

INSPECTION REPORT

Temporary Sedimentation Structure

N12-C1

Kayenta Mine

Navajo County, Arizona

For

PEABODY WESTERN COAL COMPANY



DEC 30 1998

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## INTRODUCTION

Sedimentation Structure N12-C1 is a partially incised structure with an earthen embankment, designed and reconstructed in 1994 by Peabody Western Coal Company as a temporary sedimentation structure to control runoff and sediment from portions of the disturbed mining area at the Black Mesa and Kayenta Mines. The location of Structure N12-C1 and its watershed boundary are shown on Drawing No. 85400 (Sheets L-7 and L-8) and Drawing No. 85405. The site-specific 1994 as-built plans are shown on the attached Exhibit 1. With this revised design evaluation, the N12-C1 structure will not require any field modifications.

This inspection report contains information specific to Structure N12-C1, which is in series with Sedimentation Structures N12-C2 and N12-C. 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

Existing Structure N12-C1 was inspected by a Registered Professional Engineer from Peabody Western Coal Company, to assure that the existing structure is stable and no adverse conditions exist. A detailed geotechnical investigation was not performed, rather, the information in Chapter 6, Attachment D was utilized for embankment design and during construction to assure that the as-built embankment configuration would be stable.

## SITE DESCRIPTION

### LAND USE

The N12-C2, N12-C1 and N12-C Structures have a combined watershed of 473.0 acres and are located near Coal Mine Wash at the Kayenta Mine. The 54.5-acre watershed that contributes directly to Structure N12-C1 is classified as, 43% pinion/juniper, 20% disturbed, and 37% sagebrush/grass.

## DESIGN ANALYSES

### GENERAL

Structure N12-C1 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 1998 for Peabody Western Coal Company and was used in the analyses of the structure.

### STABILITY

Structure N12-C1 is a Category A-1 embankment with a homogeneous earthen embankment compacted in lifts to design specifications and approximately 20 feet wide on top. An upstream slope of 3.5:1 (horizontal to vertical) and a downstream slope of 5:1 was constructed. Based on the total embankment height of approximately 20 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 is a 30-foot wide, riprap-lined, trapezoidal channel.

## HYDROLOGY

The hydrologic analysis was completed using the computer program SEDCAD 4 (see Appendices A, B, and C). Structure N12-C1 was constructed in series with Structures N12-C2 and N12-C. Structure N12-C1 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 at the natural stream elevation to the emergency spillway invert elevation. The three structures have a combined capacity greater than 20 acre-feet; therefore, the spillway was analyzed using the 100-year, 6-hour storm event because it is located between the other structures. Structures N12-C2 and N12-C1 were conservatively assumed to be full to the emergency spillway at the time of 100-year storm event. The storage capacity of structure N12-C1 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.

The following parameters were used in the hydrologic analysis:

1.	Water Course length, L	0.473 mi.
2.	Elevation Difference, H	192 ft
3.	Time of Concentration, T <sub>c</sub>	0.145 hr
4.	SCS Curve Number	78
5.	Rainfall Depth, 10-year, 24-hour storm	2.1 in
	100-year, 6-hour storm	2.4 in
6.	Drainage Area	54.5 acres

## HYDRAULICS

The SEDCAD 4 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, B, and C).

N12-C1 SEDIMENTATION POND HYDRAULICS TABLE

	Units	10-Yr, 24-Hr Storm	100-Yr, 6-Hr Storm
<b>Initial Reservoir Volume Condition</b>		<b>Empty</b>	<b>Full to emergency spillway</b>
<b>Inflow</b>			
Peak Flow	Cfs	34.06	289.4
Volume	ac-ft	2.5	29.4
<b>Storage</b>			
Peak Stage	Msl	N/A	6632.5
Emerg. Spillway Elev.	Msl	6630.4	6630.4
Peak Storage	ac-ft	N/A	22.5
Storage Capacity	ac-ft	18.38	18.38
<b>Outflow</b>			
Peak Flow	Cfs	N/A	248.6
Spillway Elevation	Msl	6630.4	6630.4
Embankment Crest Elev.	Msl	6635.6	6635.6
Peak Stage	Msl	--	6632.5
Freeboard	Ft	--	3.1
<b>Emergency Spillway Channel</b>			
Flow Depth	Ft	--	2.1
Critical Velocity	Fps	--	6.0
Mannings "n"	--	--	.031
Width	Ft	--	30
<b>Outflow Channel</b>			
Slope	%	--	20
Normal Velocity	Fps	--	9.3
Normal Depth	Ft	--	0.9
Mannings "n"	--	--	0.063
Riprap D <sub>50</sub>	In	--	9

### EMERGENCY SPILLWAY AND OUTLET CHANNEL

The emergency spillway and outlet channel for N12-C1 is a trapezoidal channel with dimensions listed below. The alignment and dimensions are shown on Exhibit 1.

Minimum Channel Depth	(Spillway)	5.2	ft
	(Outflow)	1.9	ft
Channel Width		30	ft
Channel Length	(Spillway)	46	ft
	(Outflow)	250	ft
Sideslopes (Horizontal to Vertical)		3:1	or flatter
Average Slope	(Spillway)	0	%
Maximum Slope	(Outflow)	20.0	%
Spillway Elevation		6630.4	ft

A minimum 15-foot long, riprap-lined, channel is 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 1994 aerial topographic mapping conducted for Peabody Western Coal Company. Structure N12-C1 is designed to contain approximately 18.38 acre-feet.

The calculations for the sediment load entering structure N12-C1 were made utilizing the Revised Universal Soil Loss Equation with the following parameters:

1.	Rainfall Factor, R	40
2.	Soil Erodibility Factor, K	0.26
3.	Slope Factor, LS	7.08
4.	Cover Factor, C	0.308
5.	Erosion Control Factor, P	0.960

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 N12-C1 has sufficient available storage capacity to contain the 10-year, 24-hour storm with adequate excess capacity to store additional flows from N12-C2. The combined sediment storage capacity was determined for the structures in series and the results of the analysis are presented in the following table.

Combined Storage for Structures N12-C2, N12-C1 and N12-C

	<u>N12-C2</u>	<u>N12-C1</u>	<u>N12-C</u>	<u>Combined</u>
Total Storage Capacity	18.95	18.38	26.41	63.74 acre-ft
10-Year, 24-Hour Storm Inflow	20.15	2.46	3.63	26.24 acre-ft
Available Sediment Storage Capacity	--	--	--	37.50 acre-ft
Sediment Inflow Rate/Year	3.30	0.52	0.95	4.77 acre-ft
Sediment Storage Life	--	--	--	7.9 years

\* \* \*

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 - Proposed N12-C1 & N12-C2 Sedimentation Pond Design



## APPENDIX A

### Hydrology, Hydraulic, and Sedimentation Calculations

**PEABODY WESTERN COAL COMPANY  
CALCULATED HYDROLOGIC DATA**

**PROJECT: N12 C AREA**

**STRUCTURE: N12-C1 Pond**

**TIME OF CONCENTRATION:**

Start Elevation (ft) = 6811  
 End Elevation (ft) = 6619  
 Elevation Difference, E (ft) = 192

Watercourse Length (ft) = 2500  
 Watercourse Length, L (mi) = 0.473

$T_c = (11.9L^3/E)^{0.385} = \underline{\underline{0.145 \text{ hours}}}$

**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
Sagebrush-Grass	B	60	11	660
Sagebrush-Grass	D	79	9.4	742.6
Pinyon Juniper	B	65	0	0
Pinyon Juniper	D	83	23.2	1925.6
Disturbed	B	86	10.9	937.4
<b>TOTAL:</b>			<b>54.5</b>	<b>4265.6</b>

Weighted CN = Total CN\*Area/ Total Area = 78

**DRAINAGE BASIN AREA:**

54.5 Acres

**PEABODY WESTERN COAL COMPANY  
CALCULATED SEDIMENTOLOGY DATA**

**PROJECT: N12-C1 Pond**

**SOIL ERODIBILITY FACTOR:**

Soil Type	Erodibility Factor, K	Area (acres)	K*Area
12A	0.38	0.8	0.30
3C	0.16	4	0.64
25	0.19	28.6	5.43
15A	0.37	2.6	0.96
27	0.36	7.6	2.74
Disturbed/Spoil	0.38	10.9	4.14
<b>TOTAL:</b>		<b>54.5</b>	<b>14.22</b>

Weighted K = Total K\*Area/ Total Area = 0.26

**SLOPE FACTOR:**

Length (ft)	Elevation Change (ft)	Slope (%)	m	Slope Angle (deg)	LS Factor
200	45	22.5%	0.6	12.7	5.86
325	45	13.8%	0.6	7.9	4.43
180	35	19.4%	0.6	11.0	4.67
170	100	58.8%	0.6	30.5	13.36

Average LS = 7.08

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
Sagebrush-Grass	40%	25%	20.4	0.13	2.65	1.00	20.40
Pinyon Juniper	40%	25%	23.2	0.14	3.25	1.00	23.20
Disturbed/Spoil	0%	0%	10.9	1.00	10.90	0.80	8.72
<b>TOTAL:</b>			<b>54.5</b>		<b>16.80</b>		<b>52.32</b>

Weighted C = Total C\*Area/ Total Area = 0.308

Weighted P = Total P\*Area/ Total Area = 0.960

**RAINFALL FACTOR:**

R = 40

PEABODY WESTERN COAL COMPANY  
CALCULATED SEDIMENT YIELD

PROJECT: N12-C1 Pond

*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.*

<u>PARAMETER DESCRIPTION</u>	<u>VALUE</u>
Annual Rainfall Factor	40.00
Soil Erodibility Factor	0.26
Length Slope Factor	7.08
Cover Factor	0.31
Practice Factor	0.96
Gross Annual Sediment Yield	21.86 tons/acre/year
Sediment Density	94.00 pcf
Gross Annual Sediment Yield	0.0107 acre-feet/acre/year
Sediment Delivery Ratio	90%
Estimated Annual Sediment Yield	0.0096 acre-feet/acre/year
Watershed Area	54.5 acres
Watershed Annual Sediment Yield	0.52 acre-feet/year
Number of years	1 years
Calculated Sediment Volume	0.52 acre-feet

N12-C1 Spillway  
Worksheet for Trapezoidal Channel

Project Description	
Project File	untitled.fm2
Worksheet	N12-C1 Emergency Spillway
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.031
Channel Slope	0.013712 ft/ft
Left Side Slope	3.000000 H : V
Right Side Slope	3.000000 H : V
Bottom Width	30.00 ft
Discharge	248.60 cfs

Results	
Depth	1.23 ft
Flow Area	41.57 ft <sup>2</sup>
Wetted Perimeter	37.80 ft
Top Width	37.40 ft
Critical Depth	1.23 ft
Critical Slope	0.013712 ft/ft
Velocity	5.98 ft/s
Velocity Head	0.56 ft
Specific Energy	1.79 ft
Froude Number	1.00
Flow is subcritical.	

## **N12-C1 Outflow Channel**

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
30.00	3.0:1	3.0:1	20.0	1.00		

### PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Depth:	0.89 ft	1.89 ft
Top Width:	35.37 ft	41.37 ft
Velocity:	9.26 fps	
X-Section Area:	29.23 sq ft	
Hydraulic Radius:	0.820	
Froude Number:	1.80	
Manning's n:	0.0630	
Dmin:	5.00 in	
D50:	9.00 in	
Dmax:	12.00 in	

**APPENDIX B**

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

**Peabody Western Coal Co.**  
**N12-C Series Ponds 10-YR.,24-HR**

DGG



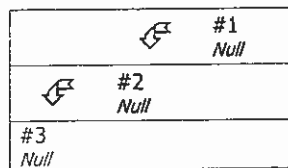
## ***General Information***

### ***Storm Information:***

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

**Structure Networking:**

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	#2	0.035	0.389	C2 Spillway
Null	#2	==>	#3	0.059	0.373	C1 Spillway
Null	#3	==>	End	0.000	0.000	



***Structure Summary:***

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	338.000	338.000	183.59	20.15
#2	54.500	392.500	198.70	22.61
#3	80.500	473.000	220.37	26.24

***Structure Detail:***

Structure #1 (Null)

*C2 Spillway*

Structure #2 (Null)

*C1 Spillway*

Structure #3 (Null)

***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	338.000	0.491	0.000	0.000	82.000	F	183.59	20.15
		<b>Σ 338.000</b>						<b>183.59</b>	<b>20.15</b>
#2	1	54.500	0.145	0.000	0.000	78.000	F	34.06	2.46
		<b>Σ 392.500</b>						<b>198.70</b>	<b>22.61</b>
#3	1	80.500	0.229	0.000	0.000	78.000	F	44.80	3.63
		<b>Σ 473.000</b>						<b>220.37</b>	<b>26.24</b>

APPENDIX C

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

**Peabody Western Coal Co.**  
**N12-C Series Ponds 100-YR., 6-HR**

DGG

## ***General Information***

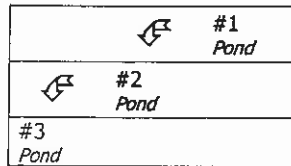
### ***Storm Information:***

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



***Structure Networking:***

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Pond	#1	==>	#2	0.035	0.389	C2 Spillway
Pond	#2	==>	#3	0.059	0.373	C1 Spillway
Pond	#3	==>	End	0.000	0.000	Pond C



***Structure Summary:***

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	In	338.000	338.000	337.99	26.06
	Out			270.81	26.06
#2	In	54.500	392.500	289.35	29.35
	Out			248.60	29.35
#3	In	80.500	473.000	266.94	34.20
	Out			76.89	34.20

***Structure Detail:***

Structure #1 (Pond)

*C2 Spillway*

Pond Inputs:

Permanent Pool Elev:	6,658.30
Permanent Pool:	18.73 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
6,658.30	46.00	3.00:1	3.00:1	25.00

Pond Results:

Peak Elevation:	6,660.73
H'graph Detention Time:	0.33 hrs
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)
6,638.40	0.000	0.000	0.000	
6,638.90	0.043	0.007	0.000	
6,639.40	0.172	0.057	0.000	
6,639.90	0.387	0.193	0.000	
6,640.00	0.440	0.235	0.000	
6,640.40	0.458	0.414	0.000	
6,640.90	0.481	0.649	0.000	
6,641.40	0.504	0.895	0.000	
6,641.90	0.528	1.153	0.000	
6,642.40	0.553	1.424	0.000	
6,642.90	0.578	1.706	0.000	
6,643.40	0.604	2.002	0.000	
6,643.90	0.630	2.310	0.000	
6,644.40	0.657	2.632	0.000	
6,644.90	0.684	2.968	0.000	
6,645.00	0.690	3.036	0.000	
6,645.40	0.710	3.316	0.000	
6,645.90	0.735	3.678	0.000	

# SEDCAD 4 for Windows

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Civil Software Design

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
6,646.40	0.761	4.052	0.000	
6,646.90	0.787	4.439	0.000	
6,647.40	0.814	4.839	0.000	
6,647.90	0.841	5.253	0.000	
6,648.40	0.869	5.680	0.000	
6,648.90	0.897	6.122	0.000	
6,649.40	0.925	6.577	0.000	
6,649.90	0.954	7.047	0.000	
6,650.00	0.960	7.143	0.000	
6,650.40	0.997	7.534	0.000	
6,650.90	1.044	8.044	0.000	
6,651.40	1.092	8.578	0.000	
6,651.90	1.141	9.136	0.000	
6,652.40	1.191	9.719	0.000	
6,652.90	1.243	10.328	0.000	
6,653.40	1.295	10.962	0.000	
6,653.90	1.349	11.623	0.000	
6,654.40	1.403	12.311	0.000	
6,654.90	1.459	13.026	0.000	
6,655.00	1.470	13.173	0.000	
6,655.40	1.520	13.771	0.000	
6,655.90	1.584	14.547	0.000	
6,656.40	1.650	15.355	0.000	
6,656.90	1.716	16.197	0.000	
6,657.40	1.784	17.072	0.000	
6,657.90	1.854	17.981	0.000	
6,658.30	1.910	18.734	0.000	Spillway #1
6,658.40	1.923	18.926	5.525	2.95
6,658.90	1.986	19.903	33.122	1.40
6,659.40	2.051	20.912	60.719	1.25
6,659.90	2.117	21.954	127.851	0.55
6,660.00	2.130	22.167	142.279	0.10
6,660.40	2.193	23.031	206.648	0.20
6,660.73	2.245	23.766	270.813	0.20 Peak Stage
6,660.90	2.272	24.147	304.037	
6,661.40	2.353	25.303	423.894	
6,661.90	2.436	26.501	565.497	
6,662.40	2.520	27.740	728.002	
6,662.90	2.605	29.021	904.111	
6,663.40	2.692	30.345	1,103.250	
6,663.90	2.780	31.713	1,322.553	

Detailed Discharge Table

Elevation	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
6,638.40	0.000	0.000
6,638.90	0.000	0.000
6,639.40	0.000	0.000
6,639.90	0.000	0.000
6,640.00	0.000	0.000
6,640.40	0.000	0.000
6,640.90	0.000	0.000
6,641.40	0.000	0.000
6,641.90	0.000	0.000
6,642.40	0.000	0.000
6,642.90	0.000	0.000
6,643.40	0.000	0.000
6,643.90	0.000	0.000
6,644.40	0.000	0.000
6,644.90	0.000	0.000
6,645.00	0.000	0.000
6,645.40	0.000	0.000
6,645.90	0.000	0.000
6,646.40	0.000	0.000
6,646.90	0.000	0.000
6,647.40	0.000	0.000
6,647.90	0.000	0.000
6,648.40	0.000	0.000
6,648.90	0.000	0.000
6,649.40	0.000	0.000
6,649.90	0.000	0.000
6,650.00	0.000	0.000
6,650.40	0.000	0.000
6,650.90	0.000	0.000
6,651.40	0.000	0.000
6,651.90	0.000	0.000
6,652.40	0.000	0.000
6,652.90	0.000	0.000
6,653.40	0.000	0.000
6,653.90	0.000	0.000
6,654.40	0.000	0.000
6,654.90	0.000	0.000
6,655.00	0.000	0.000
6,655.40	0.000	0.000
6,655.90	0.000	0.000
6,656.40	0.000	0.000
6,656.90	0.000	0.000
6,657.40	0.000	0.000
6,657.90	0.000	0.000
6,658.30	0.000	0.000
6,658.40	5.525	5.525
6,658.90	33.122	33.122
6,659.40	60.719	60.719
6,659.90	127.851	127.851
6,660.00	142.279	142.279
6,660.40	206.648	206.648
6,660.90	304.037	304.037
6,661.40	423.894	423.894
6,661.90	565.497	565.497
6,662.40	728.002	728.002
6,662.90	904.111	904.111
6,663.40	1,103.250	1,103.250
6,663.90	1,322.553	1,322.553

Structure #2 (Pond)

*C1 Spillway*

**Pond Inputs:**

Permanent Pool Elev:	6,630.40
Permanent Pool:	18.21 ac-ft

**Emergency Spillway**

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
6,630.40	46.00	3.00:1	3.00:1	30.00

**Pond Results:**

Peak Elevation:	6,632.53
H'graph Detention Time:	0.29 hrs
Dewater Time:	0.30 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)
6,610.50	0.000	0.000	0.000	
6,610.90	0.250	0.033	0.000	
6,611.00	0.255	0.059	0.000	
6,611.50	0.281	0.193	0.000	
6,612.00	0.309	0.340	0.000	
6,612.50	0.337	0.502	0.000	
6,613.00	0.367	0.678	0.000	
6,613.50	0.399	0.869	0.000	
6,614.00	0.431	1.076	0.000	
6,614.50	0.465	1.300	0.000	
6,615.00	0.500	1.542	0.000	
6,615.50	0.527	1.798	0.000	
6,616.00	0.554	2.069	0.000	
6,616.50	0.583	2.353	0.000	
6,617.00	0.612	2.651	0.000	
6,617.50	0.641	2.965	0.000	
6,618.00	0.672	3.293	0.000	
6,618.50	0.703	3.636	0.000	
6,619.00	0.734	3.996	0.000	
6,619.50	0.767	4.371	0.000	
6,620.00	0.800	4.763	0.000	
6,620.50	0.841	5.173	0.000	
6,621.00	0.882	5.603	0.000	

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Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
6,621.50	0.925	6.055	0.000	
6,622.00	0.968	6.528	0.000	
6,622.50	1.013	7.023	0.000	
6,623.00	1.058	7.541	0.000	
6,623.50	1.105	8.081	0.000	
6,624.00	1.152	8.645	0.000	
6,624.50	1.201	9.233	0.000	
6,625.00	1.250	9.846	0.000	
6,625.50	1.302	10.484	0.000	
6,626.00	1.355	11.148	0.000	
6,626.50	1.410	11.840	0.000	
6,627.00	1.465	12.558	0.000	
6,627.50	1.522	13.305	0.000	
6,628.00	1.579	14.080	0.000	
6,628.50	1.638	14.884	0.000	
6,629.00	1.697	15.718	0.000	
6,629.50	1.758	16.582	0.000	
6,630.00	1.820	17.477	0.000	
6,630.40	1.870	18.214	0.000	Spillway #1
6,630.50	1.883	18.402	6.561	3.25
6,631.00	1.947	19.360	39.333	1.50
6,631.50	2.012	20.350	72.106	1.35
6,632.00	2.079	21.372	150.937	0.65
6,632.50	2.146	22.429	242.709	0.35
6,632.53	2.150	22.486	248.595	0.05 Peak Stage
6,633.00	2.215	23.519	355.301	
6,633.50	2.285	24.644	492.895	
6,634.00	2.355	25.803	654.366	
6,634.50	2.427	26.999	838.518	
6,635.00	2.500	28.231	1,036.958	
6,635.50	2.699	29.530	1,260.185	
6,635.60	2.740	29.802	1,307.390	

## Detailed Discharge Table

Elevation	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
6,610.50	0.000	0.000
6,610.90	0.000	0.000
6,611.00	0.000	0.000
6,611.50	0.000	0.000
6,612.00	0.000	0.000
6,612.50	0.000	0.000
6,613.00	0.000	0.000

Elevation	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
6,613.50	0.000	0.000
6,614.00	0.000	0.000
6,614.50	0.000	0.000
6,615.00	0.000	0.000
6,615.50	0.000	0.000
6,616.00	0.000	0.000
6,616.50	0.000	0.000
6,617.00	0.000	0.000
6,617.50	0.000	0.000
6,618.00	0.000	0.000
6,618.50	0.000	0.000
6,619.00	0.000	0.000
6,619.50	0.000	0.000
6,620.00	0.000	0.000
6,620.50	0.000	0.000
6,621.00	0.000	0.000
6,621.50	0.000	0.000
6,622.00	0.000	0.000
6,622.50	0.000	0.000
6,623.00	0.000	0.000
6,623.50	0.000	0.000
6,624.00	0.000	0.000
6,624.50	0.000	0.000
6,625.00	0.000	0.000
6,625.50	0.000	0.000
6,626.00	0.000	0.000
6,626.50	0.000	0.000
6,627.00	0.000	0.000
6,627.50	0.000	0.000
6,628.00	0.000	0.000
6,628.50	0.000	0.000
6,629.00	0.000	0.000
6,629.50	0.000	0.000
6,630.00	0.000	0.000
6,630.40	0.000	0.000
6,630.50	6.561	6.561
6,631.00	39.333	39.333
6,631.50	72.106	72.106
6,632.00	150.937	150.937
6,632.50	242.709	242.709
6,633.00	355.301	355.301
6,633.50	492.895	492.895
6,634.00	654.366	654.366
6,634.50	838.518	838.518
6,635.00	1,036.958	1,036.958
6,635.50	1,260.185	1,260.185
6,635.60	1,307.390	1,307.390

Structure #3 (Pond)

Pond C

Pond Inputs:

Permanent Pool Elev:	6,584.56
Permanent Pool:	25.30 ac-ft

Straight Pipe



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Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev	Entrance Loss Coefficient	Tailwater Depth (ft)
48.00	72.00	15.00	0.0150	6,584.56	0.90	0.00

## Pond Results:

Peak Elevation:	6,588.95
H'graph Detention Time:	3.15 hrs
Dewater Time:	1.76 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)
6,570.90	0.000	0.000	0.000	
6,571.40	0.019	0.003	0.000	
6,571.90	0.077	0.026	0.000	
6,572.40	0.172	0.086	0.000	
6,572.90	0.305	0.204	0.000	
6,573.40	0.477	0.398	0.000	
6,573.90	0.686	0.687	0.000	
6,574.40	0.934	1.090	0.000	
6,574.90	1.219	1.627	0.000	
6,575.00	1.280	1.752	0.000	
6,575.40	1.375	2.283	0.000	
6,575.90	1.497	3.001	0.000	
6,576.40	1.625	3.781	0.000	
6,576.90	1.758	4.626	0.000	
6,577.40	1.896	5.540	0.000	
6,577.90	2.040	6.524	0.000	
6,578.40	2.189	7.581	0.000	
6,578.90	2.343	8.713	0.000	
6,579.40	2.502	9.924	0.000	
6,579.90	2.667	11.216	0.000	
6,580.00	2.700	11.485	0.000	
6,580.40	2.756	12.576	0.000	
6,580.90	2.826	13.971	0.000	
6,581.40	2.898	15.402	0.000	
6,581.90	2.970	16.869	0.000	
6,582.40	3.043	18.372	0.000	
6,582.90	3.118	19.913	0.000	
6,583.40	3.193	21.490	0.000	
6,583.90	3.268	23.105	0.000	

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
6,584.40	3.345	24.759	0.000		
6,584.56	3.370	25.296	0.000		Spillway #1
6,584.90	3.424	26.451	3.020	30.00	
6,585.00	3.440	26.794	3.909	1.25	
6,585.40	3.508	28.184	7.462	3.05	
6,585.90	3.594	29.959	13.243	2.10	
6,586.40	3.682	31.778	20.961	1.35	
6,586.90	3.770	33.641	29.978	0.90	
6,587.40	3.859	35.548	40.084	0.70	
6,587.90	3.949	37.500	51.151	0.65	
6,588.40	4.041	39.497	63.073	0.70	
6,588.90	4.133	41.541	75.774	1.20	
6,588.95	4.142	41.739	76.887	0.40	Peak Stage
6,589.40	4.226	43.631	87.508		
6,589.90	4.321	45.767	97.979		
6,590.00	4.340	46.201	100.035		
6,590.40	4.443	47.957	107.479		
6,590.90	4.574	50.212	116.197		
6,591.40	4.707	52.532	124.319		
6,591.90	4.842	54.919	131.980		
6,592.40	4.979	57.374	139.219		
6,592.90	5.117	59.898	146.013		
6,593.40	5.258	62.492	152.575		
6,593.90	5.400	65.156	158.880		
6,594.40	5.544	67.892	164.871		
6,594.90	5.691	70.701	170.749		
6,595.40	5.904	73.599	176.333		
6,595.90	6.138	76.610	181.814		
6,596.40	6.377	79.738	187.097		
6,596.90	6.620	82.987	192.258		

### Detailed Discharge Table

Elevation	Straight Pipe (cfs)	Combined Total Discharge (cfs)
6,570.90	0.000	0.000
6,571.40	0.000	0.000
6,571.90	0.000	0.000
6,572.40	0.000	0.000
6,572.90	0.000	0.000
6,573.40	0.000	0.000
6,573.90	0.000	0.000
6,574.40	0.000	0.000
6,574.90	0.000	0.000
6,575.00	0.000	0.000

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Elevation	Straight Pipe (cfs)	Combined Total Discharge (cfs)
6,575.40	0.000	0.000
6,575.90	0.000	0.000
6,576.40	0.000	0.000
6,576.90	0.000	0.000
6,577.40	0.000	0.000
6,577.90	0.000	0.000
6,578.40	0.000	0.000
6,578.90	0.000	0.000
6,579.40	0.000	0.000
6,579.90	0.000	0.000
6,580.00	0.000	0.000
6,580.40	0.000	0.000
6,580.90	0.000	0.000
6,581.40	0.000	0.000
6,581.90	0.000	0.000
6,582.40	0.000	0.000
6,582.90	0.000	0.000
6,583.40	0.000	0.000
6,583.90	0.000	0.000
6,584.40	0.000	0.000
6,584.56	0.000	0.000
6,584.90	(1)>3.020	3.020
6,585.00	(1)>3.909	3.909
6,585.40	(2)>7.462	7.462
6,585.90	(3)>13.243	13.243
6,586.40	(3)>20.961	20.961
6,586.90	(3)>29.978	29.978
6,587.40	(3)>40.084	40.084
6,587.90	(3)>51.151	51.151
6,588.40	(3)>63.073	63.073
6,588.90	(3)>75.774	75.774
6,589.40	(5)>87.508	87.508
6,589.90	(5)>97.979	97.979
6,590.00	(5)>100.035	100.035
6,590.40	(5)>107.479	107.479
6,590.90	(5)>116.197	116.197
6,591.40	(5)>124.319	124.319
6,591.90	(5)>131.980	131.980
6,592.40	(5)>139.219	139.219
6,592.90	(5)>146.013	146.013
6,593.40	(5)>152.575	152.575
6,593.90	(5)>158.880	158.880
6,594.40	(5)>164.871	164.871
6,594.90	(5)>170.749	170.749
6,595.40	(5)>176.333	176.333
6,595.90	(5)>181.814	181.814
6,596.40	(5)>187.097	187.097
6,596.90	(5)>192.258	192.258

***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	338.000	0.491	0.000	0.000	82.000	F	337.99	26.06
	$\Sigma$	<b>338.000</b>						<b>337.99</b>	<b>26.06</b>
#2	1	54.500	0.145	0.000	0.000	78.000	F	68.64	3.29
	$\Sigma$	<b>392.500</b>						<b>289.35</b>	<b>29.35</b>
#3	1	80.500	0.229	0.000	0.000	78.000	F	89.95	4.86
	$\Sigma$	<b>473.000</b>						<b>266.94</b>	<b>34.20</b>