DESIGN REPORT

Sedimentation Structure

TPC-A

Kayenta Mine

Navajo County, Arizona

for

PEABODY COAL COMPANY

Dames & Moore
10139-011-22

TABLE OF CONTENTS

INTRODUCTION

Sedimentation Structure TPC-A will be a concrete wall with a small earthen wing embankment, designed and constructed by Peabody Coal Company as a temporary sedimentation structure to control runoff and sediment from the disturbed mining areas of the Kayenta Mine. The location of Structure TPC-A is shown on Plate 1, Site Plan.

This design report contains information specific to Structure TPC-A. Regional site information is presented in the "General Report, Kayenta and Black Mesa Mines, Navajo County, Arizona for Peabody Coal Company," along with the methods and results of analyses used for slope stability, hydrology and hydraulics.

INSPECTION

The proposed site of Structure TPC-A was inspected by a senior geotechnical engineer from Dames & Moore in October, 1985 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.

SITE DESCRIPTION

LAND USE

Structure TPC-A has a 2.5-acre tributary drainage area and is located near Long House Valley at the Kayenta Mine. The watershed is classified as 100% disturbed.

CONCRETE DAM

A vertical concrete wall with a notch spillway was assumed for the hydraulic analysis and to develop the volume-elevation curve shown on Plate 2.

DESIGN ANALYSES

GENERAL

Structure TPC-A was designed by an interdisciplinary team of engineers from Dames & Moore. 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 1982 for Peabody Coal Company and was used in the analyses of the structure.

STABILITY

The concrete wall of Structure TPC-A was designed based on current ACI codes for concrete structures to be stable. The section shown on Plate 4 was checked for static stability (overturning and sliding), cantilever strength during overflow and seismic stability. The design assumes that the wall is founded in fresh competent sandstone bedrock.

HYDROLOGY

The hydrologic analysis was completed using the U.S. Army Corps of Engineers generalized computer program HEC-1, Flood Hydrograph Package. Structure TPC-A is not in series with any other structure and therefore the spillway was analyzed using the 25-year, 6-hour storm. The storage capacity of Structure TPC-A was analyzed using the 10-year, 24-hour storm.

The following parameters were used in the hydrologic analysis:

1.	Water Course length, L	0.0625	mi
2.	Elevation Difference, H	25	ft
3.	Time of Concentration, T_c	0.031	h
4.	Lag time, $0.6T_c$	0.019	h
5.	SCS Curve Number	94	
6.	Rainfall Depth, 10-year, 24-hour storm	2.1	in.
	25-year, 6-hour storm	1.9	in.
7.	Drainage Area	2.5	acres

HYDRAULICS

The HEC-1 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.

TPC-A HYDRAULICS

	Units	10-year 24-hour Storm	25-year 6-hour Storm
Initial Reservoir Volume Condition		Empty	Full to the spillway elevation
Inflow			
Peak Flow	cfs	8	10
Volume	acre-ft	0.31	0.26
Storage			
Peak Stage	ft	7308.39	7309.40
Spillway Elevation . .	ft	7309.20	--
Peak Storage	acre-ft	0.31	--
Storage Capacity . . .	acre-ft	0.48	--
Outflow			
Peak Flow	cfs	0	9
Embankment Crest Elevation	ft	--	7310.50
Peak Stage	ft	--	7309.40
Freeboard	ft	--	1.10
Spillway Channel			
Flow Depth	ft	--	0.20
Critical Velocity. . .	fps	--	2.1
Manning's "n"		--	0.040

Spillway Channel

The spillway for TPC-A will be a rectangular notch in the concrete dam.

Notch depth	1.3 ft
Notch length	30 ft

The alignment of the spillway is shown on Plate 1. The profile is shown on Plate 3 and the required wall dimensions and details are shown on Plate 4.

STORAGE CAPACITY

The impoundment volume-elevation curve shown on Plate 2, Volume-Elevation Curve, TPC-A is based on site specific topographic data developed for Peabody Coal Company in 1985, and 1985 site specific surveys, where available.

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

1.	Rainfall Factor, R	40
2.	Soil Erodibility Factor, K	0.14
3.	Slope Factor, LS	1.68
4.	Cover Factor, C	1.0
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 storage capacity of TPC-A is shown on Plate 2, Volume-Elevation Curve, TPC-A, and the results of the sediment inflow analysis are summarized in the following table.

TPC-A STORAGE

Total Storage Capacity	0.48	acre-ft
10-year, 24-hour Storm Inflow	0.31	acre-ft
Available Sediment Storage Capacity . .	0.17	acre-ft
Sediment Inflow Rate	0.011	acre-ft/yr
Sediment Storage Life	15	yrs

* * *

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

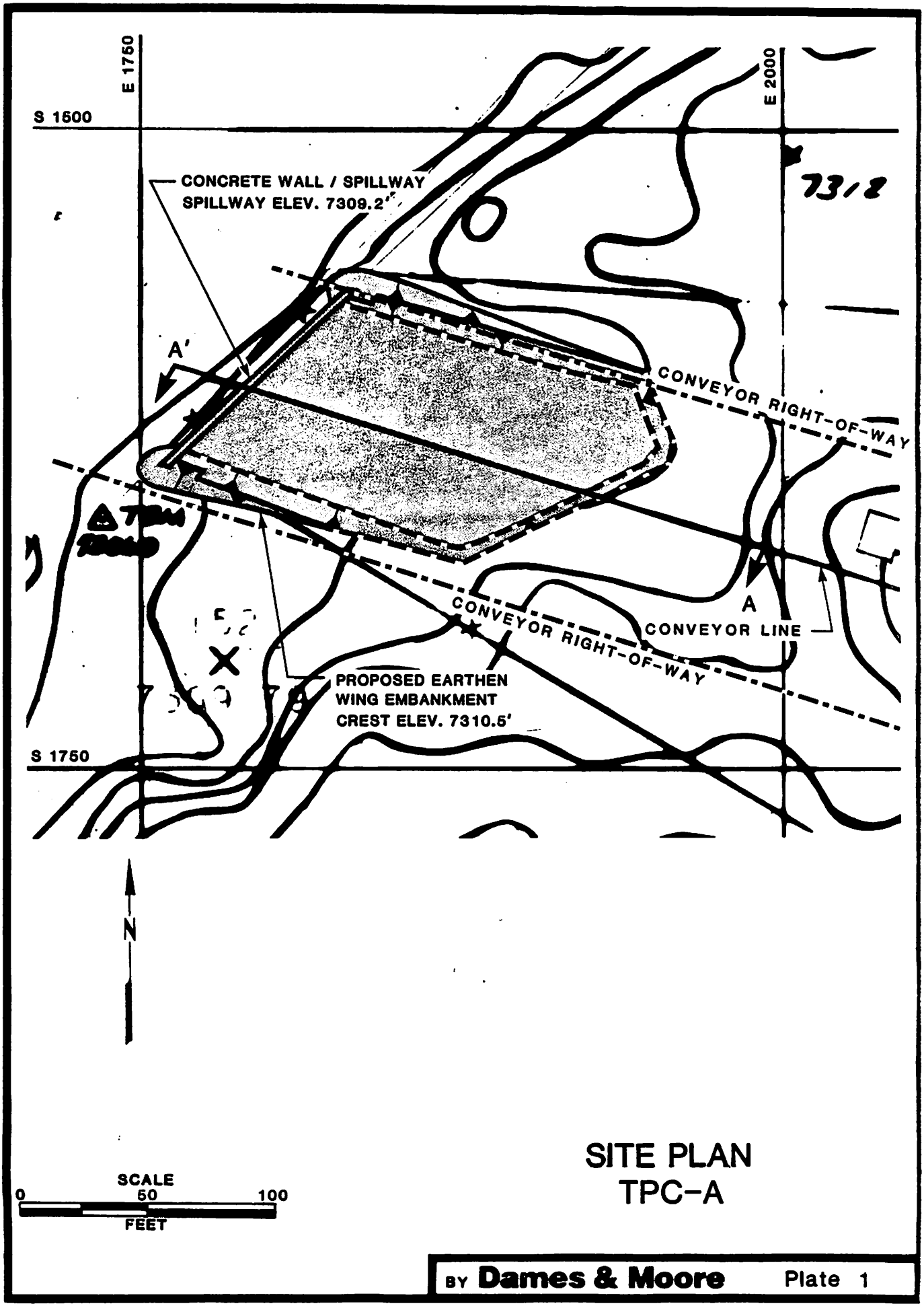
Plate 1 - Site Plan TPC-A

Plate 2 - Volume-Elevation Curve TPC-A

Plate 3 - Channel Profile TPC-A, A-A'

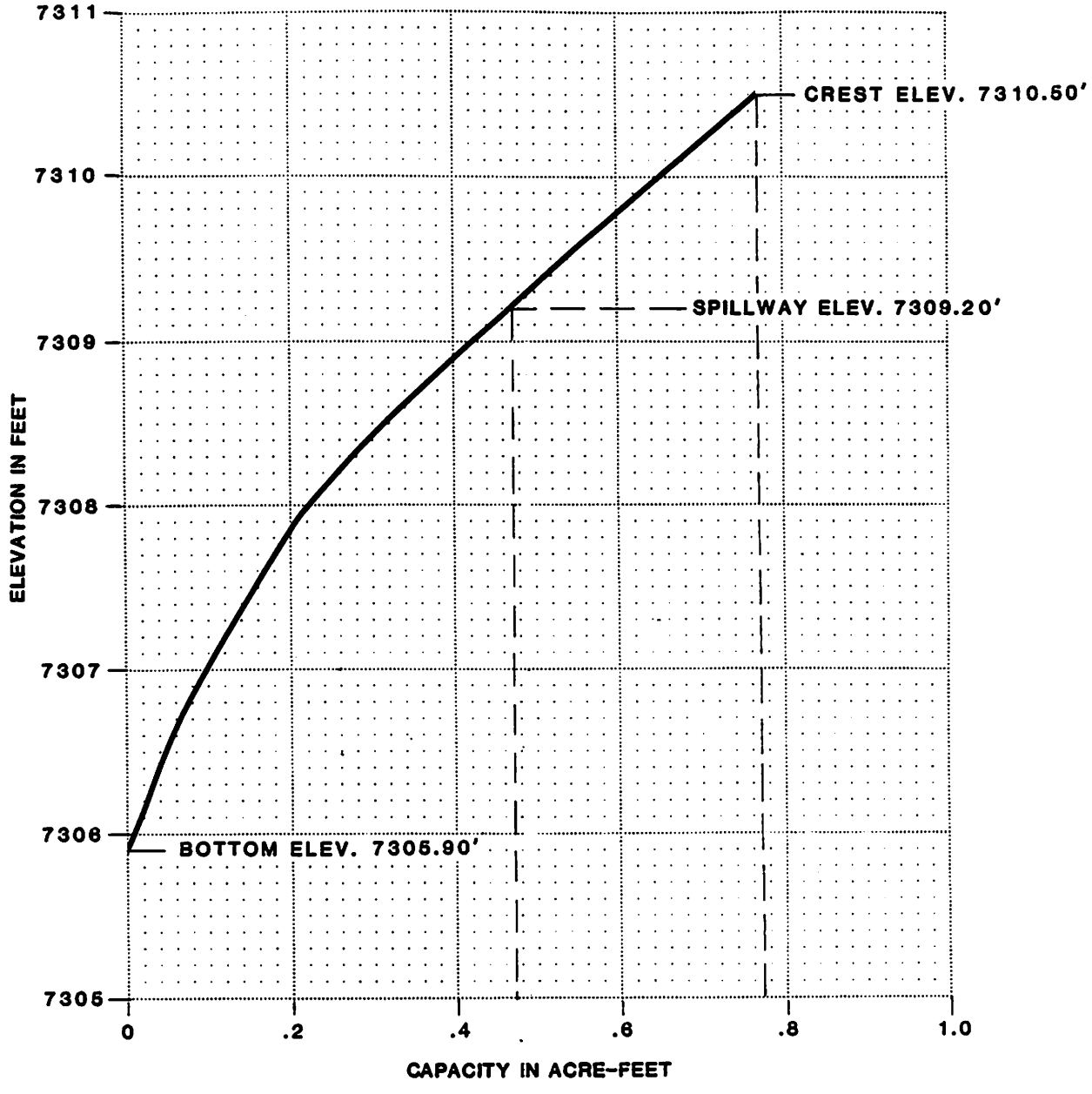
Plate 4 - Typical Section Concrete Wall Dam TPC-A

Appendix A - Hydrology and Hydraulic Calculations



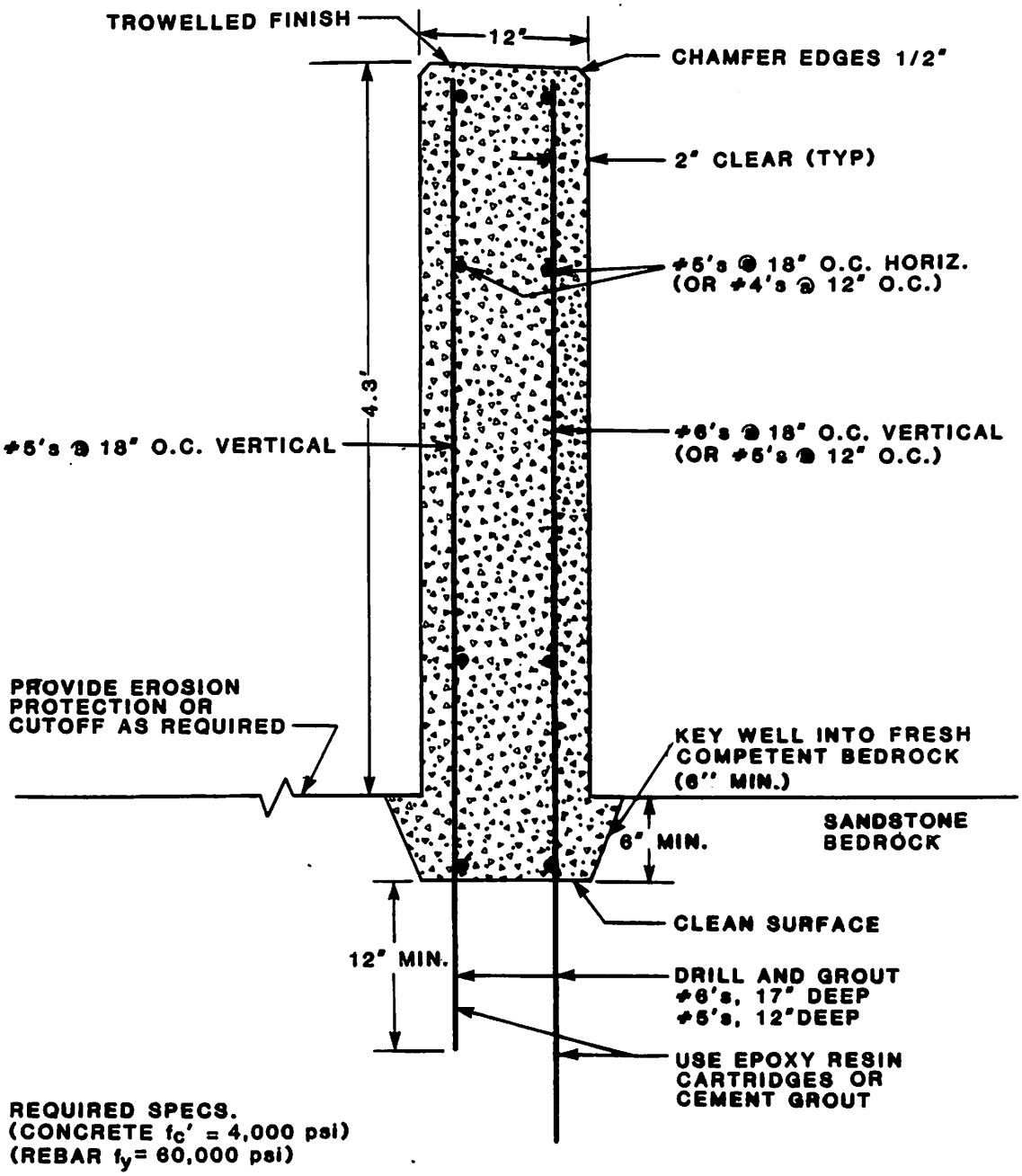
SITE PLAN
TPC-A

BY **Dames & Moore** Plate 1



VOLUME-ELEVATION CURVE TPC-A

BY **Dames & Moore** Plate 2



REQUIRED SPECS.
(CONCRETE f_c' = 4,000 psi)
(REBAR f_y= 60,000 psi)

(PROVIDE 1/2" EXPANSION JOINTS
WITH 6" WATERSTOPS AT 10 FEET
FROM EACH ABUTMENT)

SCALE: 1" = 1.0'

TYPICAL SECTION
CONCRETE WALL DAM
TPC-A

BY **Dames & Moore** Plate 4

APPENDIX A

HYDROLOGY AND HYDRAULIC CALCULATIONS

FILE PEABODY COAL CO. 10139-011-22
SUBJECT SEDIMENT POND HYDROLOGY
TPC-A SHEET ___ OF ___

REVISIONS BY ___ DATE ___ TO EO ___ BY ___ DATE ___ TO EO ___

TIME OF CONCENTRATION

ELEVATION DIFFERENCE = 25'

WATER COURSE LENGTH = 330' = .0625 mi

T_c = 0.031 hr

LAG TIME = $0.6 T_c$ = 0.018 hr
0.019

SCS CURVE NUMBER

DRAINAGE AREA (ac)	COVER TYPE	HYDROLOGIC CONDITION	SOIL TYPE	WEIGHTED CURVE NUMBER
2.5	disturbed	—	D	94

94

DRAINAGE BASIN AREA

2.5 ACRES 0.0039 SQ. MILE ✓

BY ___ DATE ___ CHECKED BY BHM 11/5/85 COPY TO EO ___

FILE PEABODY COAL CO 10139-011-22
SUBJECT SEDIMENT INFLOW
TPC-A SHEET ___ OF ___

REVISIONS BY ___ DATE ___ TO EO ___ BY ___ DATE ___ TO EO ___

UNIVERSAL SOIL LOSS EQUATION

RAINFALL FACTOR

R = 40

SOIL ERODIBILITY FACTOR

SOIL TYPE = 100% #42 ~ EH #30

K = .14

SLOPE FACTOR

LENGTH (ft.)	Δ ELEV (ft.)	SLOPE (%)	LS
330	25	7.6	1.68 ✓

COVER FACTOR

AREA (ac.)	COVER TYPE	% COVER	CANOPY (%)	WEIGHTED C
100%	disturbed	—	—	1.0

BY ___ DATE ___ CHECKED BY BHM 11/5/85 COPY TO EO ___

EROSION CONTROL FACTOR

P = 1.0

SEDIMENT INFLOW

$A = 40(.14)(1.68)(1.0)(1.0) = 9.41$ ton/acre/year

$A = 9.41\left(\frac{1}{2047}\right)(2.5)(.95) = 0.011$ acre-feet/year

Dames & Moore