05	.01	110.	1.03	10.20	175	0.00	0.00	0.00	[illegible]
1.02	2.40	80	.06	.05	.01	130.	1.03	10.40	176	0.00	0.00	0.00	[illegible]
1.02	3.00	81	.06	.05	.01	149.	1.03	11.00	177	0.00	0.00	0.00	[illegible]
1.02	3.20	82	.06	.05	.01	168.	1.03	11.20	178	0.00	0.00	0.00	[illegible]
1.02	3.40	83	.06	.05	.01	184.	1.03	11.40	179	0.00	0.00	0.00	[illegible]
1.02	4.00	84	.06	.05	.01	199.	1.03	12.00	180	0.00	0.00	0.00	4.
1.02	4.20	85	.06	.05	.01	210.	1.03	12.20	181	0.00	0.00	0.00	3.
1.02	4.40	86	.06	.05	.01	219.	1.03	12.40	182	0.00	0.00	0.00	3.
1.02	5.00	87	.06	.05	.01	227.	1.03	13.00	183	0.00	0.00	0.00	2.
1.02	5.20	88	.06	.05	.01	233.	1.03	13.20	184	0.00	0.00	0.00	2.
1.02	5.40	89	.06	.05	.01	239.	1.03	13.40	185	0.00	0.00	0.00	2.
1.02	6.00	90	.06	.05	.01	244.	1.03	14.00	186	0.00	0.00	0.00	2.
1.02	6.20	91	.26	.24	.02	252.	1.03	14.20	187	0.00	0.00	0.00	1.
1.02	6.40	92	.26	.24	.02	268.	1.03	14.40	188	0.00	0.00	0.00	1.
1.02	7.00	93	.26	.24	.02	296.	1.03	15.00	189	0.00	0.00	0.00	1.
1.02	7.20	94	.26	.24	.02	341.	1.03	15.20	190	0.00	0.00	0.00	1.
1.02	7.40	95	.26	.24	.02	406.	1.03	15.40	191	0.00	0.00	0.00	1.
1.02	8.00	96	.26	.25	.01	487.	1.03	16.00	192	0.00	0.00	0.00	1.
									SUM	36.40	34.67	1.73	[illegible]
										(925.)(	881.)(	44.)(	5069.[illegible])

Output Summary
100% PMF Event
Ozark Lead Tailings Dam
MO 30166
B8

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)

RATIOS APPLIED TO FLOWS

OPERATION	STATION	AREA	PLAN	RATIO 1 1.00
HYDROGRAPH AT	AREA1	2.66	1	8789.
	(	6.89)	(	248.88)(
HYDROGRAPH AT	AREA2	1.64	1	6423.
	(	4.25)	(	181.89)(
HYDROGRAPH AT	AREA3	1.81	1	8110.
	(	4.69)	(	229.65)(
3 COMBINED	LAKE	6.11	1	21792.
	(	15.82)	(	617.07)(
ROUTED TO	DAM	6.11	1	13278.
	(	15.82)	(	376.00)(

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1081.00	1083.00	1097.00
STORAGE	10471.	11210.	17460.
OUTFLOW	257.	330.	21465.

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
1.00	1093.41	0.00	15620.	13278.	0.00	43.33	0.00

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**********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION     JULY 1978
  LAST MODIFICATION  01 APR 80
**********************************
A1      ADAIR CREEK DAM (OZARK LEAD CO.), NO. 30166, REYNOLDS COUNTY, MISSOURI.
A2      WOODWARD-CLYDE CONSULTANTS, HOUSTON JOB 80C224-T100.
A3      PROBABLE MAXIMUM FLOODS. ( THREE SUBBASINS )
B     192       0      20      -0      -0      -0      -0      -0      -0      -0
B1      5
J       1       1       1
J1    .50
K       0   AREA1                                   1
K1 FLOOD HYDROGRAPH FOR UPPER AREA
M       1       2    2.66                     1.0
P       0      26     102     120     130     140
T                                                  -1     -87             0.0
W2           2.50
X      -1    -.05       5
K       0   AREA2                                   1
K1      FLOOD HYDROGRAPH FOR LOWER EAST HALF AREA
M       1       2    1.64                     1.0
P       0      26     102     120     130     140
T                                                  -1     -87            0.15
W2           1.69
X      -1    -.05       5
K       0   AREA3                                   1
K1      FLOOD HYDROGRAPH FOR LOWER WEST HALF AREA
M       1       2    1.81                     1.0
P       0      26     102     120     130     140
T                                                  -1     -87            0.14
W2           1.25
X      -1    -.05       5
K       3    LAKE                                   1
K1      COMBINE ALL THE THREE INFLOW FLOOD HYDROGRAPHS
K       1     DAM                                   1
K1      FLOOD ROUTING AND OVERTOPPING ANALYSES
Y                                 1       1
Y1      1                                 -1080.0      -1
Y41078.0  1078.5  1079.0  1080.0  1080.6  1082.0  1083.0  1084.0  1086.0  1088.0
Y41090.0  1092.0  1094.0  1096.0  1098.0  1100.0
Y5     0.    20.0    60.0   160.0   240.0   306.0   330.0   670.0  2300.0  4440.0
Y57350.0 10450.0 14460.0 18960.0 23970.0 29470.0
SA     0.    21.6     53.     97.    155.    227.    290.    354.    435.    590.
SE 1010.   1020.   1030.   1040.   1050.   1060.   1070.   1080.   1090.   1100.
S$1083.0
SD1097.0     2.8     1.5  1200.0
K      99
```

Input Data
50% PMF Event
Ozark Lead Tailings Dam
MO 30166
B9

Output Summary
50% PMF Event
Ozark Lead Tailings Dam
MO 30166
B10

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LAST MODIFICATION [illegible]
******  ********************

RUN  DATE: 23 APR 81
     TIME: 09.04.07

          ADAIR CREEK DAM (OZARK LEAD CO.), NO. 30166, REYNOLDS COUNTY, MISSOURI.
          WOODWARD-CLYDE CONSULTANTS, HOUSTON JOB 80C224-T100.
          PROBABLE MAXIMUM FLOODS. ( THREE SUBBASINS )

                              JOB SPECIFICATION
     NQ    NHR   NMIN   IDAY    IHR   IMIN  METRC   IPLT   IPRT  NSTAN
    192      0     20     -0     -0     -0     -0     -0     -0     -0
                       JOPER    NWT  LROPT  TRACE
                           5     -0     -0     -0

                    MULTI-PLAN ANALYSES TO BE PERFORMED
                        NPLAN= 1 NRTIO= 1 LRTIO= 1
    RTIOS=    .50

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

                         SUB-AREA RUNOFF COMPUTATION

    FLOOD HYDROGRAPH FOR UPPER AREA

                 ISTAQ  ICOMP   IECON  ITAPE   JPLT   JPRT  INAME ISTAGE  IAUTO
                 AREA1      0     -0     -0     -0     -0      1     -0     -0

                              HYDROGRAPH DATA
    IHYDG   IUHG   TAREA   SNAP  TRSDA  TRSPC  RATIO  ISNOW  ISAME  LOCAL
        1      2    2.66    -0.   2.66   1.00    -0.     -0     -0     -0

                               PRECIP DATA
           SPFE    PMS      R6     R12     R24     R48     R72     R96
             0.  26.00  102.00  120.00  130.00  140.00     -0.     -0.

                                LOSS DATA
  LROPT  STRKR  DLTKR  RTIOL  ERAIN  STRKS  RTIOK  STRTL  CNSTL  ALSMX  RTIMP
     -0    -0.    -0.   1.00    -0.    -0.   1.00  -1.00 -87.00    -0.     0.

     CURVE NO =  -87.00  WETNESS =   -1.00  EFFECT CN =   87.00

                          UNIT HYDROGRAPH DATA
                        TC= -0.      LAG=  2.50

                             RECESSION DATA
                 STRTQ=    -1.00   QRCSN=    -.05   RTIOR= 5.00

    UNIT HYDROGRAPH 40 END OF PERIOD ORDINATES, TC=   -0.  HOURS, LAG=   2.50  VOL= 1.00
      23.      70.     135.     226.     337.     422.     470.     482.     470.     431.
     385.     328.     258.     205.     166.     135.     113.      93.      74.      61.
      50.      41.      33.      26.      22.      18.      15.      12.      10.       8.
       7.       5.       5.       4.       3.       2.       2.       1.       1.       0.

  0                                 END-OF-PERIOD FLOW
 MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS   COMP Q     MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS   COMP Q

  1.01    .20       1    .00     0.    .00       2.      1.02   8.20      97    .26    .25    .01     578.
  1.01    .40       2    .00     0.    .00       2.      1.02   8.40      98    .26    .25    .01     631.
  [illegible]
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Output Summary
50% PMF Event
Ozark Lead Tailings Dam
MO 30166
B11

·7. ·5. ·5. 4. 3. 2. ·2. 1. 1. 0.

						END-OF-PERIOD FLOW							
0 MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	.20	1	.00	0.	.00	2.	1.02	8.20	97	.26	.25	.01	578.
1.01	.40	2	.00	0.	.00	2.	1.02	8.40	98	.26	.25	.01	671.
1.01	1.00	3	.00	0.	.00	2.	1.02	9.00	99	.26	.25	.01	762.
1.01	1.20	4	.00	0.	.00	1.	1.02	9.20	100	.26	.25	.01	847.
1.01	1.40	5	.00	0.	.00	1.	1.02	9.40	101	.26	.25	.01	923.
1.01	2.00	6	.00	0.	.00	1.	1.02	10.00	102	.26	.25	.01	989.
1.01	2.20	7	.00	0.	.00	1.	1.02	10.20	103	.26	.25	.01	1043.
1.01	2.40	8	.00	0.	.00	1.	1.02	10.40	104	.26	.25	.01	1088.
1.01	3.00	9	.00	0.	.00	1.	1.02	11.00	105	.26	.25	.01	1122.
1.01	3.20	10	.00	0.	.00	1.	1.02	11.20	106	.26	.25	.01	1152.
1.01	3.40	11	.00	0.	.00	0.	1.02	11.40	107	.26	.25	.01	1177.
1.01	4.00	12	.00	0.	.00	0.	1.02	12.00	108	.26	.25	.01	1199.
1.01	4.20	13	.00	0.	.00	0.	1.02	12.20	109	.88	.86	.02	1231.
1.01	4.40	14	.00	0.	.00	0.	1.02	12.40	110	.88	.87	.02	1289.
1.01	5.00	15	.00	0.	.00	0.	1.02	13.00	111	.88	.87	.01	1384.
1.01	5.20	16	.00	0.	.00	0.	1.02	13.20	112	1.06	1.05	.01	1537.
1.01	5.40	17	.00	0.	.00	0.	1.02	13.40	113	1.06	1.05	.01	1788.
1.01	6.00	18	.00	0.	.00	0.	1.02	14.00	114	1.06	1.05	.01	2058.
1.01	6.20	19	.02	0.	.02	0.	1.02	14.20	115	1.33	1.31	.01	2398.
1.01	6.40	20	.02	0.	.02	0.	1.02	14.40	116	1.33	1.32	.01	2778.
1.01	7.00	21	.02	0.	.02	0.	1.02	15.00	117	1.33	1.32	.01	3183.
1.01	7.20	22	.02	0.	.02	0.	1.02	15.20	118	2.32	2.31	.01	3626.
1.01	7.40	23	.02	0.	.02	0.	1.02	15.40	119	6.35	6.33	.02	4198.
1.01	8.00	24	.02	0.	.02	0.	1.02	16.00	120	1.41	1.41	.00	4967.
1.01	8.20	25	.02	0.	.02	0.	1.02	16.20	121	1.24	1.23	.00	5889.
1.01	8.40	26	.02	0.	.02	0.	1.02	16.40	122	1.24	1.23	.00	6979.
1.01	9.00	27	.02	0.	.02	0.	1.02	17.00	123	1.24	1.23	.00	7564.
1.01	9.20	28	.02	0.	.02	0.	1.02	17.20	124	.97	.97	.00	8269.
1.01	9.40	29	.02	.00	.02	0.	1.02	17.40	125	.97	.97	.00	8631.
1.01	10.00	30	.02	.00	.02	0.	1.02	18.00	126	.97	.97	.00	8789.
1.01	10.20	31	.02	.00	.02	0.	1.02	18.20	127	.09	.09	.00	8713.
1.01	10.40	32	.02	.00	.02	0.	1.02	18.40	128	.09	.09	.00	8357.
1.01	11.00	33	.02	.00	.02	0.	1.02	19.00	129	.09	.09	.00	7956.
1.01	11.20	34	.02	.00	.02	1.	1.02	19.20	130	.09	.09	.00	7283.
1.01	11.40	35	.02	.00	.02	1.	1.02	19.40	131	.09	.09	.00	6488.
1.01	12.00	36	.02	.00	.02	2.	1.02	20.00	132	.09	.09	.00	5697.
1.01	12.20	37	.07	.01	.05	3.	1.02	20.20	133	.09	.09	.00	4958.
1.01	12.40	38	.07	.02	.05	5.	1.02	20.40	134	.09	.09	.00	4269.
1.01	13.00	39	.07	.02	.05	8.	1.02	21.00	135	.09	.09	.00	3644.
1.01	13.20	40	.08	.03	.05	13.	1.02	21.20	136	.09	.09	.00	3088.
1.01	13.40	41	.08	.03	.05	20.	1.02	21.40	137	.09	.09	.00	2592.
1.01	14.00	42	.08	.04	.04	29.	1.02	22.00	138	.09	.09	.00	2188.
1.01	14.20	43	.10	.05	.05	41.	1.02	22.20	139	.09	.09	.00	1887.
1.01	14.40	44	.10	.06	.05	56.	1.02	22.40	140	.09	.09	.00	1662.
1.01	15.00	45	.10	.06	.04	74.	1.02	23.00	141	.09	.09	.00	1389.
1.01	15.20	46	.18	.11	.06	95.	1.02	23.20	142	.09	.09	.00	1219.
1.01	15.40	47	.49	.35	.14	127.	1.02	23.40	143	.09	.09	.00	1079.
1.01	16.00	48	.11	.08	.03	167.	1.03	0.	144	.09	.09	.00	958.
1.01	16.20	49	.10	.07	.02	216.	1.03	.20	145	0.	0.	0.	862.
1.01	16.40	50	.10	.08	.02	273.	1.03	.40	146	0.	0.	0.	779.
1.01	17.00	51	.10	.08	.02	334.	1.03	1.00	147	0.	0.	0.	703.
1.01	17.20	52	.07	.06	.01	384.	1.03	1.20	148	0.	0.	0.	637.
1.01	17.40	53	.07	.06	.01	421.	1.03	1.40	149	0.	0.	0.	588.
1.01	18.00	54	.07	.06	.01	443.	1.03	2.00	150	0.	0.	0.	498.
1.01	18.20	55	.01	.01	.00	451.	1.03	2.20	151	0.	0.	0.	423.
1.01	18.40	56	.01	.01	.00	445.	1.03	2.40	152	0.	0.	0.	386.
1.01	19.00	57	.01	.01	.00	429.	1.03	3.00	153	0.	0.	0.	366.
1.01	19.20	58	.01	.01	.00	400.	1.03	3.20	154	0.	0.	0.	281.
1.01	19.40	59	.01	.01	.00	361.	1.03	3.40	155	0.	0.	0.	232.
1.01	20.00	60	.01	.01	.00	[illegible]							

Output Summary
50% PMF Event
Ozark Lead Tailings Dam
MO 30166
B12

1	17.40	53	.07	.06	.01	421.	1.03	1.40	149	0.	0.	0.	[illegible]
1	18.00	54	.07	.06	.01	443.	1.03	2.00	150	0.	0.	0.	[illegible]
1.01	18.20	55	.01	.01	.00	451.	1.03	2.20	151	0.	0.	0.	[illegible]
1.01	18.40	56	.01	.01	.00	445.	1.03	2.40	152	0.	0.	0.	[illegible]
1.01	19.00	57	.01	.01	.00	429.	1.03	3.00	153	0.	0.	0.	[illegible]
1.01	19.20	58	.01	.01	.00	400.	1.03	3.20	154	0.	0.	0.	[illegible]
1.01	19.40	59	.01	.01	.00	361.	1.03	3.40	155	0.	0.	0.	[illegible]
1.01	20.00	60	.01	.01	.00	321.	1.03	4.00	156	0.	0.	0.	[illegible]
1.01	20.20	61	.01	.01	.00	282.	1.03	4.20	157	0.	0.	0.	[illegible]
1.01	20.40	62	.01	.01	.00	244.	1.03	4.40	158	0.	0.	0.	137.
1.01	21.00	63	.01	.01	.00	209.	1.03	5.00	159	0.	0.	0.	117.
1.01	21.20	64	.01	.01	.00	178.	1.03	5.20	160	0.	0.	0.	[illegible]
1.01	21.40	65	.01	.01	.00	150.	1.03	5.40	161	0.	0.	0.	[illegible]
1.01	22.00	66	.01	.01	.00	127.	1.03	6.00	162	0.	0.	0.	72.
1.01	22.20	67	.01	.01	.00	109.	1.03	6.20	163	0.	0.	0.	[illegible]
1.01	22.40	68	.01	.01	.00	94.	1.03	6.40	164	0.	0.	0.	[illegible]
1.01	23.00	69	.01	.01	.00	82.	1.03	7.00	165	0.	0.	0.	[illegible]
1.01	23.20	70	.01	.01	.00	72.	1.03	7.20	166	0.	0.	0.	[illegible]
1.01	23.40	71	.01	.01	.00	64.	1.03	7.40	167	0.	0.	0.	[illegible]
1.02	0.	72	.01	.01	.00	58.	1.03	8.00	168	0.	0.	0.	[illegible]
1.02	.20	73	.06	.05	.01	54.	1.03	8.20	169	0.	0.	0.	[illegible]
1.02	.40	74	.06	.05	.01	52.	1.03	8.40	170	0.	0.	0.	[illegible]
1.02	1.00	75	.06	.05	.01	55.	1.03	9.00	171	0.	0.	0.	[illegible]
1.02	1.20	76	.06	.05	.01	62.	1.03	9.20	172	0.	0.	0.	[illegible]
1.02	1.40	77	.06	.05	.01	74.	1.03	9.40	173	0.	0.	0.	[illegible]
1.02	2.00	78	.06	.05	.01	90.	1.03	10.00	174	0.	0.	0.	[illegible]
1.02	2.20	79	.06	.05	.01	110.	1.03	10.20	175	0.	0.	0.	[illegible]
1.02	2.40	80	.06	.05	.01	130.	1.03	10.40	176	0.	0.	0.	[illegible]
1.02	3.00	81	.06	.05	.01	149.	1.03	11.00	177	0.	0.	0.	[illegible]
1.02	3.20	82	.06	.05	.01	168.	1.03	11.20	178	0.	0.	0.	[illegible]
1.02	3.40	83	.06	.05	.01	184.	1.03	11.40	179	0.	0.	0.	[illegible]
1.02	4.00	84	.06	.05	.01	199.	1.03	12.00	180	0.	0.	0.	[illegible]
1.02	4.20	85	.06	.05	.01	210.	1.03	12.20	181	0.	0.	0.	[illegible]
1.02	4.40	86	.06	.05	.01	219.	1.03	12.40	182	0.	0.	0.	3.
1.02	5.00	87	.06	.05	.01	227.	1.03	13.00	183	0.	0.	0.	2.
1.02	5.20	88	.06	.05	.01	233.	1.03	13.20	184	0.	0.	0.	[illegible]
1.02	5.40	89	.06	.05	.01	239.	1.03	13.40	185	0.	0.	0.	[illegible]
1.02	6.00	90	.06	.05	.01	244.	1.03	14.00	186	0.	0.	0.	2.
1.02	6.20	91	.26	.24	.02	252.	1.03	14.20	187	0.	0.	0.	[illegible]
1.02	6.40	92	.26	.24	.02	268.	1.03	14.40	188	0.	0.	0.	[illegible]
1.02	7.00	93	.26	.24	.02	296.	1.03	15.00	189	0.	0.	0.	[illegible]
1.02	7.20	94	.26	.24	.02	341.	1.03	15.20	190	0.	0.	0.	[illegible]
1.02	7.40	95	.26	.24	.02	406.	1.03	15.40	191	0.	0.	0.	[illegible]
1.02	8.00	96	.26	.25	.01	487.	1.03	16.00	192	0.	0.	0.	1.
									SUM	36.40	34.67	1.73	179[illegible].
										(925.)(	881.)(	44.)(	5069.[illegible]

Output Summary
50% PMF Event
Ozark Lead Tailings Dam
MO 30166
B13

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)

RATIOS APPLIED TO FLOWS

OPERATION	STATION	AREA	PLAN	RATIO 1 .50
HYDROGRAPH AT	AREA1	2.66	1	4395.
	(	6.89)	(	124.44)(
HYDROGRAPH AT	AREA2	1.64	1	3212.
	(	4.25)	(	90.95)(
HYDROGRAPH AT	AREA3	1.81	1	4055.
	(	4.69)	(	114.83)(
3 COMBINED	LAKE	6.11	1	10896.
	(	15.82)	(	308.54)(
ROUTED TO	DAM	6.11	1	4980.
	(	15.82)	(	141.03)(

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1080.00	1083.00	1097.00
STORAGE	10113.	11210.	17460.
OUTFLOW	160.	330.	21465.

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
.50	1088.37	0.	13354.	4980.	0.	44.00	0.

Input Data
1% Probability Event
Ozark Lead Tailings Dam
MO 30166
B14

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**********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  01 APR 80
**********************************
    1          A1     ADAIR CREEK DAM (OZARK LEAD CO.), NO. 30166, REYNOLDS COUNTY, MISSOURI.
    2          A2     WOODWARD-CLYDE CONSULTANTS, HOUSTON JOB 80C224-T100.
    3          A3     PROBABILISTIC FLOOD - 100 YEAR. ( THREE SUBBASINS )
    4          B    250      0     15      0      0      0      0      0      0      0
    5          B1     3
    6          K      0   AREA1                              1
    7          K1 FLOOD HYDROGRAPH FOR UPPER AREA, LESTERVILLE RAINFALL
    8          M      0      2   2.66                  1.0
    9          O    192  8.038             DA =   5.00
   10          O1  .016   .016   .016   .016   .016   .016   .016   .016   .016   .016
   11          O1  .016   .016   .016   .016   .016   .016   .016   .016   .016   .016
   12          O1  .016   .016   .016   .016   .016   .016   .016   .016   .016   .016
   13          O1  .016   .016   .016   .016   .016   .016   .016   .016   .016   .016
   14          O1  .016   .016   .016   .016   .016   .016   .016   .016   .016   .016
   15          O1  .016   .016   .016   .016   .016   .016   .016   .016   .016   .016
   16          O1  .016   .016   .016   .016   .016   .016   .016   .016   .016   .016
   17          O1  .016   .016   .016   .016   .016   .016   .016   .016   .016   .016
   18          O1  .016   .016   .016   .016   .016   .016   .016   .016   .016   .016
   19          O1  .016   .016   .016   .016   .016   .016   .021   .021   .021   .021
   20          O1  .021   .021   .021   .021   .021   .021   .021   .021   .021   .021
   21          O1  .021   .021   .021   .021   .021   .021   .021   .021   .021   .021
   22          O1  .041   .041   .041   .041   .042   .042   .042   .042   .042   .042
   23          O1  .042   .042   .042   .042   .042   .042   .042   .042   .042   .042
   24          O1  .042   .041   .041   .041   .075   .076   .076   .076   .076   .076
   25          O1  .102   .102   .178   .180   .424   .769  1.685   .431   .181   .179
   26          O1  .102   .102   .076   .076   .076   .076   .076   .076   .021   .021
   27          O1  .021   .021   .021   .021   .021   .021   .021   .021   .021   .021
   28          O1  .021   .021   .021   .021   .021   .021   .021   .021   .021   .021
   29          O1  .021   .021
   30          T                                                -1    -73           0.0
   31          W2          2.50
   32          X     -1   -.05      5
   33          K      0   AREA2                                  1
   34          K1     FLOOD HYDROGRAPH FOR LOWER EAST HALF AREA
   35          M      0      2   1.64                  1.0
   36          O   -192
   37          T                                                -1    -73           0.15
   38          W2          1.69
   39          X     -1   -.05      5
   40          K      0   AREA3                                  1
   41          K1     FLOOD HYDROGRAPH FOR LOWER WEST HALF AREA
   42          M      0      2   1.81                  1.0
   43          O   -192
   44          T                                                -1    -73           0.14
   45          W2          1.25
   46          X     -1   -.05      5
   47          K      3   LAKE                                   1
   48          K1     COMBINE ALL THE THREE INFLOW FLOOD HYDROGRAPHS
   49          K      1     DAM                                  1
   50          K1     FLOOD ROUTING AND OVERTOPPING ANALYSES
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V                                         1
Y1       1                                                  -1075.0     -1
Y41078.0   1078.5   1079.0   1080.0   1080.6   1082.0   1083.0   1084.0   1086.0   1088.0
Y41090.0   1092.0   1094.0   1096.0   1098.0   1100.0
Y5     6.    20.0     60.0    160.0    240.0    300.0    330.0    670.0   2300.0   4440.0
Y57350.0  10450.0  14460.0  18960.0  23970.0  29470.0
SA     0.    21.6      53.      97.     155.     227.     290.     354.     435.     590.
SE 1010.    1020.    1030.    1040.    1050.    1060.    1070.    1080.    1090.    1100.
S11083.0
SD1097.0      2.8      1.5   1200.0
K     99
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Input Data
1% Probability Event
Ozark Lead Tailings Dam
MO 30166
B15

Output Summary
1% Probability Event
Ozark Lead Tailings Dam
MO 30166
B16

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 .UD HY   GRAPH PACKAGE (HEC-1)
 AM SAFE.   VERSION      JULY 1978
  LAST MODIFICATION  01 APR 80
 ********************************

 RUN  DATE? 81/04/23.
      TIME? 15.37.02.

                    ADAIR CREEK DAM (OZARK LEAD CO.), NO. 30166, REYNOLDS COUNTY, MISSOURI.
                    WOODWARD-CLYDE CONSULTANTS, HOUSTON JOB 80C224-T100.
                    PROBABILISTIC FLOOD - 100 YEAR. ( THREE SUBBASINS )

                                  JOB SPECIFICATION
              NO     NHR    NMIN    IDAY    IHR    IMIN   METRC    IPLT    IPRT   NSTAN
             250       0      15       0      0       0       0       0       0       0
                                   JOPER    NWT   LROPT   TRACE
                                       3      0       0       0

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

                              SUB-AREA RUNOFF COMPUTATION

             FLOOD HYDROGRAPH FOR UPPER AREA, LESTERVILLE RAINFALL

                         ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                         AREA1       0       0       0       0       0       1       0       0

                                    HYDROGRAPH DATA
             IHYDG    IUHG   TAREA    SNAP   TRSDA   TRSPC   RATIO   ISNOW   ISAME   LOCAL
                 6       2    2.66    0.00    2.66    1.00   0.000       0       0       0

                                     PRECIP DATA
                              NP   STORM     DAJ     DAK
                             192    8.84    0.00    0.00
                                    PRECIP PATTERN
        .02     .02     .02     .02     .02     .02     .02     .02     .02     .02
        .02     .02     .02     .02     .02     .02     .02     .02     .02     .02
        .02     .02     .02     .02     .02     .02     .02     .02     .02     .02
        .02     .02     .02     .02     .02     .02     .02     .02     .02     .02
        .02     .02     .02     .02     .02     .02     .02     .02     .02     .02
        .02     .02     .02     .02     .02     .02     .02     .02     .02     .02
        .02     .02     .02     .02     .02     .02     .02     .02     .02     .02
        .02     .02     .02     .02     .02     .02     .02     .02     .02     .02
        .02     .02     .02     .02     .02     .02     .02     .02     .02     .02
        .02     .02     .02     .02     .02     .02     .02     .02     .02     .02
        .02     .02     .02     .02     .02     .02     .02     .02     .02     .02
        .02     .02     .02     .02     .02     .02     .02     .02     .02     .02
        .04     .04     .04     .04     .04     .04     .04     .04     .04     .04
        .04     .04     .04     .04     .04     .04     .04     .04     .04     .04
        .04     .04     .04     .04     .08     .08     .08     .08     .08     .08
        .10     .10     .18     .18     .42     .77    1.69     .43     .18     .18
        .10     .10     .08     .08     .08     .08     .08     .08     .02     .02
        .02     .02     .02     .02     .02     .02     .02     .02     .02     .02
        .02     .02     .02     .02     .02     .02     .02     .02     .02     .02
        .02     .02

                                      LOSS DATA
      LROPT   STRKR   DLTKR   RTIOL   ERAIN   STRKS   RTIOK   STRTL   CNSTL   ALSMX   RTIMP
          0    0.00    0.00    1.00    0.00    0.00    1.00   -1.00  -73.00    0.00    0.00

            CURVE NO =  -73.00  WETNESS =   -1.00  EFFECT CN =   73.00
```

Output Summary
1% Probability Event
Ozark Lead Tailings Dam
MO 30166
B17

[illegible]	0	0.00	0.00	1.00	0.00	0.00	1.00	-1.00	-73.00	0.00 [illegible]

CURVE NO = -73.00 WETNESS = -1.00 EFFECT CN = 73.00

UNIT HYDROGRAPH DATA
TC= 0.00 LAG= 2.50

RECESSION DATA
STRTQ= -1.00 QRCSN= -.05 RTIOR= 5.00

UNIT HYDROGRAPH 52 END OF PERIOD ORDINATES, TC= 0.00 HOURS, LAG= 2.50 VOL= 1.00

24.	46.	87.	141.	212.	297.	376.	435.	472.	488.
488.	472.	443.	408.	368.	319.	265.	220.	188.	160.
137.	120.	103.	89.	75.	65.	55.	48.	41.	35.
30.	25.	22.	19.	16.	14.	12.	10.	9.	7.
6.	5.	5.	4.	4.	3.	3.	2.	2.	1.
1.	0.								

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	.15	1	.02	0.00	.02	2.	1.02	7.30	126	.04	.02	.02	[illegible]
1.01	.30	2	.02	0.00	.02	2.	1.02	7.45	127	.04	.02	.02	71.
1.01	.45	3	.02	0.00	.02	2.	1.02	8.00	128	.04	.02	.02	[illegible]
1.01	1.00	4	.02	0.00	.02	1.	1.02	8.15	129	.04	.02	.02	[illegible]
1.01	1.15	5	.02	0.00	.02	1.	1.02	8.30	130	.04	.02	.02	[illegible]
1.01	1.30	6	.02	0.00	.02	1.	1.02	8.45	131	.04	.02	.02	[illegible]
1.01	1.45	7	.02	0.00	.02	1.	1.02	9.00	132	.04	.02	.02	[illegible]
1.01	2.00	8	.02	0.00	.02	1.	1.02	9.15	133	.04	.02	.02	[illegible]
1.01	2.15	9	.02	0.00	.02	1.	1.02	9.30	134	.04	.02	.02	111.
1.01	2.30	10	.02	0.00	.02	1.	1.02	9.45	135	.04	.02	.02	[illegible]
1.01	2.45	11	.02	0.00	.02	0.	1.02	10.00	136	.04	.02	.02	121.
1.01	3.00	12	.02	0.00	.02	0.	1.02	10.15	137	.04	.02	.02	[illegible]
1.01	3.15	13	.02	0.00	.02	0.	1.02	10.30	138	.04	.02	.02	[illegible]
1.01	3.30	14	.02	0.00	.02	0.	1.02	10.45	139	.04	.02	.02	[illegible]
1.01	3.45	15	.02	0.00	.02	0.	1.02	11.00	140	.04	.02	.02	137.
1.01	4.00	16	.02	0.00	.02	0.	1.02	11.15	141	.04	.02	.02	[illegible]
1.01	4.15	17	.02	0.00	.02	0.	1.02	11.30	142	.04	.02	.02	[illegible]
1.01	4.30	18	.02	0.00	.02	0.	1.02	11.45	143	.04	.02	.02	[illegible]
1.01	4.45	19	.02	0.00	.02	0.	1.02	12.00	144	.04	.03	.02	[illegible]
1.01	5.00	20	.02	0.00	.02	0.	1.02	12.15	145	.07	.05	.03	[illegible]
1.01	5.15	21	.02	0.00	.02	0.	1.02	12.30	146	.08	.05	.03	[illegible]
1.01	5.30	22	.02	0.00	.02	0.	1.02	12.45	147	.08	.05	.03	[illegible]
1.01	5.45	23	.02	0.00	.02	0.	1.02	13.00	148	.08	.05	.03	[illegible]
1.01	6.00	24	.02	0.00	.02	0.	1.02	13.15	149	.08	.05	.03	[illegible]
1.01	6.15	25	.02	0.00	.02	0.	1.02	13.30	150	.08	.05	.03	[illegible]
1.01	6.30	26	.02	0.00	.02	0.	1.02	13.45	151	.10	.07	.03	[illegible]
1.01	6.45	27	.02	0.00	.02	0.	1.02	14.00	152	.10	.07	.03	[illegible]
1.01	7.00	28	.02	0.00	.02	0.	1.02	14.15	153	.18	.12	.05	[illegible]
1.01	7.15	29	.02	0.00	.02	0.	1.02	14.30	154	.18	.13	.05	[illegible]
1.01	7.30	30	.02	0.00	.02	0.	1.02	14.45	155	.42	.31	.11	[illegible]
1.01	7.45	31	.02	0.00	.02	0.	1.02	15.00	156	.76	.59	.17	[illegible]
1.01	8.00	32	.02	0.00	.02	0.	1.02	15.15	157	1.67	1.39	.28	[illegible]
1.01	8.15	33	.02	0.00	.02	0.	1.02	15.30	158	.43	.37	.06	[illegible]
1.01	8.30	34	.02	0.00	.02	0.	1.02	15.45	159	.18	.16	.02	[illegible]
1.01	8.45	35	.02	0.00	.02	0.	1.02	16.00	160	.18	.16	.02	[illegible]
1.01	9.00	36	.02	0.00	.02	0.	1.02	16.15	161	.10	.09	.01	[illegible]
1.01	9.15	37	.02	0.00	.02	0.	1.02	16.30	162	.10	.09	.01	[illegible]
1.01	9.30	38	.02	0.00	.02	0.	1.02	16.45	163	.08	.07	.01	[illegible]
1.01	9.45	39	.02	0.00	.02	0.	1.02	17.00	164	.08	.07	.01	[illegible]
1.01	10.00	40	.02	0.00	.02	0.	1.02	17.15	165	.08	.07	.01	[illegible]
1.01	10.15	41	.02	0.00	.02	0.	1.02	17.30	166	.08	.07	.01	[illegible]
1.01	10.30	42	.02	0.00	.02	0.	1.02	17.45	167	.08	.07	.01	[illegible]
1.01	10.45	43	.02	0.00	.02	0.	1.02	18.00	168	.08	.07	.01	[illegible]
[illegible]	11.00	44	.02	0.00	.02	0.	1.02	18.15	169	.02	.02	.00	[illegible]
									[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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1.0[illegible]	9.30	38	.02	0.00	.02	0.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1.0[illegible]	9.45	39	.02	0.00	.02	0.	1.02	17.00	164	.08	.07	.01	[illegible]
1.0[illegible]	10.00	40	.02	0.00	.02	0.	1.02	17.15	165	.08	.07	.01	[illegible]
1.01	10.15	41	.02	0.00	.02	0.	1.02	17.30	166	.08	.07	.01	[illegible]
1.01	10.30	42	.02	0.00	.02	0.	1.02	17.45	167	.08	.07	.01	[illegible]
1.01	10.45	43	.02	0.00	.02	0.	1.02	18.00	168	.08	.07	.01	[illegible]
1.01	11.00	44	.02	0.00	.02	0.	1.02	18.15	169	.02	.02	.00	[illegible]
1.01	11.15	45	.02	0.00	.02	0.	1.02	18.30	170	.02	.02	.00	[illegible]
1.01	11.30	46	.02	0.00	.02	0.	1.02	18.45	171	.02	.02	.00	[illegible]
1.01	11.45	47	.02	.00	.02	0.	1.02	19.00	172	.02	.02	.00	1272.
1.01	12.00	48	.02	.00	.02	0.	1.02	19.15	173	.02	.02	.00	[illegible]
1.01	12.15	49	.02	.00	.02	0.	1.02	19.30	174	.02	.02	.00	[illegible]
1.01	12.30	50	.02	.00	.02	0.	1.02	19.45	175	.02	.02	.00	[illegible]
1.01	12.45	51	.02	.00	.02	0.	1.02	20.00	176	.02	.02	.00	[illegible]
1.01	13.00	52	.02	.00	.02	0.	1.02	20.15	177	.02	.02	.00	[illegible]
1.01	13.15	53	.02	.00	.02	0.	1.02	20.30	178	.02	.02	.00	[illegible]
1.01	13.30	54	.02	.00	.01	0.	1.02	20.45	179	.02	.02	.00	[illegible]
1.01	13.45	55	.02	.00	.01	1.	1.02	21.00	180	.02	.02	.00	[illegible]
1.01	14.00	56	.02	.00	.01	1.	1.02	21.15	181	.02	.02	.00	[illegible]
1.01	14.15	57	.02	.00	.01	1.	1.02	21.30	182	.02	.02	.00	[illegible]
1.01	14.30	58	.02	.00	.01	2.	1.02	21.45	183	.02	.02	.00	[illegible]
1.01	14.45	59	.02	.00	.01	2.	1.02	22.00	184	.02	.02	.00	347.
1.01	15.00	60	.02	.00	.01	3.	1.02	22.15	185	.02	.02	.00	311.
1.01	15.15	61	.02	.00	.01	3.	1.02	22.30	186	.02	.02	.00	[illegible]
1.01	15.30	62	.02	.00	.01	4.	1.02	22.45	187	.02	.02	.00	[illegible]
1.01	15.45	63	.02	.00	.01	4.	1.02	23.00	188	.02	.02	.00	[illegible]
1.01	16.00	64	.02	.00	.01	5.	1.02	23.15	189	.02	.02	.00	[illegible]
1.01	16.15	65	.02	.00	.01	6.	1.02	23.30	190	.02	.02	.00	215.
1.01	16.30	66	.02	.00	.01	6.	1.02	23.45	191	.02	.02	.00	[illegible]
1.01	16.45	67	.02	.00	.01	7.	1.03	0.00	192	.02	.02	.00	[illegible]
1.01	17.00	68	.02	.00	.01	8.	1.03	.15	193	0.00	0.00	0.00	[illegible]
1.01	17.15	69	.02	.00	.01	9.	1.03	.30	194	0.00	0.00	0.00	[illegible]
1.01	17.30	70	.02	.00	.01	9.	1.03	.45	195	0.00	0.00	0.00	[illegible]
1.01	17.45	71	.02	.00	.01	10.	1.03	1.00	196	0.00	0.00	0.00	[illegible]
1.01	18.00	72	.02	.00	.01	11.	1.03	1.15	197	0.00	0.00	0.00	[illegible]
1.01	18.15	73	.02	.00	.01	12.	1.03	1.30	198	0.00	0.00	0.00	[illegible]
1.01	18.30	74	.02	.00	.01	12.	1.03	1.45	199	0.00	0.00	0.00	[illegible]
1.01	18.45	75	.02	.00	.01	13.	1.03	2.00	200	0.00	0.00	0.00	[illegible]
1.01	19.00	76	.02	.00	.01	14.	1.03	2.15	201	0.00	0.00	0.00	[illegible]
1.01	19.15	77	.02	.00	.01	15.	1.03	2.30	202	0.00	0.00	0.00	94.
1.01	19.30	78	.02	.00	.01	15.	1.03	2.45	203	0.00	0.00	0.00	[illegible]
1.01	19.45	79	.02	.00	.01	16.	1.03	3.00	204	0.00	0.00	0.00	[illegible]
1.01	20.00	80	.02	.00	.01	17.	1.03	3.15	205	0.00	0.00	0.00	[illegible]
1.01	20.15	81	.02	.00	.01	17.	1.03	3.30	206	0.00	0.00	0.00	[illegible]
1.01	20.30	82	.02	.00	.01	18.	1.03	3.45	207	0.00	0.00	0.00	[illegible]
1.01	20.45	83	.02	.00	.01	19.	1.03	4.00	208	0.00	0.00	0.00	[illegible]
1.01	21.00	84	.02	.00	.01	20.	1.03	4.15	209	0.00	0.00	0.00	[illegible]
1.01	21.15	85	.02	.00	.01	20.	1.03	4.30	210	0.00	0.00	0.00	[illegible]
1.01	21.30	86	.02	.00	.01	21.	1.03	4.45	211	0.00	0.00	0.00	[illegible]
1.01	21.45	87	.02	.00	.01	22.	1.03	5.00	212	0.00	0.00	0.00	[illegible]
1.01	22.00	88	.02	.00	.01	22.	1.03	5.15	213	0.00	0.00	0.00	[illegible]
1.01	22.15	89	.02	.00	.01	23.	1.03	5.30	214	0.00	0.00	0.00	[illegible]
1.01	22.30	90	.02	.00	.01	24.	1.03	5.45	215	0.00	0.00	0.00	[illegible]
1.01	22.45	91	.02	.00	.01	24.	1.03	6.00	216	0.00	0.00	0.00	[illegible]
1.01	23.00	92	.02	.00	.01	25.	1.03	6.15	217	0.00	0.00	0.00	[illegible]
1.01	23.15	93	.02	.00	.01	26.	1.03	6.30	218	0.00	0.00	0.00	[illegible]
1.01	23.30	94	.02	.00	.01	26.	1.03	6.45	219	0.00	0.00	0.00	[illegible]
1.01	23.45	95	.02	.00	.01	27.	1.03	7.00	220	0.00	0.00	0.00	[illegible]
1.02	0.00	96	.02	.01	.01	27.	1.03	7.15	221	0.00	0.00	0.00	[illegible]
1.02	.15	97	.02	.01	.01	28.	1.03	7.30	222	0.00	0.00	0.00	[illegible]
1.02	.30	98	.02	.01	.01	29.	1.03	7.45	223	0.00	0.00	0.00	[illegible]
1.02	.45	99	.02	.01	.01	29.	1.03	8.00	224	0.00	0.00	0.00	[illegible]
1.02	1.00	100	.02	.01	.01	30.	1.03	8.15	225	0.00	0.00	0.00	2.
1.02	1.15	101	.02	.01	.01	31.	1.03	8.30	226	0.00	0.00	0.00	2.
1.02	1.30	102	.02	.01	.01	32.	1.03	8.45	227	0.00	0.00	0.00	2.

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	[illegible]	99	.02	.01	.01	29.	1.03	8.00	224	0.00	0.00	0.00	[illegible]
	1.00	100	.02	.01	.01	30.	1.03	8.15	225	0.00	0.00	0.00	[illegible]
[illegible]	1.15	101	.02	.01	.01	31.	1.03	8.30	226	0.00	0.00	0.00	[illegible]
[illegible]	1.30	102	.02	.01	.01	32.	1.03	8.45	227	0.00	0.00	0.00	[illegible]
1.02	1.45	103	.02	.01	.01	33.	1.03	9.00	228	0.00	0.00	0.00	[illegible]
1.02	2.00	104	.02	.01	.01	35.	1.03	9.15	229	0.00	0.00	0.00	[illegible]
1.02	2.15	105	.02	.01	.01	36.	1.03	9.30	230	0.00	0.00	0.00	[illegible]
1.02	2.30	106	.02	.01	.01	38.	1.03	9.45	231	0.00	0.00	0.00	[illegible]
1.02	2.45	107	.02	.01	.01	39.	1.03	10.00	232	0.00	0.00	0.00	[illegible]
1.02	3.00	108	.02	.01	.01	41.	1.03	10.15	233	0.00	0.00	0.00	[illegible]
1.02	3.15	109	.02	.01	.01	42.	1.03	10.30	234	0.00	0.00	0.00	[illegible]
1.02	3.30	110	.02	.01	.01	43.	1.03	10.45	235	0.00	0.00	0.00	[illegible]
1.02	3.45	111	.02	.01	.01	45.	1.03	11.00	236	0.00	0.00	0.00	[illegible]
1.02	4.00	112	.02	.01	.01	46.	1.03	11.15	237	0.00	0.00	0.00	[illegible]
1.02	4.15	113	.02	.01	.01	47.	1.03	11.30	238	0.00	0.00	0.00	[illegible]
1.02	4.30	114	.02	.01	.01	48.	1.03	11.45	239	0.00	0.00	0.00	[illegible]
1.02	4.45	115	.02	.01	.01	49.	1.03	12.00	240	0.00	0.00	0.00	[illegible]
1.02	5.00	116	.02	.01	.01	50.	1.03	12.15	241	0.00	0.00	0.00	[illegible]
1.02	5.15	117	.02	.01	.01	51.	1.03	12.30	242	0.00	0.00	0.00	[illegible]
1.02	5.30	118	.02	.01	.01	52.	1.03	12.45	243	0.00	0.00	0.00	[illegible]
1.02	5.45	119	.02	.01	.01	53.	1.03	13.00	244	0.00	0.00	0.00	[illegible]
1.02	6.00	120	.02	.01	.01	54.	1.03	13.15	245	0.00	0.00	0.00	[illegible]
1.02	6.15	121	.04	.02	.02	55.	1.03	13.30	246	0.00	0.00	0.00	[illegible]
1.02	6.30	122	.04	.02	.02	56.	1.03	13.45	247	0.00	0.00	0.00	[illegible]
1.02	6.45	123	.04	.02	.02	58.	1.03	14.00	248	0.00	0.00	0.00	[illegible]
1.02	7.00	124	.04	.02	.02	60.	1.03	14.15	249	0.00	0.00	0.00	[illegible]
1.02	7.15	125	.04	.02	.02	63.	1.03	14.30	250	0.00	0.00	0.00	[illegible]
									SUM	8.84	5.56	3.28	30178.
										(224.)(	141.)(	83.)(	1081.)(2)

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RUNOFF SUMMARY, AVERAGE FLOW IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES(SQUARE KILOMETERS)

		PEAK	6-HOUR	24-HOUR	72-HOUR	AREA
HYDROGRAPH AT	AREA1	1709.	1099.	383.	153.	2.66
		(48.39)(	31.12)(	10.86)(	4.32)(	6.89)
HYDROGRAPH AT	AREA2	1448.	744.	252.	104.	1.64
		(41.01)(	21.06)(	7.13)(	2.93)(	4.25)
HYDROGRAPH AT	AREA3	1940.	834.	277.	114.	1.81
		(54.92)(	23.60)(	7.86)(	3.23)(	4.69)
3-COMBINED	LAKE	4619.	2643.	911.	370.	6.11
		(130.79)(	74.85)(	25.80)(	10.49)(	15.82)
ROUTED TO	DAM	195.	191.	142.	54.	6.11
		(5.52)(	5.41)(	4.01)(	1.54)(	15.82)

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1075.00	1083.00	1097.00
STORAGE	8426.	11210.	17460.
OUTFLOW	0.	330.	21465.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
0.00	1080.26	0.00	10206.	195.	0.00	50.00	0.00

APPENDIX C

Correspondence

11 East Adams Street
Suite 1500
Chicago, Illinois 60603
312-939-1000
Telex 253875 (WOODWARD CGO)

Woodward-Clyde Consultants

14 April 1981
Y9C00138-3

Dames & Moore
1626 Cole Blvd.
Golden, Colorado 80401

Attn: Mr Anand Praksh

Gentlemen:

Woodward-Clyde Consultants is preparing Phase I Dam Safety Inspection reports for a number of dams in southeastern Missouri. Among these dams is Ozark Lead Company's tailing dam on Adair Creek in Reynolds County, Missouri.

The "Recommended Guidelines for Safety Inspection of Dams" request that design and engineering documents such as seepage and stability analyses, construction reports, and post construction changes be reviewed as part of the inspection program. Ozark Lead has supplied us with plans of the dam and appurtenant structures, but did not have design and engineering documents readily available.

We were informed by Ozark Lead that Dames and Moore's Denver office had performed these analyses for this dam in 1977 and 1978. We request you to search your files to locate information on design and engineering recommendations, seepage and stabililty analyses (seismic and static if available), construction reports and test documentation, and any post construction changes.

Ozark Lead has requested that they approve release of information before it is sent to Woodward-Clyde Consultants. Our contact is through Mr Terry Maio, Concentrator Superintendent, Ozark Lead Company, Sweetwater, Rural Branch, Missouri, 63680, (314) 924-2222.

We appreciate your prompt attention as the schedule for this program is drawing to a close.

If you have any questions, please give me a call (312-939-1000).

Very truly yours,

Richard G. Berggreen
Project Geologist

RGB:js

cc: Terry Maio
Concentrator Superintendent
Ozark Lead Company
Sweetwater, Rural Branch
Missouri 63680

ØZARK LEAD COMPANY
Division of Kennecott Corporation
RURAL BRANCH
SWEETWATER, MISSOURI 63680
(REYNOLDS COUNTY)

TELEPHONE 314-924-2222
(SWEETWATER EXCH.)

April 27, 1981

Mr. Gordon M. Matheson
Project Engineer
Dames & Moore
1626 Cole Boulevard
Golden, CO 80401

Dear Mr. Matheson:

Terry has reviewed with me the request for more information by Woodward-Clyde. At this time we do not feel it is appropriate for you to release any of the requested information.

Sincerely yours,

M. C. Young
Operations Supt.

MCY:mcy

cc: H. A. Krueger - General Manager (OLC)
R. G. Berggreen - Project Geologist (Woodward-Clyde)

DA

FILM