SECTION 38

POST-RECLAMATION SURFACE STABILIZATION AND SEDIMENT CONTROL

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POST-RECLAMATION SURFACE STABILIZATION AND SEDIMENT CONTROL

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POST-RECLAMATION SURFACE STABILIZATION AND SEDIMENT CONTROL

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POST-RECLAMATION SURFACE STABILIZATION AND SEDIMENT CONTROL

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SECTION 38

POST-RECLAMATION SURFACE STABILIZATION AND SEDIMENT CONTROL

LIST OF REVISIONS DURING PERMIT TERM

REV. NUMBER	REVISION DESCRIPTION	DATE APPROVED

38 POST-RECLAMATION SURFACE STABILIZATION AND SEDIMENT CONTROL

38.1 **Surface Stabilization and Sediment Control Plan for Reclaimed Lands**

The sediment control plan is for reclaimed areas of Yazzie Ramp 2 and Doby Ramps 12, 13, and 14. These areas consist of Pre-law, Interim and Permanent Program lands. Some of these areas have already been reclaimed and have established vegetation, however the majority of these areas will be reclaimed during 2002. The sediment control plan relies on Best Management Practices (BMP). The BMP's on reclaimed areas demonstrate that the sediment yield for reclaimed land (post mine) is less than the sediment yield for undisturbed, premine land. The BMP that is effective in reducing sediment from reclaimed lands to levels below the premine is mulching. Mulch is applied during the reclamation process at a rate of 2 tons/acre.

To evaluate whether erosion is controlled through mulching, pre and post mine sediment yields were generated using RUSLE 1.06 and are weighted averages by watershed based on the entire area. Table 38-1 is a comparison of the pre and post mine sediment yield results. RUSLE enables the user to calculate the soil loss from a subwatershed based on RUSLE parameters, K (soil erodibility), L (slope length), S (slope gradient), C (cover), and P (practice). The practice factor was not utilized for this evaluation. The pre-mine watersheds are shown on Exhibit 38-1 and the post mine are shown on Exhibit 38-2.

Selection of the pre-mine watersheds shown on Exhibit 38-1 was based on achieving as much watershed overlap as possible with the post-mine watershed of a similar size. However, due to changes in the post-mine topography, the pre-mine and post-mine watersheds do not have the same outlets. Therefore a weighted average of sediment yield in tons/acre is used for comparison. Because the pre-mine had a drainage divide between Doby Ramp 12 and Ramps 13 and 14, sediment yield for Ramp 12 was compared separately to the post mine.

The Reclamation Surface Stabilization Handbook (p. 14) provides an Area 1 post-mine RUSLE input parameter of 0.23 for K. For the coarse fragment material placed as a soil substitute in Doby Ramp 14, a composite sample was collected and analyzed for texture. The laboratory results were used to generate a K value for this material of 0.31. The RUSLE input values used for pre-mine and post-mine are listed in Table 38-1. The mean basin slope for each watershed, pre and post, was input for the S factor. The length factor used was a function of the slope of the watershed, and the same criteria for selection was used both the pre and post mine. The cover value was derived using the RUSLE subroutine with a mulch factor of 2 tons/acre. Mulch was not applied to the portion of Doby Ramp 14 that is overlain with coarse texture material (soil substitute).

RUSLE parameter inputs for the pre-mine watersheds were determined based on detailed pre-mine soil mapping from Area 1 and pre-mine soil data from Table C, Reclamation Surface Stabilization Handbook.

Cover values were obtained from data collected from reference areas of vegetation communities. The cover values include rock, litter and live vegetation.

For both the pre-mine and post-mine watersheds, a weighted average by watershed for each RUSLE parameter was obtained and entered into RUSLE to generate sediment yield by watershed. Then an overall weighted average was determined for the drainage area.

A similar analysis for Yazzie Ramp 2 reclaimed in 2003 was generated to evaluate whether erosion can be controlled through Best Management Practices (BMP). The area is located in ramp 2 and will drain into the permanent Chinde Drainage at its outlet. The same references and methods used for Doby Ramps 12-14 were used for this evaluation. Table 38-2 compares the pre and post-mine sediment yield results and demonstrates that erosion can be controlled through mulching and a sediment control pond will not be necessary at the outlet point. Exhibit 38-3 shows the post-mine watershed of the Yazzie Ramp 2 area.

Table 38-1 Comparison of Pre-Mine ad Post-Mine Annual Sediment Yields

Pre-mine Doby Area Ramp 12

Watershed Designation	Area (ac)	K-Factor	C-Factor	LS-Factor	A-Annual Soil Loss (tn/ac)	% of Total Area	Weighted Ave. (tn/ac)
S1SWS1	39.72	0.229	0.18	0.47	0.39	16.3	0.06
S2SW1	55.69	0.226	0.19	0.16	0.14	22.9	0.03
S3SW1	81.93	0.129	0.19	0.14	0.07	33.7	0.02
S4SW1	65.82	0.143	0.19	0.19	0.1	27.1	0.03
Total	243.16						0.15

Pre-mine Doby Area Ramp 13 & 14

Watershed Designation	Area (ac)	K-Factor	C-Factor	LS-Factor	A-Annual Soil Loss (tn/ac)	% of Total Area	Weighted Ave. (tn/ac)
S1SW1	82.73	0.258	0.19	0.47	0.46	21	0.1
S2SW1	82.6	0.243	0.18	0.46	0.4	21	0.08
S3SW1	37.95	0.231	0.17	0.77	0.61	9.6	0.06
S4SW1	85.35	0.227	0.18	0.44	0.36	21.7	0.08
S5SW1	34.76	0.233	0.17	0.54	0.43	8.8	0.04
S6SW1	70.25	0.246	0.18	0.55	0.49	17.8	0.09
Total	393.64						0.44

Pre-mine Doby Area Ramp 12

Watershed Designation	Area (ac)	K-Factor	C-Factor	LS-Factor	A-Annual Soil Loss (tn/ac)	% of Total Area	Weighted Ave. (tn/ac)
PSTSW8	23.94	0.23	0.06	0.52	0.14	0.6	0.08
PST SW9	16.16	0.23	0.03	0.45	0.06	0.4	0.02
Total	40.1						0.11

Table 38-1 (Continued)

Pre-mine Doby Area Ramp 13 & 14

Watershed Designation	Area (ac)	K-Factor	C-Factor	LS-Factor	A-Annual Soil Loss (tn/ac)	% of Total Area	Weighted Ave. (tn/ac)
PSTSW1	13.39	0.23	0.02	0.99	0.46	0.06	0.01
PSTSW2	20.35	0.23	0.04	0.9	0.4	0.09	0.02
PSTSW3	16.49	0.24	0.05	1.026	0.61	0.07	0.07
PSTSW4	77.71	0.23	0.06	0.85	0.36	0.34	0.08
POSTSW5	29.1	0.27	0.18	0.89	0.43	0.13	0.11
PSTSW6	38.69	0.23	0.07	1.01	0.49	0.17	0.05
PSTSW7	33.19	0.23	0.03	0.94	0.49	0.14	0.02
Total	228.92						0.3

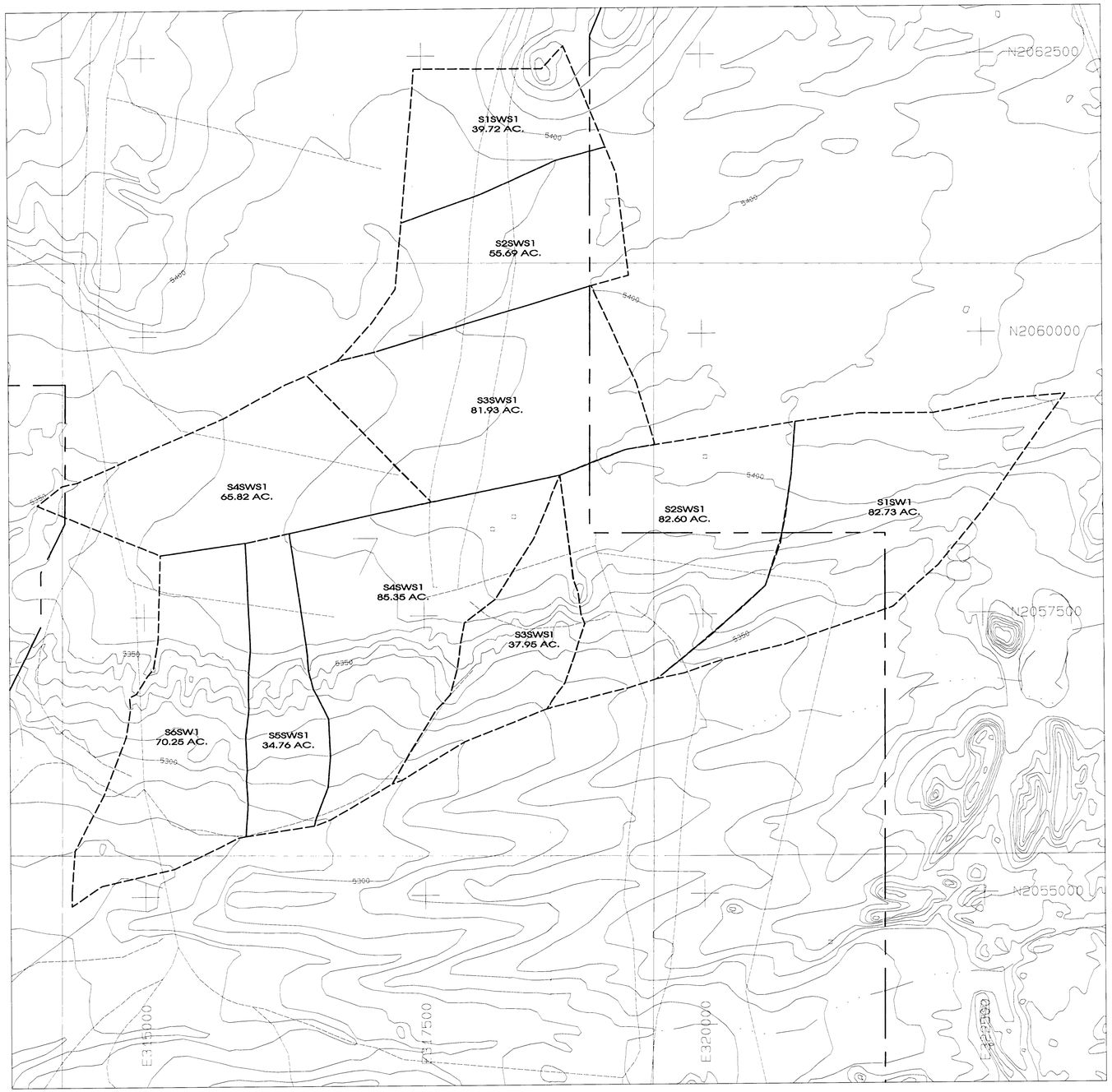
Table 38-2 Comparison of Pre-Mine and Post-mine Sediment Yields

Yazzie Ramp 2: Post Mine
Material is mix mulch/topsoiled, some revegetation

Material	R	K	K used	LS	LS used	C	C used	P	Area	% of Total	Sed Yield, tons/ac
Mulch	20	0.23	0	0.30	0.2109375	0.01	0.0070313	1	90	70.3	
Topsoil	20	0.23	0.00	0.30	0.00	0.05	0.00	1	0	0.0	
Spoil	20	0.23	0.05	1.01	0.22	0.16	0.03	1	28	21.6	
Undisturbed	20	0.19	0.02	0.41	0.03	0.09	0.01	1	10	8.0	
Revegetated	20	0.23	0.00	0.32	0.00	0.20	0.00	1	0	0.0	
	20		0.23		0.46		0.05		128		0.10

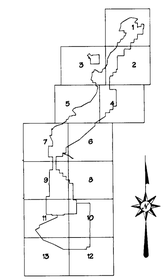
Yazzie Ramp 2: Pre Mine
All material is undisturbed

Material	R	K	K used	LS	LS used	C	C used	P	Area	% of Total	Sed Yield, tons/ac
Mulch	20	0.23	0	0.30	0	0.01	0	1		0.0	
Topsoil	20	0.23	0.00	0.30	0.00	0.05	0.00	1	0	0.0	
Spoil	20	0.23	0.00	1.01	0.00	0.16	0.00	1	0	0.0	
Undisturbed	20	0.19	0.19	0.41	0.41	0.09	0.09	1	128	100.0	
Revegetated	20	0.23	0.00	0.32	0.00	0.20	0.00	1	0	0.0	
	20		0.19		0.41		0.09		128		0.14



LEGEND

- DIRT ROAD
- WATERSHED
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- ×5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- 218 5422.45 LEASE CORNER
- L-30 LEASE/PERMIT BOUNDARY



NOTES:
1. FOR RESULTS OF THE RULSE ANALYSIS REFER TO CHAPTER 12.3.10 OF THE MINE PERMIT.

CERTIFICATION STATEMENT

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

LEONARD RAYMOND NEW MEXICO 6600 REGISTERED PROFESSIONAL ENGINEER

5-8-02

REV. No.	DATE	DRAFT BY	REVISION DESCRIPTION	ENG.	E.G.	P.E.
A	5-07-02	PJF	SUBMITTED TO OSM FOR REVIEW AND APPROVAL	LR	MC	LR

APPROVALS

EXHIBIT 38-1

BHP BILLITON NAVAJO COAL COMPANY

NAVAJO MINE

P.O. BOX 155 FRUITLAND, NEW MEXICO 87416

DOBY RAMPS 12, 13 AND 14 PREMINE TOPOGRAPHY AND DEPICTED AREAS FOR RUSLE 1.06 ANALYSIS

PREPARED BY LR	DRAWN BY PJF	SCALE 1" = 500'
APPROVED BY LR	DATE 4-08-02	

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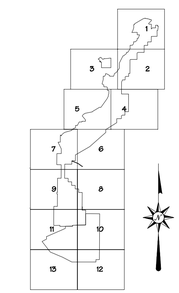
PJFOSTER Wed May 08 09:13:12 2002

LEGEND

- ROAD
- WATERSHED
- BUILDING
- FENCE
- IRRIGATION LINE
- CULVERT
- DAM
- DRAINAGE
- RAILROAD
- TREES
- POWERLINE
- ×5338.5 SPOT ELEVATION
- 5300 INDEX CONTOUR
- 5298 INTERMEDIATE CONTOUR
- 218 5422.45 L-30 LEASE CORNER
- LEASE/PERMIT BOUNDARY



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

LEONARD RAYMOND NEW MEXICO 6600 REGISTERED PROFESSIONAL ENGINEER

REV. NO.	DATE	DRAFT. BY	REVISION DESCRIPTION	ENG.	E.G.	P.E.
A	5-07-02	PJF	SUBMITTED TO OSM FOR REVIEW AND APPROVAL	AAY	MC	LR

APPROVALS

EXHIBIT 38-2

BHP BILLITON NAVAJO COAL COMPANY

NAVAJO MINE

P.O. BOX 1717 FRUITLAND, NEW MEXICO 87416

DOBY RAMPS 12, 13 AND 14 POSTMINE TOPOGRAPHY AND DEPICTED AREAS FOR RUSLE 1.06 ANALYSIS

PREPARED BY AAYOUNG	DRAWN BY PJF	SCALE 1"= 500'
APPROVED BY LR/AAY	DATE 4-08-02	

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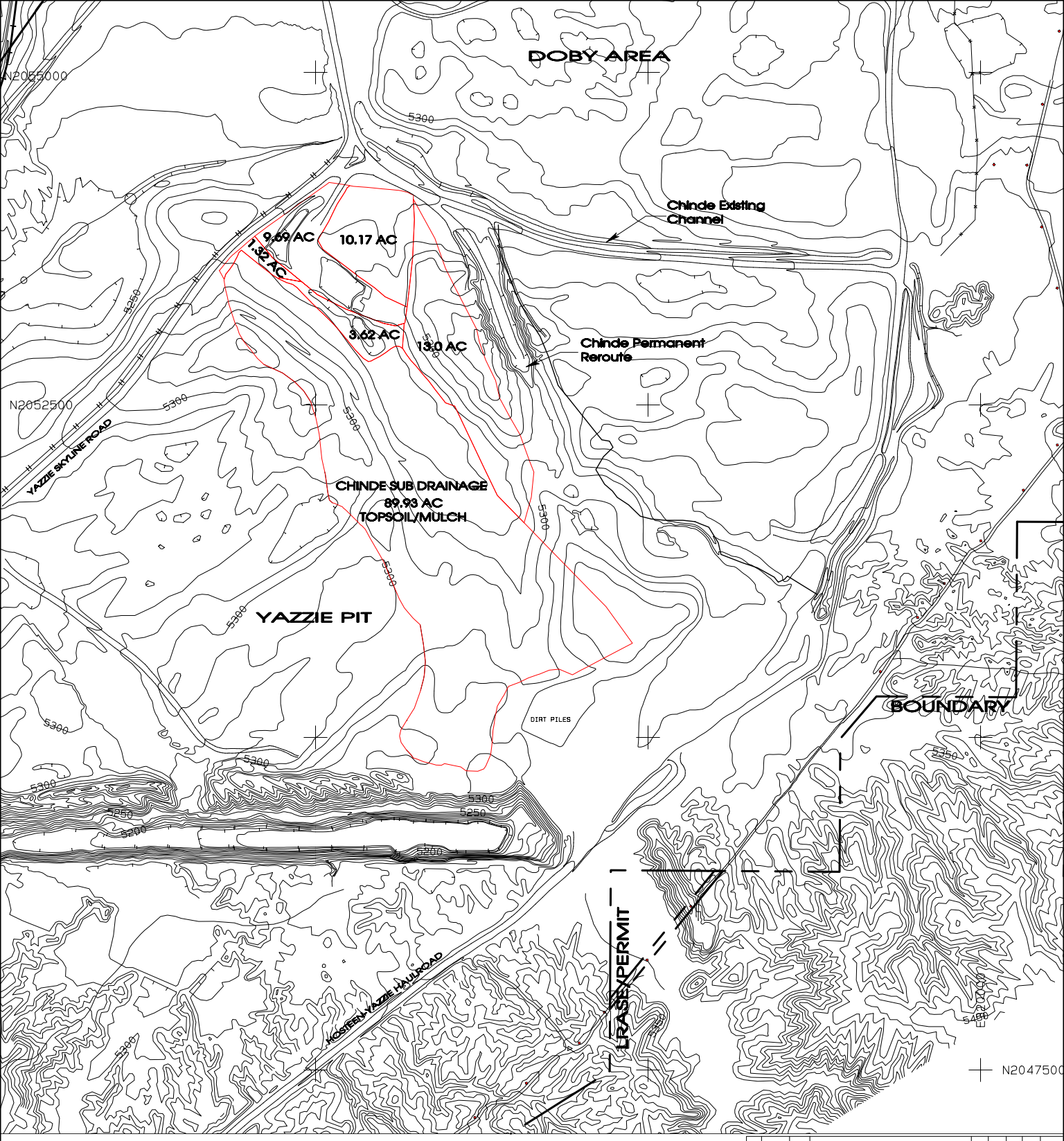

MULCH/TOPSOIL	89.93 AC
UNDIST.	10.17 AC
SPOIL	9.69 AC
	3.62 AC
	13.00 AC
	1.32 AC
TOTAL	127.73 AC

REV. No.	DATE	DRAFT. BY	REVISION DESCRIPTION	PLM	E.G.	P.E.	RPLS
				APPROVALS			

EXHIBIT 38-3

BHP NAVAJO COAL COMPANY

NAVAJO MINE

P.O. BOX 1717 FRUITLAND, NEW MEXICO 87416

CHINDE SUB DRAINAGE LOCATION MAP FOR 434 STANDARD ASSESMENT

PREPARED BY S. LYNCH	DRAWN BY PJF	SCALE 1" = NTS
APPROVED BY	DATE APR. 24, 2003	

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