DESIGN REPORT

Temporary Sedimentation Structure

N9-H

Kayenta Mine

Navajo County, Arizona

For

PEABODY WESTERN COAL COMPANY

SEP 2005
APPROVED

Registered Professional Engineer (Civil)
CERTIFICATE NO. 19182
JAMES DANIEL SCHLENVOGT
Date Signed
ARIZONA, U.S.A.

DEC 23 2004

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INTRODUCTION

Sedimentation Structure N9-H will be an earthen embankment, designed and constructed by Peabody Western Coal Company (PWCC) 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-H 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.

This design report contains information specific to Structure N9-H. 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 N9-H 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.

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SITE DESCRIPTION

LAND USE

The N9-H Structure has a watershed of 88.64 acres and is located on a tributary upstream of Yazzie Wash at the Kayenta Mine. The 88.64-acre watershed, which contributes directly to structure N9-H, is classified as 23% undisturbed and 77% spoil.

DESIGN ANALYSES

GENERAL

Structure N9-H 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.

STABILITY

Structure N9-H 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 minimum downstream slope of 4H: 1V were assumed. Based on the total embankment height of approximately 19.5 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 20-foot wide, riprap-lined, trapezoidal channel.

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HYDROLOGY

The hydrologic analysis was completed using the computer program SEDCAD4 (see Appendices A, B, and C). Structure N9-H 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. The structure has capacity less than 20 acre-feet; therefore, the spillway was analyzed using the 25-year, 6-hour storm event. The structure was conservatively assumed to be full to the emergency spillway at the time of 25-year storm event. The storage capacity of structure N9-H was analyzed using the 10-year, 24-hour storm event. The pond was verified to completely contain the 10-year, 24-hour storm event, and provide adequate sediment storage volume, without discharging into Yazzie Wash.

The following parameters were used in the hydrologic analysis:

1.	Water Course length, L	0.502 mi.
2.	Elevation Difference, H	155 ft
3.	Time of Concentration, T_c	0.168 hr
4.	NRCS Curve Number	81
5.	Rainfall Depth, 10-year, 24-hour storm 25-year, 6-hour storm	2.1 in 1.9 in
6.	Drainage Area	88.64 acres

Values reported represent the watershed, which drains directly to Pond N9-H.

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).

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N9-H 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	54.28	65.16
Volume	ac-ft	4.94	4.01
Storage			
Peak Stage	msl	N/A	6737.7
Emerg. Spillway Elev.	msl	6737.0	6737.0
Peak Storage	ac-ft	N/A	18.35
Storage Capacity	ac-ft	17.21	17.21
Outflow			
Peak Flow	cfs	N/A	30.62
Spillway Elevation	msl	6737.0	6737.0
Embankment Crest Elev.	msl	6739.9	6739.9
Peak Stage	msl	--	6737.7
Freeboard	ft	--	2.2
Emergency Spillway Channel			
Flow Depth	ft	--	0.7
Critical Velocity	fps	--	4.44
Mannings "n"	--	--	0.048
Width	ft	--	20
Outflow Channel			
Slope	%	--	25
Normal Velocity	fps	--	6.56
Normal Depth	ft	--	0.5
Mannings "n"	--	--	0.065
Riprap D_{50}	in	--	6

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EMERGENCY SPILLWAY AND OUTLET CHANNEL

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

Minimum Channel Depth	(Spillway)	2.0	ft
	(Outflow)	1.5	ft
Channel Width		20	ft
Channel Length	(Spillway)	33	ft
	(Outflow)	195	ft
Sideslopes (Horizontal to Vertical)		3:1	or flatter
Average Slope	(Spillway)	0	%
Maximum Slope	(Outflow)	25	%
Spillway Elevation		6737.0	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-H is designed to contain approximately 17.21 acre-feet.

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

1. Rainfall Factor, R — 40
2. Soil Erodibility Factor, K — 0.13
3. Slope Factor, LS — 7.86
4. Cover Factor, C — 0.82
5. Erosion Control Factor, P — 0.85

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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. Structure N9-H has sufficient storage capacity to contain the 10-year, 24-hour storm event. The storage capacity was determined for N9-H Structure and the results of the analysis are presented in the following table.

Storage for Structure N9-H

	N9-H
Total Storage Capacity (ac-ft)	17.21
10-Year, 24-Hour Storm Inflow (ac-ft)	4.94
Available Sediment Storage Capacity (ac-ft)	12.27
Sediment Inflow Rate/Year (ac-ft/yr)	1.09
Sediment Storage Life (yr)	11.3

* * *

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

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-H Proposed Sedimentation Pond

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APPENDIX A

Hydrology, Hydraulic, and Sedimentation Calculations

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CALCULATED HYDROLOGIC DATA

PROJECT: N-9 MINING AREA

STRUCTURE: H

TIME OF CONCENTRATION:

Start Elevation (ft) =	6875	
End Elevation (ft) =	6720	
Elevation Difference, E (ft) =	155	
Watercourse Length (ft) =	2653	
Watercourse Length (mi) =	0.502	
Tc = (11.9L^3/E)^0.385 =	0.168	hours

ROUTING PARAMETERS:

Between structure routing parameters were calculated using the SCS Upland mathod 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	10.434	678.21
Pinyon Juniper	D	83	0.069	5.727
Sagebrush	B	60	9.517	571.02
Distrubed Land	B	86	68.62	5901.32
TOTAL:			88.64	7156.277

Weighted CN = Total CN * Area / Total Area = 81

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:

88.64 Acres

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CALCULATED SEDIMENTOLOGY DATA

STRUCTURE: H

SOIL ERODIBILITY FACTOR:

Soil Type	Erodibility Factor, K	Area	K*Area
13A	0.37	0.091	0.03
14AB	0.37	6.575	2.43
3DE	0.15	0.069	0.01
5	0.49	0.017	0.01
16CE	0.05	13.268	0.66
Disturbed	0.12	68.62	8.23
	TOTAL	88.64	11.38

Weighted K = Total K * Area / Total Area = 0.13

SLOPE FACTOR:

Length (ft)		Slope (%)	m	Slope Angle (deg)	LS Factor
614	80	13.03%	0.60	7.42	6.01
695	93	13.38%	0.60	7.62	6.70
904	158	17.48%	0.60	9.91	10.86

Average LS = 7.86

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

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STRUCTURE: H

Cover and Practice Factors:

Cover Type	Cover (%)	Canopy (%)	Area (acres)	Cover Factor, C	C * Area	Practive Factor, P	P * Area
Pinyon Juniper	40%	25%	10.503	0.22	2.31	1.00	10.503
Sagebrush, Grass	40%	25%	9.517	0.2	1.90	1.00	9.517
Saltbrush	40%	25%	0	0.2	0.00	1.00	0
Disturbed	0%	0%	68.62	1	68.62	0.80	54.896
TOTAL:			88.64		72.83		74.92

Weighted C = Total C * Area / Total Area = 0.82

Weighted P = Total P * Area / Total Area = 0.85

RAINFALL FACTOR:

R= 40

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CALCULATED SEDIMENT YIELD

STRUCTURE: H

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)	0.13
Length Slope Factor (L)	7.86
Cover Factor(C)	0.82
Practice Factor (P)	0.85
Gross Annual Sediment Yield	28.03 tons/acre/year
Sediment Density	94.00 pcf
Gross Annual Sediment Yield	0.0137 acre-feet/acre/year
Sediment Delivery Ratio	90%
Estimated Annual Sediment Yield	0.0123 acre-feet/acre/year
Watershed Area	88.64 acres
Watershed Annual Sediment Yield	1.09 acre-feet/year
Number of Years	1.00 years
Calculated Sediment Volume	1.09 acre-feet

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TRAPEZOIDAL CHANNEL ANALYSIS
CRITICAL DEPTH COMPUTATION
N9-H POND
November 8, 2004

PROGRAM INPUT DATA

DESCRIPTION	VALUE
Flow Rate (cfs)	65.16
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)	20.0

COMPUTATION RESULTS

DESCRIPTION	VALUE
Critical Depth (ft)	0.67
Critical Slope (ft/ft)	0.04
Flow Velocity (fps)	4.44
Froude Number	1.0
Velocity Head (ft)	0.31
Energy Head (ft)	0.97
Cross-Sectional Area of Flow (sq ft)	14.69
Top Width of Flow (ft)	24.0

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N9-H POND OUTFLOW CHANNEL

Material: Riprap

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
20.00	3.0:1	3.0:1	25.0	1.00		

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	65.16 cfs	
Depth:	0.46 ft	1.46 ft
Top Width:	22.79 ft	28.79 ft
Velocity:	6.56 fps	
X-Section Area:	9.93 sq ft	
Hydraulic Radius:	0.433	
Froude Number:	1.75	
Manning's n:	0.0650	
Dmin:	3.00 in	
D50:	6.00 in	
Dmax:	9.00 in	

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APPENDIX B

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

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Peabody Western Coal
Kayenta Mine
N9-H POND DESIGN

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General Information

Storm Information:

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

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Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	88.640	88.640	54.28	4.94

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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	88.640	0.168	0.000	0.000	81.000	F	54.28	4.941
	$\sum$	**88.640**						**54.28**	**4.941**

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APPENDIX C

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

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

Gary Altsisi

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General Information

Storm Information:

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

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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	88.640	0.168	0.000	0.000	81.000	F	65.16	4.005
	$\sum$	**88.640**						**65.16**	**4.005**

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Structure Networking:

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

#1
Pond

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Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	In	88.640	88.640	65.16	4.00
	Out			30.62	4.01

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Structure Detail:

Structure #1 (Pond)

N9-H

Pond Inputs:

Initial Pool Elev:	6,737.00
Initial Pool:	17.21 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
6,737.00	33.00	3.00:1	3.00:1	20.00

Pond Results:

Peak Elevation:	6,737.69
Dewater Time:	0.25 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)
6,720.00	0.370	0.000	0.000	
6,720.50	0.414	0.196	0.000	
6,721.00	0.461	0.415	0.000	
6,721.50	0.511	0.658	0.000	
6,722.00	0.562	0.926	0.000	
6,722.50	0.617	1.220	0.000	
6,723.00	0.674	1.543	0.000	
6,723.50	0.733	1.894	0.000	
6,724.00	0.795	2.276	0.000	
6,724.50	0.859	2.690	0.000	
6,725.00	0.926	3.136	0.000	
6,725.50	0.924	3.598	0.000	
6,726.00	0.922	4.060	0.000	
6,726.50	0.919	4.520	0.000	
6,727.00	0.917	4.979	0.000	
6,727.50	0.915	5.437	0.000	
6,728.00	0.913	5.894	0.000	

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Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
6,728.50	0.911	6.350	0.000		
6,729.00	0.908	6.805	0.000		
6,729.50	0.906	7.258	0.000		
6,730.00	0.904	7.711	0.000		
6,730.50	0.969	8.179	0.000		
6,731.00	1.036	8.680	0.000		
6,731.50	1.106	9.216	0.000		
6,732.00	1.177	9.786	0.000		
6,732.50	1.251	10.393	0.000		
6,733.00	1.328	11.038	0.000		
6,733.50	1.406	11.721	0.000		
6,734.00	1.487	12.445	0.000		
6,734.50	1.570	13.209	0.000		
6,735.00	1.655	14.015	0.000		
6,735.50	1.627	14.835	0.000		
6,736.00	1.599	15.642	0.000		
6,736.50	1.572	16.435	0.000		
6,737.00	1.545	17.214	0.000		Spillway #1
6,737.50	1.665	18.017	22.084	5.50	
6,737.69	1.715	18.350	30.617	0.45	Peak Stage
6,738.00	1.790	18.880	44.168		
6,738.50	1.920	19.808	98.327		
6,739.00	2.054	20.801	162.936		
6,739.50	2.192	21.862	244.347		
6,740.00	2.335	22.993	347.159		

Detailed Discharge Table

Elevation	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
6,720.00	0.000	0.000
6,720.50	0.000	0.000
6,721.00	0.000	0.000
6,721.50	0.000	0.000
6,722.00	0.000	0.000
6,722.50	0.000	0.000
6,723.00	0.000	0.000
6,723.50	0.000	0.000
6,724.00	0.000	0.000

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Elevation	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
6,724.50	0.000	0.000
6,725.00	0.000	0.000
6,725.50	0.000	0.000
6,726.00	0.000	0.000
6,726.50	0.000	0.000
6,727.00	0.000	0.000
6,727.50	0.000	0.000
6,728.00	0.000	0.000
6,728.50	0.000	0.000
6,729.00	0.000	0.000
6,729.50	0.000	0.000
6,730.00	0.000	0.000
6,730.50	0.000	0.000
6,731.00	0.000	0.000
6,731.50	0.000	0.000
6,732.00	0.000	0.000
6,732.50	0.000	0.000
6,733.00	0.000	0.000
6,733.50	0.000	0.000
6,734.00	0.000	0.000
6,734.50	0.000	0.000
6,735.00	0.000	0.000
6,735.50	0.000	0.000
6,736.00	0.000	0.000
6,736.50	0.000	0.000
6,737.00	0.000	0.000
6,737.50	22.084	22.084
6,738.00	44.168	44.168
6,738.50	98.327	98.327
6,739.00	162.936	162.936
6,739.50	244.347	244.347
6,740.00	347.159	347.159

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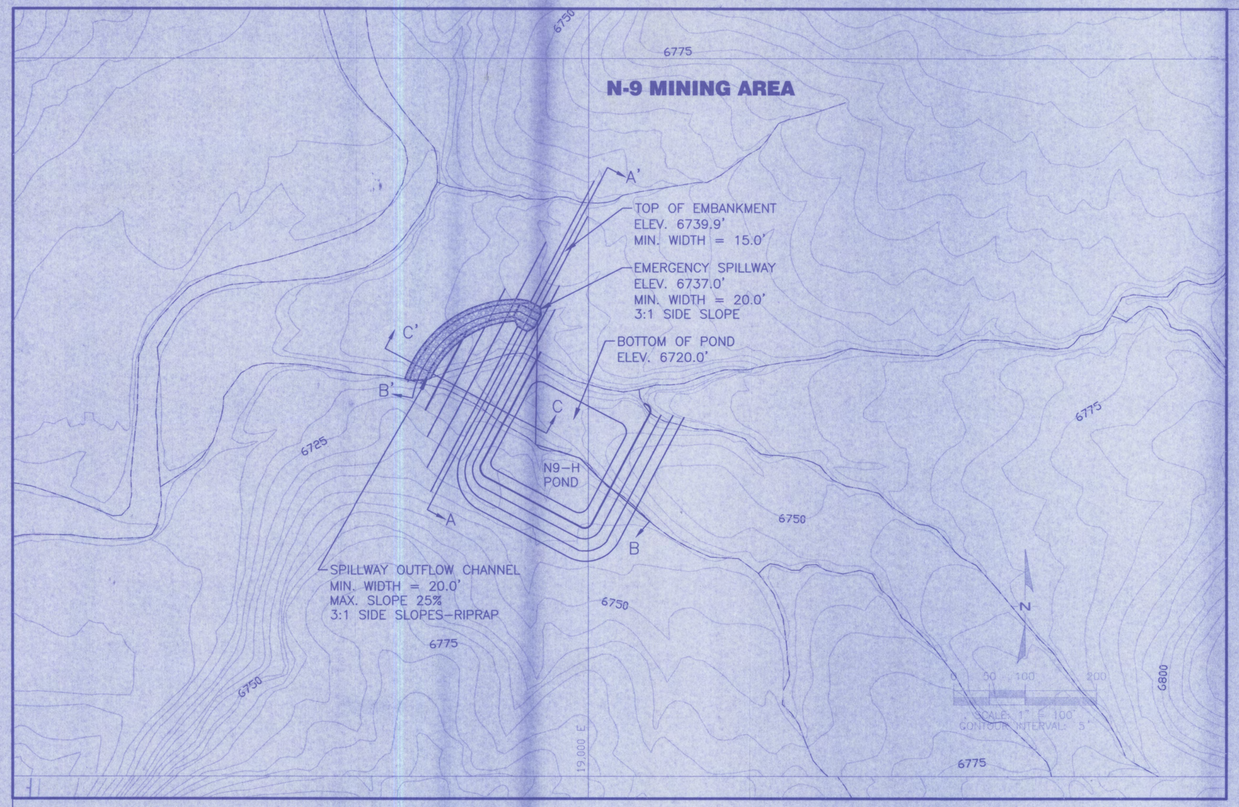
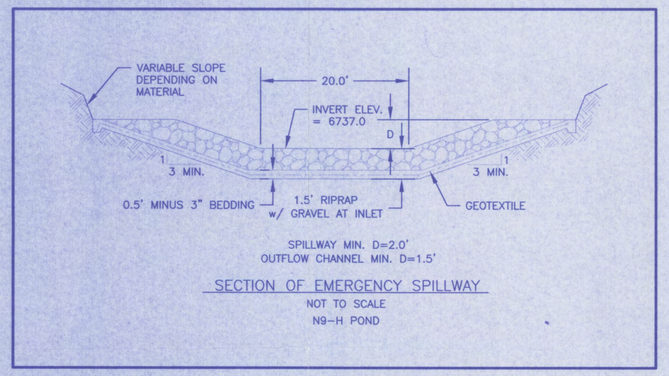




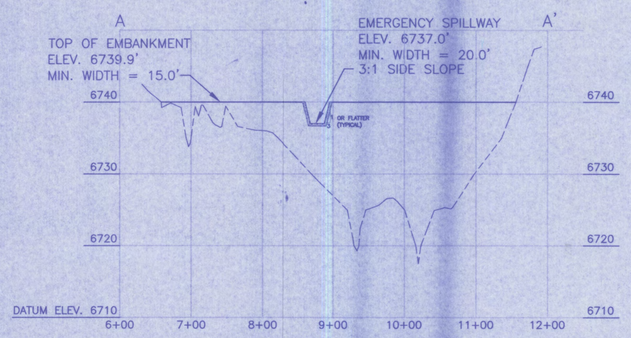
SECTION OF EMERGENCY SPILLWAY

NOT TO SCALE

N9-H POND

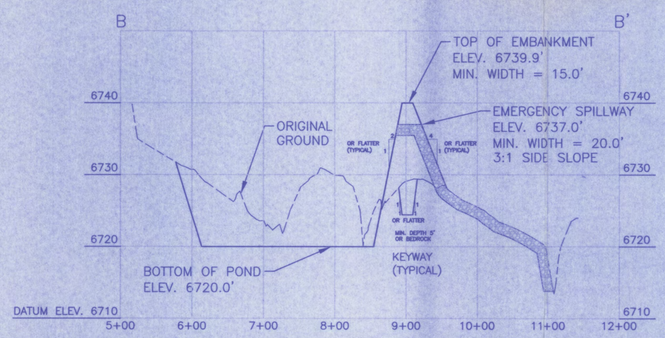
N9-H POND STAGE CAPACITY TABLE

ELEVATION (ft-msl)	STAGE (ft)	AREA (acres)	TOTAL CAPACITY (ac-ft)	DESCRIPTION
6720.0	0.0	0.48	0.00	BOTTOM OF POND
6725.0	5.0	0.78	3.14	INCISED ELEV.
6730.0	10.0	1.05	7.71	
6735.0	15.0	1.47	14.01	
6737.0	17.0	1.73	17.21	EMERGENCY SPILLWAY
6739.9	19.9	2.12	23.00	TOP OF EMBANKMENT



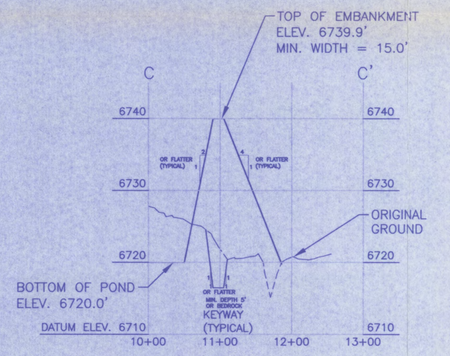
SECTION A – A'

SCALE: HORIZ. 1" = 100'
VERT. 1" = 10'



SECTION B – B'

SCALE: HORIZ. 1" = 100'
VERT. 1" = 10'



SECTION C – C'

SCALE: HORIZ. 1" = 100'
VERT. 1" = 10'

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ENGINEER'S CERTIFICATION

JAMES G. SCHLENVOGT
Engineering Supervisor
Peabody Western Coal Company

ARIZONA P.E. 18782

Date: DEC 23 2004

NOTES:
1) General location, see Drawing No. 85400, Sheet K-6 and Drawing No. 85405.
2) See Chapter 6, Black Mesa PAP for Construction Specifications.
3) See Vol. 2, Chapter 6, Attachment D, Sections 1-3 for description of Geotechnical Evaluation.
4) Salvage topsoil in accordance with approved topsoil salvage plan.
5) Reclamation of the distrubed area above the high waterline shall be in accordance with the approved reclamation plan.
6) Ponding area side slopes, typical 3:1 slope or flatter and blend into natural topography.

WOODSON
ENGINEERING AND SURVEYING, INC.
124 N. ELDEN ST.
FLAGSTAFF, AZ. 86001
PHONE: (928) 774-4636 FAX: (928) 774-4646

EXHIBIT # 1

PROPOSED N9-H
SEDIMENTATION POND DESIGN

KAYENTA MINE
PEABODY WESTERN COAL COMPANY
P. O. BOX 650 KAYENTA, ARIZONA 86033

DESIGNED BY: GA	SCALE: AS NOTED
DRAWN BY: PEK	DRAWING DATE: 11-22-04
CHECKED BY: JGS	PHOTO DATE: 05-83
CONTOUR INTERVAL: 5 FT.	DWG FILE: POND N9-H.DWG

DESIGN REPORT

Temporary Sedimentation Structure

N9-I

Kayenta Mine

Navajo County, Arizona

For

PEABODY WESTERN COAL COMPANY

SEP 2005 APPROVED

Registered Professional Engineer CERTIFICATE NO. 11782 JAMES CARL SCHLENVOGT Date Signed ..... ARIZONA, U.S.A.

DEC 23 2004

1

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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-I Proposed Sedimentation Pond

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INTRODUCTION

Sedimentation Structure N9-I will be an earthen embankment, designed and constructed by Peabody Western Coal Company (PWCC) 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-I 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.

This design report contains information specific to Structure N9-I. 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 N9-I 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.

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SITE DESCRIPTION

LAND USE

The N9-I Structure has a watershed of 25.44 acres and is located on a tributary upstream of Yazzie Wash at the Kayenta Mine. The 25.44-acre watershed, which contributes directly to structure N9-I, is classified as 5% undisturbed and 95% spoil.

DESIGN ANALYSES

GENERAL

Structure N9-I 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.

STABILITY

Structure N9-I 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 1.75H: 1V and minimum downstream slope of 3.25H: 1V were assumed. Based on the total embankment height of approximately 7 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.

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HYDROLOGY

The hydrologic analysis was completed using the computer program SEDCAD4 (see Appendices A, B, and C). Structure N9-I 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. The structure has capacity less than 20 acre-feet; therefore, the spillway was analyzed using the 25-year, 6-hour storm event. The structure was conservatively assumed to be full to the emergency spillway at the time of 25-year storm event. The storage capacity of structure N9-I was analyzed using the 10-year, 24-hour storm event. The pond was verified to completely contain the 10-year, 24-hour storm event, and provide adequate sediment storage volume, without discharging into Yazzie Wash.

The following parameters were used in the hydrologic analysis:

1.	Water Course length, L	0.311 mi.
2.	Elevation Difference, H	115 ft
3.	Time of Concentration, T_c	0.108 hr
4.	NRCS Curve Number	85
5.	Rainfall Depth, 10-year, 24-hour storm 25-year, 6-hour storm	2.1 in 1.9 in
6.	Drainage Area	25.44 acres

Values reported represent the watershed, which drains directly to Pond N9-I.

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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-I 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	24.24	30.76
Volume	ac-ft	1.84	1.53
Storage			
Peak Stage	msl	N/A	6787.6
Emerg. Spillway Elev.	msl	6787.0	6787.0
Peak Storage	ac-ft	N/A	4.26
Storage Capacity	ac-ft	3.87	3.87
Outflow			
Peak Flow	cfs	N/A	20.49
Spillway Elevation	msl	6787.0	6787.0
Embankment Crest Elev.	msl	6790.0	6790.0
Peak Stage	msl	--	6787.6
Freeboard	ft	--	2.4
Emergency Spillway Channel			
Flow Depth	ft	--	0.6
Critical Velocity	fps	--	3.81
Mannings "n"	--	--	0.048
Width	Ft	--	15
Outflow Channel			
Slope	%	--	25
Normal Velocity	Fps	--	6.27
Normal Depth	Ft	--	0.3
Mannings "n"	--	--	0.052
Riprap D_{50}	In	--	3

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EMERGENCY SPILLWAY AND OUTLET CHANNEL

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

Minimum Channel Depth	(Spillway)	1.5	ft
	(Outflow)	1.5	ft
Channel Width		15	ft
Channel Length	(Spillway)	33	ft
	(Outflow)	132	ft
Sideslopes (Horizontal to Vertical)		3:1	or flatter
Average Slope	(Spillway)	0	%
Maximum Slope	(Outflow)	25	%
Spillway Elevation		6787.0	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-I is designed to contain approximately 3.87 acre-feet.

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

1.	Rainfall Factor, R	40
2.	Soil Erodibility Factor, K	0.13
3.	Slope Factor, LS	5.03
4.	Cover Factor, C	0.96
5.	Erosion Control Factor, P	0.81

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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. Structure N9-I has sufficient storage capacity to contain the 10-year, 24-hour storm event. The storage capacity was determined for N9-I Structure and the results of the analysis are presented in the following table.

Storage for Structure N9-I

	N9-I
Total Storage Capacity (ac-ft)	3.87
10-Year, 24-Hour Storm Inflow (ac-ft)	1.84
Available Sediment Storage Capacity (ac-ft)	2.03
Sediment Inflow Rate/Year (ac-ft/yr)	0.23
Sediment Storage Life (yr)	8.8

* * *

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

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-I Proposed Sedimentation Pond

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APPENDIX A

Hydrology, Hydraulic, and Sedimentation Calculations

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CALCULATED HYDROLOGIC DATA

PROJECT: N-9 MINING AREA

STRUCTURE: I

TIME OF CONCENTRATION:

Start Elevation (ft) =	6890	
End Elevation (ft) =	6775	
Elevation Difference, E (ft) =	115	
Watercourse Length (ft) =	1642	
Watercourse Length (mi) =	0.311	
Tc = (11.9L^3/E)^0.385 =	0.108	hours

ROUTING PARAMETERS:

Between structure routing parameters were calculated using the SCS Upland mathod 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	0.538	34.97
Pinyon Juniper	D	83	0.85	70.55
Distrubed Land	B	86	24.05	2068.3
TOTAL:			25.438	2173.82

Weighted CN = Total CN * Area / Total Area = 85

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:

25.438 Acres

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PEABODY WESTERN COAL COMPANY
CALCULATED SEDIMENTOLOGY DATA

STRUCTURE: I

SOIL ERODIBILITY FACTOR:

Soil Type	Erodibility Factor, K	Area	K*Area
2B	0.43	0.85	0.37
16CE	0.05	0.538	0.03
Disturbed	0.12	24.05	2.89
	TOTAL	25.438	3.28

Weighted K = Total K * Area / Total Area = 0.13

SLOPE FACTOR:

Length (ft)		Slope (%)	m	Slope Angle (deg)	LS Factor
394	55	13.96%	0.60	7.95	5.03
450	59	13.11%	0.60	7.47	5.03

Average LS = 5.03

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

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STRUCTURE: I

Cover and Practice Factors:

Cover Type	Cover (%)	Canopy (%)	Area (acres)	Cover Factor, C	C * Area	Practive Factor, P	P * Area
Pinyon Juniper	40%	25%	1.388	0.22	0.31	1.00	1.388
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%	24.05	1	24.05	0.80	19.24
TOTAL:			25.438		24.36		20.63

Weighted C = Total C * Area / Total Area = 0.96

Weighted P = Total P * Area / Total Area = 0.81

RAINFALL FACTOR:

R= 40

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CALCULATED SEDIMENT YIELD

STRUCTURE: I

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)	0.13
Length Slope Factor (L)	5.03
Cover Factor(C)	0.96
Practice Factor (P)	0.81
Gross Annual Sediment Yield	20.14 tons/acre/year
Sediment Density	94.00 pcf
Gross Annual Sediment Yield	0.0098 acre-feet/acre/year
Sediment Delivery Ratio	90%
Estimated Annual Sediment Yield	0.0089 acre-feet/acre/year
Watershed Area	25.44 acres
Watershed Annual Sediment Yield	0.23 acre-feet/year
Number of Years	1.00 years
Calculated Sediment Volume	0.23 acre-feet

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TRAPEZOIDAL CHANNEL ANALYSIS
CRITICAL DEPTH COMPUTATION
N9-I POND
November 11, 2004

PROGRAM INPUT DATA

DESCRIPTION	VALUE
Flow Rate (cfs)	30.76
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)	15.0

COMPUTATION RESULTS

DESCRIPTION	VALUE
Critical Depth (ft)	0.49
Critical Slope (ft/ft)	0.0443
Flow Velocity (fps)	3.81
Froude Number	1.0
Velocity Head (ft)	0.23
Energy Head (ft)	0.72
Cross-Sectional Area of Flow (sq ft)	8.08
Top Width of Flow (ft)	17.94

HYDROCALC Hydraulics for Windows, Version 1.2 Copyright (c) 1996
Dodson & Associates, Inc., 5629 FM 1960 West, Suite 314, Houston, TX 77069
Phone:(281)440-3787, Fax:(281)440-4742, Email:software@dodson-hydro.com
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N9-I POND OUTFLOW CHANNEL

Material: Riprap

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
15.00	3.0:1	3.0:1	25.0	1.00		

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	30.76 cfs	
Depth:	0.31 ft	1.31 ft
Top Width:	16.85 ft	22.85 ft
Velocity:	6.27 fps	
X-Section Area:	4.91 sq ft	
Hydraulic Radius:	0.289	
Froude Number:	2.05	
Manning's n:	0.0520	
Dmin:	2.00 in	
D50:	3.00 in	
Dmax:	4.50 in	

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APPENDIX B

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

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

Gary Altsisi

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General Information

Storm Information:

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

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Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	25.440	25.440	24.24	1.84

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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	25.440	0.108	0.000	0.000	85.000	F	24.24	1.843
	$\sum$	**25.440**						**24.24**	**1.843**

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APPENDIX C

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

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Peabody Western Coal

Kayenta Mine

N9-I POND DESIGN

25YR 6HR STORM

SEP 2005
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Gary Altsisi

General Information

Storm Information:

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

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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	25.440	0.108	0.000	0.000	85.000	F	30.76	1.532
	$\sum$	**25.440**						**30.76**	**1.532**

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Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Pond	#1	==>	End	0.000	0.000	

#1
Pond

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Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	In	25.440	25.440	30.76	1.53
	Out			20.49	1.53

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Structure Detail:

Structure #1 (Pond)

Pond Inputs:

Initial Pool Elev:	6,787.00
Initial Pool:	3.87 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
6,787.00	33.00	3.00:1	3.00:1	15.00

Pond Results:

Peak Elevation:	6,787.60
Dewater Time:	0.18 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)
6,775.00	0.100	0.000	0.000	
6,775.50	0.117	0.054	0.000	
6,776.00	0.136	0.118	0.000	
6,776.50	0.156	0.191	0.000	
6,777.00	0.178	0.274	0.000	
6,777.50	0.200	0.368	0.000	
6,778.00	0.225	0.474	0.000	
6,778.50	0.250	0.593	0.000	
6,779.00	0.277	0.725	0.000	
6,779.50	0.305	0.870	0.000	
6,780.00	0.335	1.030	0.000	
6,780.50	0.341	1.199	0.000	
6,781.00	0.346	1.371	0.000	
6,781.50	0.352	1.545	0.000	
6,782.00	0.358	1.723	0.000	
6,782.50	0.364	1.903	0.000	
6,783.00	0.369	2.086	0.000	
6,783.50	0.375	2.273	0.000	

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Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
6,784.00	0.381	2.462	0.000		
6,784.50	0.387	2.654	0.000		
6,785.00	0.393	2.849	0.000		
6,785.50	0.449	3.059	0.000		
6,786.00	0.509	3.299	0.000		
6,786.50	0.572	3.569	0.000		
6,787.00	0.639	3.871	0.000		Spillway #1
6,787.50	0.641	4.191	16.963	4.15	
6,787.60	0.642	4.258	20.494	0.10	Peak Stage
6,788.00	0.644	4.512	33.925		
6,788.50	0.646	4.835	76.589		
6,789.00	0.648	5.158	128.419		
6,789.50	0.650	5.483	194.754		
6,790.00	0.653	5.809	279.741		

Detailed Discharge Table

Elevation	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
6,775.00	0.000	0.000
6,775.50	0.000	0.000
6,776.00	0.000	0.000
6,776.50	0.000	0.000
6,777.00	0.000	0.000
6,777.50	0.000	0.000
6,778.00	0.000	0.000
6,778.50	0.000	0.000
6,779.00	0.000	0.000
6,779.50	0.000	0.000
6,780.00	0.000	0.000
6,780.50	0.000	0.000
6,781.00	0.000	0.000
6,781.50	0.000	0.000
6,782.00	0.000	0.000
6,782.50	0.000	0.000
6,783.00	0.000	0.000
6,783.50	0.000	0.000
6,784.00	0.000	0.000
6,784.50	0.000	0.000

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Elevation	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
6,785.00	0.000	0.000
6,785.50	0.000	0.000
6,786.00	0.000	0.000
6,786.50	0.000	0.000
6,787.00	0.000	0.000
6,787.50	16.963	16.963
6,788.00	33.925	33.925
6,788.50	76.589	76.589
6,789.00	128.419	128.419
6,789.50	194.754	194.754
6,790.00	279.741	279.741

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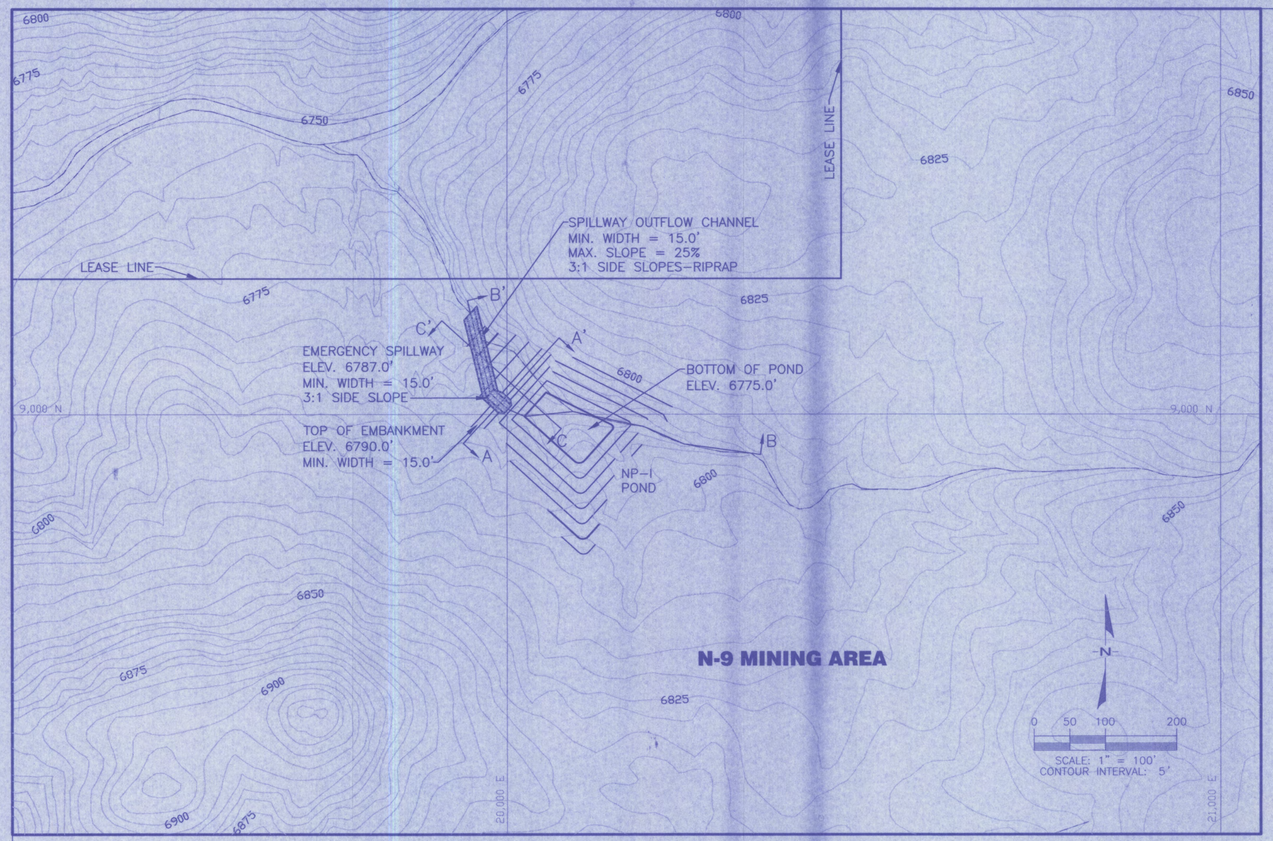
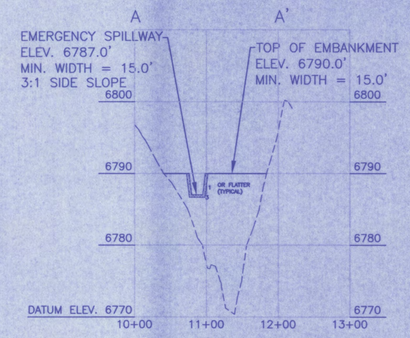
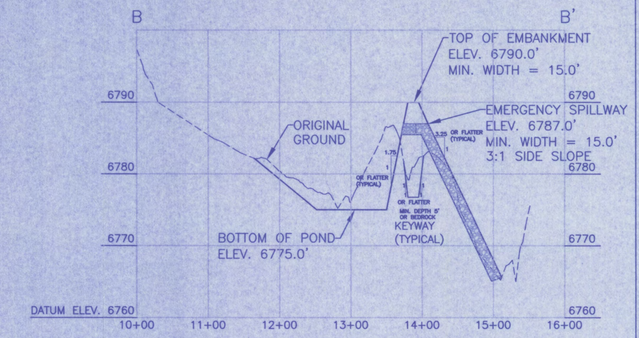




SECTION A – A'
SCALE: HORIZ. 1" = 100'
VERT. 1" = 10'



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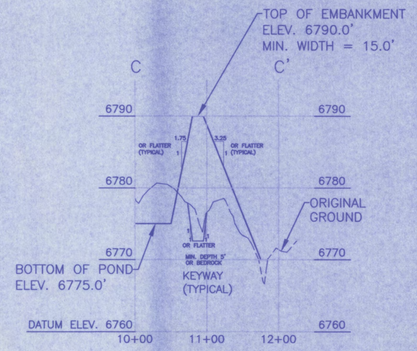
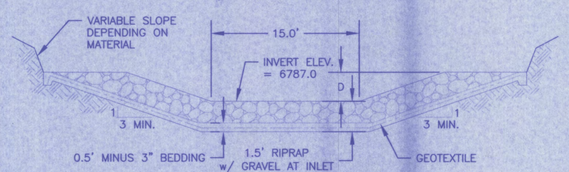
VERT. 1" = 10'



SECTION C – C'
SCALE: HORIZ. 1" = 100'
VERT. 1" = 10'

N9-I POND STAGE CAPACITY TABLE

ELEVATION (ft-msl)	STAGE (ft)	AREA (acres)	TOTAL CAPACITY (ac-ft)	DESCRIPTION
6775.0	0.0	0.14	0.00	BOTTOM OF POND
6780.0	5.0	0.27	1.03	INCISED ELEV.
6785.0	10.0	0.46	2.85	
6787.0	12.0	0.57	3.87	EMERGENCY SPILLWAY
6790.0	15.0	0.73	5.81	TOP OF EMBANKMENT



SPILLWAY MIN. D=1.5'
OUTFLOW CHANNEL MIN. D=1.5'

SECTION OF EMERGENCY SPILLWAY
NOT TO SCALE
N9-I POND

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ENGINEER'S CERTIFICATION

JAMES C. SCHLENVOGT
Engineering Supervisor
Peabody Western Coal Company

ARIZONA P.E. 18782
Date: DEC 23 2004

NOTES:
1) General location, see Drawing No. 85400, Sheet K-6 and Drawing No. 85405.
2) See Chapter 6, Black Mesa PAP for Construction Specifications.
3) See Vol. 2, Chapter 6, Attachment D, Sections 1-3 for description of Geotechnical Evaluation.
4) Salvage topsoil in accordance with approved topsoil salvage plan.
5) Reclamation of the distrubed area above the high waterline shall be in accordance with the approved reclamation plan.
6) Ponding area side slopes, typical 3:1 slope or flatter and blend into natural topography.

WOODSON
ENGINEERING AND SURVEYING, INC.
124 N. ELDEN ST.
FLAGSTAFF, AZ 86001
PHONE: (928) 774-4636 FAX: (928) 774-4646

EXHIBIT # 1
PROPOSED N9-I
SEDIMENTATION POND DESIGN
KAYENTA MINE
PEABODY WESTERN COAL COMPANY
P. O. BOX 650 KAYENTA, ARIZONA 86033

DESIGNED BY: GA	SCALE: AS NOTED
DRAWN BY: PEK	DRAWING DATE: 11-22-04
CHECKED BY: JGS	PHOTO DATE: 05-83
CONTOUR INTERVAL: 5 FT.	DWG FILE: POND N9-I.DWG

DESIGN REPORT

Temporary Sedimentation Structure

N9-J (Lower)

Kayenta Mine

Navajo County, Arizona

For

PEABODY WESTERN COAL COMPANY

SEP 2005 APPROVED

Registered Professional Engineer (Civil) CERTIFICATE NO. 18782 JAMES GARY SCHLENVOGT Date Signed

DEC 23 2004

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

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INTRODUCTION

Sedimentation Structure N9-J will be an earthen embankment, designed and constructed by Peabody Western Coal Company (PWCC) 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-J 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.

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

INSPECTION

The construction site of the proposed Structure N9-J 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.

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SITE DESCRIPTION

LAND USE

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 44.45-acre watershed, which contributes directly to structure N9-J, is classified as 8% undisturbed and 92% spoil.

DESIGN ANALYSES

GENERAL

Structure N9-J 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.

STABILITY

Structure N9-J 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 minimum downstream slope of 4H: 1V were 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 40-foot wide, riprap-lined, trapezoidal channel.

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HYDROLOGY

The hydrologic analysis was completed using the computer program SEDCAD4 (see Appendices A, B, and C). Structure N9-J will be constructed in series with proposed Structures N9-J3, N9-J2 and N9-J1. Structure N9-J is the lower pond in the series and 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. The four structures have a combined capacity greater than 20 acre-feet; therefore, the spillway was analyzed using the 100-year, 6-hour storm event in lieu of the 25-year, 6-hour storm. The structure was conservatively assumed to be full to the emergency spillway at the time of 100-year storm event. The storage capacity of structure N9-J 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 Yazzie Wash.

The following parameters were used in the hydrologic analysis:

1.	Water Course length, L	0.122 mi.
2.	Elevation Difference, H	20 ft
3.	Time of Concentration, T_c	0.072 hr
4.	NRCS Curve Number	86
5.	Rainfall Depth, 10-year, 24-hour storm	2.1 in
	100-year, 6-hour storm	2.4 in
	Drainage Area	44.45 acres

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

Muskingum routing parameters were utilized to route the 100-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).

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N9-J SEDIMENTATION POND HYDRAULICS TABLE

	Units	10-Yr, 24-Hr Storm	100-Yr, 6-Hr Storm
Initial Reservoir Volume Condition		Empty	Full to emergency spillway
Inflow			
Peak Flow	cfs	44.61	347.48
Volume	ac-ft	3.43	46.06
Storage			
Peak Stage	msl	N/A	6787.6
Emerg. Spillway Elev.	msl	6785.5	6785.5
Peak Storage	ac-ft	N/A	23.9
Storage Capacity	ac-ft	19.7	19.7
Outflow			
Peak Flow	cfs	N/A	331.4
Spillway Elevation	msl	6785.5	6785.5
Embankment Crest Elev.	msl	6789.9	6789.9
Peak Stage	msl	--	6787.6
Freeboard	ft	--	2.3
Emergency Spillway Channel			
Flow Depth	ft	--	2.1
Critical Velocity	fps	--	6.2
Mannings "n"	--	--	0.048
Width	ft	--	40
Outflow Channel			
Slope	%	--	25
Normal Velocity	fps	--	9.8
Normal Depth	ft	--	0.9
Mannings "n"	--	--	0.065
Riprap D_{50}	in	--	9

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EMERGENCY SPILLWAY AND OUTLET CHANNEL

The emergency spillway and outlet channel for N9-J 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
	(Outflow)	2.0	ft
Channel Width		40	ft
Channel Length	(Spillway)	42	ft
	(Outflow)	137	ft
Sideslopes (Horizontal to Vertical)		3:1	or flatter
Average Slope	(Spillway)	0	%
Maximum Slope	(Outflow)	25	%
Spillway Elevation		6785.5	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-J is designed to contain approximately 19.66 acre-feet.

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

1. Rainfall Factor, R — 40
2. Soil Erodibility Factor, K — 0.12
3. Slope Factor, LS — 8.64
4. Cover Factor, C — 0.94
5. Erosion Control Factor, P — 0.82

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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. Structure N9-J has sufficient storage capacity to contain the 10-year, 24-hour storm and has additional capacity to store excess runoff from the N9-J3, N9-J2 and N9-J1 watersheds. The combined storage capacity was determined for all four structures in series and the results of the analysis are presented in the following table.

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

	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

* * *

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

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) 100-Year, 6-Hour Storm Event

Exhibit #1- N9-J3, N9-J2, N9-J1and N9-J Proposed Sedimentation Ponds

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APPENDIX A

Hydrology, Hydraulic, and Sedimentation Calculations

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PEABODY WESTERN COAL COMPANY
CALCULATED HYDROLOGIC DATA

PROJECT: N-9 MINING AREA

STRUCTURE: J

TIME OF CONCENTRATION:

Start Elevation (ft) =	6790	
End Elevation (ft) =	6770	
Elevation Difference, E (ft) =	20	
Watercourse Length (ft) =	646	
Watercourse Length (mi) =	0.122	
Tc = (11.9L^3/E)^0.385 =	0.072	hours

ROUTING PARAMETERS:

Between structure routing parameters were calculated using the SCS Upland mathod 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	D	83	3.175	263.525
Sagebrush	D	79	0.289	22.831
Distrubed Land	B	86	40.99	3525.14
TOTAL:			44.454	3811.496

Weighted CN = Total CN * Area / Total Area = 86

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:

44.454 Acres

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PEABODY WESTERN COAL COMPANY
CALCULATED SEDIMENTOLOGY DATA

STRUCTURE: J

SOIL ERODIBILITY FACTOR:

Soil Type	Erodibility Factor, K	Area	K*Area
1CD	0.16	2.429	0.39
2B	0.43	0.025	0.01
3DE	0.15	0.006	0.00
7E	0.14	1.004	0.14
Disturbed	0.12	40.99	4.92
	TOTAL	44.454	5.46

Weighted K = Total K * Area / Total Area = 0.12

SLOPE FACTOR:

Length (ft)		Slope (%)	m	Slope Angle (deg)	LS Factor
394	115	29.19%	0.60	16.27	11.61
504	90	17.86%	0.60	10.12	7.84
394	75	19.04%	0.60	10.78	7.29
624	100	16.03%	0.60	9.1	7.84

Average LS = 8.64

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

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STRUCTURE: J

Cover and Practice Factors:

Cover Type	Cover (%)	Canopy (%)	Area (acres)	Cover Factor, C	C * Area	Practive Factor, P	P * Area
Pinyon Juniper	40%	25%	3.175	0.22	0.70	1.00	3.175
Sagebrush, Grass	40%	25%	0.289	0.2	0.06	1.00	0.289
Saltbrush	40%	25%	0	0.2	0.00	1.00	0
Disturbed	0%	0%	40.99	1	40.99	0.80	32.792
TOTAL:			44.454		41.75		36.26

Weighted C = Total C * Area / Total Area = 0.94

Weighted P = Total P * Area / Total Area = 0.82

RAINFALL FACTOR:

R= 40

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PEABODY WESTERN COAL COMPANY
CALCULATED SEDIMENT YIELD

STRUCTURE: J

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)	0.12
Length Slope Factor (L)	8.64
Cover Factor(C)	0.94
Practice Factor (P)	0.82
Gross Annual Sediment Yield	32.53 tons/acre/year
Sediment Density	94.00 pcf
Gross Annual Sediment Yield	0.0159 acre-feet/acre/year
Sediment Delivery Ratio	90%
Estimated Annual Sediment Yield	0.0143 acre-feet/acre/year
Watershed Area	44.45 acres
Watershed Annual Sediment Yield	0.64 acre-feet/year
Number of Years	1.00 years
Calculated Sediment Volume	0.64 acre-feet

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

PROGRAM INPUT DATA

DESCRIPTION	VALUE
Flow Rate (cfs)	347.48
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)	40.0

COMPUTATION RESULTS

DESCRIPTION	VALUE
Critical Depth (ft)	1.29
Critical Slope (ft/ft)	0.0321
Flow Velocity (fps)	6.17
Froude Number	1.0
Velocity Head (ft)	0.59
Energy Head (ft)	1.88
Cross-Sectional Area of Flow (sq ft)	56.36
Top Width of Flow (ft)	47.71

HYDROCALC Hydraulics for Windows, Version 1.2 Copyright (c) 1996
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Phone:(281)440-3787, Fax:(281)440-4742, Email:software@dodson-hydro.com
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N9-J POND OUTFLOW CHANNEL

Material: Riprap

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
40.00	3.0:1	3.0:1	25.0	3.66		

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	347.48 cfs	
Depth:	0.84 ft	4.50 ft
Top Width:	45.02 ft	66.98 ft
Velocity:	9.76 fps	
X-Section Area:	35.60 sq ft	
Hydraulic Radius:	0.786	
Froude Number:	1.93	
Manning's n:	0.0650	
Dmin:	5.00 in	
D50:	9.00 in	
Dmax:	12.00 in	

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APPENDIX B

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

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

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SEP 2005

Gary Altsisi

General Information

Storm Information:

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

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Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	44.450	44.450	44.61	3.43

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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	44.450	0.072	0.000	0.000	86.000	F	44.61	3.428
	$\sum$	**44.450**						**44.61**	**3.428**

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APPENDIX C

SEDCAD4 (Input and Output) 100-Year, 6-Hour Storm Event

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Peabody Western Coal

Kayenta Mine

N9-J POND DESIGN

100YR 6HR STORM

Gary Altsisi

SEP 2005
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General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.400 inches

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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	335.02	25.641
	Σ	**296.160**						**335.02**	**25.641**
#2	Σ	**296.160**						**264.88**	**25.641**
#3	1	138.860	0.137	0.000	0.000	84.000	F	192.00	12.022
	Σ	**435.020**						**380.62**	**37.663**
#4	Σ	**435.020**						**331.14**	**37.663**
#5	1	44.710	0.098	0.000	0.000	85.000	F	78.56	4.096
	Σ	**479.730**						**346.87**	**41.759**
#6	Σ	**479.730**						**331.11**	**41.759**
#7	1	44.450	0.072	0.000	0.000	86.000	F	81.31	4.305
	Σ	**524.180**						**347.48**	**46.064**

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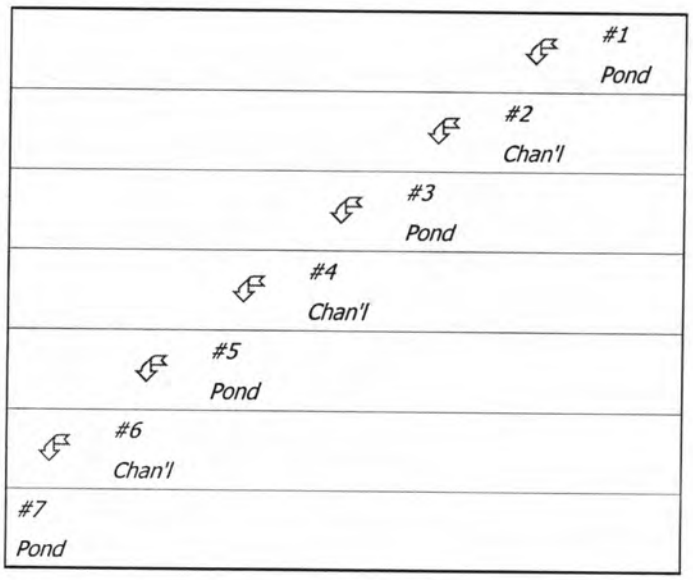
Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Pond	#1	==>	#2	0.000	0.000	N9-J3 POND
Channel	#2	==>	#3	0.000	0.000	N9-J3 SPILLWAY
Pond	#3	==>	#4	0.000	0.000	N9-J2 POND
Channel	#4	==>	#5	0.000	0.000	N9-J2 SPILLWAY
Pond	#5	==>	#6	0.000	0.000	N9-J1 POND
Channel	#6	==>	#7	0.000	0.000	N9-J1 SPILLWAY
Pond	#7	==>	End	0.000	0.000	N9-J POND



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Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	In	296.160	296.160	335.02	25.64
	Out			264.88	25.64
#2		0.000	296.160	264.88	25.64
#3	In	138.860	435.020	380.62	37.66
	Out			331.14	37.67
#4		0.000	435.020	331.14	37.66
#5	In	44.710	479.730	346.87	41.76
	Out			331.11	41.76
#6		0.000	479.730	331.11	41.76
#7	In	44.450	524.180	347.48	46.06
	Out			331.36	46.07

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Structure Detail:

Structure #1 (Pond)

N9-J3 POND

Pond Inputs:

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

Emergency Spillway

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

Pond Results:

Peak Elevation:	6,880.79
Dewater Time:	0.29 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	
6,865.50	1.025	0.506	0.000	
6,866.00	1.050	1.025	0.000	
6,866.50	1.076	1.557	0.000	
6,867.00	1.102	2.101	0.000	
6,867.50	1.128	2.658	0.000	
6,868.00	1.155	3.229	0.000	
6,868.50	1.181	3.813	0.000	
6,869.00	1.209	4.410	0.000	
6,869.50	1.236	5.022	0.000	
6,870.00	1.264	5.646	0.000	
6,870.50	1.308	6.289	0.000	
6,871.00	1.352	6.954	0.000	
6,871.50	1.397	7.641	0.000	
6,872.00	1.443	8.352	0.000	
6,872.50	1.490	9.085	0.000	
6,873.00	1.538	9.842	0.000	

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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	3.15	
6,879.00	2.145	20.788	33.351	1.60	
6,879.50	2.231	21.882	61.138	1.20	
6,880.00	2.319	23.019	128.257	0.50	
6,880.50	2.371	24.192	207.526	0.30	
6,880.79	2.402	24.898	264.877	0.15	Peak Stage
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

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

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

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Structure #2 (Riprap Channel)

N9-J3 SPILLWAY

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)}	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
25.00	3.0:1	3.0:1	25.0	4.08		

Riprap Channel Results:

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	264.88 cfs	
Depth:	0.92 ft	5.00 ft
Top Width:	30.50 ft	54.98 ft
Velocity:	10.41 fps	
X-Section Area:	25.44 sq ft	
Hydraulic Radius:	0.826	
Froude Number:	2.01	
Manning's n:	0.0630	
Dmin:	5.00 in	
D50:	9.00 in	
Dmax:	12.00 in	

Structure #3 (Pond)

N9-J2 POND

Pond Inputs:

Initial Pool Elev:	6,831.60
Initial Pool:	19.52 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
6,831.60	35.40	3.00:1	3.00:1	42.00

Pond Results:

Peak Elevation:	6,833.65
Dewater Time:	0.31 days

Dewatering time is calculated from peak stage to lowest spillway

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Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
6,815.00	0.600	0.000	0.000	
6,815.50	0.624	0.306	0.000	
6,816.00	0.648	0.624	0.000	
6,816.50	0.673	0.954	0.000	

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
6,817.00	0.698	1.297	0.000		
6,817.50	0.724	1.653	0.000		
6,818.00	0.750	2.021	0.000		
6,818.50	0.776	2.403	0.000		
6,819.00	0.804	2.798	0.000		
6,819.50	0.831	3.206	0.000		
6,820.00	0.859	3.629	0.000		
6,820.50	0.891	4.066	0.000		
6,821.00	0.924	4.520	0.000		
6,821.50	0.957	4.990	0.000		
6,822.00	0.991	5.477	0.000		
6,822.50	1.025	5.981	0.000		
6,823.00	1.060	6.502	0.000		
6,823.50	1.096	7.041	0.000		
6,824.00	1.132	7.598	0.000		
6,824.50	1.169	8.174	0.000		
6,825.00	1.206	8.767	0.000		
6,825.50	1.264	9.385	0.000		
6,826.00	1.323	10.032	0.000		
6,826.50	1.384	10.709	0.000		
6,827.00	1.446	11.416	0.000		
6,827.50	1.509	12.155	0.000		
6,828.00	1.574	12.925	0.000		
6,828.50	1.640	13.728	0.000		
6,829.00	1.707	14.565	0.000		
6,829.50	1.775	15.435	0.000		
6,830.00	1.845	16.341	0.000		
6,830.50	1.931	17.285	0.000		
6,831.00	2.019	18.272	0.000		
6,831.50	2.109	19.304	0.000		
6,831.60	2.127	19.516	0.000		Spillway #1
6,832.00	2.203	20.382	32.169	4.35	
6,832.50	2.299	21.507	72.390	1.75	
6,833.00	2.398	22.682	168.704	0.80	
6,833.50	2.499	23.906	287.540	0.40	
6,833.65	2.531	24.301	331.138	0.15	Peak Stage
6,834.00	2.602	25.181	428.353		
6,834.50	2.706	26.508	602.181		
6,835.00	2.813	27.888	803.202		

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Detailed Discharge Table

Elevation	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
6,815.00	0.000	0.000
6,815.50	0.000	0.000
6,816.00	0.000	0.000
6,816.50	0.000	0.000
6,817.00	0.000	0.000
6,817.50	0.000	0.000
6,818.00	0.000	0.000
6,818.50	0.000	0.000
6,819.00	0.000	0.000
6,819.50	0.000	0.000
6,820.00	0.000	0.000
6,820.50	0.000	0.000
6,821.00	0.000	0.000
6,821.50	0.000	0.000
6,822.00	0.000	0.000
6,822.50	0.000	0.000
6,823.00	0.000	0.000
6,823.50	0.000	0.000
6,824.00	0.000	0.000
6,824.50	0.000	0.000
6,825.00	0.000	0.000
6,825.50	0.000	0.000
6,826.00	0.000	0.000
6,826.50	0.000	0.000
6,827.00	0.000	0.000
6,827.50	0.000	0.000
6,828.00	0.000	0.000
6,828.50	0.000	0.000
6,829.00	0.000	0.000
6,829.50	0.000	0.000
6,830.00	0.000	0.000
6,830.50	0.000	0.000
6,831.00	0.000	0.000
6,831.50	0.000	0.000
6,831.60	0.000	0.000
6,832.00	32.169	32.169
6,832.50	72.390	72.390
6,833.00	168.704	168.704

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Elevation	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
6,833.50	287.540	287.540
6,834.00	428.353	428.353
6,834.50	602.181	602.181
6,835.00	803.202	803.202

Structure #4 (Riprap Channel)

N9-J2 SPILLWAY

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)}	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
42.00	3.0:1	3.0:1	25.0	2.59		

Riprap Channel Results:

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	331.14 cfs	
Depth:	0.81 ft	3.40 ft
Top Width:	46.83 ft	62.37 ft
Velocity:	9.26 fps	
X-Section Area:	35.77 sq ft	
Hydraulic Radius:	0.760	
Froude Number:	1.87	
Manning's n:	0.0670	
Dmin:	5.00 in	
D50:	9.00 in	
Dmax:	12.00 in	

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Structure #5 (Pond)

N9-J1 POND

Pond Inputs:

Initial Pool Elev:	6,807.10
Initial Pool:	19.39 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
6,807.10	32.40	3.00:1	3.00:1	47.00

Pond Results:

Peak Elevation:	6,809.03
Dewater Time:	0.32 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)
6,790.00	0.621	0.000	0.000	
6,790.50	0.644	0.316	0.000	
6,791.00	0.667	0.644	0.000	
6,791.50	0.690	0.983	0.000	
6,792.00	0.713	1.334	0.000	
6,792.50	0.737	1.696	0.000	
6,793.00	0.762	2.071	0.000	
6,793.50	0.787	2.458	0.000	
6,794.00	0.812	2.858	0.000	
6,794.50	0.838	3.270	0.000	
6,795.00	0.863	3.695	0.000	
6,795.50	0.893	4.135	0.000	
6,796.00	0.924	4.589	0.000	
6,796.50	0.955	5.059	0.000	
6,797.00	0.986	5.544	0.000	
6,797.50	1.018	6.045	0.000	
6,798.00	1.051	6.562	0.000	
6,798.50	1.084	7.096	0.000	
6,799.00	1.117	7.646	0.000	
6,799.50	1.151	8.214	0.000	
6,800.00	1.186	8.798	0.000	
6,800.50	1.225	9.401	0.000	
6,801.00	1.265	10.023	0.000	
6,801.50	1.306	10.666	0.000	
6,802.00	1.347	11.329	0.000	
6,802.50	1.388	12.013	0.000	
6,803.00	1.431	12.717	0.000	
6,803.50	1.474	13.444	0.000	
6,804.00	1.518	14.192	0.000	

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Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
6,804.50	1.562	14.961	0.000		
6,805.00	1.607	15.754	0.000		
6,805.50	1.665	16.572	0.000		
6,806.00	1.723	17.418	0.000		
6,806.50	1.783	18.295	0.000		
6,807.00	1.844	19.202	0.000		
6,807.10	1.856	19.387	0.000		Spillway #1
6,807.50	1.896	20.137	36.626	4.60	
6,808.00	1.948	21.098	82.420	1.85	
6,808.50	2.000	22.085	190.619	0.75	
6,809.00	2.052	23.098	321.502	0.45	
6,809.03	2.056	23.161	331.111	0.05	Peak Stage
6,809.50	2.106	24.137	479.414		
6,810.00	2.160	25.204	672.043		

Detailed Discharge Table

Elevation	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
6,790.00	0.000	0.000
6,790.50	0.000	0.000
6,791.00	0.000	0.000
6,791.50	0.000	0.000
6,792.00	0.000	0.000
6,792.50	0.000	0.000
6,793.00	0.000	0.000
6,793.50	0.000	0.000
6,794.00	0.000	0.000
6,794.50	0.000	0.000
6,795.00	0.000	0.000
6,795.50	0.000	0.000
6,796.00	0.000	0.000
6,796.50	0.000	0.000
6,797.00	0.000	0.000
6,797.50	0.000	0.000
6,798.00	0.000	0.000
6,798.50	0.000	0.000
6,799.00	0.000	0.000
6,799.50	0.000	0.000

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Elevation	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
6,800.00	0.000	0.000
6,800.50	0.000	0.000
6,801.00	0.000	0.000
6,801.50	0.000	0.000
6,802.00	0.000	0.000
6,802.50	0.000	0.000
6,803.00	0.000	0.000
6,803.50	0.000	0.000
6,804.00	0.000	0.000
6,804.50	0.000	0.000
6,805.00	0.000	0.000
6,805.50	0.000	0.000
6,806.00	0.000	0.000
6,806.50	0.000	0.000
6,807.00	0.000	0.000
6,807.10	0.000	0.000
6,807.50	36.626	36.626
6,808.00	82.420	82.420
6,808.50	190.619	190.619
6,809.00	321.502	321.502
6,809.50	479.414	479.414
6,810.00	672.043	672.043

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Structure #6 (Riprap Channel)

N9-J1 SPILLWAY

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)}	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
47.00	3.0:1	30.0:1	25.0	2.25		

Riprap Channel Results:

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	331.11 cfs	
Depth:	0.65 ft	2.90 ft

	w/o Freeboard	w/ Freeboard
Top Width:	68.55 ft	142.80 ft
Velocity:	8.77 fps	
X-Section Area:	37.73 sq ft	
Hydraulic Radius:	0.550	
Froude Number:	2.08	
Manning's n:	0.0570	
Dmin:	3.00 in	
D50:	6.00 in	
Dmax:	9.00 in	

Structure #7 (Pond)

N9-J POND

Pond Inputs:

Initial Pool Elev:	6,785.50
Initial Pool:	19.66 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
6,785.50	42.00	3.00:1	3.00:1	40.00

Pond Results:

Peak Elevation:	6,787.64
Dewater Time:	0.34 days

Dewatering time is calculated from peak stage to lowest spillway

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Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
6,770.00	0.774	0.000	0.000	
6,770.50	0.800	0.393	0.000	
6,771.00	0.826	0.800	0.000	
6,771.50	0.853	1.220	0.000	
6,772.00	0.881	1.653	0.000	
6,772.50	0.908	2.101	0.000	
6,773.00	0.936	2.562	0.000	
6,773.50	0.965	3.037	0.000	
6,774.00	0.994	3.527	0.000	

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
6,774.50	1.023	4.031	0.000		
6,775.00	1.053	4.550	0.000		
6,775.50	1.086	5.085	0.000		
6,776.00	1.119	5.637	0.000		
6,776.50	1.153	6.204	0.000		
6,777.00	1.187	6.789	0.000		
6,777.50	1.221	7.391	0.000		
6,778.00	1.257	8.011	0.000		
6,778.50	1.292	8.648	0.000		
6,779.00	1.328	9.303	0.000		
6,779.50	1.365	9.976	0.000		
6,780.00	1.402	10.668	0.000		
6,780.50	1.443	11.379	0.000		
6,781.00	1.484	12.111	0.000		
6,781.50	1.525	12.863	0.000		
6,782.00	1.567	13.636	0.000		
6,782.50	1.610	14.430	0.000		
6,783.00	1.654	15.246	0.000		
6,783.50	1.698	16.084	0.000		
6,784.00	1.742	16.944	0.000		
6,784.50	1.787	17.826	0.000		
6,785.00	1.833	18.732	0.000		
6,785.50	1.863	19.656	0.000		Spillway #1
6,786.00	1.912	20.599	40.113	4.85	
6,786.50	1.961	21.568	80.226	1.60	
6,787.00	2.011	22.561	178.098	1.00	
6,787.50	2.061	23.579	294.671	0.45	
6,787.64	2.075	23.861	331.356	0.15	Peak Stage
6,788.00	2.112	24.622	430.102		
6,788.50	2.164	25.691	601.243		
6,789.00	2.216	26.786	797.721		
6,789.50	2.269	27.908	1,029.168		
6,790.00	2.323	29.056	1,262.007		

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Detailed Discharge Table

Elevation	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
6,770.00	0.000	0.000
6,770.50	0.000	0.000
6,771.00	0.000	0.000
6,771.50	0.000	0.000
6,772.00	0.000	0.000
6,772.50	0.000	0.000
6,773.00	0.000	0.000
6,773.50	0.000	0.000
6,774.00	0.000	0.000
6,774.50	0.000	0.000
6,775.00	0.000	0.000
6,775.50	0.000	0.000
6,776.00	0.000	0.000
6,776.50	0.000	0.000
6,777.00	0.000	0.000
6,777.50	0.000	0.000
6,778.00	0.000	0.000
6,778.50	0.000	0.000
6,779.00	0.000	0.000
6,779.50	0.000	0.000
6,780.00	0.000	0.000
6,780.50	0.000	0.000
6,781.00	0.000	0.000
6,781.50	0.000	0.000
6,782.00	0.000	0.000
6,782.50	0.000	0.000
6,783.00	0.000	0.000
6,783.50	0.000	0.000
6,784.00	0.000	0.000
6,784.50	0.000	0.000
6,785.00	0.000	0.000
6,785.50	0.000	0.000
6,786.00	40.113	40.113
6,786.50	80.226	80.226
6,787.00	178.098	178.098
6,787.50	294.671	294.671
6,788.00	430.102	430.102
6,788.50	601.243	601.243
6,789.00	797.721	797.721
6,789.50	1,029.168	1,029.168

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Elevation	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
6,790.00	1,262.007	1,262.007

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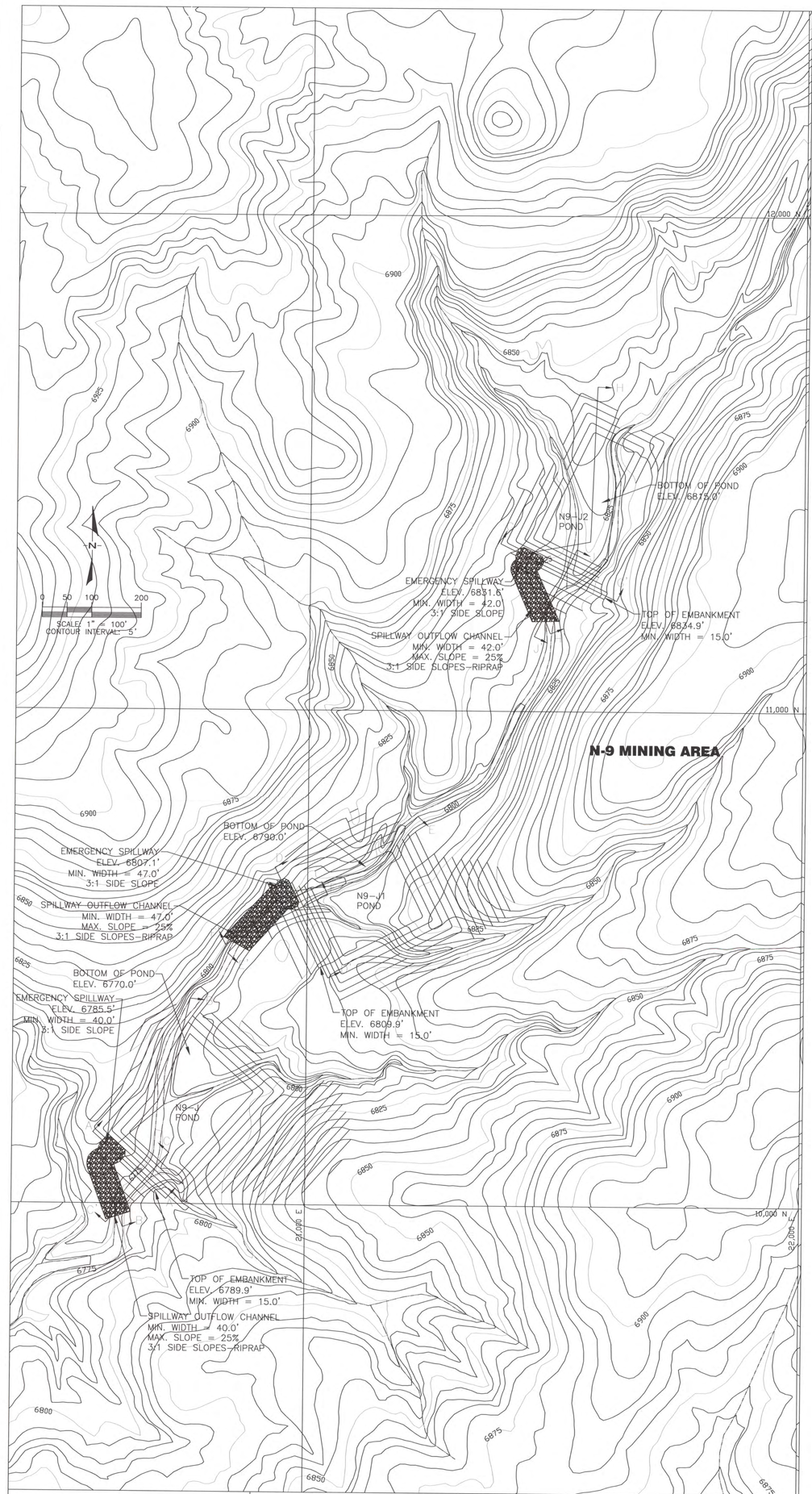
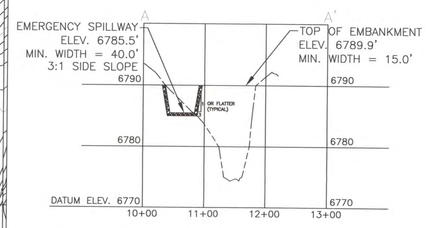
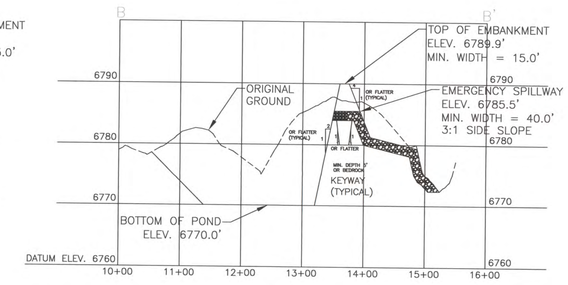




SECTION A – A'
SCALE: HORIZ. 1" = 100'
VERT. 1" = 10'



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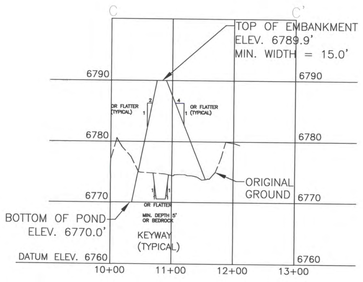
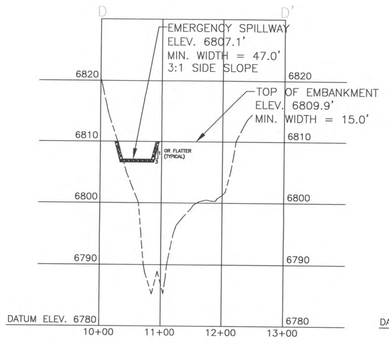
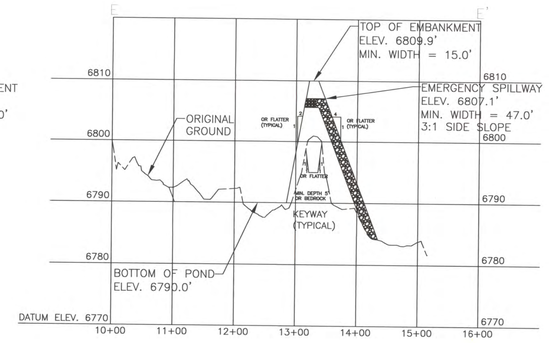
SCALE: HORIZ. 1" = 100'
VERT. 1" = 10'



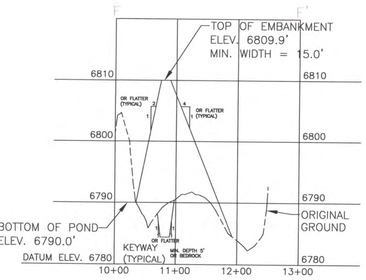
SECTION C – C'
SCALE: HORIZ. 1" = 100'
VERT. 1" = 10'



SECTION D – D'
SCALE: HORIZ. 1" = 100'
VERT. 1" = 10'



SECTION E – E'
SCALE: HORIZ. 1" = 100'
VERT. 1" = 10'



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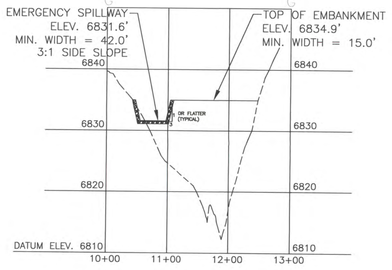

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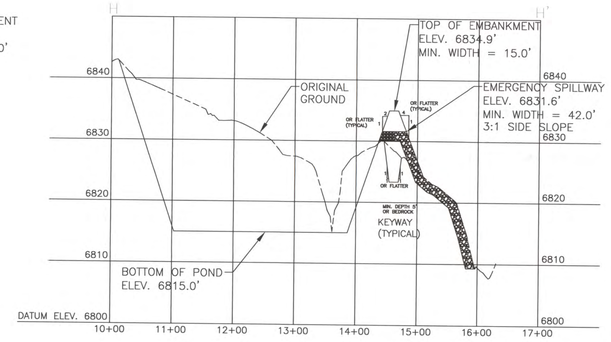
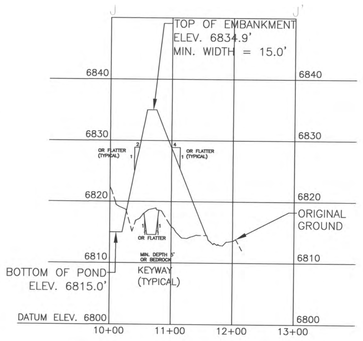
VERT. 1" = 10'



SECTION H – H'
SCALE: HORIZ. 1" = 100'
VERT. 1" = 10'



SECTION J – J'
SCALE: HORIZ. 1" = 100'
VERT. 1" = 10'

N9-J POND STAGE CAPACITY TABLE

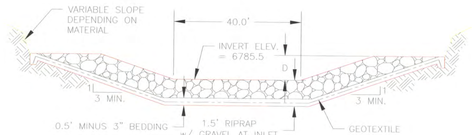
ELEVATION (ft-msl)	STAGE (ft)	AREA (acres)	TOTAL CAPACITY (ac-ft)	DESCRIPTION
6770.0	0.0	0.77	0.00	BOTTOM OF POND
6775.0	5.0	1.05	4.55	INCISED ELEV.
6780.0	10.0	1.40	10.67	
6785.0	15.0	1.82	18.73	
6785.5	15.5	1.87	19.66	EMERGENCY SPILLWAY
6789.9	19.9	2.31	29.06	TOP OF EMBANKMENT

N9-J1 POND STAGE CAPACITY TABLE

ELEVATION (ft-msl)	STAGE (ft)	AREA (acres)	TOTAL CAPACITY (ac-ft)	DESCRIPTION
6790.0	0.0	0.62	0.00	BOTTOM OF POND
6795.0	5.0	0.86	3.70	INCISED ELEV.
6800.0	10.0	1.18	8.80	
6805.0	15.0	1.60	15.75	
6807.1	17.1	1.86	19.39	EMERGENCY SPILLWAY
6809.9	19.9	2.15	25.20	TOP OF EMBANKMENT

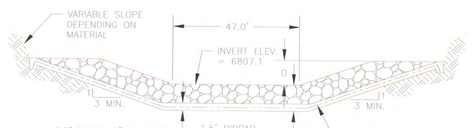
N9-J2 POND STAGE CAPACITY TABLE

ELEVATION (ft-msl)	STAGE (ft)	AREA (acres)	TOTAL CAPACITY (ac-ft)	DESCRIPTION
6815.0	0.0	0.59	0.00	BOTTOM OF POND
6820.0	5.0	0.86	3.63	INCISED ELEV.
6825.0	10.0	1.20	8.77	
6830.0	15.0	1.83	16.34	
6831.6	16.6	2.14	19.52	EMERGENCY SPILLWAY
6834.9	19.9	2.79	27.89	TOP OF EMBANKMENT



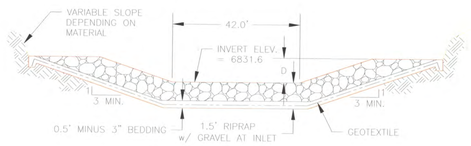
SPILLWAY MIN. D=2.5'
OUTFLOW CHANNEL MIN. D=2.0'

SECTION OF EMERGENCY SPILLWAY
NOT TO SCALE
N9-J POND



SPILLWAY MIN. D=2.5'
OUTFLOW CHANNEL MIN. D=2.0'

SECTION OF EMERGENCY SPILLWAY
NOT TO SCALE
N9-J1 POND



SPILLWAY MIN. D=2.5'
OUTFLOW CHANNEL MIN. D=2.0

SECTION OF EMERGENCY SPILLWAY
NOT TO SCALE
N9-J2 POND

ENGINEER'S CERTIFICATION

JAMES G. SCHLENDORF
Engineering Supervisor
Peabody Western Coal Company

ARIZONA P.E. 18782
Date: DEC 23 2004

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NOTES:
1) General location, see Drawing No. 85400, Sheet K-6 and Drawing No. 85405.
2) See Chapter 6, Black Mesa PAP for Construction Specifications.
3) See Vol. 2, Chapter 6, Attachment D, Sections 1-3 for description of Geotechnical Evaluation.
4) Salvage topsoil in accordance with approved topsoil salvage plan.
5) Reclamation of the distrubed area above the high waterline shall be in accordance with the approved reclamation plan.
6) Ponding area side slopes, typical 3:1 slope or flatter and blend into natural topography.

WOODSON
ENGINEERING AND SURVEYING, INC.
124 N. ELDEN ST.
FLAGSTAFF, AZ 86001
PHONE: (928) 774-4636 FAX: (928) 774-4646

EXHIBIT # 1
PROPOSED N9-J, J1 & J2
SEDIMENTATION POND DESIGN
KAYENTA MINE
PEABODY WESTERN COAL COMPANY
P. O. BOX 650 KAYENTA, ARIZONA 86033

DESIGNED BY: GA	SCALE: AS NOTED
DRAWN BY: PEK	DRAWING DATE: 11-22-04
CHECKED BY: JGS	PHOTO DATE: 06-67 & 05-83
CONTOUR INTERVAL: 5 FT.	DWG FILE: POND N9-J,J1,J2.DWG

DESIGN REPORT

Temporary Sedimentation Structure

N9-J1

Kayenta Mine

Navajo County, Arizona

For

PEABODY WESTERN COAL COMPANY

SEP 2005 APPROVED

Registered Professional Engineer (Civil) CERTIFICATE NO. 18782 JAMES GARY SCHLENVOGT Date Signed ..... ARIZONA, U.S.A.

DEC 23 2004

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DESIGN ANALYSES	2
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STABILITY	2
HYDROLOGY	3
HYDRAULICS	4
EMERGENCY SPILLWAY AND OUTLET CHANNEL	6
STORAGE CAPACITY	6

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) 100-Year, 6-Hour Storm Event
EXHIBIT #1 -N9-J3, N9-J2, N9-J1, and N9-J Proposed Sedimentation Ponds

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INTRODUCTION

Sedimentation Structure N9-J1 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-J1 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.

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

INSPECTION

The construction site of the proposed Structure N9-J1 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.

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SITE DESCRIPTION

LAND USE

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 44.71-acre watershed, which contributes directly to structure N9-J1 is classified as 32% undisturbed and 68% spoil.

DESIGN ANALYSES

GENERAL

Structure N9-J1 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.

STABILITY

Structure N9-J1 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 minimum downstream slope of 4H: 1V were assumed. Based on the total embankment height of approximately 13 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 47-foot wide, riprap-lined, trapezoidal channel.

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HYDROLOGY

The hydrologic analysis was completed using the computer program SEDCAD4 (see Appendices A, B, and C). Structure N9-J1 will be constructed in series with proposed Structures N9-J3, N9-J2 and N9-J. Structure N9-J1 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. The combined capacity of N9-J1, N9-J2 and N9-J3 exceeds 20 acre-feet; therefore, the spillway was analyzed using the 100-year, 6-hour storm event in lieu of the 25-year, 6-hour storm. All structures were conservatively assumed to be full to the emergency spillway at the time of 100-year storm event. The storage capacity of structure N9-J1 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 Yazzie Wash.

The following parameters were used in the hydrologic analysis:

1.	Water Course length, L	0.172 mi.
2.	Elevation Difference, H	25 ft
3.	Time of Concentration, T_c	0.098 hr
4.	NRCS Curve Number	85
5.	Rainfall Depth, 10-year, 24-hour storm 100-year, 6-hour storm	2.1 in 2.4 in
6.	Drainage Area	44.71 acres

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

Muskingum routing parameters were utilized to route the 100-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).

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N9-J1 SEDIMENTATION POND HYDRAULICS TABLE

	Units	10-Yr, 24-Hr Storm	100-Yr, 6-Hr Storm
Initial Reservoir Volume Condition		Empty	Full to emergency spillway
Inflow			
Peak Flow	cfs	42.60	346.87
Volume	ac-ft	3.24	41.76
Storage			
Peak Stage	msl	N/A	6809.0
Emerg. Spillway Elev.	msl	6807.1	6807.1
Peak Storage	ac-ft	N/A	23.2
Storage Capacity	ac-ft	19.39	19.39
Outflow			
Peak Flow	cfs	N/A	331.1
Spillway Elevation	msl	6807.1	6807.1
Embankment Crest Elev.	msl	6809.9	6809.9
Peak Stage	msl	--	6809.0
Freeboard	ft	--	0.9
Emergency Spillway Channel			
Flow Depth	ft	--	1.9
Critical Velocity	fps	--	5.91
Mannings "n"	--	--	0.048
Width	ft	--	47
Outflow Channel			
Slope	%	--	25
Normal Velocity	fps	--	9.1
Normal Depth	ft	--	0.8
Mannings "n"	--	--	0.067
Riprap D_{50}	in	--	9

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EMERGENCY SPILLWAY AND OUTLET CHANNEL

The emergency spillway and outlet channel for N9-J1 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
	(Outflow)	2.0	
Channel Width		47	ft
Channel Length	(Spillway)	32	ft
	(Outflow)	142	ft
Sideslopes (Horizontal to Vertical)		3:1	or flatter
Average Slope	(Spillway)	0	%
Maximum Slope	(Outflow)	25	%
Spillway Elevation		6807.1	ft

The riprapped-lined channel will extend a minimum of 15 feet beyond the toe of the embankment as shown on Exhibit 1.

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-J1 is designed to contain approximately 19.39 acre-feet.

The calculations for the sediment load entering structure N9-J1 were made utilizing the Revised Universal Soil Loss Equation with the following parameters:

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1.	Rainfall Factor, R	40
	Soil Erodibility Factor, K	0.13
3.	Slope Factor, LS	6.50
	Cover Factor, C	0.75
5.	Erosion Control Factor, P	0.86

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. Structure N9-J1, combined with Structures N9-J3, N9-J2 and N9-J has adequate storage capacity to contain the 10-year, 24-hour storm and reasonable sediment storage capacity. The combined storage capacity was determined for all four structures in series and the results of the analysis are presented in the following table.

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

	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

* * *

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

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) 100-Year, 6-Hour Storm Event

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

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APPENDIX A

Hydrology, Hydraulic, and Sedimentation Calculations

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PEABODY WESTERN COAL COMPANY
CALCULATED HYDROLOGIC DATA

PROJECT: N-9 MINING AREA

STRUCTURE: J1

TIME OF CONCENTRATION:

Start Elevation (ft) =	6815	
End Elevation (ft) =	6790	
Elevation Difference, E (ft) =	25	
Watercourse Length (ft) =	908	
Watercourse Length (mi) =	0.172	
Tc = (11.9L^3/E)^0.385 =	0.098	hours

ROUTING PARAMETERS:

Between structure routing parameters were calculated using the SCS Upland mathod 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	D	83	14.391	1194.453
Distrubed Land	B	86	30.32	2607.52
TOTAL:			44.711	3801.973

Weighted CN = Total CN * Area / Total Area = 85

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: 44.711 Acres

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PEABODY WESTERN COAL COMPANY
CALCULATED SEDIMENTOLOGY DATA

STRUCTURE: J1

SOIL ERODIBILITY FACTOR:

Soil Type	Erodibility Factor, K	Area	K*Area
1CD	0.16	13.439	2.15
7E	0.14	0.952	0.13
Disturbed	0.12	30.32	3.64
	TOTAL	44.711	5.92

Weighted K = Total K * Area / Total Area = 0.13

SLOPE FACTOR:

Length (ft)		Slope (%)	m	Slope Angle (deg)	LS Factor
559	95	16.99%	0.60	9.65	7.88
447	60	13.42%	0.60	7.65	5.17
410	75	18.29%	0.60	10.37	7.13
568	75	13.20%	0.60	7.52	5.84

Average LS = 6.50

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

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STRUCTURE: J1

Cover and Practice Factors:

Cover Type	Cover (%)	Canopy (%)	Area (acres)	Cover Factor, C	C * Area	Practive Factor, P	P * Area
Pinyon Juniper	40%	25%	14.391	0.22	3.17	1.00	14.391
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%	30.32	1	30.32	0.80	24.256
TOTAL:			44.711		33.49		38.65

Weighted C = Total C * Area / Total Area = 0.75

Weighted P = Total P * Area / Total Area = 0.86

RAINFALL FACTOR:

R= 40

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PEABODY WESTERN COAL COMPANY
CALCULATED SEDIMENT YIELD

STRUCTURE: J1

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)	0.13
Length Slope Factor (L)	6.50
Cover Factor(C)	0.75
Practice Factor (P)	0.86
Gross Annual Sediment Yield	22.31 tons/acre/year
Sediment Density	94.00 pcf
Gross Annual Sediment Yield	0.0109 acre-feet/acre/year
Sediment Delivery Ratio	90%
Estimated Annual Sediment Yield	0.0098 acre-feet/acre/year
Watershed Area	44.71 acres
Watershed Annual Sediment Yield	0.44 acre-feet/year
Number of Years	1.00 years
Calculated Sediment Volume	0.44 acre-feet

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TRAPEZOIDAL CHANNEL ANALYSIS
CRITICAL DEPTH COMPUTATION
N9-J1 POND
November 18, 2004

PROGRAM INPUT DATA

DESCRIPTION	VALUE
Flow Rate (cfs).....	346.87
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).....	47.0

COMPUTATION RESULTS

DESCRIPTION	VALUE
Critical Depth (ft).....	1.16
Critical Slope (ft/ft).....	0.033
Flow Velocity (fps).....	5.91
Froude Number.....	1.0
Velocity Head (ft).....	0.54
Energy Head (ft).....	1.71
Cross-Sectional Area of Flow (sq ft).....	58.66
Top Width of Flow (ft).....	53.97

HYDROCALC Hydraulics for Windows, Version 1.2 Copyright (c) 1996
Dodson & Associates, Inc., 5629 FM 1960 West, Suite 314, Houston, TX 77069
Phone:(281)440-3787, Fax:(281)440-4742, Email:software@dodson-hydro.com
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N9-J1 POND OUTFLOW CHANNEL

Material: Riprap

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
47.00	3.0:1	3.0:1	25.0	2.12		

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	346.87 cfs	
Depth:	0.78 ft	2.90 ft
Top Width:	51.65 ft	64.37 ft
Velocity:	9.07 fps	
X-Section Area:	38.24 sq ft	
Hydraulic Radius:	0.737	
Froude Number:	1.86	
Manning's n:	0.0670	
Dmin:	5.00 in	
D50:	9.00 in	
Dmax:	12.00 in	

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APPENDIX B

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

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Peabody Western Coal

Kayenta Mine

N9-J1 POND DESIGN

10YR 24HR STORM

Gary Altsisi

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General Information

Storm Information:

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

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Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	44.710	44.710	42.60	3.24

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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	44.710	0.098	0.000	0.000	85.000	F	42.60	3.238
	Σ	**44.710**						**42.60**	**3.238**

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APPENDIX C

SEDCAD4 (Input and Output) 100-Year, 6-Hour Storm Event

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Peabody Western Coal
Kayenta Mine
N9-J1 POND DESIGN
100YR 6HR STORM

Gary Altsisi

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General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.400 inches

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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)
#5	1	44.710	0.098	0.000	0.000	85.000	F	78.56	4.096
	$\sum$	**479.730**						**346.87**	**41.759**

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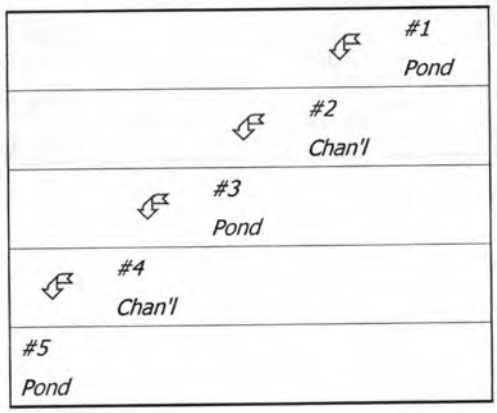
Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Pond	#1	==>	#2	0.000	0.000	N9-J3 POND
Channel	#2	==>	#3	0.000	0.000	N9-J3 SPILLWAY
Pond	#3	==>	#4	0.000	0.000	N9-J2 POND
Channel	#4	==>	#5	0.000	0.000	N9-J2 SPILLWAY
Pond	#5	==>	End	0.000	0.000	N9-J1 POND



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Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	In	296.160	296.160	335.02	25.64
	Out			264.88	25.64
#2		0.000	296.160	264.88	25.64
#3	In	138.860	435.020	380.62	37.66
	Out			331.14	37.67
#4		0.000	435.020	331.14	37.66
#5	In	44.710	479.730	346.87	41.76
	Out			331.11	41.76

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Structure Detail:

Structure #5 (Pond)

N9-J1 POND

Pond Inputs:

Initial Pool Elev:	6,807.10
Initial Pool:	19.39 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
6,807.10	32.40	3.00:1	3.00:1	47.00

Pond Results:

Peak Elevation:	6,809.03
Dewater Time:	0.32 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)
6,790.00	0.621	0.000	0.000	
6,790.50	0.644	0.316	0.000	
6,791.00	0.667	0.644	0.000	
6,791.50	0.690	0.983	0.000	
6,792.00	0.713	1.334	0.000	
6,792.50	0.737	1.696	0.000	
6,793.00	0.762	2.071	0.000	
6,793.50	0.787	2.458	0.000	
6,794.00	0.812	2.858	0.000	
6,794.50	0.838	3.270	0.000	
6,795.00	0.863	3.695	0.000	
6,795.50	0.893	4.135	0.000	
6,796.00	0.924	4.589	0.000	
6,796.50	0.955	5.059	0.000	
6,797.00	0.986	5.544	0.000	
6,797.50	1.018	6.045	0.000	
6,798.00	1.051	6.562	0.000	

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Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
6,798.50	1.084	7.096	0.000		
6,799.00	1.117	7.646	0.000		
6,799.50	1.151	8.214	0.000		
6,800.00	1.186	8.798	0.000		
6,800.50	1.225	9.401	0.000		
6,801.00	1.265	10.023	0.000		
6,801.50	1.306	10.666	0.000		
6,802.00	1.347	11.329	0.000		
6,802.50	1.388	12.013	0.000		
6,803.00	1.431	12.717	0.000		
6,803.50	1.474	13.444	0.000		
6,804.00	1.518	14.192	0.000		
6,804.50	1.562	14.961	0.000		
6,805.00	1.607	15.754	0.000		
6,805.50	1.665	16.572	0.000		
6,806.00	1.723	17.418	0.000		
6,806.50	1.783	18.295	0.000		
6,807.00	1.844	19.202	0.000		
6,807.10	1.856	19.387	0.000		Spillway #1
6,807.50	1.896	20.137	36.626	4.60	
6,808.00	1.948	21.098	82.420	1.85	
6,808.50	2.000	22.085	190.619	0.75	
6,809.00	2.052	23.098	321.502	0.45	
6,809.03	2.056	23.161	331.111	0.05	Peak Stage
6,809.50	2.106	24.137	479.414		
6,810.00	2.160	25.204	672.043		

Detailed Discharge Table

Elevation	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
6,790.00	0.000	0.000
6,790.50	0.000	0.000
6,791.00	0.000	0.000
6,791.50	0.000	0.000
6,792.00	0.000	0.000
6,792.50	0.000	0.000
6,793.00	0.000	0.000
6,793.50	0.000	0.000

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Elevation	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
6,794.00	0.000	0.000
6,794.50	0.000	0.000
6,795.00	0.000	0.000
6,795.50	0.000	0.000
6,796.00	0.000	0.000
6,796.50	0.000	0.000
6,797.00	0.000	0.000
6,797.50	0.000	0.000
6,798.00	0.000	0.000
6,798.50	0.000	0.000
6,799.00	0.000	0.000
6,799.50	0.000	0.000
6,800.00	0.000	0.000
6,800.50	0.000	0.000
6,801.00	0.000	0.000
6,801.50	0.000	0.000
6,802.00	0.000	0.000
6,802.50	0.000	0.000
6,803.00	0.000	0.000
6,803.50	0.000	0.000
6,804.00	0.000	0.000
6,804.50	0.000	0.000
6,805.00	0.000	0.000
6,805.50	0.000	0.000
6,806.00	0.000	0.000
6,806.50	0.000	0.000
6,807.00	0.000	0.000
6,807.10	0.000	0.000
6,807.50	36.626	36.626
6,808.00	82.420	82.420
6,808.50	190.619	190.619
6,809.00	321.502	321.502
6,809.50	479.414	479.414
6,810.00	672.043	672.043

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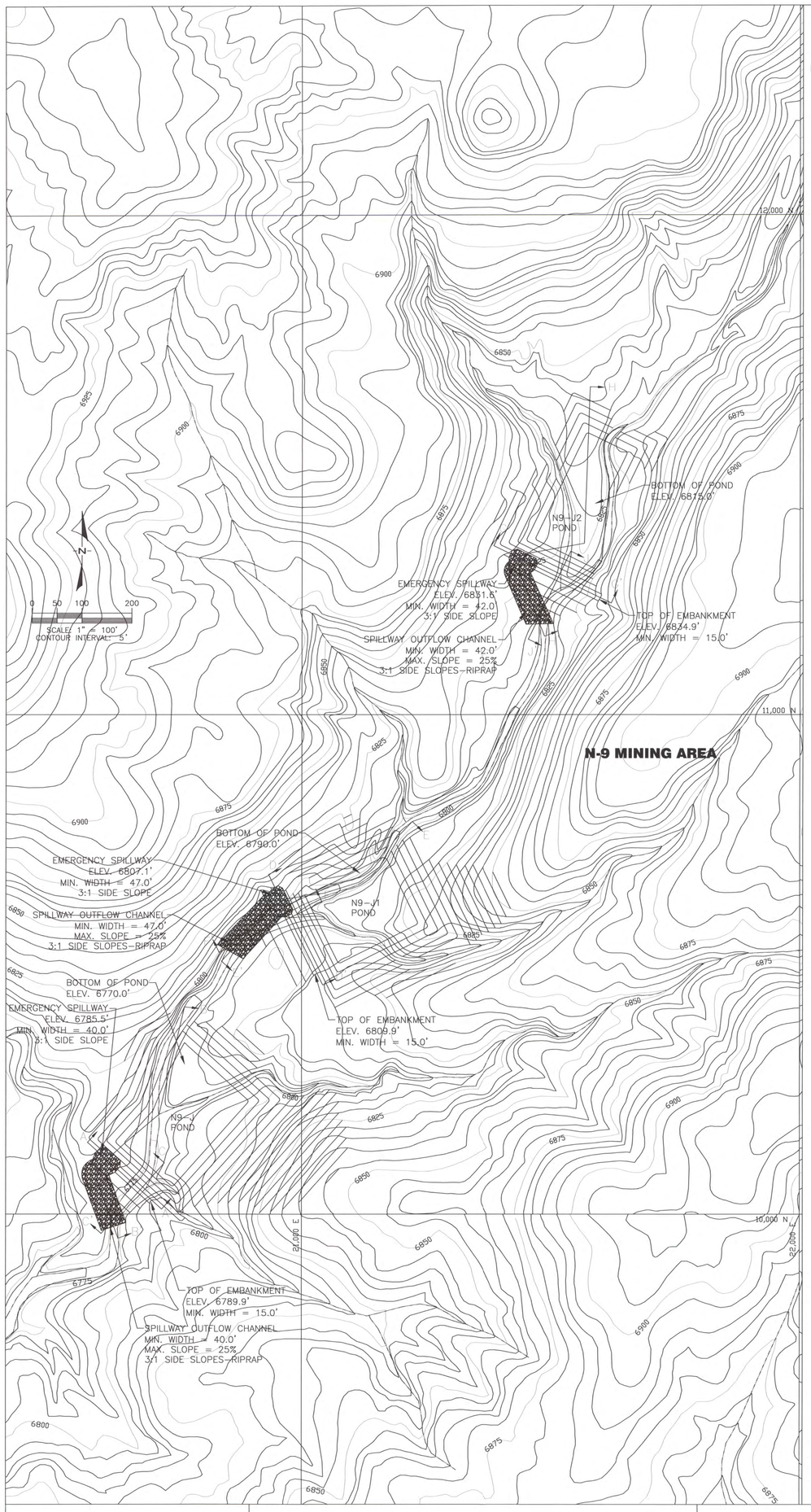

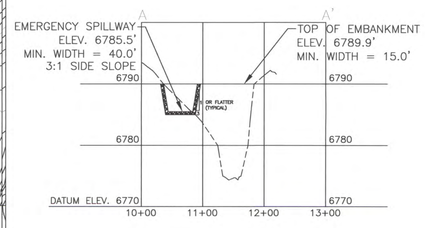

SECTION A – A'
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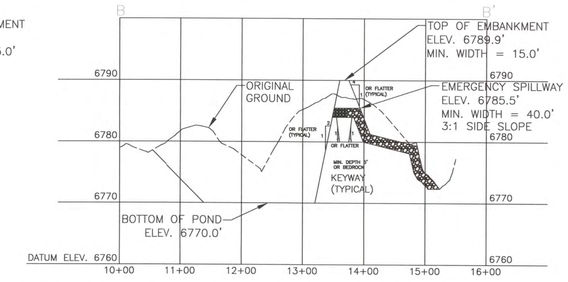
VERT. 1" = 10'



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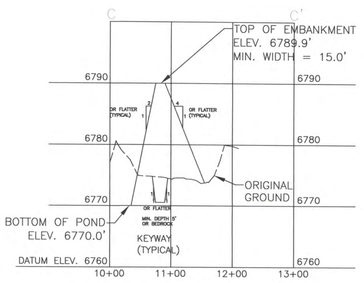

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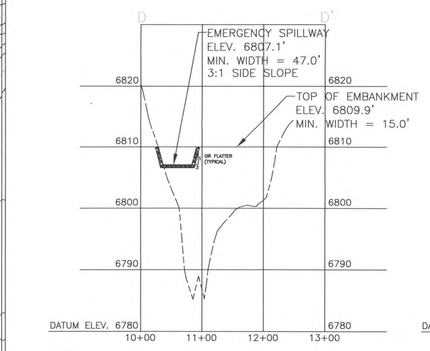

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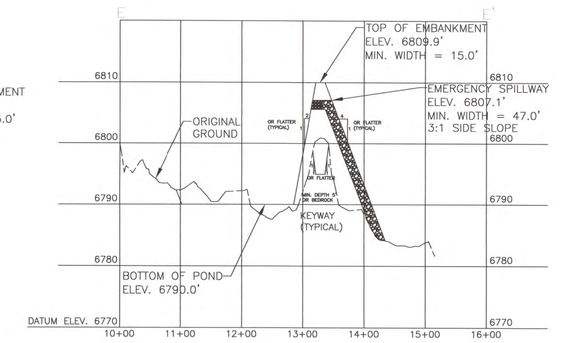

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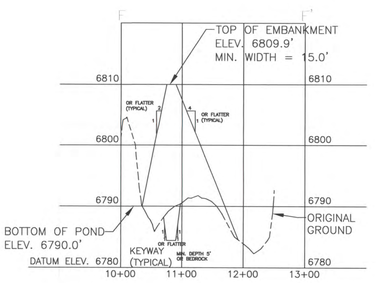

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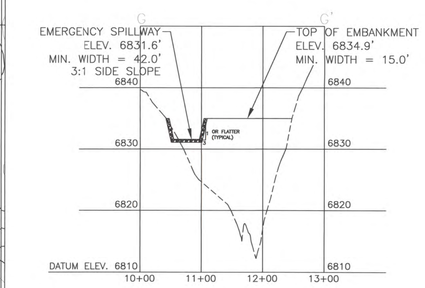

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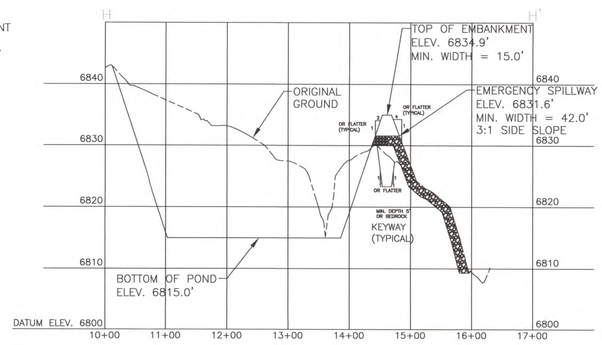

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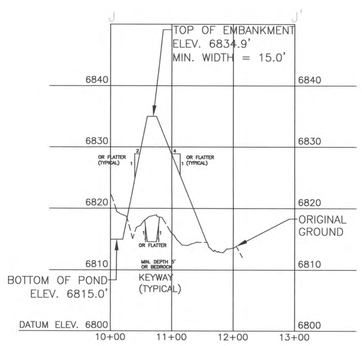


SECTION J – J'
SCALE: HORIZ. 1" = 100'
VERT. 1" = 10'

N9-J POND STAGE CAPACITY TABLE

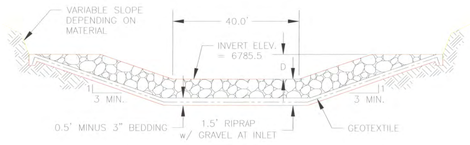
ELEVATION (ft-msl)	STAGE (ft)	AREA (acres)	TOTAL CAPACITY (ac-ft)	DESCRIPTION
6770.0	0.0	0.77	0.00	BOTTOM OF POND
6775.0	5.0	1.05	4.55	INCISED ELEV.
6780.0	10.0	1.40	10.67	
6785.0	15.0	1.82	18.73	
6785.5	15.5	1.87	19.66	EMERGENCY SPILLWAY
6789.9	19.9	2.31	29.06	TOP OF EMBANKMENT

N9-J1 POND STAGE CAPACITY TABLE

ELEVATION (ft-msl)	STAGE (ft)	AREA (acres)	TOTAL CAPACITY (ac-ft)	DESCRIPTION
6790.0	0.0	0.62	0.00	BOTTOM OF POND
6795.0	5.0	0.86	3.70	INCISED ELEV.
6800.0	10.0	1.18	8.80	
6805.0	15.0	1.60	15.75	
6807.1	17.1	1.86	19.39	EMERGENCY SPILLWAY
6809.9	19.9	2.15	25.20	TOP OF EMBANKMENT

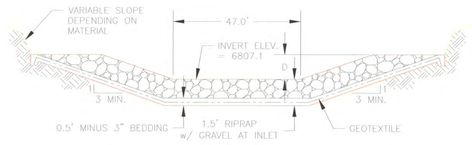
N9-J2 POND STAGE CAPACITY TABLE

ELEVATION (ft-msl)	STAGE (ft)	AREA (acres)	TOTAL CAPACITY (ac-ft)	DESCRIPTION
6815.0	0.0	0.59	0.00	BOTTOM OF POND
6820.0	5.0	0.86	3.63	INCISED ELEV.
6825.0	10.0	1.20	8.77	
6830.0	15.0	1.83	16.34	
6831.6	16.6	2.14	19.52	EMERGENCY SPILLWAY
6834.9	19.9	2.79	27.89	TOP OF EMBANKMENT



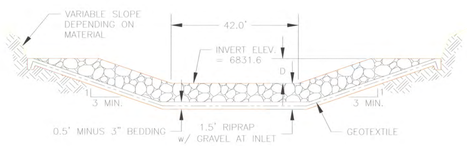
SPILLWAY MIN. D=2.5'
OUTFLOW CHANNEL MIN. D=2.0'

SECTION OF EMERGENCY SPILLWAY
NOT TO SCALE
N9-J POND



SPILLWAY MIN. D=2.5'
OUTFLOW CHANNEL MIN. D=2.0'

SECTION OF EMERGENCY SPILLWAY
NOT TO SCALE
N9-J1 POND



SPILLWAY MIN. D=2.5'
OUTFLOW CHANNEL MIN. D=2.0

SECTION OF EMERGENCY SPILLWAY
NOT TO SCALE
N9-J2 POND

ENGINEER'S CERTIFICATION

JAMES C. SCHLENVOGT
Engineering Supervisor
Peabody Western Coal Company

ARIZONA P.E. 18782
Date: DEC 23 2004

SEP 2005
APPROVED

WOODSON
ENGINEERING AND SURVEYING, INC.
124 N. ELDEN ST.
FLAGSTAFF, AZ 86001
PHONE: (928) 774-4636 FAX: (928) 774-4646

NOTES:
1) General location, see Drawing No. 85400, Sheet K-6 and Drawing No. 85405.
2) See Chapter 6, Black Mesa PAP for Construction Specifications.
3) See Vol. 2, Chapter 6, Attachment D, Sections 1-3 for description of Geotechnical Evaluation.
4) Salvage topsoil in accordance with approved topsoil salvage plan.
5) Reclamation of the distrubed area above the high waterline shall be in accordance with the approved reclamation plan.
6) Ponding area side slopes, typical 3:1 slope or flatter and blend into natural topography.

EXHIBIT # 1
PROPOSED N9-J, J1 & J2
SEDIMENTATION POND DESIGN
KAYENTA MINE
PEABODY WESTERN COAL COMPANY
P. O. BOX 650 KAYENTA, ARIZONA 86033

DESIGNED BY: GA	SCALE: AS NOTED
DRAWN BY: PEK	DRAWING DATE: 11-22-04
CHECKED BY: JGS	PHOTO DATE: 06-67 & 05-83
CONTOUR INTERVAL: 5 FT.	DWG FILE: POND N9-J,J1,J2.DWG

DESIGN REPORT

Temporary Sedimentation Structure

N9-J2

Kayenta Mine

Navajo County, Arizona

For

PEABODY WESTERN COAL COMPANY

SEP 2005 APPROVED

Registered Professional Engineer (Civil) CERTIFICATE NO. 18782 JAMES D. SCHLENVOGT Date Signed ARIZONA, U.S.A.

DEC 23 2004

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HYDRAULICS	4
EMERGENCY SPILLWAY AND OUTLET CHANNEL	6
STORAGE CAPACITY	6

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) 100-Year, 6-Hour Storm Event
EXHIBIT #1	-N9-J3, N9-J2, N9-J1, and N9-J Proposed Sedimentation Ponds

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INTRODUCTION

Sedimentation Structure N9-J2 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-J2 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.

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

INSPECTION

The construction site of the proposed Structure N9-J2 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.

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SITE DESCRIPTION

LAND USE

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 138.86-acre watershed, which contributes directly to structure N9-J2 is classified as 52% undisturbed and 48% spoil.

DESIGN ANALYSES

GENERAL

Structure N9-J2 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 1967 for Peabody Western Coal Company and was used in the analyses of the structure.

STABILITY

Structure N9-J2 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 minimum downstream slope of 4H: 1V were 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 12-foot wide, riprap-lined, trapezoidal channel.

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HYDROLOGY

The hydrologic analysis was completed using the computer program SEDCAD4 (see Appendices A, B, and C). Structure N9-J2 will be constructed in series with proposed Structures N9-J3, N9-J1 and N9-J. Structure N9-J2 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. The combined capacity of N9-J2 and N9-J3 exceeds 20 acre-feet; therefore, the spillway was analyzed using the 100-year, 6-hour storm event in lieu of the 25-year, 6-hour storm. All structures were conservatively assumed to be full to the emergency spillway at the time of 100-year storm event. The storage capacity of structure N9-J2 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 Yazzie Wash.

The following parameters were used in the hydrologic analysis:

1.	Water Course length, L	0.244 mi.
2.	Elevation Difference, H	30 ft
3.	Time of Concentration, T_c	0.137 hr
4.	NRCS Curve Number	84
5.	Rainfall Depth, 10-year, 24-hour storm 100-year, 6-hour storm	2.1 in 2.4 in
6.	Drainage Area	138.86 acres

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

Muskingum routing parameters were utilized to route the 100-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).

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N9-J2 SEDIMENTATION POND HYDRAULICS TABLE

	Units	10-Yr, 24-Hr Storm	100-Yr, 6-Hr Storm
Initial Reservoir Volume Condition		Empty	Full to emergency spillway
Inflow			
Peak Flow	cfs	103.99	380.62
Volume	ac-ft	9.44	37.66
Storage			
Peak Stage	msl	N/A	6833.7
Emerg. Spillway Elev.	msl	6831.6	6831.6
Peak Storage	ac-ft	N/A	24.3
Storage Capacity	ac-ft	19.52	19.52
Outflow			
Peak Flow	cfs	N/A	331.1
Spillway Elevation	msl	6831.6	6831.6
Embankment Crest Elev.	msl	6834.9	6834.9
Peak Stage	msl	--	6833.7
Freeboard	ft	--	1.2
Emergency Spillway Channel			
Flow Depth	ft	--	2.1
Critical Velocity	fps	--	6.3
Mannings "n"	--	--	0.048
Width	ft	--	42
Outflow Channel			
Slope	%	--	25
Normal Velocity	fps	--	9.9
Normal Depth	ft	--	0.9
Mannings "n"	--	--	0.065
Riprap D_{50}	in	--	9

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EMERGENCY SPILLWAY AND OUTLET CHANNEL

The emergency spillway and outlet channel for N9-J2 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
	(Outflow)	2.0	ft
Channel Width		42	ft
Channel Length	(Spillway)	35	ft
	(Outflow)	132	ft
Sideslopes (Horizontal to Vertical)		3:1	or flatter
Average Slope	(Spillway)	0	%
Maximum Slope	(Outflow)	25	%
Spillway Elevation		6831.6	ft

The riprapped-lined channel will extend a minimum of 15 feet beyond the toe of the embankment as shown on Exhibit 1.

STORAGE CAPACITY

The impoundment stage-capacity table (see Exhibit 1) is based on the 1967 aerial topographic mapping conducted for Peabody Western Coal Company. Structure N9-J2 is designed to contain approximately 19.52 acre-feet.

The calculations for the sediment load entering structure N9-J2 were made utilizing the Revised Universal Soil Loss Equation with the following parameters:

1.	Rainfall Factor, R	40
2.	Soil Erodibility Factor, K	0.14
3.	Slope Factor, LS	8.01
4.	Cover Factor, C	0.60
5.	Erosion Control Factor, P	0.90

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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. Structure N9-J2, combined with Structures N9-J3, N9-J1 and N9-J has adequate storage capacity to contain the 10-year, 24-hour storm and reasonable sediment storage capacity. The combined storage capacity was determined for all four structures in series and the results of the analysis are presented in the following table.

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

	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

* * *

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

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) 100-Year, 6-Hour Storm Event

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

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APPENDIX A

Hydrology, Hydraulic, and Sedimentation Calculations

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PEABODY WESTERN COAL COMPANY
CALCULATED HYDROLOGIC DATA

PROJECT: N-9 MINING AREA

STRUCTURE: J2

TIME OF CONCENTRATION:

Start Elevation (ft) =	6845
End Elevation (ft) =	6815
Elevation Difference, E (ft) =	30
Watercourse Length (ft) =	1286
Watercourse Length (mi) =	0.244
Tc = (11.9L^3/E)^0.385 =	0.137 hours

ROUTING PARAMETERS:

Between structure routing parameters were calculated using the SCS Upland mathod 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	0.285	18.525
Pinyon Juniper	D	83	70.337	5837.971
Sagebrush	B	60	0.331	19.86
Sagebrush	D	79	0.979	77.341
Distrubed Land	B	86	66.93	5755.98
TOTAL:			138.862	11709.677

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:

138.862 Acres

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PEABODY WESTERN COAL COMPANY
CALCULATED SEDIMENTOLOGY DATA

STRUCTURE: J2

SOIL ERODIBILITY FACTOR:

Soil Type	Erodibility Factor, K	Area	K*Area
14AB	0.37	0.616	0.23
1CD	0.16	68.107	10.90
7E	0.14	3.209	0.45
Disturbed	0.12	66.93	8.03
TOTAL		138.862	19.61

Weighted K = Total K * Area / Total Area = 0.14

SLOPE FACTOR:

Length (ft)		Slope (%)	m	Slope Angle (deg)	LS Factor
777	125	16.09%	0.60	9.14	8.99
772	130	16.84%	0.60	9.56	9.46
1034	180	17.41%	0.60	9.88	11.73
812	40	4.93%	0.50	2.82	1.88

Average LS = 8.01

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

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STRUCTURE: J2

Cover and Practice Factors:

Cover Type	Cover (%)	Canopy (%)	Area (acres)	Cover Factor, C	C * Area	Practive Factor, P	P * Area
Pinyon Juniper	40%	25%	70.622	0.22	15.54	1.00	70.622
Sagebrush, Grass	40%	25%	1.31	0.2	0.26	1.00	1.31
Saltbrush	40%	25%	0	0.2	0.00	1.00	0
Disturbed	0%	0%	66.93	1	66.93	0.80	53.544
TOTAL:			138.862		82.73		125.48

Weighted C = Total C * Area / Total Area = 0.60

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

RAINFALL FACTOR:

R= 40

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PEABODY WESTERN COAL COMPANY
CALCULATED SEDIMENT YIELD

STRUCTURE: J2

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)	0.14
Length Slope Factor (L)	8.01
Cover Factor(C)	0.60
Practice Factor (P)	0.90
Gross Annual Sediment Yield	24.37 tons/acre/year
Sediment Density	94.00 pcf
Gross Annual Sediment Yield	0.0119 acre-feet/acre/year
Sediment Delivery Ratio	90%
Estimated Annual Sediment Yield	0.0107 acre-feet/acre/year
Watershed Area	138.86 acres
Watershed Annual Sediment Yield	1.49 acre-feet/year
Number of Years	1.00 years
Calculated Sediment Volume	1.49 acre-feet

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TRAPEZOIDAL CHANNEL ANALYSIS
CRITICAL DEPTH COMPUTATION
N9-J2 POND
November 18, 2004

PROGRAM INPUT DATA

DESCRIPTION	VALUE
Flow Rate (cfs)	380.62
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)	42.0

COMPUTATION RESULTS

DESCRIPTION	VALUE
Critical Depth (ft)	1.32
Critical Slope (ft/ft)	0.0318
Flow Velocity (fps)	6.26
Froude Number	1.0
Velocity Head (ft)	0.61
Energy Head (ft)	1.93
Cross-Sectional Area of Flow (sq ft)	60.81
Top Width of Flow (ft)	49.94

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N9-J2 POND OUTFLOW CHANNEL

Material: Riprap

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
42.00	3.0:1	3.0:1	25.0	4.14		

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	380.62 cfs	
Depth:	0.86 ft	5.00 ft
Top Width:	47.15 ft	71.99 ft
Velocity:	9.94 fps	
X-Section Area:	38.30 sq ft	
Hydraulic Radius:	0.807	
Froude Number:	1.94	
Manning's n:	0.0650	
Dmin:	5.00 in	
D50:	9.00 in	
Dmax:	12.00 in	

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APPENDIX B

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

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Peabody Western Coal

Kayenta Mine

N9-J2 POND DESIGN

10YR 24HR STORM

Gary Altsisi

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SEP 2005

General Information

Storm Information:

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

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Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	138.860	138.860	103.99	9.44

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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	138.860	0.137	0.000	0.000	84.000	F	103.99	9.436
	Σ	**138.860**						**103.99**	**9.436**

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APPENDIX C

SEDCAD4 (Input and Output) 100-Year, 6-Hour Storm Event

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Peabody Western Coal
Kayenta Mine
N9-J2 POND DESIGN
100YR 6HR STORM

Gary Altsisi

SEP 2005
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General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.400 inches

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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)
#3	1	138.860	0.137	0.000	0.000	84.000	F	192.00	12.022
	$\sum$	**435.020**						**380.62**	**37.663**

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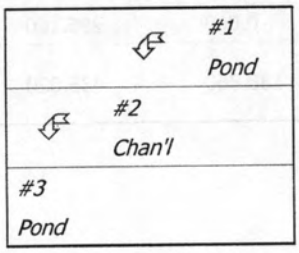
Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Pond	#1	==>	#2	0.000	0.000	N9-J3 POND
Channel	#2	==>	#3	0.000	0.000	N9-J3 SPILLWAY
Pond	#3	==>	End	0.000	0.000	N9-J2 POND



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Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	In	296.160	296.160	335.02	25.64
	Out			264.88	25.64
#2		0.000	296.160	264.88	25.64
#3	In	138.860	435.020	380.62	37.66
	Out			331.14	37.67

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Structure Detail:

Structure #3 (Pond)

N9-J2 POND

Pond Inputs:

Initial Pool Elev:	6,831.60
Initial Pool:	19.52 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
6,831.60	35.40	3.00:1	3.00:1	42.00

Pond Results:

Peak Elevation:	6,833.65
Dewater Time:	0.31 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)
6,815.00	0.600	0.000	0.000	
6,815.50	0.624	0.306	0.000	
6,816.00	0.648	0.624	0.000	
6,816.50	0.673	0.954	0.000	
6,817.00	0.698	1.297	0.000	
6,817.50	0.724	1.653	0.000	
6,818.00	0.750	2.021	0.000	
6,818.50	0.776	2.403	0.000	
6,819.00	0.804	2.798	0.000	
6,819.50	0.831	3.206	0.000	
6,820.00	0.859	3.629	0.000	
6,820.50	0.891	4.066	0.000	
6,821.00	0.924	4.520	0.000	
6,821.50	0.957	4.990	0.000	
6,822.00	0.991	5.477	0.000	
6,822.50	1.025	5.981	0.000	
6,823.00	1.060	6.502	0.000	

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Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
6,823.50	1.096	7.041	0.000		
6,824.00	1.132	7.598	0.000		
6,824.50	1.169	8.174	0.000		
6,825.00	1.206	8.767	0.000		
6,825.50	1.264	9.385	0.000		
6,826.00	1.323	10.032	0.000		
6,826.50	1.384	10.709	0.000		
6,827.00	1.446	11.416	0.000		
6,827.50	1.509	12.155	0.000		
6,828.00	1.574	12.925	0.000		
6,828.50	1.640	13.728	0.000		
6,829.00	1.707	14.565	0.000		
6,829.50	1.775	15.435	0.000		
6,830.00	1.845	16.341	0.000		
6,830.50	1.931	17.285	0.000		
6,831.00	2.019	18.272	0.000		
6,831.50	2.109	19.304	0.000		
6,831.60	2.127	19.516	0.000		Spillway #1
6,832.00	2.203	20.382	32.169	4.35	
6,832.50	2.299	21.507	72.390	1.75	
6,833.00	2.398	22.682	168.704	0.80	
6,833.50	2.499	23.906	287.540	0.40	
6,833.65	2.531	24.301	331.138	0.15	Peak Stage
6,834.00	2.602	25.181	428.353		
6,834.50	2.706	26.508	602.181		
6,835.00	2.813	27.888	803.202		

Detailed Discharge Table

Elevation	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
6,815.00	0.000	0.000
6,815.50	0.000	0.000
6,816.00	0.000	0.000
6,816.50	0.000	0.000
6,817.00	0.000	0.000
6,817.50	0.000	0.000
6,818.00	0.000	0.000
6,818.50	0.000	0.000

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Elevation	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
6,819.00	0.000	0.000
6,819.50	0.000	0.000
6,820.00	0.000	0.000
6,820.50	0.000	0.000
6,821.00	0.000	0.000
6,821.50	0.000	0.000
6,822.00	0.000	0.000
6,822.50	0.000	0.000
6,823.00	0.000	0.000
6,823.50	0.000	0.000
6,824.00	0.000	0.000
6,824.50	0.000	0.000
6,825.00	0.000	0.000
6,825.50	0.000	0.000
6,826.00	0.000	0.000
6,826.50	0.000	0.000
6,827.00	0.000	0.000
6,827.50	0.000	0.000
6,828.00	0.000	0.000
6,828.50	0.000	0.000
6,829.00	0.000	0.000
6,829.50	0.000	0.000
6,830.00	0.000	0.000
6,830.50	0.000	0.000
6,831.00	0.000	0.000
6,831.50	0.000	0.000
6,831.60	0.000	0.000
6,832.00	32.169	32.169
6,832.50	72.390	72.390
6,833.00	168.704	168.704
6,833.50	287.540	287.540
6,834.00	428.353	428.353
6,834.50	602.181	602.181
6,835.00	803.202	803.202

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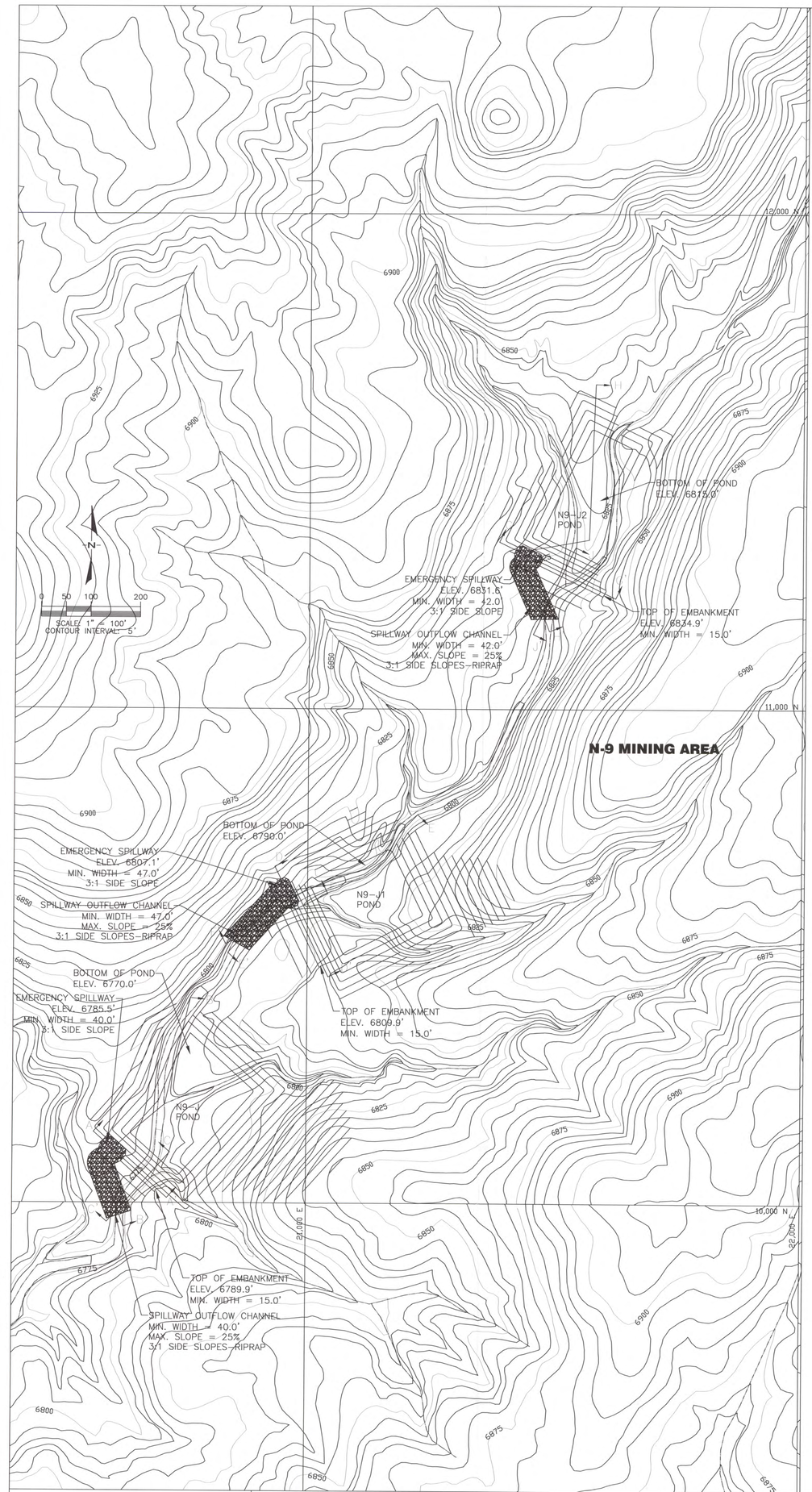

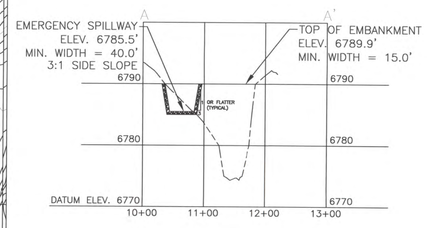

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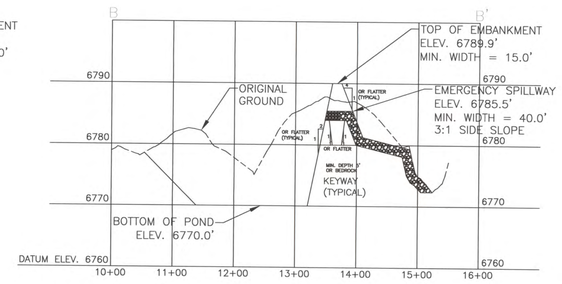

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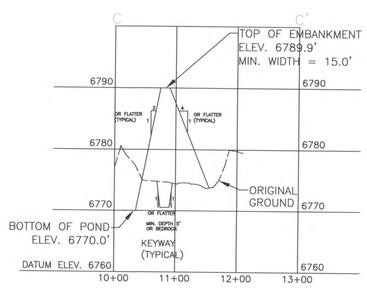

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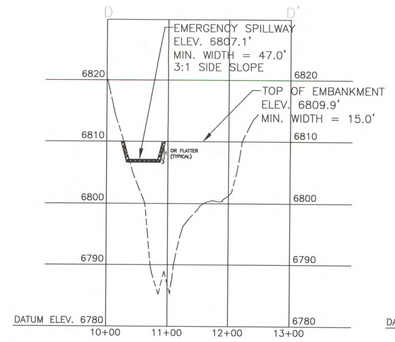

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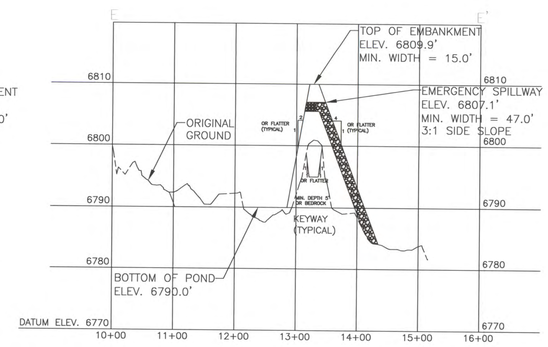

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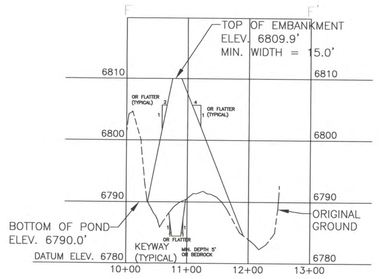

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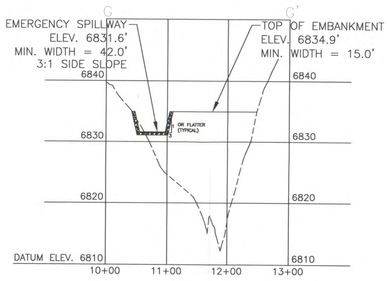

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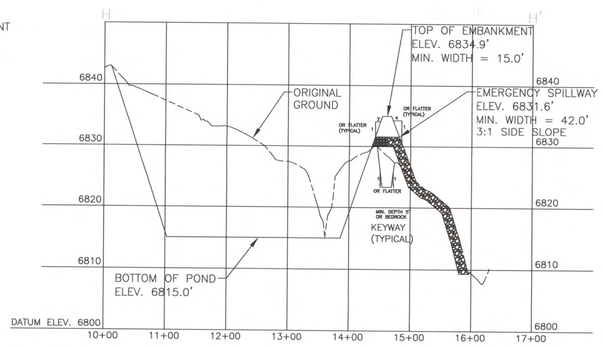

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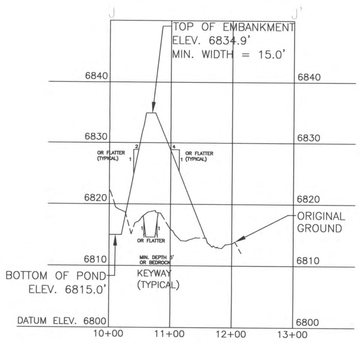


SECTION J – J'
SCALE: HORIZ. 1" = 100'
VERT. 1" = 10'

N9-J POND STAGE CAPACITY TABLE

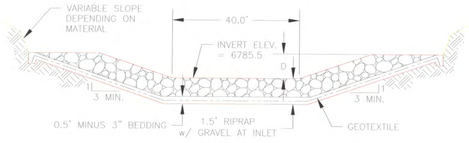
ELEVATION (ft-msl)	STAGE (ft)	AREA (acres)	TOTAL CAPACITY (ac-ft)	DESCRIPTION
6770.0	0.0	0.77	0.00	BOTTOM OF POND
6775.0	5.0	1.05	4.55	INCISED ELEV.
6780.0	10.0	1.40	10.67	
6785.0	15.0	1.82	18.73	
6785.5	15.5	1.87	19.66	EMERGENCY SPILLWAY
6789.9	19.9	2.31	29.06	TOP OF EMBANKMENT

N9-J1 POND STAGE CAPACITY TABLE

ELEVATION (ft-msl)	STAGE (ft)	AREA (acres)	TOTAL CAPACITY (ac-ft)	DESCRIPTION
6790.0	0.0	0.62	0.00	BOTTOM OF POND
6795.0	5.0	0.86	3.70	INCISED ELEV.
6800.0	10.0	1.18	8.80	
6805.0	15.0	1.60	15.75	
6807.1	17.1	1.86	19.39	EMERGENCY SPILLWAY
6809.9	19.9	2.15	25.20	TOP OF EMBANKMENT

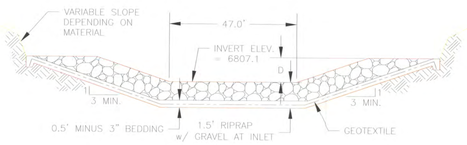
N9-J2 POND STAGE CAPACITY TABLE

ELEVATION (ft-msl)	STAGE (ft)	AREA (acres)	TOTAL CAPACITY (ac-ft)	DESCRIPTION
6815.0	0.0	0.59	0.00	BOTTOM OF POND
6820.0	5.0	0.86	3.63	INCISED ELEV.
6825.0	10.0	1.20	8.77	
6830.0	15.0	1.83	16.34	
6831.6	16.6	2.14	19.52	EMERGENCY SPILLWAY
6834.9	19.9	2.79	27.89	TOP OF EMBANKMENT



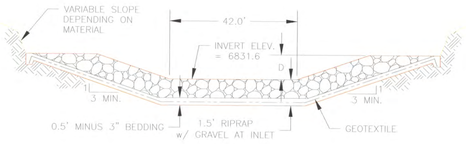
SPILLWAY MIN. D=2.5'
OUTFLOW CHANNEL MIN. D=2.0'

SECTION OF EMERGENCY SPILLWAY
NOT TO SCALE
N9-J POND



SPILLWAY MIN. D=2.5'
OUTFLOW CHANNEL MIN. D=2.0'

SECTION OF EMERGENCY SPILLWAY
NOT TO SCALE
N9-J1 POND



SPILLWAY MIN. D=2.5'
OUTFLOW CHANNEL MIN. D=2.0

SECTION OF EMERGENCY SPILLWAY
NOT TO SCALE
N9-J2 POND

ENGINEER'S CERTIFICATION

JAMES G. SCHLENVOGT
Engineering Supervisor
Peabody Western Coal Company

ARIZONA P.E. 18782
Date: DEC 23 2004

APPROVED SEP 2005

NOTES:
1) General location, see Drawing No. 85400, Sheet K-6 and Drawing No. 85405.
2) See Chapter 6, Black Mesa PAP for Construction Specifications.
3) See Vol. 2, Chapter 6, Attachment D, Sections 1-3 for description of Geotechnical Evaluation.
4) Salvage topsoil in accordance with approved topsoil salvage plan.
5) Reclamation of the distrubed area above the high waterline shall be in accordance with the approved reclamation plan.
6) Ponding area side slopes, typical 3:1 slope or flatter and blend into natural topography.

WOODSON
ENGINEERING AND SURVEYING, INC.
124 N. ELDEN ST.
FLAGSTAFF, AZ 86001
PHONE: (928) 774-4636 FAX: (928) 774-4646

EXHIBIT # 1
PROPOSED N9-J, J1 & J2
SEDIMENTATION POND DESIGN

KAYENTA MINE
PEABODY WESTERN COAL COMPANY
P. O. BOX 650 KAYENTA, ARIZONA 86033

DESIGNED BY: GA	SCALE: AS NOTED
DRAWN BY: PEK	DRAWING DATE: 11-22-04
CHECKED BY: JGS	PHOTO DATE: 06-67 & 05-B3
CONTOUR INTERVAL: 5 FT.	DWG FILE: POND N9-J,J1,J2.DWG

DESIGN REPORT

Temporary Sedimentation Structure

N9-J3 (Upper)

Kayenta Mine

Navajo County, Arizona

For

PEABODY WESTERN COAL COMPANY

SEP 2005 APPROVED

Registered Professional Engineer (Civil) CERTIFICATE NO. 18782 JAMES W. SCHLENVOGT Date Signed ARIZONA, U.S.A.

DEC 23 2004

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

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INTRODUCTION

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.

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

INSPECTION

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.

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SITE DESCRIPTION

LAND USE

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.

DESIGN ANALYSES

GENERAL

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.

STABILITY

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.

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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-J. 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 25-year, 6-hour storm	2.1 in 1.9 in
6.	Drainage Area	296.16 acres

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Values reported represent the watershed, which drains directly to Pond N9-J3. Hydrologic input parameters for structures N9-J2, N9-J1 and N9-J 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).

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N9-J3 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	184.86	215.16
Volume	ac-ft	20.13	16.63
Storage			
Peak Stage	Msl	N/A	6880.2
Emerg. Spillway Elev.	Msl	6878.4	6878.4
Peak Storage	ac-ft	N/A	23.37
Storage Capacity	ac-ft	19.53	19.53
Outflow			
Peak Flow	Cfs	N/A	151.9
Spillway Elevation	Msl	6878.4	6878.4
Embankment Crest Elev.	Msl	6883.4	6883.4
Peak Stage	Msl	--	6880.2
Freeboard	Ft	--	3.2
Emergency Spillway Channel			
Flow Depth	Ft	--	1.8
Critical Velocity	Fps	--	5.97
Mannings "n"	--	--	0.048
Width	Ft	--	25
Outflow Channel			
Slope	%	--	25
Normal Velocity	Fps	--	9.4
Normal Depth	Ft	--	0.8
Mannings "n"	--	--	0.066
Riprap D_{50}	In	--	9

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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
	(Outflow)	2.0	ft
Channel Width		25	ft
Channel Length	(Spillway)	45	ft
	(Outflow)	161	ft
Sideslopes (Horizontal to Vertical)		3:1	or flatter
Average Slope	(Spillway)	0	%
Maximum Slope	(Outflow)	25	%
Spillway Elevation		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:

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1.	Rainfall Factor, R	40
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

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

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

	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

* * *

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

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

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APPENDIX A

Hydrology, Hydraulic, and Sedimentation Calculations

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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	
Tc = (11.9L^3/E)^0.385 =	0.336	hours

ROUTING PARAMETERS:

Between structure routing parameters were calculated using the SCS Upland mathod 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
Distrubed Land	B	86	152.52	13116.72
TOTAL:			296.161	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

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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	85	12.71%	0.60	7.24	6.13
1461	145	9.92%	0.50	5.67	5.20
1014	133	13.12%	0.60	7.47	8.19
1901	154	8.10%	0.50	4.63	4.61
858	158	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	5% > Slope < 10%	m = 0.5
Slope = 4%	m = 0.4	Slope > 10%	m = 0.6

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STRUCTURE: J3

Cover and Practice Factors:

Cover Type	Cover (%)	Canopy (%)	Area (acres)	Cover Factor, C	C * Area	Practive 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

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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

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

PROGRAM INPUT DATA

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

HYDROCALC Hydraulics for Windows, Version 1.2 Copyright (c) 1996
Dodson & Associates, Inc., 5629 FM 1960 West, Suite 314, Houston, TX 77069
Phone:(281)440-3787, Fax:(281)440-4742, Email:software@dodson-hydro.com
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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)	Freeboard % of Depth	Freeboard Mult. x (VxD)
25.00	3.0:1	3.0:1	25.0	4.17		

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	215.16 cfs	
Depth:	0.83 ft	5.00 ft
Top Width:	30.00 ft	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	

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APPENDIX B

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

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

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Gary Altsisi

General Information

Storm Information:

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

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Structure Summary:

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

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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**

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APPENDIX C

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

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

Gary Altsisi

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General Information

Storm Information:

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

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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
	$\sum$	**296.160**						**215.16**	**16.633**

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Structure Networking:

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

#1
Pond

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Structure Summary:

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

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Structure Detail:

Structure #1 (Pond)

N9-J3 POND

Pond Inputs:

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

Emergency Spillway

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

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	
6,865.50	1.025	0.506	0.000	
6,866.00	1.050	1.025	0.000	
6,866.50	1.076	1.557	0.000	
6,867.00	1.102	2.101	0.000	
6,867.50	1.128	2.658	0.000	
6,868.00	1.155	3.229	0.000	
6,868.50	1.181	3.813	0.000	
6,869.00	1.209	4.410	0.000	
6,869.50	1.236	5.022	0.000	
6,870.00	1.264	5.646	0.000	
6,870.50	1.308	6.289	0.000	
6,871.00	1.352	6.954	0.000	
6,871.50	1.397	7.641	0.000	
6,872.00	1.443	8.352	0.000	
6,872.50	1.490	9.085	0.000	
6,873.00	1.538	9.842	0.000	

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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

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

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

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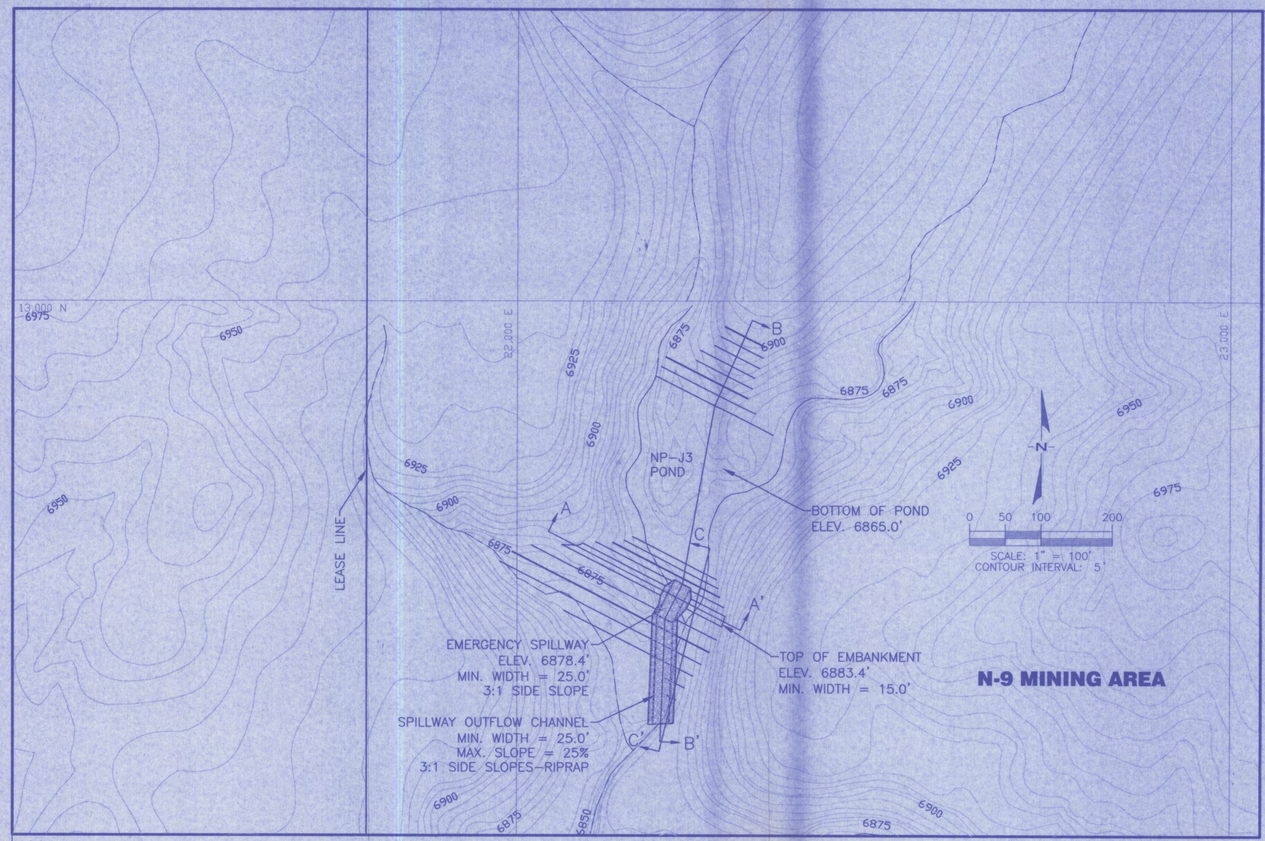
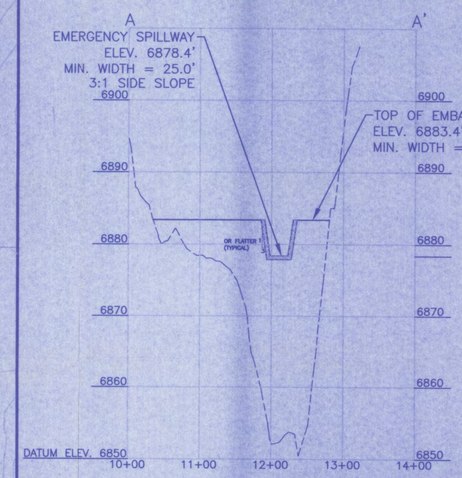
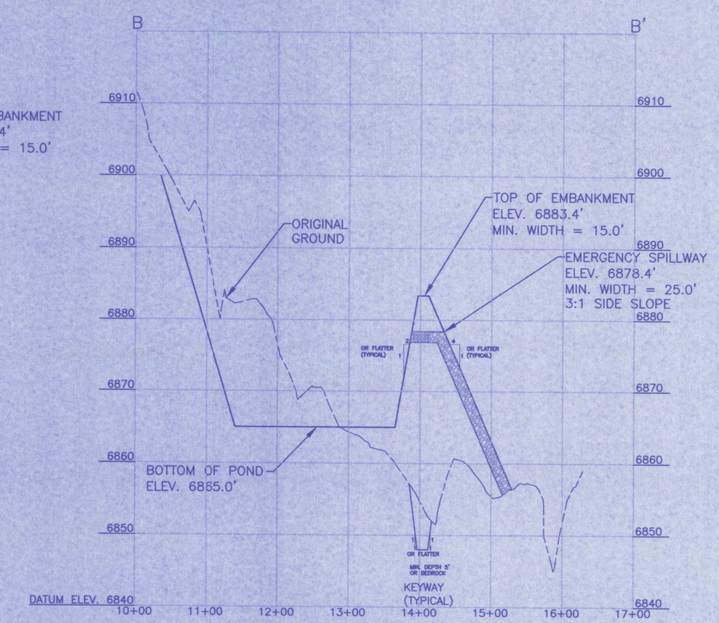
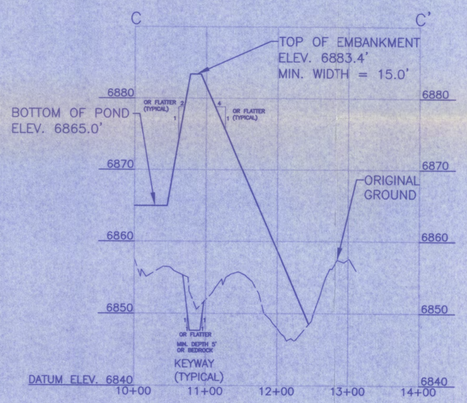




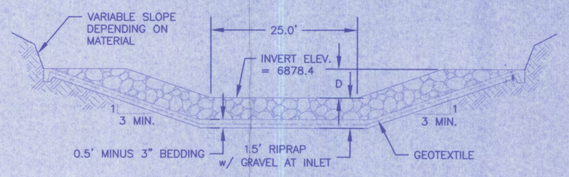
SECTION A – A'
SCALE: HORIZ. 1" = 100'
VERT. 1" = 10'



SECTION B – B'
SCALE: HORIZ. 1" = 100'
VERT. 1" = 10'



SECTION C – C'
SCALE: HORIZ. 1" = 100'
VERT. 1" = 10'



SPILLWAY MIN. D=2.5'
OUTFLOW CHANNEL MIN. D=2.0'

SECTION OF EMERGENCY SPILLWAY
NOT TO SCALE
N9-J3 POND

N9-J3 POND STAGE CAPACITY TABLE

ELEVATION (ft-msl)	STAGE (ft)	AREA (acres)	TOTAL CAPACITY (ac-ft)	DESCRIPTION
6865.0	0.0	0.96	0.00	BOTTOM OF POND
6870.0	5.0	1.30	5.65	INCISED ELEV.
6875.0	10.0	1.69	13.11	
6878.4	13.4	2.09	19.53	EMERGENCY SPILLWAY
6880.0	15.0	2.27	23.02	
6883.4	18.4	2.72	31.51	TOP OF EMBANKMENT

ENGINEER'S CERTIFICATION

JAMES SCHENDOCH DVOGT
Engineering Supervisor
Peabody Western Coal Company

ARIZONA P.E. 18782
Date: DEC 23 2004

SEP 2005
APPROVED

NOTES:
1) General location, see Drawing No. 85400, Sheet K-6 and Drawing No. 85405.
2) See Chapter 6, Black Mesa PAP for Construction Specifications.
3) See Vol. 2, Chapter 6, Attachment D, Sections 1-3 for description of Geotechnical Evaluation.
4) Salvage topsoil in accordance with approved topsoil salvage plan.
5) Reclamation of the distrubed area above the high waterline shall be in accordance with the approved reclamation plan.
6) Ponding area side slopes, typical 3:1 slope or flatter and blend into natural topography.

WOODSON
ENGINEERING AND SURVEYING, INC.
124 N. ELDEN ST.
FLAGSTAFF, AZ 86001
PHONE: (928) 774-4636 FAX: (928) 774-4646

EXHIBIT # 1
PROPOSED N9-J3
SEDIMENTATION POND DESIGN

KAYENTA MINE
PEABODY WESTERN COAL COMPANY
P. O. BOX 650 KAYENTA, ARIZONA 86033

DESIGNED BY: GA	SCALE: AS NOTED
DRAWN BY: PEK	DRAWING DATE: 11-22-04
CHECKED BY: JGS	PHOTO DATE: 05-83
CONTOUR INTERVAL: 5 FT.	DWG FILE: POND N9-J3.DWG