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PEABODY WESTERN COAL COMPANY

For

Navajo County, Arizona

Kayenta Mine

N9-13 (Upper)

Temporary Sedimentation Structure

DESIGN REPORT

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EXHIBIT # 1 -N9-J3, N9-J2, N9-J1, and N9-J Proposed Sedimentation Ponds

The construction site of the proposed Structure N9-J3 was inspected in October, 2004 by a Registered Professional Engineer from Woodson Engineering, 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.

INSPECTION

This design report contains information specific to Structure N9-J3 that is in series with sedimentation structures N9-J2, N9-J1 & N9-I. N9-J3 is the upper pond in the series. 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".

Sedimentation Structure N9-J3 will be an earthen embankment, designed and constructed by Peabody Western Coal Company as a temporary sedimentation structure to control runoff and sediment from portions of the N9 disturbed surface mining area at the Kayenta Mine. The location of Structure N9-J3 and its watershed boundary are shown on Drawing No. 85400, (Sheet K-6), and Drawing No. 85405. The site-specific general construction plans are shown on the attached Exhibit 1.

INTRODUCTION

Structure N9-J3 is assumed to be a Category A-3 embankment. The structure will be a homogeneous earthen embankment, compacted in lifts to design specifications, and approximately 15 feet wide on top. A minimum upstream slope of 2H:1V and a minimum downstream slope of 4H:1V were assumed. Based on the total embankment height of approximately 14 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 25-foot wide, riprap-lined, trapezoidal channel.

STABILITY

Structure N9-J3 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 1983 for Peabody Western Coal Company and was used in the analyses of the structure.

GENERAL

DESIGN ANALYSES

The N9-J3, N9-J2, N9-J1 and N9-J Structures have a combined watershed of 524.18 acres and are located on a tributary upstream of Yazzie Wash at the Kayenta Mine. The 296.16-acre watershed, which contributes directly to structure N9-J3, is classified as 49% undisturbed and 51% spoil.

LAND USE

SITE DESCRIPTION

HYDROLOGY

The hydrologic analysis was completed using the computer program SEDCAD4 (see Appendices A, B, and C). Structure N9-J3 will be constructed in series with proposed Structures N9-J2, N9-J1 and N9-J1. Structure N9-J3 is classified as a low hazard structure (see Drawing No. 85408). In addition, the mine area is sparsely populated with no one living in the downstream floodplain. The structure will impound less than 20 acre-feet and be less than 20 vertical feet in height from the upstream toe of the embankment of the natural stream elevation to the emergency spillway invert elevation. N9-J3 is the upper pond in the series and has a capacity of less than 20 acre-feet; therefore, the spillway was analyzed using the 25-year, 6-hour storm event. All structures were conservatively assumed to be full to the emergency spillway at the time of design storm event. The storage capacity of structure N9-J3 was analyzed using the 10-year, 24-hour storm event. The combined ponds in series were verified to completely contain the 10-year, 24-hour storm event, and provide adequate sediment storage volume, without discharging into the Yazzie Wash.

The following parameters were used in the hydrologic analysis:

1.	Water Course length, L	1.095 mi.
2.	Elevation Difference, H	265 ft
3.	Time of Concentration, T _c	0.336 hr
4.	NRCS Curve Number	84
5.	Rainfall Depth, 10-year, 24-hour storm	2.1 in
	25-year, 6-hour storm	1.9 in
6.	Drainage Area	296.16 acres

Values reported represent the watershed, which drains directly to Pond N9-J3. Hydrologic input parameters for structures N9-J2, N9-J1 and N9-J1 are presented in separate design reports.

Muskingum routing parameters were utilized to route the 25-year hydrographs between the four structures. The routing parameters are presented in Appendices B and C, and are shown on a sub-watershed basis.

HYDRAULICS

The SEDCAD4 and HYDROCALC computer programs were 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 (supporting calculations are presented in Appendices A, B, and C).

N9-J3 SEDIMENTATION POND HYDRAULICS TABLE

	25-Yr, 6-Hr Storm	10-Yr, 24-Hr Storm	Units	Initial Reservoir Volume Condition
Inflow				Full to emergency spillway
Peak Flow	215.16	184.86	Cfs	
Volume	16.63	20.13	ac-ft	
Storage				
Peak Stage	6880.2	N/A	Msl	
Emerg. Spillway Elev.	6878.4	6878.4	Msl	
Peak Storage	23.37	N/A	ac-ft	
Storage Capacity	19.53	19.53	ac-ft	
Outflow				
Peak Flow	151.9	N/A	Cfs	
Spillway Elevation	6878.4	6878.4	Msl	
Embankment Crest Elev.	6883.4	6883.4	Msl	
Peak Stage	6880.2		Msl	
Freeboard	3.2		Ft	
Emergency Spillway Channel				
Flow Depth	1.8		Ft	
Critical Velocity	5.97		Fps	
Mannings "n"	0.048		--	
Width	25		Ft	
Outflow Channel				
Slope	25		%	
Normal Velocity	9.4		Fps	
Normal Depth	0.8		Ft	
Mannings "n"	0.066		--	
Riprap D ₅₀	9		In	

EMERGENCY SPILLWAY AND OUTLET CHANNEL

The emergency spillway and outlet channel for N9-J3 will be a trapezoidal channel with dimensions listed below. The alignment and dimensions are shown on Exhibit 1

Minimum Channel Depth	(Spillway)	3.0	ft
Channel Width	(Outflow)	2.0	ft
Channel Length	(Spillway)	45	ft
Sideslopes (Horizontal to Vertical)	(Outflow)	16:1	ft
Average Slope	(Spillway)	3:1	or flatter
Maximum Slope	(Spillway)	0	%
Spillway Elevation	(Outflow)	25	%
		6878.4	ft

A minimum 15-foot long riprap-lined channel will be constructed beyond the toe of the embankment as a transition into the downstream channel.

STORAGE CAPACITY

The impoundment stage-capacity table (see Exhibit 1) is based on the 1983 aerial topographic mapping conducted for Peabody Western Coal Company. Structure N9-J3 is designed to contain approximately 19.53 acre-feet.

The calculations for the sediment load entering structure N9-J3 were made utilizing the Revised Universal Soil Loss Equation with the following parameters:

1.	Rainfall Factor, R	4.0
2.	Soil Erodibility Factor, K	0.16
3.	Slope Factor, LS	7.06
4.	Cover Factor, C	0.62
5.	Erosion Control Factor, P	0.90

Appendix A - Hydrology, Hydraulic, and Sedimentation Calculations
 Appendix B - SEDCAD4 (Input and Output) 10-Year, 24-Hour Storm Event
 Appendix C - SEDCAD4 (Input and Output) 25-Year, 6-Hour Storm Event
 Exhibit #1 - N9-J3, N9-J2, N9-J1 & N9-J Proposed Sedimentation Ponds

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

* * *

	N9-J3 (UPPER)	N9-J2	N9-J1	N9-J (LOWER)	COMBINED
Total Storage Capacity (ac-ft)	19.53	19.52	19.39	19.66	78.09
10-Year, 24-Hour Storm Inflow (ac-ft)	20.13	9.44	3.24	3.43	36.23
Available Sediment Storage Capacity (ac-ft)	-	-	-	-	41.86
Sediment Inflow Rate/Year (ac-ft/yr)	3.19	1.49	0.44	0.64	5.76
Sediment Storage Life (yr)	-	-	-	-	7.3

Combined Storage for Structures N9-J3, N9-J2, N9-J1 and N9-J

structures in series and the results of the analysis are presented in the following table.
 N9-J1 & N9-J), in series is adequate. The combined storage capacity was determined for all four
 storage to contain the 10-year, 24-hour storm; however, the storage of all four ponds, (N9-J3, N9-J2,
 the remaining storage volume available for storing sediment. Structure N9-J3 does not have sufficient

Hydrology, Hydraulic, and Sedimentation Calculations

APPENDIX A

**PEABODY WESTERN COAL COMPANY
CALCULATED HYDROLOGIC DATA**

PROJECT: N-9 MINING AREA

STRUCTURE: J3

TIME OF CONCENTRATION:

Start Elevation (ft) = 7130
End Elevation (ft) = 6865
Elevation Difference, E (ft) = 265

Watercourse Length (ft) = 5784

Watercourse Length (mi) = 1.095

$T_c = (1.49L^{0.76}/E)^{0.385} =$

0.336 hours

ROUTING PARAMETERS:

Between structure routing parameters were calculated using the SCS Upland method in SEDCAD4. Input and output parameters are shown on the SEDCAD4 printouts in Appendices C.

SCS CURVE NUMBER:

Cover Type	Soil Group	Curve Number	Area (acres)	CN*Area
Pinyon Juniper	B	65	8.388	545.22
Pinyon Juniper	D	83	135.253	11225.999
Disturbed Land	B	86	152.52	13116.72
TOTAL:				24887.939

Weighted CN = Total CN * Area / Total Area =

84

Note: During Operations the open pit will collect most of the runoff from disturbed areas. The worst case is when the open pit is reclaimed and runoff from a larger area or regraded soil reports directly to the pond.

DRAINAGE BASIN AREA:

296.161 Acres

PEABODY WESTERN COAL COMPANY
CALCULATED SEDIMENTOLOGY DATA

STRUCTURE: J3

SOIL ERODIBILITY FACTOR:

Soil Type	Erodibility Factor, K	Area	K*Area
1CD	0.16	111.21	17.79
2B	0.43	8.501	3.66
3CD	0.16	12.951	2.07
7E	0.14	2.591	0.36
X11C	0.46	8.388	3.86
Disturbed	0.12	152.52	18.30
TOTAL		296.161	46.04

Weighted K = Total K * Area / Total Area =

0.16

SLOPE FACTOR:

Length (ft)	Slope (%)	m	Slope Angle (deg)	LS Factor
669	12.71%	0.60	7.24	6.13
1461	9.92%	0.50	5.67	5.20
1014	13.12%	0.60	7.47	8.19
1901	8.10%	0.50	4.63	4.61
858	18.41%	0.60	10.43	11.18

Average LS = 7.06

The LS Factor was calculated by:

LS=(Slope Length/72.6)^m*(10.8sin(slope angle)+.03) for slopes < 9%
 LS=(Slope Length/72.6)^m*(16.8sin(slope angle)-0.5) for slopes > 9%

Where:

Slope < 3% m = 0.3

Slope = 4% m = 0.4

5% > Slope < 10% m = 0.5
 Slope > 10% m = 0.6

STRUCTURE: J3

Cover and Practice Factors:

Cover Type	Cover (%)	Canopy (%)	Area (acres)	Cover Factor, C	C * Area	Practice Factor, P	P * Area
Pinyon Juniper	40%	25%	143,641	0.22	31,60	1.00	143,641
Sagebrush, Grass	40%	25%	0	0.2	0.00	1.00	0
Saltbrush	40%	25%	0	0.2	0.00	1.00	0
Disturbed	0%	0%	152,52	1	152,52	0.80	122,016
TOTAL:							
			296,161		184,12		265,66

Weighted C = Total C * Area / Total Area = 0.62

Weighted P = Total P * Area / Total Area = 0.90

RAINFALL FACTOR:

R = 40

**PEABODY WESTERN COAL COMPANY
CALCULATED SEDIMENT YIELD**

STRUCTURE: J3

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 (R)	40.00
Soil Erodibility Factor (K)	0.16
Length Slope Factor (L)	7.06
Cover Factor(C)	0.62
Practice Factor (P)	0.90
Gross Annual Sediment Yield	24.50 tons/acre/year
Sediment Density	94.00 pcf
Gross Annual Sediment Yield	0.0120 acre-feet/acre/year
Sediment Delivery Ratio	90%
Estimated Annual Sediment Yield	0.0108 acre-feet/acre/year
Watershed Area	296.16 acres
Watershed Annual Sediment Yield	3.19 acre-feet/year
Number of Years	1.00 years
Calculated Sediment Volume	3.19 acre-feet

TRAPEZOIDAL CHANNEL ANALYSIS
 CRITICAL DEPTH COMPUTATION
 N9-J3 POND
 November 18, 2004

DESCRIPTION	VALUE
Flow Rate (cfs).....	215.16
Channel Bottom Slope (ft/ft).....	0.005
Manning's Roughness Coefficient (n-value).....	0.048
Channel Left Side Slope (horizontal/vertical).....	3.0
Channel Right Side Slope (horizontal/vertical).....	3.0
Channel Bottom Width (ft).....	25.0

COMPUTATION RESULTS

DESCRIPTION	VALUE
Critical Depth (ft).....	1.25
Critical Slope (ft/ft).....	0.033
Flow Velocity (fps).....	5.97
Froude Number.....	1.0
Velocity Head (ft).....	0.55
Energy Head (ft).....	1.81
Cross-Sectional Area of Flow (sq ft).....	36.03
Top Width of Flow (ft).....	32.52

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N9-J3 POND OUTFLOW CHANNEL

Material: Riprap

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard	Depth (ft)	% of Depth	Freeboard Mult. x (VxD)
25.00	3.0:1	3.0:1	25.0	4.17			

PADDER Method - Steep Slope Design

w/o Freeboard	215.16 cfs
Design Discharge:	5.00 ft
Depth:	30.00 ft
Top Width:	55.02 ft
Velocity:	9.38 fps
X-Section Area:	22.94 sq ft
Hydraulic Radius:	0.758
Froude Number:	1.89
Manning's n:	0.0660
Dmin:	5.00 in
D50:	9.00 in
Dmax:	12.00 in

SEDCAD4 (Input and Output) 10-Year, 24-Hour Storm Event

APPENDIX B

Peabody Western Coal
Kayenta Mine
N9-J3 POND DESIGN
10YR 24HR STORM

Gary Altstis!

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	10 yr - 24 hr
Rainfall Depth:	2.100 inches

Structure Summary:

Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
296.160	296.160	184.86	20.13
#1			

Subwatershed Hydrology Detail:

#	Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1		296.160	0.336	0.000	0.000	84.000	F	184.86	20.126
			Σ 296.160						184.86	20.126

SEDCAD4 (Input and Output) 25-Year, 6-Hour Storm Event

APPENDIX C

Peabody Western Coal
Kayenta Mine
N9-J3 POND DESIGN
25YR 6HR STORM

Gary Altsi

General Information

Storm Information:

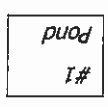
Storm Type:	NRCS Type II
Design Storm:	25 yr - 6 hr
Rainfall Depth:	1.900 Inches

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	296.160	0.336	0.000	0.000	84.000	F	215.16	16.633
		Σ 296.160						215.16	16.633

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K	Musk. X	Description
Pond	#1	==>	End	0.000	0.000	N9-J3 POND



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
# 1	296.160	296.160	215.16	16.63
In				16.63
Out			151.87	16.63

Structure #1 (Pond)

N9-J3 POND

Pond Inputs:

Initial Pool Elev:	6,878.40
Initial Pool:	19.53 ac-ft

Emergency Spillway

Spillway Elev	6,878.40	Crest Length (ft)	45.00	Left Slope	3.00:1	Right Slope	3.00:1	Bottom Width (ft)	25.00
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Pond Results:

Peak Elevation:	6,880.15
Dewater Time:	0.28 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
6,865.00	1.000	0.000	0.000	0.000
6,865.50	1.025	0.506	0.000	0.000
6,866.00	1.050	1.025	0.000	0.000
6,866.50	1.076	1.557	0.000	0.000
6,867.00	1.102	2.101	0.000	0.000
6,867.50	1.128	2.658	0.000	0.000
6,868.00	1.155	3.229	0.000	0.000
6,868.50	1.181	3.813	0.000	0.000
6,869.00	1.209	4.410	0.000	0.000
6,869.50	1.236	5.022	0.000	0.000
6,870.00	1.264	5.646	0.000	0.000
6,870.50	1.308	6.289	0.000	0.000
6,871.00	1.352	6.954	0.000	0.000
6,871.50	1.397	7.641	0.000	0.000
6,872.00	1.443	8.352	0.000	0.000
6,872.50	1.490	9.085	0.000	0.000
6,873.00	1.538	9.842	0.000	0.000

Structure Detail:

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
6,873.50	1.586	10.623	0.000	
6,874.00	1.635	11.428	0.000	
6,874.50	1.685	12.258	0.000	
6,875.00	1.735	13.113	0.000	
6,875.50	1.779	13.992	0.000	
6,876.00	1.824	14.892	0.000	
6,876.50	1.868	15.815	0.000	
6,877.00	1.914	16.761	0.000	
6,877.50	1.960	17.729	0.000	
6,878.00	2.007	18.721	0.000	
6,878.40	2.044	19.531	0.000	Spillway #1
6,878.50	2.061	19.736	5.563	3.10
6,879.00	2.145	20.788	33.351	2.05
6,879.50	2.231	21.882	61.138	0.90
6,880.00	2.319	23.019	128.257	0.50
6,880.15	2.322	23.368	151.870	0.15 Peak Stage
6,880.50	2.371	24.192	207.526	
6,881.00	2.423	25.390	304.805	
6,881.50	2.476	26.615	425.209	
6,882.00	2.530	27.866	567.183	
6,882.50	2.584	29.145	730.520	
6,883.00	2.638	30.450	906.004	
6,883.40	2.682	31.514	1,063.874	

Detailed Discharge Table

Combined	Total	Emergency Spillway (cfs)	Discharge (cfs)
6,865.00	0.000	0.000	0.000
6,865.50	0.000	0.000	0.000
6,866.00	0.000	0.000	0.000
6,866.50	0.000	0.000	0.000
6,867.00	0.000	0.000	0.000
6,867.50	0.000	0.000	0.000
6,868.00	0.000	0.000	0.000
6,868.50	0.000	0.000	0.000
6,869.00	0.000	0.000	0.000
6,869.50	0.000	0.000	0.000
6,870.00	0.000	0.000	0.000

Combined	Total	Elevation	Emergency	Spillway (cfs)	Discharge	(cfs)
0.000	0.000	6,870.50	0.000	0.000	0.000	0.000
0.000	0.000	6,871.00	0.000	0.000	0.000	0.000
0.000	0.000	6,871.50	0.000	0.000	0.000	0.000
0.000	0.000	6,872.00	0.000	0.000	0.000	0.000
0.000	0.000	6,872.50	0.000	0.000	0.000	0.000
0.000	0.000	6,873.00	0.000	0.000	0.000	0.000
0.000	0.000	6,873.50	0.000	0.000	0.000	0.000
0.000	0.000	6,874.00	0.000	0.000	0.000	0.000
0.000	0.000	6,874.50	0.000	0.000	0.000	0.000
0.000	0.000	6,875.00	0.000	0.000	0.000	0.000
0.000	0.000	6,875.50	0.000	0.000	0.000	0.000
0.000	0.000	6,876.00	0.000	0.000	0.000	0.000
0.000	0.000	6,876.50	0.000	0.000	0.000	0.000
0.000	0.000	6,877.00	0.000	0.000	0.000	0.000
0.000	0.000	6,877.50	0.000	0.000	0.000	0.000
0.000	0.000	6,878.00	0.000	0.000	0.000	0.000
0.000	0.000	6,878.40	0.000	0.000	0.000	0.000
6,878.50	5.563	6,878.50	5.563	0.000	0.000	5.563
6,879.00	33.351	6,879.00	33.351	0.000	0.000	33.351
6,879.50	61.138	6,879.50	61.138	0.000	0.000	61.138
6,880.00	128.257	6,880.00	128.257	0.000	0.000	128.257
6,880.50	207.526	6,880.50	207.526	0.000	0.000	207.526
6,881.00	304.805	6,881.00	304.805	0.000	0.000	304.805
6,881.50	425.209	6,881.50	425.209	0.000	0.000	425.209
6,882.00	567.183	6,882.00	567.183	0.000	0.000	567.183
6,882.50	730.520	6,882.50	730.520	0.000	0.000	730.520
6,883.00	906.004	6,883.00	906.004	0.000	0.000	906.004
6,883.40	1,063.874	6,883.40	1,063.874	0.000	0.000	1,063.874

