INSPECTION REPORT

Sedimentation Structure

J16-D

Kayenta Mine

Navajo County, Arizona

for

PEABODY COAL COMPANY

Dames & Moore
10139-011-22

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INTRODUCTION

Sedimentation Structure J16-D is an earthen embankment, designed and constructed in 1982 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 J16-D is shown on Plate 1, Site Plan.

This inspection report contains information specific to Structure J16-D. 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

Structure J16-D was inspected on September 10, 1985 by an inter-disciplinary team of engineers from Dames & Moore. The purpose of the inspection was to assess the safety and general condition of the structure with respect to United States Department of Interior, Office of Surface Mining (OSM) regulations.

Dames & Moore's inspection was performed in accordance with applicable 30 CFR 780 and 816 regulations and included a review of the J16-D project files and a field inspection of the structure. The most current information contained in the Peabody Coal Company files includes the 1984 and current survey data and inspections performed in 1984 and 1985 by

ANALYSES

STABILITY

Structure J16-D is a category B-1 embankment. A standard category B-1 embankment has static and seismic factors of safety equal to or greater than 1.5 and 1.2, respectively, under the following conditions:

1. Maximum height = 15 ft
2. Maximum upstream slope = 1.75 H : 1 V
3. Maximum downstream slope = 2.5 H : 1 V
4. Normal pool with steady seepage saturation conditions

The J16-D embankment is lower in height and has flatter slopes than the category standard; therefore, the embankment has factors of safety greater than the design minimum.

HYDROLOGY

The hydrologic analysis was completed using the U.S. Army Corps of Engineers generalized computer program HEC-1, Flood Hydrograph Package. Structure J16-D 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 J16-D was analyzed using the 10-year, 24-hour storm.

	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	62	79
Volume	acre-ft	3.24	2.54
Storage			
Peak Stage	ft	6595.28	6596.61
Spillway Elevation . .	ft	6595.11	--
Peak Storage	acre-ft	--	--
Storage Capacity . . .	acre-ft	2.80	--
Outflow			
Peak Flow	cfs	1	42
Embankment Crest Elevation	ft	--	6598.00
Peak Stage	ft	--	6596.61
Freeboard	ft	--	1.39

Outflow Channel

The existing outflow channel for J16-D has a trapezoidal channel with the following dimensions:

Channel width	16 ft
Channel length	50 ft
Side slopes (horizontal to vertical)	2:1
Average exit slope	15 percent

Rock provides adequate erosion protection within the channel.

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 3, Volume-Elevation Curve, J16-D.

The calculations for the sediment load entering Structure J16-D were made utilizing the Universal Soil Loss Equation with the following parameters:

1. Rainfall Factor, R 40
2. Soil Erodibility Factor, K 0.37
3. Slope Factor, LS 4.00
4. Cover Factor, C 0.337
5. Erosion Control Factor, P 1.0

HYDRAULICS

The spillway capacity of Structure J16-D is adequate but the storage capacity is inadequate. The storage capacity should be increased to 7.24 acre-feet by excavating the pond as shown on Plates 1 and 4. The trapezoidal outflow channel should be extended 20 feet along the alignment shown in Plate 1. The channel profile is shown in Plate 4 and the required dimensions are shown in Plate 5. Both the spillway and outflow channel extension should be protected against erosion using geotextile and riprap as shown in Plate 5.

Enlarging the storage capacity to 7.24 acre-feet gives additional sediment storage. The analysis of these conditions is summarized in the following table.

* * *

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

Plate 1 - Site Plan J16-D

Plate 2 - Existing Maximum Cross Section J16-D, A-A'

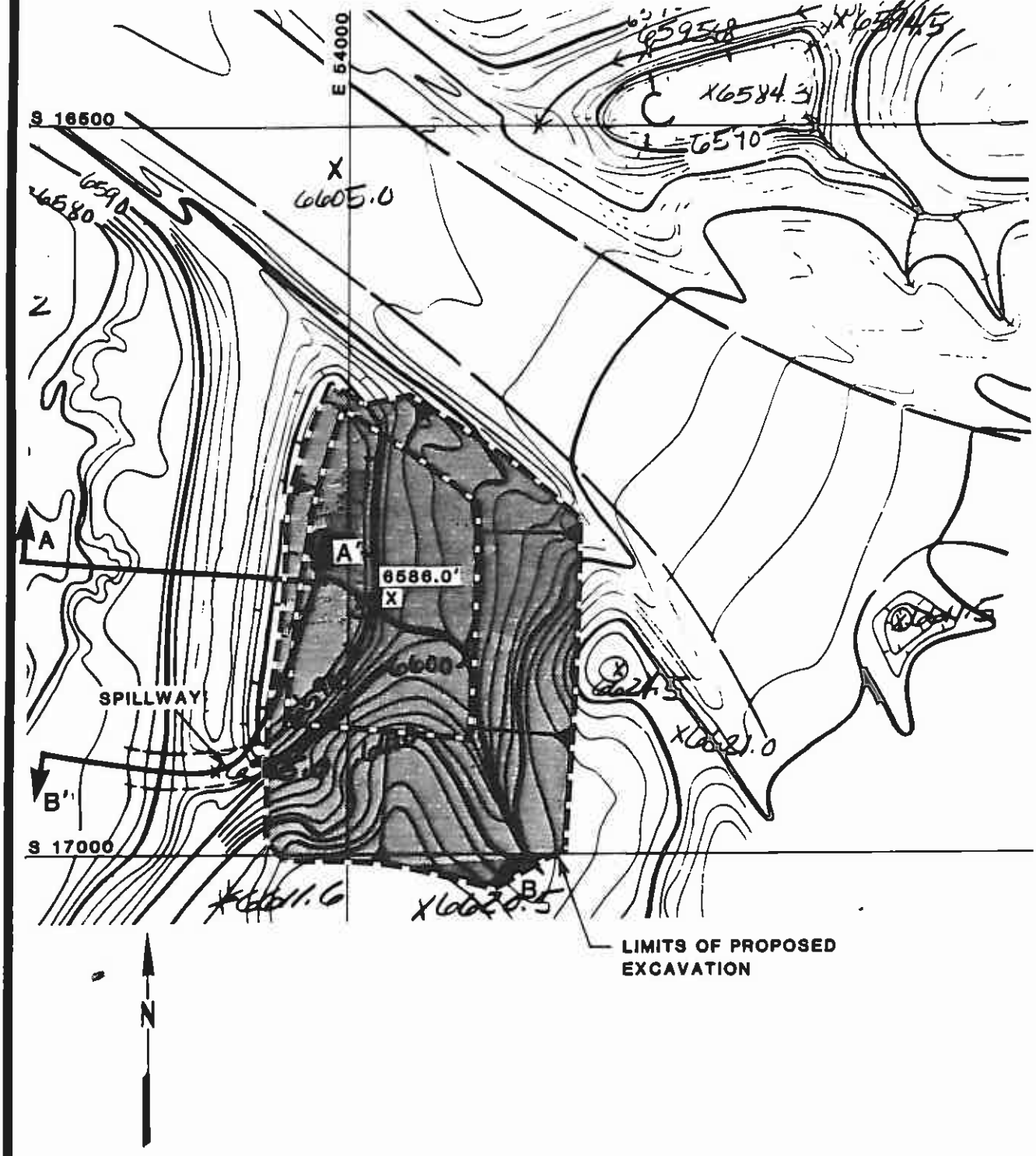
Plate 3 - Volume-Elevation Curve J16-D

Plate 4 - Channel Profile J16-D, B-B'

Plate 5 - Spillway and Outflow Channel Cross Section J16-D

Appendix A - Inspection Check List

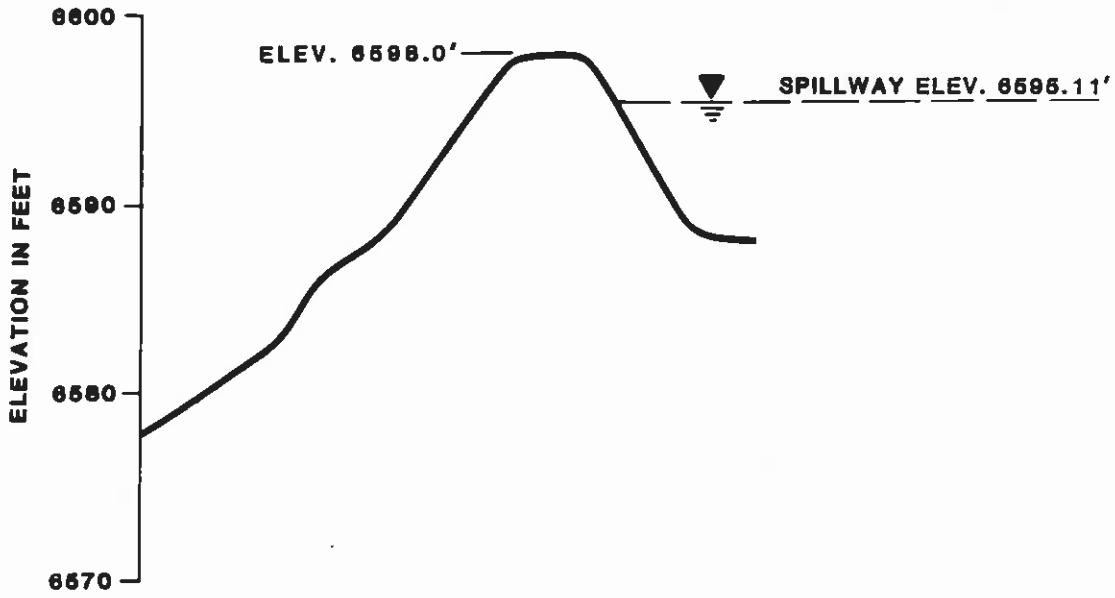
Appendix B - Hydrology and Hydraulic Calculations



SCALE
0 100 200
FEET

SITE PLAN
J16-D

BY **Dames & Moore** Plate 1



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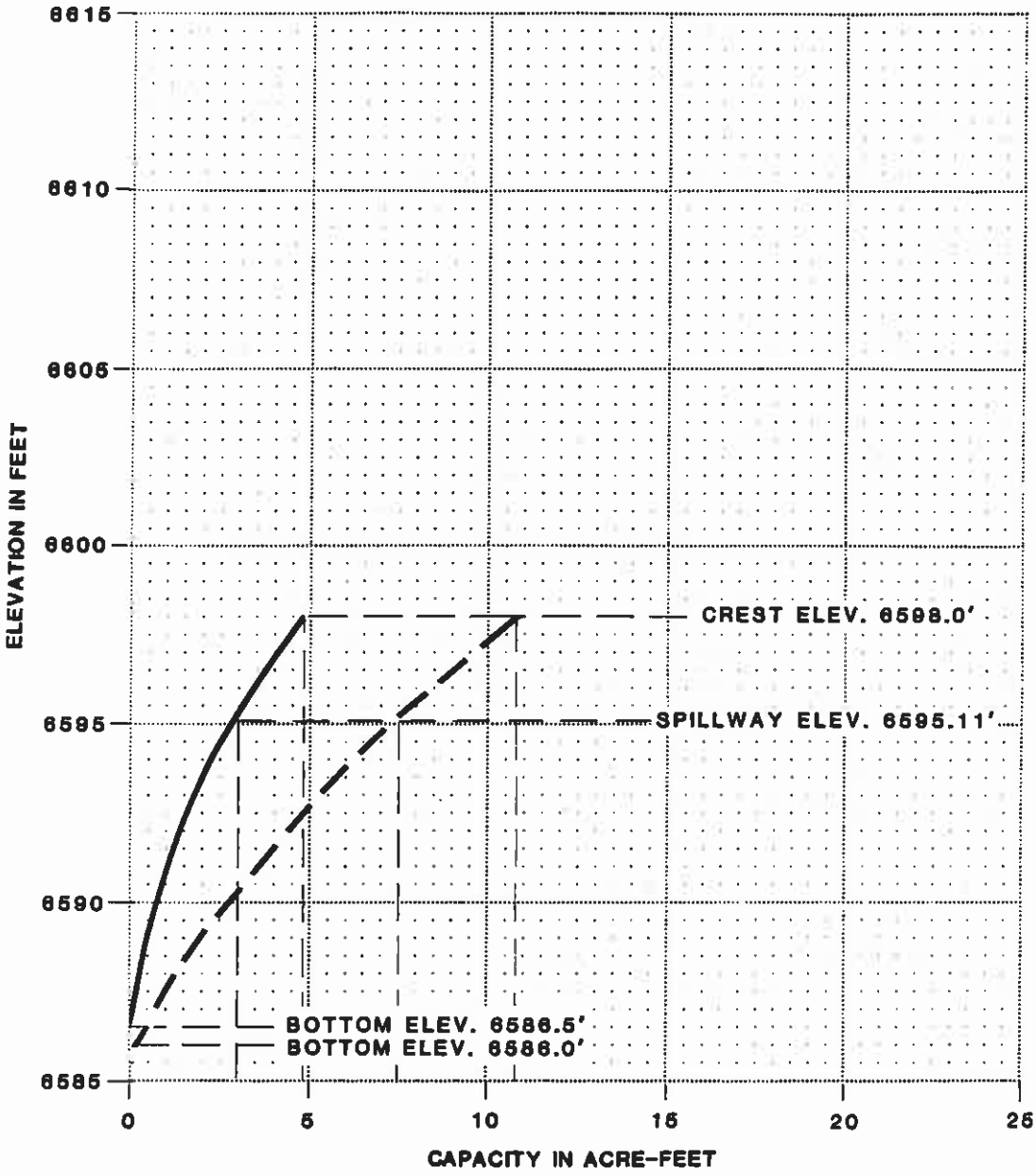
EXISTING MAXIMUM CROSS-SECTION A-A' J16-D

FOR LOCATION SEE PLATE 1

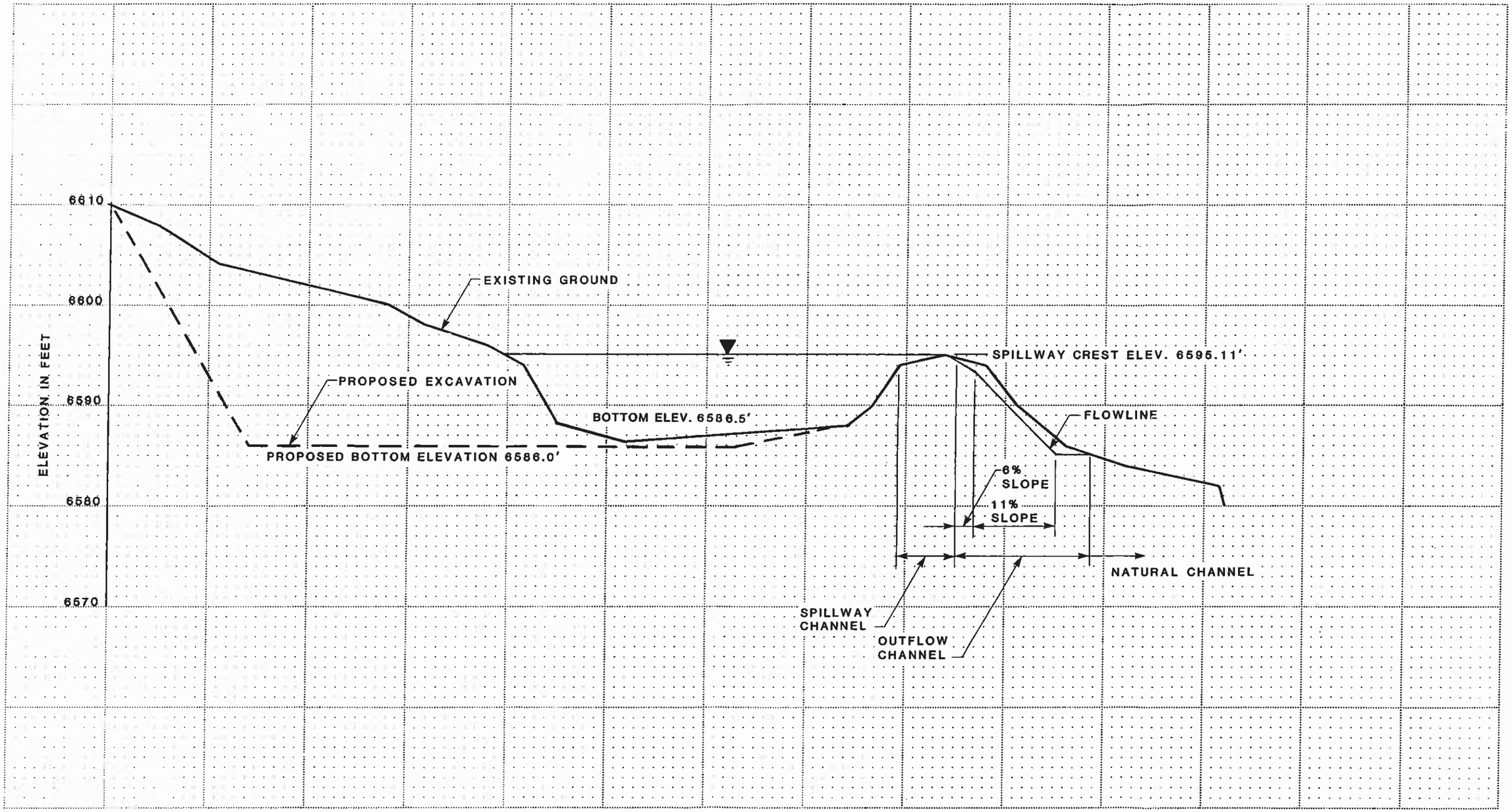
BY **Dames & Moore** Plate 2



EXISTING VOLUME
PROPOSED VOLUME

VOLUME-ELEVATION CURVE J16-D

BY **Dames & Moore** Plate 3

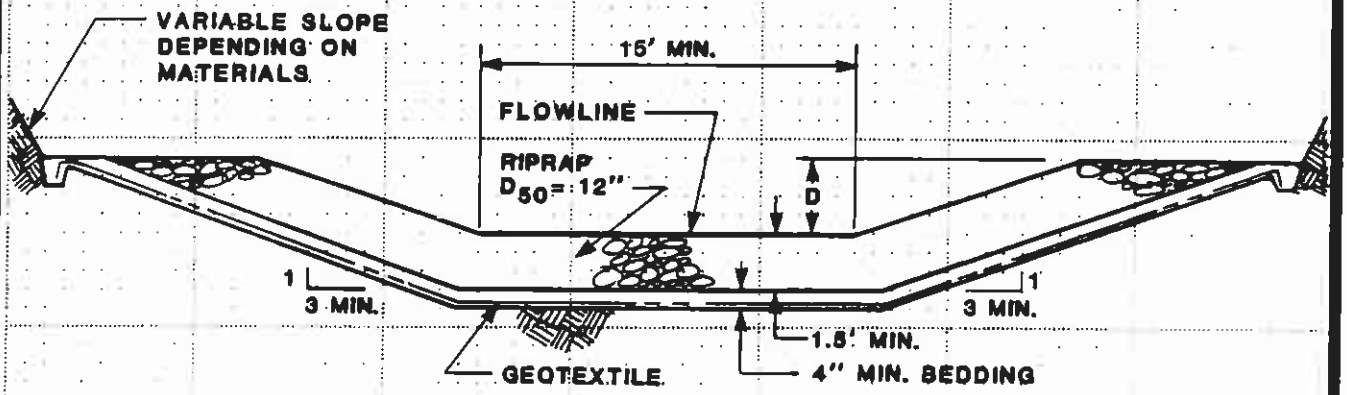


SCALE
0 50 100
FEET

CHANNEL PROFILE B-B'
J16-D

FOR LOCATION SEE PLATE 1

BY **Dames & Moore** Plate 4



SPILLWAY CHANNEL

D = 2.3'

LENGTH = 30'

FLOWLINE ELEV. = 6595.11'

OUTFLOW CHANNEL

D = 1.5'

SPILLWAY AND OUTFLOW CHANNEL CROSS SECTION J16-D

BY **Dames & Moore** Plate 5

APPENDIX A

INSPECTION CHECK LIST

Sediment Impoundment Name: J16-D
Page: 4

INSPECTION CHECK LIST

ITEM	YES	NO	REMARKS
1. CREST			16'W.
a. Any visual settlements?		X	
b. Misalignment?		X	
c. Cracking?	X		Minor cracks towards spillway
2. UPSTREAM SLOPE			Slope uneven / not trimmed 21°
a. Adequate grass cover?	X		70%
b. Any erosion?	X		Rills
c. Are trees growing on slope?		X	
d. Longitudinal cracks?		X	
e. Transverse cracks?		X	
f. Adequate riprap protection?	X		Grass
g. Any stone deterioration?			NA
h. Visual depressions or bulges?		X	
i. Visual settlements?		X	
j. Animal burrows?		X	
3. DOWNSTREAM SLOPE			19°
a. Adequate grass cover?	X		70%
b. Any erosion?	X		Rills
c. Are trees growing on slope?		X	
d. Longitudinal cracks?		X	
e. Transverse cracks?		X	
f. Visual depressions or bulges?		X	
g. Visual settlements?		X	
h. Is the toe drain dry?			NA
i. Are the relief wells flowing?			NA
j. Are boils present at the toe?		X	
k. Is seepage present?		X	
l. Animal burrows?		X	
4. ABUTMENT CONTACT. RIGHT			
a. Any erosion?	X		Gulley from Haul road
b. Visual differential movement?		X	
c. Any cracks noted?		X	
d. Is seepage present?		X	
e. Type of Material?			Haul road fill
5. ABUTMENT CONTACT. LEFT			
a. Any erosion?		X	
b. Visual differential movement?		X	
c. Any cracks noted?		X	
d. Is seepage present?		X	
e. Type of Material?			Fill from J16-E

Sediment Impoundment Name: J16-D
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ITEM	YES	NO	REMARKS
6. SPILLWAY/NORMAL			
a. Location:			
Left abutment?	X		
Right abutment?			
Crest of Embankments?			
b. Approach Channel:	X		V shaped hills
Are side slopes eroding?	X		
Are side slopes sloughing?		X	
Bottom of channel eroding?		X	
Obstructed?		X	
Erosion protection?		X	
c. Spillway Channel:	X		16'W. 21' L 3.6' below Crest 0% Slope
Are side slopes eroding?		X	
Are side slopes sloughing?		X	
Bottom of channel eroding?		X	
Obstructed?		X	
Erosion protection?		X	
d. Outflow Channel:	X		15° Slope 16'W 50'L
Are side slopes eroding?		X	
Are side slopes sloughing?		X	
Bottom of channel eroding?		X	
Obstructed?		X	
Erosion protection?	X		D50 12"
e. Weir:			
Condition?			
7. SPILLWAY/EMERGENCY			NA
a. Location:			
Left abutment?			
Right abutment?			
Crest of Embankments?			
b. Approach Channel:			
Are side slopes eroding?			
Are side slopes sloughing?			
Bottom of channel eroding?			
Obstructed?			
Erosion protection?			
c. Spillway Channel:			
Are side slopes eroding?			
Are side slopes sloughing?			
Bottom of channel eroding?			
Obstructed?			
Erosion protection?			
d. Outflow Channel:			
Are side slopes eroding?			
Are side slopes sloughing?			
Bottom of channel eroding?			
Obstructed?			
Erosion protection?			
e. Weir:			
Condition?			

Sediment Impoundment Name: J16-D
Page: 6

ITEM	YES	NO	REMARKS
8. IMPOUNDMENT			
a. Sinkholes?		X	(Elev.) feet
b. Water present?	X		(Elev.) feet
c. Siltation?	X		
d. Watershed matches soil map?		X	

9. GENERAL COMMENTS

Some cracks in crest toward spillway end. Not serious.

Canopy 0 %
Ground 30 %

APPENDIX B

HYDROLOGY AND HYDRAULIC CALCULATIONS

FILE PEABODY COAL CO 10139-01.-22
SUBJECT SEDIMENT POND HYDROLOGY
JHD SHEET ___ OF ___

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

TIME OF CONCENTRATION

ELEVATION DIFFERENCE = 6750 - 6595 = 155 ft.

WATER COURSE LENGTH = 5.2 in. = 2080 ft. = 0.394 mi. ✓

$$T_c = \left(\frac{11.9\ (0.394)^3}{155}\right)^{0.385} = 0.127 \text{ hr.}$$ ✓

LAG TIME = $0.6\,T_c$ = 0.076 hr. ✓

SCS CURVE NUMBER

DRAINAGE AREA (ac)	COVER TYPE	HYDROLOGIC CONDITION	SOIL TYPE	WEIGHTED CURVE NUMBER
2.3	S-G	poor	D	(85) .04
10.8	road	—	D	(89) .21
38.5	reclaimed (post-law)	fair	—	(81) .75
				82.8 ✓

25% EH #22
75% EH #35

use 83

DRAINAGE BASIN AREA

51.6 ACRE 0.081 SQ MILE ✓

BY S. DEL AN DATE 10-2-85
CHECKED BY BHM 10/24/85
COPY TO EO ___

FILE PEABODY COAL CO 10139-011-22
SUBJECT SEDIMENT INFLOW
J16-D SHEET ___ OF ___

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

UNIVERSAL SOIL LOSS EQUATION

RAINFALL FACTOR

R = 40

SOIL ERODIBILITY FACTOR

SOIL TYPE = 25% EH #22 (.22)(.25)
75% EH #35 (.42)(.75)
.37 ✓

K = .37

SLOPE FACTOR

LENGTH (ft.)	Δ ELEV (ft.)	SLOPE (%)	LS
500	70	14.0	5.1 (.45)
600	70	11.7	4.2 (.15)
400	35	8.8	2.3 (.20)
300	35	11.7	3.0 (.20)
			3.98

use 4.0 ✓

COVER FACTOR

AREA (ac.)	COVER TYPE	% COVER	CANOPY (%)	WEIGHTED C
4%	S-G	10	25	.04 (.36)
21%	disturbed	—	—	.21 (1.0)
75%	reclaimed	—	—	.75 (.15)
				C = .337 ✓

EROSION CONTROL FACTOR

P = 1.0

SEDIMENT INFLOW

$A = 40(.37)\left(\frac{4.0}{40}\right)(.337)(1.0) = 19.95$ ton/acre/year ✓

$A = (19.95)\left(\frac{1}{2047}\right)(57.6)(.95) = .478$ acre-feet/year ✓

BY ___ DATE ___ CHECKED BY BHM 10/24/85 COPY TO EO ___

Dames & Moore