KM-A2 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	87	120
Volume	acre-ft	4.52	3.75
Storage			
Peak Stage	ft	6517.36	6519.05
Spillway Elevation . .	ft	6517.40	--
Peak Storage	acre-ft	4.52	--
Storage Capacity . . .	acre-ft	4.54	--
Outflow			
Peak Flow	cfs	0	107
Embankment Crest Elevation	ft	—	6522.00
Peak Stage	ft	--	6519.05
Freeboard	ft	--	1.95
Spillway Channel			
Flow Depth	ft	--	1.65
Critical Velocity. . .	fps	—	4.7
Manning's "n"		—	0.040
Outflow Channel			
Slope	%	--	20
Normal Velocity. . . .	fps	--	8.8
Normal Depth	ft	--	0.4
Manning's "n"		--	0.040

Approach Channel

The existing approach channel for KM-A2 has a trapezoidal channel with following dimensions:

Channel width	30 ft
Channel length	30 ft
Side slopes (horizontal to vertical). .	2:1
Average exit slope	23 percent

Spillway Channel

The existing spillway for KM-A2 has a trapezoidal channel with the following dimensions:

Channel depth	2.5 ft
Channel width	30 ft
Channel length	15 ft
Side slopes (horizontal to vertical). .	2:1
Average exit slope	0 percent

One-half of the channel is riprapped with rock providing some erosion protection within the channel.

Outflow Channel

The existing outflow channel for KM-A2 has a trapezoidal channel with the following dimensions:

Channel width	30 ft
Channel length	90 ft
Side slopes (horizontal to vertical). .	2:1
Average exit slope	12 percent

Rock provides 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, KM-A2.

The calculations for the sediment load entering Structure KM-A2 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 5.59
4. Cover Factor, C 0.731
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 existing storage capacity of KM-A2 and the results of the sediment inflow analysis are summarized in the following table.

KM-A2 STORAGE

Total Storage Capacity	4.54	acre-ft
10-year, 24-hour Storm Inflow	4.52	acre-ft
Available Sediment Storage Capacity . .	0.02	acre-ft
Sediment Inflow Rate	0.569	acre-ft/yr
Sediment Storage Life	0	yrs

Structure KM-A2 is located upstream from Structure KM-A3. Although KM-A2 has almost no sediment storage capacity, the two structures together have sufficient storage for the 10-year, 24-hour storm and 8 years of sediment inflow. Parameters used to calculate the sediment inflow to Structure KM-A3 and the results of the combined sediment inflow analysis are summarized in the following tables.

UNIVERSAL SOIL LOSS EQUATION PARAMETERS STRUCTURE KM-A3

Rainfall Factors, R	40
Soil Erodibility Factor, K	0.36
Slope Factor, LS	14.20
Cover Factor, C	0.501
Erosion Control Factor, P	1.0

COMBINED STORAGE FOR KM-A2 AND KM-A3

	KM-A2	KM-A3	Total	
Total Storage Capacity	4.54	12.25	16.79	acre-ft
10-year, 24-hour Storm Inflow	4.52	1.11	5.63	acre-ft
Available Sediment Storage Capacity . .	0.02	11.14	11.16	acre-ft
Sediment Inflow Rate	0.569	0.913	1.48	acre-ft/yr
Sediment Storage Life	--	—	7.5	yrs

REMEDIAL COMPLIANCE PLAN

GEOTECHNICS

The inspection of Structure KM-A2 indicated that the only geotechnical problem is rill erosion on the upstream and downstream slopes, the side slopes of the spillway channel. Correction of erosion is considered a periodic maintenance task and does not require remedial action.

HYDRAULICS

The storage capacity and spillway capacity of Structure KM-A2 are adequate. The outflow channel is protected with riprap but the spillway channel is not. The spillway channel should be protected against erosion using geotextile and riprap as shown in Plate 5. Plate 4 shows the existing spillway and outflow channel profile and Plate 5 shows the channel dimensions.

* * *

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

Plate 1 - Site Plan KM-A2

Plate 2 - Existing Maximum Cross Section KM-A2, A-A'

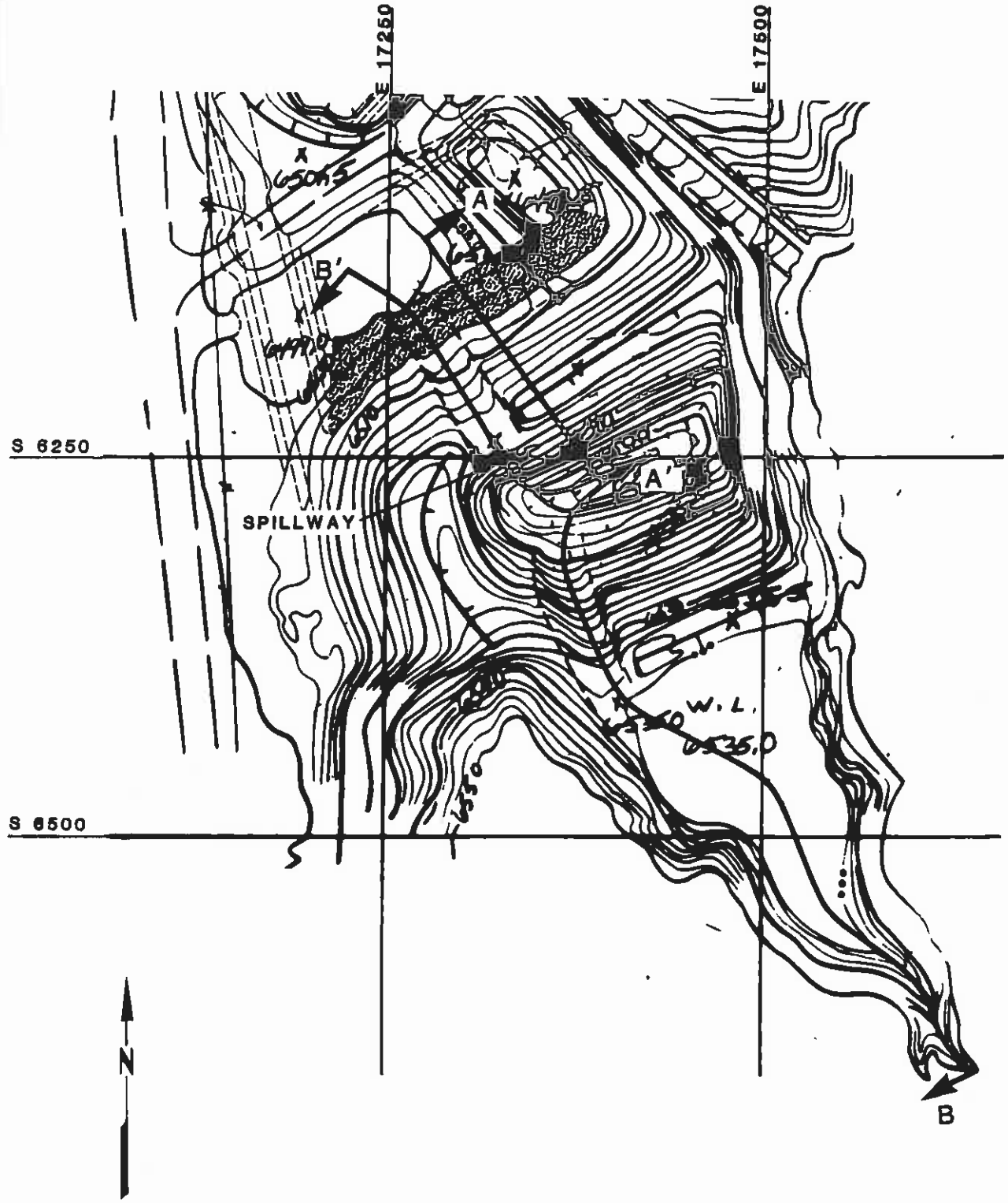
Plate 3 - Volume-Elevation Curve KM-A2

Plate 4 - Channel Profile KM-A2, B-B'

Plate 5 - Spillway Channel Cross Section KM-A2

Appendix A - Inspection Check List

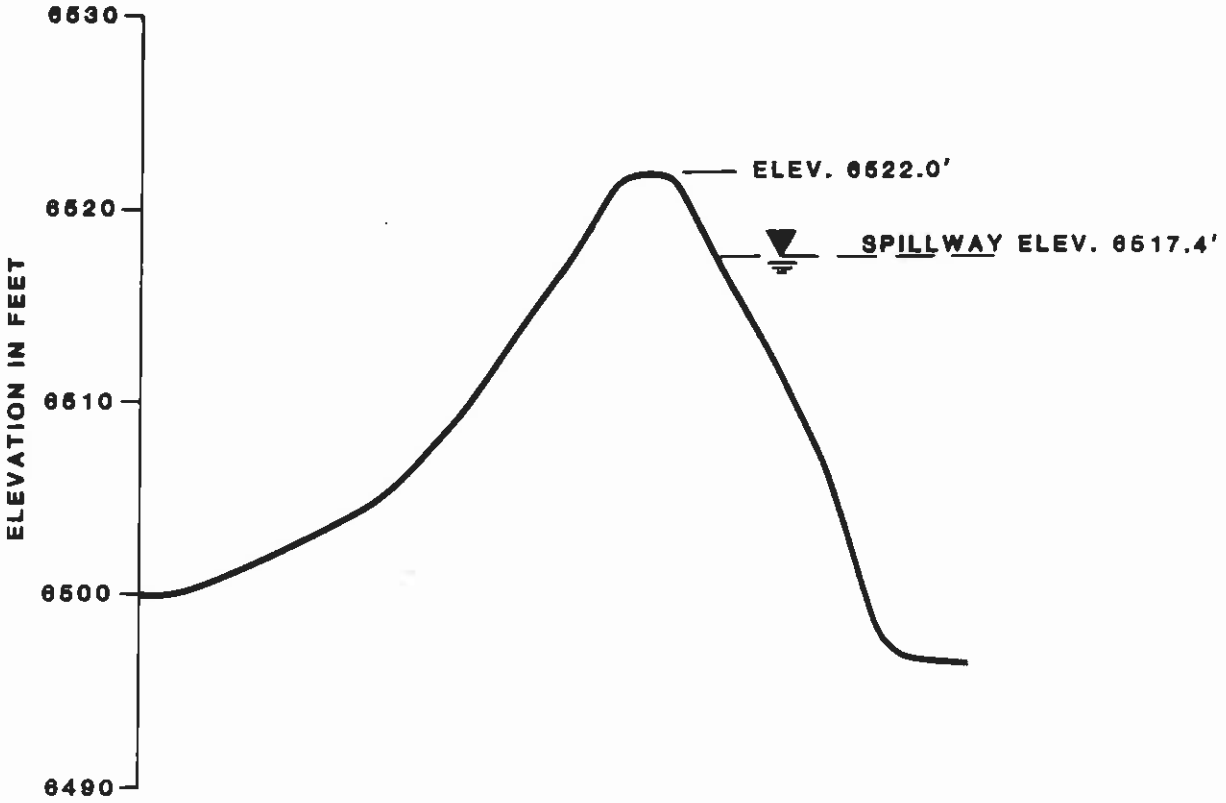
Appendix B - Hydrology and Hydraulic Calculations



SCALE
0 100 200
FEET

SITE PLAN
KM-A2

BY **Dames & Moore** Plate 1

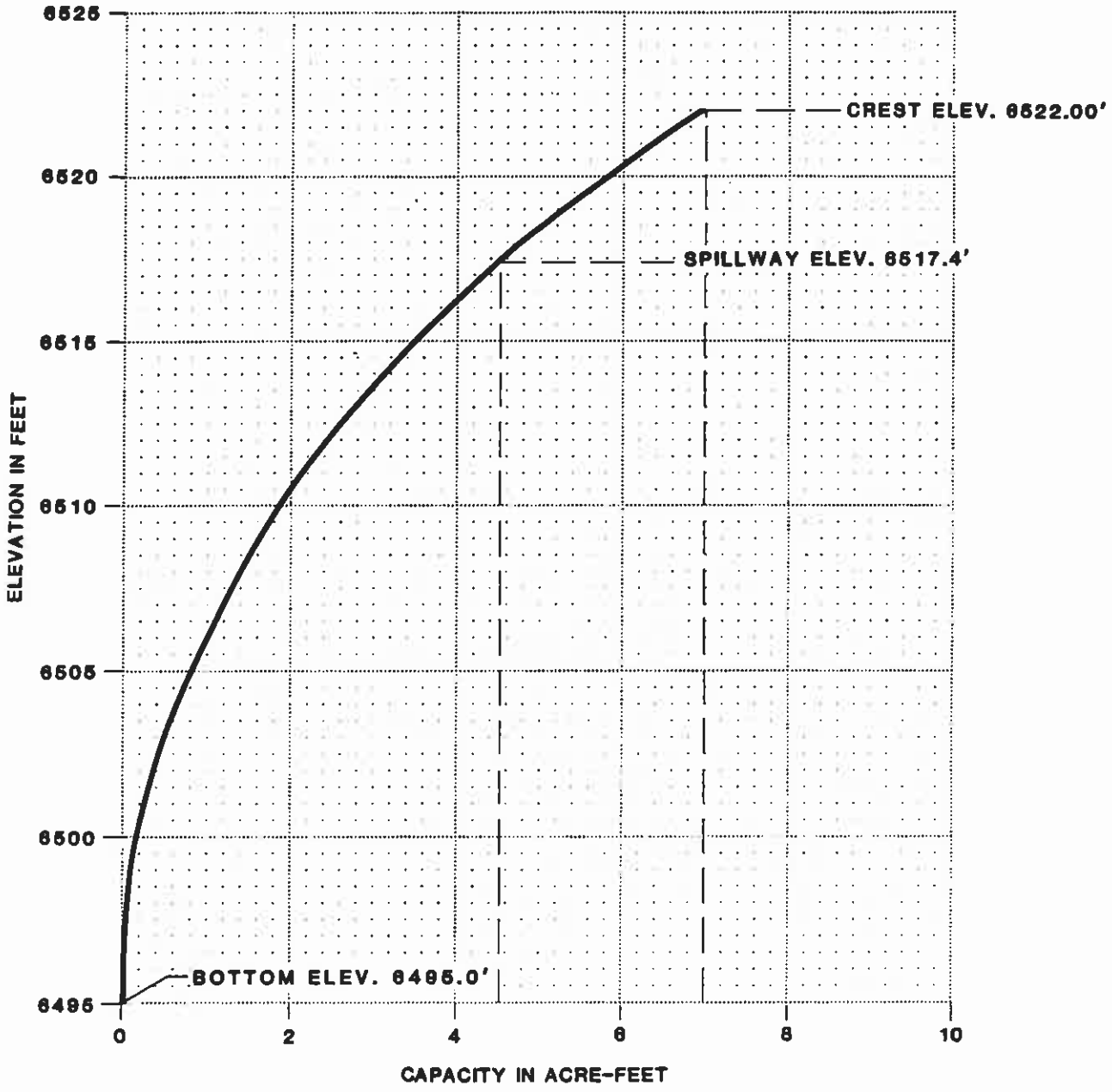


EXISTING MAXIMUM CROSS-SECTION A-A' KM-A2

FOR LOCATION SEE PLATE 1

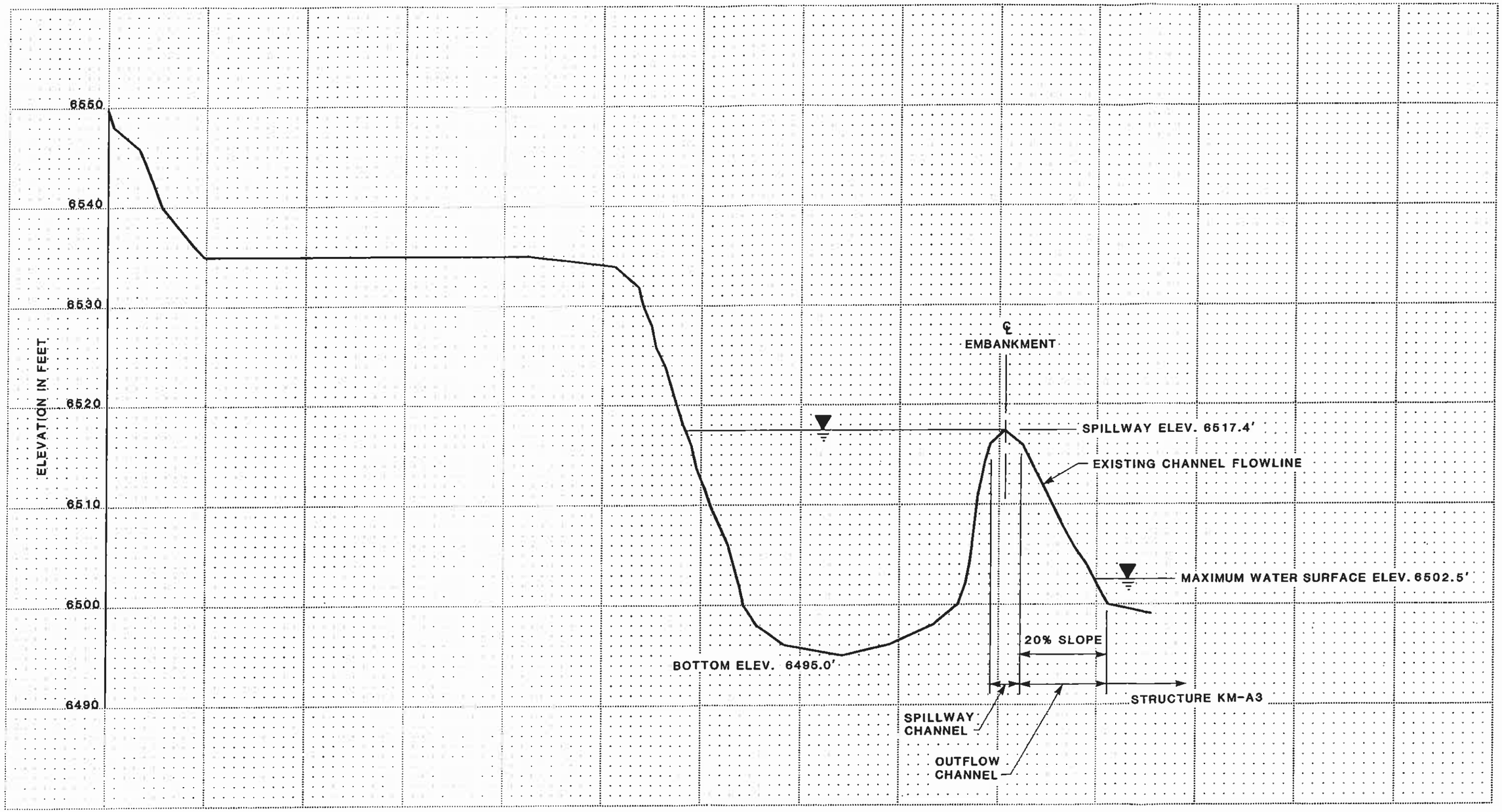
BY **Dames & Moore**

Plate 2



VOLUME-ELEVATION CURVE
KM-A2

BY **Dames & Moore** Plate 3

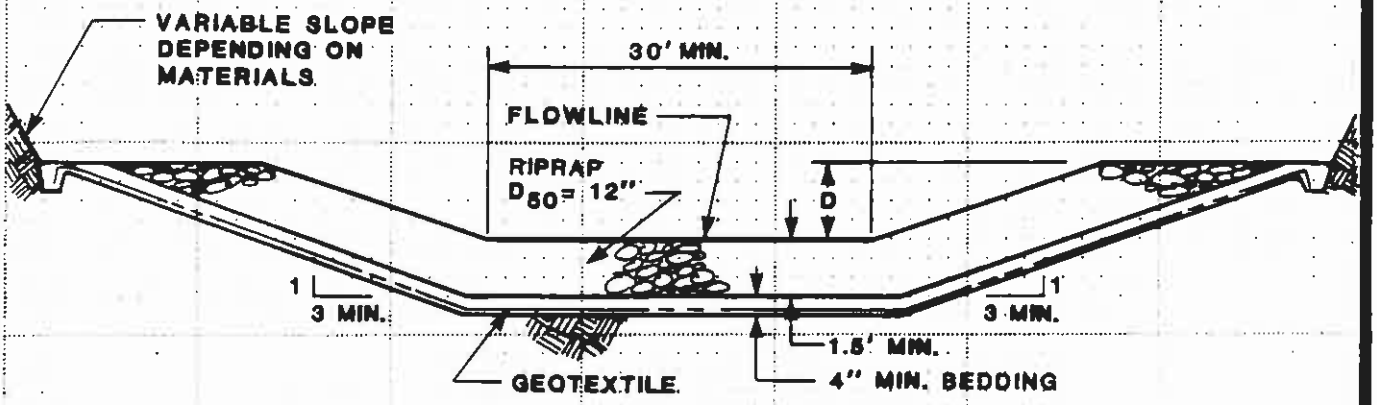


SCALE
0 100 200
FEET

CHANNEL PROFILE B-B'
KM-A2

FOR LOCATION SEE PLATE 1

BY **Dames & Moore** Plate 4



SPILLWAY CHANNEL

D = 3.0'

LENGTH = 30'

FLOWLINE ELEV. = 6517.40'

SPILLWAY CHANNEL CROSS SECTION KM-A2

BY **Dames & Moore** Plate 5

APPENDIX A

INSPECTION CHECK LIST

Sediment Impoundment Name: KM-A2
Page: 4

INSPECTION CHECK LIST

ITEM	YES	NO	REMARKS
1. CREST			14'
a. Any visual settlements?		X	
b. Misalignment?		X	
c. Cracking?		X	
2. UPSTREAM SLOPE			26°
a. Adequate grass cover?	X		50%
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			17°
a. Adequate grass cover?	X		60%
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	
b. Visual differential movement?		X	
c. Any cracks noted?		X	
d. Is seepage present?		X	
e. Type of Material?			Rock / 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?			Rock / SM

ITEM	YES	NO	REMARKS
6. SPILLWAY/NORMAL			
a. Location:			
Left abutment?			
Right abutment?			
Crest of Embankments?	X		Middle
b. Approach Channel:	X		23° 30' W 30' L
Are side slopes eroding?		X	
Are side slopes sloughing?		X	
Bottom of channel eroding?		X	
Obstructed?		X	
Erosion protection?		X	Some 25% grass
c. Spillway Channel:	X		30' W 15' L
Are side slopes eroding?	X		Rills
Are side slopes sloughing?		X	
Bottom of channel eroding?		X	
Obstructed?		X	
Erosion protection?	X	X	Partly Rock (1/2)
d. Outflow Channel:	X		12°
Are side slopes eroding?		X	
Are side slopes sloughing?		X	
Bottom of channel eroding?		X	
Obstructed?		X	
Erosion protection?	X		Rock DSD 12"
e. Weir:		X	
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?			

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

APPENDIX B

HYDROLOGY AND HYDRAULIC CALCULATIONS

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

TIME OF CONCENTRATION

ELEVATION DIFFERENCE = 6695 − 6517 = 178 ft.

WATER COURSE LENGTH = 5.5(400) = 2200 ft. = 0.417 mi.

$$T_c = \left(\frac{11.9\,(0.417)^3}{178}\right)^{0.385} = 0.128 \text{ hr.}$$

LAG TIME = $0.6T_c$ = 0.077 hr.

SCS CURVE NUMBER

DRAINAGE AREA (ac)	COVER TYPE	HYDROLOGIC CONDITION	SOIL TYPE	WEIGHTED CURVE NUMBER
2.4	P-J	average	D	(.05) 83
32.5	disturbed	—	D	(.69) 94
12.0	S-G	average	D	(.26) 79
				89.6

160% EM # 24

use 90

DRAINAGE BASIN AREA

47.9 ACRE 0.073 SQ MILE

BY S. DELAN DATE 7-27-85
CHECKED BY ___
COPY TO EO ___

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

UNIVERSAL SOIL LOSS EQUATION

RAINFALL FACTOR

R = 40

SOIL ERODIBILITY FACTOR

SOIL TYPE = 100% EM #24 = .16

K = .16

SLOPE FACTOR

LENGTH (ft.)	Δ ELEV (ft.)	SLOPE (%)	LS
300'	60'	20%	7.07 (.20)
400'	40'	10%	2.74 (.20)
300'	100'	33%	14.00 (.20)
coal stockpile? 1500'		5%	2.07 (.40)

use 5.59

COVER FACTOR

AREA (ac)	COVER TYPE	% COVER	CANOPY (%)	WEIGHTED C
5%	P-J	40	25	.05 (.14)
26%	S-G	40	25	.26 (.13)
69%	disturbed	—	—	.69 (1.0)

C = .731

EROSION CONTROL FACTOR

P = 1.0

SEDIMENT INFLOW

$$A = 40(.16)(5.59)(.731)(1.0) = 26.15 \quad \text{ton/acre/year}$$

$$A = 26.15\left(\frac{1}{2047}\right)(46.9)(.95) = .569 \quad \text{acre-feet/year}$$

BY ___ DATE ___ CHECKED BY ___ COPY TO EO ___