

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



Dames & Moore
10139-011-22

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INTRODUCTION

Sedimentation Structure J7-J is an earthen embankment, designed and constructed in 1983 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-J is shown on Plate 1, Site Plan.

This inspection report contains information specific to Structure J7-J. 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 J7-J was inspected on August 31, 1985 by an interdisciplinary 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 J7-J 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

Peabody Coal Company. The survey data developed in August 1984 was used in the analyses of the structure. Results of the field inspection are included in this report as Appendix A.

SITE DESCRIPTION

LAND USE

Structure J7-J has a 9.14-acre tributary drainage area and is located near Yucca Flats Wash at the Black Mesa Mine. The watershed is classified as 100% disturbed.

EMBANKMENT

Structure J7-J is a homogeneous earthen embankment classified as a roadway embankment. Physical characteristics of the embankment are listed in the following table:

Structure J7-J

Embankment	Residual Shale Soils
Foundation	Sandstone
Right Abutment	Residual Shale Soils
Left Abutment	Residual Shale Soils
Height	10.8 ft
Crest Width	30 ft
Upstream Slope	3.3 H : 1 V
Downstream Slope	2.9 H : 1 V

A cross-section of the embankment is shown on Plate 2, Existing Maximum Cross Section J7-J, A-A'. Grass provides erosion protection on the upstream and downstream slopes of the embankment.

ANALYSES

STABILITY

Structure J7-J is a category B-5 embankment. A standard category B-5 embankment has static and seismic factors of safety of 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 J7-J 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 J7-J 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 J7-J was analyzed using the 10-year, 24-hour storm.

The following parameters were used in the hydrologic analysis:

1. Water Course length, L 0.142 mi
2. Elevation Difference, H 62 ft
3. Time of Concentration in hours, T 0.0556 h
4. Lag time, $0.6T^C$ 0.0333 h
5. SCS Curve Number 91
6. Rainfall Depth, 10-year, 24-hour storm . 2.1 in.
25-year, 6-hour storm . 1.9 in.
7. Drainage Area 9.14 acres

HYDRAULICS

The HEC-1 program was used to evaluate inflow to the 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-J 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	24	30
Volume acre-ft	0.96	0.81
Storage		
Peak Stage ft	6357.16	6361.73
Spillway Elevation . . ft	6360.31	—
Peak Storage acre-ft	0.94	—
Storage Capacity . . . acre-ft	1.72	—
Outflow		
Peak Flow cfs	0	8
Embankment Crest		
Elevation ft	—	6363.20
Peak Stage ft	—	6361.73
Freeboard ft	—	1.47
Spillway		
Pipe Exit Velocity . . fps	—	7.7
Mannings "n"	—	0.024
Outflow Channel		
		<u>Section I</u> <u>Section II</u>
Slope %	—	8 35
Normal Velocity fps	—	3.2 5.0
Normal Depth ft	—	0.17 0.11
Manning's "n"	—	0.040 0.040

Spillway

The existing spillway for J7-J is a corrugated metal pipe (CMP) with the following dimensions:

Pipe diameter	24	in.
Pipe length	108	ft
Upstream invert elevation	6360.31	ft
Downstream invert elevation	6356.11	ft
Slope	5.2	percent

Outflow Channel

The structure presently has no outflow 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, J7-J.

The calculations for the sediment load entering Structure J7-J were made utilizing the Universal Soil Loss Equation with the following parameters:

1. Rainfall Factor, R 40
2. Soil Erodibility Factor, K 0.21
3. Slope Factor, LS 2.77
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 existing storage capacity of J7-J is shown on Plate 3, Volume-Elevation Curve, J7-J, and the results of the analysis are summarized in the following table.

J7-J STORAGE

Total Storage Capacity	1.72	acre-ft
10-year, 24-hour Storm Inflow	0.96	acre-ft
Available Sediment Storage Capacity	0.78	acre-ft
Sediment Inflow Rate	0.099	acre-ft/yr
Sediment Storage Life	8	yrs

REMEDIAL COMPLIANCE PLAN

GEOTECHNICS

The inspection of Structure J7-J indicated that the only geotechnical problem is rill erosion on the upstream and downstream slopes; and a steep downstream slope. Correction of erosion is considered a periodic maintenance task and does not require remedial action.

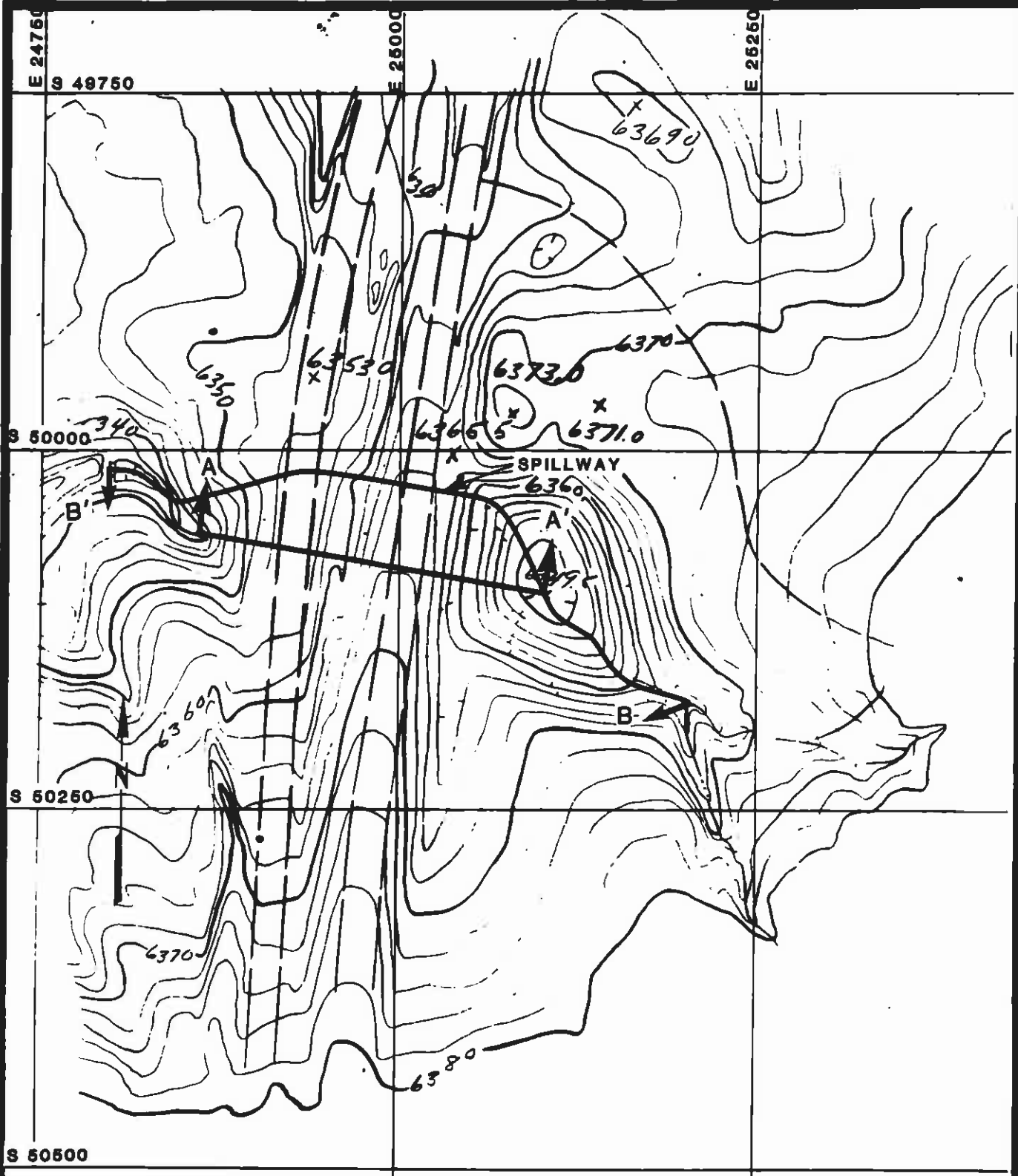
HYDRAULICS

The storage capacity and spillway capacity of Structure J7-J are adequate; however, the spillway does not have an outflow channel. A trapezoidal outflow channel should be constructed along the alignment B-B' shown in Plate 1. The channel profile is shown in Plate 4 and the required dimensions are shown in Plate 5. The outflow channel should be protected against erosion using geotextile and riprap as shown in Plate 5. A trash-rack should be installed on the inlet of the CMP to prevent clogging of the spillway.

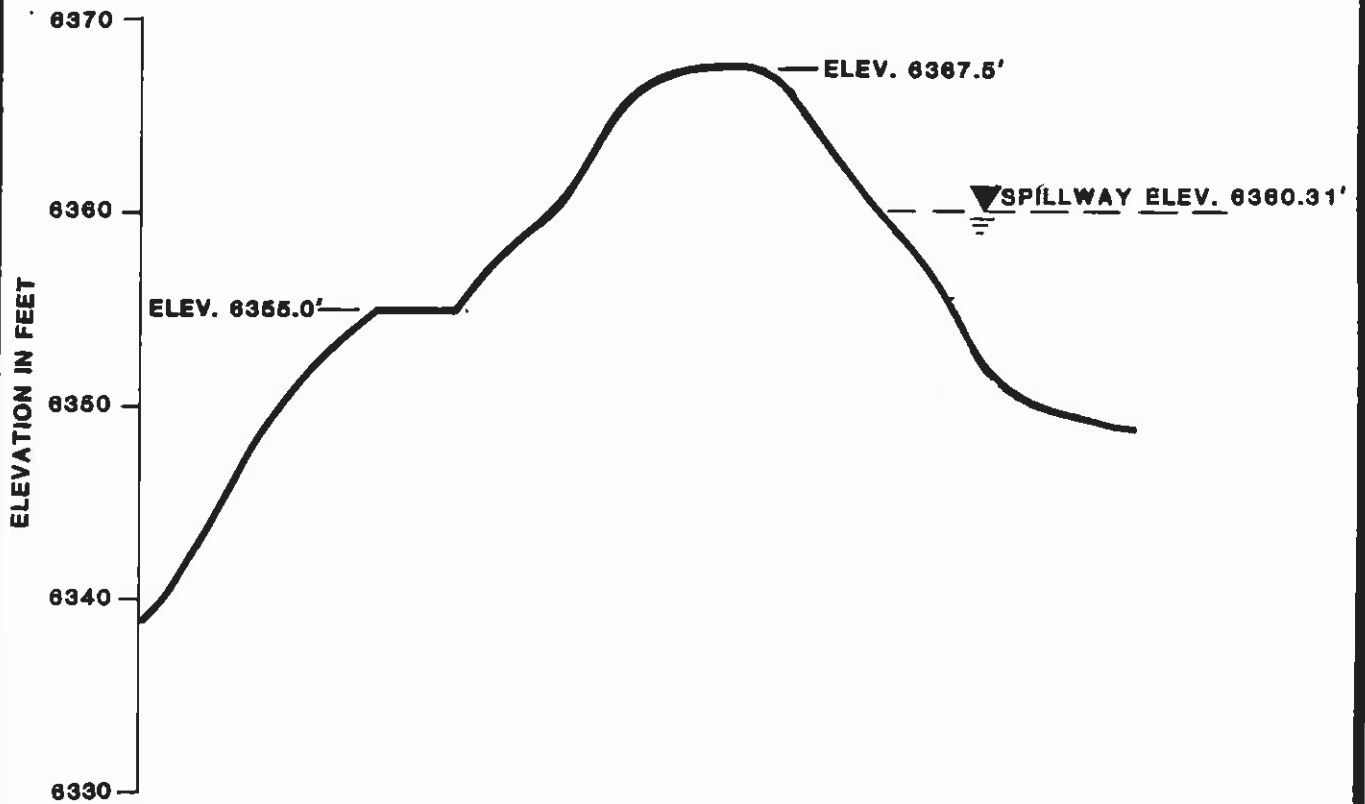
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The following plates and appendix are attached and complete this inspection report.

- Plate 1 - Site Plan J7-J
- Plate 2 - Existing Maximum Cross Section J7-J, A-A'
- Plate 3 - Volume-Elevation Curve J7-J
- Plate 4 - Channel Profile J7-J, B-B'
- Plate 5 - Outflow Channel Cross Section J7-J
- Appendix A - Inspection Check List
- Appendix B - Hydrology and Hydraulic Calculations



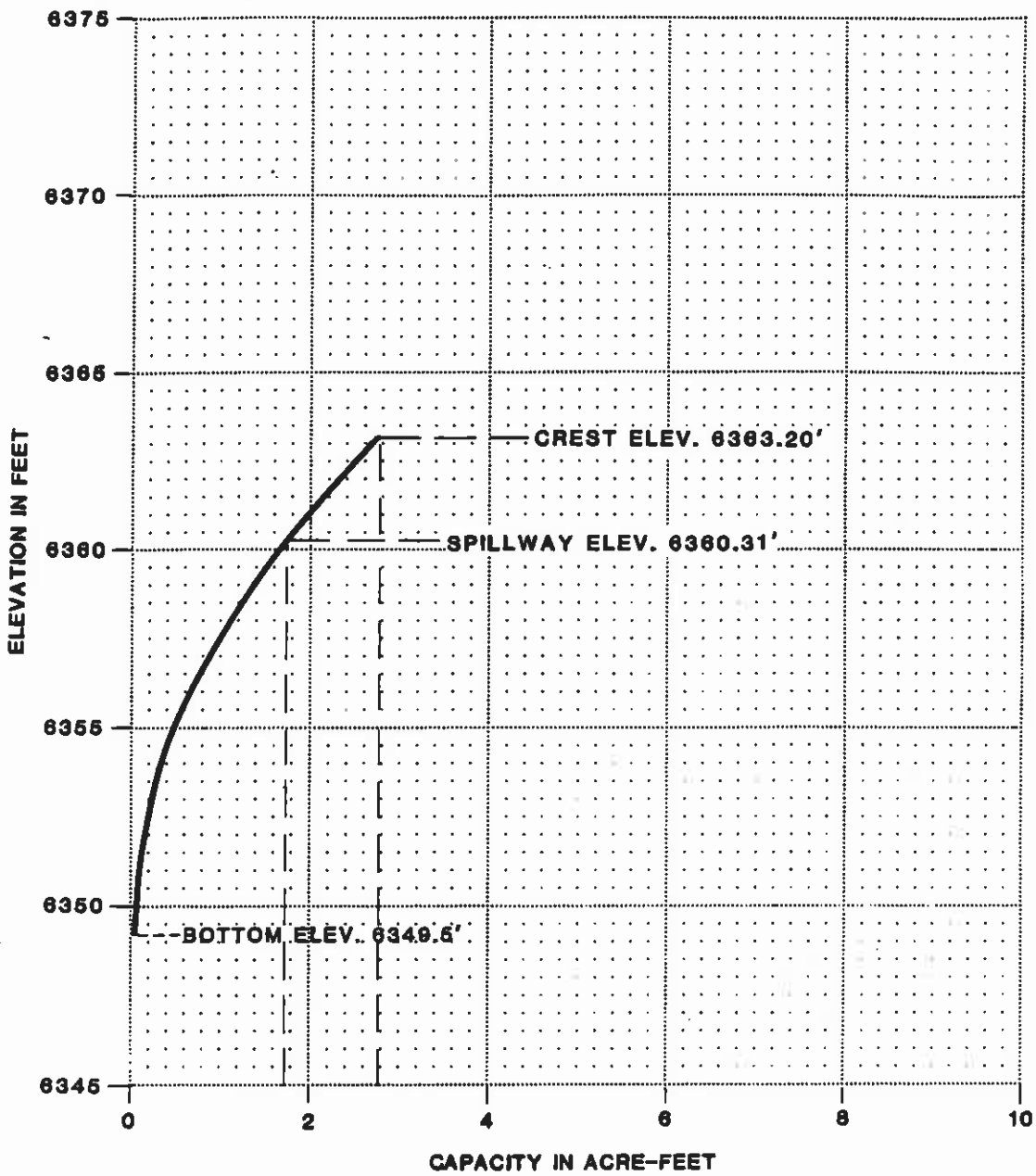
**SITE PLAN
J7-J**



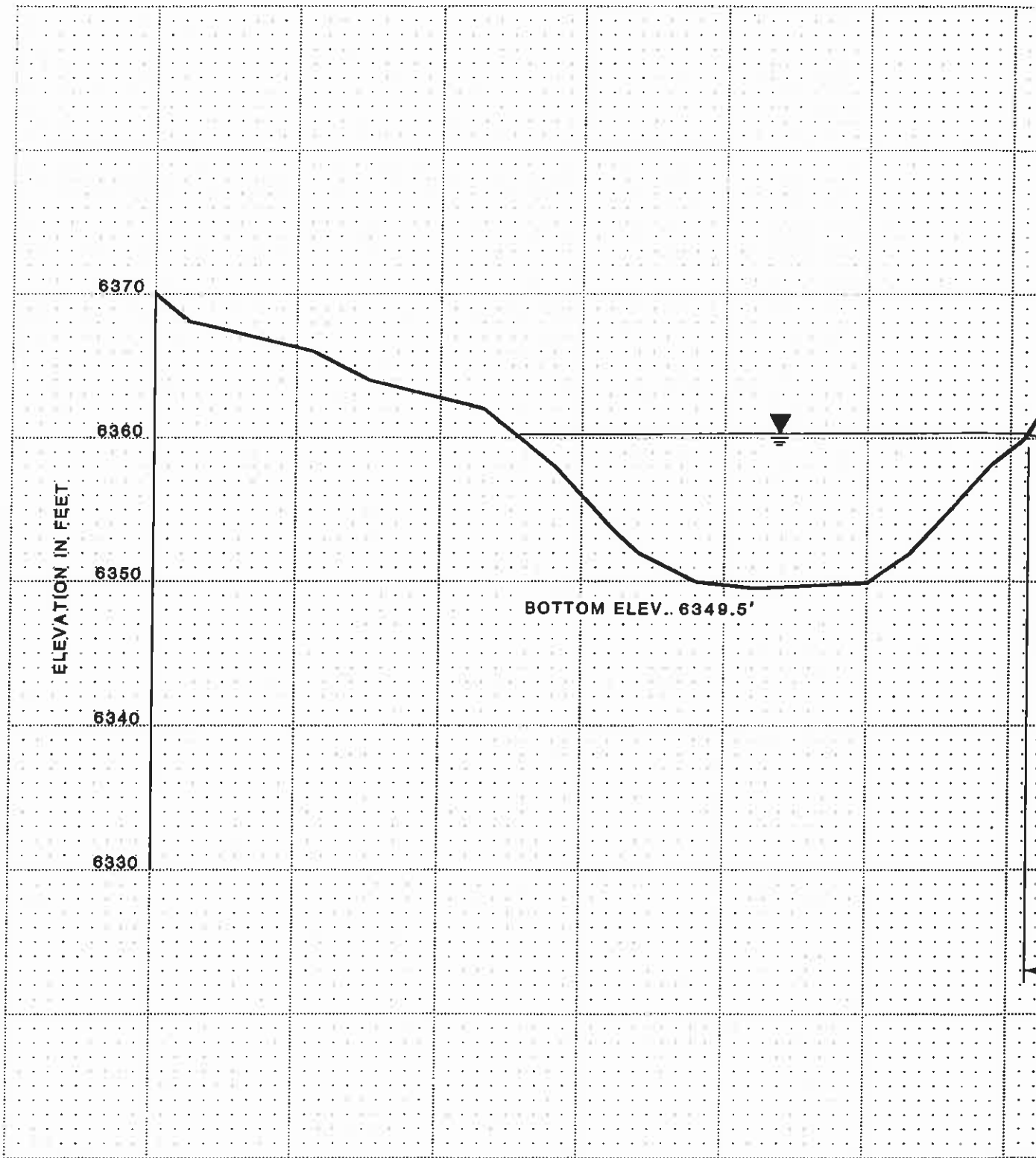
EXISTING
MAXIMUM CROSS-SECTION
A-A'
J7-J

BY **Dames & Moore**

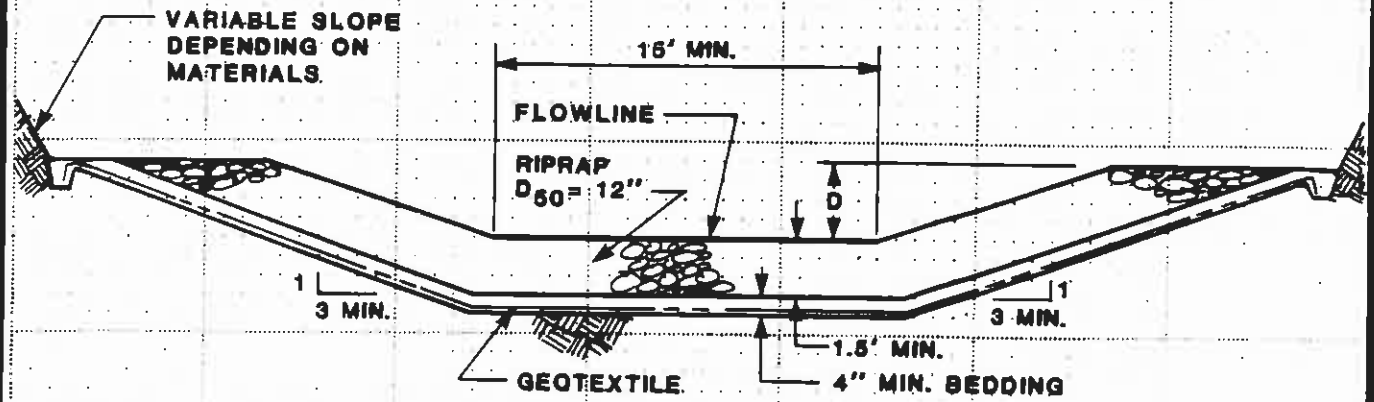
Plate 2



VOLUME-ELEVATION
CURVE
J7-J



FOR LOCATION SEE PLATE 1



OUTFLOW CHANNEL

D = 1'

OUTFLOW CHANNEL
CROSS SECTION
J7-J

APPENDIX A
INSPECTION CHECK LIST

INSPECTION CHECK LIST

ITEM	YES	NO	REMARKS
1. CREST			
a. Any visual settlements?		X	
b. Misalignment?		X	
c. Cracking?		X	
2. UPSTREAM SLOPE			
a. Adequate grass cover?	X		0% Rills
b. Any erosion?	X		
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			
a. Adequate grass cover?	X		70 Rills
b. Any erosion?	X		
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?			brown SM
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?			brown SM

ITEM	YES	NO	REMARKS	
6. SPILLWAY/NORMAL				
a. Location:				
Left abutment?				
Right abutment?				
Crest of Embankments?	X		Near Right Abutment	
b. Approach Channel:				
Are side slopes eroding?			NA	
Are side slopes sloughing?				
Bottom of channel eroding?				
Obstructed?				
Erosion protection?				
c. Spillway Channel:				
Are side slopes eroding?	X		24" CMP	
Are side slopes sloughing?			NA	
Bottom of channel eroding?			NA	
Obstructed?	X		tumbleweeds at both ends	
Erosion protection?			NA	
d. Outflow Channel:				
Are side slopes eroding?		X		
Are side slopes sloughing?				
Bottom of channel eroding?				
Obstructed?				
Erosion protection?			↓	
e. Weir:				
Condition?		X	Same Rock & exit D50 18"	
7. SPILLWAY/EMERGENCY				
a. Location:				
Left abutment?			NA	
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?				

8. GENERAL COMMENTS

No problems / clean out tubble weeds

Watershed - same as design

Canopy cover - sagebrush / grass 25%

No water in pond

ground cover average

APPENDIX B
HYDROLOGY AND HYDRAULIC CALCULATIONS

TIME OF CONCENTRATION

ELEVATION DIFFERENCE = 6420 - 6358 = 62'
 WATER COURSE LENGTH = 750' = 0.142 mi
 $T_c = \left(\frac{11.9 (0.142)^2}{62} \right)^{0.385} = 0.0556 \text{ hr} = 3.3 \text{ min}$
 LAG TIME = $0.6 T_c = 0.0333 \text{ hr}$

SCS CURVE NUMBER

<u>DRAINAGE COVER</u>	<u>HYDROLOGIC</u>	<u>SOIL</u>	<u>WEIGHTED</u>
<u>AREA (ac)</u>	<u>TYPE</u>	<u>CONDITION</u>	<u>CURVE NUMBER</u>
9.14 (100%)	DIST	—	<u>91</u>
			EH#32

DRAINAGE BASIN AREA

9.14 AC. 0.014 SQ. MI.

REVISIONS
 BY _____ TO EO _____
 BY _____ DATE _____ TO EO _____

BY _____ DATE _____
 CHECKED BY _____
 COPY TO EO _____

UNIVERSAL SOIL LOSS EQUATION

RAINFALL FACTOR

$R = 40$

SOIL ERODIBILITY FACTOR

SOIL TYPE = EH #32

$K = 0.21$

SLOPE FACTOR

<u>LENGTH (ft.)</u>	<u>Δ ELEV (ft.)</u>	<u>SLOPE (%)</u>	<u>LS</u>
650	60	9	2.77

COVER FACTOR

<u>AREA (ac.)</u>	<u>COVER TYPE</u>	<u>% COVER</u>	<u>CANOPY (%)</u>	<u>WEIGHTED C</u>
100%	DISTURBED	—	—	1.0

EROSION CONTROL FACTOR

$P = 1.0$

SEDIMENT INFLOW

$A = 40 (0.21) (2.77) (1.0) (1.0) = 23.3 \checkmark$ ton/acre/year

$A = 23.3 \left(\frac{1}{2047} \right) (9.14) (0.95) = \cancel{0.099} \checkmark$ acre-feet/year

2047? \longrightarrow 0.099

Dames & Moore

REVISIONS
 BY _____ DATE _____ TO EO _____
 BY _____ DATE _____ TO EO _____
 BY _____ DATE 10/2/85 TO EO _____
 CHECKED BY WDS
 COPY TO EO _____