

DESIGN REPORT

Sedimentation Structure

N11-A

Kayenta Mine

Navajo County, Arizona

PEABODY COAL COMPANY

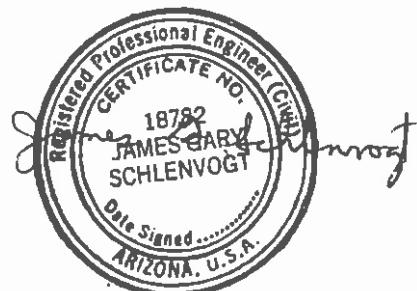


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Appendix B - SEDCAD⁺ (Input and Output) 10-Year, 24-Hour Storm Event

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

Exhibit 1 - Proposed N11-A, N11-A1, and N11-A2 Sedimentation Ponds

Introduction

Sedimentation Structure N11-A will be an earthen embankment, designed and constructed by Peabody Coal Company as a permanent impoundment structure to control runoff and sediment from the proposed N-11 surface mining area at the Kayenta Mine. The location of Structure N11-A and its watershed boundary is shown on Drawing No. 85400 (Sheet L-7), 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 N11-A located in series with upstream sedimentation structures N11-A1 and N11-A2. In addition, the spillway design for N11-A was evaluated using the 100-year, 6-hour storm assuming the upstream structures have been reclaimed. This will be the condition in approximately 2015 when N11-A1 and N11-A2 are reclaimed and N11-A remains as a permanent structure.

Prior to bond release by the regulatory authorities, Peabody Coal Company will utilize a qualified Registered Professional Engineer to review the performance standards required for N11-A. The engineer will recommend remedial work, if required, to modify or upgrade N11-A to assure compliance with the applicable permanent impoundment regulations, proposed postmining land use, and with the livestock and wildlife facility requirements in Chapter 23, Revegetation Plan, of the approved permit. The final permanent impoundment remedial plan for structure N11-A will be submitted to OSMRE approximately one year prior to final bond release.

Mine-wide design, construction, and reclamation information is presented in the "General Report, Kayenta and Black Mesa Mines, Navajo County, Arizona for Peabody 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 Structure N11-A was inspected by a Registered Professional Engineer from Peabody Coal Company to ensure that the location was suitable and no adverse conditions existed to prevent the successful construction of the structure. A detailed geotechnical investigation was not performed, rather, the information in Chapter 6,

Attachment D was utilized for embankment design. A conservative embankment category of (A-3) with an 18-foot total embankment height was utilized for the design.

Site Description

Land Use

N11-A series structures have a 498.25-acre combined drainage area and is located on a tributary to Coal Mine Wash at the Kayenta Mine. The watershed is classified as 4 percent disturbed, 6.5 percent pinon-juniper, 3.5 percent roadway, and 86 percent reclaimed. Structure N11-A has a 14.71-acre drainage area.

Design Analyses

General

Structure N11-A was designed by a Registered Professional Engineer from Peabody Coal Company. The design was performed in accordance with applicable 30 CFR 780 and 816 regulations of the United States Department of the Interior, Office of Surface Mining (OSM) and included a review of available project files. The most current information contained in the Peabody Coal Company files includes topographic maps developed from aerial photography flown in 1983 and was used in the analyses of the structure.

Stability

A homogeneous earthen embankment, compacted in lifts to design specifications, and approximately 20 feet wide on top will be constructed. An upstream slope of 3:1 (horizontal to vertical) and a downstream slope of 5:1 were assumed. Based on a total embankment height of 18 feet, these slopes are equal to or flatter than the recommended 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.

Hydrology

The hydrologic analysis was completed using the computer program SEDCAD+ (see Appendices A, B, and C). Structure N11-A is located downstream from structures N11-A1 and N11-A2. The three structures have a combined capacity that is greater than 20 acre-feet; therefore, the spillway was analyzed using the 100-year, 6-hour storm for a permanent impoundment and ponds in series. Structures N11-A1 and N11-A2 was assumed to be reclaimed and structure N11-A was conservatively assumed to be full to the emergency spillway at the

time of the 100-year storm. The storage capacity requirements of Structure N11-A was analyzed using the 10-year, 24-hour storm. The combined ponds in series were conservatively assumed to completely contain the 10-year, 24-hour storm without discharge downstream to Coal Mine Wash; plus, provide adequate sediment storage volume.

The following parameters were used in the hydrologic analysis:

	10-Year <u>24-Hr Storm</u>	100-Year <u>6-Hr. Storm</u>
1. Water Course Length, L	0.095 mi	1.875 mi
2. Elevation Difference, H	34 ft	440 ft
3. Time of Concentration, Tc	0.044 hr	0.515 hr
4. SCS Curve Number	87	82
5. Rainfall Depth	2.1 in	2.4 in
6. Drainage Area	14.71 ac	498.25 ac

Hydraulics

The SEDCAD⁺ and Dodson-Trapezoidal Channel computer programs were used to evaluate inflow to the sedimentation structure, outflow from the structure, and the resulting water surface elevations. The 10-year storm was routed through Structures N11-A1, N11-A2, and into Structure N11-A as will be the worst case scenario during mining and reclamation, and the 100-year storm was analyzed with Structures N11-A1 and N11-A2 reclaimed. The initial conditions and results of the analysis are summarized in the following N11-A hydraulics table:

N11-A HYDRAULICS TABLE

	Units	10-Yr, 24-Hr	100-Yr, 6-Hr
	Storm	Storm	Storm
Initial Reservoir Volume Condition		Empty	Full to emergency spillway elevation
Inflow			
Peak Flow	cfs	185.4	423.1
Volume	ac-ft	1.2*	38.4
Storage			
Peak Stage	msl	N/A	6590.4
Emerg. Spillway Elev.	msl	6588.0	6588.0
Peak Storage	ac-ft	N/A	24.8
Storage Capacity	ac-ft	19.0	19.0
Outflow			
Peak Flow	cfs	N/A	374.5
Spillway Elevation	msl	6588.0	6588.0
Embankment Crest Elev.	msl	6593.0	6593.0
Peak Stage	msl	---	6590.4
Freeboard	ft	---	2.6
Emergency Spillway Channel			
Flow Depth	ft	---	2.4
Critical Velocity	fps	---	6.3
Mannings "n"	---	---	0.055
Width	ft	---	40
Outflow Channel			
Slope	%	---	13.0
Normal Velocity	fps	---	9.1
Normal Depth	ft	---	1.0
Mannings "n"	---	---	0.055

* Inflow volume for the drainage area between Structures N11-A and N11-A1.

Emergency Spillway and Outlet Channel

The emergency spillway and outlet channel for N11-A will be a trapezoidal channel. The alignment and dimensions are shown on Exhibit 1 and includes the following dimensions:

Minimum Channel Depth (Spillway) . . . 3.5 ft.

(Outflow) . . . 2.0 ft.

Channel Width 40 ft.

Channel Length (Spillway) 80 ft.

(Outflow) 180 ft.

Side Slopes (Horizontal to Vertical) . . 3:1 or flatter

Average Slope (Spillway) 0 %

Maximum Slope (Outflow) 13 %

Spillway Elevation 6588.0

A minimum 15-foot long riprapped 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 1983 aerial topographic mapping conducted for Peabody Coal Company. The total storage capacity of Structure N11-A is designed to contain approximately 18.97 acre-feet.

The calculations for the sediment load entering Structure N11-A were made utilizing the Revised Universal Soil Loss Equation with the following parameters:

- | | | | |
|----|----------------------------|-------|------|
| 1. | Rainfall Factor, R | | 40 |
| 2. | Soil Erodibility Factor, K | | 0.21 |
| 3. | Slope Factor, LS | | 5.54 |
| 4. | Cover Factor, C | | 1.0 |
| 5. | Erosion Control Factor, P | | 0.43 |

The hydrologic analysis gives the storage volume required to treat the 10-year, 24-hour storm, and the remaining storage volume available for storing sediment. Although Structure N11-A has sufficient storage by itself, the structures upstream from N11-A do not have sufficient storage and contribute excess runoff downstream to N11-A. Therefore, the combined sediment storage capacity was determined for the three structures in series.

The results of the analysis are presented in the following table.

Combined Storage for Structures N11-A2, N11-A1, and N11-A

	N11-A2	N11-A1	N11-A	Combined
Total Storage Capacity	17.11	19.21	18.97	55.29 ac-ft
10-Year, 24-Hour Storm Inflow	28.40	0.60	1.21	30.21 ac-ft
Available Sediment				
Storage Capacity	---	7.34	17.74	25.08 ac-ft
Sediment Inflow Rate	10.52	0.07	0.14	10.73 ac-ft/yr
Sediment Storage Life	---	---	---	2.3 yrs

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

Appendix A - Hydrology, Hydraulic, and Sedimentation Calculations

Appendix B - SEDCAD⁺ (Input and Output) 10-year, 24-hour Storm Event

Appendix C - SEDCAD⁺ (Input and Output) 100-year, 6-hour Storm Event

Exhibit 1 - Proposed N11-A, N11-A1, and N11-A2 Sedimentation Ponds

APPENDIX A

HYDROLOGY, HYDRAULIC, AND SEDIMENTATION CALCULATIONS

N11-A

Project: N11-A Pond (In-Series)

Time of Concentration:

Elevation Difference = 6609 - 6575 = 34 ft.

Watercourse Length = 500 ft. = 0.095 mi.

Tc = [11.9(W.L.)^3/(E.D.)]^0.385 = 0.044 hr.

SCS Curve Number:

Cover Type	Soil Group	Area CN	(Acres)	CN*Area
Disturbed	B	86	13.33	1146.4
Road	C	89	<u>1.38</u>	<u>122.8</u>
			14.71	1269.2

Weighted CN = 1269.2/14.71 = 86.3 = Use 87

Drainage Basin Area:

14.71 acres 0.02 sq. miles

SEDCAD Utility-Routing Parameters:

K = 0.018 hr

X = 0.411 hr

Project: N11-A Pond (Only)

Time of Concentration:

$$\text{Elevation Difference} = 7015 - 6575 = 440 \text{ ft.}$$

$$\text{Watercourse Length} = 9900 \text{ ft.} = 1.875 \text{ mi.}$$

$$T_c = \left[\frac{11.9 (\text{W.L.})^3}{ED} \right]^{0.385} = 0.515 \text{ hr.}$$

SCS Curve Number:

Cover <u>Type</u>	Soil <u>Group</u>	Area <u>CN</u>	Area <u>(Acres)</u>	Area <u>CN x Area</u>
Reclaimed	C	81	428.50	34708.5
Road	C	89	17.56	1562.8
Pinon-Juniper	B	65	1.81	117.6
Pinon-Juniper	D	83	30.82	2558.1
Disturbed	B	86	<u>19.56</u>	<u>1682.2</u>
			498.25	40629.2

$$\text{Weighted CN} = 40629.2 / 498.25 = 81.54 = \underline{\text{Use 82}}$$

Drainage Basin Area:

498.25 acres

0.78 sq. miles

Project: N11-A Pond (In-Series)

Soil Erodibility Factor: $k = 0.21$ (graded/disturbed)

Slope Factor:

Length (ft)	Elev.	Slope (%)	M	Theta (Degrees)	LS $(L/72.6)^M * [17.2 \sin(\Theta) - 0.55]$
750	80	10.67	0.6	6.09	5.17
720	70	9.72	0.6	5.55	4.41
220	55	25.00	0.6	14.04	7.05
Avg. LS = <u>5.54</u>					

Cover Factor: $C = 1.0$

Practice Factor: $P = 0.43$ (Rough grading)

Rainfall Factor: $R = 40$

Revised USLE Calculations:

$$A = R * K * LS * C * P = 20.01 \text{ Ton/acre}$$

Sediment Inflow Rate:

$$DA = 14.71 \text{ ac.}$$

$$SDR = 0.95$$

$$SI = (A * DA * SDR * 94) / 192,400 = 0.14 \text{ ac-ft/yr}$$

TRAPEZOIDAL CHANNEL ANALYSIS
CRITICAL DEPTH COMPUTATION

July 14, 1993
N11-A SPILLWAY 100-YR., 6-HR. STORM

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	374.5
Manning's Roughness Coefficient (n-value).....	0.0550
Channel Side Slope - Left Side (horizontal/vertical)....	3.00
Channel Side Slope - Right Side (horizontal/vertical)...	3.00
Channel Bottom Width (feet).....	40.0

PROGRAM RESULTS:

DESCRIPTION	VALUE
Critical Depth (feet).....	1.35
Critical Slope (feet per foot).....	0.0416
Flow Velocity (feet per second).....	6.31
Froude Number.....	1.000
Velocity Head (feet).....	0.62
Energy Head (feet).....	1.97
Cross-Sectional Area of Flow (square feet).....	59.39
Top Width of Flow (feet).....	48.09

=====

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.3 (c) 1986
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. A manual with equations & flow chart is available.

SEDCAD+ RIPRAP CHANNEL DESIGN

N11-A SPILLWAY 100-YR., 6-HR. STORM

INPUT VALUES:

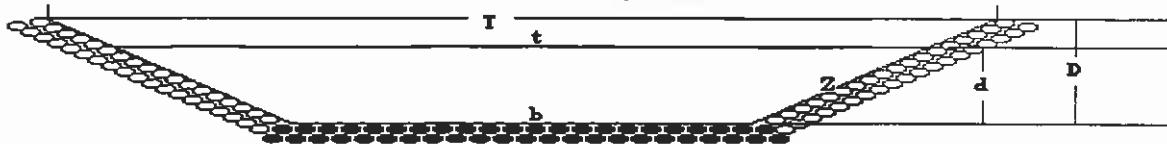
Shape	TRAPEZOIDAL
Discharge	374.50 cfs
Slope	13.00 %
Sideslopes (L and R)	3.00:1 3.00:1
Bottom Width	40.00 feet
Freeboard	1 ft

RESULTS:

Steep Slope Design - PADER Method

Depth	0.96 ft
with Freeboard	1.96 ft
Top Width	45.77 ft
with Freeboard	51.77 ft
Velocity	9.07 fps
Cross Sectional Area	41.27 sq ft
Hydraulic Radius	0.90 ft
Manning's n	0.055
Froude Number	1.68
Dmax	0.938 ft (11.25 in)
D50	0.750 ft (9.00 in)
D10	0.250 ft (3.00 in)

SEDCAD+ CHANNEL DESIGN
N11-A SPILLWAY 100-YR., 6-HR. STORM



Riprap - Steep Slope Design - PADER Method

Discharge	= 374.50 cfs	Depth (d)	= 0.96 (D = 1.96) ft
Bottom (b)	= 40.00 ft	Top width (t)	= 45.77 (T = 51.77) ft
Side slopes (Z)	= 3.0:1(L) 3.0:1(R)	Velocity	= 9.97 fps
Bed slope	= 13.00 %	Hydraulic Radius	= 0.98 ft
Manning's n	= 0.055	Froude number	= 1.68
		D _{max}	= 0.94 ft (11.25 in)
		D ₅₀	= 0.75 ft (9.00 in)
		D ₁₀	= 0.25 ft (3.00 in)

APPENDIX B

N11-A SEDCAD+ (INPUT AND OUTPUT)

10-YEAR, 24-HOUR STORM EVENT

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

N11-A SERIES POND 10-YR., 24-HR. STORM

by

Name: JGS

Company Name: PEABODY COAL COMPANY
File Name: C:\SEDCAD3\K-MINE\N11RUNN

Date: 07-16-1993

Civil Software Design -- SEDCAD+ Version 3.1
Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: PEABODY COAL COMPANY
Filename: C:\SEDCAD3\K-MINE\N11RUNN User: JGS
Date: 07-16-1993 Time: 09:40:34
N11-A SERIES POND 10-YR.,24-HR. STORM
Storm: 2.10 inches, 10 year-24 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	476.28	82	F	0.475	0.000	0.000	0.0	28.40	229.45
			Type: Pond			Label: N11-A2 POND				
111	Structure	476.28							28.40	
111	Total IN	476.28							28.40	229.45
111	Total OUT								28.40	206.79
112	1	7.26	87	F	0.035	0.000	0.000	0.0	0.60	7.53
			Type: Pond			Label: N11-A1 POND				
112	Structure	7.26							28.99	
112	Total IN	483.54							28.99	208.30
112	Total OUT								28.99	182.23
111	to 112 Routing					0.013	0.417			
113	1	14.71	87	F	0.044	0.000	0.000	0.0	1.21	15.26
			Type: Null			Label: N11-A POND				
113	Structure	14.71							30.20	
113	Total IN/OUT	498.25							30.20	185.36
112	to 113 Routing					0.018	0.411			
114	1	0.00	0	F	0.000	0.000	0.000	0.0	0.00	0.00
			Type: Null			Label: NULL				
114	Structure	0.00							30.20	
114	Total IN/OUT	498.25							30.20	185.36
113	to 114 Routing					0.000	0.000			

Civil Software Design -- SEDCAD+ Version 3.1
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Company Name: PEABODY COAL COMPANY
Filename: C:\SEDCAD3\K-MINE\N11RUNN User: JGS
Date: 07-16-1993 Time: 09:40:34
N11-A SERIES POND 10-YR., 24-HR. STORM
Storm: 2.10 inches, 10 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

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LAST POND ONLY TABLE
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J1, B1, S2
N11-A1 POND

Drainage Area from J1, B1, S2, SWS(s)1: 7.3 acres
Total Contributing Drainage Area: 483.5 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	6609.0
Crest Length (ft)	50.0
Z:1 (Left and Right)	3 3
Bottom Width (ft)	40.0

POND RESULTS:

Permanent
Pool
(ac-ft)
=====

	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN	28.99	208.30
OUT	28.99	182.23

Elevation	Peak Hydrograph Detention Time (hrs)
6610.5	0.16

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Company Name: PEABODY COAL COMPANY
Filename: C:\SEDCAD3\K-MINE\N11RUNN User: JGS
Date: 07-16-1993 Time: 09:40:34
N11-A SERIES POND 10-YR.,24-HR. STORM
Storm: 2.10 inches, 10 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

=====

POND INPUT/OUTPUT TABLE

=====

J1, B1, S1
N11-A2 POND

Drainage Area from J1, B1, S1, SWS(s)1: 476.3 acres
Total Contributing Drainage Area: 476.3 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	6622.0
Crest Length (ft)	50.0
Z:1 (Left and Right)	3 3
Bottom Width (ft)	40.0

POND RESULTS:

Permanent
Pool
(ac-ft)

=====

	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN	28.40	229.45
OUT	28.40	206.79

Elevation	Peak Hydrograph Detention Time (hrs)
6623.6	0.17

**J1, B1, S2
 N11-A1 POND**

Drainage Area from J1, B1, S2, SWS(s)1:	7.3 acres
Total Contributing Drainage Area:	483.5 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	6609.0
Crest Length (ft)	50.0
Z:1 (Left and Right)	3 3
Bottom Width (ft)	40.0

POND RESULTS:

Permanent
 Pool
(ac-ft)

=====

19.2

	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN	28.99	208.30
OUT	28.99	182.23

Elevation	Peak Hydrograph (hrs)	Detention Time
6610.5		0.16

Civil Software Design -- SEDCAD+ Version 3.1
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Company Name: PEABODY COAL COMPANY
Filename: C:\SEDCAD3\K-MINE\N11RUNN User: JGS
Date: 07-16-1993 Time: 09:40:34
N11-A SERIES POND 10-YR., 24-HR. STORM
Storm: 2.10 inches, 10 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

=====

ELEVATION-DISCHARGE TABLE

=====

J1, B1, S1
N11-A2 POND

Drainage Area from J1, B1, S1, SWS(s)1: 476.3 acres
Total Contributing Drainage Area: 476.3 acres

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
6605.00	0.0	0.0
6605.50	0.0	0.0
6606.00	0.0	0.0
6606.50	0.0	0.0
6607.00	0.0	0.0
6607.50	0.0	0.0
6608.00	0.0	0.0
6608.50	0.0	0.0
6609.00	0.0	0.0
6609.50	0.0	0.0
6610.00	0.0	0.0
6610.50	0.0	0.0
6611.00	0.0	0.0
6611.50	0.0	0.0
6612.00	0.0	0.0
6612.50	0.0	0.0
6613.00	0.0	0.0
6613.50	0.0	0.0
6614.00	0.0	0.0
6614.50	0.0	0.0
6615.00	0.0	0.0
6615.50	0.0	0.0
6616.00	0.0	0.0
6616.50	0.0	0.0
6617.00	0.0	0.0
6617.50	0.0	0.0
6618.00	0.0	0.0
6618.50	0.0	0.0
6619.00	0.0	0.0
6619.50	0.0	0.0
6620.00	0.0	0.0
6620.50	0.0	0.0
6621.00	0.0	0.0
6621.50	0.0	0.0
6622.00	0.0	0.0

6622.50	27.2	27.2
6622.70	38.1	38.1
6622.80	50.4	50.4
6622.90	62.2	62 ^
6623.00	74.9	74
6623.50	174.5	174.5
6624.00	283.7	283.7
6624.50	422.4	422.4
6625.00	586.6	586.6
6625.50	781.1	781.1
6626.00	999.5	999.5
6626.50	1241.6	1241.6
6627.00	1507.5	1507.5
6627.50	1797.3	1797.3
6628.00	2111.2	2111.2

J1, B1, S2
N11-A1 POND

Drainage Area from J1, B1, S2, SWS(s)1: 7.3 acres
Total Contributing Drainage Area: 483.5 acres

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
6590.00	0.0	0.0
6590.50	0.0	0
6591.00	0.0	0.
6591.50	0.0	0.0
6592.00	0.0	0.0
6592.50	0.0	0.0
6593.00	0.0	0.0
6593.50	0.0	0.0
6594.00	0.0	0.0
6594.50	0.0	0.0
6595.00	0.0	0.0
6595.50	0.0	0.0
6596.00	0.0	0.0
6596.50	0.0	0.0
6597.00	0.0	0.0
6597.50	0.0	0.0
6598.00	0.0	0.0
6598.50	0.0	0.0
6599.00	0.0	0.0
6599.50	0.0	0.0
6600.00	0.0	0.0
6600.50	0.0	0.0
6601.00	0.0	0.0
6601.50	0.0	0.0
6602.00	0.0	0.0
6602.50	0.0	0.0
6603.00	0.0	0 ^
6603.50	0.0	0
6604.00	0.0	0.0
6604.50	0.0	0.0
6605.00	0.0	0.0
6605.50	0.0	0.0

6606.00	0.0	0.0
6606.50	0.0	0.0
6607.00	0.0	0.0
6607.50	0.0	0.0
6608.00	0.0	0.0
6608.50	0.0	0.0
6609.00	0.0	0.0
6609.50	27.2	27.2
6609.70	38.1	38.1
6609.80	50.4	50.4
6609.90	62.2	62.2
6610.00	74.9	74.9
6610.50	174.5	174.5
6611.00	283.7	283.7
6611.50	422.4	422.4
6612.00	586.6	586.6
6612.50	781.1	781.1
6613.00	999.5	999.5

6622.50	17.50	1.91	18.05	27.24
6622.70	17.70	1.94	18.44	38.14
6622.80	17.80	1.95	18.63	50.36
6622.90	17.90	1.96	18.83	62.20
6623.00	18.00	1.98	19.03	74.91
6623.50	18.50	2.04	20.03	174.49
6623.65	18.65	2.04	20.34	206.79 Peak Stage
6624.00	19.00	2.11	21.07	283.74
6624.50	19.50	2.18	22.14	422.43
6625.00	20.00	2.25	23.25	586.56
6625.50	20.50	2.35	24.40	781.13
6626.00	21.00	2.46	25.60	999.50
6626.50	21.50	2.56	26.86	1241.61
6627.00	22.00	2.67	28.17	1507.51
6627.50	22.50	2.79	29.53	1797.32
6628.00	23.00	2.90	30.95	2111.24

J1, B1, S2
N11-A1 POND

Drainage Area from J1, B1, S2, SWS(s)1: 7.3 acres
Total Contributing Drainage Area: 483.5 acres

SW#1: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)
6590.00	0.00	0.45	0.00	0.00
6590.50	0.50	0.47	0.23	0.00
6591.00	1.00	0.49	0.47	0.00
6591.50	1.50	0.51	0.72	0.00
6592.00	2.00	0.54	0.99	0.00
6592.50	2.50	0.56	1.26	0.00
6593.00	3.00	0.58	1.54	0.00
6593.50	3.50	0.61	1.84	0.00
6594.00	4.00	0.63	2.15	0.00
6594.50	4.50	0.65	2.47	0.00
6595.00	5.00	0.68	2.81	0.00
6595.50	5.50	0.71	3.15	0.00
6596.00	6.00	0.74	3.51	0.00
6596.50	6.50	0.77	3.89	0.00
6597.00	7.00	0.80	4.28	0.00
6597.50	7.50	0.83	4.69	0.00
6598.00	8.00	0.86	5.12	0.00
6598.50	8.50	0.90	5.56	0.00
6599.00	9.00	0.93	6.01	0.00
6599.50	9.50	0.97	6.49	0.00
6600.00	10.00	1.00	6.98	0.00
6600.50	10.50	1.03	7.49	0.00
6601.00	11.00	1.06	8.01	0.00
6601.50	11.50	1.10	8.55	0.00
6602.00	12.00	1.13	9.11	0.00
6602.50	12.50	1.16	9.68	0.00
6603.00	13.00	1.20	10.27	0.00
6603.50	13.50	1.23	10.88	0.00
6604.00	14.00	1.27	11.51	0.00
6604.50	14.50	1.30	12.15	0.00
6605.00	15.00	1.34	12.81	0.00

6605.50	15.50	1.40	13.49	0.00
6606.00	16.00	1.46	14.21	0.00
6606.50	16.50	1.53	14.96	0.00
6607.00	17.00	1.60	15.74	0.00
6607.50	17.50	1.66	16.56	0.00
6608.00	18.00	1.73	17.40	0.00
6608.50	18.50	1.80	18.29	0.00
6609.00	19.00	1.87	19.21	0.00
6609.50	19.50	1.95	20.16	27.24
6609.70	19.70	1.98	20.55	38.14
6609.80	19.80	1.99	20.75	50.36
6609.90	19.90	2.01	20.95	62.20
6610.00	20.00	2.02	21.15	74.91
6610.50	20.50	2.09	22.18	174.49
6610.54	20.54	2.09	22.26	182.23
6611.00	21.00	2.17	23.25	283.74
6611.50	21.50	2.24	24.35	422.43
6612.00	22.00	2.32	25.49	586.56
6612.50	22.50	2.40	26.67	781.13
6613.00	23.00	2.48	27.89	999.50

Stage of SW#1

Peak Stage

APPENDIX C

N11-A SEDCAD+ (INPUT AND OUTPUT)

100-YEAR, 6-HOUR STORM EVENT

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

N11-A POND (ONLY) 100-YR., 6-HR. STORM

by

Name: JGS

Company Name: PEABODY COAL COMPANY
File Name: C:\SEDCAD3\K-MINE\N11A100

Date: 07-14-1993

Civil Software Design -- SEDCAD+ Version 3.1
Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: PEABODY COAL COMPANY
Filename: C:\SEDCAD3\K-MINE\N11A100 User: JGS
Date: 07-14-1993 Time: 15:21:04
N11-A POND (ONLY) 100-YR., 6-HR. STORM
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	498.25	82	F	0.515	0.000	0.000	0.0	38.42	423.14
					Type: Pond		Label: N11-A POND			
111	Structure	498.25							38.42	
111	Total IN	498.25							38.42	423.14
111	Total OUT								38.42	374.46

=====

Civil Software Design -- SEDCAD+ Version 3.1
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Company Name: PEABODY COAL COMPANY
Filename: C:\SEDCAD3\K-MINE\N11A100 User: JGS
Date: 07-14-1993 Time: 15:21:04
N11-A POND (ONLY) 100-YR., 6-HR. STORM
Storm: 2.40 inches, 100 year- 6 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

=====
LAST POND ONLY TABLE
=====

J1, B1, S1
N11-A POND

Drainage Area from J1, B1, S1, SWS(s)1: 498.3 acres
Total Contributing Drainage Area: 498.3 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	6588.0
Crest Length (ft)	80.0
Z:1 (Left and Right)	3 3
Bottom Width (ft)	40.0

POND RESULTS:

Permanent Pool (ac-ft)
=====
19.0

	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN	38.42	423.14
OUT	38.42	374.46

Elevation	Peak Hydrograph Detention Time (hrs)
6590.4	0.19

Civil Software Design -- SEDCAD+ Version 3.1
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Company Name: PEABODY COAL COMPANY
Filename: C:\SEDCAD3\K-MINE\N11A100 User: JGS
Date: 07-14-1993 Time: 15:21:04
N11-A POND (ONLY) 100-YR., 6-HR. STORM
Storm: 2.40 inches, 100 year- 6 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

=====

POND INPUT/OUTPUT TABLE

=====

J1, B1, S1
N11-A POND

Drainage Area from J1, B1, S1, SWS(s)1: 498.3 acres
Total Contributing Drainage Area: 498.3 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	6588.0
Crest Length (ft)	80.0
Z:1 (Left and Right)	3 3
Bottom Width (ft)	40.0

POND RESULTS:

Permanent
Pool
(ac-ft)

=====

19.0

	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN	38.42	423.14
OUT	38.42	374.46

Elevation	Peak Hydrograph Detention Time (hrs)
6590.4	0.19

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Company Name: PEABODY COAL COMPANY
Filename: C:\SEDCAD3\K-MINE\N11A100 User: JGS
Date: 07-14-1993 Time: 15:21:04
N11-A POND (ONLY) 100-YR., 6-HR. STORM
Storm: 2.40 inches, 100 year- 6 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

=====
ELEVATION-DISCHARGE TABLE
=====

J1, B1, S1
N11-A POND

Drainage Area from J1, B1, S1, SWS(s)1: 498.3 acres
Total Contributing Drainage Area: 498.3 acres

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
6575.00	0.0	0.0
6575.50	0.0	0.0
6576.00	0.0	0.0
6576.50	0.0	0.0
6577.00	0.0	0
6577.50	0.0	0
6578.00	0.0	0.0
6578.50	0.0	0.0
6579.00	0.0	0.0
6579.50	0.0	0.0
6580.00	0.0	0.0
6580.50	0.0	0.0
6581.00	0.0	0.0
6581.50	0.0	0.0
6582.00	0.0	0.0
6582.50	0.0	0.0
6583.00	0.0	0.0
6583.50	0.0	0.0
6584.00	0.0	0.0
6584.50	0.0	0.0
6585.00	0.0	0.0
6585.50	0.0	0.0
6586.00	0.0	0.0
6586.50	0.0	0.0
6587.00	0.0	0.0
6587.50	0.0	0.0
6588.00	0.0	0.0
6588.50	26.6	26.6
6588.80	42.5	42.5
6588.90	53.7	53.7
6589.00	66.3	66.3
6589.50	159.8	159.8
6590.00	261.5	261.5
6590.50	390.0	390.0
6591.00	538.7	538.7

6591.50	726.9	726.9
6592.00	938.9	938.9
6592.50	1166.5	1166.5
6593.00	1434.3	1434.3

Civil Software Design -- SEDCAD+ Version 3.1
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Company Name: PEABODY COAL COMPANY
Filename: C:\SEDCAD3\K-MINE\N11A100 User: JGS
Date: 07-14-1993 Time: 15:21:04
N11-A POND (ONLY) 100-YR., 6-HR. STORM
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
N11-A POND

Drainage Area from J1, B1, S1, SWS(s)1: 498.3 acres
Total Contributing Drainage Area: 498.3 acres

SW#1: Emergency Spillway

Elev	Stage	Area	Capacity	Discharge
	(ft)	(ac)	(ac-ft)	(cfs)
6575.00	0.00	0.82	0.00	0.00
6575.50	0.50	0.86	0.42	0.00
6576.00	1.00	0.91	0.86	0.00
6576.50	1.50	0.95	1.33	0.00
6577.00	2.00	1.00	1.81	0.00
6577.50	2.50	1.04	2.32	0.00
6578.00	3.00	1.09	2.85	0.00
6578.50	3.50	1.14	3.41	0.00
6579.00	4.00	1.19	3.99	0.00
6579.50	4.50	1.24	4.60	0.00
6580.00	5.00	1.29	5.23	0.00
6580.50	5.50	1.34	5.89	0.00
6581.00	6.00	1.39	6.57	0.00
6581.50	6.50	1.44	7.28	0.00
6582.00	7.00	1.49	8.01	0.00
6582.50	7.50	1.54	8.76	0.00
6583.00	8.00	1.59	9.55	0.00
6583.50	8.50	1.64	10.35	0.00
6584.00	9.00	1.70	11.19	0.00
6584.50	9.50	1.75	12.05	0.00
6585.00	10.00	1.81	12.94	0.00
6585.50	10.50	1.87	13.87	0.00
6586.00	11.00	1.94	14.82	0.00
6586.50	11.50	2.01	15.80	0.00
6587.00	12.00	2.07	16.82	0.00
6587.50	12.50	2.14	17.88	0.00
6588.00	13.00	2.21	18.97	0.00 Stage of SW#1
6588.50	13.50	2.28	20.09	26.58
6588.80	13.80	2.32	20.78	42.52
6588.90	13.90	2.34	21.01	53.72
6589.00	14.00	2.35	21.25	66.34
6589.50	14.50	2.43	22.44	159.76
6590.00	15.00	2.50	23.67	261.48
6590.44	15.44	2.50	24.79	374.46 Peak Stage
6590.50	15.50	2.57	24.94	390.04

6591.00	16.00	2.64	26.24	538.72
6591.50	16.50	2.72	27.58	726.91
6592.00	17.00	2.79	28.96	938.95
6592.50	17.50	2.86	30.37	1166.49
6593.00	18.00	2.94	31.82	1434.27

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Company Name: PEABODY COAL COMPANY
Filename: C:\SEDCAD3\K-MINE\N11RUNN User: JGS
Date: 07-16-1993 Time: 09:40:34
N11-A SERIES POND 10-YR., 24-HR. STORM
Storm: 2.10 inches, 10 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

=====
ELEVATION-AREA-CAPACITY-DISCHARGE TABLE
=====

J1, B1, S1
N11-A2 POND

Drainage Area from J1, B1, S1, SWS(s)1: 476.3 acres
Total Contributing Drainage Area: 476.3 acres

SW#1: Emergency Spillway

Elev	Stage	Area	Capacity	Discharge
(ft)	(ac)	(ac-ft)	(cfs)	

=====

6605.00	0.00	0.43	0.00	0.00
6605.50	0.50	0.45	0.22	0.00
6606.00	1.00	0.48	0.45	0.00
6606.50	1.50	0.50	0.70	0.00
6607.00	2.00	0.53	0.96	0.00
6607.50	2.50	0.55	1.22	0.00
6608.00	3.00	0.58	1.51	0.00
6608.50	3.50	0.61	1.80	0.00
6609.00	4.00	0.63	2.11	0.00
6609.50	4.50	0.66	2.44	0.00
6610.00	5.00	0.69	2.77	0.00
6610.50	5.50	0.72	3.13	0.00
6611.00	6.00	0.76	3.50	0.00
6611.50	6.50	0.79	3.88	0.00
6612.00	7.00	0.82	4.29	0.00
6612.50	7.50	0.86	4.71	0.00
6613.00	8.00	0.90	5.15	0.00
6613.50	8.50	0.93	5.61	0.00
6614.00	9.00	0.97	6.08	0.00
6614.50	9.50	1.01	6.58	0.00
6615.00	10.00	1.05	7.09	0.00
6615.50	10.50	1.10	7.63	0.00
6616.00	11.00	1.15	8.19	0.00
6616.50	11.50	1.20	8.78	0.00
6617.00	12.00	1.26	9.40	0.00
6617.50	12.50	1.31	10.04	0.00
6618.00	13.00	1.37	10.71	0.00
6618.50	13.50	1.42	11.40	0.00
6619.00	14.00	1.48	12.13	0.00
6619.50	14.50	1.54	12.89	0.00
6620.00	15.00	1.60	13.67	0.00
6620.50	15.50	1.66	14.49	0.00
6621.00	16.00	1.72	15.33	0.00
6621.50	16.50	1.78	16.21	0.00
6622.00	17.00	1.85	17.11	0.00

Stage of SW#1