

DESIGN REPORT

Temporary Sedimentation Structure

KM-A3

Kayenta Mine

Navajo County, Arizona

For

PEABODY WESTERN COAL COMPANY

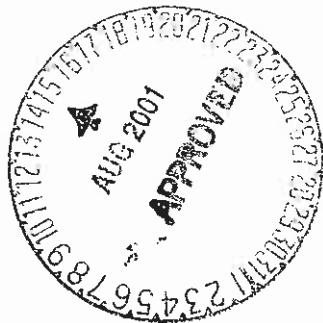


Revised 02/07/2001

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EXHIBIT #1 -KM-A3 Pond Revised Design



INTRODUCTION

Sedimentation Structure KM-A3 is an earthen embankment, designed and constructed in 1982 by Peabody Western Coal Company as a temporary sedimentation structure to control runoff and sediment from portions of the N-8 Facilities disturbance area at the Kayenta Mine. With this design report, PWCC proposes to increase the capacity of the pond structure by raising the top of embankment and spillway approximately 2 feet, primarily on the West End of the structure. The location of Structure KM-A3 and its watershed boundary are shown on Drawing No. 85400 (Sheet K-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 KM-A3. Structure KM-A3 is currently in series with Structure KM-A2. However, KM-A2 is filled with sediment and is no longer useful as a sediment pond. KM-A2 will be reclaimed and will no longer be used as a sedimentation structure. The embankment and emergency spillway of KM-A3 will be raised approximately 2 feet to contain the required storm event, the sediment for the combined KM-A2 and KM-A3 watershed areas, and provide storage for the N-8 Facilities wash-down water. 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 remedial construction site for Structure KM-A3 was inspected in October, 2000 by a Registered Professional Engineer from Peabody Western Coal Company, to assure that the site is suitable and no adverse conditions exist to prevent the successful remedial 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.



SITE DESCRIPTION

LAND USE

The KM-A3 Structure has a watershed (which includes the KM-A2 watershed) of 66.1 acres and is located on a tributary upstream of the Yellow Water Canyon Wash at the Kayenta Mine. The watershed is classified as 61% disturbed and 39% undisturbed.

DESIGN ANALYSES

GENERAL

Structure KM-A3 is an existing sedimentation structure designed and constructed in 1982 by Peabody Western Coal Company. Dames and Moore reviewed the design in 1985. Revisions were made in the design in 1996 under the supervision of a Registered Professional Engineer. The design was reviewed again in 2000 and an additional revision is recommended. PWCC proposes to raise the embankment to an elevation of 6507.5' msl and the emergency spillway invert to elevation of 6505.0' msl in order to increase the capacity of the pond, (see to Exhibit #1). 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 is used in the analyses of the structure and contained in the Peabody Western Coal Company files including topographic maps developed from aerial photography flown in 1996.

STABILITY

Structure KM-A3 is a Category B-3 embankment. The structure is a homogeneous earthen embankment, compacted in lifts to design specifications, and approximately 12 feet wide on top. The minimum upstream slopes are 2H: 1V and minimum downstream slopes are 3H: 1V and these slopes will be utilized during remedial construction. Based on the total embankment height of approximately 13.5 feet, these slopes are equal to or flatter than the recommended "worst case" embankment/foundation condition slopes in Table 3-6, Attachment D, Chapter 6; therefore, the embankment will be stable. The emergency spillway will be a minimum 20-foot wide, riprap-lined, trapezoidal channel.



HYDROLOGY

The hydrologic analysis was completed using the computer program SEDCAD4 (see Appendices A, B, and C). Structure KM-A3 is classified as a low hazard structure (see Drawing No. 85408). In addition, the mine area is sparsely populated with no one living in the downstream floodplain. The structure will impound less than 20 acre-feet and be less than 20 vertical feet in height from the upstream toe of the embankment of the natural stream elevation to the emergency spillway invert elevation. The structure is a temporary sediment containment structure and therefore, the spillway was designed to safely pass the peak flow from the 25-year, 6-hour storm event. The structure was conservatively assumed to be full to the emergency spillway at the time of 25-year storm event. The storage capacity of structure KM-A3 was analyzed using the 10-year, 24-hour storm event. The pond was verified to completely contain the 10-year, 24-hour storm event, and provide adequate sediment storage and wash-down water volume, without discharging into the Yellow Water Canyon Wash.

There is assumed to be a base flow which enters the KM-A3 Pond from the N-8 Facilities wash-down water. The water volume is too intermittent to quantify the water storage volume. To assure that adequate storage below the emergency spillway elevation will always be present in the pond to contain the runoff volume from the 10-year, 24-hour storm, a maximum water level will be maintained in the pond at approximately elevation 6503' or to allow approximately 12.3 ac.-ft. of storage for sediment and wash-down water runoff. A stake will be placed at the 6503' elevation or approximately 4.8 ac.-ft. below the emergency spillway. The survey stake will be checked periodically by PWCC personnel. The water level will be maintained at or below this elevation. If the water level rises to the survey stake elevation, PWCC will implement the dewatering plan described in Chapter 6, "Maintenance and Reclamation" section.

The following parameters were used in the hydrologic analysis:

- | | | |
|----|--|-----------|
| 1. | Water Course length, L | 0.417 mi. |
| 2. | Elevation Difference, H | 170 ft |
| 3. | Time of Concentration, T_c | 0.131 hr |
| 4. | SCS Curve Number | 85 |
| 5. | Rainfall Depth, 10-year, 24-hour storm | 2.1 in |



	25-year, 6-hour storm	1.9 in
6.	Drainage Area	66.1 acres

HYDRAULICS

The SEDCAD4 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).

The ponding area will continue to be bisected by an access road with a 48-inch CMP to equalize the water level on both sides of the road (see Cell No. 1 & Cell No. 2, Exhibit #1). A low spot (elevation 6505.5') will be graded in the road embankment to form a spillway capable of safely passing the peak flow from the 25-year, 6-hour storm from Cell No. 1 to Cell No. 2. Riprap will be placed from the spillway into Cell No. 2 as shown on Exhibit #1. In addition to the 48-inch CMP, this will allow water to overflow from Cell No. 1 to Cell No. 2 during emergency inflow conditions.

The embankment crest will be at elevation 6507.5' and the emergency spillway crest at elevation 6505.0'. The storage capacity of the revised structure is adequate for local inflow from the KM-A3 and KM-A2 watersheds. The existing trapezoidal spillway and outflow channel will be revised as shown on Exhibit #1.

Design parameters for the spillway and outflow channel are shown on the following table.



KM-A3 SEDIMENTATION POND HYDRAULICS TABLE

	Units	10-Yr, 24-Hr Storm	25-Yr, 6-Hr Storm
Initial Reservoir Volume Condition		Empty	Full to emergency spillway
Inflow			
Peak Flow	cfs	52.8	64.3
Volume	ac-ft	4.8	4.0
Storage			
Peak Stage	msl	N/A	6505.7
Emerg. Spillway Elev.	msl	6505.0	6505.0
Peak Storage	ac-ft	N/A	19.0
Storage Capacity	ac-ft	19.3	17.1
Outflow			
Peak Flow	cfs	N/A	17.6
Spillway Elevation	msl	6505.0	6505.0
Embankment Crest Elev.	msl	6507.5	6507.5
Peak Stage	msl	--	6505.7
Freeboard	ft	--	1.8
Emergency Spillway Channel			
Flow Depth	ft	--	0.7
Critical Slope	%	--	2.0
Mannings "n"	--	--	0.03
Width	ft	--	20
Outflow Channel			
Slope	%	--	33 10.5
Normal Velocity	fps	--	4.5 4.0
Normal Depth	ft	--	0.19 0.21
Mannings "n"	--	--	0.061 0.042
Riprap D ₅₀	in	--	3 1.5



EMERGENCY SPILLWAY AND OUTLET CHANNEL

The emergency spillway and outlet channel for KM-A3 will be a trapezoidal channel with dimensions listed below. The alignment and dimensions are shown on Exhibit #1.

Minimum Channel Depth	(Spillway) (Outflow)	1.7 1.2	ft ft
Channel Width		20	ft
Channel Length	(Spillway) (Outflow)	27 30	ft ft
Sideslopes (Horizontal to Vertical)		3:1	or flatter
Average Slope	(Spillway)	0	%
Maximum Slope	(Outflow)	33	%
Spillway Elevation		6505.0	ft

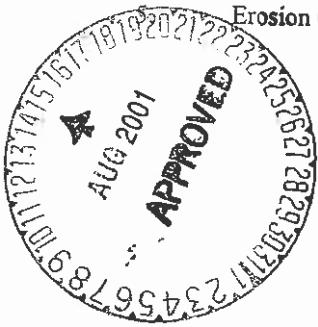
A minimum 15-foot long riprap-lined channel will be constructed beyond the toe of the embankment as a transition into the downstream channel.

STORAGE CAPACITY

The impoundment stage-capacity table (see Exhibit #1) is based on the 1996 aerial topographic mapping conducted for Peabody Western Coal Company. Structure KM-A3 is designed to contain approximately 17.1 acre-feet.

The calculations for the sediment load entering structure KM-A3 were made utilizing the Revised Universal Soil Loss Equation with the following parameters:

1. Rainfall Factor, R 40
 2. Soil Erodibility Factor, K 0.22
 3. Slope Factor, LS 5.39
 4. Cover Factor, C 0.66
- Erosion Control Factor, P 1.0



The hydrologic analysis estimates the storage volume required to contain the 10-year, 24-hour storm.

The storage capacity of structure KM-A3 and the results of the sediment inflow analysis are summarized in the following table.

Total Storage Capacity	17.1 ac-ft
10-year, 24-hour Storm Inflow Volume	4.8 ac-ft
Maximum Allowable Water Level	6503' msl
Sediment/Wash-down Water Volume Available	12.3 ac-ft
Sediment Inflow Rate	0.91 ac-ft/yr.
Sediment Storage Life	13.5 yrs

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

Appendix A- Hydrology, Hydraulic, and Sedimentation Calculations

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

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

Exhibit #1- KM-A3 Pond Revised Design



APPENDIX A

Hydrology, Hydraulic, and Sedimentation Calculations



PEABODY WESTERN COAL COMPANY
CALCULATED HYDROLOGIC DATA

PROJECT: KM AREA

STRUCTURE: KM-A3 Pond

TIME OF CONCENTRATION:

Start Elevation (ft) = 6720
End Elevation (ft) = 6550
Elevation Difference, E (ft) = 170

Watercourse Length (ft) = 2200
Watercourse Length, L (mi) = 0.417

 $T_c = (11.9L^3/E)^{0.385} = \underline{\underline{0.131 \text{ hours}}}$

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
Disturbed	B	86	8.1	696.6
Disturbed	D	94	32.4	3045.6
PJ	B	65	11.1	721.5
SG	D	79	12.2	963.8
PJ	D	83	2.3	190.9
TOTAL:				5618.4

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

DRAINAGE BASIN AREA: 66.1

RAINFALL FACTOR:

R = 40



CALCULATED SEDIMENTOLOGY DATA

PROJECT: KM-A3 Pond

SOIL ERODIBILITY FACTOR:

Soil Type	Erodibility Factor, K	Area (acres)	K*Area
24	0.16	46.9	7.50
27	0.36	19.2	6.91
TOTAL:		66.1	14.42

$$\text{Weighted K} = \text{Total K*Area} / \text{Total Area} = 0.22$$

SLOPE FACTOR:

Length (ft)	Elevation Change (ft)	Slope (%)	m	Slope Angle (deg)	LS Factor
150	60	40.0%	0.6	21.8	8.87
300	60	20.0%	0.6	11.3	6.55
160	15	9.4%	0.5	5.4	1.59
250	85	34.0%	0.6	18.8	10.31
200	65	32.5%	0.6	18.0	8.62
390	15	3.8%	0.4	2.2	0.87
420	15	3.6%	0.4	2.0	0.84
460	185	40.2%	0.6	21.9	17.46
150	1.5	1.0%	0.3	0.6	0.17
160	25	15.6%	0.6	8.9	3.36
200	2	1.0%	0.3	0.6	0.19
200	45	22.5%	0.6	12.7	5.86

$$\text{Average LS} = 5.39$$

The LS Factor was calculated by:

$$LS = (\text{Slope Length}/72.6)^{\alpha} m^{\beta} (10.8 * \sin(\text{slope angle}) + 0.03) \text{ for Slopes} < 9\%$$

$$LS = (\text{Slope Length}/72.6)^{\alpha} m^{\beta} (16.8 * \sin(\text{slope angle}) - 0.5) \text{ for Slopes} > 9\%$$

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
Undisturbed	40%	25%	25.5	0.13	3.32	1.00	25.50
Disturbed	0%	0%	40.6	1.00	40.60	1.00	40.60
TOTAL:				66.1	43.92		66.10

$$\text{Weighted C} = \text{Total C*Area} / \text{Total Area} = 0.664$$

$$\text{Weighted P} = \text{Total P*Area} / \text{Total Area} = 1.000$$

PEABODY WESTERN COAL COMPANY
CALCULATED SEDIMENT YIELD

PROJECT: KM-A3 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.

PARAMETER DESCRIPTION	VALUE
Annual Rainfall Factor	40.00
Soil Erodibility Factor	0.22
Length Slope Factor	5.39
Cover Factor	0.66
Practice Factor	1.00
Gross Annual Sediment Yield	31.24 tons/acre/year
Sediment Density	94.00 pcf
Gross Annual Sediment Yield	0.0153 acre-feet/acre/year
Sediment Delivery Ratio	90%
Estimated Annual Sediment Yield	0.0137 acre-feet/acre/year
Watershed Area	66.1 acres
Watershed Annual Sediment Yield	0.91 acre-feet/year
Number of years	1 years
Calculated Sediment Volume	0.91 acre-feet



KM-A3 Pond Spillway Outflow Channel

Material: Riprap

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
20.00	3.0:1	3.0:1	10.5	1.00		

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	17.60 cfs	
Depth:	0.21 ft	1.21 ft
Top Width:	21.28 ft	27.28 ft
Velocity:	4.01 fps	
X-Section Area:	4.39 sq ft	
Hydraulic Radius:	0.206	
Froude Number:	1.55	
Manning's n:	0.0420	
Dmin:	1.00 in	
DS0:	1.50 in	
Dmax:	3.00 in	



KM-A3 Pond Spillway Outflow Channel

Material: Riprap

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
20.00	3.0:1	3.0:1	33.0	1.00		

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	17.60 cfs	
Depth:	0.19 ft	1.19 ft
Top Width:	21.13 ft	27.13 ft
Velocity:	4.53 fps	
X-Section Area:	3.89 sq ft	
Hydraulic Radius:	0.183	
Froude Number:	1.86	
Manning's n:	0.0610	
Dmin:	2.00 in	
D50:	3.00 in	
Dmax:	4.50 in	



MEMORANDUM



MONTGOMERY WATSON

Date: 6-13-01
To: Jim Schlenvogt
From: Craig Burger/Tom Leidich
Subject: HEC-RAS modeling of flow to overtop stream bank

The Hydrologic Engineering Center's River Analysis System (HEC-RAS) was utilized to determine the stream flow that would result in overtopping of the stream bank and flow into the KM-A3 sediment control pond at the Peabody Western Mine in Kayenta, Arizona. Cross sections were generated in AutoCAD at 13 locations on the stream alignment. A Manning's number of 0.025 was selected for the stream bottom and the areas outside the stream channel based on a site visit. Steady flow water surface profiles were calculated by the HEC-RAS model based on the input.

A flow of 1,321 cfs resulted in a computed water level of 6506.1 ft at cross section 12 (see attached drawing and summary tables) where the crest of the embankment is at an elevation of approximately 6507.8 ft. Cross section 12 is expected to have the highest flow as the stream constricts at this location. The resulting 1.7 ft of freeboard is conservative compared to the approximately 3 ft of freeboard observed during the 1,321 cfs flow event on August 20, 2000.

A flow of 2,000 cfs resulted in a computed water level of 6507.5 ft at cross section 12 where the crest of the embankment is at an elevation of approximately 6507.8 ft. The computed results are believed to be conservative based on comparison with the freeboard observed during the 1,321 cfs flow event.

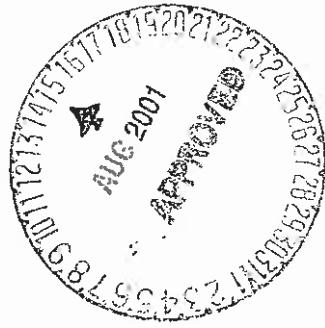
A flow of 3,000 cfs resulted in a computed water level of 6509.2 ft at cross section 12. Raising the embankment to 6509.2 ft (approximately 1.5 ft of fill) from cross section 10 to cross section 12 will result in an embankment that can contain a 3,000 cfs flow event based on the computed results. Summaries of the computed results, a figure showing the cross section locations, and the cross sections used in the model are attached.

Attachments



HEC-RAS Plan: asbuilt River: Peabody Stream Reach: by pond

Reach	River Sta#	From	To	Link ID	Width	Length	Elev.	EGS	Storage	V.C. Cont.	Flow 1987	Flow 1988	Top Width	Flood # Chl
by pond	18	1321.00	6502.00	6506.35	6507.25	0.003707	8.80	203.01	105.71					
by pond	12	1321.00	6502.00	6506.12	6504.84	6506.41	0.001120	4.53	324.95	126.38			0.78	
by pond	11	1321.00	6500.00	6505.41		6506.19	0.002319	7.10	190.28	54.48			0.43	
by pond	10	1321.00	6500.00	6505.49		6505.96	0.001229	5.92	261.75	82.80			0.62	
by pond	9	1321.00	6500.00	6504.84		6505.76	0.003080	7.68	173.69	52.02			0.47	
by pond	8	1321.00	6500.00	6504.37		6505.44	0.004011	8.32	159.16	49.29			0.71	
by pond	7	1321.00	6500.00	6504.28		6505.15	0.003440	7.50	177.01	61.24			0.80	
by pond	6	1321.00	6500.00	6504.11		6504.95	0.003264	7.37	179.25	55.84			0.74	
by pond	5	1321.00	6498.00	6503.19	6503.19	6504.86	0.005868	9.80	138.24	49.83			0.72	
by pond	4	1321.00	6498.00	6501.55	6502.24	6503.93	0.015493	12.39	106.59	48.14			0.96	
by pond	3	1321.00	6498.00	6501.92	6501.92	6503.15	0.007005	8.89	148.57	61.37			1.47	
by pond	2	1321.00	6498.00	6502.15	6500.98	6502.46	0.001587	4.49	294.18	113.89			1.01	
by pond	1	1321.00	6498.00	6500.99	6500.99	6502.15	0.007117	8.68	152.23	66.02			0.49	
														1.01



HEC-RAS Plan: asbuilt River: Peabody Stream Reach: by pond

Reach	River Sta	Top Ch	Bottom Ch	Width	Length	Area	Flow Area	Top Width	Froude # Ch
	(ft)	(ft)	(ft)	(ft)	(ft)	(sq ft)	(sq ft)	(ft)	
by pond 1	19	2000.00	6502.00	6507.35	6506.97	6508.14	0.002615	8.60	316.14
by pond 2	12	2000.00	6502.00	6507.52	6507.78	0.000681	4.43	522.07	156.12
by pond 3	11	2000.00	6500.00	6506.58	6507.58	0.002169	8.14	257.81	60.53
by pond 4	10	2000.00	6500.00	6506.79	6507.31	0.001041	6.39	382.67	101.48
by pond 5	9	2000.00	6500.00	6505.88	6507.10	0.003007	8.95	231.02	58.79
by pond 6	8	2000.00	6500.00	6505.32	6506.79	0.003990	9.78	208.94	55.91
by pond 7	7	2000.00	6500.00	6505.46	6506.44	0.002614	8.05	265.90	89.09
by pond 8	6	2000.00	6500.00	6505.25	6506.28	0.002702	8.19	250.90	69.30
by pond 9	5	2000.00	6498.00	6504.20	6506.01	0.005119	10.98	192.36	56.86
by pond 10	4	2000.00	6498.00	6502.26	6503.19	0.015189	13.98	143.50	56.73
by pond 11	3	2000.00	6498.00	6502.48	6502.73	0.008148	10.91	184.40	67.58
by pond 12	2	2000.00	6498.00	6503.12	6501.60	0.001264	4.94	411.82	129.00
by pond 13	1	2000.00	6498.00	6501.81	6503.21	0.006679	9.49	210.78	76.23
									1.01

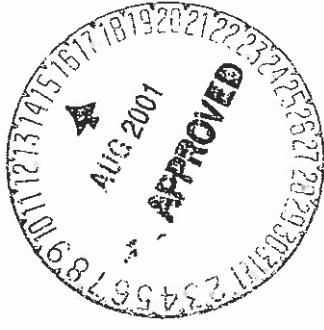
Crane
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HEC-RAS Plan: asbuilt River: Peabody Stream Reach: by pond

Reach	River Side	Top Width	Bottom Width	Side Slope	Bottom Elevation	Top Elevation	EGIS ID	Segment Length	Flow Area	Top Width	Flow Area
by pond	13	3000.00	6502.00	6509.05	6507.69	6509.62	0.001305	7.41	538.31	137.60	0.51
by pond	12	3000.00	6502.00	6509.16	6508.40	6509.40	0.000456	4.39	824.10	198.64	0.30
by pond	11	3000.00	6500.00	6507.84	6509.19	6509.19	0.002239	9.56	337.92	68.26	0.66
by pond	10	3000.00	6500.00	6508.25	6506.85	6509.52	0.000952	7.05	547.79	129.13	0.45
by pond	9	3000.00	6500.00	6507.02	6506.48	6506.61	0.003027	10.38	324.55	109.57	0.76
by pond	8	3000.00	6500.00	6506.86	6506.84	6508.33	0.002829	10.08	353.96	143.07	0.73
by pond	7	3000.00	6500.00	6507.19	6508.00	6508.00	0.001538	7.70	463.53	133.60	0.55
by pond	6	3000.00	6500.00	6506.71	6507.87	6502.55	0.002155	8.85	375.57	117.21	0.64
by pond	5	3000.00	6498.00	6505.47	6505.47	6507.61	0.004393	12.12	269.81	64.88	0.91
by pond	4	3000.00	6498.00	6503.08	6504.33	6506.94	0.013650	15.84	195.31	68.45	1.49
by pond	3	3000.00	6498.00	6503.78	6503.80	6505.65	0.005158	11.09	281.76	81.73	0.95
by pond	2	3000.00	6498.00	6504.17	6502.34	6504.85	0.001166	5.63	556.92	149.29	0.46
by pond	1	3000.00	6498.00	6502.92	6502.92	6504.40	0.004709	9.84	325.29	137.11	0.89

Critical
Roughness



----- Pearson Type III Distribution Reports -----

a for: FLUM15, Annual Series, Minimum Peak Discharge 0.0

Year	Maximum Peak CFS	Year	Maximum Peak CFS
1980	140.000	1981	329.089
1982	210.000	1983	155.000
1984	547.625	1985	119.700
1986	1400.000	1987	970.000
1988	340.000	1989	860.000
1990	1400.000	1991	400.000
1992	270.000	1993	120.000
1994	35.000	1995	35.000
1996	680.000	1997	1496.379
1998	169.388	1999	879.501

Log Mean = 2.50595

Log Skew = -0.43864

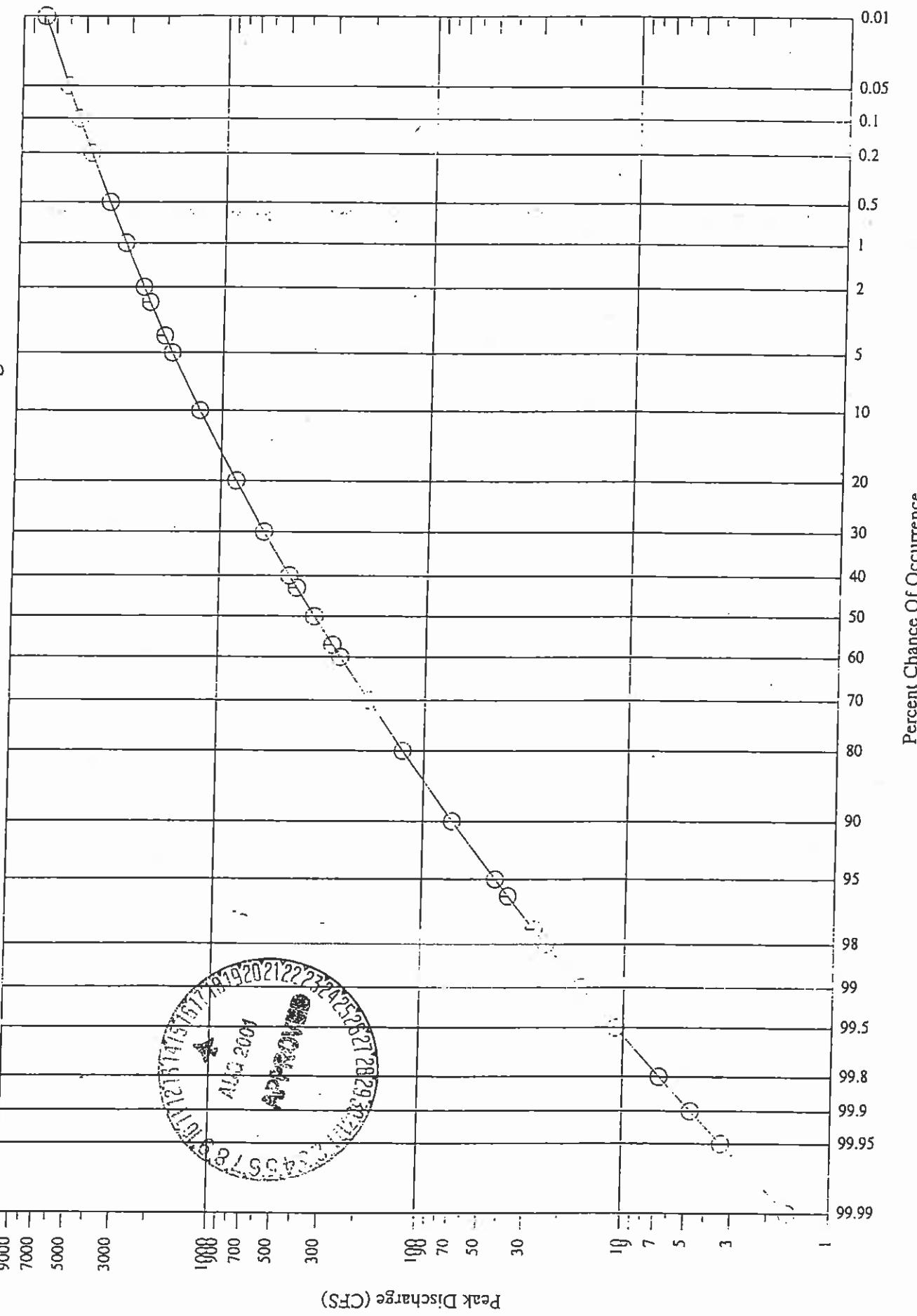
Log Std. Dev. = 0.49235

Log Coef. of Skew = -0.43864

Tr (Years)	%Tr	KTr	KTr*S	Log (Qtr)	QTr
1.0001	99.99	-4.6836	-2.3060	0.2000	1.5847
1.0005	99.95	-4.0211	-1.9798	0.5261	3.3585
1.0010	99.90	-3.7220	-1.8326	0.6734	4.7141
1.0020	99.80	-3.4127	-1.6802	0.8257	6.6943
1.0050	99.50	-2.9846	-1.4695	1.0365	10.8767
1.0101	99.00	-2.6426	-1.3011	1.2049	16.0279
1.0204	98.00	-2.2805	-1.1228	1.3832	24.1635
1.0256	97.50	-2.1586	-1.0628	1.4431	27.7418
1.0417	96.00	-1.8919	-0.9315	1.5745	37.5370
1.0526	95.00	-1.7597	-0.8664	1.6396	43.6082
1.1111	90.00	-1.3192	-0.6495	1.8565	71.8539
1.2500	80.00	-0.8133	-0.4004	2.1055	127.5093
1.4286	70.00	-0.4668	-0.2298	2.2761	188.8491
1.6667	60.00	-0.1828	-0.0900	2.4160	260.5940
1.7532	57.04	-0.1051	-0.0517	2.4542	284.5908
2.0000	50.00	0.0729	0.0359	2.5418	348.2063
2.3277	42.96	0.2462	0.1212	2.6272	423.8280
2.5000	40.00	0.3192	0.1571	2.6631	460.3509
3.3333	30.00	0.5724	0.2818	2.7878	613.4603
5.0000	20.00	0.8556	0.4213	2.9272	845.7186
10.0000	10.00	1.2254	0.6033	3.1093	1286.0504
20.0000	5.00	1.5110	0.7439	3.2499	1777.8220
25.0000	4.00	1.5909	0.7833	3.2892	1946.4590
40.0000	2.50	1.7447	0.8590	3.3650	2317.2003
50.0000	2.00	1.8118	0.8920	3.3980	2500.3007
100.0000	1.00	2.0005	0.9850	3.4909	3096.7105
200.0000	0.50	2.1651	1.0660	3.5719	3732.0506
500.0000	0.20	2.3545	1.1592	3.6652	4625.7491
1000.0000	0.10	2.4809	1.2215	3.7274	5338.3182
2000.0000	0.05	2.5954	1.2779	3.7838	6078.7393
5000.0000	0.01	2.8254	1.3911	3.8970	7889.1768

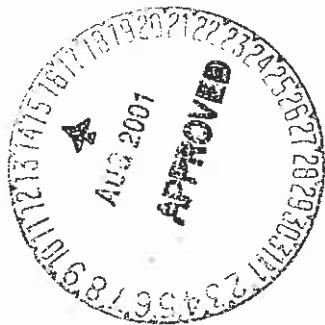


FLUM15, Annual Series, Minimum Peak Discharge 0.0



APPENDIX B

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



SEDCAD 4 for Windows

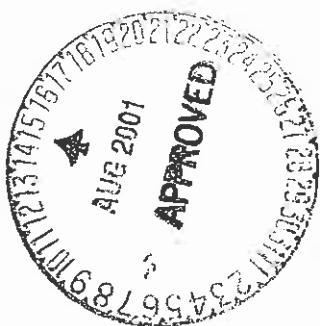
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1

PEABODY WESTERN

KM-3A Pond

10-year, 24-hour



DJK

Montgomery Watson
165 S. Union Blvd.
Suite 410
Lakewood, Co. 80228

Phone: 303 763-5140

SEDCAD 4 for Windows

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General Information

Storm Information:

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



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Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Pond	#1	==> End		0.000	0.000	Pond Km-3

#1
Pond



SEDCAD 4 for Windows

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Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	In	66.100	66.100	52.84	4.79
	Out			0.00	0.00



SEDCAD 4 for Windows

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Structure Detail:

Structure #1 (Pond)

Pond Km-3

Pond Inputs:

Initial Pool Elev:	6,494.01
Initial Pool:	17.12 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
6,505.00	22.00	3.00:1	3.00:1	20.00

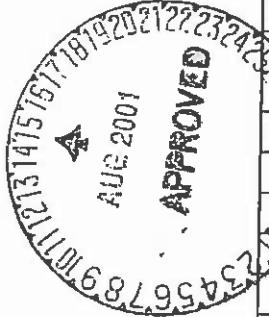
Pond Results:

Peak Elevation:	6,499.62
Dewater Time:	0.00 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)
6,494.00	0.010	0.000	0.000	
6,494.01	0.011	0.000	0.000	
6,494.50	0.059	0.016	0.000	
6,495.00	0.147	0.065	0.000	
6,495.50	0.274	0.169	0.000	
6,496.00	0.440	0.346	0.000	
6,496.50	0.616	0.608	0.000	
6,497.00	0.821	0.966	0.000	
6,497.50	1.056	1.434	0.000	
6,498.00	1.320	2.027	0.000	
6,498.50	1.481	2.727	0.000	
6,499.00	1.651	3.510	0.000	
6,499.50	1.831	4.380	0.000	
6,499.62	1.880	4.610	0.000	0.00 Peak Stage
6,500.00	2.020	5.342	0.000	
6,500.50	2.081	6.367	0.000	
6,501.00	2.143	7.424	0.000	



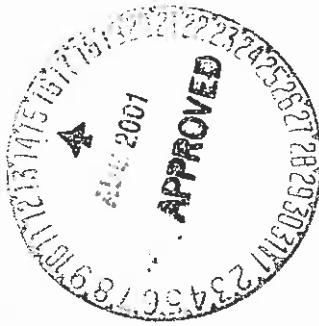
SEDCAD 4 for Windows

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Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
6,501.50	2.206	8.511	0.000	
6,502.00	2.270	9.630	0.000	
6,502.50	2.341	10.782	0.000	
6,503.00	2.413	11.971	0.000	
6,503.50	2.486	13.195	0.000	
6,504.00	2.560	14.457	0.000	
6,504.50	2.664	15.763	0.000	
6,505.00	2.771	17.122	0.000	Spillway #1
6,505.50	2.879	18.534	2.599	
6,506.00	2.990	20.001	48.727	
6,506.50	3.111	21.527	102.916	
6,507.00	3.234	23.113	174.092	
6,507.50	3.360	24.761	262.576	

Detailed Discharge Table

Elevation	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
6,494.00	0.000	0.000
6,494.01	0.000	0.000
6,494.50	0.000	0.000
6,495.00	0.000	0.000
6,495.50	0.000	0.000
6,496.00	0.000	0.000
6,496.50	0.000	0.000
6,497.00	0.000	0.000
6,497.50	0.000	0.000
6,498.00	0.000	0.000
6,498.50	0.000	0.000
6,499.00	0.000	0.000
6,499.50	0.000	0.000
6,500.00	0.000	0.000
6,500.50	0.000	0.000
6,501.00	0.000	0.000
6,501.50	0.000	0.000
6,502.00	0.000	0.000
6,502.50	0.000	0.000
6,503.00	0.000	0.000
6,503.50	0.000	0.000

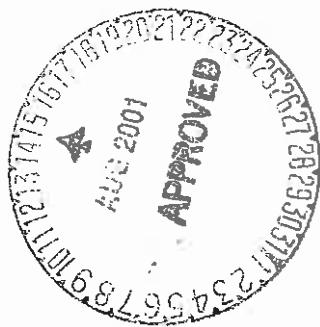


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Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)	Combined
6,504.00	0.000	0.000	
6,504.50	0.000	0.000	
6,505.00	0.000	0.000	
6,505.50	2.599	2.599	
6,506.00	48.727	48.727	
6,506.50	102.916	102.916	
6,507.00	174.092	174.092	
6,507.50	262.576	262.576	



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Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	66.100	0.131	0.000	0.000	85.000	F	52.84	4.788
Σ		66.100						52.84	4.788



APPENDIX C

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



PEABODY WESTERN
KM-3A Pond

25-year, 6-hour



DJK

Montgomery Watson
165 S. Union Blvd.
Suite 410
Lakewood, Co. 80228

Phone: 303 763-5140

SEDCAD 4 for Windows

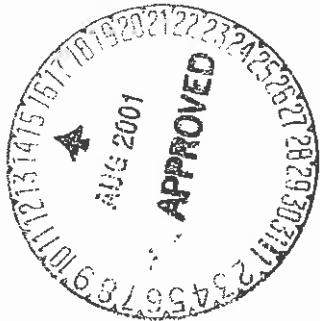
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2

General Information

Storm Information:

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



SEDCAD 4 for Windows

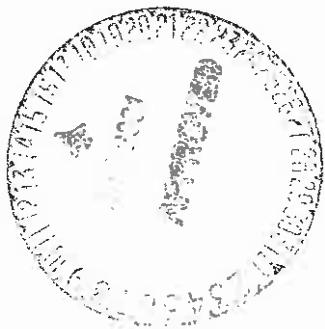
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Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K / (hrs)	Musk. X	Description
Pond	#1	=>	End	0.000	0.000	Pond Km-3

#1
Pond



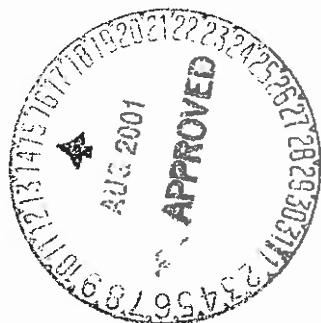
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Structure Summary:

	Immediate Contributing Area	Total Contributing Area	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	In 66.100	66.100	64.30	3.98
	Out		17.57	3.98



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Structure Detail:

Structure #1 (Pond)

Pond Km-3

Pond Inputs:

Initial Pool Elev:	6,505.00
Initial Pool:	17.12 ac-ft

Emergency Spillway

Spillway Elev (ft)	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
6,505.00	22.00	3.00:1	3.00:1	20.00

Pond Results:

Peak Elevation:	6,505.66
Dewater Time:	1.84 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)
6,494.00	0.010	0.000	0.000	
6,494.50	0.058	0.015	0.000	
6,495.00	0.146	0.065	0.000	
6,495.50	0.273	0.168	0.000	
6,496.00	0.440	0.344	0.000	
6,496.50	0.616	0.607	0.000	
6,497.00	0.821	0.965	0.000	
6,497.50	1.056	1.433	0.000	
6,498.00	1.320	2.026	0.000	
6,498.50	1.481	2.726	0.000	
6,499.00	1.651	3.508	0.000	
6,499.50	1.831	4.379	0.000	
6,500.00	2.020	5.341	0.000	
6,500.50	2.081	6.366	0.000	
6,501.00	2.143	7.422	0.000	
6,501.50	2.206	8.509	0.000	
6,502.00	2.270	9.628	0.000	

SEDCAD 4 for Windows

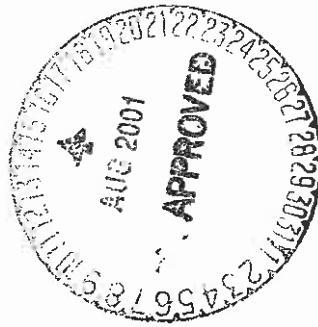
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Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
6,502.50	2.341	10.781	0.000	
6,503.00	2.413	11.970	0.000	
6,503.50	2.486	13.194	0.000	
6,504.00	2.560	14.456	0.000	
6,504.50	2.664	15.762	0.000	
6,505.00	2.771	17.120	0.000	Spillway #1
6,505.50	2.879	18.533	2.599	41.15
6,505.66	2.916	19.009	17.572	2.90 Peak Stage
6,506.00	2.990	20.000	48.727	
6,506.50	3.111	21.525	102.916	
6,507.00	3.234	23.111	174.092	
6,507.50	3.360	24.760	262.576	

Detailed Discharge Table

Elevation	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
6,494.00	0.000	0.000
6,494.50	0.000	0.000
6,495.00	0.000	0.000
6,495.50	0.000	0.000
6,496.00	0.000	0.000
6,496.50	0.000	0.000
6,497.00	0.000	0.000
6,497.50	0.000	0.000
6,498.00	0.000	0.000
6,498.50	0.000	0.000
6,499.00	0.000	0.000
6,499.50	0.000	0.000
6,500.00	0.000	0.000
6,500.50	0.000	0.000
6,501.00	0.000	0.000
6,501.50	0.000	0.000
6,502.00	0.000	0.000
6,502.50	0.000	0.000
6,503.00	0.000	0.000
6,503.50	0.000	0.000
6,504.00	0.000	0.000
6,504.50	0.000	0.000



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Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	66.100	0.131	0.000	0.000	85.000	F	64.30	3.981
Σ		66.100						64.30	3.981



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Elevation	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
6,505.00	0.000	0.000
6,505.50	2.599	2.599
6,506.00	48.727	48.727
6,506.50	102.916	102.916
6,507.00	174.092	174.092
6,507.50	262.576	262.576

