APPENDIX 11-H

NE HOSTEEN OUTSLOPE HYDROLOGY

(9/93)

APPENDIX 11-H

NORTHEAST HOSTEEN OUTSLOPES HYDROLOGY

Due to reformatting of the Navajo Mine PAP, the following references in this appendix (formerly Appendix 29-O under NM-0003C) have been changed, deleted or renumbered:

NM-0003C Reference	NM-0003D Reference
Exhibit 29-O-1	Exhibit 11-52

NAVAJO MINE
NORTHEAST HOSTEEN OUTSLOPE HYDROLOGY
July 12, 1993

INTRODUCTION

BHP Minerals International Inc., Navajo Mine is proposing to redesign the hydrology of the Northeast Hosteen Outslope (previously APPENDIX 29-M in the October 24, 1990 submittal). In the proposed design, the area is divided into two watersheds. The lower watershed (A) is the steep side slope of the spoil. Sediment from this area will be stopped by a silt fence located near the toe of the slope. The upper watershed (B) is the gently sloping top of the regraded spoil. Flow from this area will be routed through a culvert to Yazzie Pit to prevent sediment from leaving the lease. The designs were made with SEDCAD+ in accordance with 30 CFR Chap. VII Sec 816.43.

WATERSHED A

Watershed A is the steep side slope of the regraded spoil (EXHIBIT 29-O-1). The area is small (1.1 ac), and runoff from a 10 year, 24 hour storm is only 0.06 ac ft. A silt fence located near the toe of the slope is proposed to treat the runoff leaving the area. Hydrologic information for this area is presented in the SEDCAD+ printout in the Backup Information section of this appendix.

WATERSHED B

Watershed B is the gently sloping regraded spoil (EXHIBIT 29-0-1). The area is 10.6 acres and runoff from a 10 year, 6 hour storm is 0.43 ac ft. Runoff is to be contained in the area by berms and will be routed to Yazzie Pit by a culvert, downpipe, and plunge pool (see designs on EXHIBIT 29-0-1). The corrugated metal pipe culvert is 150 feet in length, 15 inches in diameter, and has a slope of 2%. The down pipe is 15 inch diamater metal pipe, and has a vertical drop of 25 feet. The plunge pool is lined with 0.25 ft D_{50} riprap, and is a minimum of 11 ft by 10 ft in area. The plunge pool is to disipate the energy of the flow and prevent erosion at the outlet of the downpipe. Hydrologic and design information for the area is presented in the Backup Information Section of this Appendix.

CONCLUSION

A combination of a silt fence, culvert, downpipe, plunge pool, and berms will prevent any additional sediment from leaving the permit area. These temporary structures will have minimal impact on the hydrologic balance, and will not endanger public property or safety.

APPENDIX 29-O

BACKUP INFORMATION

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

NE HOSTEEN OUTSLOPE, WATERSHED A, 10 YR, 24 HR EVENT

by

Name: DAVID HOAG

Company Name: BHP MINERALS INTERNATIONAL, INC.
File Name: C:\NEH_A_10

Date: 07-08-1993

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

Company Name: BHP - Utah International
Filename: C:\NEH_A_10 User: DAVID HOAG
Date: 07-08-1993 Time: 10:59:30
NE HOSTEEN OUTSLOPE, WATERSHED A, 10 YR, 24 HR EVENT
Storm: 1.58 inches, 10 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

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

Company Name: BHP - Utah International
Filename: C:\NEH_A_10 User: DAVID HOAG
Date: 07-08-1993 Time: 10:59:30
NE HOSTEEN OUTSLOPE, WATERSHED A, 10 YR, 24 HR EVENT
Storm: 1.58 inches, 10 year-24 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	1.10	89	F	0.017	0.000	0.000	0.0	0.06	0.81
			Type: Null			Label:				
111	Structure	1.10							0.06	
111	Total IN/OUT	1.10							0.06	0.81

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

Company Name: BHP - Utah International
Filename: C:\NEH_A_10 User: DAVID HOAG
Date: 07-08-1993 Time: 10:59:30
NE HOSTEEN OUTSLOPE, WATERSHED A, 10 YR, 24 HR EVENT
Storm: 1.58 inches, 10 year-24 hour, SCS Type II
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	275.00	20.00	4.47	0.02	0.017		

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

NE HOSTEEN OUTSLOPE, WATERSHED B, 10 YR, 6 HR EVENT

by

Name: DAVID HOAG

Company Name: BHP MINERALS INTERNATIONAL, INC.
File Name: C:\NEH_B_10

Date: 06-14-1993

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

Company Name: BHP - Utah International
Filename: C:\NEH_B_10 User: DAVID HOAG
Date: 06-14-1993 Time: 11:37:56
NE HOSTEEN OUTSLOPE, WATERSHED B, 10 YR, 6 HR EVENT
Storm: 1.30 inches, 10 year- 6 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

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

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

Company Name: BHP - Utah International
Filename: C:\NEH_B_10 User: DAVID HOAG
Date: 06-14-1993 Time: 11:37:56
NE HOSTEEN OUTSLOPE, WATERSHED B, 10 YR, 6 HR EVENT
Storm: 1.30 inches, 10 year- 6 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	10.60	89	F	0.110	0.000	0.000	0.0	0.43	8.39
			Type: Null			Label:				
111	Structure	10.60							0.43	
111	Total IN/OUT	10.60							0.43	8.39

Civil Software Design -- SEDCAD+ Version 3.1
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Company Name: BHP - Utah International
Filename: C:\NEH_B_10 User: DAVID HOAG
Date: 06-14-1993 Time: 11:37:56
NE HOSTEEN OUTSLOPE, WATERSHED B, 10 YR, 6 HR EVENT
Storm: 1.30 inches, 10 year- 6 hour, SCS Type II
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	1007.00	6.36	2.52	0.11	0.110		

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

Company Name: BHP - Utah International
Filename: C:\NEH_B_10 User: DAVE HOAG
Date: 06-14-1993 Time: 11:37:56
NE HOSTEEN OUTSLOPES, WATERSHED B, 10 YR 6 HR
Storm: 1.30 inches, 10 year- 6 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

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NON-POND STRUCTURE INPUT/OUTPUT TABLE
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J1, B1, S1

Drainage Area from J1, B1, S1, SWS(s)1: 10.6 acres
Total Contributing Drainage Area: 10.6 acres

Entrance Loss Coefficient	Maximum Headwater (ft)	Pipe Length (ft)	Pipe Slope (%)	Manning's n	Tailwater (ft)
0.90	3.0	150.0	2.0	0.015	0.0

Minimum Pipe Diameter Required: 15.0 inches
(See Culvert Utility Program for full performance curves)

	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN/OUT	0.43	8.39

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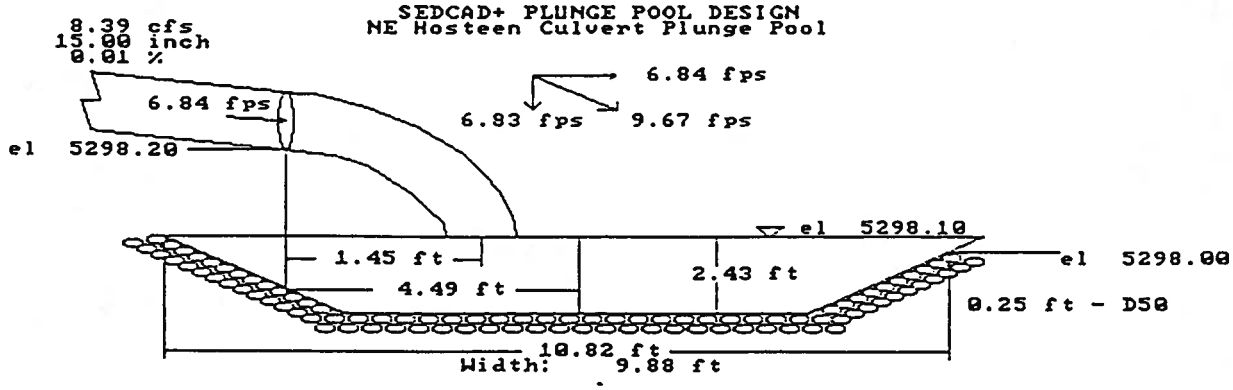
SEDCAD+ PLUNGE POOL UTILITY

NE Hosteen Culvert Plunge Pool

Design Discharge	=	8.39 cfs
Pipe Diameter	=	15.00 in
Pipe Slope	=	0.010 %
Pipe Outlet Elevation	=	5298.20
Tailwater Elevation	=	5298.10
Outlet Crest Elevation	=	5298.00
Rock D50	=	0.25 ft

Pipe Outlet and Tailwater Elevation Difference.....	0.10 feet
Tailwater and Outlet Channel Crest Elevation Difference...	0.10 feet
Required Length of Impact Pool.....	10.82 feet
Required Width of Impact Pool.....	9.88 feet
Depth of Impact Pool from the Tailwater Elevation to the Top of the Rock Riprap.....	2.43 feet
Velocity at Pipe Outlet.....	6.84 fps
Velocity of the Jet Impingement.....	9.67 fps
Horizontal Component of Jet Impingement Velocity.....	6.84 fps
Vertical Component of Jet Impingement Velocity.....	6.83 fps
Froude Number.....	2.65
Horizontal Distance from the Pipe Exit to the Center of the Jet at the Tailwater Surface.....	1.45 feet
Horizontal Distance from the Pipe Exit to the Center of the Plunge Pool.....	4.49 feet