DESIGN REPORT

Permanent Impoundment Structure

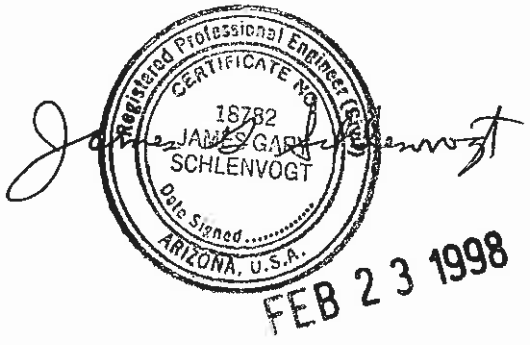
J27-RA

Black Mesa Mine

Navajo County, Arizona

for

PEABODY WESTERN COAL COMPANY



FEB 23 1998

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INTRODUCTION

Structure J27-RA is an existing earthen embankment structure constructed by Peabody Western Coal Company in the J-27 reclamation area and proposed as a permanent structure to impound a maximum of approximately 2.63 ac.-ft. of runoff from the adjacent reclaimed areas of the Black Mesa Mine. The location of structure J27-RA and its watershed boundary are shown on Drawing No. 85400 (Sheet L-10) and Drawing No. 85405. The existing structure and the site-specific general construction plans addressing the existing embankment configuration and spillway designs are shown on the attached Exhibit 1.

This design report contains information specific to structure J27-RA, which is in series with Structure J27-RC. 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 existing structure J27-RA was inspected by a Registered Professional Engineer from Peabody Western Coal Company, to assure that the existing structure is stable and no adverse conditions existed to prevent successful construction of the spillway structure. A detailed geotechnical investigation was not performed; rather, the information in Chapter 6, Attachment D was utilized to evaluate embankment design.

SITE DESCRIPTION

LAND USE

The J27-RA structure has a 45.8-acre tributary drainage area and is located on a tributary to Moenkopi Wash. The 45.8 acre watershed contributing to the J27-RA structure is classified as 19% Post-Law reclaimed and 81% Pre-Law reclaimed.

DESIGN ANALYSES

GENERAL

Structure J27-RA 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 1997 for Peabody Western Coal Company and was used in the analysis of the structure.

STABILITY

Structure J27-RA is conservatively assumed to be a Category A-5 embankment. A homogeneous earthen embankment approximately 15 feet wide on top currently exists. The upstream slope will be constructed to 2.5:1 (horizontal to vertical) or flatter slope and the downstream slope will be constructed to 3.5:1 or flatter slope. 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 10-foot wide riprap-lined trapezoidal channel.

WATER PERSISTENCE

Pond J27-RA is a relatively small pond with an adequate contributing drainage area. As a result, there is standing water in the pond over a significant portion of the year with an average depth ranging from 3 to 7 feet. Both PWCC personnel and the OSM Inspectors have observed water occurrence in the pond over a period of several years.

In addition, to determine water persistence for Structure J27-RA, runoff from average annual precipitation was compared to evaporation and infiltration rates on a monthly basis. Initially, the pond was assumed to be empty. Runoff for the first month was determined using the SCS Curve Number Method and the mean monthly precipitation for January, as presented in Appendices C and described in subsequent sections. The runoff volume was added to the pond and a water elevation and surface area were determined from the pond stage storage curve found on Appendix C. Once the water surface area was determined, the total evaporation and infiltration for the first month were calculated. The calculated evaporation and infiltration losses were subtracted from the total runoff for the first month to determined the average water increase or decrease to the pond. The final volume was then used as the starting volume for the next month and the same steps were repeated for each subsequent month. This analysis proceeded until the pond elevation and surface area stabilized, which occurred in year 2. The inputs and results are shown in Appendix C in both graphical and tabular formats. As shown by the graph and table in Appendix C, the water elevation of the

pond should stabilize between elevation 6539.5 and the spillway invert, depending on the time of year. This is the point at which runoff rates equal the evaporation and infiltration rates and or runoff discharges through the spillway and corresponds to approximately 1.5 to 2.6 ac-ft of water in the impoundment.

In 1982 and 1983, Water, Waste and Land (WWL), Consultants, also prepared a study for PWCC and OSM which is included in Volume 27, Appendix E. They evaluated and determined these types of impoundments located in areas reclaimed in the late 1970's and early 1980's were stable.

WATER QUALITY

Water in the J27-RA Permanent Impoundment comes primarily from surface water runoff from the J27 reclamation area. Given that the spoils in the J27 area do not contain material which is potentially acid- or toxic-forming and could adversely impact surface runoff water quality, Peabody Western Coal Company does not anticipate any significant water quality problems. The structure has been containing water for many years and no adverse condition from the water has been noted in the wildlife or domestic animals observed in the area.

HYDROLOGY

The hydrologic analysis was completed using the computer program SEDCAD+ (see Appendices A, and B). Structure J27-RA is constructed in series with downstream Structure J27-RC. Structure J27-RA is classified as a low hazard structure (see Drawing No. 85408). The mine area is sparsely populated with no one living in the downstream floodplain. The structure will impound less than 20 acre-feet and is less than 20 vertical feet in height from the upstream toe of embankment of the natural stream elevation to the emergency spillway invert elevation. The structure is located upstream of Structure J27-RC; and although the cumulative capacity of these impoundments is less than 20 acre-feet, the spillway was analyzed using the 100-year, 6-hour storm event given the potential for flow between structures. Structure J27-RA was conservatively assumed to be full to the invert of the emergency spillway at the time of 100-year storm event.

The following parameters were used in the hydrologic analysis for the 100-yr., 6-hr storm (see Appendix B):

		J27-RA
1.	Water Course length, L	0.456 mi.
2.	Elevation Difference, H	142 ft
3.	Time of Concentration, T_c	0.156 hr
4.	SCS Curve Number	86
5.	Rainfall Depth, 100-year, 6-hour storm	2.4 in
6.	Drainage Area	45.8 acres

HYDRAULICS

The SEDCAD+ and Flow Master 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, and B).

J27-RA SEDIMENTATION POND HYDRAULICS TABLE

	Units	100-Yr., 6-Hr Storm
Initial Reservoir Volume Condition		Full to emergency spillway
Inflow		
Peak Flow	cfs	73.7
Volume	ac-ft	4.4
Outflow		
Peak Flow	cfs	59.7
Spillway Elevation	msl	6541.0
Embankment Crest Elev.	msl	6544.0
Peak Stage	msl	6542.6
Freeboard	ft	1.4
Emergency Spillway Channel		
Flow Depth	ft	1.6
Critical Velocity	fps	5.0
Mannings "n"	--	.035
Width	ft	10
Outflow Channel		
Maximum Slope	%	16.7
Normal Velocity	fps	7.4
Normal Depth	ft	0.7
Mannings "n"	--	.057
Riprap D_{50}	in	6

EMERGENCY SPILLWAY AND OUTLET CHANNEL

The emergency spillway and outlet channel for J27-RA will be a trapezoidal channel, the alignment and dimensions are shown on Exhibit 1 and includes the following dimensions:

Minimum Channel Depth	(Spillway)	3.0	ft
	(Outflow)	1.7	ft
Channel Width		10	ft
Channel Length	(Spillway)	40	ft
	(Outflow)	125	ft
Sideslopes (Horizontal to Vertical)		3:1 or flatter	
Average Slope	(Spillway)	0.0	%
Maximum Slope	(Outflow)	16.7	%
Spillway Elevation		6541.0 ft	

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

STORAGE CAPACITY

The impoundment stage-capacity table (see Exhibit 1) is based on the 1997 aerial topography mapping conducted for Peabody Western Coal Company. Structure J27-RA is designed to contain approximately 2.63 acre-feet.

The calculations for the sediment load entering structure J27-RA were made utilizing the Revised Universal Soil Loss Equation with the following input parameters:

1.	Rainfall Factor, R	40
2.	Soil Erodibility Factor, K	0.38
3.	Slope Factor, LS	1.88
4.	Cover Factor, C	0.22
5.	Erosion Control Factor, P	1.00

To determine the potential life of the structure, the results of the sediment storage capacity for the J27-RA pond are presented in the following table.

J27-RA STORAGE

Total Available Storage Capacity	2.63	acre-feet
Sediment Inflow Rate/Year	0.13	acre-feet/year
Sediment Storage Life	20	years

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

Appendix A - Hydrology, Hydraulic, and Sedimentation Calculations

Appendix B - SEDCAD+ (Input and Output) 100-Year, 6-Hour Storm Event

Appendix C -Water Persistence Calculations

Exhibit #1 - J27-RA Permanent Impoundment Design

APPENDIX A

Hydrology, Hydraulic, and Sedimentation Calculations

I::

PEABODY WESTERN COAL COMPANY
CALCULATED HYDROLOGIC DATA

PROJECT: J27 AREA

STRUCTURE: J27-RA

TIME OF CONCENTRATION:

Start Elevation (ft) =	6680
End Elevation (ft) =	6538
Elevation Difference, E (ft) =	142
Watercourse Length (ft) =	2410
Watercourse Length, L (mi) =	0.456
Tc = (11.9L^3/E)^0.385 =	0.156

ROUTING PARAMETERS:

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

SCS CURVE NUMBER:

Cover Type	Soil Group	Curve Number	Area (acres)	CN*Area
Pre-Law Reclaimed	C	87	37.1	3227.7
Post-Law Reclaimed	C	81	8.7	704.7
TOTAL:			45.8	3932.4

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

DRAINAGE BASIN AREA:

45.8 Acres

PEABODY WESTERN COAL COMPANY
CALCULATED SEDIMENTOLOGY DATA

PROJECT: J27 AREA

STRUCTURE: J27-RA

SOIL ERODIBILITY FACTOR:

Soil Type	Erodibility Factor, K	Area (acres)	K*Area
EH#35	0.38	45.8	17.40
TOTAL:		45.8	17.40

Weighted K = Total K*Area/ Total Area = 0.38

SLOPE FACTOR:

Length (ft)	Elevation Change (ft)	Slope (%)	m	Slope Angle (deg)	LS Factor
300	20	6.7%	0.5	3.8	1.52
100	20	20.0%	0.6	11.3	3.39
150	20	13.3%	0.6	7.6	2.66
340	30	8.8%	0.5	5.0	2.12
200	15	7.5%	0.5	4.3	1.39
250	10	4.0%	0.4	2.3	0.76
400	20	5.0%	0.5	2.9	1.34

Average LS = 1.88

The LS Factor was calculated by:

LS = (Slope Length/72.6)^m(10.8*sin(slope angle) + 0.03) for Slopes < 9%*

LS = (Slope Length/72.6)^m(16.8*sin(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*

COVER AND PRACTICE FACTORS:

Cover Type	Cover (%)	Canopy (%)	Area (acres)	Cover Factor, C	C*Area	Practice Factor, P	P*Area
Pre Law	20%	0%	37.1	0.24	8.90	1.00	37.10
Post Law	40%	0%	8.7	0.15	1.31	1.00	8.70
TOTAL:			45.8		10.21		45.80

Weighted C = Total C*Area/ Total Area = 0.223

Weighted P = Total P*Area/ Total Area = 1.000

RAINFALL FACTOR:

R = 40

PEABODY WESTERN COAL COMPANY
CALCULATED SEDIMENT YIELD

PROJECT: J27 AREA

STRUCTURE: J27-RA

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

PARAMETER DESCRIPTION	VALUE	
Annual Rainfall Factor	40.00	
Soil Erodibility Factor	0.38	
Length Slope Factor	1.88	
Cover Factor	0.22	
Practice Factor	1.00	
Gross Annual Sediment Yield	6.37	tons/acre/year
Sediment Density	94.00	pcf
Gross Annual Sediment Yield	0.0031	acre-feet/acre/year
Sediment Delivery Ratio	90%	
Estimated Annual Sediment Yield	0.0028	acre-feet/acre/year
Watershed Area	45.8	acres
Watershed Annual Sediment Yield	0.13	acre-feet/year
er of years	1	years
ulated Sediment Volume	0.13	acre-feet

SEDCAD+ RIPRAP CHANNEL DESIGN

J27-RA OUTFLOW CHANNEL

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	59.70 cfs	
Slope	16.70 %	
Sideslopes (L and R)	3.00:1	3.00:1
Bottom Width	10.00 feet	
Freeboard	None	

RESULTS:

Steep Slope Design - PADER Method

Depth	0.68 ft
with Freeboard	0.00 ft
Top Width	14.06 ft
with Freeboard	10.00 ft
Velocity	7.34 fps
Cross Sectional Area	8.13 sq ft
Hydraulic Radius	0.57 ft
Manning's n	0.057
Froude Number	1.70
Dmax	0.625 ft (7.50 in)
D50	0.500 ft (6.00 in)
D10	0.167 ft (2.00 in)

J27-RA Spillway
Worksheet for Trapezoidal Channel

Project Description	
Project File	untitled.fm2
Worksheet	J27-RA Spillway
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Channel Slope	0.019996	ft/ft
Left Side Slope	3.000000	H : V
Right Side Slope	3.000000	H : V
Bottom Width	10.00	ft
Discharge	59.70	cfs

Results		
Depth	0.94	ft
Flow Area	12.01	ft^2
Wetted Perimeter	15.93	ft
Top Width	15.62	ft
Critical Depth	0.94	ft
Critical Slope	0.019996	ft/ft
Velocity	4.97	ft/s
Velocity Head	0.38	ft
Specific Energy	1.32	ft
Froude Number	1.00	
Flow is supercritical.		

APPENDIX B

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

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

J-27 AREA

by

Name: D. GLEASON

Company Name: ACZ, INC.
File Name: J:\861\0500\J-27-2II

Date: 12-12-1997

Company Name: ACZ, INC.
Filename: J:\861\0500\J-27-2II User: D. GLEASON
Date: 12-12-1997 Time: 13:46:21
J-27 AREA
Storm: 2.40 inches, 100 year- 6 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

GENERAL INPUT TABLE

Detailed Between Structure Routing:

J	B	To S	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Muskingum K (hr)	Muskingum X
1	1	2	1	8	705.15	8.57	8.78	0.02	0.022	0.418
1	2	2	1	8	1304.92	6.15	7.44	0.05	0.048	0.406
2	1	1	1	8	52.00	20.00	13.42	0.00	0.001	0.443

Company Name: ACZ, INC.
Filename: J:\861\0500\J-27-2II User: D. GLEASON
Date: 12-12-1997 Time: 13:46:21
J-27 AREA
Storm: 2.40 inches, 100 year- 6 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	45.80	86	F	0.156	0.000	0.000	0.0	4.44	73.66
		Type: Pond Label: J27-RA								
111	Structure	45.80							4.44	
111	Total IN	45.80							4.44	73.66
111	Total OUT								4.44	59.70
112	1	31.10	84	F	0.182	0.000	0.000	0.0	2.69	44.08
		Type: Null Label: NULL 1								
	Structure	31.10							7.13	
112	Total IN/OUT	76.90							7.13	103.07
111 to 112 Routing						0.022	0.418			
121	1	10.80	84	F	0.078	0.000	0.000	0.0	0.94	17.78
		Type: Pond Label: J27-RB								
121	Structure	10.80							0.94	
121	Total IN	10.80							0.94	17.78
121	Total OUT								0.94	10.35
122	1	40.90	85	F	0.098	0.000	0.000	0.0	3.75	70.35
		Type: Null Label: NULL 2								
122	Structure	40.90							4.68	
122	Total IN/OUT	51.70							4.68	80.59
121 to 122 Routing						0.048	0.407			
211	1	14.80	85	F	0.095	0.000	0.000	0.0	1.36	25.46
		Type: Pond Label: J27-RC								
211	Structure	14.80							13.17	
	Total IN	143.40							13.17	188.24
	Total OUT								13.17	158.90
112 to 211 Routing						0.001	0.443			

Civil Software Design -- SEDCAD+ Version 3.1

Company Name: ACZ, INC.
Filename: J:\861\0500\J-27-2II User: D. GLEASON
Date: 12-12-1997 Time: 13:46:21
J-27 AREA
Storm: 2.40 inches, 100 year- 6 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

POND INPUT/OUTPUT TABLE

J1, B1, S1
J27-RA

Drainage Area from J1, B1, S1, SWS(s)1: 45.8 acres
Total Contributing Drainage Area: 45.8 acres

DISCHARGE OPTIONS:

	Emergency Spillway
Riser Diameter (in)	----
Riser Height (ft)	----
Barrel Diameter (in)	----
Barrel Length (ft)	----
arrel Slope (%)	----
ning's n of Pipe	----
Spillway Elevation	----
Lowest Elevation of Holes	----
# of Holes/Elevation	----
Entrance Loss Coefficient	----
Tailwater Depth (ft)	----
Notch Angle (degrees)	----
Weir Width (ft)	----
Siphon Crest Elevation	----
Siphon Tube Diameter (in)	----
Siphon Tube Length (ft)	----
Manning's n of Siphon	----
Siphon Inlet Elevation	----
Siphon Outlet Elevation	----
Emergency Spillway Elevation	6541.0
Crest Length (ft)	40.0
Z:1 (Left and Right)	3 3
Bottom Width (ft)	10.0

D RESULTS:

Permanent Pool (ac-ft)
2.6

	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN	4.44	73.66
OUT	4.44	59.70

Peak Elevation	Hydrograph Detention Time (hrs)
6542.6	0.20

****

J1, B2, S1
J27-RB

Drainage Area from J1, B2, S1, SWS(s)1: 10.8 acres
Total Contributing Drainage Area: 10.8 acres

DISCHARGE OPTIONS:

	Emergency Spillway
Riser Diameter (in)	----
Riser Height (ft)	----
Barrel Diameter (in)	----
Barrel Length (ft)	----
Barrel Slope (%)	----
Manning's n of Pipe	----
Spillway Elevation	----
Lowest Elevation of Holes	----
# of Holes/Elevation	----
Entrance Loss Coefficient	----
Tailwater Depth (ft)	----
Notch Angle (degrees)	----
Weir Width (ft)	----
Siphon Crest Elevation	----
Siphon Tube Diameter (in)	----
Siphon Tube Length (ft)	----
Manning's n of Siphon	----
Siphon Inlet Elevation	----
Siphon Outlet Elevation	----
Emergency Spillway Elevation	6562.0
Crest Length (ft)	40.0
Z:1 (Left and Right)	3 3
Bottom Width (ft)	10.0

POND RESULTS:

	Permanent Pool (ac-ft)

=========

1.4

	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN	0.94	17.78
OUT	0.94	10.35

Peak Elevation	Hydrograph Detention Time (hrs)
6562.7	0.00

****

J2, B1, S1
J27-RC

Drainage Area from J2, B1, S1, SWS(s)1: 14.8 acres
Total Contributing Drainage Area: 143.4 acres

DISCHARGE OPTIONS:

	Emergency Spillway
er Diameter (in)	----
ıser Height (ft)	----
barrel Diameter (in)	----
Barrel Length (ft)	----
Barrel Slope (%)	----
Manning's n of Pipe	----
Spillway Elevation	----
Lowest Elevation of Holes	----
# of Holes/Elevation	----
Entrance Loss Coefficient	----
Tailwater Depth (ft)	----
Notch Angle (degrees)	----
Weir Width (ft)	----
Siphon Crest Elevation	----
Siphon Tube Diameter (in)	----
Siphon Tube Length (ft)	----
Manning's n of Siphon	----
Siphon Inlet Elevation	----
Siphon Outlet Elevation	----
Emergency Spillway Elevation	6467.0
st Length (ft)	40.0
(Left and Right)	3 3
Bottom Width (ft)	20.0

POND RESULTS:

Permanent

Pool (ac-ft)
2.1

	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN	13.17	188.24
OUT	13.17	158.90

Peak Elevation	Hydrograph Detention Time (hrs)
6469.0	0.17

****

Company Name: ACZ, INC.
Filename: J:\861\0500\J-27-2II User: D. GLEASON
Date: 12-12-1997 Time: 13:46:21
J-27 AREA
Storm: 2.40 inches, 100 year- 6 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

ELEVATION-AREA-CAPACITY-DISCHARGE TABLE

J1, B1, S1
J27-RA

Drainage Area from J1, B1, S1, SWS(s)1: 45.8 acres
Total Contributing Drainage Area: 45.8 acres

SW#1: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	
6532.00	0.00	0.01	0.00	0.00	
6533.00	1.00	0.07	0.04	0.00	
6534.00	2.00	0.17	0.16	0.00	
6535.00	3.00	0.22	0.36	0.00	
6536.00	4.00	0.27	0.61	0.00	
6537.00	5.00	0.32	0.91	0.00	
6538.00	6.00	0.37	1.25	0.00	
6539.00	7.00	0.43	1.66	0.00	
6540.00	8.00	0.48	2.11	0.00	
6541.00	9.00	0.55	2.63	0.00	Stage of SW#1
6541.70	9.70	0.60	3.04	10.90	
6541.80	9.80	0.61	3.10	14.42	
6541.90	9.90	0.62	3.16	18.33	
6542.00	10.00	0.62	3.22	22.63	
6542.50	10.50	0.66	3.54	52.82	
6542.59	10.59	0.67	3.60	59.70	Peak Stage
6543.00	11.00	0.70	3.88	92.64	
6543.50	11.50	0.74	4.25	141.13	
6544.00	12.00	0.78	4.63	207.48	

****

J1, B2, S1
J27-RB

Drainage Area from J1, B2, S1, SWS(s)1: 10.8 acres
Total Contributing Drainage Area: 10.8 acres

SW#1: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)
6554.50	0.00	0.00	0.00	0.00
6555.50	1.00	0.04	0.01	0.00
6556.50	2.00	0.10	0.08	0.00

6557.50	3.00	0.15	0.21	0.00	
6558.50	4.00	0.20	0.39	0.00	
6559.50	5.00	0.25	0.61	0.00	
6560.50	6.00	0.30	0.89	0.00	
6561.50	7.00	0.34	1.21	0.00	
6562.00	7.50	0.37	1.39	0.00	Stage of SW#1
6562.50	8.00	0.41	1.58	7.79	
6562.66	8.16	0.43	1.65	10.35	Peak Stage
6562.70	8.20	0.43	1.67	10.90	
6562.80	8.30	0.44	1.71	14.42	
6562.90	8.40	0.45	1.76	18.33	
6563.00	8.50	0.46	1.80	22.63	
6563.50	9.00	0.51	2.05	52.82	
6564.00	9.50	0.58	2.32	92.64	
6564.50	10.00	0.64	2.62	141.13	
6565.00	10.50	0.71	2.96	207.48	

****

J2, B1, S1
J27-RC

Drainage Area from J2, B1, S1, SWS(s)1: 14.8 acres
Total Contributing Drainage Area: 143.4 acres

SW#1: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	
6460.80	0.00	0.00	0.00	0.00	
6461.80	1.00	0.17	0.06	0.00	
6462.80	2.00	0.27	0.28	0.00	
6463.80	3.00	0.34	0.58	0.00	
6464.80	4.00	0.43	0.97	0.00	
6465.80	5.00	0.52	1.44	0.00	
6466.80	6.00	0.63	2.02	0.00	
6467.00	6.20	0.66	2.15	0.00	Stage of SW#1
6467.70	6.90	0.74	2.63	20.85	
6467.80	7.00	0.75	2.71	27.35	
6467.90	7.10	0.76	2.78	34.50	
6468.00	7.20	0.77	2.86	42.27	
6468.50	7.70	0.83	3.26	94.82	
6468.80	8.00	0.86	3.52	132.58	
6468.99	8.19	0.89	3.68	158.90	Peak Stage
6469.00	8.20	0.89	3.69	160.74	
6469.50	8.70	0.95	4.15	237.78	
6469.80	9.00	0.98	4.44	296.72	
6470.00	9.20	1.00	4.64	339.41	

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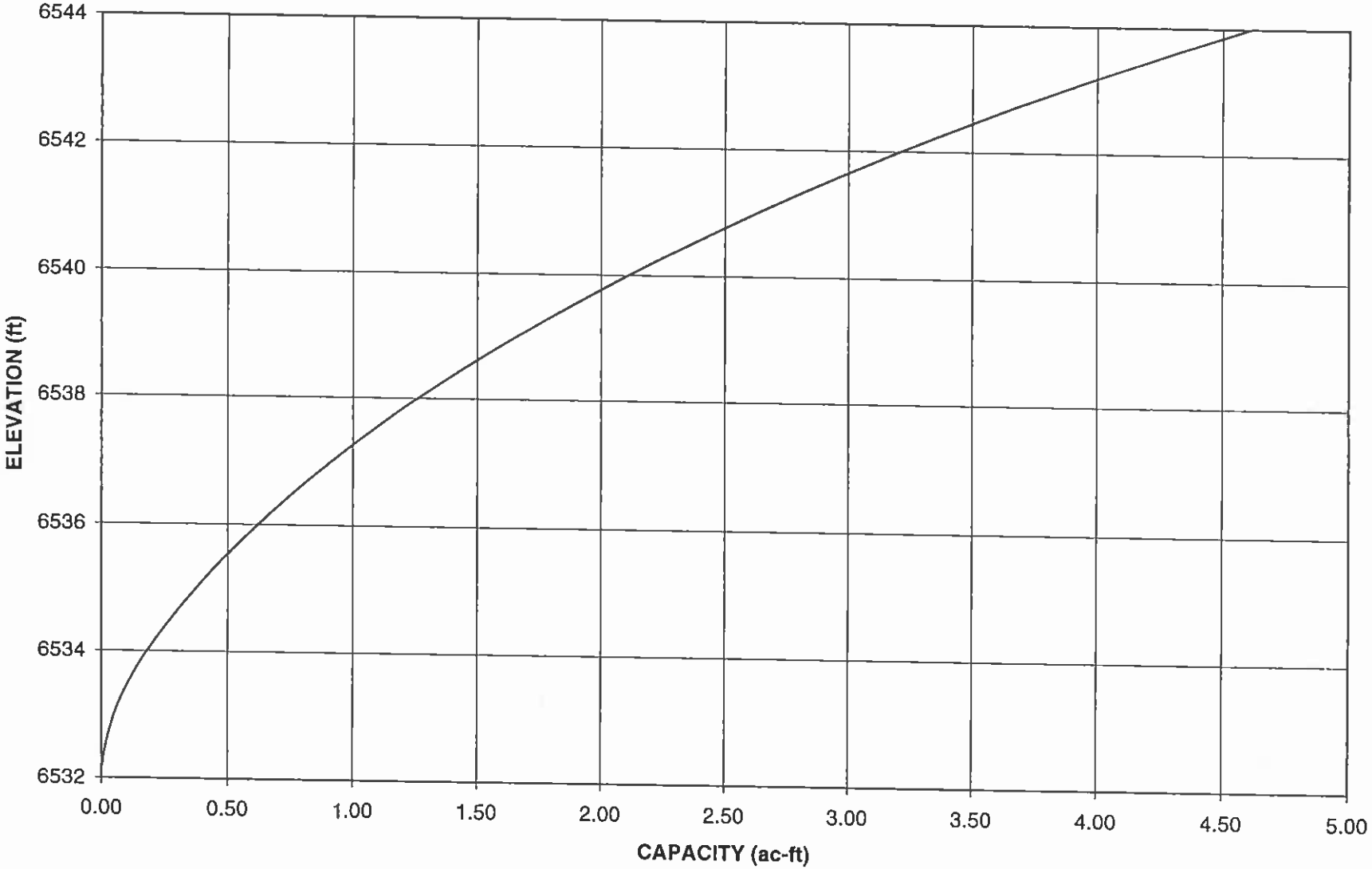
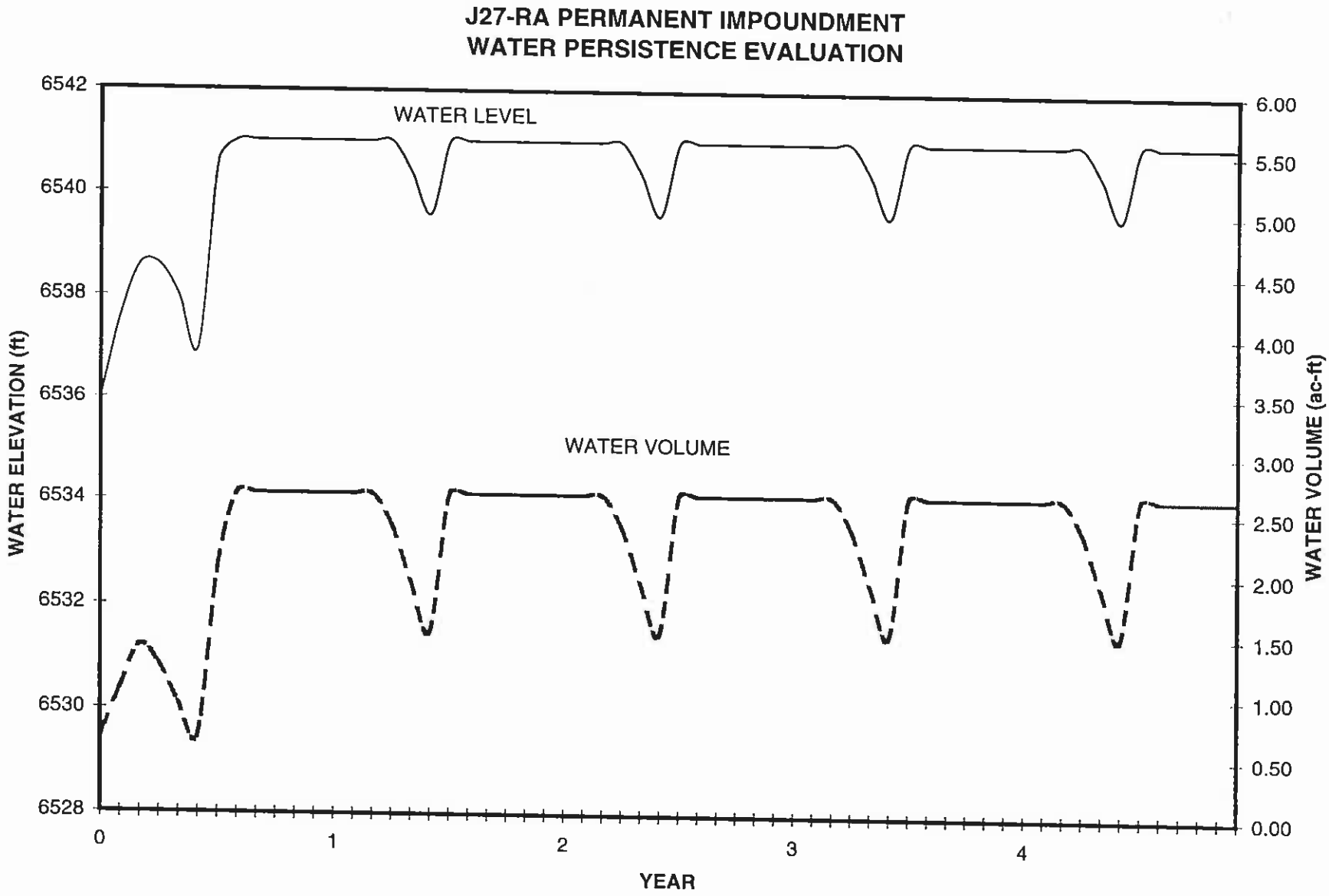
APPENDIX C

Water Persistence Calculations

PERMANENT IMPOUNDMENTJ27-RA
ELEVATION /CAPACITY CURVE




J27-RA PERMANENT IMPOUNDMENT
WATER PERSISTENCE EVALUATION
WATER LEVEL
WATER VOLUME
WATER ELEVATION (ft)
WATER VOLUME (ac-ft)
YEAR
6542
6540
6538
6536
6534
6532
6530
6528
6.00
5.50
5.00
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
0
1
2
3
4

PEABODY WESTERN COAL COMPANY
PERMANENT IMPOUNDMENT POND WATER PERSISTENCE EVALUATION

	January	February	March	April	May	June	July	August	September	October	November	December	End of Year2	End Of Year 3	End Of Year 4	End Of Year 5
Average Precipitation (inch)	0.95	0.86	0.89	0.58	0.45	0.48	1.49	1.49	0.95	1.09	0.98	1.08	1.08	1.08	1.08	1.08
Area (acres)	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8
Curve Number	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86	86
S	1.63	1.63	1.63	1.63	1.63	1.63	1.63	1.63	1.63	1.63	1.63	1.63	1.63	1.63	1.63	1.63
Run-Off (inches)	0.17	0.13	0.15	0.03	0.01	0.01	0.49	0.49	0.17	0.24	0.19	0.24	0.24	0.24	0.24	0.24
Run-Off (ac-ft)	0.66	0.50	0.55	0.13	0.03	0.04	1.85	1.85	0.66	0.93	0.72	0.91	0.91	0.91	0.91	0.91
Starting Pond Volume (ac-ft)	0	0.62	1.02	1.38	1.23	0.90	0.63	2.00	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63
Pond Volume + Runoff (ac-ft)	0.66	1.12	1.57	1.51	1.26	0.94	2.48	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63
Water Elevation (ft)	6536	6537.6	6538.6	6538.6	6538	6537	6540.6	6541	6541	6541	6541	6541	6541	6541	6541	6541
Water Surface Area (acres)	0.27	0.35	0.40	0.40	0.37	0.32	0.52	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55
Evaporation Rate (inches/month)	0.87	2.63	4.68	7.38	10.54	10.77	9.95	8.49	7.08	4.68	2.82	1.46	1.46	1.46	1.46	1.46
Evaporation (ac-ft)	0.02	0.08	0.16	0.25	0.32	0.29	0.43	0.39	0.32	0.21	0.13	0.07	0.07	0.07	0.07	0.07
Infiltration Rate (inches/month)	1.054	0.952	1.054	1.02	1.054	1.02	1.054	1.054	1.02	1.054	1.02	1.054	1.054	1.054	1.054	1.054
Infiltration (ac-ft)	0.02	0.03	0.04	0.03	0.03	0.03	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Total Water Loss (ac-ft)	0.04	0.10	0.19	0.28	0.38	0.31	0.48	0.44	0.37	0.26	0.18	0.12	0.12	0.12	0.12	0.12
Total Water Change (ac-ft)	0.62	0.40	0.36	-0.15	-0.32	-0.28	1.37	1.42	0.29	0.67	0.54	0.80	0.80	0.80	0.80	0.80
Ending Pond Volume	0.62	1.02	1.38	1.23	0.90	0.63	2.00	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63
Volume through Spillway	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.79	0.29	0.67	0.54	0.80	0.80	0.80	0.80	0.80

Notes:

1) Run-off volumes based on SCS Runoff Curve Number method: $Q = (P-0.2S)^2/(P+0.8S)$

P= Accumulative Precipitation
S= (1000/CN)-10

2) Evaporation and infiltration rates based on data presented in the report entitled " Hydrologic and Engineering Studies at the Peabody Coal Company Mines" in Permit AZ-0001, Volume 27.

3) Maximum Pond Volume 2.63 ac-ft

Need Map