



PEABODY WESTERN COAL COMPANY

For

Navajo County, Arizona

Kayenta Mine

N9-1 (Lower)

Temporary Sedimentation Structure

DESIGN REPORT

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

The construction site of the proposed Structure N9-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.

INSPECTION

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 (PAR), 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".

The site-specific general construction plans are shown on the attached Exhibit 1. 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.

INTRODUCTION

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.

STABILITY

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.

GENERAL

DESIGN ANALYSES

The N9-J3, N9-J2, N9-J1 and N9-J Structures have a combined watershed of 524.18 acres and are located on a tributary upstream of Yazzie Wash at the Kayenta Mine. The 44.45-acre watershed, which contributes directly to structure N9-J, is classified as 8% undisturbed and 92% spoil.

LAND USE

SITE DESCRIPTION

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 100-year, 6-hour storm	2.1 in 2.4 in
6.	Drainage Area	44.45 acres

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).

N9-1 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

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

Universal Soil Loss Equation with the following parameters

The calculations for the sediment load entering structure N9-J were made utilizing the Revised

approximately 19.66 acre-foot.

The impoundment stage-capacity table (see Exhibit I) is based on the 1983 aerial topographic mapping conducted for Peabody Western Coal Company. Structure N9-J is designed to contain

STORAGE CAPACITY

as a transition into the downstream channel.

A minimum 15-foot long riprap-lined channel will be constructed beyond the toe of the embankment

Minimum Channel Depth	(Spillway)	3.0	ft
Channel Width	(Outflow)	2.0	ft
Channel Length	40	ft	
Sidestopes (Horizontal to Vertical)	(Spillway)	42	ft
Average Slope	(Outflow)	137	ft
Maximum Slope	3:1	or flatter	
Spillway Elevation	%	0	%
	(Spillway)	25	%
	(Outflow)	6785.5	ft

listed below. The alignment and dimensions are shown on Exhibit I.

The emergency spillway and outlet channel for N9-J will be a trapezoidal channel with dimensions

EMERGENCY SPILLWAY AND OUTLET CHANNEL

The following appendices and drawings 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

* * *

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

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

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.

Hydrology, Hydraulic, and Sedimentation Calculations

APPENDIX A

**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

$T_c = (11.9L^{0.3}/E)^{0.385} =$

0.072 hours

ROUTING PARAMETERS:

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

SCS CURVE NUMBER:

Cover Type	Soil Group	Curve Number	Area (acres)	CN*Area
Pinyon Juniper	D	83	3.175	263.525
Sagebrush	D	79	0.289	22.831
Distributed Land	B	86	40.99	3525.14
TOTAL:				3811.496

Weighted CN = Total CN * Area / Total Area =

86

DRAINAGE BASIN AREA:

44.454 Acres

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.

PEABODY WESTERN COAL COMPANY
CALCULATED SEDIMENTOLOGY DATA

STRUCTURE: J

SOIL ERODIBILITY FACTOR:

Soil Type	Erodibility Factor, K	Area	K*Area
ICD	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	29.19%	0.60	16.27	11.61
504	17.86%	0.60	10.12	7.84
394	19.04%	0.60	10.78	7.29
624	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

STRUCTURE: J

Cover and Practice Factors:

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

**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

TRAPEZOIDAL CHANNEL ANALYSIS
 CRITICAL DEPTH COMPUTATION
 N9-1 POND
 November 18, 2004

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

PROGRAM INPUT DATA

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

COMPUTATION RESULTS

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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w/o Freeboard	
Design Discharge:	347.48 cfs
Depth:	4.50 ft
Top Width:	45.02 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

PADER Method - Steep Slope Design

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

Trapezoidal Channel

Material: Riprap

N9-3 POND OUTFLOW CHANNEL

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

APPENDIX B

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

Gary Altisi

General Information

Storm Information:

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

Structure Summary:

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

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
Σ		44.450						44.61	3.428

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

APPENDIX C

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

Gary Altisi

General Information

Storm Information:

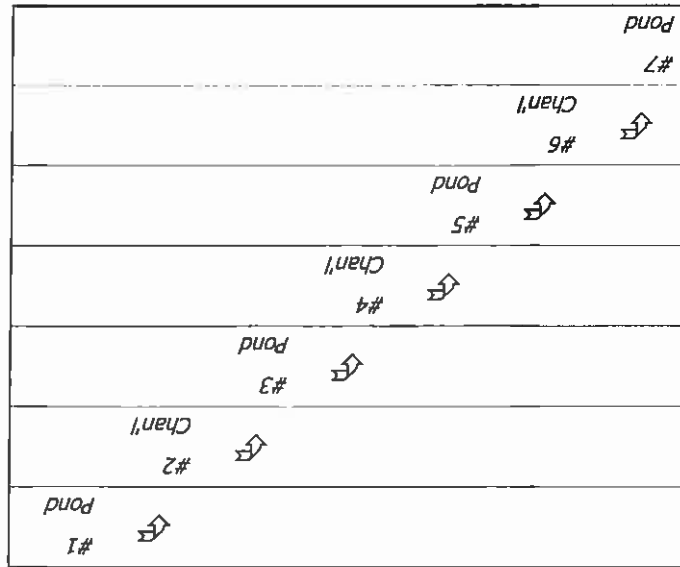
Storm Type:	NRCS Type II
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.400 inches

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	296.160	0.336	0.000	0.000	84.000	F	335.02	25.641
		Σ 296.160						335.02	25.641
#2		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		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		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

Structure Networking:

Type	#	Stru (flows Into)	#	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



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
# 1 Out			264.88	25.64
# 2	0.000	296.160	264.88	25.64
# 3 In	138.860	435.020	380.62	37.66
# 3 Out			331.14	37.67
# 4	0.000	435.020	331.14	37.66
# 5 In	44.710	479.730	346.87	41.76
# 5 Out			331.11	41.76
# 6	0.000	479.730	331.11	41.76
# 7 In	44.450	524.180	347.48	46.06
# 7 Out			331.36	46.07

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

Pond Results:

Dewatering time is calculated from peak stage to lowest spillway

Peak Elevation:	6,880.79
Dewater Time:	0.29 days

Elevation-Capacity-Discharge Table

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

Elevation (ac)	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

Combined Total Discharge (cfs)	Elevation Emergency Spillway (cfs)	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

Structure #2 (Riprap Channel)

N9-J3 SPILLWAY

Trapezoidal Riprap Channel Inputs:

Material: Riprap

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

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

Riprap Channel Results:

PADER Method - Steep Slope Design

w/o Freeboard	w/ Freeboard
Design Discharge:	264.88 cfs
Depth:	0.92 ft
Top Width:	30.50 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	6,831.60
Crest Length (ft)	35.40
Left Slope	3:00:1
Right Slope	3:00:1
Bottom Width (ft)	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	0.000
6,815.50	0.624	0.306	0.000	0.000
6,816.00	0.648	0.624	0.000	0.000
6,816.50	0.673	0.954	0.000	0.000

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
6,817.00	0.698	1.297	0.000	0.000
6,817.50	0.724	1.653	0.000	0.000
6,818.00	0.750	2.021	0.000	0.000
6,818.50	0.776	2.403	0.000	0.000
6,819.00	0.804	2.798	0.000	0.000
6,819.50	0.831	3.206	0.000	0.000
6,820.00	0.859	3.629	0.000	0.000
6,820.50	0.891	4.066	0.000	0.000
6,821.00	0.924	4.520	0.000	0.000
6,821.50	0.957	4.990	0.000	0.000
6,822.00	0.991	5.477	0.000	0.000
6,822.50	1.025	5.981	0.000	0.000
6,823.00	1.060	6.502	0.000	0.000
6,823.50	1.096	7.041	0.000	0.000
6,824.00	1.132	7.598	0.000	0.000
6,824.50	1.169	8.174	0.000	0.000
6,825.00	1.206	8.767	0.000	0.000
6,825.50	1.264	9.385	0.000	0.000
6,826.00	1.323	10.032	0.000	0.000
6,826.50	1.384	10.709	0.000	0.000
6,827.00	1.446	11.416	0.000	0.000
6,827.50	1.509	12.155	0.000	0.000
6,828.00	1.574	12.925	0.000	0.000
6,828.50	1.640	13.728	0.000	0.000
6,829.00	1.707	14.565	0.000	0.000
6,829.50	1.775	15.435	0.000	0.000
6,830.00	1.845	16.341	0.000	0.000
6,830.50	1.931	17.285	0.000	0.000
6,831.00	2.019	18.272	0.000	0.000
6,831.50	2.109	19.304	0.000	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

Combined Total Discharge (cfs)	Elevation Emergency Spillway (cfs)	(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

Structure #4 (Riprap Channel)

N9-J2 SPILLWAY

Trapezoidal Riprap Channel Inputs:

Material: Riprap

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

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

Riprap Channel Results:

PADFR Method - Steep Slope Design

w/o 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	

Structure #5 (Pond)
N9-J1 POND

Pond Inputs:

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

Emergency Spillway

Spillway Elev	6,807.10
Crest Length (ft)	32.40
Left Slope	3.00:1
Right Slope	3.00:1
Bottom Width (ft)	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	0.000
6,790.50	0.644	0.316	0.000	0.000
6,791.00	0.667	0.644	0.000	0.000
6,791.50	0.690	0.983	0.000	0.000
6,792.00	0.713	1.334	0.000	0.000
6,792.50	0.737	1.696	0.000	0.000
6,793.00	0.762	2.071	0.000	0.000
6,793.50	0.787	2.458	0.000	0.000
6,794.00	0.812	2.858	0.000	0.000
6,794.50	0.838	3.270	0.000	0.000
6,795.00	0.863	3.695	0.000	0.000
6,795.50	0.893	4.135	0.000	0.000
6,796.00	0.924	4.589	0.000	0.000
6,796.50	0.955	5.059	0.000	0.000
6,797.00	0.986	5.544	0.000	0.000
6,797.50	1.018	6.045	0.000	0.000
6,798.00	1.051	6.562	0.000	0.000
6,798.50	1.084	7.096	0.000	0.000
6,799.00	1.117	7.646	0.000	0.000
6,799.50	1.151	8.214	0.000	0.000
6,800.00	1.186	8.798	0.000	0.000
6,800.50	1.225	9.401	0.000	0.000
6,801.00	1.265	10.023	0.000	0.000
6,801.50	1.306	10.666	0.000	0.000
6,802.00	1.347	11.329	0.000	0.000
6,802.50	1.388	12.013	0.000	0.000
6,803.00	1.431	12.717	0.000	0.000
6,803.50	1.474	13.444	0.000	0.000
6,804.00	1.518	14.192	0.000	0.000

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

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

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

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)	% of Depth	Freeboard	Freeboard
47.00	3.0:1	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

Structure #7 (Pond)

N9-J POND

Pond Inputs:

w/o Freeboard	w/ Freeboard
Top Width: 142.80 ft	68.55 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	

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

Emergency Spillway

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

Pond Results:

Peak Elevation: 6,787.64
Dewater Time: 0.34 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)
6,770.00	0.774	0.000	0.000	0.000
6,770.50	0.800	0.393	0.000	0.000
6,771.00	0.826	0.800	0.000	0.000
6,771.50	0.853	1.220	0.000	0.000
6,772.00	0.881	1.653	0.000	0.000
6,772.50	0.908	2.101	0.000	0.000
6,773.00	0.936	2.562	0.000	0.000
6,773.50	0.965	3.037	0.000	0.000
6,774.00	0.994	3.527	0.000	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	

Detailed Discharge Table

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

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

