J21D

DESIGN REPORT

Temporary Sedimentation Structure

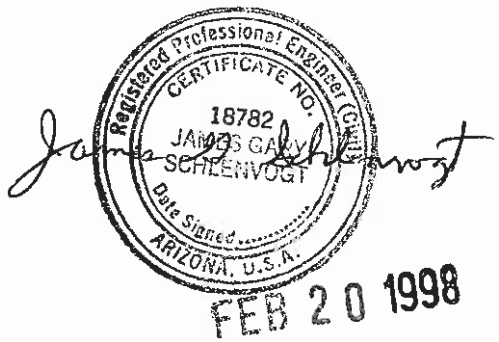
J21-D

Kayenta Mine

Navajo County, Arizona

For

PEABODY WESTERN COAL COMPANY



FEB 20 1998

TABLE OF CONTENTS

INTRODUCTION

Sedimentation Structure J21-D will be an earthen embankment, designed and constructed by Peabody Western Coal Company as a temporary sedimentation structure designed to control runoff and sediment from portions of J21 disturbed surface mining area at the Kayenta Mine. The location of Structure J21-D and its watershed boundary are shown on Drawing No. 85400 (Sheet N-10) and Drawing No. 85405. The site-specific general construction plans are shown on the attached Exhibit 1.

This design report contains information specific to Structure J21-D. Mine-wide design, construction, and reclamation information is presented in the "General Report, Kayenta and Black Mesa Mines, Navajo County, Arizona, for Peabody Western Coal Company", December, 1985 (PAP), Chapter 6, Attachment D, Volume 2, along with the methods and results of analyses used for slope stability, hydrology, and hydraulics, and in Chapter 6, Pages 11 to 42, "Sediment and Water Control Facility Plan".

INSPECTION

The construction site of the proposed Structure J21-D was inspected in August, 1997 by a Registered Professional Engineer from Peabody Western Coal Company, to assure that the site is suitable and no adverse conditions exist to prevent the successful construction of this structure. A detailed geotechnical investigation was not performed, rather, the information in Chapter 6, Attachment D was utilized for embankment design and will be utilized during construction to construct a stable embankment.

SITE DESCRIPTION

LAND USE

Structure J21-D has a 38.4-acre tributary drainage area and is located on a tributary to Dinnebito Wash at the Kayenta Mine. The watershed is classified as 35% spoil, 27% disturbed, 27% pinyon-juniper, and 11% sagebrush.

DESIGN ANALYSES

GENERAL

Structure J21-D was designed under the supervision of a Registered Professional Engineer from Peabody Western Coal Company. 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 Western Coal Company files includes topographic maps developed from aerial photography flown in 1992 for Peabody Western Coal Company and was used in the analyses of the structure.

STABILITY

Structure J21-D is assumed to be a Category A-3 embankment. The embankment category will be reevaluated during construction under the supervision of a Register Professional Engineer and Table 3-6, Attachment D, Chapter 6 will be utilized as the guidance to construct stable embankment slopes. A homogeneous earthen embankment, compacted in lifts to design specifications, and approximately 15 feet wide on top will be constructed. An upstream slope of 3:1 (horizontal to vertical) or flatter slope and a downstream slope of 3.5:1 or flatter slope is assumed. Based on the total embankment height of approximately 15 feet, these slopes are equal to or flatter than the recommended "worst case" embankment/foundation condition slopes in Table 3-6, Attachment D, Chapter 6; therefore, the embankment will be stable. The emergency spillway will be a minimum 15-foot wide riprap-lined trapezoidal channel.

J21-D SEDIMENTATION POND HYDRAULICS TABLE

	Units	10-Yr, 24-Hr Storm	25-Yr, 6-Hr Storm
Initial Reservoir Volume Condition		Empty	Full to emergency spillway
Inflow			
Peak Flow	cfs	30.3	36.7
Volume	ac-ft	2.6	2.2
Storage			
Peak Stage	msl	N/A	6895.7
Emerg. Spillway Elev.	msl	6895	6895
Peak Storage	ac-ft	N/A	7.5
Storage Capacity	ac-ft	6.8	6.8
Outflow			
Peak Flow	cfs	N/A	15.8
Spillway Elevation	msl	6895	6895
Embankment Crest Elev.	msl	6897	6897
Peak Stage	msl	--	6895.7
Freeboard	ft	–	1.3
Emergency Spillway Channel			
Flow Depth	ft	–	0.7
Critical Velocity	fps	–	3.1
Mannings "n"	–	--	.031
Width	ft	--	15
Outflow Channel			
Slope	%	--	25
Normal Velocity	fps	--	4.5
Normal Depth	ft	--	0.3
Mannings "n"	--	–	.059
Riprap D_{50}	in	--	3

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 for J21-D is shown on Exhibit 1, J21-D Stage Capacity Table, and the results of the sediment inflow analysis are summarized in the following table.

J21-D STORAGE

Total Storage Capacity	6.8	acre-ft
10-year, 24-hour Storm Inflow	2.6	acre-ft
Available Sediment Storage Capacity	4.2	acre-ft
Sediment Inflow Rate	0.63	acre-ft/yr.
Sediment Storage Life	6.7	years

* * *

The following appendices and drawing are attached and complete this design report.

Appendix A - Hydrology, Hydraulic, and Sedimentation Calculations

Appendix B - SEDCAD+ (Input and Output) 10-Year, 24-Hour Storm Event

Appendix C - SEDCAD+ (Input and Output) 25-Year, 6-Hour Storm Event

Exhibit # 1 - Proposed J21-D Sedimentation Pond Design

APPENDIX A

Hydrology, Hydraulic, and Sedimentation Calculations

PEABODY WESTERN COAL COMPANY
CALCULATED HYDROLOGIC DATA

PROJECT: J21 AREA

STRUCTURE: J21-D

TIME OF CONCENTRATION:

Start Elevation (ft) =	7040
End Elevation (ft) =	6890
Elevation Difference, E (ft) =	150
Watercourse Length (ft) =	2400
Watercourse Length, L (mi) =	0.455

Tc = (11.9L^3/E)^0.385 = 0.152 hours

ROUTING PARAMETERS:

Between structure routing parameters were calculated using the SCS Upland Method in SEDCAD+. Input and output parameters are shown on the SEDCAD+ printouts in Appendices B and C.

SCS CURVE NUMBER:

Cover Type	Soil Group	Curve Number	Area (acres)	CN*Area
Sagebrush-Grass	C	73	3.9	284.7
Pinyon Juniper	C	78	10.4	811.2
Spoil	C	86	13.5	1161
Disturbed	C	91	10.6	964.6
TOTAL:			38.4	3221.5

Weighted CN = Total CN*Area/ Total Area = 84

DRAINAGE BASIN AREA:

38.4 Acres

PEABODY WESTERN COAL COMPANY
CALCULATED SEDIMENT YIELD

PROJECT: J21-D Pond

The following spreadsheet calculates the predicted sediment yield for the project area. The gross sediment yield is determined according to the Revised Universal Soil Loss Equation.

PARAMETER DESCRIPTION	VALUE	
Annual Rainfall Factor	40.00	
Soil Erodibility Factor	0.20	
Length Slope Factor	7.22	
Cover Factor	0.71	
Practice Factor	0.93	
Gross Annual Sediment Yield	37.23	tons/acre/year
Sediment Density	94.00	pcf
Gross Annual Sediment Yield	0.0182	acre-feet/acre/year
Sediment Delivery Ratio	90%	
Estimated Annual Sediment Yield	0.0164	acre-feet/acre/year
Watershed Area	38.4	acres
Watershed Annual Sediment Yield	0.63	acre-feet/year
Number of years	1	years
Calculated Sediment Volume	0.63	acre-feet

SEDCAD+ RIPRAP CHANNEL DESIGN

J21-D

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	15.80 cfs	
Slope	25.00 %	
Sideslopes (L and R)	3.00:1	3.00:1
Bottom Width	15.00 feet	
Freeboard	None	

RESULTS:

Steep Slope Design - PADER Method

Depth	0.22 ft
with Freeboard	0.00 ft
Top Width	16.34 ft
with Freeboard	15.00 ft
Velocity	4.51 fps
Cross Sectional Area	3.50 sq ft
Hydraulic Radius	0.21 ft
Manning's n	0.059
Froude Number	1.72
Dmax	0.313 ft (3.75 in)
D50	0.250 ft (3.00 in)
D10	0.083 ft (1.00 in)

APPENDIX B

SEDCAD+ (Input and Output) 10-Year, 24-Hour Storm Event

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

PEABODY WESTERN COAL COMPANY : POND J21-D (10 YEAR, 24-HR)

by

Name: D. GLEASON

Company Name: ACZ, INC.
File Name: J:\861\0400\J21-D10

Date: 12-17-1997

APPENDIX C

SEDCAD+ (Input and Output) 25-Year, 6-Hour Storm Event

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

PEABODY WESTERN COAL COMPANY : POND J21-D (25 YEAR, 6-HR)

by

Name: D. GLEASON

Company Name: ACZ, INC.
File Name: J:\861\0400\J21-D25

Date: 01-06-1998

Company Name: ACZ, INC.
Filename: J:\861\0400\J21-D25 User: D. GLEASON
Date: 01-06-1998 Time: 11:14:09
PEABODY WESTERN COAL COMPANY : POND J21-D (25 YEAR, 6-HR)
Storm: 1.90 inches, 25 year- 6 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

POND INPUT/OUTPUT TABLE

J1, B1, S1
J21-D POND

Drainage Area from J1, B1, S1, SWS(s)1: 38.4 acres
Total Contributing Drainage Area: 38.4 acres

DISCHARGE OPTIONS:

	Emergency Spillway
Riser Diameter (in)	----
Riser Height (ft)	----
Barrel Diameter (in)	----
rrel Length (ft)	----
rrel Slope (%)	----
Manning's n of Pipe	----
Spillway Elevation	----
Lowest Elevation of Holes	----
# of Holes/Elevation	----
Entrance Loss Coefficient	----
Tailwater Depth (ft)	----
Notch Angle (degrees)	----
Weir Width (ft)	----
Siphon Crest Elevation	----
Siphon Tube Diameter (in)	----
Siphon Tube Length (ft)	----
Manning's n of Siphon	----
Siphon Inlet Elevation	----
Siphon Outlet Elevation	----
Emergency Spillway Elevation	6895.0
Crest Length (ft)	40.0
Z:1 (Left and Right)	3 3
Bottom Width (ft)	15.0

RESULTS:

Permanent Pool (ac-ft)
6.8

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: ACZ, INC.
Filename: J:\861\0400\J21-D25 User: D. GLEASON
Date: 01-06-1998 Time: 11:14:09
PEABODY WESTERN COAL COMPANY : POND J21-D (25 YEAR, 6-HR)
Storm: 1.90 inches, 25 year- 6 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

ELEVATION-AREA-CAPACITY-DISCHARGE TABLE

J1, B1, S1
J21-D POND

Drainage Area from J1, B1, S1, SWS(s)1: 38.4 acres
Total Contributing Drainage Area: 38.4 acres

SW#1: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	
6885.00	0.00	0.42	0.00	0.00	
6886.00	1.00	0.46	0.44	0.00	
6887.00	2.00	0.51	0.92	0.00	
6888.00	3.00	0.55	1.45	0.00	
6889.00	4.00	0.60	2.03	0.00	
6890.00	5.00	0.65	2.65	0.00	
6891.00	6.00	0.72	3.34	0.00	
6892.00	7.00	0.79	4.09	0.00	
6893.00	8.00	0.86	4.92	0.00	
6894.00	9.00	0.94	5.82	0.00	
6895.00	10.00	1.02	6.80	0.00	Stage of SW#1
6895.70	10.70	1.10	7.54	15.78	Peak Stage
6895.70	10.70	1.10	7.54	15.87	
6895.80	10.80	1.12	7.65	20.88	
6895.90	10.90	1.13	7.76	26.41	
6896.00	11.00	1.14	7.88	32.45	
6896.50	11.50	1.21	8.46	73.80	
6897.00	12.00	1.27	9.08	126.65	

****