DESIGN REPORT

Sedimentation Structure

N8-A

Kayenta Mine

Navajo County, Arizona

for

PEABODY COAL COMPANY

Dames & Moore
10139-011-22

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INTRODUCTION

Sedimentation Structure N8-A will be an earthen 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 N8-A is shown on Plate 1, Site Plan.

This design report contains information specific to Structure N8-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 N8-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 N8-A has a 16.4-acre tributary drainage area and is located near Yellow Water Canyon at the Kayenta Mine. The watershed is classified as 100% reclaimed.

EMBANKMENT

A homogeneous earthen embankment was assumed for the hydraulic analysis and to develop the volume-elevation curve shown on Plate 2. Upstream and downstream slopes of 2:1 and 3:1 (horizontal to vertical), respectively, 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 N8-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 1985 for Peabody Coal Company and was used in the analyses of the structure.

STABILITY

The slopes of Structure N8-A 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 and the stable slopes chosen based on the category classification of the structure.

HYDROLOGY

The hydrologic analysis was completed using the U.S. Army Corps of Engineers generalized computer program HEC-1, Flood Hydrograph Package. Structure N8-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 N8-A was analyzed using the 10-year, 24-hour storm.

The following parameters were used in the hydrologic analysis:

1.	Water Course length, L	0.19	mi
2.	Elevation Difference, H	60	ft
3.	Time of Concentration, T_c	0.0788	h
4.	Lag time, $0.6T_c$	0.0473	h
5.	SCS Curve Number	81	
6.	Rainfall Depth, 10-year, 24-hour storm .	2.1	in.
	25-year, 6-hour storm. .	1.9	in.
7.	Drainage Area	16.4	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.

N8-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	20	24
Volume	acre-ft	0.90	0.70
Storage			
Peak Stage	ft	6650.09	--
Spillway Elevation . .	ft	6652.00	--
Peak Storage	acre-ft	0.90	--
Storage Capacity . . .	acre-ft	3.00	--
Outflow			
Peak Flow	cfs	0	2
Embankment Crest Elevation	ft	--	6653.50
Peak Stage	ft	--	6652.43
Freeboard	ft	--	1.07
Spillway Channel			
Flow Depth	ft	--	0.43
Critical Velocity. . .	fps	--	1.6
Manning's "n"		--	0.035
Outflow Channel			
Slope	%	--	36
Normal Velocity. . . .	fps	--	3.1
Normal Depth	ft	--	0.04
Manning's "n"		--	0.035

Spillway Channel

The spillway for N8-A will be a trapezoidal channel with the following dimensions:

Channel depth	1.5	ft
Channel width	15	ft
Channel length	40	ft
Side slopes (horizontal to vertical). .	3:1	
Average exit slope	0	percent

Outflow Channel

The outflow channel for Structure N8-A will be a trapezoidal channel with the following dimensions:

Channel width	15	ft
Channel length	55	ft
Side slopes (horizontal to vertical). .	3:1	
Average exit slope	36	percent

The alignment of the spillway and outflow channel are shown on Plate 1. The channel profile is shown on Plate 3 and the required dimensions are shown on Plate 4. Both the spillway and outflow channel should be protected against erosion using geotextile and gravel as shown on Plate 4.

STORAGE CAPACITY

The impoundment volume-elevation curve shown on Plate 2, Volume-Elevation Curve, N8-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 N8-A were made utilizing the Universal Soil Loss Equation with the following parameters:

1. Rainfall Factor, R 40
2. Soil Erodibility Factor, K 0.42
3. Slope Factor, LS 3.90
4. Cover Factor, C 0.15
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 N8-A is shown on Plate 2, Volume-Elevation Curve, N8-A, and the results of the sediment inflow analysis are summarized in the following table.

N8-A STORAGE

Total Storage Capacity	3.00	acre-ft
10-year, 24-hour Storm Inflow	0.90	acre-ft
Available Sediment Storage Capacity . .	2.1	acre-ft
Sediment Inflow Rate	0.0748	acre-ft/yr
Sediment Storage Life	28	yrs

* * *

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

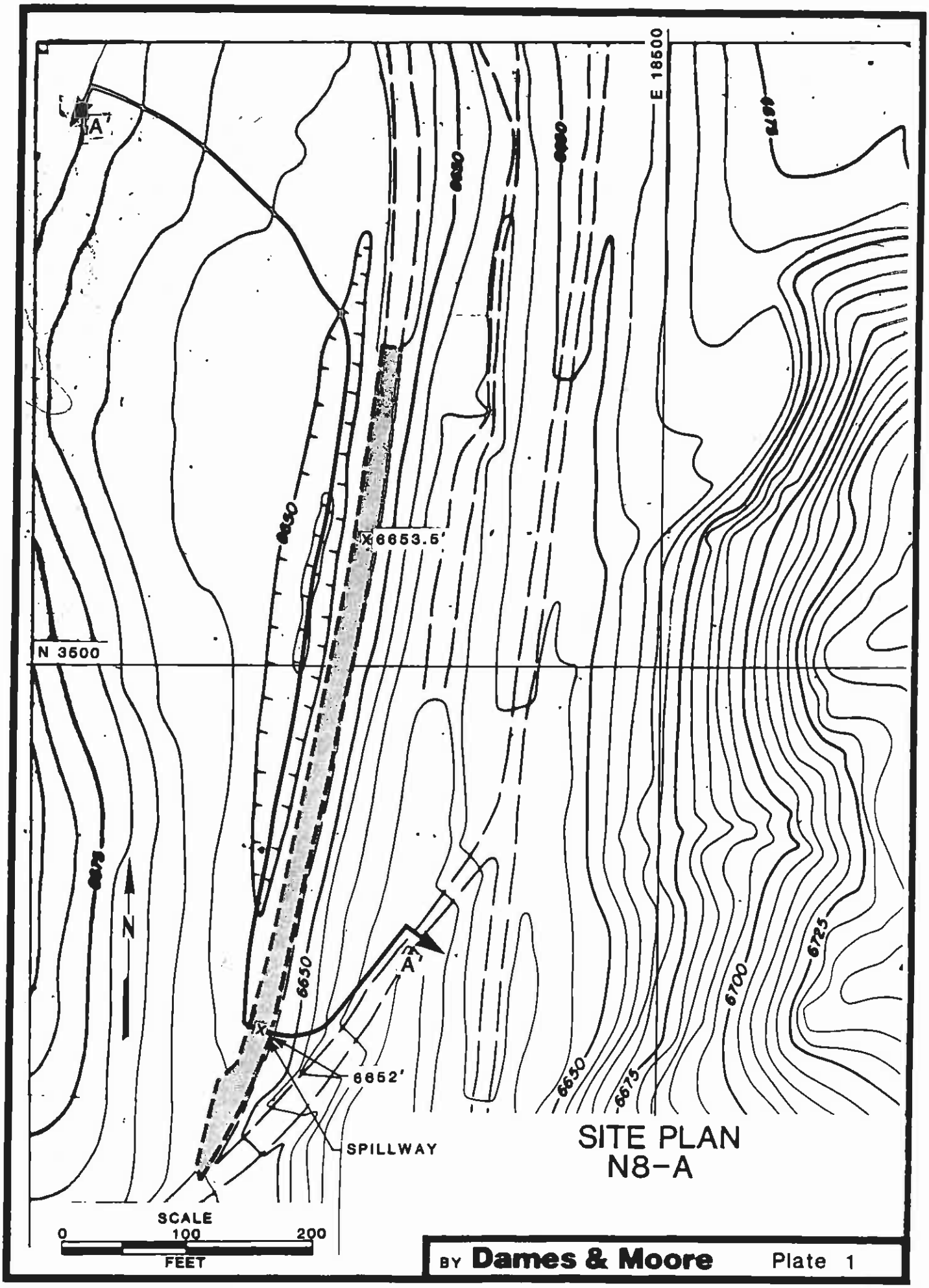
Plate 1 - Site Plan N8-A

Plate 2 - Volume-Elevation Curve N8-A

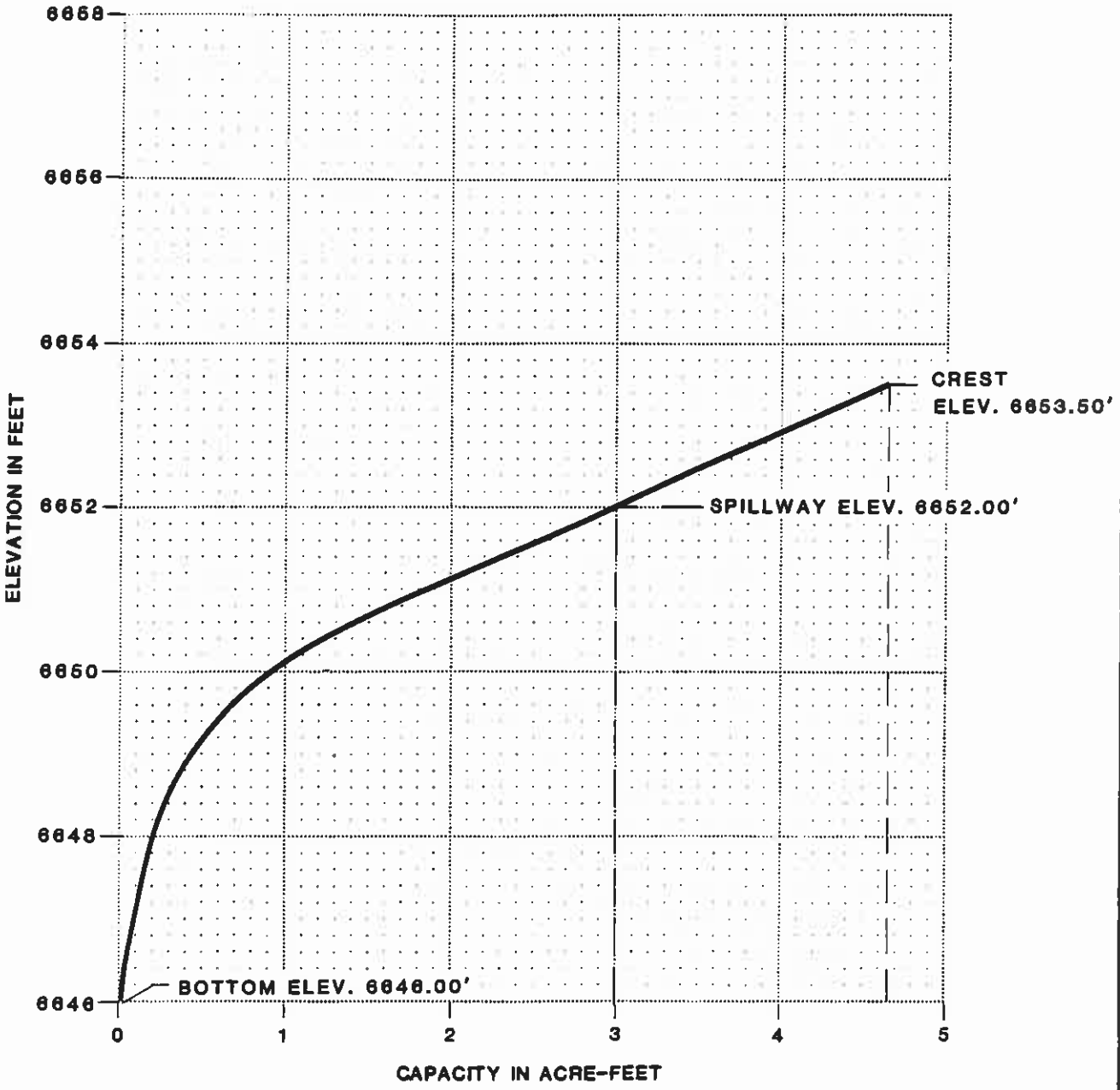
Plate 3 - Channel Profile N8-A, A-A'

Plate 4 - Spillway and Outflow Channel Cross Section N8-A

Appendix A - Hydrology and Hydraulic Calculations

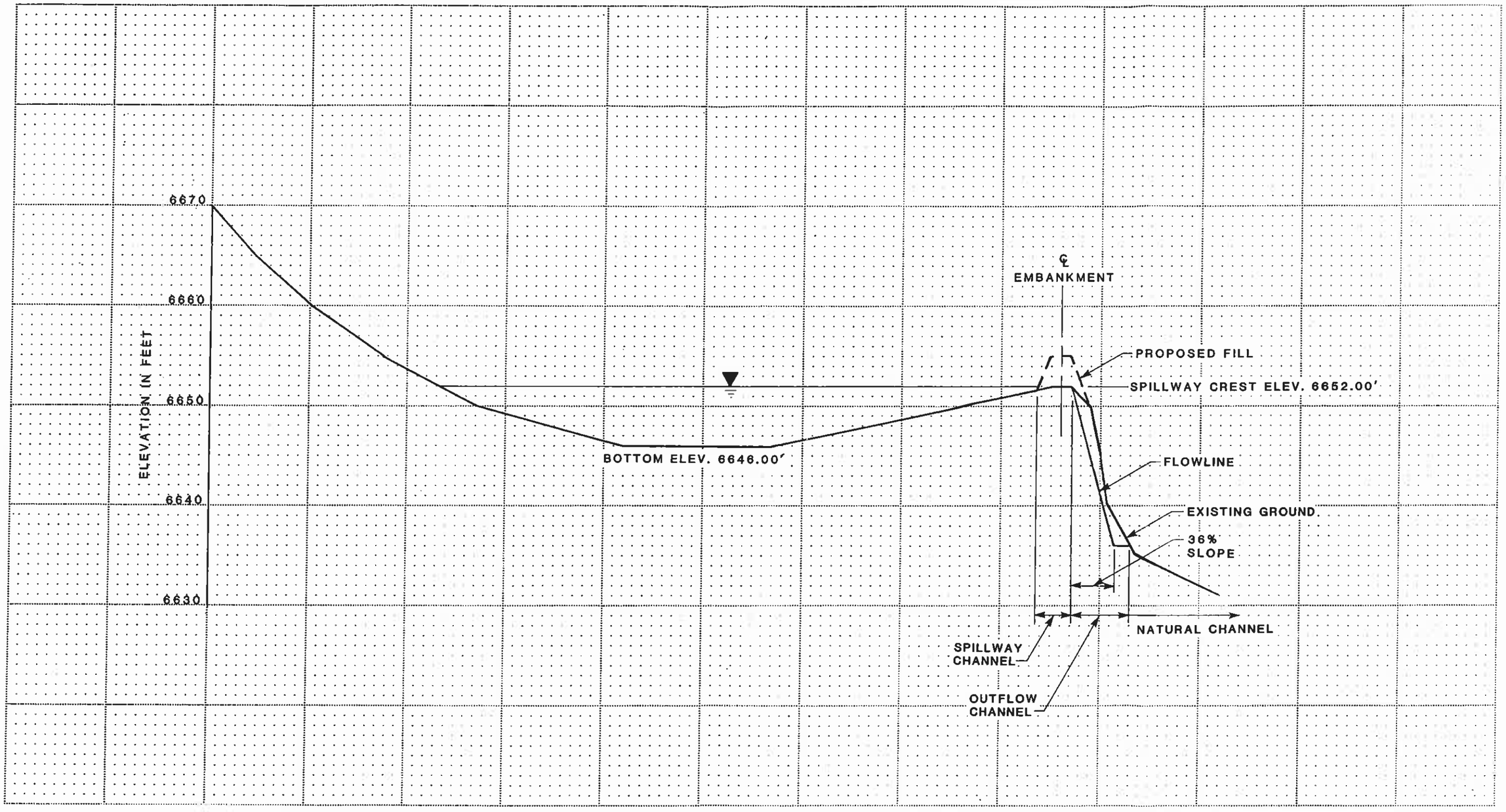


SITE PLAN
N8-A



VOLUME-ELEVATION CURVE N8-A

BY **Dames & Moore** Plate 2



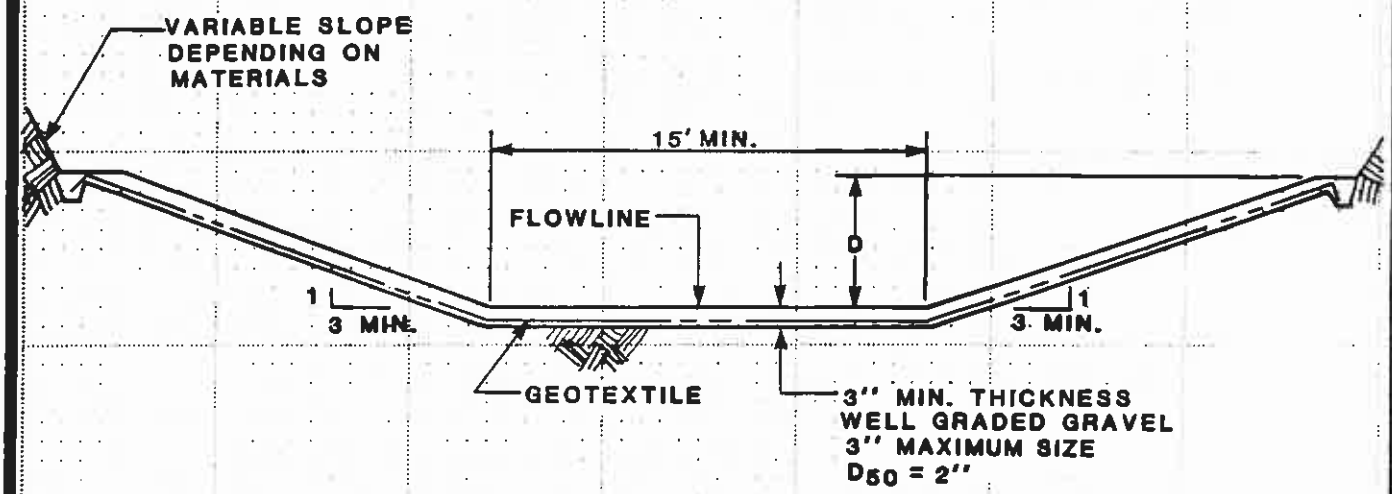
SCALE
0 100 200
FEET

CHANNEL PROFILE A-A'
N8-A

FOR LOCATION SEE PLATE 1

BY **Dames & Moore**

Plate 3



SPILLWAY CHANNEL

D = 1.5'

LENGTH = 40'

FLOWLINE ELEV.= 6652.00'

OUTFLOW CHANNEL

D = 1.0'

SPILLWAY AND OUTFLOW CHANNEL CROSS SECTION N8-A

BY **Dames & Moore** Plate 4

APPENDIX A

HYDROLOGY AND HYDRAULIC CALCULATIONS

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

TIME OF CONCENTRATION

ELEVATION DIFFERENCE = 60

WATER COURSE LENGTH = 990 = .19 mi

T_c = ~~0.0776~~ .0788 hr

LAG TIME = $0.6 T_c$ = ~~0.0776~~ .0473 hr

SCS CURVE NUMBER

DRAINAGE AREA (ac)	COVER TYPE	HYDROLOGIC CONDITION	SOIL TYPE	WEIGHTED CURVE NUMBER
16.4	reclaimed (post-law)	fair	—	81

DRAINAGE BASIN AREA

16.4 ACRE 0.0256 SQ MILE

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

FILE PEABODY COAL CO 10139-011-22
SUBJECT SEDIMENT INFLOW
N8-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 = EA#35

K = .42

SLOPE FACTOR

LENGTH (ft.)	Δ ELEV (ft.)	SLOPE (%)	LS
250	40	16	4.58 (.4) ✓
450	50	11.1	3.44 (.6) ✓
			3.90 ✓

COVER FACTOR

AREA (ac.)	COVER TYPE	% COVER	CANOPY (%)	WEIGHTED C
100%	reclaimed	—	—	.15

EROSION CONTROL FACTOR

P = 1.0

SEDIMENT INFLOW

$$A = 40(.42)(3.90)(.15)(1.0) = 9.83 \text{ ton/acre/year}$$

$$A = 9.83\left(\frac{1}{2047}\right)(16.4)(.95) = 0.0748 \text{ acre-feet/year}$$

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

Dames & Moore