

DESIGN REPORT

Sedimentation Structure

KM-TPB

Kayenta Mine

Navajo County, Arizona

PEABODY COAL COMPANY

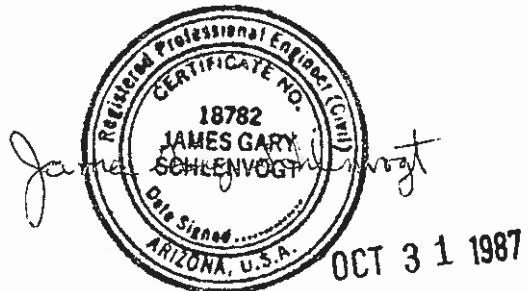


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Introduction

Sedimentation Structure KM-TPB will be an earthen embankment, designed and constructed by Peabody Coal Company as a temporary sedimentation structure to control runoff and sediment from disturbed areas of the Kayenta Mine. The location of Structure KM-TPB is shown on Plate 1, Site Plan, Drawing No. 85400 (Sheet J-7), and Drawing No. 85405. The construction is requested to replace the concrete wall structure which failed August 24, 1987. The pond will be required to control sediment and runoff from the disturbance associated with the overland conveyor and Transfer Point "B".

This design report contains information specific to Structure KM-TPB. Regional site information is presented in the "General Report, Kayenta and Black Mesa Mines, Navajo County, Arizona for Peabody Coal Company", December, 1985 (PAP), Chapter 6, Attachment D, Volume 2 along with the methods and results of analyses used for slope stability, hydrology, and hydraulics.

Inspection

The proposed site of Structure KM-TPB was inspected by a senior compliance engineer from Peabody Coal Company in August, 1987 to ensure that the site is suitable and no adverse conditions exist to prevent the successful construction of the structure. A detailed geotechnical investigation was not performed, rather the information in Chapter 6, Attachment D will be utilized for embankment design during construction.

Site Description

Land Use

Structure KM-TPB has a 38.2-acre tributary drainage area and is located on a small tributary of Yellow Water Canyon at the Kayenta Mine. The watershed is classified as 89 percent Pinon/Juniper and 11 percent disturbed.

Embankment

A homogeneous earthen embankment, a minimum of ten feet wide, was assumed for the hydraulic analysis and to develop the stage-capacity chart shown on Plate 2. Upstream and downstream slopes of 3:1 (horizontal to vertical) were used. The assumed slopes were not evaluated for geotechnical considerations such as slope stability since the foundation or

embankment material types have not been determined.

Design Analyses

General

Structure KM-TPB was designed by a senior compliance engineer from Peabody Coal Company. The design was performed in accordance with applicable 30 CFR 780 and 816 regulations of the United States Department of Interior, Office of Surface Mining (OSM) and included a review of available project files. The most current information contained in the Peabody Coal Company files includes topographic maps developed from aerial photography flown in 1984 for Peabody Coal Company and was used in the analyses of the structure.

Stability

The slopes of Structure KM-TPB will be chosen based on the stability analyses performed for existing structures in the General Report. The embankment fill materials and the type of foundation will be identified in the field during construction and stable slopes will be chosen based on the category classification of the structure.

Hydrology

The hydrologic analysis was completed using the University of Kentucky's generalized computer program SEDIMOT II (see Appendix A, B, and C). Structure KM-TPB is not in series with any other structure nor does the structure fall under the guidelines of the 30 CFR Section 77.216 for MSHA size structures. Therefore, the spillway was analyzed using the 25-year, 6-hour storm. The storage capacity of Structure KM-TPB was analyzed using the 10-year, 24-hour storm.

The following parameters were used in the hydrologic analysis:

1. Water Course length, L 0.424 mi
2. Elevation Difference, H 133 ft
3. Time of Concentration, T_c 0.147 h
4. SCS Curve Number 85
5. Rainfall Depth, 10-year, 24-hour storm 2.1 in
25-year, 6-hour storm 1.9 in
6. Drainage Area 38.2 acres

Hydraulics

The SEDIMOT II program was used to evaluate inflow to the planned sedimentation structure, outflow from the structure, and the resulting water surface elevations. The initial conditions and results of the analysis are summarized in the following table.

KM-TPB HYDRAULICS

Units	10-Year	25-Year
	24-Hour	6-Hour
Initial Reservoir Volume Condition	Empty	Full to the principal spillway elevation
Inflow		
Peak Flow cfs	32.1	39.4
Volume acre-ft	2.77	2.3
Storage		
Peak Stage ft	7229.1	7232.1
Principal Spillway		
Elevation ft	7230.00	7230.0
Peak Storage acre-ft	2.77	4.1
Storage Capacity acre-ft	3.12	5.1
Available Sediment Storage . . acre-ft	0.35	-
Sediment Inflow Rate acre-ft/yr	0.052	-
Sediment Storage Life . . . years	6.7	-
Outflow		
Peak Flow cfs	0	14.9
Embankment Crest		
Elevation ft	7234.5	7234.5
Peak Stage ft	7229.1	7232.1
Freeboard ft	5.4	2.4

Note: The principal spillway is an 18-inch drop inlet CMP which was analyzed as part of the SEDIMOT II computer analyses.

Principal Spillway

The proposed spillway for KM-TPB is a drop inlet, corrugated metal pipe with the following dimensions:

Pipe Riser 18 in.
Pipe Diameter 18 in.
Pipe Length 100 ft.
Pipe Slope 2 percent
Inlet Elevation . . . 7230.0

Emergency Spillway Channel

The emergency spillway channel for KM-TPB will be a trapezoidal channel with the following dimensions:

The outflow channel will require protection against erosion only at the outlet of the corrugated metal pipe and emergency spillway (see Plates 3 and 4).

Storage Capacity

The impoundment volume-elevation curve is based on site specific surveys conducted for Peabody Coal Company's August 1984 inspection, and 1985 resurveys, where available. Additionally, the most current topographic maps available were used in developing Plate 2, Volume-Elevation Curve, KM-TPB.

The calculations for the sediment load entering Structure KM-TPB were made utilizing the Universal Soil Loss Equation with the following parameters:

- | | | |
|----|--------------------------------------|-------|
| 1. | Rainfall Factor, R | 40 |
| 2. | Soil Erodibility Factor, K | 0.16 |
| 3. | Slope Factor, LS | 1.90 |
| 4. | Cover Factor, C | 0.240 |
| 5. | Erosion Control Factor, P | 1.0 |

The hydrologic analysis gives the storage volume required to contain the 10-year, 24-hour

storm, and the remaining storage volume available for storing sediment. The proposed storage capacity of KM-TPB and the results of the sediment inflow analysis are summarized in the following table.

KM-TPB STORAGE

Total Storage Capacity	3.12 acre-ft
10-year, 24-hour Storm Inflow	2.77 acre-ft
Available Sediment Storage Capacity	0.35 acre-ft
Sediment Inflow Rate	0.052 acre-ft/yr
Sediment Storage Life	6.7 years

The following plates and appendix are attached and complete this inspection report.

Plate 1 - Site Plan KM-TPB

Plate 2 - Stage-Capacity Chart

Plate 3 - Embankment Cross Section A-A'

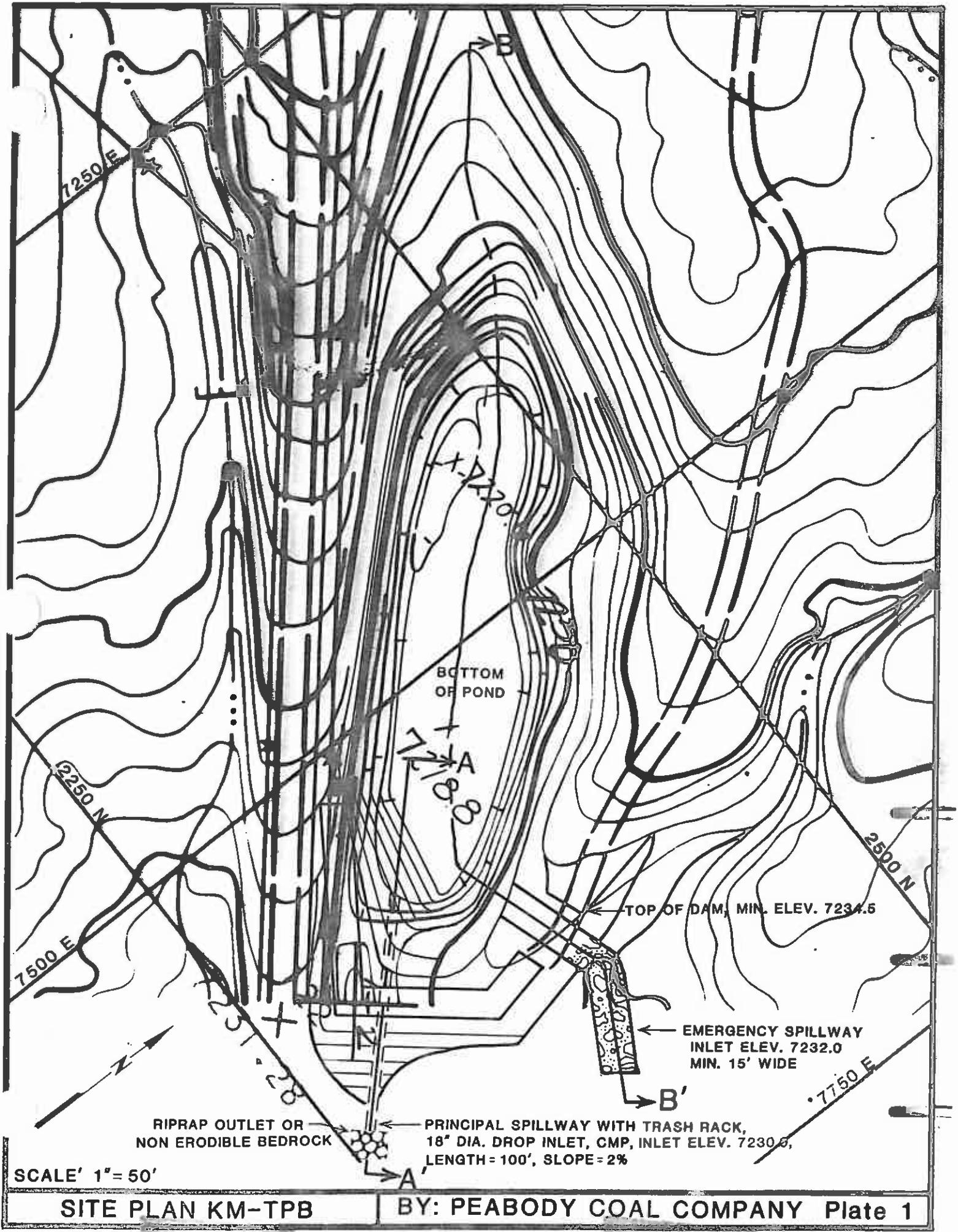
Plate 4 - Channel Profile KM-TPB, B-B'

Plate 5 - Emergency Spillway Typical Cross Section

Appendix A - Hydrology and Hydraulic Calculations

Appendix B - SEDIMOT II (Input and Output) 10-Year, 24-Hour Storm

Appendix C - SEDIMOT II (INput and Output) 10-Year, 24-Hour Storm



SCALE' 1" = 50'

SITE PLAN KM-TPB

BY: PEABODY COAL COMPANY Plate 1

Stage-Capacity Chart

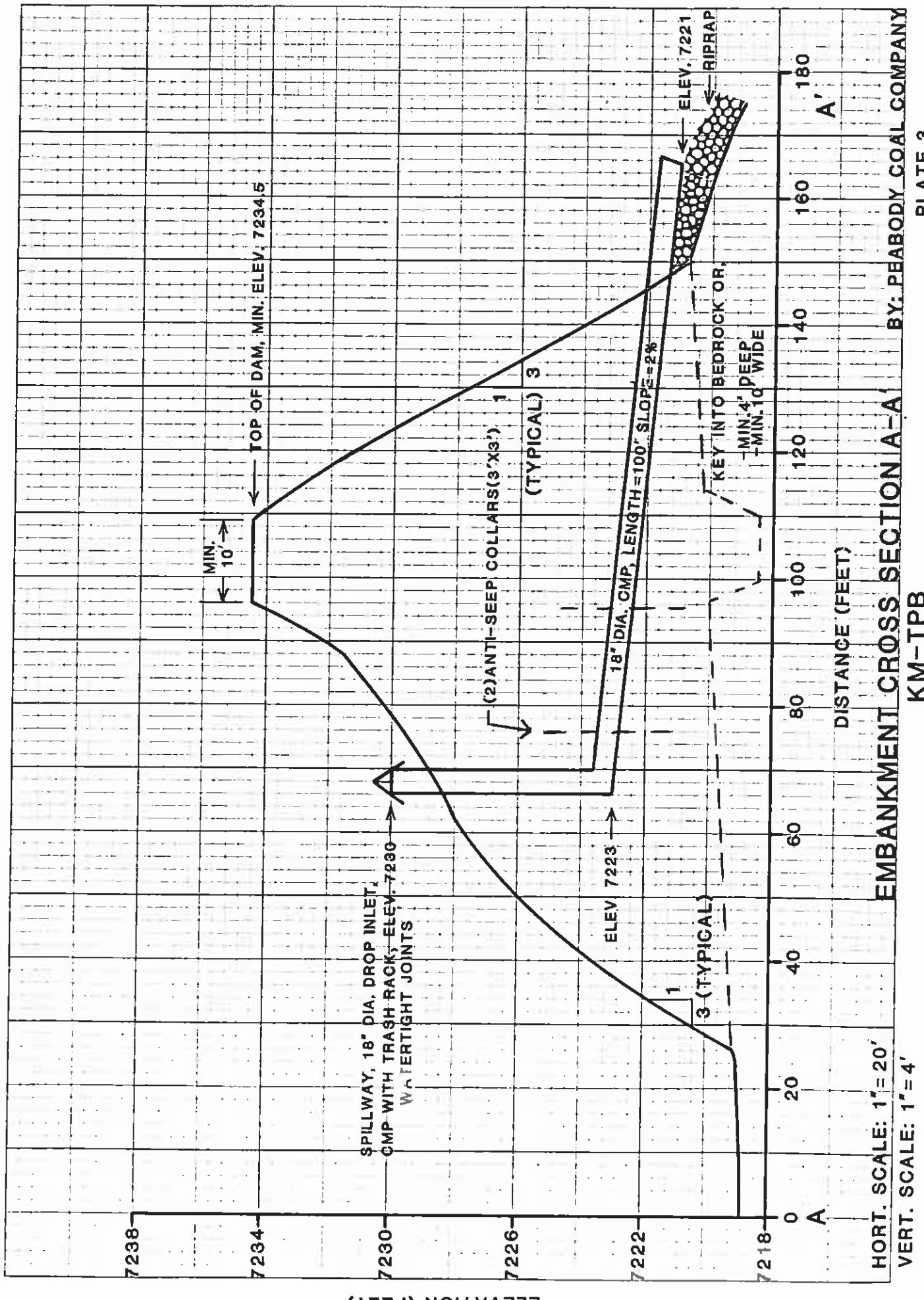
PLATE 2

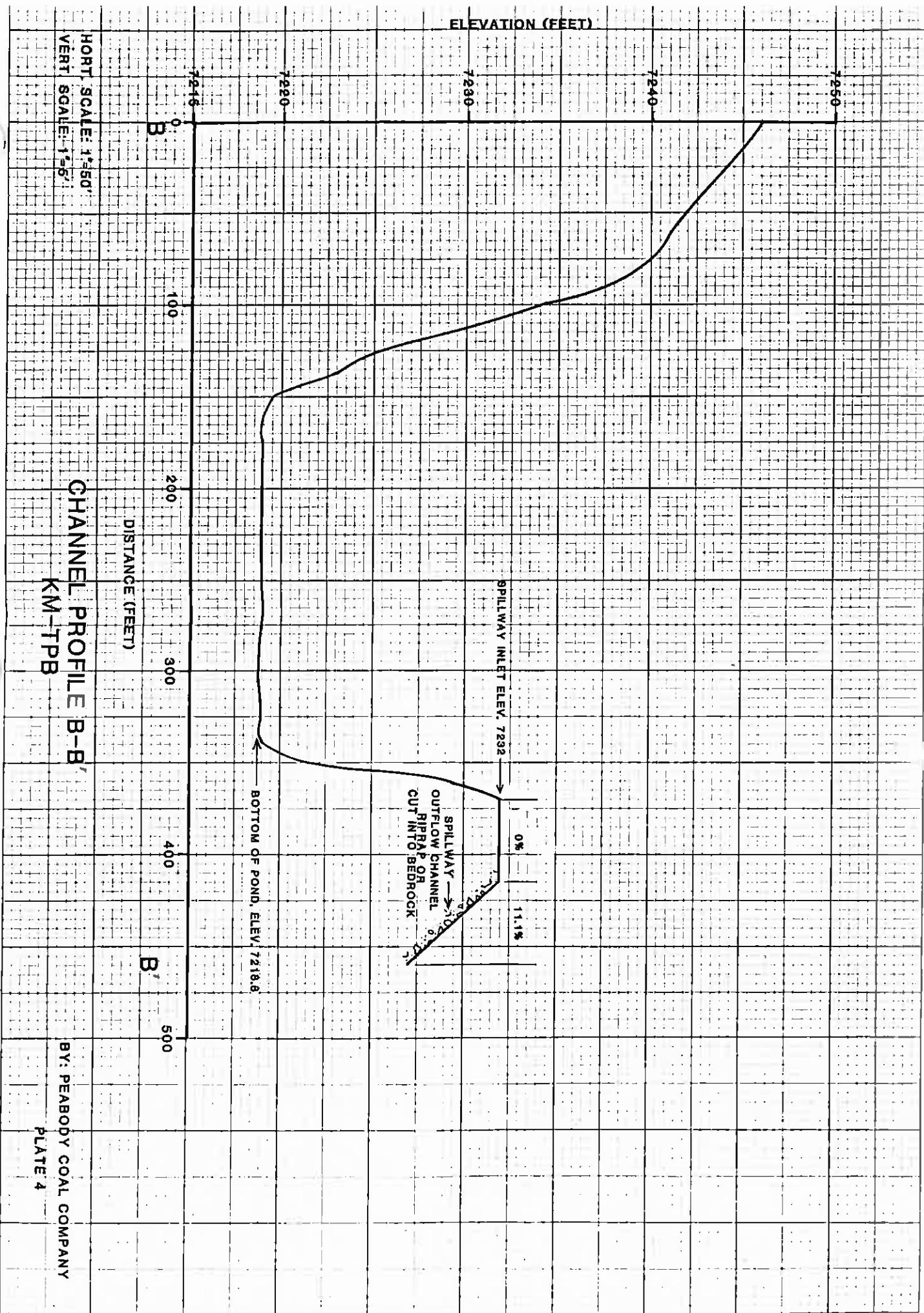
KM-TPB

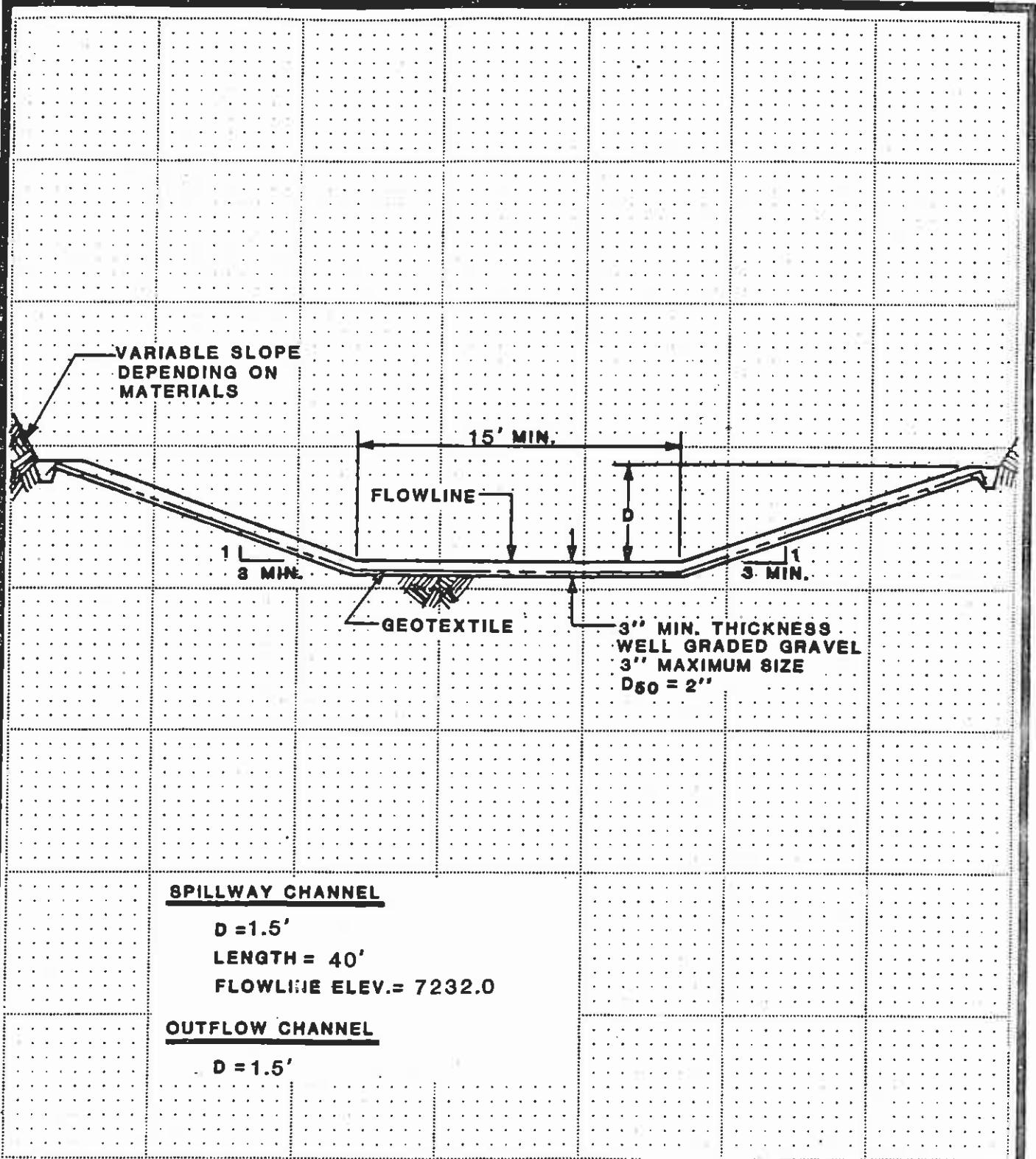
Stage-Capacity Chart

Elevation (Ft-Msl)	Stage (Ft.)	Area (Acres)	Capacity (Ac-Ft)	Total Capacity (Ac-Ft)	Description
7234.0	15.2	0.576	1.070	5.10	
7232.0	13.2	0.494	0.914	4.03	Emergency
					Spillway
7230.0	11.2	0.420	0.782	3.12	Principal
				-	Spillway
7228.0	9.2	0.362	0.687	2.33	
7226.0	7.2	0.325	0.609	1.65	
7224.0	5.2	0.284	0.519	1.04	
7222.0	3.2	0.235	0.413	0.52	
7220.0	1.2	0.178	0.107	0.11	
7218.8	0	0	0	0	Bottom of Pond

PLATE 2







EMERGENCY SPILLWAY AND OUTFLOW CHANNEL CROSS SECTION

KM-TPB

APPENDIX A

HYDROLOGY AND HYDRAULIC CALCULATIONS

KM-TPB

Time of Concentration

Elevation Difference = 7362 - 7229 = 133 ft.

Water Course Length = 5.6(400) = 2240 ft. = 0.424 mi.

$$T_c = \frac{(11.9 (0.424)^3)}{133}^{0.385} = 0.147 \text{ hr.}$$

SCS Curve Number

Drainage Area (ac)	Cover Type	Hydrologic Condition	Soil Type	Weighted Curve Number
34.0 (89%)	P-J	average	D	83 (.89)
4.2 (11%)	disturbed		D	94 (.11)
				84.2

Use: 85

Drainage Basin Area

38.2 Acre

Universal Soil Loss Equation

Rainfall Factor:

K = 40

Soil Erodibility Factor:

Soil Type = 100% EH #24 1.0(.16)

K = .16

Slope Factor:

<u>Length (ft)</u>	<u>Elev Difference (ft)</u>	<u>Slope (1%)</u>	<u>LS</u>
600	40	6.7	1.9

Use: 1.9

Cover Factor:

<u>Area (ac)</u>	<u>Cover Type</u>	<u>% Cover</u>	<u>Canopy (%)</u>	<u>Weighted C</u>
34.0 (89%)	P-J	40	25	.89(.16)
4.2 (11%)	disturbed	-	-	<u>.11(1.0)</u>
				C = .24

Erosion Control Factor:

$$P = 1.0$$

Sediment Inflow:

$$A = (40)(.16)(1.9)(.24)(1.0) = 2.92 \text{ ton/acre/year}$$

$$A = \frac{2.92(38.2)(1)(.95)}{2047} = .052 \text{ acre-feet/year}$$

APPENDIX B

SEDIMOT II (Input and Output)

10-Year, 24-Hour Storm

UNIVERSITY OF KENTUCKY COMPUTER MODEL
OF SURFACE MINE HYDROLOGY AND SEDIMENTOLOGY
FOR MORE INFORMATION CONTACT THE AGRICULTURAL
ENGINEERING DEPARTMENT

THE UK MODEL IS A DESIGN MODEL DEVELOPED TO PREDICT THE HYDRAULIC AND SEDIMENT RESPONSE FROM SURFACE MINED LANDS FOR A SPECIFIED RAINFALL EVENT (SINGLE STORM)

VERSION DATE 5-25-83

DISCLAIMER: NEITHER THE UNIVERSITY NOR ANY OF ITS EMPLOYEES ACCEPT ANY RESPONSIBILITY OR LEGAL LIABILITY FOR THE CONCLUSIONS DRAWN FROM THE RESULTS OF THIS MODEL.

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WATERSHED IDENTIFICATION 200

MANUFACTURED IDENTIFICATION CODE
KM-TPB POND (10-YEAR, 24-HOUR)

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18" CMP DROP INLET

SPILLWAY

INPUT PARTICLE SIZE-PERCENT FINER DISTRIBUTIONS

SIZE, MM	2.000	0.300	0.150	0.075	0.040	0.020
PCT FINER NO. 1	100.000	99.000	87.000	74.000	66.000	52.000
	42.000	36.000	26.000	22.000	0.000	0.000

***** INPUT VALUES *****

STORM DURATION	=	24.00	HOURS
PRECIPITATION DEPTH	=	2.10	INCHES
SPECIFIC GRAVITY	=	2.50	
LOAD RATE EXPONENT FACTOR	=	1.50	
SUBMerged BULK SPECIFIC GRAVITY	=	1.25	

* * * * * JUNCTION 1, BRANCH 1, STRUCTURE 1
 * * * * * # * # * # * # * # * # * # * # * # * *

*** HYDRAULIC INPUT VALUES FOR SUBWATERSHEDS ***

WATER SHED	AREA ACRES	CURVE NUMBER	TC HR	TT HR	ROUTING COEFFICIENTS X	UNIT HYDRO
1	38.20	85.00	0.147	0.000	0.000	1.0

*** SEDIMENT INPUT VALUES FOR SUBWATERSHEDS ***

WATER SHED	SEG NUM	SOIL K	LENGTH FEET	SLOPE PCT	CP VALUE	PART OPT	SURF COND
1	1	0.16	600.0	6.70	0.240	1.0	0.0

* * * COMPUTED VALUES FOR INDIVIDUAL WATERSHEDS * * *

WATERSHED	PEAK FLOW (CFS)	RUNOFF (INCHES)	SEDIMENT TONS	DIA M (MM)	DELIVERY RATIO 1	DELIVERY RATIO 2
1	32.10	0.87	85.49	0.014	0.932	1.000

NOTE: SEDIMENT DOES NOT INCLUDE POSSIBLE DEPOSITION BY DELIVERY RATIO 2

***** SUMMARY TABLE FOR TOTAL WATERSHED *****

RUNOFF VOLUME	=	2.7668 ACRE-FT
PEAK DISCHARGE	=	32.0979 CFS
AREA	=	38.2000 ACRES
TIME OF PEAK DISCHARGE	=	12.10 HRS
BETA	=	1.0000
RAINFALL EROSIONITY FACTOR	=	24.21 EI UNIT
PEAK CONCENTRATION	=	42025.10 MG/L
PEAK SETTLEABLE CONCENTRATION	=	17.91 ML/L
PEAK SETTLEABLE CONCENTRATION	=	22387.70 MG/L
TOTAL SEDIMENT YIELD	=	85.4872 TONS
REPRESENTATIVE PARTICLE SIZE	=	0.0137 MM
TIME OF PEAK CONCENTRATION	=	12.10 HRS
PERIOD OF SIGNIFICANT CONCENTRATION	=	14.50 HRS
VOLUME WEIGHTED AVERAGE SETTLEABLE CONCENTRATION DURING PERIOD OF SIGNIFICANT CONCENTRATION	=	9.36 ML/L
VOLUME WEIGHTED AVERAGE SETTLEABLE CONCENTRATION DURING PEAK 24 HOUR PERIOD	=	9.36 ML/L
ARITHMETIC AVERAGE SETTLEABLE CONCENTRATION DURING PERIOD OF SIGNIFICANT CONCENTRATION	=	0.00 ML/L
ARITHMETIC AVERAGE SETTLEABLE CONCENTRATION DURING PEAK 24 HOUR PERIOD	=	2.44 ML/L

***** POND RESULTS *****

***** CONTROL VARIABLES OPTIONS *****

FLOW	FRACTN	ISDO	NRHP	NSP	NCSTR
3	0	2	500	9	0

***** DROP SPILLWAY INPUTS *****

ENTRANCE LOSS COEFFICIENT	=	1.0000
BEND LOSS COEFFICIENT	=	0.5000
WEIR COEFFICIENT	=	3.1000
ORIFICE COEFFICIENT	=	0.6000
MANNING COEFFICIENT	=	0.0250
BARREL DIAMATER	=	18.00 INCHES
RISER DIAMETER	=	18.00 INCHES
LENGTH OF PIPE	=	140.00 FEET
VERTICAL HEAD DROP	=	9.00 FEET

***** BASIN GEOMETRY *****

STAGE (FT)	AREA (ACRES)	AVERAGE DEPTH (FT)	DISCHARGE (CFS)	CAPACITY (ACRES-FT)
0.00	0.000	0.00	0.00	0.00
1.20	0.178	0.60	0.00	0.11
3.20	0.235	2.42	0.00	0.52
5.20	0.284	4.17	0.00	1.04
7.20	0.325	5.86	0.00	1.65
9.20	0.362	7.53	0.00	2.33
11.20	0.420	9.12	0.00	3.12
13.20	0.494	10.58	12.03	4.03
15.20	0.576	11.93	14.80	5.10

***** STORM EVENT SUMMARY *****

TURBULENCE FACTOR	=	1.00
PERMANENT POOL CAPACITY	=	3.117 ACRE-FT
DEAD STORAGE	=	40.00 PERCENT
TIME INCREMENT OUTFLOW	=	0.10 HRS
VISCOSITY	=	0.009 Cm ² /SEC
INFLOW RUNOFF VOLUME	=	2.767 ACRE-FT
OUTFLOW ROUTED VOLUME	=	2.767 ACRE-FT
STORM VOLUME DISCHARGED (PLUG FLOW)	=	0.903 ACRE-FT

POND VOLUME AT PEAK STAGE	=	4.003 ACRE-FT.
PEAK STAGE	=	13.139 FT
PEAK INFLOW RATE	=	32.098 CFS
PEAK DISCHARGE RATE	=	11.668 CFS
PEAK INFLOW SEDIMENT CONCENTRATION	=	42025.10 MG/L
PEAK EFFLUENT SEDIMENT CONCENTRATION	=	14658.30 MG/L
PEAK EFFLUENT SETTLEABLE CONCENTRATION	=	0.0036 ML/L
PEAK EFFLUENT SETTLEABLE CONCENTRATION	=	4.50 MG/L
STORM AVERAGE EFFLUENT CONCENTRATION	=	12629.71 MG/L
AVERAGE EFFLUENT SEDIMENT CONCENTRATION	=	4295.61 MG/L
BASIN TRAP EFFICIENCY	=	80.65 PERCENT
DETENTION TIME OF LOW WITH SEDIMENT	=	1H.125 HRS
DELEHION TIME FROM HYDROGRAPH CENTERS	=	0.92 HRS
DETENTION TIME INCLUDING STORED FLOW	=	12.06 HRS
SEDIMENT LOAD DISCHARGED	=	16.54 TONS
PERIOD OF SIGNIFICANT CONCENTRATION=		
VOLUME WEIGHTED AVERAGE SETTLEABLE		
CONCENTRATION DURING PERIOD OF		
SIGNIFICANT CONCENTRATION	=	0.00 ML/L
VOLUME WEIGHTED AVERAGE SETTLEABLE		
CONCENTRATION DURING PEAK 24 HOUR		
PERIOD	=	0.00 ML/L
ARITHMETIC AVERAGE SETTLEABLE		
CONCENTRATION DURING PERIOD OF		
SIGNIFICANT CONCENTRATION	=	0.00 ML/L
ARITHMETIC AVERAGE SETTLEABLE		
CONCENTRATION DURING PEAK 24 HOUR		
PERIOD	=	0.00 ML/L

*** RUN COMPLETED ***

APPENDIX C

SEDIMOT II (Input and Output)

25-Year, 6-Hour Storm

FILE: KU-IPB SEDIHULAI PREVIOUS VM PRINTING SUBSYSTEM

PAGE 00001

KMM-TPB POUND (25-YEAR, 6-HOUR)						
	2	2	2	2	2	2
1.90	6.0	0.10	1.00			
1	2					
1	1					
2.50	1.50	1.25				
1	1					
2.0000	0.3000	0.1500	0.0750	0.0400	0.0200	0.0100
0.0001	100.00	99.00	87.00	74.00	66.00	52.00
0.00	1					
0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.1	2	1	1	1	1	1
38.20	85.000	0.147	0.000	0.000	0.000	0.000
0.160	600.0	6.70	0.240	1.000		
0.10	1.00	40.00				
3	0	9	500	2	1	0
0.000	1.20	3.20	5.20	7.20	9.20	11.20
0.00	0.178	0.235	0.284	0.325	0.362	0.420
18.00	18.00	1.00	0.50	1.00	1.10	0.60

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WATERSHED IDENTIFICATION CODE

KM-TPB POND (25-YEAR, 6-HOUR)

18" CMP DROP INLET
SPILLWAY

INPUT PARTICLE SIZE-PERCENT FINER DISTRIBUTIONS

SIZE, MM	2.000	0.300	0.150	0.075	0.040	0.020
PCT FINER NO. 1	0.010	0.005	0.002	0.001	0.000	
	100.000	99.000	87.000	74.000	66.000	52.000
	42.000	36.000	26.000	22.000	0.000	

* * * JUNCTION 1, BRANCH 1, STRUCTURE 1
 *

*** HYDRAULIC INPUT VALUES FOR SUBWATERSHEDS ***

WATER SHED	AREA ACRES	CURVE NUMBER	TC HR	TT HR	ROUTING COEFFICIENTS X	UNIT HYDRO
1	38.20	85.00	0.147	0.000	0.000	1.0

*** SEDIMENT INPUT VALUES FOR SUBWATERSHEDS ***

WATER SHED	SFC NUM	SOIL K	LENGTH FEET	SLOPE PCI	CP VALUE	PART OPT	SURF COND
1	1	0.16	600.0	6.70	0.240	1.0	0.0

* * * COMPUTED VALUES FOR INDIVIDUAL WATERSHEDS * * *

WATERSHED	PEAK FLOW (CFS)	RUNOFF (INCHES)	SEDIMENT TONS	DIA M (MM)	DELIVERY RATIO 1	DELIVERY RATIO 2
1	39.41	0.72	86.18	0.013	0.910	1.000

NOTE: SEDIMENT DOES NOT INCLUDE POSSIBLE DEPOSITION BY DELIVERY RATIO 2

***** SUMMARY TABLE FOR TOTAL WATERSHED *****

RUNOFF VOLUME	=	2.3006 ACRE-FT
PEAK DISCHARGE	=	39.4086 CFS
AREA	=	38.2000 ACRES
TIME OF PEAK DISCHARGE	=	3.10 HRS
BETA	=	1.0000
RAINFALL EROSIONITY FACTOR	=	33.96 E1 UNIT
PEAK CONCENTRATION	=	42188.18 MG/L
PEAK SETTLEABLE CONCENTRATION	=	17.61 ML/L
PEAK SETTLEABLE CONCENTRATION	=	22018.55 MC/L
TOTAL SEDIMENT YIELD	=	86.4827 TONS
REPRESENTATIVE PARTICLE SIZE	=	0.0127 MM
TIME OF PEAK CONCENTRATION	=	3.10 HRS
PERIOD OF SIGNIFICANT CONCENTRATION	=	3.80 HRS
VOLUME WEIGHTED AVERAGE SETTLEABLE CONCENTRATION DURING PERIOD OF SIGNIFICANT CONCENTRATION	=	11.16 ML/L
VOLUME WEIGHTED AVERAGE SETTLEABLE CONCENTRATION DURING PEAK 24 HOUR PERIOD	=	11.16 ML/L
ARITHMETIC AVERAGE SETTLEABLE CONCENTRATION DURING PERIOD OF SIGNIFICANT CONCENTRATION	=	0.00 ML/L
ARITHMETIC AVERAGE SETTLEABLE CONCENTRATION DURING PEAK 24 HOUR PERIOD	=	1.08 ML/L

***** POND RESULTS *****

***** CONTROL VARIABLES OPTIONS *****

FLOW	FRACTN	ISDO	NRHP	NSP	NCSTR
3	0	2	500	9	0

***** DROP SPILLWAY INPUTS *****

ENTRANCE LOSS COEFFICIENT	= 1.0000
BEND LOSS COEFFICIENT	= 0.5000
WEIR COEFFICIENT	= 3.1000
ORIFICE COEFFICIENT	= 0.6000
MANNING COEFFICIENT	= 0.0250
BARREL DIAMETER	= 18.00 INCHES
RISER DIAMETER	= 18.00 INCHES
LENGTH OF PIPE	= 140.00 FEET
VERTICAL HEAD DROP	= 9.00 FEET

***** BASIN GEOMETRY *****

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1.20	0.178	0.60	0.00	0.11
3.20	0.235	2.42	0.00	0.52
5.20	0.284	4.17	0.00	1.04
7.20	0.325	5.86	0.00	1.65
9.20	0.362	7.53	0.00	2.33
11.20	0.420	9.12	0.00	3.12
13.20	0.494	10.58	12.03	4.03
15.20	0.576	11.93	14.80	5.10

***** STORM EVENT SUMMARY *****

TURBULENCE FACTOR	= 1.00
PERMANENT POOL CAPACITY	= 3.117 ACRE-FT
DEAD STORAGE	= 40.00 PERCENT
TIME INCREMENT OUTFLOW	= 0.10 HRS
VISCOSITY	= 0.009 CM ⁻² /SEC
INFLOW RUNOFF VOLUME	= 2.301 ACRE-FT
OUTFLOW ROUTED VOLUME	= 2.300 ACRE-FT
STORM VOLUME DISCHARGED (PLUG FLOW)	= 0.433 ACRE-FT

POND VOLUME AT PEAK STAGE	=	4.084 ACRE-FT
PEAK STAGE	=	13.300 FT
PEAK INFLOW RATE	=	39.409 CFS
PEAK INFLOW SEDIMENT CONCENTRATION	=	12.172 CFS
PEAK EFFLUENT SEDIMENT CONCENTRATION	=	42100.18 MG/L
PEAK EFFLUENT SETTLEABLE CONCENTRATION	=	15309.60 MG/L
PEAK EFFLUENT SETTLEABLE CONCENTRATION	=	0.0107 ML/L
STORM AVERAGE EFFLUENT CONCENTRATION	=	13.42 MG/L
AVERAGE EFFLUENT SEDIMENT CONCENTRATION	=	13213.38 MG/L
BASIN TRAP EFFICIENCY	=	2700.63 MG/L
DEFIENITION TIME OF FLOW WITH SEDIMENT	=	90.02 PERCENT
DEFIENITION TIME FROM HYDROGRAPH CENTERS	=	9.02 HRS
DEFIENITION TIME INCLUDING STORED FLOW	=	0.92 HRS
SEDIMENT LOAD DISCHARGED	=	8.44 HRS
PERIOD OF SIGNIFICANT CONCENTRATION=	=	8.63 TONS
VOLUME WEIGHTED AVERAGE SETTLEABLE CONCENTRATION DURING PERIOD OF SIGNIFICANT CONCENTRATION	=	7.90 HRS
VOLUME WEIGHTED AVERAGE SETTLEABLE CONCENTRATION DURING PEAK 2H HOUR PERIOD	=	0.01 ML/L
ARITHMETIC AVERAGE SETTLEABLE CONCENTRATION DURING PERIOD OF SIGNIFICANT CONCENTRATION	=	0.01 ML/L
ARITHMETIC AVERAGE SETTLEABLE CONCENTRATION DURING PEAK 2H HOUR PERIOD	=	0.00 ML/L
ARITHMETIC AVERAGE SETTLEABLE CONCENTRATION DURING PERIOD OF SIGNIFICANT CONCENTRATION	=	0.00 ML/L

*** RUN COMPLETED ***

KM-TPB POND (25-YEAR, 6-HOUR)						
2	2	2	2	2	2	2
1.90	6.0	0.10	1.00			
1	2					
2.50	1.50	1.25				
2	1	1				
2.0000	0.3000	0.1500	0.0750	0.0400	0.0200	0.0100
0.0001	99.00	87.00	74.00	66.00	52.00	42.00
100.00						
0.00						
0.00	0.00	0.00	0.00	0.00	0.00	0.00
1	1	1	1	1	1	1
38.20	85.000	0.147	0.000	0.000	0.000	0.000
0.160	600.0	6.70	0.240	1.000		
0.10	1.00	40.00				
3	0	9				
0.000	1.20	3.20	5.20	7.20	9.20	11.20
0.00	0.178	0.235	0.284	0.325	0.362	0.420
0.00	0.00	0.00	0.00	0.00	0.00	0.00

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UNIVERSITY OF KENTUCKY COMPUTER MODEL
OF SURFACE MINE HYDROLOGY AND SEDIMENTOLOGY
FOR MORE INFORMATION CONTACT THE AGRICULTURAL
ENGINEERING DEPARTMENT

THE UK MODEL IS A DESIGN MODEL DEVELOPED TO PREDICT THE HYDRAULIC AND SEDIMENT RESPONSE FROM SURFACE MINED LANDS FOR A SPECIFIED RAINFALL EVENT (SINGLE STORM)

VERSION DATE 5-25-83

DISCLAIMER: NEITHER THE UNIVERSITY NOR ANY OF ITS EMPLOYEES ACCEPT ANY RESPONSIBILITY OR LEGAL LIABILITY FOR THE CONCLUSIONS DRAWN FROM THE RESULTS OF THIS MODEL.

* * * * *

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WATERSHED IDENTIFICATION GUIDE

KIN-TPB POND (25-YEAR, 6-HOUR)

15' WIDE EMERGENCY SPILLWAY

INPUT PARTICLE SIZE-PERCENT FINER DISTRIBUTIONS

	SIZE, MM	2,000	0,300	0,150	0,075	0,040	0,020
PCT FINER NO. 1	0,010	0,005	0,002	0,001	0,000		
	100,000	99,000	87,000	74,000	66,000	52,000	
	42,000	36,000	26,000	22,000	0,000		

***** INPUT VALUES*****

STORM DURATION	=	6.00	HOURS
PRECIPITATION DEPTH	=	1.90	INCHES
SPECIFIC GRAVITY	=	2.50	
LOAD RATE EXPONENT FACTOR	=	1.50	
SUBMERGED BULK SPECIFIC GRAVITY	=	1.25	

* * * JUNCTION 1, BRANCH 1, STRUCTURE 1
 *

*** HYDRAULIC INPUT VALUES FOR SUBWATERSHEDS ***

WATER SHED	AREA ACRES	CURVE NUMBER	TC HR	TT HR	ROUTING COEFFICIENTS X	UNIT HYDRO
1	38.20	85.00	0.147	0.000	0.000	0.00 1.0

*** SEDIMENT INPUT VALUES FOR SUBWATERSHEDS ***

WATER SHED	SEG NUM	SOIL K	LENGTH FEET	SLOPE PCT	CP VALUE	PART OPT	SURF COND
1	1	0.16	600.0	6.70	0.240	1.0	0.0

* * * COMPUTED VALUES FOR INDIVIDUAL WATERSHEDS * * *

WATERSHED	PEAK FLOW (CFS)	RUNOFF (INCHES)	SEDIMENT TONS	DIA M (MM)	DELIVERY RATIO 1	DELIVERY RATIO 2
1	39.41	0.72	86.48	0.013	0.910	1.000

NOTE: SEDIMENT DOES NOT INCLUDE POSSIBLE DEPOSITION BY DELIVERY RATIO 2

***** SUMMARY TABLE FOR TOTAL WATERSHED *****

RUNOFF VOLUME	=	2.3006 ACRE-FT
PEAK DISCHARGE	=	39.4086 CFS
AREA	=	38.2000 ACRES
TIME OF PEAK DISCHARGE	=	3.10 HRS
BETA	=	1.0000
RAINFALL EROSIONITY FACTOR	=	33.96 E1 UNIT
PEAK CONCENTRATION	=	42188.18 MG/L
PEAK SETTLEABLE CONCENTRATION	=	17.61 ML/L
PEAK SETTLEABLE CONCENTRATION	=	22018.55 MG/L
TOTAL SEDIMENT YIELD	=	86.4827 TONS
REPRESENTATIVE PARTICLE SIZE	=	0.0127 MM
TIME OF PEAK CONCENTRATION	=	3.10 HRS
PERIOD OF SIGNIFICANT CONCENTRATION	=	3.80 HRS
VOLUME WEIGHTED AVERAGE SETTLEABLE CONCENTRATION DURING PERIOD OF SIGNIFICANT CONCENTRATION	=	11.16 ML/L
VOLUME WEIGHTED AVERAGE SETTLEABLE CONCENTRATION DURING PEAK 24 HOUR PERIOD	=	11.16 ML/L
ARITHMETIC AVERAGE SETTLEABLE CONCENTRATION DURING PERIOD OF SIGNIFICANT CONCENTRATION	=	0.00 ML/L
ARITHMETIC AVERAGE SETTLEABLE CONCENTRATION DURING PEAK 24 HOUR PERIOD	=	1.08 ML/L

***** POND RESULTS *****

***** CONTROL VARIABLES OPTIONS *****

FLOW	FRACTN	ISDO	NRHP	NSP	NCSTR
3	0	1	500	9	0

***** BASIN GEOMETRY *****

STAGE (FT)	AREA (ACRES)	AVERAGE DEPTH (FT)	DISCHARGE (CFS)	CAPACITY (ACRES-FT)
0.00	0.000	0.00	0.00	0.00
1.20	0.178	0.60	0.00	0.11
3.20	0.235	2.42	0.00	0.52
5.20	0.284	4.17	0.00	1.04
7.20	0.325	5.86	0.00	1.65
9.20	0.362	7.53	0.00	2.33
11.20	0.420	9.12	0.00	3.12
13.20	0.494	10.58	12.03	4.03
15.20	0.576	11.93	113.80	5.10

***** STORM EVENT SUMMARY *****

TURBULENCE FACTOR	=	1.00
PERMANENT POOL CAPACITY	=	3.117 ACRE-FT
DEAD STORAGE	=	40.00 PERCENT
TIME INCREMENT	=	0.10 HRS
VISCOSEITY	=	0.009 CM**2/SEC
INFLOW RUNOFF VOLUME	=	2.301 ACRE-FT
OUTFLOW Routed VOLUME	=	2.300 ACRE-FT
STORM VOLUME DISCHARGED (PLUG FLOW)	=	0.465 ACRE-FT
POND VOLUME AT PEAK STAGE	=	4.061 ACRE-FT
PEAK STAGE	=	13.256 FT
PEAK INFLOW RATE	=	39.409 CFS
PEAK DISCHARGE RATE	=	14.870 CFS
PEAK INFLOW SEDIMENT CONCENTRATION	=	42188.18 MG/L
PEAK EFFLUENT SEDIMENT CONCENTRATION	=	15310.00 MG/L
PEAK EFFLUENT SETTLEABLE CONCENTRATION	=	0.0118 NL/L
PEAK EFFLUENT SETTLEABLE CONCENTRATION	=	12739.14 MG/L
STORM AVERAGE EFFLUENT CONCENTRATION	=	2743.73 MG/L
AVERAGE EFFLUENT SEDIMENT CONCENTRATION	=	89.72 PERCENT
BASIN TRAP EFFICIENCY	=	8.91 HRS
DETENTION TIME OF FLOW WITH SEDIMENT	=	0.90 HRS
DETENTION TIME FROM HYDROGRAPH CENTERS	=	8.30 HRS
DETENTION TIME INCLUDING STORED FLOW	=	8.89 HOURS
SEDIMENT LOAD DISCHARGED	=	

PERIOD OF SIGNIFICANT CONCENTRATION =			
VOLUME WHICH AVERAGE SETTLEABLE	=	8.00	IRS
CONCENTRATION DURING PERIOD OF			
SIGNIFICANT CONCENTRATION			
VOLUME WHICH AVERAGE SETTLEABLE	=	0.01	ML/L
CONCENTRATION DURING PEAK 24 HOUR			
PERIOD	=		
AIRTIME AVERAGE SETTLEABLE	=	0.01	ML/L
CONCENTRATION DURING PERIOD OF			
SIGNIFICANT CONCENTRATION			
AIRTIME AVERAGE SETTLEABLE	=	0.00	ML/L
CONCENTRATION DURING PEAK 24 HOUR			
PERIOD	=	0.00	ML/L

*** RUN COMPLETED ***



PEABODY COAL COMPANY
Western Division

1300 South Yale
Flagstaff, Arizona 86001
(602) 774-5253

July 2, 1987

Mr. Steve Fuller
Chief, Compliance Section
Water Management Division
U.S. Environmental Protection Agency
Region IX
215 Fremont Street
San Francisco, CA 94105

ATTN: W-4-1

Dear Mr. Fuller:

This letter and the enclosed information addresses the issue of seeps from ponds and dams at the Black Mesa mining complex raised in Mr. Ronald Clawson's May 26, 1987 inspection report. The information is provided pursuant to your June 4, 1987 letter and Recommendation 3 on Page 6 of the above-referenced report.

Peabody has performed a survey of all 156 water retention structures existing at the Black Mesa complex. The survey was designed to provide data regarding any actual or potential seeps or flows of water from locations other than the spillways of these structures. The results of the survey are as follows. Evidence of water was found to exist at or within 200 feet downstream of the embankment of 19 structures. A summary of Peabody's findings regarding these structures may be found in Exhibit 1 attached to this letter.

There is no reason to believe a relationship exists between the dams and downstream evidence of moisture for the following seven structures: CWB, J3-C, J16-I, J27-B, J28-G, N6-F, and N13-C. For example, the water below J27-B (which is not currently holding any water) emanates from a known spring which is periodically sampled in accordance with Peabody's mining permit.

Since many of the ephemeral washes on the Black Mesa leasehold have intermittent reaches due to surfacing alluvial ground water or springs, a damp spot or minor flow in a wash is not uncommon and certainly does not represent conclusive evidence of a seeping dam. As examples, no water is currently being held by Ponds CWB and J3-C; however, water or evidence of moisture exists at the downstream toes of the embankments. (Note: Neither of these structures,

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if discharging, would be NPDES sampling points since the J2-A dam is downstream and would collect and treat such discharges.) Thus, existence of moisture or water at or below the embankment of 10 of the remaining 12 structures listed in Exhibit 1 may or may not be evidence of a leaking or seeping pond. Several factors must be considered when judging the status of these structures including construction notes, the location of the damp spots, and the existence and location of recognizable flows.

Based upon our review, it is evident that only 2 of the 156 dams are yielding a measurable flow capable of being sampled - J-7 and J16-A. The flows below these structures were sampled and the results may be found in Exhibit 2. J-7 is seeping at the toe and abutment. J16-A is leaking a minor amount of water from the decant system; however, the water is being contained in the immediate vicinity of the dam and not discharged to Moenkopi Wash.

The remaining ten structures listed in Exhibit 1 may be seeping to some extent. For example, the damp spots on the embankment and at the toe of N6-C would imply a minor seep; however, the damp spot in the channel approximately 50 feet downstream is most likely unrelated to the structure. There are no measurable flows associated with these structures.

When reviewing this situation, the following facts should be considered.

1. The sediment dams are required by law. Although alternative sediment control may be employed in limited cases (e.g., silt fence, straw bales, etc.), principal sediment control is through the use of dams.
2. The principal purpose of sediment dams is to collect runoff from disturbed lands, provide for detention and settling of solids, and allow controlled releases of water.
3. All earthen dams which consistently retain water will leak. Larger earthen dams are designed with filter systems to allow for such leakage in a controlled fashion which protects the stability of the structure.
4. Water which seeps through an embankment is filtered and poses no environmental threat.
5. The existing NPDES permit was written to address spillway discharges which are the direct result of precipitation events. Non "event"-type discharges were considered and not felt to be significant at the time the permit was drafted. This knowledge is from

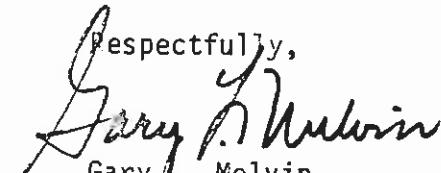
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participating with the State in the drafting process. Discharges through spillways have been sampled and reported in accordance with NPDES Permit AZ0022179.

6. Peabody is required by its mining permit to maintain an elaborate ground and surface water monitoring program. This program has not detected any adverse impacts from any surface mining activities.
7. Peabody recognized the existence of certain difficulties associated with the current NPDES permit and requested modifications in December, 1984. If adopted, the modifications would address concerns outlined in the inspection report.
8. Leaking or seeping ponds are obviously not a common or widespread phenomenon at the Black Mesa complex.

If you have any questions or wish any additional information regarding the issues outlined in the May 26, 1987 inspection report, please contact me.

Respectfully,

Gary L. Melvin
Senior Manager
Environmental Affairs

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Enclosures

EXHIBIT 1

Dam Survey Results
Black Mesa Mining Complex
June, 1987

<u>Structure</u>	<u>NPDES Pond*</u>	<u>Impounding Water</u>	<u>Comments</u>
J-7	Yes	Yes	Water flowing from toe and abutment of dam. Flow rate estimated to be 10 gpm. Flowing water was sampled.
J16-I	Yes	Yes	Damp spot in channel approximately 15 feet downstream of embankment.
J16-A	Yes	Yes	Water leaking from decant system. Flow rate estimated to be 1.5 gpm. Flowing water was sampled. Water is being collected in a depression and is <u>not</u> discharging to Moenkopi Wash.
J21-T4	No	Yes	Water seeping from toe of dam. Flow is diffuse, not capable of being measured or sampled.
J27-B	Yes	No	Diffuse seep in channel beginning approximately 10 feet downstream of embankment. Extremely low flow, not capable of being sampled. Water is from a spring.
J28-G	No	Yes	Damp spot in channel approximately 30 feet downstream of embankment.
N6-F	Yes	No	Damp spot approximately 50 feet downstream of embankment. Water in channel approximately 160 feet downstream of embankment.
N10-A	No	Yes	Water seeping from abutment of dam. Flow is diffuse, not capable of being measured or sampled.
N13-E	Yes	Yes	Damp spot approximately 15 feet downstream from embankment.

EXHIBIT 1 Con't)

Dam Survey Results
Black Mesa Mining Complex
June, 1987

<u>Structure</u>	<u>NPDES Pond*</u>	<u>Impounding Water</u>	<u>Comments</u>
N14-P	Yes	Yes	Minor signs of dampness on embankment.
TPF-D	No	Yes	Damp spot at toe of dam and in channel. Water in channel approximately 100 feet downstream of embankment. Flow is diffuse, not capable of being measured or sampled.
CWA	No	Yes	Water seeping at toe and abutment of dam. Flow is diffuse, not capable of being measured or sampled.
CWB	No	No	Damp spot at toe of embankment.
J3-C	No	No	Standing water at toe of embankment and in downstream channel. Damp spot in channel.
J3-D	Yes	Yes	Damp spot at toe of embankment.
J3-E	Yes	Yes	Standing water at toe of embankment and in downstream channel.
J7-I	Yes	Yes	Water seeping at the toe of the embankment. Damp spot downstream. Flow is diffuse, not capable of being measured or sampled.
WW9	Yes	Yes	Standing water at toe of embankment. Damp spot downstream.
N6-C	Yes	Yes	Damp spots on embankment, at toe of dam and approximately 50 feet downstream of embankment.

* Structures having the potential to discharge to the waters of the United States (no downstream dam).

EXHIBIT 2 -

Sample Analysis Results

Structure: J-7
Date : 6/24/87
Time : 0940
pH : 8.12
Settleable Solids: <0.1 ml/l
Oil and Grease : 0.488 mg/l
Flow : 5 gpm

Structure: J16-A
Date : 7/1/87
Time : 1100
pH : 8.03
Settleable Solids: <0.1 ml/l
Oil and Grease : 0.3 mg/l
Flow : 1.5 gpm