

DESIGN REPORT
Sedimentation Structure
J7-B1
Black Mesa Mine
Navajo County, Arizona
for
PEABODY COAL COMPANY



Dames & Moore
10139-011-22

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INTRODUCTION

Sedimentation Structure J7-B1 will be a partially incised structure with 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 Black Mesa Mine. The location of Structure J7-B1 is shown on Plate 1, Site Plan.

This design report contains information specific to Structure J7-B1. 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 J7-B1 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 J7-B1 has a 270.7-acre tributary drainage area and is located near Red Peak Valley at the Black Mesa Mine. The watershed is classified as 57% reclaimed and 43% disturbed.

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. The incised portion of the structure will be excavated with 3:1 (horizontal to vertical) slopes.

DESIGN ANALYSES

GENERAL

Structure J7-B1 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 J7-B1 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 J7-B1 is located upstream from Structure J7-B. The two structures have a combined storage capacity that is greater than 20 acre-feet. However, the spillway for J7-B1 was analyzed using the 25-year, 6-hour storm because J7-B is the upstream structure. The storage capacity of Structure J7-B1 was analyzed using the 10-year, 24-hour storm.

The following parameters were used in the hydrologic analysis:

1.	Water Course length, L	1.30	mi
2.	Elevation Difference, H	85	ft
3.	Time of Concentration, T _c	0.637	h
4.	Lag time, 0.6T _c	0.382	h
5.	SCS Curve Number _S	87	
6.	Rainfall Depth, 10-year, 24-hour storm .	2.1	in.
	25-year, 6-hour storm. .	1.9	in.
7.	Drainage Area	270.7	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.

J7-B1 HYDRAULICS

	Units	10-year 24-hour Storm	25-year 6-hour Storm
<hr/>			
Initial Reservoir Volume			
Condition		Empty	Full to the spillway elevation
Inflow			
Peak Flow	cfs	227	257
Volume	acre-ft	21.88	17.82
Storage			
Peak Stage	ft	6386.14	--
Spillway Elevation . .	ft	6387.00	--
Peak Storage	acre-ft	21.88	--
Active Storage			
Capacity	acre-ft	11.41	--
Incised Storage			
Capacity	acre-ft	13.75	--
Total Storage			
Capacity	acre-ft	25.16	--
Outflow			
Peak Flow	cfs	0	107
Embankment Crest			
Elevation	ft	--	6390.50
Peak Stage	ft	--	6389.25
Freeboard	ft	--	1.25
Spillway Channel			
Flow Depth	ft	--	2.25
Critical Velocity. . .	fps	--	5.4
Manning's "n"		--	0.040
Outflow Channel			
Slope	%	--	5
Normal Velocity. . . .	fps	--	6.9
Normal Depth	ft	--	0.88
Manning's "n"		--	0.040

Spillway Channel

The spillway for J7-B1 will be a trapezoidal channel with the following dimensions:

Channel depth	3.3 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 J7-B1 will be a trapezoidal channel with the following dimensions:

Channel width	15 ft
Channel length	140 ft
Side slopes (horizontal to vertical). .	3:1
Average exit slope	5 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 riprap as shown on Plate 4.

STORAGE CAPACITY

The impoundment volume-elevation curve shown on Plate 2, Volume-Elevation Curve, J7-B1 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 J7-B1 were made utilizing the Universal Soil Loss Equation with the following parameters:

1. Rainfall Factor, R 40
2. Soil Erodibility Factor, K 0.317
3. Slope Factor, LS 1.61
4. Cover Factor, C 0.52
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 J7-B1 is shown on Plate 2, Volume-Elevation Curve, J7-B1, and the results of the sediment inflow analysis are summarized in the following table.

J7-B1 STORAGE

Total Storage Capacity	25.16	acre-ft
10-year, 24-hour Storm Inflow	21.88	acre-ft
Available Sediment Storage Capacity . .	3.28	acre-ft
Sediment Inflow Rate	1.264	acre-ft/yr
Sediment Storage Life	3	yrs

* * *

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

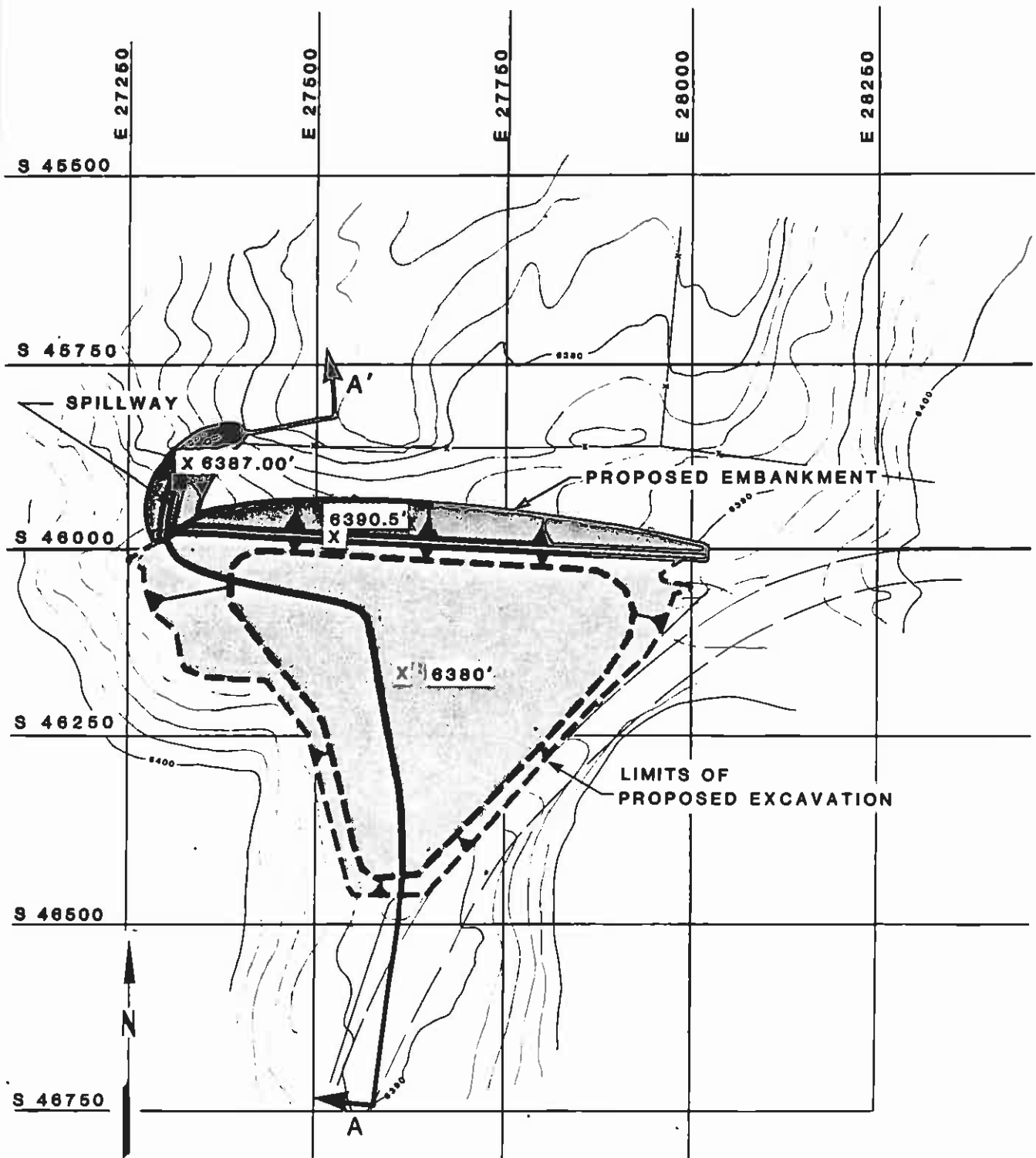
Plate 1 - Site Plan J7-B1

Plate 2 - Volume-Elevation Curve J7-B1

Plate 3 - Channel Profile J7-B1, A-A'

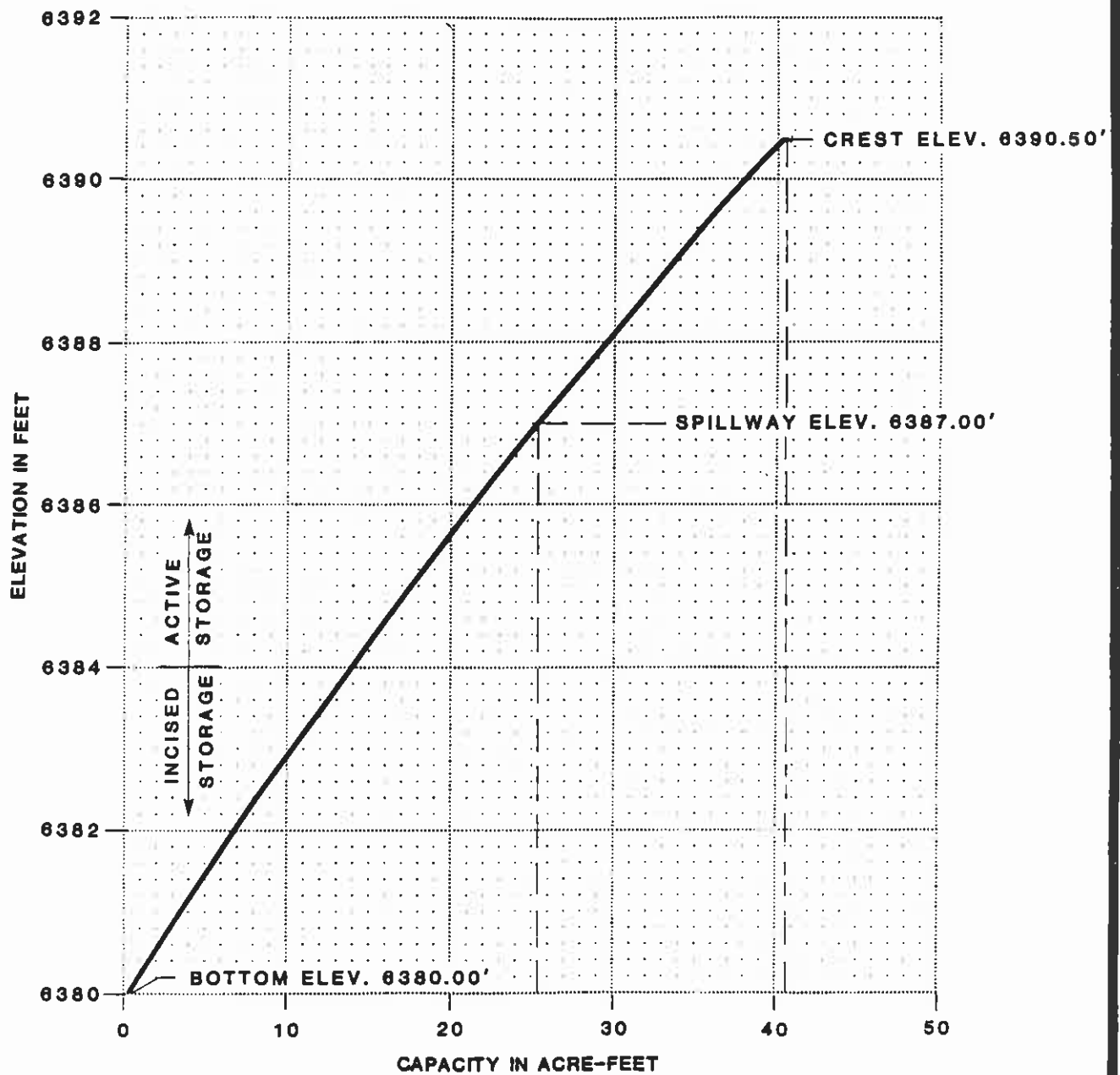
Plate 4 - Spillway and Outflow Channel Cross Section J7-B1

Appendix A - Hydrology and Hydraulic Calculations

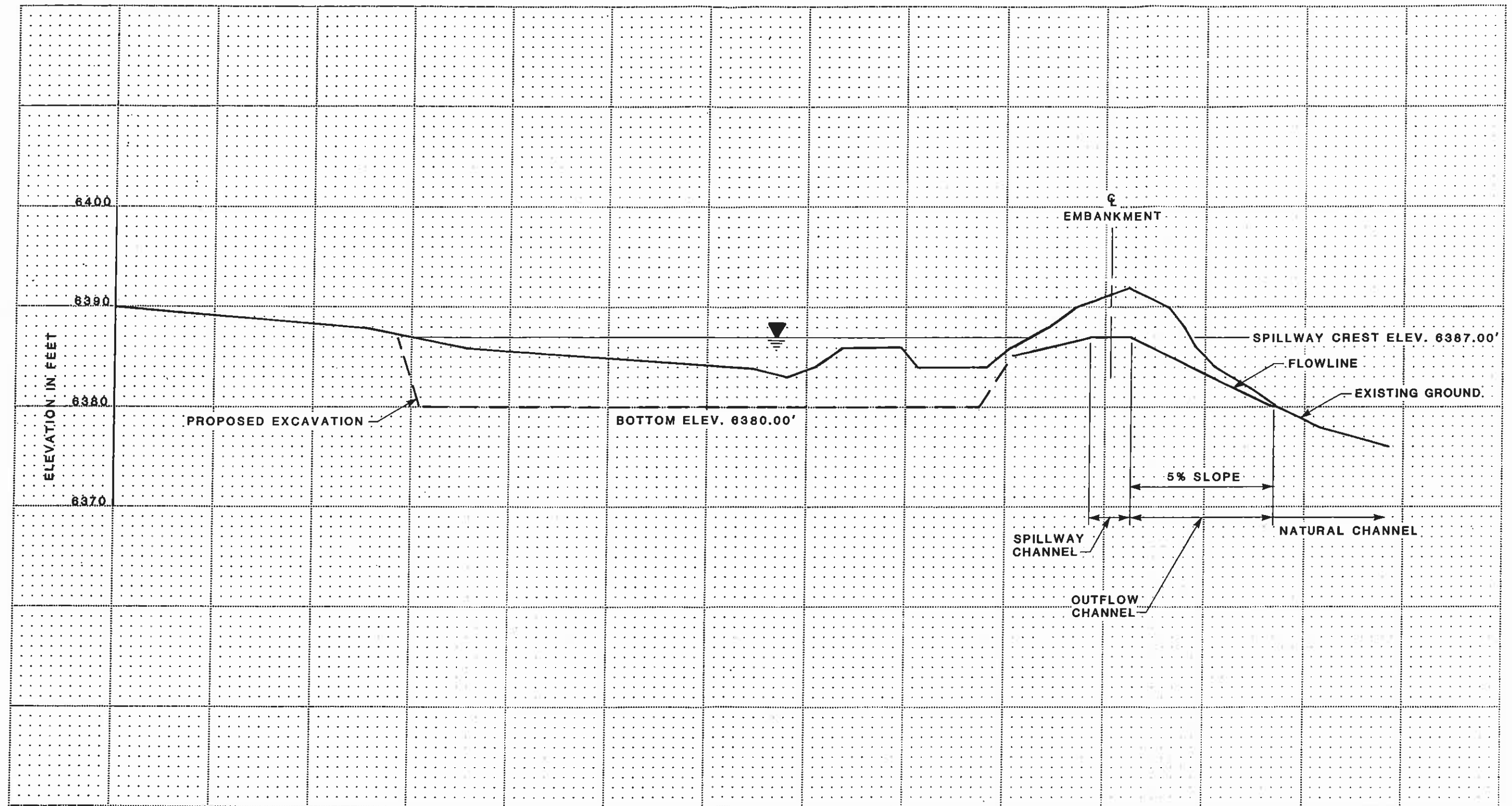


**SITE PLAN
J7-B1**

SCALE
0 200 400
FEET



VOLUME-ELEVATION
CURVE
J7-B1

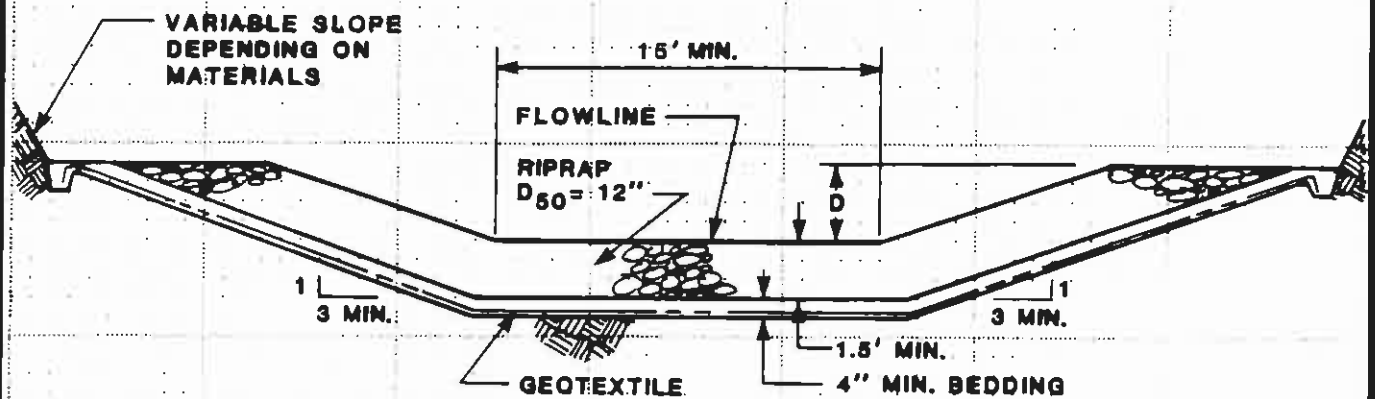


CHANNEL PROFILE A-A'
J7-B1

SCALE
0 100 200
FEET

FOR LOCATION SEE PLATE 1

BY **Dames & Moore** Plate 3



SPILLWAY CHANNEL

$D = 3.3'$

LENGTH $\approx 40'$

FLOWLINE ELEV. = 8387.00'

OUTFLOW CHANNEL

$D = 2'$

**SPILLWAY AND
OUTFLOW CHANNEL
CROSS SECTION
J7-B1**

APPENDIX A
HYDROLOGY AND HYDRAULIC CALCULATIONS

TIME OF CONCENTRATION

ELEVATION DIFFERENCE = ~~350'~~ 6470 - 6385 = 85 ft.

WATER COURSE LENGTH = 6974. = ~~1.32~~ 17.2(400) = 6980 ft. = 1.30 mi

$T_c = .376 \text{ hr} \left(\frac{11.9 (1.30)^3}{85} \right)^{0.385} = 0.637 \text{ hr}$

Lag Time = $0.6 T_c = .226 \text{ hr.} = 0.382 \text{ hr.}$

SCS CURVE NUMBER

DRAINAGE AREA (ac)	COVER TYPE	HYDROLOGIC CONDITION	SOIL TYPE	WEIGHTED CURVE NUMBER
116.8	disturbed	—	D	94 (.43)
153.9	reclaimed (post law)	—	D	81 (.57)
				<u>86.6</u>

use 87

57% EH # 35

43% EH # 23

DRAINAGE BASIN AREA

270.7 ACRES 0.423 SQ MILE

UNIVERSAL SOIL LOSS EQUATION

RAINFALL FACTOR

$$R = 40$$

SOIL ERODIBILITY FACTOR

$$\begin{array}{rcl} \text{SOIL TYPE} = & 57\% \text{ EH \#35} & .57 (0.42) \\ & 43\% \text{ EH \#23} & .43 (.18) \\ & & \hline & & .317 \checkmark \end{array}$$

$$K = .317$$

SLOPE FACTOR

<u>LENGTH (ft.)</u>	<u>Δ ELEV (ft.)</u>	<u>SLOPE (%)</u>	<u>LS</u>
600	30	5.0	1.31 (.7) ✓
900	60	6.7	2.32 (.3) ✓
			<u>1.61 ✓</u>

COVER FACTOR

<u>AREA (ac)</u>	<u>COVER TYPE</u>	<u>% COVER</u>	<u>CANOPY (%)</u>	<u>WEIGHTED C</u>
43%	disturbed	—	—	1.0 (.43)
57%	reclaimed	60	25	.15 (.57)
				<u>C = .52 ✓</u>

EROSION CONTROL FACTOR

$$P = 1.0$$

SEDIMENT INFLOW

$$A = 40 (.317) (1.61) (.52) (1.0) = 10.62 \quad \text{ton/acre/year} \checkmark$$

$$A = 10.62 \left(\frac{1}{2047} \right) (270.7) (.9) = 1.264 \quad \text{acre feet/year} \checkmark$$

REVISIONS
 BY DATE TO EO
 BY DATE TO EO

BY DATE
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