APPENDIX 11-O

LOWE - DIXON DIVERSION SEDIMENT CONTROL

(08/04/94)

NAVAJO MINE
LOWE – DIXON DIVERSION SEDIMENT CONTROL

BHP Billiton is submitting a sediment control plan for the spoils generated by the Lowe-Dixon Diversion Project. Sediment control was not addressed in the original design and this submittal would be an appendix to the project upon approval. The plan will utilize one pond designed to contain the runoff and sediment from spoils. The pond will be incised in a natural low area and will have the runoff diverted to it via channels formed of shaped berms. The pond will be designated Lowe-Dixon Diversion North Pond. Exhibit 11-73 shows the drainage areas, the pond location and the channels.

In this proposal, the sediment control pond will contain the runoff from a 100 year – 6 hour precipitation event and the five year sediment yield from the spoils. The design is in accordance with 30 CFR 816.46 (c)(2)(iii) which requires that a sedimentation pond contain the runoff generated by a 100 year – 6 hour (2.0 in.) storm event if the hydrological design does not include a combination spillway. In addition to the required volume, the pond is designed to contain five years of sediment yield and maintain 1 foot of freeboard.

The SEDCAD computer model that predicts hydrologic, hydraulic, and sediment runoff from disturbed lands was used in this design. The SEDCAD input parameters were achieved by breaking out the flow path to the pond and assigning different subwatersheds to each.

Precipitation values utilized in the designs were taken from the Navajo Mine Reclamation Surface Stabilization Handbook, Part II, Section D, June 1992; and the Peak Rates of discharge for Small Watersheds, Chapter 2, Exhibit 2-2, Engineering Field Manual, U.S.D.A., Soil Conservation Service, July 1984. The time of concentrations were calculated by measuring the longest flow path and utilizing the algorithm supplied in the SEDCAD+ manual. The soil specifics are provided in Permit NM-000C, Chapter 29, Appendix 29-N.

Periodic cleaning of the pond will be performed on an as-needed basis. Water will be pumped below the design capacity level within 10 days following a runoff event, or as soon as safe access can be provided to the site. The water will be pumped to water trucks for distribution on roads, or will be pumped to, and contained in, a mining pit.

SEDCAD computer runs for the pond and flow route are included in this packet and are summarized below:

Design Summary
100 yr-6 hr Storm Event (2.0 in.)

North Pond

Drainage Area	7.41 ac.
Runoff Volume	0.31 ac. ft.
5 year Sediment Yield	0.245 ac. ft.
Req'd Pond Volume	1.06 ac. ft
Design Pond Volume	1.33 ac. ft.
Max. Sediment Level	5378.2 ft
Elevation of Top of Pond	5384.5 ft
Peak Stage (100 yr-6 hr)	5383.5 ft.

Ditch and Inlet Summary
North Pond

Ditch	a.	b.	c.	d.
Shapte	Trapezoidal	Trapezoidal	Trapezoidal	Trapezoidal
Slope	0.16%	0.16%	7.8%	7.8%
Sideslopes	2:1	2:1	2:1	2:1
Bottom	15 ft	15 ft	15 ft	15 ft
RipRap	none	none	none	none
Inlet				
Shape	Trapezoidal	Trapezoidal	Trapezoidal	Trapezoidal
Slope	33%	33%	25%	25%
Sideslopes	3:1	3:1	3:1	3:1
Bottom	1 ft.	1 ft.	4 ft.	4 ft.
RipRap	3 in.	3 in.	Gravel	Gravel

NAVAJO MINE
LOWE - DIXON DIVERSION NORTH POND

Lowe - Dixon Diversion North Pond will contain the runoff from approximately 7.41 acres of spoil. A 1.33 acre-foot pond will contain the runoff from a 100 year - 6 hour precipitation event, five years of sediment yield, and will have 1 foot of freeboard. The pond will not overflow unless a storm event of greater precipitation than a 100 yr - 6 hr event occurs, or unless successive events immediately follow a 100 yr - 6 hr event. A SEDCAD run is enclosed for this design. A gauge post will be installed in the pond to maintain water and sediment levels at or below the 5378.2' elevation.

Four flow routes will direct the runoff to the pond and the flow rates for each have been identified. SEDCAD runs are enclosed showing the runoff volume and peak discharge, as well as channel design parameters for the routing ditches and inlet structures. Four foot high dressed berms with 2:1 sides and a four foot top will form the boundary of the ditches. Spoil material will form the bed of the ditches. The two southern inlet structures, a & b, will be trapezoidal with 3:1 sides, a 33% slope, and will be lined with 3 in. rip-rap. The two northern inlets, c & d, will be trapezoidal with 3:1 sides, a 25% slope, and will be gravel lined.

Table A lists the SEDCAD input parameters, Table B shows the average annual soil loss utilizing the MUSLE equation. A SEDCAD schematic diagram, the SEDCAD runs, pond stage/area and stage/storage curves, an incremental pond analysis, and a pond cross section complete the design.

BHP MINERALS INTERNATIONAL 11/09/94
WATERSHED INPUTS TABLE "A"
NAVAJO MINE; Lowe - Dixon Diversion North Pond

WATERSHED	a	b	c	d
Acres	3.64	2.85	0.52	0.40
Disturbed Acres	3.64	2.85	0.52	0.40
Reclaimed Acres	0.00	0.00	0.00	0.00
Curve Number				
Disturbed	93.00	93.00	93.00	93.00
Reclaimed	N/A	N/A	N/A	N/A
Undisturbed	93.00	93.00	80.00	80.00
Watershed	93.00	93.00	93.00	93.00
Control Practice Factor				
Disturbed	0.70	0.70	0.70	0.70
Reclaimed	N/A	N/A	N/A	N/A
Undisturbed	0.33	0.33	0.39	0.39
Watershed	0.70	0.70	0.70	0.70
Soil Erodibility Factor				
Disturbed	0.10	0.10	0.11	0.11
Reclaimed	N/A	N/A	N/A	N/A
Undisturbed	0.07	0.07	0.15	0.15
Watershed	0.10	0.10	0.11	0.11
Hydraulic Length (ft.)	1900	1900	280	280
Elevation Change (ft.)	36.7	36.7	39.7	39.7
Ave. Slope (%)	1.9%	1.9%	14.2%	14.2%
Velocity of Flow (fps)	1.22	1.22	8.43	8.43
Tc Utilizing Velocity	0.433	0.433	0.009	0.009
Length of Slope	60.3	60.3	36.2	36.2
Ave. Slope	34.0%	34.0%	34.0%	34.0%
Length-Slope Factor	8.210	8.210	6.044	6.044
"m"	0.6	0.6	0.6	0.6
"theta"	0.33	0.33	0.33	0.33
Travel Length	0	0	0	0
Travel Elev. Change	0	0	0.0	0.0
Travel Slope	NA	NA	NA	NA
Velocity	NA	NA	NA	NA
Tc - total	NA	NA	NA	NA
Travel Time	NA	NA	NA	NA
Muskingums X	NA	NA	NA	NA
Muskingums K	NA	NA	NA	NA

BHP MINERALS INTERNATIONAL 11/09/94
AVERAGE ANNUAL SOIL LOSS
UTILIZING THE "MUSLE" EQUATION

TABLE "B"

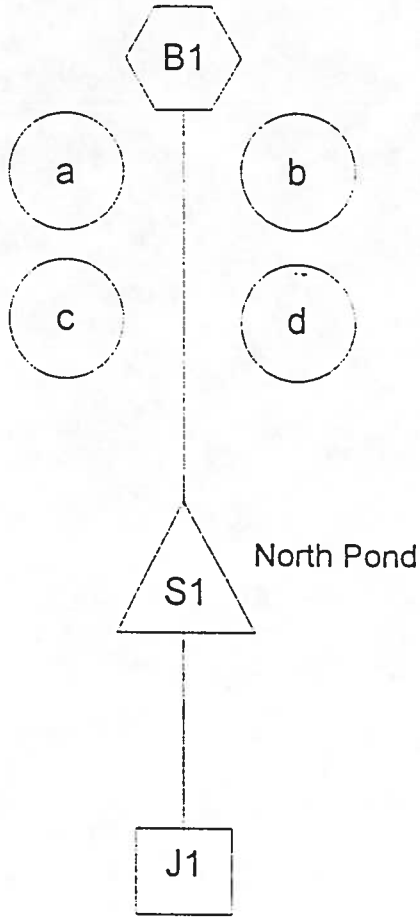
NAVAJO MINE; Lowe - Dixon Diversion North Pond

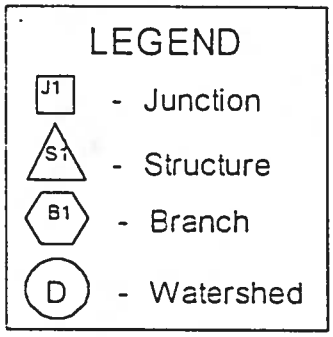
WATERSHED	a	b	c	d
Acres	3.64	2.85	0.52	0.40
Disturbed Acres	3.64	2.85	0.52	0.40
Spoil Acres	0	0	0	0
Rainfall Erosivity	20	20	20	20
Soil Erodibility Factor				
Disturbed	0.10	0.10	0.11	0.11
Spoil	N/A	N/A	N/A	N/A
Undisturbed	0.07	0.07	0.15	0.15
Watershed	0.10	0.10	0.11	0.11
Length-Slope Factor	8.210	8.210	6.044	6.044
"m"	0.6	0.6	0.6	0.6
"theta"	0.33	0.33	0.33	0.33
Control Practice Factor				
Disturbed				
Year 5	0.7	0.7	0.7	0.7
Year 10	0.7	0.7	0.7	0.7
Year 15	0.7	0.7	0.7	0.7
Year 20	0.7	0.7	0.7	0.7
Year 25	0.365	0.365	0.365	0.365
Reclaimed	N/A	N/A	N/A	N/A
Undisturbed	0.33	0.33	0.393	0.393
Watershed				
Year 5	0.70	0.70	0.70	0.70
Year 10	0.70	0.70	0.70	0.70
Year 15	0.70	0.70	0.70	0.70
Year 20	0.70	0.70	0.70	0.70
Year 25	0.37	0.37	0.37	0.37
Sediment Yield (ac.ft.)				
Year 5	0.1231	0.0964	0.0142	0.0110
Year 10	0.1231	0.0964	0.0142	0.0110
Year 15	0.1231	0.0964	0.0142	0.0110
Year 20	0.1231	0.0964	0.0142	0.0110
Year 25	0.0642	0.0503	0.0074	0.0057
Total	0.556727	0.435899	0.064413	0.049548

SEDCAD SCHEMATIC DIAGRAM

LOWE - DIXON DIVERSION

NORTH POND





CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

LOWE - DIXON DIVERSION, NORTH POND

by

Name: JPD

Company Name: BHP - Utah International
File Name: C:\SEDCAD3\N-LOWDIX

Date: 11-08-1994

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

Company Name: BHP - Utah International
Filename: C:\SEDCAD3\N-LOWDIX User: JPD
Date: 11-08-1994 Time: 13:31:32
LOWE - DIXON DIVERSION, NORTH POND
Storm: 2.00 inches, 100 year- 6 hour, SCS Type II
Hydrograph Convolution Interval: 0.1 hr

GENERAL INPUT TABLE

Specific Gravity: 2.50
Submerged Bulk Specific Gravity: 1.25

Particle Size Distribution(s):

Size (mm)	% Finer	% Finer
19.0000	100.00	100.00
3.3600	98.85	99.99
2.0000	94.99	99.90
1.0000	94.61	98.73
0.5000	87.59	84.05
0.2500	68.59	65.70
0.1050	34.70	33.65
0.0530	25.83	19.09
0.0160	20.59	12.39
0.0040	17.00	9.97
0.0010	11.47	6.33
0.0001	0.00	0.00

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

Company Name: BHP - Utah International
Filename: C:\SEDCAD3\N-LOWDIX User: JPD
Date: 11-08-1994 Time: 13:31:32
LOWE - DIXON DIVERSION, NORTH POND
Storm: 2.00 inches, 100 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	3.64*	93	F	0.433	0.000	0.000	0.0	0.40	4.87
111	2	2.85*	93	F	0.433	0.000	0.000	0.0	0.31	3.82
111	3	0.52*	93	F	0.126	0.000	0.000	0.0	0.06	0.91
111	4	0.40*	93	F	0.126	0.000	0.000	0.0	0.04	0.70
			Type: Null			Label:				
111 Structure		7.41							0.81	
111 Total IN/OUT		7.41							0.81	10.06

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Sedimentology-

SED: Sediment
SCp: Peak Sediment Concentration
SSp: Peak Settleable Concentration
24VW: Volume Weighted Average Settleable Concentration - Peak 24 hours
24AA: Arithmetic Average Settleable Concentration - Peak 24 hours

	JBS	SWS	K	L (ft)	S (%)	CP	Tt (hrs)	PS #	SED (tons)	SCp (mg/l)	SSp (ml/l)	24VW (ml/l)	24AA (ml/l)
M	111	1	0.10	60.3	34.0	0.700	0.000	2	78.8				
M	111	2	0.10	60.3	34.0	0.700	0.000	2	59.9				
M	111	3	0.11	36.2	34.0	0.700	0.000	2	8.4				
M	111	4	0.11	36.2	34.0	0.700	0.000	2	6.3				
						Type: Null		Label:					
	111 Structure								153.3				
	111 Total IN/OUT								153.3	186512	128.16	89.19	10.52

BHP MINERALS INTERNATIONAL
NAVAJO MINE
POND VOLUMES

08/04/94

POND VOLUMES USING BOTTOM DIMENSIONS

Pond	Lowe-Dixon North
BOTTOM ELEVATION	5377.5
BOTTOM LENGTH	100.0
SLOPE (x:1)	3
SLOPE (x:1)	3
BOTTOM WIDTH	46.0
SLOPE (x:1)	3
SLOPE (x:1)	3

INCREMENTAL POND RESULTS

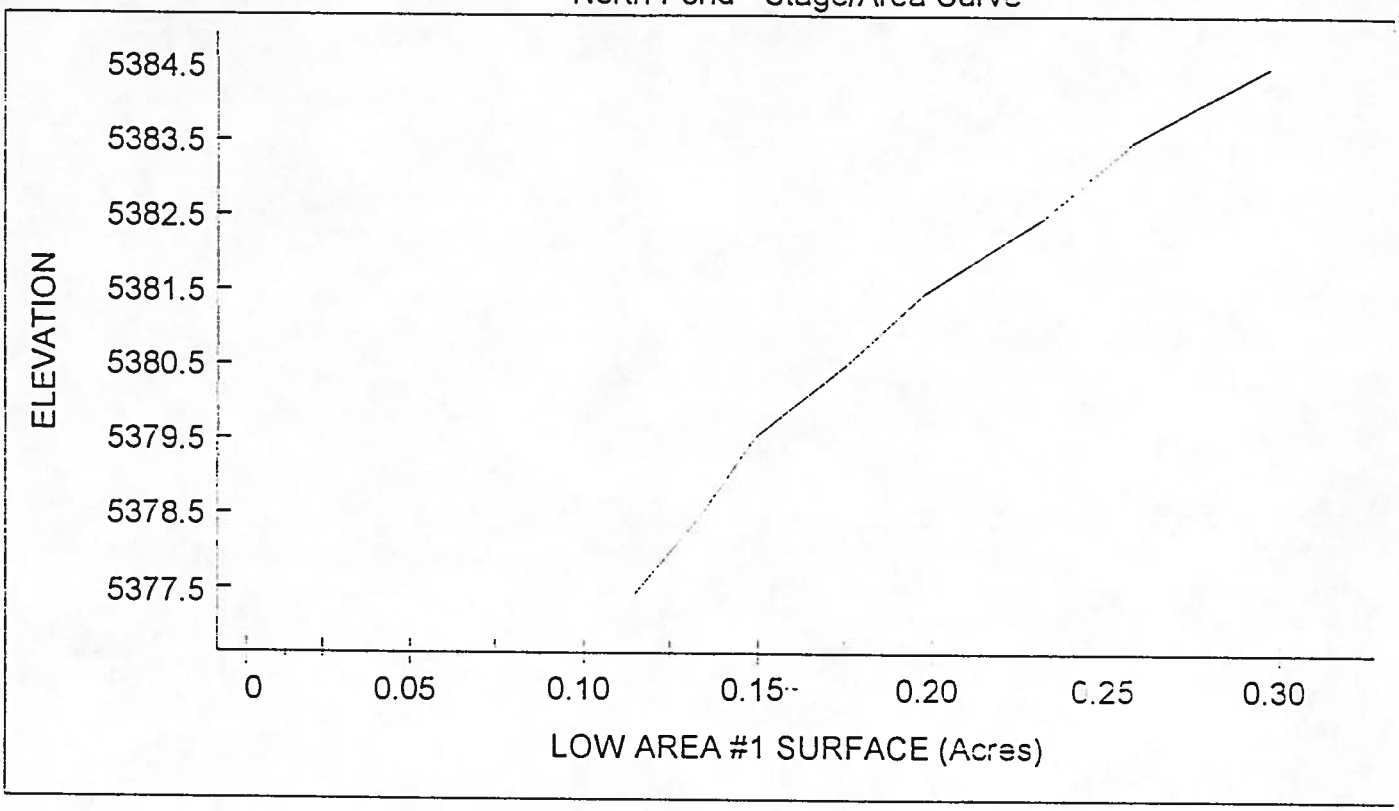
ELEVATION	VOLUME (Ac-Ft)	SURFACE (Ac)	DEPTH (Ft)
5377.5	0.00	0.11	0.0
5378.0	0.06	0.12	0.5
5378.5	0.12	0.13	1.0
5379.0	0.18	0.14	1.5
5379.5	0.25	0.15	2.0
5380.0	0.33	0.16	2.5
5380.5	0.41	0.17	3.0
5381.0	0.50	0.19	3.5
5381.5	0.60	0.20	4.0
5382.0	0.70	0.21	4.5
5382.5	0.81	0.23	5.0
5383.0	0.93	0.24	5.5
5383.5	1.06	0.26	6.0
5384.0	1.19	0.27	6.5
5384.5	1.33	0.29	7.0

POND DESIGN

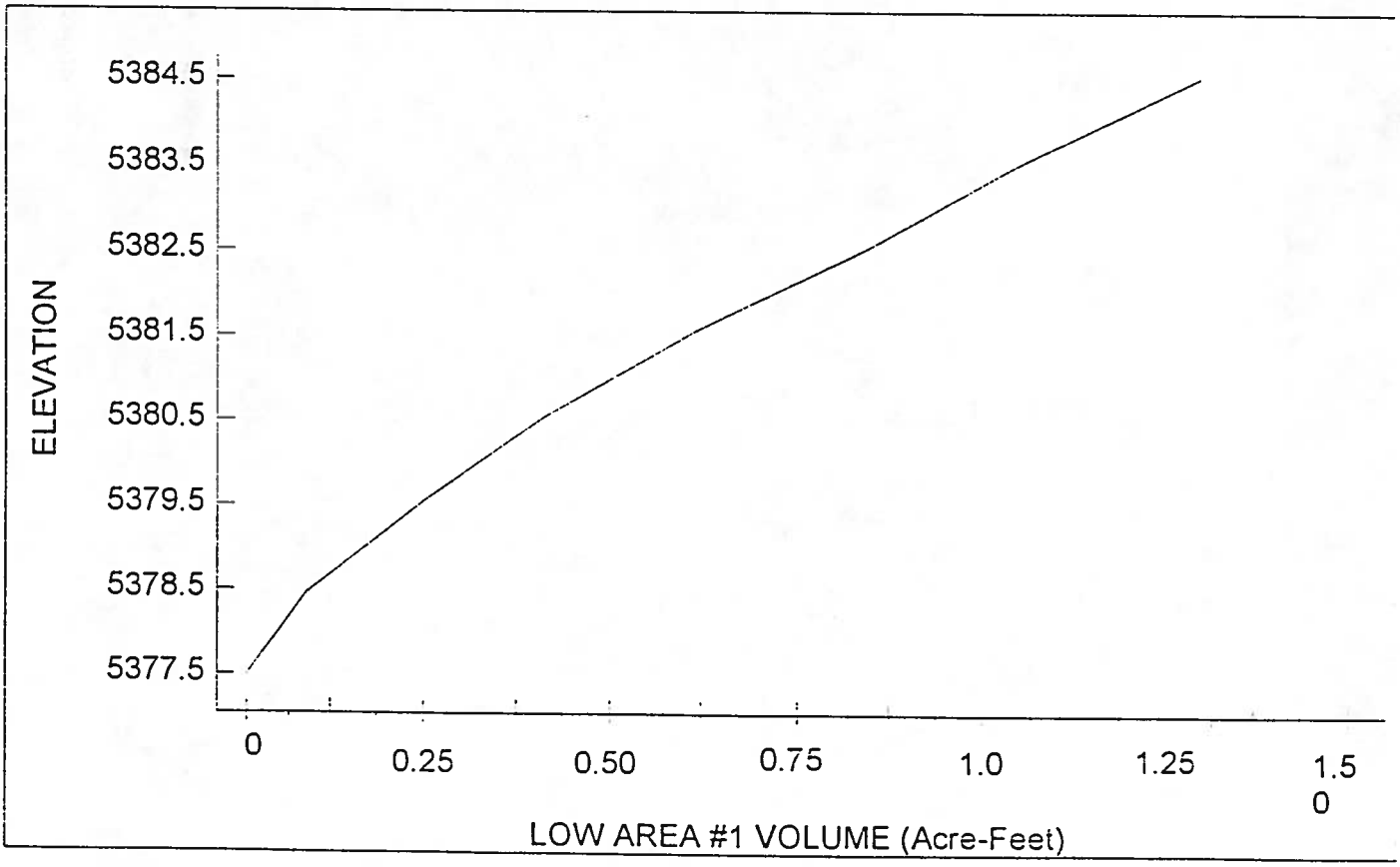
Req'd Capacity	1.06	Ac-Ft
Top Elevation	5384.5	Ft
Volume	1.33	Ac-Ft
Depth	7.0	Ft
Top Length	92.0	Ft
Top Width	145.0	Ft

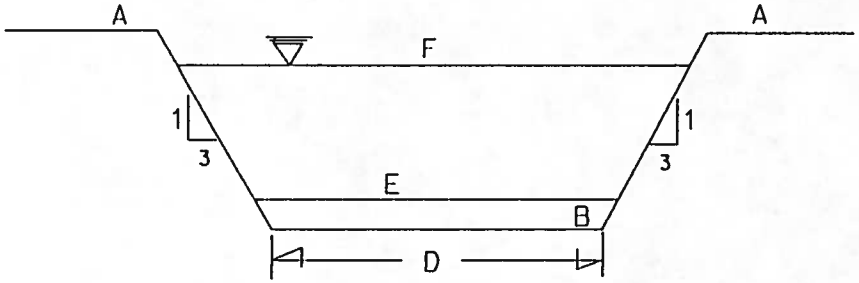
LOWE - DIXON DIVERSION SPOIL SEDIMENT CONTROL

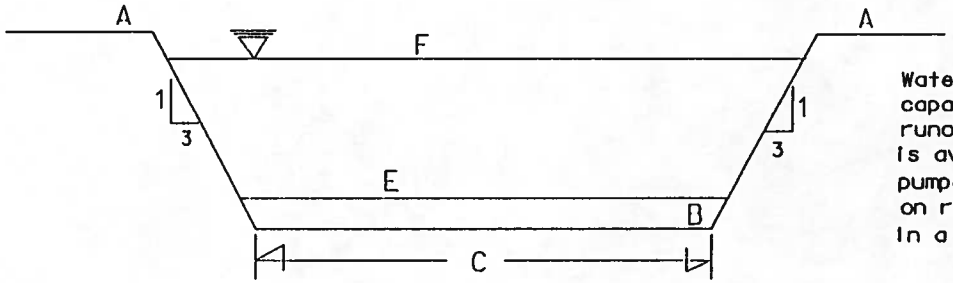
North Pond - Stage/Area Curve



North Pond - Stage/Storage Curve







Water will be pumped below the design capacity level within 10 following a runoff event, or as soon as safe access is available to the site. Water will be pumped to water trucks for distribution on roads or will pumped to and contained in a mining pit.

ITEM	DIM.	ELEV.-DIM.
ELEV. OF TOP OF POND	A	5384.5
ELEV. OF POND BOTTOM	B	5377.5
BOTTOM LENGTH (ft.)	C	100.0
BOTTOM WIDTH (ft.)	D	46.0
MAX. SEDIMENT LEVEL	E	5378.2
PEAK STAGE 100YR-6HR	F	5383.5

NOT TO SCALE

BHP MINERALS INTERNATIONAL INC.

FRUITLAND, NEW MEXICO USA

POND CROSS SECTIONS

Lowe - Dixon Diversion, North Pond

DRAWN BY: JPD	SCALE: N/A	
APPROVED BY:	DATE: 8-1-94	
DRAWING NO.	LOCATION NO.	

SEDCAD+ ERODIBLE CHANNEL DESIGN

Spoil Diversion Ditch/Berm N-A

Limiting Velocity Technique
Sediment-laden Water

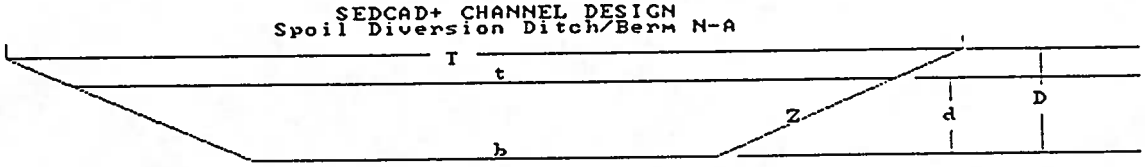
INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	4.93 cfs	
Slope	0.16 %	
Sideslopes	2.00:1 (L)	2.00:1 (R)
Bottom Width	15.00 ft	
Manning's n	0.020	
Max. Velocity	2.50 fps	
Material		
Freeboard	1 ft	

RESULTS:

Actual Discharge	4.93 cfs
Depth	0.27 ft
with Freeboard	1.27 ft
Top Width	16.06 ft
with Freeboard	20.06 ft
Velocity	1.20 fps
Cross Sectional Area	4.12 sq ft
Hydraulic Radius	0.25 ft
Froude Number	0.42

SEDCAD+ CHANNEL DESIGN
Spoil Diversion Ditch/Berm N-A



MATERIAL:
Limiting Variable: Velocity = 2.500 fps
Sediment-laden Water

Discharge	=	4.93 cfs		Depth (d)	=	0.27 (D =	1.27) ft
Bottom (b)	=	15.00 ft		Top Width (t)	=	16.06 (T =	20.06) ft
Side slopes (Z)	=	2.0:1(L)	2.0:1(R)	Velocity	=	1.20 fps	
Bed Slope	=	0.16 %		Hydraulic Radius	=	0.25 ft	
Manning's n	=	0.020		Froude number	=	0.42	

w/ Freeboard:

SEDCAD+ RIPRAP CHANNEL DESIGN

Inlet Structure N-A

INPUT VALUES:

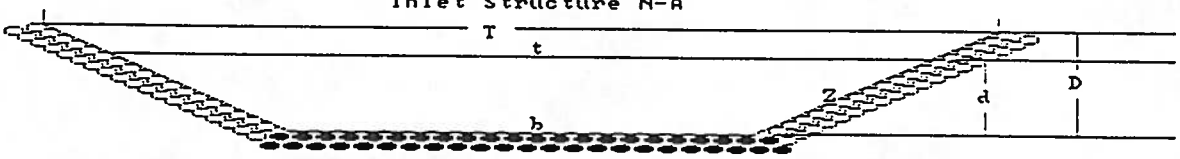
Shape	TRAPEZOIDAL	
Discharge	4.93 cfs	
Slope	33.00 %	
Sideslopes (L and R)	3.00:1	3.00:1
Bottom Width	2.00 feet	
Freeboard	1 ft	

RESULTS:

Steep Slope Design - PADER Method

Depth	0.29 ft
with Freeboard	1.29 ft
Top Width	3.75 ft
with Freeboard	9.75 ft
Velocity	5.86 fps
Cross Sectional Area	0.84 sq ft
Hydraulic Radius	0.22 ft
Manning's n	0.053
Froude Number	2.18
Dmax	0.313 ft (3.75 in)
D50	0.250 ft (3.00 in)
D10	0.083 ft (1.00 in)

SEDCAD+ CHANNEL DESIGN
Inlet Structure N-A



Riprap - Steep Slope Design - PADER Method

Discharge	= 4.93 cfs	Depth (d)	= 0.29	w/ Freeboard: (D =	1.29) ft
Bottom (b)	= 2.00 ft	Top Width (t)	= 3.75	(T =	9.75) ft
Side slopes (Z)	= 3.0:1(L) 3.0:1(R)	Velocity	= 5.86 fps		
Bed Slope	= 33.00 %	Hydraulic Radius	= 0.22 ft		
Manning's n	= 0.053	Froude Number	= 2.18		

Dmax = 0.31 ft (3.75 in)
D50 = 0.25 ft (3.00 in)
D10 = 0.08 ft (1.00 in)

SEDCAD+ ERODIBLE CHANNEL DESIGN

Spoil Diversion Ditch/Berm N-B

Limiting Velocity Technique
Sediment-laden Water

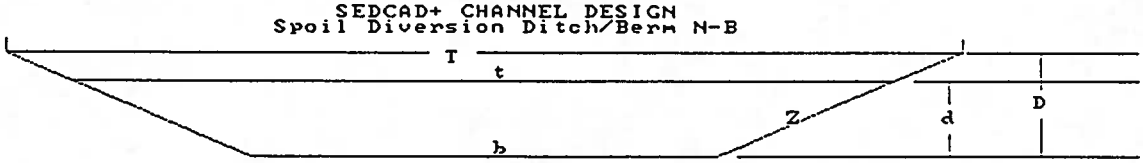
INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	3.86 cfs	
Slope	0.16 %	
Sideslopes	2.00:1 (L)	2.00:1 (R)
Bottom Width	15.00 ft	
Manning's n	0.020	
Max. Velocity	2.50 fps	
Material		
Freeboard	1 ft	

RESULTS:

Actual Discharge	3.86 cfs
Depth	0.23 ft
with Freeboard	1.23 ft
Top Width	15.92 ft
with Freeboard	19.92 ft
Velocity	1.09 fps
Cross Sectional Area	3.54 sq ft
Hydraulic Radius	0.22 ft
Froude Number	0.41

SEDCAD+ CHANNEL DESIGN
Spoil Diversion Ditch/Berm N-B



MATERIAL:
Limiting Variable: Velocity = 2.500 fps
Sediment-laden Water

Discharge	=	3.86 cfs		Depth (d)	=	0.23	w/ Freeboard: (D = 1.23) ft
Bottom (b)	=	15.00 ft		Top Width (t)	=	15.92	(T = 19.92) ft
Side slopes (Z)	=	2.0:1(L)	2.0:1(R)	Velocity	=	1.09 fps	
Bed Slope	=	0.16 %		Hydraulic Radius	=	0.22 ft	
Manning's n	=	0.020		Froude number	=	0.41	

SEDCAD+ RIPRAP CHANNEL DESIGN

Inlet Structure N-B

INPUT VALUES:

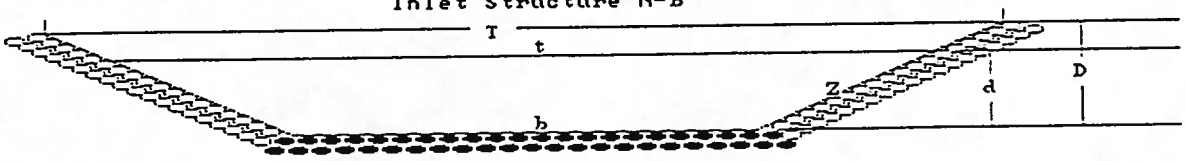
Shape	TRAPEZOIDAL	
Discharge	3.86 cfs	
Slope	33.00 %	
Sideslopes (L and R)	3.00:1	3.00:1
Bottom Width	1.00 feet	
Freeboard	1 ft	

RESULTS:

Steep Slope Design - PADER Method

Depth	0.33 ft
with Freeboard	1.33 ft
Top Width	2.96 ft
with Freeboard	8.96 ft
Velocity	5.95 fps
Cross Sectional Area	0.65 sq ft
Hydraulic Radius	0.21 ft
Manning's n	0.051
Froude Number	2.24
Dmax	0.313 ft (3.75 in)
D50	0.250 ft (3.00 in)
D10	0.083 ft (1.00 in)

SEDCAD+ CHANNEL DESIGN
Inlet Structure N-B



Riprap - Steep Slope Design - PADER Method

```
                                                          w/ Freeboard:
Discharge          =    3.86 cfs          Depth (d)          =  0.33 (D =      1.33) ft
Bottom (b)         =    1.00 ft           Top width (t)      =  2.96 (T =      8.96) ft
Side slopes (Z)    = 3.0:1(L)   3.0:1(R)  Velocity           =   5.95 fps
Bed Slope          =   33.00 %            Hydraulic Radius   =   0.21 ft
Manning's n        =    0.051             Froude number      =   2.24
                 Dmax = 0.31 ft ( 3.75 in)
                 D50  = 0.25 ft ( 3.00 in)
                 D10  = 0.08 ft ( 1.00 in)
```

SEDCAD+ ERODIBLE CHANNEL DESIGN

Spoil Diversion Ditch/Berm N-C

Limiting Velocity Technique
Sediment-laden Water

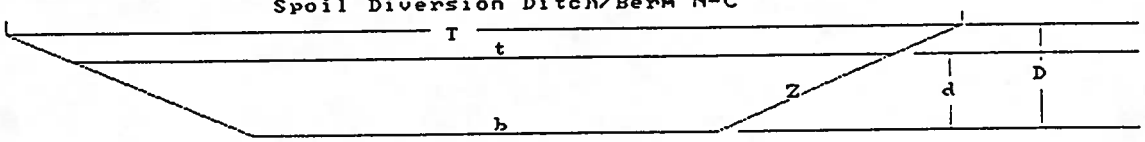
INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	0.91 cfs	
Slope	7.80 %	
Sideslopes	2.00:1 (L)	2.00:1 (R)
Bottom Width	15.00 ft	
Manning's n	0.020	
Max. Velocity	2.50 fps	
Material	SANDY LOAM NONCOLLOIDAL	
Freeboard	1 ft	

RESULTS:

Actual Discharge	0.92 cfs
Depth	0.03 ft
with Freeboard	1.03 ft
Top Width	15.12 ft
with Freeboard	19.12 ft
Velocity	2.01 fps
Cross Sectional Area	0.46 sq ft
Hydraulic Radius	0.03 ft
Froude Number	2.04

SEDCAD+ CHANNEL DESIGN
Spoil Diversion Ditch/Berm N-C



MATERIAL: SANDY LOAM NONCOLLOIDAL
Limiting Variable: Velocity = 2.500 fps
Sediment-laden Water

Discharge	=	0.92 cfs		Depth (d)	=	0.03	w/ Freeboard: (D = 1.03) ft
Bottom (b)	=	15.00 ft		Top width (t)	=	15.12	(T = 19.12) ft
Side slopes (Z)	=	2.0:1(L)	2.0:1(R)	Velocity	=	2.01 fps	
Bed Slope	=	7.80 %		Hydraulic Radius	=	0.03 ft	
Manning's n	=	0.020		Froude number	=	2.04	

SEDCAD+ ERODIBLE CHANNEL DESIGN

Inlet Structure N-C

Limiting Velocity Technique
Sediment-laden Water

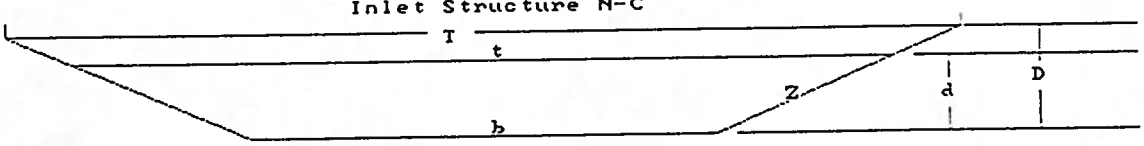
INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	0.91 cfs	
Slope	25.00 %	
Sideslopes	3.00:1 (L)	3.00:1 (R)
Bottom Width	4.00 ft	
Manning's n	0.020	
Max. Velocity	5.00 fps	
Material		
Freeboard	1 ft	

RESULTS:

Actual Discharge	0.94 cfs
Depth	0.05 ft
with Freeboard	1.05 ft
Top Width	4.29 ft
with Freeboard	10.29 ft
Velocity	4.78 fps
Cross Sectional Area	0.20 sq ft
Hydraulic Radius	0.05 ft
Froude Number	3.92

SEDCAD+ CHANNEL DESIGN
Inlet Structure N-C



MATERIAL:
Limiting Variable: Velocity = 5.000 fps
Sediment-laden Water

Discharge	=	0.94 cfs	Depth (d)	=	0.05	(D =	1.05) ft
Bottom (b)	=	4.00 ft	Top Width (t)	=	4.29	(T =	10.29) ft
Side slopes (Z)	=	3.0:1(L) 3.0:1(R)	Velocity	=	4.78 fps		
Bed Slope	=	25.00 %	Hydraulic Radius	=	0.05 ft		
Manning's n	=	0.020	Froude number	=	3.92		

w/ Freeboard:

SEDCAD+ ERODIBLE CHANNEL DESIGN

Spoil Diversion Ditch/Berm N-D

Limiting Velocity Technique
Sediment-laden Water

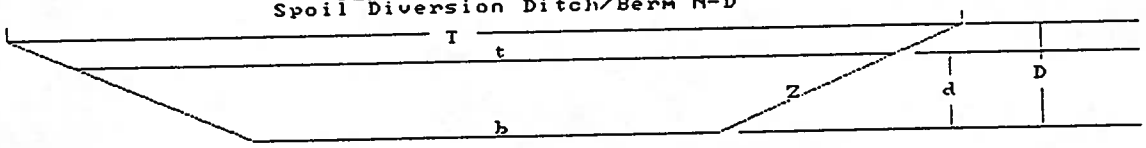
INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	0.70 cfs	
Slope	7.80 %	
Sideslopes	2.00:1 (L)	2.00:1 (R)
Bottom Width	15.00 ft	
Manning's n	0.020	
Max. Velocity	2.50 fps	
Material	SANDY LOAM NONCOLLOIDAL	
Freeboard	1 ft	

RESULTS:

Actual Discharge	0.70 cfs
Depth	0.03 ft
with Freeboard	1.03 ft
Top Width	15.10 ft
with Freeboard	19.10 ft
Velocity	1.81 fps
Cross Sectional Area	0.39 sq ft
Hydraulic Radius	0.03 ft
Froude Number	1.99

SEDCAD+ CHANNEL DESIGN
Spoil Diversion Ditch/Berm N-D



MATERIAL: SANDY LOAM NONCOLLOIDAL
Limiting Variable: Velocity = 2.500 fps
Sediment-laden Water

Discharge	=	0.70 cfs		Depth (d)	=	0.03	(D =	1.03) ft
Bottom (b)	=	15.00 ft		Top Width (t)	=	15.10	(T =	19.10) ft
Side slopes (Z)	=	2.0:1(L)	2.0:1(R)	Velocity	=	1.81 fps		
Bed Slope	=	7.80 %		Hydraulic Radius	=	0.03 ft		
Manning's n	=	0.020		Froude number	=	1.99		

w/ Freeboard:

SEDCAD+ ERODIBLE CHANNEL DESIGN

Inlet Structure N-D

Limiting Velocity Technique
Sediment-laden Water

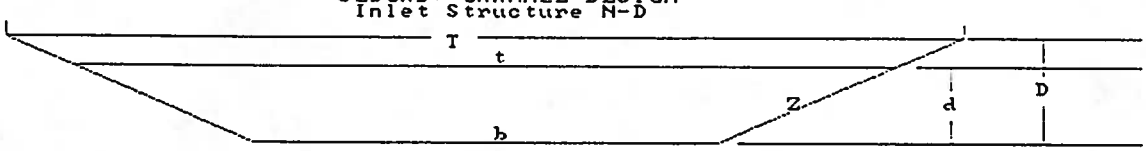
INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	0.70 cfs	
Slope	25.00 %	
Sideslopes	3.00:1 (L)	3.00:1 (R)
Bottom Width	4.00 ft	
Manning's n	0.020	
Max. Velocity	5.00 fps	
Material		
Freeboard	1 ft	

RESULTS:

Actual Discharge	0.72 cfs
Depth	0.04 ft
with Freeboard	1.04 ft
Top Width	4.24 ft
with Freeboard	10.24 ft
Velocity	4.30 fps
Cross Sectional Area	0.17 sq ft
Hydraulic Radius	0.04 ft
Froude Number	3.82

SEDCAD+ CHANNEL DESIGN
Inlet Structure N-D



MATERIAL:
Limiting Variable: Velocity = 5.000 fps
Sediment-laden Water

Discharge	=	0.72 cfs	Depth (d)	=	0.04	w/ Freeboard: (D =	1.04) ft
Bottom (b)	=	4.00 ft	Top width (t)	=	4.24	(T =	10.24) ft
Side slopes (Z)	=	3.0:1(L) 3.0:1(R)	Velocity	=	4.30 fps		
Bed Slope	=	25.00 %	Hydraulic Radius	=	0.04 ft		
Manning's n	=	0.020	Froude number	=	3.82		

Lowe-Dixon Diversion North Pond - Inlet Structure (100 yr-6 hr, 10.06 cfs) - "As-built"

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
14.00	2.0:1	2.0:1	22.0	1.00		

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Depth:	0.05 ft	1.05 ft
Top Width:	14.21 ft	18.21 ft
Velocity*:		
X-Section Area:	0.73 sq ft	
Hydraulic Radius:	0.051	
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.