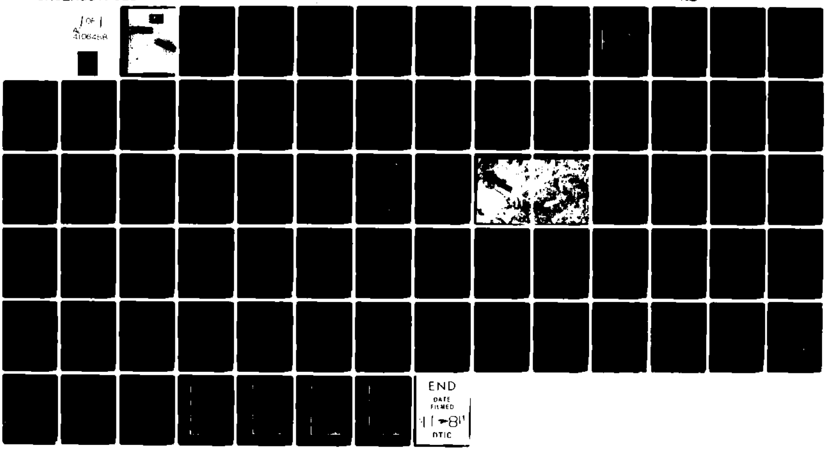
AD-A106 458 ARMY ENGINEER DISTRICT ST LOUIS MO F/G 13/13
NATIONAL DAM SAFETY PROGRAM, BRUSHY CREEK TAILINGS DAM (MO 3095--ETC(U)
AUG 79 W R BERGSTROM, F R BADER, M M EASTERLY

UNCLASSIFIED NL



AD A106458

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER	2. GOVT ACCESSION NO. AD-A106	3. RECIPIENT'S CATALOG NUMBER 458
4. TITLE (and Subtitle) Phase I Dam Inspection Report National Dam Safety Program Brushy Creek Tailings Dam (MO 30951) Reynolds County, Missouri		5. TYPE OF REPORT & PERIOD COVERED Final Report
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Corps of Engineers, St. Louis District		8. CONTRACT OR GRANT NUMBER(s) N/A
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Engineer District, St. Louis Dam Inventory and Inspection Section, LMSED-PD 210 Tucker Blvd., North, St. Louis, Mo. 63101		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer District, St. Louis Dam Inventory and Inspection Section, LMSED-PD 210 Tucker Blvd., North, St. Louis, Mo. 63101		12. REPORT DATE August 1979
		13. NUMBER OF PAGES Approximately 70
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) National Dam Safety Program. Brushy Creek Tailings Dam (MO 30951), White Basin, Reynolds County, Missouri. Phase I Inspection Report.		15. SECURITY CLASS. (of this report) UNCLASSIFIED
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dam Safety, Lake, Dam Inspection, Private Dams

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

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.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

WHITE BASIN

BRUSHY CREEK TAILINGS DAM

REYNOLDS COUNTY, MISSOURI

MO 30951

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

United States Army
Corps of Engineers
...Serving the Army
...Serving the Nation

St. Louis District

FOR: STATE OF MISSOURI

AUGUST 1979

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
BRUSHY CREEK TAILINGS DAM - MO. 30951

TABLE OF CONTENTS

LIST OF PLATES

APPENDIX

LIST OF PHOTOGRAPHS

PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam:	Brushy Creek Tailings Dam
State Located:	Missouri
County Located:	Reynolds County (Mark Twain National Forest)
Stream:	Schoolhouse Branch of Bill's Creek
Date of Inspection:	15 November 1978

Brushy Creek Tailings Dam, inventory number MO 30951, was inspected using the "Recommended Guidelines for Safety Inspection of Dams." These guidelines were developed by the Chief of Engineers, U.S. Army, Washington, D.C., with the help of Federal and state agencies, professional engineering organizations, and private engineers. The resulting guidelines are considered to represent a consensus of the engineering profession.

Based on the criteria in the guidelines, the dam is in the high hazard potential classification, which means that loss of life and appreciable property loss could occur in the event of failure of the dam. It is classified in the large size category due to its 120-foot height.

Our inspection and evaluation indicates that the spillway does not meet the criteria set forth in the guidelines for a dam having the above size and hazard potential. The guidelines recommend that the spillway be capable of safely handling the Probable Maximum Flood (PMF). A hydraulic/hydrologic analysis of this dam and reservoir indicates that any flood exceeding 55 percent of the PMF will result in excessive spillway erosion with the essential effect of overtopping the dam. A flood with a 1 percent chance of occurrence in any year (once in 100 years on the average) will be contained within the tailings reservoir without any spillway overflow.

A sudden breach of this dam could be expected to cause property damage and serious hazard to human life for a distance of approximately 30 miles downstream of the dam. Within this reach are numerous structures, the communities of West Fork and Centerville, a campground, and Missouri Highway #21. Included therein are portions of Bill's Creek, and the West Fork of the Black River.

Other deficiencies noted are: (1) uncontrolled surface erosion on the upstream embankment slope and at the southeast abutment interface with the downstream slope and (2) underdrainage filters not constructed according to currently accepted standards to properly prevent internal erosion through the underdrainage system. These deficiencies should be corrected under the direction of an engineer experienced in the design and construction of dams. Also, the lack of stability and seepage analyses on record, especially seismic and liquefaction studies considering the nature of the embankment materials and construction methods, is a deficiency which should be corrected.

The above deficiencies, while important, are not considered to critically endanger the subject structure. Hence, Brushy Creek Tailings Dam is classified as possessing minor deficiencies.

Wayne R. Bergstrom
WAYNE R. BERGSTROM
Soils Engineer
St. Louis District
Corps of Engineers

Frederick R. Bader
FREDERICK R. BADER, P.E.
Hydraulic Engineer
St. Louis District
Corps of Engineers

MICHAEL M. EASTERLY
Geologist
St. Louis District
Corps of Engineers

Submitted By SIGNED 12 SEP 1979
Chief, Engineering Division — Date

Approved By SIGNED 12 SEP 1979
Colonel, CE, District Engineer — Date

Overview of Brushy Creek Tailings Dam Looking From Southeast Abutment.

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
BRUSHY CREEK TAILINGS DAM - ID NO. 30951

SECTION I - PROJECT INFORMATION

1.1 GENERAL.

a. Authority. The National Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of safety inspection of dams throughout the United States. Pursuant to the above, the District Engineer, St. Louis District, Corps of Engineers, directed that a safety inspection of the Brushy Creek Tailings Dam be made.

b. Purpose of Inspection. The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

c. Evaluation Criteria. Criteria used to evaluate the dam were furnished by the Department of the Army, Office of the Chief of Engineers, in "Recommended Guidelines for Safety Inspection of Dams." 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.

(1) The dam is constructed of lead mine tailings, a sandy material similar to ground agricultural limestone, over a crushed rock underdrainage system and earth starter dam. The configuration of the dam, reservoir, and appurtenant structures are best described by the drawings and photos attached herewith. See Plates 1 through 6.

(2) Pertinent physical dimensions and numerical data are listed in paragraph 1.3 below.

b. Location. Northwest corner of Reynolds County, Missouri, further described as Sections 22 and 23, Township 33 North, Range 2 West.

c. Size and Classification. Large

d. Hazard Classification. High

e. Ownership. St. Joe Minerals Corporation, Viburnum, Missouri 65566

f. Purpose of Dam. Lead mine waste retention.

g. Design and Construction History. The dam was designed by the owner and an earthen starter dam was started in 1971. Thereafter, the dam was constructed incrementally by hydraulic deposition of sand-sized tailings separated by cyclones from the finer portion of the tailings slurry. Presently, the dam remains under construction and is expected to reach the final configuration (Plate B-5) in the early 1980's. Approximately 4500 tons per day (5-day week) of tailings slurry are deposited on the upstream slope of the dam and in the reservoir. See Section 2.2 for more detailed explanation.

h. Normal Operating Procedures. Inflows to the reservoir occur from: (1) normal runoff from the watershed and (2) deposition of tailings slurry. The reservoir storage is regulated by: (1) surface evaporation and (2) seepage through the dam underdrainage system into the downstream reclamation pond, subsequently to be returned by pumping to the upstream mill water reservoir. This is essentially a closed hydraulic system and no releases of mill water or mine tailings are expected. An uncontrolled spillway is provided for potential outflows from the reservoir.

1.3 PERTINENT DATA

a. Drainage Area.

Tributary to Brushy Creek Mill Dam (#30161) - 93 acres
Local runoff tributary to Brushy Creek Tailings Dam (#30951) - 546 acres
Total area tributary to Brushy Creek Tailings Dam (#30951) - 639 acres

b. Discharge at Damsite.

(1) Maximum known flood at damsite - Unknown

(2) Spillway capacity - see section 5.1(d)

(3) Seepage through underdrainage system - 75-100 gallons per minute

c. Elevation. Feet above mean sea level (msl) based upon assumed benchmark and/or USGS topographic map.

(1) Minimum top of dam - 1140

(2) Maximum top of dam - 1203

(3) Spillway crest - 1125±

(4) Streambed at centerline below dam - 1020.0

(5) Observed pool elevation - 1110±

(6) Maximum tailwater - Unknown

d. Reservoir. Length of maximum pool - 4200± ft

e. Estimated Storage. (Acre-ft of water and/or submerged tailings)

Pool Elevation	Corresponding Storage	
1020	0	
1100	1460	
1125	3250	Spillway crest
1140	4790	Top of dam (min)
1160	7500	

f. Reservoir Surface Area. (Acres)

(1) Observed pool - 68.5

(2) Spillway crest - 91.0

(3) Top of dam - 116.0

g. Dam.

(1) Type - Lead mine tailings embankment placed hydraulically.

(2) Length - 1200 ft ±

(3) Height - 120 ft (minimum)

(4) Top Width - 12 ft (minimum)

(5) Side Slopes:

(a) Downstream - 1V (Vertical) to 3.5H (Horizontal)

(b) Upstream - 1V to 4H

(6) Zoning - Original earthen starter dam has been covered by fine, sand-sized tailings both upstream and downstream.

(7) Impervious Core - Earthen starter dam as noted above.

(8) Cutoff - Compacted clayey earth trench was carried 8 to 10 feet deep to rock and extended up valley walls to approximately elevation 1050.

(9) Drainage Provisions - Crushed rock underdrain with steel outlet pipe and settling basin.

(10) Grout Curtain - None

h. Diversions. None at present.

i. Spillway.

(1) Type - Unregulated open channel ditch excavated in natural soil. Also functions as interception ditch for hillside runoff.

(2) Bottom Width - 10 ft ±

(3) Depth - Varies

(4) Side Slopes - 1V on 1H typically

(5) Bottom Slope - Varies

(6) Length - 1200 ft ±

(7) Inlet - See Photo 7

(8) Outlet - See Photo 1

j. Emergency Spillway. None

k. Regulating Outlets. None - Some uncontrolled seepage through underdrainage system. Estimated at 75 gpm on day of inspection.

SECTION II - ENGINEERING DATA

2.1 DESIGN.

No design analyses are available.

2.2 CONSTRUCTION.

The initial earthen embankment was reportedly constructed in 1971-72 by AG Construction Company, of Perryville, Missouri. After the clearing of vegetation in the dam foundation area, a keyway was excavated across the valley. This key trench was excavated 8 to 10 feet to the top of rock and was carried up the valley walls to approximately elevation 1050.

The earthen dam was then constructed over the keyway. Clayey borrow was obtained from the overburden near the northwest (right) abutment and downstream of the starter dam. Specifications used by the mining company required 12-inch maximum lifts with material densities no less than 95 percent of optimum. Reportedly, a sheepsfoot roller was utilized for compaction. Slopes were 1V on 2.5H upstream and 1V on 2H downstream.

During construction of the earthen dam, natural streamflow was diverted through a 24-inch diameter, Schedule 10, steel pipe. This pipe extended through the earthen embankment approximately at the location of the streambed. This pipe was specified to have a steel plate collar, 4 feet by 6 feet by 1/2 inch, at the dam centerline. Additionally, all joints were to be properly welded. This pipe discharged into a ditch behind a smaller dam, creating a settling basin. These features are presently entirely buried beneath the downstream slope of the main embankment. These features can be seen in Plates B-1 and B-2.

In June 1973, the first pass was made across the dam crest with a mobile cyclone rig which separated the coarser sand-sized tailings from the remainder of the waste slurry. These sands were deposited hydraulically in a single lift raising the dam crest from elevation 1053 to 1080. The spillway was raised up the northwest abutment from the original earthen dam emergency spillway elevation of 1048 to elevation 1060. This can be seen in Plate B-1. This pass was completed in October 1973.

The second pass commenced in October 1973 and was completed in July 1974. It raised the embankment crest to elevation 1110 with a new spillway at elevation 1094. A ridge was constructed upstream along the spillway at this elevation.

The third and final pass began in July 1974 and continued until it was temporarily halted in 1978. The cyclones are currently being utilized elsewhere and the completed dam section is not expected until at least late 1982. The present spillway elevation is 1125 and the planned elevation of the completed dam section is approximately 1185.

Throughout the construction period, the cyclone overflow (the fine material suspended in slurry form) has been deposited hydraulically over the upstream face of the dam.

A seepage reclamation pond was placed downstream of the dam toe. It is reportedly excavated to rock, approximately 10 feet from the natural ground surface. It is shown in Plate B-1.

During construction, the right toe area experienced overflow of the sand embankment material into the reclamation pond. A rock toe was added at that time with a drain pipe from the toe area leading into the pond. A limited portion of the toe area subsequently washed out once but was repaired and the material removed from the pond.

During the summer of 1978, an internal erosion feature appeared on the surface of the third and final pass. It was reportedly 2/3 of the dam height up the downstream slope and left of the valley centerline (looking downstream). It has been described as a 2-foot diameter, chimney-like vertical hole with a negligible depression cone at the surface. It was repaired by dropping straw into the hole and backfilling with embankment sand. No embankment material was noticed in the seepage water from the downstream drain pipe. It should be noted that a similar feature has developed more than once at a nearby facility constructed in a similar manner.

No flow through the present spillway has reportedly occurred. No slides, overtopping, or seepage problems are reported to have occurred.

2.3 OPERATION.

Runoff in excess of the needed volume of water reclaimed from the upstream portion of the reservoir must pass over the uncontrolled spillway if not stored. Flow in this spillway has not occurred. No operating records for the various inflow and outflow pumps are available.

A number of open-system piezometers have been installed and regularly monitored in the embankment. A summary of the observed piezometric readings is shown on Plate B-3.

Also shown in Appendix B (Plate B-4) are the results of gradation tests performed on samples of the embankment sand, the cyclone overflow, and unsegregated tailings materials. These tests were performed, in part, by St. Joe Minerals Corporation and also by the U.S. Bureau of Mines, under the direction of Mr. R. L. Soderberg of the latter agency.

Company personnel have indicated that the seepage drain at the dam toe discharges up to approximately 75-100 gpm. The pumps in the reclaim pipeline average approximately 75 gpm but do not operate continuously. They are operated by float-tripped switches when the pond depth exceeds approximately 3 feet. Company analyses have indicated that the water in the seepage reclamation pond is very similar to the mill process water entering the main reservoir but contains a little more iron. Only once has the company removed accumulated sediment from the seepage reclamation pond. The removal was required by the previously noted toe surface erosion into the pond.

Future plans include constructing dams at the upper end of the valley and in two side hollows, completion of the existing main embankment, construction of a permanent spillway, completion of valley filling, and conversion of the reservoir to water decantation. None of these plans are addressed herein but are depicted in part on Plate B-5.

2.4 EVALUATION.

a. Availability. The preceding construction and operation information was cooperatively provided by Mr. John E. Kennedy, Director of Environmental Control, St. Joe Minerals Corporation.

b. Adequacy. The information presented above, in combination with the field survey and visual inspection, is considered adequate to support the conclusions of this report. However, the fact that no seepage and stability analyses comparable to the requirements of the guidelines are on record is a deficiency which should be rectified.

c. Validity. No conclusions can be drawn concerning the validity of original design analyses as none are known to exist.

SECTION III - VISUAL INSPECTION

3.1 FINDINGS.

a. General. The dam and reservoir are located in a sparsely populated, generally forested area. The topography is generally rolling and locally rough.

b. Project Geology. The Brushy Creek Tailings Dam is located in the Salem Plateau Section of the Ozark Plateau Physiographic Province, an area which is underlain by horizontally bedded lower Paleozoic rocks deposited on the western flank of the Ozark Uplift. Metallic ore bodies occur locally in the lowermost Cambrian units due to the proximity of this major structural feature.

The lower slopes and valley floor at the damsite are underlain by the Ordivician Gasconade formation, a fine to coarse crystalline, cherty dolomite with a dolomitic quartz sandstone basal unit. A boring drilled in the valley near the dam axis showed a combined thickness of 593 feet of Gasconade, Eminence, Potosi, and Derby-Doerun dolomite formations below the center of the dam. The Derby-Doerun formation is underlain by a 157-foot thickness of the Davis Shale formation, followed by 300 to 400 feet of lower Cambrian dolomite and sandstone above the pre-Cambrian basement.

The bedrock surrounding the damsite is well blanketed by 10 to 20 feet of residual soil. Consequently, no outcrops were visible and the jointing and weathering characteristics of the rock could not be observed. The residuum is composed of reddish brown clay with abundant porcelainous and banded chert fragments of all sizes and small amounts of oolitic chert and fine-grained sandstone. The spillway excavation on the right abutment revealed irregular horizontal beds of chert and very highly weathered dolomite within five feet of the ground surface.

No springs, sinks, or caves were observed or reported in the reservoir area. A wet weather seep is reported to have existed prior to construction on the right abutment near the dam axis. Boreholes had been drilled in the impoundment area before the dam was constructed but were plugged to prevent water seepage into mine workings.

No evidence of faulting was observed at the damsite. No expansive clays or shales were observed or known to occur there. Some slope failures had occurred in steep (approximately 1:1.5) road cuts approximately 50 feet high in residuum close to the site. However, no similar cuts have been made in the reservoir area.

Lead and small amounts of copper and zinc are currently being recovered from a narrow, north-south trending ore body in the lower Cambrian Bonneterre dolomite formation at a depth of approximately 1000 feet below the extreme upper end of the reservoir. The mine workings have penetrated to the limits of the ore body in this area and are not expected to extend further under the impoundment. The reservoir area has been thoroughly explored and no other mineral resources have been discovered.

c. Dam. As explained in Section 2.2, the full dam section has not been completed at the northwest (right) abutment. Surface erosion, apparently caused by hydraulic material deposition, is evident at the uncompleted portion of the embankment. See Photo 1.

The downstream slope of the dam is typically 1 vertical on 3.5 horizontal. It has few discontinuities and little surface erosion. See Photos 2 and 3. There is no evidence of movement nor is there any vegetation or slope protection.

Where the downstream slope interfaces with the southeast abutment there is an erosion channel. This surface erosion is entirely in the sand tailings material and ranges up to 3 feet deep with a width of 4 to 5 feet. A diversion ditch has been provided in natural overburden materials on the abutment in order to alleviate this problem by preventing abutment runoff from reaching the embankment slope. Approximately one third of the dam height from the toe, nearly 25 trees, 4 to 14 inches in diameter, were not cleared prior to tailings disposal. These trees are partially covered by tailings on the southeast abutment interface. See Photo 3. A similar situation exists at approximately two-thirds of the dam height from the toe.

As seen in the overview photograph, there is a discontinuity on the crest at the southeast abutment. It consists of a benched area approximately 80 feet by 30 feet and about 8 feet from the dam crest. It apparently is a result of previous construction efforts and is not a significant feature except as a source of runoff concentration and, therefore, erosion.

The upstream slope is more variable than the downstream slope. As seen in Plate 5, the slope is generally near 1V on 4H. However, it is locally steeper. Wind erosion is evident by the formation of a bulging drift on the upstream side of the embankment crest. This drift has resulted from winds blowing from the downstream portion of the valley. Photos 4 and 5 show the undercutting and vertical scarp formations which occur on the upstream slope due to material deposition in fluid form. This has occurred at several locations across the length of the dam. Southeast of the valley centerline there is an erosion channel from the crest upstream to the reservoir surface. Toward the upstream end of the channel, it is up to 15 feet deep and 20 feet wide. It is reportedly due to accidental discharge from a break in the transporting pipe on the embankment crest. There is a depression near the valley centerline at approximately elevation 1150 in the upstream slope. It is 80 feet by 40 feet and is up to 6 feet deep on the downstream side. There is no apparent reason for its formation.

There is no slope protection on either the upstream or downstream slopes. Company personnel have indicated that efforts to prevent surface erosion at another mine location by placement of a clay layer only served to aggravate erosion by concentrating runoff. Current efforts at establishing vegetative cover have met with very limited success at the other mine location. Photo 6 shows that there is some construction debris remaining on the upstream slope.

d. Appurtenant Structures. The appurtenant structures for this dam essentially consist of: (1) an open-channel, unlined spillway cut into the northwest abutment, (2) an upstream dam and reservoir for use as millwater supply, and (3) a downstream collection system for seepage through and beneath the dam. Of these, only the first will be examined in this section. The latter two will be examined in succeeding paragraphs.

The spillway location has changed several times during the construction of the embankment. Its present location can be seen in Plate 3. It is viewed from the embankment crest in Photos 1 and 7. The spillway has been cut into the overburden material on the northwest valley wall. Both banks are formed by virgin material as can be seen in Photo 8. It is a gravelly, plastic clay that exhibits rainfall runoff erosion. There is no evidence of significant spillway flow. The clay material has a fissured structure with rootlets in many of the fracture separations. There is a cleared slope located above the spillway in the northwest abutment. The spillway discharges near the downstream portion of the northwest abutment.

e. Reservoir Area. During inspection, unsegregated tailings direct from the milling operation were being deposited in the reservoir (see Photo 4). These tailings then flowed on a gentle slope up-valley where the suspended tailings dropped out of the slurry material. This deposition method causes erosion at the upstream face of the dam where an undefined transition from fine material to embankment sands results (see Photo 5). After draining, the reservoir materials can support walking but are very easily liquified. Clarified water was evident in the upstream portions of the reservoir. The discharging slurry was noticeably warm resulting in reservoir temperatures warmer than the ambient air temperature.

A small reservoir is maintained in an upstream tributary valley as a mill water source. Clarified water from the several sources is pumped into this reservoir to help maintain an adequate water supply. The hydrologic impact of this reservoir upon the tailings pond is examined in Section 5.

f. Downstream Channel. Immediately downstream of the rockfill toe is a seepage collection and reclamation pond (see Photo 2). Erosion of tailings through the rock toe was evident. Reportedly, this had occurred during embankment deposition. There was an 8-inch diameter steel pipe beneath the rock toe which discharged approximately 75 to 100 gpm into the seepage reclamation pond. This pipe reportedly collects seepage from the crushed rock interior drains. The toe area near the pipe drain was somewhat wet, especially at the erosion channel in the rockfill toe.

The discharging water from the drain pipe was clear and possessed a temperature similar to that of the reservoir water. The seepage reclamation pond water was of a similar temperature but somewhat discolored. Its yellowish color was similar to the color of surface runoff water in the downstream valley area.

The downstream right toe area is somewhat flat. An 8-inch diameter steel pipe leads from this area into the pond. It was not discharging.

Downstream of the seepage reclamation pond, surface runoff from recent rainfall was evident. However, no surface evidence of excessive groundwater pressures or erosion due to seepage exit was apparent. No springs immediately downstream of the dam could be found.

3.2 EVALUATION.

Potential erosion within, and downstream of, the unlined spillway in the event of significant spillway discharge constitutes a serious hazard. Degradation caused by encroachment of this potential erosion into the embankment sand fill could be very rapid and must be prevented. Erosion protection in the spillway and discharge area should be provided. Additionally, the stability of the abutment slope above the spillway cannot be assured. A stability analysis of this slope should be performed by a professional engineer with due consideration given to potential erosion at the slope toe.

Surface erosion features should be inspected and repaired on a regular basis. The erosion gully in the upstream embankment slope and especially those at the abutment contacts are potentially troublesome and should be repaired.

As noted in Section 3.1.e., the hydraulic method of tailings deposition causes severe erosion on the upstream dam face (Photo 5). Efforts to minimize this erosion should be implemented. Additionally, sufficient freeboard between the reservoir water surface and the fine tailings deposition area (See Plate 3) should be maintained to prevent a free pool surface from resting against the upstream dam slope. Without such a precaution, wave erosion may result and the embankment seepage conditions would be altered significantly.

The depression in the upstream embankment slope, noted in Section 3.1.c., should be monitored on a regular basis for any changes in its size or depth. While possibly a result of construction efforts, it may also signify potential interior erosion as discussed in Section 6.1.b.

SECTION IV - OPERATIONAL PROCEDURES

4.1 PROCEDURES.

Reservoir regulation is performed principally by evaporation and by pumps which remove reservoir water for reuse in the mill. The mine waste, consisting of tailings in a suspended slurry form, is deposited near the upstream face of the dam and allowed to run up-valley. The suspended materials drop out of the slurry as the flow velocity is reduced. In the upper reaches of the reservoir, a pond of somewhat clarified water remains. Here it is pumped to the small upstream mill supply reservoir to be reused. Note also that water from the downstream seepage collection pond is regularly pumped back into the main reservoir.

4.2 MAINTENANCE OF THE DAM.

There is no formal maintenance and inspection program. However, there are reportedly company personnel on the damsite daily. Small bulldozers are used to fill erosion gullies at the dam abutment interfaces when necessary. Additionally, remedial efforts were directed toward correction of the "chimney"-like erosion feature discussed in Section 2.

4.3 MAINTENANCE OF OPERATING FACILITIES.

No regular maintenance program for the uncontrolled, unlined spillway exists. Pumps and associated pipelines utilized in seepage reclamation, tailings disposal, and clarified water reuse are maintained as necessary for continued operation.

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT.

No downstream warning system is known to exist. However, the reclaim pumps provide a warning to personnel if they become inoperative.

4.5 EVALUATION.

Recommended remedial efforts on the dam and spillway are discussed in Sections 3 and 7. Future maintenance on a regular basis to prevent erosion is recommended. Encroachment of large vegetation (bushes and trees) in the spillway and on the dam should be prevented as well as any animal burrows. Regular monitoring of all piezometers and analysis of the data with respect to stability and seepage as noted in Section 6 are recommended. Seepage flows should be closely monitored for changes in volume/rate, amount of transported sediment, and water quality characteristics.

It should be noted that future changes in operating procedures, including but not limited to abandonment of the reservoir as an operating waste disposal facility, cannnot be addressed herein. Such changes will have to be carefully evaluated on an individual basis and together as a whole to determine their impact on the safety of the dam and reservoir.

SECTION V - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data. No hydrologic or hydraulic design information was available for evaluation of these reservoirs and dams; however, significant dimensions of the dams and spillways were based upon design information furnished by the owner. Other dimensions of the dam and reservoir were measured and/or surveyed on the date of inspection or estimated from topographic mapping. The map used in the analysis is the 7-1/2 minute US Geological Survey quadrangle sheet for Greeley, Missouri, dated 1967. The channel of the west fork of the Black River in the hazard reach of the dam is shown on the 7-1/2 minutes quadrangle sheets for Corridon, Centerville, and Lesterville. These maps are dated 1967 and 1968. Surface soil information has not been mapped using modern soil mapping techniques, however, older information and data from nearby areas indicate that the surface soil of the upland watershed above the dam is primarily Clarksville stoney loam. This soil has been classified as belonging to hydrologic soil Group "B," a soil with a moderate rate of moisture transmission.

b. Experience Data. No recorded rainfall, runoff, discharge, or pool stage data was available for this reservoir or watershed.

c. Visual Observation.

(1) Watershed - The watershed is forested with mixed hardwoods and softwoods predominately of oak, hickory, pine, and cedar varieties. The area of the reservoir pool surface is approximately 10 percent of the total watershed area.

(2) Upper Reservoir - A portion of the drainage area above the main tailings dam is controlled by a dam and reservoir for the purposes of storing mill process water for the mining operation. This dam is basically of earthfill construction with a double 48-inch diameter corrugated metal pipe spillway supplemented by a 4-foot wide by 5-foot high box culvert. Water is supplied to the mill dam by natural runoff from 93 acres and by pumping from the reclamation pond below the main dam, and is withdrawn for use in the lead mining process. As a result of the overtopping analysis, further described in Section 5.1.d, the mill dam was determined to be capable of passing a storm of 100 percent of the Probable Maximum Flood and is otherwise not considered to significantly affect the evaluation of the primary tailings dam. This dam is further classified as being of intermediate height (85 ft.) and storage capacity (630 Ac-ft.).

(3) Tailings Reservoir - The reservoir upstream of the tailings dam is best described by maps and photographs inclosed herewith. The reservoir is partially filled by fine sand and silt-sized tailings material and the proportion of water to mine tailings cannot be determined. The extent of tailing deposition is not expected to have significant effect on the hydraulic characteristics of the reservoir. The level of tailings storage, as observed during the dam inspection, was approximately 15 feet below the crest of the spillway located at the north end of the dam embankment. Photographs and field observations reveal the unprotected tailings material of the embankment to be highly susceptable to rapid erosion by concentrated surface flows or possibly by very intense rainfall. It was observed that some difficulty has been experienced due to hillside surface runoff causing gullies at the interface of the hillside and the embankment. A diversion ditch in native soils on the south end and the "spillway" on the north end have been provided to alleviate this problem.

(4) Spillway - The "spillway" at the north end of the dam embankment is constructed in native undisturbed soils at a point just beyond the embankment. No erosion protection of rock, concrete, or vegetation is provided for this spillway. The geometry of spillway cross sections is best described by Photo No. 8. The vertical profile of the spillway is approximately parabolic, concave downward. The principal effect of this profile is a very steep channel slope near the spillway outlet, a condition which could cause erosion should significant discharge occur.

(5) Seepage - The magnitude of seepage through this dam is not hydrologically significant to the overtopping potential.

d. Overtopping Potential. One of the primary considerations in the evaluation of the safety of the Brushy Creek Tailings Dam is assessment of the potential for overtopping and consequent failure by erosion of the embankment. Since the "spillway" of this dam is composed of erodible materials, the potential consequences of significant spillway discharges are substantially the same as the overtopping of the dam embankment. Hydraulic considerations of the material erodibility and of the spillway geometry suggest that flows below a velocity of 5 feet per second or a discharge of 50 cubic feet per second will not result in substantial spillway erosion. For the purpose of determining the overtopping potential of this dam, spillway discharge of greater than 50 cubic feet per second is considered to produce the effects of overtopping.

Hydrologic analysis of the tailings dam using the data and method as inclosed and described in Appendix A, "Hydrologic Computation," indicate that a flood of greater than 55 percent of the Probable

Maximum Flood (PMF) will effectively 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 and hydrologic conditions that are reasonably possible in the region. This dam is classified by the guidelines as one of large height and intermediate storage capacity. The guidelines recommend that a dam of this size and hazard potential (high) be capable of safely passing the outflow of the Probable Maximum Flood. The following overtopping data were computed for the tailings dam, assuming no erosion of the spillway or embankment.

Percent PMF	Maximum Pool Elevation (msl)	Spillway Depth (feet)	Maximum Spillway Discharge (cu. ft. per sec.)
50	1125.8	0.3	6
55	1126.6	1.3	30
100	1136.1	10.8	990

A flood with 1 percent chance of occurrence in any year (once in 100 years on the average) will be contained within the tailings reservoir without any spillway overflow.

The tailings dam is classified as one of high hazard potential since failure of Brushy Creek Tailings Dam could result in substantial hazard to human life and flood damage to the mouth of the west fork of the Black River near Lesterville, located approximately 30 stream miles below the dam. Large amounts of sediment, debris, and tailings from the dam and impoundment could be expected to be deposited in the stream and floodplain for a large proportion of this distance. Fine sediment and washload would be carried and deposited considerably further. Within this reach of Bill's Creek and the west fork of the Black River are numerous structures, the community of West Fork (approximately 4-1/2 miles below the dam), Cook's Cave (13-1/2 miles), Sutton Bluff Campground (15 miles), Missouri Highway #21 (19 miles), and the city of Centerville (20 miles). The west fork is considered navigable by canoeists below Centerville during periods of high water.

SECTION VI - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY.

a. Visual Observations. Visual observations which adversely affect the structural stability of this dam are discussed in Section 3.

b. Design and Construction Data. Design data are unavailable but the construction history is described in Section 2.

The fine granular materials utilized in constructing the majority of the embankment should be highly susceptible to internal erosion. Plate B-4 shows the range of gradations determined from samples obtained from the cyclone underflow (sand-sized materials used in the embankment). Unsegregated tailings and cyclone overflow (fines) are also shown on Plate B-4. The rockfill drains, consisting of rock sizes greater than 6 inches in diameter, do not conform to acceptable standards for graded filters in fine sands. The potential for internal erosion cannot, therefore, be excluded.

The "chimney-like" erosional feature described in Section 2 demonstrates the potential for internal erosion. The use of straw in backfilling this feature cannot be considered to provide a permanent solution. Additionally, the tendency for the embankment sand to form weak bonds (either through capillarity or weak cementation) and stand vertically (see Photo 1) demonstrates that the embankment sand does not readily self-seal existing erosion features. Strong cementation within the sand could reduce its erosion susceptibility but was not evident at the site.

Contributing to the potential for internal erosion are the two pipes located within the structure. The plug on the downstream end of the 24-inch pipe that passes beneath the earthen starter dam, if defective, may subject the crushed stone drains to unduly large heads. Additionally, the 8-inch drain pipe that discharges into the seepage reclamation pond has no graded filters at its entrance. Such filters, provided according to currently acceptable standards, minimize the potential for internal erosion to occur at the pipe entrance.

Based upon information concerning the method of constructing the key trench, the effectiveness of the impervious cutoff at the bedrock surface is not certain. Seepage at this interface may also cause internal erosion.

Since the seepage reclamation pond has only been cleaned out once as a result of the surface erosion noted in Section 2, the volume of internally eroded material has apparently been minimal to date.

Surface erosion features at the abutment interfaces are evident. Careful observation of these interfaces is required. No impervious core and trench are carried above approximately elevation 1050, increasing the potential for internal seepage at these interfaces.

The centerline method of construction, utilized on this structure, results in an ill-defined transition between the embankment sand material and the fine material in the reservoir. However, the grain size analyses, shown in Plate B-4, demonstrate that there is indeed a transition to finer materials upstream of the embankment face. This provides a natural upstream filter system and reduces the likelihood of an uncontrolled phreatic surface located high in the main embankment. The piezometer data, summarized in Plate B-3, indicate the range of phreatic surface experienced in the embankment to date. They do not indicate the presence of significant abnormalities in overall seepage characteristics.

c. Operating Records. No operating records, apart from the piezometric data, are available.

d. Post Construction Changes. No significant post-construction changes have occurred.

e. Seismic Stability. The dam is located in Seismic Zone 2, as shown in the inspection guidelines. Since neither original design analyses nor properties of the construction materials are available, an accurate seismic analysis cannot be made. The relatively flat slopes reduce the likelihood of slope and foundation instability in the event of seismic loadings. However, the sand and silt-sized tailings material, deposited hydraulically, is expected to be susceptible to liquefaction. Failure of the embankment as a consequence of potential liquefaction cannot be excluded. The potential for such an occurrence should be thoroughly investigated by a professional engineer experienced in the design and construction of dams.

SECTION VII - ASSESSMENT/REMEDIAL MEASURES

7.1 DAM ASSESSMENT.

a. Safety. Several deficiencies exist which should be corrected. These include: spillway inadequacy due to insufficient erosion protection therein, uncontrolled surface erosion on the upstream embankment slope and at the southeast abutment interface, and underdrainage filter provisions not constructed to currently acceptable standards to properly prevent internal erosion through the underdrainage system.

b. Adequacy of Information. Lack of stability and seepage analyses, including seismic stability and liquefaction studies, is a deficiency which should be corrected, especially in light of the embankment materials and depositional method.

c. Urgency. Remedial measures should be initiated promptly on the deficiencies described herein.

d. Need for Phase II. No Phase II investigation is recommended. Action should be initiated on the measures proposed herein.

7.2 REMEDIAL MEASURES.

The following remedial measures are recommended:

a. The hydraulic capability of this dam should be increased to safely hold and/or pass a flood of PMF magnitude. This should be accomplished under the direction of an engineer experienced in the design and construction of dams. It should be noted that additional reservoir filling due to tailings disposal will alter the relationships of storm inflow, reservoir storage, and required spillway outflow.

b. The potential for failure due to internal erosion associated with the crushed rock and pipe drains should be minimized. Provisions for reducing this susceptibility through the use of graded filters and/or drains designed according to currently acceptable standards should be made.

c. In conjunction with item "b" above, a regular monitoring and inspection program should be instituted to provide for early detection of internal erosion should it occur, whether from drainage features or elsewhere on the embankment and abutments. Seepage flows should be closely monitored for changes in volume/rate, amount of transported sediment, and water quality characteristics.

d. A contingency program of remedial efforts to be instituted if internal erosion or other failure evidence becomes apparent should be formulated. This program should be maintained with all appropriate company personnel and civil officials aware of its provisions.

e. Tailings disposal should be planned to prevent a free pool surface from resting against the upstream face of the dam embankment as explained in Section 3.2.

f. Maintenance on a regular basis is recommended to repair surface erosion features, expecially those at the abutment contacts.

g. The dam should be periodically inspected by an experienced engineer and records kept of all inspections and maintenance efforts.

h. Stability and seepage analyses, including seismic stability and liquefaction studies, should be performed by a professional engineer experienced in the design and construction of dams. Additionally, a stability analysis of the abutment slope located above the spillway should be performed with due consideration given to potential erosion within the spillway at the slope toe.

Appendix A

HYDROLOGIC AND HYDRAULIC ANALYSIS

1. The hydrologic analysis used in development of the overtopping potential is based on applying a hypothetical storm to a unit hydrograph to obtain the inflow hydrograph for a reservoir routing. The Probable Maximum Precipitation is derived and determined from regional charts prepared by the National Weather Service in "Hydrometeorological Report No. 33." Reduction factors have not been applied. A 24-hour storm duration is assumed with total depth distributed over 6-hour periods in accordance with procedures outlined in EM 1110-2-1411 (SPD Determination). The maximum 6-hour rainfall period is then distributed to hourly increments by the same criteria. Within-the-hour distribution is based upon NOAA Technical Memorandum NWS HYDRO-35. The non-peak 6-hour rainfall periods are distributed uniformly. All distributed values are arranged in a critical sequence by the SPF criteria. The final inflow hydrograph is produced by deduction of infiltration losses appropriate to the soil, land use, and antecedent moisture conditions.

2. The reservoir routing is accomplished by using Modified Puls routing techniques wherein the flood hydrograph is routed through lake storage. The hydraulic capacity of the spillway is used as an outlet control in the routing. Storage in the pool area is defined by an elevation-storage capacity curve. The hydraulic capacity of the spillway is defined by an elevation-discharge curve. The storage routing effect of the upper reservoir is included in the analysis.

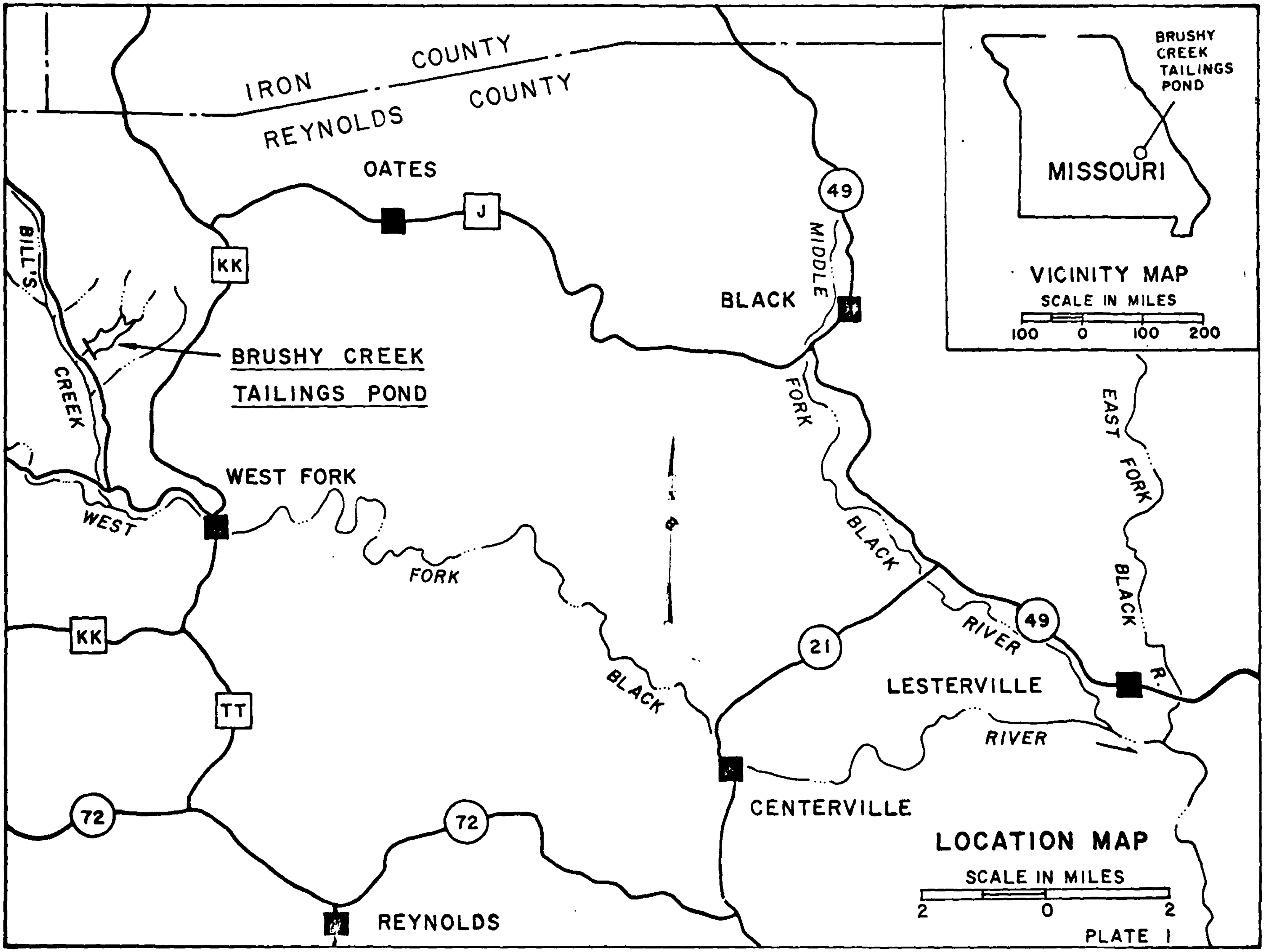
3. Dam overtopping analysis has been conducted by hydrologic methods for this dam and lake. This computation determines the percentage of the PMF hydrograph that the reservoir can contain without the dam being effectively overtopped. An output summary in this hydrologic appendix displays this information as well as other characteristics of the simulated dam overtopping.

4. The above methodology has been accomplished for this report using the systemized computer program HEC-1 (Dam Safety Version), July 1978, prepared by the Hydrologic Engineering Center, U.S. Army Corps of Engineers, Davis, California. The numeric parameters estimated for this site are listed on PLATE A-5. Definitions of these variables are contained in the "User's Manual" for the computer program.

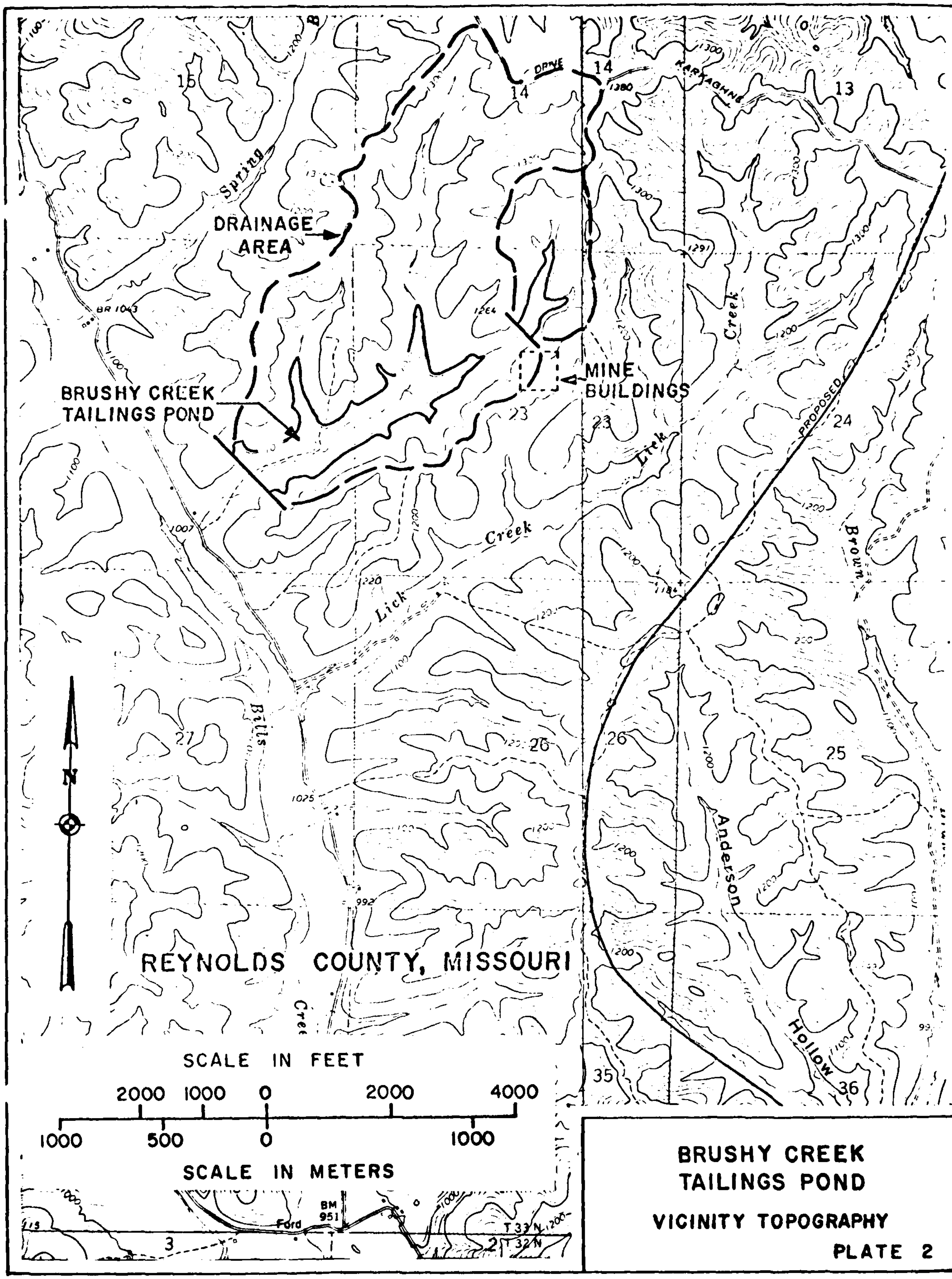
5. The spillway rating curve for the upper reservoir was computed using the methods of "Hydraulic Charts for the Selection of Highway Culverts," Hydraulic Engineering Circular #5, Bureau of Public Roads, Department of Commerce, GPO, 1965. The spillway rating curve for the open channel of the main tailings dam was developed using

the step backwater computations of computer program HEC-2, dated August 1977. Copies of the input data and output from HEC-2 are attached as pages A-1 to A-4.

6. The attached pages A-4 through A-22 are copies of input and output data for the overtopping analysis. Since this dam prevents the effects of overtopping primarily by runoff storage, an antecedent storm of the magnitude of 25 percent and 50 percent of the PMF was considered to have occurred prior to the 50 percent PMF and 100 percent PMF storms, respectively, and appropriate storage is included in the starting elevation prior to reservoir routing.



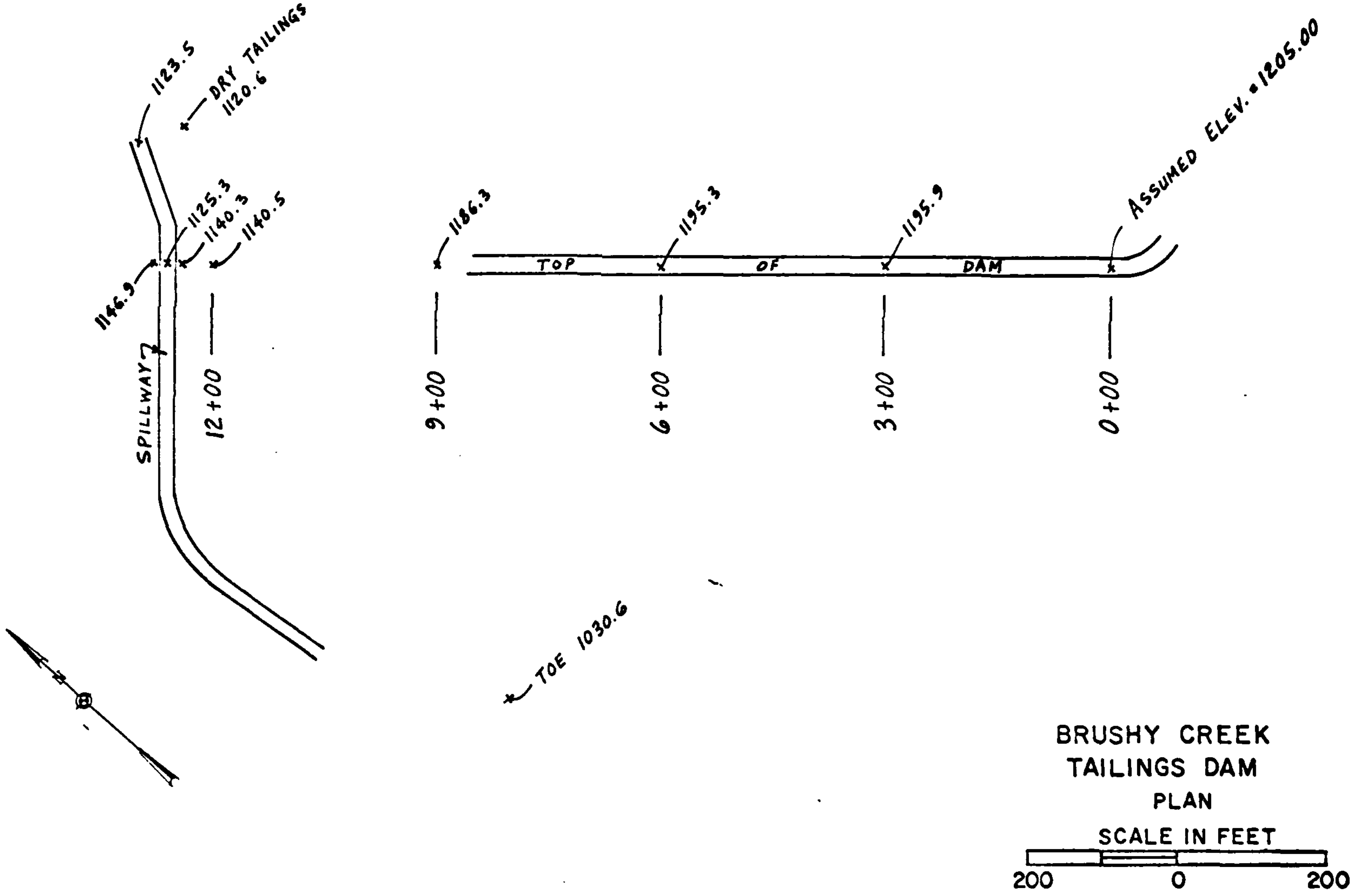
IRON COUNTY
REYNOLDS COUNTY
OATES
J
KK
BILL'S CREEK
BRUSHY CREEK TAILINGS POND
WEST FORK
WEST FORK
FORK
BLACK
49
MIDDLE FORK
BLACK
BLACK
RIVER
EAST FORK BLACK R.
21
LESTERVILLE
RIVER
CENTERVILLE
KK
TT
72
72
REYNOLDS
BRUSHY CREEK TAILINGS POND
MISSOURI
VICINITY MAP
SCALE IN MILES
100 0 100 200
LOCATION MAP
SCALE IN MILES
2 0 2
PLATE 1



BRUSHY CREEK TAILINGS POND

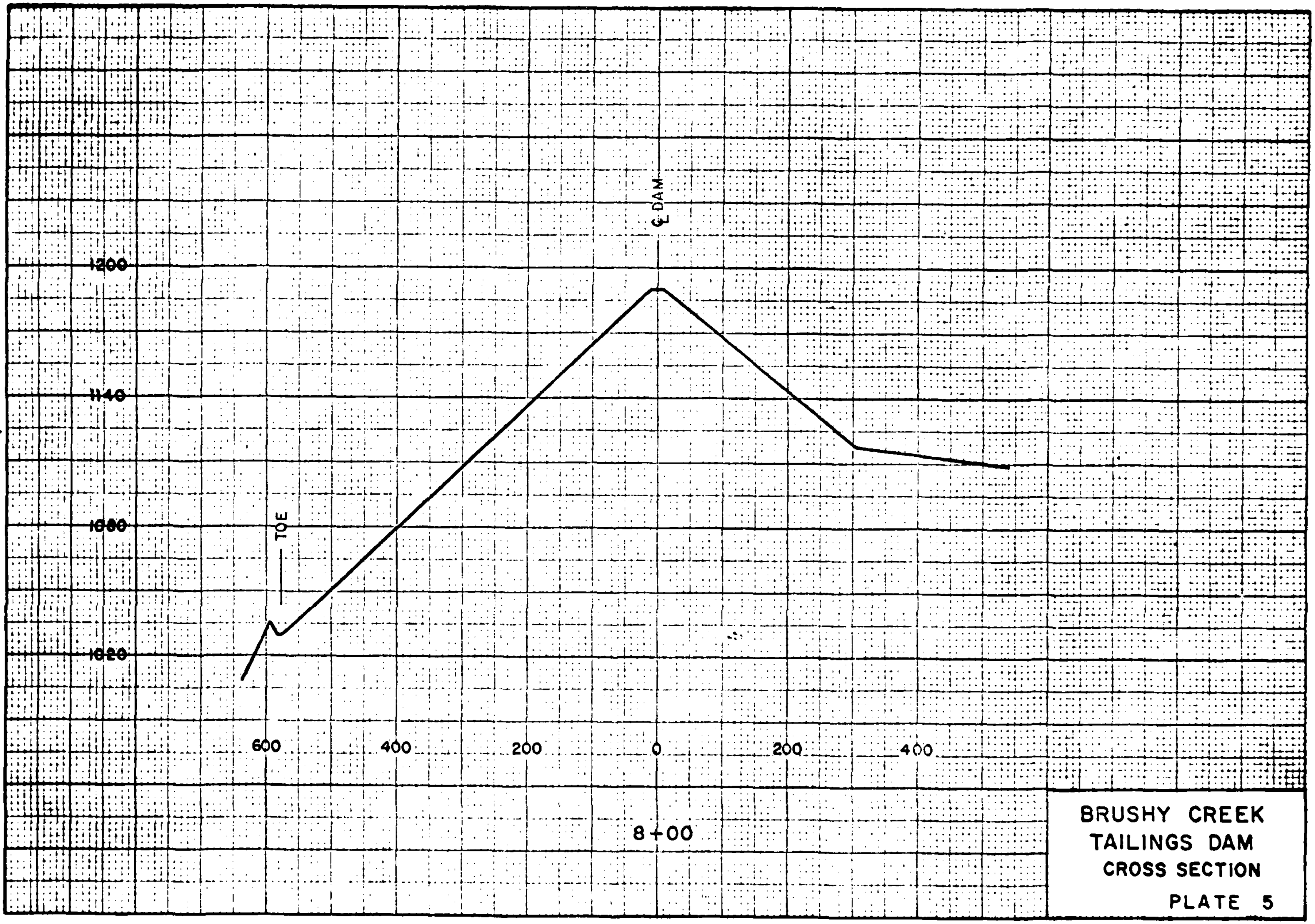
VICINITY TOPOGRAPHY

PLATE 2



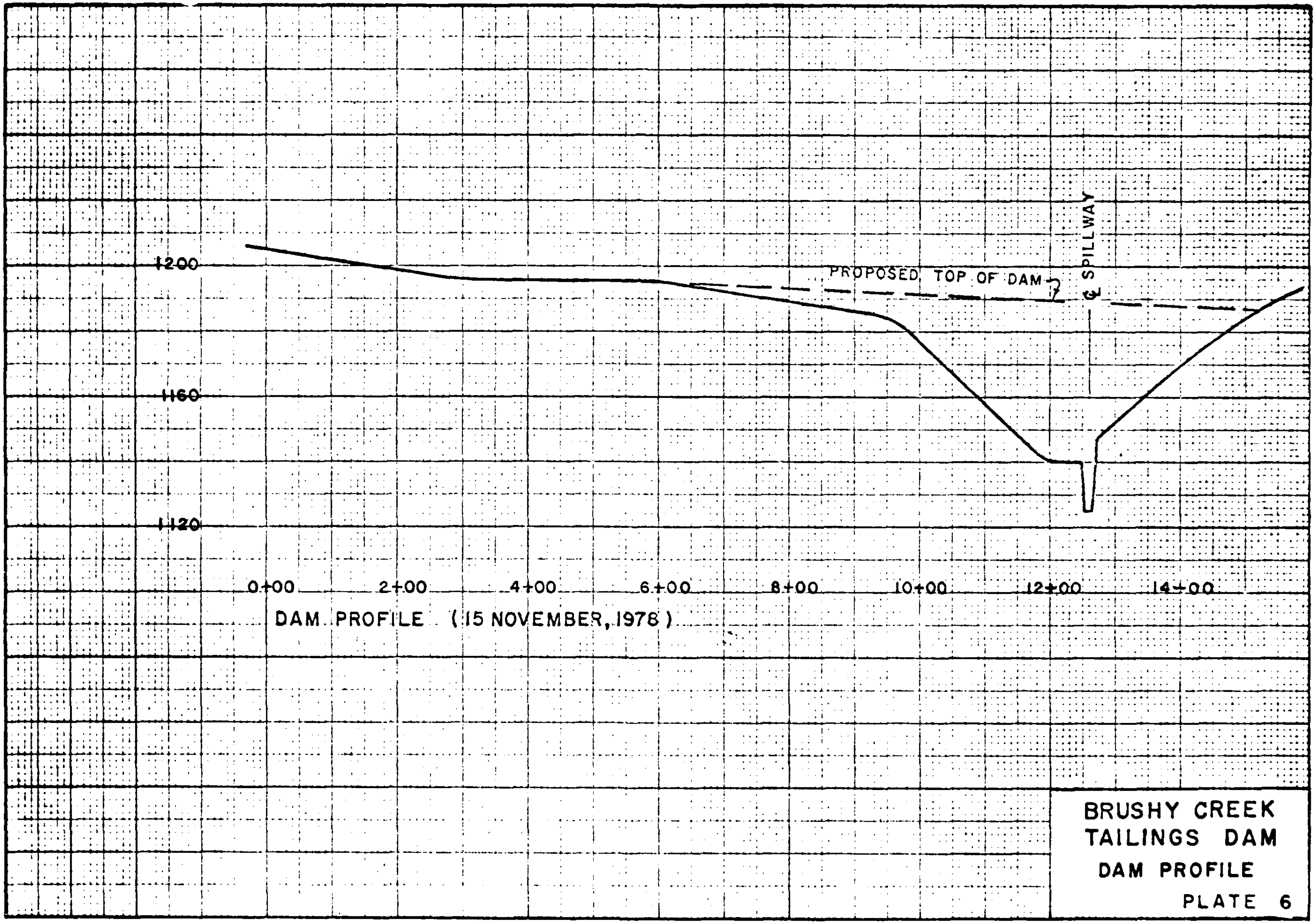
BRUSHY CREEK
TAILINGS DAM
PLAN

PLATE 4

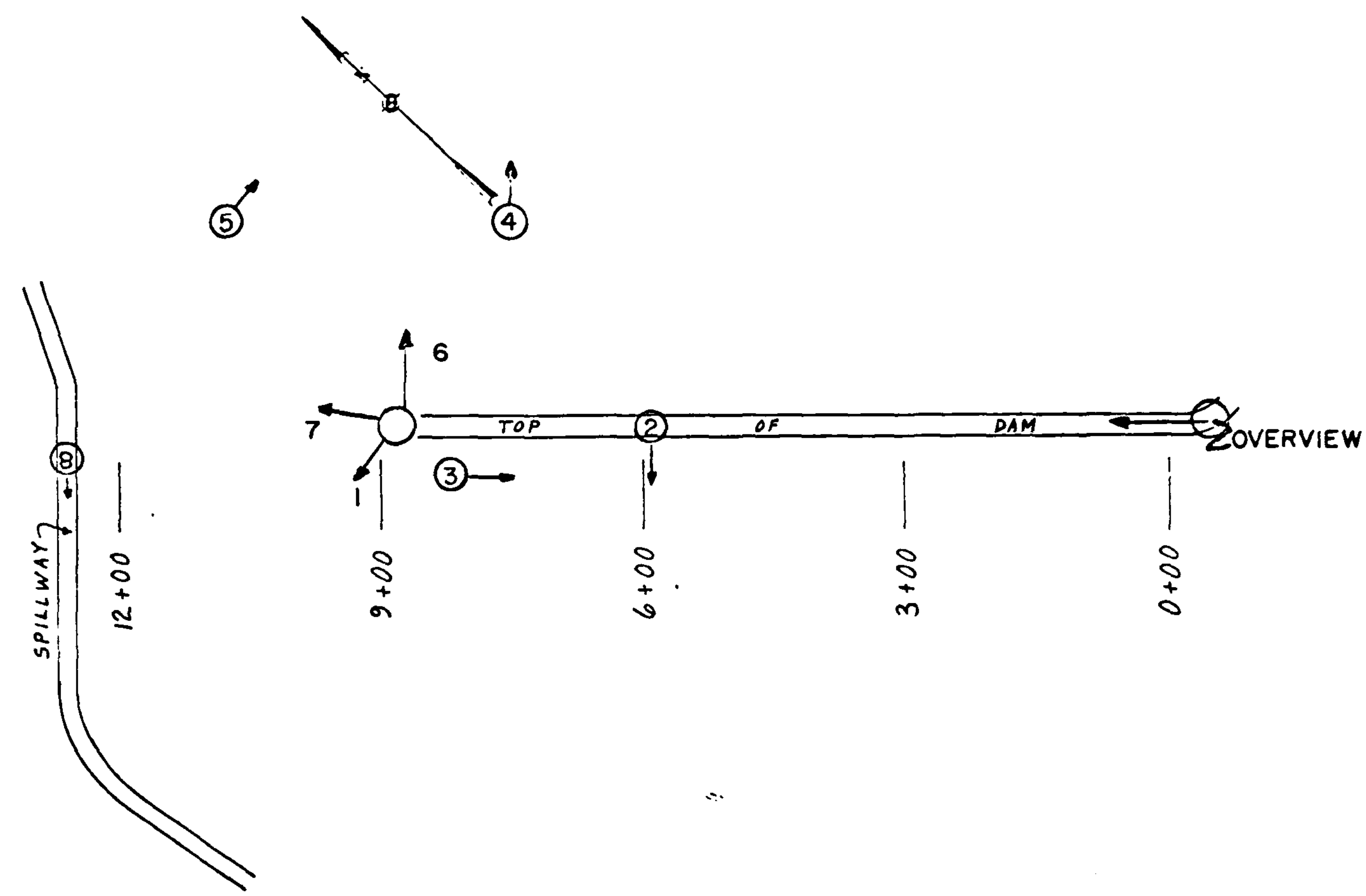


BRUSHY CREEK
TAILINGS DAM
CROSS SECTION

PLATE 5



BRUSHY CREEK
TAILINGS DAM
DAM PROFILE
PLATE 6



BRUSHY CREEK
TAILINGS DAM
PHOTO INDEX

SCALE IN FEET
200 0 200

PLATE 7

APPENDIX A

HYDROLOGIC COMPUTATIONS

```
C
C      3
C      1    STARTED PROFILES AT CRITICAL DEPTH
C    300    AXIS OF THE DAM
C    470    SECTION 470 REPRESENTS POOL ELEVATION
T1        BRUSHY CREEK TAILINGS POND  MO INV. NO. 30951
T2        BACKWATER COMPUTATIONS FOR RATING CURVE  PUCEL JAN 79
T3        SECTION 470 REPRESENTS POOL ELEVATION FOR GIVEN Q'S
J1     -10       2                        -1                              1122.31
J2       1               -1
J3      38       1       43      17       51      25      26
J5     -10
NC     .05     .05     .045      .8       .2
QT       8      10       50     100      300     500    1000    2000    3000
NV       4      .1   1122.5     .08     1123     .06    1125    .045    1200
X1       1       8     1250    1280        0
GR    1200     900   1154.7    1100   1137.2    1200    1137    1250    1122    1255
GR    1122    1265   1143.6    1280     1200    1600
NV       4      .1     1123     .08   1123.5     .06  1125.5    .045    1200
X1      50       8     1250    1280       50      50      50
GR    1200     900   1155.2    1100   1137.7    1200  1137.5    1250  1122.5    1255
GR1122.5      1265   1144.1    1280     1200    1600
NV       4      .1   1123.6     .08   1124.1     .06  1126.1    .045    1200
X1     100       8     1250    1280       50      50      50
GR    1200     900   1155.8    1100   1138.3    1200  1138.1    1250  1123.1    1255
GR1123.1      1265   1144.7    1280     1200    1600
NV       4      .1   1124.1     .08   1124.6     .06  1126.6    .045    1200
X1     150       8     1250    1280       50      50      50
GR    1200     900   1156.3    1100   1138.8    1200  1138.6    1250  1123.6    1255
GR1123.6      1265   1145.2    1280     1200    1600
NV       4      .1   1124.7     .08   1125.2     .06  1127.2    .045    1200
X1     200       8     1250    1280       50      50      50
GR    1200     900   1156.9    1100   1139.4    1200  1139.2    1250  1124.2    1255
GR1124.2      1265   1145.8    1280     1200    1600
NV       4      .1   1125.2     .08   1125.7     .06  1127.7    .045    1200
X1     250       8     1250    1280       50      50      50
GR    1200     900   1157.4    1100   1139.9    1200  1139.7    1250  1124.7    1255
GR1124.7      1265   1146.3    1250     1200    1600
NV       4      .1   1125.8     .08   1126.3     .06  1128.3    .045    1200
X1     300       8     1250    1280       50      50      50
GR    1200     900     1158    1100   1140.5    1200  1140.3    1250  1125.3    1255
GR1125.3      1265   1146.9    1280     1200    1600
NV       2     .05     1125    .045     1200
X1     470       4     1000    1320      170     170     170
GR    1200    1000   1123.5    1001   1123.5    1319    1200    1320
EJ
T1
T2
T3
J1               3                        -1                              1122.49
J2       2               -1
T1
T2
T3
J1               4                        -1                              1122.78
J2       3               -1
T1
T2
T3
ED
```

```
T3
J1          5              -1              1123.13
J2    4          -1
T1
T2
T3
J1          6              -1              1123.42
J2    5          -1
T1
T2
T3
J1          7              -1              1124.22
J2    6          -1
T1
T2
T3
J1          8              -1              1125.96
J2    7          -1
T1
T2
T3
J1          9              -1              1128.06
J2    15         -1

ER
EOI.
ED
```

SUMMARY PRINTOUT

	SECNO	CWSEL	Q	KXXNCH	DIFWSX	AREA	VCH
*	1.000	1122.31	10.00	107.53	0.00	3.17	3.16
*	1.000	1122.90	50.00	93.91	0.00	9.44	5.30
*	1.000	1123.42	100.00	75.81	0.00	15.22	6.57
*	1.000	1124.88	300.00	61.25	0.00	33.00	9.09
*	1.000	1125.97	500.00	59.81	0.00	47.83	10.45
*	1.000	1128.07	1000.00	59.39	0.00	79.58	12.57
*	1.000	1131.09	2000.00	58.78	0.00	133.35	15.00
*	1.000	1133.47	3000.00	58.31	0.00	182.36	16.45
	50.000	1123.39	10.00	84.71	1.08	9.22	1.08
	50.000	1124.46	50.00	70.41	1.56	21.56	2.32
	50.000	1125.25	100.00	62.52	1.83	31.37	3.19
	50.000	1127.45	300.00	59.61	2.57	62.05	4.83
	50.000	1129.06	500.00	60.28	3.09	87.76	5.70
	50.000	1132.09	1000.00	58.67	4.02	143.04	6.59
	50.000	1136.38	2000.00	57.81	5.29	237.78	8.41
	50.000	1140.50	3000.00	56.98	7.03	512.60	6.76
	100.000	1123.79	10.00	92.30	.40	7.17	1.39
	100.000	1124.87	50.00	72.33	.41	19.28	2.59
	100.000	1125.66	100.00	64.39	.41	28.99	3.45
	100.000	1127.90	300.00	59.64	.45	59.81	5.02
	100.000	1129.54	500.00	59.30	.48	85.65	5.84
	100.000	1132.59	1000.00	58.68	.51	141.19	7.08
	100.000	1136.89	2000.00	57.81	.51	235.94	8.48
	100.000	1140.67	3000.00	57.04	.17	472.84	7.34
	150.000	1124.37	10.00	89.06	.58	8.04	1.24
	150.000	1125.38	50.00	72.19	.52	19.44	2.57
	150.000	1126.16	100.00	64.44	.50	28.92	3.46
	150.000	1128.40	300.00	59.63	.50	59.81	5.02
	150.000	1130.06	500.00	59.29	.52	86.00	5.81
	150.000	1133.14	1000.00	58.66	.54	142.11	7.04
	150.000	1137.44	2000.00	57.79	.54	236.56	8.45
	150.000	1140.91	3000.00	57.08	.24	449.38	7.71
1							
	SECNO	CWSEL	Q	KXXNCH	DIFWSX	AREA	VCH
	200.000	1124.91	10.00	91.68	.54	7.34	1.36
	200.000	1125.92	50.00	72.88	.54	18.62	2.68
	200.000	1126.68	100.00	65.21	.52	27.95	3.58
	200.000	1128.90	300.00	59.65	.50	58.30	5.15
	200.000	1130.56	500.00	59.31	.51	84.54	5.91
	200.000	1133.65	1000.00	58.67	.52	140.54	7.12
	200.000	1137.96	2000.00	57.78	.52	235.09	8.51
	200.000	1141.16	3000.00	57.12	.25	418.64	8.24
	250.000	1125.47	10.00	89.25	.56	7.99	1.25
	250.000	1126.48	50.00	72.24	.56	19.38	2.58
	250.000	1127.24	100.00	64.61	.56	28.70	3.48
	250.000	1129.44	300.00	59.64	.54	58.97	5.09
	250.000	1131.10	500.00	59.30	.54	84.93	5.89
	250.000	1134.20	1000.00	58.65	.55	141.14	7.08
	250.000	1138.51	2000.00	57.76	.55	235.84	8.48

E>

250.000	1138.51	2000.00	57.76	.55	235.84	8.48
250.000	1141.51	3000.00	57.13	.35	406.46	8.46
300.000	1126.01	10.00	91.68	.55	7.34	1.36
300.000	1127.02	50.00	72.78	.54	18.75	2.67
300.000	1127.77	100.00	65.19	.53	27.97	3.58
300.000	1129.96	300.00	59.65	.52	57.88	5.18
300.000	1131.63	500.00	59.30	.52	83.93	5.95
300.000	1134.72	1000.00	58.65	.53	140.02	7.14
300.000	1139.03	2000.00	57.75	.53	224.48	8.53
300.000	1141.85	3000.00	57.16	.34	383.71	8.90
470.000	1126.07	10.00	49.93	.05	815.93	.01
470.000	1127.22	50.00	49.85	.20	1182.02	.04
470.000	1128.13	100.00	49.79	.36	1472.25	.07
470.000	1130.71	300.00	49.62	.75	2294.26	.13
470.000	1132.62	500.00	49.49	.99	2901.11	.17
470.000	1136.15	1000.00	49.26	1.43	4024.55	.25
470.000	1141.07	2000.00	48.93	2.03	5590.04	.36
470.000	1143.89	3000.00	48.74	2.04	6488.85	.46

SUMMARY OF ERRORS

```
CAUTION  SECNO=    1.000  PROFILE= 1  CRITICAL DEPTH ASSUMED
CAUTION  SECNO=    1.000  PROFILE= 2  CRITICAL DEPTH ASSUMED
CAUTION  SECNO=    1.000  PROFILE= 3  CRITICAL DEPTH ASSUMED
CAUTION  SECNO=    1.000  PROFILE= 4  CRITICAL DEPTH ASSUMED
CAUTION  SECNO=    1.000  PROFILE= 5  CRITICAL DEPTH ASSUMED
CAUTION  SECNO=    1.000  PROFILE= 6  CRITICAL DEPTH ASSUMED
CAUTION  SECNO=    1.000  PROFILE= 7  CRITICAL DEPTH ASSUMED
CAUTION  SECNO=    1.000  PROFILE= 8  CRITICAL DEPTH ASSUMED
1

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
  HEC2 RELEASE DATED NOV 76 UPDATED  AUG1977
  ERROR CORR -  01,02
  MODIFICATION -  50,51,52,53
$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

E01.
D
```

```
********************************
 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION      JULY 1978
   LAST MODIFICATION  26 FEB 79
********************************
A1 35   BRUSHY CREEK TAILINGS DAM - MISSOURI INVENTORY #30951
A2 35   ST.LOUIS DISTRICT CORPS OF ENGINEERS - ED-HE - DEC79 - BADER
A3 35   RATIOS OF PROBABLE MAXIMUM FLOOD
B    288       0       5       0       0       0       0       0      -2       0
B1     5
J      1       5       1
J1   .50     .55     .60     .65     .70
K      0 INFLOW1                                       1
K1     INFLOW HYDROGRAPH TO RESERVOIR DAM #30161
M      1       2    .145                     1.0                             1
P           26.0     102     120     130
T                                                     -1     -80             .10
W2           .09
X    -10     -.1     3.0
K      1    POND                                       1
K1     FLOOD ROUTING THRU UPPER RESERVOIR
Y                                    1       1
Y1     1                                         -1190.0      -1
Y4  1190    1192    1194    1195    1197    1199    1206    1212    1213    1214
Y5     0      52     140     180     252     340     560     785    1910    4020
$A     0      .6     3.4     9.2   10.36    17.2    27.0
$E  1127    1140    1160    1180    1190    1200    1220
$$  1190
$D  1212
K      0 INFLOW2                                       1
K1     INFLOW HYDROGRAPH TO TAILINGS DAM #30951
M      1       2    .853                     1.0                             1
P           26.0     102     120     130
T                                                     -1     -80             .14
W2           .32
X    -10     -.1     2.5
K      2
K      1    MAIN                             2         1
K1     FLOOD ROUTING THRU LOWER RESERVOIR
Y                                    1       1
Y1     1                                           -1116      -1
Y41125.3  1126.1  1127.2  1128.1  1130.7  1132.6  1136.2  1141.1  1143.9
Y5     0      10      50     100     300     500    1000    2000    3000
$A     0    54.6    82.3    90.7   115.8   156.0
$E  1020    1100    1120    1125    1140    1160
$$1125.3
$D1140.3
K     99
```

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

```
RUNOFF HYDROGRAPH AT       NFLOW1
ROUTE HYDROGRAPH TO          POND
RUNOFF HYDROGRAPH AT       NFLOW2
COMBINE  2 HYDROGRAPHS AT
ROUTE HYDROGRAPH TO          MAIN
```

```
BRUSHY CREEK TAILINGS DAM - MISSOURI INVENTORY #30951
ST.LOUIS DISTRICT CORPS OF ENGINEERS - ED-HE - DEC79 - BADER
RATIOS OF PROBABLE MAXIMUM FLOOD

                              JOB SPECIFICATION
   NO     NHR     NMIN    IDAY     IHR     IMIN   METRC    IPLT    IPRT   NSTAN
  288       0        5       0       0        0       0       0      -2       0
                         JOPER     NWT    LROPT   TRACE
                             5       0        0       0

                     MULTI-PLAN ANALYSES TO BE PERFORMED
                        NPLAN= 1 NRTIO= 2 LRTIO= 1
  RTIOS=    .50   1.00


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

                          SUB-AREA RUNOFF COMPUTATION

  INFLOW HYDROGRAPH TO RESERVOIR DAM #30161

             ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
            NFLOW1       0       0       0       0       0       1       0       0

                              HYDROGRAPH DATA
  IHYDG   IUHG   TAREA    SNAP   TRSDA   TRSPC   RATIO   ISNOW   ISAME   LOCAL
      1      2     .15    0.00     .15    1.00   0.000       0       1       0

                              PRECIP DATA
            SPFE     PMS      R6     R12     R24     R48     R72     R96
            0.00   26.00  102.00  120.00  130.00    0.00    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 -80.00   0.00    .14

  CURVE NO = -80.00  WETNESS =  -1.00  EFFECT CN =  80.00

                              UNIT HYDROGRAPH DATA
                           TC=  0.00    LAG=   .09

                              RECESSION DATA
             STRTQ=  -10.00    QRCSN=   -.10   RTIOR= 3.00

  TIME INCREMENT TOO LARGE--(NHQ IS GT LAG/2)

     UNIT HYDROGRAPH  7 END OF PERIOD ORDINATES, TC=   0.00 HOURS, LAG=   .09  VOL= 1.00
  379.     470.     176.     64.     23.     8.     3.
```

Q 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	.05	1	.01	.00	.01	2.	1.01	12.05	145	.22	.20	.02	120.
1.01	.10	2	.01	.00	.01	3.	1.01	12.10	146	.22	.20	.02	183.
1.01	.15	3	.01	.00	.01	3.	1.01	12.15	147	.22	.20	.02	214.
1.01	.20	4	.01	.00	.01	3.	1.01	12.20	148	.22	.20	.02	224.
1.01	.25	5	.01	.00	.01	3.	1.01	12.25	149	.22	.21	.02	228.
1.01	.30	6	.01	.00	.01	3.	1.01	12.30	150	.22	.21	.01	230.
1.01	.35	7	.01	.00	.01	3.	1.01	12.35	151	.22	.21	.01	231.
1.01	.40	8	.01	.00	.01	3.	1.01	12.40	152	.22	.21	.01	232.
1.01	.45	9	.01	.00	.01	3.	1.01	12.45	153	.22	.21	.01	233.
1.01	.50	10	.01	.00	.01	3.	1.01	12.50	154	.22	.21	.01	234.
1.01	.55	11	.01	.00	.01	3.	1.01	12.55	155	.22	.21	.01	234.
1.01	1.00	12	.01	.00	.01	3.	1.01	13.00	156	.22	.21	.01	235.
1.01	1.05	13	.01	.00	.01	3.	1.01	13.05	157	.27	.25	.01	251.
1.01	1.10	14	.01	.00	.01	3.	1.01	13.10	158	.27	.25	.01	272.
1.01	1.15	15	.01	.00	.01	3.	1.01	13.15	159	.27	.25	.01	280.
1.01	1.20	16	.01	.00	.01	3.	1.01	13.20	160	.27	.25	.01	283.
1.01	1.25	17	.01	.00	.01	2.	1.01	13.25	161	.27	.25	.01	285.
1.01	1.30	18	.01	.00	.01	2.	1.01	13.30	162	.27	.26	.01	285.
1.01	1.35	19	.01	.00	.01	2.	1.01	13.35	163	.27	.26	.01	286.
1.01	1.40	20	.01	.00	.01	2.	1.01	13.40	164	.27	.26	.01	287.
1.01	1.45	21	.01	.00	.01	2.	1.01	13.45	165	.27	.26	.01	287.
1.01	1.50	22	.01	.00	.01	2.	1.01	13.50	166	.27	.26	.01	288.
1.01	1.55	23	.01	.00	.01	2.	1.01	13.55	167	.27	.26	.01	288.
1.01	2.00	24	.01	.00	.01	2.	1.01	14.00	168	.27	.26	.01	288.
1.01	2.05	25	.01	.00	.01	2.	1.01	14.05	169	.33	.32	.01	313.
1.01	2.10	26	.01	.00	.01	2.	1.01	14.10	170	.33	.32	.01	344.
1.01	2.15	27	.01	.00	.01	2.	1.01	14.15	171	.33	.32	.01	356.
1.01	2.20	28	.01	.00	.01	2.	1.01	14.20	172	.33	.32	.01	360.
1.01	2.25	29	.01	.00	.01	2.	1.01	14.25	173	.33	.32	.01	362.
1.01	2.30	30	.01	.00	.01	2.	1.01	14.30	174	.33	.32	.01	363.
1.01	2.35	31	.01	.00	.01	2.	1.01	14.35	175	.33	.32	.01	364.
1.01	2.40	32	.01	.00	.01	2.	1.01	14.40	176	.33	.32	.01	364.
1.01	2.45	33	.01	.00	.01	2.	1.01	14.45	177	.33	.32	.01	364.
1.01	2.50	34	.01	.00	.01	2.	1.01	14.50	178	.33	.33	.01	365.
1.01	2.55	35	.01	.00	.01	2.	1.01	14.55	179	.33	.33	.01	365.
1.01	3.00	36	.01	.00	.01	2.	1.01	15.00	180	.33	.33	.01	365.
1.01	3.05	37	.01	.00	.01	2.	1.01	15.05	181	.20	.20	.00	317.
1.01	3.10	38	.01	.00	.01	3.	1.01	15.10	182	.40	.40	.01	332.
1.01	3.15	39	.01	.00	.01	3.	1.01	15.15	183	.40	.40	.01	403.
1.01	3.20	40	.01	.00	.01	3.	1.01	15.20	184	.60	.60	.01	505.
1.01	3.25	41	.01	.00	.01	3.	1.01	15.25	185	.71	.70	.01	646.
1.01	3.30	42	.01	.00	.01	3.	1.01	15.30	186	1.71	1.69	.02	1109.
1.01	3.35	43	.01	.00	.01	3.	1.01	15.35	187	2.82	2.79	.03	2025.
1.01	3.40	44	.01	.00	.01	3.	1.01	15.40	188	1.11	1.10	.01	2093.
1.01	3.45	45	.01	.00	.01	4.	1.01	15.45	189	.71	.70	.01	1493.
1.01	3.50	46	.01	.00	.01	4.	1.01	15.50	190	.60	.60	.00	974.
1.01	3.55	47	.01	.00	.01	4.	1.01	15.55	191	.40	.40	.00	706.
1.01	4.00	48	.01	.00	.01	4.	1.01	16.00	192	.40	.40	.00	542.
1.01	4.05	49	.01	.00	.01	4.	1.01	16.05	193	.31	.31	.00	447.
1.01	4.10	50	.01	.00	.01	4.	1.01	16.10	194	.31	.31	.00	379.
1.01	4.15	51	.01	.00	.01	4.	1.01	16.15	195	.31	.31	.00	357.
1.01	4.20	52	.01	.00	.01	5.	1.01	16.20	196	.31	.31	.00	349.

1.01	4.25	53	.01	.00	.01	5.	1.01	16.25	197	.31	.31	.00	346.
1.01	4.30	54	.01	.00	.01	5.	1.01	16.30	198	.31	.31	.00	345.
1.01	4.35	55	.01	.00	.01	5.	1.01	16.35	199	.31	.31	.00	345.
1.01	4.40	56	.01	.00	.01	5.	1.01	16.40	200	.31	.31	.00	345.
1.01	4.45	57	.01	.00	.01	5.	1.01	16.45	201	.31	.31	.00	345.
1.01	4.50	58	.01	.00	.01	5.	1.01	16.50	202	.31	.31	.00	345.
1.01	4.55	59	.01	.00	.01	5.	1.01	16.55	203	.31	.31	.00	345.
1.01	5.00	60	.01	.00	.01	5.	1.01	17.00	204	.31	.31	.00	345.
1.01	5.05	61	.01	.01	.01	6.	1.01	17.05	205	.24	.24	.00	320.
1.01	5.10	62	.01	.01	.01	6.	1.01	17.10	206	.24	.24	.00	299.
1.01	5.15	63	.01	.01	.01	6.	1.01	17.15	207	.24	.24	.00	278.
1.01	5.20	64	.01	.01	.01	6.	1.01	17.20	208	.24	.24	.00	274.
1.01	5.25	65	.01	.01	.01	6.	1.01	17.25	209	.24	.24	.00	272.
1.01	5.30	66	.01	.01	.01	6.	1.01	17.30	210	.24	.24	.00	272.
1.01	5.35	67	.01	.01	.01	6.	1.01	17.35	211	.24	.24	.00	271.
1.01	5.40	68	.01	.01	.01	6.	1.01	17.40	212	.24	.24	.00	271.
1.01	5.45	69	.01	.01	.01	6.	1.01	17.45	213	.24	.24	.00	271.
1.01	5.50	70	.01	.01	.01	6.	1.01	17.50	214	.24	.24	.00	272.
1.01	5.55	71	.01	.01	.01	7.	1.01	17.55	215	.24	.24	.00	272.
1.01	6.00	72	.01	.01	.01	7.	1.01	18.00	216	.24	.24	.00	272.
1.01	6.05	73	.07	.03	.04	15.	1.01	18.05	217	.02	.02	.00	203.
1.01	6.10	74	.07	.03	.04	25.	1.01	18.10	218	.02	.02	.00	182.
1.01	6.15	75	.07	.03	.03	31.	1.01	18.15	219	.02	.02	.00	163.
1.01	6.20	76	.07	.03	.03	34.	1.01	18.20	220	.02	.02	.00	146.
1.01	6.25	77	.07	.03	.03	36.	1.01	18.25	221	.02	.02	.00	131.
1.01	6.30	78	.07	.03	.03	37.	1.01	18.30	222	.02	.02	.00	117.
1.01	6.35	79	.07	.04	.03	39.	1.01	18.35	223	.02	.02	.00	105.
1.01	6.40	80	.07	.04	.03	40.	1.01	18.40	224	.02	.02	.00	94.
1.01	6.45	81	.07	.04	.03	41.	1.01	18.45	225	.02	.02	.00	84.
1.01	6.50	82	.07	.04	.03	42.	1.01	18.50	226	.02	.02	.00	76.
1.01	6.55	83	.07	.04	.03	44.	1.01	18.55	227	.02	.02	.00	68.
1.01	7.00	84	.07	.04	.02	45.	1.01	19.00	228	.02	.02	.00	61.
1.01	7.05	85	.07	.04	.02	46.	1.01	19.05	229	.02	.02	.00	54.
1.01	7.10	86	.07	.04	.02	46.	1.01	19.10	230	.02	.02	.00	49.
1.01	7.15	87	.07	.04	.02	47.	1.01	19.15	231	.02	.02	.00	44.
1.01	7.20	88	.07	.04	.02	48.	1.01	19.20	232	.02	.02	.00	39.
1.01	7.25	89	.07	.04	.02	49.	1.01	19.25	233	.02	.02	.00	35.
1.01	7.30	90	.07	.04	.02	50.	1.01	19.30	234	.02	.02	.00	31.
1.01	7.35	91	.07	.05	.02	50.	1.01	19.35	235	.02	.02	.00	28.
1.01	7.40	92	.07	.05	.02	51.	1.01	19.40	236	.02	.02	.00	25.
1.01	7.45	93	.07	.05	.02	52.	1.01	19.45	237	.02	.02	.00	24.
1.01	7.50	94	.07	.05	.02	52.	1.01	19.50	238	.02	.02	.00	24.
1.01	7.55	95	.07	.05	.02	53.	1.01	19.55	239	.02	.02	.00	24.
1.01	8.00	96	.07	.05	.02	54.	1.01	20.00	240	.02	.02	.00	24.
1.01	8.05	97	.07	.05	.02	54.	1.01	20.05	241	.02	.02	.00	24.
1.01	8.10	98	.07	.05	.02	55.	1.01	20.10	242	.02	.02	.00	24.
1.01	8.15	99	.07	.05	.02	55.	1.01	20.15	243	.02	.02	.00	24.
1.01	8.20	100	.07	.05	.01	56.	1.01	20.20	244	.02	.02	.00	24.
1.01	8.25	101	.07	.05	.01	56.	1.01	20.25	245	.02	.02	.00	24.
1.01	8.30	102	.07	.05	.01	57.	1.01	20.30	246	.02	.02	.00	24.
1.01	8.35	103	.07	.05	.01	57.	1.01	20.35	247	.02	.02	.00	24.
1.01	8.40	104	.07	.05	.01	57.	1.01	20.40	248	.02	.02	.00	24.
1.01	8.45	105	.07	.05	.01	58.	1.01	20.45	249	.02	.02	.00	24.
1.01	8.50	106	.07	.05	.01	58.	1.01	20.50	250	.02	.02	.00	24.
1.01	8.55	107	.07	.05	.01	59.	1.01	20.55	251	.02	.02	.00	24.

1.01	9.00	108	.07	.05	.01	59.	1.01	21.00	252	.02	.02	.00	24.
1.01	9.05	109	.07	.05	.01	59.	1.01	21.05	253	.02	.02	.00	24.
1.01	9.10	110	.07	.05	.01	60.	1.01	21.10	254	.02	.02	.00	24.
1.01	9.15	111	.07	.05	.01	60.	1.01	21.15	255	.02	.02	.00	24.
1.01	9.20	112	.07	.05	.01	60.	1.01	21.20	256	.02	.02	.00	24.
1.01	9.25	113	.07	.05	.01	60.	1.01	21.25	257	.02	.02	.00	24.
1.01	9.30	114	.07	.05	.01	61.	1.01	21.30	258	.02	.02	.00	24.
1.01	9.35	115	.07	.05	.01	61.	1.01	21.35	259	.02	.02	.00	24.
1.01	9.40	116	.07	.05	.01	61.	1.01	21.40	260	.02	.02	.00	24.
1.01	9.45	117	.07	.06	.01	62.	1.01	21.45	261	.02	.02	.00	24.
1.01	9.50	118	.07	.06	.01	62.	1.01	21.50	262	.02	.02	.00	24.
1.01	9.55	119	.07	.06	.01	62.	1.01	21.55	263	.02	.02	.00	24.
1.01	10.00	120	.07	.06	.01	62.	1.01	22.00	264	.02	.02	.00	24.
1.01	10.05	121	.07	.06	.01	62.	1.01	22.05	265	.02	.02	.00	24.
1.01	10.10	122	.07	.06	.01	63.	1.01	22.10	266	.02	.02	.00	24.
1.01	10.15	123	.07	.06	.01	63.	1.01	22.15	267	.02	.02	.00	24.
1.01	10.20	124	.07	.06	.01	63.	1.01	22.20	268	.02	.02	.00	24.
1.01	10.25	125	.07	.06	.01	63.	1.01	22.25	269	.02	.02	.00	24.
1.01	10.30	126	.07	.06	.01	64.	1.01	22.30	270	.02	.02	.00	24.
1.01	10.35	127	.07	.06	.01	64.	1.01	22.35	271	.02	.02	.00	24.
1.01	10.40	128	.07	.06	.01	64.	1.01	22.40	272	.02	.02	.00	24.
1.01	10.45	129	.07	.06	.01	64.	1.01	22.45	273	.02	.02	.00	24.
1.01	10.50	130	.07	.06	.01	64.	1.01	22.50	274	.02	.02	.00	24.
1.01	10.55	131	.07	.06	.01	64.	1.01	22.55	275	.02	.02	.00	24.
1.01	11.00	132	.07	.06	.01	65.	1.01	23.00	276	.02	.02	.00	24.
1.01	11.05	133	.07	.06	.01	65.	1.01	23.05	277	.02	.02	.00	24.
1.01	11.10	134	.07	.06	.01	65.	1.01	23.10	278	.02	.02	.00	24.
1.01	11.15	135	.07	.06	.01	65.	1.01	23.15	279	.02	.02	.00	24.
1.01	11.20	136	.07	.06	.01	65.	1.01	23.20	280	.02	.02	.00	24.
1.01	11.25	137	.07	.06	.01	65.	1.01	23.25	281	.02	.02	.00	24.
1.01	11.30	138	.07	.06	.01	65.	1.01	23.30	282	.02	.02	.00	24.
1.01	11.35	139	.07	.06	.01	66.	1.01	23.35	283	.02	.02	.00	24.
1.01	11.40	140	.07	.06	.01	66.	1.01	23.40	284	.02	.02	.00	24.
1.01	11.45	141	.07	.06	.01	66.	1.01	23.45	285	.02	.02	.00	24.
1.01	11.50	142	.07	.06	.01	66.	1.01	23.50	286	.02	.02	.00	24.
1.01	11.55	143	.07	.06	.01	66.	1.01	23.55	287	.02	.02	.00	24.
1.01	12.00	144	.07	.06	.01	66.	1.02	0.00	288	.02	.02	.00	24.
									SUM	33.80	31.37	2.43	36175.
										(859.)	(797.)	(62.)	(1024.36)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2088.	403.	126.	126.	36178.
CMS	59.	11.	4.	4.	1024.
INCHES		25.86	32.24	32.24	32.24
MM		656.92	818.79	818.79	818.79
AC-FT		200.	249.	249.	249.
THOUS CU M		247.	307.	307.	307.

HYDROGRAPH AT STANFLOW1 FOR PLAN 1, RTIO 1

1.	1.	2.	2.	2.	2.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.

D

E)
HYDROGRAPH ROUTING

FLOOD ROUTING THRU UPPER RESERVOIR

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

ROUTING DATA

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

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1190.	-1

STAGE	1190.00	1192.00	1194.00	1195.00	1197.00	1199.00	1206.00	1212.00	1213.00	1214.00
FLOW	0.00	52.00	140.00	180.00	252.00	340.00	560.00	785.00	1910.00	4020.00

SURFACE AREA=	0.	1.	3.	9.	10.	17.	27.
CAPACITY=	0.	3.	39.	160.	258.	394.	833.
ELEVATION=	1127.	1140.	1160.	1180.	1190.	1200.	1220.

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
1190.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
1212.0	0.0	0.0	0.

STATION POND, PLAN 1, RATIO 1

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	2.	2.	2.	2.	2.	3.	3.	3.
4.	4.	4.	4.	5.	5.	5.	6.	6.	6.
7.	7.	7.	8.	8.	8.	8.	9.	9.	9.
10.	10.	10.	11.	11.	11.	12.	12.	12.	12.
13.	13.	13.	14.	14.	14.	14.	15.	15.	15.
16.	16.	16.	16.	17.	17.	17.	17.	18.	18.
18.	18.	18.	19.	19.	19.	19.	20.	20.	20.
20.	20.	21.	21.	21.	22.	23.	25.	25.	28.
29.	30.	32.	33.	35.	36.	37.	39.	43.	42.
43.	45.	46.	48.	49.	51.	53.	55.	57.	60.
63.	66.	69.	72.	74.	77.	80.	82.	85.	87.
89.	91.	93.	97.	101.	109.	126.	146.	161.	170.
175.	178.	179.	180.	180.	180.	180.	180.	179.	179.

179.	179.	179.	179.	178.	178.	177.	176.	176.	175.
174.	173.	172.	172.	171.	170.	169.	168.	166.	164.
162.	160.	158.	156.	154.	151.	149.	146.	144.	141.
139.	136.	133.	131.	128.	125.	122.	120.	117.	115.
112.	110.	108.	105.	103.	101.	99.	97.	94.	92.
90.	89.	87.	85.	83.	81.	80.	78.	76.	75.
73.	71.	70.	69.	67.	65.	64.	63.	62.	60.
59.	58.	57.	56.	55.	53.	52.	52.	51.	50.
50.	49.	49.	48.	48.	47.	46.	46.		

STORAGE

258.	258.	258.	258.	258.	258.	258.	258.	258.	258.
258.	258.	258.	258.	258.	258.	258.	258.	258.	258.
258.	258.	258.	258.	258.	258.	258.	258.	258.	258.
258.	258.	258.	258.	258.	258.	258.	258.	258.	258.
258.	258.	258.	258.	258.	258.	258.	258.	258.	258.
258.	258.	258.	258.	258.	258.	258.	258.	258.	258.
258.	258.	258.	258.	258.	258.	258.	258.	258.	258.
258.	258.	258.	258.	259.	259.	259.	259.	259.	259.
259.	259.	259.	260.	260.	260.	260.	260.	260.	260.
259.	261.	261.	261.	261.	261.	261.	261.	261.	262.
262.	262.	262.	262.	262.	262.	262.	263.	263.	263.
263.	263.	263.	263.	263.	264.	264.	264.	264.	264.
264.	264.	264.	264.	255.	265.	265.	265.	265.	265.
265.	265.	265.	265.	256.	265.	266.	266.	265.	266.
266.	266.	265.	266.	256.	267.	267.	268.	269.	269.
270.	270.	271.	272.	272.	273.	273.	274.	275.	275.
276.	277.	277.	278.	279.	279.	280.	281.	281.	282.
283.	283.	284.	285.	285.	286.	287.	288.	289.	289.
299.	290.	291.	292.	293.	295.	300.	305.	311.	314.
316.	317.	317.	317.	317.	317.	317.	317.	317.	317.
317.	317.	317.	317.	317.	317.	317.	316.	316.	316.
315.	315.	315.	315.	314.	314.	314.	313.	313.	312.
312.	311.	310.	309.	309.	308.	307.	305.	305.	305.
304.	303.	302.	301.	301.	300.	299.	298.	293.	297.
295.	296.	295.	294.	294.	293.	292.	292.	291.	291.
290.	290.	289.	289.	288.	288.	287.	287.	286.	285.
285.	285.	285.	284.	284.	283.	283.	283.	282.	282.
282.	281.	281.	281.	280.	280.	280.	280.	279.	279.
279.	279.	278.	278.	278.	278.	277.	277.		

STAGE

1190.0	1190.0	1190.0	1190.0	1190.0	1190.0	1190.0	1190.0	1190.0	1190.0
1190.0	1190.0	1190.0	1190.0	1190.0	1190.0	1190.0	1190.0	1190.0	1190.0
1190.0	1190.0	1190.0	1190.0	1190.0	1190.0	1190.0	1190.0	1190.0	1190.0
1190.0	1190.0	1190.0	1190.0	1190.0	1190.0	1190.0	1190.0	1190.0	1190.0
1190.0	1190.0	1190.0	1190.0	1190.0	1190.0	1190.0	1190.0	1190.0	1190.0
1190.0	1190.0	1190.0	1190.0	1190.0	1190.0	1190.0	1190.0	1190.0	1190.0
1190.0	1190.0	1190.0	1190.0	1190.0	1190.0	1190.0	1190.1	1190.1	1190.1
1190.1	1190.1	1190.1	1190.1	1190.1	1190.1	1190.1	1190.1	1190.1	1190.1
1190.1	1190.1	1190.2	1190.2	1190.2	1190.2	1190.2	1190.2	1190.2	1190.2
1190.3	1190.3	1190.3	1190.3	1190.3	1190.3	1190.3	1190.3	1190.4	1190.4
1190.4	1190.4	1190.4	1190.4	1190.4	1190.4	1190.4	1190.5	1190.5	1190.5
1190.5	1190.5	1190.5	1190.5	1190.5	1190.5	1190.6	1190.6	1190.6	1190.6
1190.6	1190.6	1190.6	1190.6	1190.6	1190.6	1190.7	1190.7	1190.7	1190.7

1190.6	1190.6	1190.6	1190.6	1190.6	1190.6	1190.7	1190.7	1190.7	1190.7
1190.7	1190.7	1190.7	1190.7	1190.7	1190.7	1190.7	1190.8	1190.8	1190.8
1190.8	1190.8	1190.8	1190.8	1190.8	1190.9	1190.9	1191.0	1191.0	1191.1
1191.1	1191.2	1191.2	1191.3	1191.3	1191.4	1191.4	1191.5	1191.5	1191.6
1191.7	1191.7	1191.8	1191.8	1191.9	1192.0	1192.0	1192.1	1192.1	1192.2
1192.2	1192.3	1192.4	1192.4	1192.5	1192.6	1192.6	1192.7	1192.7	1192.8
1192.8	1192.9	1192.9	1193.0	1193.1	1193.3	1193.7	1194.2	1194.5	1194.7
1194.9	1194.9	1195.0	1195.0	1195.0	1195.0	1195.0	1195.0	1195.0	1195.0
1195.0	1195.0	1195.0	1195.0	1195.0	1194.9	1194.9	1194.9	1194.9	1194.9
1194.9	1194.8	1194.8	1194.8	1194.8	1194.8	1194.7	1194.7	1194.7	1194.6
1194.6	1194.5	1194.5	1194.4	1194.3	1194.3	1194.2	1194.2	1194.1	1194.0
1194.0	1193.9	1193.8	1193.8	1193.7	1193.7	1193.6	1193.5	1193.5	1193.4
1193.4	1193.3	1193.3	1193.2	1193.2	1193.1	1193.1	1193.0	1193.0	1192.9
1192.9	1192.8	1192.8	1192.7	1192.7	1192.7	1192.6	1192.6	1192.5	1192.5
1192.5	1192.4	1192.4	1192.4	1192.3	1192.3	1192.3	1192.3	1192.2	1192.2
1192.2	1192.1	1192.1	1192.1	1192.1	1192.0	1192.0	1192.0	1192.0	1191.9
1191.9	1191.9	1191.9	1191.9	1191.8	1191.8	1191.8	1191.8		

PEAK OUTFLOW IS 180. AT TIME 16.25 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	180.	145.	53.	53.	15295.
CMS	5.	4.	2.	2.	433.
INCHES		9.30	13.63	13.63	13.63
MM		236.28	346.16	346.16	346.16
AC-FT		72.	105.	105.	105.

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	2	.85	0.00	.85	1.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	26.00	102.00	120.00	130.00	0.00	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	-80.00	0.00	.14

CURVE NO = -80.00 WETNESS = -1.00 EFFECT CN = 80.00

UNIT HYDROGRAPH DATA
TC= 0.00 LAG= .32

RECESSION DATA
STRTQ= -10.00 QRCSN= -.10 RTIOR= 2.50

UNIT HYDROGRAPH 21 END OF PERIOD ORDINATES, TC= 0.00 HOURS, LAG= .32 VOL= 1.00

145.	464.	917.	1129.	1091.	904.	623.	414.	288.	200.
137.	94.	63.	44.	30.	21.	14.	11.	7.	4.
2.									

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	.05	1	.01	.00	.01	8.	1.01	12.05	145	.22	.20	.02	408.
1.01	.10	2	.01	.00	.01	8.	1.01	12.10	146	.22	.20	.02	475.
1.01	.15	3	.01	.00	.01	10.	1.01	12.15	147	.22	.20	.02	607.
1.01	.20	4	.01	.00	.01	11.	1.01	12.20	148	.22	.20	.02	770.
1.01	.25	5	.01	.00	.01	13.	1.01	12.25	149	.22	.21	.02	928.
1.01	.30	6	.01	.00	.01	14.	1.01	12.30	150	.22	.21	.01	1051.
1.01	.35	7	.01	.00	.01	15.	1.01	12.35	151	.22	.21	.01	1154.
1.01	.40	8	.01	.00	.01	16.	1.01	12.40	152	.22	.21	.01	1218.
1.01	.45	9	.01	.00	.01	16.	1.01	12.45	153	.22	.21	.01	1264.
1.01	.50	10	.01	.00	.01	16.	1.01	12.50	154	.22	.21	.01	1297.
1.01	.55	11	.01	.00	.01	16.	1.01	12.55	155	.22	.21	.01	1321.
1.01	1.00	12	.01	.00	.01	16.	1.01	13.00	156	.22	.21	.01	1338.
1.01	1.05	13	.01	.00	.01	16.	1.01	13.05	157	.27	.25	.01	1358.
1.01	1.10	14	.01	.00	.01	16.	1.01	13.10	158	.27	.25	.01	1337.
1.01	1.15	15	.01	.00	.01	15.	1.01	13.15	159	.27	.25	.01	1434.
1.01	1.20	16	.01	.00	.01	15.	1.01	13.20	160	.27	.25	.01	1498.
1.01	1.25	17	.01	.00	.01	15.	1.01	13.25	161	.27	.25	.01	1540.
1.01	1.30	18	.01	.00	.01	15.	1.01	13.30	162	.27	.26	.01	1583.
1.01	1.35	19	.01	.00	.01	15.	1.01	13.35	163	.27	.26	.01	1614.
1.01	1.40	20	.01	.00	.01	15.	1.01	13.40	164	.27	.25	.01	1636.
1.01	1.45	21	.01	.00	.01	15.	1.01	13.45	165	.27	.26	.01	1651.
1.01	1.50	22	.01	.00	.01	14.	1.01	13.50	166	.27	.26	.01	1663.
1.01	1.55	23	.01	.00	.01	14.	1.01	13.55	167	.27	.26	.01	1672.
1.01	2.00	24	.01	.00	.01	14.	1.01	14.00	168	.27	.26	.01	1679.
1.01	2.05	25	.01	.00	.01	14.	1.01	14.05	169	.33	.32	.01	1693.
1.01	2.10	26	.01	.00	.01	14.	1.01	14.10	170	.33	.32	.01	1728.
1.01	2.15	27	.01	.00	.01	14.	1.01	14.15	171	.33	.32	.01	1790.
1.01	2.20	28	.01	.00	.01	14.	1.01	14.20	172	.33	.32	.01	1857.
1.01	2.25	29	.01	.00	.01	14.	1.01	14.25	173	.33	.32	.01	1940.
1.01	2.30	30	.01	.00	.01	14.	1.01	14.30	174	.33	.32	.01	2001.
1.01	2.35	31	.01	.00	.01	14.	1.01	14.35	175	.33	.32	.01	2044.
1.01	2.40	32	.01	.00	.01	14.	1.01	14.40	176	.33	.32	.01	2073.

1.01	2.45	33	.01	.00	.01	14.	1.01	14.45	177	.33	.32	.01	2004.
1.01	2.50	34	.01	.00	.01	14.	1.01	14.50	178	.33	.33	.01	2110.
1.01	2.55	35	.01	.00	.01	14.	1.01	14.55	179	.33	.33	.01	2121.
1.01	3.00	36	.01	.00	.01	14.	1.01	15.00	180	.33	.33	.01	2129.
1.01	3.05	37	.01	.00	.01	14.	1.01	15.05	181	.20	.20	.00	2116.
1.01	3.10	38	.01	.00	.01	14.	1.01	15.10	182	.40	.40	.01	2070.
1.01	3.15	39	.01	.00	.01	14.	1.01	15.15	183	.40	.40	.01	2068.
1.01	3.20	40	.01	.00	.01	15.	1.01	15.20	184	.60	.60	.01	2133.
1.01	3.25	41	.01	.00	.01	15.	1.01	15.25	185	.71	.70	.01	2331.
1.01	3.30	42	.01	.00	.01	16.	1.01	15.30	186	1.71	1.69	.02	2807.
1.01	3.35	43	.01	.00	.01	17.	1.01	15.35	187	2.82	2.79	.03	3346.
1.01	3.40	44	.01	.00	.01	18.	1.01	15.40	188	1.11	1.10	.01	6426.
1.01	3.45	45	.01	.00	.01	18.	1.01	15.45	189	.71	.70	.01	7052.
1.01	3.50	46	.01	.00	.01	19.	1.01	15.50	190	.60	.60	.00	7875.
1.01	3.55	47	.01	.00	.01	20.	1.01	15.55	191	.40	.40	.00	7790.
1.01	4.00	48	.01	.00	.01	21.	1.01	16.00	192	.40	.40	.00	7036.
1.01	4.05	49	.01	.00	.01	22.	1.01	16.05	193	.31	.31	.00	5938.
1.01	4.10	50	.01	.00	.01	22.	1.01	16.10	194	.31	.31	.00	4942.
1.01	4.15	51	.01	.00	.01	23.	1.01	16.15	195	.31	.31	.00	4152.
1.01	4.20	52	.01	.00	.01	24.	1.01	16.20	196	.31	.31	.00	3533.
1.01	4.25	53	.01	.00	.01	25.	1.01	16.25	197	.31	.31	.00	3873.
1.01	4.30	54	.01	.00	.01	25.	1.01	16.30	198	.31	.31	.00	2745.
1.01	4.35	55	.01	.00	.01	26.	1.01	16.35	199	.31	.31	.00	2518.
1.01	4.40	56	.01	.00	.01	27.	1.01	16.40	200	.31	.31	.00	2356.
1.01	4.45	57	.01	.00	.01	28.	1.01	16.45	201	.31	.31	.00	2262.
1.01	4.50	58	.01	.00	.01	28.	1.01	16.50	202	.31	.31	.00	2193.
1.01	4.55	59	.01	.00	.01	29.	1.01	16.55	203	.31	.31	.00	2141.
1.01	5.00	60	.01	.00	.01	30.	1.01	17.00	204	.31	.31	.00	2107.
1.01	5.05	61	.01	.01	.01	30.	1.01	17.05	205	.24	.24	.00	2073.
1.01	5.10	62	.01	.01	.01	31.	1.01	17.10	206	.24	.24	.00	2023.
1.01	5.15	63	.01	.01	.01	32.	1.01	17.15	207	.24	.24	.00	1948.
1.01	5.20	64	.01	.01	.01	32.	1.01	17.20	208	.24	.24	.00	1854.
1.01	5.25	65	.01	.01	.01	33.	1.01	17.25	209	.24	.24	.00	1729.
1.01	5.30	66	.01	.01	.01	34.	1.01	17.30	210	.24	.24	.00	1727.
1.01	5.35	67	.01	.01	.01	34.	1.01	17.35	211	.24	.24	.00	1685.
1.01	5.40	68	.01	.01	.01	35.	1.01	17.40	212	.24	.24	.00	1657.
1.01	5.45	69	.01	.01	.01	35.	1.01	17.45	213	.24	.24	.00	1639.
1.01	5.50	70	.01	.01	.01	36.	1.01	17.50	214	.24	.24	.00	1625.
1.01	5.55	71	.01	.01	.01	37.	1.01	17.55	215	.24	.24	.00	1616.
1.01	6.00	72	.01	.01	.01	37.	1.01	18.00	216	.24	.24	.00	1610.
1.01	6.05	73	.07	.03	.04	41.	1.01	18.05	217	.02	.02	.00	1574.
1.01	6.10	74	.07	.03	.04	52.	1.01	18.10	218	.02	.02	.00	1469.
1.01	6.15	75	.07	.03	.03	73.	1.01	18.15	219	.02	.02	.00	1265.
1.01	6.20	76	.07	.03	.03	101.	1.01	18.20	220	.02	.02	.00	1015.
1.01	6.25	77	.07	.03	.03	129.	1.01	18.25	221	.02	.02	.00	783.
1.01	6.30	78	.07	.03	.03	154.	1.01	18.30	222	.02	.02	.00	715.
1.01	6.35	79	.07	.04	.03	174.	1.01	18.35	223	.02	.02	.00	652.
1.01	6.40	80	.07	.04	.03	190.	1.01	18.40	224	.02	.02	.00	595.
1.01	6.45	81	.07	.04	.03	204.	1.01	18.45	225	.02	.02	.00	543.
1.01	6.50	82	.07	.04	.03	215.	1.01	18.50	226	.02	.02	.00	496.
1.01	6.55	83	.07	.04	.03	225.	1.01	18.55	227	.02	.02	.00	452.
1.01	7.00	84	.07	.04	.02	234.	1.01	19.00	228	.02	.02	.00	413.
1.01	7.05	85	.07	.04	.02	242.	1.01	19.05	229	.02	.02	.00	376.
1.01	7.10	86	.07	.04	.02	250.	1.01	19.10	230	.02	.02	.00	343.
1.01	7.15	87	.07	.04	.02	257.	1.01	19.15	231	.02	.02	.00	313.
1.01	7.20	88	.07	.04	.02	263.	1.01	19.20	232	.02	.02	.00	286.
1.01	7.25	89	.07	.04	.02	259.	1.01	19.25	233	.02	.02	.00	261.
1.01	7.30	90	.07	.04	.02	274.	1.01	19.30	234	.02	.02	.00	239.
1.01	7.35	91	.07	.05	.02	280.	1.01	19.35	235	.02	.02	.00	217.
1.01	7.40	92	.07	.05	.02	284.	1.01	19.40	236	.02	.02	.00	198.
1.01	7.45	93	.07	.06	.02	289.	1.01	19.45	237	.02	.02	.00	181.

1.01	7.50	94	.07	.05	.02	294.	1.01	19.50	238	.02	.02	.00	165.
1.01	7.55	95	.07	.05	.02	293.	1.01	19.55	239	.02	.02	.00	151.
1.01	8.00	96	.07	.05	.02	302.	1.01	20.00	240	.02	.02	.00	142.
1.01	8.05	97	.07	.05	.02	306.	1.01	20.05	241	.02	.02	.00	142.
1.01	8.10	98	.07	.05	.02	309.	1.01	20.10	242	.02	.02	.00	142.
1.01	8.15	99	.07	.05	.02	313.	1.01	20.15	243	.02	.02	.00	142.
1.01	8.20	100	.07	.05	.01	316.	1.01	20.20	244	.02	.02	.00	142.
1.01	8.25	101	.07	.05	.01	319.	1.01	20.25	245	.02	.02	.00	142.
1.01	8.30	102	.07	.05	.01	322.	1.01	20.30	246	.02	.02	.00	142.
1.01	8.35	103	.07	.05	.01	325.	1.01	20.35	247	.02	.02	.00	142.
1.01	8.40	104	.07	.05	.01	328.	1.01	20.40	248	.02	.02	.00	142.
1.01	8.45	105	.07	.05	.01	331.	1.01	20.45	249	.02	.02	.00	142.
1.01	8.50	106	.07	.05	.01	333.	1.01	20.50	250	.02	.02	.00	142.
1.01	8.55	107	.07	.05	.01	336.	1.01	20.55	251	.02	.02	.00	142.
1.01	9.00	108	.07	.05	.01	338.	1.01	21.00	252	.02	.02	.00	142.
1.01	9.05	109	.07	.05	.01	341.	1.01	21.05	253	.02	.02	.00	142.
1.01	9.10	110	.07	.05	.01	343.	1.01	21.10	254	.02	.02	.00	142.
1.01	9.15	111	.07	.05	.01	345.	1.01	21.15	255	.02	.02	.00	142.
1.01	9.20	112	.07	.05	.01	347.	1.01	21.20	256	.02	.02	.00	142.
1.01	9.25	113	.07	.05	.01	349.	1.01	21.25	257	.02	.02	.00	142.
1.01	9.30	114	.07	.05	.01	351.	1.01	21.30	258	.02	.02	.00	142.
1.01	9.35	115	.07	.05	.01	353.	1.01	21.35	259	.02	.02	.00	142.
1.01	9.40	116	.07	.05	.01	354.	1.01	21.40	260	.02	.02	.00	142.
1.01	9.45	117	.07	.06	.01	356.	1.01	21.45	261	.02	.02	.00	142.
1.01	9.50	118	.07	.06	.01	358.	1.01	21.50	262	.02	.02	.00	142.
1.01	9.55	119	.07	.06	.01	359.	1.01	21.55	263	.02	.02	.00	142.
1.01	10.00	120	.07	.06	.01	361.	1.01	22.00	264	.02	.02	.00	142.
1.01	10.05	121	.07	.06	.01	363.	1.01	22.05	265	.02	.02	.00	142.
1.01	10.10	122	.07	.06	.01	364.	1.01	22.10	266	.02	.02	.00	142.
1.01	10.15	123	.07	.06	.01	365.	1.01	22.15	267	.02	.02	.00	142.
1.01	10.20	124	.07	.06	.01	367.	1.01	22.20	268	.02	.02	.00	142.
1.01	10.25	125	.07	.06	.01	368.	1.01	22.25	269	.02	.02	.00	142.
1.01	10.30	126	.07	.06	.01	369.	1.01	22.30	270	.02	.02	.00	142.
1.01	10.35	127	.07	.06	.01	371.	1.01	22.35	271	.02	.02	.00	142.
1.01	10.40	128	.07	.06	.01	372.	1.01	22.40	272	.02	.02	.00	142.
1.01	10.45	129	.07	.06	.01	373.	1.01	22.45	273	.02	.02	.00	142.
1.01	10.50	130	.07	.06	.01	374.	1.01	22.50	274	.02	.02	.00	142.
1.01	10.55	131	.07	.06	.01	375.	1.01	22.55	275	.02	.02	.00	142.
1.01	11.00	132	.07	.06	.01	376.	1.01	23.00	276	.02	.02	.00	142.
1.01	11.05	133	.07	.06	.01	377.	1.01	23.05	277	.02	.02	.00	142.
1.01	11.10	134	.07	.06	.01	378.	1.01	23.10	278	.02	.02	.00	142.
1.01	11.15	135	.07	.06	.01	379.	1.01	23.15	279	.02	.02	.00	142.
1.01	11.20	136	.07	.06	.01	380.	1.01	23.20	280	.02	.02	.00	142.
1.01	11.25	137	.07	.06	.01	381.	1.01	23.25	281	.02	.02	.00	142.
1.01	11.30	138	.07	.06	.01	382.	1.01	23.30	282	.02	.02	.00	142.
1.01	11.35	139	.07	.06	.01	383.	1.01	23.35	283	.02	.02	.00	142.
1.01	11.40	140	.07	.06	.01	384.	1.01	23.40	284	.02	.02	.00	142.
1.01	11.45	141	.07	.06	.01	384.	1.01	23.45	285	.02	.02	.00	142.
1.01	11.50	142	.07	.06	.01	385.	1.01	23.50	286	.02	.02	.00	142.
1.01	11.55	143	.07	.06	.01	386.	1.01	23.55	287	.02	.02	.00	142.
1.01	12.00	144	.07	.06	.01	387.	1.02	0.00	288	.02	.02	.00	142.

SUM	33.80	31.37	2.43	209223.
	(859.)	(797.)	(62.)	(5924.54)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	7875.	2346.	726.	726.	209165.
CMS	223.	66.	21.	21.	5923.
INCHES		25.59	31.68	31.68	31.68
MM		649.88	804.70	804.70	804.70
AC-FT		1163.	1441.	1441.	1441.

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

COMBINE HYDROGRAPHS

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

SUM OF 2 HYDROGRAPHS AT   PLAN 1 RTIO 1

4.	4.	5.	6.	7.	7.	8.	8.	8.	8.
8.	8.	8.	8.	8.	8.	8.	8.	8.	8.
8.	8.	8.	7.	7.	7.	7.	7.	7.	7.
7.	7.	7.	7.	7.	7.	7.	7.	8.	8.
8.	9.	9.	9.	10.	10.	11.	11.	11.	12.
12.	13.	13.	13.	14.	14.	15.	15.	15.	16.
16.	16.	17.	17.	17.	18.	18.	18.	19.	19.
19.	20.	22.	27.	38.	52.	66.	79.	90.	93.
105.	111.	117.	121.	126.	130.	133.	137.	140.	143.
146.	149.	151.	154.	156.	159.	161.	163.	165.	167.
169.	171.	173.	174.	176.	178.	179.	181.	182.	183.
185.	186.	187.	189.	193.	191.	192.	193.	194.	195.
196.	197.	198.	199.	200.	201.	202.	203.	204.	204.
205.	206.	207.	207.	208.	209.	210.	210.	211.	212.
212.	213.	213.	214.	225.	259.	327.	410.	490.	558.
606.	639.	663.	681.	695.	705.	716.	732.	757.	786.
813.	836.	853.	866.	875.	882.	888.	894.	904.	923.
958.	999.	1038.	1072.	1096.	1113.	1127.	1137.	1145.	1151.
1147.	1136.	1127.	1165.	1257.	1513.	2048.	2859.	3687.	4107.
4070.	3696.	3148.	2651.	2256.	1946.	1716.	1552.	1438.	1352.
1310.	1274.	1249.	1232.	1215.	1189.	1151.	1103.	1069.	1038.
1016.	1002.	991.	984.	979.	975.	956.	902.	798.	671.
554.	518.	484.	453.	425.	399.	375.	352.	332.	313.
295.	279.	264.	249.	236.	224.	213.	202.	192.	186.
183.	181.	179.	176.	174.	172.	170.	168.	166.	164.
162.	160.	158.	156.	154.	152.	151.	149.	147.	146.
144.	143.	141.	140.	138.	137.	135.	134.	133.	132.
130.	129.	128.	127.	126.	125.	124.	123.	122.	122.
121.	120.	120.	119.	119.	118.	118.	117.		

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	4107.	1287.	416.	416.	119816.
CMS	116.	36.	12.	12.	3393.
INCHES		11.99	15.51	15.51	15.51
MM		304.62	393.98	393.98	393.98
AC-FT		638.	825.	825.	825.

```
                                        HYDROGRAPH ROUTING

                    FLOOD ROUTING THRU LOWER RESERVOIR
                              ISTAQ    ICOMP    IECON    ITAPE     JPLT     JPRT    INAME   ISTAGE    IAUTO
                               MAIN        1        0        0        0        2        1        0        0
                                                      ROUTING DATA
                    QLOSS     CLOSS      AVG     IRES    ISAME     IOPT     IPMP                LSTR
                      0.0     0.000     0.00        1        1        0        0                   0

                              NSTPS    NSTDL      LAG    AMSKK        X      TSK    STORA   ISPRAT
                                  1        0        0    0.000    0.000    0.000   -1116.       -1

    STAGE     1125.30      1126.10      1127.20      1128.10      1130.70      1132.60      1136.20      1141.10      1143.90

     FLOW        0.00        10.00        50.00       100.00       300.00       500.00      1000.00      2000.00      3000.00

SURFACE AREA=        0.          55.          82.          91.         116.         156.

    CAPACITY=        0.        1456.        2816.        3248.        4793.        7501.

   ELEVATION=     1020.        1100.        1120.        1125.        1140.        1160.

                        CREL    SPWID     COQW     EXPW    ELEVL     COQL    CAREA     EXPL
                      1125.3      0.0      0.0      0.0      0.0      0.0      0.0      0.0

                                                DAM DATA
                                       TOPEL     COQD     EXPD    DAMWID
                                      1140.3      0.0      0.0        0.

                                     STATION    MAIN, PLAN 1, RATIO 1

                                     END-OF-PERIOD HYDROGRAPH ORDINATES

                                                 OUTFLOW
          0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
          0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
          0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
          0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
          0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
          0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
          0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
          0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
          0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
          0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
          0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
          0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
          0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
          0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
          0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
          0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
          0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
          0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
          0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
          0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
```

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	1.	1.	1.	1.	1.	1.	2.	2.
2.	2.	2.	2.	3.	3.	3.	3.	3.	3.
3.	3.	4.	4.	4.	4.	4.	4.	4.	4.
5.	5.	5.	5.	5.	5.	5.	5.	5.	6.
6.	6.	6.	6.	6.	6.	6.	6.		

STORAGE

2498.	2498.	2499.	2499.	2499.	2499.	2499.	2499.	2499.	2499.
2499.	2499.	2499.	2499.	2499.	2499.	2499.	2499.	2499.	2499.
2499.	2500.	2500.	2500.	2500.	2500.	2500.	2500.	2500.	2500.
2500.	2500.	2500.	2500.	2500.	2500.	2500.	2500.	2500.	2500.
2500.	2501.	2501.	2501.	2501.	2501.	2501.	2501.	2501.	2501.
2501.	2501.	2501.	2501.	2502.	2502.	2502.	2502.	2502.	2502.
2502.	2502.	2502.	2502.	2503.	2503.	2503.	2503.	2503.	2503.
2503.	2504.	2504.	2504.	2504.	2504.	2505.	2505.	2506.	2507.
2507.	2508.	2509.	2510.	2510.	2511.	2512.	2513.	2514.	2515.
2516.	2517.	2518.	2519.	2520.	2521.	2522.	2524.	2525.	2526.
2527.	2528.	2529.	2530.	2532.	2533.	2534.	2535.	2537.	2538.
2539.	2540.	2542.	2543.	2544.	2546.	2547.	2548.	2550.	2551.
2552.	2554.	2555.	2556.	2558.	2559.	2561.	2562.	2563.	2565.
2566.	2568.	2569.	2570.	2572.	2573.	2575.	2576.	2578.	2579.
2581.	2582.	2583.	2585.	2586.	2588.	2590.	2593.	2596.	2599.
2603.	2608.	2612.	2617.	2622.	2626.	2631.	2635.	2641.	2647.
2652.	2658.	2664.	2670.	2676.	2682.	2688.	2694.	2700.	2706.
2713.	2720.	2727.	2734.	2741.	2749.	2757.	2764.	2772.	2780.
2788.	2796.	2804.	2812.	2820.	2830.	2842.	2859.	2891.	2928.
2936.	2963.	2987.	3007.	3023.	3038.	3050.	3062.	3072.	3082.
3091.	3100.	3108.	3117.	3125.	3134.	3142.	3150.	3157.	3164.
3171.	3178.	3185.	3192.	3199.	3205.	3212.	3218.	3224.	3229.
3234.	3237.	3241.	3244.	3247.	3250.	3253.	3255.	3257.	3250.
3262.	3264.	3266.	3267.	3269.	3271.	3272.	3274.	3275.	3276.
3277.	3279.	3280.	3281.	3282.	3284.	3285.	3286.	3287.	3288.
3289.	3290.	3291.	3292.	3293.	3295.	3296.	3297.	3298.	3299.
3300.	3300.	3301.	3302.	3303.	3304.	3305.	3306.	3307.	3308.
3309.	3310.	3310.	3311.	3312.	3313.	3314.	3315.	3315.	3316.
3317.	3318.	3319.	3319.	3320.	3321.	3322.	3322.		

STAGE

1116.0	1116.0	1116.0	1116.0	1116.0	1116.0	1116.0	1116.0	1116.0	1116.0
1116.0	1116.0	1116.0	1116.0	1116.0	1116.0	1116.0	1116.0	1116.0	1116.0
1116.0	1116.0	1116.0	1116.0	1116.0	1116.0	1116.0	1116.0	1116.0	1116.0
1116.0	1116.0	1116.0	1116.0	1116.0	1116.0	1116.0	1116.0	1116.0	1116.0
1116.0	1116.0	1116.0	1116.0	1116.0	1116.0	1116.0	1116.0	1116.0	1116.0
1116.0	1116.0	1116.0	1116.0	1116.0	1116.0	1116.0	1116.0	1116.0	1116.0
1116.0	1116.1	1116.1	1116.1	1116.1	1116.1	1116.1	1116.1	1116.1	1116.1
1116.1	1116.1	1116.1	1116.1	1116.1	1116.1	1116.1	1116.1	1116.1	1116.1
1116.1	1116.1	1116.1	1116.1	1116.2	1116.2	1116.2	1116.2	1116.2	1116.2
1116.2	1116.2	1116.3	1116.3	1116.3	1116.3	1116.3	1116.3	1116.3	1116.4
1116.4	1116.4	1116.4	1116.4	1116.4	1116.4	1116.5	1116.5	1116.5	1116.5
1116.5	1116.5	1116.6	1116.6	1116.6	1116.6	1116.6	1116.6	1116.7	1116.7
1116.7	1116.7	1116.7	1116.8	1116.8	1116.8	1116.8	1116.8	1116.8	1116.9

1116.7	1116.7	1116.7	1116.8	1116.8	1116.8	1116.8	1116.8	1116.8	1116.9
1116.9	1116.9	1116.9	1116.9	1117.0	1117.0	1117.0	1117.0	1117.0	1117.0
1117.1	1117.1	1117.1	1117.1	1117.1	1117.2	1117.2	1117.2	1117.3	1117.3
1117.4	1117.4	1117.5	1117.5	1117.6	1117.6	1117.7	1117.8	1117.8	1117.9
1118.0	1118.0	1118.1	1118.2	1118.3	1118.3	1118.4	1118.5	1118.6	1118.7
1118.7	1118.8	1118.9	1119.0	1119.1	1119.2	1119.3	1119.4	1119.5	1119.6
1119.7	1119.8	1119.9	1120.0	1120.1	1120.2	1120.3	1120.5	1120.8	1121.1
1121.4	1121.8	1122.0	1122.3	1122.5	1122.6	1122.8	1122.9	1123.0	1123.1
1123.2	1123.3	1123.4	1123.5	1123.6	1123.7	1123.8	1123.9	1124.0	1124.1
1124.1	1124.2	1124.3	1124.4	1124.5	1124.5	1124.6	1124.7	1124.7	1124.8
1124.8	1124.9	1124.9	1125.0	1125.0	1125.0	1125.1	1125.1	1125.1	1125.1
1125.2	1125.2	1125.2	1125.2	1125.2	1125.2	1125.3	1125.3	1125.3	1125.3
1125.3	1125.3	1125.4	1125.4	1125.4	1125.4	1125.4	1125.4	1125.4	1125.4
1125.5	1125.5	1125.5	1125.5	1125.5	1125.5	1125.5	1125.5	1125.5	1125.6
1125.6	1125.6	1125.6	1125.6	1125.6	1125.6	1125.6	1125.6	1125.6	1125.7
1125.7	1125.7	1125.7	1125.7	1125.7	1125.7	1125.7	1125.7	1125.7	1125.7
1125.8	1125.8	1125.8	1125.8	1125.8	1125.8	1125.8	1125.8		

PEAK OUTFLOW IS 6. AT TIME 24.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	6.	2.	1.	1.	172.
CMS	0.	0.	0.	0.	5.
INCHES		.02	.02	.02	.02
MM		.56	.56	.56	.56
AC-FT		1.	1.	1.	1.

E>

OPERATION	STATION	AREA	PLAN	RATIO 1 .50	RATIO 2 .55	RATIO 3 .60	RATIO 4 .65	RATIO 5 .70
				RATIOS APPLIED TO FLOWS				
HYDROGRAPH AT	HFLOW1	.15	1	1044.	1148.	1252.	1357.	1461.
	(	.38)	(	29.55)(	32.51)(	35.46)(	38.42)(	41.37)(
ROUTED TO	POND	.15	1	180.	195.	210.	224.	239.
	(	.38)	(	5.08)(	5.51)(	5.94)(	6.35)(	6.77)(
HYDROGRAPH AT	HFLOW2	.85	1	3938.	4331.	4725.	5119.	5513.
	(	2.21)	(	111.50)(	122.65)(	133.80)(	144.95)(	156.10)(
2 COMBINED		1.00	1	4107.	4516.	4924.	5332.	5739.
	(	2.58)	(	116.31)(	127.89)(	139.43)(	150.97)(	162.50)(
ROUTED TO	MAIN	1.00	1	6.	29.	60.	97.	142.
	(	2.58)	(	.18)(	.83)(	1.69)(	2.74)(	4.03)(

1

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1190.00	1190.00	1212.00
STORAGE	258.	258.	633.
OUTFLOW	0.	0.	785.

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	1194.99	0.00	317.	180.	0.00	16.25	0.00
.55	1195.41	0.00	323.	195.	0.00	16.25	0.00
.60	1195.82	0.00	329.	210.	0.00	16.33	0.00
.65	1196.23	0.00	335.	224.	0.00	16.50	0.00
.70	1196.64	0.00	341.	239.	0.00	17.00	0.00

1

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1116.00	1125.30	1140.30
STORAGE	2498.	3275.	4828.
OUTFLOW	0.	0.	1837.

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	1125.82	0.00	3322.	6.	0.00	24.00	0.00
.55	1126.63	0.00	3398.	29.	0.00	24.00	0.00
.60	1127.37	0.00	3468.	60.	0.00	24.00	0.00
.65	1128.04	0.00	3531.	97.	0.00	24.00	0.00
.70	1128.65	0.00	3590.	142.	0.00	24.00	0.00

1\$

FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 26 FEB 79

```
COPY,FBO,
A1 35   BRUSHY CREEK TAILINGS DAM - MISSOURI INVENTORY #30951
A2 35   ST.LOUIS DISTRICT CORPS OF ENGINEERS - ED-HE - DEC79 - BADER
A3 35   RATIOS OF PROBABLE MAXIMUM FLOOD
B      288               5                                                       -4
B1       5
J        1       1       1
J1    1.00
K        0 INFLOW1                                       1
K1    INFLOW HYDROGRAPH TO RESERVOIR DAM #30161
M        1       2    .145                     1.0                               1
P             26.0     102     120     130
T                                                       -1     -80                .10
W2             .09
X      -10     -.1     3.0
K        1    POND                                       1
K1    FLOOD ROUTING THRU UPPER RESERVOIR
Y                                1       1
Y1       1                                         -1190.0      -1
Y4    1190    1192    1194    1195    1197    1199    1206    1212    1213    1214
Y5       0      52     140     180     252     340     560     785    1910    4020
$A       0      .6     3.4     9.2   10.36    17.2    27.0
$E    1127    1140    1160    1180    1190    1200    1220
$$    1190
$D    1212
K        0 INFLOW2                                       1
K1    INFLOW HYDROGRAPH TO TAILINGS DAM #30951
M        1       2    .853                     1.0                               1
P             26.0     102     120     130
T                                                       -1     -80                .14
W2             .32
X      -10     -.1     2.5
K        2
K        1    MAIN                               2       1
K1    FLOOD ROUTING THRU LOWER RESERVOIR
Y                                1       1
Y1       1                                            3100      -1
Y41125.3  1126.1  1127.2  1128.1  1130.7  1132.6  1136.2  1141.1  1143.9
Y5       0      10      50     100     300     500    1000    2000    3000
$A       0    54.6    82.3    90.7   115.8   156.0
$E    1020    1100    1120    1125    1140    1160
$$1125.3
$D1140.3
K       99
A
A
A
A
A
 EOI ENCOUNTERED.
C>
```

1

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1190.00	1190.00	1212.00
STORAGE	258.	258.	633.
OUTFLOW	0.	0.	785.

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	1198.92	0.00	376.	337.	0.00	17.00	0.00

1

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ....

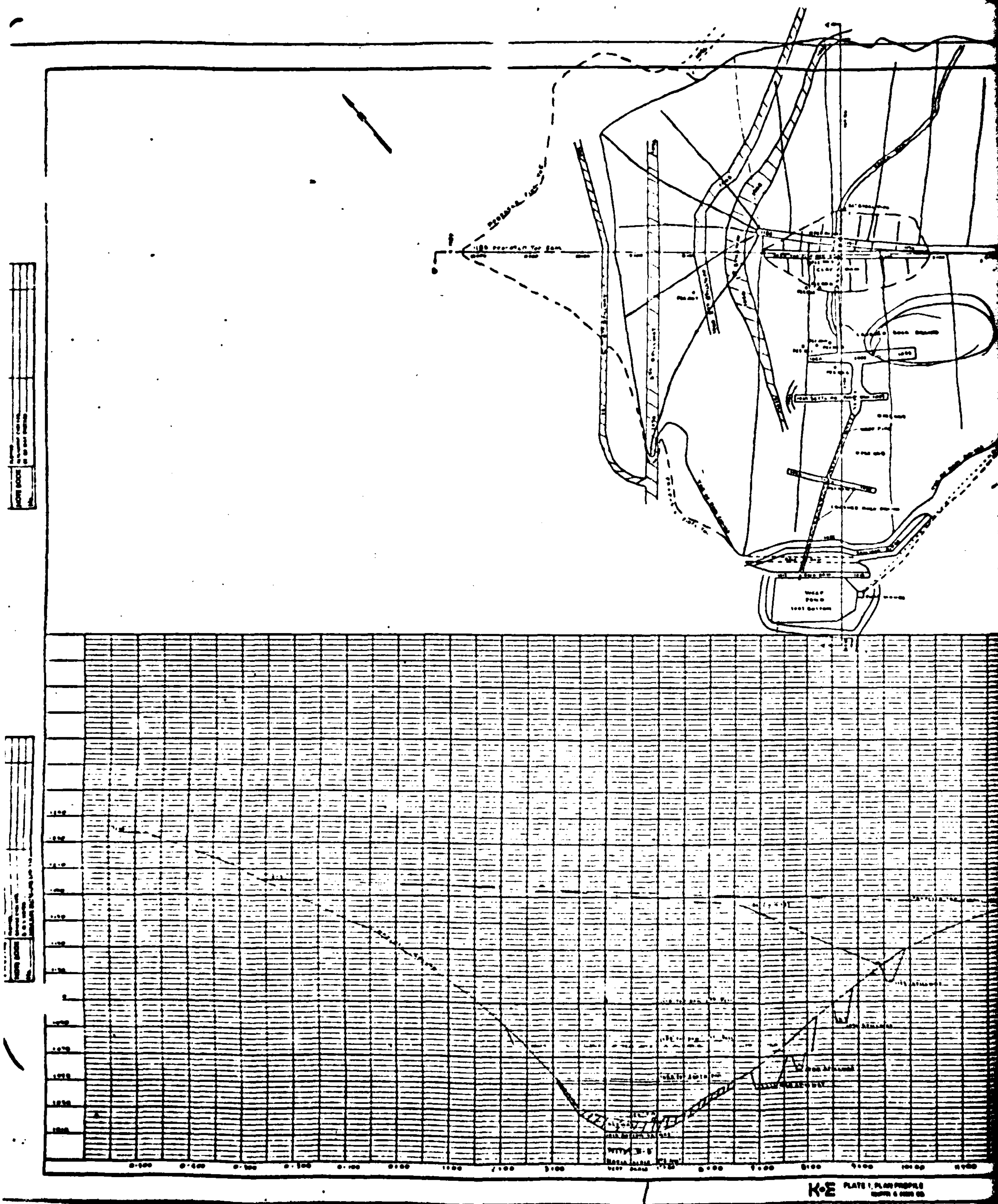
	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1123.29	1125.30	1140.30
STORAGE	3095.	3275.	4828.
OUTFLOW	0.	0.	1837.

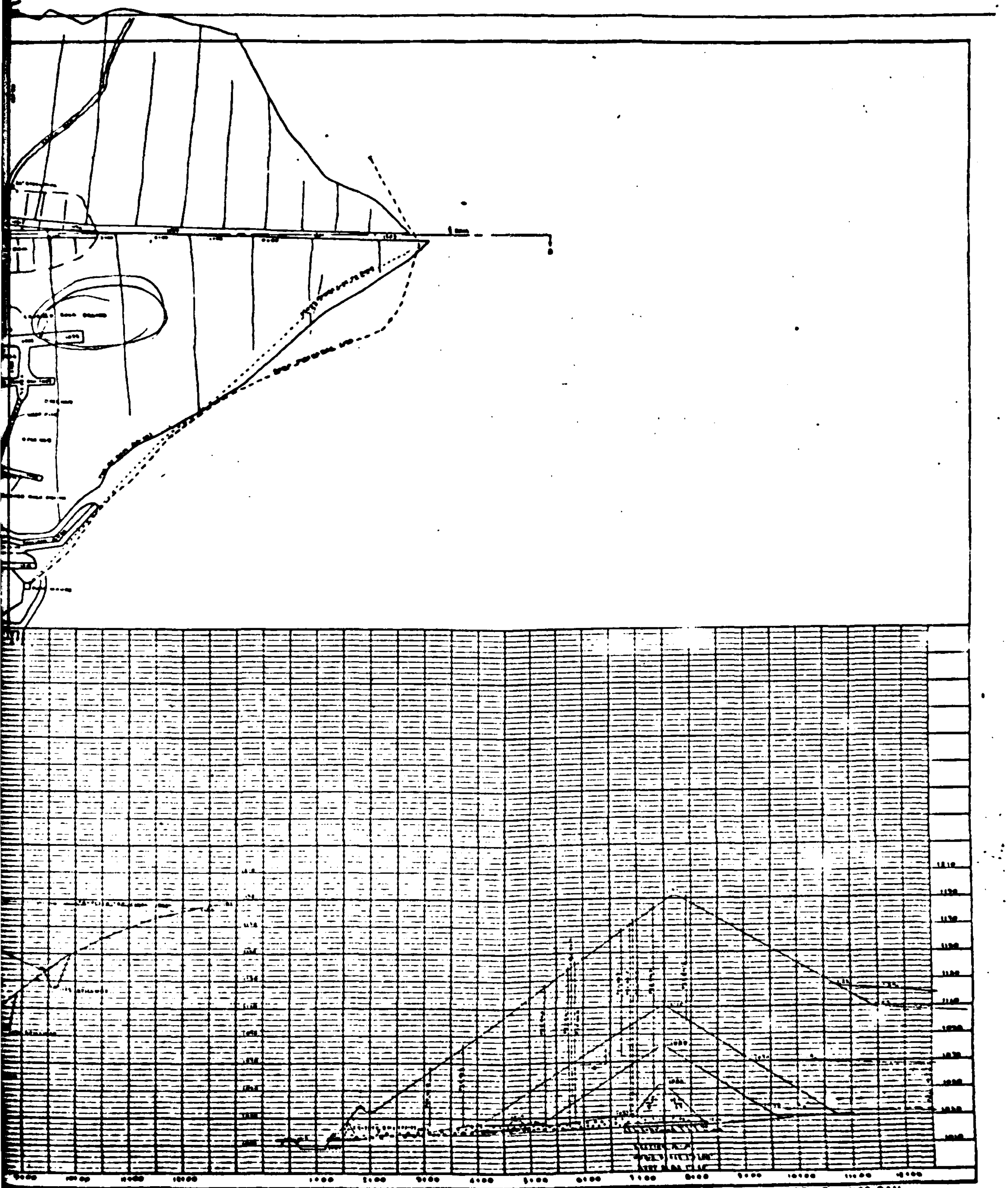
RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1136.14	0.00	4359.	992.	0.00	18.50	0.00

1IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION   JULY 1978
LAST MODIFICATION 26 FEB 79
IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII
EOI.
ED

APPENDIX B

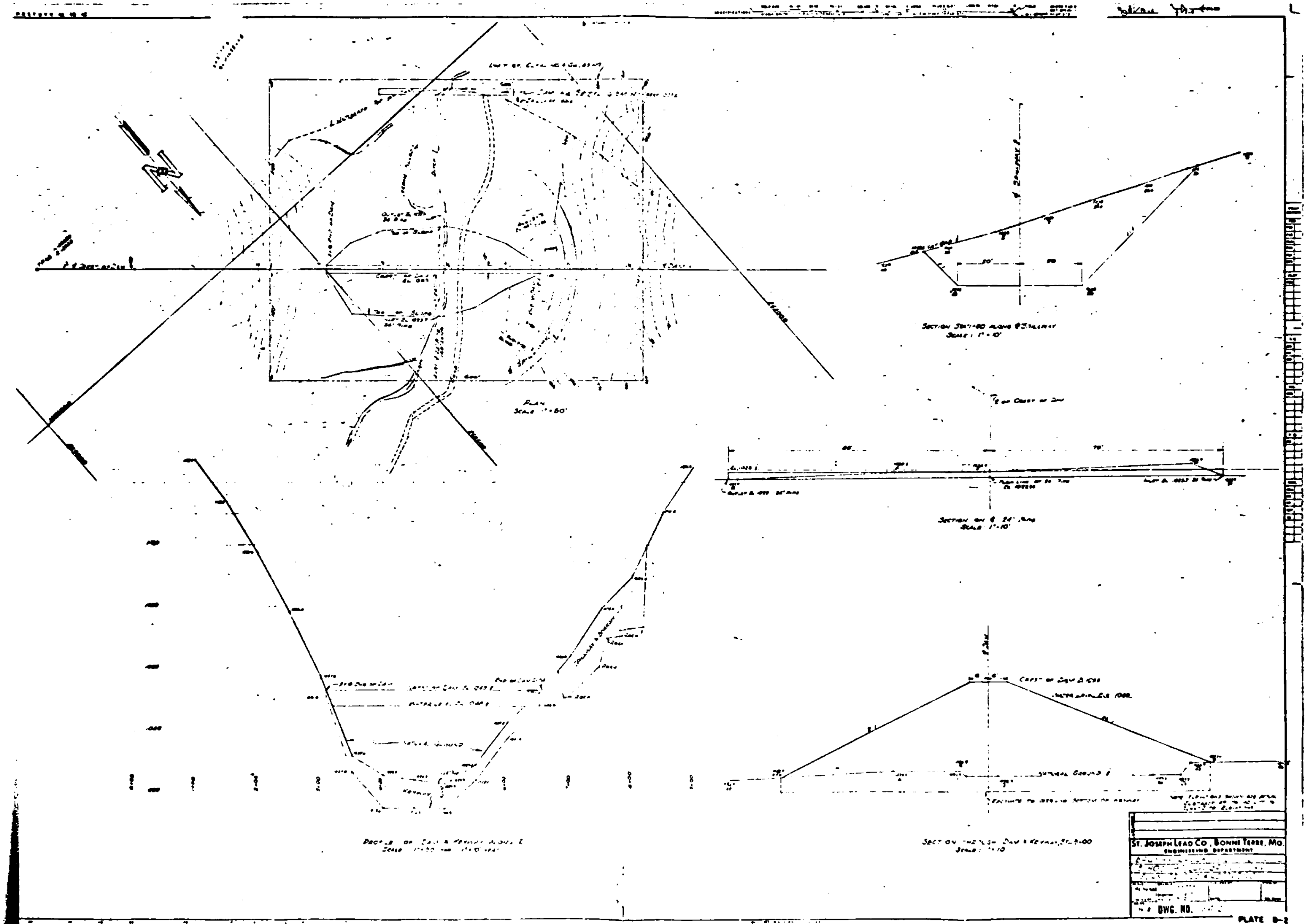
Engineering Data and Plates Furnished by the Owner





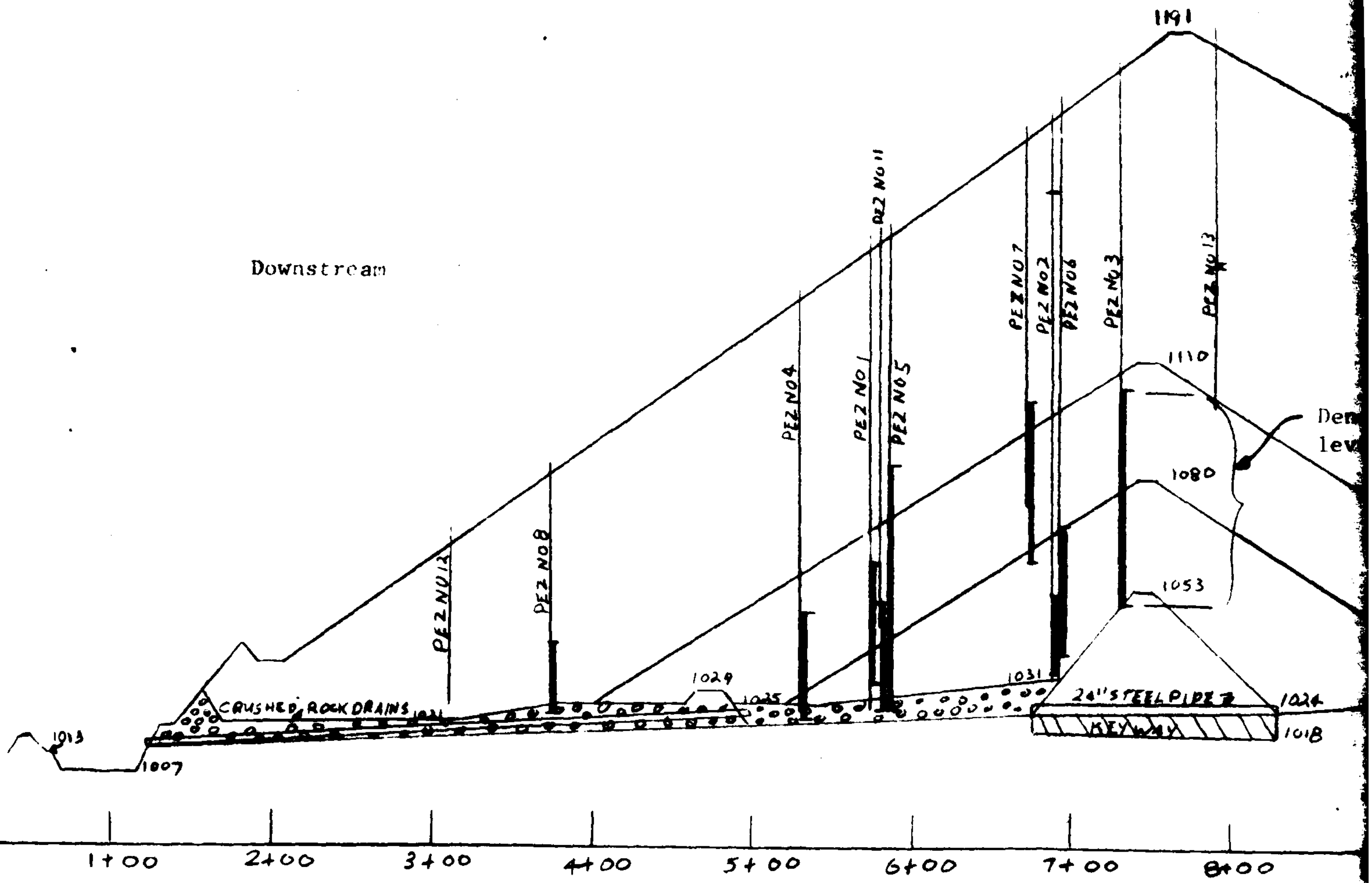
BRUSHY CREEK TAILINGS DAM
ST. JOE LEAD CO.

PLATE B-1


ST. JOSEPH LEAD CO., BONNE TERRE, MO.
ENGINEERING DEPARTMENT
DWG. NO.
PLATE B-2

NOTES:

1. Piezometers are open-system.
2. Piezometers do not lie on a single plane through the embankment. Plan locations are shown on PLATE B-[illegible].
3. Piezometer readings have been recorded approximately monthly since early 1974.
4. Piezometer 2 has three [illegible] of [illegible] readings denoted by the hatch-mark at elevation 1153. The readings were taken when the ground elevation at the piezometer was approximately [illegible]. These three readings are considered in error.

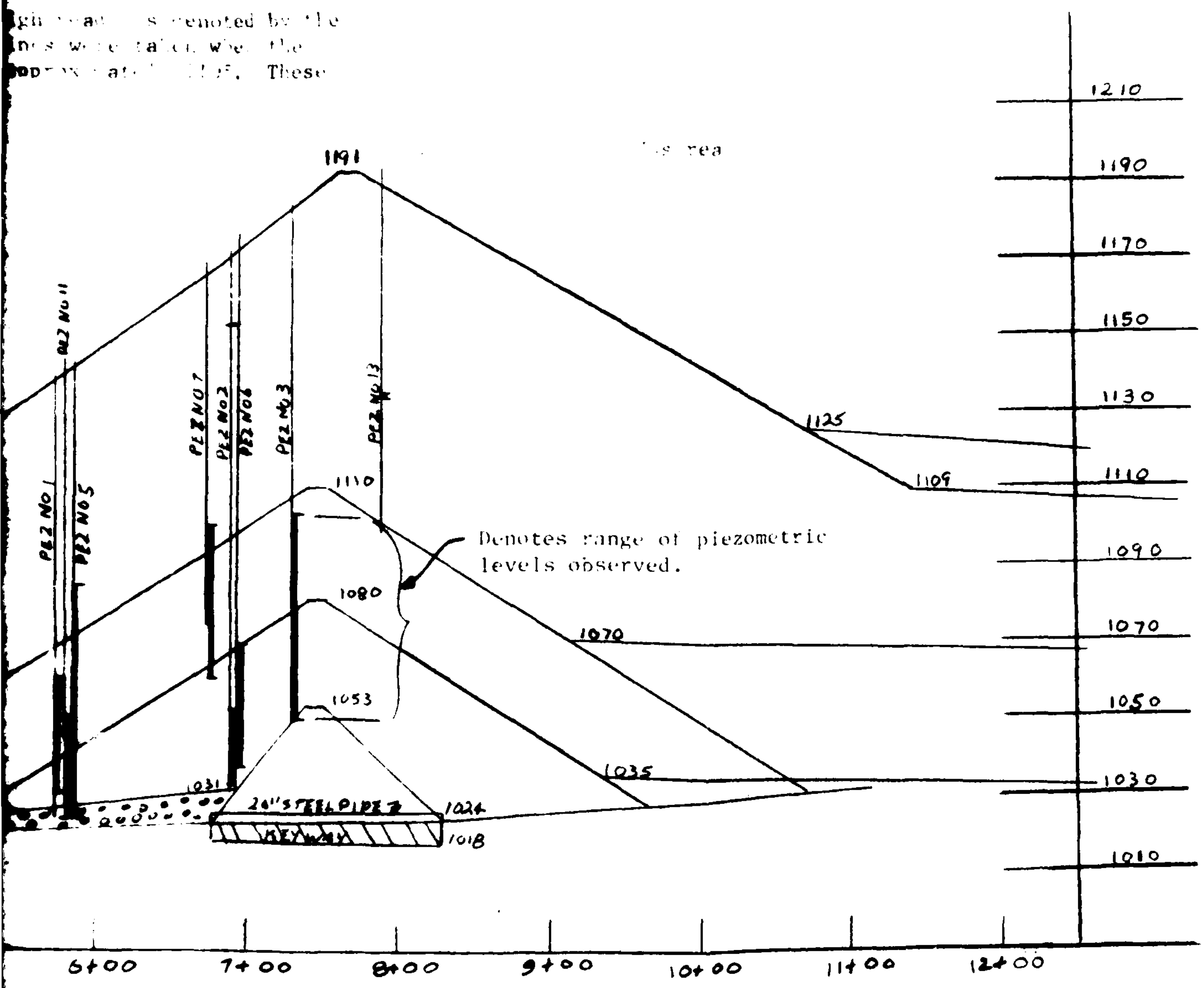


throu h the e bankrent.

pproxi ate onthl ince

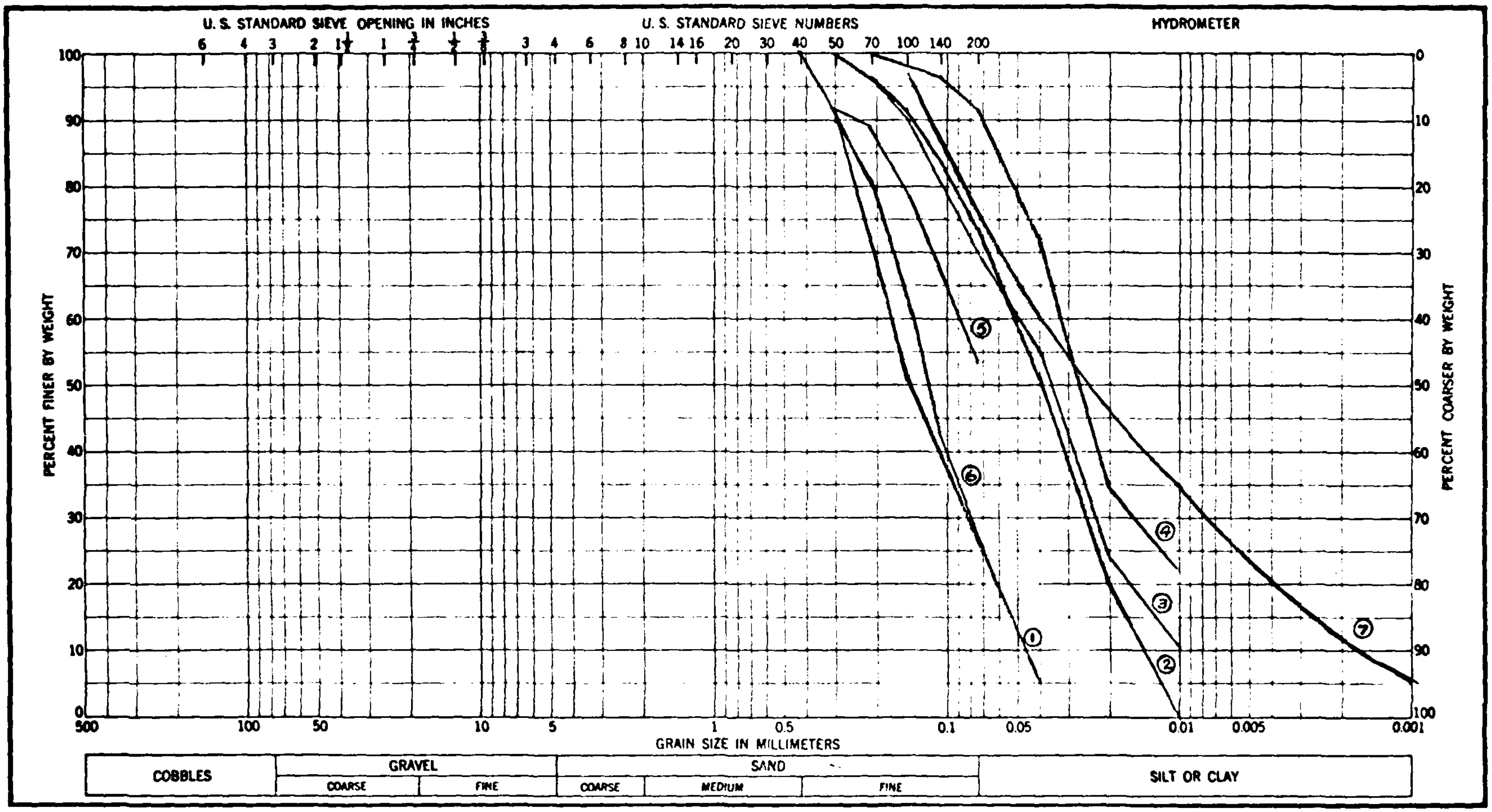
gh ear s enoted by the
ngs were taken whe the
pprox ate   . These

5. Piezome er is no sho n; it was destroyed.
6. No readi gs for Piezometer 17 are availa le.



Embankment cross section show ing range of piezome er readings.

PLATE B-3



NOTES:

1. Average of 6 analyses of cyclone underflow (dam material). Tested by USBM, December 1974.
2. Cyclone overflow (slimes) taken 3 feet from discharge. Tested by USBM, December 1974.
3. Cyclone overflow (slimes) taken 15 feet from discharge. Tested by USBM, December 1974.
4. Cyclone overflow (slimes) taken 25 feet from discharge. Tested by USBM, December 1974.
5. Unsegregated tailings at mill. Tested by St. Joe Minerals Corp., November 1978.
6. Cyclone underflow (dam material). Tested by St. Joe Minerals Corp., Novermber 1978.
7. Cyclone overfow (slimes). Tested by USBM, March 1975.

BRUSHY CREEK
TAILINGS DAM
GRADATION CURVES

PLATE B-4

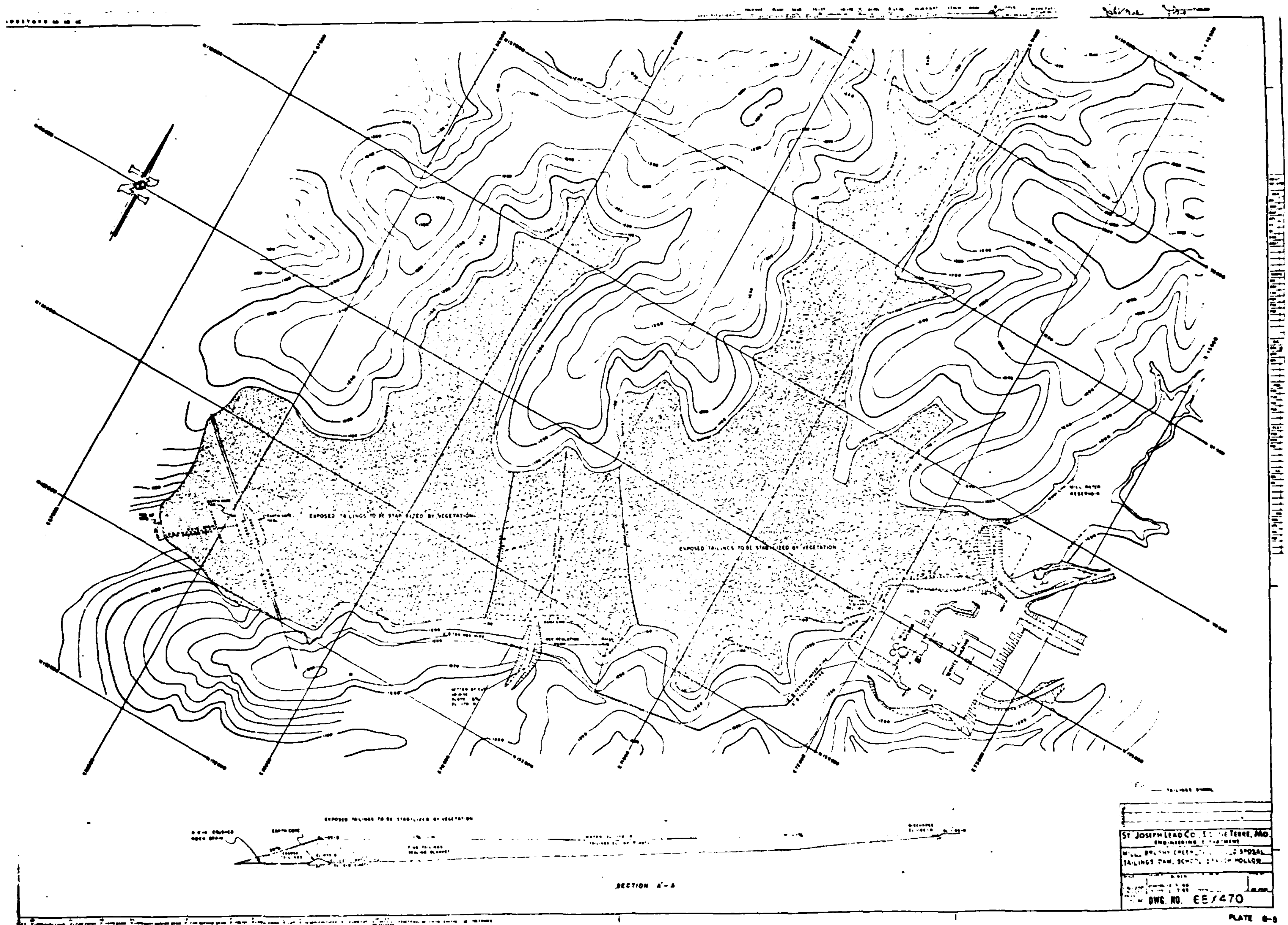

EXPOSED TAILINGS TO BE STABILIZED BY VEGETATION
EXPOSED TAILINGS TO BE STABILIZED BY VEGETATION
EXPOSED TAILINGS TO BE STABILIZED BY VEGETATION
SECTION A-A
ST. JOSEPH LEAD CO. ... TERRE, MO.
TAILINGS DAM
DWG. NO. EE/470

PLATE B-8

PHOTO 1: Downstream slope at uncompleted portion of embankment. Spillway is in background.

PHOTO 2: Downstream slope from embankment crest. Flags indicate piezometer locations Seepage reclamation pond is in background.

PHOTO 3: Downstream slope looking toward southeast (left) abutment.

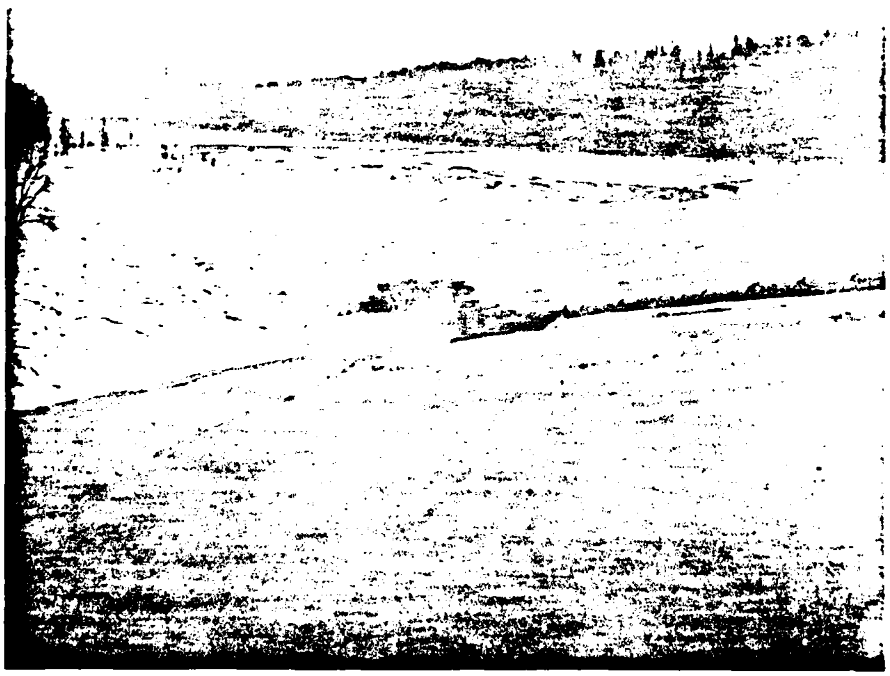


PHOTO 4: Upstream slope during deposition of unsegregated tailings.

PHOTO 5: Upstream slope with scarp created by erosion due to hydraulic method of tailings deposition

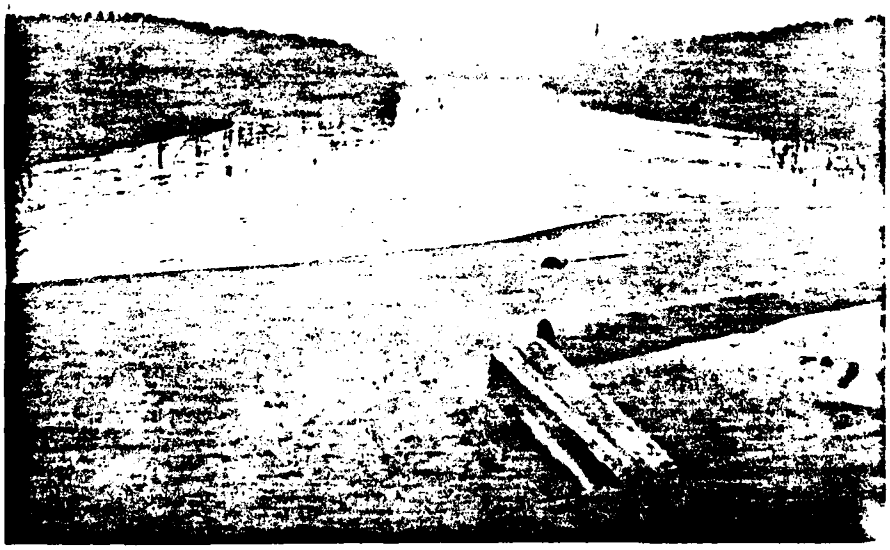


PHOTO 6: Upstream slope and tailings impoundment.

PHOTO 7: Upstream slope at uncompleted portion of embankment. Spillway entrance is in background

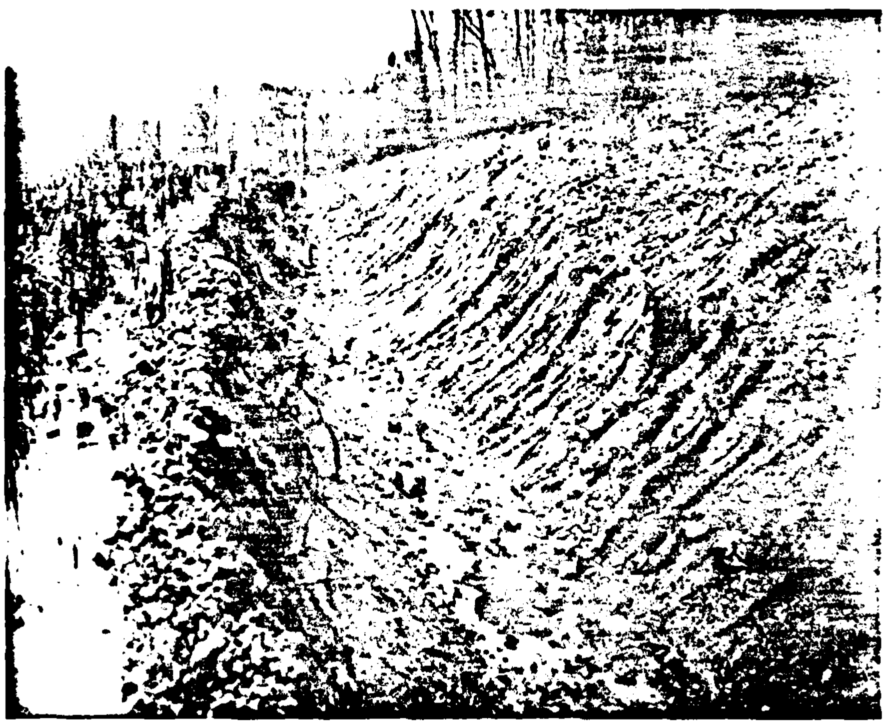
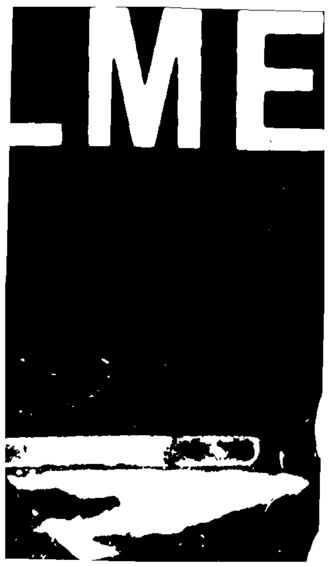


PHOTO 8: Spillway looking downstream.


LME