APPENDIX 11 - AA

APPENDIX 11-AA

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NORTH CELLS MODIFICATION
NORTH CELL A, B, & C

The watershed area is presented on Exhibit 11-113B and the pond design is presented on Exhibit 11-106. The hydrology model is presented on the attach sheet.

Revised June 2010

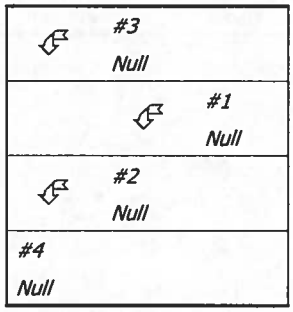
LR

BHP Navajo Coal Company
P.O. Box 1717
Fruitland, NM 87416

Phone: 505-598-4200

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	#2	0.120	0.305	
Null	#2	==>	#4	0.008	0.406	INLET TO CELL A
Null	#3	==>	#4	0.028	0.372	INLET TO CELL A
Null	#4	==>	End	0.000	0.000	



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	8. Large gullies, diversions, and low flowing streams	0.78	9.00	1,153.00	2.65	0.120
#1	**Muskingum K:**					**0.120**
#2	8. Large gullies, diversions, and low flowing streams	5.98	14.00	234.00	7.33	0.008
#2	**Muskingum K:**					**0.008**
#3	8. Large gullies, diversions, and low flowing streams	2.73	14.00	513.00	4.95	0.028
#3	**Muskingum K:**					**0.028**

Structure Detail:

Structure #3 (Null)

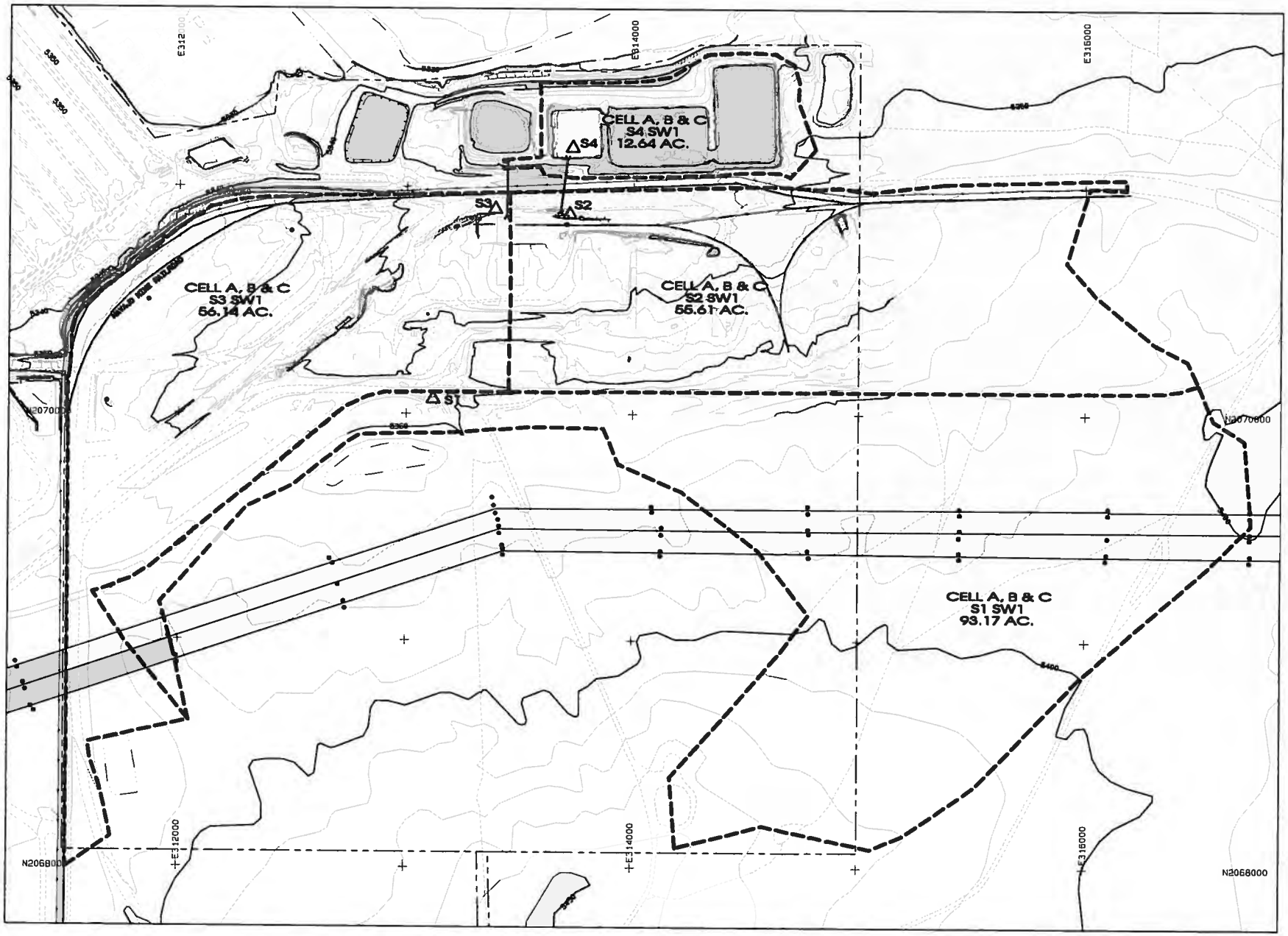
INLET TO CELL A

Structure #1 (Null)

Structure #2 (Null)

INLET TO CELL A

Structure #4 (Null)



NORTH CELL A, B & C
HYDROLOGY MODEL

Blank Pages

Page 8 through 10

Pond C removed from pages 8 through 10e. Replaced with pages 530-539 of Appendix AA.

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

BARBER LOADOUT 100 YEAR, 6HOUR HYDROLOGY CALCULATION

by

Name: Brian Sambirsky

Company Name: BHP MINERALS
File Name: A:\SEDCAD\BARBER-6

Date: 09-29-1995

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

Company Name: BHP MINERALS
Filename: A:\SEDCAD\BARBER-6 User: Brian Sambirsky
Date: 09-29-1995 Time: 09:34:57
Barber Loadout 100 year, 6hour Hydrology Calculation
Storm: 2.10 inches, 100 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	3.60	89	M	0.010	0.000	0.000	0.0	0.33	8.01
		Type: Null			Label: Barber Loadout					
111	Structure	3.60							0.33	
111	Total IN/OUT	3.60							0.33	8.01

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Company Name: BHP MINERALS
Filename: A:\SEDCAD\BARBER-6 User: Brian Sambirsky
Date: 09-29-1995 Time: 09:34:57
Barber Loadout 100 year, 6hour Hydrology Calculation
Storm: 2.10 inches, 100 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	140.00	14.29	3.78	0.01	0.010		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

AREA III SHOP POND 100 YEAR, 6 HOUR HYDROLOGY CALCULATION

by

Name: Brian Sambirsky

Company Name: BHP MINERALS
File Name: C:\BRIAN\A3SHOP

Date: 03-08-1996

Civil Software Design -- SEDCAD+ Version 3.1
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Company Name: BHP MINERALS
Filename: C:\BRIAN\A3SHOP User: Brian Sambirsky
Date: 03-08-1996 Time: 12:29:30
Area III Shop Pond 100 Year, 6 Hour Hydrology Calculation
Storm: 2.10 inches, 100 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	33.15	88	M	0.299	0.000	0.000	0.0	2.82	42.26
		Type: Null		Label: Area III Shop Pond						
111	Structure	33.15								
									2.82	
111	Total IN/OUT	33.15							2.82	42.26

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Company Name: BHP MINERALS
Filename: C:\BRIAN\A3SHOP User: Brian Sambirsky
Date: 03-08-1996 Time: 12:29:30
Area III Shop Pond 100 Year, 6 Hour Hydrology Calculation
Storm: 2.10 inches, 100 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	1800.00	2.78	1.67	0.30	0.299		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

AREA III SEWER POND 100 YEAR, 6 HOUR HYDROLOGY CALCULATION

by

Name: Brian Sambirsky

Company Name: BHP MINERALS
File Name: A:\SEDCAD\A3SEWE-6

Date: 09-29-1995

Civil Software Design -- SEDCAD+ Version 3.1
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Company Name: BHP MINERALS
Filename: A:\SEDCAD\A3SEWE-6 User: Brian Sambirsky
Date: 09-29-1995 Time: 09:35:47
Area III Sewer Pond 100 year, 6 hour Hydrology Calculation
Storm: 2.10 inches, 100 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	1.20	89	M	0.000	0.000	0.000	0.0	0.11	2.67
		Type: Null			Label: Area III Sewer					
111 Structure		1.20							0.11	
111 Total IN/OUT		1.20							0.11	2.67

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Company Name: BHP MINERALS
Filename: A:\SEDCAD\A3SEWE-6 User: Brian Sambirsky
Date: 09-29-1995 Time: 09:35:47
Area III Sewer Pond 100 year, 6 hour Hydrology Calculation
Storm: 2.10 inches, 100 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	5	15.00	33.33	5.77	0.00	0.000		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

LOWE LOADOUT 100 YEAR, 6 HOUR HYDROLOGY CALCULATION

by

Name: Brian Sambirsky

Company Name: BHP MINERALS
File Name: A:\SEDCAD\LOWE-6

Date: 09-29-1995

Civil Software Design -- SEDCAD+ Version 3.1
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Company Name: BHP MINERALS
Filename: A:\SEDCAD\LOWE-6 User: Brian Sambirsky
Date: 09-29-1995 Time: 09:36:37
Lowe Loadout 100 year, 6 hour Hydrology Calculation
Storm: 2.10 inches, 100 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	3.40	89	M	0.001	0.000	0.000	0.0	0.31	7.57
		Type: Null			Label: Lowe Loadout					
111	Structure	3.40							0.31	
111	Total IN/OUT	3.40							0.31	7.57

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Company Name: BHP MINERALS
Filename: A:\SEDCAD\LOWE-6 User: Brian Sambirsky
Date: 09-29-1995 Time: 09:36:37
Lowe Loadout 100 year, 6 hour Hydrology Calculation
Storm: 2.10 inches, 100 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	5	30.00	40.00	6.32	0.00	0.001		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

NORTHWEST DIXON POND HYDROLOGY - 100 YR 6 HR STORM EVENT

by

Name: BEN HOSKIE

Company Name: BHP MINERALS
File Name: C:\BEN\PONDS\NWDXPND

Date: 07-05-1998

Civil Software Design -- SEDCAD+ Version 3.1
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Company Name: BHP MINERALS
Filename: C:\BEN\PONDS\NWDXPND User: BEN HOSKIE
Date: 07-15-1998 Time: 16:05:04
NORTHWEST DIXON POND HYDROLOGY - 100 YR 6 HR STORM EVENT
Storm: 2.10 inches, 100 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	62.20	83	N	1.452	0.000	0.000	0.0	3.96	47.84
		Type: Null			Label: NW DIXON POND					
111	Structure	62.20							3.96	
111	Total IN/OUT	62.20							3.96	47.84

Civil Software Design -- SEDCAD+ Version 3.1
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Company Name: BHP MINERALS
Filename: C:\BEN\PONDS\NWDXPND User: BEN HOSKIE
Date: 07-08-1998 Time: 16:05:04
NORTHWEST DIXON POND HYDROLOGY - 100 YR 6 HR STORM EVENT
Storm: 2.10 inches, 100 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	2162.00	1.76	1.33	0.45	0.452		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

AS BUILT DESIGN HYDROLOGY CALCULATION - BARBER STOCKPILE POND #1

by

Name: Brian Sambirsky

Company Name: BHP MINERALS
File Name: C:\BRIAN\BARBER1

Date: 06-13-1996

Civil Software Design -- SEDCAD+ Version 3.1
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Company Name: BHP MINERALS
Filename: C:\BRIAN\BARBER1 User: Brian Sambirsky
Date: 06-13-1996 Time: 07:55:44
As built design hydrology calculation - barber stockpile pond #1
Storm: 1.58 inches, 10 year-24 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	146.60	82	M	0.905	0.000	0.000	0.0	4.81	25.37
		Type: Null		Label: Barber Stockpile #1						
111	Structure	146.60							4.81	
111	Total IN/OUT	146.60							4.81	25.37

Civil Software Design -- SEDCAD+ Version 3.1
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Company Name: BHP MINERALS
Filename: C:\BRIAN\BARBER1 User: Brian Sambirsky
Date: 06-13-1996 Time: 07:55:44
As built design hydrology calculation - barber stockpile pond #1
Storm: 1.58 inches, 10 year-24 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	4575.00	1.97	1.40	0.91	0.905		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

AS BUILT DESIGN HYDROLOGY CALCULATION - BARBER STOCKPILE #1 SPILLWAY

by

Name: Brian Sambirsky

Company Name: BHP MINERALS
File Name: C:\BRIAN\BARBER1

Date: 06-19-1996

Civil Software Design -- SEDCAD+ Version 3.1
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Company Name: BHP MINERALS
Filename: C:\BRIAN\BARBER1 User: Brian Sambirsky
Date: 06-19-1996 Time: 12:27:04
As built design hydrology calculation - barber stockpile #1 spillway
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	146.60	82	M	0.905	0.000	0.000	0.0	4.95	36.56
		Type: Pond		Label: Barber Stockpile #1						
111	Structure	146.60							4.95	
111	Total IN	146.60							4.95	36.56
111	Total OUT								4.95	26.52

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Company Name: BHP MINERALS
Filename: C:\BRIAN\BARBER1 User: Brian Sambirsky
Date: 06-19-1996 Time: 12:27:04
As built design hydrology calculation - barber stockpile #1 spillway
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	4575.00	1.97	1.40	0.91	0.905		

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Company Name: BHP MINERALS
Filename: C:\BRIAN\BARBER1 User: Brian Sambirsky
Date: 06-19-1996 Time: 12:27:04
As built design hydrology calculation - barber stockpile #1 spillway
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

POND INPUT/OUTPUT TABLE

J1, B1, S1
Barber Stockpile #1

Drainage Area from J1, B1, S1, SWS(s)1: 146.6 acres
Total Contributing Drainage Area: 146.6 acres

DISCHARGE OPTIONS:

	Emergency Spillway
Riser Diameter (in)	----
Riser Height (ft)	----
Barrel Diameter (in)	----
Barrel Length (ft)	----
Barrel Slope (%)	----
Manning's n of Pipe	----
Spillway Elevation	----
Lowest Elevation of Holes	----
# of Holes/Elevation	----
Entrance Loss Coefficient	----
Tailwater Depth (ft)	----
Notch Angle (degrees)	----
Weir Width (ft)	----
Siphon Crest Elevation	----
Siphon Tube Diameter (in)	----
Siphon Tube Length (ft)	----
Manning's n of Siphon	----
Siphon Inlet Elevation	----
Siphon Outlet Elevation	----
Emergency Spillway Elevation	5289.6
Crest Length (ft)	20.0
Z:1 (Left and Right)	5.0 4.0
Bottom Width (ft)	20.0

POND RESULTS:

Permanent Pool (ac-ft)
9.9

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Company Name: BHP MINERALS
Filename: C:\BRIAN\BARBER1 User: Brian Sambirsky
Date: 06-19-1996 Time: 12:27:04
As built design hydrology calculation - barber stockpile #1 spillway
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

ELEVATION-DISCHARGE TABLE

J1, B1, S1
Barber Stockpile #1

Drainage Area from J1, B1, S1, SWS(s)1: 146.6 acres
Total Contributing Drainage Area: 146.6 acres

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
5280.00	0.0	0.0
5281.00	0.0	0.0
5282.00	0.0	0.0
5283.00	0.0	0.0
5284.00	0.0	0.0
5285.00	0.0	0.0
5286.00	0.0	0.0
5287.00	0.0	0.0
5288.00	0.0	0.0
5289.00	0.0	0.0
5289.60	0.0	0.0
5290.00	13.3	13.3
5290.20	19.9	19.9
5290.30	25.8	25.8
5290.40	33.9	33.9
5290.50	41.9	41.9
5290.60	51.6	51.6
5291.00	96.7	96.7
5291.10	109.9	109.9
5291.60	190.8	190.8
5292.00	270.6	270.6

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Company Name: BHP MINERALS
Filename: C:\BRIAN\BARBER1 User: Brian Sambirsky
Date: 06-19-1996 Time: 12:27:04
As built design hydrology calculation - barber stockpile #1 spillway
Storm: 1.60 inches, 25 year- 6 hour, Type II-65
Hydrograph Convolution Interval: 0.1 hr

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

J1, B1, S1
Barber Stockpile #1

Drainage Area from J1, B1, S1, SWS(s)1: 146.6 acres
Total Contributing Drainage Area: 146.6 acres

SW#1: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	
5280.00	0.00	0.58	0.00	0.00	
5281.00	1.00	0.66	0.62	0.00	
5282.00	2.00	0.75	1.32	0.00	
5283.00	3.00	0.83	2.11	0.00	
5284.00	4.00	0.94	3.00	0.00	
5285.00	5.00	1.03	3.98	0.00	
5286.00	6.00	1.14	5.07	0.00	
5287.00	7.00	1.25	6.26	0.00	
5288.00	8.00	1.38	7.58	0.00	
5289.00	9.00	1.50	9.02	0.00	
5289.60	9.60	1.58	9.94	0.00	Stage of SW#1
5290.00	10.00	1.64	10.59	13.28	
5290.20	10.20	1.66	10.92	19.92	
5290.30	10.30	1.67	11.08	25.75	
5290.31	10.31	1.67	11.10	26.52	Peak Stage
5290.40	10.40	1.68	11.25	33.85	
5290.50	10.50	1.68	11.42	41.88	
5290.60	10.60	1.69	11.59	51.61	
5291.00	11.00	1.73	12.27	96.71	
5291.10	11.10	1.74	12.44	109.88	
5291.60	11.60	1.77	13.32	190.79	
5292.00	12.00	1.80	14.04	270.63	

****

	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN	4.95	36.56
OUT	4.95	26.52

Peak Elevation	Hydrograph Detention Time (hrs)
5290.3	0.00

****

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Barber Stockpile Pond 2

This pond has a single closed spillway. It is re-evaluated as a total containment structure for the 100 year-6 hour storm. The curve number was adjusted to account for the reclaimed lands. Refer to Section 11.5.4.3 of the mine permit for discussion on ponds with a single closed spillway. The pond location and watershed areas are presented on Exhibit 11-13 C & D.

LR

BHP Navajo Coal Company
PO Box 1717
Fruitland, NM
87416

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General Information

Storm Information:

Storm Type:	Type II-60
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Pond	#1	==>	End	0.000	0.000	Barber #2

#1
Pond

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	In	106.600	106.600	82.12	5.72
	Out			0.00	0.00

Structure Detail:

Structure #1 (Pond)

Barber #2

Pond Inputs:

Initial Pool Elev:	5,273.10
Initial Pool:	0.00 ac-ft

Drop Inlet

Riser Diameter (in)	Riser Height (ft)	Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev
48.00	8.30	48.00	145.00	2.21	0.0160	5,287.10

Drop Inlet

Riser Diameter (in)	Riser Height (ft)	Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev
48.00	8.30	42.00	145.00	2.21	0.0160	5,287.10

Pond Results:

Peak Elevation:	~~5,283.28~~ 5284.65
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)
5,273.00	0.000	0.000	0.000	
5,273.10	0.004	0.000	0.000	
5,273.50	0.023	0.005	0.000	
5,274.00	0.070	0.027	0.000	
5,274.50	0.110	0.072	0.000	
5,275.00	0.160	0.139	0.000	
5,275.50	0.211	0.232	0.000	
5,276.00	0.270	0.352	0.000	
5,276.50	0.336	0.503	0.000	
5,277.00	0.410	0.689	0.000	

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
5,277.50	0.454	0.905	0.000		
5,278.00	0.500	1.143	0.000		
5,278.50	0.530	1.401	0.000		
5,279.00	0.560	1.673	0.000		
5,279.50	0.585	1.959	0.000		
5,280.00	0.610	2.258	0.000		
5,280.50	0.640	2.570	0.000		
5,281.00	0.670	2.898	0.000		
5,281.50	0.695	3.239	0.000		
5,282.00	0.720	3.593	0.000		
5,282.50	0.750	3.960	0.000		
5,283.00	0.780	4.342	0.000		
5,283.28	0.793	4.567	0.000	0.00	Peak Stage
5,283.50	0.805	4.739	0.000		
5,284.00	0.830	5.147	0.000		
5,284.50	0.860	5.570	0.000	Elev. 5284.65	Peak Stage
5,285.00	0.890	6.007	0.000		
5,285.50	0.915	6.458	0.000		
5,286.00	0.940	6.922	0.000		
5,286.50	0.972	7.400	0.000		
5,287.00	1.004	7.894	0.000		
5,287.10	1.010	7.994	0.000		Spillway #1 Spillway #2
5,287.50	1.032	8.403	19.703		
5,288.00	1.060	8.926	66.511		
5,288.50	1.110	9.468	129.047		
5,288.80	1.140	9.805	157.769		

Detailed Discharge Table

Elevation	Drop Inlet (cfs)	Drop Inlet (cfs)	Combined Total Discharge (cfs)
5,273.00	0.000	0.000	0.000
5,273.10	0.000	0.000	0.000
5,273.50	0.000	0.000	0.000
5,274.00	0.000	0.000	0.000
5,274.50	0.000	0.000	0.000
5,275.00	0.000	0.000	0.000
5,275.50	0.000	0.000	0.000

Elevation	Drop Inlet (cfs)	Drop Inlet (cfs)	Combined Total Discharge (cfs)
5,276.00	0.000	0.000	0.000
5,276.50	0.000	0.000	0.000
5,277.00	0.000	0.000	0.000
5,277.50	0.000	0.000	0.000
5,278.00	0.000	0.000	0.000
5,278.50	0.000	0.000	0.000
5,279.00	0.000	0.000	0.000
5,279.50	0.000	0.000	0.000
5,280.00	0.000	0.000	0.000
5,280.50	0.000	0.000	0.000
5,281.00	0.000	0.000	0.000
5,281.50	0.000	0.000	0.000
5,282.00	0.000	0.000	0.000
5,282.50	0.000	0.000	0.000
5,283.00	0.000	0.000	0.000
5,283.50	0.000	0.000	0.000
5,284.00	0.000	0.000	0.000
5,284.50	0.000	0.000	0.000
5,285.00	0.000	0.000	0.000
5,285.50	0.000	0.000	0.000
5,286.00	0.000	0.000	0.000
5,286.50	0.000	0.000	0.000
5,287.00	0.000	0.000	0.000
5,287.10	0.000	0.000	0.000
5,287.50	9.852	9.852	19.703
5,288.00	33.256	33.256	66.511
5,288.50	64.524	64.524	129.047
5,288.80	78.884	78.884	157.769

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	106.600	0.202	0.000	0.000	81.900	M	82.12	5.723
	Σ	**106.600**						**82.12**	**5.723**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	11.07	30.00	271.00	3.320	0.022
		8. Large gullies, diversions, and low flowing streams	2.35	70.00	2,978.08	4.590	0.180
#1	**1**	**Time of Concentration:**					**0.202**

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Barber Stockpile Pond 3

The curve number was adjusted to account for the reclaimed lands. The pond location and watershed area are presented on Exhibit 11-13 C & D.

LR

BHP Navajo Coal Company
PO Box 1717
Fruitland, NM
87416

General Information

Storm Information:

Storm Type:	Type II-60
Design Storm:	10 yr - 24 hr
Rainfall Depth:	1.600 inches

Structure Networking:

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

#1
Pond

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Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	In	59.770	59.770	4.28	1.13
	Out			0.35	0.98

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	59.770	0.734	0.000	0.000	76.000	M	4.28	1.132
	Σ	**59.770**						**4.28**	**1.132**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	1.73	60.00	3,464.00	1.310	0.734
#1	**1**	**Time of Concentration:**					**0.734**

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General Information

Storm Information:

Storm Type:	Type II-60
Design Storm:	25 yr - 6 hr
Rainfall Depth:	1.600 inches

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	In	59.770	59.770	7.51	1.13
	Out			0.63	1.03

Structure Detail:

Structure #1 (Pond)

Barber Stkp Pd 3

Pond Inputs:

Initial Pool Elev:	5,348.30
Initial Pool:	3.65 ac-ft

Straight Pipe

Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev	Entrance Loss Coefficient	Tailwater Depth (ft)
12.00	250.00	2.00	0.0180	5,348.30	0.90	0.00

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
5,350.10	30.00	2.00:1	2.00:1	16.00

Pond Results:

Peak Elevation:	5,348.71
Dewater Time:	1.38 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)
5,342.00	0.000	0.000	0.000	
5,342.50	0.013	0.002	0.000	
5,343.00	0.050	0.017	0.000	
5,343.50	0.085	0.050	0.000	
5,344.00	0.130	0.104	0.000	
5,344.50	0.135	0.170	0.000	
5,345.00	0.140	0.239	0.000	
5,345.50	0.409	0.370	0.000	
5,346.00	0.820	0.671	0.000	
5,346.50	1.042	1.136	0.000	

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
5,347.00	1.290	1.718	0.000		
5,347.50	1.436	2.399	0.000		
5,348.00	1.590	3.155	0.000		
5,348.30	1.724	3.652	0.000		Spillway #1
5,348.50	1.815	4.006	0.213	20.11*	
5,348.71	1.913	4.403	0.632	13.00	Peak Stage
5,349.00	2.050	4.971	1.233		
5,349.50	2.284	6.054	2.716		
5,350.00	2.530	7.257	3.646		
5,350.10	2.557	7.512	3.681		Spillway #2
5,350.50	2.664	8.555	16.839		
5,351.00	2.800	9.921	33.291		

**Designates time(s) to dewater have been extrapolated beyond the 50 hour hydrograph limit.*

Detailed Discharge Table

Elevation	Straight Pipe (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
5,342.00	0.000	0.000	0.000
5,342.50	0.000	0.000	0.000
5,343.00	0.000	0.000	0.000
5,343.50	0.000	0.000	0.000
5,344.00	0.000	0.000	0.000
5,344.50	0.000	0.000	0.000
5,345.00	0.000	0.000	0.000
5,345.50	0.000	0.000	0.000
5,346.00	0.000	0.000	0.000
5,346.50	0.000	0.000	0.000
5,347.00	0.000	0.000	0.000
5,347.50	0.000	0.000	0.000
5,348.00	0.000	0.000	0.000
5,348.30	0.000	0.000	0.000
5,348.50	(3)>0.213	0.000	0.213
5,349.00	(3)>1.233	0.000	1.233
5,349.50	(3)>2.716	0.000	2.716
5,350.00	(5)>3.646	0.000	3.646
5,350.10	(5)>3.681	0.000	3.681
5,350.50	(5)>3.820	13.019	16.839
5,351.00	(6)>3.995	29.296	33.291

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Hosteen Stockpile Pond 1

The curve number was adjusted to account for the reclaimed lands. The pond location and watershed area are presented on Exhibit 11-13 C & D.

LR

BHP Navajo Coal Company
PO Box 1717
Fruitland, NM
87416

General Information

Storm Information:

Storm Type:	Type II-60
Design Storm:	10 yr - 24 hr
Rainfall Depth:	1.600 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Pond	#1	==>	End	0.000	0.000	Hosteen Stkp Pd 1

#1
Pond

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	In	155.540	155.540	22.17	4.01
	Out			10.73	4.01

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	155.540	0.507	0.000	0.000	79.100	M	22.17	4.008
	Σ	**155.540**						**22.17**	**4.008**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	3.97	68.00	1,712.00	1.990	0.238
		8. Large gullies, diversions, and low flowing streams	1.88	75.00	3,990.00	4.110	0.269
#1	**1**	**Time of Concentration:**					**0.507**

General Information

Storm Information:

Storm Type:	Type II-60
Design Storm:	25 yr - 6 hr
Rainfall Depth:	1.600 inches

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	In	155.540	155.540	35.34	4.01
	Out			16.02	4.01

Structure Detail:

Structure #1 (Pond)

Hosteen Stkp Pd 1

Pond Inputs:

Initial Pool Elev:	5,272.20
Initial Pool:	10.63 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
5,272.20	30.00	11.60:1	9.30:1	8.00

Pond Results:

Peak Elevation:	5,272.94
Dewater Time:	0.35 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)
5,258.00	0.080	0.000	0.000	
5,258.50	0.112	0.048	0.000	
5,259.00	0.150	0.113	0.000	
5,259.50	0.183	0.196	0.000	
5,260.00	0.220	0.297	0.000	
5,260.50	0.254	0.415	0.000	
5,261.00	0.290	0.551	0.000	
5,261.50	0.333	0.707	0.000	
5,262.00	0.380	0.885	0.000	
5,262.50	0.424	1.086	0.000	
5,263.00	0.470	1.309	0.000	
5,263.50	0.514	1.555	0.000	
5,264.00	0.560	1.824	0.000	
5,264.50	0.609	2.116	0.000	
5,265.00	0.660	2.433	0.000	
5,265.50	0.780	2.793	0.000	
5,266.00	0.910	3.215	0.000	

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
5,266.50	0.984	3.688	0.000		
5,267.00	1.060	4.199	0.000		
5,267.50	1.090	4.736	0.000		
5,268.00	1.120	5.289	0.000		
5,268.50	1.155	5.857	0.000		
5,269.00	1.190	6.444	0.000		
5,269.50	1.225	7.047	0.000		
5,270.00	1.260	7.668	0.000		
5,270.50	1.300	8.308	0.000		
5,271.00	1.340	8.968	0.000		
5,271.50	1.380	9.648	0.000		
5,272.00	1.420	10.348	0.000		
5,272.20	1.438	10.634	0.000		Spillway #1
5,272.50	1.465	11.069	6.463	6.40	
5,272.94	1.505	11.729	16.022	1.90	Peak Stage
5,273.00	1.510	11.813	17.241		
5,273.50	1.565	12.581	54.572		
5,274.00	1.620	13.377	115.502		
5,274.50	1.689	14.205	203.538		
5,275.00	1.760	15.067	328.686		

Detailed Discharge Table

Elevation	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
5,258.00	0.000	0.000
5,258.50	0.000	0.000
5,259.00	0.000	0.000
5,259.50	0.000	0.000
5,260.00	0.000	0.000
5,260.50	0.000	0.000
5,261.00	0.000	0.000
5,261.50	0.000	0.000
5,262.00	0.000	0.000
5,262.50	0.000	0.000
5,263.00	0.000	0.000
5,263.50	0.000	0.000
5,264.00	0.000	0.000
5,264.50	0.000	0.000

Elevation	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
5,265.00	0.000	0.000
5,265.50	0.000	0.000
5,266.00	0.000	0.000
5,266.50	0.000	0.000
5,267.00	0.000	0.000
5,267.50	0.000	0.000
5,268.00	0.000	0.000
5,268.50	0.000	0.000
5,269.00	0.000	0.000
5,269.50	0.000	0.000
5,270.00	0.000	0.000
5,270.50	0.000	0.000
5,271.00	0.000	0.000
5,271.50	0.000	0.000
5,272.00	0.000	0.000
5,272.20	0.000	0.000
5,272.50	6.463	6.463
5,273.00	17.241	17.241
5,273.50	54.572	54.572
5,274.00	115.502	115.502
5,274.50	203.538	203.538
5,275.00	328.686	328.686

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CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

AS BUILT DESIGN HYDROLOGY CALCULATION FOR ~~BARBER~~ Hosteen STOCKPILE #2 POND

by

Name: Brian Sambirsky

Company Name: BHP MINERALS
File Name: C:\BRIAN\HOSTEEN2

Date: 12-21-1995

Civil Software Design -- SEDCAD+ Version 3.1
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Company Name: BHP MINERALS
Filename: C:\BRIAN\HOSTEEN2 User: Brian Sambirsky
Date: 12-21-1995 Time: 10:03:16
As built design hydrology calculation - Hosteen Stockpile #2 Pond
Storm: 1.58 inches, 10 year-24 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	122.80	83	M	0.754	0.000	0.000	0.0	4.36	26.55
		Type: Null			Label: Hosteen #2 Pond					
111 Structure		122.80								
									4.36	
111 Total IN/OUT		122.80								
									4.36	26.55

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Company Name: BHP MINERALS
Filename: C:\BRIAN\HOSTEEN2 User: Brian Sambirsky
Date: 12-21-1995 Time: 10:03:16
As built design hydrology calculation - Hosteen Stockpile #2 Pond
Storm: 1.58 inches, 10 year-24 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	X
1	1	1	1	-a	5	4330.00	2.54	1.59	0.75	0.754		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

AS BUILT DESIGN HYDROLOGY CALCULATION - HOSTEEN STOCKPILE #2 SPILLWAY

by

Name: Brian Sambirsky

Company Name: BHP MINERALS
File Name: C:\BRIAN\HOSTEEN2

Date: 12-21-1995

Civil Software Design -- SEDCAD+ Version 3.1
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Company Name: BHP MINERALS
Filename: C:\BRIAN\HOSTEEN2 User: Brian Sambirsky
Date: 12-21-1995 Time: 10:01:46
As built design hydrology calculation - Hosteen Stockpile #2 Spillway
Storm: 1.60 inches, 25 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	122.80	83	M	0.754	0.000	0.000	0.0	4.48	37.71
111	Structure	Type: Pond			Label: Hosteen #2 Pond					
		122.80							4.48	
111	Total IN	122.80							4.48	37.71
111	Total OUT								3.96	2.23

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Company Name: BHP MINERALS
Filename: C:\BRIAN\HOSTEEN2 User: Brian Sambirsky
Date: 12-21-1995 Time: 10:01:46
As built design hydrology calculation - Hosteen Stockpile #2 Spillway
Storm: 1.60 inches, 25 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	4330.00	2.54	1.59	0.75	0.754		

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Company Name: BHP MINERALS
Filename: C:\BRIAN\HOSTEEN2 User: Brian Sambirsky
Date: 12-21-1995 Time: 10:01:46
As built design hydrology calculation - Hosteen Stockpile #2 Spillway
Storm: 1.60 inches, 25 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

POND INPUT/OUTPUT TABLE

J1, B1, S1
Hosteen #2 Pond

Drainage Area from J1, B1, S1, SWS(s)1: 122.8 acres
Total Contributing Drainage Area: 122.8 acres

DISCHARGE OPTIONS:

	Trickle Tube	Emergency Spillway
Riser Diameter (in)	----	----
Riser Height (ft)	----	----
Barrel Diameter (in)	12.0	----
Barrel Length (ft)	80.00	----
Barrel Slope (%)	2.25	----
Manning's n of Pipe	0.012	----
Spillway Elevation	5302.1	----
Lowest Elevation of Holes	----	----
# of Holes/Elevation	----	----
Entrance Loss Coefficient	0.9	----
Tailwater Depth (ft)	0.0	----
Notch Angle (degrees)	----	----
Weir Width (ft)	----	----
Siphon Crest Elevation	----	----
Siphon Tube Diameter (in)	----	----
Siphon Tube Length (ft)	----	----
Manning's n of Siphon	----	----
Siphon Inlet Elevation	----	----
Siphon Outlet Elevation	----	----
Emergency Spillway Elevation	----	5305.4
Crest Length (ft)	----	20.0
Z:1 (Left and Right)	-- --	3.0 3.0
Bottom Width (ft)	----	8.0

POND RESULTS:

Permanent Pool (ac-ft)
14.6

	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN	4.48	37.71
OUT	3.96	2.23

Peak Elevation	Hydrograph Detention Time (hrs)
5303.2	0.00

****

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Company Name: BHP MINERALS
Filename: C:\BRIAN\HOSTEEN2 User: Brian Sambirsky
Date: 12-21-1995 Time: 10:01:46
As built design hydrology calculation - Hosteen Stockpile #2 Spillway
Storm: 1.60 inches, 25 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

ELEVATION-DISCHARGE TABLE

J1, B1, S1
Hosteen #2 Pond

Drainage Area from J1, B1, S1, SWS(s)1: 122.8 acres
Total Contributing Drainage Area: 122.8 acres

Elevation	Trickle Tube (cfs)	Emergency Spillway (cfs)	Total Discharge (cfs)
5291.00	0.0	0.0	0.0
5292.00	0.0	0.0	0.0
5293.00	0.0	0.0	0.0
5294.00	0.0	0.0	0.0
5295.00	0.0	0.0	0.0
5296.00	0.0	0.0	0.0
5297.00	0.0	0.0	0.0
5298.00	0.0	0.0	0.0
5299.00	0.0	0.0	0.0
5300.00	0.0	0.0	0.0
5301.00	0.0	0.0	0.0
5302.00	0.0	0.0	0.0
5302.10	0.0	0.0	0.0
5303.00	1.8	0.0	1.8
5304.00	4.2	0.0	4.2
5305.00	5.8	0.0	5.8
5305.40	6.2	0.0	6.2
5306.00	6.9	8.3	15.2
5306.10	6.9	10.8	17.8
5306.20	7.0	14.3	21.4
5306.30	7.1	17.9	25.0
5306.40	7.1	22.2	29.4
5306.90	7.5	49.0	56.5
5307.00	7.6	55.8	63.4

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Company Name: BHP MINERALS
Filename: C:\BRIAN\HOSTEEN2 User: Brian Sambirsky
Date: 12-21-1995 Time: 10:01:46
As built design hydrology calculation - Hosteen Stockpile #2 Spillway
Storm: 1.60 inches, 25 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

ELEVATION-AREA-CAPACITY-DISCHARGE TABLE

J1, B1, S1
Hosteen #2 Pond

Drainage Area from J1, B1, S1, SWS(s)1: 122.8 acres
Total Contributing Drainage Area: 122.8 acres

SW#1: Trickle Tube
SW#2: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	
5291.00	0.00	0.00	0.00	0.00	
5292.00	1.00	0.26	0.09	0.00	
5293.00	2.00	0.45	0.44	0.00	
5294.00	3.00	0.69	1.00	0.00	
5295.00	4.00	0.86	1.78	0.00	
5296.00	5.00	1.05	2.73	0.00	
5297.00	6.00	1.27	3.89	0.00	
5298.00	7.00	1.51	5.28	0.00	
5299.00	8.00	1.82	6.94	0.00	
5300.00	9.00	2.16	8.93	0.00	
5301.00	10.00	2.66	11.33	0.00	
5302.00	11.00	3.21	14.26	0.00	
5302.10	11.10	3.27	14.59	0.00	Stage of SW#1
5303.00	12.00	3.77	17.75	1.81	
5303.18	12.18	3.89	18.47	2.23	Peak Stage
5304.00	13.00	4.37	21.82	4.22	
5305.00	14.00	4.90	26.45	5.75	
5305.40	14.40	5.13	28.46	6.23	Stage of SW#2
5306.00	15.00	5.47	31.64	15.18	
5306.10	15.10	5.54	32.19	17.76	
5306.20	15.20	5.61	32.75	21.35	
5306.30	15.30	5.68	33.31	24.96	
5306.40	15.40	5.75	33.88	29.36	
5306.90	15.90	6.09	36.84	56.48	
5307.00	16.00	6.16	37.46	63.40	

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Hosteen Stockpile Pond 3

This pond has a single closed spillway. It is re-evaluated as a total containment structure for the 100 year-6 hour storm. The curve number was adjusted to account for the reclaimed lands. Refer to Section 11.5.4.3 of the mine permit for discussion on ponds with a single closed spillway. The pond location and watershed areas are presented on Exhibit 11-13 C & D.

LR

BHP Navajo Coal Company
PO Box 1717
Fruitland, NM
87416

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General Information

Storm Information:

Storm Type:	Type II-60
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

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

#1
Pond

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	In	135.210	135.210	68.03	6.76
	Out			0.00	0.00

Structure Detail:

Structure #1 (Pond)

Hosteen #3

Pond Inputs:

Initial Pool Elev:	5,263.10
Initial Pool:	0.00 ac-ft

Straight Pipe

Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev	Entrance Loss Coefficient	Tailwater Depth (ft)
24.00	140.00	0.93	0.0160	5,274.80	0.90	0.00

Pond Results:

Peak Elevation:	5,273.01
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)
5,263.00	0.000	0.000	0.000	
5,263.10	0.002	0.000	0.000	
5,263.50	0.010	0.002	0.000	
5,264.00	0.030	0.012	0.000	
5,264.50	0.095	0.041	0.000	
5,265.00	0.197	0.113	0.000	
5,265.50	0.335	0.244	0.000	
5,266.00	0.510	0.454	0.000	
5,266.50	0.535	0.715	0.000	
5,267.00	0.561	0.989	0.000	
5,267.50	0.588	1.277	0.000	
5,268.00	0.615	1.577	0.000	
5,268.50	0.643	1.892	0.000	
5,269.00	0.671	2.220	0.000	
5,269.50	0.700	2.563	0.000	
5,270.00	0.730	2.921	0.000	

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
5,270.50	0.757	3.293	0.000		
5,271.00	0.784	3.678	0.000		
5,271.50	0.812	4.077	0.000		
5,272.00	0.840	4.490	0.000		
5,272.50	0.889	4.922	0.000		
5,273.00	0.940	5.379	0.000		
5,273.01	0.940	5.387	0.000	0.00	Peak Stage
5,273.50	0.989	5.861	0.000		
5,274.00	1.040	6.369	0.000		
5,274.50	1.104	6.905	0.000		
5,274.80	1.144	7.242	0.000		Spillway #1
5,275.00	1.170	7.473	0.575		
5,275.50	1.239	8.075	2.457		
5,276.00	1.310	8.713	5.509		
5,276.50	1.384	9.386	9.288		
5,277.00	1.460	10.097	13.620		
5,277.50	1.539	10.847	17.484		
5,278.00	1.620	11.636	19.790		

Detailed Discharge Table

Elevation	Straight Pipe (cfs)	Combined Total Discharge (cfs)
5,263.00	0.000	0.000
5,263.10	0.000	0.000
5,263.50	0.000	0.000
5,264.00	0.000	0.000
5,264.50	0.000	0.000
5,265.00	0.000	0.000
5,265.50	0.000	0.000
5,266.00	0.000	0.000
5,266.50	0.000	0.000
5,267.00	0.000	0.000
5,267.50	0.000	0.000
5,268.00	0.000	0.000
5,268.50	0.000	0.000
5,269.00	0.000	0.000
5,269.50	0.000	0.000
5,270.00	0.000	0.000

Elevation	Straight Pipe (cfs)	Combined Total Discharge (cfs)
5,270.50	0.000	0.000
5,271.00	0.000	0.000
5,271.50	0.000	0.000
5,272.00	0.000	0.000
5,272.50	0.000	0.000
5,273.00	0.000	0.000
5,273.50	0.000	0.000
5,274.00	0.000	0.000
5,274.50	0.000	0.000
5,274.80	0.000	0.000
5,275.00	(3)>0.575	0.575
5,275.50	(3)>2.457	2.457
5,276.00	(3)>5.509	5.509
5,276.50	(3)>9.288	9.288
5,277.00	(3)>13.620	13.620
5,277.50	(5)>17.484	17.484
5,278.00	(6)>19.790	19.790

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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	135.210	0.452	0.000	0.000	80.900	M	68.03	6.763
	Σ	**135.210**						**68.03**	**6.763**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	7.29	45.00	617.00	2.700	0.063
		8. Large gullies, diversions, and low flowing streams	1.60	85.00	5,318.00	3.790	0.389
#1	**1**	**Time of Concentration:**					**0.452**

Pages 87 – 88 blank due to text changes

Lowe Railroad Impoundment #1

Impoundment has a watershed of 105.73 acres and designed to contain the 100 year-6 hour strom event (Total Containment); therefore, no spillway is required.

Shawn Smith

Navajo Coal Company
P.O. Box 1717
Fruitland, NM 87414

Phone: (505) 598-3376
Email: shawn.smith@bhpbilliton.com

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Lowe Railroad Impoundment #1

#1
Null

Structure Detail:

Structure #1 (Null)

Lowe Railroad Impoundment #1

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	85.180	0.500	0.000	0.000	89.000	M	81.66	5.820
	2	9.850	0.180	0.000	0.000	84.200	F	14.06	0.594
	3	10.700	0.061	0.000	0.000	78.000	M	14.67	0.431
	Σ	**105.730**						**89.73**	**6.845**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	0.82	40.00	4,878.00	2.710	0.500
#1	**1**	**Time of Concentration:**					**0.500**
#1	2	8. Large gullies, diversions, and low flowing streams	2.98	100.00	3,357.00	5.170	0.180
#1	**2**	**Time of Concentration:**					**0.180**
#1	3	5. Nearly bare and untilled, and alluvial valley fans	5.71	30.00	525.00	2.390	0.061
#1	**3**	**Time of Concentration:**					**0.061**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	105.730	105.730	89.73	6.84

General Information

Storm Information:

Storm Type:	Type II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Lowe Railroad Impoundment #2

Impoundment has a watershed of 133.27 acres and designed to contain the 100 year-6 hour storm event (Total Containment); therefore, no spillway is required.

Shawn Smith

Navajo Coal Company
P.O. Box 1717
Fruitland, NM 87414

Phone: (505) 598-3376
Email: shawn.smith@bhpbilliton.com

General Information

Storm Information:

Storm Type:	Type II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Lowe Railroad Impoundment #2

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	133.270	133.270	103.69	6.65

Structure Detail:

Structure #1 (Null)

Lowe Railroad Impoundment #2

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	129.020	0.500	0.000	0.000	81.800	F	102.97	6.483
	2	4.250	0.064	0.000	0.000	78.000	M	5.83	0.171
	Σ	**133.270**						**103.69**	**6.654**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	0.82	40.00	4,878.04	2.710	0.500
#1	**1**	**Time of Concentration:**					**0.500**
#1	2	5. Nearly bare and untilled, and alluvial valley fans	6.14	35.00	570.00	2.470	0.064
#1	**2**	**Time of Concentration:**					**0.064**

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

AS BUILT DESIGN HYDROLOGY CALCULATION FOR LOWE STOCKPILE POND

by

Name: Brian Sambirsky

Company Name: BHP MINERALS
File Name: C:\BRIAN\LCOALSP

Date: 12-21-1995

Civil Software Design -- SEDCAD+ Version 3.1
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Company Name: BHP MINERALS
Filename: C:\BRIAN\LCOALSP
Date: 12-21-1995 Time: 10:09:35 User: Brian Sambirsky
As built design hydrology calculation for Lowe Stockpile Pond
Storm: 1.58 inches, 10 year-24 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	51.80	89	M	1.365	0.000	0.000	0.0	2.99	13.35
111 Structure		Type: Null 51.80			Label: Lowe Stockpile Pond					
111 Total IN/OUT		51.80							2.99	
									2.99	13.35

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Company Name: BHP MINERALS
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Date: 12-21-1995 Time: 10:09:35 User: Brian Sambirsky
As built design hydrology calculation for Lowe Stockpile Pond
Storm: 1.58 inches, 10 year-24 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	3924.00	0.64	0.80	1.37	1.365		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

AS BUILT DESIGN HYDROLOGY CALCULATION FOR LOWE STOCKPILE POND SPILLWAY

by

Name: Brian Sambirsky

Company Name: BHP MINERALS
File Name: C:\BRIAN\LCOALSP

Date: 12-21-1995

Civil Software Design -- SEDCAD+ Version 3.1
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Company Name: BHP MINERALS
Filename: C:\BRIAN\LCOALSP User: Brian Sambirsky
Date: 12-21-1995 Time: 10:07:50
As built design hydrology calculation for Lowe Stockpile Pond Spillway
Storm: 1.60 inches, 25 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	51.80	89	M	1.365	0.000	0.000	0.0	3.05	17.52
111	Structure	Type: Pond 51.80			Label: Lowe Stockpile Pond					
111	Total IN	51.80							3.05	
111	Total OUT								3.05	17.52
									3.05	15.28

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Company Name: BHP MINERALS
Filename: C:\BRIAN\LCOALSP
User: Brian Sambirsky
Date: 12-21-1995 Time: 10:07:50
As built design hydrology calculation for Lowe Stockpile Pond Spillway
Storm: 1.60 inches, 25 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	3924.00	0.64	0.80	1.37	1.365		

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Company Name: BHP MINERALS
Filename: C:\BRIAN\LCOALSP User: Brian Sambirsky
Date: 12-21-1995 Time: 10:07:50
As built design hydrology calculation for Lowe Stockpile Pond Spillway
Storm: 1.60 inches, 25 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

POND INPUT/OUTPUT TABLE

J1, B1, S1
Lowe Stockpile Pond

Drainage Area from J1, B1, S1, SWS(s)1: 51.8 acres
Total Contributing Drainage Area: 51.8 acres

DISCHARGE OPTIONS:

	Emergency Spillway
Riser Diameter (in)	----
Riser Height (ft)	----
Barrel Diameter (in)	----
Barrel Length (ft)	----
Barrel Slope (%)	----
Manning's n of Pipe	----
Spillway Elevation	----
Lowest Elevation of Holes	----
# of Holes/Elevation	----
Entrance Loss Coefficient	----
Tailwater Depth (ft)	----
Notch Angle (degrees)	----
Weir Width (ft)	----
Siphon Crest Elevation	----
Siphon Tube Diameter (in)	----
Siphon Tube Length (ft)	----
Manning's n of Siphon	----
Siphon Inlet Elevation	----
Siphon Outlet Elevation	----
Emergency Spillway Elevation	5313.6
Crest Length (ft)	26.0
Z:1 (Left and Right)	4.0 2.7
Bottom Width (ft)	16.0

POND RESULTS:

Permanent Pool (ac-ft)
5.6

	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN	3.05	17.52
OUT	3.05	15.28

Peak Elevation	Hydrograph Detention Time (hrs)
5314.2	0.00

****

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Company Name: BHP MINERALS
Filename: C:\BRIAN\LCOALSP User: Brian Sambirsky
Date: 12-21-1995 Time: 10:07:50
As built design hydrology calculation for Lowe Stockpile Pond Spillway
Storm: 1.60 inches, 25 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

ELEVATION-DISCHARGE TABLE

J1, B1, S1
Lowe Stockpile Pond

Drainage Area from J1, B1, S1, SWS(s)1: 51.8 acres
Total Contributing Drainage Area: 51.8 acres

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
5300.80	0.0	0.0
5301.00	0.0	0.0
5301.80	0.0	0.0
5302.00	0.0	0.0
5302.80	0.0	0.0
5303.00	0.0	0.0
5303.80	0.0	0.0
5304.00	0.0	0.0
5304.80	0.0	0.0
5305.00	0.0	0.0
5305.80	0.0	0.0
5306.00	0.0	0.0
5306.80	0.0	0.0
5307.00	0.0	0.0
5307.80	0.0	0.0
5308.80	0.0	0.0
5309.80	0.0	0.0
5310.80	0.0	0.0
5311.80	0.0	0.0
5312.80	0.0	0.0
5313.60	0.0	0.0
5313.80	5.5	5.5
5314.30	19.4	19.4
5314.40	25.3	25.3
5314.50	31.5	31.5

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Company Name: BHP MINERALS
Filename: C:\BRIAN\LCOALSP User: Brian Sambirsky
Date: 12-21-1995 Time: 10:07:50
As built design hydrology calculation for Lowe Stockpile Pond Spillway
Storm: 1.60 inches, 25 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

ELEVATION-AREA-CAPACITY-DISCHARGE TABLE

J1, B1, S1
Lowe Stockpile Pond

Drainage Area from J1, B1, S1, SWS(s)1: 51.8 acres
Total Contributing Drainage Area: 51.8 acres

SW#1: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	
5300.80	0.00	0.00	0.00	0.00	
5301.00	0.20	0.01	0.00	0.00	
5301.80	1.00	0.08	0.03	0.00	
5302.00	1.20	0.11	0.05	0.00	
5302.80	2.00	0.20	0.18	0.00	
5303.00	2.20	0.23	0.22	0.00	
5303.80	3.00	0.32	0.44	0.00	
5304.00	3.20	0.35	0.51	0.00	
5304.80	4.00	0.39	0.80	0.00	
5305.00	4.20	0.40	0.88	0.00	
5305.80	5.00	0.43	1.22	0.00	
5306.00	5.20	0.44	1.30	0.00	
5306.80	6.00	0.46	1.66	0.00	
5307.00	6.20	0.47	1.76	0.00	
5307.80	7.00	0.49	2.14	0.00	
5308.80	8.00	0.52	2.65	0.00	
5309.80	9.00	0.56	3.20	0.00	
5310.80	10.00	0.59	3.77	0.00	
5311.80	11.00	0.63	4.39	0.00	
5312.80	12.00	0.67	5.04	0.00	
5313.60	12.80	0.70	5.59	0.00	Stage of SW#1
5313.80	13.00	0.70	5.73	5.54	
5314.15	13.35	0.74	5.98	15.28	Peak Stage
5314.30	13.50	0.75	6.09	19.41	
5314.40	13.60	0.76	6.17	25.30	
5314.50	13.70	0.77	6.24	31.51	

****

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

SOUTHWEST DIXON POND HYDROLOGY - 100 YR 6 HR STORM EVENT

by

Name: BEN HOSKIE

Company Name: BHP MINERALS
File Name: C:\BEN\PONDS\SWDXPND

Date: 07-05-1998

Civil Software Design -- SEDCAD+ Version 3.1
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Company Name: BHP MINERALS
Filename: C:\BEN\PONDS\SWDXPND User: BEN HOSKIE
Date: 07-05-1998 Time: 15:58:23
SOUTHWEST DIXON POND HYDROLOGY - 100 YR 6 HR STORM EVENT
Storm: 2.10 inches, 100 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

==========
GENERAL INPUT TABLE
==========

STORM #1:

User-Defined Distribution

Label: type II-65

	Accumulated Time (hrs)	Accumulated Dimensionless Depth
1	0.0	0.000
2	0.5	0.006
3	1.0	0.012
4	1.5	0.019
5	2.0	0.026
6	2.5	0.034
7	3.0	0.043
8	3.5	0.055
9	4.0	0.067
10	4.5	0.083
11	5.0	0.105
12	5.5	0.139
13	6.0	0.711
14	6.5	0.789
15	7.0	0.819
16	7.5	0.837
17	8.0	0.851
18	8.5	0.861
19	9.0	0.872
20	9.5	0.880
21	10.0	0.888
22	10.5	0.894
23	11.0	0.900
24	11.5	0.905
25	12.0	0.910
26	12.5	0.915
27	13.0	0.920
28	13.5	0.925
29	14.0	0.930
30	14.5	0.934
31	15.0	0.938
32	15.5	0.943
33	16.0	0.947

34	16.5	0.951
35	17.0	0.954
36	17.5	0.958
37	18.0	0.962
38	18.5	0.966
39	19.0	0.969
40	19.5	0.973
41	20.0	0.976
42	20.5	0.979
43	21.0	0.982
44	21.5	0.985
45	22.0	0.988
46	22.5	0.991
47	23.0	0.994
48	23.5	0.997
49	24.0	1.000

****

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Company Name: BHP MINERALS
Filename: C:\BEN\PONDS\SWDXPND User: BEN HOSKIE
Date: 07-05-1998 Time: 15:58:23
SOUTHWEST DIXON POND HYDROLOGY - 100 YR 6 HR STORM EVENT
Storm: 2.10 inches, 100 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	37.80	80	F	0.355	0.000	0.000	0.0	2.01	33.73
		Type: Null			Label: SOUTHWEST DIXON POND					
111	Structure	37.80							2.01	
111	Total IN/OUT	37.80							2.01	33.73

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Company Name: BHP MINERALS
Filename: C:\BEN\PONDS\SWDXPND User: BEN HOSKIE
Date: 07-08-1998 Time: 15:58:23
SOUTHWEST DIXON POND HYDROLOGY - 100 YR 6 HR STORM EVENT
Storm: 2.10 inches, 100 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	872.52	7.45	2.73	0.09			
				-b	5	872.52	7.45	2.73	0.09			
				-c	5	872.52	7.45	2.73	0.09			
				-d	5	872.52	7.45	2.73	0.09	0.355		

Pages 110-114 Left Blank For Formatting Purposes

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

VINNEL POND HYDROLOGY

by

Name: BEN HOSKIE

Company Name: BHP MINERALS
File Name: C:\BEN\VINNEL\VINNEL

Date: 04-23-1998

Civil Software Design -- SEDCAD+ Version 3.1
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Company Name: BHP MINERALS
Filename: C:\BEN\VINNEL\VINNEL User: BEN HOSKIE
Date: 04-23-1998 Time: 12:17:53
VINNEL POND HYDROLOGY
Storm: 1.58 inches, 10 year-24 hour, type II-60
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	19.10	76	M	0.194	0.000	0.000	0.0	0.33	2.84
111	2	70.00	76	M	0.754	0.061	0.352	0.0	1.21	4.68
		Type: Null Label: J1B1S1								
111	Structure	89.10							1.54	
111	Total IN/OUT	89.10							1.54	6.00
121	1	187.40	76	M	1.829	0.000	0.000	0.0	3.24	7.23
		Type: Culvert Label: CP-123								
121	Structure	187.40							3.24	
121	Total IN/OUT	187.40							3.24	7.23
211	1	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
		Type: Pond Label: VINNEL POND								
211	Structure	0.00							4.78	
211	Total IN	276.50							4.78	11.06
211	Total OUT								4.78	10.05
111 to 211 Routing						0.021	0.387			

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Company Name: BHP MINERALS
Filename: C:\BEN\VINNEL\VINNEL User: BEN HOSKIE
Date: 04-23-1998 Time: 12:17:53
VINNEL POND HYDROLOGY
Storm: 1.58 inches, 10 year-24 hour, type II-60
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	1315.00	3.54	1.88	0.19	0.194		
1	1	1	2	-a	5	2850.00	1.10	1.05	0.75	0.754		
1	1	1	2	-1	8	900.15	1.83	4.06	0.06		0.061	0.352
1	2	1	1	-a	5	6785.00	1.06	1.03	1.83	1.829		
2	1	1	1	-a	8	455.00	3.85	5.88	0.02	0.000		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

VINNEL POND HYDROLOGY - SPILLWAY

by

Name: BEN HOSKIE

Company Name: BHP MINERALS
File Name: C:\BEN\VINNEL\SPILL\SPILL

Date: 04-23-1998

Civil Software Design -- SEDCAD+ Version 3.1
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Company Name: BHP MINERALS
Filename: C:\BEN\VINNEL\SPILL\SPILL User: BEN HOSKIE
Date: 04-23-1998 Time: 07:52:14
VINNEL POND HYDROLOGY - SPILLWAY
Storm: 1.60 inches, 25 year- 6 hour, type II-60
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	19.10	76	M	0.194	0.000	0.000	0.0	0.34	5.24
111	2	70.00	76	M	0.754	0.061	0.352	0.0	1.26	8.79
		Type: Null Label: J1B1S1								
111	Structure	89.10							1.60	
111	Total IN/OUT	89.10							1.60	11.04
121	1	187.40	76	M	1.829	0.000	0.000	0.0	3.37	13.14
		Type: Culvert Label: CP-123								
121	Structure	187.40							3.37	
121	Total IN/OUT	187.40							3.37	13.14
211	1	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
		Type: Pond Label: VINNEL POND								
211	Structure	0.00							4.97	
211	Total IN	276.50							4.97	19.60
211	Total OUT								4.97	17.95
111 to 211 Routing						0.021	0.387			

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Company Name: BHP MINERALS
Filename: C:\BEN\VINNEL\SPILL\SPILL User: BEN HOSKIE
Date: 04-23-1998 Time: 07:52:14
VINNEL POND HYDROLOGY - SPILLWAY
Storm: 1.60 inches, 25 year- 6 hour, type II-60
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr	Muskingum K (hr)	X
1	1	1	1	-a	5	1315.00	3.54	1.88	0.19	0.194		
1	1	1	2	-a	5	2850.00	1.10	1.05	0.75	0.754		
1	1	1	2	-1	8	900.13	1.83	4.06	0.06		0.061	0.352
1	2	1	1	-a	5	6785.00	1.06	1.03	1.83	1.829		
2	1	1	1	-a	8	455.00	3.85	5.88	0.02	0.000		

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Company Name: BHP MINERALS
Filename: C:\BEN\VINNEL\SPILL\SPILL User: BEN HOSKIE
Date: 04-23-1998 Time: 07:52:14
VINNEL POND HYDROLOGY - SPILLWAY
Storm: 1.60 inches, 25 year- 6 hour, type II-60
Hydrograph Convolution Interval: 0.1 hr

==========
POND INPUT/OUTPUT TABLE
==========

J2, B1, S1
VINNEL POND

Drainage Area from J2, B1, S1, SWS(s)1: 0.0 acres
Total Contributing Drainage Area: 276.5 acres

DISCHARGE OPTIONS:

	Emergency Spillway
Riser Diameter (in)	----
Riser Height (ft)	----
Barrel Diameter (in)	----
Barrel Length (ft)	----
Barrel Slope (%)	----
Manning's n of Pipe	----
Spillway Elevation	----
Lowest Elevation of Holes	----
# of Holes/Elevation	----
Entrance Loss Coefficient	----
Tailwater Depth (ft)	----
Notch Angle (degrees)	----
Weir Width (ft)	----
Siphon Crest Elevation	----
Siphon Tube Diameter (in)	----
Siphon Tube Length (ft)	----
Manning's n of Siphon	----
Siphon Inlet Elevation	----
Siphon Outlet Elevation	----
Emergency Spillway Elevation	5369.1
Crest Length (ft)	20.0
Z:1 (Left and Right)	3.0 3.0
Bottom Width (ft)	26.7

POND RESULTS:

Permanent Pool (ac-ft)
10.5

	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN	4.97	19.60
OUT	4.97	17.95

Peak Elevation	Hydrograph Detention Time (hrs)
5369.5	0.00

****

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Company Name: BHP MINERALS
Filename: C:\BEN\VINNEL\SPILL\SPILL User: BEN HOSKIE
Date: 04-23-1998 Time: 07:52:14
VINNEL POND HYDROLOGY - SPILLWAY
Storm: 1.60 inches, 25 year- 6 hour, type II-60
Hydrograph Convolution Interval: 0.1 hr

ELEVATION-DISCHARGE TABLE

J2, B1, S1
VINNEL POND

Drainage Area from J2, B1, S1, SWS(s)1: 0.0 acres
Total Contributing Drainage Area: 276.5 acres

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
5356.00	0.0	0.0
5356.50	0.0	0.0
5357.00	0.0	0.0
5357.50	0.0	0.0
5358.00	0.0	0.0
5358.50	0.0	0.0
5359.00	0.0	0.0
5359.50	0.0	0.0
5360.00	0.0	0.0
5360.50	0.0	0.0
5361.00	0.0	0.0
5361.50	0.0	0.0
5362.00	0.0	0.0
5362.50	0.0	0.0
5363.00	0.0	0.0
5363.50	0.0	0.0
5364.00	0.0	0.0
5364.50	0.0	0.0
5365.00	0.0	0.0
5365.50	0.0	0.0
5366.00	0.0	0.0
5366.50	0.0	0.0
5367.00	0.0	0.0
5367.50	0.0	0.0
5368.00	0.0	0.0
5368.50	0.0	0.0
5369.00	0.0	0.0
5369.10	0.0	0.0
5369.50	17.2	17.2
5369.70	25.7	25.7
5369.80	33.1	33.1
5369.90	43.2	43.2
5370.00	53.1	53.1

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Company Name: BHP MINERALS
Filename: C:\BEN\VINNEL\SPILL\SPILL User: BEN HOSKIE
Date: 04-23-1998 Time: 07:52:14
VINNEL POND HYDROLOGY - SPILLWAY
Storm: 1.60 inches, 25 year- 6 hour, type II-60
Hydrograph Convolution Interval: 0.1 hr

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

J2, B1, S1
VINNEL POND

Drainage Area from J2, B1, S1, SWS(s)1: 0.0 acres
Total Contributing Drainage Area: 276.5 acres

SW#1: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	
5356.00	0.00	0.00	0.00	0.00	
5356.50	0.50	0.07	0.01	0.00	
5357.00	1.00	0.26	0.09	0.00	
5357.50	1.50	0.37	0.25	0.00	
5358.00	2.00	0.50	0.46	0.00	
5358.50	2.50	0.56	0.73	0.00	
5359.00	3.00	0.63	1.03	0.00	
5359.50	3.50	0.66	1.35	0.00	
5360.00	4.00	0.69	1.69	0.00	
5360.50	4.50	0.71	2.04	0.00	
5361.00	5.00	0.74	2.40	0.00	
5361.50	5.50	0.77	2.78	0.00	
5362.00	6.00	0.80	3.17	0.00	
5362.50	6.50	0.82	3.57	0.00	
5363.00	7.00	0.85	3.99	0.00	
5363.50	7.50	0.88	4.42	0.00	
5364.00	8.00	0.91	4.87	0.00	
5364.50	8.50	0.94	5.33	0.00	
5365.00	9.00	0.97	5.81	0.00	
5365.50	9.50	1.00	6.31	0.00	
5366.00	10.00	1.04	6.82	0.00	
5366.50	10.50	1.09	7.35	0.00	
5367.00	11.00	1.14	7.90	0.00	
5367.50	11.50	1.19	8.48	0.00	
5368.00	12.00	1.23	9.09	0.00	
5368.50	12.50	1.29	9.72	0.00	
5369.00	13.00	1.34	10.37	0.00	
5369.10	13.10	1.35	10.51	0.00	Stage of SW#1
5369.50	13.50	1.41	11.06	17.16	
5369.52	13.52	1.41	11.09	17.95	Peak Stage
5369.70	13.70	1.44	11.35	25.74	
5369.80	13.80	1.45	11.49	33.09	
5369.90	13.90	1.47	11.64	43.20	
5370.00	14.00	1.48	11.78	53.12	

****

SEDCAD+ RIPRAP CHANNEL DESIGN

VINNEL POND INLET

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	19.60 cfs	
Slope	8.60 %	
Sideslopes (L and R)	4.20:1	4.20:1
Bottom Width	14.00 feet	
Freeboard	.3 ft	

RESULTS:

Steep Slope Design - Simons/OSM Method

Depth	0.17 ft
with Freeboard	0.47 ft
Top Width	15.43 ft
with Freeboard	17.95 ft
Velocity	7.85 fps
Cross Sectional Area	2.50 sq ft
Hydraulic Radius	0.16 ft
Manning's n	0.031
Froude Number	3.44
Dmax	0.313 ft (3.75 in)
D50	0.250 ft (3.00 in)
D10	0.083 ft (1.00 in)

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

VINNEL POND HYDROLOGY - EAST SIDE DITCH

by

Name: BEN HOSKIE

Company Name: BHP MINERALS
File Name: C:\BEN\VINNEL\SDITCH\SD

Date: 04-23-1998

Civil Software Design -- SEDCAD+ Version 3.1
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Company Name: BHP MINERALS
Filename: C:\BEN\VINNEL\SDITCH\SD User: BEN HOSKIE
Date: 04-23-1998 Time: 10:43:28
VINNEL POND HYDROLOGY - EAST SIDE DITCH
Storm: 1.80 inches, 2 year- 6 hour, type II-60
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	19.10	76	M	0.194	0.000	0.000	0.0	0.01	0.06
111	2	70.00	76	M	0.754	0.061	0.352	0.0	0.04	0.16
		Type: Null Label: J1B1S1								
111	Structure	89.10							0.05	
111	Total IN/OUT	89.10							0.05	0.21
121	1	187.40	76	M	1.829	0.000	0.000	0.0	0.10	0.34
		Type: Culvert Label: CP-123								
121	Structure	187.40							0.10	
121	Total IN/OUT	187.40							0.10	0.34
211	1	0.00	0	M	0.000	0.000	0.000	0.0	0.00	0.00
		Type: Pond Label: VINNEL POND								
211	Structure	0.00							0.15	
211	Total IN	276.50							0.15	0.53
211	Total OUT								0.16	0.52
111 to 211 Routing						0.021	0.387			

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Company Name: BHP MINERALS
Filename: C:\BEN\VINNEL\SDITCH\SD User: BEN HOSKIE
Date: 04-23-1998 Time: 10:43:28
VINNEL POND HYDROLOGY - EAST SIDE DITCH
Storm: 1.80 inches, 2 year- 6 hour, type II-60
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

J	B	S	SWS	Seg. #	Land Flow Condition	Distance (ft)	Slope (%)	Velocity (fps)	Segment Time (hr)	Time Conc. (hr)	Muskingum K (hr)	Muskingum X
1	1	1	1	-a	5	1315.00	3.54	1.88	0.19	0.194		
1	1	1	2	-a	5	2850.00	1.10	1.05	0.75	0.754		
1	1	1	2	-1	8	900.15	1.83	4.06	0.06		0.061	0.352
1	2	1	1	-a	5	6785.00	1.06	1.03	1.83	1.829		
2	1	1	1	-a	8	455.00	3.85	5.88	0.02	0.000		

SEDCAD+ ERODIBLE CHANNEL DESIGN

BIGHAN RECLAIM RUNOFF - EAST SIDE DITCH

Limiting Velocity Technique
Sediment-laden Water

INPUT VALUES:

Shape	TRIANGULAR	
Discharge	0.34 cfs	
Slope	4.20 %	
Sideslopes	3.00:1 (L)	2.00:1 (R)
Manning's n	0.025	
Max. Velocity	5.00 fps	
Material	SPOIL	
Freeboard	None	

RESULTS:

Actual Discharge	0.34 cfs
Depth	0.22 ft
with Freeboard	0.00 ft
Top Width	1.12 ft
with Freeboard	0.00 ft
Velocity	2.70 fps
Cross Sectional Area	0.13 sq ft
Hydraulic Radius	0.10 ft
Froude Number	1.42

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Lowe Impoundment #1

Lowe Permanent Impoundment was changed to Lowe Impoundment #1. No max. sediment or water level because this structure is not conidered a sediment structure. Spillway will be designed for a 25 yr- 6hr storm event.

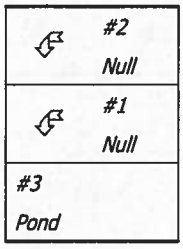
Shawn Smith

Navajo Coal Company
P.O. Box 1717
Fruitland, NM 87414

Phone: (505) 598-3376
Email: shawn.smith@bhpbilliton.com

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	#3	0.052	0.343	North Inlet - Structure 2
Null	#2	==>	#3	0.000	0.453	East Inlet - Structure 3
Pond	#3	==>	End	0.000	0.000	Pond - Structure 14



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	8. Large gullies, diversions, and low flowing streams	1.55	11.00	710.00	3.73	0.052
#1	**Muskingum K:**					**0.052**
#2	8. Large gullies, diversions, and low flowing streams	30.00	3.00	10.00	16.43	0.000
#2	**Muskingum K:**					**0.000**

Structure Detail:

Structure #2 (Null)

East Inlet - Structure 3

Structure #1 (Null)

North Inlet - Structure 2

Structure #3 (Pond)

Pond - Structure 14

Pond Inputs:

Initial Pool Elev:	5,346.00 ft
Initial Pool:	12.73 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
5,346.00	50.00	4.50:1	4.50:1	50.00

Pond Results:

Peak Elevation:	5,347.56 ft
Dewater Time:	0.61 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)	
5,340.00	0.920	0.000	0.000		
5,341.00	1.520	1.208	0.000		
5,342.00	1.760	2.846	0.000		
5,343.00	2.010	4.730	0.000		
5,344.00	2.350	6.907	0.000		
5,345.00	2.860	9.508	0.000		
5,346.00	3.600	12.731	0.000		Spillway #1
5,346.50	3.915	14.609	47.137	11.20	
5,347.00	4.230	16.645	94.274	1.25	
5,347.56	4.594	19.172	241.908	2.30	Peak Stage
5,348.00	4.880	21.196	360.209		

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)
#2	1	256.850	2.055	0.510	0.336	83.500	M	37.90	7.774
	2	138.830	0.315	0.510	0.336	83.500	M	75.09	4.219
	3	54.830	0.221	0.510	0.336	83.500	M	34.64	1.674
	4	98.180	0.277	0.176	0.362	83.500	M	56.37	2.989
	5	111.920	0.466	0.176	0.362	83.500	M	48.73	3.393
	6	37.910	0.159	0.418	0.309	83.500	M	26.65	1.172
	7	105.790	0.386	0.000	0.000	83.500	M	51.46	3.206
	Σ	**804.310**						**189.79**	**24.427**
#1	1	549.140	2.696	0.436	0.369	83.600	M	65.42	16.758
	2	191.140	0.472	0.000	0.000	83.600	M	83.31	5.848
	3	98.180	0.205	0.000	0.000	83.600	M	64.19	3.005
	Σ	**838.460**						**125.79**	**25.611**
#3	Σ	**1,642.770**						**279.19**	**50.038**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	0.77	60.00	7,840.00	0.870	2.503
		8. Large gullies, diversions, and low flowing streams	1.22	28.00	2,301.00	3.300	0.193
#1	**1**	**Time of Concentration:**					**2.696**
#1	2	5. Nearly bare and untilled, and alluvial valley fans	3.97	23.00	580.00	1.990	0.080
		8. Large gullies, diversions, and low flowing streams	2.60	178.00	6,838.00	4.840	0.392
#1	**2**	**Time of Concentration:**					**0.472**
#1	3	5. Nearly bare and untilled, and alluvial valley fans	13.68	45.00	329.00	3.690	0.024
		8. Large gullies, diversions, and low flowing streams	3.12	108.00	3,466.00	5.290	0.181
#1	**3**	**Time of Concentration:**					**0.205**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	0.79	46.00	5,799.00	0.890	1.809
		8. Large gullies, diversions, and low flowing streams	3.31	160.00	4,837.00	5.450	0.246
#2	**1**	**Time of Concentration:**					**2.055**
#2	2	5. Nearly bare and untilled, and alluvial valley fans	4.93	75.00	1,521.00	2.220	0.190

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	6	8. Large gullies, diversions, and low flowing streams	0.84	35.00	4,143.48	2.750	0.418
#2	**6**	**Muskingum K:**					**0.418**

Lowe Hole 3 Pond 2

The watershed area is presented on Exhibit 11-13D&E. The as-built is presented on Exhibit 127D. This run reflects the reconstruction of the spillway in February 2003.

LR

BHP Navajo Coal Company
Navajo Mine
PO Box 1717
Fruitland, NM 87415

Phone: 505-598-5861

General Information

Storm Information:

Storm Type:	NRCS Type II-60
Design Storm:	25 yr - 6 hr
Rainfall Depth:	1.600 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Pond	#1	==>	End	0.000	0.000	Lowe Hole 3 Pond 2

#1
Pond

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	In	628.700	628.700	113.71	34.30
	Out			109.09	34.20

Structure Detail:

Structure #1 (Pond)

Lowe Hole 3 Pond 2

Pond Inputs:

Initial Pool Elev:	5,352.50
Initial Pool:	9.79 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
5,352.50	25.00	8.00:1	9.50:1	10.80

Pond Results:

Peak Elevation:	5,354.17
Dewater Time:	1.00 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)
5,343.50	0.038	0.000	0.000	
5,344.00	0.171	0.048	0.000	
5,344.50	0.373	0.181	0.000	
5,345.00	0.652	0.434	0.000	
5,345.50	0.829	0.803	0.000	
5,346.00	1.028	1.267	0.000	
5,346.50	1.069	1.791	0.000	
5,347.00	1.110	2.336	0.000	
5,347.50	1.147	2.900	0.000	
5,348.00	1.184	3.482	0.000	
5,348.50	1.223	4.084	0.000	
5,349.00	1.262	4.705	0.000	
5,349.50	1.302	5.346	0.000	
5,350.00	1.342	6.007	0.000	
5,350.50	1.402	6.693	0.000	
5,351.00	1.463	7.409	0.000	
5,351.50	1.545	8.161	0.000	

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
5,352.00	1.630	8.955	0.000		
5,352.50	1.725	9.793	0.000		Spillway #1
5,353.00	1.820	10.680	0.713	15.04*	
5,353.50	2.010	11.637	34.257	6.90	
5,353.60	2.049	11.840	42.386	0.35	
5,354.00	2.207	12.690	84.318	0.95	
5,354.17	2.369	13.095	109.087	0.85	Peak Stage
5,354.50	2.554	13.880	157.028		
5,355.00	2.926	15.248	259.761		

**Designates time(s) to dewater have been extrapolated beyond the 50 hour hydrograph limit.*

Detailed Discharge Table

Elevation	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
5,343.50	0.000	0.000
5,344.00	0.000	0.000
5,344.50	0.000	0.000
5,345.00	0.000	0.000
5,345.50	0.000	0.000
5,346.00	0.000	0.000
5,346.50	0.000	0.000
5,347.00	0.000	0.000
5,347.50	0.000	0.000
5,348.00	0.000	0.000
5,348.50	0.000	0.000
5,349.00	0.000	0.000
5,349.50	0.000	0.000
5,350.00	0.000	0.000
5,350.50	0.000	0.000
5,351.00	0.000	0.000
5,351.50	0.000	0.000
5,352.00	0.000	0.000
5,352.50	0.000	0.000
5,353.00	0.713	0.713
5,353.50	34.257	34.257
5,353.60	42.386	42.386
5,354.00	84.318	84.318

Elevation	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
5,354.50	157.028	157.028
5,355.00	259.761	259.761

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	628.700	2.360	0.000	0.000	88.000	M	113.71	34.299
	Σ	**628.700**						**113.71**	**34.299**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	2.06	250.00	12,150.00	1.430	2.360
#1	**1**	**Time of Concentration:**					**2.360**

General Information

Storm Information:

Storm Type:	NRCS Type II-60
Design Storm:	2 yr - 6 hr
Rainfall Depth:	0.800 inches

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	In	628.700	628.700	23.79	7.70
	Out			21.51	7.61

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Lowehole-3, Pond-3 As Built

PJF

BHP Coal Company - Navajo Mine
PO Box 1717
Fruitland, NM 87416

Phone: (505) 598-3206

General Information

Storm Information:

Storm Type:	Type II-65
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.100 Inches

Structure Networking:

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

#1
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	39.610	0.191	0.000	0.000	79.670	M	32.45	2.01
	Σ	**39.610**						**32.45**	**2.01**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	5.89	98.00	1,665.00	2.420	0.191
#1	**1**	**Time of Concentration:**					**0.191**

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

LOWE HOLE 3 POND 3 INLET HYDROLOGY

by

Name: RUSSELL HARRIS

Company Name: BHP MINERALS
File Name: C:\RUSSWORK\LOWE_PON\LH3_PD3I

Date: 09-03-1997

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

Company Name: BHP MINERALS
Filename: C:\RUSSWORK\LOWE_PON\LH3_PD3I User: RUSSELL HARRIS
Date: 09-03-1997 Time: 12:50:53
LOWE HOLE 3 POND 3 INLET HYDROLOGY
Storm: 1.30 inches, 10 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	11.70	80	M	0.116	0.000	0.000	0.0	0.19	6.03
		Type: Null			Label: LH3PD3INLET					
111	Structure	11.70							0.19	
111	Total IN/OUT	11.70							0.19	6.03

SEDCAD+ ERODIBLE CHANNEL DESIGN

LH3 POND 3 INLET DESIGN

Limiting Velocity Technique
Sediment-laden Water

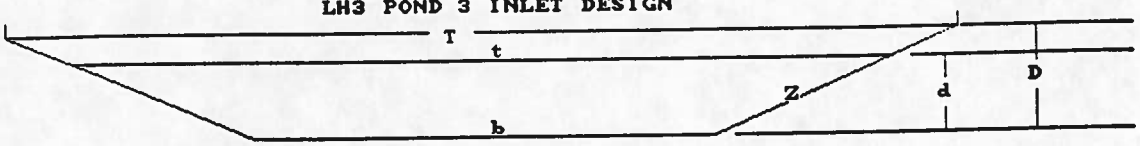
INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	6.03 cfs	
Slope	4.00 %	
Sideslopes	3.00:1 (L)	3.00:1 (R)
Bottom Width	8.00 ft	
Manning's n	0.020	
Max. Velocity	5.00 fps	
Material	SPOIL, SHALE/SANDSTONE COBBLES	
Freeboard	1 ft	

RESULTS:

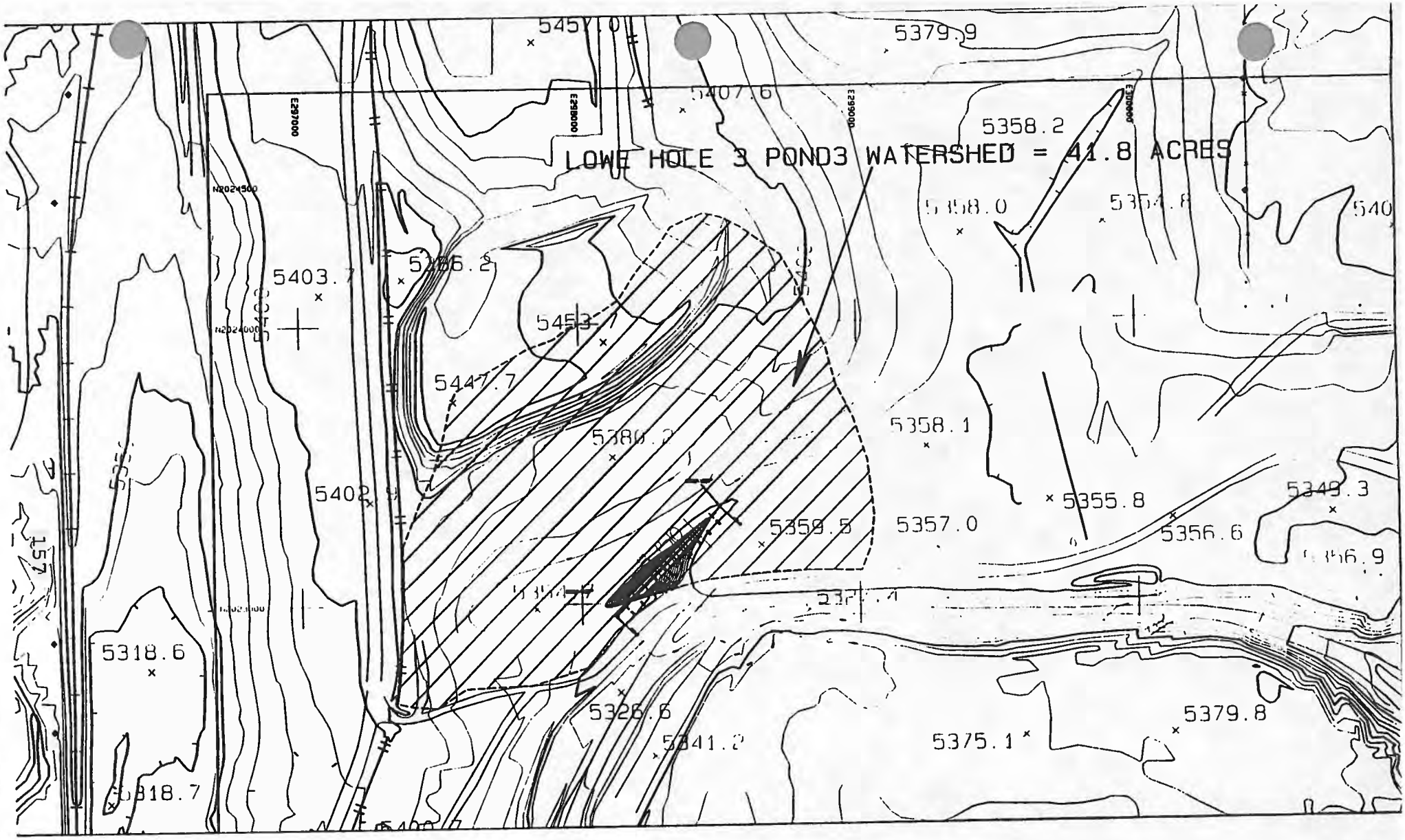
Actual Discharge	6.03 cfs
Depth	0.17 ft
with Freeboard	1.17 ft
Top Width	8.99 ft
with Freeboard	14.99 ft
Velocity	4.30 fps
Cross Sectional Area	1.40 sq ft
Hydraulic Radius	0.16 ft
Froude Number	1.92

SEDCAD+ CHANNEL DESIGN
LH3 POND 3 INLET DESIGN



MATERIAL: SPOIL, SHALE/SANDSTONE COBBLES
Limiting Variable: Velocity = 5.000 fps
Sediment-laden Water

Discharge	=	6.03 cfs	Depth (d)	=	0.17	(D =	w/ Freeboard: 1.17) ft
Bottom (b)	=	8.00 ft	Top width (t)	=	8.99	(T =	14.99) ft
Side slopes (Z)	=	3.0:1(L) 3.0:1(R)	Velocity	=	4.30 fps		
Bed Slope	=	4.00 %	Hydraulic Radius	=	0.16 ft		
Manning's n	=	0.020	Froude number	=	1.92		


LOWE HOLE 3 POND3 WATERSHED = 41.8 ACRES
5379.9
5407.6
5358.2
5358.0
5403.7
5453.7
5447.7
5380.2
5358.1
5402.9
5355.8
5349.3
5359.5
5357.0
5356.6
5318.6
5326.6
5341.2
5375.1
5379.8
5318.7

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Civil Software Design

Employee Coal Dump Modification

LR

BHP Navajo Coal Company
PO Box 1717
Fruitland, NM 87416

Phone: 505-598-5861

General Information

Storm Information:

Storm Type:	Type II - 60
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	6.200	6.200	12.12	0.53

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	6.200	0.124	0.000	0.000	89.000	M	12.12	0.531
	Σ	**6.200**						**12.12**	**0.531**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	3.72	32.00	860.00	1.920	0.124
#1	**1**	**Time of Concentration:**					**0.124**

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Block C Pond 1

This pond has a single closed spillway. It is re-evaluated as a total containment structure for the 100 year-6 hour storm. The curve number was adjusted to account for the reclaimed lands. Refer to Section 11.5.4.3 of the mine permit for discussion on ponds with a single closed spillway. The pond location and watershed areas are presented on Exhibit 11-13 C & D.

LR

BHP Navajo Coal Company
PO Box 1717
Fruitland, NM
87416

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General Information

Storm Information:

Storm Type:	Type II-60
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Pond	#1	==>	End	0.000	0.000	BC POND 1

#1
Pond

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	In	49.480	49.480	38.54	2.49
	Out			0.00	0.00

Structure Detail:

Structure #1 (Pond)

BC POND 1

Pond Inputs:

Initial Pool Elev:	5,296.25
Initial Pool:	0.00 ac-ft

Straight Pipe

Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev	Entrance Loss Coefficient	Tailwater Depth (ft)
24.00	120.00	4.16	0.0160	5,312.30	0.50	0.00

Pond Results:

Peak Elevation:	~~5,305.23~~ 5306.53
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)
5,296.00	0.000	0.000	0.000	
5,296.25	0.008	0.001	0.000	
5,296.50	0.022	0.004	0.000	
5,297.00	0.064	0.025	0.000	
5,297.50	0.113	0.069	0.000	
5,298.00	0.177	0.141	0.000	
5,298.50	0.195	0.234	0.000	
5,299.00	0.215	0.336	0.000	
5,299.50	0.224	0.446	0.000	
5,300.00	0.233	0.560	0.000	
5,300.50	0.241	0.679	0.000	
5,301.00	0.249	0.801	0.000	
5,301.50	0.258	0.928	0.000	
5,302.00	0.267	1.059	0.000	
5,302.50	0.276	1.195	0.000	
5,303.00	0.286	1.336	0.000	

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
5,303.50	0.296	1.481	0.000		
5,304.00	0.307	1.632	0.000		
5,304.50	0.317	1.788	0.000		
5,305.00	0.328	1.949	0.000		
5,305.23	0.333	2.025	0.000	~~0.00 - Peak Stage~~	
5,305.50	0.338	2.116	0.000		
5,306.00	0.349	2.288	0.000		
5,306.50	0.362	2.465	0.000	Elev. 5306.53 Peak Stage	
5,307.00	0.374	2.649	0.000		
5,307.50	0.387	2.840	0.000		
5,308.00	0.401	3.037	0.000		
5,308.50	0.415	3.241	0.000		
5,309.00	0.430	3.452	0.000		
5,309.50	0.444	3.671	0.000		
5,310.00	0.458	3.896	0.000		
5,310.50	0.472	4.129	0.000		
5,311.00	0.486	4.368	0.000		
5,311.50	0.500	4.614	0.000		
5,312.00	0.514	4.868	0.000		
5,312.30	0.524	5.023	0.000		Spillway #1
5,312.50	0.530	5.129	0.407		
5,313.00	0.545	5.398	2.457		
5,313.50	0.562	5.674	5.509		
5,314.00	0.579	5.960	9.288		
5,314.50	0.600	6.254	13.667		
5,315.00	0.622	6.560	17.519		

Detailed Discharge Table

Elevation	Straight Pipe (cfs)	Combined Total Discharge (cfs)
5,296.00	0.000	0.000
5,296.25	0.000	0.000
5,296.50	0.000	0.000
5,297.00	0.000	0.000
5,297.50	0.000	0.000
5,298.00	0.000	0.000
5,298.50	0.000	0.000
5,299.00	0.000	0.000

Elevation	Straight Pipe (cfs)	Combined Total Discharge (cfs)
5,299.50	0.000	0.000
5,300.00	0.000	0.000
5,300.50	0.000	0.000
5,301.00	0.000	0.000
5,301.50	0.000	0.000
5,302.00	0.000	0.000
5,302.50	0.000	0.000
5,303.00	0.000	0.000
5,303.50	0.000	0.000
5,304.00	0.000	0.000
5,304.50	0.000	0.000
5,305.00	0.000	0.000
5,305.50	0.000	0.000
5,306.00	0.000	0.000
5,306.50	0.000	0.000
5,307.00	0.000	0.000
5,307.50	0.000	0.000
5,308.00	0.000	0.000
5,308.50	0.000	0.000
5,309.00	0.000	0.000
5,309.50	0.000	0.000
5,310.00	0.000	0.000
5,310.50	0.000	0.000
5,311.00	0.000	0.000
5,311.50	0.000	0.000
5,312.00	0.000	0.000
5,312.30	0.000	0.000
5,312.50	(3)>0.407	0.407
5,313.00	(3)>2.457	2.457
5,313.50	(3)>5.509	5.509
5,314.00	(3)>9.288	9.288
5,314.50	(3)>13.667	13.667
5,315.00	(5)>17.519	17.519

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	49.480	0.160	0.000	0.000	81.000	M	38.54	2.493
	Σ	**49.480**						**38.54**	**2.493**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	5.68	23.00	405.00	2.380	0.047
		8. Large guilies, diversions, and low flowing streams	3.96	97.00	2,449.00	5.970	0.113
#1	**1**	**Time of Concentration:**					**0.160**

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Block C Pond 2

This pond has a single closed spillway. It is re-evaluated as a total containment structure for the 100 year-6 hour storm. The curve number was adjusted to account for the reclaimed lands. Refer to Section 11.5.4.3 of the mine permit for discussion on ponds with a single closed spillway. The pond location and watershed areas are presented on Exhibit 11-13 C & D.

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LR

BHP Navajo Coal Company
PO Box 1717
Fruitland, NM
87416

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General Information

Storm Information:

Storm Type:	Type II-60
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Pond	#1	==>	End	0.000	0.000	Block C Pd 2

#1
Pond

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Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	In	66.640	66.640	62.07	4.42
	Out			0.00	0.00

Structure Detail:

Structure #1 (Pond)

Block C Pd 2

Pond Inputs:

Initial Pool Elev:	5,300.20
Initial Pool:	0.00 ac-ft

Straight Pipe

Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev	Entrance Loss Coefficient	Tailwater Depth (ft)
24.00	120.00	3.00	0.0160	5,308.90	0.50	0.00

Pond Results:

Peak Elevation:	~~5,306.42~~ 5307.41
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)
5,300.00	0.359	0.000	0.000	
5,300.20	0.378	0.074	0.000	
5,300.50	0.407	0.191	0.000	
5,301.00	0.458	0.408	0.000	
5,301.50	0.482	0.643	0.000	
5,302.00	0.507	0.890	0.000	
5,302.50	0.528	1.149	0.000	
5,303.00	0.549	1.418	0.000	
5,303.50	0.571	1.698	0.000	
5,304.00	0.594	1.989	0.000	
5,304.50	0.618	2.292	0.000	
5,305.00	0.643	2.607	0.000	
5,305.50	0.676	2.937	0.000	
5,306.00	0.710	3.284	0.000	
5,306.42	0.760	3.595	0.000	~~0.00 Peak Stage~~
5,306.50	0.767	3.653	0.000	

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
5,307.00	0.827	4.051	0.000	Elev. 5307.41 Peak Stage	
5,307.50	0.897	4.482	0.000		
5,308.00	0.970	4.949	0.000		
5,308.50	1.068	5.458	0.000		
5,308.90	1.149	5.902	0.000		Spillway #1
5,309.00	1.169	6.018	0.145		
5,309.50	1.338	6.644	1.951		
5,310.00	1.518	7.358	4.838		
5,310.50	1.740	8.171	8.478		
5,311.00	1.978	9.100	12.746		

Detailed Discharge Table

Elevation	Straight Pipe (cfs)	Combined Total Discharge (cfs)
5,300.00	0.000	0.000
5,300.20	0.000	0.000
5,300.50	0.000	0.000
5,301.00	0.000	0.000
5,301.50	0.000	0.000
5,302.00	0.000	0.000
5,302.50	0.000	0.000
5,303.00	0.000	0.000
5,303.50	0.000	0.000
5,304.00	0.000	0.000
5,304.50	0.000	0.000
5,305.00	0.000	0.000
5,305.50	0.000	0.000
5,306.00	0.000	0.000
5,306.50	0.000	0.000
5,307.00	0.000	0.000
5,307.50	0.000	0.000
5,308.00	0.000	0.000
5,308.50	0.000	0.000
5,308.90	0.000	0.000
5,309.00	(3)>0.145	0.145
5,309.50	(3)>1.951	1.951
5,310.00	(3)>4.838	4.838
5,310.50	(3)>8.478	8.478

Elevation	Straight Pipe (cfs)	Combined Total Discharge (cfs)
5,311.00	(3)>12.746	12.746

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	66.640	0.208	0.000	0.000	85.000	M	62.07	4.416
	Σ	**66.640**						**62.07**	**4.416**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	8.27	67.00	810.00	2.870	0.078
		8. Large gullies, diversions, and low flowing streams	2.54	57.00	2,242.00	4.780	0.130
#1	**1**	**Time of Concentration:**					**0.208**

BLOCK C POND 3

This Pond is evaluated as a total containment structure for the 100 year-6 hour storm. The curve number was adjusted to account for the reclaimed lands. This pond location and watershed areas are presented on Exhibit 11-13 C&D.

Shawn Smith

Navajo Coal Company
P.O. Box 1717
Fruitland, NM 87416

Phone: (505) 598-3376
Email: shawn.smith@bhpbilliton.com

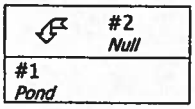
General Information

Storm Information:

Storm Type:	Type II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Pond	#1	==>	End	0.000	0.000	BLOCK C POND 3
Null	#2	==>	#1	0.257	0.346	



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	8. Large gullies, diversions, and low flowing streams	1.62	57.00	3,527.00	3.81	0.257
#2	**Muskingum K:**					**0.257**

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#2		137.510	137.510	90.84	8.89
#1	In	36.910	174.420	98.09	14.69
	Out			44.92	14.69

Structure Detail:

Structure #2 (Null)

Structure #1 (Pond)

BLOCK C POND 3

Pond Inputs:

Permanent Pool Elev:	5,273.00
Permanent Pool:	16.72 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
5,273.00	30.00	3.00:1	3.00:1	25.00

Pond Results:

Peak Elevation:	5,273.81
H'graph Detention Time:	1.01 hrs
Dewater Time:	0.43 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)	
5,266.00	1.460	0.000	0.000		
5,266.50	1.554	0.753	0.000		
5,267.00	1.650	1.554	0.000		
5,267.50	1.758	2.406	0.000		
5,268.00	1.870	3.313	0.000		
5,268.50	1.983	4.276	0.000		
5,269.00	2.100	5.297	0.000		
5,269.50	2.223	6.377	0.000		
5,270.00	2.350	7.521	0.000		
5,270.50	2.536	8.742	0.000		
5,271.00	2.730	10.058	0.000		
5,271.50	2.960	11.480	0.000		
5,272.00	3.200	13.020	0.000		
5,272.50	3.697	14.743	0.000		
5,273.00	4.230	16.723	0.000		Spillway #1
5,273.50	4.797	18.978	27.710	9.10	

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
5,273.81	5.178	20.561	44.919	1.20	Peak Stage
5,274.00	5.400	21.526	55.420		
5,274.50	5.937	24.360	121.915		
5,275.00	6.500	27.468	198.623		

Detailed Discharge Table

Elevation	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
5,266.00	0.000	0.000
5,266.50	0.000	0.000
5,267.00	0.000	0.000
5,267.50	0.000	0.000
5,268.00	0.000	0.000
5,268.50	0.000	0.000
5,269.00	0.000	0.000
5,269.50	0.000	0.000
5,270.00	0.000	0.000
5,270.50	0.000	0.000
5,271.00	0.000	0.000
5,271.50	0.000	0.000
5,272.00	0.000	0.000
5,272.50	0.000	0.000
5,273.00	0.000	0.000
5,273.50	27.710	27.710
5,274.00	55.420	55.420
5,274.50	121.915	121.915
5,275.00	198.623	198.623

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)
#2	1	137.510	0.569	0.000	0.000	84.630	M	90.84	8.89
	S	**137.510**						**90.84**	**8.89**
#1	1	36.910	0.267	0.000	0.000	84.380	M	35.45	2.35
	S	**174.420**						**98.09**	**14.69**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	1.56	53.00	3,398.59	3.740	0.252
		8. Large gullies, diversions, and low flowing streams	3.06	9.00	294.50	5.240	0.015
#1	**1**	**Time of Concentration:**					**0.267**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	5.60	146.00	2,606.25	2.360	0.306
		8. Large gullies, diversions, and low flowing streams	1.01	29.00	2,859.50	3.020	0.263
#2	**1**	**Time of Concentration:**					**0.569**

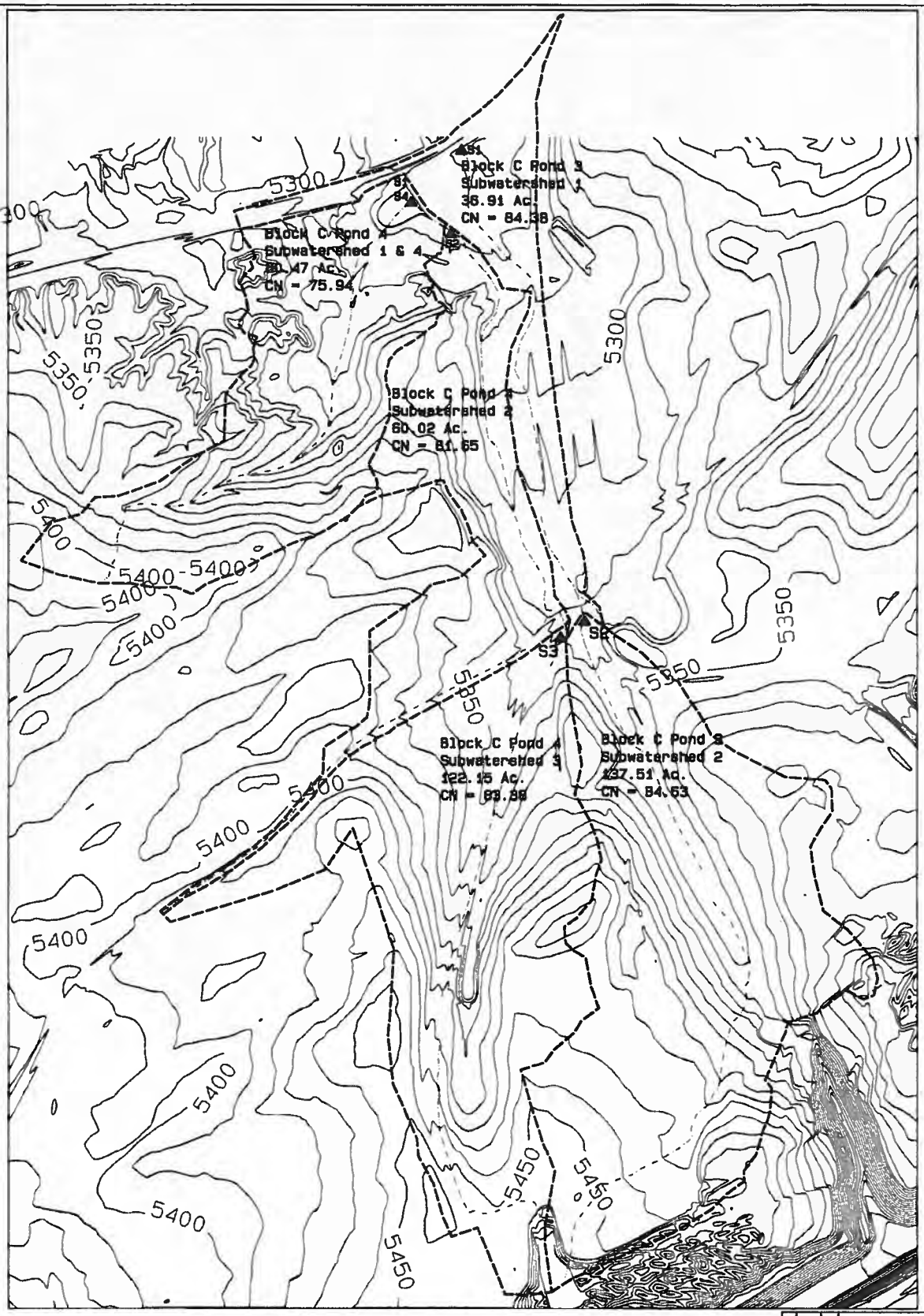


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EXHIBIT 11-13D

BHP NAVAJO COAL COMPANY

P.O. BOX 1717 FRUITLAND, NEW MEXICO 87416

STRUCTURE NETWORKING
BLOCK-C POND 3 AND POND 4
SUBWATERSHED
MAP

PREPARED BY	DRAWN BY PJF	SCALE 1"=1000'
APPROVED BY	DATE 7-16-07	

Block-C Pond 4

The watershed for the impoundment is presented on Exhibit 11-13D. The detail design is presented on Exhibit 11-136.

The pond is design to retain the runoff from the 100 year-6 hour storm event, therefore no spillway required.

Shawn Smith

Navajo Coal Company
P.O. Box 1717
Fruitland, NM 87416

Phone: (505) 598-3376
Email: shawn.smith@bhpbilliton.com

General Information

Storm Information:

Storm Type:	TYPE II-60
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#4	0.000	0.000	
Channel	#2	==>	#4	0.014	0.368	
Null	#3	==>	#2	0.231	0.344	
Null	#4	==>	End	0.000	0.000	Block-C Pond 4

		#3 *Null*
	#2 *Channel*	
	#1 *Channel*	
#4 *Null*		

Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	8. Large gullies, diversions, and low flowing streams	2.48	6.00	241.76	4.72	0.014
#2	**Muskingum K:**					**0.014**
#3	8. Large gullies, diversions, and low flowing streams	1.57	49.00	3,121.63	3.75	0.231
#3	**Muskingum K:**					**0.231**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#3	122.150	122.150	83.98	7.26
#2	60.020	182.170	106.02	10.43
#1	80.470	80.470	22.32	2.76
#4	0.000	262.640	128.27	13.19

Structure Detail:

Structure #3 (Null)

Structure #2 (Riprap Channel)

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	8.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Depth:	0.73 ft	1.73 ft
Top Width:	16.39 ft	22.39 ft
Velocity*:		
X-Section Area:	10.38 sq ft	
Hydraulic Radius:	0.624	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #1 (Riprap Channel)

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
8.00	3.0:1	3.0:1	20.0			

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Depth:	0.20 ft	0.00 ft

	w/o Freeboard	w/ Freeboard
Top Width:	9.17 ft	0.00 ft
Velocity*:		
X-Section Area:	1.68 sq ft	
Hydraulic Radius:	0.182	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #4 (Null)

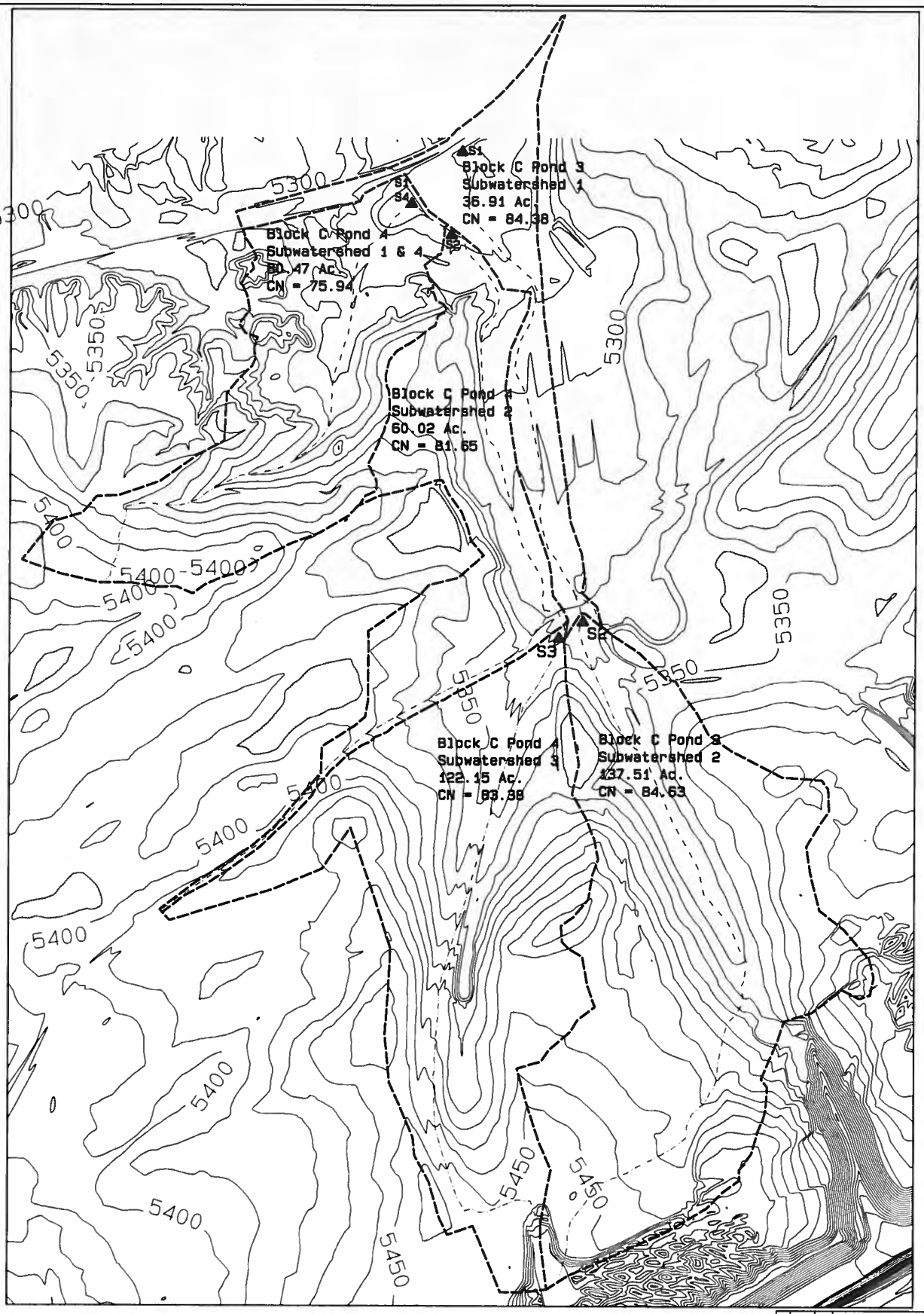
Block-C Pond 4

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)
#3	1	122.150	0.349	0.000	0.000	83.380	M	83.98	7.26
	S	**122.150**						**83.98**	**7.26**
#2	1	60.020	0.416	0.000	0.000	81.650	M	33.48	3.17
	S	**182.170**						**106.02**	**10.43**
#1	1	80.470	0.595	0.000	0.000	75.940	M	22.32	2.76
	S	**80.470**						**22.32**	**2.76**
#4	**S**	**262.640**						**128.27**	**13.19**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	3. Short grass pasture	6.44	35.00	543.36	2.030	0.074
		5. Nearly bare and untilled, and alluvial valley fans	3.06	100.00	3,269.04	1.740	0.521
#1	**1**	**Time of Concentration:**					**0.595**
#2	1	8. Large gullies, diversions, and low flowing streams	2.61	90.00	3,445.87	4.840	0.197
		8. Large gullies, diversions, and low flowing streams	1.54	45.00	2,926.82	3.710	0.219
#2	**1**	**Time of Concentration:**					**0.416**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	1.70	10.00	586.99	1.300	0.125
		8. Large gullies, diversions, and low flowing streams	3.08	131.00	4,259.27	5.260	0.224
#3	**1**	**Time of Concentration:**					**0.349**



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A	7/16/07	GD	BLOCK-C POND 3 WATERSHED MODIFIED AND POND 4 ADDED.	GD	KJ	LG
REV. No.	Date Submitted	DRAFT'T BY	REVISION DESCRIPTION	CHG. S.S.	PE	REV. APV.

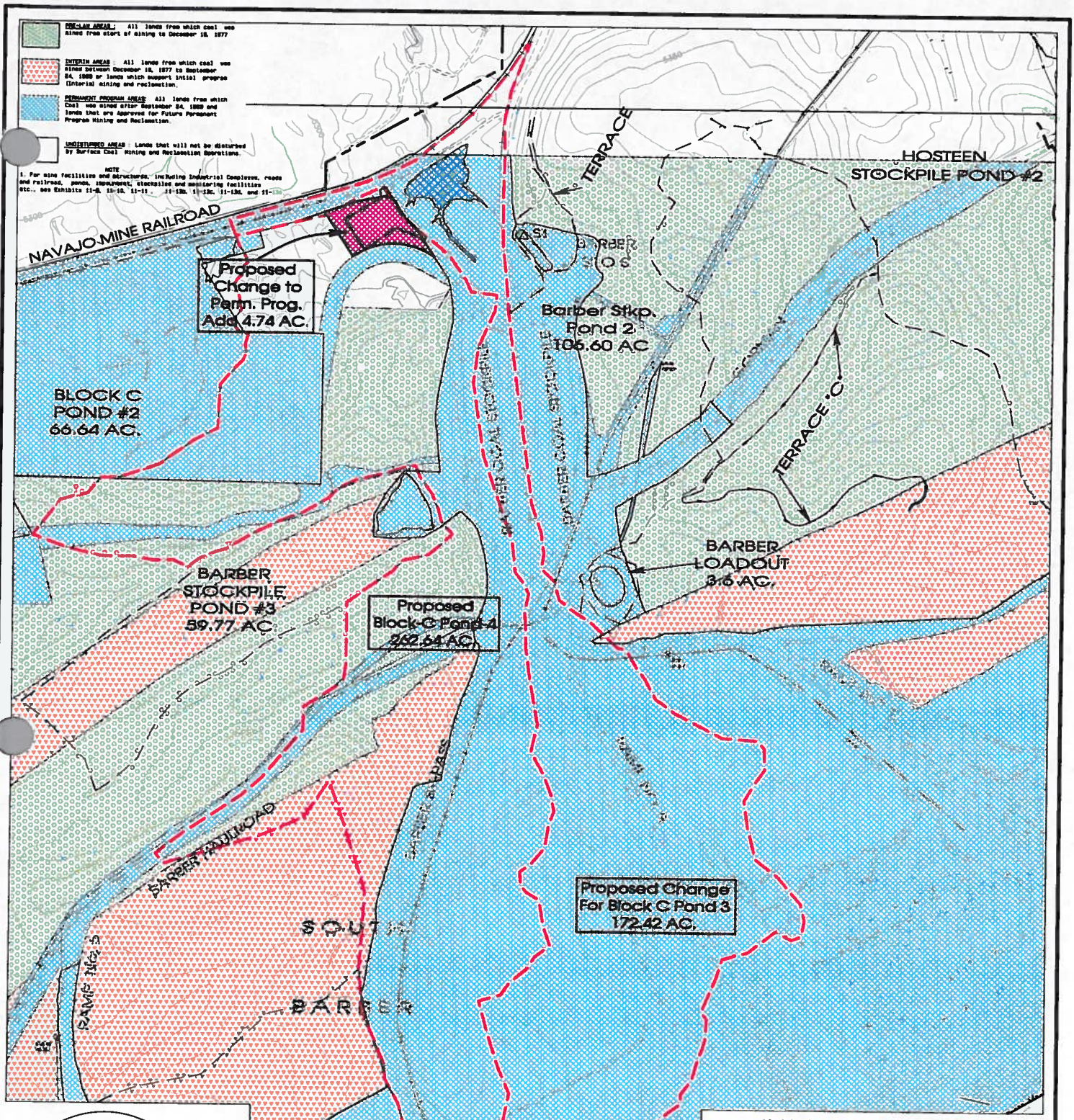
EXHIBIT 11-13D

BHP NAVAJO COAL COMPANY

P.O. BOX 1717 FRUITLAND, NEW MEXICO 87416

STRUCTURE NETWORKING
BLOCK-C POND 3 AND POND 4
SUBWATERSHED
MAP

PREPARED BY	DRAWN BY PJF	SCALE 1"=1000'
APPROVED BY	DATE 7-16-07	



(Added Jurisland Data from Exh 1_4-4of6)

REV. NO.	DATE	DRAFT. BY	REVISION DESCRIPTION	REV'D BY	E.G.	P.E.	APPROVED DATE
4-97	7-11-97	PJF	ADDED BLOCK-C POND-4 WITH WATERSHED. MODIFY BLOCK-C POND-3 WATERSHED AND SUBMITTED TO DSM FOR APPROVAL.	RY	YB	KAB	

APPROVALS

(COPY OF EXHIBIT 11-13D)

BHP NAVAJO COAL COMPANY

NAVAJO MINE

P.O. BOX 1717 FRUITLAND, NEW MEXICO 87416

AREA-II IMPOUNDMENT AND POND LOCATIONS/ WATERSHED AREAS

PREPARED BY BS/PJF	DRAWN BY PJF	SCALE 1" = 500'
APPROVED BY	DATE Nov. 26, 1995	

MAP LOCATION: (See Lower Left Corner)

KEVIN A. BAHE
NEW MEXICO
17850
LICENSED PROFESSIONAL ENGINEER

CERTIFICATION STATEMENT

I, Kevin A. Bahe, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

Pages 194-210 Blank due to text edits.

Mason Pond Modification
10 yr - 6 hr Storm Event

The location and watershed area are presented on Exhibit 11-13D. The pond modification is presented on Exhibit 11-139. The culverts (CP-120 & 140) and the inlet structures to the pond are design for the 10 yr - 6 hr storm event.

The hydrology model is presented on the attach sheet.

LR

BHP Navajo Coal Company
P.O. Box 1717
Fruitland, NM 87416

Phone: 505-598-4200

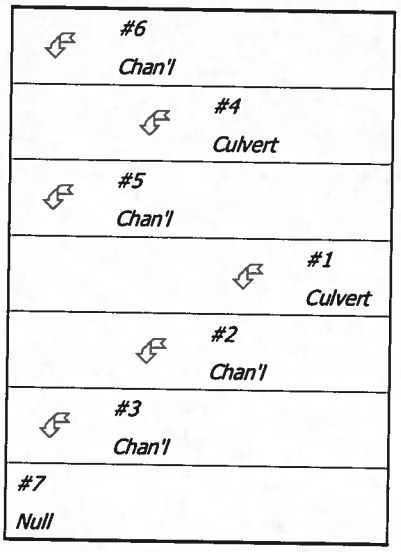
General Information

Storm Information:

Storm Type:	NM TYPE II 70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.230 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Culvert	#1	==>	#2	0.178	0.289	CULVERT CP-120
Channel	#2	==>	#3	0.000	0.000	SO CHAN TO MASON PD
Channel	#3	==>	#7	0.000	0.000	SO INLET
Culvert	#4	==>	#5	0.007	0.399	CULVERT CP-140
Channel	#5	==>	#7	0.000	0.000	EAST INLET
Channel	#6	==>	#7	0.000	0.000	NORTH INLET NORTH INLET
Null	#7	==>	End	0.000	0.000	MASON POND



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	8. Large gullies, diversions, and low flowing streams	0.60	9.00	1,492.00	2.32	0.178
#1	**Muskingum K:**					**0.178**
#4	8. Large gullies, diversions, and low flowing streams	5.03	9.20	183.00	6.72	0.007
#4	**Muskingum K:**					**0.007**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#6	4.800	4.800	2.72	0.07
#4	19.300	19.300	14.35	0.40
#5	5.600	24.900	20.54	0.60
#1	95.200	95.200	35.03	1.83
#2	6.600	101.800	34.10	2.02
#3	0.000	101.800	34.10	2.02
#7	1.700	133.200	37.20	2.76

Structure Detail:

Structure #6 (Riprap Channel)

NORTH INLET

NORTH INLET

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
1.00	3.0:1	3.0:1	6.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	2.72 cfs	
Depth:	0.28 ft	1.28 ft
Top Width:	2.67 ft	8.67 ft
Velocity*:		
X-Section Area:	0.51 sq ft	
Hydraulic Radius:	0.185 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #4 (Culvert)

CULVERT CP-140

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
100.00	1.50	0.0160	4.00	0.00	0.90

Culvert Results:

Design Discharge = 14.35 cfs

Minimum pipe diameter: 1 - 21 inch pipe(s) required

Structure #5 (Riprap Channel)

EAST INLET

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
4.00	3.0:1	3.0:1	21.3	1.00		

Riprap Channel Results:

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	20.54 cfs	
Depth:	0.56 ft	1.56 ft
Top Width:	7.33 ft	13.33 ft
Velocity:	6.53 fps	
X-Section Area:	3.15 sq ft	
Hydraulic Radius:	0.419 ft	
Froude Number:	1.76	
Manning's n:	0.0590	
Dmin:	3.00 in	
D50:	6.00 in	
Dmax:	9.00 in	

Structure #1 (Culvert)

CULVERT CP-120

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
80.00	1.90	0.0160	5.00	0.00	0.90

Culvert Results:

Design Discharge = 35.03 cfs

Minimum pipe diameter: 1 - 30 inch pipe(s) required

Structure #2 (Erodible Channel)

SO CHAN TO MASON PD

Trapezoidal Erodible Channel Inputs:

Material: Spoils & Sandstone Cobbles

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
8.00	3.0:1	3.0:1	0.6	0.0280	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	34.10 cfs	
Depth:	0.94 ft	1.94 ft
Top Width:	13.65 ft	19.65 ft
Velocity:	3.34 fps	
X-Section Area:	10.20 sq ft	
Hydraulic Radius:	0.731 ft	
Froude Number:	0.68	

Structure #3 (Riprap Channel)

SO INLET

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
7.50	3.0:1	3.0:1	8.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	34.10 cfs	
Depth:	0.41 ft	1.41 ft
Top Width:	9.94 ft	15.94 ft
Velocity*:		
X-Section Area:	3.55 sq ft	
Hydraulic Radius:	0.352 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #7 (Null)

MASON POND

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)
#6	1	4.800	0.050	0.000	0.000	80.500	M	2.72	0.070
	Σ	**4.800**						**2.72**	**0.070**
#4	1	19.300	0.103	0.000	0.000	83.600	M	14.35	0.402
	Σ	**19.300**						**14.35**	**0.402**
#5	1	5.600	0.075	0.000	0.000	89.000	M	6.19	0.203
	Σ	**24.900**						**20.54**	**0.605**
#1	1	95.200	0.272	0.000	0.000	84.900	M	35.03	1.831
	Σ	**95.200**						**35.03**	**1.831**
#2	1	6.600	0.270	0.000	0.000	89.000	M	3.61	0.192
	Σ	**101.800**						**34.10**	**2.022**
#3	Σ	**101.800**						**34.10**	**2.022**
#7	1	1.700	0.020	0.000	0.000	89.000	M	1.88	0.062
	Σ	**133.200**						**37.20**	**2.759**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	6.06	14.00	231.00	2.460	0.026
		8. Large gullies, diversions, and low flowing streams	1.46	47.00	3,216.00	3.620	0.246
#1	**1**	**Time of Concentration:**					**0.272**
#2	1	8. Large gullies, diversions, and low flowing streams	0.88	24.00	2,732.00	2.810	0.270
#2	**1**	**Time of Concentration:**					**0.270**
#4	1	5. Nearly bare and untilled, and alluvial valley fans	9.42	42.00	446.00	3.060	0.040
		8. Large gullies, diversions, and low flowing streams	1.69	15.00	888.00	3.890	0.063
#4	**1**	**Time of Concentration:**					**0.103**
#5	1	5. Nearly bare and untilled, and alluvial valley fans	10.58	11.00	104.00	3.250	0.008
		8. Large gullies, diversions, and low flowing streams	2.39	27.00	1,132.00	4.630	0.067
#5	**1**	**Time of Concentration:**					**0.075**
#6	1	5. Nearly bare and untilled, and alluvial valley fans	7.41	14.00	189.00	2.720	0.019

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	5.48	43.00	785.00	7.020	0.031
#6	**1**	**Time of Concentration:**					**0.050**

Mason Pond Modification
100 yr - 6 hr Storm Event

The location and watershed area are presented on Exhibit 11-13D. The pond modification is presented on Exhibit 11-139. The culverts (CP-120 & 140) and the inlet structures to the pond are design for the 10 yr - 6 hr storm event.

The hydrology model is presented on the attach sheet.

LR

BHP Navajo Coal Company
P.O. Box 1717
Fruitland, NM 87416

Phone: 505-598-4200

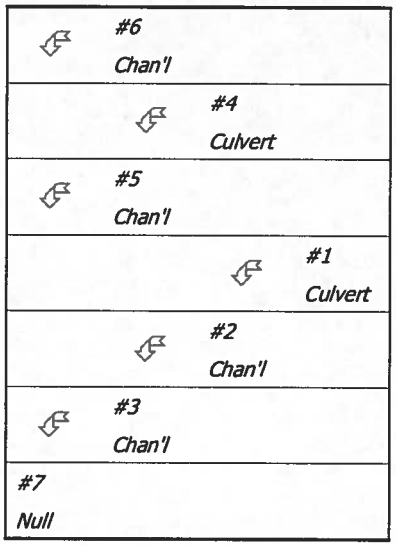
General Information

Storm Information:

Storm Type:	NM TYPE II 70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	1.960 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Culvert	#1	==>	#2	0.178	0.289	CULVERT CP-120
Channel	#2	==>	#3	0.000	0.000	SO CHAN TO MASON PD
Channel	#3	==>	#7	0.000	0.000	SO INLET
Culvert	#4	==>	#5	0.007	0.399	CULVERT CP-140
Channel	#5	==>	#7	0.000	0.000	EAST INLET
Channel	#6	==>	#7	0.000	0.000	NORTH INLET NORTH INLET
Null	#7	==>	End	0.000	0.000	MASON POND



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	8. Large gullies, diversions, and low flowing streams	0.60	9.00	1,492.00	2.32	0.178
#1	**Muskingum K:**					**0.178**
#4	8. Large gullies, diversions, and low flowing streams	5.03	9.20	183.00	6.72	0.007
#4	**Muskingum K:**					**0.007**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#6	4.800	4.800	7.26	0.22
#4	19.300	19.300	34.06	1.12
#5	5.600	24.900	46.50	1.58
#1	95.200	95.200	90.66	4.83
#2	6.600	101.800	89.57	5.27
#3	0.000	101.800	89.57	5.27
#7	1.700	133.200	96.40	7.22

Structure Detail:

Structure #6 (Riprap Channel)

NORTH INLET

NORTH INLET

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
1.00	3.0:1	3.0:1	6.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	7.26 cfs	
Depth:	0.35 ft	1.35 ft
Top Width:	3.11 ft	9.11 ft
Velocity*:		
X-Section Area:	0.72 sq ft	
Hydraulic Radius:	0.224 ft	
Froude Number*:		
Manning's n*:		
Dmin:	4.00 in	
D50:	12.00 in	
Dmax:	15.00 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #4 (Culvert)

CULVERT CP-140

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
100.00	1.50	0.0160	4.00	0.00	0.90

Culvert Results:

Design Discharge = 34.06 cfs

Minimum pipe diameter: 1 - 30 inch pipe(s) required

Structure #5 (Riprap Channel)

EAST INLET

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
4.00	3.0:1	3.0:1	21.3	1.00		

Riprap Channel Results:

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	46.50 cfs	
Depth:	0.81 ft	1.81 ft
Top Width:	8.86 ft	14.86 ft
Velocity:	8.93 fps	
X-Section Area:	5.21 sq ft	
Hydraulic Radius:	0.571 ft	
Froude Number:	2.05	
Manning's n:	0.0530	
Dmin:	3.00 in	
D50:	6.00 in	
Dmax:	9.00 in	

Structure #1 (Culvert)

CULVERT CP-120

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
80.00	1.90	0.0160	5.00	0.00	0.90

Culvert Results:

Design Discharge = 90.66 cfs

Minimum pipe diameter: 1 - 48 inch pipe(s) required

Structure #2 (Erodible Channel)

SO CHAN TO MASON PD

Trapezoidal Erodible Channel Inputs:

Material: Spoils & Sandstone Cobbles

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
8.00	3.0:1	3.0:1	0.6	0.0280	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	89.57 cfs	
Depth:	1.58 ft	2.58 ft
Top Width:	17.49 ft	23.49 ft
Velocity:	4.44 fps	
X-Section Area:	20.15 sq ft	
Hydraulic Radius:	1.120 ft	
Froude Number:	0.73	

Structure #3 (Riprap Channel)

SO INLET

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
7.50	3.0:1	3.0:1	8.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	89.57 cfs	
Depth:	0.79 ft	1.79 ft
Top Width:	12.25 ft	18.25 ft
Velocity*:		
X-Section Area:	7.81 sq ft	
Hydraulic Radius:	0.625 ft	
Froude Number*:		
Manning's n*:		
Dmin:	4.00 in	
D50:	12.00 in	
Dmax:	15.00 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #7 (Null)

MASON POND

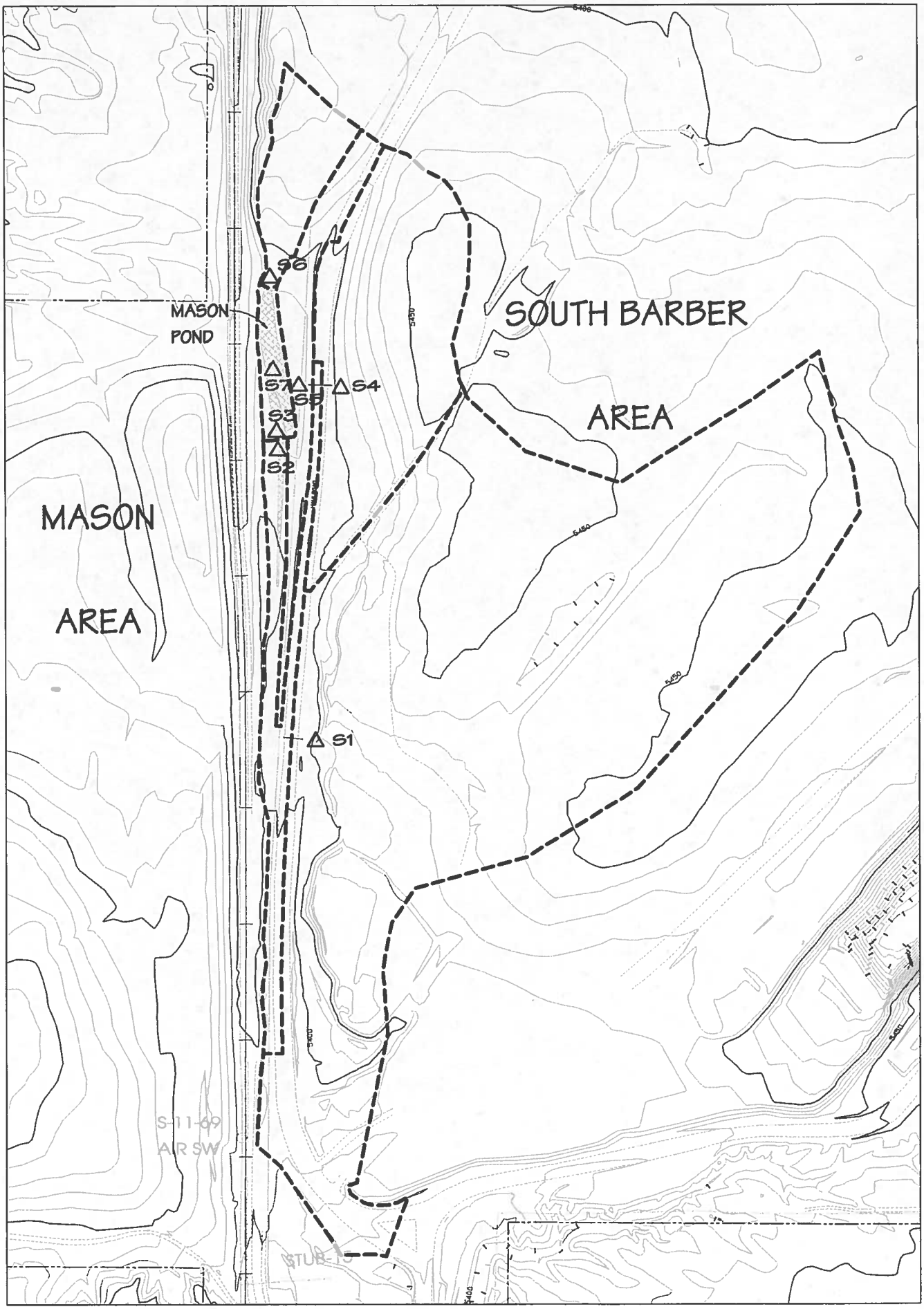
Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#6	1	4.800	0.050	0.000	0.000	80.500	M	7.26	0.223
	Σ	**4.800**						**7.26**	**0.223**
#4	1	19.300	0.103	0.000	0.000	83.600	M	34.06	1.118
	Σ	**19.300**						**34.06**	**1.118**
#5	1	5.600	0.075	0.000	0.000	89.000	M	12.45	0.464
	Σ	**24.900**						**46.50**	**1.581**
#1	1	95.200	0.272	0.000	0.000	84.900	M	90.66	4.834
	Σ	**95.200**						**90.66**	**4.834**
#2	1	6.600	0.270	0.000	0.000	89.000	M	8.13	0.438
	Σ	**101.800**						**89.57**	**5.272**
#3	Σ	**101.800**						**89.57**	**5.272**
#7	1	1.700	0.020	0.000	0.000	89.000	M	3.78	0.141
	Σ	**133.200**						**96.40**	**7.217**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	6.06	14.00	231.00	2.460	0.026
		8. Large gullies, diversions, and low flowing streams	1.46	47.00	3,216.00	3.620	0.246
#1	**1**	**Time of Concentration:**					**0.272**
#2	1	8. Large gullies, diversions, and low flowing streams	0.88	24.00	2,732.00	2.810	0.270
#2	**1**	**Time of Concentration:**					**0.270**
#4	1	5. Nearly bare and untilled, and alluvial valley fans	9.42	42.00	446.00	3.060	0.040
		8. Large gullies, diversions, and low flowing streams	1.69	15.00	888.00	3.890	0.063
#4	**1**	**Time of Concentration:**					**0.103**
#5	1	5. Nearly bare and untilled, and alluvial valley fans	10.58	11.00	104.00	3.250	0.008
		8. Large gullies, diversions, and low flowing streams	2.39	27.00	1,132.00	4.630	0.067
#5	**1**	**Time of Concentration:**					**0.075**
#6	1	5. Nearly bare and untilled, and alluvial valley fans	7.41	14.00	189.00	2.720	0.019

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	5.48	43.00	785.00	7.020	0.031
#6	**1**	**Time of Concentration:**					**0.050**



MASON POND
HYDROLOGY MODEL

Copyright 1998 Pamela J. Schwab

CR Pond 4

Worst Case Runoff Volume - AOC Topo

Ron Van Valkenburg, PE

BHP Billiton
Navajo Mine
PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	Embk. to CR Pond 4

#1
Channel

Structure Detail:

Structure #1 (Erodible Channel)

Embk. to CR Pond 4

Trapezoidal Erodible Channel Inputs:

Material: Alluvial silts colloidal

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
7.00	2.0:1	2.0:1	1.3	0.0300	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Depth:	1.42 ft	2.42 ft
Top Width:	12.69 ft	16.69 ft
Velocity:	5.84 fps	
X-Section Area:	14.01 sq ft	
Hydraulic Radius:	1.049	
Froude Number:	0.98	

CR Pond 4

As-built for CR Pond 4. Modified the east channel during the construction of Cottonwood Crossing and Staging Area.

Shawn Smith

BHP Billiton
Navajo Mine
PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

Structure Networking:

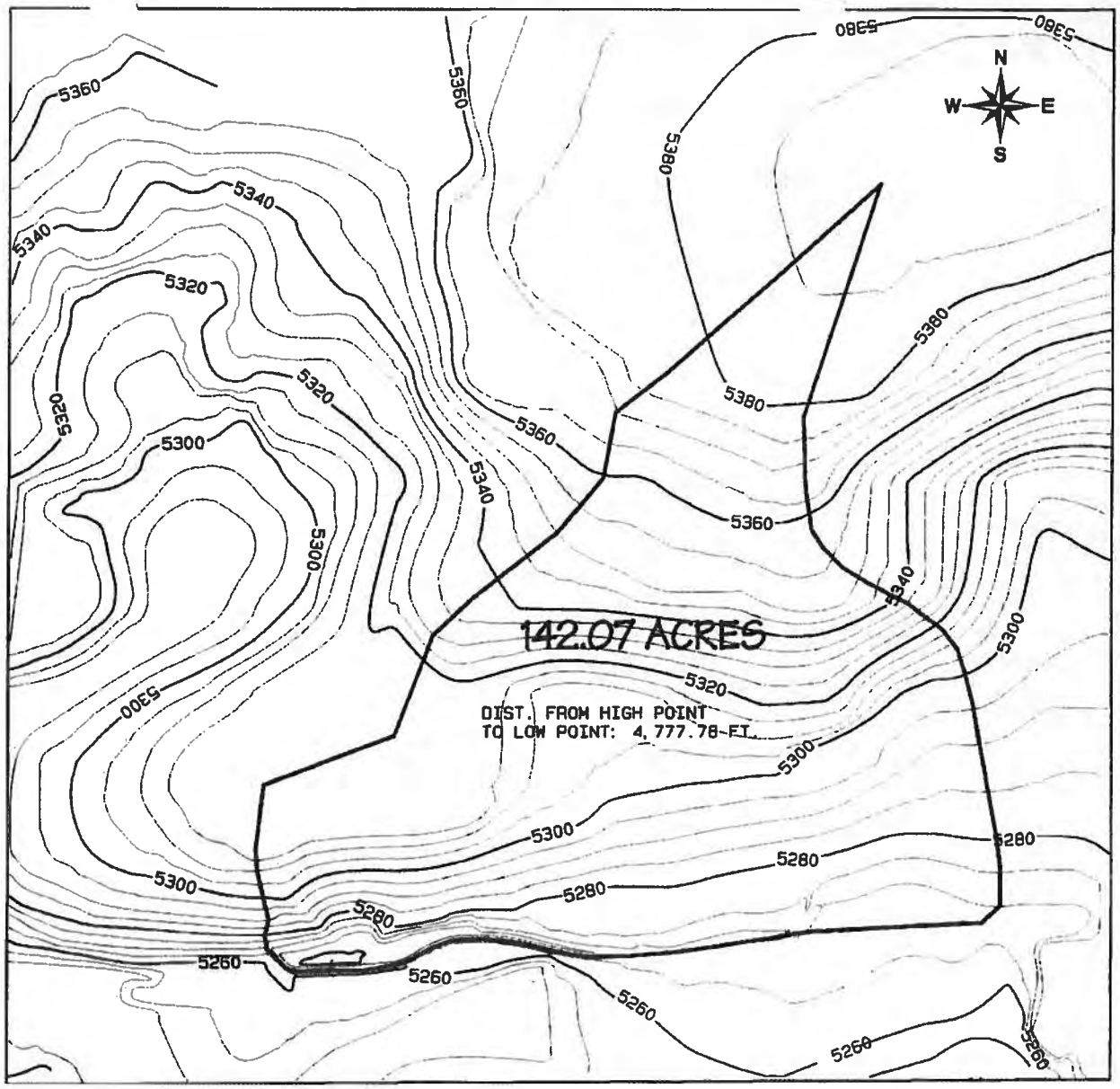
Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	CR Pond 4

#1
Null

Structure Detail:

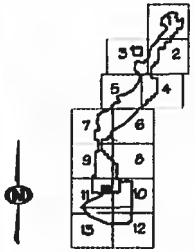
Structure #1 (Null)

CR Pond 4



LEGEND

- PAVED ROAD
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- RAILROAD
- TREES
- POWERLINE
- x5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- 5280 INTERMEDIATE CONTOUR
- WATERSHED



REV. NO.	DATE	DRAWN BY	REVISION DESCRIPTION					
B	8-07-00	PJF	Revised Watershed Bndy for CR Pond 4	LR	MC	LR		
A	10-20-98	RY	Generated Watershed for CR#4 Pond based on AOC surfaces.					

NAVAJO COAL COMPANY

NAVAJO MINE

P.O. BOX 159 FRUITLAND, NEW MEXICO 87416

AREA 3

SOUTH DIXON

COLLYER ROAD POND 4

PREPARED BY RY	DRAWN BY RY	SCALE 1" = 800'
APPROVED BY LR	DATE 10-20-98	REF DWG
DWG LOC Q:\LONE-DIXON\AREA3-TOPO-PTS.prc		

South Dixon Pond 4

The watershed is shown on Exhibit 11-13E and the pond design is presented on Exhibit 11-118.

LR

BHP Navajo Coal Company
Navajo Mine
PO Box 1717
Fruitland, NM 87415

Phone: 505-598-5861

General Information

Storm Information:

Storm Type:	NRCS Type II-60
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	44.900	44.900	52.81	4.35

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	44.900	0.315	0.000	0.000	91.000	M	52.81	4.35
	S	**44.900**						**52.81**	**4.35**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	4.23	98.50	2,330.03	2.050	0.315
#1	**1**	**Time of Concentration:**					**0.315**

PAGES 234 THROUGH 259 BLANK
DUE TO SOUTH DIXON PONDS 5 AND 6 REMOVAL

SOUTH DIXON POND 8 and SOUTH DIXON POND 7 IMPOUNDMENT Asbuilts

Hydrology model for the South Dixon Pond 8 and South Dixon Pond 7 Impoundments. The watershed subdivisions for the model are presented on Exhibit 11-13E. The as-built plan and sections are presented on Exhibit 11-38A.

Ron Van Valkenburg, PE

BHP Billiton
Navajo Mine
PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

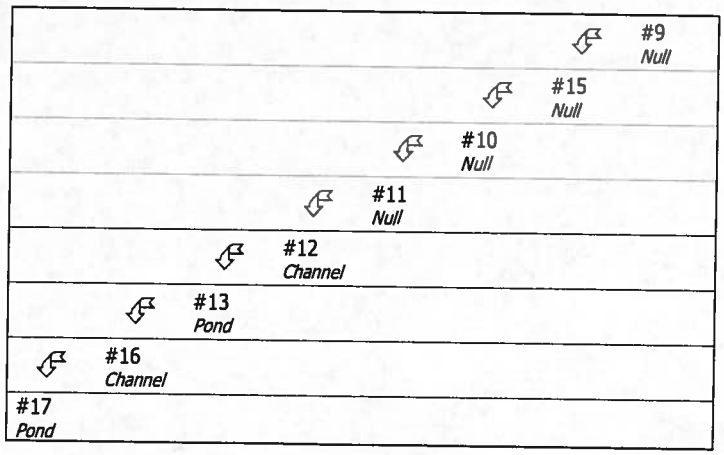
General Information

Storm Information:

Storm Type:	NRCS Type II-60
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#9	==>	#15	0.000	0.000	S9 - North Fork Drainage to existing channel
Null	#10	==>	#11	0.063	0.260	S10 - to existing channel
Null	#11	==>	#12	0.173	0.260	S11 - to existing channel
Channel	#12	==>	#13	0.092	0.260	S12 - to South Dixon Pond 8
Pond	#13	==>	#16	0.000	0.000	S13 - South Dixon Pond 8 Impoundment
Null	#15	==>	#10	0.131	0.260	
Channel	#16	==>	#17	0.000	0.000	S16 - Channel to South Dixon Pond 7
Pond	#17	==>	End	0.000	0.000	S17 - South Dixon Pond 7 Impoundment



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#10	8. Large gullies, diversions, and low flowing streams	0.38	1.59	418.42	1.84	0.063
#10	**Muskingum K:**					**0.063**
#11	8. Large gullies, diversions, and low flowing streams	0.38	4.37	1,150.00	1.84	0.173
#11	**Muskingum K:**					**0.173**
#12	8. Large gullies, diversions, and low flowing streams	0.38	2.34	615.78	1.84	0.092
#12	**Muskingum K:**					**0.092**
#15	8. Large gullies, diversions, and low flowing streams	0.38	3.30	870.00	1.84	0.131
#15	**Muskingum K:**					**0.131**

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#9		450.490	450.490	169.91	21.38
#15		0.000	450.490	169.91	21.38
#10		40.010	490.500	174.25	23.15
#11		3.560	494.060	173.28	23.36
#12		16.050	510.110	170.95	24.29
#13	In Out	16.650	526.760	170.15 160.98	25.25 25.25
#16		25.300	552.060	162.30	26.47
#17	In Out	0.000	552.060	162.30 124.91	26.47 26.47

Structure Detail:

Structure #9 (Null)

S9 - North Fork Drainage to existing channel

Structure #15 (Null)

Structure #10 (Null)

S10 - to existing channel

Structure #11 (Null)

S11 - to existing channel

Structure #12 (Erodible Channel)

S12 - to South Dixon Pond 8

Trapezoidal Erodible Channel Inputs:

Material: Cobbles and shingles

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
20.00	3.0:1	3.0:1	0.8	0.0350	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Depth:	1.57 ft	2.57 ft
Top Width:	29.45 ft	35.45 ft
Velocity:	4.39 fps	
X-Section Area:	38.94 sq ft	
Hydraulic Radius:	1.300	
Froude Number:	0.67	

Structure #13 (Pond)

S13 - South Dixon Pond 8 Impoundment

Pond Inputs:

Permanent Pool Elev:	5,281.00
Permanent Pool:	1.99 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
5,281.00	40.00	6.00:1	6.00:1	15.00

Pond Results:

Peak Elevation:	5,283.06
H'graph Detention Time:	0.27 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)	
5,277.00	0.112	0.000	0.000		
5,277.50	0.174	0.071	0.000		
5,278.00	0.250	0.176	0.000		
5,278.50	0.351	0.326	0.000		
5,279.00	0.470	0.531	0.000		
5,279.50	0.606	0.799	0.000		
5,280.00	0.759	1.140	0.000		
5,280.50	0.852	1.542	0.000		
5,281.00	0.950	1.992	0.000		Spillway #1
5,281.50	1.106	2.506	17.732	4.15	
5,282.00	1.273	3.100	35.465	1.15	
5,282.50	1.442	3.778	84.716	0.85	
5,283.00	1.622	4.544	151.420	0.40	
5,283.06	1.621	4.641	160.979	0.10	Peak Stage
5,283.50	1.763	5.390	234.285		
5,284.00	1.910	6.308	349.567		
5,284.50	2.052	7.298	490.779		
5,285.00	2.200	8.361	670.432		

Detailed Discharge Table

Elevation	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
5,277.00	0.000	0.000
5,277.50	0.000	0.000
5,278.00	0.000	0.000
5,278.50	0.000	0.000
5,279.00	0.000	0.000
5,279.50	0.000	0.000
5,280.00	0.000	0.000
5,280.50	0.000	0.000
5,281.00	0.000	0.000

Elevation	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
5,281.50	17.732	17.732
5,282.00	35.465	35.465
5,282.50	84.716	84.716
5,283.00	151.420	151.420
5,283.50	234.285	234.285
5,284.00	349.567	349.567
5,284.50	490.779	490.779
5,285.00	670.432	670.432

Structure #16 (Erodible Channel)

S16 - Channel to South Dixon Pond 7

Trapezoidal Erodible Channel Inputs:

Material: Cobbles and shingles

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
15.00	6.0:1	6.0:1	0.8	0.0350	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Depth:	1.59 ft	2.59 ft
Top Width:	34.11 ft	46.11 ft
Velocity:	4.15 fps	
X-Section Area:	39.11 sq ft	
Hydraulic Radius:	1.138	
Froude Number:	0.68	

Structure #17 (Pond)

S17 - South Dixon Pond 7 Impoundment

Pond Inputs:

Permanent Pool Elev:	5,275.00
Permanent Pool:	11.79 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
5,275.00	20.00	4.00:1	4.00:1	15.00

Pond Results:

Peak Elevation:	5,276.81
H'graph Detention Time:	1.33 hrs

Dewater Time:	0.46 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)	
5,268.00	0.550	0.000	0.000		
5,268.50	0.696	0.311	0.000		
5,269.00	0.860	0.699	0.000		
5,269.50	1.064	1.179	0.000		
5,270.00	1.290	1.767	0.000		
5,270.50	1.364	2.430	0.000		
5,271.00	1.440	3.131	0.000		
5,271.50	1.591	3.889	0.000		
5,272.00	1.750	4.724	0.000		
5,272.50	1.954	5.649	0.000		
5,273.00	2.170	6.680	0.000		
5,273.50	2.356	7.811	0.000		
5,274.00	2.550	9.037	0.000		
5,274.30	2.666	9.819	0.000		
5,274.50	2.752	10.362	0.000		
5,275.00	2.970	11.792	0.000		Spillway #1
5,275.50	3.179	13.329	2.764	6.73*	
5,276.00	3.395	14.972	39.521	2.75	
5,276.50	3.725	16.751	85.012	1.05	
5,276.81	3.943	17.966	124.913	0.55	Peak Stage
5,277.00	4.070	18.699	149.022		
5,277.50	4.379	20.811	230.578		
5,278.00	4.700	23.081	330.463		

**Designates time(s) to dewater have been extrapolated beyond the 50 hour hydrograph limit.*

Detailed Discharge Table

Elevation	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
5,268.00	0.000	0.000
5,268.50	0.000	0.000
5,269.00	0.000	0.000
5,269.50	0.000	0.000
5,270.00	0.000	0.000
5,270.50	0.000	0.000
5,271.00	0.000	0.000
5,271.50	0.000	0.000
5,272.00	0.000	0.000
5,272.50	0.000	0.000

Elevation	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
5,273.00	0.000	0.000
5,273.50	0.000	0.000
5,274.00	0.000	0.000
5,274.30	0.000	0.000
5,274.50	0.000	0.000
5,275.00	0.000	0.000
5,275.50	2.764	2.764
5,276.00	39.521	39.521
5,276.50	85.012	85.012
5,277.00	149.022	149.022
5,277.50	230.578	230.578
5,278.00	330.463	330.463

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)
#9	1	330.240	0.755	0.000	0.000	90.000	M	110.76	14.60
	2	120.250	0.353	0.500	0.300	92.700	M	79.12	6.78
	S	**450.490**						**169.91**	**21.38**
#15	**S**	**450.490**						**169.91**	**21.38**
#10	1	40.010	0.286	0.000	0.000	90.000	M	22.35	1.77
	S	**490.500**						**174.25**	**23.15**
#11	1	3.560	0.068	0.000	0.000	93.000	M	4.64	0.21
	S	**494.060**						**173.28**	**23.36**
#12	1	16.050	0.134	0.000	0.000	93.000	M	13.66	0.93
	S	**510.110**						**170.95**	**24.29**
#13	1	8.830	0.059	0.000	0.000	93.000	M	11.51	0.51
	2	7.820	0.150	0.000	0.000	93.000	M	6.65	0.45
	S	**526.760**						**170.15**	**25.25**
#16	1	25.300	0.000	0.000	0.000	91.000	M	29.29	1.22
	S	**552.060**						**162.30**	**26.47**
#17	**S**	**552.060**						**162.30**	**26.47**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#9	1	5. Nearly bare and untilled, and alluvial valley fans	4.13	95.00	2,300.01	2.030	0.314
		8. Large gullies, diversions, and low flowing streams	0.74	30.00	4,080.52	2.570	0.441
#9	**1**	**Time of Concentration:**					**0.755**
#9	2	5. Nearly bare and untilled, and alluvial valley fans	2.93	44.00	1,500.01	1.710	0.243
		8. Large gullies, diversions, and low flowing streams	3.10	65.00	2,100.02	5.270	0.110
#9	**2**	**Time of Concentration:**					**0.353**
#10	1	5. Nearly bare and untilled, and alluvial valley fans	2.24	28.00	1,252.06	1.490	0.233
		8. Large gullies, diversions, and low flowing streams	3.00	30.00	1,000.00	5.190	0.053
#10	**1**	**Time of Concentration:**					**0.286**
#11	1	5. Nearly bare and untilled, and alluvial valley fans	6.19	38.00	614.00	2.480	0.068
#11	**1**	**Time of Concentration:**					**0.068**
#12	1	5. Nearly bare and untilled, and alluvial valley fans	4.42	45.00	1,019.02	2.100	0.134

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#12	**1**	**Time of Concentration:**					**0.134**
#13	1	5. Nearly bare and untilled, and alluvial valley fans	7.63	45.00	590.00	2.760	0.059
#13	**1**	**Time of Concentration:**					**0.059**
#13	2	8. Large gullies, diversions, and low flowing streams	0.38	3.80	1,000.00	1.840	0.150
#13	**2**	**Time of Concentration:**					**0.150**
#16	1		2.25	45.00	2,000.00	0.000	0.000
#16	**1**	**Time of Concentration:**					**0.000**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#9	2	8. Large gullies, diversions, and low flowing streams	0.72	33.00	4,580.15	2.540	0.500
#9	**2**	**Muskingum K:**					**0.500**

SOUTH DIXON POND 8 and SOUTH DIXON POND 7 IMPOUNDMENT Asbuilts

Hydrology model for the South Dixon Pond 8 and South Dixon Pond 7 Impoundments. The watershed subdivisions for the model are presented on Exhibit 11-13E. The as-built plan and sections are presented on Exhibit 11-38A.

Ron Van Valkenburg, PE

BHP Billiton
Navajo Mine
PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

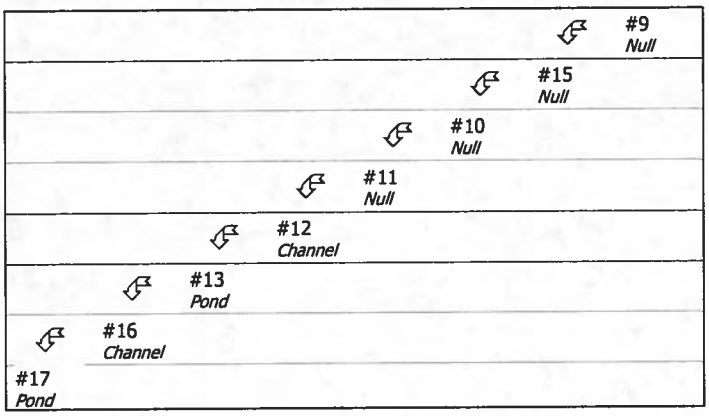
General Information

Storm Information:

Storm Type:	NRCS Type II-60
Design Storm:	25 yr - 6 hr
Rainfall Depth:	1.600 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#9	==>	#15	0.000	0.000	S9 - North Fork Drainage to existing channel
Null	#10	==>	#11	0.063	0.260	S10 - to existing channel
Null	#11	==>	#12	0.173	0.260	S11 - to existing channel
Channel	#12	==>	#13	0.092	0.260	S12 - to South Dixon Pond 8
Pond	#13	==>	#16	0.000	0.000	S13 - South Dixon Pond 8 Impoundment
Null	#15	==>	#10	0.131	0.260	
Channel	#16	==>	#17	0.000	0.000	S16 - Channel to South Dixon Pond 7
Pond	#17	==>	End	0.000	0.000	S17 - South Dixon Pond 7 Impoundment



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#10	8. Large gullies, diversions, and low flowing streams	0.38	1.59	418.42	1.84	0.063
#10	**Muskingum K:**					**0.063**
#11	8. Large gullies, diversions, and low flowing streams	0.38	4.37	1,150.00	1.84	0.173
#11	**Muskingum K:**					**0.173**
#12	8. Large gullies, diversions, and low flowing streams	0.38	2.34	615.78	1.84	0.092
#12	**Muskingum K:**					**0.092**
#15	8. Large gullies, diversions, and low flowing streams	0.38	3.30	870.00	1.84	0.131
#15	**Muskingum K:**					**0.131**

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#9		450.490	450.490	242.49	30.34
#15		0.000	450.490	242.49	30.34
#10		40.010	490.500	248.35	23.92
#11		3.560	494.060	246.78	24.21
#12		16.050	510.110	244.32	25.48
#13	In	16.650	526.760	242.66	26.81
	Out			231.47	26.81
#16		25.300	552.060	233.21	28.54
#17	In	0.000	552.060	233.21	28.54
	Out			188.81	28.54

Structure Detail:

Structure #9 (Null)

S9 - North Fork Drainage to existing channel

Structure #15 (Null)

Structure #10 (Null)

S10 - to existing channel

Structure #11 (Null)

S11 - to existing channel

Structure #12 (Erodible Channel)

S12 - to South Dixon Pond 8

Trapezoidal Erodible Channel Inputs:

Material: Cobbles and shingles

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
20.00	3.0:1	3.0:1	0.8	0.0350	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Depth:	1.93 ft	2.93 ft
Top Width:	31.55 ft	37.55 ft
Velocity:	4.92 fps	
X-Section Area:	49.64 sq ft	
Hydraulic Radius:	1.543	
Froude Number:	0.69	

Structure #13 (Pond)

S13 - South Dixon Pond 8 Impoundment

Pond Inputs:

Permanent Pool Elev:	5,281.00
Permanent Pool:	2.00 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
5,281.00	40.00	6.00:1	6.00:1	15.00

Pond Results:

Peak Elevation:	5,283.48
H'graph Detention Time:	0.24 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)	
5,277.00	0.112	0.000	0.000		
5,277.50	0.175	0.071	0.000		
5,278.00	0.252	0.177	0.000		
5,278.50	0.353	0.328	0.000		
5,279.00	0.471	0.533	0.000		
5,279.50	0.607	0.802	0.000		
5,280.00	0.759	1.143	0.000		
5,280.50	0.852	1.545	0.000		
5,281.00	0.950	1.996	0.000		Spillway #1
5,281.50	1.106	2.509	17.732	3.90	
5,282.00	1.273	3.103	35.465	1.10	
5,282.50	1.442	3.782	84.716	1.00	
5,283.00	1.622	4.547	151.420	0.40	
5,283.48	1.758	5.364	231.470	0.40	Peak Stage
5,283.50	1.763	5.393	234.285		
5,284.00	1.910	6.311	349.567		
5,284.50	2.052	7.302	490.779		
5,285.00	2.200	8.364	670.432		

Detailed Discharge Table

Elevation	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
5,277.00	0.000	0.000
5,277.50	0.000	0.000
5,278.00	0.000	0.000
5,278.50	0.000	0.000
5,279.00	0.000	0.000
5,279.50	0.000	0.000
5,280.00	0.000	0.000
5,280.50	0.000	0.000
5,281.00	0.000	0.000
5,281.50	17.732	17.732
5,282.00	35.465	35.465
5,282.50	84.716	84.716
5,283.00	151.420	151.420
5,283.50	234.285	234.285
5,284.00	349.567	349.567
5,284.50	490.779	490.779
5,285.00	670.432	670.432

Structure #16 (Erodible Channel)

S16 - Channel to South Dixon Pond 7

Trapezoidal Erodible Channel Inputs:

Material: Cobbles and shingles

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
15.00	6.0:1	6.0:1	0.8	0.0350	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Depth:	1.92 ft	2.92 ft
Top Width:	37.99 ft	49.99 ft
Velocity:	4.59 fps	
X-Section Area:	50.77 sq ft	
Hydraulic Radius:	1.325	
Froude Number:	0.70	

Structure #17 (Pond)

S17 - South Dixon Pond 7 Impoundment

Pond Inputs:

Permanent Pool Elev:	5,275.00
Permanent Pool:	11.79 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
5,275.00	20.00	4.00:1	4.00:1	15.00

Pond Results:

Peak Elevation:	5,277.24
H'graph Detention Time:	1.08 hrs
Dewater Time:	0.47 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)
5,268.00	0.550	0.000	0.000	
5,268.50	0.696	0.311	0.000	
5,269.00	0.860	0.699	0.000	
5,269.50	1.064	1.179	0.000	
5,270.00	1.290	1.767	0.000	
5,270.50	1.364	2.430	0.000	
5,271.00	1.440	3.131	0.000	
5,271.50	1.591	3.889	0.000	
5,272.00	1.750	4.724	0.000	
5,272.50	1.954	5.649	0.000	
5,273.00	2.170	6.680	0.000	

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
5,273.50	2.356	7.811	0.000		
5,274.00	2.550	9.037	0.000		
5,274.30	2.666	9.819	0.000		
5,274.50	2.752	10.362	0.000		
5,275.00	2.970	11.792	0.000		Spillway #1
5,275.50	3.179	13.329	2.764	6.73*	
5,276.00	3.395	14.972	39.521	2.60	
5,276.50	3.725	16.751	85.012	1.05	
5,277.00	4.070	18.699	149.022	0.60	
5,277.24	4.212	19.730	188.806	0.35	Peak Stage
5,277.50	4.379	20.811	230.578		
5,278.00	4.700	23.081	330.463		

**Designates time(s) to dewater have been extrapolated beyond the 50 hour hydrograph limit.*

Detailed Discharge Table

Elevation	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
5,268.00	0.000	0.000
5,268.50	0.000	0.000
5,269.00	0.000	0.000
5,269.50	0.000	0.000
5,270.00	0.000	0.000
5,270.50	0.000	0.000
5,271.00	0.000	0.000
5,271.50	0.000	0.000
5,272.00	0.000	0.000
5,272.50	0.000	0.000
5,273.00	0.000	0.000
5,273.50	0.000	0.000
5,274.00	0.000	0.000
5,274.30	0.000	0.000
5,274.50	0.000	0.000
5,275.00	0.000	0.000
5,275.50	2.764	2.764
5,276.00	39.521	39.521
5,276.50	85.012	85.012
5,277.00	149.022	149.022
5,277.50	230.578	230.578
5,278.00	330.463	330.463

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)
#9	1	330.240	0.755	0.000	0.000	90.000	M	161.24	20.99
	2	120.250	0.353	0.500	0.300	92.700	M	108.82	9.35
	S	**450.490**						**242.49**	**30.34**
#15	**S**	**450.490**						**242.49**	**30.34**
#10	1	40.010	0.286	0.000	0.000	90.000	M	32.15	2.54
	S	**490.500**						**248.35**	**23.92**
#11	1	3.560	0.068	0.000	0.000	93.000	M	6.11	0.28
	S	**494.060**						**246.78**	**24.21**
#12	1	16.050	0.134	0.000	0.000	93.000	M	18.40	1.28
	S	**510.110**						**244.32**	**25.48**
#13	1	8.830	0.059	0.000	0.000	93.000	M	15.15	0.70
	2	7.820	0.150	0.000	0.000	93.000	M	8.97	0.62
	S	**526.760**						**242.66**	**26.81**
#16	1	25.300	0.000	0.000	0.000	91.000	M	39.58	1.73
	S	**552.060**						**233.21**	**28.54**
#17	**S**	**552.060**						**233.21**	**28.54**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#9	1	5. Nearly bare and untilled, and alluvial valley fans	4.13	95.00	2,300.01	2.030	0.314
		8. Large gullies, diversions, and low flowing streams	0.74	30.00	4,080.52	2.570	0.441
#9	**1**	**Time of Concentration:**					**0.755**
#9	2	5. Nearly bare and untilled, and alluvial valley fans	2.93	44.00	1,500.01	1.710	0.243
		8. Large gullies, diversions, and low flowing streams	3.10	65.00	2,100.02	5.270	0.110
#9	**2**	**Time of Concentration:**					**0.353**
#10	1	5. Nearly bare and untilled, and alluvial valley fans	2.24	28.00	1,252.06	1.490	0.233
		8. Large gullies, diversions, and low flowing streams	3.00	30.00	1,000.00	5.190	0.053
#10	**1**	**Time of Concentration:**					**0.286**
#11	1	5. Nearly bare and untilled, and alluvial valley fans	6.19	38.00	614.00	2.480	0.068
#11	**1**	**Time of Concentration:**					**0.068**
#12	1	5. Nearly bare and untilled, and alluvial valley fans	4.42	45.00	1,019.02	2.100	0.134
#12	**1**	**Time of Concentration:**					**0.134**
#13	1	5. Nearly bare and untilled, and alluvial valley fans	7.63	45.00	590.00	2.760	0.059
#13	**1**	**Time of Concentration:**					**0.059**
#13	2	8. Large gullies, diversions, and low flowing streams	0.38	3.80	1,000.00	1.840	0.150

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#13	**2**	**Time of Concentration:**					**0.150**
#16	1		2.25	45.00	2,000.00	0.000	0.000
#16	**1**	**Time of Concentration:**					**0.000**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#9	2	8. Large gullies, diversions, and low flowing streams	0.72	33.00	4,580.15	2.540	0.500
#9	**2**	**Muskingum K:**					**0.500**

PAGES 281 AND 282 BLANK DUE TO UPDATES.

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Area 4 North Pond 3

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-115.

The pond is designed to retain the runoff from the 100 year-6 hour storm event, therefore no spillway required.

Ron Van Valkenburg, PE

BHP Billiton
Navajo Mine
PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Area 4 North Pond 3

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	8.600	8.600	21.09	0.83

Structure Detail:

Structure #1 (Null)

Area 4 North Pond 3

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	8.600	0.019	0.000	0.000	91.000	M	21.09	0.833
	Σ	**8.600**						**21.09**	**0.833**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	6.00	6.00	100.00	2.440	0.011
		8. Large gullies, diversions, and low flowing streams	20.95	88.00	420.00	13.730	0.008
#1	**1**	**Time of Concentration:**					**0.019**

Area 4 North Pond 4

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-118.

The pond is designed to retain the runoff from the 100 year-6 hour storm event, therefore no spillway required.

Ron Van Valkenburg, PE

BHP Billiton
Navajo Mine
PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	A4N Pond 4
Channel	#2	==>	#1	0.013	0.443	Southwest Berm to Pond 4
Channel	#3	==>	#1	0.006	0.452	Northeast Berm to Pond 4

#3 Chan'l
#2 Chan'l
#1 Null

Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	8. Large gullies, diversions, and low flowing streams	19.68	124.00	630.00	13.30	0.013
#2	**Muskingum K:**					**0.013**
#3	8. Large gullies, diversions, and low flowing streams	28.57	100.00	350.00	16.03	0.006
#3	**Muskingum K:**					**0.006**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#3	0.200	0.200	0.49	0.02
#2	6.600	6.600	16.19	0.64
#1	39.500	46.300	75.64	3.77

Structure Detail:

Structure #3 (Erodible Channel)

Northeast Berm to Pond 4

Triangular Erodible Channel Inputs:

Material: Alluvial silts colloidal

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
1.5:1	1.5:1	1.3	0.0250	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	0.49 cfs	
Depth:	0.40 ft	1.40 ft
Top Width:	1.20 ft	4.20 ft
Velocity:	2.05 fps	
X-Section Area:	0.24 sq ft	
Hydraulic Radius:	0.166 ft	
Froude Number:	0.81	

Structure #2 (Erodible Channel)

Southwest Berm to Pond 4

Trapezoidal Erodible Channel Inputs:

Material: Alluvial silts colloidal

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
6.00	1.5:1	3.0:1	1.9	0.0250	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	16.19 cfs	
Depth:	0.50 ft	1.50 ft
Top Width:	8.23 ft	12.73 ft
Velocity:	4.59 fps	
X-Section Area:	3.53 sq ft	
Hydraulic Radius:	0.418 ft	
Froude Number:	1.24	

Structure #1 (Null)

A4N Pond 4

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)
#3	1	0.200	0.033	0.000	0.000	91.000	M	0.49	0.018
	Σ	**0.200**						**0.49**	**0.018**
#2	1	6.600	0.084	0.000	0.000	91.000	M	16.19	0.639
	Σ	**6.600**						**16.19**	**0.639**
#1	1	39.500	0.133	0.000	0.000	91.000	M	63.76	3.113
	Σ	**46.300**						**75.64**	**3.770**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	2.62	15.00	572.01	1.610	0.098
		8. Large gullies, diversions, and low flowing streams	9.89	120.00	1,213.00	9.430	0.035
#1	**1**	**Time of Concentration:**					**0.133**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	6.45	10.00	155.00	2.540	0.016
		8. Large gullies, diversions, and low flowing streams	2.25	25.00	1,110.00	4.500	0.068
#2	**1**	**Time of Concentration:**					**0.084**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	2.22	4.00	180.00	1.490	0.033
#3	**1**	**Time of Concentration:**					**0.033**

Area 4 North Pond 4

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-118.

The pond is designed to retain the runoff from the 100 year-6 hour storm event, therefore no spillway required.

Ron Van Valkenburg, PE

BHP Billiton
Navajo Mine
PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

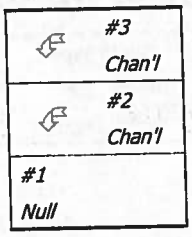
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	A4N Pond 4
Channel	#2	==>	#1	0.013	0.443	Southwest Berm to Pond 4
Channel	#3	==>	#1	0.006	0.452	Northeast Berm to Pond 4



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	8. Large gullies, diversions, and low flowing streams	19.68	124.00	630.00	13.30	0.013
#2	**Muskingum K:**					**0.013**
#3	8. Large gullies, diversions, and low flowing streams	28.57	100.00	350.00	16.03	0.006
#3	**Muskingum K:**					**0.006**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#3	0.200	0.200	0.27	0.01
#2	6.600	6.600	8.98	0.32
#1	39.500	46.300	38.57	1.88

Structure Detail:

Structure #3 (Erodible Channel)

Northeast Berm to Pond 4

Triangular Erodible Channel Inputs:

Material: Alluvial silts colloidal

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
1.5:1	1.5:1	1.3	0.0250	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	0.27 cfs	
Depth:	0.32 ft	1.32 ft
Top Width:	0.96 ft	3.96 ft
Velocity:	1.77 fps	
X-Section Area:	0.15 sq ft	
Hydraulic Radius:	0.133 ft	
Froude Number:	0.78	

Structure #2 (Erodible Channel)

Southwest Berm to Pond 4

Trapezoidal Erodible Channel Inputs:

Material: Alluvial silts colloidal

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
6.00	1.5:1	3.0:1	1.9	0.0250	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	8.98 cfs	
Depth:	0.35 ft	1.35 ft
Top Width:	7.58 ft	12.08 ft
Velocity:	3.76 fps	
X-Section Area:	2.39 sq ft	
Hydraulic Radius:	0.309 ft	
Froude Number:	1.18	

Structure #1 (Null)

A4N Pond 4

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)
#3	1	0.200	0.033	0.000	0.000	91.000	M	0.27	0.009
	Σ	**0.200**						**0.27**	**0.009**
#2	1	6.600	0.084	0.000	0.000	91.000	M	8.98	0.319
	Σ	**6.600**						**8.98**	**0.319**
#1	1	39.500	0.133	0.000	0.000	91.000	M	33.48	1.554
	Σ	**46.300**						**38.57**	**1.882**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	2.62	15.00	572.01	1.610	0.098
		8. Large gullies, diversions, and low flowing streams	9.89	120.00	1,213.00	9.430	0.035
#1	**1**	**Time of Concentration:**					**0.133**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	6.45	10.00	155.00	2.540	0.016
		8. Large gullies, diversions, and low flowing streams	2.25	25.00	1,110.00	4.500	0.068
#2	**1**	**Time of Concentration:**					**0.084**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	2.22	4.00	180.00	1.490	0.033
#3	**1**	**Time of Concentration:**					**0.033**

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South Barber Pond - Ramp 5

Pond design is presented on Exhibit 11-050. The watershed area is shown on Exhibit 11-13D.

W. Napoleon

BHP Navajo Coal Company
Box 1717
Fruitland, NM 87416

General Information

Storm Information:

Storm Type:	Type II-60
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Barber R5 Pond

#1
Null

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Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	157.400	157.400	70.00	5.43

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	106.190	0.281	0.000	0.000	76.000	M	45.55	3.661
	2	51.210	0.221	0.000	0.000	76.000	M	24.44	1.766
	Σ	**157.400**						**70.00**	**5.426**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	1.79	13.56	756.94	1.330	0.158
		8. Large gullies, diversions, and low flowing streams	2.61	56.24	2,155.83	4.840	0.123
#1	**1**	**Time of Concentration:**					**0.281**
#1	2	5. Nearly bare and untilled, and alluvial valley fans	2.31	10.00	432.56	1.520	0.079
		8. Large gullies, diversions, and low flowing streams	2.38	56.40	2,374.73	4.620	0.142
#1	**2**	**Time of Concentration:**					**0.221**

Lowe-Dixon Diversion Pond
Lowe-Dixon Diversion North Pond A

These impoundments are for stormwater control of surface water runoff from undisturbed areas upstream of Lowe Pit. There is no minimum storage containment requirement. A spillway for the Lowe-Dixon Diversion Pond is designed for a 25 yr - 6 hr storm event shown in this hydrology model.

The watershed subdivisions for the model are presented on Exhibit 11-13E. The plan, profile and typical sections are presented on Exhibit 11-150 and 11-151.

Ron Van Valkenburg, PE

BHP Billiton
Navajo Mine
PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

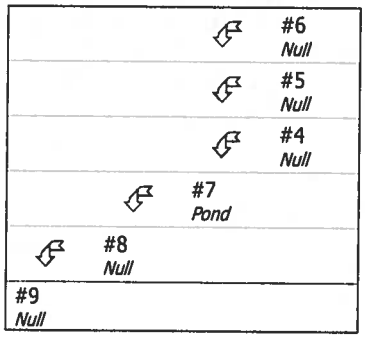
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	25 yr - 6 hr
Rainfall Depth:	1.600 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#4	==>	#7	0.000	0.000	North inlet to LDD Pond
Null	#5	==>	#7	0.000	0.000	East inlet to LDD Pond
Null	#6	==>	#7	0.000	0.000	South inlet to LDD Pond
Pond	#7	==>	#8	0.000	0.000	Lowe-Dixon Diversion (LDD) Pond
Null	#8	==>	#9	0.000	0.000	LDD North Pond A
Null	#9	==>	End	0.000	0.000	Lowe Pit



Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#6		86.260	86.260	28.88	4.05
#5		25.510	25.510	15.97	1.20
#4		1,450.720	1,450.720	486.18	78.49
#7	In	40.670	1,603.160	537.50	85.72
	Out			423.69	85.72
#8		11.100	1,614.260	425.99	86.38
#9		0.000	1,614.260	425.99	86.38

Structure Detail:

Structure #6 (Null)

South inlet to LDD Pond

Structure #5 (Null)

East inlet to LDD Pond

Structure #4 (Null)

North inlet to LDD Pond

Structure #7 (Pond)

Lowe-Dixon Diversion (LDD) Pond

Pond Inputs:

Permanent Pool Elev:	5,387.70
Permanent Pool:	16.89 ac-ft

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
5,387.70	40.00	5.00:1	4.00:1	52.00

Pond Results:

Peak Elevation:	5,389.77
H'graph Detention Time:	0.37 hrs
Dewater Time:	0.38 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)
5,376.00	0.000	0.000	0.000	
5,377.00	0.055	0.018	0.000	
5,378.00	0.220	0.147	0.000	
5,379.00	0.406	0.455	0.000	
5,380.00	0.648	0.977	0.000	
5,381.00	0.898	1.747	0.000	
5,382.00	1.188	2.786	0.000	
5,383.00	1.520	4.136	0.000	

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
5,384.00	1.892	5.839	0.000		
5,385.00	2.448	8.003	0.000		
5,386.00	3.076	10.759	0.000		
5,387.00	3.700	14.142	0.000		
5,387.70	4.166	16.895	0.000		Spillway #1
5,387.80	4.230	17.313	13.721	4.80	
5,388.00	4.358	18.172	41.297	1.10	
5,389.00	5.970	23.315	179.045	2.00	
5,389.77	7.441	28.637	423.693	1.30	Peak Stage
5,390.00	7.835	30.197	495.419		
5,391.00	9.254	38.731	955.522		
5,392.00	10.790	48.743	1,564.630		

Detailed Discharge Table

Elevation	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
5,376.00	0.000	0.000
5,377.00	0.000	0.000
5,378.00	0.000	0.000
5,379.00	0.000	0.000
5,380.00	0.000	0.000
5,381.00	0.000	0.000
5,382.00	0.000	0.000
5,383.00	0.000	0.000
5,384.00	0.000	0.000
5,385.00	0.000	0.000
5,386.00	0.000	0.000
5,387.00	0.000	0.000
5,387.70	0.000	0.000
5,387.80	13.721	13.721
5,388.00	41.297	41.297
5,389.00	179.045	179.045
5,390.00	495.419	495.419
5,391.00	955.522	955.522
5,392.00	1,564.630	1,564.630

Structure #8 (Null)

LDD North Pond A

Structure #9 (Null)

Lowe Pit

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)
#6	1	86.260	0.958	0.000	0.000	86.100	M	28.88	4.05
	S	**86.260**						**28.88**	**4.05**
#5	1	25.510	0.356	0.000	0.000	86.100	M	15.97	1.20
	S	**25.510**						**15.97**	**1.20**
#4	1	470.600	1.257	0.387	0.350	87.000	M	138.69	23.75
	2	166.700	1.396	0.534	0.354	81.100	M	26.77	5.16
	3	66.500	0.818	0.534	0.354	82.600	M	18.27	2.34
	4	96.300	0.766	0.389	0.341	90.200	M	52.64	6.21
	5	54.100	0.199	0.389	0.341	93.000	M	68.18	4.30
	6	112.200	0.398	0.332	0.342	92.700	M	109.83	8.72
	7	56.900	0.238	0.183	0.333	93.000	M	68.75	4.52
	8	89.500	0.413	0.183	0.333	91.900	M	81.35	6.56
	9	226.200	0.610	0.000	0.000	87.500	M	116.05	11.87
	10	78.400	0.397	0.000	0.000	85.400	M	43.92	3.48
	11	33.320	0.591	0.000	0.000	86.100	M	15.57	1.57
	S	**1,450.720**						**486.18**	**78.49**
#7	1	35.270	0.650	0.000	0.000	86.100	M	15.48	1.66
	2	5.400	0.000	0.000	0.000	89.000	M	8.98	0.32
	S	**1,603.160**						**537.50**	**85.72**
#8	1	11.100	0.258	0.000	0.000	89.000	M	9.95	0.65
	S	**1,614.260**						**425.99**	**86.38**
#9	**S**	**1,614.260**						**425.99**	**86.38**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#4	1	5. Nearly bare and untilled, and alluvial valley fans	1.08	35.00	3,237.00	1.030	0.872
		8. Large gullies, diversions, and low flowing streams	2.41	155.00	6,442.00	4.650	0.384
#4	**1**	**Time of Concentration:**					**1.257**
#4	2	5. Nearly bare and untilled, and alluvial valley fans	0.86	37.00	4,286.00	0.920	1.294
		8. Large gullies, diversions, and low flowing streams	4.10	92.00	2,243.00	6.070	0.102
#4	**2**	**Time of Concentration:**					**1.396**
#4	3	5. Nearly bare and untilled, and alluvial valley fans	0.93	23.00	2,478.00	0.960	0.717

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	3.83	82.00	2,141.00	5.870	0.101
#4	**3**	**Time of Concentration:**					**0.818**
#4	4	5. Nearly bare and untilled, and alluvial valley fans	0.63	10.00	1,582.00	0.790	0.556
		8. Large gullies, diversions, and low flowing streams	3.62	157.00	4,332.00	5.710	0.210
#4	**4**	**Time of Concentration:**					**0.766**
#4	5	5. Nearly bare and untilled, and alluvial valley fans	8.38	73.00	871.00	2.890	0.083
		8. Large gullies, diversions, and low flowing streams	2.64	54.00	2,043.00	4.870	0.116
#4	**5**	**Time of Concentration:**					**0.199**
#4	6	5. Nearly bare and untilled, and alluvial valley fans	4.90	80.00	1,632.02	2.210	0.205
		8. Large gullies, diversions, and low flowing streams	2.57	86.00	3,346.04	4.800	0.193
#4	**6**	**Time of Concentration:**					**0.398**
#4	7	5. Nearly bare and untilled, and alluvial valley fans	12.89	70.00	543.00	3.590	0.042
		8. Large gullies, diversions, and low flowing streams	1.40	35.00	2,508.00	3.540	0.196
#4	**7**	**Time of Concentration:**					**0.238**
#4	8	5. Nearly bare and untilled, and alluvial valley fans	3.98	30.00	754.00	1.990	0.105
		8. Large gullies, diversions, and low flowing streams	1.87	85.00	4,548.00	4.100	0.308
#4	**8**	**Time of Concentration:**					**0.413**
#4	9	5. Nearly bare and untilled, and alluvial valley fans	2.53	40.00	1,584.00	1.580	0.278
		8. Large gullies, diversions, and low flowing streams	1.61	73.00	4,546.00	3.800	0.332
#4	**9**	**Time of Concentration:**					**0.610**
#4	10	5. Nearly bare and untilled, and alluvial valley fans	3.26	50.00	1,536.00	1.800	0.237
		8. Large gullies, diversions, and low flowing streams	1.21	23.00	1,901.00	3.290	0.160
#4	**10**	**Time of Concentration:**					**0.397**
#4	11	5. Nearly bare and untilled, and alluvial valley fans	2.00	60.00	3,000.00	1.410	0.591
#4	**11**	**Time of Concentration:**					**0.591**
#5	1	5. Nearly bare and untilled, and alluvial valley fans	2.21	42.00	1,900.02	1.480	0.356
#5	**1**	**Time of Concentration:**					**0.356**
#6	1	5. Nearly bare and untilled, and alluvial valley fans	1.45	60.00	4,140.21	1.200	0.958
#6	**1**	**Time of Concentration:**					**0.958**
#7	1	5. Nearly bare and untilled, and alluvial valley fans	1.43	40.00	2,788.03	1.190	0.650

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#7	**1**	**Time of Concentration:**					**0.650**
#8	1	5. Nearly bare and untilled, and alluvial valley fans	1.88	24.00	1,275.03	1.370	0.258
#8	**1**	**Time of Concentration:**					**0.258**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#4	1	8. Large gullies, diversions, and low flowing streams	1.76	98.00	5,553.03	3.980	0.387
#4	**1**	**Muskingum K:**					**0.387**
#4	2	8. Large gullies, diversions, and low flowing streams	1.90	151.00	7,950.00	4.130	0.534
#4	**2**	**Muskingum K:**					**0.534**
#4	3	8. Large gullies, diversions, and low flowing streams	1.90	151.00	7,950.00	4.130	0.534
#4	**3**	**Muskingum K:**					**0.534**
#4	4	8. Large gullies, diversions, and low flowing streams	1.49	76.00	5,117.00	3.650	0.389
#4	**4**	**Muskingum K:**					**0.389**
#4	5	8. Large gullies, diversions, and low flowing streams	1.49	76.00	5,117.00	3.650	0.389
#4	**5**	**Muskingum K:**					**0.389**
#4	6	8. Large gullies, diversions, and low flowing streams	1.50	66.00	4,388.00	3.670	0.332
#4	**6**	**Muskingum K:**					**0.332**
#4	7	8. Large gullies, diversions, and low flowing streams	1.29	29.00	2,252.00	3.400	0.183
#4	**7**	**Muskingum K:**					**0.183**
#4	8	8. Large gullies, diversions, and low flowing streams	1.29	29.00	2,252.00	3.400	0.183
#4	**8**	**Muskingum K:**					**0.183**

Pages 364 through 376 removed by Rev 1002 submitted to OSM 1-13-10

North Fork Pond

This highwall pond is designed to contain the 100 yr - 6 hr storm event, therefore no spillway is required.

The watershed detail is presented on Exhibit 11-13E. The design plan, profile and typical sections are presented on Exhibit 11-152.

Ron Van Valkenburg, PE

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PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

General Information

Storm Information:

Storm Type:	Type II 70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	North Fork Pond

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	198.700	198.700	117.98	18.12

Structure Detail:

Structure #1 (Null)

North Fork Pond

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	198.700	1.083	0.299	0.298	90.000	M	120.71	18.12
	S	**198.700**						**117.98**	**18.12**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	1.02	10.00	980.00	1.010	0.269
		5. Nearly bare and untilled, and alluvial valley fans	2.28	101.00	4,425.36	1.510	0.814
#1	**1**	**Time of Concentration:**					**1.083**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	0.70	19.00	2,702.00	2.510	0.299
#1	**1**	**Muskingum K:**					**0.299**

Area 4 North
Perimeter Road Pond 401

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-01.

The pond is designed to retain the runoff from the 100 year-6 hour storm event, therefore no spillway required.

Ron Van Valkenburg, PE

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Fruitland, NM 87416

Phone: 505 598 2007

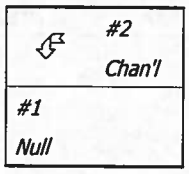
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Perimeter Road Pond 401
Channel	#2	==>	#1	0.000	0.443	East Inlet Channel



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	8. Large gullies, diversions, and low flowing streams	19.23	8.50	44.20	13.15	0.000
#2	**Muskingum K:**					**0.000**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#2	10.900	10.900	21.43	0.74
#1	9.900	20.800	40.89	1.40

Structure Detail:

Structure #2 (Riprap Channel)

East Inlet Channel

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
7.00	3.0:1	3.0:1	19.2	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	21.43 cfs	
Depth:	0.21 ft	1.21 ft
Top Width:	8.25 ft	14.25 ft
Velocity*:		
X-Section Area:	1.59 sq ft	
Hydraulic Radius:	0.191 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #1 (Null)

Perimeter Road Pond 401

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)
#2	1	10.900	0.075	0.000	0.000	85.300	M	21.43	0.735
	Σ	**10.900**						**21.43**	**0.735**
#1	1	9.900	0.012	0.000	0.000	85.300	M	19.46	0.668
	Σ	**20.800**						**40.89**	**1.403**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	16.04	85.00	530.00	12.010	0.012
#1	**1**	**Time of Concentration:**					**0.012**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	1.00	1.00	100.00	1.000	0.027
		8. Large gullies, diversions, and low flowing streams	4.78	55.00	1,150.00	6.560	0.048
#2	**1**	**Time of Concentration:**					**0.075**

Area 4 North

Perimeter Road Pond 401

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-01.

The pond is designed to retain the runoff from the 100 year-6 hour storm event, therefore no spillway required.

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Phone: 505 598 2007

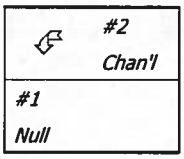
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Perimeter Road Pond 401
Channel	#2	==>	#1	0.000	0.443	East Inlet Rip-rap Channel



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	8. Large gullies, diversions, and low flowing streams	19.23	8.50	44.20	13.15	0.000
#2	**Muskingum K:**					**0.000**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#2	10.900	10.900	10.29	0.31
#1	9.900	20.800	19.63	0.59

Structure Detail:

Structure #2 (Riprap Channel)

East Inlet Rip-rap Channel

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
7.00	3.0:1	3.0:1	19.2	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	10.29 cfs	
Depth:	0.12 ft	1.12 ft
Top Width:	7.69 ft	13.69 ft
Velocity*:		
X-Section Area:	0.85 sq ft	
Hydraulic Radius:	0.109 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #1 (Null)

Perimeter Road Pond 401

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)
#2	1	10.900	0.075	0.000	0.000	85.300	M	10.29	0.309
	Σ	**10.900**						**10.29**	**0.309**
#1	1	9.900	0.012	0.000	0.000	85.300	M	9.35	0.280
	Σ	**20.800**						**19.63**	**0.589**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	16.04	85.00	530.00	12.010	0.012
#1	**1**	**Time of Concentration:**					**0.012**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	1.00	1.00	100.00	1.000	0.027
		8. Large gullies, diversions, and low flowing streams	4.78	55.00	1,150.00	6.560	0.048
#2	**1**	**Time of Concentration:**					**0.075**

Area 4 North

Perimeter Road Pond 402

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-02.

The pond is designed to retain the runoff from the 100 year-6 hour storm event, therefore no spillway required.

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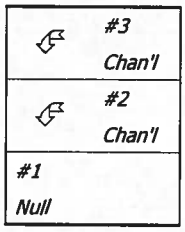
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Perimeter Road Pond 402
Channel	#2	==>	#1	0.000	0.000	Road Channel-East
Channel	#3	==>	#1	0.000	0.000	Road Channel-West



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#3	13.800	13.800	20.19	0.96
#2	82.000	82.000	119.99	5.71
#1	1.000	96.800	140.45	6.75

Structure Detail:

Structure #3 (Erodible Channel)

Road Channel-West

Trapezoidal Erodible Channel Inputs:

Material: Shales and hardpans

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
8.00	2.0:1	3.0:1	0.3	0.0250	1.00			6.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	20.19 cfs	
Depth:	0.81 ft	1.81 ft
Top Width:	12.07 ft	17.07 ft
Velocity:	2.47 fps	
X-Section Area:	8.17 sq ft	
Hydraulic Radius:	0.659 ft	
Froude Number:	0.53	

Structure #2 (Erodible Channel)

Road Channel-East

Trapezoidal Erodible Channel Inputs:

Material: Shales and hardpans

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
8.00	3.0:1	2.0:1	0.8	0.0250	1.00			6.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	119.99 cfs	
Depth:	1.65 ft	2.65 ft
Top Width:	16.27 ft	21.27 ft
Velocity:	5.98 fps	
X-Section Area:	20.08 sq ft	
Hydraulic Radius:	1.187 ft	
Froude Number:	0.95	

Structure #1 (Null)

Perimeter Road Pond 402

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)
#3	1	13.800	0.161	0.000	0.000	89.000	M	20.19	0.961
	Σ	**13.800**						**20.19**	**0.961**
#2	1	82.000	0.154	0.000	0.000	89.000	M	119.99	5.708
	Σ	**82.000**						**119.99**	**5.708**
#1	1	1.000	0.013	0.000	0.000	89.000	M	2.28	0.086
	Σ	**96.800**						**140.45**	**6.754**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	10.00	15.00	150.00	3.160	0.013
#1	**1**	**Time of Concentration:**					**0.013**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	1.00	1.00	100.00	1.000	0.027
		8. Large gullies, diversions, and low flowing streams	4.11	115.00	2,796.00	6.080	0.127
#2	**1**	**Time of Concentration:**					**0.154**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	1.00	1.00	100.00	1.000	0.027
		8. Large gullies, diversions, and low flowing streams	3.17	82.00	2,583.00	5.340	0.134
#3	**1**	**Time of Concentration:**					**0.161**

Area 4 North

Perimeter Road Pond 402

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-02.

The pond is designed to retain the runoff from the 100 year-6 hour storm event, therefore no spillway required.

Ron Van Valkenburg, PE

BHP Billiton
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PO Box 1717
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Phone: 505 598 2007

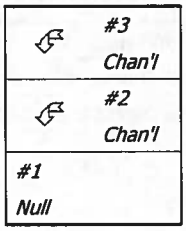
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Perimeter Road Pond 402
Channel	#2	==>	#1	0.000	0.000	Road Channel-East
Channel	#3	==>	#1	0.000	0.000	Road Channel-West



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#3	13.800	13.800	10.01	0.45
#2	82.000	82.000	59.46	2.69
#1	1.000	96.800	69.60	3.18

Structure Detail:

Structure #3 (Erodible Channel)

Road Channel-West

Trapezoidal Erodible Channel Inputs:

Material: Shales and hardpans

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
8.00	2.0:1	3.0:1	0.3	0.0250	1.00			6.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	10.01 cfs	
Depth:	0.54 ft	1.54 ft
Top Width:	10.72 ft	15.72 ft
Velocity:	1.96 fps	
X-Section Area:	5.10 sq ft	
Hydraulic Radius:	0.466 ft	
Froude Number:	0.50	

Structure #2 (Erodible Channel)

Road Channel-East

Trapezoidal Erodible Channel Inputs:

Material: Shales and hardpans

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
8.00	3.0:1	2.0:1	0.8	0.0250	1.00			6.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	59.46 cfs	
Depth:	1.13 ft	2.13 ft
Top Width:	13.66 ft	18.66 ft
Velocity:	4.85 fps	
X-Section Area:	12.25 sq ft	
Hydraulic Radius:	0.869 ft	
Froude Number:	0.90	

Structure #1 (Null)

Perimeter Road Pond 402

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)
#3	1	13.800	0.161	0.000	0.000	89.000	M	10.01	0.453
	Σ	**13.800**						**10.01**	**0.453**
#2	1	82.000	0.154	0.000	0.000	89.000	M	59.46	2.689
	Σ	**82.000**						**59.46**	**2.689**
#1	1	1.000	0.013	0.000	0.000	89.000	M	1.21	0.040
	Σ	**96.800**						**69.60**	**3.182**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	10.00	15.00	150.00	3.160	0.013
#1	**1**	**Time of Concentration:**					**0.013**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	1.00	1.00	100.00	1.000	0.027
		8. Large gullies, diversions, and low flowing streams	4.11	115.00	2,796.00	6.080	0.127
#2	**1**	**Time of Concentration:**					**0.154**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	1.00	1.00	100.00	1.000	0.027
		8. Large gullies, diversions, and low flowing streams	3.17	82.00	2,583.00	5.340	0.134
#3	**1**	**Time of Concentration:**					**0.161**

Pond 402 East Inlet Rip-rap 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)
8.00	3.0:1	3.0:1	10.0	1.00		

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	59.46 cfs	
Depth:	0.56 ft	1.56 ft
Top Width:	11.36 ft	17.36 ft
Velocity*:		
X-Section Area:	5.43 sq ft	
Hydraulic Radius:	0.470 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Pond 402 West Inlet Rip-rap 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)
6.50	3.0:1	3.0:1	6.0	1.00		

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	10.00 cfs	
Depth:	0.18 ft	1.18 ft
Top Width:	7.61 ft	13.61 ft
Velocity*:		
X-Section Area:	1.31 sq ft	
Hydraulic Radius:	0.170 ft	
Froude Number*:		
Manning's n*:		
Dmin:	1.00 in	
D50:	3.00 in	
Dmax:	3.75 in	

Velocity and Manning's n calculations may not apply for this method.

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Area 4 North
Perimeter Road Pond 404

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-04.

The pond is designed to retain the runoff from the 100 year-6 hour storm event, therefore no spillway required.

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General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Perimeter Road Pond 404

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	11.700	11.700	26.72	1.00

Structure Detail:

Structure #1 (Null)

Perimeter Road Pond 404

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	11.700	0.045	0.000	0.000	89.000	M	26.72	1.001
	Σ	**11.700**						**26.72**	**1.001**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	4.02	40.00	995.00	6.010	0.045
#1	**1**	**Time of Concentration:**					**0.045**

Area 4 North Pond 405

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-5.

The pond is design to retain the 100 yr-6 hr storm event. No spillway is required.

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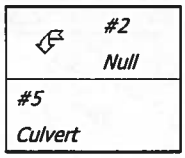
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#2	==>	#5	0.000	0.000	A4N Pond 405
Culvert	#5	==>	End	0.000	0.000	CP-189 Culvert under road



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#2	90.600	90.600	132.58	6.31
#5	0.000	90.600	132.58	6.31

Structure Detail:

Structure #2 (Null)

A4N Pond 405

Structure #5 (Culvert)

CP-189 Culvert under road

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
330.00	5.20	0.0150	23.00	0.00	0.90

Culvert Results:

Design Discharge = 132.58 cfs

Minimum pipe diameter: 1 - 36 inch pipe(s) required

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)
#2	1	90.600	0.146	0.000	0.000	89.000	M	132.58	6.307
	Σ	**90.600**						**132.58**	**6.307**
#5	Σ	**90.600**						**132.58**	**6.307**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	1	8. Large gullies, diversions, and low flowing streams	4.59	155.00	3,380.07	6.420	0.146
#2	**1**	**Time of Concentration:**					**0.146**

Area 4 North Pond 405

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-5.

The pond is design to retain the 100 yr-6 hr storm event. No spillway is required.

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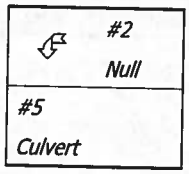
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#2	==>	#5	0.000	0.000	A4N Pond 405
Culvert	#5	==>	End	0.000	0.000	CP-189 Culvert under road



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#2	90.600	90.600	65.69	2.97
#5	0.000	90.600	65.69	2.97

Structure Detail:

Structure #2 (Null)

A4N Pond 405

Structure #5 (Culvert)

CP-189 Culvert under road

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
330.00	5.20	0.0150	23.00	0.00	0.90

Culvert Results:

Design Discharge = 65.69 cfs

Minimum pipe diameter: 1 - 30 inch pipe(s) required

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)
#2	1	90.600	0.146	0.000	0.000	89.000	M	65.69	2.971
	Σ	**90.600**						**65.69**	**2.971**
#5	Σ	**90.600**						**65.69**	**2.971**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	1	8. Large gullies, diversions, and low flowing streams	4.59	155.00	3,380.07	6.420	0.146
#2	**1**	**Time of Concentration:**					**0.146**

Area 4 North Pond 406

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-156.

The pond is designed to retain the 100-yr 6-hr storm event, therefore a spillway is not required.

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General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	A4N Pond 406

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	238.100	238.100	97.07	9.83

Structure Detail:

Structure #1 (Null)

A4N Pond 406

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	238.100	0.578	0.000	0.000	78.300	M	97.07	9.83
	S	**238.100**						**97.07**	**9.83**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	1.87	20.00	1,070.03	1.360	0.218
		8. Large gullies, diversions, and low flowing streams	1.00	39.00	3,890.00	3.000	0.360
#1	**1**	**Time of Concentration:**					**0.578**

Area 4 North Pond 407

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-157.

The pond is designed to retain the 100-yr 6-hr storm event, therefore a spillway is not required.

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General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	A4N Pond 407

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	124.800	124.800	142.00	9.98

Structure Detail:

Structure #1 (Null)

A4N Pond 407

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	124.800	0.306	0.000	0.000	87.900	M	142.00	9.98
	S	**124.800**						**142.00**	**9.98**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	0.79	6.00	760.00	0.880	0.239
		8. Large gullies, diversions, and low flowing streams	6.41	118.00	1,840.00	7.590	0.067
#1	**1**	**Time of Concentration:**					**0.306**

Area 4 North Pond 408

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-158.

The pond is designed to retain the runoff from the 100 year-6 hour storm event, therefore no spillway required.

RYazzie

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General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	A4N Pond 408

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	6.180	6.180	12.52	0.44

Structure Detail:

Structure #1 (Null)

A4N Pond 408

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	6.180	0.105	0.000	0.000	86.000	M	12.52	0.436
	Σ	**6.180**						**12.52**	**0.436**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	1.33	1.00	75.00	1.150	0.018
		8. Large gullies, diversions, and low flowing streams	0.66	5.10	767.60	2.440	0.087
#1	**1**	**Time of Concentration:**					**0.105**

Area 4 North Pond 409

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-159

The pond is designed to retain the runoff from the 100 year-6 hour storm event, therefore no spillway required.

RYazzie

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General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	A4N Pond 409

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	2.830	2.830	5.73	0.20

Structure Detail:

Structure #1 (Null)

A4N Pond 409

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	2.830	0.044	0.000	0.000	86.000	M	5.73	0.200
	Σ	**2.830**						**5.73**	**0.200**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	5.12	2.90	56.60	2.260	0.006
		8. Large gullies, diversions, and low flowing streams	2.24	13.80	614.75	4.490	0.038
#1	**1**	**Time of Concentration:**					**0.044**

Area 4 North Pond 410

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-159

The pond is design to retain the runoff from the 100 year-6 hour storm event, therefore no spillway required.

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General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	A4N Pond 410

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	2.370	2.370	4.80	0.17

Structure Detail:

Structure #1 (Null)

A4N Pond 410

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	2.370	0.059	0.000	0.000	86.000	M	4.80	0.167
	Σ	**2.370**						**4.80**	**0.167**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	1.67	1.90	113.50	1.290	0.024
		8. Large gullies, diversions, and low flowing streams	1.76	9.00	510.00	3.980	0.035
#1	**1**	**Time of Concentration:**					**0.059**

Area 4 North Pond 411

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-161

The pond is designed to retain the runoff from the 100 year-6 hour storm event, therefore no spillway required.

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General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	A4N Pond 411

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	12.500	12.500	30.66	1.21

Structure Detail:

Structure #1 (Null)

A4N Pond 411

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	12.500	0.077	0.000	0.000	91.000	M	30.66	1.210
	Σ	**12.500**						**30.66**	**1.210**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	1.79	5.00	280.00	1.330	0.058
		8. Large gullies, diversions, and low flowing streams	9.85	65.00	660.00	9.410	0.019
#1	**1**	**Time of Concentration:**					**0.077**

Area 4 North Pond 412

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-111.

The pond is designed to retain the runoff from the 100 yr-6 hr storm event, therefore no spillway required.

The ditch that diverts the flows to the pond and the inlet structures are designed for the 10 yr- 6 hr and 25 yr- 6 hr storm events, respectively.

Ron Van Valkenburg, PE

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PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

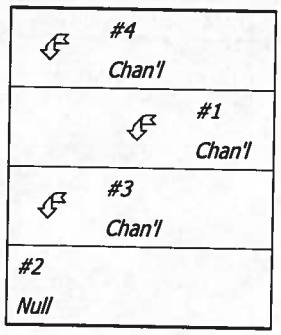
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#3	0.002	0.454	Drainage Ditch
Null	#2	==>	End	0.000	0.000	A4N Pond 412
Channel	#3	==>	#2	0.004	0.423	Inlet B (West)
Channel	#4	==>	#2	0.002	0.441	Inlet A (South)



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	8. Large gullies, diversions, and low flowing streams	31.72	46.00	145.00	16.89	0.002
#1	**Muskingum K:**					**0.002**
#3	8. Large gullies, diversions, and low flowing streams	9.55	15.00	157.00	9.27	0.004
#3	**Muskingum K:**					**0.004**
#4	8. Large gullies, diversions, and low flowing streams	18.09	17.00	94.00	12.75	0.002
#4	**Muskingum K:**					**0.002**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#4	10.900	10.900	26.73	1.06
#1	5.300	5.300	13.00	0.51
#3	3.400	8.700	21.34	0.84
#2	11.000	30.600	75.05	2.96

Structure Detail:

Structure #4 (Riprap Channel)

Inlet A (South)

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
10.00	3.0:1	3.0:1	26.4	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	26.73 cfs	
Depth:	0.15 ft	1.15 ft
Top Width:	10.91 ft	16.91 ft
Velocity*:		
X-Section Area:	1.59 sq ft	
Hydraulic Radius:	0.145 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #1 (Erodible Channel)

Drainage Ditch

Trapezoidal Erodible Channel Inputs:

Material: Stiff clay very colloidal

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
6.00	3.0:1	3.0:1	3.4	0.0280	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	13.00 cfs	
Depth:	0.39 ft	1.39 ft
Top Width:	8.33 ft	14.33 ft
Velocity:	4.68 fps	
X-Section Area:	2.78 sq ft	
Hydraulic Radius:	0.329 ft	
Froude Number:	1.43	

Structure #3 (Riprap Channel)

Inlet B (West)

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	8.8	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	21.34 cfs	
Depth:	0.31 ft	1.31 ft
Top Width:	7.87 ft	13.87 ft
Velocity*:		
X-Section Area:	2.16 sq ft	
Hydraulic Radius:	0.271 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #2 (Null)

A4N Pond 412

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)
#4	1	10.900	0.108	0.000	0.000	91.000	M	26.73	1.055
	Σ	**10.900**						**26.73**	**1.055**
#1	1	5.300	0.064	0.000	0.000	91.000	M	13.00	0.513
	Σ	**5.300**						**13.00**	**0.513**
#3	1	3.400	0.031	0.000	0.000	91.000	M	8.34	0.329
	Σ	**8.700**						**21.34**	**0.842**
#2	1	11.000	0.082	0.000	0.000	91.000	M	26.98	1.065
	Σ	**30.600**						**75.05**	**2.963**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	2.00	2.00	100.00	1.410	0.019
		8. Large gullies, diversions, and low flowing streams	4.69	50.00	1,065.00	6.500	0.045
#1	**1**	**Time of Concentration:**					**0.064**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	2.50	10.00	400.00	1.580	0.070
		8. Large gullies, diversions, and low flowing streams	17.86	100.00	560.00	12.670	0.012
#2	**1**	**Time of Concentration:**					**0.082**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	4.00	4.00	100.00	2.000	0.013
		8. Large gullies, diversions, and low flowing streams	13.24	94.00	710.00	10.910	0.018
#3	**1**	**Time of Concentration:**					**0.031**
#4	1	5. Nearly bare and untilled, and alluvial valley fans	2.44	10.00	410.00	1.560	0.073
		8. Large gullies, diversions, and low flowing streams	8.51	94.00	1,105.00	8.740	0.035
#4	**1**	**Time of Concentration:**					**0.108**

Area 4 North Pond 412

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-111.

The pond is designed to retain the runoff from the 100 yr-6 hr storm event, therefore no spillway required.

The ditch that diverts the flows to the pond and the inlet structures are designed for the 10 yr- 6 hr and 25 yr- 6 hr storm events, respectively.

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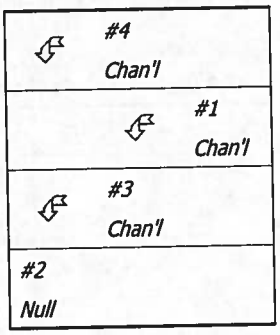
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	25 yr - 6 hr
Rainfall Depth:	1.600 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#3	0.002	0.454	Drainage Ditch
Null	#2	==>	End	0.000	0.000	A4N Pond 412
Channel	#3	==>	#2	0.004	0.423	Inlet B (West)
Channel	#4	==>	#2	0.002	0.441	Inlet A (South)



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	8. Large gullies, diversions, and low flowing streams	31.72	46.00	145.00	16.89	0.002
#1	**Muskingum K:**					**0.002**
#3	8. Large gullies, diversions, and low flowing streams	9.55	15.00	157.00	9.27	0.004
#3	**Muskingum K:**					**0.004**
#4	8. Large gullies, diversions, and low flowing streams	18.09	17.00	94.00	12.75	0.002
#4	**Muskingum K:**					**0.002**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#4	10.900	10.900	19.91	0.75
#1	5.300	5.300	9.68	0.36
#3	3.400	8.700	15.89	0.60
#2	11.000	30.600	55.89	2.09

Structure Detail:

Structure #4 (Riprap Channel)

Inlet A (South)

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
10.00	3.0:1	3.0:1	26.4	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	19.91 cfs	
Depth:	0.12 ft	1.12 ft
Top Width:	10.71 ft	16.71 ft
Velocity*:		
X-Section Area:	1.23 sq ft	
Hydraulic Radius:	0.114 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #1 (Erodible Channel)

Drainage Ditch

Trapezoidal Erodible Channel Inputs:

Material: Stiff clay very colloidal

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
6.00	3.0:1	3.0:1	3.4	0.0280	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	9.68 cfs	
Depth:	0.33 ft	1.33 ft
Top Width:	7.96 ft	13.96 ft
Velocity:	4.23 fps	
X-Section Area:	2.29 sq ft	
Hydraulic Radius:	0.283 ft	
Froude Number:	1.39	

Structure #3 (Riprap Channel)

Inlet B (West)

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	8.8	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	15.89 cfs	
Depth:	0.25 ft	1.25 ft
Top Width:	7.49 ft	13.49 ft
Velocity*:		
X-Section Area:	1.68 sq ft	
Hydraulic Radius:	0.222 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #2 (Null)

A4N Pond 412

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)
#4	1	10.900	0.108	0.000	0.000	91.000	M	19.91	0.746
	Σ	**10.900**						**19.91**	**0.746**
#1	1	5.300	0.064	0.000	0.000	91.000	M	9.68	0.363
	Σ	**5.300**						**9.68**	**0.363**
#3	1	3.400	0.031	0.000	0.000	91.000	M	6.21	0.233
	Σ	**8.700**						**15.89**	**0.595**
#2	1	11.000	0.082	0.000	0.000	91.000	M	20.09	0.753
	Σ	**30.600**						**55.89**	**2.093**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	2.00	2.00	100.00	1.410	0.019
		8. Large gullies, diversions, and low flowing streams	4.69	50.00	1,065.00	6.500	0.045
#1	**1**	**Time of Concentration:**					**0.064**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	2.50	10.00	400.00	1.580	0.070
		8. Large gullies, diversions, and low flowing streams	17.86	100.00	560.00	12.670	0.012
#2	**1**	**Time of Concentration:**					**0.082**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	4.00	4.00	100.00	2.000	0.013
		8. Large gullies, diversions, and low flowing streams	13.24	94.00	710.00	10.910	0.018
#3	**1**	**Time of Concentration:**					**0.031**
#4	1	5. Nearly bare and untilled, and alluvial valley fans	2.44	10.00	410.00	1.560	0.073
		8. Large gullies, diversions, and low flowing streams	8.51	94.00	1,105.00	8.740	0.035
#4	**1**	**Time of Concentration:**					**0.108**

Area 4 North Pond 412

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-111.

The pond is designed to retain the runoff from the 100 yr-6 hr storm event, therefore no spillway required.

The ditch that diverts the flows to the pond and the inlet structures are designed for the 10 yr- 6 hr and 25 yr- 6 hr storm events, respectively.

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Navajo Mine
PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

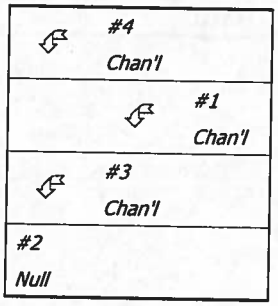
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#3	0.002	0.454	Drainage Ditch
Null	#2	==>	End	0.000	0.000	A4N Pond 412
Channel	#3	==>	#2	0.004	0.423	Inlet B (West)
Channel	#4	==>	#2	0.002	0.441	Inlet A (South)



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	8. Large gullies, diversions, and low flowing streams	31.72	46.00	145.00	16.89	0.002
#1	**Muskingum K:**					**0.002**
#3	8. Large gullies, diversions, and low flowing streams	9.55	15.00	157.00	9.27	0.004
#3	**Muskingum K:**					**0.004**
#4	8. Large gullies, diversions, and low flowing streams	18.09	17.00	94.00	12.75	0.002
#4	**Muskingum K:**					**0.002**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#4	10.900	10.900	14.83	0.53
#1	5.300	5.300	7.21	0.26
#3	3.400	8.700	11.84	0.42
#2	11.000	30.600	41.64	1.48

Structure Detail:

Structure #4 (Riprap Channel)

Inlet A (South)

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
10.00	3.0:1	3.0:1	26.4	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	14.83 cfs	
Depth:	0.09 ft	1.09 ft
Top Width:	10.55 ft	16.55 ft
Velocity*:		
X-Section Area:	0.94 sq ft	
Hydraulic Radius:	0.089 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #1 (Erodible Channel)

Drainage Ditch

Trapezoidal Erodible Channel Inputs:

Material: Stiff clay very colloidal

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
6.00	3.0:1	3.0:1	3.4	0.0280	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	7.21 cfs	
Depth:	0.28 ft	1.28 ft
Top Width:	7.66 ft	13.66 ft

	w/o Freeboard	w/ Freeboard
Velocity:	3.83 fps	
X-Section Area:	1.89 sq ft	
Hydraulic Radius:	0.243 ft	
Froude Number:	1.36	

Structure #3 (Riprap Channel)

Inlet B (West)

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	8.8	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	11.84 cfs	
Depth:	0.20 ft	1.20 ft
Top Width:	7.20 ft	13.20 ft
Velocity*:		
X-Section Area:	1.32 sq ft	
Hydraulic Radius:	0.181 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #2 (Null)

A4N Pond 412

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)
#4	1	10.900	0.108	0.000	0.000	91.000	M	14.83	0.527
	Σ	**10.900**						**14.83**	**0.527**
#1	1	5.300	0.064	0.000	0.000	91.000	M	7.21	0.256
	Σ	**5.300**						**7.21**	**0.256**
#3	1	3.400	0.031	0.000	0.000	91.000	M	4.63	0.164
	Σ	**8.700**						**11.84**	**0.420**
#2	1	11.000	0.082	0.000	0.000	91.000	M	14.97	0.532
	Σ	**30.600**						**41.64**	**1.479**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	2.00	2.00	100.00	1.410	0.019
		8. Large gullies, diversions, and low flowing streams	4.69	50.00	1,065.00	6.500	0.045
#1	**1**	**Time of Concentration:**					**0.064**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	2.50	10.00	400.00	1.580	0.070
		8. Large gullies, diversions, and low flowing streams	17.86	100.00	560.00	12.670	0.012
#2	**1**	**Time of Concentration:**					**0.082**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	4.00	4.00	100.00	2.000	0.013
		8. Large gullies, diversions, and low flowing streams	13.24	94.00	710.00	10.910	0.018
#3	**1**	**Time of Concentration:**					**0.031**
#4	1	5. Nearly bare and untilled, and alluvial valley fans	2.44	10.00	410.00	1.560	0.073
		8. Large gullies, diversions, and low flowing streams	8.51	94.00	1,105.00	8.740	0.035
#4	**1**	**Time of Concentration:**					**0.108**

Area 4 North Pond 413

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-6.

The pond is designed to retain the runoff from the 100 yr-6 hr storm event, therefore no spillway required.

The ditch that diverts the flows to the pond and the inlet structures are designed to be stable for the 10 yr- 6 hr and 25 yr- 6 hr storm events, respectively.

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Fruitland, NM 87416

Phone: 505 598 2007

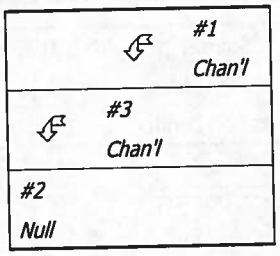
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#3	0.003	0.458	Berm V-ditch
Null	#2	==>	End	0.000	0.000	A4N Pond 413
Channel	#3	==>	#2	0.000	0.000	Rip-rap Inlet Channel



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	8. Large gullies, diversions, and low flowing streams	37.73	83.00	220.00	18.42	0.003
#1	**Muskingum K:**					**0.003**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	1.230	1.230	1.99	0.10
#3	0.330	1.560	2.65	0.13
#2	5.240	6.800	15.50	0.64

Structure Detail:

Structure #1 (Erodible Channel)

Berm V-ditch

Triangular Erodible Channel Inputs:

Material: Stiff clay very colloidal

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
3.0:1	6.5:1	4.7	0.0280	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	1.99 cfs	
Depth:	0.34 ft	1.34 ft
Top Width:	3.27 ft	12.77 ft
Velocity:	3.52 fps	
X-Section Area:	0.56 sq ft	
Hydraulic Radius:	0.169 ft	
Froude Number:	1.49	

Structure #3 (Riprap Channel)

Rip-rap Inlet Channel

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	4.0:1	4.0:1	21.6	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	2.65 cfs	
Depth:	0.04 ft	1.04 ft
Top Width:	6.30 ft	14.30 ft

	w/o Freeboard	w/ Freeboard
Velocity*:		
X-Section Area:	0.23 sq ft	
Hydraulic Radius:	0.036 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #2 (Null)

A4N Pond 413

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	1.230	0.156	0.000	0.000	91.000	M	1.99	0.097
	Σ	**1.230**						**1.99**	**0.097**
#3	1	0.330	0.011	0.000	0.455	91.000	M	0.81	0.032
	Σ	**1.560**						**2.65**	**0.129**
#2	1	5.240	0.030	0.000	0.000	91.000	M	12.85	0.507
	Σ	**6.800**						**15.50**	**0.636**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	1.84	14.00	760.00	1.350	0.156
#1	**1**	**Time of Concentration:**					**0.156**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	3.75	6.00	160.00	1.930	0.023
		8. Large gullies, diversions, and low flowing streams	23.68	90.00	380.00	14.590	0.007
#2	**1**	**Time of Concentration:**					**0.030**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	5.00	4.00	80.00	2.230	0.009
		8. Large gullies, diversions, and low flowing streams	43.75	70.00	160.00	19.840	0.002
#3	**1**	**Time of Concentration:**					**0.011**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#3	1	8. Large gullies, diversions, and low flowing streams	33.33	15.00	45.00	17.320	0.000
#3	**1**	**Muskingum K:**					**0.000**

Area 4 North Pond 413

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-6.

The pond is designed to retain the runoff from the 100 yr-6 hr storm event, therefore no spillway required.

The ditch that diverts the flows to the pond and the inlet structures are designed to be stable for the 10 yr- 6 hr and 25 yr-6 hr storm events, respectively.

Ron Van Valkenburg, PE

BHP Billiton
Navajo Mine
PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

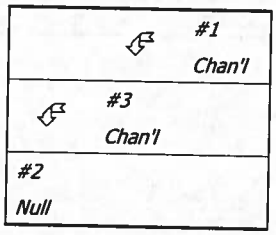
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	25 yr - 6 hr
Rainfall Depth:	1.600 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#3	0.003	0.458	Berm V-ditch
Null	#2	==>	End	0.000	0.000	A4N Pond 413
Channel	#3	==>	#2	0.000	0.000	Rip-rap Inlet Channel



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	8. Large gullies, diversions, and low flowing streams	37.73	83.00	220.00	18.42	0.003
#1	**Muskingum K:**					**0.003**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	1.230	1.230	1.44	0.07
#3	0.330	1.560	1.90	0.09
#2	5.240	6.800	11.47	0.45

Structure Detail:

Structure #1 (Erodible Channel)

Berm V-ditch

Triangular Erodible Channel Inputs:

Material: Stiff clay very colloidal

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
3.0:1	6.5:1	4.7	0.0280	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	1.44 cfs	
Depth:	0.31 ft	1.31 ft
Top Width:	2.90 ft	12.40 ft
Velocity:	3.25 fps	
X-Section Area:	0.44 sq ft	
Hydraulic Radius:	0.149 ft	
Froude Number:	1.47	

Structure #3 (Riprap Channel)

Rip-rap Inlet Channel

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	4.0:1	4.0:1	21.6	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	1.90 cfs	
Depth:	0.03 ft	1.03 ft
Top Width:	6.24 ft	14.24 ft
Velocity*:		
X-Section Area:	0.18 sq ft	
Hydraulic Radius:	0.029 ft	
Froude Number*:		
Manning's n*:		

	w/o Freeboard	w/ Freeboard
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #2 (Null)

A4N Pond 413

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	1.230	0.156	0.000	0.000	91.000	M	1.44	0.068
	Σ	**1.230**						**1.44**	**0.068**
#3	1	0.330	0.011	0.000	0.455	91.000	M	0.60	0.022
	Σ	**1.560**						**1.90**	**0.090**
#2	1	5.240	0.030	0.000	0.000	91.000	M	9.57	0.358
	Σ	**6.800**						**11.47**	**0.449**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	1.84	14.00	760.00	1.350	0.156
#1	**1**	**Time of Concentration:**					**0.156**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	3.75	6.00	160.00	1.930	0.023
		8. Large gullies, diversions, and low flowing streams	23.68	90.00	380.00	14.590	0.007
#2	**1**	**Time of Concentration:**					**0.030**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	5.00	4.00	80.00	2.230	0.009
		8. Large gullies, diversions, and low flowing streams	43.75	70.00	160.00	19.840	0.002
#3	**1**	**Time of Concentration:**					**0.011**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#3	1	8. Large gullies, diversions, and low flowing streams	33.33	15.00	45.00	17.320	0.000
#3	**1**	**Muskingum K:**					**0.000**

Area 4 North Pond 413

The watershed for the impoundment is presented on Exhibit 11-13F. The detail design is presented on Exhibit 11-6.

The pond is designed to retain the runoff from the 100 yr-6 hr storm event, therefore no spillway required.

The ditch that diverts the flows to the pond and the inlet structures are designed to be stable for the 10 yr- 6 hr and 25 yr-6 hr storm events, respectively.

Ron Van Valkenburg, PE

BHP Billiton
Navajo Mine
PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

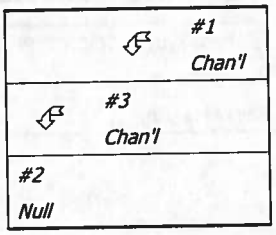
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#3	0.003	0.458	Berm V-ditch
Null	#2	==>	End	0.000	0.000	A4N Pond 413
Channel	#3	==>	#2	0.000	0.000	Rip-rap Inlet Channel



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	8. Large gullies, diversions, and low flowing streams	37.73	83.00	220.00	18.42	0.003
#1	**Muskingum K:**					**0.003**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	1.230	1.230	1.04	0.05
#3	0.330	1.560	1.36	0.06
#2	5.240	6.800	8.49	0.32

Structure Detail:

Structure #1 (Erodible Channel)

Berm V-ditch

Triangular Erodible Channel Inputs:

Material: Stiff clay very colloidal

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
3.0:1	6.5:1	4.7	0.0280	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	1.04 cfs	
Depth:	0.27 ft	1.27 ft
Top Width:	2.57 ft	12.07 ft
Velocity:	3.00 fps	
X-Section Area:	0.35 sq ft	
Hydraulic Radius:	0.132 ft	
Froude Number:	1.44	

Structure #3 (Riprap Channel)

Rip-rap Inlet Channel

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	4.0:1	4.0:1	21.6	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	1.36 cfs	
Depth:	0.02 ft	1.02 ft
Top Width:	6.20 ft	14.20 ft
Velocity*:		
X-Section Area:	0.15 sq ft	
Hydraulic Radius:	0.024 ft	
Froude Number*:		
Manning's n*:		

	w/o Freeboard	w/ Freeboard
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #2 (Null)

A4N Pond 413

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	1.230	0.156	0.000	0.000	91.000	M	1.04	0.048
	Σ	**1.230**						**1.04**	**0.048**
#3	1	0.330	0.011	0.000	0.455	91.000	M	0.45	0.015
	Σ	**1.560**						**1.36**	**0.063**
#2	1	5.240	0.030	0.000	0.000	91.000	M	7.13	0.253
	Σ	**6.800**						**8.49**	**0.317**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	1.84	14.00	760.00	1.350	0.156
#1	**1**	**Time of Concentration:**					**0.156**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	3.75	6.00	160.00	1.930	0.023
		8. Large gullies, diversions, and low flowing streams	23.68	90.00	380.00	14.590	0.007
#2	**1**	**Time of Concentration:**					**0.030**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	5.00	4.00	80.00	2.230	0.009
		8. Large gullies, diversions, and low flowing streams	43.75	70.00	160.00	19.840	0.002
#3	**1**	**Time of Concentration:**					**0.011**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#3	1	8. Large gullies, diversions, and low flowing streams	33.33	15.00	45.00	17.320	0.000
#3	**1**	**Muskingum K:**					**0.000**

Pond 301

The watershed for Pond 301 is shown on Exhibit 11-13E. The detail design is on Exhibit 11-162.

This pond is designed to retain the 100 yr-6 hr storm event, therefore no spillway is required.

R. Yazzie

BHP Billiton
Navajo Mine
PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

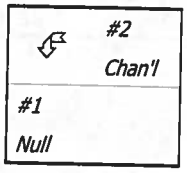
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	POND 301
Channel	#2	==>	#1	0.000	0.000	Inlet Channel



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#2	32.900	32.900	50.60	2.44
#1	0.000	32.900	50.60	2.44

Structure Detail:

Structure #2 (Riprap Channel)

Inlet Channel

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
18.00	2.0:1	2.0:1	10.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	50.60 cfs	
Depth:	0.32 ft	1.32 ft
Top Width:	19.27 ft	23.27 ft
Velocity*:		
X-Section Area:	5.90 sq ft	
Hydraulic Radius:	0.304 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #1 (Null)

POND 301

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)
#2	1	32.900	0.154	0.000	0.000	90.000	M	50.60	2.437
	Σ	**32.900**						**50.60**	**2.437**
#1	Σ	**32.900**						**50.60**	**2.437**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	1	5. Nearly bare and untilled, and alluvial valley fans	4.29	6.00	140.00	2.070	0.018
		8. Large gullies, diversions, and low flowing streams	2.55	60.00	2,353.00	4.790	0.136
#2	**1**	**Time of Concentration:**					**0.154**

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Pond 301

The watershed for Pond 301 is shown on Exhibit 11-13E. The detail design is on Exhibit 11-162.

The inlet channel is designed to be stable for the 10 yr-6 hr storm event.

Nov 2010

LR

BHP Navajo Coal Company
P.O. Box 1717
Fruitland, NM 87416

Phone: 505-598-4200

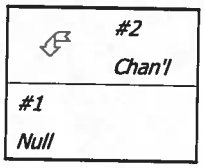
General Information

Storm Information:

Storm Type:	NM TYPE II 70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.230 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	POND 301
Channel	#2	==>	#1	0.000	0.000	Inlet Channel



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#2	32.900	32.900	23.50	1.07
#1	0.000	32.900	23.50	1.07

Structure Detail:

Structure #2 (Riprap Channel)

Inlet Channel

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	2.0:1	2.0:1	10.0	0.70		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	23.50 cfs	
Depth:	0.32 ft	1.02 ft
Top Width:	7.30 ft	10.10 ft
Velocity*:		
X-Section Area:	2.15 sq ft	
Hydraulic Radius:	0.289 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #1 (Null)

POND 301

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)
#2	1	32.900	0.154	0.000	0.000	90.000	M	23.50	1.068
	Σ	**32.900**						**23.50**	**1.068**
#1	Σ	**32.900**						**23.50**	**1.068**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	1	5. Nearly bare and untilled, and alluvial valley fans	4.29	6.00	140.00	2.070	0.018
		8. Large gullies, diversions, and low flowing streams	2.55	60.00	2,353.00	4.790	0.136
#2	**1**	**Time of Concentration:**					**0.154**

Pond 302

The watershed for this impoundment is shown on Exhibit 11-13E. The impoundment design is on Exhibit 11-162.

The pond is designed to retain the runoff from the 100-yr 6-hr storm event, therefore no spillway is required.

R. Yazzie

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Navajo Mine
PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

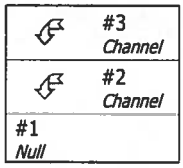
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	POND 302
Channel	#2	==>	#1	0.000	0.000	West Inlet
Channel	#3	==>	#1	0.000	0.000	East Inlet



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#3	9.940	9.940	23.54	0.91
#2	28.400	28.400	67.27	2.59
#1	3.400	41.740	98.87	3.81

Structure Detail:

Structure #3 (Riprap Channel)

East Inlet

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
10.00	2.0:1	2.0:1	25.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Depth:	0.14 ft	1.14 ft
Top Width:	10.58 ft	14.58 ft
Velocity*:		
X-Section Area:	1.48 sq ft	
Hydraulic Radius:	0.139	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #2 (Riprap Channel)

West Inlet

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	2.0:1	2.0:1	20.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Depth:	0.35 ft	1.35 ft
Top Width:	13.40 ft	17.40 ft
Velocity*:		
X-Section Area:	4.45 sq ft	
Hydraulic Radius:	0.328	
Froude Number*:		
Manning's n*:		
Dmin:	4.00 in	
D50:	12.00 in	
Dmax:	15.00 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #1 (Null)

POND 302

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)
#3	1	9.940	0.029	0.000	0.000	90.000	M	23.54	0.91
	S	**9.940**						**23.54**	**0.91**
#2	1	28.400	0.121	0.000	0.000	90.000	M	67.27	2.59
	S	**28.400**						**67.27**	**2.59**
#1	1	3.400	0.017	0.000	0.000	90.000	M	8.05	0.31
	S	**41.740**						**98.87**	**3.81**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	3.48	4.16	119.64	1.860	0.017
#1	**1**	**Time of Concentration:**					**0.017**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	3.33	4.00	120.00	1.820	0.018
		8. Large gullies, diversions, and low flowing streams	3.20	64.00	2,000.00	5.360	0.103
#2	**1**	**Time of Concentration:**					**0.121**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	25.00	20.00	80.00	5.000	0.004
		8. Large gullies, diversions, and low flowing streams	5.97	40.00	670.00	7.330	0.025
#3	**1**	**Time of Concentration:**					**0.029**

Pond 302

The watershed for this impoundment is shown on Exhibit 11-13E. The impoundment design is on Exhibit 11-162.

The pond inlets are designed for the 25-yr 6-hr storm event.

R. Yazzie

BHP Billiton
Navajo Mine
PO Box 1717
Fruitland, NM 87416

Phone: 505 598 2007

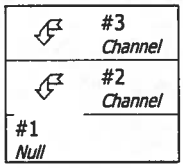
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	25 yr - 6 hr
Rainfall Depth:	1.600 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	POND 302
Channel	#2	==>	#1	0.000	0.000	West Inlet
Channel	#3	==>	#1	0.000	0.000	East Inlet



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#3	9.940	9.940	17.34	0.63
#2	28.400	28.400	49.55	1.81
#1	3.400	41.740	72.82	2.65

Structure Detail:

Structure #3 (Riprap Channel)

East Inlet

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
10.00	2.0:1	2.0:1	25.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Depth:	0.11 ft	1.11 ft
Top Width:	10.44 ft	14.44 ft
Velocity*:		
X-Section Area:	1.13 sq ft	
Hydraulic Radius:	0.108	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #2 (Riprap Channel)

West Inlet

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	2.0:1	2.0:1	20.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Depth:	0.27 ft	1.27 ft
Top Width:	13.10 ft	17.10 ft
Velocity*:		
X-Section Area:	3.45 sq ft	
Hydraulic Radius:	0.261	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #1 (Null)

POND 302

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)
#3	1	9.940	0.029	0.000	0.000	90.000	M	17.34	0.63
	S	**9.940**						**17.34**	**0.63**
#2	1	28.400	0.121	0.000	0.000	90.000	M	49.55	1.81
	S	**28.400**						**49.55**	**1.81**
#1	1	3.400	0.017	0.000	0.000	90.000	M	5.93	0.22
	S	**41.740**						**72.82**	**2.65**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	3.48	4.16	119.64	1.860	0.017
#1	**1**	**Time of Concentration:**					**0.017**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	3.33	4.00	120.00	1.820	0.018
		8. Large gullies, diversions, and low flowing streams	3.20	64.00	2,000.00	5.360	0.103
#2	**1**	**Time of Concentration:**					**0.121**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	25.00	20.00	80.00	5.000	0.004
		8. Large gullies, diversions, and low flowing streams	5.97	40.00	670.00	7.330	0.025
#3	**1**	**Time of Concentration:**					**0.029**

POND 5 & CELL A2

The watershed areas for the ponds are presented on Exhibit 11-13B. The design for Pond 5 and Cell A2 are presented on Exhibits 11-105A and 11-106, respectively. The hydrology for Pond 5 was updated in conjunction with the North Cells design modification. The hydrology model for Pond 5 and Cell A2 is attach.

Updated June 2010

LR

BHP Navajo Coal Company
P.O. Box 1717
Fruitland, NM 87416

Phone: 505-598-4200

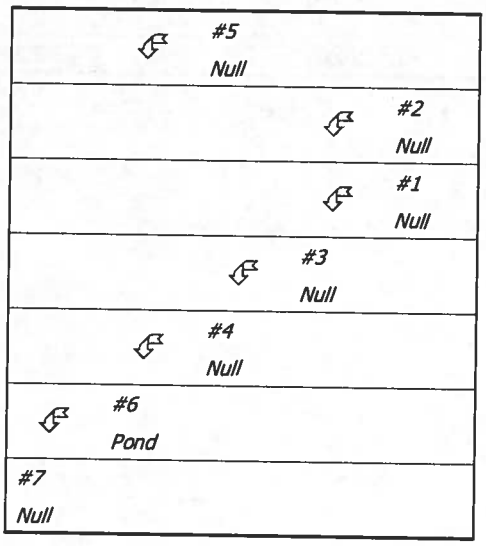
General Information

Storm Information:

Storm Type:	NM TYPE II 70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	1.960 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	#3	0.054	0.277	LIFT STATION 2
Null	#2	==>	#3	0.049	0.277	LIFT STATION 4
Null	#3	==>	#4	0.229	0.277	LIFT STATION 3
Null	#4	==>	#6	0.000	0.000	
Null	#5	==>	#6	0.000	0.000	
Pond	#6	==>	#7	0.000	0.000	POND 5
Null	#7	==>	End	0.000	0.000	CELL A2



Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#5		13.100	13.100	5.16	0.24
#2		6.600	6.600	2.45	0.13
#1		1.200	1.200	1.88	0.09
#3		9.500	17.300	10.59	0.60
#4		0.000	17.300	9.10	0.60
#6	In	11.500	41.900	36.53	1.92
	Out			2.25	1.92
#7		10.000	51.900	16.28	2.67

Structure Detail:

Structure #5 (Null)

Structure #2 (Null)

LIFT STATION 4

Structure #1 (Null)

LIFT STATION 2

Structure #3 (Null)

LIFT STATION 3

Structure #4 (Null)

Structure #6 (Pond)

POND 5

Pond Inputs:

Initial Pool Elev:	5,328.75 ft
Initial Pool:	0.14 ac-ft

Pond Results:

Peak Elevation:	5,331.72 ft
Dewater Time:	0.14 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)
5,328.40	0.390	0.000	0.000	
5,328.41	0.391	0.004	0.000	
5,328.60	0.403	0.079	0.000	
5,328.75	0.413	0.141	0.000	
5,329.00	0.430	0.246	2.250	
5,329.40	0.446	0.421	2.250	
5,330.00	0.470	0.696	2.250	
5,330.40	0.486	0.887	2.250	
5,331.00	0.510	1.186	2.250	
5,331.40	0.526	1.393	2.250	

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
5,331.72	0.539	1.565	2.250	3.45	Peak Stage
5,332.00	0.550	1.716	2.250		
5,332.40	0.570	1.939	2.250		
5,333.00	0.600	2.290	2.250		

Detailed Discharge Table

Elevation (ft)	User-input discharge (cfs)	Combined Total Discharge (cfs)
5,328.40	0.000	0.000
5,328.41	0.000	0.000
5,328.60	0.000	0.000
5,328.75	0.000	0.000
5,329.00	2.250	2.250
5,329.40	2.250	2.250
5,330.00	2.250	2.250
5,330.40	2.250	2.250
5,331.00	2.250	2.250
5,331.40	2.250	2.250
5,332.00	2.250	2.250
5,332.40	2.250	2.250
5,333.00	2.250	2.250

Structure #7 (Null)

CELL A2

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)
#5	1	12.500	0.176	0.000	0.000	70.000	M	4.27	0.191
	2	0.600	0.198	0.000	0.000	91.000	M	0.90	0.045
	Σ	**13.100**						**5.16**	**0.236**
#2	1	0.500	0.198	0.045	0.277	91.000	M	0.75	0.038
	2	6.100	0.238	0.000	0.000	70.000	M	1.80	0.092
	Σ	**6.600**						**2.45**	**0.130**
#1	1	1.200	0.138	0.000	0.000	91.000	M	1.88	0.092
	Σ	**1.200**						**1.88**	**0.092**
#3	1	1.700	0.055	0.058	0.277	91.000	M	4.07	0.160
	2	1.300	0.119	0.000	0.000	91.000	M	3.11	0.122
	3	6.500	0.218	0.000	0.000	70.000	M	2.00	0.098
	Σ	**17.300**						**10.59**	**0.601**
#4	Σ	**17.300**						**9.10**	**0.601**
#6	1	11.500	0.069	0.000	0.000	91.000	M	27.51	1.080
	Σ	**41.900**						**36.53**	**1.917**
#7	1	10.000	0.256	0.000	0.000	91.000	M	14.03	0.754
	Σ	**51.900**						**16.28**	**2.671**

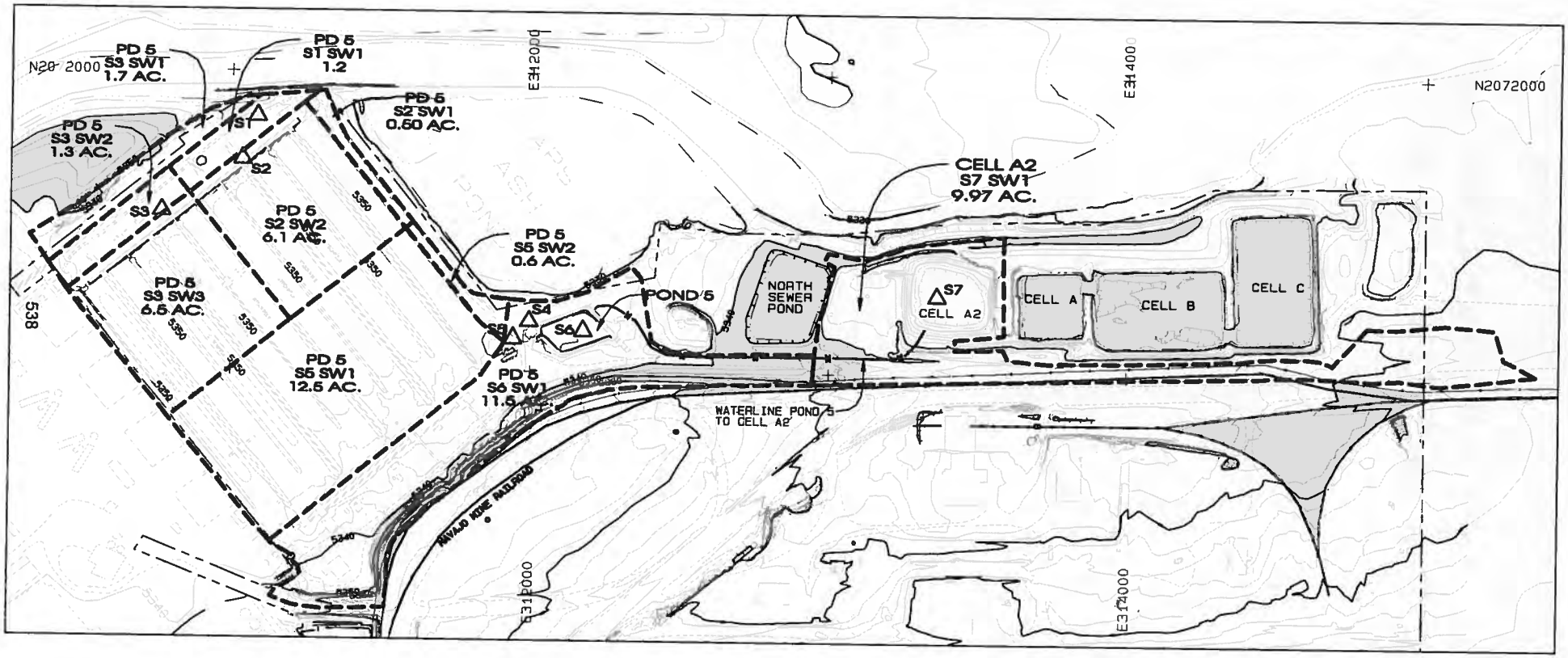
Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	0.50	1.75	350.00	0.700	0.138
#1	**1**	**Time of Concentration:**					**0.138**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	0.50	2.50	500.00	0.700	0.198
#2	**1**	**Time of Concentration:**					**0.198**
#2	2	5. Nearly bare and untilled, and alluvial valley fans	0.50	3.00	600.00	0.700	0.238
#2	**2**	**Time of Concentration:**					**0.238**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	4.00	16.00	400.00	2.000	0.055
#3	**1**	**Time of Concentration:**					**0.055**
#3	2	5. Nearly bare and untilled, and alluvial valley fans	0.50	1.50	300.00	0.700	0.119
#3	**2**	**Time of Concentration:**					**0.119**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#3	3	5. Nearly bare and untilled, and alluvial valley fans	0.50	2.75	550.00	0.700	0.218
#3	**3**	**Time of Concentration:**					**0.218**
#5	1	5. Nearly bare and untilled, and alluvial valley fans	3.00	33.00	1,100.00	1.730	0.176
#5	**1**	**Time of Concentration:**					**0.176**
#5	2	5. Nearly bare and untilled, and alluvial valley fans	0.50	2.50	500.00	0.700	0.198
#5	**2**	**Time of Concentration:**					**0.198**
#6	1	8. Large gullies, diversions, and low flowing streams	3.00	39.00	1,300.00	5.190	0.069
#6	**1**	**Time of Concentration:**					**0.069**
#7	1	5. Nearly bare and untilled, and alluvial valley fans	1.24	3.00	242.00	1.110	0.060
		8. Large gullies, diversions, and low flowing streams	1.15	26.00	2,266.00	3.210	0.196
#7	**1**	**Time of Concentration:**					**0.256**

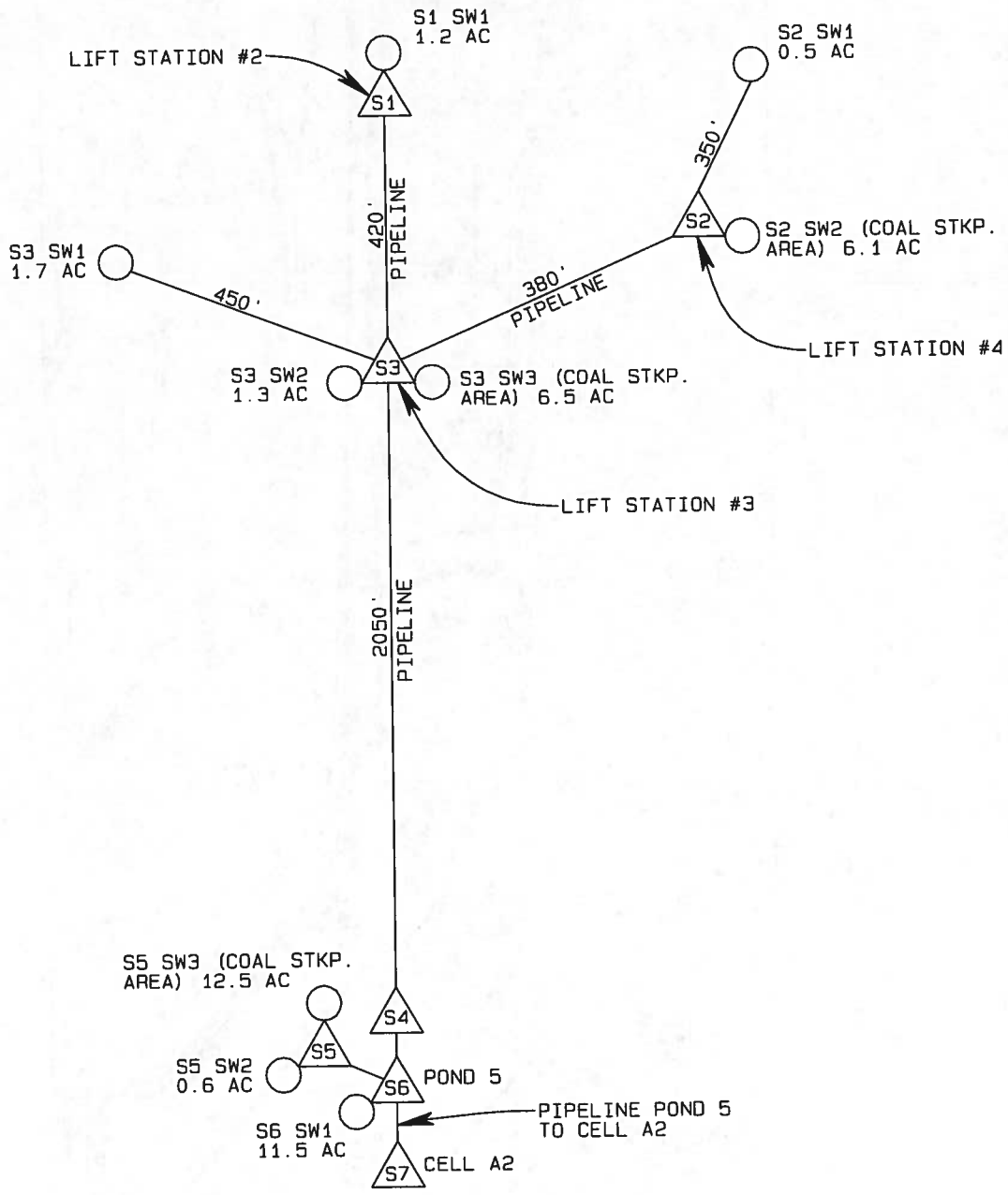
Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	1	8. Large gullies, diversions, and low flowing streams	0.50	1.75	350.00	2.120	0.045
#2	**1**	**Muskingum K:**					**0.045**
#3	1	8. Large gullies, diversions, and low flowing streams	0.50	2.25	450.00	2.120	0.058
#3	**1**	**Muskingum K:**					**0.058**



POND 5 & CELL A2
HYDROLOGY MODEL

POND 5 & CELL A2
SEDCAD MODELING SCHEMATIC



LEGEND

△ STRUCTURE

○ SUB- WATERSHEDS

FOR MORE DETAILS SEE EXHIBIT 11-15